EXHIBIT E

Appendices to Report - Review of SAP TN

November 16, 2009,

supplemented February 12, 2010

Proprietary and Highly Confidential

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I. Appendices

A. Methodology

In an effort to determine the extent at which SAP TN downloaded, copied, and distributed Oracle Software, Mandiant relied on commonly used forensic software and well accepted data analysis tools. Mandiant primarily performed the following tasks when identifying and aggregating the data from SAP TN electronic evidence:

- Reviewed directory structure, file names and file paths, and file content
- Performed file comparisons using MD5 Hashes
- Performed file comparisons using the "diff" utility

In reviewing the contents of the electronic evidence, to include directory structures, file names and file paths, Mandiant primarily used Guidance Software's EnCase[1] application. EnCase was used by Mandiant to review, identify, search, and record full paths of relevant filenames. A file path is the exact location of a file within a computer's file system. In modern computer systems, two separate files cannot have the exact same file path. This infers that the number of files on a computer system is directly based on the number of file paths.[2]

To identify files that were exact matches, Mandiant relied on the Message Digest #5 algorithm (MD5). MD5 is a common cryptographic hash algorithm with a 128-bit output or thirty-two hexadecimal characters.[3] In simpler terms, MD5 hashing takes an input value and through a series of mathematical operations, produces a unique "digital fingerprint" or numerical reference for a file. Mandiant used "md5deep", authored by Jesse Kornblum,[4] and EnCase to generate the MD5 hashes used during analysis.

Another type of file comparison Mandiant performed occurred when we compared two files that were not exact matches. In order to do this, we used a standard utility called "diff". The "diff" program is usually used to show changes between a file and a previous version of the same file.[5] The diff program reports differences between two files, expressed as a minimal list of line changes to bring either file into agreement with the other.[6] The output of the "diff" comparison is also called a "diff".

In order to automate some of our processes, Mandiant created shell scripts. Shell scripts are usually written in a specific scripting language that an interpreter must process in order to actually function. For example, a single script could be run to perform an automated sequence of tasks as opposed to manually typing in each command. Script writing is an accepted practice as the scripts reduce the likelihood of human errors when processing multiple sets of data that require the exact same operations to be conducted against that data set. Mandiant also provided the shell scripts created to automate our comparison processes in the appendices referenced in the report.

Mandiant also relied on using databases to allow more efficient and accurate analysis of the data. When appropriate, Mandiant provides the Data Definitions and the Queries executed when we

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[1] http://www.guidancesoftware.com/computer-forensics-ediscovery-software-digital-evidence.htm.
[2] Carrier, B. "File System Forensic Analysis," Addison-Wesley Professional, 2005.
[3] Stallings, W., Cryptography and Network Security, 2nd ed., New York: Prentice-Hall, 1997.
[4] http://md5deep.sourceforge.net/.
[5] Horwitz, Susan, "Identifying the semantic and textual differences between two versions of a program," ACM SIGPLAN Notices 25(6) (June 1989), p. 234-245.
[6] Hunt, James W. and McIlroy, M. Douglas. (June 1976) "An Algorithm for Differential File Comparison," Computing Science Technical Report, Bell Laboratories, p. 41.

performed analysis using databases. We also built and used databases to assist in the review of enormous log files.

B. Data Sources reviewed by Mandiant

Mandiant reviewed data from many sources, including DCITBU01, Data Warehouse, MAIL03, WEB01, Delivered Updates and Fixes, the SAS database, Pathfinder, BakTrak, CD Client Jukebox, CD Binders, AS/400, deposition testimony, and other interrogatories produced by SAP TN. Each data source is described the section below.

1. DCITBU01 and Data Warehouse

From July 14, 2008, until February 2, 2009, Mandiant was granted access to 84 *EnCase image files* representing data from 46 SAP TN systems. During this timeframe, Mandiant was allowed remote access to five different servers maintained by Forensic Consulting Services in order to review EnCase image files representing the 46 SAP TN systems.[7]

SAP TN stored the vast majority of the materials that it downloaded from Customer Connection and SupportWeb on the G drive of server DCITBU01. See eAppendix – "ORCLX-MAN-000142." Since the EnCase image files contained only the active files[8] for each system, Mandiant was unable to review unallocated space[9] on each of these drives. Therefore, Mandiant was unable to search for traces of Oracle materials that had been deleted or removed. (Deposition testimony indicates that there may be significant quantities of Oracle software that existed at one time on SAP TN systems but was deleted.)

eAppendix – "ORCLX-MAN-000141" provides a detailed list of the systems Mandiant reviewed from the 84 EnCase image files. Mandiant refers to these 46 systems collectively as "Data Warehouse" (see ORCLX-MAN-000142).

Mandiant, through Oracle's counsel, identified for production portions of the "Data Warehouse" Encase images it reviewed, and Defendants then initially produced 10,304.5 GB (over 10 TB) and approximately 10,772,535 separate files. The reviews of these systems also led Mandiant to request and obtain from Defendants file system metadata[10] for another 2,627 GB (over 2.6 TB) and 2,014,170 separate files from these 46 systems which were subsequently produced for analysis after the initial production.

Mandiant examined the data produced by SAP TN, including the 84 image files representing data from 46 computer systems. Specifically, Mandiant searched these data sources for:

- Oracle SSMs

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[7] SAP TN recollected data for many of these systems in 2009, and is continuing to make these recollected systems available as of the time of submission of this report. I reserve the right to supplement this report with respect to Data Warehouse materials either made available for review or produced too close in time to the submission of this report to allow for review and analysis.

[8] An *active file* is a file that has not been marked for deletion and is readily available to the end user.

[9] *Unallocated space* is the area on the hard drive that would contain files or file fragments that had been temporarily created or deleted by the user of the system. Computer forensic examiners are often able to recover deleted documents in their entirety from unallocated space. In this case Mandiant was not granted access to unallocated space. Therefore we were not able to search the 46 systems for trace evidence of Oracle software.

[10] *File system metadata* is administrative information about a file that records a file's characteristics. It can be generally defined as "data about data." The metadata available for a file depends on the file system of the media on which the file resides and the application that was used to create the file. The file metadata obtained by Mandiant include the time a file was created, last modified, and last accessed, as well as the size of the file, its location on disk, and other items that describe the file.

- Local Environments
- Local Environment Backups
- SAP TN Delivered Updates and Fixes / Modified Oracle Code (SSM and Environment)
- Documentation on SAP TN's support processes relating to Environments and Fixes

At the time of Mandiant's review of Data Warehouse, Mandiant's review was limited to identifying the following Oracle Enterprise Software product lines (as defined in my report, above) within the SAP TN data sources:

Oracle Materials	Product Lines Mandiant's Review Identified To Date
Oracle SSMs	PeopleSoft, JD Edwards, and Siebel
Local Environments and Backups	PeopleSoft, JD Edwards, Siebel and Oracle Database
SAP TN Delivered Updates and Fixes / Modified Oracle Code	PeopleSoft HRMS Fixes

Table 1: Product Lines within the SAP TN Data Sources

When relevant data was found, Mandiant categorized the file one of two ways, as *file production* or *metadata production*.

File Production: Mandiant categorized data for File Production by saving EnCase case files noted as "Produce". The "Produce" case files were needed by Mandiant for immediate review to determine how Oracle SSMs were obtained and used by SAP TN. SAP TN produced the files and the file metadata for items Mandiant selected for file production.

Metadata Production: Mandiant categorized data for Metadata production by saving EnCase case files noted as "Record." The "Record" case files were not needed by Mandiant for immediate production because many of the files were produced in the production of DCITBU01 in a separate review process. Mandiant ultimately instructed Defendants to produce the case files noted for "Record" after Mandiant received and reviewed the images marked as "Produce."

Mandiant received file metadata only for a subset of files reviewed on each SAP TN system, as this metadata was not produced for files not marked by Mandiant as relevant to the case. Therefore, Mandiant was unable to obtain the filenames, file sizes, and total number of all the files reviewed from July 14, 2008 through February 2, 2009.

Our specific steps to review the 84 remote images to categorize items for file production or metadata production included the following:

Step 1: Mandiant reviewed the directories on the target media looking for the following strings or case-insensitive keywords within the full path.[11]

- "PS*"[12]
- "Peopletools"
- "Peoplesoft"
- "JD Edwards"
- "Blue"
- "Documentation"

[11] The full path of a file is a method to refer to the file by its exact location on disk (i.e., "C:\Windows\System32\CMD.EXE" is the Full Path for a file called "CMD.EXE").

[12] The "*" character represents a wild card. Searches of this type identify any folders that begin with the letters "PS."

- "Environments"
- "Siebel"
- "Download"
- "Fix"
- "TN"
- "SAP"
- "Updates"
- "Titan"
- "Information Station"
- "Informix"
- "Backup"
- "Log"
- "Restore"
- "Oracle"
- "IU"
- "Sales"

Mandiant also reviewed for any directory that contained a SAP TN customer name such as Praxair, Robert Half, Harley, etc.). This search was performed via manual review. When Mandiant forensic examiners saw a directory name that contained a SAP TN customer name or customer prefix represented as a three letter code, Mandiant performed a manual review of that directory.

Step 2: Mandiant identified and reviewed all files with the following file extensions (not case-sensitive):

- ".cbl"
- ".sqr"
- ".sqc"
- ".par"
- ".c"
- ".h"

When Mandiant identified files with any of these extensions related to Oracle materials, Mandiant marked the entire directory the file was located in for either file production or for metadata production.

Step 3: Mandiant also reviewed files with ".DOC", ".XLS", ".PDF", ".EXE", ".ZIP", ".HTM", and ".HTML" extensions for relevant documents. Files were manually reviewed, depending on the working directory the file was located in. For example, when a Mandiant examiner found one of these file extensions in a directory related to the use of Oracle materials, the file was usually manually reviewed for relevance.

Step 4: Mandiant used EnCase software to review and "tag" each relevant file or directory.[13] Mandiant saved their file selections (or "tags") into two separate *case files.*[14] One of the case files contains all the files Mandiant selected for file production. The other case file contains all the files selected for metadata production.

Step 5: For both file production as well as metadata production, Mandiant performed an export function to obtain the file metadata for all selected items. Mandiant recorded the following metadata for each selected file:

[13] EnCase allows a computer forensic examiner to "bookmark" or "select" specific files.

[14] An EnCase case file allows the forensic examiner to store information about the case and record operations performed on a forensic image such as bookmarks, keyword searches, and MD5 hash values.

- File Name
- File Extension
- File Description[15]
- Full Path
- File Last Accessed Timestamp
- File Created Timestamp
- File Last Written Timestamp
- Entry Modified Timestamp
- Logical Size
- Source Evidence File

Mandiant's review could not discover all Oracle software and SSMs within the SAP TN infrastructure for the following reasons:

Mandiant did not have the opportunity to review every system at SAP TN. Specifically, Mandiant did not have the opportunity to review individual PCs and laptops, including the developer's machines, which deposition testimony (and common sense) indicates are likely to contain Oracle materials.

2. SAS Database

The SAS database was SAP TN's customer relationship management software. It was a custom application built on top of Lotus Notes. SAP TN employees used it on a daily basis, including tracking SAP TN's PeopleSoft HRMS service delivery process.

During the discovery process, Defendants produced multiple iterations of the SAS database, which Mandiant understands contain cumulative data. Mandiant relied upon the most recent version, produced in March 2009, for analysis purposes. Specifically, Mandiant used the information in the SAS database to analyze the following:

- SAP TN Customers
- SAP TN Fix IDs
- Development Documents
- Testing Documents
- Source Group Documents
- References to Environments
- Oracle Enterprise Application Software

A basic function of the SAS database was to track the development of software fixes, most commonly with a form document referred to as a Master Fix Record. Master Fix IDs generally corresponded to a SAP TN development project aimed at resolving some identified issue expected to apply to more than one customer. A Master Fix Record would be assigned a SAP TN-generated "Fix ID" to track the resolution of the issue.

A Master Fix Record contains multiple fields where SAP TN employees recorded their progress and communicated with one another about resolving the issue. A Master Fix Record was designed to track the "scoping" of the fix (identification and planning), initial development efforts in selected environments, initial testing efforts in selected environments, and information about which customers would receive the fix. Frequently, however, this data was not entered or was incomplete.

[15] The EnCase *file description* field states whether an item is a file, a directory, a file archive, a hidden file, a deleted but recovered file, or another type of file. In this case, since all the items we reviewed were either files or directories, this description field will not have too much variance.

The following table represents sample fields relied upon from the SAS database.

Field Name	Description
Fix Owner	The SAP TN employee who created the Master Fix document.
Short Description	A description of the issue the Fix ID addressed.
Active Date	The date the Master Fix document was created.
Status	The current status of the issue at the time Defendants produced SAS (ex. Available, Cancelled).
Source	The information source for creating the Fix ID, such as a regulatory website or an update published by PeopleSoft.
Available in Bundle	The bundle the Fix ID was contained in.

Table 2: Sample Fields Contained in the SAS Database

Additionally, the SAS database allowed SAP TN support engineers, developers, and testers to attach and embed files within a Master Fix document. Per Mandiant's review, such attachments, when present, included software files including code or other data, copies of the actual fixes and updates to be delivered including code or other data, test plans or other testing-related documents including screenshots of PeopleSoft applications, and/or instructional or other documentation associated with the fix. These attachments often provided additional detail about the life-cycle of the fix beyond the information on the face of the Master Fix Record. Any of these attachments may have contained material originally published by Oracle. For the HRMS fix analysis described in Appendix K, Mandiant relied on the data-entry fields in the Master Fixes as well as any relevant information in the embedded files.

3. Pathfinder

Defendants produced an application known as Pathfinder.[16] Pathfinder tracked information about Local Environments found within SAP TN's infrastructure.

The following table illustrates sample fields from Pathfinder and corresponding descriptions.

Field Name	Description
ID	The unique identifier tracked in Pathfinder to represent each entry.
Client Name	The SAP TN Customer.
Environment Name	The name used by SAP TN to track an environment.
Product Version	The PeopleSoft base application used to create an environment.
Application Server Machine	The SAP TN server containing the installed PeopleSoft base application, PeopleSoft Tools application, and PeopleSoft Tools path application.
Database Server Machine	The SAP TN server containing the database portion of the environment.
Database Server Platform	The platform database used to create and use the environment.
Database Server Release	The release of database used to create and use the environment.
NT PS Home	The server and location of PeopleSoft installed applications.
Tools Release	The PeopleSoft Tools application used to create and use the environment.
Tools Patch	The PeopleSoft Tools patch version used to create and use the environment.
Build Source	The Oracle materials the environment was created from.

[16] *See* TN Disc 190.

Table 3: Sample Fields from Pathfinder

The following table contains a sample of actual data contained in Pathfinder.

ID	Client Name	Environment Name	Product Version	Application Server Machine	Database Server Machine	Database Server Platform	Database Server Release	NT PS Home	Tools Release	Tools Patch	Build Source
86	Development	HR810DEV	8 SP1	HOMER	HOMER	SQL Server	7	\\homer\homer-rw\hr810dev	8.2	0.06	
88	Development	HR831DMO	8.3 SP1	HOMER	HOMER	SQL Server	7	\\homer\homer-rw\hr831dmo	8.2	0.06	
166	Mutual of Omaha	H881MOHO	8.8 SP1	PSDEV01	PSDEV01	Oracle	9.2.0	\\dcpstemp02\psoft\h881moho	8.46	0.15	From CD
202	Praxair	H801PRXO	8 SP1	PSDEV01	PSDEV01	Oracle	8.1.7	\\dcpstemp01\psoft\h801prxo	8.2	0.13	From CD
218	Ross Dress for Less, Inc	H801ROSO	8 SP1	PSDEV01	PSDEV01	Oracle	8.1.7	\\dcpstemp01\psoft\h801roso	8.19	0.13	From CD

Table 4: A sample excerpt from PathFinder – environment info.xls referenced in full in eAppendix – "ORCLX-MAN-000200"

Mandiant used the information in Pathfinder to help determine the number of possible locations of Environments and installs of Oracle Database on SAP TN's infrastructure. Additionally, Mandiant used Pathfinder to analyze the releases and versions of PeopleSoft software used by SAP TN to create Local Environments. eAppendix - "ORCLX-MAN-000200"[17] refers to the full set of data relied upon.

4. BakTrak

Defendants produced information from an application known as BakTrak in both native and Excel spreadsheet form.[18] Mandiant analyzed the spreadsheets, which Mandiant understands are direct exports of the underlying data in the native application. Similar to SAS, Defendants produced multiple iterations and Mandiant analyzed the most current version.

See eAppendix - "ORCLX-MAN-000133" and eAppendix – "ORCLX-MAN-000132."

BakTrak was used to track various activities related to Local Environments. BakTrak included a function tracking "check-outs" and "check-ins" when SAP TN employees reserved Environments to exclude others from working in them. BakTrak also tracked the creation of Environments, and "backups" and "restores" of Environments. A backup is a copy of all or some portion of an Environment in a compressed format.[19] A restore decompresses the backed-up data and copies it to a

[17] Mandiant uses the term "eAppendix" to refer to appendices that are too large or complex to include in a document. These appendices are provided in electronic format for your review. They are usually Excel spreadsheets.

[18] *See* TN Disc 56, TN Disc 79, TN Disc 202.

[19] *See, e.g.*, Deposition of George Lester, April 23, 2009 at 43:11-48:20; Deposition of John Baugh, February 6, 2008 at 142:4-145:16; Deposition of John Baugh, February 7, 2008 at 290:24-297:9; Defendants Responses to Plaintiffs' Second Set of Requests for Admission, Nos. 220-222 ("Defendant SAP TN ADMITS that often in the 'Backup' entries in BakTrak database where a 'Y' is indicated for 'NT,' the contents of the PS_Home file corresponding to the name under the column 'ENVIRONMENT' would have been backed-up, which could include the use of some form of compressed or zip file.").

designated location on SAP TN's infrastructure for use.[20] Thus, each backup and/or restore is a discrete copy of some amount of Oracle software.[21]

The following two tables represent sample actual data contained in BakTrak:

BCK_ID	MACHINE	APPLICATION	ENVIRONMENT	FILENAME	DATE_TIME	DESCRIPTION	DB	NT	UNIX	PERFORMED BY	REQUESTED BY	FORMAT	TN_ARCHIVE
1	HOMER	HRMS	HR810DMO	HR810DMO_20030325_1600	3/25/2003 15:18	with tax updates through 01G	Y	Y	N	chyde	NA	.ZIP	TNBK0044
1103	PSDEV01	HRMS	H831OLNI	H831OLNI_20060119_0318	1/19/2006 3:18	After Maintenance Packs 3 & 4	Y	Y	N	JBaugh	NA	.ZIP	Deleted from archive
1111	PSDEV01	HRMS	H831OLNI	H831OLNI_20060120_0818	1/20/2006 8:18	After Maintenance Packs 5 & 6	Y	Y	N	JBaugh	NA	.ZIP	Deleted from archive
1112	PSDEV01	HRMS	H831OLNI	H831OLNI_20060121_0347	1/21/2006 3:47	After Tax Updates 05-C thru 05-F	Y	Y	Y	JBaugh	NA	.ZIP	Deleted from archive
2812	DCPSTEMP01	HRMS	H801SPGM	H801SPGM_20080107_2348	1/7/2008 23:48	PY08JAN Applied & Tested	Y	Y	N	jlow	ghernandez	.ZIP	\\tempstore\PSTEMPBKUP\dcpstemp01\ps_home, \\tempstore\PSTEMPBKUP\dcpsdb01\db backups\mssql
2813	DCPSTEMP01	HRMS	H831CCIM	H831CCIM_20080107_2354	1/7/2008 23:54	PY08JAN Applied & Tested	Y	Y	N	jlow	ghernandez	.ZIP	\\tempstore\PSTEMPBKUP\dcpstemp01\ps_home, \\tempstore\PSTEMPBKUP\dcpsdb01\db backups\mssql
2814	DCPSTEMP02	HRMS	H881COHM	H881COHM_20080107_2351	1/7/2008 23:51	PY08JAN Applied & Tested	Y	Y	N	jlow	ghernandez	.zip	\\tempstore\PSTEMPBKUP\dcpstemp02\ps_home, \\tempstore\PSTEMPBKUP\dcpsdb01\db backups\mssql

Table 5: A sample excerpt from BakTrak_Backups.xls referenced in full in eAppendix – "ORCLX-MAN-000133"

RESTORE_ID	MACHINE	APPLICATION	TARGET_ENV	SOURCE_ENV	RESTORE_ARCHIVE	BACKUP_FILENAME	DATABASE_RESTORE	NT_RESTORE	UNIX_RESTORE	RESTORE_DATETIME	DESCRIPTION	PERFORMED_BY	REQUESTEDBY
51	YOGI	HRMS	HG751ANC	HG75103F	TNBK0094-TNBK0091	HG75103F_20031024_1800 (mssql7) HG75103F_20031023_0235 (from current - but cobol/sqr from backup of pshome)	Y	Y	N	11/11/2003 11:00	create Muni of Anchorage environment	chyde	NA
57	YOGI	HRMS	HS702DEV	HS70203G	TNBK0107	HS70203G_20031201_1541	Y	Y	N	12/2/2003 19:59	create 03G dev	chyde	NA
69	YOGI	HRMS	HR751TST	HR75103G	TNBK0110	HR75103G_20031213_1241	Y	Y	N	12/29/2003 9:55	create temp env for testing of 'off' payrolls, I.e. 53 weeks, 27 cycles, etc.	chyde	NA
93	YOGI	HRMS	HG751COW	HG75103E	TNBK0071	HG75103E_20030825_1325	Y	Y	N	3/22/2004 12:29	created starting environment for Cowlitz	chyde	NA

[20] *See, e.g.*, Deposition of George Lester, April 23, 2009 at 43:11-48:20; Deposition of John Baugh, February 6, 2008 at 142:4-145:16; Deposition of John Baugh, February 7, 2008 at 290:24-297:9; Defendants Responses to Plaintiffs' Second Set of Requests for Admission, Nos. 217-219 ("Defendant SAP TN ADMITS that often in the 'Restore' entries of the BakTrak database where a 'Y' is indicated for the 'NT_RESTORE,' the contents of the PS_Home file identified under the column 'SOURCE_ENV' would have been restored to the name identified under the column 'TARGET_ENV.'").

[21] This is my understanding based on conversations with Mr. Edward Screven and Mr. Norm Ackermann of Oracle.

											County support from the 'fix mastered' version of PS with all tax updates through 03D and fixes past 03D until PS stopped support		
94	YOGI	HRMS	HR751PHS	HR75103B	TNBK0050 TNBK0051	HR75103B_20030514_1326 HR75103B_20030502_0614	Y	Y	N	3/23/2004 15:44	created starting environment for Providence Hospital from the fix master version of ps with all tax updates thru 03B	chyde	NA
96	YOGI	HRMS	HG751COW	HG75103F	TNBK0091	HG75103F_20031023_0235	Y	Y	N	3/29/2004 9:35	recreated COW environment from TN 03E (03F Nt applied) - need to back out 03E in order to have good env. But we had Nt applied U&F to all prior env.	chyde	NA
111	YOGI	HRMS	HR751PHS	HR751PHS	TNBK0139	HR751PHS_20040325_0918	Y	Y	N	4/19/2004 13:50	restore to 03G	chyde	NA
116	YOGI	HRMS	HR751CMP	HR751YR2	TNBK0138	HR751YR2_20040325_1005	Y	Y	N	4/23/2004 12:25	comparison env for HR751	chyde	NA

Table 6: A sample excerpt from BakTrak_Restore.xls referenced in full in eAppendix – "ORCLX-MAN-000132"

5. MAIL03, WEB01 and Delivered Updates and Fixes

Mandiant reviewed data produced by SAP TN from systems known as "Web01" and "Mail03." SAP TN provided the files found on these systems to SAP TN customers. These systems contained SAP TN's "Delivered Updates and Fixes" or "DUF."

a. Data sources for Delivered Updates and Fixes

SAP TN generally provided three productions containing all Fixes delivered by SAP TN to its customers: TN Disc 9, TN Hard Drive 78, and TN Disc 186. Disc 9 was delivered on CD and Disc 186 and Hard Drive 78 were delivered on hard drive. Disc 9 was a predecessor to Hard Drive 78 and Disc 186, however Disc 9 contained a directory (called "Copy of Client Fix") as well as other files that were not found on either of the later productions (Hard Drive 78 and Disc 186). Mandiant identified substantial overlap between these sources.

The table below details each production of the SAP TN Fixes.

Bates	Name	Total Files (Before Decompression)	Size in GB (Before Decompression)	Date Produced	Delivery Medium	File Format
TN-OR00009557	Disc 9	9,541	2.53 GB	11/19/2007	CD	NA
TN-OR04497668	Hard Drive 78	6,474	1.44 GB	3/16/2009	HDD	.L01
TN-OR04497673	Disc 186	6,339	1.36 GB	3/20/2009	HDD	.L01
Total:	**-**	**22,354**	**5.33 GB**	**-**	**-**	**-**

Table 7: Productions of SAP TN Delivered Updates and Fixes

The table below details the file types found throughout Disc 9, Hard Drive 78, and Disc 186 before decompression.

File Extension	Count	Total Size (MB)
CBL	2	0.3
DAT	96	22.9

DMS	93	0.2
DOC	5820	821.7
EXE	9	15.7
INI	4	0.0
LOG	2	0.0
SQC	8	0.1
SQR	20	1.4
TXT	29	3.8
XLS	107	2.0
XML	4	0.3
ZIP	16066	4269.4
No File Extension	94	328.6
TOTAL	**22,354**	**54,666.4**

Table 8: File types found in "Delivered Updates and Fixes" prior to decompressing ZIP files

Mandiant identified the following directories stored on Disc 9:

- Disc 9\Mail03\ClientFix
- Disc 9\Mail03\ClientFix Test
- Disc 9\Mail03\Copy of Client Fix
- Disc 9\Mail03\\testClientFix
- Disc 9\Web01\ClientFix

Mandiant identified the following directories stored on Hard Drive 78:

- Hard Drive 78\Mail03\ClientFix
- Hard Drive 78\Mail03\ClientFixTest
- Hard Drive 78\Mail03\testClientFix

Mandiant identified the following directories stored on Disc 186:

- Disc 186\Web01\ClientFix

Figure 1 below illustrates the overlap between the productions of Delivered Updates and Fixes:

1: Mail03\Copy of Client Fix
2: Mail03\ClientFix
3: Mail03\ClientFix Test
4: Mail03\testClientFix
5: Web01\ClientFix

Figure 1: Delivered Updates and Fixes Production Overlap

SAP TN generally delivered their updates and fixes in compressed customer specific ZIP files. Each delivered ZIP file represented one or more different Fix IDs being provided to a single customer. For example, a ZIP file named "ACE-TN-PY07MAR.ZIP" represents:

A delivered update and fix to the customer "ACE", the American Counsel of Education.[22]

The "bundle" is "TN-PY07MAR" (referring to SAP TN's March 2007 bundle).

This "bundle" represents a collection of 1 or many Fix IDs and their associated File-based Objects and documents.

[22] eAppendix – "ORCLX-MAN-000212."

b. Delivered Updates and Fixes Defining the Unique Set of "Delivered Updates and Fixes"

Mandiant identified the overlap between the three data populations and took the following steps to create a unique set of data to be considered as "Delivered Updates and Fixes". This unique set of "Delivered Updates and Fixes" was created using the data stored on Disc 9, Hard Drive 78, and Disc 186 using the steps outlined below:

Step 1: Mandiant identified all data stored in TN-78 "Delivered Updates and Fixes":

- Hard Drive 78\Mail03\ClientFix directory

Step 2: Mandiant calculated the MD5 File Hashes of all files found in Hard Drive 78\Mail03\ClientFix, including 4,678 ZIP files (see ORCLX-MAN-000076).

Step 3: Mandiant calculated the MD5 file hashes for all files found in the following directories:

- Hard Drive 78\Mail03\ClientFixTest
- Hard Drive 78\Mail03\testClientFix
- Disc 186\ClientFix
- Disc 9\Mail03\ClientFix
- Disc 9\Mail03\ClientFix Test
- Disc 9\Mail03\Copy of Client Fix
- Disc 9\Mail03\testClientFix
- Disc 9\Web01\Client Fix

Step 4: Any files found in the above eight directories with MD5 file hashes not matching the hashes found in Hard Drive 78\Mail03\ClientFix (Step 2 above) were then added to the unique set of "Delivered Updates and Fixes." Files from the following directories were added to the set of "Delivered Updates and Fixes":

- Hard Drive 78\Mail03\ClientFixTest
- Disc 186\ClientFix
- Disc 9\Mail03\ClientFix
- Disc 9\Mail03\Copy of Client Fix
- Disc 9\Web01\Client Fix

Step 5: Mandiant then decompressed all resulting ZIP files created in steps 1 through 4 above. This decompression resulted in approximately 52,651 files. Several of the ZIP files were password protected, and Mandiant was able to obtain the password from Defendants.

Step 5: Once the "Delivered Updates and Fixes" files were decompressed, Mandiant calculated the MD5 file hash for every file.

Step 6: Mandiant created a database of the "Delivered Updates and Fixes" resulting from the decompression performed above. This database recorded the following information about each file:

- File Name – Name of the file.
- File Extension – Three letter extension of the file (e.g. ".SQR", ".DOC", etc.).
- Logical Size – The size in bytes of the file.
- MD5 File Hash – Corresponding MD5 file hash of the file.
- Full File Path – The exact file system location of the file.
- Parent ZIP File – The compressed ZIP file containing the file.
- ZIP File Last Written Date – The last date the containing ZIP was saved.

- Bundle Name – The Bundle containing this file.
- Client Name – The SAP TN three letter customer code to whom the file was delivered.
- Evidence Source – The electronic evidence source of the file.

The SAP TN "Delivered Updates and Fixes" included approximately 52,651 total files (consisting of 18,961 unique files), representing approximately 5.161 GB of data.

eAppendix – "ORCLX-MAN-000058" provides the metadata and filenames for all 52,651 files of the Delivered Updates and Fixes files identified above.

6. Client CD Jukebox

Mandiant identified the customer software identified by folder name, full path, and in a few cases from readme.txt or setup.ini files. A summary of Mandiant's findings are set forth below in Table 9:

Oracle Application and Enterprise Database Software	Number of Copies
CRM 8.8 SP1	1
CRM 8.9	1
EPM 8.8 SP2	1
EPM 8.9	1
FSCM 8 SP3	2
FSCM 8.4	2
FSCM 8.4 SP1	1
FSCM 8.4 SP2	10
FSCM 8.8	1
FSCM 8.8 SP1	6
FSCM 8.9	3
HRMS 8 SP1	4
HRMS 8.3 SP1	11
HRMS 8.8 SP1	14
HRMS 8.9	4

Oracle Application and Enterprise Database Software	Number of Copies
PeopleTools 8.16	1
PeopleTools 8.18	1
PeopleTools 8.19	4
PeopleTools 8.21	3
PeopleTools 8.22	10
PeopleTools 8.42	1
PeopleTools 8.43	3
PeopleTools 8.44	6
PeopleTools 8.45	4
PeopleTools 8.46	6
PeopleTools 8.47	12
PeopleTools 8.48	9
Student Administration 8 SP1	1
Siebel 6.3	1
Oracle 10g: Release 2	3

Table 9: Some Oracle Software Found in Client CD Jukebox[23]

7. CD Binders

The following table provides a summary of the relevant software identified within the CD Binders (also see ORCLX-MAN-000345 and ORCLX-MAN-000348):

Oracle Enterprise Application and Database Software		Reported Number of Copies
PeopleSoft CRM	8	1
PeopleSoft CRM	8.4	2
PeopleSoft CRM	8.4 SP1	1
PeopleSoft CRM	8.8	5
PeopleSoft CRM	8.8 SP1	3

[23] See eAppendix - "ORCLX-MAN-000134," "ORCLX-MAN-000135," and "ORCLX-MAN-000136."

Oracle Enterprise Application and Database Software		Reported Number of Copies
PeopleSoft CRM	8.9	3
Oracle Database	10g	17
PeopleSoft EPM	8.8 SP1	4
PeopleSoft EPM	8.8 SP2	1
PeopleSoft EPM	8.9	3
PeopleSoft Financials	7.5	6
PeopleSoft Financials	7.51	2
PeopleSoft Financials	7.52	9
PeopleSoft Financials	7.53	14
PeopleSoft Financials	8	3
PeopleSoft Financials	8 SP2	5
PeopleSoft Financials	8 SP3	15
PeopleSoft Financials	8.4	16
PeopleSoft Financials	8.4 SP1	11
PeopleSoft Financials	8.4 SP2	28
PeopleSoft Financials	8.8	7
PeopleSoft Financials	8.8 SP1	26
PeopleSoft Financials	8.9	18
PeopleSoft Financials	9.0	4
PeopleSoft HRMS	7	2
PeopleSoft HRMS	7.01	2
PeopleSoft HRMS	7.02	2
PeopleSoft HRMS	7.5	13
PeopleSoft HRMS	7.51	20
PeopleSoft HRMS	8 SP1	24
PeopleSoft HRMS	8.0	30
PeopleSoft HRMS	8.3	8
PeopleSoft HRMS	8.3 SP1	39
PeopleSoft HRMS	8.8	10
PeopleSoft HRMS	8.8 SP1	45
PeopleSoft HRMS	8.9	36

Oracle Enterprise Application and Database Software		Reported Number of Copies
PeopleSoft HRMS	9.0	1
PeopleSoft HRMS	Tax Updates	21
JDE		4
PeopleSoft SA	7	1
PeopleSoft SA	7.5	1
PeopleSoft SA	7.6	1
PeopleSoft SA	8.0	11
PeopleSoft SA	8.0 SP1	21
PeopleTools	7.06	1
PeopleTools	7.07	4
PeopleTools	7.53	1
PeopleTools	7.55	3
PeopleTools	7.56	1
PeopleTools	7.57	1
PeopleTools	7.58	4
PeopleTools	7.59	6
PeopleTools	7.60	5
PeopleTools	7.61	4
PeopleTools	7.62	11
PeopleTools	7.63	21
PeopleTools	8.12	1
PeopleTools	8.14	1
PeopleTools	8.15	1
PeopleTools	8.16	2
PeopleTools	8.17	2
PeopleTools	8.18	4
PeopleTools	8.19	15
PeopleTools	8.20	15
PeopleTools	8.21	13
PeopleTools	8.22	28
PeopleTools	8.4	2
PeopleTools	8.41	1
PeopleTools	8.42	9
PeopleTools	8.43	16
PeopleTools	8.44	22
PeopleTools	8.45	24
PeopleTools	8.46	23
PeopleTools	8.47	22
PeopleTools	8.48	19
Grand Total		**778**

Table A: Oracle Enterprise Application and Database Software Stored in CD Binder

See eAppendix - "ORCLX-MAN-000211"; eAppendix - "ORCLX-MAN-000213"; eAppendix – "ORCLX-MAN-000214."

8. AS/400

On November 11, 2008, Mandiant and an Oracle employee with extensive knowledge of World software, Greg Story, inspected Defendants' AS/400 in Bryan, Texas. In January 2009, Mandiant and Mr. Story further analyzed a restored version of this same AS/400. After the inspection, SAP TN created and produced complete backups of the ENT01 and WORLD partitions. On January 10, 2009, Mandiant was provided access to restored copies of a subset of SAP TN's libraries on an AS/400 system in Oracle's Denver offices.

9. Other Data Sources

Mandiant relied upon deposition testimony of former SAP TN employees and corporate representatives to further understand and determine the source of SAP TN's environments, the development and testing processes, and SAP TN's data infrastructure. In addition to testimony, Mandiant also relied upon certain of SAP TN's produced documents and discovery responses. Mandiant understands that certain discovery responses are in the process of being amended and/or supplemented by SAP TN and will review those responses for further relevant information as they are made available, and will rely on them as necessary. Mandiant also understands that certain potentially relevant SAP TN and/or third-party witnesses are scheduled to be deposed in the near future, including Carol Geiger, Jeff Buehrle, Nhat Vuong, Wanda Jones, Greg Nelson, John Baugh, Jerry Jin, and others, and Mandiant will review the transcripts of those depositions for further relevant information as they are made available, and will rely on them as necessary.

C. Mandiant databases

In order to facilitate efficient and effective code comparisons between the Registered Works and software found on SAP TN's systems, Mandiant created several databases to support its analysis.

1. File-based Objects from PeopleSoft Registered Works

Mandiant created the "Oracle Registered File-based Objects" database to record data and metadata about the SQR, SQC, and CBL files created by the 25 sets of Install Media that Oracle identified as embodying certain of its Registered Works. These install media are listed in Table 10.

Title of Oracle Registered Work	Software Bates Number
PeopleTools 7.5	ORCL00264040
PeopleTools 8.0	ORCL00264028
PeopleTools 8.10	ORCL00264035
PeopleTools 8.4	ORCL00264024 ORCL00264025
PeopleSoft HRMS 7.0	ORCL00264031
PeopleSoft HRMS 7.5	ORCL00400498
PeopleSoft HRMS 8.0	ORCL00400497
PeopleSoft HRMS 8 SP1	ORCL00264026
PeopleSoft HRMS 8.3	ORCL00264019
PeopleSoft HRMS 8.8	ORCL00264021
PeopleSoft Financials, Distribution and Manufacturing 7	ORCL00604712
PeopleSoft Financials 7.5	ORCL00400499 ORCL00466982
PeopleSoft Student Administration Solutions 8	ORCL00264039
PeopleSoft Customer Relationship Management 8	ORCL00264038

Title of Oracle Registered Work	Software Bates Number
PeopleSoft Customer Relationship Management 8.1	ORCL00604718
PeopleSoft Customer Relationship Management 8.8	ORCL00264027
PeopleSoft Financials and Supply Chain Management Enterprise 8	ORCL00604715
PeopleSoft Financials and Supply Chain Management 8 SP1 Rev 1	ORCL00604716
PeopleSoft Financials and Supply Chain Management 8 SP2	ORCL00264022
PeopleSoft Financials and Supply Chain Management 8.4	ORCL00264037
PeopleSoft Enterprise Performance Management 8 SP3	ORCL00604717
PeopleSoft Enterprise Performance Management 8.3 Rev 1	ORCL00604719
PeopleSoft Enterprise Performance Management 8.8	ORCL00264023

Table 10: Install media embodying the PeopleSoft Enterprise Application Software Registered Works

In order to identify the File-based Objects within the Registered Works, Mandiant installed each application provided by Oracle. Specifically, Mandiant installed the 23 products in an operating environment dedicated solely to code-comparison tasks. Each ISO was installed individually with license codes provided by Oracle. After installation, Mandiant copied all the installed files to a common location for the code comparison process. The copy process preserved all the original file system paths. For example, if PeopleTools 7.5 (ORCL00264040) created an installation directory of C:\PT75, the complete PT75 directory was copied to a common storage location under a path "ORCL00264040/PT75."

Mandiant created a custom program to identify the File-based Objects contained within all the installed Registered Works and populate the "Oracle Registered File-based Objects" database. For each unique File-based Object identified, Mandiant created a database record that contained the information listed in the table below:

File-based Object Record for "Oracle Registered File-based Objects" Database	
Field Name	**Description**
FileID	Auto-generated unique index number
File Name	Name of the COBOL, SQR, or SQC File Processed
File Hash	The unique MD5 hash for the file
File Type	Whether the file was a CBL, SQR, or SQC file
File Path	Full directory path of the file being imported into the database
ISO Name	Bates Number assigned to an Oracle Registered work by BM
Release	Short Version of the Release name after the Registered Work was installed such as PT75
RCS Header[24]	RCS comment for the RCS Header field
RCS Release	RCS comment for the Release field
RCS Revision	RCS comment for the Revision field
RCS VersionID	RCS comment for the Version ID
RCS Date	RCS comment for the Date field
RCS Resolution	RCS comment for the Resolution field
Number of Comments (c_comments)	An integer representing the number of lines that were comments
Number of Lines in File (c_linecount)	An integer representing the total number of lines in the File-based Object
Presence of Oracle	Set to "1" if the strings "Copyright ([Cc]).*PeopleSoft, Inc." or

[24] "RCS" or Revision Control System maintains specific text within code files up to date. RCS data can include the code's current version, update date, and other pertinent information.

File-based Object Record for "Oracle Registered File-based Objects" Database	
Field Name	**Description**
Copyright Statement (f_copyright)	"Copyright ([Cc]).*Oracle." were present in the file. Otherwise the value of the flag was set to "0."
Presence of Oracle Confidentiality Statement (f_confidential)	Set to "1" if the string "confidential and proprietary information" were present in the file. Otherwise the value of the flag was set to "0."

Table 11: File-based Object Record for Oracle Registered File-based Objects Database

The following steps outline the technical details of the tasks performed by Mandiant's custom program.

a. At the start of the database preparation process, the custom Mandiant program was given three arguments:

   - The path and name of a file in an installation directory
   - The name of the ISO the file originated in
   - A "Release Name" Mandiant obtained during the installation process. (For example, a "Release Name" for the PeopleTools 8.42 Release Candidate 4 was "PT8.42-RC4").

b. The Mandiant program retrieved an input file from the Registered Works directories and determined whether the file was an SQR, SQC, or CBL file based on file extension. If the file was not a File-based Object (SQR, SQC, CBL), then the Mandiant program proceeded to examine the next file loaded into the database. If the file was an SQR, SQC or CBL file, the process continued to Step C.

c. The Mandiant program generated an MD5 hash for the File-based Object. The MD5 hash uniquely identified the file's contents regardless of the file's name.

d. The program queried the database to determine whether the File-based Object was previously imported. Specifically, Mandiant searched the database for duplicate data in the following two fields:

   - File Hash
   - ISO Name

This allowed for duplicate files to exist as long as they were members of different Registered Works. However, the database would not include files if they had different file names but the same hash. If the file had been imported previously, the process exited and Mandiant proceeded to examine the next file contained in the Registered Works. If the file was a new file, the process continued to Step E.

e. The program searched the file for the presence of text used by programmers to track internal version and release information. This text is known as revision control system (RCS) tags. The RCS tags extracted from the source code were:

   - RCS Release
   - RCS Revision
   - RCS VersionID
   - RCS Resolution
   - RCS Date

f. The program calculated the total number of lines in the file and recorded the number in the database.

g. The program searched the file for the presence of a confidentiality statement. This statement was identified by performing a case-insensitive search for the following phrase:

- "confidential and proprietary information"

If this string was found within the file, the program set the corresponding "f_confidential" flag in the "Oracle Registered File-based Objects" database to "1." Otherwise this flag was set to "0."

h. The program searched the file for the presence of an Oracle copyright statement. The Oracle copyright statement was identified by performing a search for the following phrases:

- "Copyright ([Cc]).*PeopleSoft, Inc."
- "Copyright ([Cc]).*Oracle."

If either one of the strings was identified, the "f_copyright" flag was set to "1." Otherwise this flag was set to "0."

i. The program calculated the total number of lines that were comments, rather than source code. These comments were defined in the following manner:

- COBOL code - Cobol comments have "*" in the 7th column or a '!' in column 1
- SQR and SQC Code - Comments have a "!" in column 1

j. The program generated a database record for each File-based Object that contained the data collected from this process. The record (shown in Figure 2) was inserted into the database.

k. The next Oracle Registered file was loaded and the process started again at Step A.

When this process completed, a record for every unique file within each Oracle registered work was present in the "Oracle Registered File-based Objects" database.

The Custom Mandiant Script used to populate the Oracle registered file-based objects database is eAppendix - "ORCLX-MAN-000202."

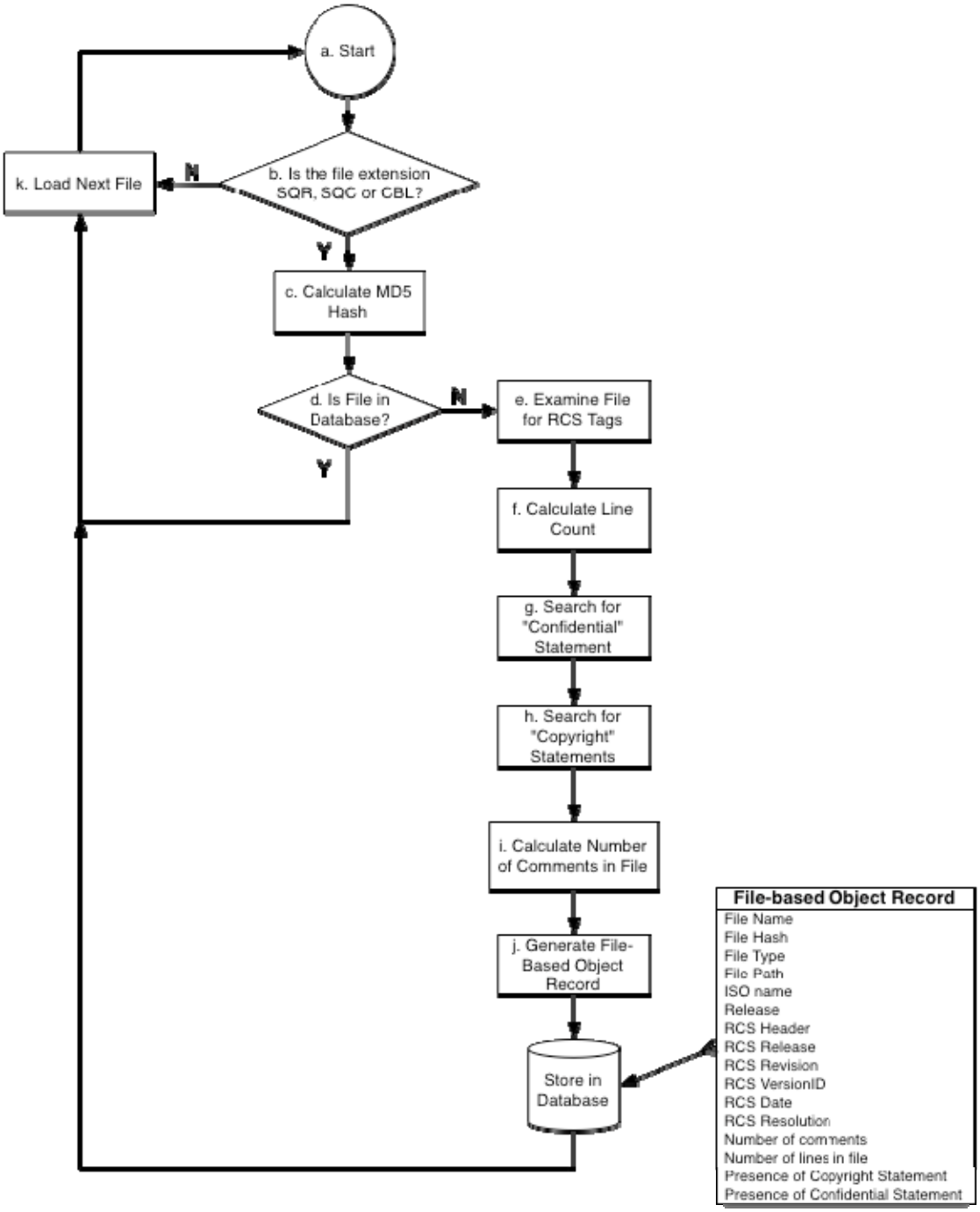

Figure 2: Creating the "Oracle Registered File-based Objects" Database

2. File-based Objects from Delivered Updates and Fixes

Mandiant created the "TN Delivered File-based Objects" database to record data and metadata about the SQR, SQC, and CBL files found in TN Delivered Updates and Fixes by examining media produced by SAP TN.

Mandiant created a custom program to identify the File-based Objects contained within Delivered Updates and Fixes and populate the "TN Delivered File-based Objects" database. For each unique File-based Object identified, Mandiant created a database record that contained the information outlined in the table below:

File-based Object Record for the "TN Delivered File-based Objects" Database	
Field Name	**Description**
FileID	Auto-generated unique index number.
File Name	Name of the COBOL, SQR, or SQC File Processed.
File Hash	The unique MD5 hash for the file.
File Type	Whether the file was a CBL, or SQR, or SQC file.
File Path	Full directory path of the file being imported into the database.
File Count	An integer to describe the total number of occurrences of a specific file. If the file hash and file source (TN09 or TN78) of an imported file match a record already present, this counter is incremented.
File Source	TN09 or TN78.
RCS Release	RCS comment for the Release field.
RCS Revision	RCS comment for the Revision field.
RCS VersionID	RCS comment for the Version ID.
RCS Date	RCS comment for the Date field.
RCS Resolution	RCS comment for the Resolution field.
Number of Comments (c_comments)	An integer representing the number of lines that were comments.
Number of Lines in File (c_linecount)	An integer representing the total number of lines in the File-based Object.
Presence of Oracle Copyright Statement (f_copyright)	Set to "1" if the strings "Copyright ([Cc]).*PeopleSoft, Inc." or "Copyright ([Cc]).*Oracle." were present in the file. Otherwise the value of the flag was set to "0"
Presence of Oracle Confidentiality Statement (f_confidential)	Set to "1" if the string "confidential and proprietary information" were present in the file. Otherwise the value of the flag was set to "0"

Table 12: File-Based Object Record for TN Delivered File-based Object Database

The custom program performed the following steps on every file that comprised the TN Delivered Updates and Fixes data set.

a. The custom Mandiant program was provided the location of the directory that contained the TN Delivered Updates and Fixes and source name "TN09" or "TN78."

b. The custom program loaded a file from the Delivered Updates and Fixes, and determined if the file was a SQR, SQC, or CBL file (a File-based Object). The program determined the file type by the file extension (".SQC", ".SQR", or ".CBL"). If the file was not one of the three types defined by File-based Objects, the process exited and proceeded to load the next file. If the file was an SQR, SQC or CBL file, the process continued to Step C.

c. The program generated an MD5 hash for each File-based Object. This MD5 hash uniquely identified the file's contents regardless of the file's name.

d. The database was queried to determine whether the File-based Object was previously imported. The custom program searched the database for duplicate data in the following two fields:

- File Hash
- File Source

e. This combination allowed for duplicate files to exist as long as they were from either TN09 or TN78. No duplicate records would be generated from the same data source. If the file had been imported previously, the process continued to Step E. If the file was new, the process continued to Step F.

f. If the file existed in the database, a counter was increased in the database. This counter tracked the total number of files for a file hash and file source. For example, if the same Cobol source code file had been distributed to 5 different customers and those customer's directories were in the TN78 data set, the database record would have the value "5" in the File Count field.

g. The program searched the file for the presence of text used by programmers to track internal version and release information. This text is known as revision control system (RCS) tags. The RCS tags extracted from the source code were:

- RCS Revision
- RCS VersionID
- RCS Resolution
- RCS Date

h. Mandiant calculated the total number of lines in the file and recorded the number in the database.

i. The program searched the file for the presence of the confidentiality statement, which could be identified by performing a case-insensitive search for the following phrase.

- "confidential and proprietary information"

If this string was found, the program set the "f_confidential" flag in the "Customer Download Folder File-based Objects" Database to "1." Otherwise this flag was set to "0."

j. The program searched the file for the presence of an Oracle copyright statement. The Oracle copyright statement was identified by performing a search for the following phrases:

- "Copyright ([Cc]).*PeopleSoft, Inc."
- "Copyright ([Cc]).*Oracle."

If either of these strings were found, the program set the "f_copyright" flag to "1". Otherwise, this flag was set to "0."

k. The program calculated the total number of lines that were comments, rather than source code. Comments were defined in the following manner:

- COBOL code - Comments have "*" in the 7th column or a "!" in column 1
- SQR and SQC Code - Comments have a "!" in column 1

l. The program generated a record that contained the data collected. The record (shown in Figure 4) was inserted into the database.

m. The program searched the file for known Fix IDs. The list of known Fix IDs was generated as described in Appendix Section: Construction of the HRMS Fix Population. The TN programmers who authored the File-based Objects typically maintained a list of Fixes that their patches addressed. An example of this is shown below in Figure 3.

n. The custom program created a one-to-one mapping for each Fix ID referenced in the File-based Object.

o. The File-based Object was copied to a storage location on the file server based on its MD5 hash value. The original file name and file path were maintained in a separate spreadsheet. The file name was changed to match the file's MD5 hash. This process allowed for rapid access to any file during the comparison process.

p. The next file from the Delivered Updates and Fixes data set was loaded and the process started again at Step A.

When this process was completed, a record for every unique File-based Object was present in the "TN Delivered File-based Objects" database.

The custom Mandiant script to populate the TN delivered file-based objects database is in eAppendix - "ORCLX-MAN-000202."

```
* TomorrowNow Modification Log                                    *
*                                                                 *
*    Modification Date:  05/11/2003                               *
*    Modification Type:  TomorrowNow Tax Update 2003C-751C        *
*                                                                 *
*    Modification Date:  06/14/2003                               *
*    Modification Type:  TomorrowNow Tax Update 2003D-751C        *
```

Figure 3: Excerpt from a CBL File Showing References to TN Fix IDs

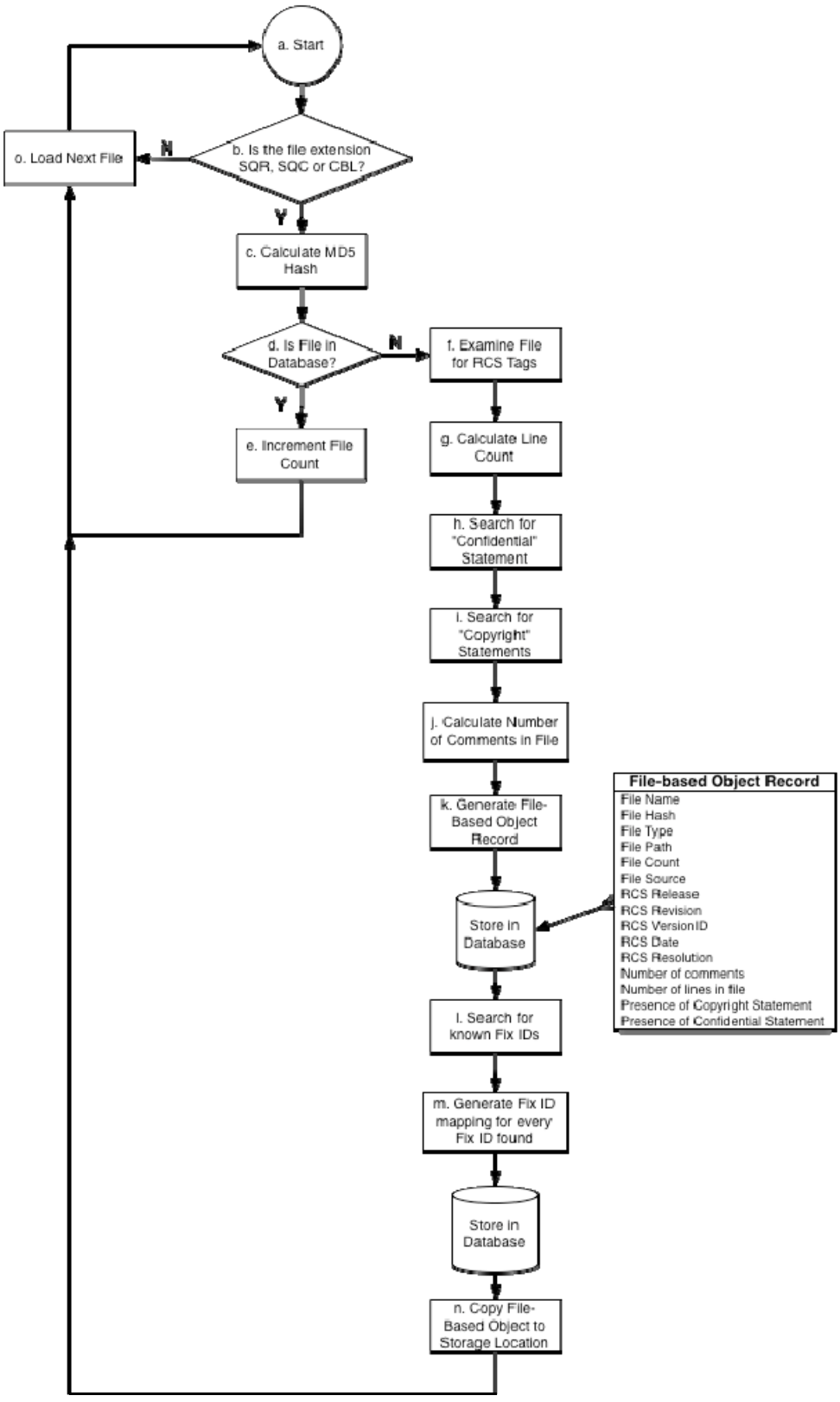
a. Start
b. Is the file extension SQR, SQC or CBL?
N
o. Load Next File
Y
c. Calculate MD5 Hash
d. Is File in Database?
N
Y
e. Increment File Count
f. Examine File for RCS Tags
g. Calculate Line Count
h. Search for "Confidential" Statement
i. Search for "Copyright" Statements
j. Calculate Number of Comments in File
k. Generate File-Based Object Record
Store in Database
l. Search for known Fix IDs
m. Generate Fix ID mapping for every Fix ID found
Store in Database
n. Copy File-Based Object to Storage Location
File-based Object Record
File Name
File Hash
File Type
File Path
File Count
File Source
RCS Release
RCS Revision
RCS Version ID
RCS Date
RCS Resolution
Number of comments
Number of lines in file
Presence of Copyright Statement
Presence of Confidential Statement

Figure 4: Creating the "TN Delivered File-based Objects" Database

3. File-based Objects from Customer Download Folders on DCITBU01_G

Mandiant created the "Customer Download Folder File-based Objects" database to record data and metadata about the SQR, SQC, and CBL files found in those folders on DCITBU01_G where the name of the folder was the name of a SAP TN customer with a PeopleSoft support contract. 209 individual customer folders were processed corresponding to 186 unique companies: complete information is in eAppendix – "ORCLX-MAN-000148."

Mandiant created a custom program to identify the File-based Objects contained within these customer folders and populate the "Customer Download Folder File-based Objects" database. For each unique File-based Object identified, Mandiant created a database record that contained the information outlined in Table 13 below:

File-based Object Record for the "Customer Download Folder File-based Objects" Database	
Field Name	**Description**
FileID	Auto-generated unique index number
File Name	Name of the COBOL, SQR, or SQC File Processed
File Hash	The unique MD5 hash for the file
File Type	Whether the file was a CBL, or SQR, or SQC file
File Path	Full directory path of the file being imported into the database
Source Name	Source Directory (e.g. BU01_PEOPLESOFT_1-20)
Client	Customer-name folder
Application	PeopleSoft Application (e.g. HRMS 8.8)
Module	PeopleSoft Module name (e.g. Payroll for North America)
RCS Header	RCS comment for the Header field
RCS Release	RCS comment for the Release field
RCS Revision	RCS comment for the Revision field
RCS VersionID	RCS comment for the Version ID
RCS Date	RCS comment for the Date field
RCS Resolution	RCS comment for the Resolution field
Number of Comments (c_comments)	An integer representing the number of lines that were comments
Number of Lines in File (c_linecount)	An integer representing the total number of lines in the File-based Object
Presence of Oracle Copyright Statement (f_copyright)	Set to "1" if the strings "Copyright ([Cc]).*PeopleSoft, Inc." or "Copyright ([Cc]).*Oracle." were present in the file. Otherwise the value of the flag was set to "0"
Presence of Confidentiality Statement (f_confidential)	Set to "1" if the string "confidential and proprietary information" were present in the file. Otherwise the value of the flag was set to "0"

Table 13: Customer Download Folder File-based Objects Record

The custom program performed the following steps on every file within the DCITBU01_G customer download folders:

a. The custom Mandiant program was provided the location of the directory that contained the Customer Download Folder Files:

   i. BU01_PEOPLESOFT_1-20

ii. BU01_LOGICAL_21-42
iii. BU01_LOGICAL_IMAGE_43-76
iv. BU01_LOGICAL_IMAGE_77-105

b. The custom program loaded a file from the Customer Download Folder files and examined the original path. The script was able to discover the SAP TN client, the PeopleSoft application and module name due to the file naming method used by TN. An example is the following path:

BU01_PEOPLESOFT_1-20/Aflac/Updates & Fixes/HRMS 8.8/Payroll for North America/642208/upd642208.zip//upd642208/upd642208_batch/filereferences/cobol

The SAP TN client in this example was "Aflac," the application was "HRMS 8.8" and the module name was "Payroll for North America."

c. The program determined if the file was a SQR, SQC, or CBL file (a File-based Object). The program determined the file type by the file extension (".SQC", ".SQR", or ".CBL"). If the file was an SQR, SQC or CBL file, the process continued to Step H.

d. If the file was not a File-based Object, the program detected if the file was a ZIP file archive. If the file was a ZIP file, the process continued to Step E. Otherwise, the program continued to Step Q, where the next file is loaded.

e. When the examined file was a ZIP archive, the program decompressed the ZIP file to a temporary directory. This allowed the program to access files within archives that were a part of the Customer Download Folder data set.

f. The program saved its running state and began an additional examination process on the expanded ZIP archive file. Progress on the current file is paused.

g. The program waited for the additional examination process to complete. When processing of the archive file was complete, the process exited and loaded the next file.

h. If the file was one of the defined File-based Object types, the program generated an MD5 hash for each File-based Object. This MD5 hash uniquely identified the file's contents regardless of the file's name.

i. The database was queried to determine whether the File-based Object was previously imported. The custom program searched the database for duplicate data in the following three fields:

- File Hash
- File Path
- File Source

No duplicate records would be generated from the same data source. If the file had been imported previously, the process continued to Step Q. If the file was new, the process continued to Step J.

j. The program searched the file for the presence of text used by programmers to track internal version and release information. This text is known as revision control system (RCS) tags. The RCS tags extracted from the source code were:

- RCS Header
- RCS Revision
- RCS VersionID
- RCS Resolution
- RCS Date

k. Mandiant calculated the total number of lines in the file and recorded the number in the database.

l. The program searched the file for the presence of the confidentiality statement, which could be identified by performing a case-insensitive search for the following phrase:

- "confidential and proprietary information"

If this string was found, the program set the "f_confidential" flag in the database to "1." Otherwise this flag was set to "0."

m. The program searched the file for the presence of an Oracle copyright statement. The Oracle copyright statement was identified by performing a search for the following phrases:

- "Copyright ([Cc]).*PeopleSoft, Inc."
- "Copyright ([Cc]).*Oracle."

If either of these strings were found, the program set the "f_copyright" flag to "1." Otherwise, this flag was set to "0."

n. The program calculated the total number of lines that were comments, rather than source code. Comments were defined in the following manner:

- COBOL code - Comments have "*" in the 7th column or a "!" in column 1
- SQR and SQC Code - Comments have a "!" in column 1

o. The program generated a record that contained the data collected. The record (shown in Figure 5) was inserted into the database.

p. The File-based Object was copied to a storage location on the file server based on its MD5 hash value. The original file name and file path were maintained in a separate spreadsheet. The file name was changed to match the file's MD5 hash. This process allowed for rapid access to any file during the comparison process.

q. The next file from the Customer Download Folder data set was loaded and the process started again at Step A.

When this process was completed, a record for every unique File-based Object was present in the "Customer Download Folder File-based Objects" database.

The custom Mandiant script used to populate the customer download folder file-based objects database is in eAppendix – "ORCLX-MAN-000202."

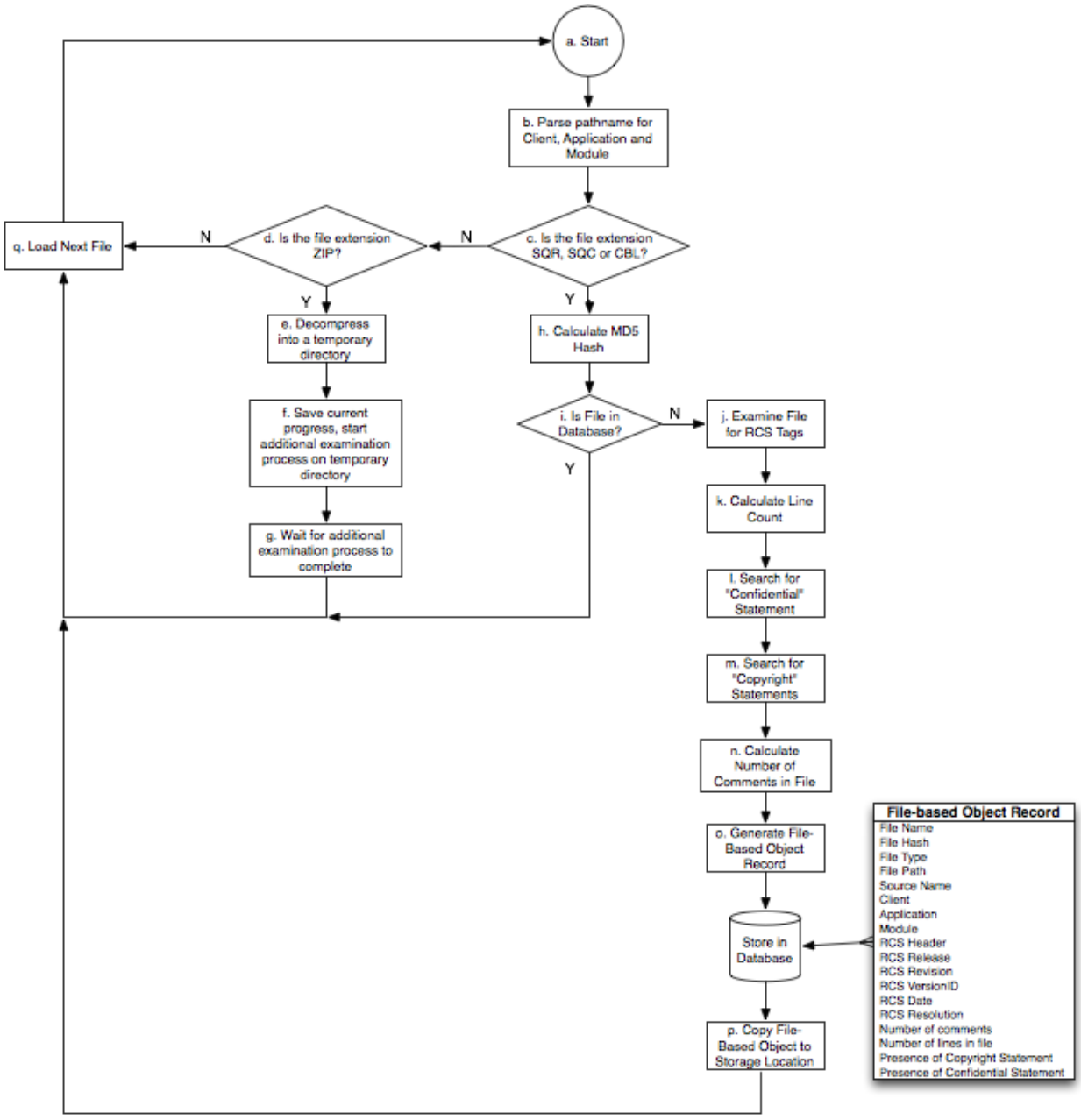

Figure 5: Creating the "Customer Download Folder File-based Objects" Database

4. Files from the Automated Databases

Mandiant analyzed the media provided by Oracle which embodied its Automated Databases for three distinct product lines: JD Edwards, PeopleSoft, and Siebel. Mandiant inspected the contents of each Automated Database to determine files consistent with Oracle documentation related to its SSMs. A significant amount of the contents within each database were compressed within ZIP files so additional steps were necessary. Mandiant performed the process outlined below to achieve an accurate representation of the relevant files within each of the Automated Databases:

a. Mandiant identified all DOC, HTM, HTML, PDF, PPT, XLS, and ZIP files within the Automated Databases by file extension. This resulted in 119,464 files matching the criteria: 109,803 for JD Edwards, 9,549 for PeopleSoft, and 112 for Siebel.

File Extensions	
.DOC	.PPT
.HTM	.XLS
.HTML	.ZIP
.PDF	

Table 14: Automated Database Material File Extensions

b. Mandiant extracted the contents of each identified ZIP file and separated the decompressed contents by product line. This resulted in 161,396 additional files of interest: 4,930 for JD Edwards, 10,779 for PeopleSoft, and 145,687 for Siebel.

c. Mandiant then identified all ZIP files by extension within the decompressed contents of the initial ZIP files.

d. Mandiant decompressed these ZIP files as well, and organized the resulting files by product again. This resulted in 27,071 additional files of interest: 3,294 for JD Edwards, 1,772 for PeopleSoft, and 22,005 for Siebel.

When this process was completed, Mandiant identified a total of 307,931 files matching our file extension criteria. Of the identified pertinent files, 246,629 were unique based upon MD5 hash values.

eAppendix – "ORCLX-MAN-000048" demonstrates all of the filenames and MD5 hash values of the contents of the Automated Databases.

D. Downloaded SSMs

To identify the unique number of SSMs within the SAP TN infrastructure, Mandiant first examined the files stored on SAP TN server "DCITBU01."[25] DCITBU01 contained over 9 million files (after decompression) in folders associated with Oracle downloads. Mandiant performed the following steps to isolate the unique SSMs on "DCITBU01":

Step 1: Mandiant identified files related to Oracle SSMs in customer specific folders on DCITBU01.

Step 2: Mandiant reduced the number of SSM files considered for review by file extension. Mandiant did this to track the SSMs that were easiest to identify by file type. Specifically, Mandiant focused on the following file types found in customer labeled directories on DCITBU01_G.

File Extensions		
.C	.H	.SQC
.CBL	.HTML	.SQL
.DAT	.HTM	.SQR
.DMS	.PAR	.XLS

[25] See Appendix B.

.DOC	.PDF	.XML
.EXE	.RTF	.ZIP

Table 15: SSM Material File Extensions

Step 3: Mandiant identified a total of 3,296,812 files with a total size 4.25 terabytes that matched this search criteria on "DCITBU01." The following table provides a breakdown of the amount of identified SSM files found on "DCITBU01":

File Extension	Size (GB)	Number of Files
.EXE	2,625.37	504,138
.PAR	1,096.19	20,043
.ZIP	346.06	149,891
.XML	92.45	78,257
.PDF	87.58	35,719
.HTML	39.68	1,646,323
.DOC	19.95	170,727
.HTM	16.73	377,211
.DAT	14.01	100,118
.XLS	5.48	35,655
.RTF	3.27	29,700
.CBL	2.40	17,451
.SQR	1.49	29,441
.SQC	1.11	9,384
.DMS	0.18	90,941
.C	0.023	172
.H	0.0064	373
.SQL	0.0025	1,268
Total	**4,351.99 GB**	**3,296,812**

Table 16: SSM Files Stored on DCITBU01

Step 4: Using MD5 hashes to determine the number of unique identified SSM files, Mandiant determined that the 3,296,812 files comprised 1,046,161 unique files. eAppendix – "ORCLX-MAN-000204" provides a list of the 1,046,161 unique files.

Step 5: Mandiant looked on the 46 systems produced in the data set known as "Data Warehouse" for additional duplicates of the 1,046,161 unique SSM files found on DCITBU01. Mandiant identified a total of 1,586,892 additional copies, with a total size of 2,024.29 GB throughout "Data Warehouse." See eAppendix – "ORCLX-MAN-000218."

In summary, Mandiant identified 4,577,317 copies of the 1,046,161 file hashes originally selected from DCITBU01 (see ORCLX-MAN-000142).

SAP TN System	Size (GB)	Number of Files
DCITBU01	4,351.99	3,296,812
TN-FS01	154.05	273,663
JDWSVR01	695.26	214,807
TNFS02	615.21	360,021
DCJDENT02	49.78	976
DCJDDEV03	49.78	975

DCJDWDEV01	20.86	9,646
DCPSTEMP01	4.28	42,768
DCPSTEMP02	3.32	24,888
HOMER	3.14	30,956
YOGI	0.98	6,106
TempStore	136.91	62,290
PSDJDDEV02	0.52	578
PSDEV01	0.31	6,717
TNWTS01	0.14	2,915
DCWTS01	0.0065	130
SBLPROD03	0.000067	2
SBLPROD02	0.0000020	1
Aggregate of Download Servers	103.04	243,066
PSNT01	**2.4**	**22,912**
Aggregate of Siebel Virtual Machines	**.7**	**10,633**
Total:	**6,192.68**	**4,610,862**

Table 17: Number of SSM Found On Data Warehouse

E. Comparison of SSMs to Registered Works

Mandiant performed a file-by-file comparison of the Customer Download Folders File-based Objects to the Registered Works. The Customer Download Folders Database was created from a subset of the SSMs on DCITBU01_G, namely, the folders of customers that SAP TN supported on PeopleSoft products. The objective was to determine how much copyrighted Oracle material from the File-based Objects in the Registered Works was included in the Customer Download Folders. These comparisons did not include JD Edwards or Siebel products, and only considered File-based Objects:

- 99.99% of the File-based Objects within the Customer Download Folders contained the Oracle copyright statement
- 99.99% of the File-based Objects within the Customer Download Folders contained the Oracle confidentiality statement
- 25% of the File-based Objects within the SAP TN Software Support Materials contained more than 98% of the best match of the Registered Oracle code
- 74% of the File-based Objects within the SAP TN Software Support Materials contained more than 90% of the best match of the Registered Oracle code

eAppendix – "ORCLX-MAN-000202" and eAppendix – "ORCLX-MAN-000014."

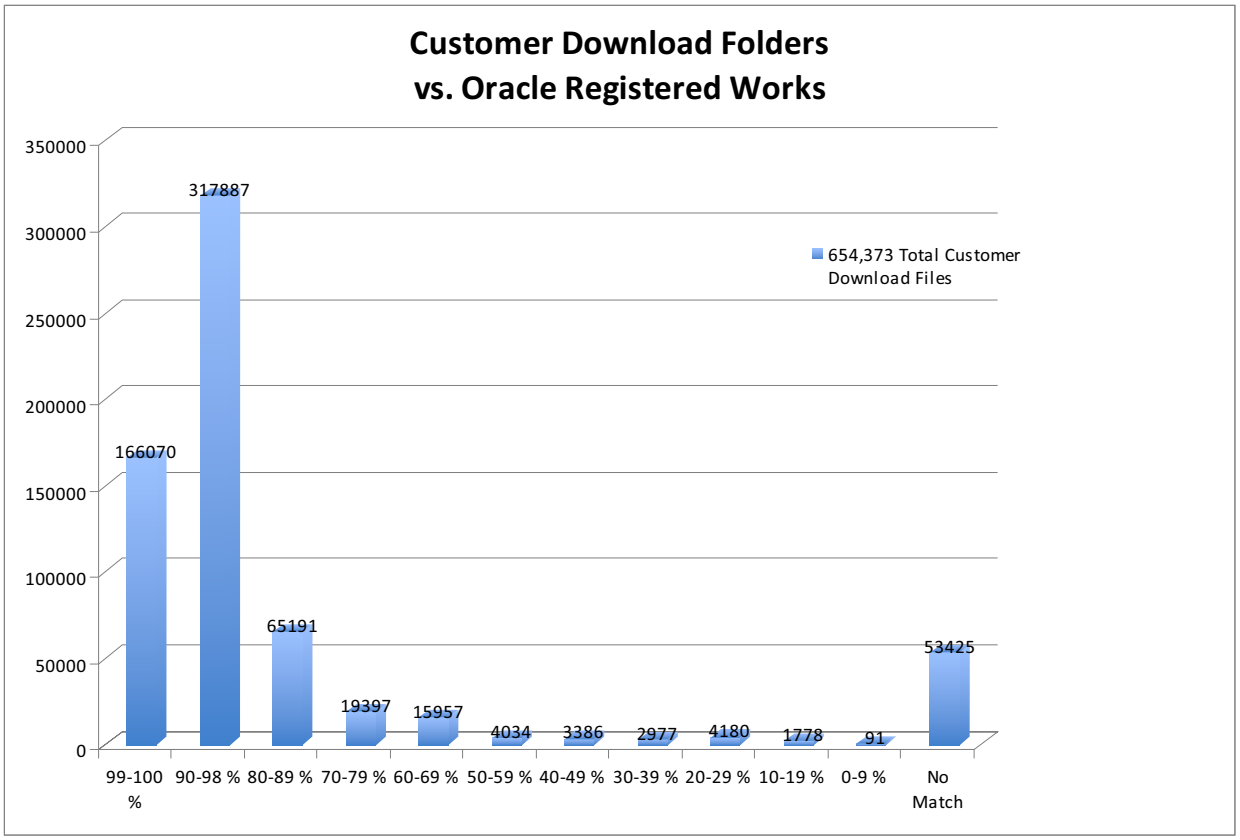

Figure 6: 74% of the File-based Objects within the SAP TN SSMs contained more than 90% of the best match of the Registered Oracle code

eAppendix – "ORCLX-MAN-000202" and eAppendix – "ORCLX-MAN-000014"

1. Statistics on Oracle/PeopleSoft Registered Software

Item	Count
Total Number of File-based Objects (unique)	31,084
Number of CBL Files	13,673
Number of SQR Files	10,135
Number of SQC Files	7,276
Number of Files Containing a Copyright Statement	31,080
Number of Files Lacking a Copyright Statement	4
Number of Files Containing a Confidentiality Statement	31,080
Number of Files Lacking a Confidentiality Statement	4

Table 18: Oracle/PeopleSoft Software Statistics

2. Statistics on Customer Download Folders

Item	Count
Total number of File-based Objects	654,784

Number of CBL files	217,029
Number of SQR files	333,157
Number of SQC files	104,598
Number of files containing a Copyright statement	654,779
Number of files lacking a Copyright statement	5
Number of files containing a Confidentiality statement	654,779
Number of files lacking a Confidentiality statement	5

Table 19: SAP TN Software Support Statistics

3. Statistics on Comparisons of Customer Download Files with Oracle Registered Software

Item	Count
Total number of comparisons performed	3,010,908
Number of TN files compared with Oracle data (SQR, SQC, CBL)	654,373
Number of TN files with a matching file name in the Oracle data	600,948
Number of TN files without a matching file name in the Oracle data	53,425

Table 20: Comparisons of Customer Download Files with Oracle Registered Software Statistics

Note that these comparisons are accurate as of November 10, 2009. At that time, the comparison process has been running for over 50 days. As of the date of this report, 100% of the Software Support Materials have been compared to 19 of the 23 Registered Works and 40% of the Software Support materials have been compared with the remaining 6 Registered Works.

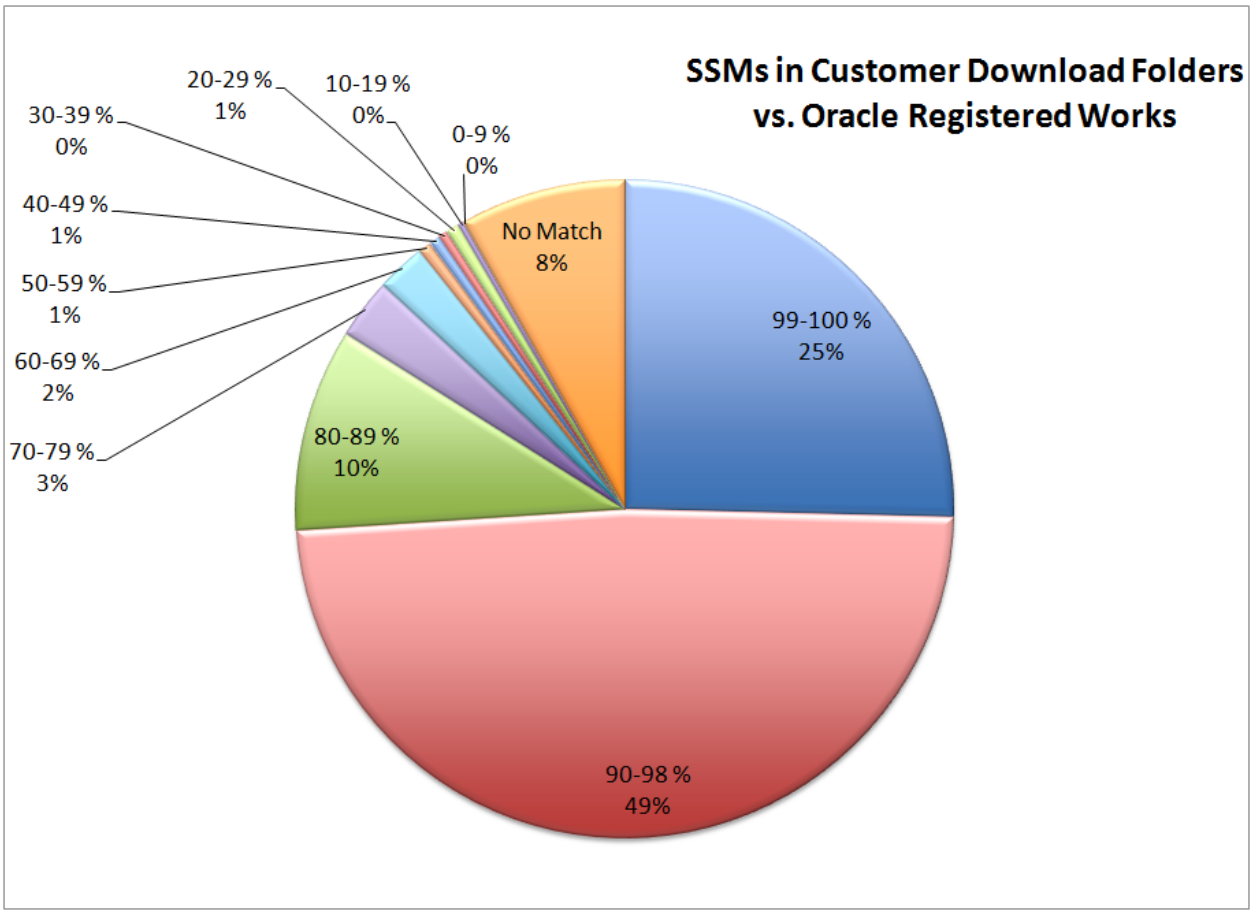

Figure 7: Distribution of SAP TN SSMs in Customer Download Folders Best Match Percentages When Compared to Registered Oracle Works

eAppendix – "ORCLX-MAN-000202" and eAppendix – "ORCLX-MAN-000194"

4. Procedure for comparison of the Oracle Registered File-based Objects to the Customer Download Folder File-based Objects

Mandiant compared pairs of files selected from the two data sources: File-based Objects from Oracle/PeopleSoft registered software and File-based Objects from customer folders on DCITBU01_G. Mandiant populated a Code Compare database with the information outlined in the table below:

Information Within the Code Compare Database	
Field Name	Description
compareID	Auto-generated unique index number
compareHash	MD5 hash of the unique comparison
softwaresupport_fileID	File ID of a File-based Object from the Customer Download Folder data set
ps_fileID	File ID of a File-based Object from the Oracle Registered data set
softwaresupport_lc	Number of lines in the SAP TN file
ps_lc	Number of lines in the Oracle registered file

c_pctdup	Percent of Oracle Registered file in the TN file
c_duplicate	Number of duplicate lines
c_TNnew	Number of new lines in the SAP TN file
c_PSnew	Number of new lines in the Oracle file
c_change	Number of lines with minor changes
c_leftig	Number of lines in Oracle file with minor changes
c_rightig	Number of lines in TN file with minor changes
diff_filename	File name of diff output

Table 21: Code Compare Database Fields

After the metadata and extracted data from both data sets were loaded into a database, Mandiant iterated through the "Customer Download Folder File-based Object" database. Each file name from this table was compared against the file names in the Oracle/PeopleSoft registered software table. If a match was found, a comparison was performed. No operations were performed on the original files that affected the contents. The flowchart in Figure 9 shows the process used to select and compare every File-based Object in the "Customer Download Folder File-based Object" database. Mandiant created a custom program to automate the following process:

a. The custom program accessed the two tables described in the prior sections of this report.

b. Mandiant's custom program loaded a file entry from the "Customer Download Folder File-based Objects" database for analysis. Note that this step executed on every file referenced in the "Customer Download Folder File-based Objects" database. This ensured each Customer Download Folder File-based Object would be compared to all Registered Works that had the same file name.

c. The program searched the "Oracle Registered File-based Objects" database for every file that matched the selected File-based Object from the "Customer Download Folder File-based Objects" database.

d. If no Oracle Registered File-based Object's name matched the Customer Download Folder File-based Object's name, this was noted in the Code Compare database with a 'placeholder record', described in Step E. Otherwise the process continued on to step F.

e. When no files matched by file name, a placeholder record was populated with the Customer Download Folder file index number (a unique value assigned to the code-based object record by the database) and a value of "0" in the PeopleSoft file ID field in the Code Compare database. The program started the process over by loading a new Customer Download Folder File-based Object entry for comparison.

f. If one or more files in the "Oracle Registered File-based Objects" database had the same file name as the Customer Download Folder File-based Object, the process looped through the comparison process for each pair of file name matches. For example, if files A, B and C from the Registered Works have the same file name as file #1 from the Customer Download Folder, the following three comparisons were performed:

- File #1 to File A
- File #1 to File B
- File #1 to File C

g. The program searched the Code-Compare database to determine whether the specific comparison had been performed. This comparison was based on the database index for each file record, the DUF file ID, and the PeopleSoft registered software file ID.

h. If the comparison had not been performed, the process continued by comparing the next pair of matched files or the process started over, and the program selected a new Customer Download Folder File-based Object for comparison.

i. If the comparison between the two files had not been performed, the program checked the database for a supplicate comparison based off of the MD5 hash values of both files. This can occur when the selected Customer Download Folder file was present in a different client's directory. If the file data had not been compared, the process continued to Step K. Otherwise it continued to Step J.

j. If the two files had previously been used in a comparison, the program duplicated the results previously obtained, marking the Customer Download Folder source to the current file. If the comparison had been performed, the process continued by comparing the next pair of matched files or the process started over, and the program selected a new TN Software Support file-based object for comparison.

k. If the comparison had not been performed, the process used a program called "diff" to generate an automated comparison of the two files. The "diff" process generated an output file that reported on several conditions as it performed a line-by-line comparison.

l. The output file from the "diff" process was preserved in a storage location for reference at a later date. All 'diff' output files are available for manual review.

m. Automated analysis of the "diff" output file was performed to extract the following results:

- Number of duplicate lines between the Customer Download Folder File-based Object and the Oracle Registered file.
- Number of lines unique to the Customer Download Folder File-based Object.
- Number of lines unique to the Oracle Registered file.
- Number of lines with minor changes between the Customer Download Folder File and Oracle Registered file.

n. Using the following equation, the program calculated the percentage of Oracle/PeopleSoft registered code that was present in the Customer Download Folder File-based Object. This figure was labeled as the value "c_pctdup" in the Code Compare database.

$$c\_pctdup = \frac{(\#\text{ of duplicate lines})}{(\#\text{ of lines in PeopleSoft Code})} * 100$$

Figure 8: Equation used to calculate percentage of Oracle/PeopleSoft registered code that was present in the Customer Download Folder File-based Object

The data collected in this iteration of the process was saved to the database.

If additional File-based Objects from the Registered Works matched the selected Customer Download Folder file, the program would return to Step F. Otherwise, the process would end for the selected SAP TN file. The next TN file would be selected and the process would begin again at Step A.

eAppendix – "ORCLX-MAN-000202"

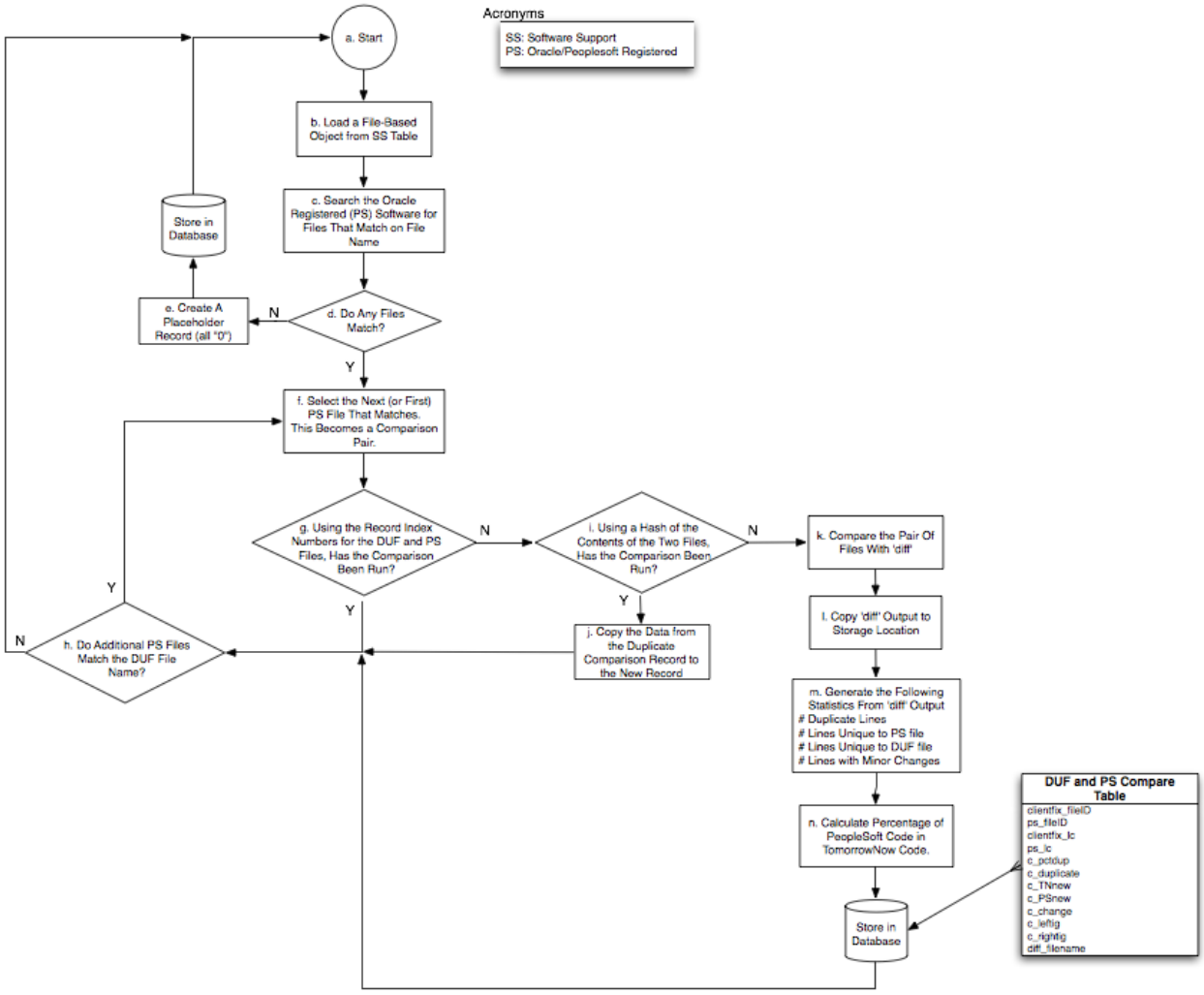

Figure 9: Illustration of the File-based Object Comparison Process

F. Comparison of Downloaded SSMs to Automated Databases

Mandiant performed an MD5 hash comparison of the files identified within the Automated Databases to the downloaded SSMs. As described above, the files of interest from the Automated Databases were compiled by file extension, and 246,629 unique MD5 hashes were used in the comparison. The objective was to determine how much Oracle material from the Automated Databases was present within the Customer Download Folders. These comparisons were performed for each product line JD Edwards, PeopleSoft, and Siebel. See ORCLX-MAN-00045, ORCLX-MAN-00046, ORCLX-MAN-000047, and ORCLX-MAN-000142.

1. Statistics on Automated Databases

Statistics on Automated Databases are listed below in Table 22:

Product Line	Number of Files Identified	Size of Identified Files in GB
JD Edwards	108,264	9.52
PeopleSoft	14,261	10.39
Siebel	28,564	1.33
Total:	**151,089**	**21.24**

Table 22: Automated Database File Statistics on DCITBU01[26]

2. Statistics on Comparisons of Customer Download Files with Oracle Registered Software

Item	Count
Total number of matches found by MD5 Hash	151,089
Number of TN files compared with Automated Databases (DOC, HTM, HTML, PDF, PPT, XLS, and ZIP)	2,415,526
Number of TN files with a matching file name in the Automated Databases	147,678
Number of TN files without a matching file name in the Automated Databases	3,411

Table 23: Comparisons of Customer Download Files on DCITBU01 with Oracle Registered Software Statistics

3. Procedure for comparison of the Automated Databases to the SSMs

Mandiant used the previously discussed files from the Automated Databases, specifically DOC, HTM, HTML, PDF, PPT, XLS, and ZIP files. Mandiant conducted the comparison of Automated Databases to the SSMs by utilizing the following process:

a. Mandiant calculated the MD5 hash values of all originally provided files as well as the decompressed contents from each ZIP file and each nested ZIP file.

b. Mandiant then searched for the 246,629 unique hash values across SAP TN's server "DCITBU01." Additionally, Mandiant conducted the same search across the entire Data Warehouse.

c. Mandiant compiled the results and determined the total number of files and size of those files for each product line.

Mandiant also conducted a manual review of 2,687 files within the Siebel folder on DCITBU01 that had names similar to the names of html files found within the Siebel Automated Database. Mandiant visually determined that 2,435 files matched.

The complete results are located in eAppendix - "ORCLX-MAN-000045", eAppendix – "ORCLX-MAN-000046", and eAppendix – "ORCLX-MAN-000047."

[26] Table 22 reports data concerning automated database files found on DCITBU01; Table 20 of my report reports data about automated database files on all SAP TN systems reviewed by Mandiant.

4. Comparison of Siebel SSMs from Custodial Productions to the Siebel Automated Database

Mandiant's review determined that SSMs downloaded from Oracle's SupportWeb often contained two standard sets of content in addition to download-specific content: an embedded Oracle survey by which customers could provide feedback to Oracle in regards to the document being viewed, and a closing section containing both confidentiality and copyright statements.

To determine whether the approximately 310,702 text files were downloads from SupportWeb, Mandiant performed three case-insensitive keyword searches. The keywords used were:

- "ORACLE CONFIDENTIAL" to identify the Oracle Confidential Statement
- "Copyright © 2006 Oracle Corporation" to identify the Oracle Copyright Statement
- "How easy was it to find" to identify the presence of the embedded Oracle survey.

The following tables provide the results of our keyword string search:

Keyword	Number of Files Containing the Keyword String Search	Percentage of Files that Contained the Keyword
"ORACLE CONFIDENTIAL"	262,275	84.4%
"Copyright © 2006 Oracle Corporation"	253,231	81.5%
"How easy was it to find"	49,293	15.9%

Table B: Results of Keyword Searches on Siebel Downloads on Custodian Machines

File Contained Oracle Survey	File Contained Oracle Copyright	File Contained Oracle Confidential	Total Number of files
Yes	Yes	Yes	825
No	Yes	Yes	251,406
Yes	Yes	No	0
Yes	No	Yes	44
No	Yes	No	0
Yes	No	No	48,424
No	No	Yes	10,000
No	No	No	3
Total			**310,702**

Table C: Combined Keyword String Results

Mandiant confirmed that approximately 99% of the total produced files contained at least one of three identifiers indicative of Oracle Software and Support Materials originating from the Siebel SupportWeb website. Approximately 310,700 of these files were Siebel SSMs downloaded from Oracle's Web site.[27] As shown in Table C, above, Mandiant identified only three files that did not match any of our search criteria. As reported in Table D, below, the content of one of the three files matched an SSM in the Siebel automated database, while the other two, which appeared to be downloads from third party software, did not.

Bates No.	EXPORTNATIVE	Notes
TN-OR09744564	\\NATIVE\TN-OR09744564\FAQ 1035.html	Matches content of FAQ1035 in Siebel automated database

[27] See eAppendix – ORCLX-MAN-000362 for complete results.

Bates No.	EXPORTNATIVE	Notes
TN-OR09918358	\\NATIVE\TN-OR09918358\wxpjoind[1].htm	Not a Siebel Download – from windowsnetworking.com
TN-OR09919014	\\NATIVE\TN-OR09919014\ntp[1].htm	Not a Siebel Download – from ntpsoftware.com

Table D: Analysis of Files with No Keyword Matches

The 310,702 files produced to Mandiant were not in native format; the Siebel Automated Database materials generally contain neither the Oracle survey nor the copyright and confidentiality closing section. Therefore, Mandiant could not match these files via MD5 hash to the Oracle Registered Works provided in the Siebel Automated Database, as any change to a file, however small, that modifies the content of a file changes its MD5 hash value. Instead, Mandiant matched exact file names on the production log to the Siebel Automated Database. Each of these files was referred to by its Bates number on the media provided.

For example, the file "TN-OR09736092.txt" was located in the path "Disc - MUV_PHI\MUVVALAC_HTML\0001\TN-OR09736092.txt". In order to determine the original file name of each Bates numbered file, Mandiant relied on the production log that correlated Bates numbered files with native file names (see ORCLX-MAN-000355).

Mandiant determined approximately 4,089 files were exact file name matches to files contained within the Siebel Automated Database (See ORCLX-MAN-000353).

Additionally, Mandiant identified files that were not exact file name matches but could be matched by normalizing file names. In order to normalize file names, Mandiant performed the following steps on file names contained in Siebel Downloads on Custodian Machines and the Automated Databases:

- Removed spaces contained in file names.
- Removed "-" when appended to the end of "alert".
- Replaced "technical" with "tech".
- Removed file extensions.

The following table identifies the steps Mandiant took to map files where the file name did not exactly match (See "ORCLX-MAN-000362).

File name Normalization	Number of File Name Changes in the Customer Download Files	Number of File Name Changes in the Siebel Automated Database
Removed spaces contained in file names	7265	904
Removed "-" when appended to the end of "alert"	1	160
Replaced "technical" with "tech"	826	2
Replace ".html" with ""	310696	113354
Replace ".htm" with ""	6	21922
Total File Name Changes	**318,794**	**136,342**

Table E: File Name Modifications

Mandiant determined an additional 6,010 files that matched by file name after Mandiant made the 5 different changes outlined in Table E to normalize the file names (See eAppendix – ORCLX-MAN-

000354). The following table represents the total number of file name matches per custodian after Mandiant made these file name changes:

Custodian	Number of File Name Matches - Exact	Number of Additional File Name Matches - Normalized	Total Number of File Name Matches
Cefola	1667	1	1668
Jahrsdoefer	2026	0	2026
Muvvalac	198	3005	3203
Phillips	198	3004	3202
Total	**4,089**	**6010**	**10,099**

Table F: File Name Matches of Siebel Downloads to the Siebel Automated Database

In order to determine whether the contents were exact content matches, Mandiant manually reviewed 39 custodian download files:

- Three alerts, three tech notes and three FAQs, selected in Bates number order, that matched by file name to the Siebel automated database without any normalization.

- 10 alerts, 10 technotes, and 10 FAQ's, selected in Bates number order, that matched by file name to the Siebel automated database after normalization of file names.

Mandiant determined that 26 of the 30 normalized-name-match files and nine exact-name-match files were exact matches in download-specific content despite having been converted to a text file and stripped of all html code. For each of the four files that did not match exactly, the Automated Database contained an updated version of the download-specific content (See ORCLX-MAN-000363 and ORCLX-MAN-000380).

These comparisons support my opinion that approximately 10,099 files present in the analyzed custodial productions are contained within the content of Oracle's automated database copyright registrations (see ORCLX-MAN-000353 and ORCLX-MAN-000354). Further, there is no way for Mandiant to verify that the SSMs in the custodial production were associated with any particular customers that might have had some license to download such files.

G. Comparison of SAP TN-attributed Fixes to the Registered Works

1. Overview

Mandiant performed a file-by-file comparison of the SAP TN PeopleSoft Delivered Updates and Fixes File-based Objects to the Registered Works Registered Works). The objective was to determine how much copyrighted Oracle material was included in the SAP TN Delivered Updates and Fixes. These comparisons did not include JD Edwards or Siebel products, and only considered the File-based Objects represented in Table 21.

- 98.4% of the File-based Objects within the SAP TN Delivered Updates and Fixes contained the Oracle copyright statement.

- 98% of the File-based Objects within the SAP TN Delivered Updates and Fixes contained the Oracle confidentiality statement.

- 52.5% of the File-based Objects within the SAP TN Delivered Updates and Fixes contained more than 90% of the best-match of the code in the Registered Works.

eAppendix – "ORCLX-MAN-000014"

a. Statistics on Oracle/PeopleSoft Registered Software

Item	Count
Total Number of File-based Objects (unique)	31,084
Number of CBL Files	13,673
Number of SQR Files	10,135
Number of SQC Files	7,276
Number of Files Containing a Copyright Statement	31,080
Number of Files Lacking a Copyright Statement	4
Number of Files Containing a Confidentiality Statement	31,080
Number of Files Lacking a Confidentiality Statement	4

Table 24: Oracle/ PeopleSoft Software Statistics

b. Statistics on SAP TN Delivered Updates and Fixes Software

Item	Count
Total Number of File-based Objects	6,447
Number of CBL Files	1,538
Number of SQR Files	3,801
Number of SQC files	1,108
Number of Files Containing a Copyright Statement	6,358
Number of Files Lacking a Copyright Statement	89
Number of Files Containing a Confidentiality Statement	6,329
Number of Files Lacking a Confidentiality Statement	118

Table 25: SAP TN Delivered Updates and Fixes Statistics

2. Procedure for Comparison of the Oracle Registered File-based Objects to the TN Delivered File-based Objects

Mandiant compared pairs of files selected from the two data sources; the File-based Objects from Oracle/PeopleSoft registered software and File-based Objects from SAP TN's Delivered Updates and Fixes repository. Mandiant populated a Code Compare database with the information outlined in the table below:

Information Within the Code Compare Database	
Field Name	Description
compareID	Auto-generated unique index number
clientfix_fileID	File ID of a File-based Object from the SAP TN DUF data set
ps_fileID	File ID of a File-based Object from the Oracle Registered data set
clientfix_lc	Number of lines in the SAP TN file

ps_lc	Number of lines in the Oracle registered file
c_pctdup	Percent of Oracle Registered file in the TN file
c_duplicate	Number of duplicate lines
c_TNnew	Number of new lines in the SAP TN file
c_PSnew	Number of new lines in the Oracle file
c_change	Number of lines with minor changes
c_leftig	Number of lines in Oracle file with minor changes
c_rightig	Number of lines in TN file with minor changes
diff_filename	File name of diff output

Table 26: Code Compare Database Fields

After the metadata and extracted data from both data sets were loaded into a database, Mandiant iterated through the Delivered Updates and Fixes table. Each file name from this table was compared against the file names in the Oracle/PeopleSoft registered software table. If a match was found, a comparison was performed. No operations were performed on the original files that affected the contents. The flowchart in Figure 11 shows the process used to select and compare every File-based Object in the "TN Delivered File-based Objects" database. Mandiant created a custom program to automate the following process:

a. The custom program accessed the two tables described in the prior sections of this report.

b. Mandiant's custom program loaded a file entry from the "TN Delivered File-based Objects" database for analysis. Note that this step executed on every file referenced in the "TN Delivered File-based Objects" database. This ensured each TN Delivered File-based Object would be compared to all Registered Works that had the same file name.

c. The program searched the "Oracle Registered File-based Objects" database for every file that matched the selected File-based Object from the "TN Delivered File-based Objects" database.

d. If no Oracle Registered File-based Object's name matched the TN Delivered File-based Object's name, this was noted in the Code Compare database with a "placeholder record," described in Step E. Otherwise the process continued on to Step F.

e. When no files matched by file name, a placeholder record was populated with the delivered update and fix file index number (a unique value assigned to the delivered code-based object record by the database) and a value of "0" in the PeopleSoft file ID field in the Code Compare database. The program started the process over by loading a new TN delivered File-based Object entry for comparison.

f. If one or more files in the "Oracle Registered File-based Objects" database had the same file name as the TN delivered File-based Object, the process looped through Steps I-J for each pair of file name matches. For example, if files A, B and C from the Registered Works have the same file name as file #1 from the TN Updates and Fixes, the following three comparisons were performed:

- File #1 to File A
- File #1 to File B
- File #1 to File C

g. The program searched the Code-Compare database to determine whether the specific comparison had been performed. This comparison was based on the database index for each file record, the DUF file ID, and the PeopleSoft registered software file ID.

h. If the comparison had not been performed, the process continued by comparing the next pair of matched files or the process started over, and the program selected a new TN Delivered File-based Object for comparison.

i. If the comparison had not been performed, the process used a program called "diff" to generate an automated comparison of the two files. The "diff" process generated an output file that reported on several conditions as it performed a line-by-line comparison.

j. The output file from the "diff" process was preserved in a storage location for reference at a later date. All "diff" output files are available for manual review.

k. Automated analysis of the "diff" output file was performed to extract the following results.

l. Number of duplicate lines between the TN Delivered File-based Object and the Oracle Registered file.

m. Number of lines unique to the TN Delivered File-based Object.

n. Number of lines unique to the Oracle Registered file.

o. Number of lines with minor changes between the TN Delivered file and Oracle Registered file.

p. Using the following equation, the program calculated the percentage of Oracle/PeopleSoft registered code that was present in the SAP TN Delivered Updates and Fixes File-based Object. This figure was labeled as the value "c_pctdup" in the Code-Compare database.

$$c\_pctdup = \frac{(\#\text{ of duplicate lines})}{(\#\text{ of lines in PeopleSoft Code})} * 100$$

Figure 10: Equation used to calculate percentage of Oracle/PeopleSoft registered code that was present in the SAP TN Delivered Updates and Fixes File-based Object

The data collected in this iteration of the process was saved to the database.

If additional File-based Objects from the Registered Works matched the selected SAP TN Delivered Updates and Fixes file, the program would return to Step F. Otherwise, the process would end for the selected SAP TN file. The next TN file would be selected and the process would begin again at step b.

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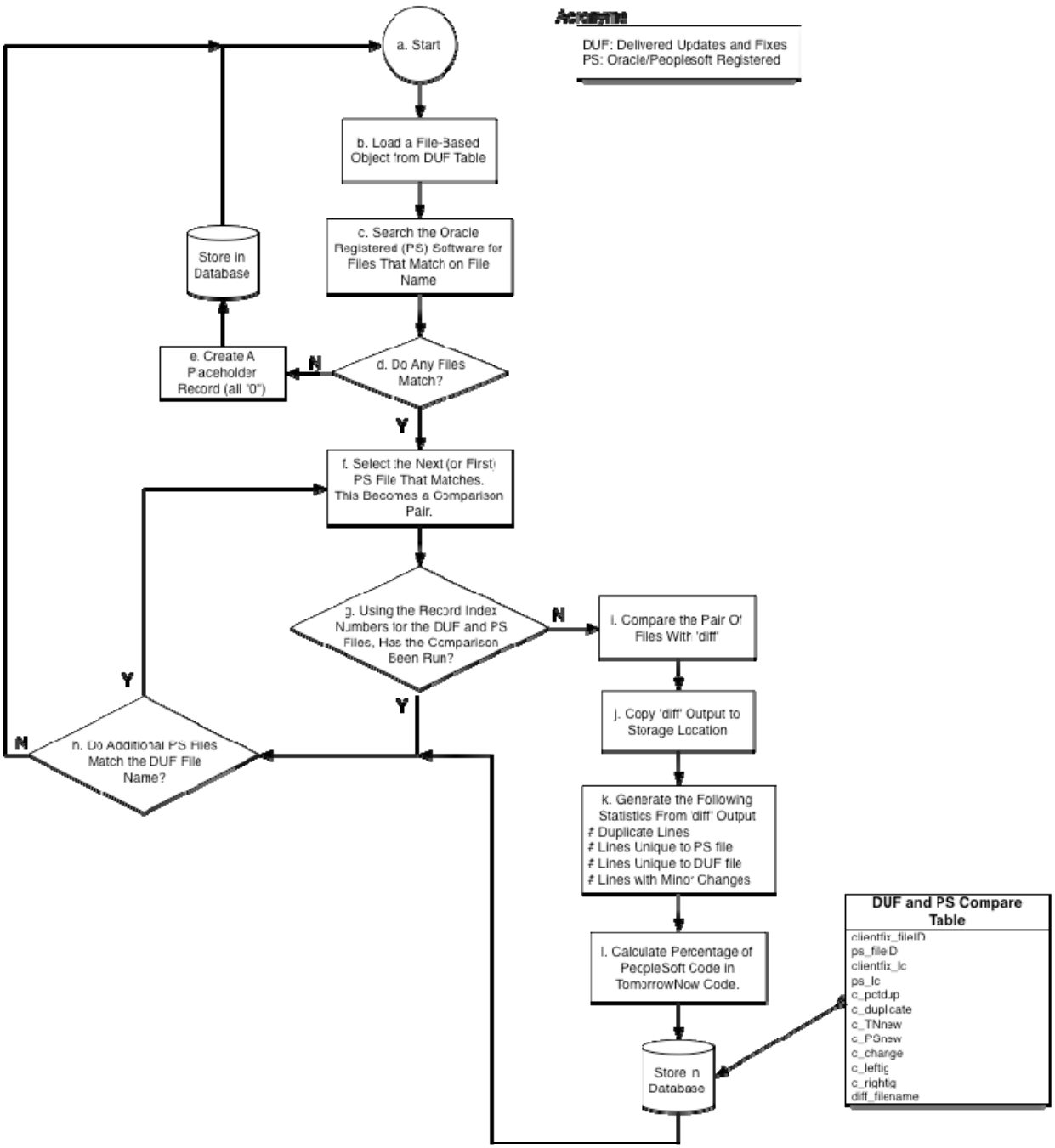

Figure 11: Illustration of the File-based Object Comparison Process

3. Procedure for Comparison of the Remaining Delivered Updates and Fixes File-based Objects to the Customer Download Folder File-based Objects

Mandiant compared pairs of files selected from the two data sources; the File-based Objects from SAP TN's PeopleSoft Delivered Updates and Fixes that had no file name match in previous

comparisons and File-based Objects from the Customer Download Folder repository. Mandiant populated a Code Compare database with the information outlined in the table below:

Information Within the Code Compare Database	
Field Name	Description
compareID	Auto-generated unique index number
CompareHash	Hash that uniquely identifies a particular comparison
DUF_fileID	File ID of a File-based Object from the SAP TN DUF data set
softwaresupport_fileID	File ID of a File-based Object from the Oracle Customer Download Folder data set
DUF_lc	Number of lines in the SAP TN Delivered Updates and Fixes file
softwaresupport_lc	Number of lines in the Oracle Customer Download Folder file
c_pctdup	Percent of Oracle Customer Download Folder file in the TN file
c_duplicate	Number of duplicate lines
c_TNnew	Number of new lines in the SAP TN file
c_PSnew	Number of new lines in the Oracle file
c_change	Number of lines with minor changes
c_leftig	Number of lines in Oracle file with minor changes
c_rightig	Number of lines in TN file with minor changes
diff_filename	File name of diff output

Table 27: Code Compare Database Fields

After the metadata and extracted data from both data sets were loaded into a database, Mandiant iterated through a list of Delivered Updates and Fixes that did not have a file name match in the previous comparison operation (TN Delivered Updates and Fixes vs. Oracle Registered). Each file name from this table was compared against the file names in the SAP TN Customer Download Folder table. If a match was found, a comparison was performed. No operations were performed on the original files that affected the contents.

The comparisons run during this operation duplicated the process described in the section titled "Comparing the Oracle Registered File-based Objects to the TN Delivered File-based Objects."

4. Findings Re Data Comparisons

a. Delivered Updates and Fixes Comparisons to Registered Works

Item	Count
Total Number of Comparisons Performed	28,271
Number of TN Files Compared with Oracle data (SQR, SQC, CBL)	6,447
Number of TN Files with a Matching a File Name in the Register Oracle Data	5,475
Number of TN Files without a Matching File Name in the Registered Oracle Data	972
Number of TN Files that did Not Match an Oracle Registered Work Filename (972) with a Matching File Name found in the SSMs Download Server (DCITBU01).	868
Number of TN Files Without a Matching File Name in the Registered Oracle Works or the SSMs on the Download Server (DCITBU01)	104

Table 28: Statistics of Comparisons of Delivered Updates and Fixes to Registered Works

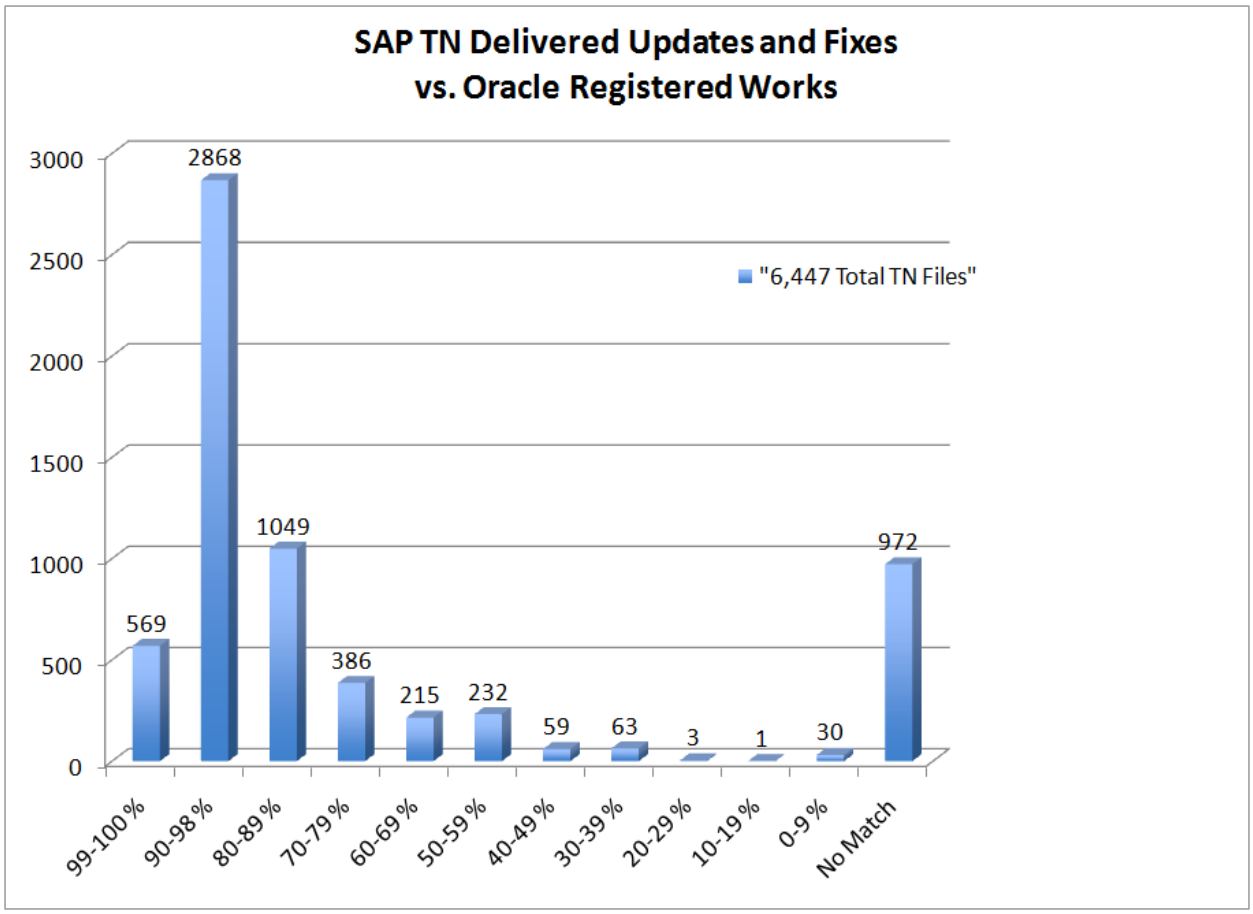

Figure 12: Percentage of Oracle Registered Works Contained within the SAP TN Delivered Updates and Fixes

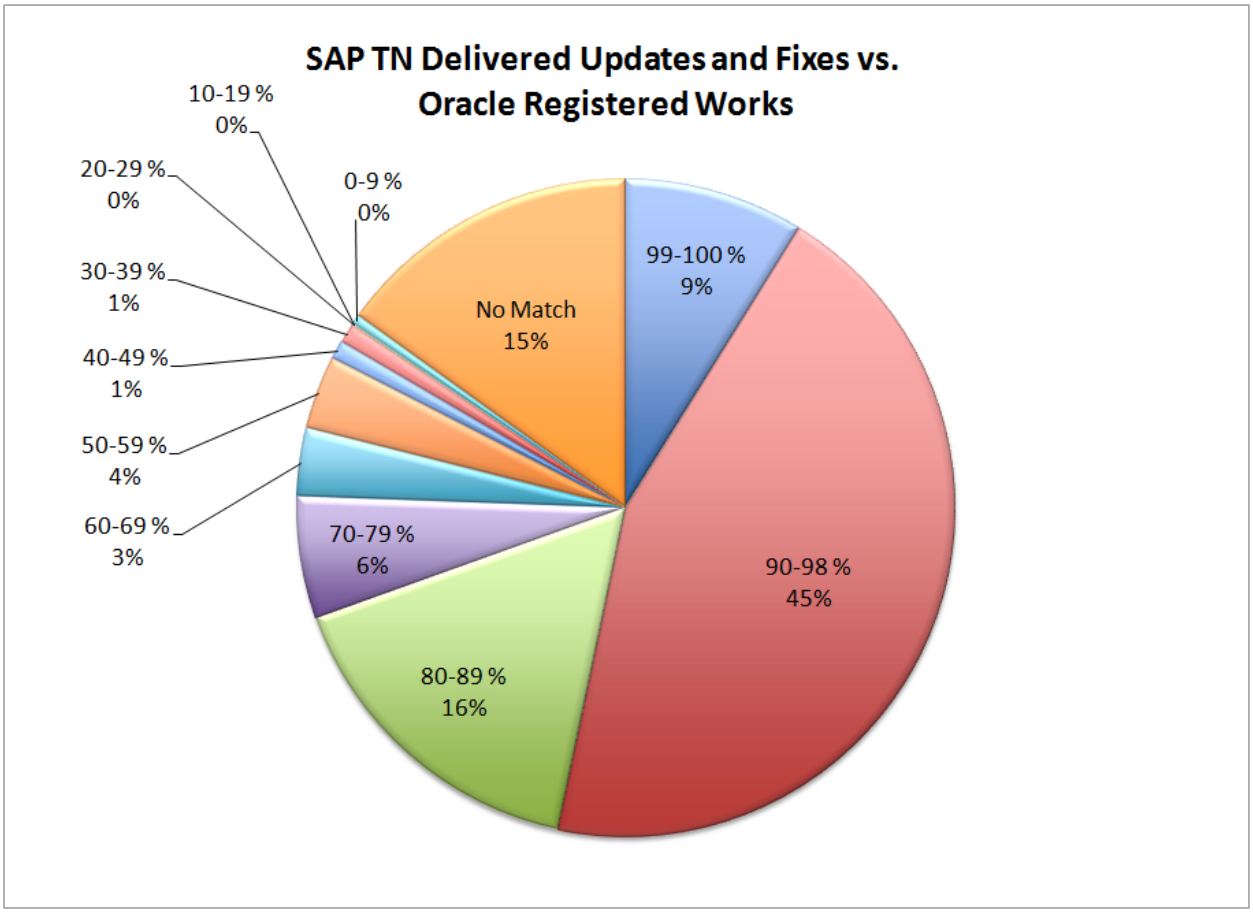

Figure 13: Distribution of SAP TN Delivered Updates and Fixes Best Match Percentages When Compared to Registered Oracle Works

b. Delivered Updates and Fixes Comparisons to Downloaded SSMs in the Customer Download Folders

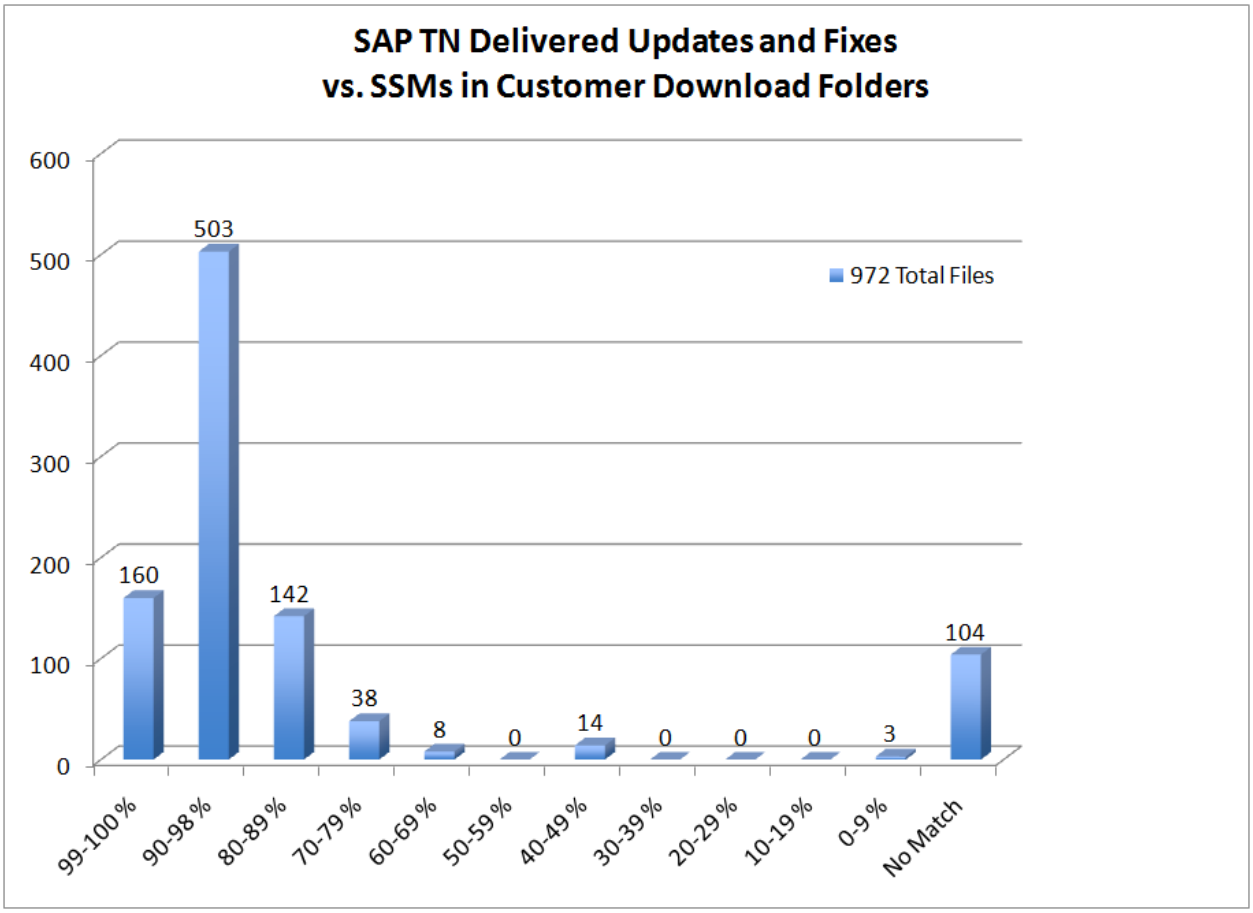

Figure 14: Percentage of SSMs in Customer Download Folders Contained Within SAP TN Delivered Updates and Fixes

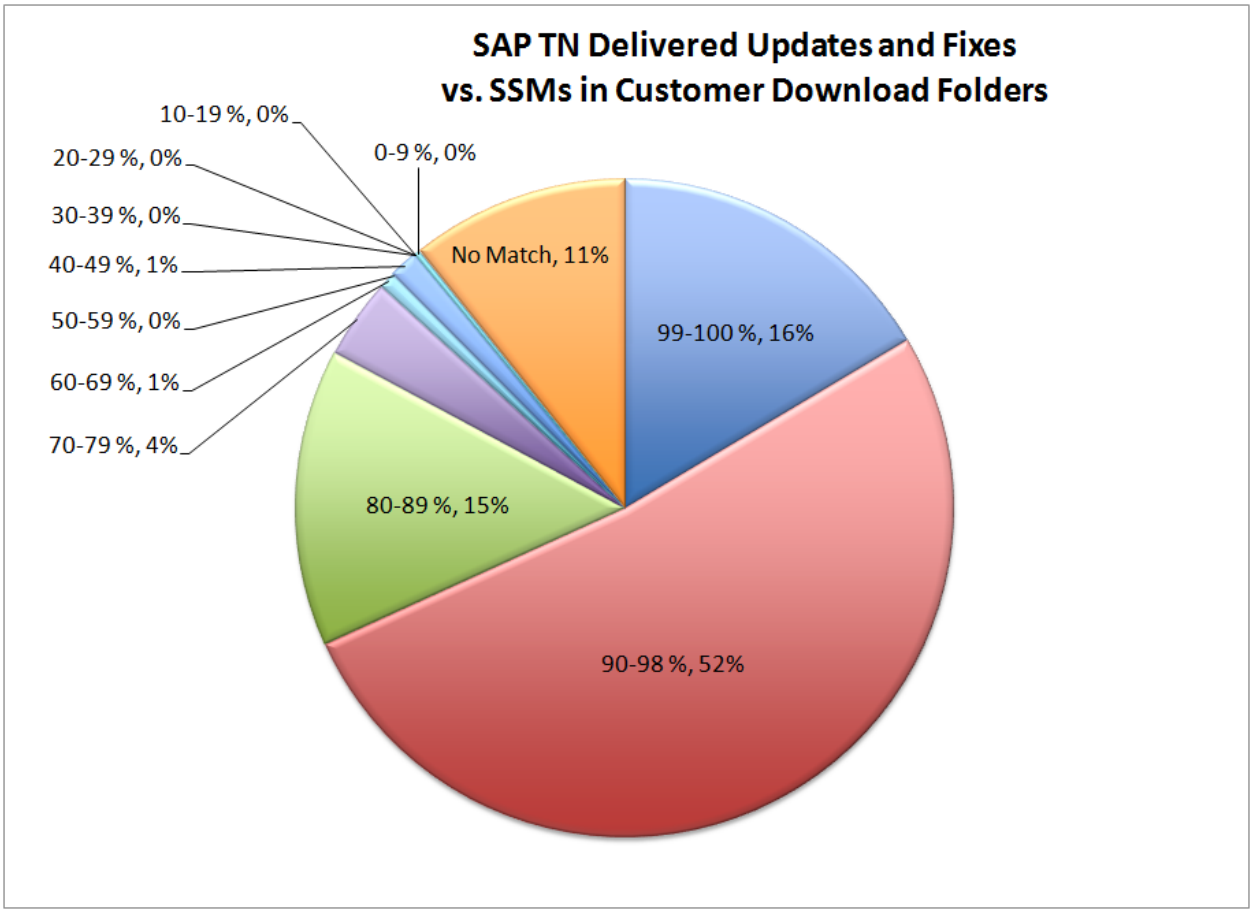

Figure 15: Distribution of SAP TN Delivered Updates and Fixes Best Match Percentages When Compared to SSMs in Customer Download Folders

eAppendix – "ORCLX-MAN-000014"

H. SAP TN Environments

Mandiant compared a sample set of SAP TN Environments against different installations of Registered Works. Comparisons between the Environments and the associated Registered Works took into account the closest matches in version numbers and application type as determined from the Environment to come to the results provided.

1. Comparison of SAP TN PS_HOMEs to PeopleSoft Application Software Registered Works

a. Methodology

For purposes of the comparison, Mandiant regarded the SAP TN Environments as composed of two separate PeopleSoft applications: the PeopleSoft base application and an associated PeopleTools version. Each Environment comparison was conducted against a registered version of a PeopleSoft base application program and a Registered Work of a PeopleSoft PeopleTools application. Each of the 41 Environments examined was compared to one or more base applications and versions of

PeopleTools. Table 29 below lists materials compared, together with file counts for the materials being compared.

Environment Name	Base Application	People Tools Application	Total Number Customer Environment Files	Total Number of Base App Files Base	Total Number of People Tools Files
c840prgm_20060418_2054	CRM 8.0	PT 8.4	11172	160	8795
c840prgm_20060418_2054	CRM 8.1	PT 8.4	11172	203	8795
c840prgm_20060418_2054	CRM 8.8	PT 8.4	11172	254	8795
c840prgm_20070309_0119	CRM 8.0	PT 8.4	11956	160	8795
c840prgm_20070309_0119	CRM 8.1	PT 8.4	11956	203	8795
c840prgm_20070309_0119	CRM 8.8	PT 8.4	11956	254	8795
c881mgio_20060631_1328	CRM 8.8	PT 8.4	16120	254	8795
c881mgio_20070219_1423	CRM 8.8	PT 8.4	8568	254	8795
c890mgio_20060731_1319	CRM 8.8	PT 8.4	16140	254	8795
c890mgio_20070219_1423	CRM 8.8	PT 8.4	8237	254	8795
e881beao_20060412_1034	EPM 8.8	PT 8.4	12927	420	8795
e890moho_20061002_2342	EPM 8.8	PT 8.4	7813	420	8795
e890moho_20070219_1404	EPM 8.8	PT 8.4	7771	420	8795
f752itro_20070423_1007	FSCM7.5	PT 7.5	3159	4337	1750
f752itro_20070423_1007	FSCM7.5	PT 8.0	3159	4337	2375
f752itro_20070423_1007	FSCM8.0	PT 7.5	3159	4825	1750
f752itro_20070423_1007	FSCM8.0	PT 8.0	3159	4825	2375
f752itro_20070423_1007	FSCM8.0 SP1	PT 7.5	3159	4876	1750
f752itro_20070423_1007	FSCM8.0 SP1	PT 8.0	3159	4876	2375
f752itro_20070423_1007	FSCM8.0 SP2	PT 7.5	3159	5836	1750
f752itro_20070423_1007	FSCM8.0 SP2	PT 8.0	3159	5836	2375
f753nclo_20070510_0907	FSCM7.5	PT 7.5	4404	4337	1750
f753nclo_20070510_0907	FSCM7.5	PT 8.0	4404	4337	2375
f753nclo_20070510_0907	FSCM8.0	PT 7.5	4404	4825	1750
f753nclo_20070510_0907	FSCM8.0	PT 8.0	4404	4825	2375
f753nclo_20070510_0907	FSCM8.0 SP1	PT 7.5	4404	4876	1750
f753nclo_20070510_0907	FSCM8.0 SP1	PT 8.0	4404	4876	2375
f753nclo_20070510_0907	FSCM8.0 SP2	PT 7.5	4404	5836	1750
f753nclo_20070510_0907	FSCM8.0 SP2	PT 8.0	4404	5836	1750
f753nclo_20070510_0907	FSCM8.0 SP2	PT 8.0	4404	5836	2375
f803prgm_20060303_1331	FSCM8.0	PT 8.1	13560	4825	7186
f803prgm_20060303_1331	FSCM8.0	PT 8.4	13560	4825	8795
f803prgm_20060303_1331	FSCM8.0 SP1	PT 8.1	13560	4876	7186
f803prgm_20060303_1331	FSCM8.0 SP1	PT 8.4	13560	4876	8795

Environment Name	Base Application	People Tools Application	Total Number Customer Environment Files	Total Number of Base App Files Base	Total Number of People Tools Files
f803prgm_20060303_1331	FSCM8.0 SP2	PT 8.1	13560	5836	7186
f803prgm_20060303_1331	FSCM8.0 SP2	PT 8.4	13560	5836	8795
f803prgm_20060303_1331	FSCM8.4	PT 8.1	13560	3958	7186
f803prgm_20060303_1331	FSCM8.4	PT 8.4	13560	3958	8795
f803rplo_20070308_1308	FSCM8.0	PT 8.1	9534	4825	7186
f803rplo_20070308_1308	FSCM8.0	PT 8.4	9534	4825	8795
f803rplo_20070308_1308	FSCM8.0 SP1	PT 8.1	9534	4876	7186
f803rplo_20070308_1308	FSCM8.0 SP1	PT 8.4	9534	4876	8795
f803rplo_20070308_1308	FSCM8.0 SP2	PT 8.1	9534	5836	7186
f803rplo_20070308_1308	FSCM8.0 SP2	PT 8.4	9534	5836	8795
f803rplo_20070308_1308	FSCM8.4	PT 8.1	9534	3958	7186
f803rplo_20070308_1308	FSCM8.4	PT 8.4	9534	3958	8795
f840pcao_20061004_1918	FSCM8.4	PT 8.4	30025	3958	8795
f840PCAO_20070314_0932	FSCM8.4	PT 8.4	29219	3958	8795
f841amim_20060423_2300	FSCM8.4	PT 8.4	14091	3958	8795
f841nclo_20070509_1455	FSCM8.4	PT 8.4	10048	3958	8795
f842cbro_20060301_1101	FSCM8.4	PT 8.4	13975	3958	8795
f842tsum_20070305_1647	FSCM8.4	PT 8.4	25238	3958	8795
f881siro_20060309_1631	FSCM8.4	PT 8.4	18592	3958	8795
f881welm_20070228_0810	FSCM8.4	PT 8.4	15568	3958	8795
f890aoso_20070509_1707	FSCM8.4	PT 8.4	37964	3958	8795
h702rhim_20060705_1307	HRMS 7.0	PT 7.5	6704	2847	1750
h702rhim_20060705_1307	HRMS 7.5	PT 7.5	6704	2830	1750
h702rhim_20070412_0941	HRMS 7.0	PT 7.5	7234	2847	1750
h702rhim_20070412_0941	HRMS 7.5	PT 7.5	7234	2830	1750
h750nfso_20060821_2313	HRMS 7.5	PT 7.5	7889	2830	1750
h750nfso_20060821_2313	HRMS 7.5	PT 8.0	7889	2830	2375
h750nfso_20060906_1024	HRMS 7.5	PT 7.5	7889	2830	1750
h750nfso_20060906_1024	HRMS 7.5	PT 8.0	7889	2830	2375
h751nclo_20080123_0146	HRMS 7.5	PT 7.5	4843	2830	1750
h751nclo_20080123_0146	HRMS 7.5	PT 8.0	4843	2830	2375
h751nclo_20080123_0146	HRMS 8.0	PT 7.5	4843	3207	1750
h751nclo_20080123_0146	HRMS 8.0	PT 8.0	4843	3207	2375
h751telo_20060322_1402	HRMS 7.5	PT 7.5	5250	2830	1750
h751telo_20060322_1402	HRMS 7.5	PT 8.0	5250	2830	2375
h801qgis_20060330_1511	HRMS 8.0 SP1	PT 8.1	14519	3259	7186

Environment Name	Base Application	People Tools Application	Total Number Customer Environment Files	Total Number of Base App Files Base	Total Number of People Tools Files
h801qgis_20060330_1511	HRMS 8.0 SP1	PT 8.4	14519	3259	8795
h801roso_20080321_1956	HRMS 8.0 SP1	PT 8.1	7004	3259	7186
h801roso_20080321_1956	HRMS 8.0 SP1	PT 8.4	7004	3259	8795
h830flio_20060403_1448	HRMS 8.3	PT 8.1	13956	4716	7186
h830flio_20060403_1448	HRMS 8.3	PT 8.4	13956	4716	8795
h830flio_20070402_1057	HRMS 8.3	PT 8.1	7725	4716	7186
h830flio_20070402_1057	HRMS 8.3	PT 8.4	7725	4716	7186
h831blsd_20060309_1735	HRMS 8.3	PT 8.1	15365	4716	7186
h831blsd_20060309_1735	HRMS 8.3	PT 8.4	15365	4716	8795
h831blsd_20060309_1735	HRMS 8.8	PT 8.1	15365	3763	7186
h831blsd_20060309_1735	HRMS 8.8	PT 8.4	15365	3763	8795
h831olni_20080327_2305	HRMS 8.3	PT 8.1	9270	4716	7186
h831olni_20080327_2305	HRMS 8.3	PT 8.4	9270	4716	8795
h831olni_20080327_2305	HRMS 8.8	PT 8.1	9270	3763	7186
h831olni_20080327_2305	HRMS 8.8	PT 8.4	9270	3763	8795
h880pilm_20070502_1328	HRMS 8.8	PT 8.4	18470	3763	8795
h881ddmo_20060308_0717	HRMS 8.8	PT 8.4	11720	3763	8795
h881ebmo_20080328_0538	HRMS 8.8	PT 8.4	10949	3763	8795
h890fuao_20080213_0206	HRMS 8.8	PT 8.4	10701	3763	8795
h890gknm_20060524_0450	HRMS 8.8	PT 8.4	23096	3763	8795
s801u21o_20061122_2238	SA 8.0	PT 8.1	2235	6991	7186
s801u21o_20061122_2238	SA 8.0	PT 8.4	2235	6991	8795
s801u21o_20080403_0112	SA 8.0	PT 8.1	2235	6991	7186
s801u21o_20080403_0112	SA 8.0	PT 8.4	2235	6991	8795

Table 29: SAP TN PS_HOME Statistics

Three separate comparisons were made for each Environment. The first comparison determined the number of unique files by MD5 hash from an installation of the PeopleSoft Registered Works that were in an Environment.

The second comparison determined the number of unique files by path name from an installation of the PeopleSoft Registered Works that were in an Environment. The following methodology was used to acquire the below results for the first two comparisons:

Step 1: Install each Registered Work of the PeopleSoft base application provided by Oracle into separate directories

Step 2: Install each Registered Work of the PeopleSoft PeopleTools application provided by Oracle into separate directories

Step 3: Recursively process a PeopleSoft Registered Work base application directory using MD5Deep to calculate the MD5 hash and path for every file

Step 4: Recursively process a PeopleSoft Registered Work PeopleTools application directory using MD5Deep to calculate the MD5 hash and path for every file

Step 5: Recursively process an Environment using MD5Deep to calculate the MD5 hash and path for every file

Step 6: To process MD5 hash comparison, run a Mandiant written script to do the following:[28]

- Sort the MD5's for the PeopleSoft Registered Works, PeopleTools and Environment in their respective alphabetical order
- Compare an MD5 hash value from the PeopleSoft Registered Work to a SAP TN customer environment
- If the current file being compared from the original PeopleSoft Registered Works base application is the same as the previous file, skip the file to take into account duplicate files within the PeopleSoft registered work environment
- If the PeopleSoft registered work MD5 is the same as the Environment MD5, count the file as existing in the Environment
- As soon as a match is found, start comparison on the next MD5 file so duplicate MD5's are not matched within the Environment
- Compare an MD5 hash value from the PeopleSoft PeopleTools Registered Work to an Environment taking into account duplicate files with the same MD5
- If the current file being compared from the original PeopleSoft PeopleTools Registered Work is the same as the previous file, skip the file to take into account duplicate files within the PeopleSoft Registered Work environment
- If the PeopleSoft registered work MD5 is the same as the Environment MD5, count the file as existing in the Environment
- As soon as a match is found, start comparison on the next MD5 file so duplicate MD5's are not matched within the Environment
- Calculate the total number of unique MD5 files within a PeopleSoft Registered Work base application and PeopleSoft PeopleTools application environments

Step 7: Within the same Mandiant written script, do the following for file path comparisons:

- Remove the customer specific installation path from the overall installation path for the PeopleSoft Registered Works, PeopleSoft PeopleTools application and Environment in alphabetical order

[28] Mandiant has produced the scripts used for these comparisons. *See* ORCLX-MAN-000187 (script to compare the results of two md5deep outputs); ORCLX-MAN-000188 (script that executes ORCLX-MAN-000187 multiple times); ORCLX-MAN-000385 (md5deep outputs).

- Sort the file paths for the PeopleSoft Registered Works base application, PeopleSoft PeopleTools application and customer environment in alphabetical order
- Compare each file path within the PeopleSoft Registered Work file path to an Environment file path
- Compare each file path within the PeopleSoft PeopleTools application file path to an Environment file path
- Calculate the total number of unique file path matches from the respective PeopleSoft Registered Works and PeopleSoft PeopleTools application environments

Step 8: Output the number Environment, Registered Works application comparisons, the total number of files in each environment, the calculated MD5 results comparison results, and calculated file path comparison results.

The third comparison involved determining the average percentage of code within File-based Objects that existed in an Environment when compared to a PeopleSoft Registered Works installation environment. This methodology incorporated Mandiant's code compare analysis between an Environment and the closest match PeopleSoft Registered Works environment. The results of the comparison returned the best match for the PeopleSoft Registered Works base application and PeopleSoft Registered Works PeopleTools application. Within the best match for both the PeopleSoft Registered Works application and the PeopleSoft PeopleTools application, the number of distinct Registered Works File-based Objects that were in the Registered Works that also existed in the Environment and the average percentage of file match.

b. Illustrative results: PeopleSoft HRMS environments

HRMS 7.02

H702rhim_20060705_1307: 99.72% of files from vanilla installation of registered version of HRMS 7.0 found in back-up; 51.79% of files were an exact match by hash.

H702rhim_20070412_0941: 99.72% of files from vanilla installation of registered version of HRMS 7.0 found in back-up; 51.79% of files were an exact match by hash.

HRMS 7.5 and 7.51

H750nfso_20060821_2313: 22.79% of files from vanilla installation of registered version of HRMS 7.5 found in back-up; 1.38% of files were an exact match by hash.[29]

H750nfso_20060906_1024: 22.79% of files from vanilla installation of registered version of HRMS 7.5 found in back-up; 1.38% of files were an exact match by hash.

H751nclo_20080123_0146: 39.36% of files from vanilla installation of registered version of HRMS 7.5 found in back-up; 4.93% of files were an exact match by hash

H751telo_20060322_1402: 92.93% of files from vanilla installation of registered version of HRMS 7.5 found in back-up; 20.23% of files were an exact match by hash

[29] H750NFSO was an HRMS 7.5 Asia Pacific environment.

HRMS 8.0 SP1

h801qgis_20060330_1511: 81.83% of files from vanilla installation of registered version of HRMS 8.0 SP1 found in back-up; 47.73% of files were an exact match by hash.

h801roso_20080321_1956: 47.90% of files from vanilla installation of registered version of HRMS 8.0 SP1 found in back-up; 5.5% of files were an exact match by hash.

HRMS 8.3 and 8.3 SP1

h830flio_20060403_1448: 68.00% of files from vanilla installation of registered version of HRMS 8.3 found in back-up; 51.34% of files were an exact match by hash.

h830flio_20070402_1057: 39.02% of files from vanilla installation of registered version of HRMS 8.3 found in back-up; 7.59% of files were an exact match by hash.

h831blsd_20060309_1735: 66.28% of files from vanilla installation of registered version of HRMS 8.3 found in back-up; 34.97% of files were an exact match by hash.

h831olni_20080327_2305: 35.37% of files from vanilla installation of registered version of HRMS 8.3 found in back-up; 17.56% of files were an exact match by hash.

HRMS 8.8, 8.8 SP1, and 8.9

h880pilm_20070502_1328: 65.29% of files from vanilla installation of registered version of HRMS 8.8 found in back-up; 65.42% of files were an exact match by hash.

h881ddmo_20060308_0717: 71.59% of files from vanilla installation of registered version of HRMS 8.8 found in back-up; 45.27% of files were an exact match by hash.

h881ebmo_20080328_0538: 40.15% of files from vanilla installation of registered version of HRMS 8.8 found in back-up; 1.09% of files were an exact match by hash.

h890fuao_20080213_0206: 38.85% of files from vanilla installation of registered version of HRMS 8.8 found in back-up; 0.91% of files were an exact match by hash.

h890gknm_20060524_0450: 62.85% of files from vanilla installation of registered version of HRMS 8.8 found in back-up; 8.1% of files were an exact match by hash.

c. Conclusion

The environment comparisons between the Environments against the PeopleSoft Registered Works environments through the use of corresponding path names confirmed a similar layout between the environments. The layout does not take into account file contents as opposed to either the MD5 analysis of the code compare analysis. Although content was not taken into account, a high percentage of file name matches indicating a similar structure and layout consistent between a SAP TN customer environment and an installation of the PeopleSoft Registered Works base application and the PeopleSoft PeopleTools Registered Works application. Similar to an MD5 comparison, the file name structure varied across different installations and Registered Works application environments ranging between matches in the lower 90% to matches in the single digit percentages. However, on average, each environment contained an average of approximately 52.6% percent of file matches by name only.

The environment comparisons between the Environments and the PeopleSoft Registered Works environments through the use of MD5 hashes consist of an all-or-nothing comparison, as an MD5 hash is unique provided a given set of data. Based on the MD5 comparison alone, a portion of the PeopleSoft Registered Works is an exact match to the Environments. However, the amount of exact PeopleSoft Registered Works data contained within the Environment is highly dependent on the number of Updates, Fixes or changes to files that have been made to the Environment. The modification of one letter within a single text file can drastically change the MD5 of the file and result in no match (for example, the change in copyright containing the year 2008 to 2009 will completely change the hash of the file). As can be identified through the results of the MD5 comparison, the percentage of exact matches is highly dependent on the PeopleSoft Registered Works base application and corresponding PeopleSoft PeopleTools Registered Works application. However, each environment averaged approximately 30.4% of exact file matches between the Environment and the PeopleSoft Registered Works customer environment.

The third comparison involving a code comparison of File-based Objects between the Environment and the PeopleSoft Registered Works environments for a sample of Environments takes into account possible updates or modifications to files that have been modified. This comparison bridges the all-or-nothing comparison done through MD5 matching and the file name comparison in which no content is actually compared. By identifying similarities in the code in individual File-based Objects that make up portions of the sample Environments to the PeopleSoft Registered Works environments, it was identified that on average, approximately 95.9% of the File-based Objects matched by content for the approximately 69.4% of the File-based Objects that matched by file name within a SAP TN client environment (see ORCLX-MAN-000158).[30]

2. Comparison of SAP TN PeopleSoft Databases to PeopleSoft Application Software Registered Works

Mandiant compared a sample set of SAP TN customer databases against corresponding installations of database associated with the PeopleSoft Registered Works software. Comparisons between the SAP TN customer databases and the associated PeopleSoft Registered Works databases took into account the closest matches in version numbers and application type as determined from the Environment to come to the results provided.

a. Methodology

A PeopleSoft database is composed of multiple tables that contain data. Each table contains a list of fields that define the structure of the table. The combination of fields makes an entire row of data. The table can contain multiple rows of data. In most cases, each table has an individual field or set of fields that define a unique key for the row of data. The key is unique in the sense that no other row will have the same value for the same field within the specific table of the database.

Comparisons between the SAP TN customer databases and the PeopleSoft Registered Works software databases consisted of 11 separate database queries. Each query was chosen based off portions of each database that remain fairly static in that the only time that portion of the databases changes is typically due to updates and patches. This removed any customer specific information that would be contained in the database, such as employee records, names, and other frequently changing data that would be unique to the customer.

Similar to Mandiant's analysis of the PeopleSoft application environment that contains both a PeopleSoft base application with a corresponding PeopleTools version, the application database also

[30] See Appendix H, Section 7.c-.d, for additional details regarding the procedure for the code comparison. A database containing the results of the code comparison for environments listed in Table 29 can also be found in the table "compare_ENVtoPS" within ORCLX-MAN-000318.

contains information from both the base application and the corresponding PeopleTools application. Within a subset of the queries run, a small number of records exist that are related to the corresponding PeopleTools versions and not the PeopleSoft base application.

Based off Mandiant's analysis, there is no way to remove all PeopleTools application specific data from the database for every query. In newer versions of the databases that correspond to PeopleTools environments, a record owner field is available from some tables; however, for older PeopleTools environments, this field does not exist within the specified tables making it impossible to differentiate between records associated with the base application and records associated with the corresponding PeopleTools version.

Based off analysis from a sampling of several databases, in the majority of cases, between 10% - 20% of the data within a corresponding query may be associated with the PeopleTools application and not the PeopleSoft base application depending on the PeopleTools and application environment installed. This amount also varied on the individual query as well. In some cases, no owner could be established even within the newer PeopleSoft environment databases.

Each database comparison was made based on the following steps:

Step 1: The SAP TN customer database was restored within a Microsoft SQL Server environment while a PeopleSoft Registered Works database was created by Oracle. The restore was conducted through MSSQL restore database functionality.

Step 2: A database query was performed against the PeopleSoft Registered Works database that most closely matched the SAP TN Registered Works environment. The queries were conducted by Oracle and the results were provided in a comma separated values text file (see ORCLX-MAN-000023 through ORCLX-MAN-000034).

File Name	Oracle Registered Works	People Tools Application	eAppendix Number
cr880ext_csv.zip	CRM 8.8	PT 8.4	ORCLX-MAN-000031
ep750ext_csv.zip	FDM 7.5	PT 7.5	ORCLX-MAN-000030
EP802EXT_csv.zip	FSCM 8.0 SP2	PT 8.1	ORCLX-MAN-000025
ep840ext_csv.zip	FSCM 8.4	PT 8.4	ORCLX-MAN-000028
HR700EXT_csv.zip	HRMS 7.0	PT 7.5	ORCLX-MAN-000034
hr750ext_csv.zip	HRMS 7.5	PT 7.5	ORCLX-MAN-000026
hr801ext_csv.zip	HRMS 8 SP1	PT 8.1	ORCLX-MAN-000024
hr830ext_csv.zip	HRMS 8.3	PT 8.4	ORCLX-MAN-000033
hr880ext_csv.zip	HRMS 8.8	PT 8.4	ORCLX-MAN-000032

Table F1: Listing of Files Containing Query Output for Registered Works Databases

Step 3: The database query was performed against the restored SAP TN customer database. The queries were conducted through MSSQL Query Analyzer by Mandiant and the results were output in a comma separated values text file (see ORCLX-MAN-000333 through ORCLX-MAN-000341).

Step 4: Within a Mandiant written script, the following occurred:[31]

- Read every database output row from both the SAP TN customer database comma separated value text file and the PeopleSoft Registered Works database.

[31] See ORCLX-MAN-000175 through ORCLX-MAN-000186.

- Based on a pre-determined unique identifying field known as a key that exists in every row, perform a comparison of the key values between the PeopleSoft Registered Works database to the same unique identifying field of the SAP TN customer database. The unique key was specific to each SQL query.

- If the unique keys matched between the PeopleSoft Registered Works databases and SAP TN databases, compare every other field within the row of data.

- For each field of data that matched between the PeopleSoft Registered Works databases with the SAP TN customer databases, increment a counter for the number of fields that matched within the row of data.

- Output the counter which represented the results of the number of rows with a specified number of field matches within the database.

b. Illustrative results: HRMS environments

HRMS 7.02

H702RHIM database: 99.44% to 100% of keys from online object tables in vanilla installation of registered version of HRMS 7.0 + registered version of PeopleTools 7.5 match in H702RHIM database; 0% to 99.72% of such rows match exactly.[32]

HRMS 8.8 and 8.9

H880PILM database: 99.84% to 100% of keys from online object tables in vanilla installation of registered version of HRMS 8.8 + registered version of PeopleTools 8.4 match in H880PILM database; 77.51% to 100% of such rows match exactly.

H890GKNM database: 86.69% to 98.73% of keys from online object tables in vanilla installation of registered version of HRMS 8.8 + registered version of PeopleTools 8.4 match in H890GKNM database; 47.64% to 93.62% of such rows match exactly.

c. Summary of Results

The first query used to compare the PeopleSoft Registered Works database against the SAP TN customer database consisted of comparing information related to individual record definitions within the respective databases. The following SQL statement was used to obtain the information from the database:

SELECT RECNAME, RECTYPE, RELLANGRECNAME, RECDESCR, DESCRLONG FROM PSRECDEFN;

In this case, the unique field representing the row of data was the field RECNAME. Of the database comparison results, on average, over 94.9% of the unique identifying fields within the PeopleSoft Registered Works database was contained within the SAP TN customer database. In the majority of cases, approximately 99% of the unique identifying fields within the PeopleSoft Registered Works database were contained within the SAP TN customer databases contained in the sample. On average, 92.1% of the PeopleSoft Registered Works database matched entirely by fields when compared against the SAP TN customer database with over half the comparison resulting in over 98% match. Full results for each query can be obtained from eAppendix – "ORCLX-MAN-000151."

[32] For H702RHIM, 84.49% of rows match exactly on all fields but one of table PSPNLDEFN, but 0% match on all fields. For the remaining tables examined for H702RHIM, lowest exact match rate is 65.24%.

The second SQL statement was used to obtain information related to panels within the PeopleSoft application. The information includes a panel description along with the panel's orientation within the application. The following SQL statement was used to obtain the information from the database:

SELECT PNLNAME, VERSION, PANELTOP, PANELLEFT, PANELRIGHT, PANELBOTTOM, DESCR, DESCRLONG FROM PSPNLDEFN;

In this case, the unique field representing the row of data was the field PNLNAME. Of the database comparison results, on average, approximately 93.7% of the unique identifying fields within the PeopleSoft Registered Works database were contained in the SAP TN customer databases. In the majority of cases, more than 98% of the unique identifying fields within the PeopleSoft Registered Works databases were contained within the SAP TN customer databases contained in the sample. On average, 63.3% of the PeopleSoft Registered Works database matched entirely by fields when compared against the SAP TN customer databases. Full results of the query can be obtained from eAppendix – "ORCLX-MAN-000151."

The third SQL statement was used to obtain information related to field definitions within the PeopleSoft application software. The information includes the field definition, along with the description and version information. The query was run on databases with PeopleTools version 8.0 and higher as the table did not exist in PeopleTools applications less than version 8. The SQL statement used to obtain the information was as follows:

SELECT FLDDEFNNAME, DESCR, VERSION, DESCRLONG FROM PSFLDDEFN;

For this query, the unique field representing to distinguish between rows of data is the field FLDDEFNNAME. Of the database comparison results, on average approximately 91.3% of the unique identifying fields within the PeopleSoft Registered Works database were contained in the SAP TN customer databases. The majority of cases, greater than 99% of the unique identifying fields within the PeopleSoft Registered Works databases were contained in the SAP TN customer databases contained in the sample. On average, 83.4% of the PeopleSoft Registered Works database matched entirely by fields when compared to the SAP TN customer databases. Full results of the query can be obtained from eAppendix – "ORCLX-MAN-000151."

The fourth SQL statement was used to obtain information related to field names within the PeopleSoft application software. The information includes the field name respective values related to that field such as the field's short and long description. Two separate queries were needed depending on the application versions. For PeopleTools applications with version less than 8, the following SQL statement was used to obtain the information from the database:

SELECT FIELDNAME, VERSION, LENGTH, DECIMALPOS, LONGNAME, SHORTNAME, DESCRLONG FROM PSDBFIELD;

For PeopleTools applications with a version of 8 or higher, the following SQL statement was used to obtain the information from the database:

SELECT PSDBFIELD.FIELDNAME, VERSION, LENGTH, DECIMALPOS, LONGNAME, SHORTNAME, LASTUPDDTTM, LASTUPDOPRID, DESCRLONG FROM PSDBFIELD, PSDBFLDLABL WHERE PSDBFIELD.FIELDNAME = PSDBFLDLABL.FIELDNAME;

Both version of the query return the same data and are based on the same unique keys that represent the individual rows of data. Of the database comparison results, on average approximately 97.3% of the unique identifying fields within the PeopleSoft Registered Works database were contained in the SAP TN customer databases. In the majority of cases, greater than 99% of the unique identifying fields within the PeopleSoft Registered Works databases were contained in the SAP

TN customer databases including three which resulted in a 100% matches on the unique identifying field. On average, 67.0% of the rows matched completely when the PeopleSoft Registered Works database was compared against the SAP TN customer database. Full results of the query can be obtained from eAppendix – "ORCLX-MAN-000151."

The fifth SQL statement was used to obtain information related messages that are contained within the PeopleSoft application software. These messages can range anywhere from informational to error messages or messages that are returned as part of the application itself. Unlike the other SQL queries, the unique identifying field in this query was a combination of the message set number through the field MESSAGE_SET_NBR and the actual message number MESSAGE_NBR. Two SQL statements were used depending on the associated PeopleTools application environment version number. For PeopleTools versions less than 8.4, the following SQL statement was used to obtain the information from the database:

SELECT MESSAGE_SET_NBR, MESSAGE_NBR, MESSAGE_TEXT, MSG_SEVERITY, DESCRLONG FROM PS_MESSAGE_CATALOG

For PeopleTools versions 8.4 or greater, the following SQL statement was used to obtain the information from the database.

SELECT MESSAGE_SET_NBR, MESSAGE_NBR, MESSAGE_TEXT, MSG_SEVERITY, LAST_UPDATE_DTTM, DESCRLONG FROM PSMSGCATDEFN;

Of the database comparison results, on average approximately 98.4% of the unique identifying fields within the PeopleSoft Registered works database were contained in the SAP TN customer databases. In the majority of cases, greater than 99% of the unique identifying fields within the PeopleSoft Registered Works databases were contained in the SAP TN customer databases including two comparisons which resulted in a 100% match of the unique identifying field. On average, approximately 91.7% of the rows matched completely with the PeopleSoft Registered Works against the SAP TN customer databases. Full results of the query can be obtained from eAppendix – "ORCLX-MAN-000151."

The sixth SQL statement was used to obtain information related to application ID's and their descriptions for the PeopleSoft application software. The SQL query could only run on versions of PeopleSoft applications that were equal to or greater than version 8. The following SQL statement was used to obtain the related information:

SELECT AE_APPLID, DESCR, DESCRLONG FROM PSAEAPPLDEFN ORDER BY AE_APPLID

In this case, the unique key for the SQL query was the field AE_APPLID. Of the database comparison results, on average approximately 90.4% of the unique identifying fields within the PeopleSoft Registered Works database were contained in the SAP TN customer databases. On average approximately, 84.6% of the rows matched completely with the PeopleSoft registered works against the SAP TN customer databases. Full results of the query can be obtained from eAppendix – "ORCLX-MAN-000151."

The seventh SQL statement was used to obtain information related to packages that were installed and running as part of the PeopleSoft application software. The SQL query could only run on version of PeopleSoft applications that were equal to version 8.4 or higher. The following SQL statement was used to obtain the related information:

SELECT DISTINCT PACKAGEROOT, DESCR FROM PSAPPCLASSDEFN ORDER BY PACKAGEROOT

In this case, the unique key for comparison was the field PACKAGEROOT which distinguishes unique rows of data. Of the database comparison results, on average approximately 82.2% of the

PeopleSoft Registered Works were contained within the SAP TN customer databases. Of this, two of the database comparisons indicated a 100% match for every field within the comparison. Full results of the query can be obtained from eAppendix – "ORCLX-MAN-000151."

The eight SQL statement was used to obtain information related to panels that are used as part of the PeopleSoft application software. This information includes a short and long description of the panel. The following SQL statement was used to obtain the related information:

SELECT PNLNAME, DESCR, DESCRLONG FROM PSPNLDEFN ORDER BY PNLNAME

In this case, the field PNLNAME represents the unique field that distinguishes the rows of data within the respective table. Of the database comparison results, on average approximately 93.75 of the unique identifying fields within the PeopleSoft Registered Works database were contained in the SAP TN customer databases. In the majority of cases, greater than 99% of the unique identifying fields within the PeopleSoft Registered Works databases were contained in the SAP TN customer databases. On average, approximately 91.7% of the rows matched completely with the PeopleSoft Registered Works against the SAP TN customer databases. Full results of the query can be obtained from eAppendix – "ORCLX-MAN-000151."

The ninth SQL statement was used to obtain information related to panel groups within the PeopleSoft application software. The following SQL statement was used to obtain the related information:

SELECT DISTINCT PNLGRPNAME FROM PSPNLGROUP ORDER BY PNLGRPNAME

For this query, the field PNLGRPNAME represents the unique key of data that was used to distinguish different, unique rows of data within the database. Of the database comparison results, on average approximately 94.3% of the PeopleSoft Registered Works database was contained in the SAP TN customer databases with the majority of the databases claiming over 99% similarity. Full results of the query can be obtained from eAppendix – "ORCLX-MAN-000151."

The tenth SQL statement was used to obtain information related to menus within the PeopleSoft application software. The information included the short and long descriptions of a menu based off the menu's name. The following SQL statement was used to obtain the related information:

SELECT MENUNAME, DESCR, DESCRLONG FROM PSMENUDEFN ORDER BY MENUNAME

For this query, the field MENUNAME represents the name of the menu and is also a unique identifying factor of the data within the associated table and represents the key that was used for the comparison of data. Of the database comparison results, on average approximately 96.3% of the unique identifying fields within the PeopleSoft Registered Works database were contained in the SAP TN customer databases. In the majority of cases, greater than 99% of the unique identifying fields within the PeopleSoft Registered Works databases were contained in the SAP TN customer databases, including four comparisons which resulted in a 100% match of the unique identifying field. On average, approximately 95.1% of the rows matched completely with the PeopleSoft Registered Works against the SAP TN customer databases with the majority of the comparisons resulting in greater than 99% matches on all fields. Full results of the query can be obtained from eAppendix – "ORCLX-MAN-000151."

The eleventh and final SQL comparison was used to obtain information related to record definitions including the record name and short and long descriptions of the record. The following SQL statement was used to obtain the related information:

SELECT RECNAME, RECDESCR, DESCRLONG FROM PSRECDEFN ORDER BY RECNAME

The field RECNAME is a unique field that was used to distinguish different unique rows of data and was used as the key for comparison. Of the database comparison results, on average approximately 94.3% of the unique identifying fields within the PeopleSoft Registered Works database were contained in the SAP TN customer databases. In the majority of cases, greater than 99% of the unique identifying fields within the PeopleSoft Registered Works databases were contained in the SAP TN customer databases. On average, approximately 92.6% of the rows matched entirely with the PeopleSoft Registered Works against the SAP TN customer databases with the majority of the comparisons resulting in greater than 98% matches on all fields. Full results of the query can be obtained from eAppendix – "ORCLX-MAN-000151."

3. PeopleSoft Registered Works MD5 Comparison Results

The results of this comparison can be found in eAppendix – "ORCLX-MAN-000197."

4. PeopleSoft Registered Works File Path Comparison Results

The Results of this comparison can be found in eAppendix – "ORCLX-MAN-000198."

5. PeopleSoft Registered Works Application Database Comparison Results

Database Name	Base Application	PeopleTools Application	Base Application Rows	Environment Application Rows	Key Only Match	1 Field in Row Match	2 Fields in Row Match	3 Fields in Row Match	Complete Row Match	Complete Row Match %	Total Number of Rows Matched on Keys	% of Rows Matched by Key
C840PRGM	CRMS 8.8	PT 8.4	11895	8374	0	16	262	276	7217	60.67	7771	65.33
F753MCCM	FSM 7.5	PT 7.5	12200	12566	0	0	10	67	11996	98.33	12073	98.96
F803PRGM	FSM 8.0 SP2	PT 8.1	27318	29097	0	0	11	108	27177	99.48	27296	99.92
F841AMIM	FSM 8.4	PT 8.4	33124	35762	0	2	12	99	32975	99.55	33088	99.89
F842TSUM	FSM 8.4	PT 8.4	33124	37910	0	2	52	382	32542	98.24	32978	99.56
F881WELM	FSM 8.4	PT 8.4	33124	48735	0	13	437	1556	28761	86.83	30767	92.88
H702RHIM	HRMS 7.0	PT 7.5	2835	3092	0	0	9	53	2772	97.78	2834	99.96
H880PILM	HRMS 8.8	PT 8.4	18478	18973	0	0	47	130	18298	99.03	18475	99.98
H890GKNM	HRMS 8.8	PT 8.4	18478	35524	0	16	226	414	16361	88.54	17017	92.09

Table 30: Results for SQL Query 1: SELECT RECNAME, RECTYPE, RELLANGRECNAME, RECDESCR, DESCRLONG FROM PSRECDEFN

Database Name	Base Application	PeopleTools Application	Base Application Rows	Environment Application Rows	Key Only Match	1 Field in Row Match	2 Fields in Row Match	3 Fields in Row Match	4 Fields in Row Match	5 Fields in Row Match	6 Fields in Row Match	Complete Row Match	Complete Row Match %	Total Number of Rows Matched on Keys	% of Rows Matched by Key
C840PRGM	CRMS 8.8	PT 8.4	4097	3139	0	4	41	55	360	227	692	1361	33.22	2740	66.88
F753MCCM	FSM 7.5	PT 7.5	5265	5299	1	3	8	14	18	457	2	4684	88.96	5187	98.52
F803PRGM	FSM 8.0 SP2	PT 8.1	10204	10738	0	0	11	16	30	53	734	9355	91.68	10199	99.95
F841AMIM	FSM 8.4	PT 8.4	11293	12087	0	0	8	19	59	67	616	10522	93.17	11291	99.98
F842TSUM	FSM 8.4	PT 8.4	11293	12584	0	1	20	67	168	160	1222	9567	84.72	11205	99.22
F881WELM	FSM 8.4	PT 8.4	11293	14453	0	26	175	346	1078	908	3389	4256	37.69	10178	90.13
H702RHIM	HRMS 7.0	PT 7.5	1952	2079	0	4	1	6	3	287	1640	0	0.00	1941	99.44
H880PILM	HRMS 8.8	PT 8.4	7712	8023	0	0	7	29	57	33	430	7152	92.74	7708	99.95
H890GKNM	HRMS 8.8	PT 8.4	7712	14596	0	8	60	126	581	436	1970	3674	47.64	6855	88.89

Table 31: Results for SQL Query 2: SELECT PNLNAME, VERSION, PANELTOP, PANELLEFT, PANELRIGHT, PANELBOTTOM, DESCR, DESCRLONG FROM PSPNLDEFN

Database Name	Base Application	PeopleTools Application	Base Application Rows	Environment Application Rows	Key Only Match	1 Field in Row Match	2 Fields in Row Match	Complete Row Match	Complete Row Match %	Total Number of Rows Matched on Keys	% of Rows Matched by Key
C840PRGM	CRMS 8.8	PT 8.4	61	39	0	0	0	32	52.46	32	52.46
F803PRGM	FSM 8.0 SP2	PT 8.1	210	216	0	0	3	207	98.57	210	100.00
F841AMIM	FSM 8.4	PT 8.4	291	323	0	0	0	290	99.66	290	99.66
F842TSUM	FSM 8.4	PT 8.4	291	340	0	6	3	281	96.56	290	99.66
F881WELM	FSM 8.4	PT 8.4	291	461	0	25	97	154	52.92	276	94.85
H880PILM	HRMS 8.8	PT 8.4	181	181	0	5	3	173	95.58	181	100.00
H890GKNM	HRMS 8.8	PT 8.4	181	354	0	5	3	160	88.40	168	92.82

Table 32: Results for SQL Query 3: SELECT FLDDEFNNAME, DESCR, VERSION, DESCRLONG FROM PSFLDDEFN

Database Name	Base Application	PeopleTools Application	Base Application Rows	Environment Application Rows	Key Only Match	1 Field in Row Match	2 Fields in Row Match	3 Fields in Row Match	4 Fields in Row Match	5 Fields in Row Match	Complete Row Match	Complete Row Match %	Total Number of Rows Matched on Keys	% of Rows Matched by Key
C840PRGM	CRMS 8.8	PT 8.4	34858	28558	0	0	33	716	8847	1712	16998	48.76	28306	81.20
F753MCCM	FSM 7.5	PT 7.5	18917	19176	0	0	2	18	90	29	18600	98.32	18739	99.06
F803PRGM	FSM 8.0 SP2	PT 8.1	53929	56713	0	1	31	10769	607	42521	0	0.00	53929	100.00
F841AMIM	FSM 8.4	PT 8.4	63115	68101	0	0	9	47	14223	918	47917	75.92	63114	100.00
F842TSUM	FSM 8.4	PT 8.4	63115	73020	0	1	11	116	14214	1255	46952	74.39	62549	99.10
F881WELM	FSM 8.4	PT 8.4	63115	95348	0	23	60	4359	11511	7002	38495	60.99	61450	97.36
H702RHIM	HRMS 7.0	PT 7.5	8311	8910	0	0	2	39	53	241	7967	95.86	8302	99.89
H880PILM	HRMS 8.8	PT 8.4	45934	47834	0	0	0	47	9545	740	35602	77.51	45934	100.00
H890GKNM	HRMS 8.8	PT 8.4	45934	91283	0	0	23	492	9764	2522	32550	70.86	45351	98.73

Table 33: Results for SQL Query 4

For PeopleTools Versions less than 8: SELECT FIELDNAME, VERSION, LENGTH, DECIMALPOS, LONGNAME, SHORTNAME, DESCRLONG FROM PSDBFIELD;

For PeopleTools Versions 8 or Higher: SELECT PSDBFIELD.FIELDNAME, VERSION, LENGTH, DECIMALPOS, LONGNAME, SHORTNAME, LASTUPDDTTM, LASTUPDOPRID, DESCRLONG FROM PSDBFIELD, PSDBFLDLABL WHERE PSDBFIELD.FIELDNAME = PSDBFLDLABL.FIELDNAME;

Database Name	Base Application	PeopleTools Application	Base Application Rows	Environment Application Rows	Key Only Match	1 Field in Row Match	2 Field Matches	Complete Row Match	Complete Row Match %	Total Number of Rows Matched on Keys	% of Rows Matched by Key
C840PRGM	CRMS 8.8	PT 8.4	45684	41343	26	289	625	39918	87.38	40858	89.44
F753MCCM	FSM 7.5	PT 7.5	12777	13137	7	32	39	12660	99.08	12738	99.69
F803PRGM	FSM 8.0 SP2	PT 8.1	34115	36300	5	31	78	34001	99.67	34115	100.00
F841AMIM	FSM 8.4	PT 8.4	40409	44151	13	49	163	40143	99.34	40368	99.90
F842TSUM	FSM 8.4	PT 8.4	40409	49459	44	196	703	39163	96.92	40106	99.25
F881WELM	FSM 8.4	PT 8.4	40409	66179	139	1070	2979	36152	89.47	40340	99.83
H702RHIM	HRMS 7.0	PT 7.5	4661	16299	150	1395	75	3041	65.24	4661	100.00
H880PILM	HRMS 8.8	PT 8.4	27791	29984	17	53	308	27410	98.63	27788	99.99
H890GKNM	HRMS 8.8	PT 8.4	27791	50902	70	341	1808	24920	89.67	27139	97.65

Table 34: Results for SQL Query 5

For PeopleTools Versions less than 8.4: SELECT MESSAGE_SET_NBR, MESSAGE_NBR, MESSAGE_TEXT, MSG_SEVERITY, LAST_UPDATE_DTTM, DESCRLONG FROM PS_MESSAGE_CATALOG;

For PeopleTools Versions 8.4 or Higher: SELECT MESSAGE_SET_NBR, MESSAGE_NBR, MESSAGE_TEXT, MSG_SEVERITY, LAST_UPDATE_DTTM, DESCRLONG FROM PSMSGCATDEFN;

Database Name	Base Application	PeopleTools Application	Base Application Rows	Environment Application Rows	Key Only Match	1 Field in Row Match	Complete Row Match	Complete Row Match %	Total Number of Rows Matched on Keys	% of Rows Matched by Key
C840PRGM	CRMS 8.8	PT 8.4	292	183	5	11	159	54.45	175	59.93
F803PRGM	FSM 8.0 SP2	PT 8.1	621	677	0	17	598	96.30	615	99.03
F841AMIM	FSM 8.4	PT 8.4	853	928	1	9	837	98.12	847	99.30
F842TSUM	FSM 8.4	PT 8.4	853	1034	1	17	827	96.95	845	99.06
F881WELM	FSM 8.4	PT 8.4	853	1535	67	156	537	62.95	760	89.10
H880PILM	HRMS 8.8	PT 8.4	616	635	0	2	613	99.51	615	99.84
H890GKNM	HRMS 8.8	PT 8.4	616	990	7	9	518	84.09	534	86.69

Table 35: Results for SQL Query 6: SELECT AE_APPLID, DESCR, DESCRLONG FROM PSAEAPPLDEFN ORDER BY AE_APPLID

Database Name	Base Application	PeopleTools Application	Base Application Rows	Environment Application Rows	Key Only Match	Complete Row Match	Complete Row Match %	Total Number of Rows Matched on Keys	% of Rows Matched by Key
C840PRGM	CRMS 8.8	PT 8.4	162	39	0	31	19.14	31	19.14
F841AMIM	FSM 8.4	PT 8.4	11	34	0	10	90.91	10	90.91
F842TSUM	FSM 8.4	PT 8.4	11	69	0	10	90.91	10	90.91
F881WELM	FSM 8.4	PT 8.4	11	688	0	11	100.00	11	100.00
H880PILM	HRMS 8.8	PT 8.4	25	36	0	25	100.00	25	100.00
H890GKNM	HRMS 8.8	PT 8.4	25	297	0	23	92.00	23	92.00

Table 36: Results for SQL Query 7: SELECT DISTINCT PACKAGEROOT, DESCR FROM PSAPPCLASSDEFN ORDER BY PACKAGEROOT

Database Name	Base Application	PeopleTools Application	Base Application Rows	Environment Application Rows	Key Only Match	1 Field in Row Match	Complete Row Match	Complete Row Match %	Total Number of Rows Matched on Keys	% of Rows Matched by Key
C840PRGM	CRMS 8.8	PT 8.4	4097	3139	27	54	2659	64.90	2740	66.88
F753MCCM	FSM 7.5	PT 7.5	5265	5299	5	26	5156	97.93	5187	98.52
F803PRGM	FSM 8.0 SP2	PT 8.1	10204	10738	4	71	10124	99.22	10199	99.95
F841AMIM	FSM 8.4	PT 8.4	11293	12087	2	56	11233	99.47	11291	99.98
F842TSUM	FSM 8.4	PT 8.4	11293	12584	30	125	11050	97.85	11205	99.22
F881WELM	FSM 8.4	PT 8.4	11293	14453	201	670	9307	82.41	10178	90.13
H702RHIM	HRMS 7.0	PT 7.5	1952	2079	1	25	1915	98.10	1941	99.44
H880PILM	HRMS 8.8	PT 8.4	7712	8023	22	18	7668	99.43	7708	99.95
H890GKNM	HRMS 8.8	PT 8.4	7712	14596	114	145	6596	85.53	6855	88.89

Table 37: Results for SQL Query 8: SELECT PNLNAME, DESCR, DESCRLONG FROM PSPNLDEFN ORDER BY PNLNAME

C840PRGM	CRMS 8.8	PT 8.4	1665	1302	1184	71.11
F753MCCM	FSM 7.5	PT 7.5	2627	2606	2561	97.49
F803PRGM	FSM 8.0 SP2	PT 8.1	4523	4788	4519	99.91
F841AMIM	FSM 8.4	PT 8.4	4910	5335	4908	99.96
F842TSUM	FSM 8.4	PT 8.4	4910	5524	4887	99.53
F881WELM	FSM 8.4	PT 8.4	4910	6248	4422	90.06
H702RHIM	HRMS 7.0	PT 7.5	1433	1508	1429	99.72
H880PILM	HRMS 8.8	PT 8.4	4718	4805	4715	99.94
H890GKNM	HRMS 8.8	PT 8.4	4718	7718	4291	90.95

Table 38: Results for SQL Query 9: SELECT DISTINCT PNLGRPNAME FROM PSPNLGROUP ORDER BY PNLGRPNAME

Database Name	Base Application	PeopleTools Application	Base Application Rows	Environment Application Rows	Key Only Match	1 Field in Row Match	Complete Row Match	Complete Row Match %	Total Number of Rows Matched on Keys	% of Rows Matched by Key
C840PRGM	CRMS 8.8	PT 8.4	288	233	1	3	219	76.04	223	77.43
F753MCCM	FSM 7.5	PT 7.5	406	405	1	0	399	98.28	400	98.52
F803PRGM	FSM 8.0 SP2	PT 8.1	732	756	1	3	728	99.45	732	100.00
F841AMIM	FSM 8.4	PT 8.4	745	779	0	2	743	99.73	745	100.00
F842TSUM	FSM 8.4	PT 8.4	745	798	0	6	738	99.06	744	99.87
F881WELM	FSM 8.4	PT 8.4	745	816	9	16	677	90.87	702	94.23
H702RHIM	HRMS 7.0	PT 7.5	101	101	0	1	100	99.01	101	100.00
H880PILM	HRMS 8.8	PT 8.4	235	241	0	1	234	99.57	235	100.00
H890GKNM	HRMS 8.8	PT 8.4	235	396	3	4	220	93.62	227	96.60

Table 39: Results for SQL Query 10: SELECT MENUNAME, DESCR, DESCRLONG FROM PSMENUDEFN ORDER BY MENUNAME

Database Name	Base Application	PeopleTools Application	Base Application Rows	Environment Application Rows	Key Only Match	1 Field in Row Match	Complete Row Match	Complete Row Match %	Total Number of Rows Matched on Keys	% of Rows Matched by Key
C840PRGM	CRMS 8.8	PT 8.4	11895	8374	273	202	7296	61.34	7771	65.33
F753MCCM	FSM 7.5	PT 7.5	12200	12566	5	57	12011	98.45	12073	98.96
F803PRGM	FSM 8.0 SP2	PT 8.1	27318	29097	10	81	27205	99.59	27296	99.92
F841AMIM	FSM 8.4	PT 8.4	33124	35762	12	61	33015	99.67	33088	99.89
F842TSUM	FSM 8.4	PT 8.4	33124	37910	48	272	32658	98.59	32978	99.56
F881WELM	FSM 8.4	PT 8.4	33124	48735	386	1328	29053	87.71	30767	92.88
H702RHIM	HRMS 7.0	PT 7.5	2835	3092	0	13	2821	99.51	2834	99.96
H880PILM	HRMS 8.8	PT 8.4	18478	18973	47	118	18310	99.09	18475	99.98
H890GKNM	HRMS 8.8	PT 8.4	18478	35524	232	306	16479	89.18	17017	92.09

Table 40: Results for SQL Query 11: SELECT RECNAME, RECDESCR, DESCRLONG FROM PSRECDEFN ORDER BY RECNAME

6. Additional SAP TN Environments Considered For Supplemental Report

Mandiant identified additional live environments and backups on PSDEV02, DCPSB01, and PSNT01. These systems were produced too late to be included in our original report. Mandiant reviewed the contents of this data and supplemented its earlier conclusions, as follows:

a. PSDEV02 and PSNT01

SAP TN produced PSDEV02 and PSNT01 on December 1, 2009, and January 8, 2010, respectively. The Encase images for PSDEV02 and PSNT01 contained 60 backup Environments, including approximately 21 Environment backups containing PS_HOMEs. Table G lists the 21 backup Environments Mandiant found on PSDEV02 and PSNT01 and identifies the two environments Mandiant used for file comparisons to Oracle Registered Works (see the "Used For Comparison" column):

Backup Filename	File Path	Used For Comparison
h751telo_20080318_2237.tar.gz	PSdev02_D03\backup\ps_home\	No
h830flio_20080131_0934.tar.gz	PSdev02_D03\backup\ps_home\	Yes
h801roso_20080131_2119.tar.gz	PSdev02_D03\backup\ps_home\	No
h831armo_20080131_1506.tar.gz	PSdev02_D03\backup\ps_home\	No
h831fcso_20080202_1407.tar.gz	PSdev02_D03\backup\ps_home\	No
h751nclo_20080324_1820.tar.gz	PSdev02_D03\backup\ps_home\	Yes
h831hono_20080326_1859.tar.gz	PSdev02_D03\backup\ps_home\	No
h831blsd_20080203_1807.tar.gz	PSdev02_D03\backup\ps_home\	No
h881wmio_20080131_0612.tar.gz	PSdev02_D03\backup\ps_home\	No
h881riio_20080318_1120.tar.gz	PSdev02_D03\backup\ps_home\	No
h831shnd_20080326_2305.tar.gz	PSdev02_D03\backup\ps_home\	No
h801cago_20080318_1343.tar.gz	PSdev02_D03\backup\ps_home\	No
h751sbho_20080318_2035.tar.gz	PSdev02_D03\backup\ps_home\	No
h801bgpo_20080318_1916.tar.gz	PSdev02_D03\backup\ps_home\	No
h881ccoo_20080319_1114.tar.gz	PSdev02_D03\backup\ps_home\	No
h831sced_20080319_1743.tar.gz	PSdev02_D03\backup\ps_home\	No
h831armo_20080321_1029.tar.gz	PSdev02_D03\backup\ps_home\	No
h831olni_20080327_2305.tar.gz	PSdev02_D03\backup\ps_home\	No
h831wakd_20080324_133228.tar.gz	PSdev02_D03\backup\ps_home\	No
f842shnd_20080422_0312.tar.gz	PSdev02_D03\backup\ps_home\	No
fs803dmo_20070508_1522.zip	psnt01f\PSNT01-F\Temp\	Yes

Table G: List of PS_HOME Backups Recovered From PSDEV02

b. DCPSDB01

SAP TN produced DCPSDB01 on November 12, 2009. The Encase image contained additional PeopleSoft software, including approximately 66 local environments containing PeopleSoft Databases (See ORCLX-MAN-000342).

7. Comparison of PS_HOMEs on PSDEV02 and PSNT01 to PeopleSoft Enterprise Application Software Registered Works

Two of the 20 SAP TN PS_HOME environments recovered from PSDEV02 were created at times later than the latest SAP TN Local Environment backups for the corresponding products and versions from our initial PS_HOME comparisons, as shown in Table H. In addition, one SAP TN Local Environment backup found on PSNT01 was created at a later time than the corresponding product and version from our initial PS_HOME comparisons. In other words, the filenames for these three backup Environments indicate later backup creation dates than the other backups we analyzed for the corresponding Oracle Enterprise Application Software versions (See ORCLX-MAN-000154).

Backup Filename	Version	System	Last Written Date	Latest Last Written Date from Initial Report for Software Version
h830flio_20080131_0934.tar.gz	H830	PSDEV02	01/31/08	4/18/2007
h751nclo_20080324_1820.tar.gz	H751	PSDEV02	03/24/08	1/23/2008
fs803dmo_20070508_1522.zip	F803	PSNT01	05/09/07	03/08/07

Table H: SAP TN PS_HOME Backups Used for Comparisons[33]

Each SAP TN PS_HOME Environment was compared to both a registered version of a PeopleSoft base application program and a registered version of a PeopleSoft PeopleTools application, consistent with the methodology described in Appendix H of the initial report.

a. Methodology

Mandiant performed multiple comparisons for each SAP TN PS_HOME backup Environment listed in Table H, including:

1. MD5 hash comparisons to the most similar registered works.
2. File name comparisons to the most similar registered works.
3. File-based Object comparisons to the most similar registered works.

MD5 comparisons are all-or-nothing evaluations that reveal whether the content of two files is exactly identical or not. File-based Object comparisons determine the percentage of code from a Registered Work File-based Object found in a SAP TN Local Environment backup PS_HOME where the two files have the same name. File name comparisons check solely whether the File-based Object file names from the Registered Works are found within the SAP TN Local Environment backup PS_HOMEs.

As with the previous analyses, Mandiant created automated scripts to aid in the processing of the comparisons of the three SAP TN PS_HOME Local Environment backups (see eAppendix ORCLX-MAN-000187 and ORCLX-MAN-000375). The script ORCLX-MAN-000375 automates the PERL script (ORCLX-MAN-000187) that performs the comparisons.

b. Oracle Registered File-based Objects Database

Mandiant re-created the "Oracle Registered File-Based Objects" database described in Appendix C, section 1, of the initial report, limiting the database to data and metadata about the SQR, SQC, and CBL files from 9 sets of Install Media that Oracle identified as embodying certain of its Registered Works.

[33] Full file system metadata can be found in ORCLX-MAN-000344.

Title of Oracle Registered Work	Software Bates Number
PeopleTools 7.5	ORCL00264040
PeopleTools 8.10	ORCL00264035
PeopleTools 8.4	ORCL00264024 ORCL00264025
PeopleSoft Financials and Supply Chain Management 8	ORCL00264039
PeopleSoft Financials and Supply Chain Management 8 SP1 Rev 1	ORCL00604716
PeopleSoft Financials and Supply Chain Management 8 SP2	ORCL00264022
PeopleSoft Financials and Supply chain Management 8.4	ORCL00264037
PeopleSoft HRMS 7.5	ORCL00400498
PeopleSoft HRMS 8.3	ORCL00264019

Table I: Install media embodying the PeopleSoft Enterprise Application Software Registered Works

c. Creation of the SAP TN Local Environment Backup PS_HOME File Based Objects Database

To record data and metadata about the SQR, SQC, and CBL files created by the three PS_HOME directories contained within the Local Environments listed in Table H, Mandiant created a new "SAP TN Local Environment Backup PS_HOMEs" database. As with our prior analyses, Mandiant decompressed the backups recovered from the logical images of PSDEV02 and PSNT01 in order to identify the File-based Objects within the PS_HOMEs directories. Mandiant used this database to perform the code comparisons.

Mandiant used a script (see ORCLX-MAN-000377 and ORCLX-MAN-000378) to identify the File-based Objects contained within all the decompressed SAP TN Local Environment PS_HOME backups to populate the "SAP TN Local Environment Backup PS_HOMEs" database in accordance with methodologies used in our prior PS_HOME file based object comparisons. For each unique File-based Object identified, Mandiant created a database record that contained the information listed in the table below:

File-based Object Record for "SAP TN Local Environment Backup PS_HOME File Based Objects" Database	
Field Name	Description
FileID	Auto-generated unique index number
File Name	Name of the COBOL, SQR, or SQC File Processed
File Hash	The unique MD5 hash for the file.
File Type	Whether the file was a CBL, SQR, or SQC file.
File Path	Full directory path of the file being imported into the database.
Client	The client associated with the PS_HOME
DB_type	The database type of the SAP TN PS_HOME backup
Last_written_date	Date the compressed PS_HOME backups preserved as the last written date
RCS Header	RCS comment for the RCS Header field.
RCS Release	RCS comment for the Release field.
RCS Revision	RCS comment for the Revision field.
RCS VersionID	RCS comment for the Version ID.
RCS Date	RCS comment for the Date field.
RCS Resolution	RCS comment for the Resolution field.
Number of Comments (c_comments)	An integer representing the number of lines that were comments.

Number of Lines in File (c_linecount)	An integer representing the total number of lines in the file-based object.
Presence of Oracle Copyright Statement (f_copyright)	Set to "1" if the strings "Copyright ([Cc]).*PeopleSoft, Inc." or "Copyright ([Cc]).*Oracle." were present in the file. Otherwise the value of the flag was set to "0".
Presence of Oracle Confidentiality Statement (f_confidential)	Set to "1" if the string "confidential and proprietary information" was present in the file. Otherwise the value of the flag was set to "0".

Table J: Database Record Fields for SAP TN Local Environment Backup PS_HOMEs Database

The process followed was the same as that described in Appendix C, Section 1, of the initial report, except that analysis and de-duplication was performed based on client and file path instead of ISO name.

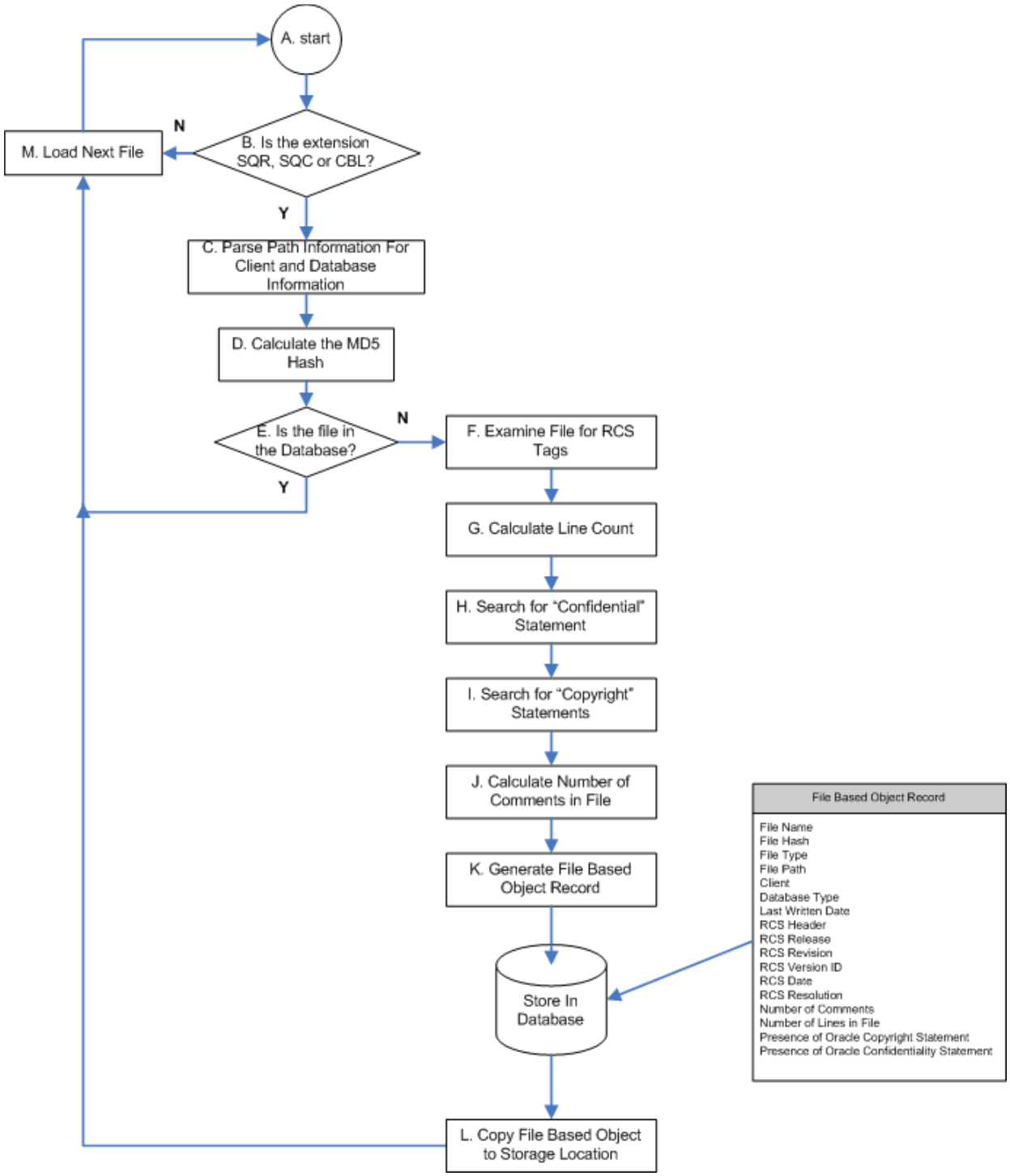

Figure A: Creating the "SAP TN Local Environment Backup PS_HOMEs" Database

A Mandiant shell script (see ORCLX-MAN-000378) was used to populate the "SAP TN Local Environment Backup PS_HOMEs" database.

d. Procedure for Comparison of the Oracle Registered File-Based Objects to the SAP TN Backup PS_HOME Directories

Mandiant compared pairs of files selected from the two data sources: File-based Objects from Registered Works and File-based Objects from each uncompressed backup Local Environment PS_HOME in Table H. As in its initial report, Mandiant populated a code compare database with the information outlined in the table below.

Information Within Oracle Registered Work to PS_HOME Comparison Database	
Field Name	Description
compareID	Auto-generated unique index number
environment_fileID	File ID of a File-based Object from the SAP TN PS_HOME Backup data set
ps_fileID	File ID of a File-based Object from the Oracle Registered data set
clientfix_lc	Number of lines in the SAP TN file
ps_lc	Number of lines in the Oracle registered file
c_pctdup	Percent of Oracle Registered file in the TN file
c_duplicate	Number of duplicate lines
c_TNnew	Number of new lines in the SAP TN file
c_PSnew	Number of new lines in the Oracle file
c_change	Number of lines with minor changes
c_leftig	Number of lines in Oracle file with minor changes
c_rightig	Number of lines in TN file with minor changes
diff_filename	File name of diff output

Table K: Code Comparison Database Table

As in the comparisons from my initial report, the database described in Table K was populated according to the procedure discussed in Appendix E, section 4. Mandiant created a custom program to automate the comparison of the Oracle Registered Works database" to the "SAP TN Local Environment Backup PS_HOMEs" database (See ORCLX-MAN-000376).

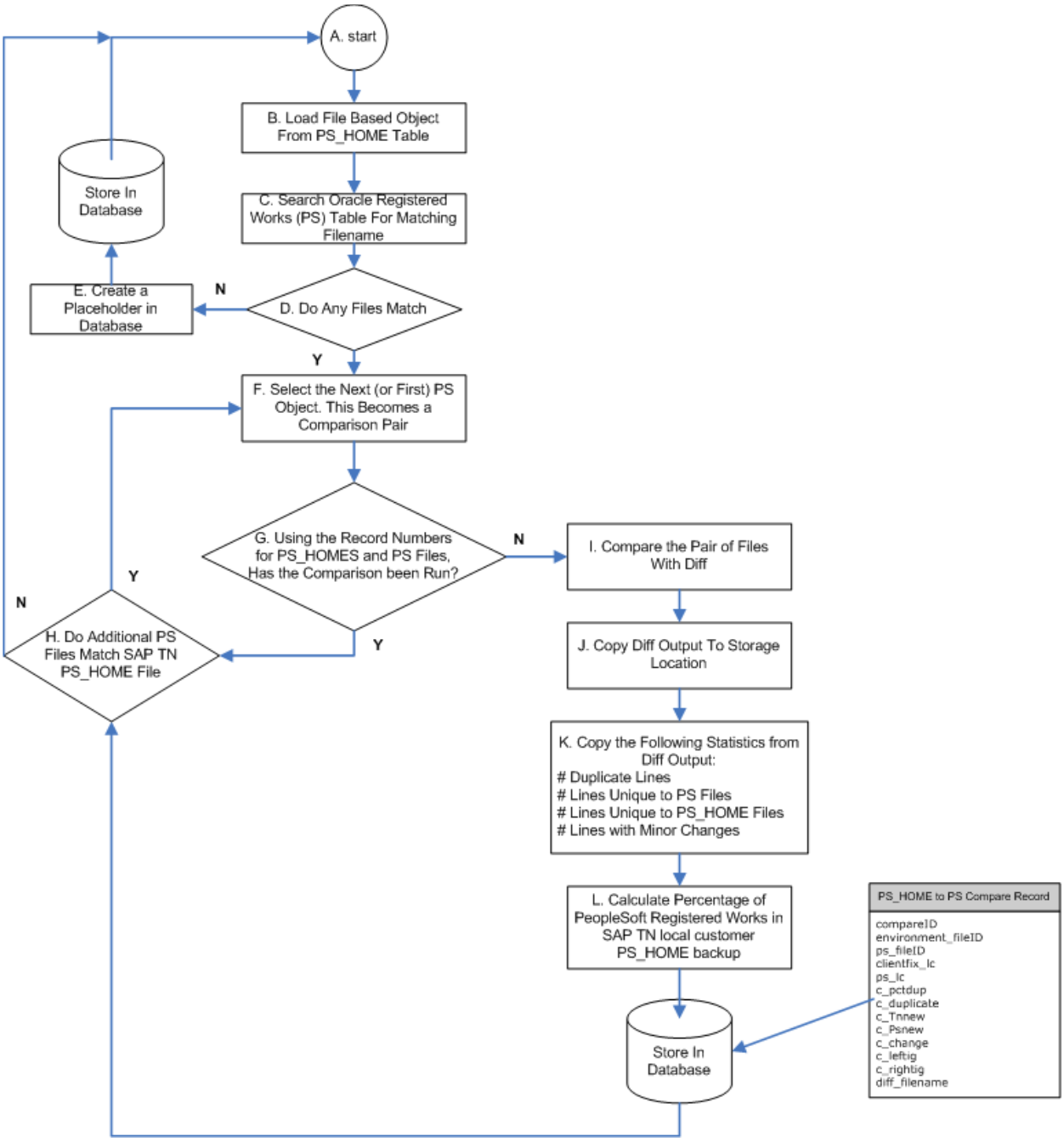

Figure B: Process to Compare PeopleSoft Registered Works File-based Objects to SAP TN Local Environment PS_HOME Backups

e. Summary of Results

MD5, file name and File-based Object comparisons for the SAP TN Local Environment backup PS_HOMEs in Table H are summarized below (See ORCLX-MAN-000350 for complete details of the PS_HOME file-based comparisons, and ORCLX-MAN-000364 for results of the code comparisons).[34]

Comparison of PS_HOME "fs803dmo_20070508_1522" to FSCM 8.0 SP2 with PeopleTools 8.1

MD5 Comparison: 46.71% of the files matched exactly by MD5 hash when compared to FSCM 8.0 SP2 with PeopleTools 8.1

Code Comparison: 99.49% of the File-based Objects in the Oracle Registered Works (FSCM 8.0 SP2 with PeopleTools 8.1) matched by file name to the File-based Objects contained in the SAP TN Local Environment PS_HOME backup. Of the File-based Objects within the Oracle Registered Works, approximately 99.19% of code within those File-based Objects matched code within the SAP TN Local Environment PS_HOME backup.

Comparison of PS_HOME "h751nclo_20080324_1820" to HRMS 7.5 with PeopleTools 7.5

MD5 Comparison: 3.42% of the files matched exactly by MD5 hash when compared to HRMS 7.5 with PeopleTools 7.5.

Code Comparison: 75.87% of the File-based Objects in the Oracle Registered Works (HRMS 7.5 with PeopleTools 7.5) matched by file name to the File-based Objects contained in the SAP TN Local Environment PS_HOME backup. Of the File-based Objects within the Oracle Registered Works, approximately 94.13% of code within those File-based Objects matched code within the SAP TN Local Environment PS_HOME backup.

Comparison of PS_HOME "h830flio_20080131_0934" to HRMS 8.3 with PeopleTools 8.1

MD5 Comparison: 4.32% of the files matched exactly by MD5 hash when compared to HRMS 8.30 with PeopleTools 8.1.

Code Comparison: 79.97% of the File-based Objects in the Oracle Registered Works (HRMS 8.3 with PeopleTools 8.1) matched by file name to the File-based Objects contained in the SAP TN Local Environment PS_HOME backup. Of the File-based Objects within the Oracle Registered Works, approximately 96.70% of the code within those File-based Objects matched code within the SAP TN Local Environment PS_HOME backup.

The table below is an updated summary of environment comparisons from my initial and supplemental reports. The three environments denoted with an asterisk in the "Environment Name" column were all superseded by the more recently created PS_HOME directories found on PSDEV02 and PSNT01. The "N/A" corresponds to Environments where Mandiant did not perform a code comparison with the Registered Works:

Environment Name	Total Unique MD5 Matches of Original in Environment %	Total % Match of FBO's	Total Average Percentage of Code Match for Unique FBO's
c840prgm_20060418_2054	38.82	96.22	96.26
c840prgm_20070309_0119	38.82	96.22	96.12
c881mgio_20060631_1328	27.79	97.23	95.98

[34] Results of the code comparison for environments listed in Table H can be found in the table "psdev02_compare_ENVtoPS" within ORCLX-MAN-000364.

Environment Name	Total Unique MD5 Matches of Original in Environment %	Total % Match of FBO's	Total Average Percentage of Code Match for Unique FBO's
c881mgio_20070219_1423	4.03	94.71	96.03
c890mgio_20060731_1319	26.48	N/A	N/A
c890mgio_20070219_1423	3.58	91.69	96.63
e881beao_20060412_1034	30.47	96.24	96.35
e890moho_20061002_2342	3.58	94.35	95.37
e890moho_20070219_1404	3.58	91.29	96.03
f752itro_20070423_1007	0.6	63.93	97.57
f753nclo_20070510_0907	55.75	44.27	96.57
f803prgm_20060303_1331	55.76	50.94	99.12
f803rplo_20070308_1308*	31.99	28.13	98.09
f840pcao_20061004_1918	56.63	88.71	99.27
f840PCAO_20070314_0932	56.61	88.71	99.27
f841amim_20060423_2300	54.1	58.27	98.71
f841nclo_20070509_1455	44.81	46.73	98.70
f842cbro_20060301_1101	43.34	84.92	98.49
f842tsum_20070305_1647	49.12	86.90	95.98
f881siro_20060309_1631	27.08	69.53	95.31
f881welm_20070228_0810	15.65	52.05	91.53
f890aoso_20070509_1707	27.65	35.55	93.93
fs803dmo_20070508_1522	46.71	99.49	99.19
h702rhim_20060705_1307	61.08	98.82	94.19
h702rhim_20070412_0941	61.08	98.82	93.56
h750nfso_20060821_2313	30.73	41.43	91.14
h750nfso_20060906_1024	30.73	41.43	91.14
h751nclo_20080123_0146*	8.49	75.87	94.13
h751nclo_20080324_1820	3.42	15.53	87.83
h751telo_20060322_1402	47.07	95.58	94.27
h801qgis_20060330_1511	46.8	47.70	96.00
h801roso_20080321_1956	4.92	50.46	94.87
h830flio_20060403_1448	53.97	74.26	98.03
h830flio_20070402_1057*	8.79	74.26	97.40
h830flio_20080131_0934	4.32	9.61	94.10
h831blsd_20060309_1735	47.07	44.23	97.22
h831olni_20080327_2305	18.02	49.39	97.08
h880pilm_20070502_1328	51.85	72.06	95.14
h881ddmo_20060308_0717	39.9	N/A	N/A

Environment Name	Total Unique MD5 Matches of Original in Environment %	Total % Match of FBO's	Total Average Percentage of Code Match for Unique FBO's
h881ebmo_20080328_0538	4.52	77.94	95.94
h890fuao_20080213_0206	4.22	76.08	91.57
h890gknm_20060524_0450	30.45	71.01	93.45
s801u21o_20061122_2238	0.21	30.51	96.67
s801u21o_20080403_0112	0.21	28.09	97.30

Table L: Summary of PS_HOME Directory Comparisons

The "Total % Match of FBO's" column recorded the percentage of File-based Objects stored within the most similar Registered Work that matched by file name to the File-based Objects in the SAP TN Environment. The "Total Average Percentage of Code Match for Unique FBO's" recorded the average amount of Oracle Registered Works lines of code that were included within the corresponding SAP TN file (matched by file name). As shown in Table L, Mandiant found File-based Objects containing Oracle code in every SAP TN Local Environment PS_HOME backup that was analyzed. Each PS_HOME backup contained one or more File-based Objects that exactly matched File-based Objects from the Registered Works, resulting in MD5 Hash matches. When matching by file name, the average percentage of code from a Registered Works File-based Object that was present in the corresponding SAP TN File-based Object for each PS_HOME backup that was analyzed ranged between 87.83% and 99.27%.[35] See ORCLX-MAN-000358 for the details concerning Table L above.

8. Comparison of PeopleSoft Databases on DCPSDB01 to PeopleSoft Registered Works Application Databases

As stated above, DCPSDB01 contained approximately 66 local environments containing PeopleSoft Databases (See ORCLX-MAN-000342).

Mandiant selected 8 of these environments for analysis (shown in Tables M and N). Five of these environments were Generic Environments. Mandiant analyzed them to determine if they incorporated the PeopleSoft and PeopleTools schema. Mandiant selected the H751COAM, H801SPGM, and H831ALIM environments for comparison because we had not yet compared these Oracle Enterprise Software Application versions in our prior database comparisons.

Database Name	File Path	Last Written Date
D702DATM	DCPSDB01\D\Microsoft SQL DB\MSSQL$PSMSSQLDB\Data\D702DATM_Data.MDF	07/12/07
D751DATM	DCPSDB01\D\Microsoft SQL DB\MSSQL$PSMSSQLDB\Data\D751DATM_Data.MDF	07/12/07
D810DATM	DCPSDB01\D\Microsoft SQL DB\MSSQL$PSMSSQLDB\Data\D810DATM_Data.MDF	07/12/07
D831DATM	DCPSDB01\D\Microsoft SQL DB\MSSQL$PSMSSQLDB\Data\D831DATM_Data.MDF	07/12/07

[35] File-based Object file-name matches and code comparisons by file-name match were not performed for c890mgio_20060731_1319 or h881ddmo_20060308_0717. These comparisons are reported as "N/A" in Table L.

Database Name	File Path	Last Written Date
D881DATM	DCPSDB01\D\Microsoft SQL DB\MSSQL$PSMSSQLDB\Data\D881DATM.mdf	07/12/07

Table M: Listing of Development PeopleSoft Database Backups Recovered from DCPSDB01

Database Name	File Path	Last Written Date
H751COAM	DCPSDB01\D\Microsoft SQL DB\MSSQL$PSMSSQLDB\Data\H751COAM_Data.mdf	10/04/07
H801SPGM	DCPSDB01\D\Microsoft SQL DB\MSSQL$PSMSSQLDB\Data\H801SPGM_Data.mdf	10/04/07
H831ALIM	DCPSDB01\D\Microsoft SQL DB\MSSQL$PSMSSQLDB\Data\H831ALIM_Data.mdf	07/03/07

Table N: Listing of Customer-Labeled PeopleSoft Database Backups Recovered from DCPSDB01

A PeopleSoft Database is composed of some or all of a PeopleSoft Schema, usually populated with data. Each table in a PeopleSoft Schema has a defined structure, comprising one or more fields. The combination of fields makes an entire row of data. The table can contain multiple rows of data. In most cases, each table has an individual field or set of fields that defines a unique key for the row of data. The key is unique in the sense that no other row will have the same values for the same fields within the specific table of the database.

Mandiant compared the PeopleSoft Databases listed in Tables M and N (the "DCPSDB01 Databases") against PeopleSoft Databases associated with the PeopleSoft Registered Works (the "Registered Works Databases"). During the MD5 and file path comparisons, Mandiant identified trends that existed to determine the closest matched Registered Works environment when compared to an SAP TN Local Environment. Mandiant used this information in combination with the version numbers and application type for the databases contained on DCPSDB01 for comparisons to the Registered Works Databases. This allowed Mandiant to compare SAP TN backup databases to Registered Works Databases should file based comparisons not be available.

a. Methodology

Mandiant began our analysis by using the following query results from the initial report:

Oracle Registered Works	File Name	eAppendix Number
HRMS 7.0	HR700EXT_csv.zip	ORCLX-MAN-000034
HRMS 7.5	hr750ext_csv.zip	ORCLX-MAN-000026
HRMS 8 SP1	hr801ext_csv.zip	ORCLX-MAN-000024
HRMS 8.3	hr830ext_csv.zip	ORCLX-MAN-000033
HRMS 8.8	hr880ext_csv.zip	ORCLX-MAN-000032

Table O: Listing of Files Containing Query Output for Registered Works Databases

Eleven separate queries were run against the DCPSDB01 Databases listed in Tables M and N:

- Queries 1 and 11 identify PeopleTools and PeopleSoft Enterprise Application Software records.

- Queries 2 and 8 identify the PeopleTools and PeopleSoft Enterprise Application Software panels.
- Query 3 identifies the PeopleTools and PeopleSoft Enterprise Application Software file layouts.
- Query 4 identifies the PeopleTools and PeopleSoft Enterprise Application Software fields.
- Query 5 identifies the PeopleTools and PeopleSoft Enterprise Application Software messages (error, informational, etc.).
- Query 6 identifies the PeopleTools and PeopleSoft Enterprise Application Software application engines.
- Query 7 identifies the PeopleTools and PeopleSoft Enterprise Application Software application packages.
- Query 9 identifies the PeopleTools and PeopleSoft Enterprise Application Software panel groups (a/k/a components).
- Query 10 identifies the PeopleTools and PeopleSoft Enterprise Application Software menus.

These queries are described in detail in Appendix H to the initial report. The results of the queries run against the DCPSDB01 Databases can be found in the following files:

DCPSDB01 Database	File Name	eAppendix Number
D702DATM	d702datm_sql.zip	ORCLX-MAN-000371
D751DATM	d751datm_sql.zip	ORCLX-MAN-000372
D810DATM	d810datm_sql.zip	ORCLX-MAN-000365
D831DATM	d831datm_sql.zip	ORCLX-MAN-000366
D881DATM	d881datm_sql.zip	ORCLX-MAN-000367
H751COAM	h751coam_sql.zip	ORCLX-MAN-000368
H801SPGM	h801spgm_sql.zip	ORCLX-MAN-000369
H831ALIM	h831alim_sql.zip	ORCLX-MAN-000370

Table P: Listing of Files Containing Query Output for DCPSDB01 Databases

As in the initial report, the query results in Table O were automatically compared to those in Table P through use of a script. See ORCLX-MAN-000373 and ORCLX-MAN-000374.

b. Summary of Results

The following table outlines the average complete row match for the environments listed. As with all prior comparisons, Query 3, Query 6, and Query 7 may not return results for all databases we analyzed. Query 3 and Query 6 return results when executed on PeopleTools versions greater than PeopleTools 7.5, and Query 7 returns results for versions of PeopleTools 8.4 and higher. These three queries are marked with an asterisk in the table below:

Environments	Q1	Q2	Q3*	Q4	Q5	Q6*	Q7*	Q8	Q9	Q10	Q11
Average For DATM Environments	98.08	51.19	98.53	58.83	25.81	59.27	100	98.62	99.58	99.16	93.2
Average For: H751COAM H801SPGM H831ALIM	97.33	49.82	100	10.36	97.91	66.2	0	98.67	99.38	99.13	98.83
Average for Initial Report Databases	92.05	63.31	83.45	66.96	91.71	84.63	82.16	91.65	94.3	95.07	92.57

Environments	Q1	Q2	Q3*	Q4	Q5	Q6*	Q7*	Q8	Q9	Q10	Q11
Overall Average	94.76	57.37	89.98	53.11	73.42	72.49	84.71	94.94	96.75	96.99	93.86

Table Q: Summary of Average Complete Row Match Among SAP TN Databases Compared to Registered Works

Based on our analysis and on conversations with Tanya Ishiguro, Mandiant concluded that each database in Table Q was a PeopleSoft Database containing a PeopleSoft Schema. Mandiant further concluded that each PeopleSoft Database reviewed contained Oracle code, in that there were row matches on the various queries performed. Every complete row match from any of the 11 queries demonstrates that an exact copy of a user interface, business logic or program functionality component of PeopleTools and PeopleSoft Enterprise Application Software is present in the SAP TN PeopleSoft Database as an online object or other PeopleSoft Database content. Every match by key demonstrates the existence of a user interface, business logic or program functionality component that was likely based on an online object or other PeopleSoft Database content from PeopleTools and PeopleSoft Enterprise Application Software. See ORCLX-MAN-000357 for the details outlined in Table Q, above.

I. Environment list

1. Illustrative results: HRMS

HRMS 7.02

BakTrak: 119 backups of 38 distinct HRMS 7.02 environments recorded; 121 restores to 39 distinct HRMS 7.02 environments recorded.

Data Warehouse: 194 back-ups found for 38 distinct HRMS 7.02 environments.

Data Warehouse: 19 environments found for 16 distinct HRMS 7.02 environments.

HRMS 7.5, 7.51, and 7.6

BakTrak: 570 backups of 69 distinct HRMS 7.5, 7.51 and 7.6 environments recorded; 437 restores to 63 distinct HRMS 7.5, 7.51 and 7.6 environments recorded.

Data Warehouse: 619 back-ups found for 58 distinct HRMS 7.5, 7.51 and 7.6 environments.

Data Warehouse: 69 environments found for 52 distinct HRMS 7.5, 7.51, 7.6 environments.

HRMS 8.0 SP1

CD Client Jukebox: At least four full or partial sets of Install Media for HRMS 8.0 SP1.

BakTrak: 392 backups of 44 distinct HRMS 8.0 SP1 environments recorded; 212 restores to 37 distinct HRMS 8.0 SP1 environments recorded.

Data Warehouse: 529 back-ups found for 36 distinct HRMS 8.0 SP1 environments.

Data Warehouse: 71 environments found for 45 distinct HRMS 8.0 SP1 environments.

HRMS 8.3 and 8.3 SP1

CD Client Jukebox: At least 11 full or partial sets of Install Media for HRMS 8.3 SP1

BakTrak: 641 backups of 44 distinct HRMS 8.3 and 8.3 SP1 environments recorded; 306 restores to 38 distinct HRMS 8.3 or 8.3 SP1 environments recorded.

Data Warehouse: 653 back-ups found for 38 distinct HRMS 8.3 or 8.3 SP1 environments.

Data Warehouse: 101 environments found for 56 distinct HRMS 8.3 or 8.3 SP1 environments.

HRMS 8.8, 8.8 SP1, 8.9, and 8.9 SP1

CD Client Jukebox: At least 14 full or partial sets of Install Media for HRMS 8.8 SP1; at least 4 full or partial sets of Install Media for HRMS 8.9.

BakTrak: 478 backups of 37 distinct HRMS 8.8, 8.8 SP1, 8.9, and 8.9 SP1 environments recorded; 194 restores to 25 distinct HRMS 8.8, 8.8 SP1, 8.9 or 8.9 SP1 environments recorded.

Data Warehouse: 662 back-ups found for 35 distinct HRMS 8.8, 8.8 SP1, 8.9 or 8.9 SP1 environments.

Data Warehouse: 95 environments found for 72 distinct HRMS 8.8, 8.8 SP1, 8.9 or 8.9 SP1 environments.

2. Summary of results

- 532 environment names observed
- Total BakTrak entries demonstrating reproduction: 2669 backups, 2593 restores
- 3222 compressed environment backups of either PS_HOME or database components found on Data Warehouse
- 566 uncompressed PS_HOME or database components found on Data Warehouse

Complete results can be found in eAppendix – "ORCLX-MAN-000159", eAppendix – "ORCLX-MAN-000123" and "ORCLX-MAN-000382."

J. Customer support contract data

Mandiant collected information from SAS about the versions of HRMS for which each customer received support. One correction was made: Foot Locker, Inc. (FLI) was recorded as an HRMS 8.3 customer and not an HRMS 8.3 SP1 customer.[36]

Filter on Measure 102A (Column F)	Critical (Measures_Critical Tab)	Retrofit (Measures_Retrofit Tab)	Total
"equals 7 or contains 7.0"	414	84	498
"contains 7.5 or contains 7.6"	603	74	677
"contains 8 SP1"	652	0	652
"contains 8.3"	644	1	645
"contains 8.8 or contains 8.9"	541	0	541

Table R: Filters run against ORCLX-MAN-000059, Measure 102A

HRMS 7 and 7.02

Delivered Updates and Fixes: 498 Fixes delivered to at least one customer that contracted with SAP TN for service on HRMS 7.0 or HRMS 7.02. Application of any of these Fixes to a local environment resulted in a derivative work. Application of any of these Fixes by at least one customer that contracted with SAP TN for service would have resulted in a derivative work.

HRMS 7.5, 7.51, and 7.6

Delivered Updates and Fixes: 677 Fixes delivered to at least one customer that contracted with SAP TN for service on HRMS 7.5, 7.51 or 7.6. Application of any of these Fixes to a local environment resulted in a derivative work. Application of any of these Fixes by at least one customer that contracted with SAP TN for service would have resulted in a derivative work.

[36] *See* Deposition of Matthew Bowden, December 5, 2008 at 149:17-24.

HRMS 8.0 SP1

Delivered Updates and Fixes: 652 Fixes delivered to at least one customer that contracted with SAP TN for service on HRMS 8.0 SP1. Application of any of these Fixes to a local environment resulted in a derivative work. Application of any of these Fixes by at least one customer that contracted with SAP TN for service would have resulted in a derivative work.

HRMS 8.3 and 8.3 SP1

Delivered Updates and Fixes: 645 Fixes delivered to at least one customer that contracted with SAP TN for service on HRMS 8.3 or 8.3 SP1. Application of any of these Fixes to a local environment resulted in a derivative work. Application of any of these Fixes by at least one customer that contracted with SAP TN for service would have resulted in a derivative work.

HRMS 8.8, 8.8 SP1, 8.9, and 8.9 SP1

Delivered Updates and Fixes: 541 Fixes delivered to at least one customer that contracted with SAP TN for service on HRMS 8.8, 8.8 SP1, 8.9 or 8.9 SP1. Application of any of these Fixes to a local environment resulted in a derivative work. Application of any of these Fixes by at least one customer that contracted with SAP TN for service would have resulted in a derivative work.

A listing of the Fix IDs and the versions of HRMS the recipients of that fix were licensed to according to SAP TN's records can be found in eAppendix – "ORCLX-MAN-000059". A listing of the SAP TN customer contract dates can be found in eAppendix - "ORCLX-MAN-000064."

K. SAP TN-attributed Fixes for PeopleSoft HRMS

Extrapolated results from AACG can be found at ORCLX-AACG-000001 and ORCLX-AACG-000002.

1. DAT File analysis

Mandiant analyzed SAP TN's Delivered Updates and Fixes to determine how Environments were used to create data changes[37] that subsequently get applied to specific customer environments and delivered to customers.

a. Methodology

This section describes the methodology used by Mandiant to identify how Environments were used to create data changes contained in SAP TN's Delivered Updates and Fixes. A data change is a fix delivered to a customer that modifies the contents or the structure of the PeopleSoft Database in an Environment, frequently to update the customer's software with new or modified government tax regulations. The data change fix is typically delivered as a file with a ".DAT" file extension (DAT File). The DAT File contains database modifications created in and exported from a PeopleSoft environment using PeopleSoft applications. The objectives of Mandiant's analysis were to determine if the data change fixes SAP TN delivered to each customer were created using that customer's software, and if multiple customers received an identical data change Fix created using a copy of another customer's software.

In order to accomplish this task, Mandiant analyzed files containing data changes in SAP TN Delivered Updates and Fixes. Specifically, Mandiant relied upon metadata referenced in each DAT File. The following bullets represent the metadata contained within a DAT File:

[37] *Data changes* are modifications to the database portion of PeopleSoft environments.

- "**REM Database**" – The "REM Database" field is the database portion of a PeopleSoft Environment used to create the data change.

- "**REM Started**" – The "REM Started" field contains the timestamp of when the PeopleTools application began creating the data change file from a PeopleSoft environment.

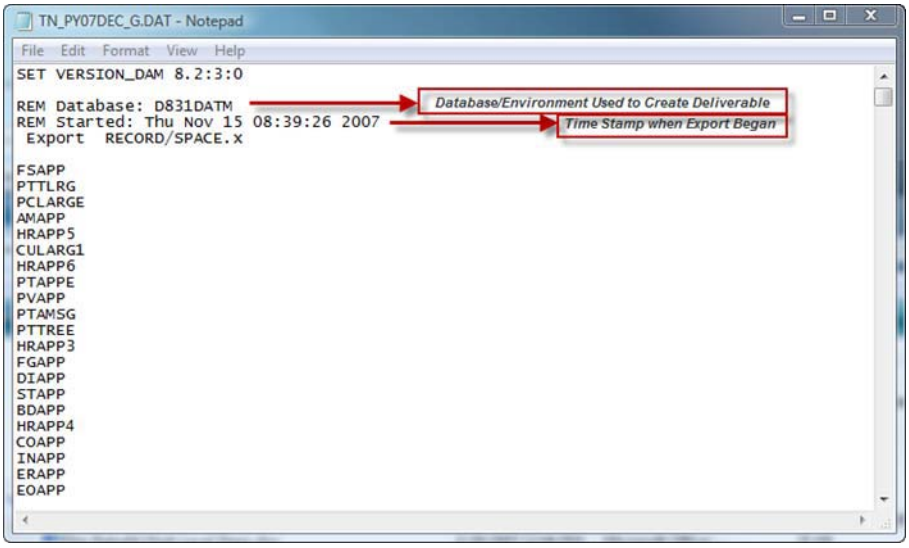

Figure 16: Metadata included in the beginning of a DAT file named "TN_PY07DEC_G.DAT" with a unique MD5 hash of 617837f851db79d838f38201adec749d

In order to determine how Environments were used by SAP TN to create data changes, Mandiant built a database with the information outlined in the table below for each DAT File:

Information Within the DAT File Database	
Field Name	Description
file_name	Name of the DAT File
preview	The context of the metadata extracted.
hit_text	The metadata extracted from each file.
file_ext	The file extension.
hash_value	The unique MD5 Hash for the file.
REM_DB	Environment name used to create and export the DAT File
REM_DB_type	Classifies the environment as "Generic" or states the customer prefix contained in the REM_DB
REM_DB_equals_client	If the "REM_DB_type" is equal to "client_receive"
REM_DATE	The date of when a PeopleSoft application began creating the data change.
REM_TIME	The time of when a PeopleSoft application began creating the data change.
last_accessed	Last accessed timestamp according to the file system.
file_created	Last created timestamp according to the file system.
last_written	The timestamp of last time it was written according to the file system.
entry_modified	The timestamp of when the entry was modified according to the file system.
logical_size	The logical size according to the file system.

client_receive	The customers prefix receiving the DAT File.
full_path	Full directory path of the file being imported into the database

Table 41: DAT File Database Fields

Mandiant recorded the fields within the database by using the following steps:

Step 1: Mandiant identified all files in Delivered Updates and Fixes with a file extension of ".DAT".

Step 2: Mandiant searched the contents of each identified file for references to a "REM Database:" by using EnCase. EnCase displays the results by displaying two fields that can be exported for analysis:

- Preview – Displays additional data before and after each keyword hit.
- Hit Text – Contains the results of each keyword hit.

Step 3: Mandiant exported the "Preview" and "Hit Text" for each file with a valid reference to a "REM Database." The "Hit Text" included the database name and timestamp of when the PeopleSoft application began creating the change. Additionally, Mandiant exported the following metadata fields from EnCase for each corresponding file:

- File Name
- File Extension
- Hash Value
- Last Accessed
- File Created
- Last Written
- Entry Modified
- Logical Size
- Full Path

Step 4: Mandiant created additional fields in the database by extracting information from the collected metadata in Step 3:

The customer receiving the data change:

Customer Receiving Data Change	
Path	**Customer Receiving**
TN78_and_Outside\TN78-Mail03-ClientFix\TN-PY05OCT**RHI**-TN-PY05OCT**RHI**-TN-PY05OCT.zip\ZipVolume**RHI**-TN-PY05OCT\PY05OCT\PY05OCT_BATCH\data\05PRT702_TN.DAT	RHI – (Robert Half Incorporated)

Figure 17: Customer Receiving the Data Change Field

The environment used to create the data change:

Environment Used to Create Data Change	
Hit Text	**Environment**
REM Database: **D702DATM** REM Started: Thu Sep 15 14:44:11 2005	D702DATM

Figure 18: Environment Used to Create the Data Change

The timestamp of the data change:

Timestamp of Data Change Creation Started	
Hit Text	**Timestamp**
REM Database: D702DATM REM Started: **Thu Sep 15 14:44:11 2005**	Thu Sep 15 14:44:11 2005

Figure 19: Timestamp of the Data Change

Step 5: Mandiant categorized the Environments TN used to create each data change by the following criteria:

- *Generic* – No customer specific prefix contained in the Environment name:
  - Example: D831DATM would be identified as generic since there is no customer prefix specified within the name of the Environment.
  - If a Generic Environment was identified, "Generic" would be recorded in Mandiant's database.
- *Customer Specific* – A customer prefix was identified in the Environment name:
  - Example: H881COHM would be identified as COH, or City of Huntsville. See eAppendix – "ORCLX-MAN-000212."
  - If an Environment was identified, the customer prefix was recorded in Mandiant's database, such as "COH".
- *Unknown* – Mandiant was unable to determine if the Environment was generic or customer specific:
  - Example: E842P7AZ
  - If an unknown Environment was identified, "Unknown" would be recorded in Mandiant's database.

Step 6: Mandiant then identified each DAT File applied to a customer specific Environment that matched or did not match the customer receiving the data change. The following information was recorded in the "REM_DB_equals_client" field:

- *Yes* - The correct customer specific Environment was used to create a data change delivered to a customer.
- *No* – The wrong customer specific Environment was used to create a data change delivered to a customer.
- *NA* – Cannot be determined since the Environment was either Generic or Unknown

b. Findings

Mandiant was able to identify 6,508 data changes delivered to approximately 123 unique SAP TN customers. Out of those 123 SAP TN customers, approximately 120 customers received at least

one data change from a Generic Environment. Additionally, 39 customers received at least one data change from the wrong customer specific Environment.[38] Furthermore, only two customers always received data changes from the correct Environment. Overall, 121 customers (98%) received at least one change created from a Generic or incorrect client labeled Environment.

6,256 DAT Files, or 96.1% of all data changes, were created from a Generic Environment. 91 DAT Files, or 1.4% of all data changes, were created from incorrect client-labeled Environments. Only 2.5% of all data changes were created from the correct customer specific environment. Overall, 158 DAT files were identified as matching the correct environment to the correct receiving customer. .01% of all data changes could not be identified as generic or customer specific. Three DAT Files were not counted in this analysis since the environment used to generate them could not be categorized. See ORCLX-MAN-000152.

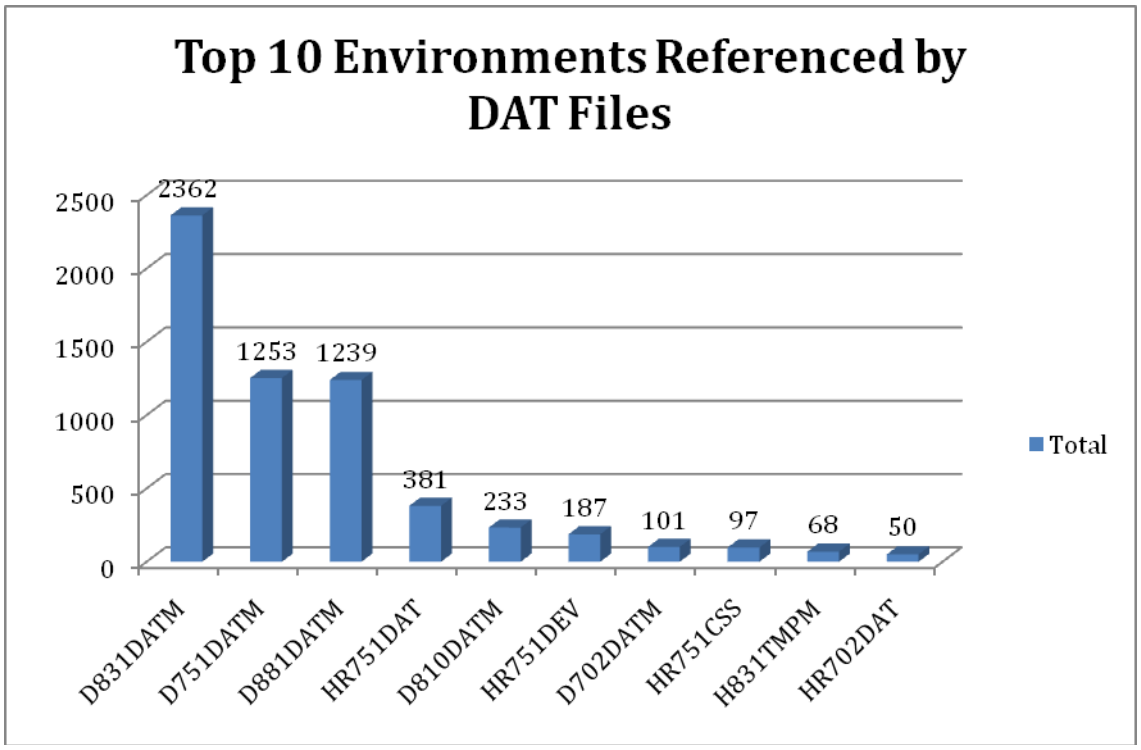

Figure 20: Top ten Environments Used to Support Multiple Customers

[38] Client Specific Environments are PeopleSoft environments that are attributed a specific SAP TN client.

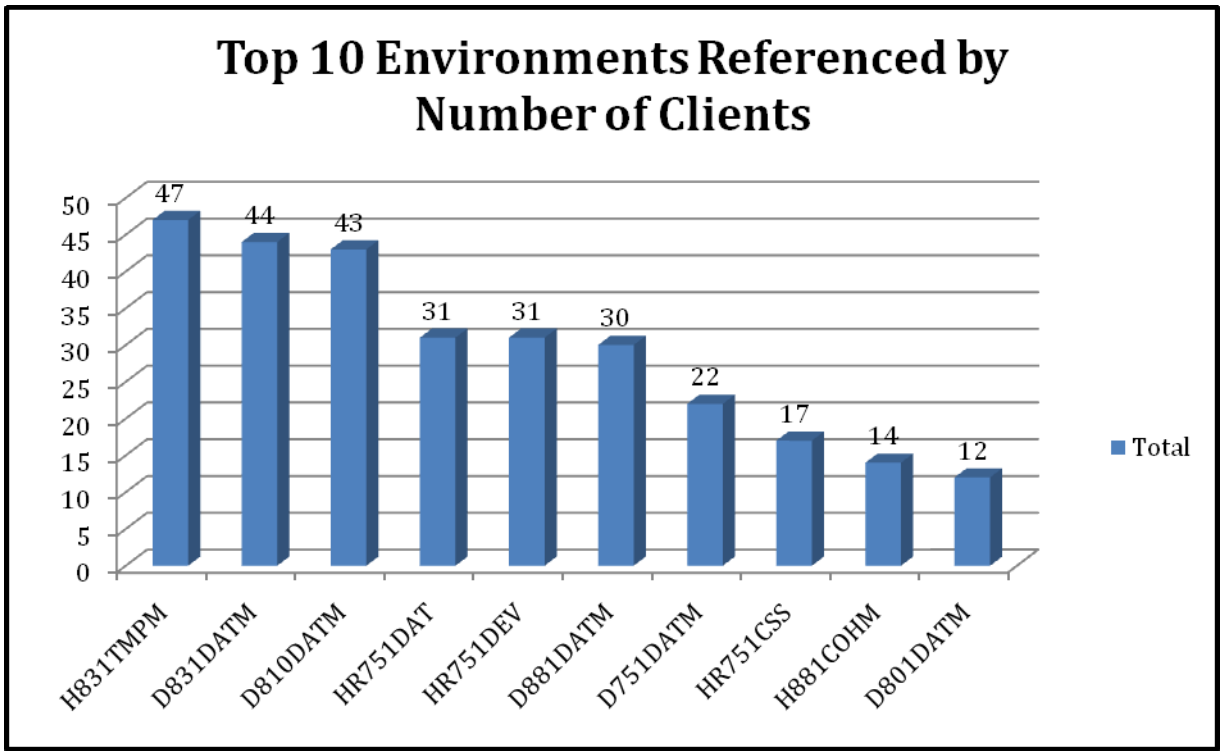

Figure 21: Top 10 Environments Used to Support Multiple Customers

2. Construction of the HRMS Fix Population

In generating the HRMS Fix population, Mandiant focused on Updates and Fixes that were delivered to SAP TN customers while also attempting to eliminate the possibility of "double counting" duplicated objects.

The following paragraphs outline the methodology Mandiant used to create the HRMS fix population for analysis:

Step 1: Mandiant used both produced versions of SAS Enterprise v3.5.1 to generate a master list of all Fix IDs. Specifically Mandiant:

- Navigated to view "4. Master Fixes / By Fix ID" in the SAS database.
- Selected all fixes.
- Exported all fixes to a text file, making sure to check the "Include View Titles" box. eAppendix - "ORCLX-MAN-000053" and eAppendix - "ORCLX-MAN-000052" contain the results of these queries.
- Mandiant combined these two text documents into a single list of HRMS Fix IDs.

Step 2: Mandiant created a list that contained all Fix IDs that appeared exactly once by performing the following tasks:

- Removed all exact duplicates.

- Where multiple fixes were identical save for prefixes, Mandiant considered only the highest Fix identified, based on the following hierarchy:

    - CSS-TN-1234567890
    - TN-1234567890
    - TLA-TN-1234567890, where "TLA" was any customer's three-letter acronym assigned from SAP TN.
    - 1234567890

Step 3: Mandiant removed all Fix IDs that referenced "Synch-up Bundles." Mandiant identified Synch-up bundles as a master Fix ID meeting any of the following criteria:

- The Fix ID contained "SYNC" in its name.

- The Fix ID is CKE-TN-03C-04B or 2003C-2004E.

Mandiant did not include Synch Up bundles in an effort to avoid redundant analysis. Synch Up Bundles usually contained no new File-based Objects or code but were instead a package of previously developed Fixes sent to newly on-boarded SAP TN customers. Mandiant would have already performed analysis on the fixes contained in Synch Up Bundles and Mandiant's intent was to perform analysis only on Fix IDs that included new development.

Step 4: Mandiant removed all Fix IDs that referenced any "Critical Support Bundles." Mandiant identified "Critical Support Bundles" bundles by removing from the HRMS Fix Population all Fix IDs meeting all of the following criteria:

- The Fix ID was in the form of "TN-PYyyxxx" (Where "yy" = a two-digit year and "xxx" = three-letter month abbreviation, or "xxx" equals "CAN" or "FNL").

- The SAS database contained both a Master Fix entry and a Master Bundle entry for this Fix ID.

Step 5: Mandiant removed the test fixes by identifying Fix IDs meeting any of the following criteria:

- Any Fix ID identified as part of the bundle with bundle ID "001 Test 2006Q3".

- The Fix ID was "0501053303," "0521071345" or "001 Test 2006Q3".

Step 6: Mandiant removed all fixes not designated as fixes for the HRMS product line.

Step 7: Mandiant separated the remaining Fix IDs (after Steps 1 through Step 6 were completed) into two categories; "Critical Support" and "Retrofit." Mandiant categorized each Fix ID based on the following criteria:

- Critical Support:

    - All fixes where the SAS database contained a Master Fix record with an active date greater than or equal to 1/1/2006 were categorized as "Critical Support" fixes.

    - All remaining fixes where the SAS database contained a Master Fix record beginning with "CSS-TN-" were Critical Support fixes.

- All remaining fixes where the SAS database contained a Master Fix record beginning with "XXX-TN-,", where "XXX" represented any customer's three-letter acronym, were Critical Support fixes.

- Retrofit:

  - All other fixes not identified as Critical Support fixes. Mandiant used the above methods to categorize all non-Critical Support fixes as Retrofit because the Retrofit bundles often included fixes not assigned to any Fix ID.

The above steps reduced the total number of Fix IDs from all SAS versions from 1,773 to 1,626. On 4/8/2009, 15 additional fixes were identified as non HRMS fixes and were removed. Additionally, fixes "CKE-TN-03C-04B" and "2003C-2004E" were also removed, reducing the total number of Fix IDs from 1,626 to 1,609 Fix IDs.

See eAppendix – "ORCLX-MAN-000206" for the list of Fix IDs broken out by population. See ORCLX-AACG-000005 for the list of Fix IDs in sample order selected by AACG.

3. Determination of "First Deliverable"

Mandiant defined *First Deliverable* as the initial occurrence a SAP TN customer received a reference to a specific Fix ID. For example, the first time Praxair received a file referencing the Fix ID 030804664, Mandiant categorized that file as "First Deliverable" of the 030804664 Fix ID for Praxair.

Mandiant aimed to determine the first occurrence that each Fix ID or reference to that Fix ID was delivered to a specific SAP TN customer. Mandiant approached this by determining the "First Deliverable" of each Fix ID to each unique customer. Mandiant performed the following operations to identify the First Deliverable of a Fix ID for each SAP TN customer:

Step 1: Mandiant identified 1773 unique Fix IDs contained within the SAS database Master Fix Records. See Section "Defining HRMS Fix Population"; eAppendix – "ORCLX-MAN-000051" is a listing of these unique Fix IDs.

Step 2: Mandiant searched every "Delivered Update and Fix" file for each of the 1773 unique Fix IDs in order to associate each file with the specific Fix ID the file addressed. It is important to note that the Fix ID to file ratio was not necessarily one-to-one. In other words, one file could contain multiple fixes within its contents. Conversely, the data required for one fix could be spread across multiple files. Each row represented one Associated File for one Fix.

Step 3: Mandiant also identified the files with a file name or file path containing a Fix ID. Those files were then associated to the Fix ID found in the filename or file path. For example, file ctx910rm.sqr was associated with Fix ID 0102085972 because the file existed in a location containing the Fix ID: CSS-TN-0102085972\BAX-TN-0102085972\0102085972\TN-0102085972_BATCH\sqr\ctx910rm.sqr.

Step 4: Mandiant created a database table that contained the results of the search performed above in Step 2 and Step 3. This table included every reference to the 1773 unique Fix IDs, and the corresponding files in which these references were contained.

This operation resulted in identifying approximately 18,835 unique Delivered Updates and Fixes files referencing Fix IDs a total of 525,161 times. eAppendix – "ORCLX-MAN-000054" contains a detailed list of each Fix ID reference. It is important to note that if a single file referenced 10 different Fix IDs within its contents, eAppendix – "ORCLX-MAN-000054" would represent the file with 10 separate rows, pairing the filename to each of the 10 Fix IDs it referenced.

The resulting table, representing all 525,161 Fix ID references found, contained the following fields:

- Filename – Name of the file
- Fix ID – One of the Fix IDs referenced in the file
- Logical Size – The size in bytes of the file
- File MD5 Hash – Corresponding MD5 hash of the file
- Full File Path – The exact file system location of the file

Mandiant identified 18 different file types that contained references to plain text Fix IDs. These file types are listed in Table 42:

File Types That Contained Fix ID References		
.CBL	.KEY	.SQL
.DAT	.LNK	.SQR
.DMS	.LOG	.TMP
.DOC	.RPT	.TXT
.HTM	.RTF	.XLS
.INI	.SQC	.XML

Table 42: List of File Types that Referenced SAP TN Fix IDs

Step 5: Using the data in the tables created above (eAppendix - "ORCLX-MAN-000058" and eAppendix – "ORCLX-MAN-000054"), Mandiant created a query to determine for each Fix ID, the files associated with the Fix ID, the customers receiving each file, and the dates each customer received those files.[39]

Step 6: Mandiant sorted the table in ascending order by Fix ID delivery date. In other words, Mandiant ordered the Fix ID references contained within the file from oldest to most recent. Mandiant made the assumption that the ZIP file's last written timestamp was an approximate date in which the SAP TN customer received the file.[40]

Step 7: Mandiant created another table that recorded the first occurrence of each Fix ID reference for each SAP TN customer. If to the same customer, with the same ZIP file last written time, each file was catalogued as "First Deliverable." See eAppendix – "ORCLX-MAN-000055."

In some cases, a ".DMS" file and its associated ".DAT" file were considered "first deliverable" for that fix if the ".DMS" file name or file location contained the Fix ID and the ".DMS" file contents did not contain any other Fix IDs. The process for determining ".DMS" and ".DAT" first deliverables is described in Measure 105 and the files are listed in eAppendix – "ORCLX-MAN-000071."

Step 8: Mandiant created a second table that recorded all subsequent deliverables of a Fix ID to a customer (see eAppendix – "ORCLX-MAN-000057"). Mandiant created a Visual Basic program that automated this calculation, and followed the general steps outlined below:[41]

[39] ORCLX-MAN-000054 and ORCLX-MAN-000058 were joined by MD5 hash.

[40] ORCLX-MAN-0000387 lists all 4,607 zip files, unique by file name, together with their associated last written dates. Files outside of a zip file were treated as having the earliest possible delivery date.

[41] The Visual Basic program, input for the program and instructions for use of the program were produced as ORCLX-MAN-000386, ORCLX-MAN-000387 and ORCLX-MAN-000388, respectively.

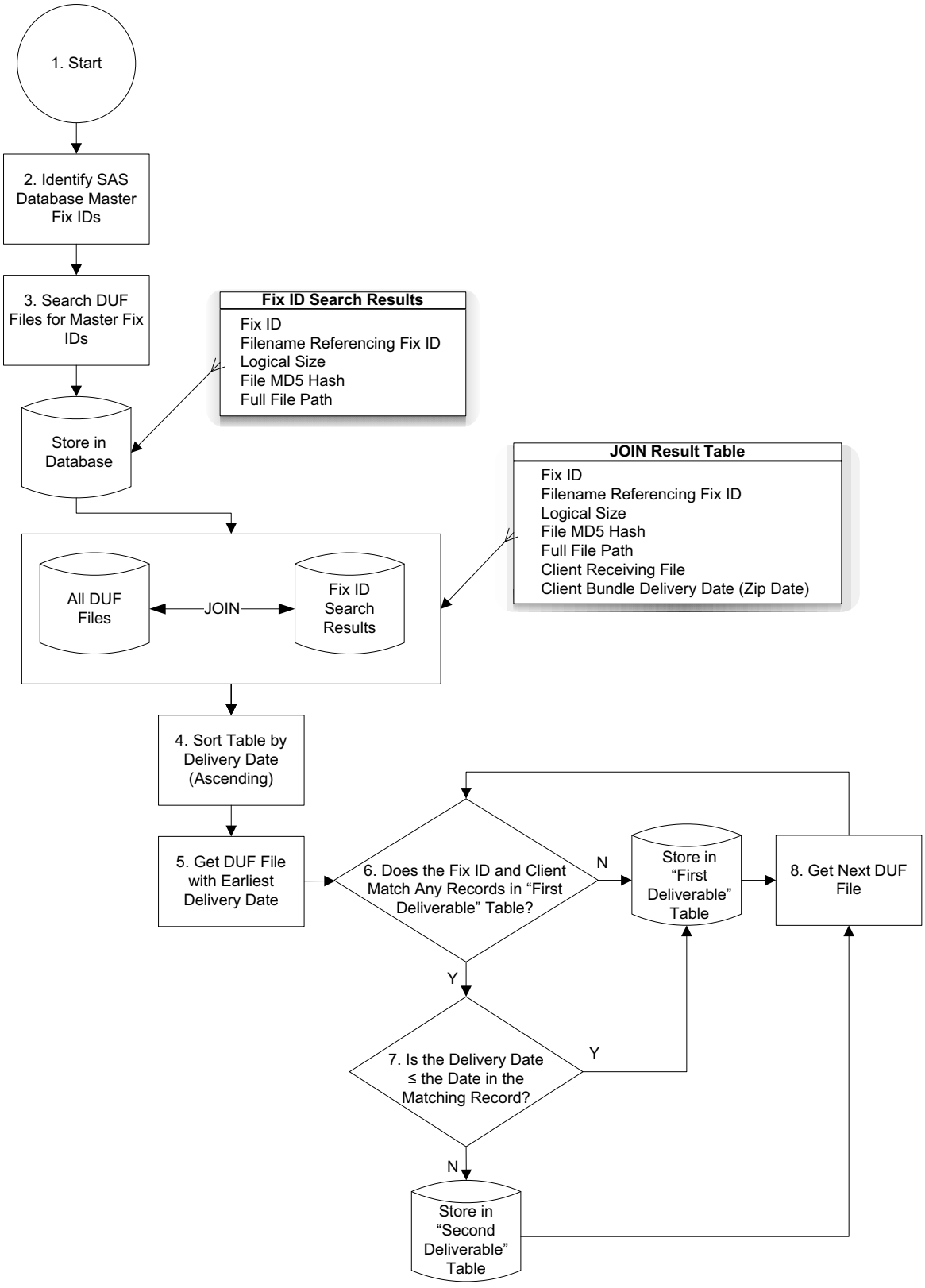
1. Start
2. Identify SAS Database Master Fix IDs
3. Search DUF Files for Master Fix IDs
Store in Database
Fix ID Search Results
Fix ID
Filename Referencing Fix ID
Logical Size
File MD5 Hash
Full File Path
JOIN Result Table
Fix ID
Filename Referencing Fix ID
Logical Size
File MD5 Hash
Full File Path
Client Receiving File
Client Bundle Delivery Date (Zip Date)
All DUF Files
JOIN
Fix ID Search Results
4. Sort Table by Delivery Date (Ascending)
5. Get DUF File with Earliest Delivery Date
6. Does the Fix ID and Client Match Any Records in "First Deliverable" Table?
N
Store in "First Deliverable" Table
8. Get Next DUF File
Y
7. Is the Delivery Date ≤ the Date in the Matching Record?
Y
N
Store in "Second Deliverable" Table

Figure 22: Process for determining "First Deliverable"

It is important to note that this method of determining "First Deliverable" often yielded very conservative object counts. Many SAP TN fix deliveries were often preceded by the delivery of a cover letter template to SAP TN clients informing them of the fix they were about to receive. Because these letters contained the Fix ID and had a delivery date that preceded the code based files, Mandiant classified the document as "First Deliverable" while classifying the "File-based Objects" related to the fix as "Subsequent Deliverables."

For example, for Fix ID 2005C-751G, client Brigham Young University (BYU) received a document ("BYU-TN-2005C-751G.doc") containing the Fix ID and notifying BYU of the delivery of the Fix ID. This document existed outside the ZIP file TN used to deliver the File-based Objects ("BYU-TN-2005C-751G.zip") and also has an earlier file "last written" date. Mandiant's method classified this document as the BYU's "first deliverable" of 2005C-751G. The 23 ".SQR",".SQC", and ".CBL" files contained within the ZIP file were conservatively classified as "subsequent deliverables."

Table 43 below lists Fix IDs with "first deliverable" counts affected by earlier delivery of SAP TN cover letter documentation:

Sample Fix IDs Contained in SAP TN Cover Letter Documents				
1512064989	2004C-751G	2005A-751C	2005C-702C	2005D-702C
1303074321	2004D-751C	2005A-751G	2005C-702P	2005D-702P
2004A-751C	2004D-751G	2005B-702C	2005C-751C	2005D-751C
2004A-702C	2004E-751G	2005B-702P	2005C-751G	2005D-751G
2004C-751C	2004F-751C	2005B-751C	2005C-760S	2005D-760S

Table 43: Fix IDs Contained in SAP TN Cover Letter Documentation

4. Measurements for HRMS Fix Analysis

Mandiant was asked to maintain 44 different measurements to support an effort to understand SAP TN's development and distribution process. These measurements, as well as other supplemental measurements Mandiant had to maintain, are included as eAppendix – "ORCLX-MAN-000059."[42] Mandiant received data in support of several measures from Oracle; this data is included as eAppendix - "ORCLX-MAN-000063," eAppendix – "ORCLX-MAN-000064," eAppendix – "ORCLX-MAN-000212," and eAppendix - "ORCLX-MAN-000216."[43] Mandiant maintained these measures for each specific Fix ID.

a. Measure 101

Mandiant determined the number of Oracle software releases and versions to which each Fix ID applied.

Mandiant reviewed the SAS database and recorded the number of values in the "Application Release" field. The following picture provides an illustration of what was recorded for Fix ID "0104054962":

[42] Much of the information produced in support of this Section can also be found in Mandiant's HRMS Fix Analysis Access database, produced as ORCLX-MAN-000316. The measure definitions can also be found at ORCLX-MAN-000205.

[43] Data comprising ORCLX-MAN-000216 was collected from SAS and the "Consultant Docs and Templates" directory on TN-FS01, both of which were produced by Defendants.

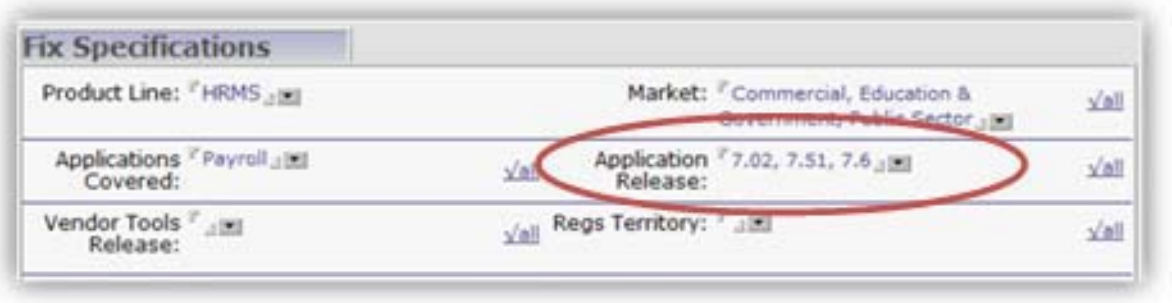

Figure 23: SAS Database "Application Release" field

Figure 23 above yielded a measure of "3," for having three separate versions supported by the Fix ID – 7.02, 7.51, and 7.6.

b. Measure 102

Mandiant recorded the number of Oracle software releases and versions SAP TN contractually supported for the customers that received the Fix ID. Mandiant relied upon analysis of Delivered Updates and Fixes as well as review of the SAS database and Data Warehouse documentation.

Mandiant determined this measure by adhering to the following process:

Step1: Mandiant identified all SAP TN customers that received the Fix ID and the date which the customers likely received the Fix ID by reviewing eAppendix – "ORCLX-MAN-000055."

Step 2: Mandiant relied on data from eAppendix – "ORCLX-MAN-000064" to determine the PeopleSoft software versions on which SAP TN was supporting each customer at any given time.

Step 3: Mandiant linked files with extensions ".SQR", ".SQC", ".CBL", and ".DAT" from eAppendix – "ORCLX-MAN-000055" with the "PeopleSoft HRMS Contracts from SAS" table by three letter customer code.

Step 4: Mandiant then compared the ZIP last written time to the start and end dates for the SAP TN contract maintained by the "PeopleSoft HRMS Contracts from SAS" table.

Step 5: If the ZIP last written date from the eAppendix – "ORCLX-MAN-000055" table was within the timeframe of the contractual agreement, Mandiant recorded the software version listed in column C of the "PeopleSoft HRMS Contracts from SAS" table.

Step 6: Mandiant created a working table that tracked all the software versions associated with the Fix ID. This table is provided as eAppendix – "ORCLX-MAN-000065."

Step 7: In October 2009, further analysis of SAS database documentation provided details surrounding 30 Fix IDs and the associated recipient SAP TN customers and recipient dates that required additional calculations for Measure 102. The data Mandiant recorded for these 30 Fix IDs is provided as eAppendix – "ORCLX-MAN-000063."

Step 8: Mandiant functionally repeated Step 3 through Step 5. The results of these comparisons are provided as eAppendix - "ORCLX-MAN-000066."

Step 9: Mandiant identified files with extension ".DMS" from eAppendix – "ORCLX-MAN-000055" and where the ".DMS" file contained the Fix ID within the contents of the file and not in the

file name or file path. These files were then linked with the "PeopleSoft HRMS Contracts from SAS" table by three letter customer code.

Step 10: Mandiant functionally repeated Step 5 for the files identified in Step 9. The results are listed in - eAppendix – "ORCLX-MAN-000067."

Step 11: Mandiant identified files with extension ".DMS" from eAppendix - "ORCLX-MAN-000054" and where the ".DMS" file path or name contained the Fix ID but the file contents did not.

Step 12: Mandiant functionally repeated Step 5 for the files identified in Step 11. The results are listed in eAppendix – "ORCLX-MAN-000068."

Step 13: Mandiant performed a union of eAppendix – "ORCLX-MAN-000065", eAppendix – "ORCLX-MAN-000066", eAppendix – "ORCLX-MAN-000067", and eAppendix – "ORCLX-MAN-000068", resulting in a list of the unique software versions the SAP TN customers receiving the Fix ID were under service contract at the time the fix was delivered.

Step 14: Mandiant then counted the total number of unique software versions each Fix ID applied to and recorded the results in eAppendix – "ORCLX-MAN-000069." The possible software versions counted are listed below:

- 7
- 7.02
- 7.5
- 7.51
- 7.6
- 8 SP1
- 8.3
- 8.3 SP1
- 8.8
- 8.8 SP1
- 8.9
- 8.9 SP1

c. Measure 102A

In the steps outlined above (Measure 102), Mandiant also identified the names of the software versions to which each Fix ID applied. Mandiant recorded these Oracle Software version names in Measure 102A. The possible software versions Mandiant recorded are listed below:

- 7
- 7.02
- 7.5
- 7.51
- 7.6
- 8 SP1
- 8.3
- 8.3 SP1
- 8.8
- 8.8 SP1
- 8.9
- 8.9 SP1

For example, for Fix ID "030804664," Mandiant identified seven customers that received the Fix ID (ARC, FTI, PRX, QGI, RWC, SBH, and TEL). Mandiant reviewed the contract information extracted from the SAS database and recorded each Oracle software version for which these seven customers had service contracts during the time frame of the fix delivery. In this case, these seven customers were licensed to a total of three PeopleSoft HRMS versions: 7.51, 8 SP1, and 8.3 SP1.

d. Measure 103

Mandiant recorded the status of each fix according to data contained within the SAS database. Each Fix ID could only have one of the following "Status" values:

- [blank]
- Available for Client Use
- Cancelled
- Completed – Ready to Post
- On Hold
- Open – Bundle Development
- Open – Bundle Test
- Open – Design
- Open – Development
- Open – Documentation
- Open – Final QA
- Open – Scope
- Open – Test
- Research Only

Mandiant obtained this value by reviewing the SAS database and recording the value in the "Status" field. Figure 24 below provides an illustration of what was recorded as Measure 103 for Fix ID "0104054962":

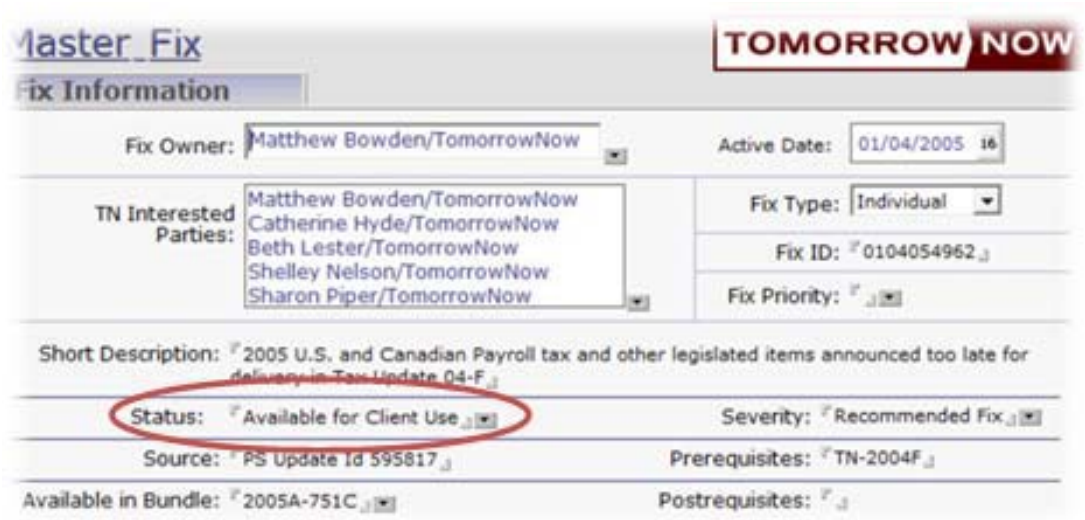

Figure 24: SAS Database "Status" field

e. Measure 104

Mandiant recorded the number of unique File-based Objects (CBL, SQR, or SQC files) associated with the first deliverable of any Fix ID.

Step1: Mandiant reviewed the files recorded in eAppendix - "ORCLX-MAN-000055" and identified the unique File-based Objects and their corresponding MD5 file hashes.

Step2: Mandiant recorded the number of unique files associated with the "first deliverable" of the specific Fix ID. If the same file was delivered to multiple customers, the file hash was counted only once.

Mandiant maintained the results in eAppendix - "ORCLX-MAN-000070."

f. Measure 105

Mandiant recorded the number of unique ".DAT" and ".DMS" files associated with the first deliverable of any Fix ID.

Measure 105 was a multi step process to address the following characteristics:

- ".DAT" files rarely referenced the Fix ID within the ".DAT" file contents.
- ".DMS" files usually contained references to specific Fix IDs.
- ".DMS" files usually contained references to an associated ".DAT" file.

Mandiant had to align or link ".DAT" files whose contents rarely referenced Fix IDs with their associated data mover script (".DMS" file) whose contents usually referenced Fix IDs. Although a few ".DAT" files referenced Fix IDs, under the majority of cases, Mandiant could not associate a ".DAT" file with a specific Fix ID without additional "link" analysis.

Mandiant performed the following steps to link a ".DAT" file that did not reference a Fix ID to a specific Fix ID:

Step 1: Mandiant identified each DMS file that referenced a specific Fix ID (see eAppendix - "ORCLX-MAN-000054").

Step 2: Mandiant reviewed each DMS file to identify the ".DAT" file it referenced.

Figure 25 below shows an excerpt from a DMS file named "TN_PY04DEC_U.dms" referencing the Fix ID "TN-1130043216." This file also referenced a single ".DAT" file called "TN_PY04DEC_U.dat":

```
SET INPUT TN_PY04DEC_U.DAT;
SET LOG TN_PY04DEC_U.LOG;
```

```
REMARK
\ TN-1130043216
/
```

Figure 25: Example of "TN_PY04DEC_U.dms" File Contents

Step 3: Mandiant identified the customer specific bundle containing each .DMS file.

For example, Figure 26 below shows the decompressed the customer specific bundle directory structure where the "TN_PY04DEC_U.DMS" file was stored:

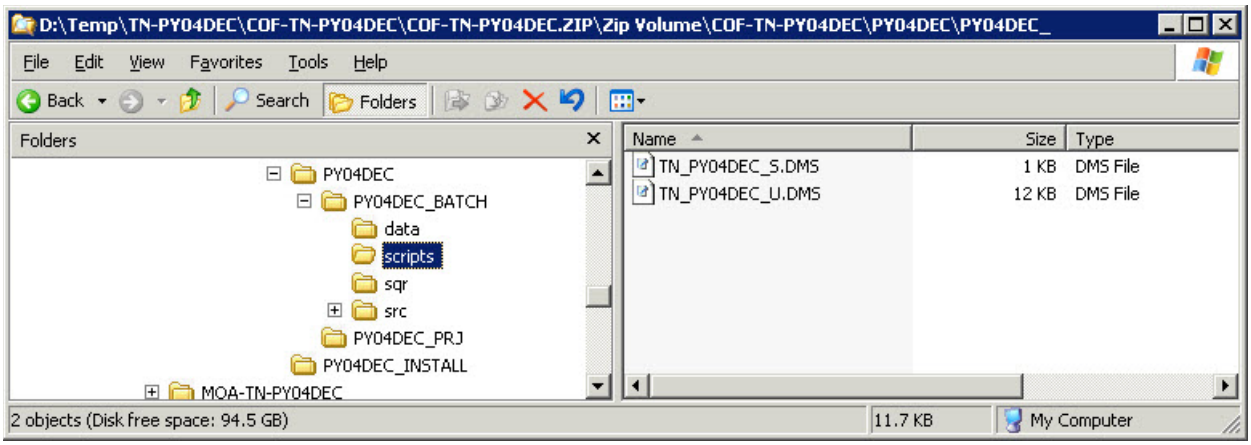

Figure 26: Common Location of ".DMS" File

Step 4: Mandiant reviewed the contents of the customer specific bundle to find the exact ".DAT" filename referenced in the ".DMS" in Step 3 above.

In Figure 27, the customer specific bundle file was named "COF-TN-PY04DEC." Mandiant reviewed its sub directories to find the exact ".DAT" file the DMS referenced. Therefore, Mandiant reviewed the "data" sub directory for the customer specific bundle and "linked" the ".DAT" file to the DMS referencing the Fix ID. Figure 27 below shows how the ".DAT" file was found in relation to its corresponding DMS file:

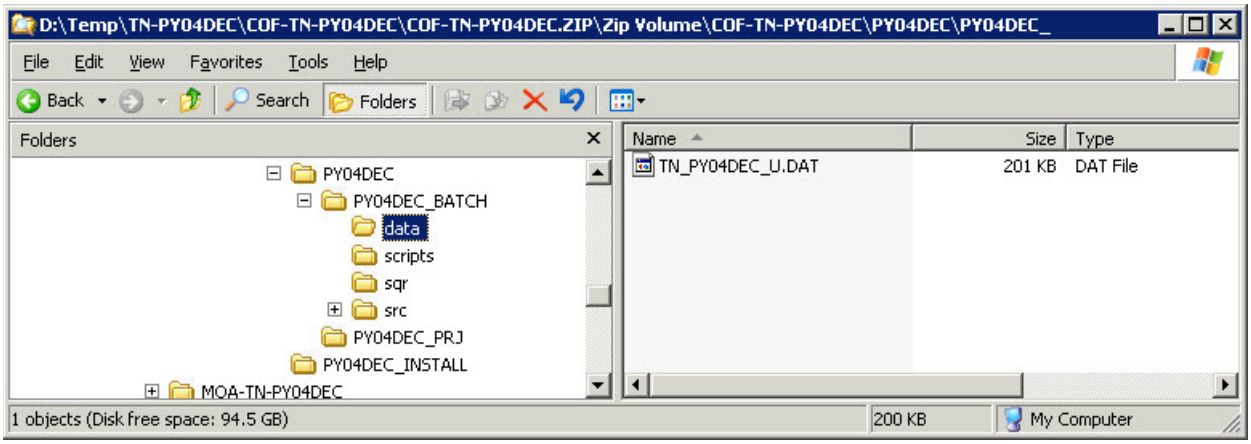

Figure 27: Common Location of ".DAT" File

For example, in the case of "TN_PY04DEC_U.DMS" in the figures above, Mandiant linked the "TN_PY04DEC_U.DAT" file in the customer specific bundle "COF-TN-PY04DEC" to the Fix ID "TN-1130043216."

Step 5: Mandiant utilized SQL queries to identify and associate the ".DMS" and ".DAT" files to a Fix ID. If the exact ".DAT" filename referenced in the ".DMS" existed in the same customer specific bundle, Mandiant considered any Fix IDs referenced within the ".DMS" file to also be Fix IDs referenced by the associated ".DAT" file.

Mandiant identified files in the following categories:

".DMS" and ".DAT" files from eAppendix - "ORCLX-MAN-000055"

- ".DMS" files that did not necessarily reference a ".DAT" file but that contained the Fix ID within the ".DMS" file contents
- ".DAT" files that were not necessarily linked by a ".DMS" file but that contained the Fix ID within the ".DAT" file contents
- ".DMS" files containing the Fix ID and a reference to a ".DAT" file
- ".DAT" files linked to by the ".DMS" files containing the Fix ID

  ".DMS" and ".DAT" files from eAppendix – "ORCLX-MAN-000054"

- ".DMS" files with a file name containing the Fix ID or existing in a path containing the Fix ID but not containing a Fix ID within the contents of the file
- ".DAT" files linked to by the ".DMS" files with a file name containing the Fix ID or existing in a path containing the Fix ID

Mandiant filtered to exclude files with the names such as "msg.DAT", "pcm.DAT", "PDM.DAT", "PJM.DAT", "PSD.DAT", "RDM.DAT", "XTM.DAT", and "FIELD.DAT". These filenames were often associated with online-object changes and usually did not contain plain text custom code.

Mandiant recorded these first deliverable ".DAT" and ".DMS" files per fix in eAppendix – "ORCLX-MAN-000071."

g. Measure 106

Measure 106 was the total number of unique ".SQR", ".SQC", ".CBL", ".DAT", and ".DMS" files associated with a first deliverable of a Fix ID.

Step 1: Mandiant summed the totals of Measure 104 with Measure 105.

h. Measure 107

Mandiant recorded the number of unique ".SQR", ".SQC", ".CBL", ".DAT", and ".DMS" files for the set of files that were never associated with subsequent deliverable. Mandiant recorded only those files where each time a SAP TN customer received that particular file, it was the first time that the customer had received anything pertaining to that Fix ID. Therefore this measure counts files that were never subsequently delivered to the same customer, and no SAP TN customer received the files counted in this measure more than once. Conservatively, an exact file delivered to the same customer at different times would not be in this subset, even though that could be reasonably considered as a second delivery of a first deliverable.

Step 1: Mandiant determined the ".SQR", ".SQC", and ".CBL" files associated with the first deliverable of each Fix ID and the ".DAT" and ".DMS" files identified in Measure 105 for each Fix ID.

Step 2: Mandiant then determined all the files associated with subsequent deliveries of the Fix ID.

See eAppendix - "ORCLX-MAN-000055"; eAppendix – "ORCLX-MAN-000071"; eAppendix - "ORCLX-MAN-000057."

Step 3: Mandiant performed a SQL query to return only those files (based on MD5 file hash) that were listed in eAppendix - "ORCLX-MAN-000055" or eAppendix – "ORCLX-MAN-000071" for a particular fix but not listed in eAppendix – "ORCLX-MAN-000057" for that same fix.

Step 4: Mandiant filtered the results to include only files with the extensions ".SQR", ".SQC", ".CBL", ".DAT", and ".DMS."

Step 5: Mandiant further filtered the list to exclude filenames such as "msg.DAT", "pcm.DAT", "PDM.DAT", "PJM.DAT", "PSD.DAT", "RDM.DAT", "XTM.DAT", and "FIELD.DAT." These filenames were often associated with online-object changes and usually did not contain plain text custom code.

Mandiant recorded the results in eAppendix "ORCLX-MAN-000072."

i. Measure 107A

Mandiant recorded the hashes counted in Measure 107 in eAppendix "ORCLX-MAN-000072."

j. Measure 108

Mandiant determined the number of copies of the Files Associated with First Deliverable throughout all the Delivered Updates and Fixes.

Step 1: Mandiant identified all first deliverable MD5 file hashes by reviewing eAppendix – "ORCLX-MAN-000055" and eAppendix – "ORCLX-MAN-000071."

Step 2: Mandiant filtered the list to include only files with extensions ".SQR", ".SQC", ".CBL", and ".DMS."

Step 3: Mandiant determined the number of copies of files per Fix ID.

Step 4: Mandiant then determined the number of copies of linked ".DAT" files per fix using the steps outlined in Measure 105.

Mandiant recorded the results in eAppendix - "ORCLX-MAN-000073."

k. Measure 109

Mandiant determined the number of copies of the first deliverable ".SQR", ".SQC", ".CBL", ".DAT", and ".DMS" files throughout the "alternate sources" of Delivered Updates and Fixes. "Alternate sources" of Delivered Updates and Fixes was defined as the Hard Drive 78 directories called "ClientFix Test," "testClientFix," Disc 186 "ClientFix," and Disc 9 "\Mail03\Copy of Client Fix."

Step 1: Mandiant calculated the MD5 hashes of the ZIP files from Delivered Updates and Fixes. These files were contained on the hard drive labeled Hard Drive 78, within the "Mail03\Mail03.L01\ClientFix." These hashes are recorded in eAppendix -"ORCLX-MAN-000076."

Step 2: Mandiant counted the number of occurrences of the ZIP file MD5 hashes identified in Step 1 throughout all the Delivered Updates and Fixes. Mandiant searched for ZIP files throughout the following directories:

- Hard Drive 78\Mail03\ClientFixTest
- Hard Drive 78\Mail03\testClientFix
- Disc 186\WEB01\ClientFix

- Disc 9\Client Fixes\MAIL03\Copy of Client Fix

Files that were already considered part of "Delivered Updates and Fixes" (as determined in Section: Defining the Unique Set of "Delivered Updates and Fixes") were excluded from the count of Measure 109. Mandiant recorded the location of each matching ZIP file in eAppendix - "ORCLX-MAN-000075."

Step 3: Mandiant identified the number of times each ".SQR", ".SQC", ".CBL", ".DAT", and ".DMS" file in eAppendix – "ORCLX-MAN-000055" and eAppendix – "ORCLX-MAN-000071" was delivered in a ZIP file contained in our counts of Step 2 above.

Step 4: Mandiant excluded counts of filenames such as "msg.DAT", "pcm.DAT", "PDM.DAT", "PJM.DAT", "PSD.DAT", "RDM.DAT", "XTM.DAT", and "FIELD.DAT." These filenames were often associated with online-object changes and usually did not contain plain text custom code.

Step 5: Mandiant recorded the results in eAppendix - "ORCLX-MAN-000074."

I. Measure 110

Mandiant identified all files within the Data Warehouse that were copies of the ".SQR", ".SQC", ".CBL", ".DAT", and ".DMS" Files Associated with First Deliverable (Measure 107) with no subsequent delivery. In other words, Measure 110 counted the total number of "first deliverable" files identified in Measure 107 throughout Data Warehouse.

Step 1: Mandiant searched the following 32 systems within "Data Warehouse" for copies of the first deliverable hashes that were not subsequent deliveries (Measure 107):

List of Systems Searched within Data Warehouse			
BU02_G1_07253	BU02_G2_07504	BU02_G3_07253	BU02_G4_07506
DCJDDEV03_07437	DCJD EdwardsNT02_07460	DCJDWDEV01_07564	DCPSTEMP01_E_07234
DCPSTEMP02_07247	DCWTS01_07823	HOMER1_7246	JDWSVR01_C_07678
JDWSVR01_G_07562	PSDEV01_HD1_07813	PSDEV01_HD2_07809	PSDEV01_HD3_07749
PSDEV01_LV00_07252	PSDEV01_LV01_07685	PSDEV03_db_07744	PSDJDDEV02_07250
SBLPROD01_08239	SBLPROD02_08236	SBLPROD03_08231	TempStore_CE_07461
TN-FS01_F_07204	TN-FS01_F_07216	TN-FS01_F_12112008_07217	TN-FS02_E_07824
TNWTS-01_C_07680	TNWTS01_D_07566	TNWTS01_Z_07568	YOGI_07560

Table 44: List of Systems Searched Within Data Warehouse for Measure 110.

Step 2: Mandiant created a hash set representing the files identified in eAppendix - "ORCLX-MAN-000072."

Step 3: Mandiant searched the "Data Warehouse" images listed above for files with MD5 hashes matching the hash set created in Step 2.[44]

Step 4: Mandiant then used the data listed in eAppendix - "ORCLX-MAN-000072" to determine the associated Fix IDs of the files found in Data Warehouse.

Step 5: Mandiant recorded the number of copies per fix in eAppendix - "ORCLX-MAN-000077."

[44] Path information for matching files can be found in table "tblPrB1_Copies_in_DW" within ORCLX-MAN-000316, the HRMS Fix Analysis Database.

m. Measure 111

Mandiant identified copies of ".SQR", ".SQC", ".CBL", ".DAT", and ".DMS" within eAppendix – "ORCLX-MAN-000055," stored in compressed ZIP files in "Data Warehouse".

Step 1: Mandiant calculated the MD5 sums of the ZIP files located on Hard Drive 78, with the "Mail03\ClientFix" directory (see eAppendix - "ORCLX-MAN-000076").

Step 2: Mandiant counted the number of occurrences of the ZIP files listed in Step 1 throughout the following 32 systems from "Data Warehouse":[45]

List of Systems Searched within Data Warehouse			
BU02_G1_07253	BU02_G2_07504	BU02_G3_07253	BU02_G4_07506
DCJDDEV03_07437	DCJD EdwardsNT02_07460	DCJDWDEV01_07564	DCPSTEMP01_E_07234
DCPSTEMP02_07247	DCWTS01_07823	HOMER1_7246	JDWSVR01_C_07678
JDWSVR01_G_07562	PSDEV01_HD1_07813	PSDEV01_HD2_07809	PSDEV01_HD3_07749
PSDEV01_LV00_07252	PSDEV01_LV01_07685	PSDEV03_db_07744	PSDJDDEV02_07250
SBLPROD01_08239	SBLPROD02_08236	SBLPROD03_08231	TempStore_CE_07461
TN-FS01_F_07204	TN-FS01_F_07216	TN-FS01_F_12112008_07217	TN-FS02_E_07824
TNWTS-01_C_07680	TNWTS01_D_07566	TNWTS01_Z_07568	YOGI_07560

Table 45: List of Systems Searched Within Data Warehouse for Measure 111.

Step 3: Mandiant counted the number of times each ".SQR", ".SQC", ".CBL", ".DAT", and ".DMS" associated with first deliverable (listed in eAppendix – "ORCLX-MAN-000055") was delivered in a ZIP file contained in our counts of step 2 above.

Step 4: Mandiant excluded counting occurrences of the following filenames: "msg.DAT", "pcm.DAT", "PDM.DAT", "PJM.DAT", "PSD.DAT", "RDM.DAT", "XTM.DAT", and "FIELD.DAT."

Mandiant recorded the number of files copies per fix in eAppendix - "ORCLX-MAN-000078."

n. Measure 112

Mandiant identified and counted the occurrences of the first deliverable hashes that were not subsequent deliveries files as identified in Measure 107 and stored within the environment backups (PS_Homes) found throughout Data Warehouse.

In order to complete this task, Mandiant decompressed over 10 TB of data stored within the Environment Backups, then calculated the MD5 file hashes for SQR", ".SQC", ".CBL", ".DAT", and ".DMS" files that were stored in the Environment Backups. Mandiant then compared these hashes to the hashes we identified in Measure 107.

Step 1: Mandiant decompressed 2,994 Environment Backup files resulting in approximately 10TB of data. (see eAppendix – "ORCLX-MAN-000080" and "ORCLX-MAN-000329").

Step 2: Mandiant calculated the MD5 hashes for the ".SQR", ".SQC", ".CBL", ".DAT", and ".DMS" files stored within the compressed Environment Backups.[46]

[45] Path information for matching files can be found in table "tblZips_fromTN78_DU_DW_Copies" within ORCLX-MAN-000316, the HRMS Fix Analysis Database.

Step 3: Mandiant counted the number of files found in the decompressed backups with the MD5 hashes of the hashes identified in Measure 107.

Step 4: Mandiant referred to the data listed in eAppendix - "ORCLX-MAN-000072" to associate each file to a Fix ID.[47]

Step 5: Mandiant counted the number of file copies found in the decompressed Environment Backups and recorded the results in eAppendix - "ORCLX-MAN-000079."

o. Measure 113

Mandiant identified the number of ".SQR", ".SQC", ".CBL", ".DAT", and ".DMS" files associated with "first deliverable" assumed to be found in environment backups referenced in the BakTrak database.

For this Measure, Mandiant only analyzed environment backups listed in BakTrak that were not found in Data Warehouse. Mandiant performed this step to avoid potential "double counting" of files existing in Data Warehouse as well as listed in BakTrak.

Overall, Mandiant determined there were 445 environment backups not found in Data Warehouse which included an application of a First Deliverable. *See* ORCLX-MAN-000325.

The following steps were used to determine the number of files:

Step 1: Mandiant reviewed the BakTrak database and identified BakTrak entries that were not found in Data Warehouse. Mandiant completed this process by comparing each file name listed in BakTrak with the file names of actual backups identified in Data Warehouse.

Step 2: When a match was found, Mandiant analyzed the description field in BakTrak and identified all entries with a description referencing an application of a Fix. Figure 28 below shows extracted descriptions from BakTrak that identify an application of a First Deliverable.

BakTrak DESCRIPTION Field
After PY07JUN applied
After PY07AUG applied
After PY07OCT Applied & Tested
After PY07DEC Applied & Tested
After PY08JAN Applied & Tested
PY05JUN Applied
PY05AUG applied and tested
PY05OCT Applied and Tested - PsHome only

Figure 28: Sample Descriptions from the BakTrak Database

Step 4: Mandiant recorded the bundle name for each entry in BakTrak.

---

[46] Hash values and corresponding file paths for files within the compressed backups can be found in ORCLX-MAN-000319, the Uncompressed Backups Hash Database. File paths for the compressed backups themselves can be found in ORCLX-MAN-000329.

[47] ORCLX-MAN-000319 and ORCLX-MAN-000072 were joined by MD5 hash.

Step 5: Mandiant identified and recorded all customer specific environments listed in BakTrak with the corresponding three letter customer code.

Step 6: Mandiant created a subset of BakTrak entries that adhered to all three of the following criteria:

- Must be a customer specific environment.
- Must list an application of a First Deliverable in the Description field of BakTrak.
- File Name of environment backup is not found in Data Warehouse.

Step 7: Mandiant created a SQL query to identify and count each ".SQR", ".SQC", ".CBL", ".DAT", and ".DMS" file in eAppendix – "ORCLX-MAN-000055" and eAppendix – "ORCLX-MAN-000071" with an associated BakTrak entry with the same three letter customer code and bundle.

Mandiant recorded the results in eAppendix - "ORCLX-MAN-000081."

p. Measure 114

Mandiant relied on data from eAppendix - "ORCLX-MAN-000216" that counted the number of Objects attached to a Master Fix Record.

Mandiant's QC confirmed that the listed number counted the contents of each compressed file (".EXE" and ".ZIP") attached to an SAS database record, so long as the compressed file was not obviously a download from Oracle, and counted the number of Cobol, SQR, SQC, DAT, and DMS files within each file. The team further counted each Cobol, SQR, SQC, DAT and DMS file directly attached to the SAS database record.[48]

q. Measure 115

Mandiant recorded the number of environment names referenced in any ".DAT" files identified in Measure 105.

For every ".DAT" file associated with the Fix ID, Mandiant looked for a remark within the ".DAT" file that referenced the environment in which the file was created. Specifically, nearly all ".DAT" files contained a line similar to "REM Database: [A123BCDE]," where "A123BCDE" was a reference to the environment "[A123BCDE]."

Step 1: Mandiant searched all Delivered Updates and Fixes files for the following term:

- "REM Database: .....*REM Started: ....."

The results of this search recorded each ".DAT" filename, MD5 File Hash, and the environment referenced. The results are listed in eAppendix - "ORCLX-MAN-000083." For example, the string search hit on the text highlighted in Figure 29 below. This figure shows the file "UPD0809074409_TN.DAT" had an environment reference to "H801BAXO." This file existed in "CSS-TN-0809074409\GVR-TN-0809074409\GVR-TN-0809074409.zip \GVR-TN-0809074409\0809074409\0809074409_BATCH\data\":

[48] So long as the object was attached to the Master Fix Record and not clearly a download from Oracle, it was counted, even if the object was not clearly tied to a version delivered to customers.

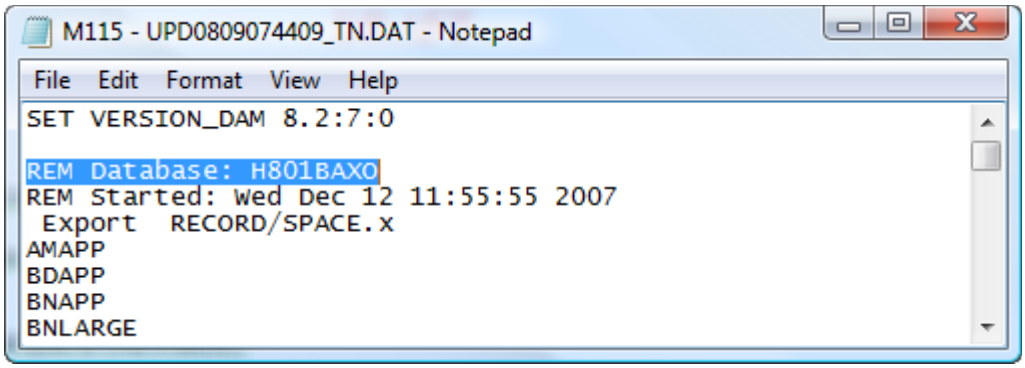

Figure 29: Environment Reference Found In "UPD0809074409_TN.DAT"

Step 2: Mandiant referenced the files in eAppendix – "ORCLX-MAN-000071" and matched the MD5 hash value of these files to any ".DAT" files identified in Step 1.

Step 3: Mandiant determined all environment names referenced per Fix ID.

The environment names per fix are listed in eAppendix - "ORCLX-MAN-000082."

r. Measure 115A

Mandiant maintained a supplemental measure for Measure 115 that listed the exact environment names referenced by the ".DAT" files associated with the Fix ID. These environment names were maintained in eAppendix - "ORCLX-MAN-000082."

s. Measure 116

Mandiant relied on data from eAppendix - "ORCLX-MAN-000216" that recorded each environment referenced as having been used specifically for replication, development, unit testing, or individual fix testing. Where documentation established the use of source groups, environment data was recorded on a per-source-group basis to the extent possible. Environments clearly used at some stage in development (other than bundle testing) were recorded as an environment used that did not match any other category. Mandiant performed a QC of this data using the following protocol:

- For retrofit bundles that were sample fixes and had an Excel project plan, each environment stated as used for a particular development step for the sample fix was recorded as having been used so long as the specific task was marked as 100% complete in the project plan.
- For Word documents containing test plans and other development documentation,
    - where a Word document contained both a heading listing an environment name and, within the section under the heading, one or more screenshots containing an environment name, the screenshot(s) rather than the heading were recorded;
    - where a Word document contained a heading listing an environment name but no screenshots, the heading was recorded, so long as there was no evidence that the document was an unused template;
    - where analysis of a Word document in the Data Warehouse would have resulted in the recording of environment names that made no sense for the particular sample fix (for instance, 2002-level environments for a 2003 bundle-level sample fix), absent evidence

to the contrary, the Word document was assumed to have been mistakenly included, and no environment names were recorded.

- For references in the body of an SAS database record (tables or free-text), environments listed as being used were recorded as being used, absent some indication to the contrary.

- For each DAT file attached to an SAS database record, the environment referenced in the DAT was recorded as being used (in the "does not match any category" column).

- For each DAT file found in the Data Warehouse and attributable to a sample fix, the environment referenced in the DAT was recorded as being used (in the "does not match any category" column) only if no DAT objects were present in Delivered Updates and Fixes for that sample fix.

The total number of environments recorded for a sample fix, excluding duplicates, was reported as measure 116.

t. Measure 116A

Mandiant relied on data from eAppendix - "ORCLX-MAN-000216" that listed the environment names counted for Measure 116 for each sample fix.

u. Measure 117

Mandiant performed a union of the environment names listed in Measure 115A and Measure 116A to provide a total count of unique environment names associated with the Fix ID.

v. Measure 117A

Mandiant maintained a supplemental measurement for Measure 117 that listed the unique environment names referenced in Measures 115A and 116A for the specific Fix ID. Measure 117A represented the unique set of environment names referenced by a Fix ID as a union of 115A and 116A.

w. Measure 118

Mandiant counted the total number of customers that received a ".SQR", ".SQC", ".CBL", ".DAT", or ".DMS" file associated with first deliverable referencing a Fix ID.

Step 1: Mandiant reviewed eAppendix - "ORCLX-MAN-000055" and filtered the list to only include files with extensions ".SQR, ".SQC", or ".CBL" associated with each fix.

Step 2: Mandiant reviewed eAppendix – "ORCLX-MAN-000071" and filtered the list to only include ".DAT" and ".DMS" files associated with each fix.

Step 3: Mandiant then identified the number of unique customers receiving each Fix ID.[49]

eAppendix - "ORCLX-MAN-000085" is a list of customers that yielded Measure 118.

[49] Mandiant did not include "CSS" or "ACL" in their count of clients as these three-letter references did not refer to SAP TN HRMS clients.

x. Measure 118A

Mandiant listed the three letter customer code for all SAP TN customers identified in Measure 118.

y. Measure 119

Measure 119 counted the number of customers receiving the fix that were not already identified in Measure 118. This measure was based on a comparison of data in 119A to data in 118A.

z. Measure 119A

Mandiant relied on data from eAppendix - "ORCLX-MAN-000216" that recorded the exact names of the additional customers that received the Fix ID, as listed in SAS.

Specific instructions were as follows:

- When reviewing the fix entry in the SAS database, the following characteristics were considered when identifying the customers to be counted in this measure:
    - Customer was listed in SAS database under the Fix ID entry.
    - Customer had a delivery timestamp.
    - Customer had indication of delivery, such as status of "published & notified."

aa. Measure 120

Mandiant calculated the total number of unique customers receiving each Fix ID based on analysis of Delivered Updates and Fixes, the SAS database, and documentation from the SAS database and Data Warehouse.

Step 1: Mandiant added the unique customer counts recorded in Measure 118 and Measure 119.

bb. Measure 120A

Mandiant maintained a supplemental measurement for measure 120 that listed the unique client names referenced in Measures 118A and 119A for the specific Fix ID. Measure 120A represented the unique set of client names referenced by a Fix ID as a union of 118A and 119A.

cc. Measure 121

Mandiant determined the number of ZIP files within the Delivered Updates and Fixes that contained documentation that was associated with first deliverable.

Step 1: Mandiant reviewed eAppendix - "ORCLX-MAN-000055" and filtered to include only those files with the following extensions:

- .DOC
- .XLS
- .PDF
- .RTF
- .TXT

- .PPT
- .RPT

Step 2: Mandiant filtered the results to exclude files not contained within ZIP files. Mandiant performed this step to avoid potential "double counting" of a document existing within a compressed file as well as outside the compressed file.

Step 3: For each Fix ID, Mandiant counted the unique ZIP files containing documents referencing that Fix ID (see eAppendix - "ORCLX-MAN-000086").

dd. Measure 122

Mandiant determined the number of customers receiving a ".DAT" file created in an environment not specifically designed for the customer receiving the fix. In other words, Mandiant counted the number of times a ".DAT" file was delivered to a customer, and that ".DAT" file was created in another customer's environment or created in a generic environment.

Step 1: Mandiant created a SQL query to perform the ".DAT", ".DMS", and Fix ID linking outlined in Measure 105 and Measure 115 above. This returned a list of environments referenced per Fix ID and per customer. Mandiant created a list of the environments and the customers that were supported by them. See eAppendix - "ORCLX-MAN-000088."

Step 2: Mandiant then updated this SQL query to return the instances where the environment name referenced in the .DAT file did not contain the three letter customer code of the customer receiving the file.

For example, SAP TN Customer (FLI), Foot Locker Inc., received file "UPD0530068652_TN.DAT" (see Figure 30 below). This file existed in: "\CSS-TN-0530068652\FLI-TN-0530068652\FLI-TN-0530068652.zip\ FLI-TN-0530068652\0530068652\0530068652_BATCH\data\." This ".DAT" file contained an environment reference to "H831TSUM" which does not contain Foot Locker, Inc's three letter code of "FLI." "TSU" is a reference to SAP TN Customer "Tropical Shipping USA, LLC."

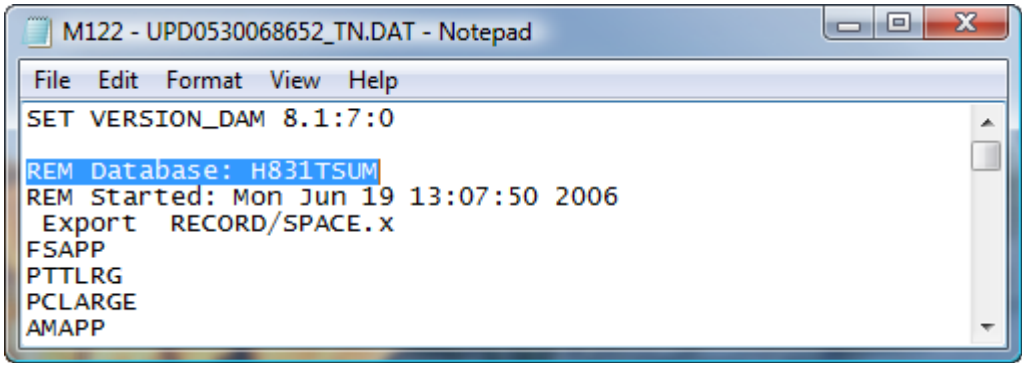

Figure 30: Environment Reference Found in "UPD0530068652_TN.DAT".

Step 3: Mandiant then counted the number of unique customers per fix that received the "environment mismatched" .DAT file and maintained the results in eAppendix - "ORCLX-MAN-000087."

ee. Measure 122A

Mandiant maintained a list of the customers receiving ".DAT" files referencing environments not specifically designed for the customer receiving the fix. This list is detailed in eAppendix - "ORCLX-MAN-000087."

ff. Measure 123

Mandiant counted the number of customers that were listed in data received for Measure 123A.

gg. Measure 123A

Mandiant relied on data from eAppendix - "ORCLX-MAN-000216" that recorded the names of the customers that received Fixes created through Cross-Use. Mandiant's QC validated that each listed customer's specific environment[50] had not been used at every stage in the development process for which any environment was recorded.

hh. Measure 124

Mandiant counted the number of customers that were listed in data received for Measure 124A and were also listed in Measure 120A.

ii. Measure 124A

Mandiant relied on data from eAppendix - "ORCLX-MAN-000216" that recorded the names of the customers that were documented as being developed as part of a source groups of size greater than one. Mandiant's QC validated that each listed customer was referred to in documentation as being a member of a source group of size greater than one.

jj. Measure 125

Mandiant determined the number of customers that received a ".SQR", ".SQC", ".CBL", or ".DAT" file associated with a first deliverable where another customer received the exact same file. Mandiant did not include ".DMS" because they were conservatively considered to be generic scripts with simplistic functions.

Step 1: Mandiant reviewed eAppendix – "ORCLX-MAN-000054" to determine the number of customers receiving each unique MD5 file hash.

Step 2: Mandiant created a SQL query to determine the "first deliverable" files contained in eAppendix - "ORCLX-MAN-000055" and eAppendix – "ORCLX-MAN-000071" that were delivered to more than one customer. Mandiant recorded the number of unique customers per fix that received the same files as other customers in eAppendix - "ORCLX-MAN-000090."

kk. Measure 125A

Mandiant maintained a list of the customers identified in Measure 125. This list is detailed in eAppendix - "ORCLX-MAN-000090."

[50] See Appendix P.

ll. Measure 126

Calculation was equivalent to calculation for Measure 123, save that if an environment was used both for the customer as to which was designated and for another customer, such use was considered contaminated.

An environment was presumed to have been used for other customers where more than one customer receiving support on the same release and service pack level received the fix but only one customer on that release was documented as having been used at a particular stage of the fix development process. "Same release" was defined as the same version and service pack release, save that HRMS 8.9 SP1 was deemed equivalent to HRMS 8.9 for customers with environment names that began with "H890."

mm. Measure 126A

Mandiant received data for a measure that recorded the names of the customers that received Fixes created through Cross-Use or Additional-Customer Contamination. Mandiant's QC validated, for each listed customer, that either the customer was listed in Measure 123A or that the customer's specific environment[51] had been used to support additional customers as part of the Fix-delivery process.

nn. Measure 127

Mandiant determined the total number of unique customers who were counted in at least one of the following categories:

- Received a first deliverable ".DAT" file referencing an environment not specifically designed for the customer receiving the fix based on analysis of Delivered Updates and Fixes.

- Received a first deliverable ".SQR", ".SQC", ".CBL", or ".DAT" file that was also delivered to another customer based on analysis of Delivered Updates and Fixes.

This count is the union of the unique customers counted in Measure 122 and Measure 125.

Step 1: Mandiant reviewed the customers listed in Measure 122A and Measure 125A.

Step 2: Mandiant counted the unique customers per fix that were present in either Measure 122A or Measure 125A. A customer listed in both Measure 122A and Measure 125A for the same fix would be counted only once.

The results were maintained in eAppendix - "ORCLX-MAN-000091."

oo. Measure 127A

Mandiant listed the customers that comprised measure 127 in eAppendix - "ORCLX-MAN-000091."

[51] See Appendix P.

pp. Measure 128

Mandiant determined the total number of unique customers who were counted in at least one of the following categories:

- Received a first deliverable ".DAT" file referencing an environment not specifically designed for the customer receiving the fix based on analysis of Delivered Updates and Fixes.
- Received a first deliverable ".SQR", ".SQC", ".CBL", or ".DAT" file that was also delivered to another customer based on analysis of Delivered Updates and Fixes.
- Received a first deliverable where either some other customer's environment or a generic environment was used at any point to develop, test or generate files for this customer's fix based on the SAS database and documentation review.

Were members of a source group of size greater than one based on SAS database and documentation review.

Step 1: Mandiant reviewed the customers listed in Measure 122A, Measure 123A, Measure 124A, and Measure 125A.

Step 2: Mandiant counted the unique customers per fix that were present in Measure 122A or Measure 123A or Measure 124A or Measure 125A. A customer listed in multiple measures for the same fix would be counted only once.

The results were maintained in eAppendix - "ORCLX-MAN-000092."

qq. Measure 128A

Mandiant listed the customers that comprised Measure 128 in eAppendix - "ORCLX-MAN-000092."

rr. Measure 129

Mandiant determined the total number of unique customers who were counted in at least one of the following categories:

- Received a first deliverable ".DAT" file referencing an environment not specifically designed for the customer receiving the fix based on analysis of Delivered Updates and Fixes.
- Received a first deliverable ".SQR", ".SQC", ".CBL", or ".DAT" file that was also delivered to another customer based on analysis of Delivered Updates and Fixes.
- Received a first deliverable where either some other customer's environment or a generic environment was used at any point to develop, test or generate files for this customer's fix based on the SAS database and documentation review.
- Were members of a source group of size greater than one based on the SAS database and documentation review.

- An environment attributed to them but built from a different customer's software/install media used to develop, test or generate files for this fix based on the SAS database and documentation review.

Step 1: Mandiant reviewed the customers listed in Measure 122A, Measure 123A, Measure 124A, Measure 125A, and Measure 126A

Step 2: Mandiant counted the unique customers per fix that were present in Measure 122A, Measure 123A, Measure 124A, Measure 125A, or Measure 126A. A customer listed in multiple measures for the same fix would be counted only once.

The results were maintained in eAppendix - "ORCLX-MAN-000093."

ss. Measure 129A

Mandiant listed the customers that comprised Measure 129 in:

eAppendix - "ORCLX-MAN-000093."

tt. Measure 130

Mandiant calculated the percentage of total SAP TN customers receiving each fix that were counted in at least one of the following categories:

- Received a first deliverable ".DAT" file referencing an environment not specifically designed for the customer receiving the fix based on analysis of Delivered Updates and Fixes.

- Received a first deliverable ".SQR", ".SQC", ".CBL", or ".DAT" file that was also delivered to another customer based on analysis of Delivered Updates and Fixes.

Step 1: Mandiant identified the total number of unique customers receiving files developed in an improper fashion, either by mismatched environments based on Mandiant's ".DAT" file analysis or by exact-files matching in deliveries to multiple customers (Measure 127) and divided by the total number of unique customers receiving the Fix ID (Measure 118).

Measure 130 was based on analysis of the Delivered Updates and Fixes. The number of customers receiving contaminated files based on the SAS database and documentation review was not considered in this percentage.

(Measure 127 ÷ Measure 118) was calculated on a per fix basis.

uu. Measure 131

Mandiant calculated the percentage of total SAP TN customers receiving each fix that were counted in at least one of the following categories:

- Received a first deliverable ".DAT" file referencing an environment not specifically designed for the customer receiving the fix based on analysis of Delivered Updates and Fixes.

- Received a first deliverable ".SQR", ".SQC", ".CBL", or ".DAT" file that was also delivered to another customer based on analysis of Delivered Updates and Fixes.

- Received a first deliverable where either some other customer's environment or a generic environment was used at any point to develop, test or generate files for this customer's fix based on SAS database and documentation review.

- Were members of a source group of size greater than one based on SAS database analysis and review of documentation.

Step 1: Mandiant identified the total number of unique customers receiving files developed in an improper fashion, including by mismatched environments based on ".DAT" file analysis and or by exact-files matching in deliveries to multiple customers or by environment cross use or by source group aggregation (Measure 128) and divided by the total number of unique customers receiving the fix (Measure 120) based on analysis of Delivered Updates and Fixes as well as the SAS database and documentation review.

(Measure 128 ÷ Measure 120) was calculated on a per fix basis.

vv. Measure 132

Mandiant calculated the percentage of total SAP TN customers receiving each fix that were counted in at least one of the following categories:

- Received a first deliverable ".DAT" file referencing an environment not specifically designed for the customer receiving the fix based on analysis of Delivered Updates and Fixes.

- Received a first deliverable ".SQR", ".SQC", ".CBL", or ".DAT" file that was also delivered to another customer based on analysis of Delivered Updates and Fixes.

- Received a first deliverable where either some other customer's environment or a generic environment was used at any point to develop, test or generate files for this customer's fix based on SAS database and documentation review.

- Were members of a source group of size greater than one based on SAS database analysis and documentation review.

- An environment attributed to them but built from a different customer's software/install media is used to develop, test or generate files for this fix based on SAS database and documentation review.

Step 1: Mandiant identified the total number of unique customers receiving files developed in an improper fashion, including by mismatched environments based on ".DAT" file analysis or by exact-files matching in deliveries to multiple customers or by environment cross use or by source group aggregation or by software cross use (Measure 129) and divided by the total number of unique customers receiving the fix (Measure 120) based on analysis of Delivered Updates and Fixes as well as the SAS database and documentation review.

(Measure 129 ÷ Measure 120) was calculated on a per fix basis.

ww. Measure 133

Mandiant calculated the total number of copies of ".SQR", ".SQC", ".CBL", ".DAT", and ".DMS" files associated with "first deliverable" throughout the following data sources:

- Delivered Updates and Fixes (Measure 108)

- Delivered Updates and Fixes from alternate sources including Disc 9, Disc 186 (Measure 109)
- Data Warehouse (Measure 110)
- Data Warehouse Compressed Files (Measure 111)
- Environment Backups – decompressed (Measure 112)
- BakTrak References (Measure 113)

Step 1: Mandiant summed the totals in Measure 108, Measure 109, Measure 110, Measure 111, Measure 112, and Measure 113.

(Measure 108 + Measure 109 + Measure 110 + Measure 111 + Measure 112 + Measure 113) was calculated on a per fix basis.

xx. Measure 134

Mandiant calculated the total number of copies of ".SQR", ".SQC", ".CBL", ".DAT", and ".DMS" files associated with "first deliverable" throughout the following data sources:

- Delivered Updates and Fixes (Measure 108)
- Delivered Updates and Fixes from alternate sources including Disc 9, Disc 186 (Measure 109)
- Data Warehouse (Measure 110)
- Data Warehouse Compressed Files (Measure 111)
- Environment Backups – decompressed (Measure 112)
- BakTrak References (Measure 113)
- SAS database Entries (Measure 114)

Step 1: Mandiant summed the totals in Measure 108, Measure 109, Measure 110, Measure 111, Measure 112, Measure 113, and Measure 114.

(Measure 108 + Measure 109 + Measure 110 + Measure 111 + Measure 112 + Measure 113 + Measure 114) was calculated on a per fix basis.

yy. Measure 135

Mandiant determined the number of unique first deliverable ".SQR", ".SQC", ".CBL", ".DAT", and ".DMS" files found in eAppendix - "ORCLX-MAN-000055" and eAppendix – "ORCLX-MAN-000071" that were delivered to more than one customer. Mandiant did not include ".DMS" files because they were considered to be generic scripts with simplistic functions.

Step 1: Mandiant reviewed eAppendix – "ORCLX-MAN-000054" to determine the number of customers receiving each unique MD5 hash.

Step 2: Mandiant created a SQL query to determine the "first deliverable" files delivered to more than one customer. See eAppendix – "ORCLX-MAN-000054"; eAppendix - "ORCLX-MAN-000055"; eAppendix – "ORCLX-MAN-000071."[52]

Step 3: Mandiant calculated the number of unique files per fix delivered that were delivered to more than one customer. The results were recorded in eAppendix - "ORCLX-MAN-000094."

[52] The SQL query (labeled "135_qryTaint_Fix_Hash") was produced as ORCLX-MAN-000316.

zz. Measure 135A

Mandiant maintained a list of the MD5 hash values of ".SQR", ".SQC", ".CBL", ".DAT", and ".DMS" files associated with "first deliverable" that were delivered to more than one customer. This list is detailed in eAppendix - "ORCLX-MAN-000094."

aaa. Measure 136

Mandiant determined the number of ".DAT" files associated with "first deliverable" that were delivered to customers with a mismatched environment reference. In other words, Mandiant identified the number of occurrences of ".DAT" files delivered to SAP TN customers where that ".DAT" file was created in another customer's environment or created in a generic environment.

Step 1: Mandiant created a SQL query to perform the ".DAT", ".DMS", and Fix ID linking outlined in Measure 115 and Measure 105 above. This returned a listing of the Fix ID and of the customers receiving the file, the environments referenced, and the MD5 hash value of the ".DAT" file. See eAppendix - "ORCLX-MAN-000095."

Step 2: Mandiant updated this SQL query to return only instances where the environment name referenced in the ".DAT" file did NOT contain the three letter customer code of the customer receiving the file.

Step 3: Mandiant identified the number of unique MD5 file hashes of the ".DAT" files referencing a mismatched environment. Mandiant recorded the results in eAppendix - "ORCLX-MAN-000096."[53]

bbb. Measure 136A

Mandiant listed each MD5 hash of ".DAT" files identified in Measure 136 in eAppendix - "ORCLX-MAN-000096."

ccc. Measure 137

Mandiant identified the total number of unique ".SQR", ".SQC", ".CBL", ".DAT", and ".DMS" files associated with "first deliverable" that were counted in at least one of the following categories:

- The file was delivered to more than one SAP TN customer (HASH Contamination).
- The file referenced an environment that did not contain the three letter code of the receiving customer (DAT Contamination).

This count is the union of the unique files counted in Measure 135 and Measure 136.

Step 1: Mandiant reviewed the MD5 hash values listed in Measure 135A and Measure 136A.

Step 2: Mandiant counted the unique MD5 hash values per fix that were present in either Measure 135A or Measure 136A. A hash value listed in both Measure 135A and Measure 136A for the same fix would be counted only once.

[53] ORCLX-MAN-000096 comprises the unique, combined results of queries "136_qryDMS_DATLink_I_B1_DAT_BADEnv_HASH," "136_qryDMS_DATLink_II_B1_DMS_FixInside_DAT_BADEnv_HASH," and "136_qryDMS_DATLink_III_DMS_NoFix_Inside_BADEnv_HASH," all found within the HRMS Fix Analysis Database, produced as ORCLX-MAN-000316.

The results were maintained in eAppendix - "ORCLX-MAN-000097."

ddd. Measure 137A

Mandiant listed the hash values counted in Measure 137 in eAppendix - "ORCLX-MAN-000097."

eee. Measure 138

Mandiant calculated the percentage of total unique "first deliverable" ".SQR", ".SQC", ".CBL", and ".DAT" files per fix that were delivered to multiple customers or that referenced a mismatched environment based on analysis of Delivered Updates and Fixes.

Step 1: Mandiant identified the total number of unique files developed in an improper fashion, either by mismatched environments based on Mandiant's ".DAT" file analysis or by exact-files matching in deliveries to multiple customers (Measure 137) and divided by the total number of unique first deliverable ".SQR", ".SQC", ".CBL" files (Measure 104) and ".DAT" files (Measure 142).

(Measure 137 ÷ (Measure 104 + Measure 142)) was calculated on a per fix basis.

fff. Measure 139

Mandiant calculated the number of unique ".SQR", ".SQC", and ".CBL" files attached to the relevant Master Fix Record in SAS. Mandiant relied on data from eAppendix - "ORCLX-MAN-000216" that counted the subset of unique Objects recorded in Measure 114, limited to ".SQR", ".SQC", and ".CBL" files.

ggg. Measure 140

Mandiant calculated the number of unique ".DAT" and ".DMS" files attached to the relevant Master Fix Record in SAS. Mandiant relied on data from eAppendix - "ORCLX-MAN-000216" that counted the subset of unique Objects recorded in Measure 114, limited to ".DAT" and ".DMS" files.

hhh. Measure 141

Mandiant calculated Measure 141 as the sum of Measure 139 and Measure 140.

iii. Measure 142

Mandiant recorded the number of unique ".DAT" files associated with the first deliverable of any Fix ID. Mandiant counted the subset of Objects recorded in Measure 105, limited to DAT Objects clearly identifiable as Associated Files.

jjj. Measure 143

Mandiant recorded the number of unique ".DMS" files associated with the first deliverable of any Fix ID. Mandiant counted the subset of Objects recorded in Measure 105, limited to DMS Objects clearly identifiable as Associated Files.

kkk. Measure 144

Mandiant calculated the percentage of total unique "first deliverable" ".DAT" files that were delivered to customers with a mismatched environment reference.

Step 1: Mandiant identified each occurrence of ".DAT" files delivered to a customer where that ".DAT" file was created in another customer's environment or created in a generic environment (DAT Contamination captured in Measure 136).

Step 2: Mandiant then divided by the total number of unique "first deliverable" ".DAT" files identified in Measure 142.

(Measure 136 ÷ Measure 142) was calculated on a per fix basis.

L. Detailed analysis of TN Fix 1012062843 for JD Edwards World A7.3

1. Evidence Analyzed

As discussed above, SAP TN after Mandiant's inspection of SAP TN's AS/400 in Bryan, Texas, SAP TN created backups of that server's ENT01 and WORLD partitions. In order to review source code of interest, Oracle restored the libraries of interest from tape backups generated from the SAP TN AS/400 system in Bryan, Texas to an AS/400 system in Oracle's Denver offices. On January 10, 2009, Mandiant was provided access to restored copies of the SAP TN libraries listed in Table 46. These libraries were selected by Mandiant and Oracle. Mandiant reviewed the source code with assistance from Greg Story, an Oracle Senior Database Administrator familiar with installations of J.D. Edwards World on AS/400 servers.

List of Libraries Provided by SAP TN				
BBDEVOB81	BBTNSC81	I807896	KWESECA73	SBCOBJ
BBDEVSC81	BSI2006	I807916	KWESRC	SBCSRC
BBJDOB81	CDF2006	I808319	KWFIX	SPX2006
BBJDSC81	CDF2006_1	I808745	KWJDOB73	SSI2006
BBLWORK	DCC2006	I808892	KWSECA73	TNOW
BBMISSING	EDI2006	I810590	KWTNOBJ	TNTSOB73
BBMODOB81	EGGER	JDFOBJCM2	KWTSCM73	TNTSSC73
BBMODSC81	EGGER1	KASSEC	LPC2006	TSB2006
BBSEC81	I807655	KNW2006	LXK2006	VKA2006
BBTNOB81	I807656	KWEOBJ	NCI2006	

Table 46: List of Libraries Provided by SAP TN

Mandiant focused its analysis on 13 libraries with names ending in "2006." These contained source code objects related to World Year-end 2006 updates. These updates were primarily related to changes in tax laws.

Library	Description
BSI2006	Binney Smith 2006 YE Changes
CDF2006	CAPTAIN D 2006 YE Changes
CDF2006_1	CAPTAIN D 2006 2nd YE Changes

DCC2006	Decorative Concepts 2006 YE Changes
EDI2006	Education Direct 2006 YE Changes
KNW2006	Koontz-Wagner 2006 YE Changes
LPC2006	Lincoln Property 2006 YE Changes '
LXK2006	Lexmark 2006 YE Changes
NCI2006	DO NOT SEND Nitta Castings 2006 YE Changes
SPX2006	SPX 2006 YE Changes
SSI2006	Solar Sources 2006 YE Changes
TSB2006	Texas Sch Brd 2006 YE Changes
VKA2006	Veka 2006 year end

Table 47: Libraries of Interest

2. Methodology

Mandiant performed a review of the source code found from SAP TN's World AS/400 to gain an understanding of SAP TN's development practices concerning World software fixes and to determine if any copying of JD Edwards-provided year-end 2006 fixes from one customer environment to another had occurred.

To understand the findings, a working understanding of AS/400 storage at a logical level is necessary:

- The AS/400 does not have a classical "file system" found on most computer systems. Instead, everything is stored in a native database in libraries. A library is mostly analogous to a directory or folder on a standard Windows or UNIX.

- Inside of libraries are "objects." Objects can be thought of as containers, somewhat similar to a ZIP archive on a Windows system.

- Objects contain "members," which are the most similar to files on a standard computer system. For example:

    - KNW2006 is a library
    - JDESRC is an object in that library
    - P04515 is a member in the JDESRC object

- The RPG III programming language used in the bulk of the members analyzed is column-dependent. This limits the flexibility the programmer has with whitespace and other stylistic touches that could possibly be used as a "fingerprint" of plagiarized code.

- Any line in an RPG III program with an asterisk in column 7 is a comment and is not executed. These comments are the place where two functionally equivalent RPG III

programs can differ, content wise. For example, the following two lines of code are both equally valid comments:

- TN06 I***> 394 395 TTTFI
- TN06 I* 394 395 TTTFI

- Additionally, the method a programmer uses to indicate that a section of commented code continues is also up to programmer prerogative. The use of double-quotes, pipe characters, or periods in column 8 is common but none of these marks are required.

3. Discussion

Mandiant selected the KNW2006/JDESRC object as the basis for comparison with the other 12 libraries being reviewed because:

- The members of KNW2006/JDESRC had the earliest modification dates.
- The members of KNW2006/JDESRC had the widest range of modification dates.
- The KNW2006/JDESRC object contained the most members used by other objects.
- KNW2006/JDESRC relates to Koontz Wagner, which is the only customer for which SAP TN is known to have had Local Environments for A7.3.

The members of the remaining 12 objects each had very discreet periods in which modification occurred, if any modification occurred at all. Due to this difference in modification time periods, Mandiant used the KNW2006/JDESRC object as the template by which modifications to other members in other libraries were reviewed.

During the calendar year of 2006, Mandiant noticed that the changes to source code in KNW2006/JDESRC occurred on 37 days between 8/12/2006 and 12/11/2006. The following table describes when SAP TN made changes to the KNW2006/JDESRC object:

Dates in Which KNW2006/JDESRC Members were Changed[54]			
8/12/2006	9/20/2006	10/11/2006	11/13/2006
8/14/2006	9/25/2006	10/19/2006	11/30/2006
8/16/2006	9/26/2006	10/20/2006	12/1/2006
8/18/2006	9/27/2006	10/23/2006	12/6/2006
9/8/2006	9/28/2006	10/25/2006	12/7/2006
9/11/2006	9/29/2006	10/26/2006	12/8/2006
9/12/2006	10/2/2006	10/27/2006	12/11/2006
9/13/2006	10/5/2006	10/30/2006	
9/14/2006	10/6/2006	11/6/2006	
9/18/2006	10/9/2006	11/8/2006	

Table 48: Dates the KNW2006/JDESRC Members were Changed in 2006

[54] An additional change dated 1/19/2006 was disregarded as not relating to the Year End 2006 Fix.

The following table shows that no other library was altered or changed on more than 5 unique days during 2006:

Object Name	Dates Changes were Made				
CDF2006/JDESRC	12/5/2006	12/7/2006	12/8/2006		
DCC2006/TNSRC	12/12/2006				
EDI2006/JDESRC	11/2/2006	11/6/2006	11/14/2006		
LPC2006/JDESRC	11/2/2006	11/6/2006			
LXK2006/JDESRC	10/31/2006	11/1/2006	11/6/2006		
SPX2006/JDESRC	12/22/2006				
SSI2006/JDESRC	11/6/2006	11/7/2006	11/8/2006	11/12/2006	11/14/2006
TSB2006/JDESRC	1/9/2007				
VKA2006/JDESRC	1/16/2007				
NCI2006/JDESRC	No Changes Made in 2006				
CDF2006_1/JDESRC	No Changes Made in 2006				
BSI2006/JDESRC	No Content				

Table 49: Dates the JDE Source Code was Changed in the 12 Objects in 2006

The changes made to KNW2006/JDESRC members are presented in eAppendix – "ORCLX-MAN-000207.". These changes occurred in 26 unique members. In all cases, any KNW2006/JDESRC members that were modified had been modified prior to changes to the same members in other customers' objects.

Mandiant was able to compare the 26 modified members in the KNW2006/JDESRC object to 82 corresponding members in the other 12 objects. When Comparing the JD Edwards source code contained in the 26 members of the KNW2006/JDESRC object to the 82 corresponding members in the 12 objects:

- 39 members out of 82 (47.6%) contained changes that were identical to the changes made in the KNW2006/JDESRC library.
- 30 members out of 82 (36.6%) contained functionally identical code, with the differences almost solely in the comments field.
- 12 members out of the 82 members (14.6%) were never changed in 2006.
- 1 member out of 82 (1.2%) contained different code.

Tables 50 and 51 below provide an overview of the changes made to the KNW2006/JDESRC object's members compared to the other 12 objects that contained JDE source code as follows:

- The items marked "Same" demonstrate where the KNW2006 changes occurred first, and the exact changes were made to the members in other Objects, to include identical formatting of comments.
- The items marked "Similar" demonstrate where the changes were only a few characters different. Ordinarily, the functional code was identical, but comments were added or the formatting of comments was modified. For example, JDESRC/PO4515 in the KNW2006 library has the following commented code:

```
TN06 I***> 394 395 TTTFI
TN06 I***> 396 410 TTEFLN
```

Where the equivalent code in DCC2006/TNSRC is as follows:

```
TN06 I** 394 395 TTTFI
TN06 I** 396 410 TTEFLN
```

eAppendix – "ORCLX-MAN-000207 provides additional details about similar code in the members found in 12 objects.

- Items marked "Different" illustrate where the changes made in the member were not similar to the changes in the corresponding member within the KNW2006 object.
- Items marked "None" denotes when a member was not changed or updated in 2006.
- The items marked "NA" illustrate where a member did not exist in the corresponding object.

KNW2006 JDESRC	DCC2006 TNSRC	CDF2006 JDESRC	TSB2006 JDESRC	EDI2006 JDESRC[55]	LPC2006 JDESRC	LXK2006 JDESRC	NCI2006 JDESRC	SPX2006 JDESRC	SSI2006 JDESRC	VKA2006 JDESRC
J04515	Same	Same	Same	Same	Same	Same	Different	None	Same	Similar
J04515JQ	Same	Same	Same	Same	Same	Same	None	None	Same	Similar
P04512FP	Same	Same	Same	Similar	Similar	NA	NA	None	NA	Same
P04515	Similar	Similar	Similar	Same	Similar	Same	None	None	Similar	Similar
P045151	Similar	Similar	Similar	Similar	Similar	Same	None	None	Similar	Similar
S045154	Similar	Similar	Similar	Similar	Similar	NA	NA	NA	NA	Similar
V04515	Similar	Similar	Same	Similar	Similar	Same	None	None	Same	Same

Table 50: Comparison of Changes Made in KNW2006/JDESRC to Changes in Other Objects

Object Name	Additional Information
SSI2006/JDESRC	14 additional members (P06735, P06765, P06767, P06767A, P06770, P067703, P06771, P06771L, S06770, S067701, S067702, S067703, S06771, S06771L) had the same changes and comments as those made in KNW; three additional members (P06761, P067701, P067702) had the same changes and similar comments.
BSI2006/JDESRC	No members
CDF2006_1/JDESRC	No changes to members (only two, P04512FP and S045154, are present)

Table 51: Additional information on Year End 2006 library objects

M. JD Edwards System Code Analysis

Mandiant used information provided by Oracle and internally generated documents to match files found within JD Edwards customer specific folders on DCITBU01 to Oracle system codes. Mandiant followed two separate processes depending on whether World or OneWorld downloads were identified within the customer folder. Mandiant performed these analyses to determine if SAP TN had downloaded files that they were not licensed to according to Exhibit 1634.

1. General Methodology

a. Mandiant identified all unique customer specific folders with JD Edwards products across SAP TN's central download repository, identified as "DCITBU01."

b. Mandiant then extracted metadata for each identified customer specific folder about every file within that folder using EnCase.

[55] The Object EDI2006/JDESRC contained 28 additional members that were not contained in the KNW2006/JDESRC Object. None of these members were changed or updated in 2006.

c. Mandiant analyzed the exported metadata for each image to identify which JD Edwards product lines that company was using World, OneWorld, or both.

d. Mandiant conducted a separate analysis depending on what product line(s) were identified in the previous step.

If the identified product line was OneWorld on Exhibit 1634, Mandiant performed the following:

a. Mandiant created a subset of files consisting of customer files that both had a matching two letter prefix and were identified in the Reverse Proxy Logs.[56] (See ORCLX-MAN009).

b. Mandiant matched the first two-letter prefix of all files to a known list verbally provided by Oracle. *See* ORCLX-MAN-000015.

c. Mandiant made corresponding matches of identified files to specific version levels of the OneWorld product using material verbally supplied by Oracle.

d. Mandiant identified the number of files each company was licensed to download by matching the determined product version information found in the previous step to the information in Exhibit 1634.

If the identified product line was World on Exhibit 1634, Mandiant performed the following:

a. Mandiant compiled information provided by Oracle to generate a filename to system code mapping. *See* ORCLX-MAN-000013.

b. Mandiant compared the filenames within each identified customer folder to the filenames in the system code mapping.

c. Mandiant identified all files which could be matched by filename and their corresponding system code.

d. Mandiant removed files corresponding to multiple system codes from the analysis.

e. Mandiant analyzed the system codes using the information provided in Exhibit 1634 to determine how many licensed and unlicensed files were within each company folder.

Mandiant identified 13,737 unlicensed file downloads for OneWorld customers and 23,612 unlicensed downloads for World. The complete results of both the OneWorld and World analyses can be found in eAppendix - "ORCLX-MAN-000103," eAppendix – "ORCLX-MAN-000104", eAppendix – "ORCLX-MAN-116".

2. Oracle Provided System Codes

Oracle provided Mandiant with lists of system codes for Merck, Metro Machine Corporation, OCE Technologies, SPX, and Yazaki North America. *See* ORCLX-000002, ORCLX-MAN-000003, ORCLX-MAN-000004, ORCLX-MAN-000005, ORCLX-MAN-000006. Oracle more specifically produced

[56] The list of files identified in the Reverse Proxy Logs is generally present as the "System.Codes" tab in the customer-specific spreadsheets produced at ORCLX-MAN-000220 to ORCLX-MAN-000264, ORCLX-MAN000330, and ORCLX-MAN-000331. The system code information was derived from ORCLX-MAN-000016 and ORCLX-MAN-000017.

to Mandiant OneWorld system codes for Merck, OCE Technologies, SPX, and Yazaki North America as well as World system codes for Metro Machine Corporation, OCE Technologies, and Yazaki North America. Mandiant adhered to the methodology outlined above for all World analyses; however, Mandiant performed the process outlined below to analyze the OneWorld system codes.

For provided OneWorld system codes, Mandiant utilized information internally generated to match filenames to corresponding system codes:

a. Mandiant used the generated information to make comparisons between all filenames in customer folders and the Reverse Proxy Logs to match them to system codes.[57]

b. Mandiant removed files corresponding to multiple system codes from the analysis.

c. Mandiant determined the total number and metadata about which files each company was and was not licensed to by comparing the system codes found in the previous step to the Oracle provided system codes.

Company Folder	Unlicensed Files OneWorld	Unlicensed Files World
Merck	3,450	0
OCE Technologies	1,570	3,076
SPX Cooling	2,674	0
SPX Flow	807	0
SPX Weil-McLain	3,597	0
Yazaki	10,250	1,547
Metro Machine	0	4,363
Total	22,348	8,986

Table 52: Results of Oracle Provided System Code Analysis

From the analysis Mandiant determined that 31,334 files were unlicensed downloads. The total results for both analyses can be found in eAppendix - "ORCLX-MAN-000116." Mandiant similarly analyzed the downloads identified in log files, which results can be found in ORCLX-MAN-000137. *See also* ORCLX-MAN-000310, ORCLX-MAN-000311, ORCLX-MAN-000314, and ORCLX-MAN-000315.

3. Removal of files corresponding to multiple system codes

As stated above, files corresponding to multiple system codes were removed for all analyses of World described in Section 1 and for the analyses of OneWorld described in Section 2. For example, the "System.Codes" tab found in ORCLX-MAN-000264 includes the following data:

Excel Row #	Filename	System Code
23	JD10215	43 - Purchase Order Processing
24	JD10222	30 - Product Data Management 48 - Product Data Management

Table S: Sample contents of ORCLX-MAN-000264, "System.Codes" tab

[57] See preceding footnote.

Row 24 would be removed from analysis of files on a system-code basis, since the filename corresponded to multiple system codes. Row 23 would be retained, since the filename corresponded to a single system code. See ORCLX-MAN-000383, a listing for the World and OneWorld product lines of each filename tied to a single system code.

N. Registered ESU's and Other Registered Works

Mandiant was provided with a number of Oracle registered ESU's and other Registered Works. Mandiant searched for these files across 58 SAP TN hard drive images and DCITBU01 using the subsequent procedure.

a. Mandiant first extracted all the contents of an Oracle provided .ISO file identified with the ID number, 00264056.

b. Mandiant then compiled the extracted contents with other provided Registered Works.

c. Mandiant calculated the MD5 hash value of all of the extracted contents and other Registered Works.

d. Mandiant used Guidance Software's EnCase to compile these MD5 hash values into a hash set.

e. Mandiant searched for any MD5 matches across the 58 SAP TN hard drive images and DCITBU01 using EnCase. When matches were found, Mandiant exported metadata such as file path information and extension. See ORCLX-MAN-000146.

f. For a small subset of the registered files, Mandiant employed keyword searches within EnCase to identify specific Solution ID's provided by Oracle. See ORCLX-MAN-000332.

g. Mandiant compiled the metadata and extrapolated the number of registered ESU's found as well as the physical location of each registered file.

SAP TN Server	Number of Registered ESUs
DCITBU01	87
JDWSVR01	26
DCJDWDEV01	1
Total:	114

Table 53: Location of Matching ESUs

The full results of the search can be found in eAppendix – "ORCLX-MAN-000146." Mandiant identified six other Registered Works; the full reference is in eAppendix - "ORCLX-MAN-000145" and eAppendix – "ORCLX-MAN-000332."

O. JD Edwards OneWorld Xe Analysis

Mandiant attempted to identify default installations of the Xe product throughout SAP TN systems through the identification of .C and .H files. Mandiant performed a search for all identified files according to the following procedure.

a. Mandiant identified all .C and .H files within a default Xe installation.

b. Mandiant calculated the MD5 hash value of these files which resulted in 13,147 unique hashes.

c. Mandiant then searched for these hash values across the 58 SAP TN hard drive images and documented all relevant metadata for matching files.

d. Mandiant compiled the results from each image into a single spreadsheet found in eAppendix – "ORCLX-MAN-000121."

P. BakTrak Environment Lineage Analysis

Mandiant was supplied "BakTrak Restore.xls." Mandiant understood this to represent SAP TN's log of environment restores. A restore is defined as taking a previously created environment archive and regenerating that archive as a live and working environment copy. See eAppendix – "ORCLX-MAN-000132." Of the 245 unique environments listed in eAppendix - "ORCLX-MAN-000132," 210 environments were found to have been created from a differing environment backup.

1. General Methodology

SAP TN's data in eAppendix - "ORCLX-MAN-000132" contained information regarding environment backups including filenames, the date the restore was performed, a brief description of the actions taken, and the user performing the restore. eAppendix – "ORCLX-MAN-000132" also detailed the backup environment name being restored and the new environment name the restore would be called. Respectively, SAP TN recorded this data under the column headings "SOURCE_ENV" and "TARGET_ENV."

For example, BakTrak "RESTORE ID" 744 lists a "SOURCE_ENV" name of "H831ARMO" and "TARGET_ENV" name of "H831SKBO". This was understood to mean that the source environment of "H831ARMO" was used to create a new copy of that environment under the name "H831SKBO". This notion agrees with the text contained in this item's "DESCRIPTION" field: "Created H831SKBO using H831ARMO backup".

Mandiant attempted to understand the relationship and lineage between the environments listed in eAppendix – "ORCLX-MAN-000132." In doing so, Mandiant considered the "SOURCE_ENV" to be the parent of the "TARGET_ENV" child. Efforts were made to then trace all ancestors of the environments listed according to eAppendix – "ORCLX-MAN-000132." This was accomplished by taking each parent in "SOURCE_ENV" and searching for that environment's parent. If no parent was found, that "SOURCE_ENV" environment name was the beginning of that lineage. However, if a parent was found, then Mandiant performed a reiterative process to find each parent's parent until the beginning of the lineage was reached. Mandiant stored these results in eAppendix – "ORCLX-MAN-000126."

For environments names listed with differing "TARGET_ENV" and "SOURCE_ENV" names, Mandiant created a graph illustrating each environment name's ancestors and descendants as listed in eAppendix – "ORCLX-MAN-000132." See eAppendix – "ORCLX-MAN-000128." The first page of the illustration lists the 35 environment names with no parent listed in eAppendix - "ORCLX-MAN-000132." The subsequent pages show each "parent" environment and the "children" environments.