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FY19 Status Report on the Computing Systems for the Yucca Mountain Project TSPA-LA Models and Preliminary Testing of a Selected Process Model

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ABSTRACT

Sandia National Laboratories continued evaluation of total system performance assessment (TSPA) computing systems for the previously considered Yucca Mountain Project. This was done to maintain the operational readiness of the computing infrastructure (computer hardware and software) and knowledge capability for total system performance assessment) type analysis, as directed by the National Nuclear Security Administration (NNSA), DOE 2010. The FY19 task included continued operation of the cluster; maintenance of the TSPA-LA models (with GoldSim 9.60.300); preliminary assessment of the status of the Infiltration Model (a process model that feeds the TSPA-LA). In addition, precautionary actions were needed to extend the life of the cluster hardware. To do that, three new nodes were added to the cluster. In the event any of the original nodes fail they will be replaced with the new nodes, thereby maintaining the core capability. The 2014 cluster and supporting software systems are currently fully operational to support TSPA-LA type analysis.

ACKNOWLEDGEMENTS

The authors would like to express their gratitude to Tito Bonano (8840), Kevin McMahon (8842) and Chris Camphouse (8842) for their technical interest and programmatic support. The authors would also like to thank Timothy Seigler (09322) for cluster life extension work, Bob D'Spain (10777) for technical support with migration of the storage system and Michael Wallace (8844) for technical review of the report.

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ACRONYMS AND DEFINITIONS

CL2014	2014 TSPA server cluster (computing hardware)
COTS	Commercial off-the-shelf
DLL	Dynamically Linked Libraries
DOE	Department of Energy
DTN	Data Tracking Number
GB	Gigabyte
GW	Ground Water
HLW	High-Level Radioactive Waste
HPC	High Performance Computing
LHS	Latin Hypercube Sampling
MASSIF	Mass Accounting System for Soil Infiltration and Flow
NNSA	National Nuclear Security Administration
OS	Operating System
PC	Personal Computer
PTC	Parametric Technology Corporation
RAM	Random Access Memory
SNL	Sandia National Laboratories
TSPA	Total System Performance Assessment
TSPA-LA	Total System Performance Assessment for the License Application
YMP	Yucca Mountain Project

1 INTRODUCTION

Sandia National Laboratories (SNL) continued evaluation of the total system performance assessment (TSPA) computing systems for the previously considered Yucca Mountain Project (YMP). This was done to maintain the operational readiness of the computing infrastructure (computer hardware and software) and knowledge capability for total system performance assessment (TSPA) type analysis, as directed by the National Nuclear Security Administration (NNSA), DOE 2010. This work is a continuation of the ongoing readiness evaluation reported in Lee and Hadgu (2014), Hadgu et al. (2015), Hadgu and Appel (2016) and Hadgu et al. (2017). The TSPA computing hardware (2014 server cluster - CL2014) and storage system described in Hadgu et al. (2015) were used for the current analysis. One floating license of GoldSim with Versions 9.60.300, 10.5, 11.1 and 12.0 was installed on the cluster head node, and its distributed processing (DP) capability was mapped on the cluster processors. Other supporting software were tested and installed to support TSPA-type analysis on the server cluster. The current tasks included maintenance of the TSPA-LA system (hardware and software), and preliminary assessment of the Infiltration Model, a process model that feeds to the TSPA-LA. CL2014 is currently running smoothly. As discussed in Section 2.1.1 additional nodes have been added to the cluster to replace any future failed nodes. Versions 9.60.300, 10.5, 11.1 and 12.0 are currently operational on the cluster. The 2014 server cluster and supporting software systems (i.e. the software that are directly used in the TSPA models) are now fully operational to support TSPA-LA type analysis with the GoldSim version used for the license application (GoldSim, 2007).

In FY15, through FY19 SNL conducted evaluation of the TSPA computing system to verify the readiness of the capability to perform TSPA-type analysis of the Yucca Mountain repository following the 2014 server replacement. The reports by Hadgu et al. (2015), Hadgu and Appel (2016), Hadgu et al. (2017) and Hadgu et al. (2018) documented the work performed to achieve and maintain the readiness of the computing infrastructure (computer hardware and software) and knowledge capability to perform TSPA-type analyses. The reports provided details of specifications of the 2014 computer hardware, the evaluation of the required components of the hardware and software systems, as well as the instructions to setup and conduct the TSPA-LA type simulations and post-processing of the model output. This report is a continuation of the work performed since 2015.

As was done in previous work one of the goals of this work is to demonstrate the readiness of the 2014 hardware and software systems. This is to ensure that the computing system can support reliable execution of the TSPA-LA models and post-processing of the model output. The other goal of this work is to begin assessment of the status of the Infiltration Model and related software. The following main topics were identified for the current investigation to evaluate the status of the TSPA-LA model capability.

- Maintaining readiness of the TSPA-LA including cluster life extension.
- Preliminary assessment of software used for the Infiltration Analysis component of YMP License Application process models.

2 THE TSPA COMPUTING SYSTEM

2.1 The TSPA Server Cluster Hardware (CL2014)

The TSPA computing system (the hardware and software), is discussed in detail in Hadgu et al. (2015). The original TSPA cluster (CL2014) consisted of a total of 32 Dell PowerEdge R620 servers, each with 3.0 GHz Intel® Xeon® E5-2690 dual quad-core processors (20 processors per server) and 128 GB RAM. The 2014 servers reside on the Sandia DMZ domain and are running under the Windows Server 2012 r2, 64-bit operating system. The system was optimized for installation and execution of the GoldSim software required to run the GoldSim distributed processing module utility (GoldSim 2010, 2017). The distributed processing module utility is a program extension to GoldSim which allows use of multiple computers connected over a network to share the computational burden of a Monte Carlo simulation. The module is the essential feature to efficiently manage and execute multiple realizations of the TSPA-LA model run on the cluster processors. In the 2014 configuration of the total of 32 blade servers, one blade server is used as the head node, and 31 servers are used as the compute nodes dedicated to run GoldSim-based TSPA models. In 2019 steps were taken for cluster life extension as discussed Section 2.1.1.

2.1.1 The TSPA Server Cluster Hardware (CL2014) Life Extension

The cluster CL2014 has been in service since 12/2014 and the original warranty has expired. Precautionary actions were needed for further use of the hardware. A decision was made to add three new nodes which would replace any failed nodes over the next three years. Details of a life extension proposal are given Appendix A.

Three Dell PowerEdge R640 nodes have now been purchased and added to the existing nodes. The three new nodes have been racked, powered and connected to the network. Ports were activated, and cables ran to finalize the network connectivity. The new nodes were configured within the same operating system as the rest of the cluster. The upgraded CL2014 cluster currently contains the master node (CL2014-1) and 34 compute nodes (CL2014-2 to CL2014-35) for a total of 35 nodes.

Remedial work was also carried out to maintain smooth functioning of the TSPA cluster. During the year, the memory of one of the older nodes (i.e. CL2014-14) failed. Four replacement RAMs (DELL 16 GB RAM – 2Rx4 RDIMM) were purchased and installed. The cluster is fully operational after the replacement.

Testing of the modified cluster and the individual new nodes was conducted and is described in Section 3.

2.1.2 The TSPA Server Cluster Hardware (CL2014) Backup System

The CL2014 cluster has data backup and recovery system. The backup and recovery service follow SNL corporate standards for the following:

- **Backup and Restoration of Data**: Corporate Databases follow standards and procedures defined by the Enterprise Database Administration group (Archean, CL2014 head node, and CL2014-2 compute node is backed up by Enterprise).
  - https://sharepoint.sandia.gov/sites/backup/default.asp
  - Backup and Data restoration from corporate is only for CL2014-1 (head node) and CL2014-2 (compute node). Data from the rest of the compute nodes are not restored as all data are transferred from the compute nodes to the head node after each GoldSim run.
  - If any of the compute nodes fails, RAID array 1 is used to restore the compute node by replacing hard drives of dead servers. The backup from corporate is a just in case disaster recovery layer.
  - CL2014 cluster data is being backed up by the SAN and disaster recovery.
  - All questions and issues are to be reported to the Corporate Enterprise team via Corporate Computing Help Desk.

- **Full File Server Backups:** Performed monthly. Incremental server backups are performed nightly.
  - Back up for the File Server is done by corporate.
    - Request for retrieving data from the backup for the CL2014 cluster is to be submitted via ticket through Corporate Computing Help Desk.
- **File Restoration:** Within 1 business day (requested via the Corporate Computing Help Desk). Customer must provide file name and location to facilitate restoration.

2.2. The TSPA Data Storage

Adequate storage space was allocated on the network drive on which the YMP data was stored (FS02SNLNTY/collab6). However, the maintenance contract has expired for the server on which the data resided. The data has now been migrated to a new server with uptodate operating system. Appendix B describes the data migration. Contents of the new server have been compared to the old server to make sure that the migration was done properly. As described in Appendix B screen shots show that the contents of the two storage systems are identical.

A limited disk storage space is available on the head node of the TSPA cluster. That is intended mainly for installation of application software, storage of small files by individual users using the cluster, as well as storage of model output files while a run is carried out. The space is not sufficient for storing all TSPA model output files. The total size of the files contained in a TSPA LA model output DTN ranges from a few gigabytes to tens of gigabytes, and some DTNs are close to 100 gigabytes. The DTN package includes GoldSim model files, model output data files, post-processed data files, plot files, etc. The total size of the GoldSim model and model output files from a routine TSPA-LA model run typically ranges from about one gigabyte to 10 gigabytes depending on the modeling cases. To clear space on the head node, TSPA model output files need be transferred to the storage system described above.

3 CONFIRMATION OF TSPA-LA MODEL RUNS ON THE MODIFIED CLUSTER (CL2014) WITH GOLDSIM VERSION 9.60.300.

This section discusses the confirmation of the TSPA-LA model reproducibility on the modified TSPA server cluster (CL2014) using GoldSim Version 9.60.300. Confirmatory test runs were conducted to quantify the effect of adding the new nodes to the cluster. The Nominal modeling case was selected for the confirmatory tests because it contains the lowest number of realizations (300) and is thus faster to run. Thus, the Nominal modeling case for 1 million years was run on the modified server cluster (CL2014) for the test cases. The test runs were executed on multiple number of processors on the cluster utilizing the GoldSim distributed processing modules (GoldSim 2007).

A total of two tests were made for the confirmation tests using the nominal modeling case. The tests are listed below. Outputs of the runs were evaluated for the confirmatory analysis. The model output reproducibility confirmation was conducted by comparing the output from the new model runs with the output for the TSPA-LA Nominal modeling case retrieved from the DTN MO0710ADTSPAWO.000 (GW Modeling cases (v5.005) without Final Documentation) (SNL 2008). For the model reproducibility confirmation, the model output parameter total dose was chosen. The confirmatory analysis used graphical comparison.

3.1. Test 1: Nominal Modeling Case for 1 Million Years (300 Realizations)

For Test 1 a run was made with 300 realizations of the nominal modeling case for 1 million years using 300 processors that included processors from the new nodes. The run was made on nodes Cl2014-6 to Cl2014-35 with 10 processors each, for a total of 300 processors. The processors used for the run include the new nodes 33, 34, and 35. The run time (0:32:57) was compared with that of the cluster before the upgrades (0:36:45). Comparison of the run times shows a seed up of 10.34 %. The mean total dose was also compared with the output of the TSPA LA. The results are shown in Figure 1. The results are identical, demonstrating an excellent reproducibility of the original TSPA-LA model result by the model test runs on the upgraded CL2014 cluster.

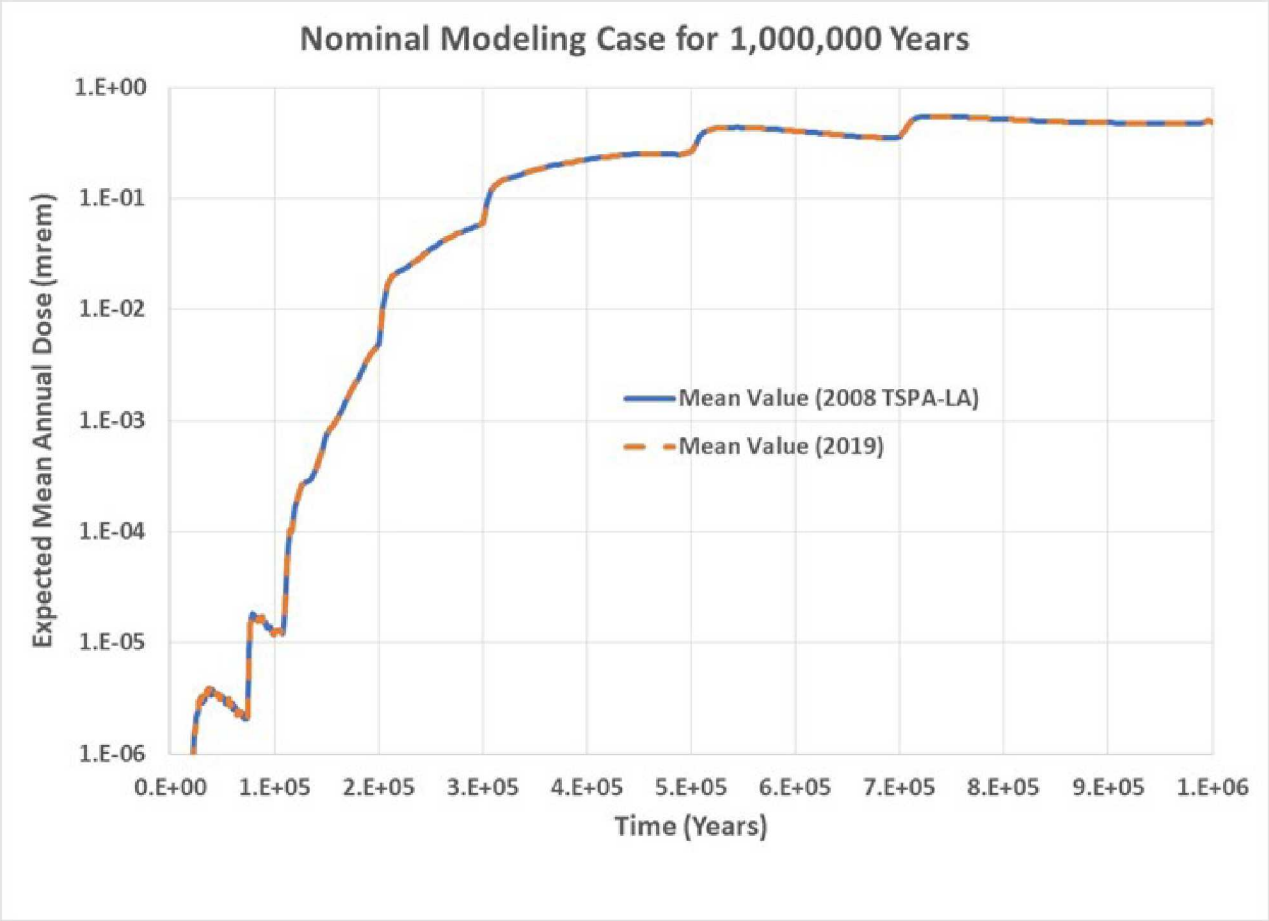

Figure 1. Comparison of Model Results of Expected Mean Annual Dose for the Nominal Modeling Case for 1,000,000 Years after repository Closure: TSPA-LA and Test 1 (300 realizations).

3.2. Test 2: Nominal Modeling Case for 1 Million Years (3 Realizations)

A second test of the new nodes without the addition of old nodes. For this test the first 3 realizations of the nominal modeling case for 1 million years were run using 3 processors. A run was made using the 3 new nodes (with one processor each). A second run was made with 3 of the old nodes (with one processor each). The run times and expected annual does for each of the realizations were compared.

The first run exercised one processor each from the new nodes Cl2014-33, Cl2014-34 and Cl2014-35, for a total of 3 processors. The run time for this run was (0:20:26). The second run was made on the original nodes CL14-6, Cl214-7 and CL2014-8. The run time for this run was (0:23:21). Comparison of the run times shows a speed up of 12:49 % with the new nodes. The expected total dose for each realization were also compared with the output of the old cluster. The results are

shown in Figure 2. The results are identical, demonstrating an excellent reproducibility of the original TSPA-LA model result by the model test runs on the upgraded CL2014 cluster.

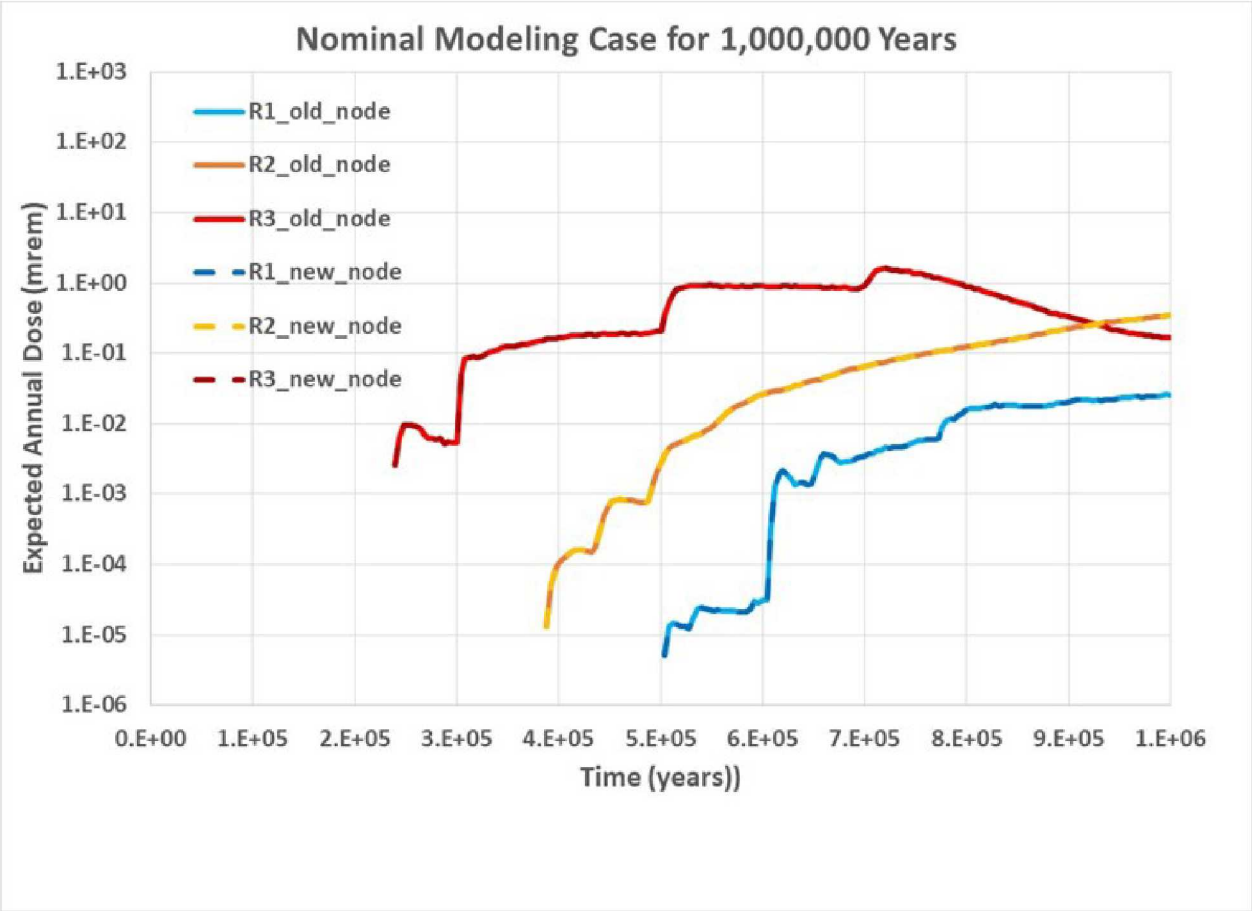

Figure 2. Comparison of Model Results of Expected Annual Dose for the Nominal Modeling Case for 1,000,000 Years after repository Closure (Test 2). The results are for the first three realizations of the modeling case. The figure shows results of the old nodes (Cl2014-6,7,8) and the new nodes (Cl2014-33,34,35).

4 PRELIMINARY ASSESSMENT OF THE STATUS OF SELECT PROCESS MODELS: INFILTRATION MODEL

The FY18 status report (Hadgu et al., 2018) included an inventory and a preliminary assessment of software used in the process models that were part of the YMP License Application. In the current report further investigation of the status of one of the process models and related software is discussed. The process model of interest is the Infiltration Model. The Infiltration Analysis is documented in SNL (2007). As part of the YMP License Application a model was developed to estimate net infiltration at Yucca Mountain from near surface soil layers into the underlying bedrock based on daily water balance. The resulting model, MASSIF ((Mass Accounting System for Soil Infiltration and Flow), incorporates uncertainty analysis for Present-Day and potential future climate states. The software that were used for infiltration analysis are described in SNL (2007, Section 3) and in Hadgu et al. (2018, Section 3.2.1). The primary software used for infiltration analysis is Mathcad 13.1. In this report the focus is on the use of this commercial off-the-shelf software (COTS) in developing net infiltration.

The infiltration calculation procedure is described in detail in SNL (2007, Section 6.5.6). The analysis is based on three climate states: Preset-Day, Monsoon and Glacial Transition. Uncertainty analysis is performed using aleatory and epistemic sampled parameters for each climate state. Latin Hypercube Sampling (LHS) is used to generate sampled parameters for two replicates. In the analysis each replicate consists of 20 realizations of input parameter values. For each realization, a separate weather input file was generated, which used the sampled values of these parameters. For each realization, the appropriate weather input file and parameter set were selected, and the MASSIF net infiltration model was run for each of the 11 watersheds separately.

MASSIF was run in a separate Mathcad file for each of the realizations. Names of these files were of the form *Present Day R1 V03.xmcd*. The first part of the name indicates the climate (Present-Day, Monsoon, Glacial Transition). The second part of the name (R1 or R2) indicates the replicate number. The third part of the name (V01 thru V20) indicates realization number. Within each of the 40 Mathcad files (20 realizations _ 2 replicates), the MASSIF routine was executed for each of the 11 watersheds.

The MASSIF net infiltration model was developed and implemented using Mathcad 13.1 on a PC running Windows XP. As the model is the main component of the infiltration analysis, this report concentrates on assessment of the status of the model and the software used. As stated in Hadgu et al. (2018) Mathcad version 13.1 is not available in software configuration management. Moreover, the version is currently no longer supported by Parametric Technology Corporation (PTC), the vendor. To investigate if later versions of the software could be used on a PC with WINDOWS 10 operating system, a test case was used. The test case was obtained from Data Tracking Number (DTN) SN0701T0502206.037. The test case is located in: SN0701T0502206.037\20070215\Welcome to Massif\Massif\Present Day Uncertainty/Examples. The test case includes rerunning a Present Day Infiltration component and comparing results with the original. Specifically, the test case is on Present Day, Replicate 2, Realization 8. Both Mathcad 14.0 and 15.0 were used to run the example infiltration case. The run was launched from a PC and error messages related to Input/Output were encountered. Part of the Mathcad file is shown in Appendix C together with some internal results. The problem areas are in "red", indicating errors.

The error messages, also shown below, refer to reading precipitation and watershed data. Further investigation will be needed to understand the extent of the problem in the MASSIF infiltration model and to find solutions.

$$\begin{pmatrix} \text{Precip} \\ \text{weight} \\ \text{elev\_ref} \end{pmatrix} := \left| \begin{array}{l} \text{Weatherfile} \leftarrow \left| \begin{array}{l} \text{Directory} \leftarrow \text{"..\..\Present Day Precipitation\"} \\ \text{File\_Base} \leftarrow \text{"Weather Summary v2.1 present\_day "} \\ \text{LHS\_marker} \leftarrow \text{concat("0", substr(LHS, 1, 3))} \\ \text{concat(Directory, File\_Base, LHS\_marker, "\_", Replicate, ".xls")} \end{array} \right. \\ \text{Weather(Weatherfile)} \end{array} \right.$$

$$\overrightarrow{\text{Cells} := \text{rows(READPRN(Wshed))}}$$

5 SUMMARY AND CONCLUSION

The purpose of this work is to evaluate and maintain operational readiness of the computing infrastructure (computer hardware and software) and knowledge capability to perform TSPA-LA type analyses. The following tasks were conducted in FY19.

- Evaluation and maintenance of the CL2014 TSPA server cluster system to support reliable executions of the TSPA-LA models and associated analysis and calculations. Three new nodes have been installed to help in life extension of the server cluster. The new nodes would replace any future failed nodes of the original hardware. Memory malfunctions of one of the original nodes have been addressed. The cluster is now fully operational with increased capacity.
- Retrieval of the TSPA-LA model files required input files and other associated files of the TSPA-LA modeling cases.
- Execution of the TSPA-LA model on the TSPA cluster servers (CL2014), ensuring reliable run executions utilizing the GoldSim distributed processing module and reproducible stochastic sampling schemes (GoldSim 2007). To test the performances of the new nodes and the upgraded cluster, the Nominal Modeling Case was run using GoldSim 9.60.300 with various number of processors (as described in Section 3). The execution times were faster than previous runs due to the addition of faster Dell PowerEdge R640 nodes.
- Preliminary assessment of the status of the Infiltration Analysis, a process model that feeds to the TSPA-LA, was conducted. The MASSIF Model, the model representing Infiltration Analysis, was originally developed using Mathcad Version 13.1. The version is no longer supported by the vendor. An example test case of the MASSIF Model was run using Mathcad versions 14 and 15. The run was interrupted due to Input/Output errors as described in Section 4 and Appendix C. Further testing is needed to assess the extent of the problem and to find remedial solutions.

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APPENDIX A. PROPOSAL FOR LIFE EXTENSION OF CLUSTER CL2014

Below is a copy of an email sent by Timothy Seigler, Mission Computing Services (09322), Sandia National Laboratories on 7/31/2019 on a proposal for life extension of the TSPA cluster (CL2014).

In order to extend the life of the CL2014 cluster, MCS is proposing adding two to three nodes to the cluster and configured to the original chipset and specs as close as possible. The older chips bring the cost up a little but also guarantees the base code runs as expected.

Dell will no longer warranty the existing Dell servers (R620) or extend the service contract. Parts may be hard if not impossible to get if and when hardware fails. By adding additional nodes to the cluster and increasing the computing capacity of the existing CL2014 cluster, a node failure should not cause a disruption in service. Based on the age of the existing cluster nodes and some historical overheating issues, we predict two to three servers may fail over the next three years.

Risk:

- *Not adding additional nodes to the existing CL2014 cluster now may result in a decreased number of cores and computing power sometime over the next three years*
- *May not be able to find parts to repair failed nodes*
- *Waiting to purchase additional nodes may result in the inability to purchase the same chip sets in future Dell products. Dell is deprecating the older chip sets for the newer Cascade Lake chips*

Proposed Solution:

- *Add two or three additional compute nodes to the CL2014 cluster increasing the number of cores and computing capability to compensate for any anticipated failures over the next three years*
- *Use failed R620 servers as spare parts to keep the CL2014 cluster from falling below current specification and core numbers*
- *Order the additional servers this Fiscal year (if possible), before the 4th generation chip sets are no longer available for purchase*

Cost:

I worked with Dell and Wildflower (Carsten), to put together a 1U dell R640 that is as close to the older R620s as we could get. We are limited on what chips were available because newer chips came out in April. We also spec'd out a Dell R630 as a cheaper option and should still work well as a cluster node but has a slower chip. It is always good to have a choice. A faster bus and ram should help make up performance differences

R630: $7,896.16 (Each). Lead time is 3 days from order. Should make it on the dock well before 9/20/2019 if ordered by 7/6/2019.

R640: (Recommended): $13,690.33 (Each). Lead time is 5 days from order. Should make it on the dock before 9/20/2019 if ordered by 7/6.2019.

Note: I recommend at least two additional nodes should be added to the CL2040 cluster to extend the overall life another three years. Three would be optimal.

APPENDIX B. MIGRATION OF THE STORAGE SYSTEM

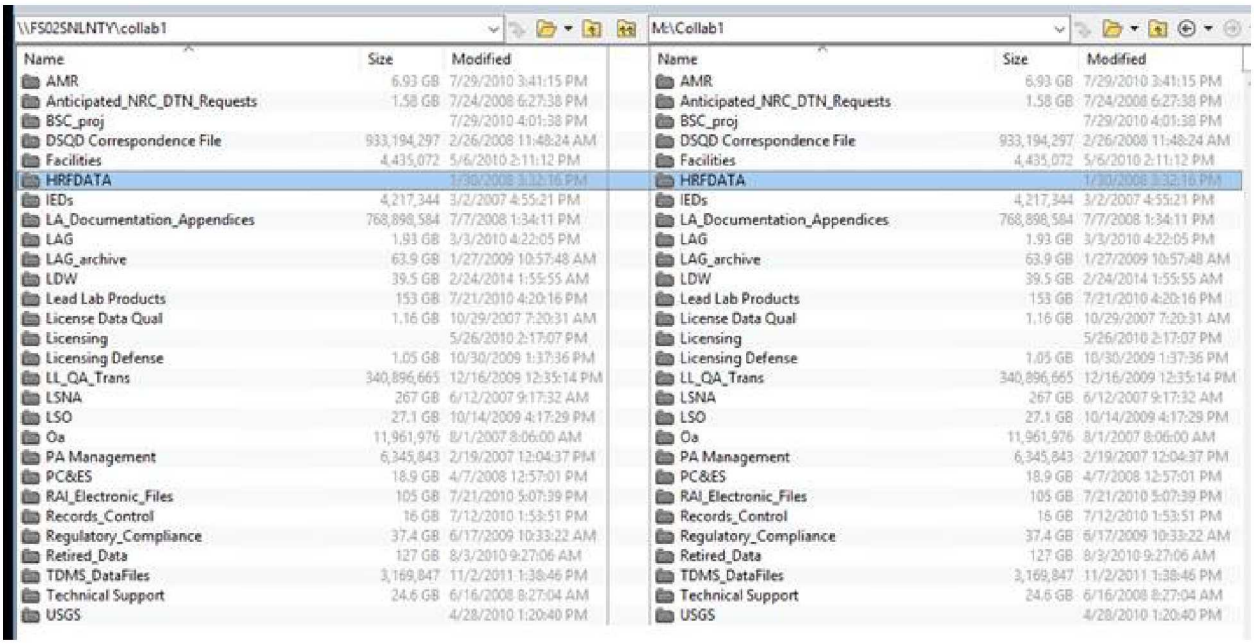
Below is a report by Bob D'Spain (10777) on the data migration effort, sent in an email dated 1/7/2020.

The YMP Dataset that is currently residing on FS02snlnty is on a server OS that is going out of support in the next two weeks. In addition, the storage array that the data sits on is also far out of warranty and the SAN team is experiencing high disk failure rates.

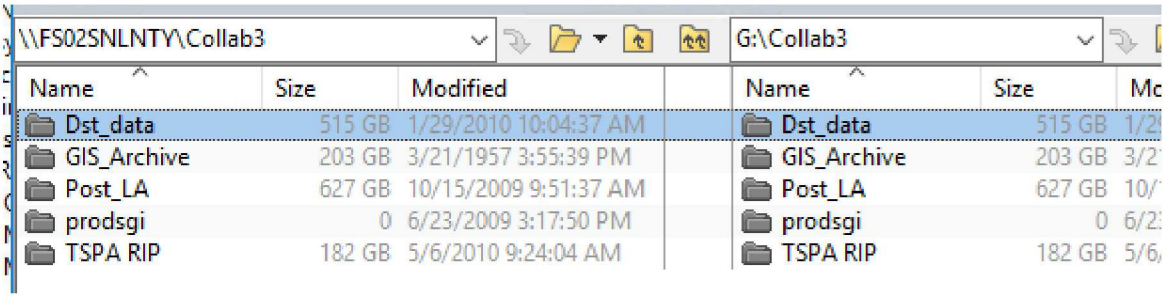
This data has been copied to a new server with a modern OS and on a new storage array that is still under warranty. This process has been accomplished once before and basically follows this procedure. Data will be copied and synced from the old server to the new server. Currently there are 17 disks involved. Once that data copy has been completed, we'll run a different application to compare the contents in the two locations. Screenshots will be provided to ensure and verify all data is identical. After that has been completed and confirmed, We'll get the shares and access set up on the new system to mimic what is in place on the old one. In addition, we'll be working with both the backup and SAN teams to ensure the new system is being backed up and the data is being replicated to a secondary location, probably Cal.

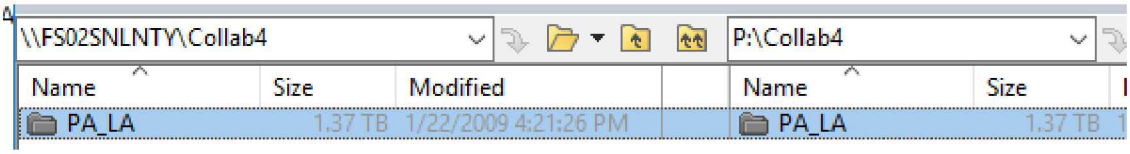
When this is all complete, the old systems will be taken offline. We will determine if we can dispose of or need to hold longer.

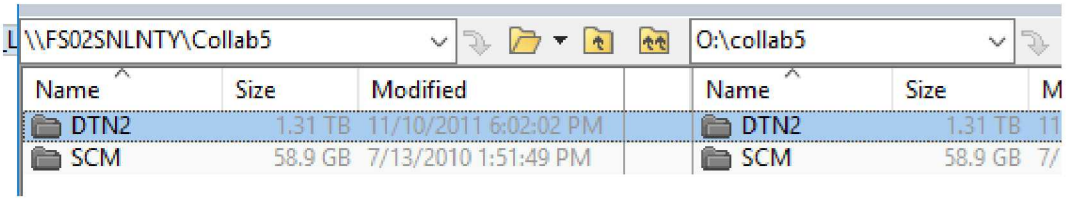
The data migration has now been completed. The new storage system has been mapped to the TSPA cluster (Cl2014) for easy access. Bob D'Spain (10777) has provided side-by-side screen shots of the old and new storage systems as shown below. The screen shots show that the migrated data is identical to the original.

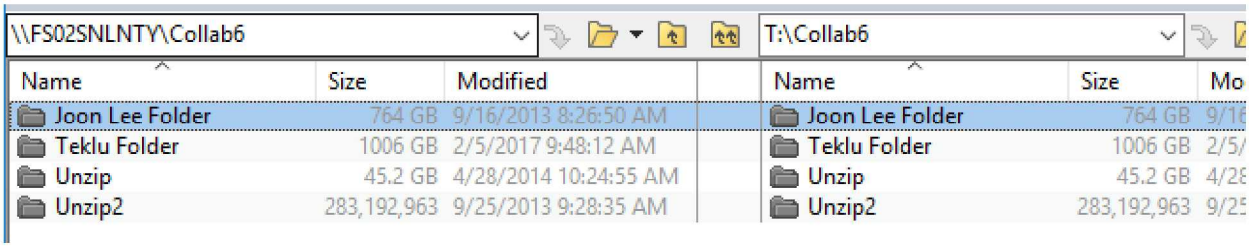


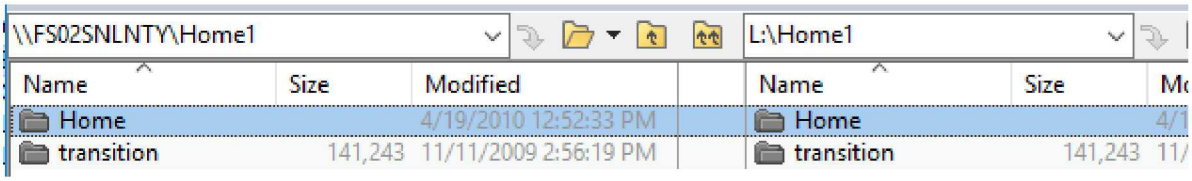
See Collab2 breakout below.







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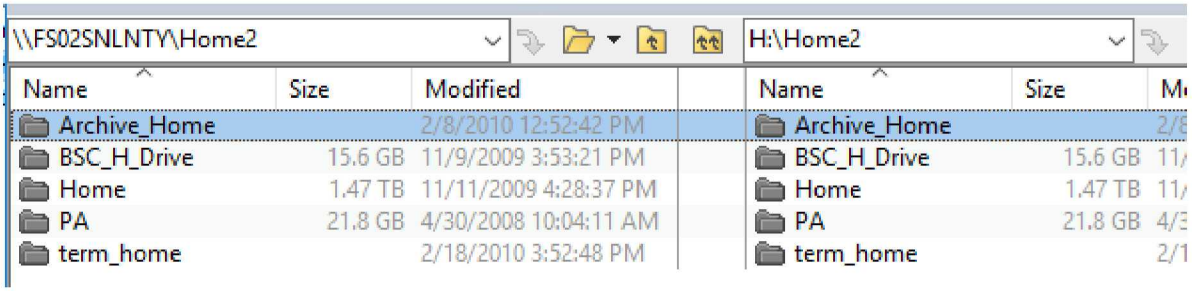
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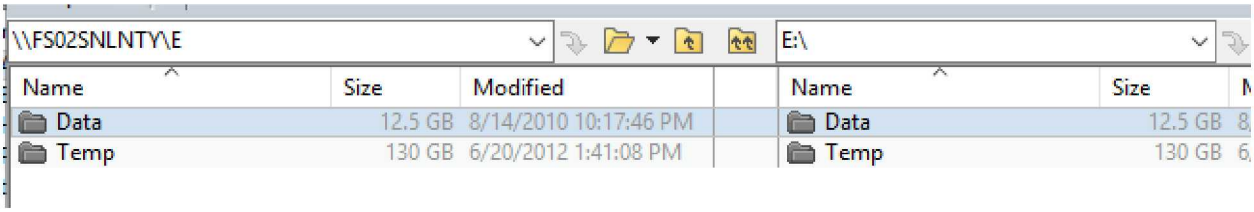
11/9/2009 3:53:21 PM
Home
1.47 TB
11/11/2009 4:28:37 PM
PA
21.8 GB
4/30/2008 10:04:11 AM
term_home
2/18/2010 3:52:48 PM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Name
Size
Modified
Data
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Temp
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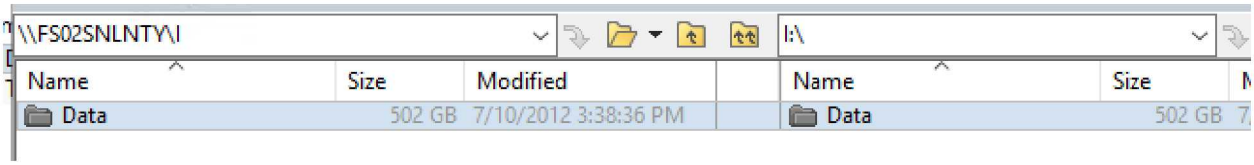
6/20/2012 1:41:08 PM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I:\
Name
Size
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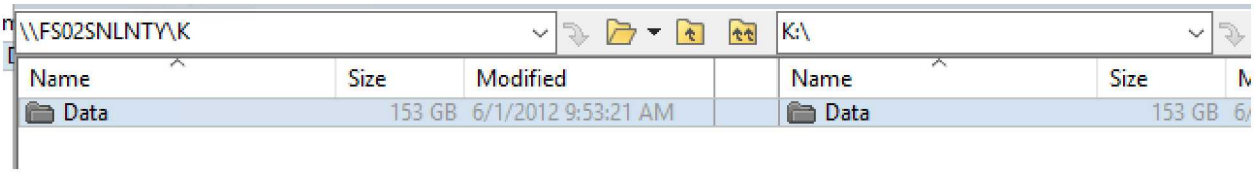
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Size
Modified
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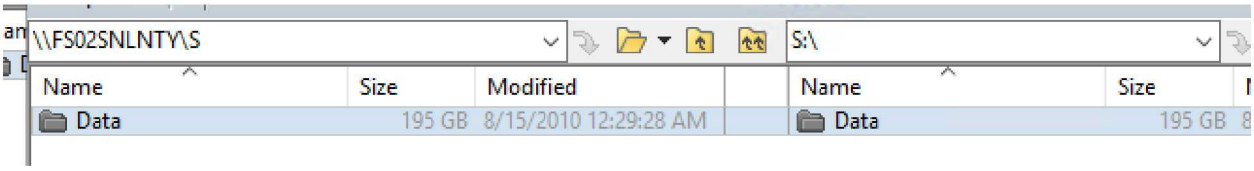
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Name
Size
Modified
Data
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8/15/2010 12:29:28 AM


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R:\
Name
Size
Modified
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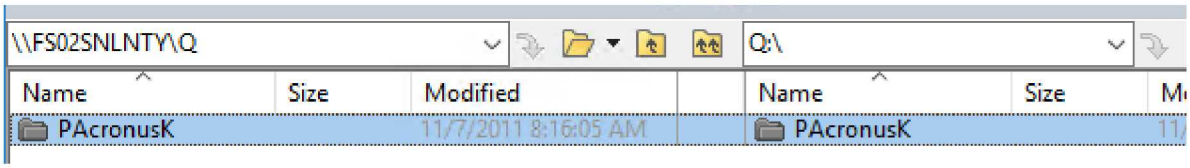
2/14/3226 7:03:09 AM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Q:\
Name
Size
Modified
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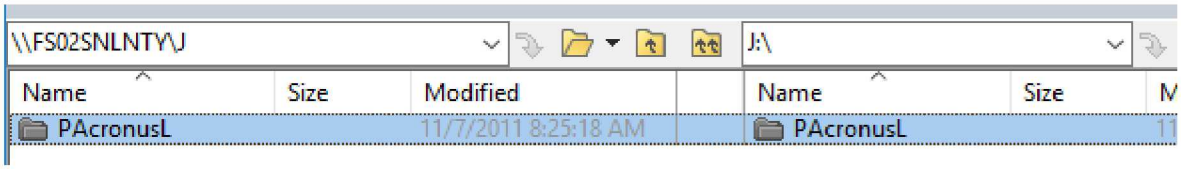
11/7/2011 8:16:05 AM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J:\
Name
Size
Modified
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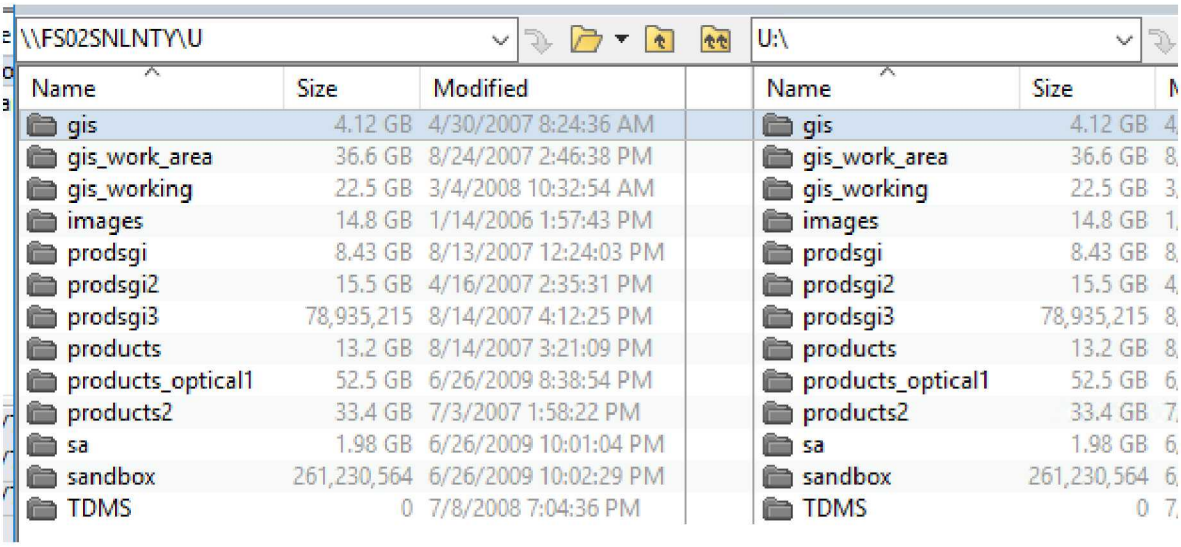
11/7/2011 8:25:18 AM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U:\
Name
Size
Modified
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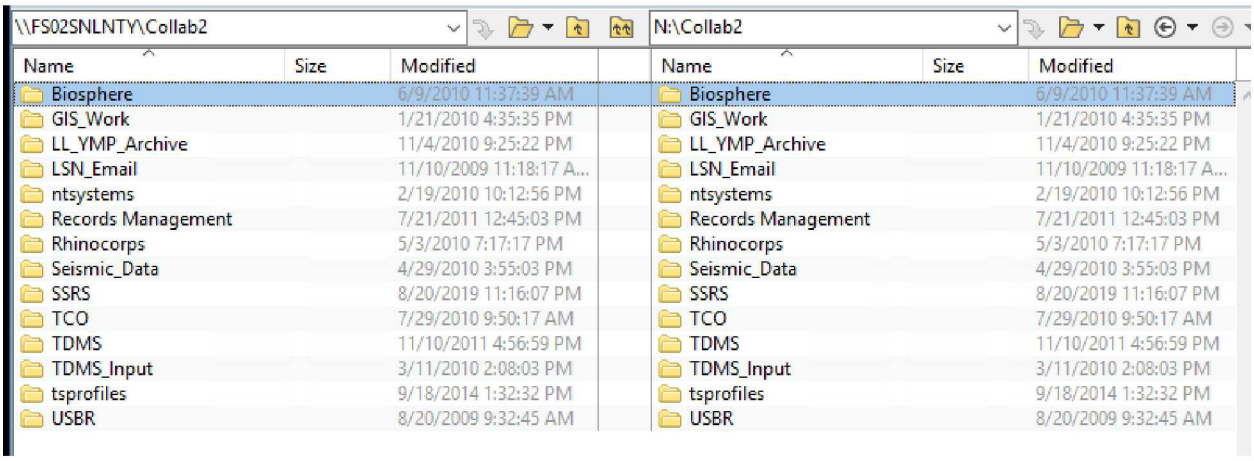
gis_work_area 36.6 GB 8/24/2007 2:46:38 PM
gis_working 22.5 GB 3/4/2008 10:32:54 AM
images 14.8 GB 1/14/2006 1:57:43 PM
prodsgi 8.43 GB 8/13/2007 12:24:03 PM
prodsgi2 15.5 GB 4/16/2007 2:35:31 PM
prodsgi3 78,935,215 8/14/2007 4:12:25 PM
products 13.2 GB 8/14/2007 3:21:09 PM
products_optical1 52.5 GB 6/26/2009 8:38:54 PM
products2 33.4 GB 7/3/2007 1:58:22 PM
sa 1.98 GB 6/26/2009 10:01:04 PM
sandbox 261,230,564 6/26/2009 10:02:29 PM
TDMS 0 7/8/2008 7:04:36 PM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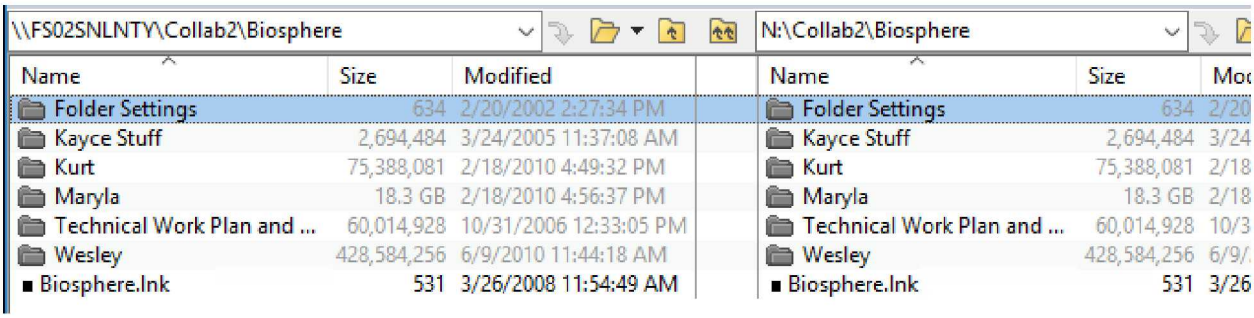
N:\Collab2
Name
Size
Modified
Biosphere 6/9/2010 11:37:39 AM
GIS_Work 1/21/2010 4:35:35 PM
LL_YMP_Archive 11/4/2010 9:25:22 PM
LSN_Email 11/10/2009 11:18:17 A...
ntsystems 2/19/2010 10:12:56 PM
Records Management 7/21/2011 12:45:03 PM
Rhinocorps 5/3/2010 7:17:17 PM
Seismic_Data 4/29/2010 3:55:03 PM
SSRS 8/20/2019 11:16:07 PM
TCO 7/29/2010 9:50:17 AM
TDMS 11/10/2011 4:56:59 PM
TDMS_Input 3/11/2010 2:08:03 PM
tsprofiles 9/18/2014 1:32:32 PM
USBR 8/20/2009 9:32:45 AM



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Name	Size	Modified
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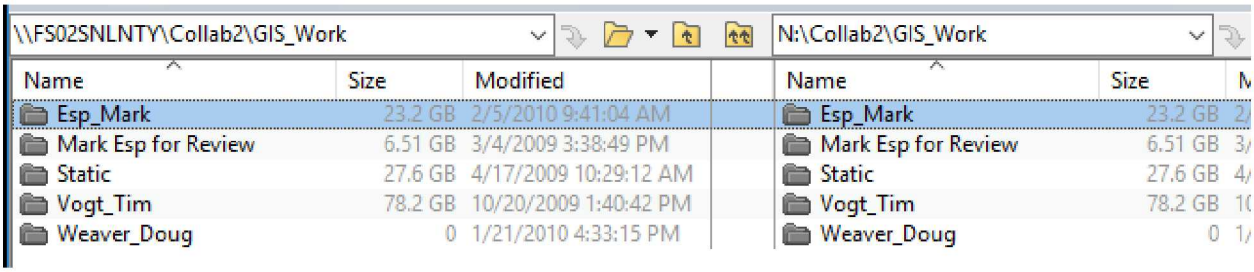
Kayce Stuff	2,694,484	3/24/2005 11:37:08 AM
Kurt	75,388,081	2/18/2010 4:49:32 PM
Maryla	18.3 GB	2/18/2010 4:56:37 PM
Technical Work Plan and ...	60,014,928	10/31/2006 12:33:05 PM
Wesley	428,584,256	6/9/2010 11:44:18 AM
Biosphere.lnk	531	3/26/2008 11:54:49 AM

N:\Collab2\Biosphere

Name	Size	Mod
Folder Settings	634	2/20
Kayce Stuff	2,694,484	3/24
Kurt	75,388,081	2/18
Maryla	18.3 GB	2/18
Technical Work Plan and ...	60,014,928	10/3
Wesley	428,584,256	6/9/
Biosphere.lnk	531	3/26

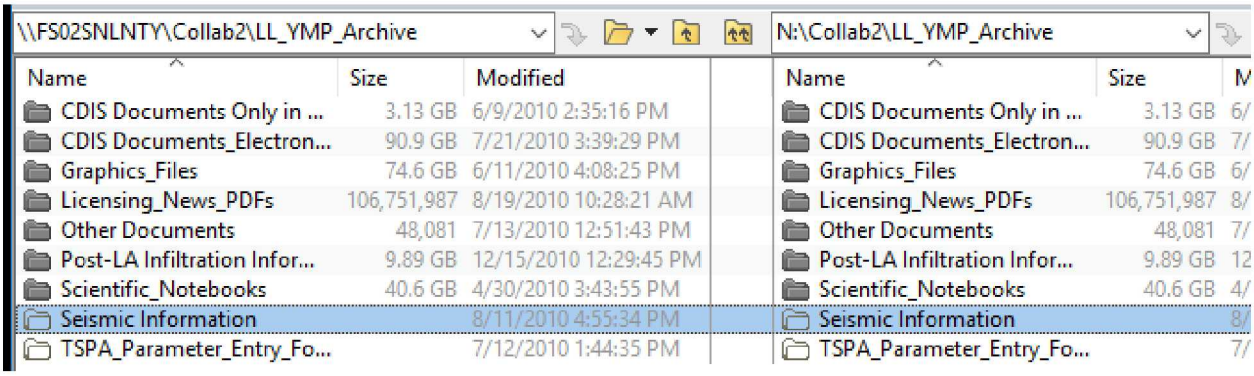


\\FS02SNLNTY\Collab2\GIS_Work

Name	Size	Modified
Esp_Mark	23.2 GB	2/5/2010 9:41:04 AM
Mark Esp for Review	6.51 GB	3/4/2009 3:38:49 PM
Static	27.6 GB	4/17/2009 10:29:12 AM
Vogt_Tim	78.2 GB	10/20/2009 1:40:42 PM
Weaver_Doug	0	1/21/2010 4:33:15 PM

N:\Collab2\GIS_Work

Name	Size	M
Esp_Mark	23.2 GB	2/
Mark Esp for Review	6.51 GB	3/
Static	27.6 GB	4/
Vogt_Tim	78.2 GB	10
Weaver_Doug	0	1/

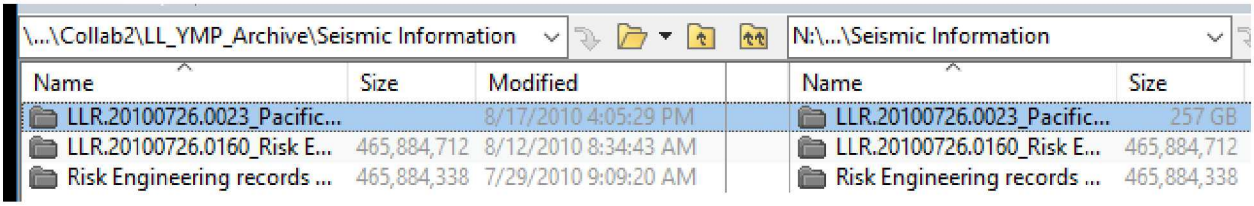


\\FS02SNLNTY\Collab2\LL_YMP_Archive

Name	Size	Modified
CDIS Documents Only in ...	3.13 GB	6/9/2010 2:35:16 PM
CDIS Documents_Electron...	90.9 GB	7/21/2010 3:39:29 PM
Graphics_Files	74.6 GB	6/11/2010 4:08:25 PM
Licensing_News_PDFs	106,751,987	8/19/2010 10:28:21 AM
Other Documents	48,081	7/13/2010 12:51:43 PM
Post-LA Infiltration Infor...	9.89 GB	12/15/2010 12:29:45 PM
Scientific_Notebooks	40.6 GB	4/30/2010 3:43:55 PM
Seismic Information		8/11/2010 4:55:34 PM
TSPA_Parameter_Entry_Fo...		7/12/2010 1:44:35 PM

N:\Collab2\LL_YMP_Archive

Name	Size	M
CDIS Documents Only in ...	3.13 GB	6/
CDIS Documents_Electron...	90.9 GB	7/
Graphics_Files	74.6 GB	6/
Licensing_News_PDFs	106,751,987	8/
Other Documents	48,081	7/
Post-LA Infiltration Infor...	9.89 GB	12
Scientific_Notebooks	40.6 GB	4/
Seismic Information		8/
TSPA_Parameter_Entry_Fo...		7/



\...\Collab2\LL_YMP_Archive\Seismic Information

Name	Size	Modified
LLR.20100726.0023_Pacific...		8/17/2010 4:05:29 PM
LLR.20100726.0160_Risk E...	465,884,712	8/12/2010 8:34:43 AM
Risk Engineering records ...	465,884,338	7/29/2010 9:09:20 AM

N:\...\Seismic Information

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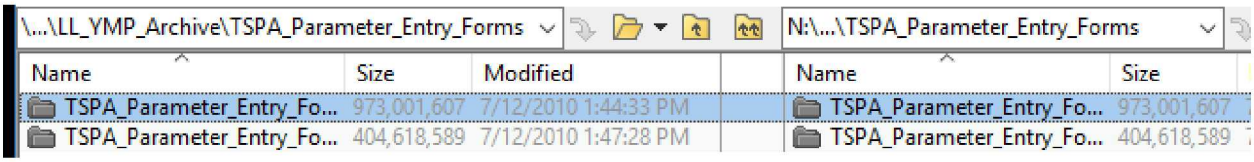
LLR.20100726.0023_Pacific...	257 GB
LLR.20100726.0160_Risk E...	465,884,712
Risk Engineering records ...	465,884,338



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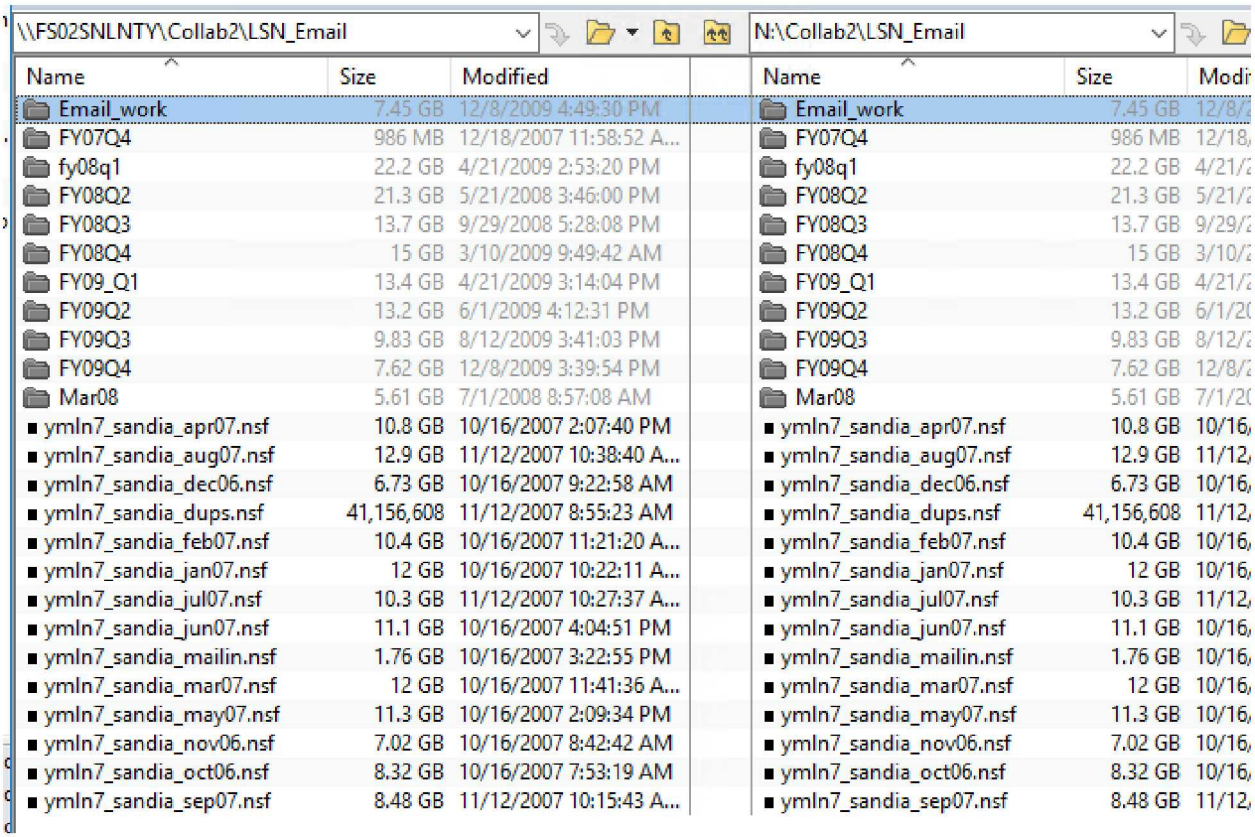
Name	Size	Modified
TSPA_Parameter_Entry_Fo...	973,001,607	7/12/2010 1:44:33 PM
TSPA_Parameter_Entry_Fo...	404,618,589	7/12/2010 1:47:28 PM

N:\...\TSPA_Parameter_Entry_Forms

Name	Size
TSPA_Parameter_Entry_Fo...	973,001,607
TSPA_Parameter_Entry_Fo...	404,618,589



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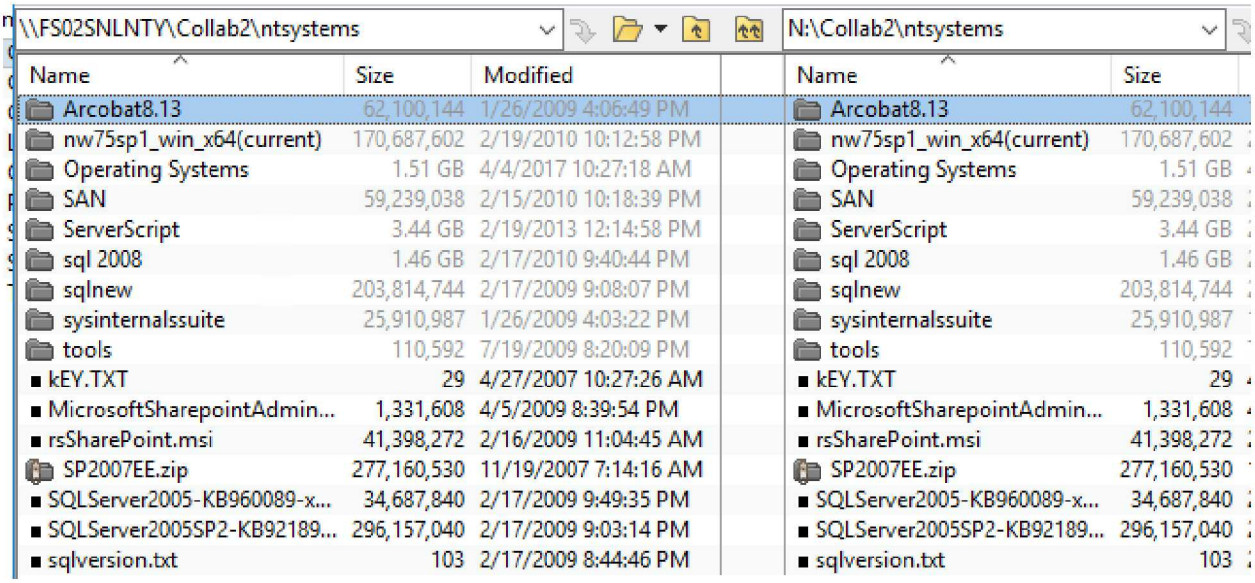
FY07Q4	986 MB	12/18/2007 11:58:52 A...
fy08q1	22.2 GB	4/21/2009 2:53:20 PM
FY08Q2	21.3 GB	5/21/2008 3:46:00 PM
FY08Q3	13.7 GB	9/29/2008 5:28:08 PM
FY08Q4	15 GB	3/10/2009 9:49:42 AM
FY09_Q1	13.4 GB	4/21/2009 3:14:04 PM
FY09Q2	13.2 GB	6/1/2009 4:12:31 PM
FY09Q3	9.83 GB	8/12/2009 3:41:03 PM
FY09Q4	7.62 GB	12/8/2009 3:39:54 PM
Mar08	5.61 GB	7/1/2008 8:57:08 AM
ymln7_sandia_apr07.nsf	10.8 GB	10/16/2007 2:07:40 PM
ymln7_sandia_aug07.nsf	12.9 GB	11/12/2007 10:38:40 A...
ymln7_sandia_dec06.nsf	6.73 GB	10/16/2007 9:22:58 AM
ymln7_sandia_dups.nsf	41,156,608	11/12/2007 8:55:23 AM
ymln7_sandia_feb07.nsf	10.4 GB	10/16/2007 11:21:20 A...
ymln7_sandia_jan07.nsf	12 GB	10/16/2007 10:22:11 A...
ymln7_sandia_jul07.nsf	10.3 GB	11/12/2007 10:27:37 A...
ymln7_sandia_jun07.nsf	11.1 GB	10/16/2007 4:04:51 PM
ymln7_sandia_mailin.nsf	1.76 GB	10/16/2007 3:22:55 PM
ymln7_sandia_mar07.nsf	12 GB	10/16/2007 11:41:36 A...
ymln7_sandia_may07.nsf	11.3 GB	10/16/2007 2:09:34 PM
ymln7_sandia_nov06.nsf	7.02 GB	10/16/2007 8:42:42 AM
ymln7_sandia_oct06.nsf	8.32 GB	10/16/2007 7:53:19 AM
ymln7_sandia_sep07.nsf	8.48 GB	11/12/2007 10:15:43 A...

N:\Collab2\LSN_Email

Name	Size	Modi
Email_work	7.45 GB	12/8/
FY07Q4	986 MB	12/18/
fy08q1	22.2 GB	4/21/
FY08Q2	21.3 GB	5/21/
FY08Q3	13.7 GB	9/29/
FY08Q4	15 GB	3/10/
FY09_Q1	13.4 GB	4/21/
FY09Q2	13.2 GB	6/1/20
FY09Q3	9.83 GB	8/12/
FY09Q4	7.62 GB	12/8/
Mar08	5.61 GB	7/1/20
ymln7_sandia_apr07.nsf	10.8 GB	10/16/
ymln7_sandia_aug07.nsf	12.9 GB	11/12/
ymln7_sandia_dec06.nsf	6.73 GB	10/16/
ymln7_sandia_dups.nsf	41,156,608	11/12/
ymln7_sandia_feb07.nsf	10.4 GB	10/16/
ymln7_sandia_jan07.nsf	12 GB	10/16/
ymln7_sandia_jul07.nsf	10.3 GB	11/12/
ymln7_sandia_jun07.nsf	11.1 GB	10/16/
ymln7_sandia_mailin.nsf	1.76 GB	10/16/
ymln7_sandia_mar07.nsf	12 GB	10/16/
ymln7_sandia_may07.nsf	11.3 GB	10/16/
ymln7_sandia_nov06.nsf	7.02 GB	10/16/
ymln7_sandia_oct06.nsf	8.32 GB	10/16/
ymln7_sandia_sep07.nsf	8.48 GB	11/12/



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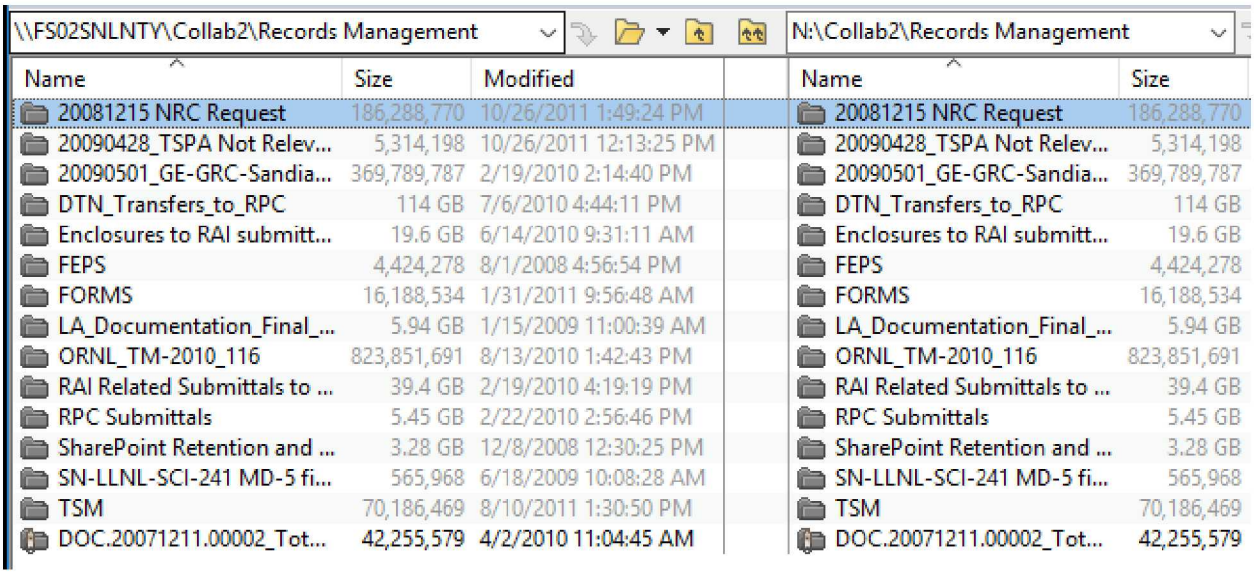
Name	Size	Modified
Arcobat8.13	62,100,144	1/26/2009 4:06:49 PM
nw75sp1_win_x64(current)	170,687,602	2/19/2010 10:12:58 PM
Operating Systems	1.51 GB	4/4/2017 10:27:18 AM
SAN	59,239,038	2/15/2010 10:18:39 PM
ServerScript	3.44 GB	2/19/2013 12:14:58 PM
sql 2008	1.46 GB	2/17/2010 9:40:44 PM
sqlnew	203,814,744	2/17/2009 9:08:07 PM
sysinternalssuite	25,910,987	1/26/2009 4:03:22 PM
tools	110,592	7/19/2009 8:20:09 PM
kEY.TXT	29	4/27/2007 10:27:26 AM
MicrosoftSharepointAdmin...	1,331,608	4/5/2009 8:39:54 PM
rsSharePoint.msi	41,398,272	2/16/2009 11:04:45 AM
SP2007EE.zip	277,160,530	11/19/2007 7:14:16 AM
SQLServer2005-KB960089-x...	34,687,840	2/17/2009 9:49:35 PM
SQLServer2005SP2-KB92189...	296,157,040	2/17/2009 9:03:14 PM
sqlversion.txt	103	2/17/2009 8:44:46 PM

N:\Collab2\ntsystems

Name	Size
Arcobat8.13	62,100,144
nw75sp1_win_x64(current)	170,687,602
Operating Systems	1.51 GB
SAN	59,239,038
ServerScript	3.44 GB
sql 2008	1.46 GB
sqlnew	203,814,744
sysinternalssuite	25,910,987
tools	110,592
kEY.TXT	29
MicrosoftSharepointAdmin...	1,331,608
rsSharePoint.msi	41,398,272
SP2007EE.zip	277,160,530
SQLServer2005-KB960089-x...	34,687,840
SQLServer2005SP2-KB92189...	296,157,040
sqlversion.txt	103



\\FS02SNLNTY\Collab2\Records Management

Name	Size	Modified
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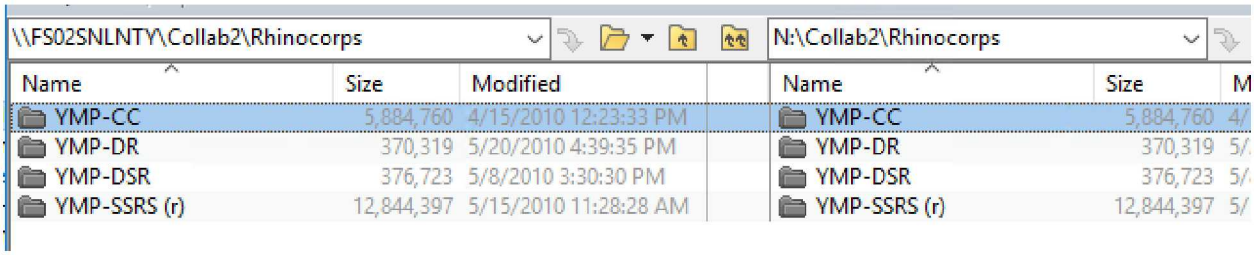
20090428_TSPA Not Relev...	5,314,198	10/26/2011 12:13:25 PM
20090501_GE-GRC-Sandia...	369,789,787	2/19/2010 2:14:40 PM
DTN_Transfers_to_RPC	114 GB	7/6/2010 4:44:11 PM
Enclosures to RAI submitt...	19.6 GB	6/14/2010 9:31:11 AM
FEPS	4,424,278	8/1/2008 4:56:54 PM
FORMS	16,188,534	1/31/2011 9:56:48 AM
LA_Documentation_Final_...	5.94 GB	1/15/2009 11:00:39 AM
ORNL_TM-2010_116	823,851,691	8/13/2010 1:42:43 PM
RAI Related Submittals to ...	39.4 GB	2/19/2010 4:19:19 PM
RPC Submittals	5.45 GB	2/22/2010 2:56:46 PM
SharePoint Retention and ...	3.28 GB	12/8/2008 12:30:25 PM
SN-LLNL-SCI-241 MD-5 fi...	565,968	6/18/2009 10:08:28 AM
TSM	70,186,469	8/10/2011 1:30:50 PM
DOC.20071211.00002_Tot...	42,255,579	4/2/2010 11:04:45 AM

N:\Collab2\Records Management

Name	Size
20081215 NRC Request	186,288,770
20090428_TSPA Not Relev...	5,314,198
20090501_GE-GRC-Sandia...	369,789,787
DTN_Transfers_to_RPC	114 GB
Enclosures to RAI submitt...	19.6 GB
FEPS	4,424,278
FORMS	16,188,534
LA_Documentation_Final_...	5.94 GB
ORNL_TM-2010_116	823,851,691
RAI Related Submittals to ...	39.4 GB
RPC Submittals	5.45 GB
SharePoint Retention and ...	3.28 GB
SN-LLNL-SCI-241 MD-5 fi...	565,968
TSM	70,186,469
DOC.20071211.00002_Tot...	42,255,579

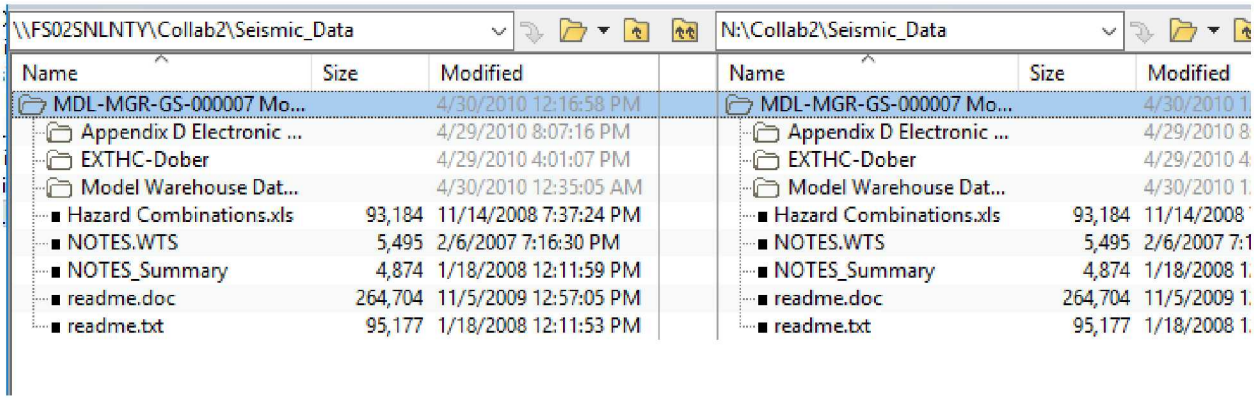


\\FS02SNLNTY\Collab2\Rhinocorps

Name	Size	Modified
YMP-CC	5,884,760	4/15/2010 12:23:33 PM
YMP-DR	370,319	5/20/2010 4:39:35 PM
YMP-DSR	376,723	5/8/2010 3:30:30 PM
YMP-SSRS (r)	12,844,397	5/15/2010 11:28:28 AM

N:\Collab2\Rhinocorps

Name	Size	M
YMP-CC	5,884,760	4/
YMP-DR	370,319	5/
YMP-DSR	376,723	5/
YMP-SSRS (r)	12,844,397	5/

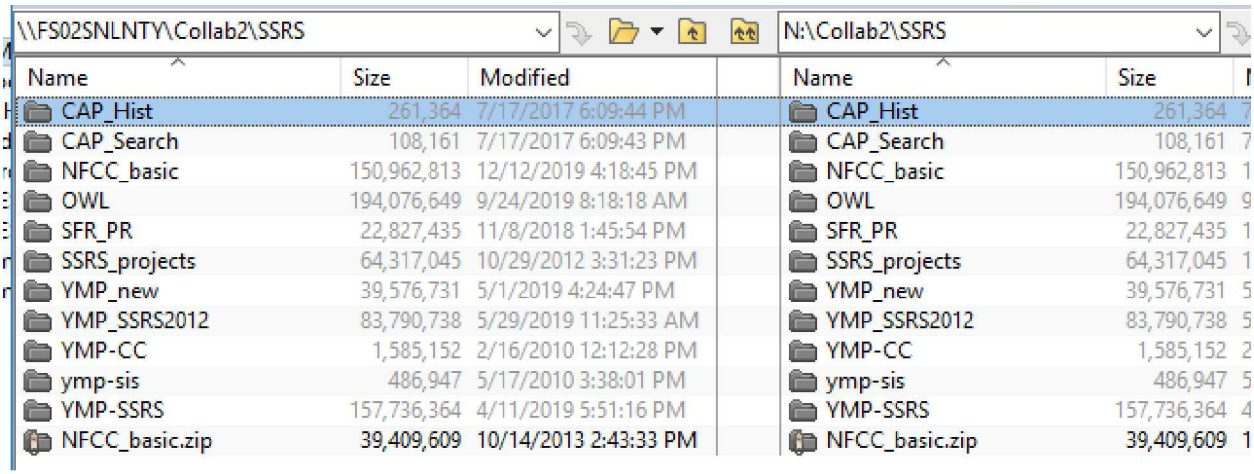


\\FS02SNLNTY\Collab2\Seismic_Data

Name	Size	Modified
MDL-MGR-GS-000007 Mo...		4/30/2010 12:16:58 PM
Appendix D Electronic ...		4/29/2010 8:07:16 PM
EXTHC-Dober		4/29/2010 4:01:07 PM
Model Warehouse Dat...		4/30/2010 12:35:05 AM
Hazard Combinations.xls	93,184	11/14/2008 7:37:24 PM
NOTES.WTS	5,495	2/6/2007 7:16:30 PM
NOTES_Summary	4,874	1/18/2008 12:11:59 PM
readme.doc	264,704	11/5/2009 12:57:05 PM
readme.txt	95,177	1/18/2008 12:11:53 PM

N:\Collab2\Seismic_Data

Name	Size	Modified
MDL-MGR-GS-000007 Mo...		4/30/2010 1
Appendix D Electronic ...		4/29/2010 8
EXTHC-Dober		4/29/2010 4
Model Warehouse Dat...		4/30/2010 1
Hazard Combinations.xls	93,184	11/14/2008
NOTES.WTS	5,495	2/6/2007 7:1
NOTES_Summary	4,874	1/18/2008 1
readme.doc	264,704	11/5/2009 1
readme.txt	95,177	1/18/2008 1

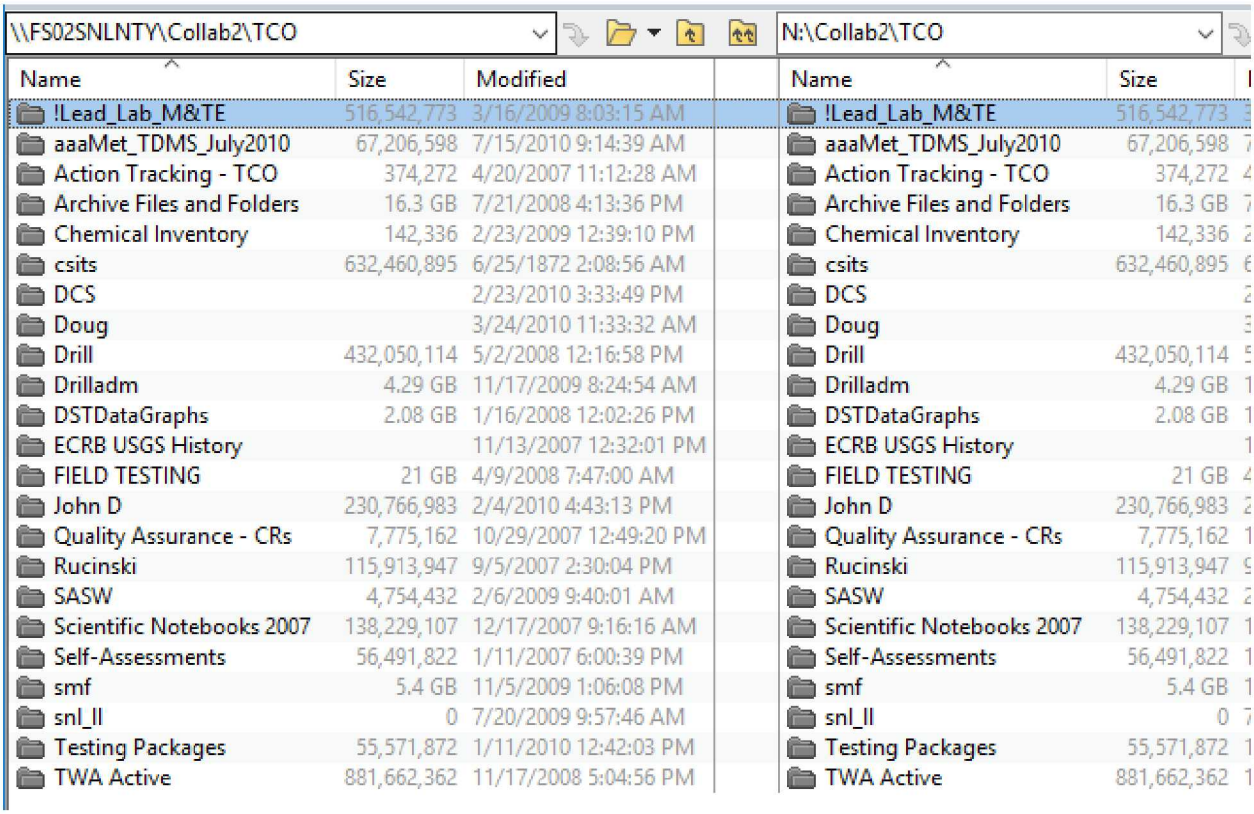


\\FS02SNLNTY\Collab2\SSRS

Name	Size	Modified
CAP_Hist	261,364	7/17/2017 6:09:44 PM
CAP_Search	108,161	7/17/2017 6:09:43 PM
NFCC_basic	150,962,813	12/12/2019 4:18:45 PM
OWL	194,076,649	9/24/2019 8:18:18 AM
SFR_PR	22,827,435	11/8/2018 1:45:54 PM
SSRS_projects	64,317,045	10/29/2012 3:31:23 PM
YMP_new	39,576,731	5/1/2019 4:24:47 PM
YMP_SSRS2012	83,790,738	5/29/2019 11:25:33 AM
YMP-CC	1,585,152	2/16/2010 12:12:28 PM
ymp-sis	486,947	5/17/2010 3:38:01 PM
YMP-SSRS	157,736,364	4/11/2019 5:51:16 PM
NFCC_basic.zip	39,409,609	10/14/2013 2:43:33 PM

N:\Collab2\SSRS

Name	Size
CAP_Hist	261,364
CAP_Search	108,161
NFCC_basic	150,962,813
OWL	194,076,649
SFR_PR	22,827,435
SSRS_projects	64,317,045
YMP_new	39,576,731
YMP_SSRS2012	83,790,738
YMP-CC	1,585,152
ymp-sis	486,947
YMP-SSRS	157,736,364
NFCC_basic.zip	39,409,609

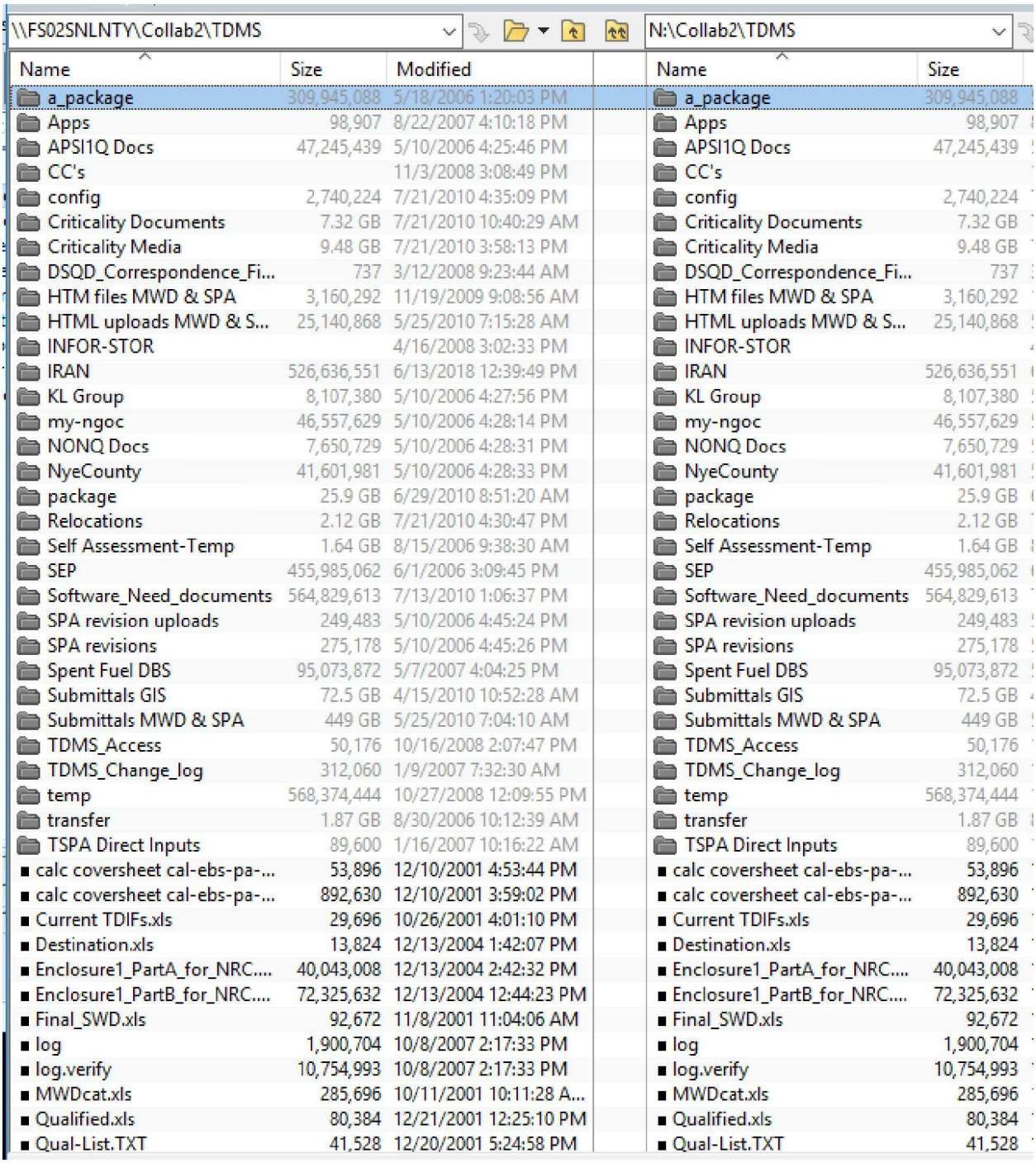


\\FS02SNLNTY\Collab2\TCO

Name	Size	Modified
!Lead_Lab_M&TE	516,542,773	3/16/2009 8:03:15 AM
aaaMet_TDMS_July2010	67,206,598	7/15/2010 9:14:39 AM
Action Tracking - TCO	374,272	4/20/2007 11:12:28 AM
Archive Files and Folders	16.3 GB	7/21/2008 4:13:36 PM
Chemical Inventory	142,336	2/23/2009 12:39:10 PM
csits	632,460,895	6/25/1872 2:08:56 AM
DCS		2/23/2010 3:33:49 PM
Doug		3/24/2010 11:33:32 AM
Drill	432,050,114	5/2/2008 12:16:58 PM
Drilladm	4.29 GB	11/17/2009 8:24:54 AM
DSTDataGraphs	2.08 GB	1/16/2008 12:02:26 PM
ECRB USGS History		11/13/2007 12:32:01 PM
FIELD TESTING	21 GB	4/9/2008 7:47:00 AM
John D	230,766,983	2/4/2010 4:43:13 PM
Quality Assurance - CRs	7,775,162	10/29/2007 12:49:20 PM
Rucinski	115,913,947	9/5/2007 2:30:04 PM
SASW	4,754,432	2/6/2009 9:40:01 AM
Scientific Notebooks 2007	138,229,107	12/17/2007 9:16:16 AM
Self-Assessments	56,491,822	1/11/2007 6:00:39 PM
smf	5.4 GB	11/5/2009 1:06:08 PM
snl_ll	0	7/20/2009 9:57:46 AM
Testing Packages	55,571,872	1/11/2010 12:42:03 PM
TWA Active	881,662,362	11/17/2008 5:04:56 PM

N:\Collab2\TCO

Name	Size
!Lead_Lab_M&TE	516,542,773
aaaMet_TDMS_July2010	67,206,598
Action Tracking - TCO	374,272
Archive Files and Folders	16.3 GB
Chemical Inventory	142,336
csits	632,460,895
DCS	
Doug	
Drill	432,050,114
Drilladm	4.29 GB
DSTDataGraphs	2.08 GB
ECRB USGS History	
FIELD TESTING	21 GB
John D	230,766,983
Quality Assurance - CRs	7,775,162
Rucinski	115,913,947
SASW	4,754,432
Scientific Notebooks 2007	138,229,107
Self-Assessments	56,491,822
smf	5.4 GB
snl_ll	0
Testing Packages	55,571,872
TWA Active	881,662,362



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Name	Size	Modified
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Apps	98,907	8/22/2007 4:10:18 PM
APSI1Q Docs	47,245,439	5/10/2006 4:25:46 PM
CC's		11/3/2008 3:08:49 PM
config	2,740,224	7/21/2010 4:35:09 PM
Criticality Documents	7.32 GB	7/21/2010 10:40:29 AM
Criticality Media	9.48 GB	7/21/2010 3:58:13 PM
DSQD_Correspondence_Fi...	737	3/12/2008 9:23:44 AM
HTM files MWD & SPA	3,160,292	11/19/2009 9:08:56 AM
HTML uploads MWD & S...	25,140,868	5/25/2010 7:15:28 AM
INFOR-STOR		4/16/2008 3:02:33 PM
IRAN	526,636,551	6/13/2018 12:39:49 PM
KL Group	8,107,380	5/10/2006 4:27:56 PM
my-ngoc	46,557,629	5/10/2006 4:28:14 PM
NONQ Docs	7,650,729	5/10/2006 4:28:31 PM
NyeCounty	41,601,981	5/10/2006 4:28:33 PM
package	25.9 GB	6/29/2010 8:51:20 AM
Relocations	2.12 GB	7/21/2010 4:30:47 PM
Self Assessment-Temp	1.64 GB	8/15/2006 9:38:30 AM
SEP	455,985,062	6/1/2006 3:09:45 PM
Software_Need_documents	564,829,613	7/13/2010 1:06:37 PM
SPA revision uploads	249,483	5/10/2006 4:45:24 PM
SPA revisions	275,178	5/10/2006 4:45:26 PM
Spent Fuel DBS	95,073,872	5/7/2007 4:04:25 PM
Submittals GIS	72.5 GB	4/15/2010 10:52:28 AM
Submittals MWD & SPA	449 GB	5/25/2010 7:04:10 AM
TDMS_Access	50,176	10/16/2008 2:07:47 PM
TDMS_Change_log	312,060	1/9/2007 7:32:30 AM
temp	568,374,444	10/27/2008 12:09:55 PM
transfer	1.87 GB	8/30/2006 10:12:39 AM
TSPA Direct Inputs	89,600	1/16/2007 10:16:22 AM
calc coversheet cal-ebs-pa-...	53,896	12/10/2001 4:53:44 PM
calc coversheet cal-ebs-pa-...	892,630	12/10/2001 3:59:02 PM
Current TDIFs.xls	29,696	10/26/2001 4:01:10 PM
Destination.xls	13,824	12/13/2004 1:42:07 PM
Enclosure1_PartA_for_NRC....	40,043,008	12/13/2004 2:42:32 PM
Enclosure1_PartB_for_NRC....	72,325,632	12/13/2004 12:44:23 PM
Final_SWD.xls	92,672	11/8/2001 11:04:06 AM
log	1,900,704	10/8/2007 2:17:33 PM
log.verify	10,754,993	10/8/2007 2:17:33 PM
MWDcat.xls	285,696	10/11/2001 10:11:28 A...
Qualified.xls	80,384	12/21/2001 12:25:10 PM
Qual-List.TXT	41,528	12/20/2001 5:24:58 PM

N:\Collab2\TDMS

Name	Size
a_package	309,945,088
Apps	98,907
APSI1Q Docs	47,245,439
CC's	
config	2,740,224
Criticality Documents	7.32 GB
Criticality Media	9.48 GB
DSQD_Correspondence_Fi...	737
HTM files MWD & SPA	3,160,292
HTML uploads MWD & S...	25,140,868
INFOR-STOR	
IRAN	526,636,551
KL Group	8,107,380
my-ngoc	46,557,629
NONQ Docs	7,650,729
NyeCounty	41,601,981
package	25.9 GB
Relocations	2.12 GB
Self Assessment-Temp	1.64 GB
SEP	455,985,062
Software_Need_documents	564,829,613
SPA revision uploads	249,483
SPA revisions	275,178
Spent Fuel DBS	95,073,872
Submittals GIS	72.5 GB
Submittals MWD & SPA	449 GB
TDMS_Access	50,176
TDMS_Change_log	312,060
temp	568,374,444
transfer	1.87 GB
TSPA Direct Inputs	89,600
calc coversheet cal-ebs-pa-...	53,896
calc coversheet cal-ebs-pa-...	892,630
Current TDIFs.xls	29,696
Destination.xls	13,824
Enclosure1_PartA_for_NRC....	40,043,008
Enclosure1_PartB_for_NRC....	72,325,632
Final_SWD.xls	92,672
log	1,900,704
log.verify	10,754,993
MWDcat.xls	285,696
Qualified.xls	80,384
Qual-List.TXT	41,528

\\FS02SNLNTY\Collab2\TDMS_Input

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P&CE ERD03 DTN's	110,094,738	9/18/2009 9:37:45 AM
SN0702PAIPC1CA.001	341,575,261	2/24/2009 11:15:42 AM

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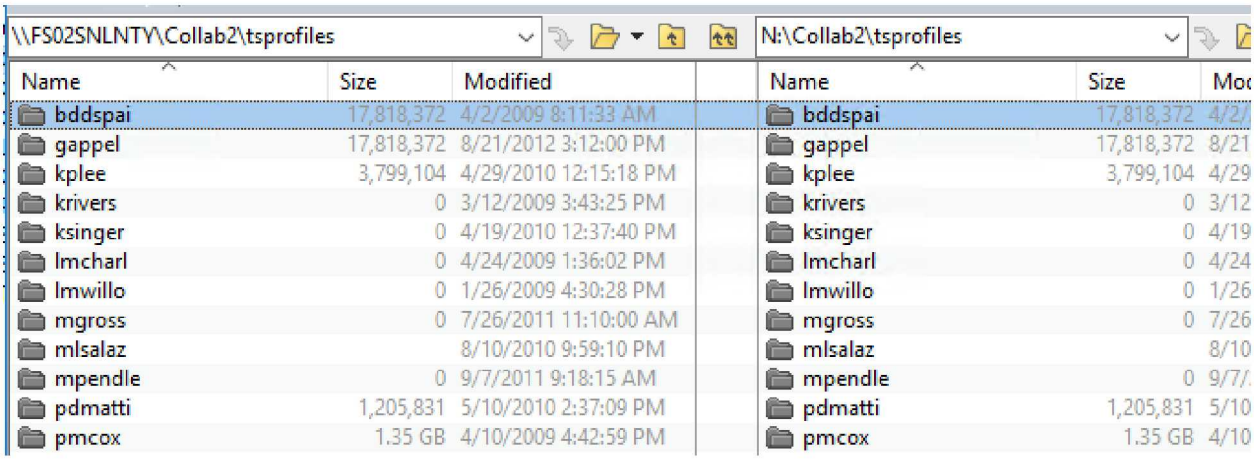
Name	Size
DTN-SN1003ERD1CRFF_000	90,307
P&CE ERD03 DTN's	110,094,738
SN0702PAIPC1CA.001	341,575,261



\\FS02SNLNTY\Collab2\tsprofiles

Name	Size	Modified
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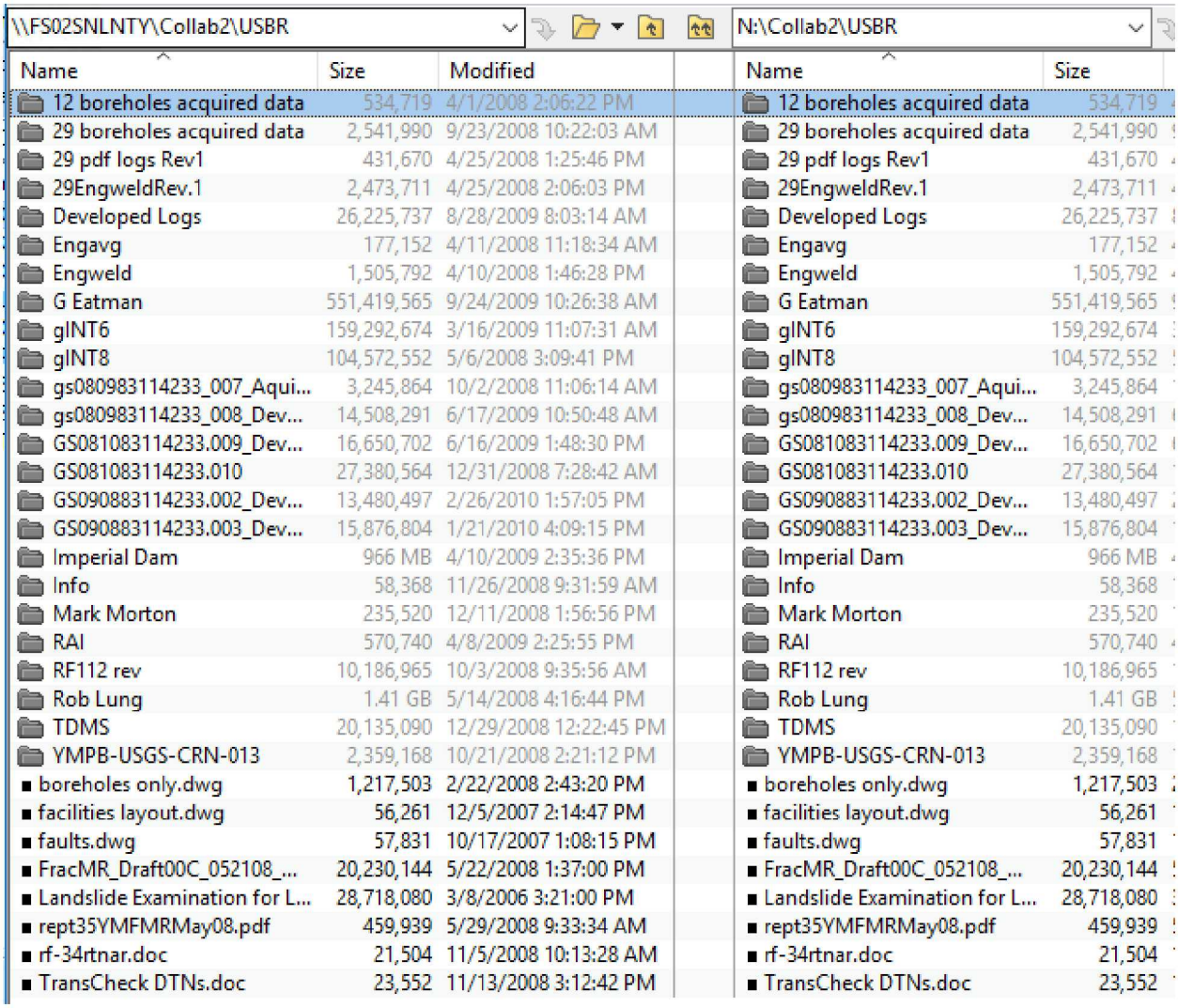
gappel	17,818,372	8/21/2012 3:12:00 PM
kplee	3,799,104	4/29/2010 12:15:18 PM
krivers	0	3/12/2009 3:43:25 PM
ksinger	0	4/19/2010 12:37:40 PM
lmcharl	0	4/24/2009 1:36:02 PM
lmwillo	0	1/26/2009 4:30:28 PM
mgross	0	7/26/2011 11:10:00 AM
mlsalaz		8/10/2010 9:59:10 PM
mpendle	0	9/7/2011 9:18:15 AM
pdmatti	1,205,831	5/10/2010 2:37:09 PM
pmcox	1.35 GB	4/10/2009 4:42:59 PM

N:\Collab2\tsprofiles

Name	Size	Mod
bddspai	17,818,372	4/2/
gappel	17,818,372	8/21
kplee	3,799,104	4/29
krivers	0	3/12
ksinger	0	4/19
lmcharl	0	4/24
lmwillo	0	1/26
mgross	0	7/26
mlsalaz		8/10
mpendle	0	9/7/
pdmatti	1,205,831	5/10
pmcox	1.35 GB	4/10



\\FS02SNLNTY\Collab2\USBR

Name	Size	Modified
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29 boreholes acquired data	2,541,990	9/23/2008 10:22:03 AM
29 pdf logs Rev1	431,670	4/25/2008 1:25:46 PM
29EngweldRev.1	2,473,711	4/25/2008 2:06:03 PM
Developed Logs	26,225,737	8/28/2009 8:03:14 AM
Engavg	177,152	4/11/2008 11:18:34 AM
Engweld	1,505,792	4/10/2008 1:46:28 PM
G Eatman	551,419,565	9/24/2009 10:26:38 AM
gINT6	159,292,674	3/16/2009 11:07:31 AM
gINT8	104,572,552	5/6/2008 3:09:41 PM
gs080983114233_007_Aqui...	3,245,864	10/2/2008 11:06:14 AM
gs080983114233_008_Dev...	14,508,291	6/17/2009 10:50:48 AM
GS081083114233.009_Dev...	16,650,702	6/16/2009 1:48:30 PM
GS081083114233.010	27,380,564	12/31/2008 7:28:42 AM
GS090883114233.002_Dev...	13,480,497	2/26/2010 1:57:05 PM
GS090883114233.003_Dev...	15,876,804	1/21/2010 4:09:15 PM
Imperial Dam	966 MB	4/10/2009 2:35:36 PM
Info	58,368	11/26/2008 9:31:59 AM
Mark Morton	235,520	12/11/2008 1:56:56 PM
RAI	570,740	4/8/2009 2:25:55 PM
RF112 rev	10,186,965	10/3/2008 9:35:56 AM
Rob Lung	1.41 GB	5/14/2008 4:16:44 PM
TDMS	20,135,090	12/29/2008 12:22:45 PM
YMPB-USGS-CRN-013	2,359,168	10/21/2008 2:21:12 PM
boreholes only.dwg	1,217,503	2/22/2008 2:43:20 PM
facilities layout.dwg	56,261	12/5/2007 2:14:47 PM
faults.dwg	57,831	10/17/2007 1:08:15 PM
FracMR_Draft00C_052108_...	20,230,144	5/22/2008 1:37:00 PM
Landslide Examination for L...	28,718,080	3/8/2006 3:21:00 PM
rept35YMFMRMay08.pdf	459,939	5/29/2008 9:33:34 AM
rf-34rtnar.doc	21,504	11/5/2008 10:13:28 AM
TransCheck DTNs.doc	23,552	11/13/2008 3:12:42 PM

N:\Collab2\USBR

Name	Size
12 boreholes acquired data	534,719
29 boreholes acquired data	2,541,990
29 pdf logs Rev1	431,670
29EngweldRev.1	2,473,711
Developed Logs	26,225,737
Engavg	177,152
Engweld	1,505,792
G Eatman	551,419,565
gINT6	159,292,674
gINT8	104,572,552
gs080983114233_007_Aqui...	3,245,864
gs080983114233_008_Dev...	14,508,291
GS081083114233.009_Dev...	16,650,702
GS081083114233.010	27,380,564
GS090883114233.002_Dev...	13,480,497
GS090883114233.003_Dev...	15,876,804
Imperial Dam	966 MB
Info	58,368
Mark Morton	235,520
RAI	570,740
RF112 rev	10,186,965
Rob Lung	1.41 GB
TDMS	20,135,090
YMPB-USGS-CRN-013	2,359,168
boreholes only.dwg	1,217,503
facilities layout.dwg	56,261
faults.dwg	57,831
FracMR_Draft00C_052108_...	20,230,144
Landslide Examination for L...	28,718,080
rept35YMFMRMay08.pdf	459,939
rf-34rtnar.doc	21,504
TransCheck DTNs.doc	23,552

APPENDIX C. INFILTRATION ANALYSIS EXAMPLE CALCULATION

In this Appendix part of the Mathcad file for the test case described in Section 4 is shown. The file was obtained from Data Tracking Number (DTN) SN0701T0502206.037 in folders: SN0701T0502206.037\20070215\Welcome to Massif\Massif\Present Day Uncertainty/Examples. The test case is on Present Day, Replicate 2, Realization 8.

On what follows the file was opened and run using Mathcad 14.0. The run was launched from a PC with WINDOWS 10 operating system. Part of the Mathcad file is shown below together with some internal results. Error messages related to Input/Output were encountered. The problem areas are in "red", indicating errors. The "yellow" highlighted messages indicate the nature of the errors. The error messages appear to be related to reading precipitation and watershed data. There may be a need to convert the related coding from Mathcad 13.1 to later versions. Further work is needed to identify and solve the Input/Output issues.

Present Day Infiltration Example Calculation

Click Here for Explanations of the Steps in This File

Step 1: Define the climate, replicate, and realization

The climate is Present Day: Climate:= "PD"

The replicate number is: Replicate:= "R2"

The LHS number is: LHS:= "V08"

The output file name prefix is: prefix:= concat("\" , LHS, "\")

The output file name extension is: extension:= concat("_" , Climate, "_" , Replicate , "_" , LHS)

Step 2: Read in the input values file

Reference:D:\TSPA\FY19\Infiltration_Model\DTNs\FY19_Tests\SN0701T0502206.037\20070215\Welcome to Massif\Massif\Present Day Uncertainty\Examples_for_FY2019_Check\Present Day Input Values R2.xmcd(R)

Step 3: Define the varied inputs

The varied inputs are:

$$\begin{pmatrix} h_{.plant} \\ Z_{.r} \\ Z_{.e} \\ depth\_soils\_4 \\ rockks\_5 \\ rockks\_6 \\ HC\_579 \\ rew \\ K_{.c\_min} \\ C_{.Kcb_2} \end{pmatrix} :=$$

Varied Parameter	Symbol	Value	Units	Source
Plant height	h_{plant}	0.3409	m	LHS_PD_R2.OUT
Root zone depth	Z_r	0.8492	m	LHS_PD_R2.OUT
Evaporation layer depth	Z_e	0.1978	m	LHS_PD_R2.OUT
Soil depth of depth class 4	$depth_{soils\_4}$	0.4216	m	LHS_PD_R2.OUT
Saturated conductivity of rock type 5	$rockks_5$	5.80138E-07	m/s	LHS_PD_R2.OUT
Saturated conductivity of rock type 6	$rockks_6$	3.21586E-07	m/s	LHS_PD_R2.OUT
Holding capacity of soil types 5,7, and 9	HC_579	0.1599	-	LHS_PD_R2.OUT
Readily evaporable water	rew	8.476	mm	LHS_PD_R2.OUT
Minimum crop coefficient	K_{c_min}	0	-	LHS_PD_R2.OUT
NDVI' Kcb slope	CKcb_2	8.862	-	LHS_PD_R2.OUT

$$LHS\_Parameters \leftarrow Select(str2num(substr(LHS, 1, 3)))$$

$$\begin{pmatrix} LHS\_Parameters_2 \\ LHS\_Parameters_3 \\ LHS\_Parameters_4 \\ LHS\_Parameters_5 \\ \exp(LHS\_Parameters_6) \\ \exp(LHS\_Parameters_7) \\ LHS\_Parameters_8 \\ LHS\_Parameters_9 \\ LHS\_Parameters_{10} \\ LHS\_Parameters_{11} \end{pmatrix}$$

$$\begin{pmatrix} h_{.plant} \\ Z_{.r} \\ Z_{.e} \\ depth\_soils\_4 \\ rockks\_5 \\ rockks\_6 \\ HC\_579 \\ rew \\ K_{.c\_min} \\ C_{.Kcb_2} \end{pmatrix} = \begin{pmatrix} 0.341 \\ 0.849 \\ 0.198 \\ 0.422 \\ 5.801 \times 10^{-7} \\ 3.216 \times 10^{-7} \\ 0.16 \\ 8.476 \\ 0 \\ 8.862 \end{pmatrix}$$

Step 4: **Assign units and extend the varied parameters**

$$\begin{pmatrix} Z_r \\ Z_e \\ depth_{soils_4} \\ rew \end{pmatrix} := \begin{pmatrix} Z_{.r} \cdot m \\ Z_{.e} \cdot m \\ depth\_soils\_4 \cdot m \\ rew \cdot mm \end{pmatrix} \qquad \begin{pmatrix} rockks_5 \\ rockks_6 \end{pmatrix} := \begin{pmatrix} rockks\_5 \\ rockks\_6 \end{pmatrix} \cdot \frac{m}{s} \qquad \begin{pmatrix} fieldcap_5 \\ fieldcap_7 \\ fieldcap_9 \end{pmatrix} := \begin{pmatrix} wilt\_pt_5 + HC\_579 \\ wilt\_pt_7 + HC\_579 \\ wilt\_pt_9 + HC\_579 \end{pmatrix}$$

$$C_{.Kcb} = \begin{pmatrix} -0.05 \\ 8.862 \end{pmatrix}$$

The saturated conductivity of rocktypes 490 and 491 are set equal to rocktype 405.

$$\begin{pmatrix} rockks_{90} \\ rockks_{91} \end{pmatrix} := \begin{pmatrix} rockks_5 \\ rockks_5 \end{pmatrix}$$

Step 5: **Read the precipitation file:**

$$\begin{pmatrix} Precip \\ weight \\ elev\_ref \end{pmatrix} :=$$

```
Weatherfile ← Directory ← "..\..\Present Day Precipitation\"
              File_Base ← "Weather Summary v2.1 present_day "
              LHS_marker ← concat("0", substr(LHS, 1, 3))
              concat(Directory, File_Base, LHS_marker, "_", Replicate, ".xls")
Weather(Weatherfile)
```

The upper bound must be greater than the lower bound.

$$\sum weight - 1 = \blacksquare\blacksquare$$

This variable is underfined

Step 9: **Define a vector (Wshed) that contains the name and path of all the watersheds (11) in the domain**

Wshed :=
- "..\..\Watershed Files\01_Yucca_Wash.csv"
- "..\..\Watershed Files\02_Drill_Hole_Wash.csv"
- "..\..\Watershed Files\03_Dune_Wash.csv"
- "..\..\Watershed Files\04_Solitario_Canyon1.csv"
- "..\..\Watershed Files\05_Plug_Hill.csv"
- "..\..\Watershed Files\06_Jet_Ridge1.csv"
- "..\..\Watershed Files\07_Solitario_Canyon2.csv"
- "..\..\Watershed Files\08_Jet_Ridge2.csv"
- "..\..\Watershed Files\09_Jet_ridge3.csv"
- "..\..\Watershed Files\10_Solitario_Canyon3.csv"
- "..\..\Watershed Files\11_Solitario_Canyon4.csv"

Cells := rows(READPRN(Wshed))

Cells = ▪▪

Attempted to read or write protected memory. This is often an indication that other memory is corrupt. This variable is undefined.

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None	Not Applicable	Not Applicable

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Tito Bonano	8820	ejbonan@sandia.gov
Russell Chris Camphouse	8842	rccamph@sandia.gov
Teklu Hadgu	8842	thadgu@sandia.gov
Tim Kotoski	9322	takotos@sandia.gov
Chad Wilkes	9322	cmwilke@sandia.gov
Technical Library	9536	libref@sandia.gov

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