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Migrate +200 TB databases in less than 1 day

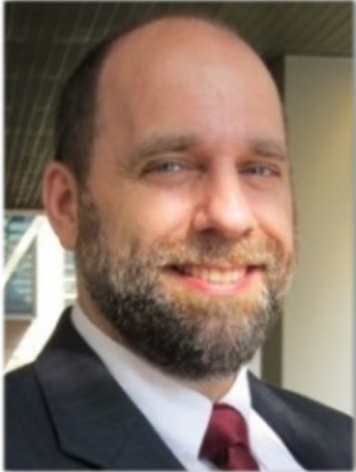
Roy F Swonger
Vice President
Database Upgrades & Utilities
Oracle Corporation



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\$> whoami



20+ years w/Oracle

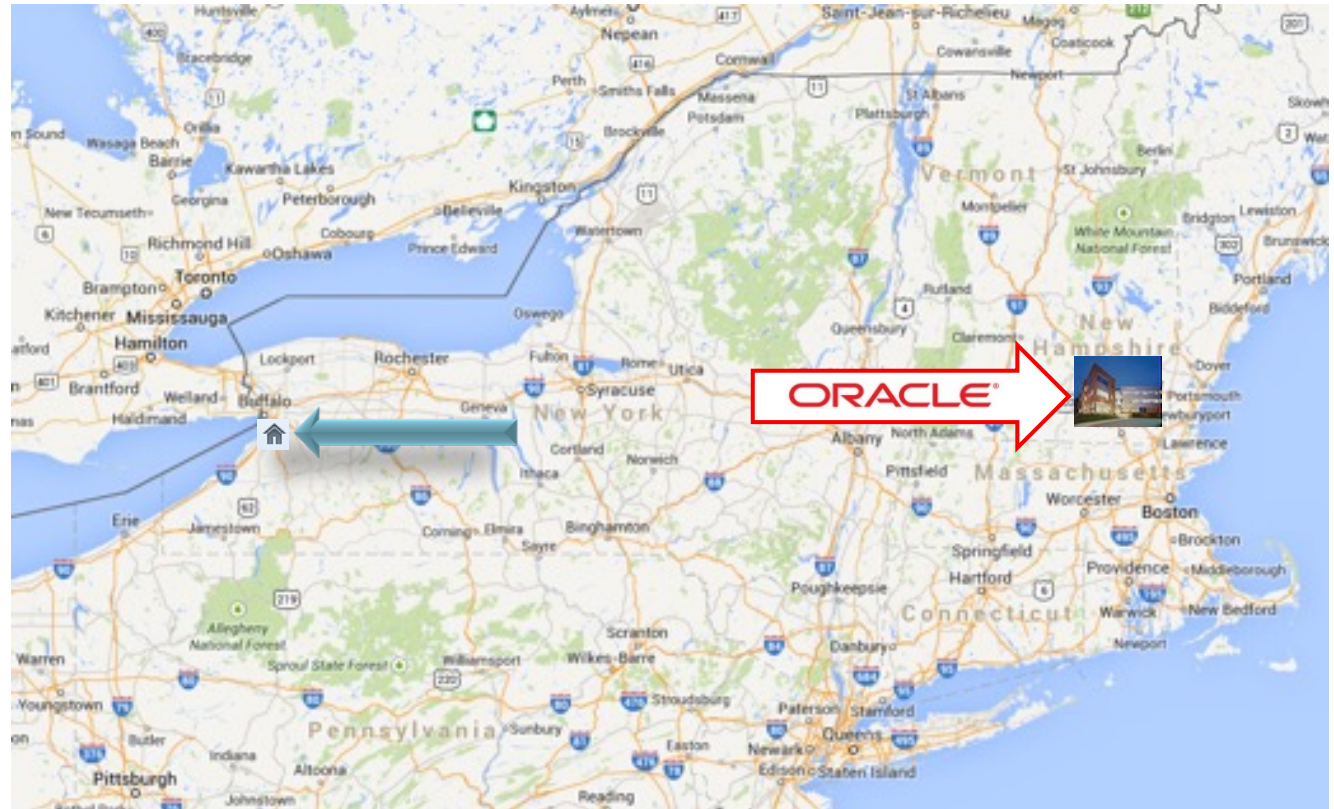
15 years managing

Data Pump

Database Upgrade

SQL*Loader

Transportable Tablespaces



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Agenda

- Migration Basics
 - The Murphy's Law Case
 - 230TB in less than one day
 - Further Information

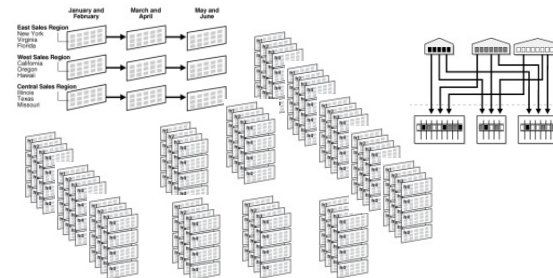
Most Common Database Migration Techniques

Data Pump

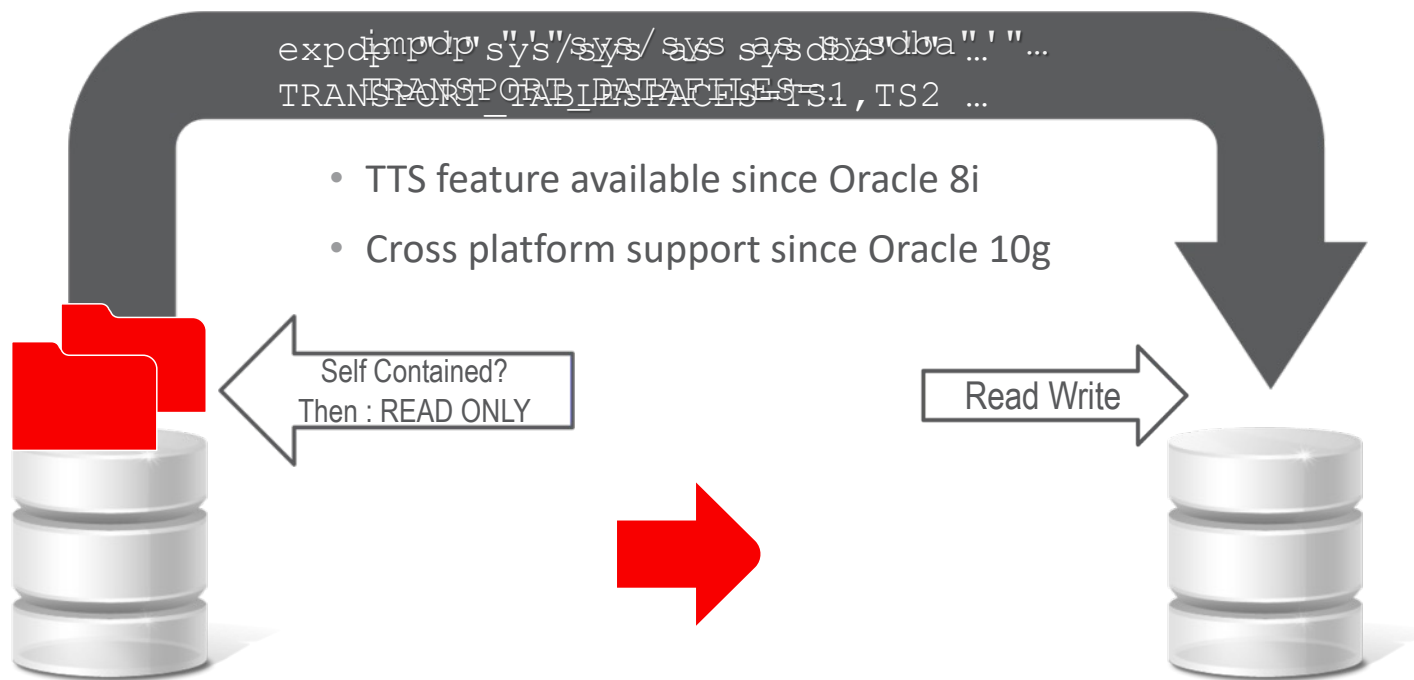
- Smaller databases
- Simple

Transportable Tablespaces

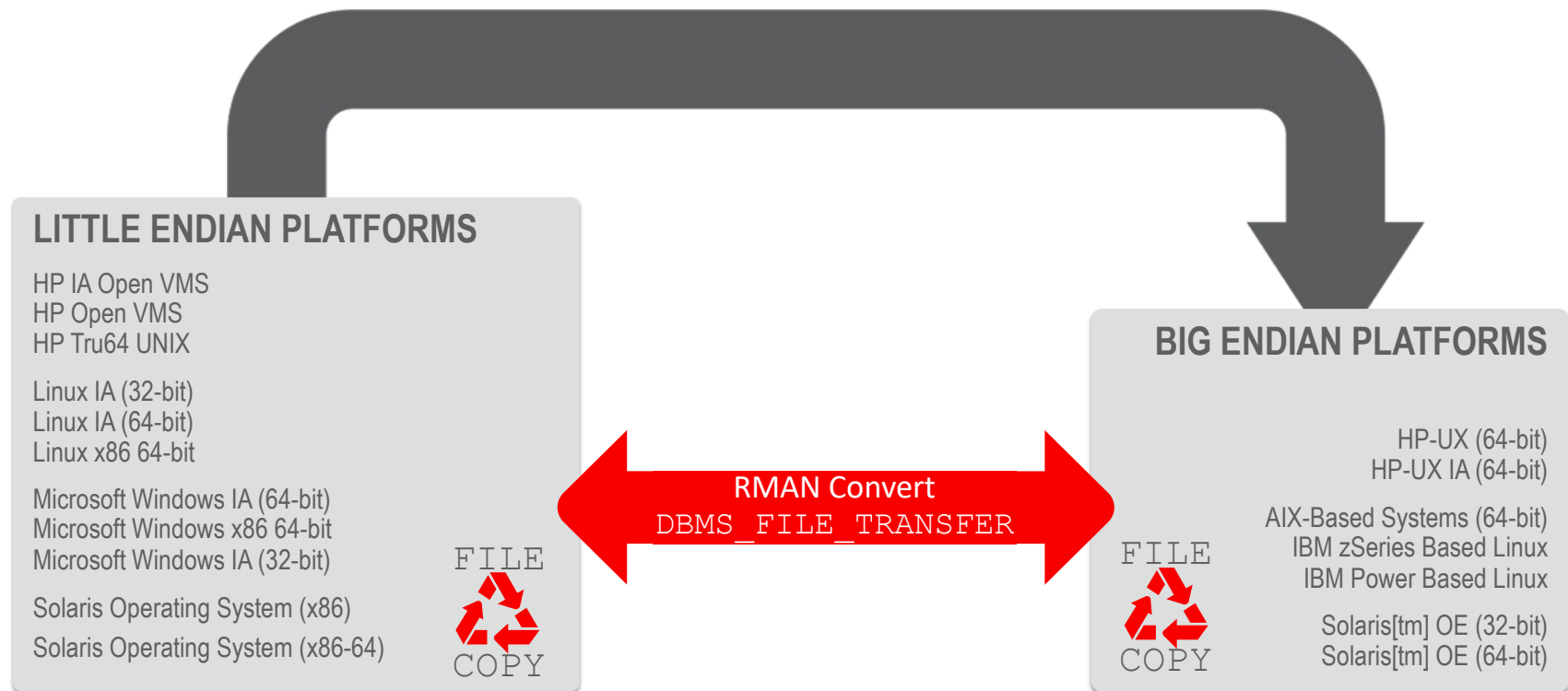
- Larger databases
- More complex
- Database complexity is your enemy



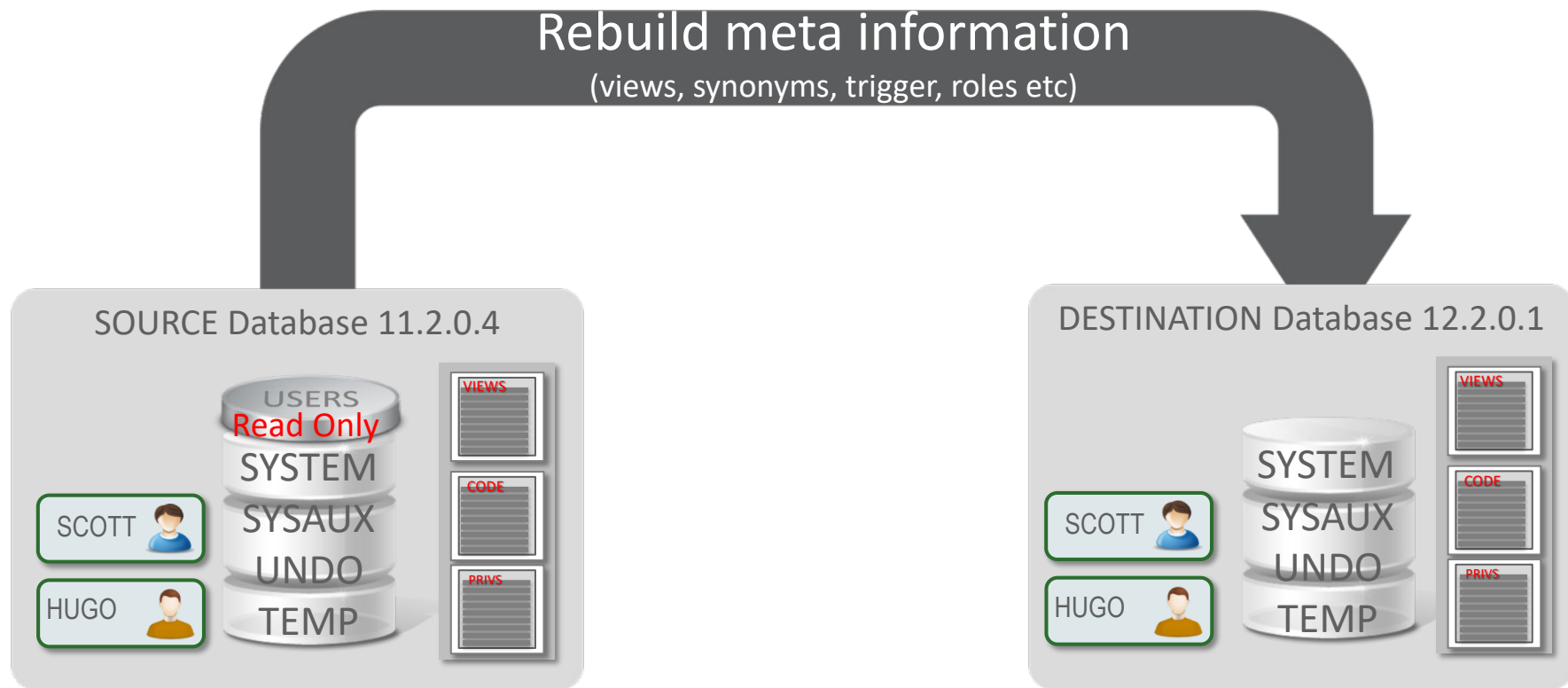
Transportable Tablespaces



Cross Platform Migration



Transportable Tablespaces



Rebuilding Meta Information

- Brute force approach:



- Data Pump

- expdp/impdp CONTENT=METADATA_ONLY

- Smart approach:

- DBMS_METADATA

- `SELECT DBMS_METADATA.GET_DDL('SYNONYM', SYNONYM_NAME, OWNER) FROM all_synonyms where owner='PUBLIC' and table_owner not in ('SYS');`



The biggest pain points of TTS?

- Copy and convert a large database
- Rebuild all the meta information

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TTS: Pain Points

Size

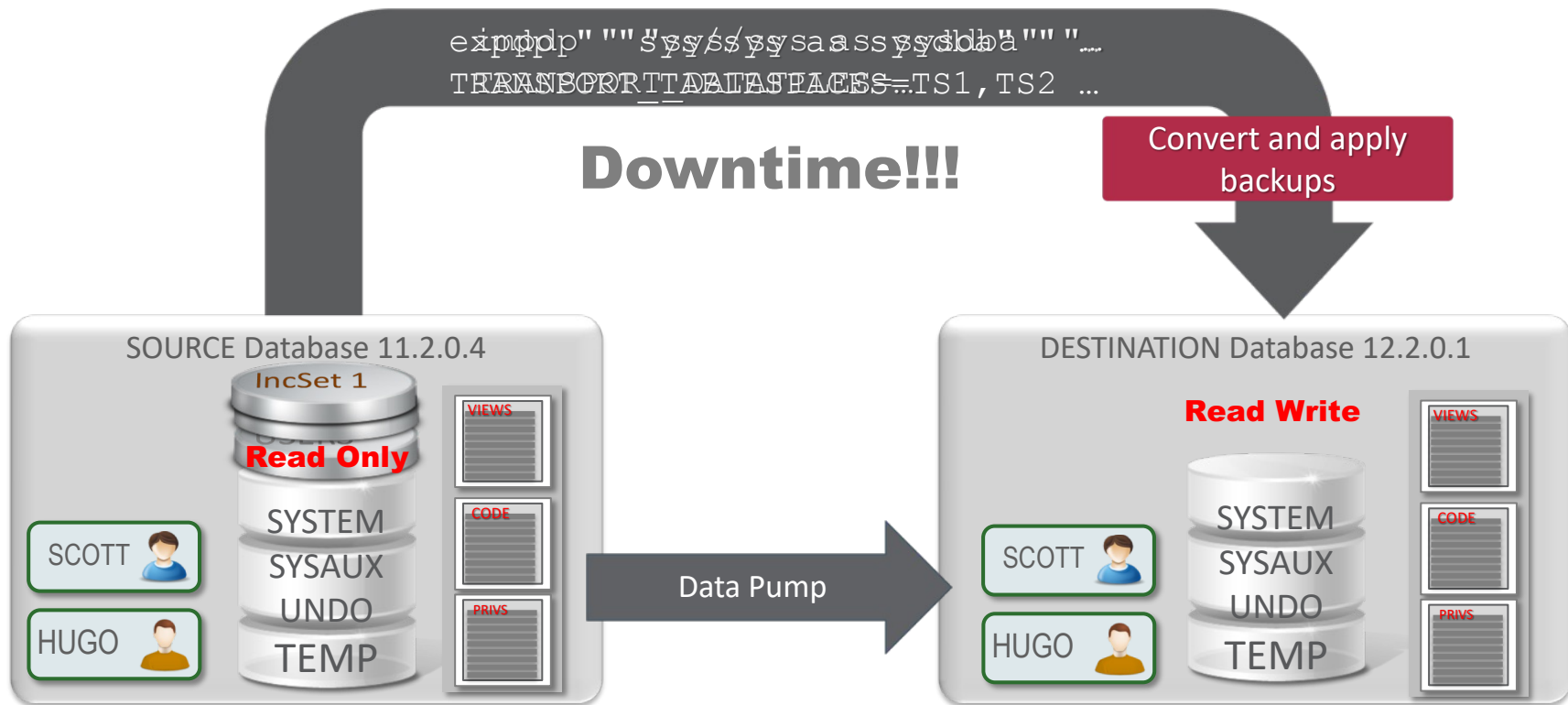
- RMAN Incremental Backups
 - PERL scripts in [MOS Note:1389592.1](#) and in [MOS Note: 2005729.1](#)
 - Source: 10.2.0.3 or newer
 - Target: 11.2.0.4 or newer

Complexity

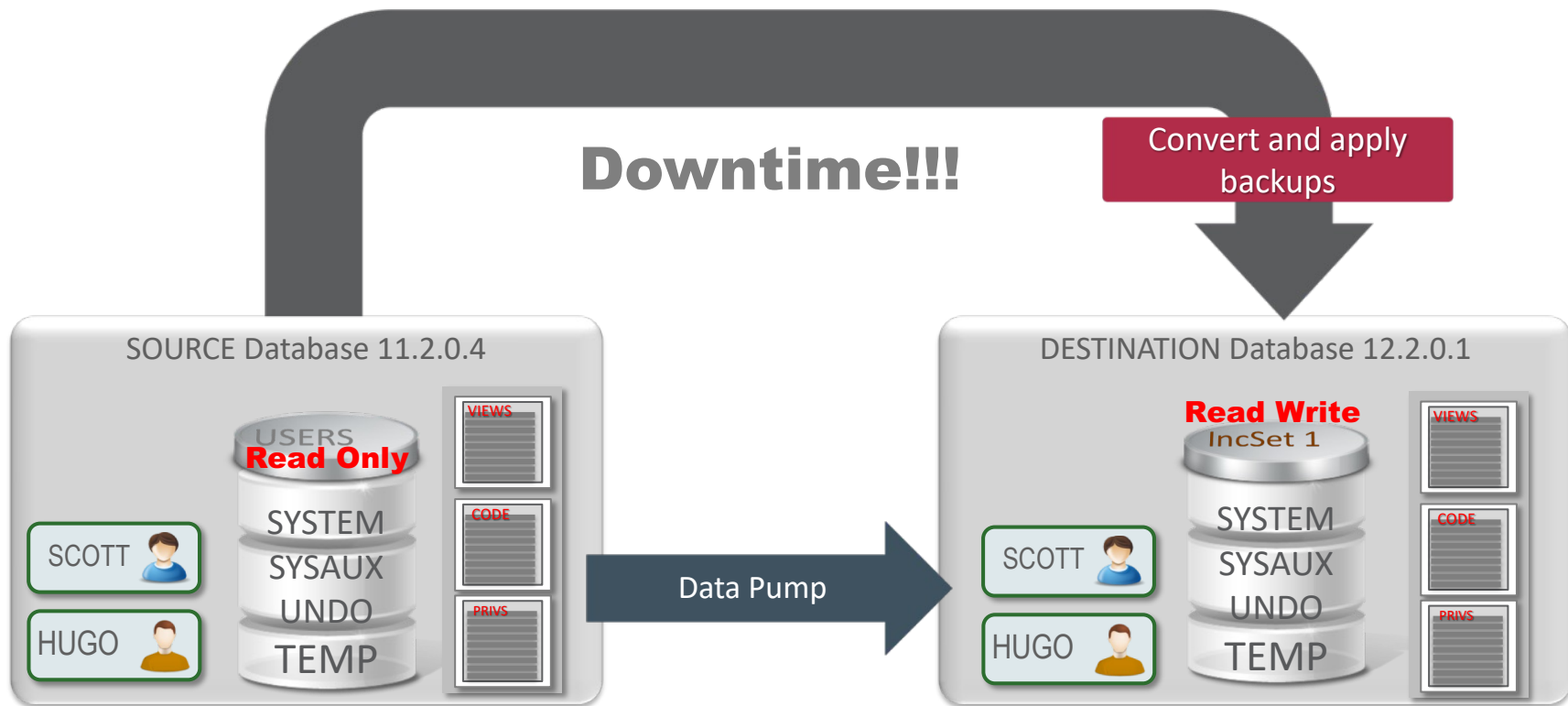
- Full Transportable Export/Import
 - One-Command Migration with Data Pump
 - Source: 11.2.0.3 or newer
 - Target: 12.1.0.1 or newer



TTS Platform Migration with Incremental Backups



FTEX Platform Migration with Incremental Backups





Let's do it

Full Transportable Export/Import
using RMAN Incrementally Rolled Forward Backups

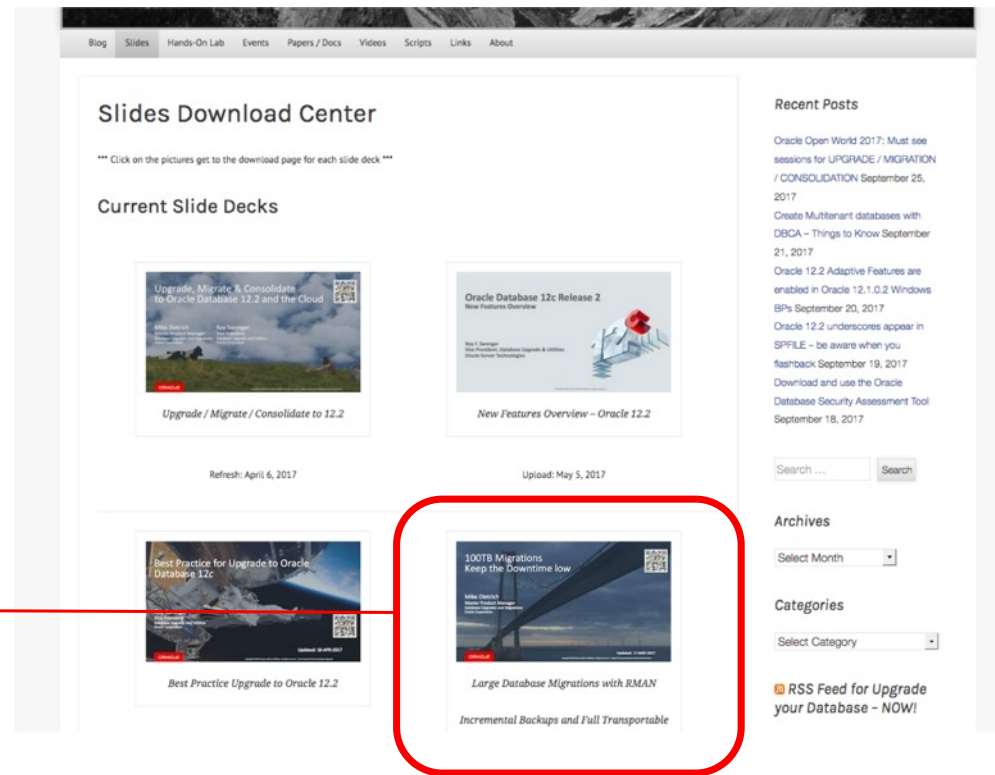
Source: http://www.wikiwand.com/fr/Vol_en_wingsuit

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<https://MikeDietrichDE.com>

For full details
please download



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Phase 1 - Create Destination Database



- Create a destination database
 - COMPATIBLE equal or higher
 - Identical

- Database character sets
- National character sets
- Time zone versions



<https://mikedietrichde.com/2016/12/08/create-a-database-with-non-default-time-zone/>

Phase 1 - Download and Edit PERL Scripts



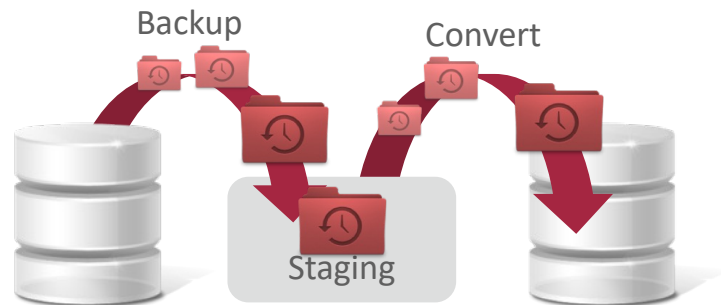
For 11g source: [MOS Note: 1389592.1](#)

For 12c source: [MOS Note: 2005729.1](#)

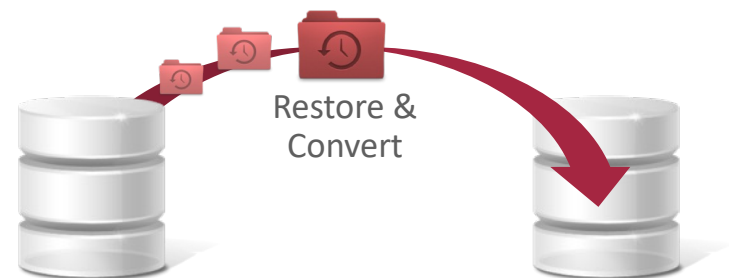


Phase 1 - Method

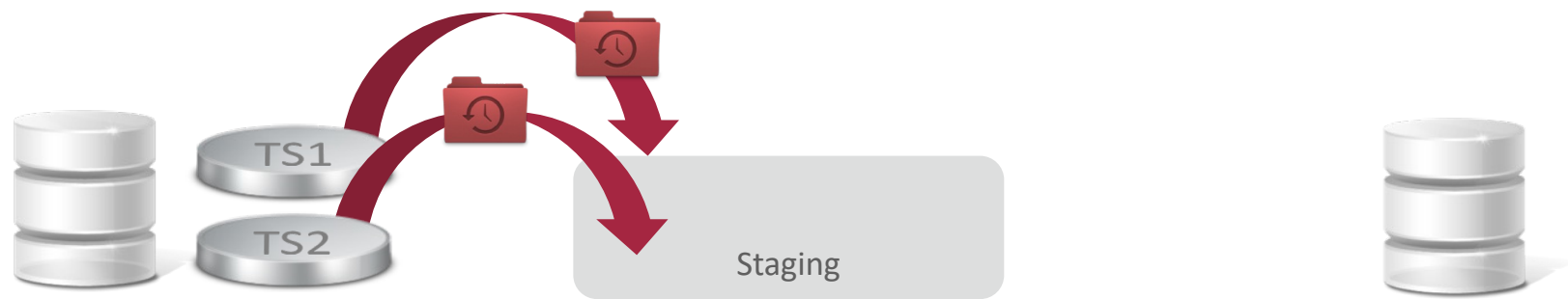
- Choose the best method
 - RMAN backup / convert



- DBMS_FILE_TRANSFER



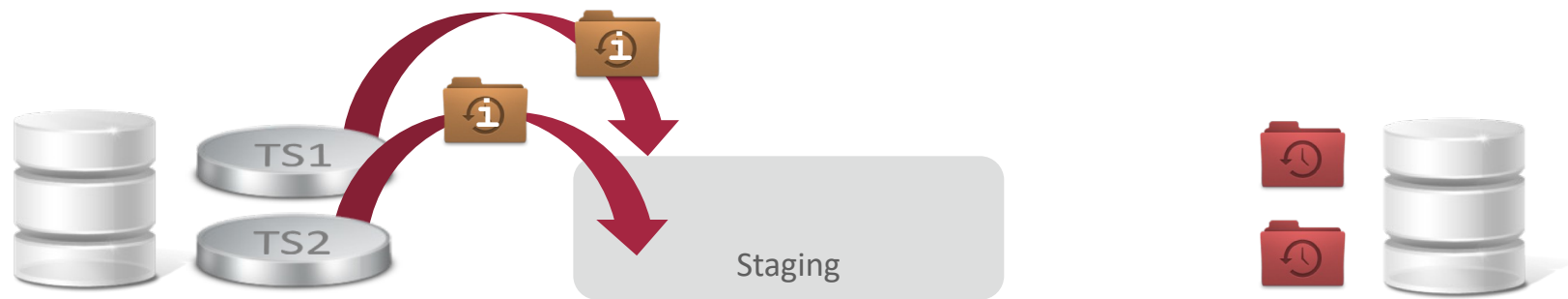
Phase 2 - Initial Level 0 Backup



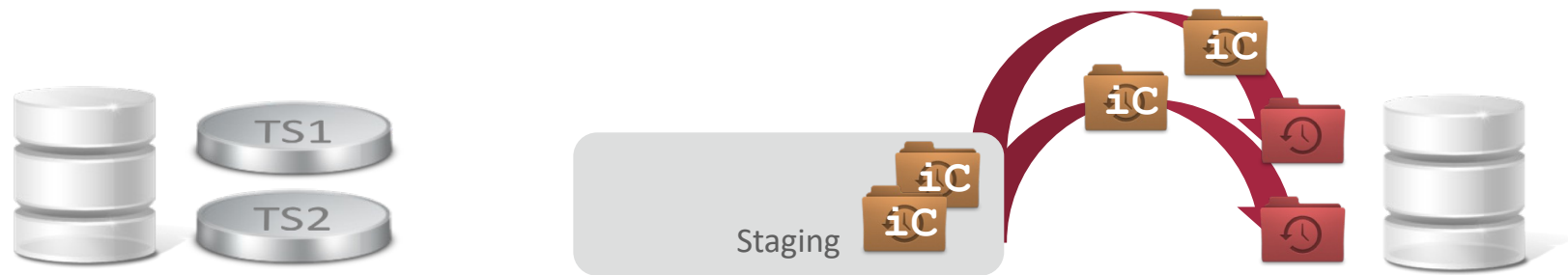
Phase 2 - Conversion of Level 0 Backup



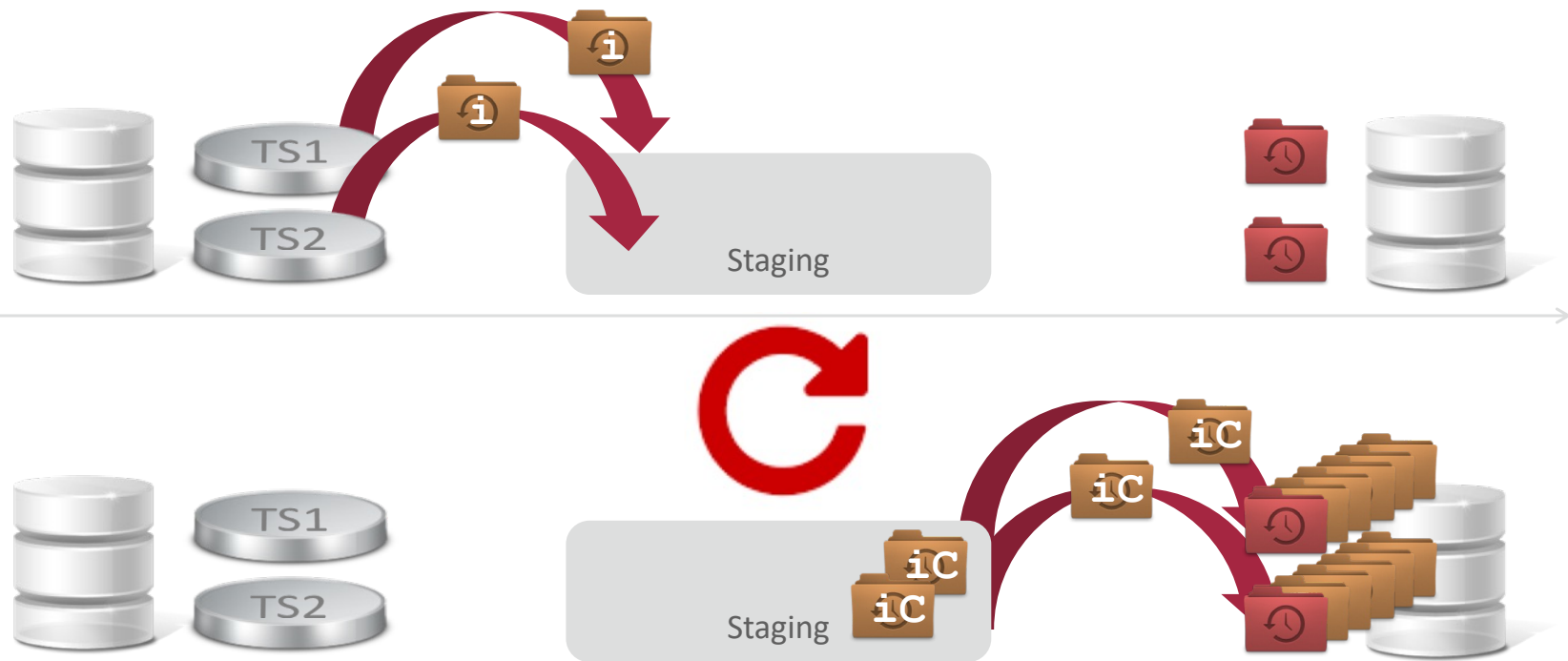
Phase 3 - Incremental Level 1 Backups



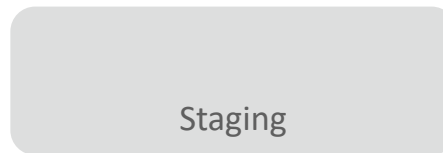
Phase 3 - Convert Incremental Level 1 Backups and Merge



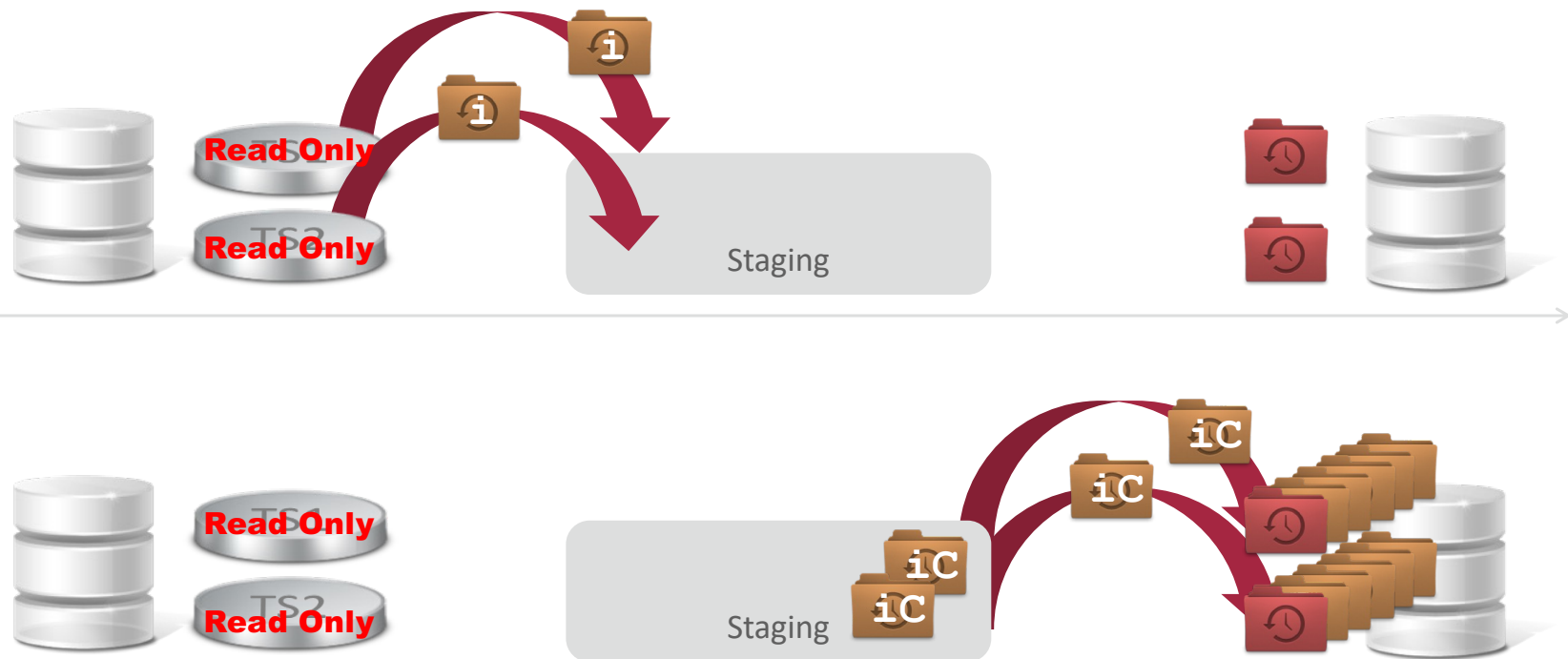
Phase 3 - **REPEAT** Convert Incremental Level 1 Backups



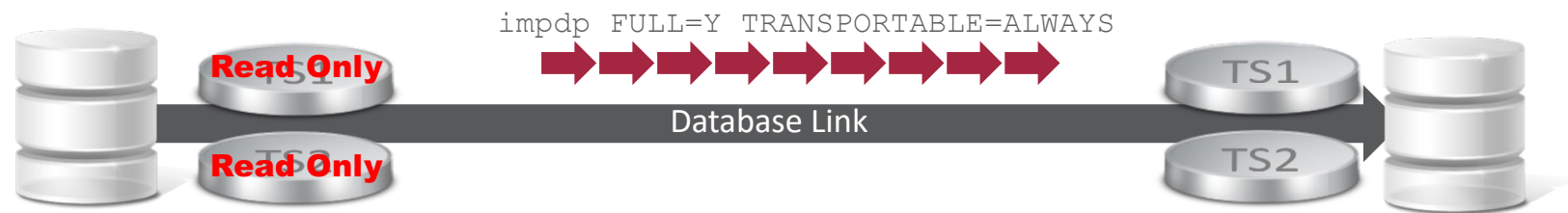
Phase 4 - **DOWNTIME** - Tablespaces Read-Only



Phase 4 - **FINAL** Incremental Level 1 Backups




Phase 5 - Metadata Migration - FTEX




Phase 6 - Validation and Cleanup



Agenda

- 
- Migration Basics
 - The Murphy's Law Case
 - 230TB in less than one day
 - Further Information

A satellite night view of Europe, showing the continent's outline and the dense network of city lights. The lights are concentrated in the western and central parts of the continent, with some smaller clusters in the east. The background is a dark blue/black space.

Anything that can go wrong will go wrong

This is called Murphy's Law

Photo Credits: NASA

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Anonymous

Customer

- Based somewhere in Europe

Project

Constraints

Preparation

Upgrade

Success?

Remarks

Overview and Timeline

Customer

Project

Constraints

Preparation

Upgrade

Success?

Remarks

- Migration of a large DWH
 - >100 TB and growing
 - 50 TB indexes
- IBM AIX to Exadata with Oracle Linux
- Oracle 11.2.0.4 to Oracle 12.1.0.2

The usual constraints

Customer

Project

Constraints

Preparation

Upgrade

Success?

Remarks

- Huge database
- DWH team not always believing in project
- Bigfile tablespaces >16 TB
- Outage for cutover: one weekend

RMAN Incremental Backup Strategy

Customer

Project

Constraints

Preparation

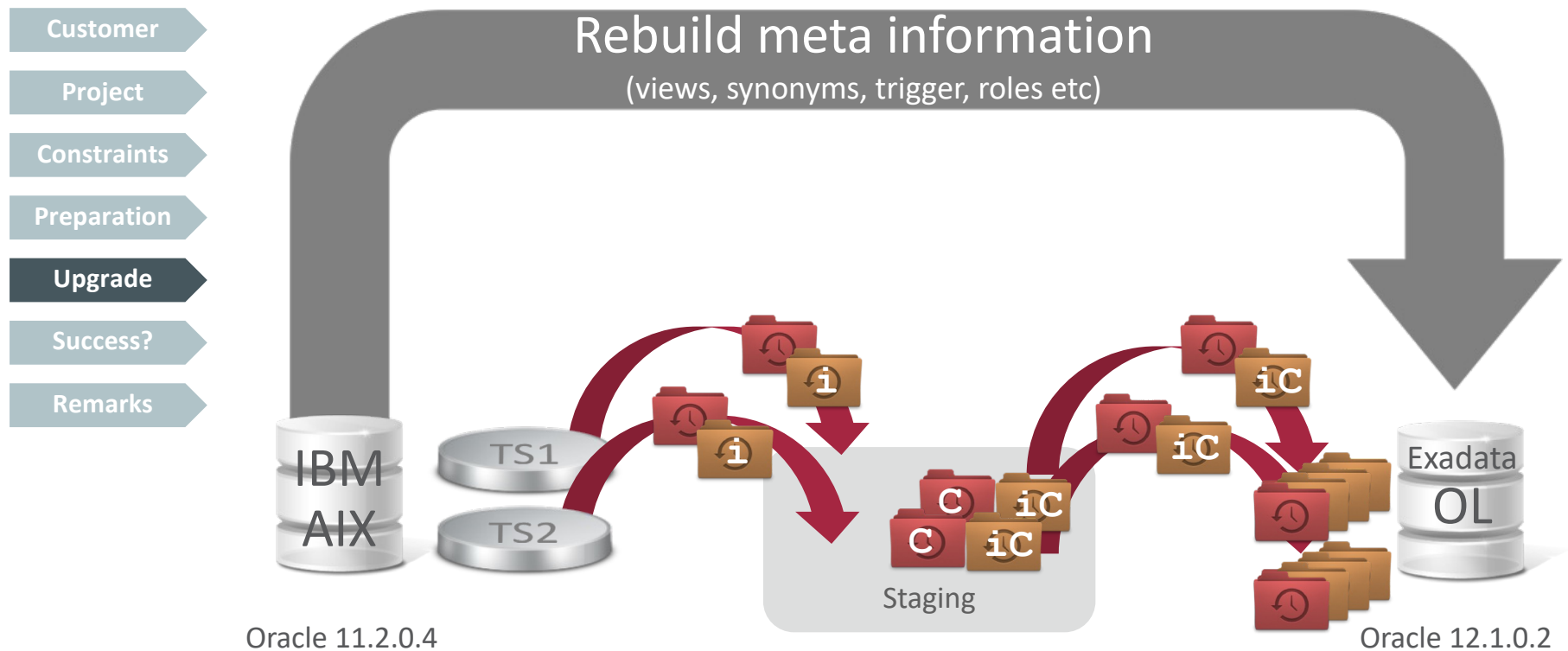
Upgrade

Success?

Remarks

- Using the PERL scrips from [MOS Note: 1389592.1](#)
- **First** issue:
 - Level 0 Backups to NFS/ZFS filer fail
 - AIX file system does not support files >16 TB
 - Solution: Pipe, split into pieces, glue together
- **Second** issue:
 - Data Pump fails because of values >16 TB in SEG\$
 - Solution: Get a patch built and apply it
- **Third** issue:
 - Meta export takes VERY long - many partitions, subpartitions, indexes
 - Workaround: Performance treatments, exclude indexes

Upgrade/Migration concept



Upgrade Conclusion

Customer

Project

Constraints

Preparation

Upgrade

Success?

Remarks

- Test migrations completed
 - Production migration to happen after tests completed

When things are really large ...

Customer

Project

Constraints

Preparation

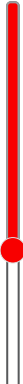
Upgrade

Success?

Remarks

- Make sure you have a clone or a standby for TTS
 - Downtime for READ ONLY phase can be a real issue
- Make sure your network is in good shape

Agenda

- 
- Migration Basics
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 - Further Information



Migrate a very large database

230 TB and growing ...

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- Jay Barnhart
 - Senior Technical Manager for the Enterprise Application Solutions (EAS) national practice
 - 25+ years working with the Oracle technology stack
 - Numerous ERP and Oracle Engineered Systems implementation projects
 - Many other consulting engagements
- Please send an email request to jay.barnhart@centricconsulting.com to get Jay's whitepaper on implementing an XTTS solution for very large databases

Centric Consulting

Customer

Project

Constraints

Preparation

Upgrade

Success?

Remarks

- Centric Consulting

- Centric Consulting is a management and technology consulting company. We have over 700 consultants with extensive experience delivering high-profile projects for clients of all shapes and sizes, including Fortune 500 companies
- Oracle Platinum Partner

- Key Focus Areas

- Highly capable consultants
- Passion for delivering results
- Long term relationship focused
- Easy to work with

- Please visit www.centricconsulting.com for more information about Centric Consulting

((CENTRIC))
In Balance

ORACLE Platinum
Partner

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Overview and Timeline

Customer

Project

Constraints

Preparation

Upgrade

Success?

Remarks

- The Client
 - One of the top healthcare insurance providers in the United States
 - Over 50,000 employees, over \$50 BILLION annual revenue
- The Database
 - Source: AIX 8.3, Oracle Database 11.2.0.3, SIDB on filesystem
 - Target: Exadata running Oracle Linux, Database 12.1.0.2, RAC/ASM
 - **230+ TB** (and growing!)
 - Generates ~1.2TB redo *per hour*
 - Enterprise data warehouse & operational data store
 - Critical for day-to-day operations
 - **Minimizing downtime** is critical
 - Data Guard in place for disaster recovery

Constraints

Customer

Project

Constraints

Preparation

Upgrade

Success?

Remarks

- Huge, active database
- Initial attempts using Oracle GoldenGate were unsuccessful
 - Could not keep up with massive redo generation
- V2 of migrations scripts limitations
 - Did not handle addition of tablespaces during migration
 - Single-threaded file transfer

File Transfer



Customer

Project

Constraints

Preparation

Upgrade

Success?

Remarks

- Single-threaded file transfer
 - V2 `xttdriver.pl` script reads tablespaces from the `xtt.properties` file
 - The default only processes one tablespace at a time
 - You can configure up to 8 data files to be processed concurrently by setting the `PARALLEL` parameter in `xtt.properties`
 - Transfer was much too slow for our efforts
 - We got about 100 MBs per second throughput
 - For 230 TB, this would equate to almost 27 days (!) just for the Prepare Phase
- Workaround
 - Customized the process by creating **forty (40)** identical directories that each held a complete XTTS utility installation
 - Broke up 530+ tablespaces into 40 fairly equal tablespace groups
 - Migrated 40 jobs concurrently with `PARALLEL=2`, or 80 files at a time
 - Result: ~800 MB/sec throughput, reduced prepare phase from 27 days to **6 days**

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Customizations

Customer

Project

Constraints

Preparation

Upgrade

Success?

Remarks

- Further customizations
 - Custom scripts created to balance the tablespaces for each directory
 - Modified `dbopen.sql` script
 - Cross-check scripts to ensure all tablespaces were being migrated
 - Custom scripts to kick off all 40 prepare, convert, incremental, convert / roll-forward, and SCN advance phases
 - Custom script to create the import Data Pump par file for the Plug-In Step
 - Load balanced RMAN CONVERT
 - Found that running the initial CONVERT of the Prepare Phase was best done by running the conversion on all four nodes in the Exadata
 - This allowed up to convert over **230 TBs** in under **10 hours**.

Architecture



Customer

Project

Constraints

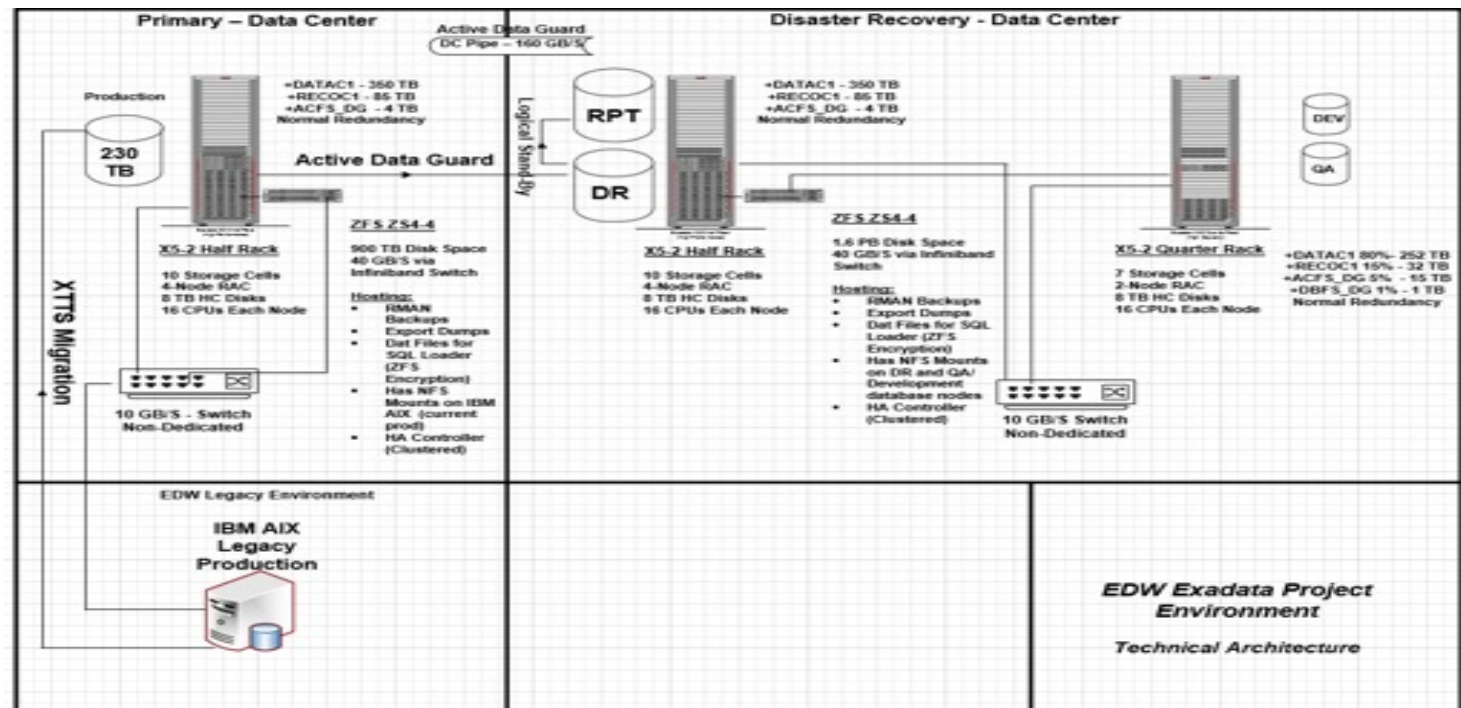
Preparation

Upgrade

Success?

Remarks

• Environment:



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Upgrade Conclusion

Customer

Project

Constraints

Preparation

Upgrade

Success?

Remarks

- Migrated & Upgraded
 - AIX -> Linux
 - 230+ TB
 - Database 11.2.0.3-> 12.1.0.2
 - Single Instance -> RAC
- In **18-hour** READ ONLY window!

Always get the latest ...



Customer

Project

Constraints

Preparation

Upgrade

Success?

Remarks

- Make sure to get the latest version of the scripts
 - **12C - Reduce Transportable Tablespace Downtime using Cross Platform Incremental Backup ([Doc ID 2005729.1](#))**
 - Version 3 of XTTS Utility came out June 2017 and allows for tablespace and data files to be added during the migration
- Plan for unexpected “features” to occur
 - Data Pump patches for TTS migration may vary by version
 - Bug fixes for migration scripts themselves
- Customize the process for VLDBs
 - Otherwise the Prepare Phase may take too long

Migration Timeline



https://centricconsulting.com/case-study-centric-improves-oracles-cross-platform-transportable-tablespace-xtts-utility_eas/

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Newsletter Sign-Up

[Case Study] Centric Improves Oracle's Cross Platform Transportable Tablespace (XTTS) Utility

September 27, 2017

by [Jay Barnhart](#)

SHARE:




Migrating databases from different operating system versions with Oracle's XTTS utility can be a slow and painful process. But we figured out an innovative way to help accelerate that process.

 Share This

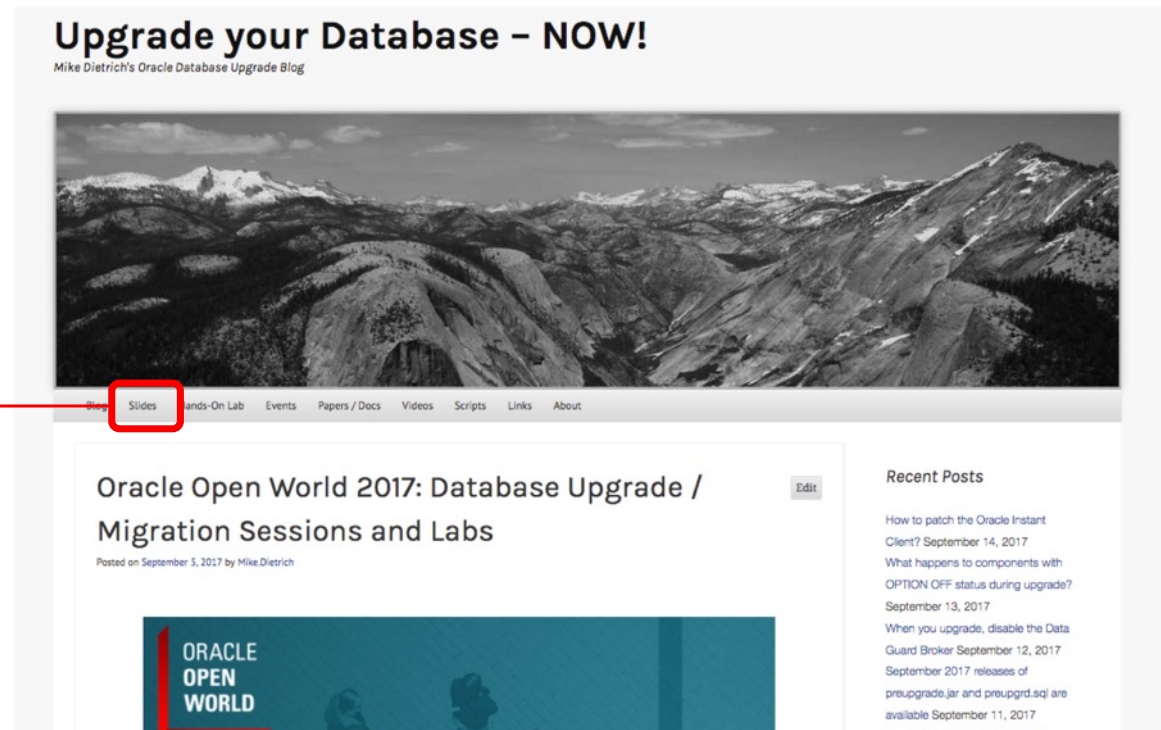
Recent News & Insights By Author

[Case Study] Centric Improves Oracle's Cross Platform Transportable Tablespace (XTTS) Utility

Program Agenda with Highlight

- 
- Migration Basics
 - The Murphy's Law Case
 - 230TB in less than one day
 - Further Information

Slides Download: <https://MikeDietrichDE.com>



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