

State Street Case Study

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STATE STREET

Agenda

- State Street Company Overview
- Exadata Environment
- RMAN 11g Features Used
- ZFS with Direct NFS
- RMAN 12c Excitement

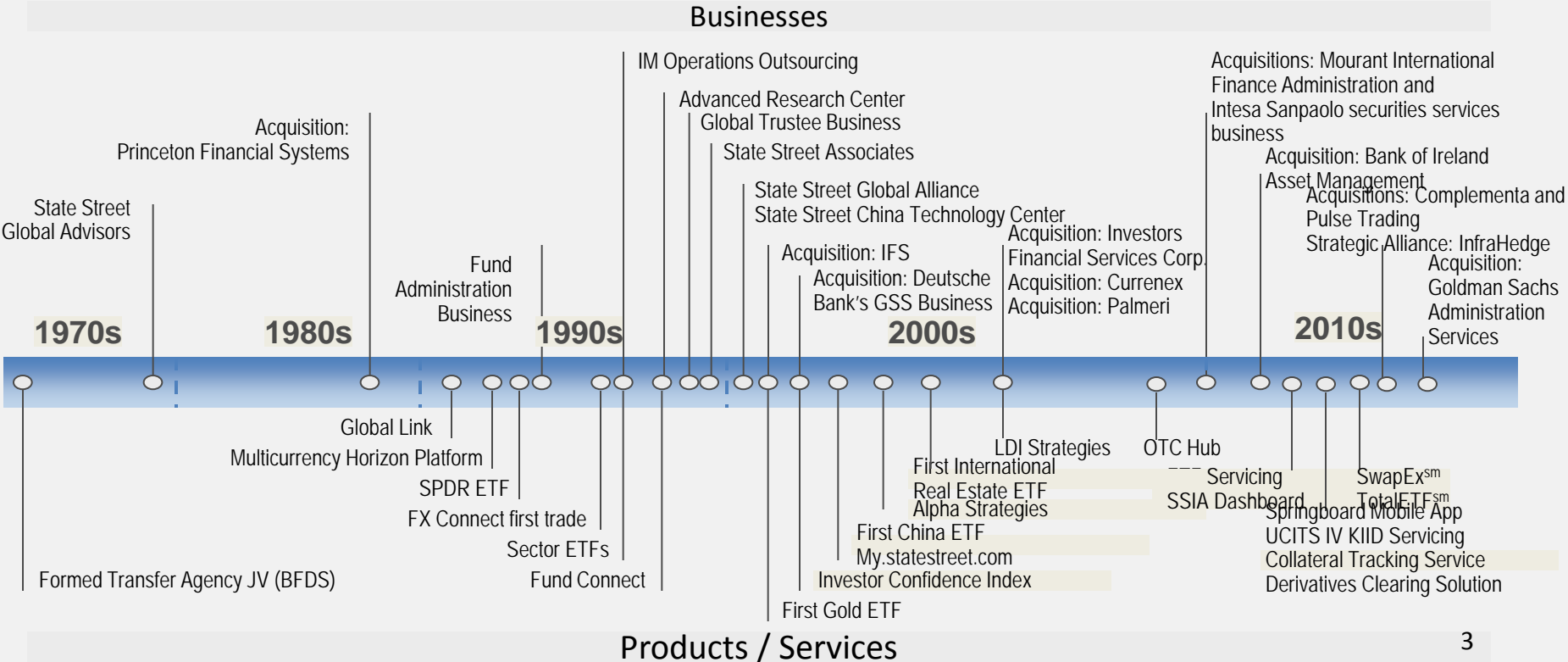


STATE STREET®



Our History

Culture of Innovation – Proven Track Record



Our Company Today

Strong Global Enterprise

STATE STREET®

STATE STREET GLOBAL ADVISORS.

Developing investment strategies that make the best use of client capital

- Assets under management of \$2.1 trillion*
- One of the world's largest managers of institutional assets
- Provider of a comprehensive range of investment strategies that span the risk/return spectrum
- With approximately \$340 billion* in ETF assets under management, we have one of the broadest ranges of ETFs in the industry

STATE STREET GLOBAL MARKETS.

Research and trading solutions that improve the efficient use of client capital

- Global leader in investment research, trading and securities lending
- Total of approximately \$2.5 trillion in average lendable assets for Q4 2012
- \$16.8 trillion in foreign exchange and interbank volume traded in 2012
- Source of investor behavior and other research, advanced portfolio strategies, trade process optimization and global connectivity across multiple asset classes and markets

STATE STREET GLOBAL SERVICES.

Maintaining the inventory of client capital and dividends/interest

- Assets under custody and administration of \$24.4 trillion*
- One of the world's leading investment service providers
- Provides fund accounting, fund administration, custody, investment operations outsourcing, recordkeeping, performance and analytics, and transfer agency services

* As of December 31, 2012

Our Company Today

Strong Global Presence*

29,660 employees worldwide

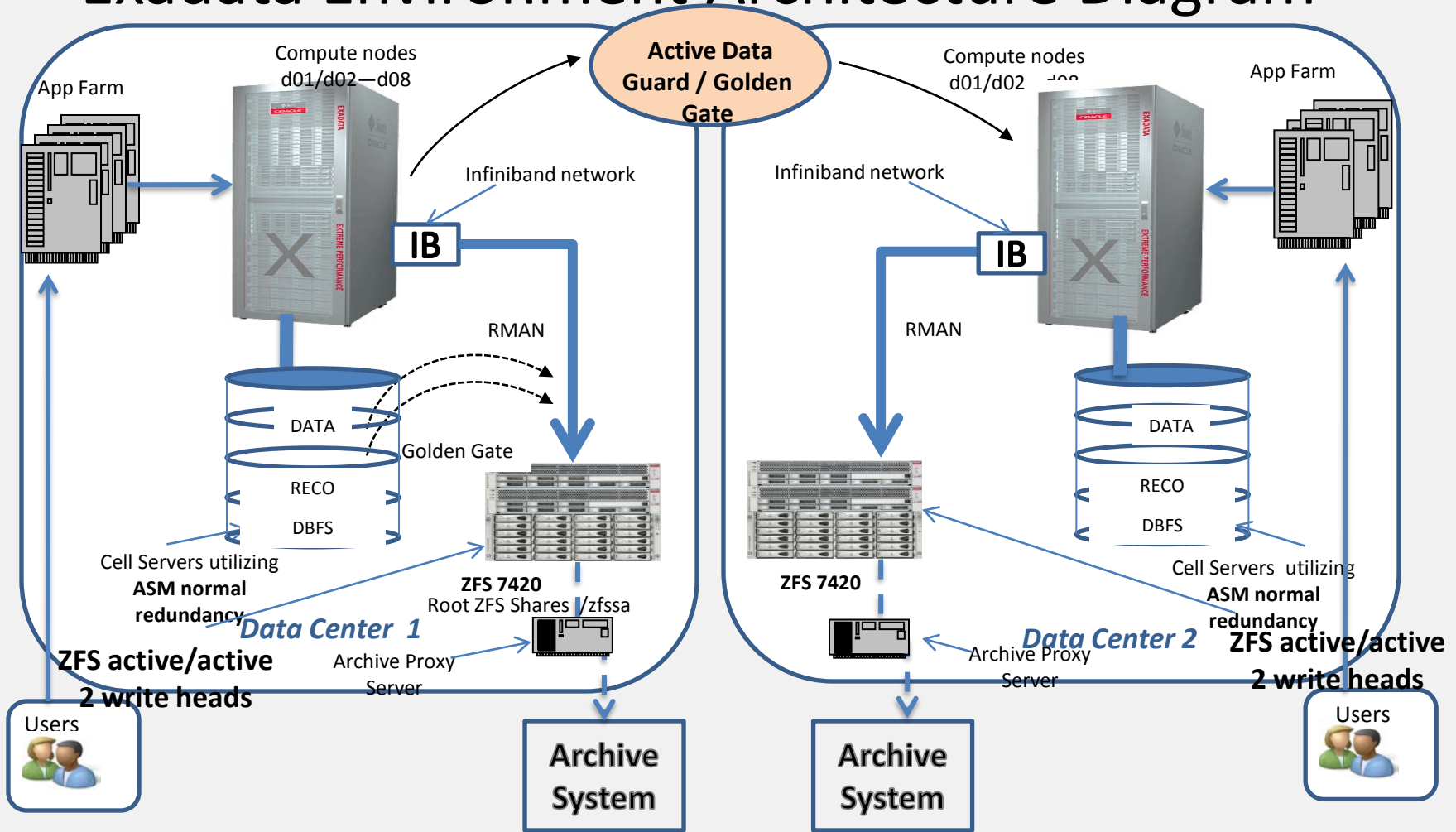


* As of December 31, 2012

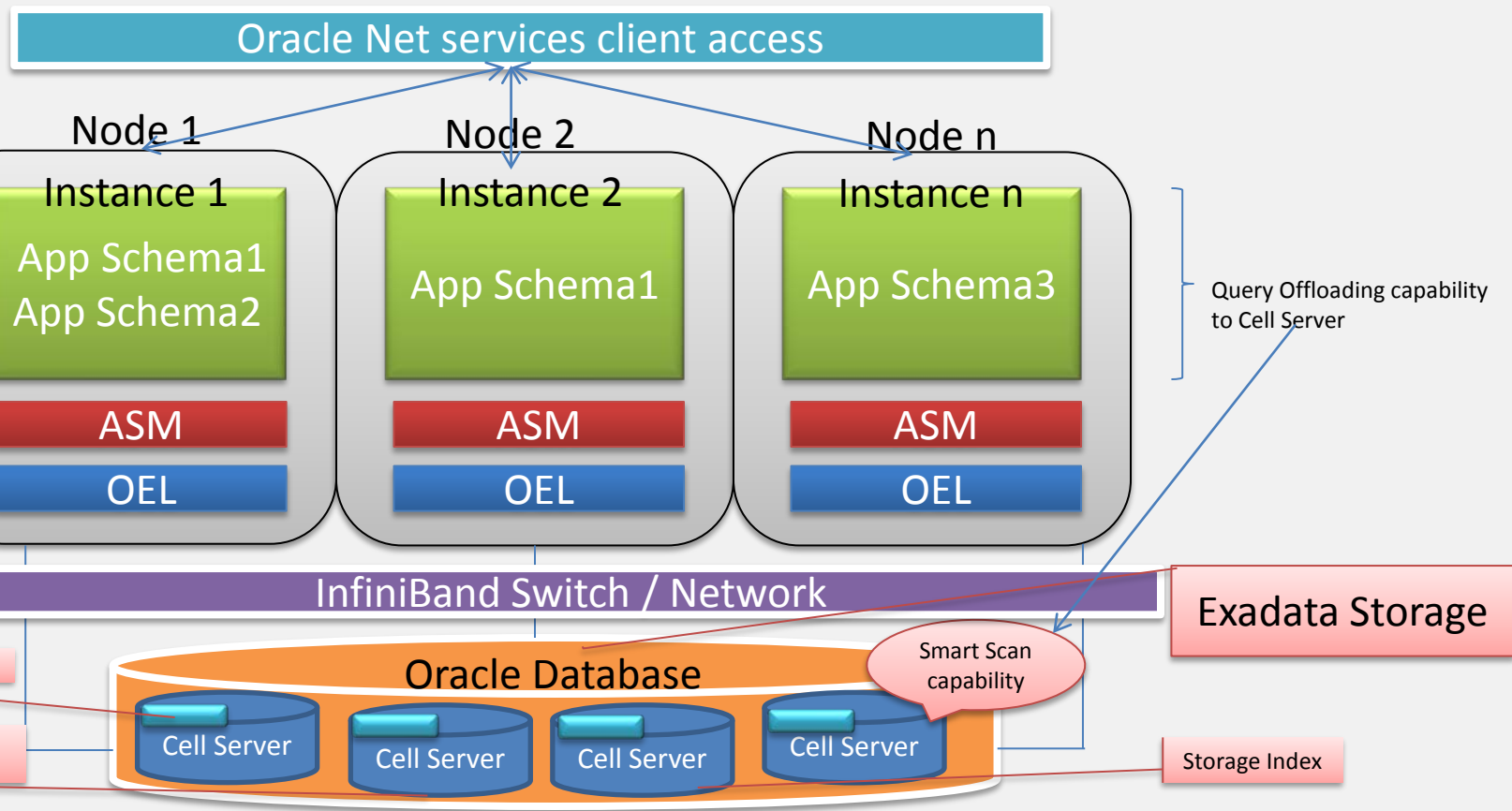
Exadata Environment Components

- Exadata X2-2/X3-2 also utilizing multi-racking
 - 12 full rack and 1 half rack used with multi-racking
 - Largest database 28TB, with most in 4-10TB range and some in 500GB to 2TB range
 - All running Oracle Database 11.2.0.3
- ZFS 7420 (2 write heads) for RMAN backups
 - 2 Exadatas share a ZFS
 - Golden Gate trail files also stored on ZFS
 - TSM RMAN Proxy Copy used to copy ZFS backups to tape for long term retention needs
- ASR (Hardware failures via Automatic Service Request creation)
- Golden Gate for data replication
- Oracle Enterprise Manager 12c
 - SNMP traps to Netcool -> Remedy
 - ZFS Plugin for OEM12c

Exadata Environment Architecture Diagram



Exadata



RMAN 11g Features Used at State Street

- **Compression using ZLIB**
 - `RMAN> CONFIGURE COMPRESSION ALGORITHM 'ZLIB';`
 - Typical compression ratios of at least 25%
 - Requires Advanced Compression Option
- **Parallel backup of the same data file**
 - In Oracle Database 11g RMAN, channels can break data files into chunks known as 'sections'.
 - `BACKUP INCREMENTAL LEVEL 0 DATABASE .. SECTION SIZE <x>`
 - Our setup is on Exadata using ASM.
 - On traditional systems, if the data file resides on a single disk, there is no advantage to using parallel backups within the data file.
- **DUPLICATE database from backup**
 - Used for creating standby and non-production testing environments
 - RMAN enhances **DUPLICATE** so that a connection to the source database is no longer required
 - Eliminates RMAN session dependency on WAN network connection back to source when creating new standby databases.
 - In an event of a failure during **DUPLICATE**, RMAN identifies the failure point and resumes from that point the next time **DUPLICATE** is run.
- **Backup Strategy**
 - Weekly Full and Daily Incremental Backups

RMAN 11g Features Used at State Street

- “Oops”..dropped a tablespace

- With RMAN 11g, recovery of a tablespace has been further simplified
- `RMAN>RECOVER TABLESPACE TS_NAME UNTIL TIME "TO_DATE('08/23/2013 10:20:30','MM/DD/YYYY HH24:MI:SS')"` `AUXILIARY DESTINATION '/ZFSSA/DBSPACE/DB';`
- Once completed, tablespace will be offline so only thing left to do is:
 - `SQL> ALTER TABLESPACE TS_NAME ONLINE;`

- Archived Log Deletion Policy Enhancements

- Used to ensure log shipment for the Active Data Guard environment is completed prior to deletion of archived logs via RMAN on primary database.
- `CONFIGURE ARCHIVELOG DELETION POLICY`
`{CLEAR |`
`TO {APPLIED ON [ALL] STANDBY |`
`BACKED UP integer TIMES TO DEVICE TYPE deviceSpecifier |`
`NONE |`
`SHIPPED TO [ALL] STANDBY}`

RMAN Backups Utilizing ZFS and Direct NFS

- RMAN / ZFS / DNFS

- Performance boost for backups using out of the box ZFS setup
- CPU reduction on compute nodes using out of the box ZFS setup
 - Direct NFS Client is capable of performing concurrent direct I/O, which bypasses any operating system level caches and eliminates any operating system write-ordering locks.
 - Direct NFS Client performs asynchronous I/O, which allows processing to continue while the I/O request is submitted and processed.
- DNFS Setup
 - To enable Direct NFS Client, you must replace the standard Oracle Disk Manager (ODM) library with one that supports Direct NFS Client while the DB is down.
 - `Exadata_Host#> cd $ORACLE_HOME/lib`
 - `Exadata_Host#> cp libodm11.so libodm11.so_stub`
 - `Exadata_Host#> ln -s libnfsodm11.so libodm11.so`
 - Validation/Management via views
(`v$dnfs_servers`, `v$dnfs_stats`, `v$dnfs_channels`)

Future Promising Technologies

- RMAN 12c Excitement

- Taking Exports on large databases is time consuming - there have been certain situations in the past where an export would make sense, but was not desirable.
- Of the several great 12c features presented, the one we're most excited about is **table recovery**.
 - On our Exadata platforms, we do not perform exports - only RMAN backups - and these can now be used to perform any type of recovery per our requirements.

Thank You !!



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