WholeSale: Global, Complex, Time Sensitive

- Commercial Banking
  - $112 Billion Loan Balance
  - 35,000 Real Estate Investors

- Investment Bank
  - 100+ Trading Desks
  - 10 Billion Shares traded

- TSS
  - $4 Trillion Overnight clearance
  - $16.9 Trillion Assets Under Custody

- Asset Management
  - $1.9 Trillion Assets Under Supervision
  - 350 Investment Strategies

International Revenue increased 20%

2010: 41%
2011: 48%
JPMorgan Chase has a global technology footprint

Infrastructure scale
- > 950K+ sq ft datacenter space, 32 Datacenters
- 50K+ servers
- 150PB of storage
- 300K endpoints
- ~$4BN infrastructure investment
- 60K mobile endpoints

Application scale
- 14K applications
- ~$4BN investment in application development and support per year
- 8K+ Oracle instances
- Thousands of Oracle migrations to 11.2
Data Guard – A Business Solution

- Data Guard / Physical Standby offers a significant business solution for business continuity & operations
- With every release, continues to grow in stability and feature set
- Originally used to be purely a DR solution, now being used for backup, testing, reporting and upgrades
- Real Time Apply and Active Data Guard features have made significant improvements to the platform
- Offers different protection modes: maximum performance or maximum availability
- Effectively replaces storage replication
Effectively replaced Storage Replication (SRDF)

Storage replication has many limitations:

- Database opening at DR site has overhead – it is not as swift as data guard
- Frequent validation of synchronization between primary and secondary site is essential (periodical drills to verify the integrity of data)
- Synchronous SRDF can have a negative impact on database at the primary database; Async does not guarantee data protection
- High bandwidth and expensive network / fiber is generally required
- The solution does not allow offloading database activities such as backup or read-only reporting
- Additional licensing costs are charged by the storage vendor
Active Data Guard

- Opens in read-only mode while apply is in progress
- Available for reporting (query against real-time data)
- Available for Backups
- Automatic Block Repair
- Switchover and Snapshot standby
- Visible Monitoring
- Provides confidence
- Prevents corruption

Challenges
- Often, reporting needs meta data preparation / low volume of writes
- Use of sequences / global temporary table
- Synchronous has performance impact
- Asynchronous can cause data loss
Data Loss Protection

- Data Loss protection is a big concern
- Business Continuity is an important consideration
- JPMC’s Data Centers are spread across country
- Latency ranges from 20 ms to 40ms
- On large and active systems, SYNC has an appreciable performance impact

<table>
<thead>
<tr>
<th>Key Attributes</th>
<th>SYNC</th>
<th>AFFIRM</th>
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<tbody>
<tr>
<td></td>
<td>ASYNC</td>
<td>NOAFFIRM</td>
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Sync vs. ASYNC

- There is always a challenge deciding between SYNC and ASYNC.
- The business wants a no data loss option; some key challenges remain:
  - Data centers not geographically near-by
  - SYNC has huge impact on primary performance
Data Guard Far sync standby Advantages

- Provides the ability to failover to a terminal database with no data loss
- Far sync standby is supported for either maximum performance or maximum availability mode
- Because far sync standby has no data files, it is easy to setup without increasing storage cost

Far Sync Standby: Light weight Standby In the same data center or near by (relatively close)
12c Features to Enhance

New Features that would be vastly helpful:
- FAST Sync
- Sequences
- Global Temporary Table
- Global Data Services