

Data Centre Excellence IV

Long-distance synchronous replication can work

Sean Daly – CLS Programme Executive
1st December 2008





Introduction





- **World's largest multi-currency cash settlement system**
- **Settles matched trades on a payment versus payment (PvP) basis**
 - **Guarantees principal amount in the event of counterparty failure**
- **Eliminates Foreign Exchange (FX) settlement risk**
- **Settlement is final using central bank funds and operating within a standard legal framework & operating rules**
- **Supported by a robust and resilient infrastructure**
 - **One of six critical market infrastructures**

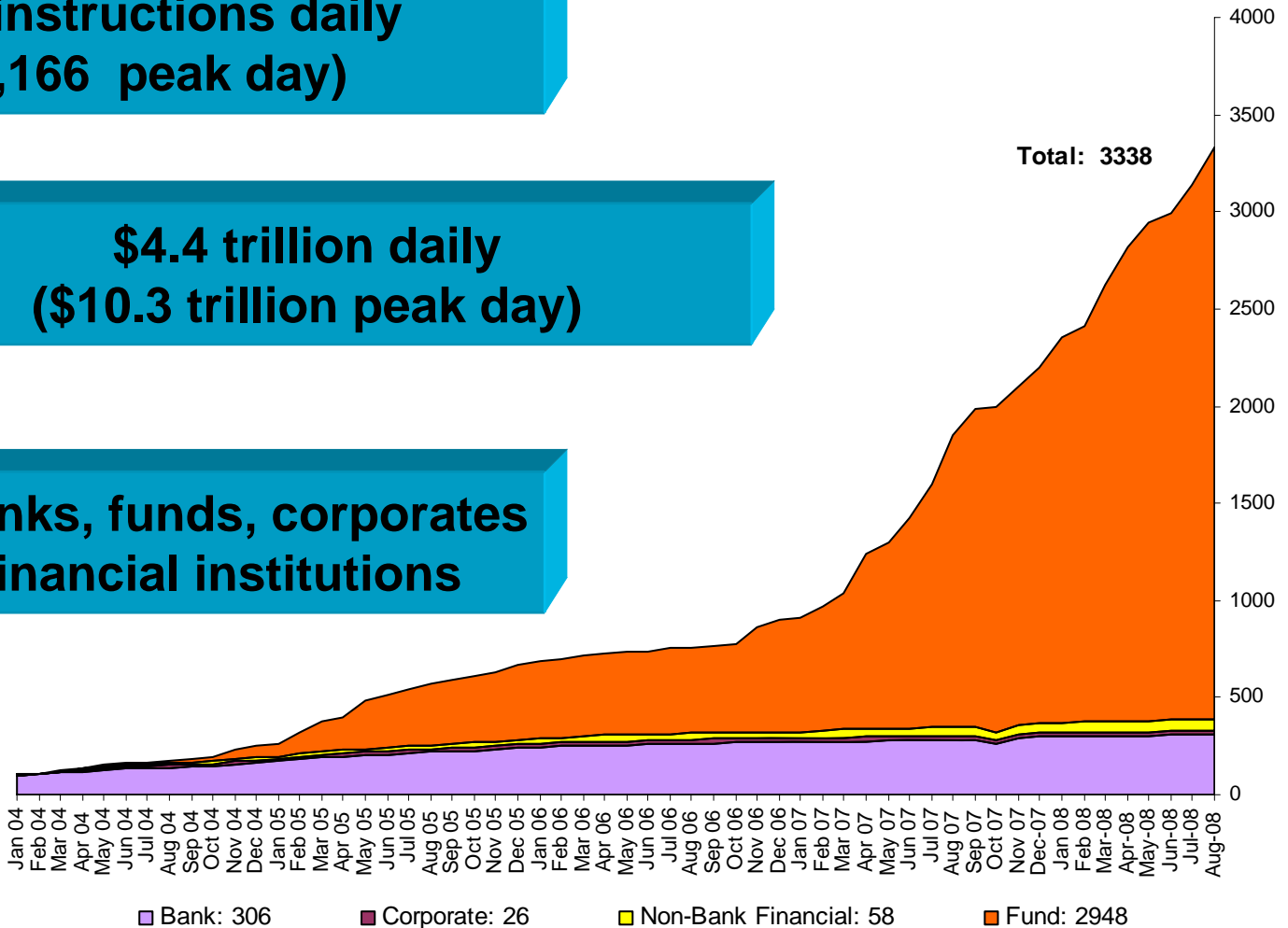
CLS participation



**700,000 instructions daily
(1,554,166 peak day)**

**\$4.4 trillion daily
(\$10.3 trillion peak day)**

**Over 3,300 banks, funds, corporates
and other financial institutions**

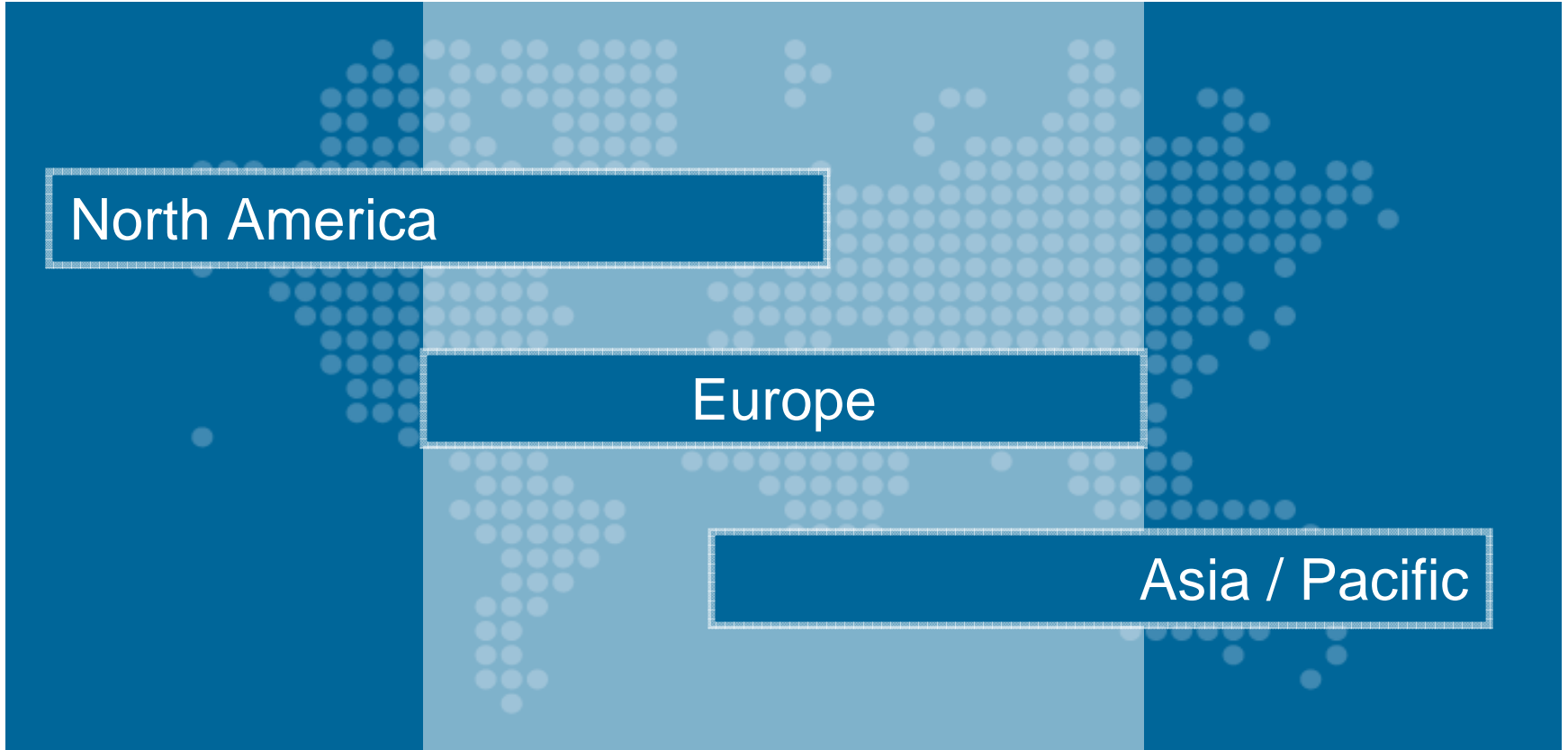


CLS Shareholders

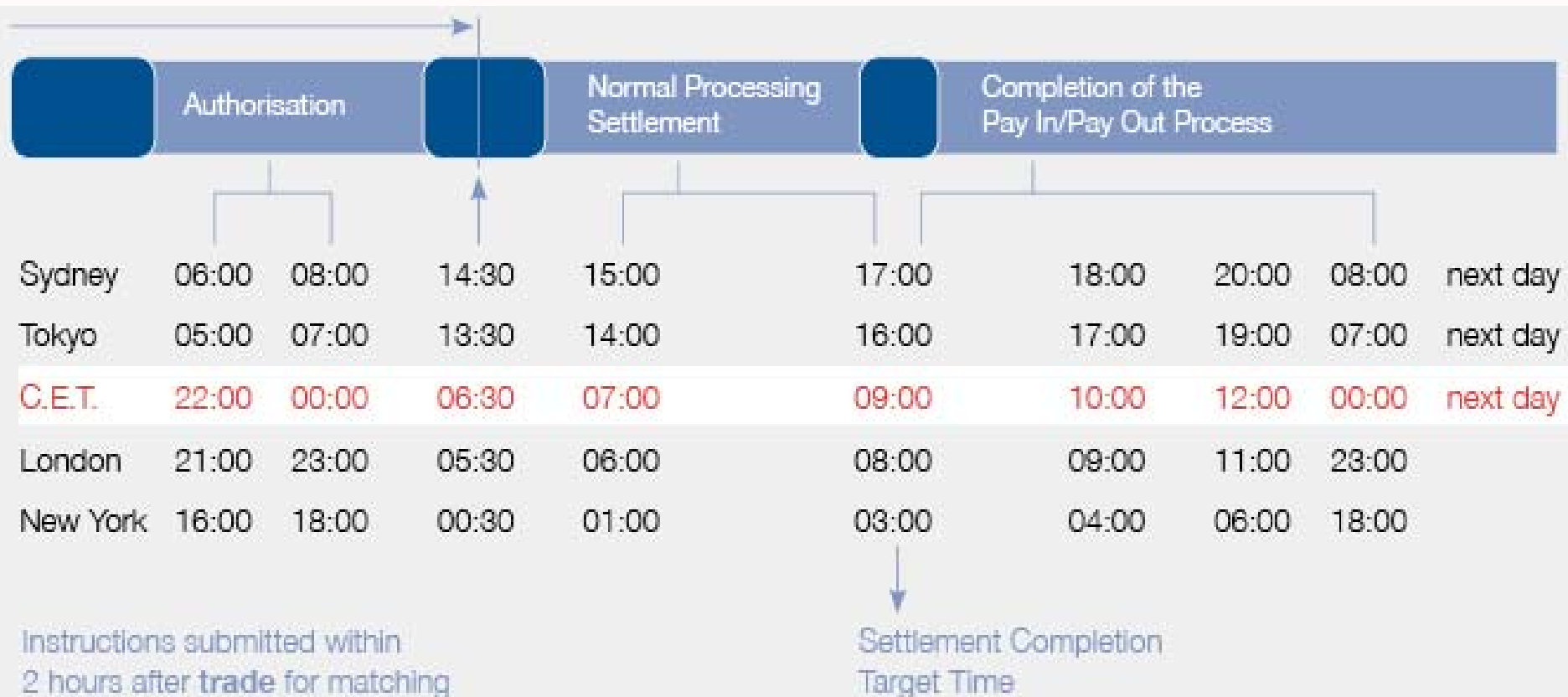


Australia - Australia & New Zealand Banking Group • Commonwealth Bank of Australia • National Australia Bank • Westpac Banking Corporation • **Belgium** - Fortis Bank • KBC Bank • **Canada** - Bank of Montreal • The Bank of Nova Scotia • CIBC • Royal Bank of Canada • The Toronto-Dominion Bank • **China** – Bank of China • **Denmark** - Danske Bank • Nordea • **France** - BNP Paribas • Caisse Nationale De Credit Agricole • Société Générale • **Germany** - Bayerische Landesbank • Commerzbank • Deutsche Bank • DZ Bank • Dresdner Bank • Hypo Vereinsbank • WestLB • **Israel** – Bank Hapoalim • Bank Leumi • **Italy** –Intesa Sanpaolo • UniCredit • **Japan** - The Bank of Tokyo-Mitsubishi UFJ, Ltd • Mizuho Corporate Bank • Norinchukin Bank • Sumitomo Mitsui Banking Corporation • The Sumitomo Trust & Banking Co., Ltd. • **Korea** – Kookmin Bank • Korea Exchange Bank • Shinhan Bank • **Luxembourg** – Dexia Banque Internationale a Luxembourg • **Netherlands** - ABN AMRO Bank • ING Bank • Rabobank Nederland • **Norway** – DnB NOR • **Singapore** – DBS Bank • Oversea-Chinese Banking Corporation • United Overseas Bank • **South Africa** – Standard Bank • **Spain** - BBVA • Banco Popular Espanol • Banco Santander • **Sweden** - Skandinaviska Enskilda Banken • Svenska Handelsbanken • **Switzerland** - Credit Suisse • UBS • Zurcher Kantonalbank • **United Kingdom** - Barclays Bank • HSBC Holdings • Royal Bank of Scotland • Standard Chartered Bank • **United States** - American International Group • Bank of America • The Bank of New York • Bear Stearns Securities • Citibank • The Goldman Sachs Group • JPMorgan Chase • Mellon Bank • Merrill Lynch • Morgan Stanley & Co. • Northern Trust Corporation • State Street Bank and Trust Co.

Global linking of domestic payment systems



How CLS works





➤ Background

- Demanding Service Level Agreements
- No room for failure
- Demanding Disaster Recovery and Business Continuity timeframes (30mins)

➤ Architectural Design

- No single point of failure
- Mirror 'everything'
- Synchronous replication
- 'Active / Active' solutions
- Operational activities (people) and technology core separate
- Operational Business Continuity site relatively close



- CLS Bank International (CLS Bank) is supervised and regulated as a bank by the US Federal Reserve
- Deemed as one of the most critical financial infrastructures
- Mandatory compliance with ***Interagency Paper on Sound Practices to Strengthen the Resilience of the U.S. Financial System ('White Paper')***
- CLS Bank needs to be able to withstand any regional disaster and be able to resume its service from another location in another region, within two hours



Synchronous replication limitation – unable to extend beyond 150km (round trip):

- Increased latency with distance
- Application queue building
- Possible recovery impacts



CLS took its application to IBM's labs to test its performance over a test network with configurable latency.

High Performance centre application evaluation:

- Built from back-ups in 4 weeks
- Progressively increased simulated latency from 1 millisecond to 14 milliseconds
- Distances simulated:-200km, 400km, 600km and 800km

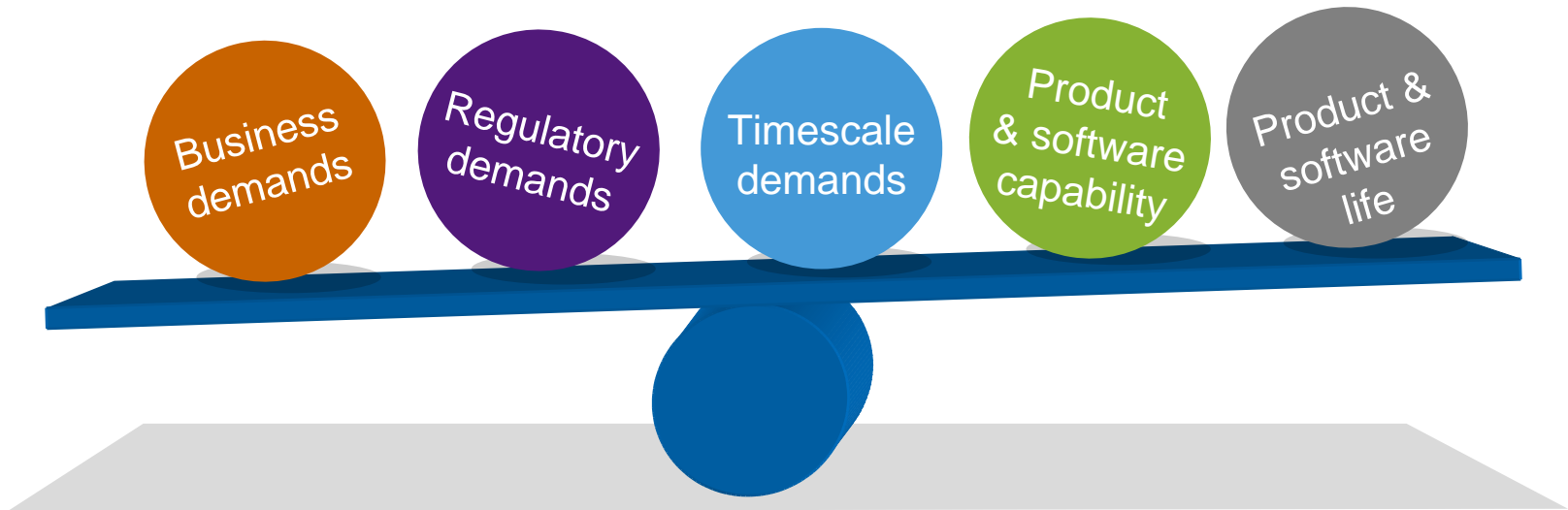
Results:

- Application did not break but slowed
- Queues did build ultimately rendering the services unusable as defined
- Performance bottlenecks re-affirmed

Conclusion: APPLICATION would NOT be a BARRIER

The challenge

- A highly available, highly resilient infrastructure now had to become regionally resilient too
- How to retain business model in a timely manner
- Whilst balancing key factors:





Business Strategy Opportunity – Non-deliverable Forwards (NDFs)

- New product development was linked into a move to regionally resilient model
- Product Application designed to handle 20 milliseconds latency

Network Provider needed to achieve high hurdles:

- Dense Wavelength Division Multiplexing (DWDM)
- Separacy
- Diversity
- 99.999% availability
- Data centre selected within the limits of the High performance application testing results (>400km – 800km Round trip)



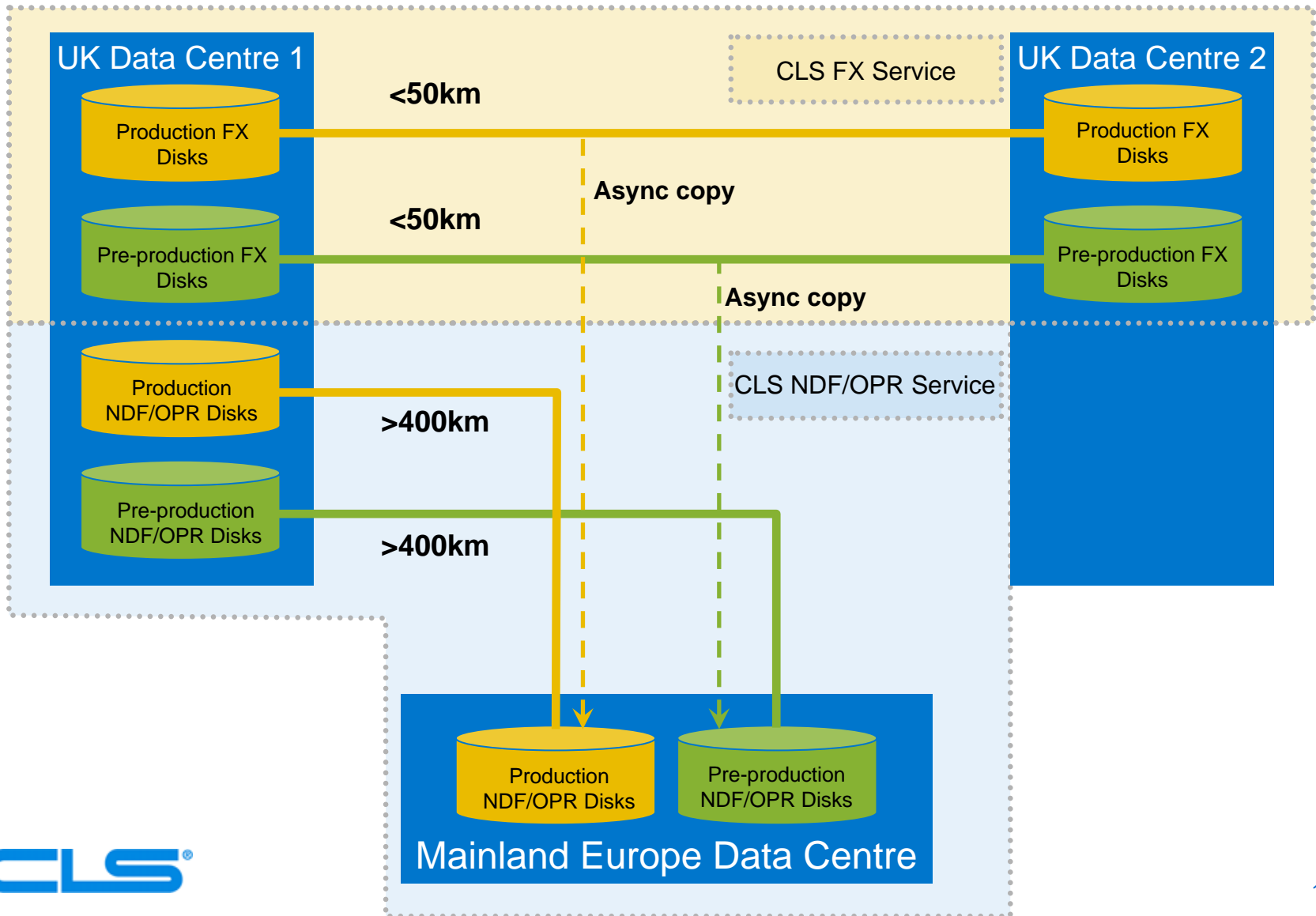
chosen as preferred partner

- Network operational since early 2006

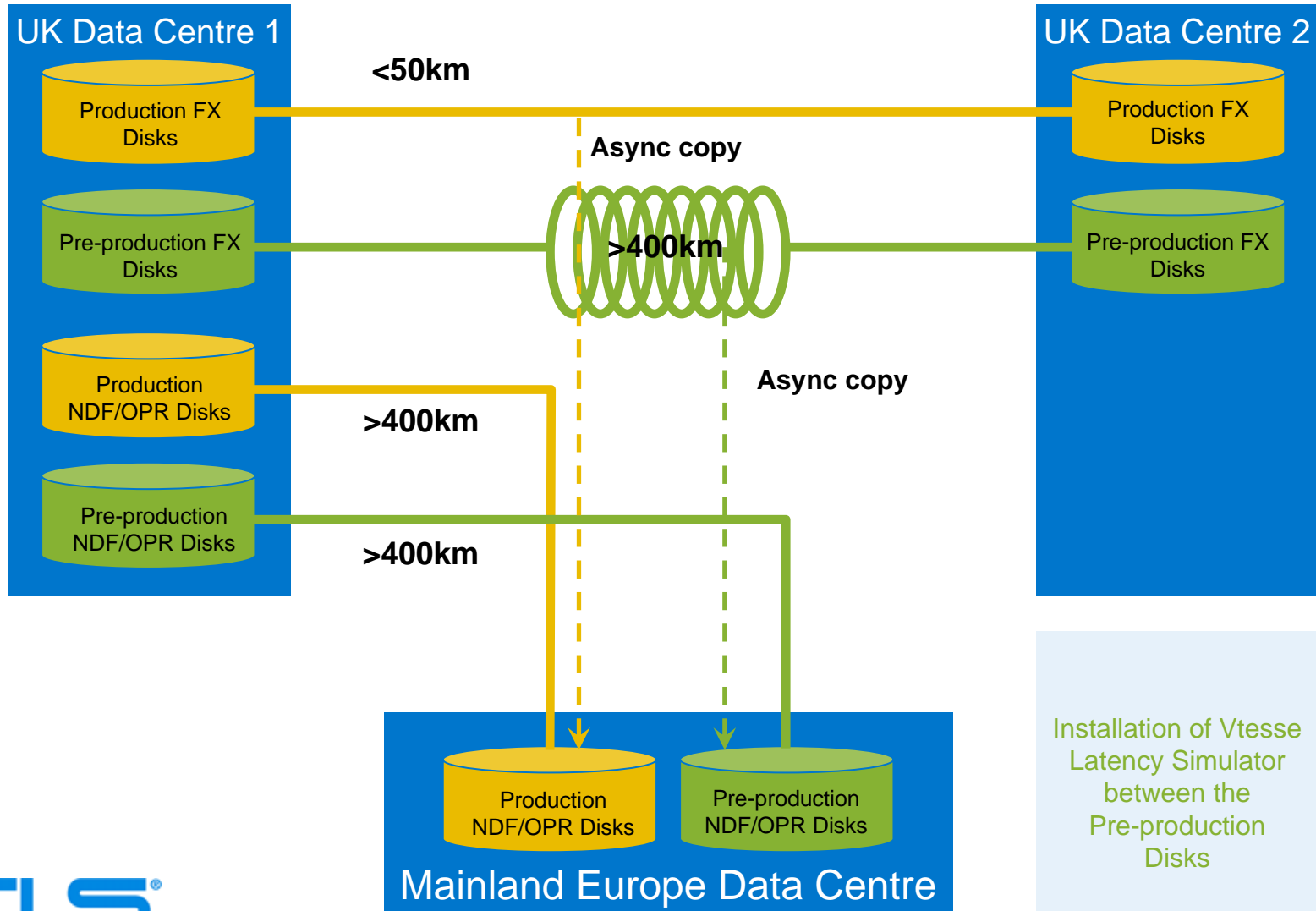


- Removal of 'stove-pipe' processing
- Current settlement application re-engineered in the areas of stress highlighted with the high performance centre evaluation. This involved:
 - Tuning of Database intensive jobs (specifically write-intensive activities)
 - Greatest gains were from the introduction of a 'Bulk Commit' approach to committing transactions to the Databases
- Enhancements validated in a Pre-Production environment with a 'Latency Simulator' from Vtesse

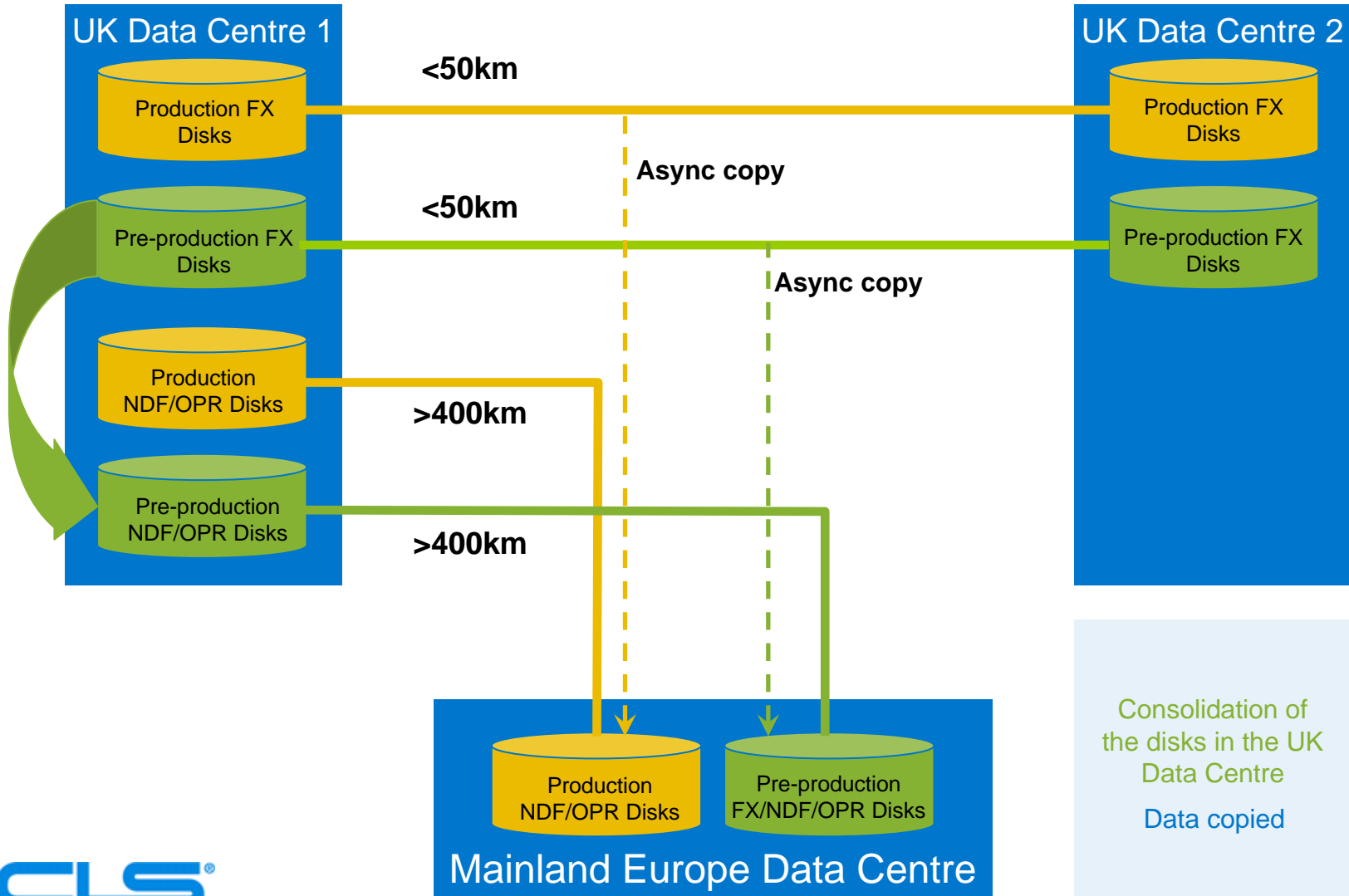
How it was done



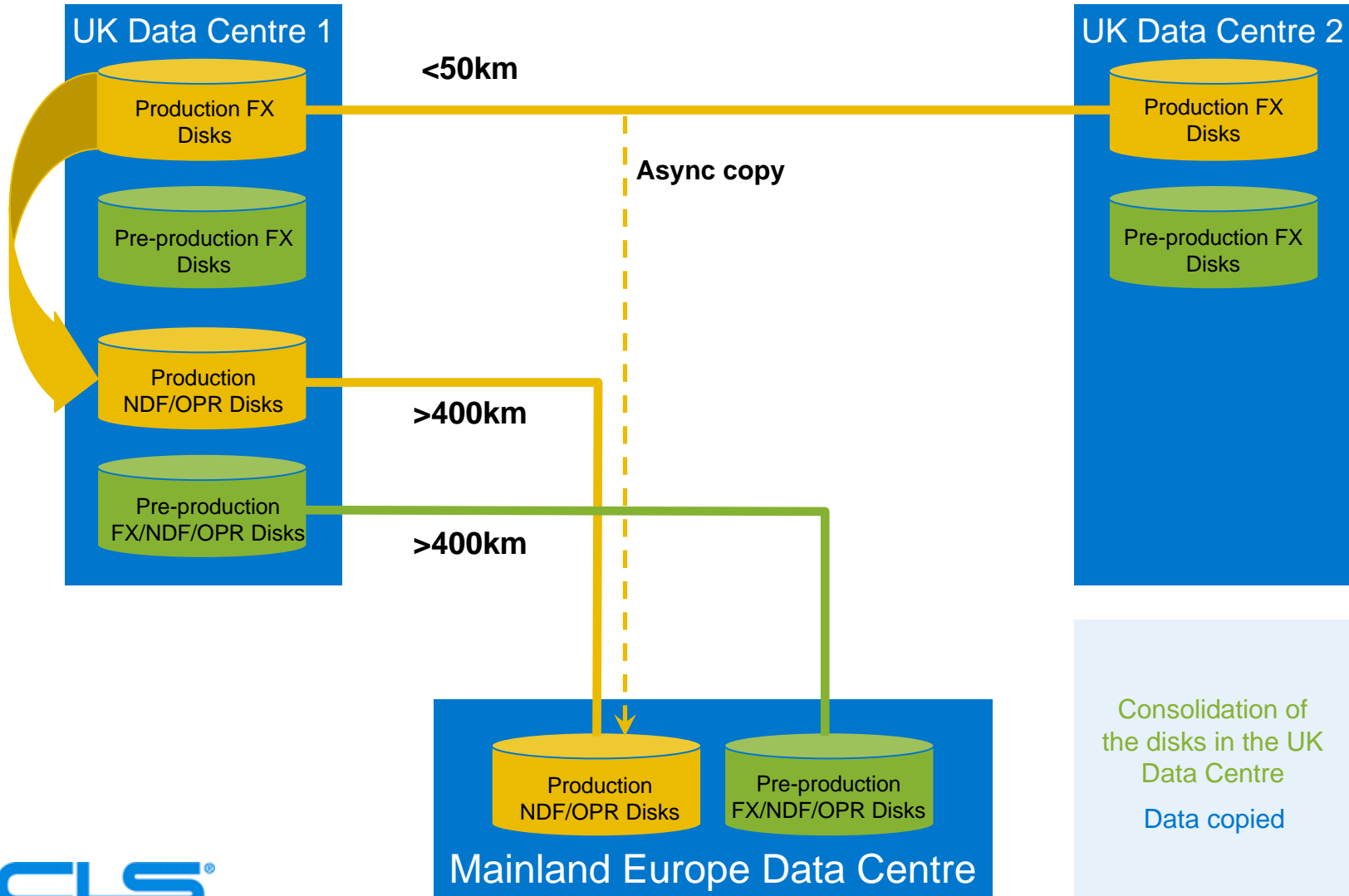
How it was done – latency simulator



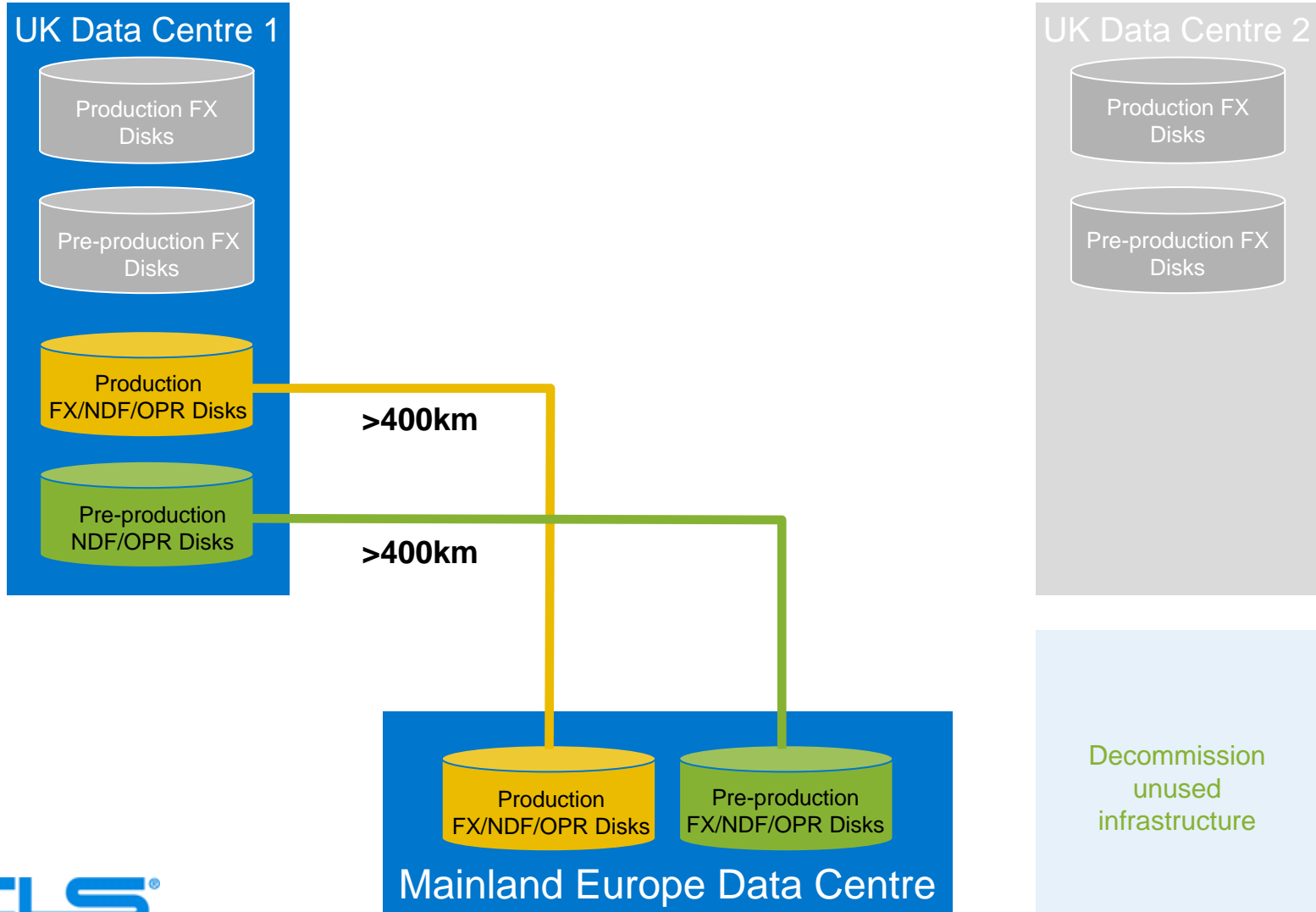
How it was done – Pre-Production Disk Move



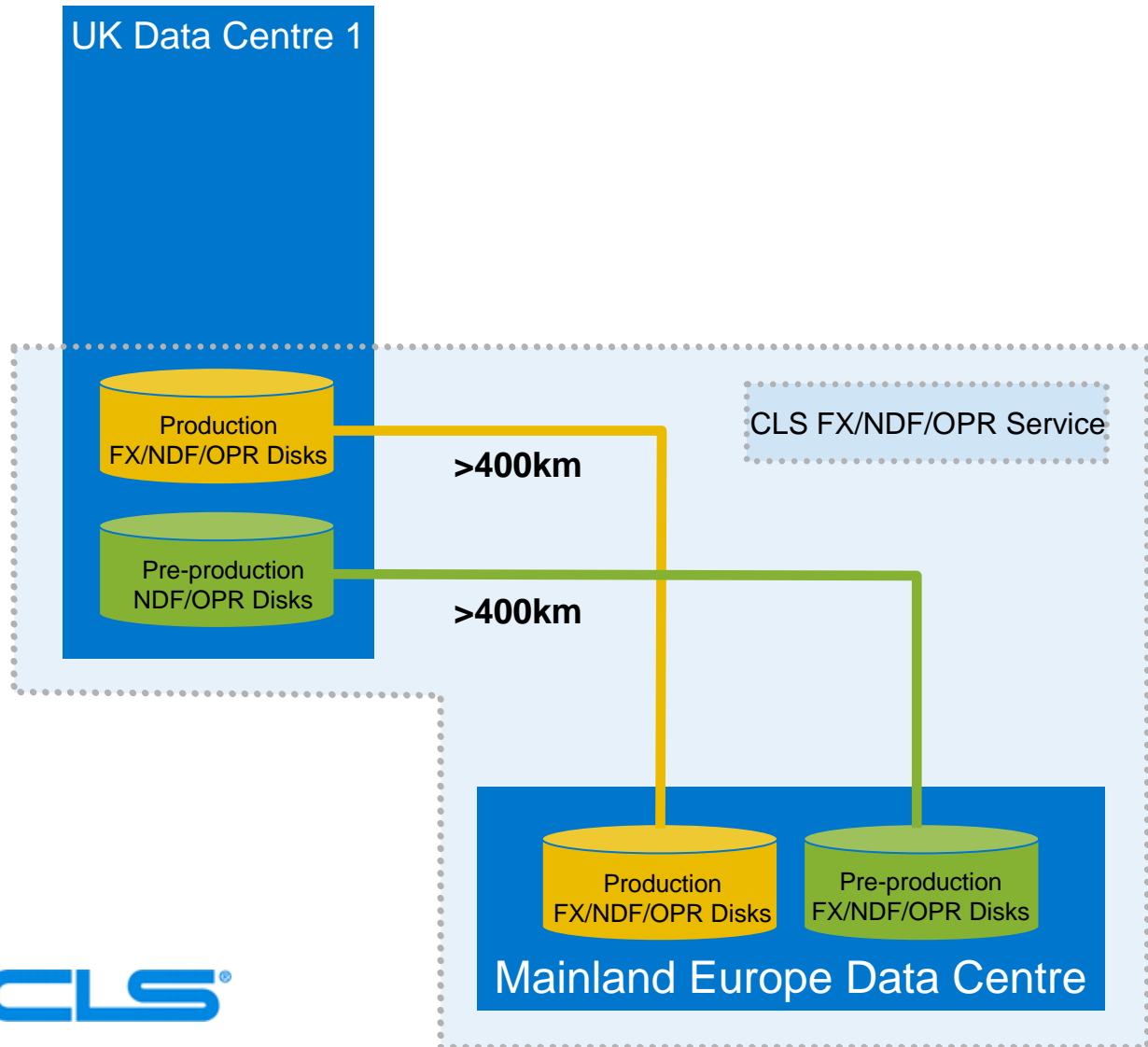
How it was done – Production Disk Move



How it was done – Decomm of retired infrastructure



How it was done – Current Status



Final State – as of
8 November 2008



We now run two fully synchronous services in a long-distance configuration:

- Pre-production – 700,000 FX trade instructions per day
- Production – circa 700,000 FX trade instructions per day

Decommissioning of one UK data centre now underway



- Return to a single recovery strategy, i.e.: Synchronous solution
- Reduces the pressure on the financial markets which was present with the asynchronous solution. After suffering a regional disaster, we can still guarantee no data loss.
- Financial benefits of returning to two data centres
- Simpler operational procedures
- Reduction in management overhead

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