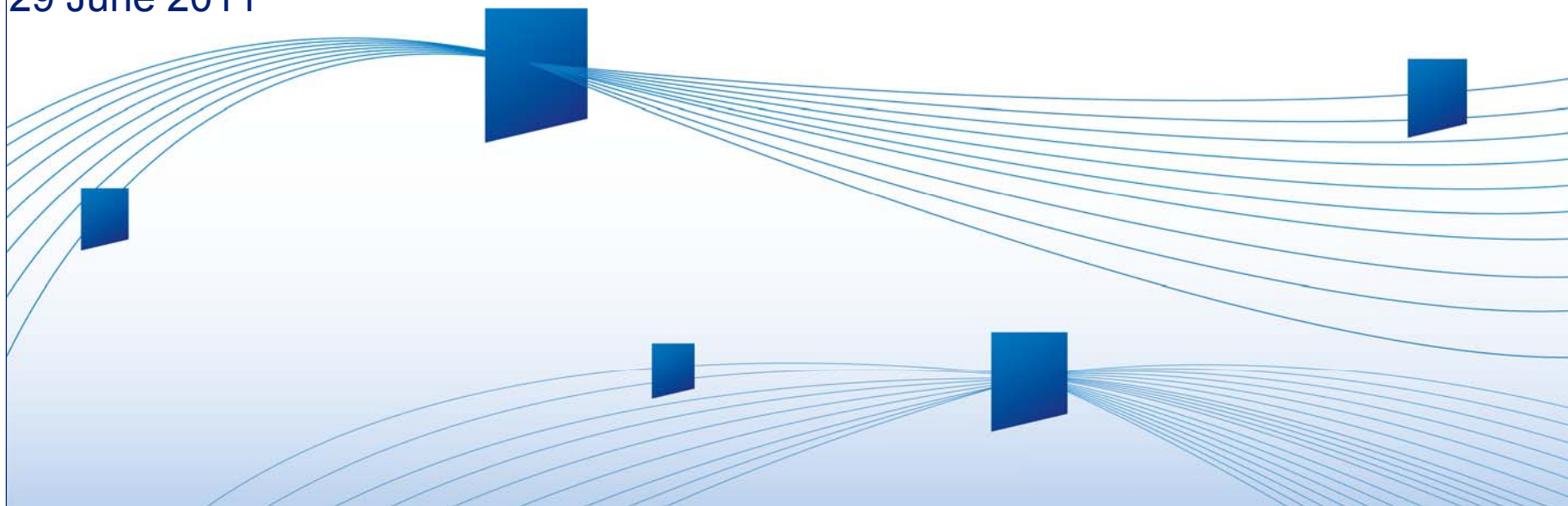


Bandwidth Demand in the Financial Industry – The Growth Continues

Andrew F. Bach
29 June 2011



Agenda

- The business needs that drive the technology
- What we deployed
- What technology we need next



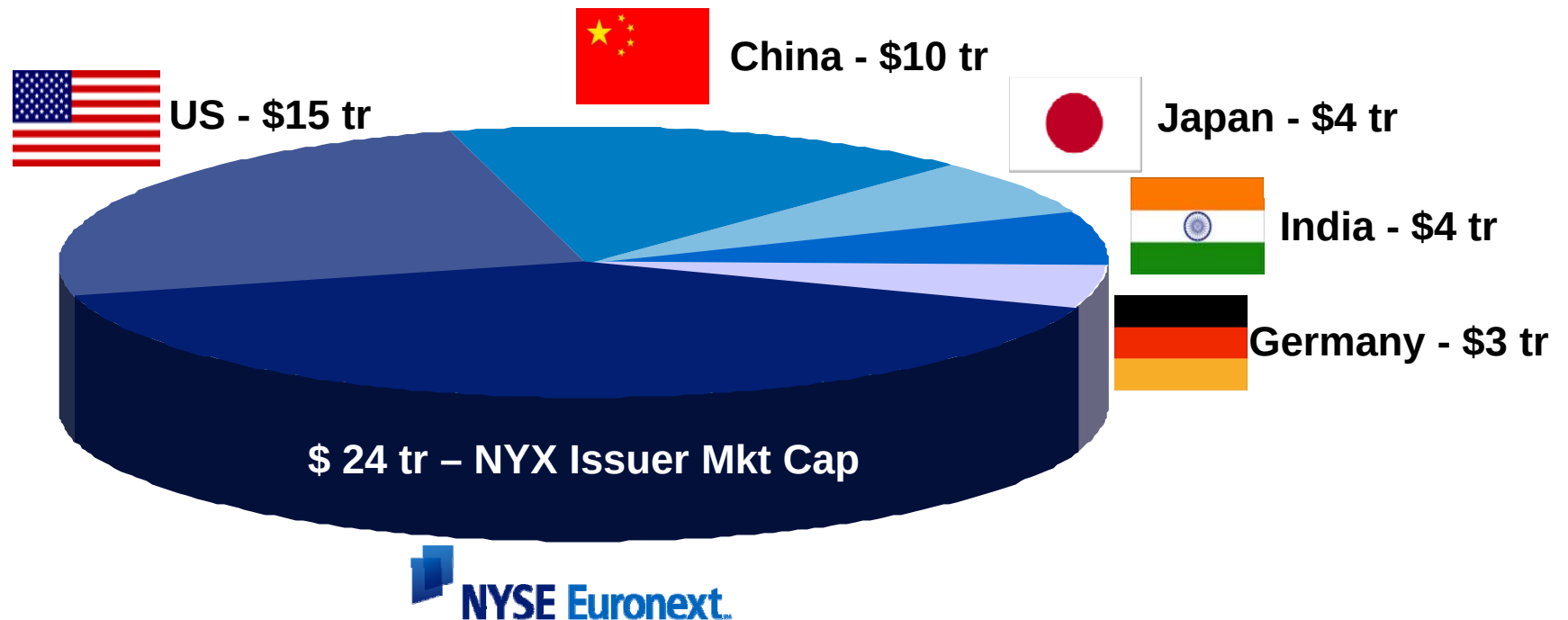
THE BUSINESS NEEDS THAT DRIVE THE TECHNOLOGY

Scale of the Business

The total market cap of all our listed companies is over **\$24 Trillion....**

...Compared to country GDPs, that would make us the largest economy in the world.

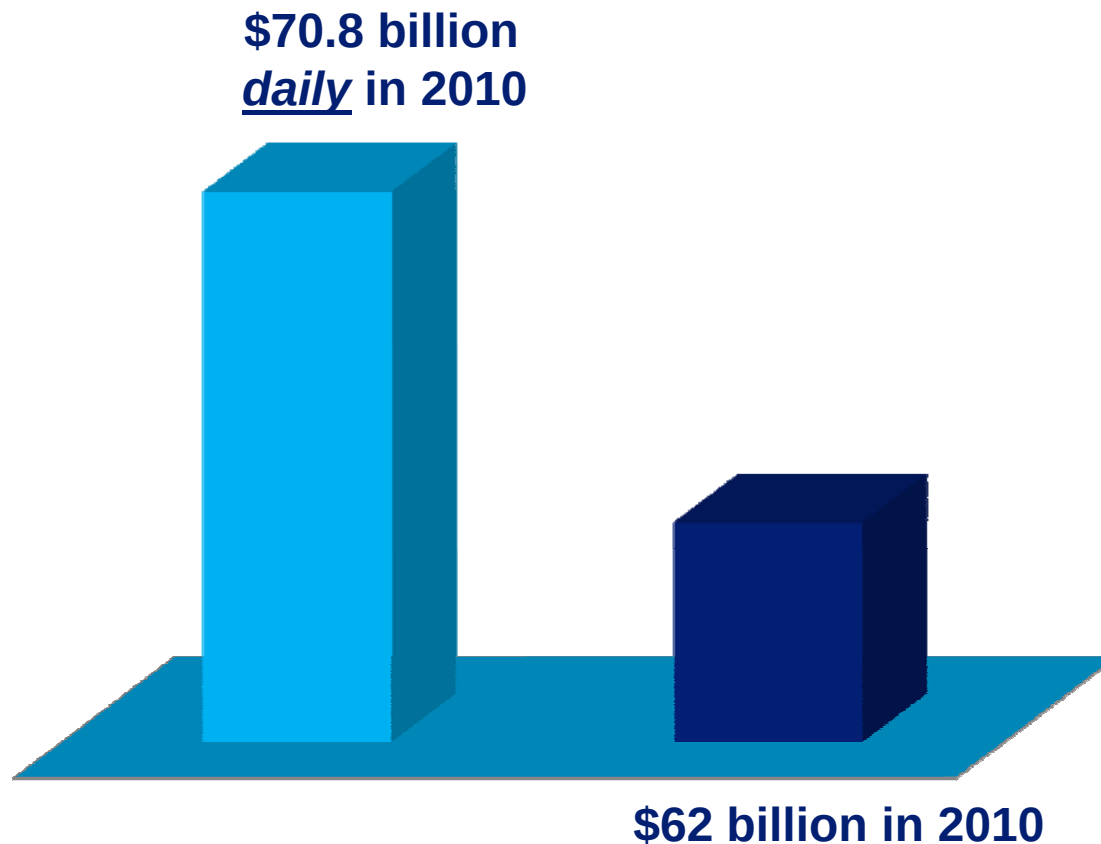
Largest Economies by GDP (in Trillions of \$)



Scale of Transactions

In the U.S., NYSE Euronext exchanges execute **\$70.8 billion** in financial transactions every day...

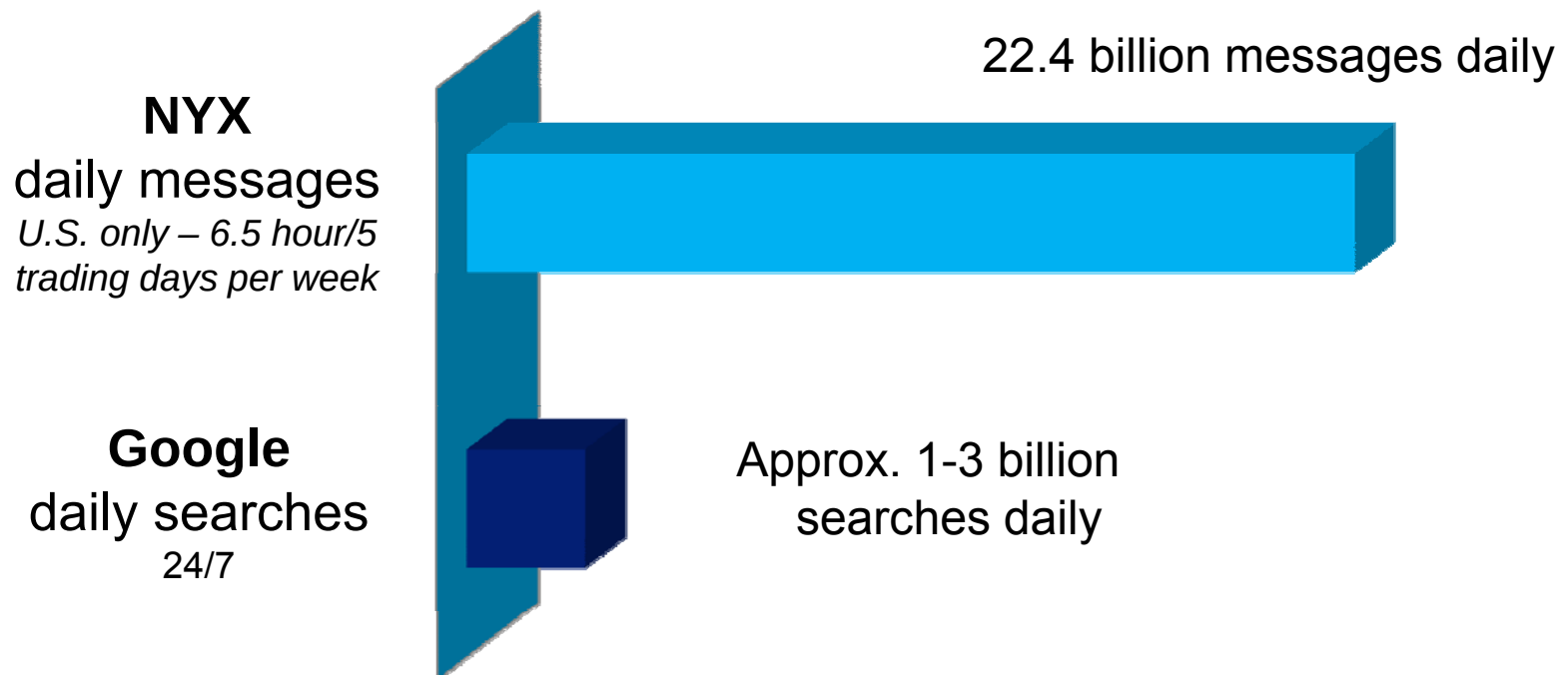
...eBay handled **\$62 billion** all of last year.



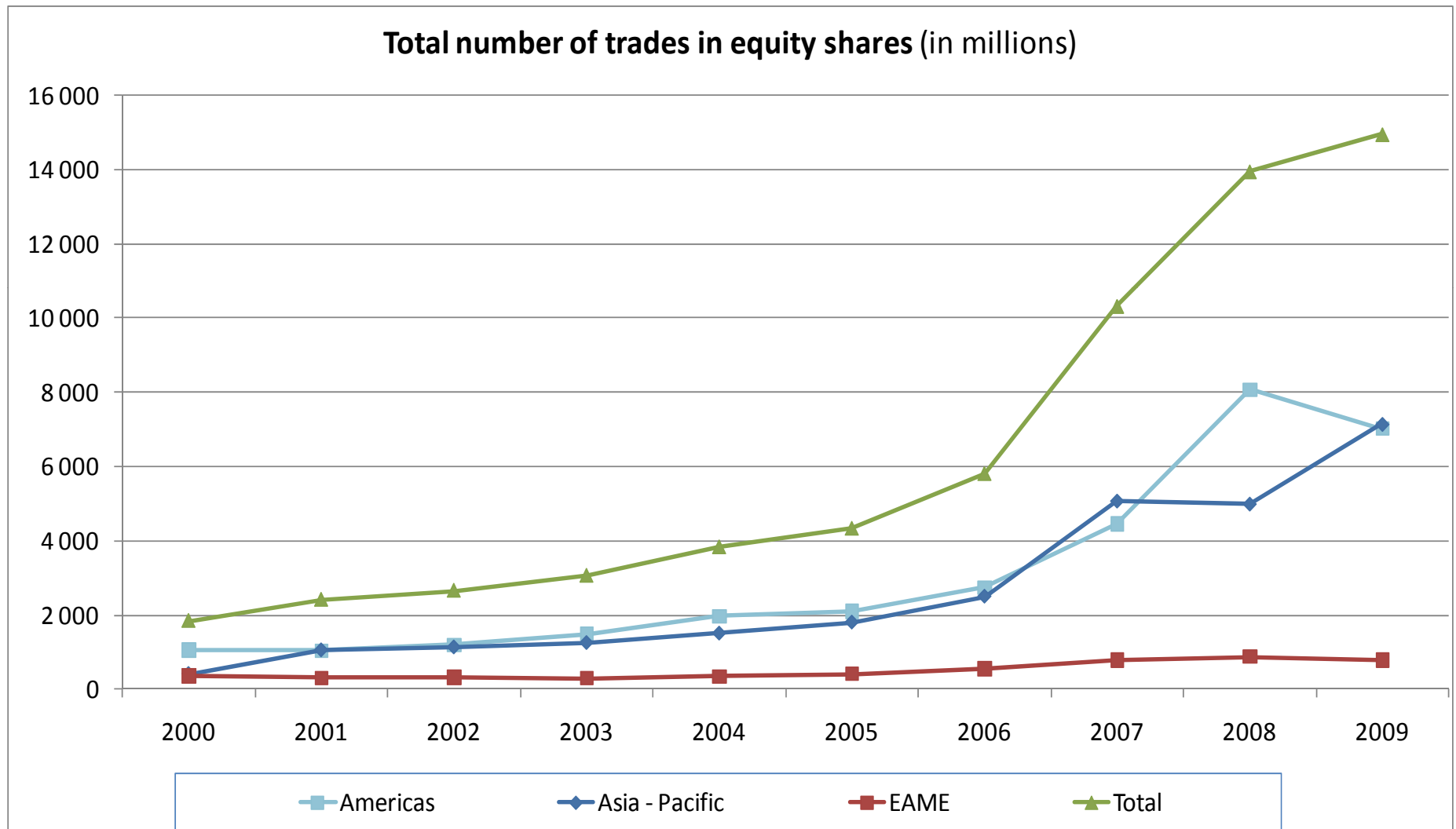
Message Activity

In the U.S. alone, NYSE Euronext process more than **22.4 billion messages** each day...
...That's **7.5** times more than the number of internet searches Google handles daily.

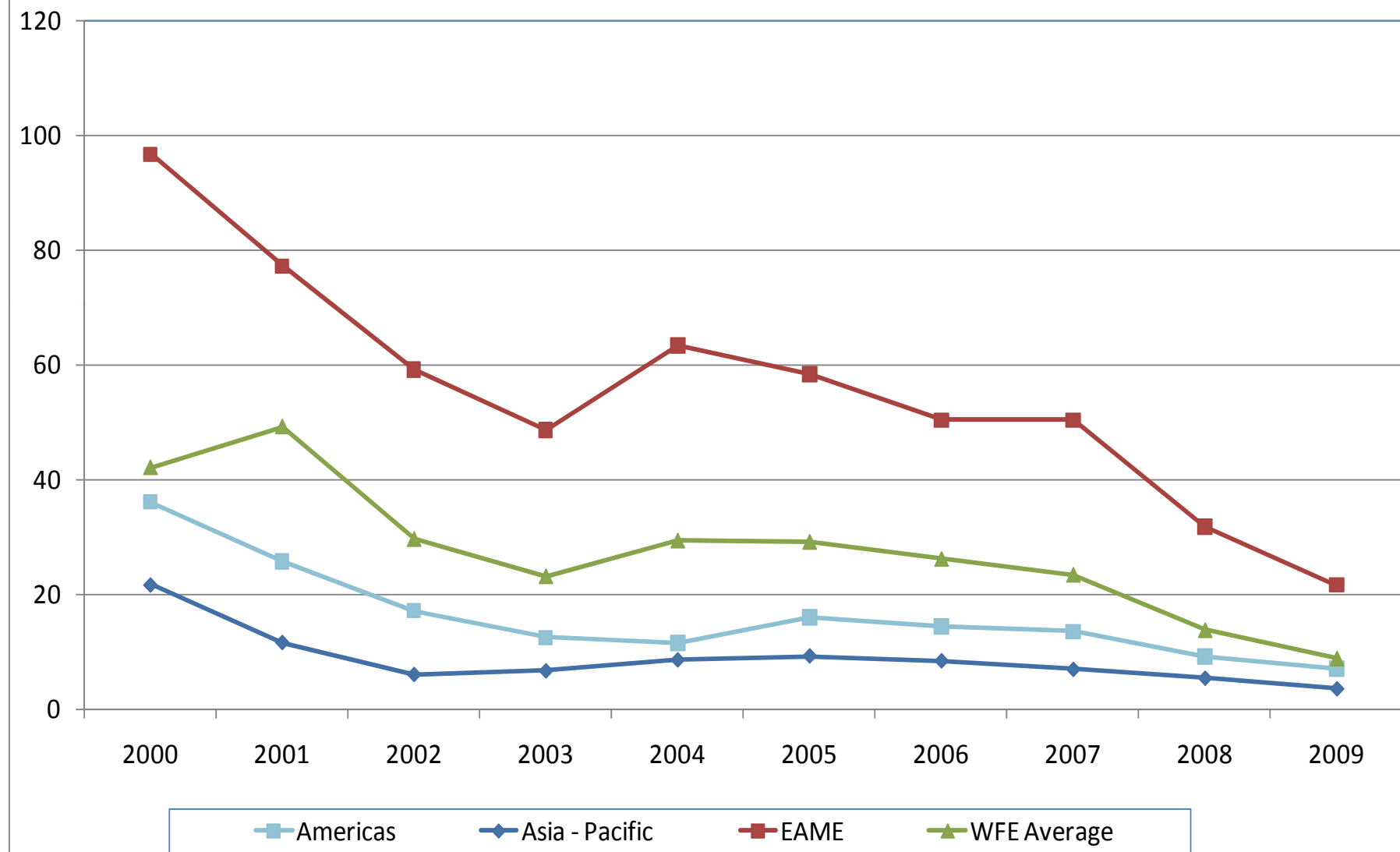
Number of Messages/Transactions per day



Total number of Trades in Equity Shares +700%



Average value of trade - USD thousands (weighted by share value trading)

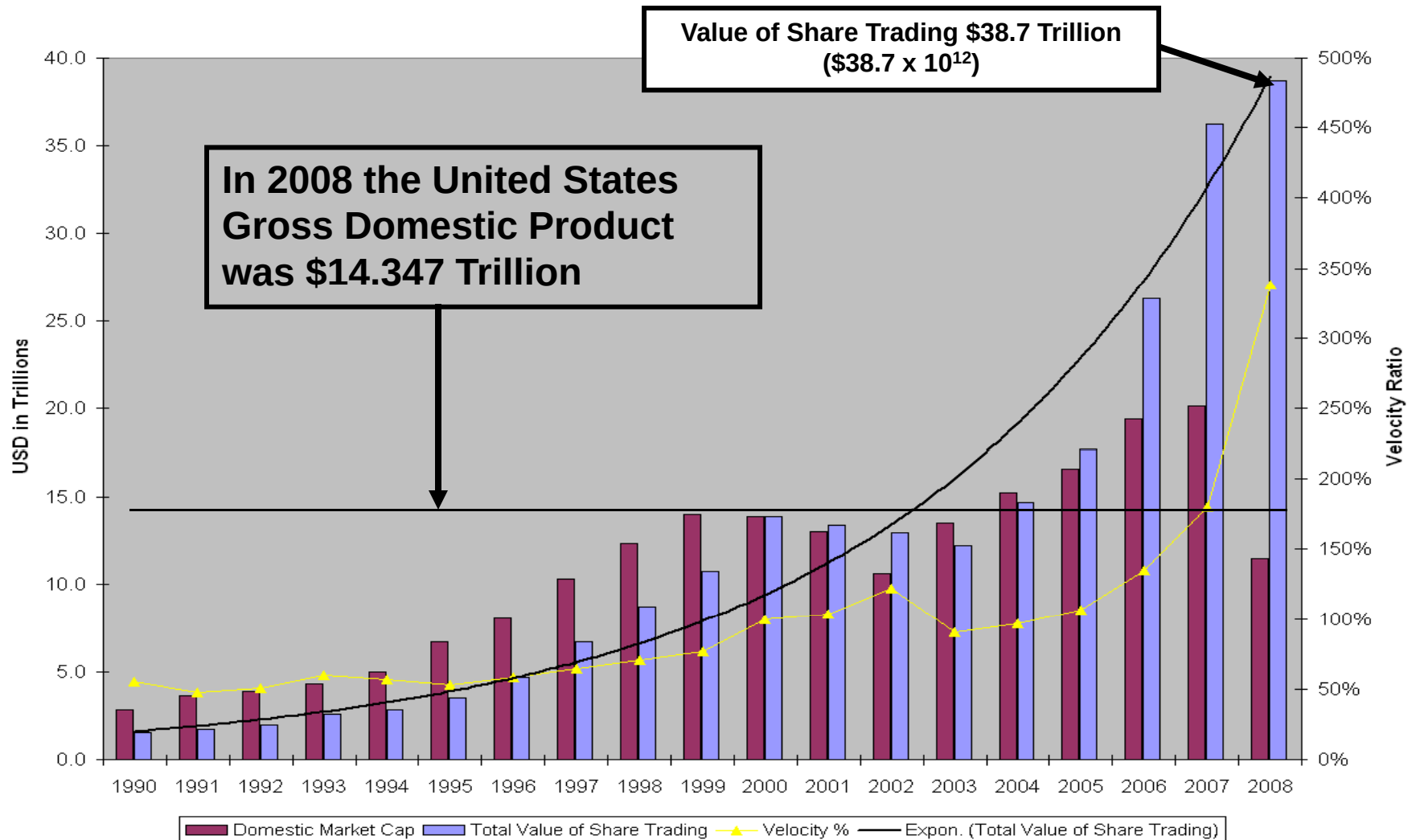


Data Source: World Federation of Exchanges (www.world-exchanges.org)

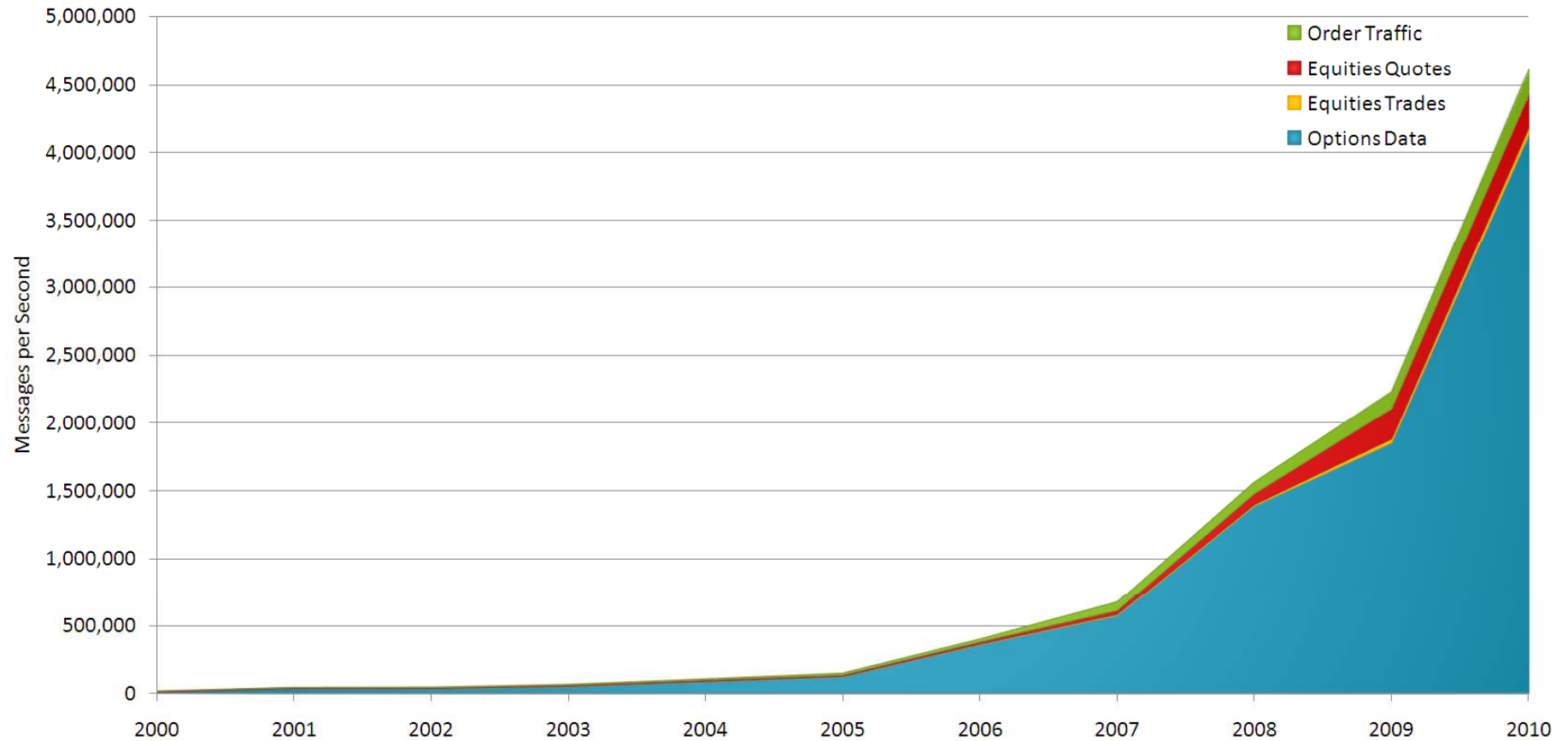
Latency and Market Data

- Low latency market data is uncompressed, requiring more bandwidth
- Competitiveness of the market is no longer measured in milliseconds (ms), but in microseconds (μ s)
- Any delay or queuing inserted into the trading path must be eliminated
- Delaying market data wreaks havoc on trading applications and is significantly worse than discard

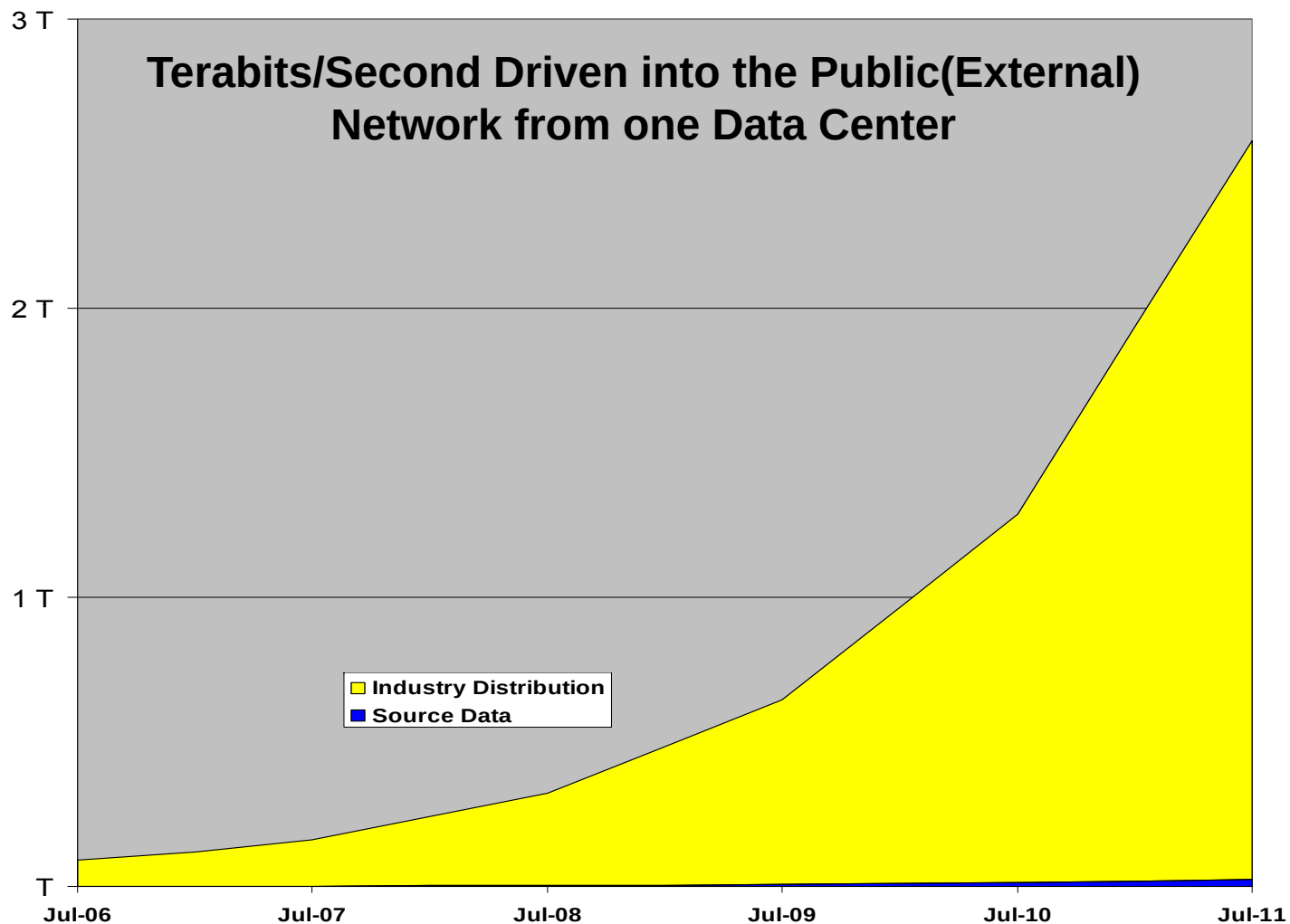
Market Capitalization and Value of Share Trading



Increasing Market Data Rates



Bandwidth Distributed to the Financial Community



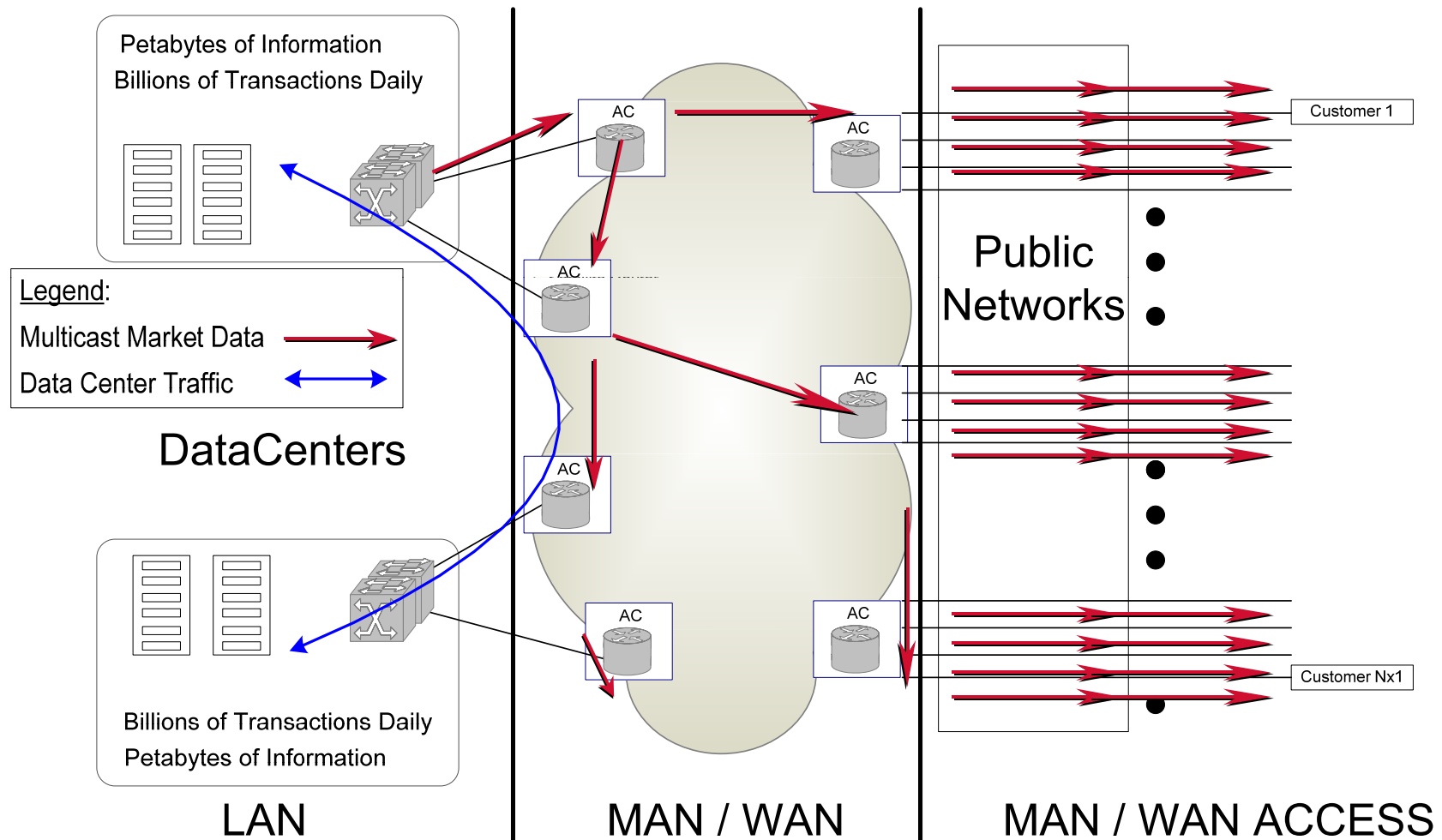


THE TECHNOLOGY THAT WAS DEPLOYED

Technology Foot Print

- Network
 - Network devices (Routers, Switches, etc) 6,000
 - 1G Ports or below 200,000
 - 10G ports 10,000
 - Route table 500,000
 - Entitlements 40,000
 - Telco Circuits 20,000
 - Data Center Core Bandwidth 18,350,000,000,000
- Processing
 - Servers $\approx$ 10,000
 - Cores $\approx$ 60,000
- Storage $\approx$ 10 PB

Exemplar External Network



Optical Footprint (one data center only)

- First Plan:
 - 4 -100G wave delivering 40 - 10G Ethernet circuits (0.4Tb)
- Currently Deployed:
 - 13 - 100G waves delivering 130 – 10G Ethernet circuits (1.3Tb)
 - 27 – 10G waves (0.27Tb)
 - 88 – λ 's (0.88Tb)
 - Total 128 λ 's delivering 2.45Tb/S
- Currently Deployed:
 - 26 – 10G waves (0.26Tb)
 - 16 – 10G waves delivering 160 -1 G Ethernet (0.16Tb)
 - Total 42 λ 's delivering 0.42Tb/S
- Grand Total 170 λ 's delivering 2.87Tb/S



WHAT TECHNOLOGY WE NEED NEXT

Pushing the Technology Edge

- Flat “cloud” network within the four walls of the data center
 - Will fully support storage
 - Will support bandwidth on demand
 - Ultra low latency and jitter
 - Very reliable – without adding layers of redundant switches
 - Scalable to 10,000’s of ports at 10G/40G and beyond
 - Core interconnect will need to support/exceed 1T
- Seamless view and operation independent of location
- Fully extensible to the local wide area (about 50 miles diameter)
 - DWDM integrated into the data center Router
 - GMPLS full controlled and managed from the data center routers
- Limited by speed of light in a vacuum only

Closing Comments

- Global expansion continues
- Consolidation continues
- Technology race accelerating