

High Speed Networking and the race to zero

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Agenda

- Who We Are
- Global Financial Industry
- Bandwidth Trends in the Financial Industry
- Latency in the Financial Community
- Data center network considerations
- Data center location considerations
- Conclusion

NYSE Euronext

- NYSE Euronext (NYX) operates the world's leading and most liquid exchange group, and seeks to provide the highest levels of quality, customer choice and innovation.
- Global Cash Equities - Exchanges in five countries
 - NYSE
 - Euronext Paris
 - Euronext Lisbon
 - AMEX
 - Euronext Brussels
 - Euronext Amsterdam
 - Alternext
- Global Derivatives
 - NYSE ARCA
 - Liffe Paris
 - Liffe Lisbon
 - Liffe London
 - AMEX
 - Liffe Brussels
 - Liffe Amsterdam
- Operate Software and technology services
 - Secure Financial Transaction Infrastructure (SFTI)
 - Wombat
 - TransactTools

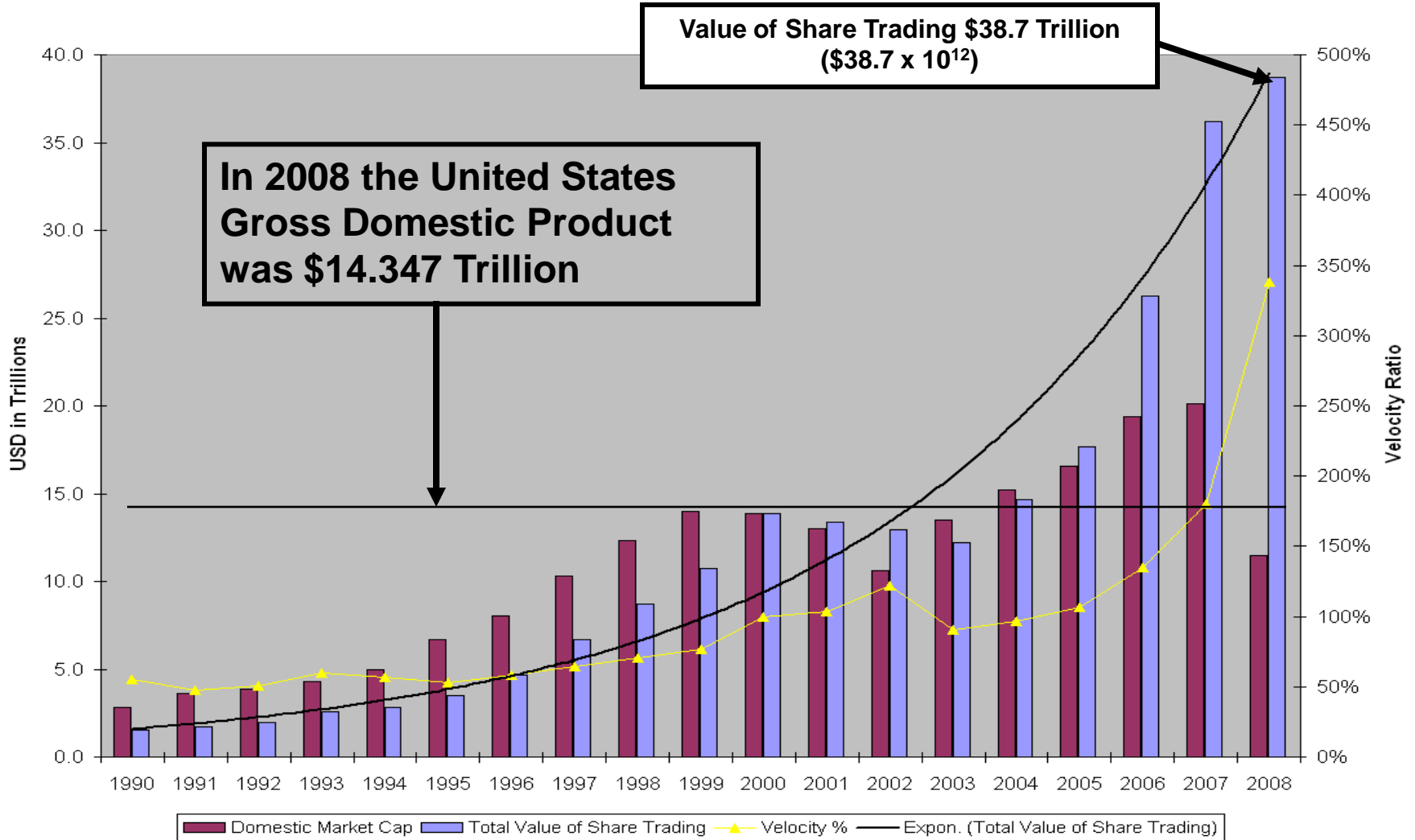
NYSE Euronext

- NYSE Euronext has over 3,497 listed companies with a combined market capitalization of \$12.0 trillion dollars as of June 2009.
- NYSE Euronext's equity exchanges transact an average daily trading value of approximately \$154 billion (as of Dec. 31, 2008), which represents more than one-third of the world's cash equities trading.
- NYSE Euronext is part of the S&P 500 index and the only exchange operator in the S&P 100 index.

Global Financial Industry

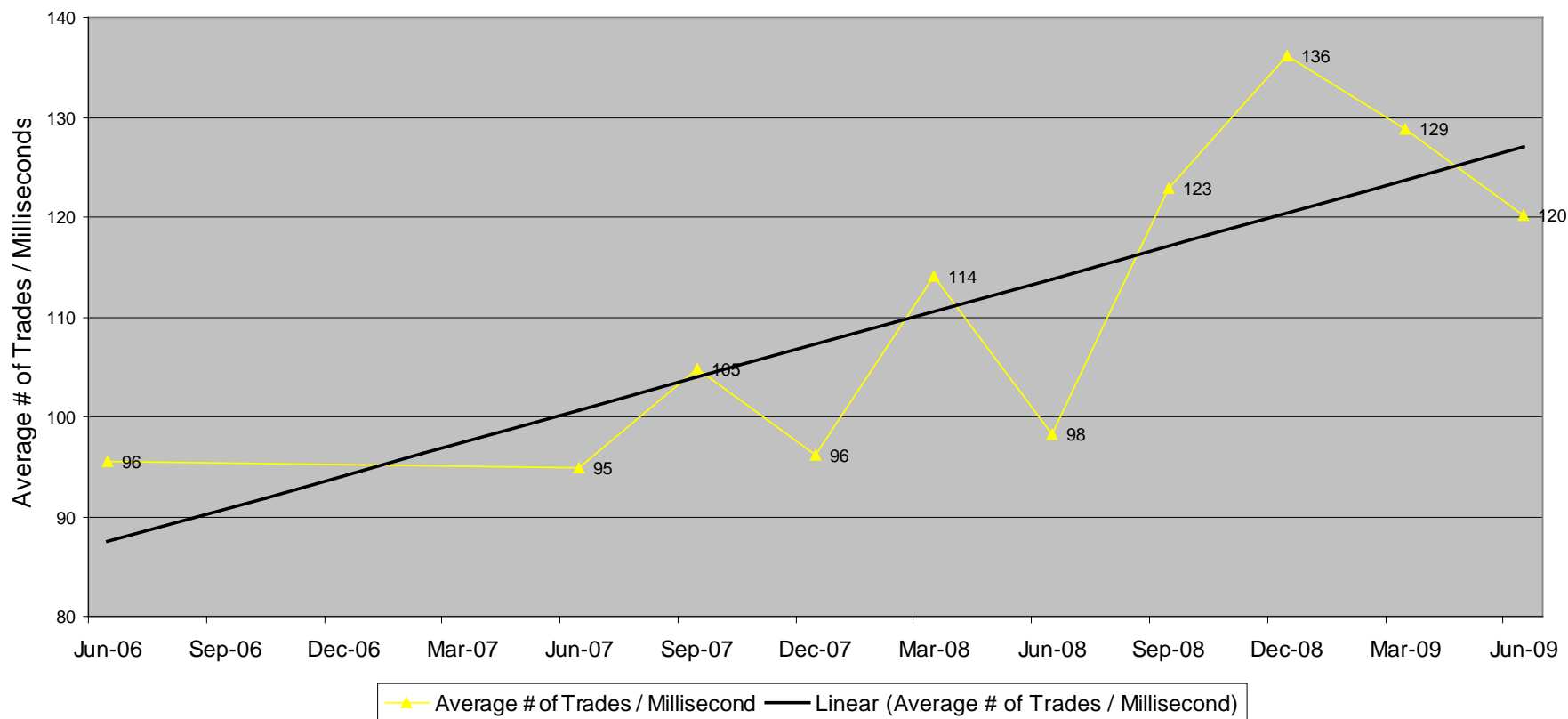
- Increasing Customer Access Choices up to 10GbE
- Expansion and Trading Globally
- Increased Sensitivity to Latency & Speed
- Data Volume Increasing
- Bandwidth Requirements Expanding
- Growing Global Alliances

Market Capitalization and Value of Share Trading



Trade Trends

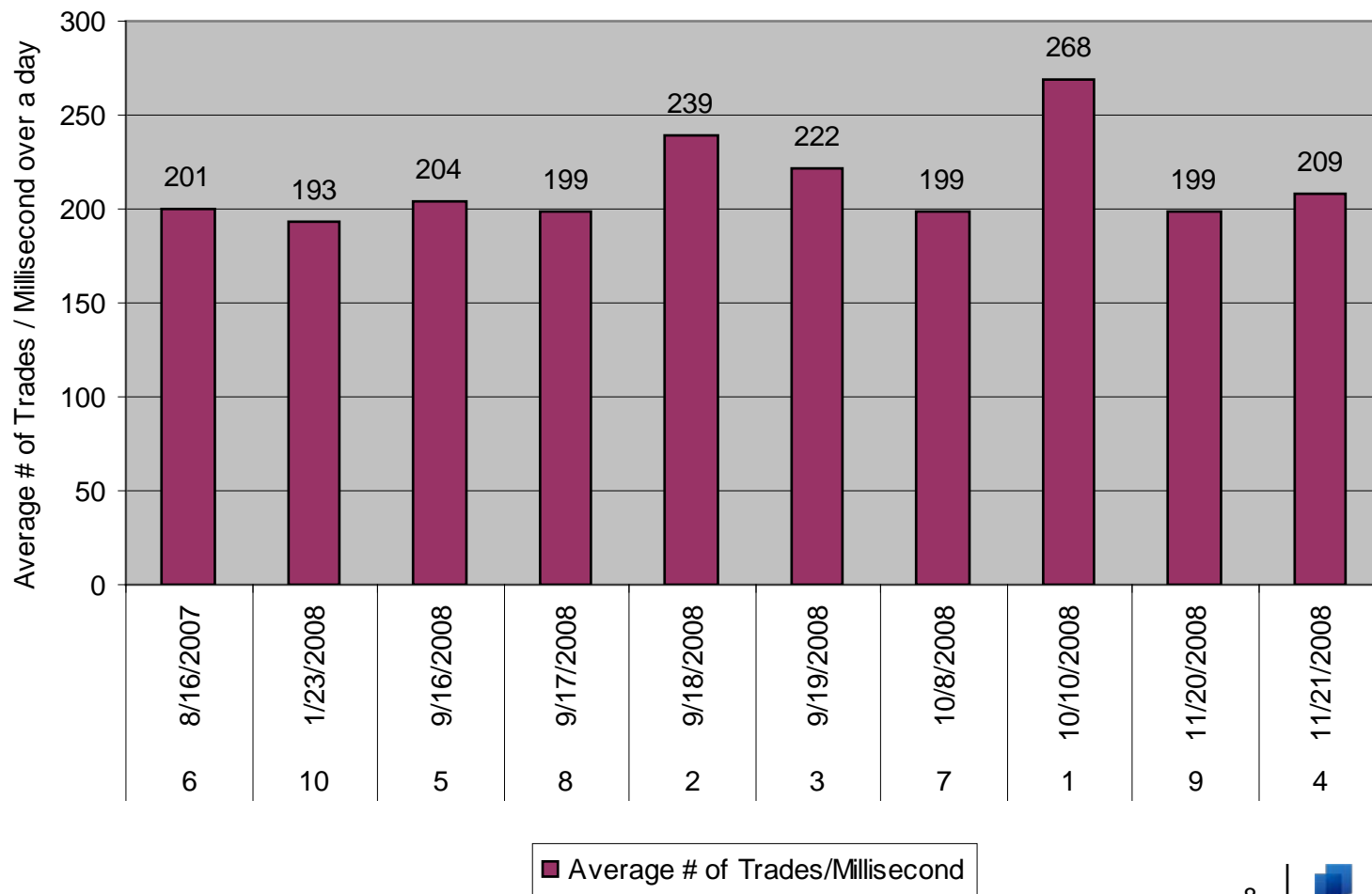
Average Issues Traded / Millisecond over a Quarter



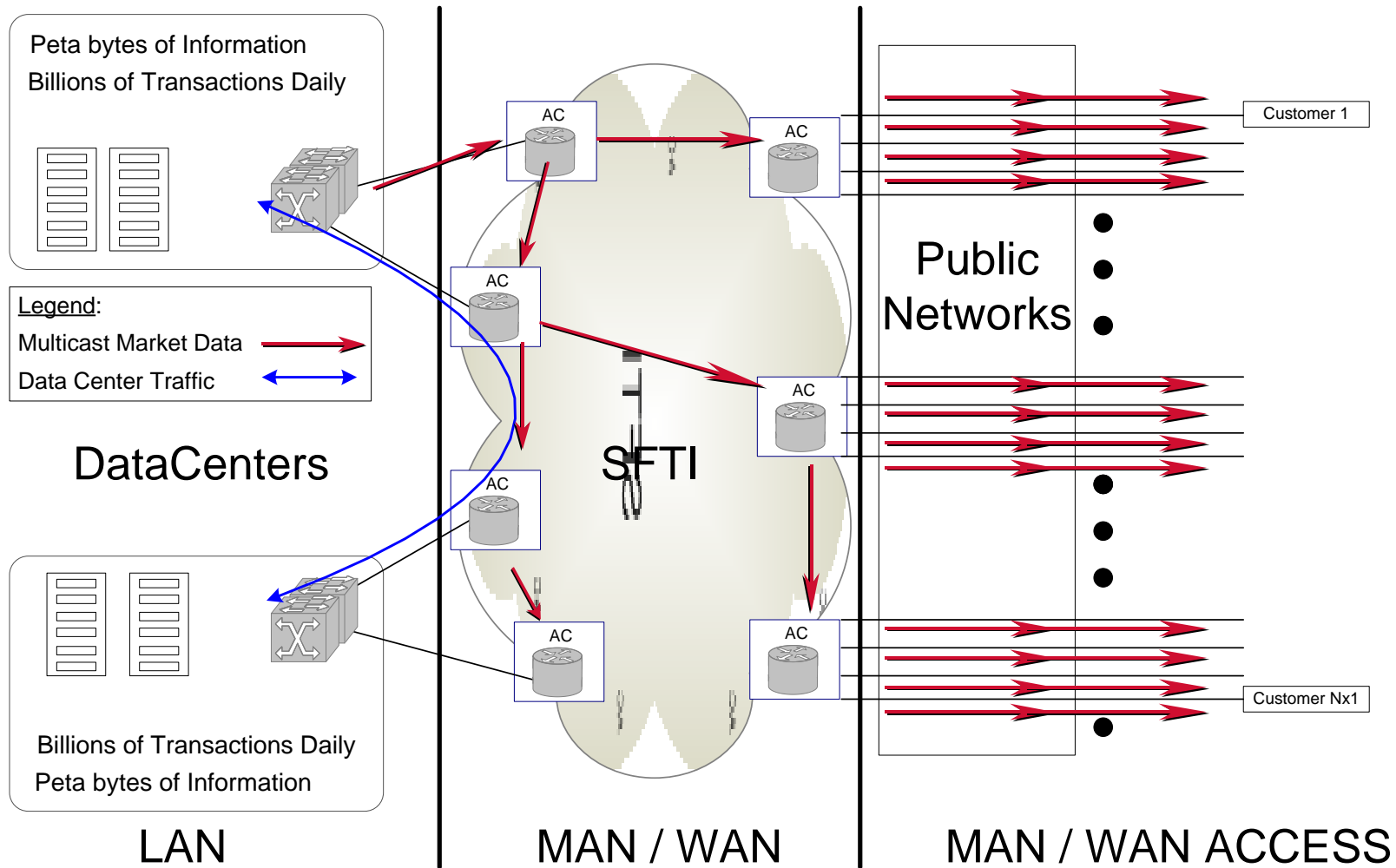
Includes volume executed on the NYSE, NYSE Arca, and NYSE Alternext (AMEX) in all

Trade Trends – Top 10 Days NYSE Group

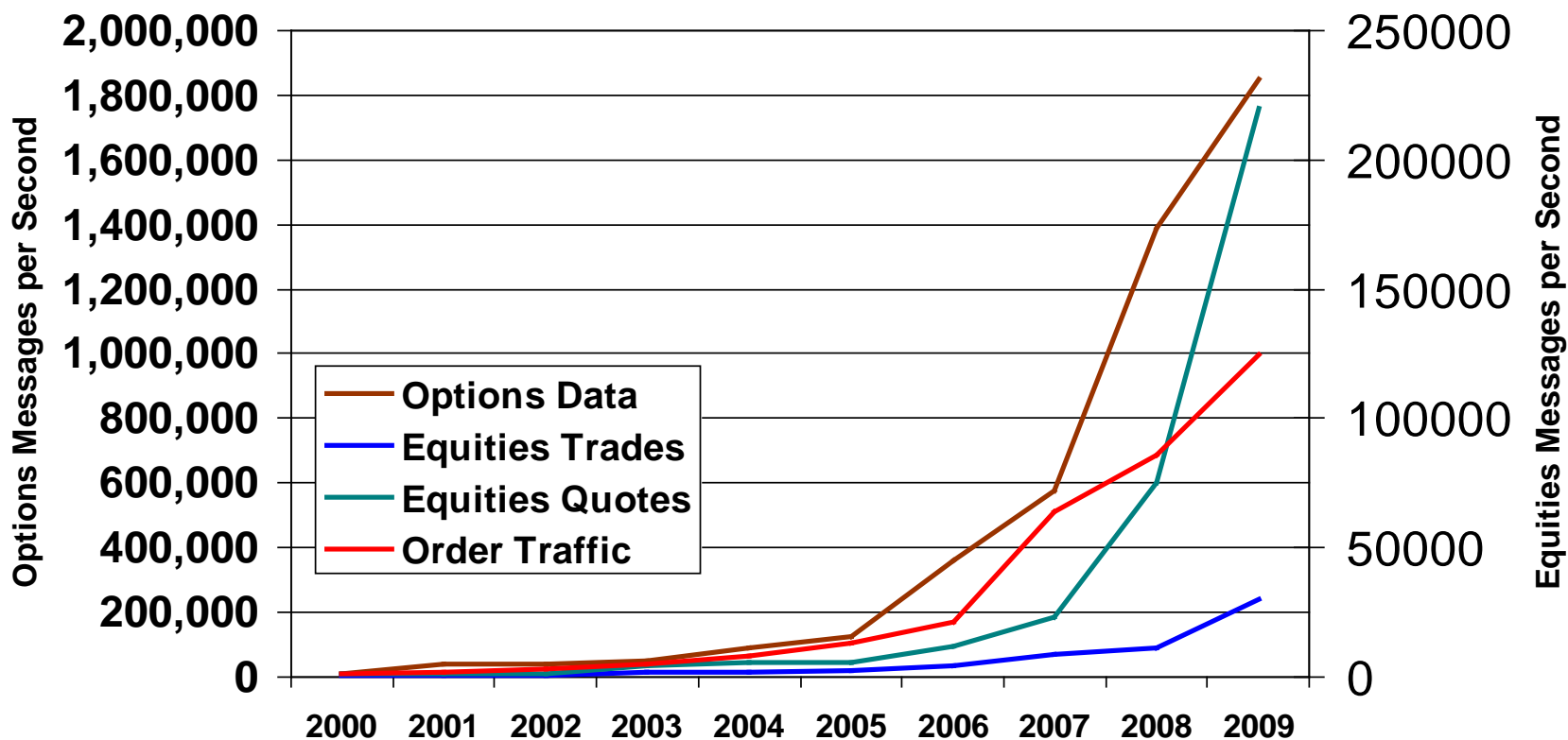
Top 10 NYSE Group Volume Days



NYSE Euronext Architecture

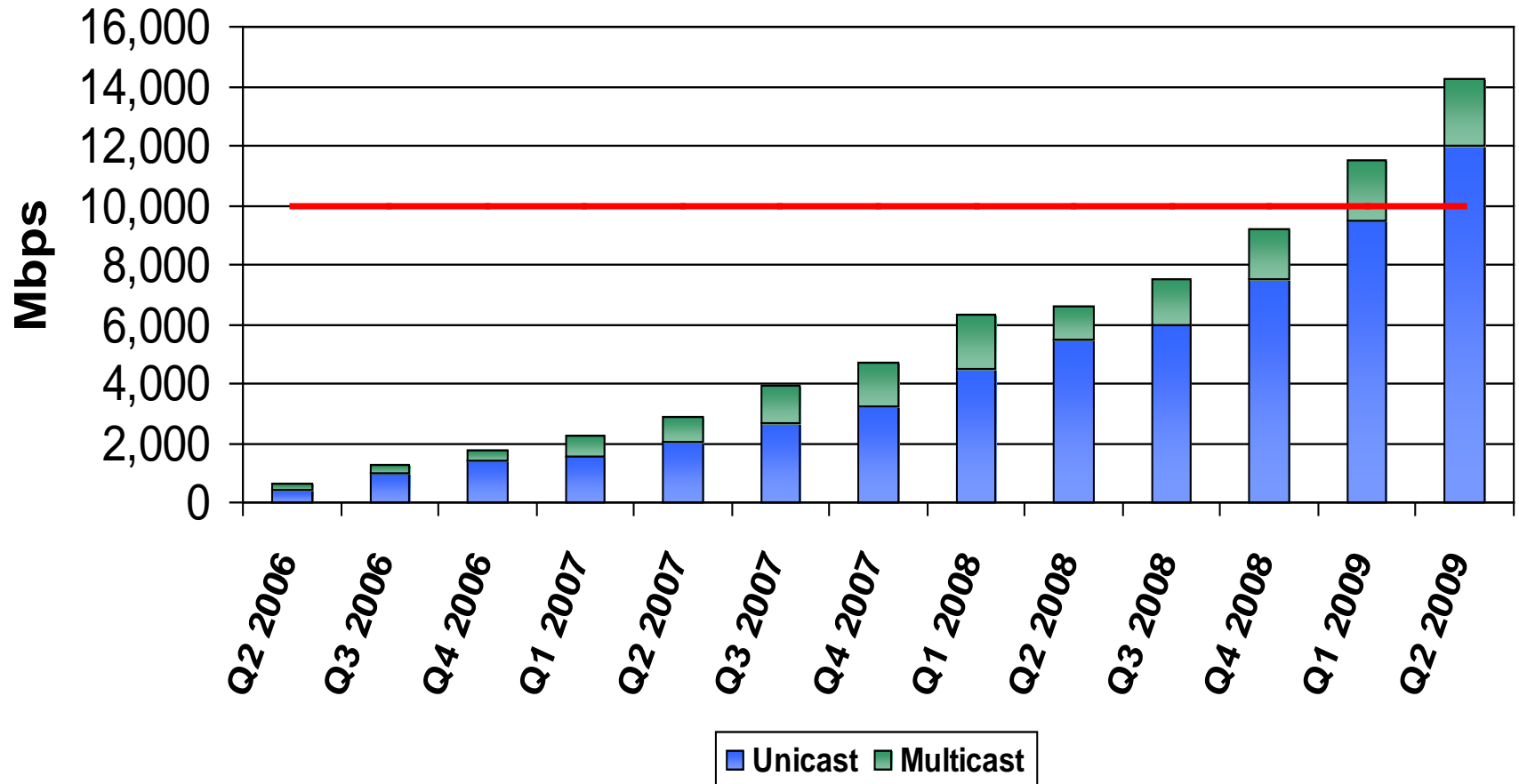


Increasing Market Data Rates

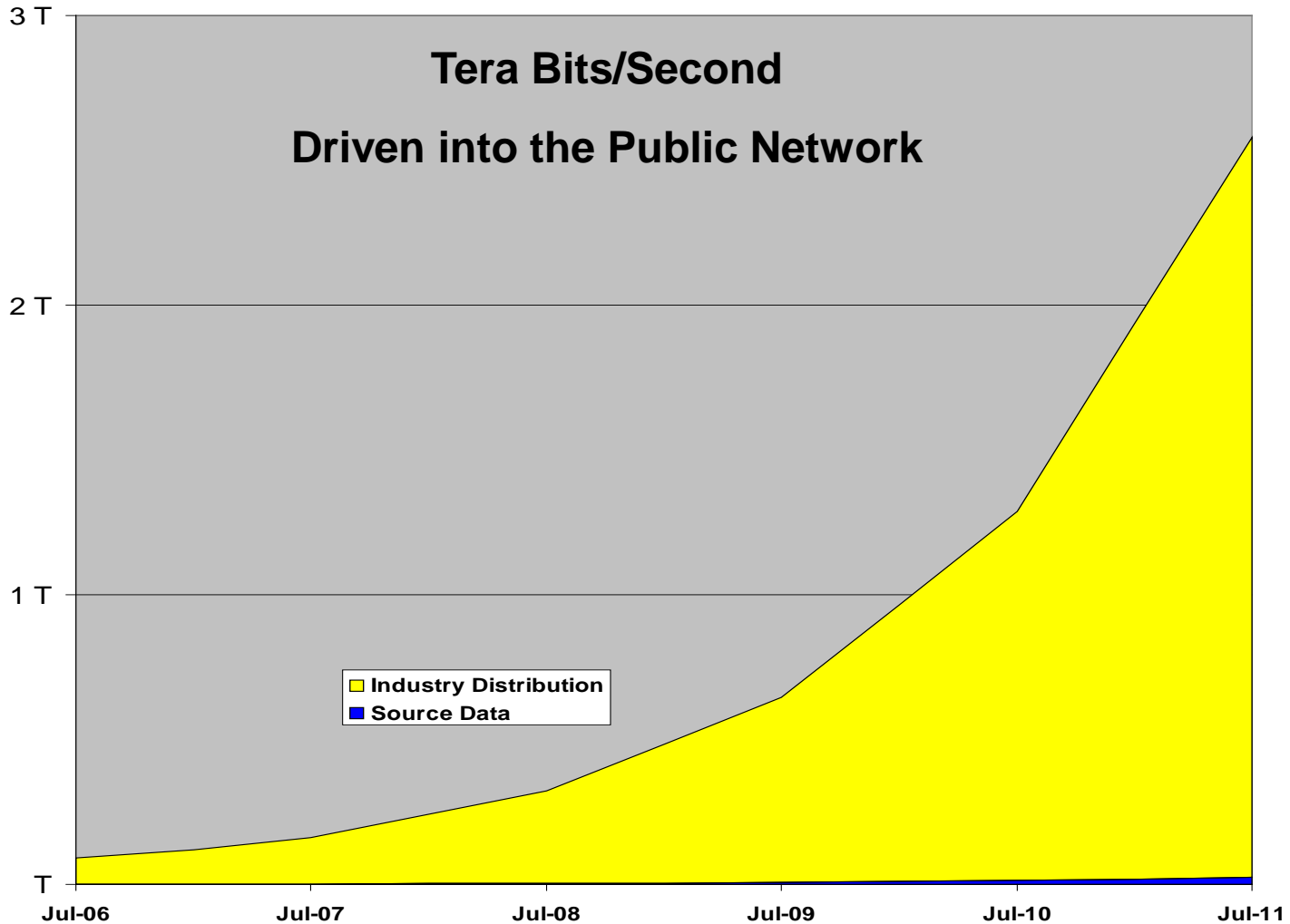


Message rates based capacity allocated

SFTI Wide Area Bandwidth Growth



Bandwidth Distributed to the Financial Community



Latency requirements

- 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

Drive to Zero Latency

- Clients must have the latest technology to compete in the ultra low latency high frequency trading market
- Ten milliseconds of latency could potentially result in a 10% drop in revenues for a firm *
- Saving 5 microseconds could cost \$200,000 per year. But for a trading firm, the cost of reducing latency can never be too high *

Requirements for a data center network

- Flat network but not L2
- Sub micro second hop time
- Minimal hops 2 - end of the hierarchical network
- Application assist embedded in the switching fabric
- LAG just will not work
- What is old is new – Welcome back the Clos network
- Support for your customers Co location equipment

How to pick where to place your data center

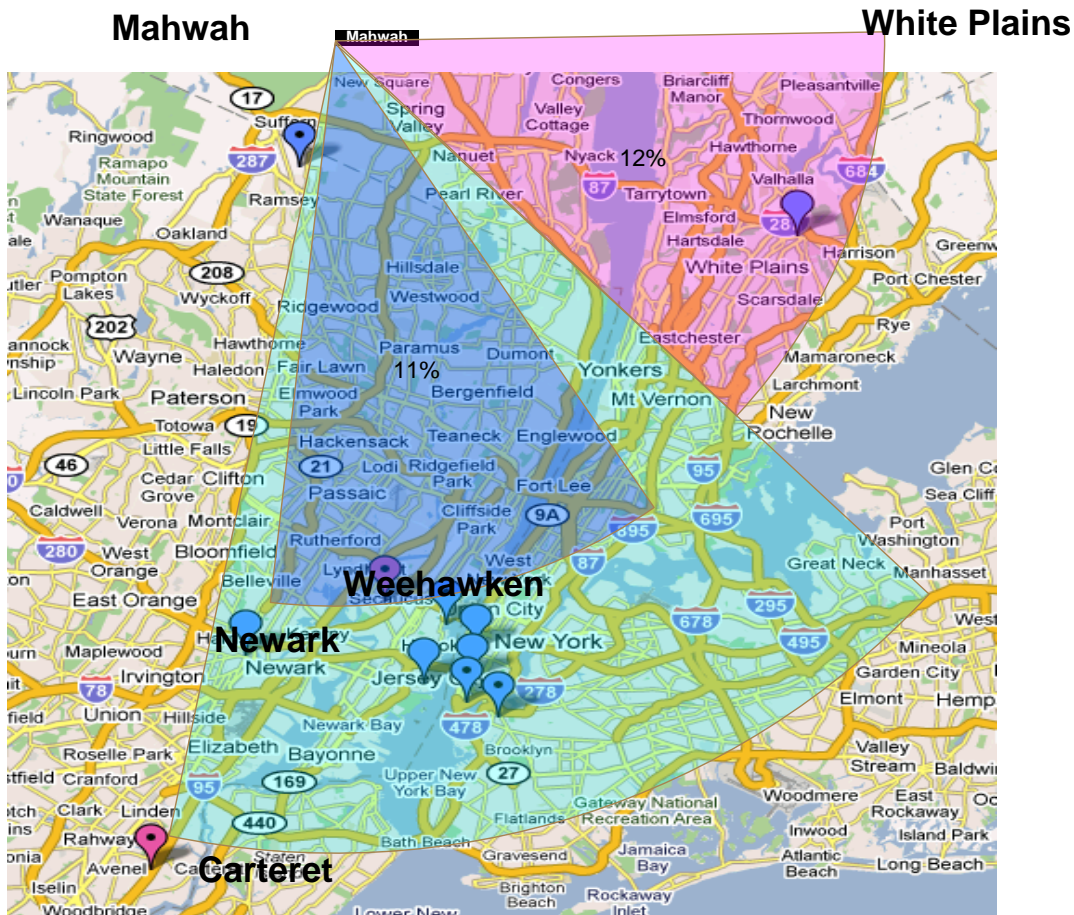
- **Yesterday**

- Low cost power
- Low cost cooling
- Access to carriers
- Easy people access

- **Today**

- Source of abundant power
- High capacity cooling
- Access to dark fiber
- Dark site
- Time to your customers' data center
- Time to your competitors' data center

Speed of Light Latencies From Mahwah

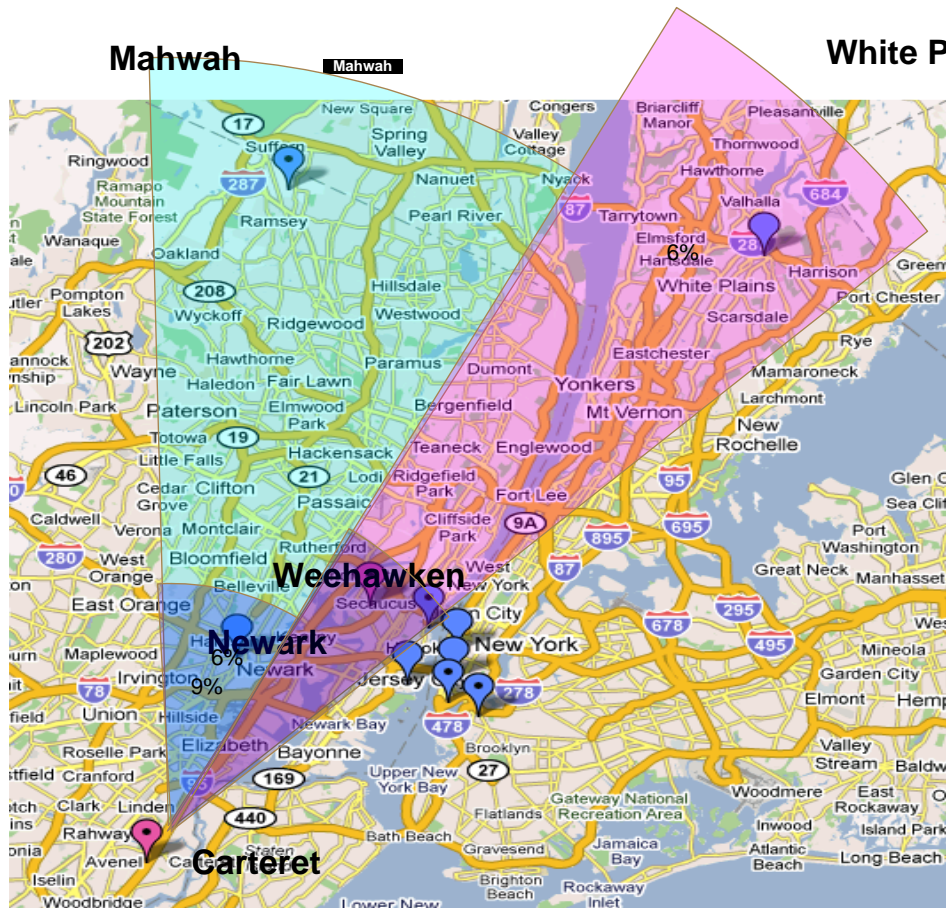


One Way Calculated Latencies

- Mahwah to Newark or Weehawken
140 microseconds
26 line of sight miles
- Mahwah to White Plains
135 microseconds
25 line of sight miles
- Mahwah to Carteret
216 microseconds
40 line of sight miles

Note: All locations are for illustration purposes only and do not reflect actual locations

Speed of Light Latencies From Carteret

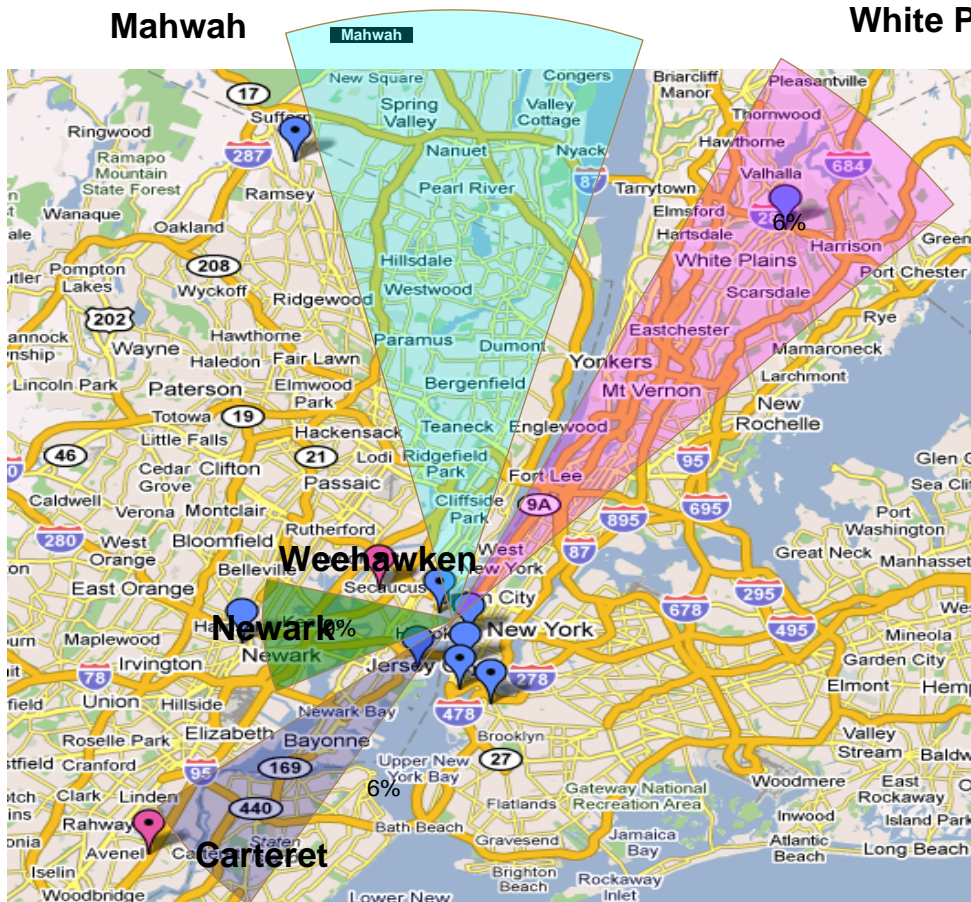


One Way Calculated Latencies

- **Carteret to Newark**
76 microseconds
14 line of sight miles
- **Carteret to Weehawken**
108 microseconds
20 line of sight miles
- **Carteret to White Plains**
259 microseconds
48 line of sight miles
- **Carteret to Mahwah**
216 microseconds
40 line of sight miles

Note: All locations are for illustration purposes only and do not reflect actual locations

Speed of Light Latencies From Weehawken



One Way Calculated Latencies

- Weehawken to Newark
54 microseconds
10 line of site miles
- Weehawken to Carteret
108 microseconds
20 line of site miles
- Weehawken to White Plains
135 microseconds
25 line of site miles
- Weehawken to Mahwah
140 microseconds
26 line of site miles

Note: All locations are for illustration purposes only and do not reflect actual locations

Closing comments

- Bandwidth demands continue to grow
- Latency is key to the business
- Data center location needs to be optimized for latency
- New generation of network is needed to keep up