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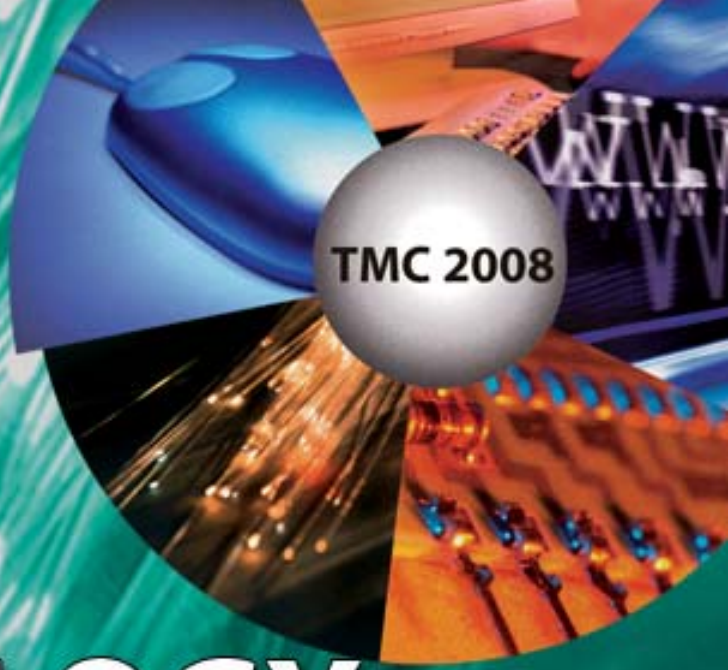


2008 TECHNOLOGY MANAGEMENT CONFERENCE & EXHIBIT

JUNE 10-12, 2008 | HILTON NEW YORK

Capacity Growth- Evidence, Warnings and Alternatives

Panelists:

Michael H. Boston, *Principal*
Trade Support Group Operations Manager Securities
Bank of America

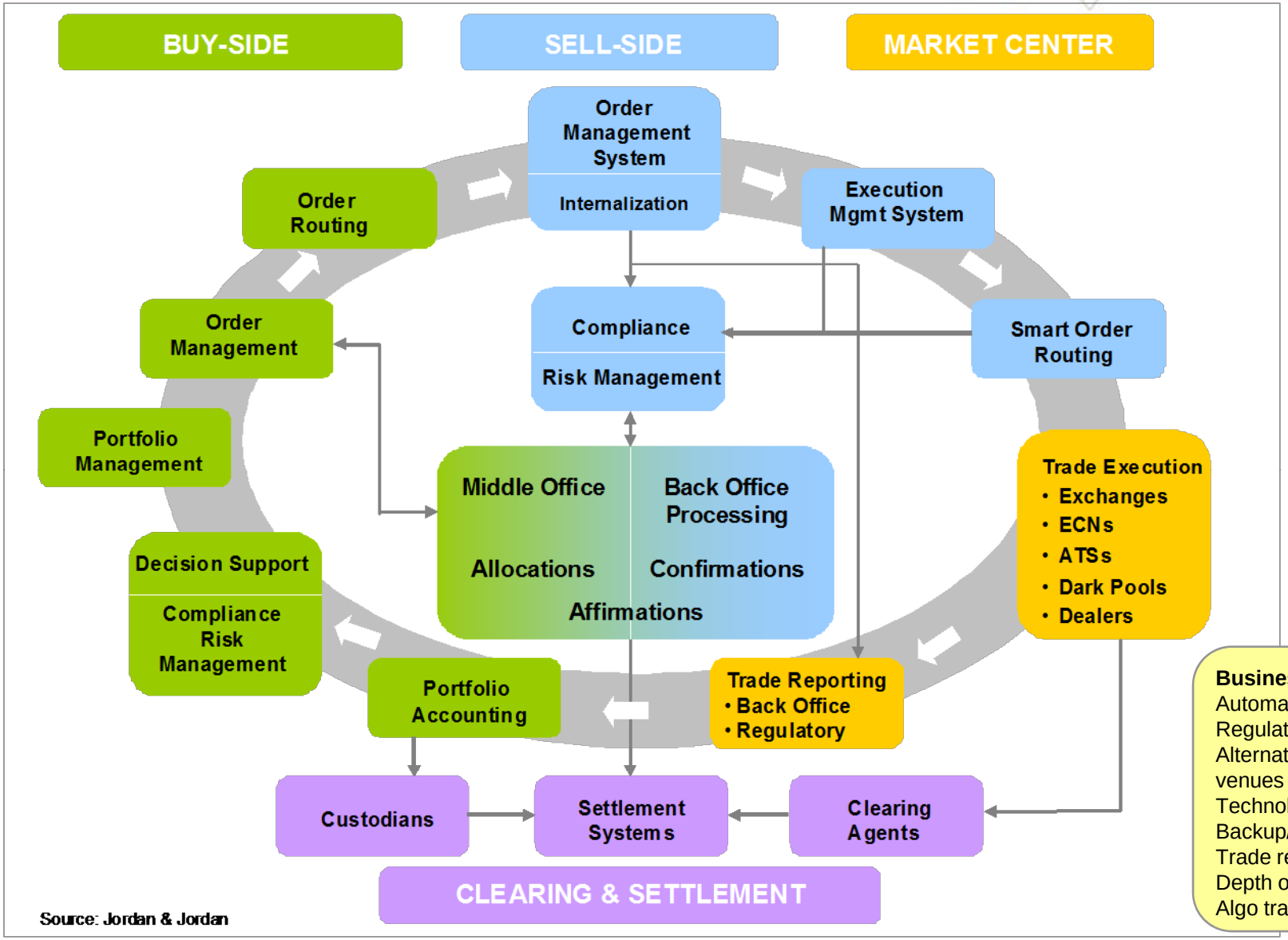
Jacob Granek, *Managing Director*
Depository Trust & Clearing Corporation

Thomas J. Jordan, *President & CEO*
Jordan & Jordan

Panel Agenda

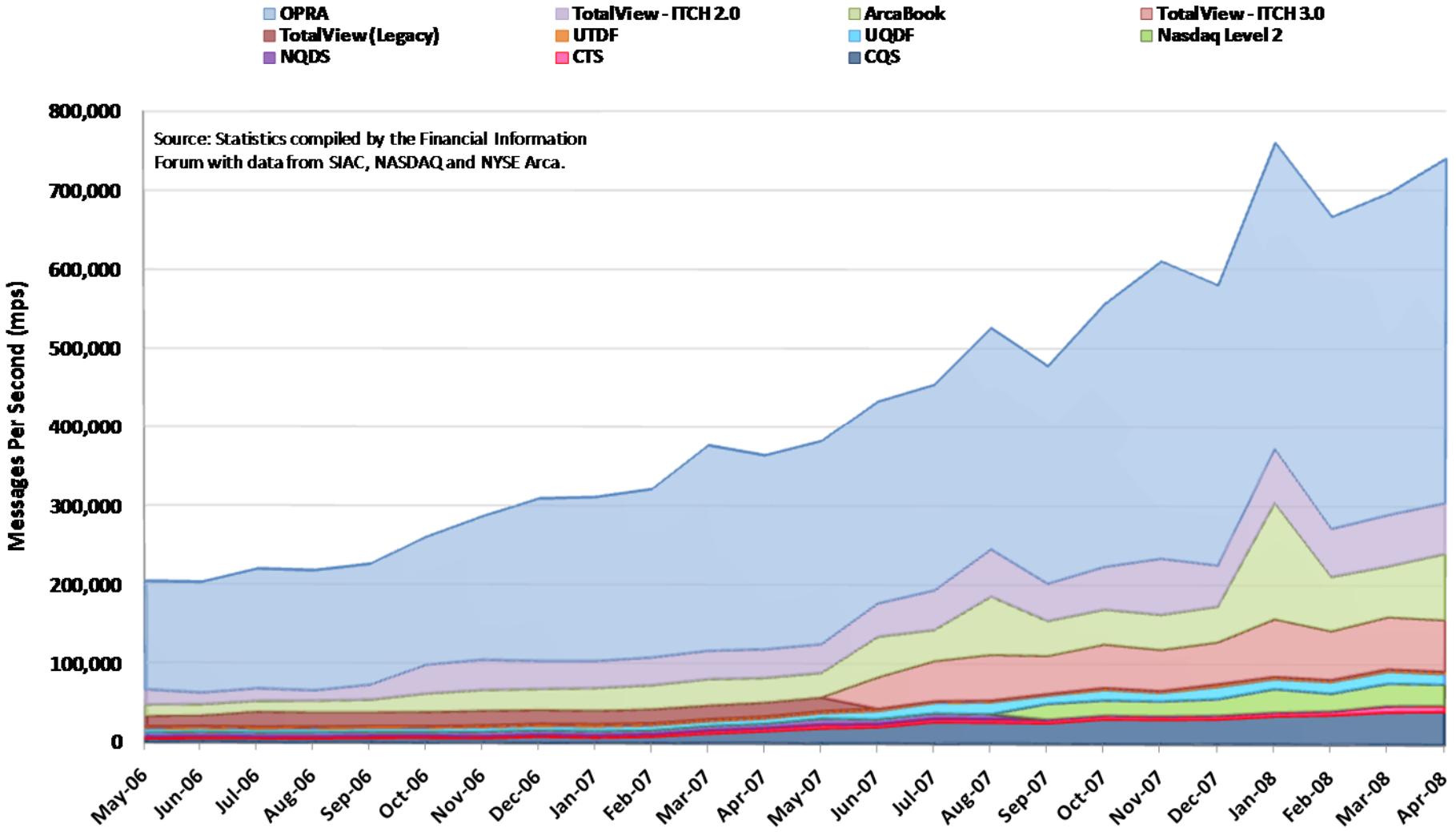
- Understand current capacity needs in front and back office
- Use data and disciplined approach to measuring risk of capacity shortfall
- Discuss potential alternatives for handling capacity

US Securities Trade Flow

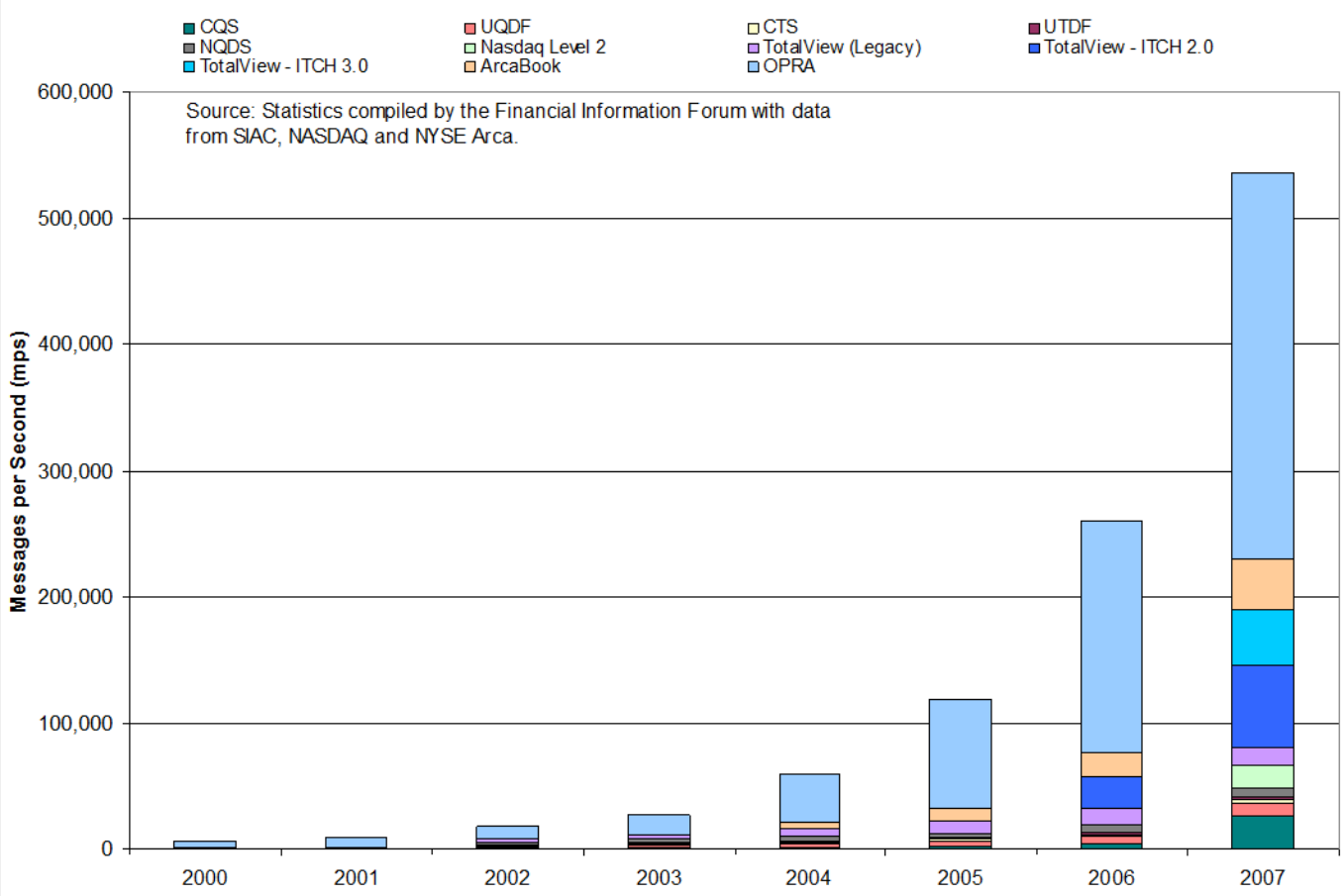


Business Drivers:
Automated trading
Regulation
Alternative trading venues
Technology
Backup/DR sites
Trade reporting
Depth of book
Algo trading

Consolidated Options & Equities 5 Second Peak Rates



Consolidated Options & Equities 1 Minute Peak Rates More Than Doubled in 2007; Equities Alone Tripled



Combined Options & Equities

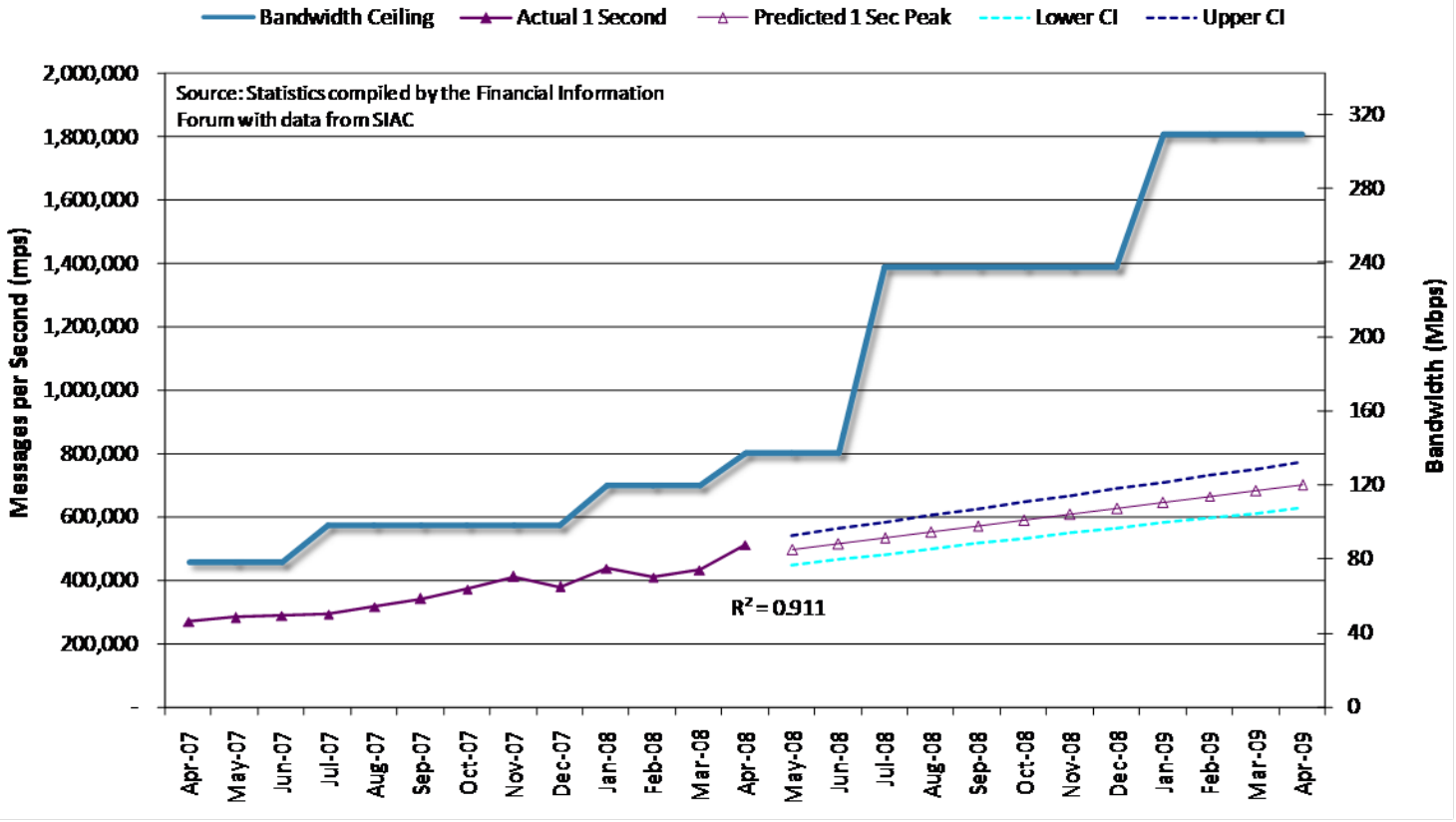
Year	1 Min Peak Total	% Change
2000	7,086	
2001	8,564	21%
2002	18,489	116%
2003	26,647	44%
2004	60,072	125%
2005	118,872	98%
2006	260,269	119%
2007	535,105	106%

Combined Equities Only

Year	1 Minute Peaks	% Change
2000	1,252	
2001	1,546	23%
2002	8,398	443%
2003	10,948	30%
2004	21,813	99%
2005	32,533	49%
2006	77,313	138%
2007	229,067	196%

Note: 2007 statistics reflect the addition of new Nasdaq feeds: Nasdaq Level 2, TotalView – ITCH 2.0, and TotalView – ITCH 3.0.

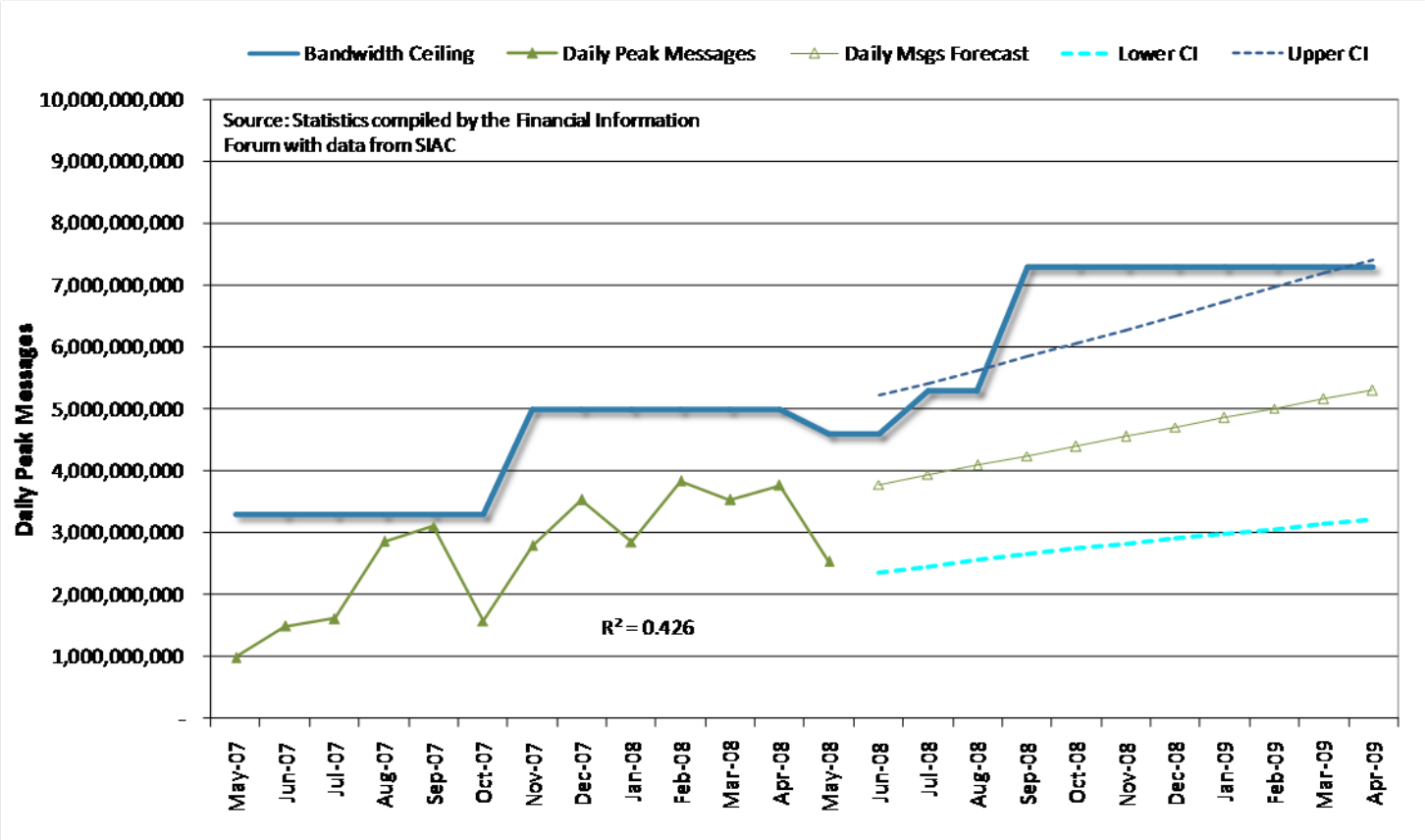
Projection Based on OPRA 1 Sec Peak Rates FAST feed



Actual 1 Sec Peak	
May-07	282,304
Jun-07	288,098
Jul-07	292,522
Aug-07	315,442
Sep-07	340,244
Oct-07	371,567
Nov-07	411,838
Dec-07	378,151
Jan-08	436,973
Feb-08	408,867
Mar-08	432,328
Apr-08	511,186
Predicted 1 Sec Peak	
May-08	*494,464*
Jun-08	*513,598*
Jul-08	*532,115*
Aug-08	*551,249*
Sep-08	*570,383*
Oct-08	*588,900*
Nov-08	*608,034*
Dec-08	*626,550*
Jan-09	*645,684*
Feb-09	*664,818*
Mar-09	*682,100*
Apr-09	*701,234*

- While a good fit to historical data, OPRA ceilings indicate that the impact of automated equity trading and other market events is driving bandwidth requirements
- Current OPRA Ceiling: 801,000 mps (137 Mbps); Jul 2008: 1,387,000 mps (237.2 Mbps); Jan 2009: 1,807,000 mps (309 Mbps)
- The ASCII network for Equity & Index Options was terminated on April 21, 2008. Going forward the Equity & Index Options service will only be available on the FAST network.

Projection Based on OPRA Daily Peak Messages Rates

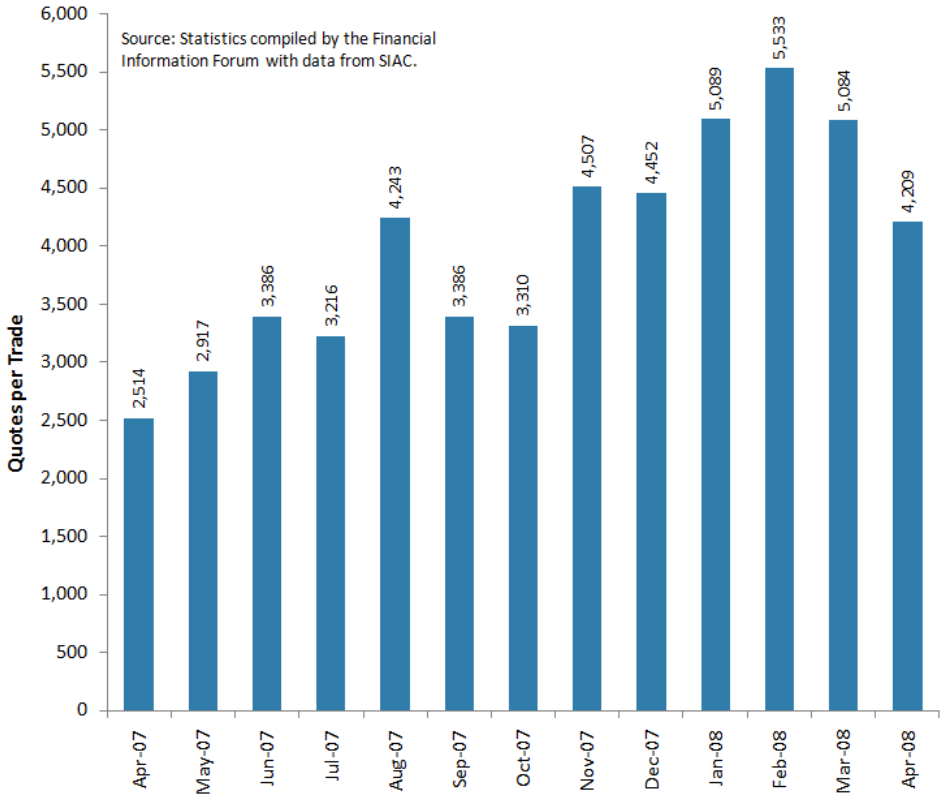


Actual Daily Peak Msgs	
May-07	1,493,095,563
Jun-07	1,615,453,188
Jul-07	2,861,633,652
Aug-07	3,106,080,620
Sep-07	1,577,267,799
Oct-07	2,790,727,810
Nov-07	3,535,933,017
Dec-07	2,853,687,989
Jan-08	3,842,725,036
Feb-08	3,534,764,467
Mar-08	3,769,148,978
Apr-08	2,534,062,124
Predicted Daily Peak Msgs	
May-08	*3,784,234,162*
Jun-08	*3,939,707,653*
Jul-08	*4,090,165,870*
Aug-08	*4,245,639,361*
Sep-08	*4,401,112,852*
Oct-08	*4,551,571,069*
Nov-08	*4,707,044,560*
Dec-08	*4,857,502,777*
Jan-09	*5,012,976,268*
Feb-09	*5,168,449,759*
Mar-09	*5,308,877,428*
Apr-09	*5,464,350,919*

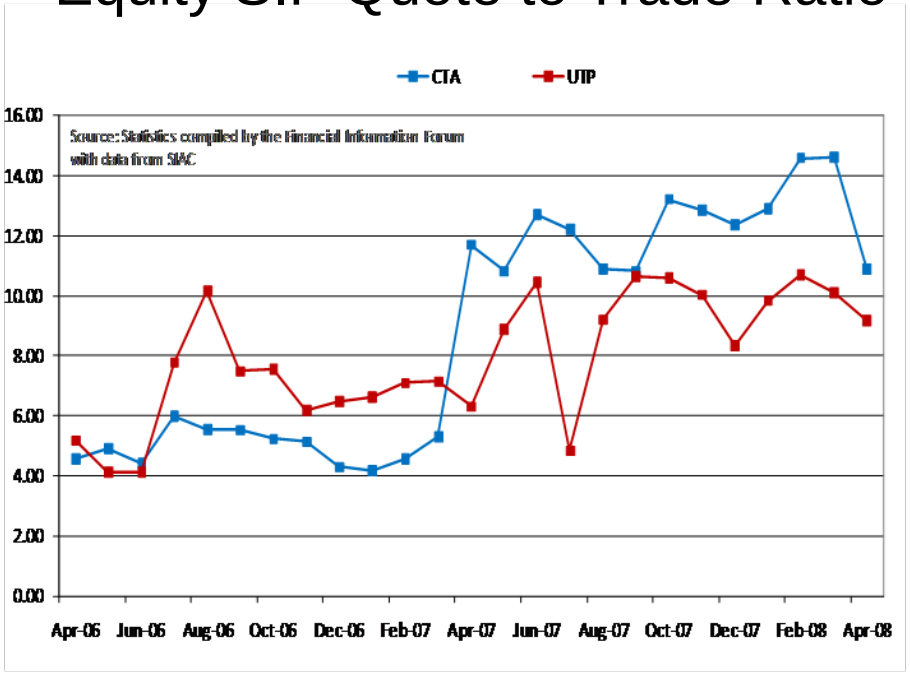
- While a good fit to historical data, OPRA ceilings indicate that the impact of automated equity trading and other market events is driving bandwidth requirements.
- Current OPRA Ceiling: 5.3 billion total messages per day; Jul 2008: 7.3 billion total messages per day; Jan 2009: 9.7 billion total messages per day

Quote to Trade Ratio

OPRA Quote to Trade Ratio

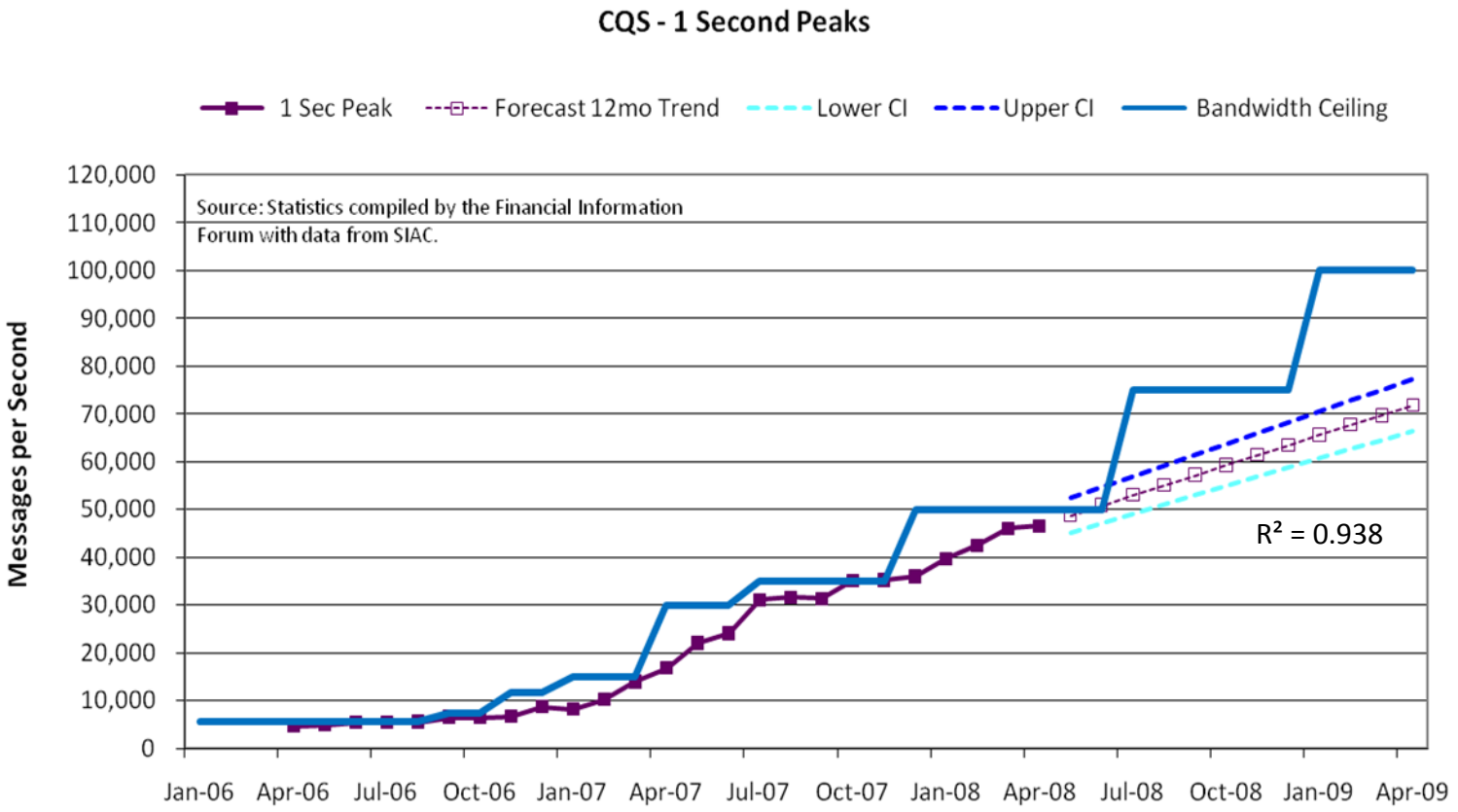


Equity SIP Quote to Trade Ratio



- OPRA Peak Quote to trade Ratio 4,800:1
- CTA Quote to Trade Ratio averaged 12:1
- UTP Quote to Trade Ratio averaged 9:1
- Cancel to Order Ratio for equities estimated at 90%

Automated Equity Trading Impact: CQS 1 Second Peak Forecasts

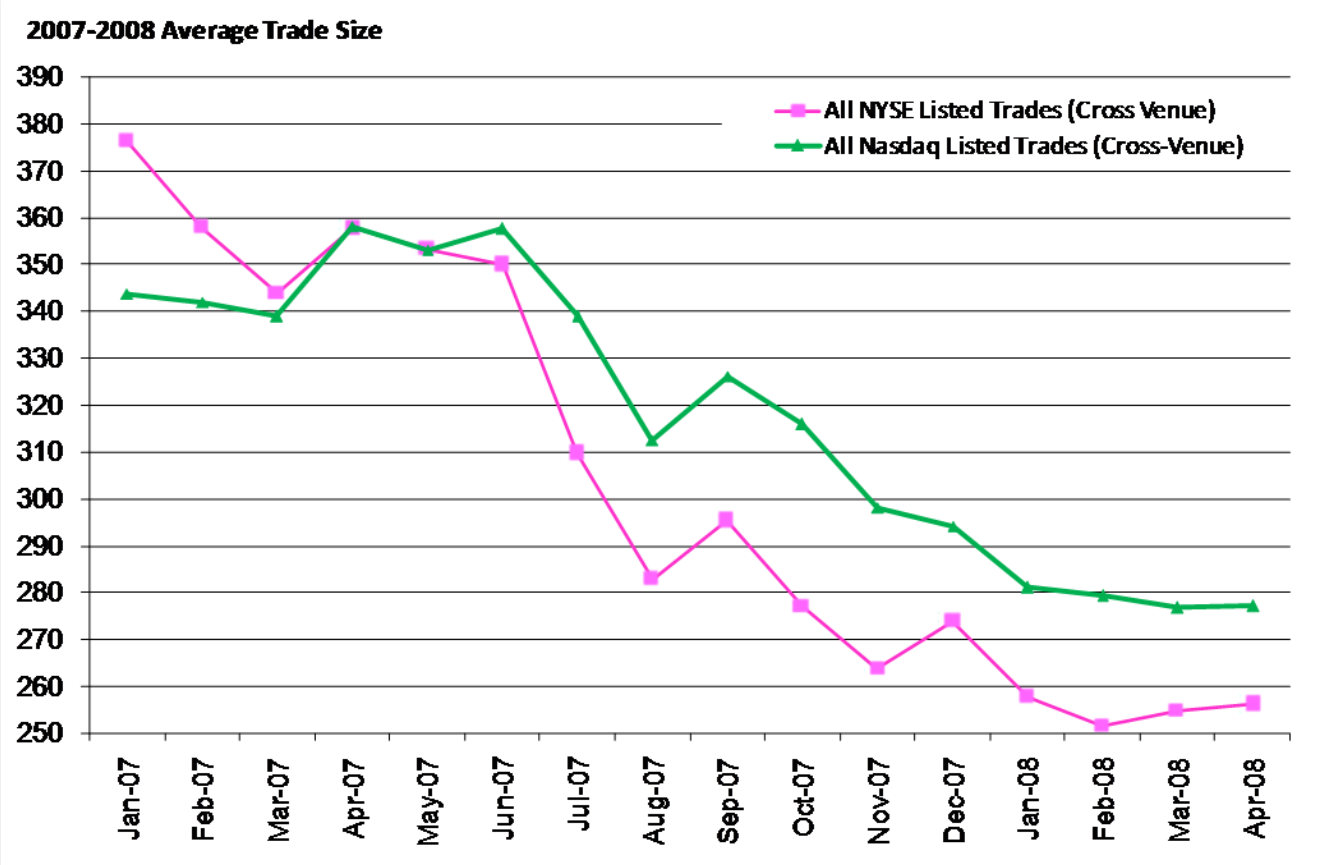


Actual 1 Second Peak	
May-07	22,013
Jun-07	24,049
Jul-07	31,051
Aug-07	31,586
Sep-07	31,398
Oct-07	35,113
Nov-07	35,241
Dec-07	36,055
Jan-08	39,734
Feb-08	42,460
Mar-08	46,048
Apr-08	46,540
Predicted 1 Second Peak	
May-08	*48,735*
Jun-08	*50,873*
Jul-08	*52,941*
Aug-08	*55,078*
Sep-08	*57,216*
Oct-08	*59,284*
Nov-08	*61,421*
Dec-08	*63,490*
Jan-09	*65,627*
Feb-09	*67,764*
Mar-09	*69,695*
Apr-09	*71,832*

- In the past 12 months, CQS 1 Second peak has more than doubled.
- CQS April 1 Second Peak was within 7% of the 50,000 mps bandwidth ceiling.
- Forecasts since Jan08 have been within 5% of the Apr08 peak.
- CQS Ceilings - Currently: 50,000 mps; July 2008: 75,000 mps; Jan 2009: 100,000 mps

Average Trade Size

- In Apr 2008, NYSE Listed Average Trade Size was 256 shares; down 28% from Apr 2007
- In Apr 2008, NASDAQ-Listed Average Trade Size was 277 shares; down 23% from Apr 2007

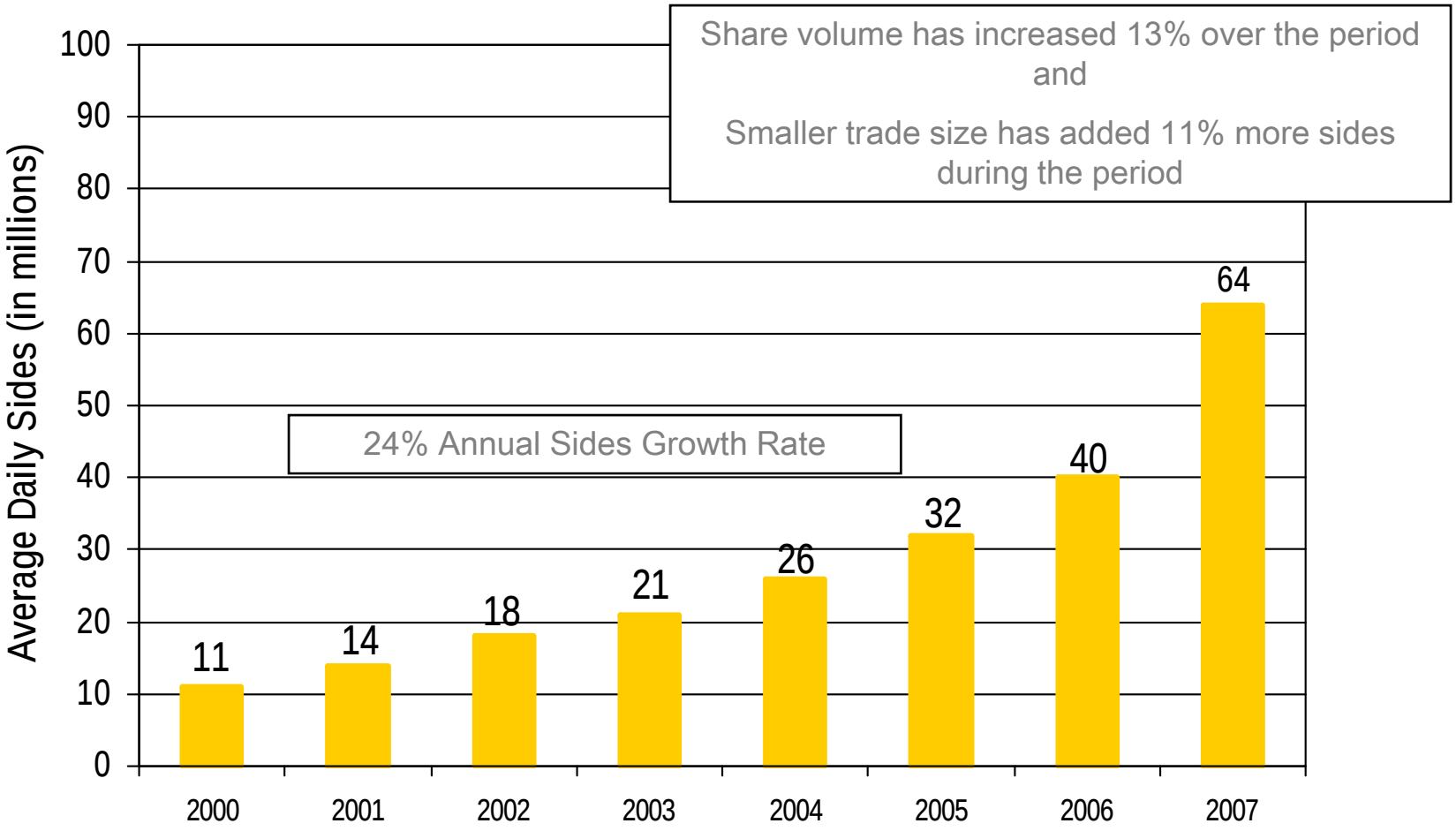


Source: NYSE Data Library at: http://www.nyse.com/marketinfo/datalib/1089312755646.html
NASDAQ Daily Market Statistics at: http://www.nasdaqtrader.com/trader.aspx?id=marketshare

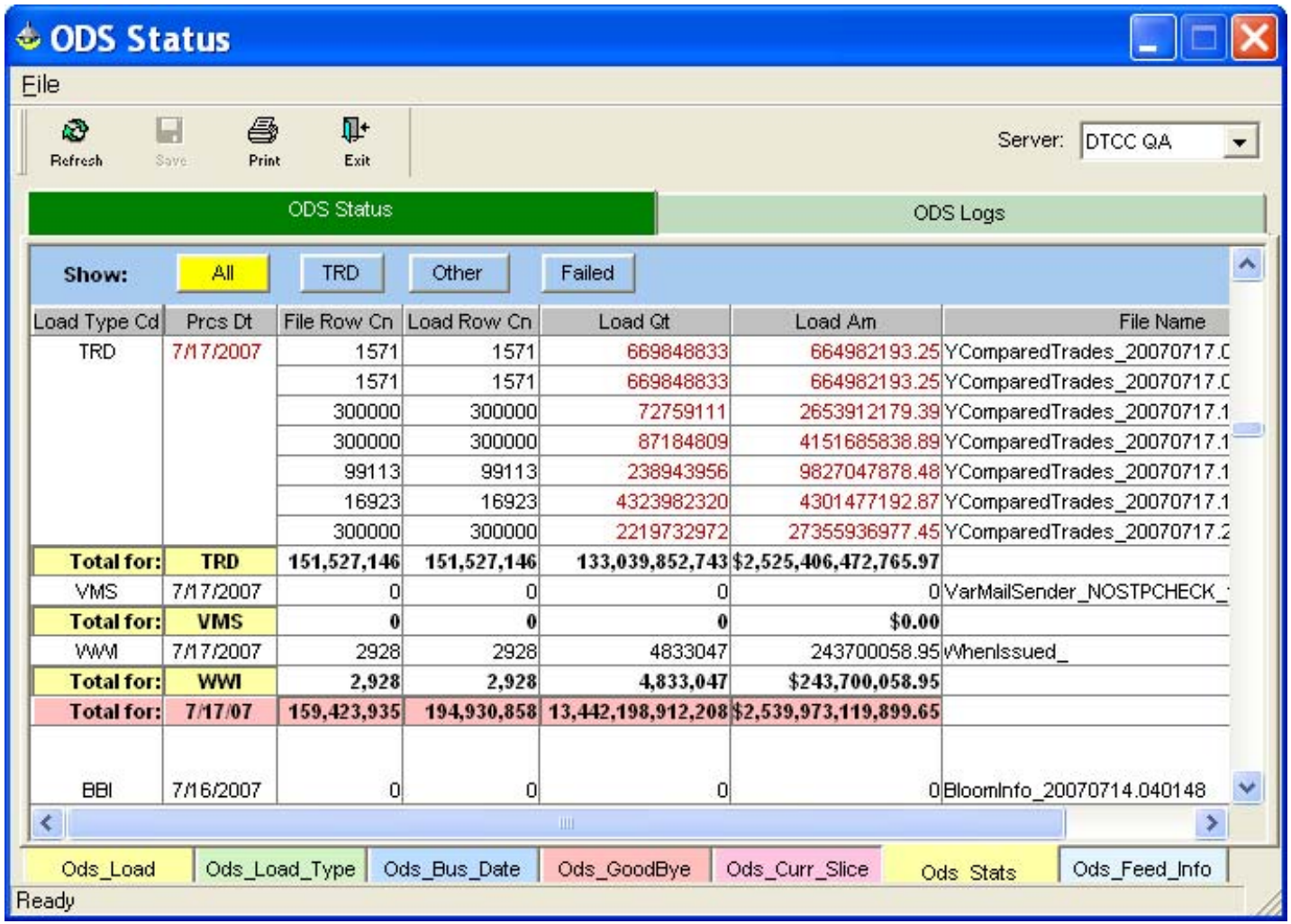
Security Processing Growth

- **DTCC - Equity trade side volume has shown significant year to year expansion**
  - **32 million average daily trade side volume in 2005**
  - **41 million average daily trade side volume in 2006**
  - **65 million average daily trade side volume in 2007**
  - **88 million YTD average daily trade side volume in 2008 (as of Apr 4)**
  - **On January 23, 2008, NSCC processed peak volume of 141 million trade sides**
- **Capacity initiative implemented in July 2007 increased equities clearance and risk management rated capacity from 160 million trade sides per day to 280 million sides per day**
- **2008 corporate goal to reach 450 million side capacity from current 280 million rating**

NSCC Clearing Sides:
Historical Growth Rate 2000 – 2007

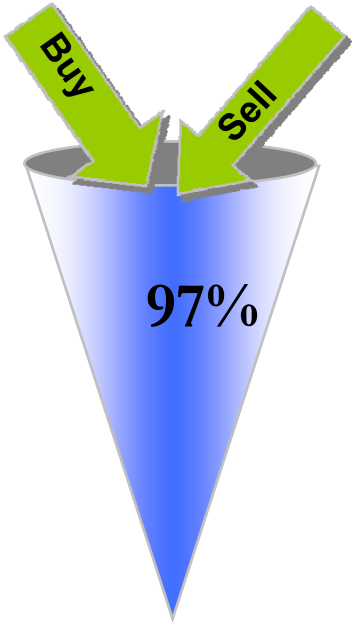
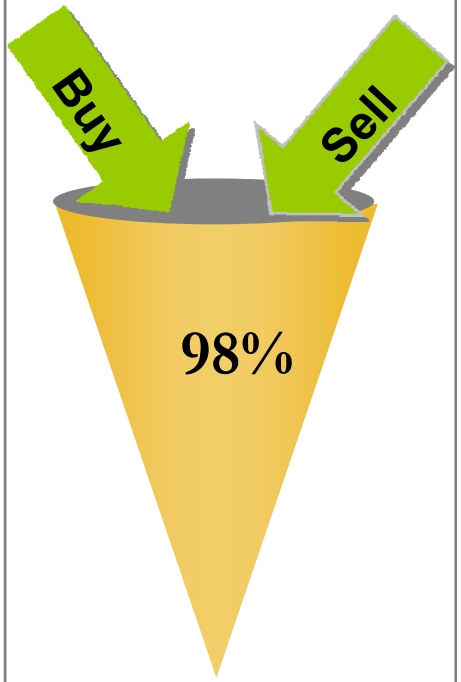
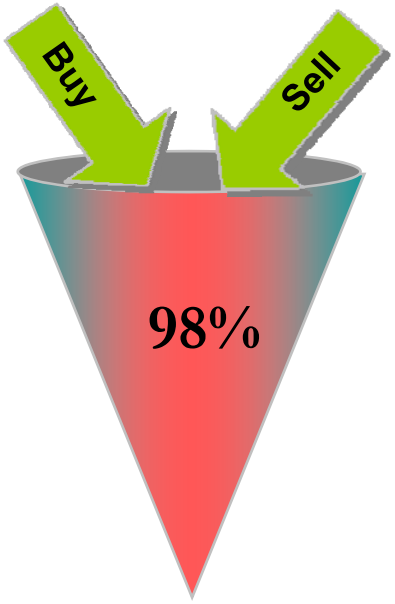
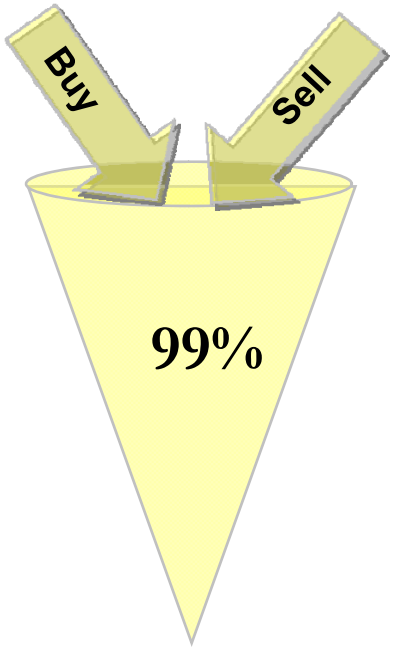


Capacity Testing



NSCC:
Peak Days Netting Factor

$ in billions

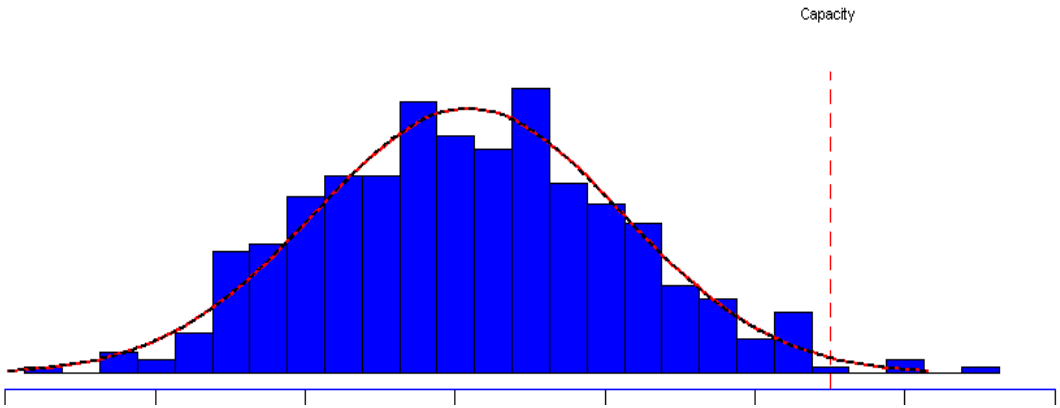
June 6, 2003	May 10, 2004	June 8, 2006	August 16, 2007
$495	$766	$1,021	$2,230
			
97%	98%	98%	99%
$12.5	$14.7	$16.6	$31.1
30.2 million sides	39.6 million sides	62.7 million sides	125.1 million sides

Understanding Processing Capacity

- How many trades can your system successfully process (throughput) in a given day taking trading patterns and batch time into account?
- How to determine process capability
  - Understand your process capacity limits
  - Gather volume data
  - Define your risk tolerance (specification limits)
  - Calculate your probability of failure
  - Track and report your risk

Capacity Limits

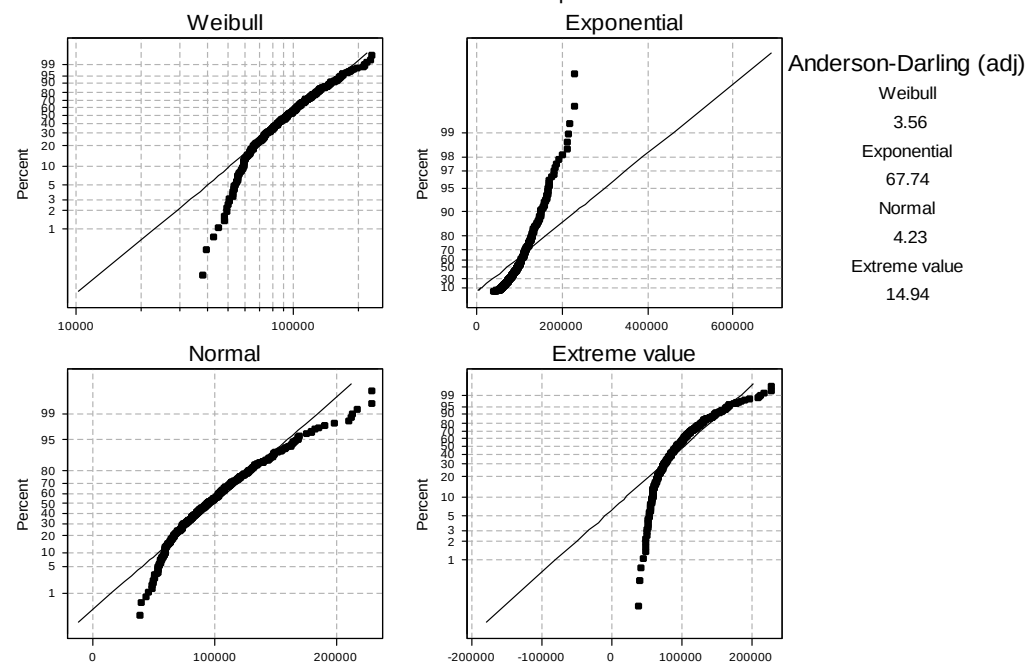
- Create an E2E process flow
- Determine capacity of each system in flow
- Capacity of the process is equal to the capacity of the system with the lowest capacity
- Gather daily volume statistics by process flow (desk)

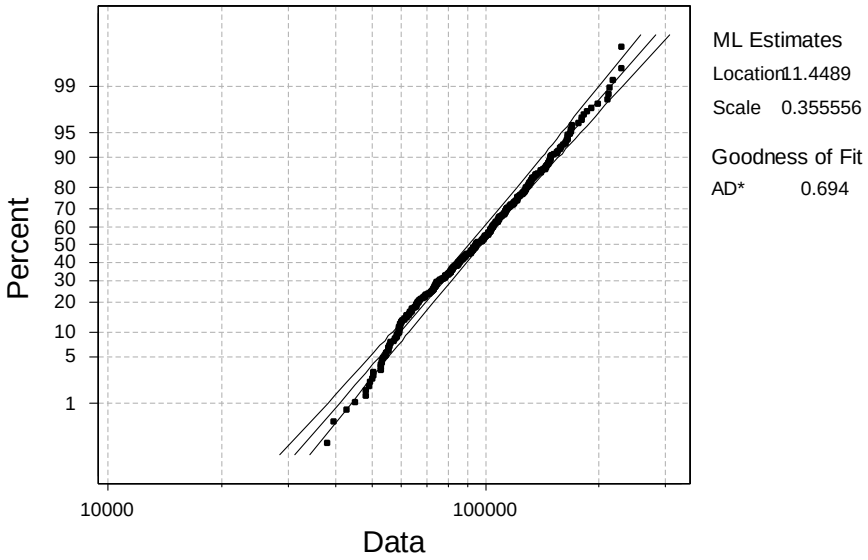


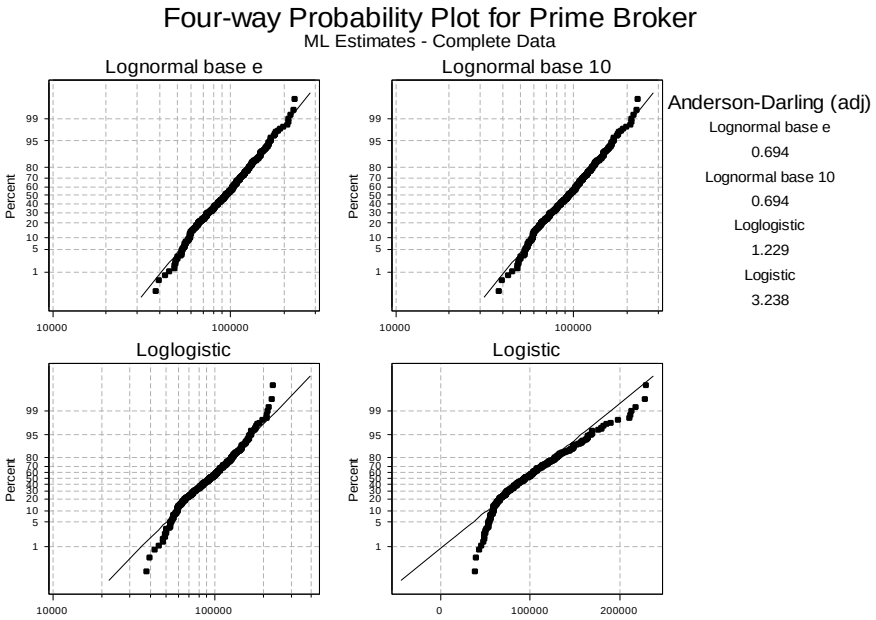
The area to the right of the capacity line represents the probability of failure, i.e. exceeding your capacity.

Risk Tolerance

- Industry Standard
  - Multiplies of Peak
    - Easy to calculate
    - Time tested
- New Point of View
  - Probability of Failure
    - Statistically Significant
    - Identifies hidden risk
  - What probability of failure is acceptable at your firm? 1%, .5%, .05%







Probability Plot for Prime Broker

Cumulative Distribution Function

Lognormal with location = 11.4489 and scale = 0.355556

x	P(X <= x)
3.00E+05	0.9995

Tracking and Reporting Risk

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Previous Week

Normal

LOB	5-Day Average	Capacity	Peak Value (1/3/07 - Present)	Peak Date	Standard Deviation	Z-score	Variance Risk	Chance of Exceeding Capacity	Peak Risk	Ratio: Capacity to Peak	Previous 5-Day Average	% Change
Desk 1	950,000	3,000,000	2,300,000	January 15, 2008	364,620	5.62	Green	0.000001%	Red	1.30	1,067,840	-12%
Desk 2	550,000	4,000,000	1,600,000	January 15, 2008	230,170	14.99	Green	0.000000%	Green	2.50	437,660	20%
Desk 3	1,900,000	12,000,000	5,250,000	January 15, 2008	653,180	15.46	Green	0.000000%	Green	2.29	1,958,770	-3%
Desk 4	3,800,000	16,853,570	8,500,000	August 2, 2007	1,461,630	8.93	Green	0.000000%	Yellow	1.98	3,351,560	12%
Desk 5	40,000	3,000,000	500,000	August 2, 2007	39,780	74.41	Green	0.000000%	Green	6.00	45,540	-14%
5-Day Average Total	7,240,000										6,861,370	5%

Non-normal

LOB	5-Day Average	Capacity	Peak Value (1/3/07 - Present)	Peak Date	Standard Deviation	Probability Plot	Variance Risk	Chance of Exceeding Capacity	Peak Risk	Ratio: Capacity to Peak	Previous 5-Day Average	% Change
Desk 1	950,000	3,000,000	2,300,000	January 15, 2008	364,620	Lognormal (e)	Yellow	0.050000%	Red	1.30	1,067,840	-12%
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5-Day Average Total	7,240,000										6,861,370	5%

Variance Risk Definitions	
Green	Z-score exceeds 3.75, chance of randomly exceeding Capacity is less than .01%
Yellow	Z-score lies between 2.75 and 3.75, chance of exceeding Capacity lies between .3% and .01%.
Red	Z-score is less than 2.75, chance of exceeding Capacity is greater than .3%.

Peak Risk Definitions	
Green	Capacity is equal or greater than 2 times peak volume
Yellow	Capacity is between 1.5 and 2 times peak volume
Red	Capacity is less than 1.5 times peak volume

Strategies to Address Capacity Challenges If Justified

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Network Capacity	Processing Capacity	Storage Capacity
FAST compression ratios around 80%, shrinking some trade messages from their original 241 bytes to a compressed size of 29 bytes. With less bytes to process, compression and decompression latency also improves.	**Multi-core** CPUs increase processing throughput and add flexibility to developers looking to ensure balanced utilization. For example, configuring both cores in a dual core CPU to process multicast group 1 and 2 from OPRA respectively.	**Compress** data stored for regulatory purposes to minimize disk footprint and overall storage costs easing storage management.
Multicast technologies ensure there is only one copy of packet on network branch with subscribers, relieving branches with non-subscribers. Multicast messaging products capable of zero-message loss at rates surpassing million messages per second.	**Specialized processors such as Cell and FPGA.** Cell for parallel processing in High Performance Computing for graphics and floating point intense applications. Field Programmable Gate Arrays accelerate overall processing by executing instructions in a specialized coprocessor. For example, FPGA's that receive and process market data can boost throughput by saving CPU cycles required to move messages through protocol stack to operating system.	**Outsource** regulatory data storage requirements to gain economies of scale. Storage hosting providers provide dynamic storage accommodating peak market volumes. Network data providers provide access to all quotes and trades used by regulators during audits.
InfiniBand provides true fabric architecture that leverages switched, point-to-point channels with data transfers up to 120 Gbps. With support for Remote Direct Memory Access (RDMA), throughput maximized and latency minimized.	**Code Rewrite** of trading and market data applications to utilize concurrency constructs like multi-threading in order to exploit multiple CPU cores. Techniques and tools which promote multi-threading to wider programming audience are key.	**File Virtualization** allows customers to increase storage servers but make them look like a single storage box, simplifying management and increasing the utilization of 'stranded' free space.
Conflation allows data consumers to throttle streaming data rates by suppressing price updates within a specified time interval. Frequently traded instruments producing 1000+ price updates per second can overwhelm subscribers only interested in most recent price on a second-by-second basis.	**Application Process Review** to identify duplicate operations e.g. retiring applications and streamlining processing e.g. netting transactions for processing and expanding at end of cycle.	**Consolidate** trading systems storing similar data to minimize storage requirements.
Partitioning content across multicast groups (e.g. OPRA's 24) introduces flexibility to downstream subscribers looking to address capacity issues by balancing data volume across network infrastructure.	**Grids** both data and compute grids offer highly-resilient, dynamically scalable distributed processing infrastructure to distribute load in compute intensive/data intensive environments.	
Extranet Providers offer single high-throughput connection to access broad range of marketplaces, data vendors and business partners.	**Add Hardware** only after addressing with other approaches (e.g. Code Rewrite, Consolidation). Blades with small form factor minimize datacenter space. Cost/benefit analysis of adding hardware needs to be monitored closely.	

Environment

Virtualization reduces number of servers that have to be powered up. Allows for deployment of widely distributed applications while minimizing data center physical server requirements.

Multi-core processors save energy and exhibit higher processing throughout per watt.

Power Efficiency with advanced power management tools that enable measuring, analyzing and dynamic provisioning of power.

Server Consolidation of redundant applications and servers to reduce hardware footprint and ease power consumption.

Source: Jordan & Jordan

Summary

- Market data volume is expanding at astronomical rates
- Order cancellation rates are high and average trade size is declining
- Equity trade side volume has shown significant year to year expansion
- Plan in place to measure and test capacity limits
- Firms should plan for being able to handle 2.5x peak rates
- Firms need to explore alternatives to find the best firm-wide fit for expanding capacity
- Visit Exhibit Hall to discuss alternatives
- Panelists' Contact Information
  - Michael H. Boston: mboston@bofasecurities.com
  - Jacob Granek jgranek@dtcc.com
  - Thomas J. Jordan tjjordan@jandj.com