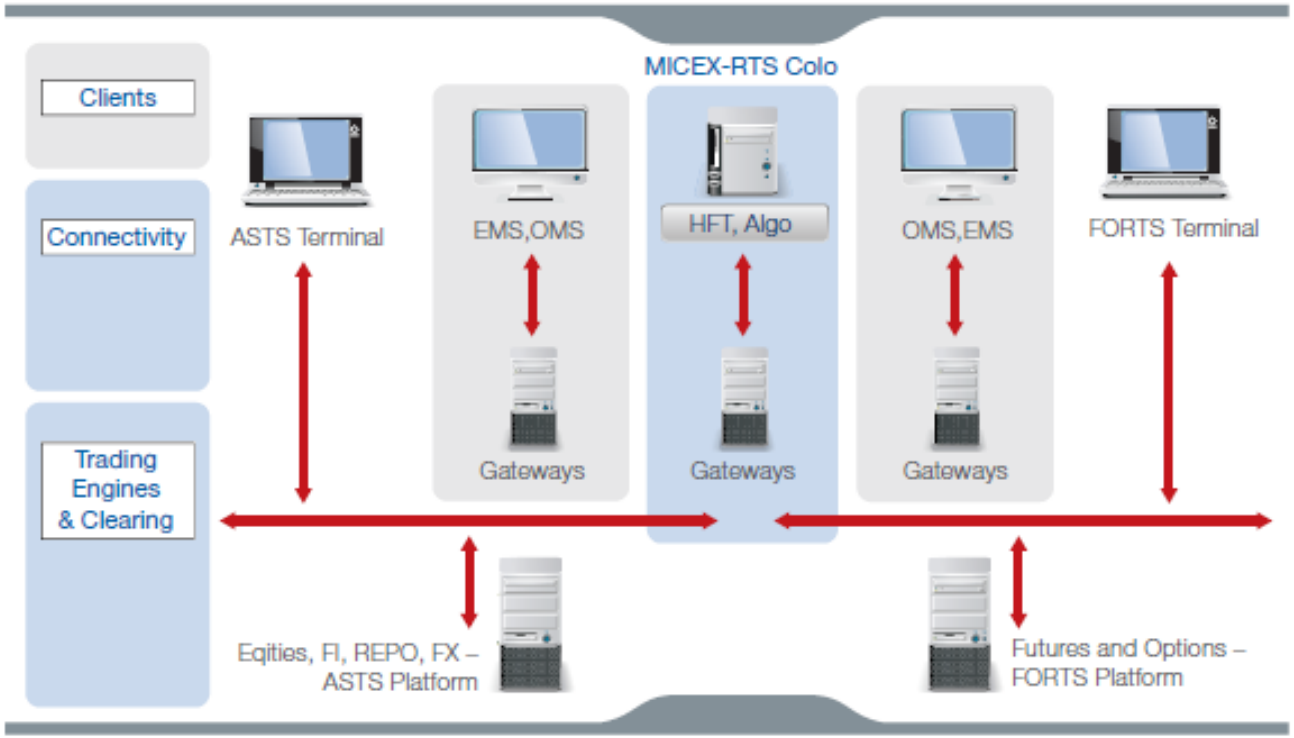
Overview of Moscow Exchange technology - current state and future plans

August 2012,
Moscow

Overview of the current technology landscape

Moscow Exchange trading and access infrastructure



ASTS & FORTS Platforms:

- Order-driven market
- Quote-driven market
- Discrete auctions
- REPO
- CCP clearing
- Pre-trade risk management
- DMA services
- Client connectivity:
  - *Proprietary API*
  - *FIX trading interface*
  - *UDP multicast FIX FAST*
  - *ITCH (evaluating solutions)*
- Tested throughput - 20,000 orders/second for each market
- Market data: level 1, level 2 and full depth order book
- Online clearing

Two trading platforms:

- ASTS – Equities, FI, REPO & FX
- FORTS – Derivatives and “Standard” section of Equities market

Today each platform has individual

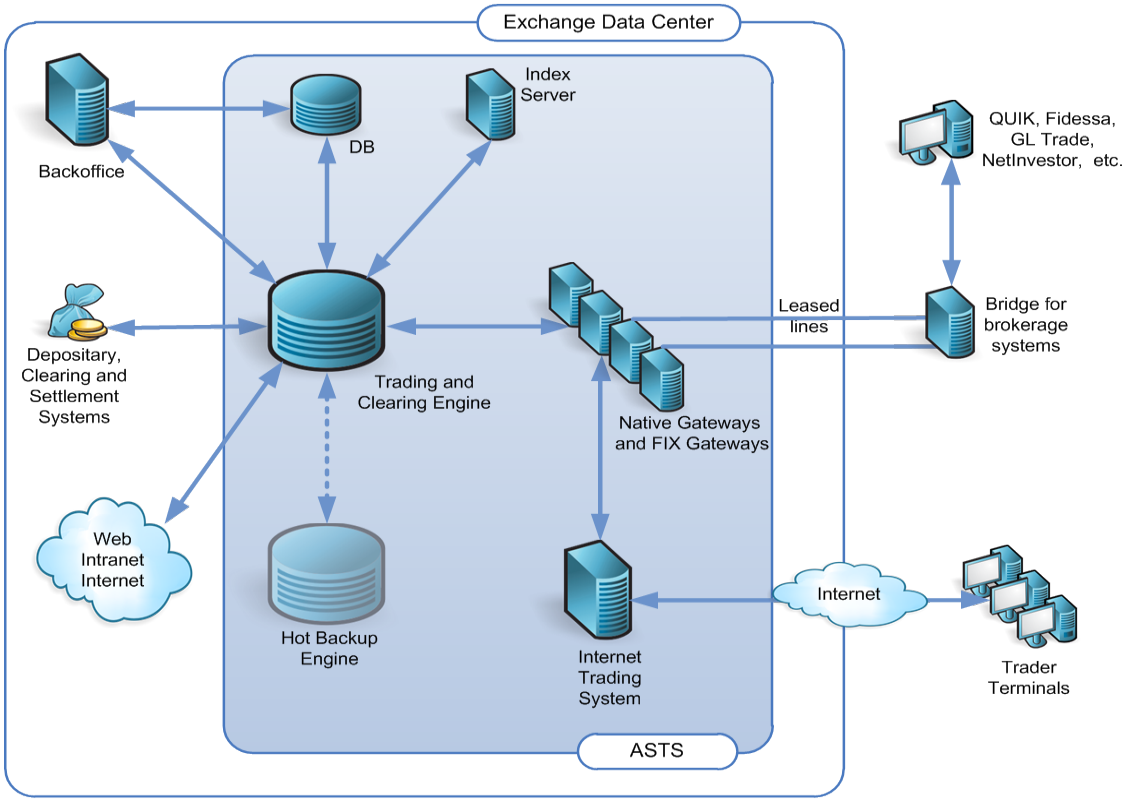
- Risk management
- Clearing
- Connectivity layer

Globally Connected

- FIX and FIX/FAST (including UDP multicast) as well as proprietary APIs for execution and market data delivery

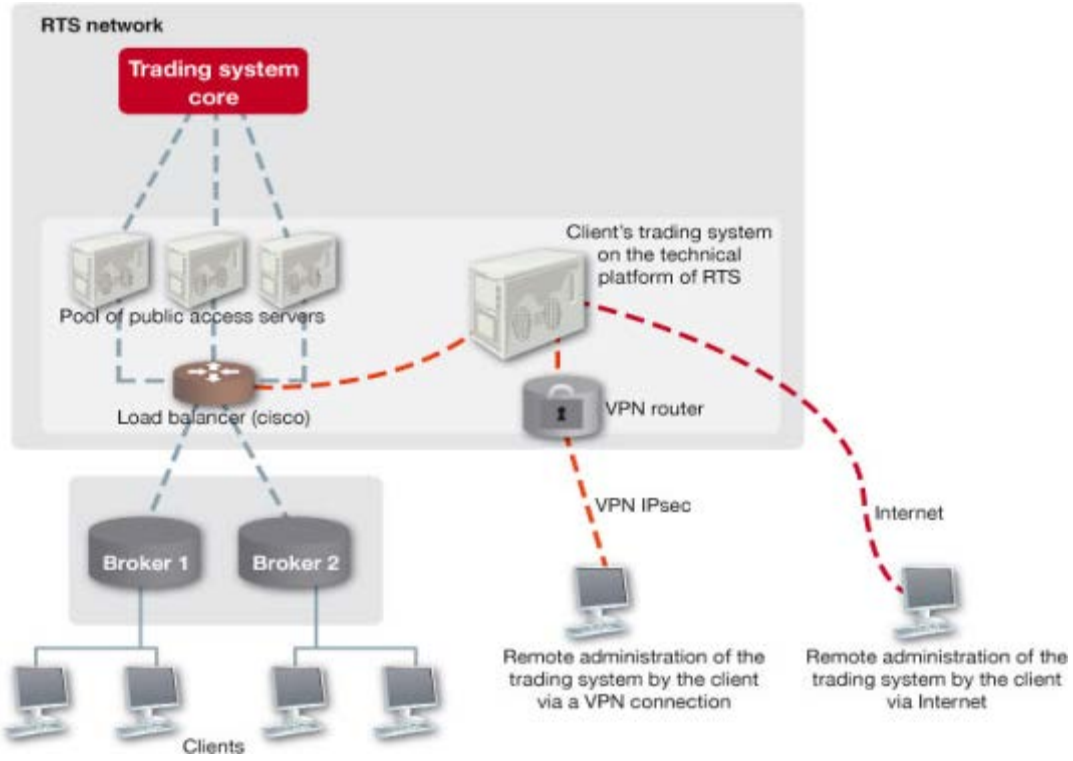
- Connectivity solutions through domestic and global Network Service Providers (NSP) and international point of presence at LD4 in London. The Exchange is accessible by 8 telco providers including:
  - BT Radianz, SFTI (pending certification by the Exchange), Orange, TMX Atrium (coming summer Q1 2013)
- 300+ electronic broker systems and Independent Software Vendors (ISVs) are certified to access the Exchange including:
  - Bloomberg, CQG, Fidessa, Orc, Reuters, SunGard (more are in the pipeline)

ASTS Trading platform – runs Equities (main section), bonds, FX and Money markets



- Runs on Linux platform
- Based on multi-tier architecture
- Client connectivity protocols:
  - Proprietary API for both transactions and market data (MICEX Bridge)
  - FIX 4.4 trading interface
  - UDP multicast FIX 5.0 SP2 FAST market data stream
- Door-to-door latency ~ 500 microseconds
- Tested throughput: 20 000 orders per second on each market
- Market data: level 1, level 2 and full book. Orders are published via MICEX FIX/FAST UDP multicast service 0.5 ms after the order is processed and confirmed to its sender
- Runs with hot backup

FORTS Trading platform – runs Derivatives and “Standard” section of Equities market



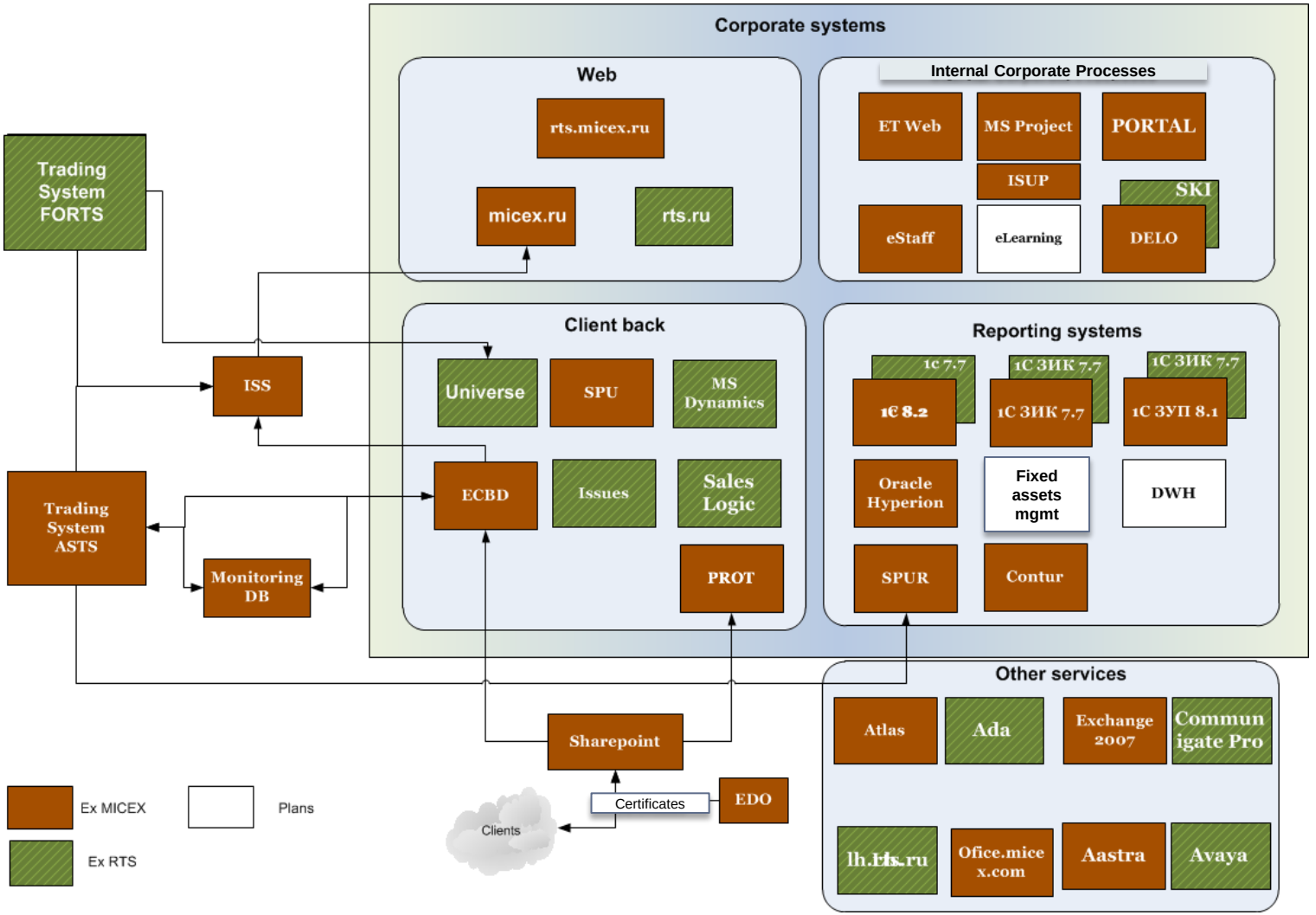
- Runs on Windows platform
- Based on “information bus – like” architecture (with Plaza II middleware)
- Client connectivity protocols:
  - FIX/FAST
  - Plaza II (proprietary API)
- Sponsored market access is available
- Door-to-door latency ~ 2 - 3 milliseconds
- Tested core throughput: 20 000 orders per second
- Market data: level 1, level 2 and full depth order book
- Provides unified data replication framework for clients’ applications (with Plaza II middleware)

- matching engine capacity – 1500 orders \ sec => matching engine latency 670 microseconds
- Market data dissemination Latency (book, trades, prices)– 75 milliseconds
- Non-critical data dissemination Latency (positions, status of instruments) – 500 milliseconds
- Orders per second (average for march 2012) - 909
- Current round trip time (acknowledgement time) – 10 milliseconds

Moscow Exchange Technology Services Team's capability

- Certification and testing services for new client/vendor technologies
- Dedicated English-speaking client relationship team for a smooth on-boarding process
- Cross connected exchange data centers in Moscow
- Comprehensive exchange co-location with variable footprint sizing options (rack and unit based)

Overview of non-trading applications landscape



Data centers infrastructure

Bolshoy Kislovsky

- 1K+ network ports
- 50+ Switches, Routers and Security appliances
- 10+ Gbps links for critical or latency sensitive systems
- DC Interconnectivity
- Dark fiber cables with redundancy and diversified routes
- N*10 Gbps links between DCs

M1

- 500+ network ports;
- 20+ Switches, Routers and Security appliances;
- 10+ Gbps links for critical or latency sensitive systems;
- DC Interconnectivity
- Dark fiber with redundancy and diversified routes
- N*10 Gbps links between DCs

Kolskaya

- 300+ network ports;
- 50+ Switches, Routers and Security appliances;
- 1+ Gbps links for critical or latency sensitive systems;
- DC Interconnectivity
- Dark fiber cables with redundancy and diversified routes
- N*10 Gbps links between DCs

New primary DC

- Planned for 2014
- Tired III Certified
- 500 racks

Inter DC Links

Servers:
High ,Middle and Entry level systems (majoritly HP and IBM)

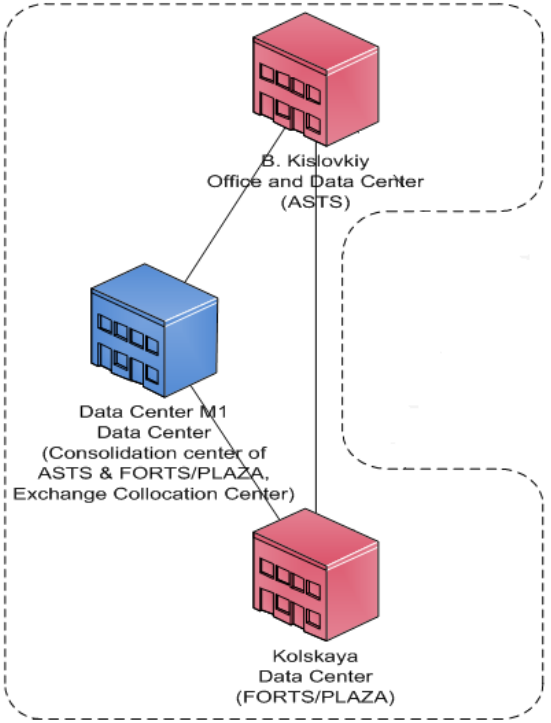
Data Storage:
High-End and Mid-Range level systems (majoritly HP and IBM)

SAN:
Dedicated FiberChannel (Brocade based)

Network:
High-End Switches and Routers (Cisco Systems 65/49xx and Nexus)

Site infrastructure

- 24x7x365 access, CCTV, access control systems, armed security officers, etc;
- Power feeds:
- 2+ power feeds to each site, backed by Generators with minimum 8 hours fuel autonomy;
- UPS:
- N+N or 2*(N+1) redundancy;
- Climate:
- Minimum N+1 redundancy;
- Connectivity:
- Multiply NSP and carriers on site;



Core infrastructure

Data Centers

3 Data Centers (DC) in Moscow.

- 2 primary DCs and one reserve
- DCs interconnect with dark fiber-links with diversified routes
- Wide area telecom infrastructure (“Trading network”)
- Comprehensive Exchnage Collocation offering with variable options
- Remote link available by Network Service Providers

Connectivity

Remote access

Based on NSP services, secure L3 VPN network under MICEX-RTS control and monitoring

List of NSP`s

- Orange BS
- Relline
- Macomnet
- MTS (Comstar)
- BeeLine (Vympelcom)
- Megafon (Metrokom, Peterstar)

International FSP`s

- SFTI
- BT Radianz
- TMX Atrium (in process)

OS & DB

OS:

- RadHat Enterprise RealTime
- Microsoft Windows
- RadHat Enterprise
- SLES

Databases:

- Oracle
- IBM Informix
- Firebird
- MS SQL

All critical equipment is under 24x7x365 service

Control and monitoring

Servers

HP OpenView OVO

Networks

- HP Open View NNM
- Cisco Works LMS
- PRTG
- Cisco NAM

Security

- Cisco MARS
- Security Manager

Sites Infrastructure

BMS, Vendor based systems

IT Equipment

Servers:

High ,Middle and Entry level systems (majoritly HP and IBM)

Data Storage:

High-End and Mid-Range level systems (majoritly HP and IBM)

SAN:

Dedicated FiberChannel (Brocade based)

Network:

High-End Switches and Routers

(Cisco Systems 65/49xx and Nexus)

Moscow Exchange technology compared to international peers

MICEX-RTS trading platforms compared to peers' trading platforms

	NYSE-Euronext	NASDAQ OMX	LSE	DB-Eurex	HKEX	TSE	BM&F BOVESPA	MICEX-RTS ASTS	MICEX-RTS FORTS
Instruments									
Equities	+	+	+	+	+	+	+	**+**	**+(phased out)**
Fixed income	+	+	+	+	+	-	-	**+**	**-**
FOREX	-	-	-	-	-	-	-	**+**	**+(phased out)**
REPOs	-	-	-	+	-	-	-	**+**	**-**
Futures and options	+	+	-	+	+	+	+	**+(phased out)**	**+**
"Standard" trading methods (Order-driven market, Quote-driven market, Call-auctions)	+	+	+	+	+	+	+	**+**	**+**
"Standard" order types (limit, market, iceberg etc.)	+	+	+	+	+	+	+	**+**	**+**
"Synthetic" orders on-the-fly	-	+	-	-	-	-	-	**-**	**-**
Real-time risk-management/clearing	-	-	-	-	-	-	+	**+**	**+**

MICEX-RTS is favorably positioned compared to its international peers

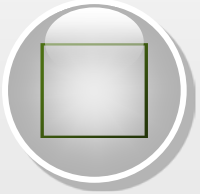
MICEX-RTS trading platforms compared to peers' trading platforms

	NYSE-Euronext	NASDAQ OMX	LSE	DB-Eurex	HKEX	TSE	BM&F BOVESPA	MICEX-RTS ASTS	MICEX-RTS FORTS
DMA	+	+	+	+	+	+	+	**+**	**+**
Connectivity	FIX + API	FIX, ITCH, OUCH + API	FIX, ITCH + API	FIX + API	FIX + API	FIX + API	FIX + API	**FIX + API**	**FIX + API**
Latency (microseconds)	< 1000	< 100	~ 100	~ 1000 - 2000	No data available	~ 2000	~ 1100	**~ 500**	**~ 1000 - 2000**

MICEX-RTS trading platforms compared to peers' trading platforms: Universal platform vs. different platforms for spot and derivatives markets

Different platforms for spot and derivatives markets

- NYSE Euronext
- Deutsche Boerse – Eurex
- HKEX
- SGX
- BM&FBOVESPA (now)
- MICEX-RTS



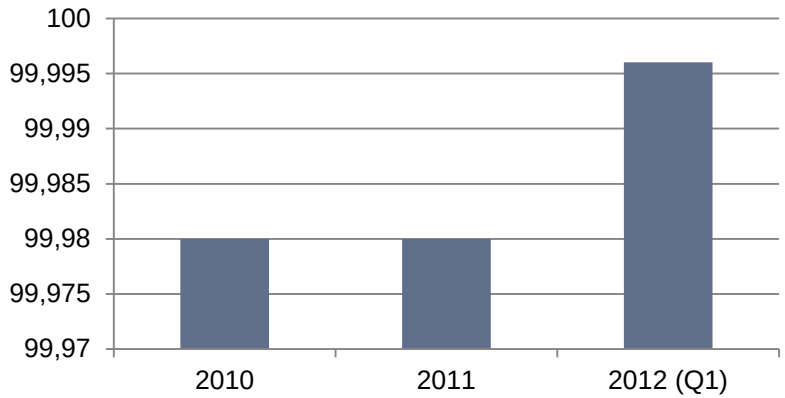
One universal platform

- BM&FBOVESPA (planned)
- NASDAQ OMX (Genium INET)
- BATS

•Post merger MICEX-RTS will centralize all derivatives products on FORTS, while ASTS will power all spot markets.
•The decision to combine spot & derivatives on one platform will be made by the end of 2012

Systems stability and availability

- Information Security & Business Continuity Department constantly monitors and manages all incidents related to system & data integrity and availability.
- No incidents related to unauthorized data disclosure or unauthorized system access occurred in the past three years
- Overall trading systems availability 2012 YTD is 99,98% and compares well to the industry (for example, in 2011 LSE Equities market availability was at 99,7%)
- Overall trading system availability ratio



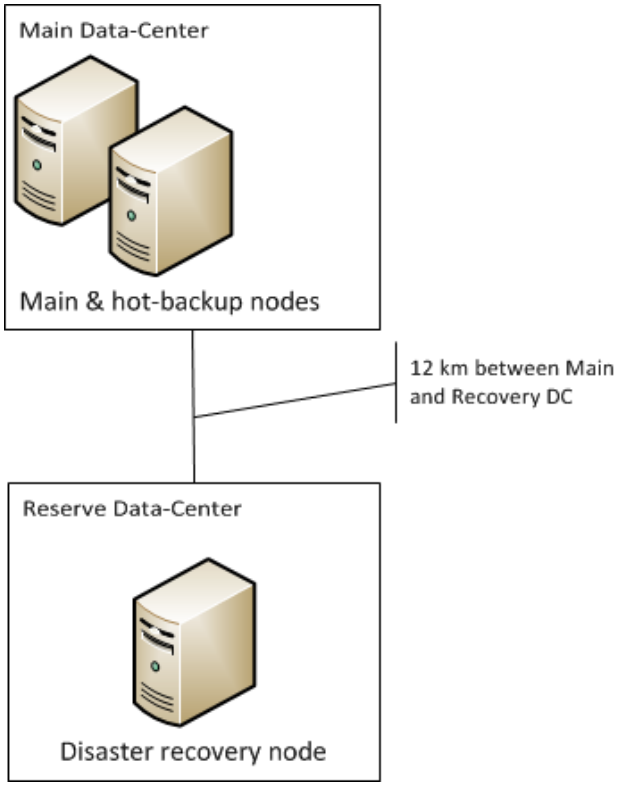
IT Risk Management

- IT Risk Management is a part of responsibilities of Information Security Department and conducted in accordance with the international Standards*
  - **Identification** – Incident investigations, self-assessments, monitoring
  - **Validation** – Impact analysis, determining of risk business and technical owners, risk acceptance, avoidance, transfer and mitigation decision
  - **Planning** – acceptance, avoidance, transfer and mitigation planning
  - **Control** – plan execution control, risk and risk environment monitoring
  - **Reporting** – risk states and plan statuses reporting to management and risk business owners

* Information Security Department started preparation for ISO 27001 certification

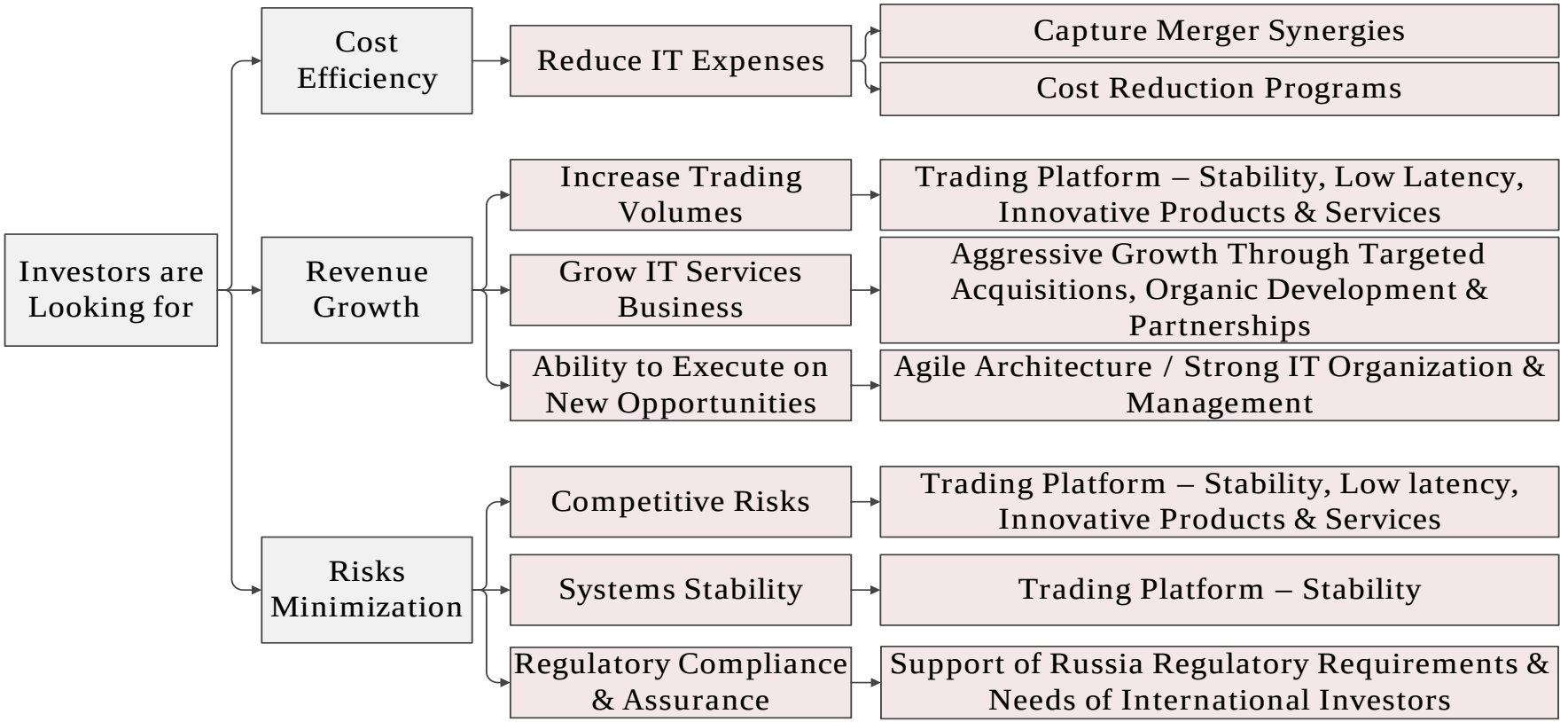
Redundancy and recovery procedures

- The Exchange has a dedicated team to cover all business-continuity-related questions.
- All system are assessed as a part of Business Impact Analysis (BIA)
- Key and critical systems have scheme with 3 nodes: 2 nodes in cluster or hot-backup scheme in main data-center and 1 node for Disaster recovery in Reserve data-center
- Main and Reserve data-centers are located in Moscow 12 km apart
- Non-critical system has also backup in Reserve data-center and recovery times are up to their specified RTO (Recovery Time Objective)
- The recovery plans are being reviewed on annual basis or after any significant change. This year the team plans to revise the Exchange recovery plans to keep them in line with BS25999 standard. The Exchange also plans to pass BS standard certification in the beginning of 2013.

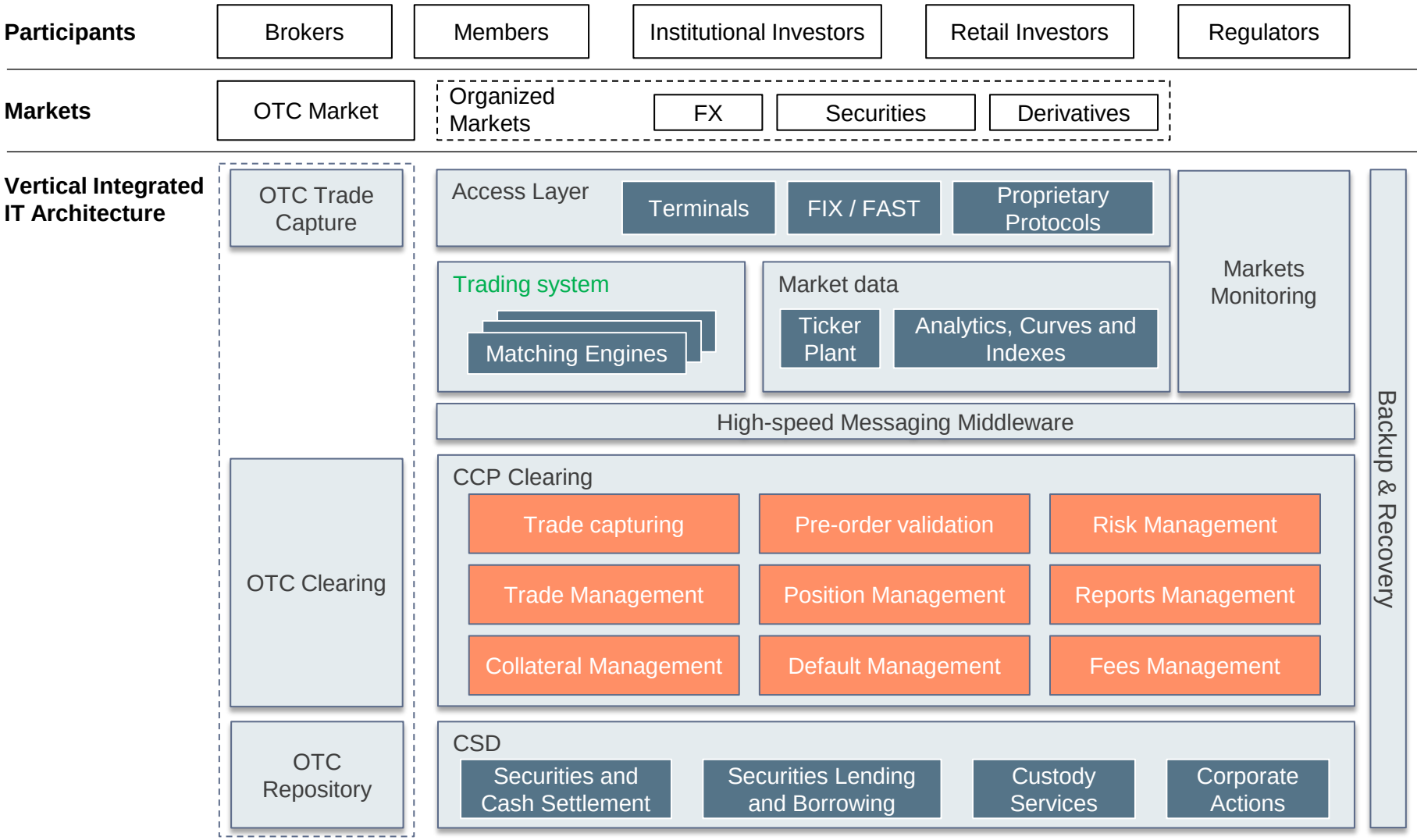


Overview of our future plans and initiatives

Moscow Exchange IT Strategy reflects investor and clients interests



2015 Target vertically integrated technology architecture of the Moscow Exchange Group



Next Generation Trading System – target characteristics

Unified trading system for all markets

- All existing markets, trading sessions and instruments coverage; easy to add new trading capability
- An efficient Clearing supported T+n with CCP, single clearing procedure for all markets, real time risk management
- IT services (market data, cloud services, etc.)

Connectivity integrated into global financial network

- Standard FIX/FAST connectivity for execution and market data delivery
- Unified Exchange terminals including trade terminals, clearing terminal with embedded digital signatures, etc.

High-speed system performance and throughput in line with global peers

- 200 000 transactions per second (by 2015) per each market
- 0.3 ms latency (by 2015)

High service availability up to 99.98 %

- Persistent operability in case of single component failure
- Fault-tolerance in case of error processing of one instrument or group of instruments
- Less than 30 minutes recovery time after significant failure

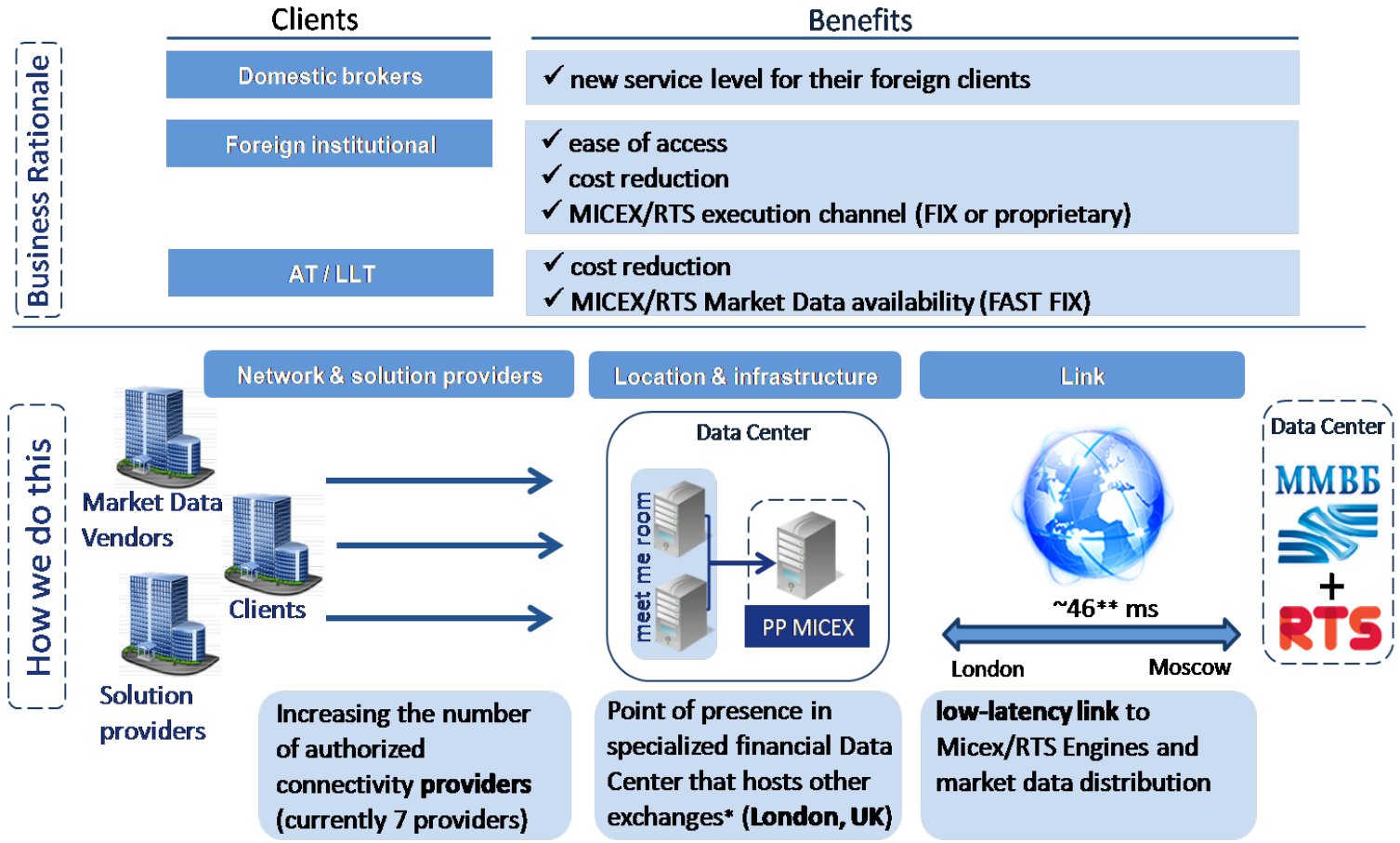
Fast and safe maintainability

- Flexibility to increase development speed
- Ability to deploy isolated changes into production system

2012 key projects: Infrastructure

Project	Status
The simultaneous access to ASTS & FORTS/PLAZA services using ex. MICEX network	Done
Building common integrated service of network providing to MICEX-RTS via NSP	In progress
Bridging MICEX and RTS Networks	Done
Build consolidated Co-Lo & the backup for FORTS/PLAZA in the integrated infrastructure	In progress
The technical solution unification to provide access to global financial networks	Done
Development optimized connectivity to ASTS services	In progress
Point of Presence (PoP) in London (UK)	In progress (live by 01.10.2012)

International point of presence in London – coming live September 2012



2012 key projects: Applications

Projects	Status
Enhancement of trading clearing system ASTS – created separated ASTS clearing module.	In progress
ASTS: new methods of matching to speed up platform	In progress
ASTS: multicast push gateway	In progress
Low-latency FIX transactional version	In progress
Roll out of FORTS 3.9 with improved throughput and latency	Q4 2012
Prototyping trading messaging bus to support new clearing architecture	In progress
Building integrated complex testing system of trading & clearing functionality	In progress
MIS MICEX-RTS	In progress

ММВБ MICEX

RTS БИРЖА

Thanks
Q&A Session