Tutorial 1: Overview of Information Systems in Financial Systems Q1

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a) Despite the historical technical difficulties faced by the Tokyo Stock Exchange (TSE), why do you think the exchange decide to go ahead with the upgrades?

- Advancement of finance technology expand types of trading activities
- Securities companies and institutional investors employing algorithm-based program trading
- Online trading becoming more popular
- Need for faster order execution and market information distribution
- Solve software glitches caused by the previous system - they have invested resources to improve technology from 2005-2010
- Competition in the Asia market rising, with Shanghai Stock Exchange (SSE) and The Stock Exchange of Hong Kong (SEHK)
- Can remain competitive in today's world and keep their status as Asia's top bourse
- Can be on par with other international exchanges

b) What are the potential benefits of having such a new system?

Speed:

- 0.2 milliseconds for order response time and 0.5 milliseconds for Information delivery time
- Observe and act on fast-moving market trends

Reliability:

- Can help in facilitating a wider range of trading strategies and attract a greater variety of market participants:
  - High-frequency traders
  - Statistical arbitrageurs that operate in other markets around the world

Transparency:

- Provide real-time market data faster as compared to previous system
- Handles more quotes feed (from 5 to 8)
- Improves accessibility into TSE

b) What are the potential benefits of having such a new system?

Scalability:

- Able to double capacity during peak period
- Capacity can be expanded within one week

Innovation:

- Using high performance, high reliability servers
- High-speed in-memory data management software (Symfoware)

c) What are some of the risks involved with such a system?

1. Security Issues

- Very hard to completely secure a system
- Attackers constantly come up with new ways to obfuscate their intent and hack into a system
- Example: In 2020, New Zealand Stock Exchange was knocked offline for two days in a row due to a cyber-attack, coming from offshore via its network service provider

1. Software Risks

- System Vulnerabilities (software bugs that cause glitches)
  - New updates to the system can introduce unexpected vulnerabilities
- Stability Problems
- Efficiency Weaknesses

c) What are some of the risks involved with such a system?

3. Hardware Risk

- Even if all software bugs are fixed and system security is good, there exists certain hardware issues
  - One specific or outdated piece of hardware malfunctioning can have major consequences on the system
  - More prone to physical damage or crashes
  - Heavy maintenance of equipment
- **Hardware failure on 2 Feb 2012** – had to temporarily suspend trading of nearly 250 stocks and financial instruments for **more than 3 hours**. Only 1 year since its launch
- **Same hardware failure on 1 Oct 2020** – $6 trillion stock market had to **come to a halt for a full day**. First time in almost 15 years that the exchange had suffered a complete trading outage
  - Knock-on effect on servers called information distribution gateways
  - Prevented the distribution of market data, market participants had no idea if the information was accurate

d) In 2018, SGX updated their new high-speed trading engine. What is the name of this new engine? What are its key characteristics?

	SGX Reach	SGX Titan
What is it for?	Securities Trading	Derivatives Trading
Key Characteristics/ Benefits	- Built on NASDAQ OMX Genium platform - High-speed and reliable access for members - Varying levels of access speeds available - Brings better **liquidity** and greater **velocity** to the market - **Multiple connectivity options** via SGX's Managed Network Services, Co-Location Services, Liquidity Hubs, and approved network service providers	- Built on NASDAQ's Genium INET version 4 platform - High-speed and reliable access - Enables a range of market functions such as order sending, market feed, quotations and drop copies of transactions

d) Why do you think SGX decided to invest in this new system?

Promote Global Trading Environment:

- Established presence at key data centres in Chicago, London, New York and Tokyo.
- Aim to **radically lower cross-border connectivity costs** to SGX and **facilitate participation in Asia's growing markets** by a larger number of **global trading firms**.
- Aim to become the **"Asian Gateway"** by improving **connectivity** with major exchanges & provide global reach for Asian issuers (2-way exchange between Asia and the World)

Improvements in system:

- In 2011, SGX invested $250 million in improvements to **enhance market quality and liquidity**. SGX Reach, SGX Data Centre and SGX co-location services are all part of this effort.

d) In what ways are these motivations similar to or different from those faced by TSE?

	SGX REACH	TSE ARROWHEAD
Improved system: Efficiency	Both stock exchanges aimed to reduce order response time and quicken execution → to allow for more orders	
Improved system: Execution Capability	Range from 20 to 100 transactions per second (10-50ms per transaction)	Process orders in 5ms (2010 version) 0.2ms (2019 update)
Main Goal of upgrading to new system	To create a **seamless experience for the users** by creating a platform with **multiple connectivity options**: SGX's Managed Network Services, Co-Location Services, etc Aim to promote a **global trading environment** by increasing worldwide connectivity	Designed to greatly **accelerate** TSE's order response and information distribution **speeds** Used as a means to **remain competitive** by catering to more users with differing trading strategies