

arrowhead

~ the next-generation trading system ~

Tokyo Stock Exchange, Inc.

Contents

1. Introduction
2. Summary of arrowhead
3. Change of trading rules
4. Expansion of market data
5. Working towards lower latency
6. Conclusion



1. Introduction: Market environment surrounding the TSE

Expansion of Best Execution Duty

- » Raised awareness of execution cost (timing cost) due to best execution duties
- » Reduced tick sizes
- » Progression of internalized benchmark trading such as block trading, VWAP trading, etc.

Advanced and diversified trading methods

- » Increased algorithmic trading and DMA trading
- » Expansion of trading linked to other products, other markets, and benchmarks (especially statistical arbitrage or stat arb)
- » Rise of automatic order placement services, etc. in addition to increased popularity of internet trading, etc.

Competition in execution ability between securities firms

- » Increased significance of execution ability and services brought about by intensified competition in commissions and spreads
- » Competition in system processing capacity and speed between securities firms
- » Increasingly selective approach to execution markets and securities firms based on system processing capacity, speed, etc.

Exchange vs/with ECN

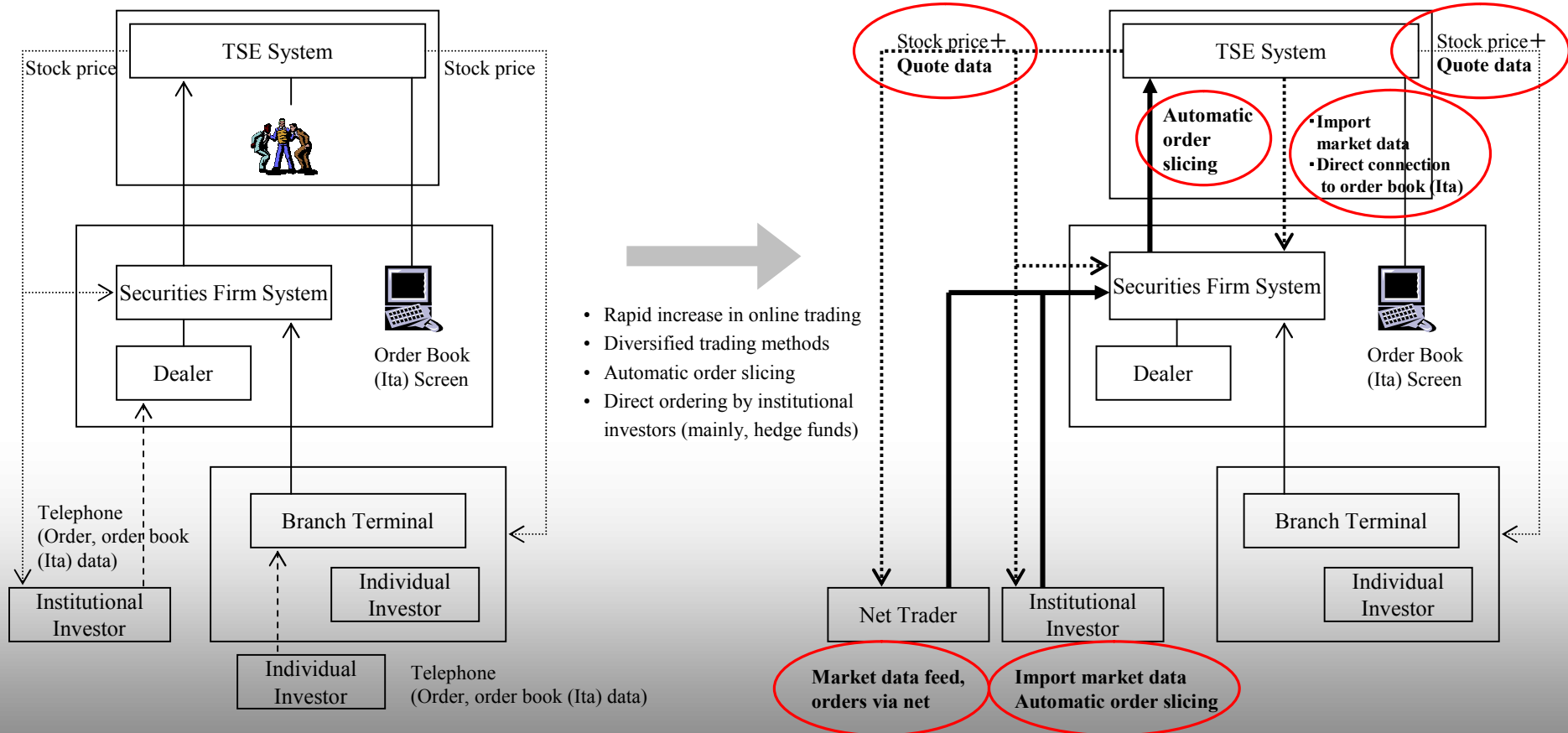
- » Increasingly selective approach to execution markets and securities firms based on system processing capacity and speed
- » Rise of alternative markets which have processing capacity or execution speed surpassing that of existing exchanges
- » Improvements in legacy systems, acquisition of ECN, etc.



Developments in the exchange markets and expectations...

1. Introduction: Changes in order placement activity by market participants

- Individual Investors: As fast trading while monitoring real-time market data is now possible, this has led to a growing share of internet trading and a significant increase in the number of orders.
- Institutional Investors / Securities Companies: Diversified trading styles such as large lot basket, VWAP, arbitrage trading, etc. Importing market data of such transactions in real-time and using certain programs to perform automatic order slicing is now mainstream.

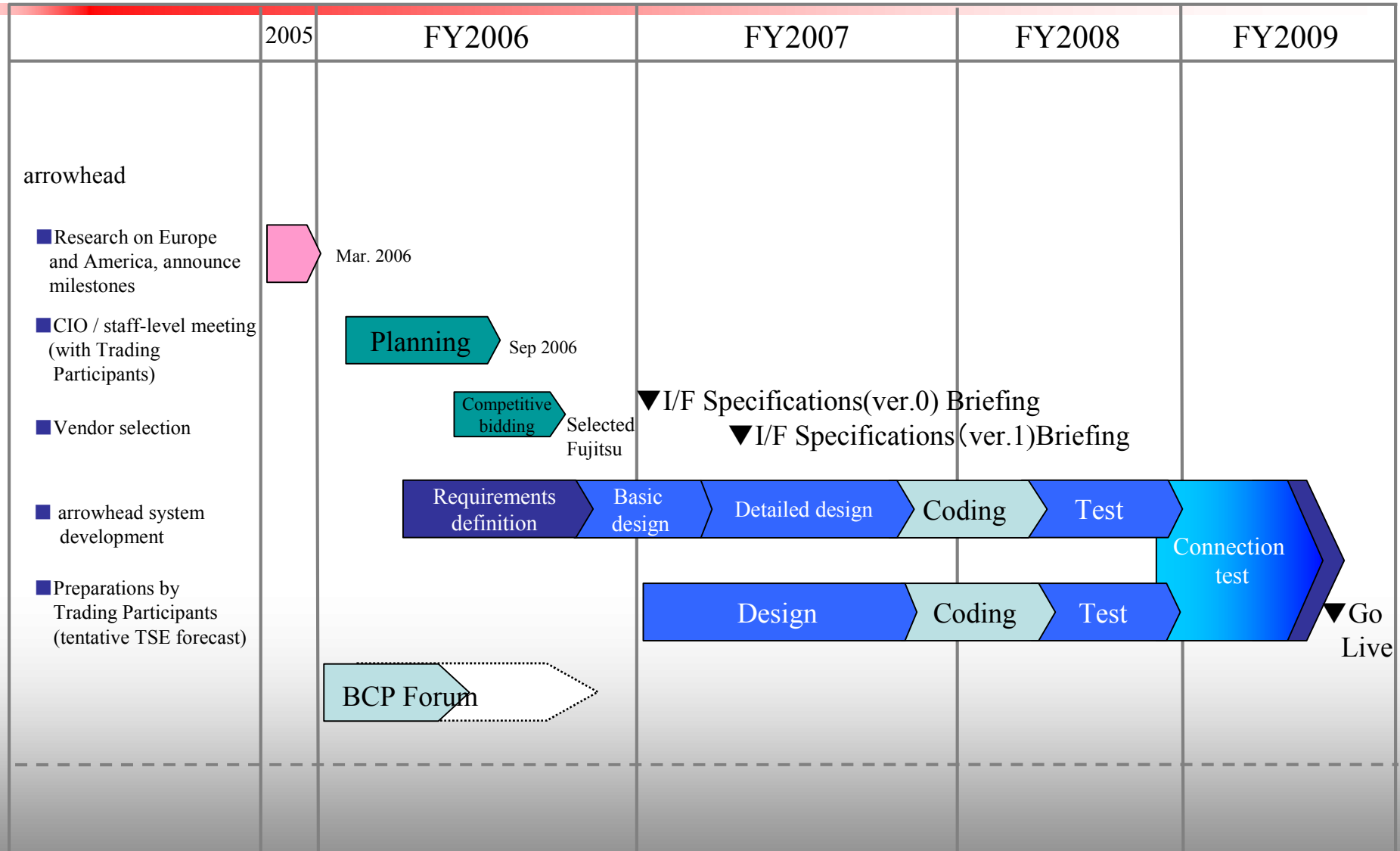


2. Summary of arrowhead: What is arrowhead?

» What is arrowhead?

- Name of the next-generation trading system scheduled for launch in January 2010.
- Handles auction trading of all cash products (stocks and convertible bonds).
- Combining low latency with an order response, and high reliability brought about by the protection of trading information such as order, execution, and order book information by synchronized 3-node data back-up memory, arrowhead is an exchange system of the highest global standard.

2. Summary of arrowhead: Project schedule



2. Summary of arrowhead: Basic concept

Compile and present basic concept of arrowhead structure, based on overseas research

Reliability/ Scalability	<ul style="list-style-type: none"> ◆ Able to accommodate within approx. one week in the case where the predetermined scalability criteria was exceeded. [Scalability criteria (assumed)] The case where actual peak value of no. of orders per minute exceeds half of no. of orders that can be received per minute (=system threshold limit value) = prepare capacity that is twice the peak no. of orders per minute
Low Latency	<ul style="list-style-type: none"> ◆ 2 millisecond Order Response ◆ 2.5 millisecond Information Distribution
Flexibility	<ul style="list-style-type: none"> ◆ Able to accommodate diverse products, new trading rules, and their changes within a short period of time ◆ Parameter functions with optional business logic attachments
Robustness	<ul style="list-style-type: none"> ◆ Highly Reliable System built with State-of-the-Art Technology ◆ Construct secondary site (back-up center). Recovery within 24 hours.
Others	<ul style="list-style-type: none"> ◆ Enhanced data distribution function ◆ Durable and reliable system operation ◆ Enhanced security