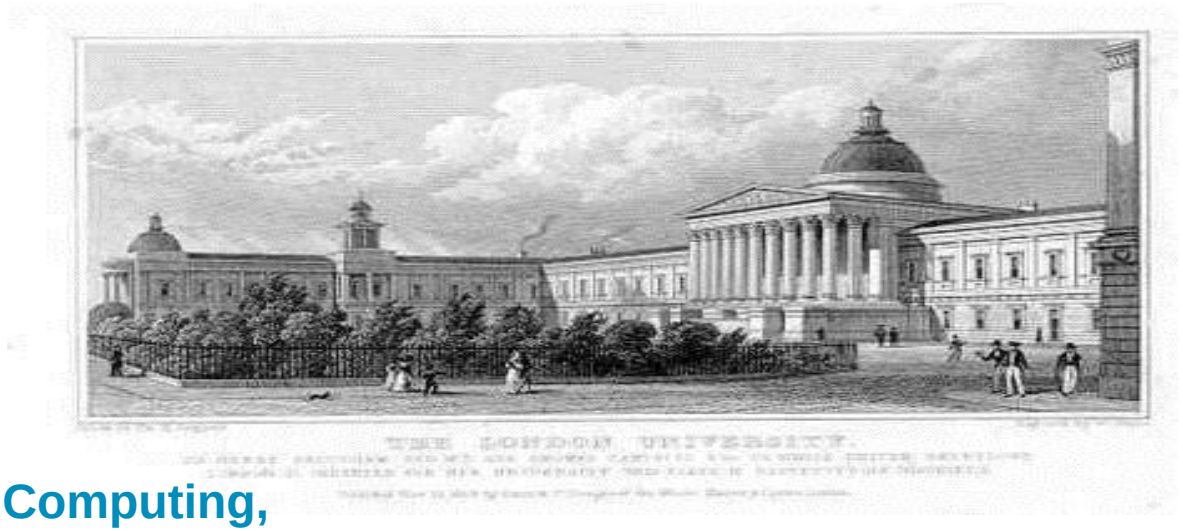
Distributed Computational Finance Infrastructure for Algorithmic and Proprietary Trading



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Background

- Algorithmic and high-frequency trading is growing rapidly accounting for 70% of US equity volumes in 2011 (according to Reuters and Bloomberg)
- Algorithmic and high-frequency trading is a major concern due to potential catastrophic ‘Flash Crashes’
- Understanding the key elements of algorithmic trading, interactions between algorithms, trading infrastructure and experimental facilities may be beneficial in designing better algorithms and distributed support systems

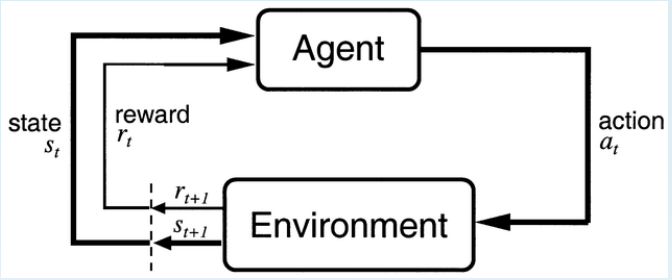
Algorithmic Trading (AT)

Algorithmic Trading is a field of computational finance that combines different analytical techniques from statistics, machine learning and economics to create algorithms capable of taking, executing and administering investment decisions with optimal levels of profit and risk.

AT aims to automate one or more stages of the trading process:

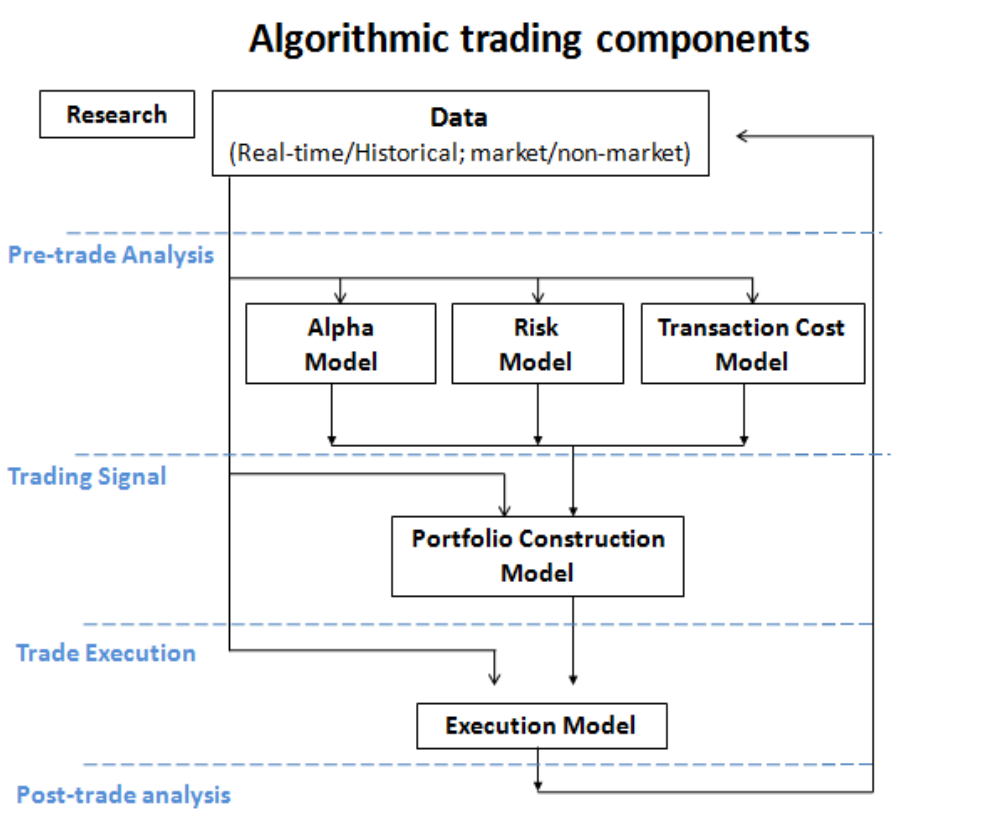
- pre-trade analysis (data analysis – state of the world analysis),
- signal generation (decision taking process – policy formation)
- trade execution (execution of actions – policy execution)
- post-trade analysis (evaluation of results - utility analysis)

AT and Multi-Agent Systems



- Agent (**AT Strategy**)
  - State-of-the-world (**Pre-trade Analysis**)
  - Policy (**Signal Generation**)
- Environment (**Electronic Market Exchange**)
  - Continuous stream of market feeds containing information about financial securities
  - Different levels of data available (market events, order book information, averaged data)
- Actions
  - Various types of **order instructions** (limit, market, cancel …)
- Reward/Feedback (**Post-trade analysis**)
  - Order execution reports
  - Account updates (positions held)

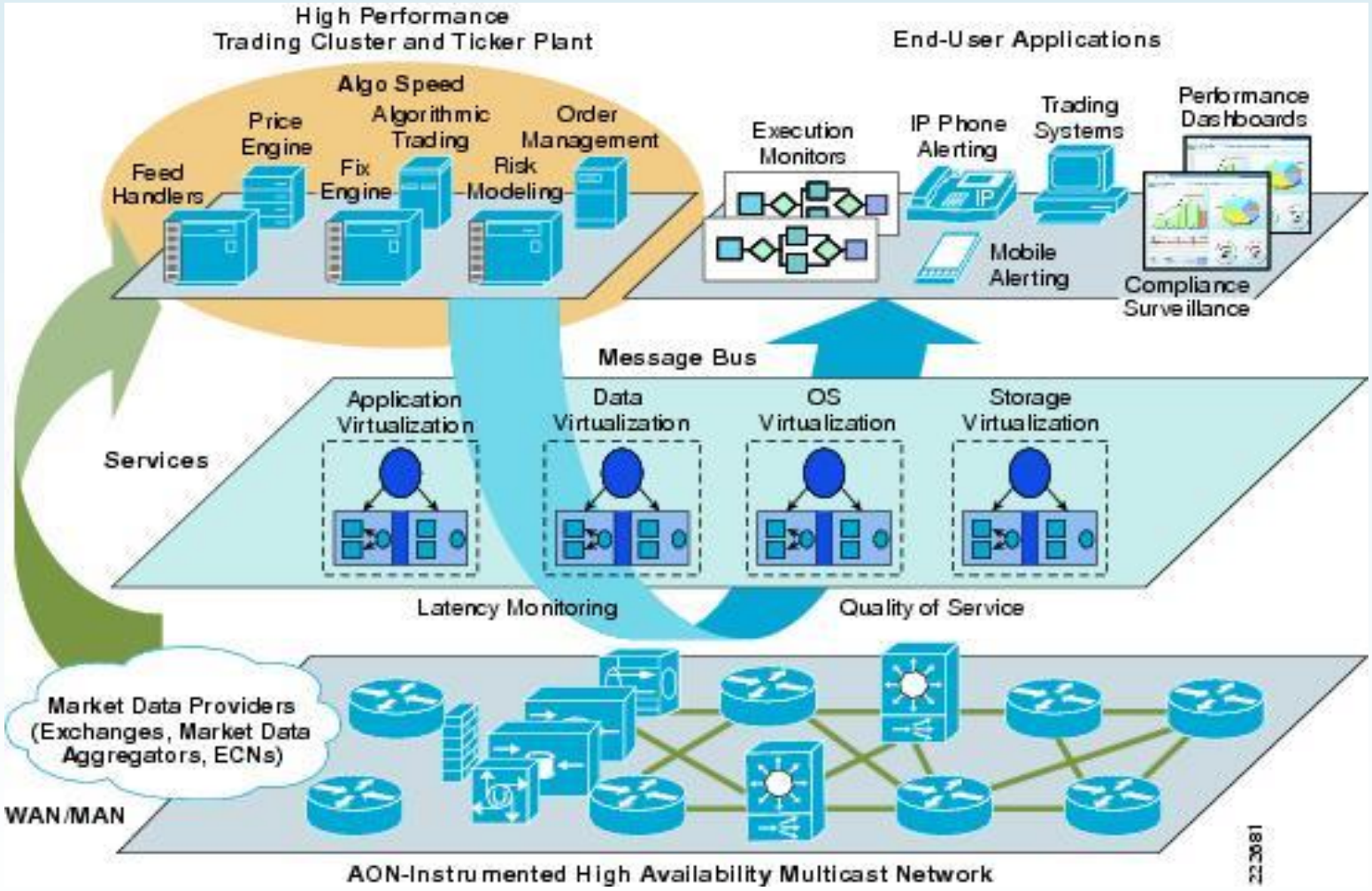
AT Model Architecture



- Common Models:
  - Arbitrage
  - Hedging
  - Momentum
  - Breakout
  - Mean-reversion
  - Pairs
  - Portfolios (Markowitz)

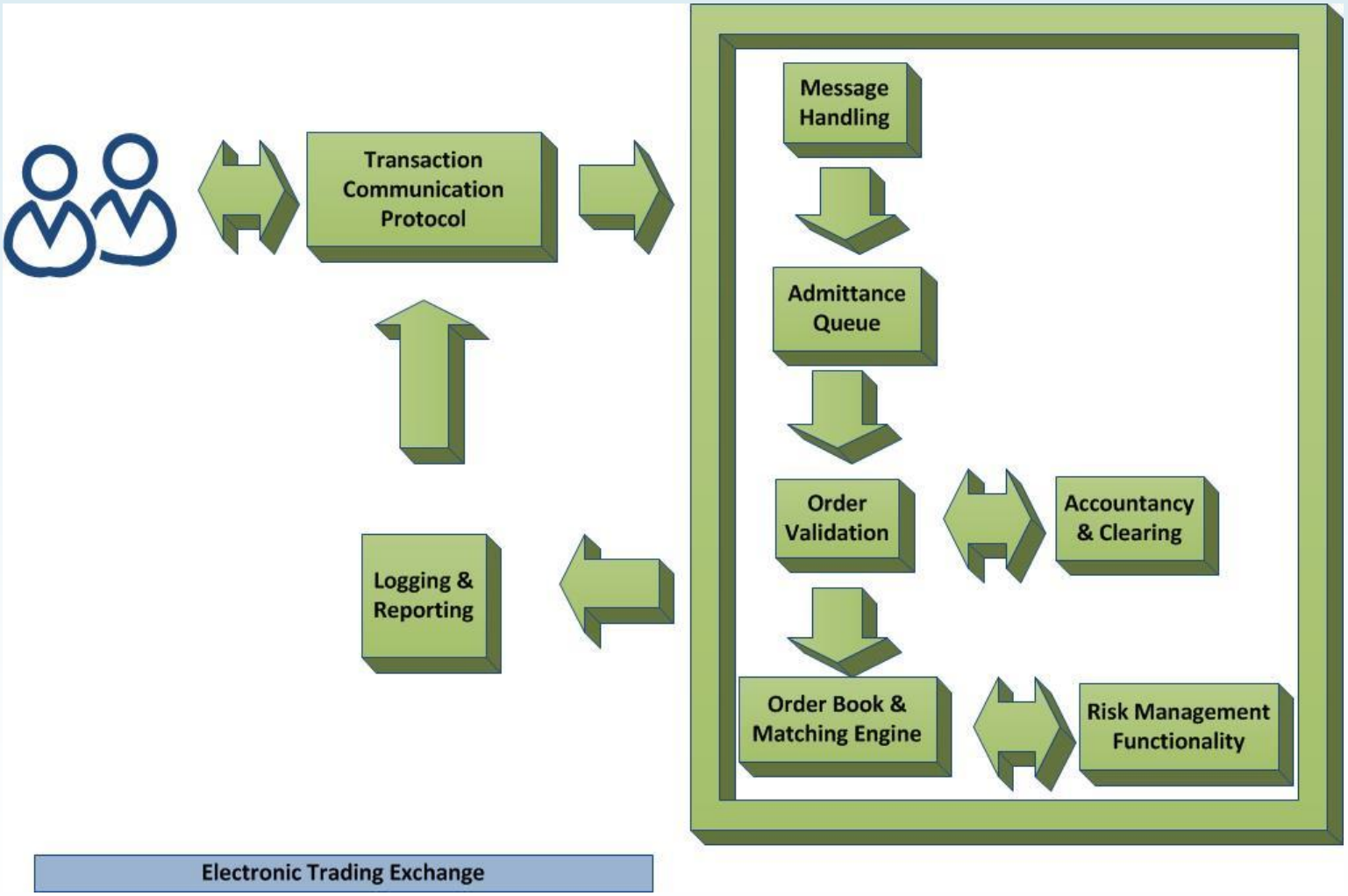
Computational Finance Infrastructure

Trading Floor Infrastructure

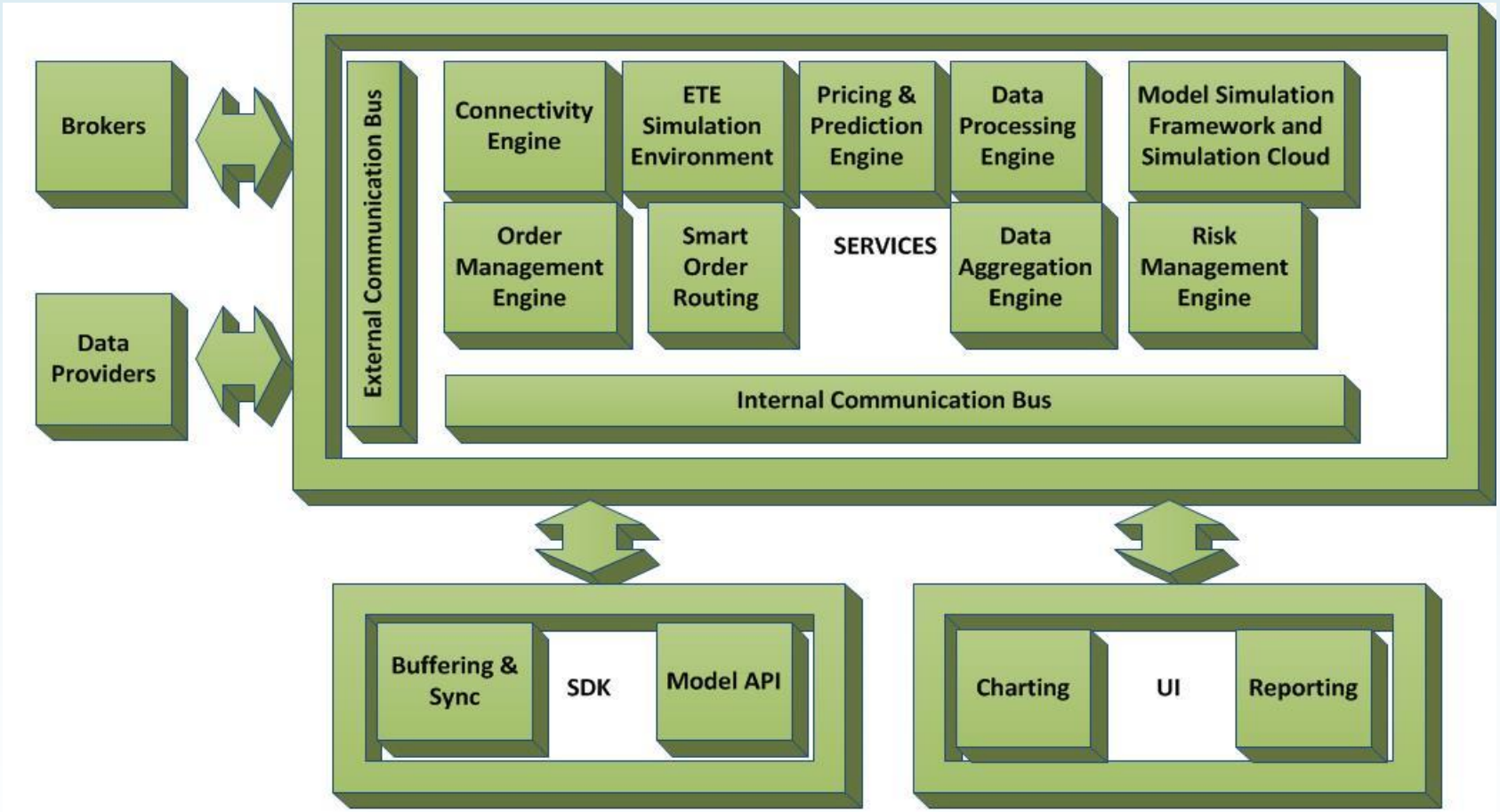


Risca M., Malik D., Kessler A.:" Trading Floor Architecture", Cisco Systems, 2007

Electronic Trading Exchange



Algorithmic Trading Platform



Algorithmic Trading Platform

Experimental Computational Facilities for Modelling, Simulation and Model Lifespan Management

- **Computational Simulation Environments** are crucial for effective lifespan management of trading algorithms, evaluation of their stability, estimation of their optimal parameters and their expected risk and profit statistics.

- The environments are predominantly designed for testing, optimisation and monitoring of algorithms running in virtual or real trading mode

- **Prerequisites**:
  - Understanding of key elements and low-level features of AT models
  - Identification of key simulation processes that can be performed on AT models

DRACUS (Distributed Analytics, Control & Utilities System)

- Complex social, financial, economic models require significant amount of computational power, fast and reliable information management facilities and significant amount of data resources
- With DRACUS project we are interested in complementing ATRADE and SocialSTORM project by supporting execution and simulation of general analytic models where users can code the logic of a model and use the system to test their hypothesis.

- Back-test model simulations on the cluster
- Stress-test model simulations on the cluster
- Forward-test (Monte-Carlo) model simulations on the cluster
- Cluster-based model optimisation
- Multi-Agent model simulations on the cluster
- Model life-span management
- Programmatic remote access and control via systems' SDK
- Generic job deployment and management for custom modelling

DRACUS Collaboration Opportunities

- **PhD, MSc, BSc** collaboration on R&D of the systems
- Collaboration on **final year project organization** and management
- Collaboration on **results publication** and utilisation of the systems
- Please **get in touch** for more details.

Questions?

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