Module 4 - Trading Systems

MSc in Quantitative Finance (MQF), 2024

What is a Trading System?

- Trading system can refer to:
  - A set of rules that can be based on technical indicators, fundamental analysis or market study to form buy and sell signals (also known as the trading strategy). Trader executes the trading signals and manage the risk manually.
  - Computer software that automatically generate orders based on predefined set of rules by a trading strategy. This is an automated trading system, also known as algorithmic trading if the strategy is based on some formulas and mathematical finance. Some examples are:
    - Systematic trading
    - Market making
    - Statistical arbitrage
- Algorithmic trading often requires high speed market data at sub-milliseconds and operates at high order rates (hundreds if not thousands of orders per second). We call them high frequency trading (HFT).

System Requirements

- Strategy type and data input requirements
- Trading frequency and real-time requirements
- PnL and risk management requirements
- User monitoring and controls requirements
- Deployment requirements (servers specification, network latency)
- Choice of programming languages
- Backtesting requirements
- Data capture requirements
- Post-trade requirements

System Requirements and Designs

Components of a trading system:

- Exchange connectivity
- Market data gateways
- Order gateways
- Order Management System (OMS)
- Trading engine (signals, strategy, execution)
- Risk Management System (position, risk, pnl)
- Post-trade dropcopy

Network Types and Latencies

- Type of connectivities
- Low latency connectivity - leased line, dark-fibres, high-frequency radio
- Reliabilities and securities
- Speed of transmission - milliseconds

References:

1. https://www.verizon.com/business/en-sg/terms/latency/
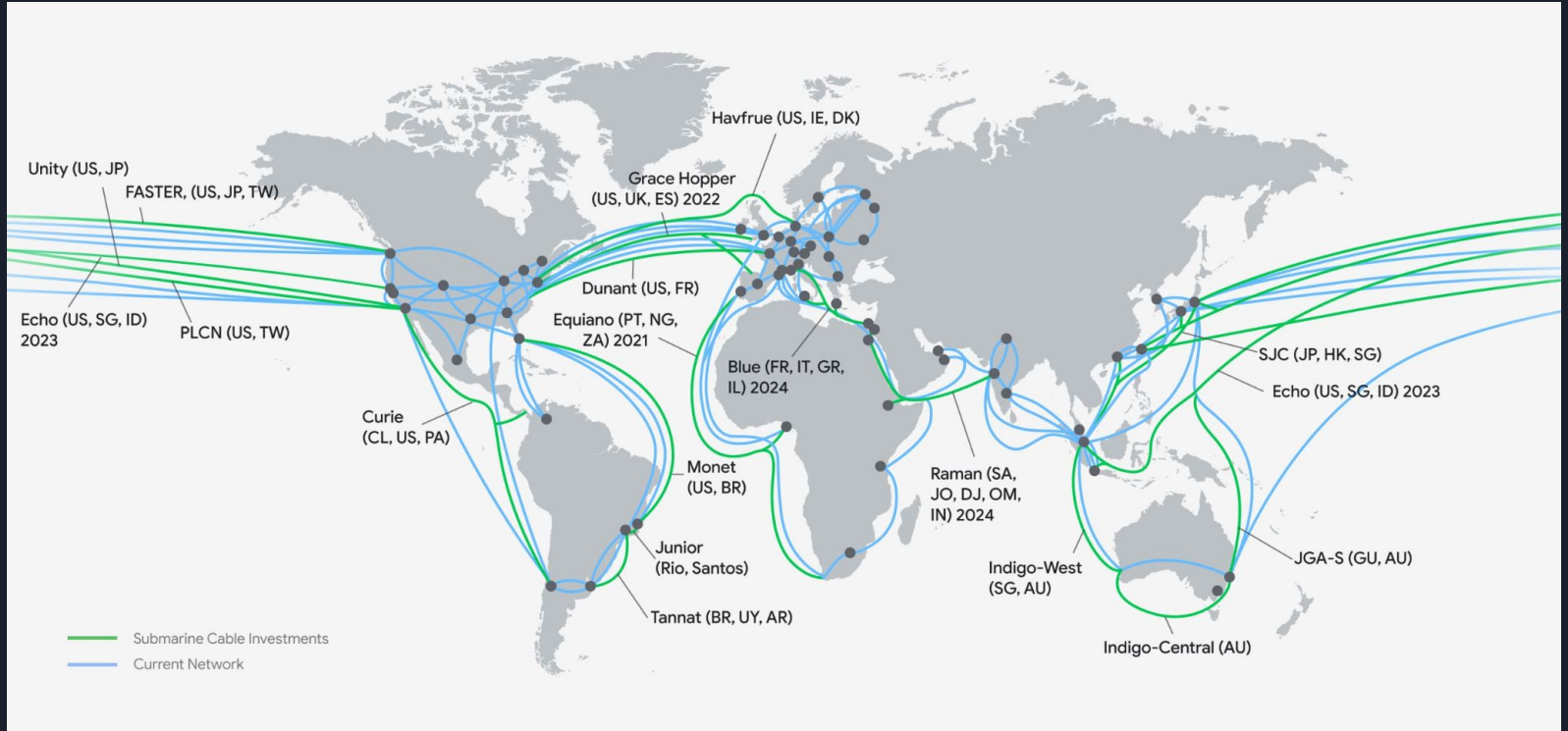
Connectivity and Colocation (Colo)

- Physical location of servers - why it matters?
- Trading exchanges run on servers in Data Centres.
- HFT firms spend millions each year placing their trading models as close to exchange servers to gain an advantage in speed.
- This practice is known as colocation, where trading computers are placed in the same data centers that house an exchange's computer servers.
- The purpose is to minimize data latency to the scale of few milliseconds, to be the first in market to get the price update, and first to execute an order.

Trading Protocols

Protocols	Data Format	Network
REST	JSON, XML, YAML	Internet or Leased line
Websocket		
FIX	Tag/value encoding	
Simple Binary Encoding	Binary data	
Proprietary API	(any)	

Data Centers, Network, Latency

Unity (US, JP)
FASTER, (US, JP, TW)
Echo (US, SG, ID) 2023
PLCN (US, TW)
Havfrue (US, IE, DK)
Grace Hopper (US, UK, ES) 2022
Dunant (US, FR)
Equiano (PT, NG, ZA) 2021
Blue (FR, IT, GR, IL) 2024
Curie (CL, US, PA)
Monet (US, BR)
Junior (Rio, Santos)
Tannat (BR, UY, AR)
Raman (SA, JO, DJ, OM, IN) 2024
SJC (JP, HK, SG)
Echo (US, SG, ID) 2023
Indigo-West (SG, AU)
JGA-S (GU, AU)
Indigo-Central (AU)

Submarine Cable Investments
Current Network

Reference: https://cloud.google.com/about/locations#network

Classroom exercises: week_04

- Storage of sensitive information
- Create a method to send order
- Develop a simple periodic buy and sell strategy
- Develop a range trading strategy