ARTIFICIAL INTELLIGENCE IN CAPITAL MARKETS TRADING
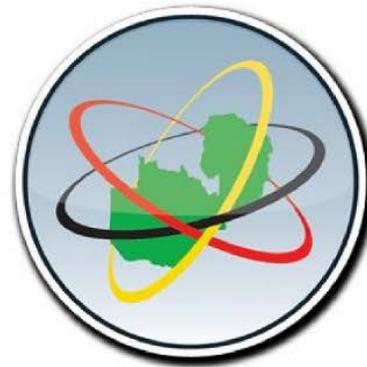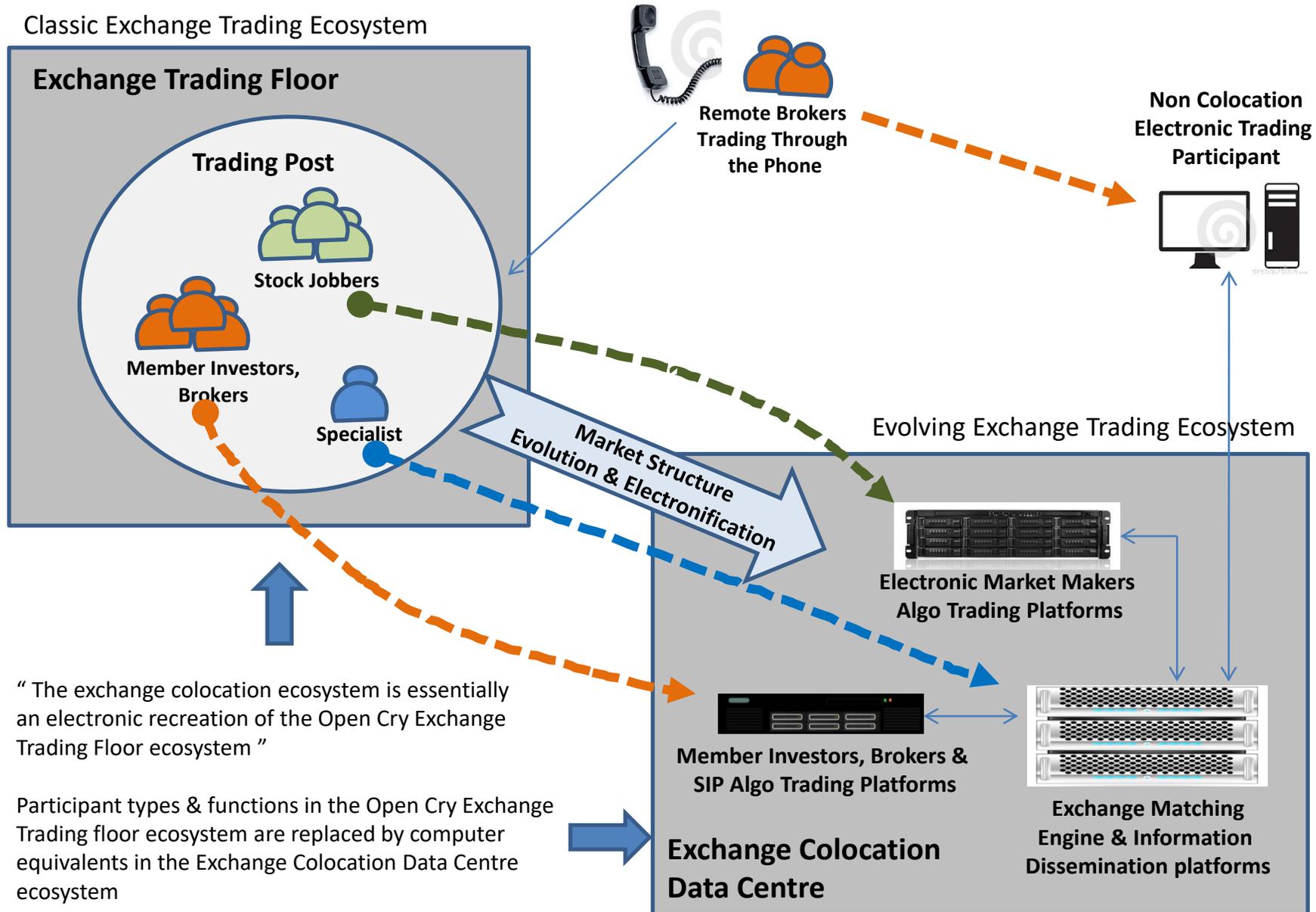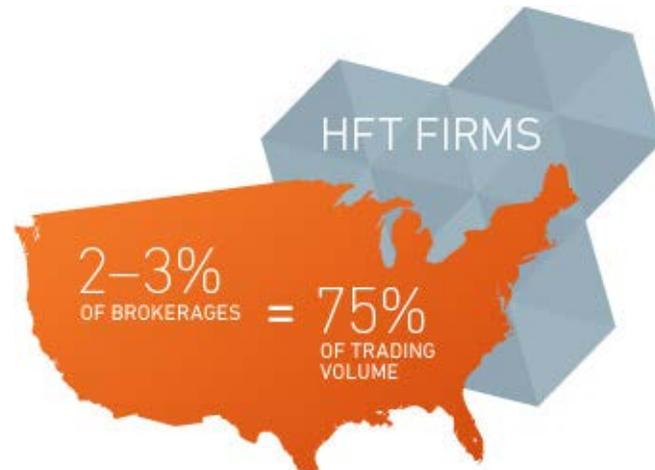
From the Open Cry Exchange Trading Floors to Exchange Colocation Data Centres

Classic Exchange Trading Ecosystem

Exchange Trading Floor

Trading Post

Stock Jobbers

Member Investors, Brokers

Specialist

Remote Brokers Trading Through the Phone

Non Colocation Electronic Trading Participant

Evolving Exchange Trading Ecosystem

Market Structure Evolution & Electronification

Electronic Market Makers Algo Trading Platforms

Member Investors, Brokers & SIP Algo Trading Platforms

Exchange Matching Engine & Information Dissemination platforms

Exchange Colocation Data Centre

" The exchange colocation ecosystem is essentially an electronic recreation of the Open Cry Exchange Trading Floor ecosystem "

Participant types & functions in the Open Cry Exchange Trading floor ecosystem are replaced by computer equivalents in the Exchange Colocation Data Centre ecosystem

The use of A.I. in Capital Markets Trading   Dr. Dennis C. Mwansa

The Speed Race in Capital Markets Trading

US Markets statistics for 2012

What is High Frequency Trading?

No consensus on precise definition characterized by

- Rapid turn over of securities with little or no positions held at the end of the trading day

- Use of advanced technological sophistication and low latency relative to competitors

- Not a strategy in itself but a method of achieving given strategies such as
  - Market Making
  - Statistical Arbitrage
  - Latency Arbitrage (Seeking profit from temporary price imbalances in the same instruments at different market venues)

- Commonly used by both Prime Brokers and Proprietary Trading Groups particularly the Electronic Market Makers

The Speed Race in Capital Markets Trading: The strategies

Market Making Strategy

- A market maker is a trader quoting both a price to buy and a price to sell a security
- Many trading venues have Designated Market Makers for given securities
- Designated Market Makers have an obligation to provide quotes to buy or sell in return for rebates or reduced trading fees (**Maker Taker system**)
- Most secondary market platforms (ATS, MTF, PTS) depend on designated market makers to create liquidity
- Unofficial market makers can operate on most exchanges but they do not have the obligation to always quote a buy or sell price nor do they receive rebates on trades
- Banks offering currency exchange services are one example of commonly encountered market making in everyday life

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Statistical Arbitrage (Commonly called Stat-Arb)

- Distinct financial instruments (e.g. stocks of Airlines and price of crude) can have a relationship in how their prices change over time
- The change in one instrument before a corresponding change in the related instrument presents an opportunity for arbitrage
- The relationship between the instruments is usually calculated from historical trends over long periods of time

Latency Arbitrage

- Capability to process and react to market events before competitors so as to profit when the general market moves in the anticipated direction
- If the same financial is traded on more than one venue, there may be short-term price differences among the venues
- It is possible to buy an instrument at the lower price venue and sell it at the higher price venue before the price is harmonized (i.e. Beat the time it takes for the information to become well known)

The Speed Race in Capital Markets: Where are we now ? What has been the impact?

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INFRASTRUCTURE

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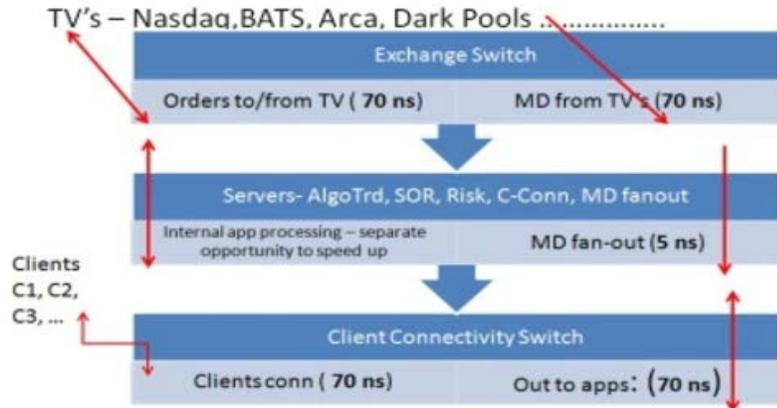### Deutsche Bank Shaves Trade Latency Down to 1.25 Microseconds

Offering a new hardware-based DMA technology to high frequency shops, the bank said it's breaking the speed barrier of software-based solutions.

Ivy Schmerken
News

In the arms race to serve the high frequency trading crowd whose strategies

Decrease Colo Network Latencies via $18K 48 port FPGA L1-3 switches, to 285 ns, down from few ms

TV's – Nasdaq,BATS, Arca, Dark Pools ....

| Exchange Switch |
| Orders to/from TV (**70 ns**) | MD from TV's (**70 ns**) |

| Servers- AlgoTrd, SOR, Risk, C-Conn, MD fanout |
| Internal app processing – separate opportunity to speed up | MD fan-out (**5 ns**) |

Clients
C1, C2,
C3, ...

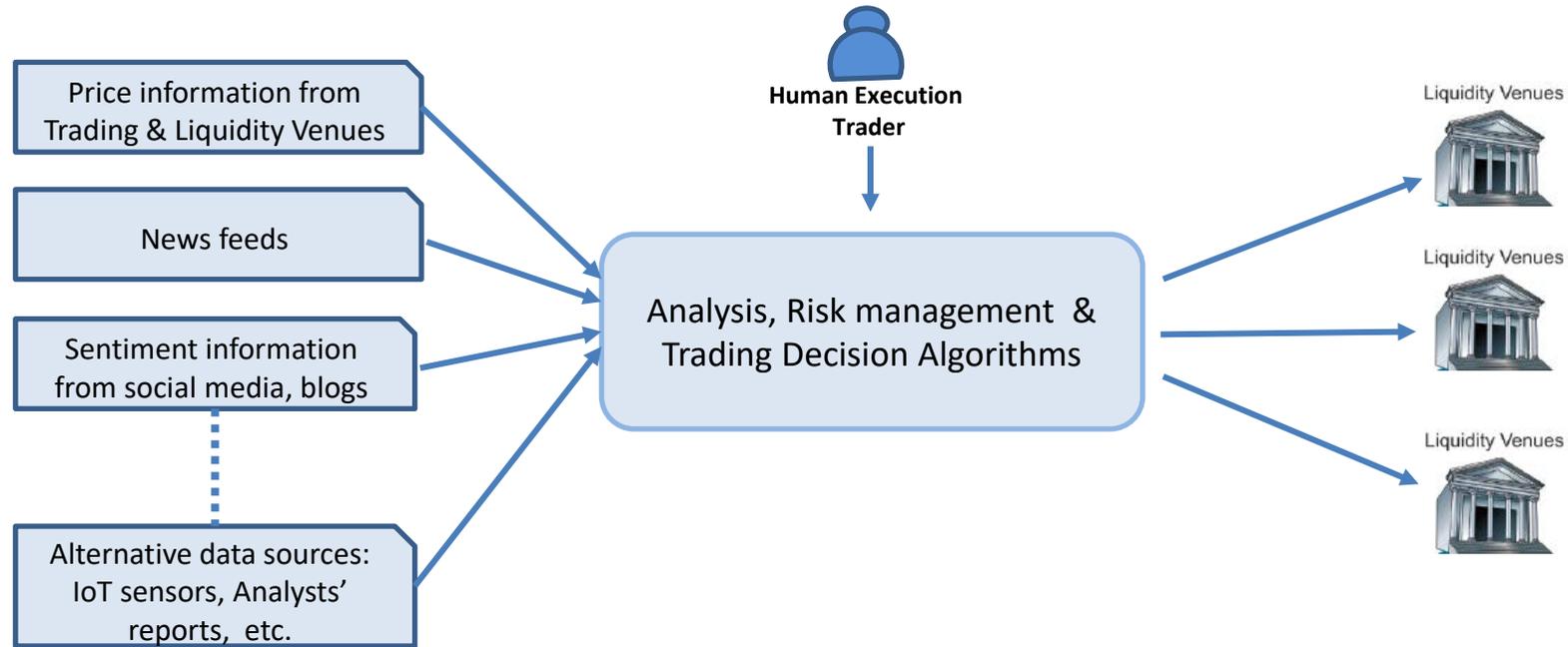| Client Connectivity Switch |
| Clients conn (**70 ns**) | Out to apps: (**70 ns**) |

FPGA based, multi-layer switches (L1-3), 5 ns L1 switching - market data (MD) fan-out, 70 ns L2 aggregation, result in 220 ns network latencies. 70 ns aggregation is less than half the latency of the best conventional switches (70 vs 160 or ~90ns). The 70 ns aggregation for each ~client connectivity (C), receiving MD, order flow, saves at least 515 ns for client to/from Trading Venue (TV) order ack times: (360 ns for the 4 x ~90 ns L2 flows 155ns for L1 MD). Factor less deterministic traditional switches' latencies, advantages at peak processing may be more than few milliseconds – eternities for electronic trading.

Gone in a FLASH: May 6, 2010 —

PREVIOUS CLOSE: 10,868.10

Dow industrials
Close
10,520.32
-3.2%

A Flash in The Market
Stock markets plunged suddenly on May 6 of this year and gained speed as computer programs prevented losses. But almost as quickly, the market recovered much of the decline.

1 1:00 Volatility in some stocks increases in a down market.

2 2:30 Unusually nervous trading pushes overall volatility up sharply; the Dow is down 2.5 percent.

3 2:32 A program to sell $4.1 billion in E-Mini futures starts; other traders react by starting to sell.

4 2:41 Selling in the futures market spreads to stocks; automated trading programs react to the sharp drops by shutting down.

5 2:46 After trading in E-Mini futures is paused for five seconds, alleviating the pressure to sell, the market begins to recover.

2:46
9,869.62
-9.2%

10 A.M.   11 A.M.   12 P.M.   1 P.M.   2 P.M.   3 P.M.

Sources: Bloomberg (Dow industrials); Securities and Exchange Commission   THE NEW YORK TIMES
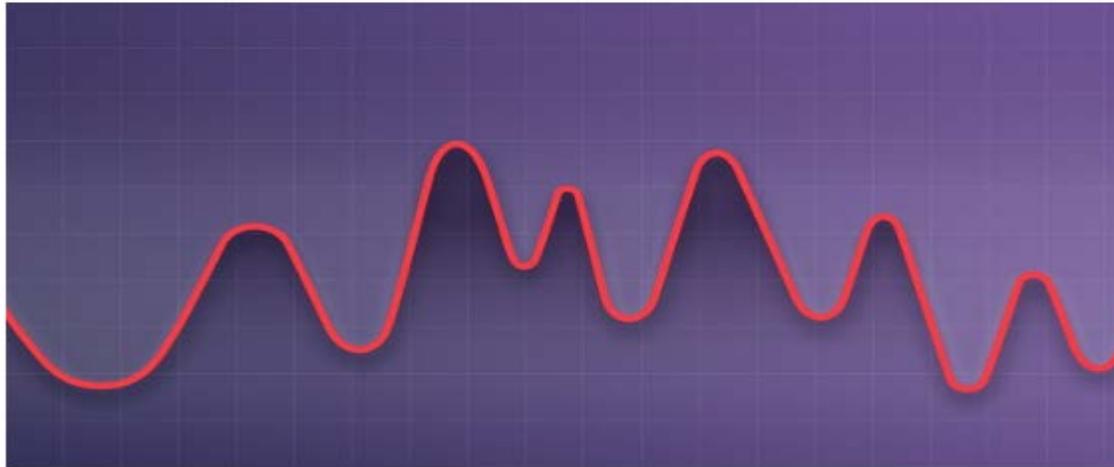
The Data Deluge

"Trading Securities is increasingly an Information Intensive decision making processes"

Data-intensive functions such as risk management and transaction cost analysis (TCA) once relegated to the back office for processing long after trades were executed must now be performed fast enough for traders to use the results in real time. Increasingly more risk controls are taking place before the trade, driven by regulation and a desire to minimize risk exposure.

The whole idea is to do something no other human—and no other machine—is doing. "Finance is a domain where you benefit not just from being smart," "but from being smart in a different way from others."

- Ben Goertzel AIDYIA

Source: https://www.wired.com/2016/01/the-rise-of-the-artificially-intelligent-hedge-fund/

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Why is the world's largest money manager letting a computer manage clients' money?

Artificial Intelligence Powered Players in the Capital Markets
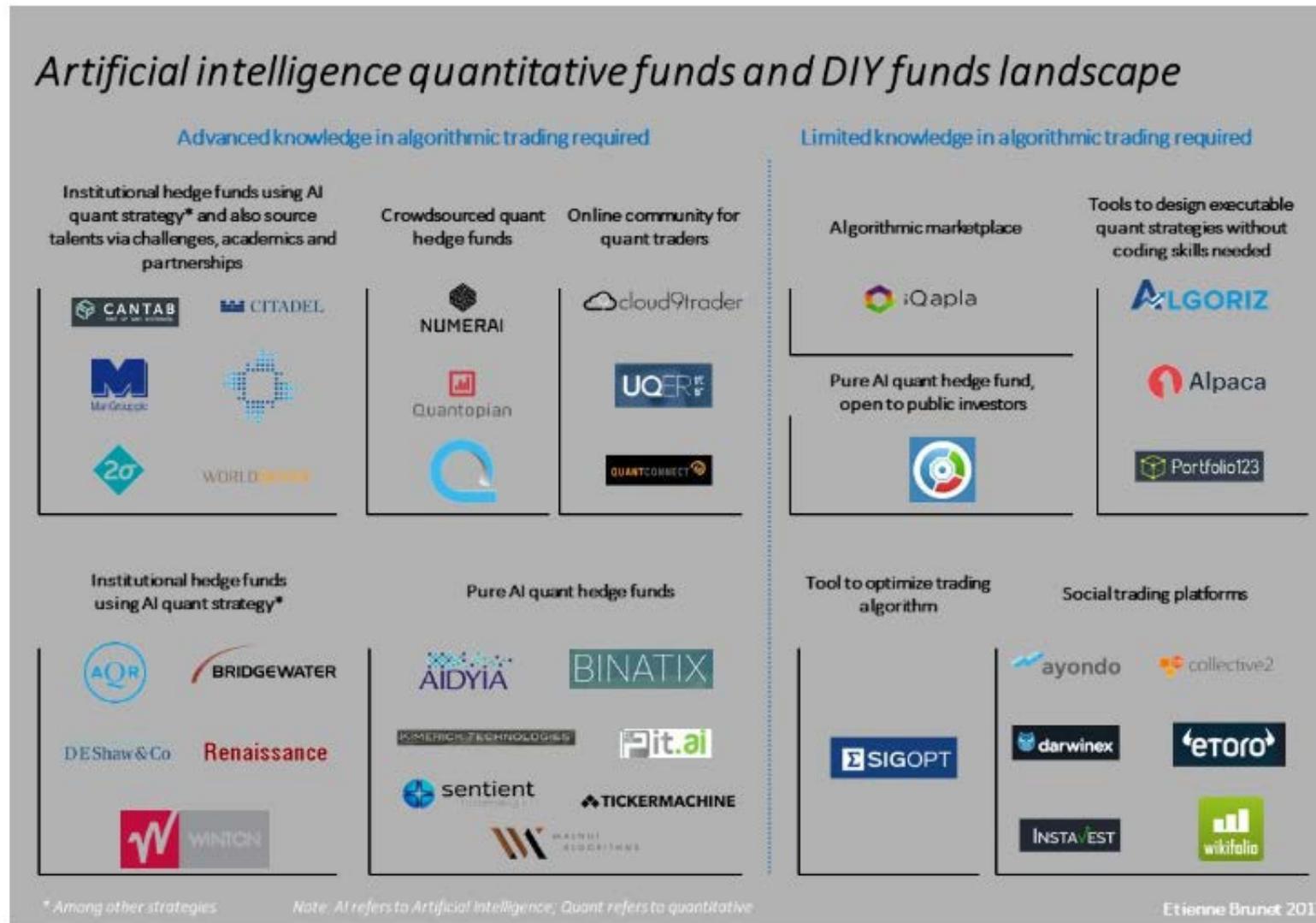
Artificial intelligence quantitative funds and DIY funds landscape

Source: