

Last year I introduced Algo-Operations as one of the 5 hotspots of our Financial Systems strategy. This year I like to focus exclusively on it because the concept is catching on and we have made progress.

In the past 20 years we focused on **STP – Straight Through Processing:** basically eliminating paper and linking administrative work steps into uninterrupted process flows. In the next 10 years, we will be **automating decision processes.**

Last year I explained how Google operates with automated decision processes, this year I like to add another example.

Both companies are clearly in a business very different from our financial services clients – most importantly, they did not have a burden of legacy infrastructure.

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WHAT'S YOUR POSITION?



Algorithmic Operations

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First a recap on Google. Google is not in the search business; Google is in the fully automated advertising business. Let me explain their evolution.

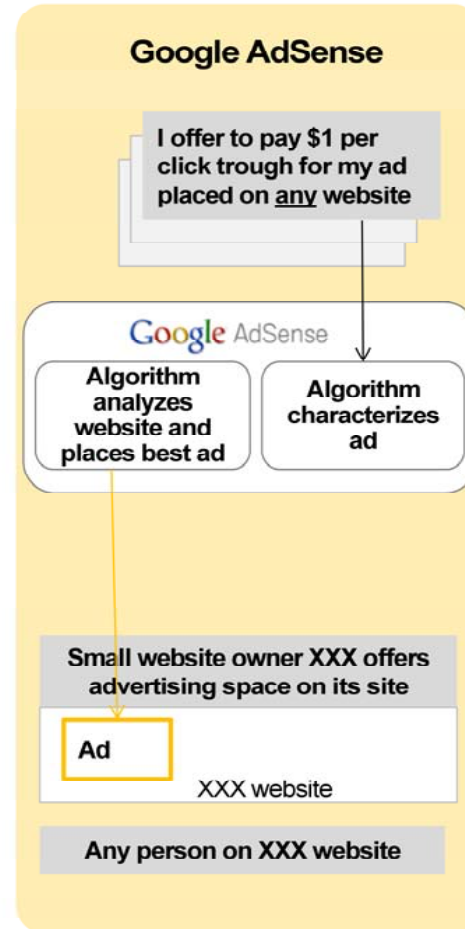
- 1. AdWords** conceived in 2000:
Google auctions off advertising space on it's web-pages showing search results. The operation is fully automated – algorithms select the best offer for each advertising opportunity and place the best add.
- 2. AdSense** started in 2005:
Google auctions off advertising space on participating websites. Algorithms characterize each ad and match it with be most appropriate website.

Today AdWords and AdSense together generate \$70 million in daily revenues 364 days a year.

The key insight is that most operations in this \$25 billion business are automated and controlled by algorithms. No human decides which ad gets selected and placed. Google employees constantly improve their algorithms to characterize ads, matching viewers and speed up auctions.

Internet advertising

“Look ma – no hands!”



1.5 million advertisers pay ~\$70 million

Google

1 million websites use AdSense and collect ~\$15 million

Every Day!

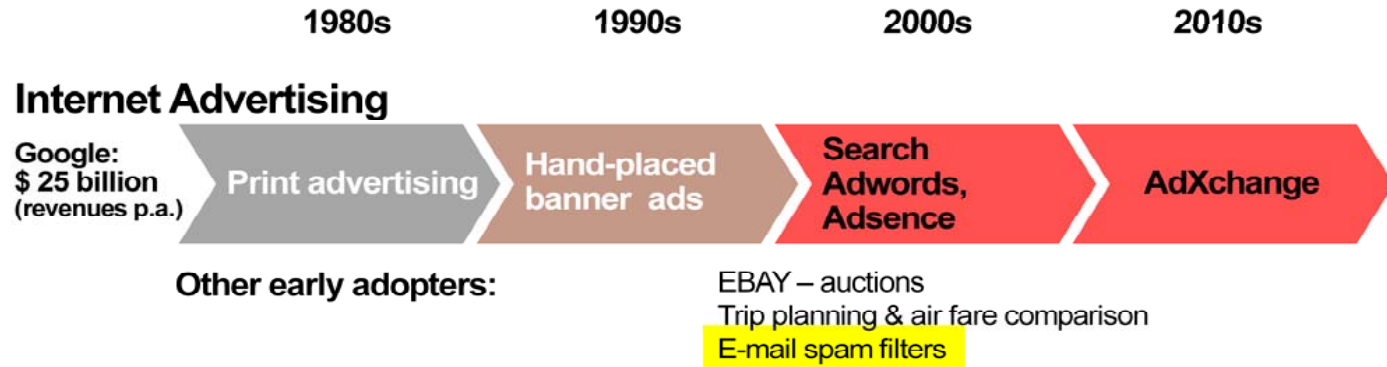
Internet advertising is today the largest fully automated information business. But there are **other early adopters of the same principles:**

- look how **EBAY** automated the auction business for physical goods, or
- how **trip planning** and airfare comparison sites have replaced travel agents, or
- how **spam-filters** today block out 95% of all email traffic before it even hits your inbox.

Let me explain this last example to give another perspective on algorithmic operations.

Each of you probably receives between 100 and 200 emails per day – and you feel totally overwhelmed. The reality is: **each of you is sent between 1,000 and 2,000 email a day and spam-filters save you.**

Emergence of Algo Operations



Here is how **Barracuda**, one of the more sophisticated spam filtering companies work.

They **serve around 80,000 companies in 80 different countries**. These companies may be banks or mail hosters with millions of email users.

These users **receive around 1.5 billion emails per day**. Problem is over 90% of them are spam and need to be blocked before you see them.

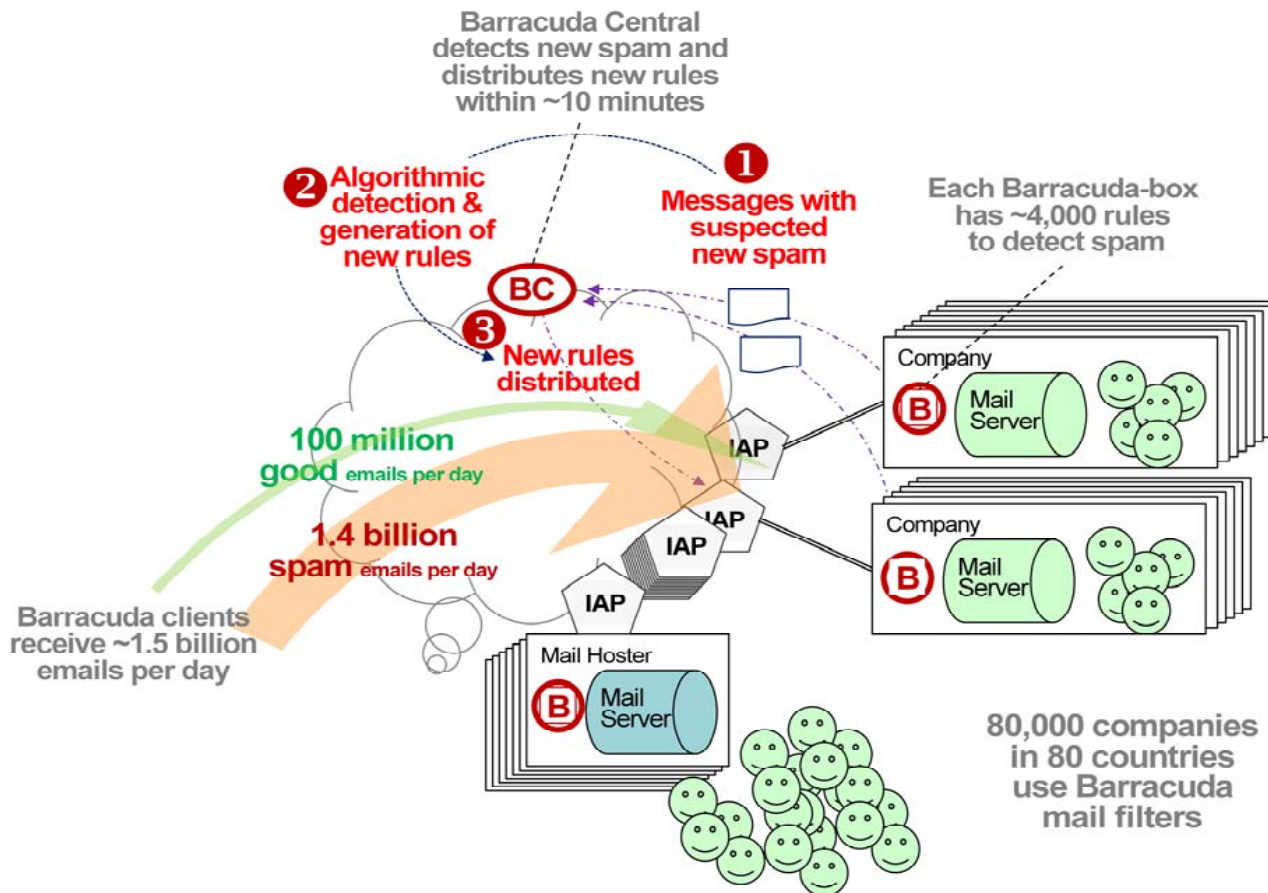
This blocking is done by a Barracuda box which sits in front of each internal mail server. They **expose each incoming mail to around 4,000 rules which detect and block the spam messages**.

The challenge: **how do you continuously update these rules defending against the new spam messages created each day?**

Each of the boxes, if authorized by the client, send suspected e-mail messages back to **Barracuda central** where another set of algorithms and specialist decide whether they are indeed spam, and if so, create new rules which are sent out to all 80,000 boxes. All of this happens within around 10 minutes!

Without fully automated spam filtering we would have long given up reading our inboxes!

E-Mail spam filtering



We see algorithms also creeping into financial operations. Algorithmic trading and order routing is the most visible example having evolved similar to internet advertising. Interestingly, Algo trading was started by small companies in New Jersey realizing that by full automation they can run circles around the big brokerage houses on Wall Street. By now the big banks have

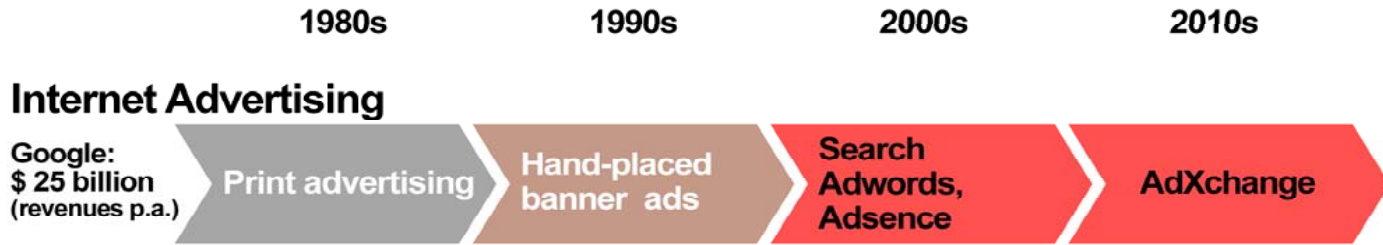
But there are other early adopters of rules based automation in finance, like

- Pre-trade compliance
- Payment reconciliation
- Retail credit approvals
- “Know your client” activities, and
- Mutual fund pricing and administration, and

My argument today is that this development will rapidly expand in finance in the **back-offices** and dramatically alter the competitiveness of those who embrace this trend early. Think of algo-ops as the next step after STP.

Let me explain by taking a closer look at Fund Administration.

Emergence of Algo Operations



Other early adopters:

- EBAY – auctions
- Trip planning & air fare comparison
- E-mail spam filters

Finance: Algorithmic Trading (Equities)



Other early adopters in Finance:

- Pre-trade compliance
- Payment reconciliation
- Retail credit approvals
- Know your client
- Mutual fund pricing & administration

Fund Administration can be segmented into 5 interlinked daily steps

- Reconciliation
- New trades
- Pricing of instruments
- Valuation of Funds
- Reporting

Globally funds hold around \$60 trillion in assets. Assuming administration costs of around 2.5 bp p.a. this translates into Fund Administration “revenues” (internal or paid to third parties) of \$15 billion. Labor cost account for around one third, or 5 billion. This translates into around **50,000 employees** being engaged in this work.

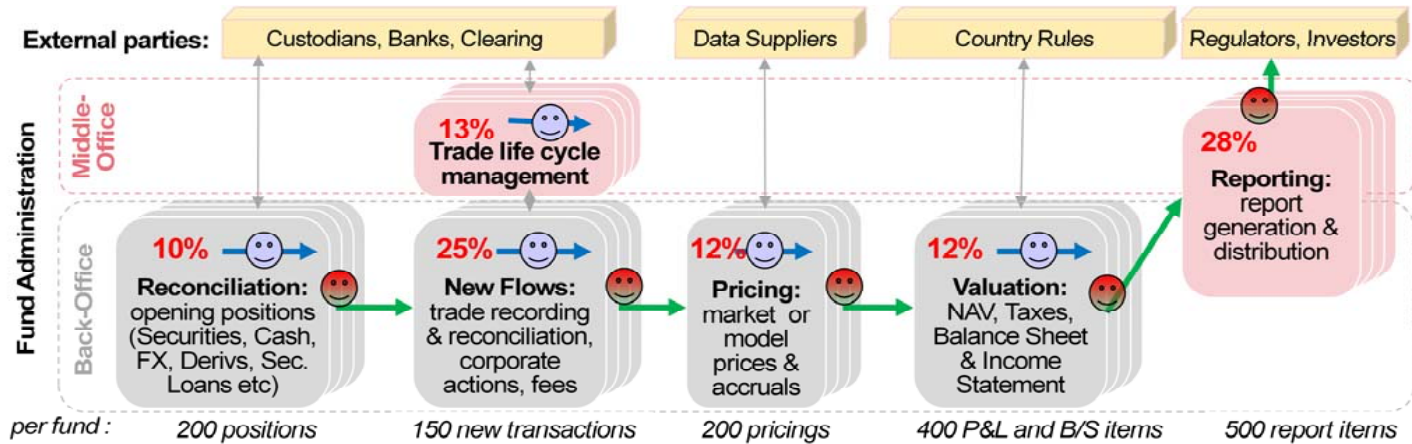
Most of these employees do 2 kinds of jobs:

- They perform an **action** applying data on a transaction or position and storing the results in a shared database
- They **check** somebody else’s action and hand the job to the next Actor.

Our engagements with major fund administrators has proven that we can **reduce labor by around 30%** through introduction of algorithms, mostly in:

- Data quality & reconciliation
- Automated checking
- Sequencing & load balancing and
- Process improvements

Example: Fund Administration

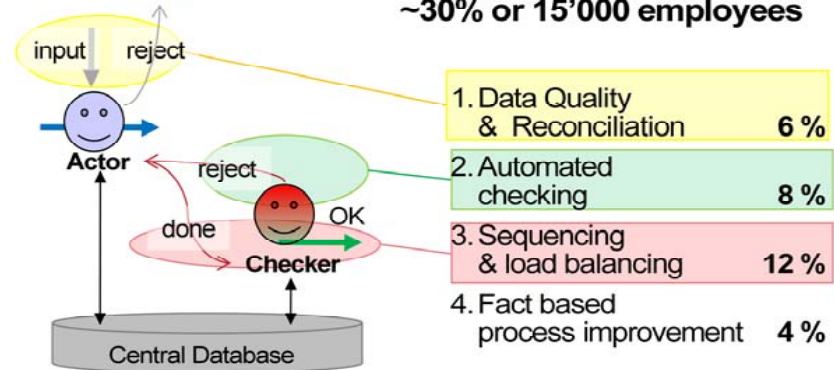


Global Fund Assets: \$ 60 trillion
Fund Administration costs: 2.5bp p.a.

Global FA “Revenue”: \$ 15 billion
Less costs: **Employees** -\$ 5 billion
Infrastructure -\$ 2 billion
IT -\$ 4 billion
Suppliers -\$ 1 billion
Gross Margin (20%) **\$ 3 billion**

Employees: **Trade Cycle Mgmt** 13%
Reconciliation 10%
New Flows 25%
Pricing 12%
Valuation 12%
Reporting 28%

What do the 50,000 employees do?



Potential labor cost reduction through algorithmic operations: ~30% or 15’000 employees

Within fund administration, pricing and NAV calculation is usually **the resource bottleneck** because instrument prices become available only late in the day (4pm) and NAVs have to be delivered by around 6pm. The workload in 2 hour window therefore often defines the number of staff required overall. As a consequence automating this operation is critical.

The illustration outlines the process for an administrator handling 500 funds which contain together 20,000 different instruments. Theoretically each instrument needs its own algorithm to verify its price, in reality the **algorithms can be grouped into hierarchies with inherited analytics** for say bonds or equities etc.

To monitor the process (see separate iPad prototype demo) **time stamps** are critical because they allow to give **early alerts** to delayed price feeds which are often the source of trouble.

Fund Administration – daily algorithmic pricing



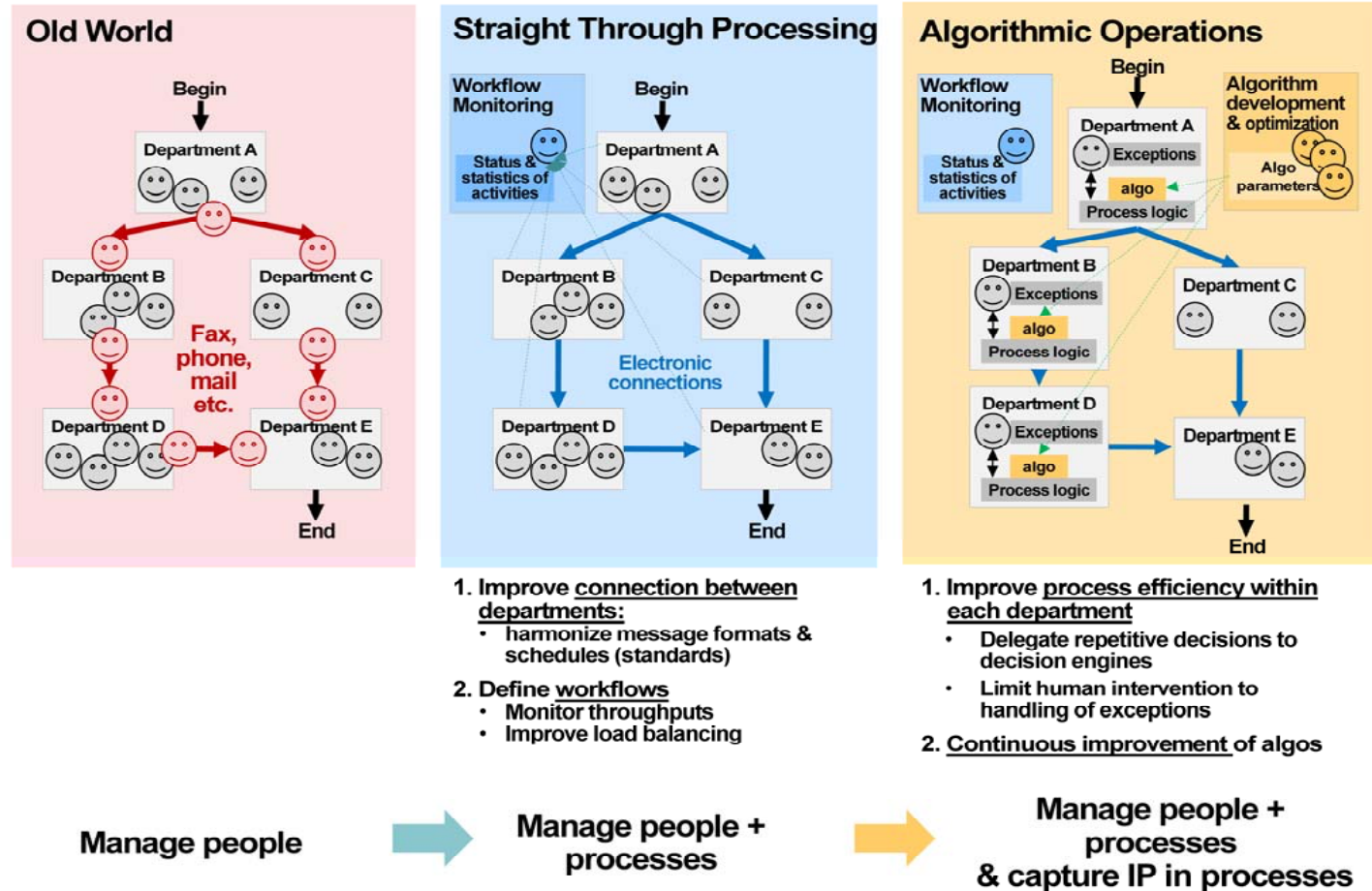
“Algorithmic Operations” is not a new label for Workflow Management or Straight-Through-Processing, it has **very different characteristics**.

- **STP** focuses on improving the connection between business units . A STP process is usually hard-coded into an application. Workflow management generally reduces errors and improves load balancing
- **Algo-Ops** focus on automating the decision processes within a business unit. The algorithms are soft-coded so they can be continuously improved with parameter settings. Algorithms can only be introduced after workflows have been defined. Manual labor is used exclusively to handle exceptions and to improve the algorithms

The **three key benefits** in algorithmic operations are:

- **Increased speed , agility and lower costs**(as best illustrated in algorithmic trading – allowing trading decisions far faster than humans could contemplate)
- Framework for **continuous process improvement**
- **Capturing intellectual property of processes in the business.** Process knowledge no longer walks out the door every night.

What’s the difference to STP?

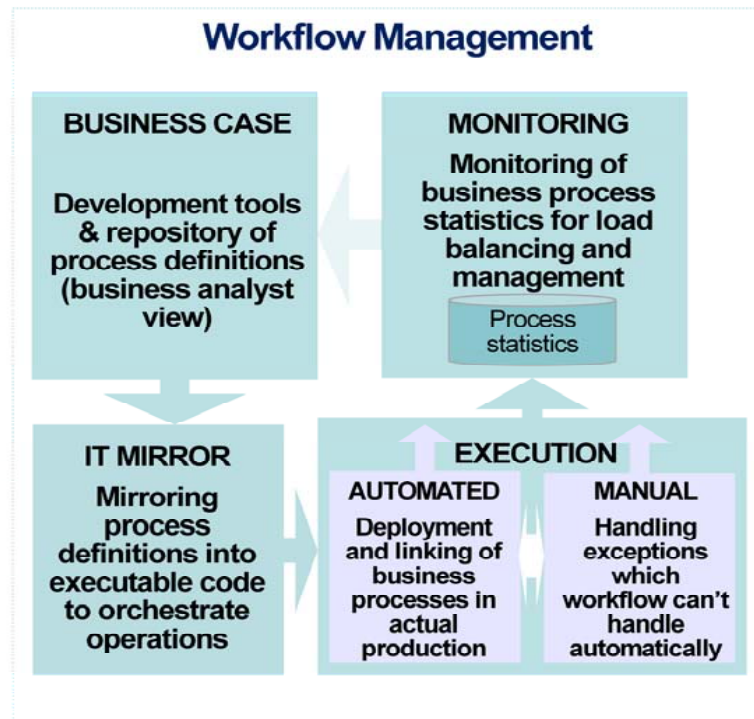


We are well advanced in our workflow and process management tools:

- a modeling environment for business analysts to define processes,
- a mirrored translation of that business process into executable code,
- a deployment environment for execution and
- a monitoring facility. the "Control Room"

Now we are preparing to take the next step – expanding the platform to include algorithms. This is more complex.

Business Process Management Systems (Workflow)

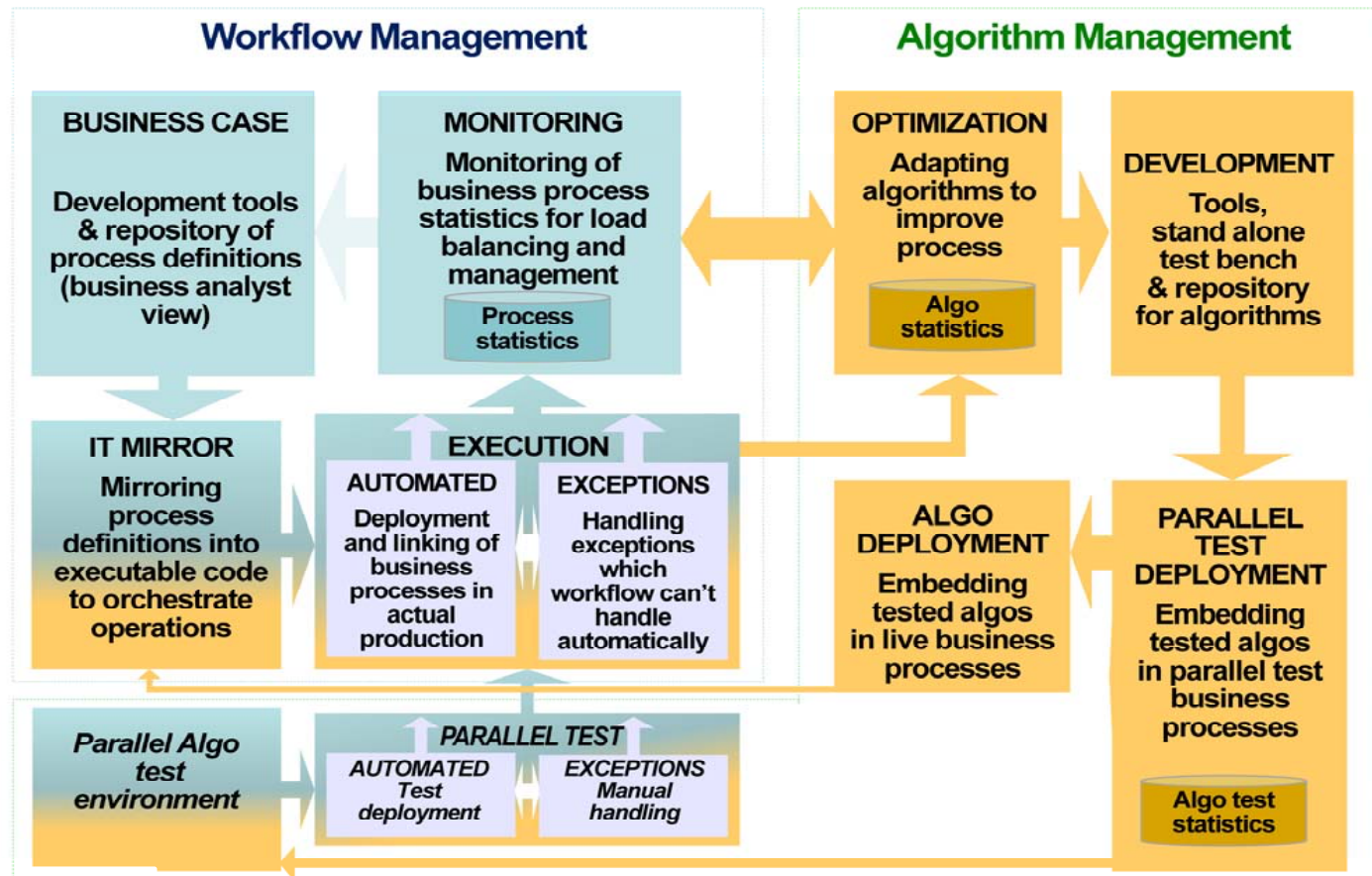


To manage algorithms we need:

- A development, test bench and repository for algorithms,
- A parallel test environment which lets us test algorithms as if they were implemented in full production
- A deployment mechanism which imbeds the algorithms into the respective processes and executes them,
- an optimization framework to adapt the decision rules in the algorithms

This is how we think about catching the wave of algorithmic operations.

BPMS (Workflow) + AMS (Algorithms) = Algo Operations



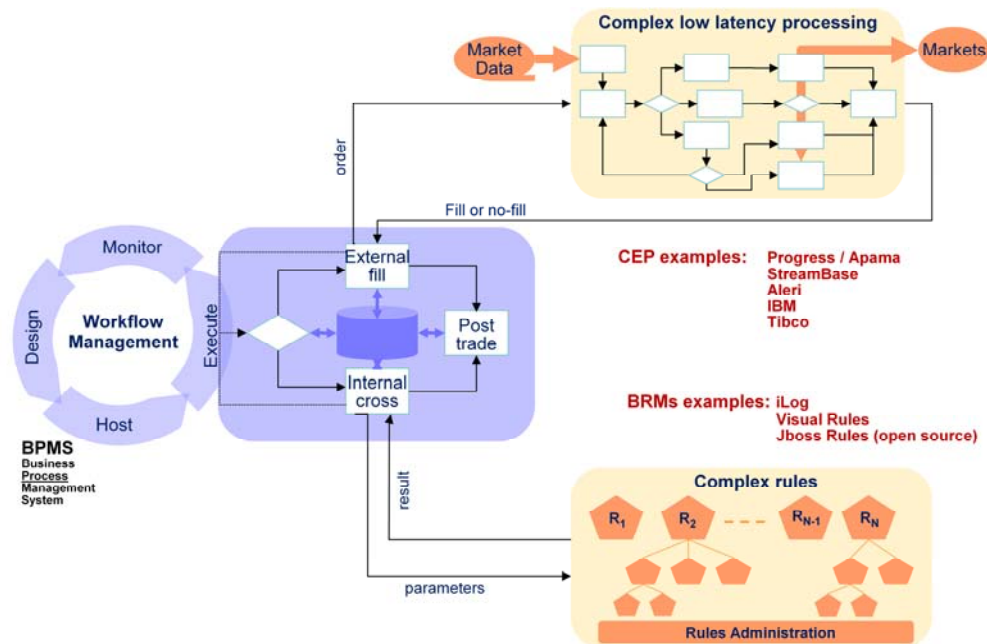
We can distinguish between two classes of algorithmic platforms.

- **Complex Event Processing platforms** focus on monitoring large amounts of continuous data triggering operations which must be executed at very high speeds. They are usually deployed in trading operations.
- **Business Rules Management Systems** focus on handling and maintaining large sets of complex rules which are invoked in a Business Process platform.

The graphic illustrates the difference in a simplified example on how a broker may handle a customer order. He prefers to internalize the trade and that may involve some complex rules. Alternatively he has to execute the trade in the market and he would do that through an order execution platform.

The key difference is persistence: business process platforms store the results of every step in a database to assure recoverability. In Complex Event Processing platforms all steps are done in memory to achieve the high throughput of data and low latency.

Two classes of Algo-Platforms: CEP & BRMS



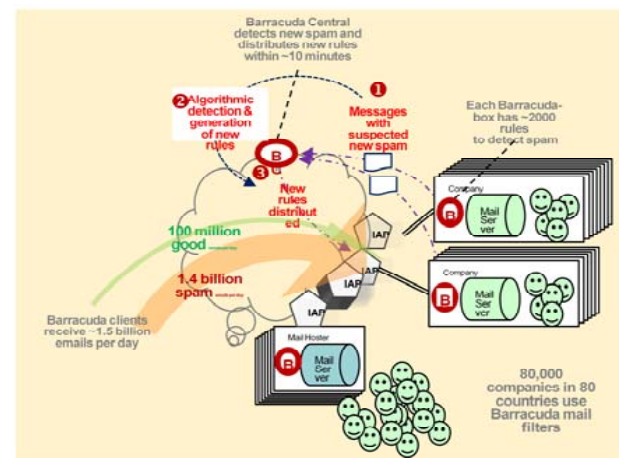
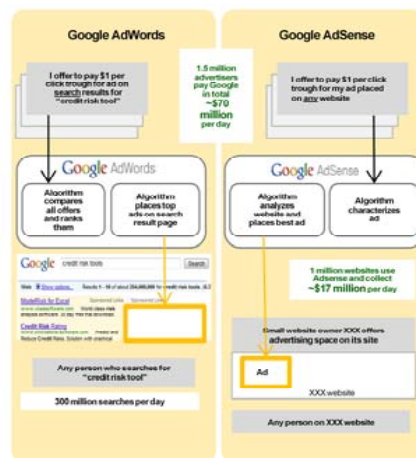
So, back to the two examples I described at the outset. What do they have in common?

1. The bulk of the repetitive daily operational **decisions are fully automated**.
2. A significant amount of the intellectual man-power of the employees is focused on **continuously improving** the algorithms.
3. This automation has allowed to provide the service at a cost level and the speed which would not have been possible in a conventional fashion – **thus entirely new businesses were created on a green field**.

So, here is the key challenge our clients face: they can't restart their operations from scratch in a green field. They live in an environment loaded with legacy structures and processes. But compared to these new businesses their operations are incredibly inefficient.

Whoever figures out first **how to transition** to this new world of algorithmic operations will win hands down. My suggestion is to further build out the STP environments – however with the clear objective to get to algorithmic operations.

Remember Google & Barracuda



1. Repetitive decisions fully automated
2. Intellectual man-power focused on improving algorithms
3. Service costs reduced by a factor of >100 creating new businesses

Our clients' challenge: transitioning out of your legacy environment

Business Process Management, or Workflow Management have brought us STP. The development and deployment cycle is relatively slow: We spend a long time analyzing a business until we complete and implement a new process, and we update a once established process rather infrequently.

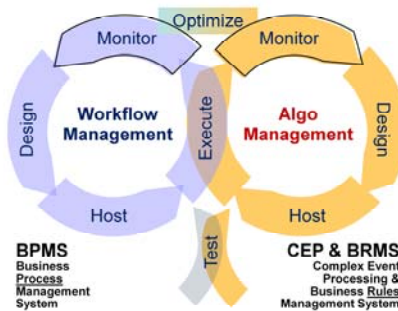
Business Rules or Algorithms however need to be continuously adapted to the changing environment and new insights for improved decisions. The cycle times are faster and the incremental changes smaller. Thus the BPM platforms need to evolve to be able to test and handle the continuously changing rules.

Both are very difficult to implement in a legacy environment which often has out-of-date workflows and undocumented decision processes. But pressures to reduce costs and increase response times and agility force the change.

The key benefit is in capturing the Intellectual Property in the workforce and change their job from experienced execution to continuous improvement.

So, we need to think ahead and design the STP architectures so they can accommodate the coming revolution.

Take-Aways



1. **Difficult** to evolve in legacy environment.
2. **Pressure building** to improve mid & back-office efficiencies
3. **Capture IP** in operational decisions.
4. **Jobs change** to continuous improvement.
5. Requires evolution of **IT platform.**