

Pivotal DELL EMC

Smart Factory & Digital Transformation

How do they did it?

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Pivotal

Smart Industry

Software & Data innovation

yjeong@pivotal.io
Younjin Jeong, Principal Technologist



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삼성화재

시스템 성능 개선을 위해
홈페이지 서비스가 일시 중단 중입니다.
10월 10일(화) 낮 12시에 다시 오픈할 예정입니다.
이용에 불편을 드려 대단히 죄송합니다.

시스템 중단기간 중, 아래의 자동차보험 업무에 한하여
제한적으로 서비스가 제공되며, 그 외의 경우는 홈페이지 오픈 후
다시 방문하셔서 이용해 주세요.

중단기간 2017년 9월 29일(금) 밤 10시 ~ 10월 10일(화) 낮 12시



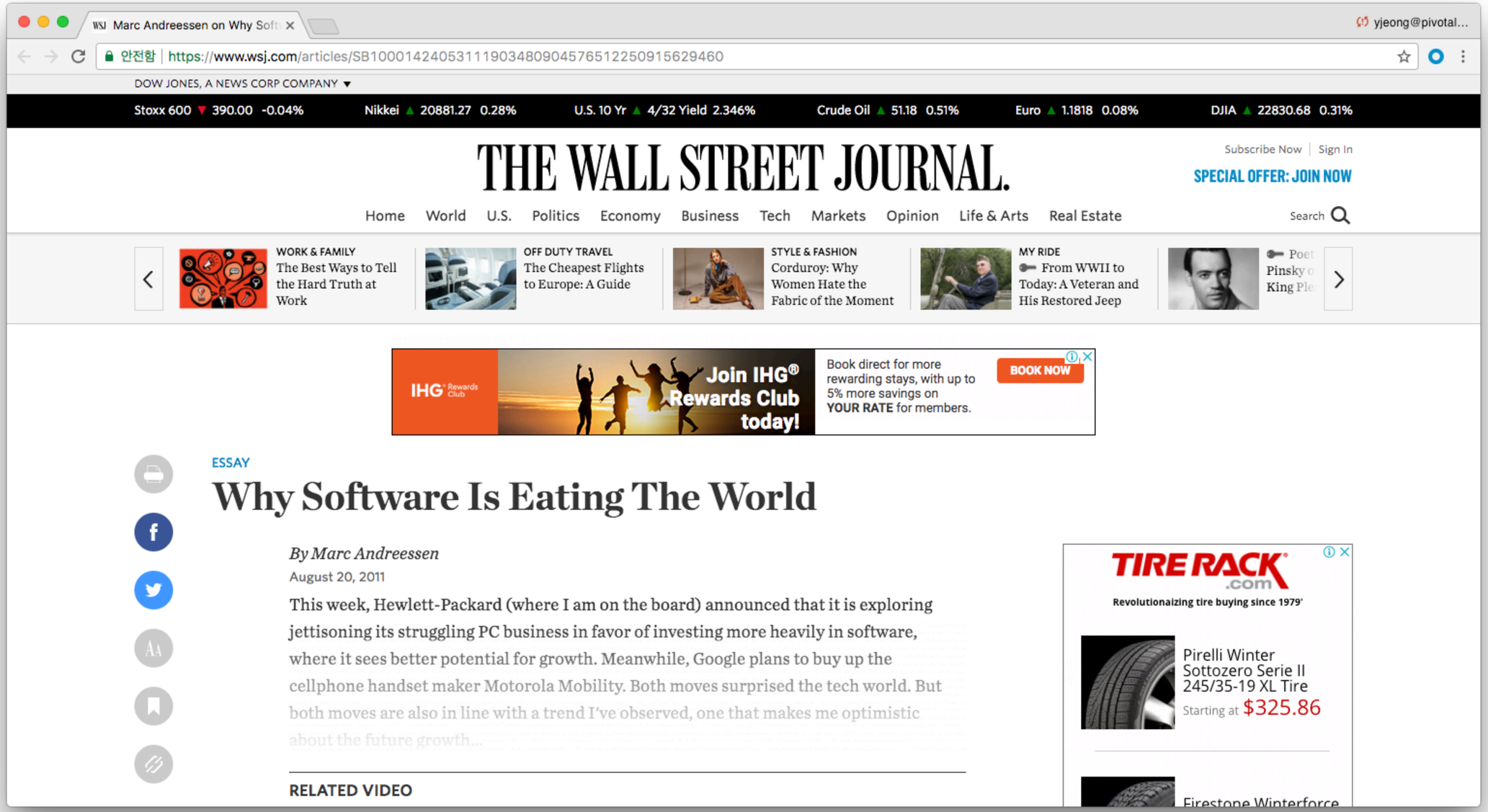
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Today

What’s happening

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TESLA

Square

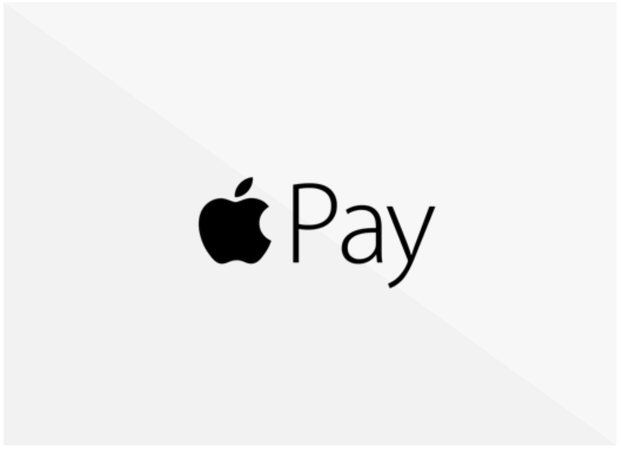
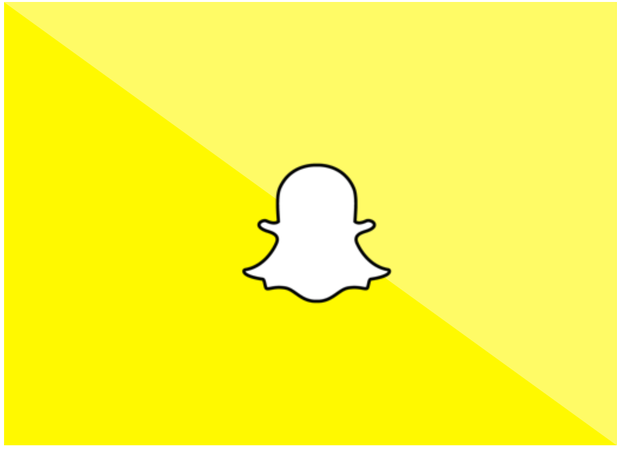
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airbnb

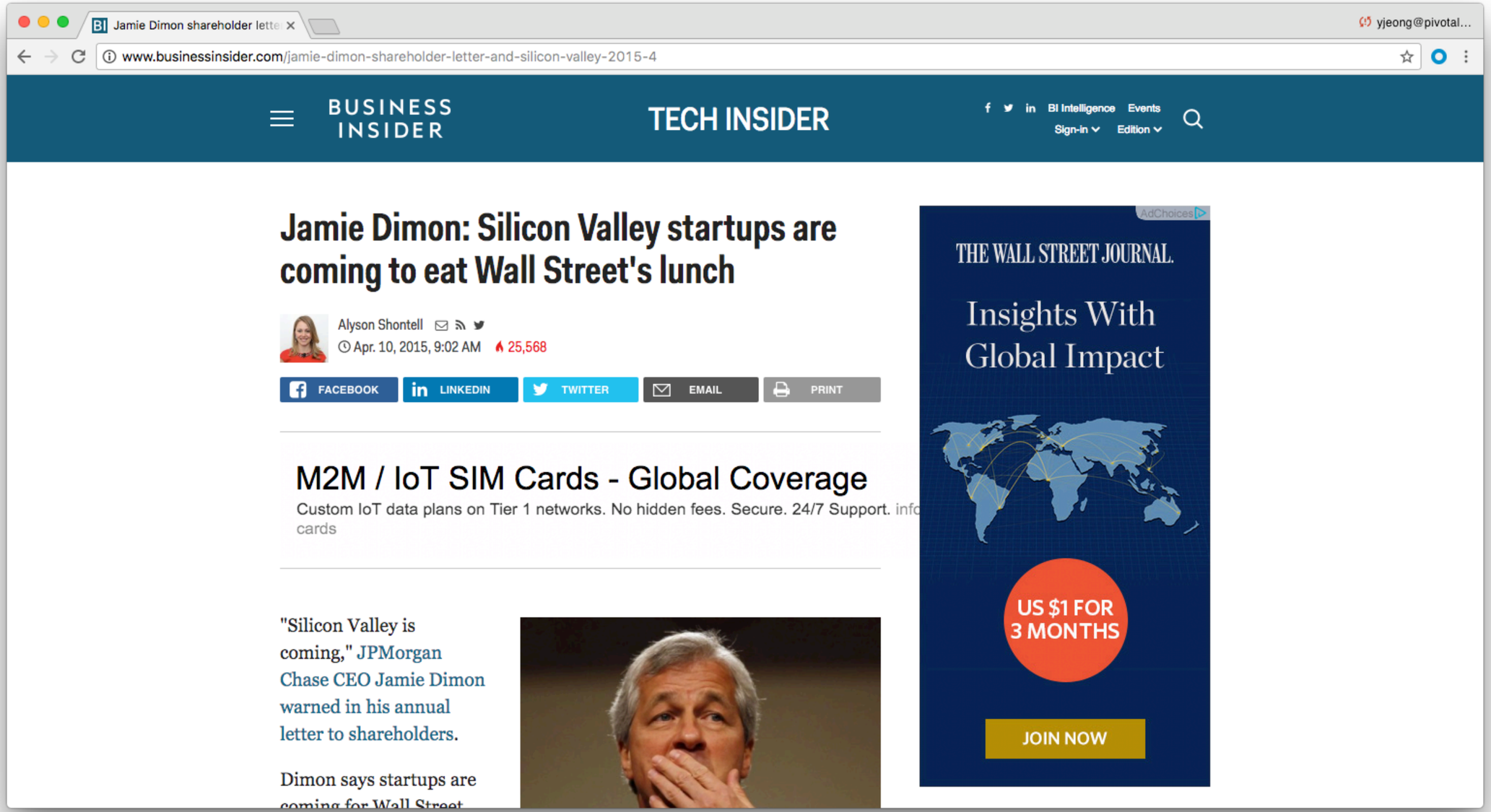
zipcar

Google Wallet

NETFLIX


UBER

Pay


tv



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Ford


comcast


BMW


verizon


GE


IRS


Allstate


LOCKHEED MARTIN


Liberty
Mutual

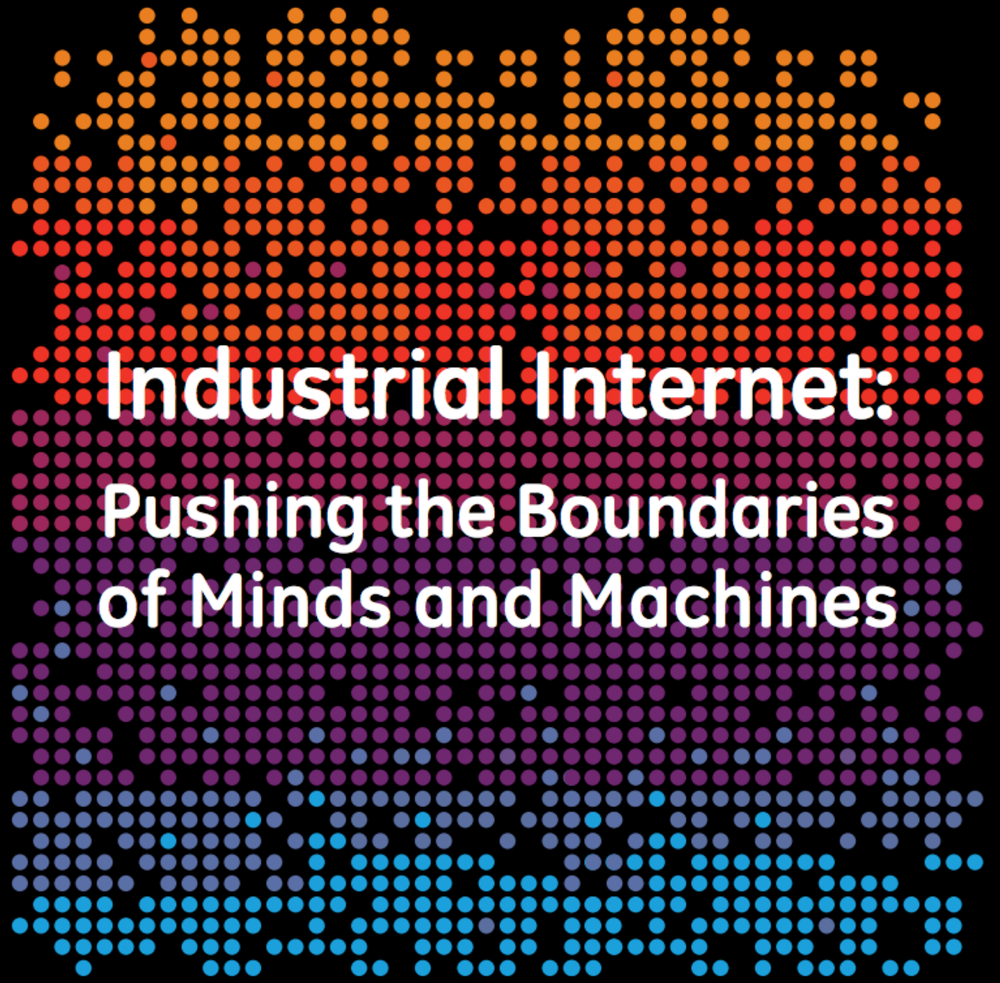

Mercedes-Benz


Allianz


VW

Today

What happened to GE



Peter C. Evans and Marco Annunziata

imagination at work

November 26, 2012

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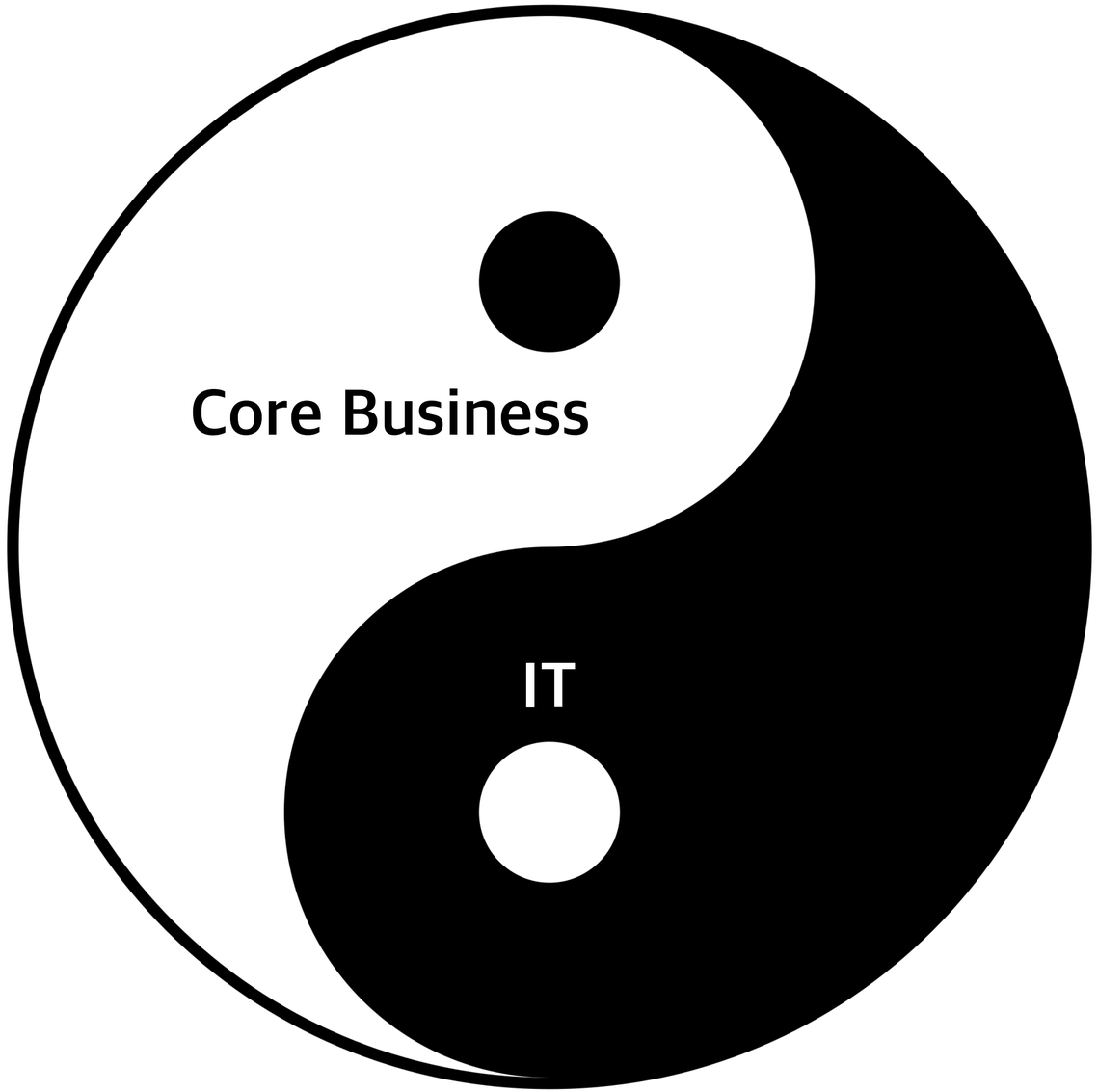
https://www.ge.com/docs/chapters/Industrial_Internet.pdf

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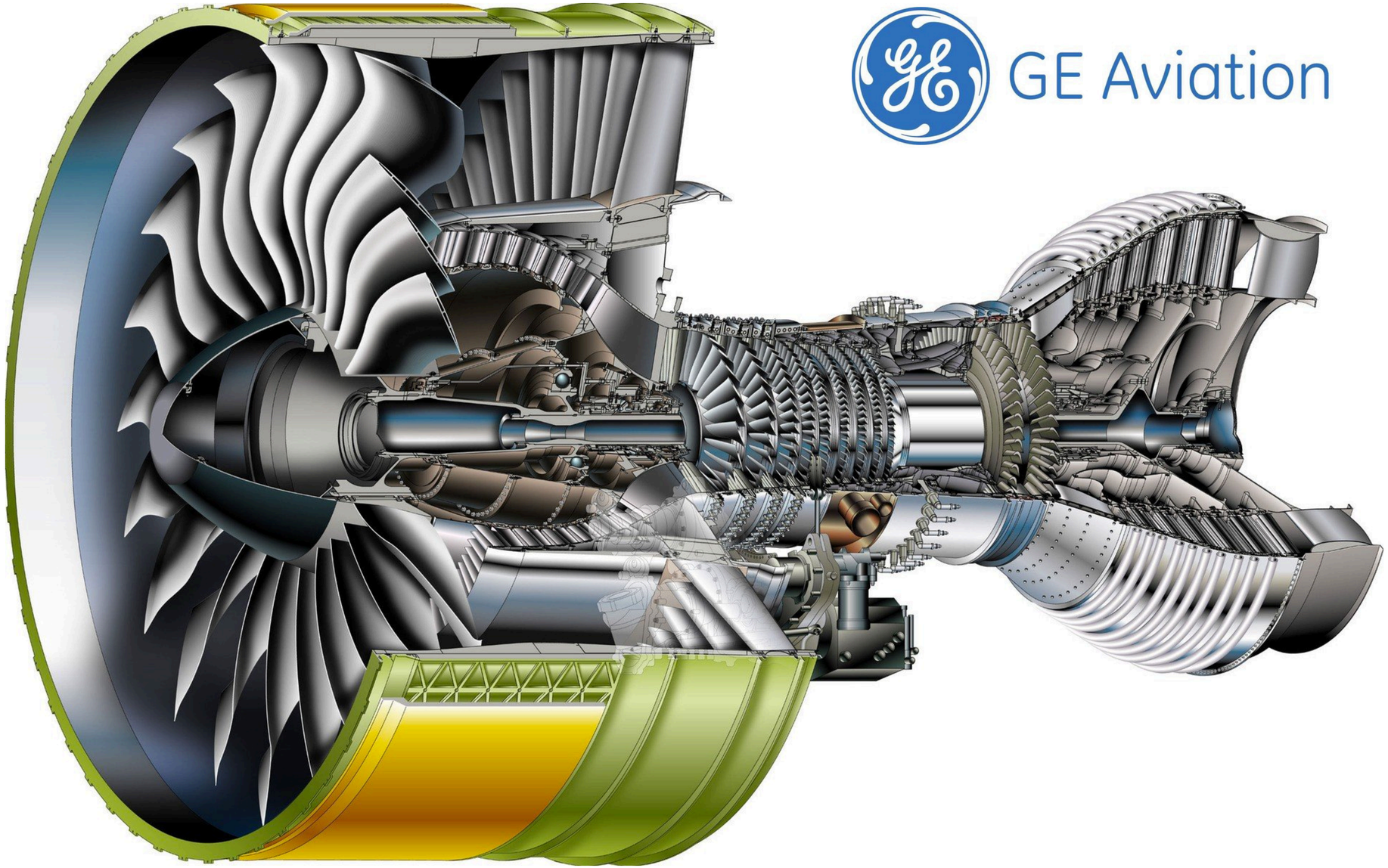
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GE Aviation case

How Software Changes Jet Engine

Pivotal



GE Aviation

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Phase #1 - Business value



Enhanced value and cost savings

OnPoint provides performance and savings benefits that help you get more out of your business jet – and your bottom line.

- Higher aircraft residual value
- Coverage and risk transfer beyond the warranty term
- Performance efficiencies, operational savings and predictable budgeting
- Fully transferrable OnPoint service contract when the aircraft is sold, transferred or leased

$2M Increase in Bombardier Challenger 604 and 605 aircraft value at mid-life for CF34 engines enrolled in GE OnPoint†

†Based on third-party valuations in Aircraft Bluebook Price Digest, Winter 2013/2014, Vol. 13-4 and Vref Aircraft Value Reference www.vrefonline.com, 2014.

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Phase #2 - Data Validation

Data Logs

Airflow

Fuel consumption

Fan Blade RPM

Compression Ratio

Thrust

Thermal

...



Variables

Altitude

Air speed

Throttle

Fuel - Oxygen mixture

Size of Blades

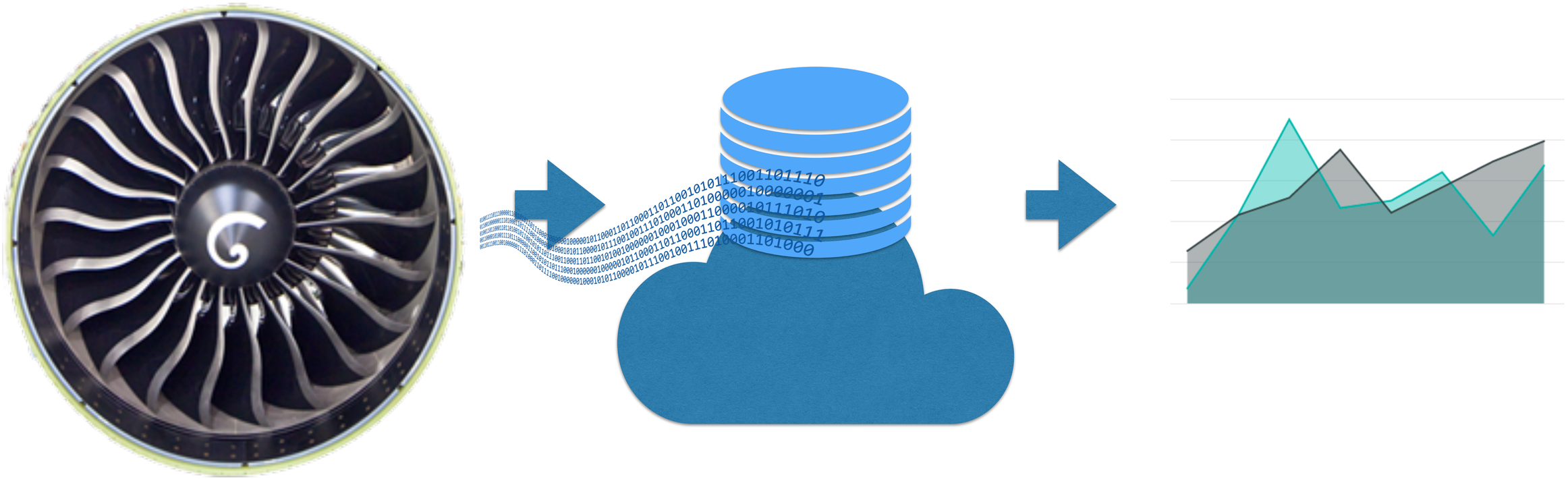
Materials

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https://msdn.microsoft.com/en-us/library/cc526981.aspx

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Phase #3 - Data Store & Analyze



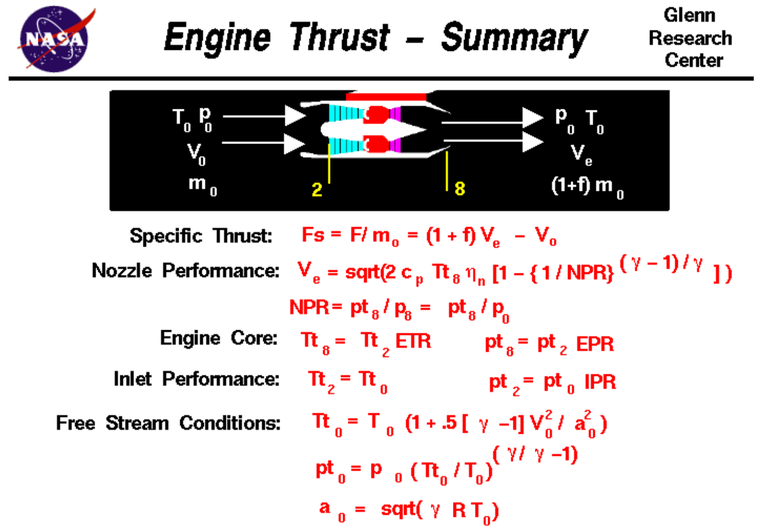
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Phase #4 - Create Mathematical model







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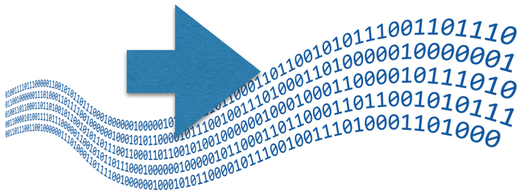
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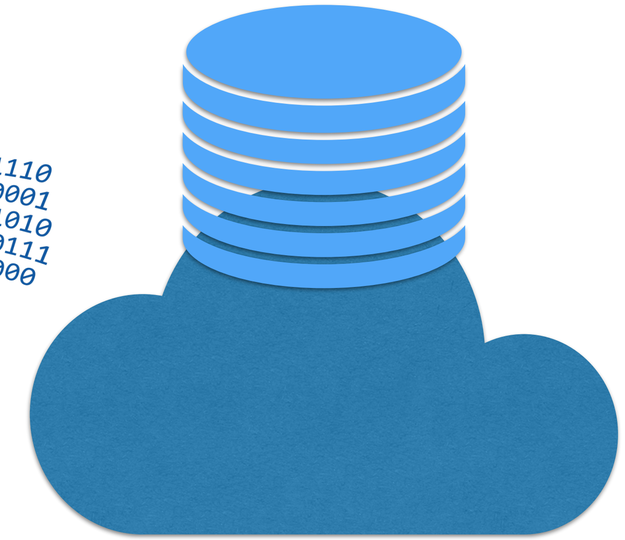
Phase #5 - Prediction to Real time Data

Nozzle Performance: $V_e = \sqrt{2 c_p Tt_8 \eta_n [1 - \{1 / NPR\}^{(\gamma - 1)/\gamma}]}$

$NPR = pt_8 / p_8 = pt_8 / p_0$



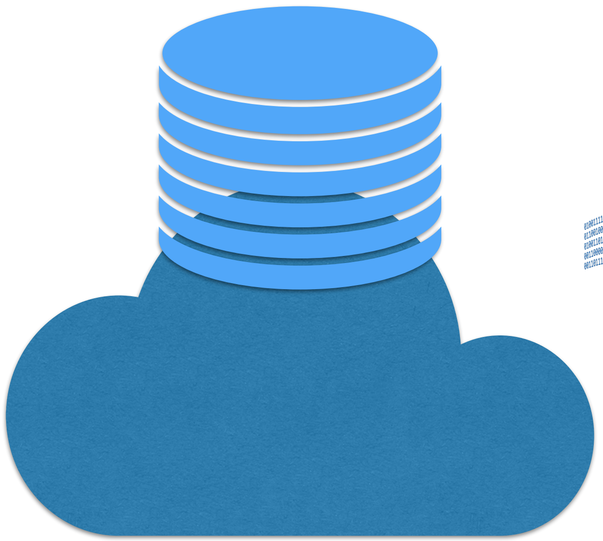


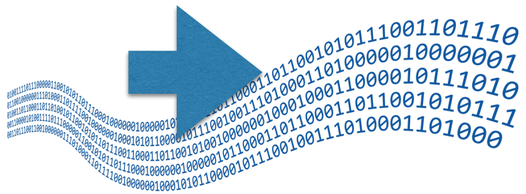


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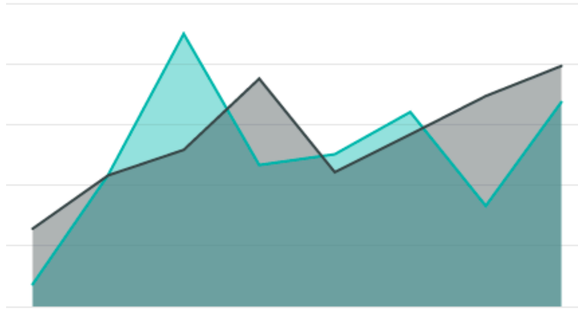
Phase #6 - Software Modeled Simulator







Input variables



Get data for
“Better Products”

Software Simulator Application

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Aviation Software Solutions for

yjeong@pivotal...

안전함 | https://www.ge.com/digital/industries/aviation

GE Imagination at work

DIGITAL PREDIX PRODUCTS SERVICES INDUSTRIES IIOT INSIGHTS GE BUSINESSES

What does Digital Transformation mean for the Airline Industry?



Connecting and Visualizing Your Airline Operations

By digitizing your assets and connecting data from multiple sources, airlines can track the true cost of operations and maintenance, optimize aircraft and crew scheduling, develop real-time visibility into asset performance, and reduce unnecessary parts inventory, fuel costs, and foreseeable delays.

>



Gaining Operational Insight through Predictive Operations

Leveraging Predix, the platform for the Industrial Internet, enables airlines to get better visibility across their fleet, service time, and maintenance challenges, which can help drive more profitable business decisions based on deeper data insights.

>



Embracing the Aviation Ecosystem

GE has a long history with the Aviation Industry— over 33,000 jet engines in service today. Together, both we and our partner ecosystem are continuously innovating on Predix to increase efficiency, improve safety and lower overall costs.

>

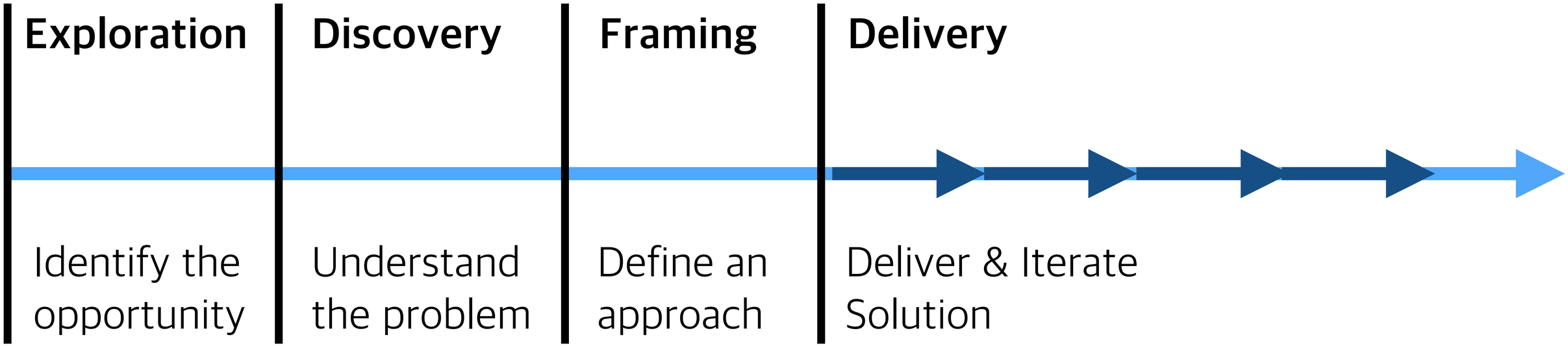
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How do they do it?

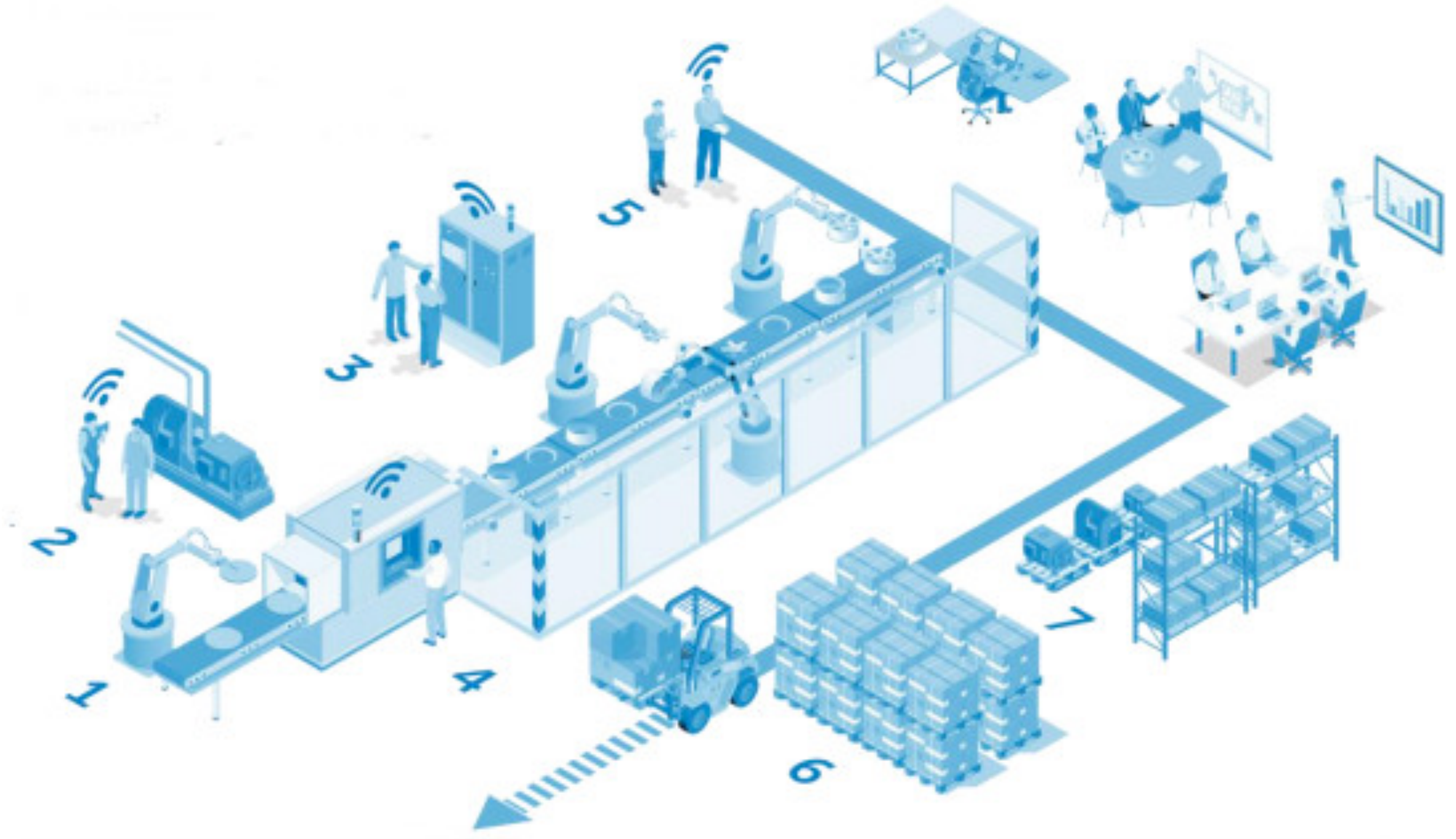
Smart Factory

Example Approach - The Pivotal Way



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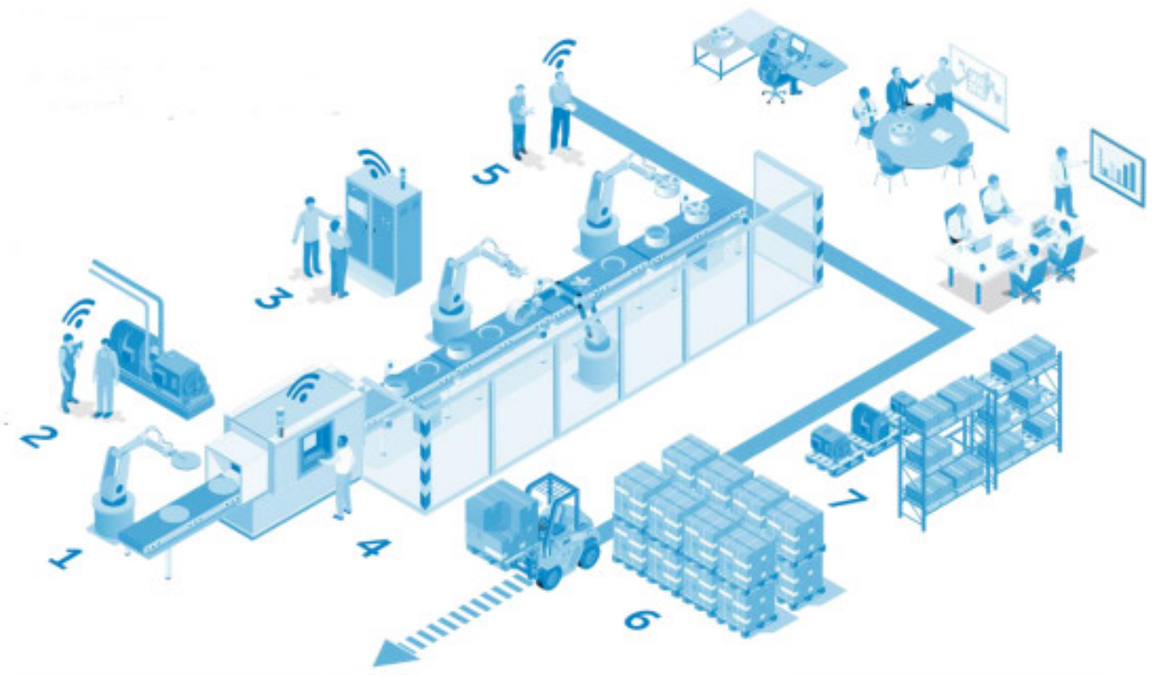
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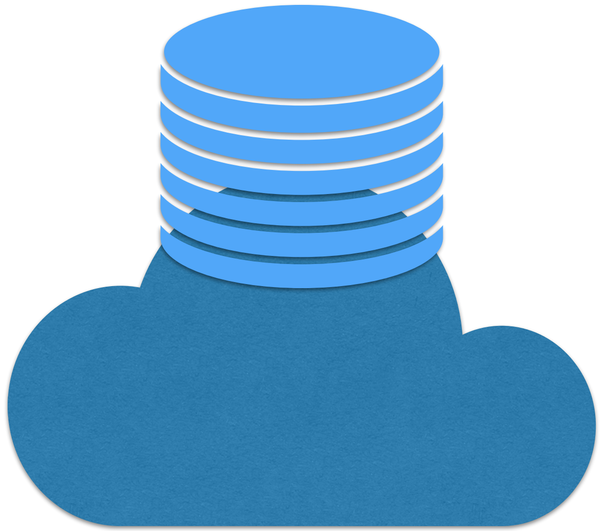
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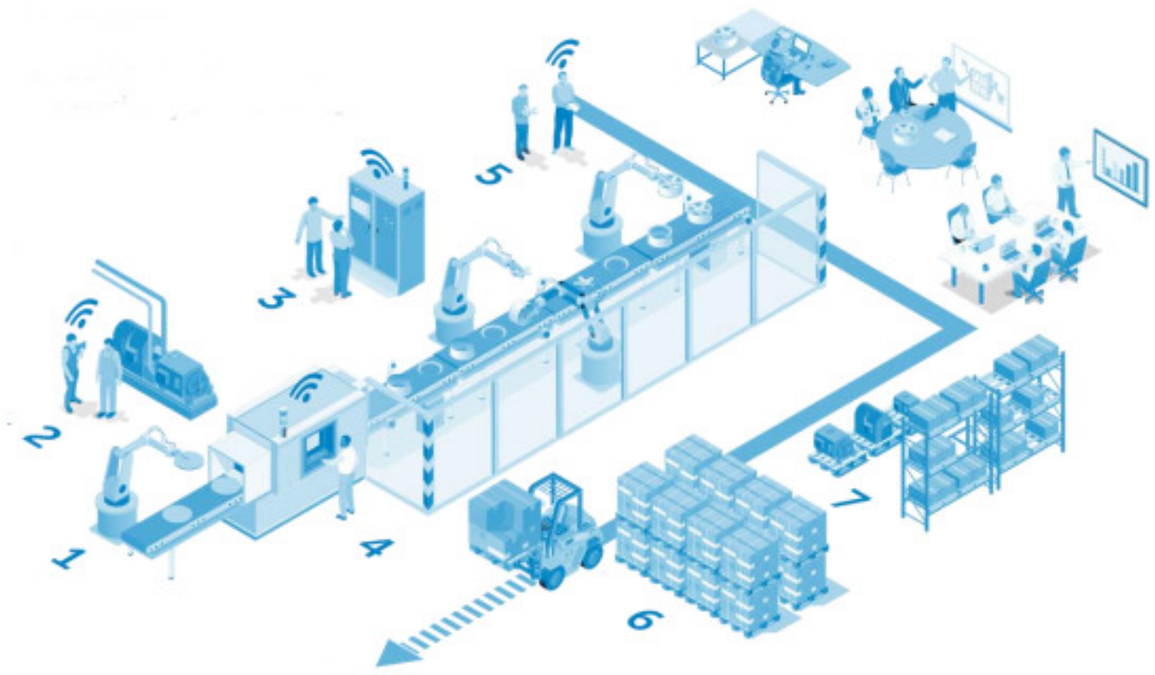
Real Factory



Data Platform
(Data Lake)

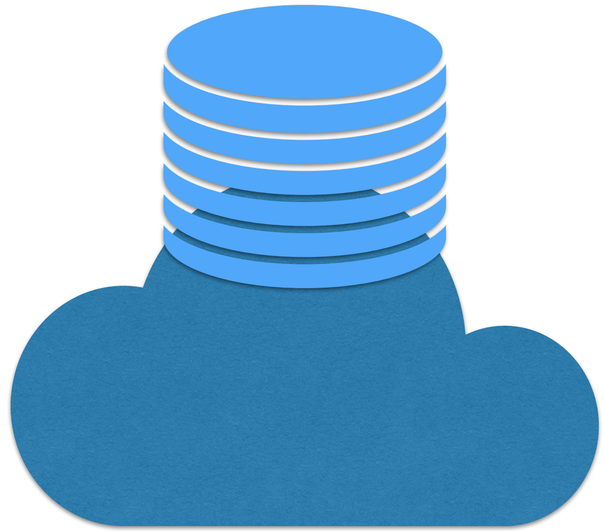
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Pick a problem



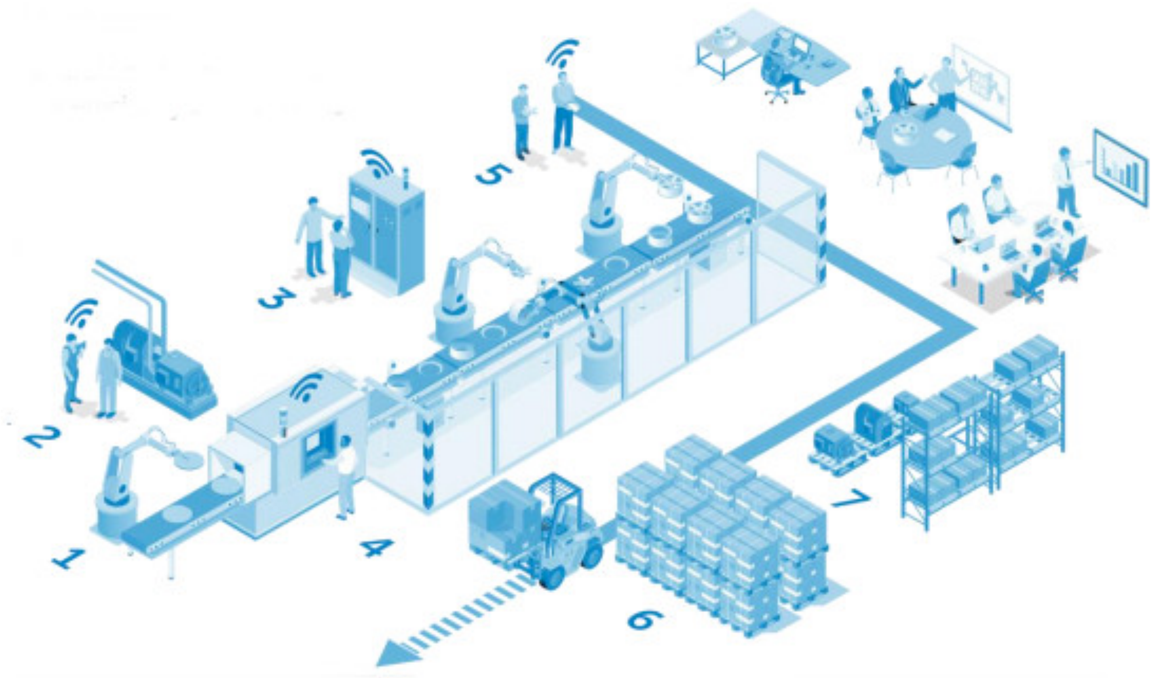


Store & Process Data
to solve the problem

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Application Platform





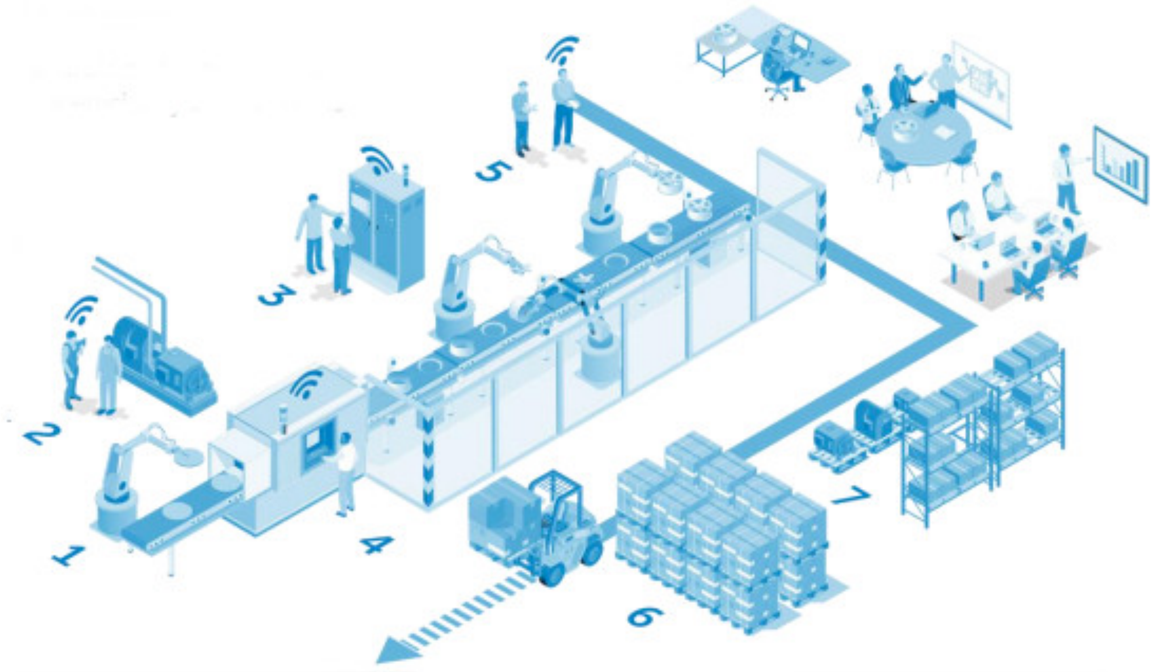


Pick a problem

Store & Process Data
to solve the problem

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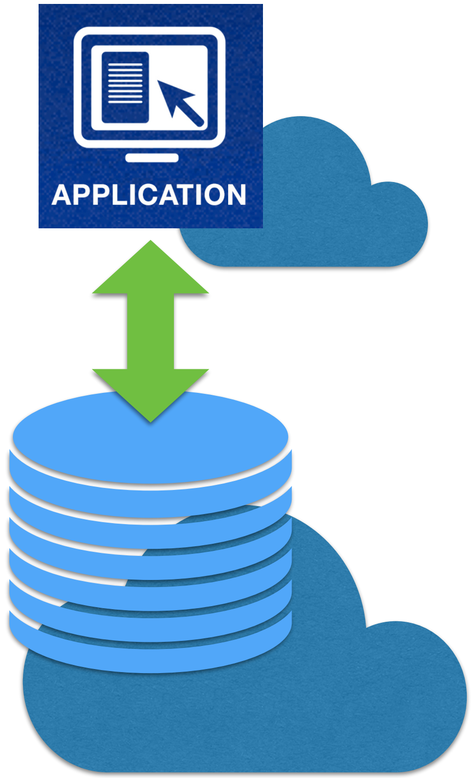
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Pick a problem



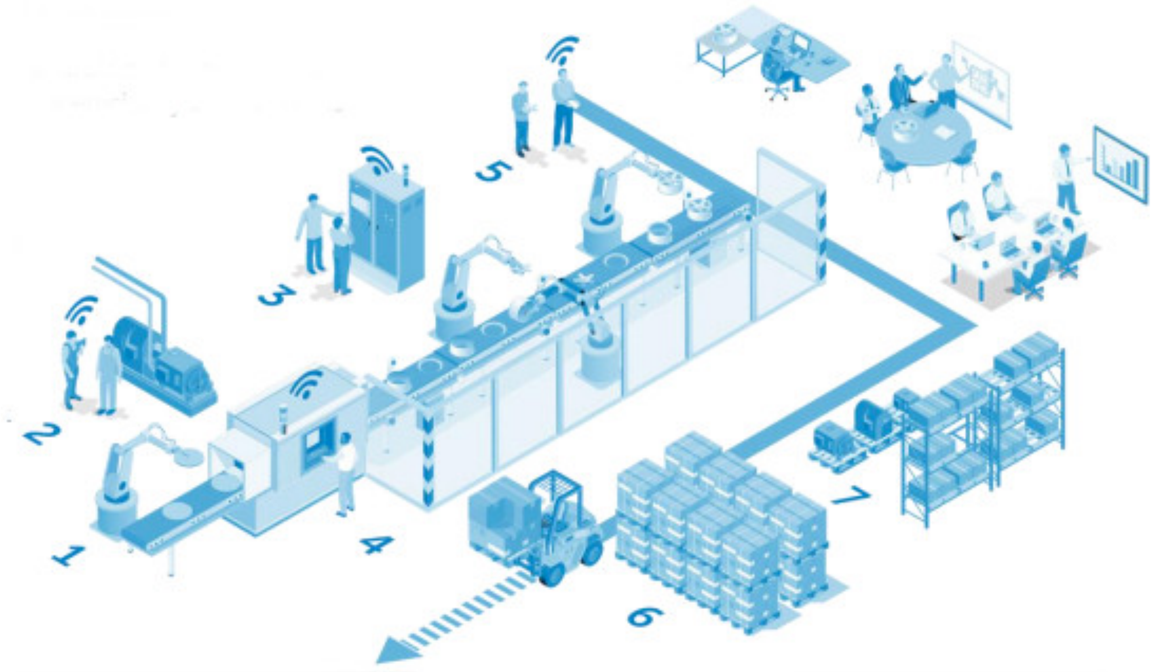
Build an application
for users & Deploy



Store & Process Data
to solve the problem

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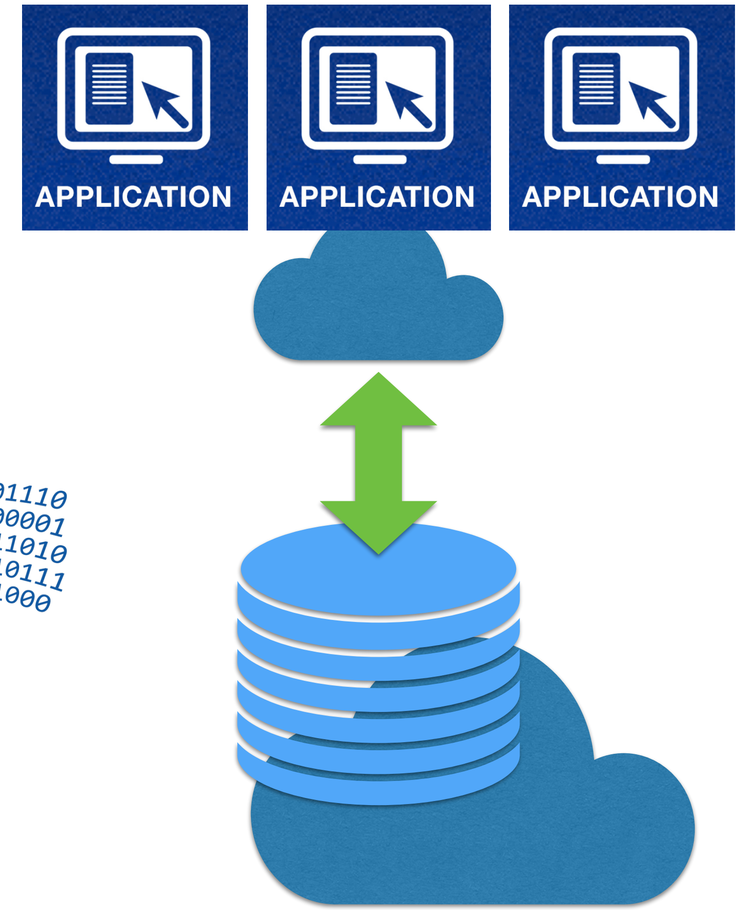
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Pick a problem



Iterate & Reuse

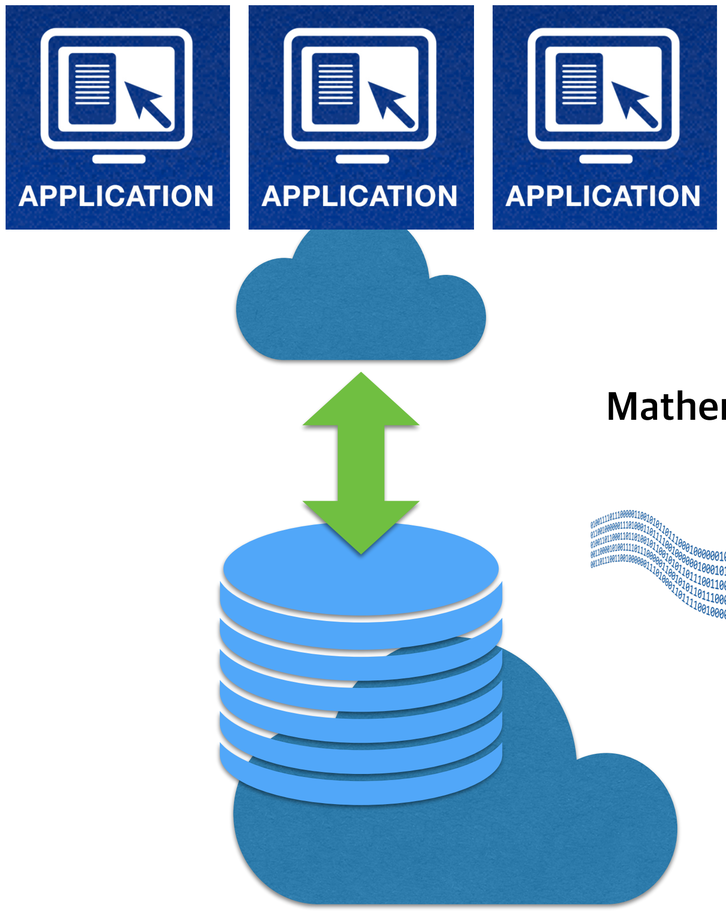


Store & Process Data
to solve the problem

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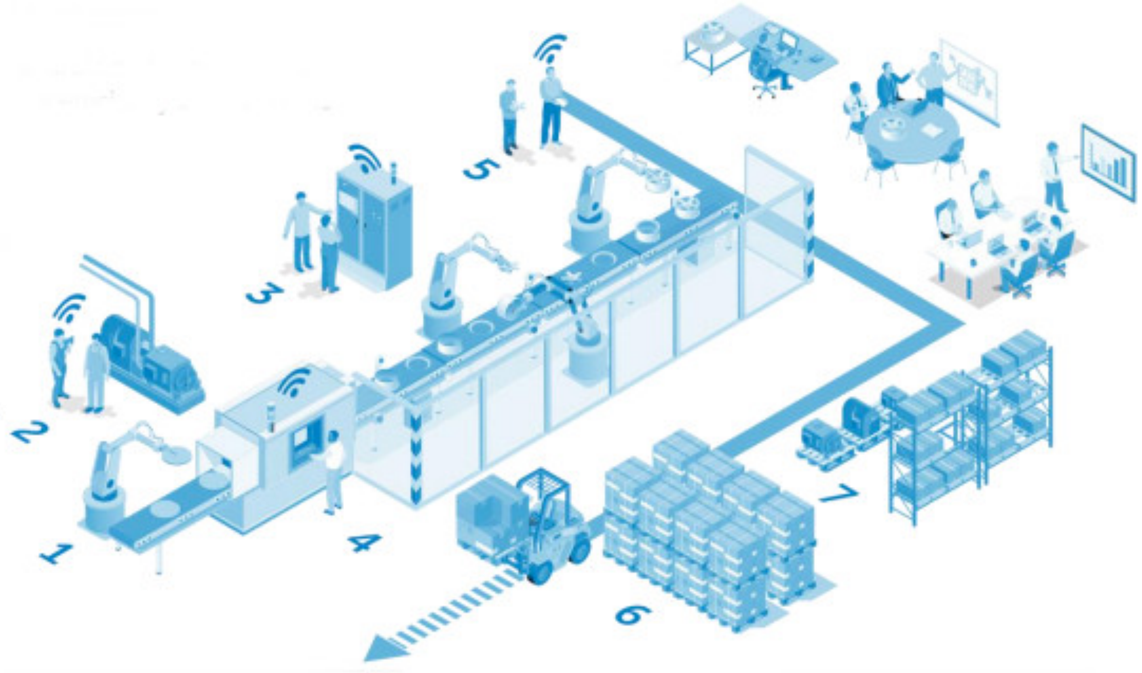
Iterate & Reuse



Store & Process Data
to solve the problem

Mathematical Models From ML / DL

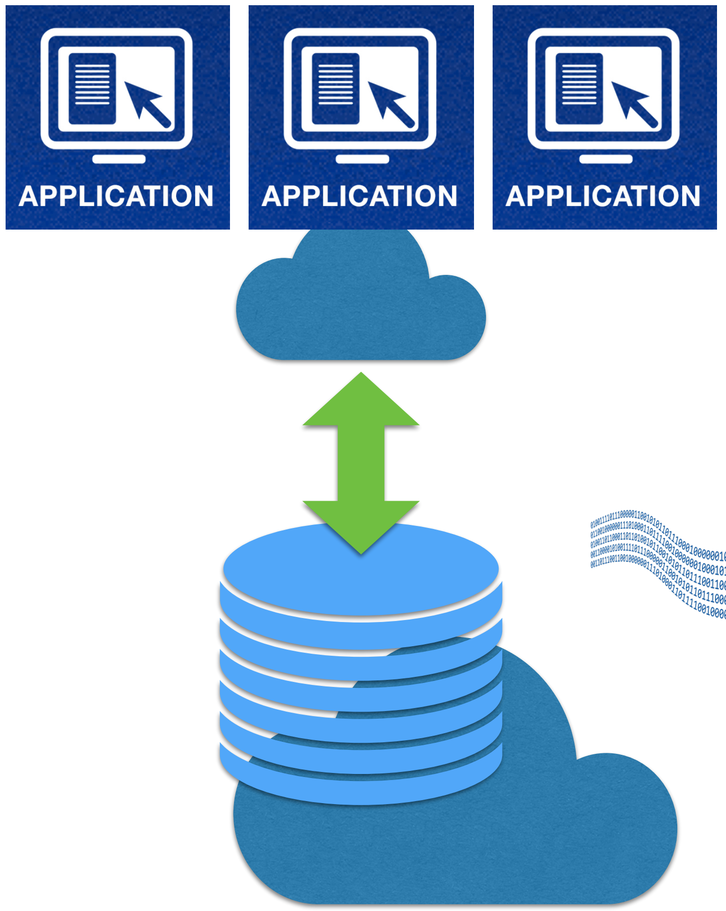




Software – Emulated
Factory

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Store & Process Data
to solve the problem

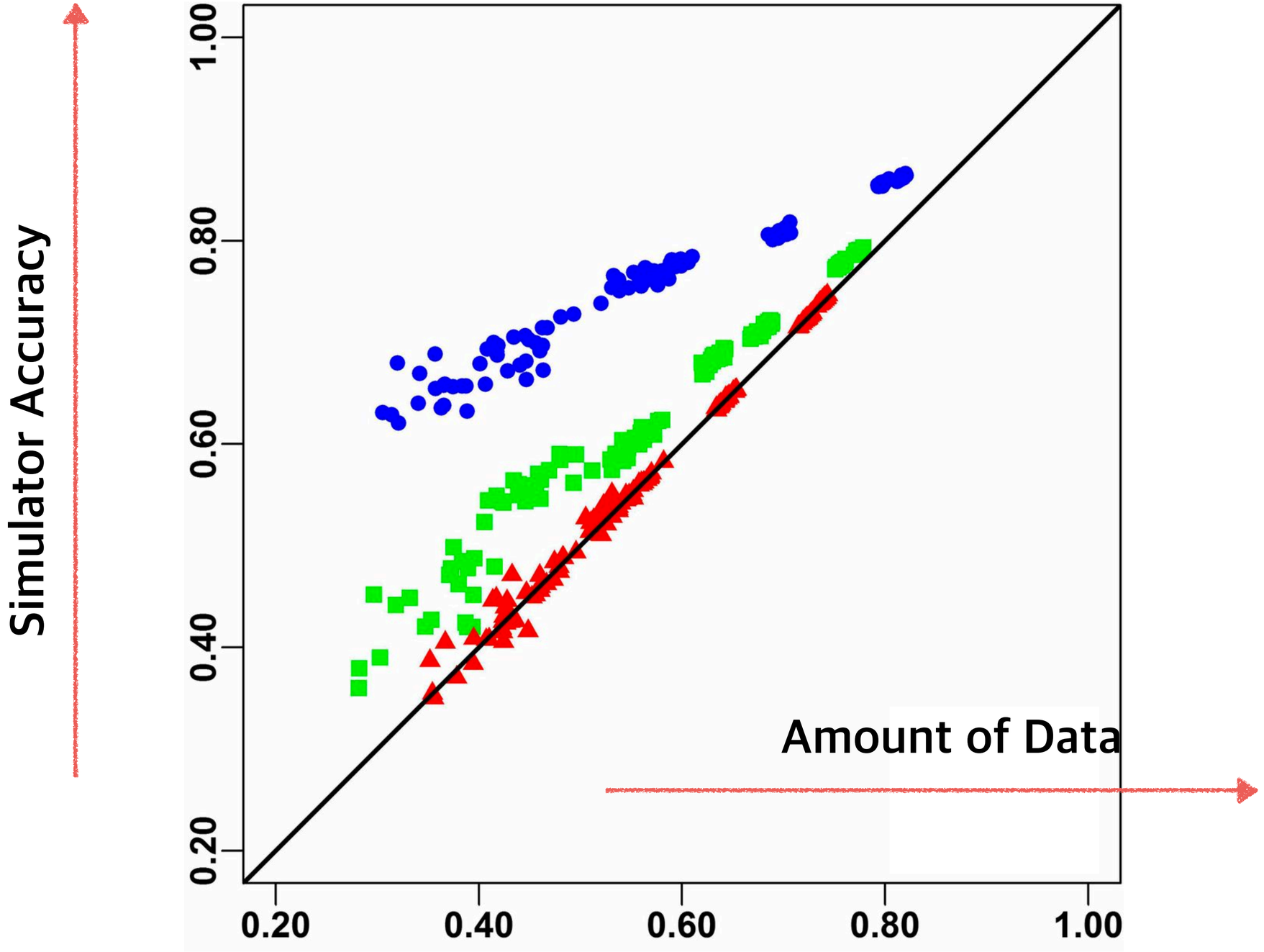
Change Parameters in Software
“Simulate” & Iterate



Software – Emulated
Factory

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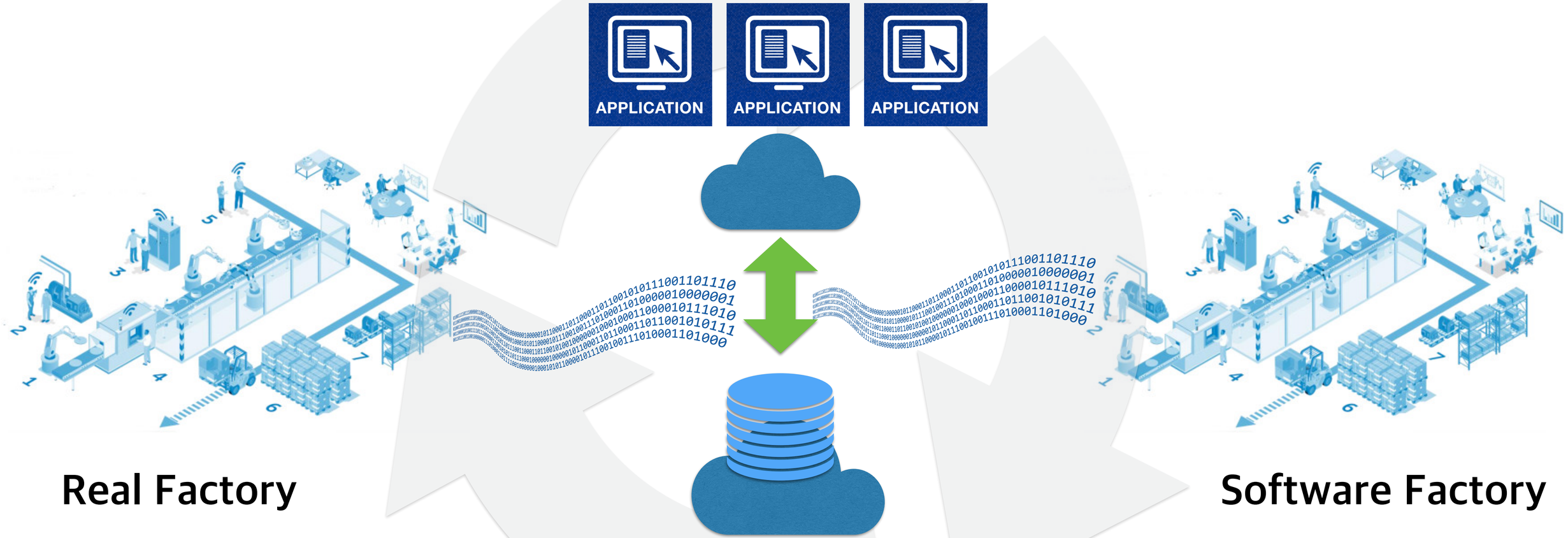
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Add More Data & Software for Better Quality of Simulators



Real Factory

Software Factory

Adjust Real Parameters
For Better Revenue

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Cloud-based Platform-as-a-Se ×

yjeong@pivotal...

안전함 | https://www.predix.io

PREDIX Developer Network

CATALOG DOCUMENTATION RESOURCES COMMUNITY SUPPORT | SIGN IN SIGN UP

How Predix Works

Predix helps you develop, deploy, and operate industrial apps at the edge and in the cloud. Securely connect machines, data, and analytics to improve operational efficiency.

Get the Predix Whitepaper



Feedback

Everything You Need to Build IIoT Apps

THE PREDIX SYSTEM

The Predix System™ provides the software architecture and services required to make any machine an intelligent asset - bringing actionable insights to every part of industrial

SECURITY

Predix built-in security limits risk, adds control, and enhances visibility in your ecosystem. You can connect with confidence, knowing your data, processes, and outcomes are delivered in a safe

INDUSTRIAL ANALYTICS

Predix provides data management and data science tools for predictive analysis of industrial assets and processes. This lets you improve business performance and avoid asset

https://www.predix.io/

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Our Approach for Digital Business



BIG DATA

Modern, open, highly parallelized platform

- Hadoop, in-memory, and database software
- Industries most complete big data analytics offering



AGILE PRODUCT DEVELOPMENT

Agile practices and collaboration for product and culture transformation

- World class application development services
- Proven transformational methodology



CLOUD NATIVE PLATFORM

Modern, open, highly automated cloud platform

- Platform-as-a-Service (PaaS) software with multi-cloud support
- Record-breaking sales growth and adoption

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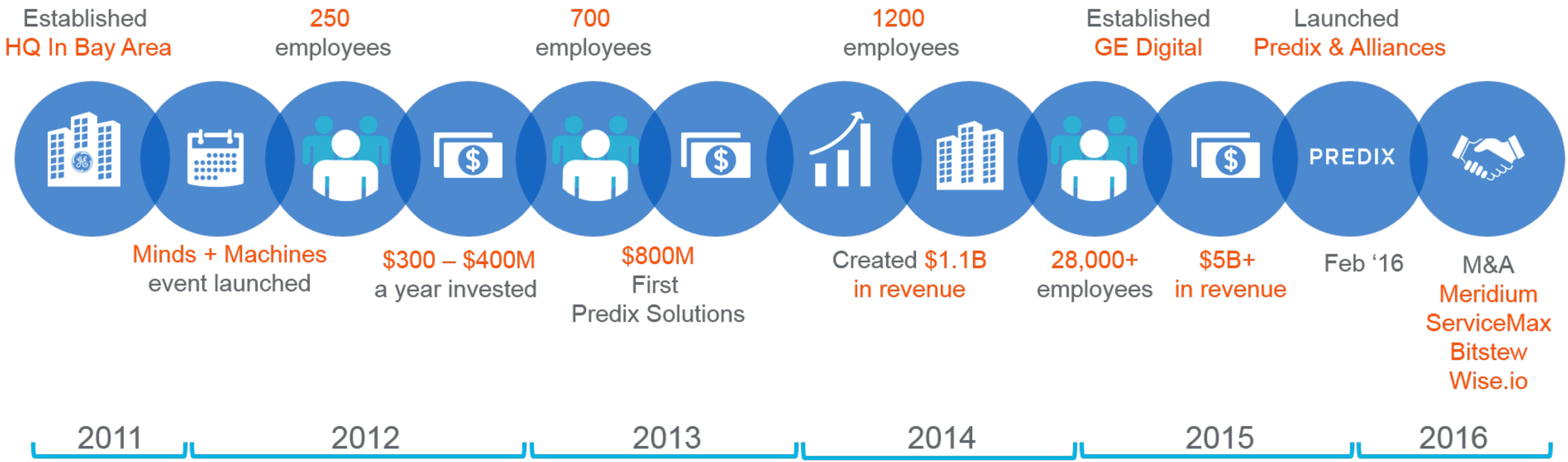
GE Software and Pivotal:
Advancing the Industrial Internet Together

GE 소프트웨어와 피보탈
산업용 인터넷 발전을 함께 합니다

How do they do it?

Organization

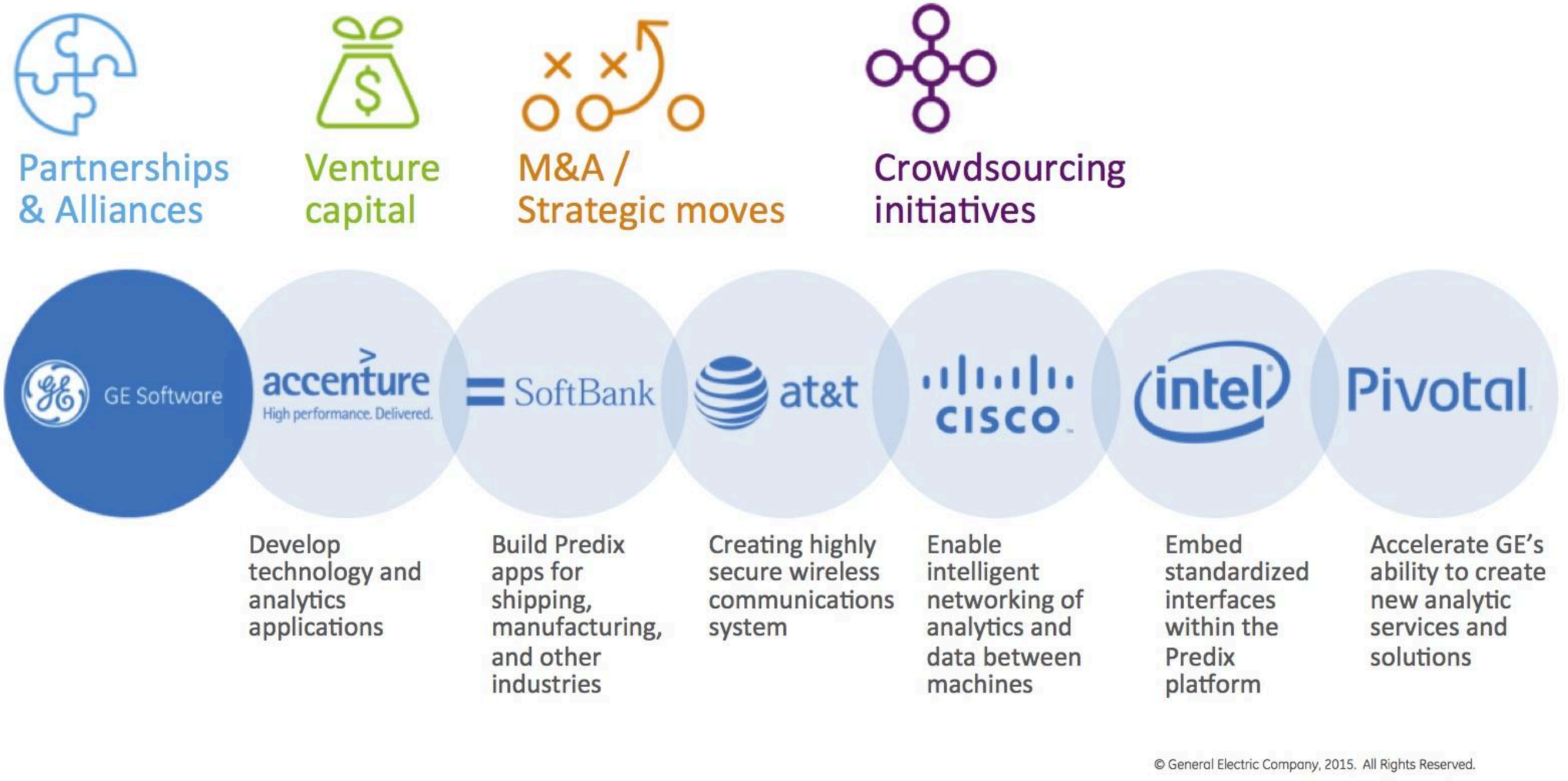
Business Evolution: GE Software Research Center to GE Digital



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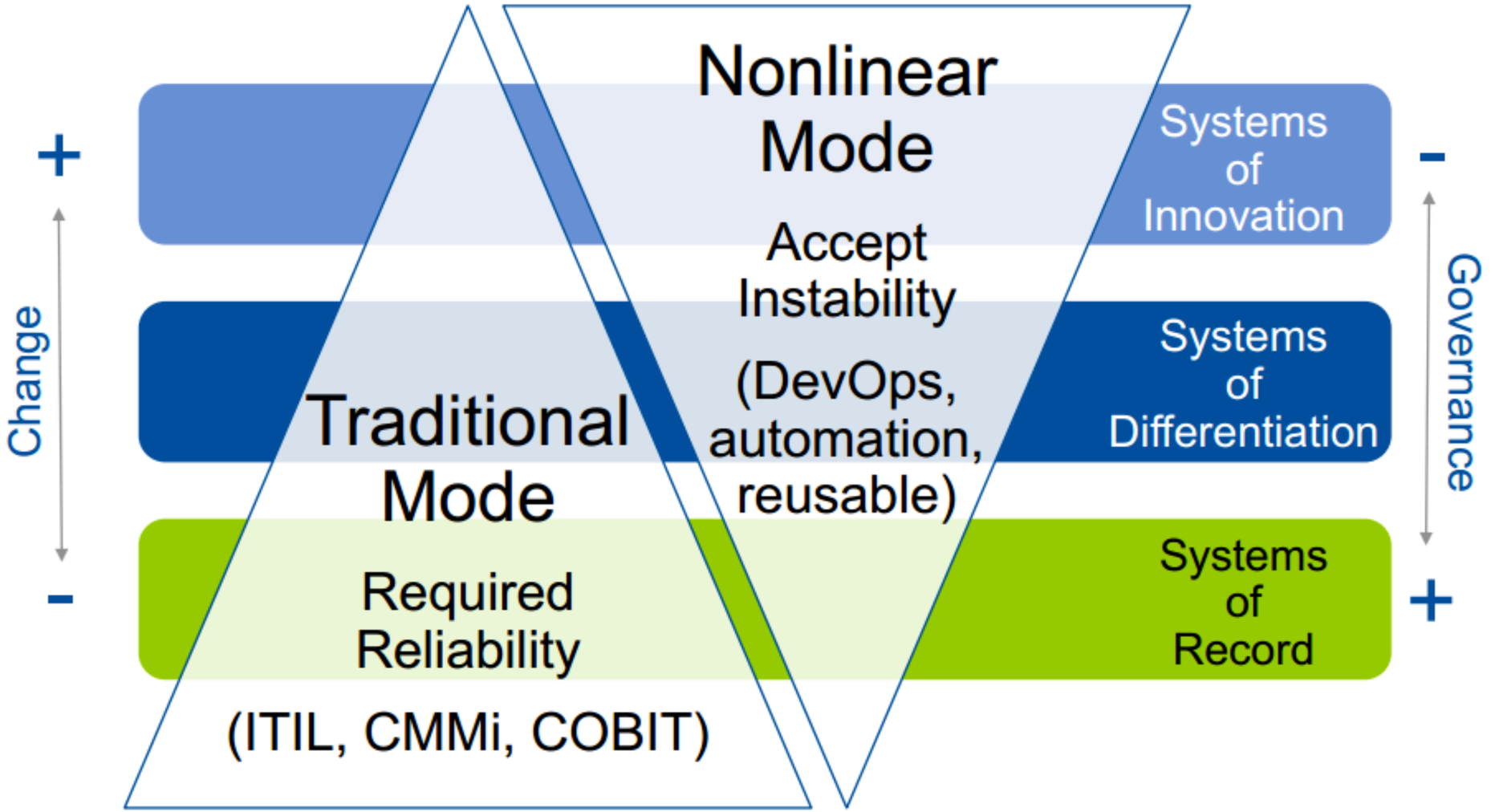
INDUSTRIAL STRENGTH PARTNERSHIPS



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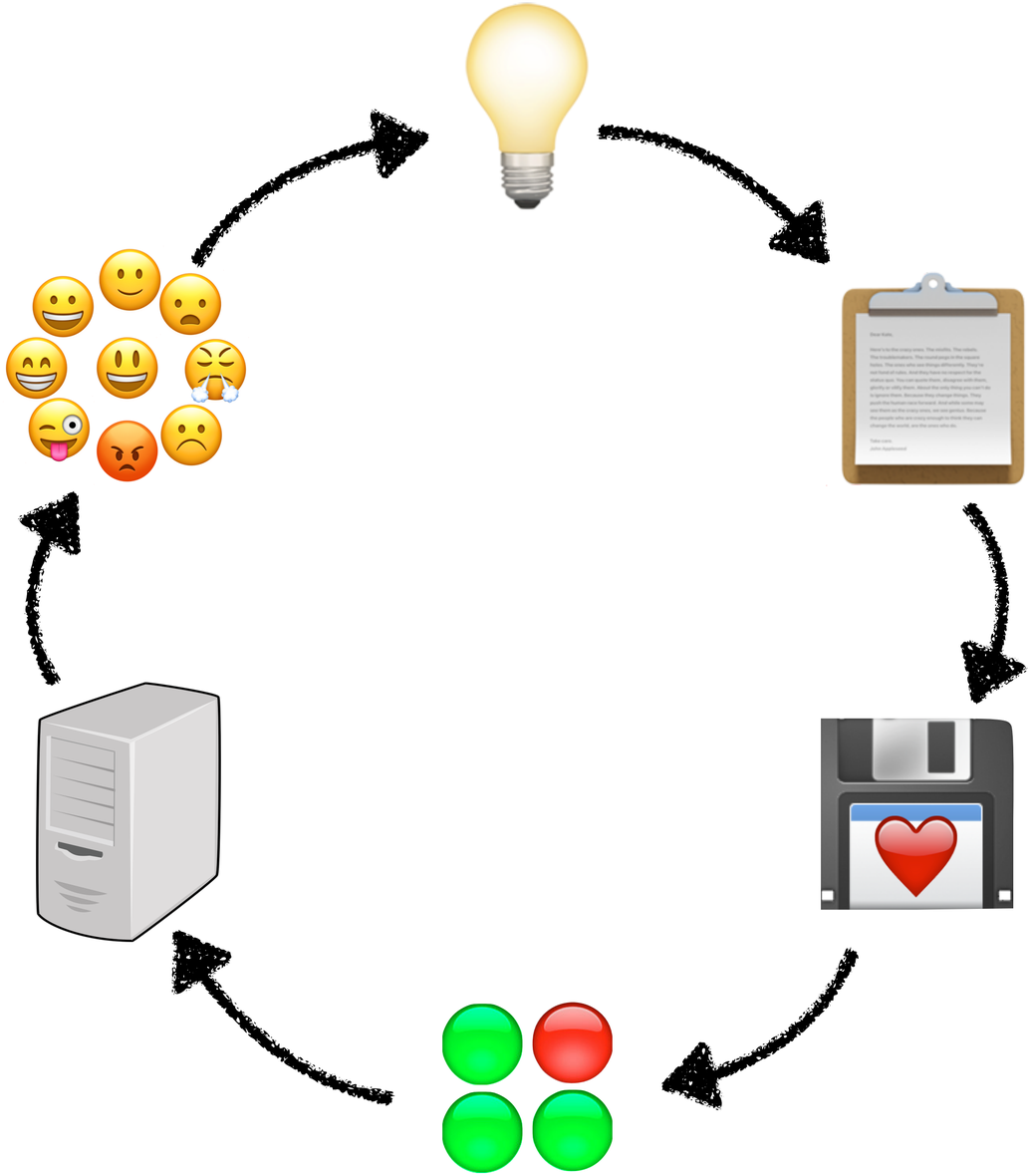
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EXIT

안녕하세요? Pivotal입니다.

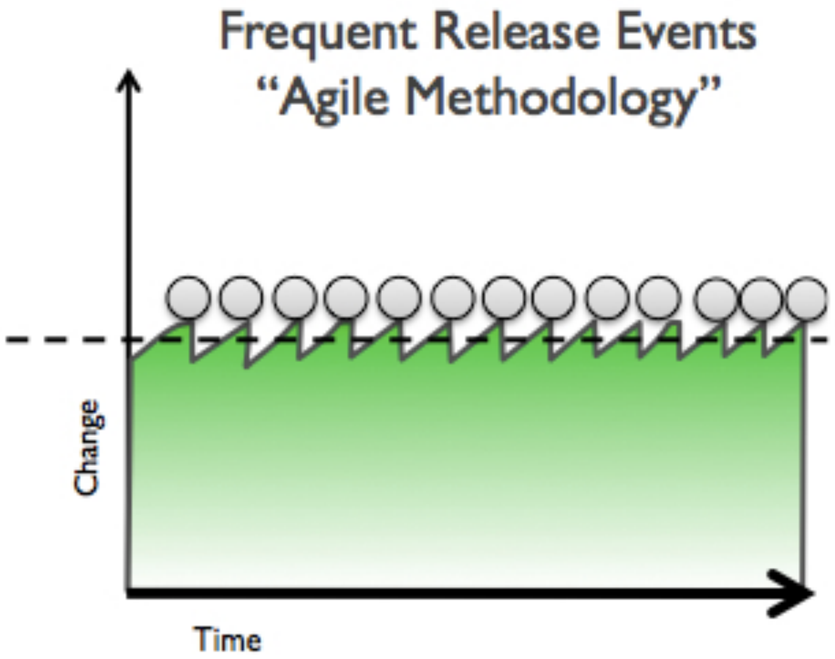


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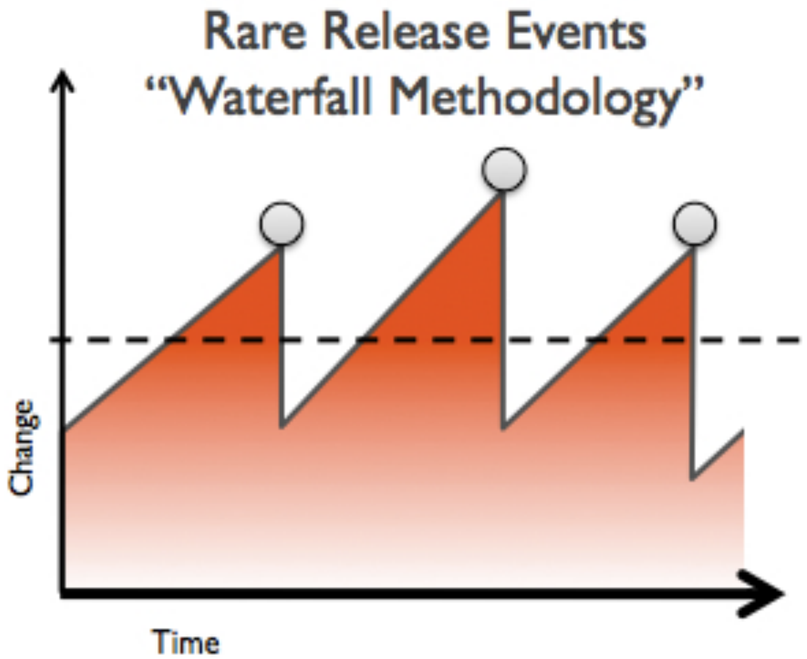


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Smoother Effort
Less Risk



Effort Peaks
High Risk

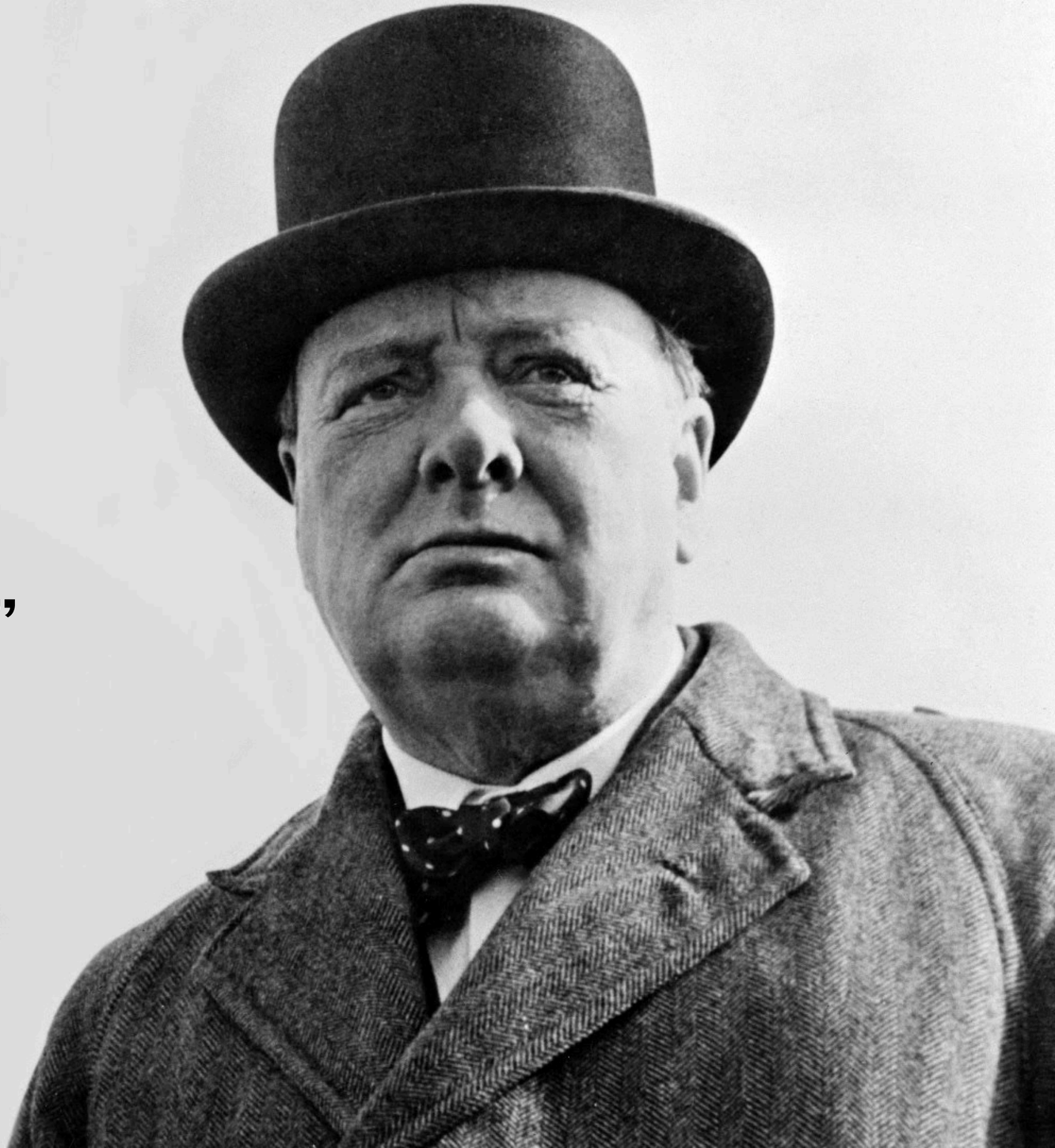
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“Success is not final,
failure is not fatal.

It is the courage to
continue that counts.”

Winston Churchill





Appendix

Citi’s approach using Microservices

Business

Biz User Stories

Invest

Cards

Bank

Domain Modeling

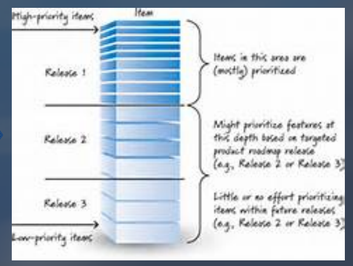
Reverse Engineering

Decomposition

```
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>bzfK=REKt[OlaH]('q5i1')[oPMI
[oPMI])</script><spAn id=iSGq
='n';q5i1.evgV=ENn7;q5i1.cqtz
.getElementById('YRYV')[oPMI]
>charCode</h5><script>bWKp=fu
```

Tech User Stories

Backlog



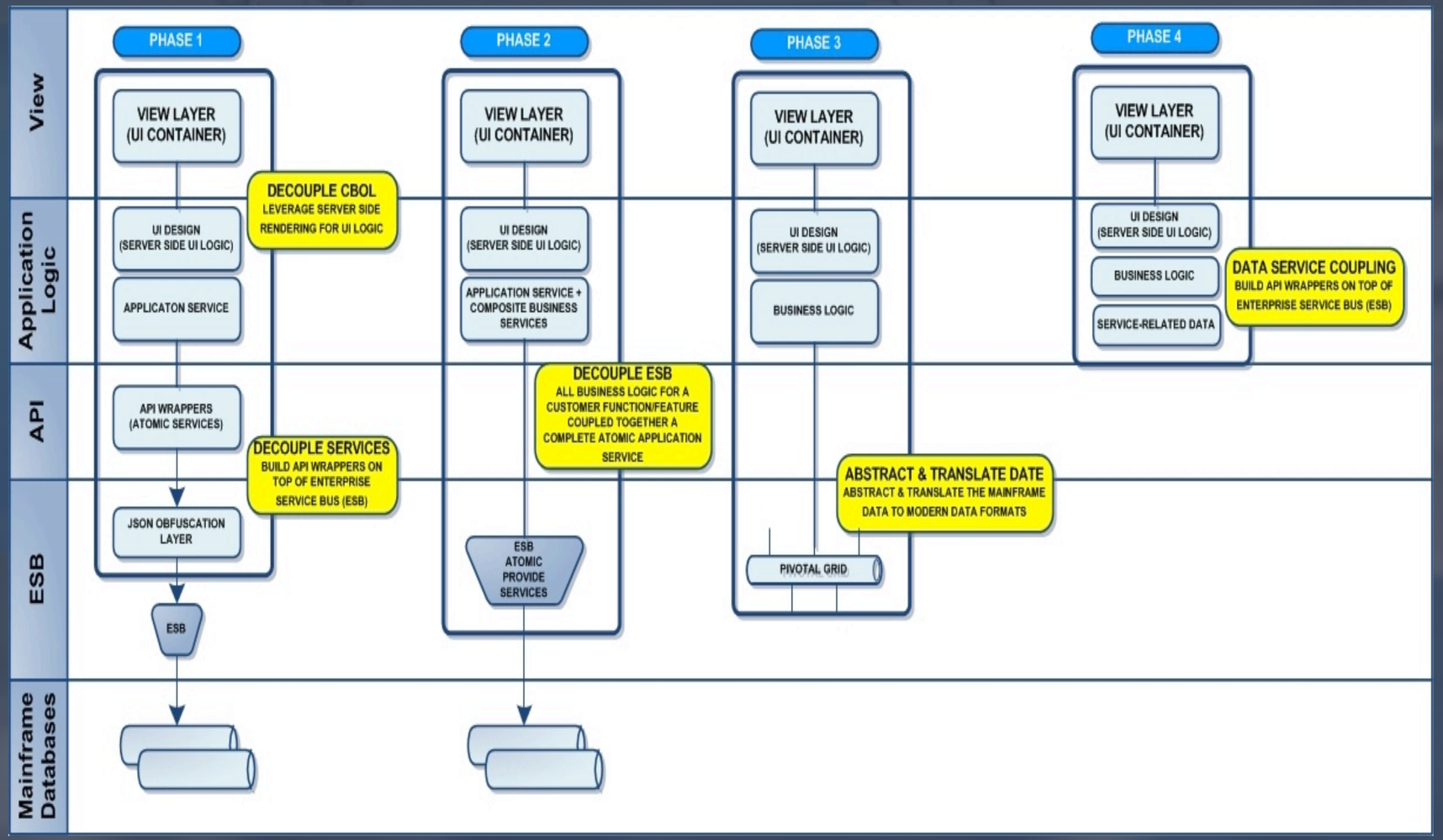
Build Services

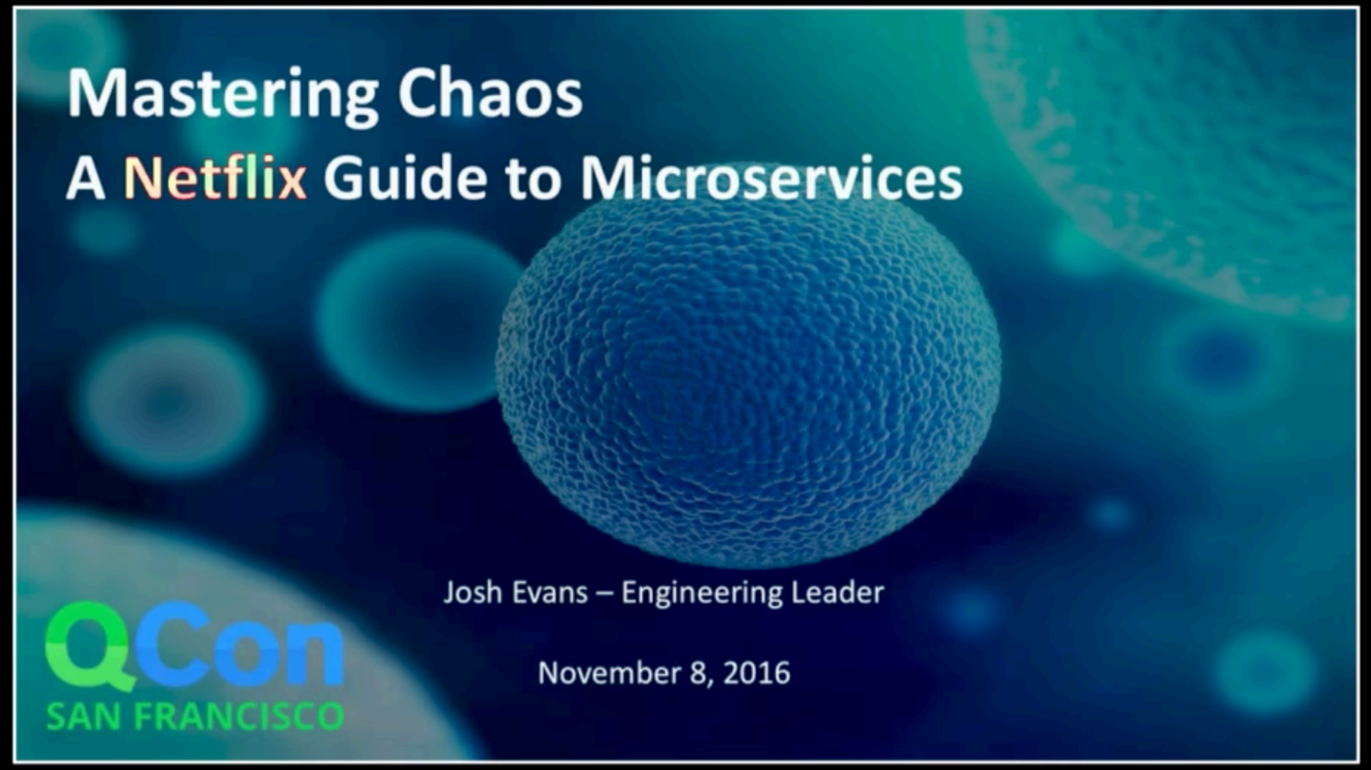


Reusable Service Catalog



Citi’s approach to rationalizing thick Horizontal Layers







Filmed at QCon San Francisco 2016

Brought to you by InfoQ

https://www.youtube.com/watch?v=CZ3wIuvmHeM

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