
From Data to Value

Complex to Simple

Data

Sensors, Hardware, Things,
Cloud, Platform,
Ecosystem, Analytics

Value

Where is the value and how
can we provide it?

DESIGNED BY readwriteLABS

IOT Revolution Landscape 2.0

3,482 Companies in North America - May 2018

POWERED BY spoke

CONNECTED APPS & PROCESS

SMART CONSUMER/USER (1,134)

FACILITATIVE REALITY (216)

CONNECTED HOMES (597)

SHARED ECONOMY (15)

SMART HEALTH (177)

CONNECTED CARS (56)

SMART ENTERPRISE (601)

TRANSPORTATION (61)

MANUFACTURING (75)

RETAIL (91)

HEALTHCARE (268)

OIL&GAS/ ENERGY (73)

BUILDING & CONSTRUCTION (33)

CONNECTED INTELLIGENCE

SMART DATA (764)

BIG DATA (121)

DATA SECURITY (202)

AI & MACHINE LEARNING (441)

SMART CLOUDS (303)

CLOUD LIFE CYCLE (22)

EVENT & CLOUD INTEGRATION (44)

DATA CENTER (53)

CLOUD SECURITY (159)

IAAS (18)

PAAS (7)

CONNECTED EDGE

CONNECTED & AUTONOMOUS THINGS (412)

WEARABLES (126)

ROBOTS (99)

VEHICLES (53)

DRONES (62)

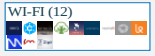
MACHINES (72)

SMART NETWORKS (60)

VPN/NETWORK SECURITY (132)

ETHERNET WIRED (32)

WI-FI (12)

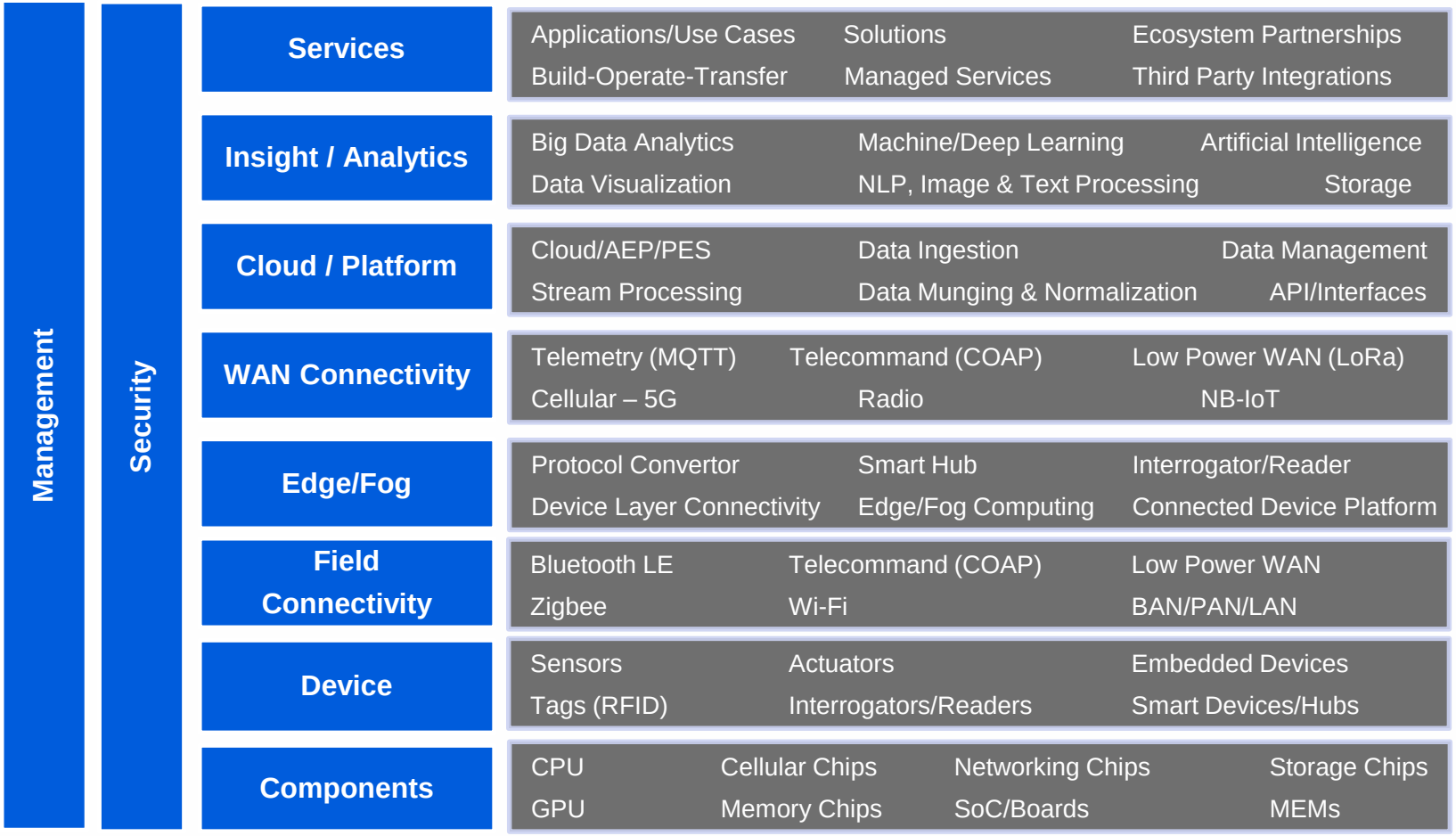


PLATFORMS (61)

CELLULAR (9)

SATELLITES (22)

Building the right Data infrastructure for your DX/IoT journey



Dan Yarmoluk

- Strategic Development, ATEK AssetScan
- Podcast “All Things Data”
- MBA
- Graduate Degree - Data Science
- Twitter: @YarmolukDan
- LinkedIn: Dan Yarmoluk
- Email:
  yarm2858@stthomas.edu
  daniel.yarmoluk@gmail.com
- www.vertiai.com
- Forthcoming IIoT & Data Science book

VertiAI

AssetScan
The power of analytics. Delivered.

The value in IoT is *action* derived from data, information, insights...

…reinvent customer experiences with connected devices


People don’t buy IoT,
they buy a solution
to a problem

Digital Transformation

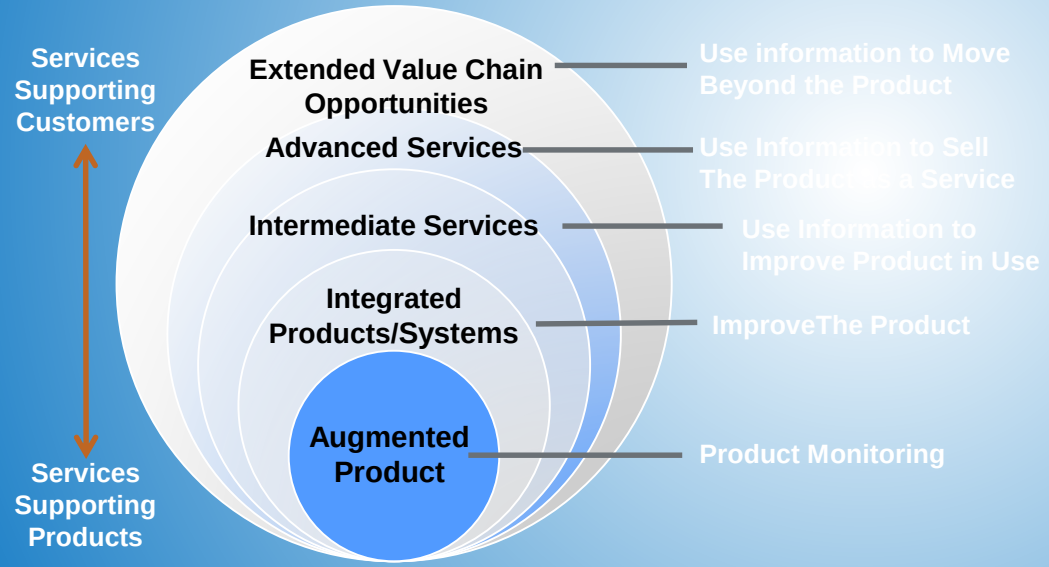
Digital Transformation

- Digital Business is the creation of new business designs blurring the digital and physical worlds

- New business designs refer new kinds of products and services, business models, industry models as well as new ways creating value for customers

Example: GoodYear Tire

Categories of Value Creation from IoT



- ServiTIZE the Product
- Service-led Competitive Strategy
- Participate in a Larger Value Chain/Stream
- Value-based Pricing in an Otherwise Commodity, Cost-Plus Environment
- Must Understand the Customer's Business Process and Determine the Right Business Model

Source: Goodyear Global Innovation Dept.

Impact of Digital Transformation on Business

Customers are realizing real business impact

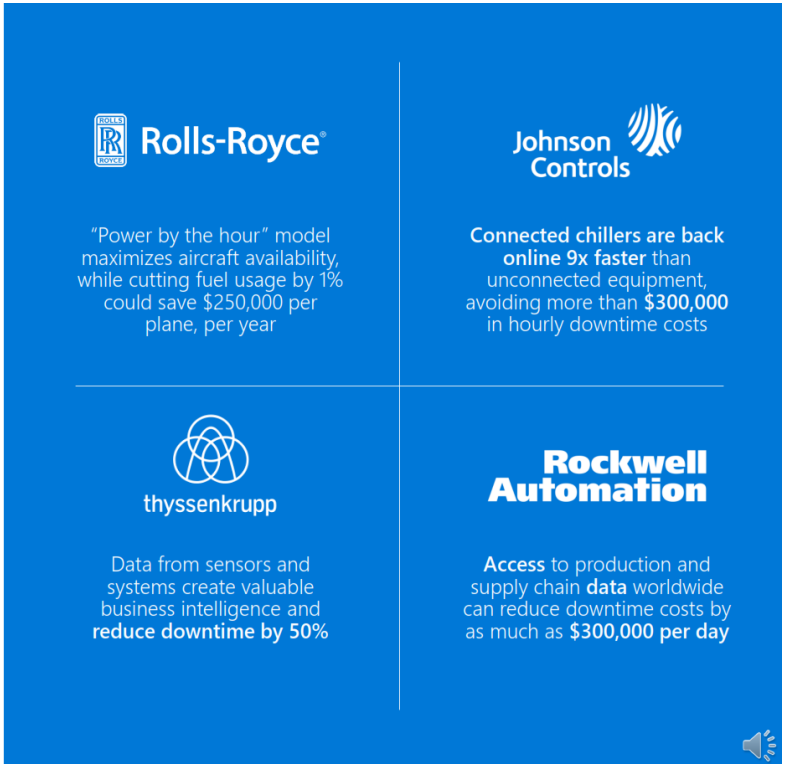
$100M
average increase in operating income among the most digitally transformed enterprises

55%
average gross margin for businesses with leading data and analytics capabilities

"With IoT, we're going in and having **real business conversations** that introduce our customers to new paths of revenue."

Priya Gore
BlueMetal, an Insight company

Microsoft IoT Influence Model, Keystone Strategy, 2016



Finding Meaning and Mindset

Ideas From Billionaire Mindsets and Where You Fit In

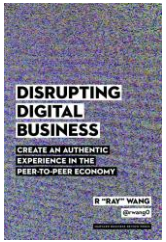
<u>Agility trumps size</u>

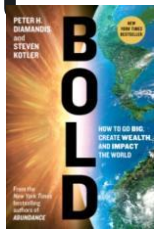
Kodak went bankrupt in 2012 and Instagram was bought by Facebook for $1 billion with only 13 employees

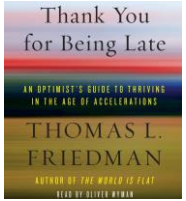
Disrupt Yourself, or Someone Else Will
Estimated that 40% of the Fortune 500 companies will be gone in 10 years

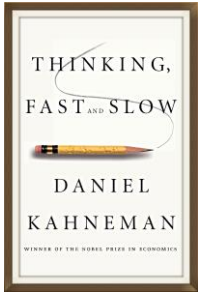
Digitizing a service (think AirBnB and Uber)

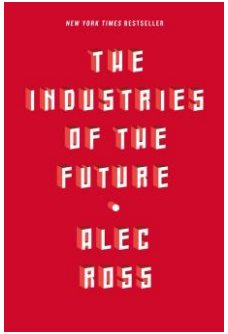
<u>Customers demand a seamless omnichannel experience</u>

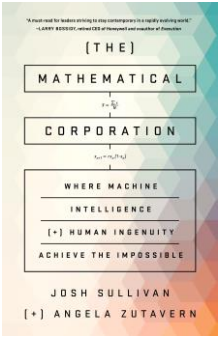


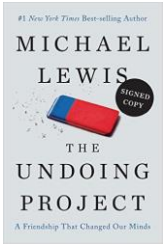


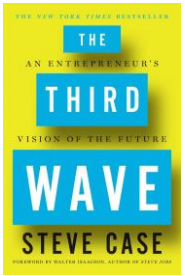


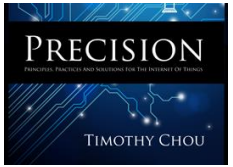




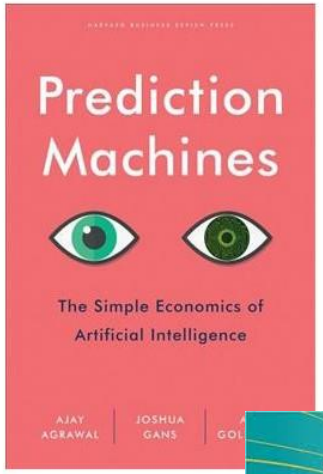


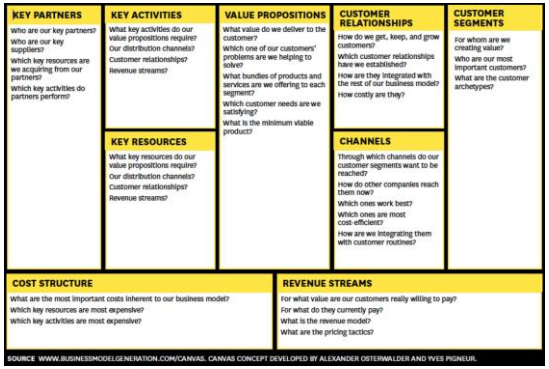


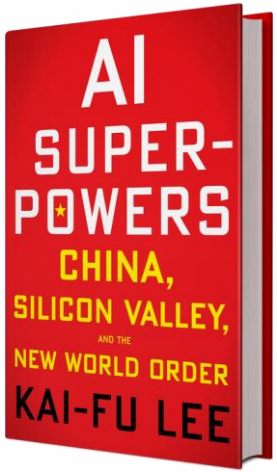


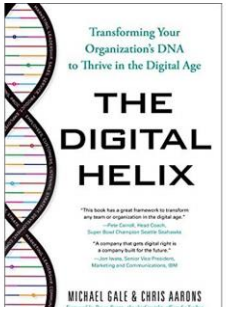


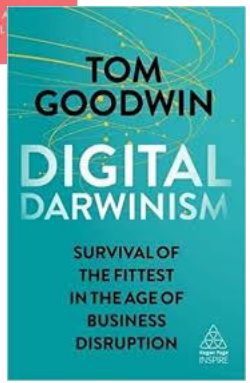
Finding Meaning and Minds

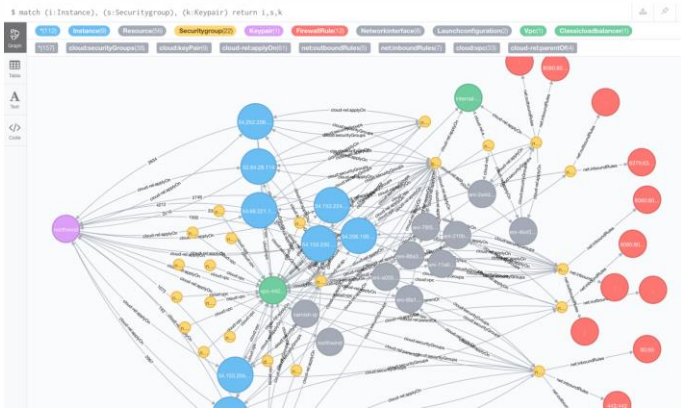




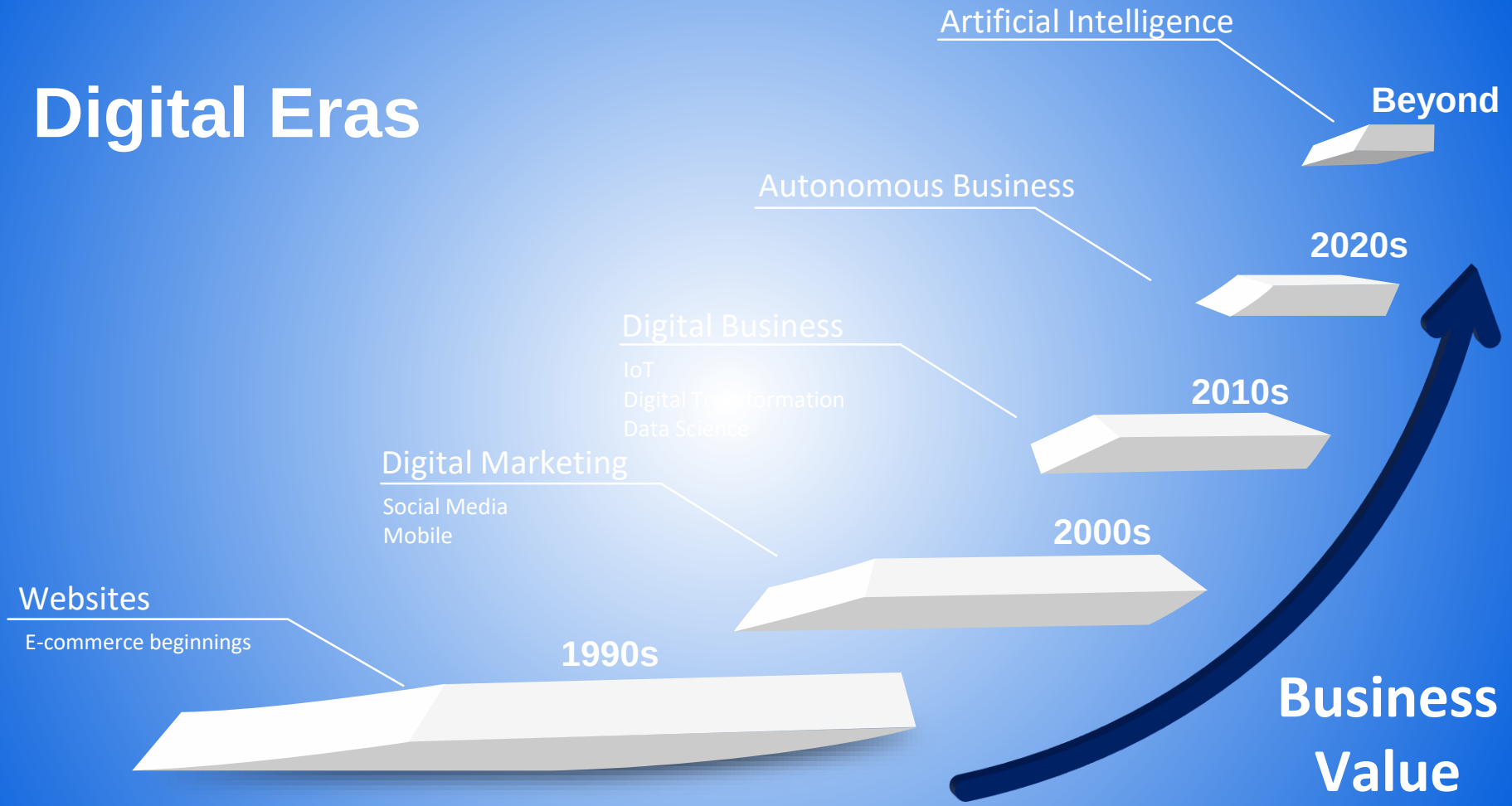






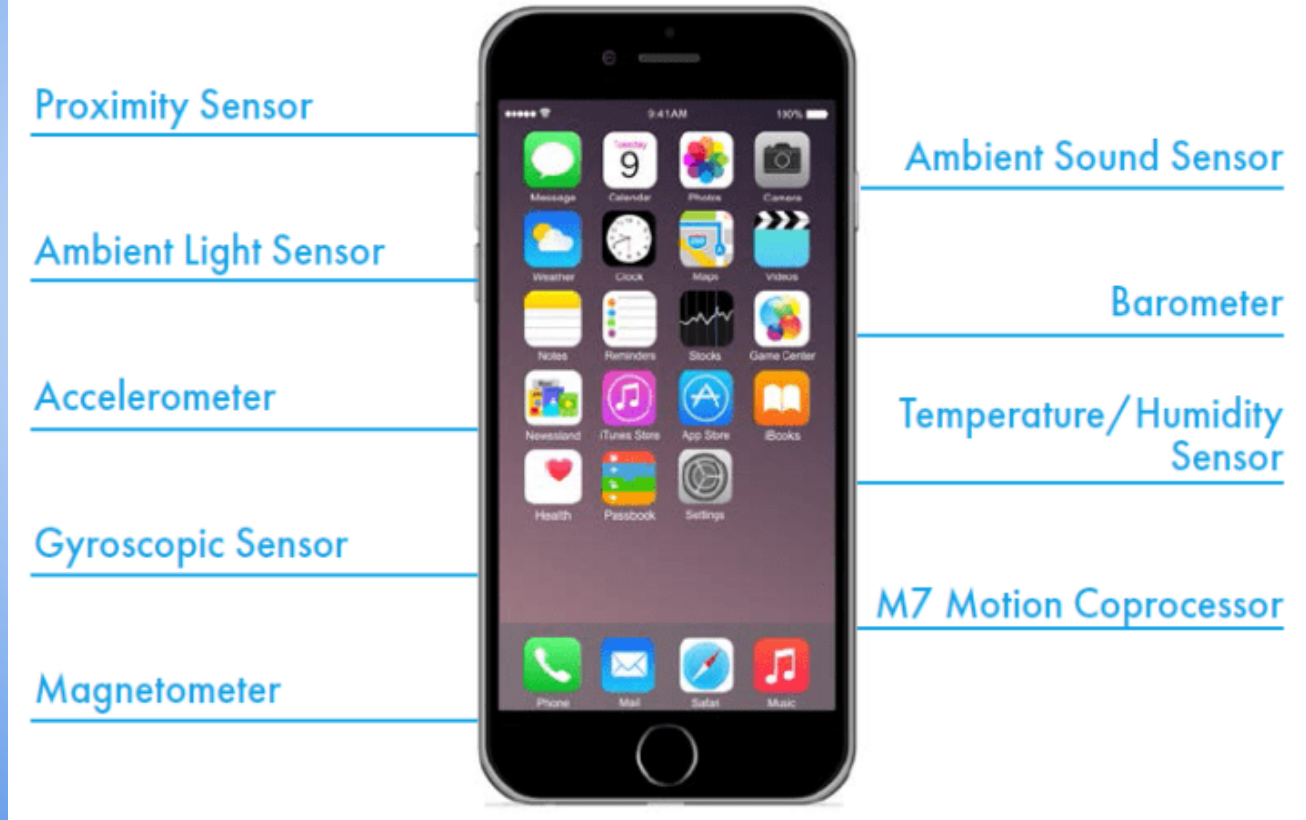


Digital Eras

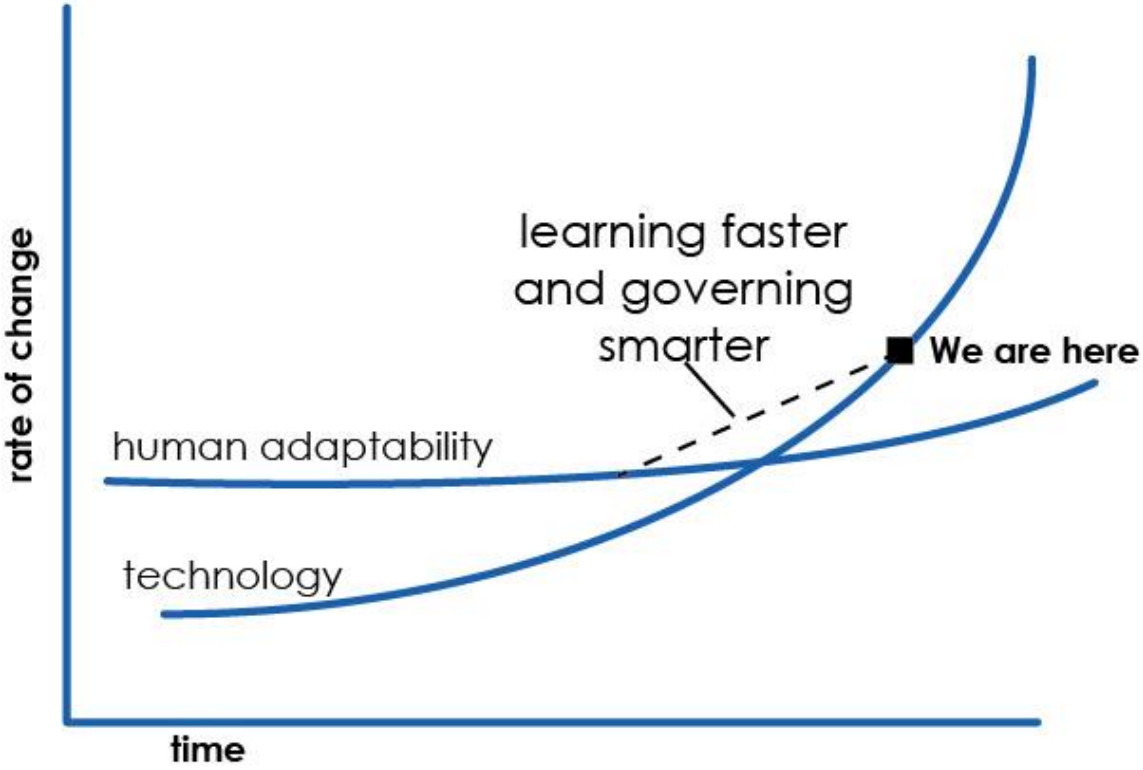


Exponential and Enabling Technologies

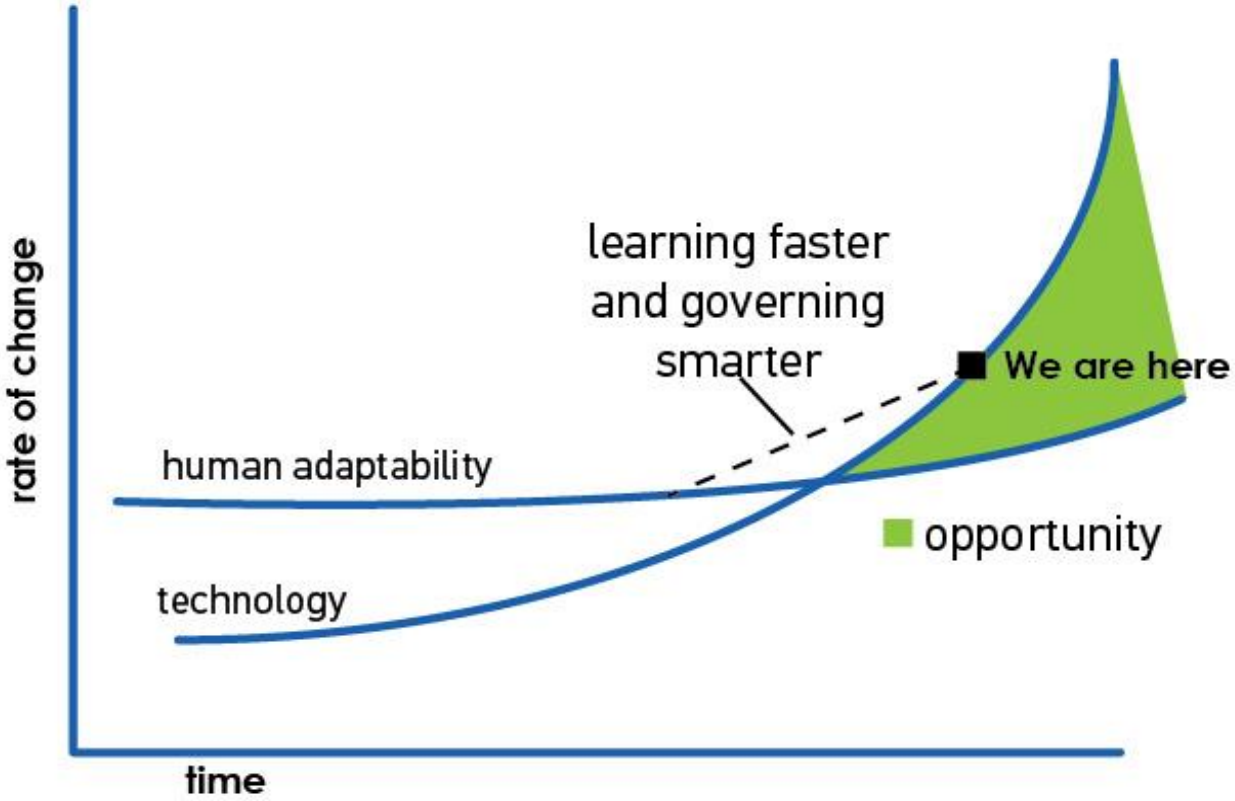
- Cloud Computing
- Computational systems
- Networks and sensors
- Material Sciences
- Artificial intelligence
- Robotics
- Digital Manufacturing



Technology Adoption Drag



Adoption Drag…Presents Opportunity



Internet of Things Future

IoT: What is the growth really?

B x P x T

IoT: What is the growth really?

B x P x T is:

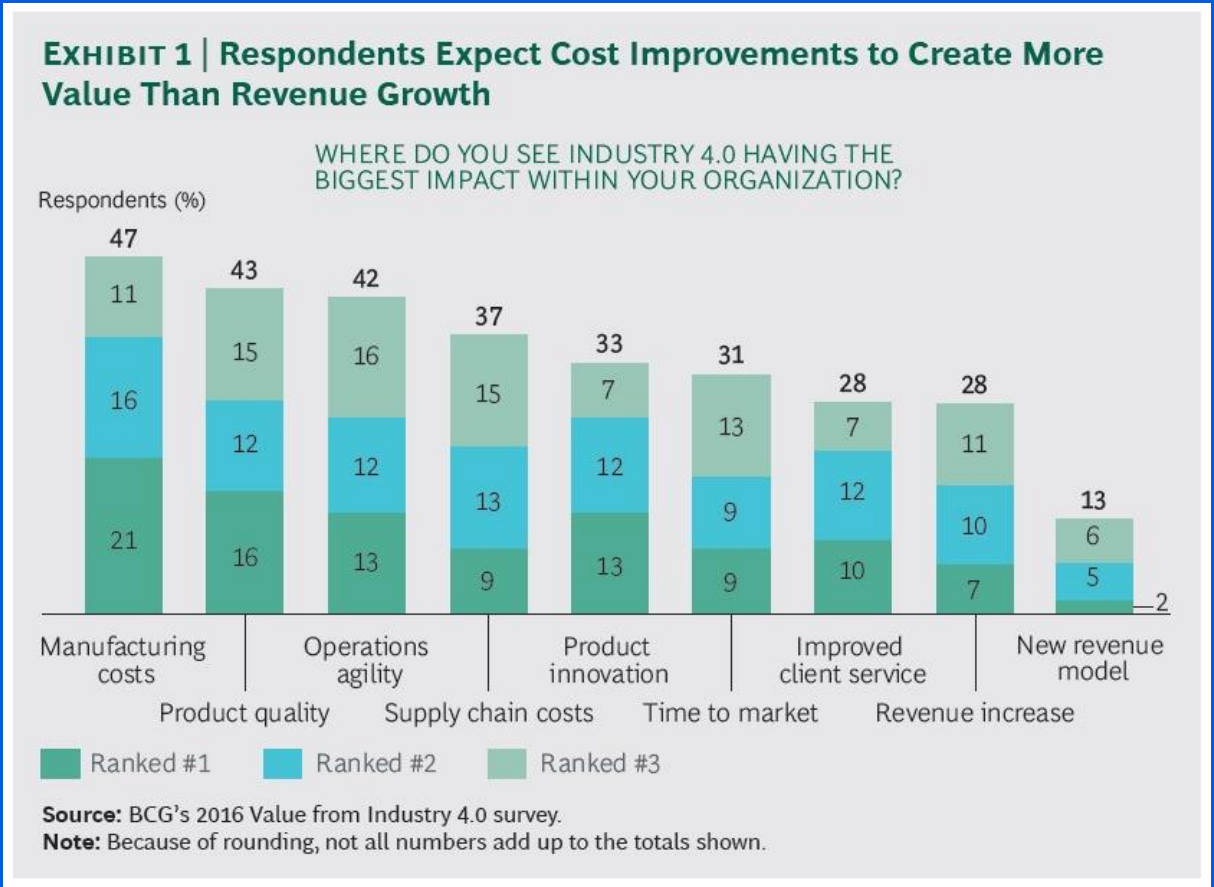
Businesses x People x Things

- Estimated 130 million enterprises
- 3 billion people on internet and growing
- 2020 25 billion things will be connected to Internet

What is the Industrial Internet of Things Value?

- IIoT is creating a universe of sensors, which enable an accelerated, deep learning of existing operations
- These data tools allow for rapid contextualization, automatic pattern and trend detection
- Furthering this of manufacturing operations will finally allow for true quantitative capture of formerly “expert” qualitative operations

Cost Improvements Seen as Most Value



Manufacturing is leader in IoT spending

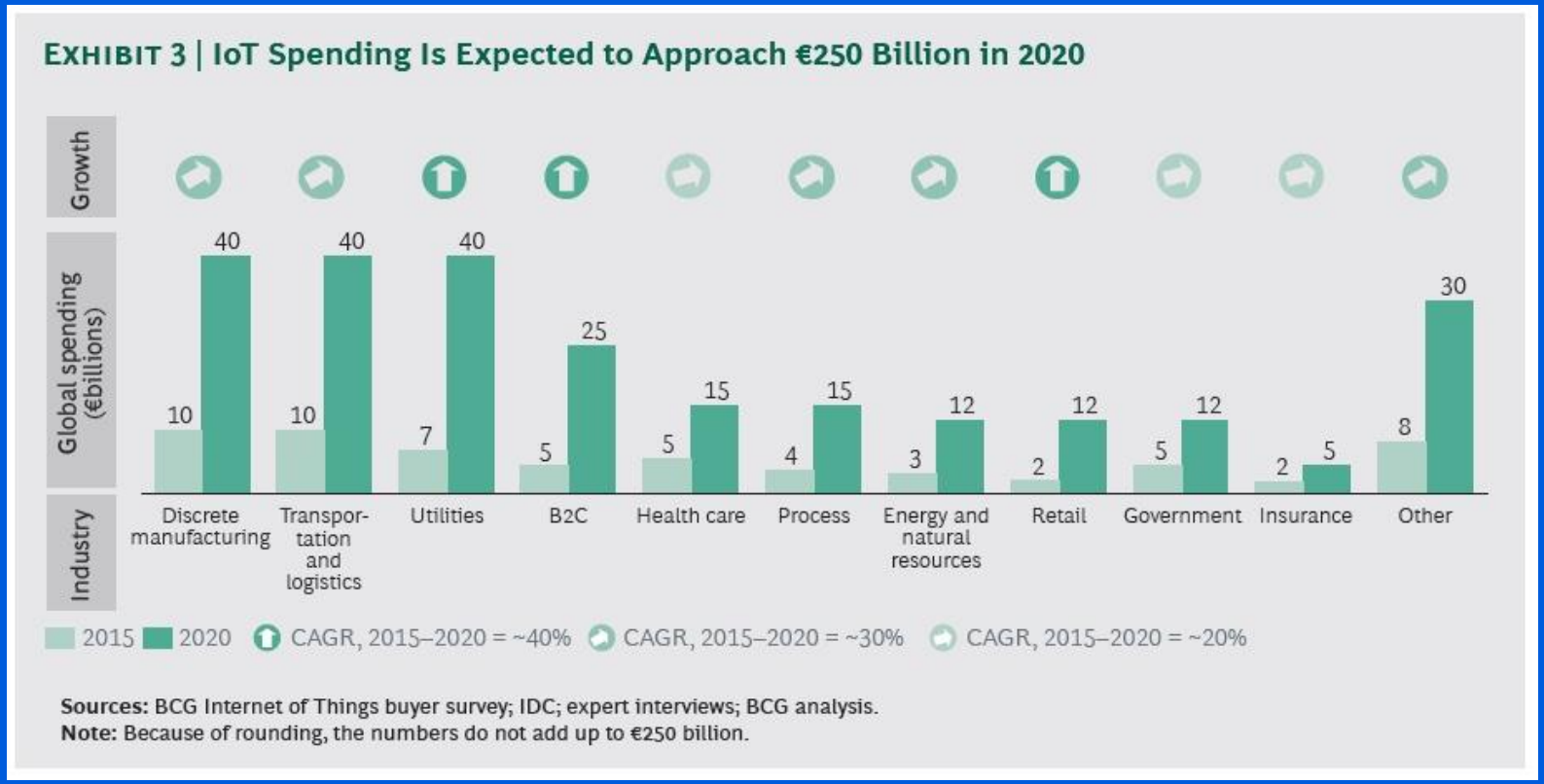
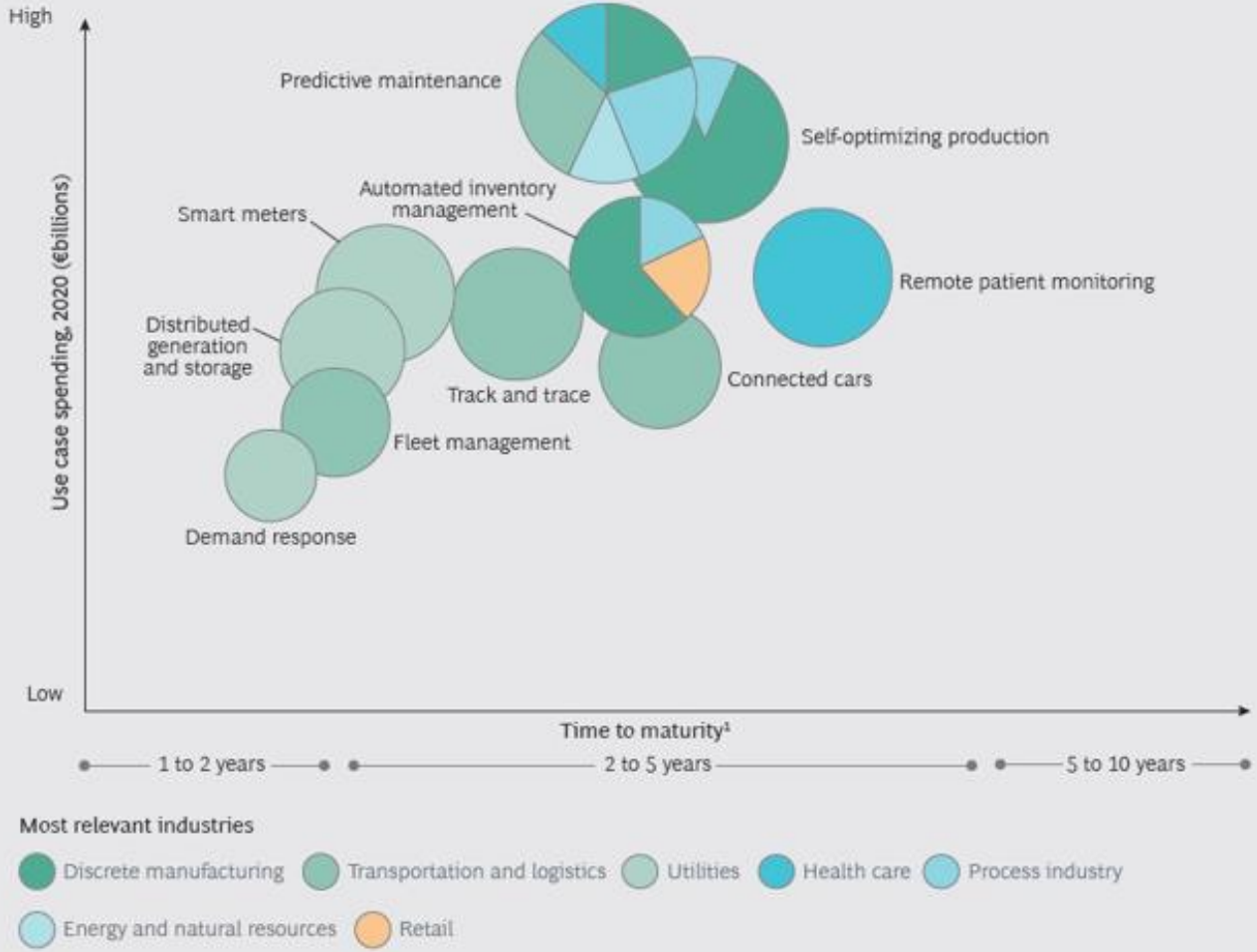
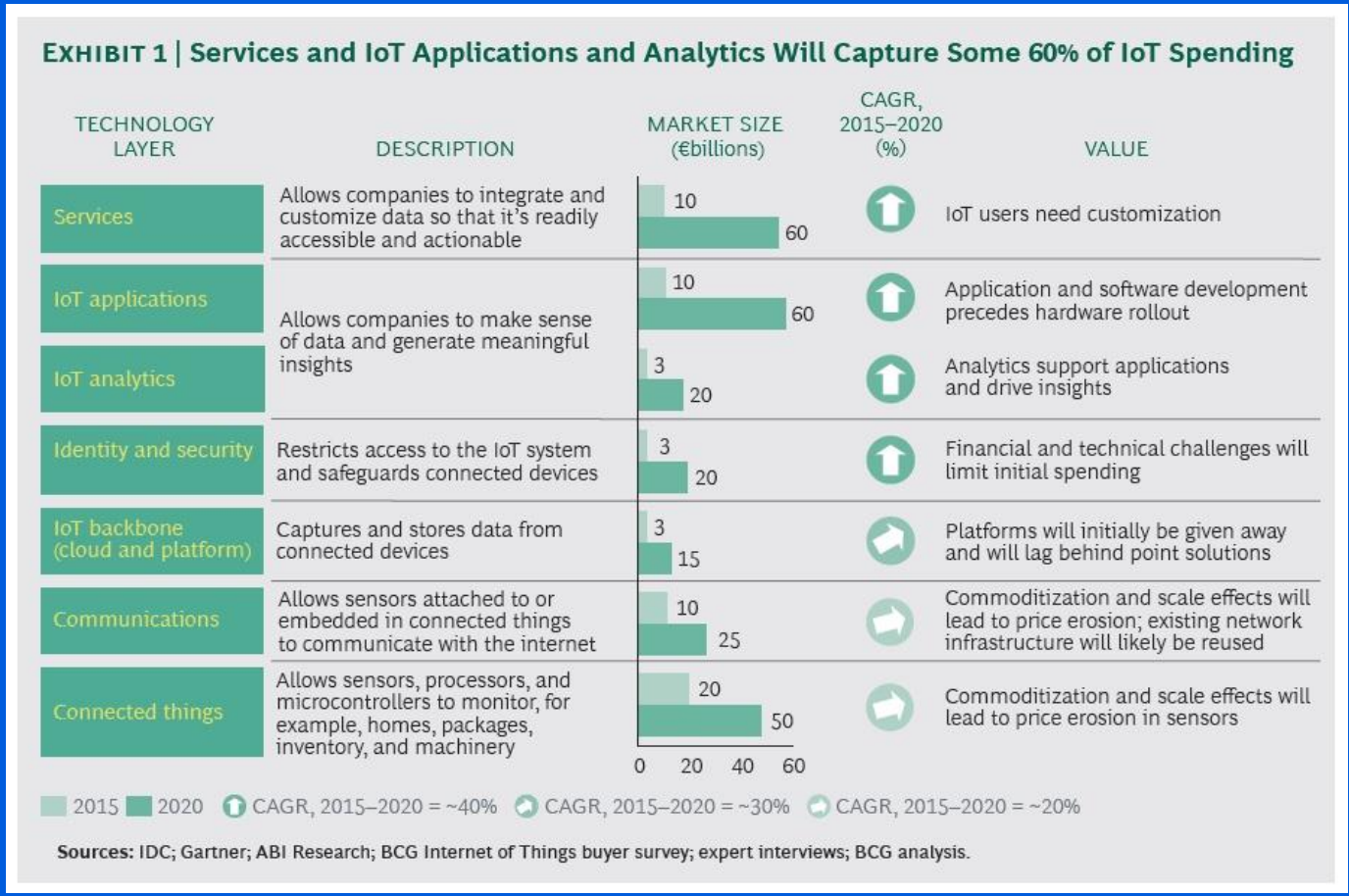


EXHIBIT 2 | Ten Use Cases Will Drive IoT Growth Through 2020



Value in Service, Applications & Analytics




nest
18
HEATING
20


15:15
100%
Thermostat
18
HEATING
20
42%
INSIDE HUMIDITY
HEAT
SCHEDULE
HISTORY


18
HEATING
20

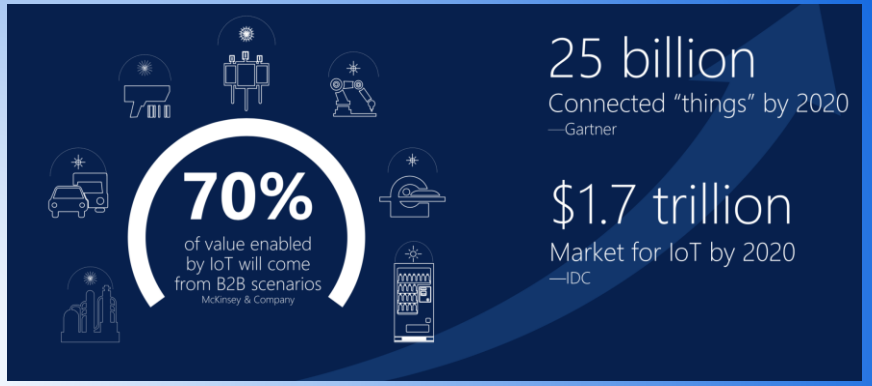

SMART Cart

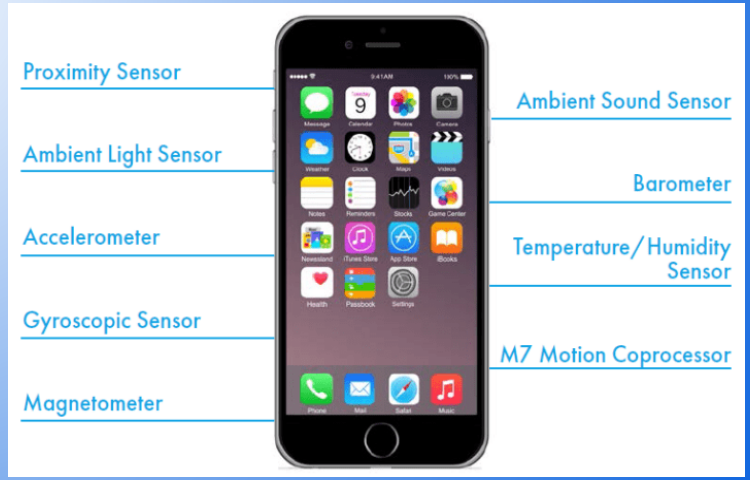
IoT Framework – Not the Internet of People

- Most first and second generation enterprise software as focused on people
- Focused on things like e-commerce, buy a book, issue a purchase order, recruit more employees or communicate with others
- Things aren't people, might seem obvious, but…

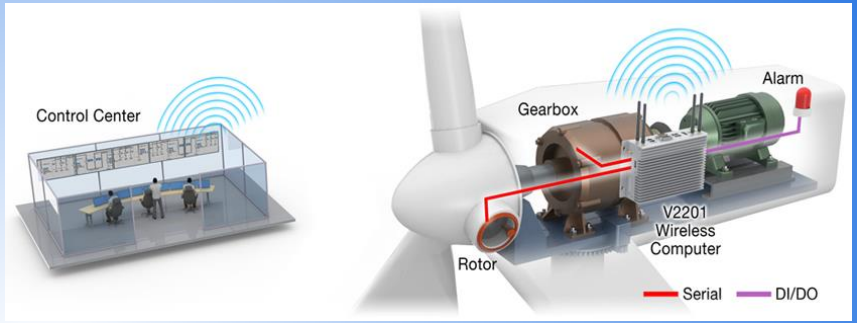
IoT Framework – Things Are Not People

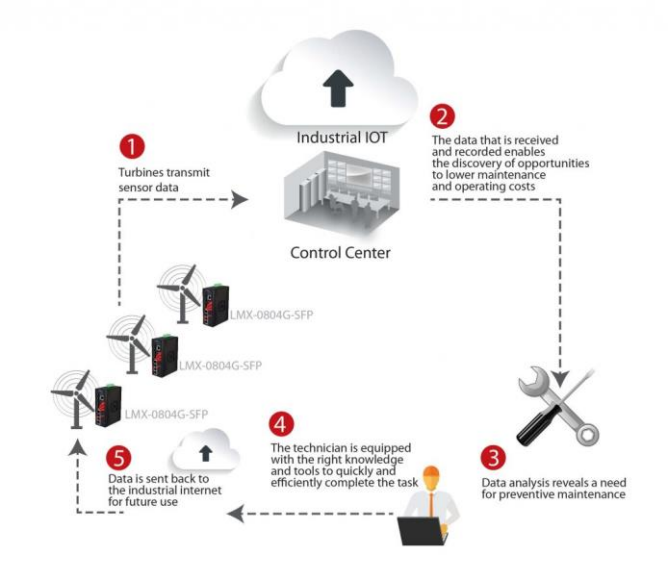
- A lot more things than people
- Things can tell you more than people
- Things can talk constantly

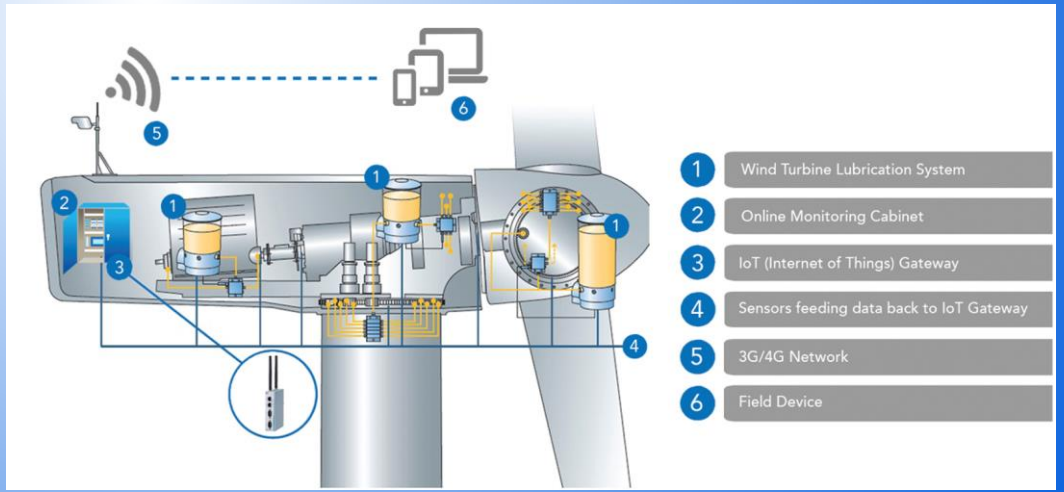




Things In Practice – Wind Turbine







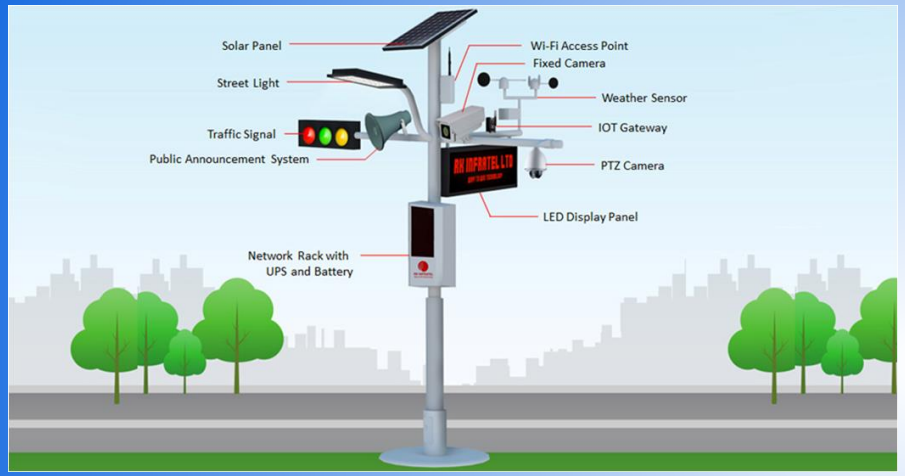
Things In Practice – Clinical Hematology Analyzers

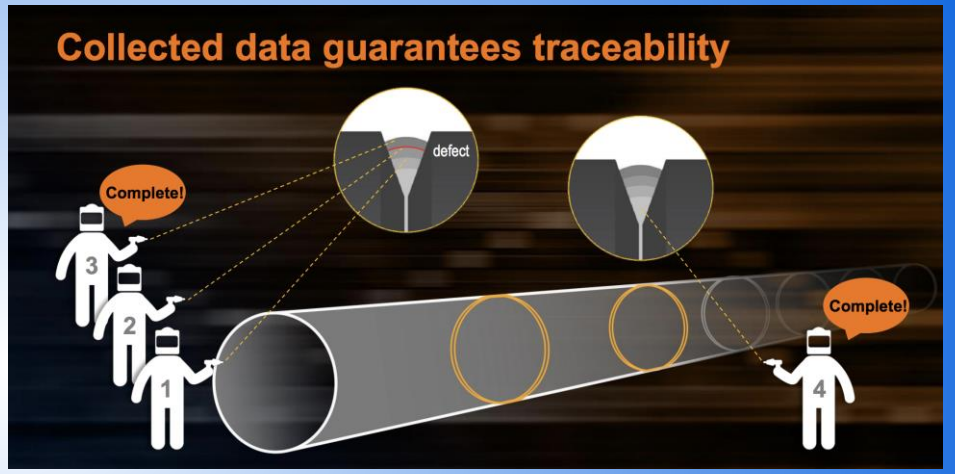
- Hematology analyzers used in patient and research settings to count and characterize blood cells for disease detection and monitoring
- Complete Blood Count (CBC), White Blood Cell Count (WBC) as well as cell structure and small cell populations to diagnose rare blood disorders
- Systems can now conduct 150 samples/hour
- Save 1,000 to 90,000 patient results with Histograms and graphics

Things In Practice – High Volume Mail Inserters

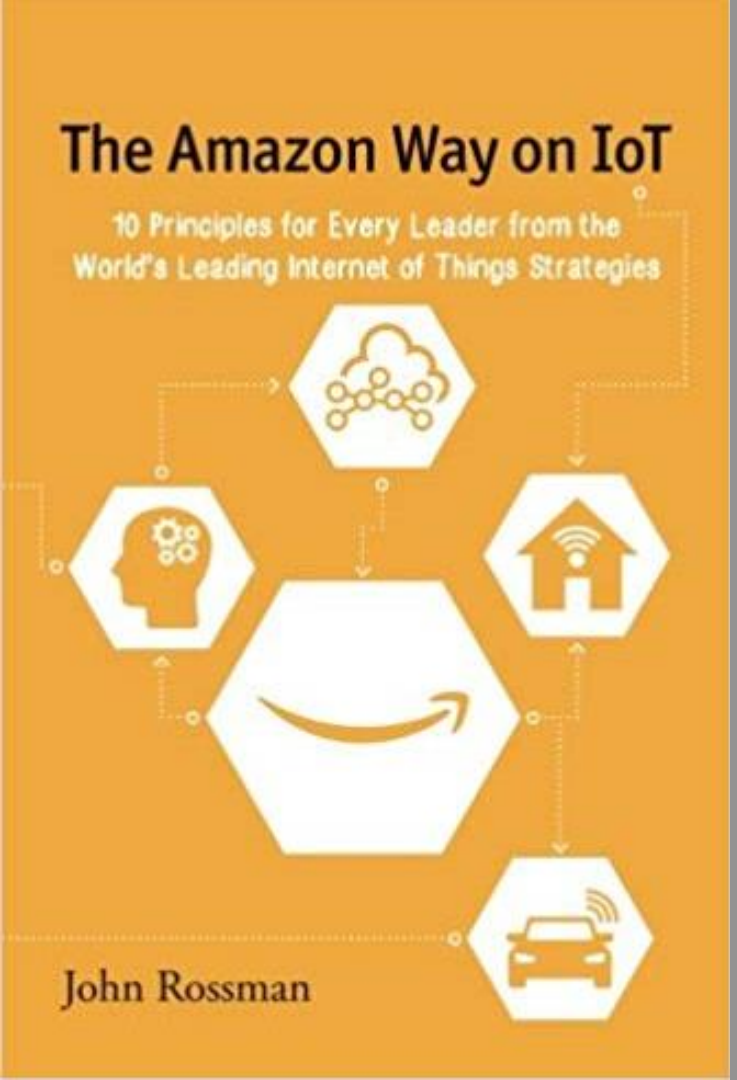
- Banks statements and a lot of physical mail
- Pitney Bowes Epic Inserter can stuff 22,000 envelopes per hour
- Hundreds of sensors to monitor flow of mail and feedback to control system such as RPM, velocity of mail, position and skew of mail, vacuum where air is used to control machine
- Sensors are all attached to a local compute and storage
- Industrial PC mounted inside machine, networked and synced
- Current PCs are Intel processors with 4GB memory and 500 GB hard drive
- Runs Windows 7 with RTX, real-time extensions for motion control
- Security uses TrendMicro antivirus software

Things In Practice – Construction Equipment





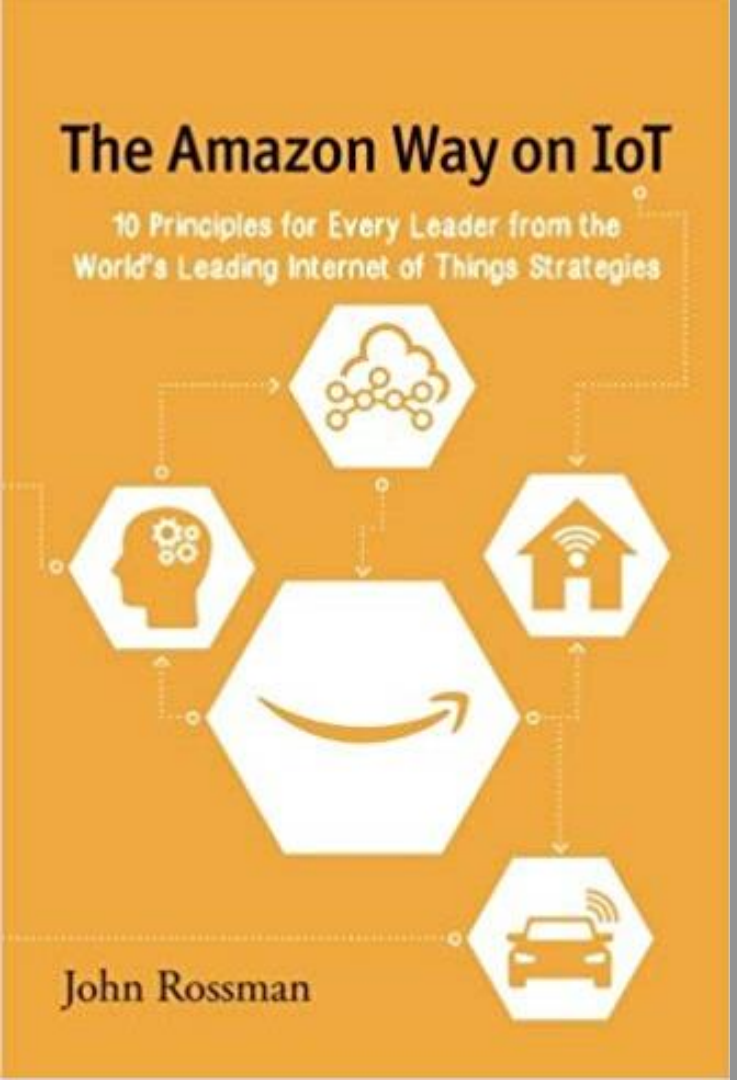
THE AMAZON WAY ON IOT
10 PRINCIPLES ON IOT STRATEGIES



Technical Perspective:

IoT is made of a growing body of sensors around world, collecting and transmitting data.

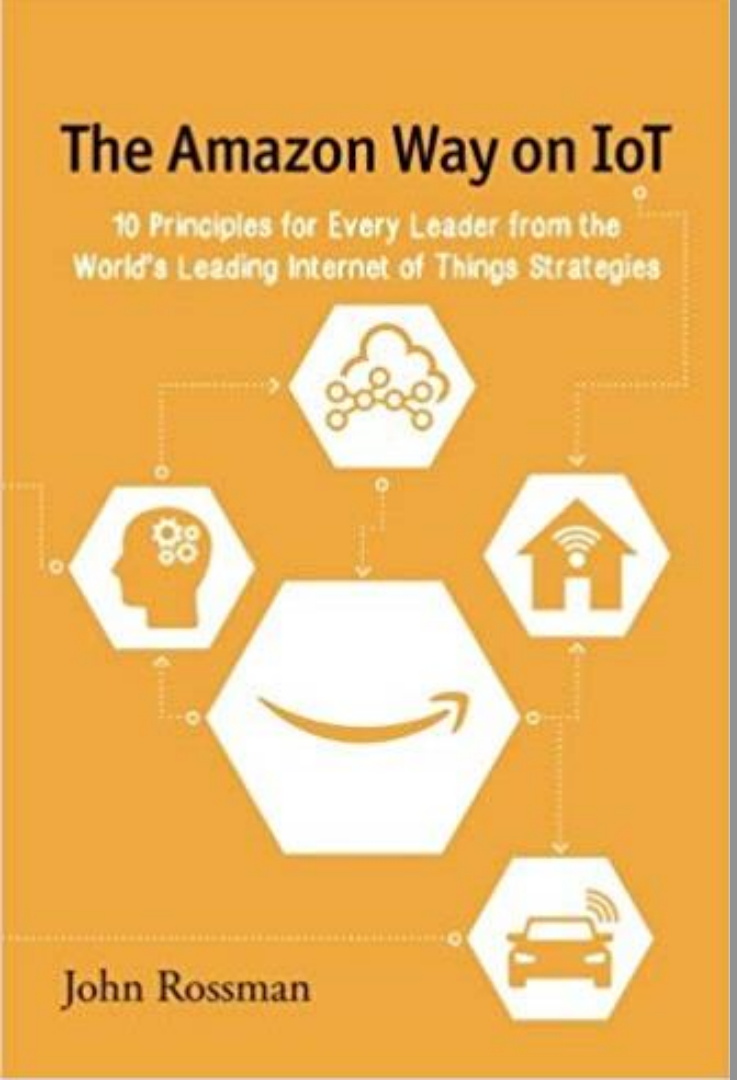
IoT also refers to rules and events being to applied to that data to make adjustments to systems and organizations.



Conceptual:

IoT is the ability to create digital awareness of the physical world we live in

Digital pulse made up of data that we can aggregate to improve the world around us

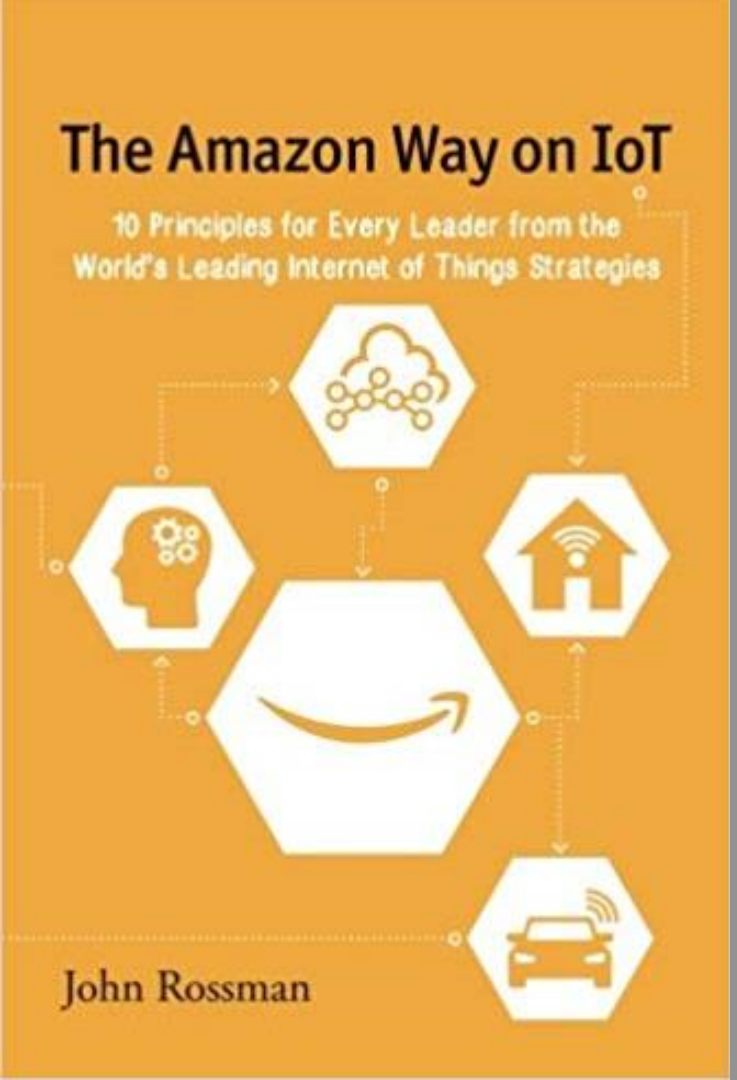


The IOT Triple Threat or Key Opportunities:

1. Reinventing Customer Experience

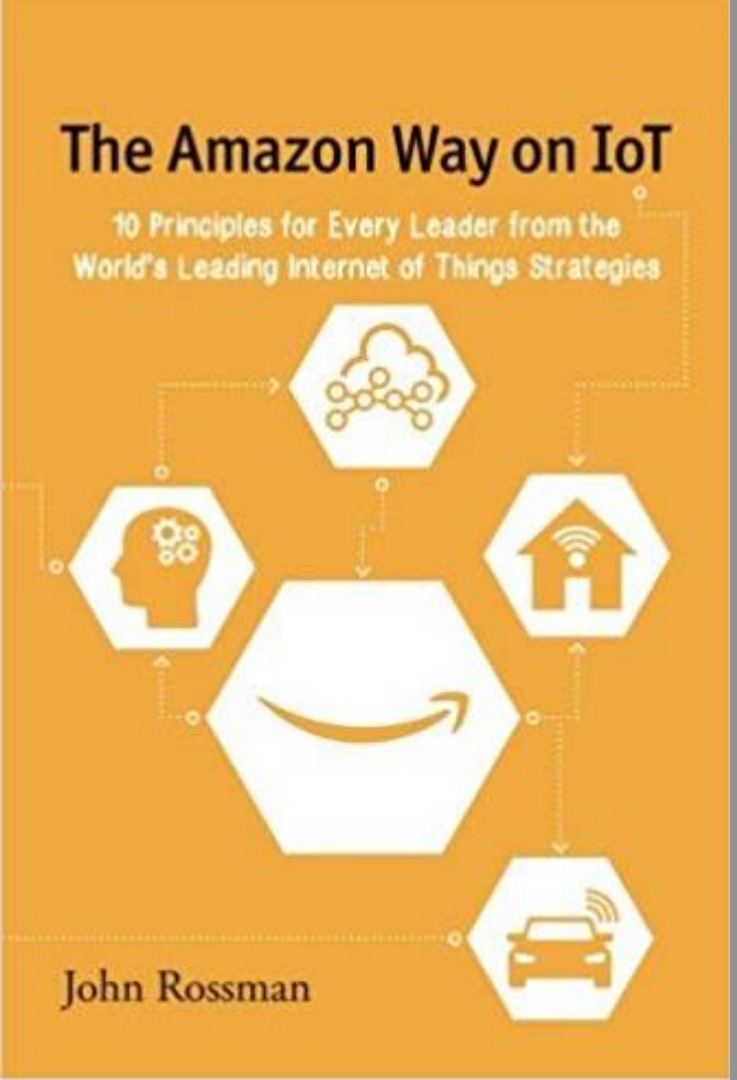
2. Improving Operational Effectiveness

3. Developing new business models

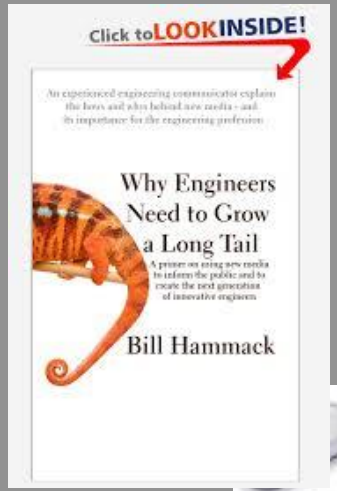


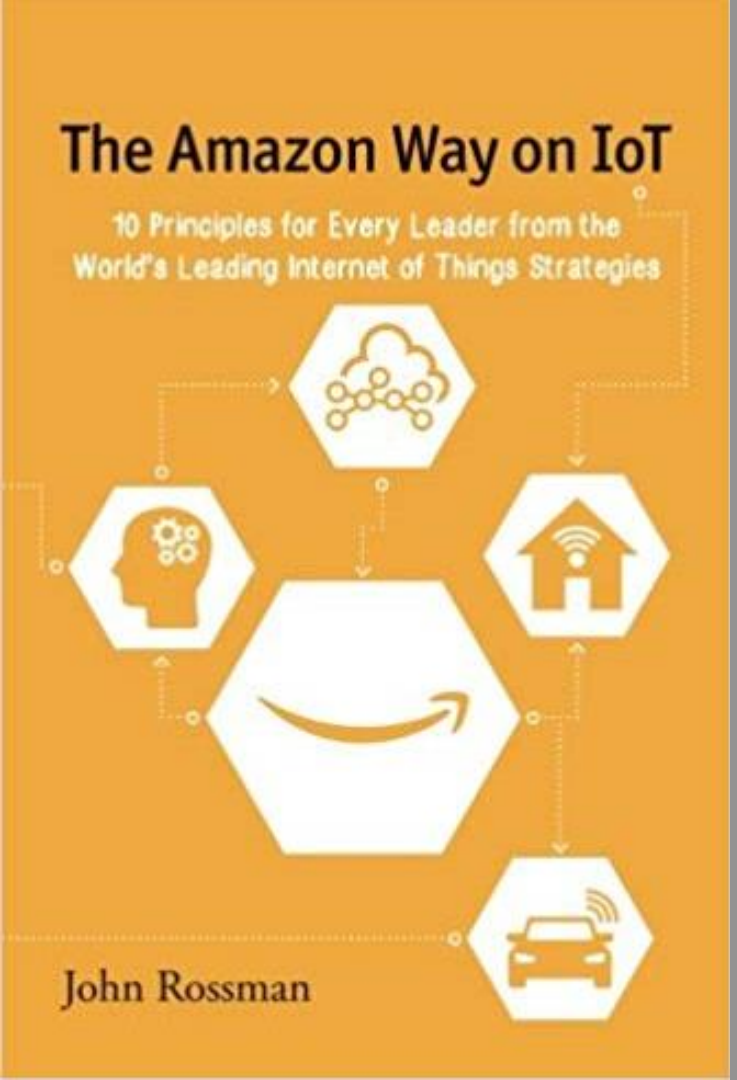
Principle #1

The Internet of Things won't get you anywhere unless you're obsessing over your customers and their experiences and how connected devices can solve their problems



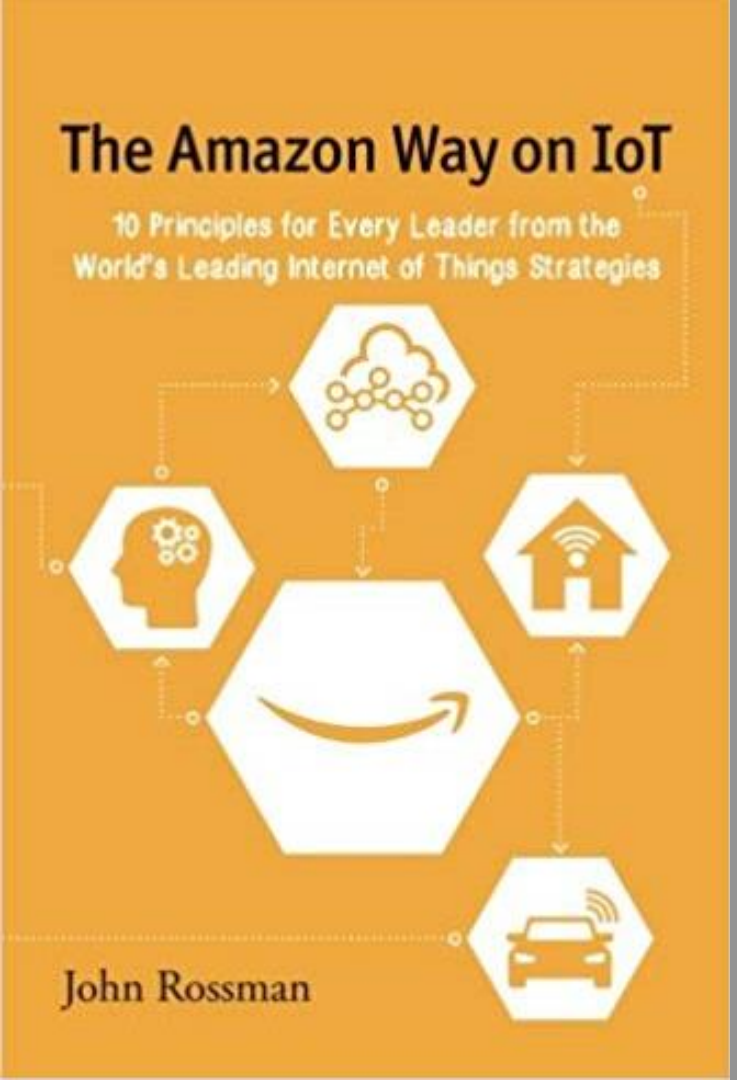
Principle #1 –Obsess on customer



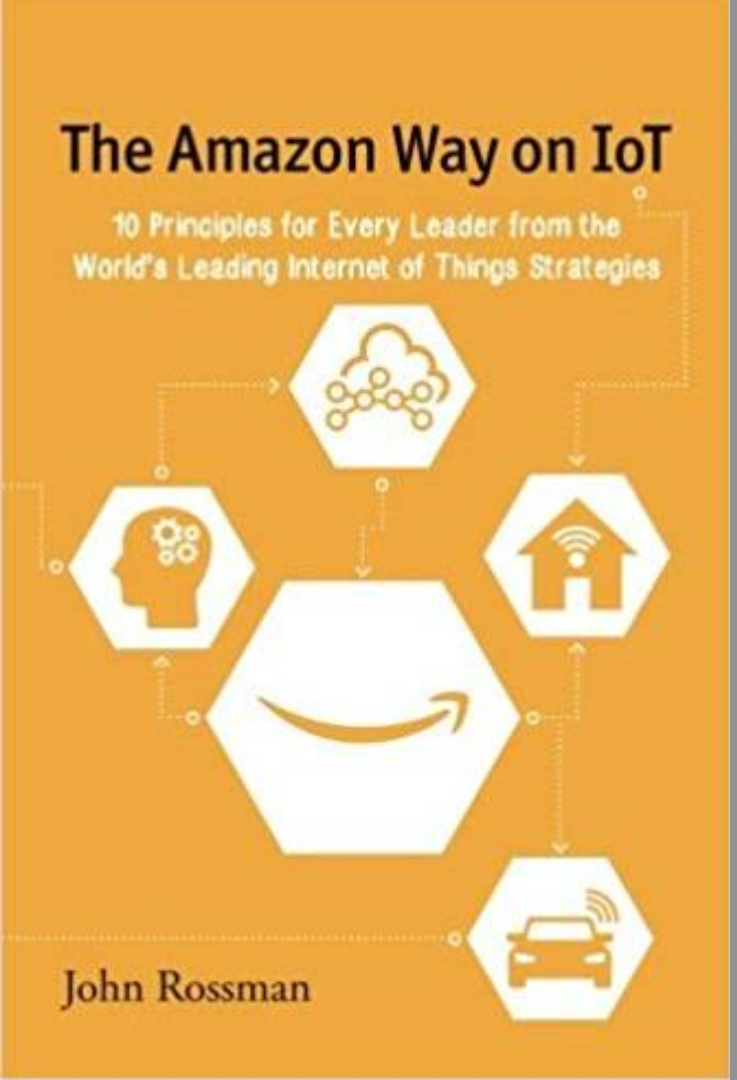


Principle #2

Customers expect seamless experiences across platforms and channels. The Internet of Things will be instrumental to helping you create this, enabling new interactions that bring ease and delight to your customers.

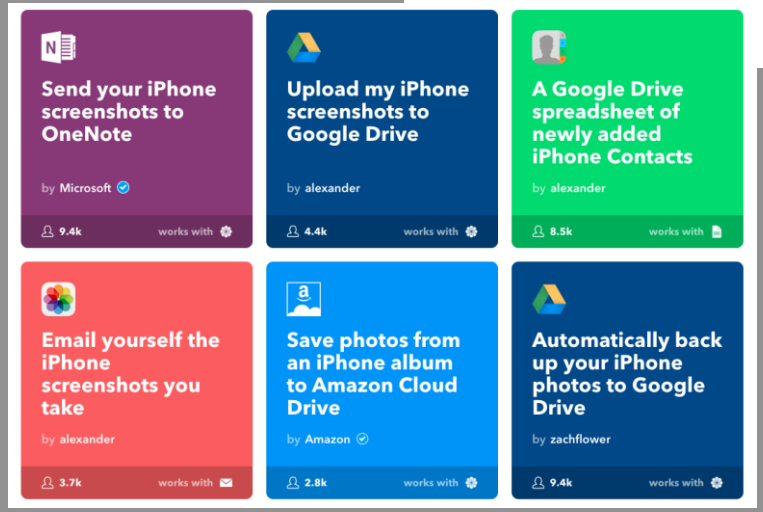


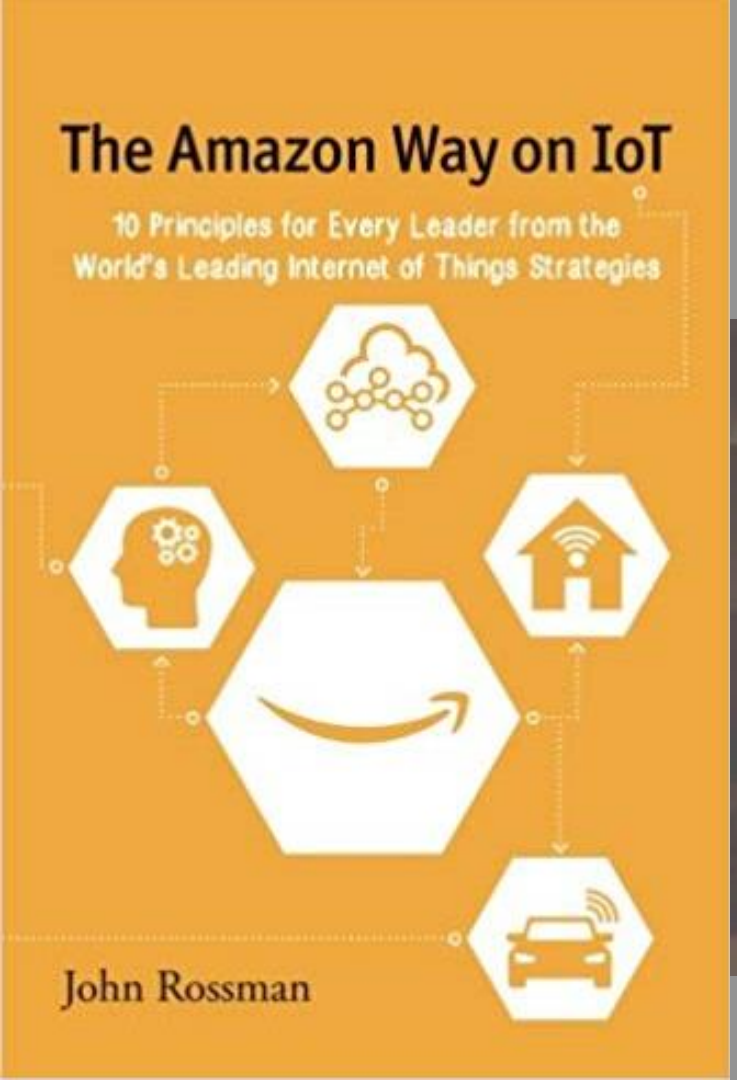
Principle #2 – Seamless and New Interactions



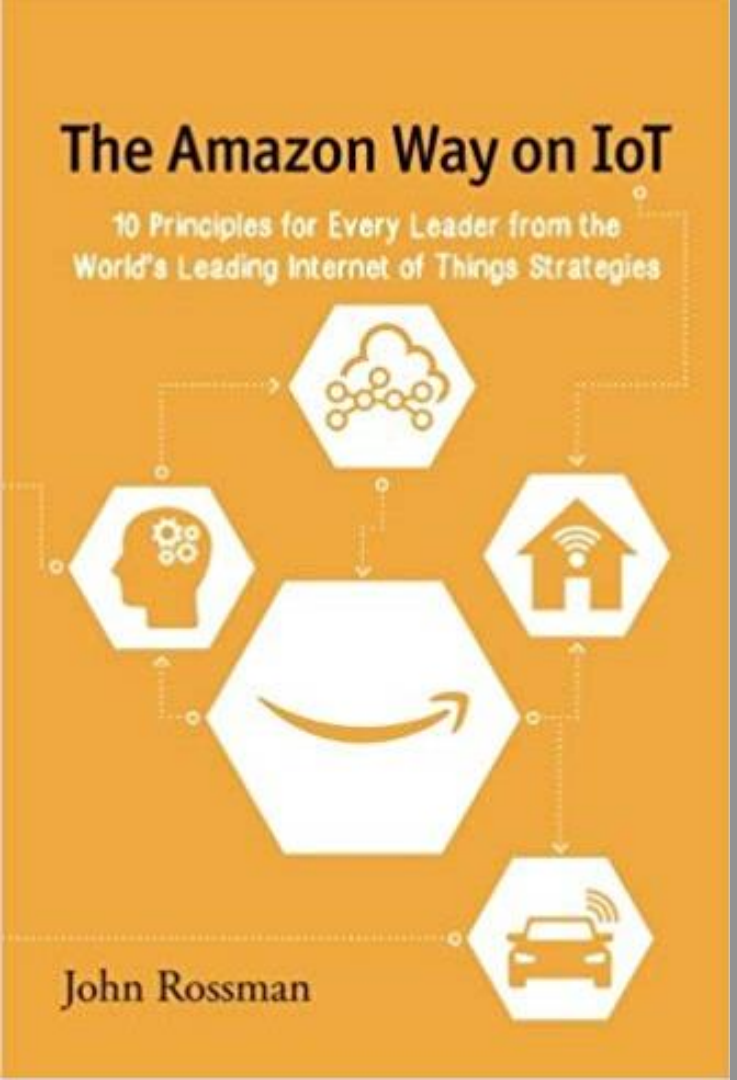
Principle #2 – Seamless and New Interactions

IFTTT
ifthisthenthat



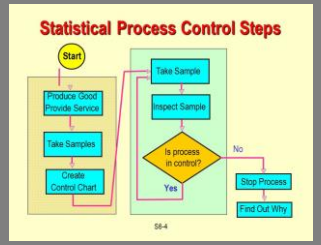


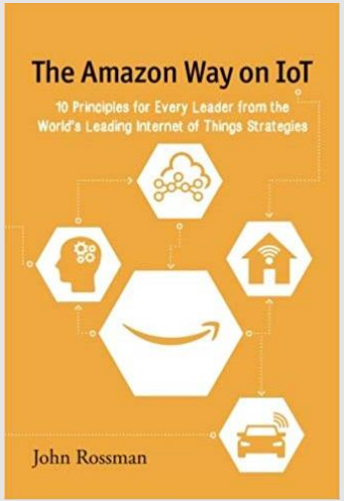
IFTTT
ifthisthenthat



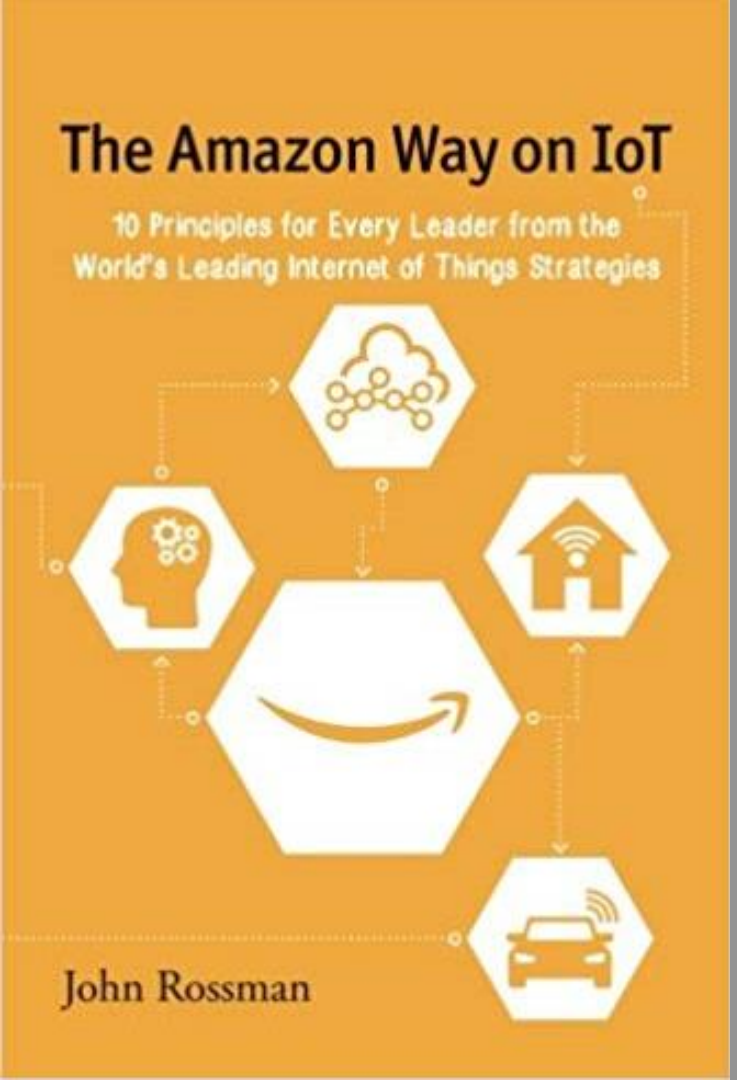
Principle #3

Connected devices are a powerful enabler for monitoring and improving your operations to make your company more efficient, competitive and profitable



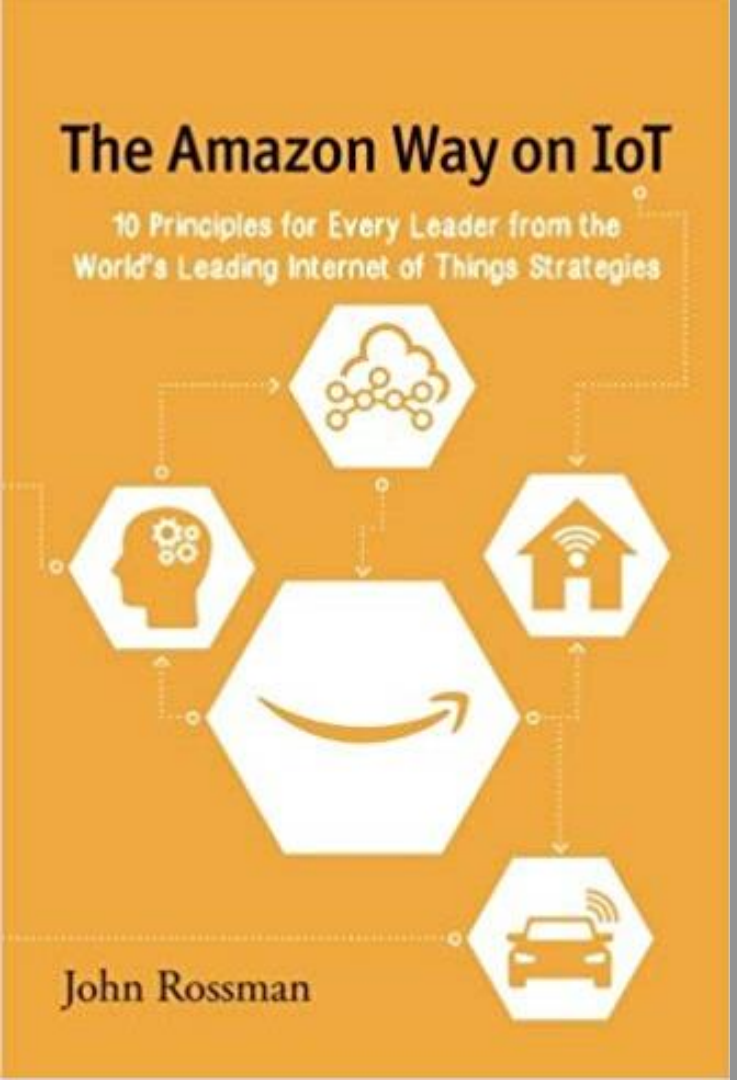


Principle #3 --monitoring and improving your operations to make your company more efficient, competitive and profitable



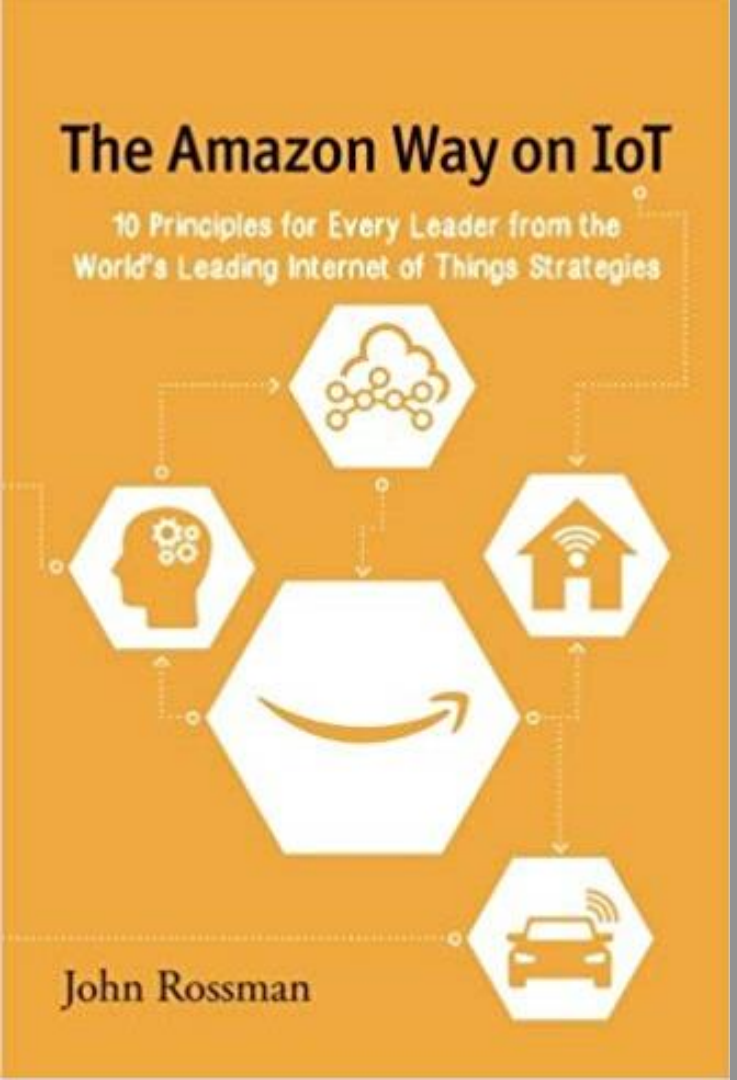
Principle #4

Using mathematical equations and the Internet of Things, you can track the levers and processes of your business, learn more about specific processes, and gather data that will power and inform those equations, driving improvements and efficiencies



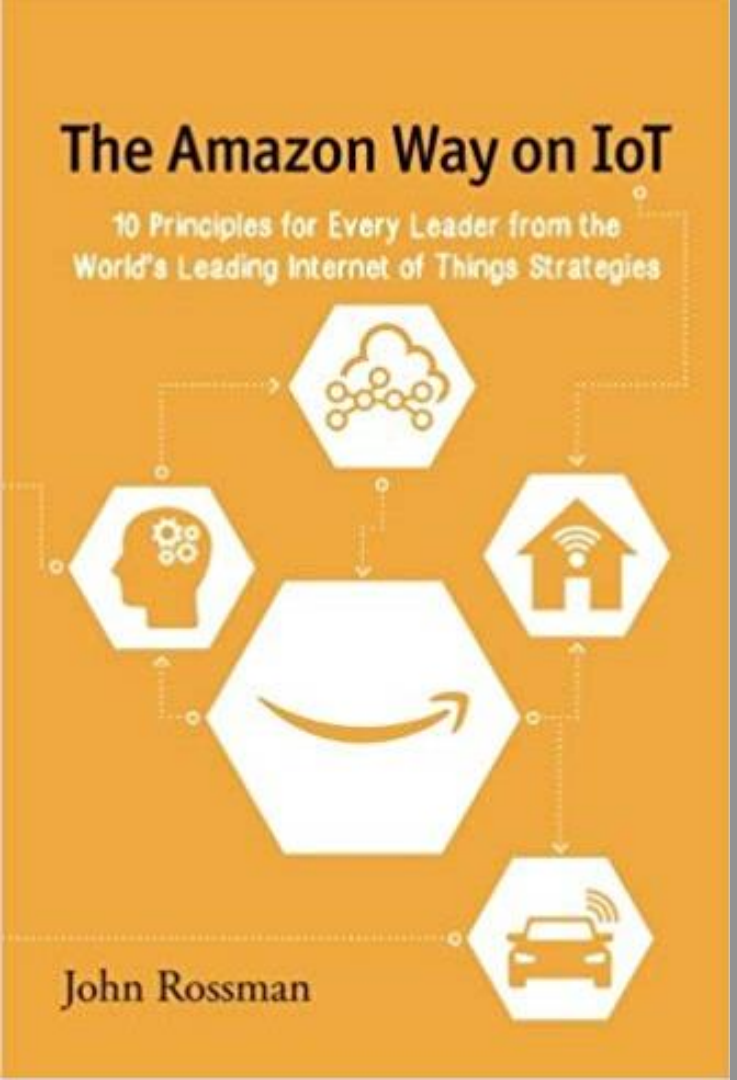
Principle #5

Successfully innovating with the Internet of Things requires a big and powerful vision, but to reach that vison, you'll need to create a series of small, agile experiments



Principle #6

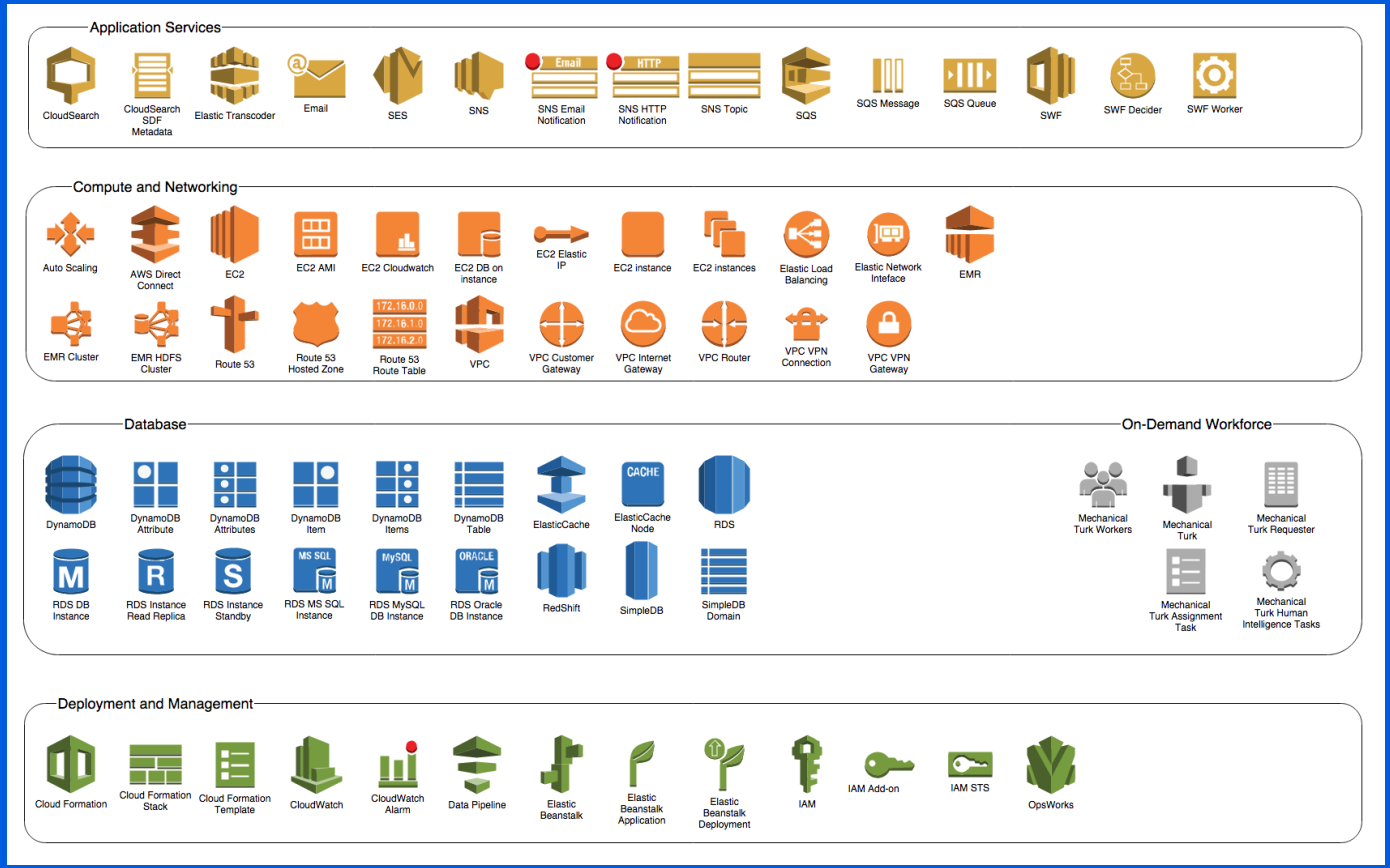
Building a platform business model, which allows others to leverage your capabilities to build and grow their own businesses, creates a stronger sustainable, competitive advantage. IoT can create a platform business model, leveraging their connected devices for other companies to use

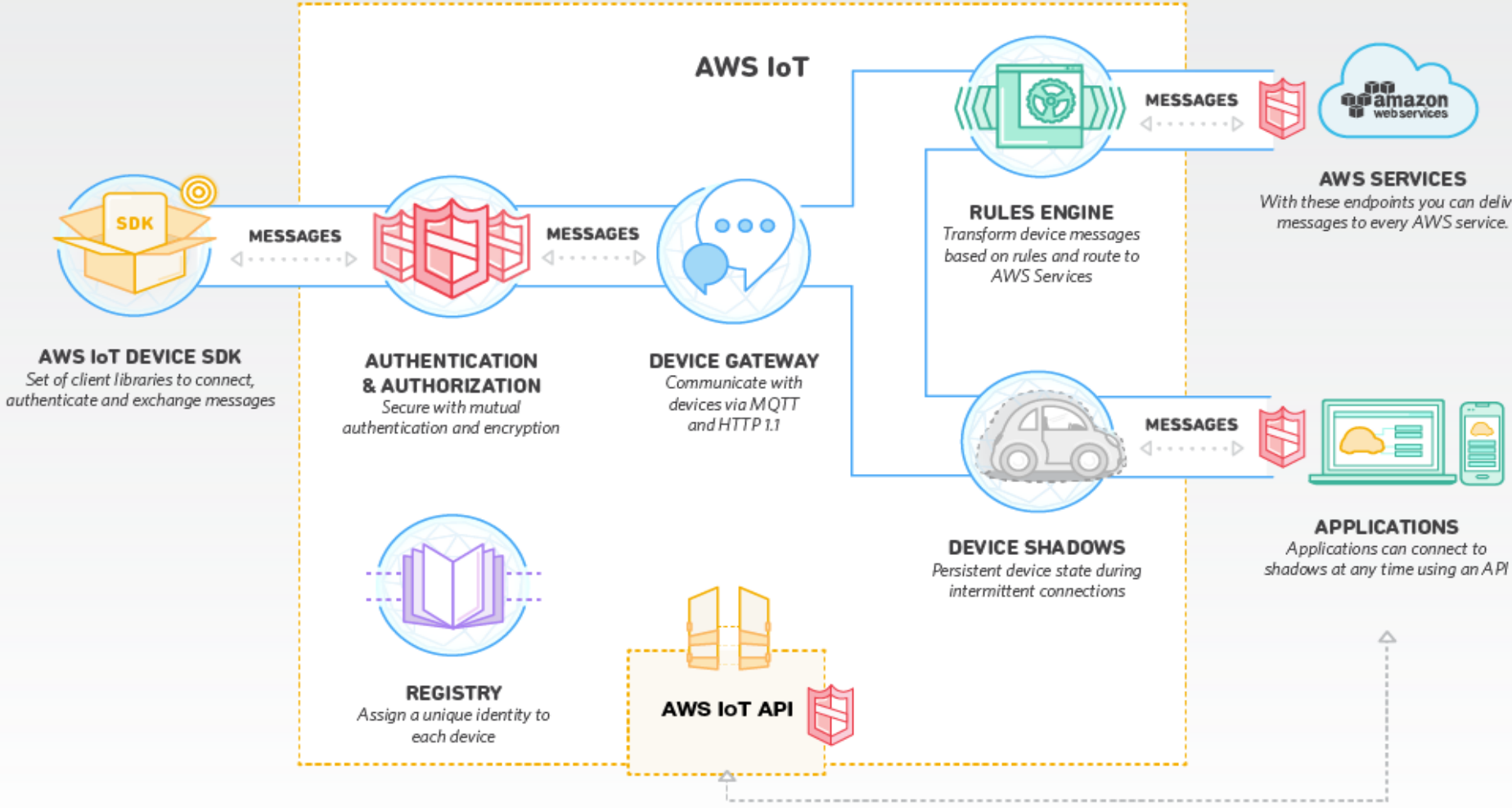


Principle #6 – Platform business model

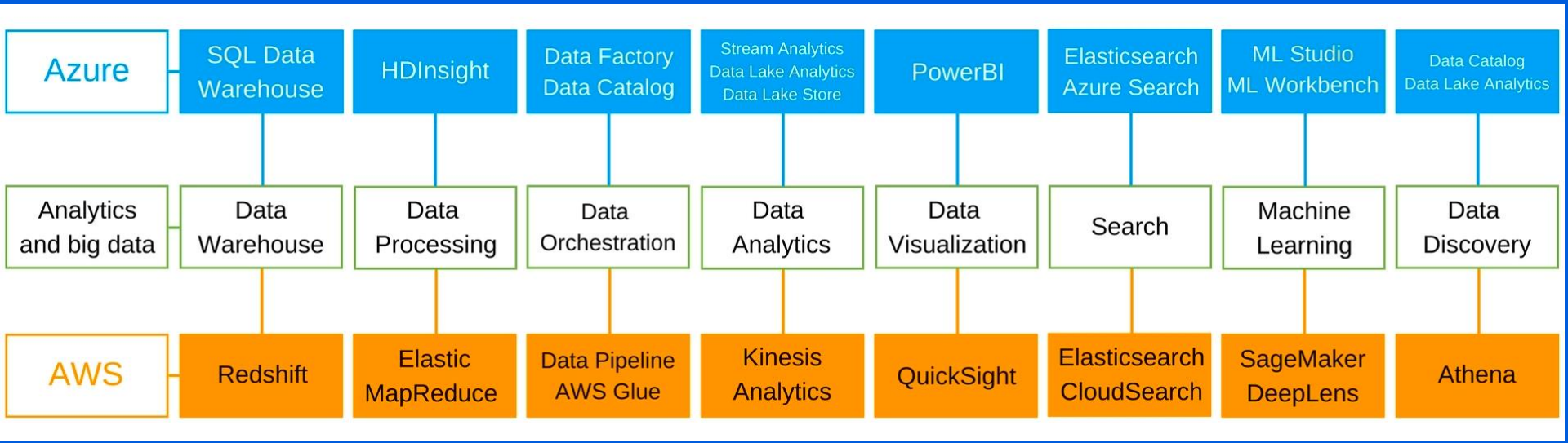
fulfillment by amazon

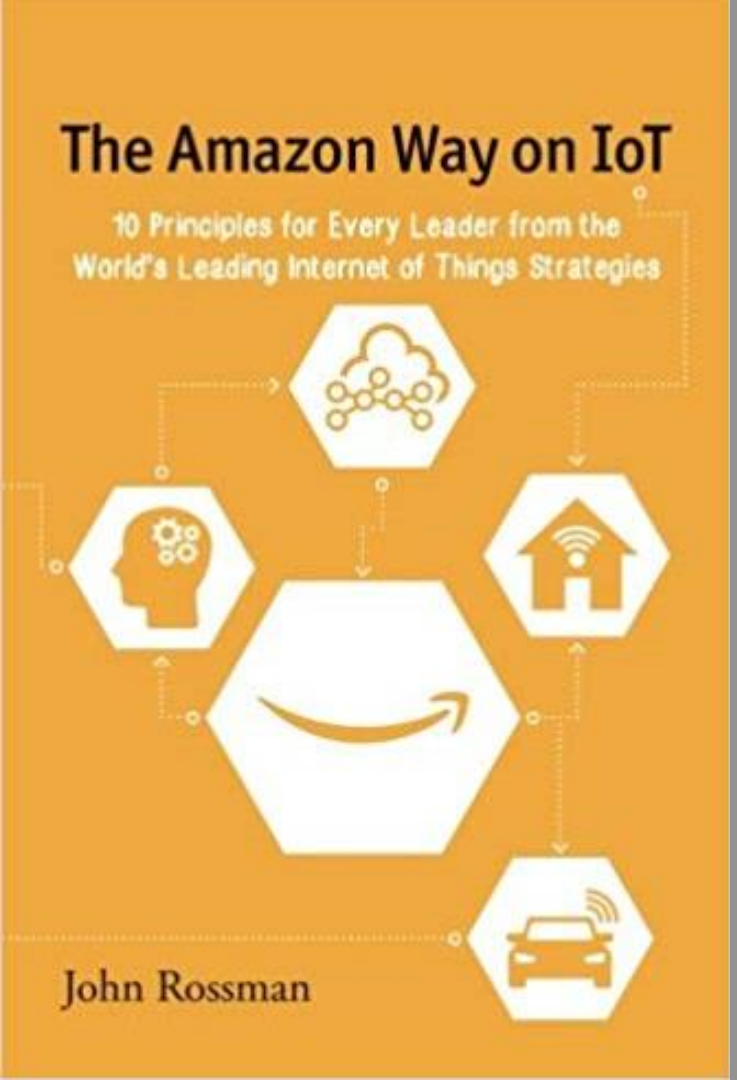
Principle #6 – Platform business model




AWS IoT
SDK
MESSAGES
MESSAGES
MESSAGES
MESSAGES
amazon web services
AWS IoT DEVICE SDK
Set of client libraries to connect, authenticate and exchange messages
AUTHENTICATION & AUTHORIZATION
Secure with mutual authentication and encryption
DEVICE GATEWAY
Communicate with devices via MQTT and HTTP 1.1
RULES ENGINE
Transform device messages based on rules and route to AWS Services
AWS SERVICES
With these endpoints you can deliver messages to every AWS service.
DEVICE SHADOWS
Persistent device state during intermittent connections
APPLICATIONS
Applications can connect to shadows at any time using an API
REGISTRY
Assign a unique identity to each device
AWS IoT API

Principle #6 – Platform business model



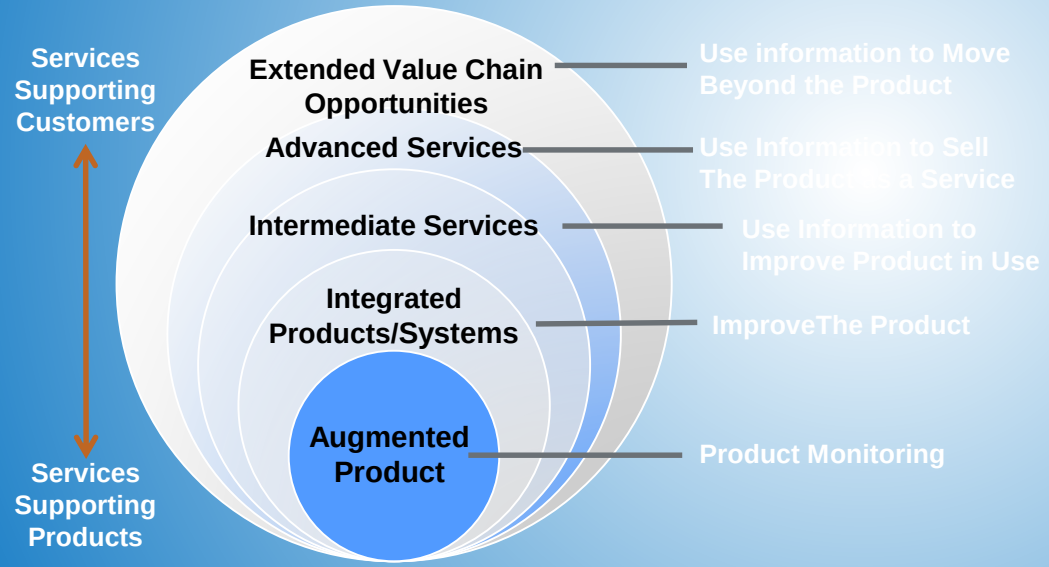


Principle #7

Connected devices facilitate the create of outcome-based businesses, an innovative model in which customers pay for the results of a product or service provides the results rather than product or service itself, shifting ownership, effectiveness, and maintenance responsibilities back to the provider and aligning customer and provider interests

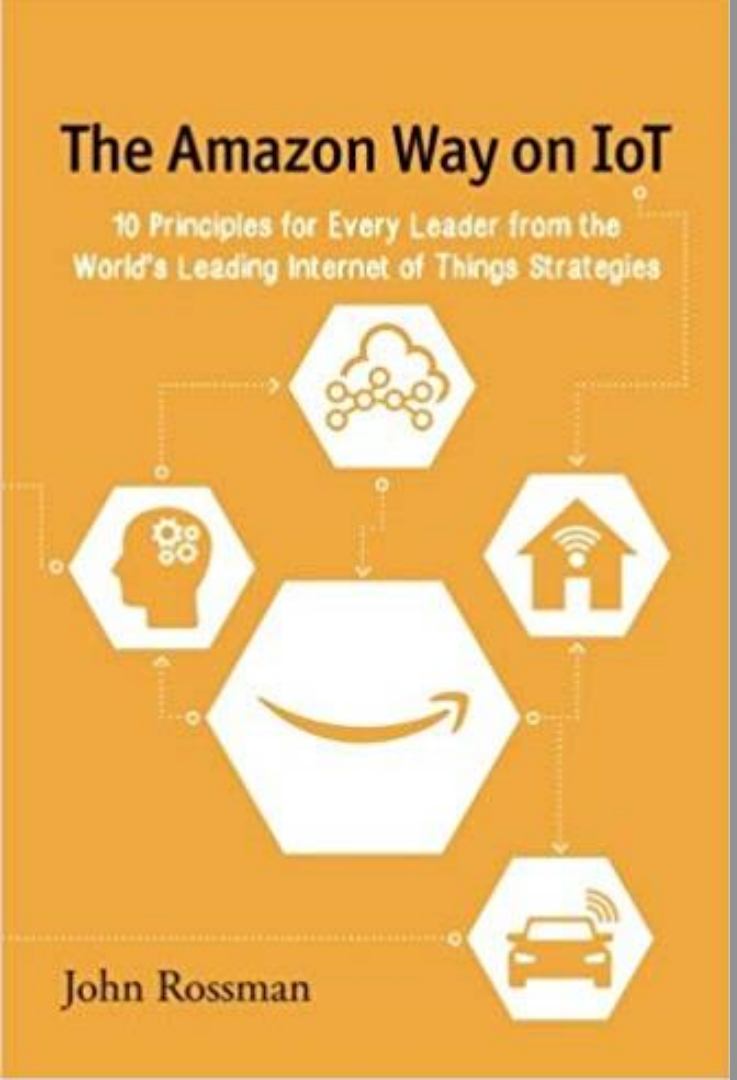
Example: GoodYear Tire

Categories of Value Creation from IoT



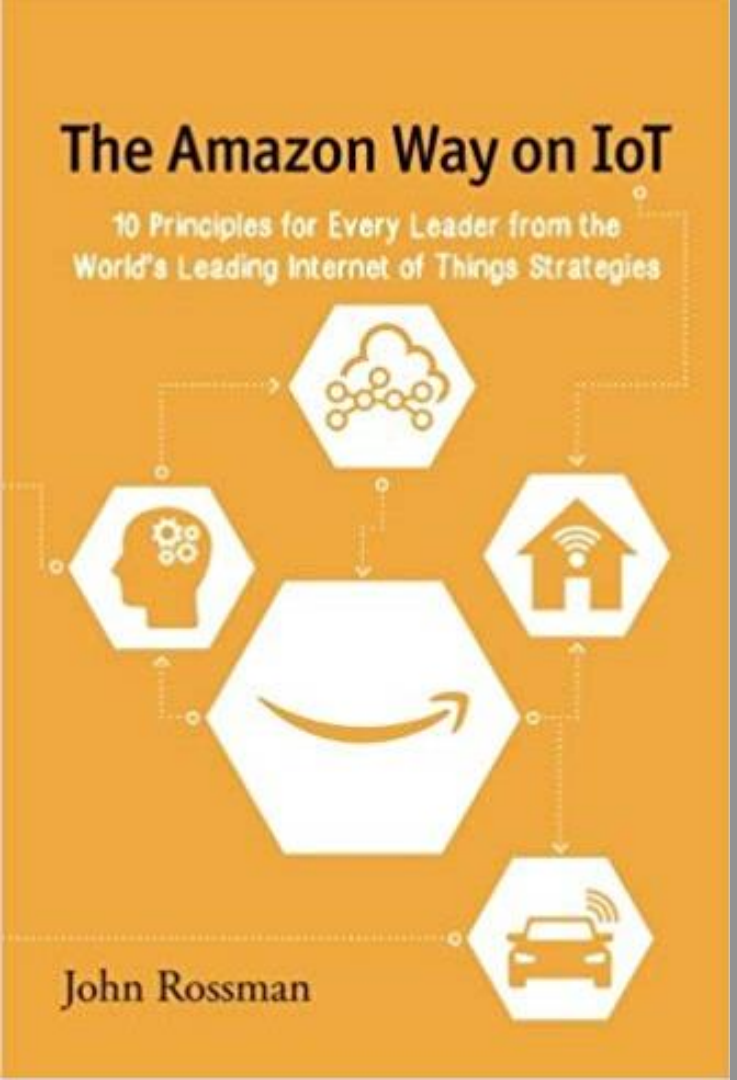
- ServiTIZE the Product
- Service-led Competitive Strategy
- Participate in a Larger Value Chain/Stream
- Value-based Pricing in an Otherwise Commodity, Cost-Plus Environment
- Must Understand the Customer's Business Process and Determine the Right Business Model

Source: Goodyear Global Innovation Dept.



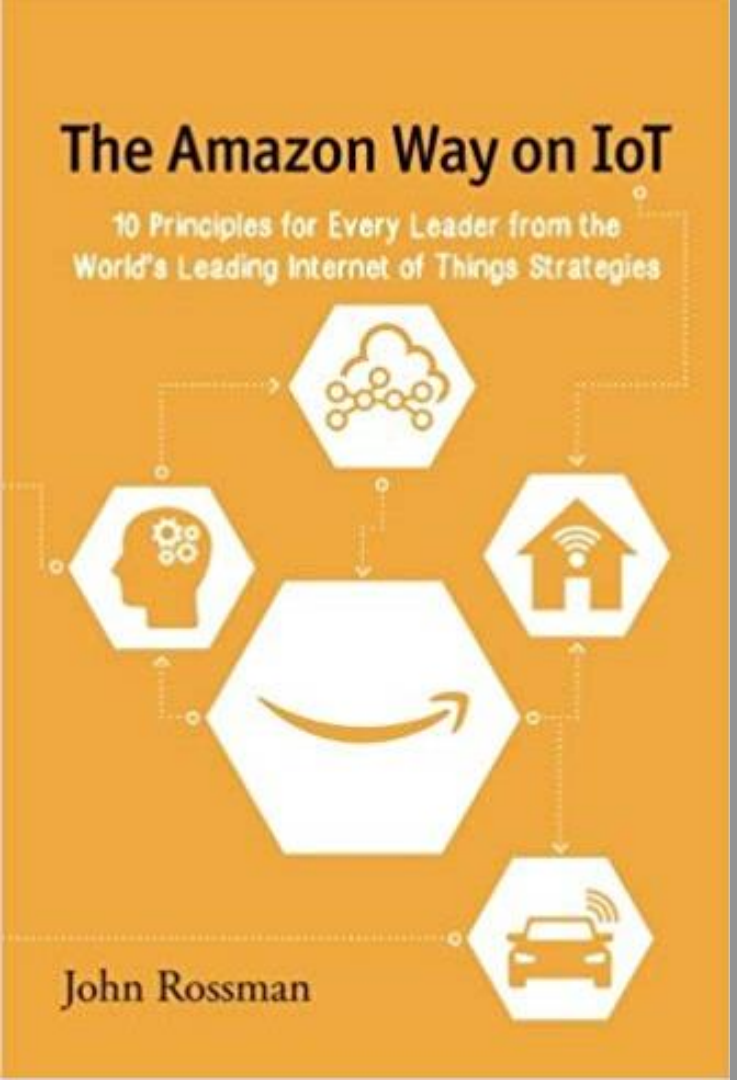
Principle #8

Through the Internet of Things, companies can collect unprecedented volume and variety of data – the new "black gold" which they will syndicate to create valuable new businesses and revenue streams



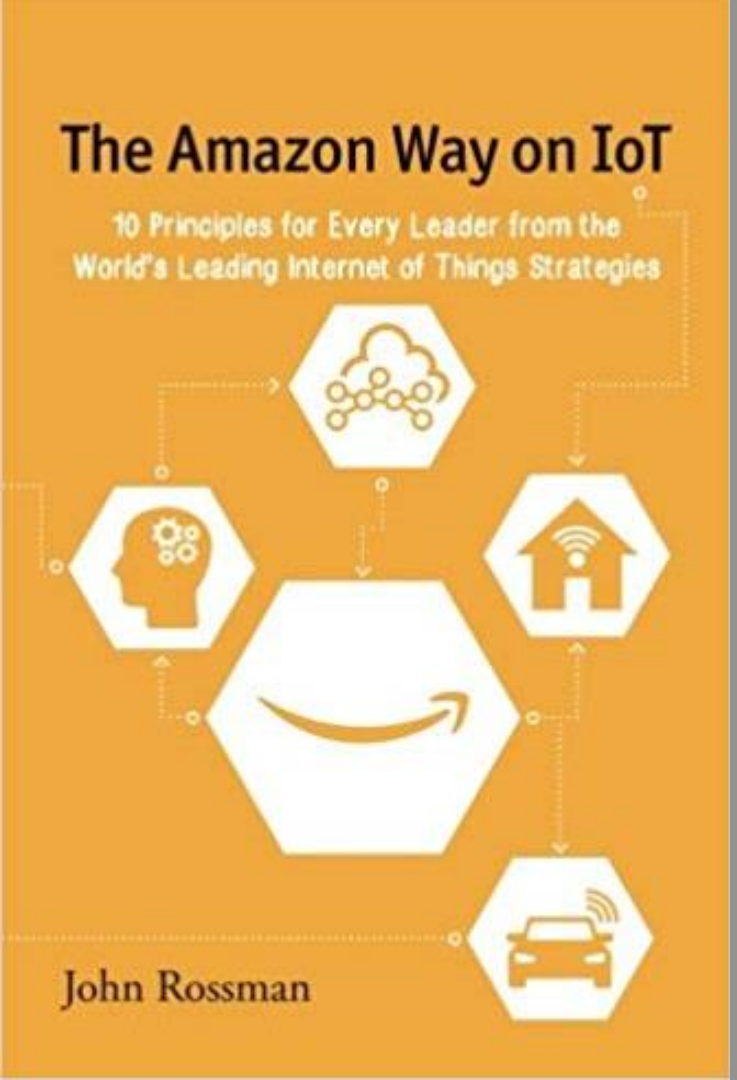
Principle #9

Innovation and growth come from a constant exploration and strategic bets into new products and services. The Amazon to identify those typically starts with your existing products and services and move up and move down the value chain. IoT creates new opportunities for expansion up and down the value chain.

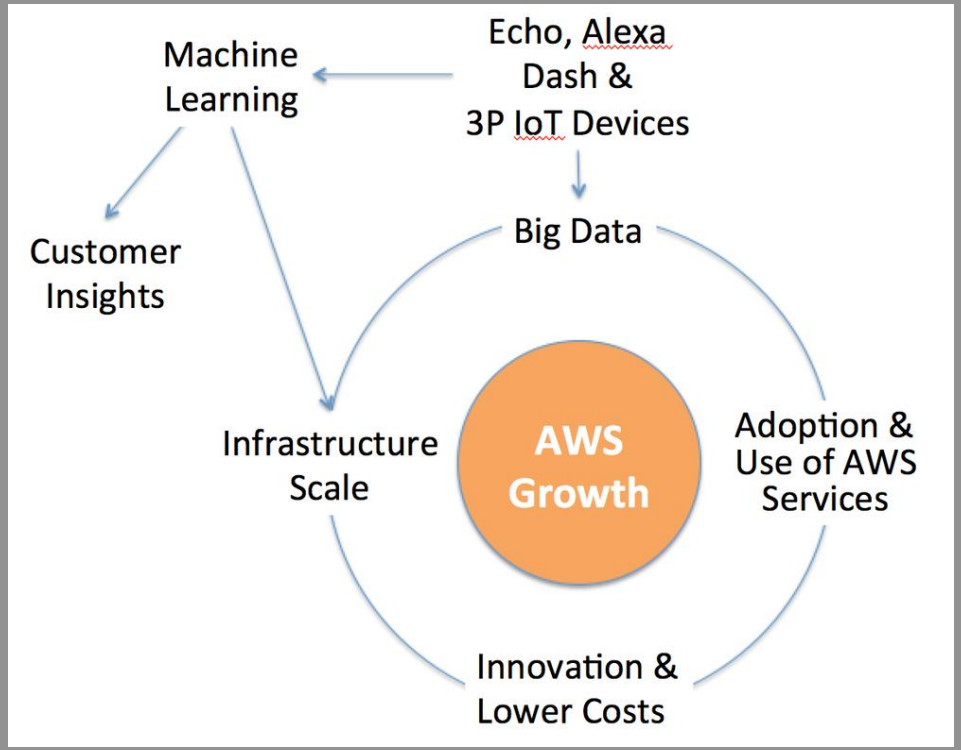


Principle #10

If you have a clear understanding of the systems dynamics – or flywheel model – of your business, you can use the Internet of Things to identify and execute on opportunities and risks in your business.

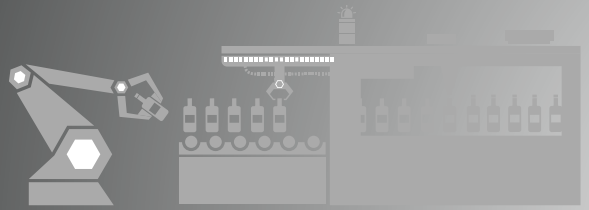


Principle #10 – The Flywheel



Critical Industrial Assets

Production Line Machinery and Ancillary Equipment



Robots and Assembly

Milling, Forming, Molding

CNC

Dies, Presses, Welding

Field Level Assets

Transportation

Fleets, planes, trains, ships, automobiles, trucks, tanks, buses

Networks

Electrical grids, telecom, IT, security, water/wastewater

Buildings

Property, real estate, universities, stadiums, and corporate offices

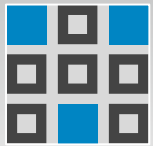
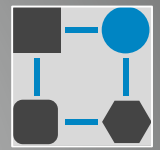
Heavy Equipment

Earthmovers, mining, cranes, distribution, warehouse and forklifts

Energy Generation

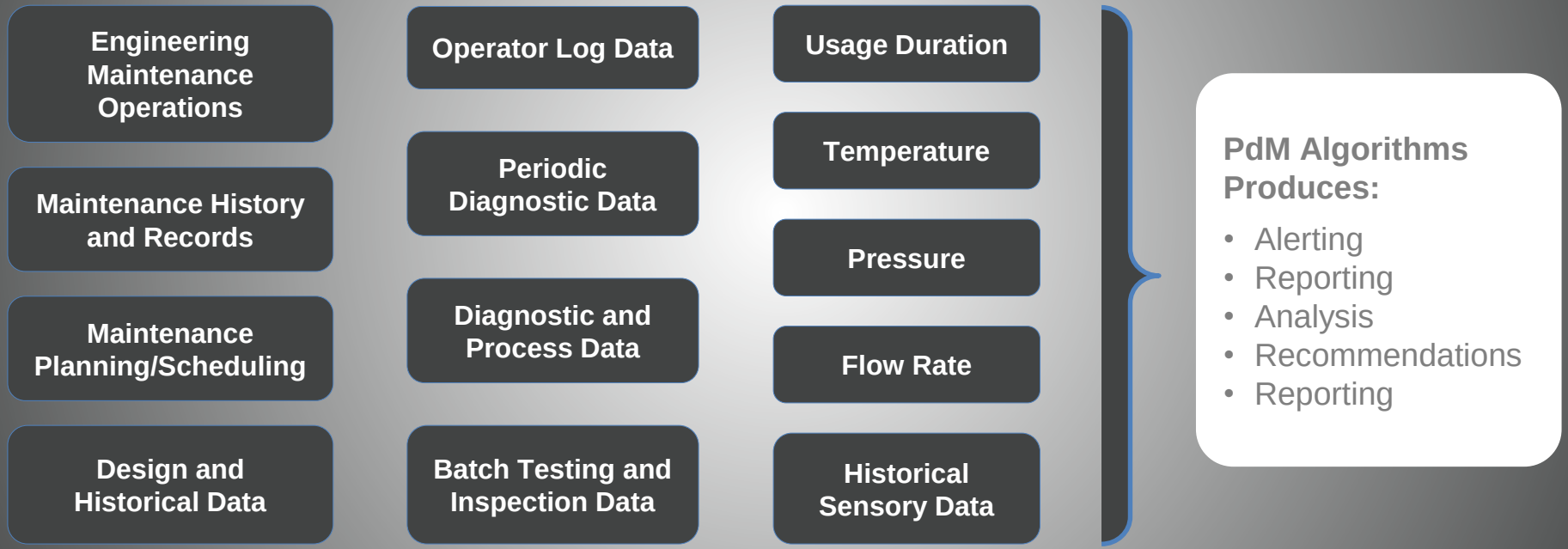
Wind/gas turbines, nuclear plants, solar panels, oil drills/rigs

Collecting Asset Data

			
Type	**Real Time** **Structured/Unstructured** (Streaming from asset)	**Big Data (Batch)** **Structured** (Databases, systems)	**Big Data (Batch)** **Unstructured** (Free-form, raw text)
What	Measurement, control, videos temperature, sequences, tweets, telematics, environmental,	Asset name, location, production line information, spares inventory, costs	Inspection reports, maintenance and operator logs, survey reports
Where	Sensors, PLCs, DCS, HMI, SCADA systems, drives, controls, instruments	ERP, EAM, MES systems, ICS databases, SCADA, financial systems, data warehouses	Business systems, workstations, email, social media, notes

Combing Workflow and Data to Attain Insights

A predictive function based on current and historical data used to derive and deliver the measures

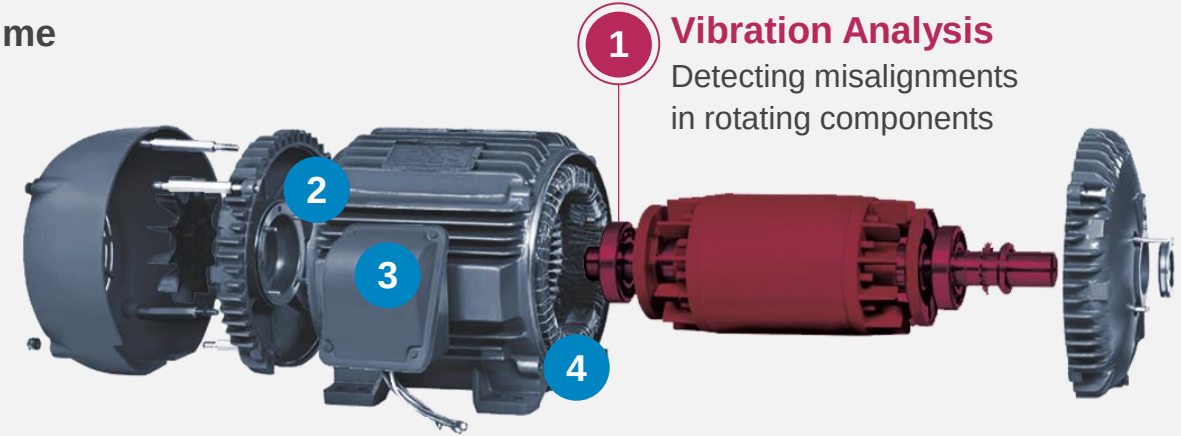


Using PdM to Predict Motor Failure

Preempt costly, unplanned downtime

Predicting Motor Failure

4 key predictive maintenance actions that lead to uncovering a problem before it stops production



1 Vibration Analysis
Detecting misalignments in rotating components

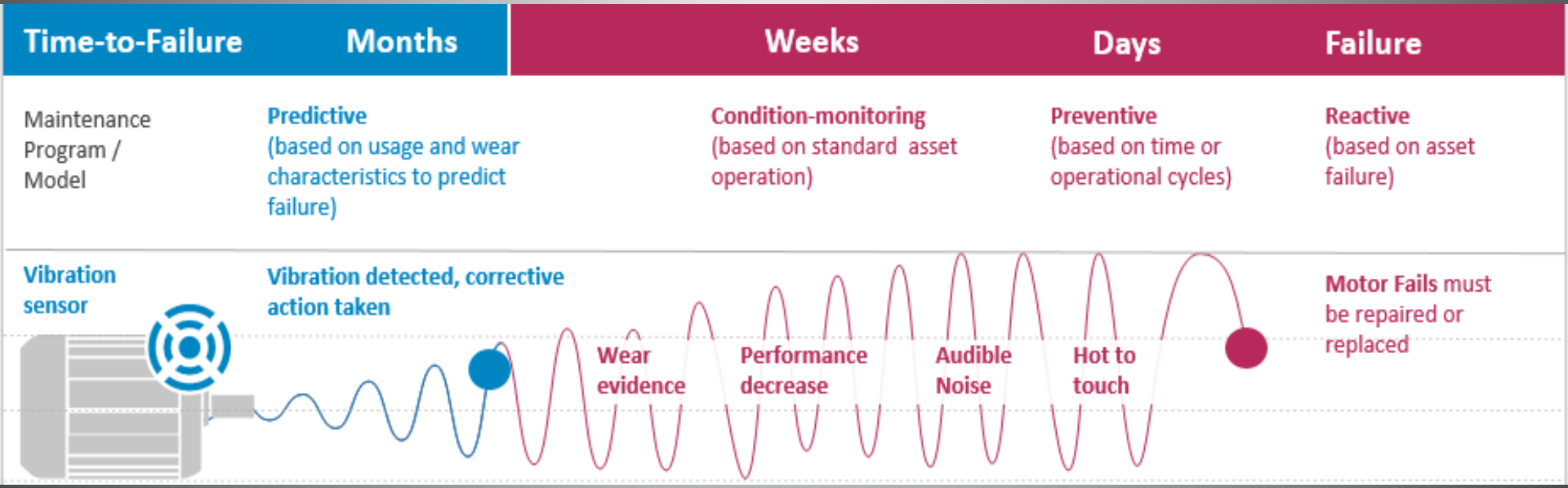
2 Ultrasound Monitoring
Detect inaudible leaks or friction inside the motor

3 Infrared Thermography
Detect excessive heat in components like bearings or circuitry

4 Lubrication Testing
Detect metal particles in oil, indicating grinding

Vibration Analysis Preempts Unplanned Downtime

The following example illustrates the amount of time that it takes to detect a potential failure interval for each of the four maintenance models commonly used today. PdM enables you to save time and money by detecting the failure based on data sources before damage to the machine occurs.



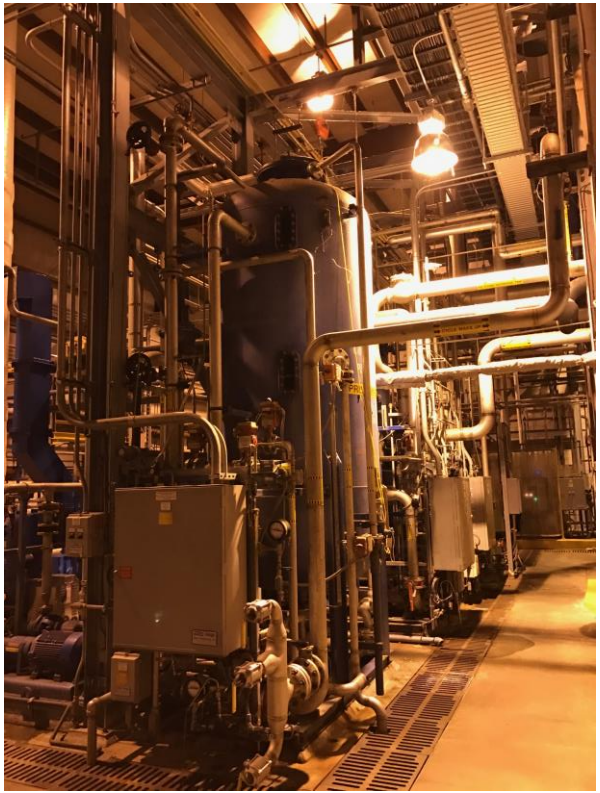
Value Proposition

- Essential Asset Monitoring vs. Critical Asset only
- Continuous Asset Monitoring vs. Monthly Diagnostics
- Automated Alerting to Various User Groups
- Dashboards and Analytics to Visually Explore; Root Cause
- Reduce Unplanned Maintenance – 30, 60 or 90 days in advance
- Reduced Planned Maintenance on Healthy Assets
- Operator Confidence Up and Less Operator Error
- Reduction in Expedited Logistics and Premium Pricing
- Integration into Workflow and Repair
- OPEX Pricing Model

Value Proposition vs. Constraints

- Extremely Lean Staff: Break-fix or periodic maintenance -- putting fires out
- Legacy Systems have Critical (not Essential) Assets integrated with SCADA or PLC systems
- Cannot utilize current reports nonetheless new automated alerting nor reporting – no expertise or no time or do not trust
- Budgetary constraints anything above a maintenance budget

IIoT Predictive Maintenance Today



Value Proposition vs. Constraints

- No Time
- No Expertise
- No Budget
- Not Enough People
- Primitive Diagnostics
- Users of machines are different than repair technicians
- Has enough problems
- Does not to need to be informed of another problem but rather having a solution for the issue scheduled to be fixed

Real Value Proposition

- Periodic blood pressure check
- Continuous blood pressure monitoring
- Radiologist (domain expert) to read results
- ALERT! Signs of a heart attack
- Sound alarm; schedule and perform surgery
- The real prescription is HOW to deliver the value in a business MODEL

OT Roles Today

- No Time
- No Expertise
- No Budget
- Not Enough People
- Primitive Diagnostics
- Users of machines are different than repair technicians
- Has enough problems
- Does not to need to be informed of another problem but rather having a solution for the issue scheduled to be fixed

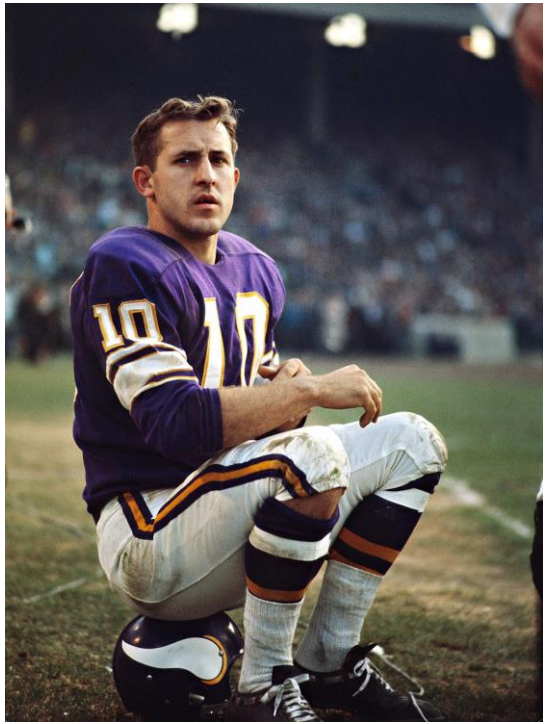
OT Roles Today

- Cannot consume streaming dashboards
- Skeptical of Data Science, Technology solutions without real world testing
- Conservative work culture
- Positions and goals aligned around “break fix mentality” keeping them employed
- Incentives, tools and re-educating is needed to move the needle

OT/IT Convergence – an Evolution

- IT roles will have to facilitate discussions between subject matter experts, operations, and new technologies to prove value to a skeptical audience
- IT roles will require more domain expertise
- OT roles will require more analytical expertise
- Education and lifelong learning and a culture to learn will be required

OT/IT Convergence – an Evolution



OT/IT Convergence – an Evolution

Vertical AI Startups:

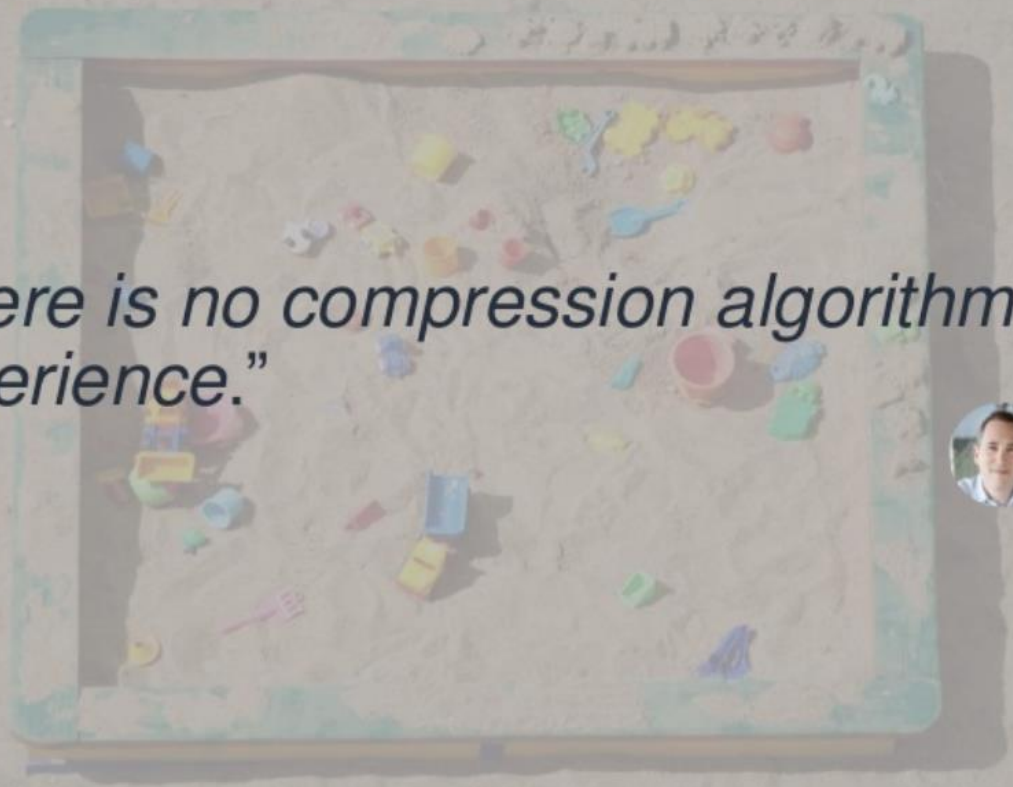
Solving Industry-specific problems by combining AI and Subject Matter Expertise

Full Stack Products

- Full-stack fully integrated solution to the end customer problem from the interface that solves for the need all the way down the stack to the functionality, models and data
- Ecosystem is more defensible than just proprietary data or models

Subject Matter Expertise

- Full-stack solutions requires deep subject matter expertise
- Selling these products requires trust, respect and relationships within the industry
- Teams combining SME and technical are able to model domain richly and drive innovation from thinking outside the box by understanding what the box is
- Teams with domain only are stuck in the box, and Silicon Valley are stuck out in left field



“There is no compression algorithm for experience.”

Andy Jassy
AWS CEO

Proprietary Data

- Defensible AI are built on proprietary data by aggregating public data and enriching it in some challenging way, running simulations and training datasets
- Adding more to the “data flywheel” to capture unique data to serve needs of unique models and needs of customer
- Data Value Chain ensures the customer’s motivation is aligned with your motivation that compounds value of proprietary dataset

AI Delivers Core Value

- Amazon, FB and Netflix are all companies that use AI to drive very high percentage of lift in revenue and engagement but is delivering ecommerce, social media and video entertainment
- Vertical AI is not the core value, but an attachment that optimizes the core value

What is Value

“People don’t need a drill, they need a three inch hole”

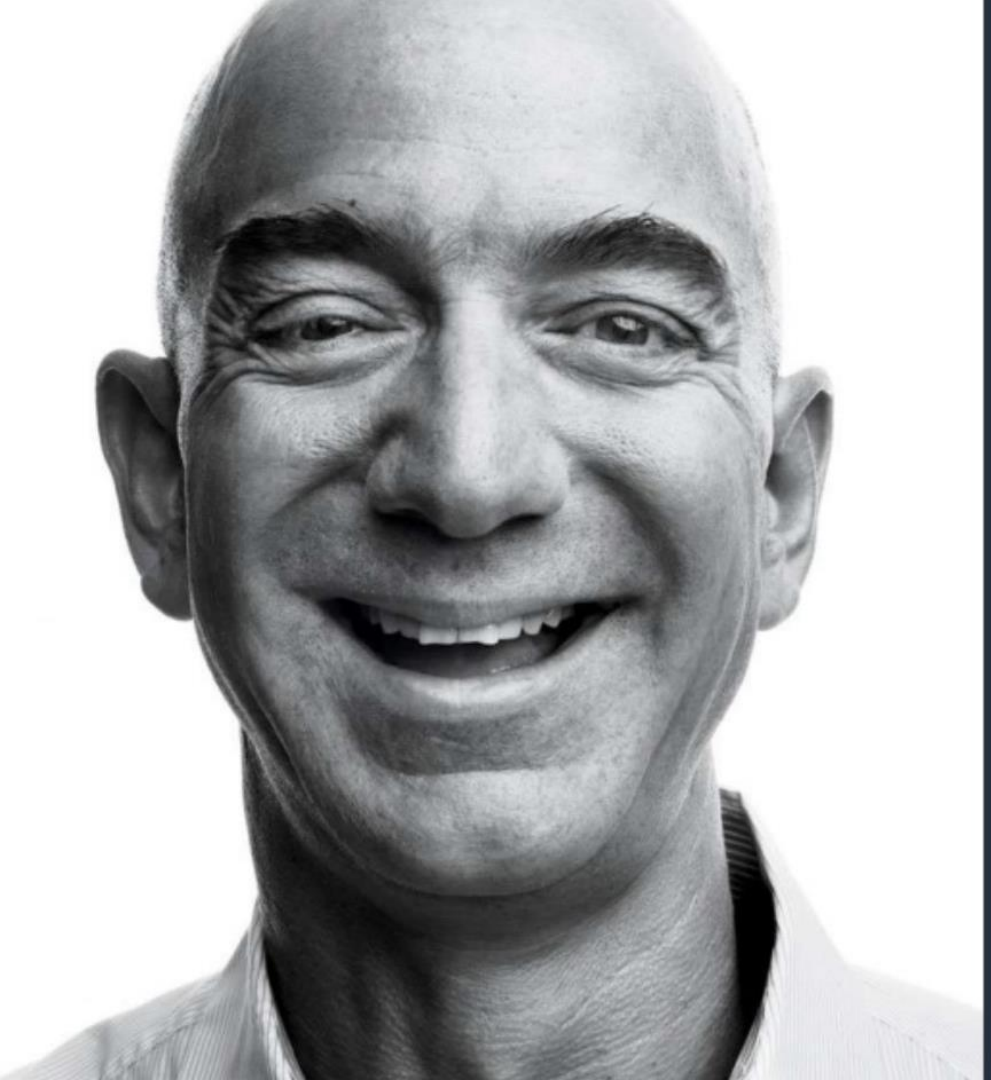
What is Value – Another Iteration

Solving Industry-specific problems by combining AI and Subject Matter Expertise & the Evolution of Digital Transformation & Unrelated Musings

Organizational Change

(organization * culture)

f (*innovation*) = (mechanisms * architecture)



"Most companies write the software, they get it all working, and then they throw it over the wall to the marketing department, saying 'here is what we built, go write the press release.' That process is the one that's actually backwards."

Jeff Bezos
Founder and Chief Executive Officer
Amazon.com, Inc.

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Mechanism Example

Working backwards from the customer

Write the Press Release: Think big and focus on the customer need

Write the FAQ: Customer and internal stakeholder

Define the user interaction and write the manual

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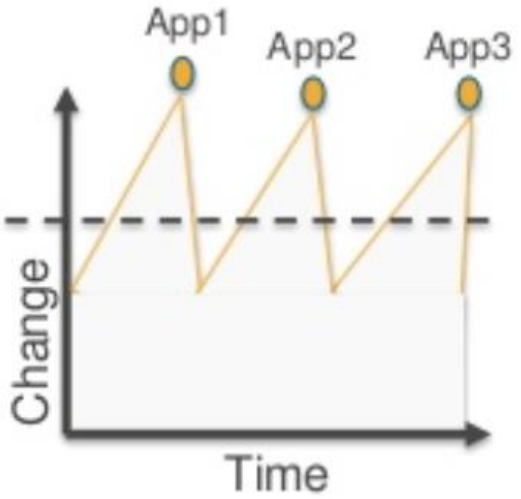
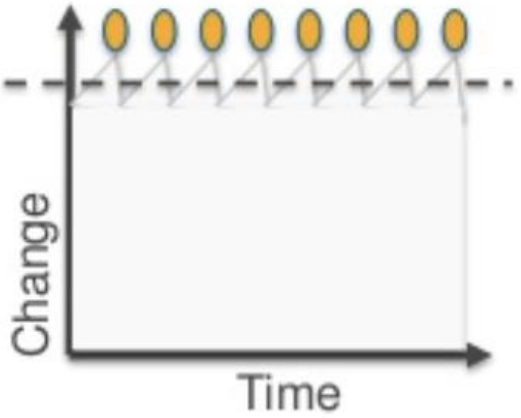
Migration Methodology

Big Bang Migrations
"Waterfall Methodology"



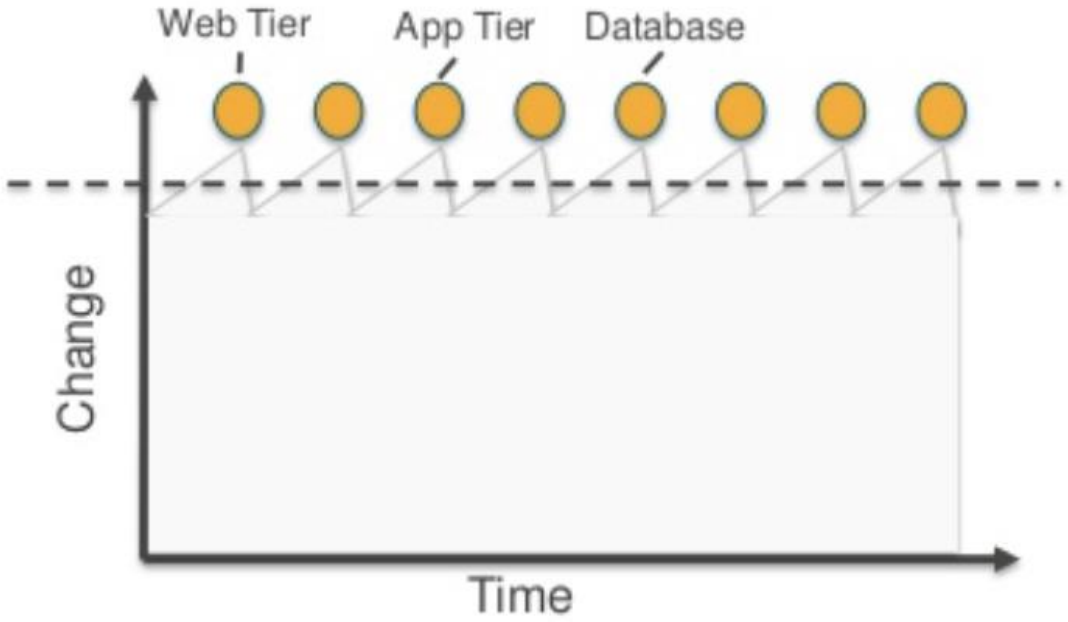
Larger Effort
Increased Risk

Iterative Migration
"Agile Methodology"



Smaller Efforts
Minimized Risk

Agile Process



Cloud adoption outcomes

Migration is not an outcome

(Neither is Digital transformation or DevOps)

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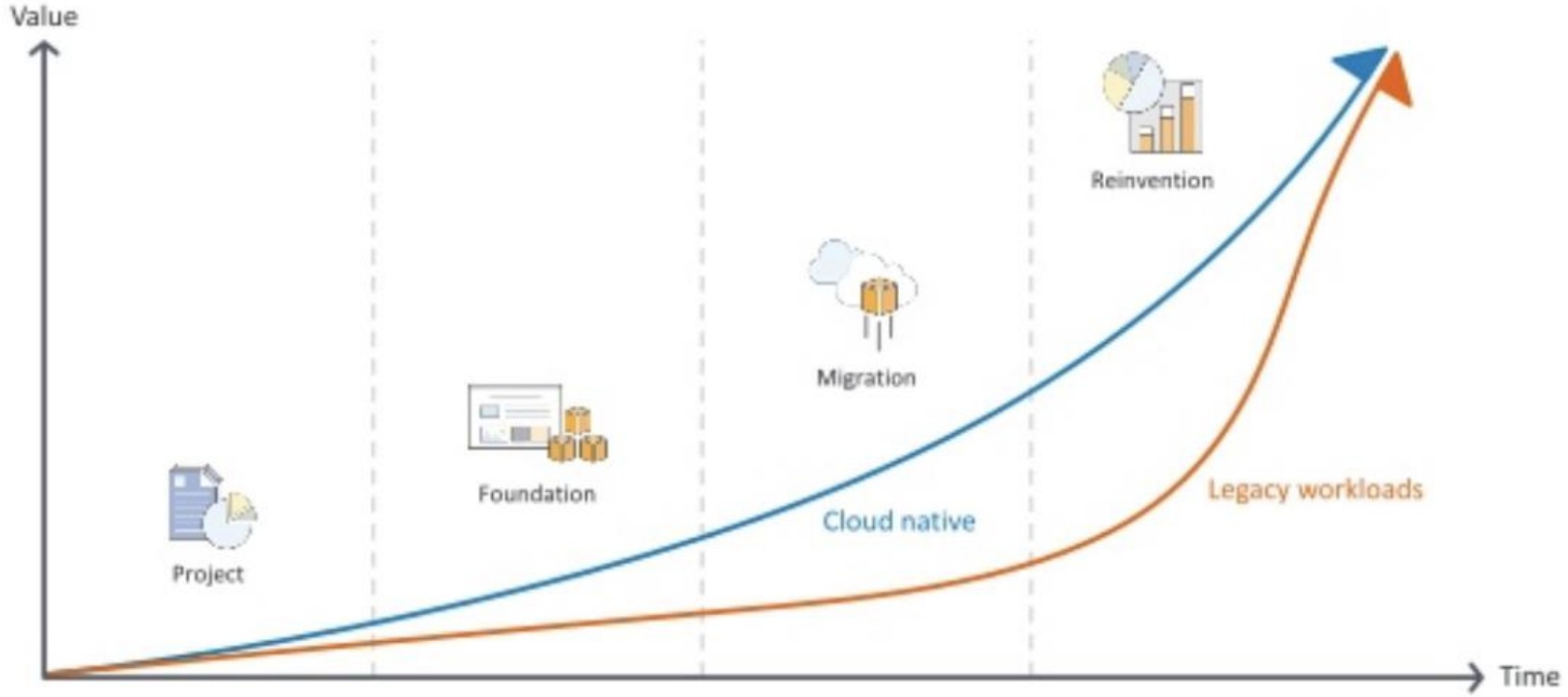
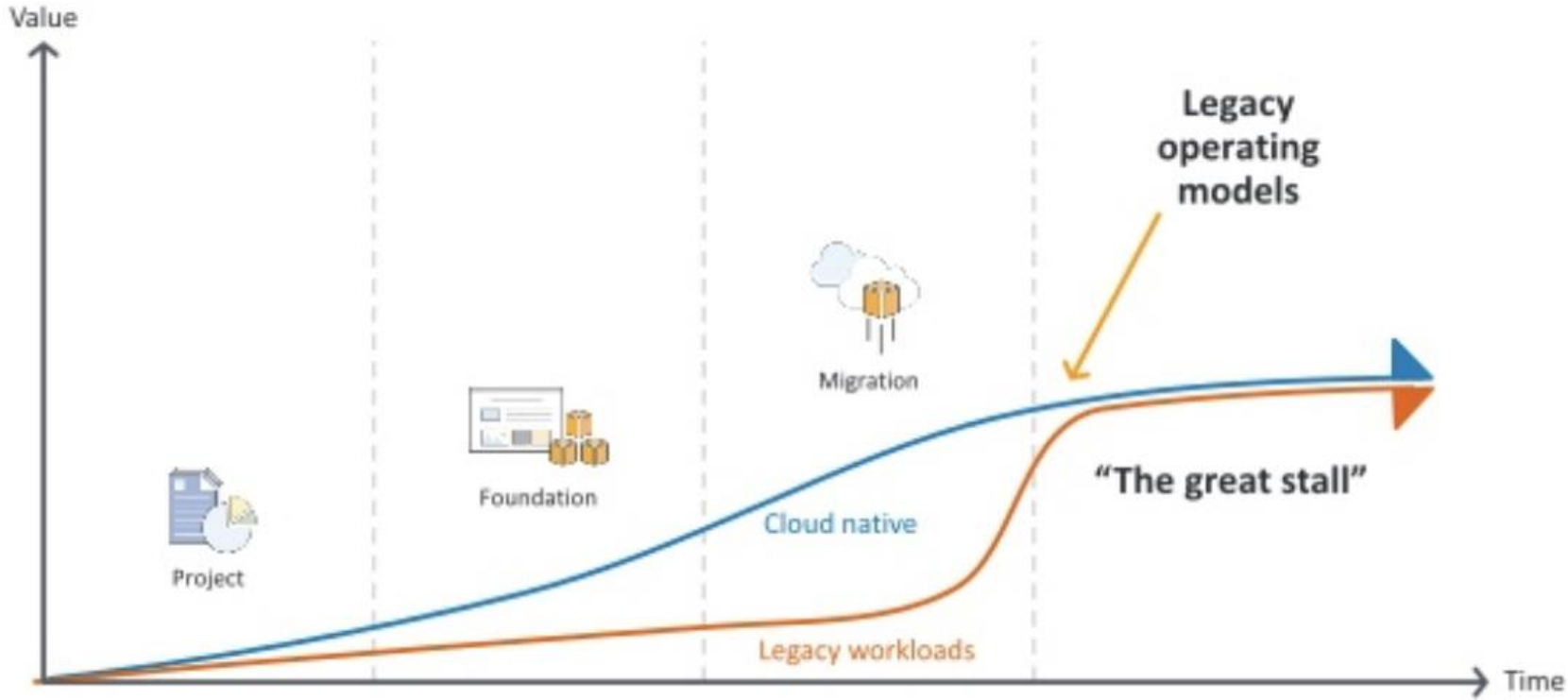
Ideal cloud adoption curve



Cloud adoption reality



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Enterprise Migration Risk

Forgetting to consider operations early in the planning process

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Cloud adoption reality

> Infrastructure and operations skills gaps will cause 75% of organizations to experience visible business disruptions by 2020.

Gartner

May 2018

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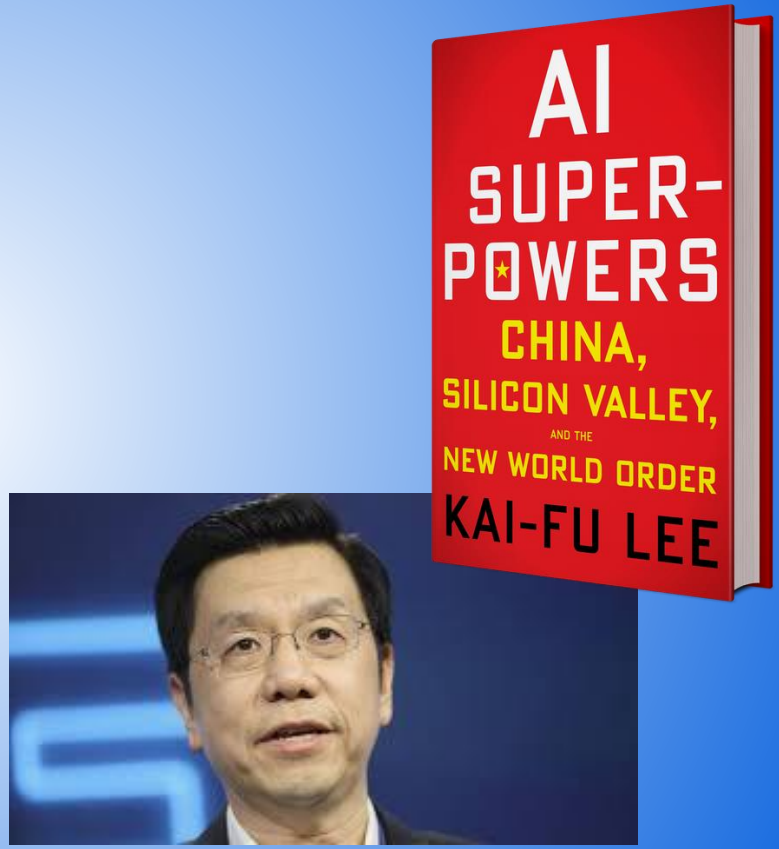
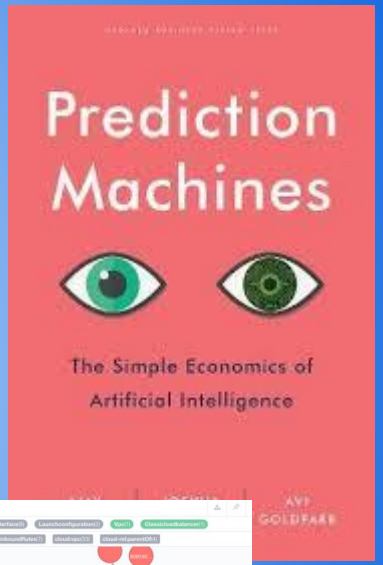
A.I. is a National Policy Priority in China

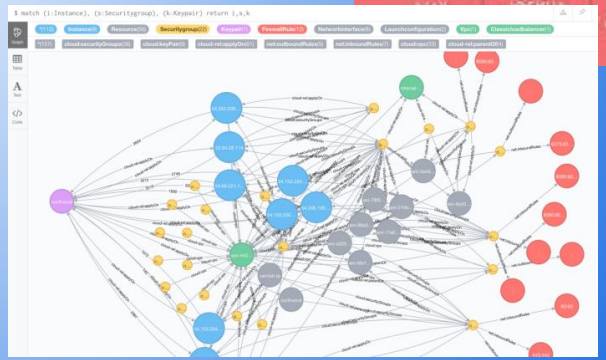
- Hyper competitive environment
- Invented in USA some could argue, but refined and delivered better in China
- Data privacy rates are secondary to pushing technology forward, massive China data, no privacy issues are pushing deep learning to new heights
- Patent data reflects interesting insight



Machine Learning, A.I. are in infancy and the shiny object

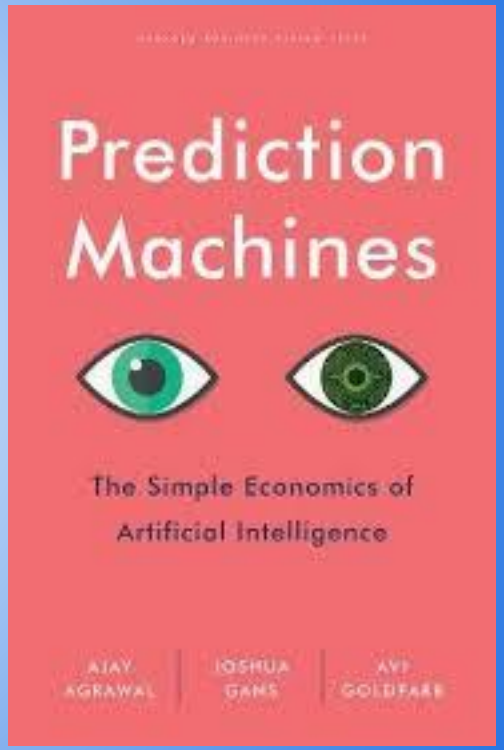
- Machine Learning analytical organizations and platform solutions are everywhere (it's tough, SME dependent and yet to see it successful beyond ML classification)
- ML will become a commodity, points to value of data, business model and delivering value
- Prediction with granularity will become a commodity, so choosing right problems to solve will be more valuable





Prediction becomes Cheap

- Prediction is at the heart of making decisions under uncertainty. Our businesses and personal lives are riddled with such decisions
- Prediction tools increase productivity--operating machines, handling documents, communicating with customers
- Uncertainty constrains strategy
- Better prediction creates opportunities for new business structures and strategies to compete
- Data and delivery become more valuable



The Battle is Cloud Migration & Enterprise Architecture

- Good data, ETL is what will be the black gold if prediction is cheap
- Business model and delivery, solving problems with technology in background is formula for success
- Deep domain experience coupled with digital transformation
- Skills, processes, interdependencies, agile, scrum all require a new cloud native to experiment in small experiments in a risk-free environment → production → upkeep and evolve
- Digital transformation is technology, organizational change at the intersection of tech, business and people from legacy processes or workloads in hybrid clouds
- Connected hybrid cloud or “multicloud” and applications need to be seamless, secure and streamlined
- Edge processing and connection to cloud or “fog” for real-time analysis

The Battle = Dealing with Exponential Change & Ambiguity

- We need a place to iterate quickly and often
- We need a place to experiment without risk (landing zone)
- We need to be agile and innovate
- We need to focus on continual improvement over enterprise operations and growth after cloud migration
- These overarching needs points me to the most important people are architects that are data and customer obsessed, balancing systems, processes, workloads, end-point value streams and the centrality node