

# Information Systems for Digital Transformation

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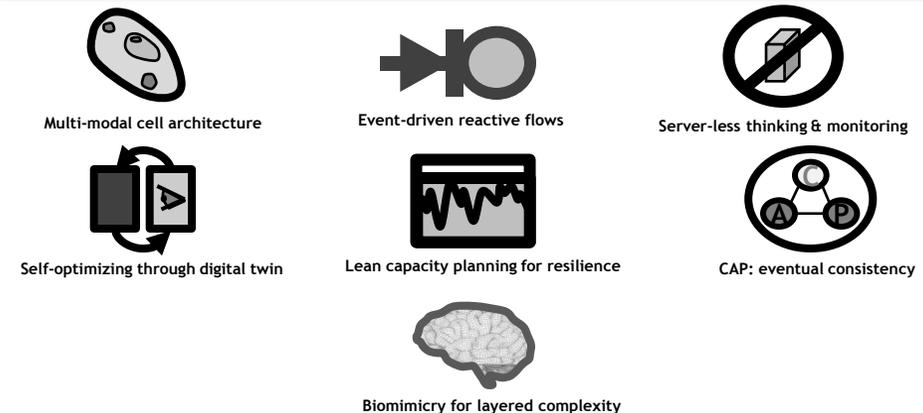
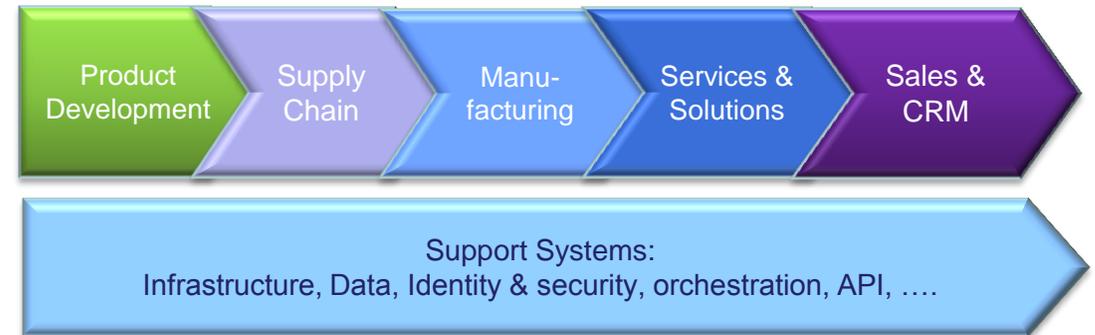
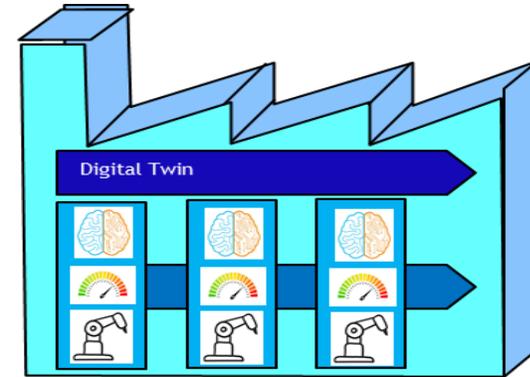
**CSDM - Complex Systems Design & Management**  
**December 18<sup>th</sup>, 2018 (v0.3)**

# Outline

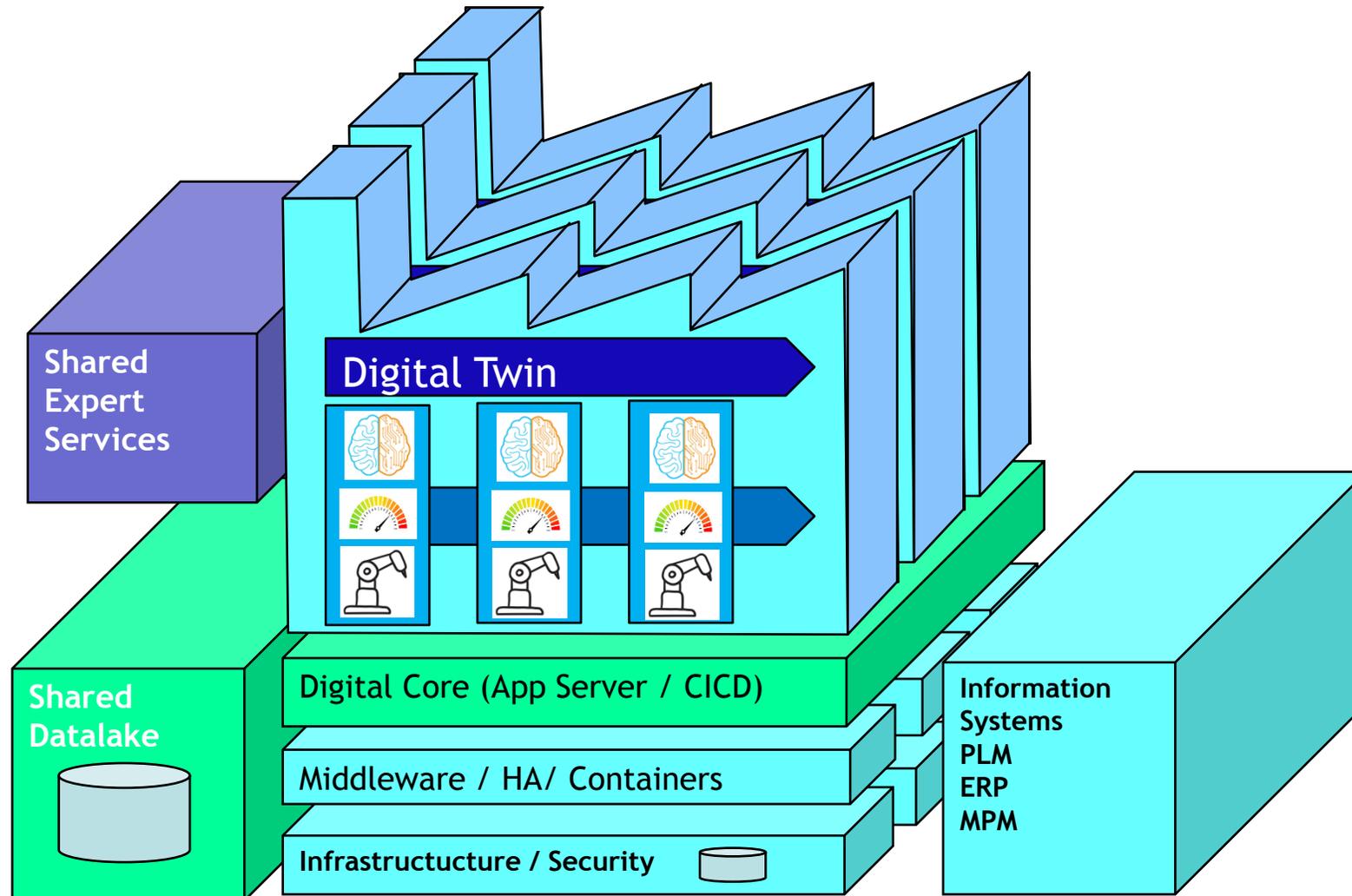
- Part 1 : Digital Transformation

- Part 2: Digital-Ready Information Systems

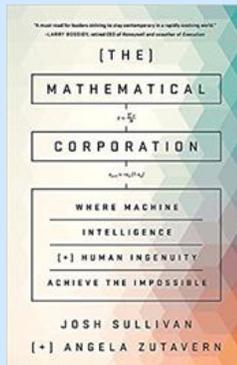
- Part 3: IT Transformation



# Industry 4.0 : Digital Manufacturing, Digital Twin & Digital Workspaces



- AI in Manufacturing to absorb complexity
  - cope with variability
  - cope with manufacturing process complexity
- Augmented humans and augmented environments
  - machine vision & sensors for enhanced perception
- End to End process optimization  
Merck Example



# Exponential Technologies for Digital Customer Management

- ⦿ Empower your customers to get what they want  
“Markets are conversations”
- ⦿ Digital customer targeting enhanced with AI  
e.g., Amadeus or IHG Continental
- ⦿ Leverage vibrant service ecosystems  
to deliver the best experience.  
Cf. Siri to Salesforce/Einstein integration



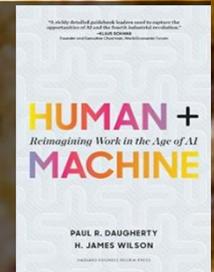
# Digital Supply Chains meet Demand Management

- Reactive Supply Chain and S&OP coupled with demand management
- Demand Management connected to manufacturing and logistics
- AI & ML to optimize complex chains : the FAA example



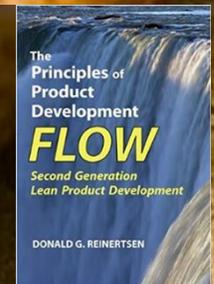
# Product Development and Knowledge Engineering

- AI and generative ML techniques to re-invent product expertise



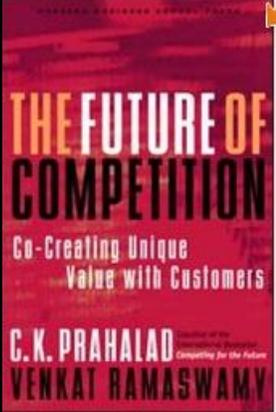
- AI as a tool to capture, share and scale process and product knowledge

- Digital as a support tool for Lean Product Design  
Customer to Design, Design to customer



# “Software is eating the world”

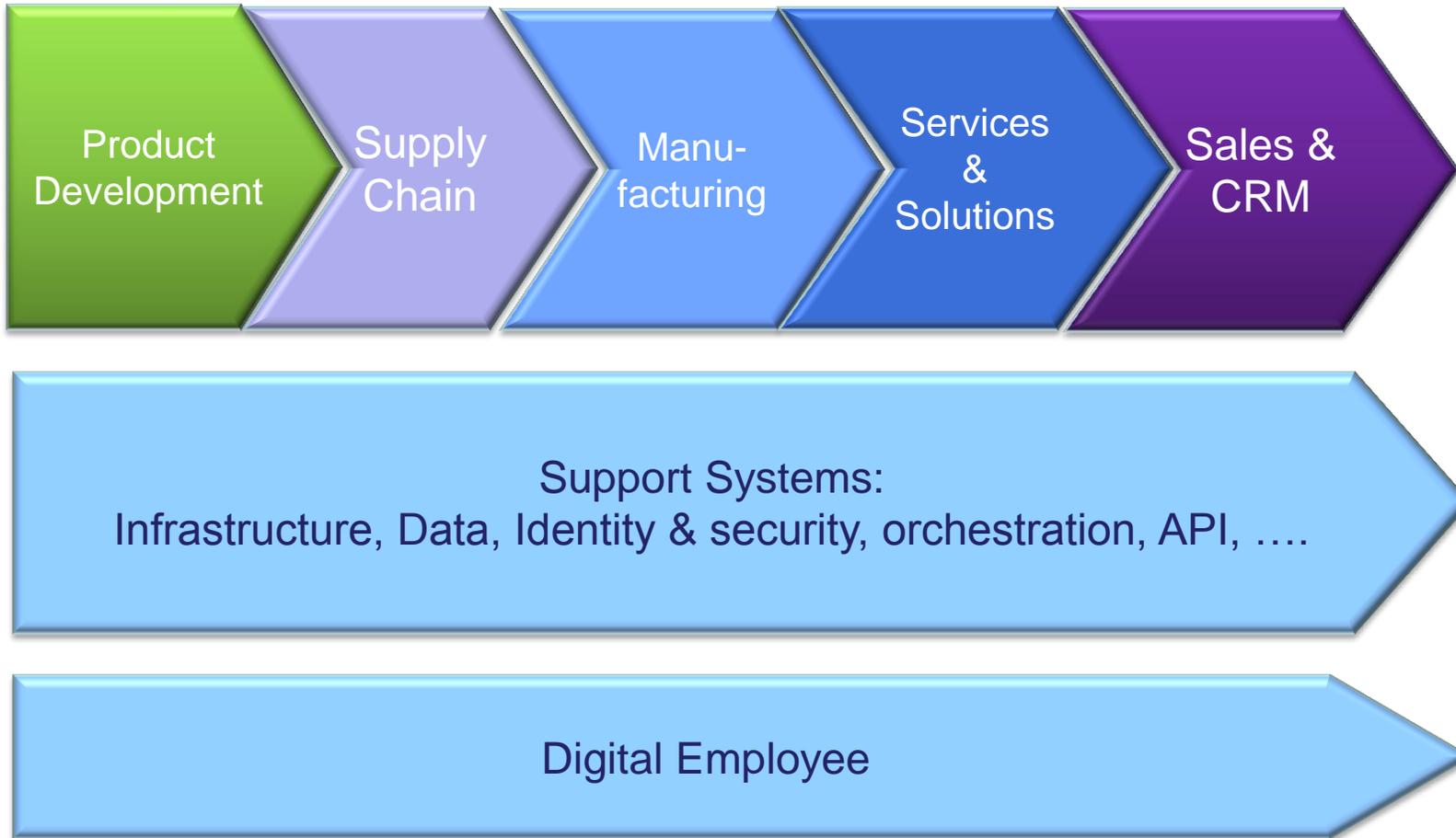
- The customer picks the (software) environment for value creation (B2C & B2B)
- Companies must learn to project their strengths outside and to participate in extended value chains
- Platform to attract software ecosystems / outside excellence



Part II

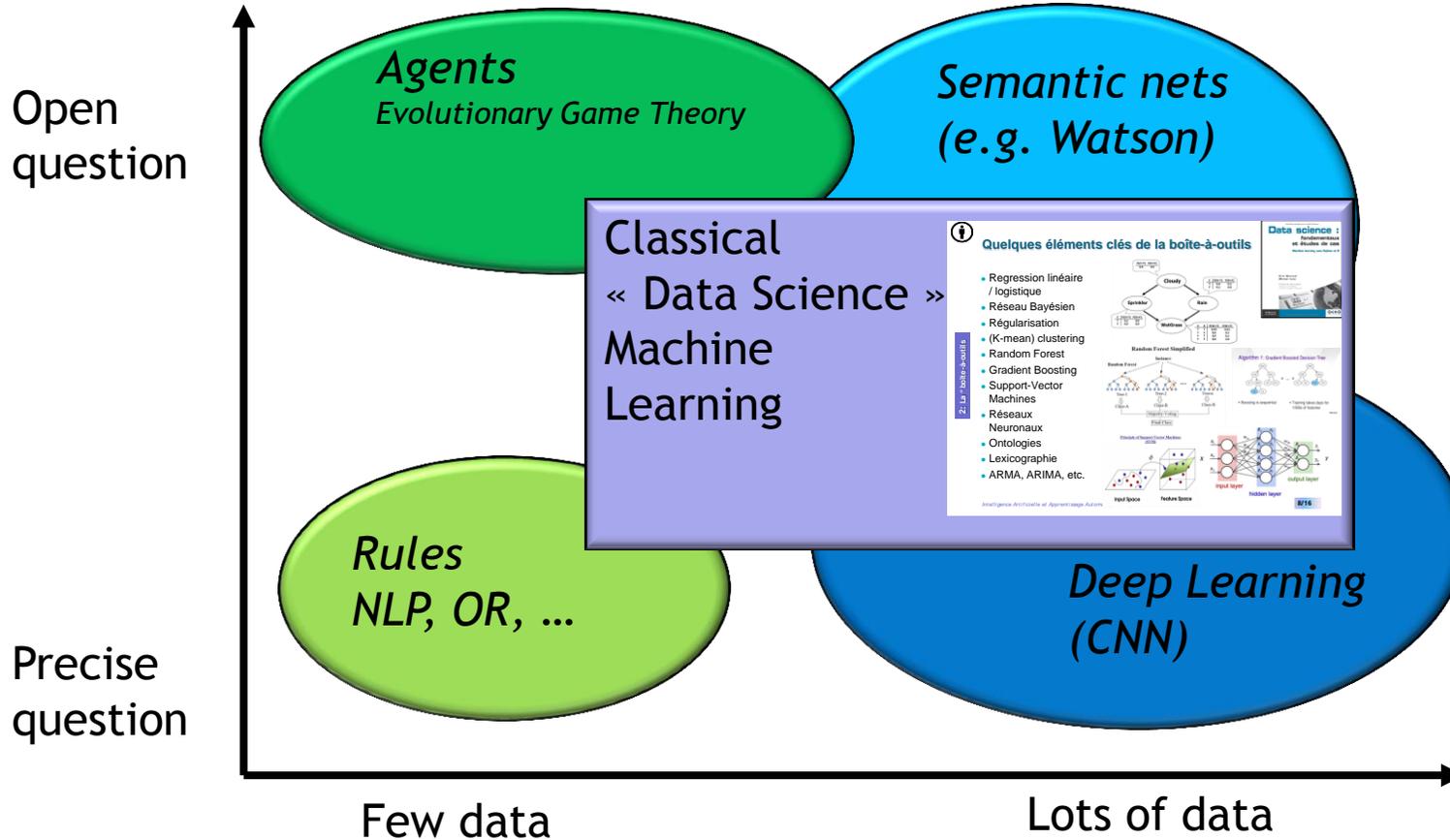
# Digital-Ready Information Systems

# Information Systems as Core Digital Capability



- Digital Fabric
  - API / integration
  - High Availability
  - Data infrastructure
- Support for IOT
- Security & Identity
- Share “digital core” ... but each digital world has its own ecosystems
  - “Servant Leadership” position of IT services to support software expansion

# Exponential Information Systems : Ready for AI & ML



- Rich Toolbox
  - Amazing progress in perception
  - Easily available (open source)
  - Data infrastructure
- Lots of meta-heuristics
  - Reinforcement learning, Transfer learning
  - Auto-encoders, Adversarial training ....
  - Randomization, Generation
- Expected from IT
  - Modern SW stack
  - Data infrastructure excellence
  - Open architecture

# Reactive Systems

## DEPARTURES

TIME	DESTINATION	FLIGHT	GATE	REMARKS
12:39	LONDON	CL 903	31	CANCELLED
12:57	SYDNEY	UQ5723	27	CANCELLED
13:08	TORONTO	IC5984	22	CANCELLED
13:21	TOKYO	AM 608	41	DELAYED
13:37	HONG KONG	IC5471	29	CANCELLED
13:48	MADRID	EK3941	30	DELAYED
14:19	BERLIN	AM5021	28	CANCELLED
14:35	NEW YORK	ON 997	11	CANCELLED

### Event-Driven

- Hierarchical event model
- Scalable through distribution
- Leverage Internet-issued technologies: e.g., Kafka



### Open

- Open boundaries (API)
- Transparent publish/subscribe
- Message-passing



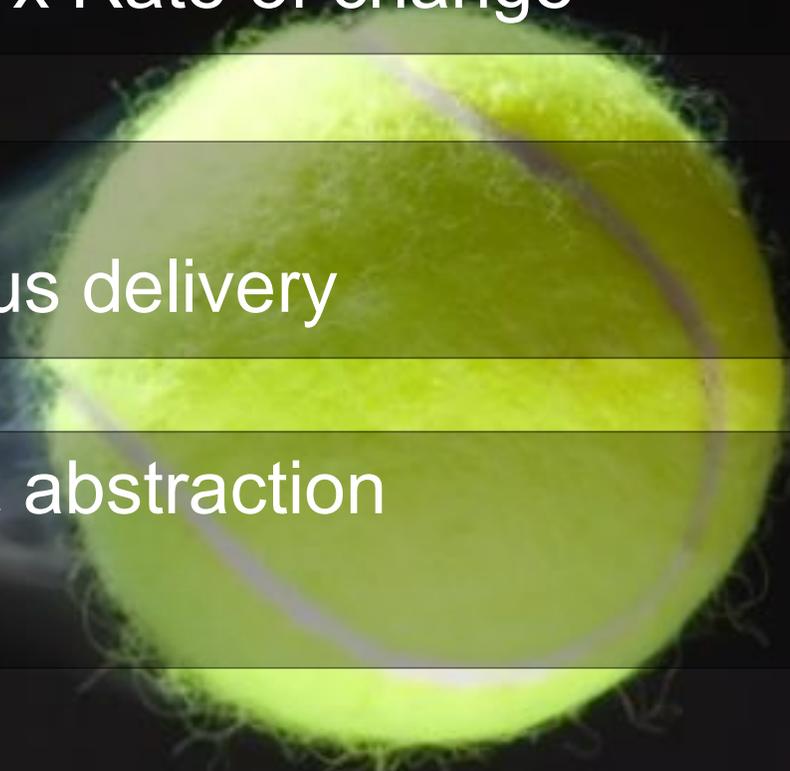
### Reactive

- Optimize for throughput & latency
- Complex Event Processing (CEP) & automation

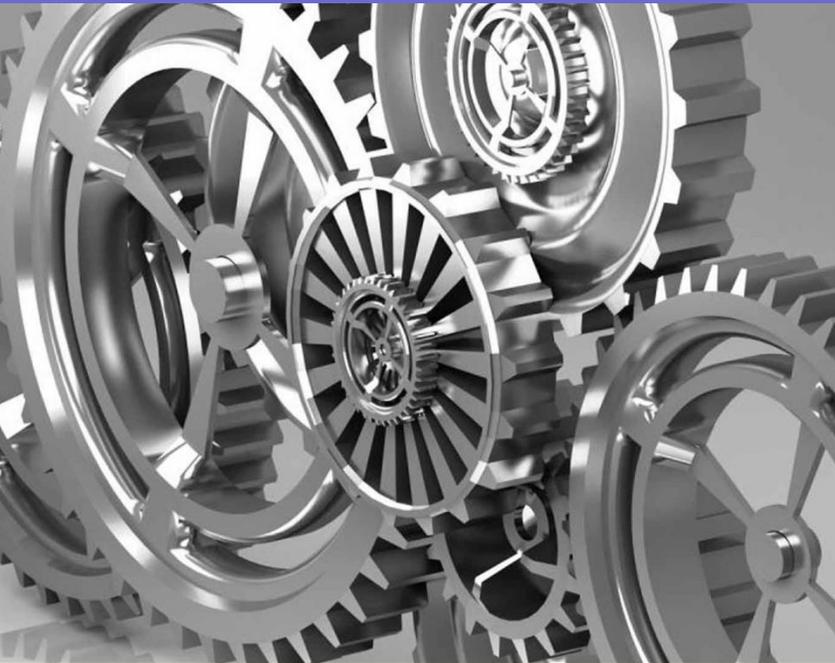


# Organize for Constant Change and Refresh

- “Newton law” :  
Energy to adapt = ‘System weight’ x Rate of change
- Information System as Flows  
From continuous build to continuous delivery
- “Whitebox integration” : scripting & abstraction  
less code & higher level code

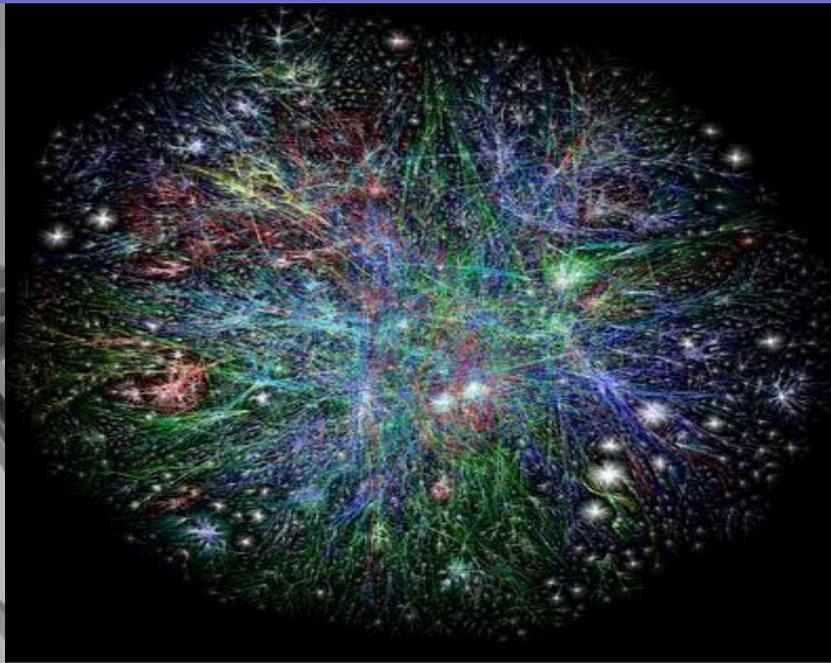


# Data Infrastructure Principles



## Pivot Business Objects

- REST API foundations
- Shared semantics (AI ready)
- Rosetta stone for standards and platform strategy



## Change Driven

- CAP Theorem
- Eventual consistency synchronized with Business Processes
- Right-time architecture (events)



## Flows & Streams

- Deconstructing databases event-sourcing
- Hot & cold (e.g.,  $\lambda$  architecture)
- Flow computing lends to distribution and serverless processing

Part III

# IT Transformation

# Multi-Modal Cellular Architecture



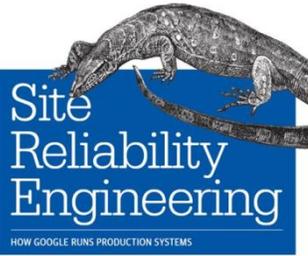
- API based
  - Modularity / decoupling
  - Adapt to complexity
- Support variable refresh rates
  - Only way to cope with legacy
- Adapt to change from Outside to inside
  - Fractal pattern: generalization of bi-modal (FAST IT on the edge)
  - Recursive Requirement: Demand core API from your suppliers !

# Constant Focus on Technical Debt

- Reduce inertia : pruning / refactoring / decommissioning ... Refactoring at system scale – modularity & decoupling
- Automate install & des-install CI(CD)<sup>2</sup> : Continuous Deletion
- “Evergreen” up-to-date software & hardware infrastructure : zero obsolescence / zero late patching

# Resilient Architecture and Chaos Engineering

- Resilience and High Availability is a critical performance goal of digital systems
- Decoupling & Redundancy + Monitoring & Automation
- Chaos Engineering => Self-monitoring + self-optimizing + self-repair



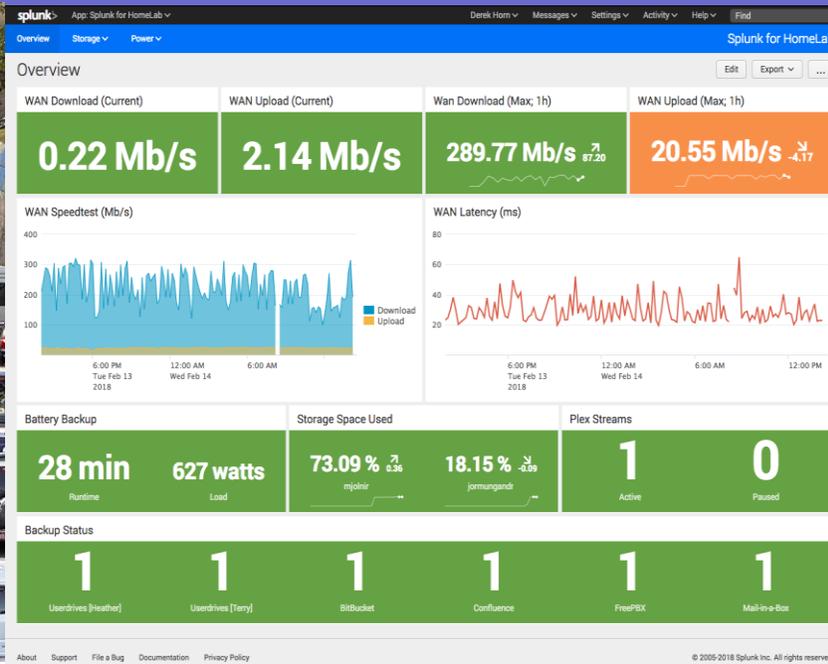
Edited by Betsy Beyer, Chris Jones,  
Jennifer Petoff & Niall Richard Murphy



# Performance Engineering



## Capacity Planning



## AI for IT

- Predictive maintenance for IT
- Splunk to advanced ML
- Self-healing : automate adaptive behavior



## Activity monitoring

- Throughput / latency / availability
- Cloud service orchestration (BAM)
- “Digital Twin” by design : CMDB, introspection API and event logs

- Transverse activity : business to platform to infrastructure
- Key for change management
- Continuous testing (N+2)

# Software Craftmanship & Systems Engineering Culture

**Joy,  
Inc.**

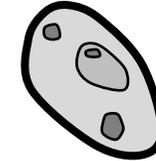
How We Built  
a Workplace  
People Love

Richard Sheridan  
Co-founder and CEO, Neo Innovators

- Continuous learning / kaizens and katas  
Maximize autonomy for delivery teams
- From “Show & Share” to “Love your code”  
Develop and value software excellence
- Lean & Agile software factories : Rites & tools  
One customer / One system

# Conclusion

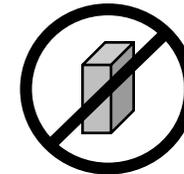
- Exponential Information Systems to support the digital transformation
- Systems Engineering has never been so exciting 😊  
Exponential revolution is happening now
- “*It happens on the gemba*”  
We need to train a new generation of business & process engineers with hands-on IS experience



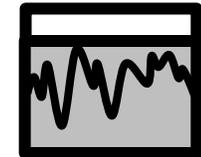
Multi-modal cell architecture



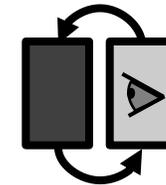
Event-driven reactive flows



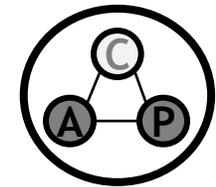
Server-less thinking & monitoring



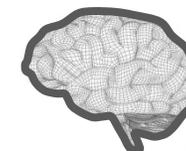
Lean capacity planning for resilience



Self-optimizing through digital twin



CAP: eventual consistency



Biomimicry for layered complexity