



# Navigating The Tectonic Shift of Digital Transformation

引导数字化转型中的构造转变

Jane Ren, CEO, Atomiton

October, 2017



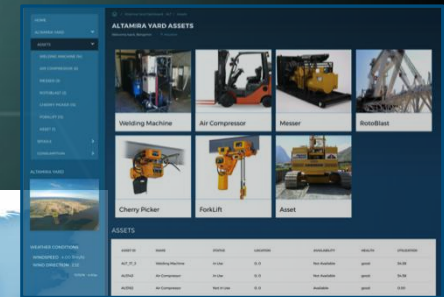
# Atomiton – Industrial Internet of Things Platform

工业物联网平台公司

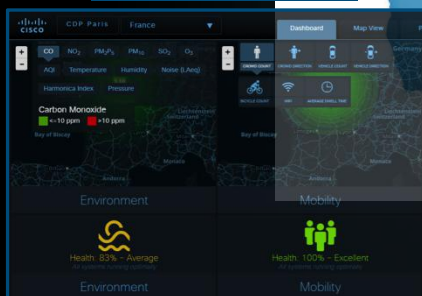
- Globally deployed in Oil and Gas, Precision Agriculture, Smart Cities
- Connect, digitize, orchestrate and optimize industrial assets and processes

Atomiton

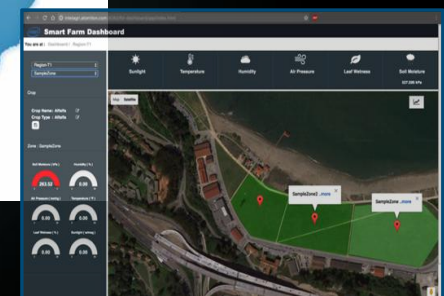
Energy/Oil and Gas



Smart Cities




Precision Agriculture





# Navigating The Tectonic Shift of Digital Transformation

- 
- An aerial view of a large red and white offshore supply ship sailing on the ocean. The ship has a green deck with yellow safety markings, including a helipad. It is connected to several smaller boats by ropes. The ship is moving towards the right side of the frame.
1. The tectonic shifts of digitization – 数字化带来的构造转变
  2. The 3 architectures of transformation – 三种构架的转型
  3. Understand the opportunity landscape – 了解机会所在

“统治芯片的人统治整个世界，统治数据  
的人统治整个世界”

A middle-aged man with short grey hair, wearing a dark suit jacket over a light-colored striped shirt, is captured mid-speech on a stage. He is gesturing with both hands raised, palms facing forward. In his right hand, he holds a small black object, possibly a remote or a microphone. The background is dark with some faint, out-of-focus light patterns. The overall lighting is focused on the speaker, creating a professional and engaging atmosphere.

*"Those who rule chips will rule the entire world. Those who rule data will rule the entire world."*



A photograph of two men, Jeff Immelt and John Flannery, standing in front of a large, stylized GE logo. Jeff Immelt is on the left, wearing a dark suit and a light blue shirt, smiling and looking towards John Flannery. John Flannery is on the right, wearing a dark suit, a white shirt, and glasses, smiling and looking towards Jeff Immelt. The background is a light blue wall with the large, stylized GE logo in a darker blue. Two white text boxes are overlaid on the image, one on the left and one on the right, containing quotes. The overall tone is professional and positive.

*“Every company has to be a software company”*

*“Our future is digital.”*

*Jeff Immelt  
Former Chairman, CEO,*

*John Flannery  
Chairman, CEO, GE*



*“Adapt or perish, now as ever, is  
nature's inexorable imperative.” -- H.  
G. Wells*



# Technological Shifts



1. Merging between the physical and the digital -融合物质和数字
2. Redrawing the human machine boundary — 重画人机边界
3. Shifting foundations in the technology stack — 技术堆栈的基础变革



Externalization of the control and processing of machine functions, which are dynamically defined by intelligent software, responding to changing environments

机器功能的控制和处理的外部化，由智能软件动态定义，响应不断变化的环境





# VIRTUAL REALITY

虚拟现实

*Geoscientists at Shell's Virtual Reality Centre in the Netherlands interpret a subsurface model of a prospective exploration site.*

荷兰壳牌石油公司的虚拟现实中心。地质学家研究一个潜在勘探点的地下模型。



### Motor A1

Power ON

Speed 239 RPM

Current 19.60 Amps

ETM 8423 Hours

Online YES

300.0

200.0

100.0

0.0

60 70 80 90 100 110

1 Minute

### Motor A2

**Motor Schematics**  
Wiring Diagrams

**email Maintenance**  
Rob. G. Handy

**Vendor Website**  
iQuest, inc.

**Enter PM Action**  
iQuest Preventative Maintenance

**Report a Problem**  
With this equipment

Monitoring Assets  
监控仪器

VIRTUAL REALITY



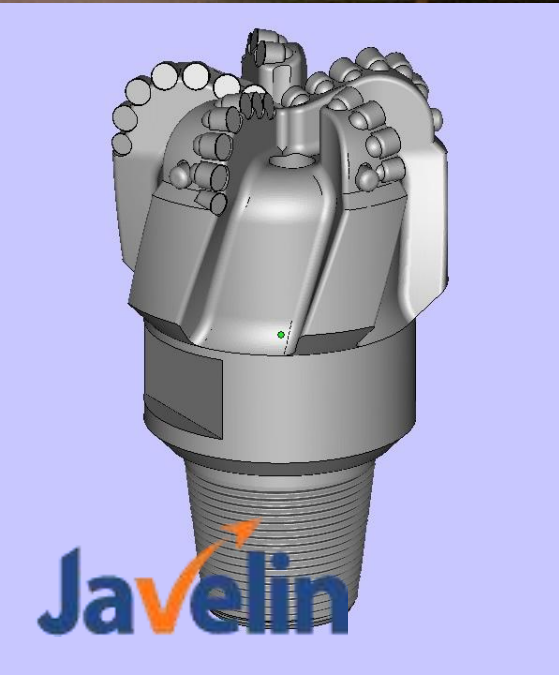
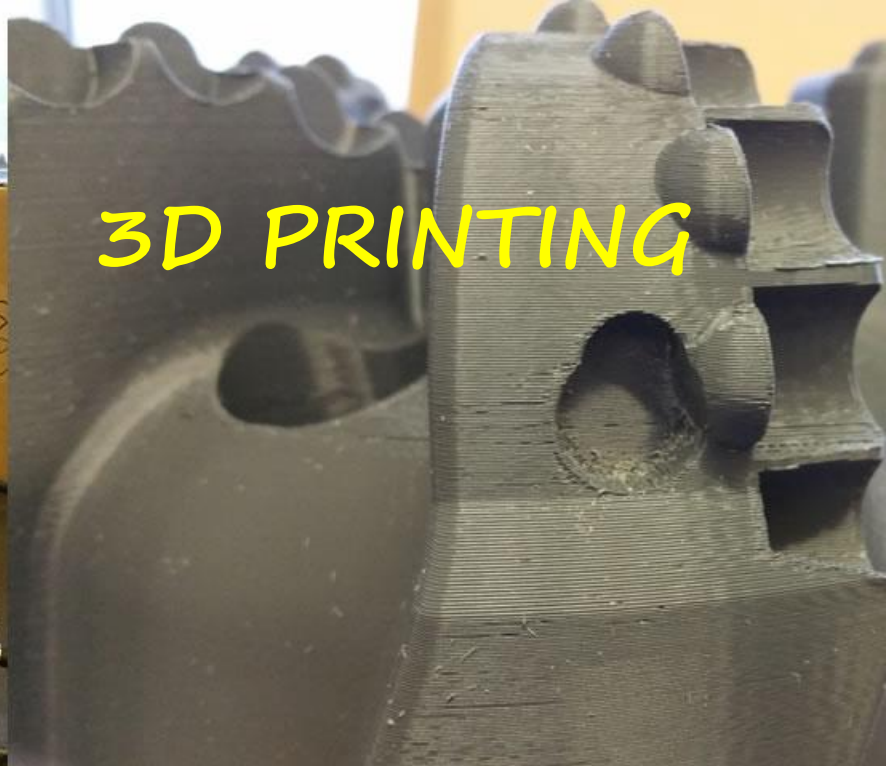


# VIRTUAL REALITY

*Simulation for training and safety*

培训和安全模拟



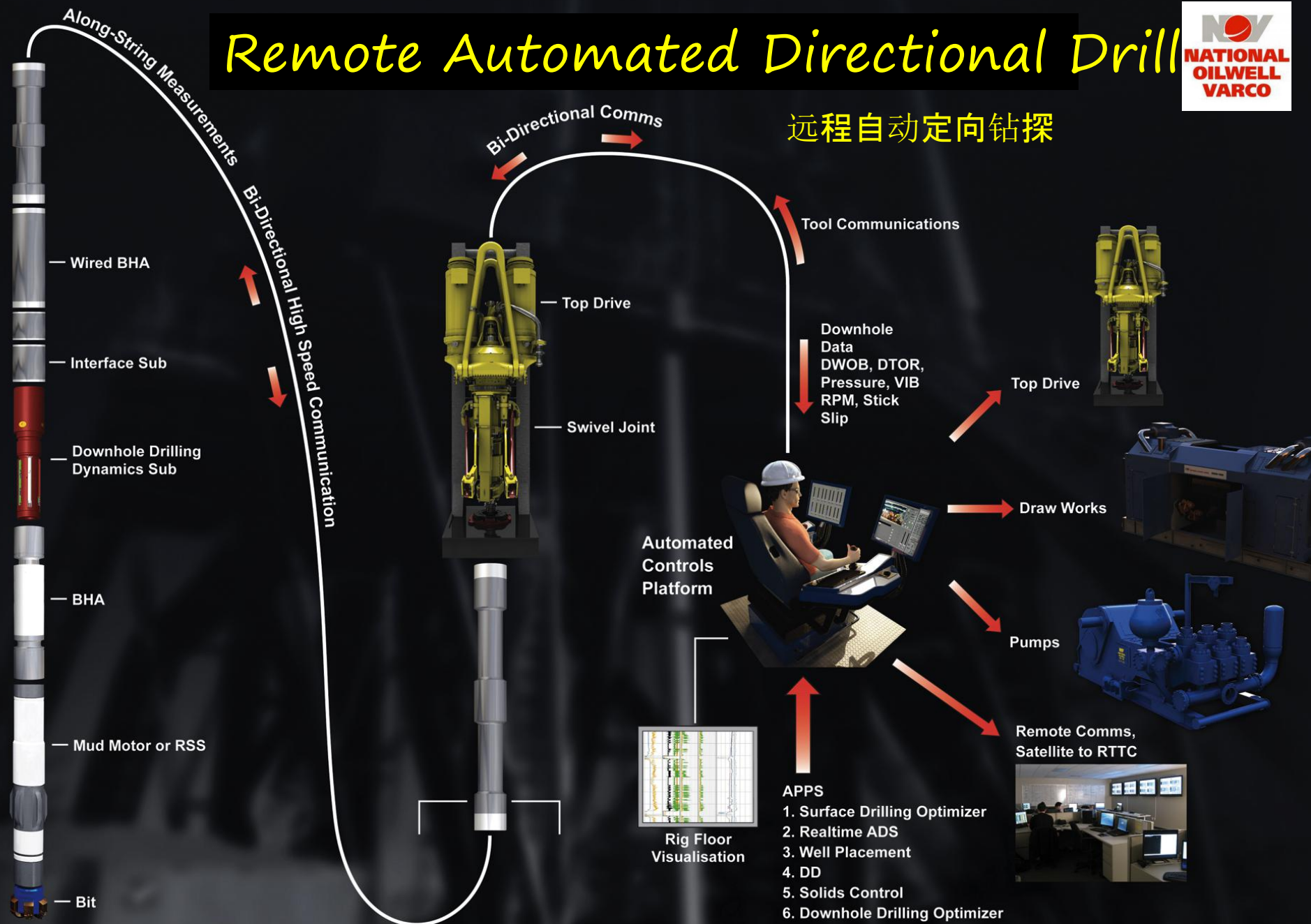


Javeline is a Canadian Supplier of Stratasys and Objet 3D Printing



# Remote Automated Directional Drill

远程自动定向钻探



# Ocean Exploration with Artificial Intelligence

## 用人工智能进行海洋探索

麻省理工学院的计算机科学和人工智能实验室(CSAIL)正在与埃克森美孚公司合作,为海洋勘探创建自学习潜水机器人。机器人软件和它们的“智慧”将使它们能够在恶劣的条件下自主地运行,并以自己的意愿改变任务参数来探索奇怪的异常现象。





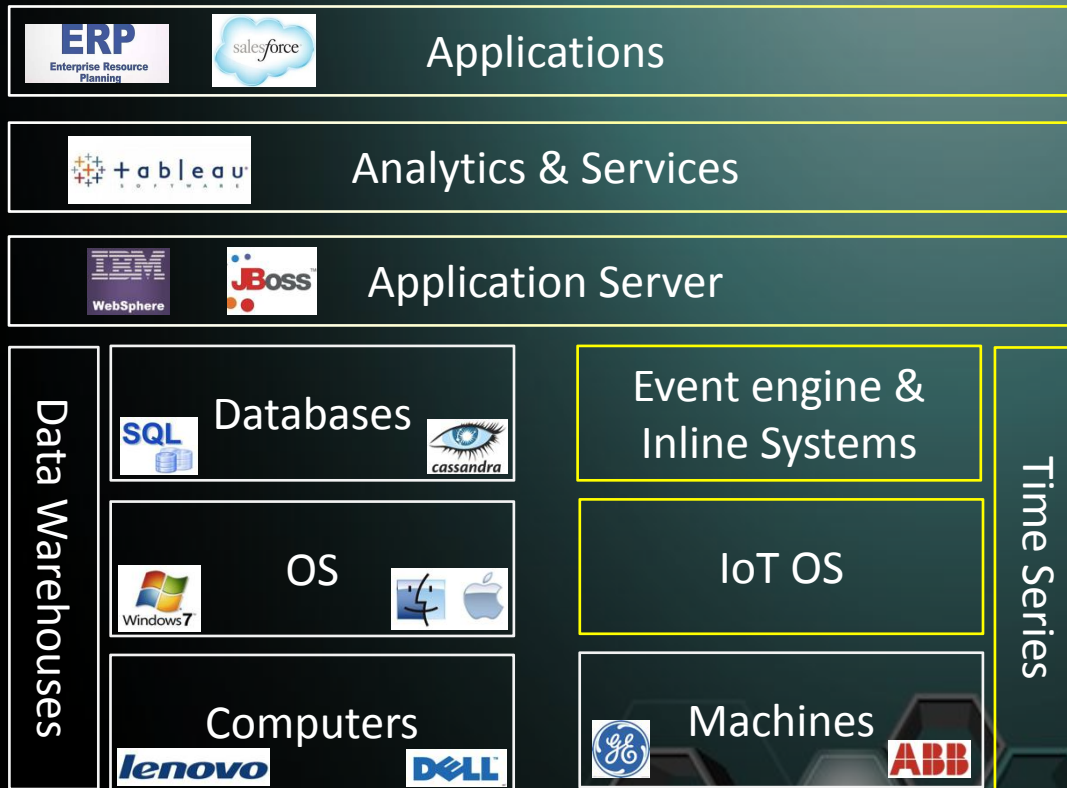


Shell's innovation in collaboration with Subsea 7 has created an Autonomous Inspection Vehicle that claims to provide safer and better inspections – at a significant cost savings. 壳牌石油公司与海底7合作的创新了一种自动检测车，声称提供更安全和更好的检查 – 明显降低了成本。

# Foundational Changes in the Software Stack

Human Users

Machine Users



- Databases will no longer be the single source of truth; 数据库将不再是真相的唯一来源。
- Traditional servers will cease to be the only computing backbone; 传统的服务器将不再是唯一的计算骨干网
- People are no longer the sole user of applications; 人们不再是应用程序的唯一用户




# Business Model Disruptions

1. The transition between product and service business models - 产品与服务商业模式之间的转型
2. Industrial, hardware companies becoming digital, software companies - 工业, 硬件企业成为数字, 软件公司
3. Vertical competition versus horizontal competition — 垂直竞争而不是横向竞争



# "Power By The Hour"



*The airline does not pay for the engines, but for the time they are flying. Now the engine manufacturer has a strong incentive to improve the reliability of its engines, but also a strong lever to push out third-party maintenance providers.*

航空公司不买发动机，只买飞行时间。这样发动机的制造商有很大的动力来提高发动机的可靠性，也是推动第三方维修提供商的强大杠杆。

*Today, "engine manufacturers General Electric, Pratt & Whitney, and Rolls-Royce all have performance-based contracts with commercial airlines in which their compensation is tied to product availability (hours flown),"*



# Become a digital industrial company

GE DIGITAL PORTFOLIO OVERVIEW



Software Defined  
HA Turbine

+



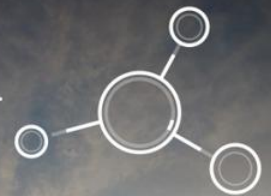
Predix™

+



Digital Twin

+



Suite of Apps

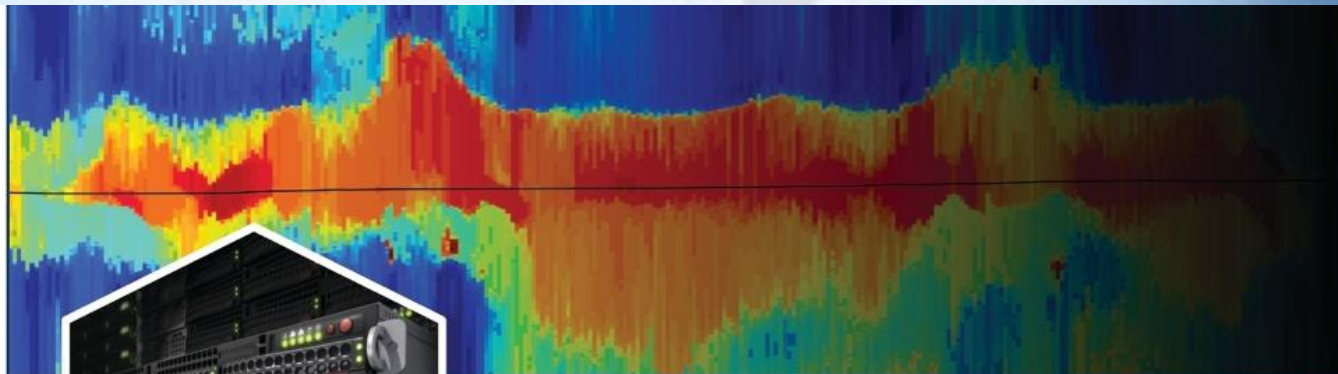




# Schlumberger

Investor Conference 2014

TECHNOLOGY RELIABILITY EFFICIENCY INTEGRATION



## Leading into the Digital Future

Ashok Belani—Executive Vice President, Technology

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# The Energy Internet

Using advanced sensors and software applications to connect billions of devices, machines and systems from energy generation, transaction and consumption processes is the foundation of the Energy Internet.

**能源互联网**的基础: 使用先进的传感器和软件应用程序连接数十亿应用在能源生产, 交易和消费流程中的设备, 机器和系统。

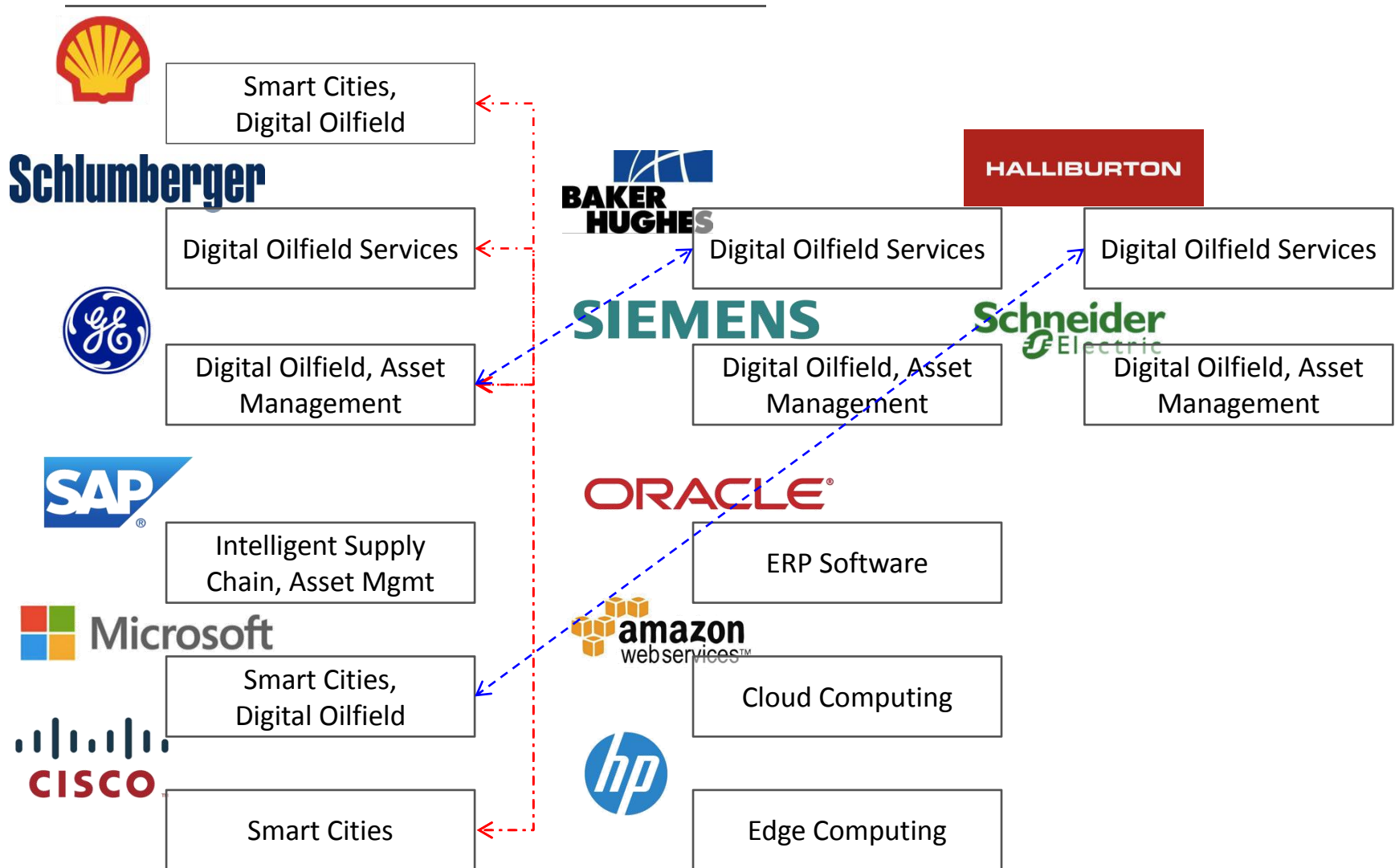


## EnOS™

EnOS™ is a smart, scalable and open platform that is enabling the Internet of Things for Energy; the Energy Internet. Through real-time computing and data analysis it provides intelligent control for how, where and when devices produce, store and use energy.

Orchestrating all types of energy infrastructure, EnOS™ connects renewable energy generation, energy storage, electric vehicles, smart grids, smart meters and appliances, and other breakthrough technologies. It is the complete solution for a future connected energy world.

# From Horizontal to Vertical Competition





# The operations

1. IT and OT - 信息技术和操作技术部门之间
2. CIO taking center stage - 首席信息官担任核心职务
3. CDO and the digital talent gap - 首席数字官员和数字人才的缺乏



# Clashing of the IT and OT

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## Operations Technology (OT)



8:00 AM

- Mechanical engineers
- Work in the field
- Run critical operations
- Must touch and see



LUNCH TIME

- On premise
- Change is costly
- Risk averse

## Information Technology (IT)



8:00 AM

- Computer engineers, business analysts
- Sit in headquarters
- Fix issues when reported
- Prefer working virtually



LUNCH TIME

- Cloud centric
- Change is a norm
- Innovation is a virtue



# CIOs Taking Strategic Roles

*Some 56% of CIOs report directly to the CEO in the 2016 edition of the CIO 100, an increase in the number of Chief Information Officers answering to the Chief Executive for the third consecutive year.*

2016年56%的首席信息官直接在首席执行官下工作，向首席执行官报告，已经是连续第三年的增加。



# The Chief *Digital* Officers



*At the end of 2015 there were approximately 2,000 CDOs. CDO hires have been doubling every year and I expect there to be 2,500 CDOs by the end of 2016.”*

*Companies like Caterpillar, Air New Zealand, Michelin, CVS, Target and GE, just to name a few, are hiring CDOs and in some cases, teams of digital experts across their business units.*

*“The pressure from boards of directors and influential shareholders is instigating CEO action. Appointing a CDO is a fast and effective way to signal that a company is taking digital transformation seriously.”*



# 3 Architectures of Transformation



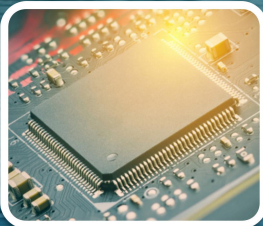
## Business Architecture

- The value, ROI, offering, business models, competitive strategy, etc. underlying the ultimate success of digital transformation



## Operating Architecture

- The teams, competencies, organizational alignments, processes required for execution



## Technical Architecture

- The technology, architecture, solutions, systems enabling the transformation

# Identify High Value Business Opportunities

***Decide the WHAT***

***“WHAT”*** *drives the Who, Where, and How...*





# Data Paralysis – “Hoarding” Data As if They Were Gold “囤积”数据就好像他们是黄金一样

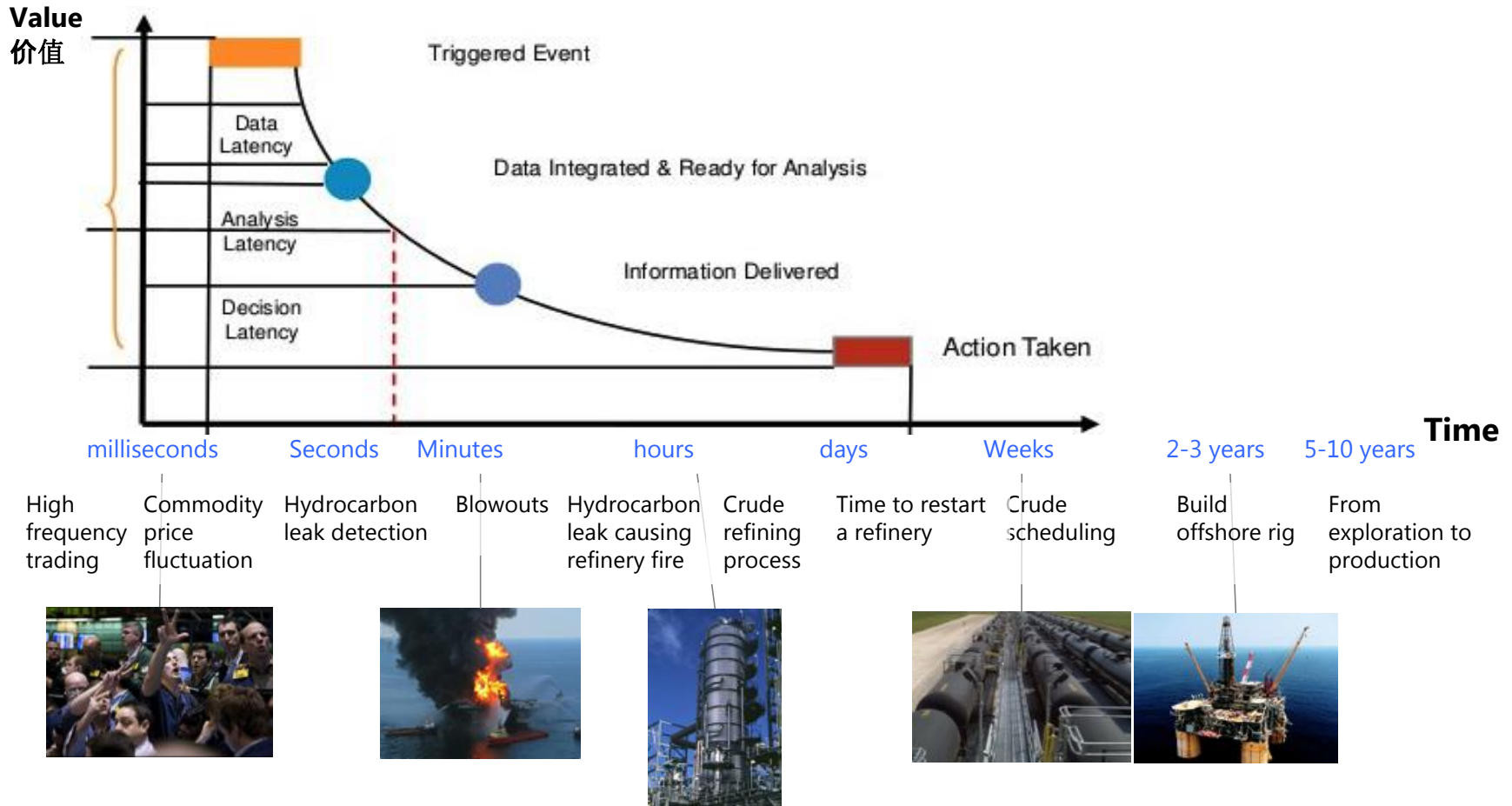
- *“Data is the new gold!”*
- *“We generate megabytes of data a day. Let’s collect them all”*
- *“We have collected petabytes of data”*



# Data Is Not Gold. Data Is Spinach

## 数据不是黄金 数据是菠菜

### The Time Value of Oil and Gas Data – 石油产业数据的时间价值





# Analytics Paralysis – Data Science Without Domain Science 分析麻痹 – 无领域科学的数据科学

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## Today's Biggest Need in Analytics Initiatives: Common Sense

**Banking  
CIO  
Outlook**

*“Through in-depth predictive analytics, utilizing advanced statistics, the website spurious correlations, has determined the U.S. per capita consumption of sour cream has a 99 percent correlation to motorcycle riders killed over that same period. The strategic initiative is clear, lower our consumption of sour cream and it will be safer for our neighbor to take out his Harley for a joy ride. The data is accurate and the model has been built by a Harvard PhD, but where is the common sense?”*

通过深入的预测分析，利用先进的统计数据，根据网站虚伪性的关系，已确定了美国酸奶的人均消费量与同期摩托车骑手的死亡率有99%的相关性。战略举措是很明确的，如果降低酸奶的消费，我们大家就可以更安全开心地去骑哈雷戴维森摩托车了。这里的数据是准确的，模型也是由哈佛的博士建立的，但是有无常识呢？

# The Digitization Decision Grid - 决策网格

## Information Problems

信息问题

- Tacit knowledge
- Intuitive knowing : drilling operators, geologists, field engineers...

- Pipeline corrosive agents
- Leading costs of drilling
- Causes of blowouts
- Boiling ranges and yields

**UNKNOWN-  
KNOWN'S**  
潜在的知识

**KNOWN-  
KNOWN'S**  
众所周知的

Undefined  
未定义的

Well-Defined  
定义明确的

- “Black Swan” events
- Complex systems
- Global peaks

**UNKOWN-  
UNKOWN'S**  
不明的未知数

**KNOWN-  
UNKNOWN'S**  
已知的未知数

- What predicts equipment failure?
- What predicts production rate?
- How to optimize refinery profit?

知识问题

## Knowledge Problems



# The Digitization Decision Grid

## Information Problems

### 信息问题

- Tacit knowledge
- Intuitive knowing : drilling operators, geologists, field engineers...

- Pipeline corrosive agents
- Leading costs of drilling
- Causes of blowouts
- Boiling ranges and yields

#### UNKNOWN-KNOWN'S

潜在的知识



*Shrink* 心理医生

#### KNOWN-KNOWN'S

众所周知的



*Cobbler* 皮匠

### Undefined 未定义的

### Well-Defined 定义明确的

#### UNKNOWN-UNKNOWN'S

不明的未知数



*Cosmologist* 宇宙学家

#### KNOWN-UNKNOWN'S

已知的未知数



*Detective* 侦探

- “Black Swan” events
- Complex systems
- Global peaks

- What predicts equipment failure?
- What predicts production rate?
- How to optimize refinery profit?

### 知识问题

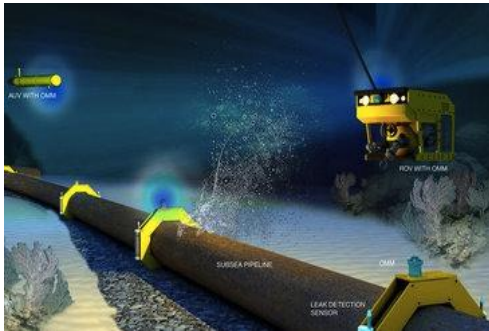
## Knowledge Problems

# Distinguish Information Problems from Knowledge Problems

## Information Problem

信息问题

Is there a leak in the underwater pipeline?



We will **find out** if we use the right means

- Solved by information technologies (detecting, processing, integration, alerts, in-time responses, workflows...)
- Need only current data (speed & quality)

## Knowledge Problem

知识问题

What conditions lead to machine failures?



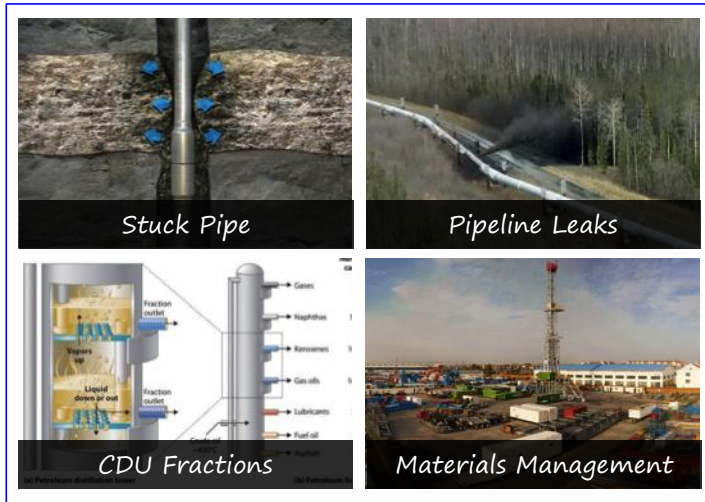
We **don't know**. We want to understand

- Solved by science, data science (research, experiments, algorithms/machine learning, ...)
- Need sufficient historical data (quantity & quality)



# Well-Defined Problems Are Low Hanging Fruits

定义明确的问题可以带来近期的收获



## KNOWN-KNOWNs

### Well-defined Information Problems

- Information or knowledge exists somewhere (digitally, physically, or both)
- Inefficiencies in obtaining, integrating, distributing or using information



## KNOWN-UNKNOWNs

### Well-defined Knowledge Problems

- Knowledge gaps with business values
- The outcome/output is defined. Potential variables/inputs are identified
- We have some hypotheses

# 3 Ways to Spot Information Problems

**1. Talk to operations and field teams –**  
与运营和现场团队交谈  
Operators, site managers, field engineers





# 3 Ways to Spot Information Problems

A full-page background image showing a male worker in profile, facing right. He is wearing a white hard hat, safety glasses, and an orange jumpsuit. He is holding a clipboard and looking down at it. The background is an industrial facility with large yellow and white pipes, valves, and a large black handwheel for a valve.

**2. Recognize informational “frictions” –**  
认识到信息“摩擦点”  
Silo’s, delays



# 3 Ways to Spot Information Problems

**3. Look for operational variabilities –**  
寻找操作变量  
productivity, utilization, cost





# What is A Well-Defined Knowledge Problem?

## Sequence of Problem Solving

## 1. Problem Defined

## 问题定义了

1970's

## 2. Method Defined

## 方法定义了

1990's

2000's

2010's

### 3. Solution Defined

问题解决了

### Kick tolerance calculation

Predict bit wear using  
discrete element method

## Predict type 2 diabetes from generics

## Predict cancer prognosis

## Still in a Sci-Fi movie



Only humans can  
define the problem  
(or humanoid computers)

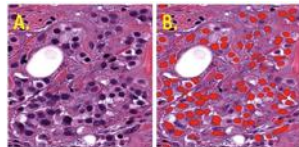
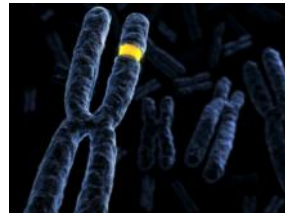


Figure. A) A hematoxylin and eosin stained Nottingham grade III breast cancer sample with B) nuclei automatically identified and segmented (masked red) and prepared for feature extraction.

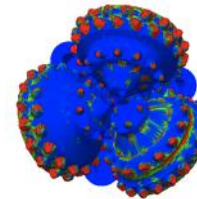
Computer can extract the “features” for learning

# Deep Learning



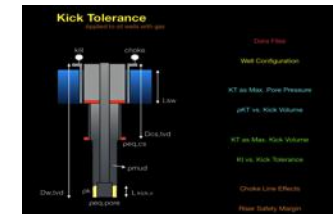
Computer program  
can automatically  
selects methods

# Machine Learning



Computer can use selected methods to refine results

# Machine Learning



Computer can automate repeating tasks

## Calculation & statistics

## Strong Artificial Intelligence

# Altered Street Signs Confuse Self-Driving Cars

## 改变的街道标志迷惑了自驾车



Lesson #1. Most situations with dynamic, ill-defined contexts can only be interpreted by humans (for now)

Lesson #2. If you do use machine learning – take proactive steps to capture and encode contextual variables (do not let them become noise to computers)

Lesson #3. The better the problem is defined, the less likely contextual noise will obfuscate the result



# Take Aways

1. Digital transformation is redefining the boundaries of business, operating and technical models
2. The value of data diminishes with time (Data is Spinach)
3. Define the WHAT – business problem first
4. Distinguish information problems from knowledge problems
5. Start from well-defined problems



# Instructor

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Jane Ren  
CEO, Atomiton

Jane Ren is the CEO of Atomiton, Inc., a technology company delivering the next generation IoT platform. Under Jane's leadership, Atomiton was named a "Top 20 Disruptive Influence in Tech" by the CFO Magazine in 2017, for its IoT software stack deployed in oil and gas, smart cities, and industrial automation.

Prior to Atomiton Jane was the Chief Business Architect at GE Global Software Center, where she spearheaded digital business transformations across GE's Healthcare, Transportation, Aviation and Energy businesses. She product managed the core software platform to drive GE's "Industrial Internet" initiative. Previously at Cisco, Jane was responsible for GTM strategies and major customer engagements for the Service Exchange Platform.

A medical doctor by training, Jane worked as an internist and then a healthcare executive before joining the tech industry.

Jane received her MBA from University of California, Berkeley, and her MD from Peking Union Medical College (now Tsinghua University).





Thank You.

# Workshop Agenda

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1. Introductions and getting started (André, 20 min)
2. **"Navigating The Tectonic Shift of Digital Transformation"** (Jane, 25 min)
3. Introduction of PROSCI as a CM tool, including the usage of the kick off excel (André, 20 min)
4. Agile discussion and population of Kick off tool (under supervision of Jane and André, 25 min)
5. Feedback rounds and Q&A (tables to Group) plus comments J and A. (Jane leads, 30 min)