What is big data?

Velocity

Variety

Volume

- Monitoring
- Analytics
- Metrics
- Machine Learning
- Cloud Computing
- IoT

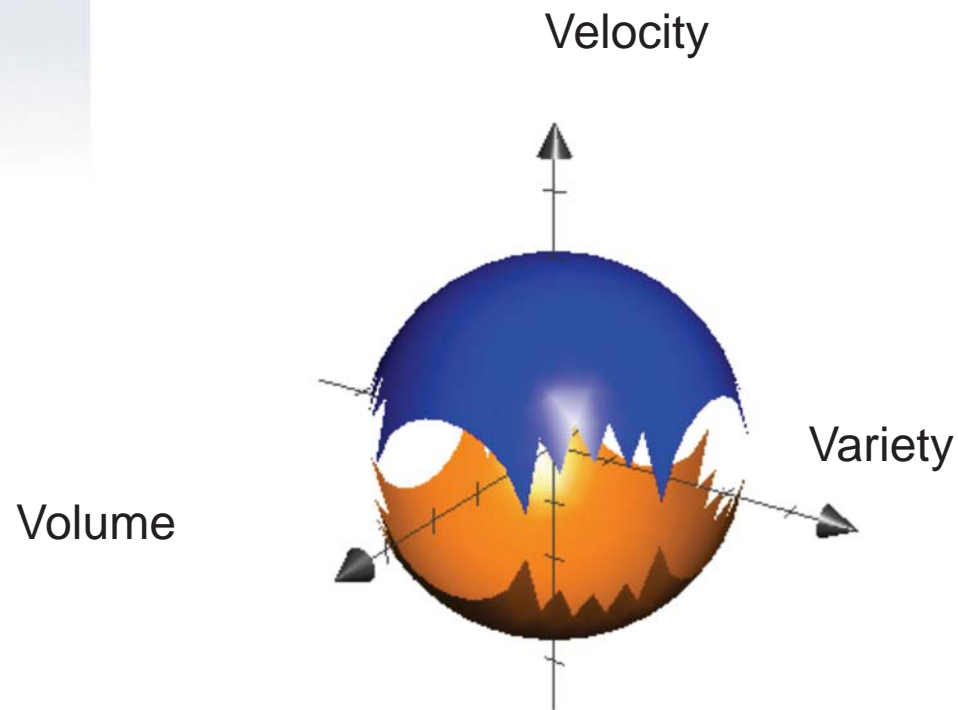Data transferred now

1400000 GB = 1400 TB per minute

What is big data?

Velocity

Variety

Volume

Emergency of knowledge

Emergent knowledge

Do you know how much data is being generated in your site?

10 TB - 100 TB per year

Do you know which percentage of data is used to get knowledge?

1% - 10%

Big data in the Nature: the aggregation process
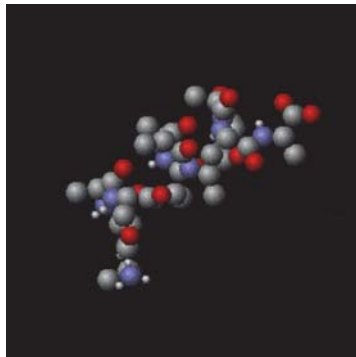
volume of information + variety + speed of combination

Big data and the magic of the granularity

Big data in the industry

Volume of generated data

545 MILLION samples per hour

9 MILLION samples per minute

152,000 samples per second

4 BILLION samples per shift

13 BILLION samples per day

4 TRILLION samples per year
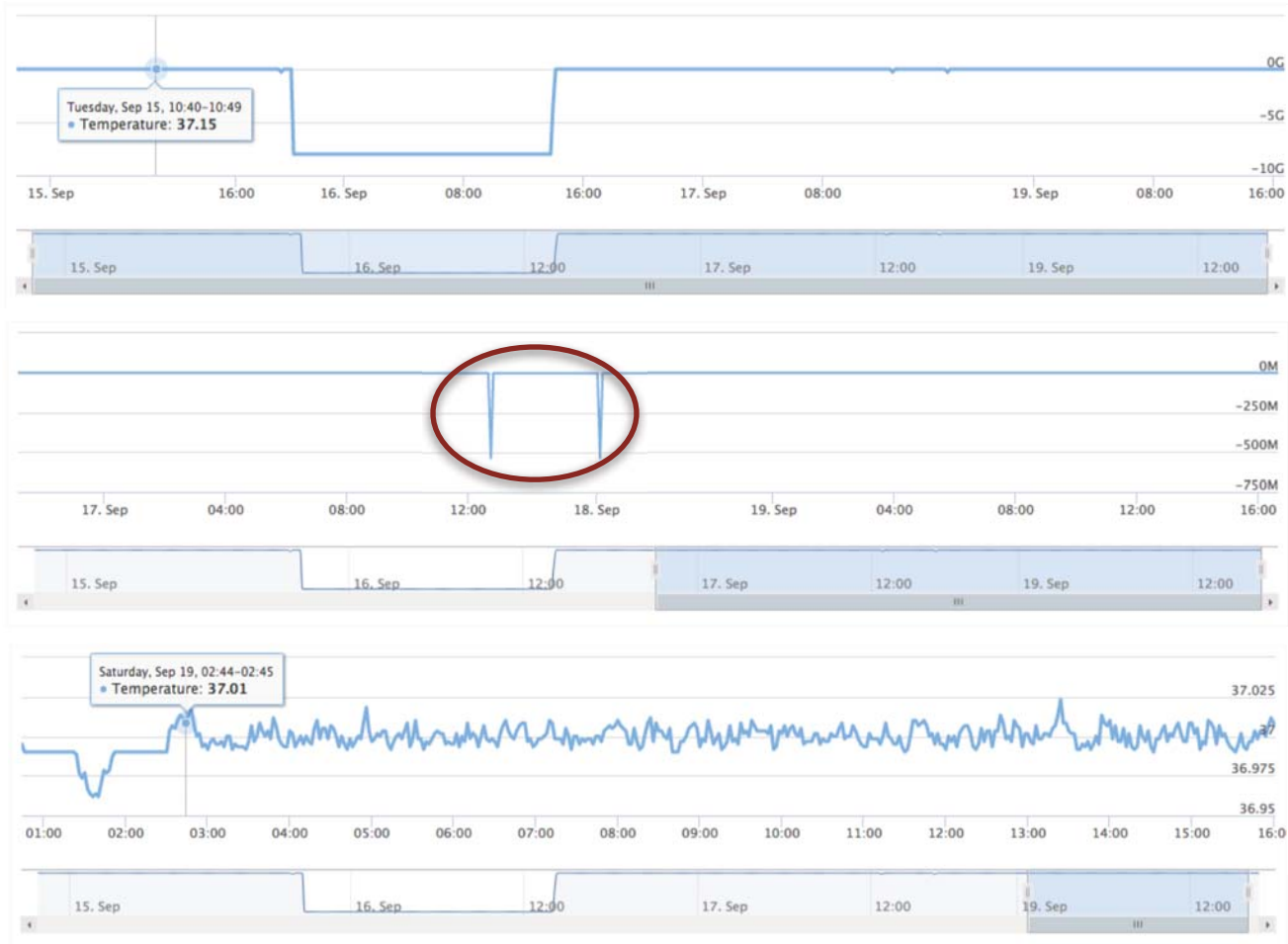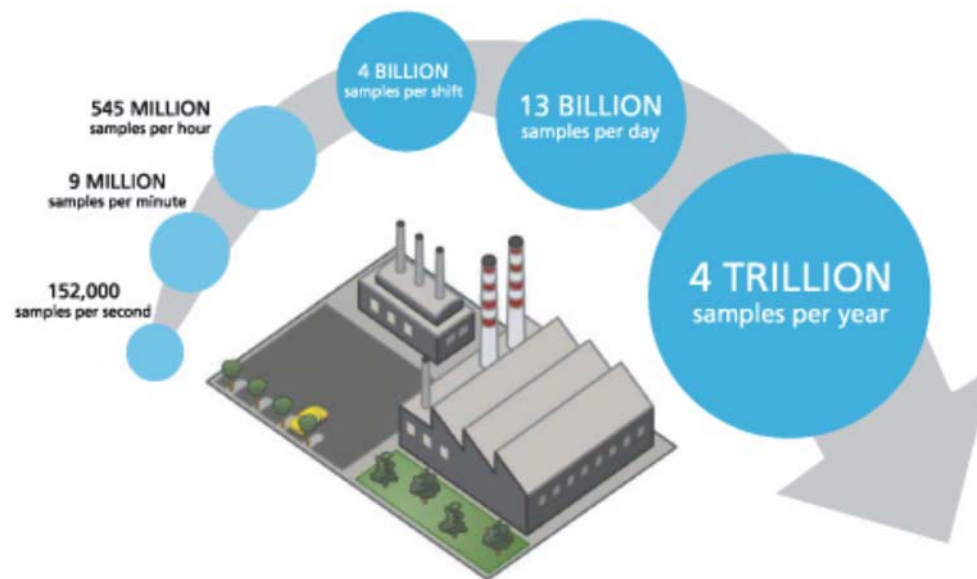
Devices in the industries can generate big data. Source: ISA.

	TB / year
Chemical	2 - 10
Pharma	50 -100
Biotech	100 - 1000

Big data in the industry

	PRODUCTIVITY INCREASE	SALES INCREASE
RETAIL	49%	$9.6B
CONSULTING	39%	$5.0B
AIR TRANSPORTATION	21%	$4.3B
CONSTRUCTION	20%	$4.2B
FOOD PRODUCTS	20%	$3.4B
STEEL	20%	$3.4B
AUTOMOBILE	19%	$2B
INDUSTRIAL INSTRUMENTS	18%	$1.2B
PUBLISHING	18%	$0.8B
TELECOMMUNICATIONS	17%	$0.4B
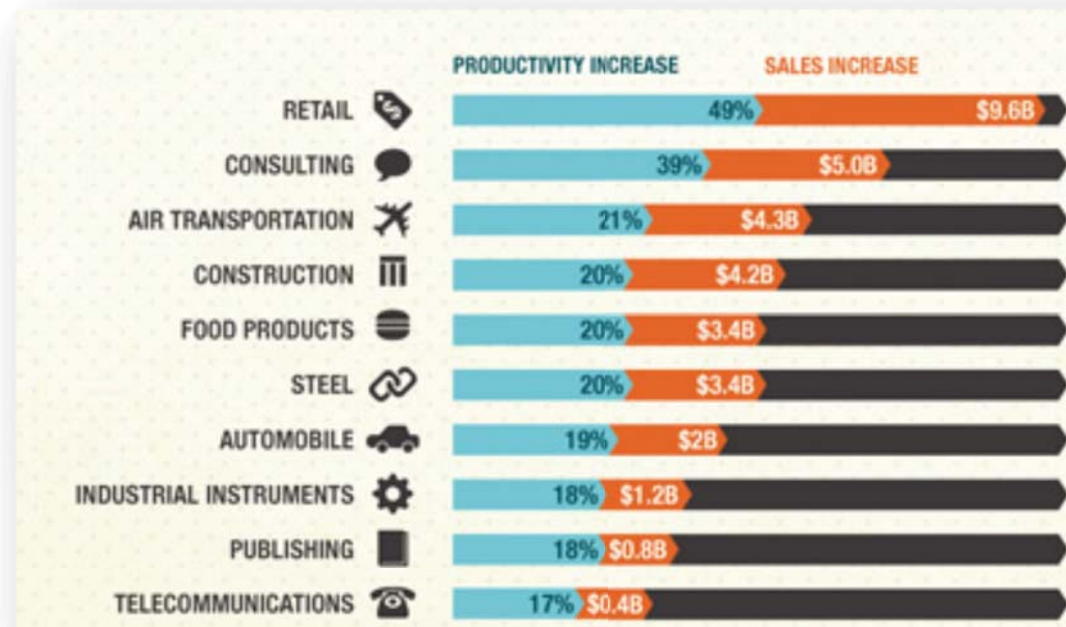
The use of big data in different industries has been contributed in the direct benefit on production and sales activities. Source: Wipro

Understanding processes under the big data point of view

INPUT

PROCESS

PROCESS

OUTPUT

WHILE

or

DATA

DATA

DATA

?
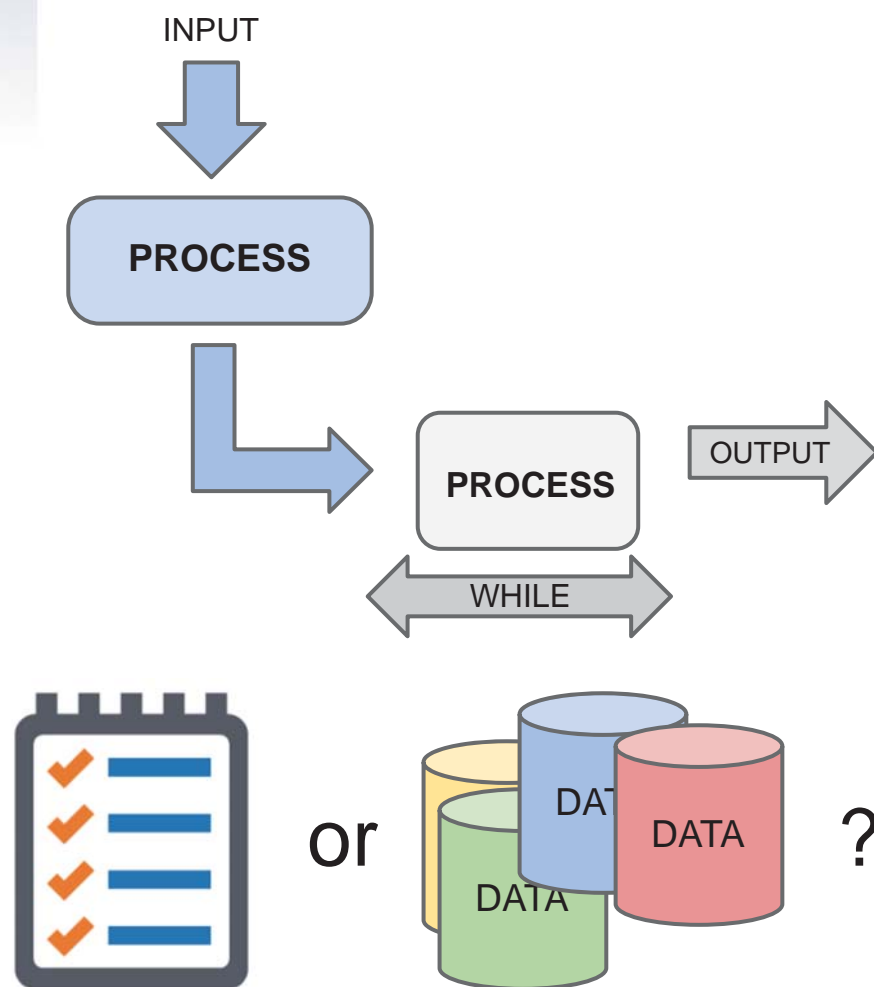
Some questions...

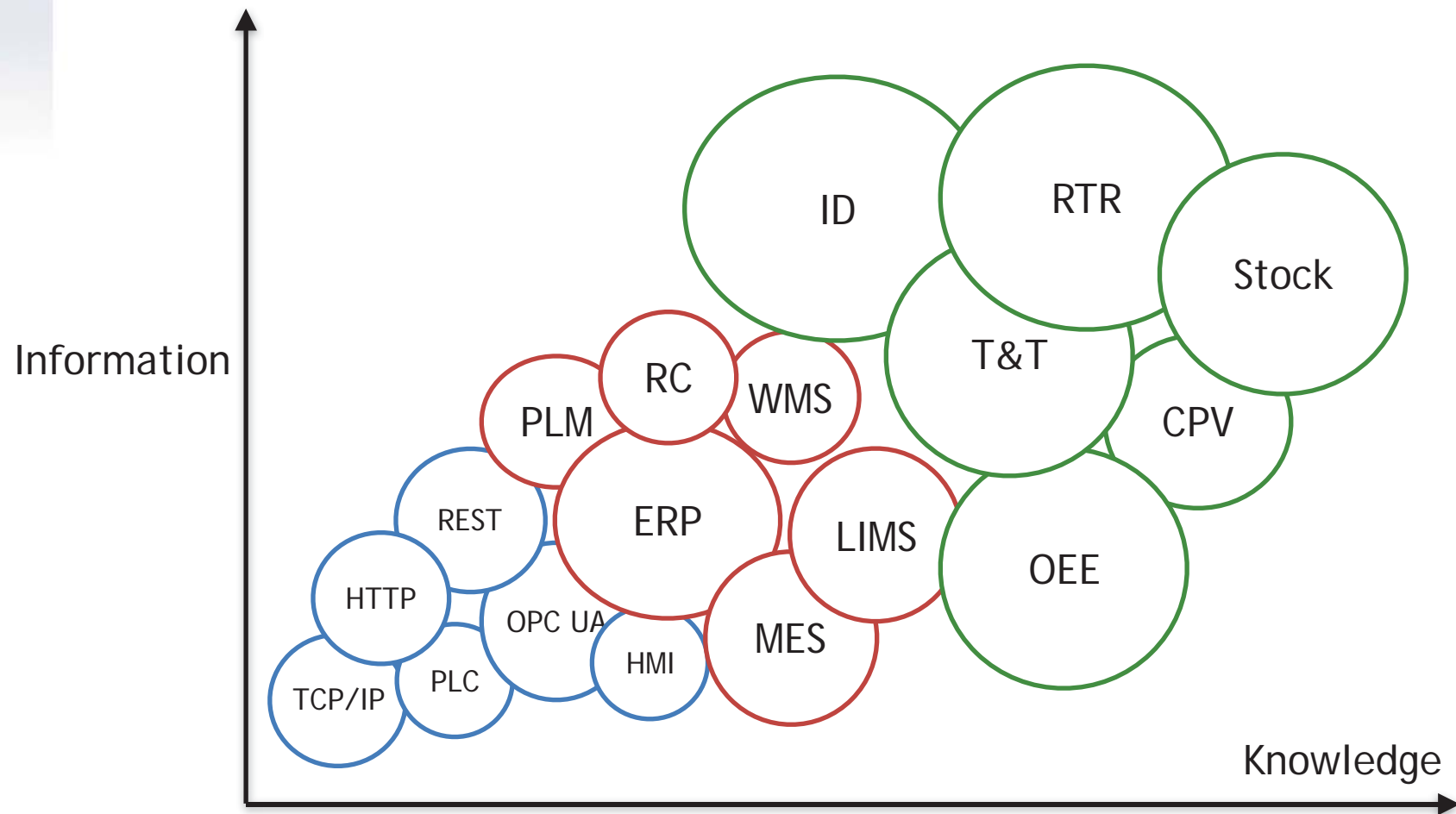- Can be considered the data as discrete information?
- Is realistic to manage data in isolated phases?
- The information generated in a process, is strictly related with data produced in the own process?
- Is the knowledge resident in the CPP and CQA?
- Could arise more knowledge from the cumulus of real data?

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Understanding processes under the big data point of view

Information

Knowledge

ID · RTR · Stock · T&T · CPV · RC · WMS · PLM · ERP · LIMS · OEE · REST · MES · HTTP · OPC UA · HMI · TCP/IP · PLC

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Understanding processes under the big data point of view

Executing processes in the new perspective

Classic view

Smart view

INPUT → PROCESS → OUTPUT
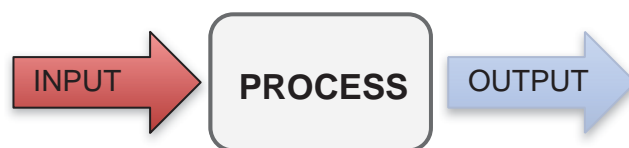
PROCESS

Data acquisition
Data storage
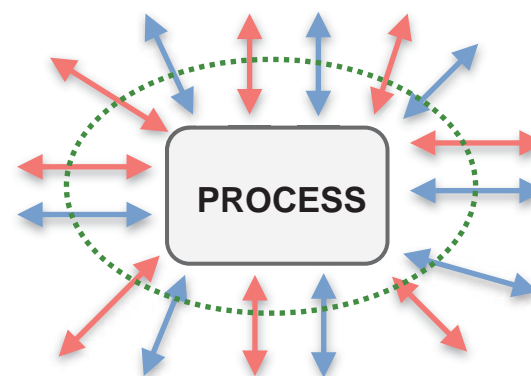
Data evaluation
Data analysis
Data decision
Data mission

Traceability: a clear example about the use of big data in processes

Traceability as a dynamic view

Product Genealogy	Product, part & asset lifecycle traceability

Product ancestry:
How a product item was generated

Life of a product item:
What happened with a product item

Batch ID

Item serialized
product instance

Production

Supply chain

Batch Traceability

Packaged product Event Repository
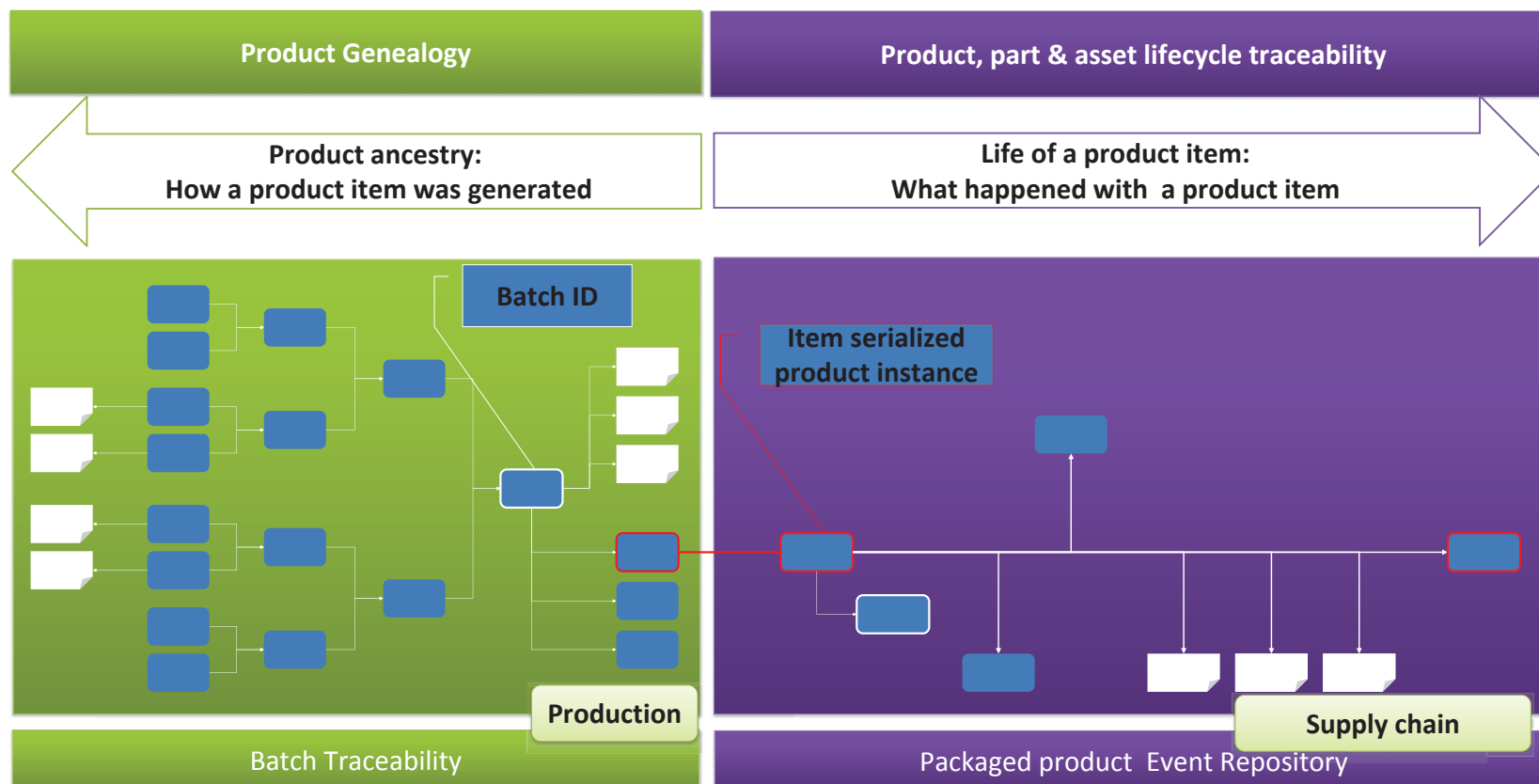
Traceability: a clear example about the use of big data in processes

Safe & secure supply chain model

Safe and Secure Supply Chain

Pharmaceutical Co → Wholesaler → Pharmacy

Product Security	Transaction Security
Product Authentication / ID Authentication	Track / Trace
Authentication	**Pedigree**
✓ Individual Product Security	✓ Chain of Custody Security

©SupplyScape Corporation
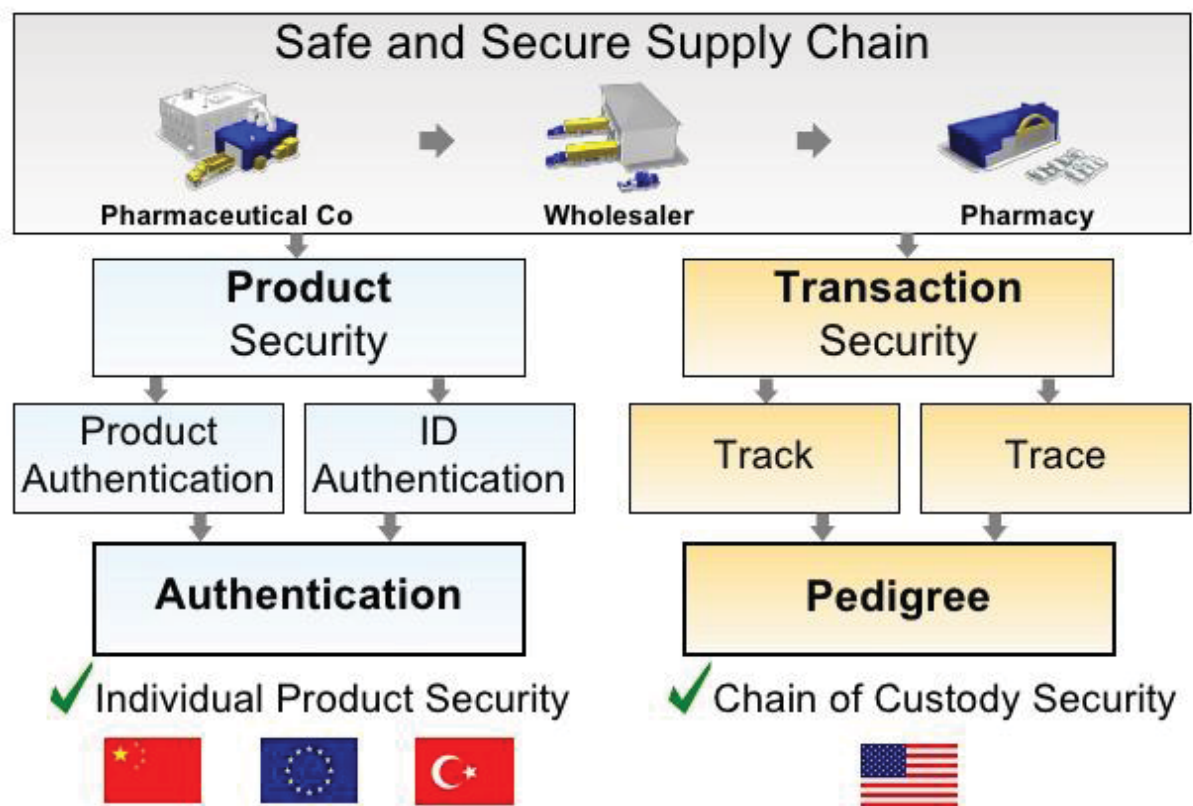
The 4h Industrial Revolution

Science   Engineering   Technology

Cloud
2015

Electronics
1954

Industrialization
1913

Power generation
& automation
1782

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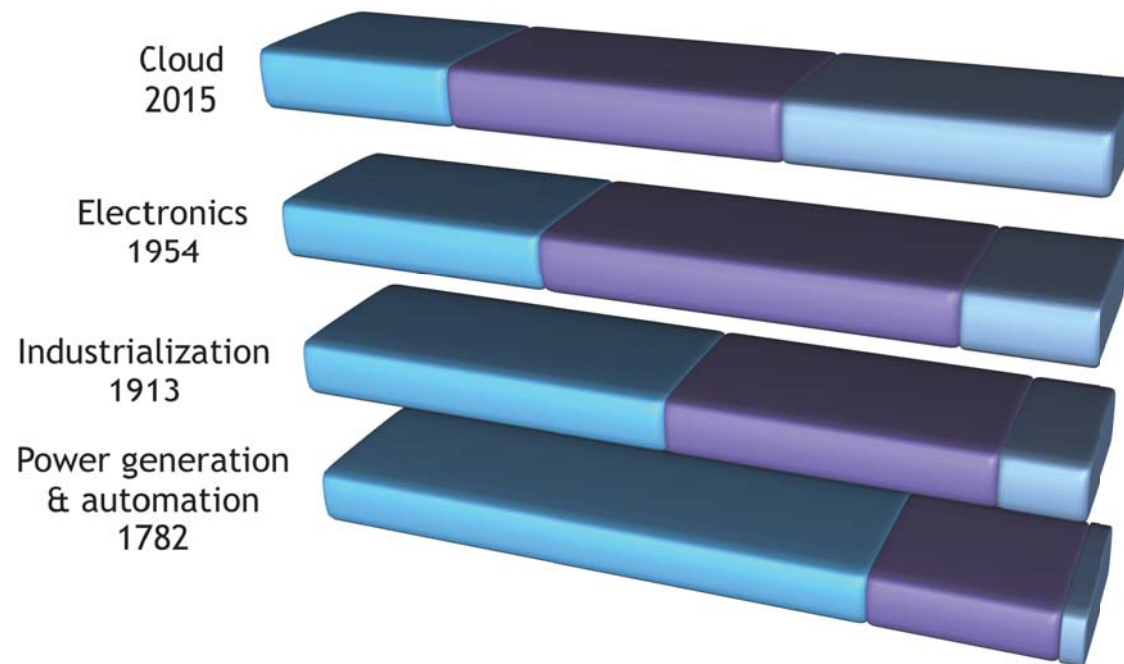
Factors

- Unavoidable downing: social, commodities, media and the own technology
- Quick compensation: efforts to accommodate data are fast returned
- Easy access to the information: data are indiscriminately shoot
- Competitiveness: To survive, it is required to improve
- Globalization: There is no limits to the market
- Cost reduce: While grows the productivity
- Intrinsic attraction: that is undeniable

Enablers

Enablers to achieve the smart factory

- Cloud technologies: delegating power to the cloud
- Virtualization: Drastically server resources reduction
- Internet accessibility: technical and physical infrastructures
- Software & Hardware maturity: Experience and history
- Explosion and expansion: World wide access to web-tech
- REST: Thin http/https calls
- Web browsers: Chrome, Firefox, Safari, etc.
- IoT: Easy way to communicate devices
- Providers: Specialized services on smart resources
- Culture: A new way to understand technologies
- Governmental funding: $2 \cdot 10^8$ € (e.g. of forecast in Germany)

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Tech elements for big data

Technological elements

- Cloud or Master Data Center
- Computer scaling
- Tools to process huge amount of data (e.g. Hadoop)
- Network availability
- New protocols: MQTT
- Statistics tools for big data (multivariate analysis, aggregation, ML, etc.)
- Products as SAAS (AWS, Google, Redis, …)
- Enhanced security (e.g. asymmetric keys)
- Metrics

IoT must be considered as the big data producer
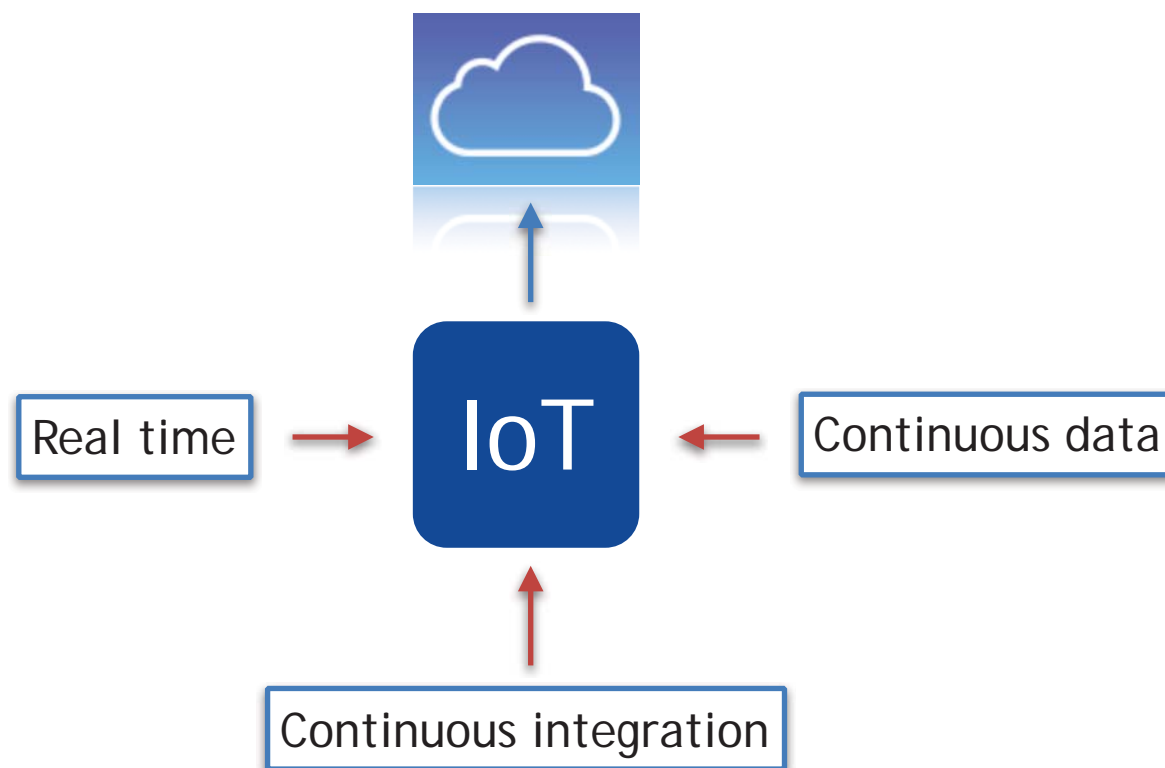
Information vs. Knowledge

Nowadays ...

The information can be considered as a free resource

The knowledge is one of the most valuable goods

To take the right decision
To foresee unknown events
To be more efficient
To be more competitive
To understand our own processes
To discover new horizons of the reality

Examples about emergent knowledge

Real experiences

- Seasonal and temporary influences
- Joining unknown extremes in the supply chain:
    - clinical trials and patient success
    - production and logistics
    - retirements and pharmacists
- Unexpected correlations between automatic and manual processes
- Predictions checked in real-time: CPV
- Campaigns
- Inclusion of new variables in the performance processes
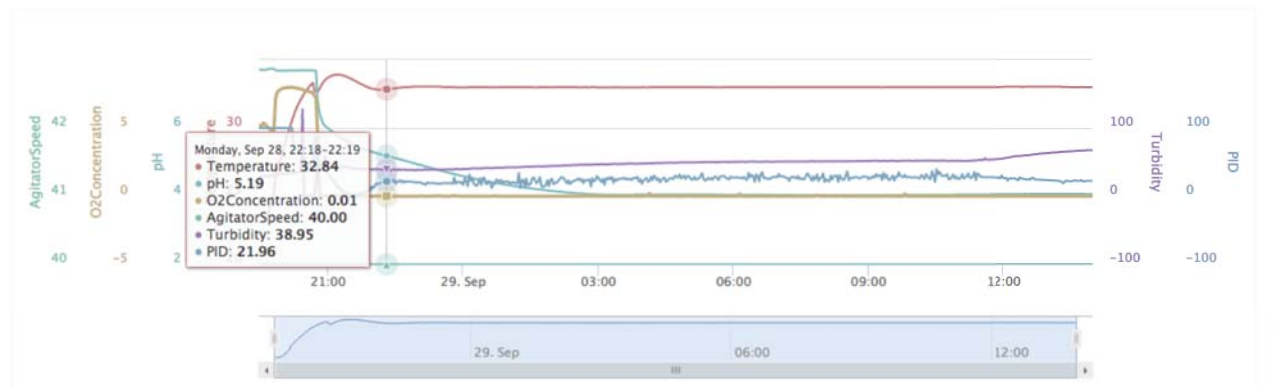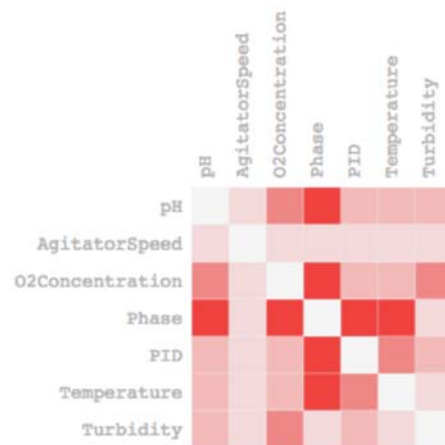- Preventive maintenance based on real data

Examples about emergent knowledge

Real experiences

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Examples about emergent knowledge

Real experiences

< Back

🔔 TemperatureControl

✏ Edit agent

| Agent Information | Real Time Evaluation | Historical Activity |

| Points of Graphic | 200 | Frequency Iteration | 5 | Get Records | 20 | Time | seconds ⬍ |
| Number Predictions | 3 | Polynomial degree | 4 | Number Samples | 20 | Type Trendline | polynomial ⬍ |

Stop   Start

ThermometerT1

OK

TemperatureControl
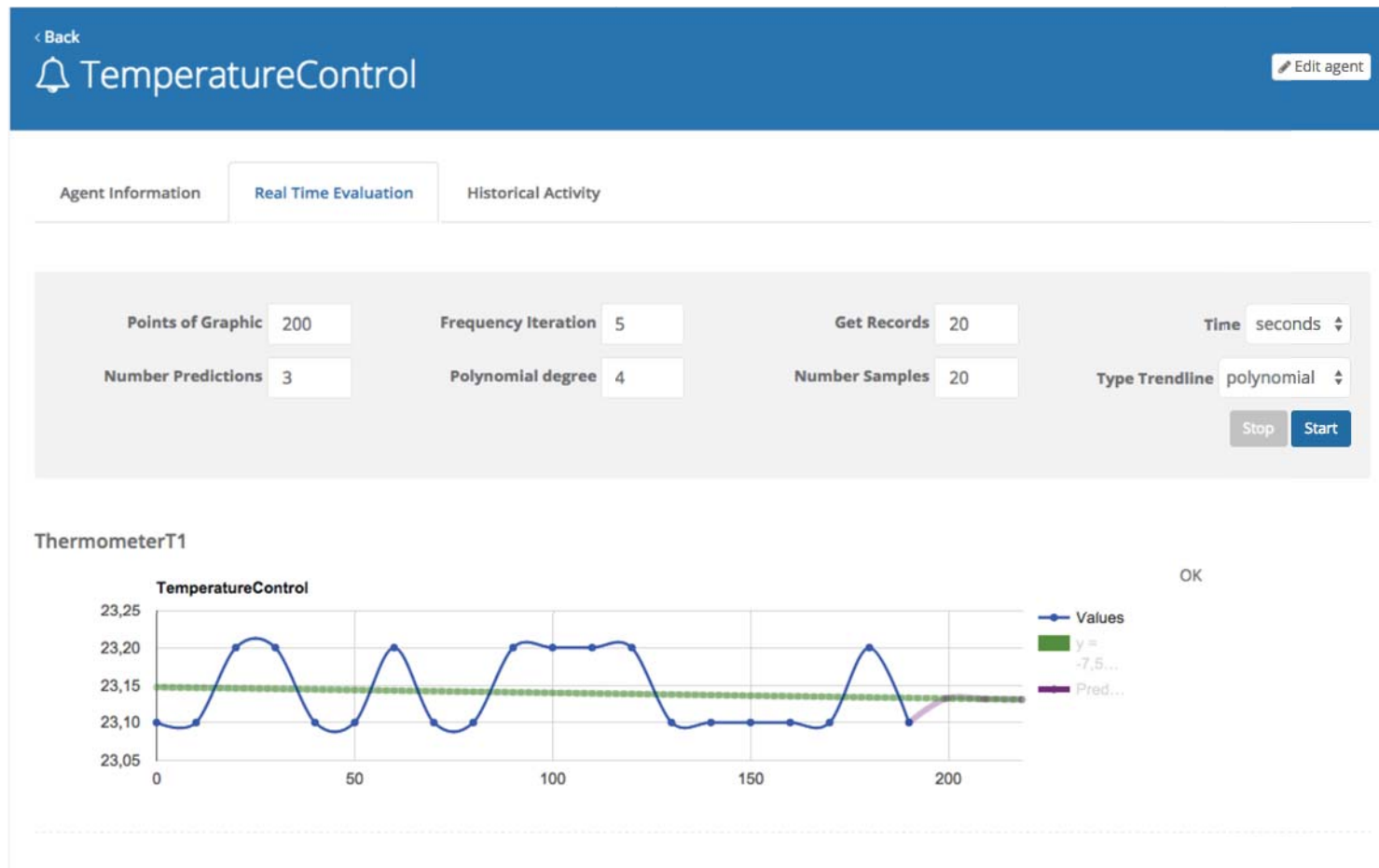
Real projects

- Consider modeling in parallel to the validated base
- Make tuning comparing both scenarios: current & new
- Monitoring and analyzing results from both scenarios
- Set big data environment for non-critical processes or with less impact
- Migrate the rest of processes asap

Premise: push as much information as possible!

The handicaps

**The limits are not in the technology** ...

- The resistance to the change

- Inertial projection

- Accommodation in the current ground

- Difficult to understand the new reality

- New methodologies, new technologies: € - $

- Afraid to the cloud

- Wrong conceptions (security, persistency, accessibility, ...)

How much cost the progress?
**Do we have referentes in the history of the Industry?**

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Examples of emergent knowledge
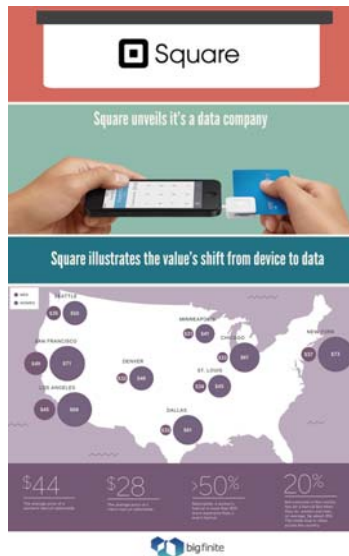
Square, a platform originally presented as a device plus a backend to process credit card payments, announced recently its focus to generate a new revenue stream: big data and analytics. Using its massive amount of transaction's data square offers valuable information to a new range customers
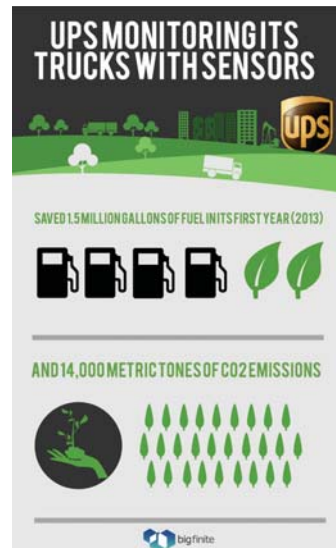
UPS, one of the earliest adopters of business analytics, is moving to a new dynamic package routing program which will save the company tens of millions each year in fuel costs. "UPS executives don't necessarily view Big Data as new," Guest Columnist Thomas H. Davenport writes, "but they do view it as providing revolutionary benefits through evolutionary implementation."

The company has negotiated deals with multiple energy partners in the U.S. Some utility partners are willing to spend $30 to $60 per year and per thermostat to be able to turn the air conditioner up when it's a hot day. This way, the utility can levels load on the grid. Partners don't have direct access to the thermostats, they just sign a deal with Nest, and then Nest has access to the thermostats. Moreover, it's a recurring revenue stream.

Rio Tinto's Pilbara region mines, railways and ports generate 2.4 terabytes of data a minute, and its new, state-of-the-art processing centre in Brisbane is working towards processing this valuable information. The company recently reported that its new processing centre in Brisbane has already reduced the company's costs by US $80 million

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