Make Your Things Smart and Connected

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.NET Gadgeteer & Gravicode

About Me

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Founder of
PT Gravicode Multinovative Plexindo

Initiator of Gadgeteer Indonesia
https://www.facebook.com/netgadgeteerindonesia

Contributor in Makers.ID
http://makers.id

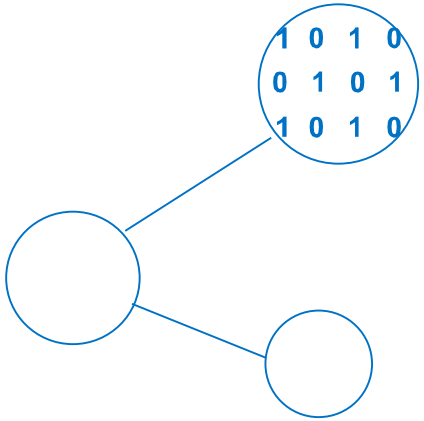
Agenda

10:30	11:15	**Module 1**: Presentation
11:15	12:00	**Module 2**: Demo Time !!

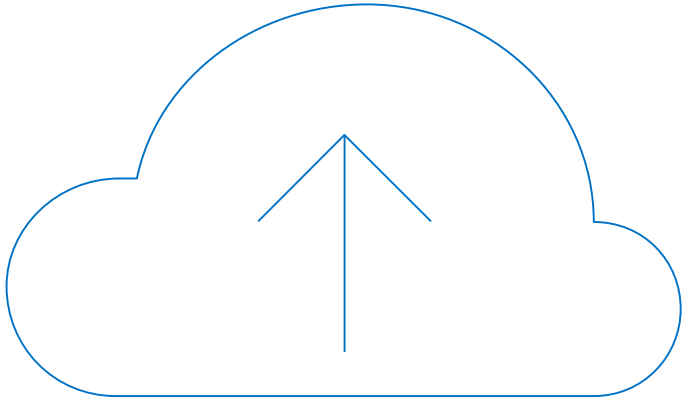
Topics

- What is the Internet of Things?
- Taking advantage of IoT
- Make your things connected
- Make your things smart
- How to get started

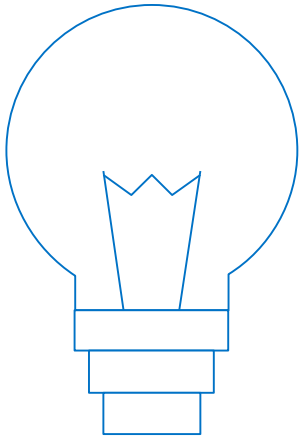
Three major trends converging



Data



Cloud



Intelligence

Tech Trends : What's next ?

- **80's** Computer – IBM (Faster Processing)
- **90's** Software – Microsoft (Productivity)
- **00's** Web – Google (Information Retrieval)
- **10's** Mobile – Apple (App Store)
- **20's** IoT - ?

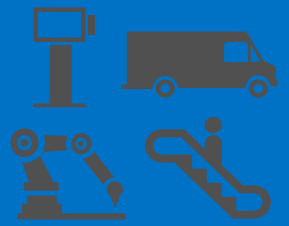
What is the Internet of Things?

Internet of Things

"network-connected devices with embedded processing power…"

Internet of Things

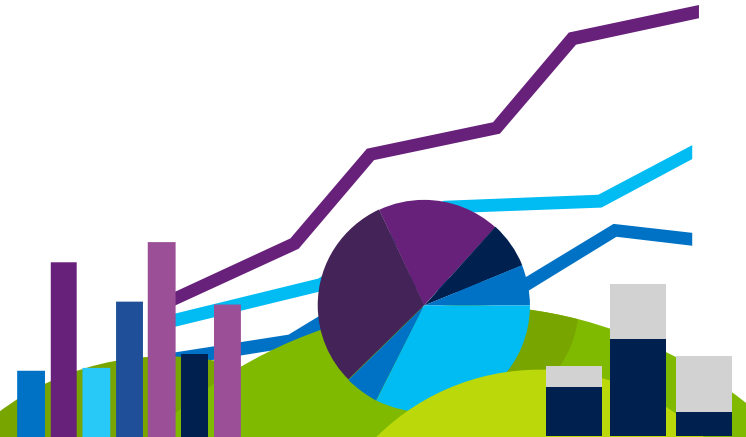
Things



Connectivity

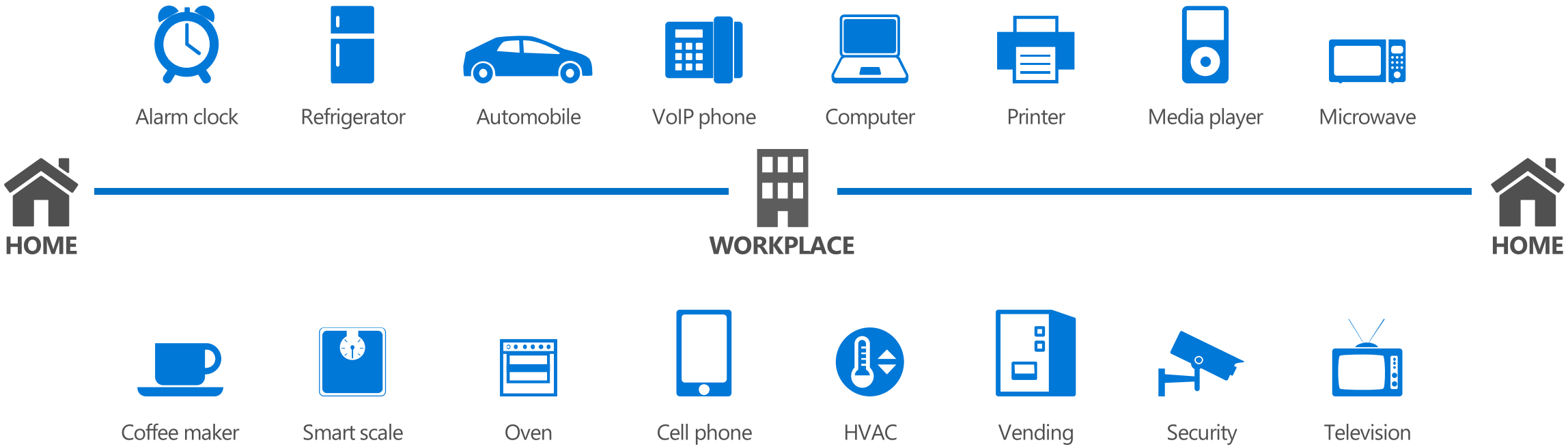
Data

Analytics



*Microsoft's definition of IoT

IoT 2010


Alarm clock
Refrigerator
Automobile
VoIP phone
Computer
Printer
Media player
Microwave
HOME
WORKPLACE
HOME
Coffee maker
Smart scale
Oven
Cell phone
HVAC
Vending
Security
Television

IoT 2016

Medication adherence

Health monitoring

Pet tracking

Behavior modification

Object tracking

Child and elder monitoring

Sports and fitness

Smart lighting

Indoor navigation

Beacons and proximity

Trip tracking and car health

HOME — **COMMUTE** — **WORKPLACE** — **COMMUTE** — **HOME**

Smart appliances

Food and nutrition tracking

Identity

Office equipment

Smart vending machines

Bike ride stats and protection

Sleep tracking

Air conditioning and temperature control

Environmental sensors

Information capture

Control

Home security

Home automation

Leak detection

Garden, lawn and plant care

New devices and sensors

Entertainment systems

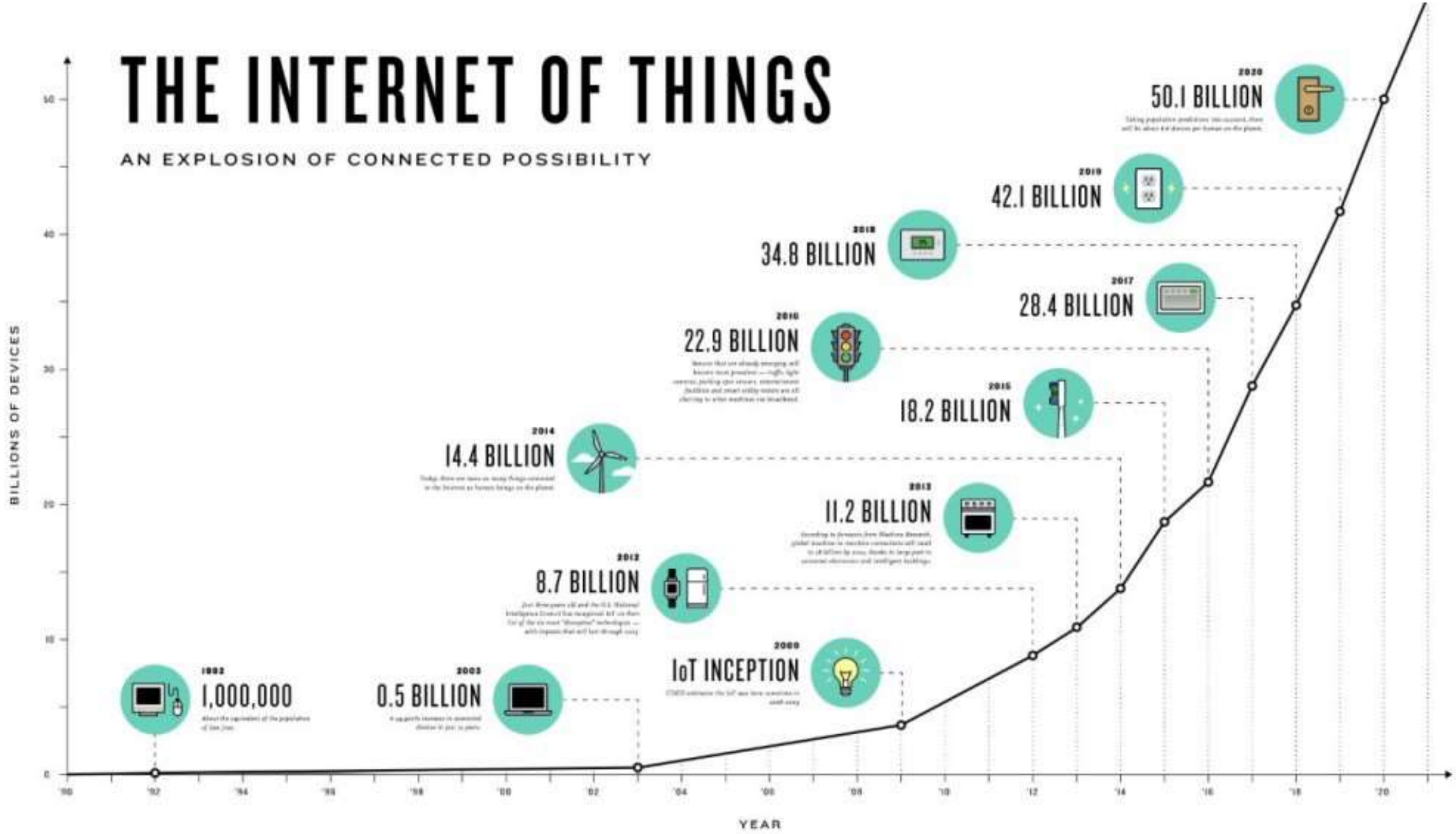
$7.2 TRILLION

worldwide market for IoT solutions by 2020

IDC: Worldwide and Regional Internet of Things (IoT) 2014–2020 Forecast

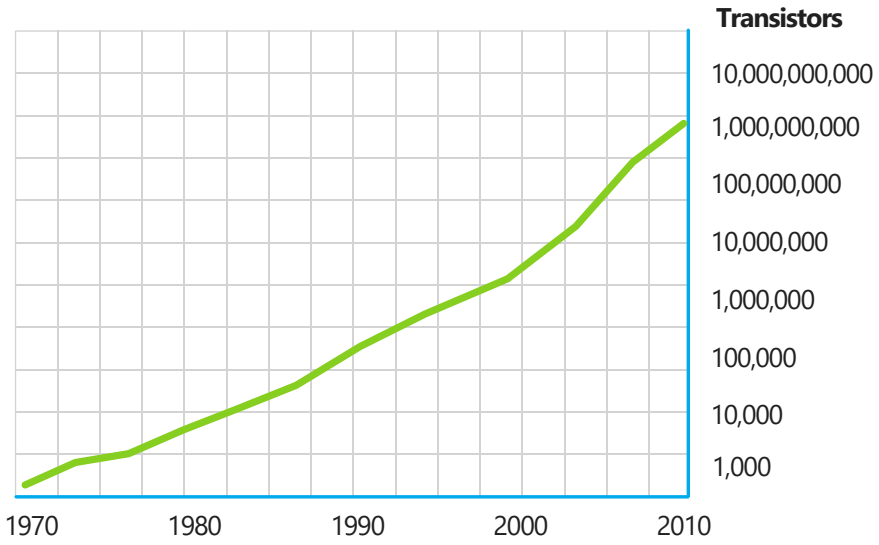
THE INTERNET OF THINGS

AN EXPLOSION OF CONNECTED POSSIBILITY

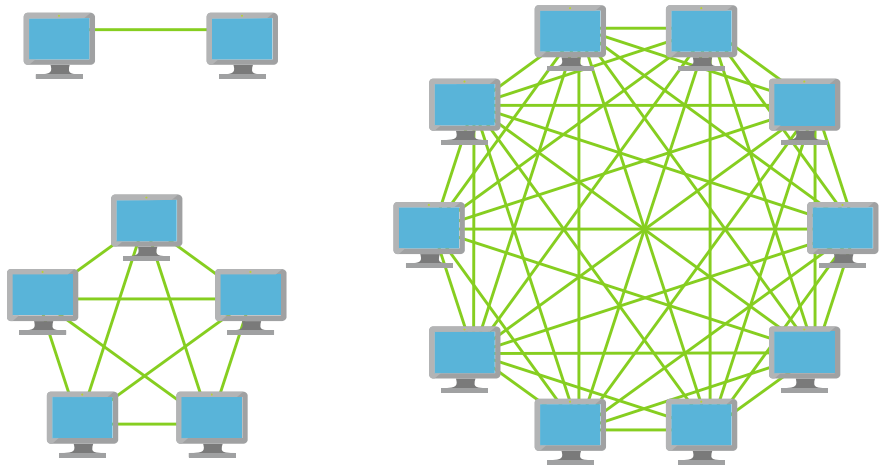


Disruptive Forces

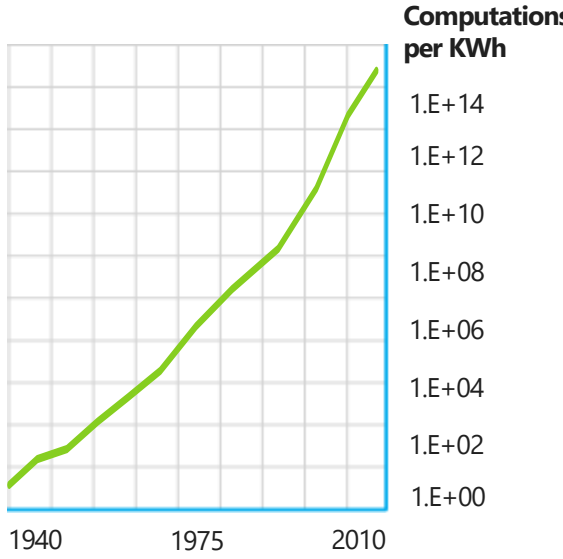
Moore's Law



Metcalf's Law

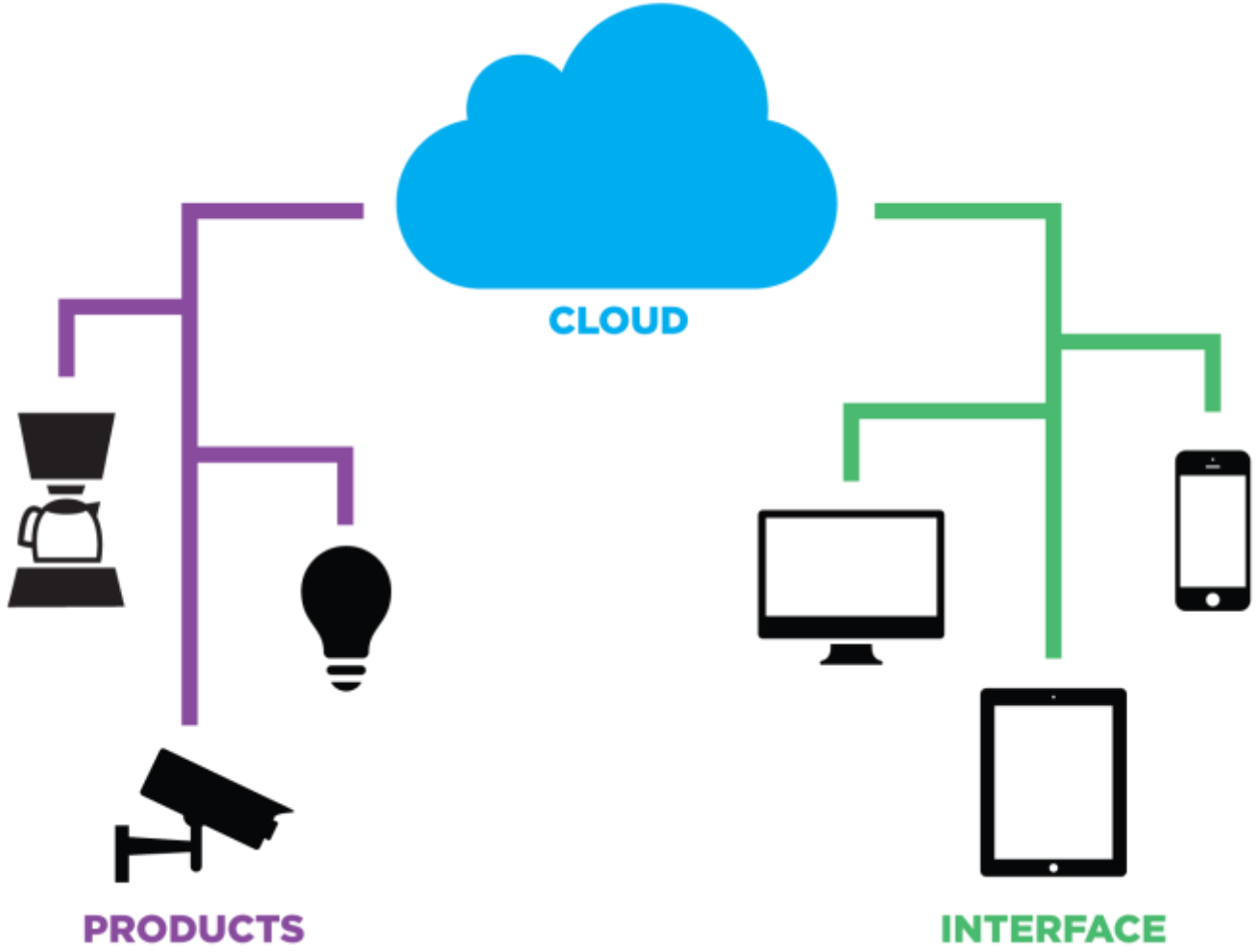


Koomey's Law

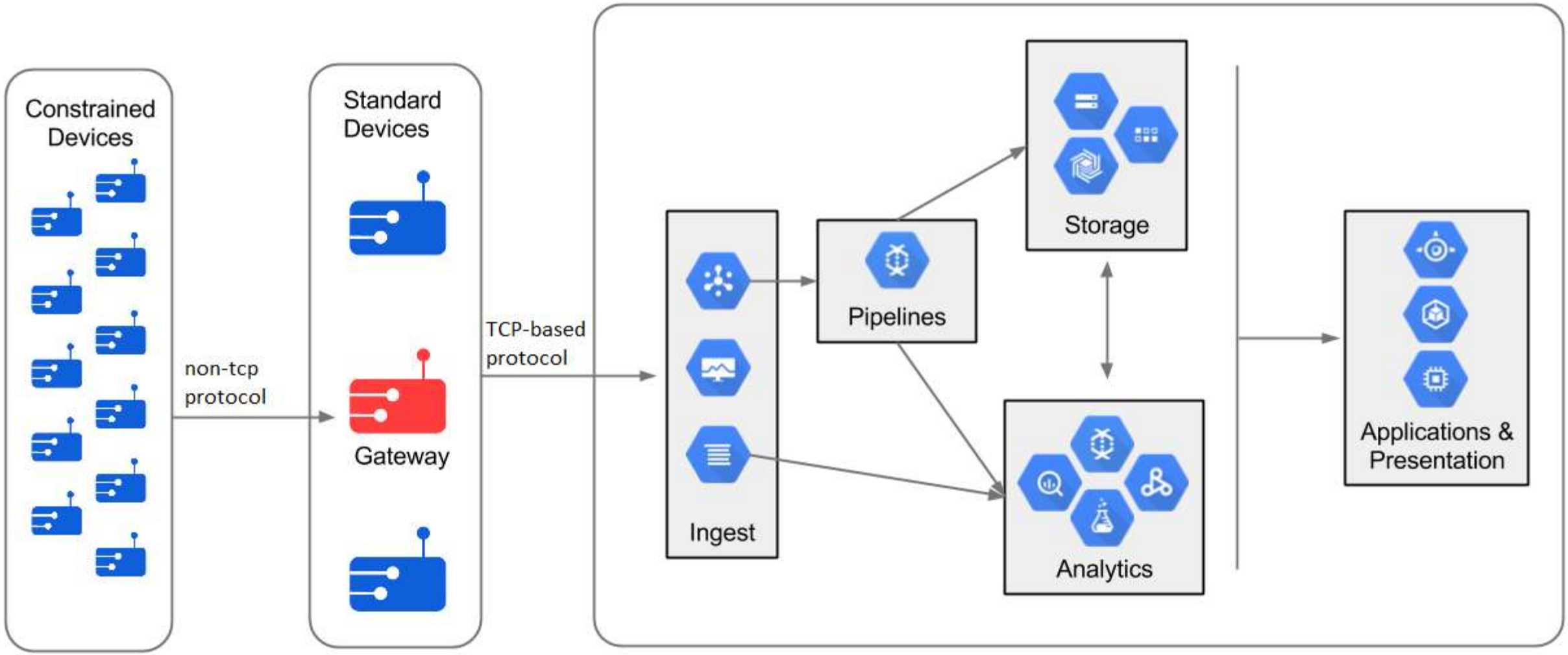


And more importantly:
what can you do by combining and analyzing signals from all of these IoT devices?

Common IoT Architecture



Common IoT Architecture



a Thing

Sensor / Actuator

Radio Transreceiver / Network Interface

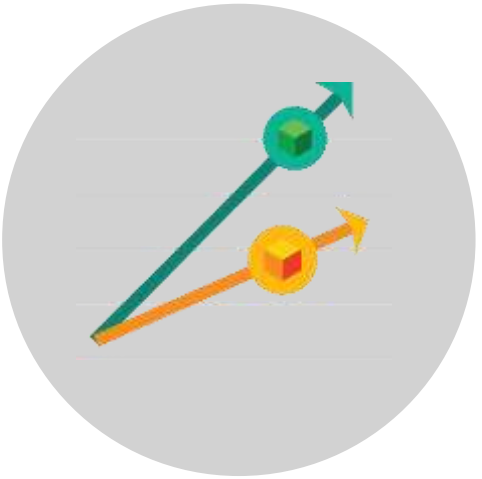
MCU / MPU

Energy Source

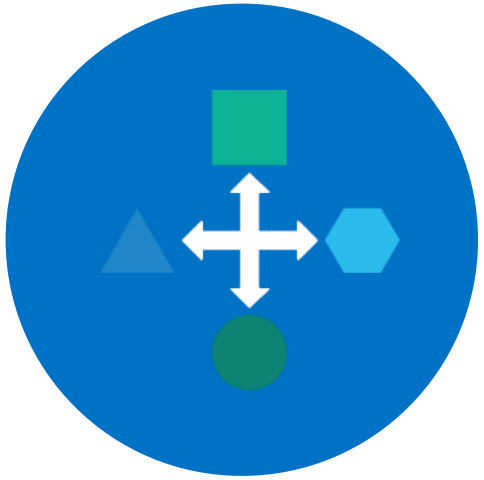
Taking advantage of IoT

Business leadership imperatives

Reduce
costs and
inefficiencies



Increase
revenue with
existing assets

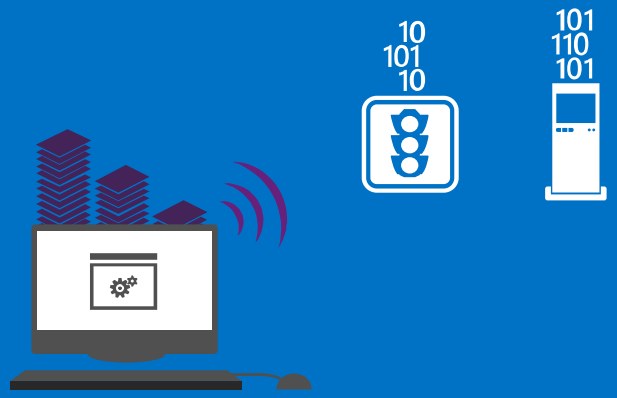


Create
new business
models

Make IoT real to the business

Improve efficiency

Decrease costs through asset monitoring



Enable innovation

Increase revenue through product improvement
Ex. Feature Optimization

Transform your business

Create additional revenue streams by offering new services
Ex. Predictive Maintenance

New monetization opportunities

Reach new customers and access untapped markets by expanding service offerings

Enable better post-sale services and unlock new customer service scenarios

Develop new business models based to disrupt existing markets

Kaiser Permanente	Expects to **reduce outpatient visits** for routine checks and reporting of vital signs Provides **better insight** into patient data, improving the **efficiency** and **workflow** for nurses, dieticians, and other staff

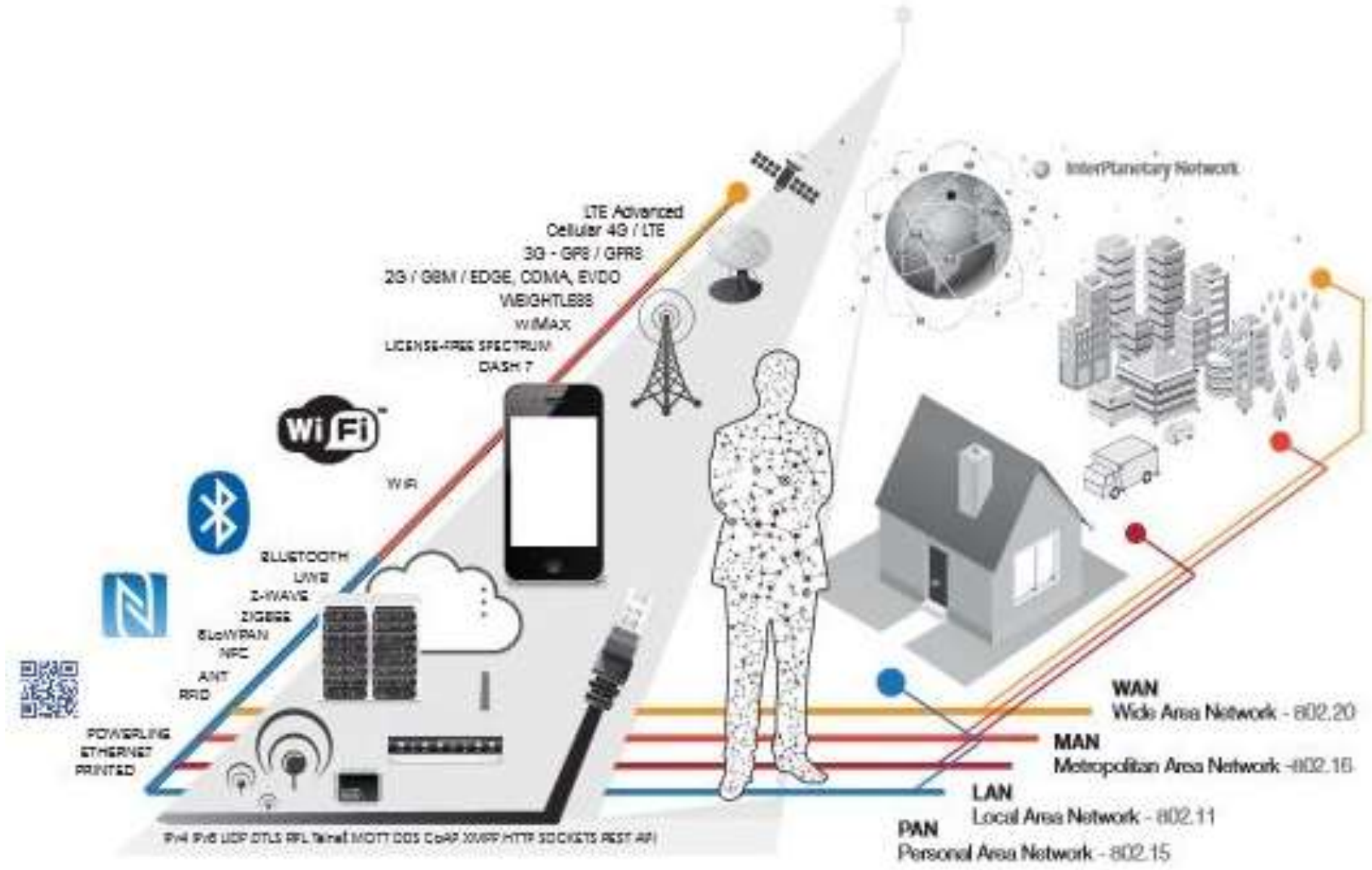
Prototyping a new remote patient-monitoring service with the potential to improve patient comfort and care, reduce hospital admissions and re-admissions, and drive great efficiencies.

KAISER PERMANENTE®

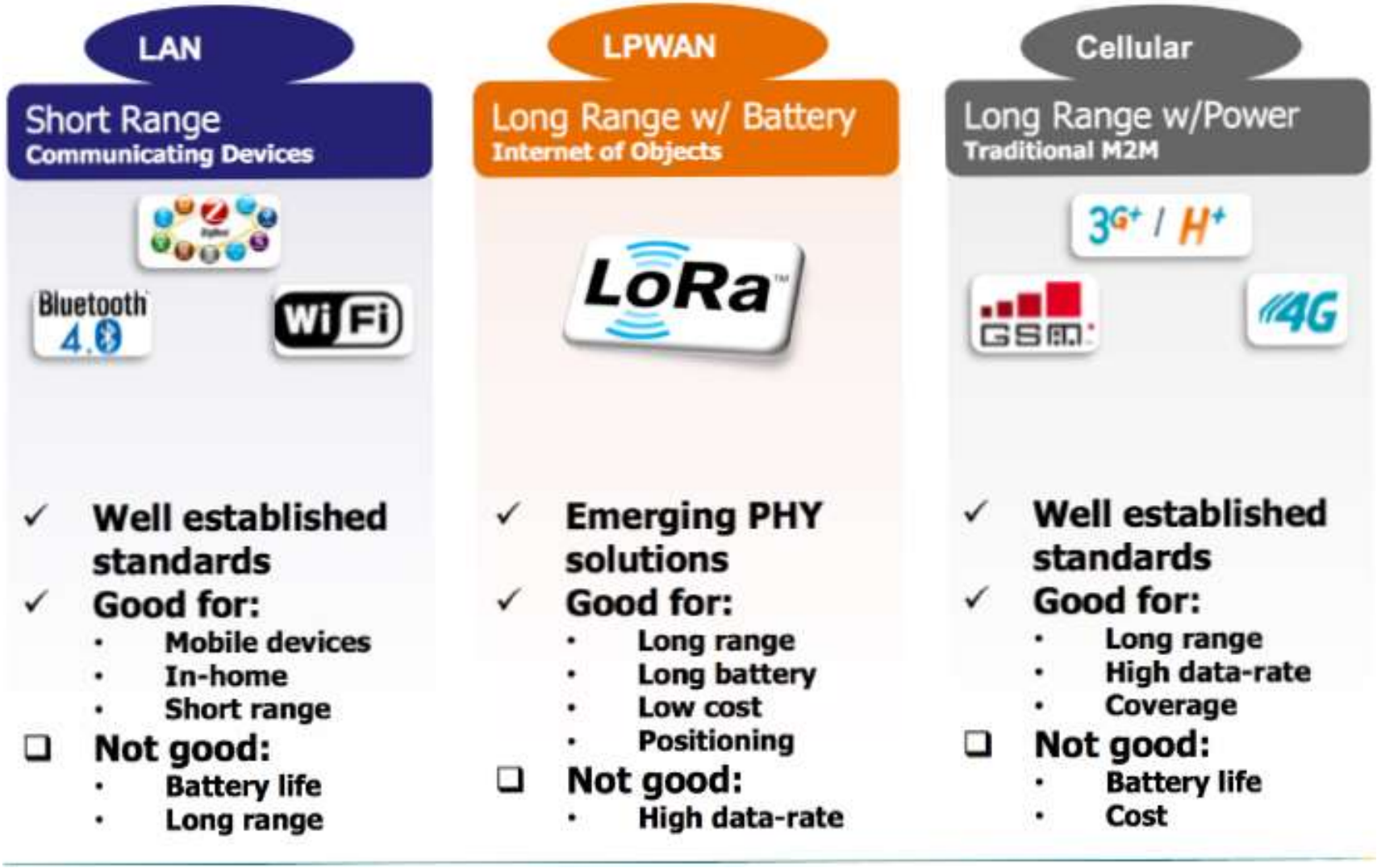
Create the Internet of Your Things

Make your things connected

How to connect things ?



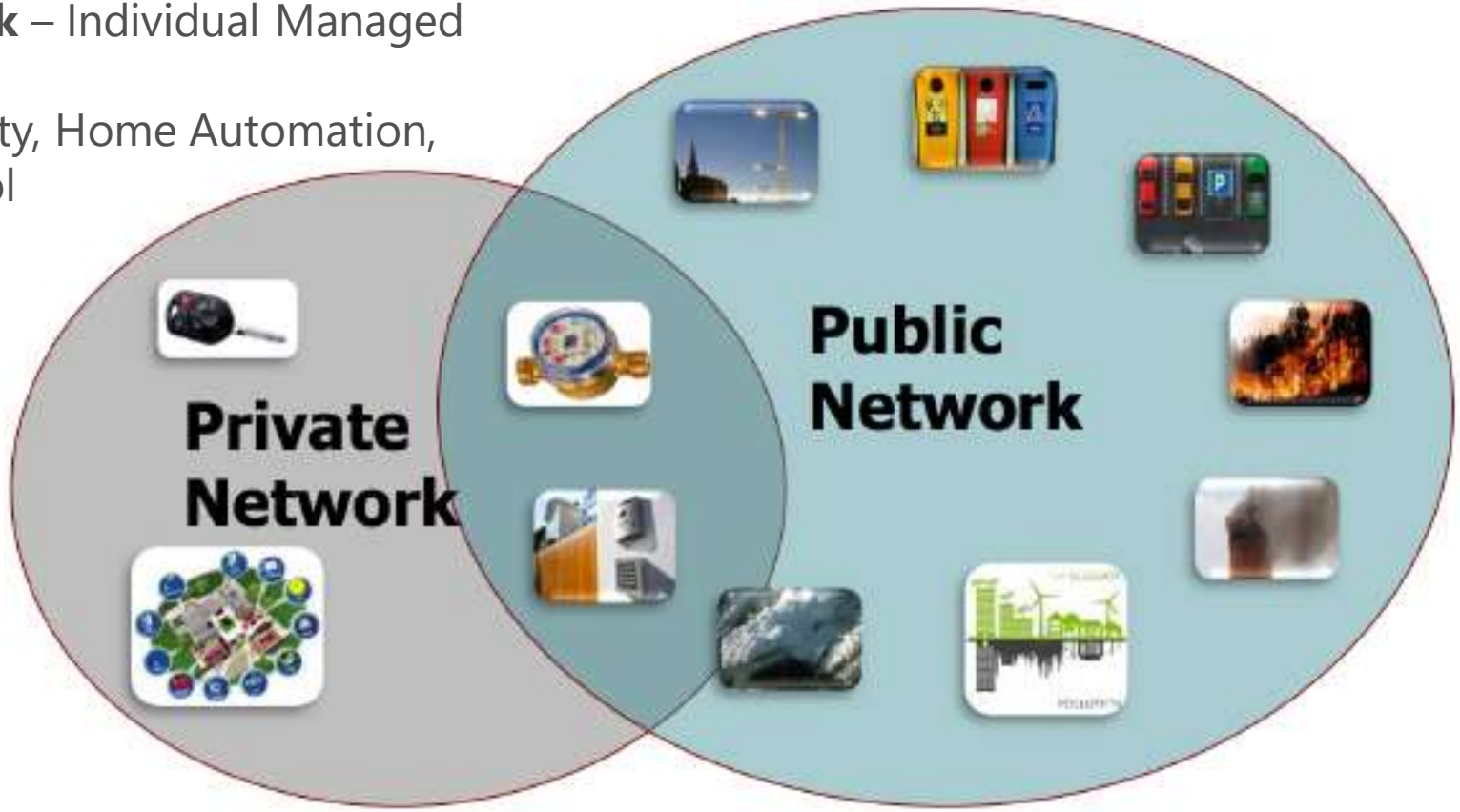
Communication tech segments trade-offs



Private vs public network

Public Network – Telecom/Operator Managed Networks
Smart City, BMKG, Crisis Center, Public Parking, etc

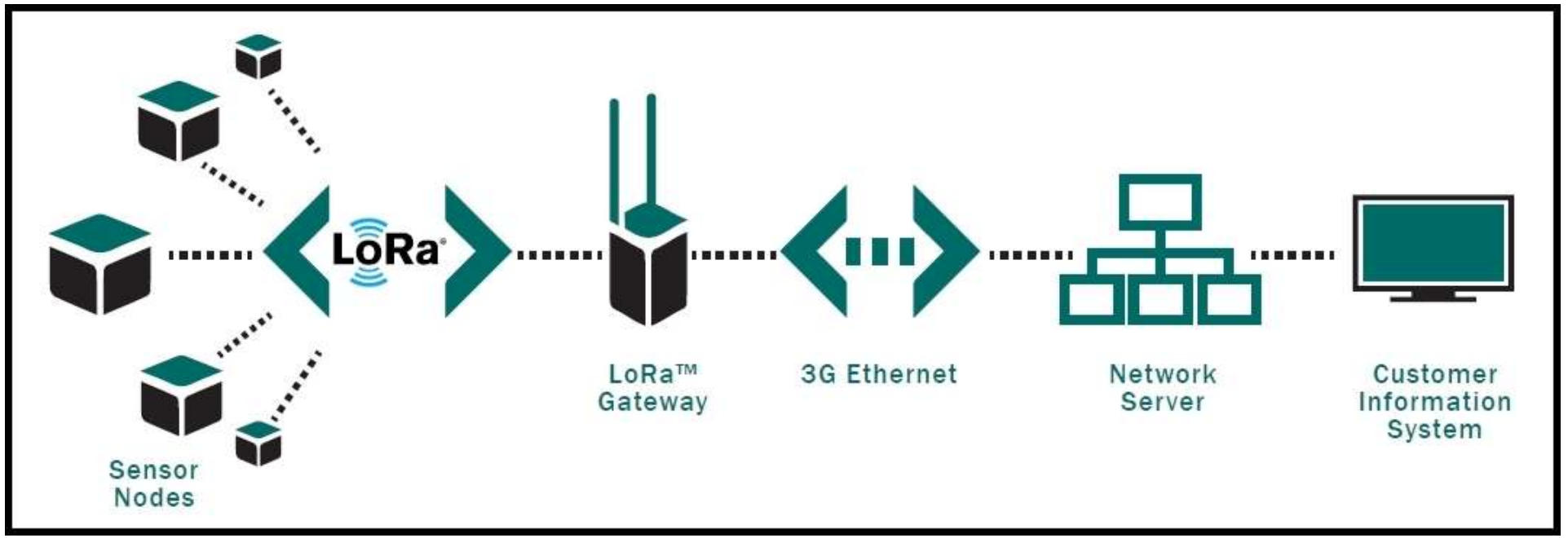
Private Network – Individual Managed Network
Metering, Security, Home Automation, Industrial Control



LoRa: low energy and long range

"LoRa stands for Long Range Radio. It is the wireless technology mainly targetted for M2M and IoT networks "

-quoted from http://www.rfwireless-world.com/



Communication Technology

pick the right tech for your project

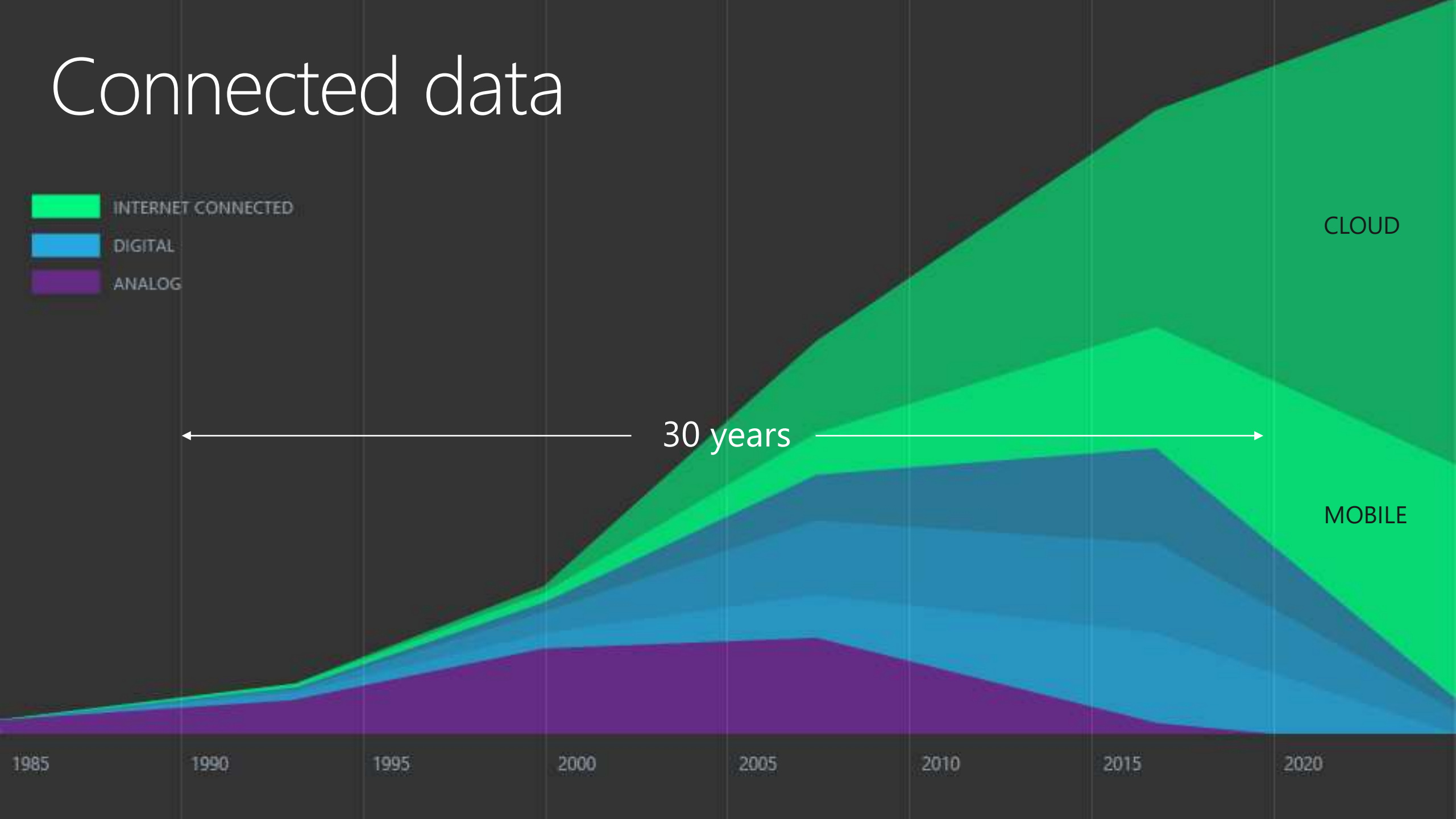
Factors	WIFI	BLUETOOTH	LORA/SIGFOX	MESH NETWORK	Cellular
USE CASE	• Barcode scanners in factories • Connected machines	• Light control • Proximity monitors • Disposable asset trackers (Active RFID)	• Automatic meter reading • GPS tracking devices (in a defined area)	• HVAC sensing and control • Lighting control (high density)	• GPS telematic trackers • Smart meters • Connected cars
BENEFIT	• Near ubiquitous network coverage in enterprises • Inexpensive chipsets and modules • Can be power efficient, if application and polling rate is designed well	• Low Cost: disposable or competitive product lines. • High datarates • Long battery life	• Power efficient • Inexpensive chipsets • Low certification costs	• Resilient physical system architecture • Modification or expansion can happen without system disruption • Good power budget if designed correctly	Ubiquitous network coverage
CONSIDERATIONS	• Friction for 3rd party devices joining WiFi networks • Provisioning of credentials s difficult	• Very short range • Requires key coordination at both endpoint and access Point • Needs access point (phone or application specific device)	• Low data throughput • Networks do not exist everywhere • Quality of Service not guaranteed in unlicensed spectrum. • Current provisioning and key management schemes make large scale manufacturing difficult.	• Short range • Link performance problems • Deployment difficult • Interoperability is often not possible due to configuration differences and key management	• Recurring cost • Expensive chipsets • Short battery life • Expensive certification
Product Eg.			LoRaWAN, SigFox, Ingenu	Zigbee, Z-wave,6LoWPAN	

Make your things smart

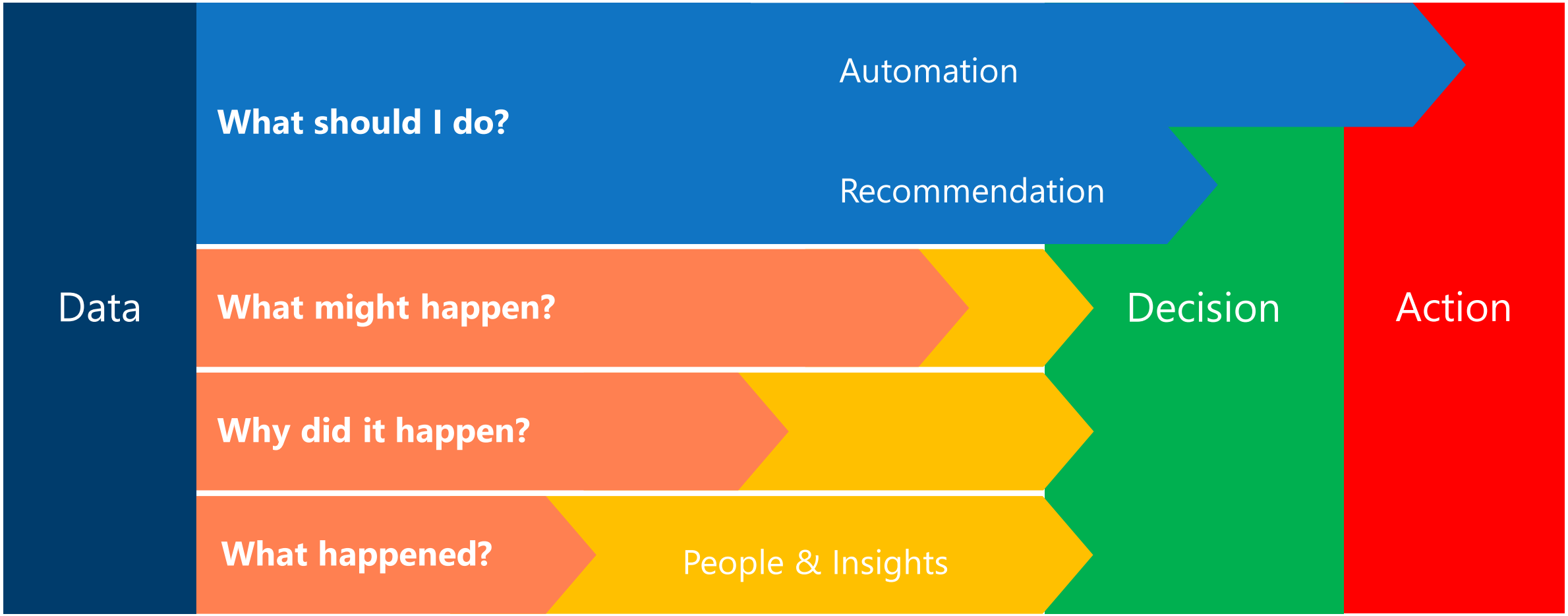
AI

Process your data with intelligence

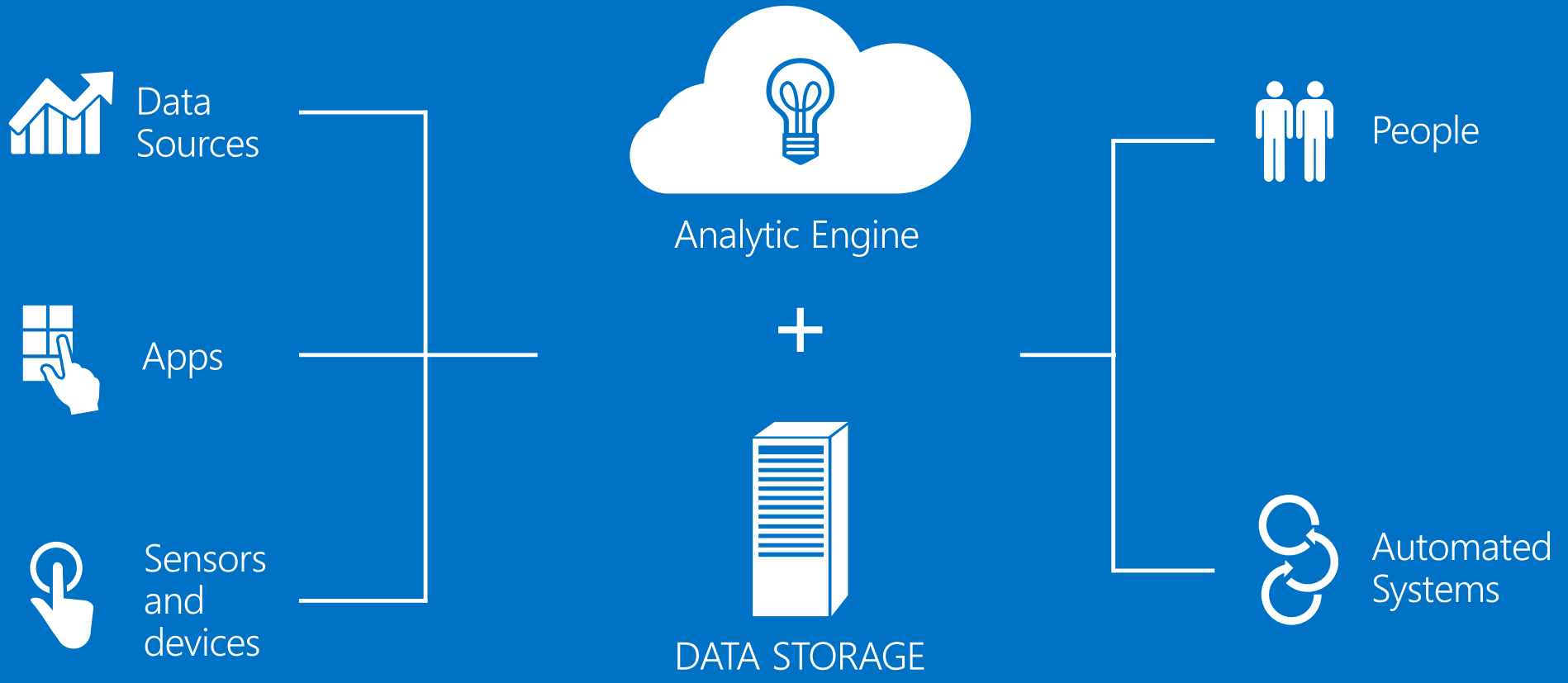
Connected data



Big Data + Predictive Analytics = Business Value



From data to decisions to action



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ARMY EXAMINER
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Calif.

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D. Fabian, Esq.
208 Columbia Street
Portland
ORE.

W.H.Moore, Esq.
Brockport,
New York.

Mrs. P Brown
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S2K 2S2
SASKATOON
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SASK
HELP RETAR
CHILDRE
AIDEZ L
ENFANT AP
CANADA
KAULBACH ISLAND
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KAULBACH ISLAND
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Blue Jay
Kingfisher
INBOUND
P.K.I., Ltd,
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Chester, N.S.,
Canada

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1	1	5	4	3
7	5	3	5	3
5	5	9	0	6
3	5	2	0	0

Training examples

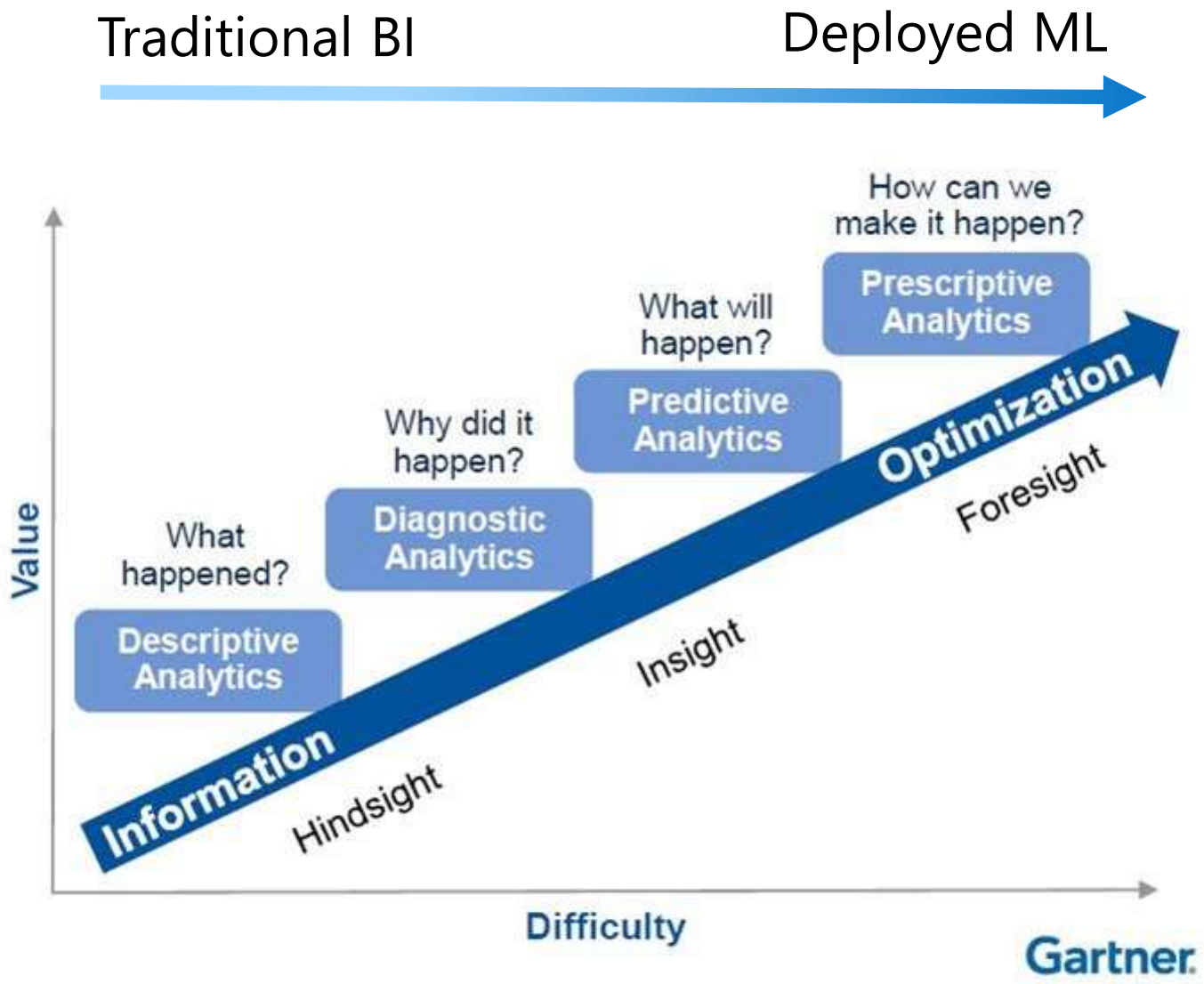
Training labels

Accurate digit classifier

Machine learning system

2

Types of Analytics

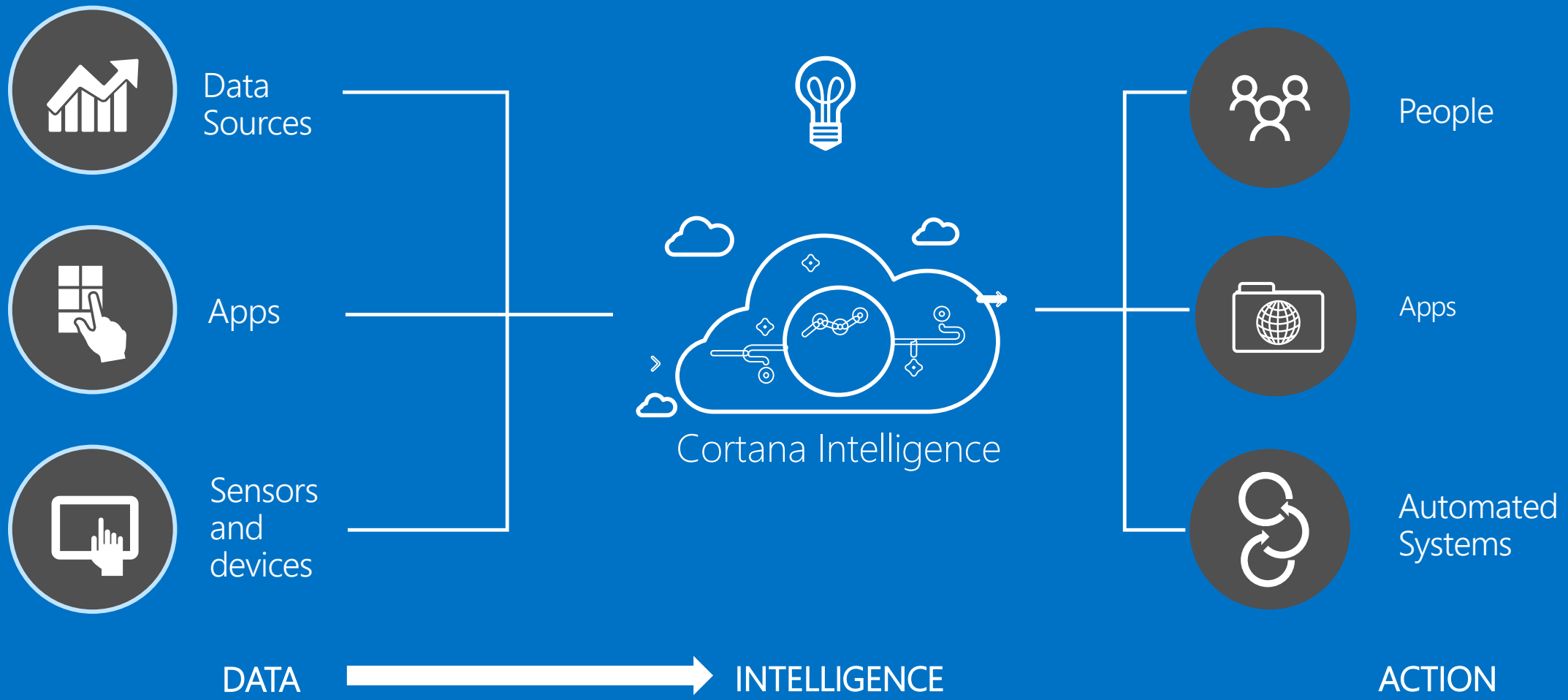


Cloud Analytic Providers

AND MANY MORE..

Microsoft Cortana Intelligence Suite

Transform data into intelligent action in the cloud



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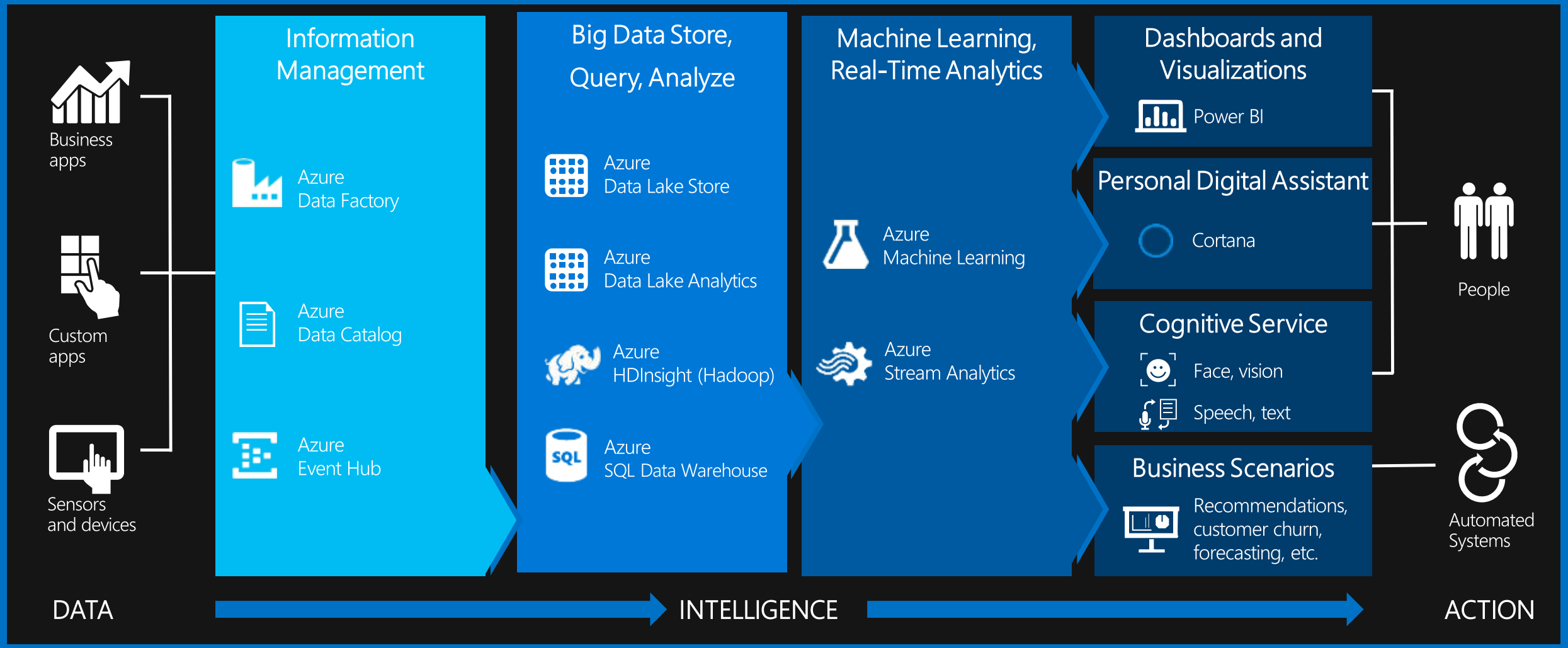


Cognitive Services

Vision	Speech	Language	Knowledge	Search
Computer vision	Speaker recognition	Text analysis	Academic knowledge	Bing search API
Face	Speech	Bing speller	Entity linking services	Bing image search API
Emotion	Custom Recognition	Web language model	Knowledge exploration service	Bing video search API
Video		Linguistic analysis	Recommendations	Bing news search API
		Language understanding		Bing auto suggestions API
		Translator		

Cognitive APIs

http://gallery.cortananalytics.com

Face APIs

Microsoft's state-of-the-art cloud-based face algorithms to detect and recognize human faces in images.

Computer Vision APIs

Image processing algorithms designed to return information based on visual content and generate your ideal thumbnail.

Text Analytics

Bring your unstructured text, and use this API to perform sentiment analysis and key phrase extraction.

Speech APIs

Easily include speech driven actions into your applications using algorithms to process spoken language.

Scenarios

Government	Fraud Detection	Threat Detection	Cyber Security	Social Graph Analysis for Suspicious Activity	Energy Network Management
Financial Services	Fraud Detection	Credit Risk Scoring	High Speed Arbitrage	Abnormal Trading	Customer Segmentation
Health & Life Sciences	Fraud Detection	Campaign and Sales Program	Patient Care Quality and program analysis	Drug discovery and development	Disease detection
Consumer	Demand Forecasting	Basket Analysis	Campaign Management	Supply Management	Event based targeting

More scenarios

Web Scale Use Cases	Clickstream Segmentation & recommendation	Ad targeting/Selection, Forecasting & optimization	Click Fraud Detection And Prevention	Social Graph Analysis for Risk Management/Marketing	Customer Segmentation
Telecommunications	Pricing Optimizations	Customer Churn Management	CDR Analysis	Network Performance Optimization	User Behavior Analysis
Energy Industry	Energy Trading	Risk Management	Asset Management	Smart Grid Management	Power Generation Management
Legal Discovery	ESI Processing	Collaborative Discovery	Social graph analysis		

How to get started

Dev Skills

Programming Languages for IoT

Thing side

Backend side

Mobile side

Development Platform

Platforms for IoT

Espruino

Particle

TEENSY

Sming

and many more…

Development Boards

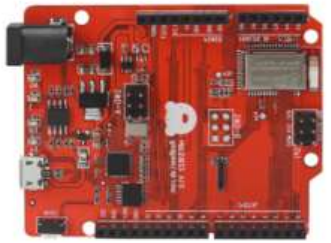
Development Boards

Arduino

Arduino 101

Indonesia-made
Bluino

ESP8266

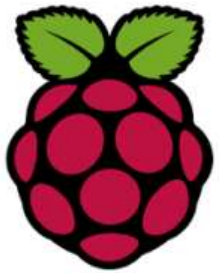


nRF BLE

Particle.io
Photon, Electron

Espruino

Nucleo
mbed



Raspberry Pi

.NET Gadgeteer

More : http://www.postscapes.com/internet-of-things-hardware/

Special Mention

DycodeX's ESPectro Core

32-bit RISC CPU: Tensilica Xtensa LX106 bekerja di 80 MHz*

64 KiB untuk penyimpanan instruksi RAM, 96 KiB untuk data RAM

IEEE 802.11 b/g/n Wi-Fi

16 GPIO pin

SPI, I^2C,I^2S, UART

1 10-bit ADC

Built-in USB to TTL

Auto-flashing untuk upload sketch atau firmware

Reset, flash button

Built-in programmable LED, button

RGB LED (WS2812 atau nama dagangnya Neopixel)

1 Konektor I2C Grove

Pin header yang dapat digunakan langsung ke I2C OLED display

Ekternal Power: LiPo battery menggunakan JST connector, atau bisa dengan 5V~6V konektor Micro USB

Tools & IDE

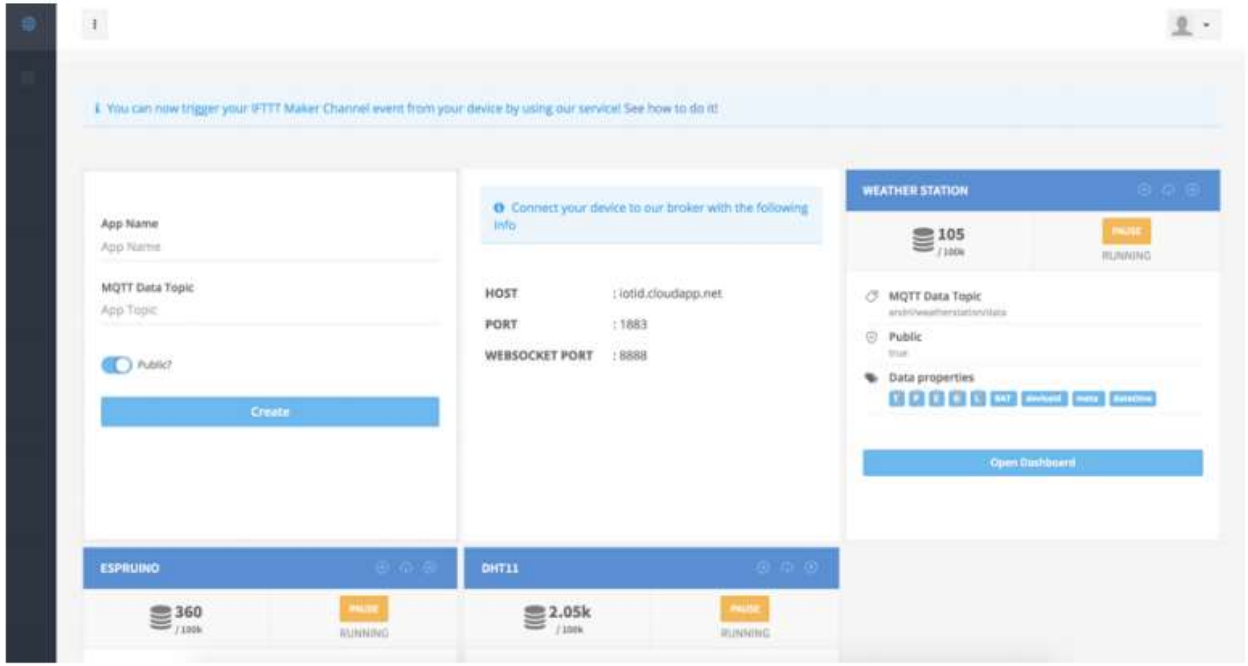
Tools & IDE for IoT

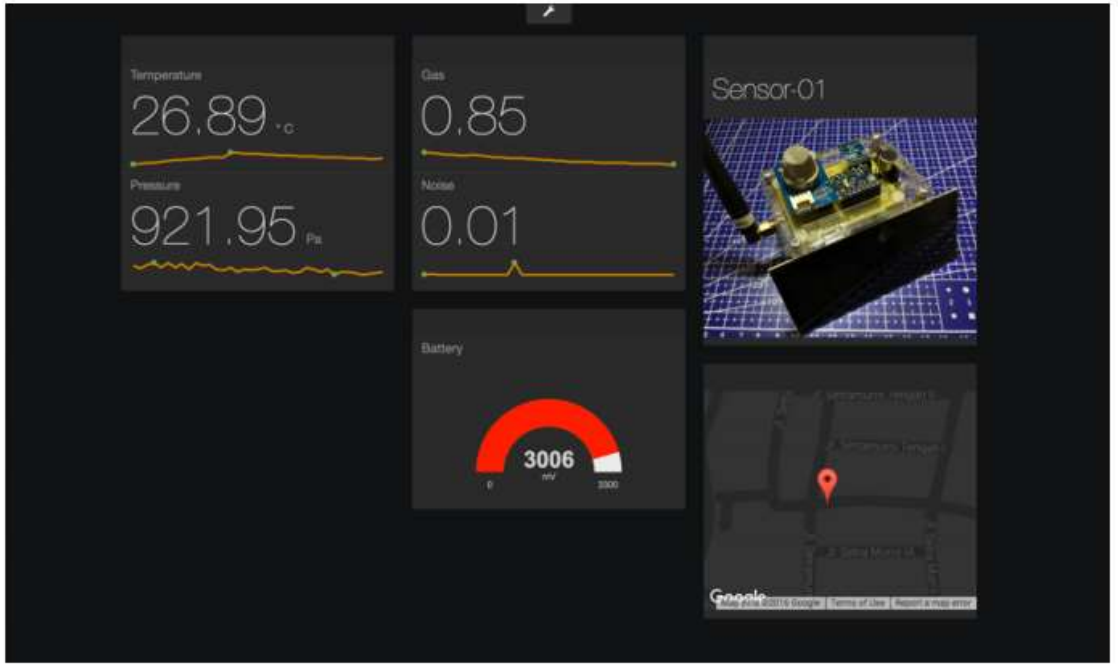
IoT Clouds

IoT Cloud Providers

and a whole lot more…

Special Mention



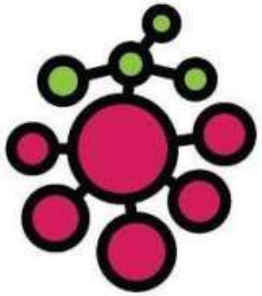


MA{K}ESTRO

Cloud.makestro.com

Operating System

OS for IoT



Communication Protocols

Protocols for IoT

Protocols Comparation

Protocol	*Transport*	*Messaging*	*2G,3G,4G (1000's)*	*LowPower and Lossy (1000's)*	*Compute Resources*	*Security*	*Success Stories*	*Arch*
Azure-IoT	AMPQ or Https/TCP	Rqst/Rspnse	Excellent	Good	10K-100Ks RAM Flash	High-Manditory	Weraables	Client-Server
CoAP	UDP	Rqst/Rspnse	Excellent	Excellent	10Ks/RAM Flash	Medium - Optional	Utility field area ntwks	Tree
Continua HDP	UDP	Pub/Subsrb Rqst/Rspnse	Fair	Fair	10Ks/RAM Flash	None	Medical	Star
DDS	UDP	Pub/Subsrb Rqst/Rspnse	Fair	Poor	100Ks/RAM Flash +++	High-Optional	Military, Industrial	Bus
DPWS	TCP		Good	Fair	100Ks/RAM Flash ++	High-Optional	Web Servers	Client Server
HTTP/ REST	TCP	Rqst/Rspnse	Excellent	Fair	10Ks/RAM Flash	Low-Optional	Smart Energy Phase 2	Client Server
MQTT & MQTT-SN/S	TCP	Pub/Subsrb Rqst/Rspnse	Excellent	Good	10Ks/RAM Flash	Medium - Optional	IoT Msging	Tree
SNMP	UDP	Rqst/Response	Excellent	Fair	10Ks/RAM Flash	High-Optional	Network Monitoring	Client-Server
Thread	UDP	Rqst/Rspnse	Excellent	Excellent	10Ks/RAM Flash	High-Manditory	Nest?	Mesh
UPnP	UDP	Pub/Subscrb Rqst/Rspnse	Excellent	Good	10Ks/RAM Flash	None	Consumer	P2P Client Server
XMPP	TCP	Pub/Subsrb Rqst/Rspnse	Excellent	Fair	10Ks/RAM Flash	High-Manditory	Rmt Mgmt White Gds	Client Server
ZeroMQ	UDP	Pub/Subscrb Rqst/Rspnse	Fair	Fair	10Ks/RAM Flash	High-Optional	CERN	P2P

Demo Time !!

Demo 1:
Create your own camera

Demo 2:
Create Game Arcade

Demo 3:
Remote Monitoring using LoRa

Demo 4:
Create Shell Based Operating Environment

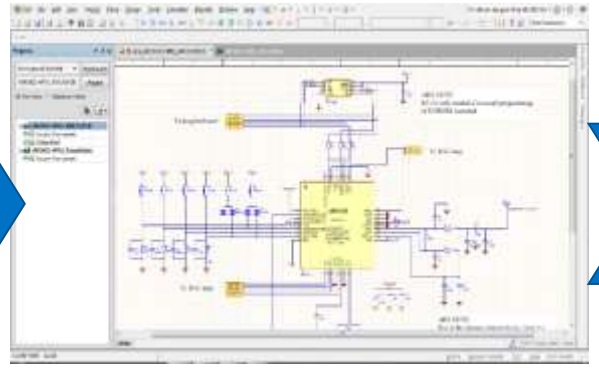
Demo 5:
Door Lock with **Face Recognition**

Demo 6:
Create your RC Car

Demo 7:
Create Smart Assistant

Prototype to production

Create your Prototype

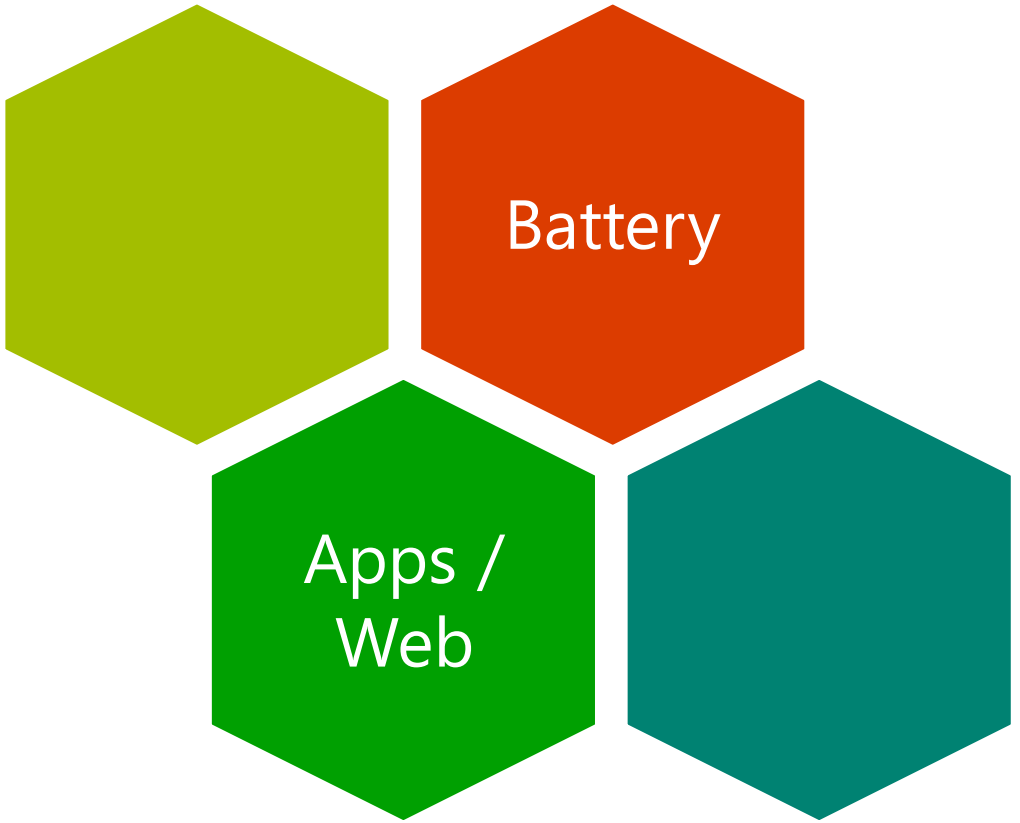


Design your own circuit with hardware consultant

Design your case

Send to Manufacture

BIG IoT Challenges

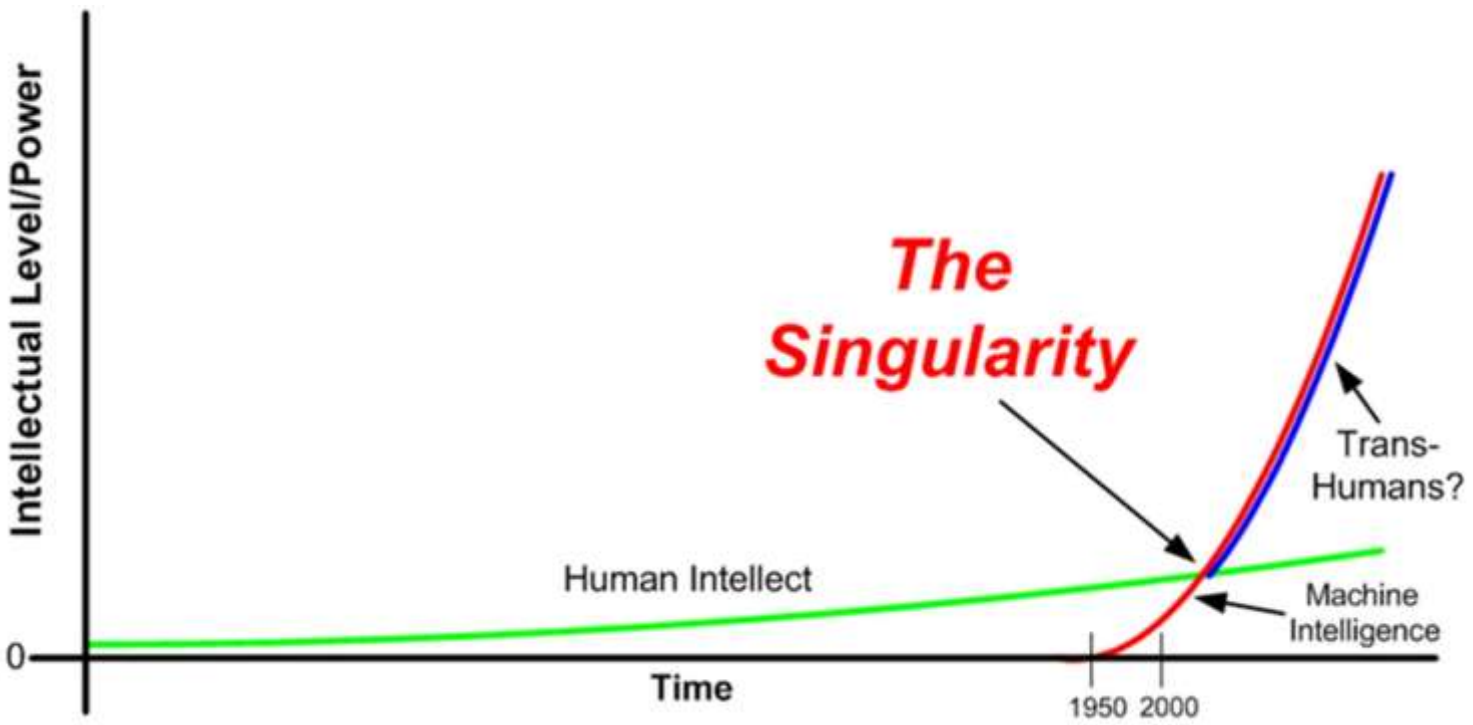


Technology Singularity

It's possible because…

2045

- Data Everywhere
- All Connected because of Web
- Well Organized Data and API
- Faster Processing



* https://en.wikipedia.org/wiki/Predictions_made_by_Ray_Kurzweil

Start Making Now

The Internet of Things starts with **your things**

- Build on the infrastructure you already have
- Create your own device, or add more devices to the ones you already own
- Get more from the data that already exists

Start realizing the potential of the Internet of **Your Things.**

THANK YOU

See you in another chapter…

Please visit our page:

https://www.facebook.com/netgadgeteerindonesia

And share your ideas and awesome ‘things’ to us…