

Internet of Things

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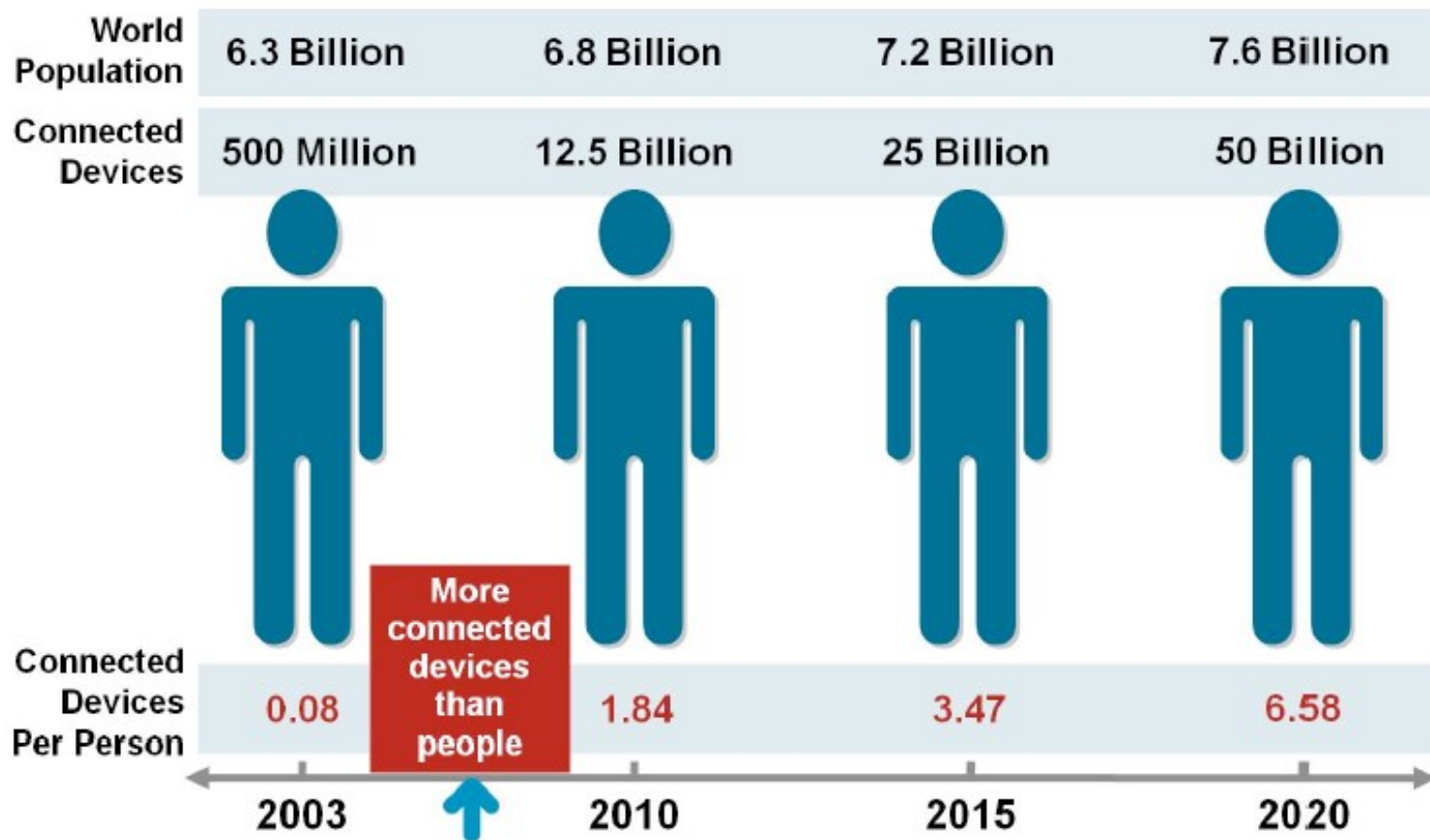
Internet of Things

IoT

A new era where
things can talk via
the Internet



50 Billion Connected Devices in 2020



+ Consumer Demand

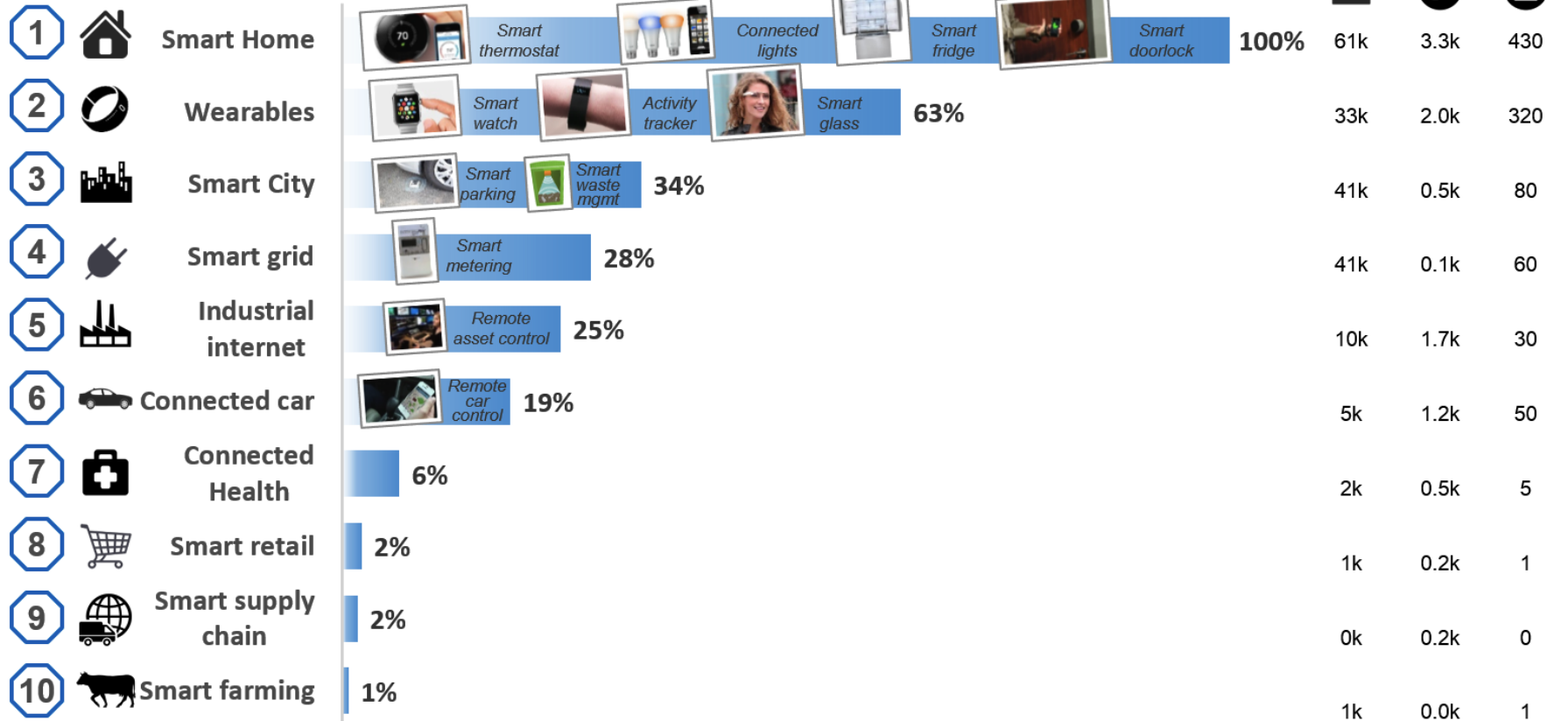


IoT Analytics – Quantifying the connected world

Applications

Overall popularity (and selected examples)

Scores



1. Monthly worldwide Google searches for the application 2. Monthly Tweets containing the application name and #IOT 3. Monthly LinkedIn Posts that include the application name. All metrics valid for Q4/2014.

Sources: Google, Twitter, LinkedIn, IoT Analytics



IoT will change the way we



Graphene Wristband for
Blood sugar monitor



Yale Lock
\$152

Amazon
Echo Dot, Echo
\$49, \$179



Samsung
Family Hub Fridge
\$5799



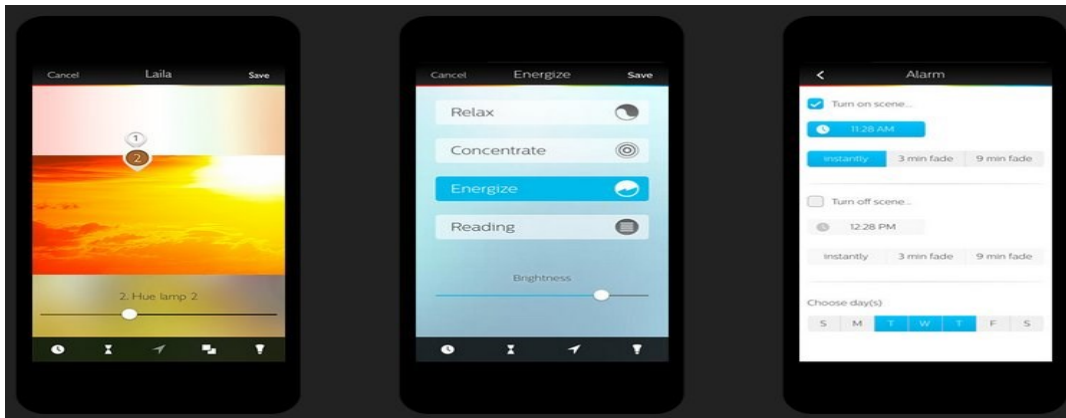
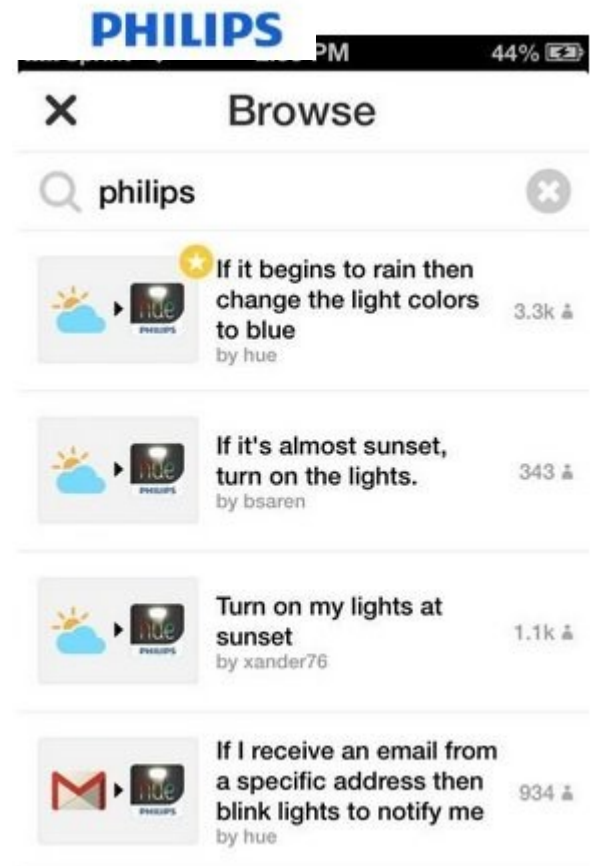
Dash Buttons
\$4.99



Nest
\$249



Tesla Model 3
\$35,000



+Temperature Control - Google Nest



Nest Learning Thermostat \$199



The Nest Learning Thermostat is the first thermostat to get ENERGY STAR certified. It learns what temperature you like and builds a schedule around yours. Since 2011, the Nest Thermostat has saved billions of kWh of energy in millions of homes worldwide.* And independent studies showed that it saved people an average of 10% to 12% on heating bills and 15% on cooling bills. So in under two years, [it can pay for itself](#).



“The Internet of Things (IoT) is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment.”

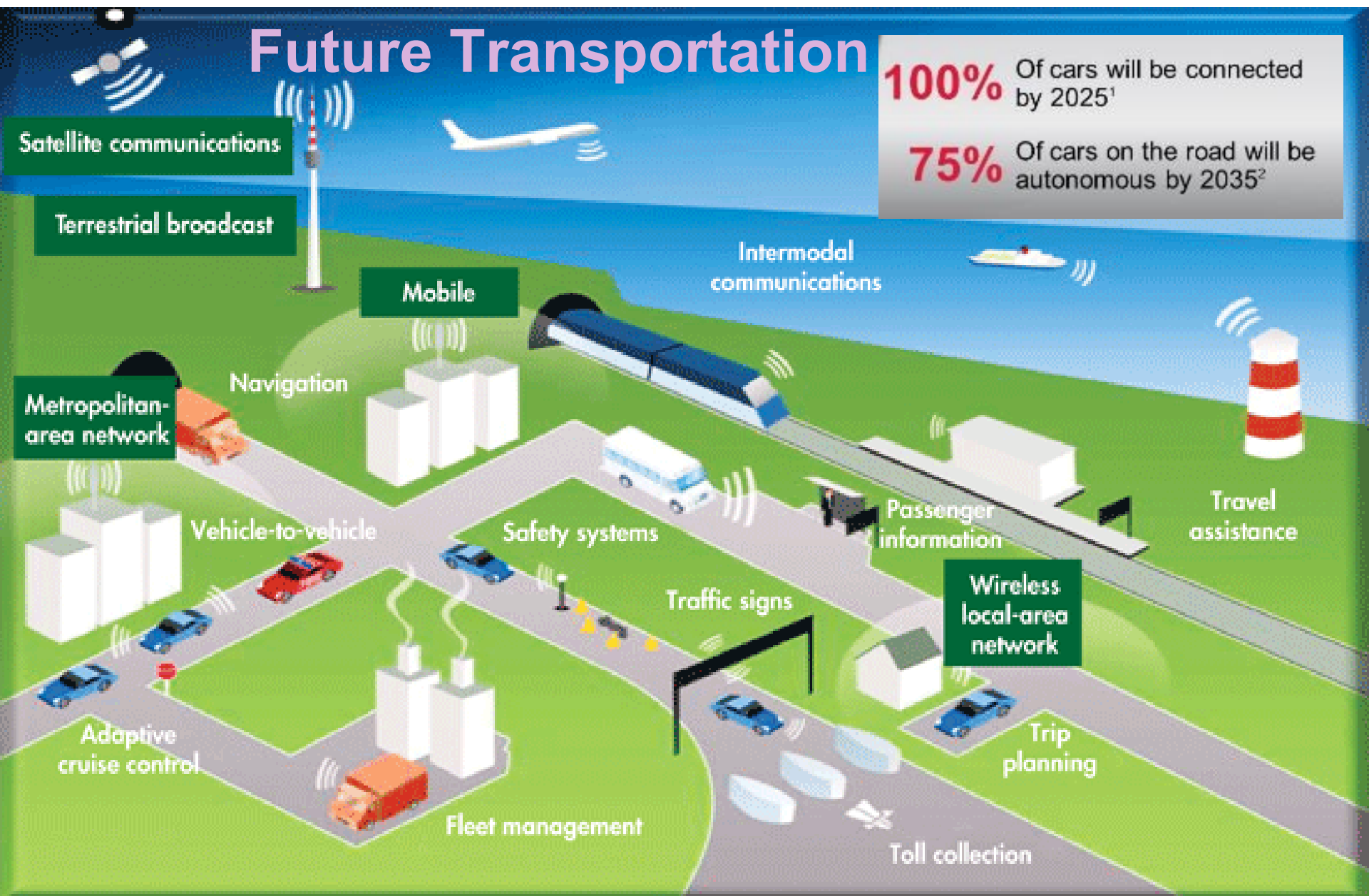
(Gartner:<http://www.gartner.com/it-glossary/internet-of-things/>)

“A global infrastructure for the information society, enabling advanced services by interconnecting {physical and virtual} things based on existing and evolving interoperable information and communication technologies.” (International Telecommunication Union – ITU)

"A dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual “things” have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network.". (IoT European Research Cluster – IERC)

Future Transportation

100% Of cars will be connected by 2025¹
75% Of cars on the road will be autonomous by 2035²



FUTURE FARMS

small and smart

SURVEY DRONES

Aerial drones survey the fields, mapping weeds, yield and soil variation. This enables precise application of inputs, mapping spread of pernicious weed blackgrass could increase Wheat yields by 2-5%.

FLEET OF AGRIBOTS

A herd of specialised agribots tend to crops, weeding, fertilising and harvesting. Robots capable of microdot application of fertiliser reduce fertiliser cost by 99.9%.

FARMING DATA

The farm generates vast quantities of rich and varied data. This is stored in the cloud. Data can be used as digital evidence reducing time spent completing grant applications or carrying out farm inspections saving on average £5,500 per farm per year.

TEXTING COWS

Sensors attached to livestock allowing monitoring of animal health and wellbeing. They can send texts to alert farmers when a cow goes into labour or develops infection increasing herd survival and increasing milk yields by 10%.

SMART TRACTORS

GPS controlled steering and optimised route planning reduces soil erosion, saving fuel costs by 10%.

Market Opportunity



Smart Home



Smart Health



Smart Farm



Smart Energy

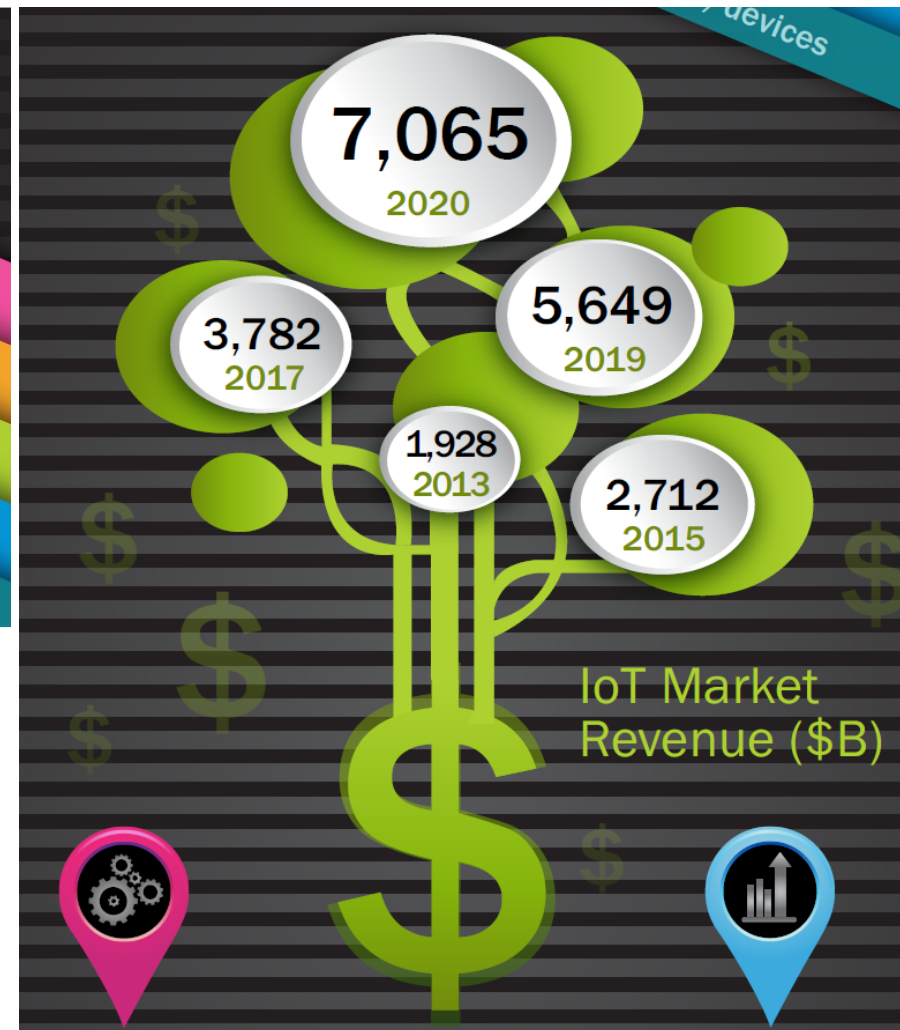


Smart Logistics



Smart Factory

IoT Market



IoT Benefits



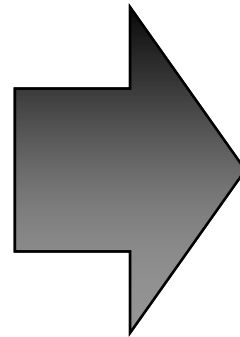
Reduce cost

Increase Efficiency

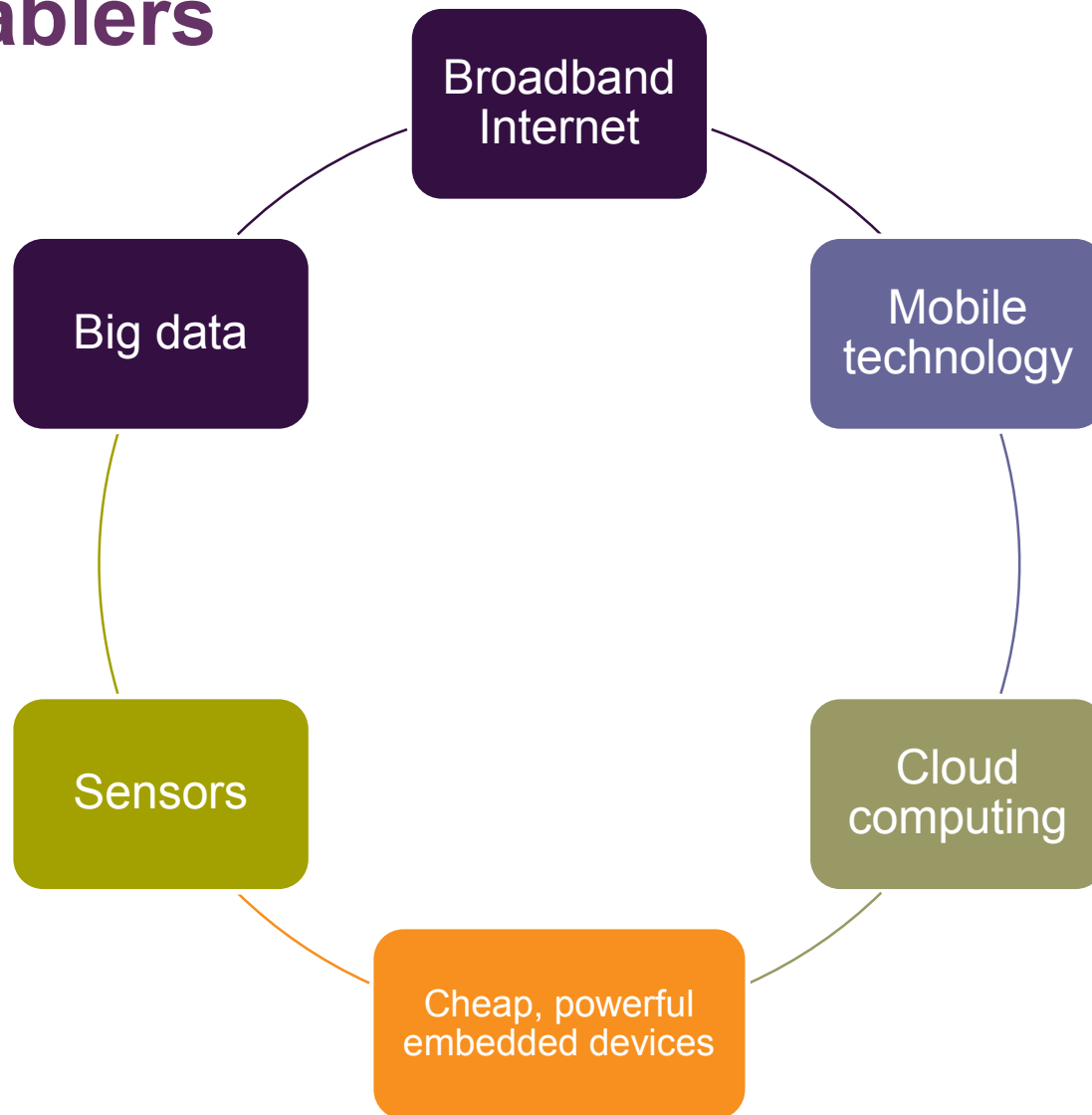


Value-added products

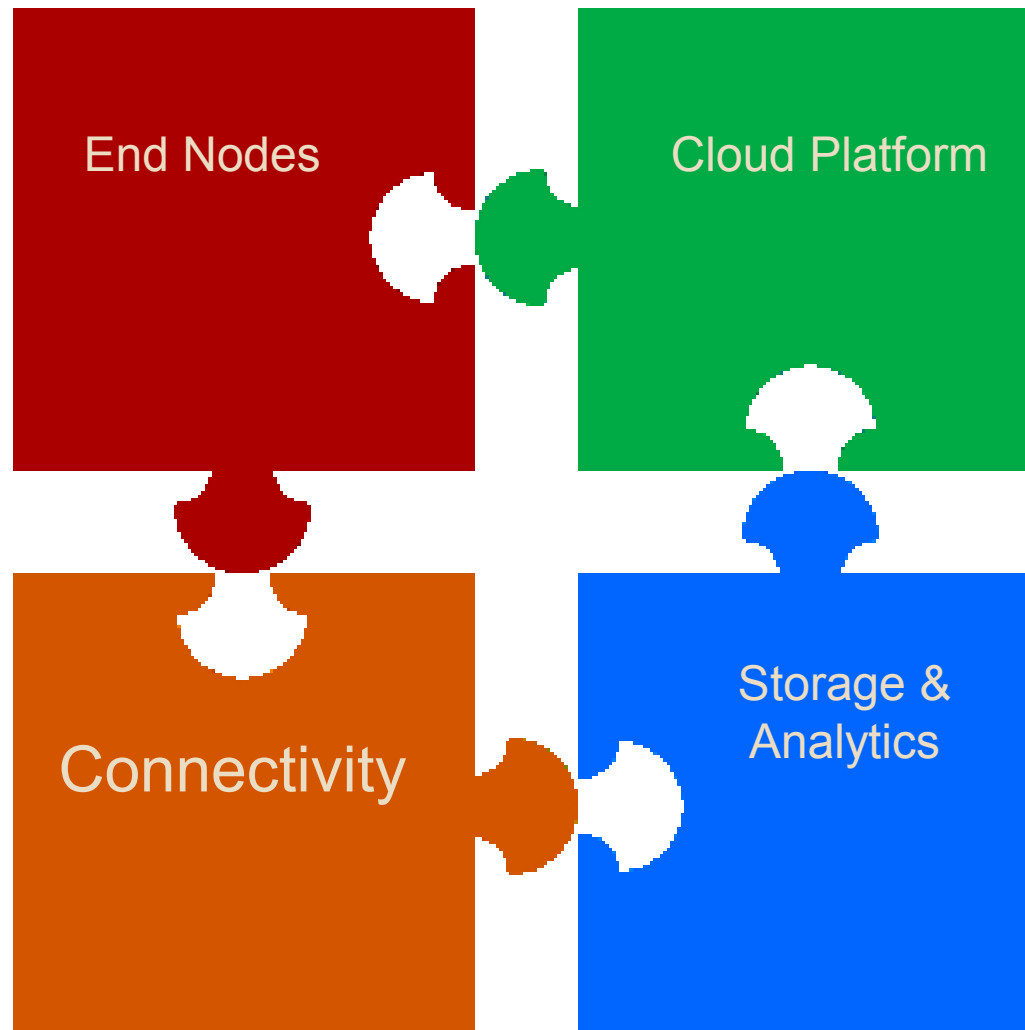
Innovative services



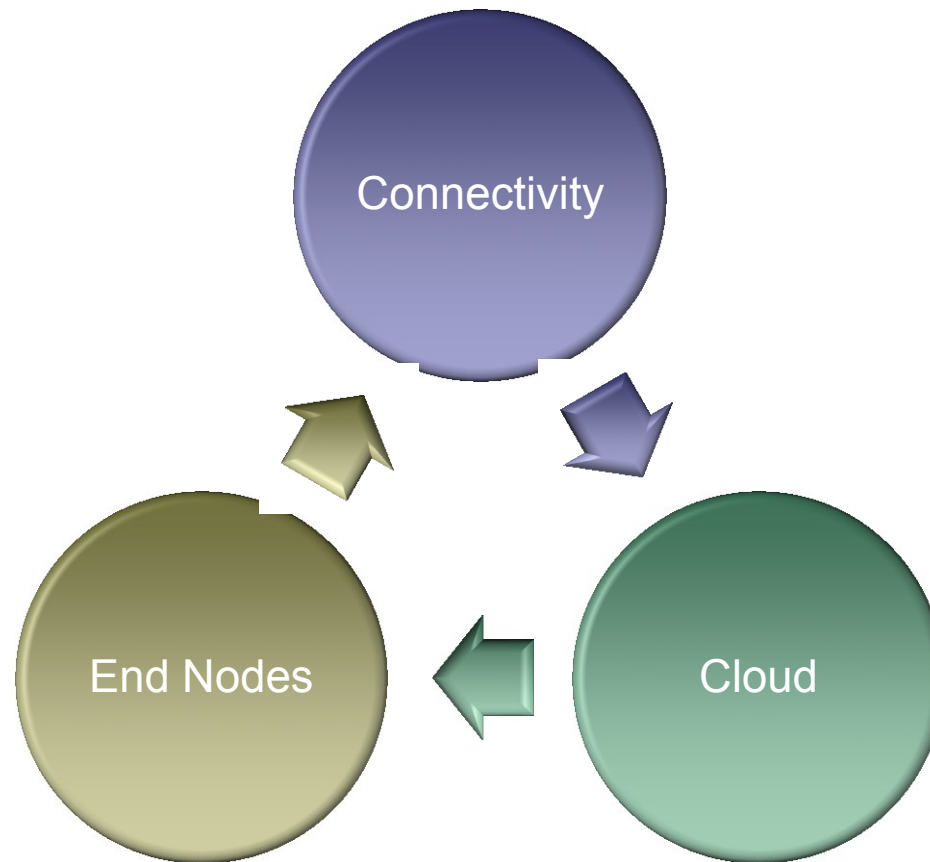
IoT Enablers



Internet of Things Ecosystem



IoT Components



IoT End Nodes



- ❑ **Sensors**
 - ❑ Light, temperature, humidity, location, presence,...
- ❑ **Actuators**
 - ❑ Controllers, things that can take action

End Node Types

Microcontroller:

ARDUINO UNO R3
280 BAHT



ARDUINO MEGA
450 BAHT



NODEMCU
250 BAHT



ESP8266
MODULE
100 BAHT



Single-board PCs

RASPBERRY PI
ZERO



RASPBERRY PI 3
1190 BAHT



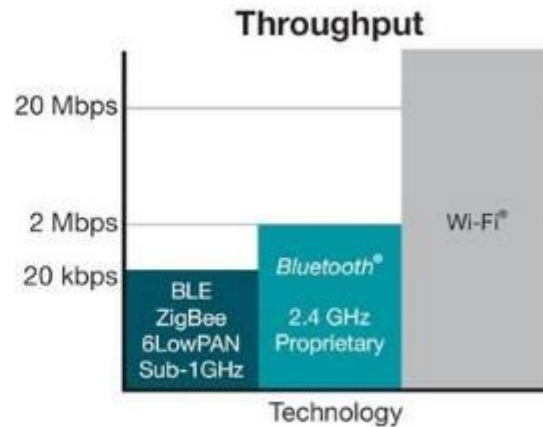
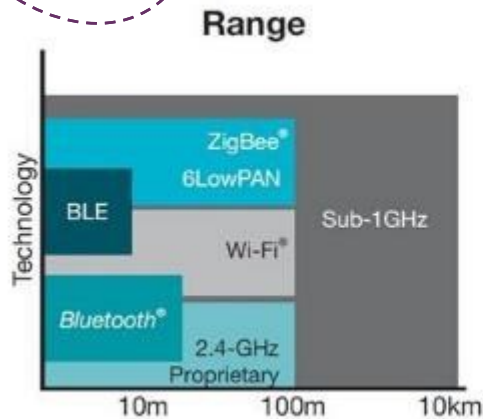
BEAGLEBONE BLACK
1,700 BAHT



Mobile devices Computers



IoT Connectivity



Low-Power Wide Area Network

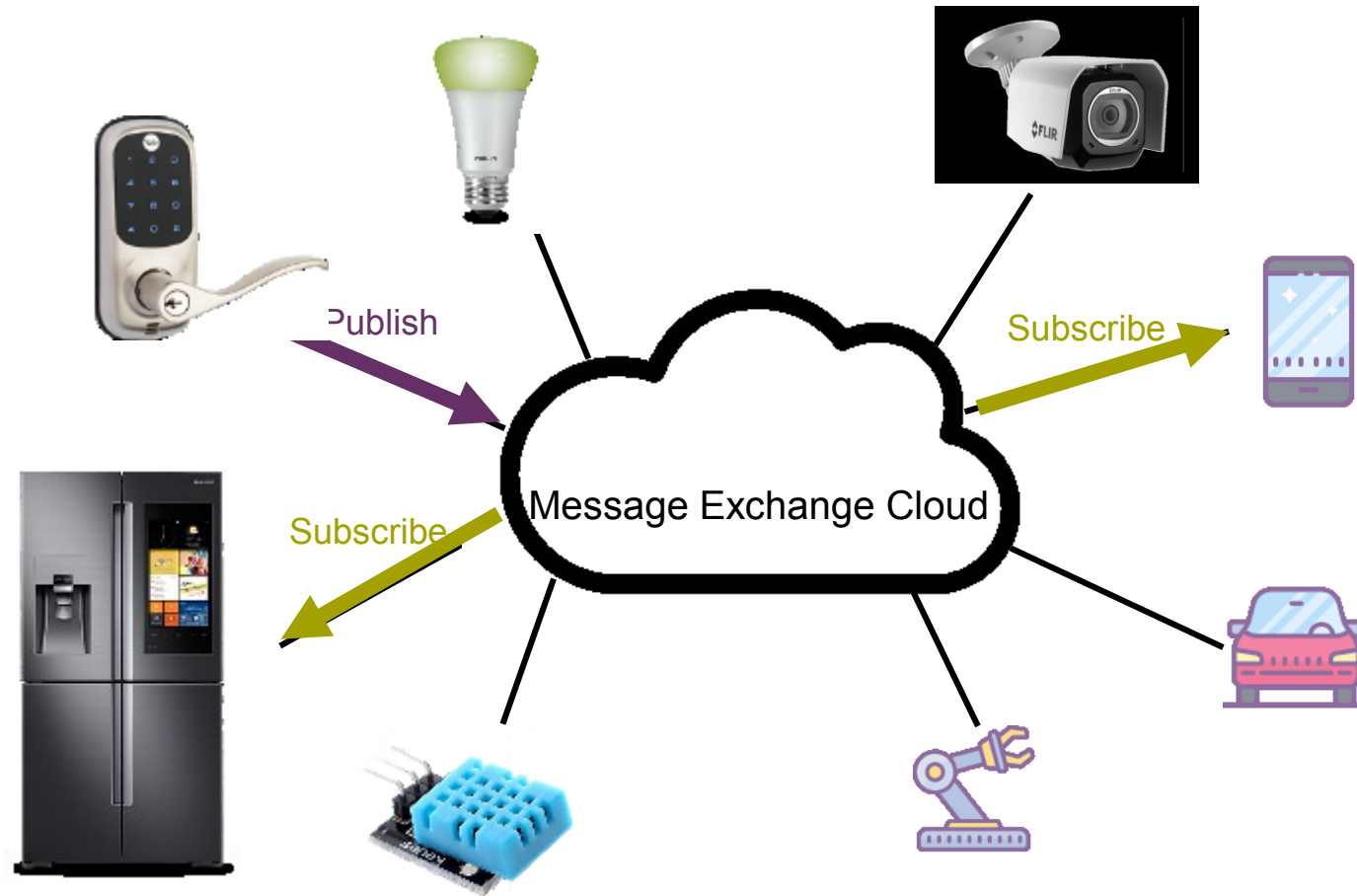


NB-IoT

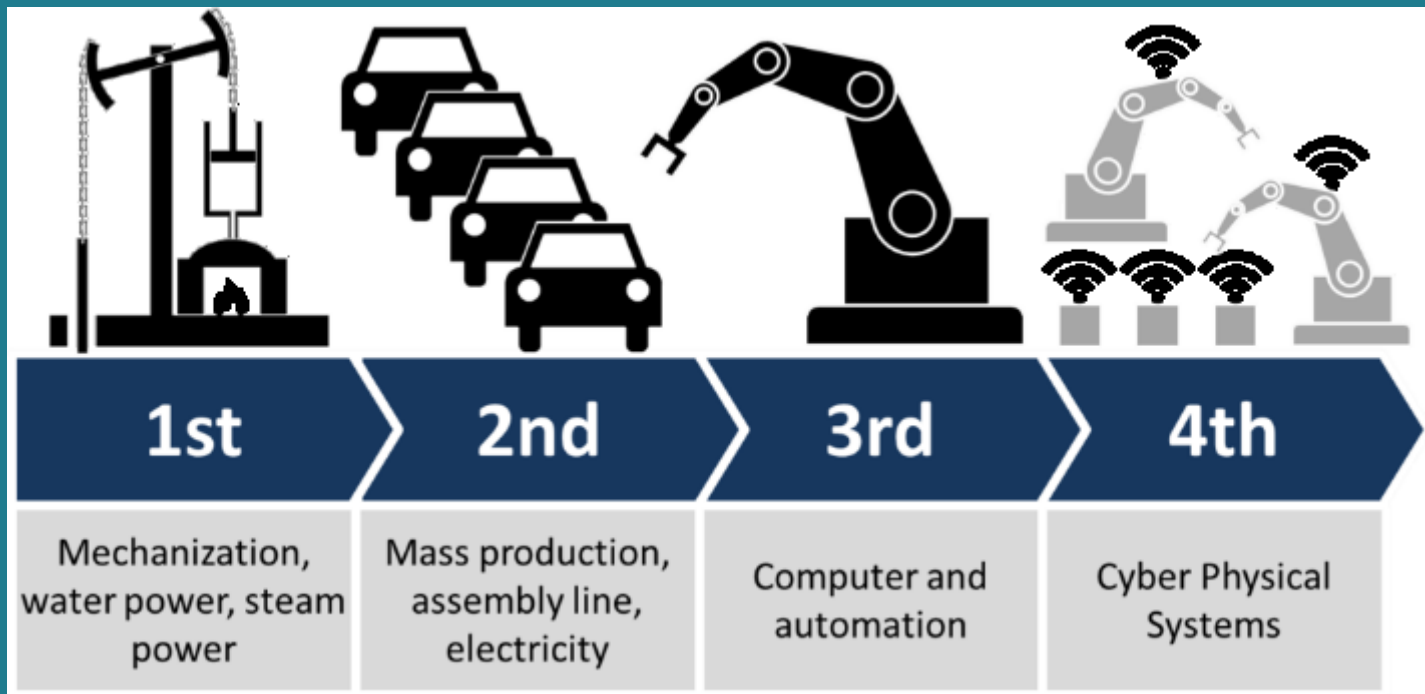


| | Local Area Network Short Range Communication | Low Power Wide Area (LPWAN) Internet of Things | Cellular Network Traditional M2M |
|--|---|--|--|
| | 40% | 45% | 15% |
| | Well established standards In building | Low power consumption Low cost Positioning | Existing coverage High data rate |
| | Battery Live Provisioning Network cost & dependencies | Emerging standards | Autonomy Total cost of ownership |
| | Bluetooth 4.0 | NB-IoT | 3G+ / H+ |

IoT Cloud



Industry 4.0

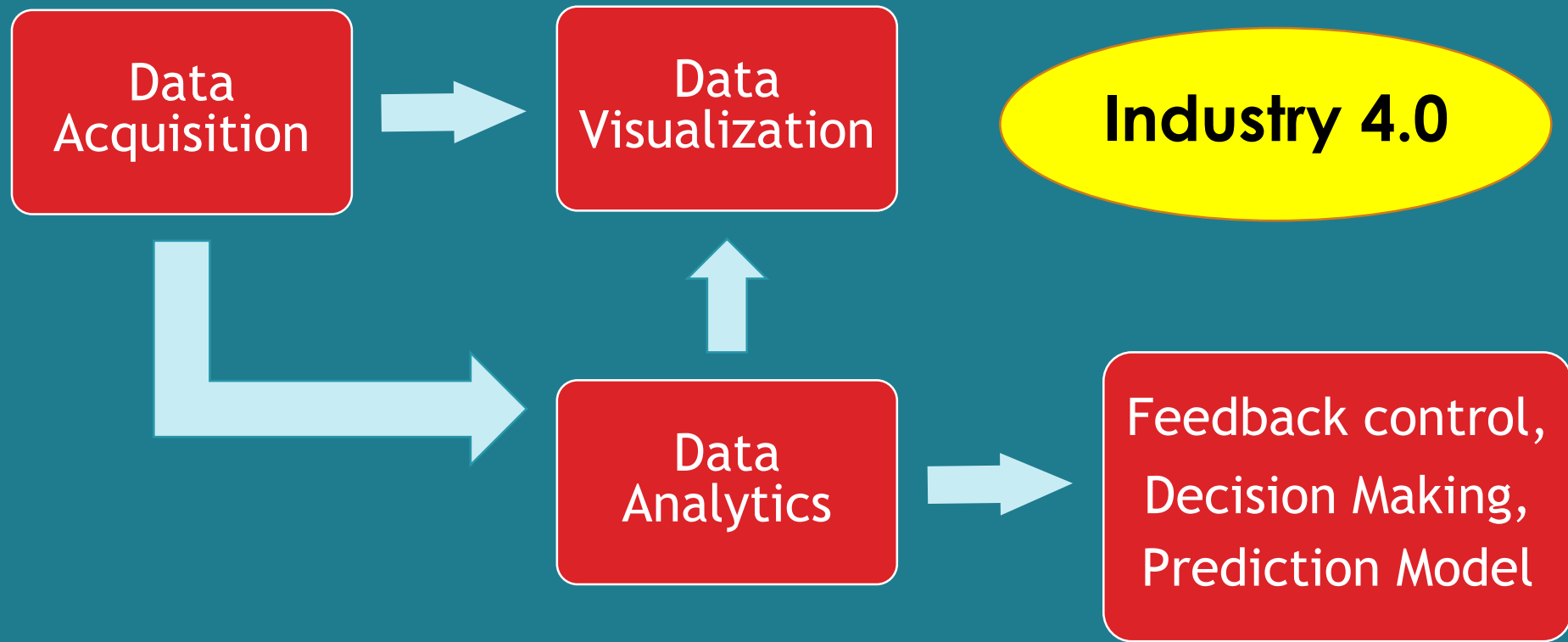


The figure is credited to
Christoph Roser,
<http://www.allaboutlean.com/industry-4-0/>


Thailand

**How to prepare
for Industry 4.0?**

IoT: Sense → Collect → Analyze → React



Cloud Manufacturing

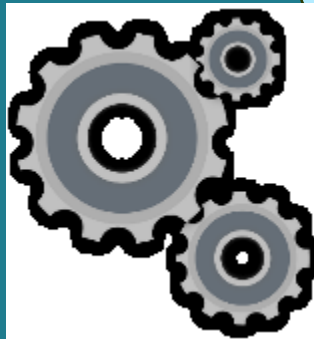
Cisco's Kinetic

Siemens' MindSphere

IBM's Watson

GE's Predix

Microsoft Azure



Conclusions

- Internet of Things → **Integration of Everything** (human, machine, process, system, information).
- **Information** is the key to success.
 - Monitor, control, visualize, react
 - High quality data or information can help you make better decisions.
- Benefits : competitive advantage, cost saving, high productivity and quality