Internet of Things: Connected World

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- IoT = Internet of Everything
- M2M
- Next information revolution

- 1% of physical world is connected to Internet
- Huge potential

Potentials

- Innovative business process
- Operational efficiency
- New customer services

What is IoT

- Network of Physical Objects

- Embedded systems with electronics, software, sensors
- Enable objects to exchange data with manufacturer, operator, other devices through network infrastructure

- Allow remote control
- Direct integration = computer + physical world

Result: Automation in all fields

M2M World of Connected Services

The Internet of Things

Beecham Research

IOT/M2M MARKET OVERVIEW

IoT Revenue* expected by 2020

$397.88
Home

$279.08
Cities

$210.28
Buildings

$76.18
Transport

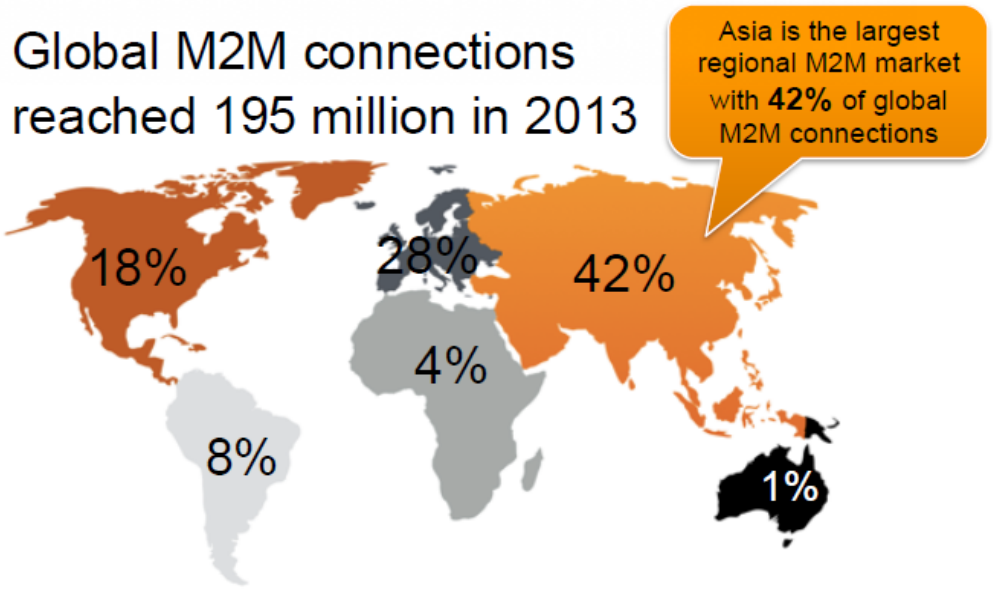
$46.78
Health

*Billions USD

Fraunhofer FOKUS

M2M connections account for 2.8% of all global mobile connections, double the 1.4% in 2010

Global M2M connections reached 195 million in 2013



The market will grow to 3.2 billion connections worldwide by 2024

The following is a list of countries by IoT devices online per 100 inhabitants as published by the OECD in 2015.[33]

Rank	Country	Devices online	Relative size
1	South Korea	37.9	
2	Denmark	32.7	
3	Switzerland	29.0	
4	United States	24.9	
5	Netherlands	24.7	
6	Germany	22.4	
6	Sweden	21.9	
6	Spain	19.9	
9	France	17.6	
10	Portugal	16.2	
11	Belgium	15.6	
11	United Kingdom	13.0	
13	Canada	11.6	
14	Italy	10.2	

Rockwell Automation fuels the oil and gas industry with IoT

- <video>

A bit of history

- The term "Internet of Things" is coined by Kevin Ashton 1999.
- Early example, 1982, Coke machine at Carnegie Mellon University was connected to internet: report its inventory and temperature


LG

Applications

- Media
- Environmental monitoring
- Infrastructure management
- Manufacturing
- Energy management
- Medical and health care systems
- Building and home automation
- Transportation

Applications (cont.)

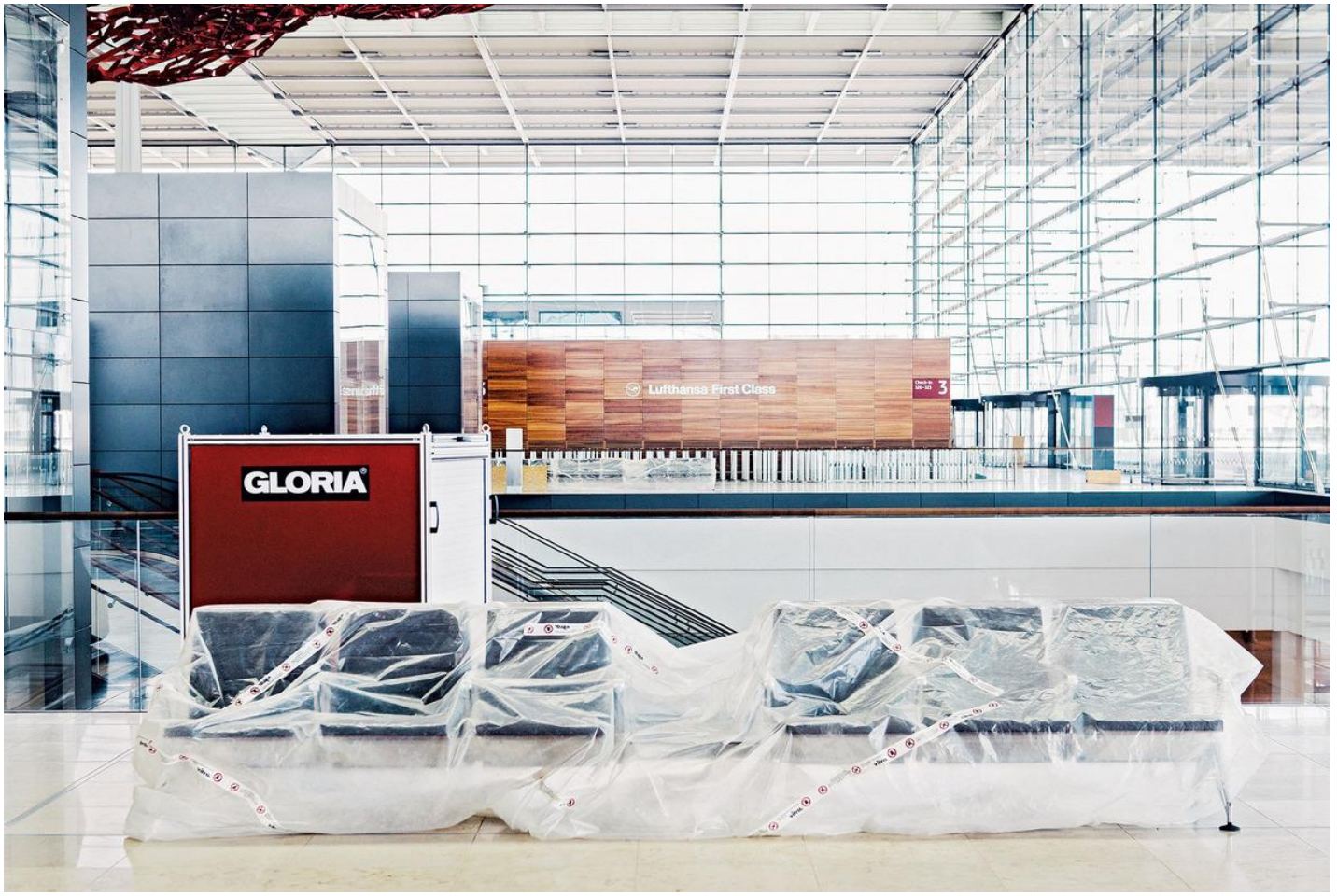
- Media IoT + Big Data
  target advertisement to customized content
- Infrastructure management
  monitoring structural condition, scheduling maintenance
- Waste management
- Safety management

Example: German Airport Problems

Berlin Brandenburg International Airport

Berlin Brandenburg International Airport

- 600 million euros project
- schedule to be opened in June 2012, now expected to be completed in 2017
- “Just months before the scheduled June 2012 opening, the terminal was a mess. Careless workers stepped on and shattered glass being installed by other companies. Heavy equipment rolled across the terminal floor, scratching expensive tiles. Tempers flared; small contractors complained they weren’t getting paid and threatened to walk off the job.”



Germany spends €16 million a month just to maintain the unfinished facility.
Photographer: Eriver Hijano for Bloomberg Businessweek

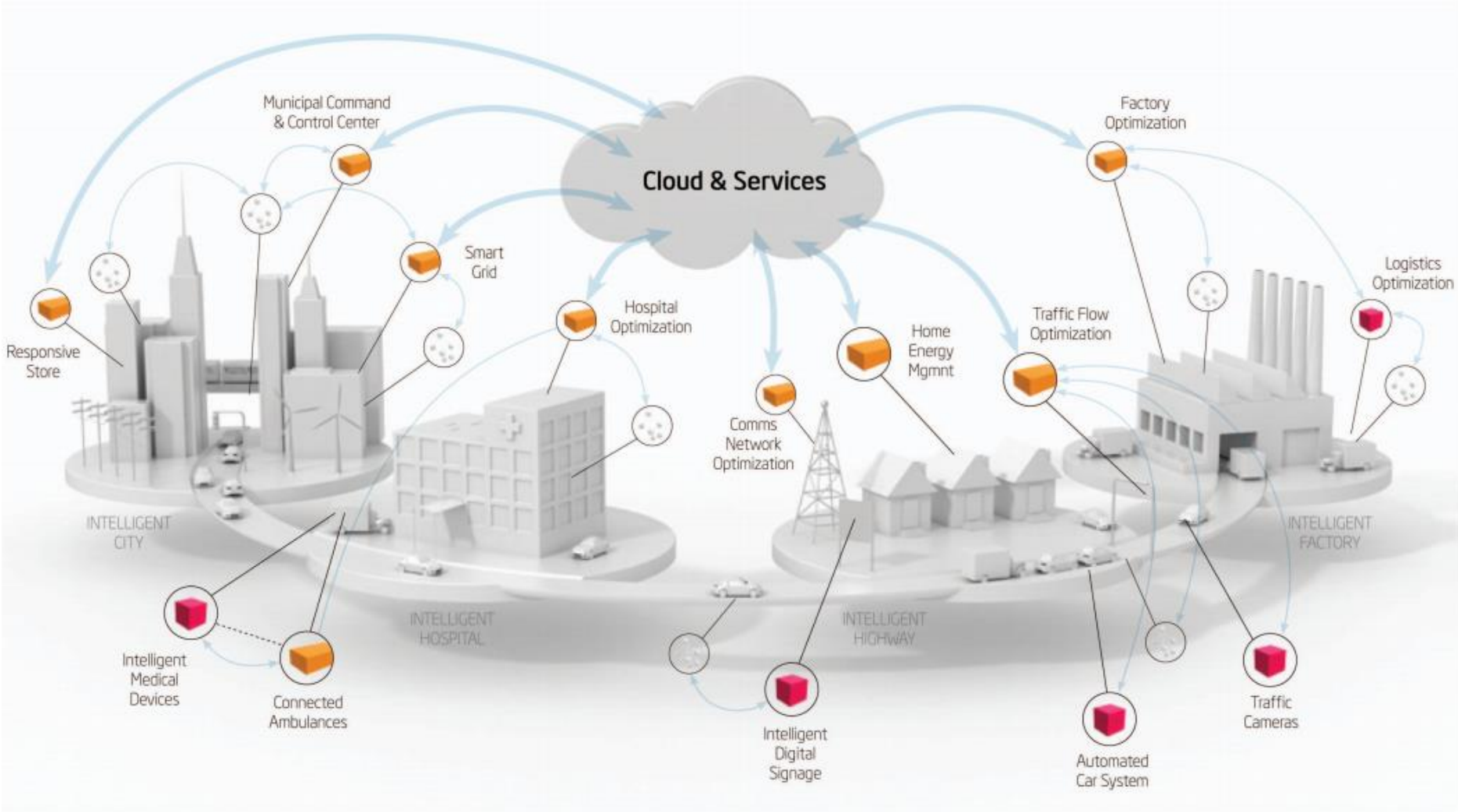
- IoT can be used to monitor and coordinate the construction site in real-time

Applications (cont.)

- Manufacturing
  - monitoring product demand
  - real-time manufacturing production
  - manage supply chain network

  - <KuKa video>

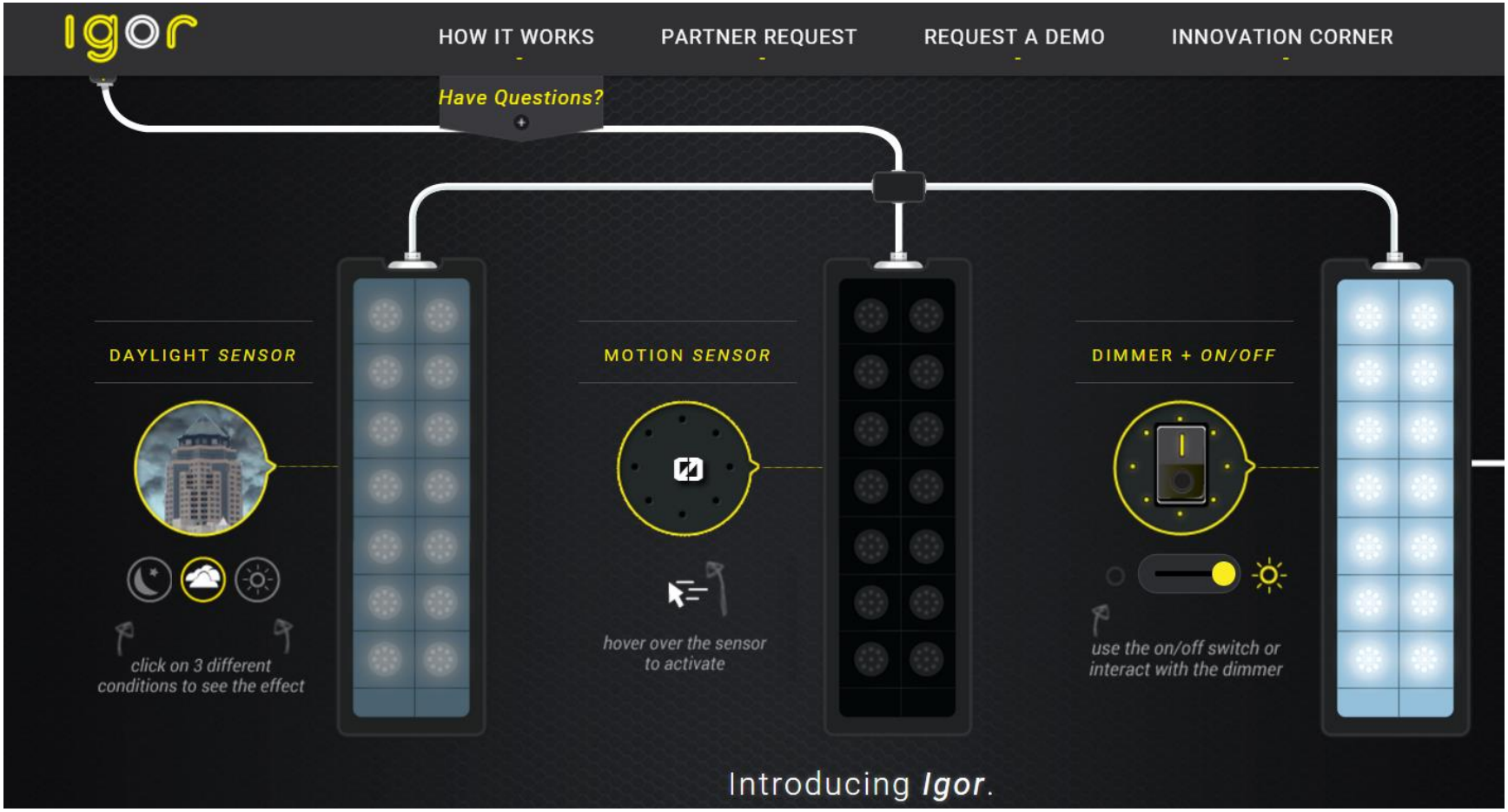
Smart Cities



Examples of Connected Devices

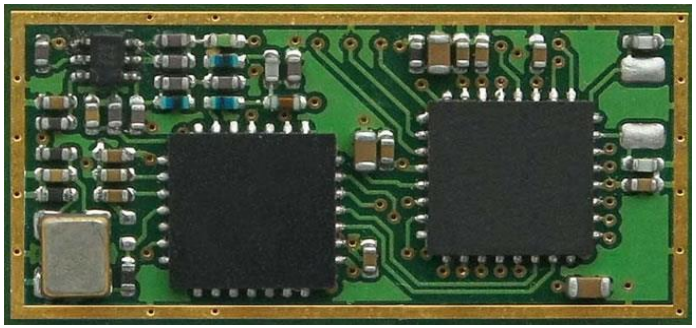
Agriculture

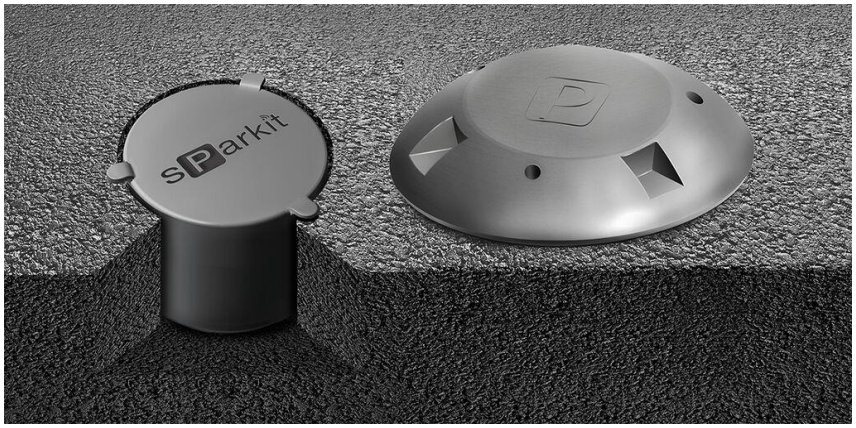
Intelligent Lighting



Ultra Narrow Band Communication

PARAMETER	GSM / CDMA	IEEE 802.15.4.MESH NETWORKS	NWAVE
Nodes served by base station	20,000	64,000	1,000,000
Typcial Commuincation Range	3/2 (km/mi)	30/100 (m/ft)	10/7 (km/mi)
Energy Radiation	2000 mW	10 mW	25-100 mW
Autonomous Operation (2.5Ah battery)	2 months	1-2 years	10 years
Signal Penetration within buildings	Average	Average	High
Cost of base station	High	Low	Low
Cost of Modem	High	$8-12	Low




sParkit


N Wave

Intelligent Vision

- Chronocam
- <video>

simularity

Solutions Technology Partners About Us Contact Us Blog

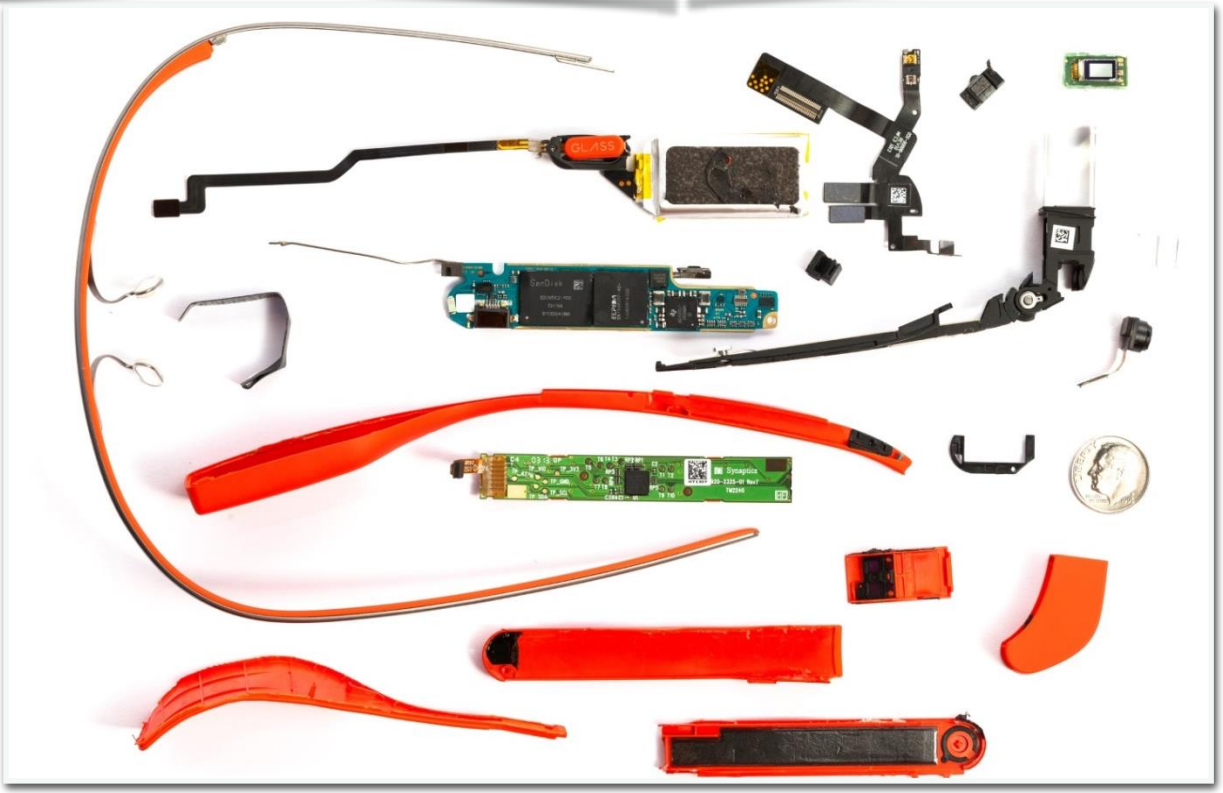
Simularity offers targeted, easy-to-use software solutions for:

- Internet of Things

Artificial Intelligence For Event Prediction and Anomaly Detection

We've built an artificial intelligence that learns. It creates a multivariate and complex view of the world based on the data it ingests and is able to do temporal reasoning, and learning on the fly, without models to train and deploy, nor rules to create.

The more data it observes, the smarter it gets. This makes


GLASS

Thursday, July 9, 2015

CMU LEADS GOOGLE EXPEDITION TO CREATE TECHNOLOGY FOR "INTERNET OF THINGS"

Campus Will Be Living Lab For Interconnected Sensors, Gadgets

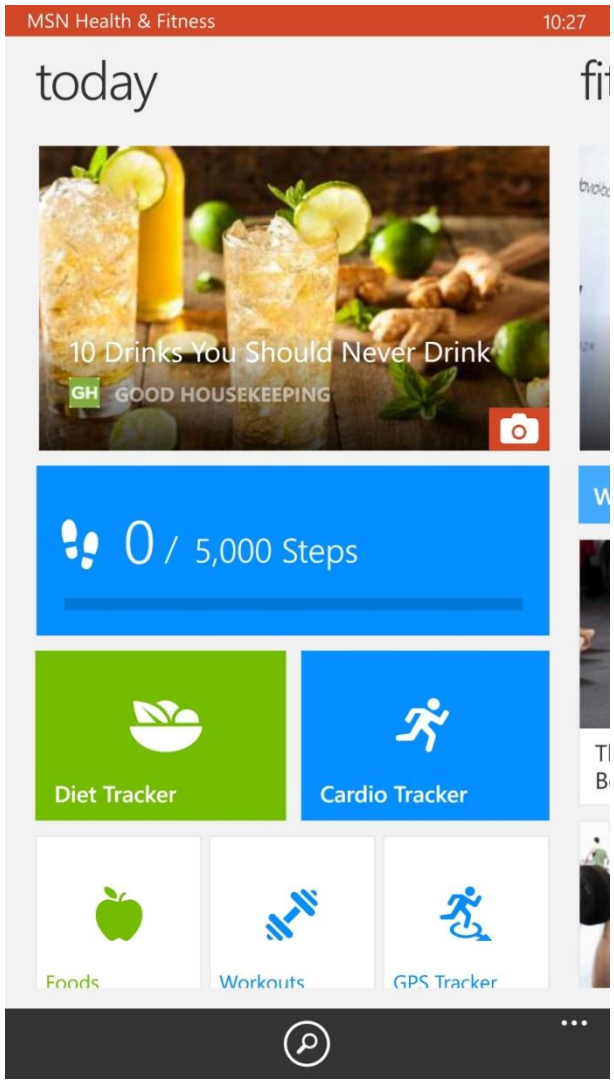
By Byron Spice / 412-268-9068

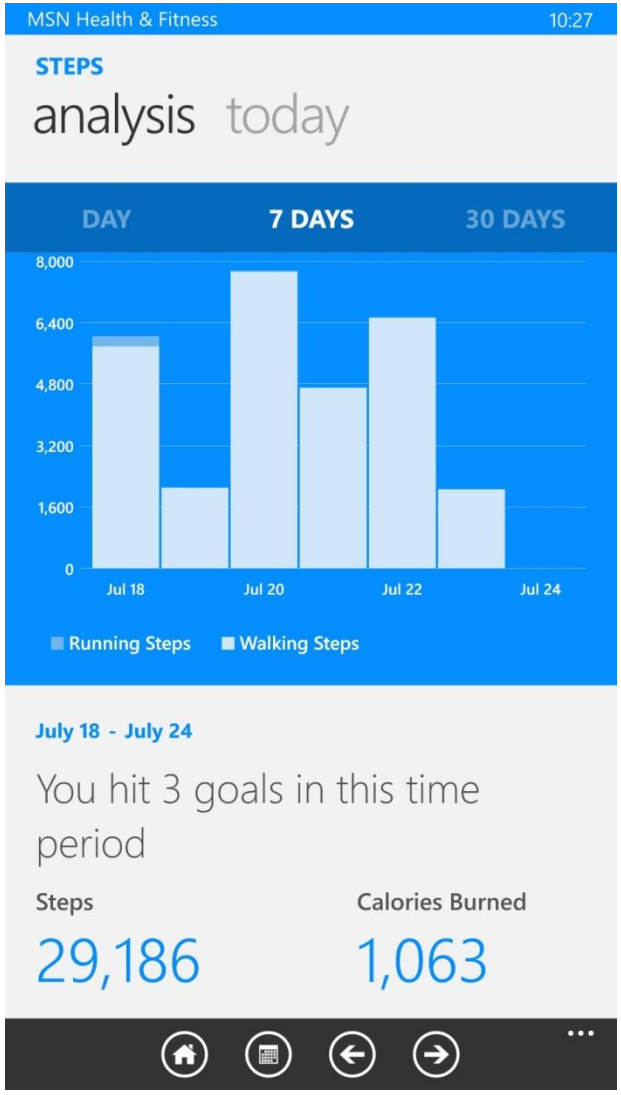
- “The goal of our project will be nothing less than to radically enhance human-to-human and human-to-computer interaction through a large-scale deployment of the Internet of Things (IoT) that ensures privacy, accommodates new features over time and enables people to readily design applications for their own use,” said Anind K. Dey, lead investigator of the expedition and director of CMU’s Human-Computer Interaction Institute.

- “We will demonstrate the use of personalized privacy assistants that help users configure the many privacy settings necessary to ensure that they retain adequate control over their data,”

"Snap2It" lets users link to a printer or projector simply by taking a smartphone photo of it.


10:26
LUMIA SENSORCORE SAMPLE
steps
22 July 2015
6531
walking steps 6531
running steps 0
5000
2500
00
06
12
18
24


MSN Health & Fitness
10:27
today
10 Drinks You Should Never Drink
GH GOOD HOUSEKEEPING
0 / 5,000 Steps
Diet Tracker
Cardio Tracker
Foods
Workouts
GPS Tracker


MSN Health & Fitness
10:27
STEPS
analysis today
DAY
7 DAYS
30 DAYS
8,000
6,400
4,800
3,200
1,600
0
Jul 18
Jul 20
Jul 22
Jul 24
Running Steps
Walking Steps
July 18 - July 24
You hit 3 goals in this time period
Steps
29,186
Calories Burned
1,063

Impact

- Civic engagement
- Privacy, autonomy and control
- technology <> just tools
- technology = active agent

- IoT = Human augmentation (Tim O Reilly)
- data-driven decision making

Impact (cont.)

- Security

  cyber attack in Physical world

  spy on people in their own homes

- Increase in electronics waste 10x

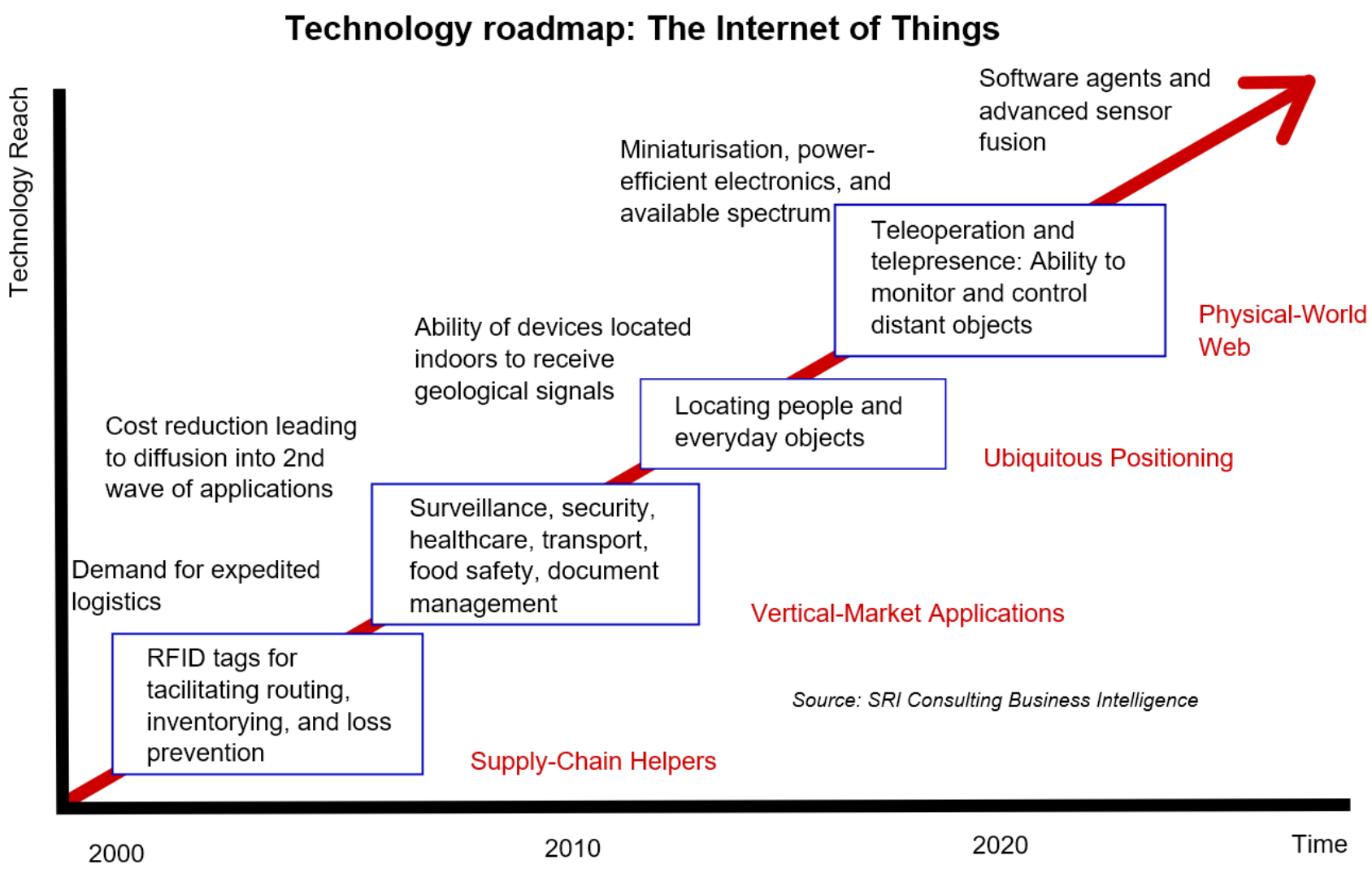
Technology roadmap

- 50-100 Trillion objects,
- each person carries 1000-5000 trackable objects

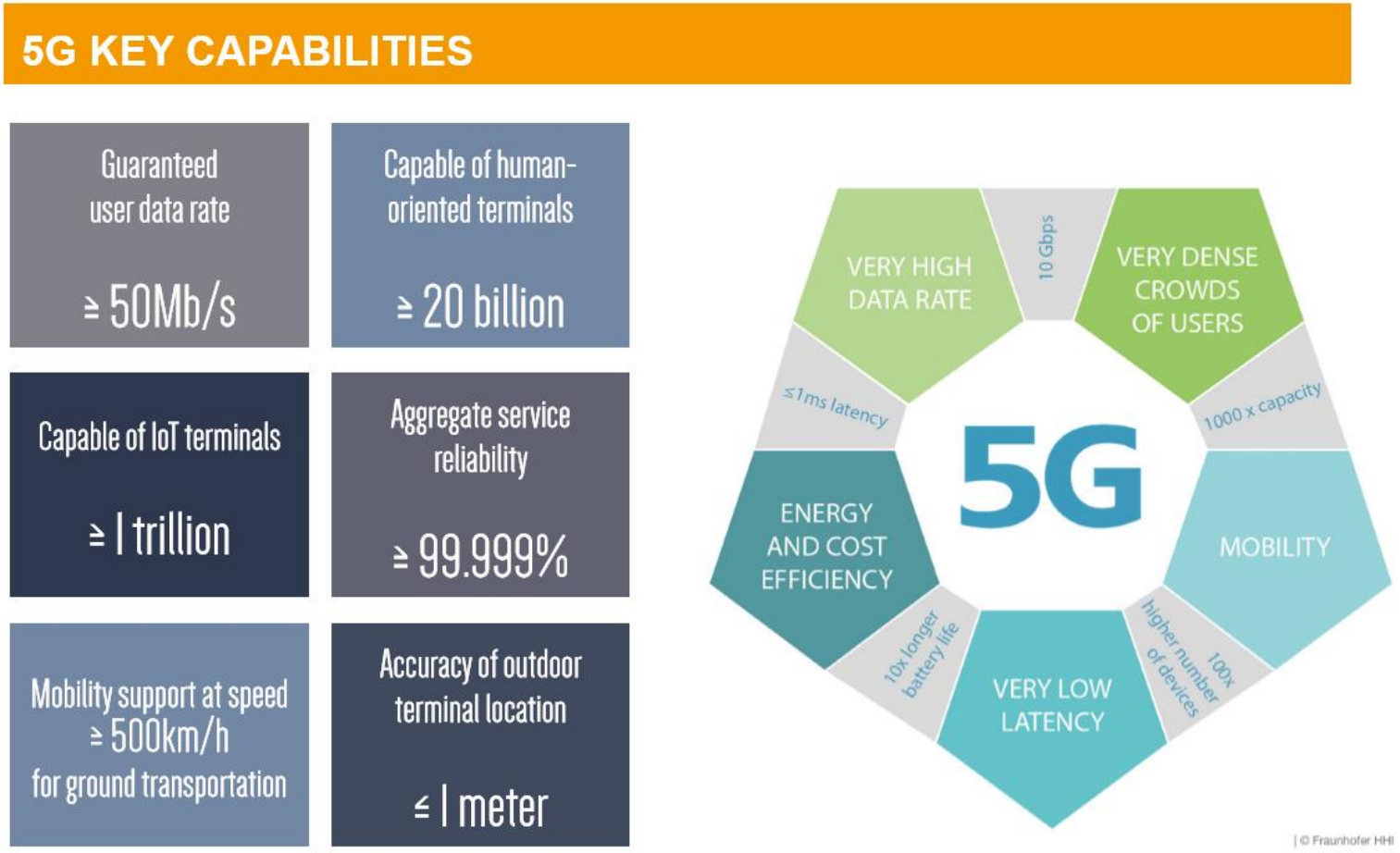
- computer manage and inventory objects and people

- transform daily life

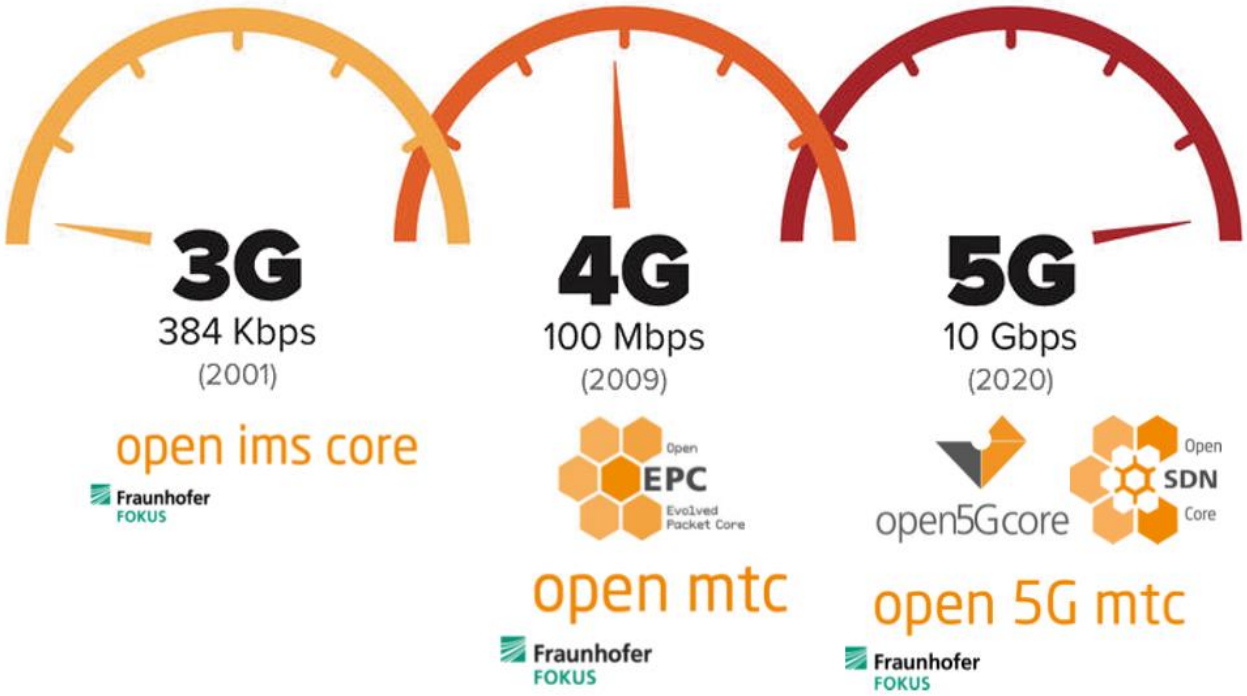
- bottom up, convergence of data from IoT into applications, web-of-things


Technology roadmap: The Internet of Things
Technology Reach
Software agents and advanced sensor fusion
Miniaturisation, power-efficient electronics, and available spectrum
Teleoperation and telepresence: Ability to monitor and control distant objects
Physical-World Web
Ability of devices located indoors to receive geological signals
Locating people and everyday objects
Ubiquitous Positioning
Cost reduction leading to diffusion into 2nd wave of applications
Surveillance, security, healthcare, transport, food safety, document management
Vertical-Market Applications
Demand for expedited logistics
RFID tags for tacilitating routing, inventorying, and loss prevention
Supply-Chain Helpers
Source: SRI Consulting Business Intelligence
2000
2010
2020
Time

Backbone (5G)


5G KEY CAPABILITIES
Guaranteed user data rate
≥ 50Mb/s
Capable of human-oriented terminals
≥ 20 billion
Capable of IoT terminals
≥ 1 trillion
Aggregate service reliability
≥ 99.999%
Mobility support at speed ≥ 500km/h for ground transportation
Accuracy of outdoor terminal location
≤ 1 meter
VERY HIGH DATA RATE
10 Gbps
VERY DENSE CROWDS OF USERS
≤1ms latency
1000 x capacity
5G
ENERGY AND COST EFFICIENCY
MOBILITY
10x longer battery life
VERY LOW LATENCY
higher number of devices
100x
© Fraunhofer HHI

ENABLING TOOLKITS EVOLUTION



5G USE CASES

Broadband access everywhere

50+ MBPS EVERYWHERE

Broadband access in dense areas

PERVASIVE VIDEO

Higher user mobility

HIGH SPEED TRAIN

Massive Internet of Things

SENSOR NETWORKS

Extreme real-time communications

TACTILE INTERNET

Lifeline communications

NATURAL DISASTER

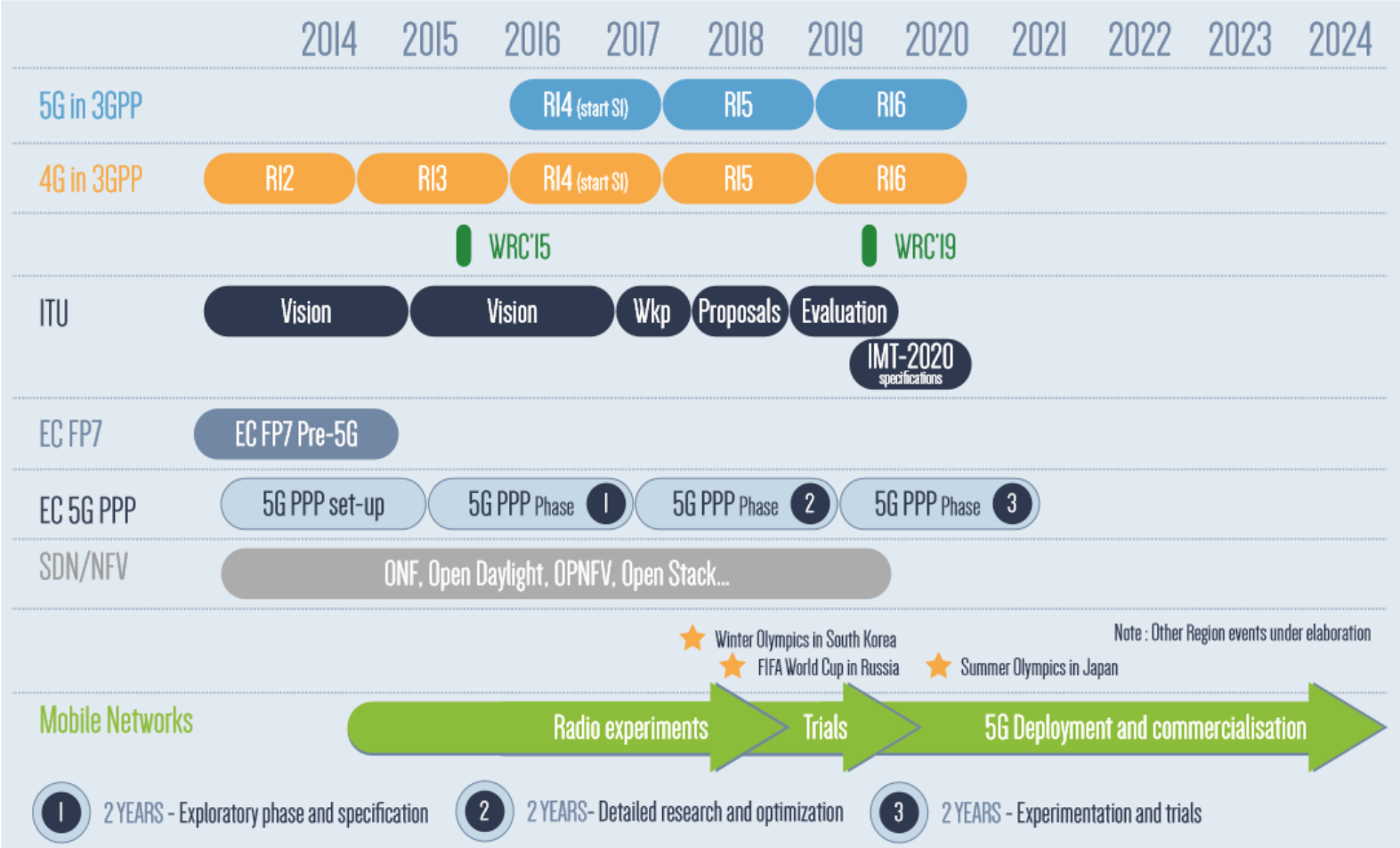
Ultra-reliable communications

E-HEALTH SERVICES

Broadcast-like services

BROADCAST SERVICES

5G ROADMAP (5G PPP)



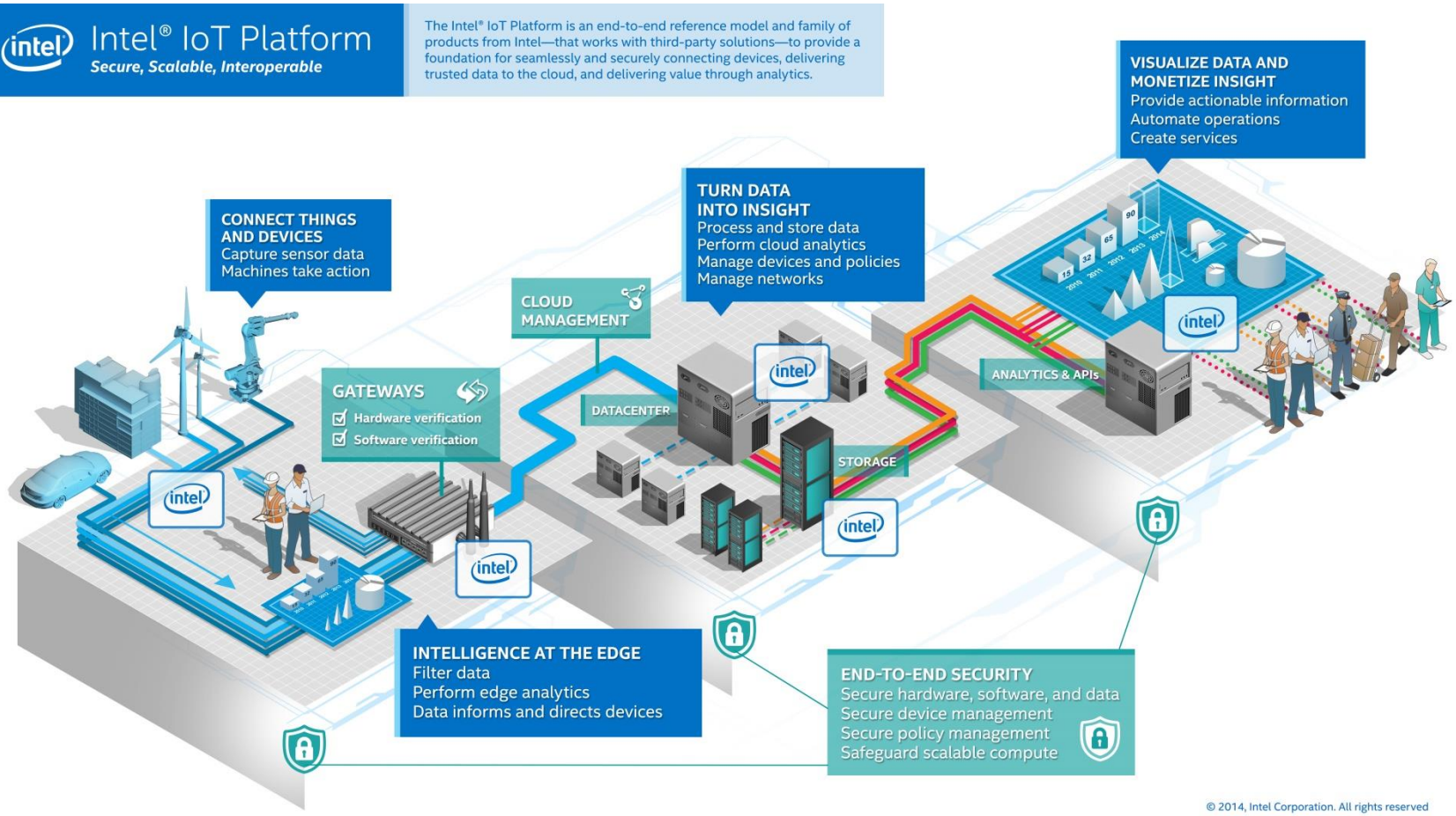
Trending

- Cisco IoT Grand Challenge
- IoT World Forum in Dubai
- Intel IoT platform

Intel® IoT Platform

Secure, Scalable, Interoperable

The Intel® IoT Platform is an end-to-end reference model and family of products from Intel—that works with third-party solutions—to provide a foundation for seamlessly and securely connecting devices, delivering trusted data to the cloud, and delivering value through analytics.



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