Introduction to Mobile Computing and the IoT
Wireless and Mobile Computing

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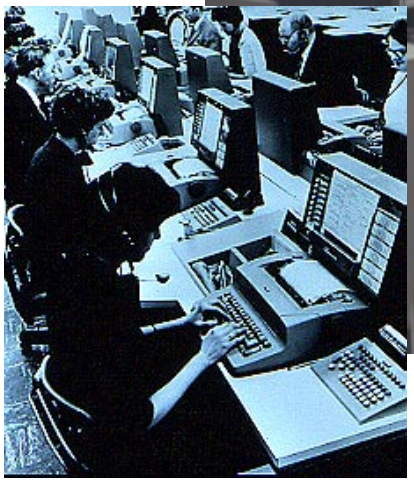
Session Overview

- The mobile computing paradigm
- The ubiquitous computing paradigm
- Elements of mobile and ubiquitous computing
- Enabling technologies
- Computer science challenges
- Applications and their role


FRIDEN


LEO MARK I


IBM

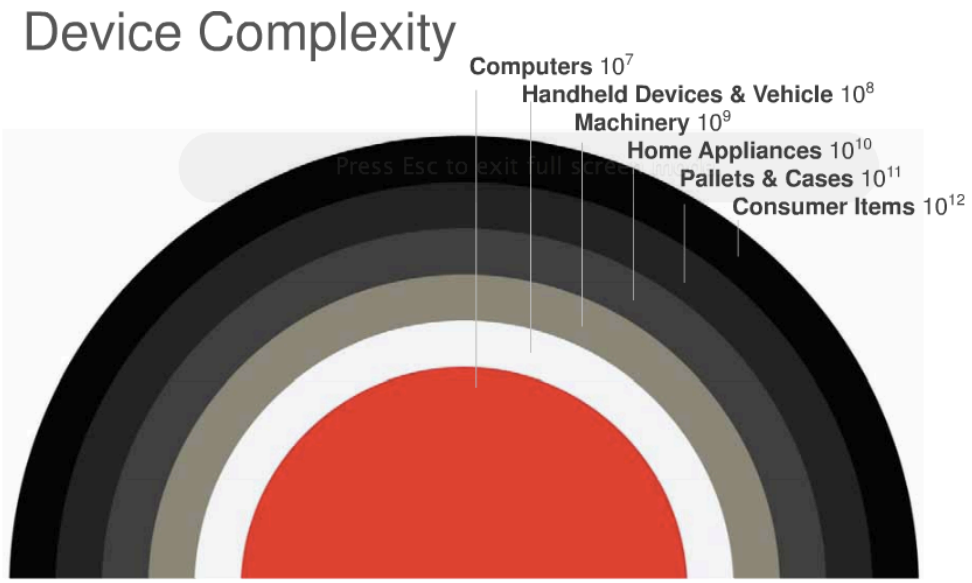



NOKIA

Main ingredients

- Possible due to minaturisation of computing and communication devices
- Automatic links between physical and digital worlds
- Reality embedded with and embedded in information space aka cyber-physical space
- Dual existence for
  - People
  - Places
  - Things

Device numbers vs. complexity



Example

- BMW 745i
- 2,000,000 LOC
- Windows CE
- 53 8-bit processors
- 11 32-bit processors
- 7 16-bit processors
- Multiple networks

What networks does this car have?

What other networks can you think of?

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Mobile Computing

- The application of small, portable, and wireless computing and communication devices
- Being able to use a computing device even when being on the move (and thus changing location)
- Portability is one aspect of mobile computing
  - portable vs. mobile
- Mobile telephony in particular allows you to make and receive voice calls on the move

Mobile Computing Ingredients

- Device
  - laptop, PDA, mobile phone, tablet, smart phone
- Network
  - cellular telephony, data over cellular, wi-fi, Bluetooth, Zigbee, infra-red, 3G, 4G
- System support
  - routing, billing, voice mail, data routing

- In-depth discussion of the issues raised by mobile systems architectures later today

What does ubiquitous mean?

- Dictionary definition:
  - being or seeming to be everywhere at the same time;
  - omnipresent;
  - found in large quantities everywhere;
  - "all over the place."
- Term introduced by Mark Weiser (but others have also described the vision, notably Ken Sakamura)

machine-to-machine communications

ubiquitous computing deeply embedded computing

ambient intelligence B4G mobile Internet of Things

pervasive computing

cyber-physical systems wireless sensor networks

calm computing intelligent environments

smart cities sentient computing everywhere computing

smart planet web of things Future Internet

ubiquitous sensor networks connected objects smart homes

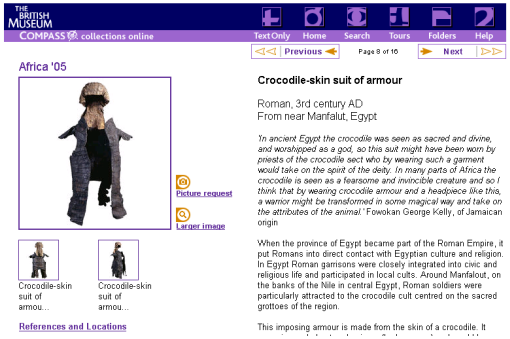
Cyber-physical Systems

Physical

Physical (material) entities:

- People
- Objects
- Places

Digital



Digital entities:

- Object info and location
- Maps
- Person info
- Activities

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Ubiquitous Computing

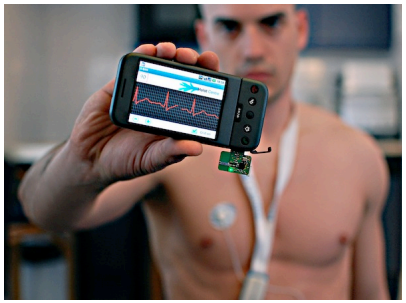
- Ubiquitous computing:
  - activates the world,
  - is invisible, everywhere computing that does not live on a personal device of any sort, but is in the woodwork everywhere,
  - makes a computer so imbedded, so fitting, so natural, that we use it without even thinking about it.
- Also called: pervasive, deeply embedded, 4G mobile or sentient computing, and ambient intelligence.

Commercial applications

Energy

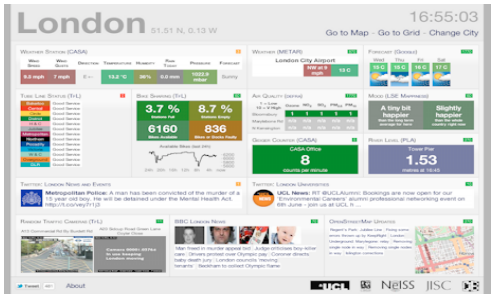
demand adaptation
micro-production

Healthcare



self-care
quantified self

Cities



patterns, routines
and unusual events

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Samsung Galaxy Note II

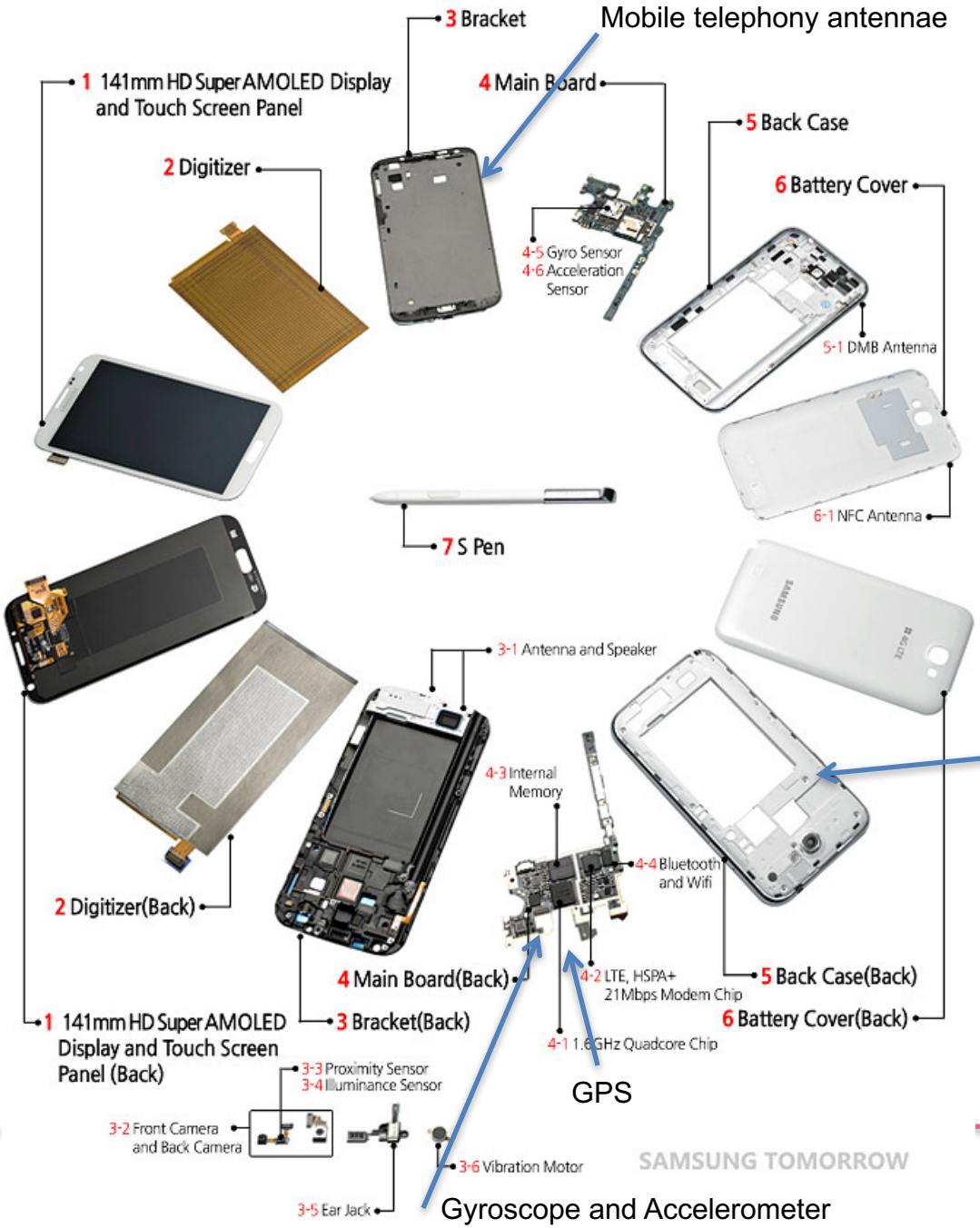

Image source:
http://blog.gsmarena.com/

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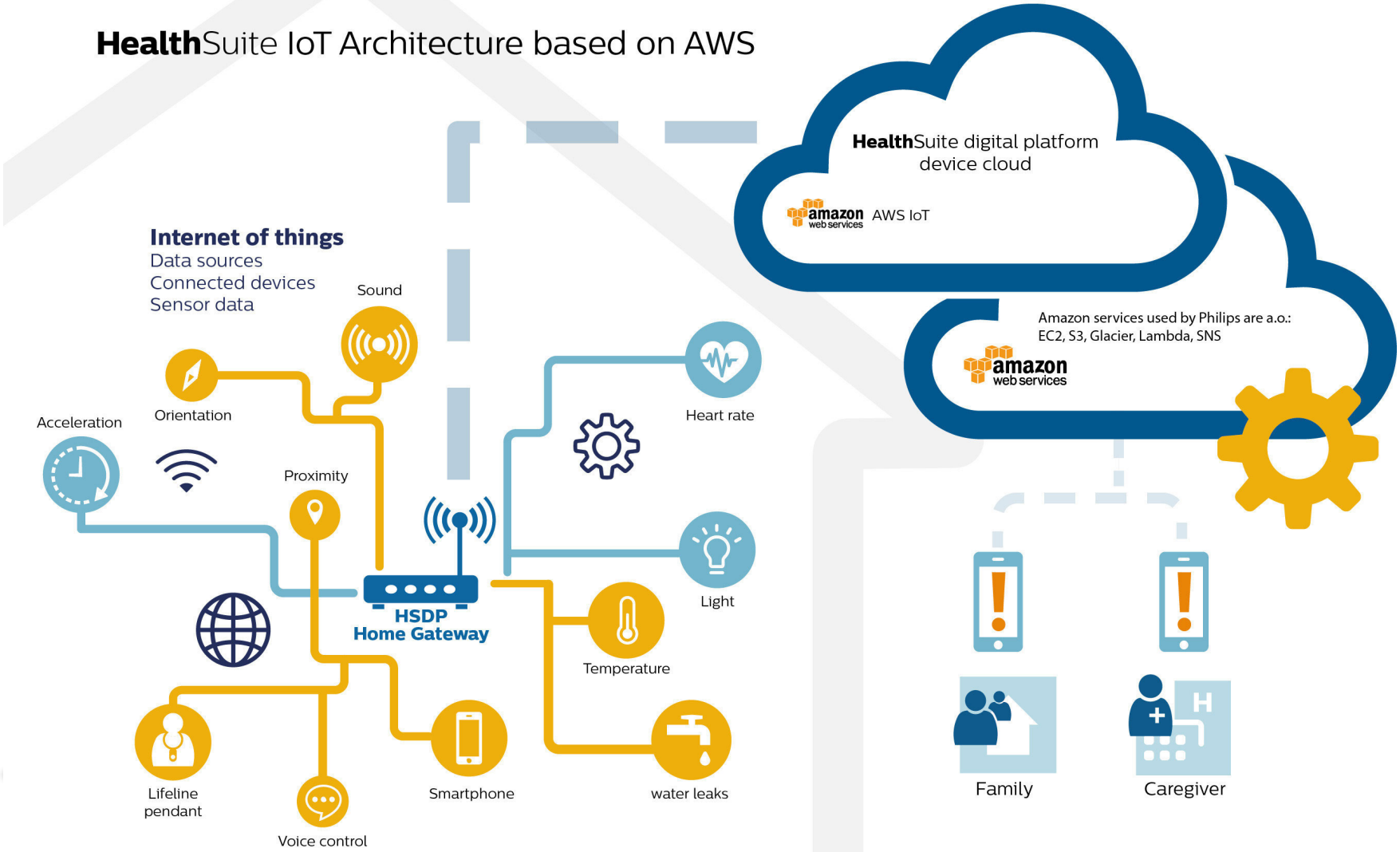
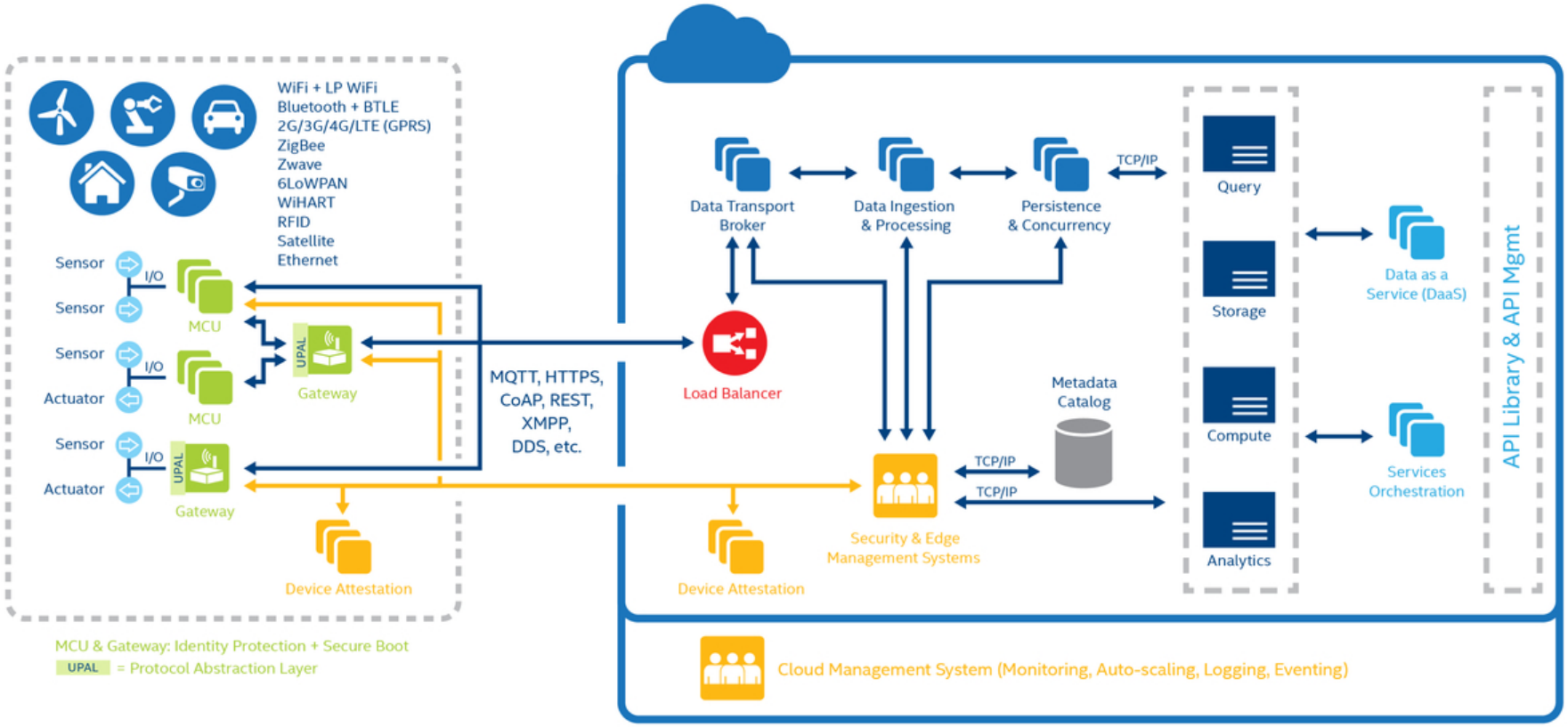
Anatomy of an IoT Device

nest

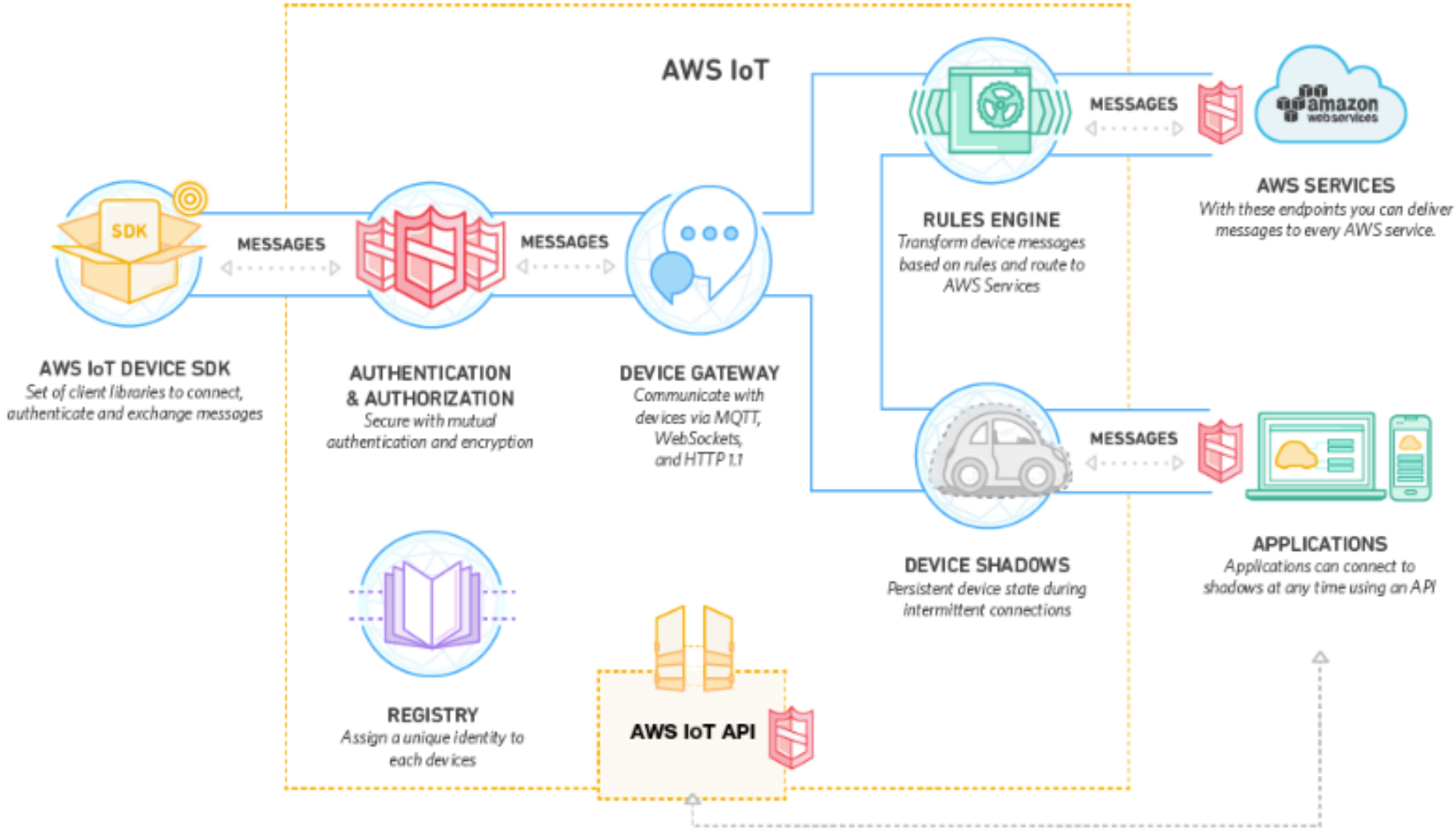
Philips IoT platform



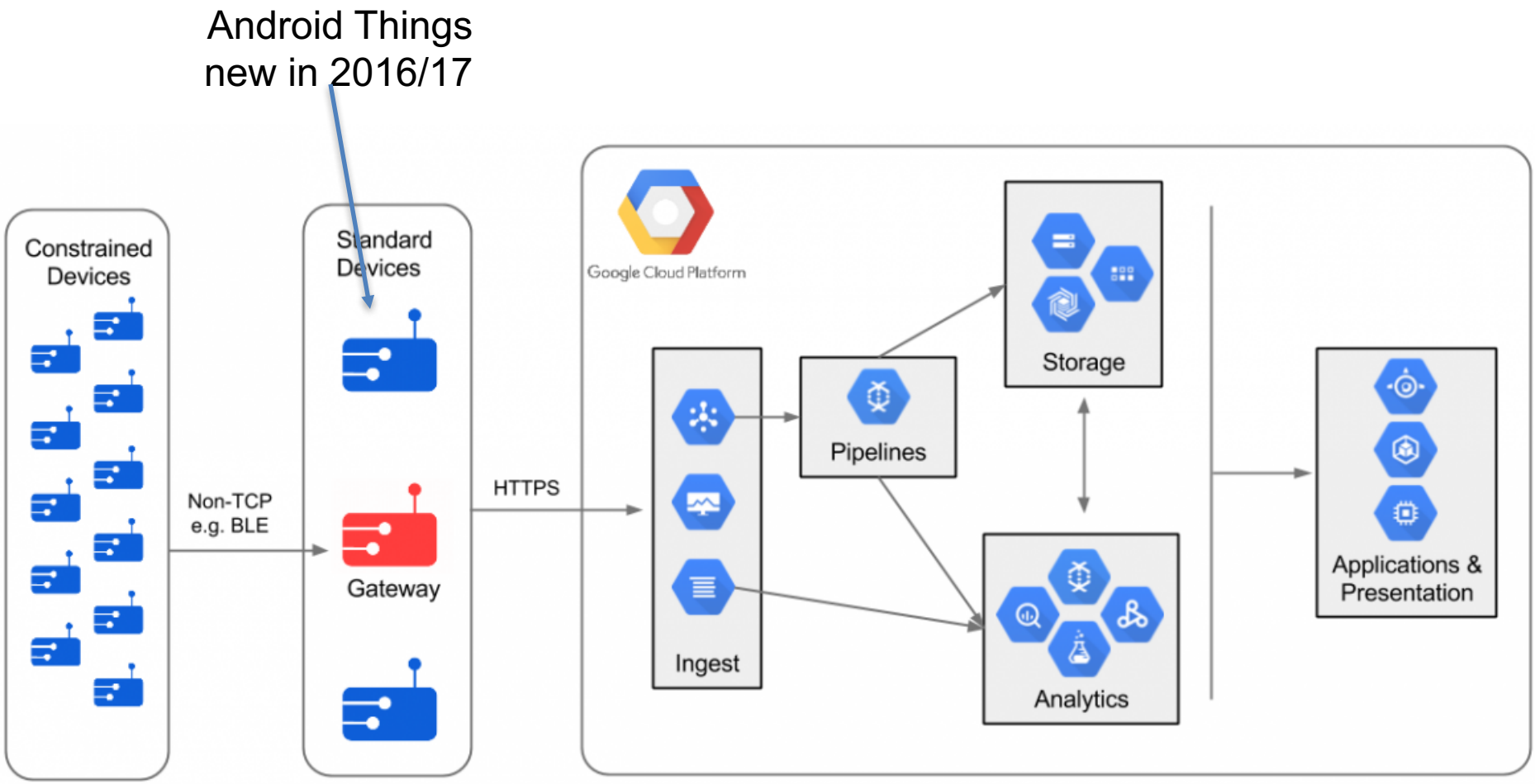
Intel IoT platform



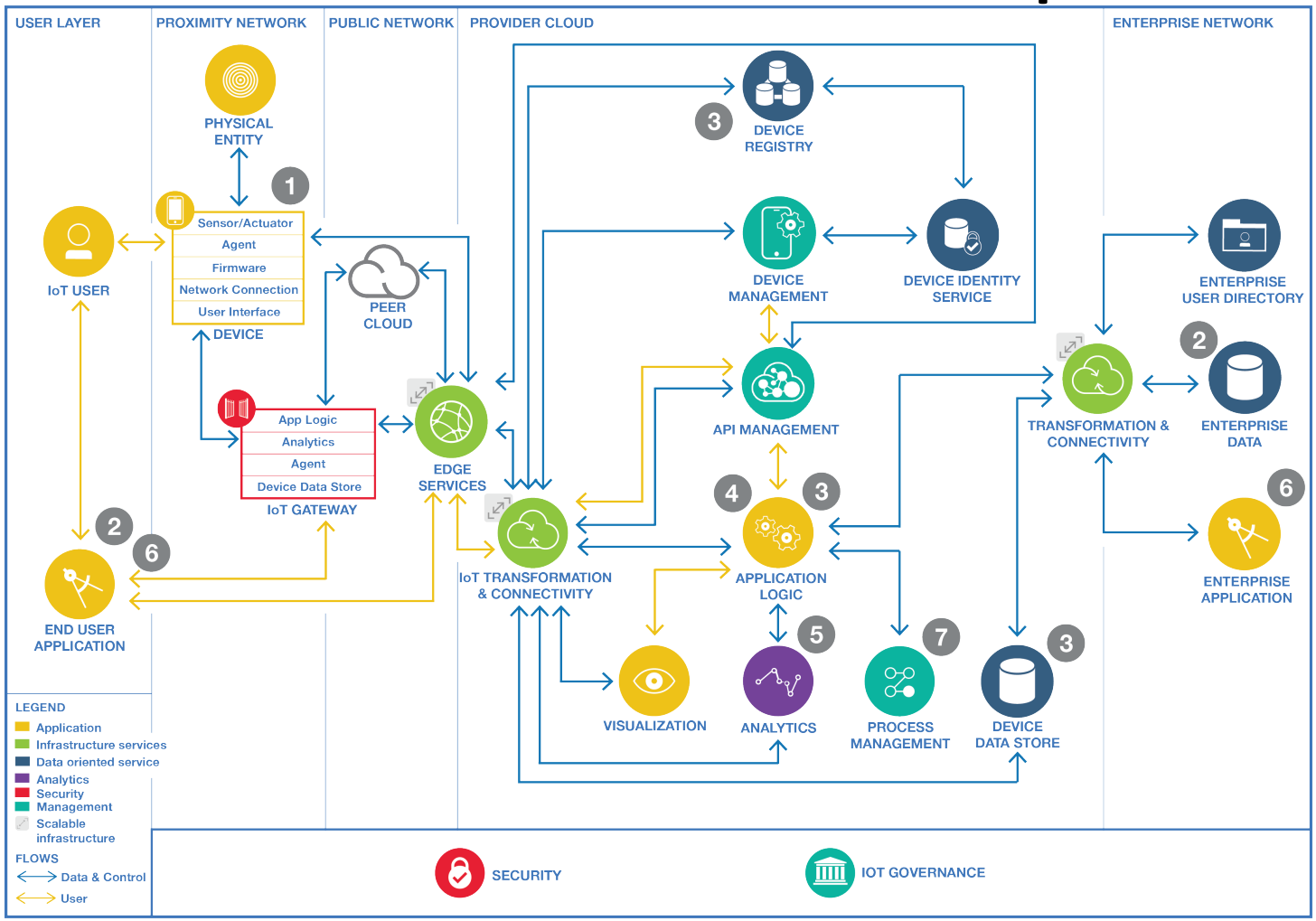
Amazon IoT platform



Google IoT platform



IBM IoT platform



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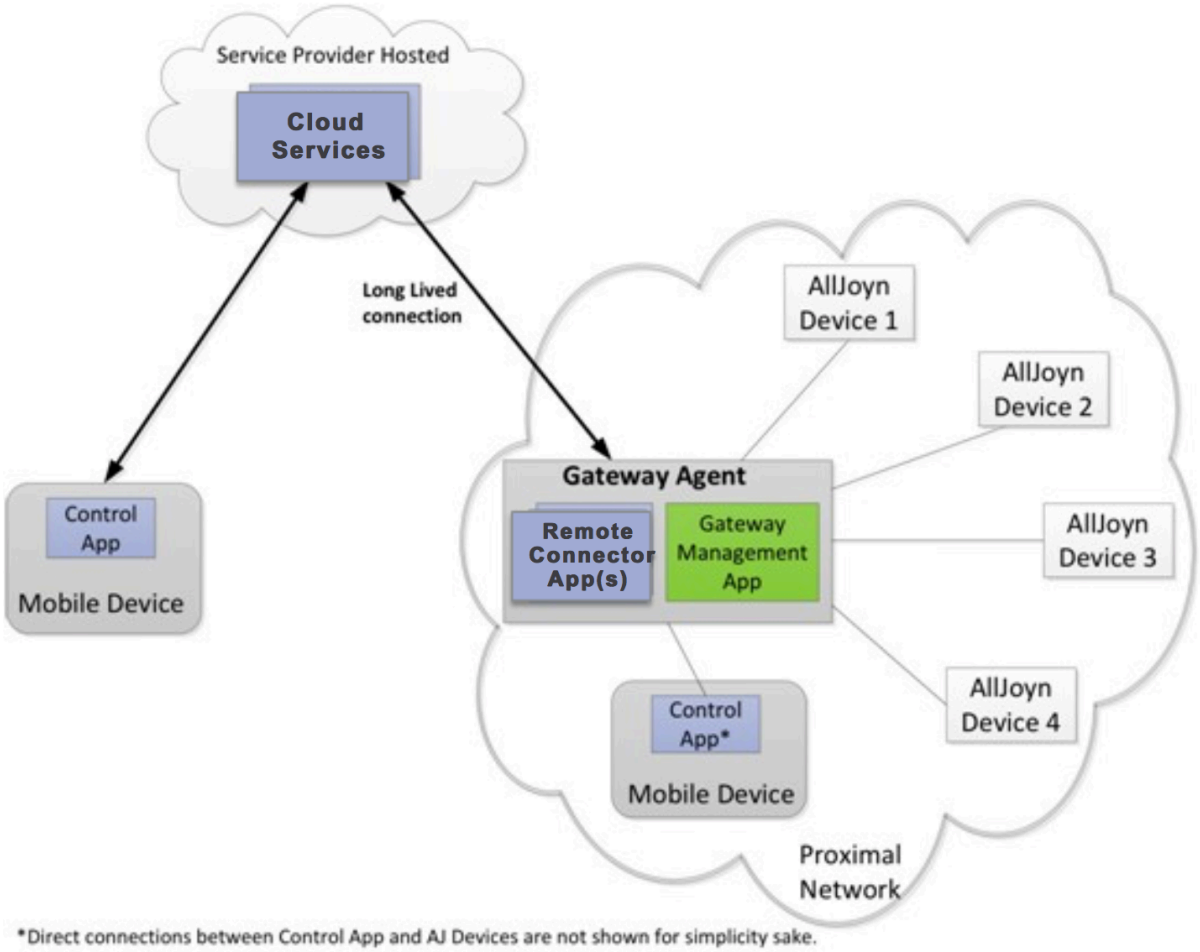
AllJoyn Alliance



*Direct connections between Control App and AJ Devices are not shown for simplicity sake.