

# Wireless challenges in the Ageing in Place environment

CWTe 2015 Research Retreat

21 October 2015

TU/e

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Philips Research

October 21, 2015

**PHILIPS**

# Outline

Context

Philips  
approach

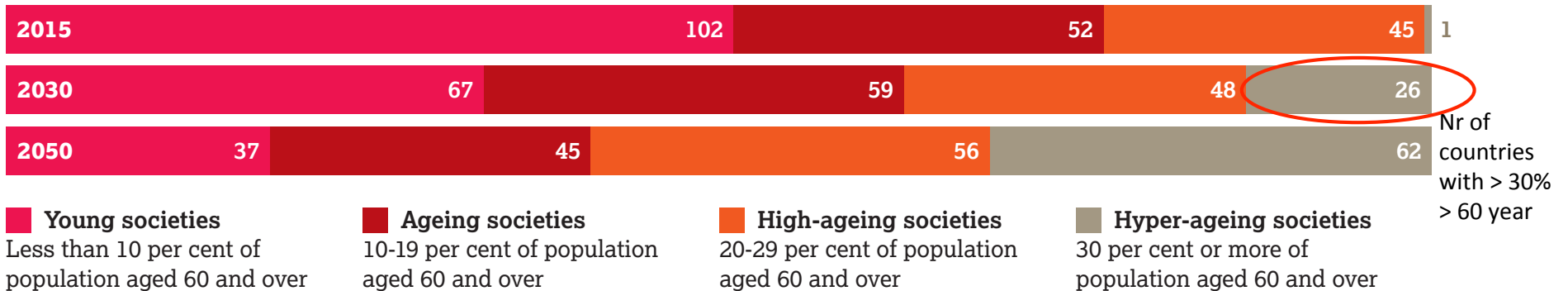
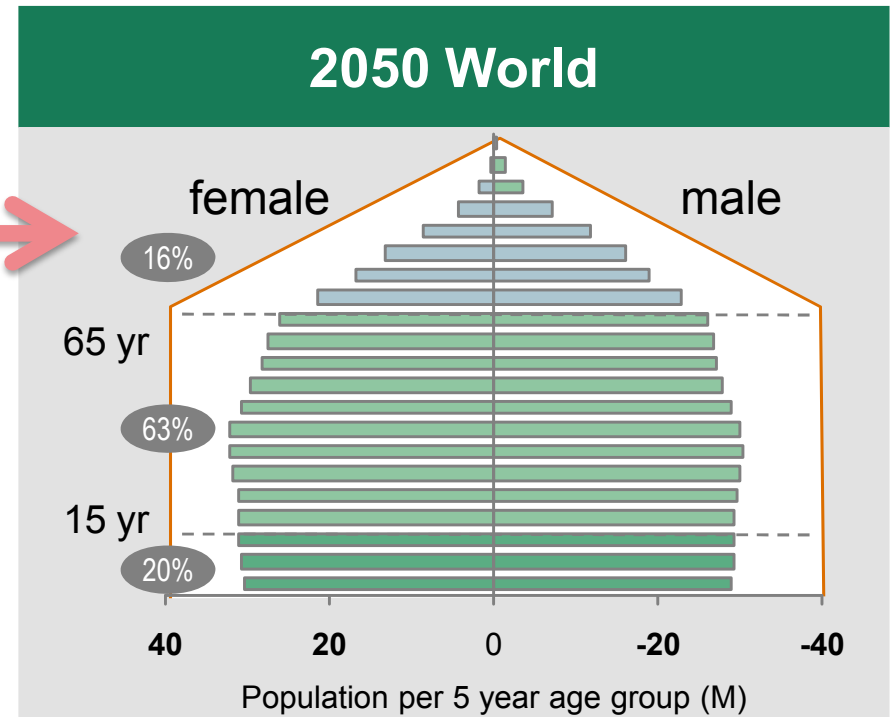
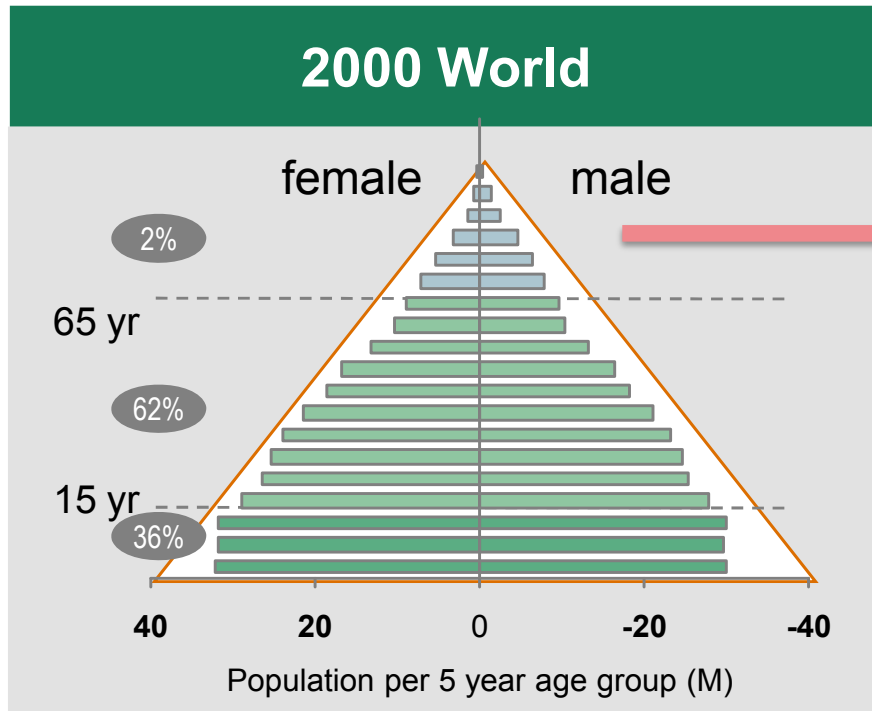
Trends

Ageing in  
Place  
applications

Wireless  
Challenges

# Context

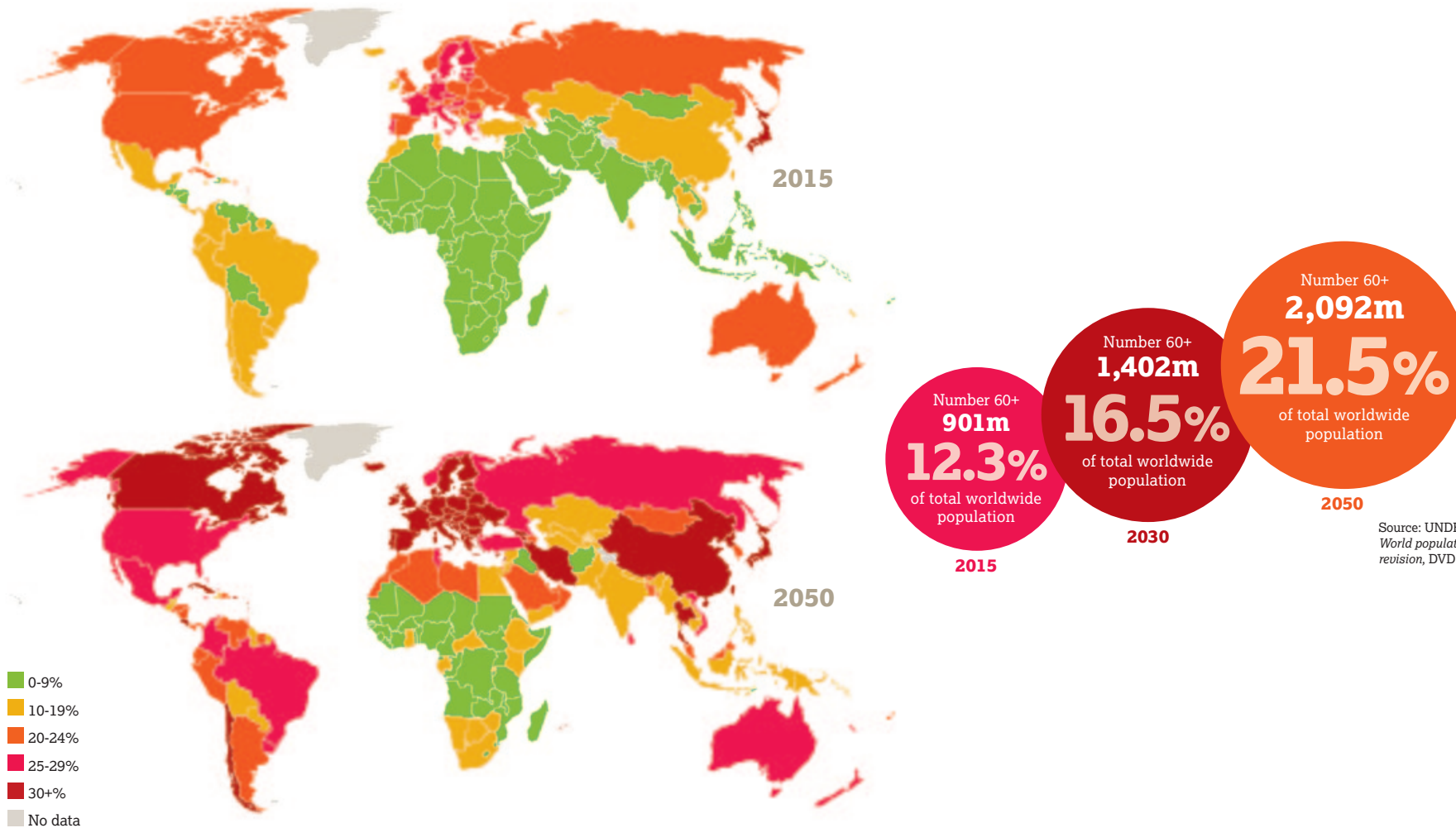
# Ageing population



Source: UNDESA Population Division, *World population prospects: the 2015 revision*, DVD Edition, 2015

# Countries with faster ageing population

Proportion of population aged 60 or over in 2015 and 2050



Source: UNDESA Population Division, *World population prospects: the 2015 revision*, DVD Edition, 2015

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# US Emergency Department visits by elderly

More than one third results in hospitalization

**19 million**

emergency department  
visits by US older adults

- **38%** arrive by ambulance
- **36%** result in hospital admission



Injuries and falls are the number one cause of ED visits (Unintentional falls make up 13.5%), but also heart disease, chest pain, abdominal pain, adverse drug reactions, COPD, pneumonia and urinary tract infections are common causes of ED visits in older adults.

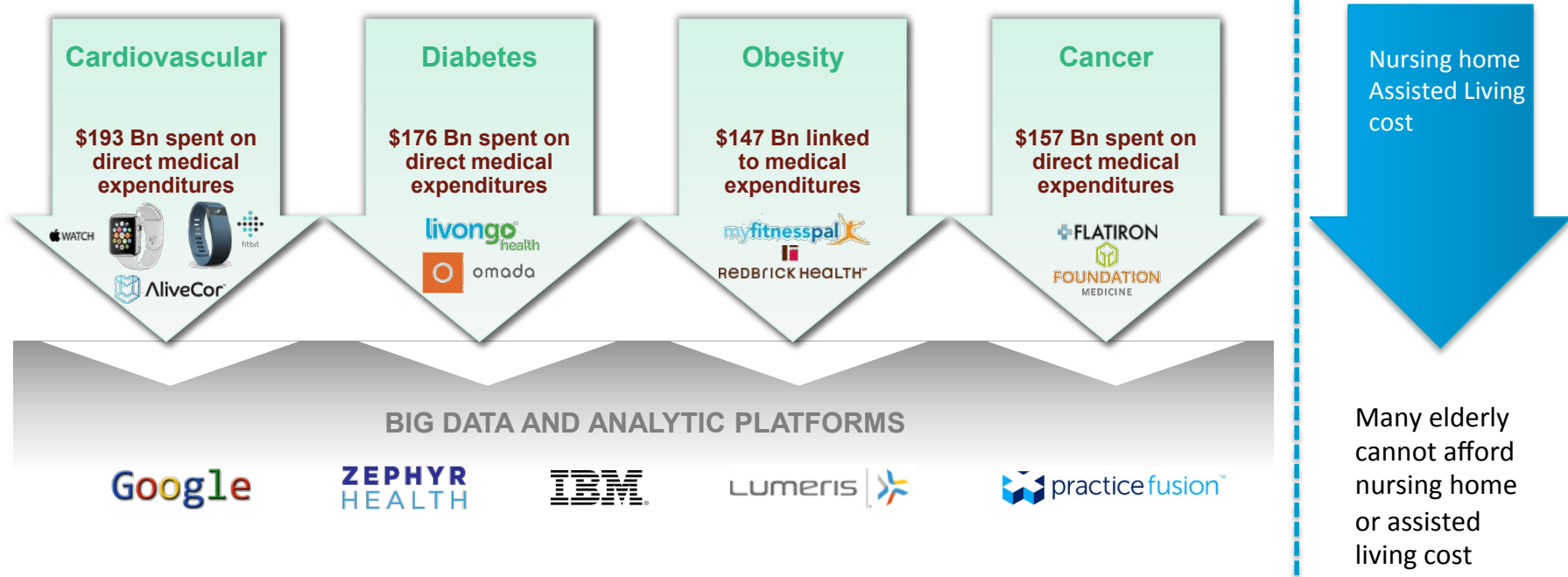
Ref: NCHS data brief 130 - Emergency Department Visits by Persons Aged 65 and Over: United States, 2009–2010

# Cost of healthcare

## US example

### Lower Healthcare Costs by Utilizing Technology to Help Manage and Prevent Chronic Diseases

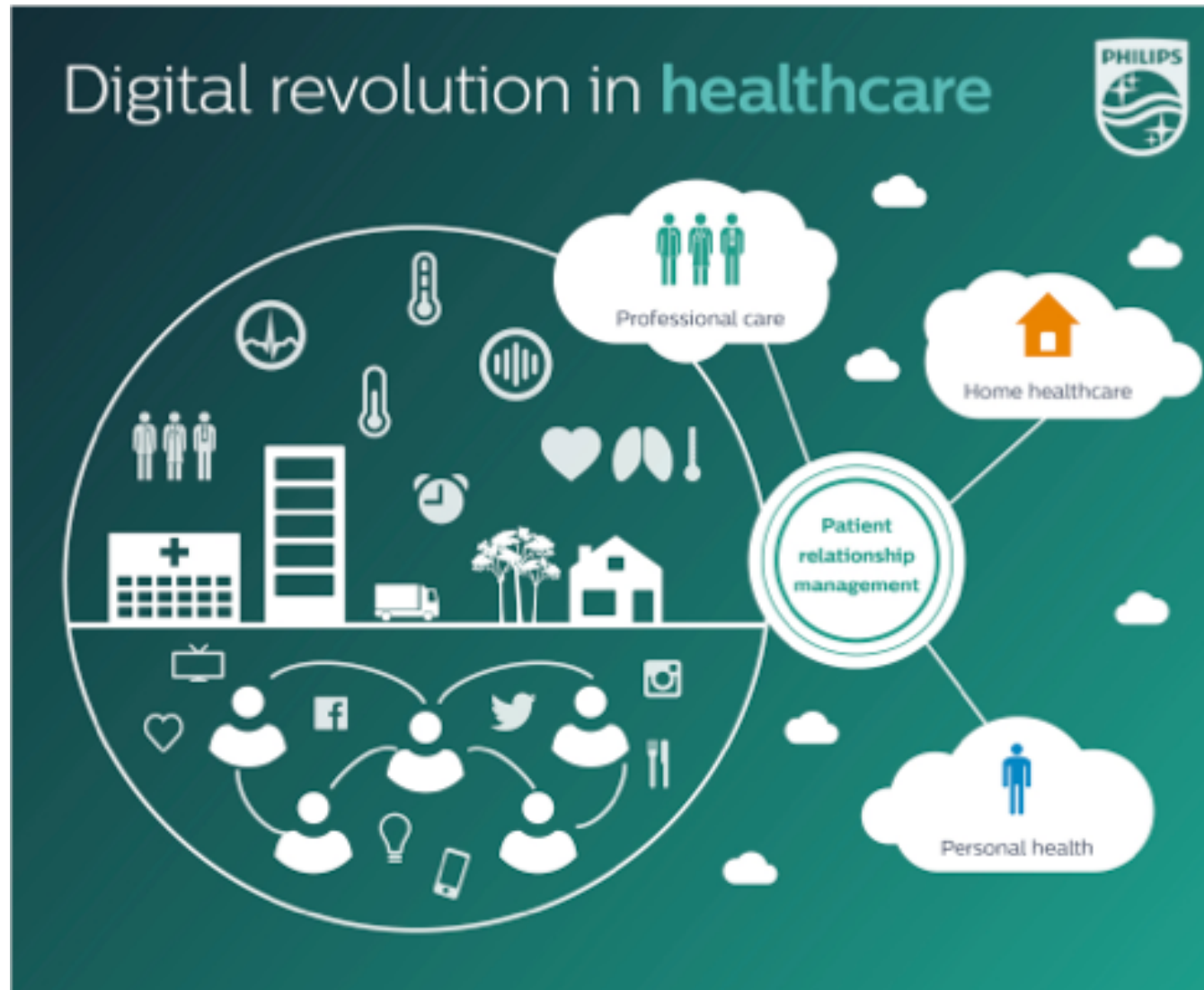
- In 2013, the US government spent \$591 billion on Medicare. However, Medicare is projected to have insufficient funds to pay all hospital bills beginning in 2030
- Chronic disease accounts for 86% of US healthcare costs, which can be reduced by enabling the healthcare ecosystem with innovative technology



@KPCB Source: Beth Seidenberg, KPCB General Partner and Lynne Chou, KPCB Partner. Sources: Kaiser Family Foundation website and CDC website <http://www.cdc.gov/chronicdisease/overview/>

# Care is changing

From professional to consumer





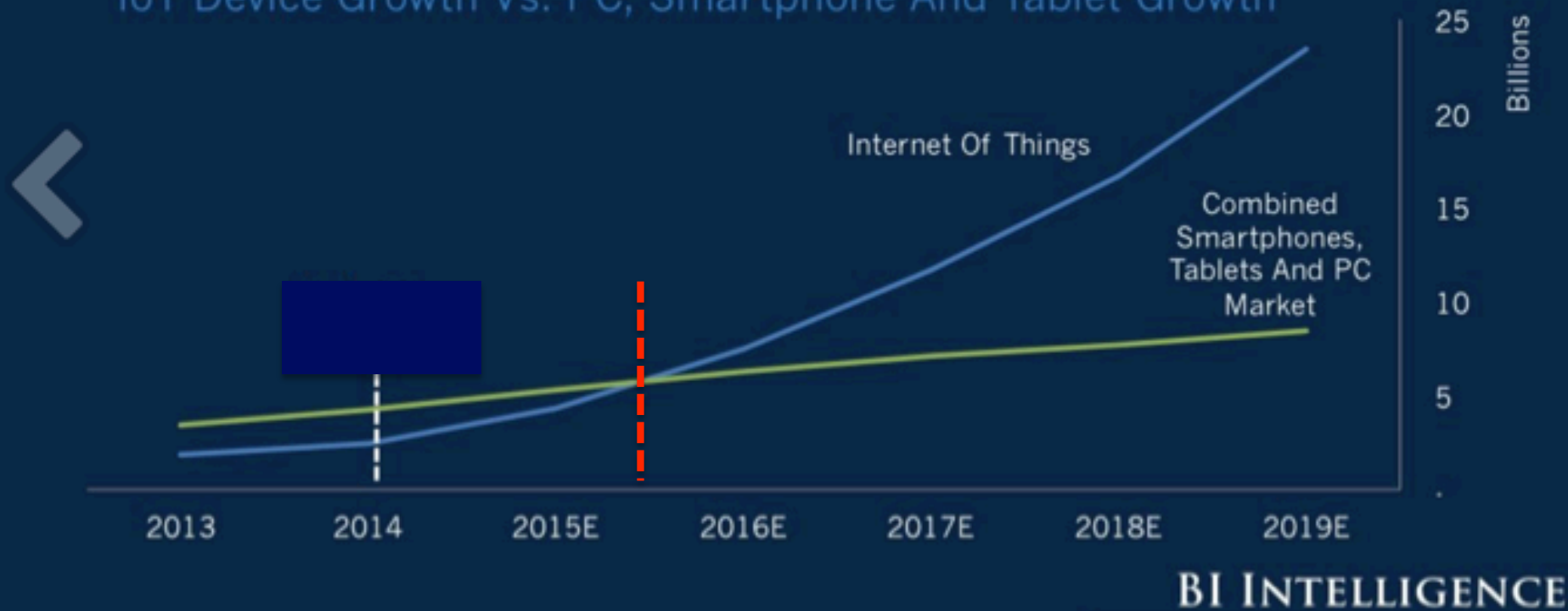
# Trends

# Internet of Everything

Fastest growth in IoE/IoT devices

It Will Soon Be Larger Than The PC, Tablet, And Smartphone Markets Combined

IoT Device Growth Vs. PC, Smartphone And Tablet Growth



BI INTELLIGENCE

Source: BI Intelligence Estimates

# Internet of Everything

Healthcare will benefit

Nearly All Industries Will Benefit,  
But Early Adopters Are In Logistics ...

Top Industries With Investments In IoT Solutions



BI INTELLIGENCE

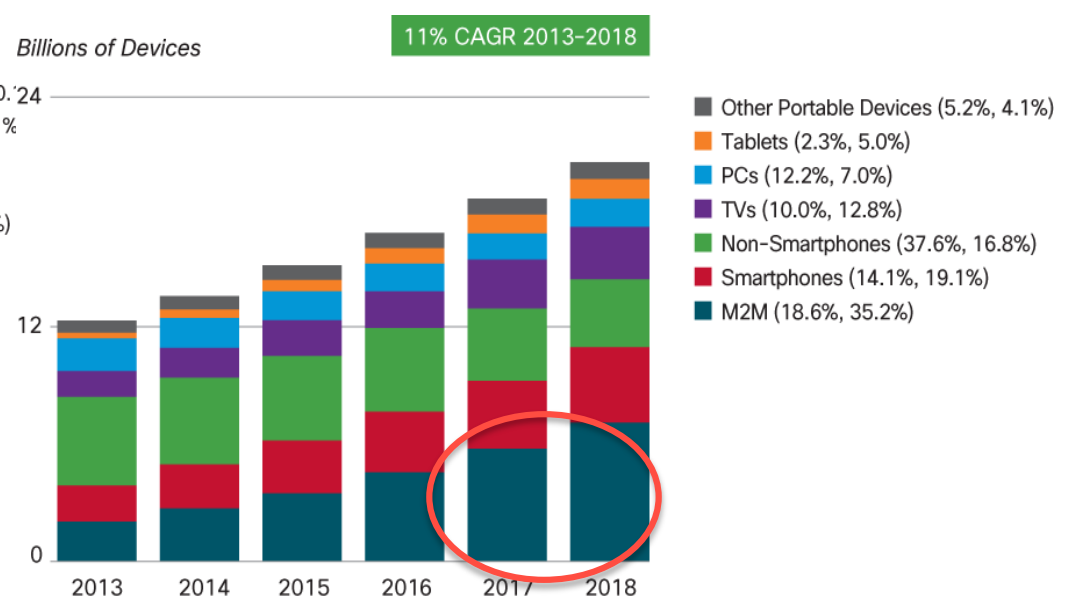
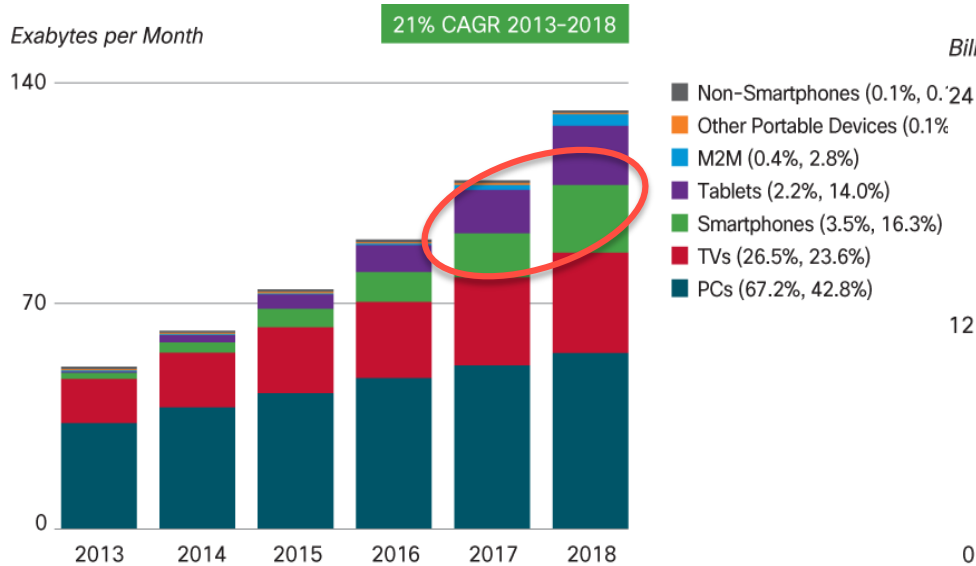
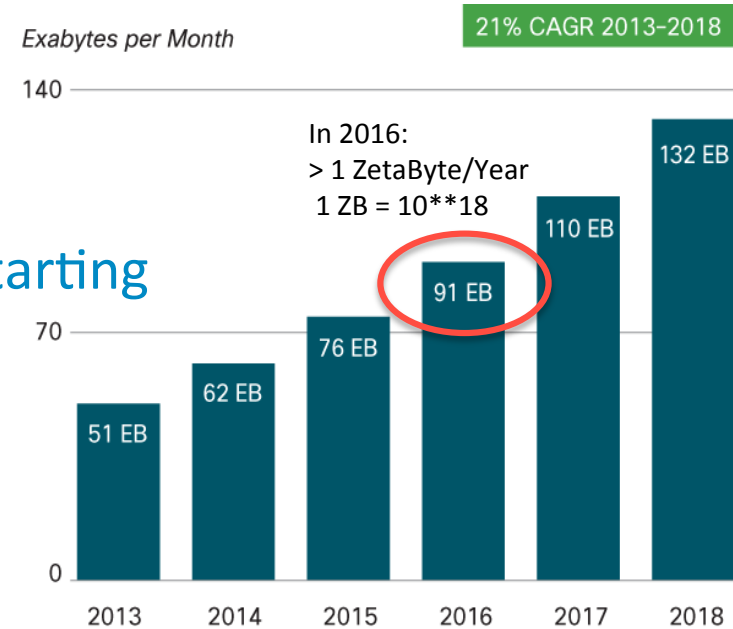
Source: BI Intelligence Estimates

# Trend : internet traffic growth

Amount of data is staggering – we are just starting

More than 1 Zetabyte per year in 2016

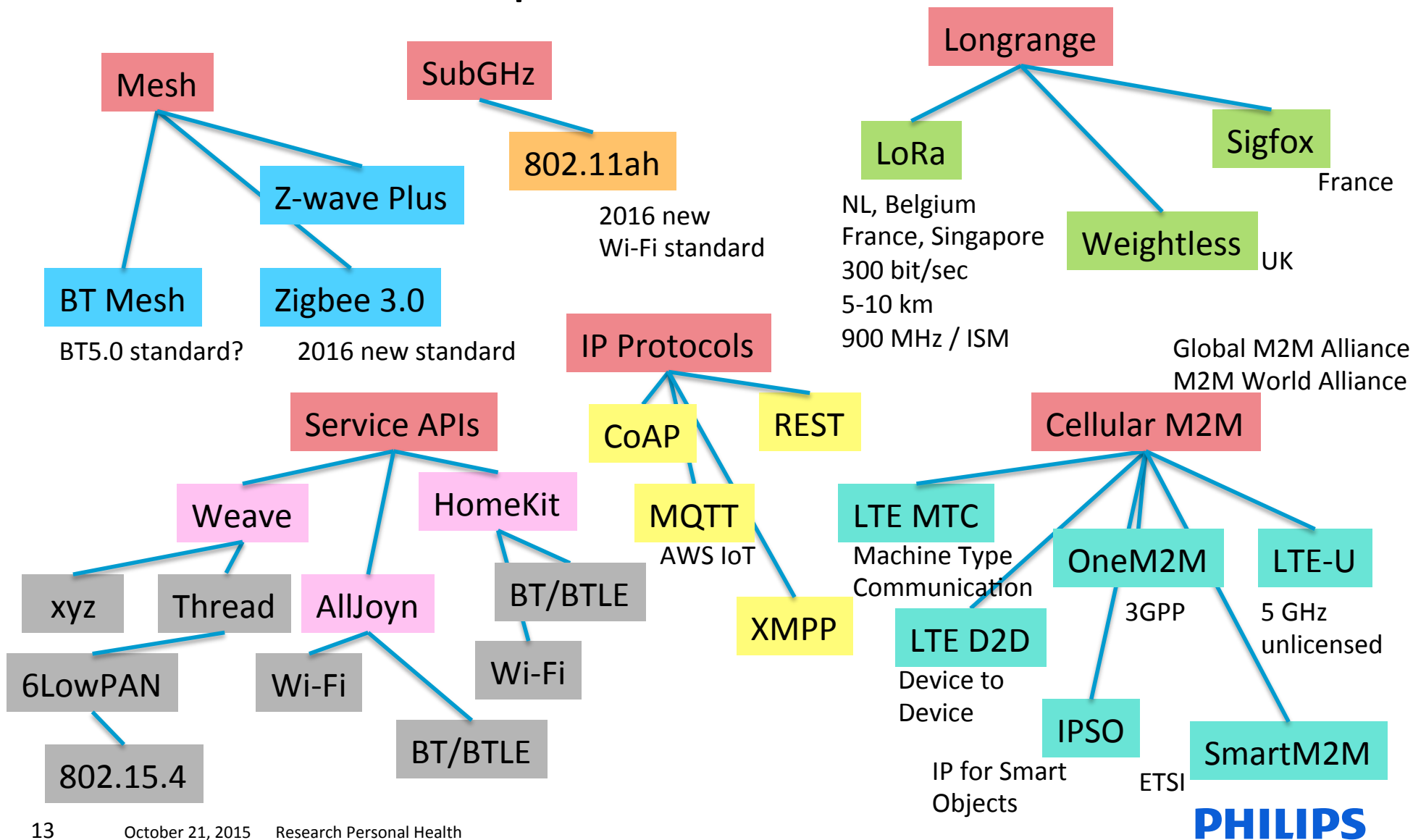
All movies ever made in 3 sec in 2018



Source: Cisco VNI, 2014

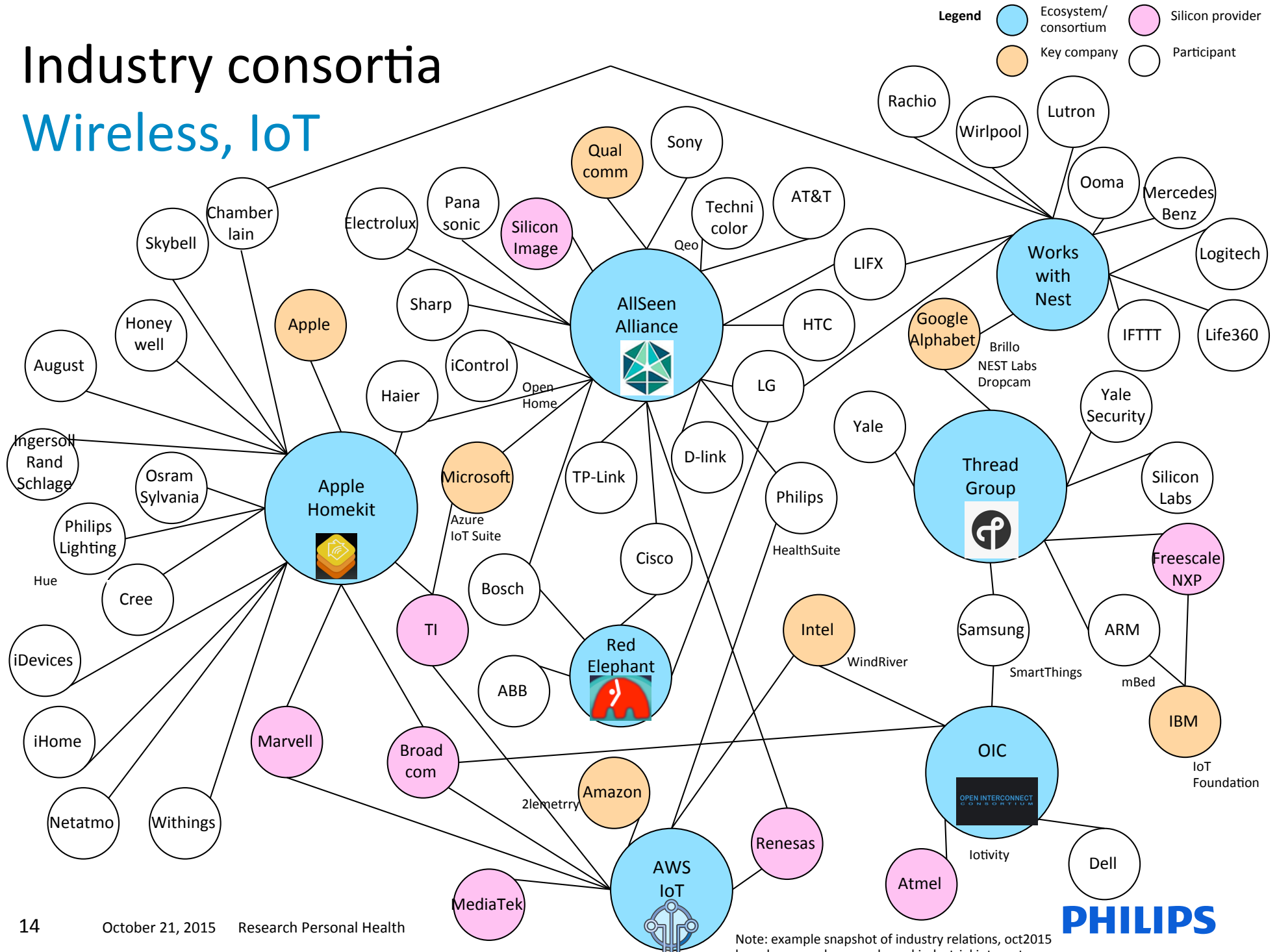
The percentages in parentheses next to the legend denote the device traffic shares for the years 2013 and 2018, respectively.

# Trends landscape



# Industry consortia

## Wireless, IoT





# Philips HSDP



# Elderly Care Journey (video)



# Care continuum

## Consumer and professional health converging



**We see two major opportunities:**

- **“Industrialization of care”**: enable providers to deliver lower-cost care with better outcomes
- **Drive convergence of professional health care and consumer spaces**

# The challenge is to create a healthcare experience that is as intuitive and effective as on-line banking or shopping

## For administrators

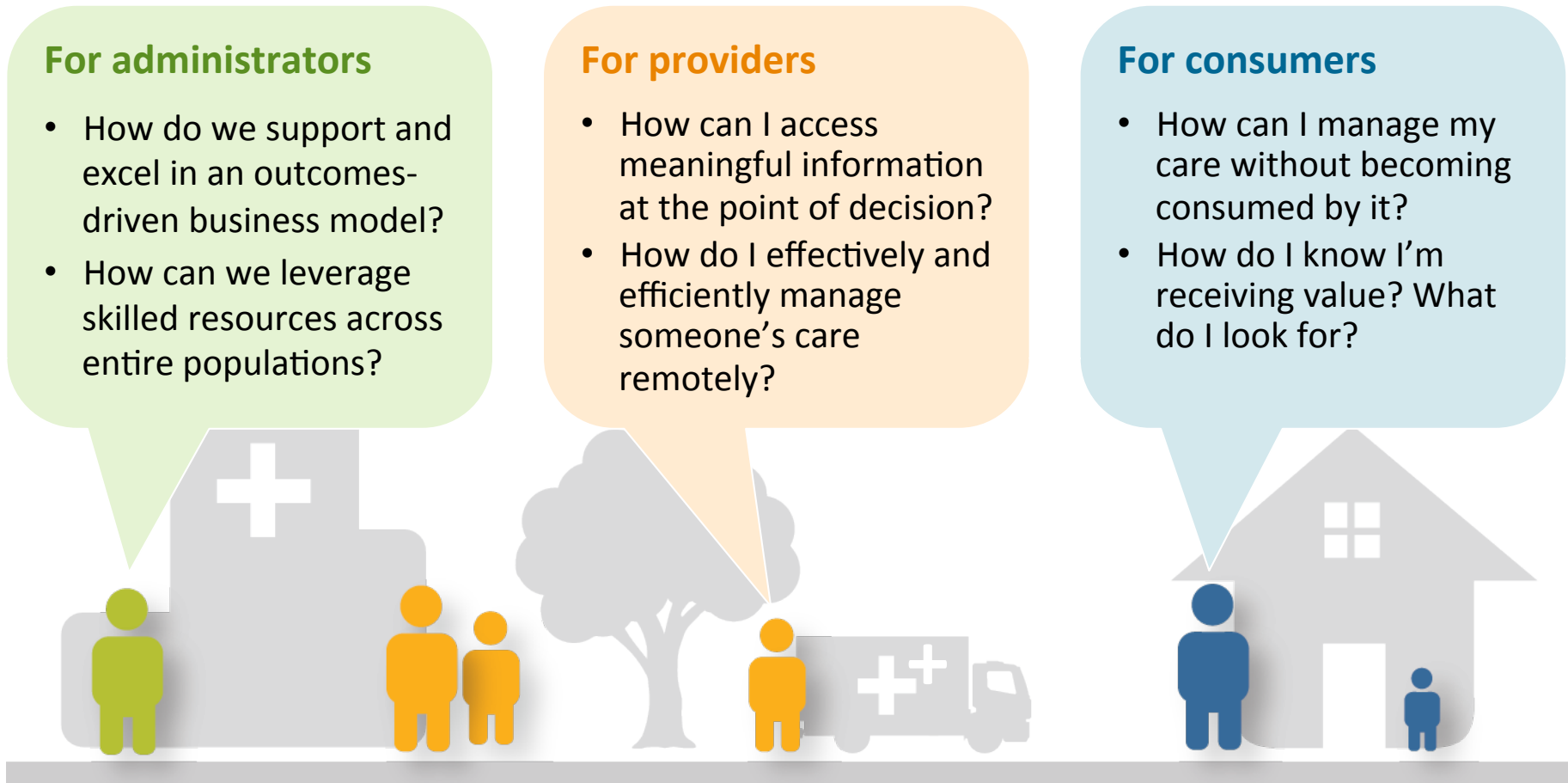
- How do we support and excel in an outcomes-driven business model?
- How can we leverage skilled resources across entire populations?

## For providers

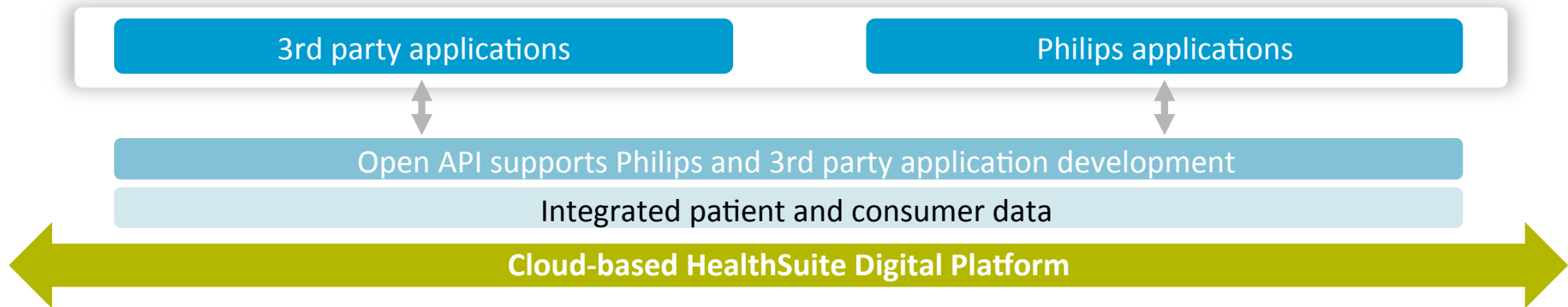
- How can I access meaningful information at the point of decision?
- How do I effectively and efficiently manage someone's care remotely?

## For consumers

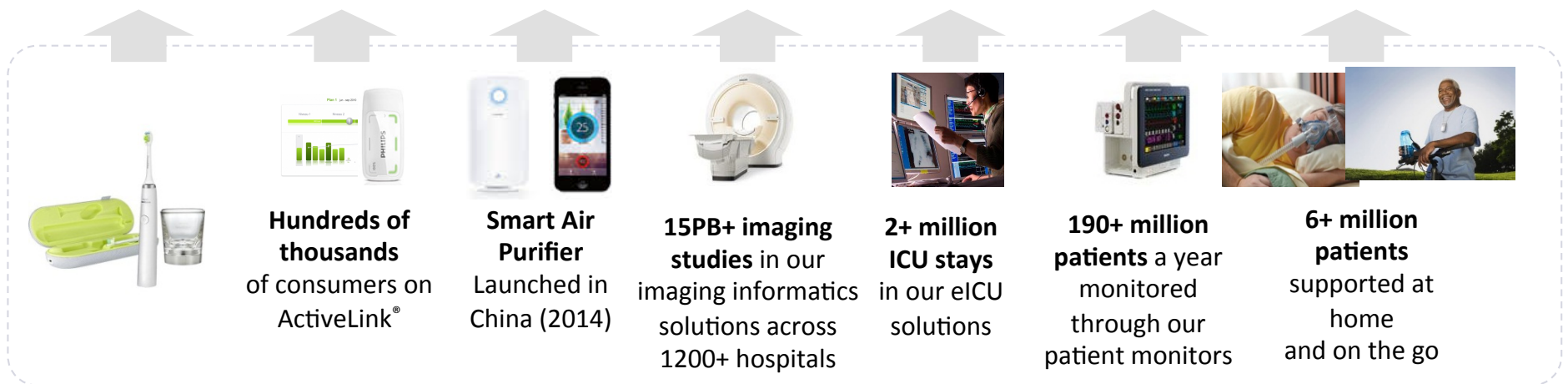
- How can I manage my care without becoming consumed by it?
- How do I know I'm receiving value? What do I look for?



# Philips HealthSuite Digital Platform designed to support the Health Continuum



*Multiple devices / applications contribute to a rich data set*



**Hundreds of thousands** of consumers on ActiveLink®

**Smart Air Purifier** Launched in China (2014)

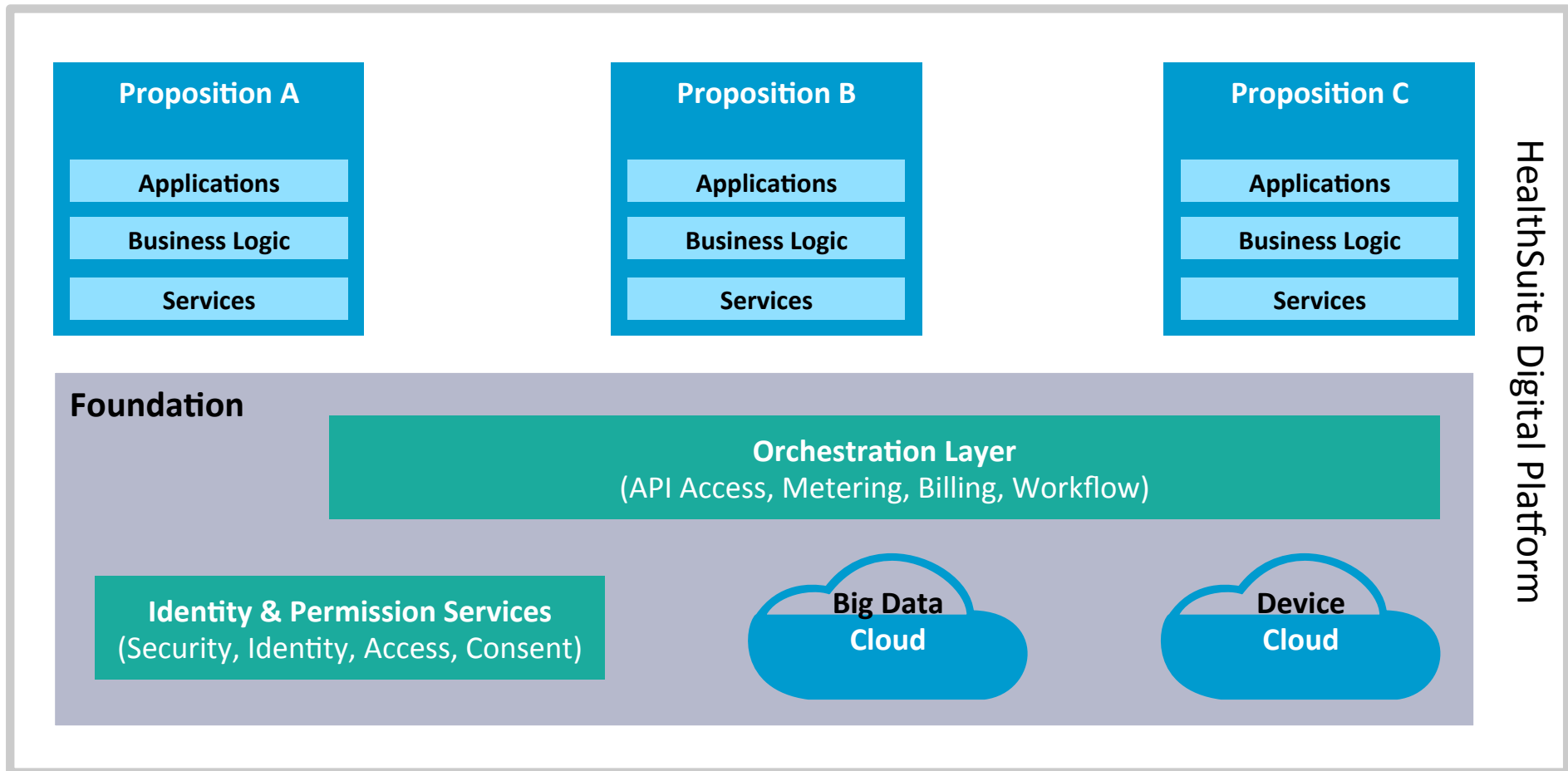
**15PB+** imaging studies in our imaging informatics solutions across 1200+ hospitals

**2+ million ICU stays** in our eICU solutions

**190+ million patients** a year monitored through our patient monitors

**6+ million patients** supported at home and on the go

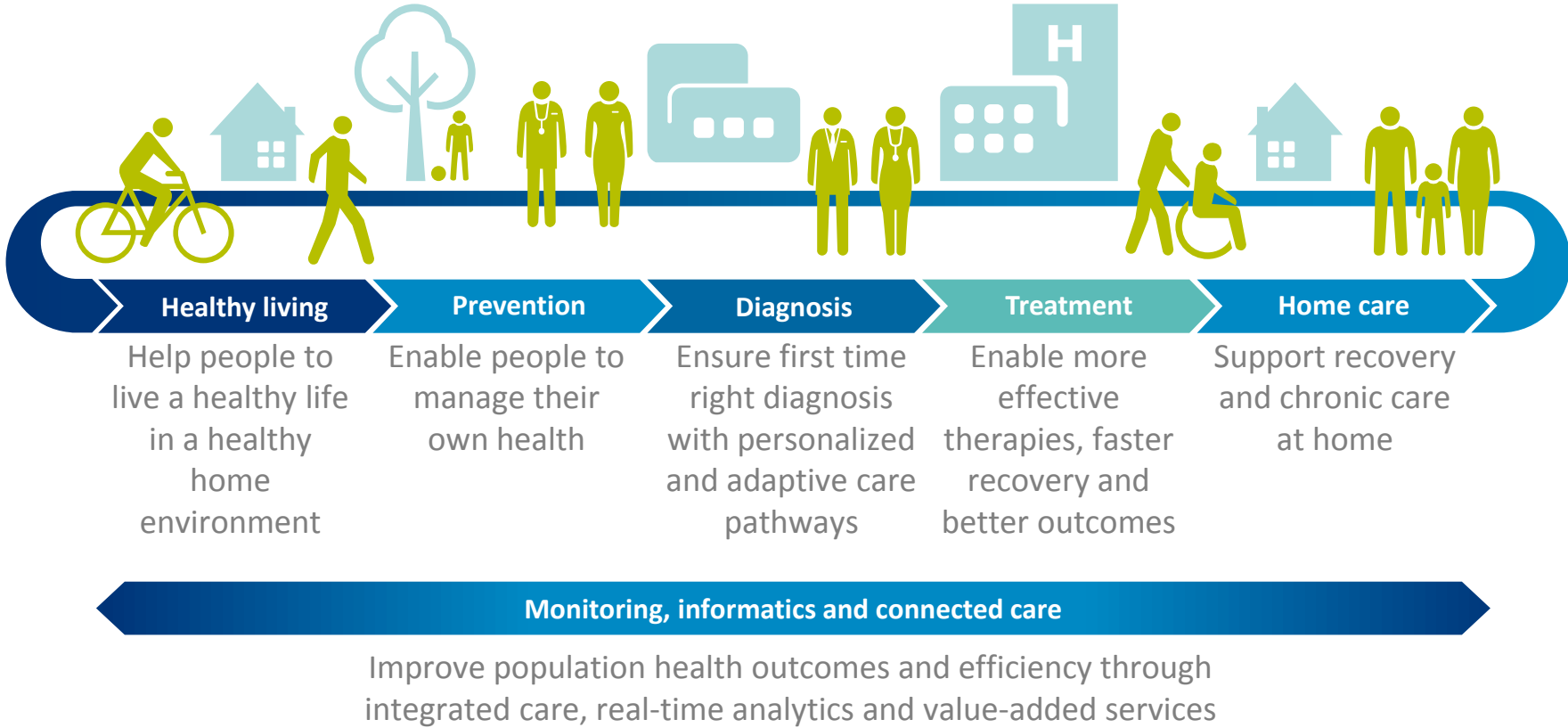
# Propositions based upon HSDP



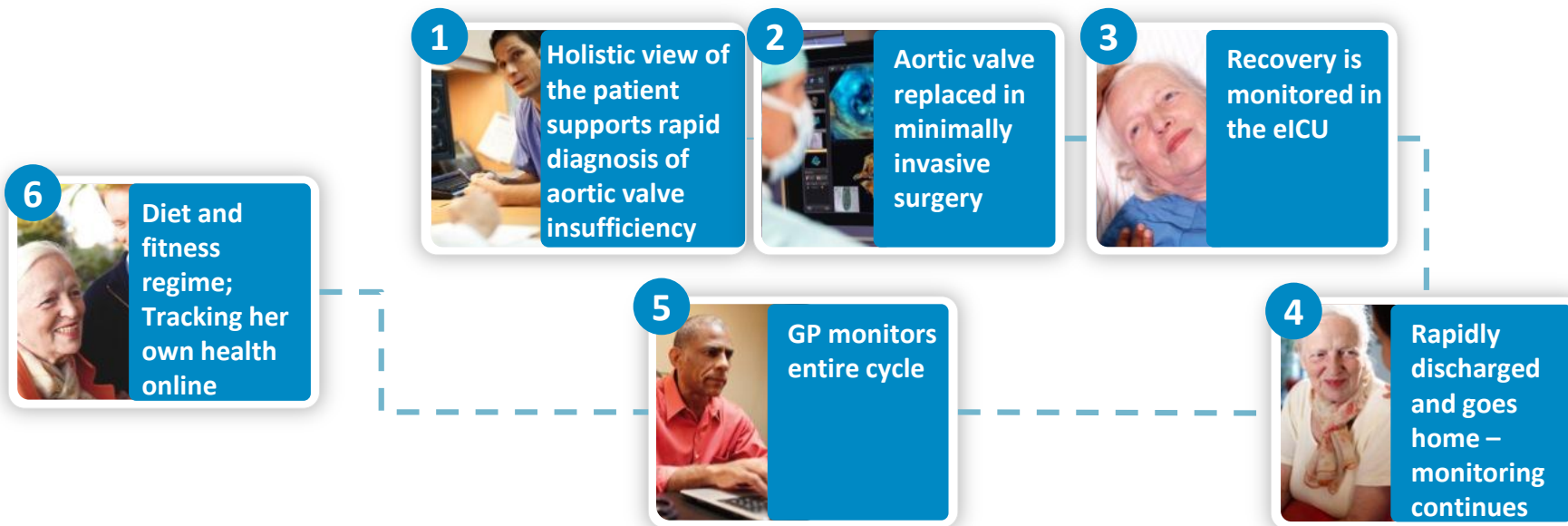
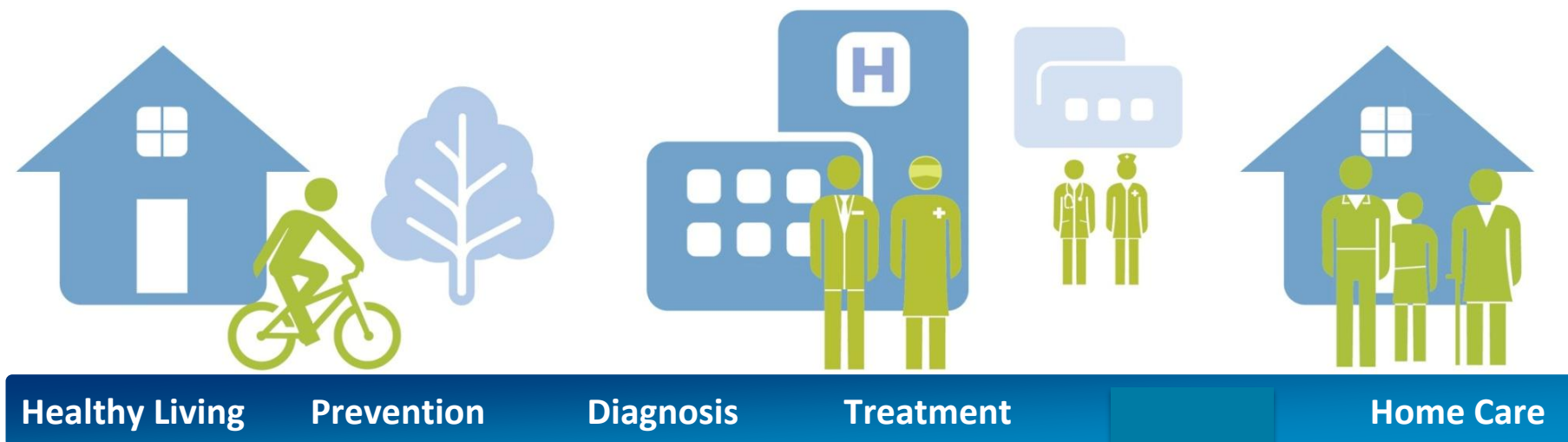
# Ageing in place

# Healthcare customer and consumer needs

## Care continuum for elderly / ageing consumers



# Example





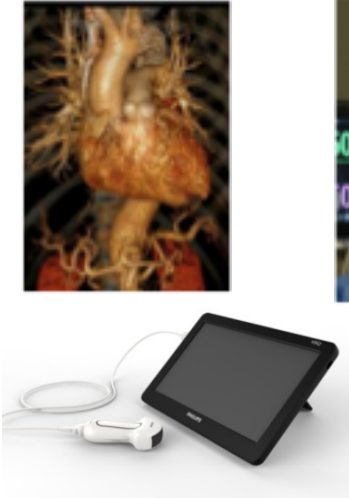
# HealthSuite Digital Platform connects Philips and third party solutions across the continuum of care



**Prevention**



**Diagnosis**



**Intervention**



**Treatment**



**At Home**



**HealthSuite digital platform – open platform enabling solutions**

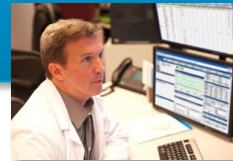
# Ageing in place

How to support ageing in your own home?

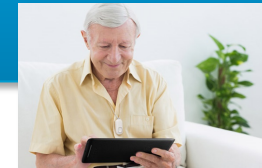
Personal Emergency response systems



Activity of Daily Living Monitoring systems



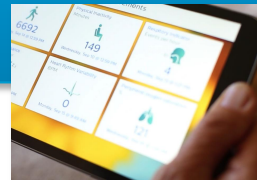
Social care systems



Medication management systems



eHealth systems



Other Wellbeing systems

# Ageing in place

All support systems require some type of wireless connectivity



Personal Emergency response systems

3G

Sub  
GHz

Wi-  
Fi



eHealth/Vital Signs systems

3G

BTLE

Other Wellbeing systems

3G  
4G

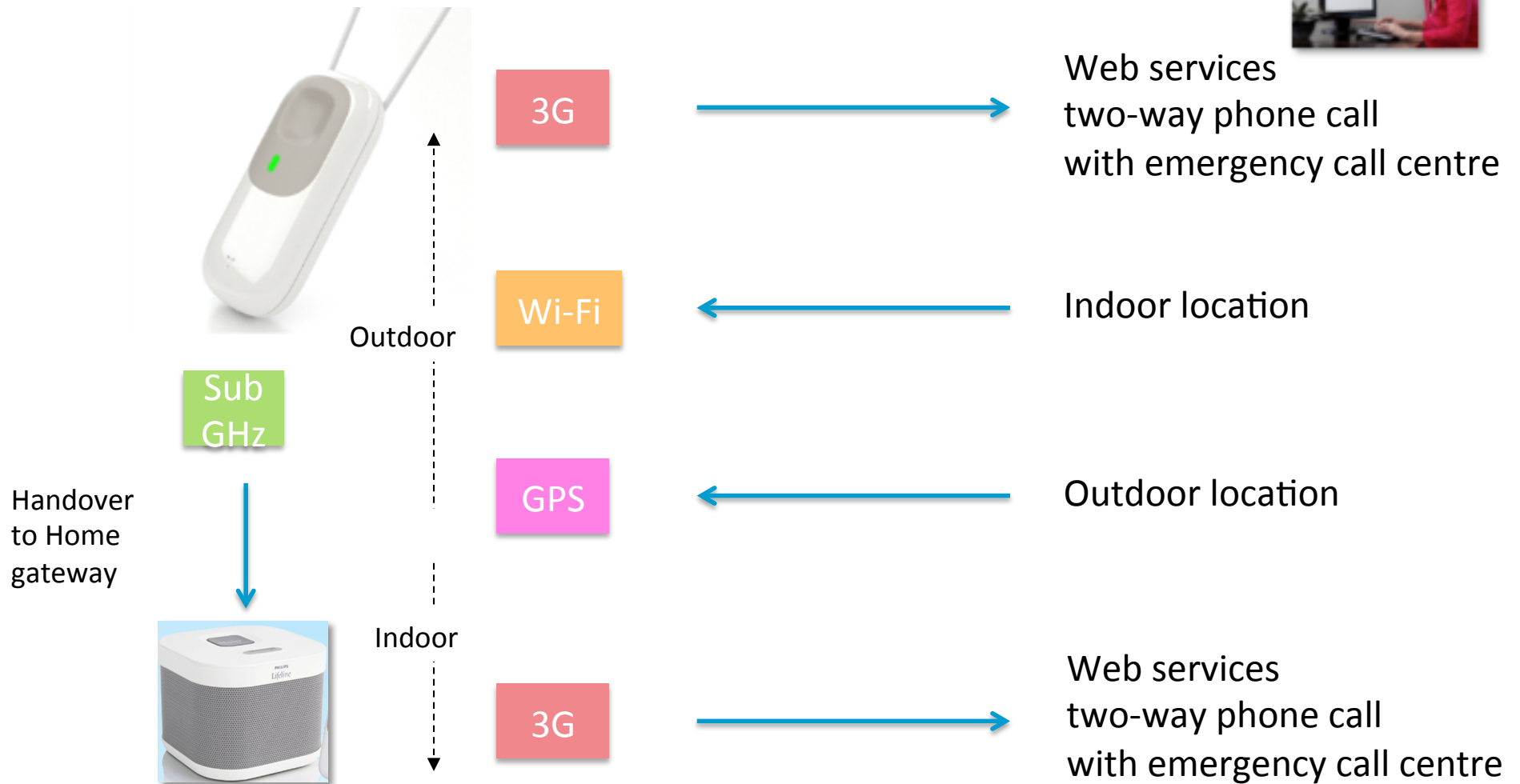
Wi-  
Fi

BTLE

LoRa

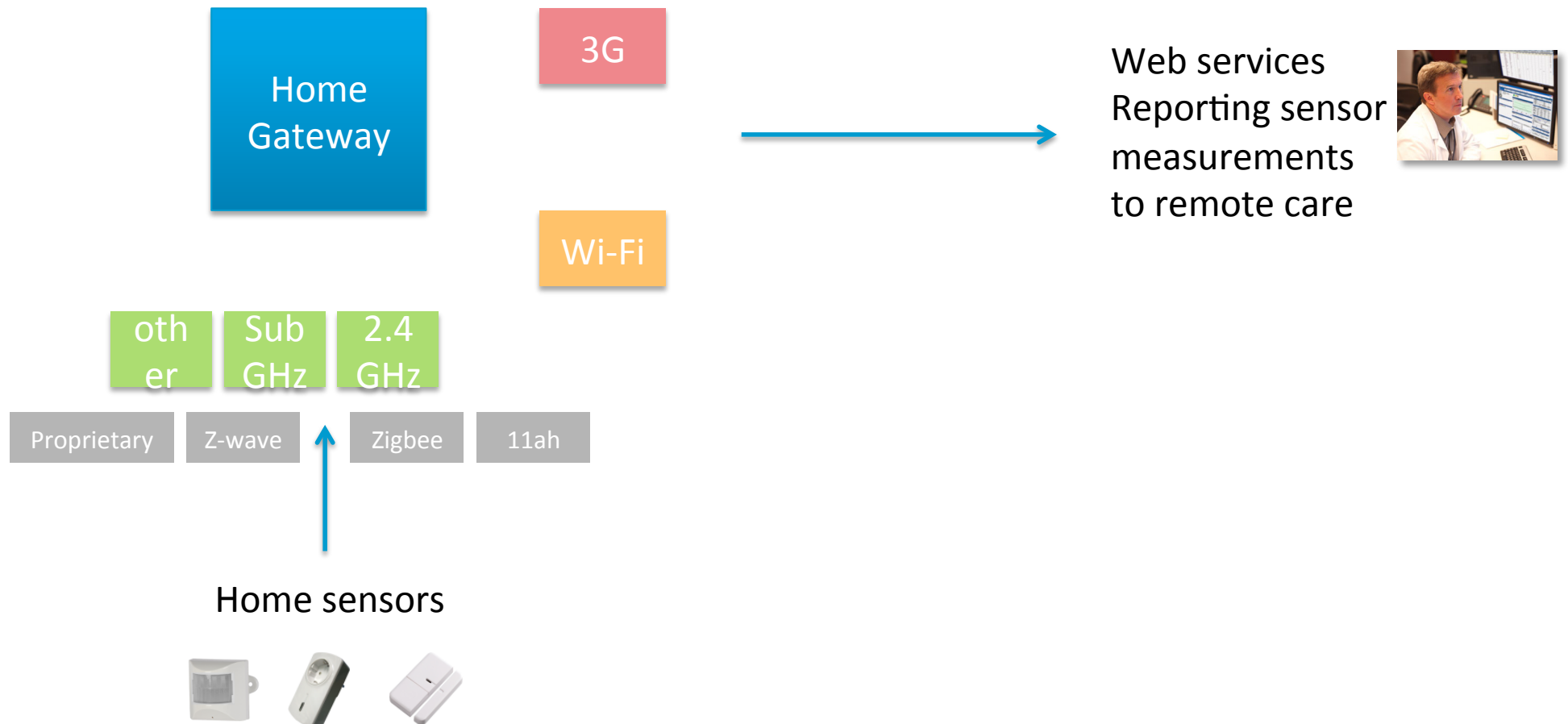
# Case 1 – Lifeline GoSafe

Personal help and automatic fall detection of frail elderly



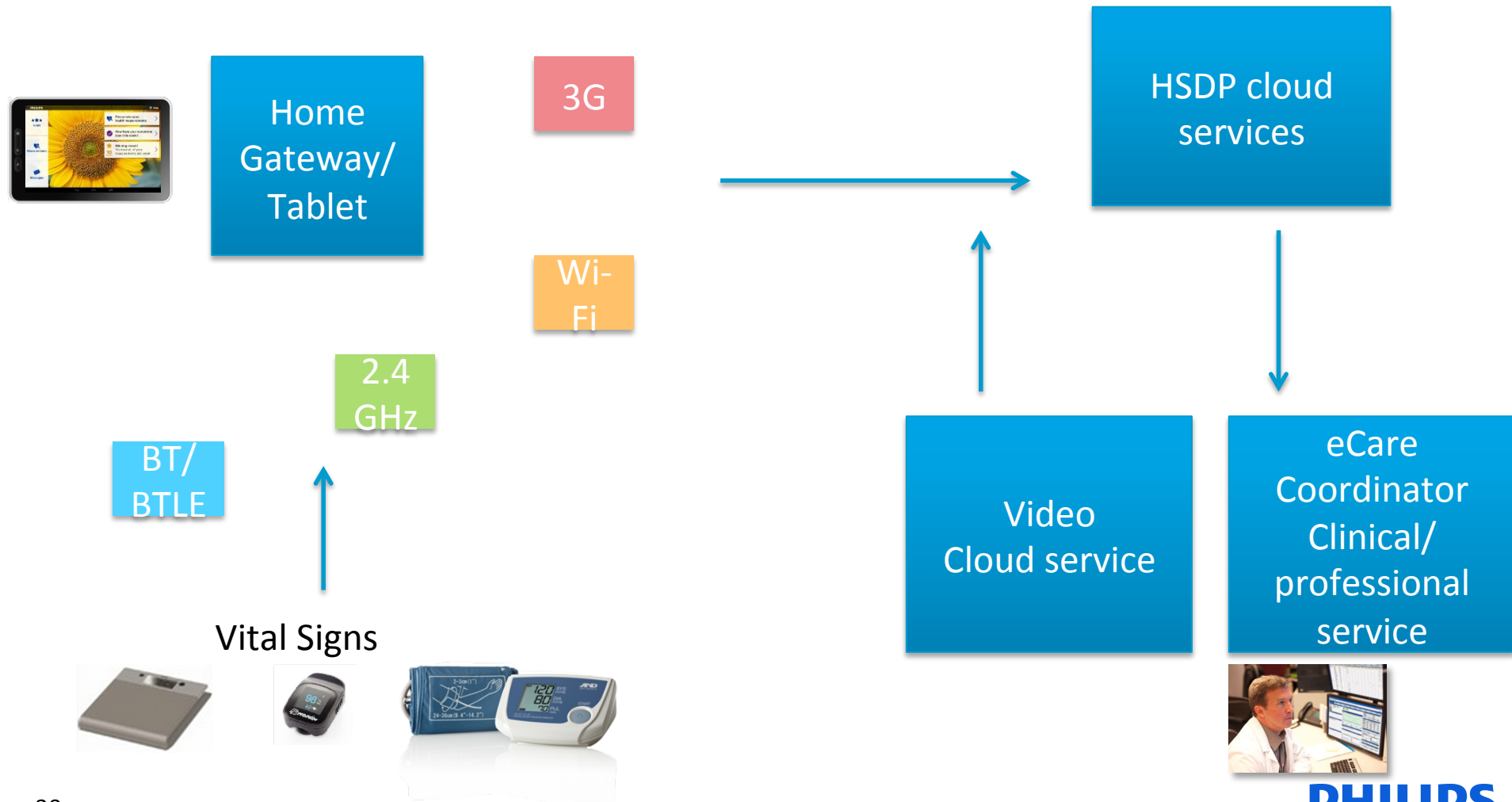
# Case 2 – Activity of Daily Living Monitoring

Monitoring home situation of frail elderly



# Case 3 – Vital Signs Monitoring/eHealth

Elderly Chronic Diseases Management/ Ambulatory care



# Wireless challenges (1)

## Homes of elderly

- Battery powered sensors
  - Tradeoff between transmit power, number of sensor activations, richness of data transmitted
  - Frequency of changing batteries → more than 1 year
  - Transition from sleep mode
- Distance in the home
  - Single hop
  - Multi hop/mesh (need for powered nodes)
- Penetration in the home
  - Multiple walls
  - Blockage by human bodies
- No wired internet available
  - In many cases elderly do not have internet at home
- 3G coverage
  - Often no coverage with a single provider
  - Fallback to GPRS if at end of cellular range (no video capability anymore)
  - Placement at home of 3G router

# Wireless challenges (2)

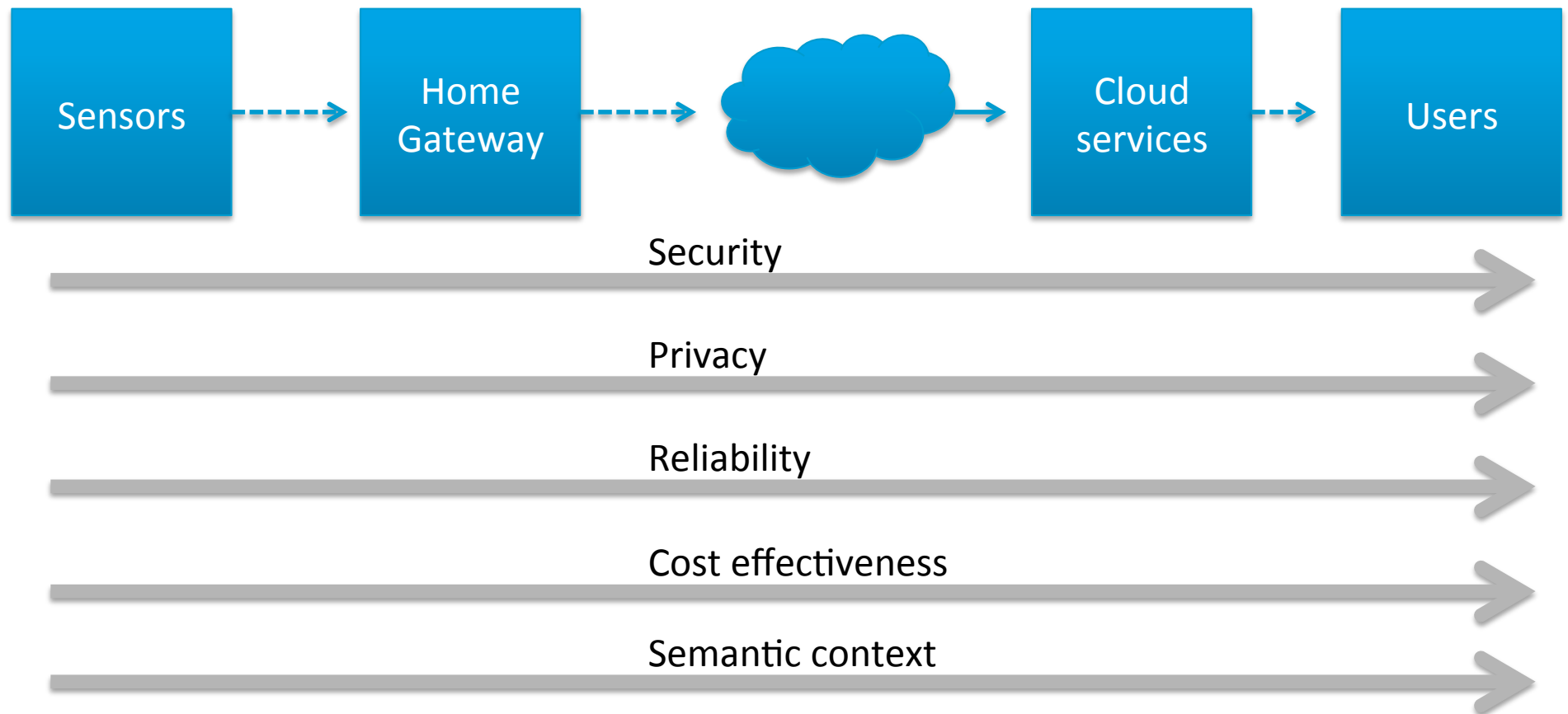
## Characteristics of elderly / other

- Unobtrusiveness
  - Do elderly in the home notice the sensors
  - On body versus off body sensors
- Cost of sensors
  - Tradeoff with multiple sensors or single wireless sensors
- Availability
  - Off the shelf from various vendors
  - Proven in the field
- Differentiation between multiple persons
  - In the neighborhood of wireless sensors
- Geographical
  - Spectrum availability
  - Duty cycle
  - Afraid of electro magnetic radiation



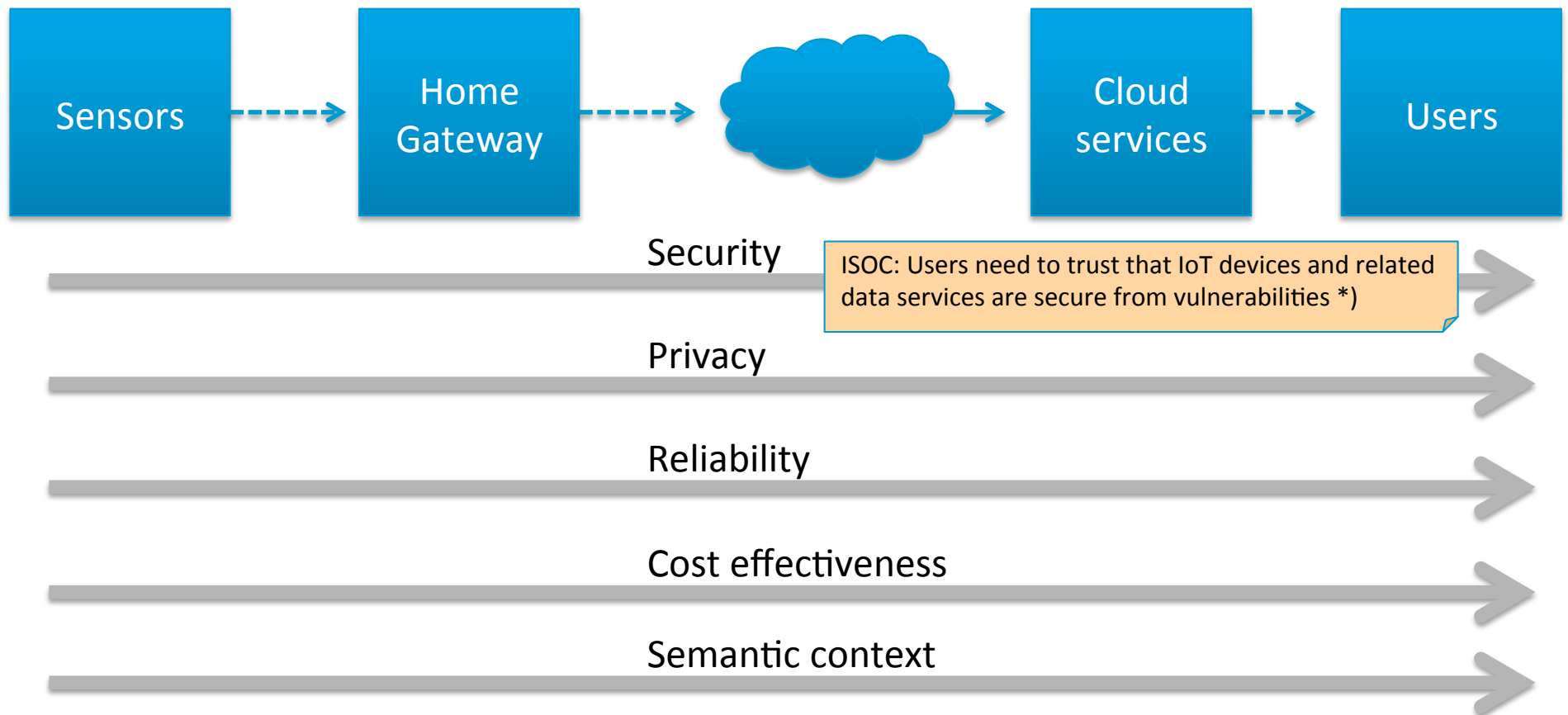
# End to end challenges

Many wireless connections involved



# End to end challenges

Many wireless connections involved



# Final thoughts

# Final thoughts



- Society needs to deal with the ageing population
  - Unobtrusive monitoring with IoE/IoT and wireless sensor networks is a key technical opportunity
  - Competing platforms – multiple will exist with cloud integration
  - Enabling new services for ageing in place
  - Security and privacy will be key
- 
- Some questions/challenges for the research community
    - Low power battery powered wireless sensors with multi year lifetime
    - Streaming low data rate data while preserving lifetime (e.g. heart rate, ECG)
    - Distance in a home of an elderly
    - Semantics of billions of wireless sensors

