

# IoT – the world of connected devices

Doris Keitel-Schulz  
MPSoC 2017



# Internet Trends show Solid User Growth but Slowing Smartphone Growth

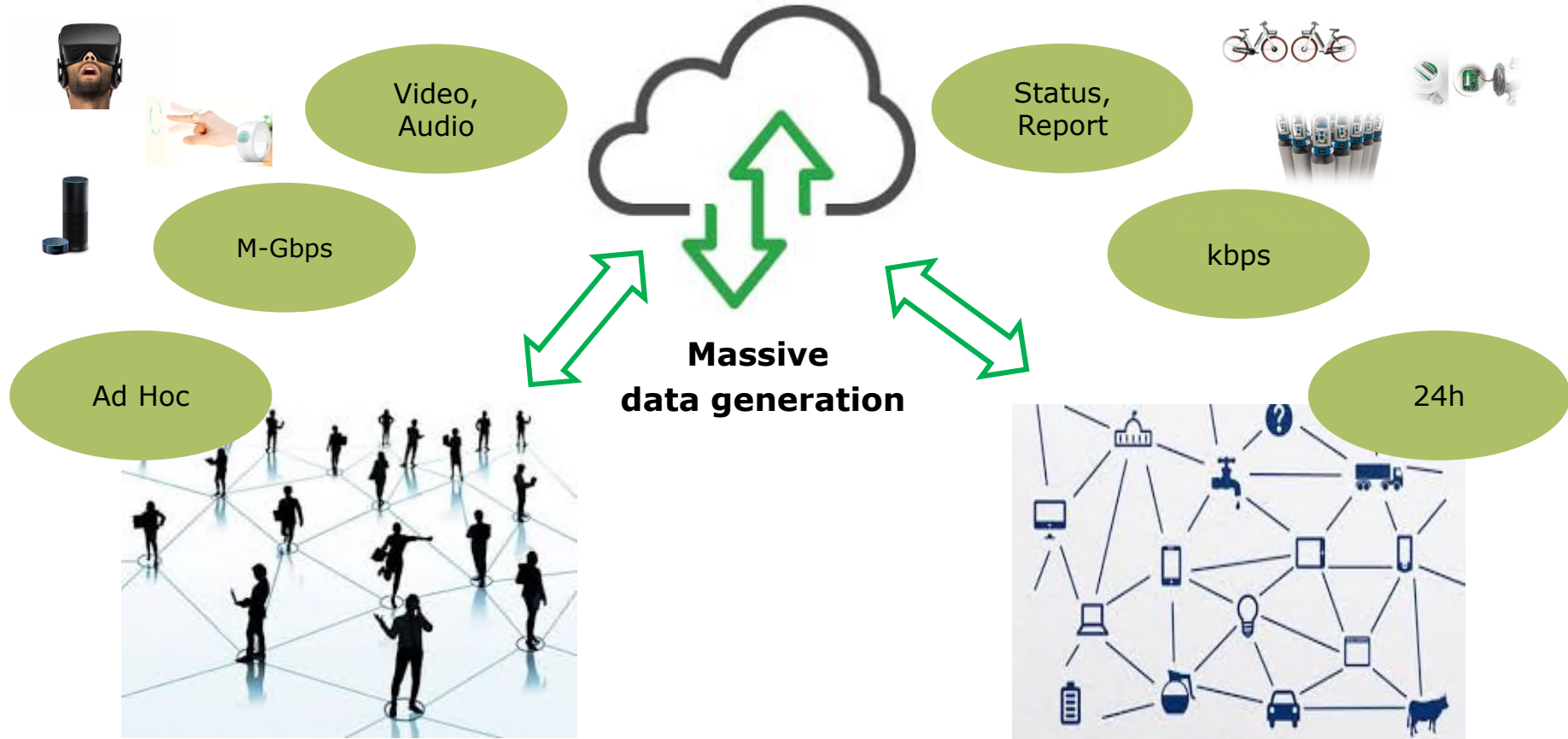


- 1) Global Internet Users = 3.4B...Flat Growth +10% vs. 10% Y/Y...**  
+8% vs. 8% Y/Y (ex. India)
- 2) Global Smartphone Shipments = Slowing +3% vs. +10% Y/Y**
- 3) Global Smartphone Installed Base = Slowing +12% vs. +25% Y/Y**
- 4) USA Internet Usage (Engagement) = Solid +4% Y/Y**

## ***So what is next?***

From Kleiner Perkins INTERNET TRENDS 2017

# IoT – from connected people to connected things



## Important Trends

Higher speed for more content  
Novel human machine interface  
Fast battery charging

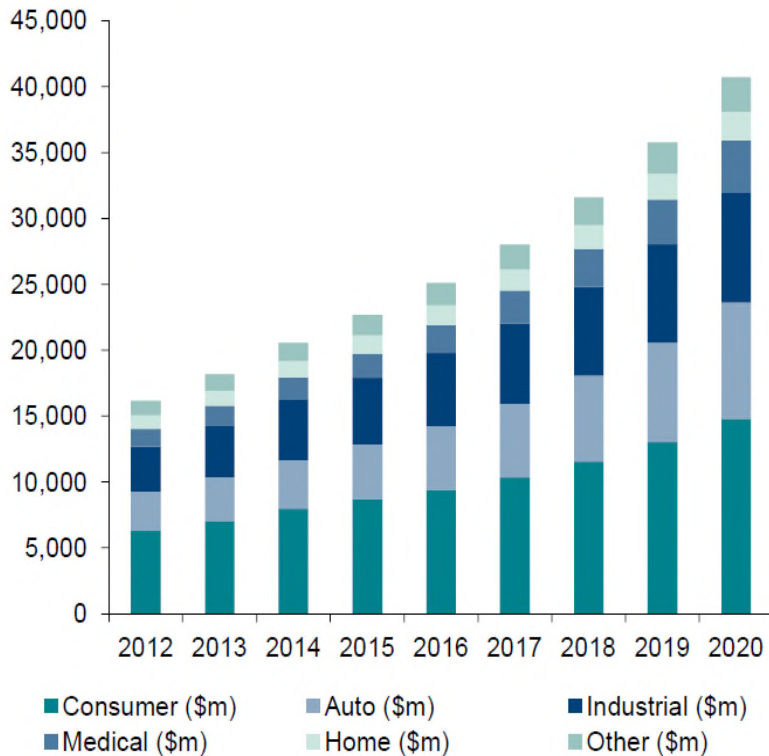
## Important Trends

Local analytic for smart features  
Limited human interaction  
Low power for long battery lifetime

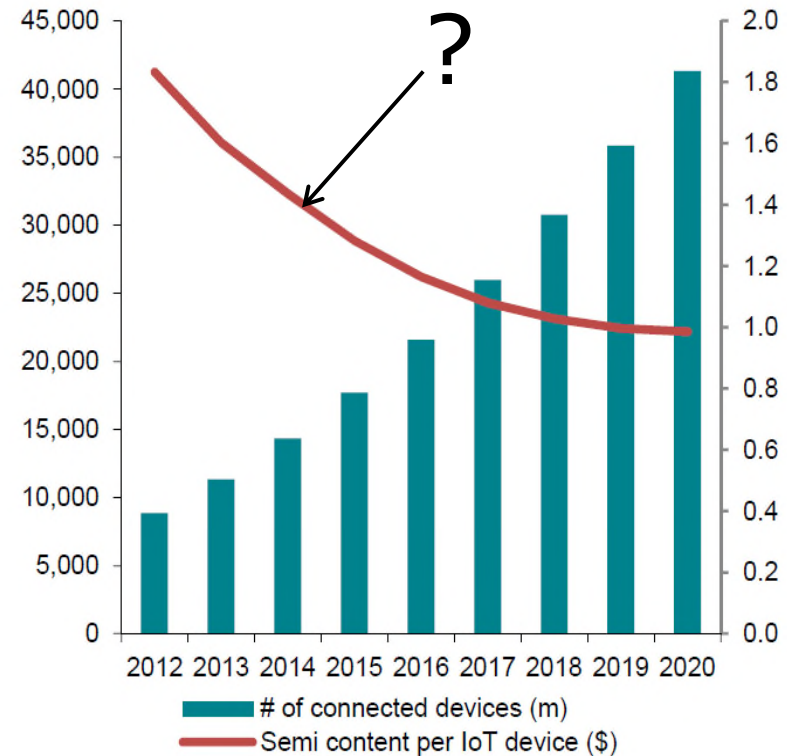
# Predictions for the IoT and IIoT market

## IoT semi sales expected to expand at a 12% CAGR to 2020

IoT semi sales by application area



Semi content (USD) per connected device



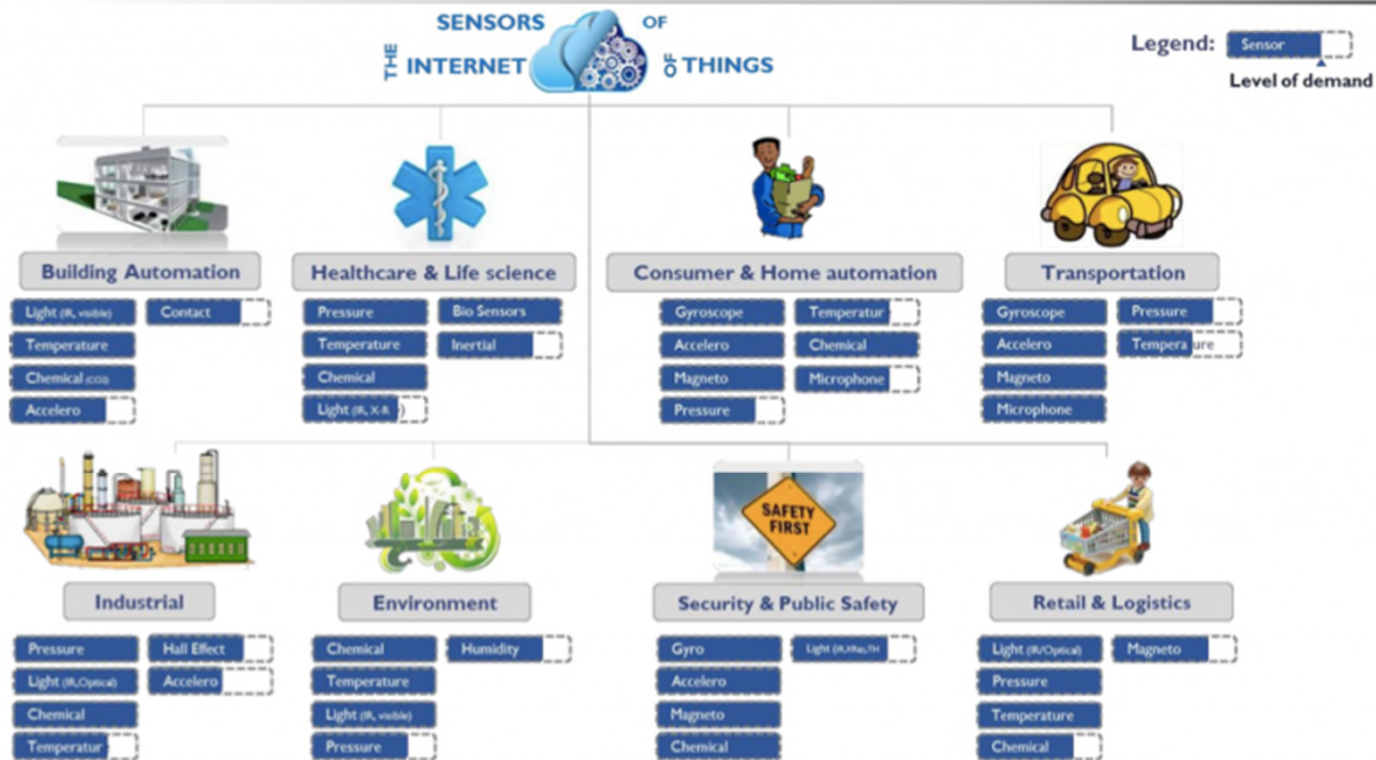
Source: Exane BNP Paribas estimates ; IBS

# Silicon/Semiconductor based sensors as enablers



## TECHNOLOGIES OF IOT

8 segments, unlimited opportunities



Yole's presentation - Sensors for IoT - Sensors Expo - Long Beach, CA, 2015

# What we can do : i.e. the future refrigerator

## Voice recognition & interaction

- > Small size
- > Long lifetime
- > compatibility with other modules

## Face recognition to recommend related to food, recipes according to personal eating habits

- > Small size
- > Long lifetime
- > compatibility with other modules



## Food identification for refrigerator food inventory management

- > Accuracy > 85%
- > Reaction time < 5s
- > Operation condition: (5 ~ -18 °C, 40% ~ 95% RH)
- > Micro-equipment, lifetime > 10 years, no special maintenance

## Detect Pesticide Residues on the fruit and vegetable products (four categories: organic phosphorus, organic chlorine, pyrethrins, carbamates).

- > high detection accuracy (ppm level)
- > non-destructive testing
- > detection time within 1min

## Identify freshness of food, also in case of mixed food

- > accuracy +/- 10%
- > response time less than 3s
- > Operation condition: (5 ~ -18 °C, 40% ~ 95% RH)
- > Micro-equipment, lifetime > 10 years, no special maintenance



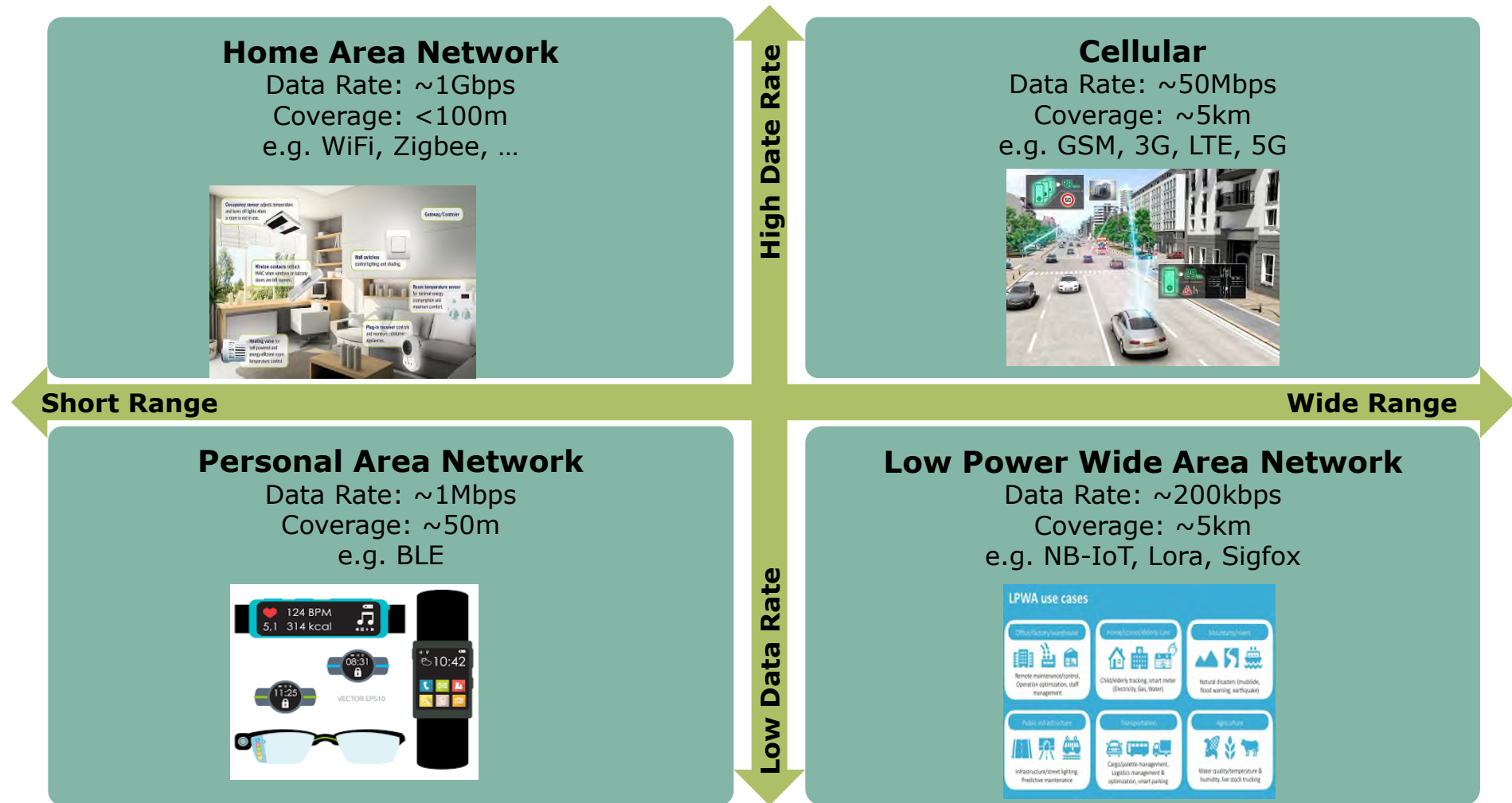
# Examples for the application areas

Application Segment	Application & Examples
<b>Assets Tracking &amp; Protection</b>	Asset Sharing: Shared bike, Shared equipment, Asset Monitoring: Transportation tracking Asset Protection: Expensive goods
<b>Infrastructure &amp; Environment monitoring</b>	Environment Monitoring: Air quality, Water quality .... Infrastructure Mgmt.: Parking system, Traffic monitoring Home Monitoring: Food freshness...
<b>Utility Metering</b>	Utility Metering: Water, Gas, Lighting, Electricity
<b>Predictive Maintenance</b>	Predictive Supply: On need vs scheduled maintenance Preventive Maintenance: Machine surveillance
<b>Smart, Connected Lighting</b>	Indoor Lighting System: Building, home lighting Outdoor Lighting System: Street lighting

Low power, medium to low data rate, wide range connected IoT solutions are expected to be the mainstream



**Device Segmentation per Connectivity**

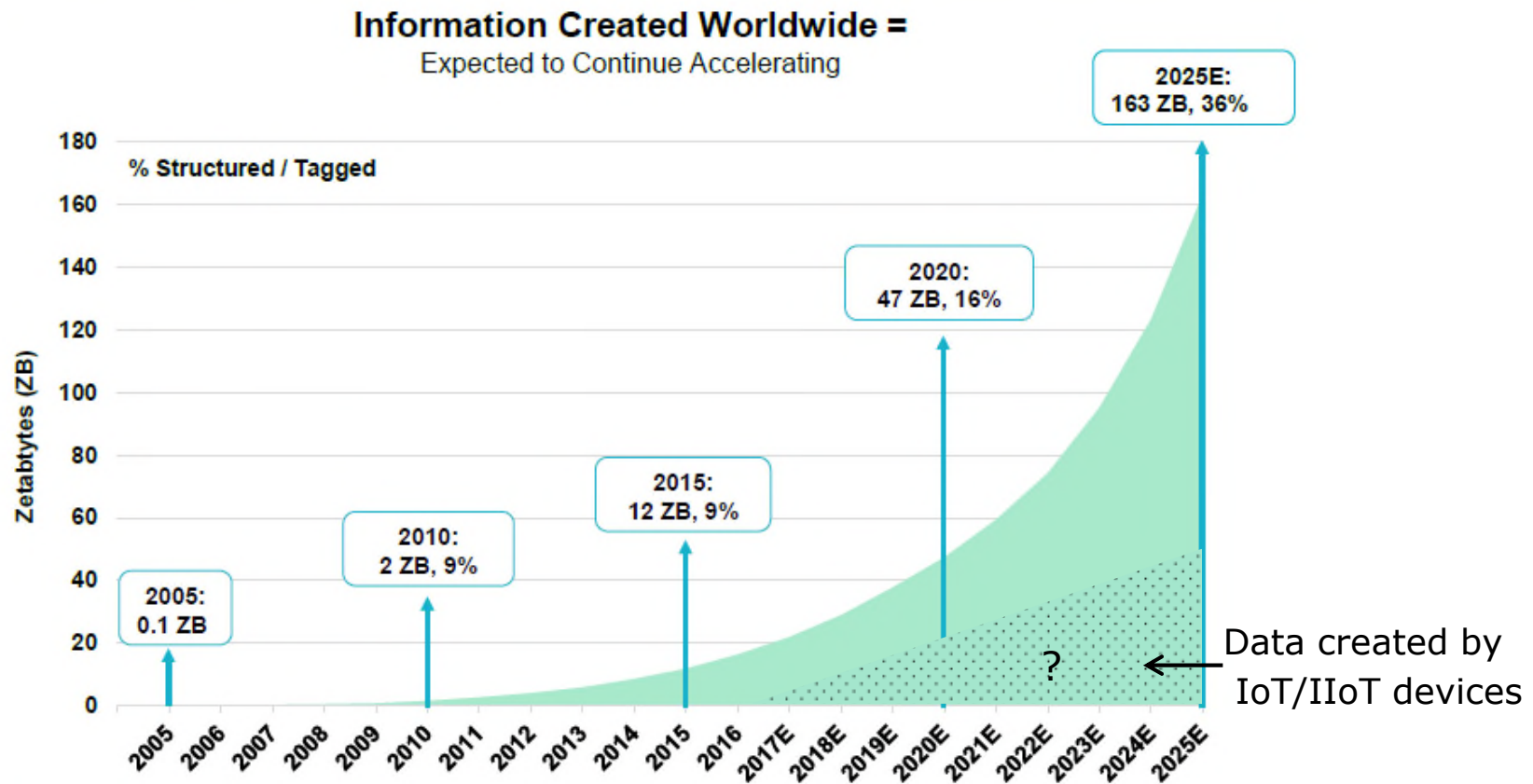


~1.8 Billion connected devices to be shipped in 2021, exclude mobile phone, tablet, PC

Assessed based on Source: Mobile\_Experts\_Internet\_of\_Things\_The\_Big\_Picture\_2016; IHS\_Markit\_LPWA\_Market\_Report\_2017



# Total Information created

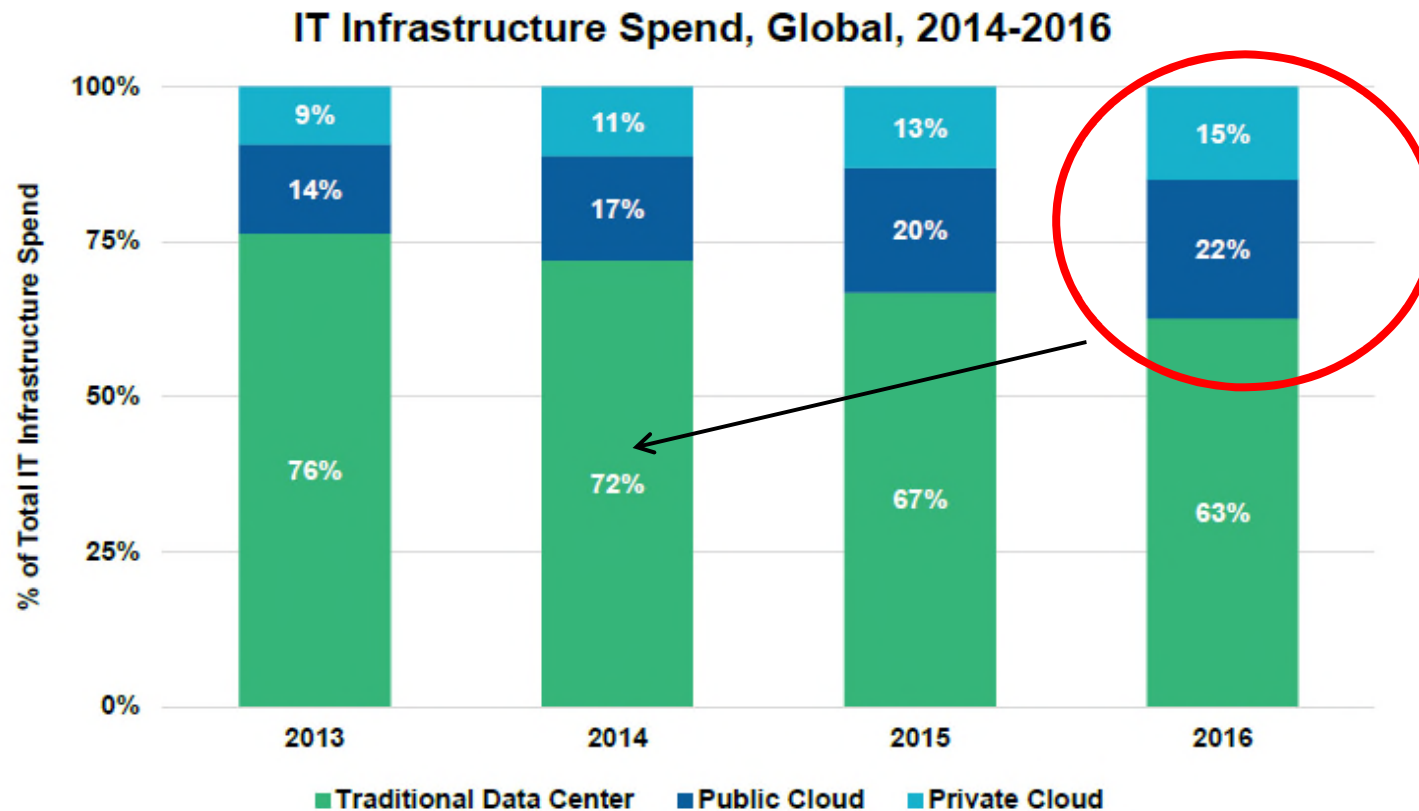


Source: IDC DataAge 2025 Study

# Security - what happens to our new 'natural resource' the data



The tendency is clearly towards more privacy and security



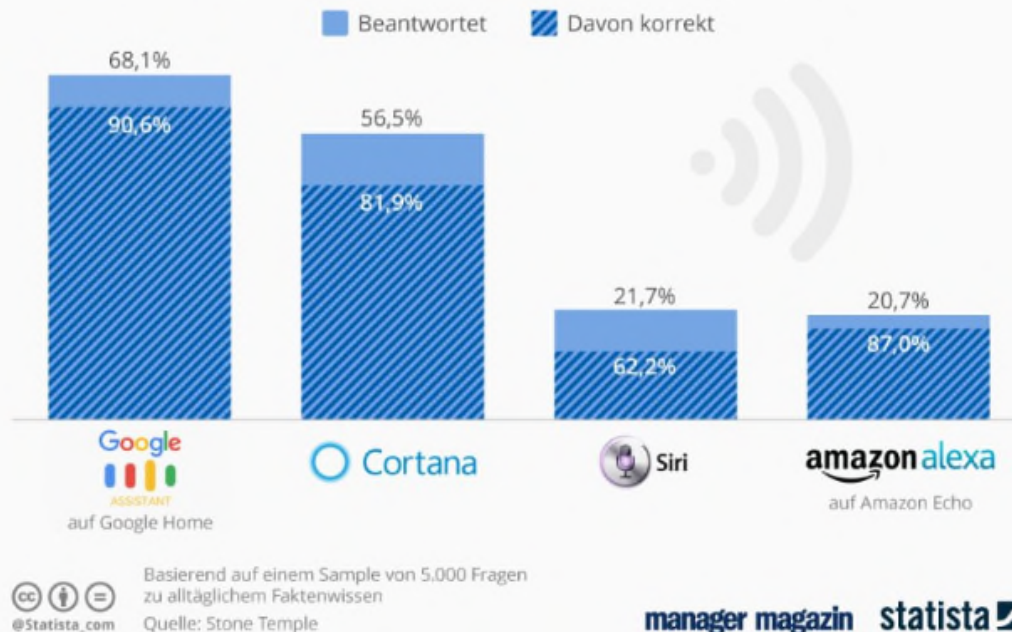
Source: IDC Worldwide Quarterly Cloud IT Infrastructure tracker

# Smart devices – a first quite simple attempt



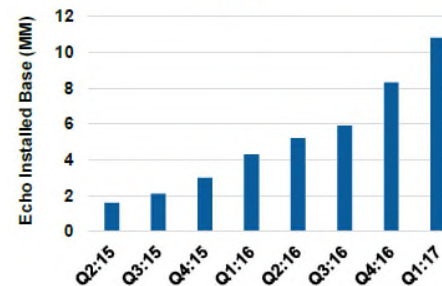
## Wie smart sind "smarte" Assistenten?

% der Fragen zu Allgemeinwissen, die Smart Assistants (korrekt) beantworten

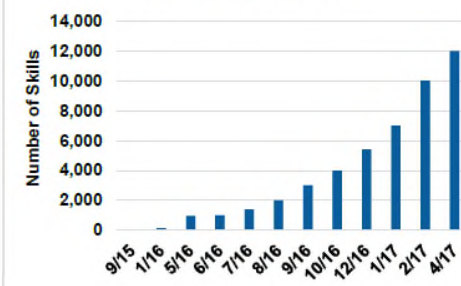


How to improve significantly?  
Putting data in in the cloud is not enough!

Amazon Echo Device Installed Base, USA



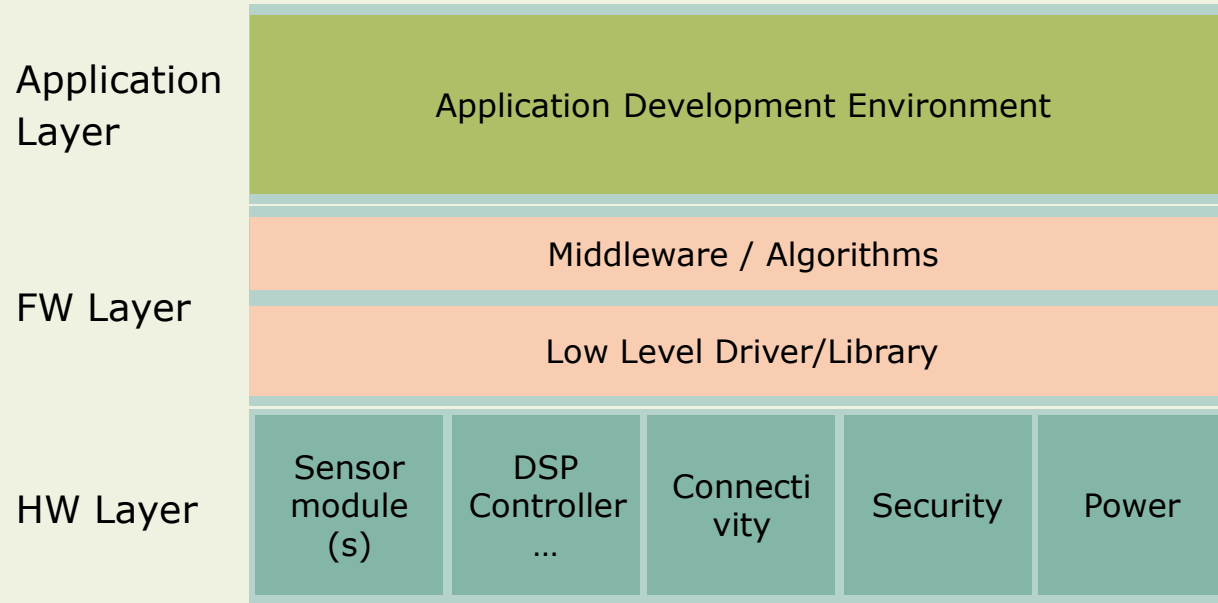
Amazon Echo Skills Broadening Use Cases



Source: Kleiner Perkins

# IoT and IIoT Solutions

## Ingredience of IoT/IIoT Solutions



# What are the main questions for the different applications



How long is the runtime without charging the battery

How much processing power is needed locally

How much/which memory is needed locally

What are the environmental requirements

Which communication / localization standards will be applied

Which security levels are necessary

.....

How many different devices are really necessary





Part of your life. Part of tomorrow.

