



# Start with Privacy A Technical Perspective

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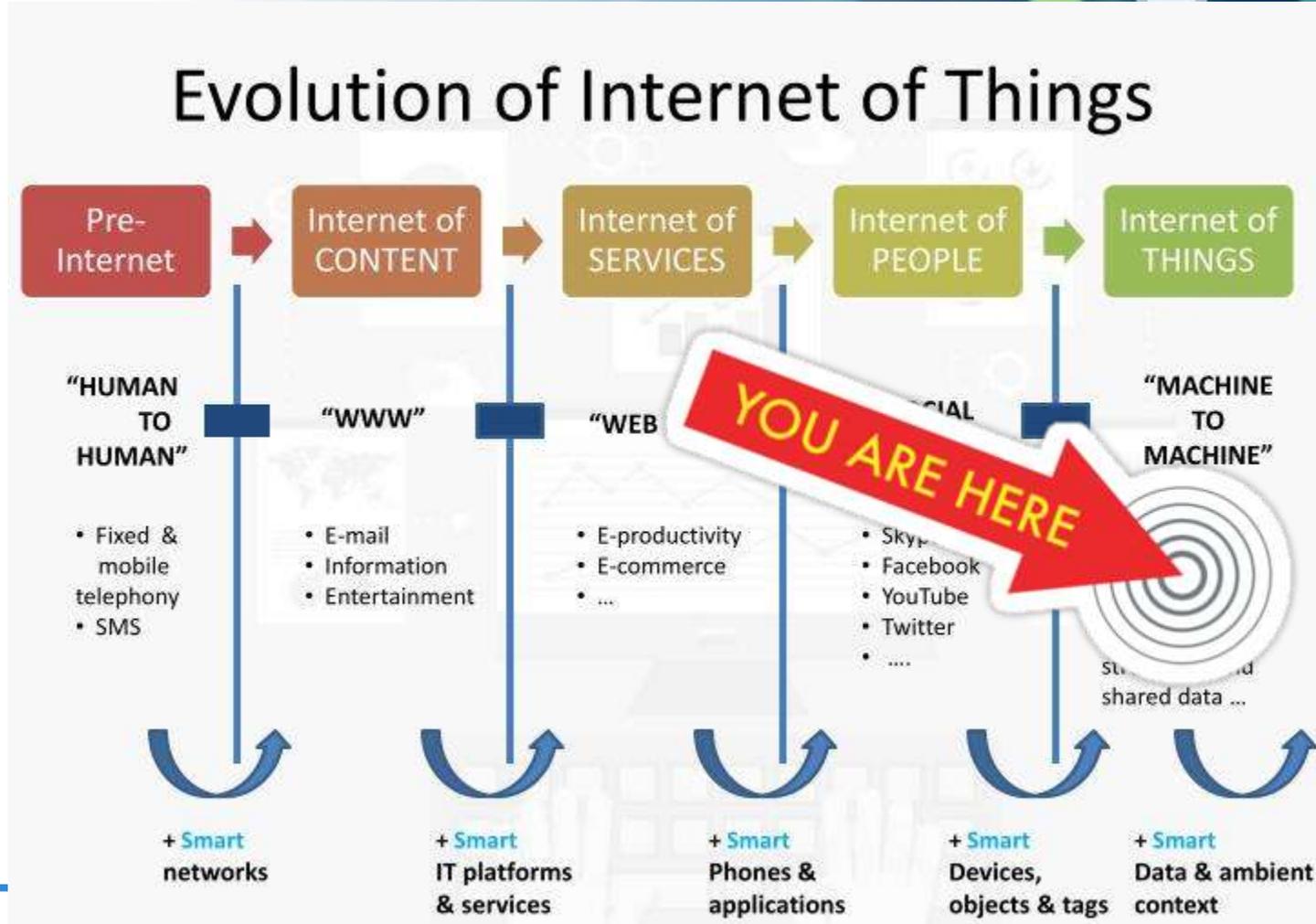
February 3<sup>th</sup> 2017



# Agenda

- Conceptual Model of a Modern Internet Service
- Concrete Example - Amazon Echo
- Comments on Server Side Technologies
- Focus on Client Side, Echo and Beyond

# Evolution of IoT

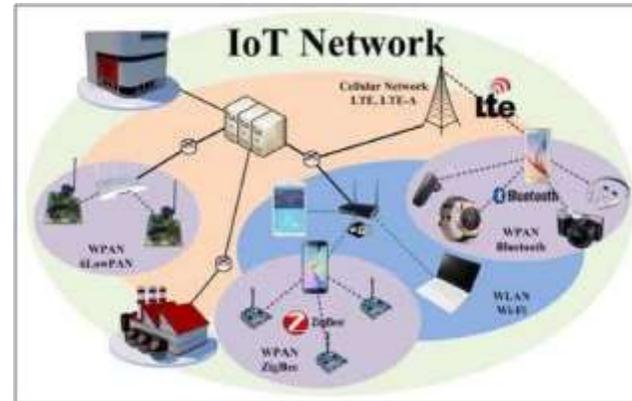


# Conceptual Model of IoT Service

## Device



## Network

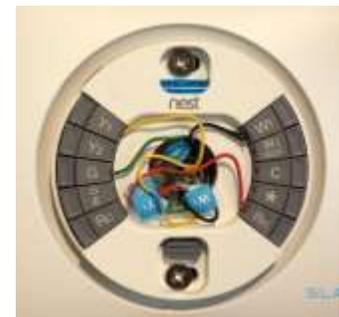


## Cloud

### Platform



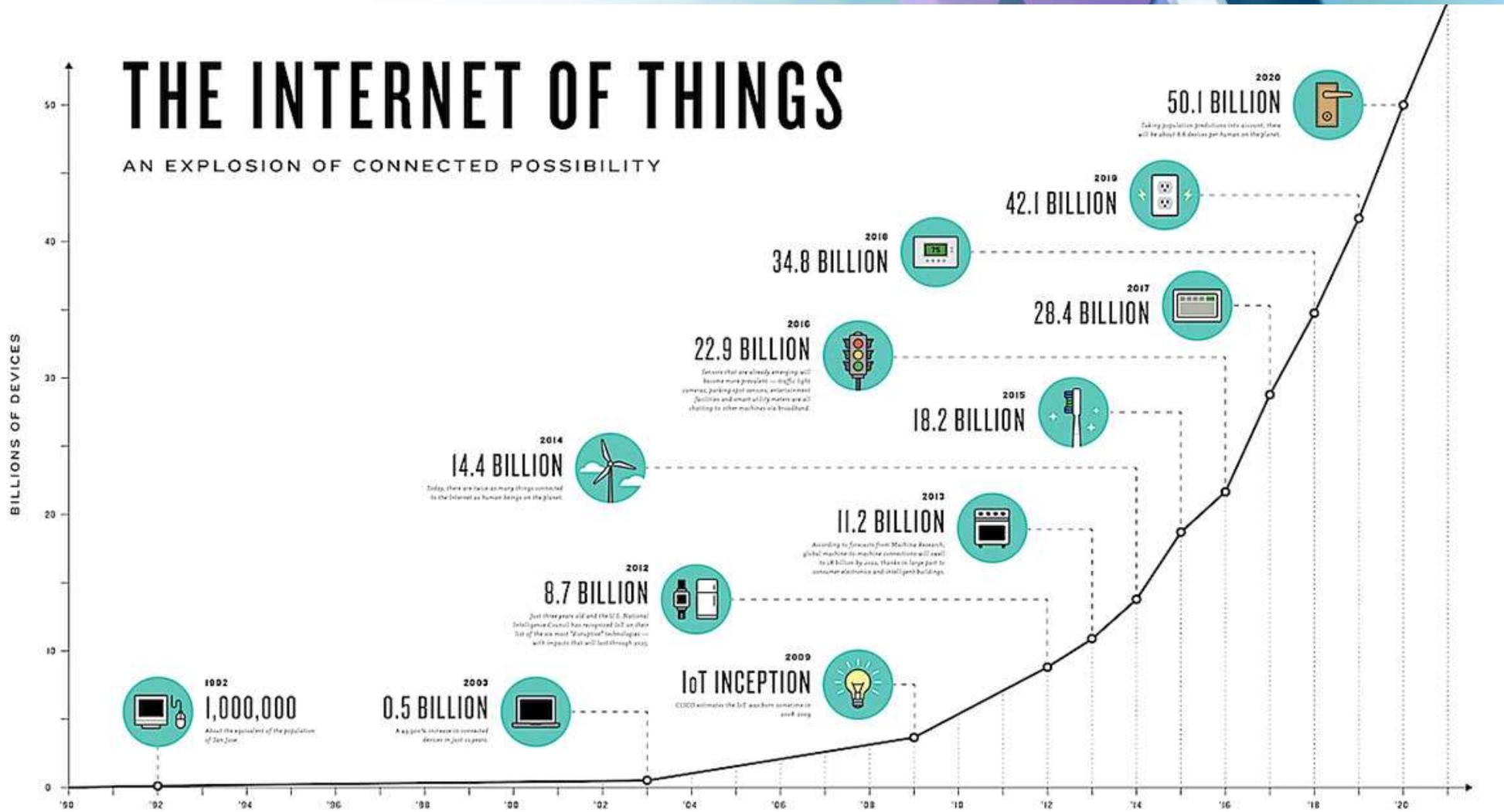
### Services



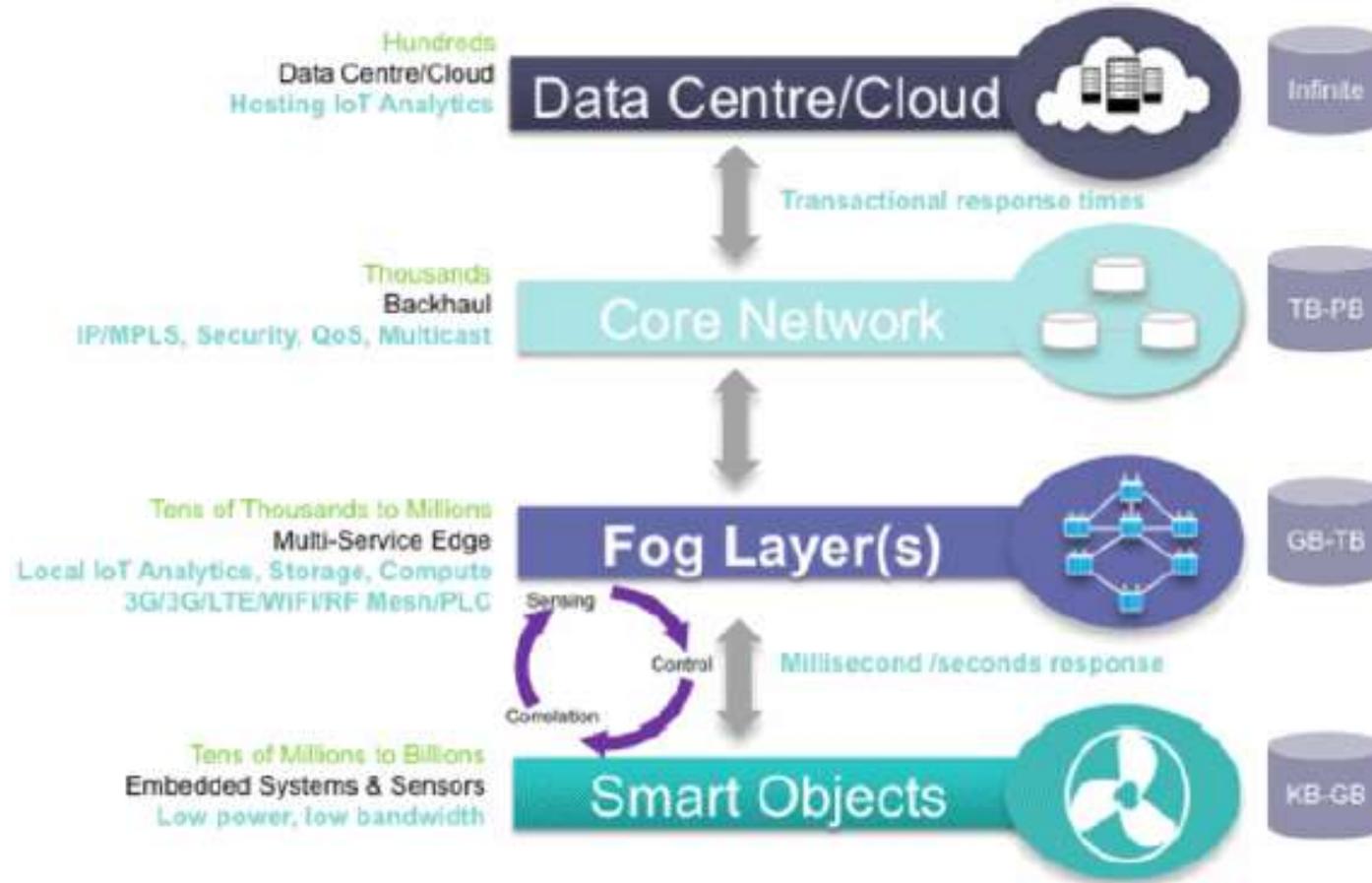
# Add a Layer for IoT



# Growth of IoT



# The Fog



- ▶ Conceptual Compute Layer
- ▶ Orchestrates Millions
- ▶ Millisecond Response

# Add A Layer for IoT

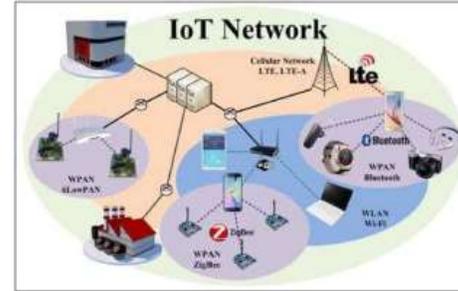
## Device



## Fog



## Network



## Cloud

### Platform

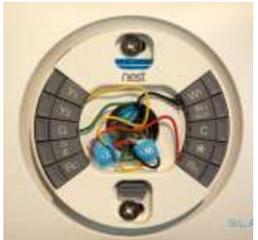
amazon alexa

IBM Watson

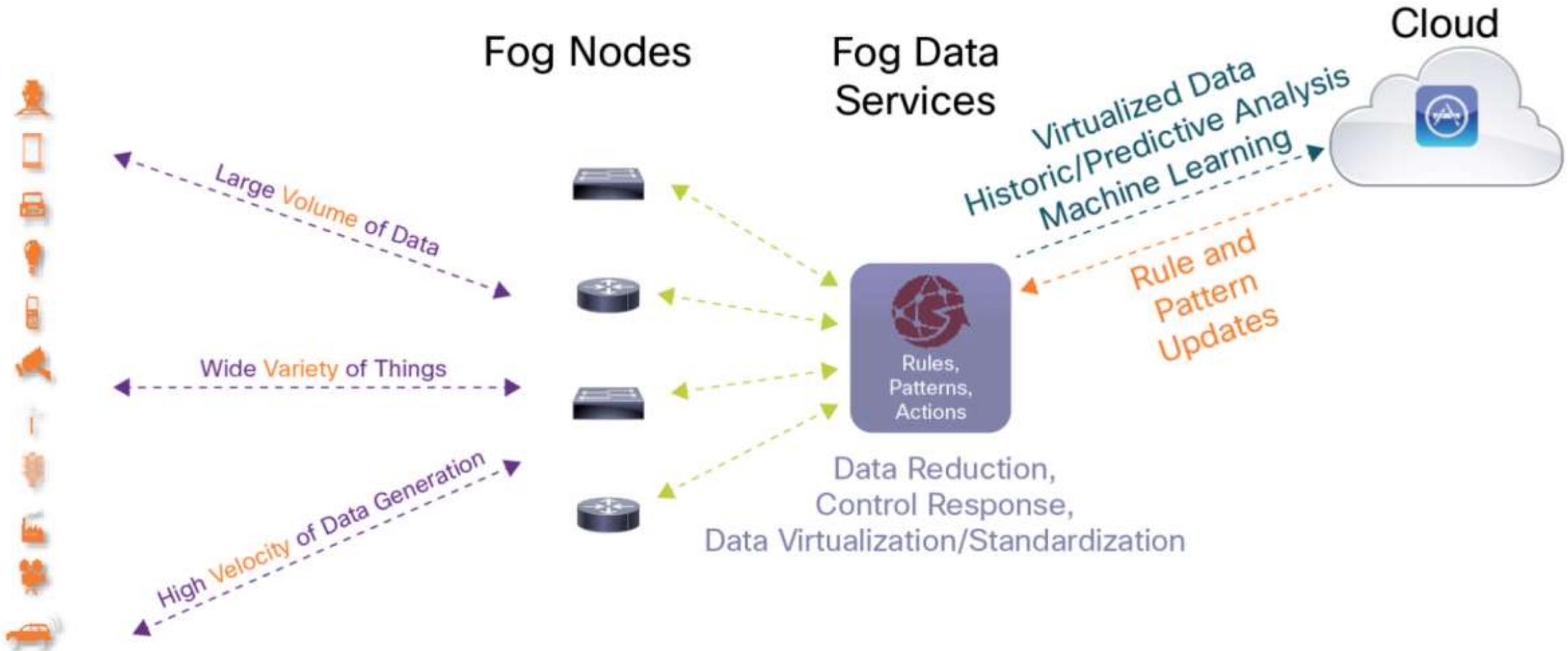
Microsoft Azure IoT

Internet of Things

### Services



# Add A Layer for IoT



# Alexa Specific Example

Device



Network



Alexa Specific Example



ISP

Cloud

Platform



Service



# Alexa Specific Example



Alexa, Play  
James Taylor  
from Spotify

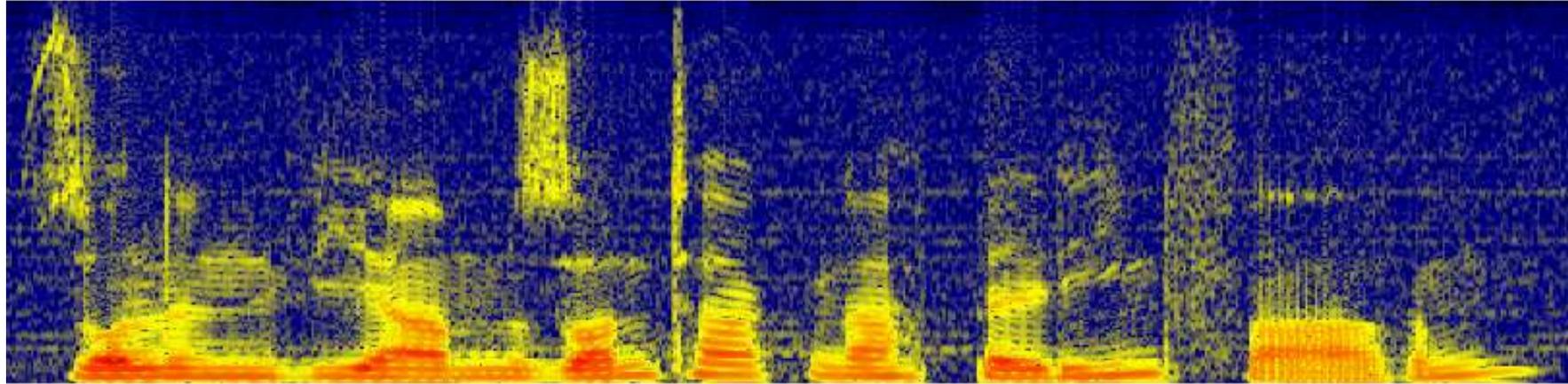
# Signal from Noise

## FAR-FIELD VOICE RECOGNITION

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# Voice Recognition Technologies

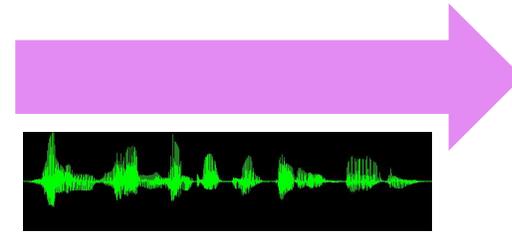


- ▶ Raw Recording in Noise Room



- ▶ Echo Cancelled Voice Pattern

# Encrypts and Compress

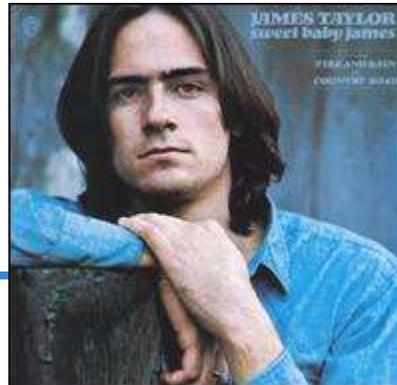


# Server Processing

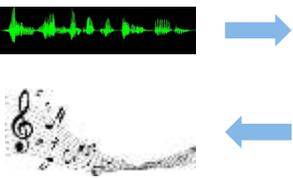
amazon alexa  
User Portal



“Play James Taylor”



Alex Voice Services Platform



“Now Playing Sweet Baby James from Spotify”

# Back End Technologies

## Extensible Nature of the Platform

- Who owns the data
- How does the user give permission or control

Voice Recognition  
Machine Learning

# Machine Learning

- Predictive maintenance or condition monitoring
- Warranty reserve estimation
- Propensity to buy
- Demand forecasting
- Process optimization
- Telematics

## Manufacturing



- Predictive inventory planning
- Recommendation engines
- Upsell and cross-channel marketing
- Market segmentation and targeting
- Customer ROI and lifetime value

## Retail



- Alerts and diagnostics from real-time patient data
- Disease identification and risk stratification
- Patient triage optimization
- Proactive health management
- Healthcare provider sentiment analysis

## Healthcare and Life Sciences



- Aircraft scheduling
- Dynamic pricing
- Social media – consumer feedback and interaction analysis
- Customer complaint resolution
- Traffic patterns and congestion management

## Travel and Hospitality



- Risk analytics and regulation
- Customer Segmentation
- Cross-selling and up-selling
- Sales and marketing campaign management
- Credit worthiness evaluation

## Financial Services



- Power usage analytics
- Seismic data processing
- Carbon emissions and trading
- Customer-specific pricing
- Smart grid management
- Energy demand and supply optimization

## Energy, Feedstock, and Utilities



# Voice Recognition and Machine Learning

## World's Largest Companies by Market Cap

Accurate as of July 29, 2016 (10:50am ET)

**Apple** \$567.75 billion

**Alphabet** \$546.49 billion

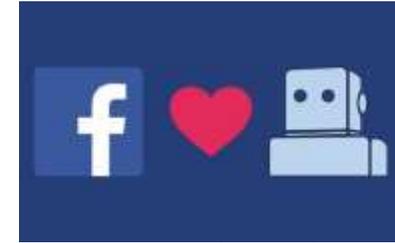
**Microsoft** \$445.14 billion

**Amazon** \$366.95 billion

**Facebook** \$364.26 billion

Slate

Source: Google Finance



wit.ai



Hi, I'm Cortana.

amazon echo



# Client Technologies (Anthromphic)

## Augmented Reality / Augmented Senses

- Bionic Hearing
- Hyperspectral computer aided vision
- Real time language translation

# Bionic Ears



Reasonable Expectation of Privacy?????

# Thank You

The right of the people to be secure in their persons, houses, papers and effects, against unreasonable searches and seizures shall not be violated



Susan Hallowell,  
Director of TSA's research lab  
taken with backscatter x-ray  
system