THE INTERNET OF THINGS

OVERVIEW & OUTLOOK

Presented at ***TFI Communications Technology Asset Valuation Conference***

January 28-29, 2015
Radisson Downtown, Austin, Texas

DUB DUBLIN

Your Challenge:

Value cutting edge technology assets that are changing so fast they seem to have a shelf life just the far side of…

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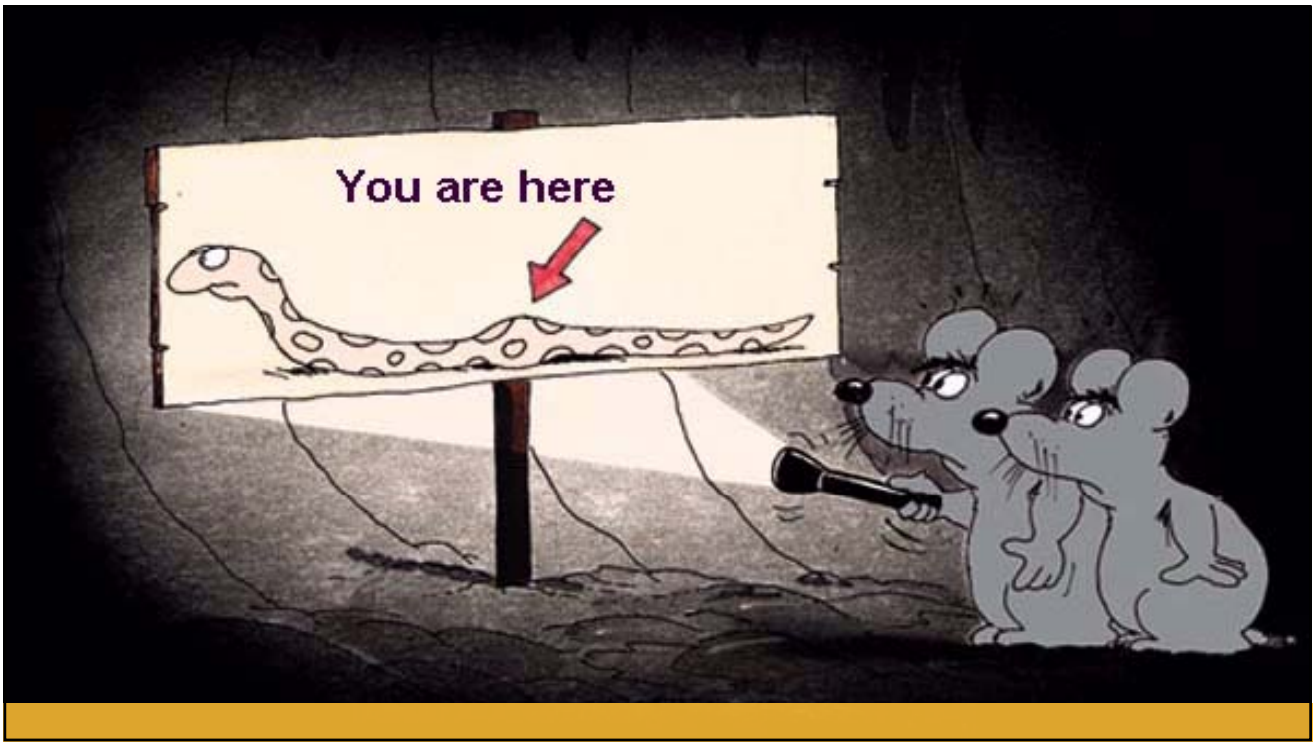
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What *is* the Internet of Things?

> **“The Internet of Things (IoT) is increasing the connectedness of people and things on a scale that once was unimaginable.”**

“Connected devices outnumber people by 1.5 to 1”

IoT is growing because of:

- **Growth in analytics and cloud computing**
- **Increasing interconnectivity of machines and personal smart devices**
- **The proliferation of applications connecting supply chains, partners, and customers**

-Cisco

“What is IoT?”

Wearables?

Embedded Devices?

Smart Phones?

Building & Energy Management?

Logistics, Supply Chain, & Asset Tracking??

Home Automation?

PCs, Tablets, and Webbooks?

Smart/Brilliant Sensors?

Smart Grid?

ALL of this and much more”

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Three key components of IoT

1. SENSORS & ACTUATORS (Real world devices)
2. CONNECTIVITY (Networks, Wired & Wireless)
3. POLICY, PEOPLE, & PROCESSES

Don’t forget that the network itself is part of the IoT!

The Internet of Things

A Revolutionary *NEW* Idea… or is it?

WHAT HAPPENED

100 YRS AGO

LAST SUNDAY? (JAN 25, 1915)

PRIZE FOR CORRECT ANSWER (WITHOUT USING PHONE OR INTERNET)

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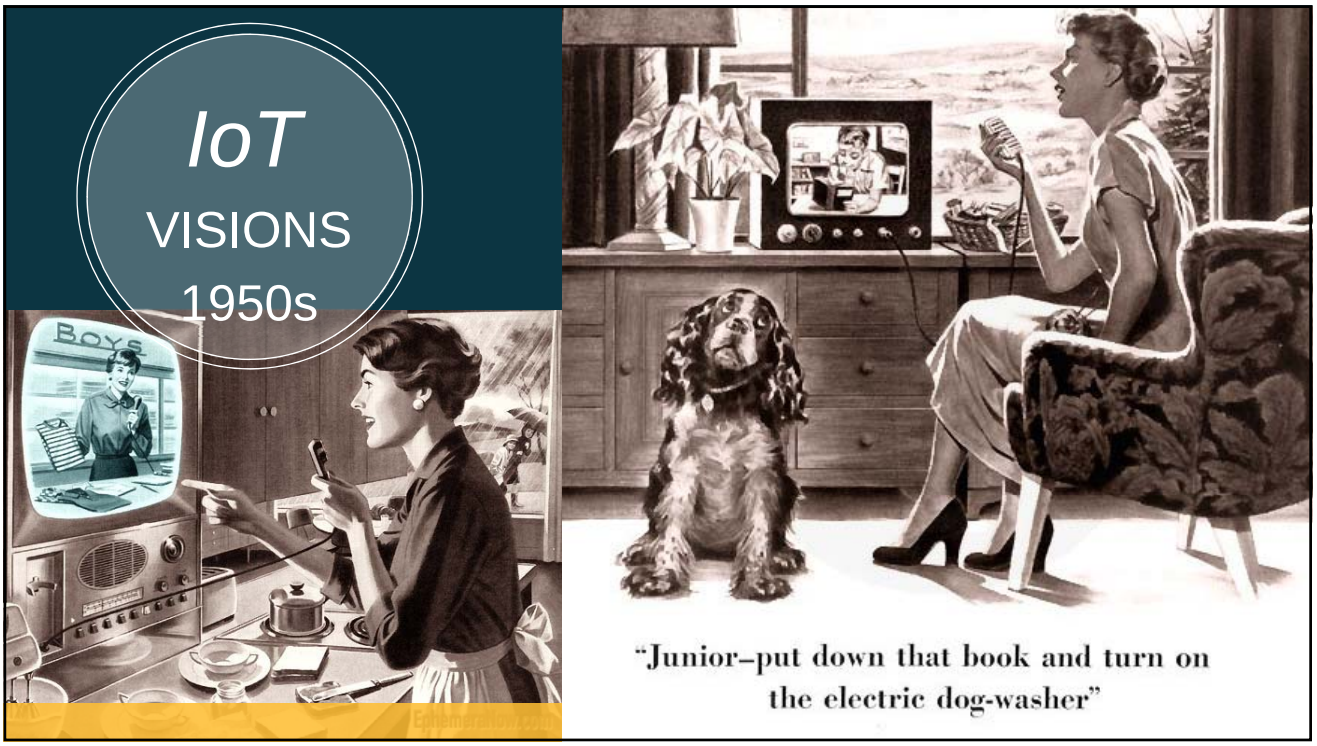
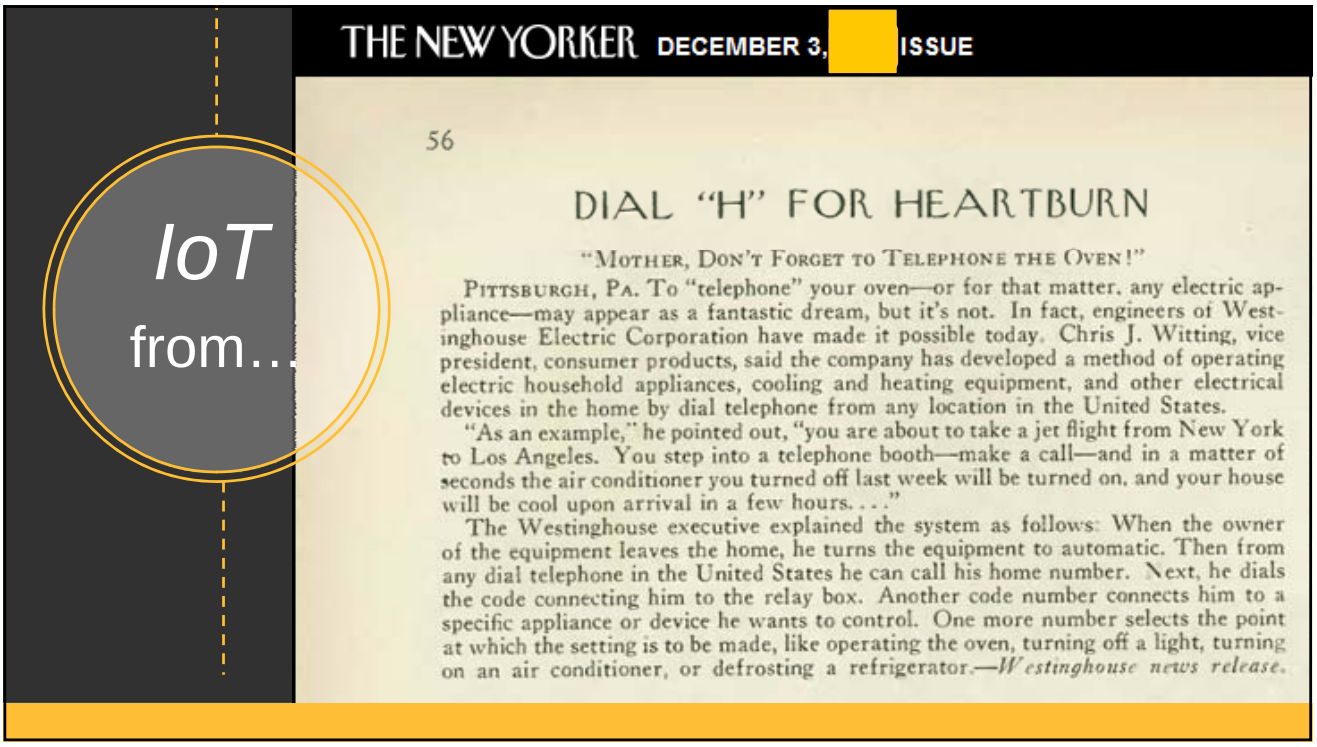
IoT Visions 1922
RADIO CONTROLLED AIRPLANES
Radio Controlled Airplanes
CREWLESS SHIPS CONTROLLED BY RADIO
Crewless Ships Controlled by Radio
RADIO POWER DISTRIBUTOR
Radio Power Distributor
Radio Clock
RADIO CLOCK
CORRESPONDENCE BY RADIO
Correspondence by Radio
RADIO POWER ROLLER SKATES
Radio Power Roller Skates
Radio Business Controller
RADIO BUSINESS CONTROLLER
Television & Automatic Radiophone
TELEVISION AND AUTOMATIC RADIOPHONE
Radio Heater
RADIO HEATER


IoT
VISIONS
1950s
BOYS
"Junior–put down that book and turn on the electric dog-washer"

IoT from…



THE NEW YORKER DECEMBER 3, ISSUE

56

DIAL "H" FOR HEARTBURN

"MOTHER, DON'T FORGET TO TELEPHONE THE OVEN!"

PITTSBURGH, PA. To "telephone" your oven—or for that matter, any electric appliance—may appear as a fantastic dream, but it's not. In fact, engineers of Westinghouse Electric Corporation have made it possible today. Chris J. Witting, vice president, consumer products, said the company has developed a method of operating electric household appliances, cooling and heating equipment, and other electrical devices in the home by dial telephone from any location in the United States.

"As an example," he pointed out, "you are about to take a jet flight from New York to Los Angeles. You step into a telephone booth—make a call—and in a matter of seconds the air conditioner you turned off last week will be turned on, and your house will be cool upon arrival in a few hours. . . ."

The Westinghouse executive explained the system as follows: When the owner of the equipment leaves the home, he turns the equipment to automatic. Then from any dial telephone in the United States he can call his home number. Next, he dials the code connecting him to the relay box. Another code number connects him to a specific appliance or device he wants to control. One more number selects the point at which the setting is to be made, like operating the oven, turning off a light, turning on an air conditioner, or defrosting a refrigerator.—*Westinghouse news release.*

Technologies for the Internet of Things

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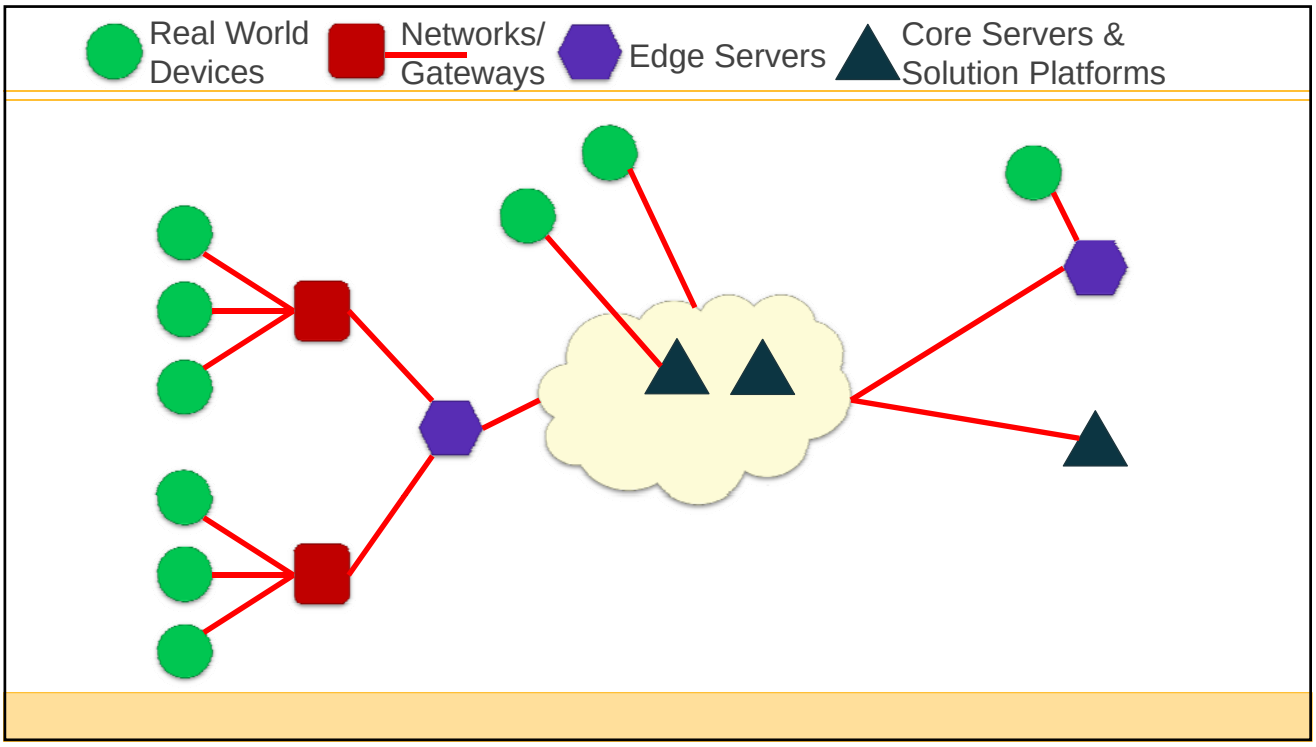
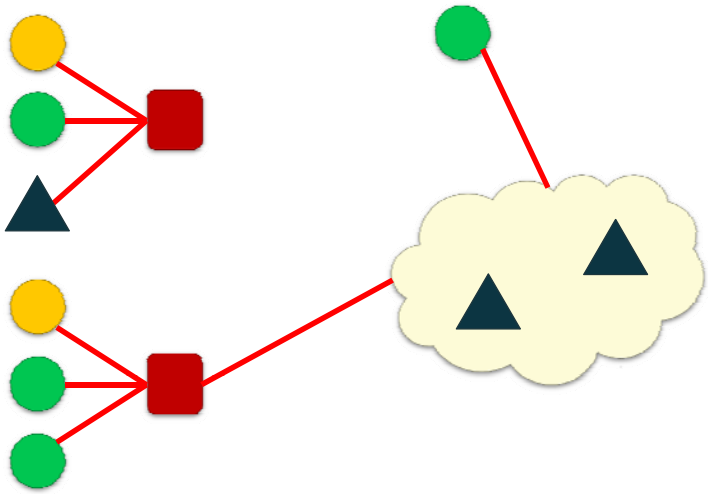


IoT Network Architectures



Why send all the data to the cloud?

Is that really necessary or even desirable?

When is local control better?

IoT impact comes from “Things” containing:

- Sensors
- Actuators
- Controllers
- Applications (software)
- Possibly user interfaces
- Interconnection to other Things
- Interconnection to services that operate in the Cloud and on private networks

Real World Interface Devices (Things)

Servers & Platforms

Networks

State of the Internet of Things

INTERNET OF THINGS

MARKET (HYPE?) PROJECTIONS

IT'S BIG. REALLY BIG.
(TRUST US, WE'RE ANALYSTS…)

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"Cisco CEO Pegs IoT as $19 (or 14?) Trillion Market by 2020"

"GE: "Industrial Internet" has potential to add $10-15 Trillion to global GDP over 20 years."

"Gartner: IoT to generate incremental revenue >$300 Billion in 2020"

"IDC: WW market for IoT solutions:

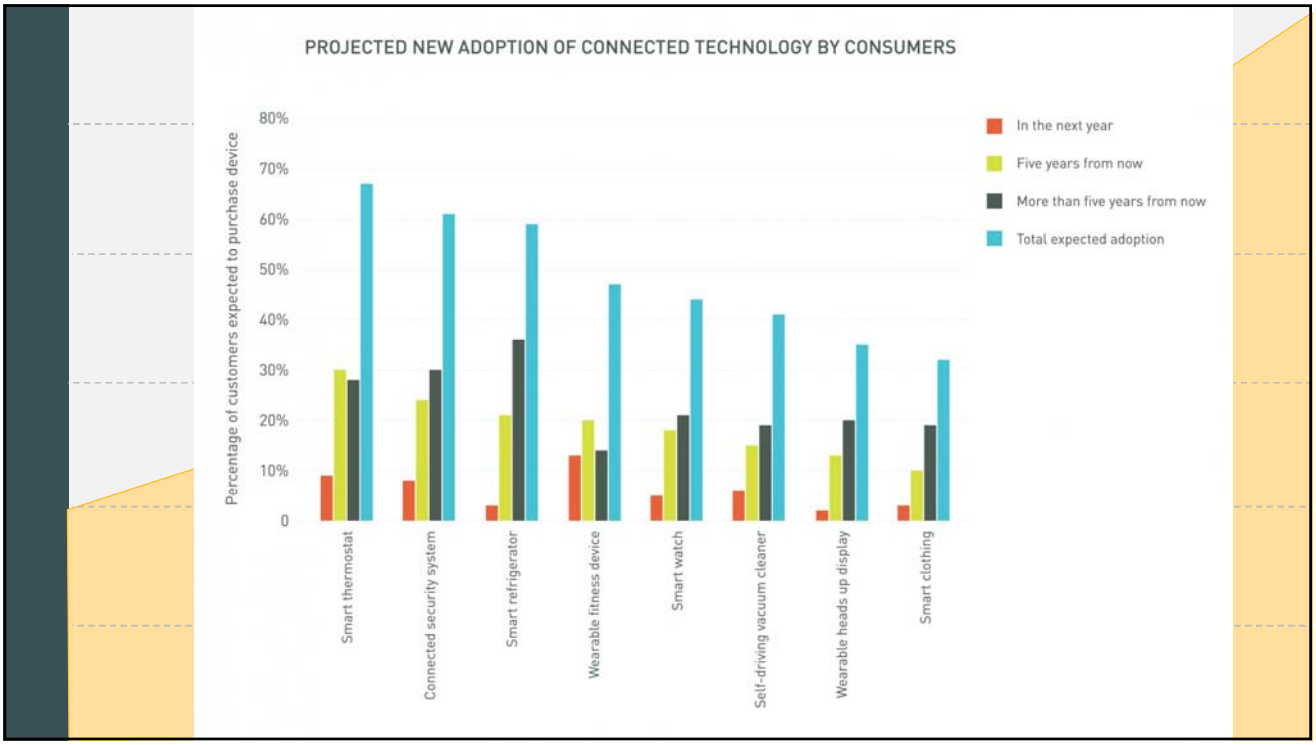
2013: $1.9T

2020: $7.1T"

“Morgan Stanley: $1.3T annual savings in US through driverless cars”

“On World: Internet-connected wireless light bulbs & lamps: 2.4M 2013 ➔ 100+M 2020”

“Endeavour: 10% of US owns a modern activity tracker; ½ no longer use it, ⅔ of those quit using in first six months”

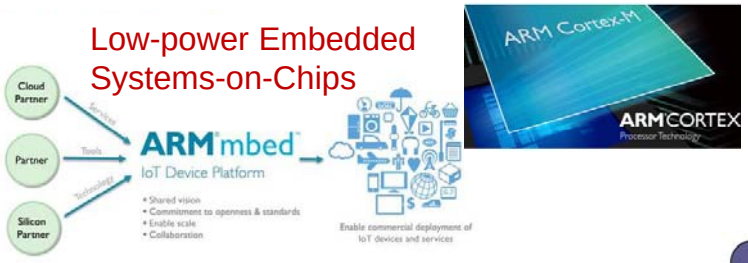


INTERNET OF THINGS

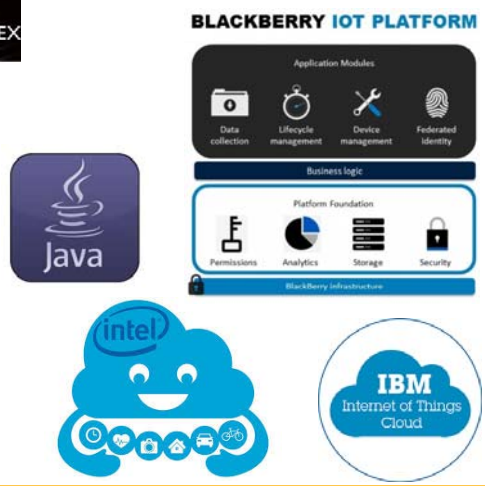
TECHNOLOGIES & EXAMPLES

Emerging Technologies & Solutions

Low-power Embedded Systems-on-Chips



Cloud Platforms, APIs, & Ecosystems



Advanced Wireless Sensor Networks

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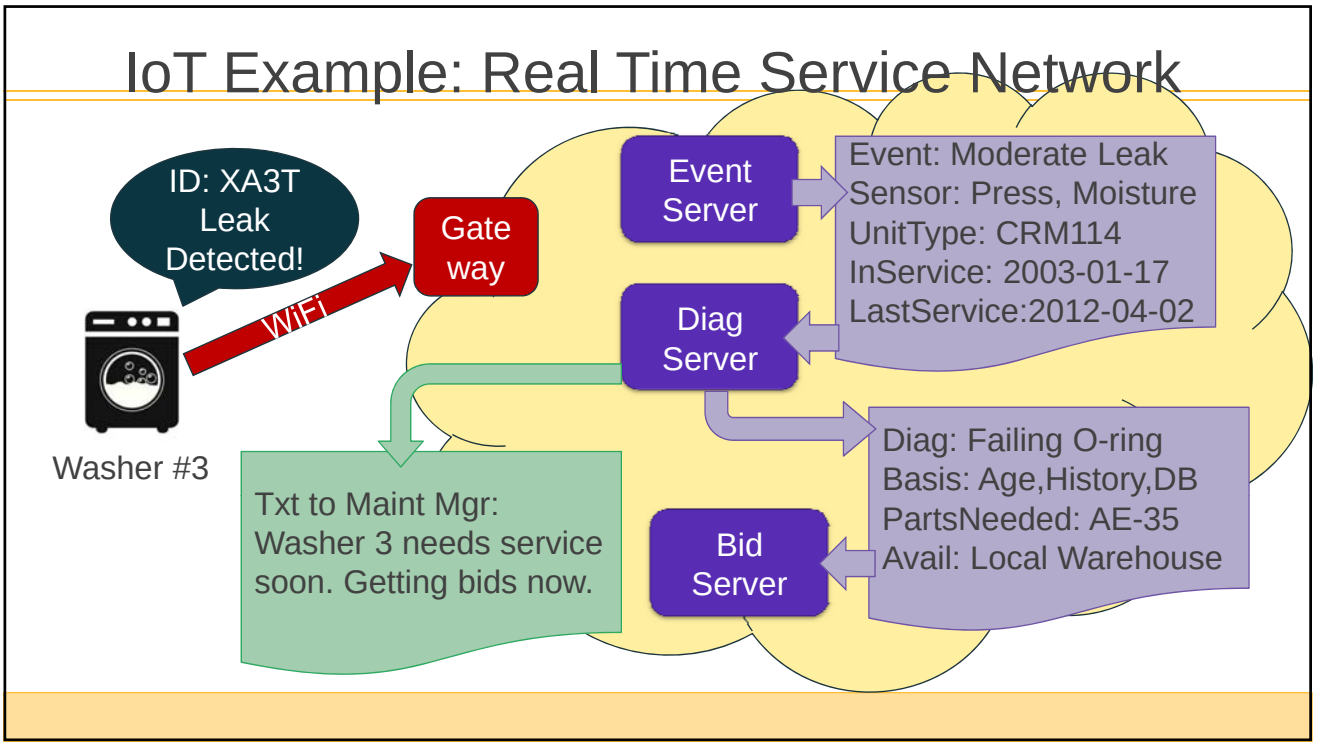
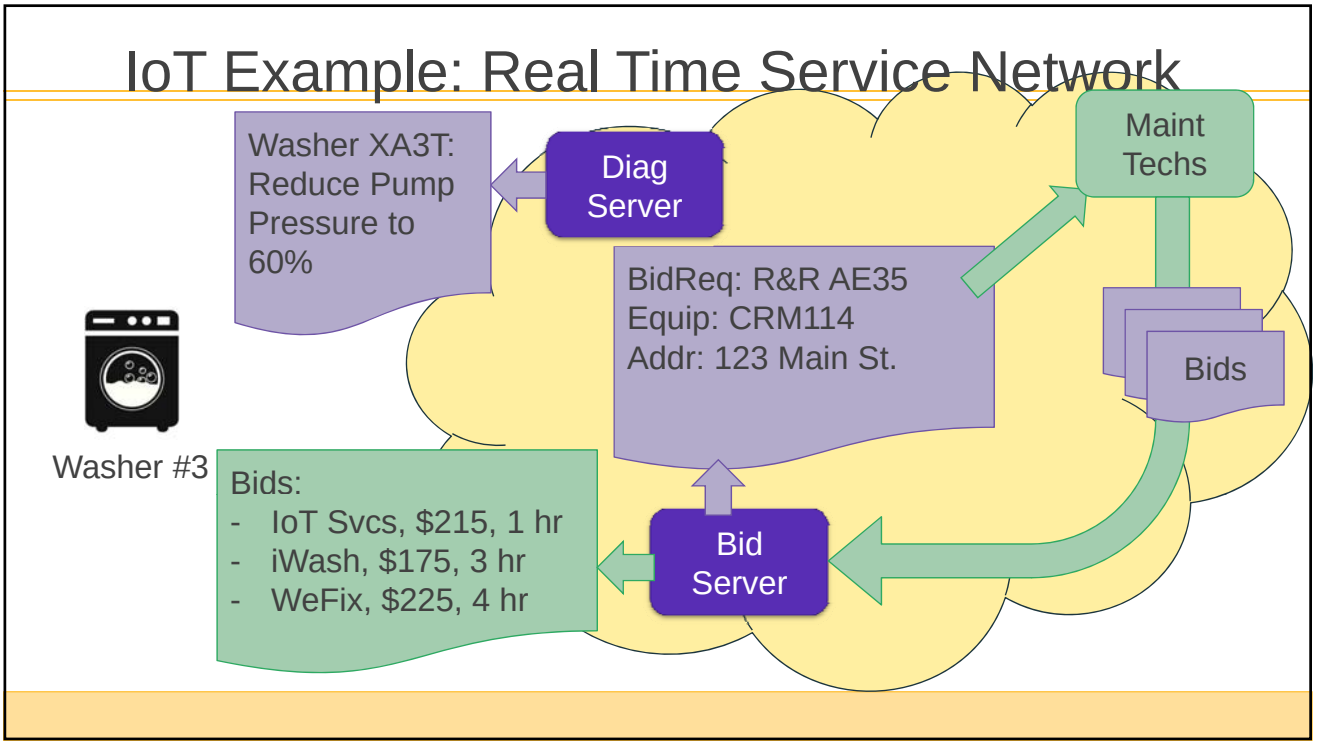
Please contact speaker or TFI regarding reproducing presentation material.

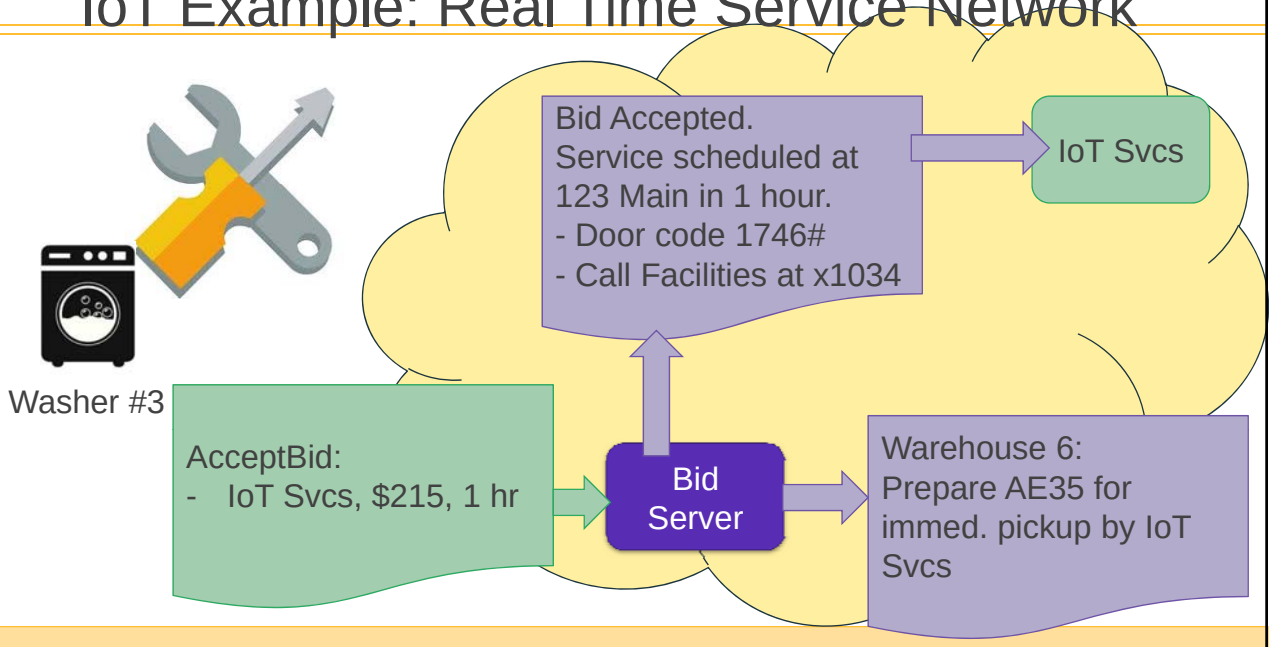
IoT Example: Real Time Service Network



IoT Example: Real Time Service Network



IoT Example: Real Time Service Network



IoT Challenges: Standards & Interoperability

The ugly underbelly of IoT?

- Vendors pushing Proprietary standards, APIs, and messaging formats (lock-in)
- Custom coding (too) often required
- Wireless Sensor Net incompatibility

IoT Challenges: Integration

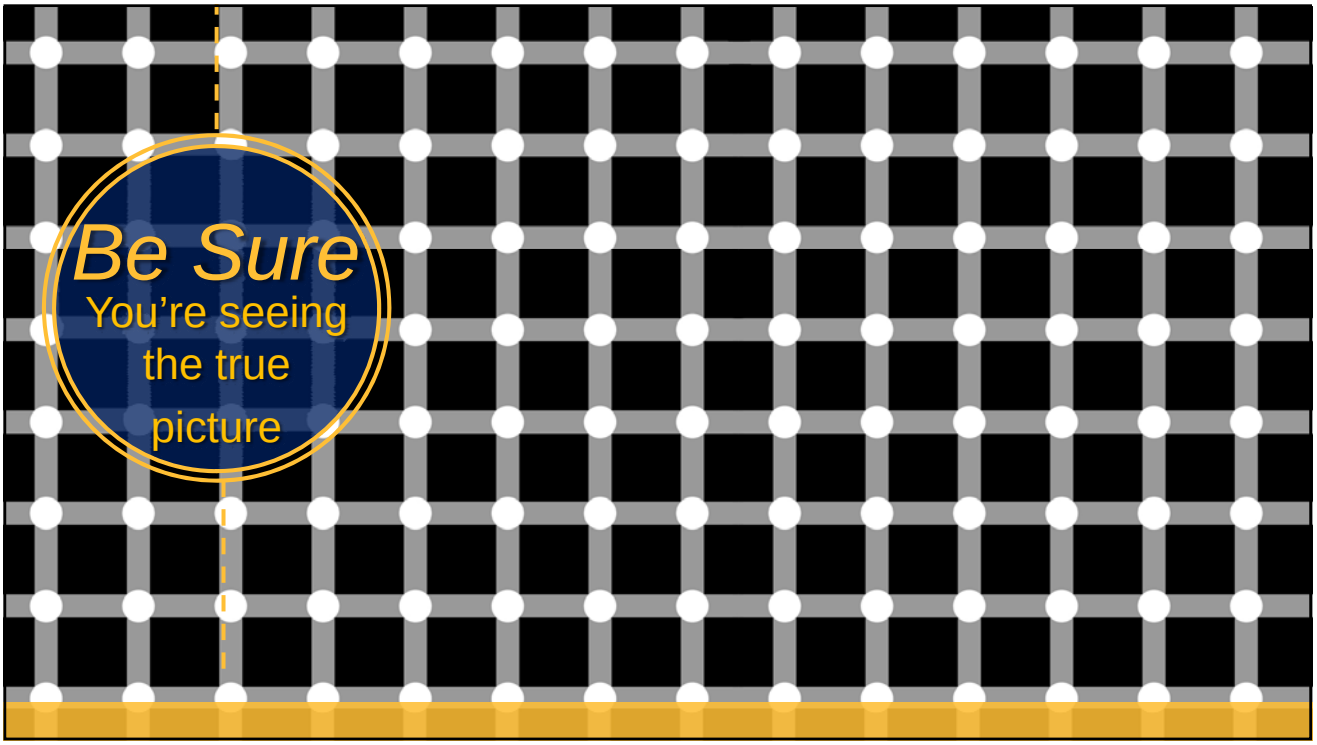
- "Vietnam" of standards, APIs, protocols, message & data formats, etc.
- IoT protocols alone: HTTP/REST, MQTT, CoAP, XMPP, DDS, AMQP, etc. Not hard individually, but can be hard combinatorially.

IoT Challenges: Hidden Costs

- Ongoing platform/service subscription costs
  - Data storage
  - Data Communications
  - Platforms & Services
  - How will you know when a service can be safely cancelled? Or even if it's used?

IoT Challenges: Security & Privacy

- Security is biggest IoT Challenge today
  - Really hard to do well and future-proof
  - Updates are challenging at best
  - Interoperability and standardization are difficult
- Privacy – Confidentiality vs. Integrity Breaches
  - Coercion – soft at first, moving to hard
  - Auto: Discount ➔ Required (coming?)
  - Health: EMR already mandated by ACA, many gray areas



CONTACT

Dub Dublin
CEO, ATXware
dub@atxware.com
+1-512-853-9504

Built the world's first embedded Internet-enabled sensors (WiFi & PoE) in 2002

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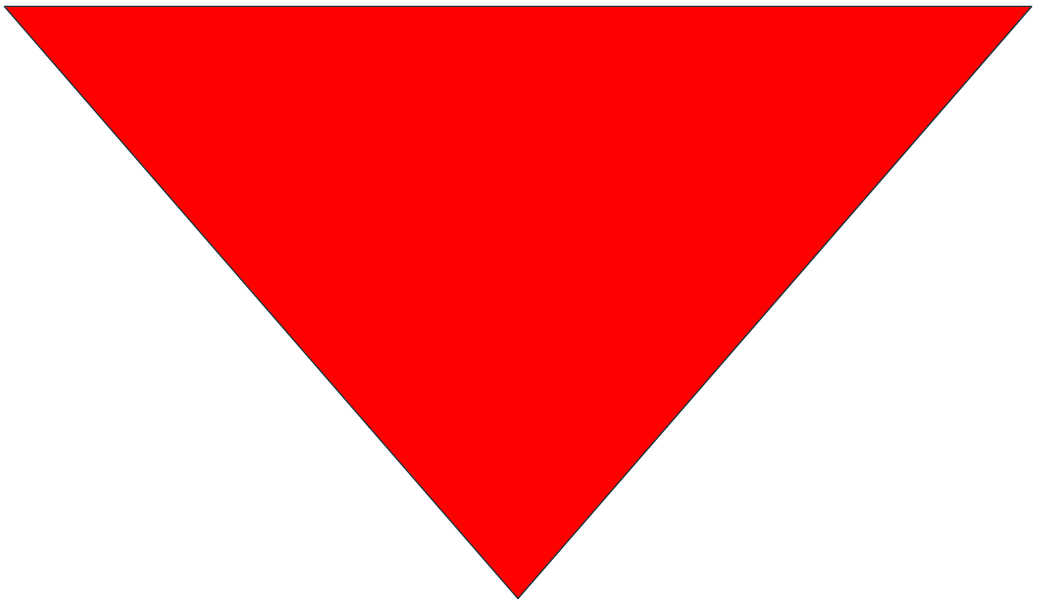
THANK YOU



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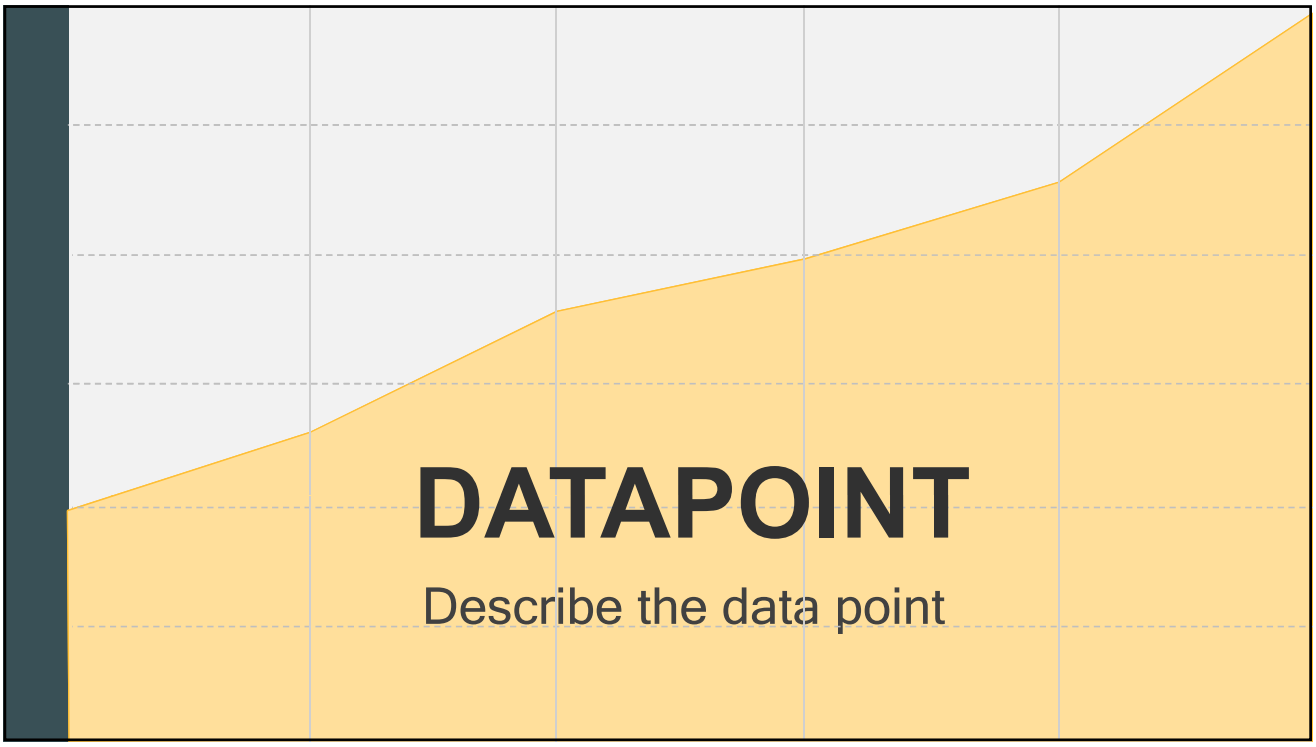
"ADD A HIGH-LEVEL IMPACT STATEMENT OR QUOTE HERE."


DATAPOINT
Describe the data point