WELCOME TO IoT INSIGHTS

CONFERENCE KICK-OFF

Emcee & Presenter: Michael Carter

Senior Consultant, JLL Smart Building Program

Impact of IoT

The three entities using IoT ecosystems include businesses, governments, and consumers.

Consumers

5B | devices installed by 2020

$900M | spent (2015-2020)

$400M | ROI (2015-2025)

Governments

7.7B | devices installed by 2020

$2.1B | spent (2015-2020)

$4.7B | ROI (2015-2025)

Businesses

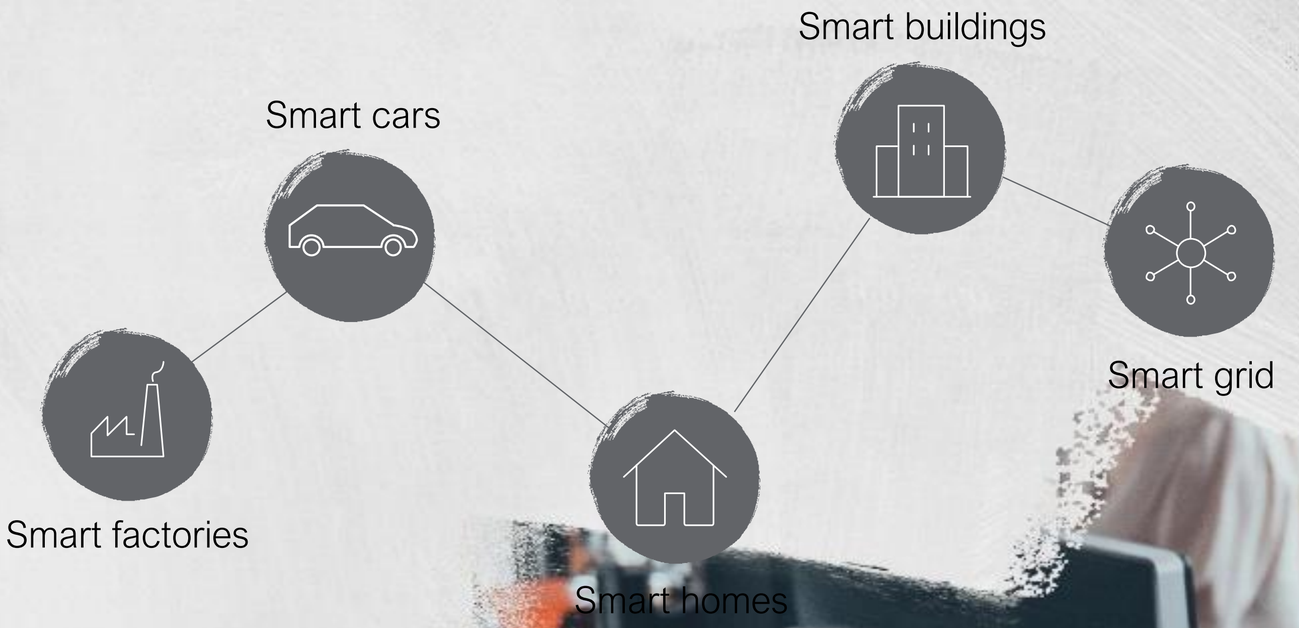
11.2B | devices installed by 2020

$3B | spent (2015-2020)

$7.6B | ROI (2015-2025)

IoT and ME

The Internet of Things (IoT) is the network of physical objects, devices, vehicles, buildings and other items which are embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data.



Digitalization and How the Internet of Things Changes Everything

Presenter: Andrew Milne, Ph.D.

Tidebreak

Digit(al)ization and How the Internet Changes Everything

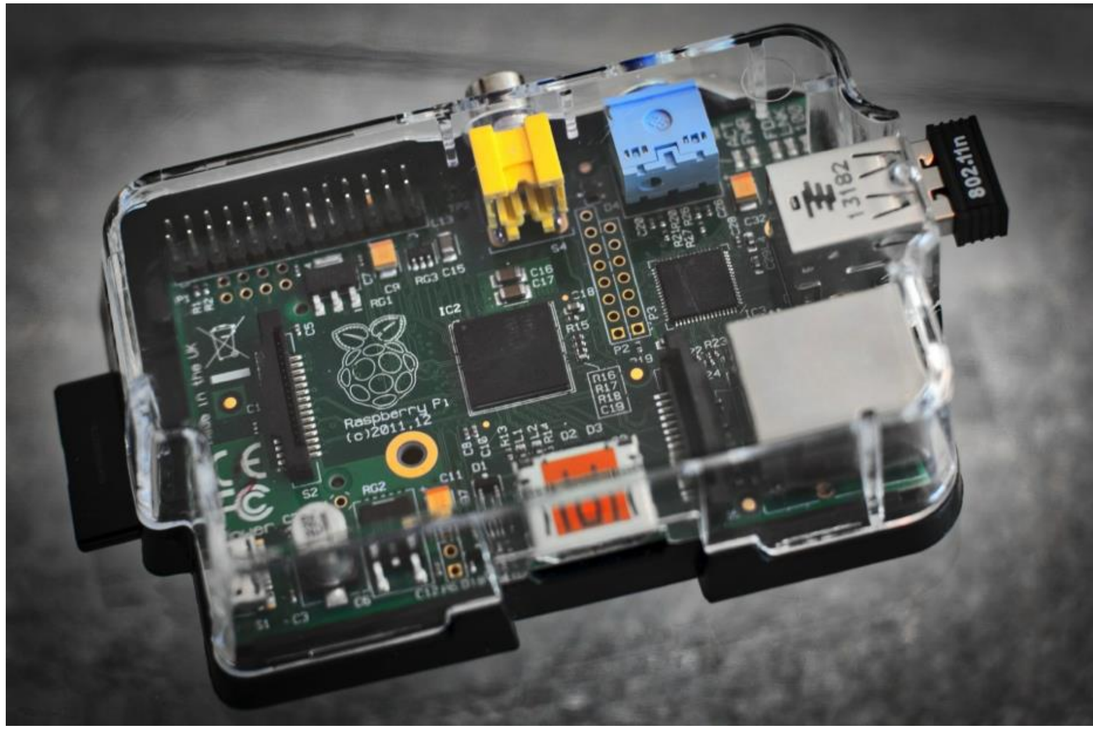
Andrew J. Milne, Ph.D.

CEO - Tidebreak Inc.

The Impact the Internet has on Our Lives

“I cannot imagine a life without…”

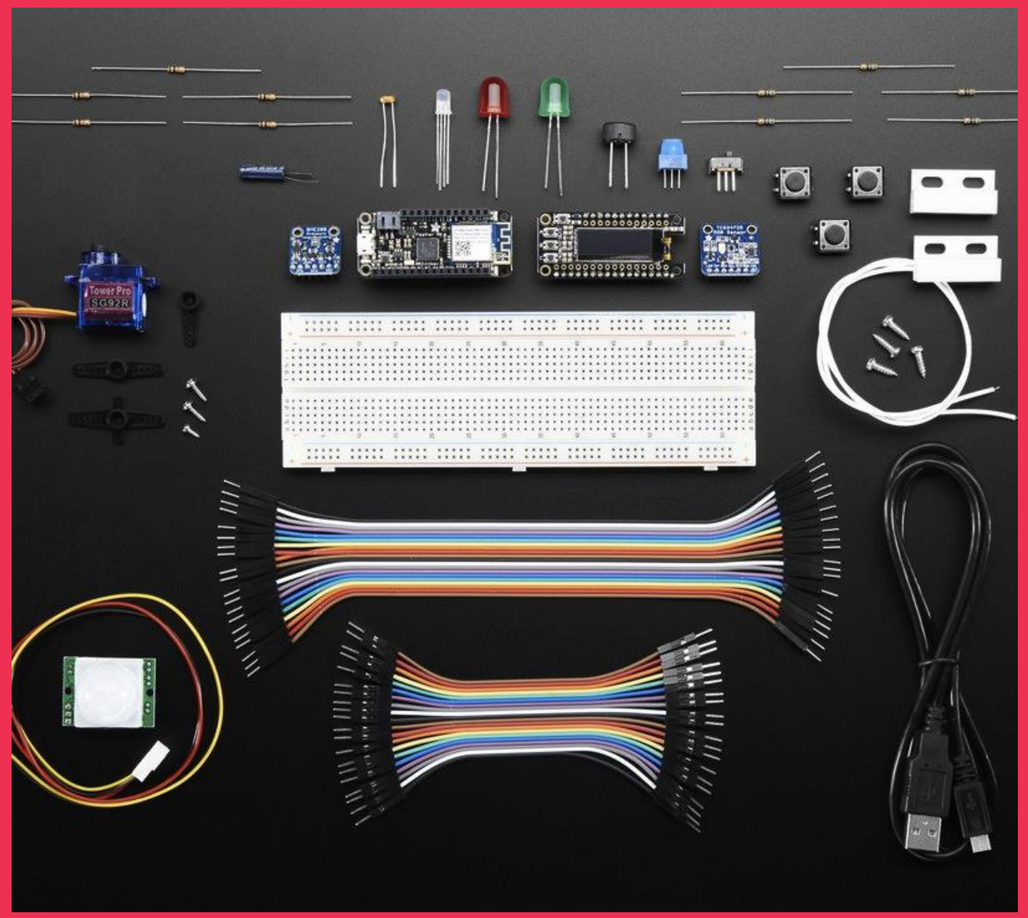
- A mobile phone: 97%
- The Internet: 84%
- A car: 64%
- My current partner: 43%



% of 14 – 29 year olds

Source: BITKOM – Bundesverband Informationswirtschaft, Telekommunikation und neue Medien

Objectives for Today



- What is IoT?
- How is IoT impacting businesses and other organizations?
- How to discover and exploit new opportunities?
- Implications specific to the AVIXA community

What is IoT?

IoT’s Protocol Soup

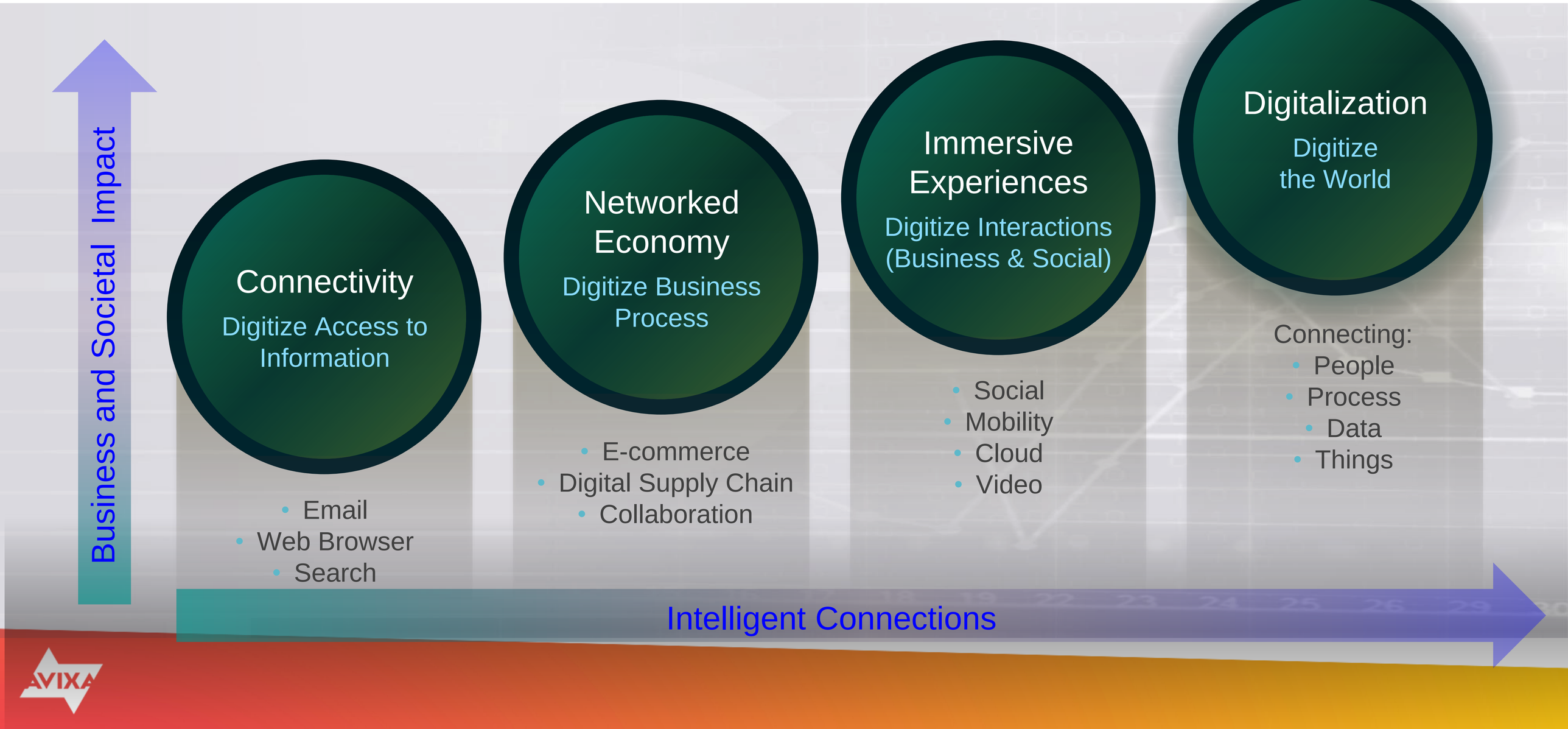
1. **Infrastructure** (ex: 6LowPAN, IPv4/IPv6, RPL)
2. **Identification** (ex: EPC, uCode, IPv6, URIs)
3. **Communications / Transport** (ex: Wifi, Bluetooth, LPWAN)
4. **Discovery** (ex: Physical Web, mDNS, DNS-SD)
5. **Data Protocols** (ex: MQTT, CoAP, AMQP, Websocket, Node)
6. **Device Management** (ex: TR-069, OMA-DM)
7. **Semantic** (ex: JSON-LD, Web Thing Model)
8. **Multi-layer Frameworks** (ex: Alljoyn, IoTivity, Weave, Homekit)

Everything Connected

“The Internet of Things is the interconnected sphere of physical devices with the Internet and other networks through uniquely identifiable IP addresses, whereby data is gathered and communicated through embedded sensors, electronics and software. “

Source: https://www.i-scoop.eu/internet-of-things-guide/

Evolution of the Internet




The World is
CHANGING FAST
Market
Transitions
Technology
Transitions
Economic
Transitions
PACE OF CHANGE

MASSIVE WAVE
of Economic Opportunity

$19T

Private Sector: $14.4T
Public Sector: $4.6T

Machine-to-Machine (M2M) $7.4T

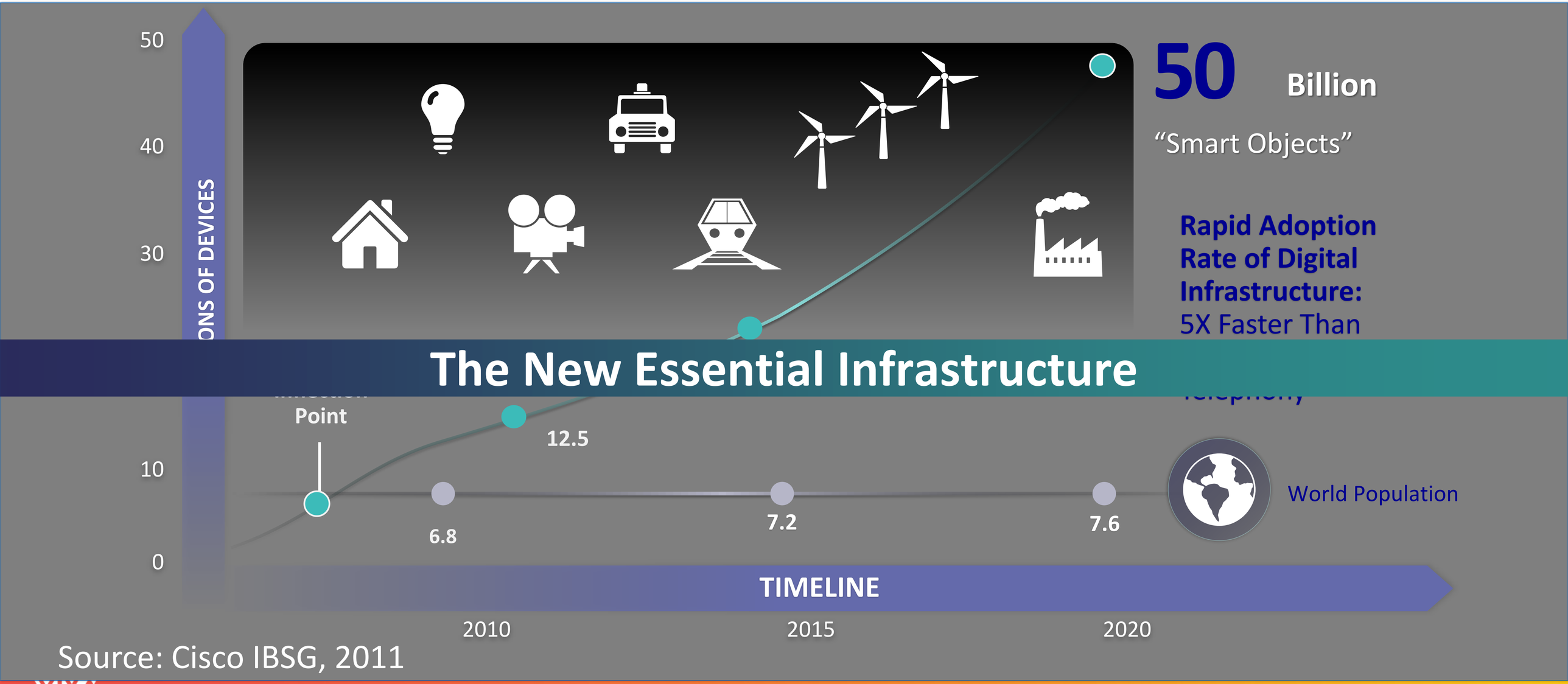
Machine-to-People (M2P) $4.6T

People-to-People (P2P) $7.0T

Basic IoT Segments

- Machine-to-Machine – **Intelligent Machines**
  - Connect the world's machines, facilities, fleets and networks with advanced sensors, controls and software applications
- Machine-to-People – **Advanced Analytics**
  - Combines the power of physics-based analytics, predictive algorithms, automation and deep domain expertise
- People-to-People – **People at Work**
  - Connecting people at work or on the move, any time to support more intelligent design, operations, maintenances and higher service quality and safety

IoT is Here Now – and Growing!



50 **Billion**

"Smart Objects"

Rapid Adoption Rate of Digital Infrastructure: 5X Faster Than

The New Essential Infrastructure

Source: Cisco IBSG, 2011

New to the Internet

Simple, Smart, Value, Cloud Access, Device Agnostic, Big Data

This nest thermostat learns automatically

Phillips hue LED internet connected

Connected Band & Shoe

Soil Sensors
Water, Nutrients

Real-Time Parking Information For Residents & Visitors

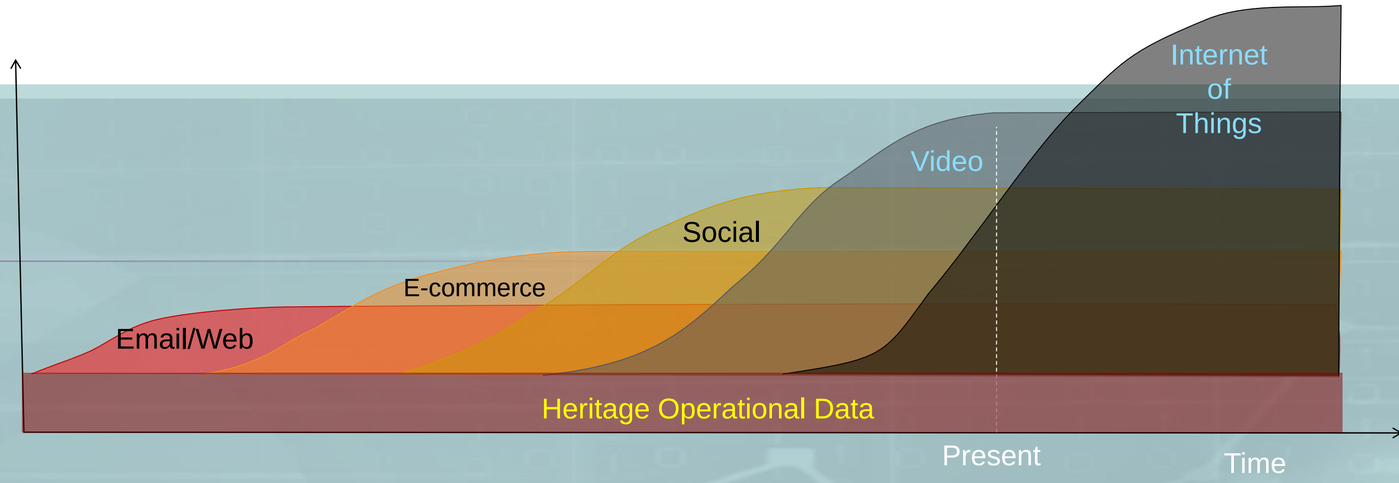
Connected Objects Generate Big Data

46 million smart meters in the U.S alone
1.1 billion data points (.5TB) per day

A single consumer packaged good manufacturing machine generates 13B data samples per day

A large offshore field produces 0.75TB of data weekly
A large refinery generates 1TB of raw data per day

10TB of data for every 30 minutes of flight
With >25,000 flights per day, petabytes daily



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Projected world population in 2016 is 7.3 Billion, with 10 Billion mobile-connected devices

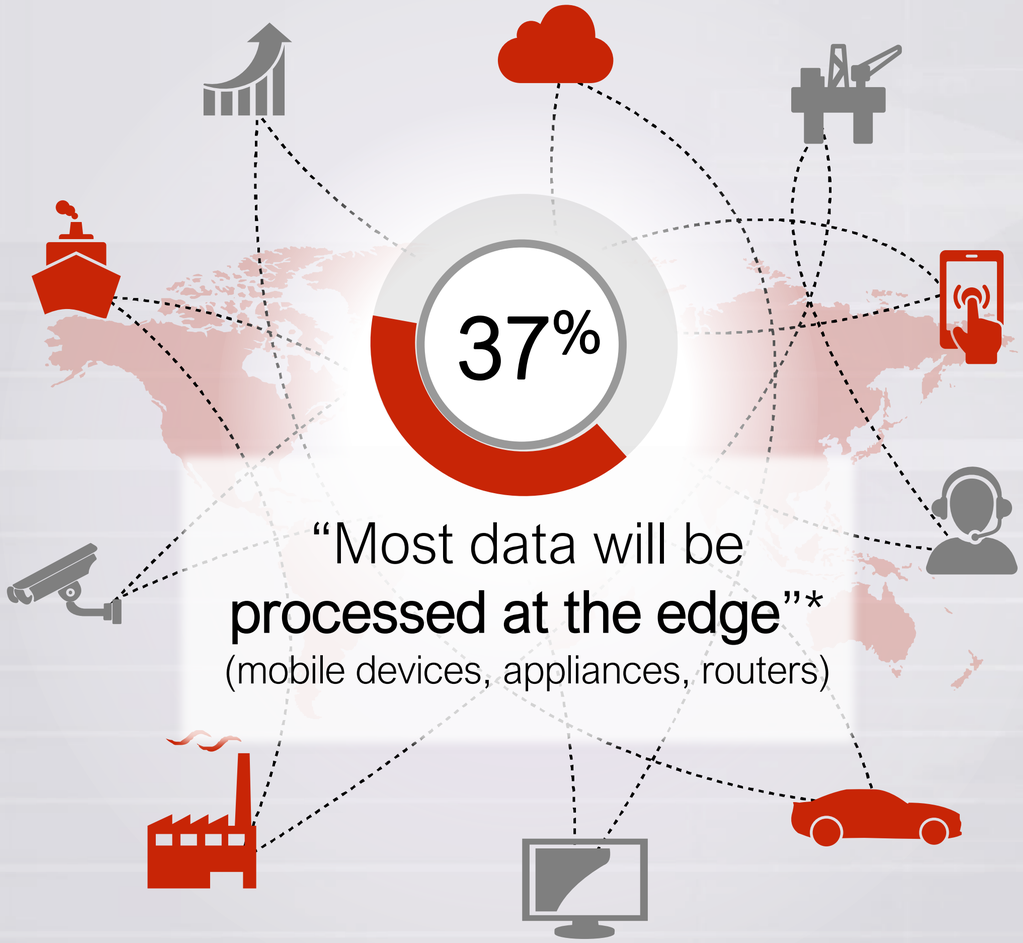
In 2016, global IP traffic will reach 1.3 zettabytes; growing 4-fold from 2011 to 2016

In 2016, there will be nearly 19 billion global network connections (fixed and mobile);
- the equivalent of two and a half connections for every person on earth

The World Generates More Than 2 Exabytes of Data Every Day

Explosion of Data at the Edge for Digital Enterprises

Widely Distributed, Streaming, Short Shelf Life, Too Big to Move



Three years from now, where will most data generated by Internet of Things solutions be processed?

*Source: Cisco Consulting Services Global IoT Study, 2014

1230 respondents

The Era of “Augmented Perception” (Milne)

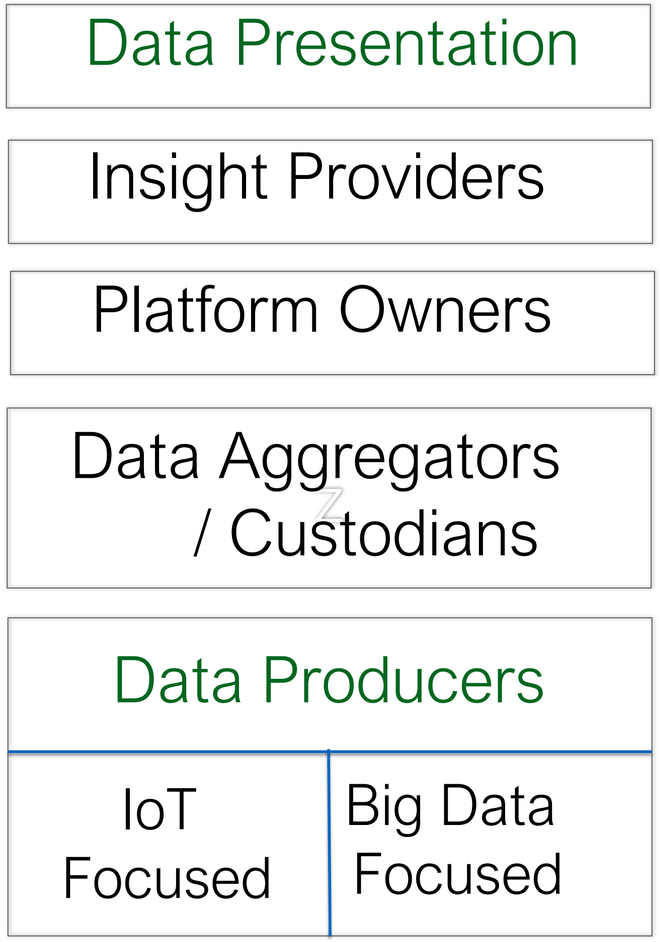
- **Distributed sensor systems (IoT)** that can sense phenomena in the physical world and create accessible digital data sets from that information in real-time
- **“Cloud-enabled” digital data centers** where organizations can collect, aggregate, and manipulate large data sets from multiple different systems and for different purposes
- **Artificial intelligence (AI) / machine learning (ML)** approaches that can process data sets and derive data-based insights (often in real-time) in a manner human analysts could not achieve
- **New forms of interface** – mobile devices, natural language programming (NLP; e.g. Siri, Alexa), AR, VR, etc. – that can deliver insights to users with appropriate contexts (e.g. predicted time to destination using GPS and traffic data.)

Common IoT Data Types

- **Location**
  Where a particular thing is positioned geospatially.
- **Environment**
  Based on the measurement of environmental variables
- **Machine**
  Data automatically created from a computer process, equipment, application, or other machine without the intervention of a human.
- **Health**
  Data collected from sensors that monitor vital signs.
- **Events**
  Point at which an action or occurrence transpired.
- **Attribute**
  Characteristic of an object that can be categorized and/or counted
- **Motion**
  Movement or position of an object or human being.
- **Orientation**
  Relative position of an object .
- **Facial Expression**
  Visual state of a human face that can indicate their identity, focus of attention, emotional state, etc.
- **Spoken Language**
  Utterances made by one or more people, while alone or together. In a group.

Source: Opher, A. et al.“The Rise of the Data Economy: Driving Value through Internet of Things Data Monetization”

The “Data Economy” Framework



Interactive UI, Experiences, Data Discovery, Customer Loyalty

Embedded Analytics, Crowd-sourced Algorithms

API’s, Direct Data Sharing

Open Channels, Discovery, Interoperability

Collecting, Accessing & Controlling Large Data Sets

Source: Opher, A. et al.“The Rise of the Data Economy:
Driving Value through Internet of Things Data Monetization”

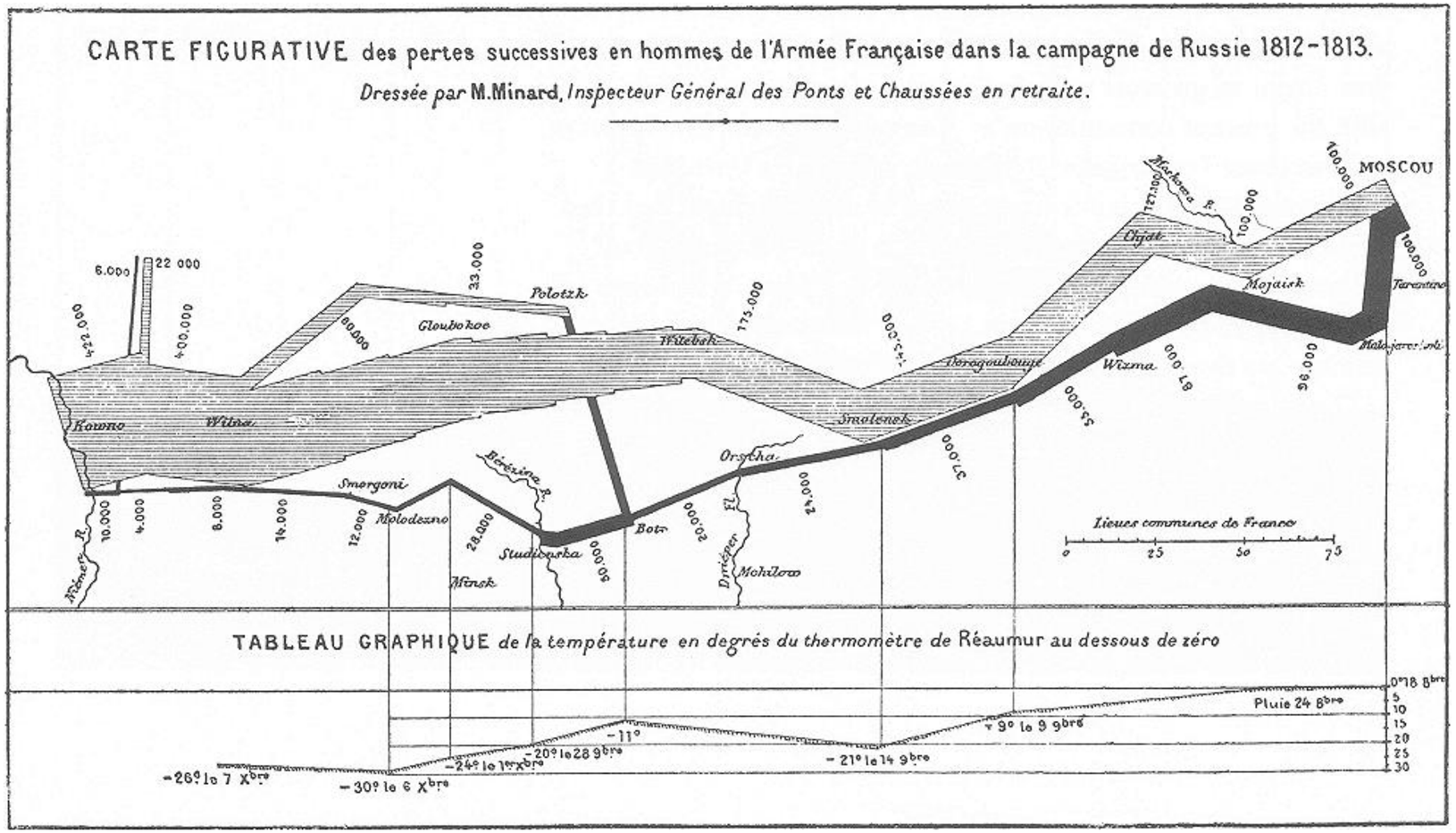
Costs as a Data Producer

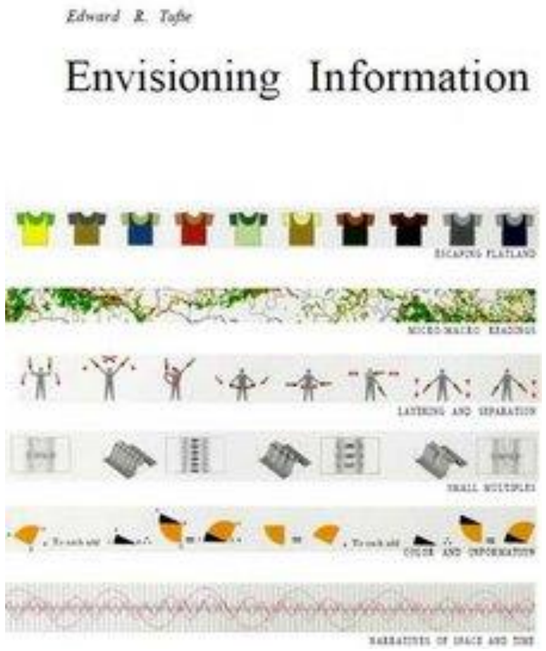
- Data collection & curation
- Systems to interact with data
- Integration
- Security
- Talent
- Liability
- Brand reputation

Opportunities for Data Presentation – e.g. Weather

Source: Opher, A. et al.“The Rise of the Data Economy:
Driving Value through Internet of Things Data Monetization”

The Power of Data Visualization





The Data Presentation Opportunity

Data Presenters make complex and large datasets easy for business users to consume. They allow consumers to have intuitive access to the underlying data and its derivatives. Users expect to be able to visualize, interact, manipulate, and discover new insights.

In an IDG study[1], 51% of respondents stated that big data needs to "make relevant data more consumable without relying on data scientists". Data Presenters that make data consumable will drive consumer loyalty and increase revenue.

[1]http://www.prnewswire.com/news-releases/idg-research-survey-exposes-pent-up-demand-for-consumable-big-data-to-make-it-rapidly-actionable-207558891.html

Source: Opher, A. et al."The Rise of the Data Economy: Driving Value through Internet of Things Data Monetization"

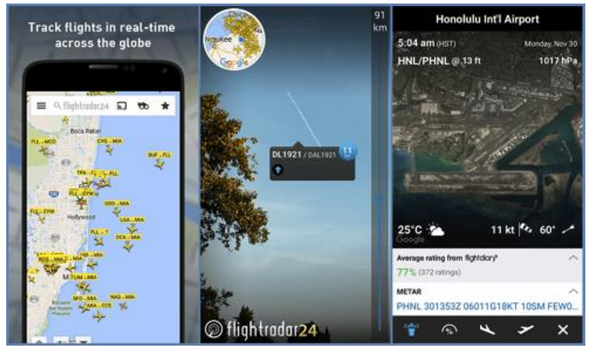
The Importance of Good Experience Design

- The average app loses 77% of its users within three days after it's downloaded.
- In the U.S., 30% of the time when an app is downloaded, a person never opens it more than twice.

Source: http://www.wsj.com/articles/a-few-ways-to-declutter-your-phone-1456117380

New Interface Opportunities

Amazon Echo



360° Cameras w/
Facial Analytics

Wrist-mounted Cellular
Sensor-Enabled Devices

Natural Language Processing Units

Augmented Reality

Information Display
& Interactive Controller

How is IoT impacting businesses and other organizations?

Every Business, Country & City is

Becoming Digital

0100
1011
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Digital

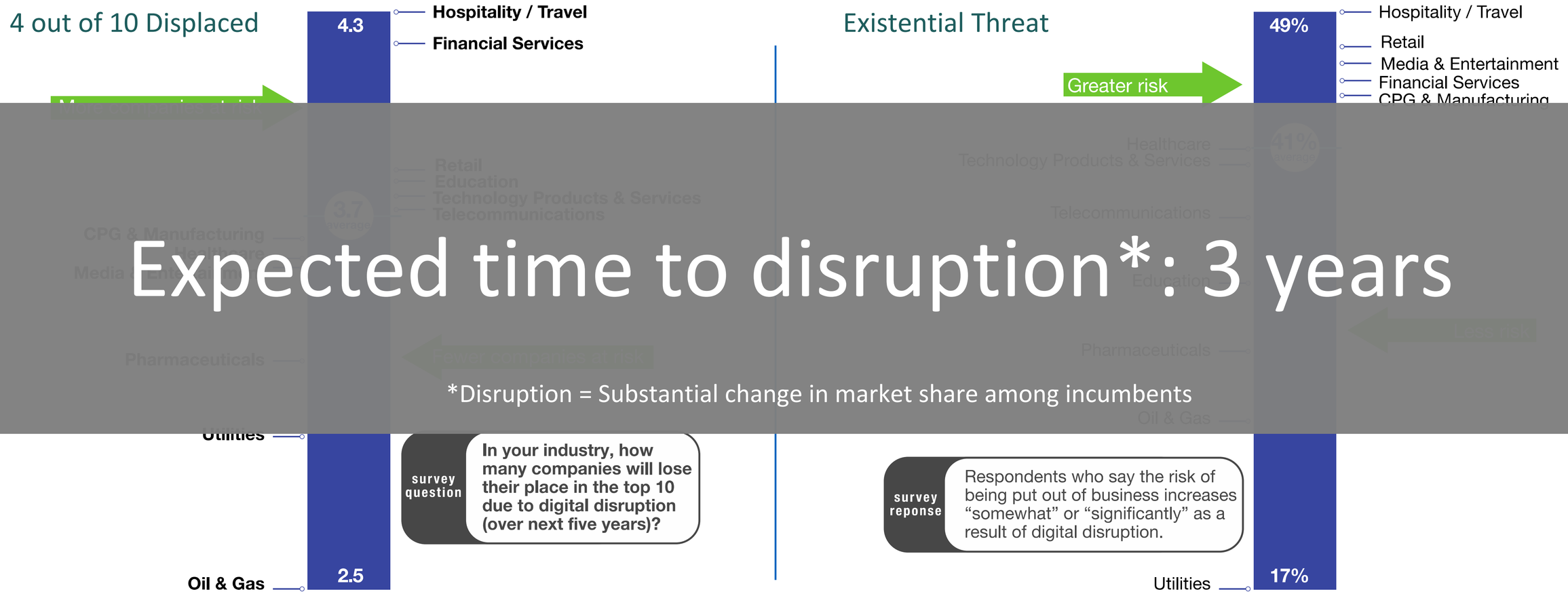
By 2020,
75%
of businesses will become fully digital or preparing to be.

Only
30%
of these digitization efforts will be successful.

What is the
#1 reason companies don't succeed?
Failure to innovate and reinvent themselves.

The Mighty Will Fall

Disruption to Shake Up all Industries, and Shake Out 4 of 10 Market Leaders



Expected time to disruption*: 3 years

*Disruption = Substantial change in market share among incumbents

Source: Global Center for Digital Business Transformation, 2015

Digitization is Disrupting Businesses

The world's largest taxi company owns no vehicles.

The world's most popular media company creates no content.

The world's most valuable retailer has no inventory.

The world's largest accommodation provider owns no real estate.

Digitization is Transforming Businesses

UPS My Choice

Delivery Control
Personalized Service

Customer Experience

Physical and Virtual
RFID Content

Use your Imagination

How will you digitize to
create value?

American Express

Personalized Service
Through Mobile

Starbucks Apps

Order Ahead
Skip the Line

"People don't want computers. They want to relate, share, communicate, enjoy, learn, discover, analyze and create."

Gartner

Transforming Content, Space & Technology

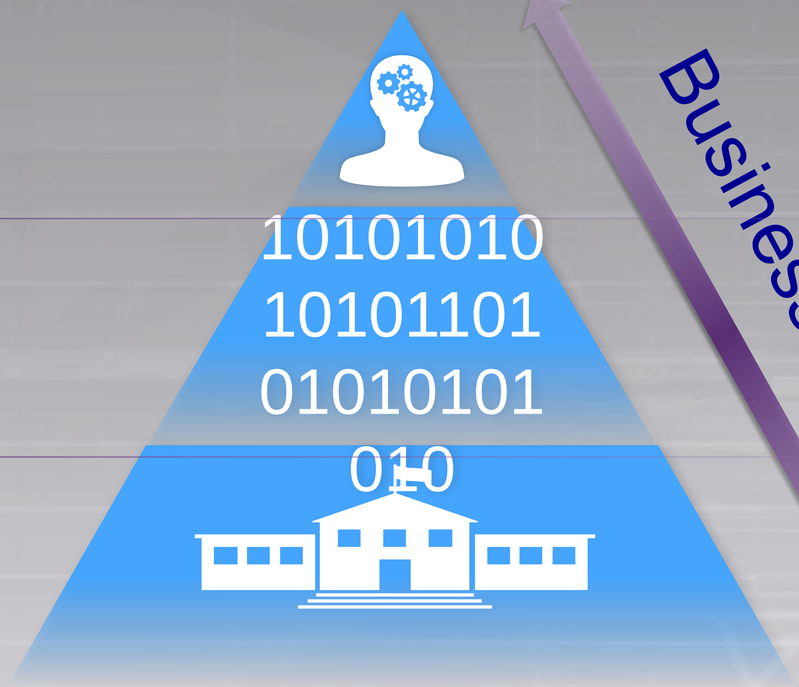
AV is the bridge between:

Physical and virtual, analog & digital, space and cyberspace, human and machine

Audio-Visual Experience

Information Technology

Facilities



More Important

Business Benefit

Less Important

Audio-visual information is a key element of the user experience

How can we discover and exploit new opportunities that IoT creates?

The Possibilities of Sensing

- What are the things we CAN sense?
- What are the things we WANT to sense?
- HOW will we sense these things?
- Interplay between sensing and senses?
- Relationship between sensing and insights?

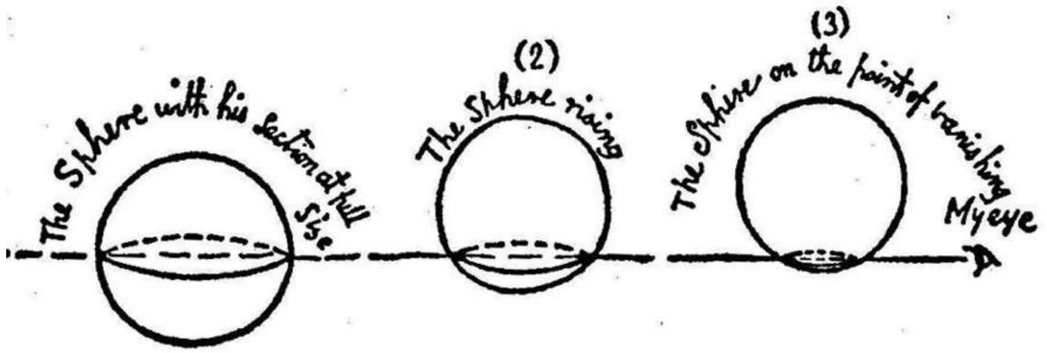
In Search of Transformational Outcomes…

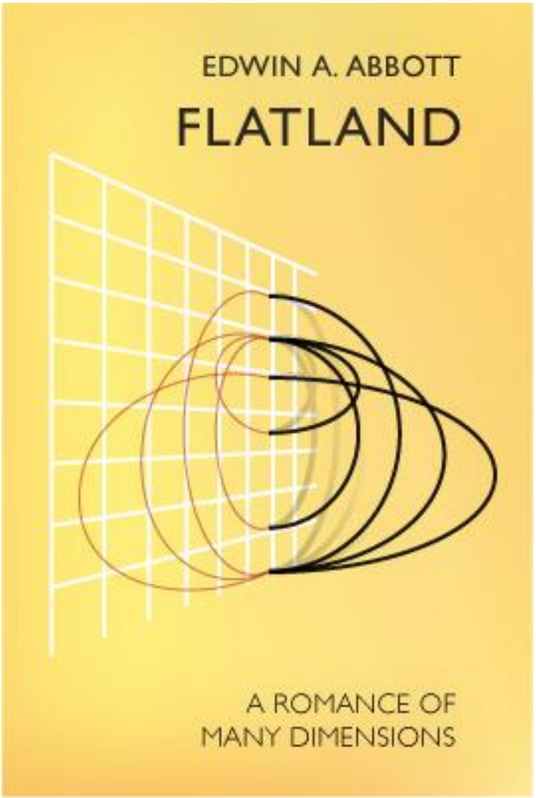
The question and evolution increasingly will not be about the Internet of Things but about the broader digital transformation economy picture with outcomes and integration in mind and de facto overlapping sets of technologies being a given.

Source: https://www.i-scoop.eu/internet-of-things-guide/

Avoiding a Flatland World-View

- Working with a 2-D perspective
- Living in a 3-D world
- Open up to disruptive opportunities





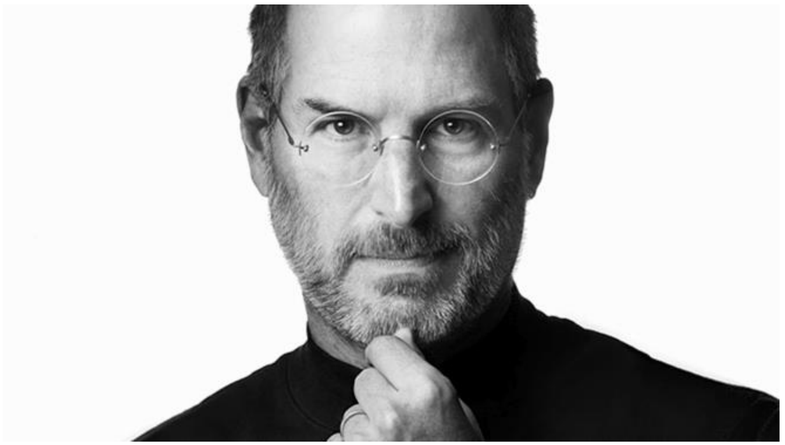
Novel Interfaces: Awareness Portal

- Familiar components, new combination
- Timing as part of interface algorithm
- No manipulative interface

Sawhney, N. et al. 2000. Aware Community Portals: Shared Information Appliances for Transitional Spaces (MIT)

“A lot of times, people don’t know what they want until you show it to them.”

- Steve Jobs



January, 2007

From a phone to a "breakthrough Internet device"

September, 2017

From a watch to a "breakthrough personal IoT portal"

Old Questions: “Re-Wrapping” Business

- What data can we collect from our customers’ operations and other sources using new technologies?

- How can we combine available data with other information to create new information-based offerings (that our customers haven’t developed themselves)?

Plant.IO: Digitalizing Agriculture with IoT

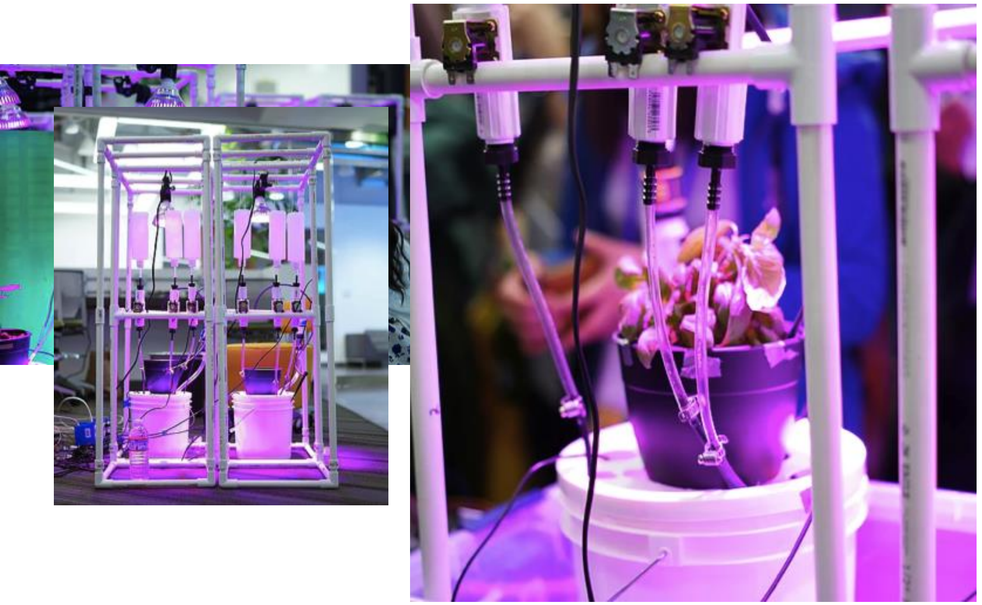
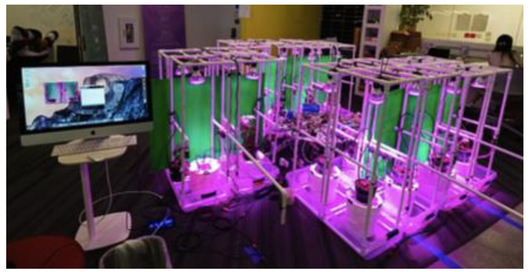


Photo Credit: INFOSYS



- Minimize waste
- Maximize yield

- Automated hydroponics
  Sensor inputs
- Machine learning
- Iterative prototyping
- 45 days / $40

From the business of molecules to the business of growth

New Questions: Transforming Business

- Are we working with the right set of customers?
- Have our customers properly defined their businesses?
- What objectives are key to our customers' success?
- What information do our customers need…
  …to achieve their current objectives?
  …to open up new business options?
- How do we collect data that will serve our customers' information needs?
- How do we deliver actionable insights to customers?
- What other data/insights might impact customers' performance in the future?

Implications Specific to the AVIXA Community

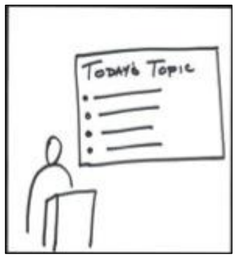
Experience Design – Live Events

- RFID opportunities for exhibit halls
  - Serious visits, returns vs. drive-bys
  - What % of target demographic is in hall
  - Special offers broadcast to target

- Opportunities for attendees
  - Record of which booths visited
  - Get post-show contacts / offers

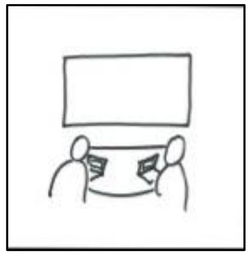
Experience Design – Meetings

- Recognizing the needs for different kinds of meetings

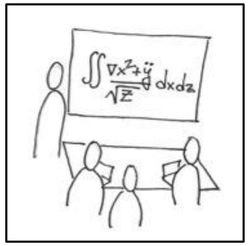


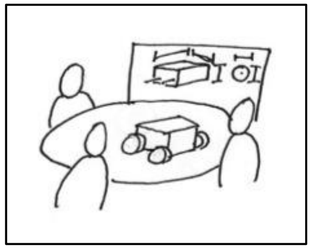
Presentation

Agenda Driven Meeting


Deliverable Development


Brainstorming


Decision Analysis


Product Design

From <u>good meeting room technology</u> to <u>good meetings.</u>

Experience Design – Built Environments

- Designing Across the Globally-Connected Enterprise

From digital signage to immersive information/communication

Impact on proAV Constituencies

- Consultants
- Integrators
- Independent Programmers
- Manufacturers
- Live Events
- Technology Managers

Impact on Consultants

- Understand human communication patterns at a more detailed level
- Develop designs that reach further than the current systems design boundaries

Impact on Integrators

- Transform into service providers that leverage installed systems
  - Installation services
  - Remote management
  - Software development
  - Data analytics providers
  - Data presentation design
- Use analytics tools to deliver valuable mission-related insights

Impact on Independent Programmers

- Shift away from traditional control system programming languages

- Software development
  - Leverage standards-based environments
  - Tie together distributed sensing systems
  - Data analytics and visualization tools for communication performance metrics

Impact on Manufacturers

- Develop sensor-integrated systems
- Push computing to network "edge"
- Reduce amount of custom installation
- Enable rapid JIT solution customization
  - Increased modularization, "bolt" together
  - Collaboration with "front-line" providers (Consultants, Integrator

Impact on Live Events

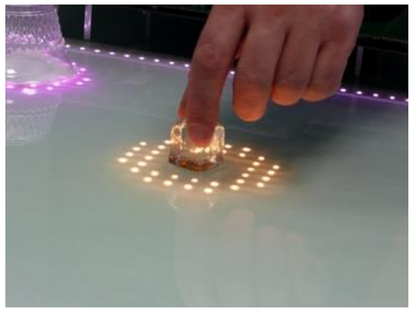
- How can real-time analytics, coupled with mobile devices and wearables enhance the live event experience?
- Consider different sectors
  - Business
  - Performing arts
  - Entertainment
  - Worship

Impact on Technology Managers

- Reduction – not elimination – of on-premises technology systems
- Increased role to broker third-party services to meet customer needs
- Need to anticipate new technologies and match them to organizational needs

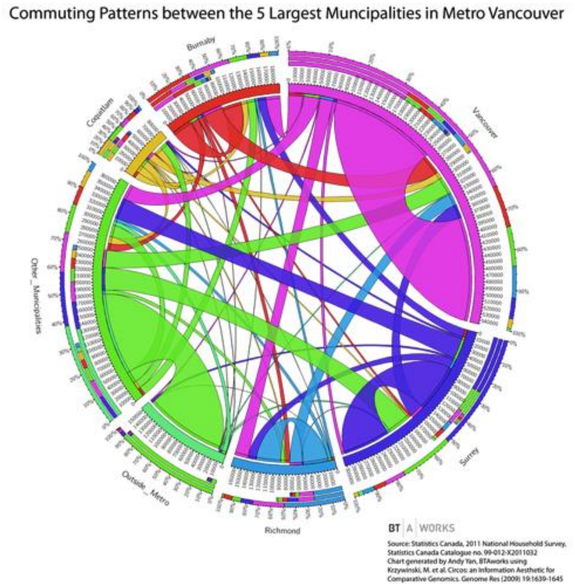
Post-Desktop Interface Examples

- Health monitoring apps + peripherals
  - FitBit, Apple Watch
- Social interaction indicators (wearables)
  - E.g. Proximity-based social matchmaking IDs
- Ambient communities of interest
  - E.g. "Digital graffiti" from MIT Stata Center
- Ambient information devices for process mediation
  - E.g. Microphone as a participation sensor



Designing for New Modes of Communication

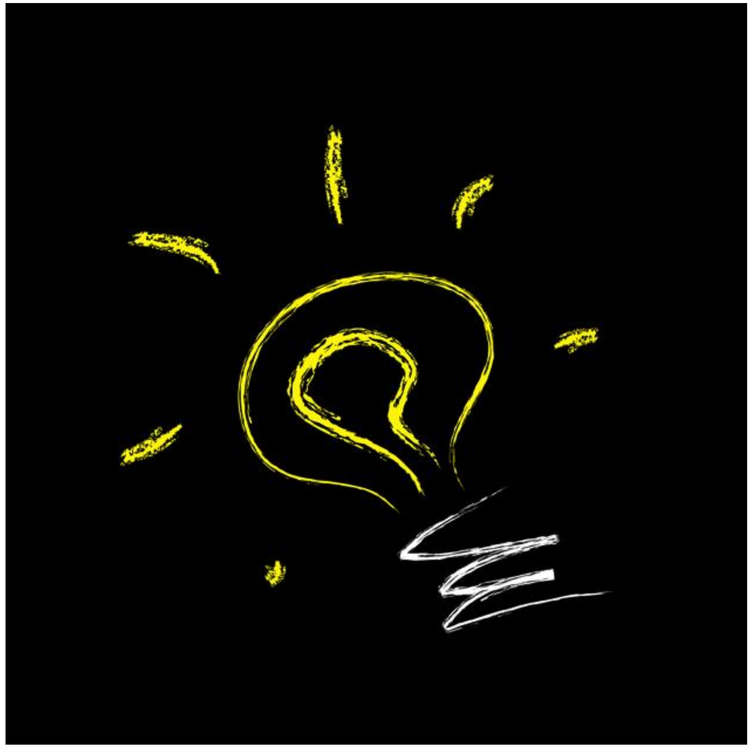
- The "Art" of the human experience vs. transactional information handling
  - Emotional responses (Feel)
  - Interpersonal interaction vocabularies (Act)
  - Visualizing information (Perceive)
- Crowdsourcing social interaction
  - Characterize community from devices carried
  - Build interactive experiences based on who is present



Processing Data / Developing Insights

- Better communication – What are best practices in communication and what factors indicate these practices?
- Better business analytics -- What mission-related insights can data from IoT systems provide?
- Better performance – How might these insights *shape* human activity, organizational performance?

Achieving Transformation



- Focus on “valued experiences”
- New approaches to design
- Retooling the workforce
- Integrator becomes technology broker
- Look outside “silos” for opportunity amid disruption

Key Takeaways

- IoT and AV connect the unconnected – creating new values
- ~85% of the “things” in the world are still unconnected
- Consumption models & expectations are changing
- Digitization is disrupting traditional business models
- Focus shifting to business and mission outcomes
- Technologies are evolving at an exponential pace
- M2M, M2P & P2P communications are interconnecting
- *Audio Visual information is at the heart of the user experience*

“The End of the Beginning…”

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Networking & Lunch Break

Almo E4 Showfloor

12:00 p.m. – 1:30 p.m.

IoT In the Real World

Emcee & Presenter: Michael Carter

Senior Consultant, JLL Smart Building Program

The value proposition

3 $3/SF

Building efficiency & energy management

Smart Buildings

30 $30/SF

Space utilization & workplace strategy

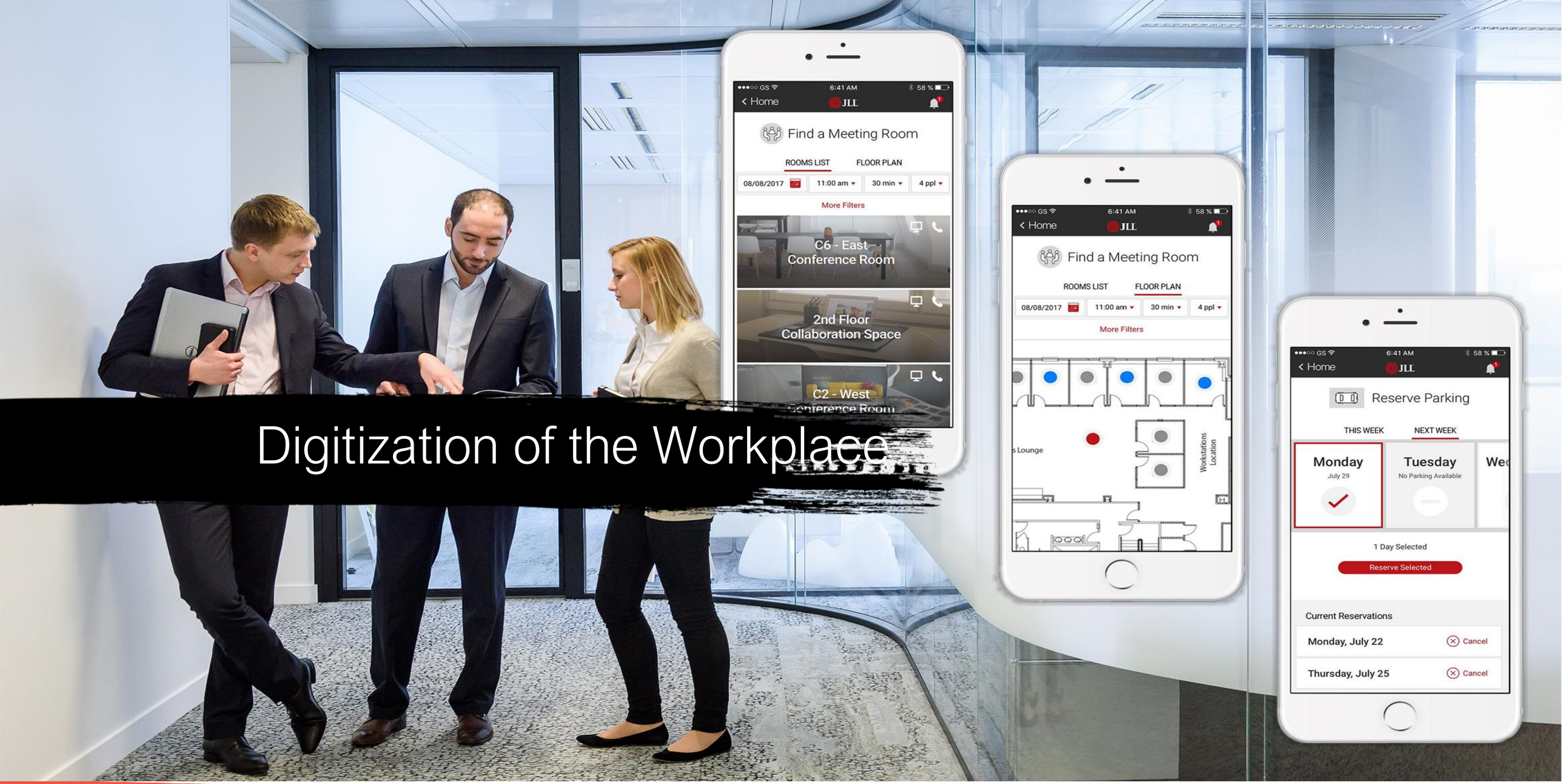
Smart Workplace

300 $300/SF

Employee productivity & occupant experience

Smart Experience

IoT in the Workplace


Digitization of the Workplace
Home
JLL
Find a Meeting Room
ROOMS LIST
FLOOR PLAN
08/08/2017
11:00 am
30 min
4 ppl
More Filters
C6 - East Conference Room
2nd Floor Collaboration Space
C2 - West Conference Room
Reserve Parking
THIS WEEK
NEXT WEEK
Monday
July 29
Tuesday
No Parking Available
1 Day Selected
Reserve Selected
Current Reservations
Monday, July 22
Thursday, July 25
Cancel

Knowledge is power

IoT Analytics and Security

Design Engineer

TEECOM

IoT Analytics and Security

IoT Starts at Sensors

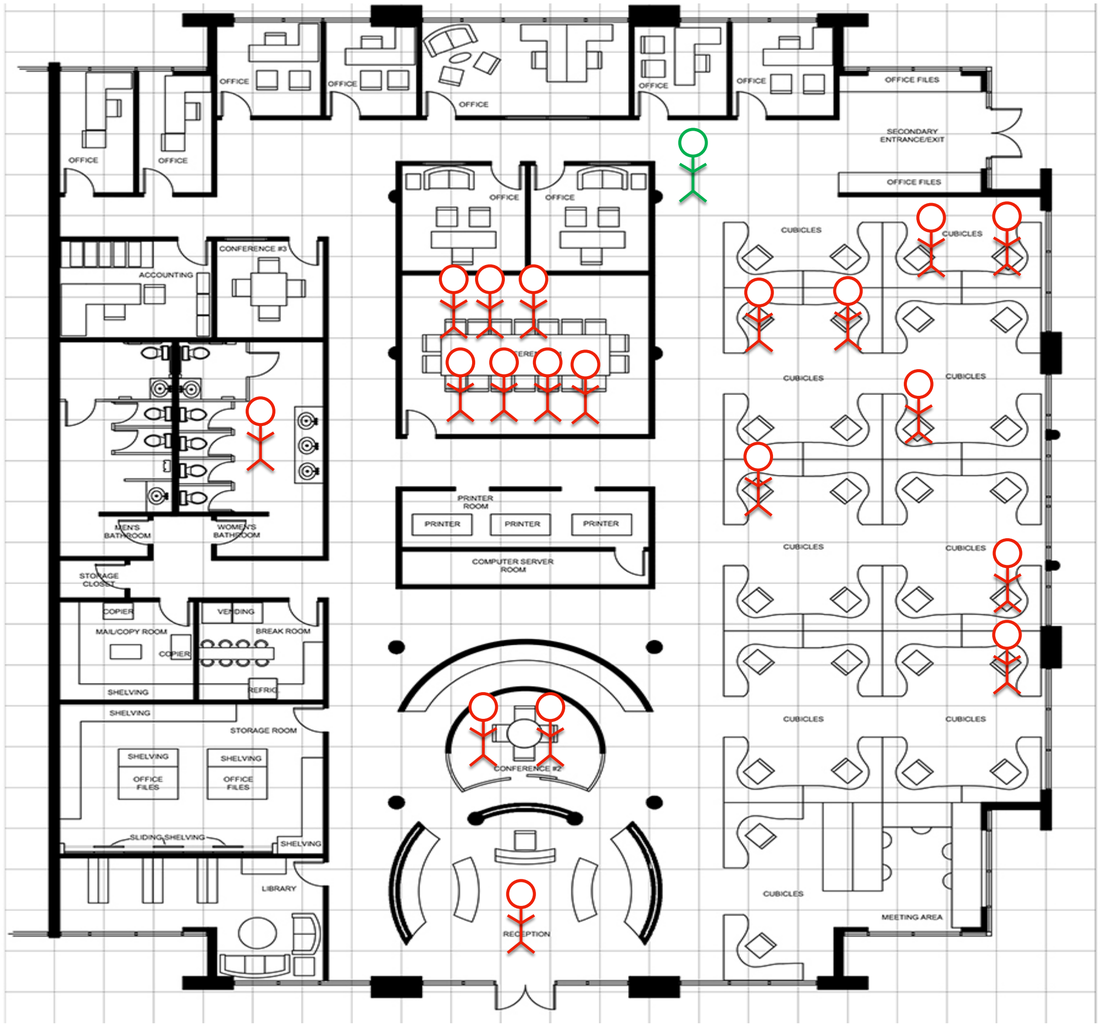
- Bluetooth
- Wi-Fi
- NFC
- Network Connections

- Fitness trackers
- Connected Cars
- Smart TVs
- Smart appliances
- Connected Homes
- Most Important: That Device in your pocket: <u>YOUR PHONE</u>

IoT Analytics

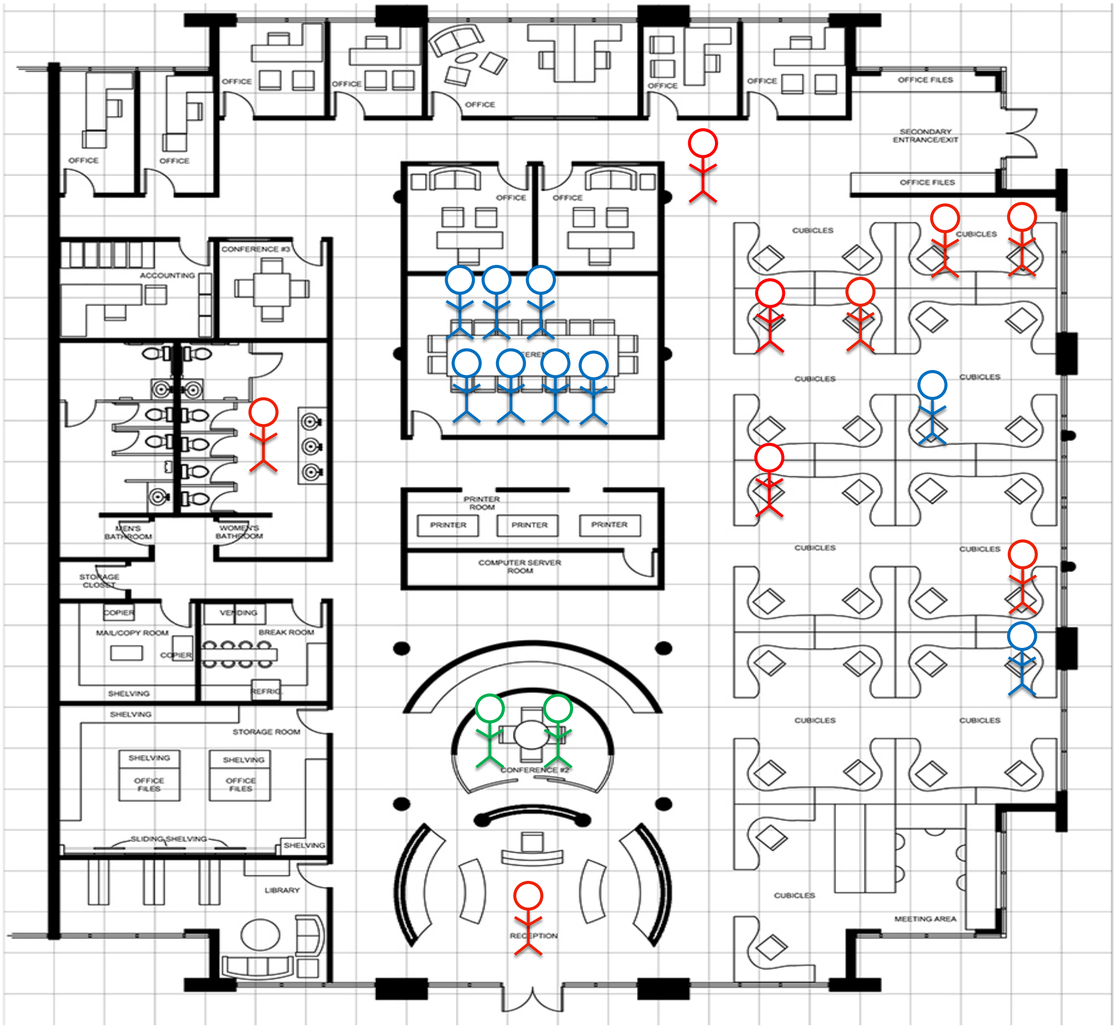
- Every smart device is tracking something – whether you know it or not.
- Knowing what to do with that data is the future of *all* business.

IoT Analytics



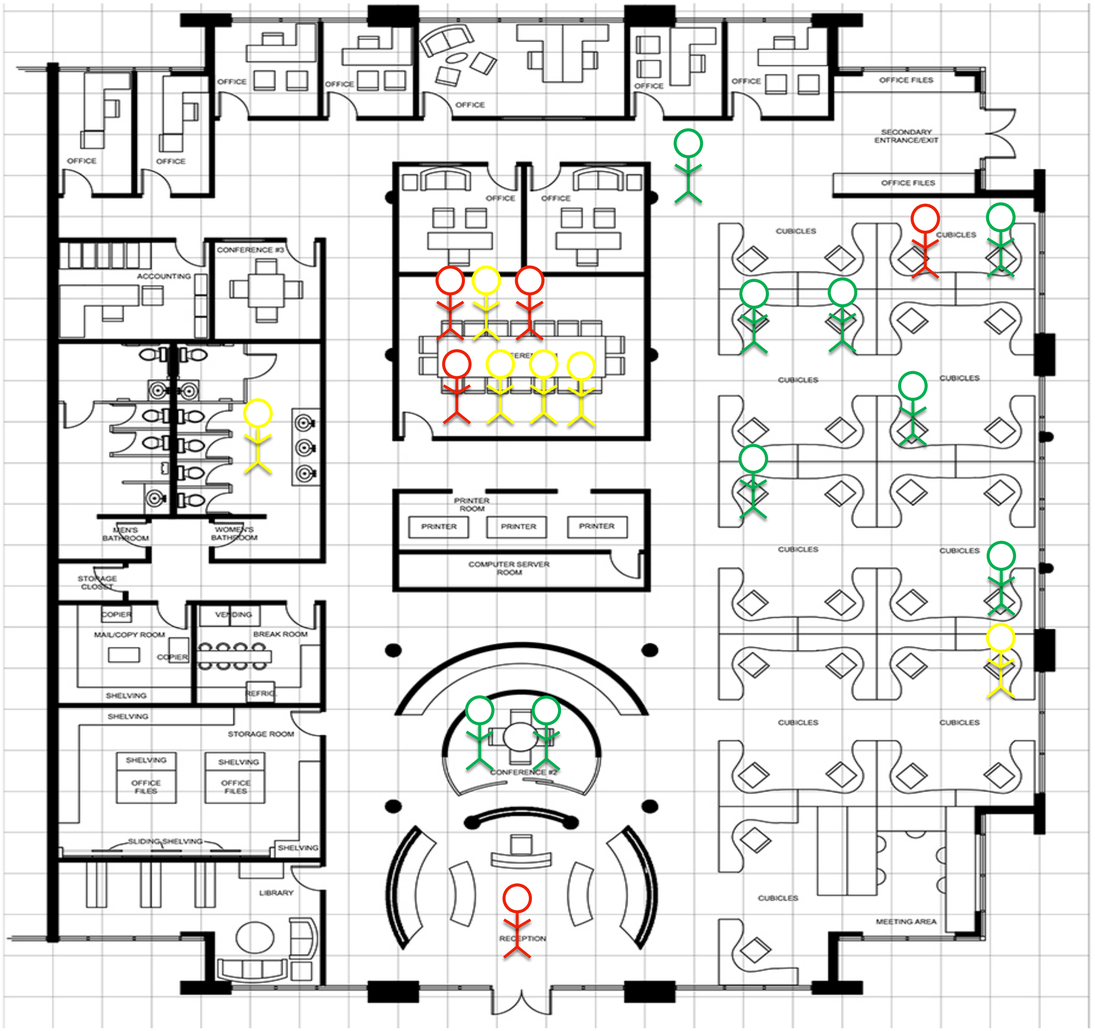
- Who?
  - Use the data to know who is in the building or individual rooms.

IoT Analytics



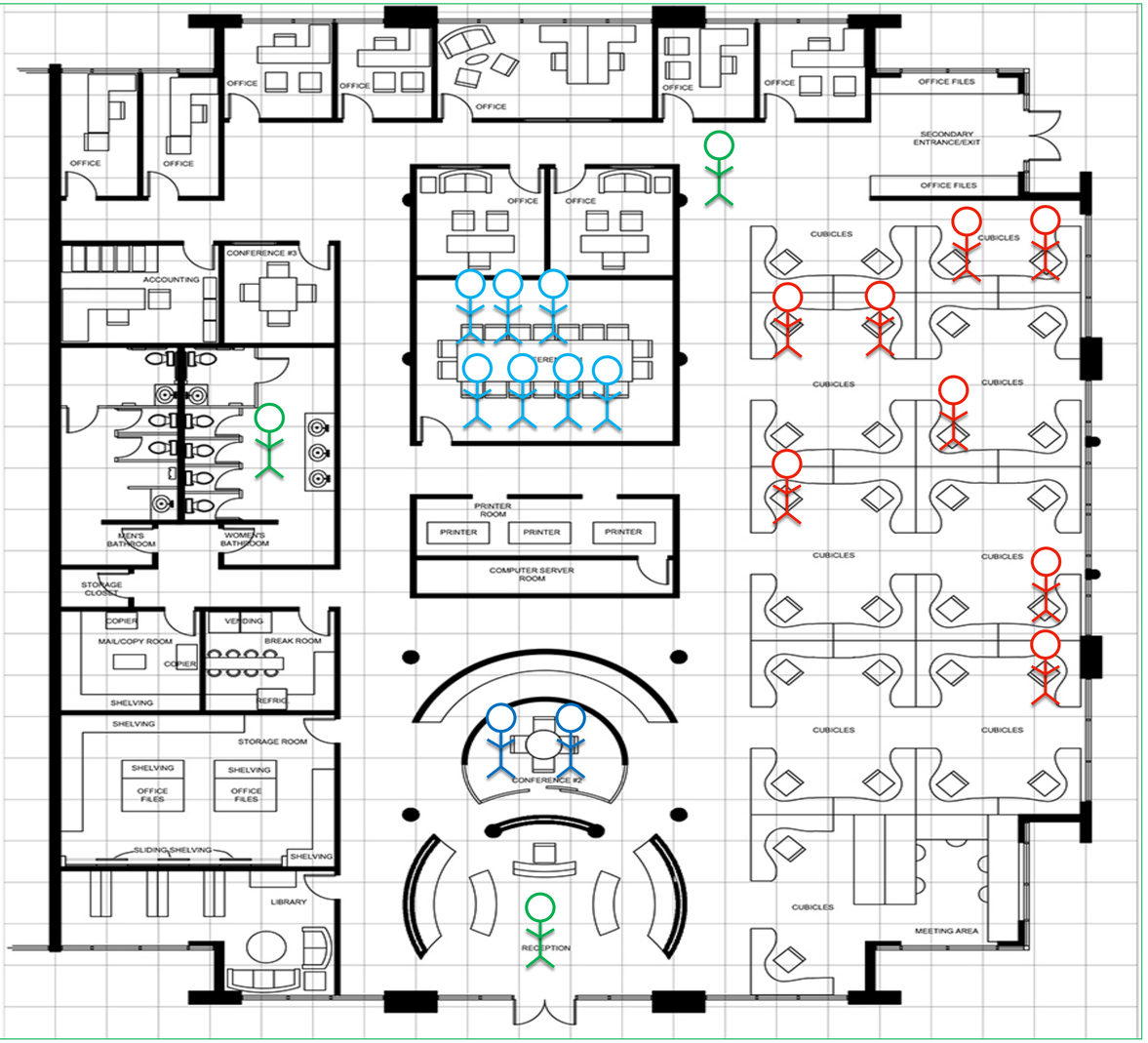
- Where?
  - Where are people in the building
- What?
  - What are these people using the building to do?

IoT Analytics



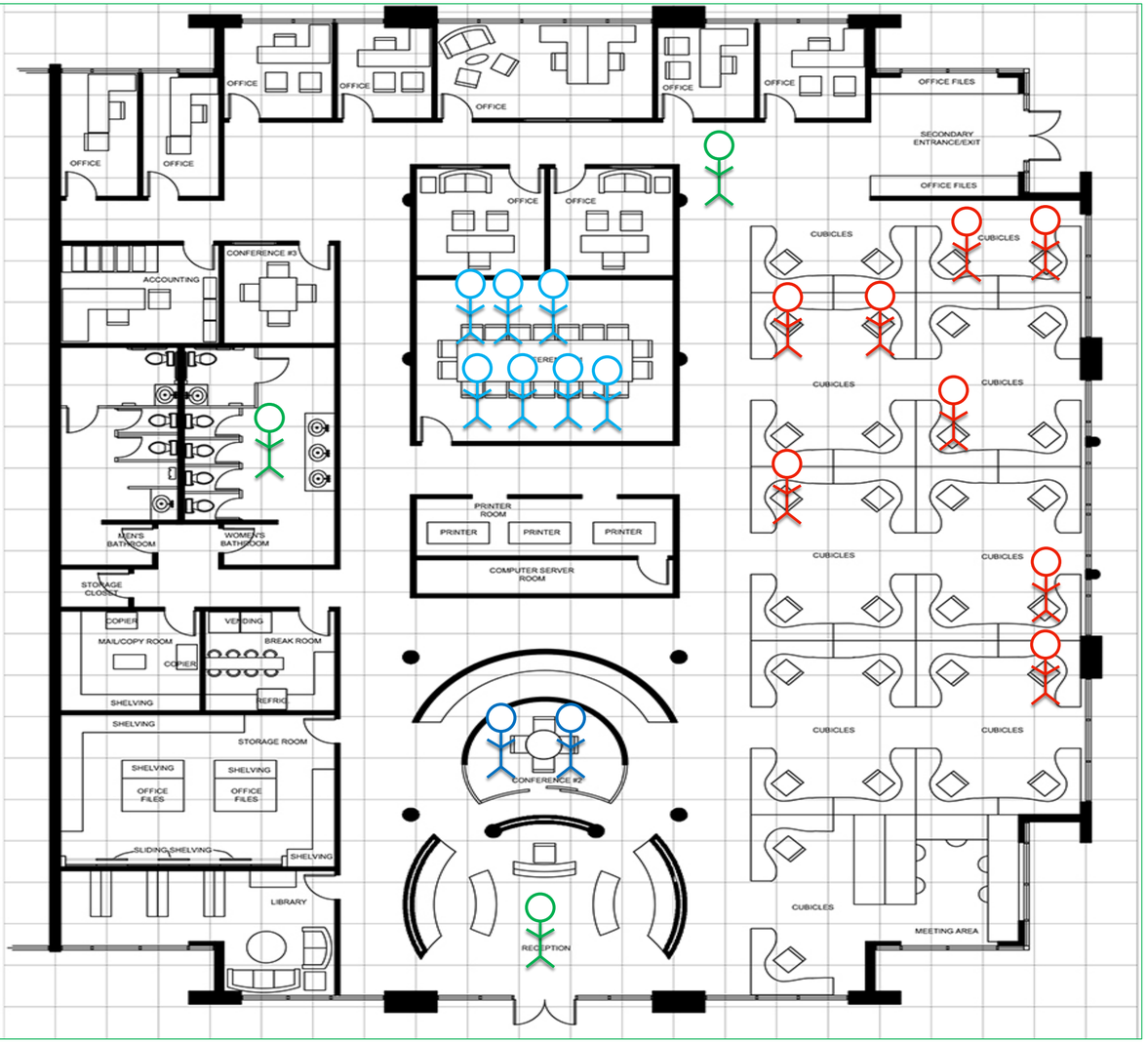
- When?
  - When are people using the meeting spaces?

IoT Analytics



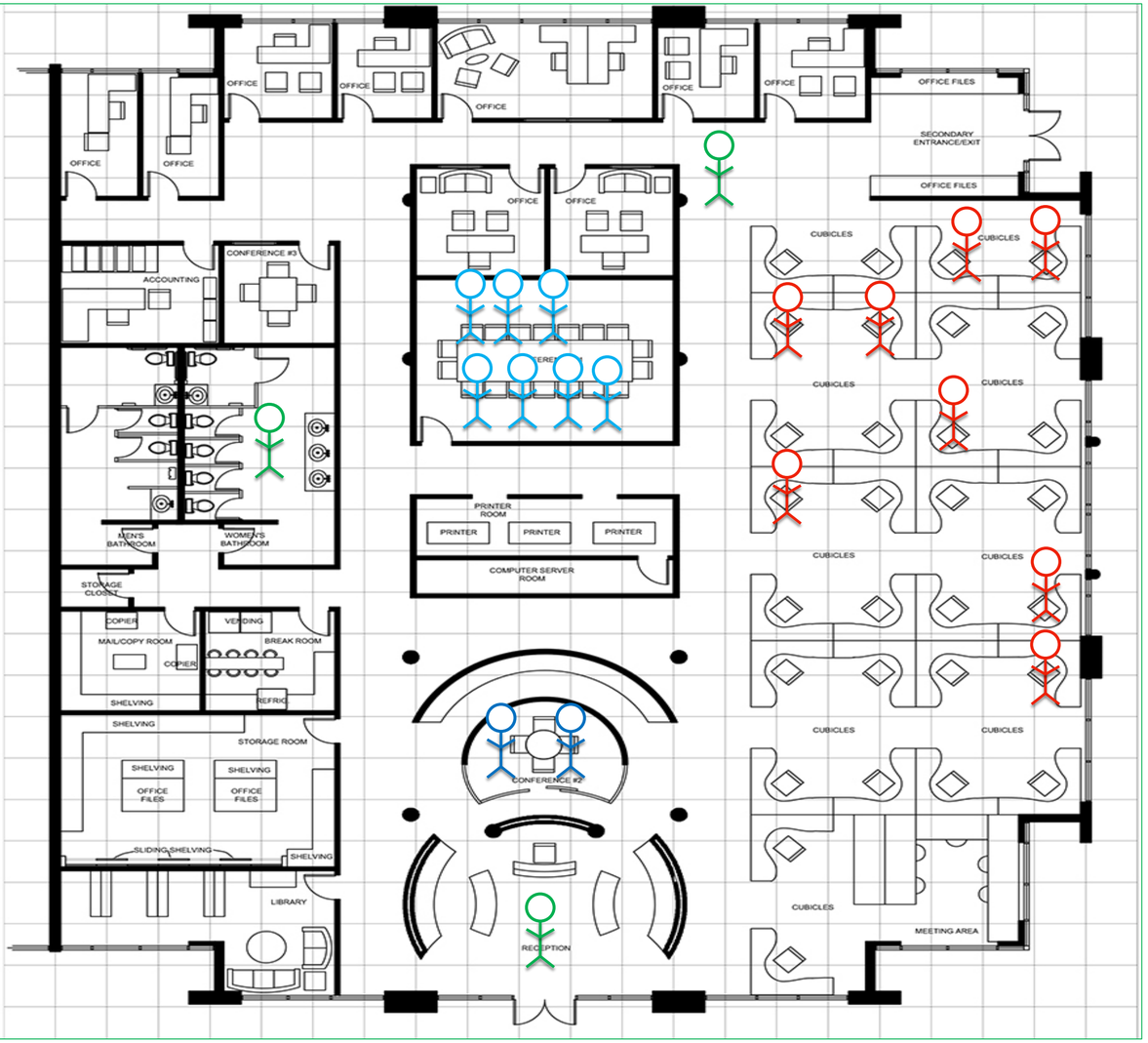
- Where?
  - Where are they in the building?

IoT Analytics



- Why?
  - Track why the people chose that space to meet
    - Size of room?
    - Available Tech?

IoT Analytics



- How?
  - How are people putting the spaces to use?
    - Group VC?
    - Huddle room w/ presentation?
    - At desk VC?
    - Squatter?

IoT Analytics

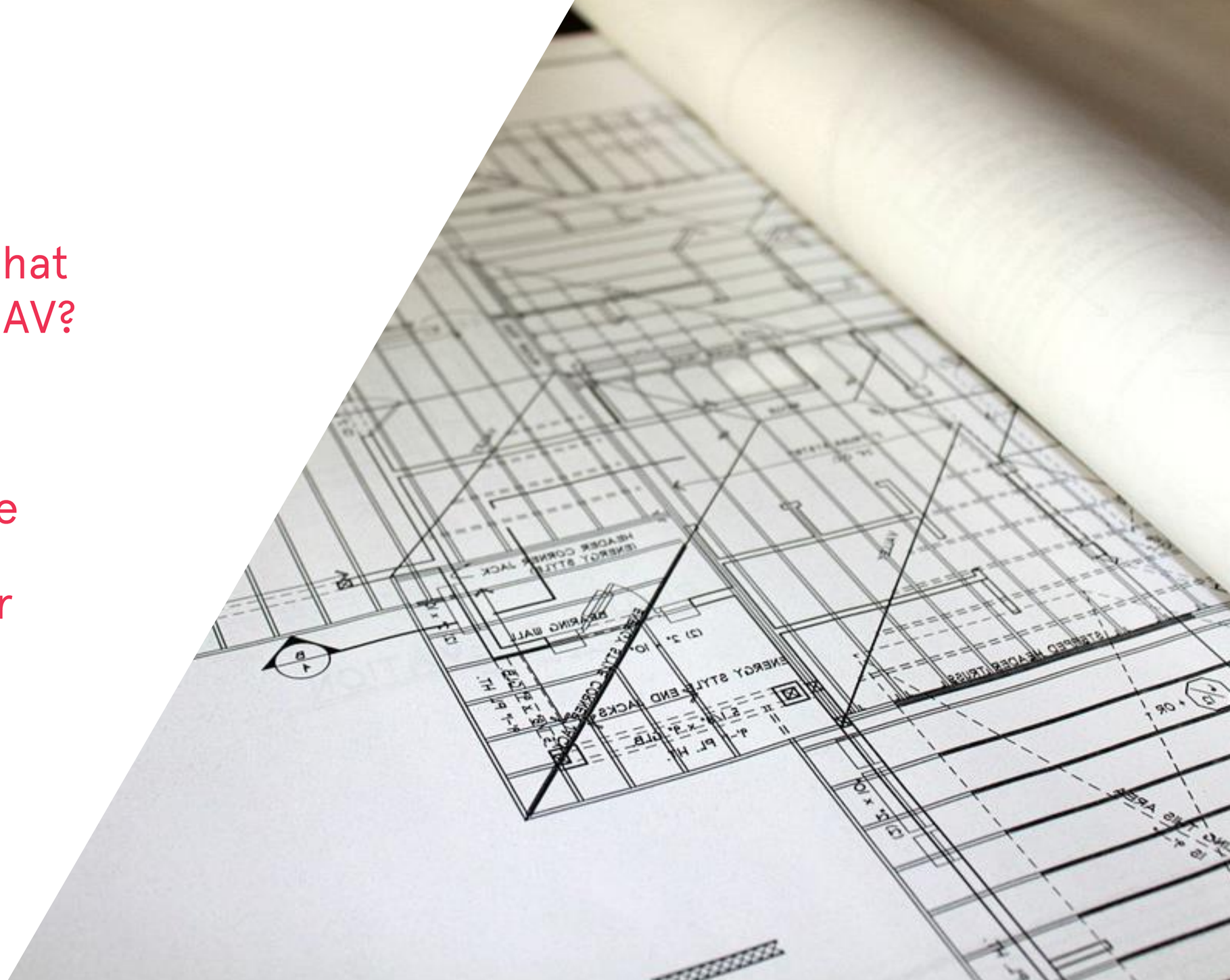
That's a **LOT** of information being gathered on

- Employees
- Guests
- Clients
- Anyone in the building.

IoT Analytics

How are you putting that information to use in AV?

- System Design
- System Maintenance
- Client Education for Future Planning



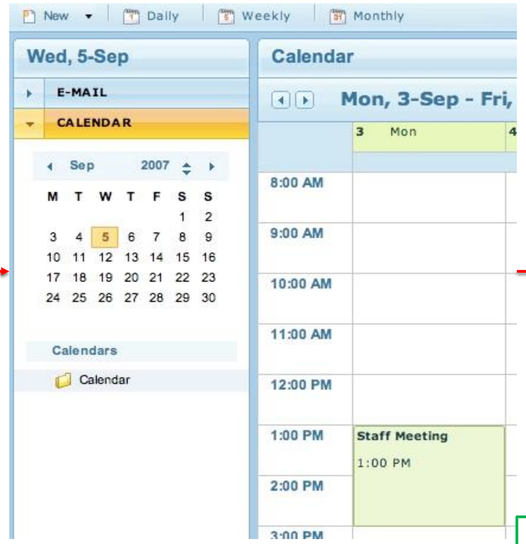
IoT Applications

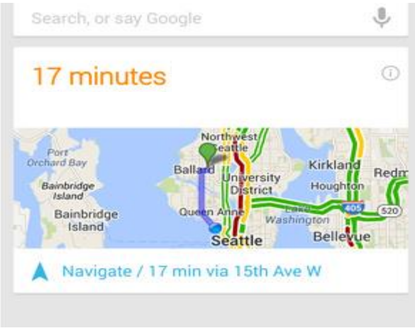
- Digital Signage
  - Beacons
  - Phone Apps
  - Data Collection
  - Data Analyzed
  - Relevant Information

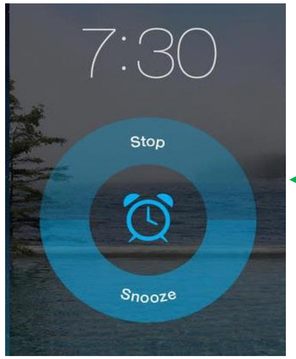
IoT Applications

- Corporate
  - Occupancy triggers systems
  - Room setting preferences
  - Environmental Controls

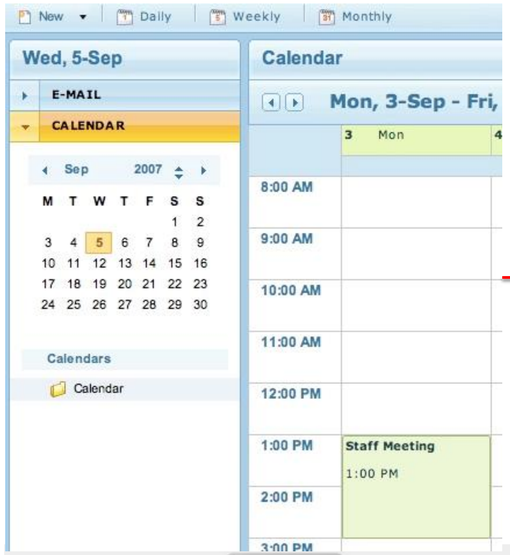
IoT Applications







IoT Applications

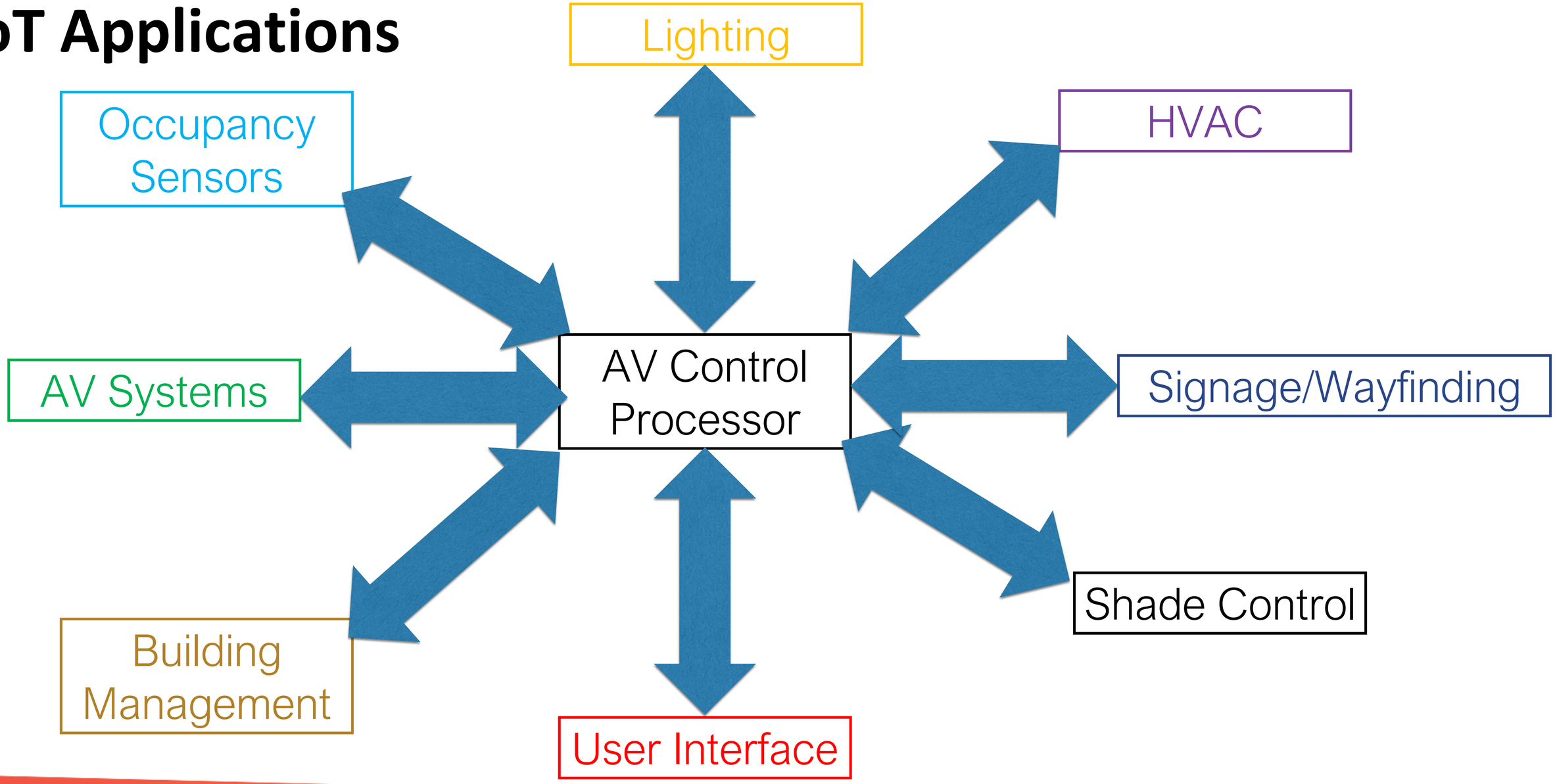


IoT Applications

Access Store App:

- Personal Information shared
  - Past purchases
  - Contacts
  - Calendar
  - Storage
  - Location

IoT Applications



IoT Analytics

Current challenges:

- Figuring out how to gather the info
- Figuring out how to interpret the info

But *mostly:*

Keeping the information **secure**

MORE CONVENIENT

MORE SECURE

Pick Your Point

IoT Security

- Smart Watch
- Digital Calendar
- Traffic & Weather app
- Phone Alarm
- Smart Coffee Pot
- Smart Lights
- Smart Home appliances
- Any network connected device

IoT Security

- Smart Watch
- Digital Calendar
- Traffic & Weather app
- Phone Alarm
- Smart Coffee Pot
- Smart Lights
- Smart Home appliances
- Any network connected device

For each device you connect to the network you are allowing more access to your information.

IoT Security

- What information are you transmitting?
- Where is that information stored?
- Who has access to it?
- Who did you give permission to?

Sony
Entertainment
Network

Heartland

J.P.Morgan

Anthem®

Don’t be the breach!

IoT Security

Distributed Denial of Services (DDoS)

- Taking control of unsecured devices
- Use the devices to occupy server requests

IoT Security

What did the hackers use?

- Network cameras
- CATV Boxes
- IP Speakers
- Hundreds of devices

Hacks aren’t just accessing your data!

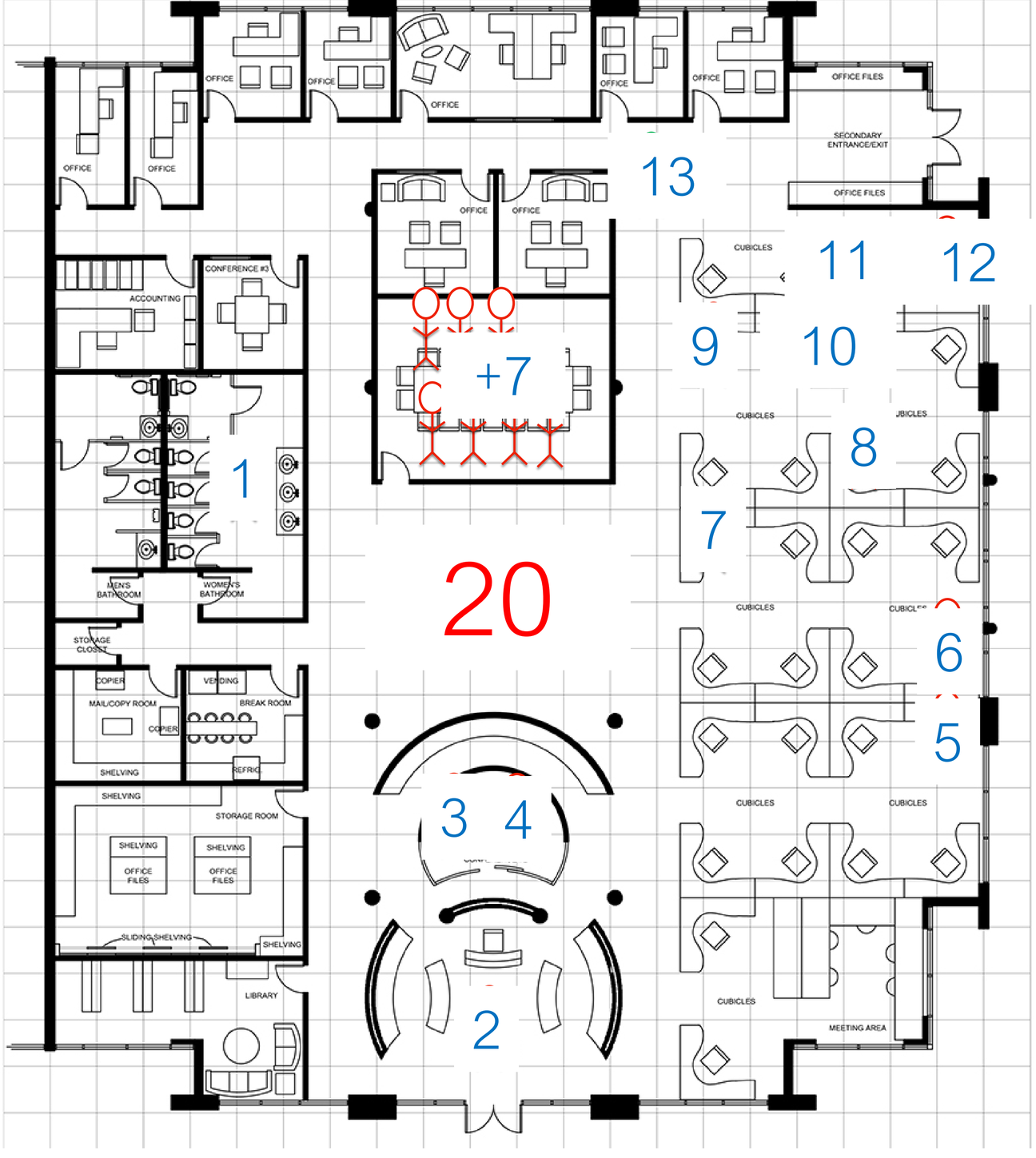
IoT Security

Rule 41

If your device has been compromised, even without your knowledge, and is used in a digital attack, it is susceptible to remote search by Federal Law Enforcement.

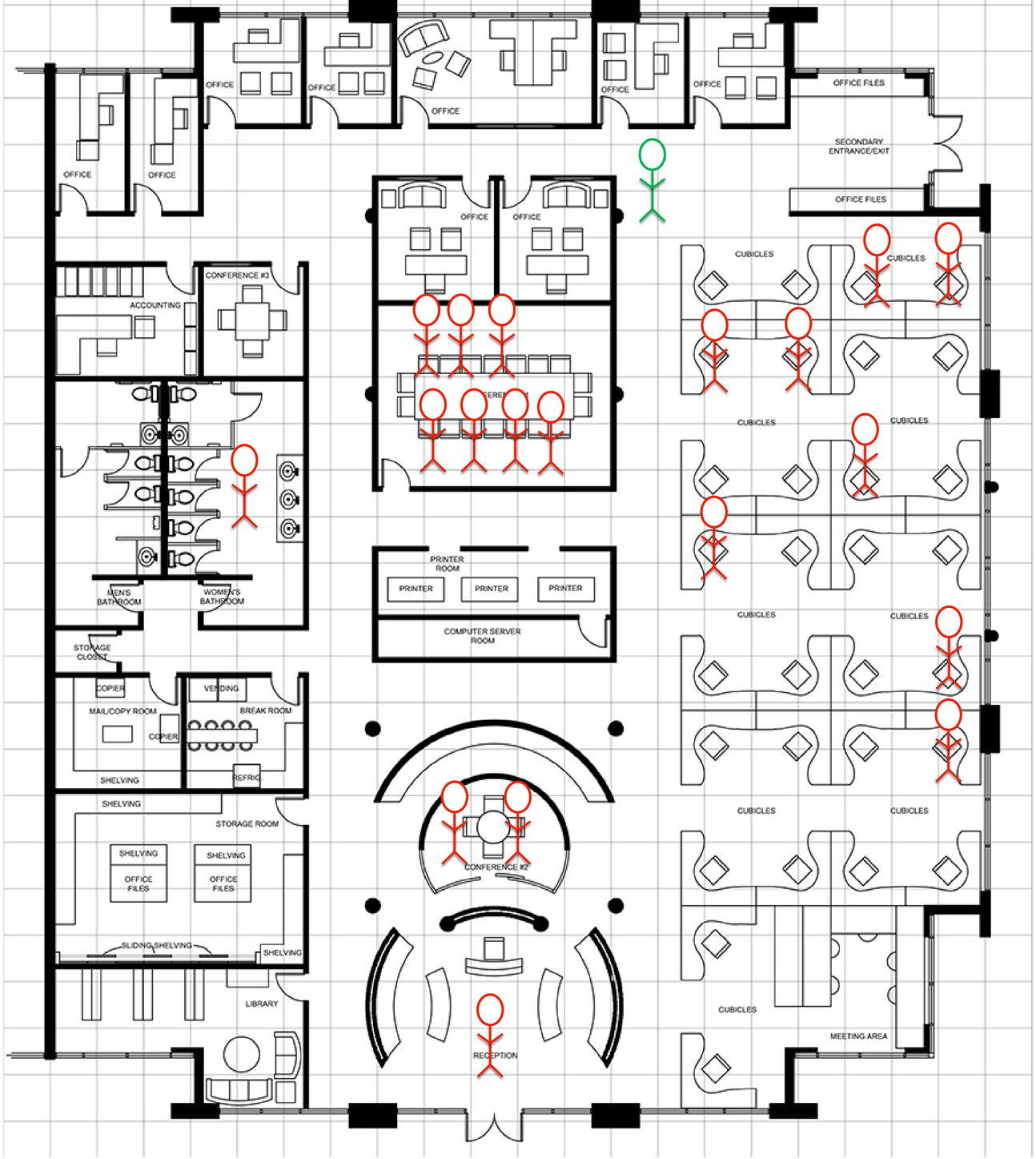
The hack we *don't* know about is the most dangerous of all.

March 2017 - WikiLeaks releases documents state the CIA has been able to compromise Apple and Android devices allowing them to bypass encryption in applications and retrieve text or audio before it's encrypted.



Will IoT be a big or small problem in corporate AV?

Count the number of devices connected to the network.



Will IoT be a big or small problem in corporate AV?

Each device could be infected with malware providing someone direct access to

- The Network
- Information

Why would someone want to hack my fitness tracker?

Your IoT devices are just gateways onto a network.

Hackers are seeking the weakest link to the network.

BLEEPINGCOMPUTER

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Home > News > Security > Someone Published a List of Telnet Credentials for Thousands of IoT Devices

Someone Published a List of Telnet Credentials for Thousands of IoT Devices

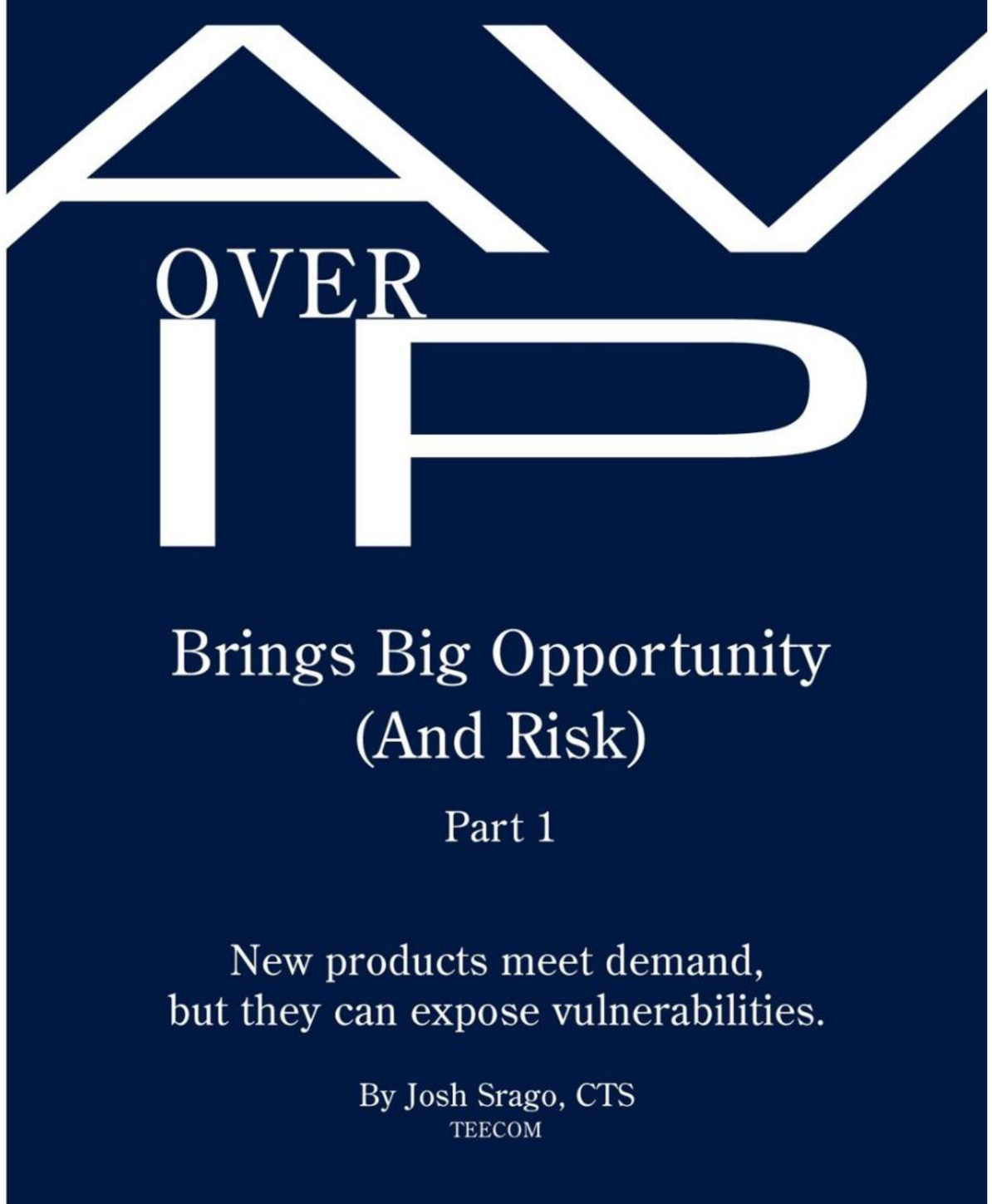
By Catalin Cimpanu August 26, 2017 01:32 PM 1

A list of thousands of fully working Telnet credentials has been sitting online on Pastebin since June 11, credentials that can be used by botnet herders to increase the size of their DDoS cannons.

The list — spotted by Ankit Anubhav, a security researcher with New Sky Security — includes an IP address, device username, and a password, and is mainly made up of default device credentials in the form of "admin:admin", "root:root", and other formats. The Pastebin list includes 143 credential combos, including the 60 admin-password combos from the Mirai Telnet scanner.

Is there security in the IoT world?

The devices are typically not secured – but the network can be.

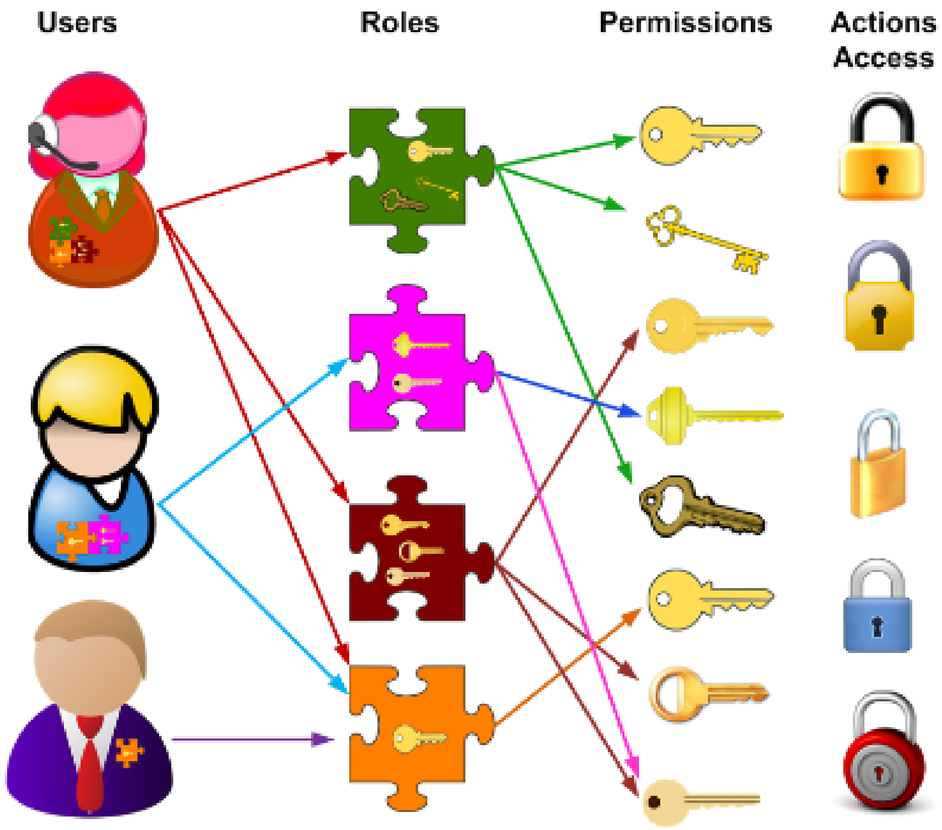


The future of IoT and AV comes down to IT partnership & understanding.

IT folks know the importance and practice of data security.

AV Must adopt these practices when implementing connected tech.

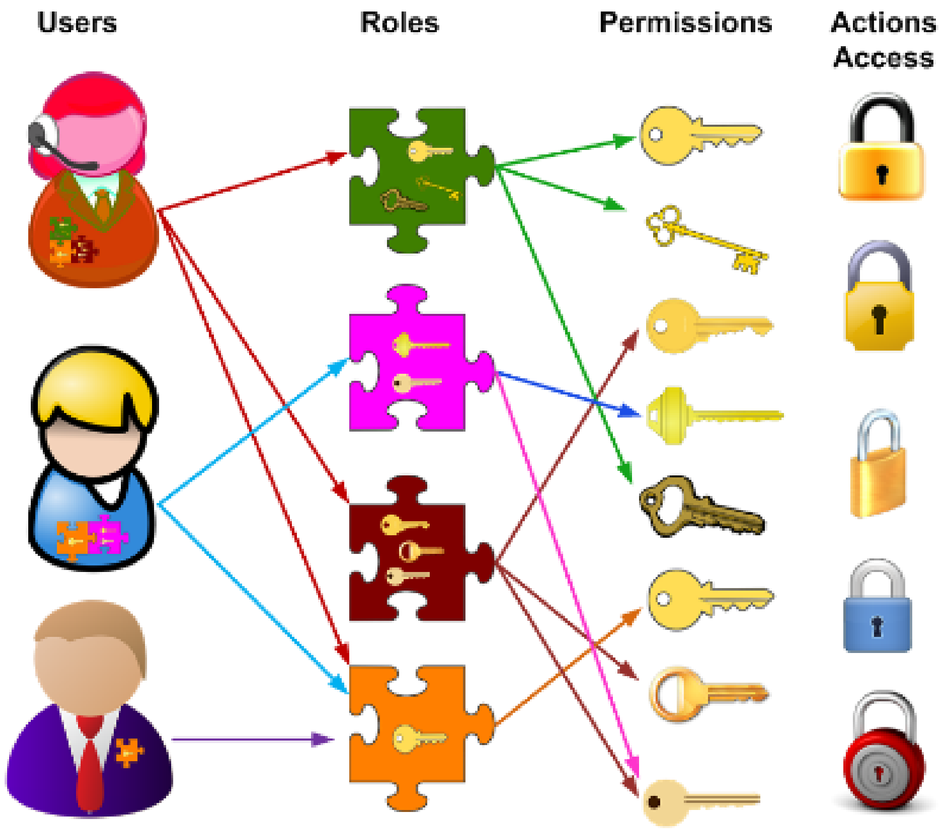
IoT Security



How can we protect our clients data – and ourselves?

- Access Control: AAA
  - Authentication
    - Is the user who they say they are?
  - Authorization
    - Does the user have permission to do the task
  - Accounting
    - Accurate records of system access & changes

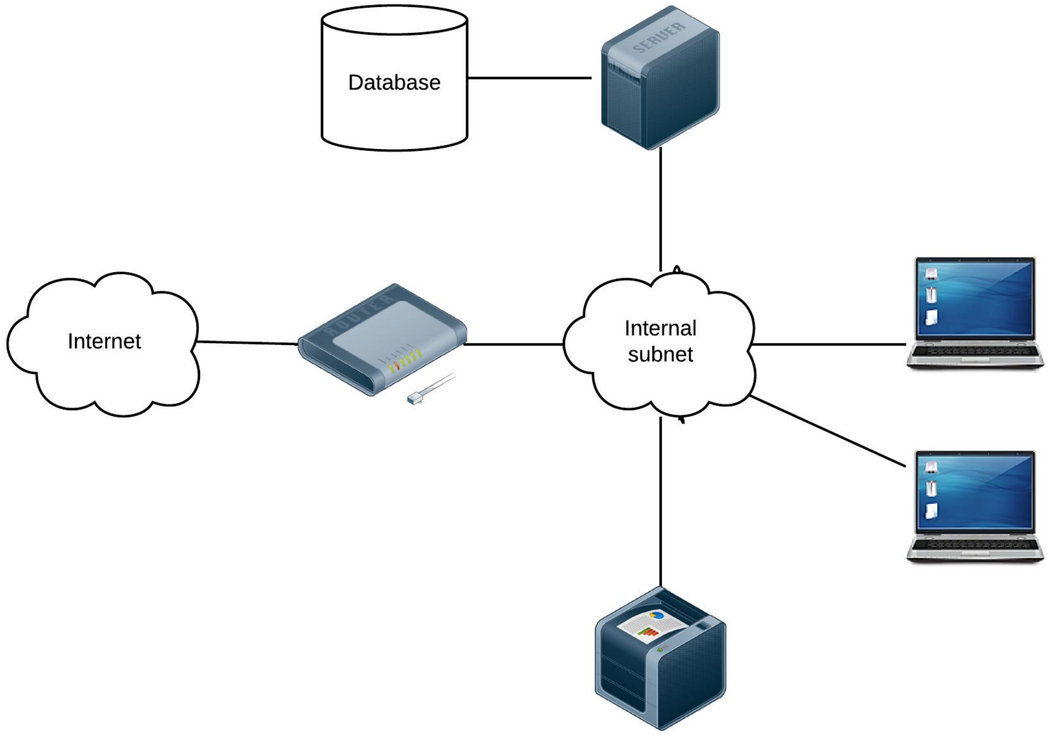
IoT Security



How can we protect our clients data – and ourselves?

- Passwords
  - Strict requirements
- Enhanced Security
  - Dual Authentication
- User role
  - Access? Alter? Move?

IoT Security

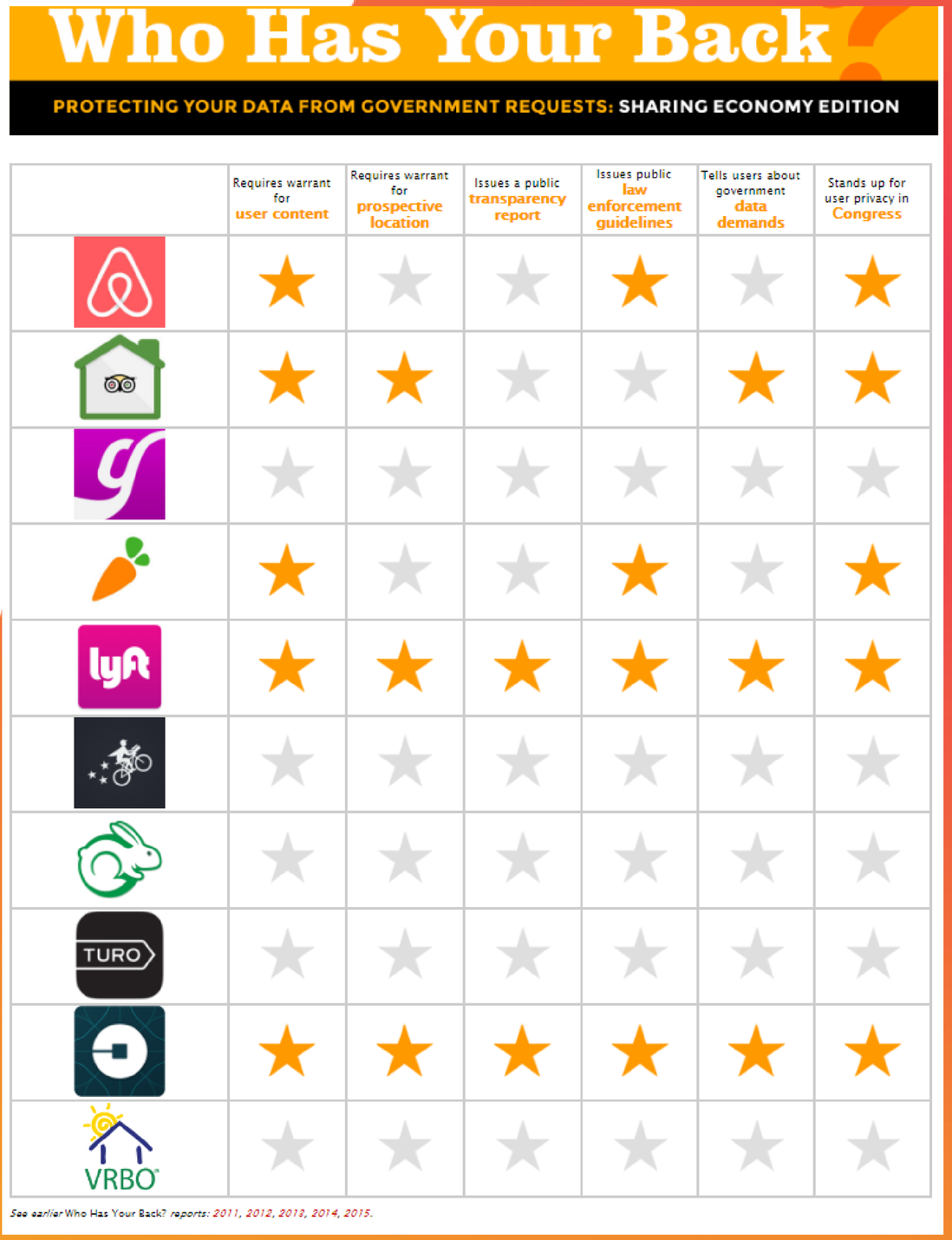


How can we protect our clients data – and ourselves?

- VPNs
  - Restricts access, scheduled access only
- VLANs
  - Separation of data
- Air Gap Networks
  - Not always available, but useful for devices not needing regular communication.

Known Issue Getting Attention

Who do you trust with your data?



The more convenience, the less secure.

The more accessible data, the less privacy.

Security

+

Analytics

=

Future of Internet of Things

Thank You!

Josh Srago, CTS
TEECOM
Josh.srago@teecom.com
@Jsrago on Twitter

Michael Carter, Senior Consultant, JLL Smart Building Program
Andrew Milne, Ph.D., CEO, Tidebreak
Josh Srago, CTS, DMC –D-4K, Design Engineer, TEECOM

IoT Exhibit Hall Tour

3:00 p.m. – 3:30 p.m.