The Internet of Things

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Helping You Navigate the World of AIDC

About the Speaker

- Rich Vossel, Lead Consultant and Owner of Vossel LLC, an AIDC consulting firm.

- Industry leader in the application of all forms of AIDC and their supporting technologies. Over the past 34 years he has designed, developed, maintained, managed, and promoted systems that use bar codes, memory devices, Radio Frequency Identification (RFID), smart cards, biometrics, satellite tracking and wireless infrastructures and backbones.

- Member of several AIDC standards groups, AIM Global and the AIDC100.

What is IoT?

- Origin of the term "Internet of Things" is clouded in mystery and has many definitions.

- Introduced by MIT, Auto-ID Center linking it to RFID and EPC.

- Simply put, it's physical items (things) communicating with each other through a network (Internet).

The Long Definition

The Internet of Things (IoT) is a global network infrastructure, **linking physical and virtual objects** through the use of interoperable data capture and communication methods. Standards-based object identification, sensor and connection capability provide for the development of independent cooperative services and applications **characterized by a user-defined degree of autonomy.** – AIM Global IoT Subcommittee

The IoT is Many Things…

- Everyone views the IoT through their own industry lens.
- Like the story of the blind men and the elephant, they all come back with a different interpretation of the same thing.
  - It's AIDC
  - It's a sensor platform
  - It's a global network
  - It's part of the cloud
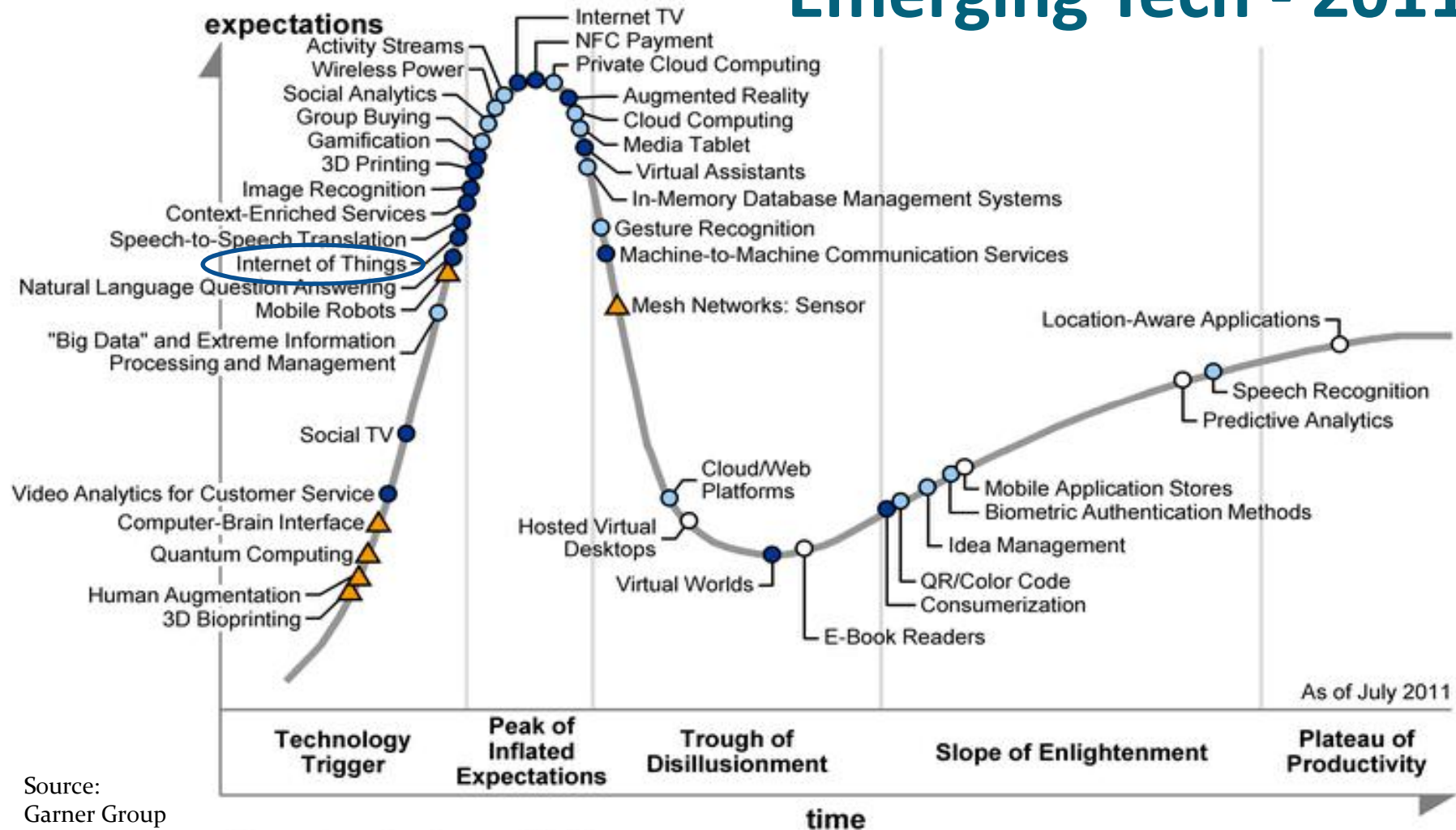 - It's Skynet and the end of us all.

Why is it Important?

- By 2015 there will be over 1 trillion devices on the Internet.
- People currently provide the vast majority of the data entered.
- The Internet is currently all about moving data between people, not things.

Iot will change all that. It's goal is to uniquely identify *everything* and get them talking.

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expectations

Activity Streams
Wireless Power
Social Analytics
Group Buying
Gamification
3D Printing
Image Recognition
Context-Enriched Services
Speech-to-Speech Translation
Internet of Things
Natural Language Question Answering
Mobile Robots
"Big Data" and Extreme Information Processing and Management

Social TV

Video Analytics for Customer Service
Computer-Brain Interface
Quantum Computing
Human Augmentation
3D Bioprinting

Internet TV
NFC Payment
Private Cloud Computing
Augmented Reality
Cloud Computing
Media Tablet
Virtual Assistants
In-Memory Database Management Systems
Gesture Recognition
Machine-to-Machine Communication Services

Mesh Networks: Sensor

Location-Aware Applications

Speech Recognition
Predictive Analytics

Cloud/Web Platforms
Mobile Application Stores
Biometric Authentication Methods
Hosted Virtual Desktops
Idea Management
Virtual Worlds
QR/Color Code
Consumerization
E-Book Readers

As of July 2011

Technology Trigger	Peak of Inflated Expectations	Trough of Disillusionment	Slope of Enlightenment	Plateau of Productivity

time

Source:
Garner Group

Years to mainstream adoption:

○ less than 2 years   ◔ 2 to 5 years   ● 5 to 10 years   △ more than 10 years   ⊗ obsolete before plateau

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Driving the Way Forward…

- Short range protocols are being standardized (DASH7, Zigbee, Z-Wave, 6LoWPAN, X10)
- RF Chips are getting cheaper.
- Antenna structure are getting more efficient.
- Sensor platforms are getting smaller.
- Networks are getting higher bandwidth.

People can no longer provide all the data.

Sensors are key

- Technology, like RFID, makes a good base to work from. However, where does the information come from?

- In the past, people would just enter it and in turn create errors. Humans are poor sensors.

- AIDC Helps identify things but not much more. It's just one of the inputs.

Sensors provide the input data for the device and are the way by which the device *perceives* the world.

Types of Sensors

- Temperature
- Humidity/Moisture
- Physical Switch
- Light
- Line Break
- Infrared Beam
- Motion (outside device)
- Motion (device moves)
- *AIDC (Barcode/pRFID)*

- Outdoor Position – GPS
- Indoor Position – RTLS
- Shock
- Pressure
- Chemical
- Diagnostics
- Device activation
- Chem/Bio agents
- Vital signs

Communications Methods

- Internet Connection (wired or wireless)
- GPRS/GSM/CDMA
- Satellite
- Short Range wireless
- Security

Good standards are ***critical*** when dealing with widespread application of IoT.

Autonomy is Very Important

- It's one thing to have the device (or thing) sense the world. The questions is, what does it do with that information?

- If a human must review, judge or select the data, we are still looking at the old rules.

The device ***must*** be able to react to the sensor input and produce a response that is meaningful without human interaction. Data without action is useless.

So what Apps are out there?

- AIM Global in conjunction with Ohio University researched the current IoT "like" applications.

- In Spring 2012, a list was generated which produced about 100 examples which was reduced to a list of representative areas.

IoT Application Areas

- Advertising
- Agriculture
- Building Automation
- Business Processes
- Customer Experience
- Customer Service
- Environmental
- Food Chain

- Health and Safety
- Perishables
- Replenishment
- Retail
- Retail Experience
- Supply Chain
- Social

Source: AIM Global IoT Subcommittee

OnStar

- Developed by GM, provides a link between the car and a central call center.

- **Sensors Used:** Position (GPS), motion, shock, airbag activation, car diagnostics.

- **Communications:** CDMA phone network (voice and data)

- **Autonomy:** If the car gets in an accident, the center is notified of the event. Help can be sent without being asked for. Stolen vehicle tracking. Remote ignition block.

Nest Thermostat

- A learning thermostat for the home.
- **Sensors Used**: Temperature and room motion
- **Communications:** WiFi (Home network)
- **Autonomy:** It learns from usage patterns how to set the temperature for the HVAC system to maximize energy savings. It reports usage and can be controlled via WiFi from a phone or computer. Autoaway changes the home to away mode when no one is detected. Multiple devices talk to each other.

Nike+

- Separate device (watch) and/or iPhone/iPod app that collects sensor data on the activity of the user.

- **Sensors Used:** Motion (3 axis accelerometer), location (GPS), pressure (shoe sensor), heart rate (Wearlink+)

- **Communications:** Proprietary link between devices and iPod/iPhone. Also compatible with Polar Wearlink+ interface.

- **Autonomy:** All the intelligence is in the phone/watch and linked to the sensor device. Data collected can be reported to a main server for comparison.

i-Pot Teapot

- Tea pot used to report the activity of the user, mostly elderly, to a caregiver.

- **Sensors Used:** Device usage.

- **Communications:** WiFi link

- **Autonomy:** The usage pattern is reported to a remote site without any action from the user. The caregiver is alerted when the pattern changes (or stops) indicating that the user should be contacted.

GlowCaps

- Pill bottle cap that provides reminders, track usages and orders refills. This is a service as well as a device.

- **Sensors Used**: Device usage/pill count.

- **Communications**: WiFi link

- **Autonomy:** Provides reminders (cap glows or through other devices), social support (emails to family/friends), tracks compliance (printed reports), and orders refills (manually or automatic).

Smart Refrigerator

- Tracks usage and replenishment. Current models have an LCD screen which provides notes, calendars, shopping lists, music, photos, and device controls.

- **Sensors Used:** Device usage and barcode/RFID scanners (future)

- **Communications:** WiFi link

- **Autonomy:** Current devices are used primarily to control the refrigerator through collecting usage data and as a central touch PC. Future models will also track item use and provide reordering.

Sparked

- Embedded sensor in cows that measure health and movement.
- **Sensors Used:** Vital Sign Sensor and location (GPS).
- **Communications:** Wireless, standard unknown.
- **Autonomy:** Provides the information on the cow including vital signs and tracks location. Information is reported to a central server. The information is processed and reported as a particular health situation to the farmer, such as a cow about to give birth.

Tweeting Bar

- Reports the usage and status of kegs at a bar by using a twitter account: http://twitter.com/tweetingbar

- **Sensors Used:** Device usage (flow sensor on tap)

- **Communications:** Wired to a computer that accesses the Internet/Twitter.

- **Autonomy:** The application on the computer monitors the keg usage rate and reports on the status using a twitter account. This allows a large number of people to track the keg status through witty twitter posts.

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Ninja Blocks

- User configurable blocks that have a Ninja on them (seriously). They come with a couple of sensors and can be configured to send messages or tweets.

- **Sensors Used:** Motion (3 axis), Temperature, Humidity, proximity (inferred), Webcam (external), light, switch (button). More being developed.

- **Communications:** Wired or WiFi (option).

- **Autonomy:** Using Ninja Cloud, you can configure and control the Ninja Blocks.

Other applications

- Remote chemical and biological sensors.
- Collection of movement data (phones, cameras).
- Product shelf location and condition (Wine)
- Xbox Kinect (movement tracking)
- Widenoise (sound data collection)
- Full building automation
- Moisture based irrigation
- Android@home

Countries Sponsoring IoT

- Europe funded about 40 IoT projects for €28 million.
- China has put IoT on their 5 year plan – 5 billion Yuan.
- UK has just sponsored £500k for IoT projects.
- Other countries (Japan, Korea, Malaysia) have sponsored projects or Universities to show how IoT will affect their country.
- The USA has basically done nothing. AIM Global has sponsored a committee to show the legislature why the USA is being left behind in this advancing technology.

Conclusion

- IoT is still emerging but there is no unified approach.
- Communications standards will be important.
- Sensors are key.
- Autonomy of the device producing actionable information.
- Many applications have been fielded but it's just the beginning.
- Many countries are starting to invest money but the USA greatly lags everyone else.
- AIM Global IoT Committee for the industry.

Questions?

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