Smart Home & The Internet of Things

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Smart Home Video
You COULD have a Smart Home TODAY

....if you are this guy

Xanadu 2.0 Home in WA
• 7 years to build ($63M)
• 300 contractors – of which 100 were electricians
• Over 100 computers
• $80K in digital screens
• Massive integration of tech and custom software
• Pool has an underwater stereo system
The Internet of Things

The ‘Internet of Things’ will generate $14,400,000,000 of value over the next decade¹.

There will be 40 times more devices than people on the Internet in 2020².

IDC estimates there will be approximately 212 billion things globally by the end of 2020. Extreme Networks estimates that 5 billion people will have Internet access.

¹ [read.bi/1yDOQO3] ² [http://www.idc.com/getdoc.jsp?containerId=prUS24366813]
## IoT Application Ranking

### Applications

<table>
<thead>
<tr>
<th>Applications</th>
<th>Overall popularity (and selected examples)</th>
<th>Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong> Smart Home</td>
<td>Smart thermostat</td>
<td>Connected lights</td>
</tr>
<tr>
<td><strong>2</strong> Wearables</td>
<td>Smart watch</td>
<td>Activity tracker</td>
</tr>
<tr>
<td><strong>3</strong> Smart City</td>
<td>Smart parking</td>
<td>Smart waste</td>
</tr>
<tr>
<td><strong>4</strong> Smart grid</td>
<td>Smart metering</td>
<td>28%</td>
</tr>
<tr>
<td><strong>5</strong> Industrial internet</td>
<td>Remote asset control</td>
<td>25%</td>
</tr>
<tr>
<td><strong>6</strong> Connected car</td>
<td>Remote car control</td>
<td>19%</td>
</tr>
<tr>
<td><strong>7</strong> Connected Health</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td><strong>8</strong> Smart retail</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td><strong>9</strong> Smart supply chain</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td><strong>10</strong> Smart farming</td>
<td>1%</td>
<td></td>
</tr>
</tbody>
</table>

IoT Analytics, 2015
Home Automation is Enabling IoT
What Technology buyers have & would like to have…

<table>
<thead>
<tr>
<th></th>
<th>Currently Have</th>
<th>Would Like to Have</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireless home security system</td>
<td>15%</td>
<td>50%</td>
</tr>
<tr>
<td>Programmable thermostat</td>
<td>7%</td>
<td>47%</td>
</tr>
<tr>
<td>Security cameras</td>
<td>7%</td>
<td>40%</td>
</tr>
<tr>
<td>Lighting control system</td>
<td>7%</td>
<td>39%</td>
</tr>
<tr>
<td>Wireless home audio system</td>
<td>5%</td>
<td>39%</td>
</tr>
<tr>
<td>Home Theatre</td>
<td>19%</td>
<td>37%</td>
</tr>
<tr>
<td>Multi-zone HVAC system</td>
<td>11%</td>
<td>37%</td>
</tr>
<tr>
<td>Central vacuum system</td>
<td>7%</td>
<td>34%</td>
</tr>
<tr>
<td>Energy management system/display</td>
<td>4%</td>
<td>32%</td>
</tr>
<tr>
<td>Outdoor speakers &amp; audio controls</td>
<td>8%</td>
<td>31%</td>
</tr>
<tr>
<td>Smart irrigation system</td>
<td>5%</td>
<td>30%</td>
</tr>
<tr>
<td>Whole house control system</td>
<td>3%</td>
<td>30%</td>
</tr>
</tbody>
</table>

NEST

• Nest Thermostat
  – Learns your schedule, programs itself, can be controlled from your phone

• Nest Protect
  – Smoke and CO detector; pinpoints location of problem and sends message to your phone

• Robust Sales
  – In 2013, Nest was selling 40,000-50,000 thermostats per month
  – Estimates in 2014 were for 100,000 units sold each month
  – Was on track for $300 million in annual revenue

• Acquisition
  – Google paid $3.2 billion
  – 10x revenue

• Interfaces
  – Google’s goal: connect everything over time
  – Connected devices help complete Google’s suite of software and services
Simpli Safe Home Security Systems

- **Do it yourself, expandable**
  - Motion sensors, window break sensors, water sensors, freeze sensors, entry sensors

- **SmartPhone Control**
  - Apps for Android, iOS, and Windows
  - Text alerts: home visitors, cabinet and room monitors

- **Security Monitoring**
  - Monitor your home in different modes whether you are home or away
  - $15/month for professional remote monitoring

- **Sales**
  - Starts at $230 for basic motion and entry sensors
  - Total sales grew from $1.4 million in 2010 to $38.4 million in 2013
  - Raised $57 million in venture capital in 2014
Quirky Products from GE

• Connected products for a Smarter Home
  – Connected LED bulbs and hub
  – Wall outlet with energy monitor
  – Smart window air conditioner
  – Egg minder
  – ... and many more

• Invented by real people
  – Ideas submitted online
  – Quirky develops products – 90/10 revenue split
  – 417 products developed to date

• Partnered with GE
  – $30 million investment to experiment with faster manufacturing

• Wink App
  – Interfaces with all Quirky SmartHome products
Smart Home

• **Sensors**
  – To measure temperature, humidity, daylight, motion, vital signs, etc...

• **Controllers**
  – PC or Hub for device management

• **Actuators**
  – Motorized valves, switches and motors

• **Buses**
  – Wired or wireless communication

• **Interfaces**
  – For human-machine and/or machine-to-machine interaction

• **Network**
  – Home area network (HAN)
  – Connection to servers (cloud or home)
Smart Home Business Landscape

1) Makers of IoT Devices
   - Sensors, Controllers, and Actuators
     In Oct 2014, more than 2 million Internet connected LED lights, and by 2020, over 100 million.
     Source: IoT Analytics and onworld

2) IoT software providers
   - Software layer to communicate and manage IoT device

3) Vertically Integrated Products
   - Home IoT kits and hub <-> cloud <-> Free Apps@user’s cellphone
     In Jan 2014, Nest sold 100,000 thermostats a month with an average price of $250. That’s $300M for one type of IoT device from one company.
     Source: Morgan Stanley
4) Cloud services
   • Offer whole solution without having to build out any Internet infrastructure
   • The internet of things is becoming the next cloud battleground. Source: Gigaom

5) Design, Installation, and Maintenance
   • Cater to home owner’s preferences
   • Typically very high end
   • Aggregating disparate systems
Smart Home: Network Role is Critical

Three Categories of Connectivity*:
1. Fixed/Mobile Dev. & Appliances
2. Users/Assets
3. Anywhere Control

* Wired technologies (e.g. HomePlug, MoCA,...) will not become key contributors to the future of IoT, due to cost of infrastructure, limited bandwidth and/or lack of support by many IoT “things”
# Key Wireless Connectivity Options

## IoT Connectivity Technology Enablers: Physical vs. Logical

<table>
<thead>
<tr>
<th>Fixed/Mobile Dev. &amp; Appliances</th>
<th>Users/Assets</th>
<th>Anywhere Control</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technology</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WiFi /PS</td>
<td>Bluetooth / BLE</td>
<td>RFID</td>
<td>Cellular/3G 4G, 4G+</td>
</tr>
<tr>
<td>Pros</td>
<td>Cons</td>
<td></td>
<td>Applications</td>
</tr>
<tr>
<td>• Low Cost</td>
<td>• Battery life or No Battery (Passive)</td>
<td>• Global Wireless Connectivity</td>
<td>Sensors and device appliances, can exchange information &amp; effectively share decision making process to offer a certain type of service</td>
</tr>
<tr>
<td>• Capacity</td>
<td>• Location Tracking</td>
<td>• SMS &amp; other low cost services</td>
<td></td>
</tr>
<tr>
<td>• Data rate</td>
<td>• Good Indoor Penetration</td>
<td>• Security</td>
<td></td>
</tr>
<tr>
<td>• Range</td>
<td>• Battery Life</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Integration with Cellular</td>
<td>• Mesh Architecture</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Future Core Tech.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓?</td>
</tr>
</tbody>
</table>

## Pros
- Low Cost
- Capacity
- Data rate
- Range
- Integration with Cellular

## Cons
- Battery life (standard WiFi)
- Minimal Massaging
- (PS-WiFi)
- Security issues
- Data Rate
- Short Range
- Very Low Data Rates
- Security issues
- Readability problems (Near: Water, metal, human Body)
- Battery life
- Airtime Costs
- Indirect Connectivity to Sensors
IOT Data & Technology Challenges

• Lack of Standardization

• Radio Frequency in home is unmanaged
  – 2.4G is over-crowed
    WIFI, BT, Zigbee, Micro-wave, coreless phone are operated in 2.4G
  – Is 5G clean?
    • 5G could be crowded once you have many WIFI devices in home, your neighbor could interference your devices, especially in apartment complex

• IOT devices will generate immensity data
  – Data management and storage options are critical components of IoT
  – Critical to separate private data from the corporate data
  – Primary value in an IoT system is in the ability to perform analytics on the acquired data and extract useful insights

• Security and Privacy are key
  – Hacker can hack PC, phone, they can hack your IOT devices
Internet of Things could be Cloud of Things

- Cloud can solve many of these technical challenges
  - manage radio frequency to minimize interference
  - Perform computational tasks for small devices
  - Cloud can monitor & upgrade IoT devices

- Cloud can resolve the need to build out separate infrastructures
  - Deal with storage, access and management of the data collected

- Not All IoT Data Is Important – Analyze data, find patterns, before long term storage
Obstacles to Smart Home Growth

Global Smart Home Device Shipments

- Obstacles
  - Cost / Value
  - Complexity
  - Connectivity
  - Aggregation of data & mgmt.
  - Standards
  - Privacy/Security
  - Energy/Power

Source: ABI Research, TechNavio, Pike Research, BI Intelligence Estimates
Final Thoughts

Broader adoption limited until value vs. cost/complexity is balanced

- Value vs. Cost/Complexity will drive the market
  - Increased value offerings
  - Reduction in cost of IoT
  - Simplification of deployment
- Near term (~3 yrs) the market will continue to be dominated by rich, impressers & greens
- 5-8 years likely to deliver broader adoption of IoT devices for Smart Home
- Opportunity
  - Cost will continue to drop - Solve complexity & aggregation of devices
Questions?

Thank You
Gartner Hype Curve

- Internet of Things
- Natural Language Question Answering
- Wearable User Interfaces
- Consumer 3D Printing
- Cryptocurrencies
- Complex-Event Processing
- Big Data
- In-Memory Database Management Systems
- Content Analytics
- Hybrid Cloud Computing
- Gamification
- Augmented Reality
- Machine-to-Machine Communication Services
- Mobile Health Monitoring
- Enterprise 3D Printing
- Activity Streams
- In-Memory Analytics
- Gesture Control
- 3D Scanners
- Speech Recognition
- Consumer Telematics

As of July 2014

- Innovation Trigger
- Peak of Inflated Expectations
- Trough of Disillusionment
- Slope of Enlightenment
- Plateau of Productivity

Plateau will be reached in:
- less than 2 years
- 2 to 5 years
- 5 to 10 years
- more than 10 years
- obsolete before plateau