ZigBee
Wireless Sensor & Control Networks and the Hospitality Industry

November 7, 2008

Bob Heile, Chairman, ZigBee Alliance

www.zigbee.org
Wireless Sensor Networks
Application & Markets

Building Automation
Security
HVAC
AMI
Lighting Control
Access Control

Energy Management
Demand Response
Net Metering
AMI, SCADA

Personal Health Care
Patient monitoring
Fitness monitoring

Industrial Control
Asset Mgt
Process Control
Environmental Energy Mgt
Agricultural

Telecom Services
M-commerce
Info Services
Object Interaction (Internet of Things)

Consumer Electronics
TV
VCR
DVD/CD
Universal Remotes

PC & Peripherals
Mouse
Keyboard
Joystick

Home Control
Security
HVAC
Lighting Control
Access Control
Irrigation
Wireless Sensor & Control Networks Requirements

- Networks that can form by themselves, scale to large sizes and operate very reliably for years without any operator intervention
- Very long battery life (years off of a AA cell), very low infrastructure cost (low device & setup costs) and very low complexity and small size
- Device data rate and QoS needs are low
- Standardized protocols are necessary to allow multiple vendors to interoperate
- High level of network security is required
ZigBee Alliance Overview

- Organized as an independent, neutral, nonprofit corporation in 2002

- Open and global
  - Anyone can join and participate
  - Membership is global
  - Multitude of technology providers

- Activities include:
  - Specification creation
  - Certification and compliance programs
  - Branding, market development and user education
ZigBee Alliance Promoters

...plus over 280 member companies from around the world
ZigBee Adoption ---

✓ Over 85K downloads of the ZigBee specification

✓ Growing acceptance and adoption across a range of markets and applications
  - Home Automation and Control
  - Building Automation
  - Personal, Home, and Health Care
  - ZigBee Smart Energy

✓ Announced deployments around the world
ZigBee Value Proposition

- Standard protocol developed and supported by over 300 companies (today) from around the world
- Meets key market needs
  - No new wires
  - Easy to install and maintain (mesh, self organizing, self healing)
  - Reliable (mesh, multiple channels, demonstrated interference tolerance)
  - Secure (AES 128)
  - Ability to scale to thousands of nodes
  - Long battery life (years on a AA)
  - Low Cost (open standard)
- Solutions available from multiple vendors through the value chain
  - Silicon → Platforms → Modules → Tools → Products
What is ZigBee?

Some Technology Basics!
ZigBee Network Characteristics

- Up to 65,536 (client) nodes per network
- 16 channels in the global 2.4 GHz band
- Support for regional Sub 1GHz bands
- 250Kbps data rate
- Optimized for timing-critical applications and power management
- Full Mesh Networking Support
- 128bit AES security

Network coordinator
ZigBee Router
ZigBee End Device
Communications flow
Virtual links
ZigBee Compliant Platform [ZCP]

- Platform certification - ensures all parts of the stack other than the application are compliant with the ZigBee Standard.
- Allows Network interoperability but does not imply interoperability at the application layer.
- There are multiple Compliant Platforms to choose from.
ZigBee Application Profiles

- Application profiles define what messages are sent over the air for a given application
- Devices with the same application profiles interoperate end to end
- ZigBee publishes a set of public profiles, but vendors may create manufacturer specific ones as well
ZigBee Public Profiles

- Commercial Building Automation (CBA)
- Home Automation (HA)
- Personal, Home and Hospital Care (PHHC)
- Smart Energy (SE)
- Telecom Applications (TA)

- Future profiles proposed by member companies…
■ Scope & Purpose

► Applications targeted at a commercial building environment. Such an environment may: have a coverage area of up to 100,000 square feet or more; be typically professionally managed; buildings may have unrestricted access, with attendant security implications; inter-working with an installed base of existing products on other networks is considered

■ Status

► Profile Specification Complete
► Test Program In Progress
ZigBee Commercial Building Automation (CBA)

Lighting Ballast

Occupancy Sensor

Wall Switch

System Commissioning

PDA Controller

Lighting Management System
Home Automation

Scope & Purpose

- Applications for the residential automation market to allow OEMs to produce products that will meet the needs of customers ranging from DIY homeowners to professional installers.

Status

- Profile Specification Complete
- Test Program Complete
ZigBee Home Automation (HA)

- TV/Display
- Set-top-box
- Lighting
- Switches
- Security
- Entry Systems
- Closures
- Heating/cooling
- Remote access
- Appliances
Scope & Purpose

The PHHC profile will be used by all the devices which jointly cooperate to fulfill the requirements of a non-invasive health care application. The devices involved in a health care application could be separated in medical devices (blood pressure monitor, oxygen saturation monitor, EEG, etc.) and non-medical devices (gateway, cell phone, light system, etc.). The health care application can be separated into the following categories:

- Chronic disease monitoring
- Personal wellness monitoring (ensuring an individual's wellness and safety)
- Physical fitness
- Elderly care – assisted living

Status

- Technical Requirements Document: Complete
- Profile specification: In progress
ZigBee Personal, Home, & Health Care (PHHC) - Assisted Living

**Facility**
- Blood Pressure Meter
- Weighing Scale
- Smoke Detector

**Residents**
- Positioning Strap
- Panic Button
- Fall Detector

**Staff**
- Mobile Phone
- Central Monitoring Station

[Image showing a facility with equipment labels and staff members]
Smart Energy

- **Scope & Purpose**
  - Applications for two-way communications of metering data and energy management to provide more efficient and reliable energy usage. Goes beyond automated meter reading to demand-response systems for real-time pricing and voluntary load shedding.

- **Status**
  - Profile specification: Complete
  - Test program: Complete
The AMI Revolution

- Support for Intelligent Grid
- Home Automation
- Demand Response
- RTP / CPP / Hourly Rates
- Remote Disconnect / Prepayment
- Smart Meter
- Mandatory Time Based Rates / Opt Out
- Voluntary Time Based Rates / Opt In
- Outage Reporting
- New Products & Services / Voluntary TOU
- Revenue Protection / Theft Detection
- Enterprise Meter Data Management
- Operational Improvements
- Revenue Cycle Improvements
- TOU / Demand / Net Metering
- Meter Reading Cost & Efficiency
- AMI
- AMR
- FN-AMR
- Open Protocols
- 2-Way
- Drive-by
- Walk-by
Features supported by ZSE profile include:

- Basic metering [measurements, historical information, etc]
- Demand Response (DR) and Load Control
- Pricing [multiple units and currencies, price tiers, etc.]
- Text messages
- Device support for Programmable Communicating Tstats (PCTs), In Home Displays (IHDs), Load Control Devices, Energy Management Systems, etc.
- Security to allow consumer only, utility only or shared networks
ZigBee Smart Energy
Key to Advanced Energy Management

- Home Area Networks are a key component to Smart Metering / AMI
  - Time-of-use pricing
  - Demand Response / Load Control
  - Customer choice

- ZigBee is the wireless HAN technology of choice
  - Mature, open standard
  - Proven, robust, secure
  - Selected by the leading AMI/HAN deployments
Urgent demand for Smart Energy + compatibility with mainstream Home Automation systems enables customer choice.
The ZigBee Smart Energy Advantage

- Broad support within the Energy Supply Community, Regulators, and OEMs (>25 million meter deployed by 2012 in USA alone)

- Active Community Outside of Smart Energy
  - Home Automation, Commercial Building Automation, Telecommunications, Personal Home and Hospital Care, Industrial Automation, to name a few!

- Rock-Solid Network Stack
  - ZigBee network stack vetted over many years
  - Meshing, routing, security, and other details well defined, tested, and certified

- IEEE 802.15.4 (Global 2.4 GHz Spectrum)
## Where to find ZigBee Smart Energy

<table>
<thead>
<tr>
<th>California</th>
<th>Regulatory approval; large scale pilot 2008; ZigBee specified for HAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern California Edison (SCE)</td>
<td>Regulatory approval; large scale pilot 2008; Open Standard specified for HAN, Using ZigBee Smart Energy</td>
</tr>
<tr>
<td>Pacific Gas &amp; Electric (PG&amp;E)</td>
<td>Regulatory approval; large scale pilot 2008; Open Standard specified for HAN, Using ZigBee Smart Energy</td>
</tr>
<tr>
<td>San Diego Gas and Electric (SDG&amp;E)</td>
<td>Regulatory approval; large scale pilot 2008; Open Standard specified for HAN, Using ZigBee Smart Energy</td>
</tr>
</tbody>
</table>

### Texas

<table>
<thead>
<tr>
<th>Company</th>
<th>Action Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CenterPoint</td>
<td>Filed plans to pilot 250,000 meters with ZigBee Smart Energy</td>
</tr>
<tr>
<td>Oncor</td>
<td>Filed plans to deploy 3.3M smart meters using ZigBee Smart Energy</td>
</tr>
<tr>
<td>Reliant Energy</td>
<td>Rolling out ZigBee Smart Energy products to residential customers</td>
</tr>
<tr>
<td>TXU</td>
<td>Offering free demand response thermostats using ZigBee Smart Energy</td>
</tr>
</tbody>
</table>

### Others in USA

<table>
<thead>
<tr>
<th>Company</th>
<th>Action Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detroit Edison</td>
<td>Plan to automate 2.6M electric and 700K gas meters starting in 2009, using ZigBee Smart Energy</td>
</tr>
<tr>
<td>Virginia</td>
<td>Dominion putting out 200K unit pilot using ZigBee Smart Energy</td>
</tr>
</tbody>
</table>
## Where to find ZigBee Smart Energy

<table>
<thead>
<tr>
<th>Country</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Australia</strong></td>
<td></td>
</tr>
<tr>
<td>Victoria</td>
<td>Mandatory rollout beginning Q1 2009; ZigBee Smart Energy required for HAN</td>
</tr>
<tr>
<td>New South Wales</td>
<td>Proposal + approval underway</td>
</tr>
<tr>
<td><strong>Europe</strong></td>
<td></td>
</tr>
<tr>
<td>Gothenburg, Sweden</td>
<td>ZigBee NAN (Last Mile Communications) in deployment now (300K to Q1 2009) with support for future ZigBee HAN (Local Communications) adoption</td>
</tr>
<tr>
<td>Others…</td>
<td>Various European trials not widely publicised yet, mainly for AMR/NAN/Last Mile communications</td>
</tr>
</tbody>
</table>
ZigBee Smart Energy
Future Enhancements

- ZigBee Smart Energy Working Group Will Continue to Push Forward
- Best Practices, FAQ, etc.
- Forward-Thinking Developments (PHEVs, V2G, etc.)
- Interoperability with other network technologies (Powerline, etc...)
Energy Efficiency in Hotels

- Hotel energy management
  - Centralized HVAC control ensures empty rooms are not cooled or heated unnecessarily
  - Battery operated thermostats, occupancy detectors, humidistats can be placed for convenience
  - Multi-hop mesh network makes installation fast and easy
  - Realized 40% energy savings
  - Being deployed in--
Telecommunication Application

Scope & Purpose

The profile applies to telecom value-added services and supplementary services to enhance and fulfill the telecom network functions, and it also includes some applications integrated with some mobile terminals and plug-in modules.

Status

- Specification: Complete
- Test program: In progress
The Home and Beyond from a Telecom perspective

Handset is the hub of the interaction between user and objects

ZigBee Smart Home

- Home Automation & Control
  - Lights, HVAC, Domestic appliances
  - Entertainment (e.g. DTT)
  - Healthcare, Tele-assistance
  - Monitoring & Security (e.g. temperature, gas)

Digital Smart City
- Access Control
- Parking payment system
- Infomobility services (e.g. traffic control)
- Environmental Monitoring
- Localization

M-Commerce Services
- m-payments (bar, shops, supermarkets)
- m-ticketing (cinema, train, bus)

Source: Mathnetworks
Wireless Sensor Networks - Why ZigBee?

1. Broad industry support (300 member companies)
2. Open Standards protocol
3. Products available from multiple sources
4. Low power (operate on batteries for years)
5. Reliable
6. Ability to scale to large numbers of devices
7. No new wires
8. Low maintenance (meshing, self organizing, remote upgradability)
9. Standards based security [AES128]
10. Guaranteed interoperability by product certification/compliance testing
For More Information

www.ZigBee.org

Bob Heile
Chairman, ZigBee Alliance
bheile@ieee.org