EnOcean Alliance Members Meeting

Technical overview

Marian Hönsch / Technical Working Group

05.04.2018
Agenda

Technology Explained in few slides

Organization: How the TWG Works & 2018 Programs

Roadmap Focus 2018, Technology & Programs

IoT
- EnOcean over IoT, Next gen EEP,
- Product Database
- Standard product Labels
Focus 2018

Technical Task Groups

- Remote Commissioning
- EEP – Communication Profiles
- Security
- Product Labeling

Ongoing Technical Programs

- EEP Approval Committee
- Certification Program

Strategic initiative

- EnOcean IoT
Protocols:
- EEP / Signal Telegram
- Remote Management – ReMAN
- Remote Commissioning - ReCOM
- Smart Acknowledge
- Security / Encryption
- Next gen EEPs – Ideas
- EnOcean over IP

Product definitions
- Certification
- EOA Labeling
- Electronic Datasheet
Remote Commissioning
Remote Management – REMAN

Remote Commissioning (RECOM) :
- Builds on REMAN
- Defined new function codes for SYS_EX
- Complex processes – link tables, device parameters, discovery
- This is the **interesting protocol**

Remote Management (REMAN) :
- the SYS_EX telegram and structure definition
- Basic processes and function
Remote Commissioning - Use Cases

- **Set Up** - During commissioning of newly installed networks

- **Maintenance** - When modifications, by adding and removing devices and/or changing devices’ configuration parameters.

- **Replace** - When replacing a non-operating device with a pre-commissioned, ready to install one.

- **Troubleshooting** - When trouble shooting an operating EnOcean network.
Three pillars

Interoperable Remote Commissioning

- Remote Commissioning Specification
- Cross-Device Interoperable Communication Standard
- Standardized Device Features Description
- Unified Product Labeling & Reference in Field
- Commissioning Tools
- Remote Commissioning Device Certification

EnOcean Eco System

- teach-in manually
- configured proprietary
- limited device description
- teach-in automatically
- standardized remote configuration
- full device description
Get Product Id

Commissioned device

1. Scan Product ID and EnOcean ID
1. Query Device Description File with Product ID

https://enocean-alliance.com/ddf/[MAN-ID][PRODUCT-ID]

2. Get DDF - XML
Use case – Linking

1. Scan the switch
2. Add switch to Link Table
3. Switch will immediately work
Use Case - Parameters

- Set temperature in HVAC
- Dimmer settings
- Energy settings
- Control panel set up
- Timers in occupancy
Technology Explained in few slides

Smart Acknowledge
Smart Acknowledge

Smart acknowledge bi-directional communication between a self-powered device and a line-powered device

1st: **Measurement Value**
(e.g. temperature, humidity, set+, set-)

2nd (SMART ACK): **Parameter Update**
(e.g. display value, set-point zero, display “window open!”)
Smart ACK Principle

Extremely short time interval
Only here the receiver is switched on!
Security
## Security level survey

<table>
<thead>
<tr>
<th></th>
<th>Metering Products (Sensors)</th>
<th>Comfort &amp; Energy Saving Products (Controls power consuming or generating devices)</th>
<th>Safety &amp; Security Products (Protecting high value assets or human life)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confidentiality</td>
<td>AES encryption</td>
<td>AES encryption</td>
<td>AES encryption</td>
</tr>
<tr>
<td>Authenticity</td>
<td>AES CMAC with counter</td>
<td>AES CMAC with counter</td>
<td>AES CMAC with counter</td>
</tr>
<tr>
<td>Integrity</td>
<td>AES CMAC</td>
<td>AES CMAC</td>
<td>AES CMAC</td>
</tr>
<tr>
<td>DoS Protection</td>
<td>Absence &amp; Relay detection</td>
<td>Absence &amp; Relay detection</td>
<td>Absence &amp; Relay detection</td>
</tr>
</tbody>
</table>

- Telegram encryption (hide meaning) and authentication (avoid unauthorized control)
- EnOcean score high in Fraunhofer (AISEC) security survey
### En-\ decapsulation of non-secure RORG

<table>
<thead>
<tr>
<th>Non-secure</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RORG</td>
<td>DATA</td>
<td>TXID</td>
<td>STATUS</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secure</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0x31</td>
<td>RORG</td>
<td>ENC_DATA</td>
<td>RLC</td>
<td>CMAC</td>
</tr>
<tr>
<td>TXID</td>
<td>STATUS</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PUBLIC KEY is for all devices same

= 0x3410de8f1aba3eff9f5a117172eacabd
Technology Explained in few slides

EEP / Signal Telegram
EEP / GP (Application Interface)

EEP

What is it

- “Translation between Bytes and Meaning”
- Mechanism to encode / interpret EnOcean telegrams based on a “magic number”
- Foundation for functional interoperability between products

What should be done

- Number of defined EEP keeps growing, but support for new EEP is limited
- Short term item is to separate status & configuration from normal reporting
- Long term item is secure application level interoperability and next gen profiles
Extending devices EEP functionality with common features.

Energy storage at: **80 %**
Energy harvesting conditions are: “**very good**”

Trigger: **last device status**

Signal: **device status**

I can hear:
- **10 IDs** with **very good** radio quality
- **5 IDs** with **average** radio quality
EnOcean over IP
IoT - All about connecting devices
## Representation of EnOcean devices in IP – mostly EEP related REST Api, JSON Data Model

<table>
<thead>
<tr>
<th>Nr.</th>
<th>JSON model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>systemInfo</td>
<td>version of Interface with EnOcean base information</td>
</tr>
<tr>
<td>2</td>
<td>profile</td>
<td>EEP functionality / functions: Which information will send a specific profile or device and which states can be set?</td>
</tr>
<tr>
<td>3</td>
<td>device</td>
<td>informations about known devices of the Interface</td>
</tr>
<tr>
<td>4</td>
<td>telegram</td>
<td>incoming and outgoing telegrams</td>
</tr>
<tr>
<td>5</td>
<td>state</td>
<td>saved states of devices</td>
</tr>
</tbody>
</table>
Basic structure of Interface response:

```json
{
   "header": {
      "status": 200,
      "content": "states",
      "timestamp": "2015-08-11T18:10:15.574+0200"
   },
   "states": [
      {
         "deviceId": "019604F9",
         "friendlyId": "valve",
         "functions": [{
            "key": "setPointInverse",
            "value": "0",
            "valueKey": "false",
            "timestamp": "2015-08-11T18:09:54.115+0200",
            "age": "21459"
         }, {
            "key": "valve",
            "value": "15",
            "unit": "%",
            "timestamp": "2015-08-11T18:09:54.115+0200",
            "age": "21459"
         }]
      }
   ],
   "deviceId": "019604F9",
   "friendlyId": "valve",
   "timestamp": "2015-08-11T18:11:24.205+0200",
   "direction": "from",
   "functions": [{
      "key": "valve",
      "value": "0",
      "unit": "%"
   }],
   "telegramInfo": {
      "data": "8",
      "status": "0",
      "dbm": -45,
      "rorg": "A5"
   }
}
```
Certification
Overview of EnOcean Alliance Certification Process

**Preparation Phase**
- Test plan
- Test lab identified
- Device documentation (public)

**Testing Phase**
- Test results
- Devices specific parameters
- Devices specific documentation

**Documentation Phase**
- Certification documentation
- Data for database
- Certification document

**Review Phase**
- Certification number
- Certification document
- Product data published
- EnOcean certified logo

EnOcean Device Manufacturer
Certification Versions

- Air Interface Certification
  - "Certified Platform"
    Only for module & platform manufacturers.

- Air Interface Certification
  + Profile Declaration
  - "Certified Product 2.0"
    Only for legacy products.

- Air Interface Certification
  + Profile Certification
  + Energy Harvesting Certification (Dec 17)
  + Radio performance Certification (Nov 17)
  - "Certified Product 3.0"
    For all new products. Legacy products optional.
Self-Certification. Low Effort. Low / No Cost.

- **EnOcean Alliance Certification Manager**
  Armin Pelka

  certification@enocean-alliance.org

- **Certified Product Database**

  https://www.enocean-alliance.org/ja/products/
Labeling
**Labeling**

**What is defined?**
- Label content is separated into fields (according to ANSI MH10.8.2-2010)
- Label shall be machine readable too
- Mandatory Fields:
  - **Product ID**: 6 bytes
  - **EURID**: 4 bytes
    - Manufacturer Assigned
    - Module manufacturer assigned
- Optional Fields:
  - **AES Security Key**: 16 bytes
  - **Recom code**: 4 bytes
  - **Manufacturer tags**: ...

What is up to the manufacturer?

- Label type – NFC, QR, BAR etc.
- Label properties: pixel size, coding, dimensions
- Label position
How the TWG Works
EnOcean Alliance

TWG – Technical Work group
TTG – Technical Task group
Rules of the Game... For content creation

TTG Create 6-12 Months (exclusive access)

TWG Approve 4 weeks
Focus 2018
Focus 2018

Technical Task Groups

- Remote Commissioning
- EEP – Communication Profiles
- Security
- Product Labeling

Ongoing Technical Programs

- EEP Approval Committee
- Certification Program

Strategic initiative

- EnOcean IoT
Focus 2018

Remote Commissioning & Remote Management

- Secure communication
- Range Extension over repeater
- Range Extension over multiple hops
- Device Description File – extension promotion amongst members

TTG Head:
EnOcean
ViCOS
EEP Communication Profile

- Definition of Signal Telegram and associated features
- EEP v3 – new concept – long term

- Simplified EEP Specification release process
- Tool for profile submission and description

TTG Head:
TWG Chair
Focus 2018

**Security**

- Incorporate (bidirectional) high Security concept to existing specification
- Review and extend existing features
- Secure communication inside Recom

TTG Head:
EnOcean
Labeling

- Review standard for multi-purpose protocol use
- Promote standard to members
- Incorporate feedback and expand

TTG Head (Specification owner):
EnOcean GmbH
EAC – EEP Approval Committee *(Program)*

- Ongoing meetings and review of new submissions of EEPs
- ensure high quality standards
- active support interoperability

**EAC Program Updates - New Profile submits include:**
- Test for EEP Certification
- IP Representation

Program Head:
Diehl
Certification program

- Add Energy harvesting specification to the list of specifications
- Promote Certification v2.0 & 3.0
- Extend existing product database

Certification Manager:
Armin Pelka
EnOcean IoT

- Initiative to introduce **new generation of devices** with IoT features

- Short Term goals:
  - Include IP Description of additional EEPs

- Mid Term goals:
  - Certification 4.0 – application behavior certification
  - Database of Device Description Files – *electronic datasheet*
  - Mandatory Product labeling according to specification
  - Next Generation EEPs 3.0
  - Alliance approved commissioning tool

Head:
Digital Concepts, ViCOS, EnOcean
Next gen EEPs – Ideas

- EEP 3.0
  - Similar to IP representation of Profiles

Few ideas
- Fixed ranges & scaling for all future profiles
  (endless variance caused more pain than gain)

<table>
<thead>
<tr>
<th>Temperature</th>
<th>10 bits</th>
<th>0.1 Steps</th>
<th>-40° C to 60° C</th>
</tr>
</thead>
</table>

- Atomic functions (no complex hidden process)

- Status reports & synchronization & acknowledges
IoT - All about connecting devices
Key features:
- Precise end application identification - Product label
- Electronic data sheet
- Device complies with certification and IoT ideas
  - Atomic functionality
  - All parameters can be read / write
  - Status of synchronized over all user interface (display, phone, cloud)
- Application decision take outside end-devices
- Remote commissioning support
- Documentation: Back Up file
Installers Tool – Implementation Scenario

Product Manufacturers Distribution Channels

- PRODUCT #A-1
- PRODUCT #A-n
- PRODUCT #Z-1
- PRODUCT #Z-n

DDF Format (standardized)  PCAT Format

EnOcean Alliance Tool Manufacturer

Product Manufacturers Distribution Channels

- EnOcean Alliance Look & Feel
- One Single Tool, All Devices
- Devices Interoperability
- ReCOM Compliant, ReMAN Compliant

Installers Tool

Software Package EnOcean TRX
Customer Support

Installer

Typically NO EnOcean Alliance Member!
Local language support is a MUST!

EnOcean Product-ID
EnOcean Standardized Label / QR-Code
Device Description File
EnOcean Back-Up File
(all standardized)
Electronic Datasheet

Describes all features and aspects of the end product with given semantics – configuration parameters
Publically available
Standardized form

```xml
<?xml version="1.0"?>
<xs:schema>
  <!-- need to do the schema definition, namespace, etc -->

  <xs:element name="Device"/>
  <!-- does this have a type? -->
  <xs:complexType>
    <xs:sequence>
      <xs:element name="Manufacturer_Name" type="xs:string"/>
      <xs:element name="Manufacturer_ID" type="xs:string"/>
      <xs:element name="EEP" type="xs:string"/>
      <xs:element name="GP" type="xs:string"/>
      <xs:element name="Name" type="xs:string"/>
      <xs:element name="Desc" type="xs:string"/>
      <xs:element name="Firmware_Version" type="xs:string"/>

      <xs:element name="Supported_EEPs" maxOccurs="unbounded" minOccurs="1">
        <xs:complexType>
```
Precise end-application identification

Requirement for perfect and seamless operation:
Precise end-application - Specific for final look & features

End-application reference:  A  B  C  D  ...
Localization (e.g. in room) is required for remote set up

network identification (communication ID)

ACTION: Localize Z

<table>
<thead>
<tr>
<th>Communication ID</th>
<th>Product reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Light</td>
</tr>
<tr>
<td>Y</td>
<td>Light</td>
</tr>
<tr>
<td>Z</td>
<td>Light</td>
</tr>
<tr>
<td>W</td>
<td>Light</td>
</tr>
</tbody>
</table>
EnOcean becoming Things

1.a Scan communication ID and application identification

1.b Get via air

2. Query Electronic Datasheet with End-application reference

3. Commission Device
EnOcean becoming Things.

Key:

- **Specific end-application description**
- **Identification in field**
- **Remote control of features and configuration**
IoT Spec – Coming up

- **EnOcean over IP**
  - First Specification that lays the groundwork for a complete IoT Spec
    - Describes the communication behavior of a gateway between EnOcean Radio and IP-World
  - Doesn’t specify the behavior of devices (actuators, sensors)
  - Doesn’t specify organizational rules for an End to End (Device to User Interface) usage

- **Why we need a IoT Spec.**
  - EnOcean has to reflect the changes and progresses in the IP/IoT world for the Ecosystem to grow and prosper.
  - First Paper Created: EnOcean devices becoming Things_IP Regulations V0.4
    - Quick look through to get the idea...

- **What should be part of the IoT Spec**
  - EnOcean Specifications 2.0, 3.0
  - EnOcean over IP Spec
  - Existing Specifications need to be extended
  - New Specifications have to be created.
Physical, Data, Network Layer

- Timing behaviour GW <-> Device
  - Timeslots in Adressing of devices (100 ms)
  - Burst Avoidance
    - GW -> Dimming with slider
    - Device -> State reports blind actuator
- Remote Management/Remote Commissioning extension:
  - ReMan/ReCom over repeater (similar: From Hub to Switch)
  - ReCom: 2-Channel Actuator -> Which Switch for which channel?
  - ReCom: Integration of application logic into ReCom definition
- Addressing of devices with ADT, answer of devices with Broadcast)

Transport, Session Layer

- Existing Security
  - Key Exchange over the air ...
- Security “Plus” or 2.0

Presentation, Application Layer

- Ack after Receive
- Ack after Execution
Contact
For further information
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