



**enocean<sup>®</sup>alliance**  
*No Wires. No Batteries. No Limits.*

## EnOcean Alliance Members Meeting

Technical overview

Marian Hönsch / Technical Working Group

05.04.2018

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

## Technical Task Groups



Remote Commissioning



EEP – Communication Profiles



Security



Product Labeling

## Ongoing Technical Programs



EEP Approval Committee



Certification Program

## Strategic initiative



EnOcean IoT

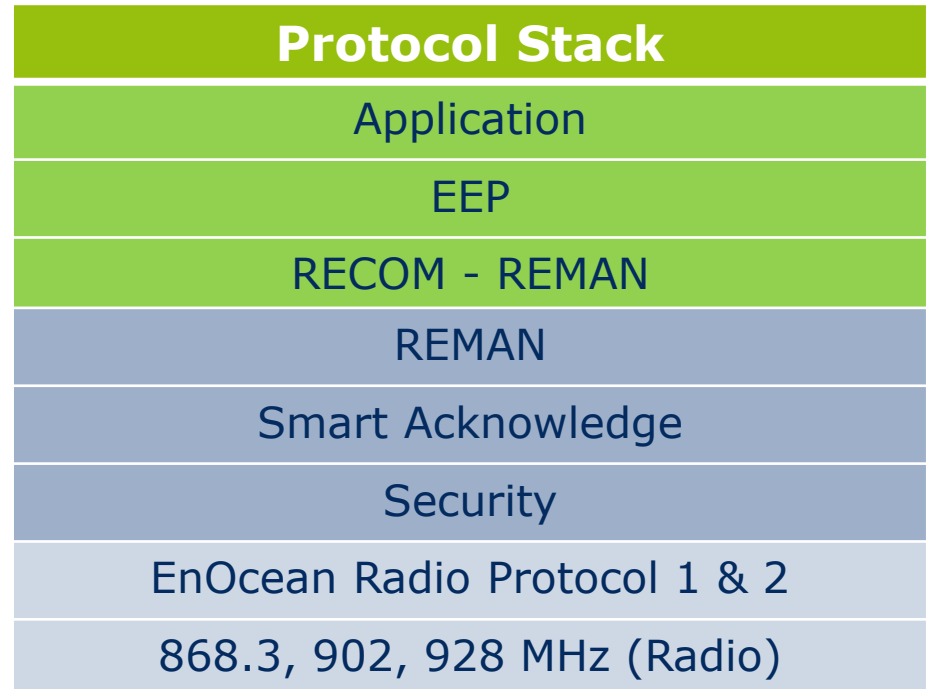
# Technology Explained in few slides

## 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 Commissioning

## Remote Management

### 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**

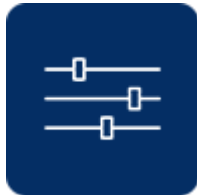
### Remote Management (REMAN) :

- 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.

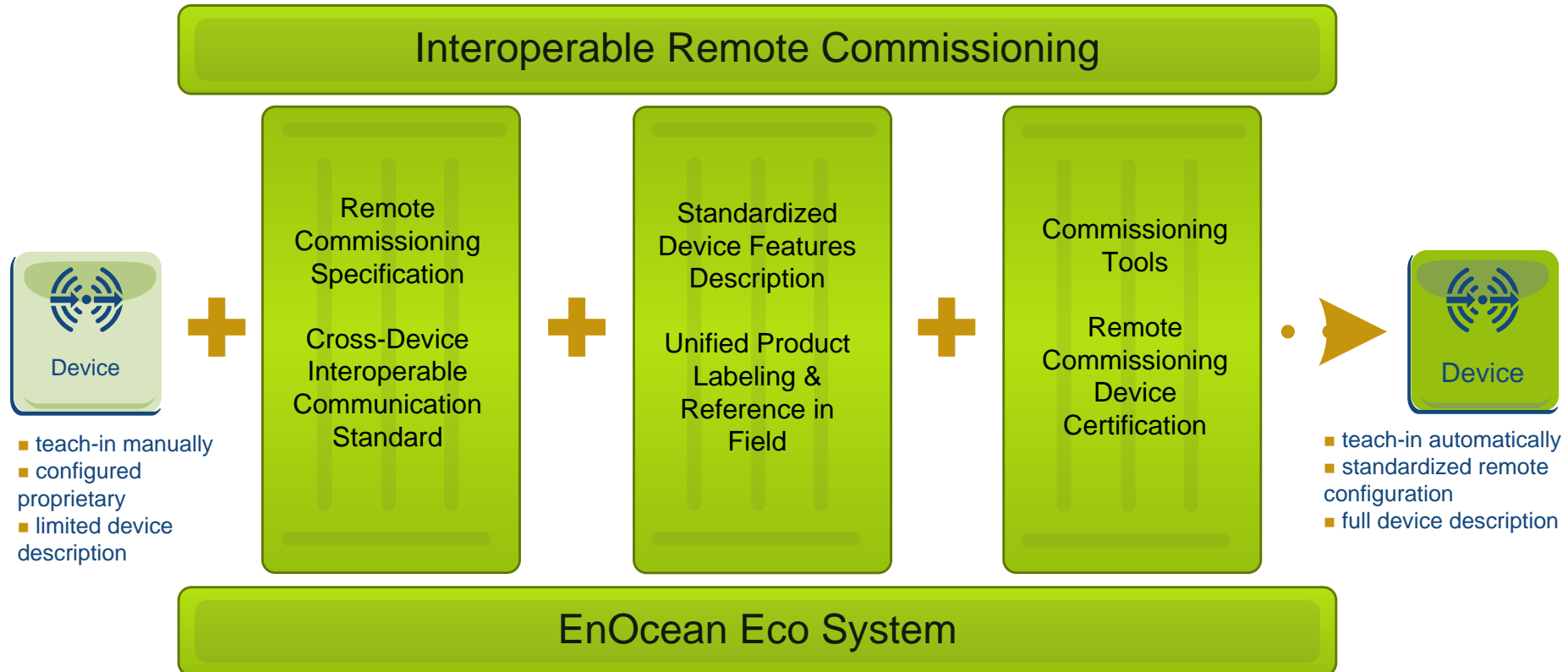


- **Replace** - When replacing a non-operating device with a pre-commissioned, ready to install one.



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

# Three pillars





# Get Product Id

Commissioned  
device



1. Scan Product ID  
and EnOcean ID



# Get Device Description file

## 1. Query Device Description File with Product ID

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

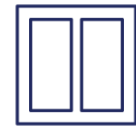


## 2. Get DDF - XML



# Use case – Linking

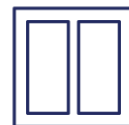
1. Scan the switch



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



## 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-)

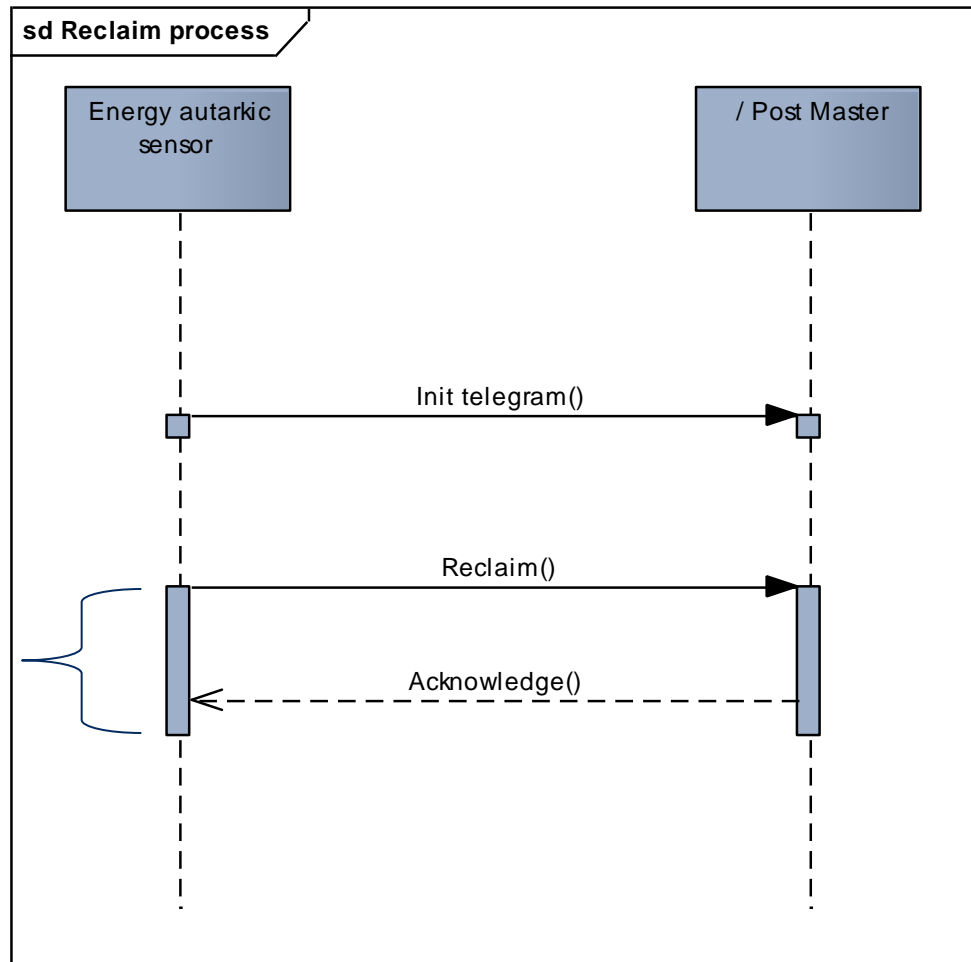


## 2nd (SMART ACK): **Parameter Update**

(e.g. display value, set-point zero, display "window open!")

# Smart ACK Principle

Extremely short time interval  
Only here the receiver is  
switched on!



# Technology Explained in few slides

## Security

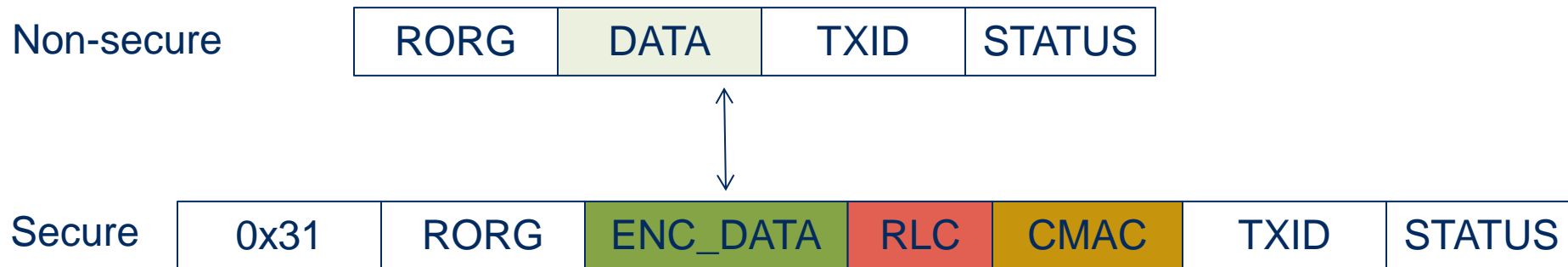


# Security level survey

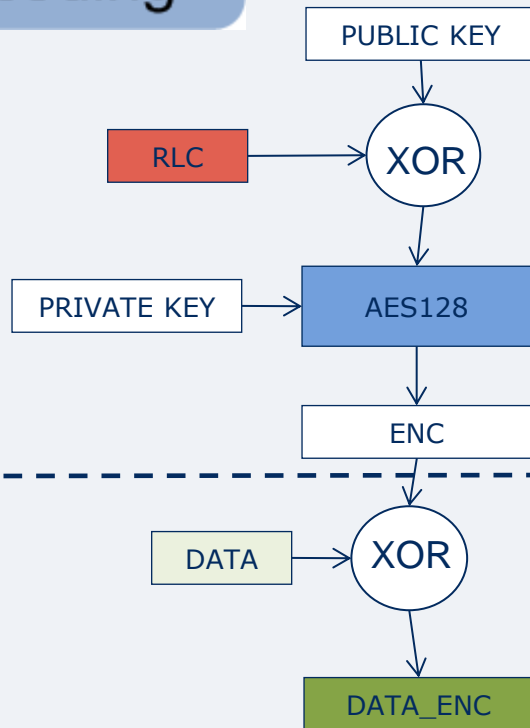
	<b>Metering Products (Sensors)</b>	<b>Comfort &amp; Energy Saving Products (Controls power consuming or –generating devices)</b>	<b>Safety &amp; Security Products (Protecting high value assets or human life)</b>
Confidentiality	AES encryption	AES encryption	AES encryption
Authenticity	AES CMAC with counter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

- Telegram encryption (hide meaning) and authentication (avoid unauthorized control)
- EnOcean score high in Fraunhofer (AISEC) security survey

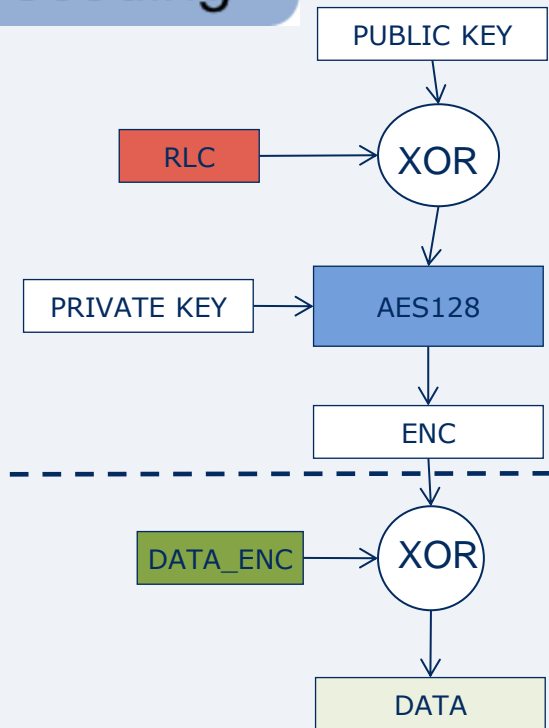
## En- \ decapsulation of non-secure RORG



## Encoding



## Decoding



PUBLIC KEY is for all devices same  
= 0x3410de8f1aba3eff9f5a117172eacabd  
> EnOcean GmbH - © 2013

# 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**

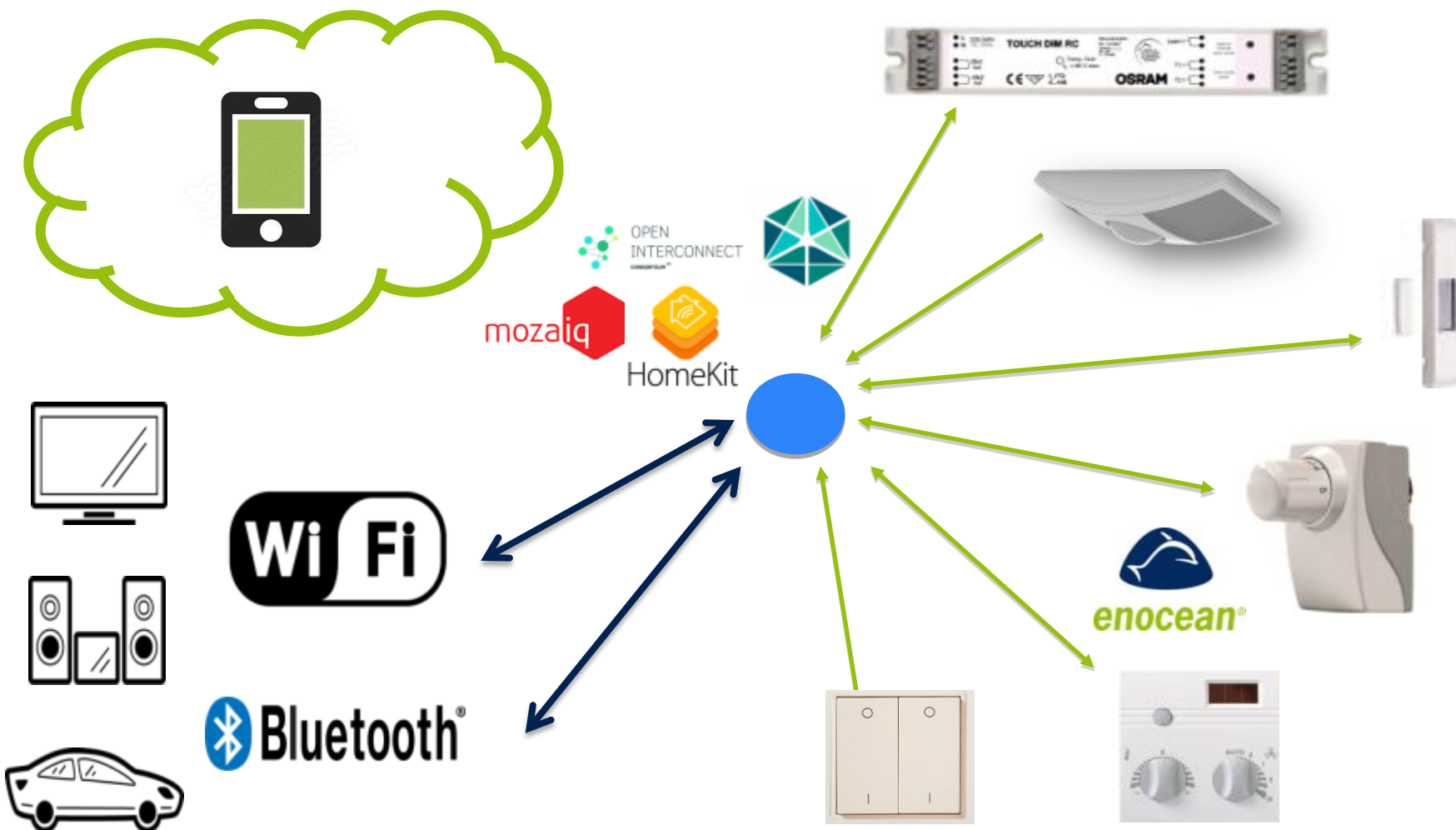
Signal: **device status**



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

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

REST route	HTTP method
/devices/states or /device/{deviceId}/stream	GET

```

{
  "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"
    } ]
  } ]
}

```

**146**

```

{
  "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"
  }
}

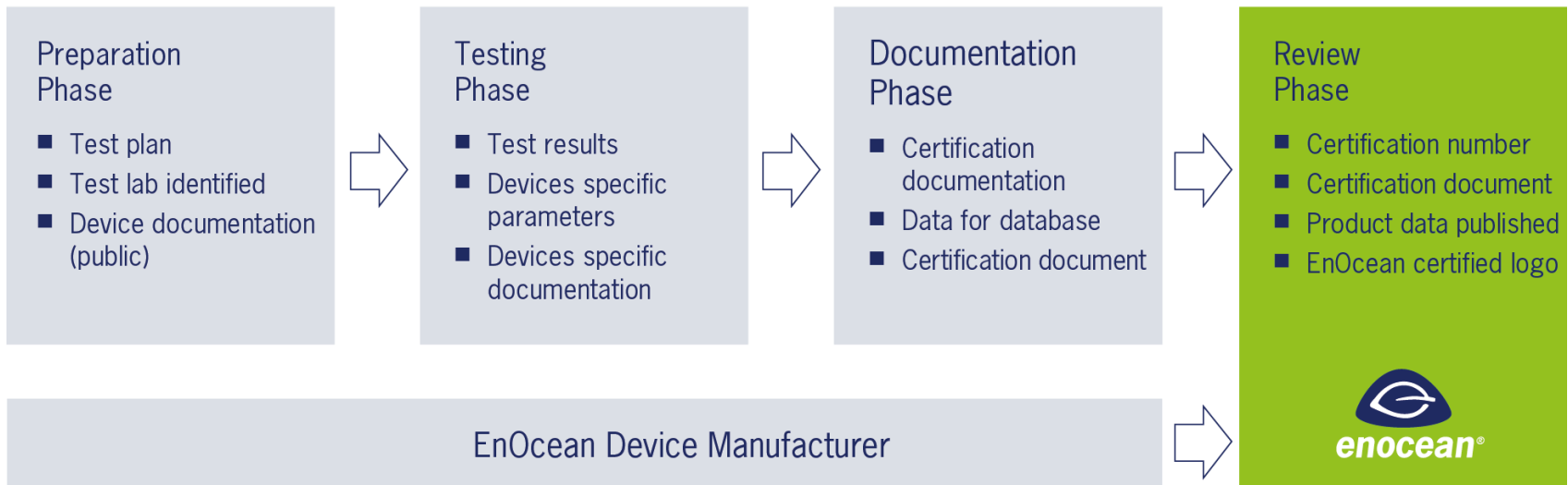
```

# Technology Explained in few slides

## Certification

# Certification

## Overview of EnOcean Alliance Certification Process



# 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.

PRODUCT SEARCH

Search ...

FREQUENCY

868 MHz (ASK): Europe, China (11)  
868 MHz (FSK): China (0)  
902 MHz: USA, Canada (5)  
928 MHz: Japan (5)

CERTIFIED PRODUCT

Show Only Certified (7)

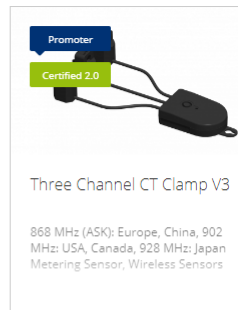
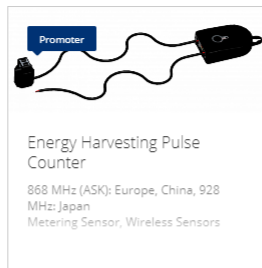
MANUFACTURER

All Manufacturers ▼

PRODUCT CATEGORY

Accessories (188)  
☐ Accessories Misc. (146)  
☐ Repeater (32)

Gateway & Building



- EnOcean Alliance Certification Manager  
Armin Pelka

[certification@enocean-alliance.org](mailto:certification@enocean-alliance.org)

- Certified Product Database

<https://www.enocean-alliance.org/ja/products/>

# Technology Explained in few slides

## 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**

*Manufacturer Assigned*

**EURID**  
**4 bytes**

*Module manufacturer assigned*

- Optional Fields:

**AES Security Key**  
**16 bytes**

**Recom code**  
**4 bytes**

**Manufacturer tags**  
...

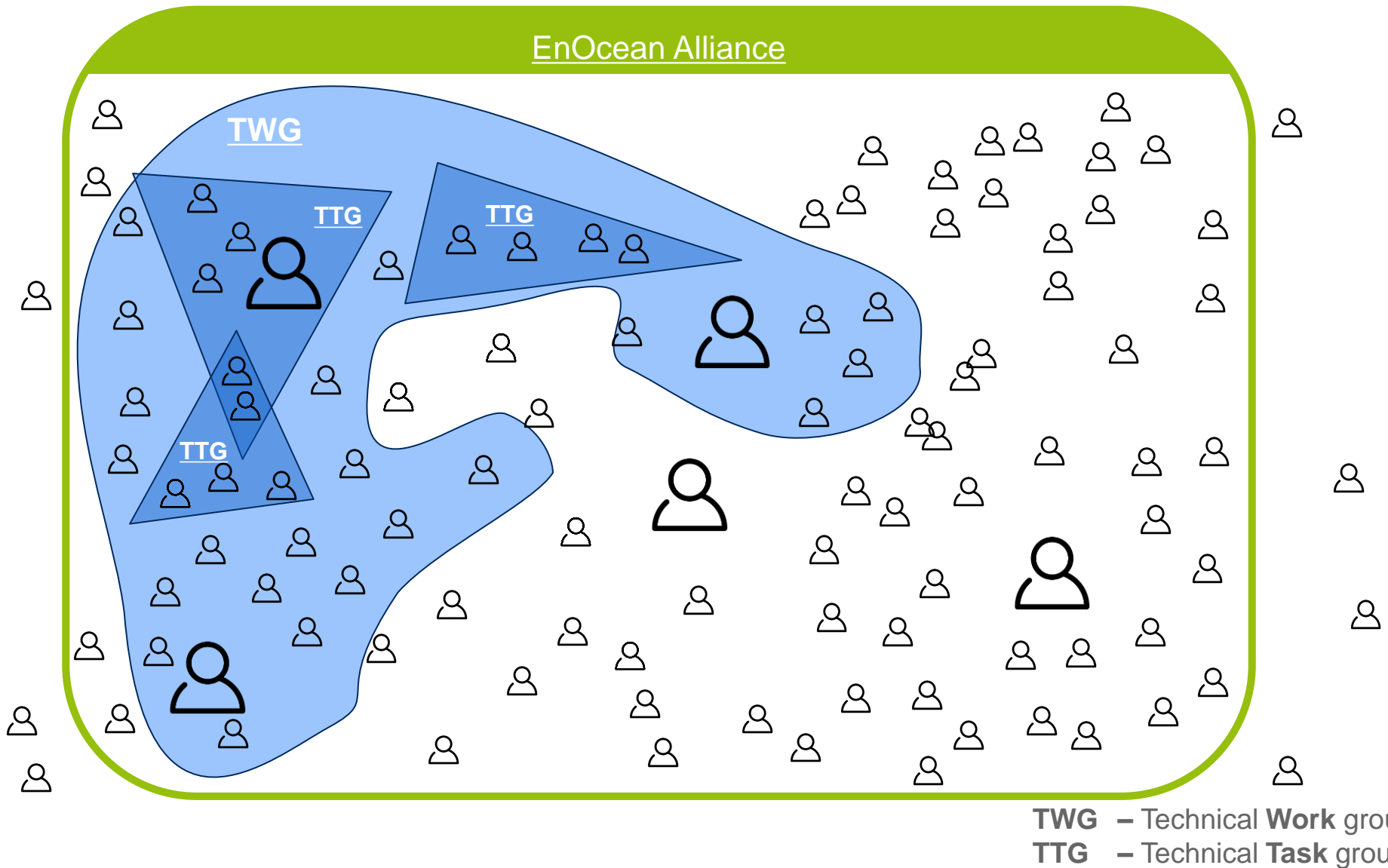


## What is up to the manufacturer?

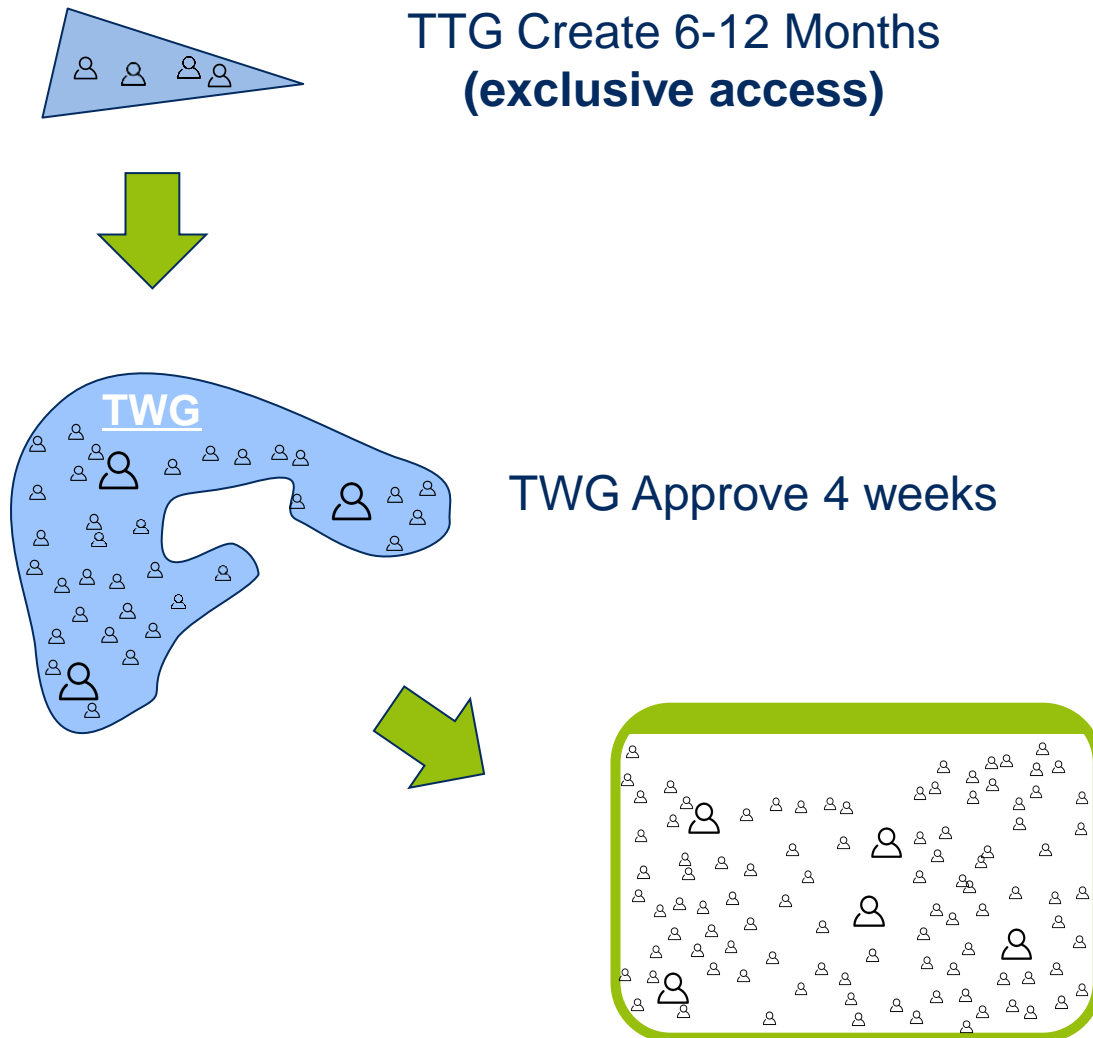
- Label type – NFC, QR, BAR etc.
- Label properties: pixel size, coding, dimensions
- Label position

## How the TWG Works

# Organisation



# Rules of the Game.. For content creation



## 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



## 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





## 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

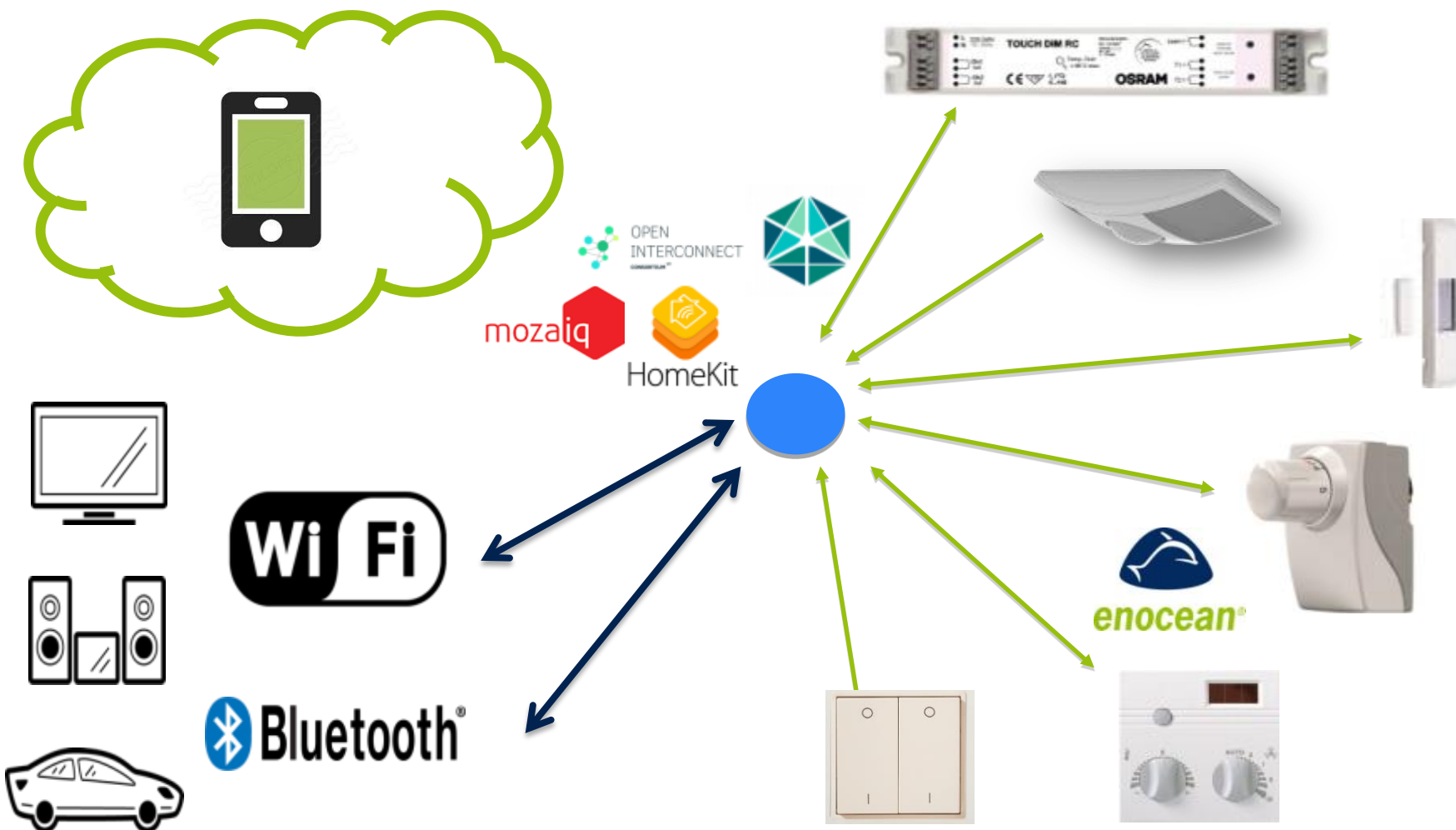
## Few ideas

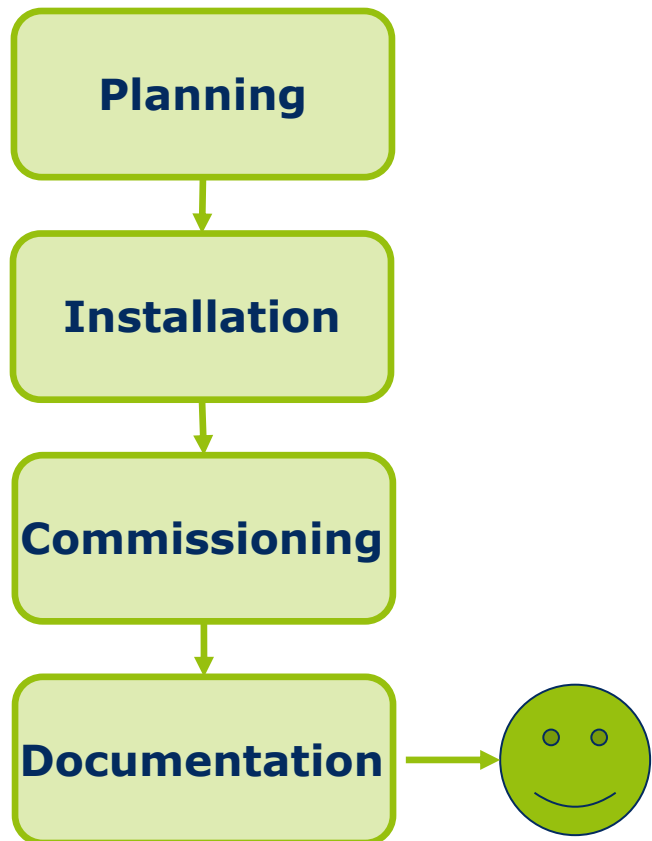
- Fixed ranges & scaling for all future profiles  
(endless variance caused more pain than gain)

<b>Temperature</b>	<b>10 bits</b>	<b>0.1 Steps</b>	<b>-40° C to 60° C</b>
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- Atomic functions (no complex hidden process)
- Status reports & synchronization & acknowledges

# IoT - All about connecting devices





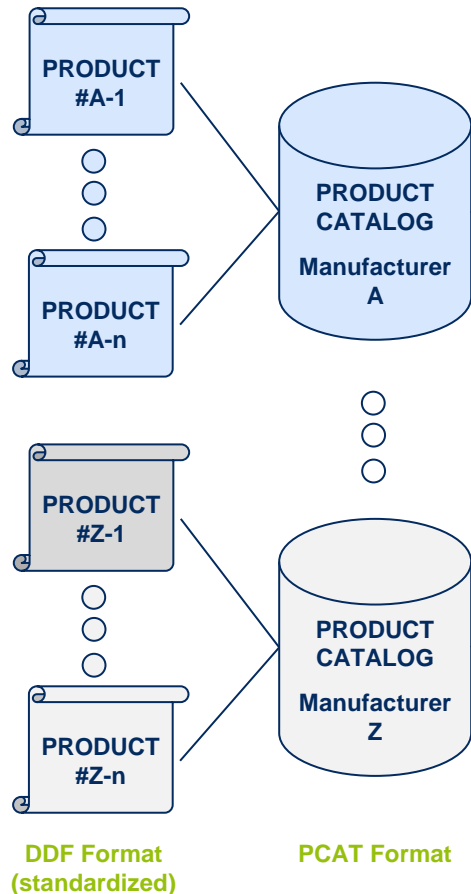
## Key features:

- 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

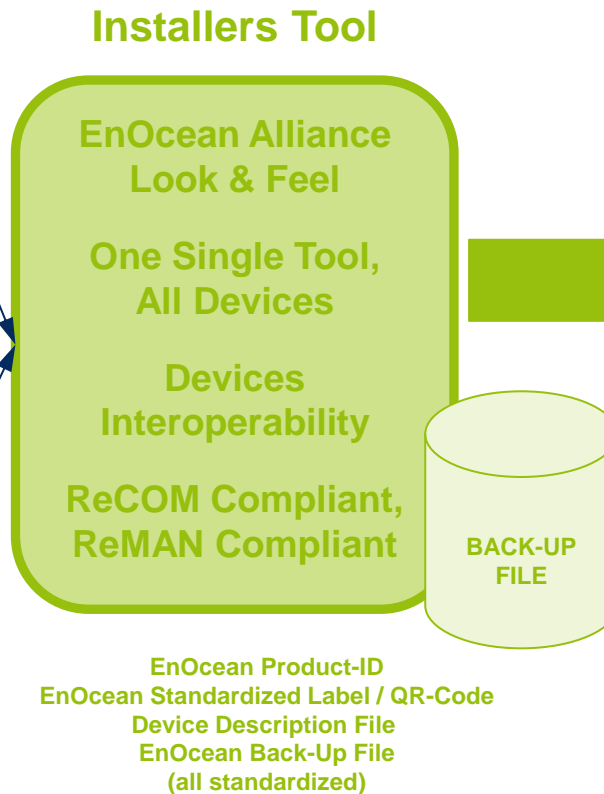


# Installers Tool – Implementation Scenario

## Product Manufacturers Distribution Channels



## EnOcean Alliance Tool Manufacturer



## Product Manufacturers Distribution Channels



**Describes all features and aspects of the end product with given semantics – configuration parameters**

**Publically available**

**Standardized form**

**EXAMPLE**

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

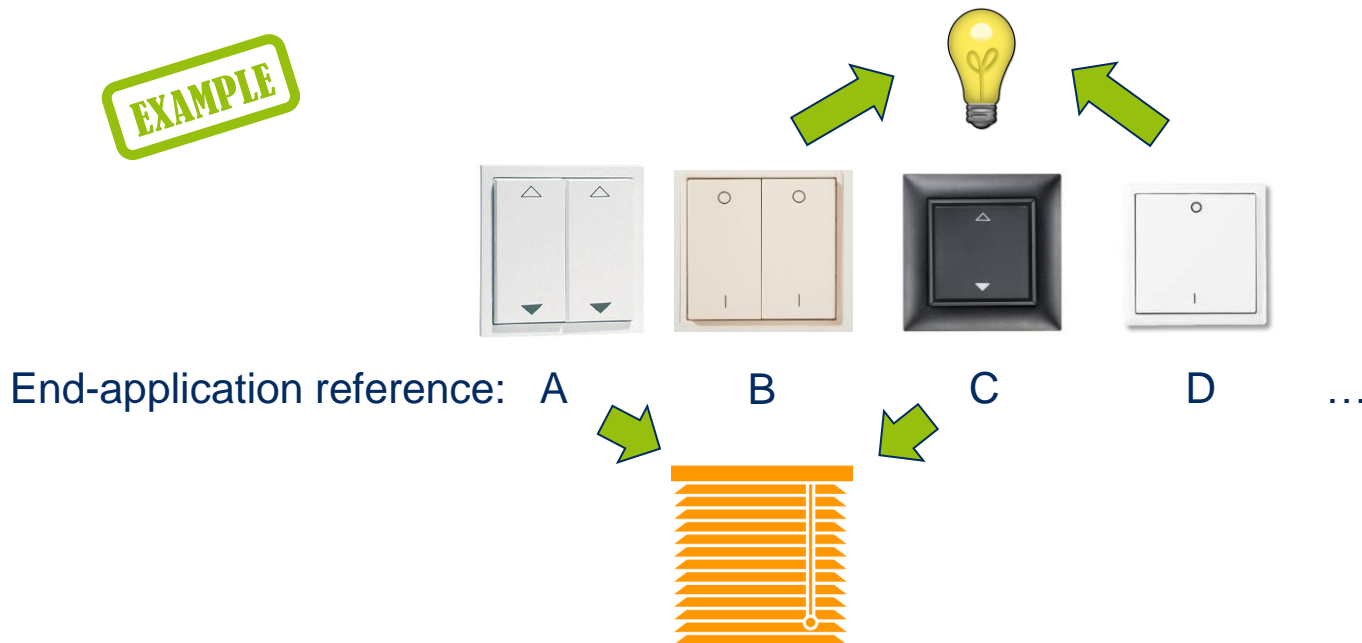
  <xs:element name="Device"> <!-- does this have a type? -->
    <xs:complexType>
      <xs:sequence>
        <xs:element name="Manufacturer_Name" type="xs:string"/>
        <xs:element name="Manufacturer_ID" type="xs:string"/>
        <xs:element name="EEP" type="xs:string"/>
        <xs:element name="GP"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



# Localization in field

**Localization (e.g. in room) is required for remote set up**  
network identification (communication ID)



Communication ID	Product reference
X	Light
Y	Light
Z	Light
W	Light

# EnOcean becoming Things

**EXAMPLE**

Product



1.a Scan communication ID  
and application identification

1.b Get via air

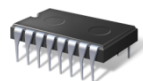


2. Query Electronic Datasheet  
with End-application reference



3. Commission Device

Product



## EnOcean becoming Things.

Key:

- **Specific end-application description**
- **Identification in field**
- **Remote control of features and configuration**



## ■ 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 Addressing 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



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