



KNX in the IoT world

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Content of Presentation



KNX : more than 25 years proven technology

- 10 Unique Value Propositions of KNX
- KNX: the technology in a nutshell

The IoT world: is there a need for yet another IoT solution?

- Trying to resolve interoperability, reliability and long term support
- Cooperation of KNX with other organizations for IoT
- KNXnet IP – KNX IoT WebServices – KNX IoT ontology – KNX IoT fully IP based devices

KNX IoT architecture

Overview

KNX 10 Unique Value Propositions (2)

6. One common design and commissioning tool

- ETS™ Engineering Tool Software
- Easy Mode mechanisms however allow linking without ETS for simple functions and smaller scale installations

7. Fit for use on different media and in different application domains

- Twisted Pair, wireless, IP and PL
- Lighting, Façade control, security, any type of zoned HVAC control, Monitoring, Metering, Load shedding, Scheduling, Audio control,

8. Seamless interoperability

- Between products of different manufacturers/application domains

9. Common Training

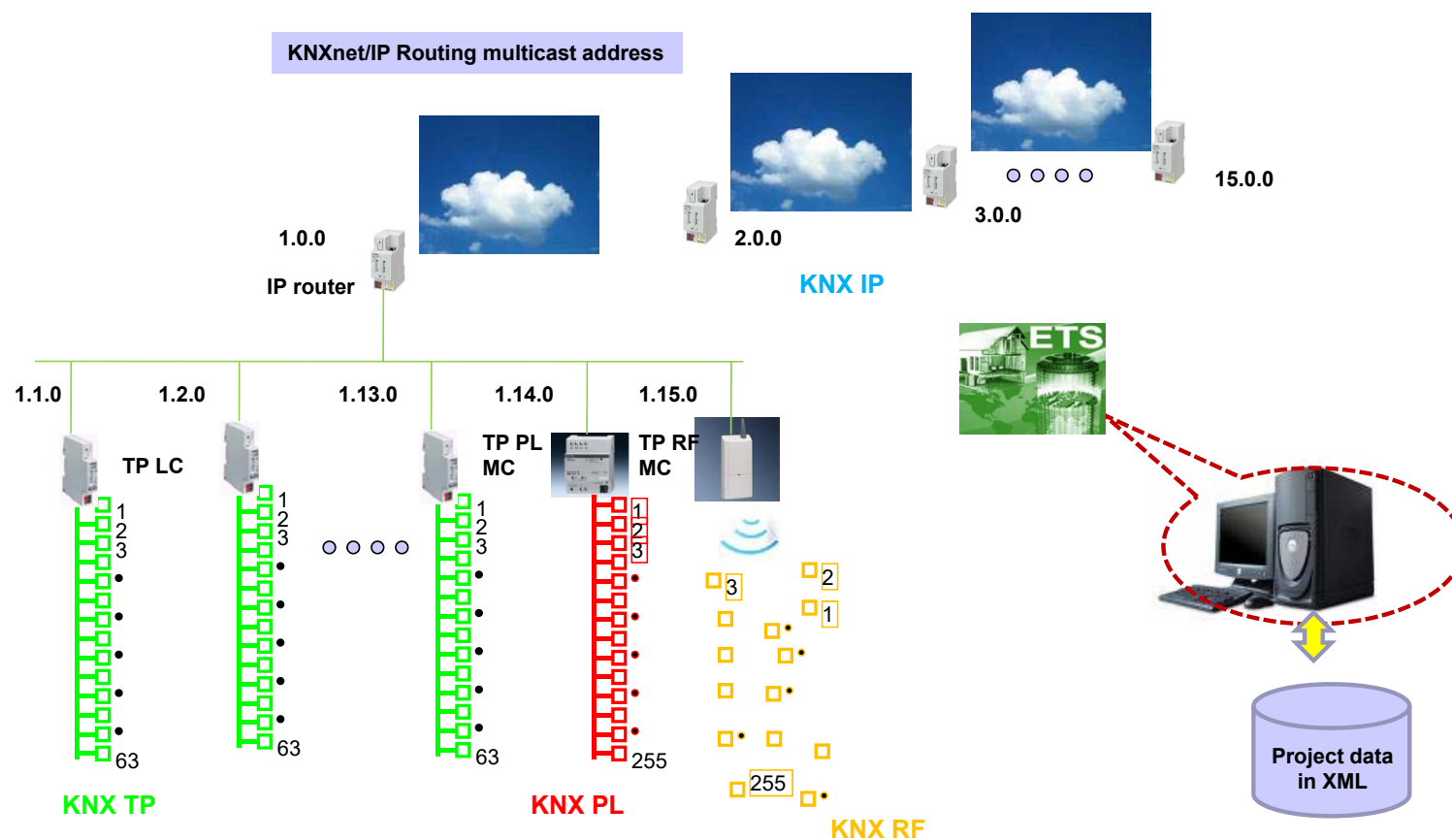
- Network of independent KNX training centers in many countries worldwide
- Currently more than 400 training centers in 66 countries worldwide

10. Large service network of qualified contractors/designers/integrators

- Nearly 70000 listed KNX partners from 158 countries



KNX: the current technology in a nutshell



IoT market

No standardized integrations



■ Interoperability, reliability and long term support is not solved yet

Most IoT devices are built for 1 specific use case

Example: There is the need to buy along with a Smart doorbell a wall plug as chime

- Although: IoT smoke detector has WiFi and a speaker → not usable as chime
- Although: SmartTV and setup boxes have network access and audio output → not usable as chime
- Dependency on hard linked proprietary cloud solutions. User is not the owner of the data, no choice in hosting.



IoT market

A lot of dependencies – Building automation differs from IT on long term support



- IoT devices are depending on multiple external services:

- Internet connection 
- Security/updates from a single supplier
- APIs that change over time
- External authentication
- External databases
- Cloud services
- Changing physical network layers



Standardization is needed to guarantee reliability and long term support

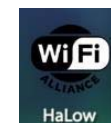
Semantics needed to make devices understand each other directly

IoT Standardization

Many initiatives



- Lots of other alliances
- We need something that works towards the KNX ecosystem both on software and physical level
 - On the other hand we cannot ignore what happens in the market and need to make sure solutions are widely accepted and future proof
 - KNX has however no intention to create new Physical layers, but wishes to use IP as the lowest layer.



IoT Standardization

Many initiatives



- KNX is a member of the Fairhair Alliance to work on a solution with wide market acceptance
- KNX solutions on top of Fairhair blueprints for lower network levels, standardization by KNX
- For KNX IoT Web Service Gateways: KNX Web services make use of existing standards oBIX, BACnet/WS, OPC/UA



KNX vs IoT – different worlds

Need for translation layer

Phones – Notebooks and cloud services want to interact with building automation over the internet:

- Different medium
- Different language



IP Based
Web browser technologies

KNX TP or KNXnet/IP
Standardized binary data

- Browser can only use web technologies HTTP, Websockets, JavaScript. No direct UDP messages possible.
- KNXnetIP does not foresee discovery and connectivity in internet in a secure way

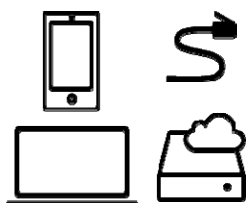
- Good solution within KNX ecosystem within LAN
- KNXnet/IP was not designed for IT integration but for
 - local usage and setup
 - backbone of building
 - Tunneling and routing within LAN

KNX vs IoT – different worlds

Today's option 1: Making the bridge manually with KNXnet/IP

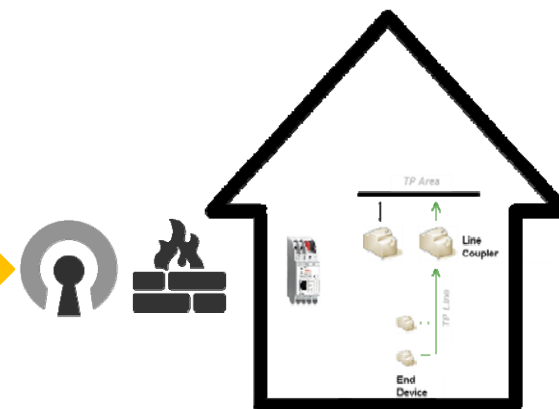
KNXnet/IP connection is possible:

- KNX world can connect with KNXnet/IP and open the building by adding VPN solutions.
- IP world can talk binary KNX



IP Based

Implementing KNXnet/IP in IT applications



KNX TP or KNXnet/IP

connectivity/security via VPN, not part of KNX standard

- KNXnet/IP uses KNX specific concepts that raise the implementation effort
- Difficult to setup and to make it work reliable and secure
- Many KNX and project knowledge required

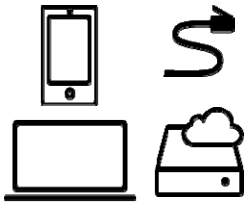
- Installer responsible for setting up and securing non trivial solution
- Requires knowledge on VPN, port forwarding, port numbers, IP addresses, ...

KNX vs IoT – different worlds

Today's option 2: Making the bridge by 3th party products

Complete solutions are available from the market:

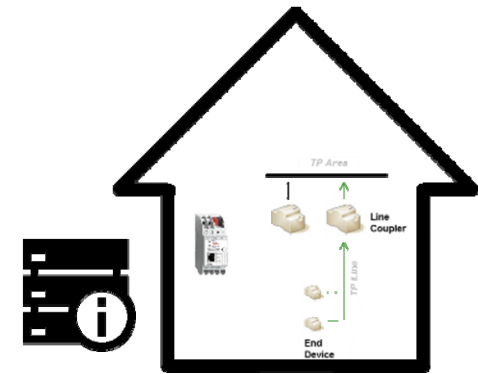
- Gateway that translates to understandable IT formats
- Software requires specific gateway



IP Based

Software adopted to manufacturer specific interface

- Software has no universal way to connect to gateway, manufacturer specific
- Lower adoption of software additions because there is no clear standardized path to connect to building



Gateway

Offers IT friendly interface with lower effort

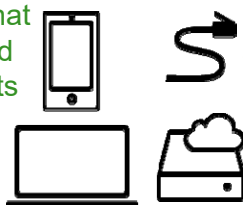
- Good web gateway solutions available by manufactures but not standardized by KNX Association
- Protocol specifications not always available, requires specific product knowledge and specific setup/configuration

KNX vs IoT – different worlds

Today's option 3: KNX IoT Web services

KNX IoT 1.0 - Web services:

- Standardized Gateway that translates to standardized understandable IT formats
- Step towards uniformization of application layer

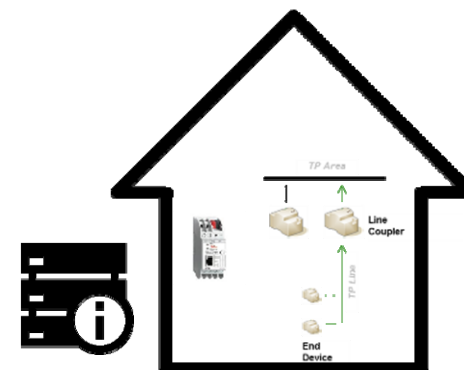


IP Based

Connectivity/security not standardized yet

- Application layer is more clear by the specifications.
- Security and connectivity not standardized, IT side cannot discover and connect in standard way yet.
- Needs more semantic information from implicit available information on KNX side

standardized application layer



Gateway

More similarities, no runtime compatibility yet

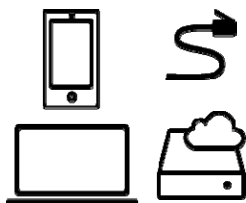
- Unifying solutions based on existing web services standards oBIX, OPC/UA and BACnet/WS
- Exploring information from within ETS
- Needs to be standardized further
 - Caching, push notifications, security, connectivity, lower different protocol options

KNX in the IoT world: KNX IoT Gateways

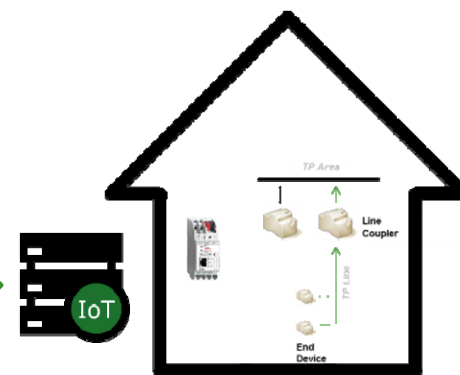
- Current ongoing work: KNX IoT Middleware with rich semantics release 2018

KNX IoT Web services:

- Standardized Gateway that translates directly to understandable IT formats
- Software only needs credentials/identifications



IP Based KNX data driven on IP protocols



Gateway KNX IoT middleware

- Providing data driven KNX information on IT protocols
- Standardized solution for discovery and connectivity: The customer simply enters his credentials to talk to his/her home gateway – no further need for VPN tunnels
- Security according to IT standards
- every KNX web service home gateway communicates with his installation

- Synchronizing between middleware and KNX ecosystem from within ETS
- Exposing information in standardized IT compliant way: the web service gateway presents information about the installation in a much richer and standardized format based on a new KNX ontology. The client software (= machine) can interpret this data without further human intervention → much easier configuration of client software by installer – no need to enter KNX specific information (e.g. group addresses)

The need for flexibility and innovation

Combined with standardization



■ We don't know what devices will exist tomorrow

Allow flexibility to try new stuff

■ We do know what exists today

Interoperability needed towards existing possibilities



Example Google glass

- Unknown when new innovative devices are created and what all use cases will be
- Need mappings to existing functionality (Lights, TV, Blinds, Navigation, calls, ...)
- commonly agreed semantics need to enable integration with all kind of products that understand the functionality in a human way

Let devices **SEE** the message in a way they understand

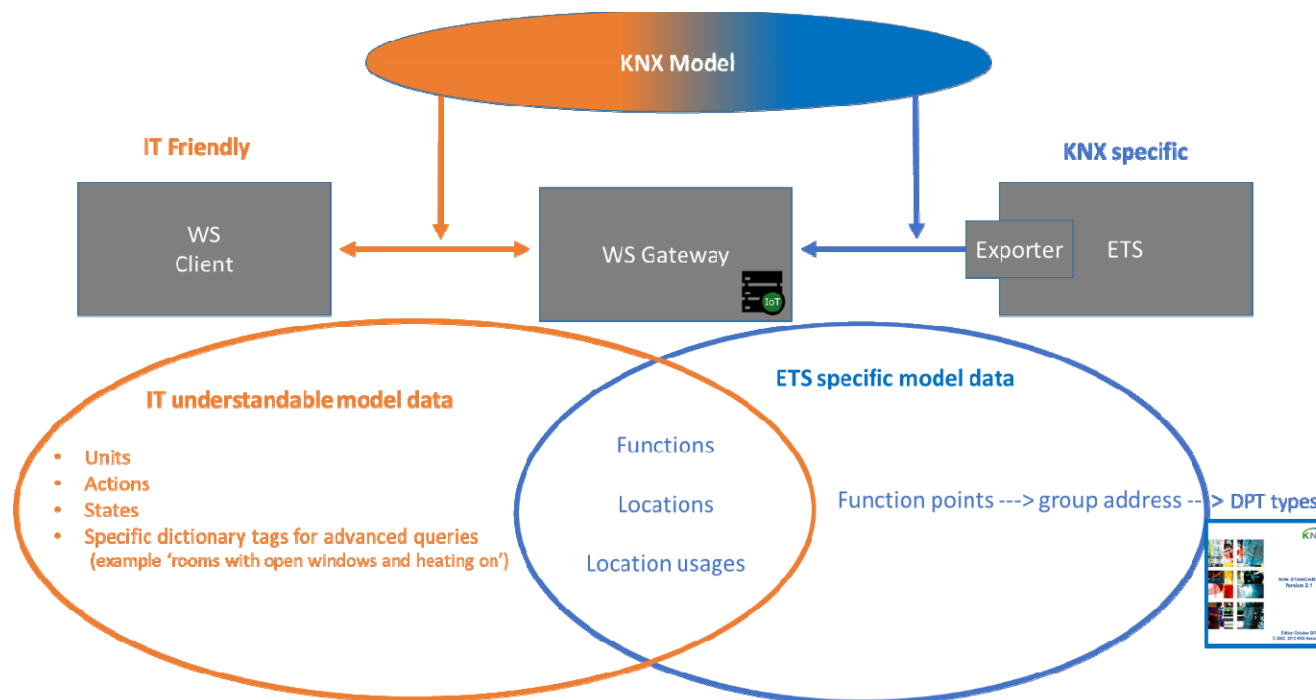
- Increased value on software level and interoperability towards the large IoT world
- Shared semantic understanding of the installation will be the basis towards auto-learning and auto-configuration features.



KNX taxonomy with an IT and KNX specific model data

Orange side needed for KNX IoT gateways and for fully IP based KNX devices

Blue side needed for KNX IoT Gateways

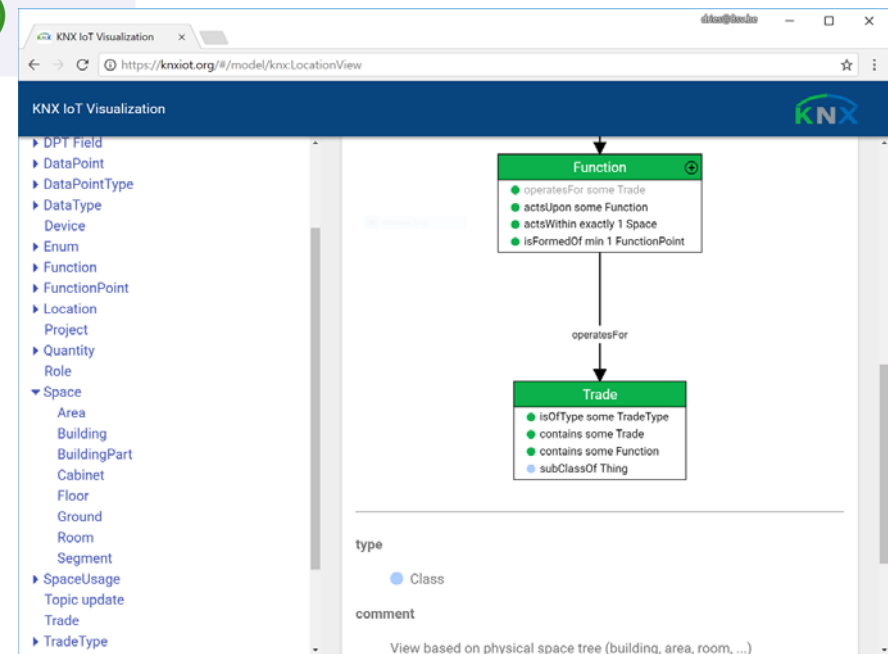


KNX IoT Semantics: file serialization and format



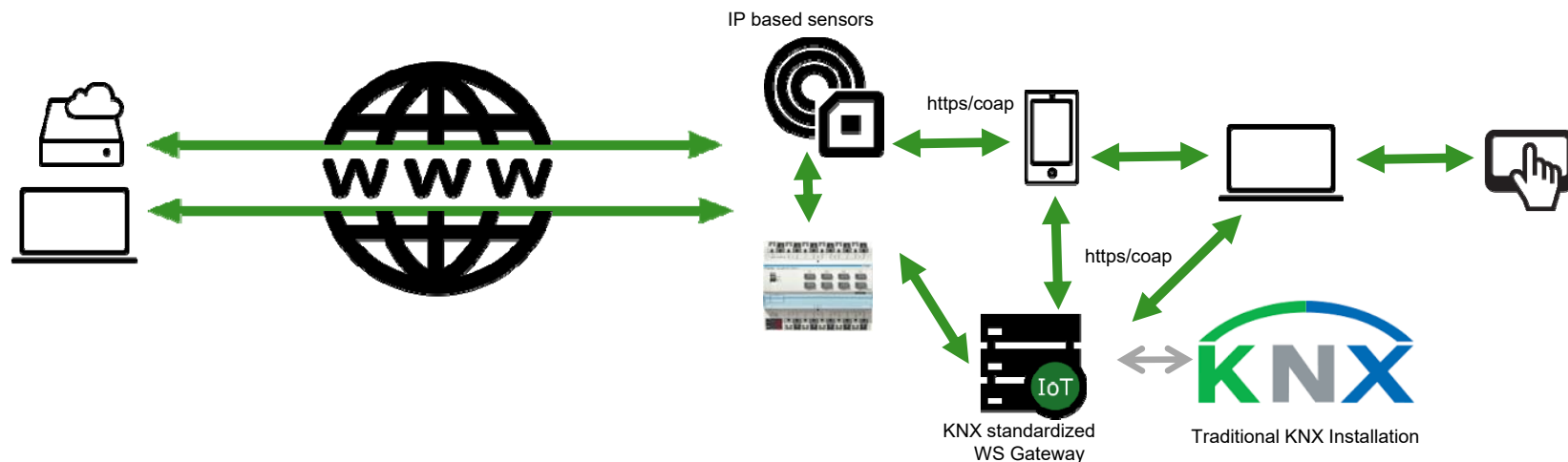
IoT Model	KNX IoT Project information	IoT Runtime
Created with triples in Turtle	JSON-LD	JSON-LD (+JSON +CBOR)

- Model based on “Linked data” with Triples to increase structural amount of information
- Visualizer created to browse the model including graphical drawings



KNX in the IoT world: fully IP based KNX devices

Current work: Fully IP based KNX devices - release 2020



- KNX devices no longer have to “sit” behind a KNX WS Gateway and have to be based on TP and/or RF
- KNX devices can fully “sit” on IP (only) and communicate between them and/or with a KNX WS Gateway (if still present in the installation)
- KNX devices fully talk a protocol that is possibly no longer defined by KNX (including security mechanisms): however rich semantic information of KNX devices, proven/certified interoperability and one tool remain main assets of KNX
- new IP based solutions (e.g. Thread or the like) are added to KNX specific media (TP, RF)

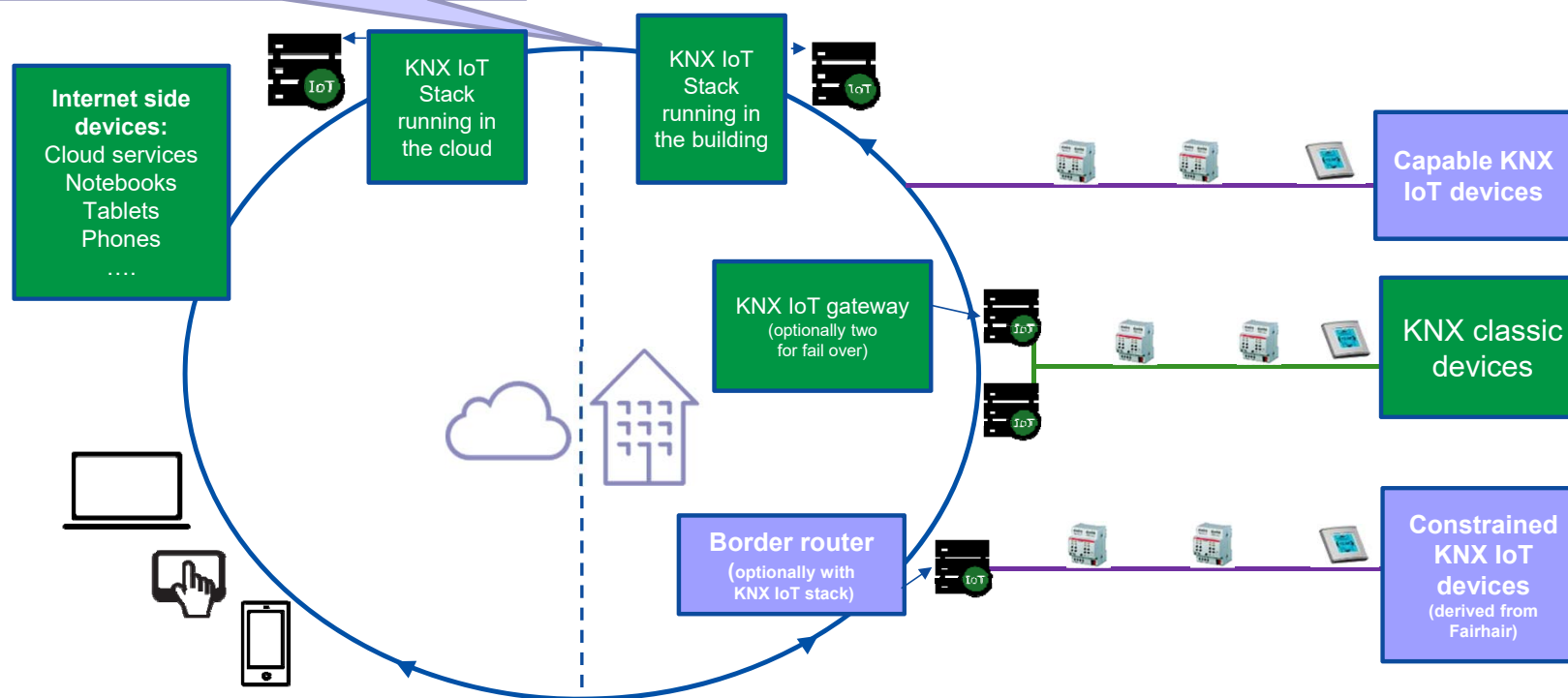
KNX IoT architectural overview

Network Topology – Components



KNX IoT Backbone =
High availability cluster with replica sets
responsible for distributing both the project
information and runtime data

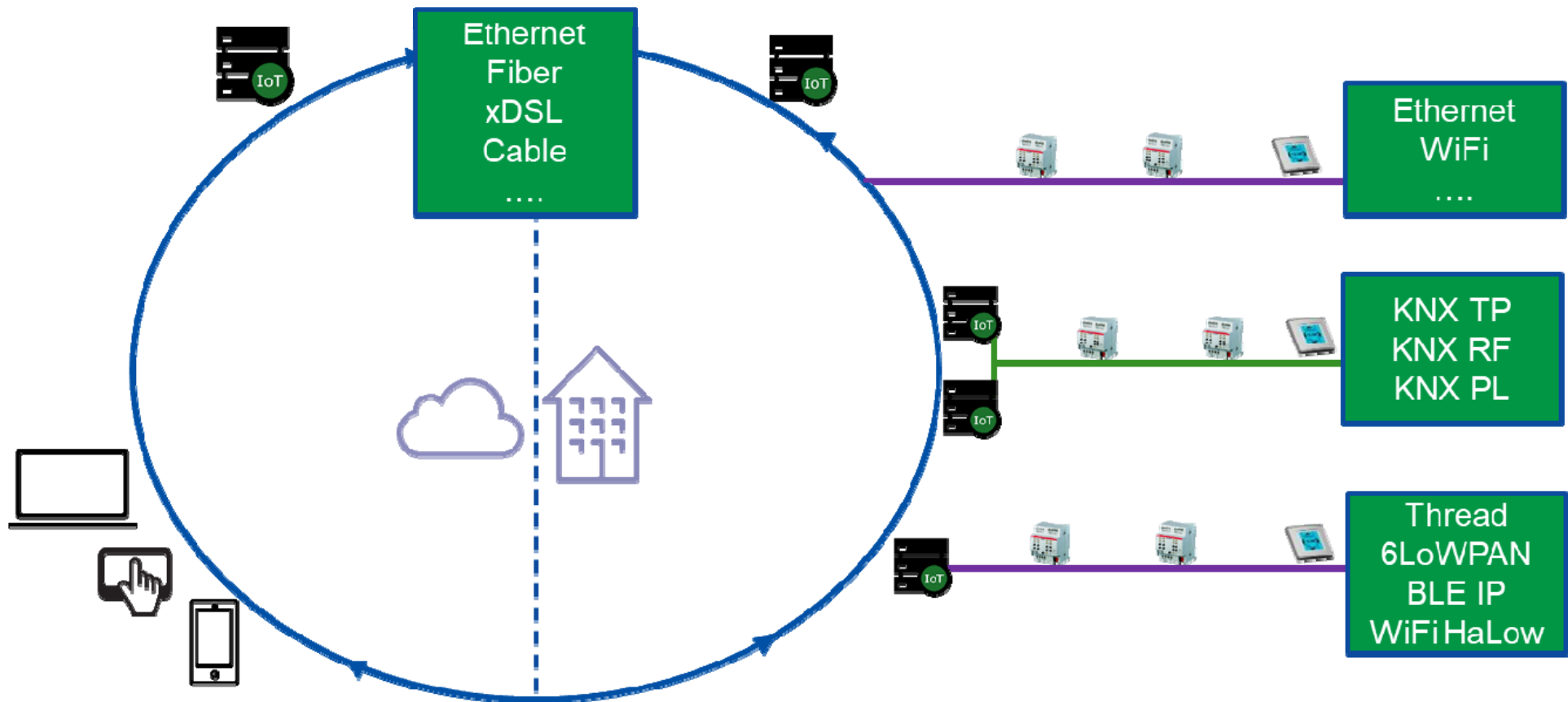
Network topology Components KNX IoT



KNX IoT architectural overview

Network topology – Layer 1/2 - Physical

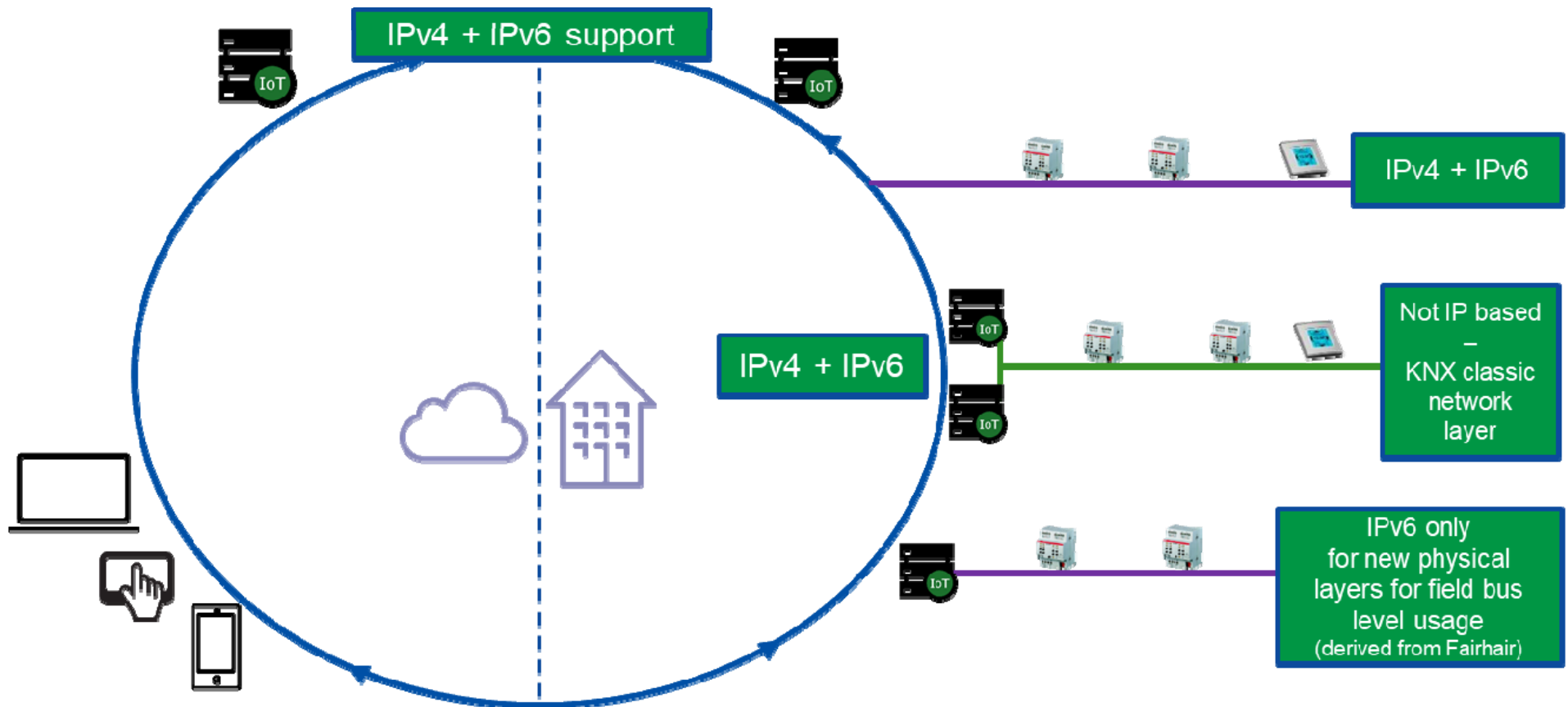
Network topology
Layer 1-2 - physical



KNX IoT architectural overview

Layer 3 – Network Layer

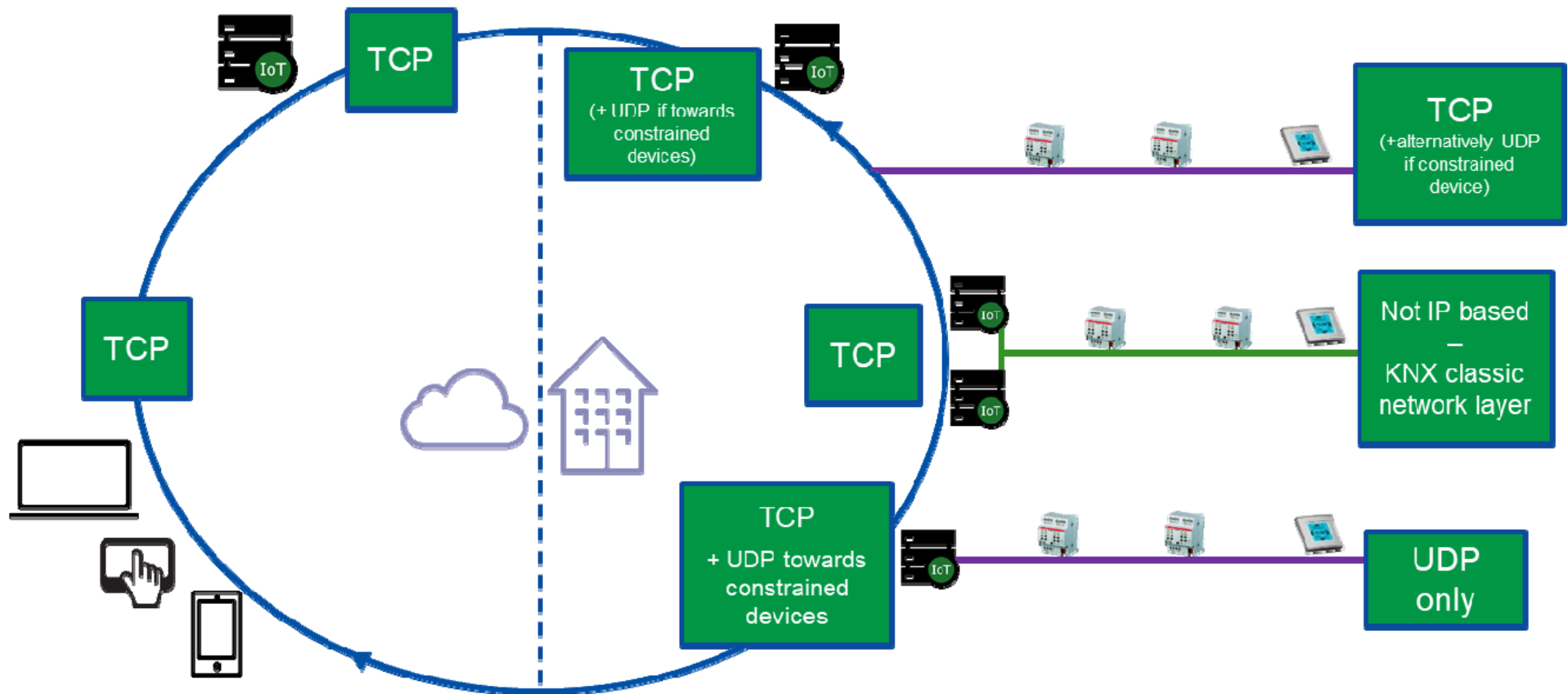
Network topology
Layer 3 – Network layer



KNX IoT architectural overview

Layer 4 – Transport Layer

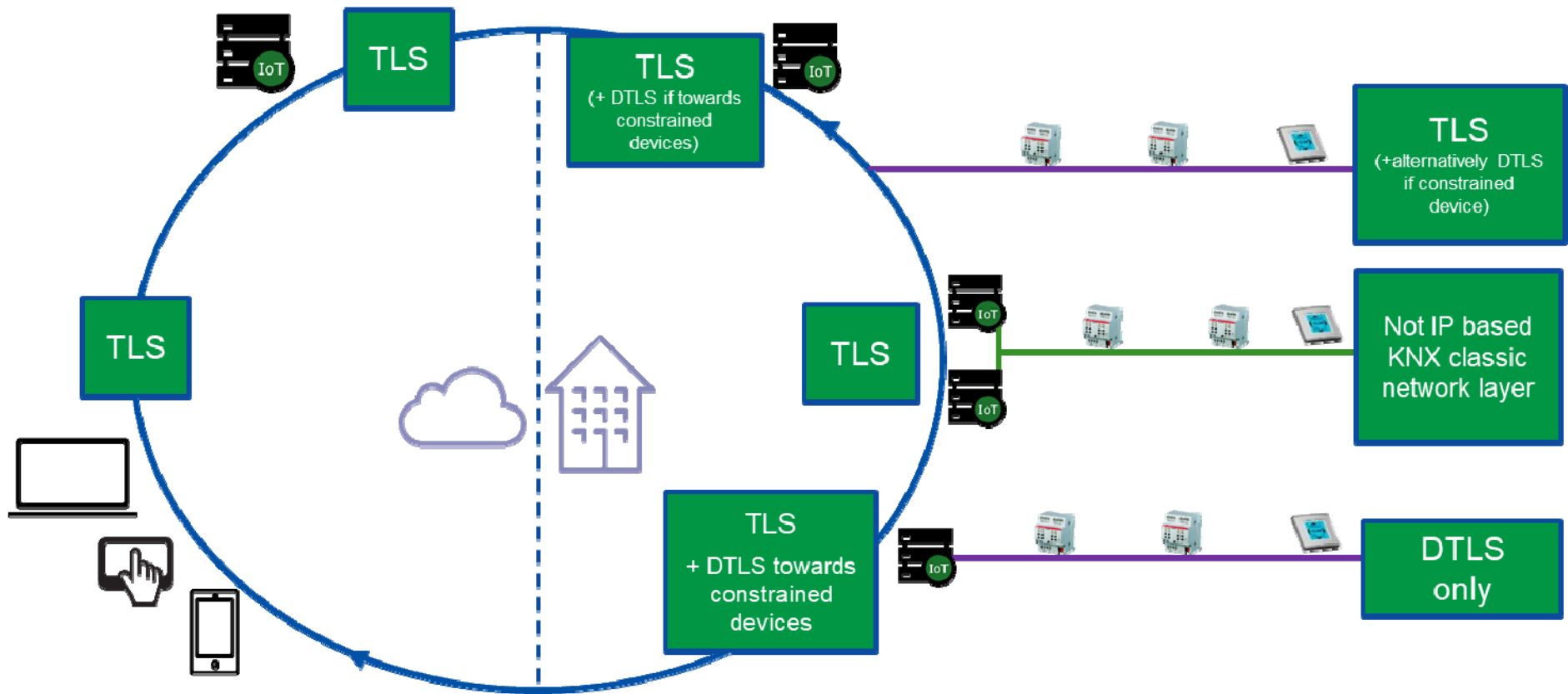
Network topology Layer 4 – Transport layer



KNX IoT architectural overview

Security

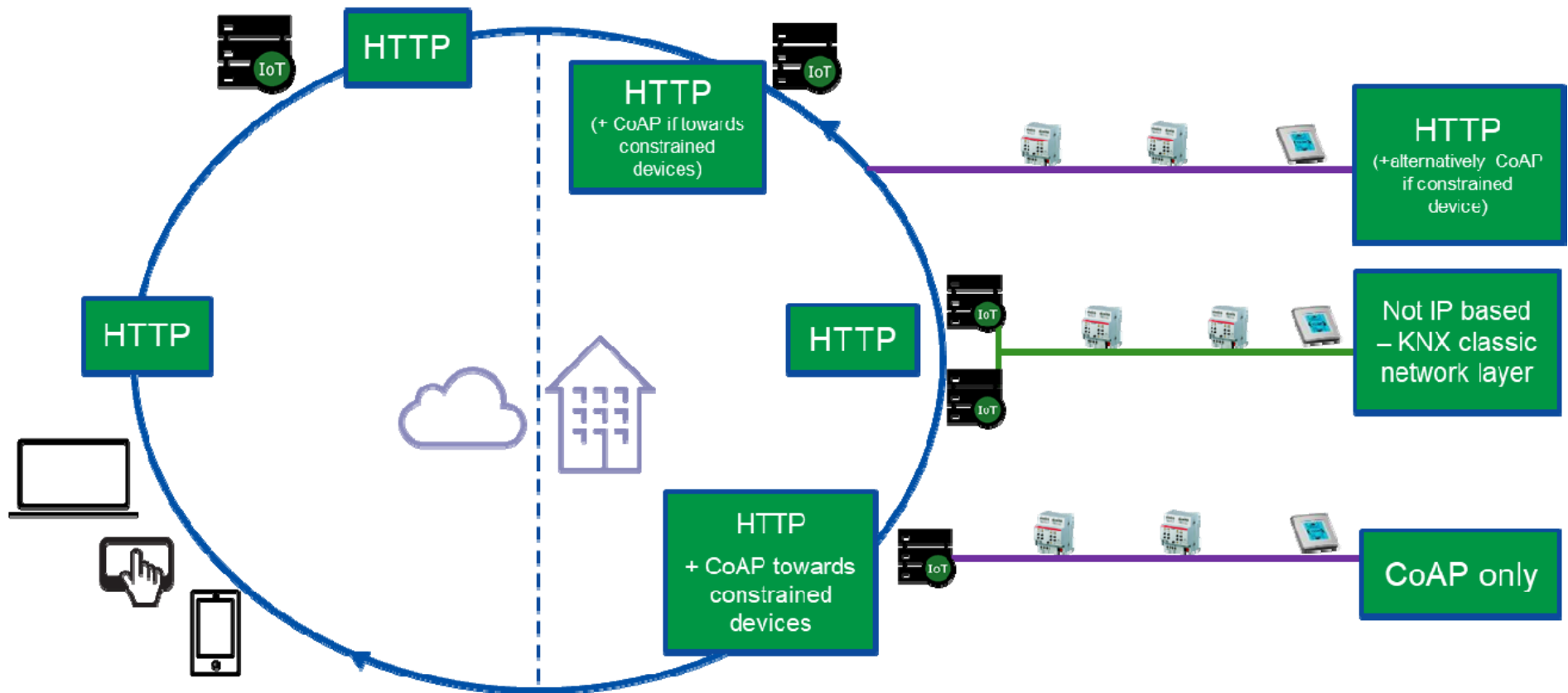
topology
Security base protocol



KNX IoT architectural overview

Layer 7

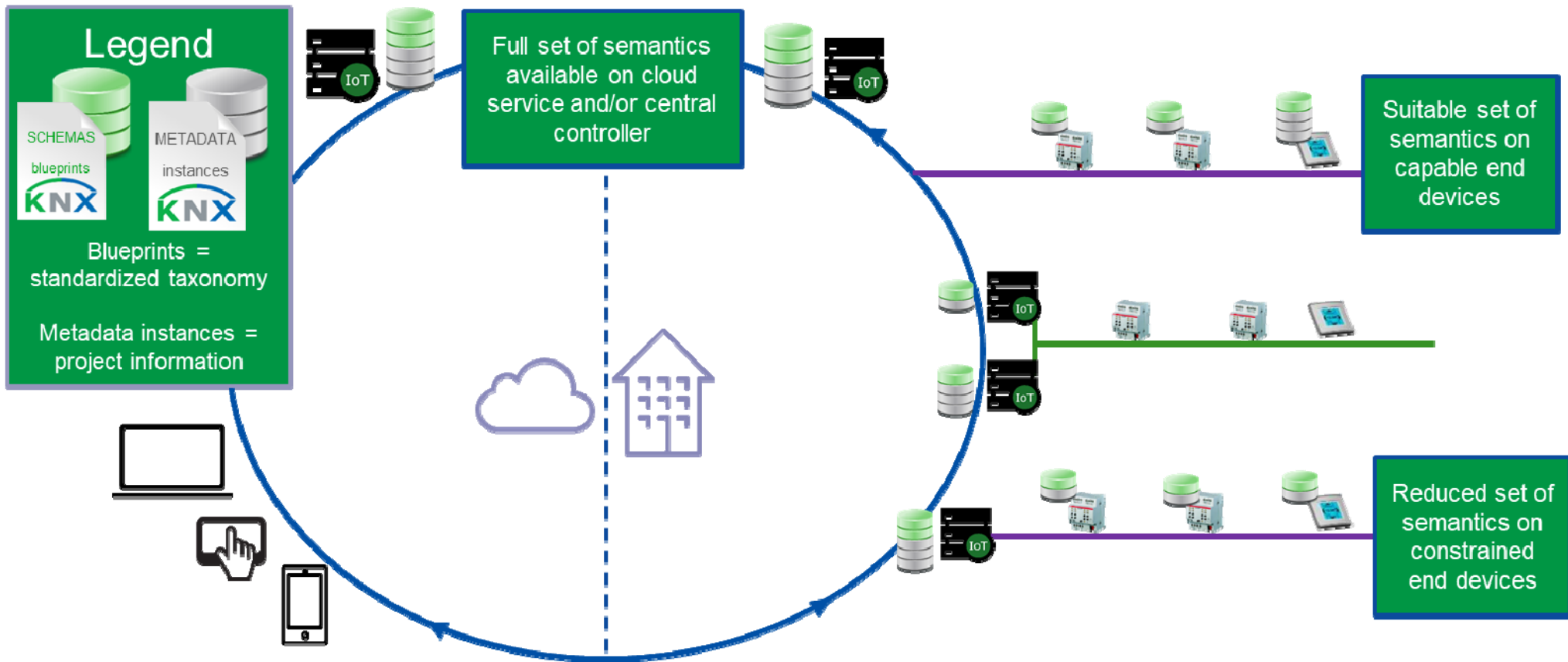
topology
Layer 7 – Base protocol



KNX IoT architectural overview

KNX Semantics

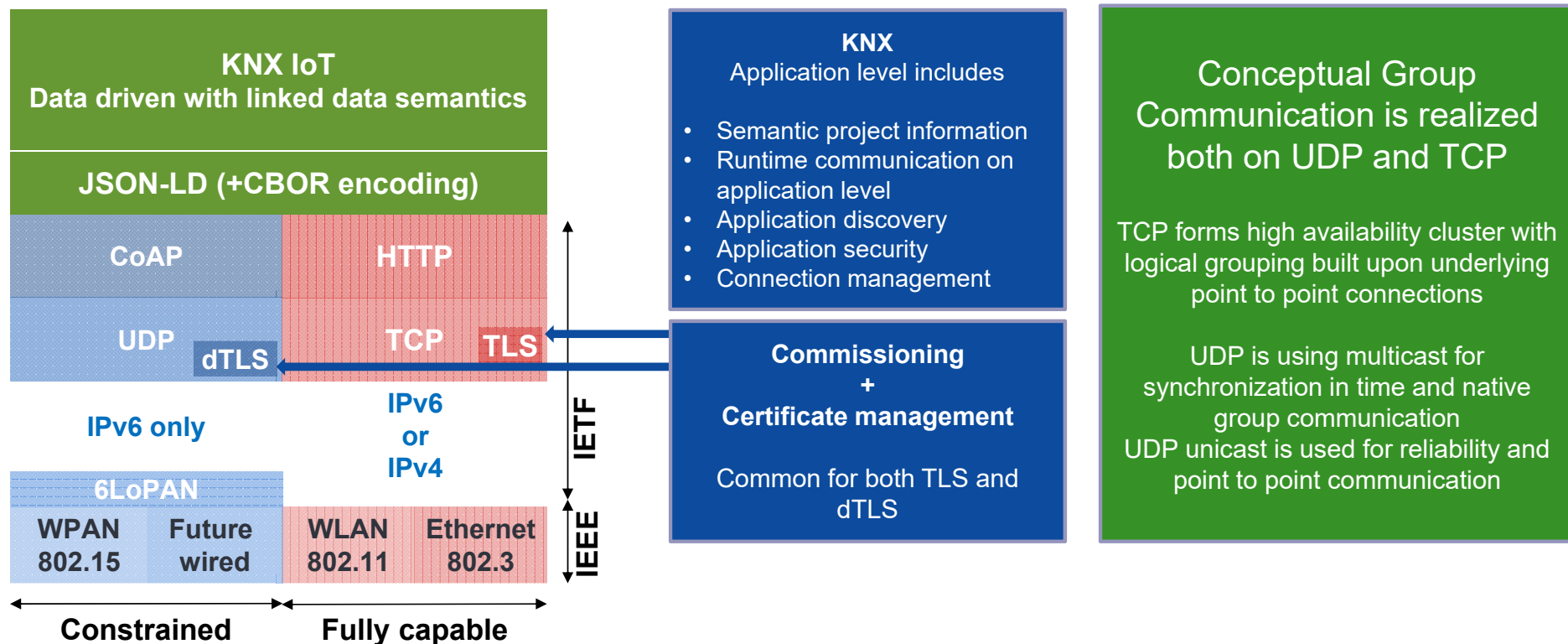
topology
Layer 8 – KNX semantics



Intended KNX IoT Architecture - overview



Communication stack base protocols



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for your attention**

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