Application Release To Market
KNX bus for building automation system
STKNX chipset

EMEA Application team

January, 28th 2019

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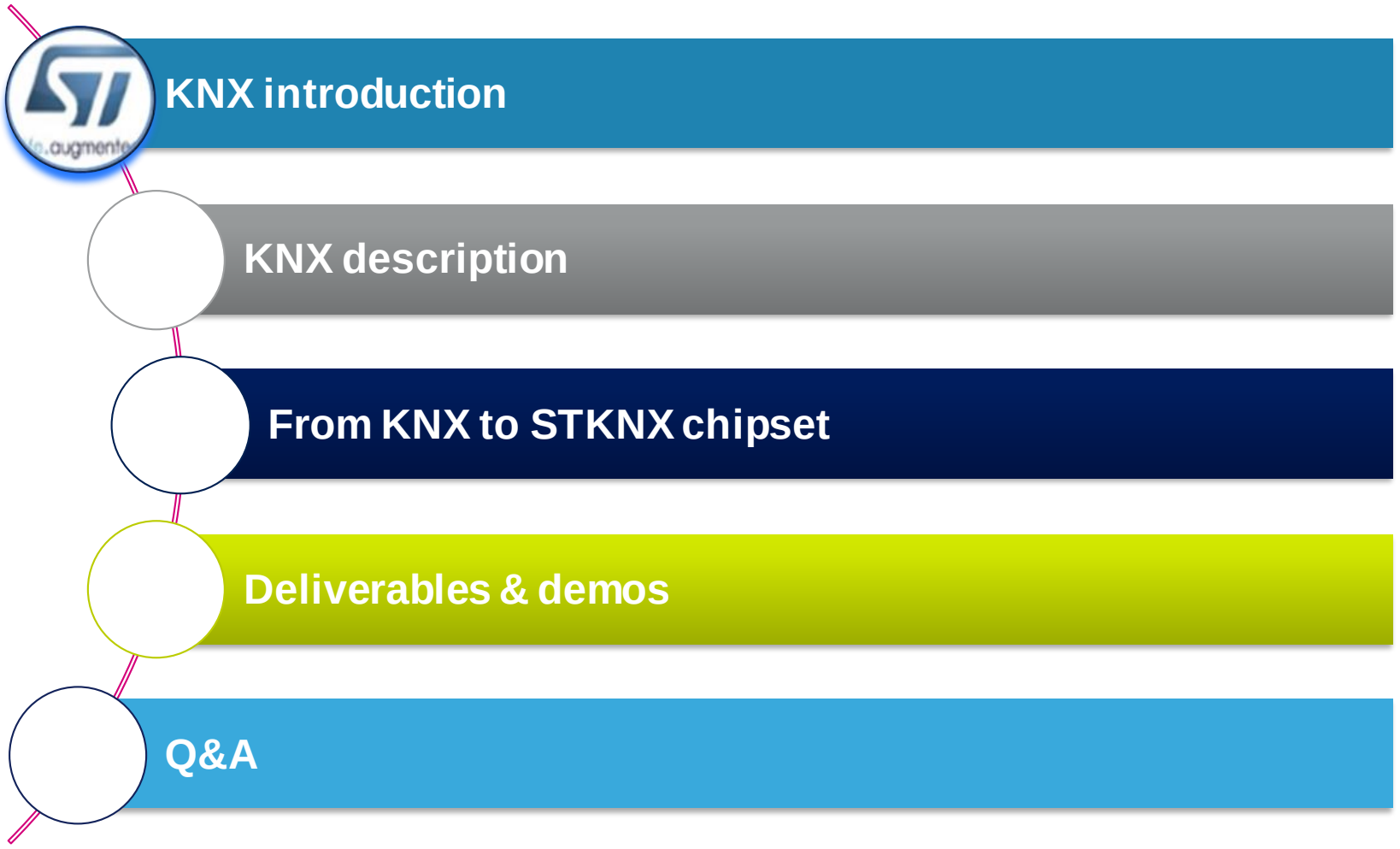
Agenda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Glossary & acronyms

BC = Backbone coupler

LC = Line coupler

DVC = Bus device

LR = Line repeater

PS/Ch = Power supply with choke

S = Brightness sensor

RC = Routing counter

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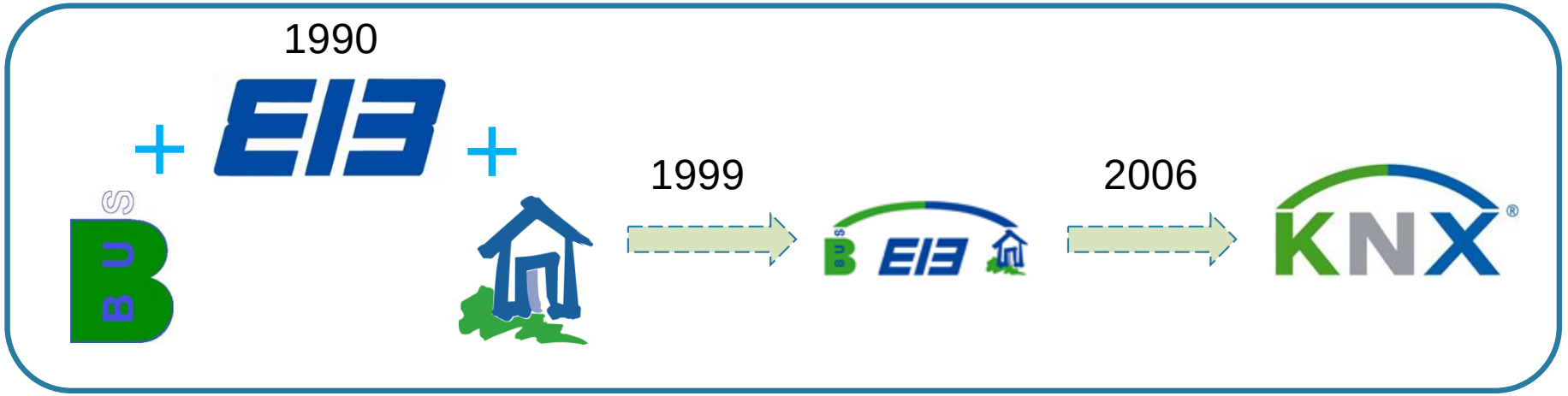
History of KNX



- Foundation: 1990

Under the name 'EIB Association': European Installation Bus

- 1999

Merger with two other associations

  - Batibus (France)
  - European Home System association (The Netherlands)

- 2006: new name "KNX Association" (Konnex)

KNX association activities

- Definition of a truly open standard ‘KNX™’ for intelligent homes and buildings
- Establishing the KNX Trademark as a token for quality and multi-vendor interworking
- Granting the KNX trademark for KNX compatible products (product certification)
- Development, sales and support of the common tool software called ETS™
- National and international standardization activities
- Training, Promotion, Technical support, etc…

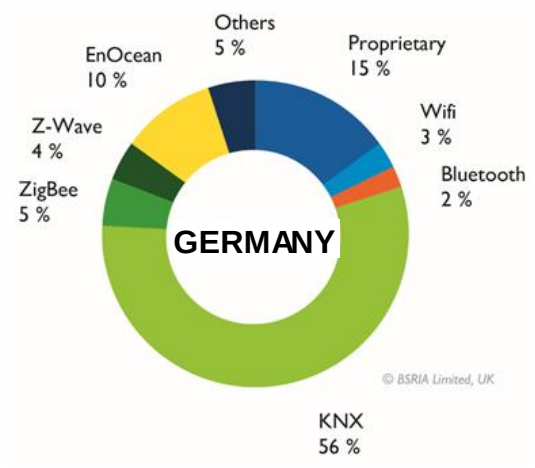
Main benefits

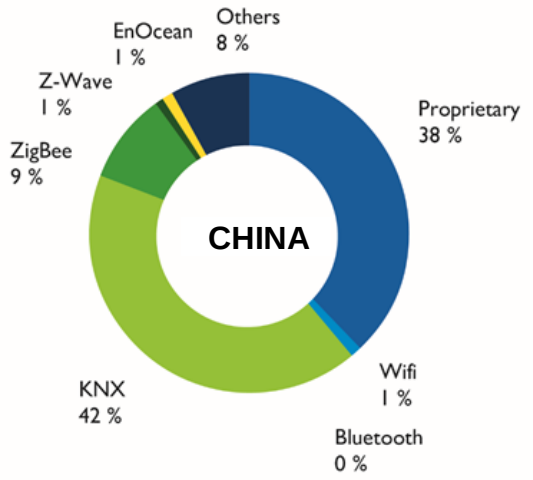
- KNX is a recognized standard: **EN50090 - EN13321-1/2 - ISO/IEC14543-3 - GB/T 20965** (P.R. China) **-** referenced in **US ANSI/ASHRAE** standard 135
- More than **400 KNX members**
- Product compliance is checked at neutral test laboratories => **Guaranteed Interoperability**
- One Tool ETS™ (Engineering Tool Software) for:
  - Design
  - Configuration
  - Diagnostics

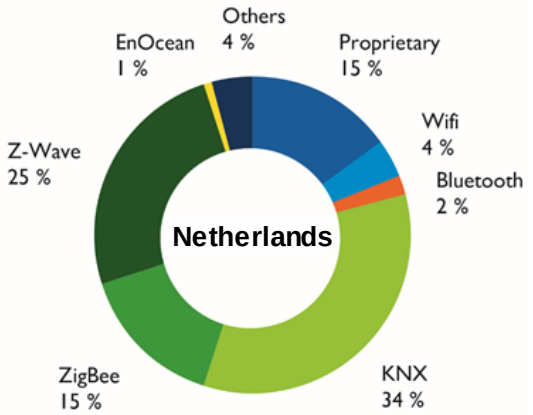
Main benefits

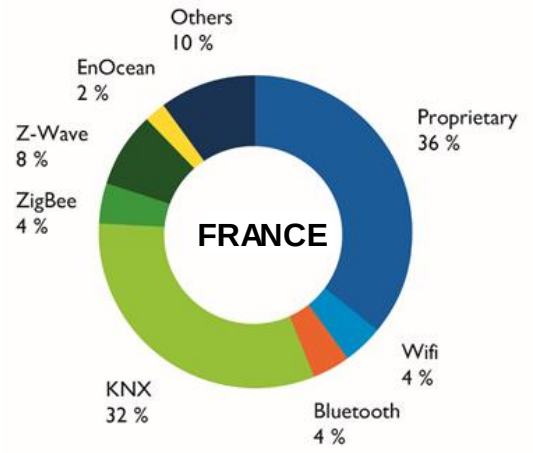
Fit for use in ALL applications in home and building control

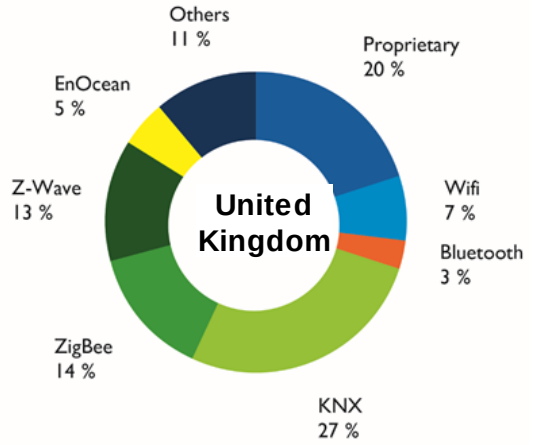
Smart Home/Light Commercial market study 2017











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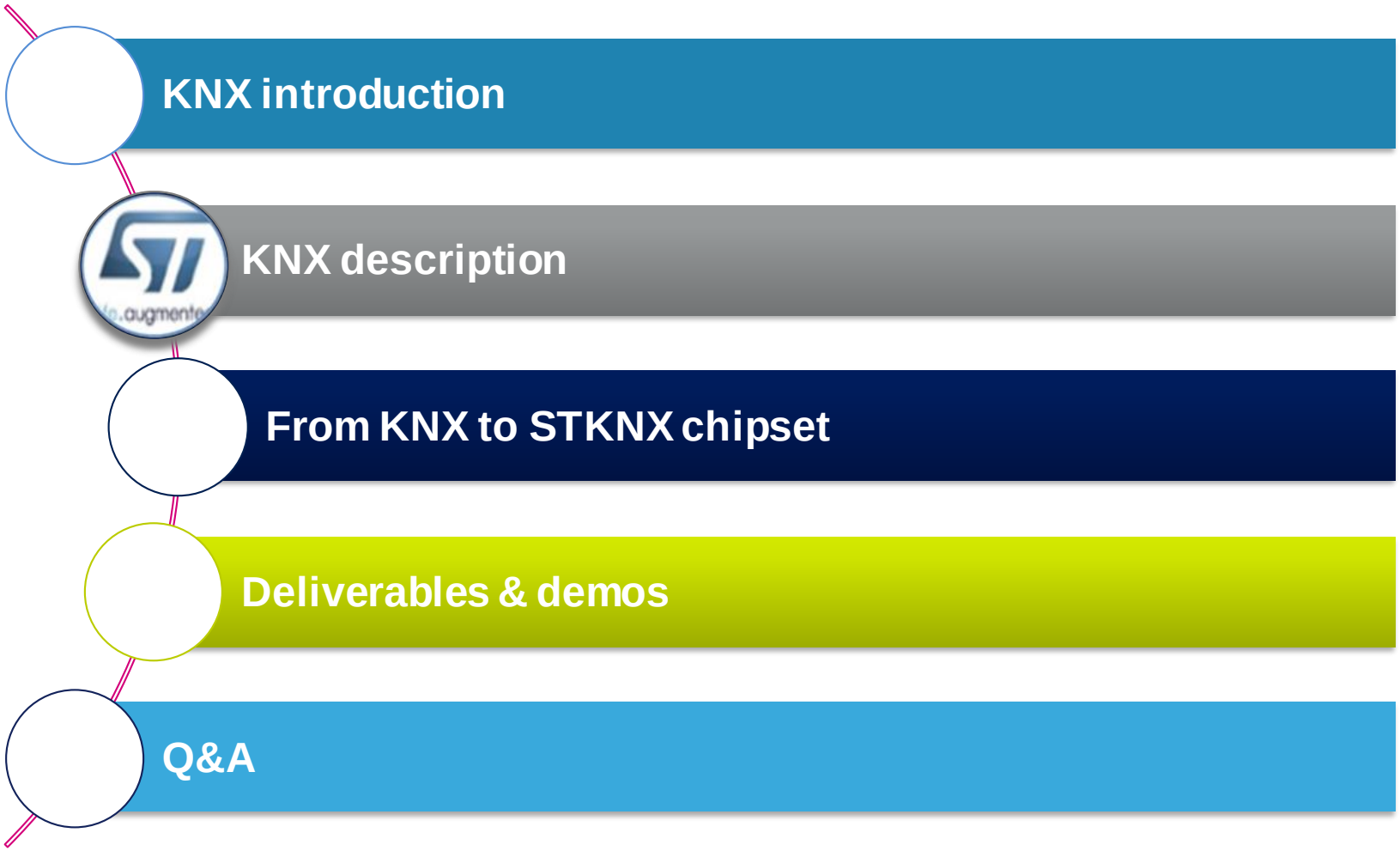
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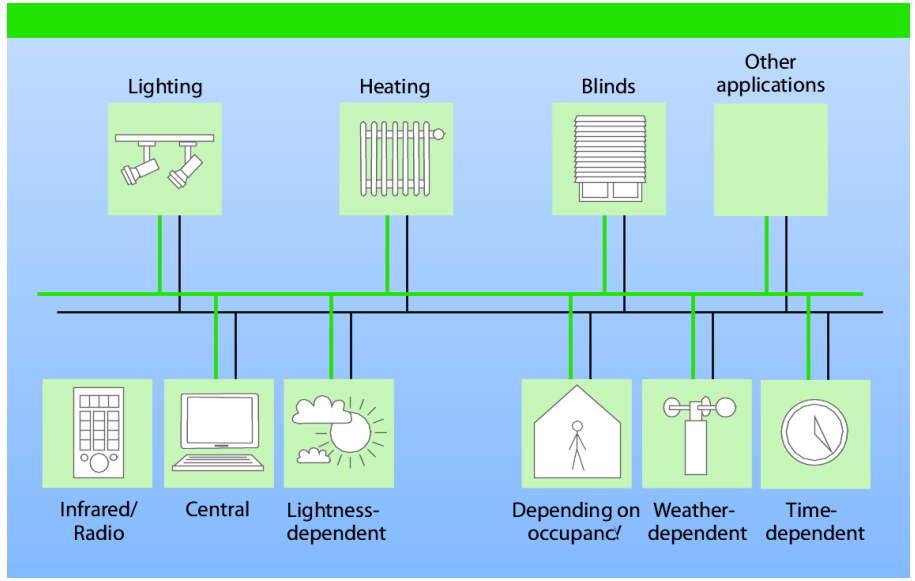
HW description

Areas of application for the various media

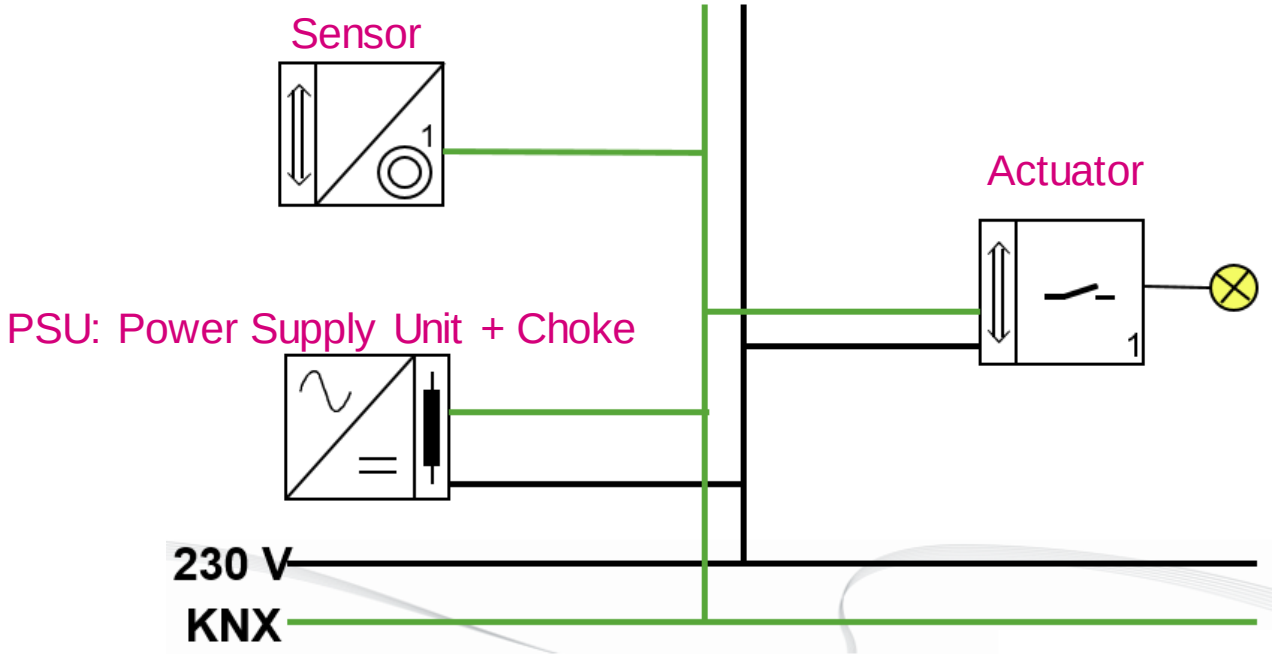
Medium	Transmission via	Preferred areas of application
Twisted Pair	Separate control cable	• New installations • Extensive renovations • Highest level of transmission reliability
Powerline	Existing network (Neutral conductor must be available)	• If no additional control cable can be installed • When 230 V cable is available
Radio Frequency	Radio line	• When no cables can be installed
IP	Ethernet/WIFI	• In large installations where a fast backbone is needed • For communication with mobile devices

KNX – Introduction to the TP technology

- One cable (green) parallel to the 230V cable
- The KNX green cable:
  - Connects sensors (switches) and actuators (loads)
  - Supplies power to the bus devices
- There is **no Central Unit**: each KNX device has its own intelligence
- KNX can be used both in small installations (flats) as well as large projects (hotels, administration buildings...)
- Configuration can be modified **anytime** (eg partitions moving, …)



Minimal structure of a KNX TP installation



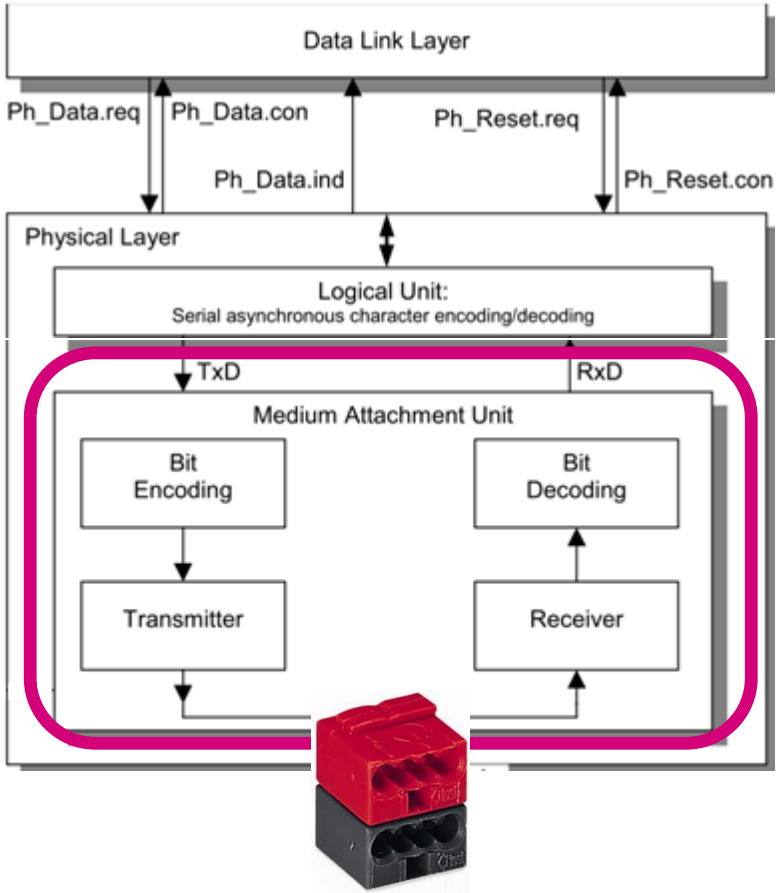
- The 230V is necessary at least for the Power Supply Unit
- Sensor: manual switch, temperature sensor, movement detector
- Actuator: Light relay, motor, …

Sensor/Actuator structure

- The Logical Unit converts the serial bit stream to bytes and vice versa

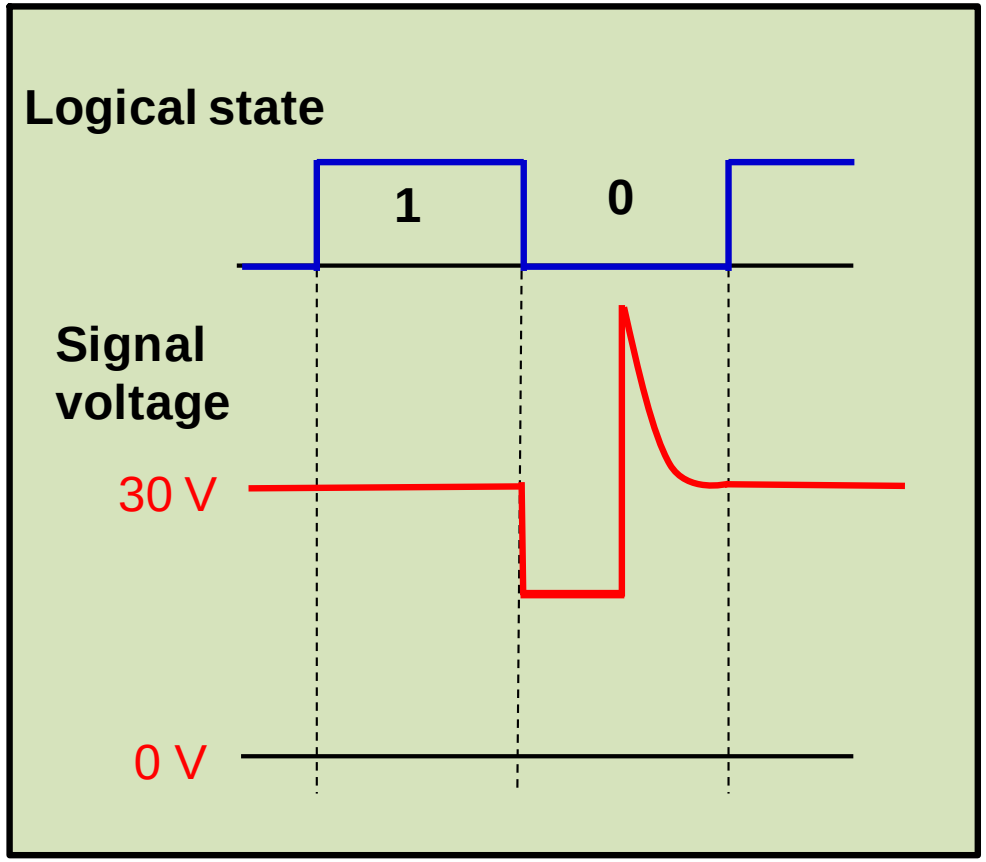
- The MAU (Medium Attachment Unit) **= STKNX**
  1. Converts digital serial stream into analog signals and vice versa
  2. Extracts DC power from the KNX bus

- A specific connector connects a device or a bridge to the KNX bus



KNX TP bit structure

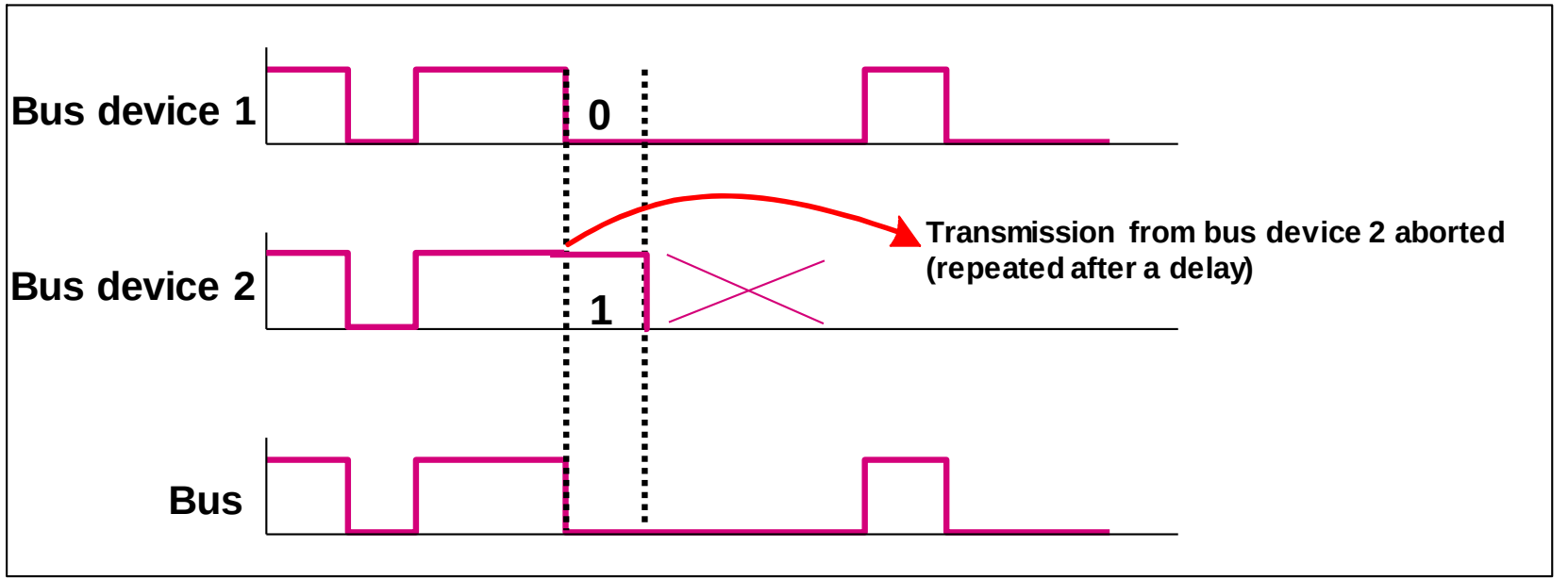
“0“ and “1“ are the two logical states a bit can have.



A Bit in KNX TP:
Logic “0“ → current drawn
Logic “1“ → no current drawn

This implies that – when several devices are sending simultaneously, the one sending a “0“ can continue to send

Telegram collision



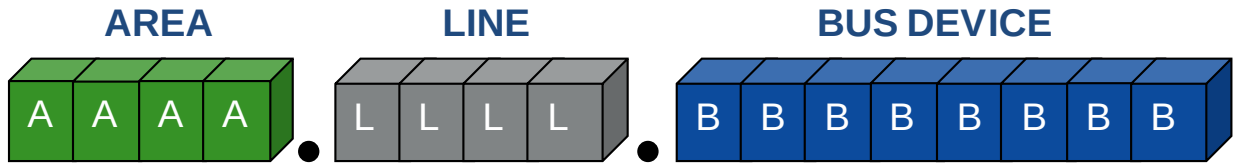
The bus devices listen to the bus while transmitting.

As soon as a bus device with the logical state ”1“ detects the logical state “0“ (=flow of current on the line), it stops transmitting to give way to the other sending device.

KNX addressing

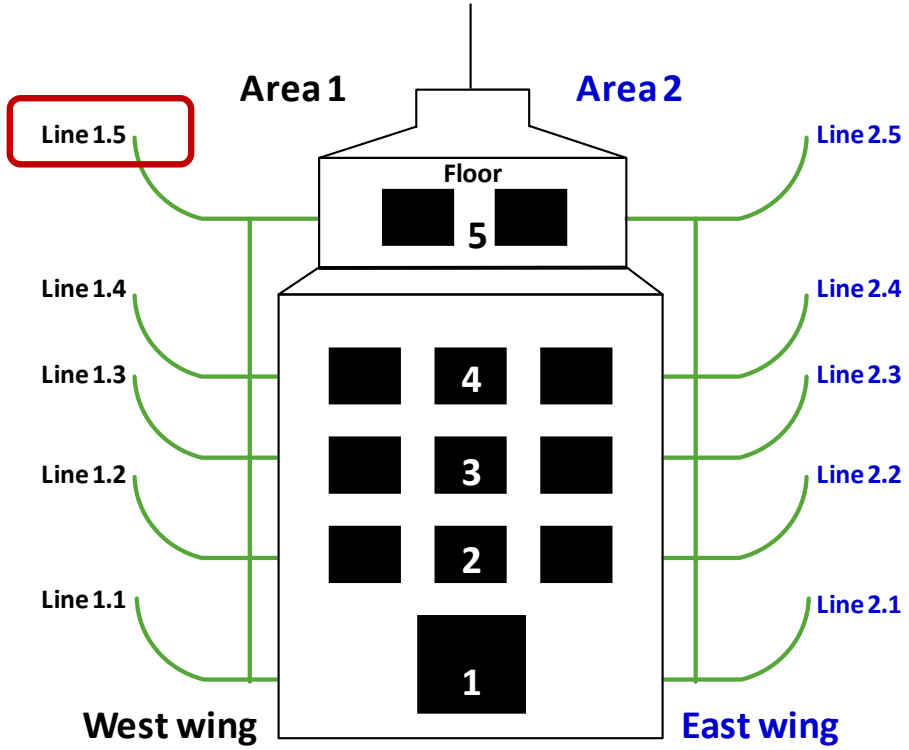
1. Individual address

Structure:



Possible values: 0…15 0…15 0…255

Example:



Area		Line		Bus Device
No.	Comment	No.	Comment	No.
0	Area 0	0	Backbone line	0..255
1	West wing	5	5th floor	0...255
		4	4th floor	
		3	3rd floor	
		2	2nd floor	
		1	1st floor	
		0	Main line West	
2	East wing	5	5th floor	0...255
		4	4th floor	
		3	3rd floor	
		2	2nd floor	
		1	1st floor	
		0	Main line West	

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1. Individual address

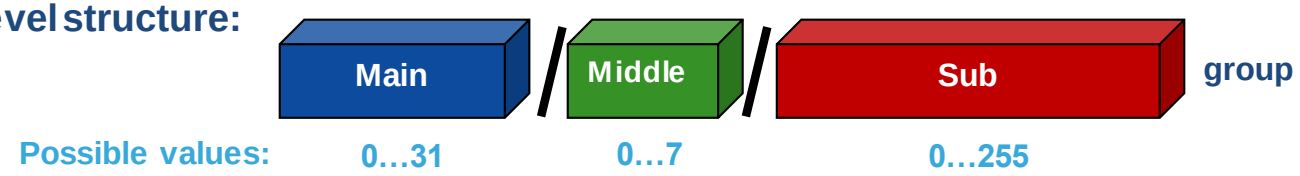
- The individual address is used during the commissioning stage (~ network installation): you assign 1 address per device connected on the bus

- The individual address is also used for the following purposes after the commissioning stage:
  - Diagnosis, error rectification, modification of the installation by reprogramming
  - Addressing of the interface objects using commissioning tools or other devices.

Important: The individual address has **no significance during normal operation** of the installation.

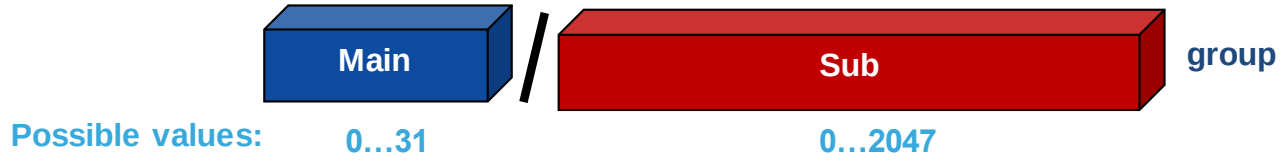
2. Group address = define a function

- **Choice 1: 3-level structure:**

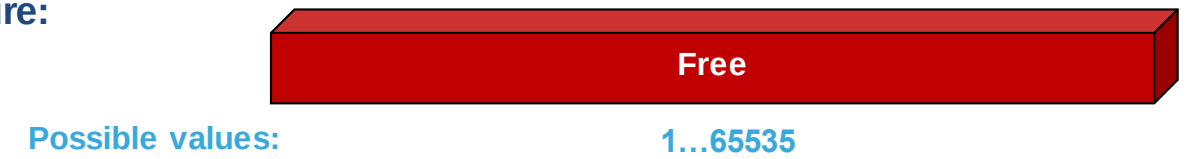


As an example: **Main** can be the floor number
Middle the type of function (light, heat, blind&shutters, etc…)
Sub can be the function (#1=light 1 control, #2=light 2 control, #3=shutter 2 control, etc…)

- **Choice 2: 2-level structure:**



- **Free structure:**



Adressing in KNX

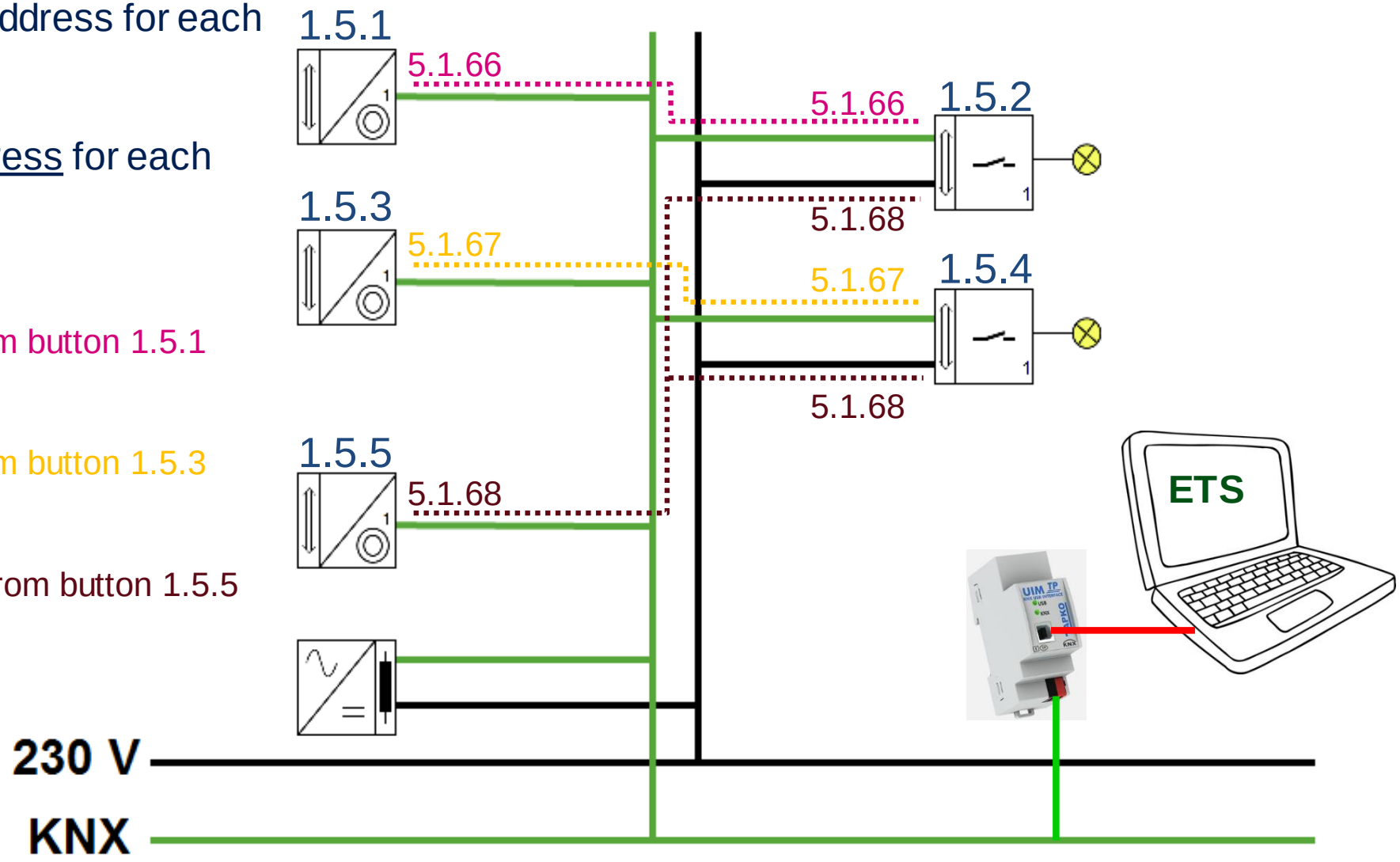
1- Assign a unique individual address for each sensor and actuator

2- Assign a unique Group Address for each function

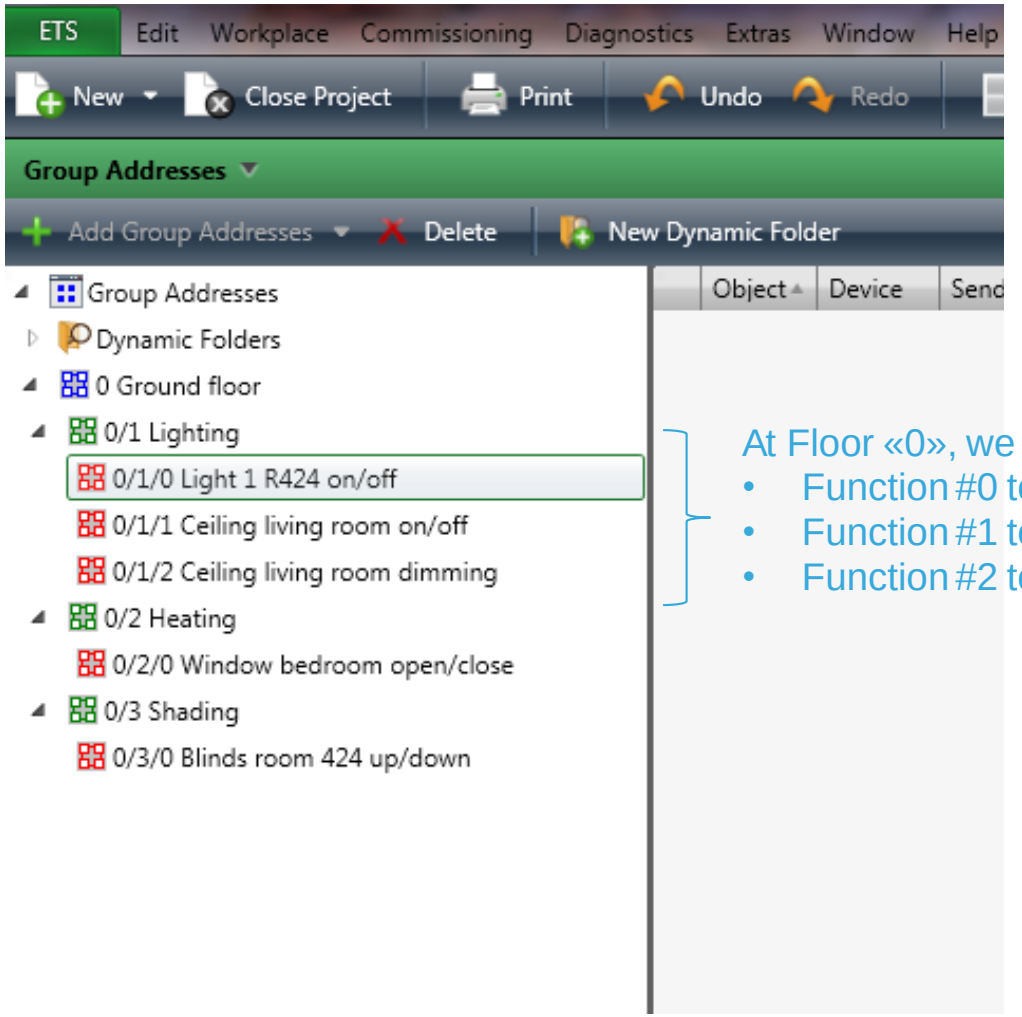
* Fonction 5.1.66
  =switch ON/OFF light 1.5.2 from button 1.5.1

* Fonction 5.1.67
  =switch ON/OFF light 1.5.4 from button 1.5.3

* Fonction 5.1.68
  =global lights switch ON/OFF from button 1.5.5



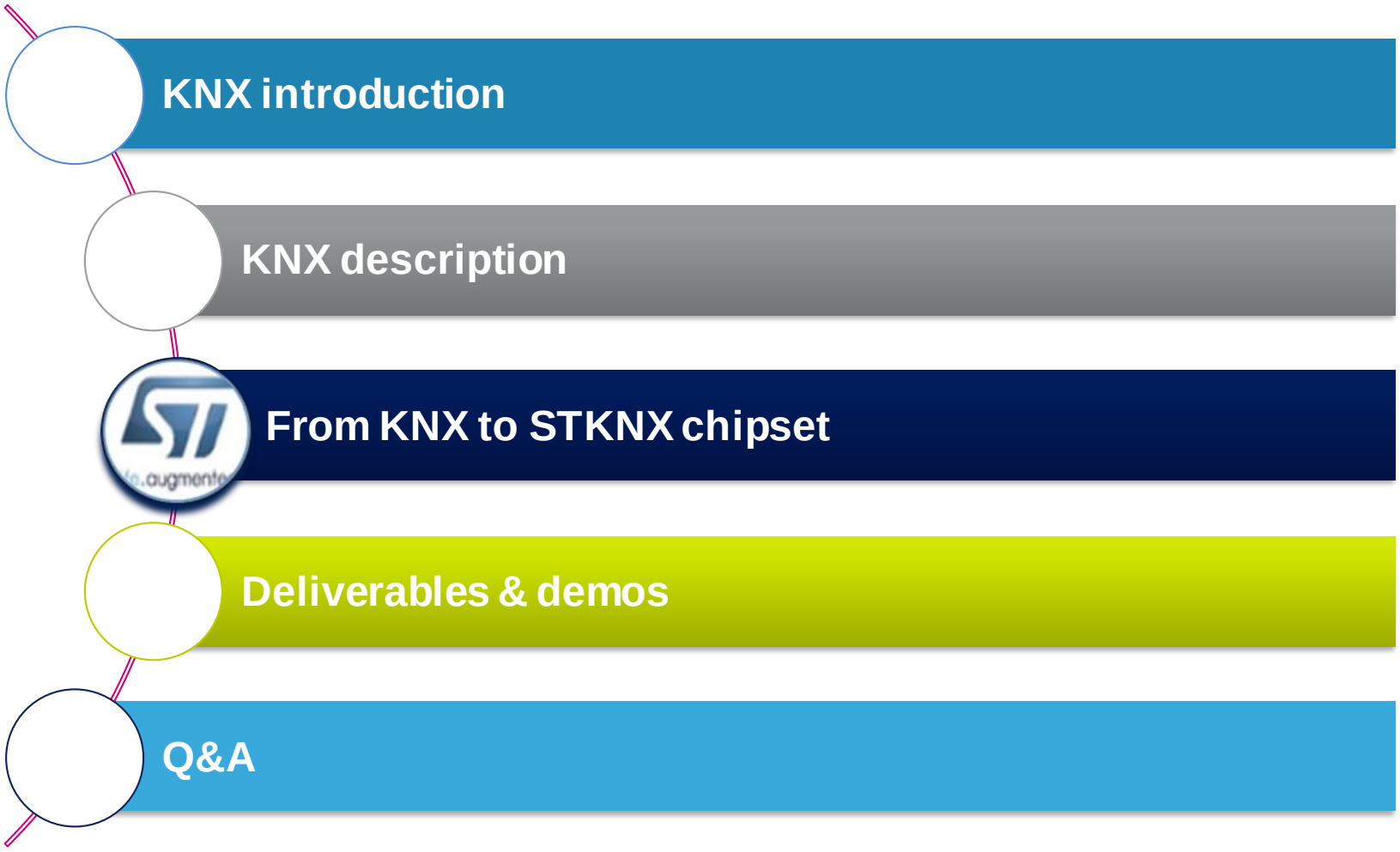
Example: structure of group addresses in ETS



At Floor «0», we have defined some light («1») fonctions :

- Function #0 to switch on/off Light 1
- Function #1 to switch on/off ceiling light
- Function #2 to dim ceiling light

Agenda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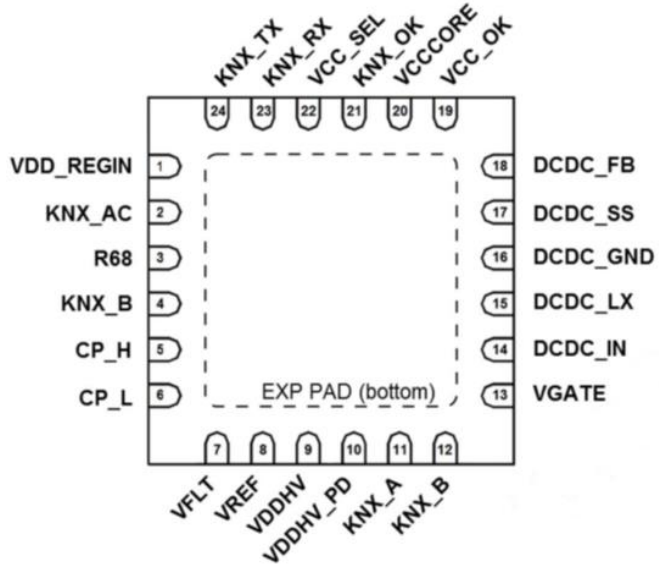
STKNX benefits

- TP1-256 KNX certified
- **Smallest solution** on the market (4*4 mm)
- **Low cost**
- Simple "Bit" interface to µC
- No crystal required



Competition

- TP-PHY

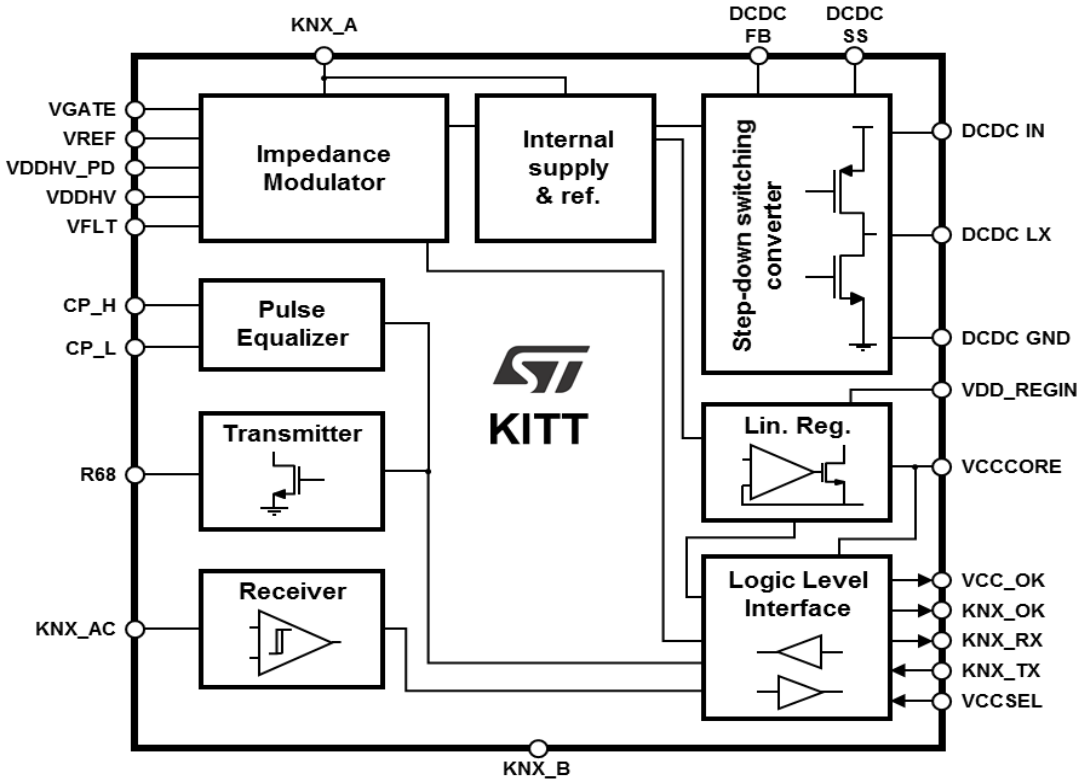
	µC i/f	Package	Pin count	Parts count	Crystal	Regulators	Fan-in max
ST Micro	Bit	4x4 x1	x24	x23	No	1 Lin 1 DCDC	30mA
ELMOS	Bit/UART/SPI	7x7 x1	x32	x17	Yes	1 DCDC	20mA
ON Semi	Bit/UART/SPI	6x6 x1	x40	x20	Option	1 Lin 1DCDC	40mA
Siemens	UART	6x6 x1	x36	x14	Yes	1 DCDC	40mA

STKNX description

- Application:
  - Integrated **twisted pair** KNX Transceiver for smart Home and building connectivity

- Main Features:
  - Supports bus current up to 30mA
  - 2 integrated **voltage regulators** for external use:
    - Selectable 3.3V / 5V – 20mA **linear regulator**
    - Adjustable 1V to 12V – 150mA high efficiency DC/DC
  - -40°C/+85°C operating temperature range

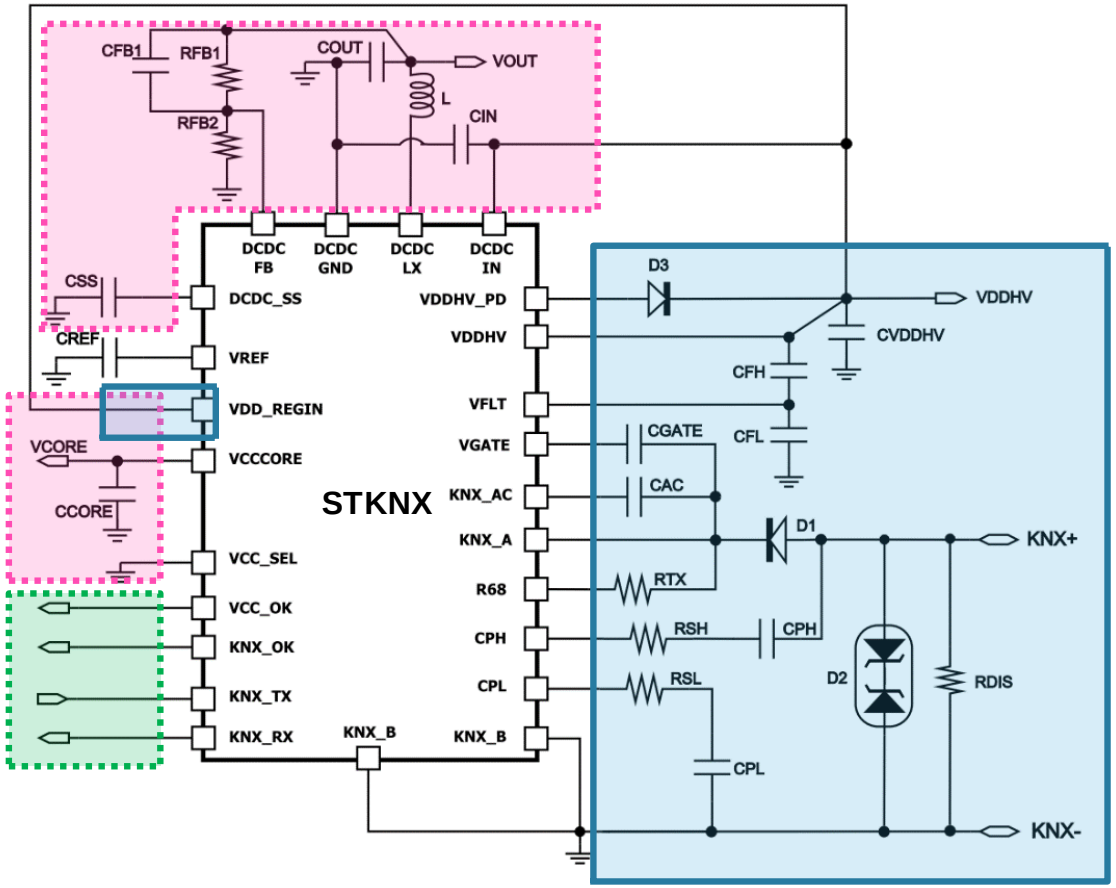
- Package:
  - 4x4 VQFNPN 24 leads



STKNX integrated transceiver

- Typical application circuit

- Voltage regulators
  - Buck converter with 1V ÷ 12V adjustable output – 150mA max
  - Linear regulator with 3.3V / 5V – 20mA max programmable output



- Bus interface
  - Impedance modulator / power extractor
  - Receiver
  - Transmitter
  - Pulse equalizer

KNX bus

Choke

PSU

- µC interface
  - TX input
  - RX output
  - KNX_OK and VCC_OK output

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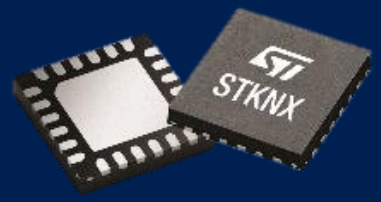
STKNX complete solution

STKNX



Twisted Pair Transceiver

Certification March 2017

STM32

Wide choice of µController

STM32 dvt ecosystem

KNX stack

Partnership with

TAPKO TECHNOLOGIES GMBH

KAIStack SW support

Closed partnership with **TAPKO**:

- Join design of the chipset
- STKNX has been certified with TAPKO stack, by TAPKO
- TAPKO promotes our chipset with their customers (ISE)

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STKNX promotion

Benefits of using the TAPKO stack:

- **The platform is certified**, including STM32: reduced cost for product certification
- TAPKO has certified the platform with a lot of profiles to fit all cases
- The stack can be provided as a binary or as a full source → direct support from TAPKO
- The price is much cheaper than a certification - No royalties on the stack

If the customer wants to use its own KNX stack:

- He must certify its stack (physical HW certification + Link layer ~ 50K€)
- The bit interface is specific, with strong real-time constraints on Host side
- No FW support

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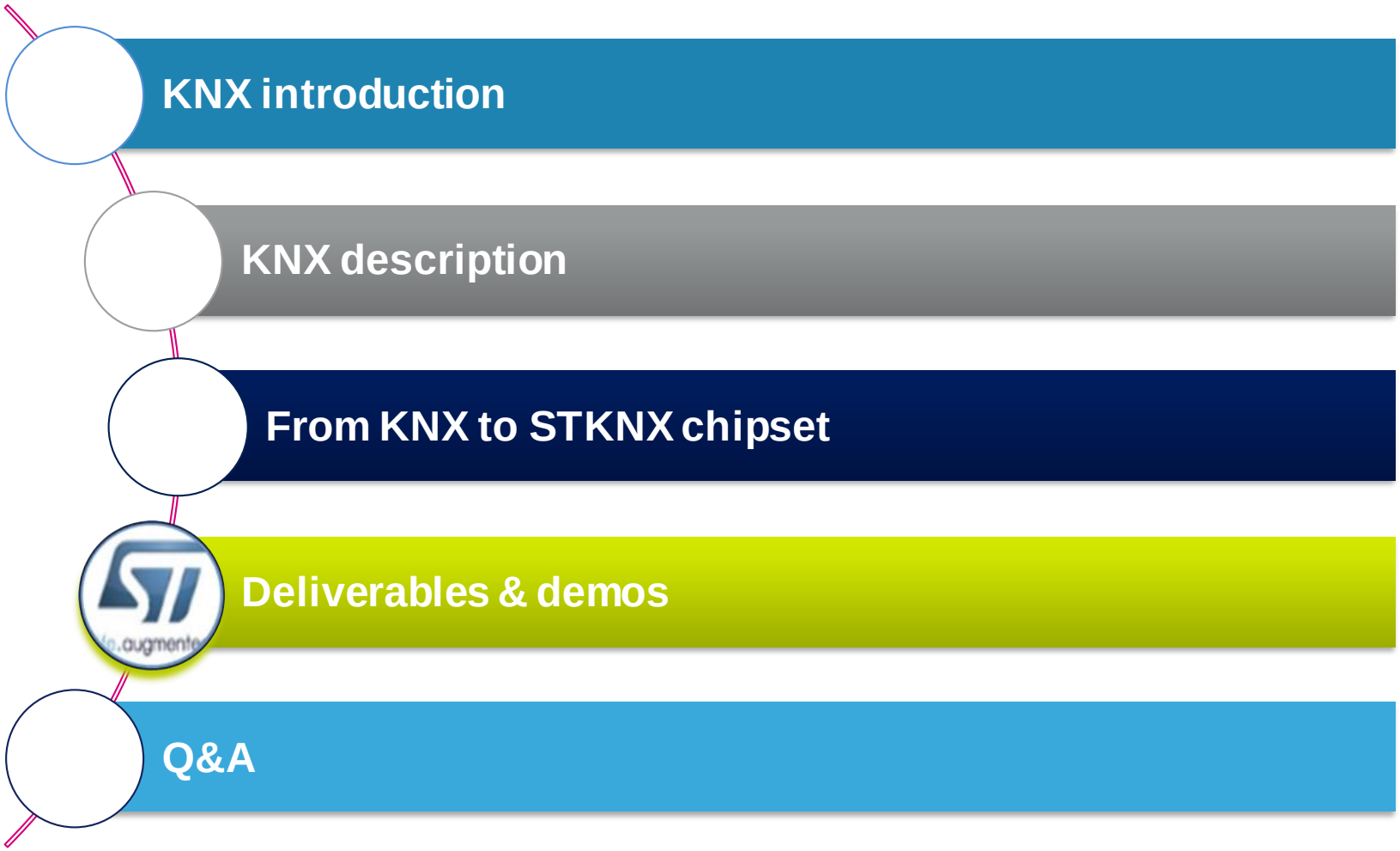
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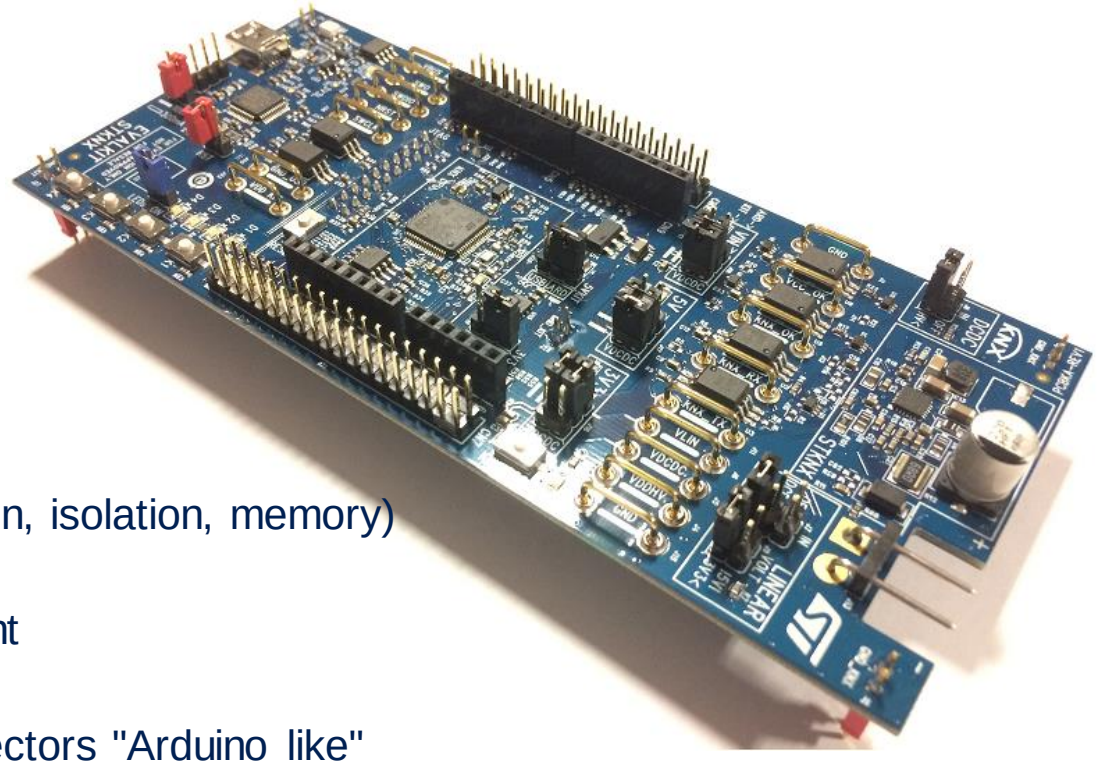
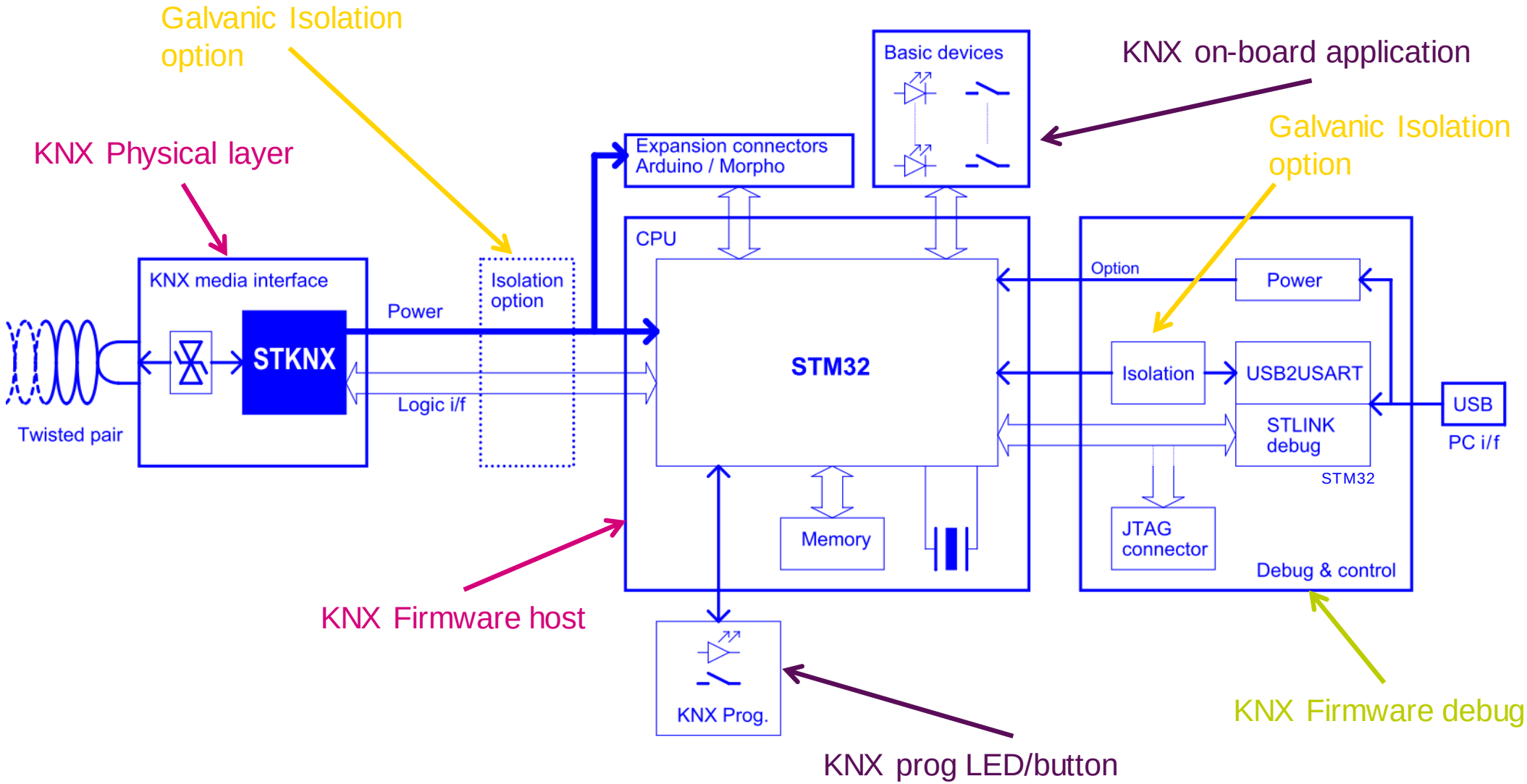
EVALKITSTKNX purposes

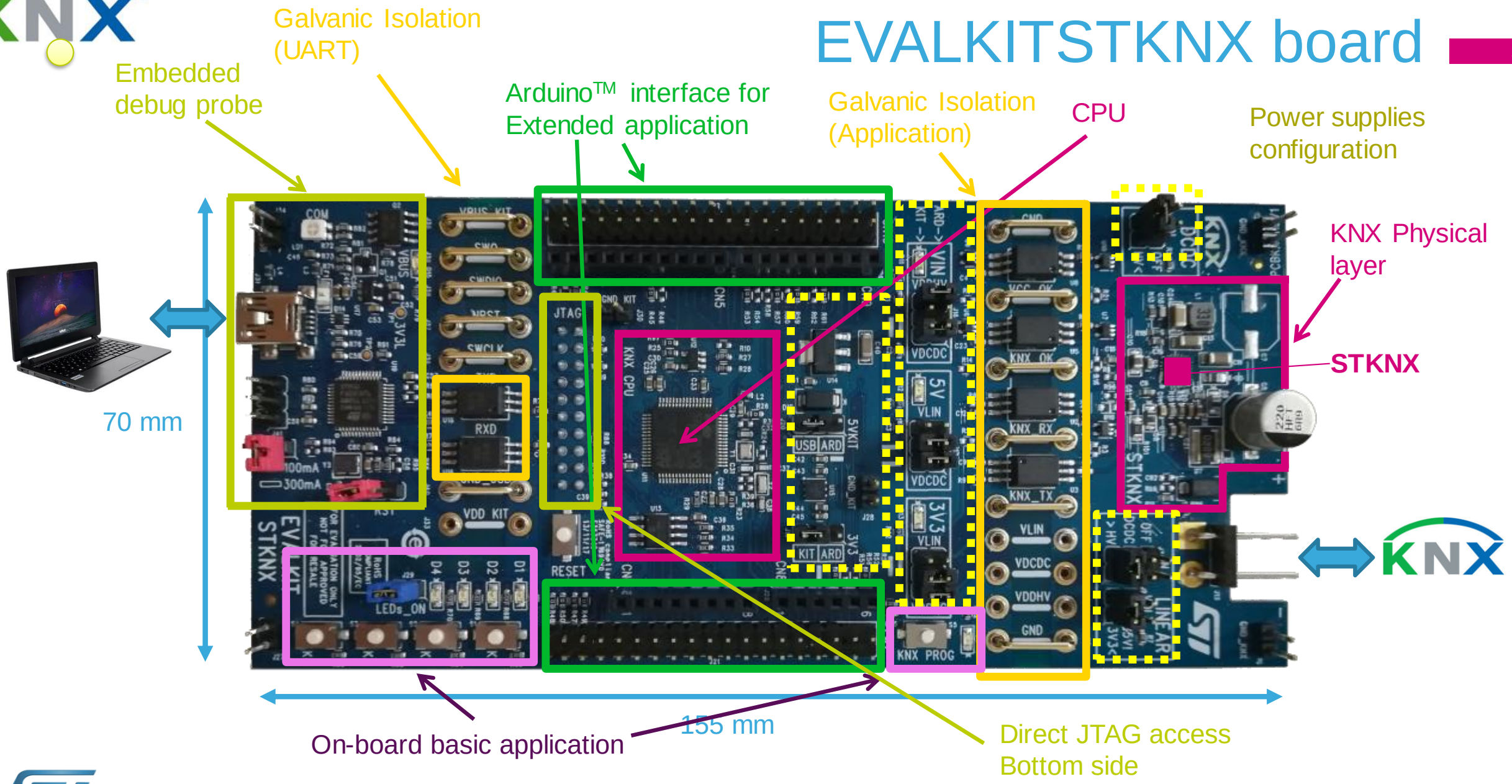


- Evaluate STKNX performances
- Evaluate basic KNX node (demo FW included)
- Develop/Debug your own KNX application FW (no probe needed)
- Test every STKNX possible hardware configuration (supplies, fan-in, isolation, memory)
- Supply the kit from single USB cable for "on desk" FW development
- Build your own prototype of KNX device thanks to extension connectors "Arduino like"
- STKNX area routed with x2 copper layers for reference layout

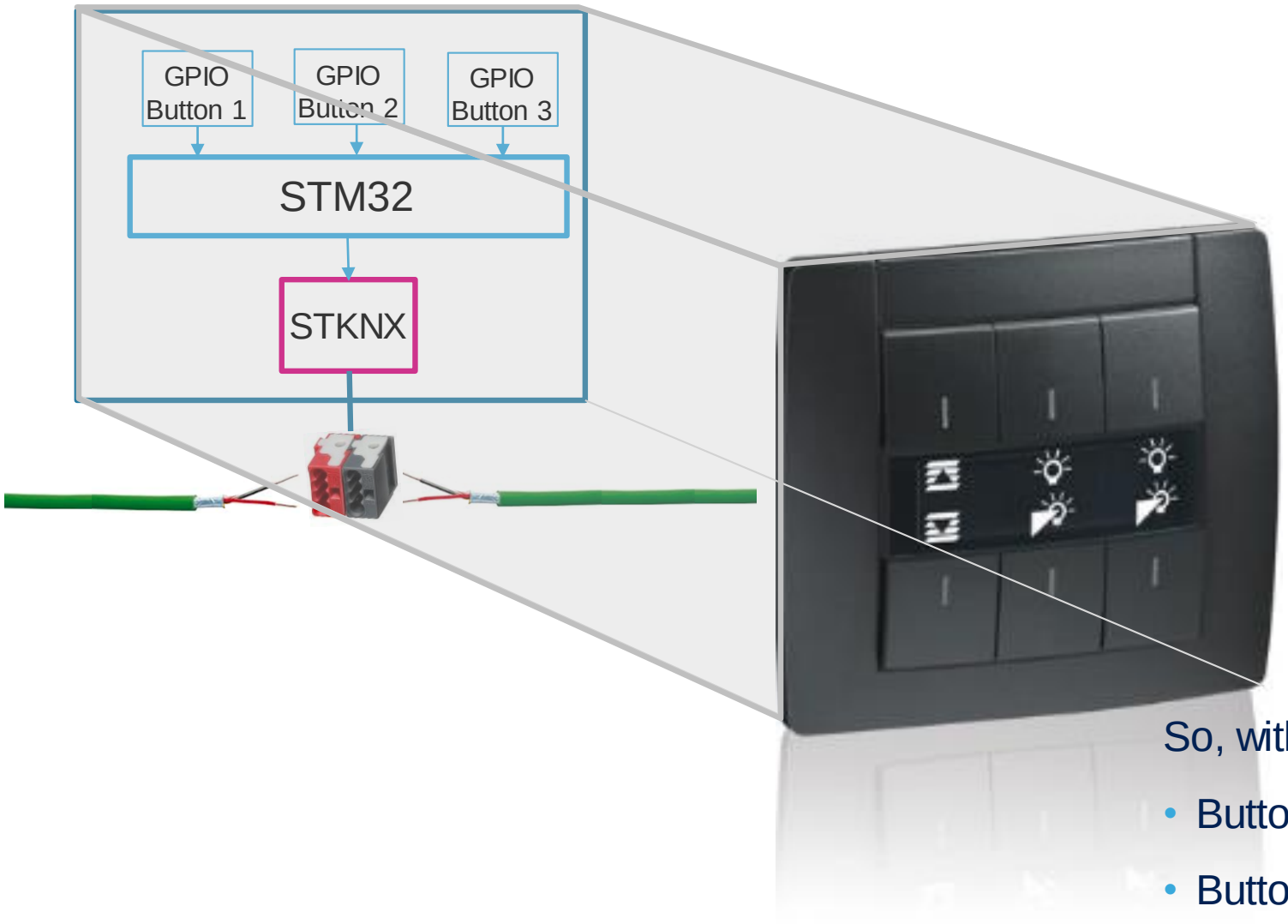
EVALKITSTKNX block diagram



EVALKITSTKNX board



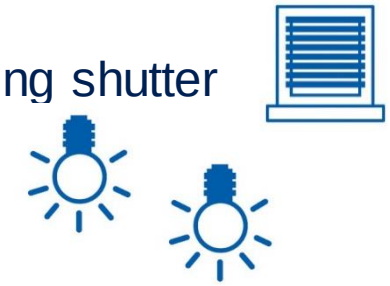
STKNX application example



- STM32 gets information from the 2 buttons (on/off, up/down)
- Thanks ETS tool, each button has been assigned to 1 function, into 1 group address
- STM32 will send button state change over KNX bus, through STKNX: the actuator(s) assigned into the same group address will interpret the command

So, with only a 2 wires bus:

- Button 1 could control the rolling shutter
- Button 2 could control light 1
- Button 3 could control light 2



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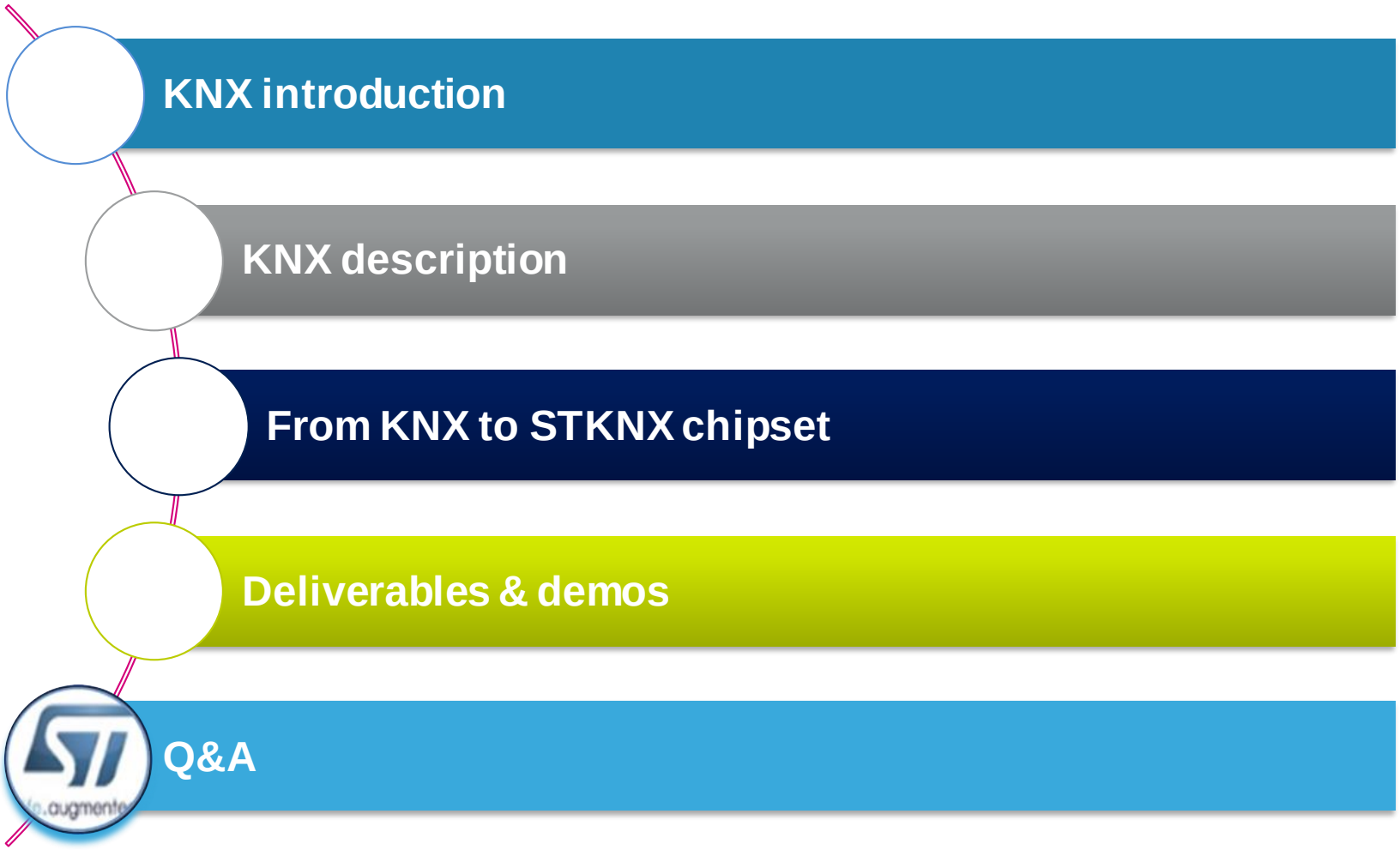
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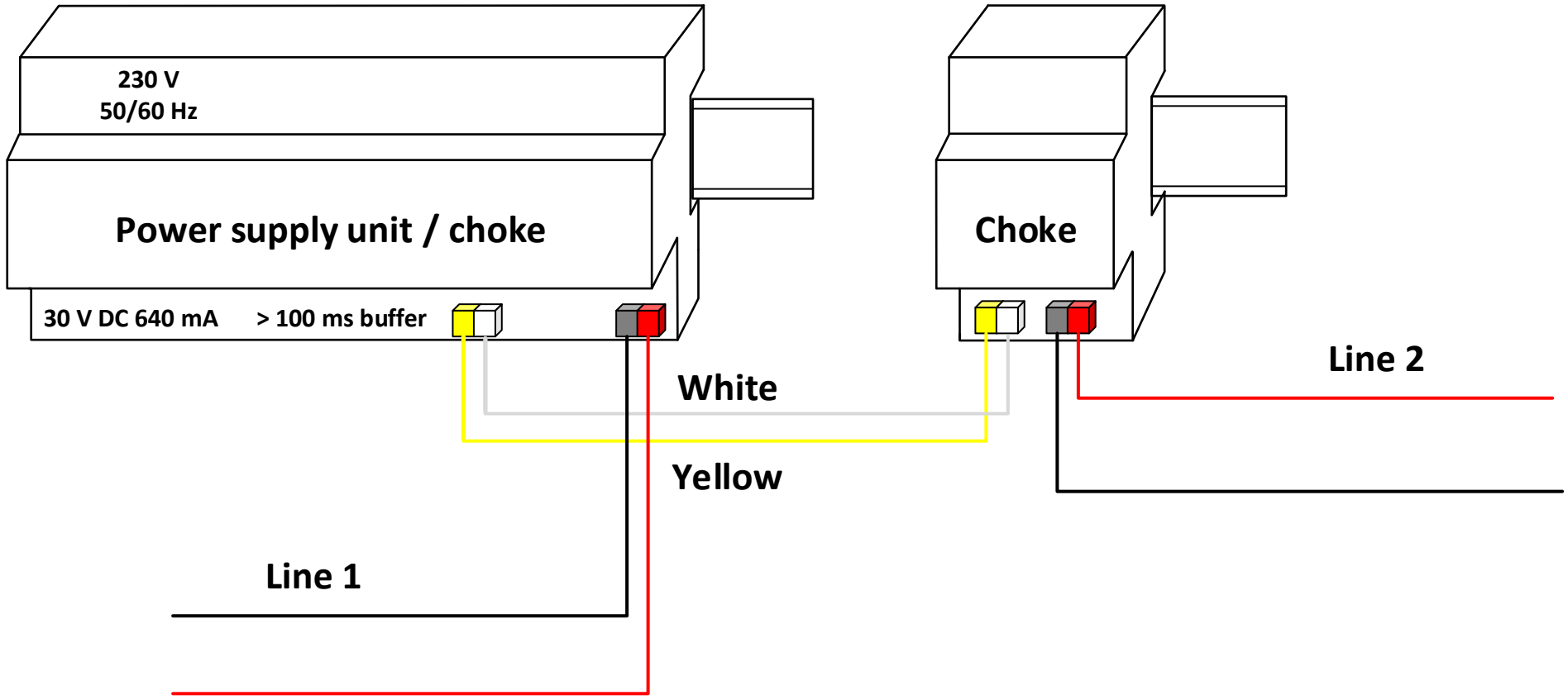
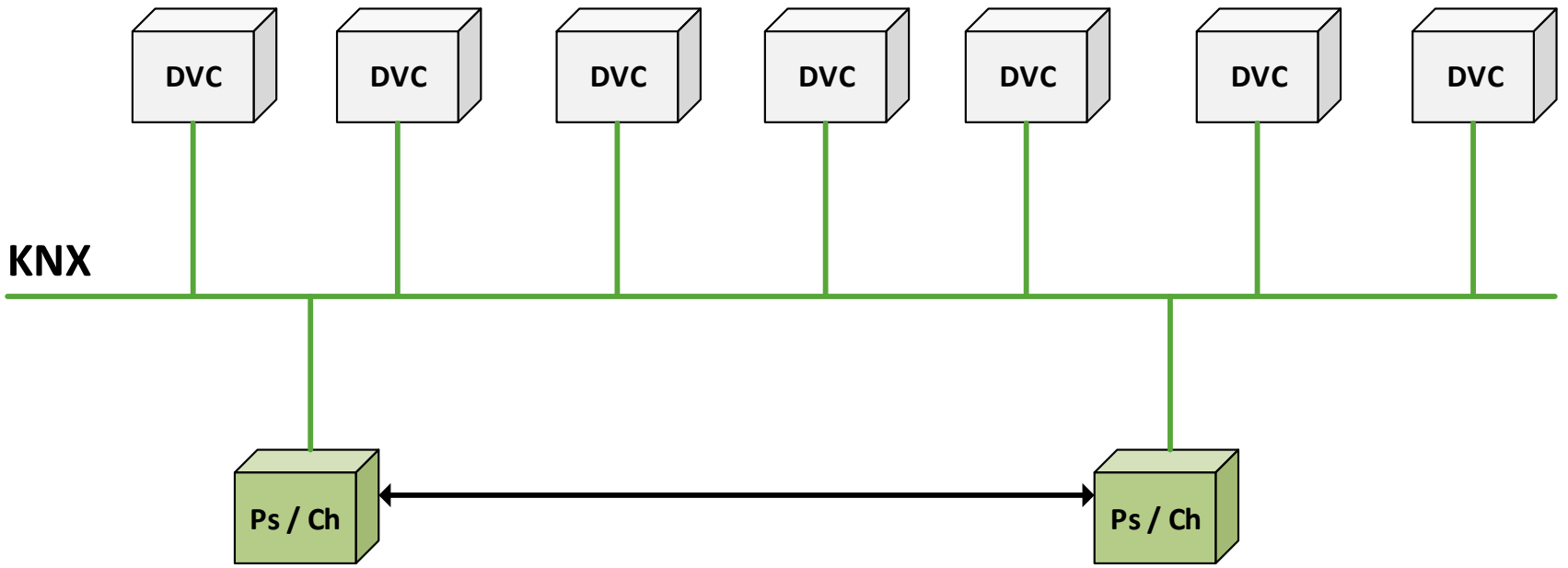
ANNEX

Power supply for two lines



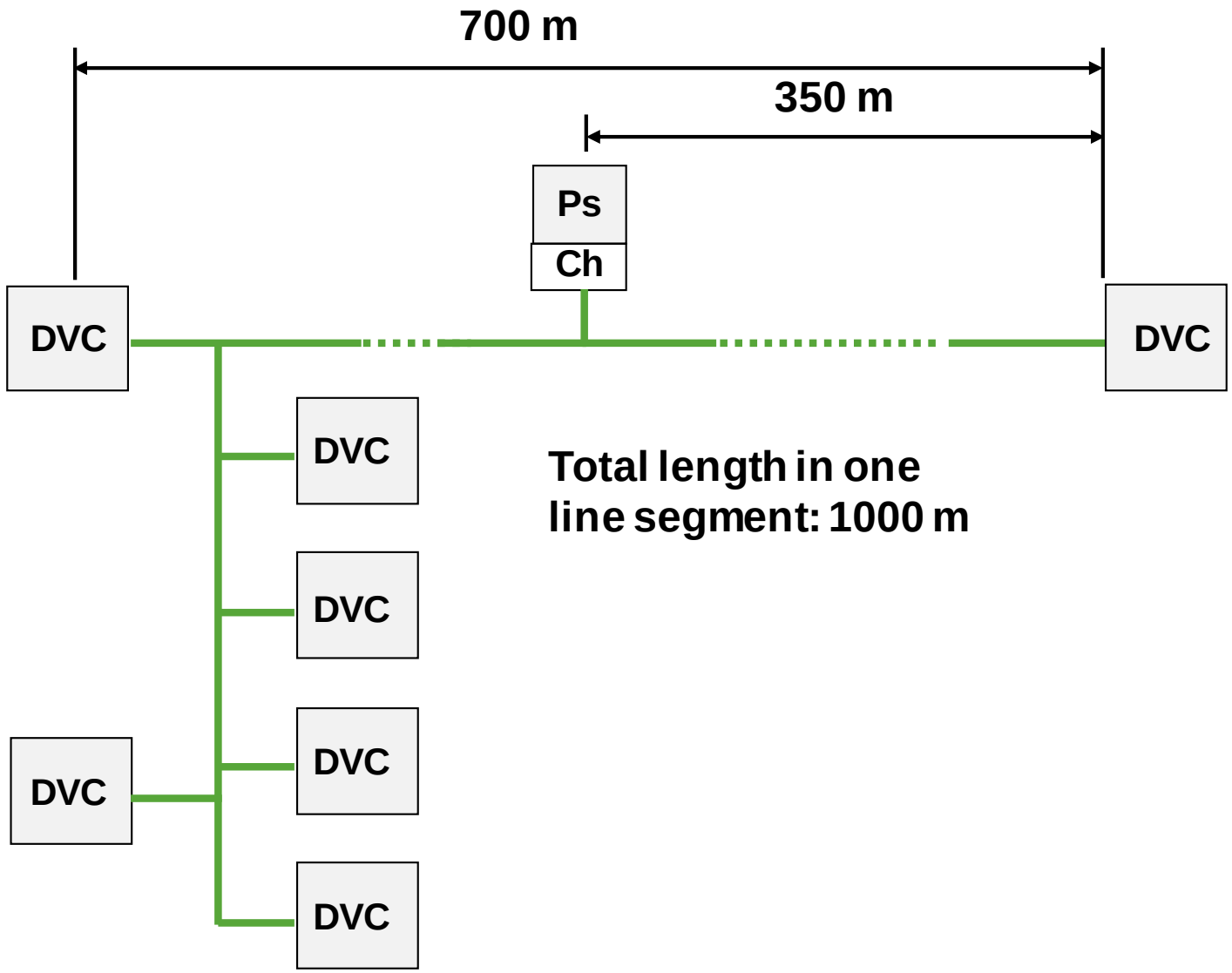
Two power supply units on one line



Minimum distance between power supplies as specified by the manufacturer

- Each device shall declare its maximum consumption by multiple of 10mA (fan-in)
- Each PSU shall declare its maximum output current by multiple of 10mA
- The parameter name is fan-in: 1 ⇒ 10mA, 2 ⇒ 20mA, etc …
- Fan-in allows to select correctly the Power supply according to attached devices

Max. cable lengths in a line segment



KNX TP1-256 system parameters

Parameter	Characteristics
Topology	Linear, Star, Tree or mixed – no termination needed
Baud Rate	9600 bps
Devices supplying	Normal: bus powered devices Optional: **RPD** Remote Powered Devices
Device power consumption	3mA to 12mA (x fan-in)
Power Supply Unit	DC 24V rated, 30V max
Nb of PSU's per physical segment	max. 2
Number of connectable devices per physical Segment	max. 256
Nb of addressable devices per physical segment	max. 255
Total cable length per physical segment	max. 1000m
Distance between 2 devices	max. 700m
Total number of devices in a network	Over 65000
Protection against shock	SELV: Safety Extra Low Voltage
Physical signal	Balanced baseband signal encoding