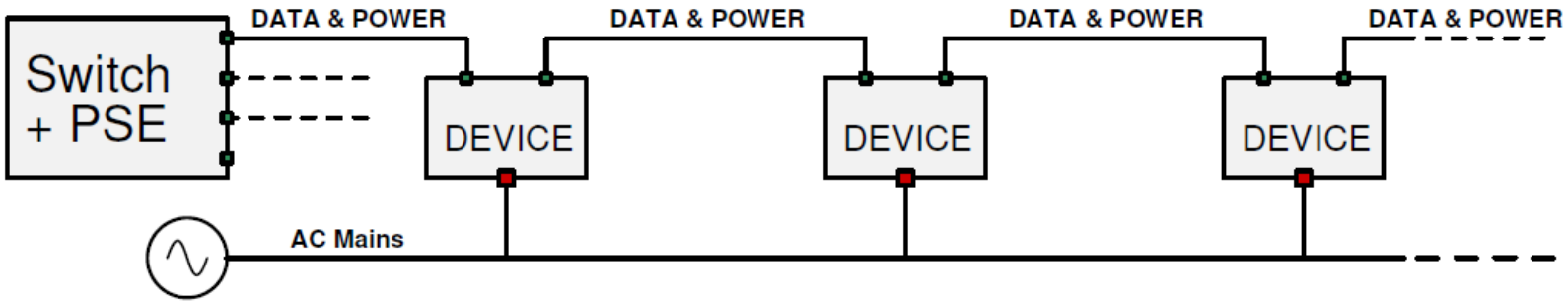
SPMD Usecase Library

Usecases

Name	**Contact**	**Affiliation**
Prof. Lighting controls	Lennart Yseboodt	Signify
Industrial Sensor Networks	Christopher Pohl	Beckhoff Automation
Industrial In-Cabinet Use Case	Bill Martin	Rockwell Automation
Elevators	Ari Kattainen	Kone

Library

Usecase: Prof. Lighting controls



Devices (luminaires, sensors, …) are connected in passive linear topology. DALI carries a limited amount of power, and offers bus based data at very low data rate.

Requirements for 10BASE-T1:

1. **Redundancy:** Device fault doesn't interrupt data & power flow
2. **Power:** Mains failure doesn't interrupt data & power flow
3. **Topology:** Linear wiring possible (active or passive)

Presentation: <URL>

Usecase: Prof. Lighting controls

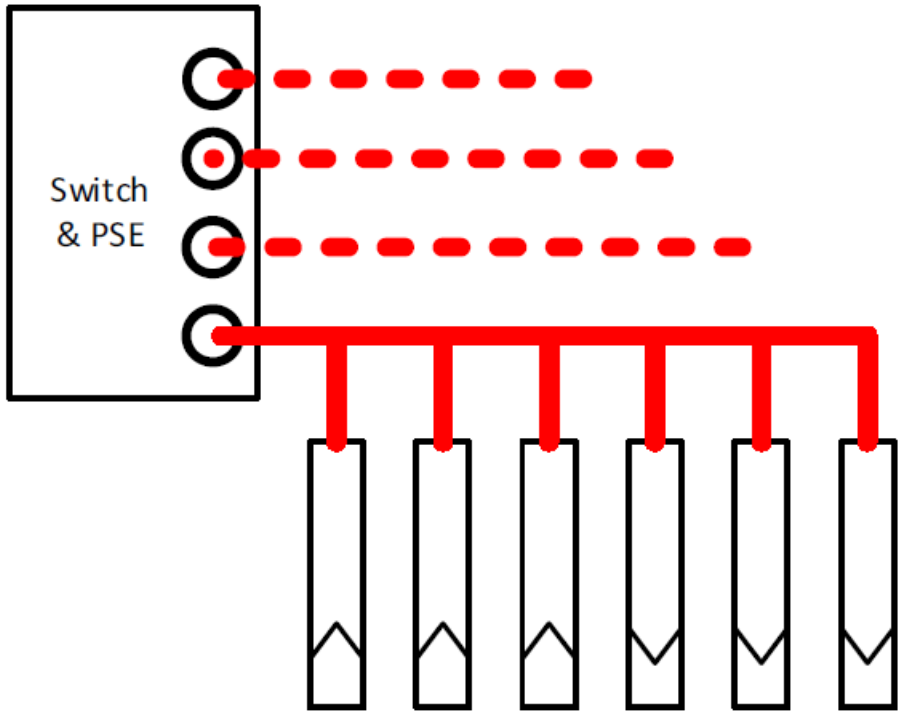
Item	Min Value	Desired value	Extra information
Supported nodes on one mixing segment	8	16	
Minimum supported cable length	30	50	
Acceptable cable gauges	#28 to #23		
Required power for a node	5	More=better	
Required initial power allocation	1W	1.5W	1W per current understanding of power requirements of 10BASE-T1
60V voltage OK ?	Yes		
Interoperability level for the application	Plug&play		
Pass through or T connection	Passthrough		Passthrough is preferred due to installer familiarity
Hotpluggability	Required		
Possible market (in #nodes/year)			

Presentation: http://www.ieee802.org/3/10SPE/public/Nov2016/yseboodt_10spe_01_1116.pdf

Usecase: Industrial Sensor Networks

- Lower end multidrop bus **including power**
- Easy to wire in the field
- Small footprint

- Significantly reduce wiring cost
- Allow for more sensors in the field (condition monitoring, predictive maintenance, IIOT, …)



Presentation: http://www.ieee802.org/3/SPMD/public/sep19/spmd_pohl_01_0919.pdf

Usecase: Industrial Sensor Networks

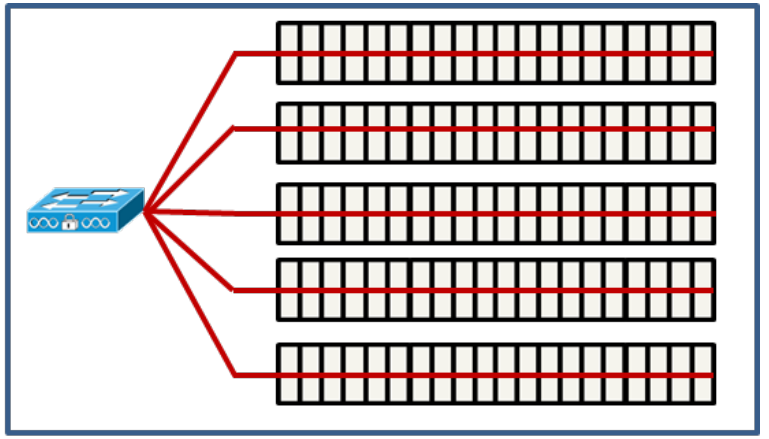
Item	Min Value	Desired value	Extra information
Supported nodes on one mixing segment	8	32	
Minimum supported cable length	50	75	
Acceptable cable gauges	#24 to #18		
Required power for a node	2W		Tolerating current peaks from (e.g.) solenoid switching is more important than greater overall power
Required initial power allocation	~0.15W + PHY	~0.25W + PHY	
60V voltage OK ?	Yes **		24V tolerated in engineered solutions + what kind of tolerance is generally attached to 60V?
Interoperability level for the application	engineered		
Pass through or T connection	T		
Hotpluggability	Required		
Possible market (in #nodes/year)	3 million +		

Presentation: http://www.ieee802.org/3/SPMD/public/sep19/spmd_pohl_01_0919.pdf

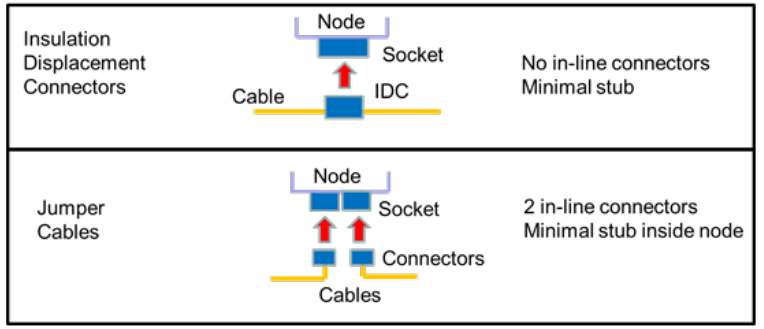
Usecase: Motor Control Cabinet

- A typical cabinet might contain 5 rows of 20 devices
- Low port count switch serves the segments.
- Replace 100 wires with 5 multidrop modular connections
- Reduces material costs, cabinet size, assembly time, etc.

- Low voltage contactor 2020 market projection - $5B
  - technology.ihs.com/581715/contactors-database-2017
- Overload protection device 2020 market projection - $1B
  - technology.ihs.com/515493/overload-protection-devices-database-2017
- Industrial Edge Networking (Source: IHSMarkit)
  - Ethernet connected nodes CAGR 2016-2021: 15.4%
  - L2 Managed Switches CAGR 2018-2024: 13.9%



Example logical topology



Example connectivity options

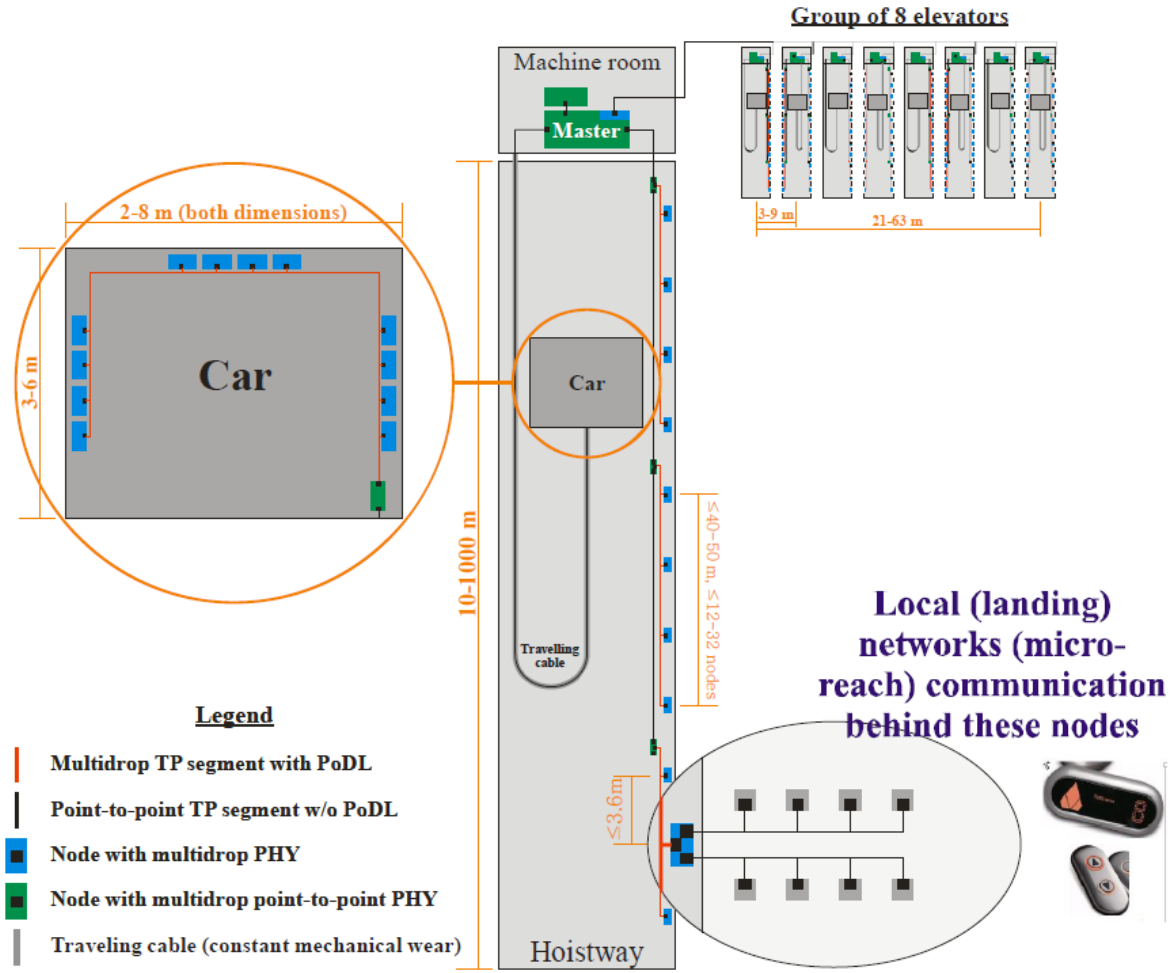
Presentation: http://www.ieee802.org/3/SPMD/public/sep19/martin_SPMD_01_0919.pdf

Usecase: Motor Control Cabinet

Item	Min Value	Desired value	Extra information
Supported nodes on one mixing segment	40	64	
Minimum supported cable length	25	75	
Acceptable cable gauges	#24 -#20		
Required power for a node	0.5W	1W	
Required initial power allocation	0.5W		
60V voltage OK ?	No		
Interoperability level for the application	Engineered		
Pass through or T connection	T connection		
Hotpluggability	Required		
Possible market (in #nodes/year)			

Presentation: http://www.ieee802.org/3/SPMD/public/sep19/martin_SPMD_01_0919.pdf

Usecase: Elevators



Presentation: http://www.ieee802.org/3/cg/public/Nov2017/kattainen_huszak_3cg_01b_1117.pdf

Usecase: Elevators

Item	Min Value	Desired value	Extra information
Supported nodes on one mixing segment	16	24	Current RS485 product max config. is 1+16 nodes, 5 m cable between nodes and 100W power at 24VDC and 4A.
Minimum supported cable length	50	75	4m cable x 12 floors
Acceptable cable gauges	24 to 16		Equals to 0,25 to 1,5 mm2
Required power for a node	5W	More=better	Separate wires for power are acceptable
Required initial power allocation	1W	1,5W	
60V voltage OK ?	Yes, desired value 24VDC		Currently 24VDC is standard in Elevator applications.
Interoperability level for the application	Engineered		
Pass through or T connection	Pass through		
Hotpluggability	No		Node physical order in the chain needs to be known. Current solution is seprate output to input wire between nodes.
Possible market (in #nodes/year)	30 000 000 nodes		Total world wide elevators market is 1 000 000 per year having average 30 mixing segment nodes. Currently dominated with RS485, CAN and proprietary serial.

Presentation: http://www.ieee802.org/3/cg/public/Nov2017/kattainen_huszak_3cg_01b_1117.pdf

Supplemental Material

Industrial Sensor Networks: 60V

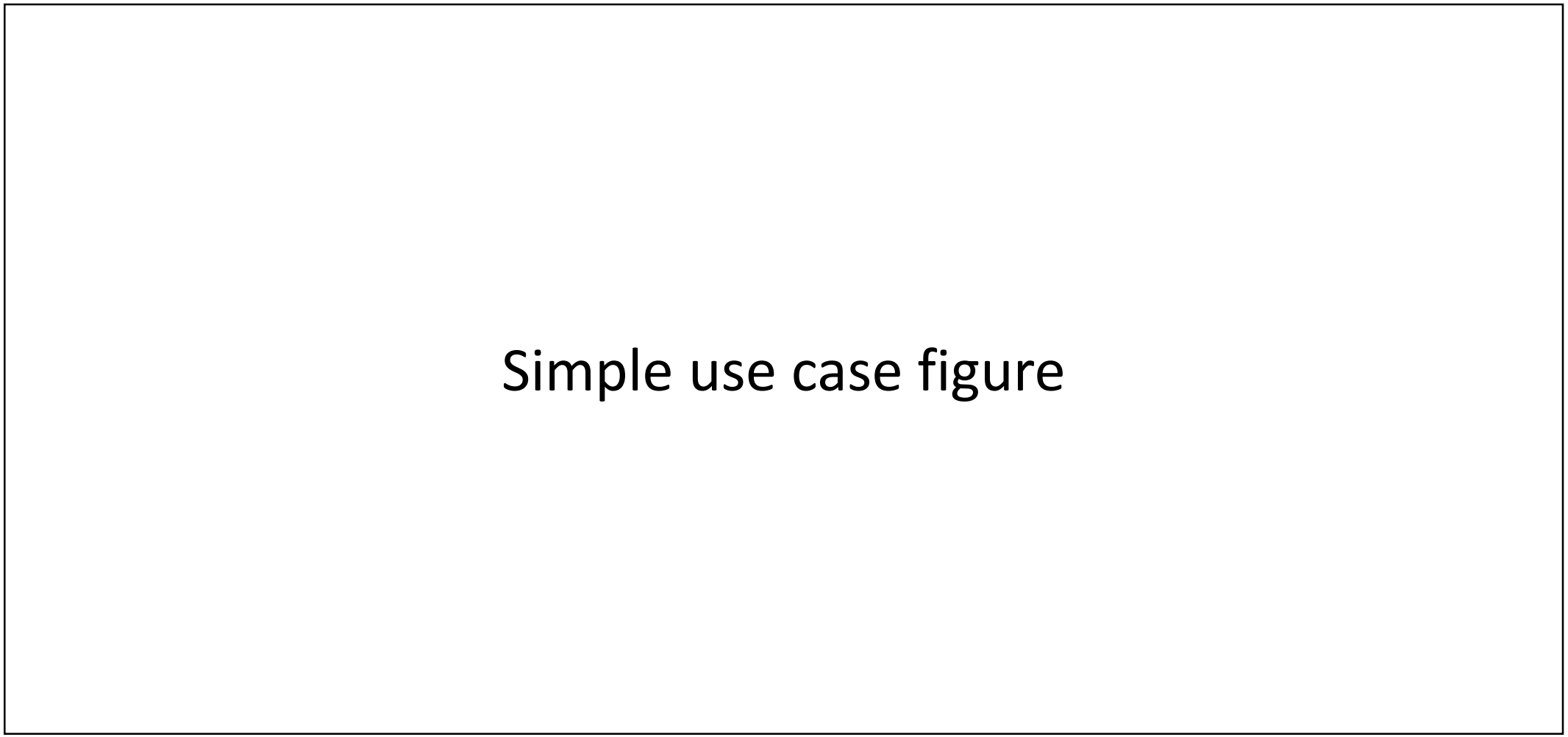
- Industrial 24V is defined with a tolerance (-15%/+20%)
- This is required for any non-theoretical use case because of
  - SELV is 60V DC and below!
  - All components (e.g. power supplies!) come with a tolerance
  - Varying resistances, e.g. due to cabling
  - Alien noise + communication over power line
  - …
- Therefore, it looks like 48V (-15%/+20%) to me, allowing for SELV designs
- Also: wide input voltage range supply components up to 60V are readily available

Industrial Sensor Networks: Stub Lengths

- In Indianapolis, up to 10m were discussed
- This is not possible in any pratically feasible bus with more than a few 100 kBaud because
  - Impedances at the taps don‘t match
  - Results in reflections
  - Results in loss of signal strength
  - Can only be handled by a lot of electrical trickery and strict rules… not feasible
- → Stubs must be very few cm

Template

Usecase: <TITLE>



Usecase: <TITLE>

Item	Min Value	Desired value	Extra information
Supported nodes on one mixing segment			
Minimum supported cable length			
Acceptable cable gauges			
Required power for a node			
Required initial power allocation			
60V voltage OK ?			
Interoperability level for the application			
Pass through or T connection			
Hotpluggability			
Possible market (in #nodes/year)			

Presentation: <URL>

Item	Description
Supported nodes on one mixing segment	Indicate the numbers of nodes on a single mixing segment. The minimum reflects the number of nodes needed for the usecase to make sense. The desired value represents a natural fit for the application. Both numbers could be the same.
Minimum supported cable length	Is the length you need between the two furthest nodes on the mixing segment.
Acceptable cable gauges	What cable gauges can be accepted for the application (consider cost, size, bend radius, …)
Required power for a node	How much power is needed in the node to run the application. This is the power level as measured at the connector of the device. Note that there may be a rectifier or other elements that cause some loss (2% to 5% typical).
60V voltage OK ?	Is it acceptable for the input voltage to be up to 60V ? If not, what is the reason ?
Required initial power allocation	Because this is a bus powered system, a node needs to be permitted to draw some amount of power after being plugged in. This power is used to communicate with the PSE about the power requirements. The system should be able to operate it's PHY with this power. How much power do you foresee to need for this. This is different from the "Required power for a node" which is about the complete power need of the device.
Interoperability level for the application	Choose between "plug&play" or "engineered" system. Plug & play means that a compliant device works when connected to a network of other compliant devices. There is no need for configuration or to verify if devices will be compatible or not. Engineered system means that you will use the standard within your own products or that the end user can determine which devices will work in the system.
Pass through or T connection	See slide 4-6 of http://grouper.ieee.org/groups/802/3/SPMD/public/sep19/spmd_cjones_01_0919.pdf If the application cannot be equipped with two connectors, select T connection. If it must be possible to live connect a new node without disconnecting other nodes, also select T connection.
Hotpluggability	Should it be supported to connect new devices while the bus is powered and guaranteed that this does not cause devices to be interrupted (eg. Reboot, lose long stretches of data). If not required, select no.
Possible market size	Potential market expressed in number of nodes. Do not express this in currency of any kind due to IEEE SA rules.

Thank You