

1 pair or 2 pairs for RTPGE: Impact on System Other than the PHY Part 1: Weight & Space

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Motivation

- This slideset compares the impact the decision to use 1 pair or 2 pairs for RTPGE has on the system other than the PHY
- The 5 principle comparison criteria are:

- The logic performance
- The EMC performance
- The power consumption
- The weight and space use
- The (relative) costs

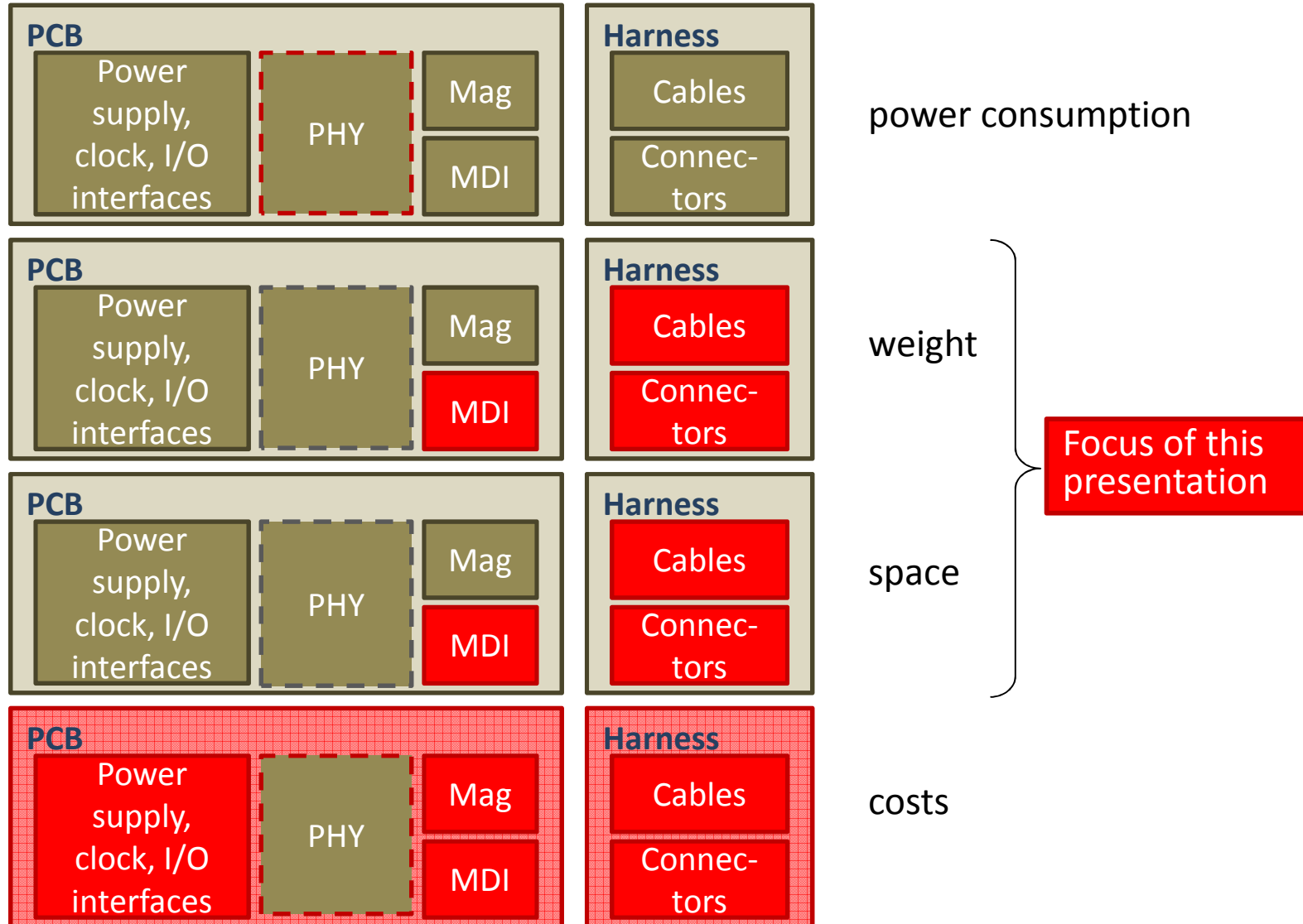
Mainly PHY concepts related and therefore not considered in this presentation

Part 1: Focus of this presentation

Potential Part 2

Relevant aspects for system comparison other than PHY

Elements Considered for

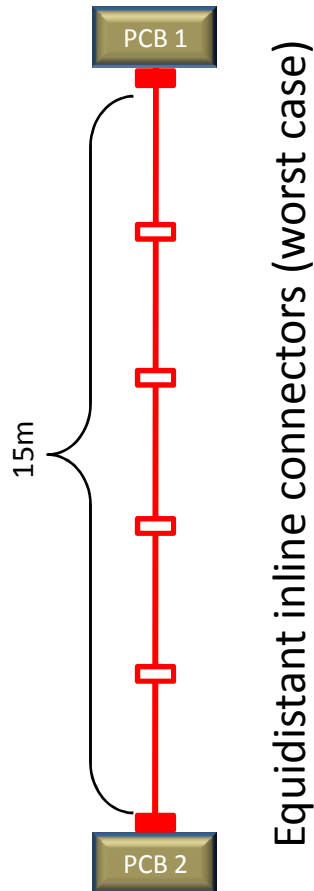


Input Data

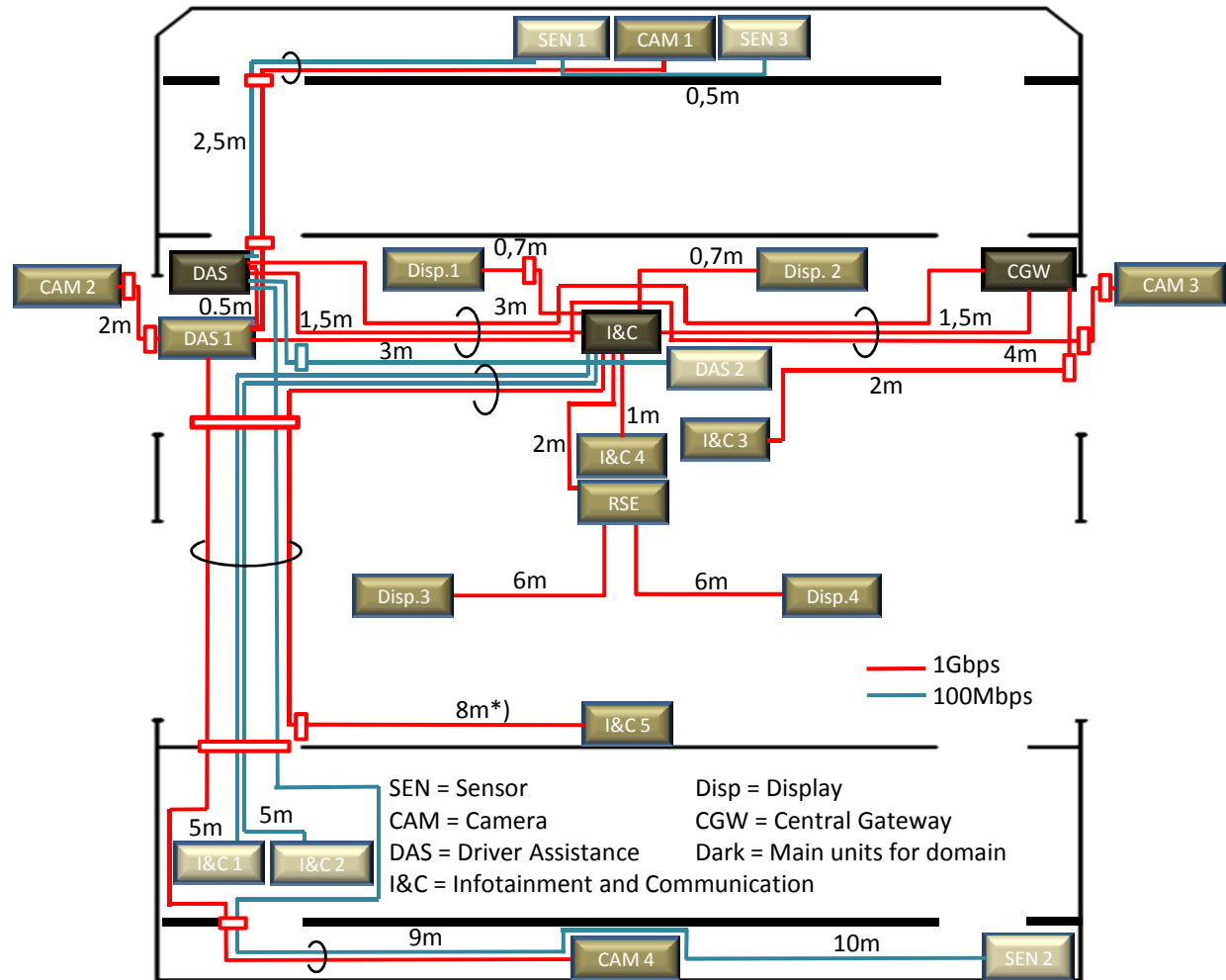
- Topologies investigated
- ECU connections considered
- Cable values
- Connector values
- Use of multi-pin connectors

Topologies Investigated (1)

Topology 1



Topology 2 (see back up also)



*) Average cable length for 1Gbps (not considering inline connectors) is 3,15m, 3,5m for Ethernet in general

Topologies Investigated (2)

	Topology 1	Topology 2*)
Overall length of cabling [m]	15m	50m
Number of links	1	16**)
Number of MDIs	2	32**)
Number of inline connectors	4	13
Number of cable segments	5	29
Number of PHYs	2	11
Number of Switches	0	5

*) only 1Gbps

***) one redundant link

ECU Investigated

Example Connections to I&C ECU

Type of connections	Number of those connections	Number of pins per connections	Number of pins	Connectors
power supply*)	1	2	2	multipin
analogue out*)	4	2	8	multipin
CAN	2	2	4	multipin
microphones	5	3	15	multipin
aux in	1	4	4	multipin
100 Mbps	2	3	6	multipin
other	10	1	10	multipin
Σ connectors/Pins	1-2		49	
To antennas	9	2	18	dedicated
USB	3	4	12	dedicated
Σ connectors/Pins	12			
Gbps	7	3/5	21/35	Tbd.

*) requires larger pins / pin spacing

Cable Values*)

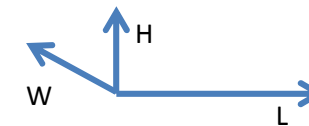
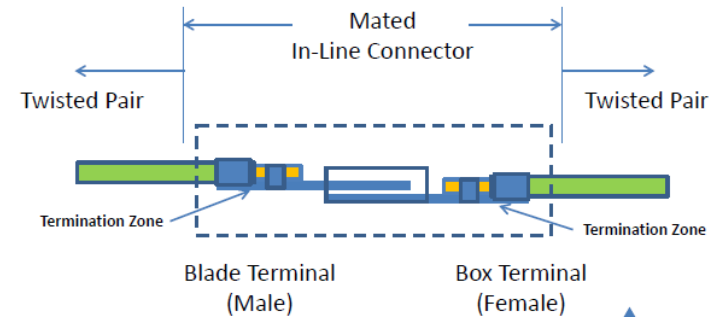
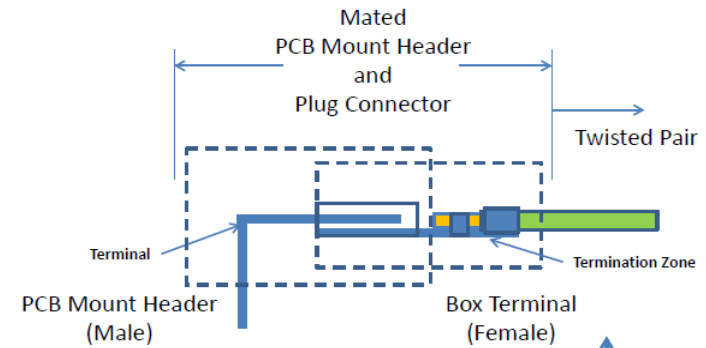
Type	Subtype	weight [g/m]		diameter Ø [mm]	
		one pair	two pairs	one pair	two pairs
UTP; 0,18mm ²	no jacket	5,30	2x1pair	2,24	4,29
	one jacket	12,00	20,22	3,78	5,94
	individual jackets		2x1pair		7,62
UTP; 0,35mm ²	no jacket	9,27	2x1pair	2,54	4,87
	one jacket	20,18	32,96	4,04	6,81
	individual jackets		2x1pair		8,13
Coax		14,26	2x1pair	3,20	6,55
STP	one shield	25,69	40,45	4,72	7,27
	individual shields		2x1pair		9,49

*) Averaged input from 6 independent sources

Connector Values

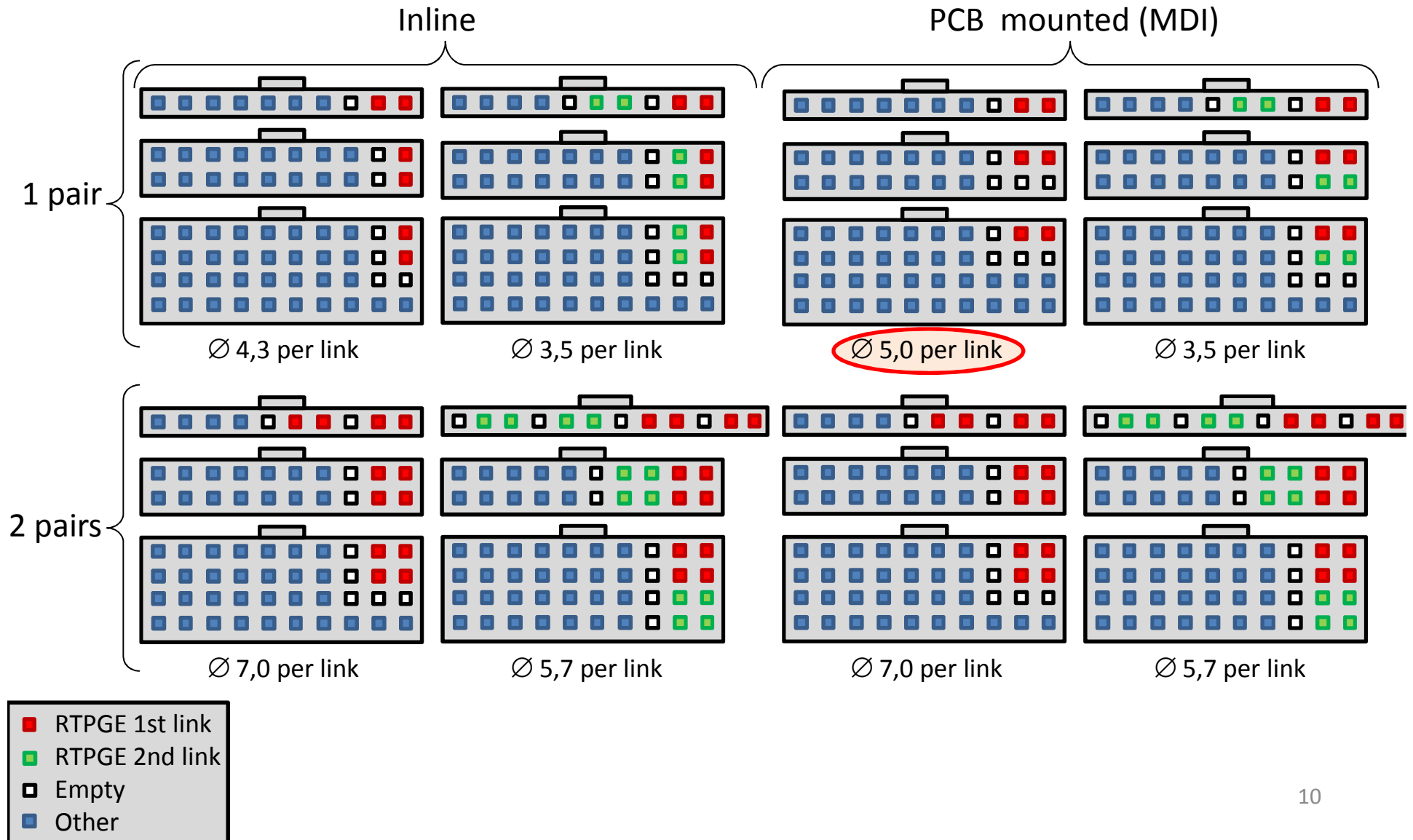
Type	weight [g]	
	PCB	inline
Multipin 2 pins	2,24	2,40
Coax	3,2	2,30
Shielded (1/2pairs)	6,4/7,2	9,00

Type	Size backplane	
	W[mm]	H[mm]
Multipin 2 pins	4,5	8
Coax	11	13
Shielded *)	12	13



*) Assumed to be the same for 1 pair or 2 pairs

Example Multipin-Connector Use



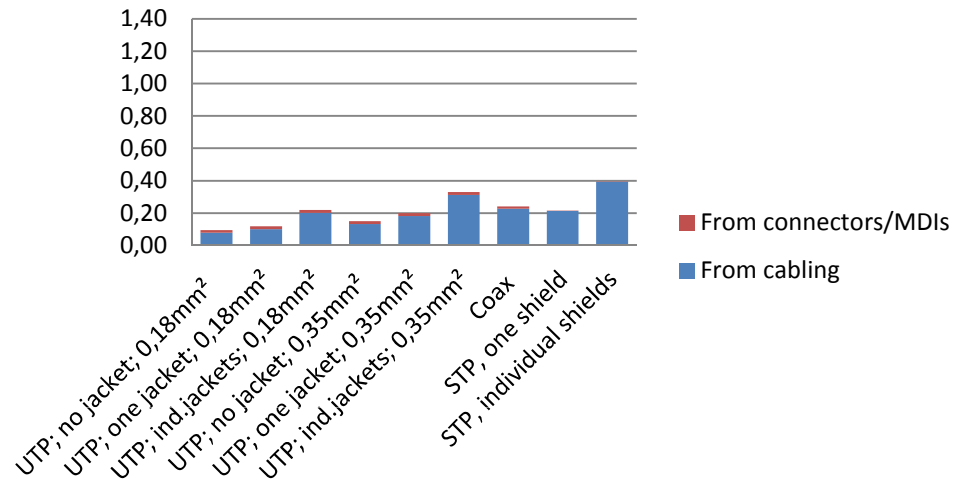
Results

- Weight
- Space

Impact on Weight

Topology 1

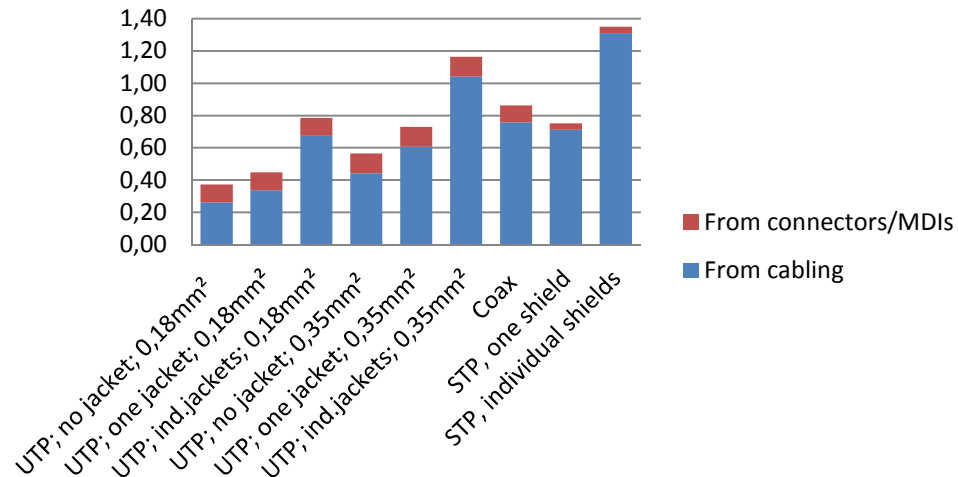
additional weight of second pair [kg]



An additional pair of wires adds between 0,37 and 1,35 kg of weight in a fully equipped car

Topology 2

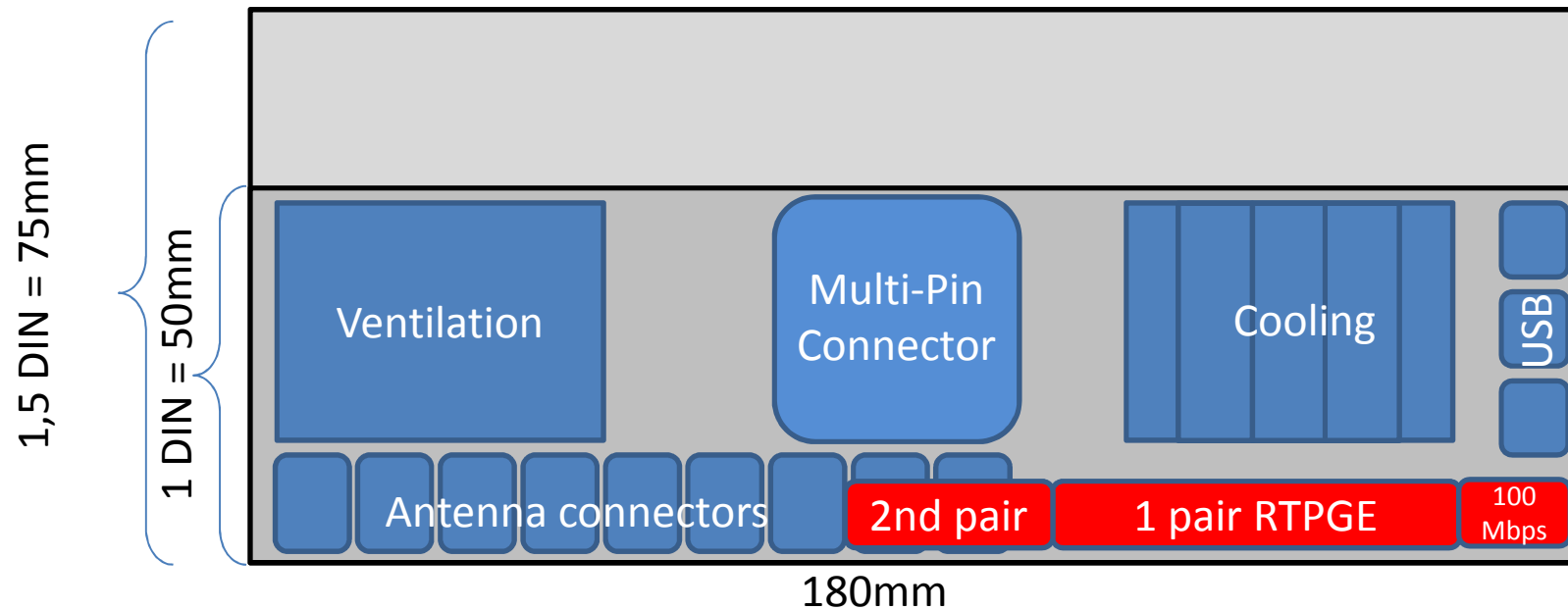
additional weight of second pair [kg]



Weight affects CO2 emission and costs directly

Impact on Space

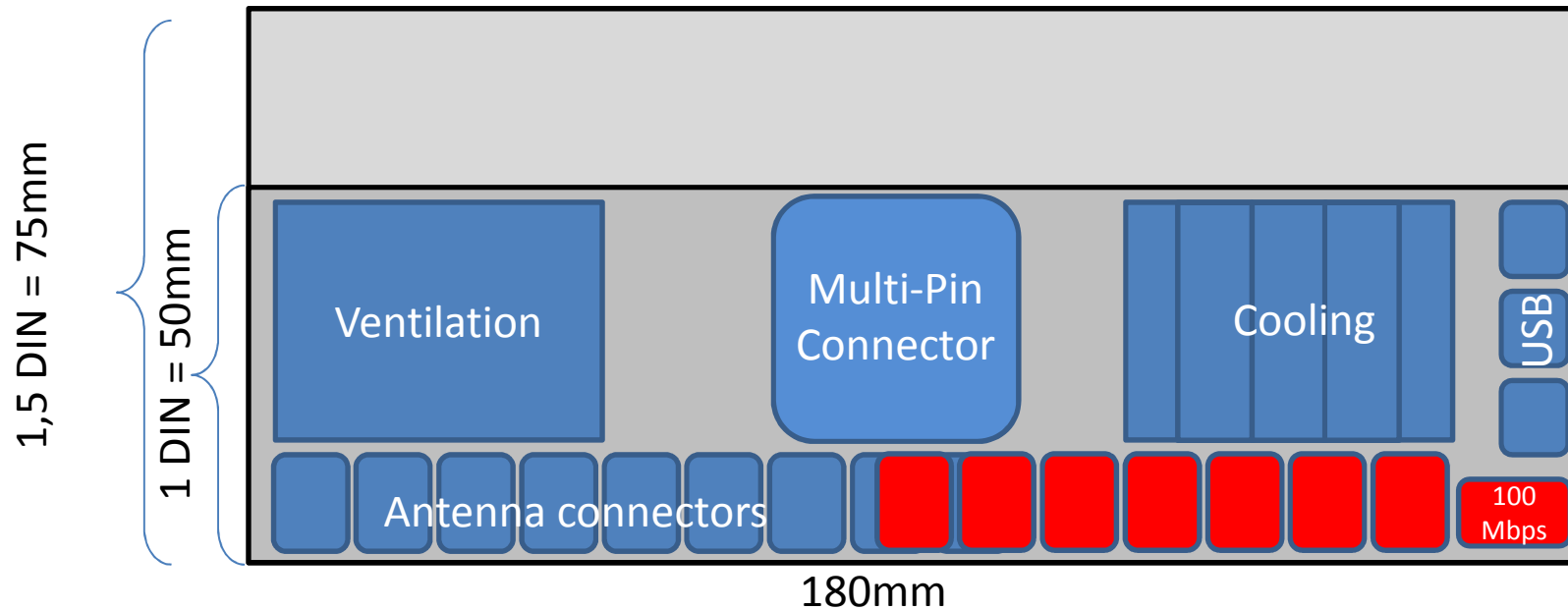
Using Multipin Connector for RTPGE



- Example back plane of I&C ECU with one horizontal and one vertical PCB
- Extending the size to 1,5DIN has little effect as some connectors (antennas, Ethernet, USB) need to be directly connected to PCB
- Space is sparse. A fully equipped I&C ECU cannot accommodate the second pair.

Impact on Space

Using Distinct Connectors for RTPGE



- Example back plane of I&C ECU with one horizontal and one vertical PCB
- Extending the size to 1,5DIN has little effect as some connectors (antennas, Ethernet, USB) need to be directly connected to PCB
- Having to use distinct connectors for the RTPGE links is unfavorable

Summary

- For the evaluation of the impact of a second pair needed for RTPGE transmission input data on the following topics was presented
 - Topologies
 - ECU connections
 - Cable & Connector
 - The automotive Ethernet use of multi-pin connectors
- In the topology shown a second pair adds between 0,37 and 1,3kg of weight (=CO2=costs)
- Additionally a second pair can easily overstrain the space constraints of communication intense ECUs

Back Up Material

Additional Info on Topology 2

- Topology 2 is an example topology that does not represent any real car, but a combination of values from several
- For the channel (interference) model, other topologies need to be considered additionally. This topology has a maximum of 3 RTPGE cables next to each other
- The 100Mbps links have been added to indicate the playing field. The better the RTPGE solution the more links will be Gbps, the more expensive Gbps the fewer links will upgrade.

