IEEE802.3 HSSG

100GE – 10/40km Economic Feasibility

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Deutsche Telekom · T-Systems

100GE – 10/40km Economic Feasibility

HSSG approved Objectives – Overview

HSSG approved objectives

#1 Support full-duplex operation only

#2 Preserve the 802.3/Ethernet frame format at the MAC Client service interface

#3 Preserve minimum and maximum Frame Size of current 802.3 Std

#4 Support a speed of 100 Gb/s at the MAC/PLS interface

#5 Support at least 10km on SMF

#6 Support at least 100m on OM3 MMF

#7 Support a BER better than or equal to 10-12 at the MAC/PLS

#8 Support at least 40 km on SMF

100GE – 10/40km Economic Feasibility

Fiber Link – Cost model for additional fiber link costs

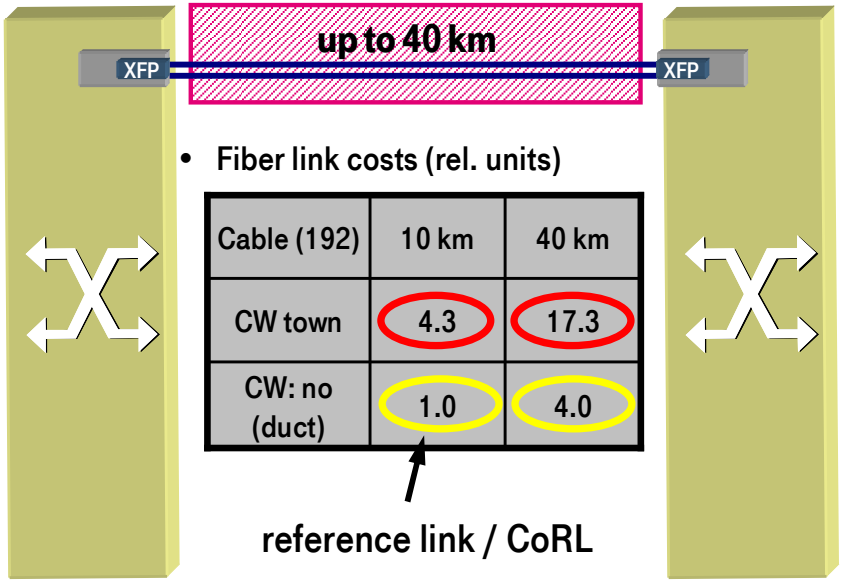
- Total link costs are composed of interface costs plus additional fiber link costs based on costs of reference link
- Relative fiber link cost based on cost of reference link (CoRL: 10 km, duct, no civil work, 192 fibers per cable)

$$\text{relative fiber link cost} = \left(\frac{\text{cable cost} + \text{fiber laying cost} + \text{civil work cost}}{\text{fibers per cable} \bullet \text{CoRL}} \right) \bullet \text{fibers per link} \bullet \text{number of links} \bullet \text{fiber length}$$

fiber cost per km / CoRL

2 1 up to 40 km

1 channel fiber link

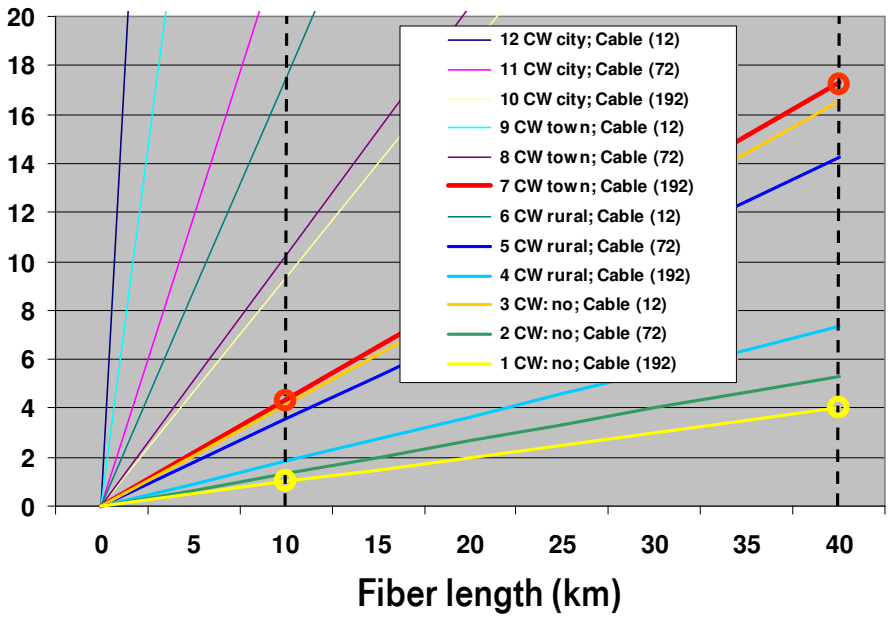


- Fiber link costs (rel. units)

Cable (192)	10 km	40 km
CW town	4.3	17.3
CW: no (duct)	1.0	4.0

reference link / CoRL

Relative fiber link cost



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Fiber Link – 100 Gbit/s scenario with 10 x 10 Gbit/s fiber links

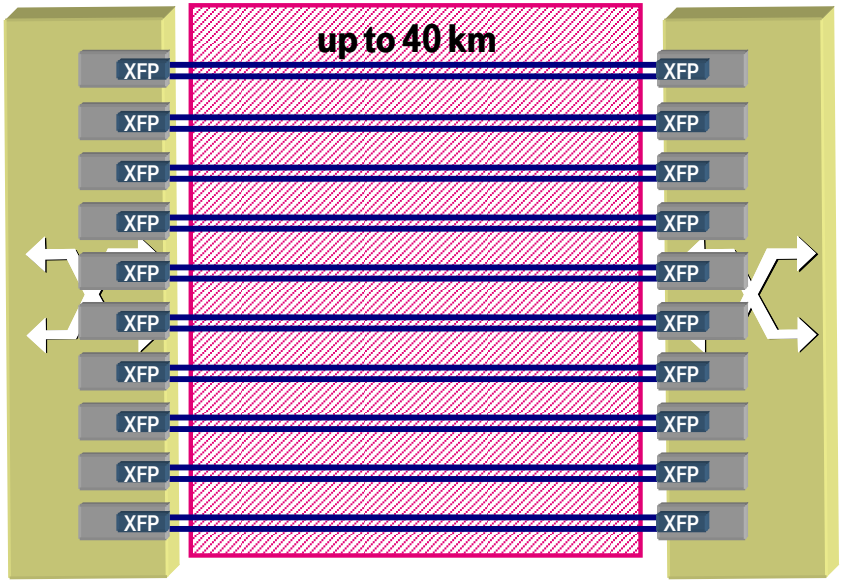
- Parameters (all costs are relative to costs of the reference link (CoRL))

Fibers per cable	12	72	192	Civil work cost per km / CoRL	duct	rural	town	city
Cable cost per km / CoRL)	0.88	3.2	8.0		0	8.0	32.0	80.0
Fiber laying cost per km/CoRL	1.6			Fibers per link	2			
Fiber length	Considered up to 40 km			Number of links	Considered up to 10			

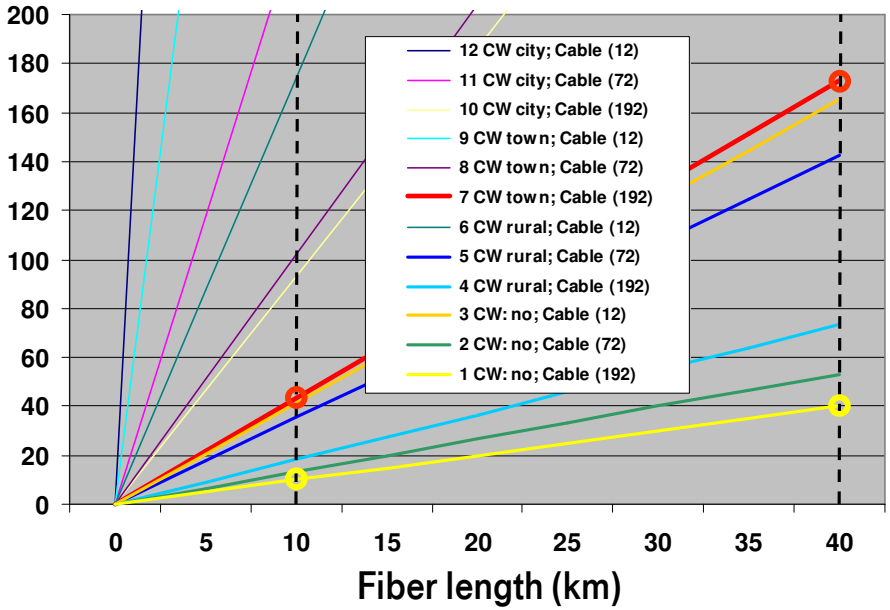
- Relative fiber link cost

Cable (192)	10 km	40 km
CW town	43.3	173.3
CW: no (duct)	10.0	40.0

10 channel fiber link



Relative fiber link cost



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Fiber Link – 100 Gbit/s scenario with 10 x 10 Gbit/s WDM link

$$\text{relative fiber link cost (WDM link)} = \frac{2 \bullet (\text{WDM basic} + 10 \bullet \text{WDM transponder}) + \text{fiber link cost (one fiber link)}}{\text{CoRL}}$$

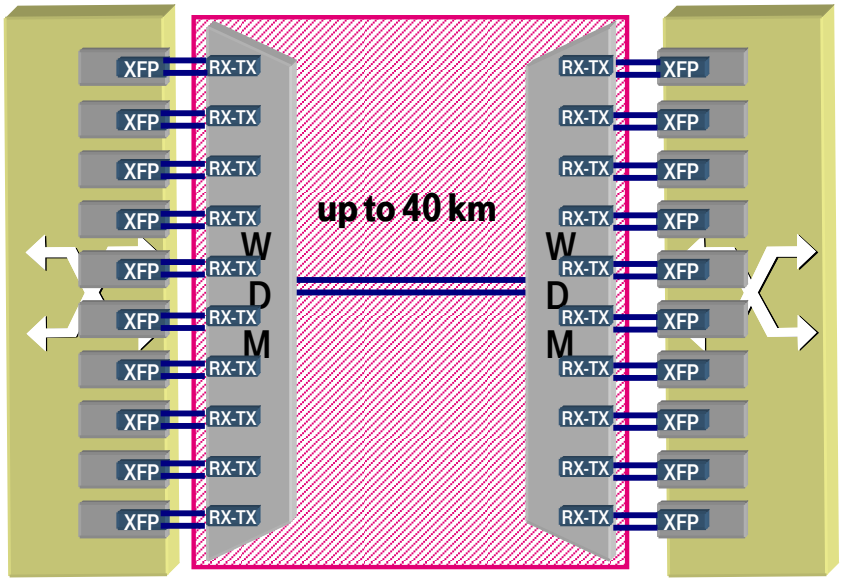
- WDM extended Model / CoRL

WDM basic cost / CoRL	102.3
WDM transponder cost / CoRL	12.3

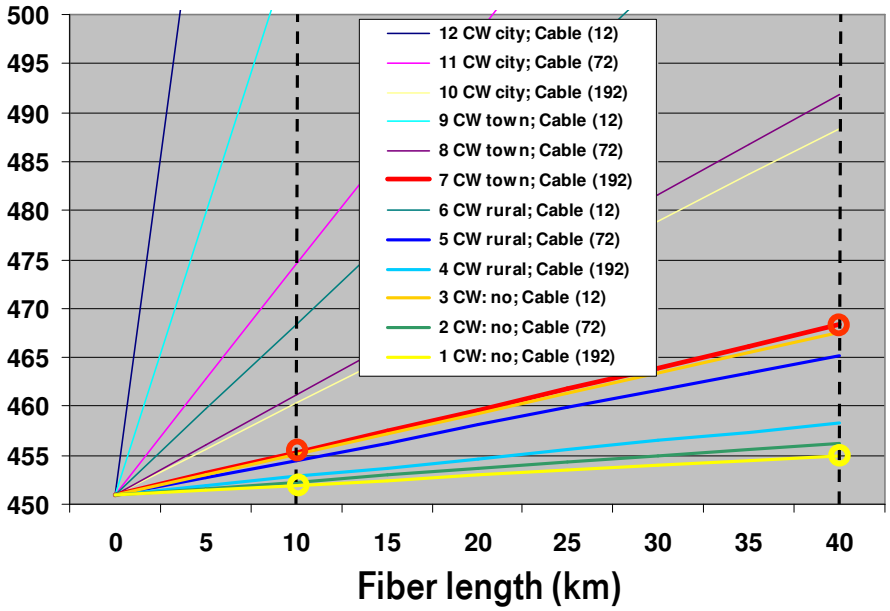
- Relative fiber link cost (based on CoRL)

Cable (192)	10 km	40 km
CW: town	455,3	468.3
CW: no (duct)	452.0	455.0

1 channel fiber link



Relative fiber link cost



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Fiber Link – 100 Gbit/s scenario with 4 x 10 km (if no 40 km PHY)

$$\text{relative fiber link cost (4 x 40 km)} = \frac{3 \bullet (\text{switch} + 2 \bullet \text{line card} + 2 \bullet \text{100GE pluggable}) + \text{fiber link cost (4 x 10 km links)}}{\text{CoRL}}$$

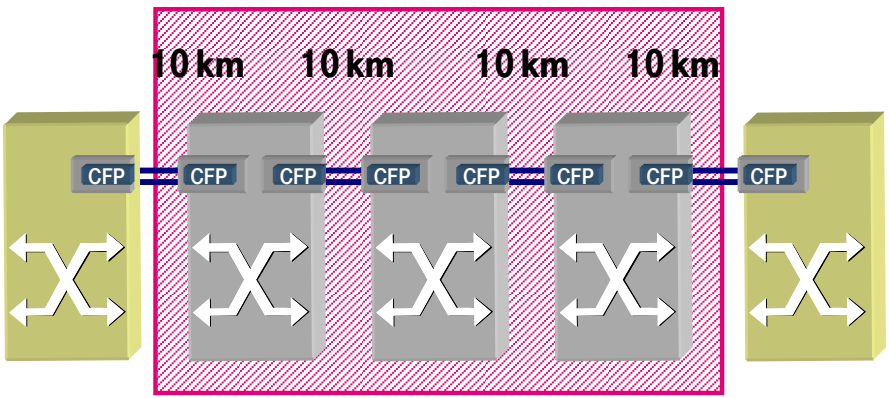
- 40 km (4 x 10km long reach) extended model / CoRL

Switch cost / CoRL	40.0
100 GE line card cost / CoRL	40.0
100 GE-LR pluggable cost / CoRL	15.4

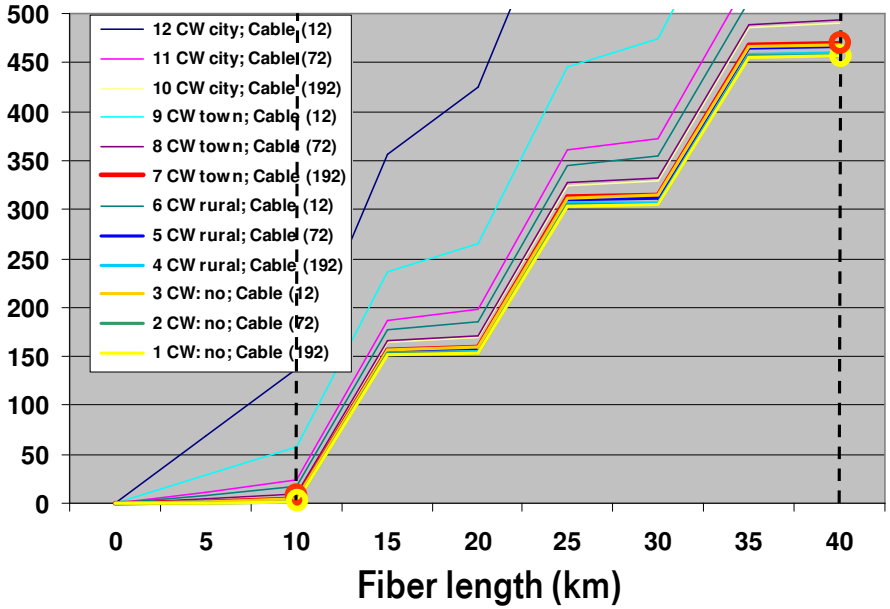
- Relative fiber link cost (based on CoRL)

Cable (192)	10 km	40 km
CW: town	4.3	469.6
CW: no (duct)	1.0	456.3

4 x 10 km, 1 channel fiber link



Relative fiber link cost



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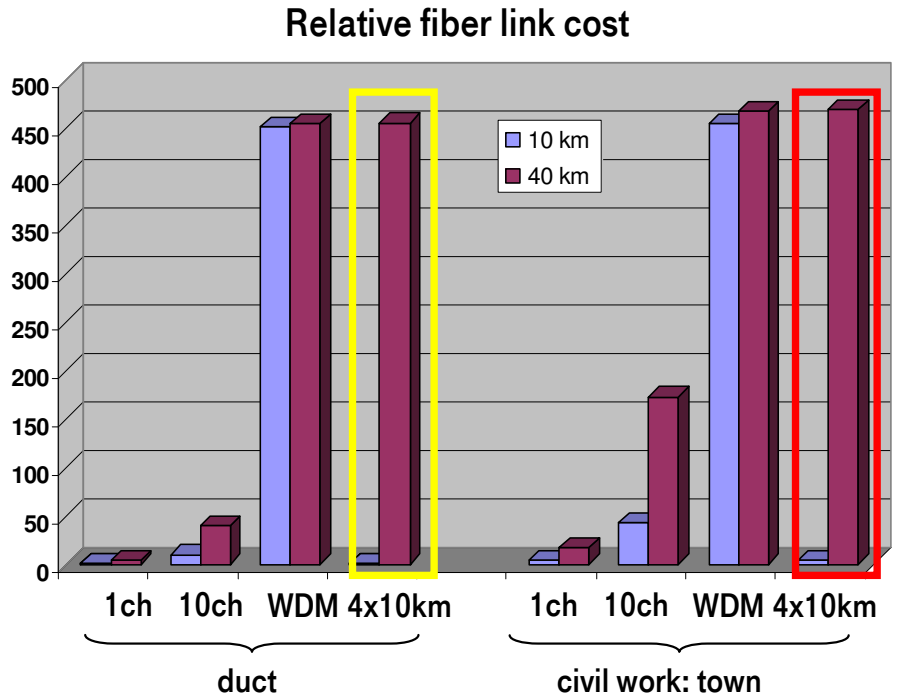
Ethernet Link Scenario – Conclusion

- Cost model for additional relative fiber link costs based on a reference fiber link (10 km, duct, 192 fibers/cable)
- Beside the costs of the 100GE interface itself, additional fiber link costs are relevant
  - Support economical feasibility of 100GE interfaces for 10 and 40 km reach
  - Strong dependence on infrastructure environment ⇒ use already installed fiber infrastructure
- Migration of 40 km links (10GE to 100GE) needs 100GE–40km reach interfaces to avoid large additional link costs
- Support of HSSG objective – Support at least 40 km on SMF

Parameters	10 km cost / CoRL	40 km cost / CoRL
1ch fiber link, duct (reference link)	1.0	4.0
100GE, 10ch fiber link, duct	10.0	40.0
100GE, 10ch WDM link, duct	452.0	455.0
100GE, 1ch, 4x10km fiber link, duct	1.0	456.3
1ch fiber link, CW: town	4.3	17.3
100GE, 10ch fiber link, CW: town	43.3	173.3
100GE, 10ch WDM link, CW: town	455.3	468.3
100GE, 1ch, 4x10km fiber link, CW: town	4.3	469.6



Thank you

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