

Experiments on optical layer and breakable research networks



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Czech

Light

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Outline

- ◆ Motivations for our experiments
- ◆ Numerical simulations
- ◆ Practical results
- ◆ CzechLight – experimental network
- ◆ Conclusions

Motivations

- ◆ Utilization of dark fibres
- ◆ Cost effective solutions
- ◆ 1 GE and 10 GE everywhere
- ◆ Nothing-in-line (NIL) approach
- ◆ Drawback and problems with in-line amplifiers (EDFAs, Raman)

Numerical simulations

- ◆ To estimate the maximum span length @10Gbit/s with G.652/G.655 fibres
- ◆ Optimization of input powers (EDFA, Raman) and dispersion compensation ratio
- ◆ Theoretical analysis of the Raman effects

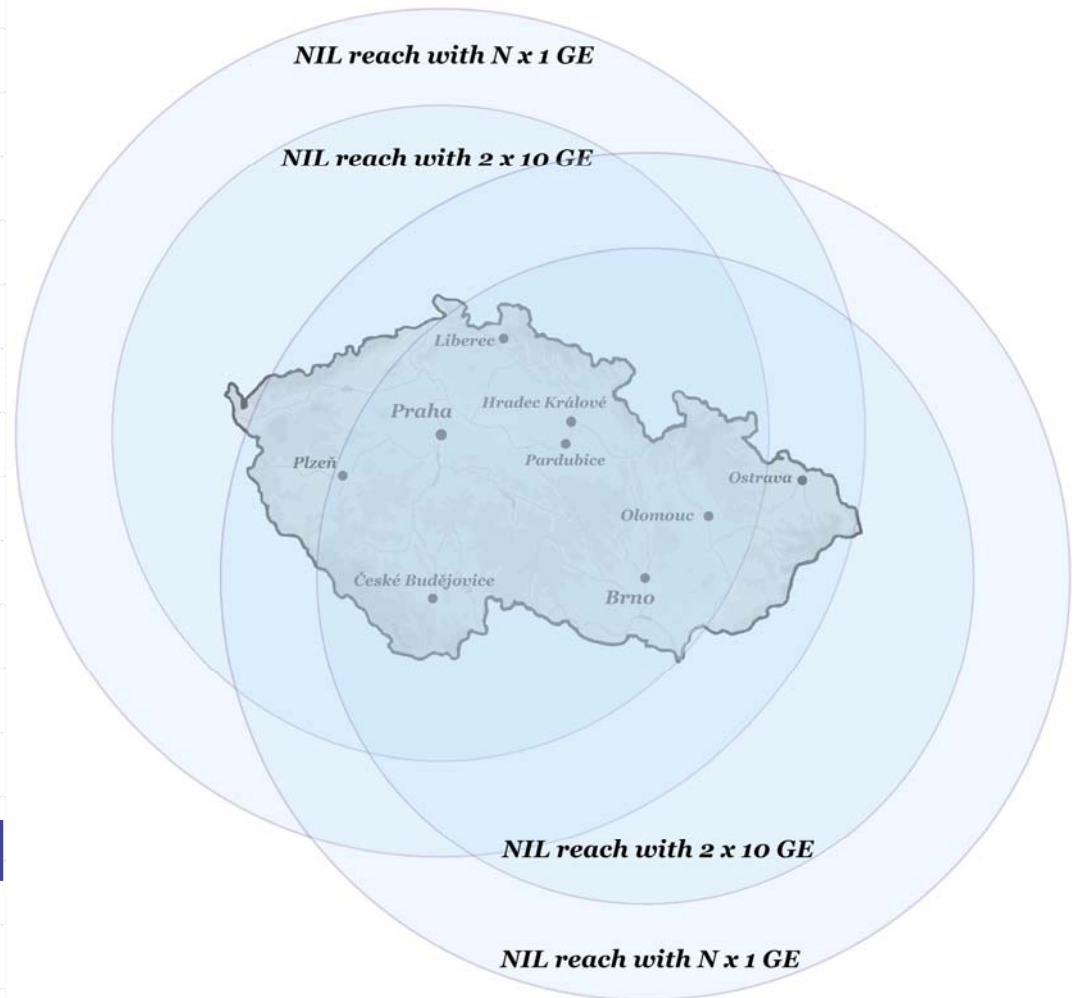
Practical results

- ◆ 2 x 1 GE plus 2 x 10 GE over 202 km [1]
- ◆ 2 x 10 GE over 252 km [2]
- ◆ Non DWDM equipment, easy to set up (with optical tunable filters)

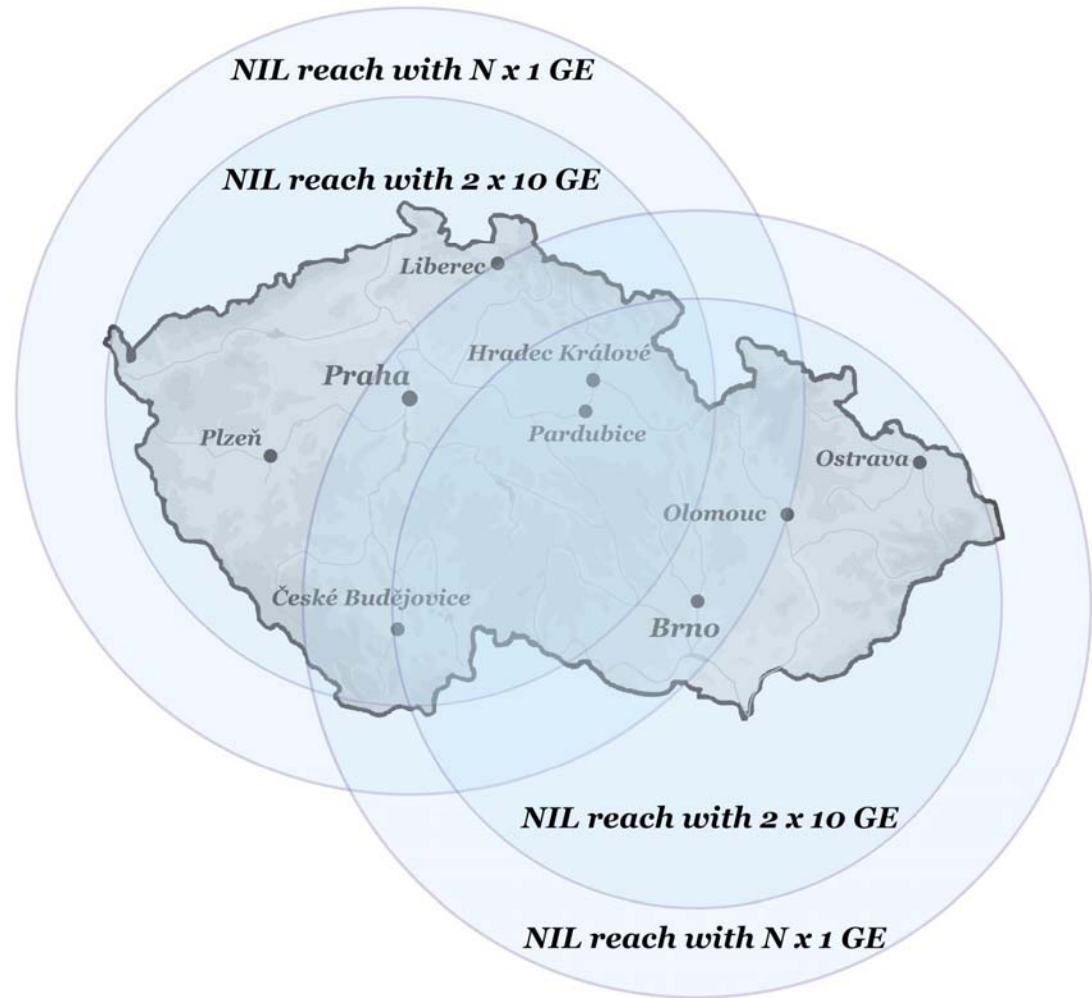
- ◆ All-optical gain-clamped (AOGC) RFA [3], [4]
- ◆ A new method for gain stabilization

Practical results – the map of Czech republic

- ◆ Air distances
- ◆ Corrections needed
- ◆ Air to fibre distance ratio – AFDR
- ◆ $AFDR = 0,65$
(worst case for Praha-Brno fibre:
190 km/290 km)
- ◆ From reference [5]



Practical results – the map of Czech republic



- ◆ Corrected diameters
- ◆ CzechLight experimental network
- ◆ From reference [5]

CzechLight

- ◆ Today – one Cisco ONS 15454 in Praha (February 2003)
- ◆ 2,5 Gb/s circuit to Amsterdam (NetherLight)
- ◆ CESNET is now a TransLight Affiliate Member
- ◆ Upgrade to 10 G with another 15454 in Brno
- ◆ For supercluster/grid users, other researchers
- ◆ Experimental AND breakable network (independent on production IP network - CESNET2)

CzechLight

- ◆ How to transform research results into practical life?
- ◆ Future deployment of WDM/DWDM NIL 1 GE and 10 GE transmissions
- ◆ Deployment of AOGC RFA
- ◆ Utilization of results of the Liberouter project – www.liberouter.org (1 GE and 10 GE interface cards, repeaters, transponders,...)
- ◆ Experiments with OOO switching and GMPLS?

Conclusions

- ◆ Cost effective deployment of multi-channel 1 GE and 10 GE pipes (NIL, if possible)
- ◆ All-optical gain stabilization in multiwavelengths networks
- ◆ Breakable experimental networks (CzechLight)
- ◆ Lightpaths (one stream of photons) and bandwidth on demand

Acknowledgements

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- ◆ [3] Karásek, M. - Kaňka, J. - Honzátko, P. - Radil, J. , „Protection of Surviving Channels in All-Optical Gain-Clamped Lumped Raman Fibre Amplifier: Modelling and Experimentation.“, In: Optics Communications 231, 2004.
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Thank you for your attention!