



Beyond 100G in CESNET

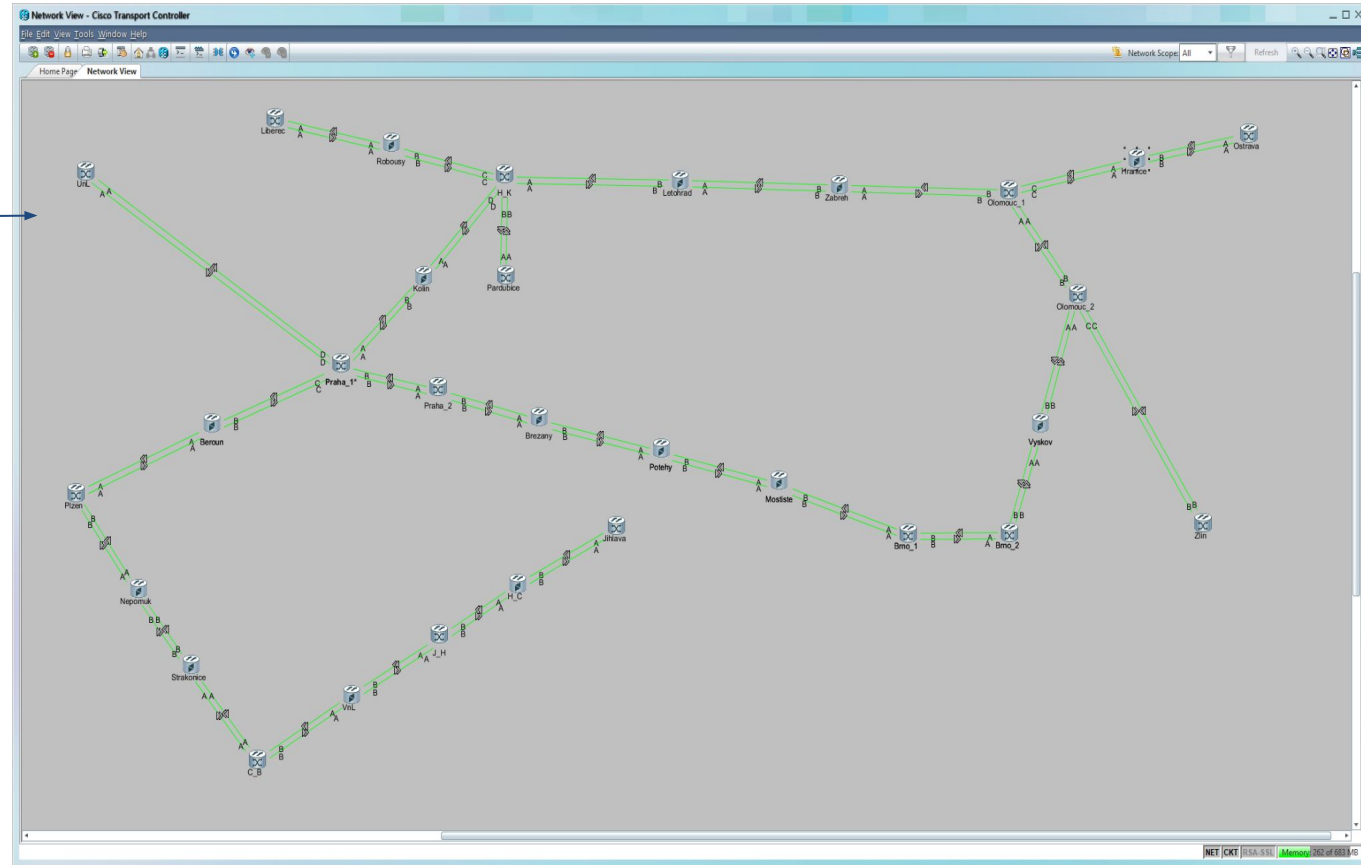
Michal Hažlinský, 13.12.2021 - 6th SIG-NGN

■ Two optical systems

- CISCO NCS
 - Recently modernized
 - Flexgrid
 - This picture →
 - Approx 1/3 of all the footprint
- Czech Light OLS
 - near EOL... upcoming modernization

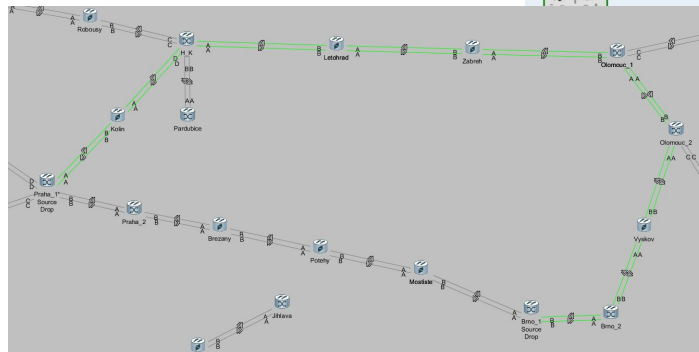
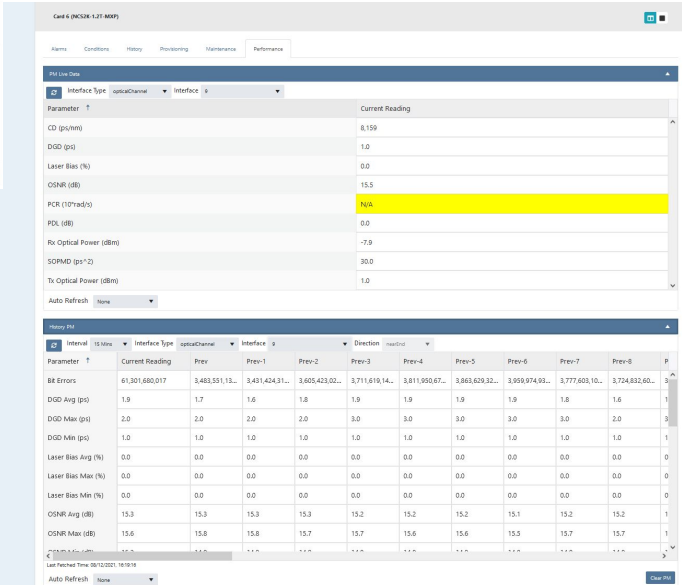
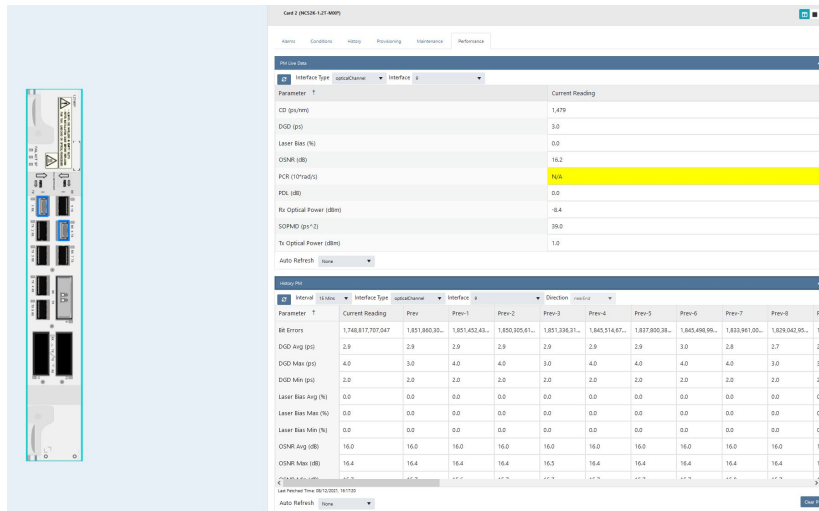
■ Main ring

- Praha - Hradec Kralove - Olomouc - Brno - Praha
- 100G in production
- 200G ready
- 400G trials

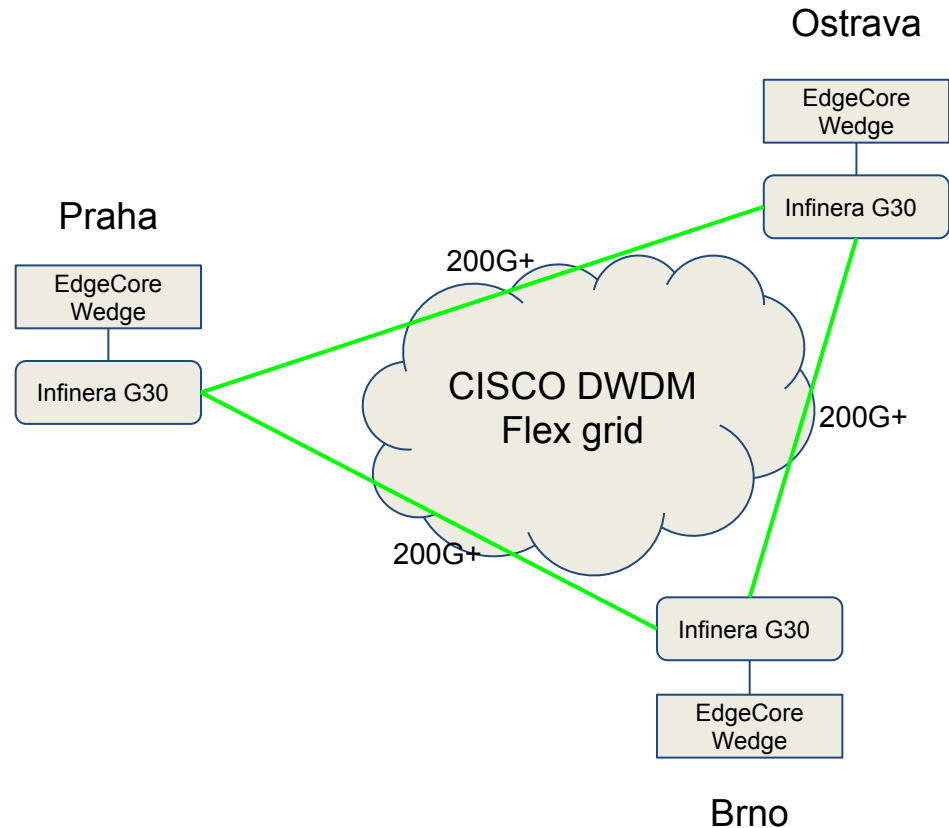


Example: Praha-BRNO

- CISCO NCS2K-1.2T-MXP
- Main line: approx. 300km, span loss range 13.5 - 22.5 dB, 4 spans, OSNR 16.2 dB 16QAM
- Backup: 464km, span loss range 13 - 24.5 db, 8 spans, OSNR 15.5
- One "ugly" span with 24.5 dB loss.



- Network infrastructure for advanced research application
- To employ most recent trends in networking
- Semi-production
 - To allow solutions to prove itself
- DCI over AW
 - Infinera G30
- L2/3 - EdgeCore WEDGE 100G



■ Praha - Ostrava

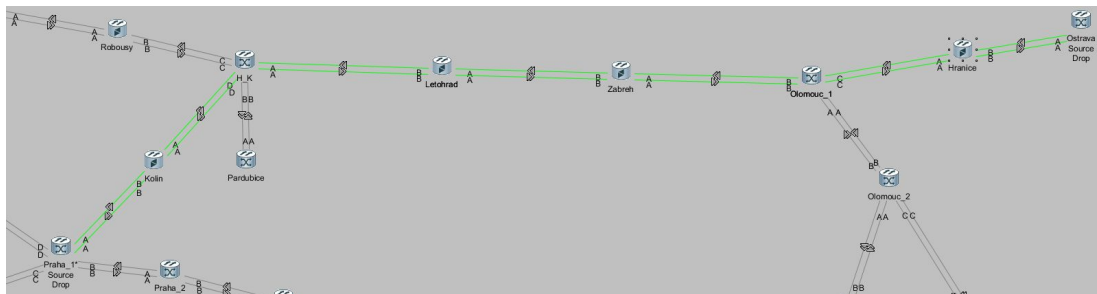
- Infinera Grove G30 equipped by CHM2T unit
- 529 km
- 7 spans
- span loss range 13.7 - 24.5 db
- OSNR 22.2 dB from Prg 23.6 db from Ova
- 16QAM
- 75GHz channel
- preFEC BER 0.03089...

Port Path	Alias Name	Service Label	Type	Mode	Admin	Oper
1 sheff-1	sheff-1		G30-FRUC-1RU		up	up
2 sskf-1/1	sskf-1/1		CHM2T		up	up
3 poft-1/1/1	poft-1/1/1		line	16QAM_400G	up	up
4 ocd-qs-1/1/1	ocd-qs-1/1/1		ocd-qs		up	up

Gauges	instnt	avg	min	max
optical-frequency	19530000	19530000	19530000	19530000
in-optical-frequency	19529991	19529998	19529952	19530119
bit-err-nsa-pm-fec	0.020992026	0.020995519	0.020923889	0.0217481464
chromatic-dispersion	7468	7464	7450	7492
in-optical-power	-11.7	-11.6	-12.2	-11.5
g-factor	5.4	5.3	5.3	5.5
osnr	22.2	22.5	21.9	22.8
polarization-dependent-loss	1.1	1.1	0.6	1.2
out-optical-power	3.0	3.0	2.9	3.0
bit-err-nsa-pm-fec	0.0000000	0.0000000	0.0000000	0.0000000
differential-group-delay	2	2	1	3

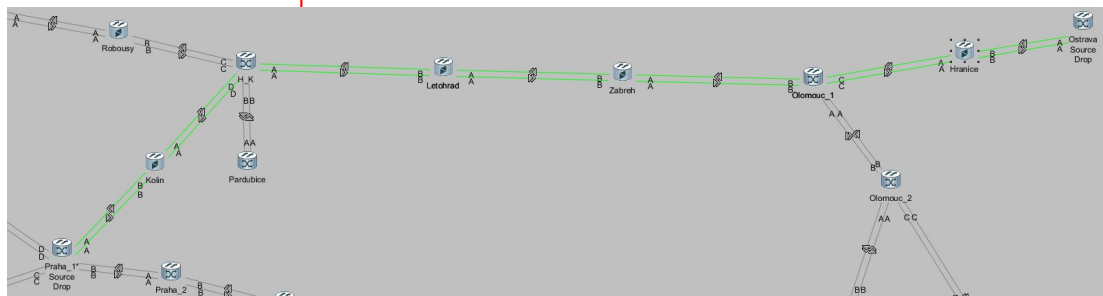
Port Path	Alias Name	Service Label	Type	Mode	Admin	Oper
1 sheff-1	sheff-1		G30-FRUC-1RU		up	up
2 sskf-1/1	sskf-1/1		CHM2T		up	up
3 poft-1/1/1	poft-1/1/1		line	16QAM_400G	up	up
4 ocd-qs-1/1/1	ocd-qs-1/1/1		ocd-qs		up	up

Gauges	instnt	avg	min	max
optical-frequency	19530000	19530000	19530000	19530000
in-optical-frequency	19529993	19529992	19529934	19530044
bit-err-nsa-pm-fec	0.020972022	0.020971151	0.020927622	0.020995765
chromatic-dispersion	7464	7464	7450	7471
in-optical-power	-8.6	-9.7	-10.7	-8.4
g-factor	5.9	5.9	5.8	6.0
osnr	23.6	23.5	22.8	23.9
polarization-dependent-loss	1.2	0.6	0.1	1.7
out-optical-power	2.9	2.9	2.8	3.1
bit-err-nsa-pm-fec	0.0000000	0.0000000	0.0000000	0.0000000
differential-group-delay	2	2	1	4



■ Praha - Ostrava

- Infinera Grove G30 equipped by CHM2T unit
- 529 km
- 7 spans
- span loss range 13.7 - 24.5 db
- OSNR 22.2 dB from Prg 23.6 db from Ova
- 16QAM
- 75GHz channel
- pre FEC BER 0.4012...
- **post FEC BER 0.0065**



Port/Path	Alias Name	Service Label	Type	Mode	Admin	Oper
slot 1	slot 1		C20-FRUC-1RU		UP	UP
slot 1/1	slot 1/1		CHM2T		UP	UP
post-1/1/1	post-1/1/1		line	32QAM_500G	UP	UP
och-os-1/1/1	och-os-1/1/1		och-os		UP	UP

Metric	instnt	avg	min	max
optical-frequency	19536020	19536020	19536020	19536020
optical-frequency	19536032	19536032	19536032	19536036
bit-error-rate-pre-fec	0.0318343802	0.401289161	0.0317276103	1.000000000
chromatic-dispersion	7465	4620	5	7469
optical-power	0.9	-43.2	00.5	-7.9
o-factor	5.3	3.2	0.0	5.3
osnr	25.1	15.3	0.0	25.6
polarization-dependent-loss	0.6	0.5	0.0	1.2
optical-power	0.9	0.9	0.7	1.2
bit-error-rate-post-fec	0.01499461	0.00501143	0.00000000	0.01499461
efficiency-group-ibay	2	3	5	3

Port/Path	Alias Name	Service Label	Type	Mode	Admin	Oper
odu-1/1/1/odu0-1	odu-1/1/1/odu0-1		odu		UP	DOWN
odu-1/1/1/odu0-1/odu4-1	odu-1/1/1/odu0-1/odu4-1		odu		UP	DOWN
odu-1/1/1/odu0-1/odu4-2	odu-1/1/1/odu0-1/odu4-2		odu		UP	DOWN
odu-1/1/1/odu0-1/odu4-3	odu-1/1/1/odu0-1/odu4-3		odu		UP	DOWN
odu-1/1/1/odu0-1/odu4-4	odu-1/1/1/odu0-1/odu4-4		odu		UP	DOWN
odu-1/1/1/odu0-1/odu4-5	odu-1/1/1/odu0-1/odu4-5		odu		UP	DOWN
post-1/1/2	post-1/1/2		line	64QAM_500G	DOWN	DOWN
post-1/1/3	post-1/1/3		client	100G0E	DOWN	DOWN
post-1/1/4	post-1/1/4		client	100G0E	DOWN	DOWN
post-1/1/5	post-1/1/5		client	100G0E	DOWN	DOWN
post-1/1/6	post-1/1/6		client	100G0E	DOWN	DOWN
post-1/1/7	post-1/1/7		client	100G0E	DOWN	DOWN
post-1/1/8	post-1/1/8		client	100G0E	DOWN	DOWN
post-1/1/9	post-1/1/9		client	100G0E	DOWN	DOWN
post-1/1/10	post-1/1/10		client	100G0E	DOWN	DOWN
post-1/1/11	post-1/1/11		client	100G0E	DOWN	DOWN
post-1/1/12	post-1/1/12		client	100G0E	DOWN	DOWN
post-1/1/13	post-1/1/13		client	100G0E	DOWN	DOWN
post-1/1/14	post-1/1/14		client	100G0E	DOWN	DOWN
slot 1/2	slot 1/2				UP	UP
slot 1/3	slot 1/3				UP	UP
slot 1/4	slot 1/4				UP	UP
slot 1/5	slot 1/5		FSU		UP	UP
slot 1/6	slot 1/6		FAN		UP	UP

