

measurement & training services

optical, protocol, video, power, power quality & energy

power quality & EMC & Instrumentation & Vibration

fixed and portable PQ & energy monitoring, EMC immunity

telecommunication & networks

wireless & wireline testing, optical transport testing

fiber

physical layer testing, protocol testing, fiber splicers & cleaning, tools

Synchronisation

Time and Frequency Synchronization Solutions, NTP Servers



Data Center Interconnect: Testing 400G-ZR optical links

FHI  IT INFRA



INFRA

HET KENNISEVENT OVER COMPUTERRUIMTES, DATACENTERS EN CLOUD COMPUTING

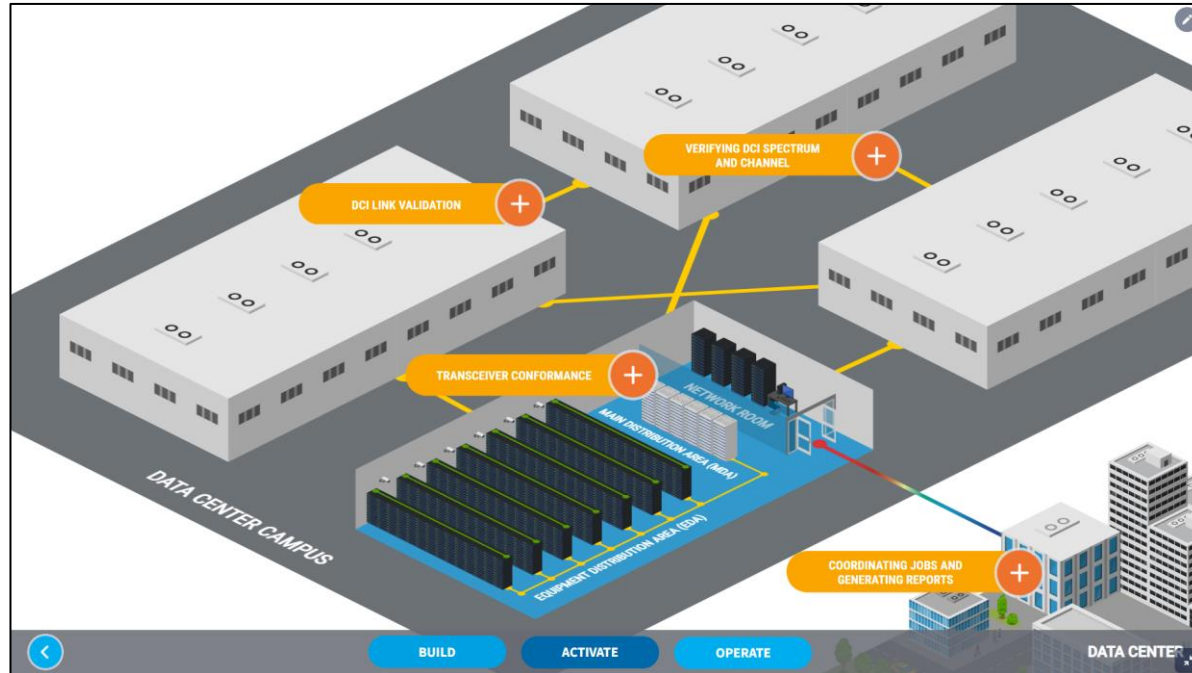


16 november 2023

1931 Congrescentrum 's-Hertogenbosch

INTRODUCTION

- The test, monitoring & analytics experts
- Headquartered in Canada



95%+
of leading service providers using EXFO

No.1
in optical test solutions

1,900
employees in 25 countries and customers in 120 countries

30+
years of pioneering essential solutions and technologies

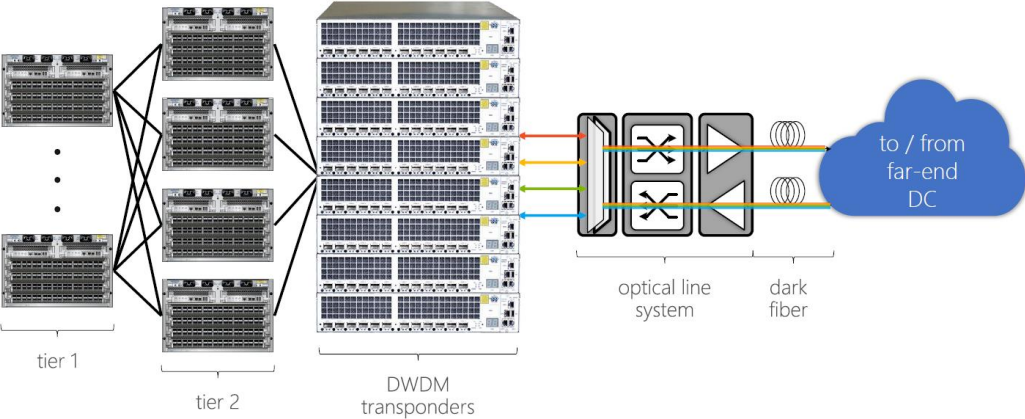


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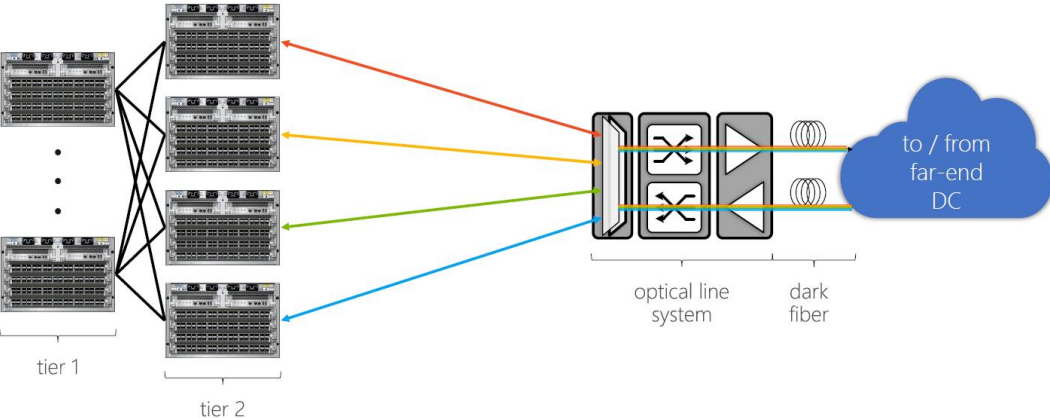
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NETWORK ROOM TRANSFORMATION

Legacy transponder optical architecture



DWDM PAM4/Coherent DCI optical architecture



Source: Microsoft azure



ACTIVATION STEPS

1

Inspect connectors and transceivers

2

Perform coherent bit-error-rate-test (BERT)

3

Generate report and share results

4

Install 400G-ZR transceivers and equipment cords

5

Activate data center interconnect

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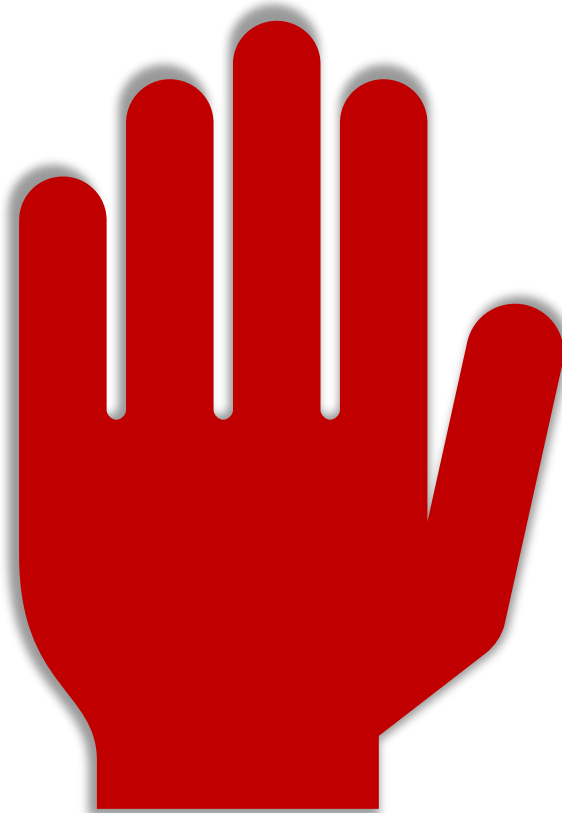
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PROBLEM!!

1

Inspect
connectors and
transceivers



STOP

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TROUBLESHOOTING



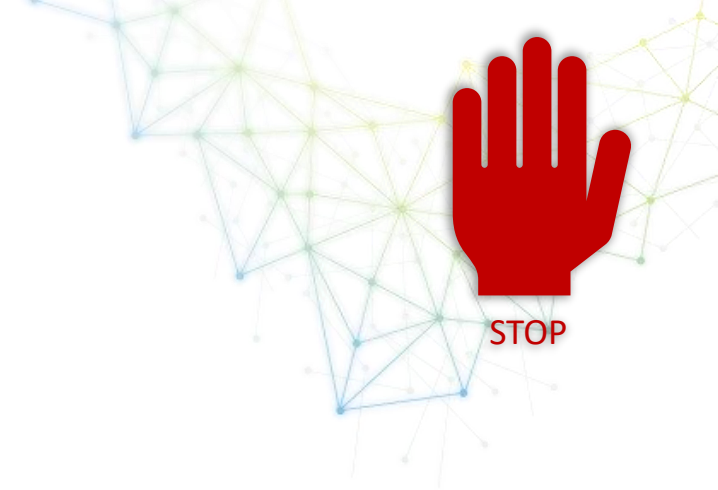
INSPECT INFRASTRUCTURE

- Fiber connectors on equipment cords
- Fiber connectors on panel/frame
- Optical stub/lens on transceivers



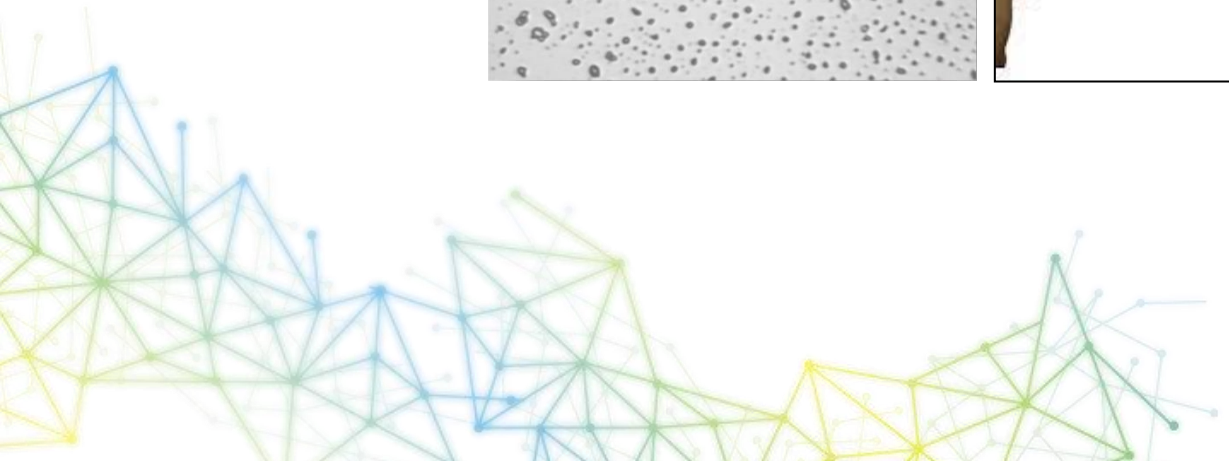
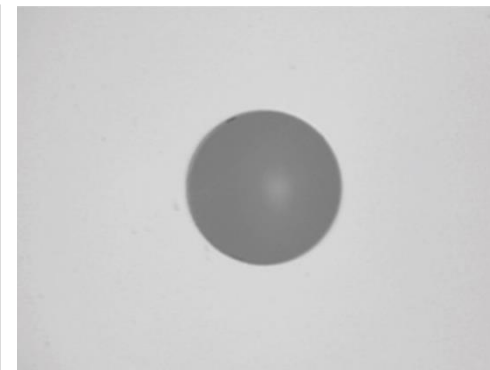
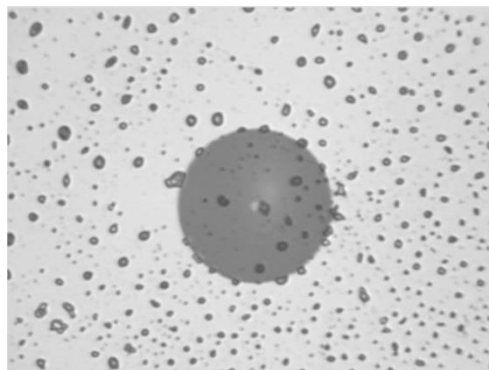
The logo for "rood EXFO" is at the top, with "rood" in blue and "EXFO" in a larger blue font. Below it is the "IT INFRA" logo, featuring a blue 3D cube with "IT" on the front face and "INFRA" to its right. At the bottom, the text "16 november 2023 | 's-Hertogenbosch" and the website "WWW.FHI.NL/ITINFRA" are displayed.

TROUBLESHOOTING



Possible root cause

Connector/lens dirt (clean) or damage (replace)



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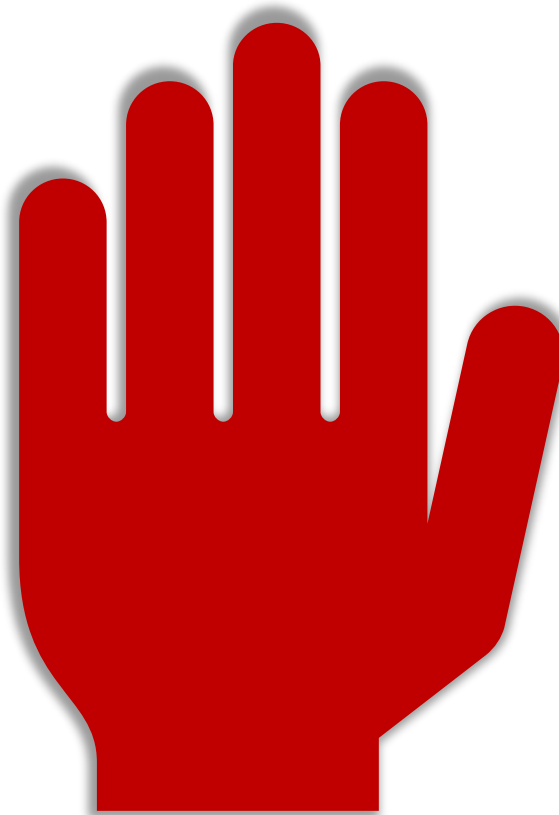
PROBLEM!!

1

Inspect connectors and transceivers

2

Perform coherent bit-error-rate-test (BERT)



STOP

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TROUBLESHOOTING



Review BERT Results and check for:

- Errors and alarms
- Wavelength tuning
- TX/RX power
- Optical metrics



Ethernet tester supporting coherent optics



TROUBLESHOOTING



Run diagnostics on transceivers to look for additional issues:

- Electrical inputs/outputs
- Optical TX/RX Power
- Bit Error
- Skew
- Power
- Temperature



Ethernet tester supporting coherent optics



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TROUBLESHOOTING



Possible root cause

Coherent transceiver



Router/switch hardware or software configuration issue



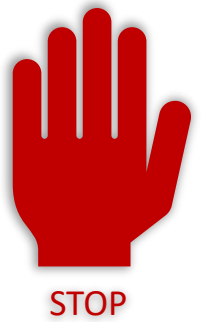
Transmission path



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TROUBLESHOOTING



Review BERT Results and check for:

- Errors and alarms
- Wavelength tuning
- TX/RX power
- **Optical metrics**




Port 1 - 400ZR+ (OFEC, 16QAM) [481.108374 Gbit/s]

Local Degrade Remote Degrade Remote PHY Fault

FED FDD

Threshholds

Physical Interface

Laser	TX Power (dBm)	Wavelength (nm)	RX Power (dBm)
ON 	-10.51	1547.715323	-10.6

Laser OFF at Start-Up Power Range (dBm) -23.0 To 0.0

TX Frequency

Frequency (GHz) 481.108371102

Offset (ppm) Fixed - 0.0 + Step Size (ppm) 1.0

Optical Metrics

Metric	Current	Metric	Current
CD (ps/nm)	0	PDL (dB)	0.9
CFO (MHz)	0	SOPCR (krad/s)	0
DGD (ps)	3.00	SOPMD (ps ²)	68.00
OSNR (dB)	35.7		

Interface TA4-QSFP-DD QSFP56-DD

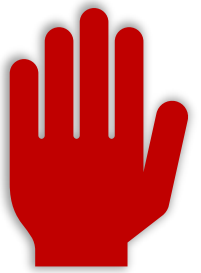
Ethernet tester supporting coherent optics



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TROUBLEHOOTING



STOP

Optical Metrics	
Spectral	Dispersion
Optical Signal to Noise Ratio	Chromatic Dispersion
Carrier Frequency Offset	Differential Group Delay
	Polarization Dependent Loss
	State of Polarization Change Rate
	Second Order Polarization Mode Dispersion



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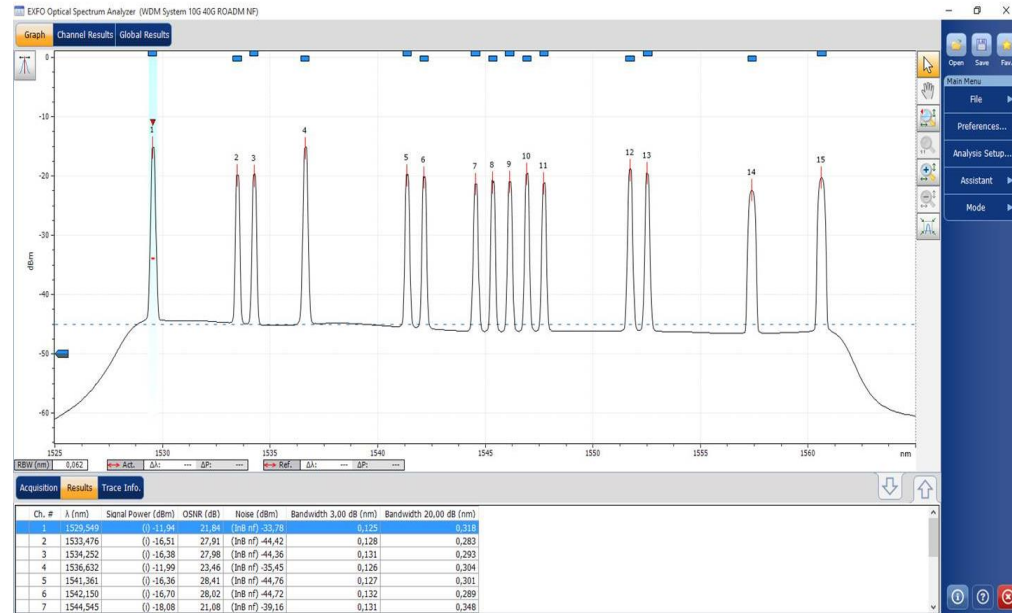
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TROUBLESHOOTING



Examine spectrum

- Central wavelength
- Wavelength and power drift
- Non-linear Impairments (pulse spreading, crosstalk, carrier leakage)
- Spectrum power balancing (amplified)



Optical Spectrum Analyzer

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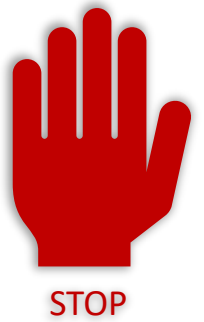
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TROUBLESHOOTING

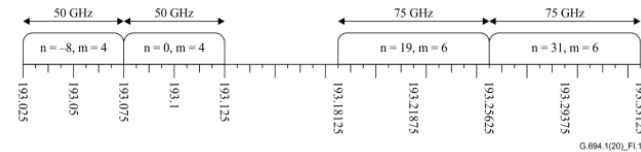


Possible root causes

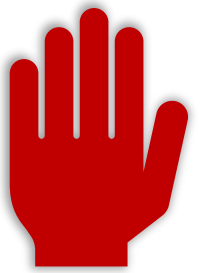
Patching issue



Channel spacing / grid issue (50GHz & 100GHz)



TROUBLEHOOTING



STOP

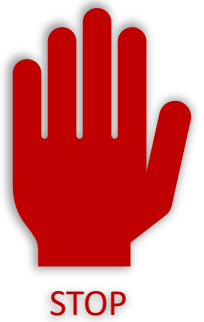
Spectral	Dispersion
Optical Signal to Noise Ratio	Chromatic Dispersion
Carrier Frequency Offset	Differential Group Delay
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	Second Order Polarization Mode Dispersion



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TROUBLESHOOTING



Possible root cause

Problem with physical fiber between data centers sites



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SUMMARY AND RECOMMENDED TEST KIT

1

Inspect connectors and transceivers

2

Perform coherent bit-error-rate-test (BERT)

3

Generate report and share results

4

Install 400G-ZR transceivers and equipment cords

5

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Fiber Inspection Scope



Coherent Optical Ethernet Tester



Optical Spectrum Analyzer

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THANK YOU

C.N. Rood

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Standnummer: 14

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