



Nortel 40G/100G Adaptive Optical Engine

October 2009

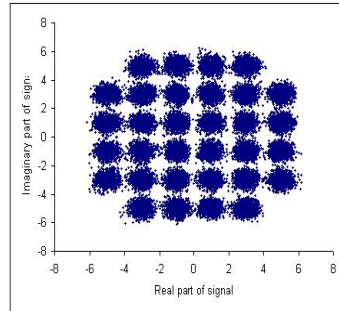
NORTEL

Business made simple

Coherent Opens Up 3D Capacity Evolution



QAM, M-ARY



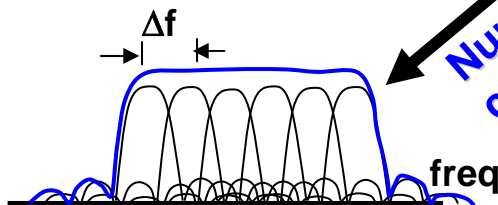
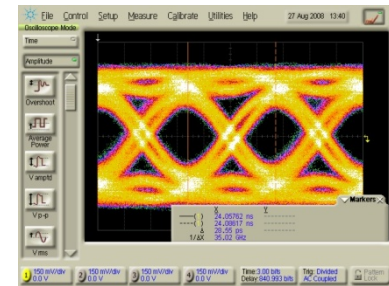
Three mechanisms to grow capacity

- Challenge the baud rate
- Challenge the bit/symbol
- Challenge fixed λ spacing

Bits per symbol

Symbols per second

Number of carriers



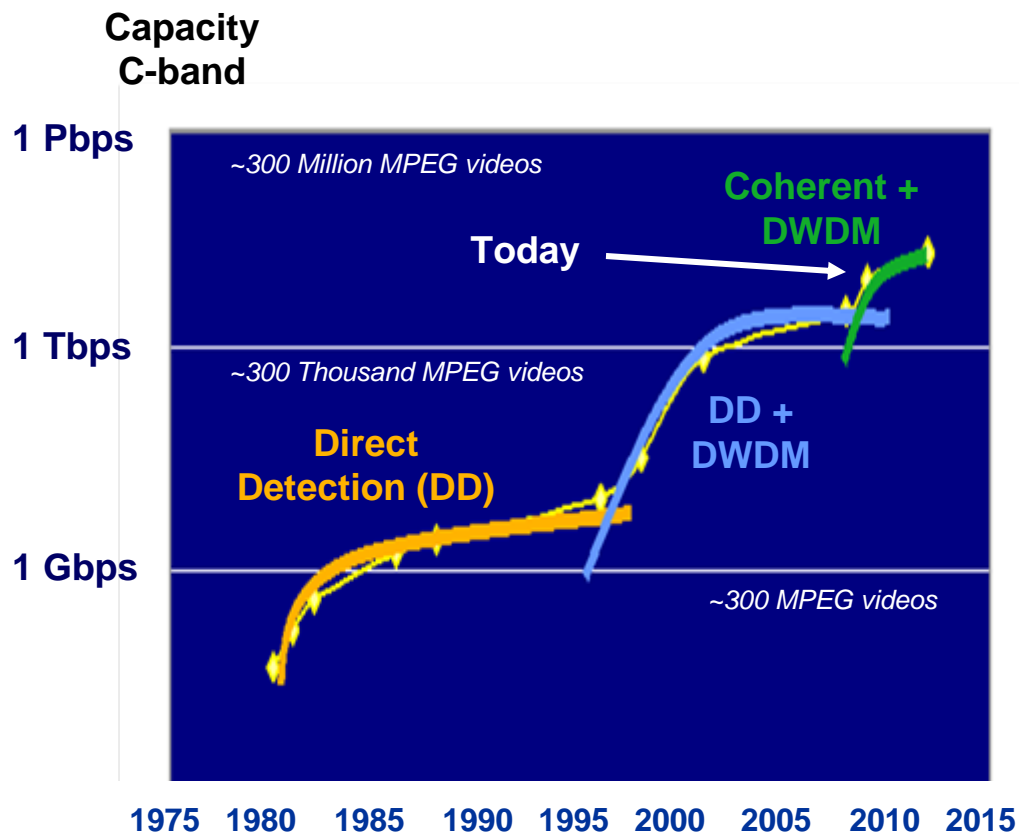
Flexibility in Spectrum Optimization Enabled by DSP



40G/100G System: Baseline Nortel Tenets

Investment Tenets

- Lower system life cycle cost/bit/Km
- No network re-engineering: 10G rules/reach for 40G/100G
- Simplify: no compensating units
- Agile photonic infrastructure with unrestricted networking



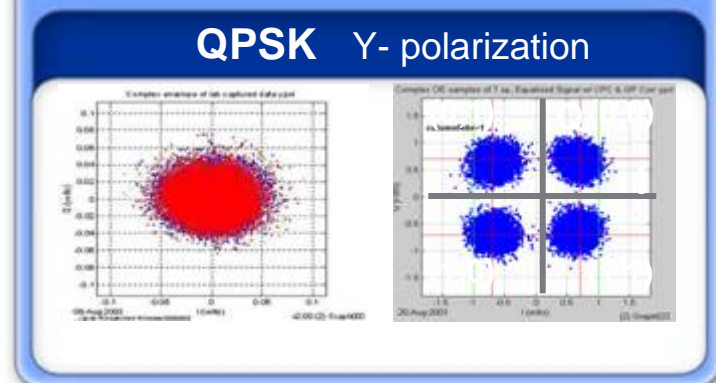
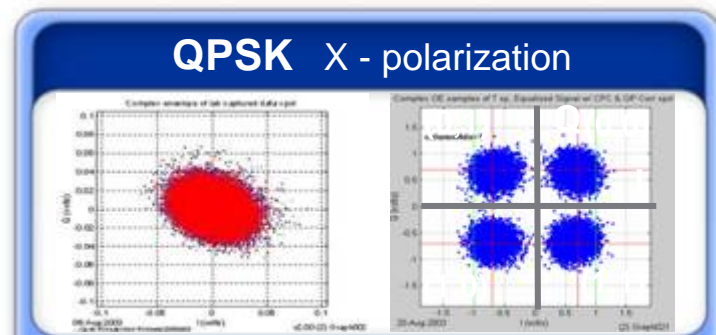
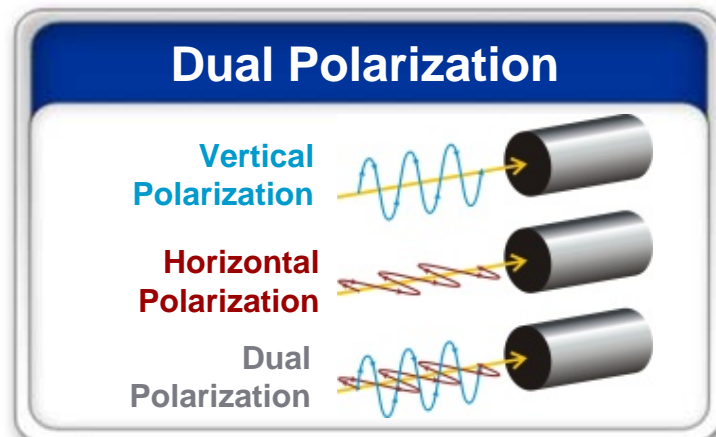
**Plug and Play Optical
Future Proof Evolution**

**Volume Deployable
Fiber Efficient**



40 Gbps Dual Polarization QPSK

- 40 Gbit/s on a single λ at 10 GBaud
 - Using Quadrature Phase Shift Keying (QPSK), 2 bits/symbol: **X 2**
 - 2 orthogonal polarizations: **X 2**
 - World's 1st Integrated 40G coherent digital receiver
- Propagates like a 10 Gbps signal
 - For non-linear impairments, dispersion tolerance, PMD tolerance, etc...
 - **Uses 10G components:** cost optimized, mature technologies with numerous vendors
- Fully leverages existing 10G infrastructure
 - **Same Reach** - no λ reduction to overcome increase in noise
 - **Same tolerance of cascaded ROADMs**
 - **No Dispersion Compensation required**
 - **Dual Polarization provides better PMD performance than 10G systems**
 - All fiber that could be used for 10G can now be used for 40G
- Viable option for 100G transmission





Nortel's 100G Technology

100 Gb/s Modulation

- Spectral efficiency leap with techniques borrowed from wireless transmission
- Coherent FDM Dual Polarization QPSK, 14Gbaud
- High tolerance to 50GHz cascaded ROADMs

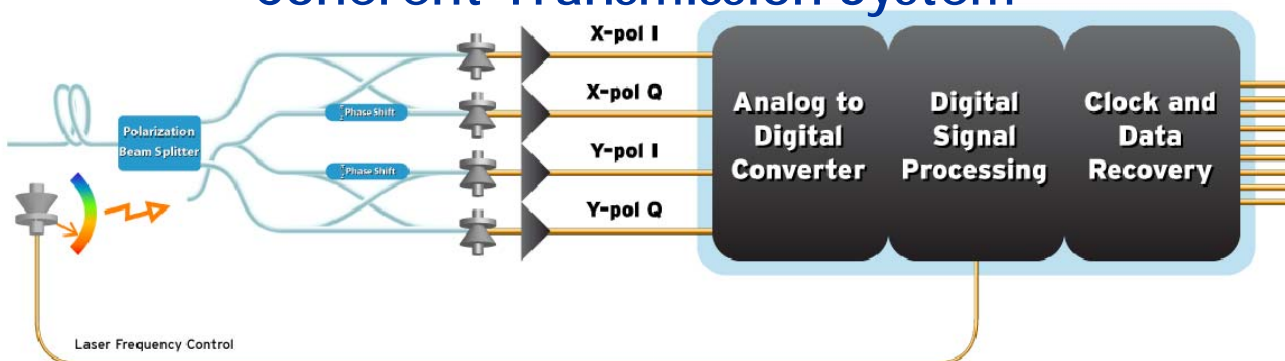
Coherent Detection

- Intelligent interpretation-- amplitude, phase, polarization
- 1000Km+ reach without regeneration
- +/- 40,000 ps/nm CD, 20ps mean DGD PMD tolerance
- Simplified colourless networking
- DSP at CMOS speeds

Client Encapsulation

- ODU4 encapsulation of 100 GbE
- Full rate ODU4 (112 Gbps) for service transparency
- Fully instrumented for network and service management

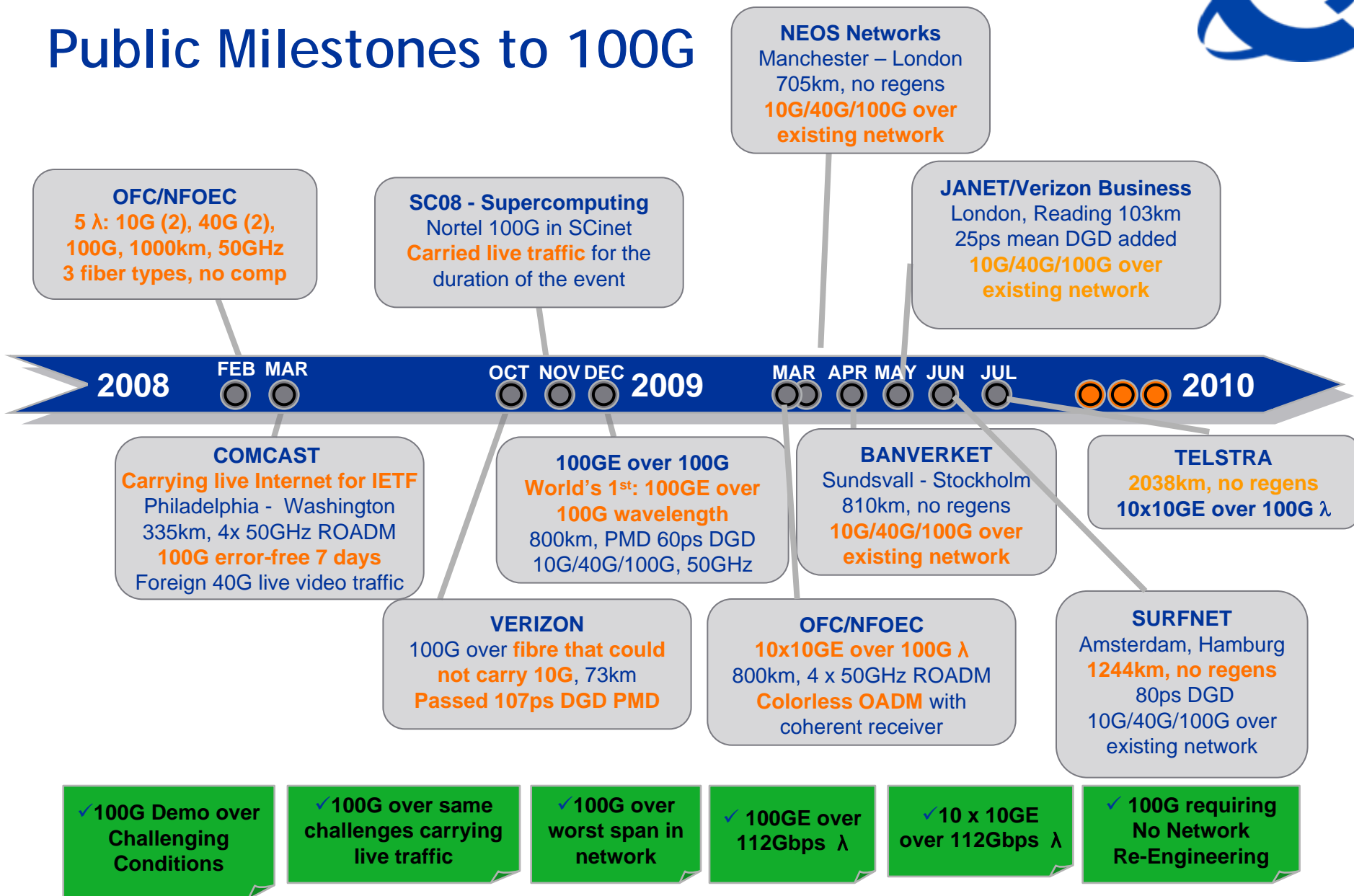
Coherent Transmission System



Leveraging Technology from Volume Deployed 40G



Public Milestones to 100G





Reference Links to 100G Trials:

- [Comcast 100G Trial, March 2008](#)
- [Verizon 100G Trial, October 2008](#)
- [100G Carrying Live Traffic for SC08 Event, November 2008](#)
- [100GE over 100G Wavelength, December 2008](#)
- [10x10GE over 100G Wavelength, March 2009](#)
- [NEOS Networks 100G trial, March 2009](#)
- [Banverket 100G Trial, April 2009](#)
- [JANET, Verizon Business 100G Trial, May 2009](#)
- [SURFnet 100G Trial, June 2009](#)
- [Telstra 100G Trial, July 2009](#)

OME 6500 Platform Flexibility



40G

40G
ULH

100G





NORTEL