

40, 100Gbps & beyond

40 and 100Gbps Market

Ovum's CAGR

Transponder	Revenues	65% till 2015
	Volumes	100% till 2015
	Line cards	Volumes 79% till 2014

Challenges

Coherent Rx ASIC

- Costs \$15m to \$20m to develop
- Likely at least a dozen players/ partnerships developing ASIC
- Includes
 - A/D converters
 - digital signal processor
 - 40nm CMOS version will integrate soft-decision FEC too
- 56 to 64 Gsamples/s

Maturity of the supply chain

System vendors

- NSN
- Ciena
- Fujitsu

Transponders available 2011

- Mintera
- Finisar hints at pursuing DP-QPSK
- CoreOptics
- JDS Uniphase

Pursuing 40G coherent

40G DQPSK

- Opnext
- Oclaro
- JDS Uniphase

Some example 40Gbps developments

Why upgrade?

Economics

- Rule-of-thumb: 40G: 2.5x the cost 10G
- In practice: 40G > 4x 10G
- Next transition point: 100G: 2x 40G
- 80 10Gbps DWDM channels = cost lighting up one channel new fibre

Examples

- BT: Likely to adopt 40Gbps in near future
- AT&T: Backbone already upgraded, Now metro, international, Planning coherent optimised links
- Verizon Business: Limited 40G DPSK, 2010 Start deploying DQPSK, 2011/12 100G coherent optimised links
- China Telecom: Large deployment of DQPSK

Technologies

40Gbps

- Optical Duobinary (ODB): Used for metro
- DPSK: Simple; works fine up to 1200km, Limited dispersion tolerance
- DQPSK: Better tolerance to Polarisation mode dispersion (PMD), Needs wavelength management, Passing through multiple filter stages
- DP-QPSK: Most complex, Best tolerance to PMD (Eliminates dispersion compensation fibre, Reduces latency by 10 to 20%), Needs wavelength management (AlcaLu claims it has solved this)

100Gbps

- Defacto: DP-QPSK
- Others: Ofidium's OFDM tranponder, ADVA Optical Networking's custom metro/ enterprise approach (Price close to 10x10Gbps)

After 100Gbps

Speeds?

- 200Gbps
- 400Gbps
- 1Tbps

Options to boost capacity

- Redesign links: Raman amplifiers, No dispersion fibre
- Gridless: Adds up to 30% extra spectrum
- Schemes being considered: Increments of 25GHz, Channels of any size
- Modulation: QAM (16, 64, 256), OFDM
- soft-decision FEC