



# WS5: 100 Gb/s - How, where, when?

## Sunday, 14:30-17:30h

*Organisers:*

*Jörg-Peter Elbers, ADVA AG Optical Networking*

*Glenn Wellbrock, Verizon Business*



# 100G is hot

- ▶ “Every 10G lambda deployed today will become a 100G lambda by 2012” – *AT&T spokesperson*<sup>1</sup>
- ▶ “We're trying, in the backbone space, as quickly as possible, to get to 100 GigE” – *Stuart Elby, Verizon*<sup>2</sup>
- ▶ “Facebook would use 100-Gbit/s Ethernet right now if we had it.” – *Donn Lee, Facebook*<sup>3</sup>

<sup>1</sup> E. Griliches, IDC, IRR WDM&NGN Conf., Jun 2009

<sup>2</sup> Lightreading, May 2009

<sup>3</sup> Lightreading, Sept 2009

**Common theme: Larger bandwidth, higher efficiency, lower cost per bit**



# 100G is more than long-haul transport

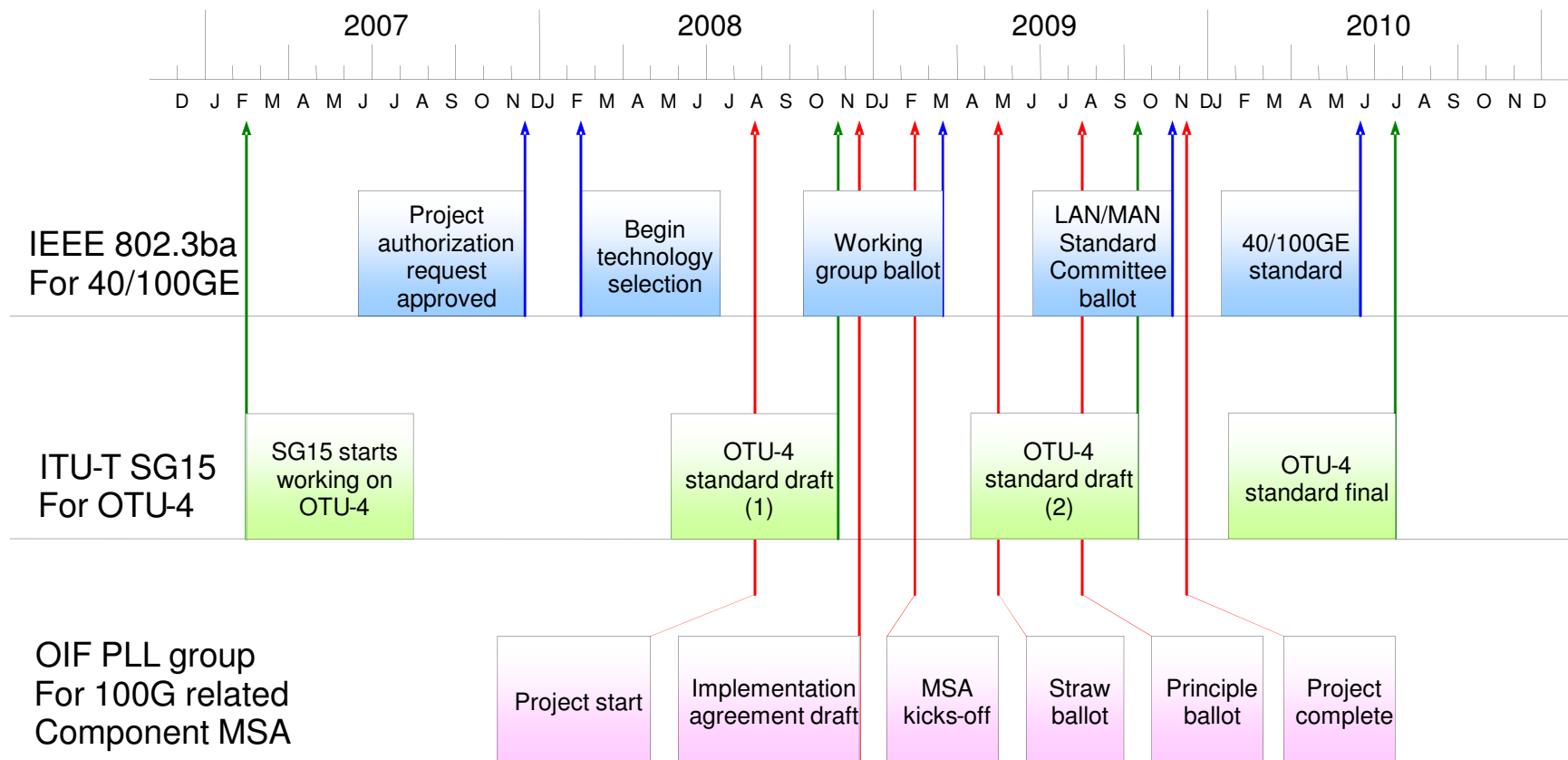


[source: company websites. Pictures show examples only]

**HP/grid/cloud computing, DC connectivity, routing, switching & transport**



# 100G standards are maturing



[source: T.J. Xia, Verizon]



# 40GE/100GE interfaces are set

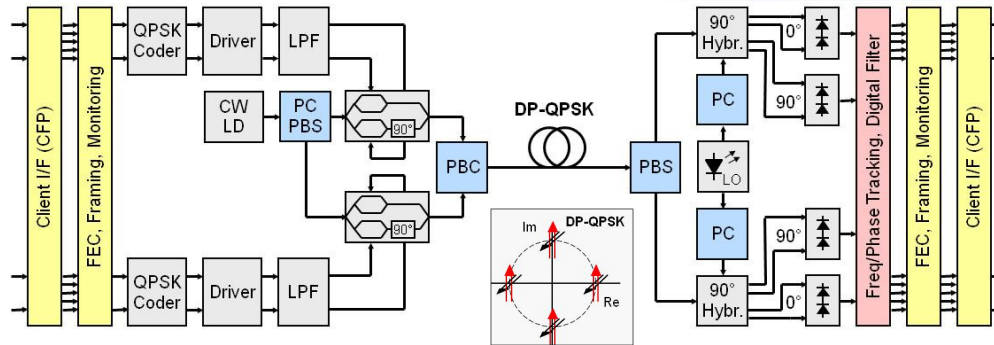
Name	Description
40GBASE-KR4	40 Gb/s PHY using 40GBASE-R encoding over four lanes of an electrical backplane (See Clause 84)
40GBASE-CR4	40 Gb/s PHY using 40GBASE-R encoding over four lanes of shielded balanced copper cabling (See Clause 85)
40GBASE-SR4	40 Gb/s PHY using 40GBASE-R encoding over four lanes of multi-mode fiber, with reach up to at least 100 m (See Clause 86)
40GBASE-LR4	40 Gb/s PHY using 40GBASE-R encoding over four WDM lanes on single-mode fiber, with reach up to at least 10 km (See Clause 87)
100GBASE-CR10	100 Gb/s PHY using 100GBASE-R encoding over ten lanes of shielded balanced copper cabling (See Clause 85)
100GBASE-SR10	100 Gb/s PHY using 100GBASE-R encoding over ten lanes of multi-mode fiber, with reach up to at least 100 m (See Clause 86)
100GBASE-LR4	100 Gb/s PHY using 100GBASE-R encoding over four WDM lanes on single-mode fiber, with reach up to at least 10 km (See Clause 88)
100GBASE-ER4	100 Gb/s PHY using 100GBASE-R encoding over four WDM lanes on single-mode fiber, with reach up to at least 40 km (See Clause 88)

[source: IEEE 802.3ba]

**Optical client module standards (CFP, CXP) are defined**

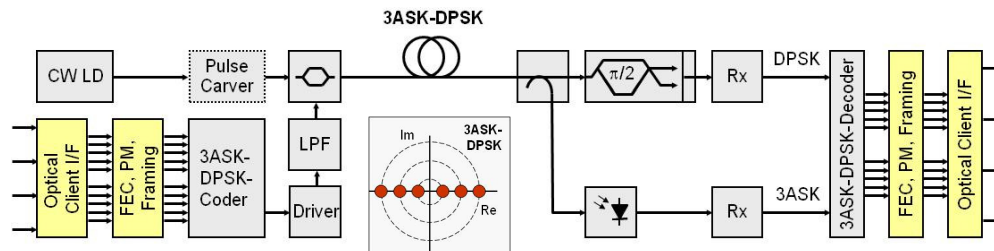


# 100G DWDM transport leaves options



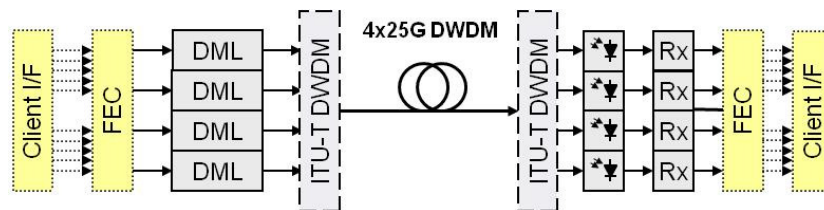
LH/core transport (>600km):

- ▶ Coherent RX & DSP technology
- ▶ DP-QPSK modulation format (28GBd)
- ▶ 50GHz spectral occupancy



Metro/regional transport (<600km):

- ▶ Off-the shelf components
- ▶ Multi-level modulation formats, e.g. 3ASK-DPSK
- ▶ 100GHz spectral occupancy



Enterprise transport (<200km):

- ▶ 4x25Gb/s DWDM channels (50GHz grid)
- ▶ Derived from IEEE 802.3ba standard
- ▶ 200GHz spectral occupancy

**Photonic & electronic integration is key to manufacturability & scale**



# Workshop questions

- ▶ Which will be the market drivers for a 100G rollout?
- ▶ In which (network) area will 100G first be introduced?
- ▶ When is the 100G introduction likely to happen?
- ▶ Which technologies will be used?
- ▶ Which optical performance can be expected?



# Workshop agenda

- ▶ Introduction  
*Jörg-Peter Elbers, ADVA AG Optical Networking; Glenn Wellbrock, Verizon Business*
- ▶ Market overview and outlook for 100G  
*Dana Cooperson, Ovum-RHK*
- ▶ 100G as infrastructure - A carrier's view  
*Yutaka Miyamoto, NTT Labs*
- ▶ 100G and beyond for data-center connectivity  
*Bikash Koley, Google*
- ▶ Long-haul 100G transmission - the system vendor challenge  
*Dirk van den Borne, NSN*
- ▶ 100G in router networks: Opportunities & challenges, risks & rewards  
*Luc Ceuppens, Juniper*
- ▶ 100G cost & performance optimization  
*Ross Saunders, Opnext*
- ▶ 100G client interfaces  
*Chris Cole, Finisar*
- ▶ Panel discussion





ADVANCE

# Thank you

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