Dimensioning issues utilizing advanced multicore fibres

Lars Dittmann
Technical University of Denmark, DTU
ld@com.dtu.dk
Does “Moors law” apply to optical networks?

- Optical communication has probably been the most important enabler for the success of the Internet. (Otherwise we have been forced to use microwave tubes – advanced pluming.)

- How do we retain the capacity growth in the global network?
- Is higher bitrates on transport networks the ultimate goal to ensure Internet growth?
- Can classic traffic engineering methods still be applied for future networks?
- Is bandwidth growth just bandwidth growth – or do we need to be more detailed in order to plan and dimensioning the future global network.
Traffic aggregation as a way to cost efficient networking
Fundamental assumptions for statistical gain in traffic aggregation

• Similar profiles of application load – to exploit law of large numbers
  – Traffic engineering was fundamentally developed for single service networks – today we have multiservice/integrated service networks
• Independent user behavior
  – Today heavy traffic is often related to events – and therefore often correlated (and multicast systems are badly deployed)
• Large ration between application bandwidth and resource bandwidth
  – In the past the ratio between access and core network bitrates was at least 1000 – now much lower (100-500) and still falling.

What is driving the traffic growth??
The internet of things

50 billion units
(in 2025)

Source: Ericsson
How do we obtain higher network capacity?

• Can we learn from electronics – has optical transmission reached a maximum where parallelism is the (only) way forward (as in electronics)?
• What is the most cost-efficient bitrate (single source)?
• Can parallel resources appear as a single large resource?
• Is service integration applicable to all levels of a network?
Multicore fibre – what is new?

- Ultra high speed transmission - Pbit/s demonstrated
- BUT - Classic transceiver system with fan-in fan-out units
- Networking perspective depends on interworking in end-points.
- How will multicore resources differentiate from the wavelength dimension?
- Will multicore resources and wavelength resources be of same kind of or different dimensions?

Source: NTT
Flat network architecture requires significant increase in northbound links of TOR switch (from typical 2 to several hundreds) – bitrate scaling through parallelism.

- Low cost solution
- Mechanical integration with transceiver module for fault management and high availability insurance
- Server location latency independent (minimal need for process migration !!)
- Low latency
- Support Pbit/s DCN’s
DCN example

Combining Optics and SDN In next Generation data centre Networks

www.fp7-cosign.eu
The COSIGN approach

**Manual, Painful, Error-prone**
- Workload deployment requires time and intervention of different admin roles
- Connectivity of workload components is static
- Performance is achieved with over provisioning, questionable scaling characteristics

**Discrete, Heterogeneous, Complex**
- Multiple management roles and domains
- Unable to make global decisions efficiently and dynamically
- Requires expertise in different vendor technologies

**Consolidated, Converged, Programmable**
- Unified IT and SDN orchestrator
- Converged IT + Network virtualization for data centers
- Efficient and optimized virtual resource utilization and allocation
- Enhanced abstraction mechanisms for emerging optical technologies

**High-performance optical solutions**
- Flattened DC network architecture
- Fast TOR switch
- 3D stacked transceiver
- InP fast switch
- Low loss beam-steering switch
- Hollow-core and Multi-core fibers

**Control Plane**

**Orchestrated Management**

**Data Plane**

**Automated, Streamlined, Optimized**
- Rapid and flexible workload management
- On demand resource allocation and release
- Scalable and efficient virtualized workload components connectivity

**Cabling mess**
- Many different incompatible interconnects
## COSIGN Partners

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A unique combination of skills and know-how for a coordinated hardware and software design.
The future of multicore fibre networking

• Need development in close interaction with transceiver and optical switch development – possible, but needs to be cost efficient

• In support of parallelisms in networking – as in computing.

• In support of fast circuit switching with adaptive capacity assignment for optical networking – compensate for lack of optical memory (optical packet switching with 70-80 % utilization and 10^-9 packet loss is not within reach for the next 10-20 years)

• Support for service segregation in the physical layer – e.g. fast circuits for heavy video streaming – packet/burst mode network for IoT and classic internet applications.

• All optical of single and multicore (core bundles) for addaptive support packet and circuit core networks.

• A potential new level of freedom in the traffic engineering !!

• Potential early adoption in DCN’s
Advanced multicore fibre
– an enabler for a reliable Internet based on (partial) circuit switching