Dimensioning issues utilizing advanced multicore fibres

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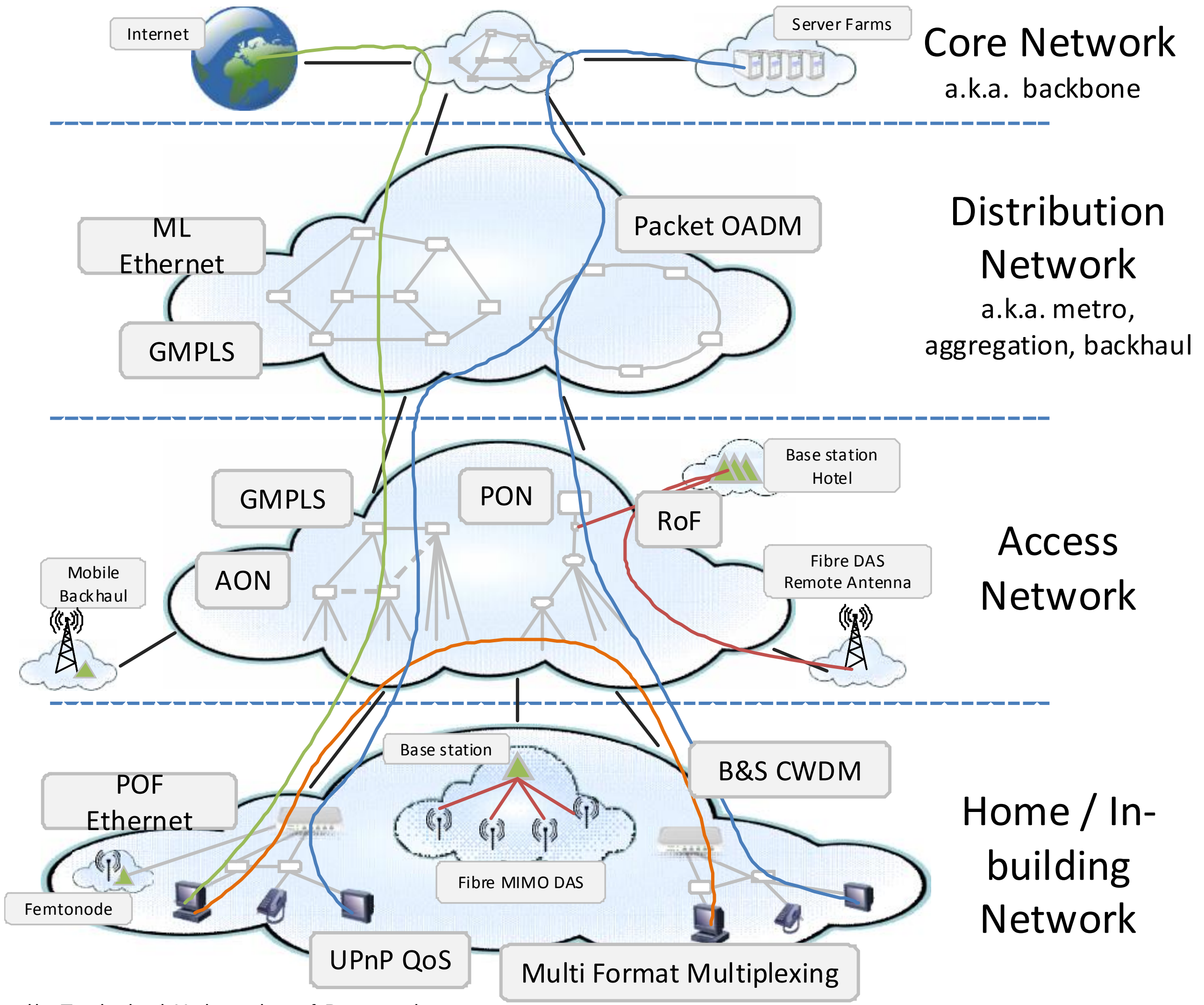
Does “Moors law” apply to optical networks?

- 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



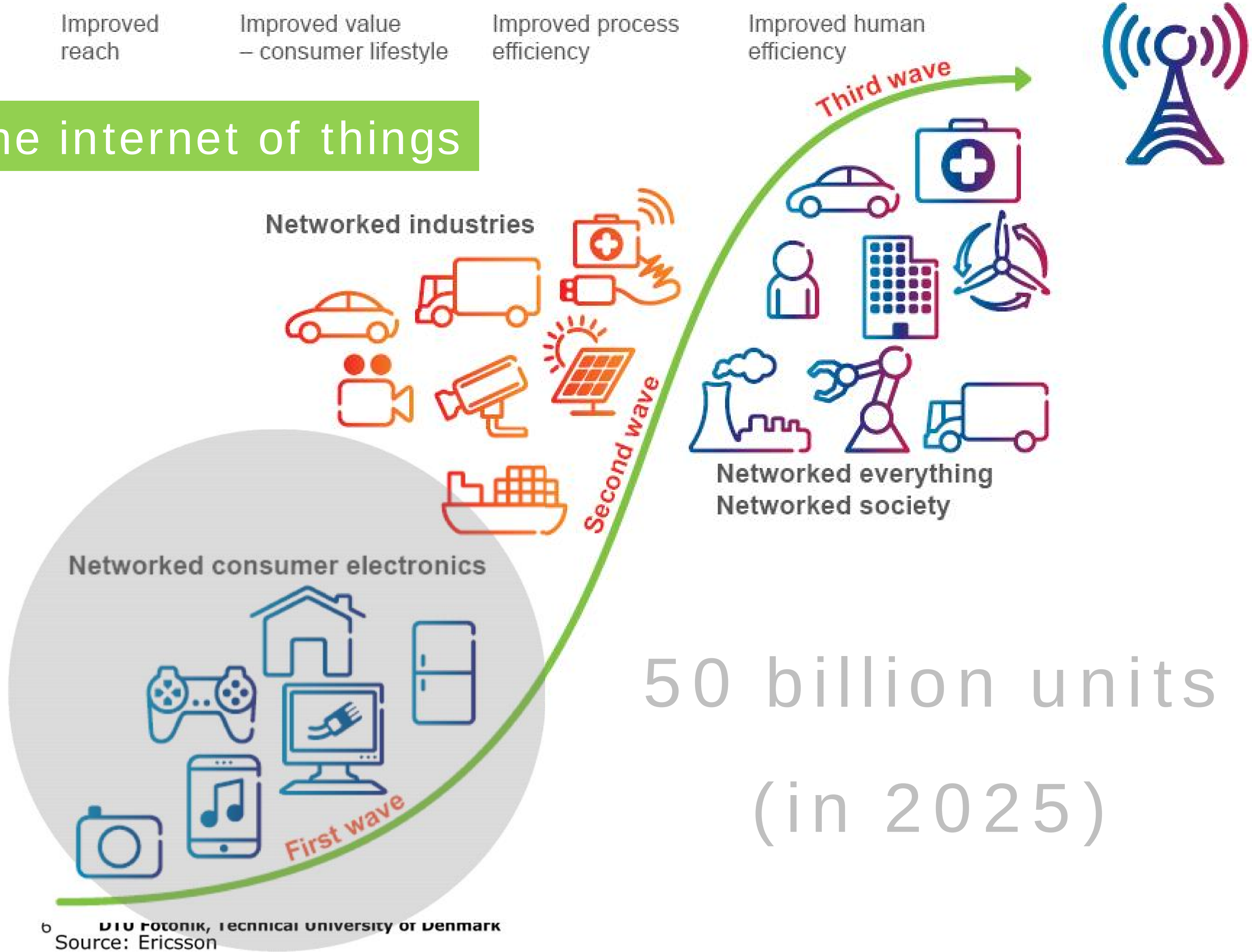
Fundamental assumptions for statistical gain in traffic aggregation

- 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??


Samsung SMART TV
8K - UHDTV
7680x4320
4K 3840 x 2160
2K - HD
192
720
p

the internet of things



50 billion units

(in 2025)

Source: Ericsson

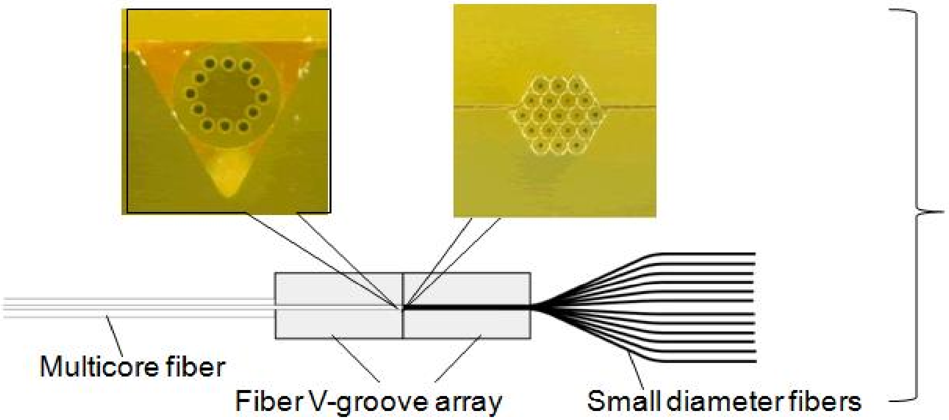
How do we obtain higher network capacity?

- 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

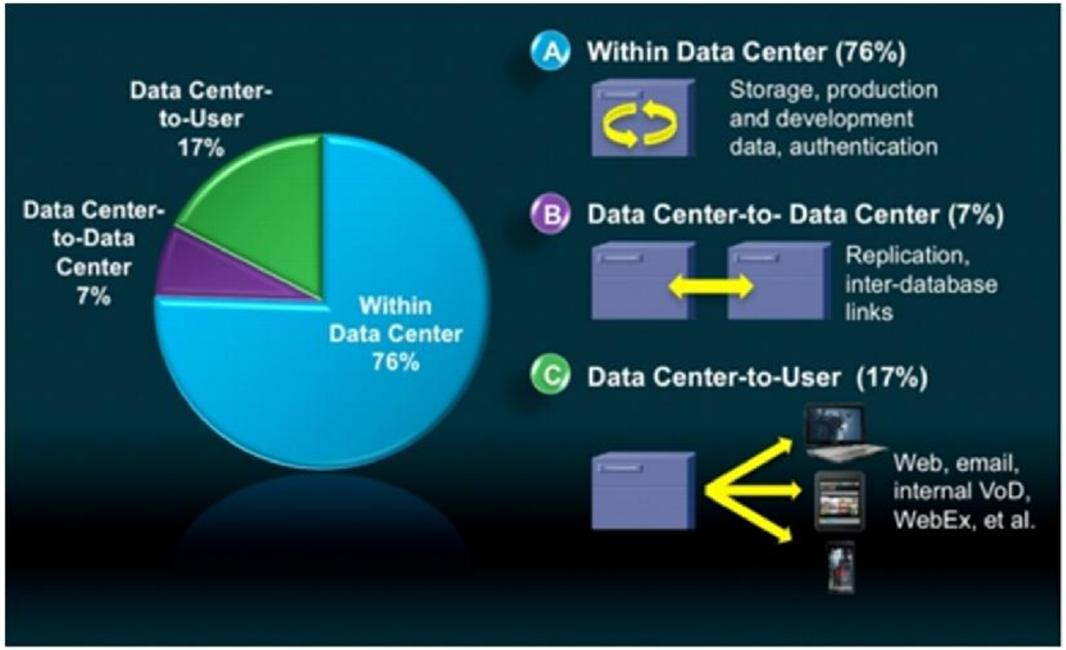


Fan-in fan-out device prototype

DCN – a case story for exploitation of multicore fibre.

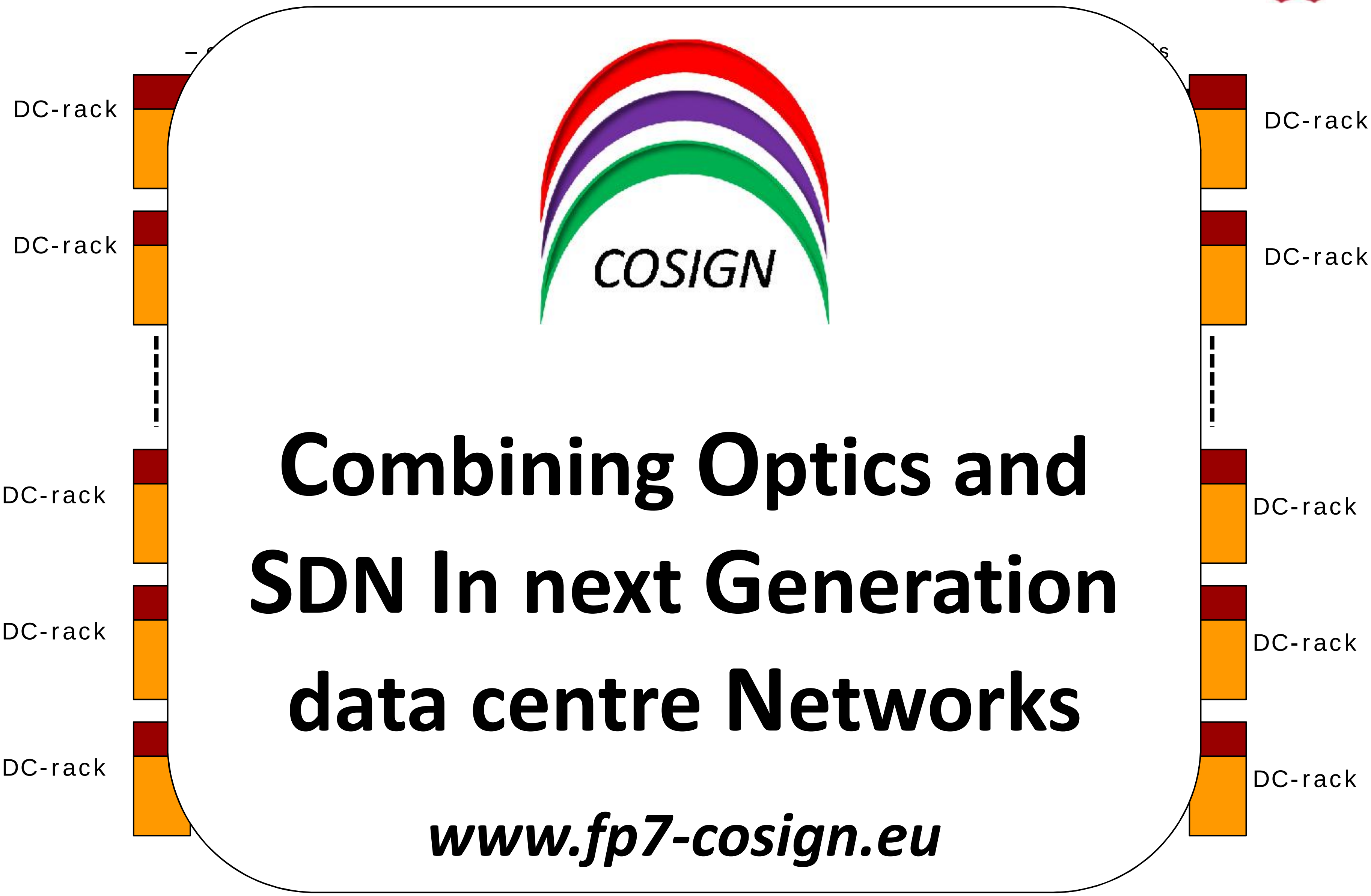
Flat network architecture requires significant increase in northbound links of TOR switch (from typical 2 to several hundreds) – bitrate scaling through parallelism.

- 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



Source: Cisco

DCN example



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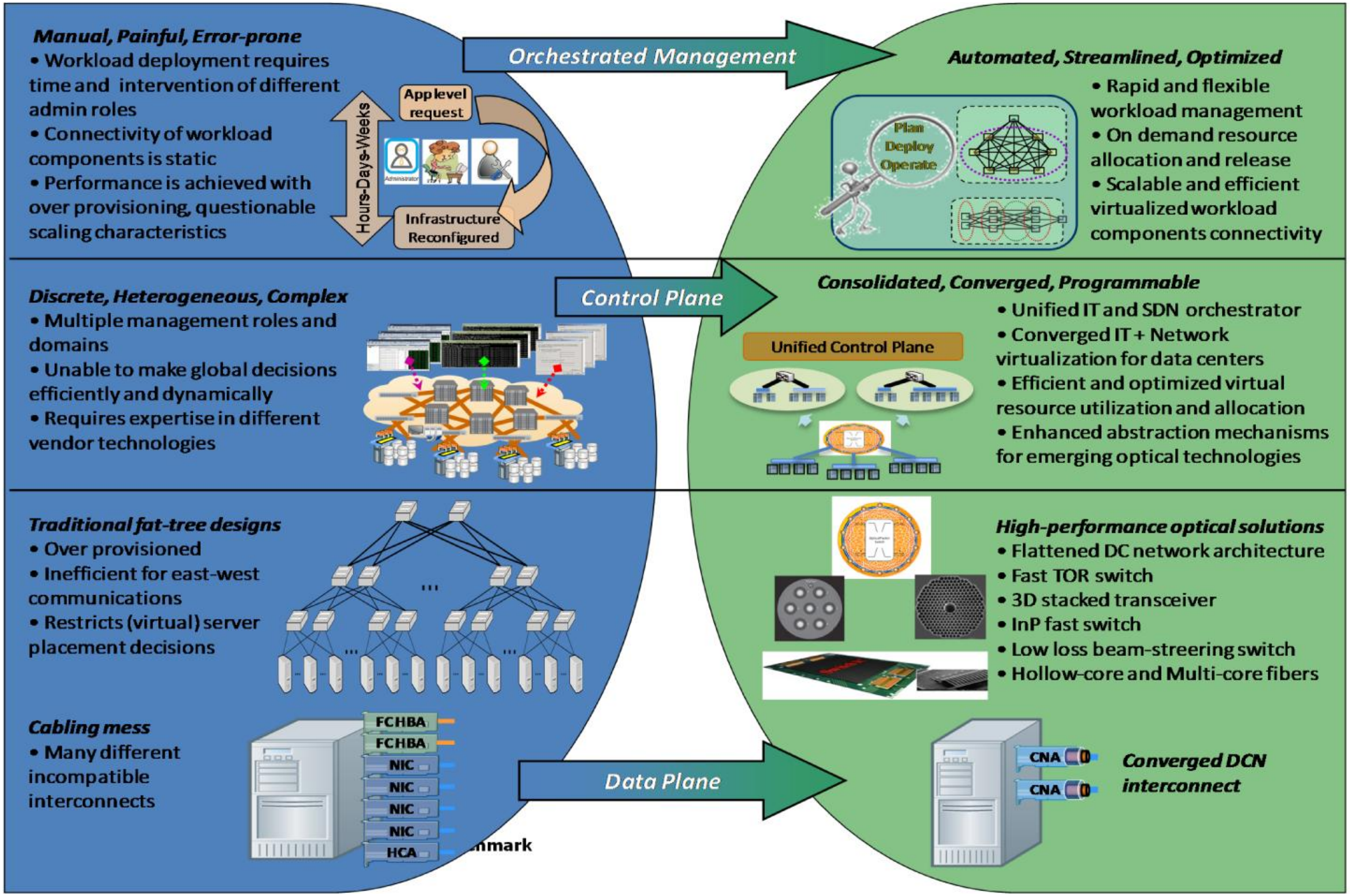
The COSIGN approach



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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