Towards a scalable and flat IP core network

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Traffic explosion drives the need for extreme network efficiency and scalability



Source: NSN

NSN expects exponential traffic growth of 50% p.a. or more in most markets.

Growth is fueled mainly by residential entertainment services and video.

The gap between network capacity investments and revenue growth is increasing. Network operators will be forced to maximize network efficiency and scalability.



Router trends for capacity and power efficiency



Capacity scaling

Based on historic trends, router capacity per chassis is expected to grow 10x in 10 years (+25% yoy).

Limiting factors include power consumption, electrical backplanes, network interfaces and others.

Power efficiency

Power efficiency is driven by semiconductor technology.

Technology evolution would suggest +20% improvement.

Note: +25% p.a. would be needed for fixed power/chassis.



DWDM trends for capacity and power efficiency





Capacity scaling

Based on historic trends, capacity of 80-channel WDM systems is expected to grow 6x in 10 years (+20% yoy trend).

Going beyond 20T with 400G and 80 channels may be challenging.

Power efficiency

Power efficiency is driven by optical components as well as semiconductor technology.

Higher integration (e.g. 4x 10G) will increase power efficiency.

Complex modulation and electrical impairment compensation may impact power efficiency.



Existing hierarchical core network structures are inefficient and will evolve ...



Towards a flat IP core network architecture

Flat core: single layer of densely meshed core routers Note: the number of sites must be limited to keep network complexity manageable and increase traffic per node pair to fill transmission pipes





Flat IP core brings significant savings in terms of core router capex and power consumption (opex)



16 Gross core router power cost 14 12 **Hierarchical** core 10 Mio US\$ Core Outer 8 6 4 Flat core 2 0 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 Calculations are for a hypothetical network serving 10mio BB lines.

Core router capex

Flat IP core enables more than 60% savings on router capex. Investments are almost flat until 2015 (with gradual transition), more inline with revenue growth.

Core router power consumption

Gross power consumption includes air conditioning overhead.

Power consumption (opex) is also significantly reduced by a flat core.

Improvement is lower relative to capex because of contribution of older HW to power consumption.



Summary and conclusions

Technology evolution of core network components is not fast enough to compensate expected traffic growth rates

Core network architectures are evolving to meet extreme network efficiency and scalability requirements

Evolution towards a flat IP core is an essential step to address scalability and efficiency requirements

Further coordination between routing and transport layers is expected to optimize opex

