ICT Networking Energy Footprint and Opportunities

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Abstract

The global energy consumption of the ICT networks has remained relatively small (2-3%) despite the significant global IP traffic growth (> 50% CAGR), but it has been growing primarily due to growth in the access networks, and the data-center computationally-intensive applications. Therefore, IC and optical technology and architectural advancements are needed to contain its energy footprint.

At the same time, "smart" networking promises significant (> 10%) improvements in the overall energy consumption, primarily from advancements in "smart-grid" power distribution, transportation, and buildings.

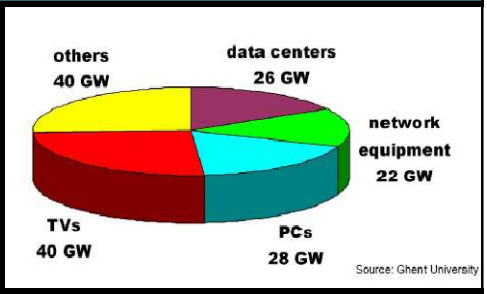
Cisco, for further details contact loukas@cisco.com

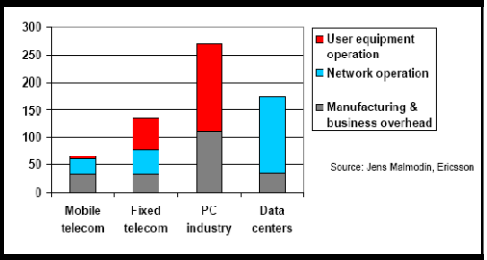
Outline

- ICT Network Energy Footprint
  - 1-3 % mostly due to access and DC
- NGN Technology & Architecture Advancements
  - CMOS, IP Routers, Optical, IP-over-DWDM, FTTH
- "Smart" NGN efficiencies
  - Smart-grid, transportation, buildings
- Summary

ICT Energy Footprint

2006 USA	GW
All Electricity	350
Building	250
Electronics	25
Telecom Network	*2-3*





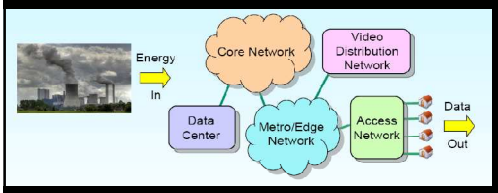
ICT ~ 8% Energy Footprint

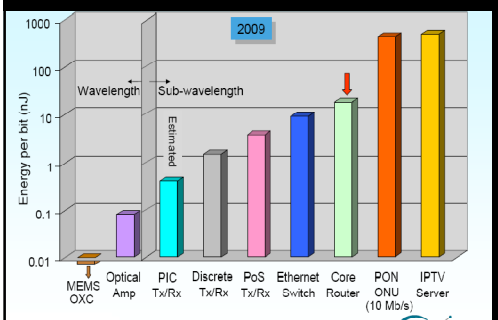
Network around 1% mainly from Access Network (> 70% today).

Data Centers 1-2% (mainly from servers).

Telecom Energy Analysis

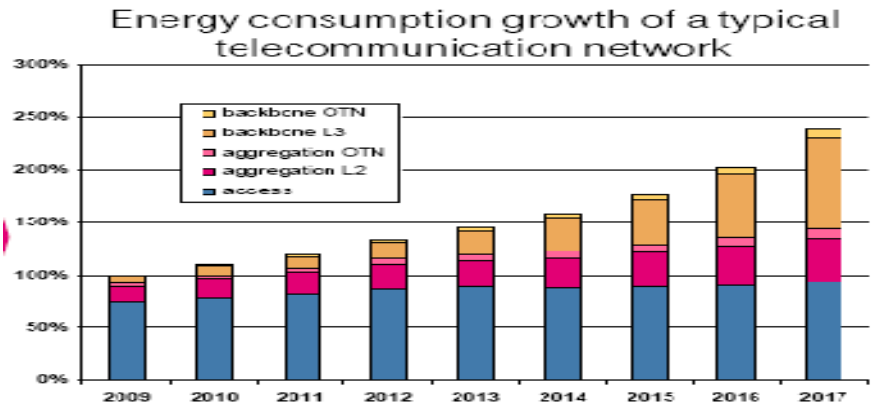
R. Tukcer et. al. IEEE OFC 2009





- **Planning very critical;**
  - **– Converged architectures**
  - **– Scalable platforms and capacity utilization (ASICs, interconnects, chassis fill factor)**
- **Access > 60% of consumption**
- **Servers (500 nJ/bit) 1000% more than other equipment**

Network Access importance



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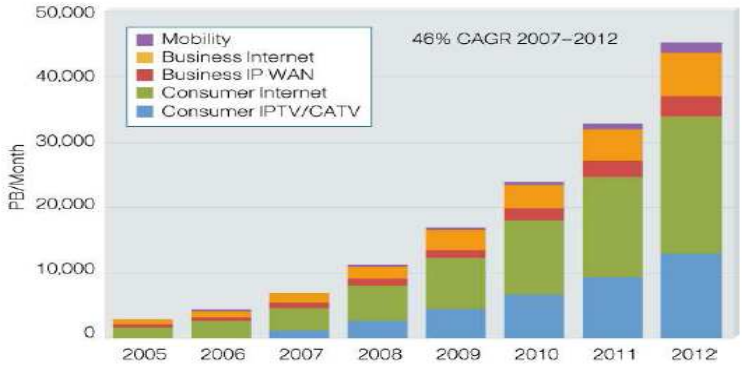
IP Networks Growth to the Zettabyte Era

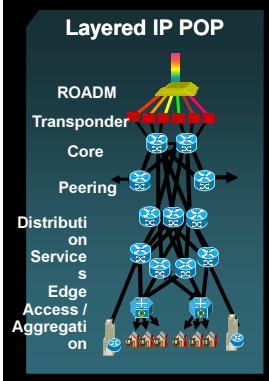
Figure 1. Cisco Forecasts 44 Exabytes per Month of IP Traffic in 2012

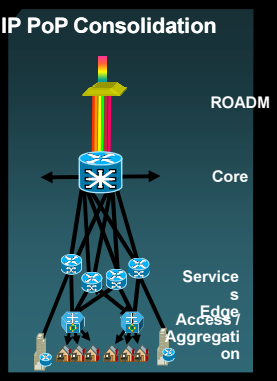


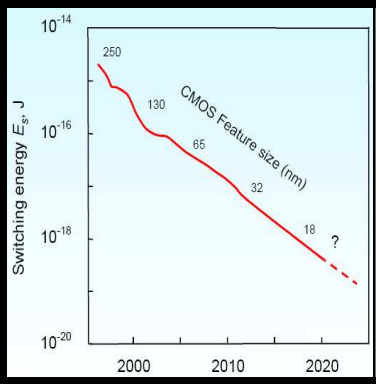
For more details, see the paper entitled "Cisco Visual Networking Index – Forecast and Methodology 2007–2012."
Source: Cisco, 2008

http://www.cisco.com/en/US/netsol/ns827/networking_solutions_sub_solution.html

Technology Benefits for Network Systems







Technology advancements = Energy benefits in Scaling Network Systems:
- Electronics: CMOS 40% CAGR, ASIC
- DWDM (EDFA, ROADM, PIC, 100G, WC) > 50% CAGR
- System Innovation (sleep mode, green mode etc)

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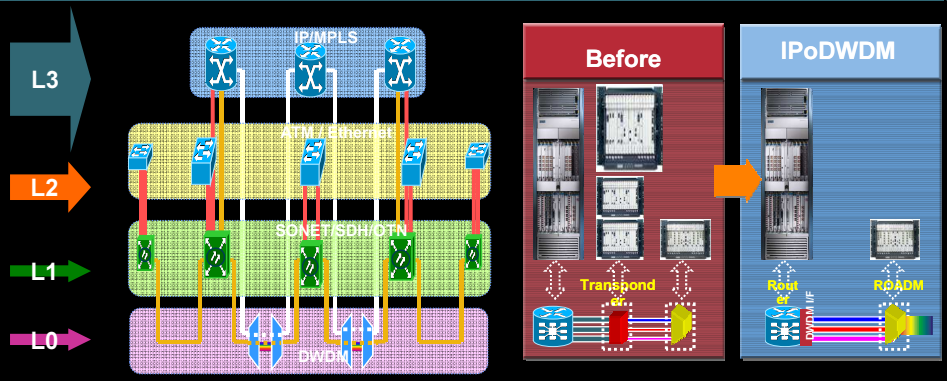
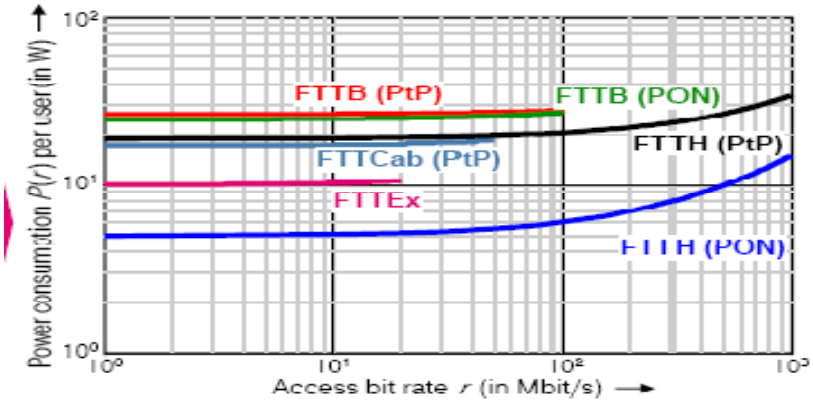
Architecture Evolution – IP-over-DWDM Transport



- Eliminate unnecessary Layers and minimize underutilized Equipment
- Maximize Architecture and Equipment Scalability

Architecture Evolution – FTTH Access



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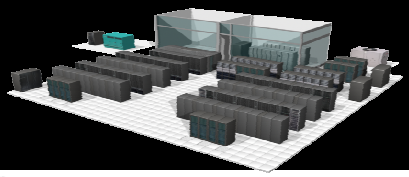
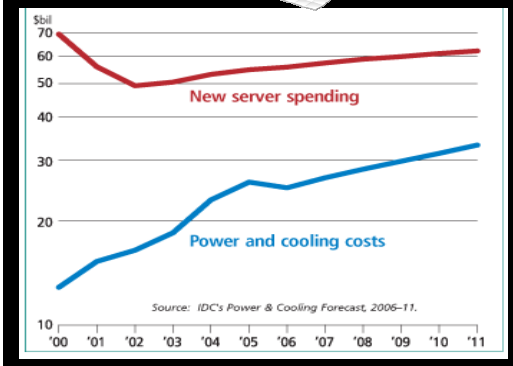
Data Center Power & Cooling Cost raises fast



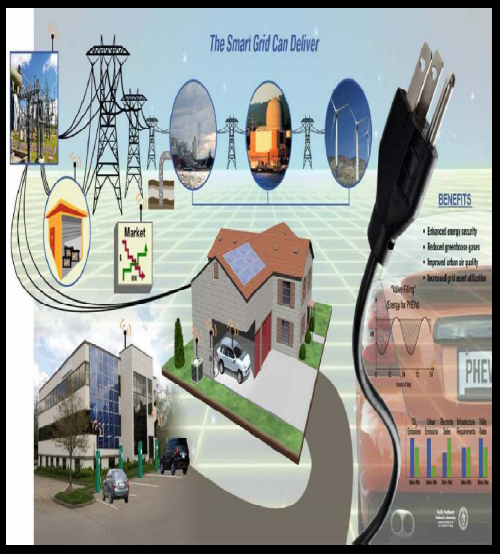


- **Servers (500 nJ/bit) 10x more than other equipment**
- **New advanced solutions call for:**
  - **Architectures Convergence**
  - **Consolidation, Virtualization**
  - **Scalable platforms**

"Intelligent" NGN Efficiencies

- **"Smart" NGN efficiencies up to 30% of Energy Footprint**
- Power distribution "Smart-Grid"
- Transportation, and Buildings
- **"Intelligent Urbanization"**

  Top 20 Cities use 75% of WW energy
- **Network as the 4th utility**



Summary

- ICT Networking Energy 1-3 %, mostly due to access and Data-Centers
- NGN Technology & Architecture Advancements (CMOS, Routers, IP-over-DWDM, FTTH) promise to contain Energy footprint, in spite the > 50% Traffic CAGR
- “Smart” NGN efficiencies > 10%, mostly in Power distribution (Smart-Grid), transportation, and buildings

Thank you

Looking forward to your questions/comments

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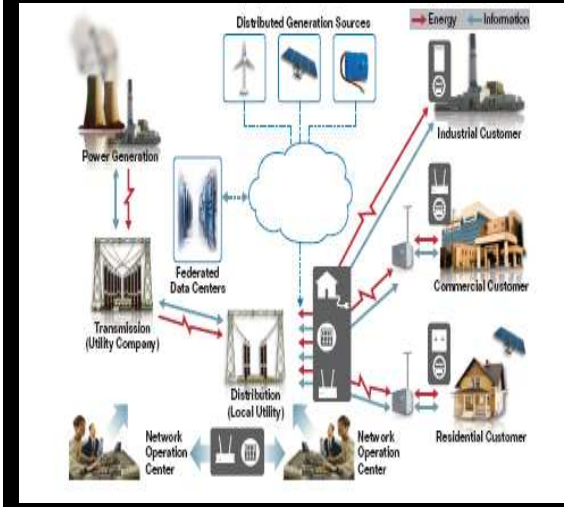
Smart Grid Infrastructure



- **Advanced connectivity and intelligence/control of Power Distribution network (100Ks nodes)**
- **Connect 200M C&I and 2B residential nodes**
- **Multiple Applications:**
  - **Monitoring**
  - **Metering**
  - **Renewable management**
  - **Demand side management**

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