NEDO Project on Development of Next-Generation High-Efficiency Network Device Technology
- Project Status Towards Energy Saving -

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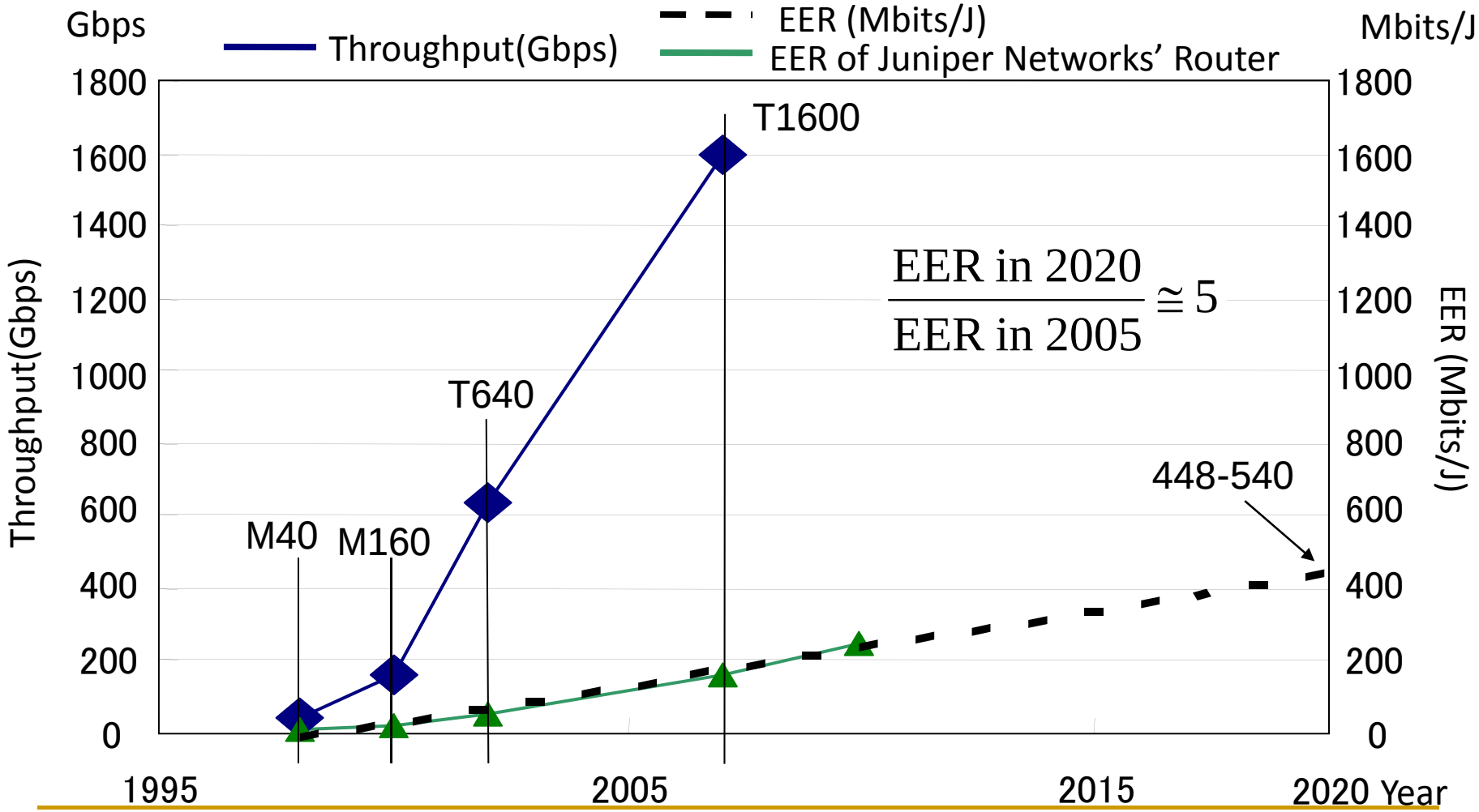
Outline

- Introduction and Objectives
- Target Areas of Development
- Photonic I/O Devices for 100GbE and 40GbE
- High Density Optical Backplane
- Dynamic Optical Path Network
- Conclusions

Introduction and Objectives

Router Throughput and Its Energy Efficiency Rating



Introduction and Objectives

- Evolution of current router technology may fail in 2020

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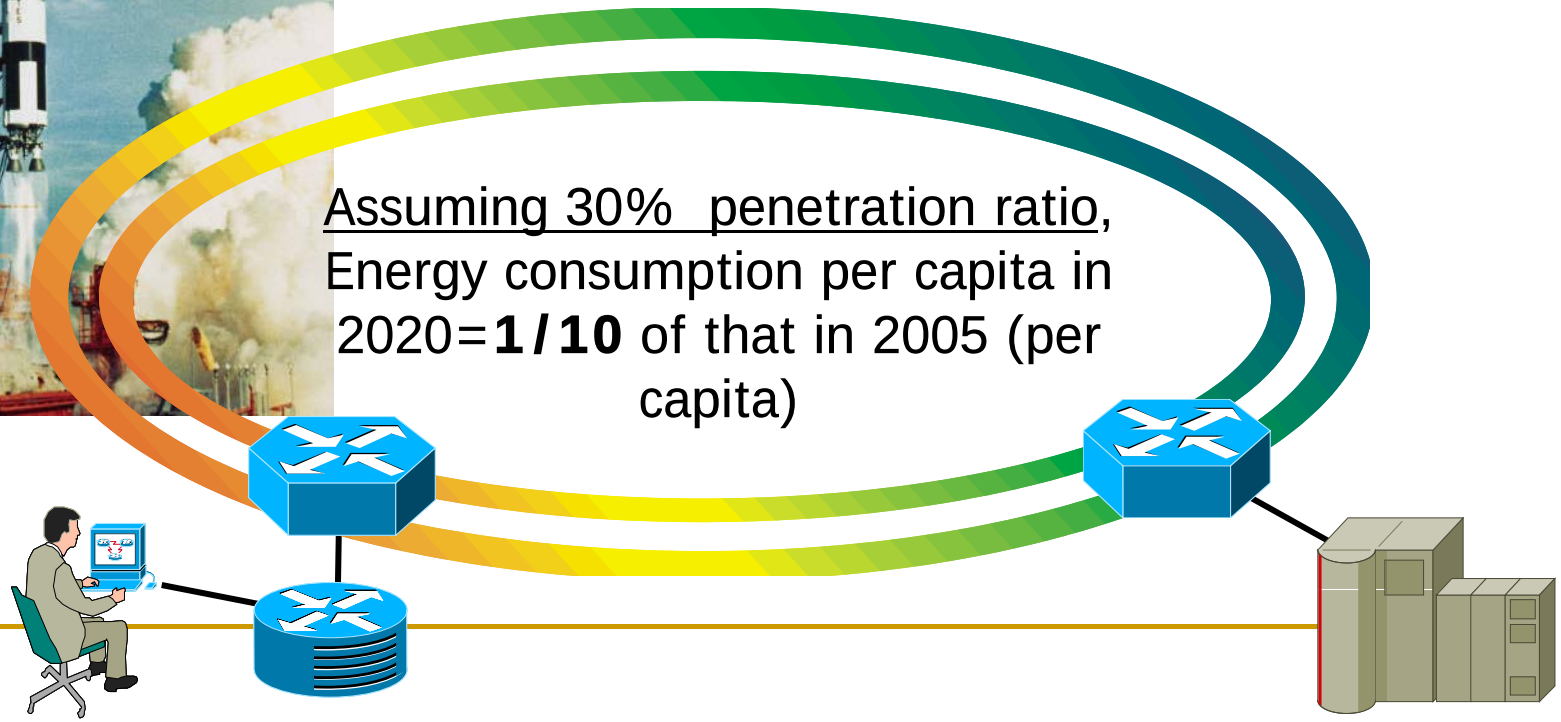
Why so much energy is required to transfer weightless information?

- The broadband subscribers in the world=215M in 2005(Penetration=3.35%：WHITE PAPER Information and Communications in Japan).
- World Population in 2020=7,500M.
- Energy consumption per capita =1/35

Assuming 30% penetration ratio, Energy consumption per capita in 2020=**1/10** of that in 2005 (per capita)



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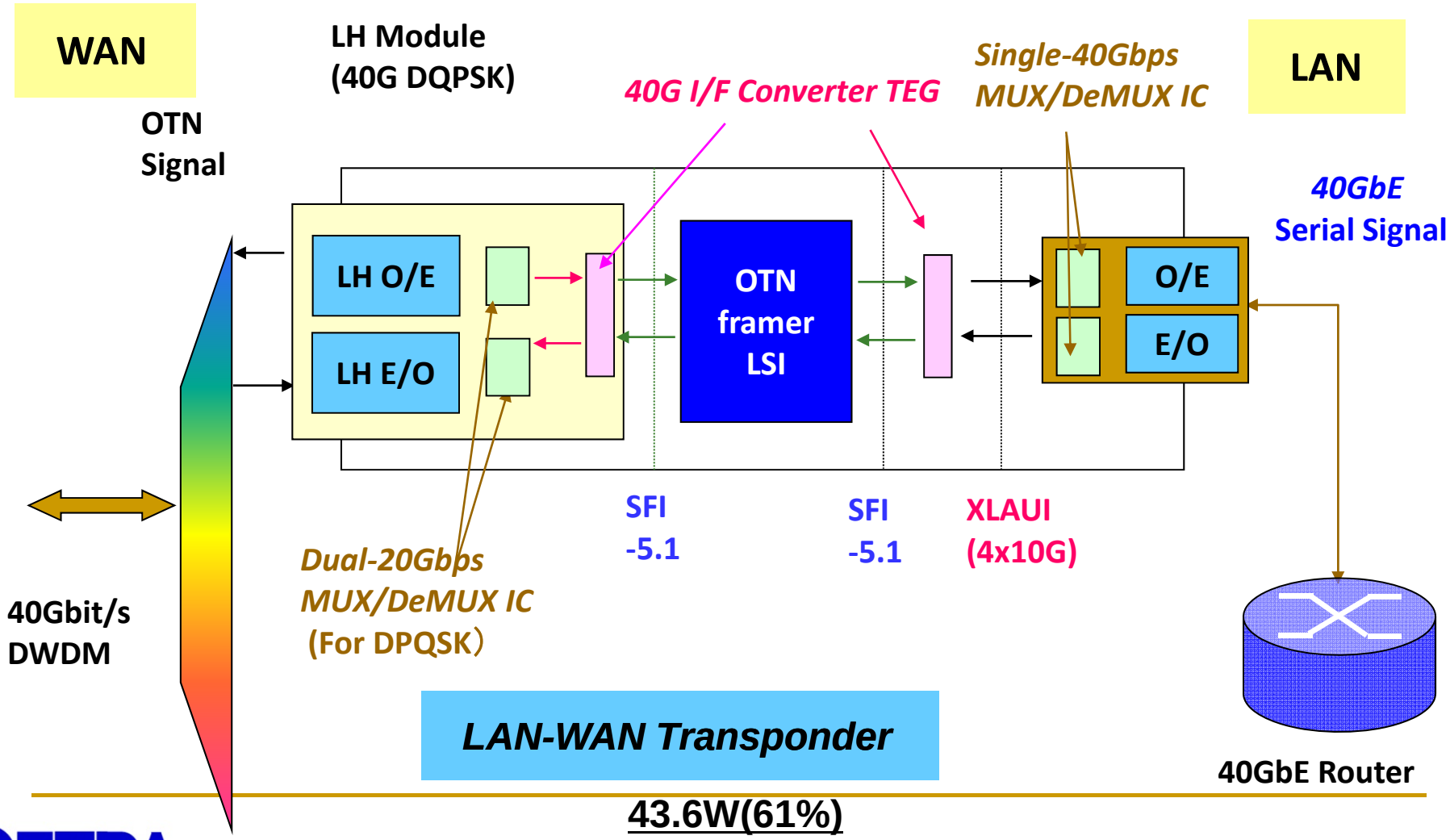
Target Areas of Development

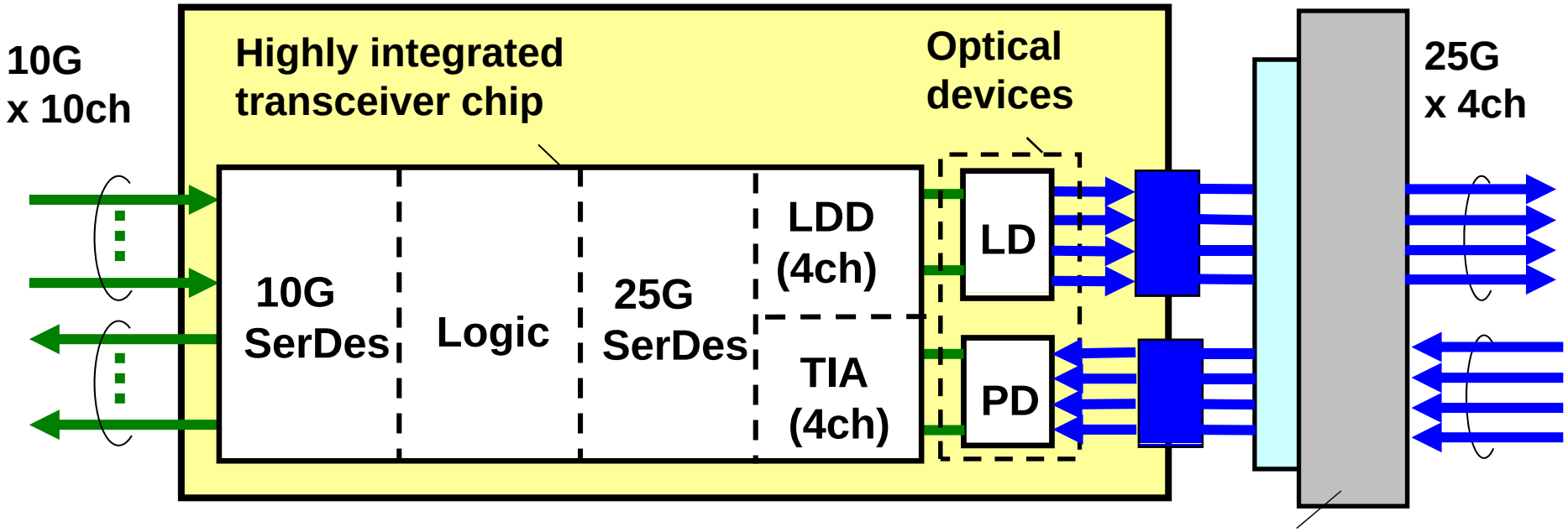
- Next Generation Network must be energy efficient!
  - ✓ Using Optics is our solution.
- For the current demands
  - Photonic I/O Devices for 100GbE and 40GbE
- For the demands in the near future
  - High Density Optical Backplane
- For the demands in the future
  - Photonic Path Switching

Photonic I/O Devices for 100GbE and 40GbE
- 40Gbit/s chipsets for LAN-WAN -



Photonic I/O Devices for 100GbE and 40GbE
- Highly Integrated 25Gbps - 4ch Optical Transceiver -

- ✓ One chip LDD/TIA integrated with 4ch x 25Gbps Serdes
- ✓ Low power consumption: 25mW/Gbps (estimated)
- ✓ 4ch x 25Gbps LD and PD arrays

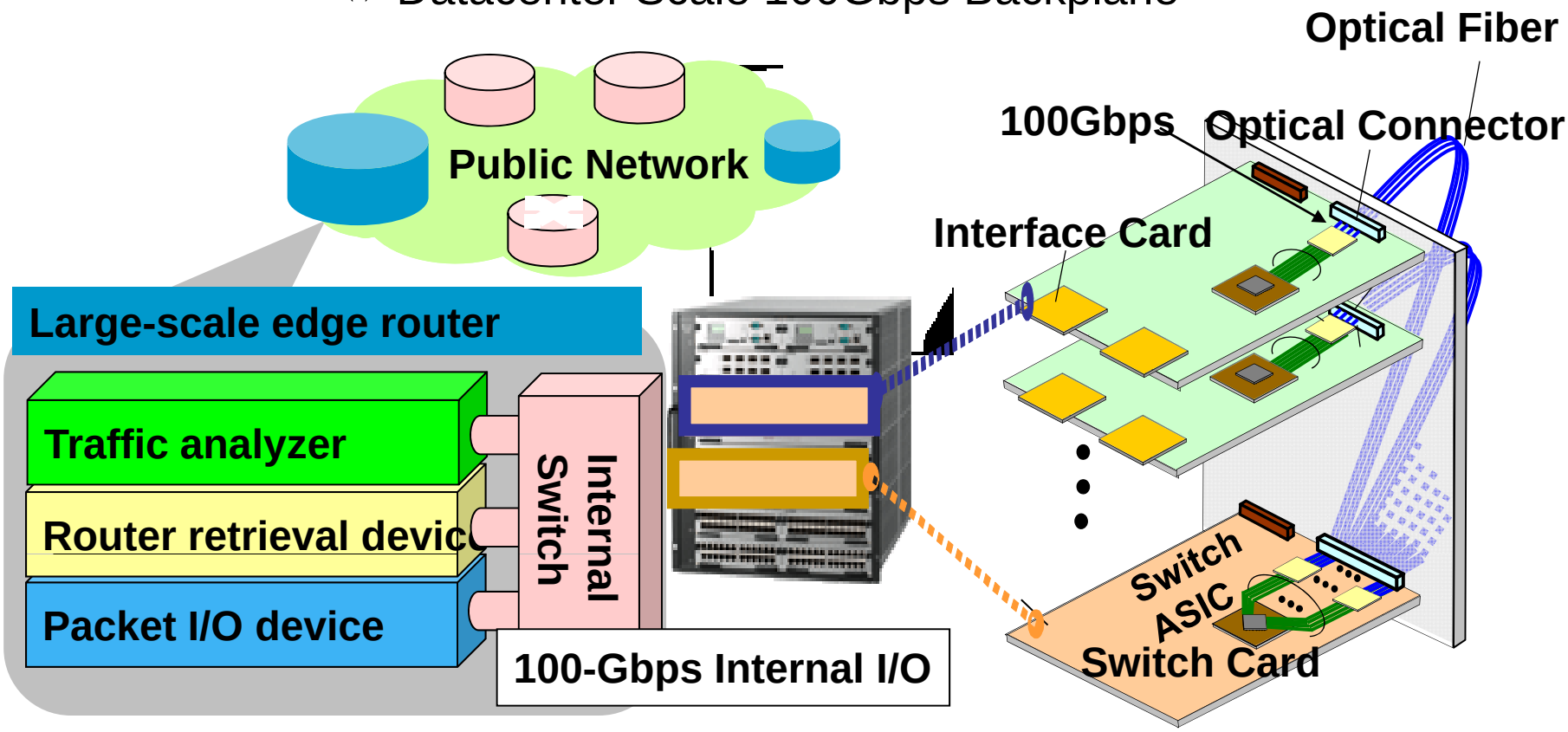


LD: laser diode, LDD: LD driver, PD: photo diode, TIA: transimpedance amplifier

25mW/Gbps(63%)

High Density Optical Backplane with 25Gbps-4ch(100Gbps) Transceiver

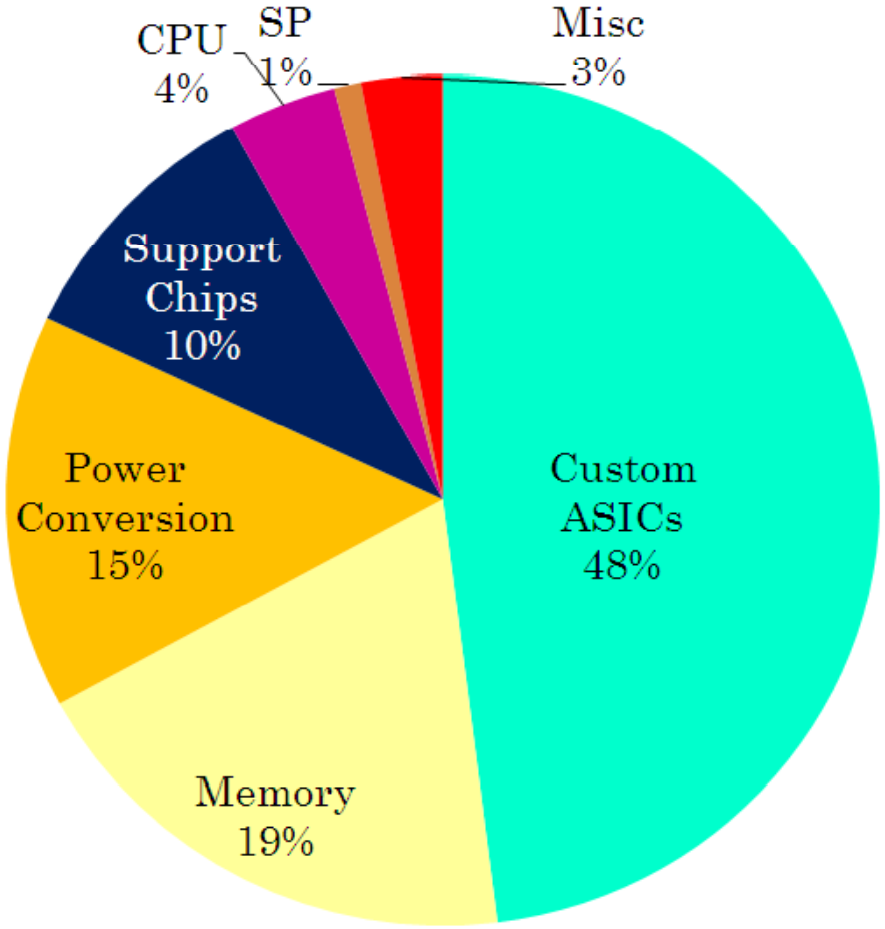
Overcome the current technological barrier of 6.5Gbps&1m
⇔ Datacenter Scale 100Gbps Backplane

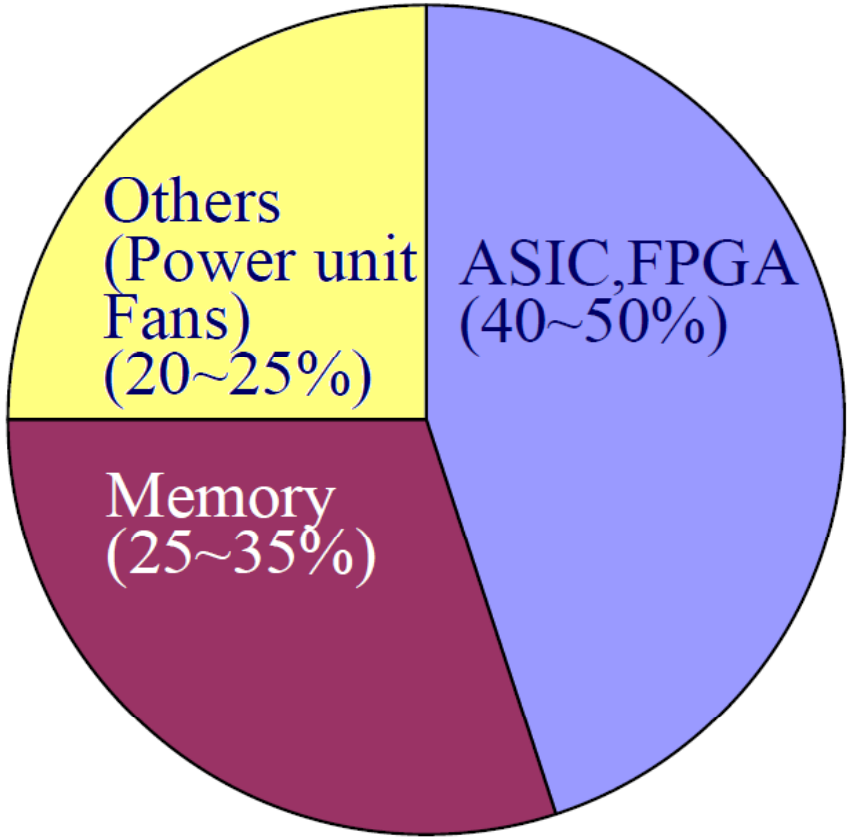


25mW/Gbps

Large Scale Dynamic Optical Path Network

- Router Throughput and Its Energy Efficiency Rating -



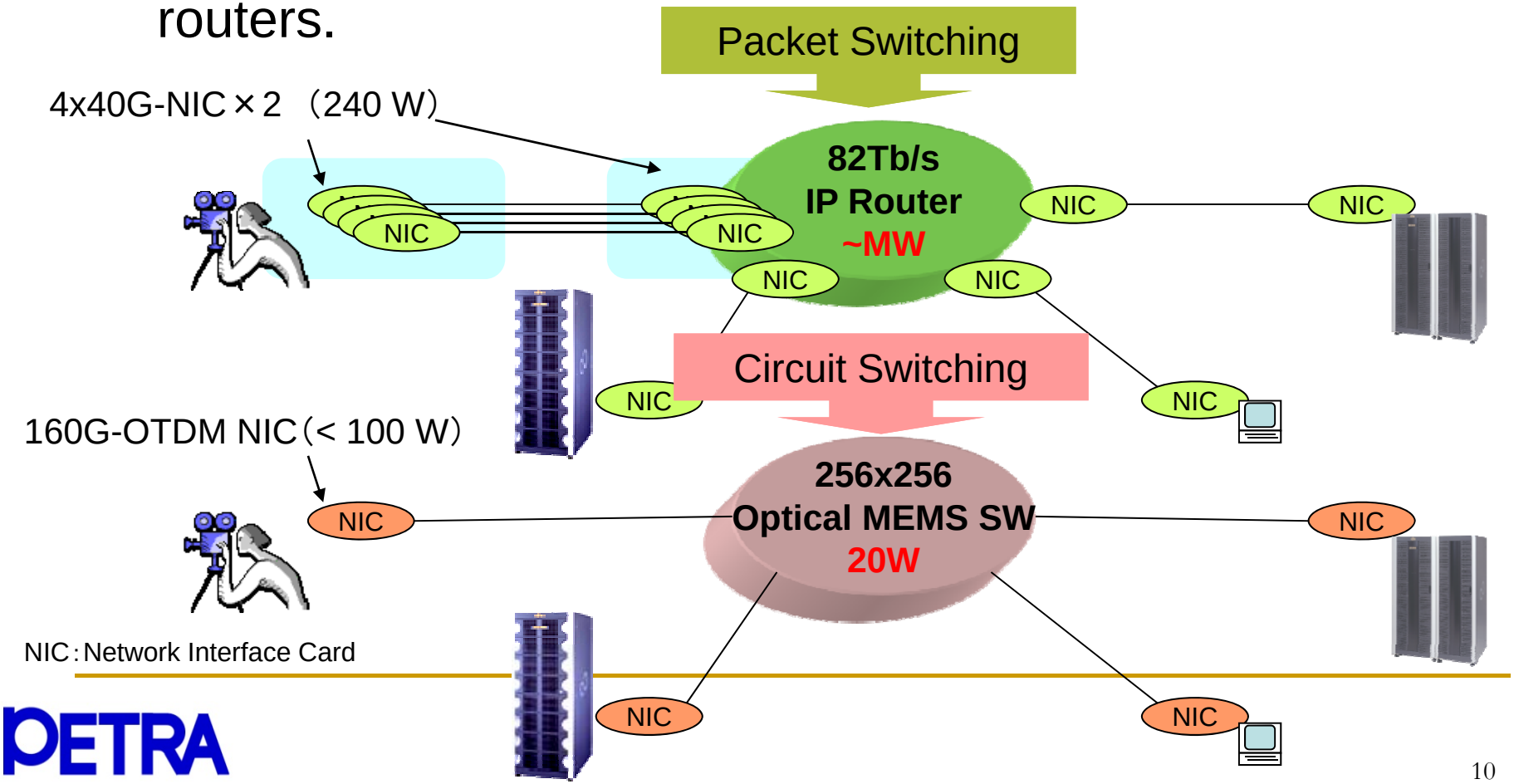


CISCO **TCAM= Gasguzzler** Hitachi

Large Scale Dynamic Optical Path Network

- Circuit switching better suits real-time video services -

- At 82 Tb/s throughput, Optical circuit switch operates almost at four orders of magnitude lower electricity than IP routers.

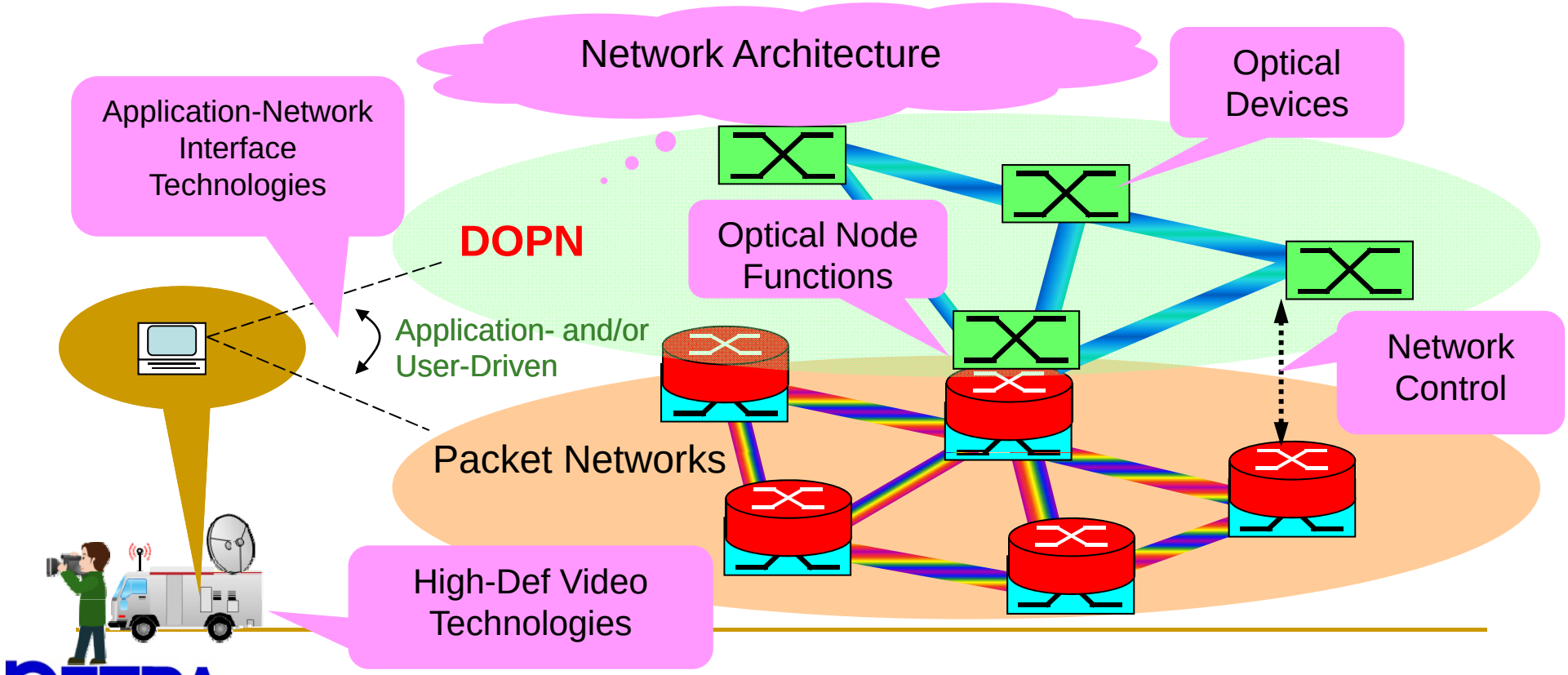


Large Scale Dynamic Optical Path Network (DOPN)

- Application- and/or User-Driven Switching in Optical Layer -

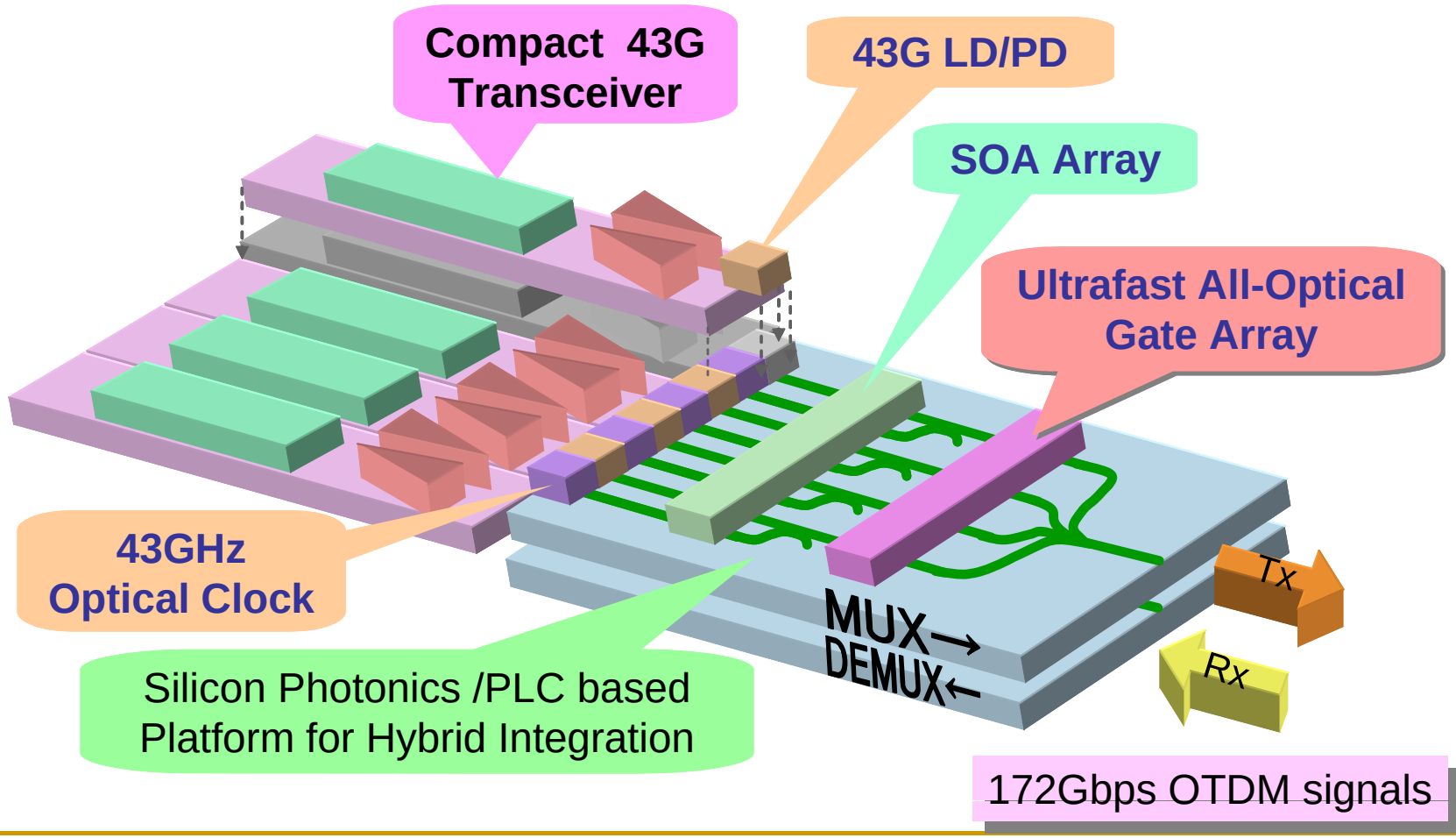
- Total Capacity:
  1,000-10,000 Times Larger
- Energy Consumption:
  Decrease by 3 digits

- Main Services:
  High-Def Video Based
- User Connectivity:
  10-100Gbps



Ref. VICTORIES Project at AIST supported by MEXT

Large Scale Dynamic Optical Path Network (DOPN)
- Integrated 160G OTDM-IC Module -



100W

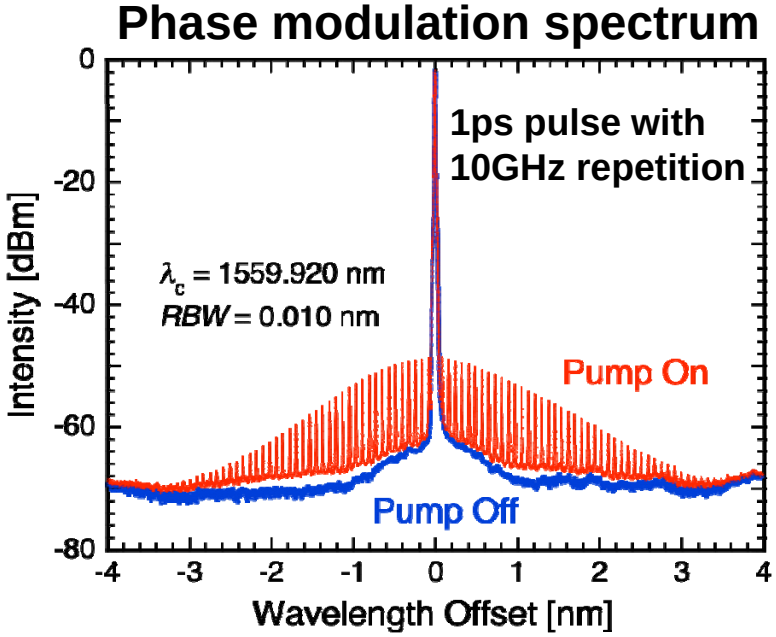
Picosecond cross-phase modulation in integratable ISBT(intersubband transition)

Phase modulated TE light

InGaAs/AlAs/AlAsSb coupled double quantum well

TE light

TM pump light



H. Tsuchida et al., Opt. Lett., 32,751 (2007)

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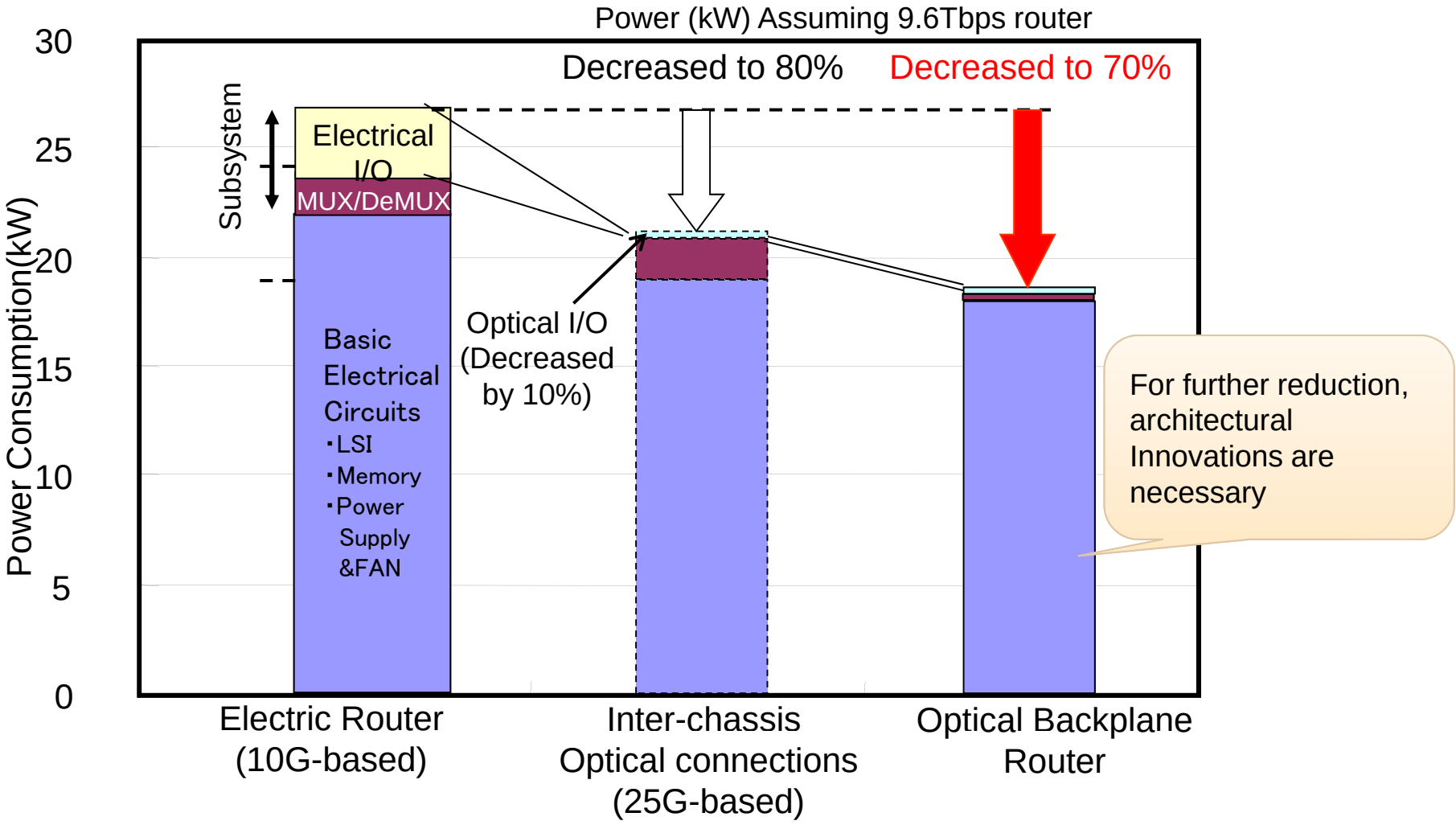
Acknowledgements

- *This work was performed under management of the PETRA supported by NEDO*
- *Most of the slides were based on the previous presentations by the NEDO Project, "Development of Next-generation High-efficiency Network Device Technology project"*
  - *NEDO: New Energy and Industrial Technology Development Organization*
  - *PETRA: Photonics Electronics Technology Research Association*

Conclusions



Existing Technology → Basic Plan (Device Level) → Future Architecture Level → Project Plan