



R&D on Multi-band Metro-network architecture using terrific Multiple wavelength M^3 WaveNet

Orchestrating a brighter world

NEC

EpiPhotonics

Advanced Network Research Laboratories, NEC Corporation
Yamanaka Laboratory, Keio University EpiPhotonics Corp.

Highly efficient ROADM network configuration technologies for multi-band networks (NEC)

In wavelength path networks, challenges include the introduction of wavelength converters to improve optical path accommodation efficiency and the development of technology to deal with changes in path characteristics due to the effects of Raman tilt.

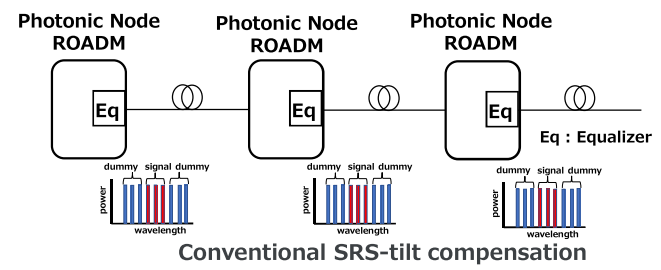
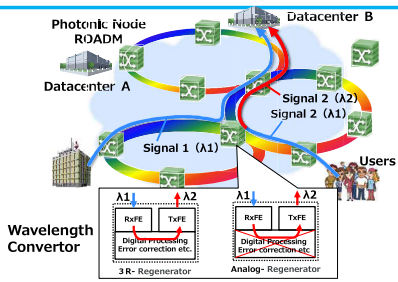
- Study on multi-band network analysis technology to estimate the impact of wavelength conversion, Raman tilt, etc. on transmission performance in wide-band network.
- We will develop a new estimation algorithm for optical path monitoring technology to achieve a monitoring error of $\pm 5\%$.

Path quality varies depending on path attributes (path length, w/ ,w/o wavelength convertor etc.)

Conventionally, SRS-tilt is determined with dummy signals and compensated using equalizer

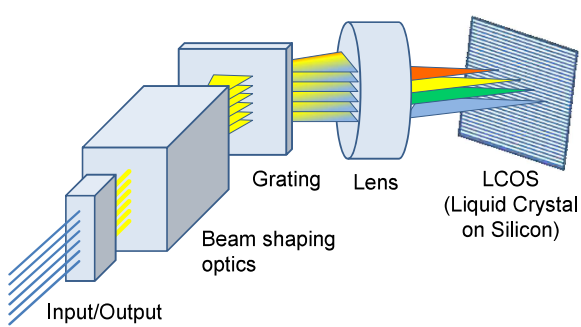
Development of monitoring technology in multi-band network to improve network utilization efficiency

Development of a compensation method suitable for metro area networks with a small number of paths

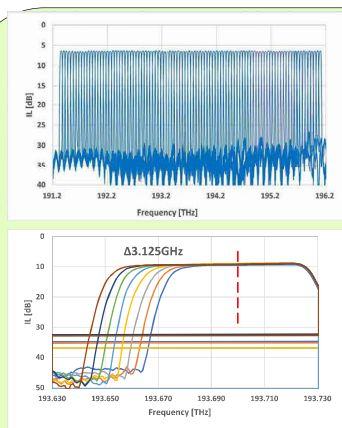


Ultra-High Channel Count Programmable WSS (EpiPhotonics)

- 200 channels covering C+L bands Large-scale LCOS based WSS.
- Programmable port configuration without physical setting.
- Programmable flexible grids.
- Low power consumption enabled by no temperature control.

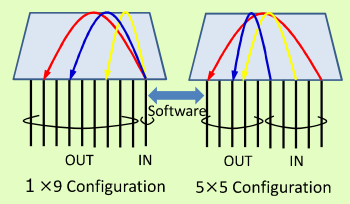


Conceptual WSS Design



Programmable Tuning

Current: 96 channels
Target: 200 channels



Programmable Reconfiguration

These research results were obtained from the commissioned research (JPJ012368C08501) by National Institute of Information and Communications Technology (NICT), JAPAN.



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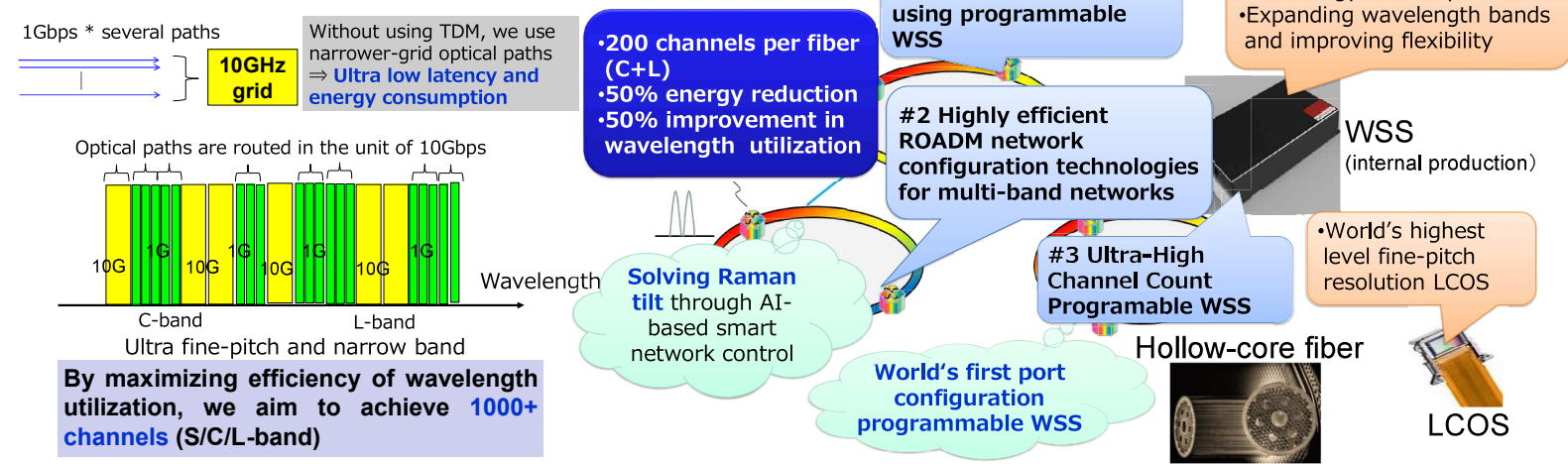
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Paradigm Shift in Metro Networks for "Direct Wavelength Connectivity"

Research goal: Develop innovative multiband massive WDM metro networks (M3) that provide "direct wavelength connectivity" among users.

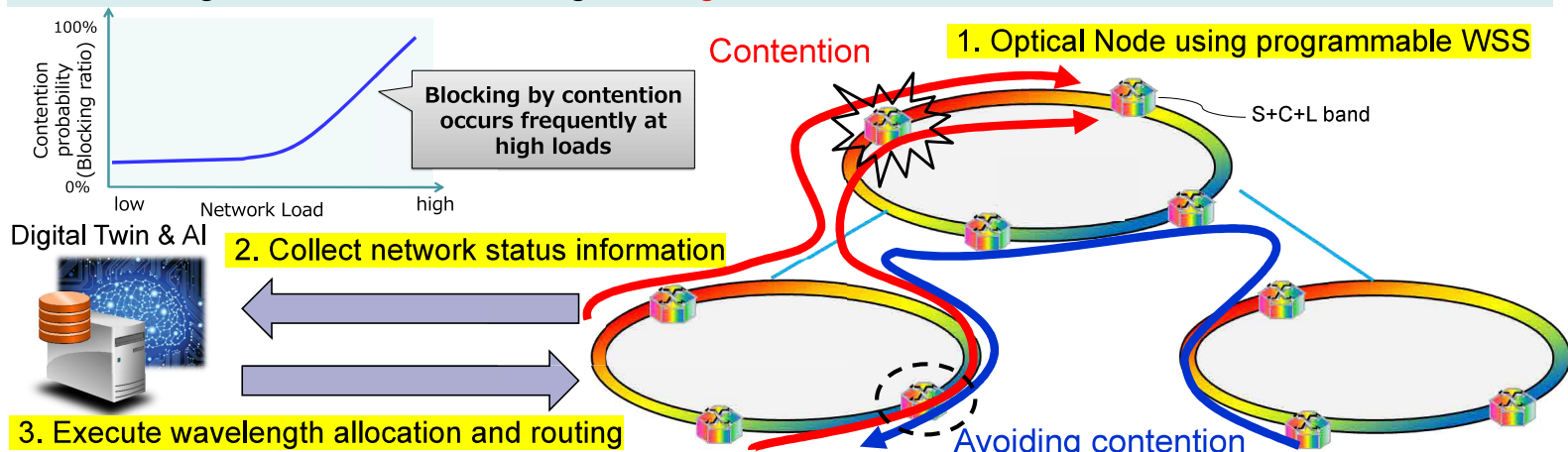
- Increase **current 10 channels** per fiber by more than 1,000 times to **several 1,000 channels**.
- Development of **cost-effective and energy-efficient WSS**
 - #1 : Power-efficient metro node architecture using programmable WSS (Keio University)
 - #2 : Highly efficient ROADM network configuration technologies for multi-band networks (NEC)
 - #3 : Ultra-High Channel Count Programmable WSS (EpiPhotonics)

Basic concept of M^3 WaveNet



Power efficient metro node architecture using programmable WSS (Keio University)

- Conventional contentionless WSS has issues of high cost and high-power consumption
- 1. Node architecture suitable for metro networks based on **Programmable WSS**
⇒ **Reduction of power consumption**
- 2. Reproduction of network conditions by **Digital Twin**
- 3. Wavelength Allocation and Routing with **Digital Twin & AI** } ⇒ **Avoiding contention**



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