IMPAIRMENT AWARE CROSS-LAYER ENABLED SUB-WAVELENGTH SWITCHING NETWORK: SIMULATION STUDY AND EXPERIMENTAL VALIDATION

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Motivation

The internet is fast approaching the zettabyte era. With emerging diverse applications, there is exploding bandwidth demand which is resulting in unsustainable energy consumption. The access aggregation network is currently a major bottleneck that prevents the high BW capacity of the core from reaching the edge users. To address this challenge, CIAN has been developing an all optical, cross-layer enabled intelligent aggregation node, the CIAN box, which is projected to reduce energy consumption (by 100x), improve BW utilization (by 4x) and increase network efficiency.

CIAN Box Architecture

- Real-time physical layer impairment monitoring
- Communication between physical layer and higher layers
- Intelligent allocation of resources

Simulation Study: Static vs. CIAN Box Network

- Static → OSNR = OSNR_{min} + OSNR_{penalty}
- CIAN Box → OSNR = OSNR_{min}

- Regenerator placement and dimensioning algorithm considering static approach on Pan-European network
- O/E/O pools (same in both cases) so that a maximum loss rate B^{2v1}=10^{-3} is met at every node
- Routing solved offline using a MILP algorithm to minimize contention in network
- Asynchronous transmission, poisson traffic with average packet size of 1Mb

Simulation Results

I. Fewer regeneration
II. Reduced packet loss
III. Improved failure recovery

Work in Progress: Experimental Validation

- 3-node CIAN Box test-bed
- Three test-cases:
  i. Packet OSNR < minimum threshold
  ii. Packet OSNR > minimum threshold but CAN NOT reach next regeneration node
  iii. Packet OSNR > minimum threshold and CAN reach next regeneration node
- Demonstrate:
  i. reduced packet loss probability and number of regenerations
  ii. dynamic resource allocation based on Quality of Service
  iii. intelligent distributed control plane