Data Center Interconnection with Terabit Channels

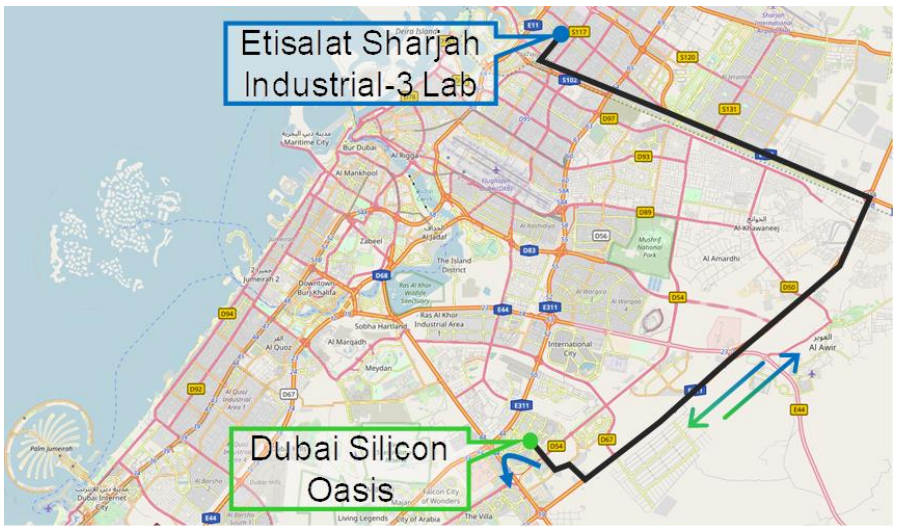
50.8 Tb/s Transmission Capacity Record Over Deployed Fiber Network

Enabled by Single-Carrier Terabit+-Channels

Opportunity

In September 2019 researchers from Nokia Bell Labs along with Nokia's Optical Business Unit demonstrated the world's first WDM transmission experiment on a field-deployed fiber network where each of the 40 carriers delivers a net bitrate greater than 1.25 Tb/s yielding a total net bitrate of 50.8 Tb/s using the conventional EDFA amplified C-Band.

The field trial, setting an optical transmission capacity record, was conducted in the United Arab Emirates (UAE) over Etisalat's fiber-optic network, one of the world's leading telecom groups in emerging markets. 40 channels formed by probabilistically constellation shaped (PCS) optical carriers, each transporting a huge data rate of more than 1.25 Tb/s, was sufficient to push the capacity for a DCI typical fiber span of 93 km beyond 50 Tb/s. The G.652-fiber link with EDFA amplification in C-band in loopback configuration was situated in Dubai area.



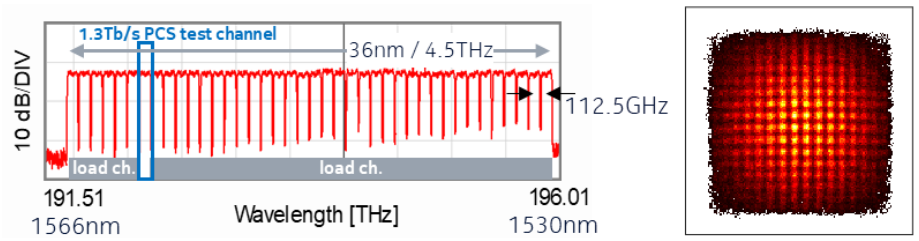
Map of field deployed 93 km fiber link in loop back from Sharjah to Dubai

The Terabit wavelengths employed Nokia Bell Labs' pioneering Probabilistic Constellation Shaping (PCS) technology, optimized spatially coupled LDPC encoding and a dense WDM packing.

Results were presented during the post deadline session at the European Conference on Optical Communications (ECOC) in Dublin[1].

Breakthrough Innovations

- Probabilistic Constellation Shaping (PCS) based on 256-QAM to ensure an average bitrate of 1.27 Tb/s over all 40 channels resulting in 50.8 Tb/s total system capacity
- Optimized spatially coupled LDPC encoding with low overhead for forward error correction (FEC), achieving an information rate of 6.7 bits/symbol/pol for a total error-free bit rate of 1.30 Tb/s in a single-channel scenario
- 100-GBaud high-constellation signals on a 112.5-GHz wavelength grid cover 4.5 THz bandwidth in the optical C-band, yielding a total spectral efficiency of 11.29 bits/s/Hz after FEC decoding



Optical 50.8-Tb/s spectrum formed by 40 channels of 1.2 Terabit/s (left). Each channel carried a PCS-256QAM constellation (right).

Description

The demo shows the operation of the key transport equipment which enabled this record field trial over deployed fiber.

The hardware setup of NOKIA Bell Labs in the premise of Etisalat UAE in Sharjah (Industrial-3 Lab)

Contact

roman.dischler@nokia-bell-labs.com
karsten.schuh@nokia-bell-labs.com
henning.buelow@nokia-bell-labs.com

Partners

NOKIA IP&Optical Networks
Etisalat UAE

1 F. Buchali, K. Schuh, R. Dischler, M. Chagnon, V. Aref, H. Buelow, Q. Hu, F. Pulka, M. Frascolla, E. Alhammadi, A. Samhan, I. Younis, M. El-Zonkoli, P. Winzer, "1.3-tb/s Single-Channel and 50.8-tb/s WDM Transmission Over Field-Deployed Fiber," ECOC 2019, Dublin, PD.1.3