A Presentation on

Energy Consumption Analysis of Converged Networks : Node Consolidation vs Metro Simplification*

*Based on the paper presented with the same name on OFC/NFOEC Technical Digest 2013 OSA by Skubic,B & Pappa,I

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Introduction

Network Energy Consumption

- Key aspect of network power consumption is the architecture
- Main idea is Active sites (Active : energy consuming components) reduction
- The Literature of TCO has been examined within EU FP-7 OASE Project
- Paper addresses mainly two solutions ;

    1. Node Consolidation
    2. DWDM-centric transport solution

EU FP-7 Project OASE

- The Major goal

  Network simplification with reduced TCO

- Central Access Nodes (CAN), they may concentrate up to 200,000 customers. Savings are expected from abandoning real estate, better utilization of Optical Line Terminations (OLT), fibers, aggregation-network resources, power supply and air conditioning devices, and from lower operations and maintenance cost.

- Analysis, relevant requirements for NGOA have been defined, including sustainable perclient bit rates (150 Mb/s, 300 Mb/s, 500 Mb/s), maximum downstream/upstream asymmetry of 2:1, fanout per PON (1:64 to 1:256), and reach (min. 40 km).

- The study shows that for low bandwidth demand (up to 150 Mb/s per user), a hybrid active/passive solution using G-PON with optional remote OLT and passive-WDM backhaul yields lowest cost in the considered cases of active-site consolidation.

- From a cost point of view, WR-WDM-PON becomes more advantageous compared to TDMA-based systems for even higher bandwidths (≥500 Mb/s per customer), and for higher site-consolidation degrees.

Specific Challenges

1. We have to reduce the number of active sites – However densification of radio access sites are **increasing**
2. Node consolidation of access sites limits the user number, capabilities and provider benefits
3. Longhaul system energy consumption is high
4. We don‘t want any bottlenecks when optimizing the network architecture – **watch out the WSS !**

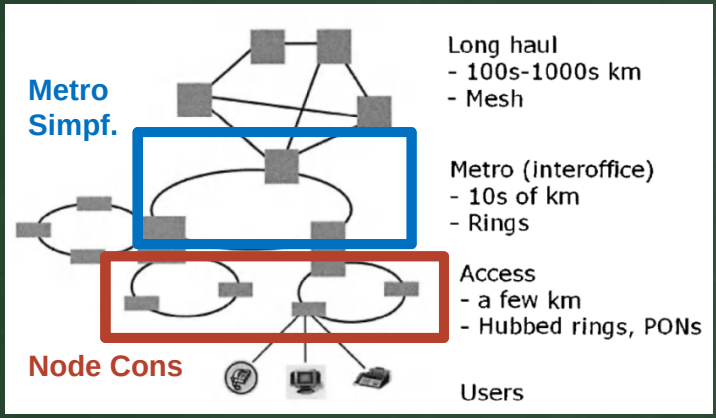
Node Consolidation

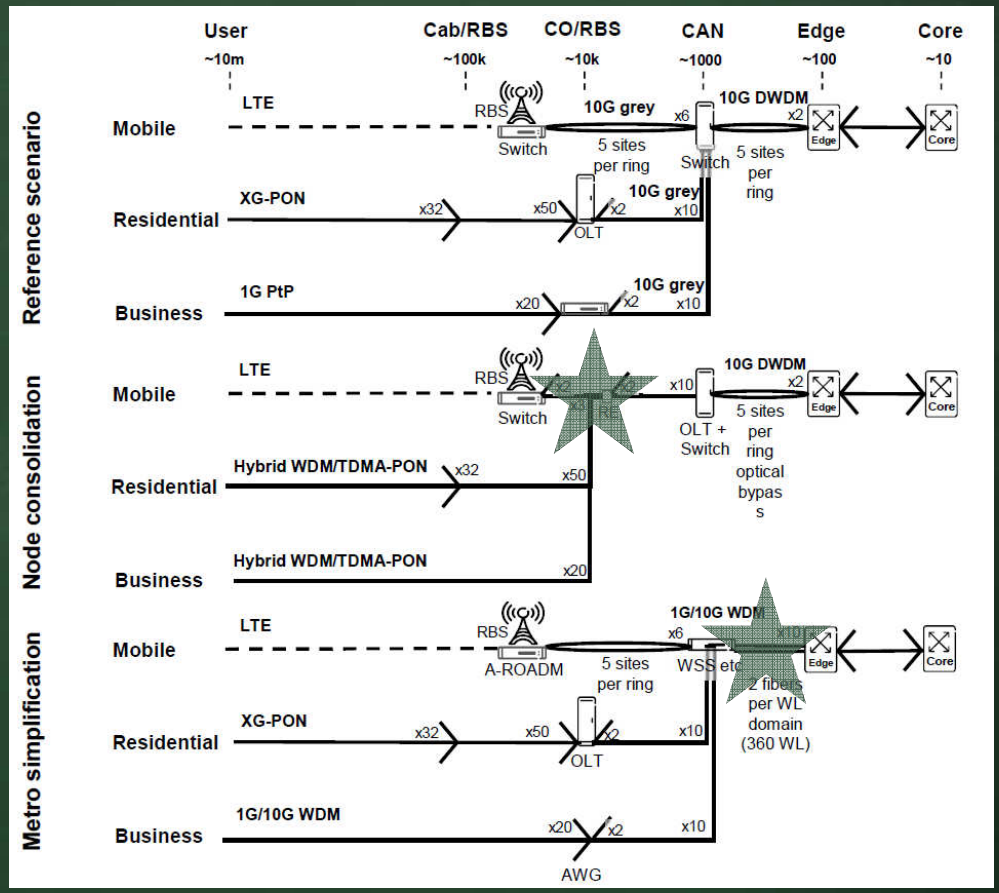
- Access Network Segment
- HIGH trade-off between system power consumption vs systems capabilities
- Limited Access segment causes data traffic density and agression.

DWDM-centric solution

- Metro (Intra Office) Network Segment
- LOW trade-off between system power consumption vs systems capabilities
- Bottleneck possibility with the Wavelenght seclective switching (WSS)

Architectural Aspects





Results

Indicate that :

Metro simpflication is MORE effective reducing the Network Power consumption despite the fact that the total number of active sites are not significantly reduced !!

Fact :

Through the frame of the given scenarios - What really matters in reducing the power consumption in the networks – is parallel with the **OPTIMAL** (no less, not much) number and placements of the active network nodes.

Additional Readings & References

1. ‘The Energy Consumption Analysis of Converged Networks : Node Consolidation vs Metro Simplification‘ Skubic B, Pappa I, 2013
2. ‘Optical DWM Networks’ Mukherjee B, 2006 Springer books
3. ‘Optical Metro/Access Networks’ presentation by Dr. Mustafa A.G. Abushaghur, Rochester Institute of Technology
4. ‘Results from EU FP7 Project OASE on Next Generation Optical Access‘ Hölsermann R, Grobe K, Breuer D . 2013 ITG Fahbericht
5. ‘Fiber Routing, Wavelength Assignment and Multiplexing for DWDM-Centric Converged Metro-Aggregation Networks’ Zhang S, Xia M, Dahlfort S. ECOC 2013
6. ‘Hierarchical Wireless and Optical Access Networking - Convergence and Energy Efficiency’ Parker C, Martin R, Guild K. Walker S D. ICTON 2011
7. ‘Next Generation Optical Access Networks - from TDM to WDM’ Ll. Gutierrez, P. Garfias, M. De Andrade

Important Note

In the paper ‘The Energy Consumption Analysis of Converged Networks : Node Consolidation vs Metro Simplification‘ Skubic B, Pappa I, 2013, the reference number [2] cannot be found and is therefore wrong citated. ECOC 2012 Workshop 4 took place on 16 September 2012 is indeed a seminar on ‚Next generation optical and converged access networks‘ by Lange C. Breuer D and Weis E from Deutsche Telekom Group. Information can be gathered online from here : www.ecoc2012.org/documents/ecoc2012_programme_12-09-09.pdf - Page 4

Thank You All

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