Power-Aware Rationale for Using Coarse-Grained Transponders in IP-Over-WDM Networks - DTU Orbit (08/11/2017)

Power-Aware Rationale for Using Coarse-Grained Transponders in IP-Over-WDM Networks

Power consumption is becoming one of the most significant limitations while seeking new solutions to cope with the traffic demand increase. 100 Gbps optical transmission technology has the potential to accommodate upcoming traffic demands with improved figures for W/Gbps compared to previous generations. However, the adoption of such coarse-grained bit-rate granularity with lower flexibility for traffic grooming raises important questions: (1) What repercussions do they have on the overall power consumption and thus operational expenditures (OPEX) compared to legacy fine-grained designs (i.e., using 10 Gbps technology)? (2) What is the long-term cost of coarse-grained designs? We define a power-aware mixed integer linear programming (MILP) formulation based on actual modular architectures where modules are upgraded as the network traffic increases. We introduce, for the first time, important practical constraints which were neglected by previous works, so that there is correspondence between interface modules and transponders instead of assuming a single type of interface module per line card, and we use accurate power consumption values instead of using approximations per port. We also present a comprehensive analysis on the trade-off between power consumption and available optical capacity, and power consumption and capital expenditure (CAPEX) for three different scenarios, defining the impact of provisioning the network with higher granularity transmission technology. Regarding the available optical capacity versus power consumption, 37.7% additional optical network capacity is achieved when using exclusively 100 Gbps technology at 13.3%-32.4% power consumption expenses and 15.3% optical network capacity at only a 2.6%-8.8% power consumption penalty when using 40 and 100 Gbps technologies. From a CAPEX perspective, up to 19.4% savings can be achieved by provisioning ahead using coarse-grained designs.

General information

State: Published
Organisations: Department of Photonics Engineering, Metro-Access and Short Range Systems, Networks Technology and Service Platforms, Federal Institute of Technology of Espírito Santo
Authors: Saldaña Cercos, S. (Intern), Resendo, L. C. (Ekstern), Ribeiro, M. R. N. (Ekstern), Fagertun, A. M. (Intern), Tafur Monroy, I. (Intern)
Pages: 825-836
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information

Journal: Journal of Optical Communications and Networking
Volume: 7
Issue number: 9
ISSN (Print): 1943-0620
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.621 SNIP 1.325 CiteScore 3.06
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.883 SNIP 1.736 CiteScore 3.39
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.861 SNIP 1.857 CiteScore 3.24
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.605 SNIP 1.693 CiteScore 2.51
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.839 SNIP 1.918 CiteScore 2.71
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.897 SNIP 3.962 CiteScore 2.99
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1

Scopus rating (2010): SJR 0.705 SNIP 2.38
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.713 SNIP 1.04
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.575 SNIP 0.857
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.442 SNIP 0.749
Scopus rating (2006): SJR 0.551 SNIP 0.935
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.527 SNIP 1.306
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.655 SNIP 1.181
Scopus rating (2003): SJR 0.405 SNIP 0.48
Web of Science (2003): Indexed yes
Original language: English
COMPUTER, OPTICS, TELECOMMUNICATIONS, ENERGY SAVINGS, DESIGN, Energy-efficiency, Optical networks, Traffic grooming
DOIs:
10.1364/jocn.7.000825
Source: FindIt
Source-ID: 2280287842
Publication: Research - peer-review › Journal article – Annual report year: 2015