

OFC'09 Summary

---Core Networks Part II

Ming Xia

OFC'09 Technical Sessions on Core Networks

- . OMG: Optical Grids and Enabling Technologies
- . OML: IP/Optical Integration
- . OMG: Advanced Optical Network Infrastructure
- . OMQ: Optical Network Architecture
- . OWI: Impairment-Aware Networking
- . OWK: Applications over Optical Networks
- . OWL: Multi-Layer and Multi-Domain Networks
- . OWY: Multi-Layer Resilience
- . OThJ: Network Elements
- . OThO: Traffic Aggregation and Scheduling
- . OThQ: Network Design and Energy Efficiency
- . PDPD: Post-Deadline Papers Session

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NFOEC'09 Technical Sessions on Core Networks

- NTuA: Converged Ethernet Networks
- NTuB: GMPLS and Network Control
- NThA: Ethernet and High-Speed Systems
- NThE: Efficient Network Designs
- NThF: IP over DWDM Networks

NFOEC'09 Technical Sessions on Core Networks

- NTuA: Converged Ethernet Networks
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- NThE: Efficient Network Designs
- **NThF: IP over DWDM Networks**

Optical Grids and Enabling Technologies

Code	Title	Author/Affiliate	Topic	Trends
OMG1	Virtualized Optical Network (VON) for Agile Cloud Computing Environment	Masahiko Jinno and Yukio Tsukishima NTT, Japan	A virtualized optical network is proposed for increased agility and flexibility into a cloud computing by providing any-to-any connectivity.	Cloud computing, network virtualization, Novel Sensing and measuring technologies.
OMG2	Maximizing the Revenues for Distributed Computing Applications over WDM Networks	Xin Liu, Chunming Qiao, Ting Wang SUNY Buffalo/ NEC Labs America	Provisioning both network and computing resources for distributed computing applications over WDM networks, with the objective of revenue maximization.	
OMG3	Differentiated Scheduling for Delay-Sensitive and Delay-Tolerant Jobs in Optical Grids	Chonggang Wang, Wei Wei, Ting Wang NEC Labs America	A differentiated scheduling algorithm for delay-sensitive jobs and delay-tolerant jobs in Optical Grids. Lower overall blocking probability is achieved.	

Optical Grids and Enabling Technologies(Contd.)

Code	Title	Author/Affiliate	Topic	Trends
OMG4	Wavelength path reconfigurable AWG-STAR employing coprime-channel-cycle arrayed-waveguide gratings	Osamu Moriwaki, et al. NTT, Japan	Propose a novel flexible AWG-STAR system that employs two kinds of cyclic frequency AWGs whose repetition channel numbers are coprime. Wavelength path can be reconfigured independently.	Cloud computing, network virtualization, Novel Sensing and measuring technologies.
OMG5	Remote Measurements of Lengths by Excess-Fraction Method Using Opt Fiber Ntwks Tandem Interferometer	H. Matsumoto and A. Hirai/ U. Tokyo, National Inst. of Adv Industrial Sci and Tech, Japan	Remotely measure practical lengths by excess fraction method using a tandem low-coherence interferometer through optical fiber networks.	
OMG6	Compensation of the power fluctuations in	Massimo Olivero, Politecnico di	Technique to compensate power fluctuations occurring in intensity-based plastic optical	

fluctuations in intensity-based plastic optical fiber sensors	Politecnico di Torino, Italy	intensity-based plastic optical fiber sensors is presented. One referencing wavelength is used.
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Applications over Optical Networks

Code	Title	Author/Affiliate	Topic	Trends
OWK1	Ultra High Definition Media over Optical Networks (CineGrid)	Cees de Laat / Univ. Amsterdam	Build an interdisciplinary community use and exchange of very-high-quality digital media over photonic networks.	Multimedia over OTN, 4K-uncompressed high quality video over OTN.
OWK2	Service-Oriented Multi-Granular Optical Network Testbed	Yixuan Qin et al /Collaboration between U Essex, UK Scuola Superiore Sant'Anna, Italy U. of Bologna, Italy CNIT, Pisa, Italy,	Present a service-oriented multi-granular multi-format network demonstrator using SOONJIT protocols to support VoD HD and QuadHD multimedia.	
OWK3	4K Uncompressed Streaming over Multicast-capable 80 (8λ x 10) Gbps Colored Optical Packet Switching Network using SOA Switch and Stacked OC-Label Processing	Nobuyuki KATAOKA, et al.,/Collaboration between National Inst. Info & Commun Tech, Fujitsu Lab, Keio Univ., NTT, and Osaka Univ.	Field trial of 4K streaming over 80 Gbps colored optical packet switching network using broadcast-and-select switch and stacked optical-code label processing.	

Applications over Optical Networks (Contd.)

Code	Title	Author/Affiliate	Topic	Trends
OWK4	A Bandwidth Challenge at Super Computing (SC) Conference: Large-Scale Data Transfer	Ken T. Murata/ National Institute of Information and Communications Technology/Ehime University, Japan	Make full use of 10Gbps network for scientific applications. Transfer large-scale numerical data at NICT (in Japan) to SC 2007 venue in Reno, USA.	Multimedia over OTN, 4K-uncompressed high quality video over OTN.

	Using 10Gbps Network			
Code	Title	Author/ Affiliate	Topic	Trend
OWL1	Optical Multi-Domain Routing	Xavi Masip and Marcelo Yannuzzi/ Technical University of Catalonia, Spain	Reviews the current limitations in multi-domain routing as well as some of the research lines in the optical area.	Multi-layer, multi-domain routing with OTN. PCE integrated with GMPLS
OWL2	PCE-based Network Design for Multi-domain Layer 1 Virtual Private Networks	Xiuzhong Chen, etal./Collaboration between BUPT CN, Insti.for Infocomm Res., SG and SJTU CN	Propose a novel resource demand model and a BFS-based algorithm for multi-domain L1VPN.	
OWL3	PCE communication protocol for resource advertisement in multi-domain BGP-based networks	F. Chugini/ Collaboration between CNIT, Italy and Scuola Superiore Sant'Anna, Italy	Proposed message enables effective PCE-based computations with stability, scalability, and inter-domain information confidentiality preserved.	

Multi-Layer and Multi-Domain Networks

Multi-Layer and Multi-Domain Networks (Contd.)

Code	Title	Author/Affiliate	Topic	Trends

OWL4	On Resource Provisioning for Multi-Domain Networks	Xiaolan J. Zhang, Sun-il Kim and Steven S.Lumetta/ Collaboration between UIUC and U. Alabama	Study multi-domain resource dimensioning /routing techniques with limited information sharing.	Multi-layer, multi-domain routing with OTN. PCE integrated with GMPLS
OWL5	Avoiding Path-Vectors in Multi-Domain Optical Networks	Marcelo Yannuzzi and Xavi Masip/ Technical Univ. of Catalonia, Spain	Propose a modified path-vector protocol which can reduce blocking and converge faster with less number of routing messages exchanged.	
OWL6	Multi-Layer Network Architectures	Jan Spaeth, TesatSpacecom GmbH & Co., Germany	Study the basic issues, key questions, and important challenges in planning, building, and operating multi-layer networks.	

Multi-Layer Resilience.

Code	Title	Author/ Affiliate	Topic	
OWY1	Robust Application Specific and Agile Private (ASAP) Networks Withstanding Multi-layer Failures	X. Liu, C. Qiao, T. Wang/ SUNY Buffalo and NEC Lab	Robust network design supporting critical distributed computing over WDM networks, considering concurrent and multi-layer failures.	Recovery/Restoration in multi-layer. Waveband routing/protection
OWY2	Rerouting of 1+1 Optical Channels: Cost Benefits for Incrementally Planned Networks	Clara Meusburger, Dominic A. Schupke/ <i>NSN Germany, Tech. Univ. München, Germany</i>	Show re-optimizing 1+1 protected networks for multiple time periods can lead to cost benefits.	
OWY3	Survivable Hierarchical Optical Path Networks	Y. Yamada, H. Hasegawa, and K. Sato/ Nagoya University, Japan	Propose a hierarchical optical path network design algorithm ensuring wavelength path protection	

Employing Waveband and Wavelength Path Protection	Japan	path protection.	
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Multi-Layer Resilience (Contd.)

Code	Title	Author/Affiliate	Topic	
OWY4	Reliable Multi-Bit-Rate VPN Design for Ethernet over WDM Carrier Services	Marwan Batayneh, Dominic A. Schupke, Marco Hoffmann, and Andreas Kirstaedter /UCDavis, NSN, Germany, and Univ Stuttgart, Germany	Study cost-efficient and reliable design of multi-bit-rate virtual private network (VPN) in a Mixed-Line-Rte (MLR) WDM optical network for multipoint-to-multipoint carrier Ethernet services.	Recovery/Restoration in multi-layer. Waveband routing/protection
OWY5	Multilayer Network Resilience	Andrzej Jajszczyk/ AGH University of Sci. and Tech. Krakow, Poland	Tutorial	

Network Design and Energy Efficiency

Code	Title	Author/Affiliate	Topic	Trends
OThQ1	CAPEX and OPEX in Aggregation and Core Networks (Invited)	Claus G. Gruber / NSN, Gemany	New modeling approaches of CaPEX and OpEX to jointly optimize the total cost of ownership (TCO are introduced.	Energy efficiency of optical networks, Modeling of CaPEX and OpEx.
OThQ2	Multihopping and Waveband Assignment in Limited Reconfigurable WDM Networks	Onur Turkcu and Suresh Subramaniam/ George Washington Univ.	Compare the performance of various transponder waveband assignment algorithms. Propose an algorithm to find a multihopped route with minimum OEO conversions.	
OThQ3	Cost-Efficient Non-Blocking WDM Network Upgrade	Rajesh Roy and Massimo Tornatore/	Investigate periodic capacity upgrades to handle traffic growth in optical WDM mesh networks with significant cost savings by	

	Upgrade	Univ. Calif, Davis	significant cost savings by appropriate upgrading capacity both spatially and temporally.	
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Network Design and Energy Efficiency (Contd.)

Code	Title	Author/Affiliate	Topic	Trends
OThQ4	Design, performance evaluation and energy efficiency of optical core networks based on the CANON architecture	A.Stavdas, T. Orphanoudakis, C.(T) Politi, A.Drakos/ Univ. of Peloponnese, Greece	Apply dynamic networking based on node clustering in reallife core networks and achieve better performance compared to conventional burst switching techniques.	Energy efficiency of optical networks, Modeling of CaPEX and OpEx.
OThQ5	Architectures for Energy-Efficient IPTV Networks	Jayant Baliga, Robert Ayre, Kerry Hinton, Rodney S. Tucker/ U. Melbourne, AU	Energy consumption model of IPTV storage and distribution is provided for VoD networking with minimized. Energy consumption.	
OThQ6	Risk Assessment in SLA-Based WDM Backbone Networks	Ming Xia, Joon ho Choi, and Ting Wang/ UC Davis and NEC Lab	A method to assess SLA violation risk for service provisioning in a WDM backbone network is proposed, which reveals service availability and path availability	

Network Design and Energy Efficiency (Contd.)

Code	Title	Author/Affiliate	Topic	Trends
OThQ7	Power Saving Architectures for Unidirectional WDM Rings	Cerutti, L. Valcarenghi, P. Castoldi/ Scuola Superiore Sant'Anna, Italy	Compares the optimal power-saving designs of uni-directional WDM rings using first-generation, all-optical, and multi-hop (hybrid).	Energy efficiency of optical networks, Modeling of CaPEX and

IP/Optical Integration

Code	Title	Author/Affiliate	Topic	Trends
OML1	Multi-Card Wavelength Scheduling in Modular Optical Packet Switches	Pier Giorgio Raponi, / Scuola Superiore Sant'Anna and Ericsson, Sweden	Propose a two-step scheduler for input-queued multi-card optical packet switches.	IP over DWDM, OTN with GMPLS, on-demand provisioning, Traffic Engineering.
OML2	Global Load Balancing of Zero-Bandwidth TE LSPs in MPLS Networks	Filippo Cugini, /CNIT, Italy, Scuola Superiore Sant'Anna and Ericsson, Sweden	Propose an iterative algorithm to achieve global load balancing of zero-bandwidth TE LSP without resorting to additional routing protocol extensions.	
OML3	Availability-Guaranteed Connection Provisioning with Delay Tolerance in Optical WDM Mesh Networks	Cicek Cavdar, Massimo Tornatore, and Feza Buzluca/ Istanbul Technical University (ITU), Turkey/ UC Davis	Propose a dynamic provisioning scheme using user-centric SLA metric, called delay tolerance, for availability-guaranteed shared-path-protected connection provisioning	

IP/Optical Integration (Contd.)

Code	Title	Author/Affiliate	Topic	Trends
OML4	LSP Request Bundling in a PCE-Based WDM Network	Jawwad Ahmed, P. Monti, L. Wosinska / The Royal Inst of Tech, Sweden	Bundle LSP requests to improve the network optimization. Pros and cons of the bundling approach are evaluated.	IP over DWDM, OTN with GMPLS, on-demand provisioning, Traffic Engineering.
OML5	Data-Plane Architectures for Multi-Granular OBS Network	Michele Savi, / U. Bologna, Italy, U. Essex, Scuola Superiore Sant'Anna, Italy	Presents multi-granular OBS node architectures able to manage multiservice traffic according to the required Quality-of-Service (QoS).	

OML6	SIP-Based Service Platform for On-Demand Optical Network Services	B. Martini, P. Castoldi, F. Callegati / CNIT, Italy, U. Bologna, Italy, Scuola Superiore Sant'Anna, Italy	Reports the experimental validation of a SIP-based service platform for optical transport networks.	
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IP/Optical Integration (Contd.)

Code	Title	Author/Affiliate	Topic	Trends
OML7	IP and Optical Integration in Dynamic Networks	Ori Gerstel/ Cisco, USA	Discuss the reasons for why dynamic DWDM networking has not been productized, as well as the enabling IP/optical capabilities that make this technology deployable.	IP over DWDM, OTN with GMPLS, on-demand provisioning

GMPLS and Network Control

Code	Title	Author/Affiliate	Topic	Trends
NTuB1	Multi ASON and GMPLS Domains Interworking Trials for Automatically Switched Ethernet VLAN Path Provisioning	Satoru Okamoto / Keio University, Japan	Achieve seamless end-to-end Ethernet VLAN path provisioning over multi ASON and GMPLS network domains.	OTN+GMPLS, VLAN, network virtualization, fast provisioning
NTuB2	GMPLS Ethernet and PBB-TE (A Carrier's View)	Kenichi Ogaki and Tomohiro Otani/KDDI R&D Lab, Inc., Japan	Discuss the applicability of GMPLS architecture to Ethernet transport networks. Results of implementations of GMPLS controlled Ethernet are presented.	
NTuB3	Virtual Network Topology Manager (VNTM) and Path Computation Element (PCE) Cooperation in Multi-Layer GMPLS Networks	N. Andriolli, F. Cugini, L. Valcarenghi, P. Castoldi, A. Welin/SSSA, Italy, CNIT, Italy, and Ericsson, Sweden	Present a VNTM-PCE architecture for the effective configuration of Virtual TE Links.	

GMPLS and Network Control (Contd.)

Code	Title	Author/Affiliate	Topic	Trends
NTuB4	Experimental GMPLS Routing for Dynamic Provisioning in Translucent Wavelength Switched Optical Networks	R. Martínez, R. Casellas, R. Muñoz, T. Tsuritani, T. Otani/ CTTC, Spain, 2KDDI R&D Lab Inc., Japan	Present an OSNR-based IRWA algorithm with GMPLS extensions for dynamic provisioning in translucent WSON. Experimental evaluation is conducted in the ADRENALINE test-bed	OTN+GMPLS, VLAN, network virtualization, fast provisioning
NTuB5	A Fast, Robust Signaling Protocol for Enabling Highly Dynamic Optical Networks	Ronald A. Skoog, Arnold L. Neidhardt/ Telcordia, USA	Developed a new signaling protocol for highly dynamic optical networks that enables 100 ms setup time, which supports both working and backup paths.	

IP over DWDM Networks

Code	Title	Author/Affiliate	Topic	Trends
NThF1	Operational Solutions for an Open DWDM Layer	Ori Gerstel/ Cisco Systems	Operational issues of implementing alien wavelengths over an open DWDM network, the feasibility is demonstrated using a commercial management tool and DWDM system.	IP over DWDM, eliminating short-range interface. Alien wavelength
NThF2	Alien Wavelength Transport: An Operational and Economic Analysis	Serge Melle/ Infinera Corp., United States	Compare a new alien wavelength architecture used in long-haul IP over WDM networks against traditional transponder-based WDM.	
NThF3	Network Design and Architectures for Highly Dynamic Next-Generation IP-over-Optical Long Distance Networks	Chiu, et al, / ATT Lab, Telcordia,	Present initial network architectures and capacity-efficient design for an IP/Optical network with highly dynamic IP and wavelength services.	

IP over DWDM Networks (Contd.)

Code	Title	Author/Affiliate	Topic	Trends
NThF4	Elimination of DWDM Transponders over a Deployed IP over DWDM Network Using Novel DWDM XFP Transceivers with Integrated G.709 and Forward Error Correction	Stephan Harren/ euNetworks AG, Germany, Xantaro, Germany, Smartoptics, Norway, and Menara Networks, US	Demonstrate elimination of DWDM transponders in an IP over DWDM for the first time using DWDM XFP MSA transceivers.	IP over DWDM, eliminating short-range interface. Alien wavelength
NThF5	Interworking of IP and OTN Networks-Making IP over OTN a Reality	Mark Nowell/ Cisco, Canada	Discuss the issues of interworking of the IP networks and the OTN networks.	

Conclusion

Trends

- Grid/Cluster Computing/Cloud Computing over optical network infrastructure.
- Service-oriented optical network.
- Multi-layer, multi-domain routing/protection/restoration.
- Fusion of OTN and Ethernet.
- IP directly over DWDM.
- Energy efficiency.