D5.3 "Dissemination activities in the second half of the project"

Status and Version:	Final version 2.0	
Date of issue:	30.09.2012	
Distribution:	Public	
Author(s):	Name	Partner
Aracil	Javier	UAM
Lopez	Victor	UAM
Fernández-Palacios	Juan	TID
Georgiades	Michael	PrimeTel
Zervas	George	UEssex
Simeonidou	Dimitra	UEssex
Carrozzo	Gino	NXW
Bernini	Giacomo	NXW
Basham	Mark	INT
Checked by:		

Table of Contents

1 Executive Summary

This document contains the information regarding dissemination activities in the second half of the project.
The MAINS dissemination activities are realized through the Project Web Site and the participation in:

- Workshops: MAINS organized two workshops at FUNEMS 2012 and ECOC 2012
- Conferences:
  - ECOC 2011 (3 papers)
  - FUNEMS 2012 (3 papers)
  - ECOC 2012 (4 regular papers, 1 postdeadline paper)
  - ONDM 2012 (4 papers)
  - ICTION 2012 (1 paper)
- Exhibitions: MAINS booth at ECOC
- Magazines:
  - OSA Optics Express journal (4 papers)
    IEEE Com Mag (1 joint MAINS-STRONGEST-ONE paper)

2 Achieved dissemination activities

2.1 Project website

The project website (http://www.ist-mains.eu) is maintained with updated information about the project. In the section documents (http://www.ist-mains.eu/documents/) public deliverables and publications are updated.

A private area was created to allow reviewers accessing project information.

2.2 Dissemination at Internet public media

MAINS has been referenced twice in LightReading, one of the most relevant Internet publications on telecom industry:

- " Intune Waxes Lyrical" : (http://www.lightreading.com/blog.asp?blog_sectionid=384&doc_id=224946&)

- "Intune Joins Telefonica Project".: http://www.lightreading.com/document.asp?doc_id=188136

2.3 Workshops organized by MAINS

Workshops organised by MAINS in the second half of the project:

FUNEMS 2012 "Workshop on Optical networking standardization strategies", 4 July 2012, Berlin (Germany).

Tiltle	Speaker
Overview of CAON Standardization Activities	Juan Pedro Fernandez-Palacios, TELEFONICA R&D, Spain
ACCORDANCE Standardization Activities on NGPON2	Thomas Pfeiffer, Alcatel-Lucent Bell Labs, Germany
On the IETF Standardization Opportunities for Sub-wavelength Optical Networks	Juan Pedro Fernandez-Palacios, TELEFONICA R&D, Spain
Multilayer and Multidomain Interworking Architectures based on PCE	Oscar Gonzalez de Dios, Telefonica I+D, Spain
Standardization Opportunities on Optical Network and IT Convergence	Nicola Ciulli, Nextworks s.r.l., Italy
Challenges of Cognitive Networks Standardization - CHRON	Andrzej Tymecki, ORANGE, Poland

Table 1: FUMENS workshop detailed program

All the presentations are available at FUNEMS website: http://www.futurenetworksummit.eu/2012/

ECOC 2012, "Workshop on control plane architectures for new optical switching technologies enabling flexibility in time, frequency and space domains", 16 September 2012, Amsterdam (The Netherlands).

Title	Speaker	Affiliation
Toward building optical packet and circuit switched networks	Hiroaki Harai	NICT
OpenFlow Control for Optical Networks	Reza Nejabati	University of Essex
Control Plane Architectures for Flexgrid Networks	Raul Muñoz	CTTC
Resource Control and Service Management architectures for seamless datacenter and network integration	Dominique Verchere	Alcatel Lucent
GMPLS extensions for sub-wavelengths in time and frequency	Gino Carrozzo	Nextworks

domain		
New challenges on optical control plane standardization	Juan Pedro Fernandez-Palacios	Telefonica I+D

Table 2: Technical presentations at ECOC 2012 workshop

Control Plane demonstrations			
Title	Speaker	Affiliation	Duration
ADRENALINE testbed demonstration of a GMPLS-based unified control plane for multi-layer (MPLS-TP/WSON) networks in the STRONGEST project	Ricardo Martínez	CTTC	25 min
Multidomain Control Plane for Subwavelength Optical Networks	George Zervas, Giacomo Bernini	University of Essex, Nextworks	25 min

Table ~~32~~: Control Plane demonstrations at ECOC 2012 workshop

2.1 MAINS booth at ECOC

MAINS project results and demos were presented at ECOC 2012 Exhibition. Our booth was visited by representatives of Google, Cisco, Verizon, DT, Paris Tech, UPC and LightReading.

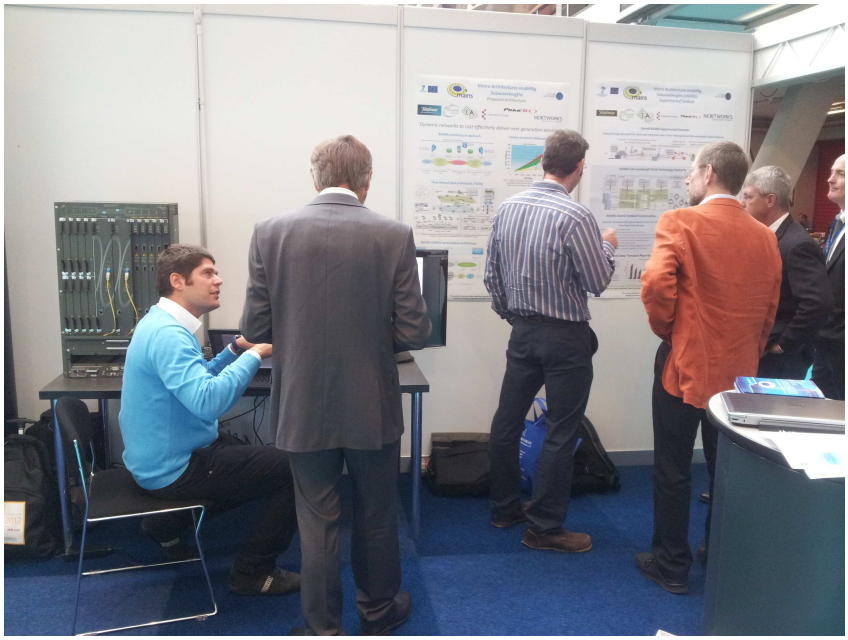

Figure 2-1: MAINS booth at ECOC

2.2 Scientific Publications

2.2.1 Technoeconomic analysis and Application Scenarios

Future Network & Mobile Summit Conference: http://www.futurenetworksummit.eu/2012/

- Kiss Kalló, Victor Lopez, John Dunne, Mark Basham, J.P. Fernández-Palacios, "Benefits of Optical Packet Switching for Router By-pass in Metro Networks". Future Networks and Mobile Summit, Berlin, Germany, July 2012.

Abstract: This paper builds on previous work [1] on IP off-loading over multigranular photonic switching technologies to provide an in-depth techno-economic analysis for a real metro scenario. The main contribution of the paper is that it demonstrates a 42% capital cost reduction in favour of the proposed IP-offloading architecture, when compared against currently used, typical all-IP architectures. This is achieved by performing packet transport, aggregation, switching and grooming in the optical layer within an IP off-loading architecture using the Optical Packet Switch and Transport (OPST) technology. Such results show that multi-granular optical technologies are a strong candidate for solving the bottleneck problem caused by video streaming, cloud services and mobility in metropolitan area networks. Finally, the paper also discusses other, cumulative benefit aspects of multi-granular technologies, such as video and next-generation cloud services.

The 15th International Conference on Optical Networking Design and Modeling (http://ondm2012.essex.ac.uk)

- Kiss Kalló, J, Shields, Raymond Carley, Víctor López, J.P. Fernández-Palacios, "Cost-Effective Sub-wavelength Solution for Data Centre Location in Scaled Next-Generation Networks", submitted to Optical Network Design and Modeling, ONDM 2012, Colchester, UK.

Abstract: This paper summarises the modeling results obtained with a sub-wavelength optical packet switching technology, called OPST (Optical Packet Switch and Transport), when compared against an IPoDWDM solution. In particular, the impact of data centre location in the network on the network cost is studied for two architectures based on different technologies. Data centre location, routing strategies, service mix, traffic growth and subscriber service take-up is modelled to obtain a broad view about the cost sensitivities in these networks.

The main contribution of the paper is to demonstrate that resilience to data centre location and changing traffic patterns enable the sub-wavelength packet optical solution to achieve cost savings of 150% when compared to the IPoDWDM approach. Such flexibility of the packet optical solution also enables 100-300% of power consumption cost reduction and an average 150% savings on rack cabinets for typical configurations.

- Kiss Kalló, Raymond Carley, Conor O'Malley, Victor Lopez, J. P. Fernández-Palacios, "Economic Modelling of Uncertain Next-Generation Network Evolution", submitted to Optical Network Design and Modeling, ONDM 2012, Colchester, UK.

Abstract: In this paper the uncertainties and the implied level of risk associated with next-generation network architectures is modelled using Monte Carlo simulation, aimed at understanding network economics evolution. A high number of network parameters – like incremental network deployment, data centre location, network architecture, service mix, traffic growth and subscriber take-up – are modelled. A wide range of values is used for these parameters to gain understanding of their impact on network cost. Such an approach provides insight into the risk level undertaken by operators when building their network infrastructure based on a specific forecast. Thus, the core result of this analysis is that a subwavelength optical packet forwarding technology can de-risk network investments by 500% when compared to a next-generation IPoDWDM solution. Second, in a scaled network scenario the sub-wavelength solution also provides 150% capital savings. Finally, on the medium and long term the sub-wavelength approach yields a cost benefit for 99.8% of the configurations, when compared to an IPoDWDM architecture.

2.3 Architectural design and demonstration

Future Network & Mobile Summit Conference: http://www.futurenetworksummit.eu/2012/

- Georgios S. Zervas, Bijan Rahimzadeh Rofee, Yan Yan, Dimitra Simeonidou, Giacomo Bernini, Gino Carrozzo, Nicola Ciulli, "Control and Transport of Time Shared Optical Networks (TSON) in Metro Areas", Future Network & Mobile Summit 2012, Berlin, Germany, July 2012.

Abstract: This paper proposes an innovative metro mesh optical node and a two-fold control plane architectural solution composed of vertically interoperable sub-wavelength enabled GMPLS and TSON layers. Experimental results demonstrate very high throughput (8.68 Gbps) low latency (<160 μs) and low (<25 μs) jitter performance of the node. GMPLS protocol extensions are also provided to support such metro mesh network.

- Juan Fernandez-Palacios, Mark Basham, Michael Georgiades, "E2E-OAM in convergent Sub-wavelength-MPLS environments". Future Network & Mobile Summit 2012, Berlin, Germany, July 2012.

Abstract: This paper presents an End-to-End (E2E) OAM architecture for Telco networks including a Sub-wavelength domain. It addresses two mainissues: compatibility between MPLS networks and different Sub-wavelength technologies, and scalability of the OAM flows across the whole network. The case for OPST Sub-wavelength technology in the data plane has been studied extensively, however this is the first study on aa methodology to scale the number of OAM flows. Finally the inter-carrier issue in E2E OAM is also explored.

OSA Optics Express journal

- Georgios S. Zervas, Joan Triay, Norberto Amaya, Yixuan Qin, Cristina Cervelló-Pastor, and Dimitra Simeonidou, "Time Shared Optical Network (TSON): a novel metro architecture for flexible multi-granular services", Optics Express Vol. 19, Iss. 26, pp. B509–B514, 2011

Abstract: This paper presents the Time Shared Optical Network (TSON) as metro mesh network architecture for guaranteed, statistically-multiplexed services. TSON proposes a flexible and tunable time-wavelength assignment along with one-way tree-based reservation and node architecture. It delivers guaranteed sub-wavelength and multi-granular network services without wavelength conversion, time-slice interchange and optical buffering. Simulation results demonstrate high network utilization, fast service delivery, and low end-to-end delay on a contention-free sub-wavelength optical transport network. In addition, implementation complexity in terms of Layer 2 aggregation, grooming and optical switching has been evaluated.

- S. Askar, G. Zervas, D.K. Hunter, D. Simeonidou, "A novel ingress node design for video streaming over optical burst switching networks", Optics Express, Vol. 19, Iss. 26, pp. B191-B196, 2011

Abstract: This paper introduces a novel ingress node design which delivers enhanced video streaming quality over optical burst switching networks. Ns2 simulations show that the proposed scheme delivers improved video traffic quality without affecting other traffic, such as best effort traffic. The average gain in video PSNR was 5 dB over existing burst cloning schemes, with a maximum end-to-end delay of 17 ms, and jitter of less than 0.35 ms. The extra load carried by the network was comparatively small (a maximum of 12% in the worst-case scenario), while examining the trade-off with received video quality confirms the value of the proposed scheme, especially when there is a high proportion of video traffic.

- Yan Yan, Yixuan Qin, Georgios Zervas, Bijan Rofoee, Dimitra Simeonidou, "High Performance and Flexible FPGA-Based Time Shared Optical Network (TSON) Metro Node", submitted to Optics Express special issue for ECOC2012

Abstract: The paper presents the architecture, implementation and evaluation of the flexible and finely granular Time Shared Optical Network (TSON) metro node. It focuses on the FPGA-based Layer 2 TSON metro node system. The experimentally measured results show exceptional performance of up to 8.68Gbps throughput per 10Gbps port, 95.38% of theoretical maximum throughput, latency of less than 160μsec and jitter of less than 25μsec

- B.R. Rofoee, G. Zervas, Y. Yan, N. Amaya, Y. Qin, D. Simeonidou, "Network-on-and-off-Chip Architecture on Demand for Flexible Optical Intra-Datacenter Networks", submitted to Optics Express special issue for ECOC2012

Abstract: The paper presents a novel network on-and-off chip approach for highly efficient and transparent intra-datacenter communications. The implemented FPGA-based network on-chip line card enables hitless adaptation between Ethernet and TSON, which is supported by a flexible network off-chip of AoD, demonstrating end-to-end high performance results.

IEEE Communications Magazine • September 2012

- Luis M. Contreras, Víctor López, Óscar González de Dios, Alejandro Tovar, Fernando Muñoz, Amanda Azañón, Juan Pedro Fernández-Palacios, and Jesús Folgueira, Telefónica I+D. "Toward Cloud-Ready Transport Networks"

Abstract: This article presents an operator's view of the evolution towards a transport network ready to support cloud services, which are hosted in data centers and reachable through the network. This work shows the reasons why current transport networks are not efficiently designed for a cloud environment, and it describes the architecture for a cloud-ready network. To show the feasibility of such a cloud-ready network, we present three experimental validations of the concepts to support our network evolution.

The 37th European Conference and Exhibition on Optical Communication: http://www.ecoc2011.org/

- G. S. Zervas, J. Triay, N. Amaya, Y. Qin, C. Cervelló -Pastor, D. Simeonidou, "Time Shared Optical Network (TSON): A Novel Metro: Architecture for Flexible Multi-Granular Services", 37th European Conference on Optical Communication (ECOC 2011), We.9.K.6, Geneva, Switzerland, Sept. 2011

Abstract: This paper presents the TSON metro mesh network architecture for guaranteed, statistically-multiplexed services. It proposes tunable time-wavelength assignment, one-way tree-based reservation and node architecture. Results demonstrate high network efficiency, fast service delivery and guaranteed QoS.

- Shavan Askar, Georgios Zervas, David K. Hunter, Dimitra Simeonidou "A Novel Ingress Node Design for video streaming over Optical Burst Switching Networks", 37th European Conference on Optical Communication (ECOC 2011), Tu.6.K.6, Geneva, Switzerland, Sept. 2011

Abstract: This paper introduces a novel ingress node design capable of enhancing the quality of streamed video without incurring higher network load. Simulation results show an average of 6 DB gain in video quality with the worst case scenario.

16th Conference on Optical Network Design and Modeling (ONDM 2012),

http://ondm2012.essex.ac.uk/

- Yixuan Qin, Yan Yan, Georgios S. Zervas, Bijan R. Rofoee, Norberto Amaya and Dimitra Simeonidou, "Software/Hardware defIned NEtwork (SHINE): A Novel Adaptive Optical Network Framework for Future Internet", ONDM, April 2012

Abstract: A novel Software/Hardware defIned Network (SHINE) framework for future optical network is proposed in this paper. An FPGA based SHINE adaptive network element (SANE) carrying time shared optical network (TSON) service and 10G Ethernet service is implemented. A cross-platform C++/Qt based SHINE IDE incorporating fine/coarse granular instruction set is developed to simply compose node/network manually or automatically. Five types of SHINE working flows, i.e. node on demand, network on demand, node self-adaptation, node generation, and network generation, are depicted, then demonstrated and selectively evaluated. Particularly, a hitless switch-over between sub-wavelength service (TSON) and low latency fat pipe service (10G Ethernet) (network on demand), and a receiver automatically detects transmitter's change (i.e. switch-over from TSON to Ethernet), then adjusts itself (node self-adaption), are highlighted.

- Georgios Zervas, "Flexible Optical Metro Networks for Future Services", presentation at "Network & IT Convergence For Future Internet" workshop organised by CaON Initiative and GEYSERS Project at ONDM 2012

The 38th European Conference and Exhibition on Optical Communication: http://www.ecoc2012.org/

- Yan Yan, Yixuan Qin, Georgios Zervas, Bijan Rofoee, Dimitra Simeonidou, "High Performance and Flexible FPGA-Based Time Shared Optical Network (TSON) Metro Node", We.3.D.6, ECOC, September 2012

Abstract: The paper presents the architecture, implementation and evaluation of the flexible and finely granular Time Shared Optical Network metro node (TSON). The results show exceptional performance, throughput 95.38% of theoretical maximum, latency less than 160μsec and jitter less than 25μsec.

- Bijan Rahimzadeh Rofoee, George Zervas, Yan Yan, Norberto Amaya, Dimitra Simeonidou, "Flexible and Adaptive Optical Metro Networking on Fixed/Flex Grid Exploiting Hybrid Time/Frequency for Shared Resource Allocation", Tu.3.D.5, ECOC, September 2012

Abstract: A novel metro network architecture for co-existing Fixed-Grid and Flex-Grid networks is proposed. It delivers adaptive resource allocation in time and frequency dimensions for Fixed-Grid sub-wavelength, wavelength, waveband and Flex-Grid super-channel services over AoD optical nodes. Fixed and Flex Grid sharing spectrum show improved performance.

- B.R. Rofoee, G. Zervas, Y. Yan, N. Amaya, Y. Qin, D. Simeonidou, "Network-on-and-off-Chip Architecture on Demand for Flexible Optical Intra-Datacenter Networks", Th.2.B.2, ECOC, September 2012

Abstract: The paper presents a novel network on-and-off chip approach for highly efficient and transparent intra-datacenter communications. The implemented FPGA-based network on-chip line card enables hitless adaptation between Ethernet and TSON, which is supported by a flexible network off-chip of AoD, demonstrating end-to-end high performance results.

- M.P.Anastasopoulos, A.Tzanakaki, G.Zervas, B.Rofoee, R.Nejabati, D.Simeonidou,"Virtualization over Converged Wireless, Optical and IT elements in Support of Resilient Cloud and Mobile Cloud Services, Joint GEYSERS-MAINS activity, P5.15, ECOC, September 2012

Abstract: This paper studies the interconnection of fixed and mobile users with computing resources through heterogeneous optical/wireless networks. An MILP model for virtualization of physical infrastructures is proposed. The impact of service characteristics on energy consumption and resource requirements is quantified.

- Bijan R.Rofoee, George Zervas, Yan Yan, Dimitra Simeonidou, Giacomo Bernini, Gino Carrozzo, Nicola Ciulli, John Levins, Mark Basham, John Dunne, Michael Georgiades, Alexander Belovidov, Lenos Andreou, David Sanchez, Javier Aracil, Victor Lopez, Juan. P. Fernández-Palacios, "First Demonstration of Ultra-low Latency Intra/Inter Data-Centre Heterogeneous Optical Sub-lambda Network using extended GMPLS-PCE Control Plane", **Postdeadline**, Th.3.D.5, ECOC, September 2012

Abstract: This paper reports on the first user/application-driven multi-technology optical sub-lambda intra/inter Data-Centre (DC) network demonstration. Extended GMPLS-PCE controls two heterogeneous intra-DC optical sub-lambda networks to deliver dynamic and guaranteed data transfer of ultra-low latency (<270μs) and jitter (<10μs) for end-to-end services.

14th International Conference on Transparent Optical Networks http://www.nit.eu/icton-2012

- Victor Lopez, Zervas, G. ; Yixuan Qin ; Lopez-Buedo, S. ; Simeonidou, D. ; Aracil, J. ; Fernandez-Palacios, J "Implementation of an OBS access node supporting multiple services". ICTON 2012, 2 July Coventry (England).

Abstract: Network operators want to deliver multiple services to the end customers. This leads to the need of efficient transport of data using optical network technologies. OBS is a promising technology for metro networks, where the operator can locate their servers to

provide services such as video, backup or PC virtualization. These services are competing for shared network bandwidth when running in parallel. This work develops an FPGA-based access edge node, which operates with multiple QoS applications. This paper describes the architecture of the design as well as the behaviour of the implemented solution.

2.4 Concertation Activities and liasons with other projects

MAINS has actively participated in the CAON and Concertation meetings organised at programme level relating to the ICT Future Networks area. According to it, Juan Fernandez-Palacios attended to the two Concertation Meetings held in Brussels in 2012 (10/02/2011, 08/10/2011, 13/02/2012) as well as to the CAON meeting help in Geneva (20/09/2011). Furthermore, MAINS results and demos will be presented at the Future Networks Concertation Meeting scheduled by 10-11 October 2012.

Currently, Juan Fernández-Palacios is co-chair of the CAON (Convergent Access and Optical Networks) cluster where is coordination the standardization activities carried out within the cluster. Furthermore, MAINS has also contributed to NEXT!WORK and CAON white papers providing its vision on metro network evolution.

Liaisons with other projects

MAINS has actively collaborated with STRONGEST. As final results of this collaboration, a control plane interoperability demo between MAINS and STRONGEST was presented at ECOC 2012 and reported on D4.4.

3 Conclusions

This deliverable summarizes the results of the MAINS consortium in the second half of the project. The project has disseminated its main results by means of press releases, workshops, scientific publications and concertation activities.