

e-photon/ONE: Workshop Report

OECC Workshop on Optical Packet and Burst Switching

12th July, Tokyo, Japan

Report by MJ O'Mahony, Univ of Essex, UK

Workshop Organisers

M.J. O Mahony, University of Essex, UK [**on behalf of e-photon/ONE**]

Dan Blumenthal, University of California SB, USA

Ken-ichi Kitayama, University of Osaka, Japan

Summary

In recent years there has been considerable global activity on research into optical packet and burst switching for telecommunications networks. The objective of this workshop was to understand the status of research in these technical areas across Japan, Korea, Europe and the USA. To this end a programme was organised, bringing together government and funding managers, to understand regional priorities in these areas, together with researchers to understand the technical progress and key issues facing these challenging technologies.

The workshop was supported by the IEICE, the Japan Support Centre for Advanced Telecommunications Technology Research, and the EU network of Excellence e-photon/One.

Main Highlights

Session 1: Optical Networking R&D:-Government Funding Programmes

- **EU Research Initiatives:**

Dr Nicholas Nicholson [Scientific Officer, Research Infrastructure Unit, European Commission]

The talk presented the background and current status of the EU Framework programmes. The importance of the European Research Area was highlighted, together with how the interconnection of national research networks [NRENS] through GEANT supported this concept. The issue of NRENS owning their own fibre and networks [a topic also highlighted in the plenary conference talk by Prof deFanti] was raised.

- **OBS Activities in Korea:**

Prof Minho Kang, Optical Internet Research Centre [OIRC], Information and Communications University, Korea

Korea is number 1 in broadband density, and OIRC [together with Samsung and ETRI] are active in OBS research for the future optical internet. The presentation presented roadmaps for optical network research up to the year 2007. Variations of OBS were examined and AOBS [advanced OBS], which involves traffic engineering, QoS support, contention resolution, protection is chosen as a way forward. The presentation highlighted achievements of OIRC in the domain of OBS including results in network and node architectures and control plane. An OBS testbed has been implemented jointly with Samsung, and OIRC is keen on international collaboration.

- **MPHPT [Ministry of Public management, Home affairs, Posts and telecommunications**

Mr Yoshiaki Takeuchi [Director of the Research and Development Office]

Mr Takeuchi spoke about "*Japan's strategy for the Promotion of R&D in Photonic Network Technology*".

A fascinating talk. Some key points were:

- 15 m broadband subscribers now in Japan
- Cost comparison: 9cents/100kbps[Japan] compared with Belgium 115 cents/100kbps
- E-Japan priority Programme [2003] includes:
 - 1000 WDM multiplexing [2005]
 - 10 Tbps photonic router [without OEO conversions by 2005]
 - WDM optical access
 - Development of optical subsystems using nano-technology
- Growing importance of Photonic Networking [rapid increase in network traffic]
- Targets for 2010 in photonic networking set
- Test beds of great importance
- Promotion of international collaboration important for establishing standards

- **R&D in the USA:**

Presentations by Prof Blumenthal on packet switching and also Dr Qiao on OBS .Blumenthal's was in three parts:

1. A discussion on the integration of IP and the optical domain. IP packets within the SDH frame are examined at the network edge and appropriately routed across the network taking account of the IP address.

2. Wavelength conversion using a two stage subsystem-the first a XGM providing a variable input wavelength with fixed output wavelength: the second a XPM converter providing a fixed input variable output [combined with an integrated tunable laser]. Thus a variable input, variable output conversion is achieved, which provides regeneration and label deletion.

The presentation on OBS by Dr Qiao covered the interesting topic of TCP over OBS.

Session II: R&D Activities USA:

- **Photonic Burst Switching:** Shlomo Ovadia-Intel Corporation

- **Challenges of Optical Label Switching:-** Gee-Kung Chang, Georgia institute of Technology
This presentation looked at network deployment targets for OLS [optical label switching], across core, regional and access. An overview of the technologies used was given, together with novel techniques for label generation and payload multiplexing.

Session III: R& D activities (EU)

Optical Packet Switching :-IST-DAVID- Lars Dittman-Tech Univ Denmark

IST-STOLAS:- Didier Colle, Univ of Ghent

Information on DAVID, STOLAS projects available on OPTIMIST web site www.ist-OPTIMIST.org

OPSNET:- UK National project:- Dimitrios Klonidis, Univ of Essex

A UK National Research Council project [2001-2004] led by University of Essex , together with Univs of Cambridge and Strathclyde. The project involves the realisation of an optical packet switch [for the core network], which is demonstrated at 40 Gb/s and is realised with technologies that allow operation at 160 Gb/s. An edge node [from UK Project OPERON] allows aggregation and classification of incoming IP packets to form a variable length optical packet.

Session IV:R&D Activities Asia

***Note:** NiCT [National Institute of Communications Technology] is a new entity created in April 2004 from the old CRL[communications research laboratories] and TAO[Telecommunications Advancement Organisation of Japan]. It is a state funded laboratory and has impressive laboratories including material growth and fabrication. It has approximately 500 full time staff, total staff 1500.*

NiCT OBS Programme: Optical Burst Switching network using PLC and MEMs switches:- Dr Akio Sahara (NTT)

Main points:

- Discussed collaborative OBS experiment NTT+NiCT+Fujitsu
- 6 node network with 2 MEMs switches and 6 PLC switches
- PLC switches in <6 ms; MEMs = 1 ms
- 3 D MEMs used, 128x128 channel
- 2 way signalling used, GMPLS
- Connection set-up time <30 ms

NiCT: Optical code label processing and its application to packet switched networks

Dr Naoya Wada

Main points:

- Discussed OPS based on BPSK label and PLC processor
- All-optical label processing
- Optical buffer and scheduler
- Operation at 40 Gb/s-very impressive demonstrator

OPS/OBS:- Research Activities in China:- Dr Jian Wu-Beijing University of Posts & Telecommunications

- Funding for IT R&D growing rapidly in last two years
- Major research projects include (**highlighted ones discussed briefly**):
 - Tb/s WDM and smart nodes
 - Tb/s optical packet switching technologies
 - **Optical burst switching testbed**
 - Optical memory
 - **100 Gb/s LAN based on optical packet technology**

Issues & conclusions:

- Japan, Korea China are seriously working on OBS and OPS [many aspects of work are common to OBS/OPS]; this is in contrast to EU.
 - NiCT has a 5 year programme on OBS involving industry and universities
- NiCT laboratories allow research devices to be developed-of great benefit to system and network researchers.
- In Asia photonic networking is seen as a key area for investment and detailed targets are in place for transmission and switching technologies.
- In China there has been a significant increase in funding for R&D in recent times
- In Japan there is increasing collaboration between industry and research institutes
- Nano-technology is seen as a way forward to reduce size and power of photonic subsystems.

Japan, Korea & China are very interested in collaboration with Europe.

Mike O Mahony
July 2004

Further Information: Proceedings are held by Mike O' Mahony [mikej@essex.ac.uk], but I need to get permission from presenters to release slides hardcopy.