

Net!Works

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SUCCESS STORIES

OPTICAL COMMUNICATIONS



Networked
Society

EUROPEAN RESEARCH & INNOVATION IN TELECOMMUNICATIONS



AN INTERNATIONAL SUCCESS BOLSTERED BY EU-FUNDED RESEARCH

Hardly visible to end-users, 90% of all digital information is transported over optical networks. Fibre-optic communication is the backbone of the information society today. It will become even more important in the future.



From ground breaking discoveries, such as optical fibres and EDFAs over products such as WDM systems and OXCs to global standards such as SDH, OTN and ASON, Europe has been at the forefront of optical communications R&D for nearly 50 years. The EU Framework Programme played a pivotal role in developing several generations of optical networks over the last 25 years.

7 of the top 20 network operators are headquartered in Europe. 6 of the 20 largest optical equipment manufacturers have major R&D centres in Europe and represent more than 30% of the global equipment market. Two of the top 3 component manufacturers have operations in Europe. Over a hundred SMEs' and universities deliver complementary innovation on network, system, or component levels. According to a recent Photonics21 study, optical technologies leverage a telecommunication infrastructure market of 350 Billion € and impact more than 700,000 jobs in Europe.

By 2020, at least a 10-fold increase in fibre capacity and Tb/s per wavelength will be required. Fibre communication will move closer to the user and will become a critical infrastructure in datacentre, private, home, vehicle and sensor networks. Based on its strength and expertise, Europe is well positioned to respond to these challenges, if it continues to invest!

MANY ARCHITECTURES, CONCEPTS AND TECHNOLOGIES HAD THEIR ORIGINS IN COLLABORATIVE RESEARCH PROJECTS, CO-FUNDED BY THE EUROPEAN UNION.

The investment of Framework Programme funds in optical communications has created a network of experts from industry and academia, provided education and has contributed directly and indirectly to the creation of over a hundred thousand jobs in Europe for highly-skilled knowledge workers. The collaborative approach of the projects allowed consensus building on central topics such as the optical network evolution and network control. The results, disseminated in publications and standard contributions, formed a solid foundation for the product roadmaps of participating system/component manufacturers and enabled network operators to develop their technology introduction strategies ahead of time.

1990

1995

2000

2005

2010

2015

2020

WDM CAPACITY

2.5 Gb/s
1 x 2.5G

20 Gb/s
8x 2.5G

800 Gb/s
80 x 10G
8x 2.5G

3.2 Tb/s
80 x 40G

10 Tb/s
96 x 100G

25 Tb/s
M x 400G

100 Tb/s
N x 1000G

NETWORK ARCHITECTURE

No WDM
Point-to-point

200 GHz WDM
Fixed OADM rings

50 GHz DWDM
ROADM rings

200 GHz WDM
Fixed OADM rings

50 GHz DWDM
Multi-degree (MD)
ROADM mesh

Flexible Grid
DWDM
Colour-/
directionless
MD-ROADM
mesh

Flexible Grid
DWDM
Contentionless
MD-ROADM
mesh

STANDARDS

SDH

WDM
TMN

NG-SDH, OTNv1
ASON

OTNv2
GMPLS

OTNv3
PCE

OTNv4
Multi-layer PCE

OTNv5

FP PROJECT CONTRIBUTIONS (METRO/CORE)

MWTN:
WDM network
demonstrator

**HIGHWAY,
MIDAS, SPEED,
UPGRADE,
ESTHER:**
40Gb/s
transmission

**PHOTON,
WOTAN,
BLISS, OPEN:**
Wavelength-
routed networks
at 10Gb/s

**MEPHISTO,
DEMON, PLATO,
MOON, METON:**
Optical transport
network
management

**TOPRATE,
FASHION:**
Early >100Gb/s
realisations

METEOR:
40Gb/s ring
networks

**LION, WINMAN,
DAVID:**
Multi-layer/
domain
management
& contro

e-Photon/ONe+:
DSP techniques,
coherent detection

NOBEL I/II:
Metro & core
evolution
scenarios and their
experimentation,
GMPLS
interoperability,
reference
networks,
DP-QPSK
transmission

**PHOSPHORUS,
MUPBED:**
GMPLS-controlled
research
infrastructures

BONE, TRIUMPH:
100G technologies;
optical burst
switching

STRONGEST:
Optical & packet
integration,
multi-domain/layer
PCE,fl exgrid &
>100G networks

DICONET:
physical
constraints in
modelling and
routing; reference
networks

GEYSERS, ONE:
IT & networking
convergence