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The STRONGEST NEWSLETTER

Periodic newsletter based on views and achievements from the FP7 STRONGEST project

Hot topics

What is STRONGEST ?

Collaborations: the MAINS Project

Contents

What is STRONGEST ?

STRONGEST ("Scalable, Tunable and Resilient Optical Networks Guaranteeing Extremely-high Speed Transport") is an Integrated Project that was approved within the fourth Call of the Seventh Framework Programme of the European Commission (Theme 2009.1.1 "The Network of the Future") and started its activity on January 1st, 2010.

STRONGEST's main goal is to design and demonstrate an evolutionary ultra-high capacity multi-layer transport network, based on optimized integration of Optical and Packet nodes, and equipped with a multi-domain, multi-technology control plane, overcoming the problems of current networks that still provide limited scalability, are neither cost effective nor energy efficient and do not properly guarantee end-to-end quality of service.

STRONGEST's main goal is to design and demonstrate an evolutionary transport network ensuring higher scalability, energy efficiency, cost effectiveness and better end-to-end quality of service.

STRONGEST is an industry led project; the consortium brings together major European industrial players, leading Telecom operators, Universities and Research Centres and as such, it enables the necessary synergies and creates an ideal environment for innovation and development.

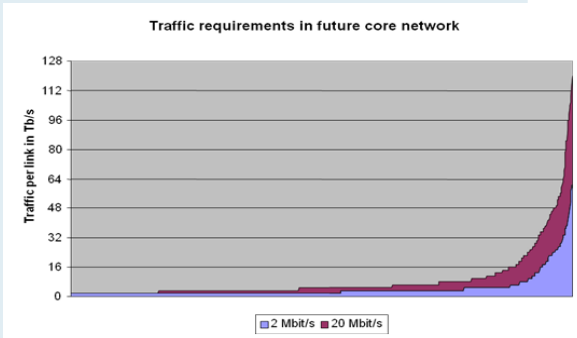
The European scale of the project is made necessary by the development of a new reality in which countries and federations are inextricably linked. To have a common view at European level is essential to apply the project's outcomes.

A major impact from STRONGEST will be to strengthen the position of European industry in the field of future internet and to reinforce the European leadership in optical networks technologies. The design of a more efficient transport network with reduced cost per bit and the particular attention to energy efficiency will turn into benefit to the entire Community.

Outline

High speed transmission goes beyond 100Gb/s

Massive future access bandwidth demand (e.g. 2 or 20Mb/s, further moving towards 100 Mbit/s per customer) will call for a significant boost to core network bandwidth.
Indeed, high speed transmission is about to go through yet another revolution. An early non-coherent version of 100Gb/s transmission system has been available for a short while, but full scale deployment requires coherent modulation, to overcome the stringent performance requirements of dispersion, signal to noise ratio and PMD. This coherent solution is already at the prototype stage and full products will appear from early 2011. In the meanwhile the ITU and IEEE have worked together to produce synergistic Ethernet and OTN standards which hopefully will lead to common industry technology development and hence early cost effectiveness.



Core links, ordered in increasing capacity, to support future access demand of 2 or 20Mb/s

Moreover, the industry is beginning to explore what comes next. At OFC 2010 in San Diego, popular topics included:

- Variable bit rate transmission using OFDM, where each wavelength pipe carries just as much capacity as required.
- Transmission rates of 200G, 400G and as high as 1Tb/s. There is no agreed bit rate for standardisation above 100G yet, though one opinion is that the huge development effort made for 100Gb/s should continue to be useful for the next generation – suggesting 400Gb/s would be preferred. At OFC, Google said they would need 1Tb/s by 2013.
- Overcoming the present ITU wavelength grid. Bit rates higher than 100G could occupy greater than the standard 50GHz grid, so consideration is now being given to relaxing the grid.

If you wish to get in touch with us, please contact: contact-strongest@ac.upc.edu.

Views

Why do we need novel transport networks?

New applications, an increased number of users and a higher bandwidth usage per user will lead to massive core bandwidth growth. How can that amount of information be transported? In addressing this fundamental question, we are concerned with three issues: in 2020, the bandwidth required will be two orders of magnitude higher than currently, transport network equipment must use much less electrical power than today, the transport network cost will have to rise sub-linearly with bandwidth to allow users to afford it.

Hence, novel transport networks will have to be developed and deployed well in advance, to offer fully fledged solutions to such challenging issues.

Motivation: huge bandwidth growth

The throughput of the Internet has been growing exponentially for more than 20 years and it is expected that this growth will continue for the coming years. Moreover, in an attempt to overcome the current economic slowing down, many countries are significantly supporting the expansion of public information infrastructure, that will lead to even higher growth.

Also, new, potentially disruptive services will appear; in the residential market we will see triple-play with ultra-high definition video, 3D Internet, 3D-multimedia, and multimedia supported social networking. Additionally business services and other demanding applications such as Tele-Medicine or applications which we cannot imagine today will eventually gain huge momentum.

Motivation: more bandwidth at the same price

Consumers are currently paying roughly the same for broadband services as they were originally for dial-up access, which offered several orders of magnitude less bandwidth. This means that, as a general rule, customers expect more bandwidth at about the same price

In the future, as access bandwidth will increase by yet further orders of magnitude, the core will have to be upgraded by the same factor. As the end-user prices for these bandwidths will not increase in the same order of magnitude, any network upgrade must come at a significantly lower cost than today.

Motivation: electrical power efficiency and overall emission reduction

Currently the power consumption of ICT is estimated to account for approximately 2% of the global greenhouse gas emissions. About 14% of these emissions are attributed to the telecommunication networks. Note that this does not include the data centres (16%) or the user premises devices such as modems and PCs (18%).

In the current telecommunications networks the vast majority of the power consumption can be attributed to mobile and fixed line access networks. The current trend is to replace the copper based technologies by fibre. The reasons for these replacements are the significantly higher bandwidth, lower power consumption of optical technologies and reduced sensitivity of power consumption to raising bit rates.

Additionally, when increasing the bandwidth the energy demand for routers becomes a bottleneck, because the router power consumption exponentially increases as a function of the bit-rate. This is demonstrated in the figure below. If this trend is continued, the share in power consumption of the core and aggregation networks will largely increase.

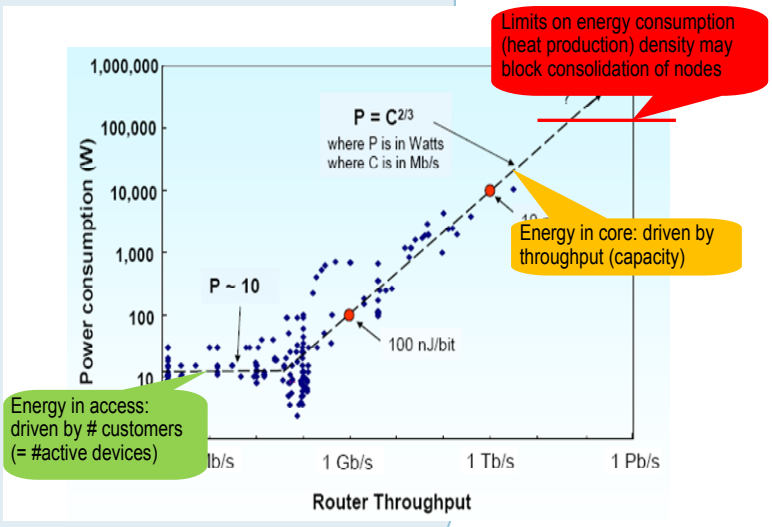
Currently, the access network is dominating overall energy consumption, but in the future the core will become increasingly more important and feasibility limits may be reached (growing traffic volumes and more node consolidation). For these reasons innovation needs to stay well below these limits, even to avoid further growth of energy.

Motivation: end-to-end Quality of Service

Present networks only guarantee intra-domain QoS, but do not assure end-to-end QoS, with technical and commercial implications.

If, in the future, more sophisticated transport technologies is used, including for instance virtualization of resources, monitoring and assurance of end-to-end quality will become mandatory. This will also facilitate quick and low-cost introduction of new services.

The Internet growth will continue for the coming years, and new potentially disruptive services will appear...yet, customers expect more bandwidth at about the same price... hence any network upgrade must come at a significantly lower cost than today



Power consumption of routers related to throughput
(From: M. Pickavet et al. "Energy footprint of ICT", METI, 2006, Nordman, 2007)

The STRONGEST technical approach

Future huge capacity transport networks, designed with minimum cost and power consumption, are the motivation behind STRONGEST. For the future traffic volumes, current networks have too many tiers, too many nodes and too many IP routers. Hence, the Project is studying, by means of performance and techno-economic analyses, novel network solutions for the metro and core segments, based on efficient transport structures and flexible control functions. The Project will move along well established guidelines, considering both transport architecture and technology aspects, and will work out both medium and long term views.

In the data plane, both the number and nature of network nodes shall be reconsidered, looking for the optimum combination of L1 (Optical) and L2 (Packet Transport) technologies. Likely transport candidates are the wavelength switched optical networks (WSON) and the new transport-oriented packet transport networks (e.g. MPLS-TP) for Ethernet service delivery; alternatively, sub-wavelength bypass could also be provided by optical transport network (OTN). In the long term Optical Burst Switching (OBS) will be considered as well. In this way reducing the number of IP routers will become possible by performing traffic switching, as far as possible, in the optical domain, to obtain both scalability and the desired reduction of costs and power consumption. Also, attention will be paid to the progressive maturity of very high bit rate transmission techniques, such as 100 Gbit/s and above.

In the control plane a solution shall be pursued that allows end-to-end services delivery crossing domains that are heterogeneous in terms of technologies (circuit transport networks and connection-oriented packet transport networks), control plane models (e.g. multi-layer/multi-region), OAM mechanisms, vendors and operators. This automatic control plane can incorporate such advanced features as virtualization of network resources that allows a complete decoupling of service level (client) with respect to the transport level (server). This will lead to a simplification of connection requests and will permit quick and low-cost introduction of new services independent of underlying transport platform.

The investigated network architectures, forwarding concepts and control mechanisms shall be implemented in the laboratory and experimentally validated; these technical investigations will offer the proof-of-concept of the new network architectures and provide demonstration platforms that will significantly facilitate and accelerate the deployment of the new technologies.

Finally, to encourage and promote the diffusion and acceptance of its achievements, STRONGEST shall contribute to the development of new European and global interoperable standards for multi-layer and multi-domain data and control plane, thus also reinforcing the European position in standardization bodies and fora. The proposed new solutions will be presented to the relevant working groups in ETSI, IETF, IEEE, OIF and ITU-T standardization organizations.

STRONGEST Work breakdown

STRONGEST scientific and technical activities of the project are organised into 4 main Work Packages:

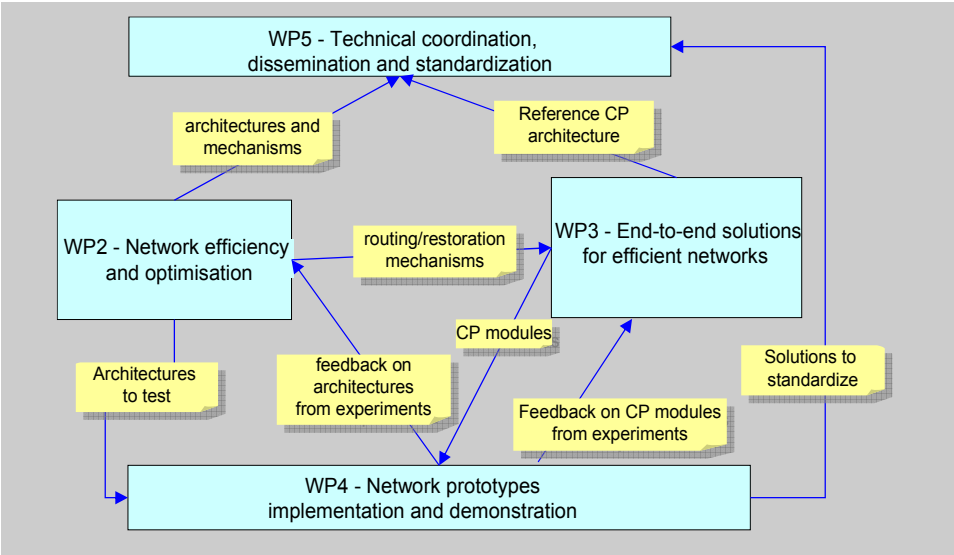
WP2 “Network efficiency and optimization”; its main goal is to design efficient and optimized network architectures for new transport solutions.

WP3 “End-to-end solutions for efficient networks”; its main goal is to provide efficient solutions to support end-to-end services delivery across domains that are heterogeneous in terms of technologies.

WP4 “Network prototypes implementation and demonstration”; its main goal is the implementation, integration and experimental validation of the developed solutions.

WP5 “Technical coordination, dissemination and standardization”, for guaranteeing strong coordination of all the technical activities in the project, including dissemination and standardization.

Finally, all the activities related to the management of the project are included in WP1 “Project Management”.



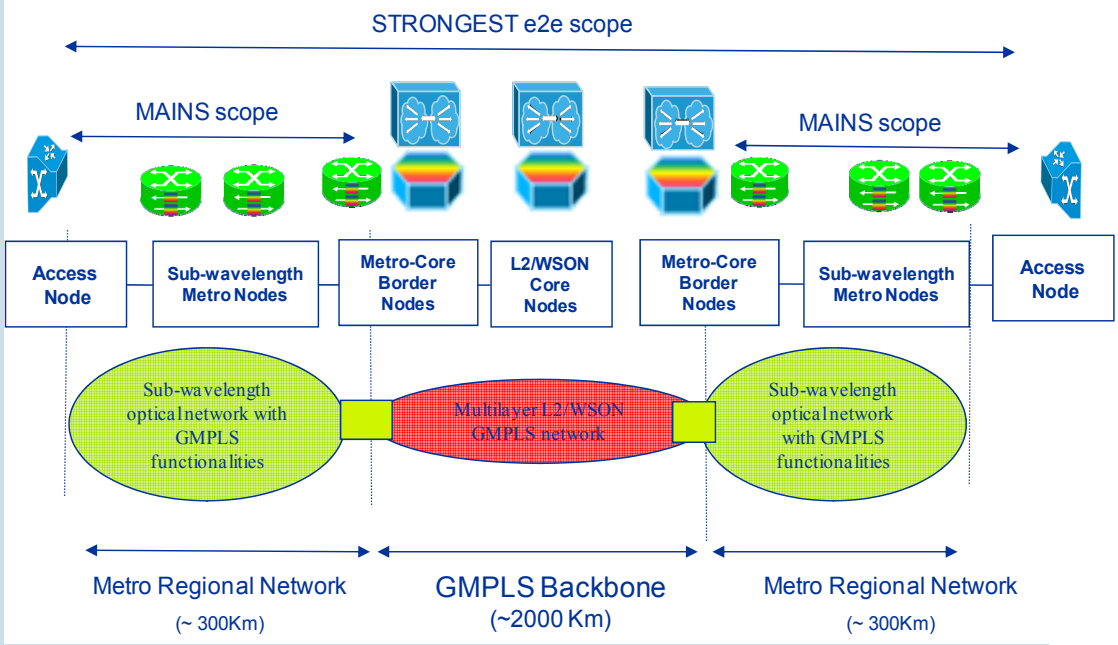
STRONGEST workpackages and their relationships

Collaborations

The MAINS project

MAINS (Metro Architecture EnabliNg Subwavelength) is a STREP Project in the EU's 7th Framework Programme having as main objective to design and demonstrate a cost-effective metro-regional network architecture based on optical subwavelength transport technologies with enhanced control plane capabilities allowing applications and network interworking. MAINS architecture is based on two key technological pillars: subwavelength optical switching technologies in the data plane (i.e. optical bursts and packets), and an enhanced GMPLS architecture in the control plane to extend network control to the subwavelengths, and ease the interworking of network and IT resources. MAINS application scenario is the metro-regional network, which comprises the network segment between the access network and the long-haul core network.

Potential collaboration activities between STRONGEST and MAINS are expected to be focused on both control and data plane interworking issues between GMPLS subwavelength domains, to be implemented in MAINS, and multilayer L2/WSON GMPLS domain, to be implemented in STRONGEST.



STRONGEST—MAINS collaboration scope

Events, participations and contributions

The **STRONGEST kick-off meeting** was held in Turin (Italy) on January 19th-21st, 2010, hosted by Telecom Italia. During the meeting the activities of the various workpackages were presented and discussed. The General assembly agreed on the year workplan, on the establishment of relationships with other FP7 projects (ETICS, MAINS and GEYSERS) and on the presentation of project contributions to various events in 2010.

The STRONGEST project contributed to the "Future Networks 5th FP7 Concertation meeting" that was held in Brussels on January 26th -28th, 2010. In that event a short presentation about STRONGEST objectives and workplan was given.

During the "**Future Internet Cluster Meeting**", that was held in Sophia Antipolis on March 9th, 2010, first contacts were established among STRONGEST and the other FP7 projects ETICS and GEYSERS.

The invited paper "Energy-Efficiency in Telecommunications Networks: Link-by-Link versus End-to-End Grooming" by W. Van Heddeghem et al. was given at ONDM2010 in Kyoto, Japan, Feb 2010.

A joint contribution on PCEP Extensions for GMPLS(draft-margaria-pce-gmpls-pcep-extensions-01) was presented by Nokia-Siemens-Networks and Telefonica I+D in IETF.

In the near future

- Munich, May 18th—20th, 2010: STRONGEST second plenary meeting.
- Florence, June 16th - 18th, 2010: Future Network & Mobile Summit. Project presentation and participation in a panel discussion about energy efficiency in transport

Scalable, Tunable and Resilient Optical Networks Guaranteeing Extremely-high Speed Transport

STRONGEST

website: www.ict-strongest.eu

Partners: *Telecom Italia (IT), Alcatel-Lucent Deutschland (D), British Telecom (UK), CTTC (ES), CNIT (IT), Deutsche Telekom (D), Ericsson (IT), IBBT (BEL), Nokia Siemens Networks & Co. KG (D), Telefonica (ES), Universitaet Stuttgart (D), Universitat Politècnica de Catalunya (ES), University of Essex (UK), University of Peloponnese (GR), VECOMM (IT), PrimeTel PLC (CY), Nokia Siemens Networks Israel (IS)*

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FUTURE NETWORKS

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STRONGEST