STRONGEST – Document

Deliverable D1.1

Project Presentation

Status and Version:	Version 1.0 public, Final	
Date of issue:	31.01.2010	
Distribution:	Project Internal	
Author(s):	Name	Partner
	Andrea DI GIGLIO	Telecom Italia
	Emilio VEZZONI	VECOMM

Checked by:	WP leaders

Table of Contents

1 Introduction

The STRONGEST project ("Scalable, Tunable and Resilient Optical Networks Guaranteeing Extremely-high Speed Transport") was approved within the 4th IST Call of the Seventh Framework Programme of the European Commission (Theme 2009.1.1 "The Network of the Future") and was started on Jan 1st, 2010, based on Contract Number: *INFSO-ICT 247674*.

The purpose of this deliverable is to describe the STRONGEST content, explicating and detailing the scope, the objectives, the workplan and the expected impact of the Project in the European telecommunication industry and research.

Additional information about the Consortium composition, possible cooperations with other projects and a summary of practical information are also provided.

1.1 Document History

Version	Date	Authors	Comment
0.01	15/01/2010	A. Di Giglio, E. Vezzoni	Agreement about ToC
0.02	25/01/2010	A. Di Giglio, E. Vezzoni	Final draft version for quality check
0.03	27/01/2010	E. Vezzoni	Proposed amendments from the quality check
0.04	28/01/2010	A. Di Giglio, E. Vezzoni	Amended version after quality check
0.05	28/01/2010	E. Vezzoni	Final revision
1.00	30/01/2010	A. Di Giglio, E. Vezzoni	Final Version after comments from WP leaders and quality check

1.2 Document Overview

In details, this document is organized as follows:

- Section 2 describes the project scope and the objectives, as detailed in the Annex I [Annex I] to the Contract.
- Section 3 describes the technical approach of the project and its organization in Work Packages and Tasks.
- Section 4 describes the expected impact of STRONGEST.
- Section 5 describes the Consortium composition.
- Section 6 outlines possible relationships with other projects and initiatives.
- Section 7 summarizes the main project data.

2 Project objectives

2.1 Project scope and main objective

Internet traffic has been growing quickly for many years, despite adverse economic conditions, and this growth will continue in the future, calling for a further, significant increase in networks capacity. Moreover, being the traffic increase unpredictable, more flexible bandwidth management will also be necessary, instead of fixed allocated bandwidth. Yet, to effectively cope with these demanding requirements, the cost of network solutions based on existing technologies is still too high.

In addition, in line with the EC goal of reducing the overall CO_2 emissions, energy efficiency should be widely improved, using whenever possible optics instead of electronics where only transport is required. For these reasons, the key requirements for innovative ultra-high bandwidth networks refer to scalability, flexibility, assurance of end-to-end quality of service and energy efficiency, beside reduction of total cost of ownership.

In the data plane, current equipment and network architectures still provide limited scalability, are not cost-effective and do not properly guarantee end-to-end quality of service.

In the control plane, the open issue is to define an end-to-end control structure that allows different technologies and domains to inter-work efficiently, incorporating virtualization of network resources.

Based on these rationale, STRONGEST's main goal is **to design and demonstrate an evolutionary ultra-high capacity multilayer 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 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 will be 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 European leadership in optical networking technologies. The design of a more efficient transport network with reduced cost per bit and the particular attention paid to energy efficiency will turn into benefit to the entire Community.

Network operators have a tough target to reduce CO_2 emissions, whilst at the same time supporting significantly higher information bandwidth. They will use the results of STRONGEST, which will provide the optimum transport network architecture to achieve these targets.

STRONGEST results will be as well exploited by vendors to develop traffic engineering solutions running in multi-technologies and multi-domain context, and the related control plane in both legacy nodes and new optical/packet nodes.

Finally, academic partners plan to use the STRONGEST results for further enhancement of knowledge transfer, training and skills creation in the field of telecommunication networks, and more specifically in the field of optical networks.

2.2 Detailed Objectives

STRONGEST Consortium also identified:

Objective 1: Feasibility study

To analyse the feasibility of the proposed architectures by means of performance and techno-economic impact studies, aiming at network performance and cost optimization (see also following objectives 2-5).

Objective 2: Reduction of energy consumption

To identify the best solutions to reduce the energy consumption of the telecommunication network. Efficient combinations of optical and electrical components will be investigated. The consortium is aiming to foster Europe's technology leadership in energy saving technologies.

Objective 3: Combination of the best of transport technologies

To research, develop, analyze and experimentally validate the optimum combination of L1 (Optical) and L2 (packet transport, sub-wavelength multiplexing, …) transport technologies.

Objective 4: Control Plane for end-to-end service delivery

To pursue end-to-end services delivery crossing domains which 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.

Objective 5: Enabling the virtualization of resources.

To enable the virtualization of resources, allowing the cooperation among heterogeneous data-plane technologies; this will permit quick and low-cost introduction of new services independent of underlying transport platform.

Objective 6: Experimental validation.

To experimentally validate the investigated network architectures, forwarding concepts and control mechanisms in an experimental implementation; therefore, quantitative technical laboratory investigations will be carried out. This will help in showing the proof-of-concept of the new network architectures and providing demonstration platforms that significantly facilitate and accelerate the deployment of the new technologies.

Objective 7: Contribution to standard bodies and fora

To contribute to the development of new European and global interoperable standards for multi-layer and multi-domain data and control plane, thus reinforcing European position in standardization bodies and fora. The proposed new control and management mechanisms will be presented to the relevant working groups in IETF, IEEE802, OIF and ITU-T standardization organizations.

Objective 8: Fostering scientific collaborations

To foster the scientific exchange and collaboration between other scientific projects and organizations such as IST FEDERICA, BONE, AKARI (Japanease research Project) and GENI (American research Program); also, the STRONGEST Consortium has very recently initiated contacts with newly started IST projects, operating in adjoining areas, particularly with IST GEYSERS, IST MAINS and IST ETICS.

Objective 9: Education

To educate European and international researchers and key staff including research managers and industrial executives.

The achievement of the main objectives can be measured and verified by the STRONGEST management during the Project life according to parameters and metrics described in Table 1.

Table 1 – Objectives verification

Objective	**Parameter**	**Metrics**
1. Feasibility Study	Network scalability (bit/s, # of users) Node scalability (throughput, bit/s)	Compliance with x 100 traffic increase by 2020. [NSP] 100 Tbit/s throughput per node
2. Reduction of energy consumption	Power consumption (J/bit)	Power consumption (per bit) reduction by 100 in 2020 [PICKAVET]
3. Combination of the best of transport technologies	TCO (€)	TCO optimization in multi-layer and multi-domain architectures. [NSP]
4. Control Plane for end-to-end service delivery	Provisioning time (sec) Restoration time (sec) TCO (€)	Provisioning and restoration time less then current networks 20% TCO for unified control plane [NSP]
5. Enabling of virtualization of resources	Efficiency in network resource usage	Increase of network efficiency (offered traffic/installed resources) [FEAMSTER] [ZHU]
6. Experimental validation	Test list (to be defined with WP2 and WP3)	Compliance with the test list

7. Contribution to standard bodies and fora	Contributions to ITU-T,IETF, OIF, ETSI	Number of contributions
8. Fostering scientific collaboration	Organization of Workshops Collaborations with other Projects Papers for journals and conferences	Number of organized workshops (tentatively 2) Number of collaborations Number of papers
9. Education	Internal Company workshops Academic lectures	Number of events

3 Technical Approach and Work Breakdown

STRONGEST scientific and technical activities of the project are organised in 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 among 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"

3.1 Description of Workpackages

3.1.1 WP1 "Project Management"

Main WP1 objectives can be summarized as follows:

- Scope management (approval of any change or integration of the deliverables contents).
- Risk management (risk identification and qualitative analysis).
- Consortium management (changes in Consortium structure and contractors role and responsibilities).
- Project Control (scope, quality and time control of deliverables).
- Gender issues management.
- Project reporting (Periodic Reports, Hearings presentations and organization).
- Administrative issues (cost claims management and funding management).
- Development and management of the project mail distribution lists and web site.

The activities in WP1 will be broken into the following two tasks:

T1.1 Project management (leader: Telecom Italia)

This task is in charge of Scope, Risk and Consortium management and Project Control. The Partners roles are organized according to the "Integrated Projects Consortium Agreement" EICTA model, with the Project Board responsibilities assigned to the General Assembly. The work methodology will be accurately defined in Deliverable D1.2 "Project Management Plan".

T1.2 Project reporting, administrative, and gender issues (leader: Telecom Italia) This Task is responsible for the preparation of official Project Reports as required by the European Commission. The Task will also manage the cost claim preparation, the distribution of the Community contributions, and all financial and gender issues as well.

This task is as well responsible for development and maintenance of the project mail distribution lists and web site.

3.1.2 WP2 "Network efficiency and optimization"

WP2 will mainly focus on the design of novel transport network architecture solutions fulfilling the scalability, quality, cost and energy efficiency requirements of future packet based Petabit/s transport networks. The solutions defined by STRONGEST are characterized by optimized usage of photonic and electronic Layer 1 and Layer 2 switching technologies and, at the same time, minimizing the use of Layer 3 technologies to overcome scalability and efficiency issues of electronic omnipresent IP Layer 3 based solutions and will be verified in terms of performance and overall efficiency. Accompanying studies will elaborate some important aspects related to the integration of STRONGEST transport network solutions into an overall service provisioning environment, in particular the virtualization of transport resources and the impact of content distribution schemes. Architectural options exploiting new Layer 2 aggregation schemes will be studied in the frame of medium and longer term evolution steps of the proposed solutions.

Main WP2 objectives can be summarized as follows:

- Design of efficient and optimized network architectures for new transport networking solutions (metro/regional and core segments) capable of handling huge traffic volume in the most efficient manner (e.g. carbon footprint, minimal joules/bit, overall absolute energy-efficiency etc.):
  - Packet transport network and node architectures with minimized deployment of L3 routers to achieve scalability to 100 Terabit/s throughput per node with best cost and energy efficiency
  - Verification of architecture solutions by planning, dimensioning and Total Cost of Ownership (TCO) optimization studies
- Design of concepts for virtualization of transport resources
- Design of transport architectures reflecting the impact of content distribution schemes
- Design of architectures exploiting new L2 aggregation schemes
- Definition of migration strategies for the introduction of STRONGEST architectures from existing to long term scenario in step-wise approach
- Definition of architectures to be demonstrated in WP4 and inclusion of feedback from implementation
- Definition of routing and restoration mechanisms to be designed in WP3 and demonstrated in WP4

The activities in WP2 will be broken into the following four tasks:

T2.1 Requirements and reference scenarios (leader: British Telecom)

This task will define the network requirements and forecasts to medium and long term scale on the basis of reference network scenarios.

T2.2 Node architectures and data plane technologies for energy efficiency and scalability (leader: Nokia Siemens Networks Israel)

This task will define energy efficient and scalable node architectures and assess related data plane technologies.

T2.3 Network planning/dimensioning/optimization strategies and mechanisms for network operation (leader: Telefónica I+D)

This task will perform the planning, dimensioning and optimization studies on STRONGEST architecture solutions in close cooperation with the other tasks of WP2 in order to justify the selected network architecture and node solutions in terms of total cost, energy and performance optimization.

T2.4 Overall network architecture (leader: Telecom Italia)

This task will define the overall energy efficient, scalable transport network architectures chosen by STRONGEST exploiting the most promising data plane technologies and the most appropriate resource allocation and routing mechanisms. Based on the selected mid term and long term architecture variants, step-wise migration strategies will be elaborated for the evolution of current network architectures.

3.1.3 WP3 "End-to-end solutions for efficient networks"

WP3 aims at providing efficient solutions to support end-to-end service delivery crossing domains which are heterogeneous in terms of technologies (circuit transport networks and connection-oriented transport packet networks), control plane models (e.g. multi-layer/multi-region), vendors and operators. The activities will focus on two evolutionary network scenarios:

- Medium-Term scenario, which addresses the interworking between heterogeneous GMPLS-controlled networks, such as WSON and MPLS-TP.
- Long-Term scenario, that addresses the solutions including new architectures for metro and core optical transport networks investigated in the WP2 supporting enhanced network dynamics, finer (sub-lambda) BW granularity and achieving scalability to multiple tens of Terabit/s throughput per node with best cost and energy efficiency.

Main WP3 objectives can be summarized as follows:

- Design and analysis of End-to-End OAM
- Design of a unified Control Plane flexible architecture
- Definition of End-to-End services and traffic admittance schemes

The solutions defined in the activities carried out in WP3 will be taken as input for T5.4 of WP5, in order to be proposed to the standardization bodies.

The modules defined in the activities carried out in WP3 will be implemented and experimentally tested to evaluate their performance in WP4.

The activities in WP3 will be broken into the following three tasks:

T3.1 End-to-end OAM (leader: Alcatel-Lucent)

This task will define and analyze an efficient end-to-end OAM structure, taking into account both medium-term and long-term scenarios, in order to simplify the network operation.

T3.3 End-to-end Control Plane (leader: CNIT)

This task will address the definition and the analysis of a unified control plane to control different technologies (e.g. both L2SC and LSC switching capabilities), including traffic engineering (TE) information dissemination, path computation and signalling, and potential extensions to the GMPLS-based protocols for a unified control plane.

T3.3 End-to-end services and Traffic Admittance solutions (leader Nokia Siemens Networks Israel)

This task will address two main topics: the first one is to investigate the impact of the network architecture defined in WP2 and the corresponding control plane architecture

defined in T3.2, on the service definition and identification of new types of services (e.g. the impact of flow aggregates and traffic grooming) while the second one is to investigate and design different traffic admittance schemes for such services. The purpose of such study is to derive architectures, technologies, and mechanisms that maximize the operational efficiency of networks, while providing an enhanced experience to the end user.

3.1.4 WP4 "Network prototypes implementation and demonstration"

Main WP4 objectives are the implementation, integration and experimental validation of the STRONGEST's reference network architecture for new metro and core networking solutions designed in WP2 and WP3.

In particular, WP4 will focus on two innovative and evolutionary networking approaches:

- Medium-Term networking solutions based on the introduction of a PCE-based architecture for efficient inter-domain inter-carrier path computation in multi-layer GMPLS-controlled transport networks such as hybrid wavelength switched optical networks (WSON) and connection-oriented packet transport networks (e.g MPLS-TP) for Ethernet service delivery.
- Long-Term networking solutions based on new optical metro and core switching nodes. For the metro domain, the solutions will support enhanced network dynamics and finer (sub- wavelength) bandwidth granularity while for the core nodes they will achieve scalability to multiple tens of Terabit/s throughput per node with best cost and energy efficiency.

Furthermore, demonstration activities in WP4 will generate important inputs to the dissemination and standardization activities to be done in WP5.

As far as possible, network infrastructure previously implemented by Projects NOBEL Phase 2 and PHOSPHORUS will be utilized and enhanced for the STRONGEST's experiments.

The activities in WP4 will be broken into the following three tasks:

T4.1 Experimental activities on medium-term networking solutions integrating data and control plane (leader: CTTC)

This task will be focused on the development and integration of the different modules of the medium term node prototypes. Afterwards, these node prototypes will be the basis of the network prototypes to be implemented for demonstration purposes.

T4.2 Experimental activities on long-term networking solutions integrating data and control plane (leader: University of Essex)

This task will be focused on the implementation, integration and demonstration of long-term network prototypes.

T4.3 Experimental activities on pure control plane (leader: Nokia Siemens Networks Germany)

This task will experimentally validate the feasibility, interoperability and scalability of some control plane solutions defined in WP3 and implemented in T4.1 and T4.2.

3.1.5 WP5 "Technical coordination, dissemination and standardization"

Main WP5 objectives can be summarized as follows:

- Technical coordination of WP work ensuring the harmonization and consistency of the different activities with the objectives of the Project;
- Coordination with other Projects (within and possibly outside FP7);
- Coordination of dissemination and training activities (e.g. participation to conferences, organisation of Workshops and Events, etc)
- Coordination of activities relevant to standardisation carried out by the Project

The activities in WP4 will be broken into the following four tasks:

T5.1 WP coordination and architecture consistency task force (leader: rotation among WP leaders)

This Task is responsible for guaranteeing a strong technical coordination among all the WPs, thus ensuring a consistent development of the activities for the achievement of the overall objectives of the Project.

T5.2 Exploitation of results task force (leader: Telefónica I+D)

This Task will monitor and coordinate the research activities done in WP2, WP3 and WP4 in order to assure that the STRONGEST proposed solutions will have a potential for industrial and commercial application, as well as for developing, creating or providing new services.

T5.3 Dissemination and training task force (leader: UPC)

This Task is focused on the organization of dissemination and training activities.

The dissemination of STRONGEST results will be realized in many different ways, i.e.: the publication of a regular bulletin with online summary of key technical issues, the preparation of a Project flyer and of contributions to workshops, conferences and magazines.

The training efforts will be focused on the realisation of training events on specific aspects of the evolution of optical networks, the publication of positioning/white papers and of web tutorials on relevant topics and the dissemination of non-confidential STRONGEST project achievements and results to the external research community, in particular in new and associated EU countries.

T5.4 Standard contribution task force (leader: Nokia Siemens Networks Germany)

This Task coordinates the standardization activities carried out inside STRONGEST.

The work will start with an analysis of the ongoing activities in the standardization bodies (e.g. ITU-T, IETF, OIF, ETSI) with the objective of identifying relevant topics to which the project could contribute (e.g. MPLS-TP). The Task will then organize specific task forces for the definition of a common view and the coordination of consistent input for the involved standardization bodies by leveraging the involvement of many STRONGEST's Partners to the main Standard bodies and fora.

3.2 WPs Interdependencies

Previous sections detail that Scientific and Technical activities of the project have been organized in 3 main Work Packages:

- WP2 – Network efficiency and optimization

- WP3 – End-to-end solution for efficient networks
- WP4 – Network prototypes implementation and demonstration

WP1 and WP5 are mainly devoted respectively to Project management and coordination among technical activities.

Relationships among the four technical work packages are shown in Figure 1.

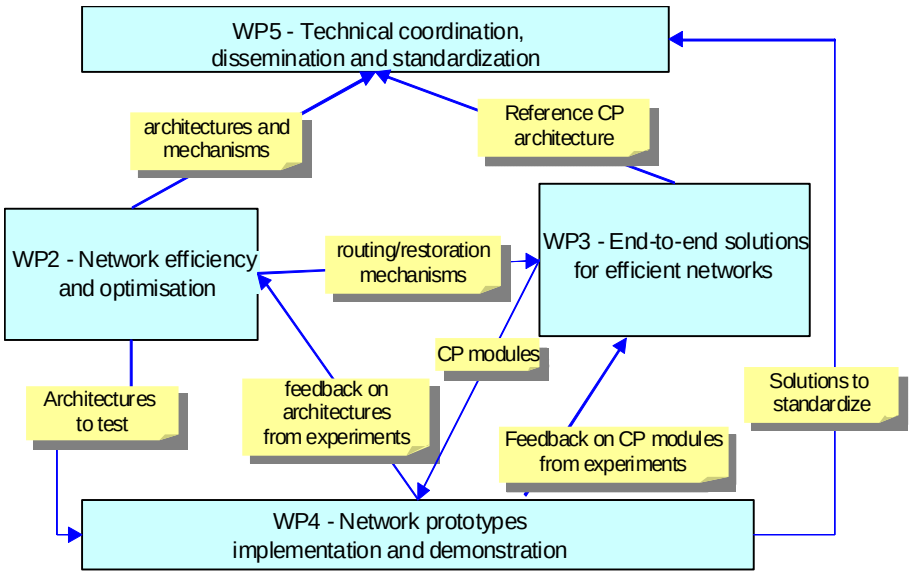

Figure 1– STRONGEST: interactions among Work Packages

WP2's main goal is to design an efficient and optimized network architecture for new transport networking solutions, while WP3 aims to provide efficient solutions to support end-to-end services delivery across domains that are heterogeneous in terms of technologies.

Intermediate and final WP2 and WP3 results will feed WP5 and WP4.

WP5, once received information from WP2 and WP3, will coordinate technical activities, giving feedbacks to WP2 and WP3 to avoid overlapping and harmonize the whole STRONGEST research.

WP5 uses WP2 and WP3 results also for dissemination, training activities and to contribute to standardization bodies and fora. Technical coordination is mainly driven by WP5. In any case, WP2 and WP3 can communicate directly about specific technical issues; as an example, WP2 will provide routing/resilience mechanisms to WP3. The information exchange between WP4 and theoretical WPs (WP2 and WP3) is completely bi-directional. WP4 receives data-plane (from WP2) and Control Plane (from WP3) architecture for setting-up experiments; feedbacks from experiments (information flow in the opposite direction, from WP4 to WP2 and WP3) is essential to steer WP2 and WP3 researches on the correct direction. A more detailed view of WP interdependencies is shown in Table 2.

Table 2 – Detailed Work Packages interdependencies

		TO			
		WP2	WP3	WP4	WP5
FROM	WP2		Definition of Reference networks and scenarios and Optimized methods and algorithms on Multi-Layer routing and Traffic Eengineering	Reference networks and scenarios and TCO and power optimized data plane solutions	Provision of TCO and power optimized network architectures
	WP3	Feedback of Control Plane & Path Computation Element solutions to Total Cost of Ownership optimization		Definition of the medium and long-term control plane reference architecture to be implemented in WP4;	Medium-term and Long-term Control Plane reference architectures; contribution to standardization related to Control Plane issues
	WP4	Feedback from experiments about the performance of network architectures and resource allocation mechanisms defined in WP2; Definition of the network prototypes and optimized methods/algorithms on ML routing and TE to be implemented in WP4	Feedback on the performance (e.g scalability, survivability, etc) of control plane functionalities defined in WP3		Experimetal demonstrations for dissemination and standardization purposes
	WP5	Selection of STRONGEST network architecture(s)	Selection of STRONGEST network, control plane and node architecture(s)	Test specifications for standardization purposes	

3.3 Deliverable list

The following table details the full list of STRONGEST deliverables.

Del. no.	Deliverable name	WP no.	Delivery date[1] (proj. Month)
D1.1	Project Presentation	1	1
D1.2	Project Management Plan	1	3
D1.3	Gender equality Plan	1	6
D1.4	Report on the gender equality Plan	1	36
D2.1	Efficient and optimized network architecture: Requirements and reference scenarios	2	9
D2.2	STRONGEST node & network architectures for energy efficiency and scalability	2	18
D2.3	Network planning/dimensioning/optimization strategies and mechanisms for network operation	2	24

[1] Month in which the deliverables will be available. Month 1 is January 2010, marking the start date of the project, and all delivery dates being relative to this start date.

D2.4	Final results on novel packet based Petabit transport networks fulfilling scalability, quality, cost and energy efficiency requirements	2	36
D3.1	Medium-Term multi-domain reference model and architecture for OAM, Control Plane and E2E services	3	8
D3.2	E-NNI extensions , PCE multi-domain architecture, OAM parameters and Traffic Admittance	3	12
D3.3	Medium-Term scenario conclusions and E-NNI , PCE multi-domain architecture and virtualization solutions for Long-Term scenario	3	24
D3.4	Final report on WP3 activity and performance analysis	3	36
D4.1	Report on implementation and demonstration plans	4	12
D4.2	Network prototypes	4	30
D4.3	Experimental validation of STRONGEST network prototypes: results and analysis	4	36
D5.1	Plans for coordination, dissemination and standardization activities	5	6
D5.2	Coordination, dissemination and standardization activities in Year 1	5	12
D5.3	Coordination, dissemination and standardization activities in Year 2	5	24
D5.4	Coordination, dissemination and standardization activities in Year 3	5	36
D5.5	Exploitation plan	5	36

4 Exploitation of results and expected impact

The consortium includes participants from major European telecommunications players, thus exploitation by and within each partner's organization is an obvious outcome for the results obtained by STRONGEST. Furthermore, the major partners are also involved in standardization bodies (ITU-T, IETF, OIF, ETSI, etc.), and are committed to foster international standards in the advanced optical networking area. The partners will therefore be highly dedicated to push the STRONGEST architecture in ongoing standards discussions.

The STRONGEST consortium consists of contributors who clearly represent the main actors in the networking field. It is composed of telecommunications operators (TI, BT, DT, TID and PrimeTel), who understand the end user requirements that drive innovation of new networking concepts, and the resulting deployment issues. Also, system vendors (ALUD, TEI and NSN) are present, that have a vast know-how in developing deployable systems, and have therefore the ability to transform project outcomes in actual end products. Of course, academic partners (UST, UPC, UEssex and UoP) and research centres (CTTC, IBBT, CNIT) are also there, being in charge of generating new ideas, which can be then instantiated by the industrial partners.

Bringing together partners that understand and participate in all aspects of the research process will maximise the chances of successful exploitation of the project output and turn into economic benefits. Telecommunication network operators can exploit the project outcomes to realize lower cost, ultra-high capacity network infrastructure for the benefit of end-users; system vendors can realize revenues from developing standards compliant systems, fit for deployment by operator networks; research institutes and universities can take advantage of the intellectual property generated through the project by exploitation of know-how in commercial ventures (e.g licensing) or future research projects.

Figure 2 shortly describes the desirable roll-out of STRONGEST's outcomes from validation to deployment.

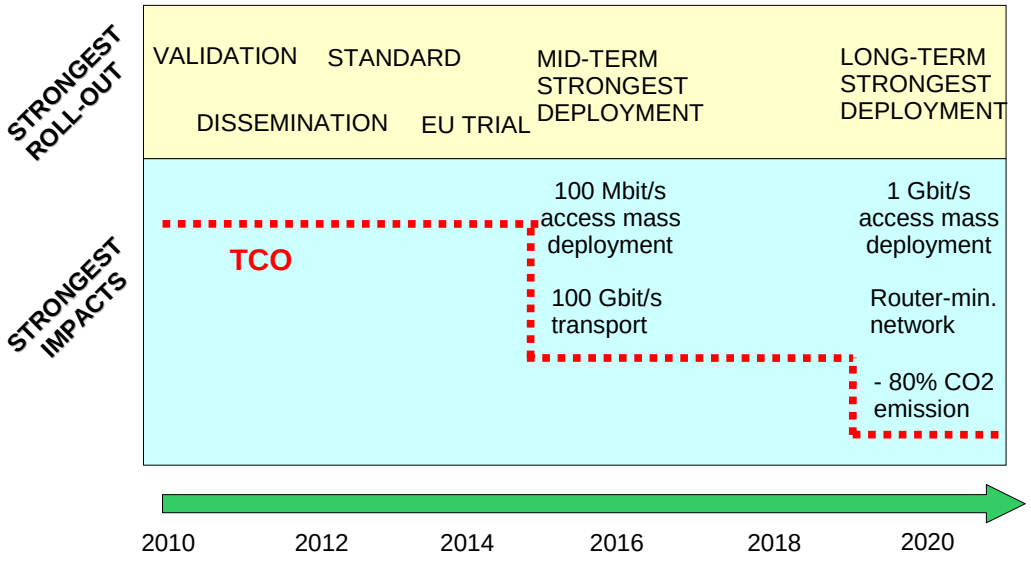

Figure 2– roll-out of STRONGEST outcomes and main impacts on telecommunications networks

The described roll-out process will have a significant impact on the transformation of communication network infrastructures by setting the foundations of novel network architectures. The project overall activity will have a strong impact on the European telecommunication market, resulting in five main outcomes:

- Strengthening the position of European industry in the field of Future Internet technologies and reinforce European leadership in optical networking technologies.
- Increasing the economic efficiency of access/transport infrastructures (cost/bit).
- Facilitating the creation of Global standards, interoperability and European IPRs reflecting federated and consistent roadmaps.
- Creating wider market opportunities from new classes of applications.
- Accelerating the uptake of the next generation of networks and service infrastructures.

5 STRONGEST Consortium

The composition of the STRONGEST consortium is shown in the following table:

Beneficiary Number *	Beneficiary name	Beneficiary short name	Country
1 (coordinator)	Telecom Italia S.p.A.	TI	Italy
2	Alcatel-Lucent Deutschland AG	ALUD	Germany
3	British Telecommunications PLC	BT	UK
4	Centre Tecnologic de Telecomunicacions de Catalunya	CTTC	Spain
5	Consorzio Nazionale Interuniversitario per le Telecomunicazioni	CNIT	Italy
6	Deutsche Telekom AG	DT	Germany
7	Ericsson Telecomunicazioni S.p.A.	TEI	Italy
8	Interdisciplinar Instituut Voor Breedbandtecchnologie VZW	IBBT	Belgium
9	Nokia Siemens Networks GMBH & Co. KG	NSN-G	Germany
10	Telefonica Investigacion y Desarrollo SA	TID	Spain
11	Universitaet Stuttgart	UST	Germany
12	Universitat Politècnica de Catalunya	UPC	Spain
13	University of Essex	UEssex	UK
14	University of Peloponnese	UoP	Greece
15	VECOMM di Vezzoni Emilio	VEC	Italy
16	PrimeTel PLC	PRI	Cyprus
17	Nokia Siemens Networks Technologies Israel 1990 Ltd	NSN-I	Israel

6 Cooperation with other IST Projects and Other Initiatives

Even though the consortium is already composed by highly qualified Partners, a strong interaction is desirable at the European and world level to reach significant acceptance and deployment of the proposed solutions. From the beginning, STRONGEST is establishing formal cooperations with other complementary FP7 projects. It is particularly important to achieve a real impact in standardisation, and later successful industrial deployment. Beside standard bodies, where the consortium is very active, relevant ongoing projects have been already identified, with which STRONGEST is willing to strongly interact to provide common solutions for the future public network infrastructure, that can be implemented and accepted worldwide. Preliminary contacts have been already established with the following projects:

IST FEDERICA (Federated e-infrastructure dedicated to European Researchers innovating in computing network architectures): The FEDERICA project aims at supporting research experiments on new Internet architectures and protocols, creating a versatile, scalable, European wide "technology agnostic" infrastructure, separated from the production networks, but with the possibility to interoperate, and it is open to host researchers hardware and applications, adopting the paradigm that "the infrastructure is the network". STRONGEST and FEDERICA are sharing the field of research that is transport networks.

IST BONE (Building the Future Optical Network in Europe: The e-Photon/ONe Network): The BONE-proposal builds on the foundations laid out by the e-Photon/ONe projects in the previous Framework Programme. The BONE-project intends to validate the e-Photon/ONe effort by stimulating a more intensified collaboration, exchange of researchers and building on Virtual Centres of Excellence that can serve to the European optical networking community by promoting education and training activities, research tools and test-labs, and pave the way to new technologies and architectures.

JAPAN AKARI: The AKARI Architecture Design Project aims to implement a new generation network by 2015, developing a network architecture and creating a network design based on that architecture. AKARI's philosophy is to pursue an ideal solution by researching new network architectures from a clean slate without being impeded by existing constraints. Once these new network architectures are designed, the issue of migration from today's conditions can be considered using these design principles. STRONGEST and AKARI have several points of contact, like the design of an innovative architecture or the assurance of end-to-end QoS.

U.S. GENI (Global Environment for Network Innovations): GENI is an experimental suite of infrastructure designed to support Network Science and Engineering experiments ranging from new research in network and distributed system design to the theoretical underpinnings of network science, network policy and economics, societal values, and the dynamic interactions of the physical and social spheres with communications networks. Such research holds great promise for new knowledge about the structure, behaviour, and dynamics of our most complex systems (e.g. networks of networks) with potentially huge social and economic impact.

Also, the STRONGEST Consortium has very recently initiated contacts with newly started IST projects, operating in adjoining areas, particularly with **IST GEYSERS** (about virtualization of network resources), **IST MAINS** (about the development of a control plane

including sub-wavelength technology) and **IST ETICS** (about the assurance of end-to-end QoS).

Apart from the above-mentioned interactions, information exchange with other related national and regional initiatives, as well as participation in ICT horizontal activities, will be reinforced by the project coordinator.

7 Useful information and Project data

Project Coordinator: *Andrea DI GIGLIO (Telecom Italia S.p.A.)*

Tel: +39 011 2287533 Fax: +39 06 41863906

Email: andrea.digiglio@telecomitalia.it

Project website: **www.ict-strongest.eu**

Project duration: 01/01/2010 – 31/12/2012

Funding scheme: **IP**

Total Cost: **€ 12.636.126**

EC Contribution: **€ 7.386.016**

Contract Number: INFSO-ICT *247674*

8 Acknowledgements

The present document is a shortened version of Annex I (Part B); the authors therefore acknowledge the valuable contributions of all the Partners that have contributed to Annex I.

9 References

[Annex I] Annex I to the Contract

[PICKAVET] M. Pickavet, R. Van Caenegem, S. Demeyer, P. Audenaert, D. Colle, P. Demeester, R. Leppla, M. Jaeger, A. Gladisch, and H.-M. Foisel, "Energy footprint of ICT," in Broadband Europe 2007, Dec. 2007).

[NSP] Network Strategy Partner, "Total Cost of Ownership Comparison: Ethernet Transport vs VPLS and MPLS" November 2008

[ZHU] Y. Zhu, J. Rexford, A. Bavier, and N. Feamster, "UFO: A resilient layered routing architecture," Princeton University technical report TR-780-07, June 2007.

[FEAMSTER] N. Feamster, L. Gao, and J. Rexford, "How to lease the Internet in your spare time," Georgia Tech Technical Report GT-CSS-06-10, August 2006.

10 Acronyms

BM	Burst Mode
CAPEX	Capital Expenditures
E-NNI	External Network-to-Network Interface
E2E	End-to-end
GMPLS	Generalized Multi-Protocol Label Switching
IP	Internet Protocol
IPTV	Internet Protocol Television
MAN	Metropolitan Area Network
NGN	Next Generation Networks
OBS	Optical Burst Switching
OPEX	Operational Expenditures
PTN	Packet Transport Network
PTT	Packet Transport Technology
TE	Traffic Engineering
WP	Work Package