Celtic-Plus
Smart Connected World

Project Information

SASER-SaveNet

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Project Website

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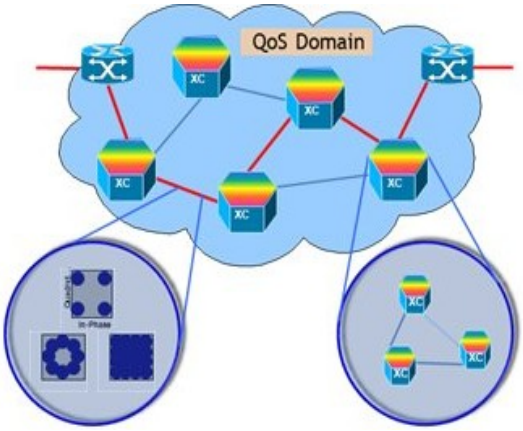
Safe and Secure European Routing

The Internet has become an indispensable part of peoples life and has developed to a fundamental infrastructure. Its current architecture lacks many features which are associated with a trusted, safe and secure communication medium. SASER targets to investigate and develop concepts and technologies for a European solution for Safe and Secure Routing in the network.

Main focus

SASER-SaveNet is focused on novel architectures and solutions for a safe and secure next generation telecommunication infrastructure. Methods and protocols to ensure security and privacy by means of encryption, authentication, authorization, etc. are mainly performed on higher network layers commonly ignoring that security sensitive services strongly depend on a reliable physical and transport infrastructure consisting of the optical layer (Wavelength Division Multiplex, WDM), the transport layer (OTH/SDH) and the Internet Protocol (IP) layer. Therefore attention must be paid to following aspects.

- Service quality and reliability experience: Services considered as being critical for health, economy, industry, privacy, public supply of energy, information, etc. are today not treated on the public Internet but separately on dedicated network resources.
- Instantaneous access: The availability of communication resources, services and content via public internet often suffers from Distributed Denial of Service (DDoS) attacks, hardware failures, protocol and software deficiencies, operational faults, etc. resulting in unsustainable latencies or even complete blackouts.
- Scalability: Increase in the number of Internet users and the anticipated dramatic growth in traffic volume over the next decade are posing huge challenges on transport networks with the need to provide the above mentioned features at sustainable costs and energy. An obvious approach is currently not available.



SASER targets investigation and development of concepts and technologies for a European solution for Safe and Secure Routing in the network, taking into account the predicted dramatic traffic growth, which is key for reliability, safety and security of future networks.

Approach

The research work of SASER-SaveNet is focused on novel architectures and solutions for a safe and secure next generation telecommunication infrastructure.

Security, safety, and reliability aspects will be addressed by applying innovative coding approaches to achieve safe and reliable transmission. Efficient packet coding schemes are investigated for safe end-to-end packet transport and error correction coding schemes for higher order modulation formats to combat impairments

Safe and reliable networking based on efficient multi-layer protection, restoration and disaster recovery schemes will be investigated to cope with hardware and software failures in transport infrastructure and control. Moreover, scalable, reliable and energy-efficient network and node architectures will be developed, taking benefit from low energy optical transport networking techniques. Centralized versus decentralized node architectures and related layer depended functionalities will be studied.

Replacement of core routers by integrated optical/electrical nodes with different switching granularities, to achieve scalability with higher node throughput at drastically reduced energy consumption. Extensive use of optical switching is investigated to bypass, energy hungry electronic packet processing entities, thus improving scalability and feasibility of 2020 telecom infrastructure while simultaneously increasing reliability since 99,999% is available in optical equipment.

Novel photonic switching technologies for efficient large scale nodes will be developed to overcome scalability and energy limitations of electronic solutions.

Integrated multi-layer, multi-domain control and management to ensure carrier-grade Quality-of-Service, reliability of end-to-end communication regarding network failures and attacks enabling autonomous, automated, and simplified network operation. Multi-layer network optimization regarding reduction of Capex and Opex.

Network virtualization is investigated in order to enhance network safety due to network slicing, since errors can be isolated more easily. Additionally, resource utilization is increased so Return-of-Investment (ROI) is maximised.

Node architectures for optical packet switching (POADM), which is based upon wavelength demultiplexer, optical gates and wavelength multiplexer, is investigated. Potential for integration of key optical components of the POADM node is studied. Real-time multi-format burst mode receiver for POADM networks will be developed for system studies, Benefits of optical packet switching for wireless backhauling regard throughput and latency is evaluated . A time-domain interleaved networking concept (TWIN) is studied as alternative for backhauling of converged fixed-wireless networks.

Physical layer transmission aspects are addressed by investigation of high spectral efficiency and energy efficient transport of optical signals. Adaptive format transmission using software-defined optics is a key technology to make optimum use of the spectral resources. Efficient data conversion and digital signal processing enable flexible high throughput transmission

Compact optoelectronic components and integrated optics are key building blocks for compact, efficient transponder to achieve high reliability and system availability. High level of component and subsystem integration is the basis to achieve stable operation of adaptive terminal equipment. Compact semiconductor based components are developed for short term and integrated optics based on silicon-photonics for the long term.

Mode division multiplexing in few-mode fibres is an alternative approach to increase capacity beyond limits of higher constellation transmission over single-mode fibre. Optical few-mode-multiplexer and demultiplexer are developed to achieve 1Tb/s transmission.

Main results

- Design of safe, secure, reliable and energy efficient networks
- Investigation of security issues of a reliable physical transport infrastructure consisting of optical layer, transport layer and Internet Protocol layer by taking benefit of process encapsulation, virtualisation, modular control and adaptive, flexible and reliable optics
- Evaluation of cost and energy consumption of hierarchical, multi-layer networks when multi-rate and elastic interfaces are used
- Network and hybrid optical network node architecture with integrated multi-layer control plane
- New recovery strategies in multi-layer networks together with introduction of dynamic monitoring and proactive restoration for improving the optical network resiliency
- Real-time detection of violating traffic, attacks and faults to ensure reliable operation of the network
- Performance evaluation of POADM for mobile backhauling including mobility management
- Integrated opt. Packet Add Drop Multiplexer in silicon photonics
- Implementation and evaluation of a time-domain interleaved metro network (TWIN)
- Techno-economic and business comparison of POADM and TWIN
- Energy efficient and reliable adaptive optical systems based on software defined coherent transponder and advanced error correction coding schemes for adaptive, safe and reliable transport
- Compact, robust and reliable optical subsystems based on integrated electronic and optoelectronic components, hybrid integration of components and finally on highly integrated Si-Photonics
- Implementation and validation of a Real-Time Burst Mode Receiver
- Exp. demonstration of Tb/s mode division multiplexed transmission

Impact

The development of convergent networks and optical systems beyond 100G are of high importance. In the core network a shift from classic IP-routing to new technologies is expected, offering the European SASER consortium chances to develop alternative solutions, based on extensive replacement of core routers by integrated optical/electrical nodes with different switching granularities and bypassing capabilities to minimize complex and energy hungry packet processing whenever appropriate.

About Celtic-Plus

Celtic-Plus is an industry-driven European research initiative to define, perform and finance through public and private funding common research projects in the area of telecommunications, new media, future Internet, and applications & services focusing on a new „Smart Connected World“ paradigm. Celtic-Plus is a EUREKA ICT cluster and belongs to the intergovernmental EUREKA network. Celtic-Plus is open to any type of company covering the Celtic-Plus research areas, large industry as well as small companies or universities and research organisations. Even companies outside the EUREKA countries may get some possibilities to joine a Celtic-Plus project under certain conditions.

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