Celtic-Plus project SASER
Safe and Secure European Routing

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SASER - General Project Description

Project Type

- Celtic+ Project, funded by national funding agencies
  e.g. BMBF, DGCIS, Tekes
- Focus on security, safety features for core networks

Project Duration

01.07.2012 – 31.08.2015 (38 months)
(Different starting points in different countries or clusters)

Project Volume

- ~ 80 Mio. €, ~ 500 PY
- Funding by: BMBF / Germany, DGCIS/France, Tekes / Finland

Project Partners

- 64 partners (industry, SME, universities and research institutes)
- 5 countries (Germany, France, UK, Denmark and Finland)
- Clustered in 3 sub-projects + 3 cross activities

SASER – Key Activities

Key topic 1: Security, safety, and reliability aspects

- Network security by protection against external and internal attacks (e.g. intrusion detection, backdoor detection)
- Safe and reliable transmission by applying innovative coding (packet coding schemes, error correction coding schemes)
- Safe and reliable networking (multi-layer protection, restoration and disaster recovery)

Key topic 2: Networking aspects

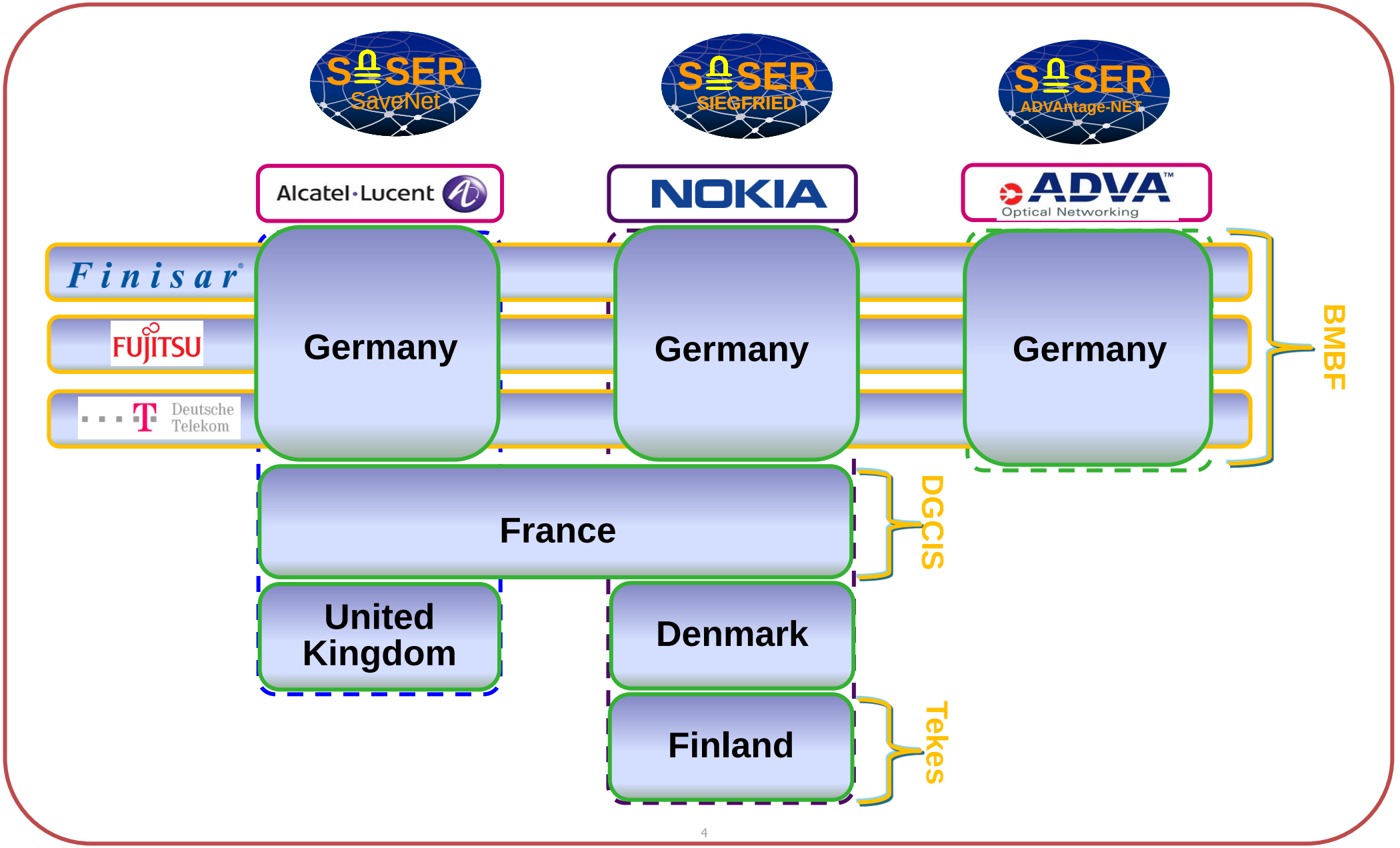
- New architectures (node architectures, network virtualization, SDN)
- Use novel photonic switching technologies
- Multi-x control, management and optimization
- Resilience

Key topic 3: Physical layer transmission aspects

- Adaptive format transmission employing flexible bandwidth channels and using software-defined optics to make optimum use of system spectral resources
- Data conversion and digital signal processing schemes for high throughput transmission at low energy consumption
- Digital signal processing for mitigation of optical components' limitations

Key topic 4: Reference scenarios, test infrastructure and system tests

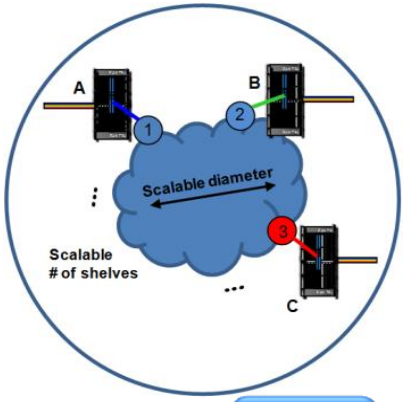
SASER – Structure of Celtic+ Project

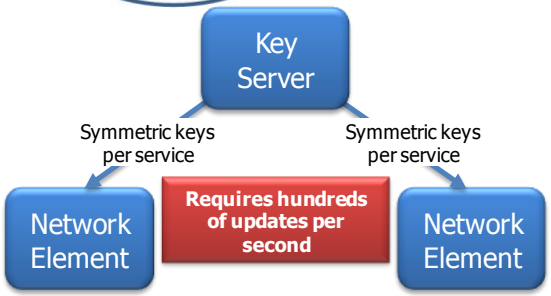


SASER-SaveNet

Distributed node and network architectures

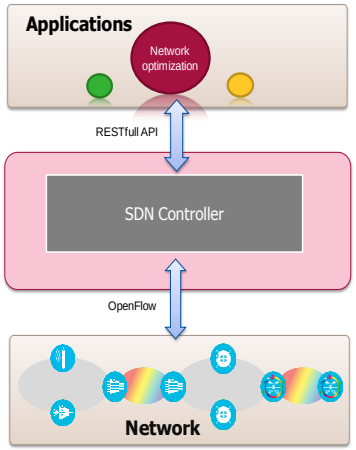
- Managed as a single node
- Central/distributed switch fabric
- Topologies: ring, star, mesh
- Novel distributed control architectures





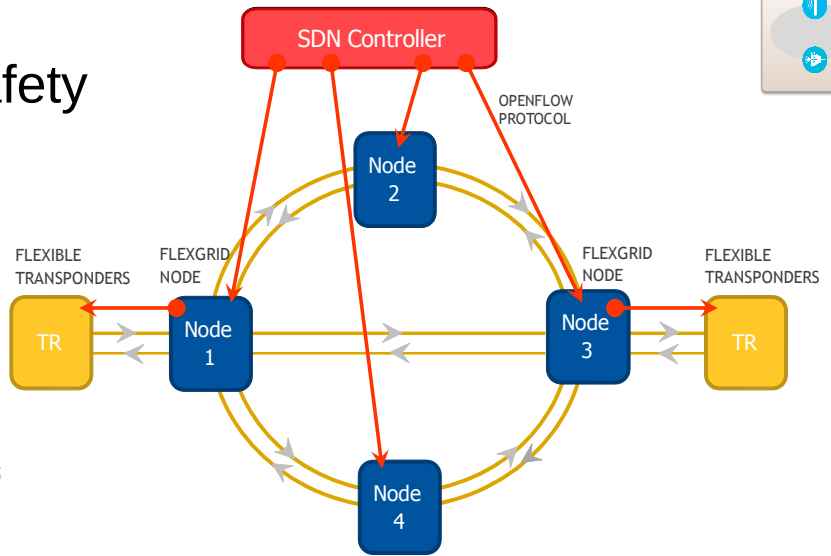
Traffic encryption

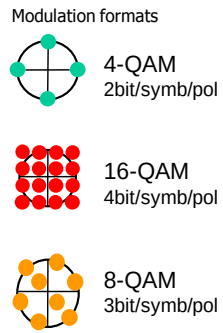
- to ensure carrier-grade Quality-of-Service and reliability wrt. network failures and attacks (see Demo D6)



Network optimization

- Acts on deployed networks
- Novel incremental approach to enhance safety





Transport SDN demonstrator

- Architectural concepts that encompass the programmability of multiple network layers (see Demo D1)

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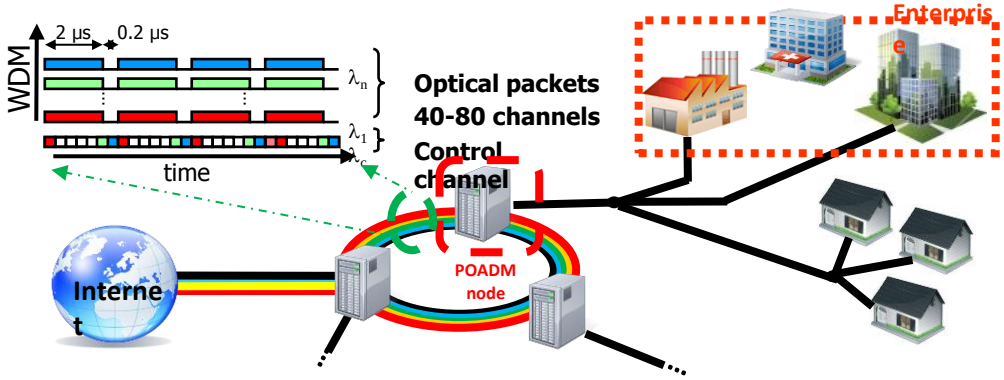
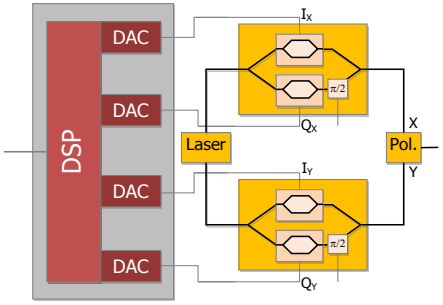
Node architectures for optical packet switching

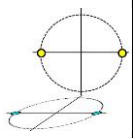
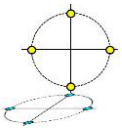
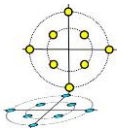
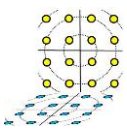
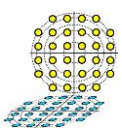
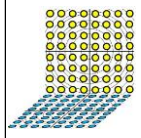
- POADM node architecture based upon wavelength demultiplexers, optical gates and wavelength multiplexer
- Benefits of optical packet switching for wireless backhauling with respect to network throughput and latency.
- A time-domain interleaved networking concept (TWIN) is studied as alternative concept for backhauling of converged fixed-wireless networks.



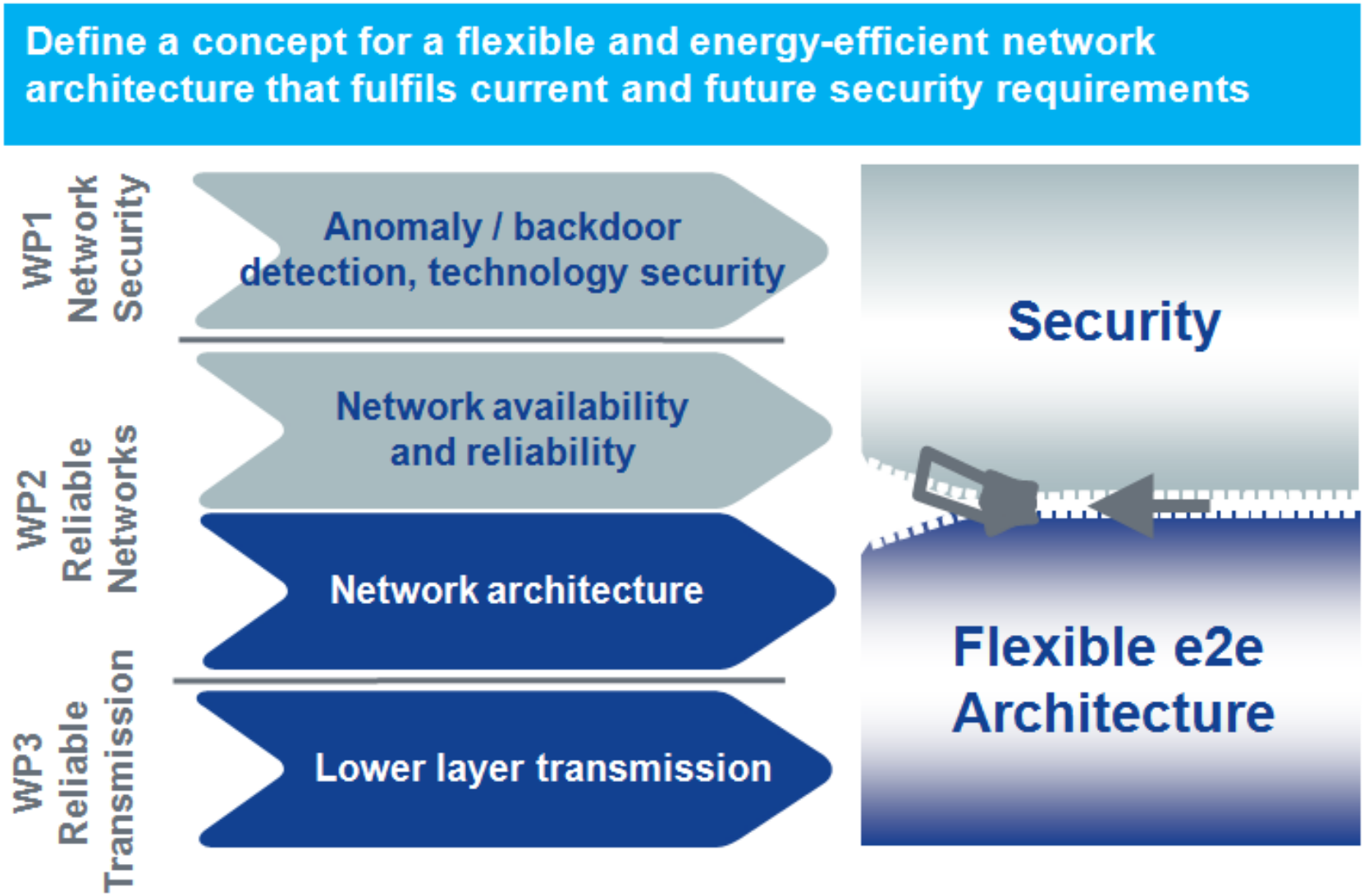
Physical layer transmission aspects

- high spectral efficiency and energy efficient transport
- Adaptive format transmission using software-defined optics is one of the key technologies to make optimum use of system spectral resources.
- Efficient data conversion and digital signal processing schemes enable flexible high throughput transmission at low energy consumption



Modulation format	PM-BPSK	PM-QPSK	PM-8QAM	PM-16QAM	PM-32QAM	PM-64QAM
bits/Symbol	2x1	2x2	2x3	2x4	2x5	2x6
Constellation						
OSNR penalty (dB)	0	0	2	4	6	8.5

SASER-SIEGFRIED: Project Objectives



SASER-SIEGFRIED:
Project Work Package Structure and Partners

	WP0 – Project Management (16 PM)	WP1 – Network Security (657 PM)	WP2 – Reliable Networks (829 PM)	WP3 – Reliable Transmission Techn. (738 PM)
Germany (1032 + x PM ~ 7.6 Mio. € funding, 15 partners)	NOKIA Associated Partners: Deutsche Telekom, Federal Office for Information Security	NOKIA, TUM Technische Universität München, RUB, FHP, Fraunhofer AISEC	NOKIA, ZIB, Universität Kassel, Technische Universität Braunschweig, i3, lrz, Eberhard Karls Universität Tübingen, TUM Technische Universität München	Coriant, Deutsche Telekom, Fraunhofer Heinrich Hertz Institute, technische universität dortmund, FUJITSU, Finisar, ihp, Fraunhofer Heinrich Hertz Institute
France (317 PM, 5 partners)			orange, TELECOM Bretagne	orange, Photline, TELECOM Bretagne, TELECOM ParisTech, EKINOPS, KEOPSYS
Denmark (36 PM)				DTU
Finland (855 PM, 5 partners)	VTT	VTT, intel Security, MPY, 2NS Second Nature Security, EXFO	VTT, intel Security, MPY, 2NS Second Nature Security, EXFO	VTT, intel Security, MPY, 2NS Second Nature Security, EXFO

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Routing and transmission in

flexible and secure metro and enterprise optical networks

- System manufacturer
- Software vendor
- Research institute
- Universities

technische universität dortmund

Christian-Albrechts-Universität zu Kiel

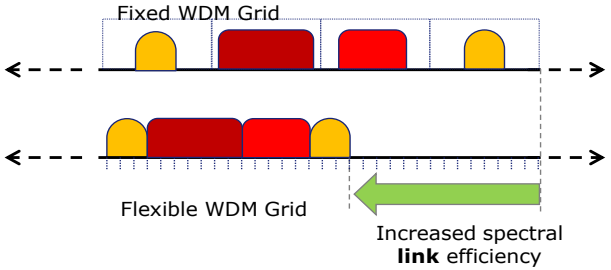
HELMUT SCHMIDT UNIVERSITÄT
Universität der Bundeswehr Hamburg

ulm university universität ulm

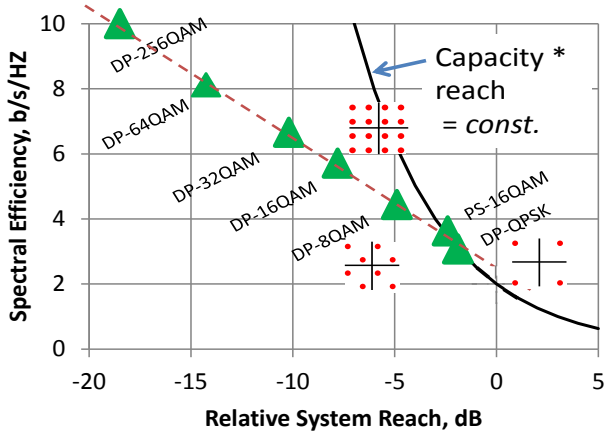
SASER-ADVAntage-NET

Optical layer flexibility as a basis for a safe and secure network

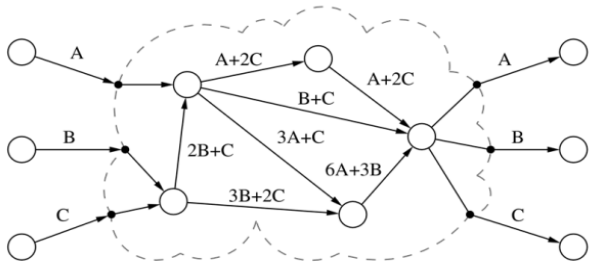
- Network aspects -
  - Optimum design and evolution of a flexible network architecture



- Physical layer flexibility -
  - Amplification of dynamic optical signals
  - Mixed modulation formats
  - Flexible bandwidths and data rates



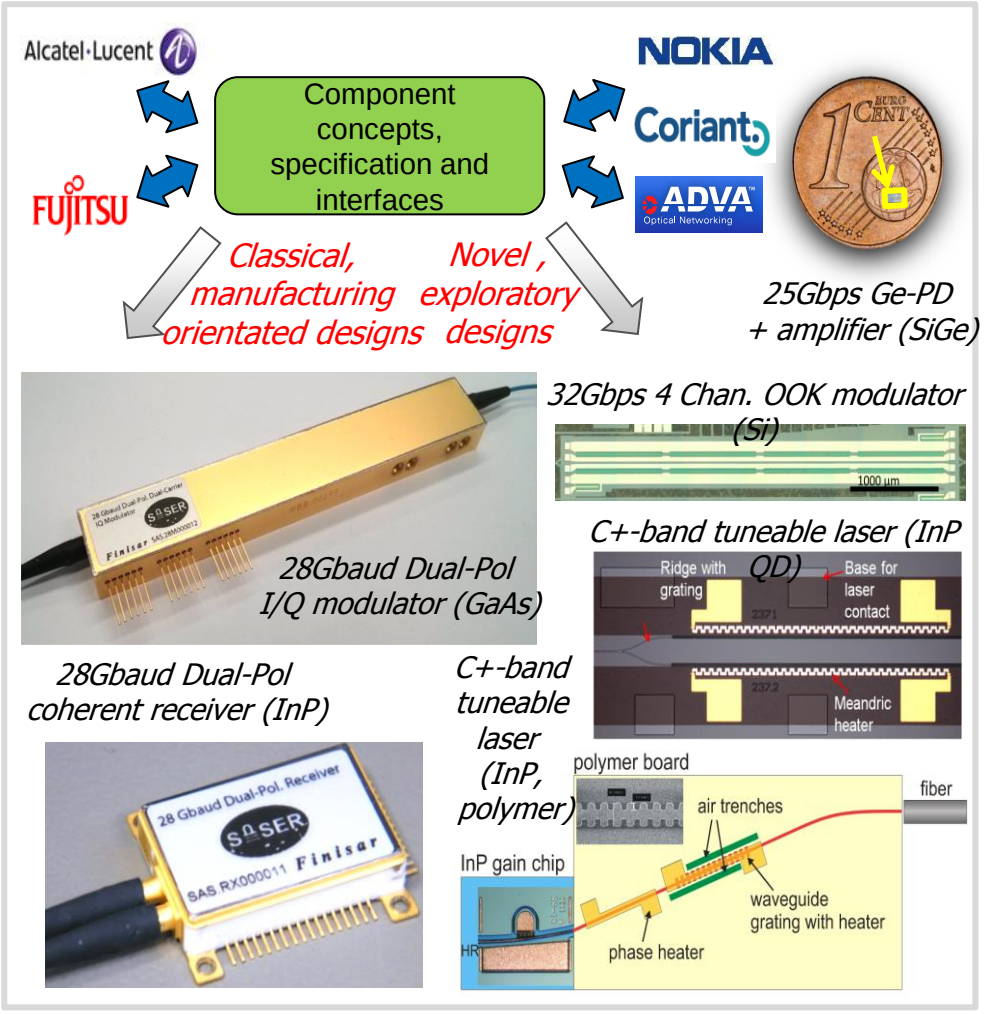
- Physical layer security -
  - Coherent based quantum key distribution
  - Network coded transmission to avoid risk of wire-tapping



SASER-Q1 Horizontal.
Optical Components

Finisar®

- Project objectives
  - ✓ The industrial and academic partners of this horizontal project provide next-generation optical components for the development of flexible and secure systems within SASER
  - ✓ Based on a strong collaboration and state-of-the-art know-how of the partners, different material systems (InP, GaAs, polymer and silicon) are employed to produce novel laser, transmitter and receiver modules
  - ✓ Allowing the system partners to get their hands on these novel component in an early state of the development gives them a head start in their development and serves the European interests.
- FNSR coordinates the horizontal project “Optical components”
- FNSR is member of the national and European SASER coordination committee



TU berlin
UNIKASSEL VERSITÄT
Fraunhofer Heinrich Hertz Institute
AMO
SASER
RWTH AACHEN UNIVERSITY
ihp innovations for high performance microelectronics
University of Stuttgart Germany

New innovative ADC/DAC test chip and DK solutions

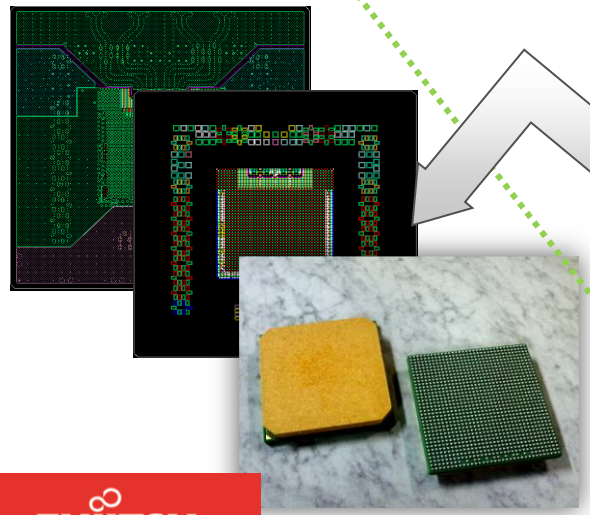
- **WP1: Work on concepts and possible target specification with all partners (done)**
- **WP2/WP4: R&D on ADC/DAC test chip & DKs (done)**
- **WP3/WP5: Test, Evaluation and Debugging of ADC/DAC test chip & DK**

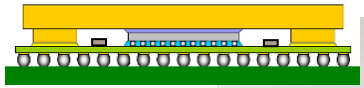
  Providing support to partners for bring-up, test and optimization of DKs. ONGOING!

Test chip: A/D +Mem. + I/Os...
→ *Basic feature-sets*

Package: Interfaces + I/Os …
→ *Product oriented: E/O –system*

DK: Connector + Vs + I/Os +SW…
→ *System/Network oriented*





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Alcatel·Lucent

Nokia Siemens Networks

Coriant

ADVA Optical Networking

Fraunhofer Heinrich Hertz Institute

FUJITSU
Fujitsu Semiconductor Europe GmbH

SASER-Q3 Horizontal.

Test infrastructure and system tests.

- Project objectives
  - ✓ Deutsche Telekom T-Labs provides a testbed infrastructure
  - ✓ Develop reference scenarios with partners
  - ✓ Perform modular tests with partner's solutions
  - ✓ Disseminate results and support standardization
- Secure and dynamic NFV application ⇨ First testbed activities
  - Mid-Term Demo (Nokia, Uni Würzburg, BISDN, Fraunhofer, T-Labs)
  - Accepted for demo publication at SIGCOMM, Chicago, 08/2014
- Deutsche Telekom T-Labs is heading the working committee WC4
  - Reference scenarios, test infrastructure, and system tests
  - "Test Networks" and "Reference Networks" groups