



*Attack analysis and Security concepts for
MOBILE Network infrastructures
supported by collaborative Information exchAnge*

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ASMONIA Overview and Reference Architecture for Collaborative Information Exchange

ASMONIA Security Research Project

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01.04.2011

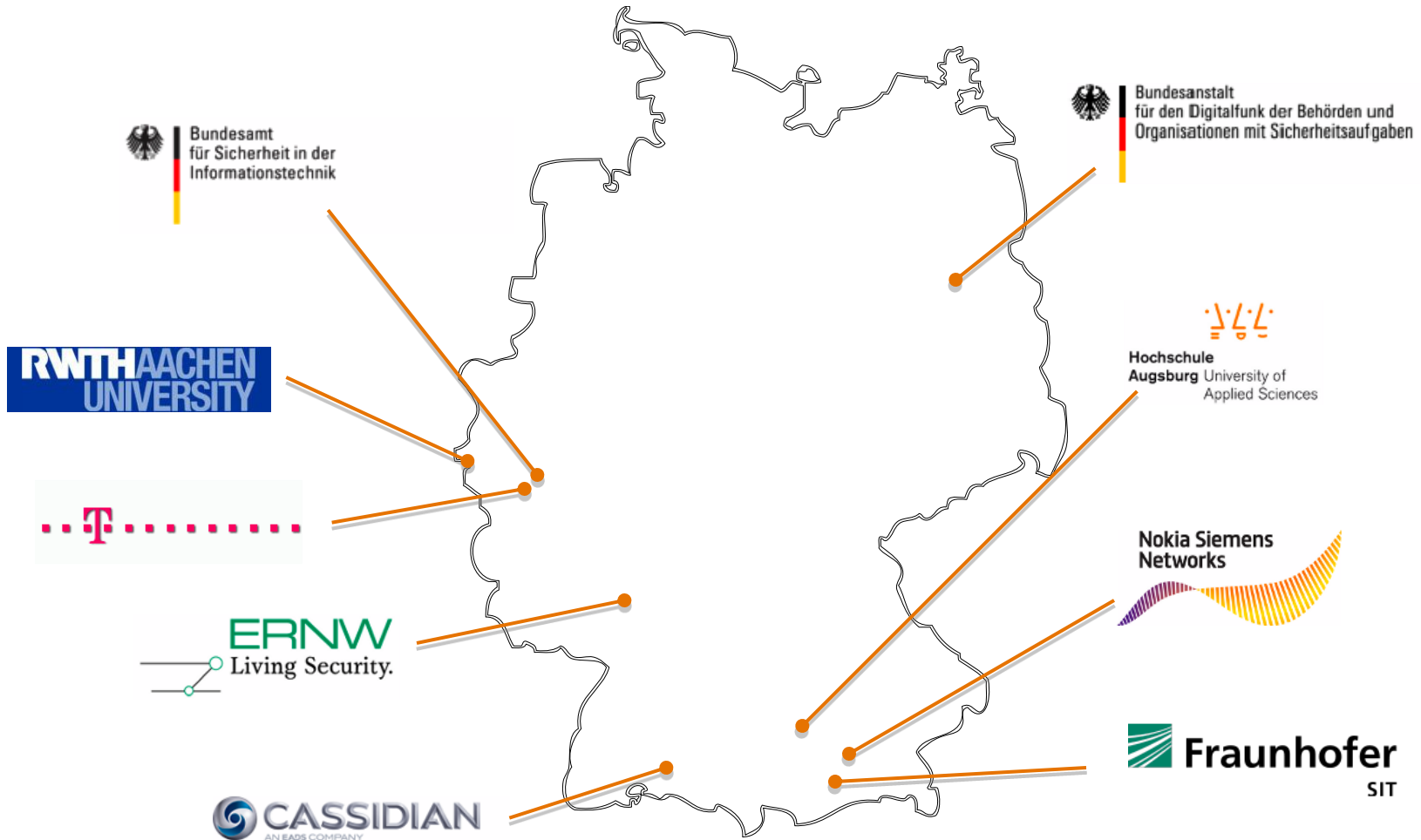
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Section: Project Overview

- Who we are
- Funding
- Status







Project Consortium



Project Consortium



Partners

- CASSIDIAN 
- ERNW GmbH 
- FhG SIT
Fraunhofer Institute for Secure Information Technology 
- Nokia Siemens Networks 
- RWTH
Rheinisch-Westfälische Technische Hochschule Aachen 
- University of Applied Sciences Augsburg (HSA) 

Associated Partners

- BDBOS
Federal Agency for Digital Radio of Security Authorities and Organisations 
- BSI
Federal Office for Information Security 
- DTAG
Deutsche Telekom AG 

Administrative Project Data



- BMBF sponsored project
- Start in September 2010 for 33 months (May 2013)
- More than 330 PM planned
- EUR 2.8 Mio funding

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Attack analysis and Security concepts for MOBILE Network Infrastructures,
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Deliverables

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ASMONIA News

- [Press release on ASMONIA project start](#)

2010-10-22

The [press release](#) on the ASMONIA project start which was published on October, 20th is referenced by several websites.

- [Launch of ASMONIA website](#)

2010-10-15

The ASMONIA website has been launched today to make available [interesting information](#) on the project as well as [deliverables and publications](#) which will be published in the future.

- [ASMONIA project start](#)

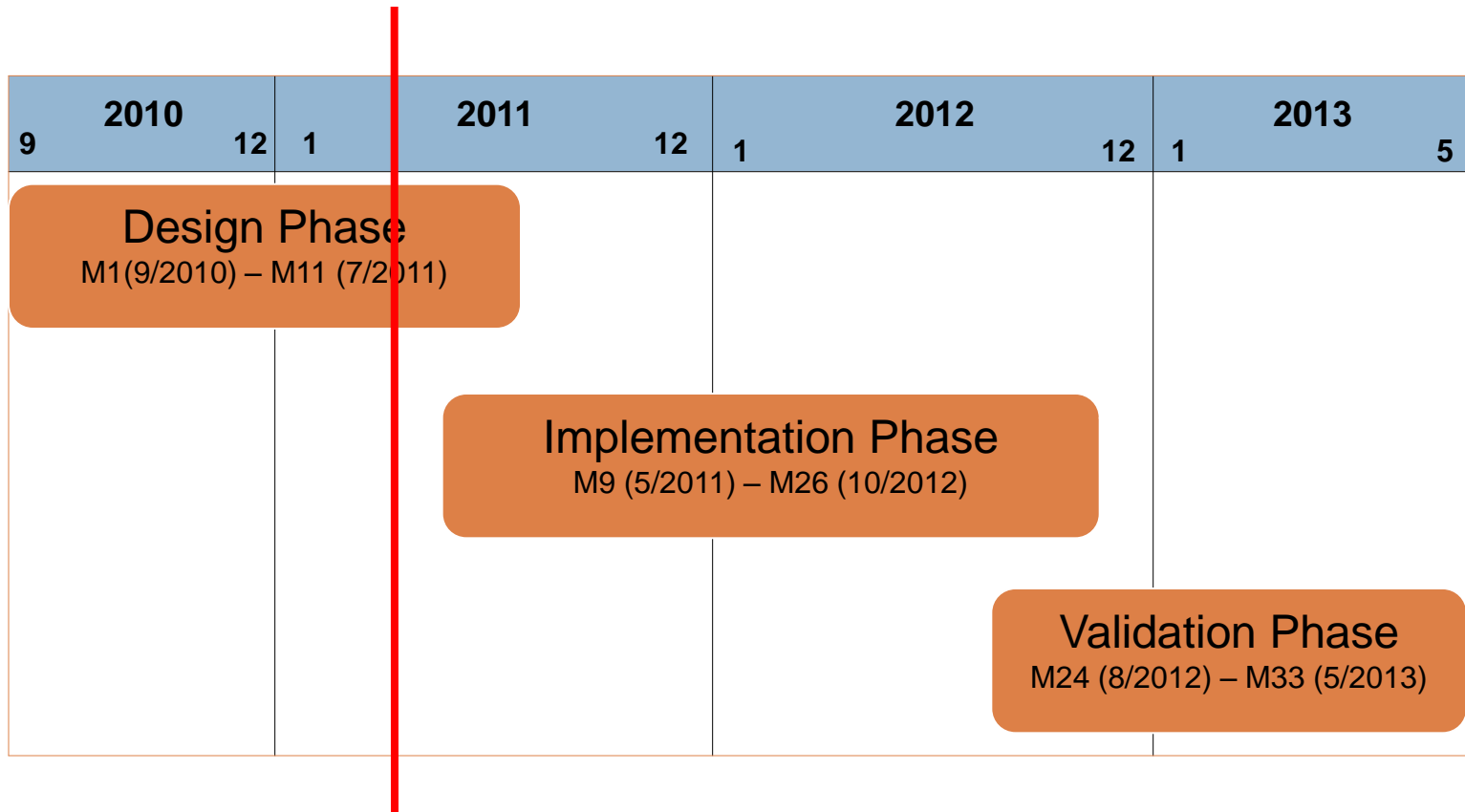
2010-09-01

Today the BMBF sponsored project ASMONIA (Attack analysis and Security concepts for MOBILE Network infrastructures, supported by collaborative Information exchAnge) has been started.

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Project status



Project status



- Project is now in the Design phase

- First (intermediate) results
 - ▣ Initial threat and risk analysis finished
 - ▣ First assumptions manifested in reference architecture
 - ▣ Initial use cases identified

- Ambitious project objectives:
 - ▣ Improve terminal and NE integrity and security
 - ▣ Improve attack detection and mitigation
 - ▣ Enable collaboration across administrative domains

Section: Motivation

- Overall
- One Network Operator
- Across Network Operators
- Critical Infrastructure

Overall Motivation



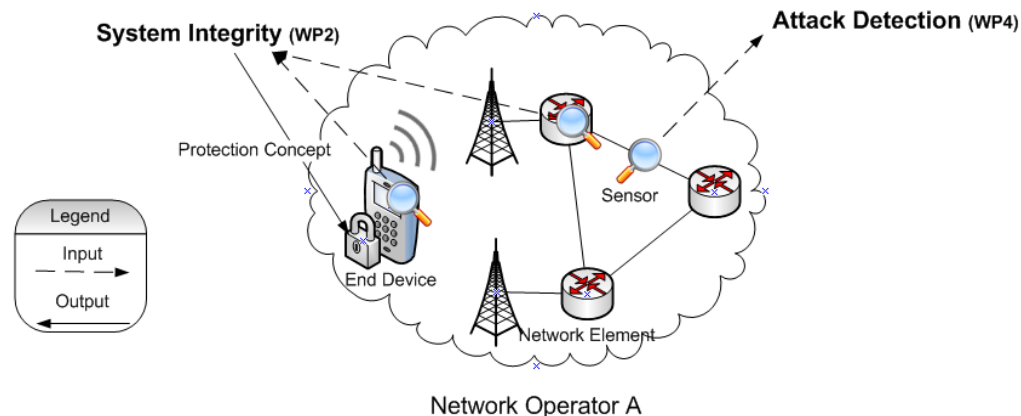
- Different Smartphone OSs and security architectures
 - ▣ Symbian, Android, iOS, RIM, Windows Mobile etc.
 - ▣ Distribution mechanisms of Smartphone Apps
- Business models of underground economy more and more applied on mobile platforms
 - ▣ From proof of concepts to automated broad scale attacks
- Changes in network infrastructure when migrating to 4G might lead to new threats that have to be addressed
- Collaborative data exchange advantageous to mitigate attacks

Motivation: Single Network Operator



□ Network operator's motivation

- Improving terminal security by solutions that allow identifying system integrity problems
 - For terminals (open OS, Smartphones)
 - For NE of access network infrastructure
- Improving malware and attack detection and handling



Motivation: Multiple Network Operators



- **Network operators' motivation**
 - Improving terminal security by solutions that allow identifying system integrity problems
 - For terminals (open OS, Smartphones)
 - For NE of access network infrastructure
 - Improving malware and attack detection and handling
- **...with emphasis on several operators' infrastructure**
 - Sharing knowledge on vulnerabilities or attacks (situational information, reputation, fairness)
 - Evaluating use of elastic solutions for improving overall availability
 - Deriving assertions about „system health“ and situational awareness

Motivation: Critical Infrastructure (1/3)



- **Telecommunication networks are part of critical infrastructures:**
 - More and more transactions, delivery processes, control procedures, business processes based on the use of telecommunication networks
 - Cross-relationships between telecommunications and critical infrastructure (electricity supply, transport, ...) reinforce

Motivation: Critical Infrastructure (2/3)

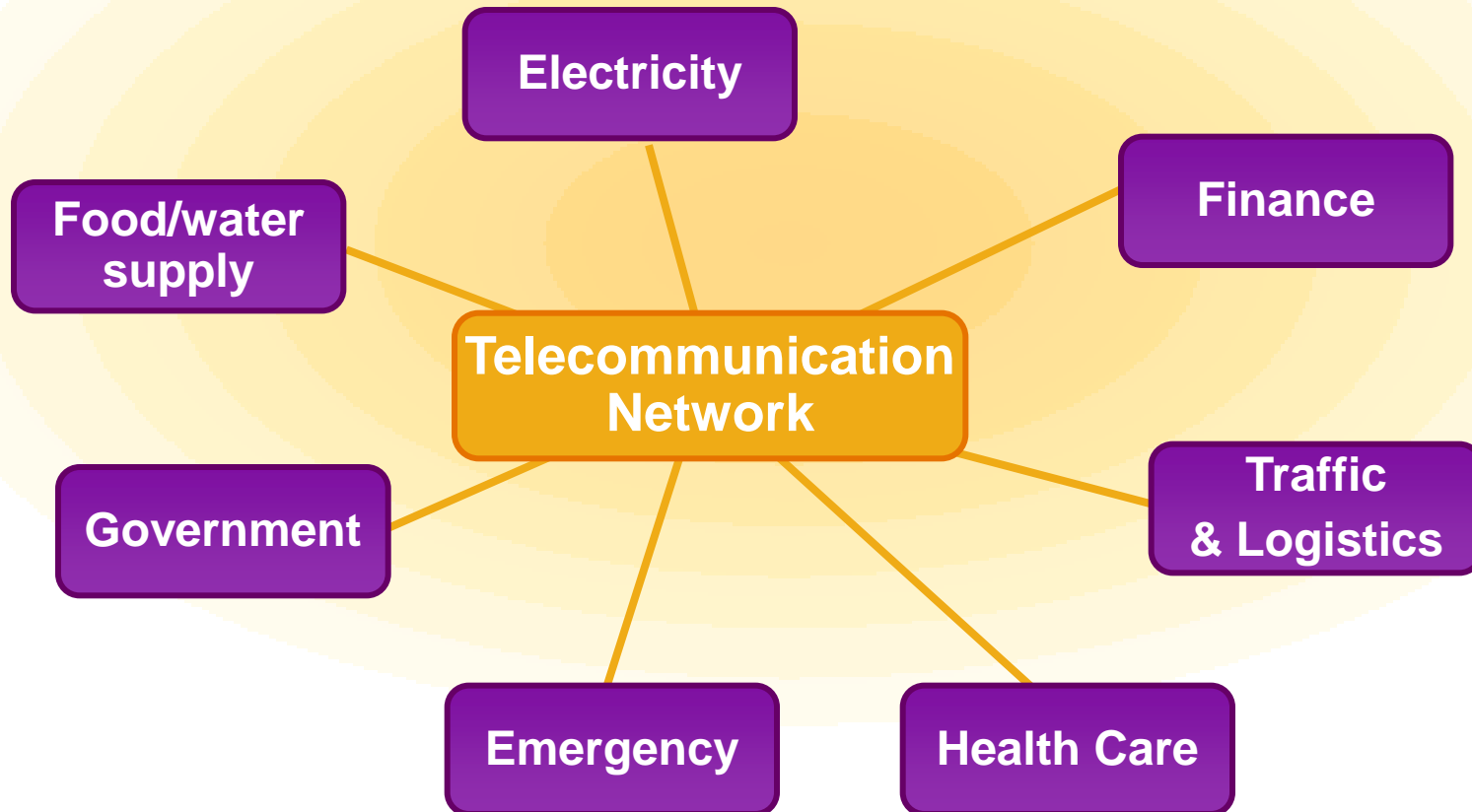


- **At the same time, the exposure of telecommunication networks against attacks is growing:**
 - Global Internet connectivity
 - Increasing complexity and functionality of the networks
 - Worldwide availability and "trade" with attack tools and illegally obtained results (-> "criminal eco-system")
 - Increasing physical accessibility of telecommunications equipment
 - The achievable amount of damage increases the attractiveness of attacks, e.g., by ideologically motivated adversaries, or as a military threat potential

Motivation: Critical Infrastructure (3/3)



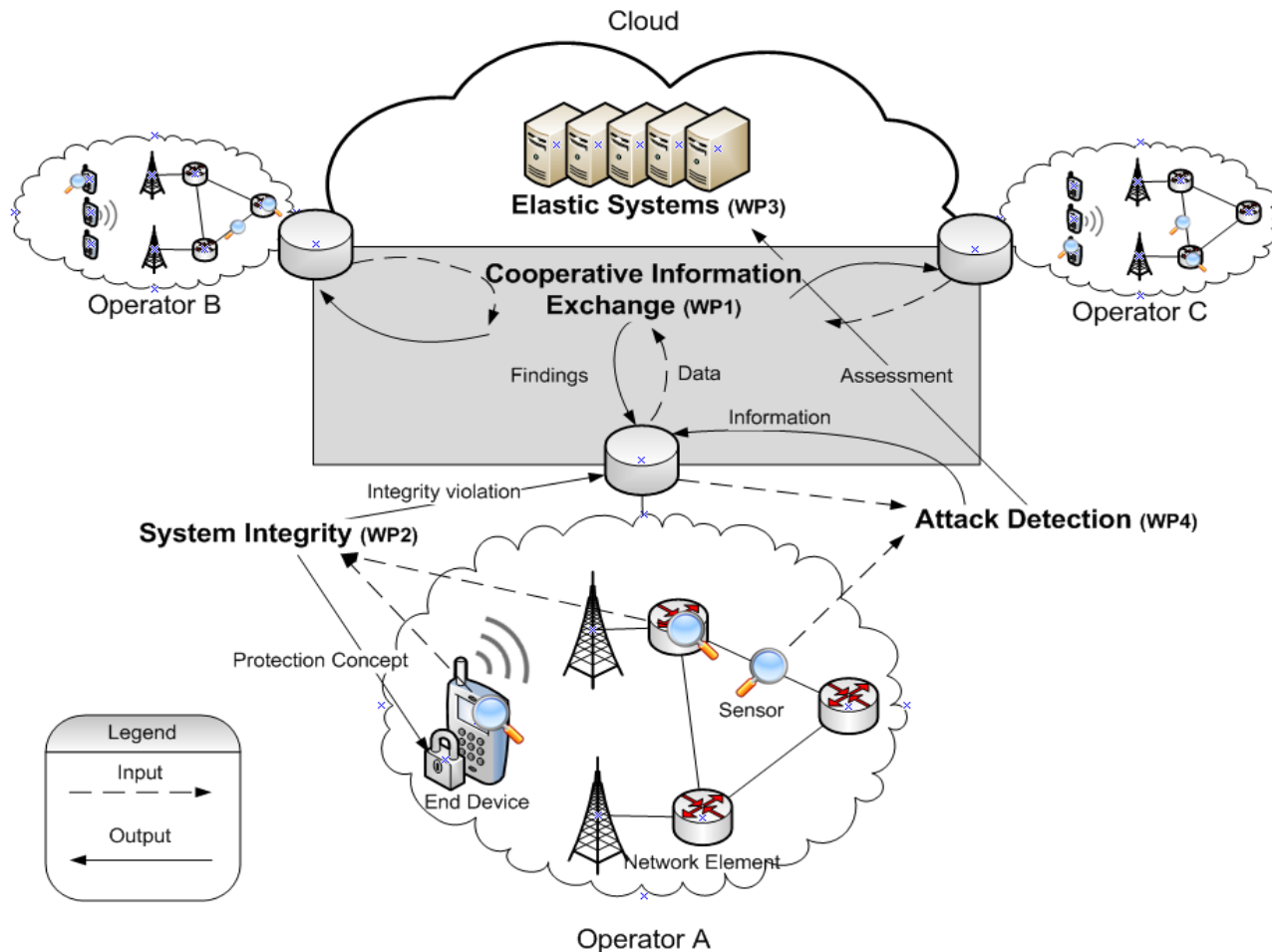
- Double role: critical infrastructure & connecting link



Section: Approach

- ASMONIA Big Picture
- Tasks overview
- Technology components

ASMONIA Big Picture



Integrity Protection & Attack Detection



- On network elements in access network
 - ▣ SW-Integrity protection as a priority protection measure

- On terminals
 - ▣ OS hardening concepts
(L4 μ kernel, Open Kernel Labs OKL4, TrustZone ...)
 - ▣ lightweight attestation as runtime validation measure

- Malware
 - ▣ honeypot based malware detection methods

Cloud Computing Scenarios Considered

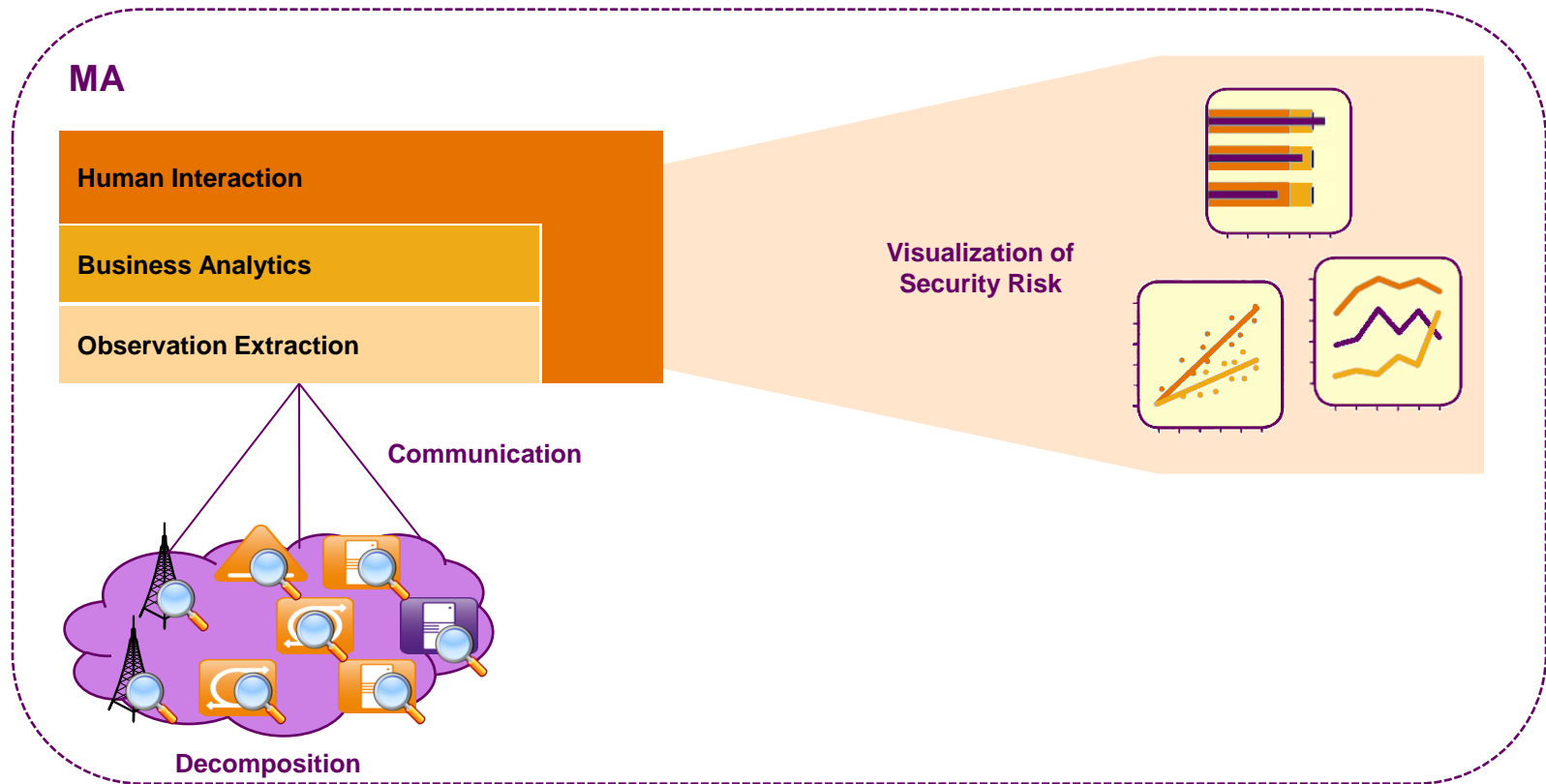


- Cloud as a means to store and evaluate messages
 - ▣ Integration of messages about events and warnings with different origins

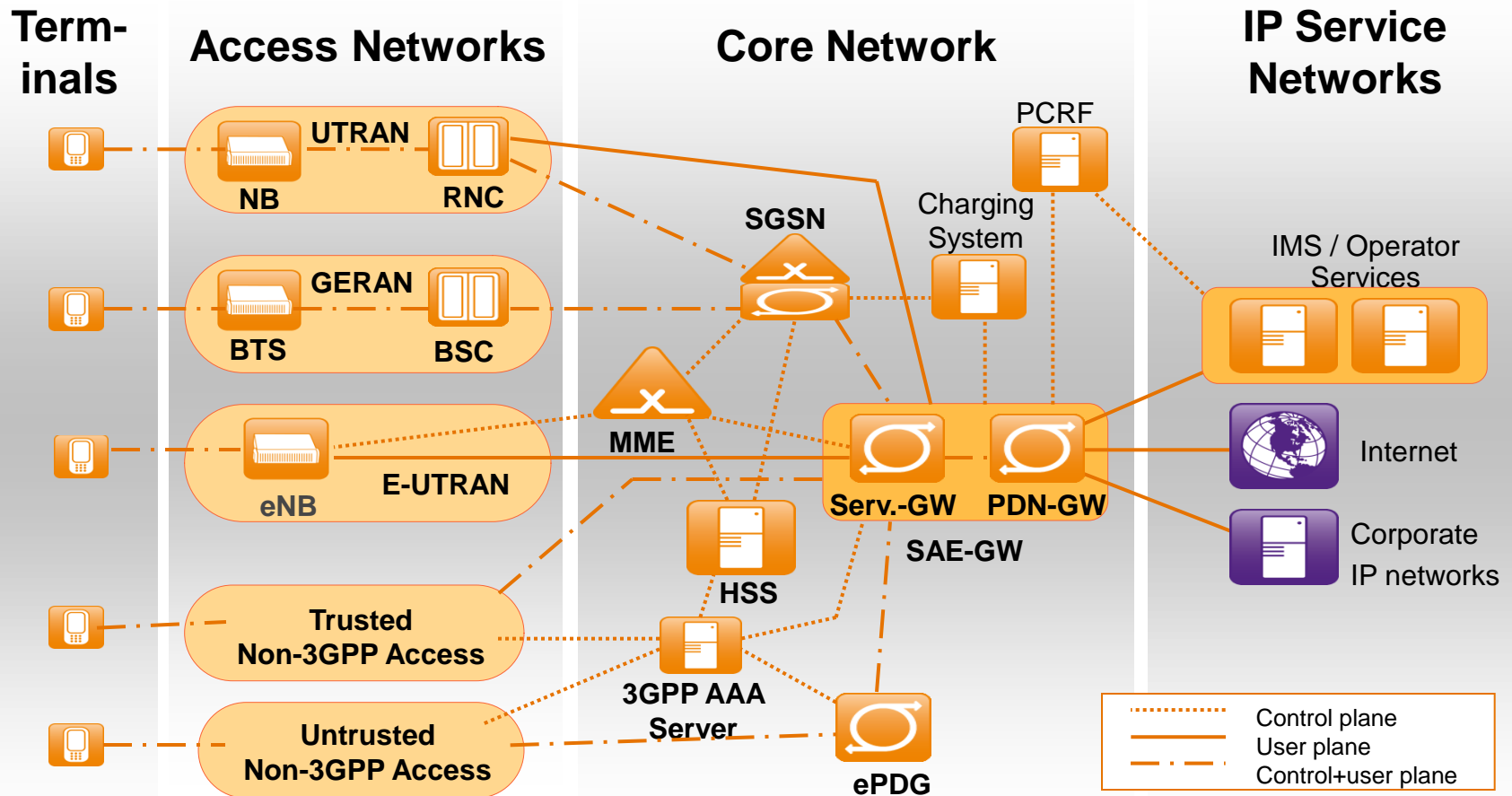
- Cloud as a means to enhance availability and security in overload and outage situations
 - ▣ Instantiate telecommunication system capabilities in elastic systems to improve failure situation and reconfiguration handling

- Management of shared cloud resources
 - ▣ Aspects of cloud management including scalability and instantiation of components in the cloud

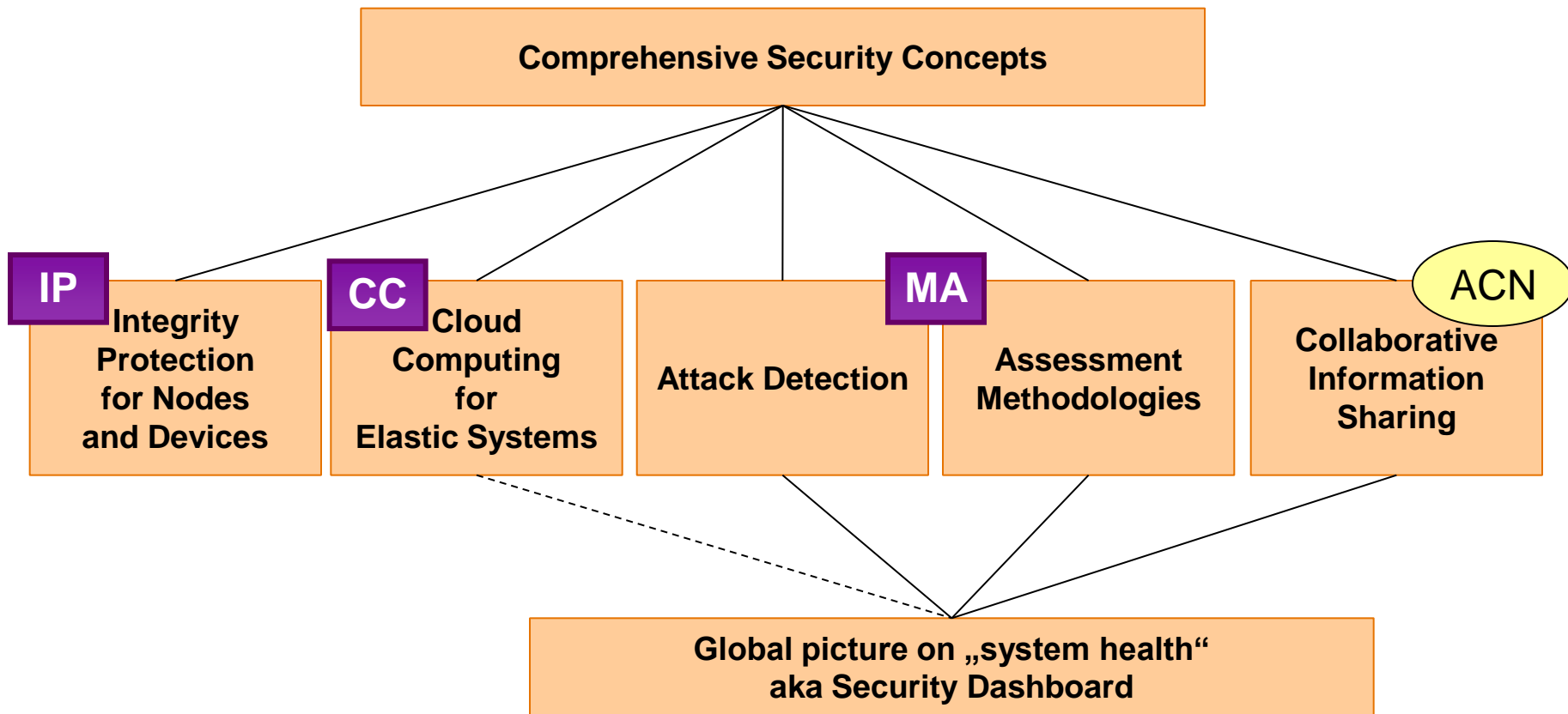
Single/Multiple Network Operator System Health



Threat & Risk Analysis



Dependencies of Technology Components



Section: Collaboration

- Collaborative Information Exchange
- Use Case
- Challenges & Requirements
- Proposed Components

Collaborative Information Exchange



- Objective
 - Attack mitigation by exchanging signatures and warnings

- Methodology
 - Information sharing of incident related data between mobile operator networks
 - Exploitation of heterogeneous environments

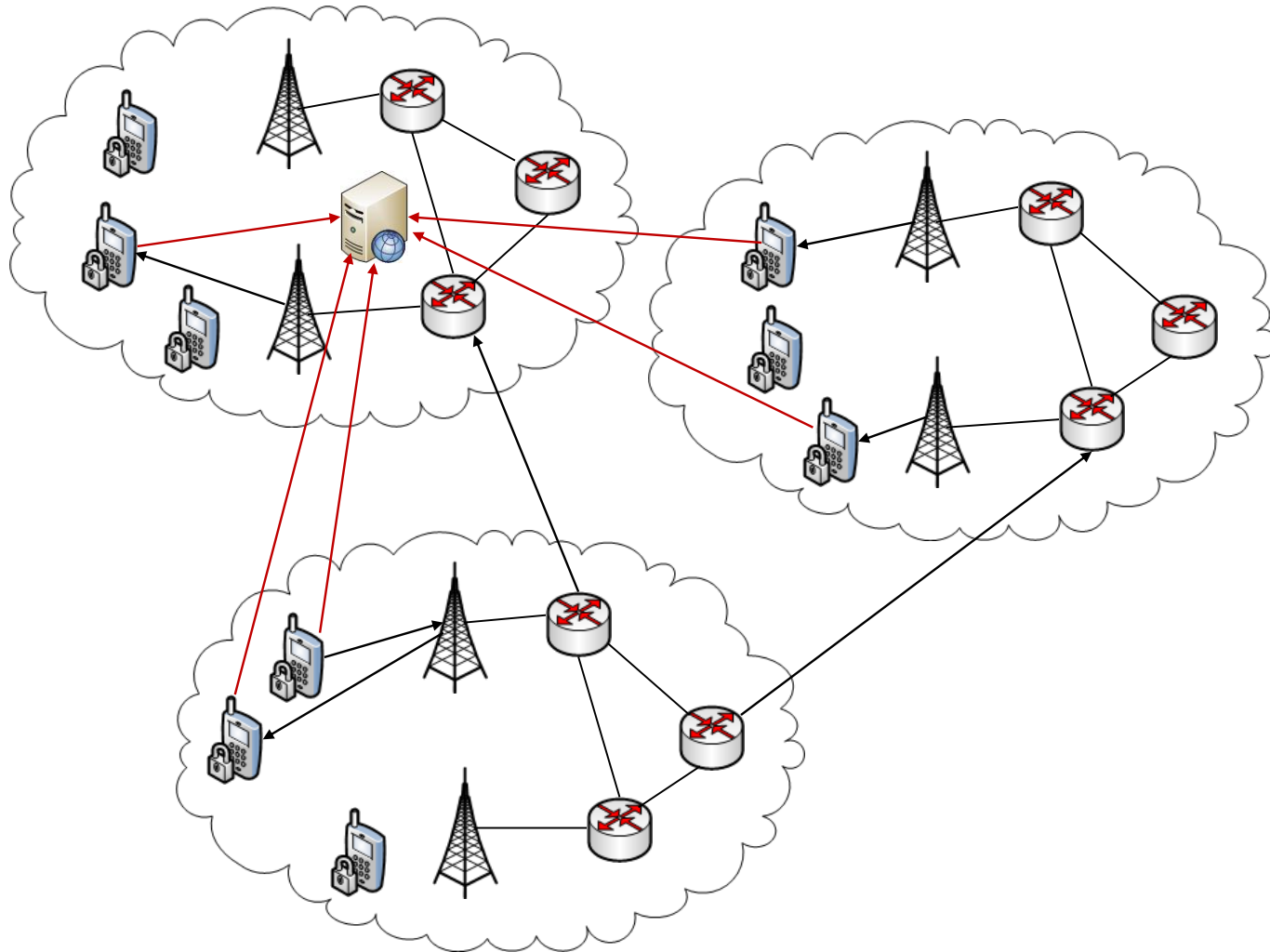
- Requirements
 - Taking into account privacy and security considerations
 - Interfaces to existing Early Warning Systems

Use Case Example



- Unknown mobile malware (worm) infects specific Smartphones depending on their OS in multiple operator networks
- Botnet is formed and used for a DDoS attack on a service of an operator or third party
- Attack is detected and local and global system health states are created and exchanged
- Cloud computing systems are used to provide additional resources and handle overload situation
- Incident related data is exchanged between operators to mitigate attack impact and restore infected devices to a trustworthy configuration

Use Case: Unknown Smartphone worm



Challenges & Requirements



- Incident related data might include sensitive information of operators, e.g. network infrastructure details, vulnerable services etc.
 - ▣ Loss of reputation must be prevented
 - Anonymizing and sanitizing information before sharing is essential
 - However, data must contain enough information to be useful for recipient
- ASMONIA Collaboration Network (ACN) needs to be highly available
 - ▣ Single points of failure must be avoided
 - Usage of a distributed, completely decentralized infrastructure

Challenges & Requirements



- Information shared between operators must not be modified by attackers
 - ▣ The integrity and confidentiality of messages in the ACN must be guaranteed
 - Shared information must be encrypted and signed by sender

- External attackers must not be able to inject falsified messages into the ACN
 - ▣ A closed user group for authorized participants must be established
 - The authenticity of messages must be guaranteed, e.g., by using certificates

Proposed Components

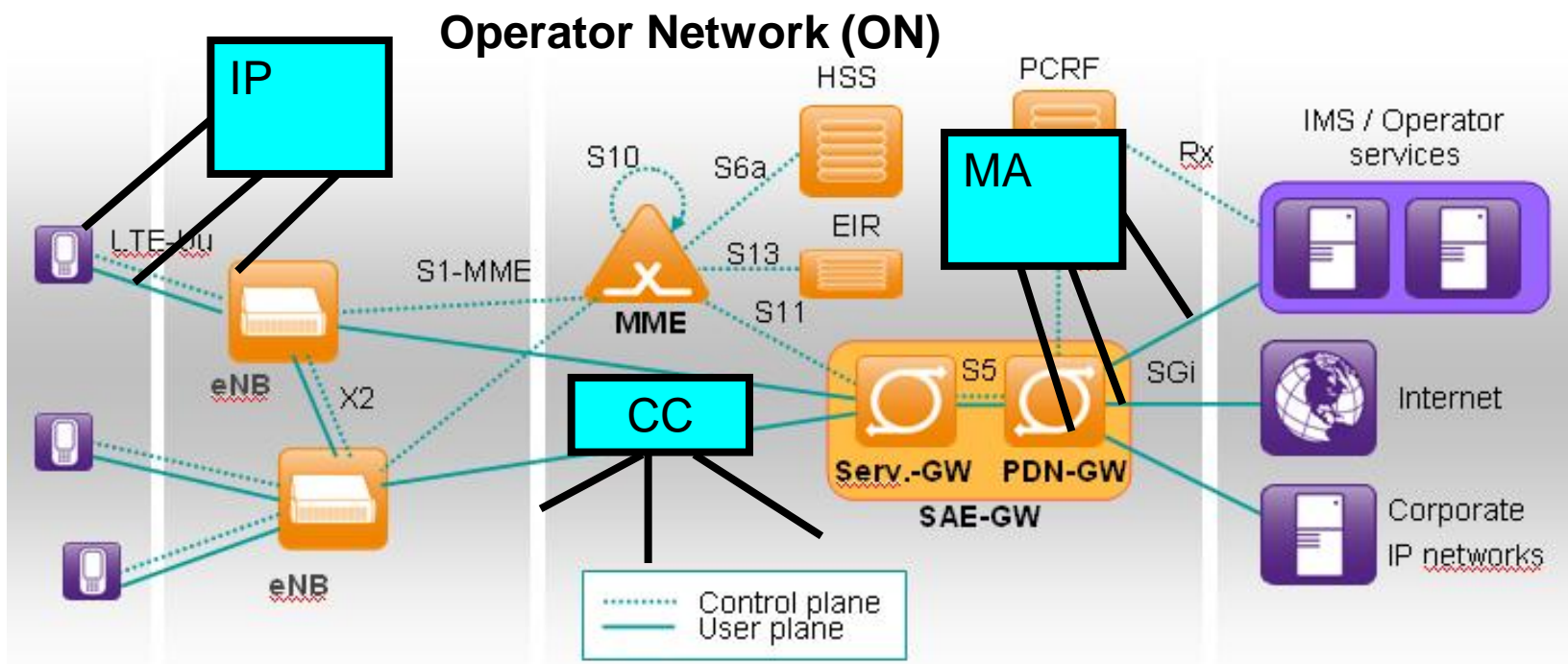


- Traceable Anonymous Certificates (TAC) [1]
 - Traceable Anonymous Certificates (TAC) provide key material to en-/decrypt and sign exchanged information without revealing a participant's real identity
- P2P Overlay Networks (GUnet [2], GAP [3])
 - P2P Overlay Networks (e.g., GUnet) improve resilience and anonymity of the data exchange channels itself by using redundant and indirect routes
- Secure MultiParty Computation [4]
 - Secure Multiparty Computation (MPC) enables participants to share security incident related data in a privacy preserving way to enhance detection and mitigation of attacks

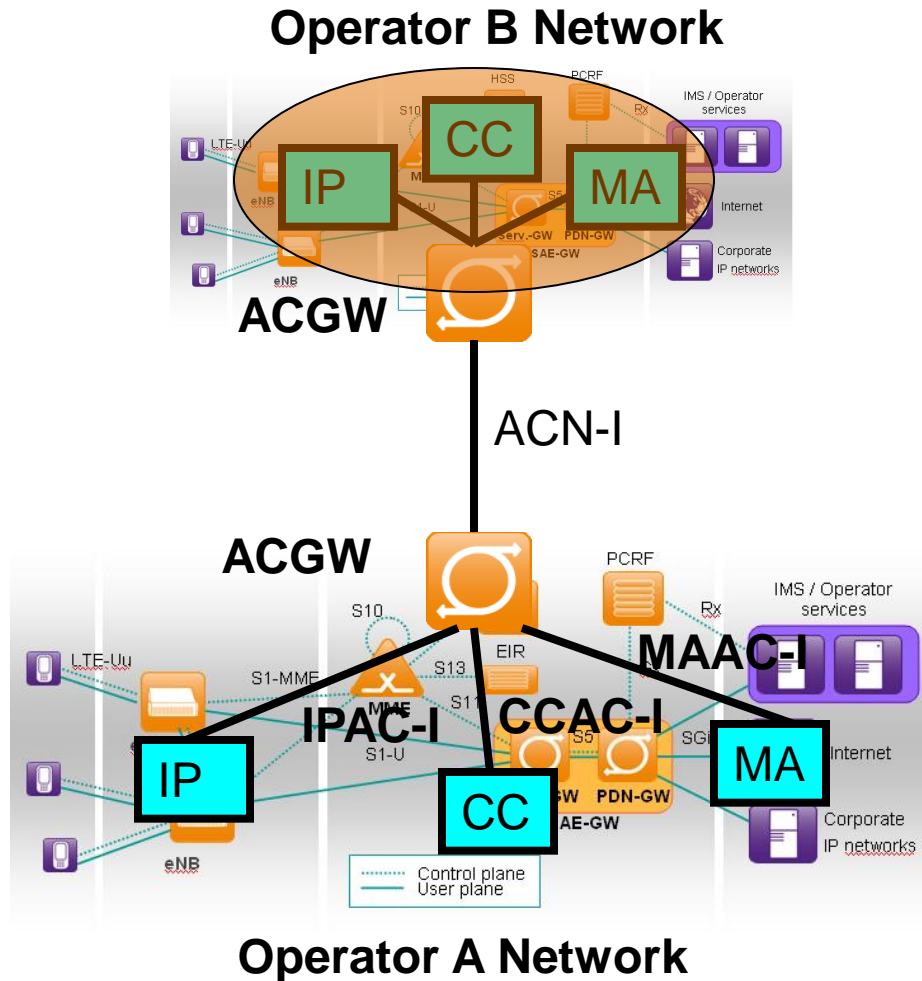
Section: Reference Architecture

- Mobile Operator Network Infrastructure
- Functional Clusters
- ASMONIA Collaboration Gateway (ACGW)
- ASMONIA Collaboration Network (ACN)

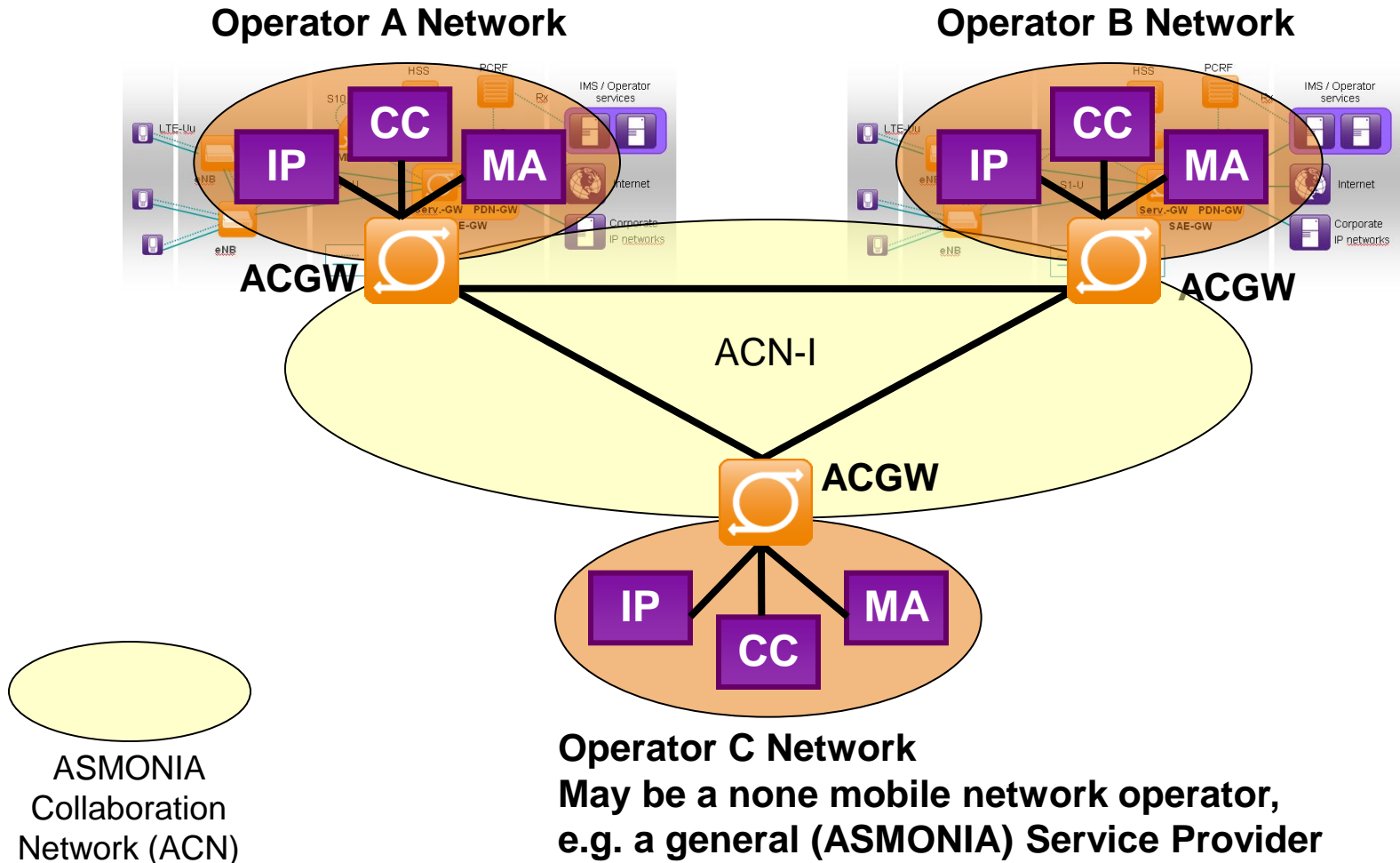
Reference Architecture – Functional Clusters (FC)



Reference Architecture – ACGW



Reference Architecture – ACN



Section: Conclusion

- Objectives
- Future Work

Project Objectives



- Improve terminal and NE integrity and security
- Improve attack detection and mitigation techniques
- Evaluate usage of cloud systems to support ASMONIA tasks
- Enable collaboration across administrative domains
- Definition of protection concepts to improve security of mobile network infrastructures

Future Work



- Detailed specification of functional and security requirements of the introduced elements
- Evaluation if proposed components meet the defined requirements
- Definition of a flexible architecture for future modules and integration of interfaces to existing Early Warning Systems
- Simulation of proposed system architecture to validate practicability and performance of our approach

References



- [1] RFC 5636, Aug. 2009
- [2] K. Bennett, C. Grothoff, T. Horozov, I. Patrascu, and T. Stef. Gnunet—a truly anonymous networking infrastructure. In *Proc. Privacy Enhancing Technologies Workshop (PET)*. (Mar. 2002).
- [3] K. Bennett and C. Grothoff. Gap practical anonymous networking. *Lecture notes in computer science, pages 141–160, 2003*.
- [4] M. Burkhart, M. Strasser, D. Many, and X. Dimitropoulos. Sepia: Security through private information aggregation. Technical report, Computer Engineering and Networks Laboratory, ETH Zurich, Switzerland, October 2009.