

Access Network Discovery and Selection in the Future Broadband Wireless Environment

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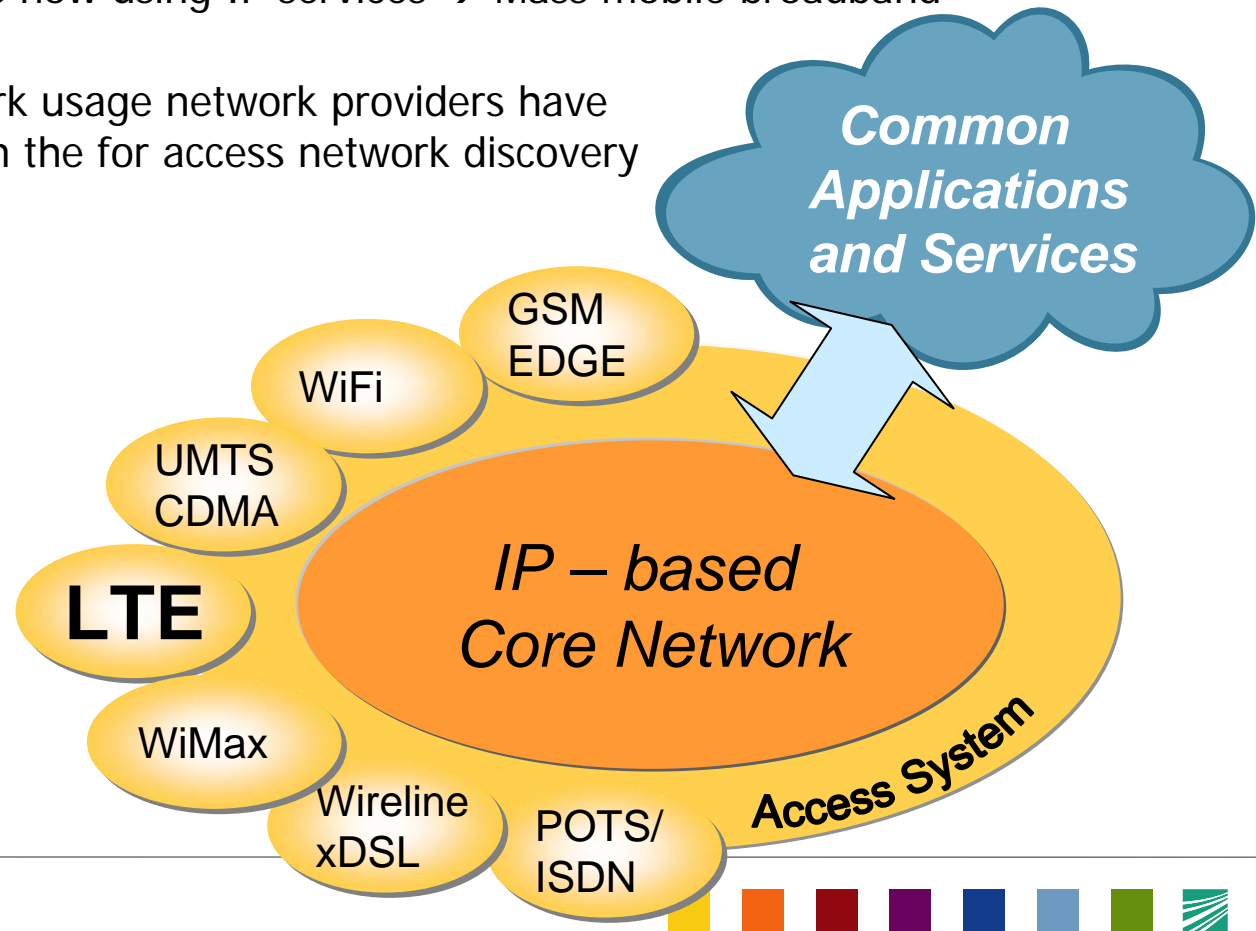
Outline

- Motivation - Access Network Discovery and Selection
- 3GPP Evolved Packet Core
- Beyond ANDSF
 - Subscription based ANDSF
 - Dynamic Discovery
 - Location Enabler
 - Femtocells Discovery and Selection
- Fraunhofer FOKUS OpenEPC realization
 - OpenEPC introduction
 - ANDSF Realization
 - OpenEPC ANDSF Evaluation
- Conclusions

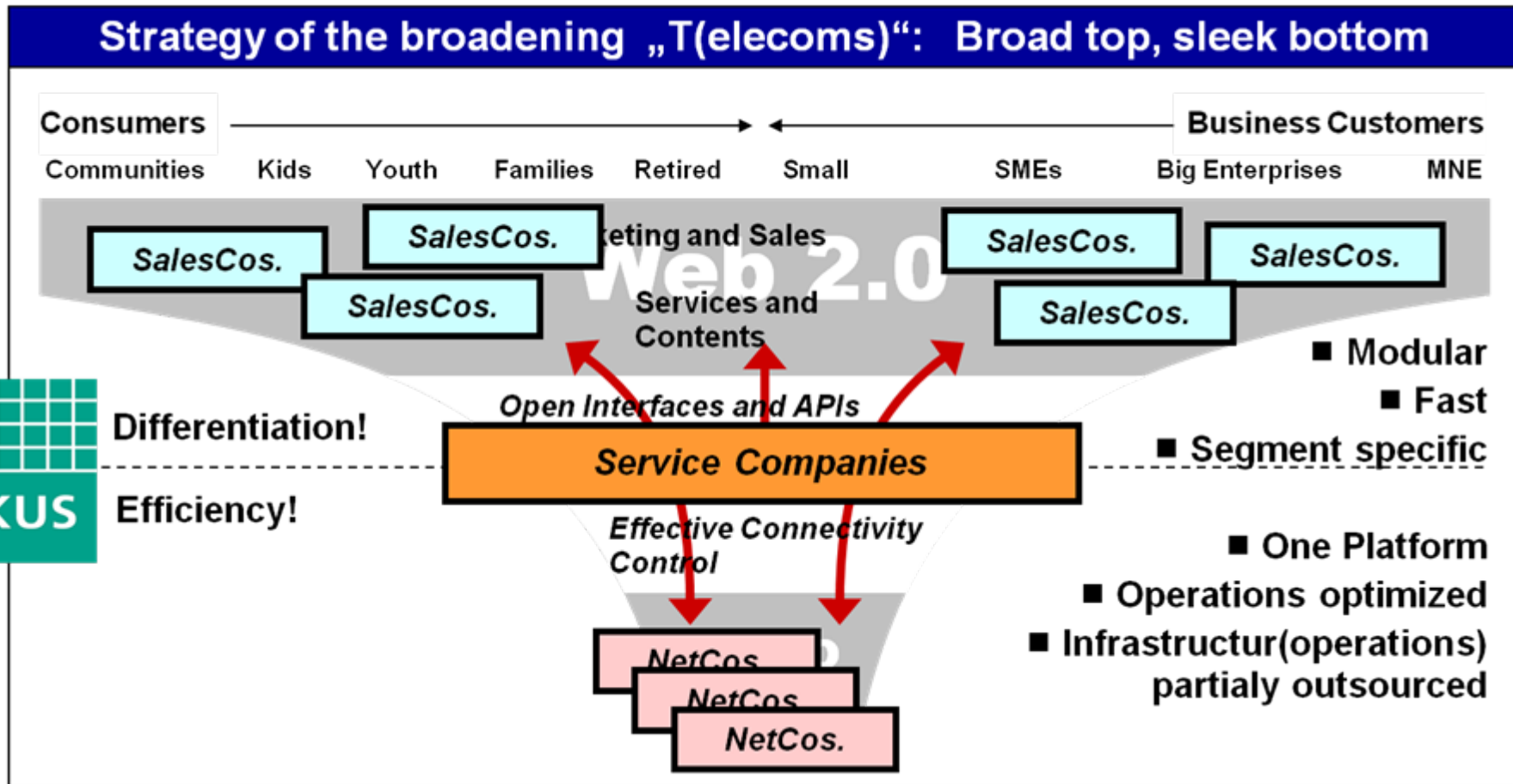
Access Network Discovery and Selection

Motivation

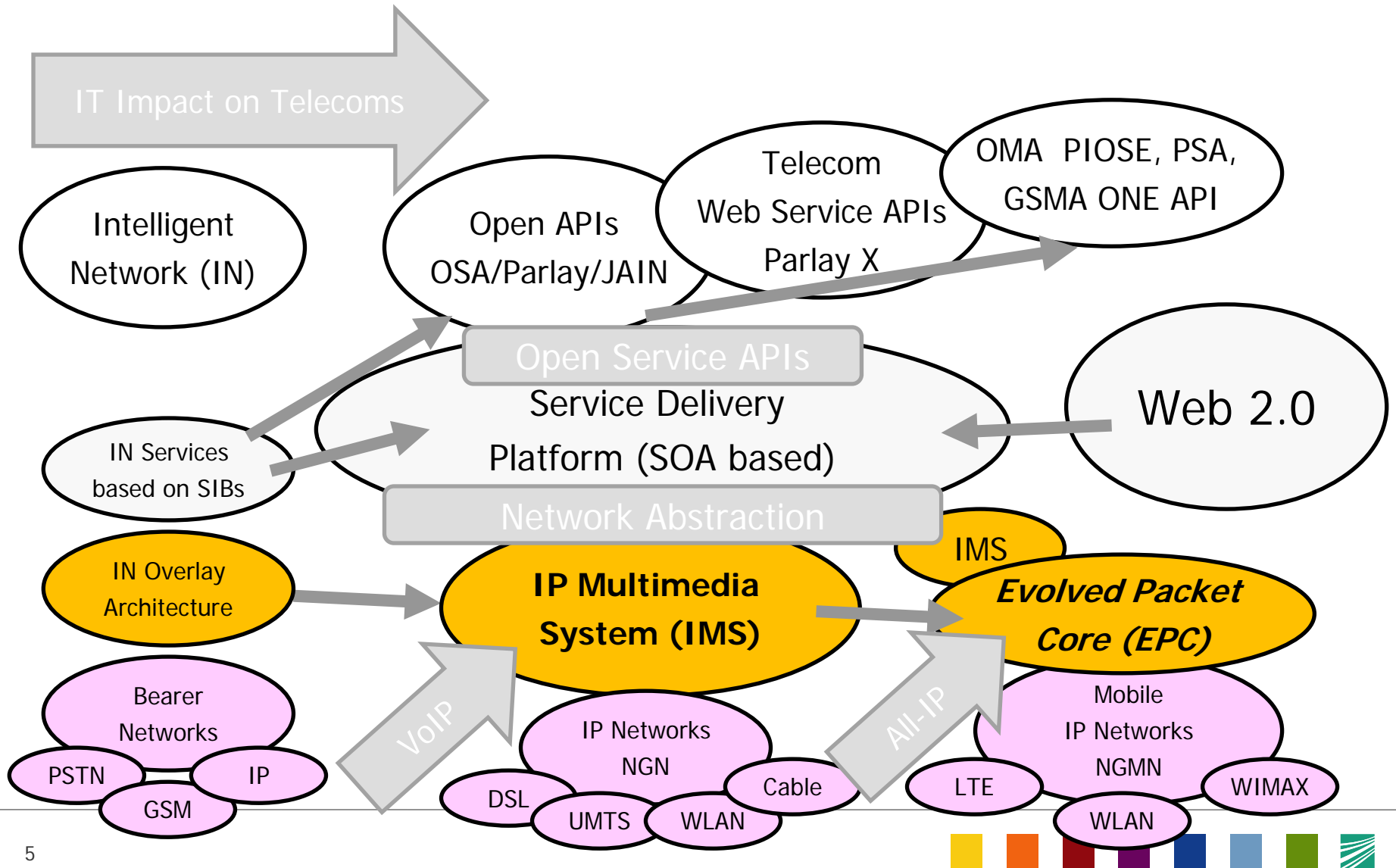
- New access technologies are deployed/older accesses are maintained → Dense wireless environments
- More Mobile Devices are now using IP services → Mass mobile broadband communication
- For an optimized network usage network providers have to provide indications on the for access network discovery and selection



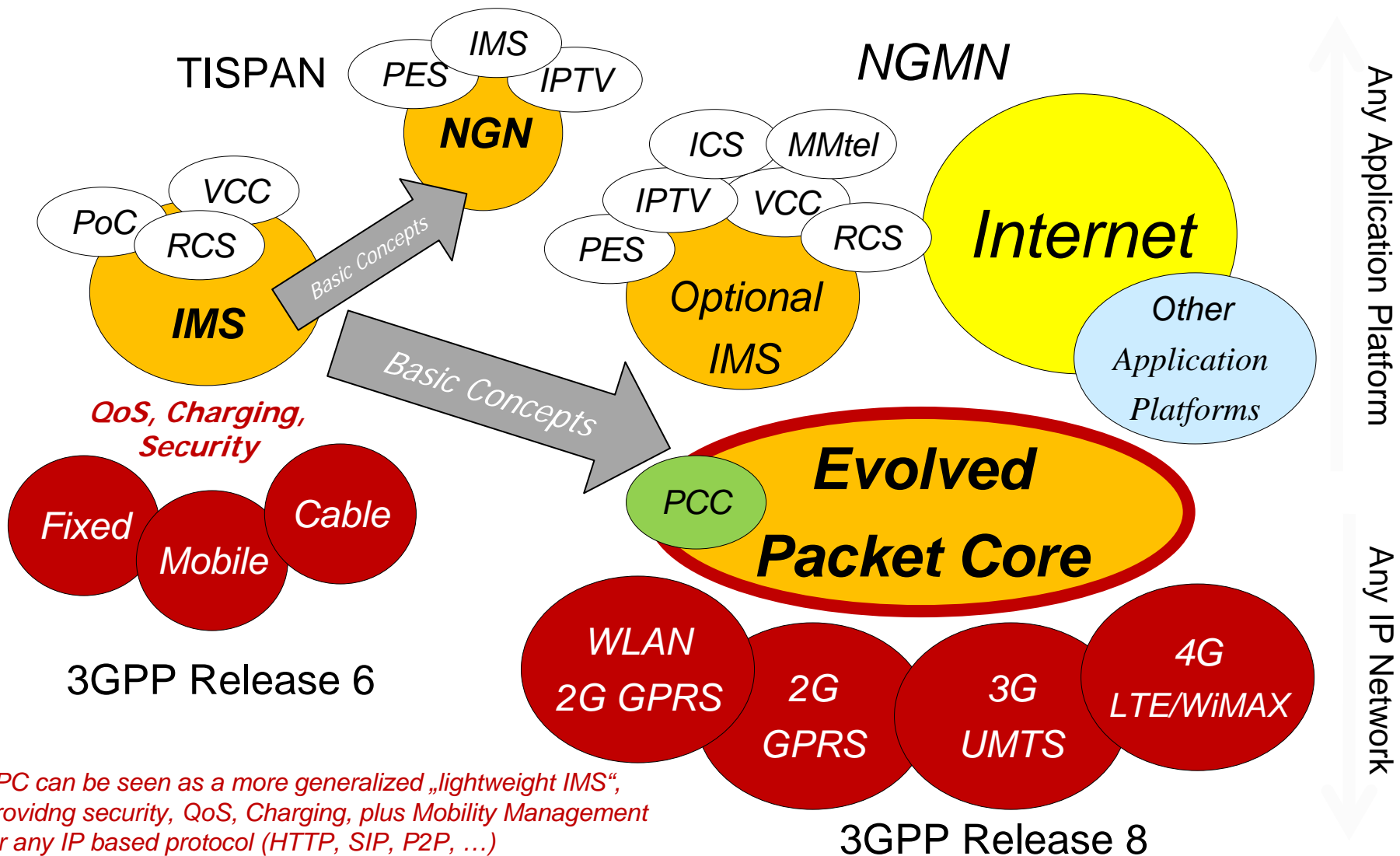
Future Service and Network Diversity requires Partnerships



Multi Access Network Service Platforms: From IN to IMS to EPC



Concept Reuse: From IMS for NGN to EPC for mobile all-IP networks

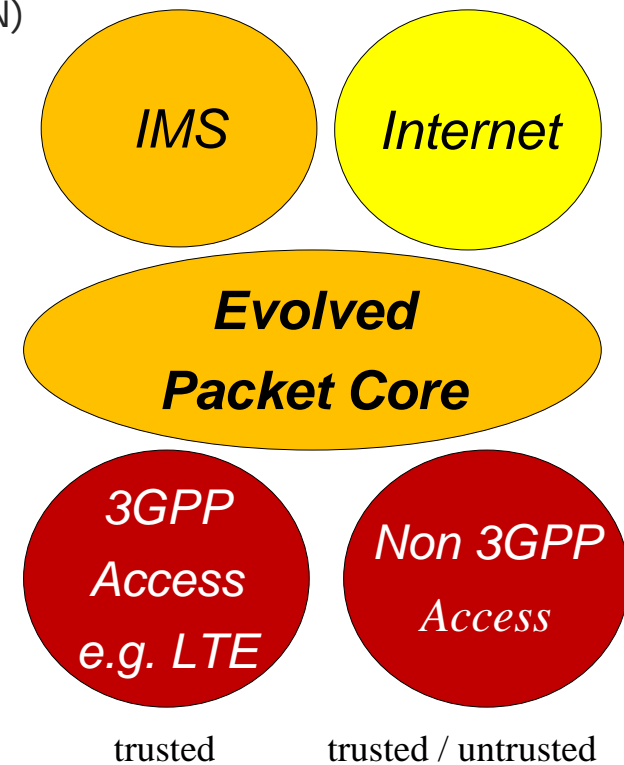


EPC can be seen as a more generalized „lightweight IMS“, Providing security, QoS, Charging, plus Mobility Management for any IP based protocol (HTTP, SIP, P2P, ...)



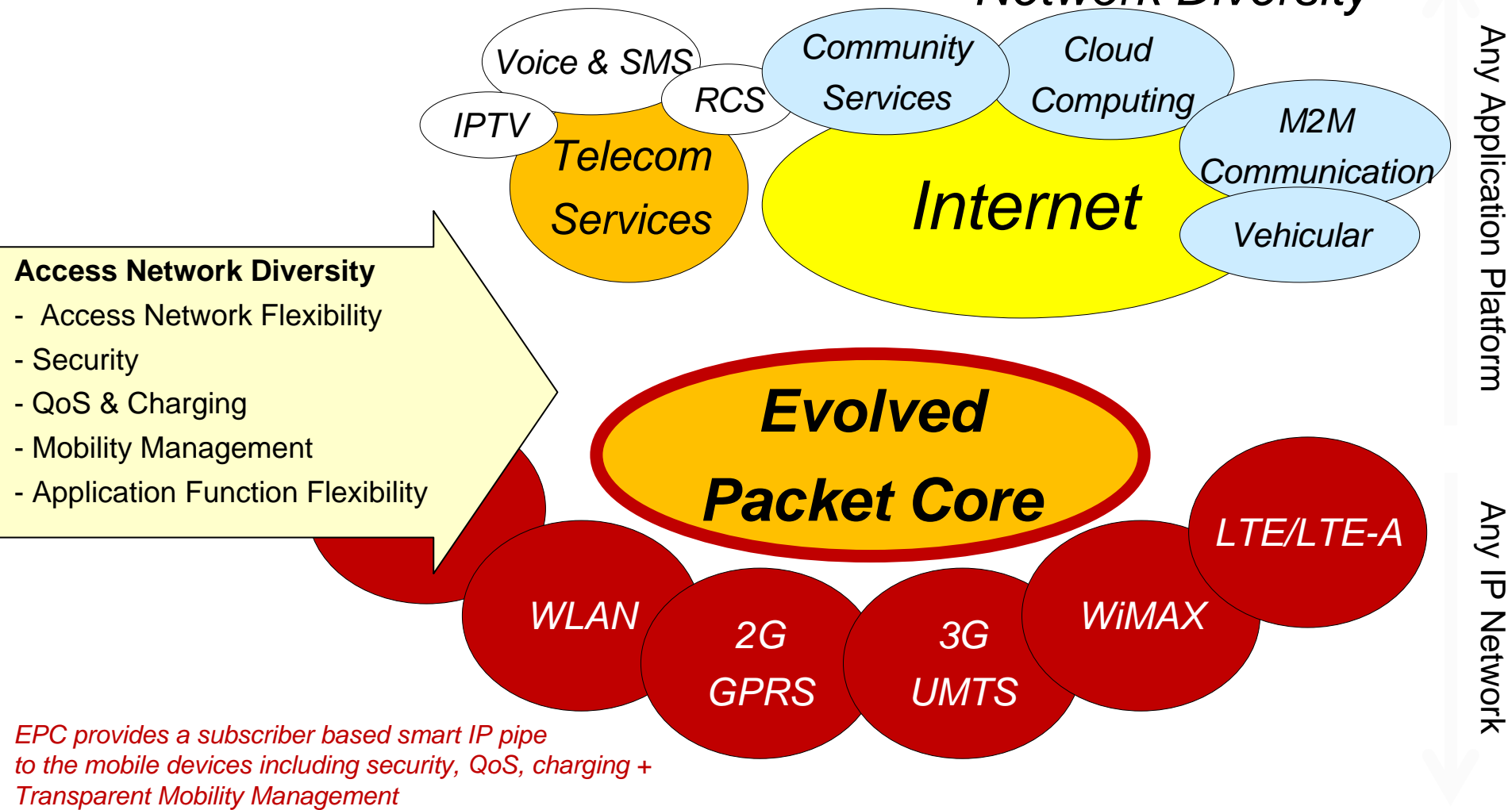
Evolved Packet Core (EPC)

- EPC is part of the 3GPP Evolved Packet System (EPS)
- The EPC is a multi-access core network based on the Internet Protocol (IP) one common packet core network for both
 - trusted networks including
 - 3GPP Access (LTE-E-UTRAN, UMTS-UTRAN, GPRS-GERAN)
 - Non 3GPP Access (WIMAX, CDMA2000/HRPD)
 - and untrusted networks including
 - Non-3GPP Access (WLAN)
- EPC provides connection to IP service domains
 - IMS
 - Internet (or others, e.g. P2P etc.)
- Important EPC functions include:
 - NAS and security (AAA)
 - mobility and connectivity management
 - policy QoS control and charging (PCC)



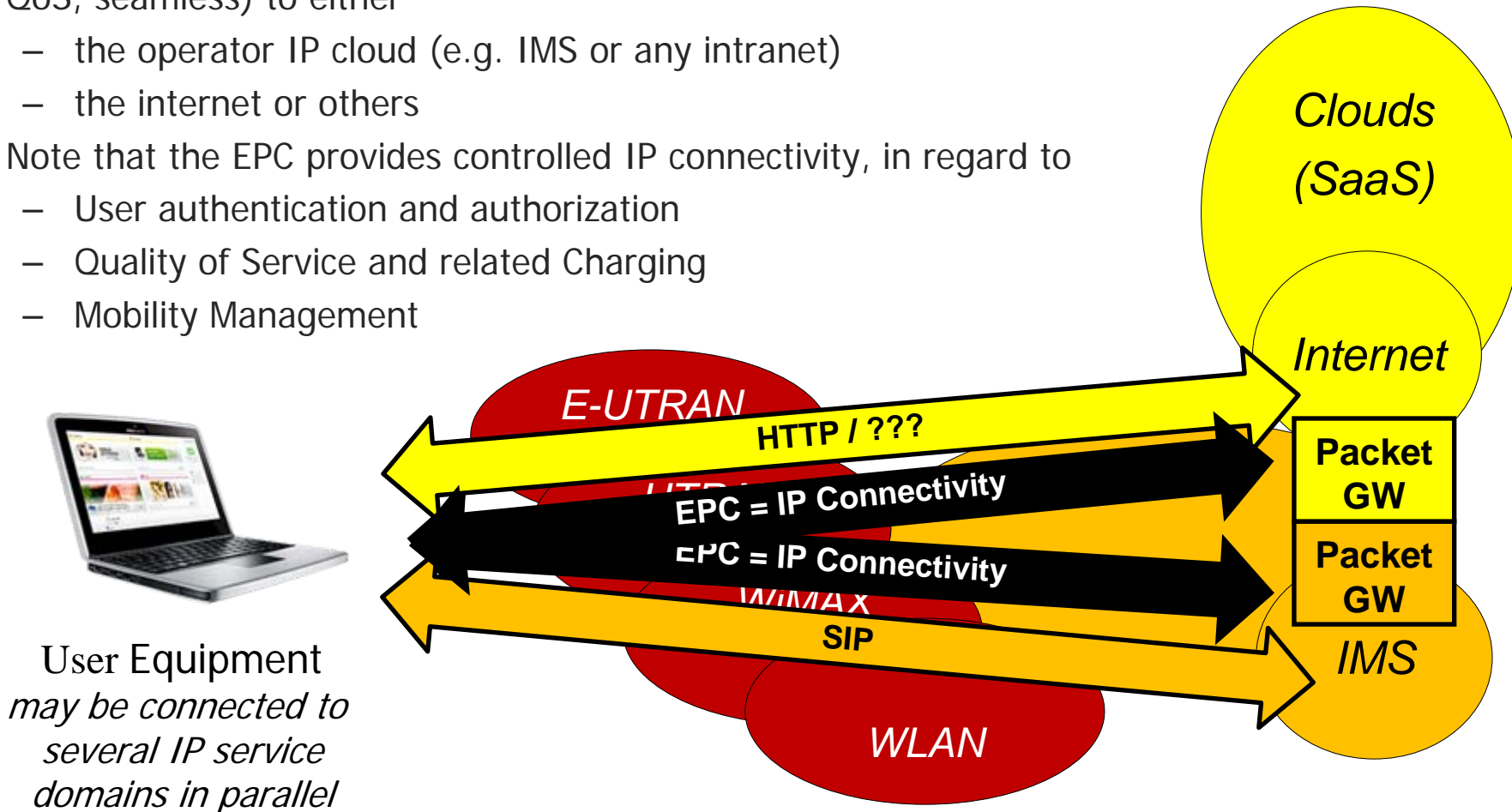
3GPP Evolved Packet Core

Mobile Broadband Network Diversity

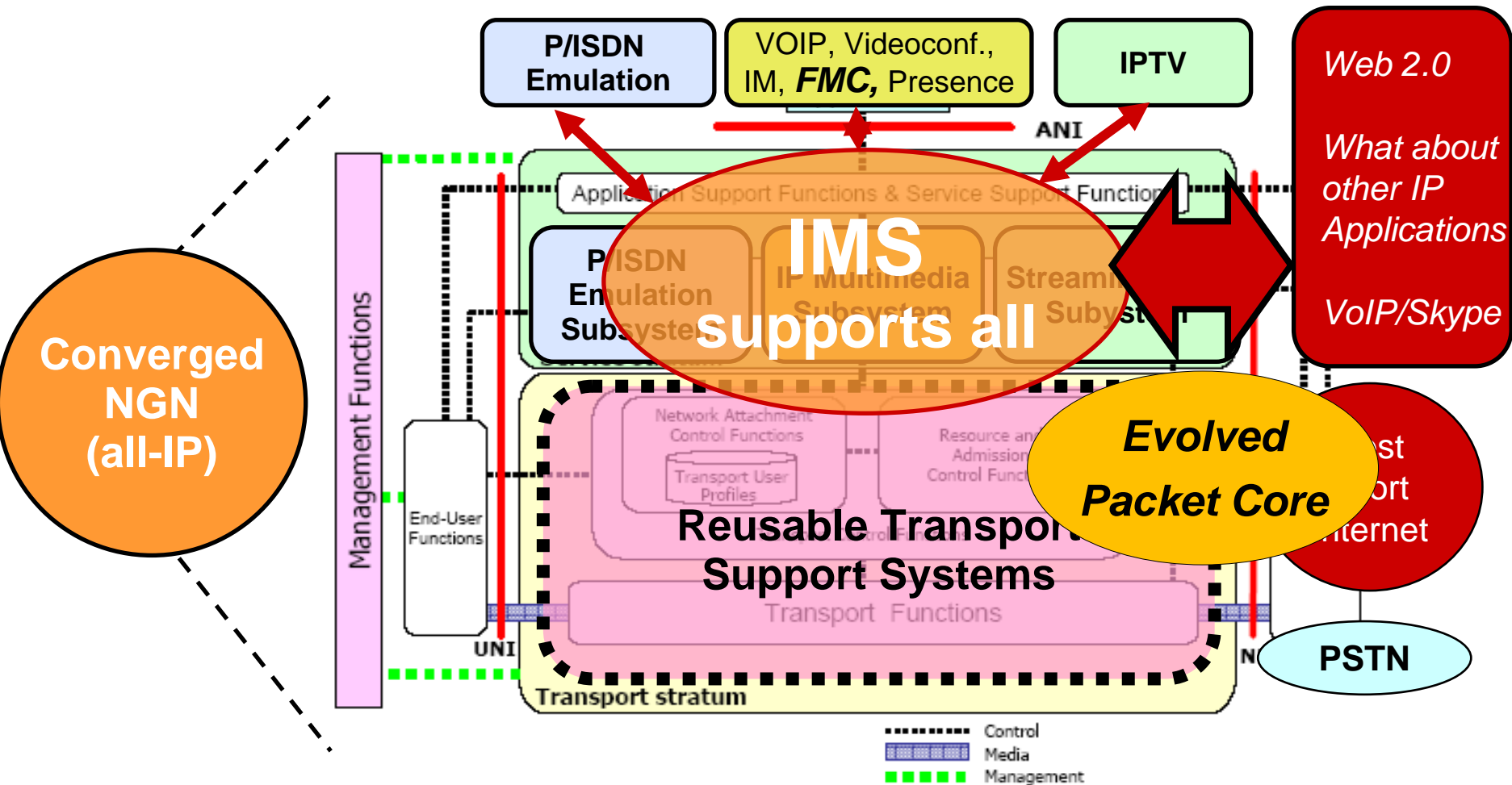


EPC Capabilities = Seamless IP Connectivity (= ABC)

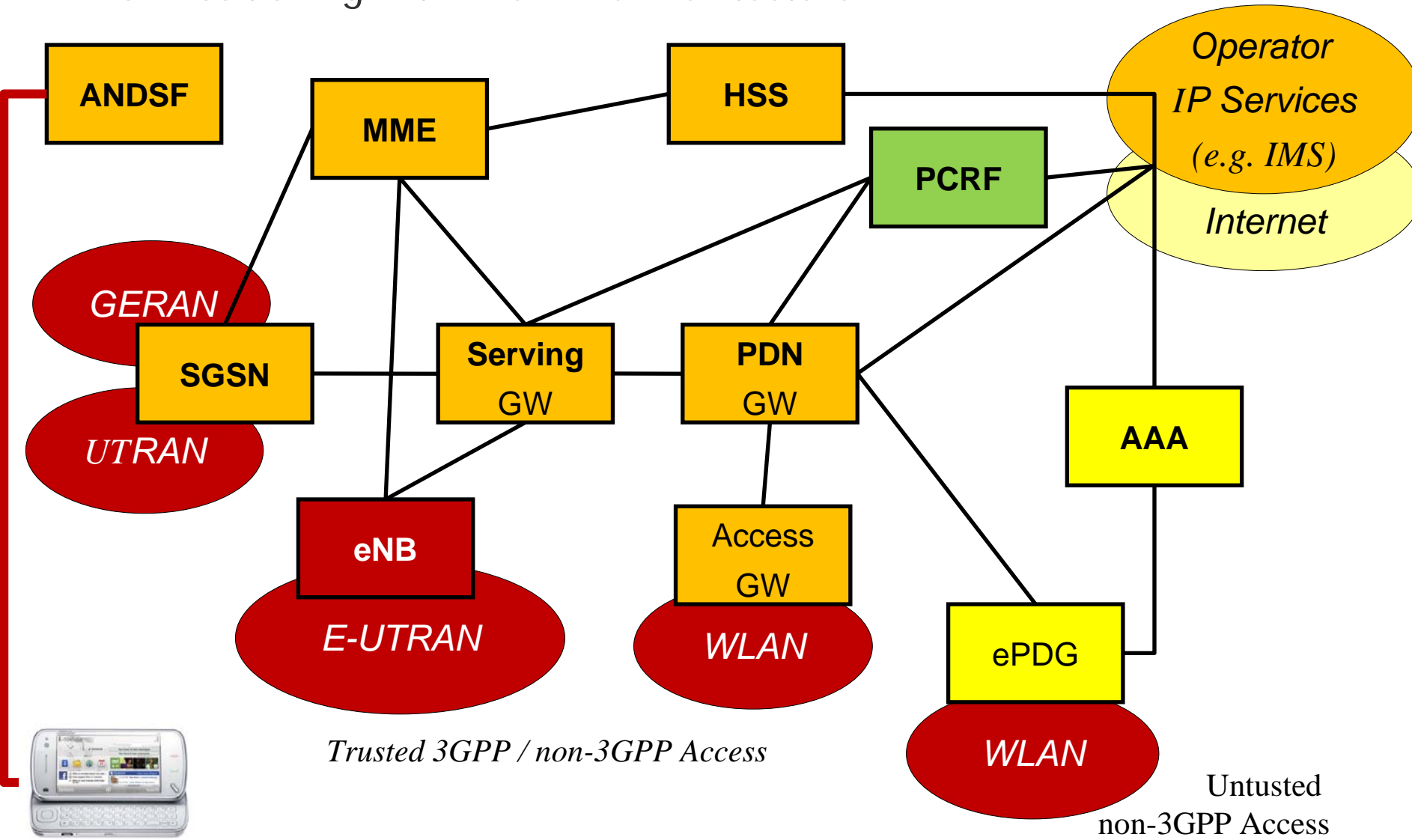
- The EPC allows multiple access networks to be connected in a controlled way (secure, QoS, seamless) to either
 - the operator IP cloud (e.g. IMS or any intranet)
 - the internet or others
- Note that the EPC provides controlled IP connectivity, in regard to
 - User authentication and authorization
 - Quality of Service and related Charging
 - Mobility Management



IMS is the common control platform within the NGN for many Application Domains



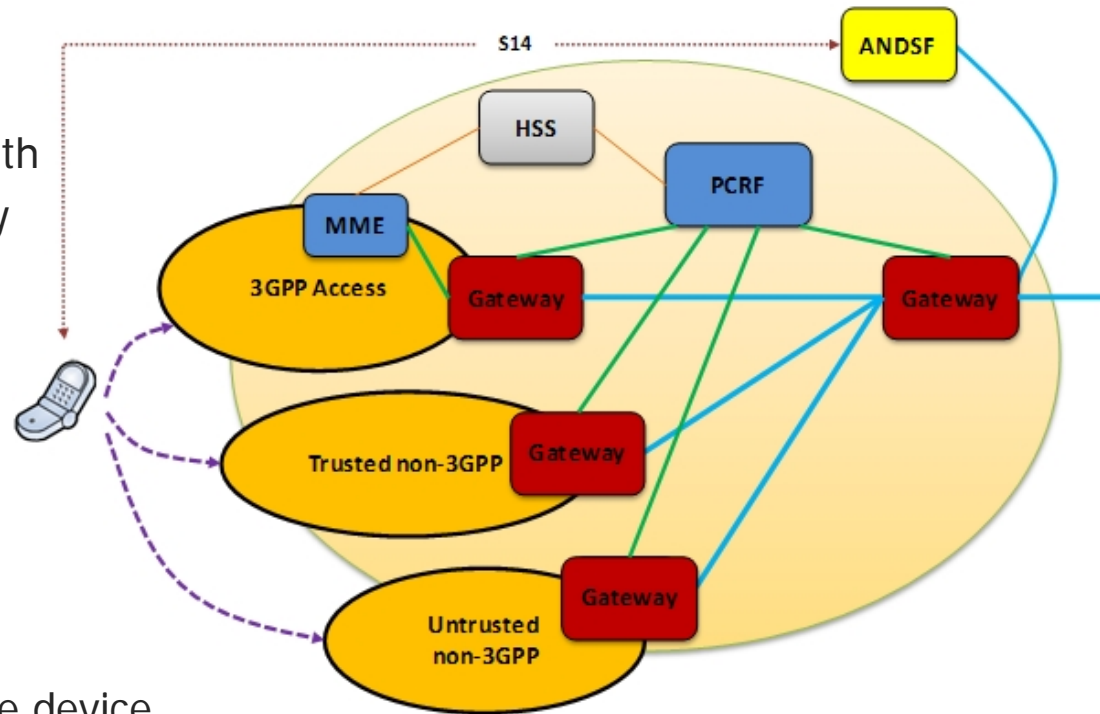
ANDSF Positioning within full EPC Architecture



3GPP Evolved Packet Core in a Nutshell

Access Network Discovery and Selection Function (ANDSF)

- Separated data and control planes
- Gateways
 - Enforce decisions on the data path
 - Maintain transparent the mobility
- Control entities – PCRF & MME
 - Policy based decisions
 - Authentication & Access Control
 - Resource reservation (QoS)
- HSS – the subscriber database
- ANDSF – the novel entity for access network discovery and selection
 - Provides indications to the mobile device
 - Information is transferred as XML data
 - Application level communication to the mobile devices
 - OMA Device Management over HTTP over TLS or other
 - No other connections to the network provider functions



Beyond ANDSF

Extensions and Further Development

- ANDSF is in an initial stage of standardization
 - Only the minimal interface to the mobile device is defined
 - Limited definition on how the ANDSF should work internally
 - No connection to other entities
 - Relies only on its own information for the decisions
 - Limited dynamic operations

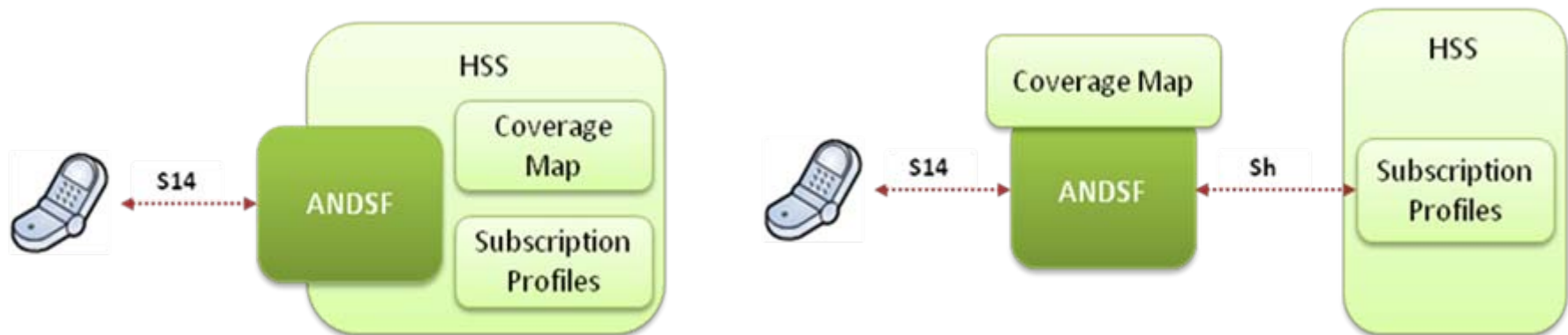
- Extensions proposed:
 - Subscription based ANDSF
 - Dynamic Access Network Discovery Information
 - ANDSF as Location Enabler
 - ANDSF for Femtocells Discovery and Selection



Beyond ANDSF (II)

Decisions based on Subscription Profiles

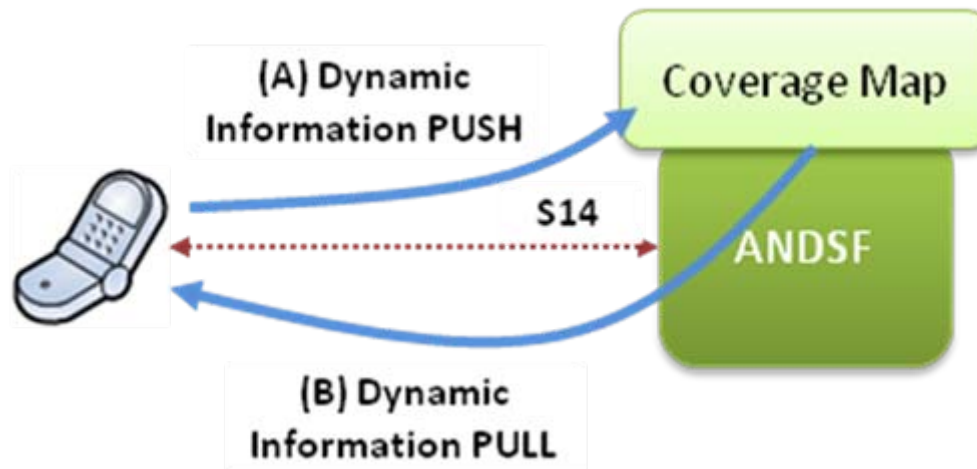
- Efficient processing oriented towards the users and their devices
 - Selection based on the access networks to which the user is allowed to connect to
 - Selection based on the device capabilities
 - ANDSF is a OMA DM enabled component
 - Reducing the information exchanged over the wireless link
 - Reducing the required processing in the mobile device



Beyond ANDSF (III)

Dynamic Discovery

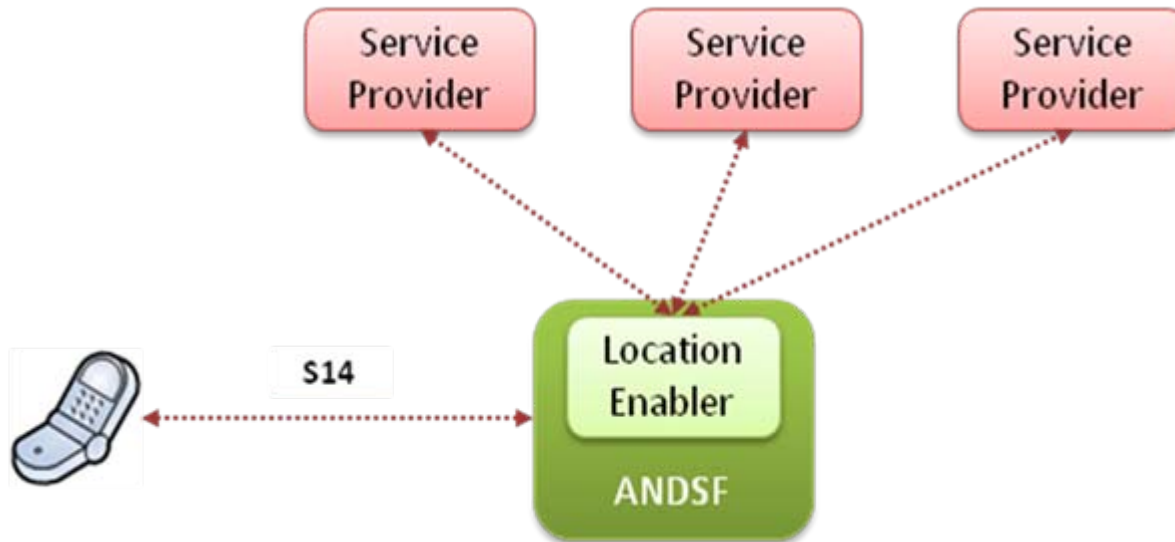
- Independence of operator provisioned accesses
 - Over-The-Top enabler for the Always Best Connected scenario
 - Access Failover immediate processing
 - No administrative operations requested
- Mobile Devices feed the Coverage Map with information on vicinity accesses
- The dynamic discovery information is transferred back to the mobile devices



Beyond ANDSF (IV)

ANDSF as Location Enabler

- Support from the Always-Best-Connected enabler towards the services
 - Mobile devices transfer to ANDSF location information
 - ANDSF can provide this information to services
 - Single location mechanism
 - Communication of ANDS requirements towards the ANDSF
 - Independence from the network operators may be obtained



Beyond ANDSF (V)

Femtocell Discovery and Selection

- Femtocells are small area cells of a wide area technology (i.e. UMTS, LTE etc.)
 - Designed to extend the available throughput in specific areas – at home premises

- In initial stages femtocells will be deployed only at the user premises
 - Discovery and selection of femto-accesses is similar to the WiFi discovery and selection
 - Limited coverage
 - Limited users – only the house-hold users
 - Fast loss of signal

- ANDSF provides the means to integrate femto-accesses for network discovery and selection
 - Integration with the wide area network increases the overhead of processing
 - The femtocells are not available for all the users!
 - For the ANDSF, the access network selection is similar to the inter-technology selections

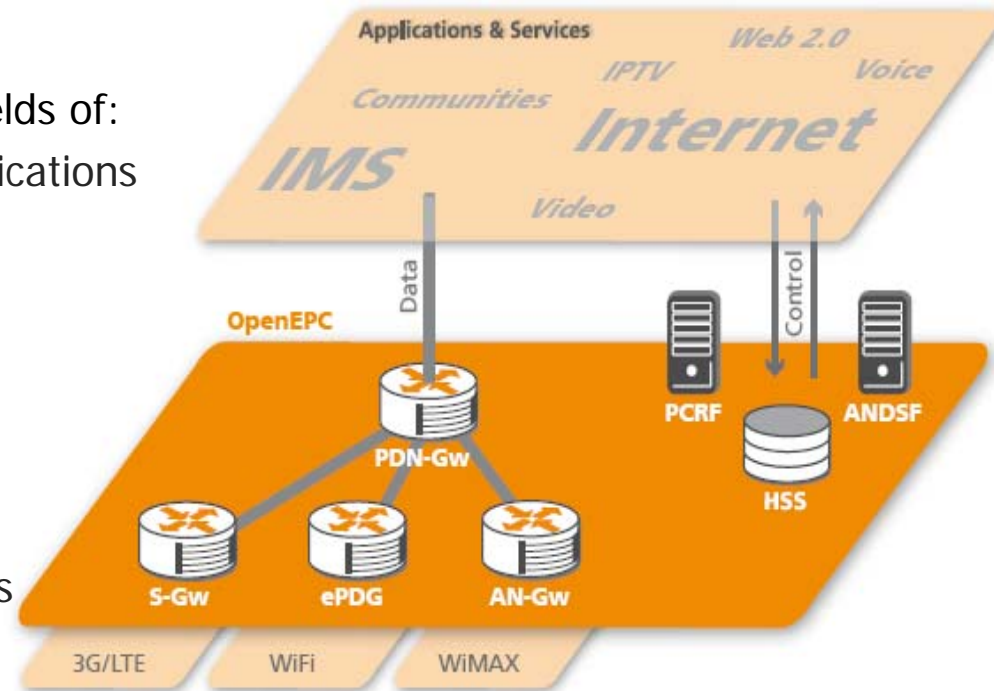


Fraunhofer FOKUS Realization - OpenEPC

The research platform for Future Mobile Communication



- OpenEPC research toolkit includes the main functionality of the 3GPP Evolved Packet Core (Release 9):
 - High performance
 - Adaptable to different deployments
 - Extensible to specific research needs
- OpenEPC can be used for R&D in the fields of:
 - QoS, Mobility, Security, Mobile Applications
- OpenEPC Rel. 1 enables:
 - Subscription based procedures for:
 - Always Best Connected scenario
 - Resource Reservation
 - Mobility Support
 - Mobile device integration
 - Integration with specific applications
- More information: www.OpenEPC.net

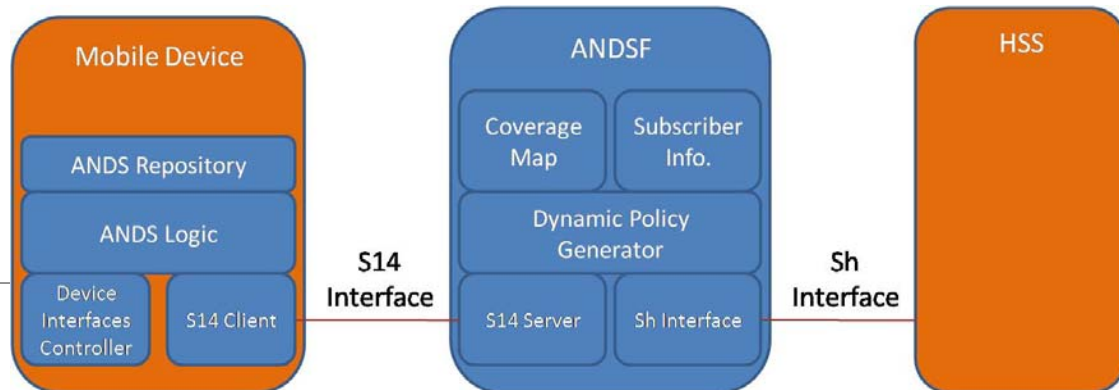




Fraunhofer FOKUS Realization – OpenEPC (II)

OpenEPC ANDSF

- ANDSF contains the following functions:
 - Coverage Map – information on the access networks available
 - Subscriber Info – maintains information on the subscribers using the NDS service
 - Sh Interface – retrieves subscription profile from the HSS
 - S14 Server – retrieves requests from the mobile devices
 - Dynamic Policy Generator – a policy engine generating specific policies based on the triggers and on the information received from the other entities
- Mobile Device Extension: small application
 - ANDS Repository – maintains the information received from ANDSF
 - Device Interface Controller – connection to the device interfaces
 - S14 Client – interface of communication with the ANDSF
 - ANDS Logic – processing logic for the policies





Fraunhofer FOKUS Realization – OpenEPC (III)

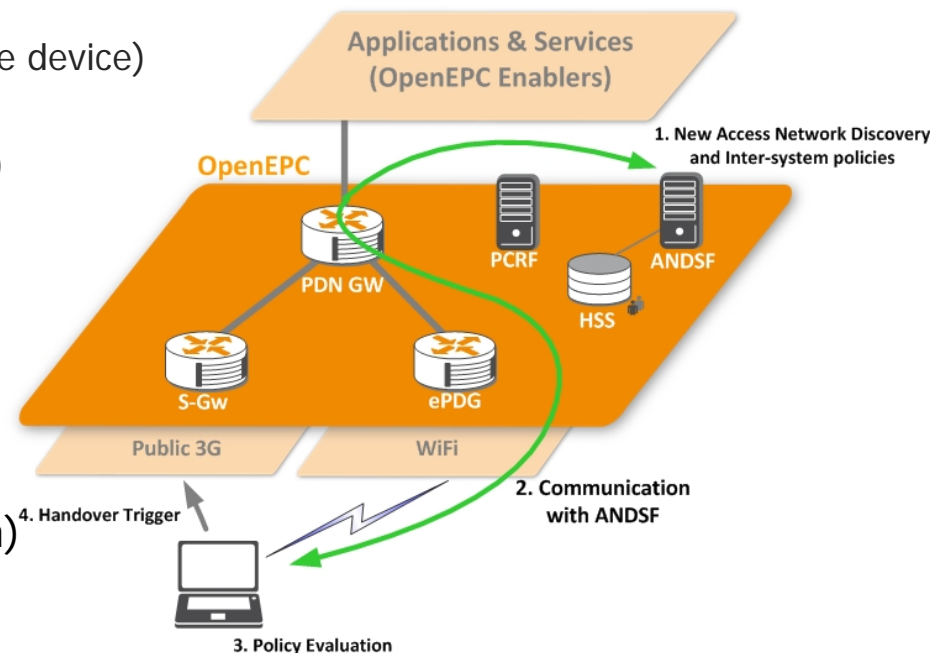
OpenEPC ANDSF Evaluation Scenario

- Operators are able to balance subscribers between access networks
- The best access network is selected for the current requirements of the mobile devices

1. New policies have to be pushed to the mobile device
 - ANDSF policy engine takes the decision based on:
 - Subscriber information
 - Location changed (received from the mobile device)
 - Coverage Map changes
 - Administrative (through the admin console)

2. OMA DM Push mode communication
3. Policy evaluation in the mobile device
4. A handover is triggered

- The procedure is independent of the actual communication (such as a different application)
- no high time constraints are considered
- no influence on the seamless handovers



OpenEPC

R&D Topics



- Goal is to **cover the entire technology spectrum for communication for vertically integrated research in the area of future mobile seamless communication** from mobile devices to applications

Network Support for Future Mobile Applications

- Mobile Cloud Computing
- Remote management of smart home environment
- M2M communication / sensor network integration
- Ambient Aware Applications /Future Internet Network Enablers



Mobility Management

- Harmonization of mobility layers
- Scalability of Next Gen Mobile Networks
- Multi-access and IP flow mobility
- Traffic steering
- Optimized Access Network Discovery and Selection
- Mobile device support for mobility

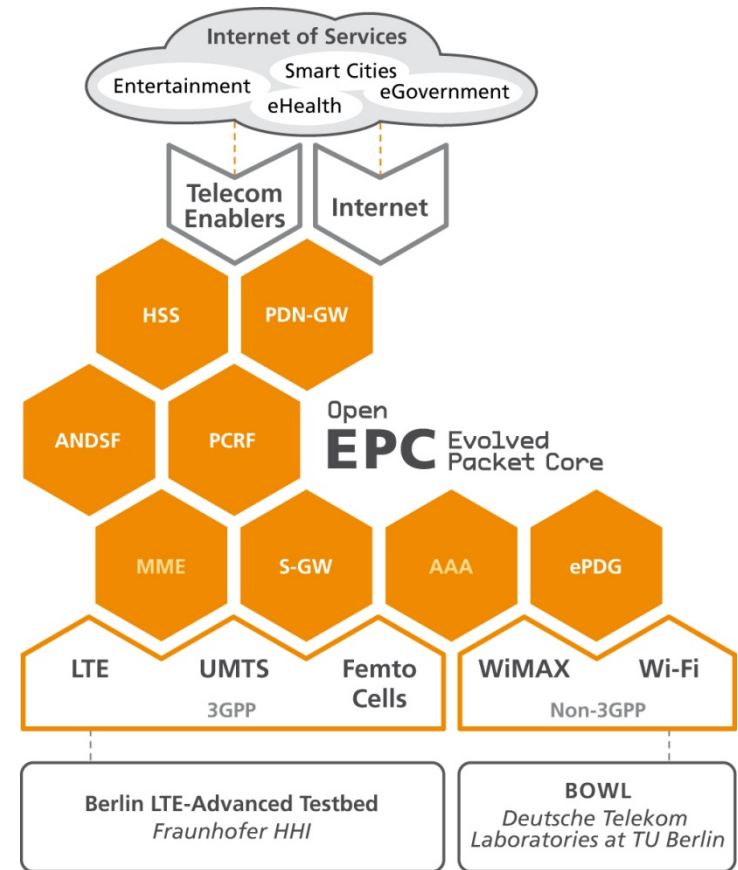
Resource Management & Security

- Convergence for fixed and mobile QoS and AAA topics
- Packet classification mechanisms
- Evolution of PCC & QoS support for all-IP data services
- Aspects of Femtocell integration to EPC

Related Testbed

Future Seamless Communications (FUSECO) Playground

- State of the art testbed infrastructure as a cooperation of Berlin's Next Generation Mobile Network expertise for
 - **EPC** from Fraunhofer FOKUS
 - **LTE-Advanced** at the Fraunhofer HHI
 - **WLAN** Networks at the Berlin Open Wireless Network from the Dt. Telekom Labs @ TU Berlin
- Enabling to prototype application support for
 - handover optimization across heterogeneous networks
 - support for Always Best Connected (ABC)
 - subscriber profile based service personalization
 - QoS provisioning and related charging
 - controlled access to IMS based services
 - controlled access to Internet/Mobile Clouds
- More information: www.fuseco-playground.org



Conclusions

- Access Network Discovery and Selection is an open research issue for future mass mobile broadband communication
- A set of extension concepts can be considered as to optimize the usage of the network
 - Subscriber information based decisions
 - Dynamic discovery
 - Location enabler for applications for ANDSF
 - Femto-access discovery and selection
- Fraunhofer FOKUS OpenEPC toolkit enables the research in the area of mass mobile broadband communication
 - Includes access network discovery and selection functionality
- OpenEPC ANDSF contains the 3GPP standard features + the Subscriber information based decisions
 - OpenEPC ANDSF is the foundation for further research in the area of access network discovery and selection
- OpenEPC ANDSF was evaluated through an Always Best Connected scenario
 - No implications on the active communication of the mobile devices was perceived



Coming up

1st FOKUS FUSECO Forum

Right after ICIN in Berlin



- ***„Business and Technical Challenges of Seamless Service Provision in Converging Next Generation Fixed and Mobile Networks“***
- **Follow up of famous FOKUS IMS Workshop Series**
- **Event date: October 14-15, 2010**
 - **Day One: LTE and EPC Tutorials and FUSECO Playground Demos**
 - **Day Two: Interactive Workshop with Operator Talks and Vendor Panel**
- **More at: www.FUSECO-Forum.org**



Coming up

IEEE Globecom FUSECO Workshop



Friday, 10 December
Miami, Florida

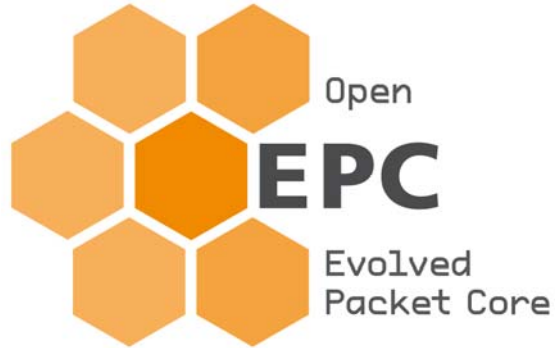
IEEE Globecom 2010 FUSECO Workshop

Future Seamless Communication: Packet Core Evolution
and Seamless Multimedia Application Platforms

- Follow up of Globecom 2009 NGMN/EPC Business Developing Forum
- Paper Submission due: July 2, 2010
- Conference date: December 10, 2010
- More at www.FUSECO-workshop.org



Questions ???



www.OpenEPC.net



www.FUSECO-Playground.org

Recent Publications

- Corici M., Magedanz T., Vingarzan D., Weik P., „*Enabling Ambient Aware Service Delivery in Heterogeneous Wireless Environments*“, IEEE Globecom 2010 - Communications Software, Services and Multimedia Applications Symposium - Next Generation Services and Service Platforms, 6-10 Dec. 2010, Miami, USA, accepted for publication
- Corici M., Magedanz T., Vingarzan D., Pampu C., Zhou Q., „*Access Network Reselection based on Momentary Resources in a Converged Wireless Environment*“, IEEE Globecom 2010 - Next Generation Networking Symposium - IEEE Globecom 2010 - Next Generation Networking Symposium, 6-10 Dec. 2010, Miami, USA, accepted for publication
- Corici M., Magedanz T., Vingarzan D., Weik P., „*Prototyping Mobile Broadband Applications with the Open Evolved Packet Core*“, 2010 14th International Conference on Intelligence in Next Generation Networks (ICIN) - Weaving Applications into the Network Fabric, 11-14 Oct. 2010, Berlin, Germany, accepted for publication
- Corici M., Magedanz T., Vingarzan D., Pampu C., Zhou Q., „*Proactive Vertical Handover Optimizations in the 3GPP Evolved Packet Core*“, Second International ICST Conference on Mobile Networks and Management, 22-24 Sep. 2010, Santander, Spain, accepted for publication
- Corici M., Magedanz T., Vingarzan D., „*3GPP Evolved Packet Core – the Next Generation Mobile Networks all-IP architecture*“, World Telecommunications Congress 2010, Vienna, Austria, accepted for publication
- Corici M., Fiedler J., Magedanz T., Vingarzan D., „*Access Network Discovery and Selection in the Next Generation Mobile Networks Environment*“, in Proceedings of Mobilware 2010, The Third International ICST Conference on MOBILE Wireless MiddleWARE, Operating Systems, and Applications, Chicago, USA.
- Corici M., Gouveia F., Magedanz T., Vingarzan D., „*OpenEPC: A Technical Infrastructure for Early Prototyping of Next Generation Mobile Network Testbeds*“, in Proceedings of TRIDENTCOM 2010, 6th International Conference on Testbeds and Research Infrastructures for the Development of Networks and Communities, Berlin, Germany.

