SHARING

SELF-ORGANIZED HETEROGENEOUS ADVANCED RADIO NETWORKS GENERATION

Deliverable D6.1

Progress on overall architecture issues

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Abstract:

This study aims at assessing the impact of the innovations considered in the project on the network architecture. For this purpose the UMTS and LTE networks are considered along with their corresponding O&M system architecture. Both functional and organic network architecture are considered to be potentially impacted by the innovations.

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Version	Date	Author	Summary of main changes
0.1	30/09/2014	Serban Purge (Orange)	Initial version

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EXECUTIVE SUMMARY

The main goal of the project is defining and designing features aiming at improving the performances and user experience in heterogeneous networks. Along with the benefits brought by these features, also called innovations in the scope of the project, comes the impact of these features on the network architecture.

The goal of this study is to assess the impact of the project’s innovations on UMTS and LTE functional and organic network architectures.

By definition the Functional Architecture (FA) defines the logical nodes of a network, the set of functions for each node and the interfaces with the associated protocol stacks that interconnect the logical nodes.

The Organic Architecture (OA) defines how the logical nodes are mapped into physical network nodes. It also defines how the logical interfaces are mapped on physical links and which are the requirements in terms of e.g. latency, bandwidth or jitter that the physical links have to meet for the support of the logical interfaces. It also defines the overall network requirements such as synchronization support for example

In the scope of this study, we identified the following impact a feature may have on the functional or organic network architecture.

FA: New logical node(s): new nodes are required in the functional architecture.

FA: New logical interface(s): new interfaces with the corresponding protocols are required in the functional architecture.

FA: New function(s) in existing node(s): new functions are required in the existing nodes of the logical architecture.

FA: New signalling on existing interface(s): New messages exchanges are required for the existing protocols of the functional architecture interfaces.

OA: Synch network support: in order to work properly the innovation requires synchronization in the network.

OA: Low latency support: the innovation is time sensitive and requires a low latency in order to work properly.

OA: High bandwidth support: the innovation is bandwidth sensitive and requires a high bandwidth capacity links in order to work properly.

This study highlights that the most impacted area is the LTE network architecture.From the entire set of requirements that we identified in this area 32% can be considered with “high” impact on the functional architecture (FA: New logical node(s), 23.81% and FA: New logical interface(s), 7.94%) and 53.97% can be considered with medium impact on the functional architecture (FA: New function(s) in existing node(s), 38.10% and FA: New signaling on existing interface(s), 15.87%).

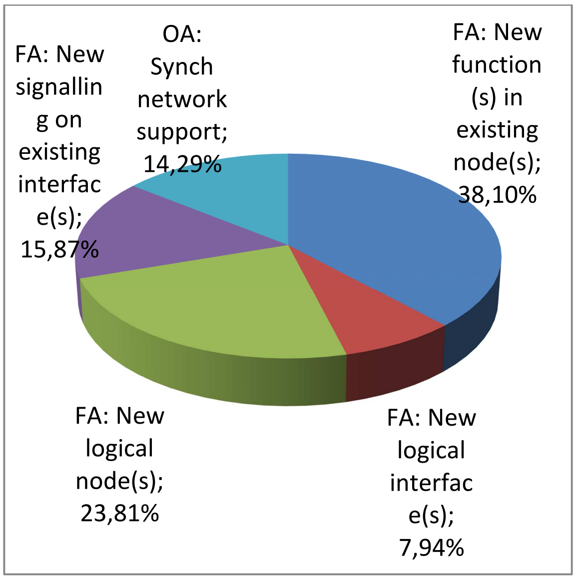

Figure 1: SHARING project's innovations' impact on LTE network architecture

The remaining part of the identified impacts concerns the organic architecture of LTE networks for which the only requirement that has been identified is the support for network synchronization.

1 Introduction

The main goal of the project is defining and designing features aiming at improving the performance and user experience in heterogeneous networks. Along with the benefits brought by these features, also called innovations in the scope of the project, comes the impact of these features on the network architecture.

The goal of this study is to assess the impact of the project's innovations on UMTS and LTE network architectures.

UTRAN logical architecture and UTRAN logical architecture for Home Node B (HNB) support which are considered in the project are presented in Figure 2 and Figure 3 below.

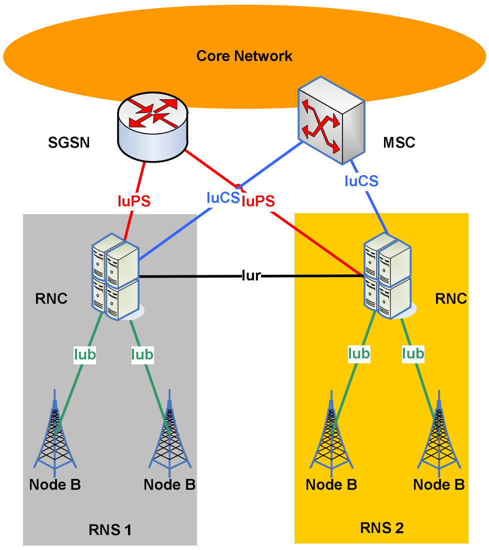

Figure 2: UTRAN Architecture

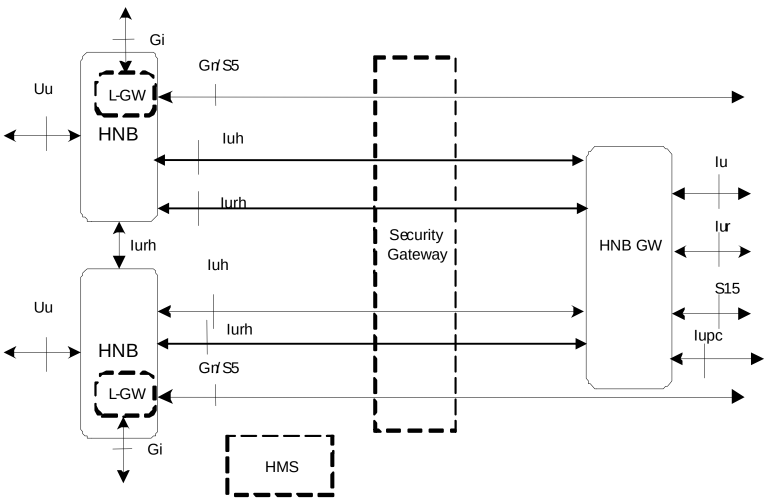

Figure 3: UTRAN Architecture for HNB (3GPP TS 25.467-c20) [1]

For LTE, we consider the EUTRAN architecture presented in Figure 4 and the EUTRAN architecture forHome eNode B (HeNB) support presented in Figure 5.

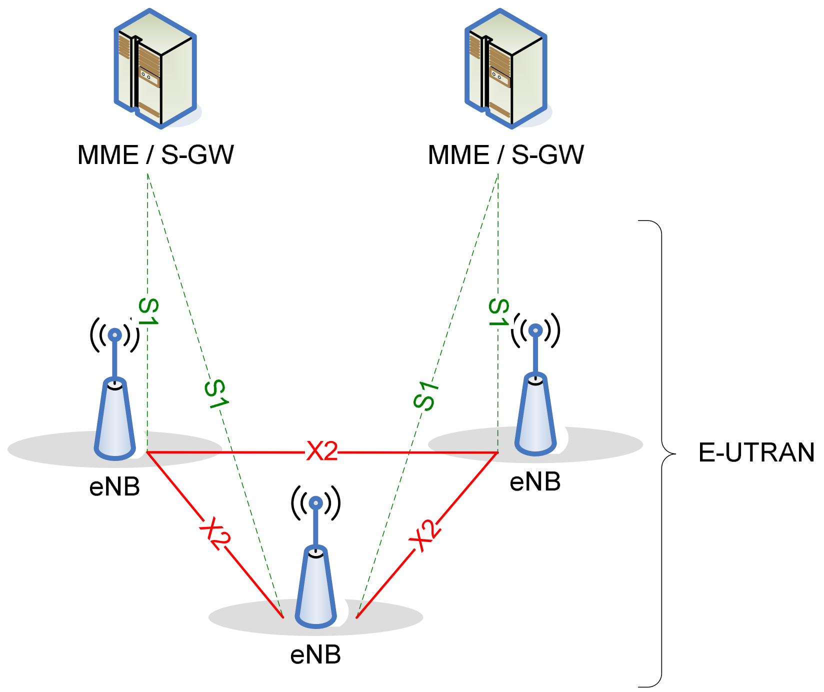

Figure 4: EUTRAN Architecture (3GPP TS36.300-C30) [2]

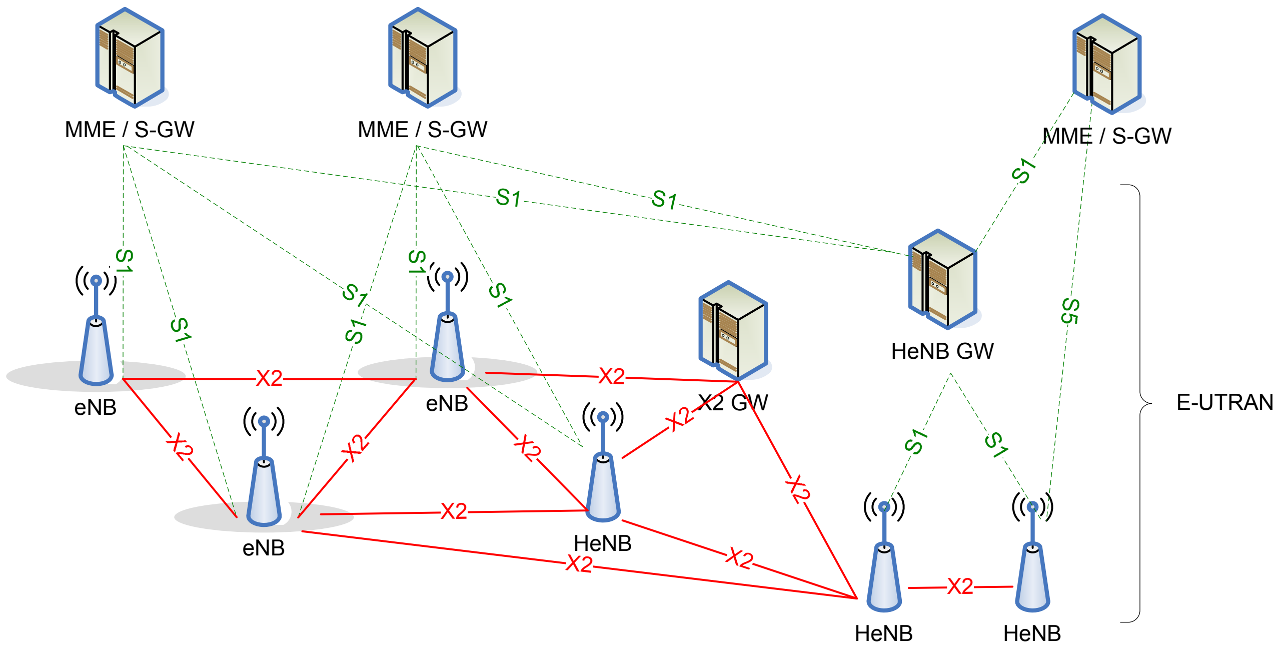

Figure 5: EUTRAN Architecture for HeNB (3GPP TS36.300-C30) [2]

Along with the (E)UTRAN architectures presented above we also consider the Operation and Maintenance (O&M) system architecture for UMTS and LTE. In both cases, the O&M part of the network architecture comes as an over layer architecture consisting of two layers. The Element Management System (EMS) layer has the role of managing the equipment in the RAN which is connected via the southbound interface. The Network Management System (NMS) regroups the network management functions and it is connected to the EMS layer via the northbound interface as presented in the Figure 6.

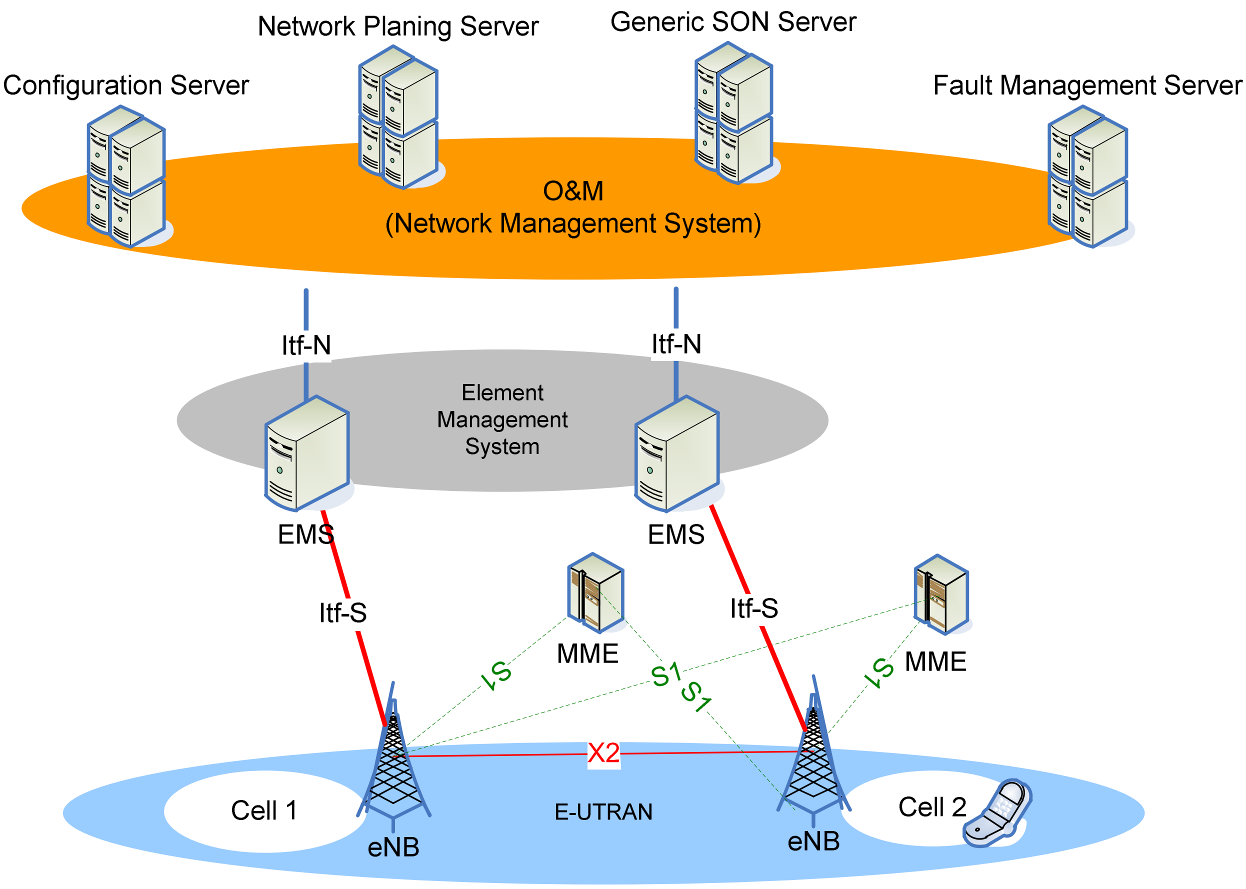

Figure 6 O&M architecture for Radio Access Networks

2 INNOVATIONS IMPACT ON NETWORK ARCHITECTURE

When assessing the impact an innovation may have on network architecture we have to make the distinction between the functional or logical network architecture and the organic network architecture.

By definition the functional architecture defined the logical nodes of a network, the set of functions for each node and the interfaces with the associated protocol stacks that interconnect the logical nodes.

The organic network architecture defines how the logical nodes are mapped into physical network nodes. It also defines how the logical interfaces are mapped on physical links and which are the requirements in terms of e.g. latency, bandwidth or jitter that the physical links have to meet for the support of the logical interfaces. It also defines the overall network requirements such as synchronization support for example.

In the scope of this study, we identified the following impact a feature may have on the functional or organic network architecture.

FA: New logical node(s): new nodes are required in the functional architecture

FA: New logical interface(s): new interfaces with the corresponding protocols are required in the functional architecture

FA: New function(s) in existing node(s): new functions are required in the existing nodes of the logical architecture

FA: New signalling on existing interface(s): New messages are required for the existing protocols of the functional architecture interfaces.

OA: Synch network support: in order to work properly the innovation requires synchronization in the network

OA: Low latency support: the innovation is time sensitive and requires a low latency in order to work properly

OA: High bandwidth support: the innovation is bandwidth sensitive and requires a high bandwidth capacity links in order to work properly

The aforementioned impacts are applicable for LTE, UMTS and their corresponding O&M systems. For the sake of clarity, we decided to highlight the area of impact as follows:

- FA: New logical node(s) – impact on the functional architecture of LTE.
- FA (UMTS/HSPA): New logical node(s) - impact on the functional architecture of UMTS / HSPA.
- FA (EMS/NMS): New logical node(s) - impact on the functional architecture of EMS/NMS.

2.1 Overview of Innovations' network architecture impact

As part of the cross work packages work the list of project innovations with their description was built so that to enable the contributors to work package 6 to assess the impact of the innovations on the network architecture. This list is presented in Table 1 below.

WP	Company	Innovation Name
WP3	CEA-LETI	DL CoMP with interference rejection at the receiver
WP3	CEA-LETI	Joint Interference and location prediction
WP3	EUR	Interference alignment with incomplete CSIT

WP3	EUR	JP-CoMP with Limited Backhaul
WP3	EUR	Spatial CSIT Allocation for JP-CoMP Schemes
WP3	EUR	Topological interference management with transmitter cooperation
WP3	FT	Broadcast Channel Feedback in Cooperated Multiple Antenna Systems
WP3	FT	Cross-layer performance evaluation of CoMP
WP3	FT	Link adaptation and scheduling for turbo-CWIC receivers
WP3	FT	Multipoint Coordination Schemes for LTE-Advanced Networks
WP3	SEQ	Enhanced Spatial Modulation Schemes
WP3	SEQ	Interference Cancellation within Imperfect Channel Information in LTE DL Transmission
WP3	SUP	Relay aided interference Mitigation
WP3	SUP	Secure Communication with imperfect CSI
WP3	TCS	Interference cancellation at the receiver and advanced transceivers
WP3	TCS	Transmitter-side Solutions to Suppress or Avoid Interference with Advanced MIMO Schemes
WP4	AVEA	Seamless Offloading in HetNets
WP4	ERICSSON	HS combined cell
WP4	ERICSSON	Re-activation of a sleeping cell
WP4	ERICSSON	UL/DL separation
WP4	FT	Antenna tilt optimization for interference management in LTE-A HetNets
WP4	FT	Capacity optimization through Active Antenna Systems (AAS) in LTE macro cell networks
WP4	FT	Enhanced Inter-Cell Interference Co-ordination (eICIC) for interference management in LTE-A HetNets
WP4	FT	Load Balancing (LB) via transmit power optimization in LTE macro cell networks
WP4	FT	Mobility Load Balancing (MLB) in LTE macro cell networks

WP4	FT	Performance and energy efficiency evaluation in LTE Heterogeneous Networks via virtual small cells
WP4	MERCE	Centralized techniques for ON/OFF energy saving in HetNet campus scenario
WP4	MERCE	Coordinated carrier aggregation in campus of home base stations
WP4	MERCE	Decentralized techniques for base station power setting in HetNet campus scenario
WP4	MERCE	Distributed synchronization algorithm based on over-the-air signalling transmission for HetNets
WP4	MERCE	Distributed techniques for coverage control in HetNet campus scenario
WP4	MERCE	Ellispoid techniques for coverage control in HetNet campus scenario
WP4	SUP	Asymptotic/fundamental limits
WP4	SUP	Distributed RRM
WP4	TTI	Conversion Block
WP4	TTI	Dynamic cell ON/OFF switching
WP4	UOULU	Coordination based enhanced mobility
WP4	UOULU	Multiflow carrier aggregation
WP4	UOULU	Opportunistic switch on/off
WP4	UOULU	UL/DL optimization
WP5	CEA-LETI	Joint Channel and Network LDPC coding
WP5	EUR	Coding and collaborative scheduling for multiple-relays
WP5	FT	LTE Central Scheduling
WP5	NTUK	LTE resource reuse for D2D communication
WP5	TCS	Inter-Cluster Comm
WP6	ECE	Antenna Smart Grid Solutions for Outdoor DAS (Distributed Antenna Systems)
WP6	ECE	Extension of Performance Evolution for Femto -> Small Cells
WP6	Magister	GMDT Control Plane Solution
WP6	Magister	GMDT User Plane Solution

Table 1: List of innovations considered in the study

The results of the assessment of innovations' impact on the network architecture are presented in below

Row Labels	Count of Impact
FA (EMS/NMS) : New signalling on existing interface(s)	6,17%
FA (EMS/NMS): New function(s) in existing node(s)	6,17%
FA (EMS/NMS): New logical interface(s)	2,47%
FA (EMS/NMS): New logical node(s)	2,47%
FA (UMTS/HSPA) : New signalling on existing interface(s)	1,23%
FA (UMTS/HSPA): New function(s) in existing node(s)	2,47%
FA: New function(s) in existing node(s)	29,63%
FA: New logical interface(s)	6,17%
FA: New logical node(s)	18,52%
FA: New signalling on existing interface(s)	12,35%
OA (UMTS/HSPA): Synch network support	1,23%
OA: Synch network support	11,11%
Grand Total	**100,00%**

Table 2: Innovations' impact on network architecture

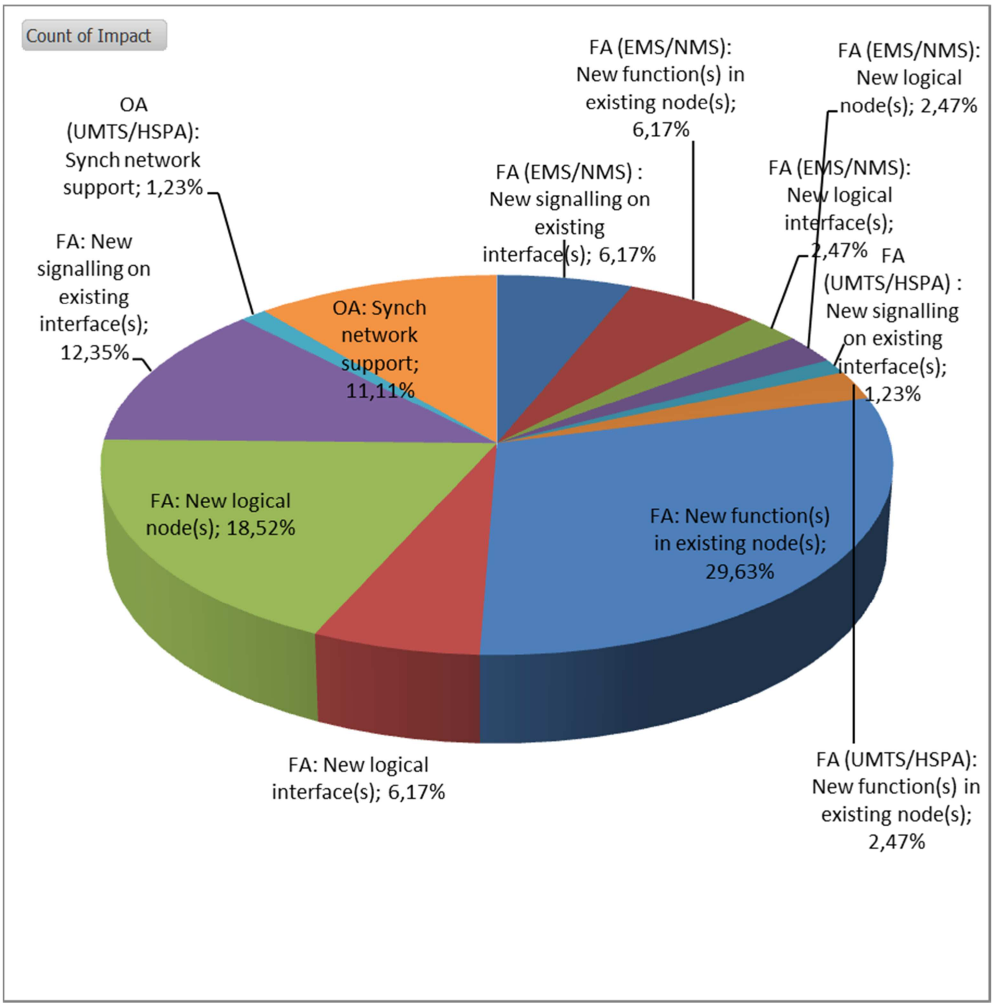

Figure 7: Innovations' impact on network architecture

One can see from Figure 7 that the top leading impacts on the network architecture from the project's innovations FA: New signaling on existing interface(s) are: FA: New function(s) in existing node(s) (29.63%), FA: New logical node(s) (18.52%), FA: New signaling on existing interface(s) (12.35%) and OA: Synch network support (11.11%).

2.2 Impact on LTE functional and organic architecture

As presented in the previous section LTE network architecture is an area of high impact for SHARING innovations. The most common impact is the requirement of a new function in one of the existing nodes followed by the requirement for a new node in the functional architecture as presented in Table 3.

Row Labels	Count of Impact
FA: New function(s) in existing node(s)	38,10%
FA: New logical interface(s)	7,94%
FA: New logical node(s)	23,81%
FA: New signalling on existing interface(s)	15,87%
OA: Synch network support	14,29%
Grand Total	**100,00%**

Table 3: Innovations' impact on LTE network architecture

As far as the organic architecture is concerned, Figure 8 shows that only the support for a synchronized network is required by the project innovations.

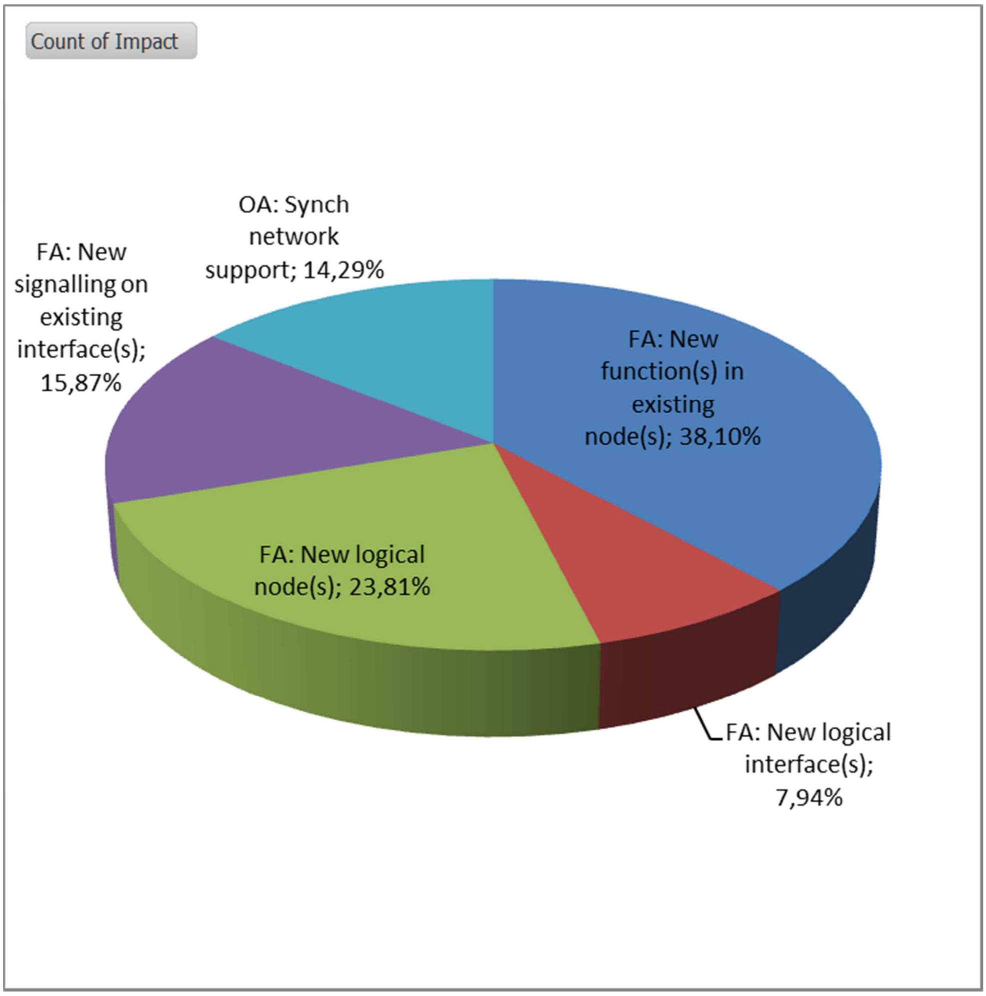

Figure 8: Innovations' impact on LTE network architecture

Table 4 gives the detailed list of features impacting the LTE network architecture with their corresponding impact.

WP	Company	Innovation Name	Impact Type
WP 3	CEA-LETI	DL CoMP with interference rejection at the receiver	FA: New function(s) in existing node(s)
WP 3	CEA-LETI	Joint Interference and location prediction	FA: New function(s) in existing node(s)
WP 3	EUR	JP-CoMP with Limited Backhaul	FA: New function(s) in existing node(s)
WP 3	SUP	Relay aided interference Mitigation	FA: New function(s) in existing node(s)
WP 3	SUP	Secure Communication with imperfect CSI	FA: New function(s) in existing node(s)
WP 3	TCS	Interference cancellation at the receiver and advanced transceivers	FA: New function(s) in existing node(s)

WP 3	TCS	Transmitter-side Solutions to Suppress or Avoid Interference with Advanced MIMO Schemes	FA: New function(s) in existing node(s)
WP 4	ERICSSON	UL/DL separation	FA: New function(s) in existing node(s)
WP 4	FT	Performance and energy efficiency evaluation in LTE Heterogeneous Networks via virtual small cells	FA: New function(s) in existing node(s)
WP 4	MERCE	Centralized techniques for ON/OFF energy saving in HetNet campus scenario	FA: New function(s) in existing node(s)
WP 4	MERCE	Coordinated carrier aggregation in campus of home base stations	FA: New function(s) in existing node(s)
WP 4	MERCE	Decentralized techniques for base station power setting in HetNet campus scenario	FA: New function(s) in existing node(s)
WP 4	MERCE	Distributed synchronization algorithm based on over-the-air signalling transmission for HetNets	FA: New function(s) in existing node(s)
WP 4	MERCE	Distributed techniques for coverage control in HetNet campus scenario	FA: New function(s) in existing node(s)
WP 4	MERCE	Ellispoid techniques for coverage control in HetNet campus scenario	FA: New function(s) in existing node(s)
WP 4	SUP	Distributed RRM	FA: New function(s) in existing node(s)
WP 4	TTI	Dynamic cell ON/OFF switching	FA: New function(s) in existing node(s)
WP 4	UOULU	Coordination based enhanced mobility	FA: New function(s) in existing node(s)
WP 4	UOULU	Opportunistic switch on/off	FA: New function(s) in existing node(s)
WP 4	UOULU	UL/DL optimization	FA: New function(s) in existing node(s)
WP 4	UOULU	UL/DL optimization	FA: New function(s) in existing node(s)
WP 5	CEA-LETI	Joint Channel and Network LDPC coding	FA: New function(s) in existing node(s)
WP 5	FT	LTE Central Scheduling	FA: New function(s) in existing node(s)

WP 5	NTUK	LTE resource reuse for D2D communication	FA: New function(s) in existing node(s)
WP 3	FT	Broadcast Channel Feedback in Cooperated Multiple Antenna Systems	FA: New logical interface(s)
WP 3	FT	Cross-layer performance evaluation of CoMP	FA: New logical interface(s)
WP 3	FT	Link adaptation and scheduling for turbo-CWIC receivers	FA: New logical interface(s)
WP 3	FT	Multipoint Coordination Schemes for LTE-Advanced Networks	FA: New logical interface(s)
WP 5	FT	LTE Central Scheduling	FA: New logical interface(s)
WP 3	FT	Broadcast Channel Feedback in Cooperated Multiple Antenna Systems	FA: New logical node(s)
WP 3	FT	Cross-layer performance evaluation of CoMP	FA: New logical node(s)
WP 3	FT	Link adaptation and scheduling for turbo-CWIC receivers	FA: New logical node(s)
WP 3	FT	Multipoint Coordination Schemes for LTE-Advanced Networks	FA: New logical node(s)
WP 4	ERICSSON	Re-activation of a sleeping cell	FA: New logical node(s)
WP 4	MERCE	Centralized techniques for ON/OFF energy saving in HetNet campus scenario	FA: New logical node(s)
WP 4	MERCE	Coordinated carrier aggregation in campus of home base stations	FA: New logical node(s)
WP 4	MERCE	Ellispoid techniques for coverage control in HetNet campus scenario	FA: New logical node(s)
WP 4	SUP	Asymptotic/fundamental limits	FA: New logical node(s)
WP 4	TTI	Conversion Block	FA: New logical node(s)
WP 4	TTI	Dynamic cell ON/OFF switching	FA: New logical node(s)

WP 4	UOULU	Coordination based enhanced mobility	FA: New logical node(s)
WP 4	UOULU	Multiflow carrier aggregation	FA: New logical node(s)
WP 5	EUR	Coding and collaborative scheduling for multiple-relays	FA: New logical node(s)
WP 5	TCS	Inter-Cluster Comm	FA: New logical node(s)
WP 3	CEA-LETI	DL CoMP with interference rejection at the receiver	FA: New signalling on existing interface(s)
WP 3	CEA-LETI	Joint Interference and location prediction	FA: New signalling on existing interface(s)
WP 3	SUP	Relay aided interference Mitigation	FA: New signalling on existing interface(s)
WP 3	SUP	Secure Communication with imperfect CSI	FA: New signalling on existing interface(s)
WP 4	MERCE	Decentralized techniques for base station power setting in HetNet campus scenario	FA: New signalling on existing interface(s)
WP 4	MERCE	Distributed synchronization algorithm based on over-the-air signalling transmission for HetNets	FA: New signalling on existing interface(s)
WP 4	MERCE	Distributed techniques for coverage control in HetNet campus scenario	FA: New signalling on existing interface(s)
WP 4	UOULU	Opportunistic switch on/off	FA: New signalling on existing interface(s)
WP 5	CEA-LETI	Joint Channel and Network LDPC coding	FA: New signalling on existing interface(s)
WP 5	NTUK	LTE resource reuse for D2D communication	FA: New signalling on existing interface(s)
WP 3	CEA-LETI	DL CoMP with interference rejection at the receiver	OA: Synch network support
WP 3	EUR	JP-CoMP with Limited Backhaul	OA: Synch network support
WP 3	FT	Broadcast Channel Feedback in Cooperated Multiple Antenna Systems	OA: Synch network support

WP 3	FT	Cross-layer performance evaluation of CoMP	OA: Synch network support
WP 3	FT	Link adaptation and scheduling for turbo-CWIC receivers	OA: Synch network support
WP 3	FT	Multipoint Coordination Schemes for LTE-Advanced Networks	OA: Synch network support
WP 3	SUP	Relay aided interference Mitigation	OA: Synch network support
WP 3	SUP	Secure Communication with imperfect CSI	OA: Synch network support
WP 5	TCS	Inter-Cluster Comm	OA: Synch network support

Table 4: List of innovations impacting the LTE network architecture

2.3 Impact on UMTS functional and organic architecture

For the UMTS/HSPA functional architecture the impact of project's innovations is quite limited to the features requiring only the deployment of new functions in the existing nodes or new signalling on the existing interfaces. So to say that no new nodes or new interfaces are required for the support of the innovations.

Row Labels	Count of Impact
FA (UMTS/HSPA) : New signalling on existing interface(s)	25,00%
FA (UMTS/HSPA): New function(s) in existing node(s)	50,00%
OA (UMTS/HSPA): Synch network support	25,00%
Grand Total	**100,00%**

Table 5: Innovations' impact on UMTS/HSPA network architecture

As far as the organic architecture is concerned the only impact implied by the innovations is the support for a synchronized network.

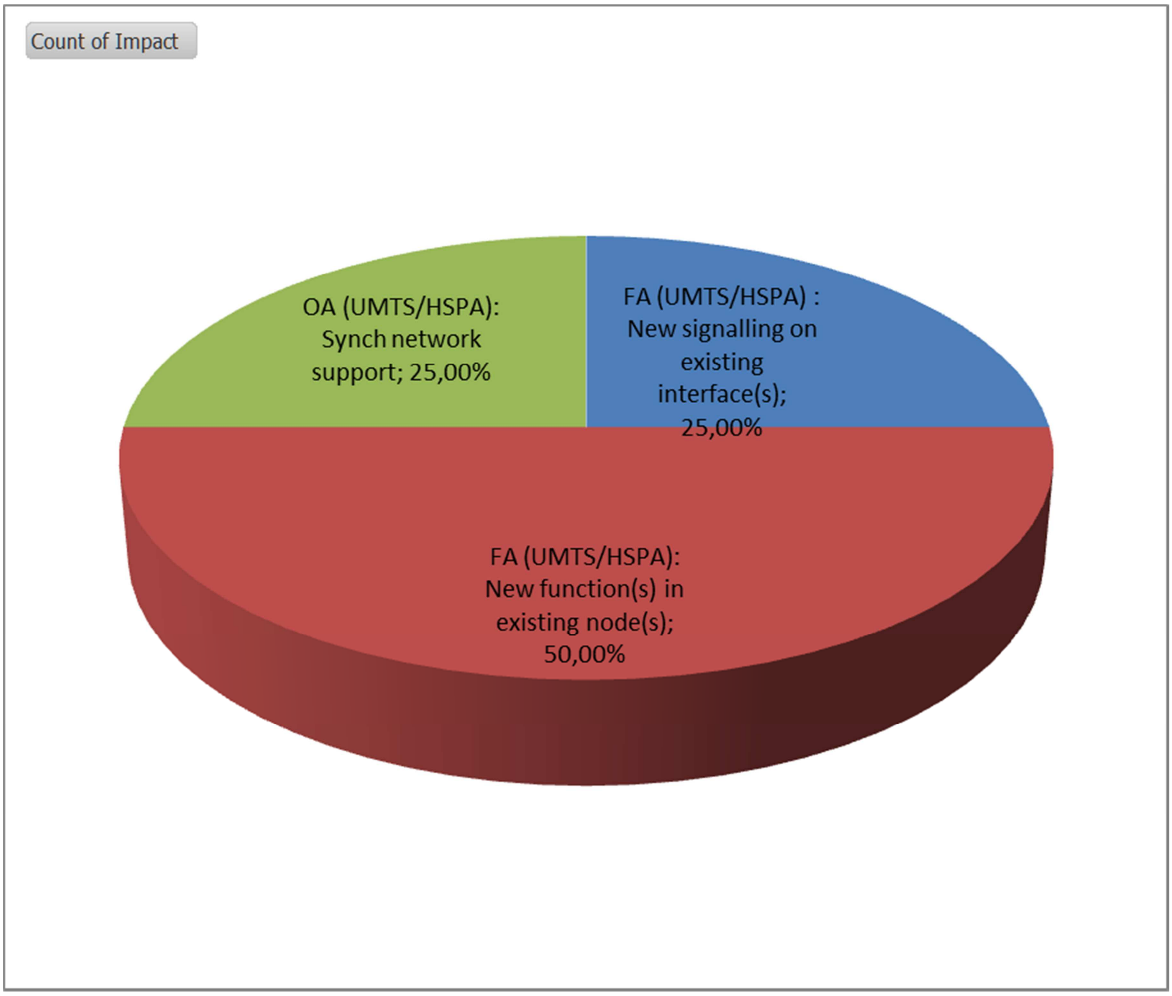

Figure 9: Innovations' impact on UMTS/HSPA network architecture

WP	Company	Innovation Name	Impact Type
WP5	TCS	Inter-Cluster Comm	FA (UMTS/HSPA) : New signalling on existing interface(s)
WP4	AVEA	Seamless Offloading in HetNets	FA (UMTS/HSPA): New function(s) in existing node(s)
WP4	ERICSSON	HS combined cell	FA (UMTS/HSPA): New function(s) in existing node(s)
WP4	ERICSSON	HS combined cell	OA (UMTS/HSPA): Synch network support

Table 6: List of innovations impacting the UMTS/HSPA network architecture

2.4 Impact on O&M functional and organic architecture

The O&M part of UMTS/HSPA and LTE networks is also an area of important impact concerning project's innovations.

The identified impacts can go from "medium" such as FA (EMS/NMS): New function(s) in existing node(s) or FA (EMS/NMS): New signalling on existing interface(s) to "high" which are FA (EMS/NMS): New logical node(s) and FA (EMS/NMS): New logical interface(s).

Nevertheless, since the functional architecture for O&M is not so strictly defined as the functional architecture of RANs, the importance of highly impacting criteria is not the same in the O&M area as in the RAN area.

Row Labels	Count of Impact
FA (EMS/NMS) : New signalling on existing interface(s)	35,71%
FA (EMS/NMS): New function(s) in existing node(s)	35,71%
FA (EMS/NMS): New logical interface(s)	14,29%
FA (EMS/NMS): New logical node(s)	14,29%
Grand Total	**100,00%**

Table 7: Innovations' impact on O&M network architecture

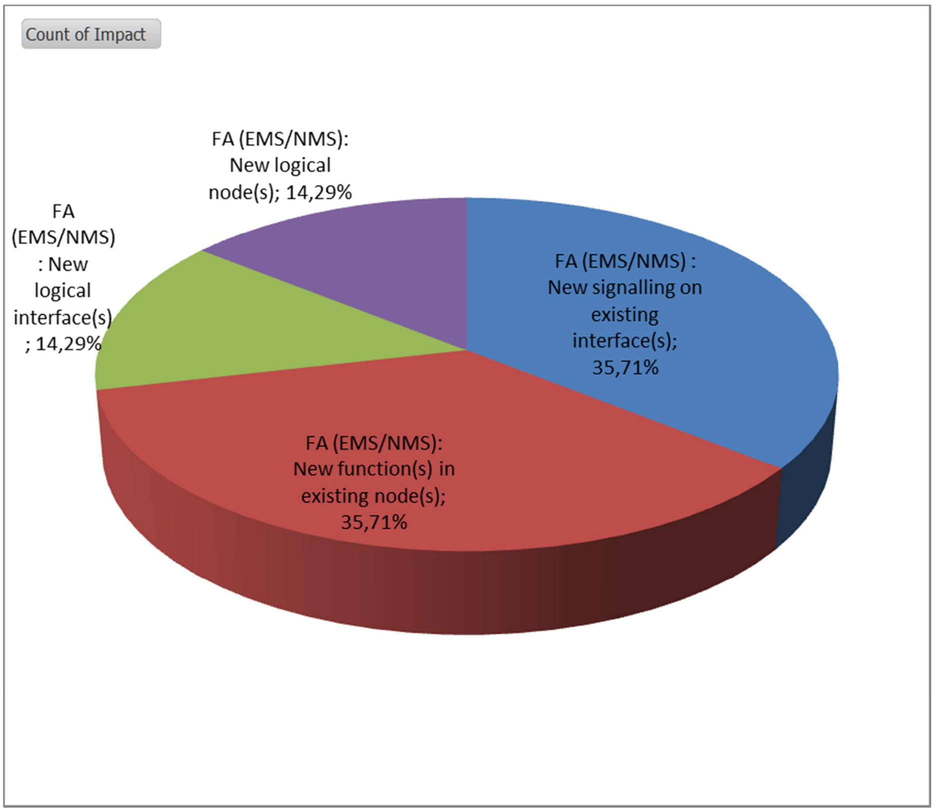

Figure 10: : Innovations' impact on O&M network architecture

WP	Company	Innovation Name	Impact Type
WP 4	FT	Antenna tilt optimization for interference management in LTE-A HetNets	FA (EMS/NMS) : New signalling on existing interface(s)
WP 4	FT	Capacity optimization through Active Antenna Systems (AAS) in LTE macro cell networks	FA (EMS/NMS) : New signalling on existing interface(s)

WP 4	FT	Enhanced Inter-Cell Interference Co-ordination (eICIC) for interference management in LTE-A HetNets	FA (EMS/NMS) : New signalling on existing interface(s)
WP 4	FT	Load Balancing (LB) via transmit power optimization in LTE macro cell networks	FA (EMS/NMS) : New signalling on existing interface(s)
WP 4	FT	Mobility Load Balancing (MLB) in LTE macro cell networks	FA (EMS/NMS) : New signalling on existing interface(s)
WP 4	FT	Antenna tilt optimization for interference management in LTE-A HetNets	FA (EMS/NMS): New function(s) in existing node(s)
WP 4	FT	Capacity optimization through Active Antenna Systems (AAS) in LTE macro cell networks	FA (EMS/NMS): New function(s) in existing node(s)
WP 4	FT	Enhanced Inter-Cell Interference Co-ordination (eICIC) for interference management in LTE-A HetNets	FA (EMS/NMS): New function(s) in existing node(s)
WP 4	FT	Load Balancing (LB) via transmit power optimization in LTE macro cell networks	FA (EMS/NMS): New function(s) in existing node(s)
WP 4	FT	Mobility Load Balancing (MLB) in LTE macro cell networks	FA (EMS/NMS): New function(s) in existing node(s)
WP 6	Magister	GMDT Control Plane Solution	FA (EMS/NMS): New logical interface(s)
WP 6	Magister	GMDT User Plane Solution	FA (EMS/NMS): New logical interface(s)
WP 6	Magister	GMDT Control Plane Solution	FA (EMS/NMS): New logical node(s)
WP 6	Magister	GMDT User Plane Solution	FA (EMS/NMS): New logical node(s)

Table 8: List of innovations impacting the O&M network architecture

3 Conclusion

This study shows the impact that the innovations from the SHARING project may have on the functional and organic architecture of the UMTS, HSPA and LTE networks as well as on their corresponding Operations and Maintenance system architecture.

It is highlighted in the study that the most impacted area is the LTE network architecture. From the entire set of requirements that we identified in this area 32% can be considered with "high" impact on the functional architecture (FA: New logical node(s), 23.81% and FA: New logical interface(s), 7.94%) and 53.97% can be considered with medium impact on the functional architecture (FA: New function(s) in existing node(s), 38.10% and FA: New signaling on existing interface(s), 15.87%).

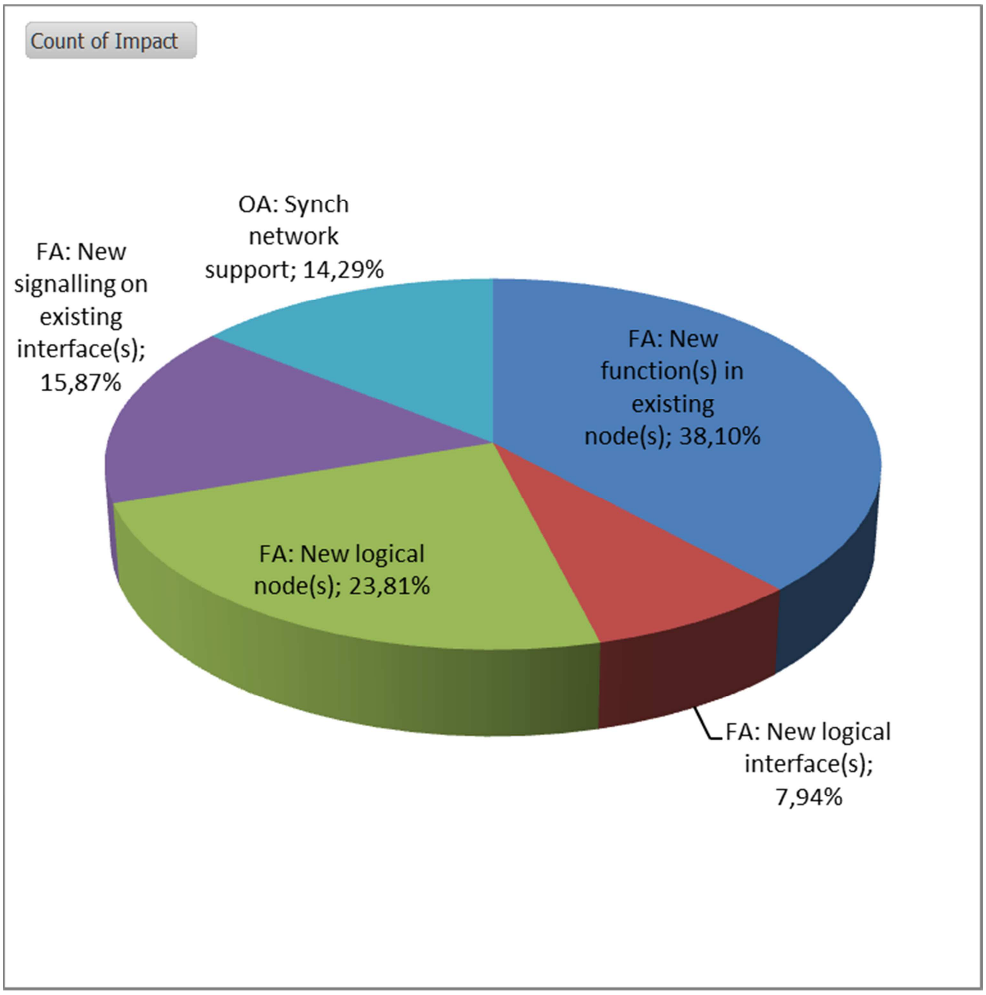

Figure 11; SHARING project's innovations' impact on LTE network architecture

The remaining part of the identified impacts concerns the organic architecture of LTE networks for which the only requirement that has been identified is the support for network synchronization.

REFERENCES

[1] 3GPP TS 25.467-c20, "UTRAN architecture for 3G Home Node B (HNB); Stage 2".

[2] 3GPP TS 36.300-c30, "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2.

Appendix

None

GLOSSARY

ACRONYM	DEFINITION
3GPP	Third Generation Partnership Project
ABS	Almost Blank Sub-frame
ACTS	Advanced Communications Technologies and Services
ADSL	Asymetric Digital Subscriber Line
AMC	Adaptive Modulation and Coding
ANR	Agence Nationale de la Recherche
AP	Access Point
ARPU	Average Revenu Per User
ASIC	Application Specific Integrated Circuit
BAN	Body Area Network
BBU	Base Band Unit
BEFEMTO	Broadband evolved Femto
BRAN	Broadband Radio Access Network
BS	Base Station
BTS	Base Transceiver Station
CA	Carrier Aggregation
CAPEX	Capital Expenditure
CCIR	Commité Consultatif International des Radiocommunications
CDMA	Code Division Multiplexing Access
CEPT	Conférence Européenne des Postes et Télécommunications
CO	Confidential
COMP	Coordinated Multi-Point
COST	european Cooperation in Science and Technology

CRC	Cyclic Redundancy Check
CRS	Common Reference Signal
CS	Coordinated Scheduling
CSG	Closed Subscriber Group
CSI	Channel State Information
CSIT	Channel State Information at Transmitter
CT	Core network and Terminals
CTO	Chief Technical Officer
CTU	Chief Technical Officer
CWC	Centre for Wireless Communications
CoMP	Coordinated Multi-Point
D2D	Device to Device
DARPA	Defense Advanced Research Projects Agency
DL	Downlink
DRX	X-Ray Diffraction (in French)
DSL	Digital Subscriber Loop
DSTL	Defence Science and Technology Laboratory
DVB	Digital Video Broadcasting
EC	European Commission
eICIC	Enhanced Inter-Cell Interference Cancellation
eNB	evolved Node B
EPC	Evolved Packet Core
EPON	Ethernet Passive Optical Network
ETSI	European Telecommunications Standards Institute
EU	European Union
FDD	Frequency Division Duplex

FPGA	Field Programmable Gate Array
FRN	Fixed Relay Node
GA	General Assembly
GPRS	General Packet Radio Service
GPS	Global Positionning System
GSM	Global System for Mobile
GSMA	GSM Alliance
GW	Gateway
HARQ	Hybrid Automatic Repeat reQuest
HDR	Habilitation à Diriger les Recherches
HF	High Frequencies
HO	Hand Over
HSDPA	High Speed Downlink Packet Access
HSPA	High Speed Packet Access
HW	Hardware
HeNB	Home eNB
IA	Interference Alignment
IC	Interference Cancellation
ICIC	Inter-Cell Interference Cancellation
IMT	International Mobile Telecommunications
IP	Internet Protocol
IPR	Intellectual Property Rights
ITU	International Telecommunication Union
JP	Joint Processing
KPI	Key Performance Indicator
LAN	Local Area Network
LDPC	Low Density Parity Check

LTE	Long Term Evolution
LTE-A	Long Term Evolution - Advanced
MA	
MAC	Medium Access Control
MC	Multi Carrier
MIMO	Multiple Input Multiple Output (MU-MIMO see MU)
MME	Mobility Management Entity
MRN	Mobile Relay Node
MS	Mobile Station
MTC	Machine Type Communications
MU	Multi-User
NAS	Network Access Server
NFC	Near Field Communications
NGMN	Next Generation Mobile Networks
OFDM	Orthogonal Frequency Division Multiplexing
OFDMA	OFDM Access
OPEX	Operational Expenditure
OSTBC	Orthogonal Space Time Block Code
PAPR	Peak to Average Power Ratio
PC	Personal Computer
PDCP	Packet Data Convergence Protocol
PHY	Physical Layer
PM	Project Manager
PU	Public
QMR	Quarterly Management Report
QoS	Quality of Service

RAN	Radio Access Network
RAT	Radio Access Technology
RF	Radio Frequency
RLC	Radio Link Control
RN	Relay Node
RNC	Radio Network Controler
RRC	Radio Resource Control
RRM	Radio Resource Management
RTD	Research and Technical Developpment
SC	Single Carrier
SME	Small and Medium Entreprise
SNR	Signal to Noise Ratio
SON	Self Optimizing/Organizing Network
SW	Software
TA	Tracking Area
TCO	Total Cost of Ownership
TD	Time Division
TDD	Time Division Duplex
TM	Task Manager
TR	Technical Requirement
TTI	Transmission Time Interval
TX	Transmit
UE	User Equipment
UK	United Kingdom
UL	Uplink
UMTS	Universal Mobile Telecommunication System
UT	User Terminal

UTRA	Universal Terrestrial Radio Access
UTRAN	Universal Terrestrial Access Network
UWB	Ultra Wide Band
VNI	Visual Networking Index
VPL	Vehicle Penetration Loss
WCDMA	Wideband Code Division Multiplexing Access
Wi-Fi	Wireless Fidelity
WLAN	Wireless Local Area Network
WP	Work Package
WPL	Work Package Leader
WiFi	Wireless Fidelity