CONFIG

Convergent Core Architecture for Next Generation Networks

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Brussels, April 6th, 2016

Presentation Outline

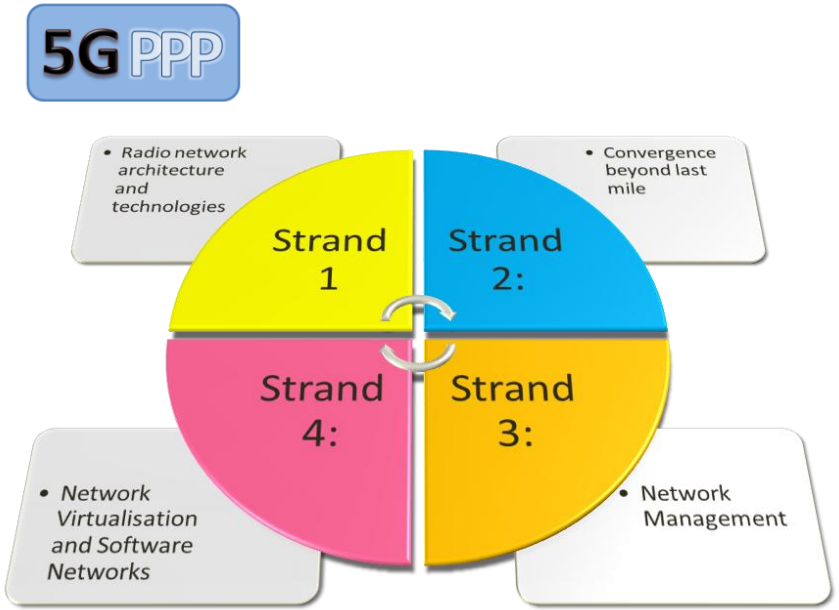
- Project Intro, Motivation, Consortium
- CONFIG Objectives and Plan
- Architecture Design Rationale, Principles and Model
- Achievements

The Origins of the Project

Conceived within 5G-PPP Phase 1 Convergence Strand

The project proposal targeted:

- Holistic 5G Network Architecture design
- Convergent Core Network
- Control Plane Design



CONFIG Consortium

Not been selected by EU, key partners agreed to run the project unfunded

The Consortium Initially Included:

- Network Operators (Deutsche Telekom, Orange, Telenor)
- Vendors (Huawei, NEC, Thales)
- SMEs (Bcom, Ubitech)
- Research Institutions (Eurescom, Iminds, I2Cat)
- Academic Institutions (IT Aveiro, Uni Kaiserslautern)

The original Consortium has been extended:

- Fraunhofer Fokus (Germany)
- Interdigital (UK)
- King's College London (UK)
- Aalto University (Finland)

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Project Objectives

To build 5G on top of the High Level Requirements widely recognised a the time the project proposal was being written, CONFIG identified 4 key objectives:

- Develop a 5G modular functional framework
  (**Architecture Flexibility / Vertical Integration**)
- Conceive an access-agnostic 5G Core Network
  (**Heterogeneous Access Integration**)
- Develop a Context Information framework
  (**Providing Smart/Tailored Connectivity**)
- Lead standardisation future paths, impacting on 3GPP, IETF, ONF
  (**Impact on Real Systems**)

Project Plan – Work Packages, Tasks and Timeline

The Project Includes two WPs

- WP1: Use Case, Requirements and Architecture High Level Design
- WP2: Detailed Design, Solutions Evaluation and Prototyping

Project Timeline has been synched with 3GPP SA1/SA2 work plans

			Month																	
WP	Task	Task Leader	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.1: Use cases and System Requirements	Eurescom																		
1	1.2: 5G Control Plane System Archietcture	Huawei																		
1	1.3: North Bound Interfaces	Orange																		
1	1.4: Context Awareness Framework	Telenor																		
1	1.5: Market and Business Impact	Bcom																		
2	2.1: Requirements for Intelligent Connectivity	Thales																		
2	2.2: Intelligent Connectivity Setup&Mainteinance	NEC																		
2	2.3: Intelligent Connectivity Solutions	Huawei																		
2	2.4: Evaluation of Intelligent Connectivity	Huawei																		
2	2.5: Prototyping of Intelligent Connectivity	DT																		
2	2.6: Showcase	DT																		
					15-Sep			15-Dec			16-Mar			16-Jun			16-Sep			16-Dec
											We Are Here									

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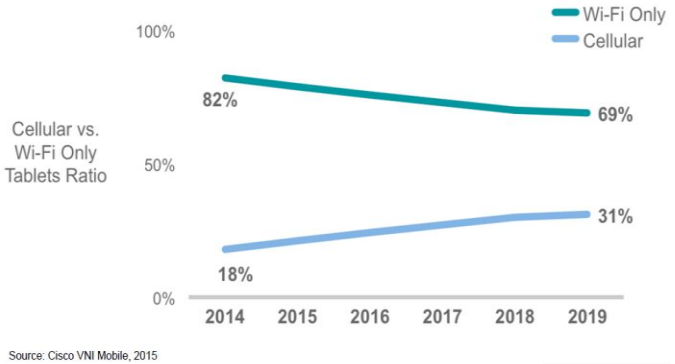
Next Generation Core Network Design Drivers (T1.1)

Heterogeneity of Deployed Access/Devices: Heterogeneous Access Integration

Device/Traffic Heterogeneity

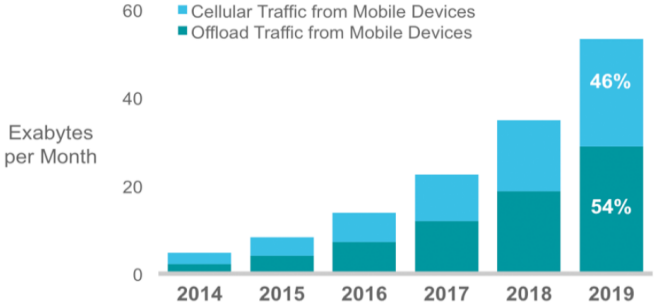
* Monthly basic mobile phone data traffic.
Source: Cisco VNI Mobile, 2015

Multi RAT Capable Devices



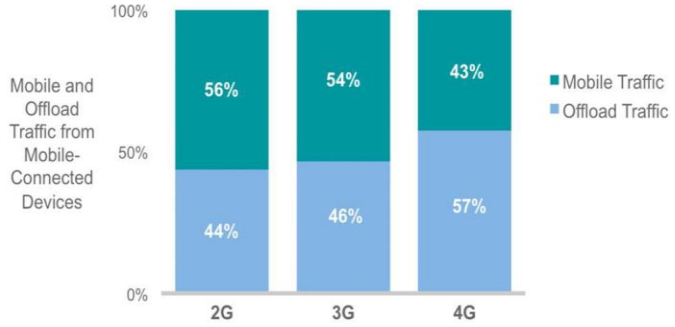
Source: Cisco VNI Mobile, 2015

Offloading to non Cellular Systems



Offload pertains to traffic from dual mode devices (excluding laptops) over Wi-Fi/small cell networks.
Source: Cisco VNI Mobile, 2015

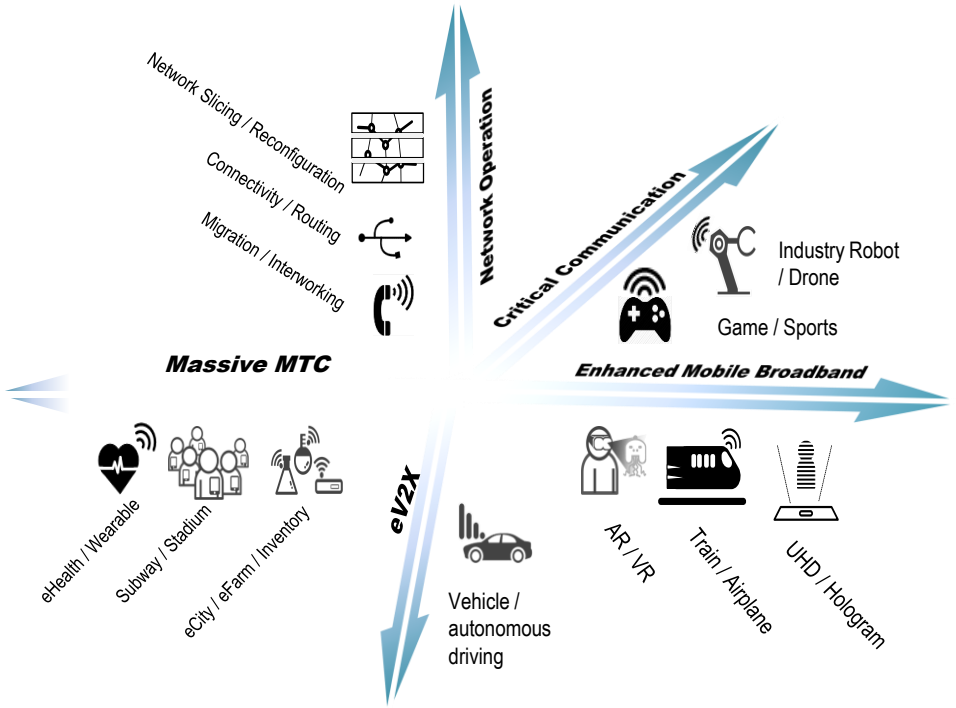
Offloaded vs. Cellular



Source: Cisco VNI Mobile, 2015

Next Generation Core Network Design Drivers (T1.1)

Use Cases Diversity: Architecture Flexibility/Network Slicing



Picture from 3GPP SA1 TR 22.891 v1.0.0

CONFIG Design Principles (T1.2)

To adhere to drivers, CONFIG formulated the following design principles

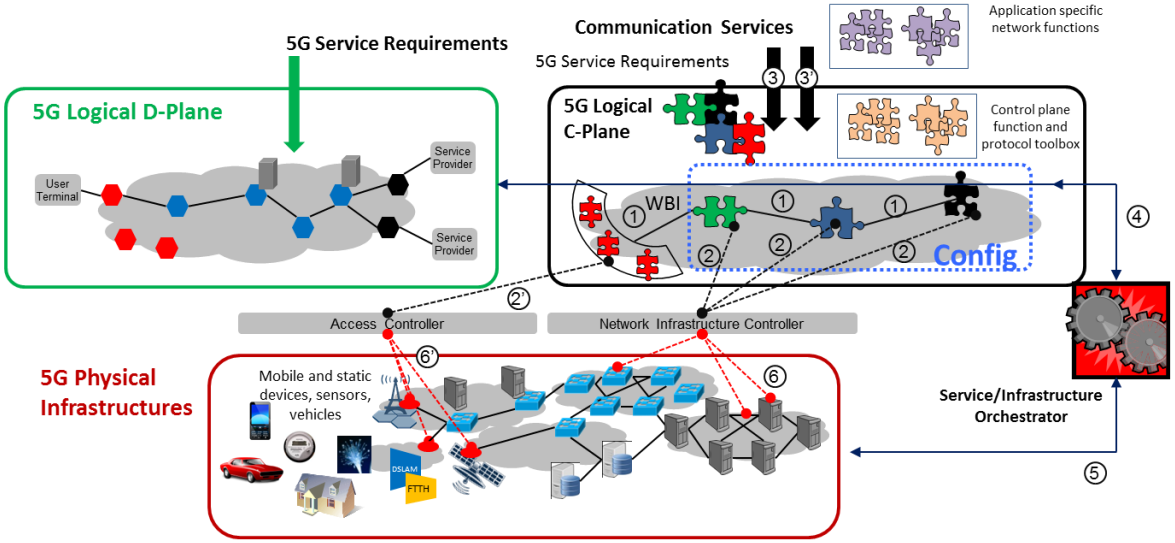
- **Architecture Modularisation**: 5G tailored end to end network architectures, including C-plane and D-plane, shall be defined upon a set of basic Building Blocks (BBs), including Access network and Core Network functions

- **Access Independent Core:** 5G Core Network related basic BBs shall be defined minimising the dependency towards the supported Access Networks.

- **Support of independent logical networks**: 5G networks shall enable the concept of Network Slicing.

Network slice: an independent logical network, defined by the interconnection of a set of BBs, independently instantiated and operated over the physical infrastructure, to support the communication service of a particular use case

CONFIG Core Network Architecture Model (T1.2)



Legend

5G Logical C-Plane
- 5G Logical Network Functions (Core/Access)
- 5G Logical Network Access Functions
- Application Specific Network Functions

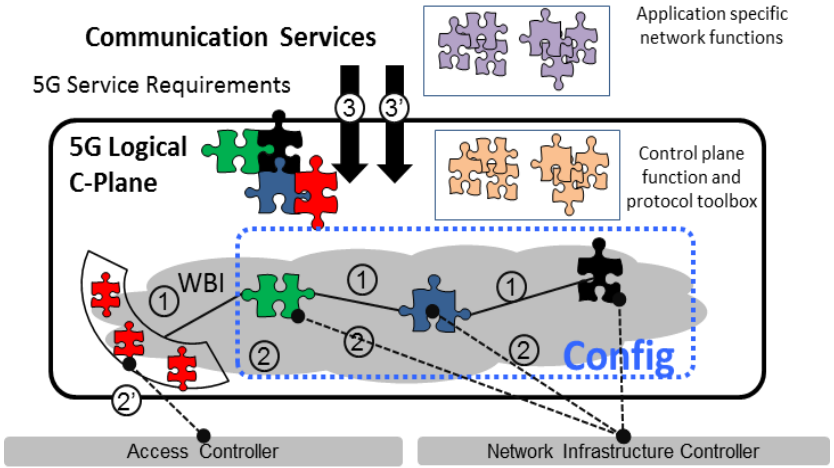
① 5G NF Interface
② 5G NF – Controller Interface
③ CONFIG Service Interface
④ C- Plane/D-Plane to Orchestrator Interface
⑤ Orchestrator to infrastructures interface
⑥ Controller to infrastructure interface

5G Logical D-Plane
- 5G Logical Network Function (e.g. Logical access points)
- 5G Logical Network Function (e.g. Logical forwarding nodes, virtual switch)
- 5G Logical Network Function (e.g. Logical D-Plane endpoints, virtual PDN-GW)
- 5G Logical Network Function (e.g. cache, media GW, transcoders)

5G Network Physical Infrastructure
- Access node (wireless, wireline, satellite)
- Forwarding element
- Compute/storage resource
- SDN/Wireless SDN-like APIs

CONFIG Core Network Architecture Model (T1.2)

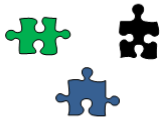
Zooming-in the Control Plane



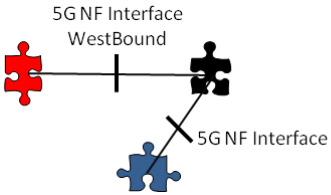
Key Questions:

- Which accesses do we want to integrate?

- Which Logical Network functions do we need?

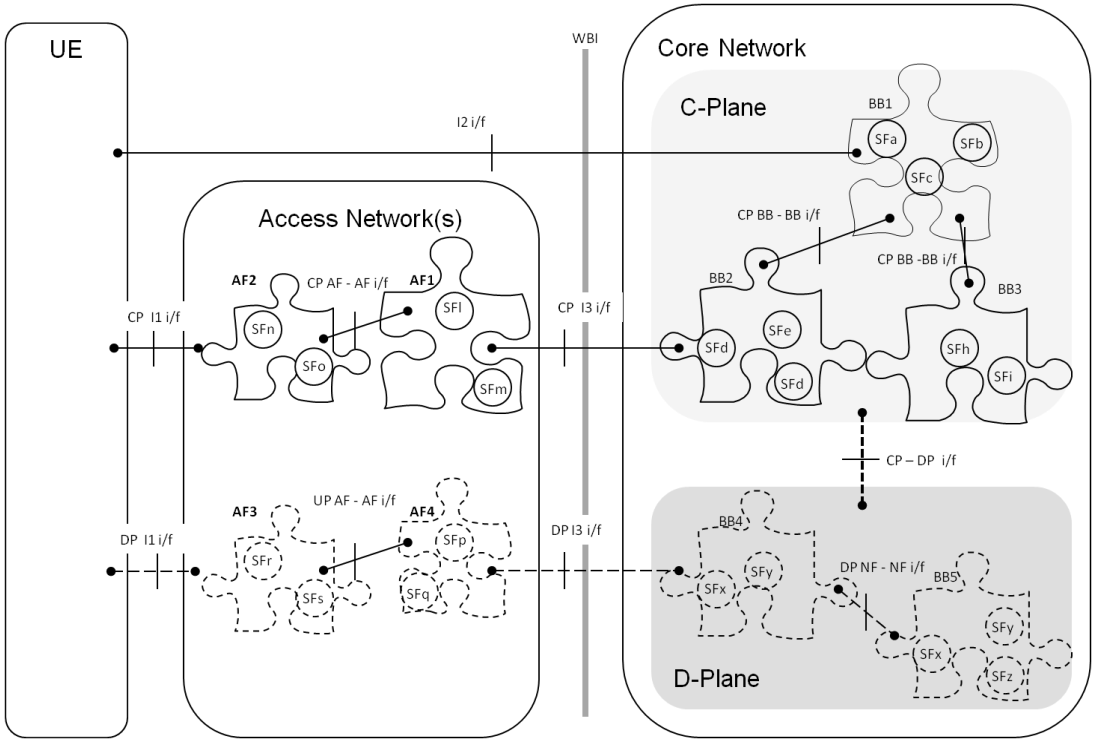


- Which 5G NF interface do we need to define?



CONFIG Core Network Architecture Model (T1.2)

Overall Model, BBs, SFs, i/f



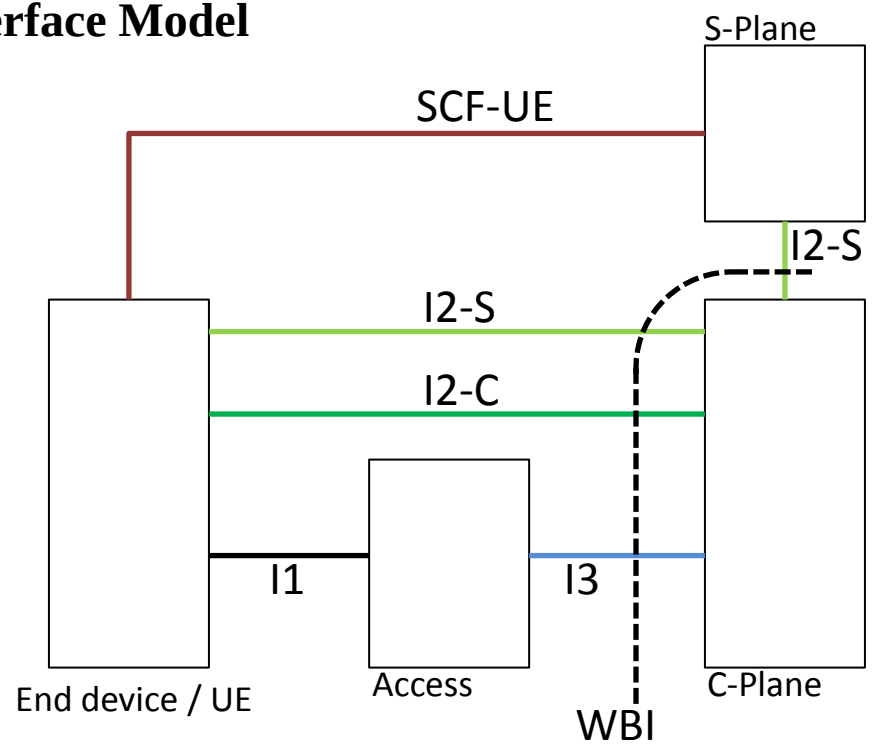
CONFIG Core Network Architecture Model (T1.2)

Basic Building Blocks and Sub-Functions

Building Block Name	Acronym	Sub Functions	Info Stored	Procedures
Access Function	AF			
Connectivity Management	CM			
Security and AAA management	SAM			
Mobility Management	MM			
Flow Management	FM			
Context Awareness Engine (Recently Added)	CAE			

CONFIG Core Network Architecture Model (T1.2)

Interface Model



WBI

I3: access network – C-plane, for network attachment and mobility, and access node configuration

I2-C: end device – C-Plane, for network attachment and mobility, and for device configuration

I2-S: application – C-Plane, for session establishment (appl. on S-Plane, i.e. in application servers or on End device)

Other interfaces (not in the scope):

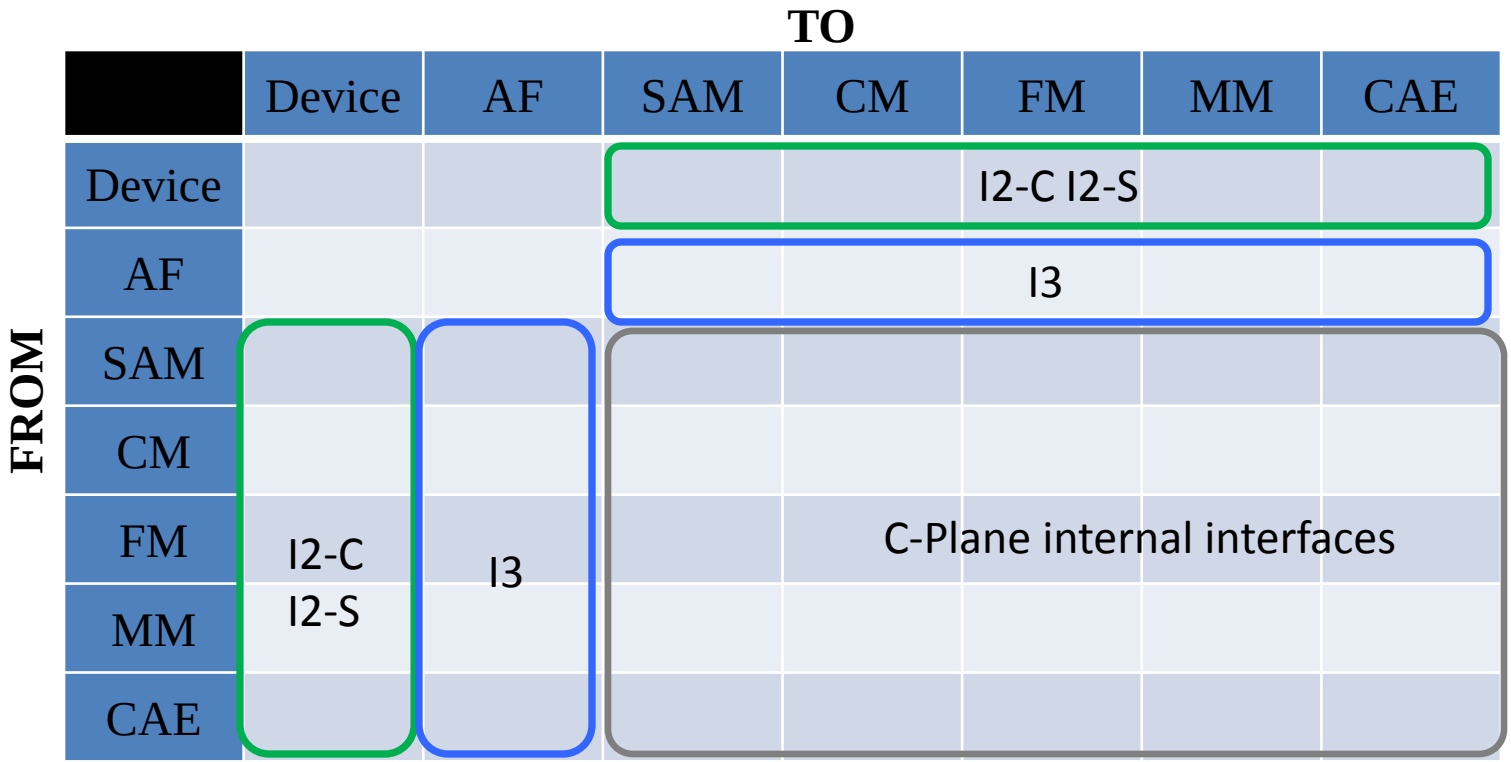
I1: access specific

SCF-UE: end device – S-Plane, for service establishment

SCF: Service Control Function (ITU NGN)

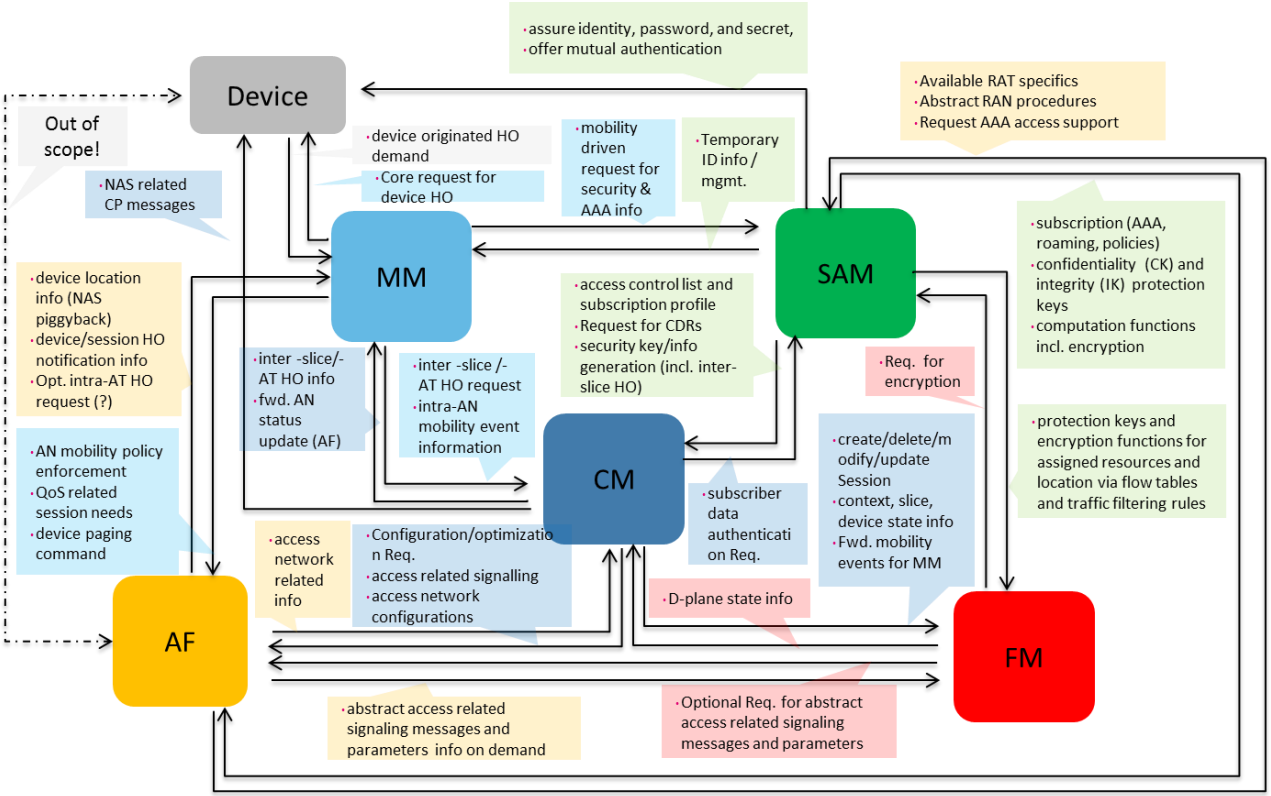
CONFIG Core Network Architecture Model (T1.2)

Interface Model



CONFIG Core Network Architecture Model (T1.2)

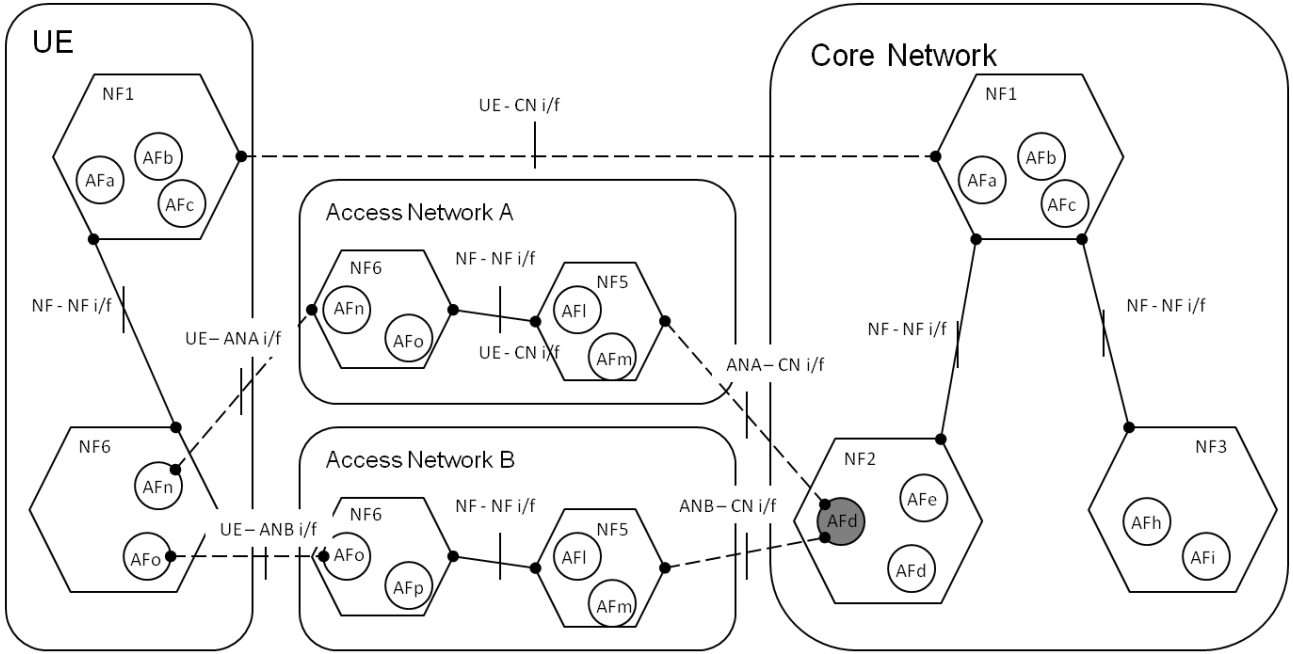
Inter BB - Interfaces



CONFIG Core Network Architecture Model (T1.2)

Heterogeneous Access Integration – Approaches to Solutions (I)

- BB terminating multiple CN – AN interfaces
- SF bridging CN- ANs requirements



In this picture:

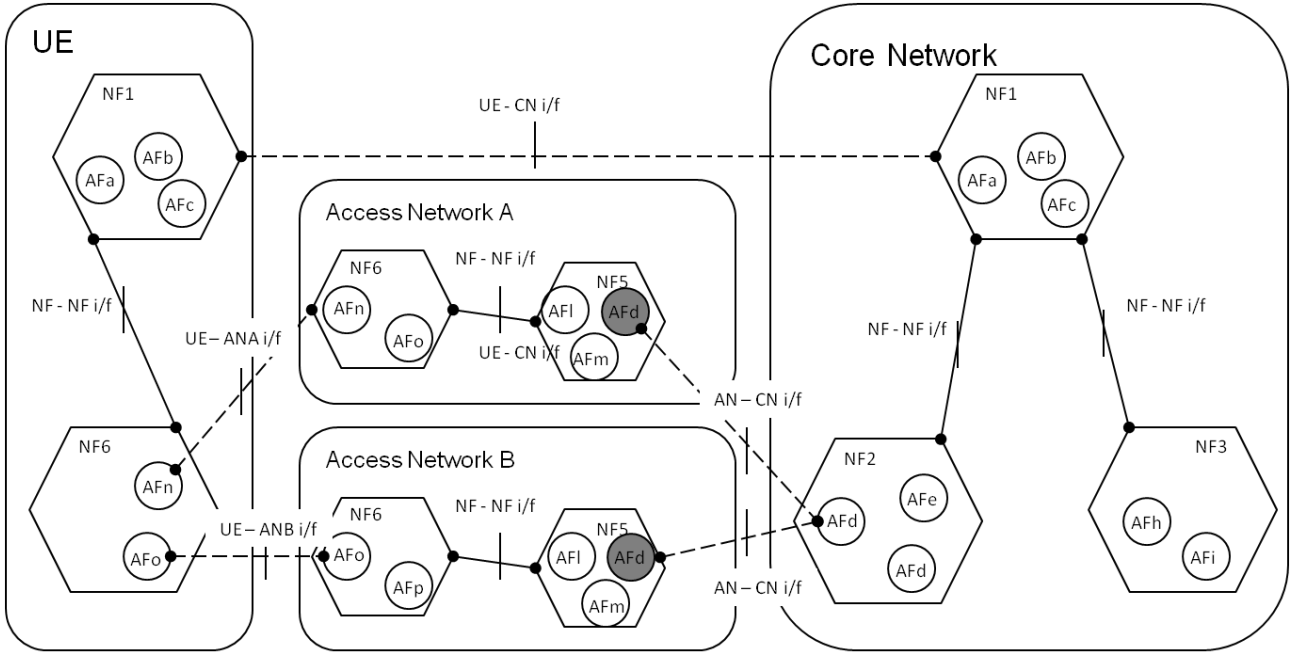
NFi = BBi

AFj = SFj

CONFIG Core Network Architecture Model (T1.2)

Heterogeneous Access Integration – Approaches to Solutions (II)

- BB at ANs supporting a single AN – CN interface



In this picture:

NFi = BBi

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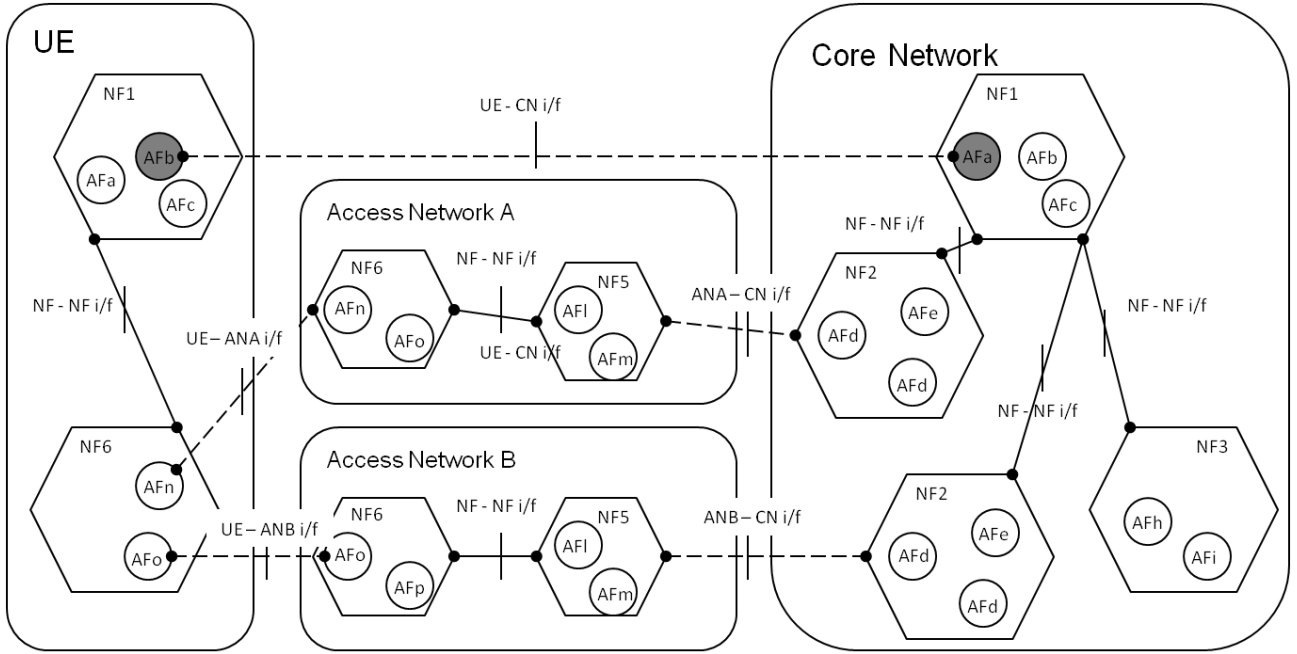
CONFIG Core Network Architecture Model (T1.2)

Heterogeneous Access Integration – Approaches to Solutions (III)

- "Loose" ANs integration via convergent UE – CN Non Access Stratum



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CONFIG Impacts on 3GPP: Achievements

From CONFIG to 3GPP via individual partner

From CONFIG to 3GPP via multi-partners agreement

Objective 4: CONFIG tangibly impacted on both 3GPP SA1 and SA2

SA1 Rel 14: Smarter TR 22.891 v1.0.0 approved Sept 2015

- TR 22.891 Use Case 5.1 Ultra reliable Communication
  - Includes CONFIG use case 2.3 WAMCS (Wide Area Monitoring and Control Systems)
- TR 22.891 Use Case 5.27: Multi Access network integration
  - map to CONFIG use case 3.1 Access Agnostic Convergent Core Network

SA2 Rel 14 SA2 SID – Study on Architecture for Next Generation System

- Justification

  Network functions will run as software components on operators' telco-cloud systems rather than using dedicated hardware components. The architecture should therefore be as cloud-friendly as possible, to improve distribution of processing by separation of control from data forwarding.
  For the agile introduction of new technology, one driver is to allow independent evolution of radio and the core network.
  Another driver is to facilitate architecture convergence between the 3GPP access and other access technologies (e.g. WLAN, Fixed Broadband Access).

- Objectives

  The new architecture shall support at least the new RAT(s), the evolved LTE, non 3GPP access types and minimize access dependencies.
  Proposals can be based on an evolution of the current architecture or on a "clean slate" approach.
  The study shall consider scenarios of migration to the new architecture.

- Currently Discussing Solutions for Key issues

Reference

[1]: Cisco, "Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2014–2019", White Paper

[2]: Ericsson, "Ericsson Mobility Report, On the Pulse of the Networked Society", June 2015

[3]: NGMN, 5G White Paper, www.ngmn.org/fileadmin/ngmn/content/downloads/Technical/2015/NGMN_5G_White_Paper_V1_0.pdf

[4]: H. J. Einsiedler, A. Gavras, P. Sellstedt, R. Aguiar, R. Trivisonno, D. Lavaux, "*System Design for 5G Converged Networks*", in Networks and Communications (EuCNC), 2015 European Conference on, Jun. 2015

[5]: CONFIG D1.1 Deliverable v1.0, Task 1.1 Team, "*Set of Use Cases supported by the Holistic 5G Converged Network Architecture*", December 2015

[6]: CONFIG D1.3 Deliverable v1.0, Task 1.2 Team, "*Overall 5G Convergent Control Plane Design*", March 2016

Thank You!

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