ETSI GANA Knowledge Plane (KP) Platforms and Federations of ANs

Autonomic Management and Control (AMC) Paradigm

Presenters: **Dr. Muslim Elkotob: Vodafone**
Dr.-Ing. Ranganai Chaparadza; Vodafone consultant/Capgemini Engineering
Dr. Benoit Radier: Orange
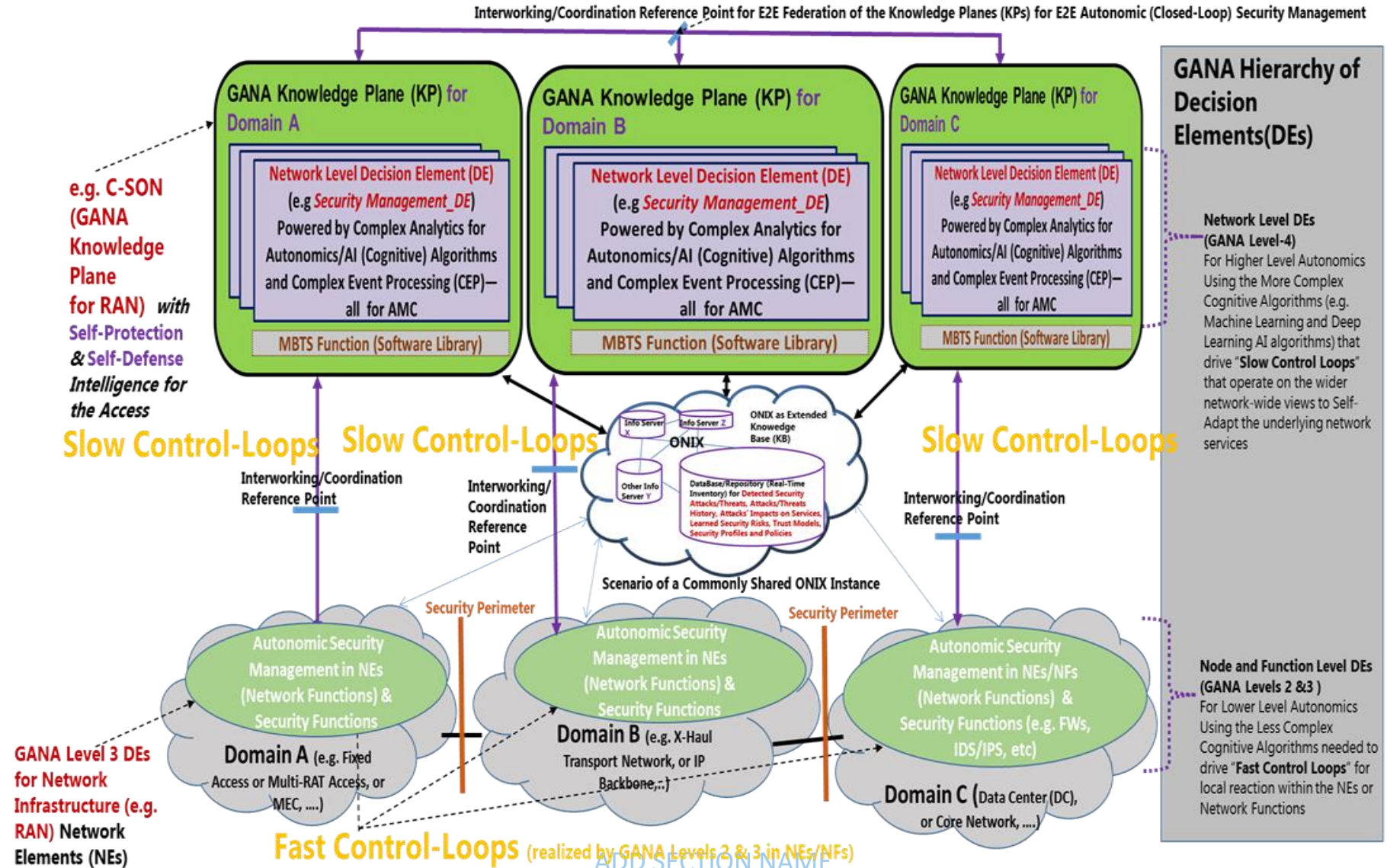**Dr. Said Soulhi: Verizon**

Multi-SDO Meeting Presentation
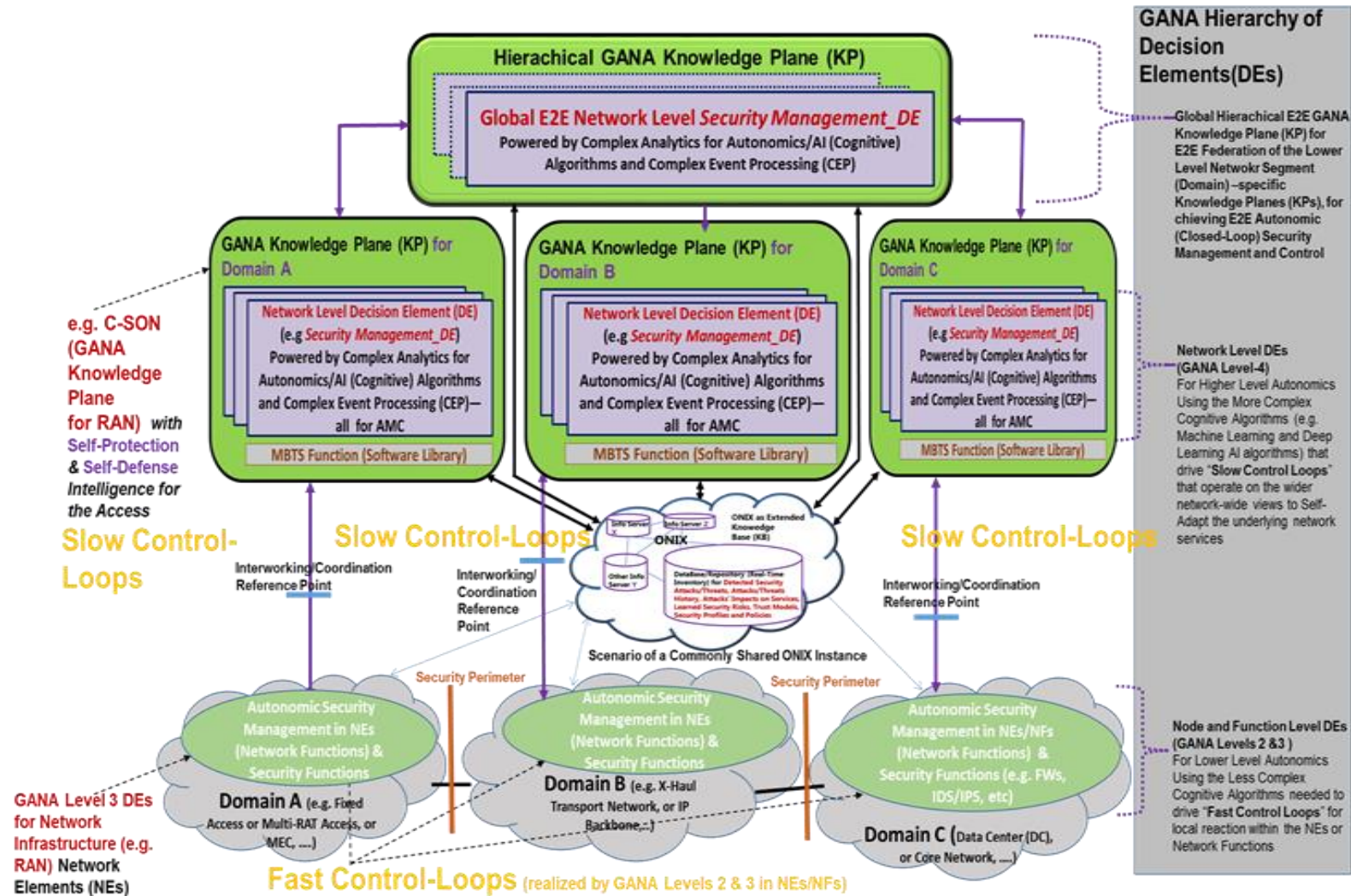
5th September 2022

ANs Federations

GANA KPs Federations for E2E Autonomics: Option: Horizontal Federation of GANA Knowledge Planes (KPs) Platforms

Interworking/Coordination Reference Point for E2E Federation of the Knowledge Planes (KPs) for E2E Autonomic (Closed-Loop) Security Management

GANA Knowledge Plane (KP) for Domain A

Network Level Decision Element (DE) (e.g Security Management_DE) Powered by Complex Analytics for Autonomics/AI (Cognitive) Algorithms and Complex Event Processing (CEP)—all for AMC

MBTS Function (Software Library)

GANA Knowledge Plane (KP) for Domain B

Network Level Decision Element (DE) (e.g Security Management_DE) Powered by Complex Analytics for Autonomics/AI (Cognitive) Algorithms and Complex Event Processing (CEP)—all for AMC

MBTS Function (Software Library)

GANA Knowledge Plane (KP) for Domain C

Network Level Decision Element (DE) (e.g Security Management_DE) Powered by Complex Analytics for Autonomics/AI (Cognitive) Algorithms and Complex Event Processing (CEP)—all for AMC

MBTS Function (Software Library)

GANA Hierarchy of Decision Elements(DEs)

Network Level DEs (GANA Level-4) For Higher Level Autonomics Using the More Complex Cognitive Algorithms (e.g. Machine Learning and Deep Learning AI algorithms) that drive "Slow Control Loops" that operate on the wider network-wide views to Self-Adapt the underlying network services

Node and Function Level DEs (GANA Levels 2 &3) For Lower Level Autonomics Using the Less Complex Cognitive Algorithms needed to drive "Fast Control Loops" for local reaction within the NEs or Network Functions

e.g. C-SON (GANA Knowledge Plane for RAN) *with* **Self-Protection** & **Self-Defense** Intelligence for the Access

Slow Control-Loops **Slow Control-Loops** **Slow Control-Loops**

Info Server X, Info Server Z, **ONIX**, ONIX as Extended Knowledge Base (KB), Other Info Server Y, DataBase/Repository (Real-Time Inventory) for Detected Security Attacks/Threats, Attacks/Threats History, Attacks' Impacts on Services, Learned Security Risks, Trust Models, Security Profiles and Policies

Interworking/Coordination Reference Point

Interworking/Coordination Reference Point

Interworking/Coordination Reference Point

Scenario of a Commonly Shared ONIX Instance

Security Perimeter

Security Perimeter

Autonomic Security Management in NEs (Network Functions) & Security Functions

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Autonomic Security Management in NEs/NFs (Network Functions) & Security Functions (e.g. FWs, IDS/IPS, etc)

GANA Level 3 DEs for Network Infrastructure (e.g. RAN) Network Elements (NEs)

Domain A (e.g. Fixed Access or Multi-RAT Access, or MEC, ...)

Domain B (e.g. X-Haul Transport Network, or IP Backbone,..)

Domain C (Data Center (DC), or Core Network, ...)

Fast Control-Loops (realized by GANA Levels 2 & 3 in NEs/NFs)

Example of a GANA Instantiation onto a particular Network Architecture and its associated Management & Control Architecture

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Instantiation of GANA onto 3GPP EPC Core & Backhaul Network (ETSI TR 103 404); and Federated/Interworking GANA Knowledge Planes for RAN-, Backhaul- and 3GPP EPC Core Networks complemented by low level autonomics

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C2 General

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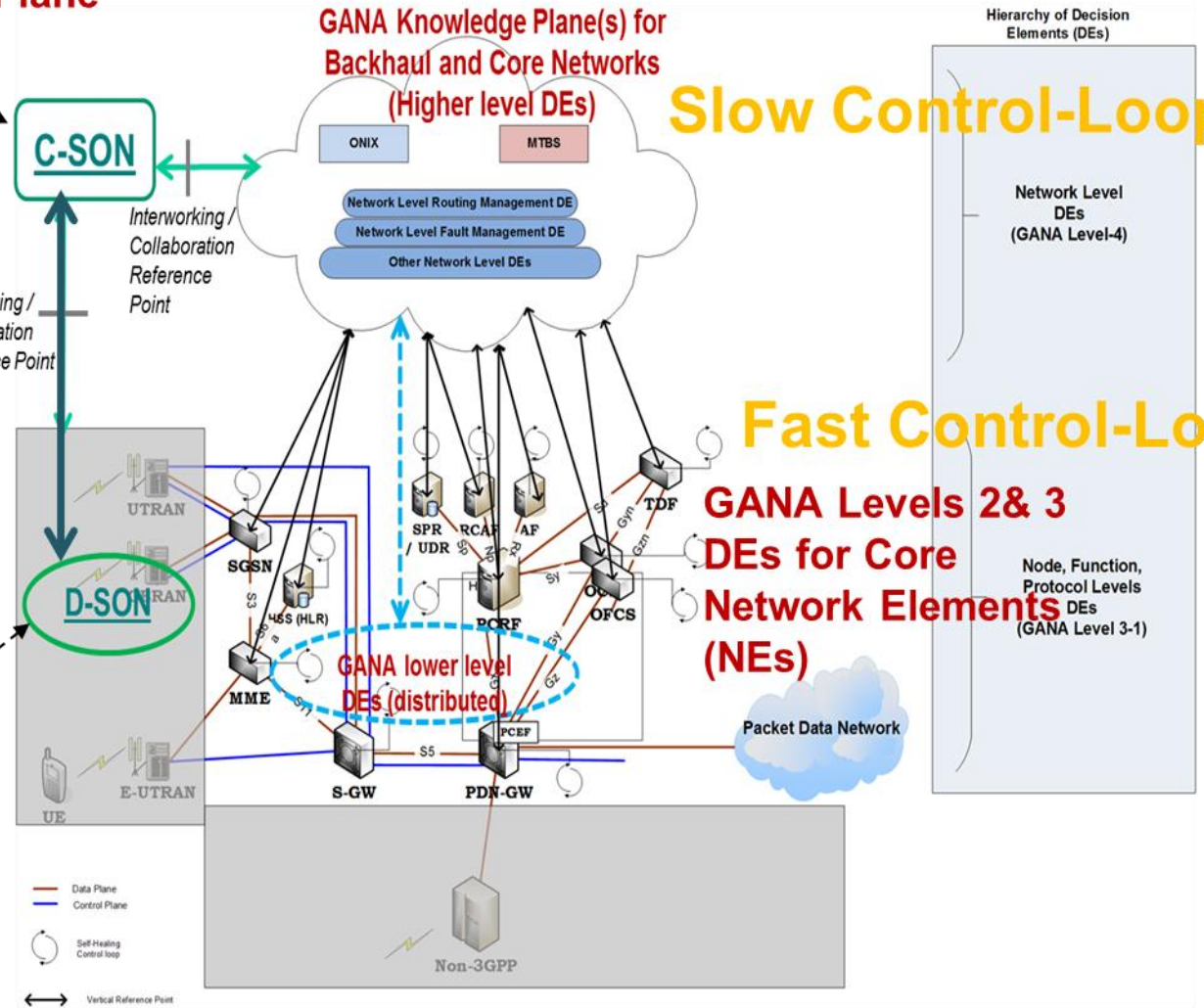
The Protocols and APIs Required. Call for Action for Joint efforts

ETSI GANA Model Adoption in NGMN's Autonomic Networking Requirements in E2E 5G Architectures, and ETSI Implementation Fmwk

Elements of the Knowledge Plane - Cognition with fast and slow feedback
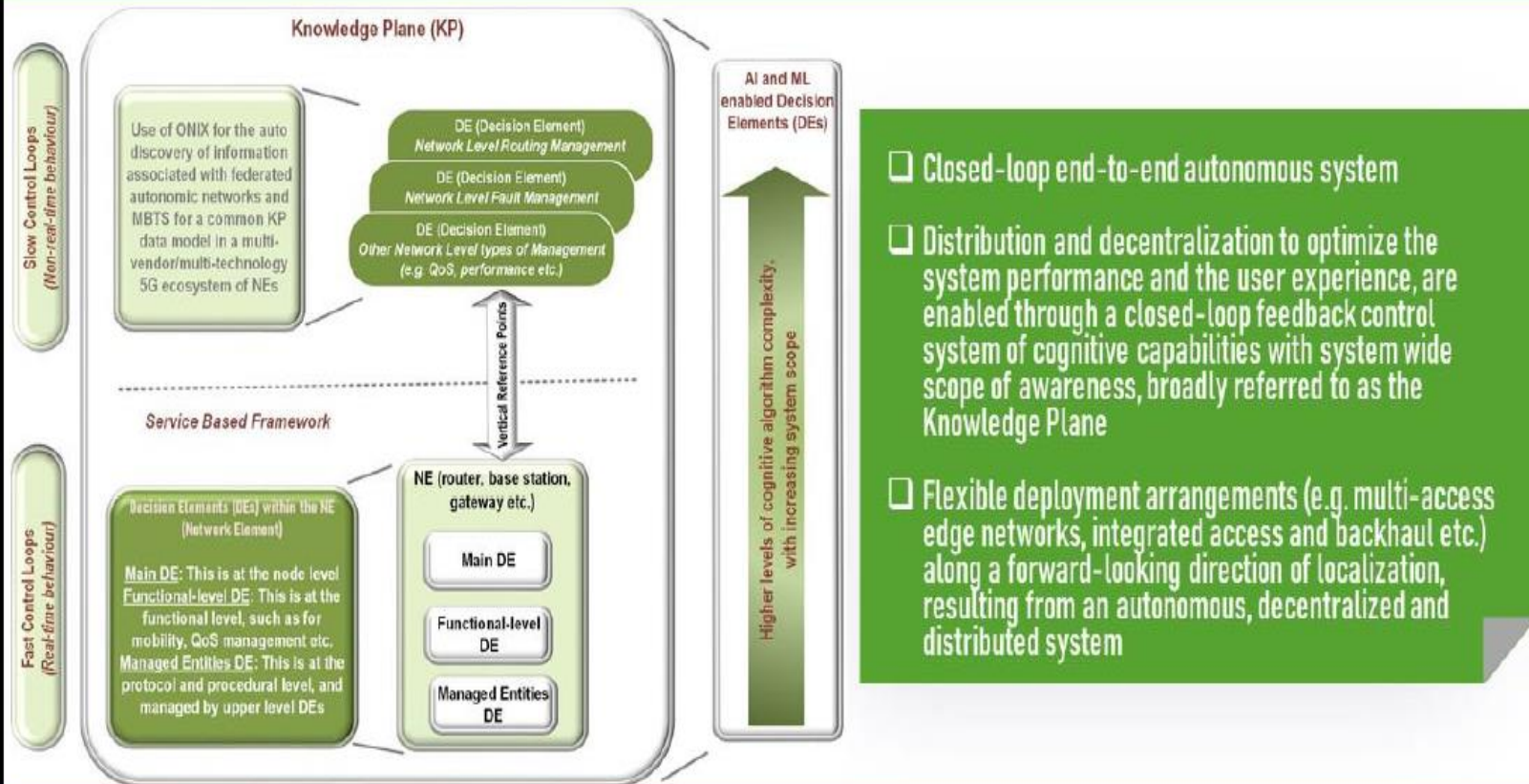
Based on NGMN 5G E2E architecture framework

IEEE Future Networks –Autonomic Networking – January 2021

ETSI has published

ETSI TR 103 747 *on Implementing Federated GANA Knowledge Planes (KPs) Platforms for E2E Multi-Domain Federated Autonomic Management and Control (AMC) of Slices in NGMN E2E 5G Architecture*

ETSI GANA Model Adoption in NGMN's Autonomic Networking Requirements in E2E 5G Architectures, and ETSI Implementation Fmwk

Generic Autonomic Network Architecture – KP (Knowledge Plane)

ONIX
F-MBTS
Net DE
F-MBTS
AMC-MBTS
EM/NM
Management and Network Orchestration

RAN - KP
Example: 5G RAN CU-DU split

Backhaul - KP
Example: IAB – Integrated Access Backhaul

CN - KP
Examples: 5G CN, PCF (Policy Control Function)
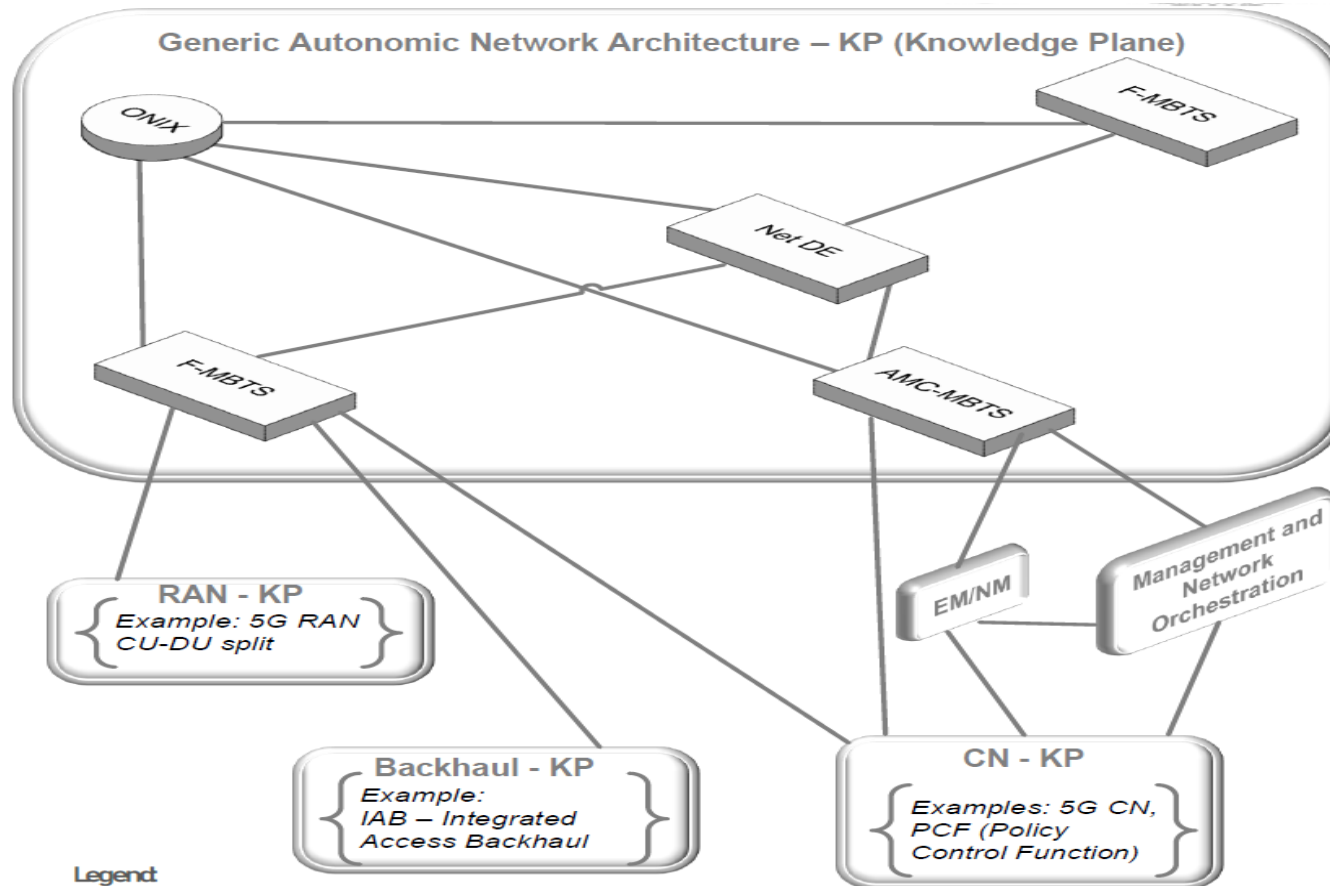
Legend:
5G CN: 5G Core Network
5G RAN: 5G Radio Access Network
AMC-MBTS: Autonomic Management and Control – Model Based Translation Service
CU-DU split: 5G RAN Centralized Unit – Distributed Unit partitioning
EM: Element Management
F-MBTS: Federation – Model Based Translation Service
KP: Knowledge Plane
Net DE: Network Decision Element
NM: Network Management
ONIX: Overlay Network for Information eXchange

ETSI has published

ETSI TR 103 747 *on*

Implementing Federated GANA Knowledge Planes (KPs) Platforms for E2E Multi-Domain Federated Autonomic Management and Control (AMC) of Slices in NGMN E2E 5G Architecture
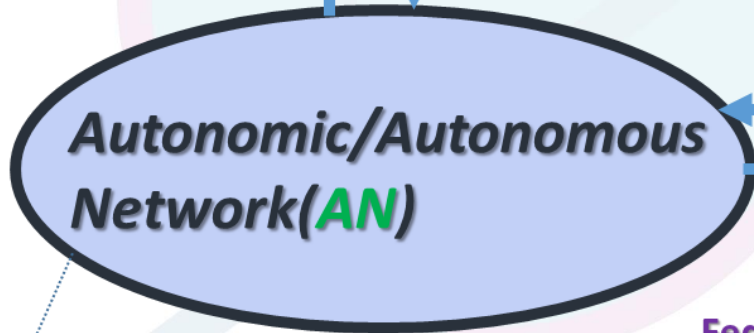
C2 General

IEEE Proposal: Conceptual Model for Developing the COPAAN Blueprint

Governance Interface of an AN

Human Actors
1. AN Governor (i.e. AN Super User)
2. Other AN Users

- The **Human Actors** need to be defined in the Blueprint, including the Types of Actors and Multiplicity on the Governance Interface as well
- **Generic Primitives/Procedures** and associated **Attributes** of the Governance and Federation Interfaces and Invokers & Directionality of Primitives Invocations need to be defined
- The Internals and Design Principles of ANs and ASs as their Building Blocks should be left to the various SDOs/Fora working on AN Architectures
- The Generic Primitives/Procedures of the Generic Interfaces (e.g. as Generic APIs) should then be inherited by the individual SDOs/Fora into their AN Frameworks and extended, _AND/OR_ that the Generic Primitives/Procedures would be made to invoke Primitives/Procedures specific to AN Frameworks of specific SDOs/Fora

Autonomic/Autonomous Network(AN)

Autonomic/Autonomous Network(AN)

Federation Interface of an AN

- There are different Classes of ANs and the Industry now need a Blueprint that describes the various Classes of ANs and Characterizations of the AN Operational Principles that are **Common across AN Classes** and those that are **Common across ANs that belong to the same Class**

Benefits of the Blueprint of Common AN Ops Principles:
- Enable Test and Certifications of ANs based on the Common Operational Principles
- Enable Integrability and Interopearbility among ANs
- Provide for Differentiating Factors for ANs, to aid Procurement of ANs

Facts regarding AN Framework Standardization in various SDOs/Fora: There are already a number of SDOs/Fora working on their AN Architectures: There is a way to achieve some level of harmonization that enables Integrability and Interoperability of AN Architectural Frameworks from various SDOs/Fora and Implementations thereof, without disrupting the roadmaps of the SDOs/Fora

Thank you