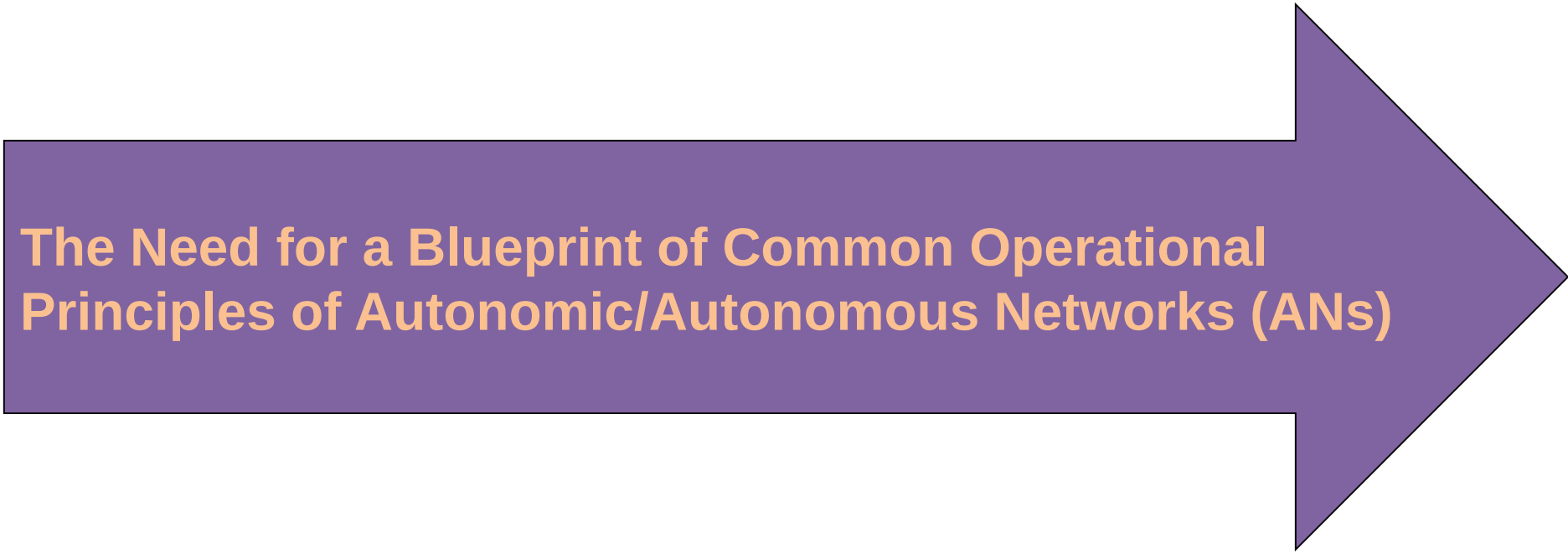
Towards Development of a Blueprint of Common Operational Principles for Autonomic/Autonomous Networks (ANs)

26th April 2021

Presenters: ***Dr. Ranganai Chaparadza,*** *PhD:* ***IEEE INGR Future Networks: Systems Optimization WG & Standardization Building Blocks (SBB) WG, Capgemini Engineering-Vodafone Consultant,***

Dr. Muslim Elkotob*: PhD:* ***IEEE INGR Future Networks: Systems Optimization WG & Standardization Building Blocks (SBB) WG, Vodafone***


The Need for a Blueprint of Common Operational Principles of Autonomic/Autonomous Networks (ANs)

General Mission Statement on Autonomic/Autonomous Networking and Standards Harmonization Approaches

- **Mission Statement**:
  - **What the industry really needs now is a Blueprint of High Level Requirements (Operational Principles) that an Autonomous Network or System should fulfil in terms of its interaction with Human Operators, i.e. its Governance by the Human Operators, and the interaction of an AN with another AN or ANs in a Federation of ANs operations for the delivery of E2E services across ANs**

- **Approaches for enabling Integrability and Interoperability of AN Architectural Frameworks from various SDOs/Fora and Implementations thereof:**
  - There are a number of Architecture Scenarios/Frameworks emerging in SDOs/Fora that are linked to Autonomic/Autonomous Networking, and the way to harmonization could be to develop Ontologies and MetaModels that provide for Mappings among the Concepts in the various Architectural Scenarios/ so as to enable to Generate from the Ontologies and MetaModels Integration APIs that can be used by Implementers in enabling to interoperate Solutions that are implemented and deployed based on a Mix of the Architecture Scenarios/Frameworks: → *This calls for setting up Neutral Project(s), e.g. publicly funded Research/R&D Projects), that can Study the various Architecture Scenarios/Frameworks and produce the required Ontologies and MetalModels*

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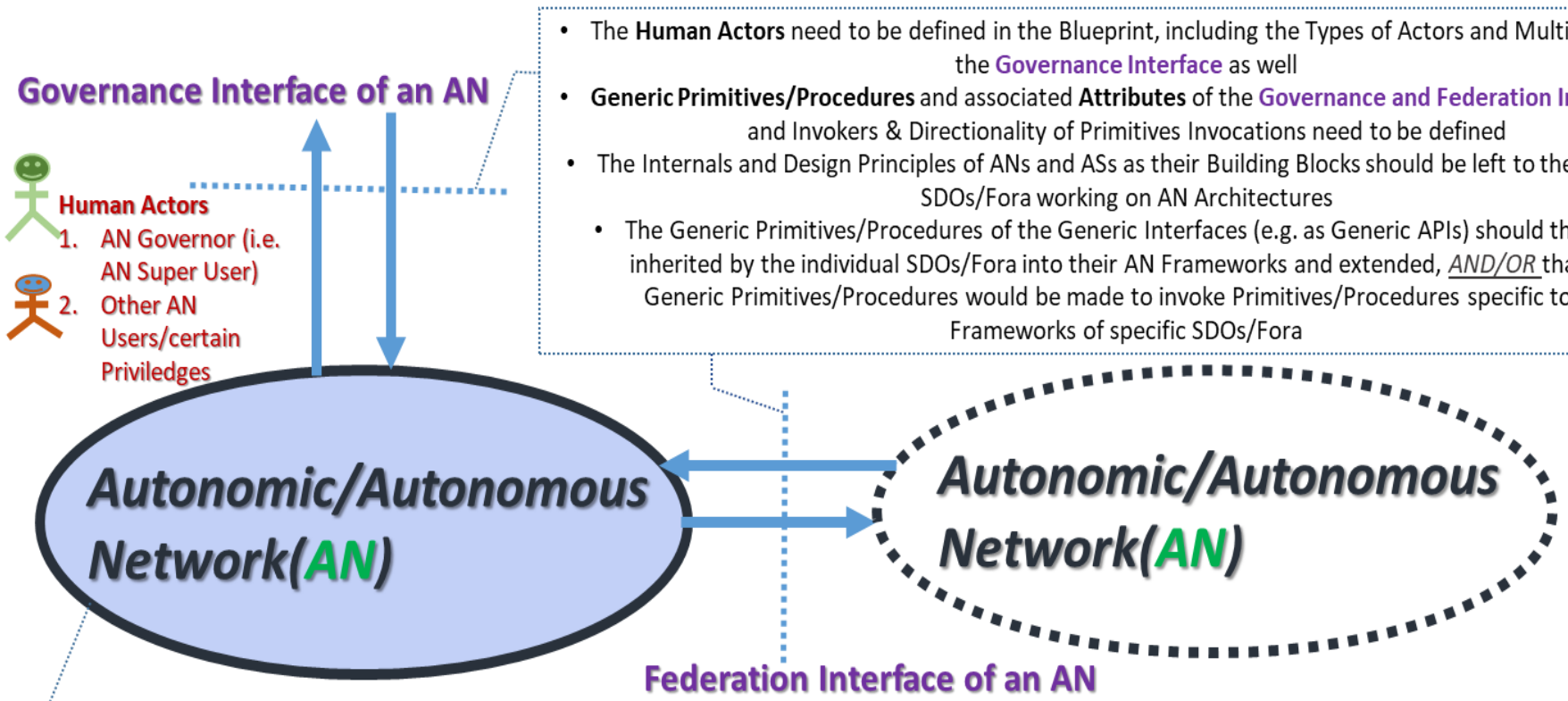
Proposal: Conceptual Model for Developing the Blueprint



- 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

- **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 Frameworks 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

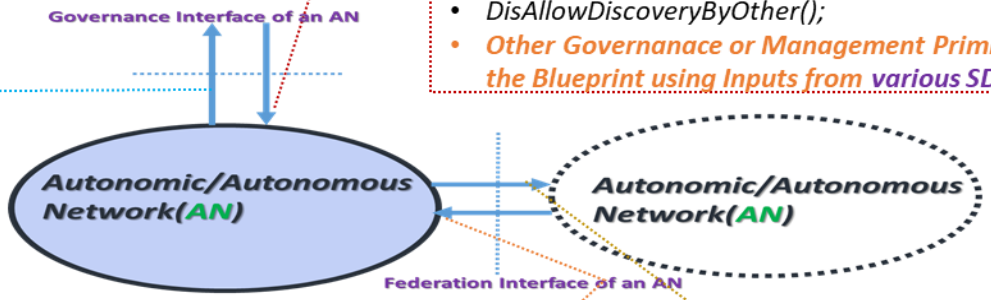
Proposal: Examples of Primitives of the Conceptual Model that would need to be specified and detailed in the Blueprint

- *AsynchroneousReport();*
- *FeedbackReportToUserSolicitation();*
- *EscalationOfSituation(Params: Situation Description);*
- *GetIntevention();*
- ***Other Primitives required on the Governance Interface should be defined and Detailed by the Blueprint using Inputs from various SDOs/Fora AN Frameworks & Other Inputs***

- *SetModeOfOperation(Param: Open-Loop/Closed-Loop)*
- *GetCapabilityDescriptionModel();*
- *GovernanceInputsSupply(Params: Config Profile, Goals, Policies, Intents, etc);*
- *GetCurrentCapabilities();*
- *SetLevelOfAutonomy(Param: Level_or_Degree of Autonomy);*
- *GetCurrentRecommendation ();*
- *DescribeImpactOfChange(Params: e.g. Goals, Policies, Vertical Downstream Intent, etc);*
- *GetReport(Param: TimeWindow);*
- *EstablishFederation(Param: List of ANs);*
- *PauseFederation(Param: Time);*
- *ResumeFederation(Param: Time);*
- *TerminateFederation();*
- *ListActiveFederations();*
- *ShowPotential();*
- *AllowDiscoveryByOther();*
- *DisAllowDiscoveryByOther();*
- ***Other Governanace or Management Primitives should be defined and Detailed by the Blueprint using Inputs from various SDOs/Fora AN Frameworks & Other Inputs***

Human Actors

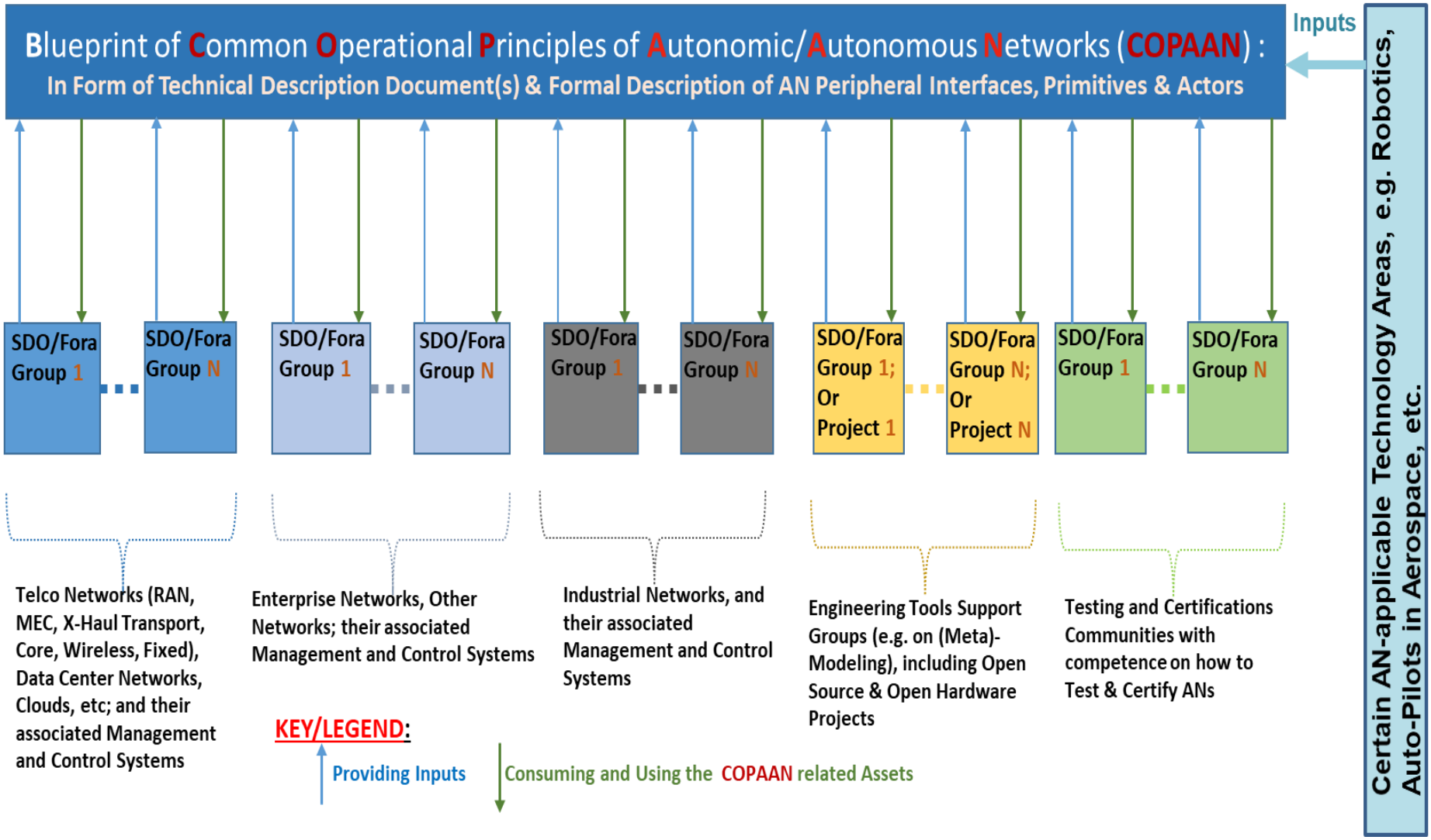
1. AN Governor (AN Super User)
2. Other AN Users /Priviledged…)



- *FederationEstablishment_Reply();*
- *PausingFederation_Reply(Param: Time);*
- *ResumingFederation__Reply(Param: Time);*
- *TerminatingFederation_Reply();*
- *FeedbackToHorizontal_IntentSupply();*
- *ResponseToNegotiateFederatedAutonomicManagementAndControl();*
- *AcknowledgementToSharingStateInfo();*
- *ResponseToRequestForStateInfo();*
- ***Other Federation Primitives should be defined and Detailed by the Blueprint using Inputs from various SDOs/Fora AN Frameworks & Other Inputs***

- *FederationEstablishmentRequest();*
- *PausingFederation(Param: Time);*
- *ResumingFederation(Param: Time);*
- *TerminatingFederation();*
- *Horizontal_IntentSupply();*
- *NegotiateFederatedAutonomicManagementAndControl();*
- *SharingStateInfo();*
- *RequestForStateInfo();*
- ***Other Federation Primitives should be defined and Detailed by the Blueprint using Inputs from various SDOs/Fora AN Frameworks & Other Inputs***

Proposal: Building the Blueprint (COPAAN): Inputs for Developing the COPAAN & Outputs Consumption by SDOs/Fora



Other Topics of relevance to building the Blueprint and Lessons learnt from Non-Telco Industries

- **Autonomous Networks are characterized by Legal, Regulatory Concerns:**
  - **Which other industries (automotive, marine) have addressed** by creating **defined maturity level for degrees of autonomy** which are combinations of behaviour, interaction with humans and technical features and capabilities. There are lessons we can learn from various fields where "autonomous systems" implementations have been achieved to some degree. **Lessons that help us to define and capture desirable operational principles that can be shared across SDOs'/Fora's AN-related architectures are very vital.**

  - **Lessons from Other Industries or Technology Areas** should be considered, e.g. the Area of Robotics as applied to various fields such as Medicine, Mining, etc.; Aerospace (e.g. use of Auto-Pilots)
  - **Need for Taxonomoy Harmonization on ANs**
  - **Other Very Important Topics presented during the IEEE Systems Optimization WG Workshop 2021 that should be considered in Developing the Blueprint**

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Proposal: A Call for a Project to work on Producing the Blueprint and an SDO/Forum to Evolve and Maintain it