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Group Specification

Autonomic network engineering for the self-managing Future Internet (AFI); Scenarios, Use Cases and Requirements for Autonomic/Self-Managing Future Internet

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Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group Autonomic network engineering for the self-managing Future Internet (AFI).

1 Scope

The present document contains a description of scenarios, use cases, and definition of requirements for the autonomic/self-managing future internet based on a Top-down & Bottom-up methodology and related master templates we defined as a dedicated tool. Scenarios and use cases selected in the present document reflect real-world problems which can benefit from the application of autonomic/self-management principles. This list will be enriched and extended with new set of scenarios and use cases in the next release.

1.1 Global description background

As network operators need to address numerous issues such as deregulated markets, open competition, explosion of digital services, converged fixed-mobile services, converged IT-Network (Virtualisation, Clouds) and operation efficiency, they are facing new business and technical challenges. Consequently, they are striving to build a new ecosystem comprising end-to-end solutions, created through strategic alliances within the telecommunications sector including third parties MVNO/MVNEs, competitors becoming partners (Radio infrastructure sharing or "RAN Sharing" agreement, for instance), Clouds Services Providers, Virtual Network Providers, consumers becoming content producers, outsourcing partners, integrators. For this reason the networks they are operating and the associated OSS (Operations Support System) must be intelligent, agile, open, secure, flexible and autonomic (i.e. operating with minimum human intervention).

As driving forces from the network evolution perspective, we can highlight the deployment of key emerging technologies such as IP Multimedia Subsystem (IMS) / Next Generation Network (NGN), Long Term Evolution (LTE) / Evolved Packet Core (EPC), Future Internet, Internet of Things, Machine to Machine, IaaS/NaaS/CaaS (Infrastructure, Network, Communication as a Service) etc. The underlying network architectures, so called "flat architecture" will increase the amount of equipments required while at the same time the major operators' requirement is to lower operating costs (OPEX).

That means, some level of the notion of being "autonomics" should be embedded into network equipment and OSS at a first phase for the configuration purpose, but Future Network infrastructure should incorporate more and more autonomic features in order to maintain operational costs under control when it comes to a large scale deployment phase. The same should be also applicable during the "operation phase" and "optimisation phase", all lifelong of the network. This needs embedding Self-optimisation, Self-Healing features. In this context, requirements aiming at building Trust & Confidence on these Self-functions, in one hand, and the coordination of interaction of various Autonomics functions in the other hand, must be implemented in order to ensure a global optimum while targeting a local optimum per Autonomics function activated through the same optimisation parameter. Without this coordination, we could not prevent the fact that some parameters can lead to the optimisation of one Autonomics function while at the same time, it negatively impacts another Autonomics function. This results in an unstable behaviour of the network. That means, the coordination of interaction of Autonomics functions deployed in a network is a major requirement as well from operators' perspective. In case of failure of an Autonomics function, a process must be specified and designed to allow the operator to keep control of the management of the network through its OSS and related tools by desactivating a given autonomics function as long as a solid Trust & confidence has not being built.

Currently, there is a lot of work being carried out on autonomics, mostly conducted by the research community but from the operational point of view there is little common understanding on how autonomic technologies can help and how they will impact current operation models of the operators. There is a need to build a new management environment that can definitely contribute to the efficiency of business units and reduce OPEX. Autonomics and Self-Management related technologies are envisioned as the solution for a player to control its own environment and at the same time assuring the end to end view, which emerges from the individual behaviors of all the players.

Work Item 1 focuses on the set of requirements for Autonomic and Self-Managing Future Networks to efficiently help the operator to face new market realities and on the definition of the operational requirements for operators to take advantage of such advanced infrastructure. The Operational Model is far beyond the classical centralized management approaches, looking for innovative methods for controlling and managing distributed decision making functions embedded in an autonomous and intelligent infrastructures.

Work Item 1 establishes a framework for "Scenarios, Use Cases and Requirements for the Self-Managing Future Networks" contributed by Network Operators and other players such as content providers, etc into this AFI Specifications. This framework is based on Templates and Tables.

1.2 AFI Methodology

Figure 1 depicts the AFI Top-Down & Bottom-up Methodology. This methodology is composed of two horizontal layers, high level "operators' requirements, use cases and scenarios" at the bottom and "Generic Autonomic Network Architecture" (GANA), interconnected at the top, with each other to show that some input flows from one process to the other.

A vertical layer provides inputs and enablers in terms of "Use Cases" for the bottom layer and "GANA" for the top layer. In this vertical layer we gather outcome provided by the AFI's stakeholders (research community, operators' experience, vendors' experience, customer quality of experience, etc.

The outcome will be the definition of an "Implementable Autonomic Network Architecture" (IANA) composed of Autonomic functional blocks, reference points, Info Models/Data Models and associated implementation neutral specifications.

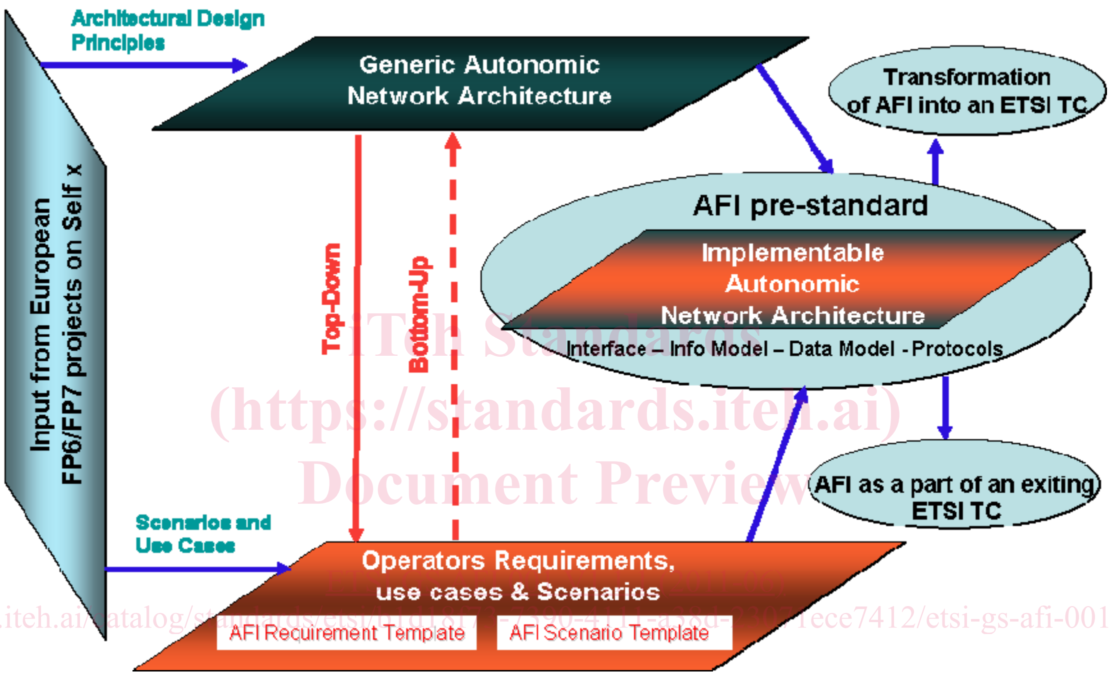

Figure 1: AFI Top-Down & Bottom-up Methodology

In order to meet the operators requirements will be defined, we need to instantiate this "Generic Autonomic Network Architecture" by applying its prescribing "generic autonomicity and self-management concepts and principles" into an existing network architecture such as the NGN architecture. The result of this instantiation of GANA is an "Implementable Autonomic Network Architecture" (IANA) as a production network in the short-term, and evolves into the mid-term and then long-term.

To achieve this goal, the inclusion of operators' operation requirements in this "GANA" is required. That means, which reference point should or shall be translated into interface. And which Information Models and Policy Frameworks should be translated into related rules, data models and protocols (syntax, semantic) from implementation point of view. This is linked to the choice of the right and cost effective ones from integration point of view in the OA&M/OSS systems.

This results in the "AFI pre-standard" based in what we named "Implementable Autonomic Network Architecture" as the major AFI deliverable.

Besides, this instantiation will map the "GANA" on to the hierarchical management architecture at network level, service level and policy management level of an existing architecture, will result in an "Autonomic architecture" when the "generic autonomicity and self-management concepts and principles" prescribed by the GANA are applied by fusion with an existing architecture in use by the industry.

These instantiations or mappings must be driven by operators' use cases. The industry (Equipment suppliers, the OSS vendors) will play a major role as well.

In this context, end to end inter-domain issues are also treated when it comes to deliver end to end service through numerous networks or sub-networks (in the case of partioning). Besides, building trust and confidence on the "Implementable Autonomic Network Architecture" by designing test and validation framework is a major topic of this AFI Methodology.

1.3 AFI Process & Roadmap

1.3.1 AFI Process

Figure 2 depicts the different steps of the AFI process. It shows strong relationship between the three work items structuring the AFI work so far. AFI WI#1 specification describes high level operators Requirements, Use Cases and Scenarios. These requirements are used as input toWI#2 which is in charge of specifying the "Generic Autonomic Network Architecture".

WI#3 will map and instanciate the GANA to current networks based on scenarios described in WI#1 and by refining the high level requirements and including operation requirements. The outcome is transforming an existing architecture into an "Autonomic architecture" or "Autonomic-Aware architecture".

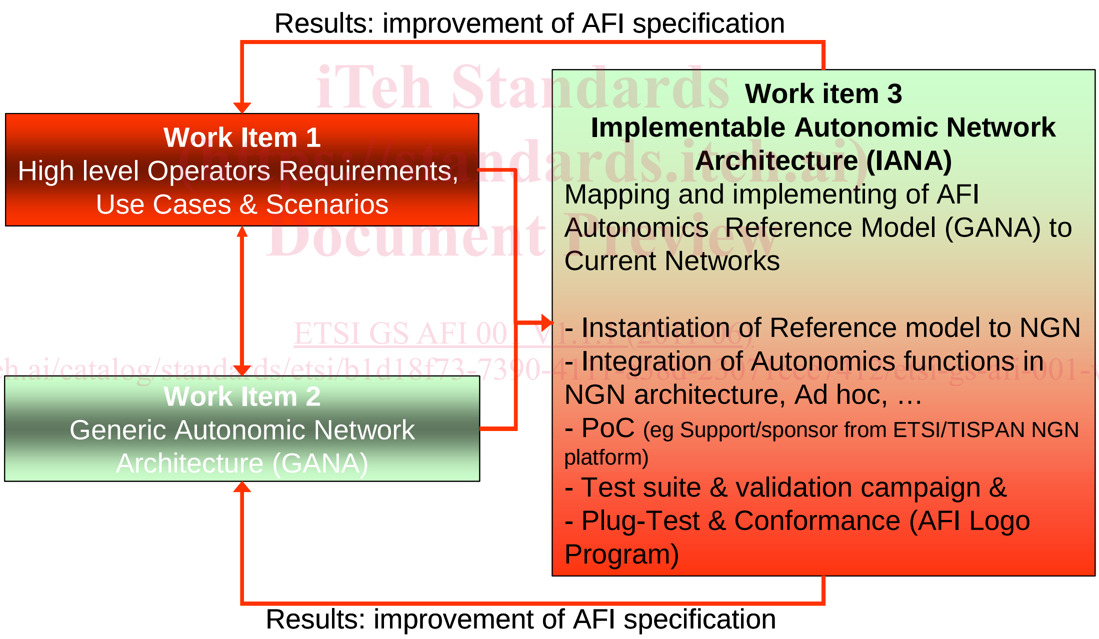

Figure 2: AFI process

In order to consolidate this transformed architecture, conformance tests and validation framework is specified in order to build trust and confidence in the AFI specification. This validation process is used for improvement purpose of the AFI specification and could also be used as basis to creating a kind of "AFI logo label/Certification" if needed.

1.3.2 AFI Roadmap

Figure 3 depicts AFI structure, process, roadmap, and deliverables. In this process, AFI stakeholders provide the input to the WIs (Work Item) on the one hand, and feedback and adjustment, on the other hand, in order to help bridging the gap or to create new WIs. Maintenance and updating activity is included in this process as well.