Unified Management Framework: Processes and tools for establishing autonomies in the management of networks and services

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Autonomics, ten years already

“build computer systems that regulate themselves much in the same way our autonomic nervous system regulates and protects our bodies”
Barriers for telcos and vendors adoption

- Very poor standards in the field of autonomic networking
- Management chain of Operators (NE-EMS-NMS-OSS/BSS) is often not taken into account
- Very low emphasis on service management over multiple network segments – Technology specific solutions
- The operator’s control of autonomic nodes was not well addressed
- Confidence and trust were not identified as requirements – the focus was mainly on the provision self-x functionalities.
- Migration scenario wasn’t identified. i.e. the path to cross from legacy management to autonomic one
- The cost of introducing autonomies was not evaluated
- Lack of business scenario and the corresponding revenue value
Univerself’s scope and objectives

Today
Loosely interacting domains

Future Network
Decentralized and dynamic network of networks

Network & Service Ecosystem
Loosely interacting domains

Today
Loosely interacting domains

Service & Network Operator Challenges

Project Challenges

Today
Loosely interacting domains

Today
Loosely interacting domains

Federation of intelligence
- Dynamic
- Architecture Agnostic

Optimum efficiency

Opex savings

Capex savings

Intelligence embodiment

Technology Maturation

Building Confidence & Trust

Control plane

Mngmnt plane

Self-organisation

Cognition

Enabled by

UMF

Evolves through

Unites

Enables

Enables

Routine Mngmnt

Governance

Technology Maturation

Building Confidence & Trust

Optimum efficiency

Opex savings

Capex savings
UMF objectives

Unified Management Framework

1. Technology agnostic end-to-end service management
2. Unification of existing Management Approaches and Systems
3. Network Governance
4. Management of Future Networks
5. Embedding of autonomic paradigm in any type of network

Enables Single Operator
UMF structure

• UMF is a set of design patterns, interworking interfaces, life cycle facilities and recommendations for the design of network empowerment functions and their smooth embodiment in any type of networks regardless the underlying technology

• UMF is composed of two parts:
  – UMF core: set of all the “must have” features, those that are fundamental for the design of an autonomic management system: governance, embodiment, knowledge and information sharing, orchestration.
  – UMF techno-specific primitives: interfaces, design patterns that belong to specific networking technologies.
UMF design methodology

High level requirements
- State of the art
- General characteristics

UMF Design and Specification
- UMF release 1
- UMF release 2
- UMF release 3

Use cases
- Requirements
- Refinement
- Implementation
- Assessment

Top Down approach
Bottom Up approach
Six use cases expressing real life operators problems are investigated in UniverSelf Project:

- Use Case 1 focuses on self-diagnosis and healing in both **IP networks/IMS services and VPN networks**
- Use Case 2 aims at simulation and emulation results about stability and performance of a network (with a great number of nodes and real impairments) with **cross-layer and cross-domain** self-configuration mechanisms
- Use case 3 focuses on the dynamic virtualization and **migration of data/content and network entities** (gateways and servers) nearer to users
- Use case 4 aims at resolving traffic rise/congestion problems and the associated deterioration of service provisioning by means of policy-based coordination of **SON** entities
- Use Case 5 envisages an operator-governed, automated, end-to-end, service (or new traffic) deployment on top of heterogeneous networks encompassing both **RANs and backhaul/core segments**
- Use Case 6 aims to demonstrate the importance of the network and service governance, through the use of IPTV services running on top of both **fixed and mobile networks**
Use cases analysis (1/2)

- “Black Box” methodology: decomposition of the use in a set of sub problems (black boxes) at different level of granularity.

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Use Case Name

Inputs

1. 1st problem
2. 2nd problem
... 
k. k-th problem

Outputs

2.1 1st sub-problem
2.2 2nd sub-problem
... 
2.k k-th sub-problem
```
Use cases analysis (2/2)

- Identification of:
  - Functions required to solve the use case problems
  - Models, consisting of information & knowledge bases required to fulfill the Functions’ operation
  - Interfaces, justifying interworking among black boxes

- Grouping of common functions and designation of reusable functional blocks as part of UMF
UMF functional blocks (1/2)

- Eleven FBs are defined:
  - **Monitoring (MON_FB):** collection of monitoring data from network, service and end user equipment
  - **Situation Analysis/Diagnosis (SAD_FB):** monitored data processing, filtering, correlation, etc.
  - **Candidate Solutions Computation (CSC_FB):** inference of potential solutions (reparation/mitigation plans, (re)configuration) to an identified situation
  - **Solution Selection and Elaboration (SSE_FB):** decision taking (of either a reparation/mitigation plan or a configuration action) resolution of possible incoherence/conflicts
  - **Configuration Enforcement (CE_FB):** enforcing the configuration decision (both configuration and reconfiguration actions (re-optimizations))
UMF functional blocks (2/2)

- **Solution Evaluation/Assessment (SEA_FB):** evaluating the solution and possibly triggering further actions or fine-tuning/optimizations

- **Governance (GOV_FB):** business goals/policies edition in high level terms through a human-to-network (H2N) interface and visualization of network events

- **Policy Derivation and Management (PDM_FB):** translating high level goals/objectives provided through H2N interface (Governance) into low level policies

- **Cooperation (CO_FB):** coordinating/orchestrating self-x managing and managed entities including conflicts resolution

- **Information and Knowledge Building (IKB_FB):** referring to any function (e.g. build/store/retrieve/update/modify/exploit) related to dynamic, high level information and knowledge

- **Profiles and Models (PM_FB):** representing static knowledge stored in databases e.g. existing information on the managed elements, the offered applications, the served users and equipment etc.
Applying UMF to SON LTE use case

G_FB: Governance
PDM_FB: Policy Derivation and Management
M_FB: Monitoring
SAD_FB: Situation Analysis/Diagnosis
IKB: Information and Knowledge Building
SSE_FB: Solution Selection and Elaboration
C_FB: Cooperation Functional Block
SEA_FB: Solution Evaluation/Assessment

H2N
OA&M

Operation/Business Support System (OSS/BSS)
Network Management System (NMS)
Access Network

SSE_FB: Solution Selection and Elaboration
C_FB: Cooperation Functional Block
SEA_FB: Solution Evaluation/Assessment

G_FB: Governance
PDM_FB: Policy Derivation and Management
M_FB: Monitoring
SAD_FB: Situation Analysis/Diagnosis
IKB: Information and Knowledge Building
Message flows between functional blocks

G_FB: Governance
PDM_FB: Policy Derivation and Management
M_FB: Monitoring
SAD_FB: Situation Analysis / Diagnosis
IKB: Information and Knowledge Building
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SSE_FB: Solution Selection and Elaboration
C_FB: Cooperation Functional Block
SEA_FB: Solution Evaluation / Assessment
UniverSelf Plans for Standardisation

AI ISG
GANA Instantiation
Architectural Reference Model for Autonomic Networking
Scenarios, Use Cases, and Requirements

WI#1
Joint contribution from participating Network Operators
Proposal of Working Group within NGMN

3GPP
New requirements (e.g. governance, monitoring), New set of use cases for SON in LTE-Advanced, Requirements related to SON coordination

NGMN
New elements not currently addressed by “AFI-GANA”

WI#2
New Scenarios, Use cases & requirements

TMForum
Introduce autonmics to eTOM – TMF information model CIM/SID/Den-ng

Learning for TE, Learning for Routing, Learning for Fault-diagnosis
In accordance to areas of interest (see Complexity BoF announcement at IETF81)
Network Complexity

AFI-GANA
Joint contribution from participating Network Operators
Proposal of Working Group within NGMN

UMF
GANA Instantiation

Wireless Interface (Wl#1)
New Scenarios, Use cases & requirements

Wireless Interface (Wl#2)
New elements not currently addressed by "AFI-GANA"

Wireless Interface (Wl#3)
Trust and certification

Wireless Interface (Wl#4)
Create a new WI

Joint contribution from participating Network Operators
Proposal of Working Group within NGMN

Learning for TE, Learning for Routing, Learning for Fault-diagnosis
In accordance to areas of interest (see Complexity BoF announcement at IETF81)
Network Complexity

Protocols and algorithms for managing constrained devices, Autonomics in the Internet

NGMN
New requirements (e.g. governance, monitoring), New set of use cases for SON in LTE-Advanced, Requirements related to SON coordination

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THANK YOU!