UNIVERSELF

Aims at overcoming the growing management complexity of future networking systems, and to reduce the barriers that complexity and ossification pose to further growth.
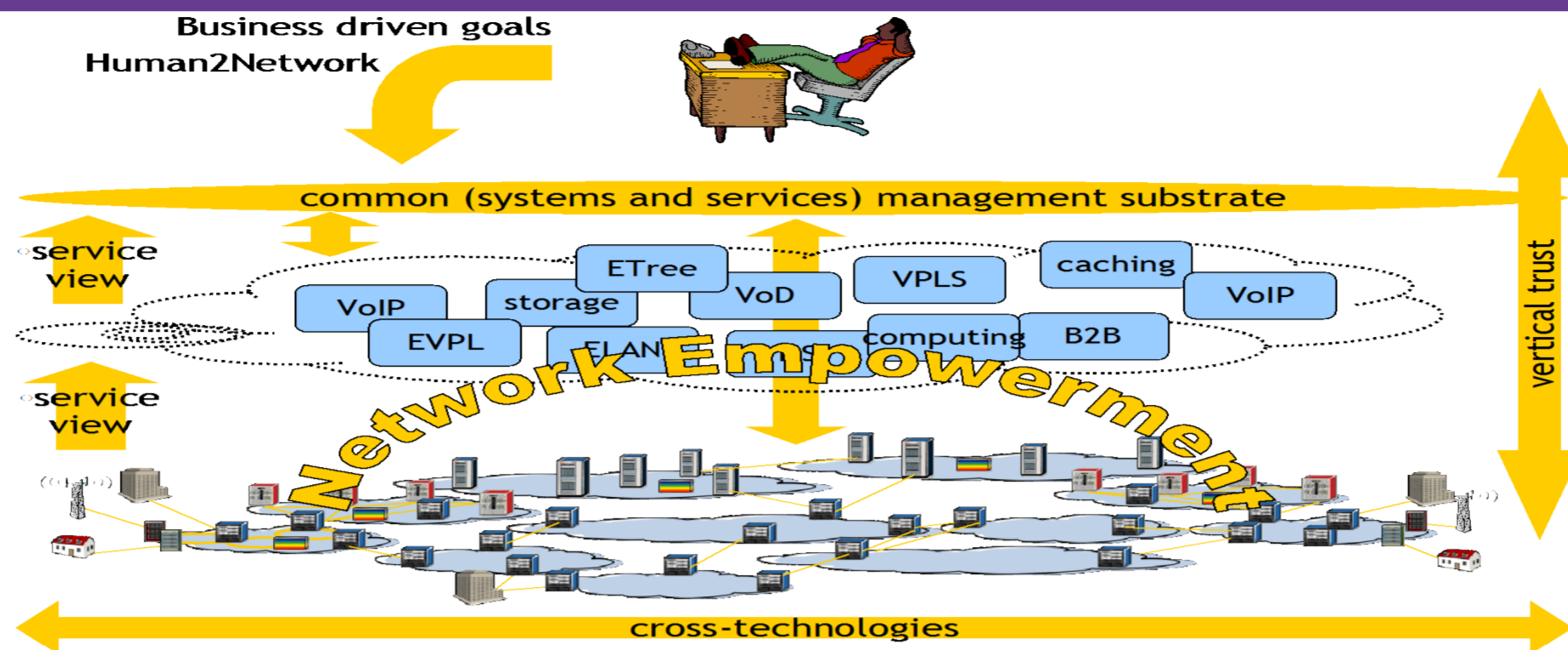
SEVENTH FRAMEWORK PROGRAMME

www.univerself-project.eu

Main Objectives

○ **Context:**

➢ Substantial progress in the field of autonomics research across the world and especially in Europe.

➢ Most research efforts focussed on solving manageability bottlenecks in a given technological domain, while services extend anywhere, regardless of the technological boundaries (e.g., wireline/wireless).

➢ Need for new techniques enabling the transformation of operational models, the evolution of networks towards a flexible playground for operators, and more generally techniques participating to the increase of the return on investment.

○ **UniverSelf arises from this context and it has four major goals:**

➢ Design of a Unified Management Framework for the different existing and emerging architectures, or for architectures designed in past autonomic research. This unified and evolvable framework will constitute a cross-technology (wireless and wireline), common substrate for both systems and services. ("Cleaned state" not "Clean slate")

➢ Design of all required functions to achieve self-management and embed these features right into the systems and network equipments that constitute the infrastructure and support service delivery, paving the way to full network empowerment.

➢ Impact on the industry and the push of European research into the direction of exploitation. This will be done by demonstrating the possibility to deploy autonomic solutions in carrier grade networks

➢ Bring confidence and trust into autonomic technologies for telecommunication networks. Definition of certification techniques for autonomics empowered systems.

Technical Approach

Business driven goals
Human2Network

common (systems and services) management substrate

service view — ETree, VoIP, storage, VoD, VPLS, caching, VoIP, EVPL, LAN, computing, B2B

Network Empowerment

service view

vertical trust

cross-technologies

○ **UniverSelf combines both top-down and bottom-up methodologies and it is organised as follows:**

➢ Unified Management Framework (WP2) aims at federating self-management approaches and architectures to release a global autonomic management system for both current and future networks and services, spanning wireline and wireless technologies.

➢ Network Empowerment (WP3) is dedicated to the study, design and evaluation of common classes of algorithms with self-x and cognitive capabilities together with the requirements for their embodiment into network functions.

➢ Deployment and Impact (WP4) has the mission of: i. producing use-case refinements (pointing out real manageability bottlenecks and the related requirements); ii. making simulations and emulations of the solutions designed by the joint work of WP2 and WP3; iii. eventually deploying them into test-beds for experimental validation; iv. analyzing the impact of above solutions; v. making the assessments for establishing trust in autonomics.

➢ Trend Setting (WP5) has the mission to disseminate the research outcomes and give international visibility to the project and its corresponding findings, as well as to actively support the trust and certification initiative.

○ Use-cases ("Self-diagnosis/healing (emphasis on IMS/VoIP)", "Network stability and performance", "Virtualization and migration of data/content & respective network entities", "Self-Organizing Network operation/collaboration according to policies", "Operator-governed end-to-end autonomic joint network and service management" and "Network and services governance") are an essential structuring element of UniverSelf and they take the form of a life-cycle analysis from identification to prototyping/validation throughout the work-packages, which in turns strongly participates to the realization of an Integrated Project and maximizes the efficiency of these work-packages.

Key Issues

○ Key issues are arising from the use-cases and the complexity they impose to system management problem solving approaches. Key issues for UMF design and the embodiment of intelligence are:

➢ Unification,

➢ Finding the correct level of abstraction and generalization across heterogeneous components,

➢ Identifying commonalities in the nature of different problems,

➢ Finding common classes of algorithms for seemingly different problems,

➢ In a context where proprietary intelligence is a differentiator, the identification of the suitable elements for standardization (architecture, protocols, mechanisms, data formats, interfaces, others systems)
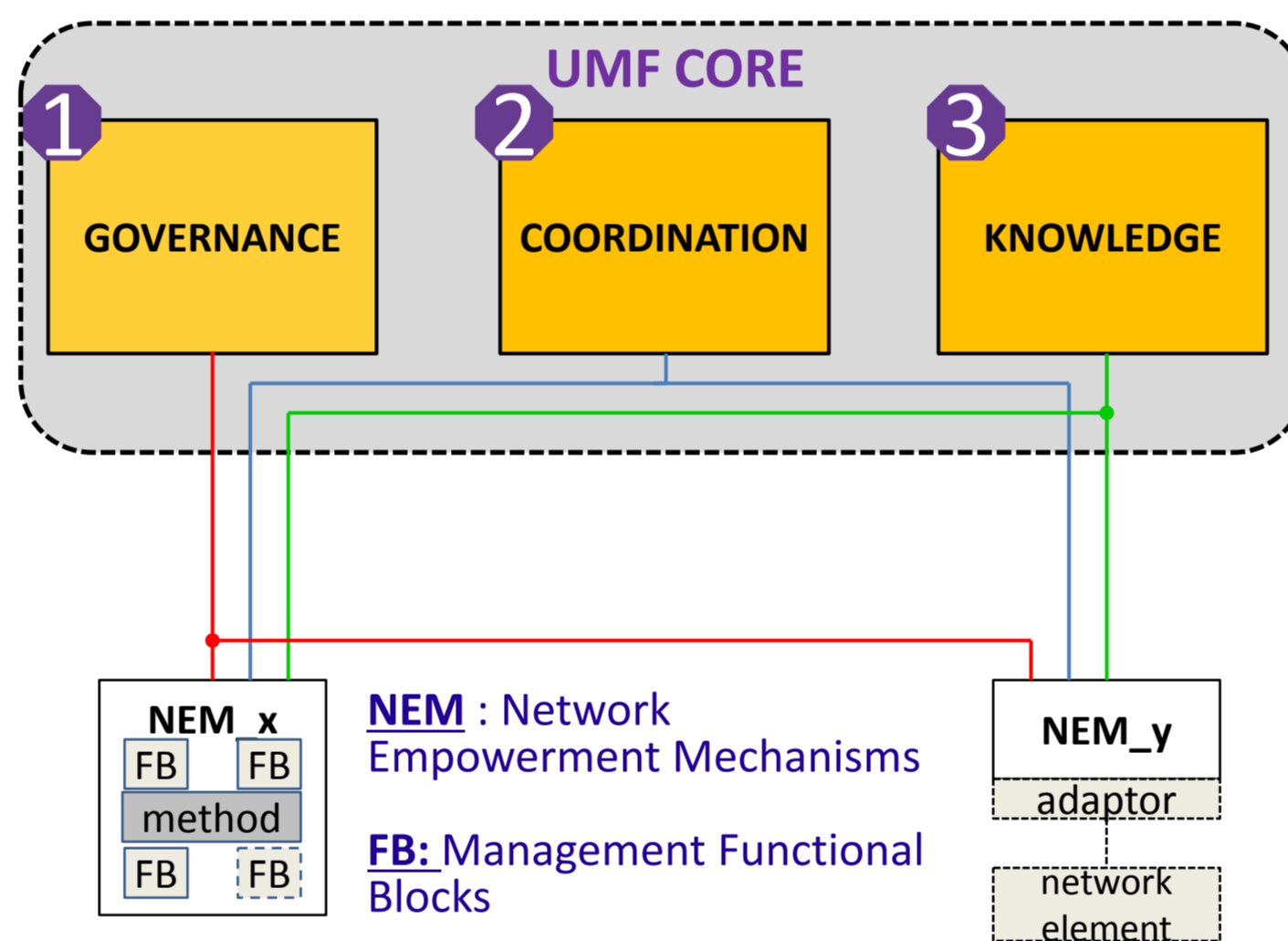
Key Impact Factors

➢ Providing operators flexible infrastructures for increased network demand, new business opportunities as well as efficient services integration, reinforcing European leadership.

➢ Self-x capabilities, enabling dynamic optimized network resource usage and allocation, resulting in reduced CapEx/OpEx and human intervention.

➢ Pre-standard specifications, combined with a strong large scale experimental validation phase.

➢ A novel unified framework easing the development and integration of end-to-end global interconnectivity, cooperation and real-time experience future internet services.

Unified Management Framework

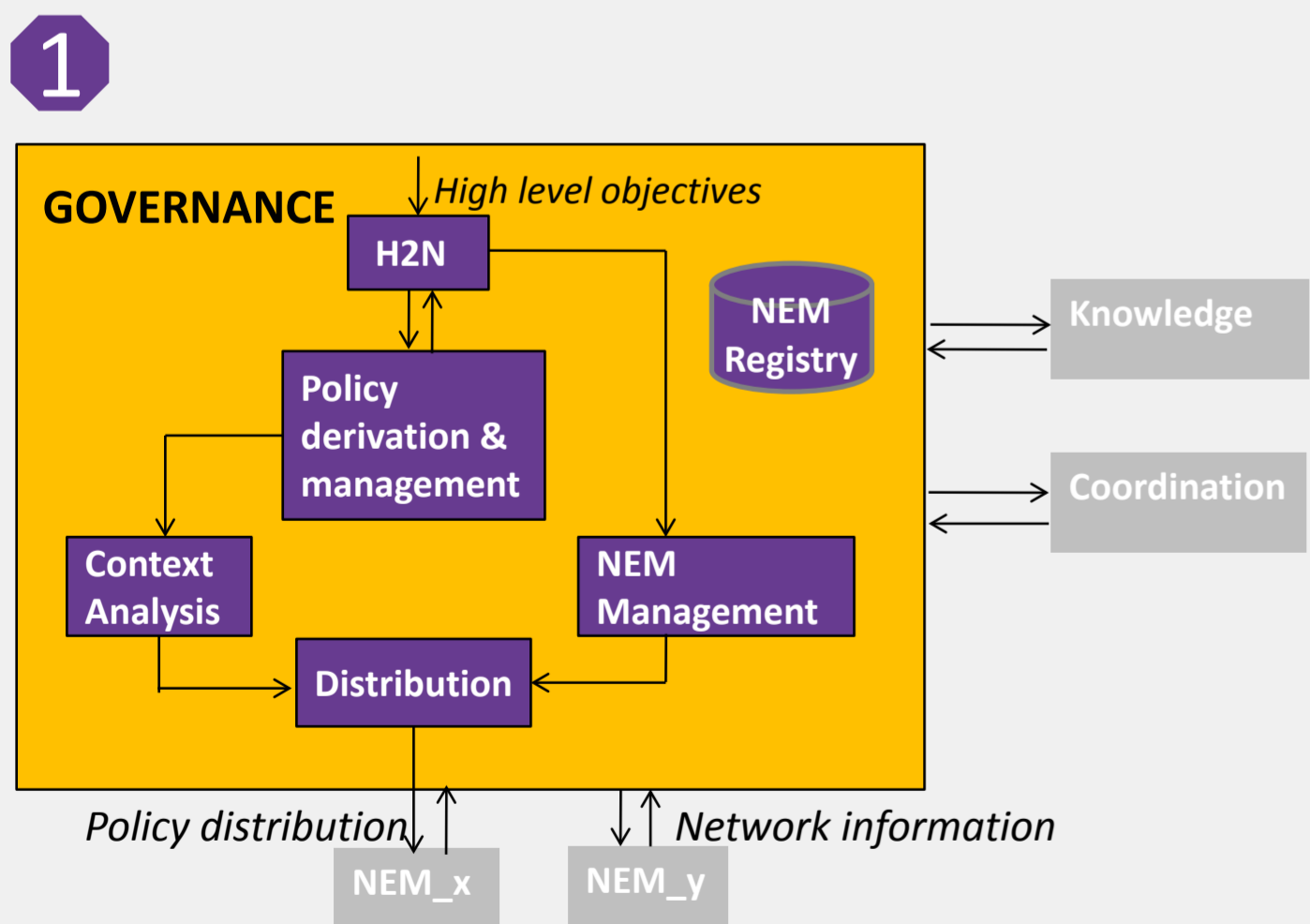### NEM – Network Empowerment Mechanism

○ Achieve a **self-management** function with a specific purpose.

○ Kind of **atomic** component for **autonomic** network management.

○ Design approach: use the **relevant** method to solve a **concrete** operational problem in a **specific** networking environment.

○ So, NEM = **method** + **objective** + **context**

➢ Wireless Access Load Balancing NEM

➢ Load Level Estimation NEM (Self-Organizing Maps)

➢ ICIC NEM (Genetic Algorithm, Simulated Annealing Algorithm)

➢ CORE Routing Optimization NEM (Heuristic Algorithm)

➢ Dynamic Resource Mgmt & Stability Control NEM (Decentralized and coordinated resource management)

➢ Context Management Optimization NEM (Optimal placement/relocation of information collection/aggregation nodes)

➢ Virtual Infrastructure Management NEM

SEE DEMO BOOTH

UMF CORE

1 GOVERNANCE   2 COORDINATION   3 KNOWLEDGE

NEM_x — FB, FB, method, FB, FB

NEM : Network Empowerment Mechanisms

FB: Management Functional Blocks
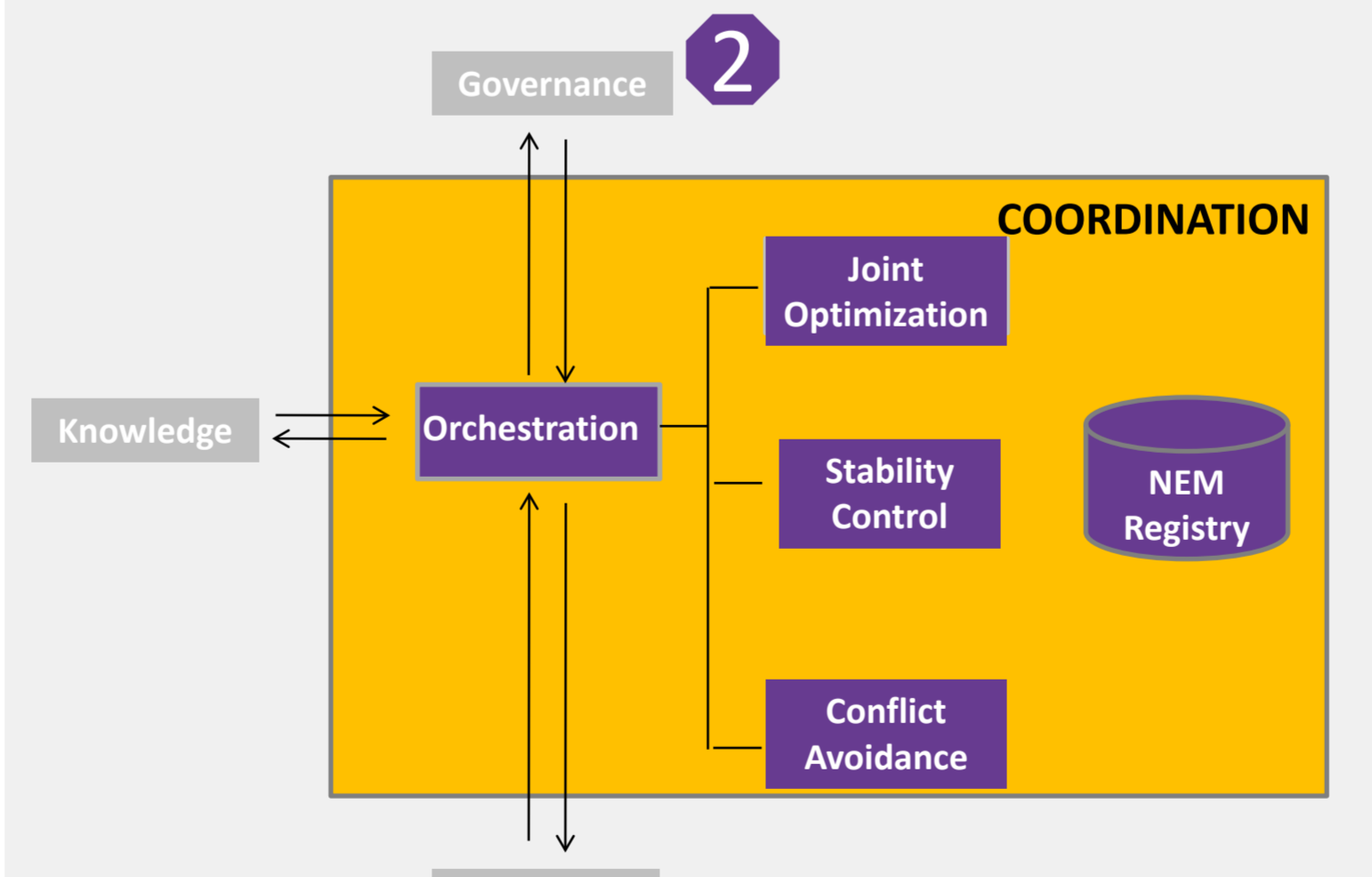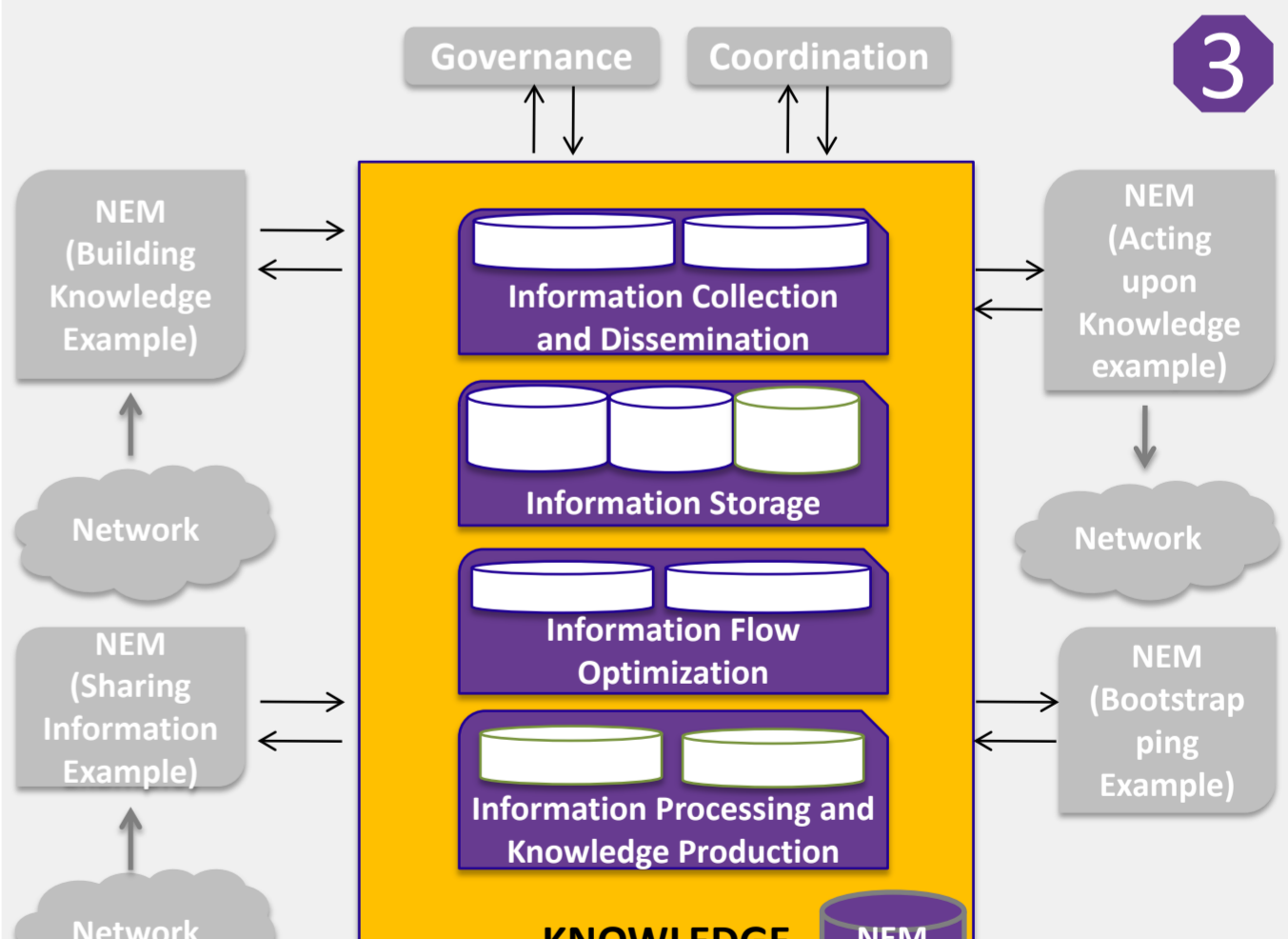
NEM_y — adaptor — network element

UMF vs. NEMs

○ When a NEM is deployed, it has to deal with its environment: the operator, the network/service equipments, the legacy management systems and also the other NEMs

○ Targeting a seamless deployment and trustworthy interworking of a large number of NEMs requires:

➢ Tools to deploy, drive and track progress of NEMs → **Governance/Human-to-Network tools**.

➢ Tools to avoid conflicts, ensure stability and performance when several NEMs are concurrently working → **Coordination/Orchestration mechanisms**.

➢ Tools to make NEMs find, formulate and share relevant information to enable or improve their functioning → **Knowledge management**.

➢ Tools to Allow NEMs getting monitoring data and enforcing configuration actions at equipment level → **specific adaptors**.

○ **UMF CORE = GOVERENANCE – COORDINATION – KNOWLEDGE**

1

GOVERNANCE — High level objectives — H2N — Policy derivation & management — NEM Registry — Knowledge — Coordination — Context Analysis — NEM Management — Distribution

Policy distribution — Network information — NEM_x — NEM_y

○ **Governance** is responsible for:

➢ The interaction between human operator and network

➢ The determination of NEMs' behaviour

○ Governance→NEM

➢ configuration commands for determination of NEM's status/mode

➢ report request for the environment conditions and NEM's operational conditions and configuration characteristics

○ NEM→Governance

➢ Report with the demanded information

2

Governance — Knowledge — COORDINATION — Orchestration — Joint Optimization — Stability Control — NEM Registry — Conflict Avoidance — NEMs

○ **Coordination** is responsible for:

➢ Orchestration of multiple NEMs, in the framework of the Governance policies, in order to be achieved specific operation and solution of definite problems

➢ Avoidance of conflicts between NEMs

➢ Stability control of inter-working NEMs

➢ Joint optimization of NEMs for optimization of the whole managed system

○ Coordination →NEM

➢ Commands to drive coordination including: tokens, timing, constraints, status (active/idle), etc

○ NEM→ Coordination

➢ Information on the NEMs' operation including: parameters, metrics, scope, utility functions, etc

3

Governance — Coordination — NEM (Building Knowledge Example) — Information Collection and Dissemination — NEM (Acting upon Knowledge example) — Network — Information Storage — Network — NEM (Sharing Information Example) — Information Flow Optimization — NEM (Bootstrapping Example) — Network — Information Processing and Knowledge Production — Network — KNOWLEDGE — NEM Registry

○ **Knowledge** is responsible for:

➢ Information/knowledge collection, aggregation, storage and distribution across all UMF functional areas

○ Knowledge →NEM

➢ Commands to retrieve, share, derive and manage knowledge (e.g. publish, subscribe, push, pull, request, store, notify messages)

○ NEM→Knowledge

➢ Registration of NEMs

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