

# ETSI ZSM work on Closed- Loop Automation

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ANIMA WG

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# ETSI ZSM ISG

- Zero Touch Network and Service Management
- Created Dec. 2017, renewed for 2-years term → Dec. 2021
- Objectives:
  - Define an end-to-end automated network and service management architecture
  - Support both legacy and virtualized network infrastructures
  - Collaborate with relevant open-source projects, standardization bodies and fora
  - Create a foundation for diverse open source groups to produce interoperable solutions
- Links:
  - ZSM Technology Page: <http://www.etsi.org/zsm>
  - ZSM Wiki: <https://zsmwiki.etsi.org/>
  - ZSM Open Area (Draft specs): <http://docbox.etsi.org/ISG/ZSM/Open>
  - ZSM Portal (members' working area): <http://portal.etsi.org/zsm>

# ZSM framework reference architecture

**ZSM service aka management service:** A set of offered management capabilities.

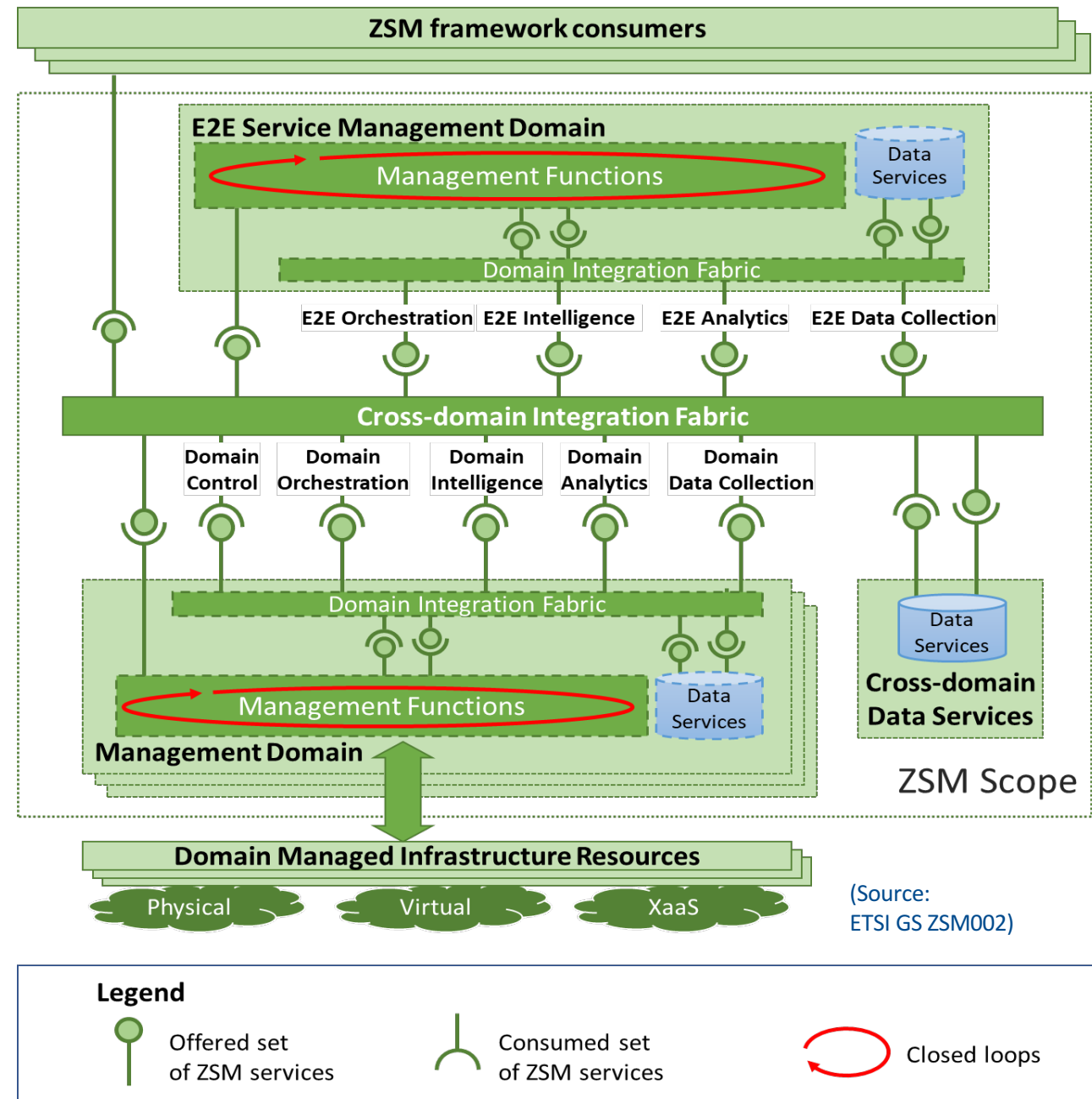
**Management function:** Logical entity playing the roles of service consumer and/or service producer.

**Integration fabric:** A management function, playing the roles of both service consumer and service producer, that enables interoperability and communication between management functions within and across management domains.

**Cross-domain data services:** Services that allow to share data with authorized consumers across domains.

**Management domain:** A scope of management delineated by a technological, business, administrative or other boundary.

**E2E service management domain:** A management domain specialized to manage E2E services.



# ZSM architecture feature:

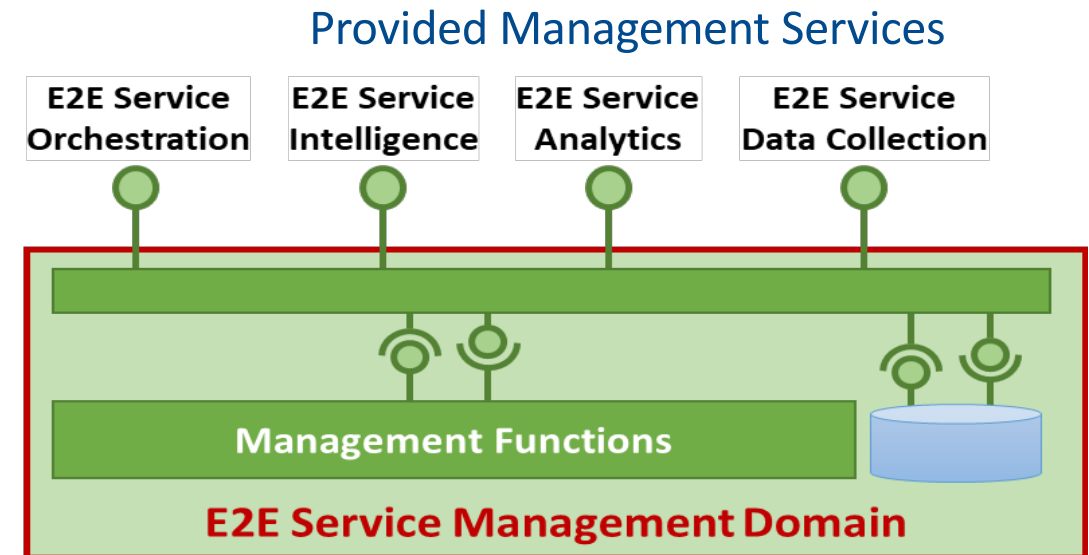
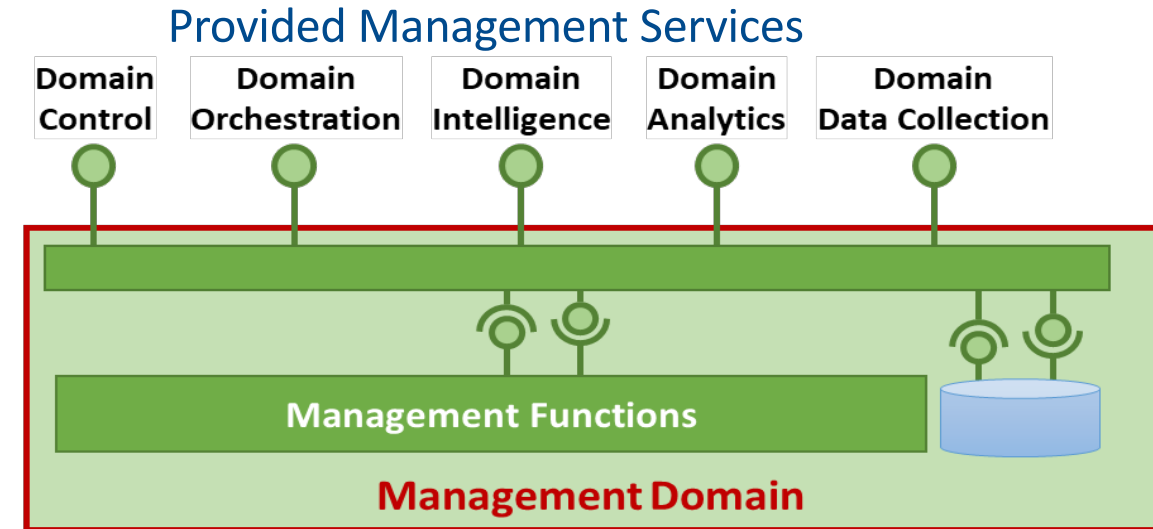
## Separation of concerns in management

### Management Domain (aka Network Management Domain)

- Scope of management delineated by e.g. technological or organizational boundaries
- Manages resources and services based on these
- Provides management services and decouples the inner domain details from the outside world
- Can consume management services from other management domains

### E2E Service Management Domain

- Manages E2E services that span multiple management domains
- Provides and consumes management services
- Coordinates between management domains



# ZSM architecture feature: Service-based

The ZSM architecture defines management services which can be provided and consumed by management functions.

(The realization of management functions is out of scope.)

## Domain data collection

- Event notification services
- Performance measurements streaming service
- Performance measurements collection service
- Log collection service

## Domain analytics

- Analytics services
- Domain condition detection service
- Data optimization services

## Domain intelligence

- AI model management service
- Deployed AI model assessment service
- AI training data management service
- Knowledge base service
- Health issue reporting service

## Domain orchestration

- Domain orchestration service
- Feasibility check service
- Managed services catalogue management service
- Testing service
- Domain inventory information service
- Domain inventory management service
- Domain topology information service

## Domain control

- Resource configuration management service
- Resource lifecycle management services
- Configuration data generation service

## E2E service data collection

- E2E performance data reporting service

## E2E service analytics

- Analytics services
- E2E service quality management service
- E2E service condition detection service

## E2E service intelligence

- AI model management service
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## E2E service orchestration

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## Integration fabric services

- Management services registration service
- Management services discovery service
- Management communication service
- Management service invocation routing service
- Management capability exposure configuration service

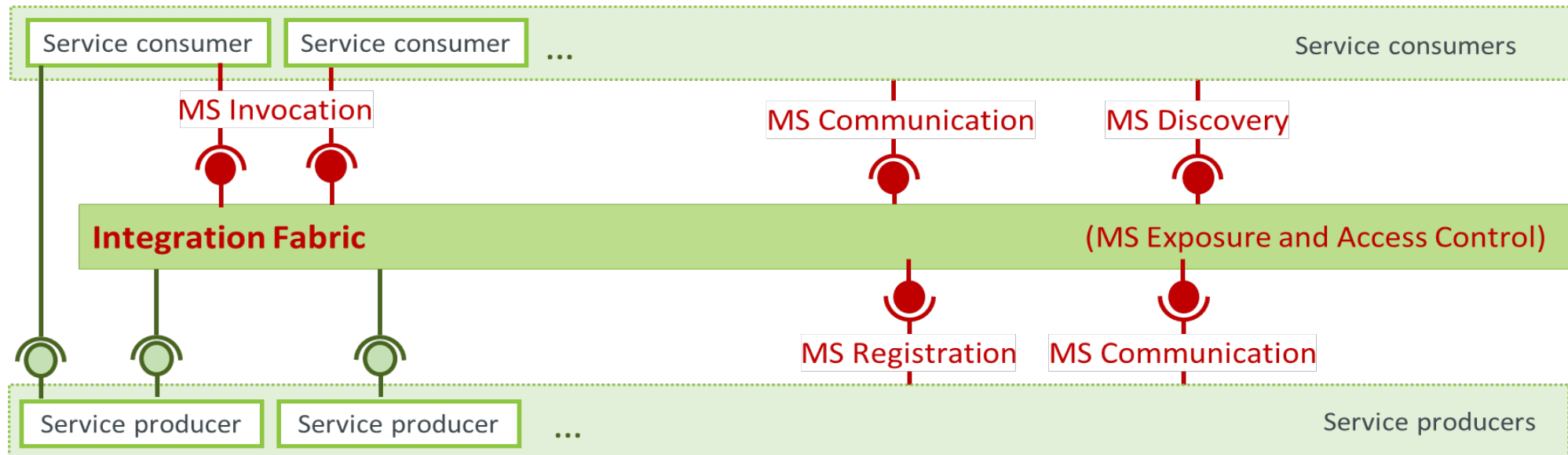
## Data services

- Data store management service
- Data persistence services
- Data processing service

# ZSM architecture feature: Integration fabric

The integration fabric allows management services (MS) to interoperate and communicate.

- MS communication → synchronous & asynchronous, e.g. event notifications and streaming data
- MS registration and discovery
- MS invocation, including support for service meshes (direct invocation also possible)
- MS exposure management and access control



# ZSM architecture feature: Enabling automation based on closed loops

## Observe

- *Data collection services* monitor the managed entities (resources and services), and provide live performance and fault data to support closed-loop automation.

## Orient

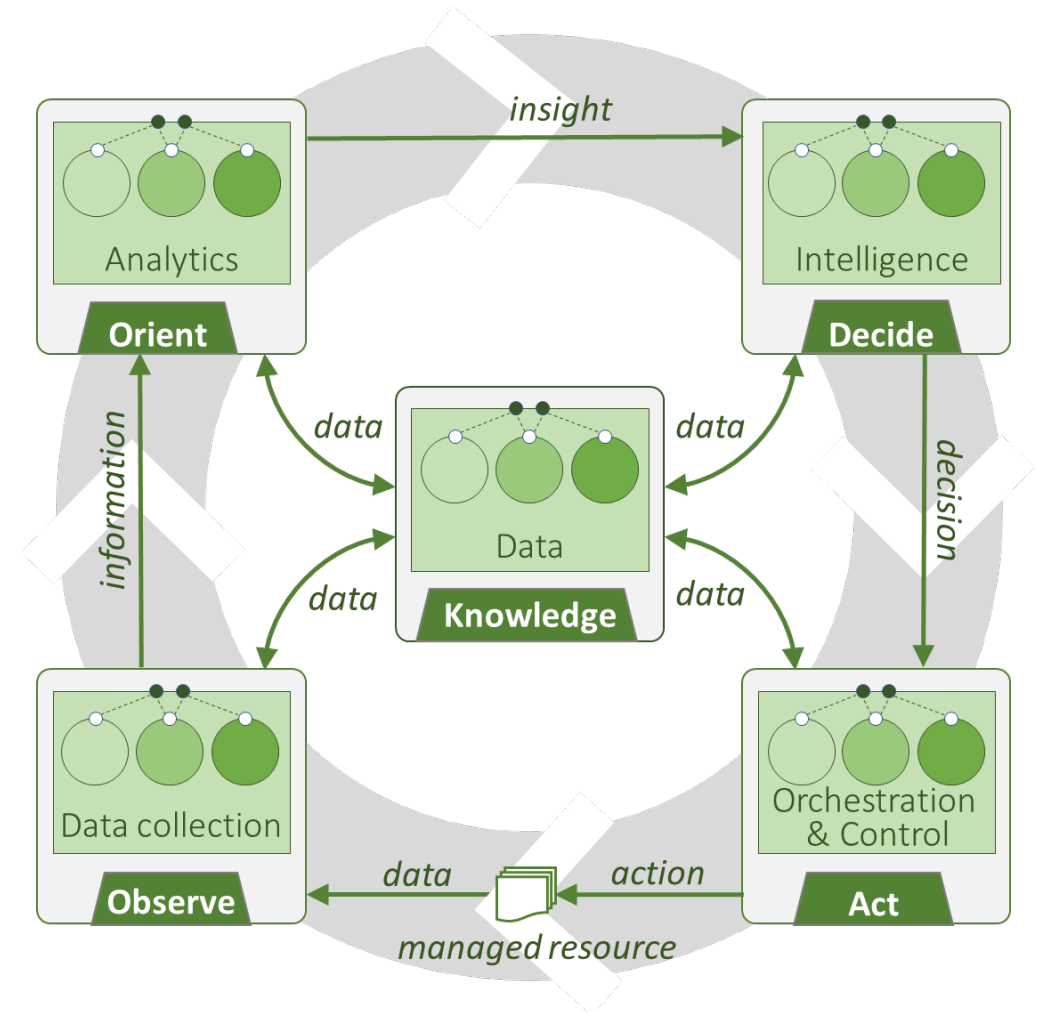
- *Analytics services* provide specific insights based on data collected by data collection services and on other data / knowledge.

## Decide

- *Intelligence services* provide specific decisions and recommendations, to drive closed-loop automation.

## Act

- *Orchestration services* automate workflows and processes to handle instantiation and lifecycle management of the managed services.
- *Control services* individually steer the state of each managed entity (resource, service).



# ETSI GS ZSM002

- The specification was published by ETSI in August 2019 and is publicly available here:  
[https://www.etsi.org/deliver/etsi\\_gs/ZSM/001\\_099/002/01.01.01\\_60/gs\\_zsm002v010101p.pdf](https://www.etsi.org/deliver/etsi_gs/ZSM/001_099/002/01.01.01_60/gs_zsm002v010101p.pdf)

**V 1.1.1 (2019-08)**



## **ETSI GS ZSM 002**

Zero-touch Network and  
Service Management  
(ZSM);

Reference Architecture



## 3 new WIs on Closed-Loop Automation adopted in June 2019

### **ZSM009-1 Closed-loop automation: Enablers ; Rapporteur: Ericsson**

- This work item describes how to enable closed-loop automation based on the ZSM architectural framework. The work item specifies how to automatically deploy and configure closed loops involving both the E2E service management domain and the management domains. Closed loops running within the managed entities are out-of-scope. The specification will include (i) means for coordination, delegation, escalation, etc. between closed loops, (ii) the use of policies, rules, intents and/or other forms of inputs to steer their behaviour, and (iii) interactions between closed loops and external entities. The deliverable will specify stage-2 generic enablers and flexible procedures for closed-loop automation.

### **ZSM009-2 Closed-loop automation: Solution ; Rapporteur: Huawei**

- This work item describes specification for solutions of particular E2E service and network automation use cases, based primarily on the generic enablers and architectural elements for closed loops defined in ZSM002, ZSM009-1. The solution will specify how the E2E management loop interacts with ZSM consumers with specifics for the selected use cases. The WI will make recommendations on the preferred option if multiple solutions are available.

### **ZSM009-3 Closed-loop automation: Advanced topics ; Rapporteur: Nokia**

- This study investigates advanced topics related to closed-loop operations such as learning and cognitive capabilities (e.g. based on different degrees of use and integration of artificial intelligence technologies), ways to set and evaluate levels of oversight, autonomy, and operational confidence on the behaviour of the closed loops. The study will document problem statements and technical challenges, derive potential requirements, capture and evaluate potential solution options, and provide recommendations for further standardization activities.

Completion by mid 2020 (target).

# ZSM current activities on Closed Loop Automation

Overall: Two main drivers/areas of work:

- **Multi-vendor closed loop design**
- **Closed loops spanning multiple domains**

## ZSM009-1

- Requirements refinement for stage-2 specification of the closed loop enablers
- Design and modeling of closed loops components based on disaggregated view, asynchronous operations and enabling multiple inputs and outputs between the closed loop stages/functions.
- Deriving the key challenges for interoperability and composition, e.g. manage by escalation/delegation/coordination, data-, event- and intent-driven, relationship schemes (peer, hierarchical), etc.

## ZSM009-2

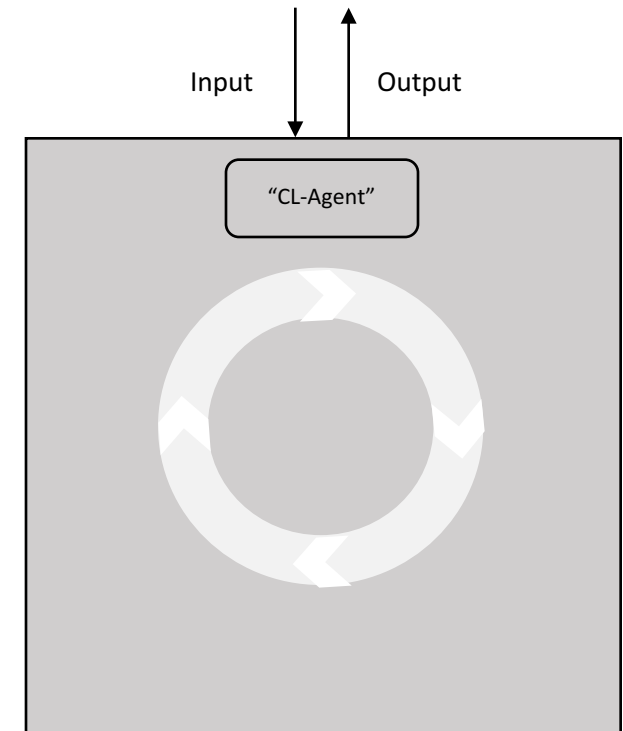
- Scenarios illustrating the nature of exchanges between CL stages, for use cases such as provisioning of new resources, instantiation of back-up resources, dynamic monitoring adaptation

## ZSM009-3

- Investigate scale of CL capabilities (levels of automation) and integration of AI technologies in closed loops

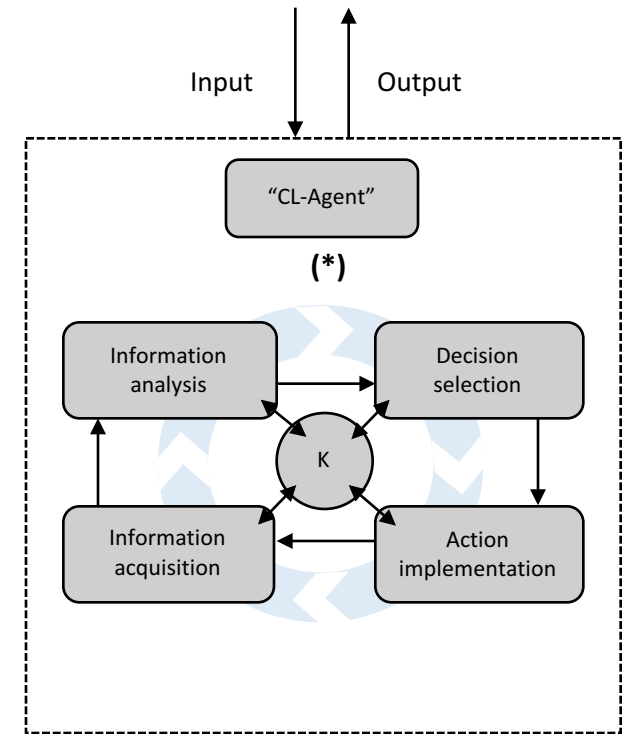
# “Black-box” closed loop (BB-CL)

- An abstracted view of the CL. The CL is seen as one “integrated” element.
- Aim at focusing the CL management to its “external” behavior via “outer” interfaces.
- Input interface conveys:
  - Governance information such as goal(s), operating conditions and scope (escalation, boundaries, managed entities, data sources...) and lifecycle management
  - Coordination information such as coordination messages (e.g. inform, recommend, enforce)
  - Knowledge information e.g. from other CLs, other entities
- Output interface conveys:
  - Governance information such as capabilities, constraints and requirements, action and status reports
  - Knowledge discovered, produced
  - Actions e.g. on managed entities, for coordination purpose, for escalation
- CL-Manager:
  - A logical function responsible for managing the CL external interactions
  - Purpose in the diagram is to outline the need for such a function in addition to the other CL functions/steps
- Remarks:
  - Operator may not be able, or may not need, or may not want to know about the CL internals; and be only interested in the outcome of the CL (remain in the utility envelope).
  - Granularity of control? On/off, step-wise? → a task for the CL lifecycle design/specification
  - Granularity of configuration? Utility-based, parameters tuning for different steps? → cf. intent-/outcome-driven aspect; and a task for the governance design/specification



# “White-box” closed loop (WB-CL)

- An (less) abstracted view of the CL with visibility on the CL steps.
- Aim at focusing on the CL internal behaviors management via “inner” interfaces.
- Same external interfaces as BB-CL.
- New functions to support:
  - Need to provide ability to compose and adapt the steps of the CL
  - Need Steps capability description and pair-wise characteristic information



(\*): links b/w CL-Manager and other functions not shown for clarity

# ZSM CLs and ANIMA ASAs

- Roughly, ZSM closed loops == ANIMA autonomic service agents
- ZSM will develop specifications for closed-loop automation
- Could be of interest to ANIMA and wider community on
  - Enablers: generic components, interactions patterns, composition
  - Solutions: use cases applying enablers and standards based components
  - Advanced topics: next generation closed loop design and operations and potential areas for future standardization