Artificial Intelligence Framework for Network Management

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Motivation

- Automated management systems need AI methods to tackle with the complexity of new networks and the analysis of large amounts of initially disconnected data.

- Current ecosystem has several limitations and requirements:
    - ML solutions are limited to bound tasks—current management systems require a comprehensive and broad solution.
    - Different AI services—potentially from multiple vendors—must be able to cooperate to increase the situations that the management system is able to detect and overcome.
    - Knowledge management functions must provide efficient for support intelligent reasoning operations and explainable AI methods—e.g., data stream processing to support fast response with not-huge storage.
    - Requirements for NDT conception and exploitation must be considered from the beginning.

- We define the functions and capabilities required to effectively apply AI to NM—namely, the AINEMA framework.

Problem Statement

- How can AI methods become support stone for any step of the network management process?

- How is the AI-focused data life-cycle: How is the **DIKW** process?
  - How is data, information, and knowledge formatted, stored, processed, and communicated?
  - How can data formats and methods from different vendors coexist?

- How are evidences of network problems (intelligence information) gathered and analyzed to take <u>good</u> strategic decisions?

- How is management decision effectiveness assessed?

- How are NDT operations supported?

- How can external data <u>nurture</u> AI processes?

Solution

- AINEMA provides a framework with the following functions and capabilities:

  - Functions and data formats for acquiring, modeling, storing, and distributing data and knowledge across the management system components—e.g., monitoring data, network configurations, and AI decisions.

  - The ability of composing AI functions from an existing or provided set of AI methods to collectively accomplish local, E2E, or global intelligence tasks for network OAM.

  - AI and knowledge hub capable of managing AI module life-cycle, as well as supporing the whole operation by receiving data, knowledge, and localized decisions from AI modules as well as desired actions or recommendations.

- AINEMA also addresses some of AI challenges from [irtf-nmrg-ai-challenges]:

  - Action planning is addressed by specific functions—descrbed below.

  - AI explanations are obtained by the intelligence reasoning methods—e.g., running a case-based reasoner or a tree-based learning algorithm alongside more powerful and complex algorithms, such as neural networks.

- AINEMA operation is intended to be guided by policies and requirements, generally expressed as **network intents**, and the decision effectiveness is assessed by a closed loop cycle.

Operation (I)

Relation with Other Works
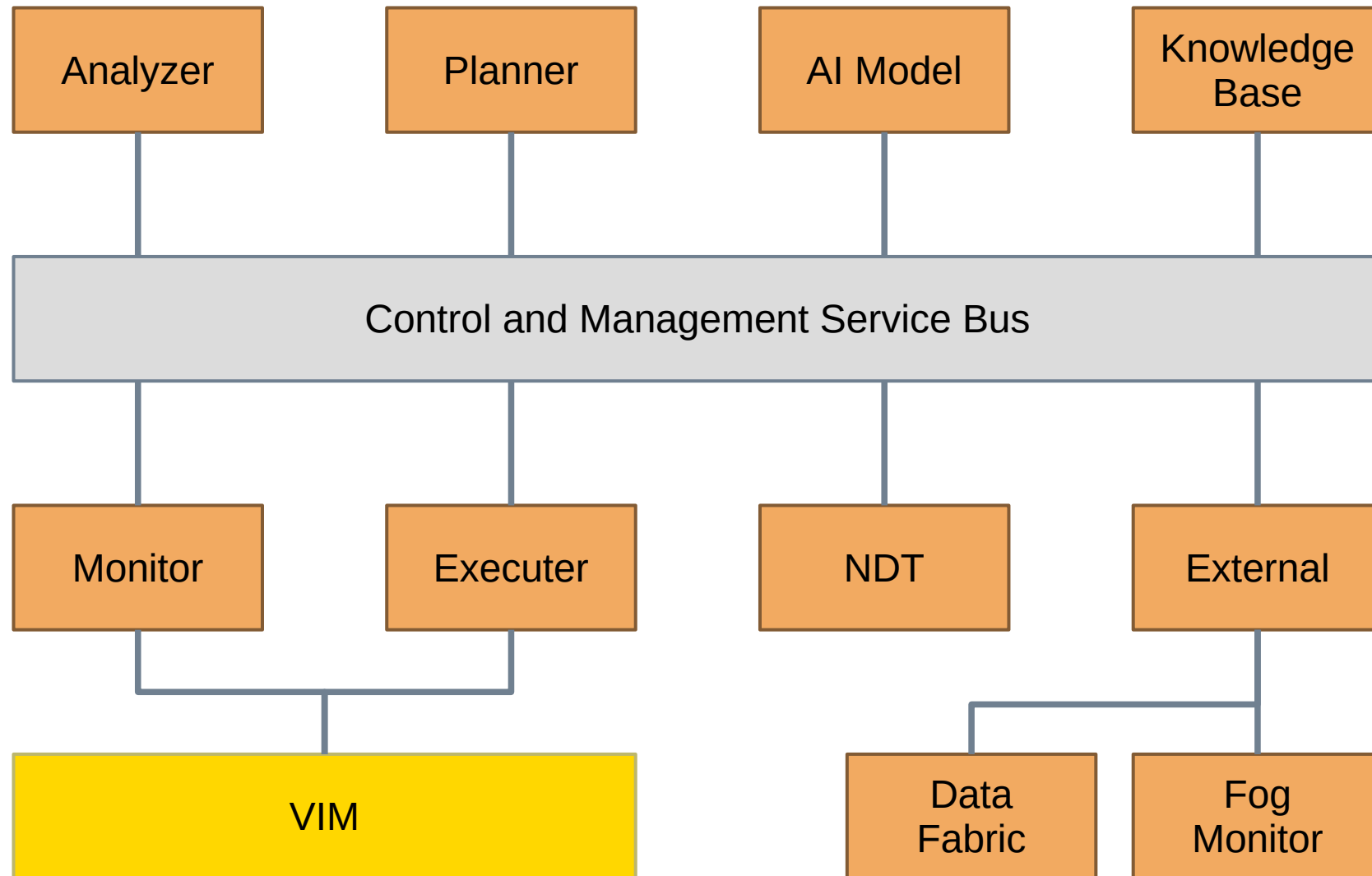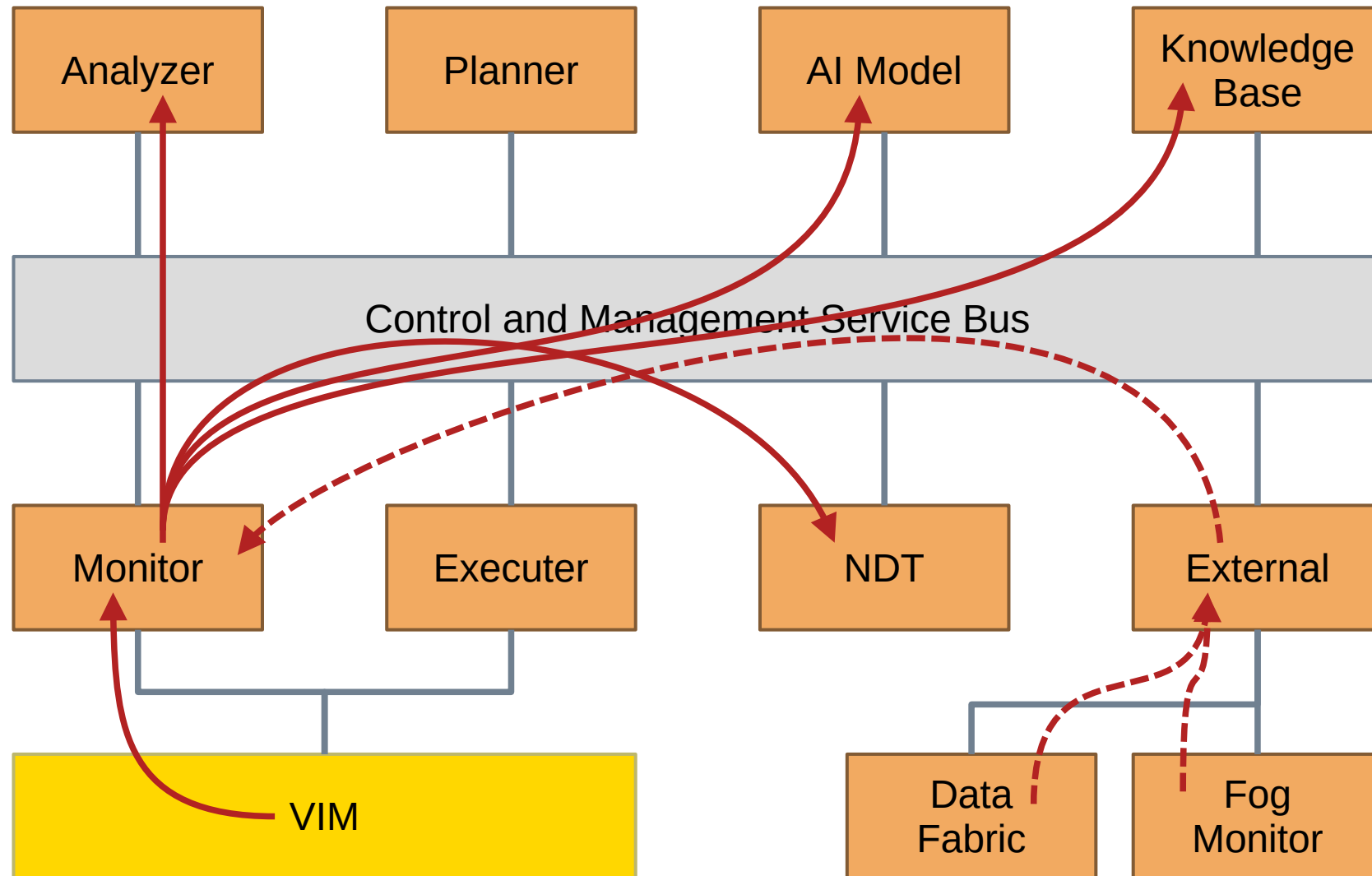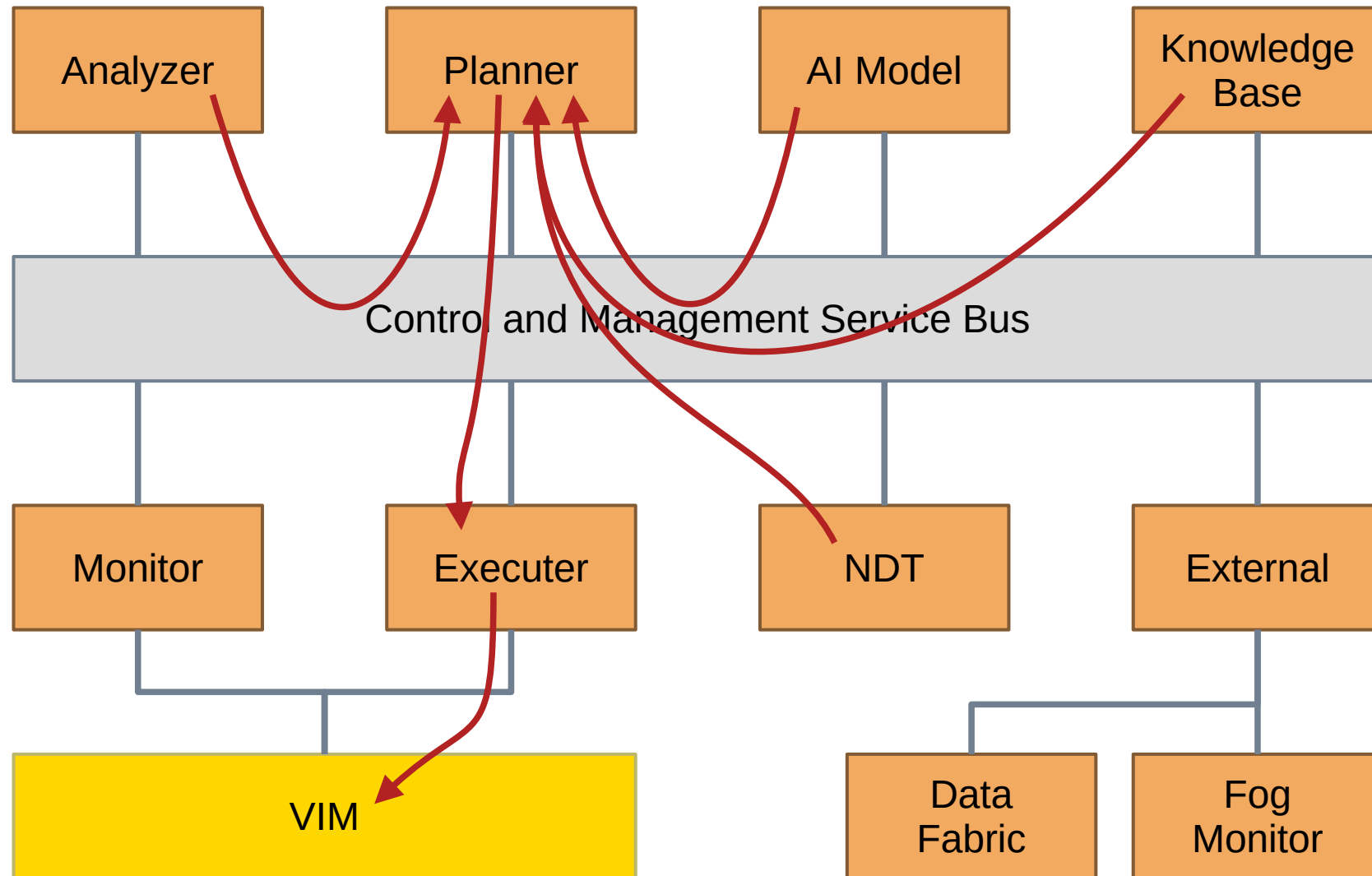
- AINEMA is aligned with ETSI-NFV-MANO:

  - Functions and interfaces defined by NFV-MANO are extended with composition and cooperation functions.

- AINEMA supports the construction of NDT and implements policies defined as intents to support IBN.

- A basic prototype of the AINEMA framework is being constructed and evaluated under the ARCA name.

Goals

- We aim to involve NMRG with AINEMA:

    - AI functions can be aligned with AINEMA and evaluated alonside other AINEMA functions and capabilities.

- We ask for NMRG to support in the identification of particular concepts that can or should be worked separately in drafts for NMRG and/or other RGs and/or WGs.

- Of course, **feedback is highly welcome!**

Thanks for Your Attention

Questions?

– EOF –