An Intent-driven Management Framework

draft-sun-nmrg-intent-framework-00

Qiong Sun (China Telecom, Presenter)
Will LIU (Huawei)
Kun Xie (BUPT)

Background

This document is a start to describe Intent-driven framework, its elements, and interfaces.

- Framework for Generic Intent-driven Management
  - Overall Framework
- Sample Operation
  - Intent layer
  - Control layer
  - Network layer
- TBD: We will add a use case example (e.g. SD-WAN) to show how to work with this framework.

Overall Framework

Intent-driven Management Framework

- Intent layer
- Control layer
- Network layer


```
                          +------------------+------------------+
                          |                  |                  |
                          |    Operator      |  User / Application |
                          |                  |                  |
                          +------+-----------+------------+-----+-----------+
                          |Intent model      |eligible check|experience|
                          |request           |check         |check     |
                          +------------------+-----------------------------+
                          |Intent Layer
                          |               +--------------+ +--------------+
+---------+               |               |              | |              |
|         |               |               | Management   | | Translation  |
|Intent   |   |+----------+               |              | |              |
|         |   ||| Intent   |              +--------------+ +--------------+
|Designer+-->|| Repository|
|         |   ||          |               +--------------+ +--------------+
|         |   ||          |               |              | |              |
+---------+   |+----------+               | Decision     | | Verification |
                          +-|-------------+------------+-+ +-------------+-+
                          +----------------+-------------------------------+
                          |                |           |         |
                          | configure      |Verify     |monitor
+-------------------------\-----------------\----------\-------------+
|                                                                   |
|                         Control Layer                             |
|                                                                   |
+-------------------------------------------------------------------+
                          | Status Collection   | Configuration
                          |                     |
+-------------------------\-----------------\----------\-------------+
|                                                                   |
|                       Network Element(i)                          |
|                                                                   |
+-------------------------------------------------------------------+

        Figure 1 Intent-driven Management Framework
```
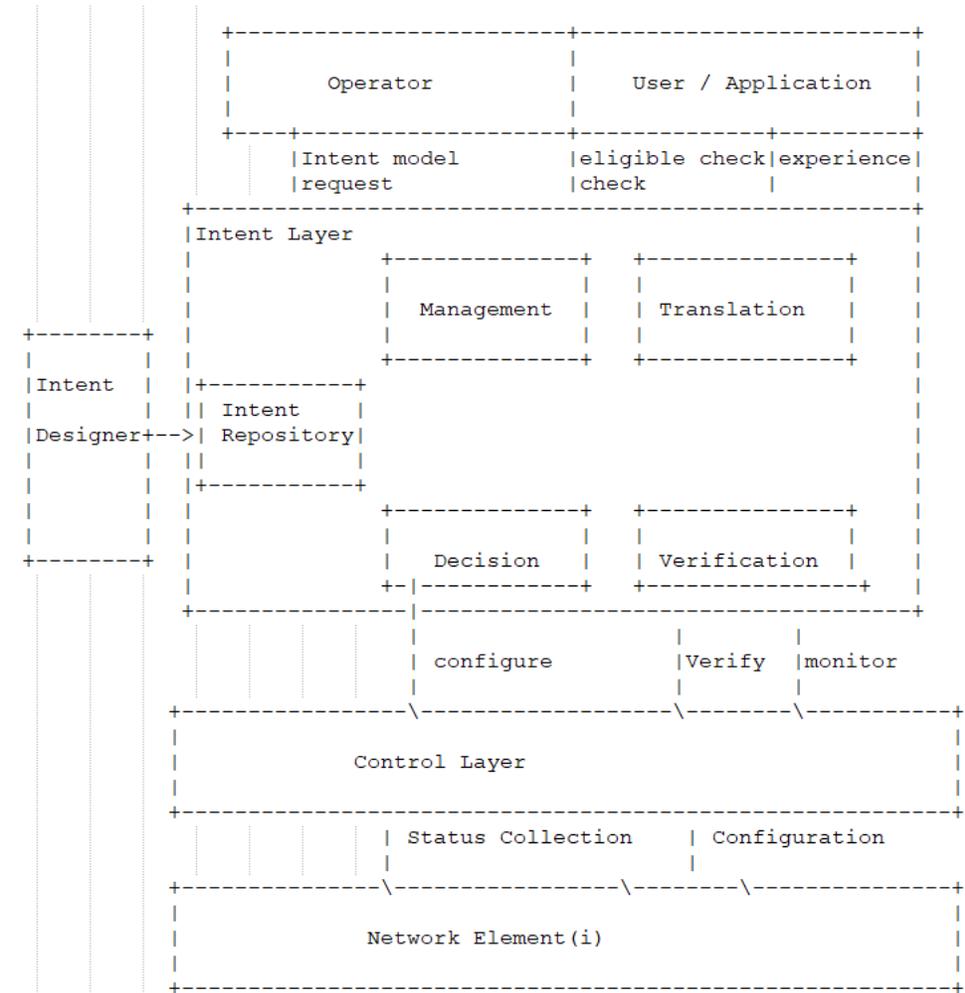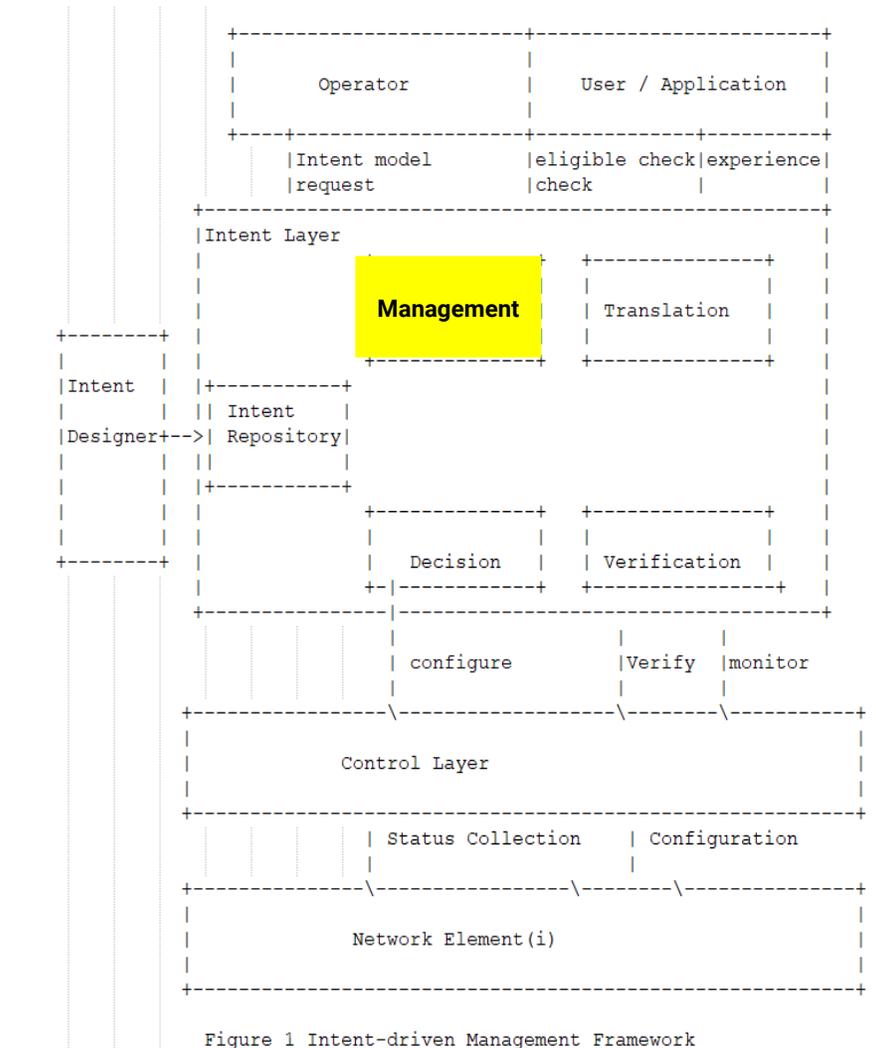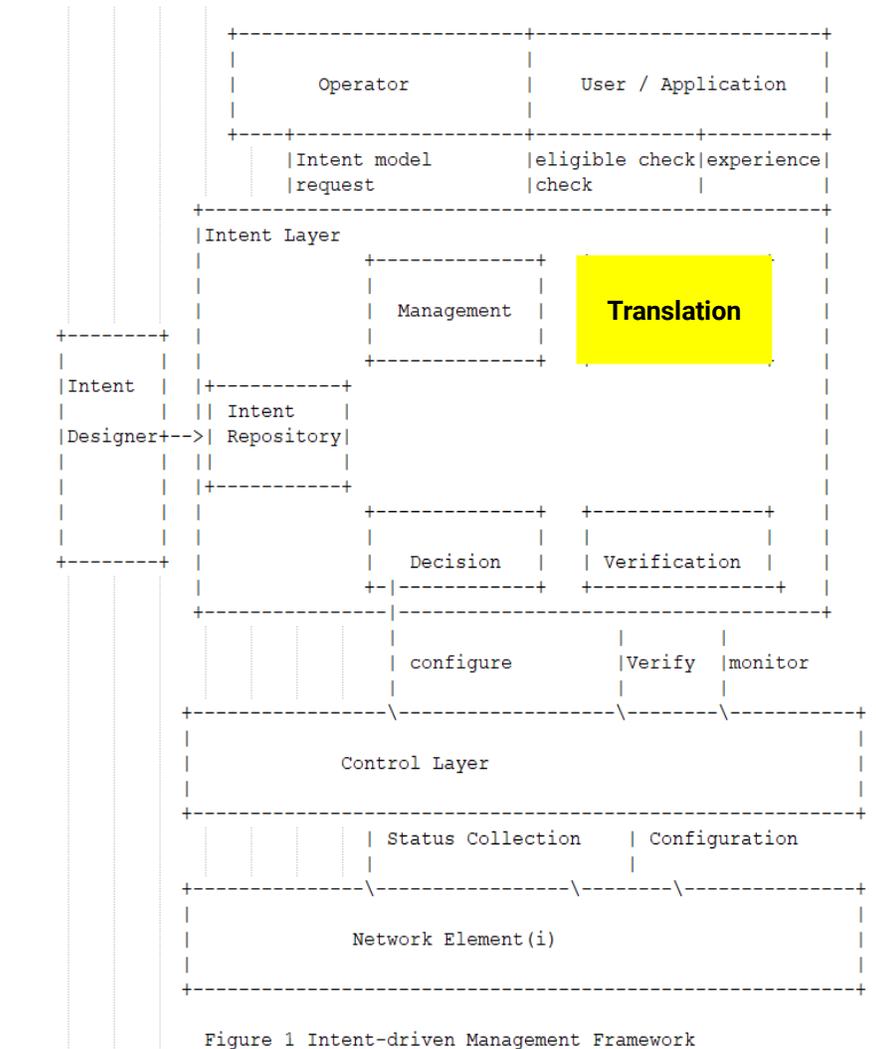
Intent layer-Management

1. **The intent management layer needs to verify and classify the intents** ,eligible intent will be further submitted to the intent translation, ineligible intent will be fed back to the user.

2. **The management module also needs to interact with the decision module and may receive the negative feedback from decision module when the configuration execution does not work as expected**, in which cases the management module would require translation module to do secondary processing.

3. The management module also needs to regulate the life cycle of the intent demand, because in the process of intent demand, the modules of the intent layer does not only process once , but continuously verify and update the configuration in the closed loop.

```
            +------------------+------------------------+
            |                  |                        |
            |     Operator     |    User / Application   |
            |                  |                        |
            +----+-------------+-------------+----------+
                 |Intent model  |eligible check|experience|
                 |request       |check         |          |
            +----+-------------------------------------+
            |Intent Layer
            |    |                    |  +--------------+
            |    |              +-------+ |              |
            |    |              |Management| | Translation |
   +--------+   |              |         | |             |
   |        |   |              +---------+ +--------------+
   |Intent  |   |+----------+
   |        |   || Intent   |
   |Designer+-->| Repository|
   |        |   ||          |
   |        |   |+----------+
   |        |   |              +----------+ +------------+
   |        |   |              |          | |            |
   +--------+   |              | Decision | | Verification|
            |   |            +-|----------+ +------------+
            +---+----------------------------------------+
                    |              |      |
                    | configure    |Verify |monitor
                    |              |      |
            +---------------\----------------\----------\-----------+
            |                                                       |
            |     Control Layer                                     |
            |                                                       |
            +-------------------------------------------------------+
            |              | Status Collection  | Configuration
            |              |                    |
            +-------------\-----------------\--------\-------------+
            |                                                     |
            |     Network Element(i)                              |
            |                                                     |
            +-----------------------------------------------------+

    Figure 1 Intent-driven Management Framework
```

Figure 1 Intent-driven Management Framework

Intent layer-Translation

1. The translation module needs to analyze the semantics of the intent and formulate the corresponding configuration, then output the configuration plan to the verification module.

2. Translation module also needs to translate and split the semantics contained in the intent demand.

3. In this step, artificial intelligence (AI) can be used as an auxiliary reference for the translation module.
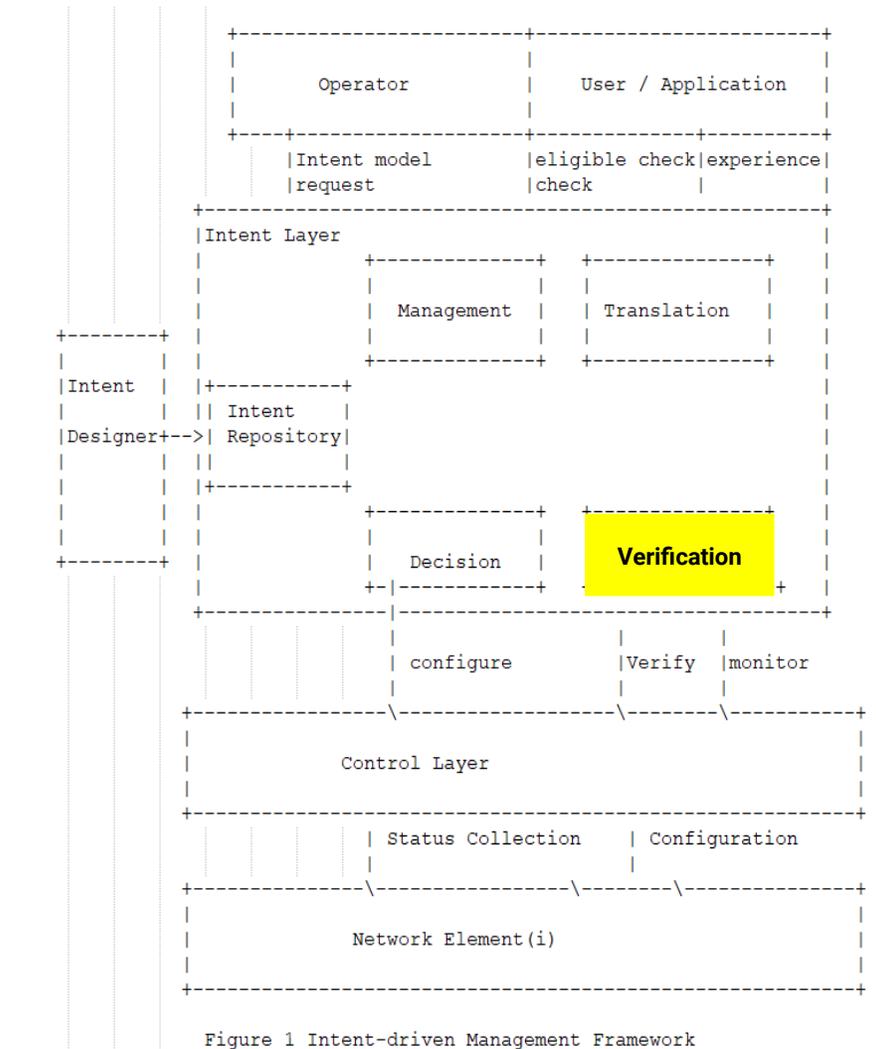
```
                +--------------------+----------------------+
                |                    |                      |
                |      Operator      |    User / Application |
                |                    |                      |
                +----+---------------+----------+-----------+
                     |Intent model    |eligible check|experience|
                     |request         |check         |          |
          +----------------------------------------------------+
          |Intent Layer
          |          |           +-------------+   ========
          |          |           |             |   Translation
          |          |           |  Management |   ========
+--------+|          |           |             |
|        ||          |           +-------------+
|Intent  ||    +-----------+
|        ||    ||  Intent  |
|Designer+-->| Repository|
|        ||    ||          |
|        ||    |+-----------+
|        ||          +-------------+   +---------------+
|        ||          |             |   |               |
+--------+|          |   Decision  |   |  Verification |
          |          +-|-----------+   +---------------+
          +---------------|--------------------+
                    |             |        |
                    | configure   |Verify  |monitor
                    |             |        |
          +-------------------\----------\----------\-----------+
          |                                                     |
          |         Control Layer                               |
          +-----------------------------------------------------+
                    | Status Collection   | Configuration
                    |                     |
          +---------------\------------------\---------\---------------+
          |                                                            |
          |         Network Element(i)                                 |
          +------------------------------------------------------------+

        Figure 1 Intent-driven Management Framework
```

Intent layer-Verification

The verification module has two functions:

1. Configurable verification ： Verify whether the configuration can be executed in the actual network environment according to the real-time network status, and provide relevant information to the decision module as feedback;
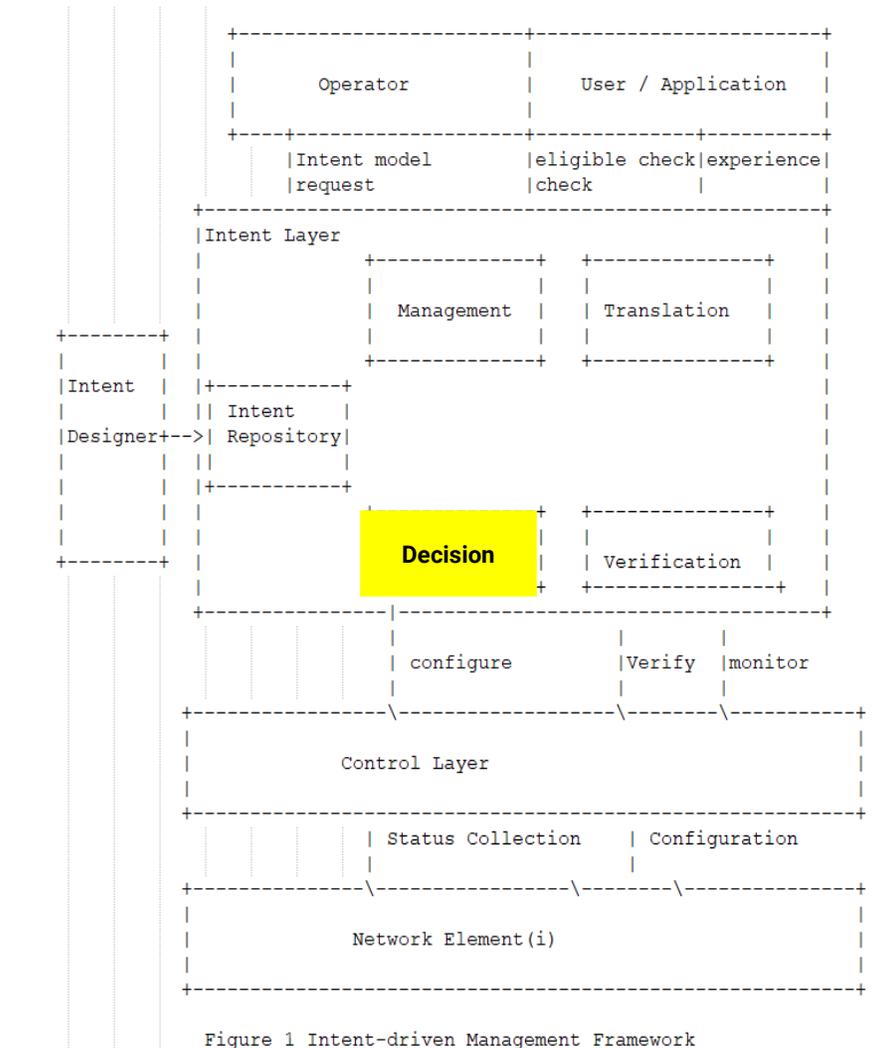
2.Validity verification ： when the configuration is actually executed, the network status may not change as expected, in which cases, it is necessary to verify whether the execution of the configuration works out as expected.

The network is dynamically changing, so network verification should be continuous in real time.

```
                    +------------------+------------------+
                    |                  |                  |
                    |    Operator      |  User / Application |
                    |                  |                  |
                    +------------------+------------------+
                     |Intent model     |eligible check|experience|
                     |request          |check         |          |
                    +--------------------------------------------+
                    |Intent Layer                                 |
                    |         +---------------+  +--------------+ |
                    |         |               |  |              | |
                    |         |  Management   |  |  Translation | |
          +--------+|         |               |  |              | |
          |         |         +---------------+  +--------------+ |
          |Intent   |  +-----------+                             |
          |         |  || Intent   |                             |
          |Designer+-->| Repository|                             |
          |         |  ||          |                             |
          |         |  |+-----------+                            |
          |         |         +---------------+  +--------------+ |
          +--------+|         |               |  | Verification | |
                    |         |  Decision     |  |              | |
                    |         +-|-------------+  +--------------+ |
                    +--------------------------------------------+
                             |  configure      |Verify  |monitor  |
                             |                 |        |         |
          +------------------\-----------------\--------\---------+
          |                                                       |
          |   Control Layer                                       |
          |                                                       |
          +-------------------------------------------------------+
          |              | Status Collection  | Configuration     |
          |              |                    |                   |
          +--------------\-----------------\--------\-------------+
          |                                                       |
          |   Network Element(i)                                  |
          |                                                       |
          +-------------------------------------------------------+

        Figure 1 Intent-driven Management Framework
```

Intent layer-Decision

1. **It can process the data transmitted by the verification module, and then decide whether the configuration can be delivered to control layer.**

2. The decision module supports empirical knowledge from top administrators to help make decisions.

3. When the user's intent is not implemented or the network status is getting abnormal, the decision module needs to make optimization or remedial measures by notifing the intent management module to make prompt response.

```
                    +---------------------+--------------------+
                    |                     |                    |
                    |     Operator        |    User / Application|
                    |                     |                    |
                    +--------+------------+-----------+--------+
                    |Intent model    |eligible check|experience|
                    |request         |check         |          |
            +----------------------------------------------------+
            |Intent Layer                                        |
            |         +--------------+  +--------------+          |
            |         |              |  |              |          |
            |         |  Management  |  | Translation  |          |
    +--------+  |     |              |  |              |          |
    |        |  |     +--------------+  +--------------+          |
    |Intent  |  |+-----------+                                    |
    |        |  || Intent    |                                    |
    |Designer+-->| Repository|                                    |
    |        |  ||           |                                    |
    |        |  |+-----------+                                    |
    |        |  |    +------------+  +---------------+            |
    |        |  |    |            |  |               |            |
    +--------+  |    |  Decision  |  | Verification  |            |
            |        +------------+  +---------------+            |
            +----------------+-----------------------------------+
                             |configure      |Verify  |monitor
            +----------------\--------------\--------\---------+
            |                                                  |
            |          Control Layer                           |
            +--------------------------------------------------+
            |            | Status Collection  | Configuration  |
            |            |                    |                |
            +----------------\-----------------\--------\------+
            |                                                  |
            |          Network Element(i)                      |
            |                                                  |
            +--------------------------------------------------+

            Figure 1 Intent-driven Management Framework
```

Intent layer-Intent Repository

Policy repository as a database of "intent" - "configuration"

information should be able to interact with the intent management

module and the translation module, provide mapping between the

"intent" and "configuration" for the translation module .

Figure 1 Intent-driven Management Framework
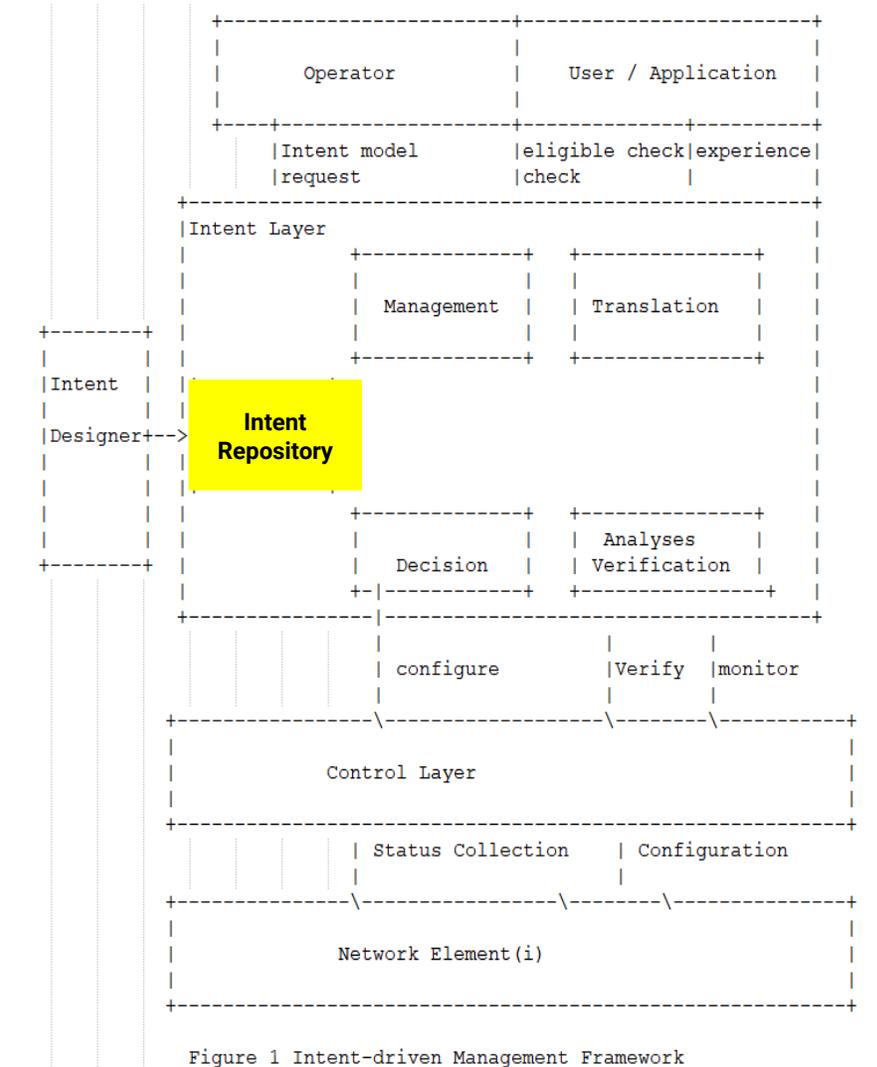
Control layer & Network layer

Layer	Function
Control layer	**Configuration delivery：** Deliver the configuration set of the intent layer to the network layer to ensure that the configuration is successfully executed
	Network status collection： Perceive information about the network layer, and transmit information to the intent layer to assist the intent layer to formulate a reasonable strategy.
Network layer	**Configuration execution：** Can be configured with predefined rules and templates, or can be fully dynamically configured according to the controller
	Network status awareness： Collect information such as network topology, traffic, and feedback the information to the network status collection function for subsequent verification.
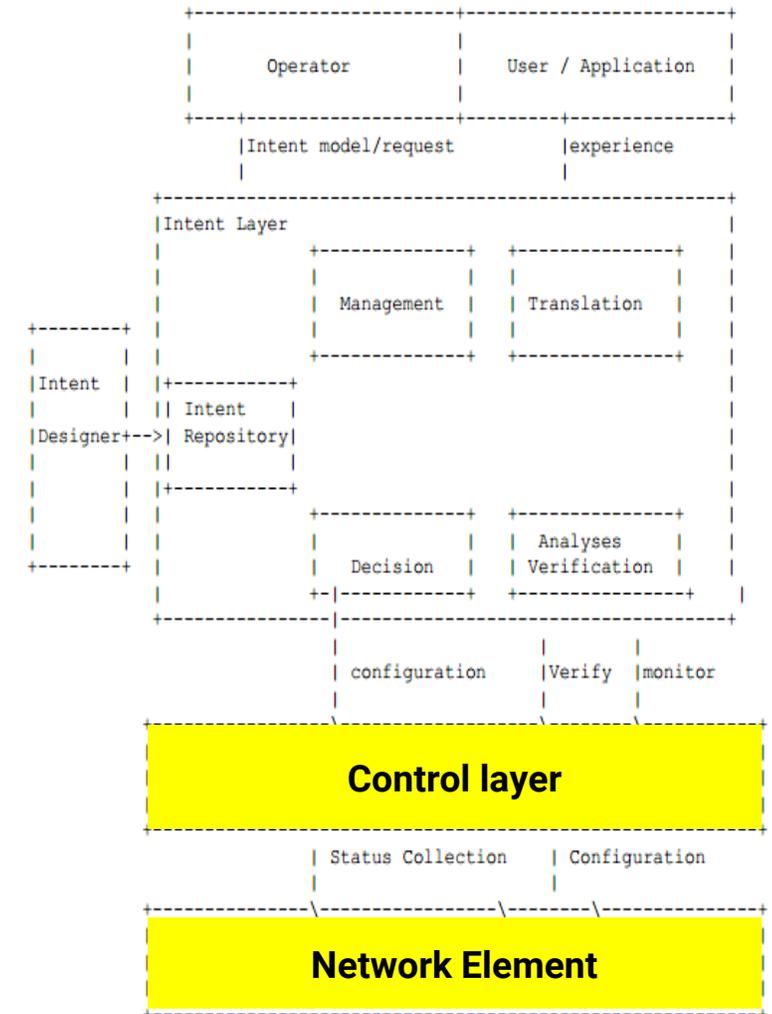
Figure 1 Intent-driven Management Framework

Next step

- Next step
    - Add Use Cases / Intent Examples to show how to use this framework
    - Have received offline comments and will update accodingly
- Your comments are welcome to improve the document, especially on intent examples.
- You are also welcome to join our work!