PlugFest

O-RAN Global PlugFest Spring 2024

PoC for Multi-Operator SMO, utilizing AI
Venue: COSMOS

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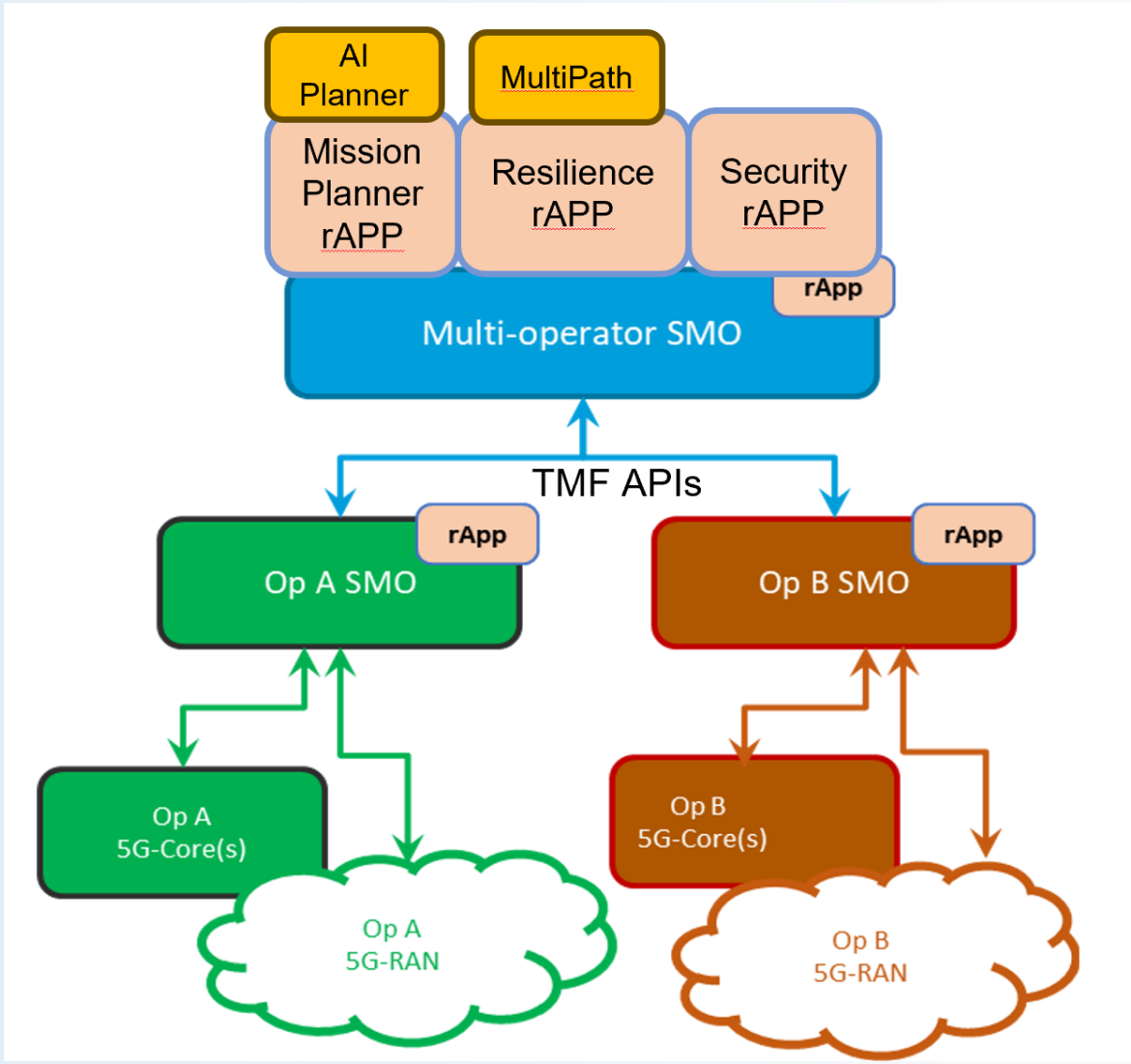
PoC for Multi-Operator SMO, utilizing AI

Multi-Operator SMO within INDIGO

- Multi-Operator (MO) SMO aggregates and coordinates across operators and subnets
- MO SMO is based on O-RAN SMO Specifications
  - Current focus on Non-RT RIC, Slicing, and Service Orchestration capabilities
- Use cases are implemented by rApps hosted by MO-SMO Non-RT RIC
- MO-SMO MNO operate their networks
  - Expose services and resources from the Operator SMO using standard APIs
- MO-SMO is also able to provide orchestration and management of “local” resources and subnets



Planning in AI

- AI planning is a subfield of Artificial Intelligence (ML is another.)

- Planning has the view of an agent acting in the world, with a goal.
- Terminology: a knowledge domain consists of
  - model of the 'world',
  - actions the agent can take,
  - helpful methods that the agent can use.
- A goal/task that the agent wants to achieve (state of world).

- A planner (planning algorithm): finds a sequence of actions, the plan, that achieves the agent's goal/performs the task.

- A planner is specific to a knowledge domain.

Planner and network SMOs

1. The planner complements functionality in the operator SMOs, or in associated apps.
2. It can use algorithms in black boxes, e.g. optimization algorithms, as well as trained ML models.
3. Planner communicates only with MO-SMO:
   - Respects “planner, MO-SMO, operator SMO” hierarchy.
   - Each operator SMO is assumed to be able to manage its own network, as if planner didn’t exist.
4. Gets involved only when a given task requires coordination among multiple operator SMOs via the MO-SMO.

Planner's knowledge base

1. Geographical region of interest: mission, disaster, emergency, …
   - Multiple operators may cover various pieces of region.
   - Region is divided into disjoint coverage areas by an app in MO-SMO.
   - Each operator SMO publishes some capability templates in each of these areas.
2. Topology for each operator's network:
   - Divided into access (RAN), transport, core subnets following 3GPP.
   - Currently planner deals with RAN only.
   - Visibility of these topologies to MO-SMO/planner assumes a co-operative context.
3. Tasks for planner: e.g.

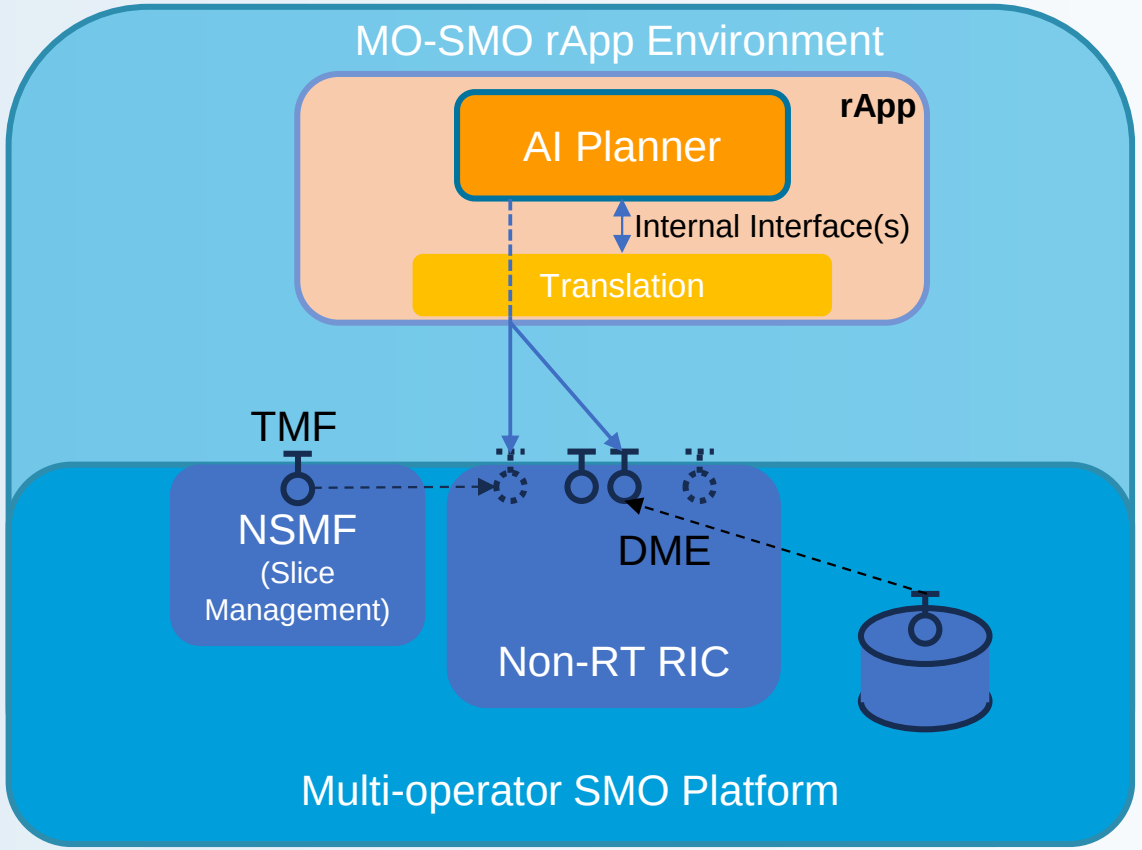
   create a slice covering areas a1, a2, … with certain performance, resilience, and security parameters.

Planner: managing capabilities

- Performance:
  - Performance parameters in SMO capability templates.
  - Choice of provisioning algorithms.
- Resilience:
  - Cooperative: coordinate resource sharing, virtual or physical, among operator SMOs in RAN.
  - Non-cooperative: deploy ad-hoc networks/facilities, e.g. COWS, drones, …
  - Multipath:
- Security:
  - ZeroTrust

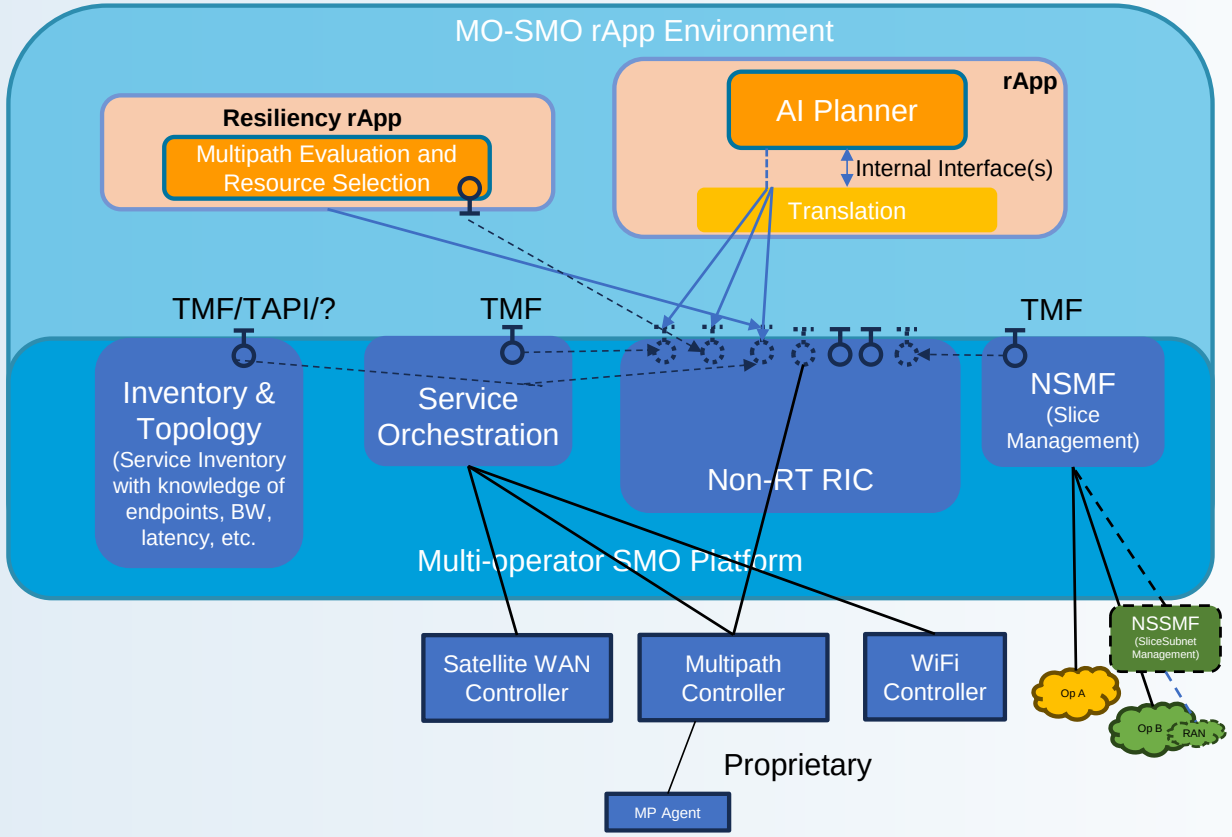
Example MO-SMO Interaction with AI Planner for Mission App

- Mission App includes AI Planner and is delivered as rApp
- MO-SMO Non-RT RIC hosts Mission App and exposes O-RAN R1 interface
- Additional services
  - TMF 633 for service/slice catalog
  - TMF 641 for service/slice order
  - TMF 638 for service/slice inventory
  - Resources using TMF639, TMF 640, …
  - Topology using TBD
  - …



Example MO-SMO Interaction with Multi-path Resilience App

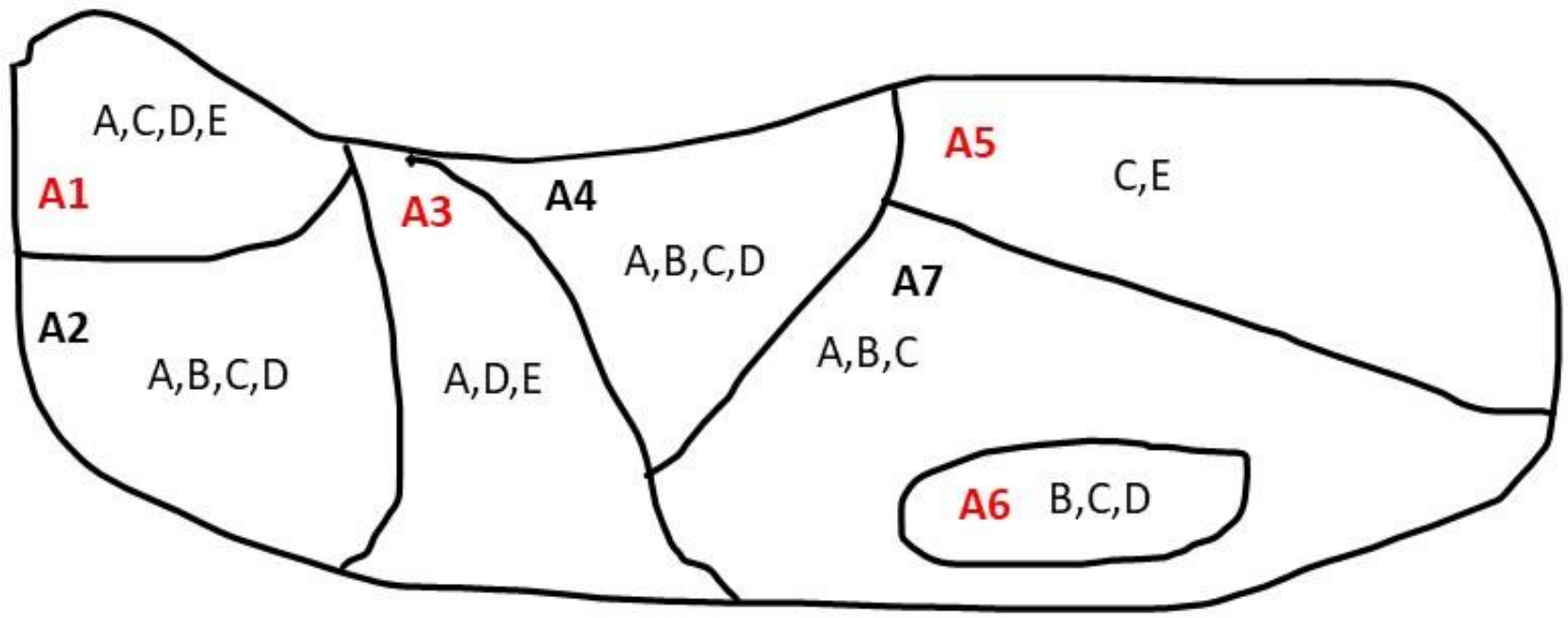
- Integrate MNO SMO for AnyG services/slices
  - Subnet aware for ability to combine across MNO
- Integrate subnet controllers for other services
  - Both underlay (WiFi, Satellite, etc) and Multi-Path
  - Prefer standard models/APIs
- Expose services and Data
  - TMF for Service Catalog, Ordering, Inventory
  - Topology and others



INDIGO Mission AI Demo

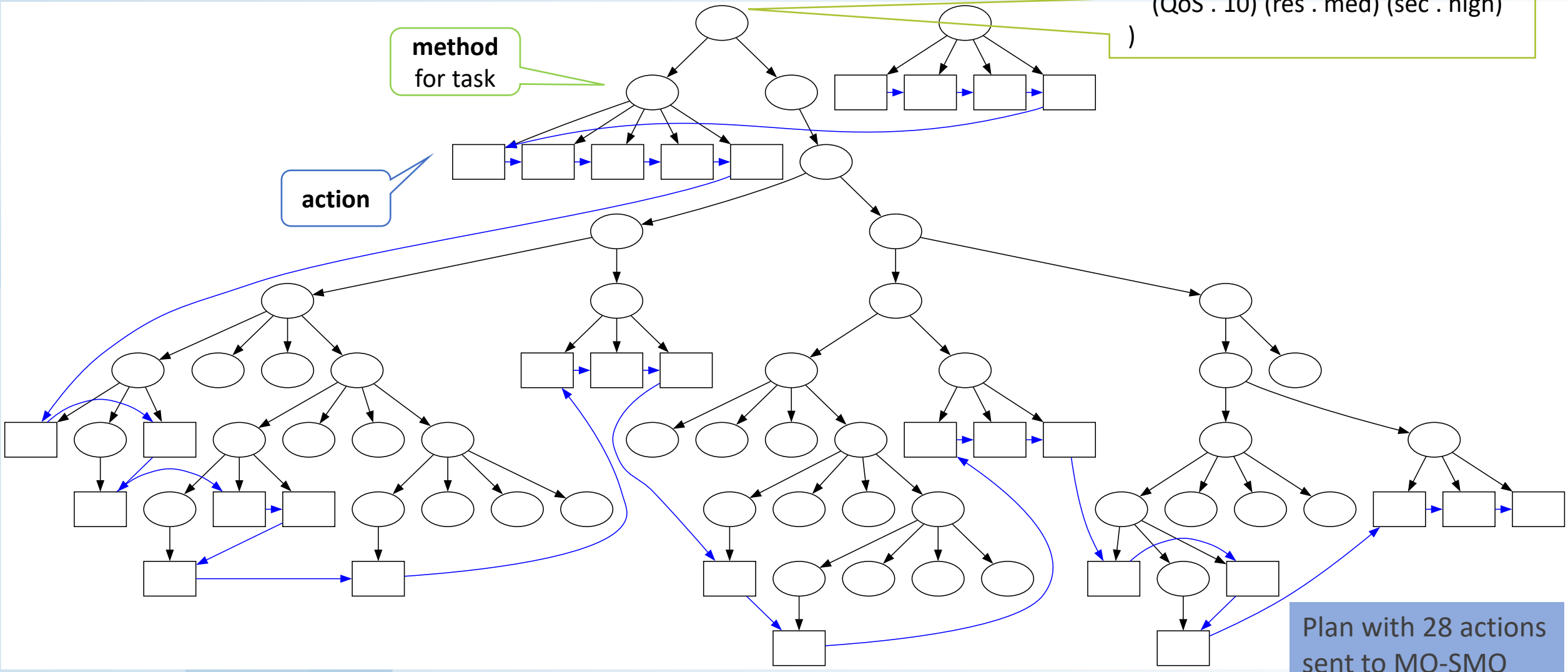
Island scenario

Create a slice with QoS=10, resilience=medium, security=high, covering areas A1, A3, A5, A6, using up to 5 available operators, whose networks are in degraded states.



Resulting `white box' AI Plan

(:**task** provision-slice-for-service JF
(cvg . (A1 A3 A5 A6)
(QoS . 10) (res . med) (sec . high)
)



Plan with 28 actions sent to MO-SMO

MO-SMO Summary

- SMO functionality based on O-RAN
- Leveraging open, standard interfaces
- Aggregating information from MNO and local subnets
- Exposing services, resources, and other information
- Hosting Apps using O-RAN Non-RT RIC with R1 interface
- Human-centric system (re-)configuration AI Planner
- ML based mission planning user interface