Autonomic Functions Coordination By The Example

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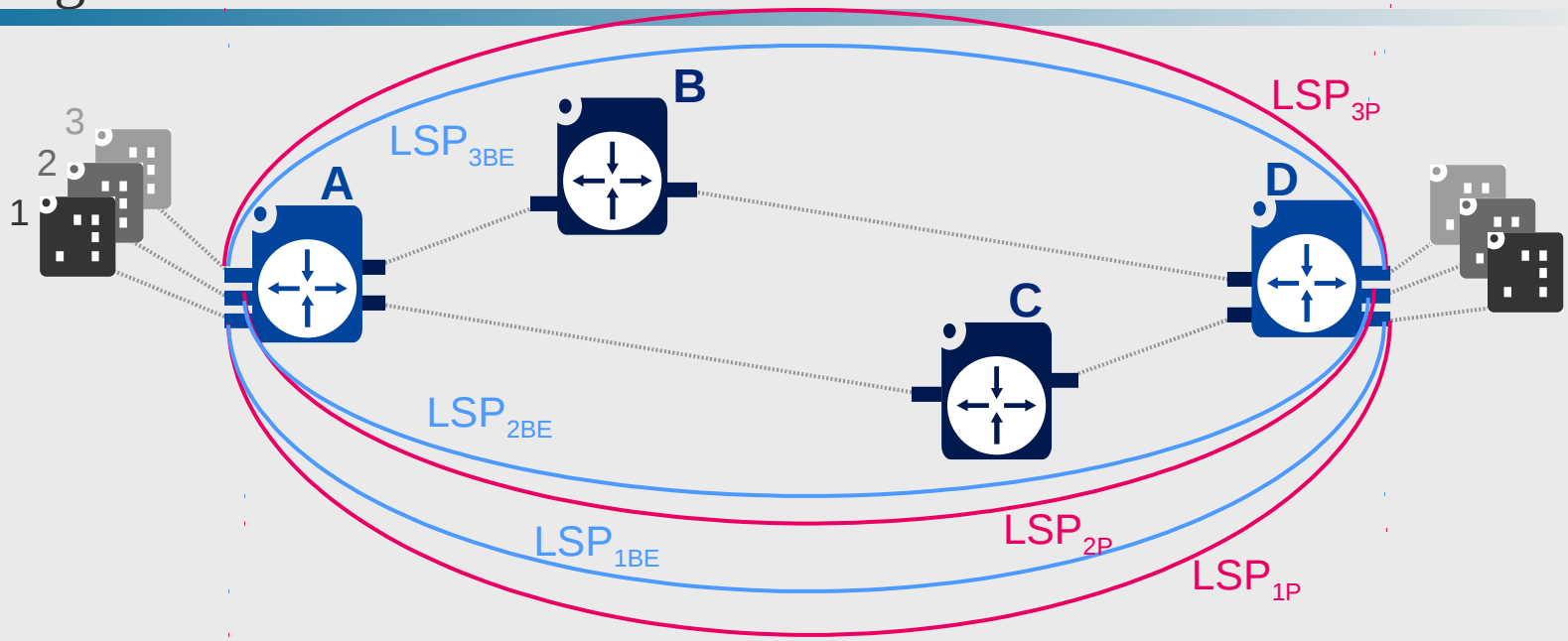
Objectives

- Show feasibility of coordination between ASAs

- Identify required elements for a coordination function

- Derive requirements for ASA and ANI

Explaining the use case

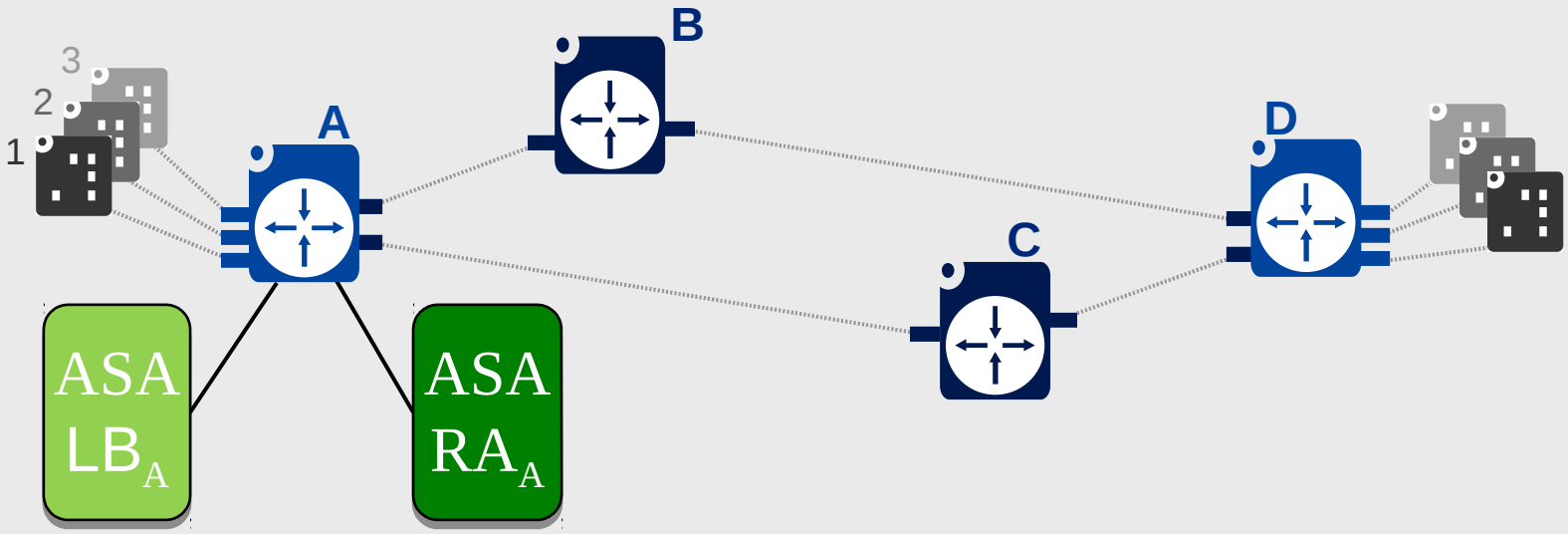


Network composed of:

- edge and core routers
- 3 clients on the edges
- 2 types of traffic for each client (premium/best-effort)
- 6 LSP to cope with each traffic

Explaining the use case

ASA sets



2 ASAs running on router A

- Load Balancing ASA

  Balances client traffic between network interfaces

- Risk Aware Routing ASA

  Avoids paths at risk for premium traffic

1st ASA – Traffic Engineering ASA

Deployable over edge router

When deployed

- Monitors network interfaces loads
- Modifies LSPs routes to balance load

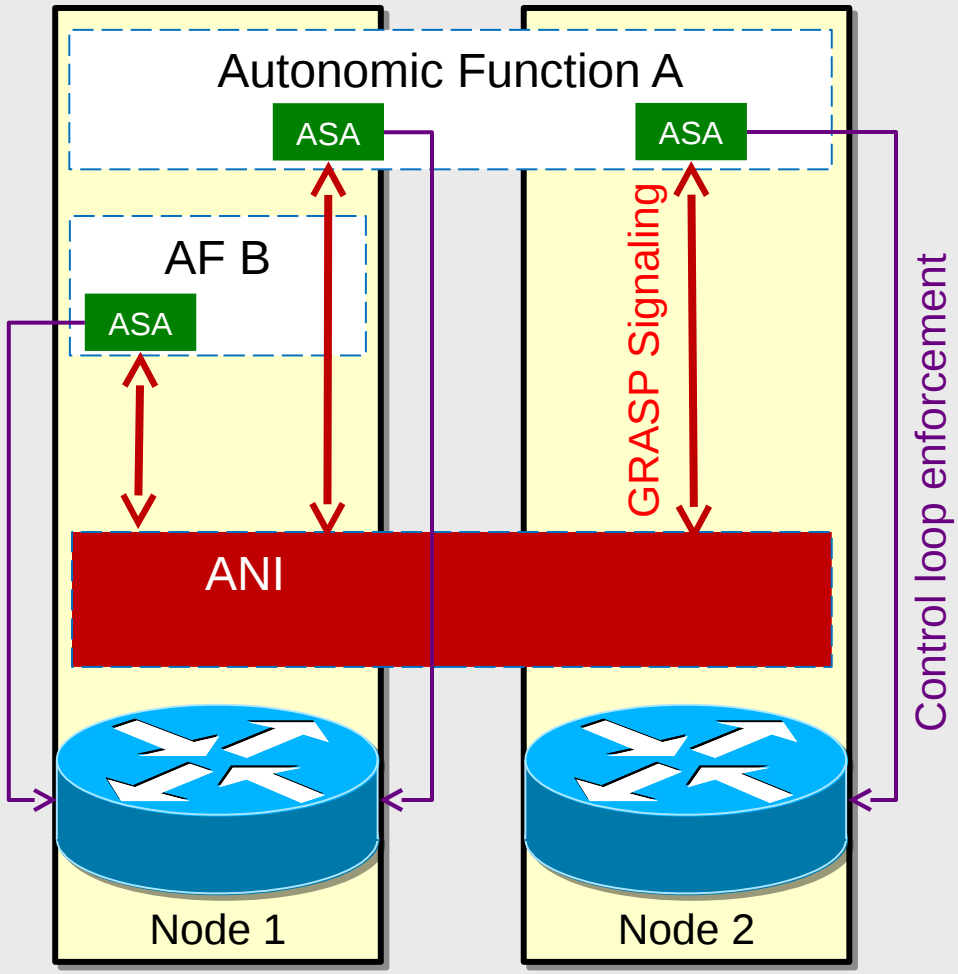
2nd ASA – Risk Aware ASA

Deployable over edge router

When deployed

- Monitors network interfaces risks of failure
- Modifies Premium LSPs routes to reduce their failure exposition

ASA plugging to ANI and device



Current ANIMA picture

- Excerpt from Ref Model
- ASA use GRASP signaling in-between them
- ASA monitor the node and modify its state directly using either NetConf, OpenFlow, SNMP, CLI…

Deployment of ASAs onto network equipment

Deployment means:

- The process during which the ASA “gets in touch” with the device(s) it controls

During deployment:

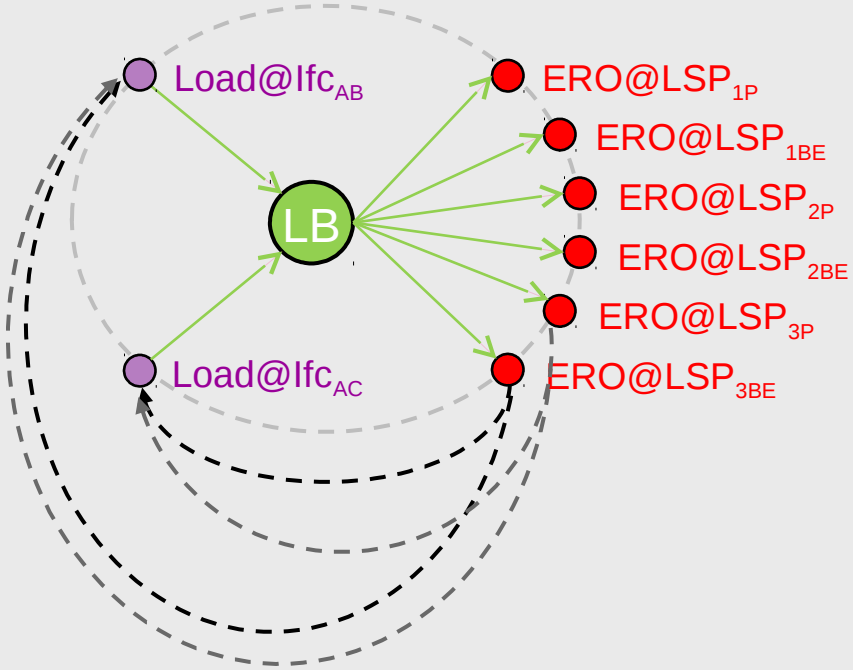
- ASA should establish session with the device(s) (credentials?)
- ASA should collect from the device some setting info (e.g. nbr of interfaces and interfaces id)
- Use these collected info to compute its Instance Manifest
  - Compute the actual metrics
  - Compute the actual parameters
- Share its Instance Manifest within the ANI
  - Either a selective sharing or broadcast sharing

1st ASA – Load Balancing ASA

Instance Manifest

Deployed over router A:

- Monitors network interfaces loads
- Modifies LSPs routes to balance load



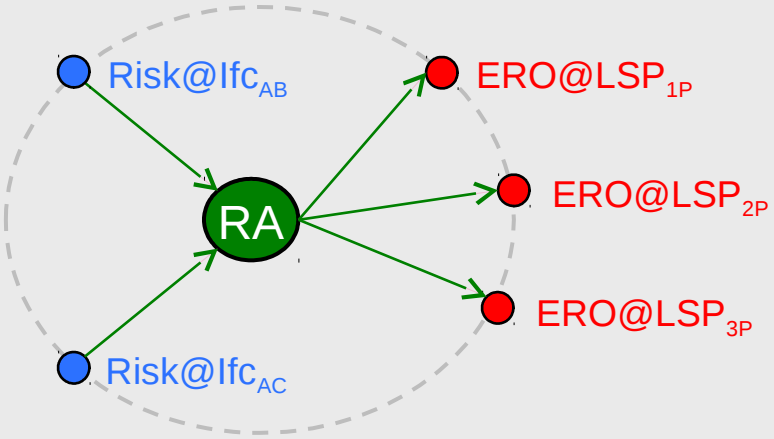

```
<InstanceManiofest>
   <ASA_Class_ID>
      <Name>LoadBalancing</Name>
      <Provider>AnimaCorp</Provider>
      <Version>1.0.0</Version>
   </ASA_Class_ID>

<ASA_Instance_ID>3567456</ASA_Instance_ID>
   <AcquiredInputs>
      <InfoSpec>
         <name>InterfaceLoad</name>
         <contentType>Numeric</contentType>
         <context>
            {RtrA:IfcAB , RtrA:IfcAB}
         </context>
      </InfoSpec>
   </AcquiredInputs>
   <PossibleActions>
      <ActionSpec>
         <name>LSPPath</name>
         <contentType>ERO</contentType>
         <context>{LSP1P, LSP1BE, LSP2P,
         LSP2BE, LSP3P, LSP3BE}
         </context>
      </ActionSpec>
   </PossibleActions>
</InstanceManifest>
```

2nd ASA – Risk Aware ASA

Instance Manifest

Deployed over router A:

- Monitors network interfaces risks of failure
- Modifies Premium LSPs routes to reduce their failure exposition




```
<InstanceManifest>
   <ASA_Class_ID>
      <Name>RiskAware</Name>
      <Provider>AnimaCorp</Provider>
      <Version>1.0.0</Version>
   </ASA_Class_ID>

<ASA_Instance_ID>7167456</ASA_Instance_ID>
   <AcquiredInputs>
      <InfoSpec>
         <name>InterfaceRisk</name>
         <contentType>Probability</contentType>
         <context>
            {RtrA:IfcAB , RtrA:IfcAB}
         </context>
      </InfoSpec>
   </AcquiredInputs>
   <PossibleActions>
      <ActionSpec>
         <name>LSPPath</name>
         <contentType>ERO</contentType>
         <context>{LSP1P, LSP2P, LSP3P}
         </context>
      </ActionSpec>
   </PossibleActions>
</InstanceManifest>
```

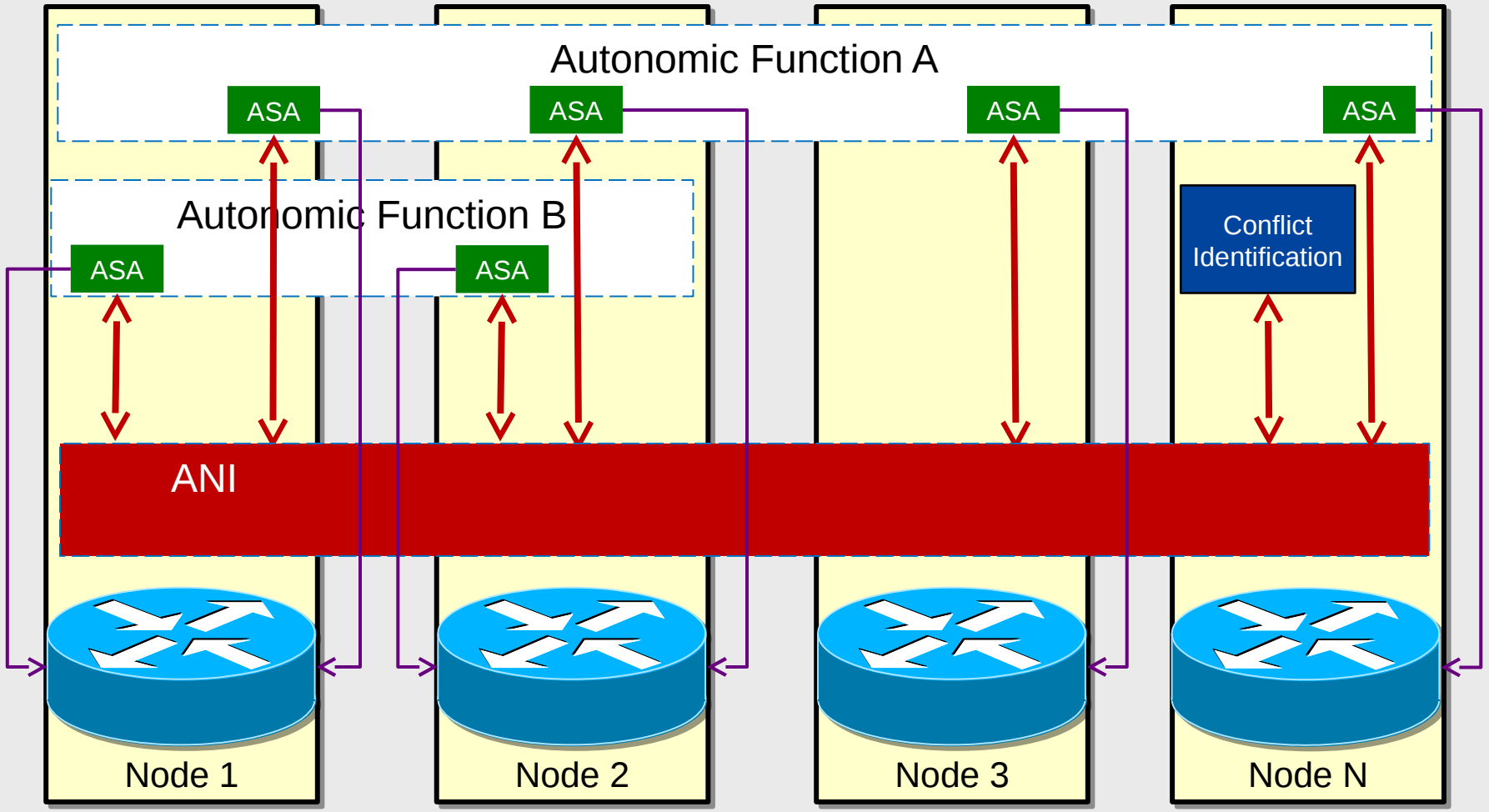
And now – ASA Execution

Conflict Identification

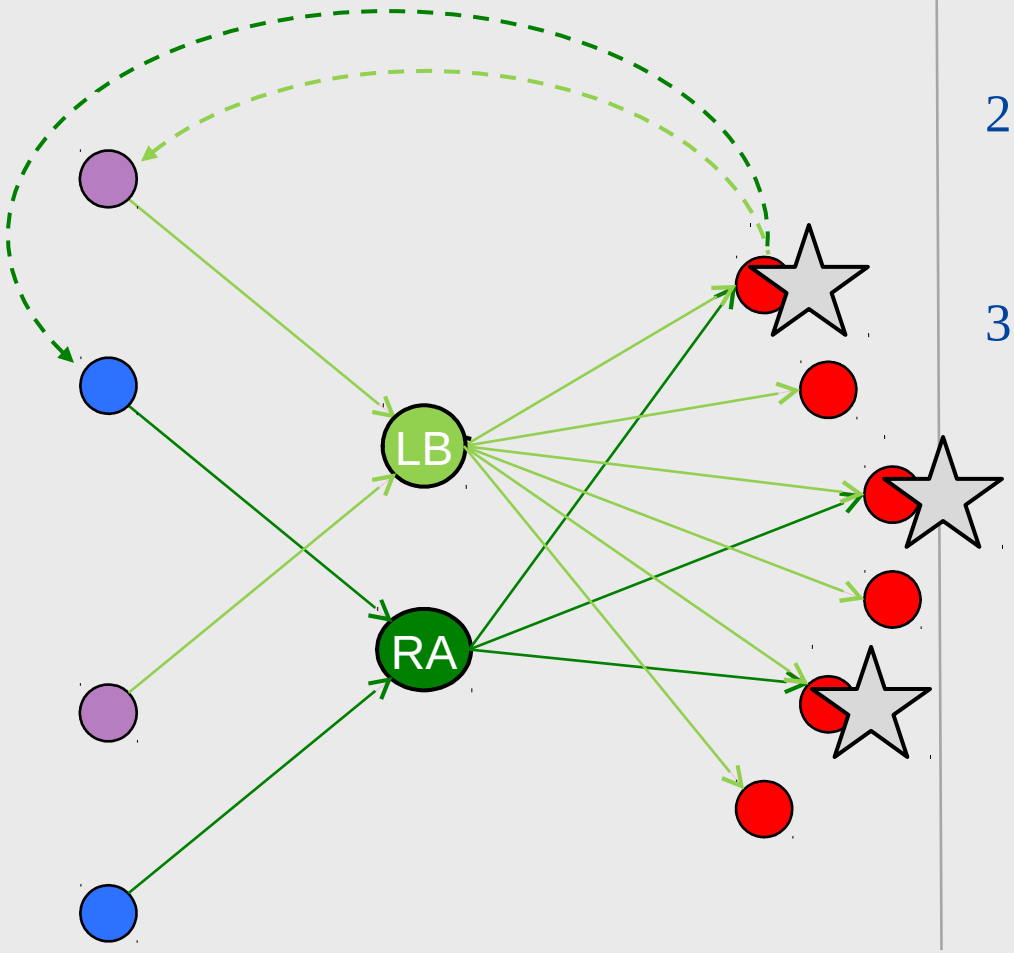
- Role:
  Identify potential conflicts
- Inputs:
  Instance Manifests of All ASAs in the ANI
- Outputs:
  Groups of ASAs (or Autonomic Functions) that may be conflicting

- Situated:
  Either as a part of the ANI
  Or sitting on top of ANI
  (Can be distributed)

Situated Conflict Identification entity



Conflict identification



1. Aggregate the graphs provided by each ASA Instance Manifest
2. Identify loops:
   - Loops formed by different ASAs
   - Loops sharing edges
3. Return list of ASAs implied in conflicting loops

```
<PotentialConflict>
   <ConflictID>1</ConflictID>
   <ConflictingASAs>
      {7167456 , 3567456}
   </ ConflictingASAs>
</PotentialConflict>
```

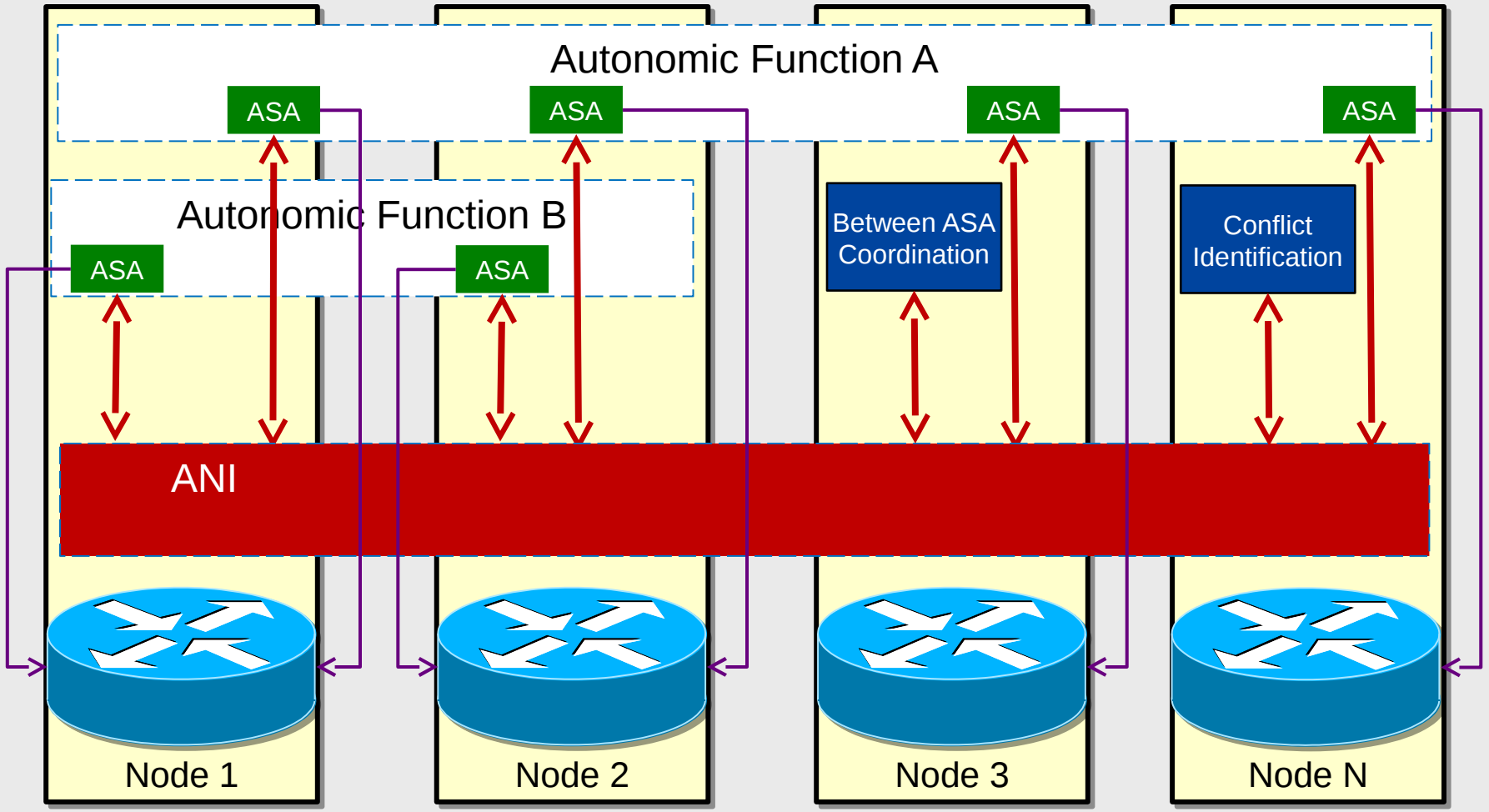
And now – ASA Execution

Between ASA Coordination

- Role:
  Address potential conflict between ASAs
- Inputs:
  Potential Conflict description from Conflict Identification
- Outputs:
  Control commands to ASAs

- Situated:
  Either as a part of the ANI
  Or sitting on top of ANI
  (Can be distributed)

Situated Coordination entities

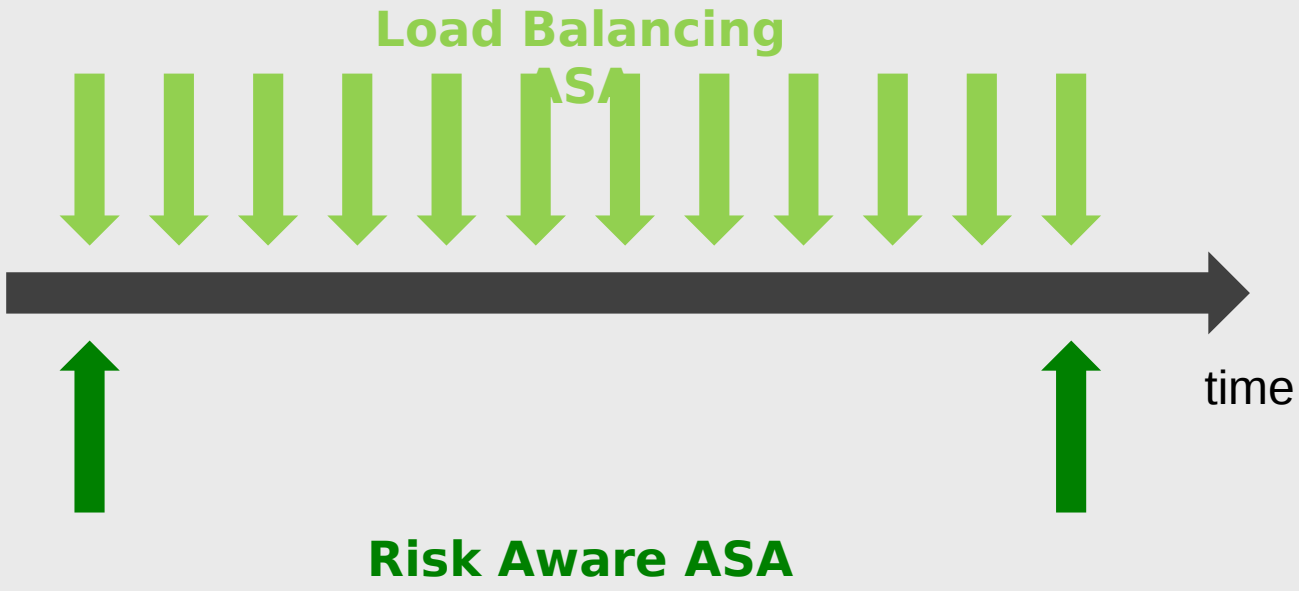


Between ASA coordination

1. Receives a Potential Conflict description
2. Identify applicable algorithm:
   - Depending on available algorithms
   - Depending on control capacities disclosed by ASAs Instance Manifest (If applicable, otherwise supposed no more than start/stop)
3. Instantiate an algorithm process in charge of the ASA group
4. If applicable set algorithm parameters
   - Depending on ASA priorities (from Intents)
   - Depending on ASAs features additionally disclosed by Instance Manifest
5. Run the algorithm process, which sends control commands to ASA (e.g. a random token determines which ASA can execute)

Time separation method

Allow the least impacting ASA to converge in-between two iterations of the most impacting one



Conclusion

Conflict resolution based on common coordination components is feasible

- Applicable to ASA complying to set of requirements (manifests)
- Showing the step-by-step process
- Showing the information to be conveyed
- Showing possible formats (XML based, but can be TLV based)
- Providing a basic method to achieve the process (multiple algorithms possible)

Conclusion

ASAs must follow a defined process

ASA Life-cycle

Know what ASA "does" to the network

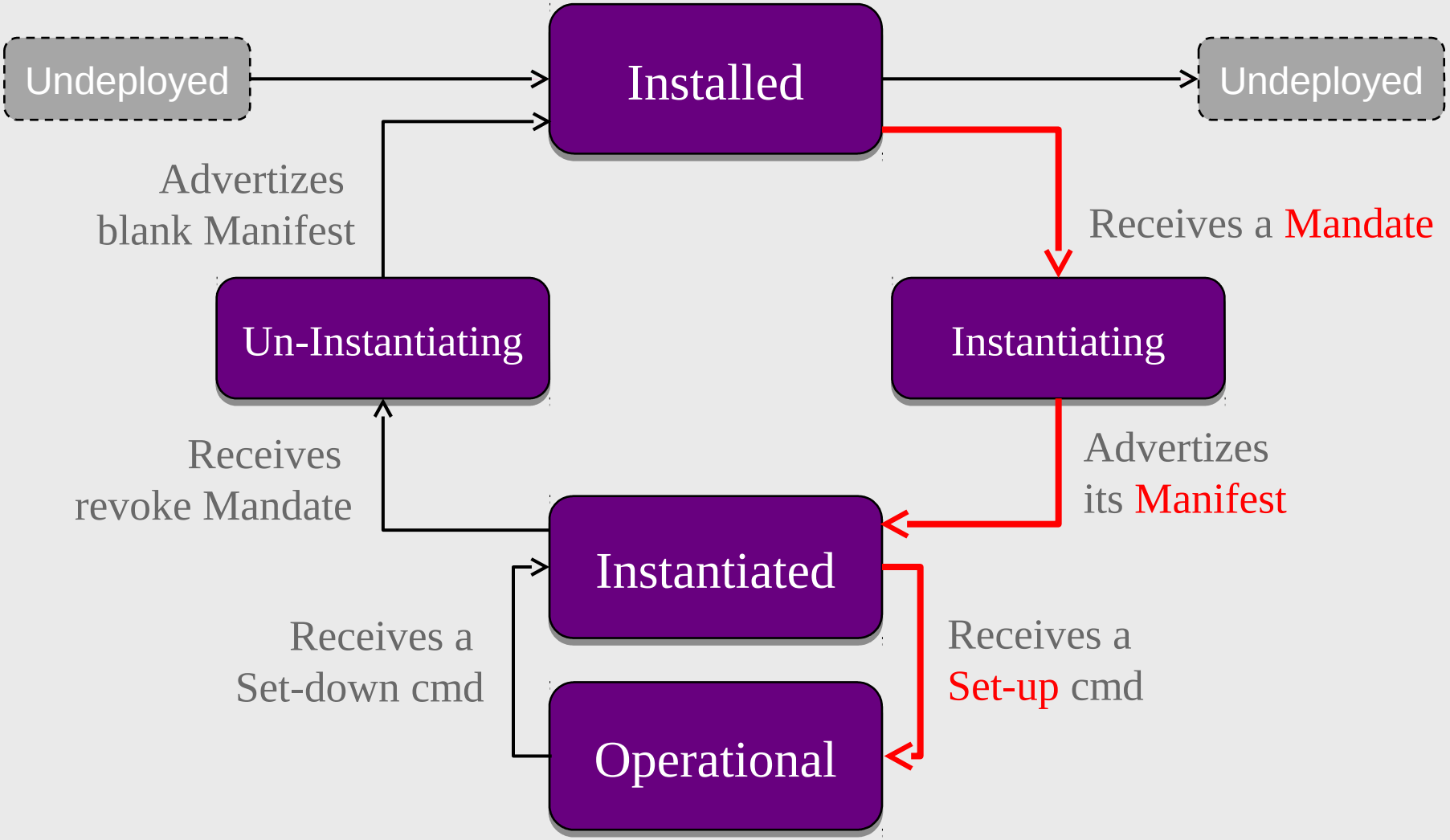
Instance Manifest

Control when/how ASA runs

Start/Stop

Conclusion

ASA life-cycle



Augmenting ANI with ASA Life Cycle Management