FACILITY FOR LARGE-SCALE ADAPTIVE MEDIA EXPERIMENTATION

FLAME Service Delivery Platform

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InterDigital Europe

Urban Hacking in 5G

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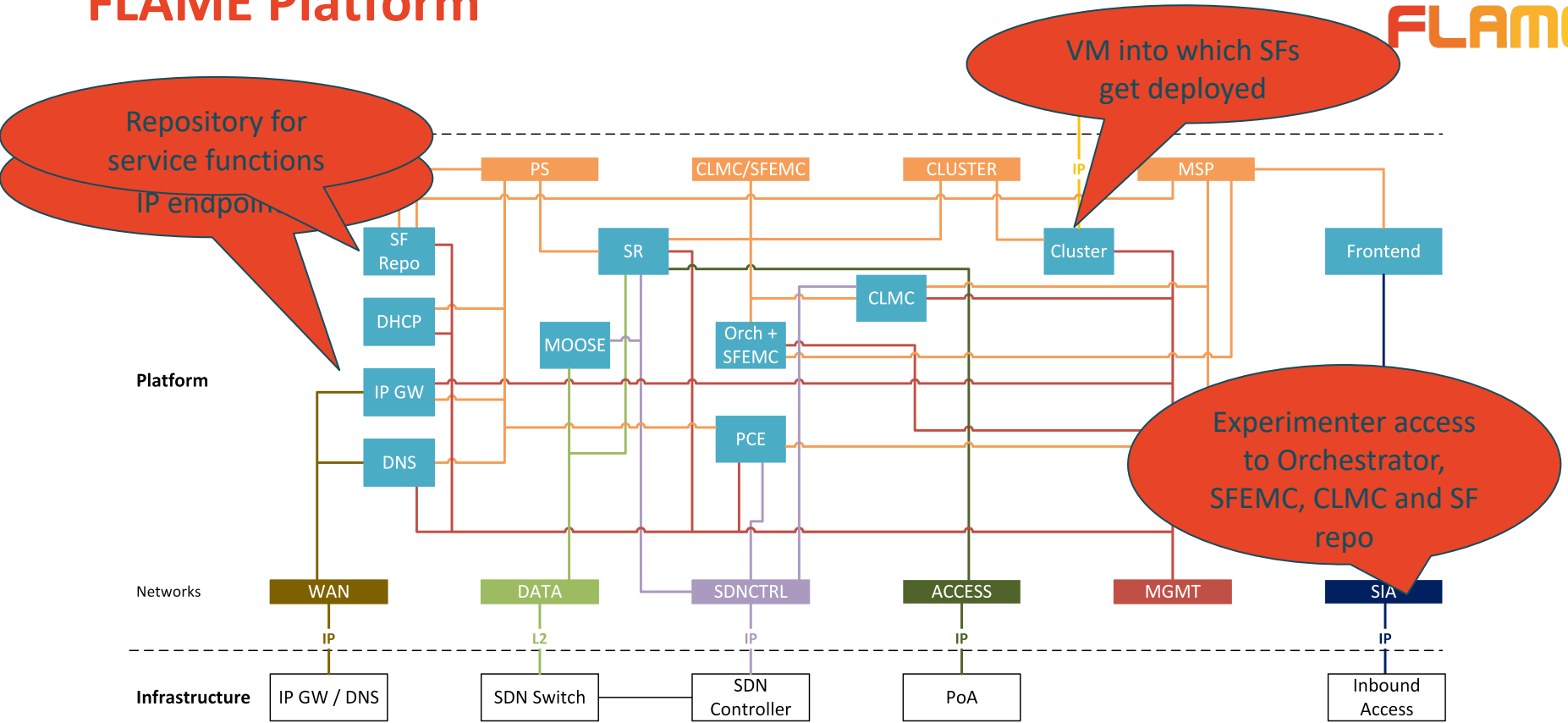
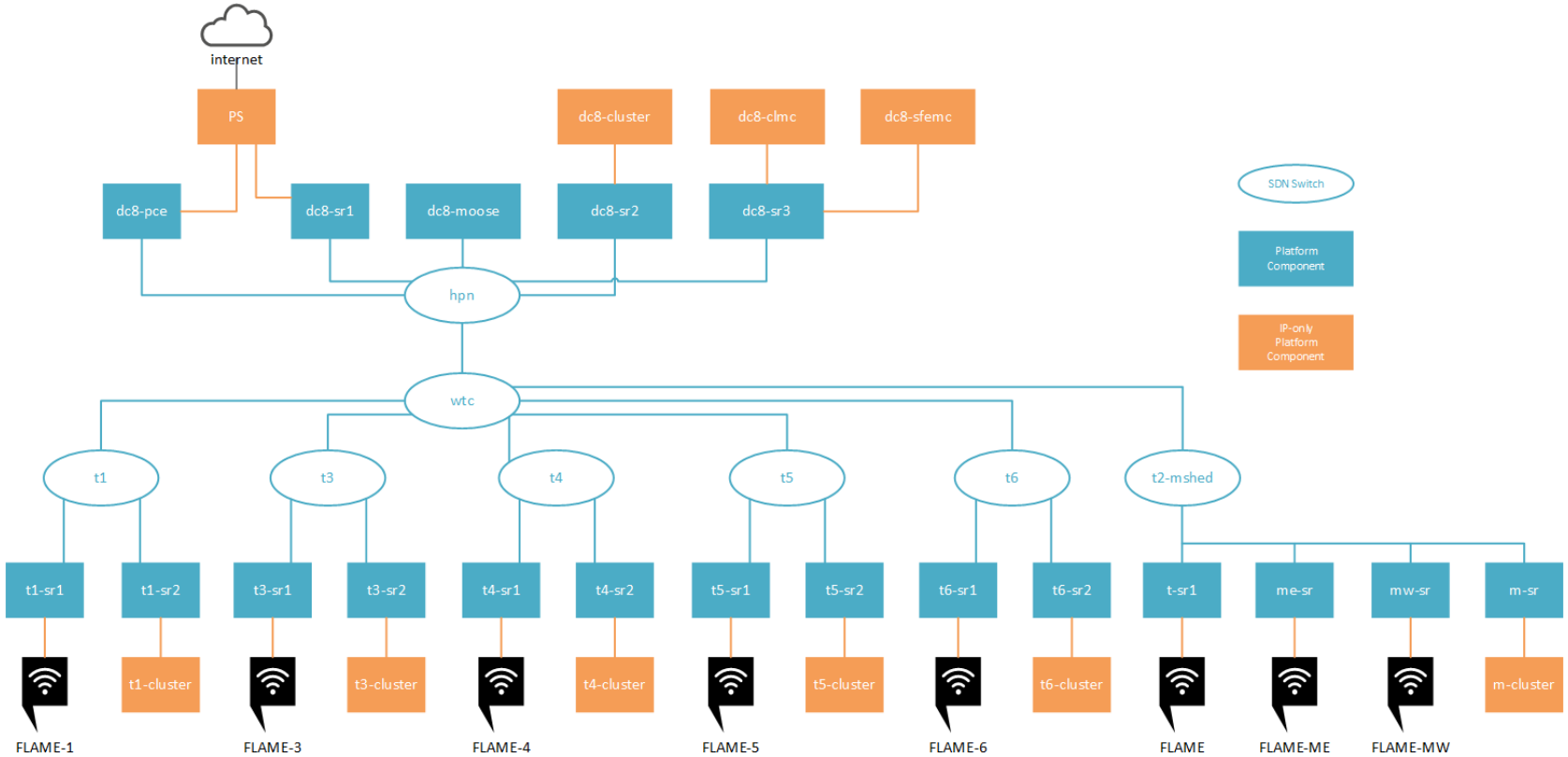
FLAME Platform

FLAME Platform



FLAME Platform in Bristol



Foundational Media Services

- FLAME identified a set of services which are commonly used by service providers
- FMS are pre-packaged SFs uploaded to the platform's SF repository
- All FMS offer a RESTful API utilising the advances of the platform for HTTP-based services

Foundational Media Services

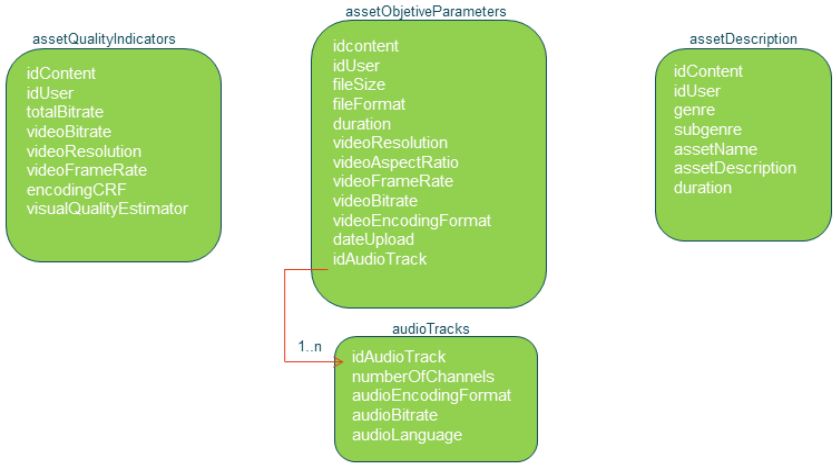
- Set of commonly used services provided to experimenter:
  - Content ingest and storage
  - Adaptive streaming
  - Transcoding, transrating and content conditioning
  - Media quality analysis
  - Proxy storage

Content Ingest and Storage

- Module for ingestion, storage and retrieval of assets
- Common functionality required by media service providers
- It includes a simplified database to keep some information about the stored contents
- Working as content repository, interoperating with the rest of FMS

Metadata Database for Audio & Video Content

- Required by media services to store information about the content
- Schema by default and methods to charge a personalised one
- Technical parameters of the contents
- Spec for content description (e.g., asset name)



Adaptive Streaming

- Offers MPEG DASH and HLS
- Resolution and bitrate is automatically adapted depending on the network and receiver capabilities
- Current implementation conceived for video-on-demand

Transcoding, Transrating and Content Conditioning

- Transcoding: encoding process in a different format to increase compression
- Transrating: encoding process in the same format to increase compression
- Conditioning:
  - Transcoding / transrating at different bitrates
  - Segment alignment to enable switching between qualities
- AVC and HEVC encoding formats

Media quality analysis

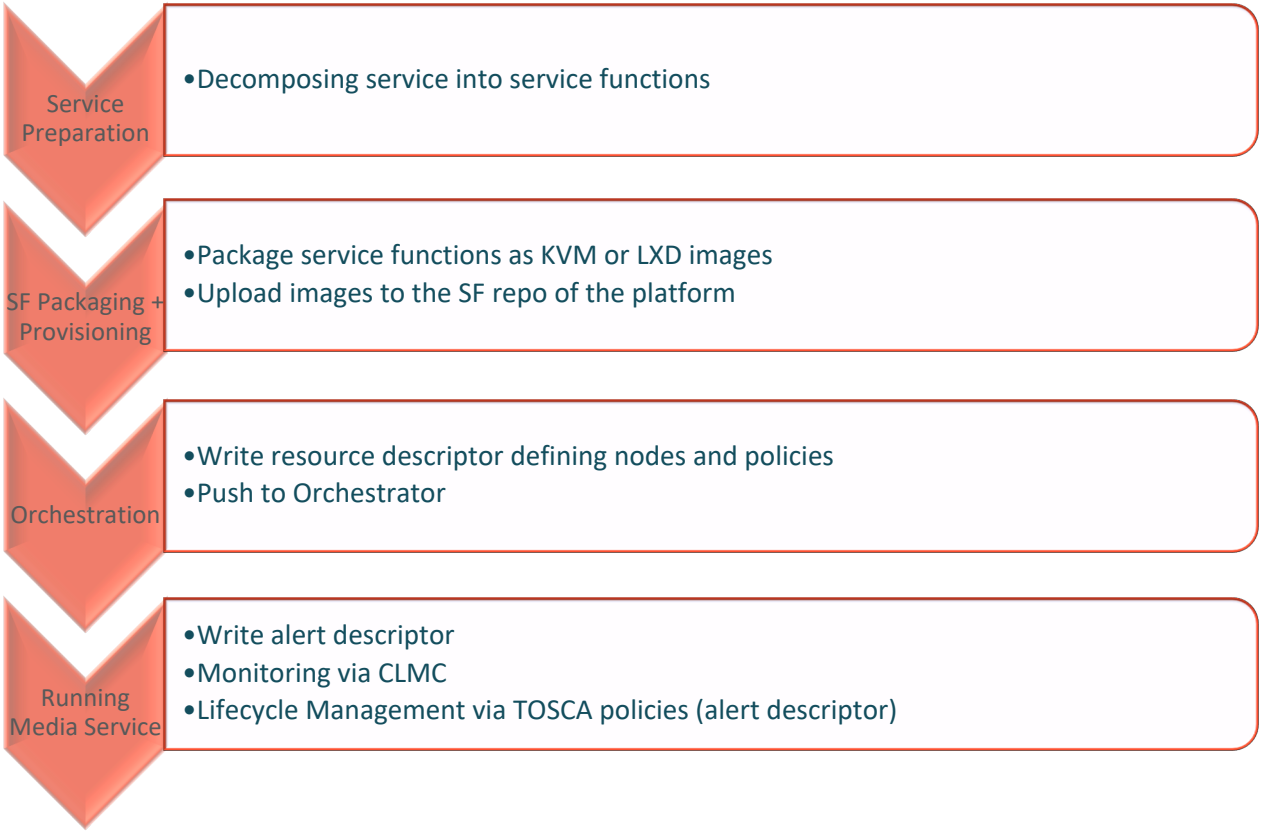
- Extraction of technical parameters
- First approach for quality estimation (e.g., video bitrate)
- Based on ffmpeg (ffprob)
- Consistent with metadata database

Proxy Storage

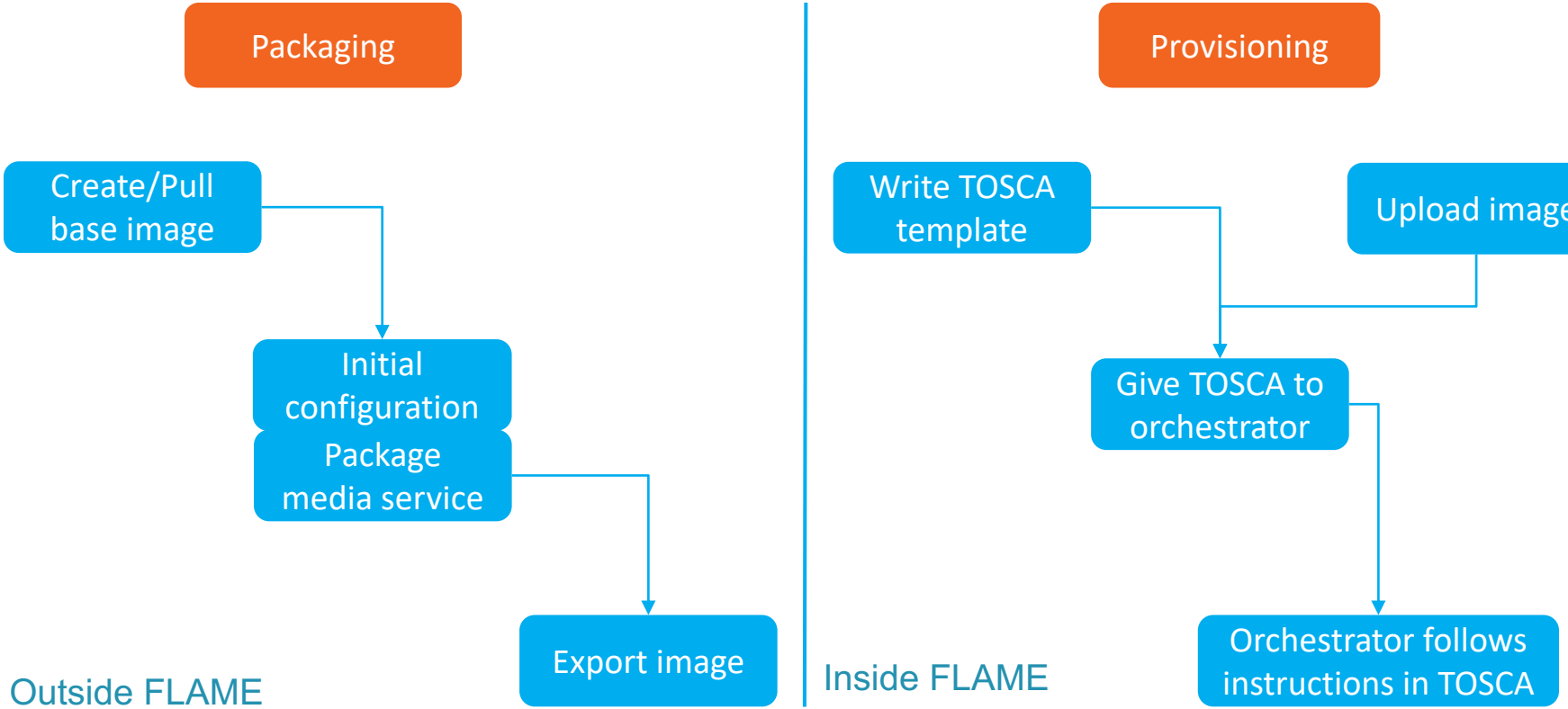
- Complements storage FMS
- 1 master storage and n proxy caches at edge
- If web resource is not available it is fetched from master
  - Otherwise, resource is served from proxy cache
- Comes with default caching strategies

Experimentation API

Workflow



Packaging and Provisioning Workflow



TOSCA in FLAME

- TOSCA is used to communicate desired *resource* orchestration
- FLAME TOSCA is TOSCA compliant: only new types are defined on top of TOSCA NFV standard
- Node and policy types specified to define service deployment and lifecycle of service function endpoints

Adoptions from TOSCA

Item	Relevant for FLAME
Node Templates	✓
Groupings	✓
Relationships	✗
Policies	✓
(Build-)Plans	✗

FLAME Definitions in TOSCA - Nodes

- FLAME defined their own type of SF Endpoint type
- Applies for every node which can be managed by SFEMC:

eu.ict-flame.nodes.ServiceFunction

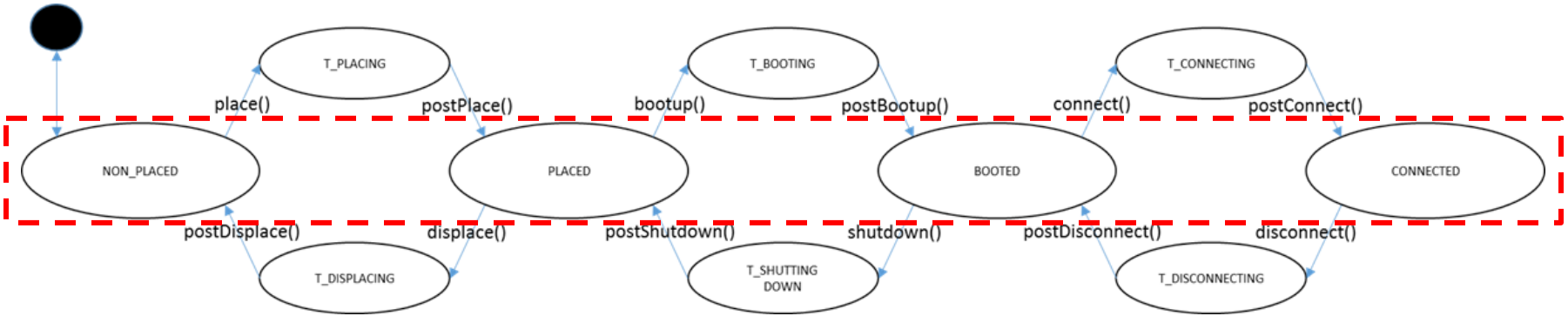
- Within this element, properties are specified such as
  - Addressable FQDNs (SF Identifiers)
  - Hypervisor-type (KVM or LXD)
  - URL from where the packaged SF can be retrieved
  - SF cloud properties (vCPUs, RAM, disk)

FLAME Definitions in TOSCA - Policies

- TOSCA Policies are a type of requirement that govern use or access to resources which can be expressed independently from specific applications
- We have defined two types of policies so far:
  - Initial Policy: A special policy type and is defined as **eu.flame.policies.InitialPolicy** and these labeled policies shall be processed only at the beginning of the run-time of the deployment. It determines the first targeted state for the deployed nodes.
  - State Change Policy: The second policy is defined as **eu.flame.policies.StateChange** and represents the FLAME-specific policy templates. Within this type of policies, we enhanced the policy's elements with a time element which allows scheduling of the policy (i.e., when the policy is active).

Lifecycle Management

- States are self-defined lifecycle keywords for the work with the State Machine inside the SFEMC. Allowed target states are:
  - eu.ict-flame.sfemc.state.lifecycle.connected: Push the Endpoint to CONNECTED state,
  - eu.ict-flame.sfemc.state.lifecycle.booted: Push the Endpoint to BOOTED state,
  - eu.ict-flame.sfemc.state.lifecycle.placed: Push the Endpoint to PLACED state



Resource Descriptor Example

```
topology_template:

policies:
    - init:
        type: eu.ict-flame.policies.InitialPolicy
        description: Start the nodes initially
        triggers:
          inital_trigger:
            condition:
              constraint: initialize
            action:
              protest-service:
                dc8-sr3-cluster1-cluster: eu.ict-flame.sfe.state.lifecycle.connected
                m-sr1-cluster1-cluster: eu.ict-flame.sfe.state.lifecycle.placed
                t1-sr1-cluster1-cluster: eu.ict-flame.sfe.state.lifecycle.placed
                t3-sr1-cluster1-cluster: eu.ict-flame.sfe.state.lifecycle.placed
                t4-sr1-cluster1-cluster: eu.ict-flame.sfe.state.lifecycle.placed
                t5-sr1-cluster1-cluster: eu.ict-flame.sfe.state.lifecycle.placed
                t6-sr1-cluster1-cluster: eu.ict-flame.sfe.state.lifecycle.placed
```

Resource Descriptor Example

```
policies:
    - init:
        type: eu.ict-flame.policies.InitialPolicy
        description: Start the nodes initially
        triggers:
          inital_trigger:
            condition:
              constraint: i
            action:
              protest-serv
                dc8-sr3-cl
                m-sr1-clu
                t1-sr1-cl
                t3-sr1-cl
                t4-sr1-c
                t5-sr1-c
                t6-sr1-c
- high_latency_check:
        type: eu.ict-flame
        description: Check
        triggers:
          check_trigger:
            description: C
            condition:
              constraint:
              period: 600
            action:
              protest:
                m-sr1-clus
```

```
- high_latency_check:
        type: eu.ict-flame.policies.StateChange
        description: Check Latency and peform a connect of another node …
        triggers:
          check_trigger:
            description: Check high latency on relationships
            condition:
              constraint: clmc::service_latency_exceeded
              period: 600 # integer required, unit: seconds
            action:
              protest:
                m-sr1-cluster1-cluster: eu.ict-flame.sfe.state.lifecycle.connected
```

Alert Descriptor Example

```
tosca_definitions_version: tosca_simple_profile_for_nfv_1_0_0
description: TOSCA Alerts Configuration document
imports:- flame_clmc_alerts_definitions.yaml
metadata:
  servicefunctionchain: companyA-Vr

topology_template:
 policies:
    - high_latency_poli
        type
        trigg
          serv
            des
            even
            metri
            condit
              thres
              granul
              aggrega
              resource
                flame_l
              comparis
            action:
              implement
                - flame
                - http:
```

```
- high_latency_policy:
      type: eu.ict-flame.policies.Alert
      triggers:
        service_latency_exceeded:
          description: This event triggers when the mean network latency …
          event_type: threshold
          metric: network.latency
          condition:
            threshold: 45
            granularity: 120
            aggregation_method: mean
            resource_type:
              flame_location: m-sr1-cluster1-cluster
            comparison_operator: gt
          action:
            implementation:
              - flame_sfemc
              - http://companyA.alert-handler.ict-flame.eu/high-latency
```

FLAME

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