Intro to The Workflow Orchestrator

Chris Cummings
Network Automation Software Engineer
Energy Sciences Network (ESnet)
Lawrence Berkeley National Laboratory
U.S. Department of Energy

TechEx
September-2023
What is Intent Based Networking?

- A high level definition of a Network Service
- Describes a service, but not *how* to implement it.
- Abstracts service offerings from implementation details
What is Orchestration?

• Coordination of multiple computer and network systems
• Translates network *intent* into network *configuration*
• Workflow-based method for provisioning services
• Method for ensuring consistency in service delivery
What is Orchestration NOT?

- A replacement for network engineers
- A way to have one network engineer do the job of multiple engineers
- A single tool to run all of ESnet
Benefits of Orchestration

- Orchestration creates consistent configurations for complex services
- Reduces the chance for human error
- Makes the network more reliable
- Allows engineers to focus on more design than deployment (less busy-work)
What are workflows?

Finite resources exist in other systems.

The workflow contains the “Steps” needed to complete the work.

Orchestrator stores the final product until we break it all apart again.
ESnet6 Provisioning Stack

ESDB (network intent)
Prefix Manager (L3 prefix generation)
Stardust (historic network state)
Discovery Service (current network state)
Topology Service (network topology)

Orchestrator

ESDB GUI
Workflow GUI

ServiceNow (incident/change management)
Git (revision control)
NameSurfer (IPAM)
Other (PeeringDB, RADB, etc.)

Cisco NSO
Ansible Tower

High-Touch Edge
Open Line System
Packet Network
Supporting Equipment
NFV/Compute
ESnet6 Provisioning Workflow

1. Assigned task
2. Plan service
3. Populate planned service
4. Instantiate service

Network Planner

ESDB

Orchestrator

Support Systems

NSO

Network

Planning / Change Function

Activation Function
Demonstration

- ECMP Group (Backbone Link)
ECMP Group Steps

```python
def create_backbone_link() -> StepList:
    return {
        "construct_blink_model",
        "determine_bandwidth",
        "determine_circuit_latency",
        "store_process_subscription(Target.CREATE)",
        "generate_dns_names(flavor="bb")",
        "set_status(SubscriptionLifecycle.PROVISIONING)",
        "provision_ipv4_block",
        "provision_ipv6_block",
        "set_name_on_ip_blocks",
        "provision_ip(“a”, “ipv4”)",
        "provision_ip(“a”, “ipv6”)",
        "provision_ip(“z”, “ipv4”)",
        "provision_ip(“z”, “ipv6”)",
        "assemble_nso_payload",
        "nso_dry_run_cli_patch",
        "confirm_dry_run_results",
        "patch_esdb_interface(“a”)",
        "patch_esdb_interface(“z”)",
        "patch_esdb_circuit()
        new_esdb_state=NSO_ADMIN_STATE_TO_ESDB_STATE[NSOBackboneLinkAdminState.MAINTENANCE]
        [new_esdb_circuit_state]
        )
        "patch_nso",
        "set_status(SubscriptionLifecycle.ACTIVE)"
    }
```
Each service container is connected to the OOB management interface of the network elements.

cr6 devices are Nokia vSIMs running 20.10R5
mpr1 devices are experimental vQFXs running 18.4
customer(nsp/host) devices are running SR-Linux/latest

Z00001
Questions?