NETWORK AUTOMATION AND PROGRAMMABILITY:

Reality Versus The Vendor Hype When Considering Legacy And NFV Networks

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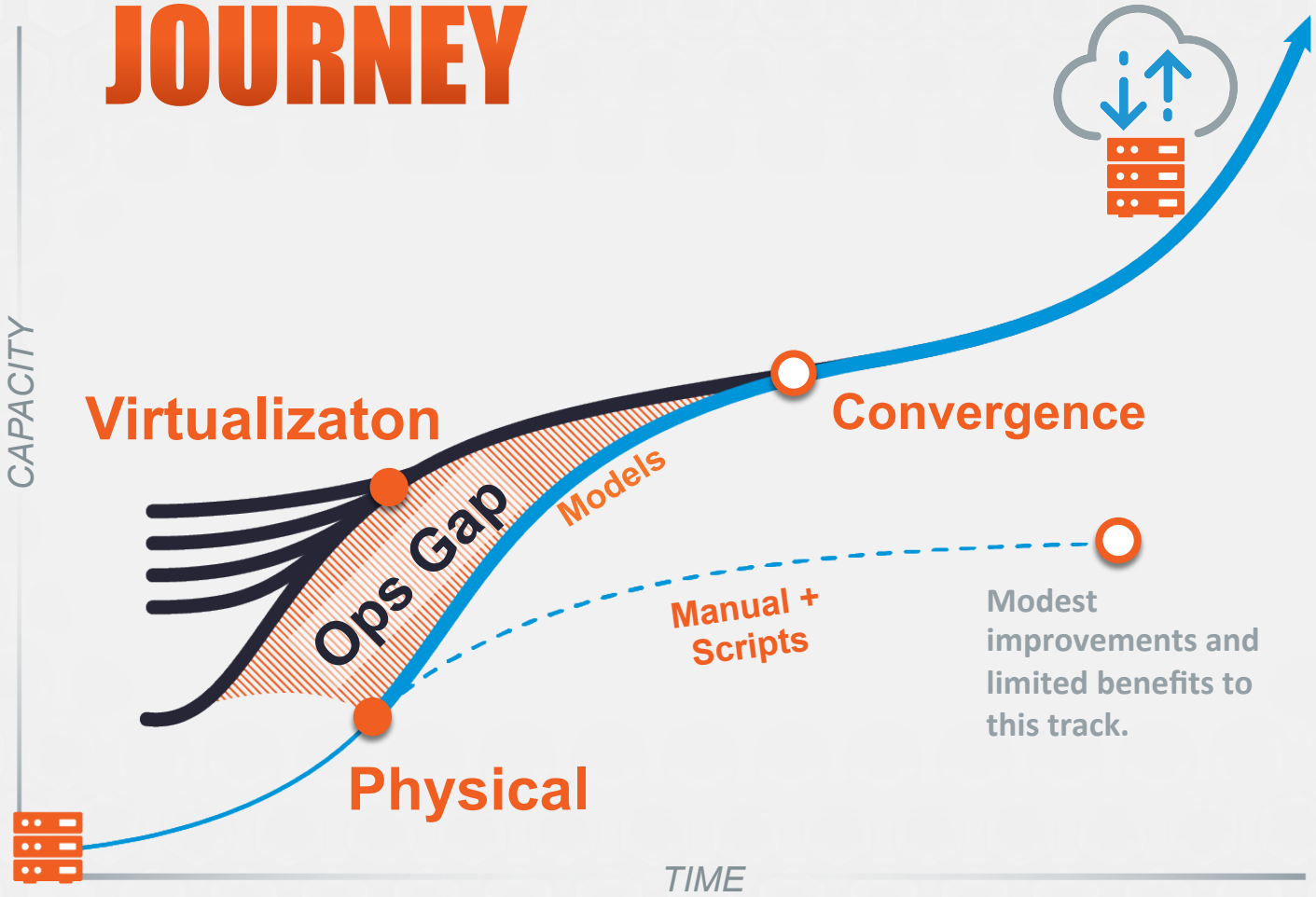
itential

INTRODUCTION

- Automation is a Journey
- Traditional vs Future Automation
- Vendor Hype
- Network Reality

JOURNEY


CAPACITY
TIME
Virtualizaton
Convergence
Ops Gap
Models
Manual + Scripts
Physical
Modest improvements and limited benefits to this track.

PROGRAMMABILITY: WHAT IS IT?

- Software-like interfaces to network
  - APIs
  - NETCONF
- Intelligent Models/Templates
  - YANG
  - YAML
  - TOSCA

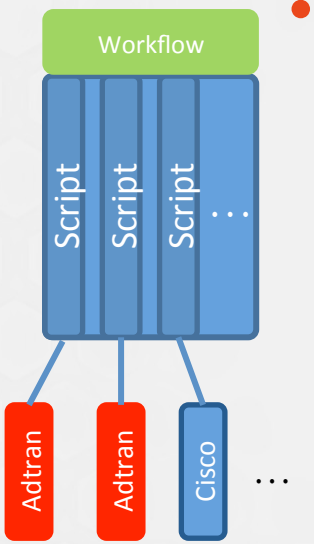
TERMINOLOGY

- NETCONF – NETwork CONFiguration – created to achieve config goals SNMP could not
- YANG – Yet Another Next Generation – modeling language for data sent via NETCONF
- YAML – YAML Ain't Markup Language – modeling used by tools such as NAPALM and OpenStack HEAT (among others) to map items to native config

TERMINOLOGY

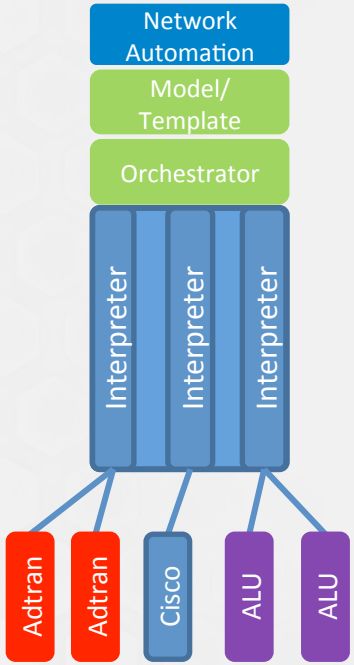
- NFV – Network Function Virtualization – virtualization of network devices
- TOSCA – Topology and Orchestration Specification for Cloud Applications – modeling (YAML) of cloud based network services.

TRADITIONAL SCRIPT-BASED



- Script-based
  - Not as scalable
  - Labor intensive to maintain
  - Avoids need for IT involvement
  - Human Driven Automation is best case

FUTURE MODEL-BASED



- Model-based automation
  - Scalable
  - Smaller number of Models to manage
  - May require IT involvement
  - Policy/Event Driven Automation is goal

THE HYPE

- Just use NETCONF and you can automate everything
- YANG is easy and standard
- NFV is going to virtualize everything, which means it will be automated
- Automation is easy

REALITY: NETCONF/YANG

- Network Devices:
  - Most are not NETCONF compliant
  - Some vendors are approaching it from an API perspective versus NETCONF, but:
    - Most have no API access available
  - All YANG is not created equally

REALITY: YANG EXAMPLE (EXCERPT)

```
typedef ip_types {
  type enumeration {
    enum ipv4;
    enum ipv6;
  }
}

typedef interface_types {
  type enumeration {
    enum Ethernet;
    enum FastEthernet;
    enum GigabitEthernet;
    enum TenGigE;
    enum xe;
  }
}


  container itential_policy {

      common:action acl-load {
        common:info "Load acls with bulk payload";
        common:actionpoint itential-policy-acl-load;
        input {
          leaf payload {
            type string;
            description "bulk payload";
          }
        }
        output {
          leaf config {
            type string;
            description "Native config response";
          }
        }
      }

      list access_list
      {
        uses ncs:service-data;
        ncs:servicepoint "itential-policy-access-control-list";
        common:info "Itential Policy: Access List Entries";
        key "name device_name ip_type";
```

```
          leaf name {
            type string;
          }
          leaf device_name {
              type leafref {
                path "/ncs:devices/ncs:device/ncs:name";
              }
          } //close device_name
          leaf ip_type {
            type ip_types;
            common:info "IPv4 or IPv6 Access List";
          }

          list rule {
            key order;
            ordered-by user;
                leaf order {
                  type string;
                  common:info "The order position of the rule.";
                }
                  leaf action {
                    type enumeration{
                        enum permit;
                        enum deny;
                    }
                    common:info "Permit or Deny the rule";
                  }
                  leaf protocol {
                    type string;
                    common:info "The protocol of the rule. Example: icmp,
ipv4,tcp, udp, etc.";
                  }
                  leaf-list source_host {
                    type string;
                    common:info "The source host in IPv4, IPv6, or
range.";
                  }

                  leaf-list destination_host {
                    type string;
                    common:info "The source host in IPv4, IPv6, or
range.";
                  }
```

- Sample excerpt of YANG managing ACLs

REALITY: NETCONF GENERATED

```
admin@ncs% set itential_policy access_list acl_1 mgracl_junos0 ipv4 rule 10
action deny destination_host 4.21.1.10 source_host [ 3.3.3.3 4.4.4.4 ] protocol
tcp service ssh
[ok][2017-03-28 13:41:07]

[edit]
admin@ncs% commit dry-run outformat native
native {
    device {
        name mgracl_junos0
        data <rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
                  message-id="2">
                <edit-config xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
                  <target>
                    <candidate/>
                  </target>
                  <test-option>test-then-set</test-option>
                  <error-option>rollback-on-error</error-option>
                  <config>
                    <configuration xmlns="http://xml.juniper.net/xnm/1.1/xnm">
                      <firewall>
                        <family>
                          <inet>
                            <filter>
                              <name>acl_1</name>
                              <term>
                                <name>term10</name>
                                <then>
                                  <discard/>
                                </then>
                                <from>
                                  <source-port>ssh</source-port>
                                  <source-address>
                                    <name>3.3.3.3</name>
                                  </source-address>
                                  <source-address>
                                    <name>4.4.4.4</name>
                                  </source-address>
                                  <protocol>tcp</protocol>
                                  <destination-address>
                                    <name>4.21.1.10</name>
                                  </destination-address>
                                </from>
                              </term>
                            </filter>
                          </inet>
                        </family>
                      </firewall>
                    </configuration>
                  </config>
                </edit-config>
              </rpc>
    }
}
[ok][2017-03-28 13:41:09]

[edit]
admin@ncs%
```

CONCLUSION: NETCONF/YANG

- Operational complexity is high
- To be effectively used management tools are needed:
  - Cisco NSO (formerly Tail-f) seems to be the best option from a vendor at the moment
- Not supported widely enough to be useful, yet
- Intersection of developer and network engineering skillsets

NETCONF/YANG TOOLING

Commercial:

- Applied Informatics
- GoAhead
- SNMP Research
- Cisco/Tail-f Systems
- Many NFV MANO solutions use YANG

Open Source:

- Ncclient (client)
- netopeer (client/server)
- YencaP (client/server)
- Yuma (client/server)
- YANG on top of NAPALM – in beta

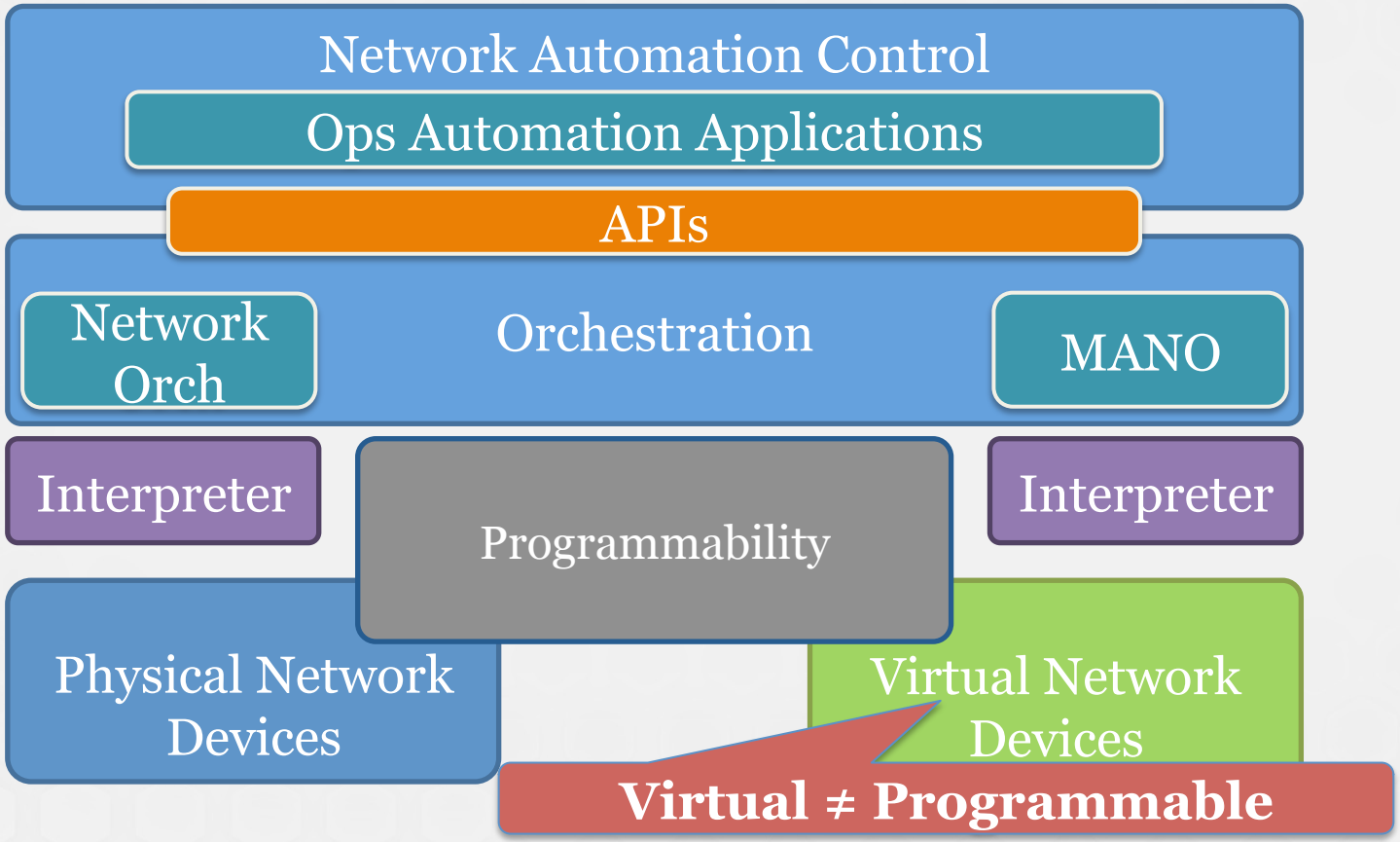
REALITY: NFV

- NFV is a focus for many, but NFV ≠ Programmable
  - NFV is still in its infancy
  - Virtualization is near maturity, BUT…
  - The management and tooling on top of it is not
- Collision of IT Ops and network engineering skillsets

THE ANSWER?

- Creating an automation framework that can be flexible and grow with the emerging technology
- Programmability matters, the technology enabling it does not…much

HIGH LEVEL APPROACH



TOOLING NEEDS & OPTIONS

- Interpreter: translates models/templates to device understood commands
  - NAPALM
  - Ansible Network Modules
  - Chef Cookbooks for Cisco and Juniper
  - Puppet Modules
  - Proprietary: Cisco NSO NEDs, etc.

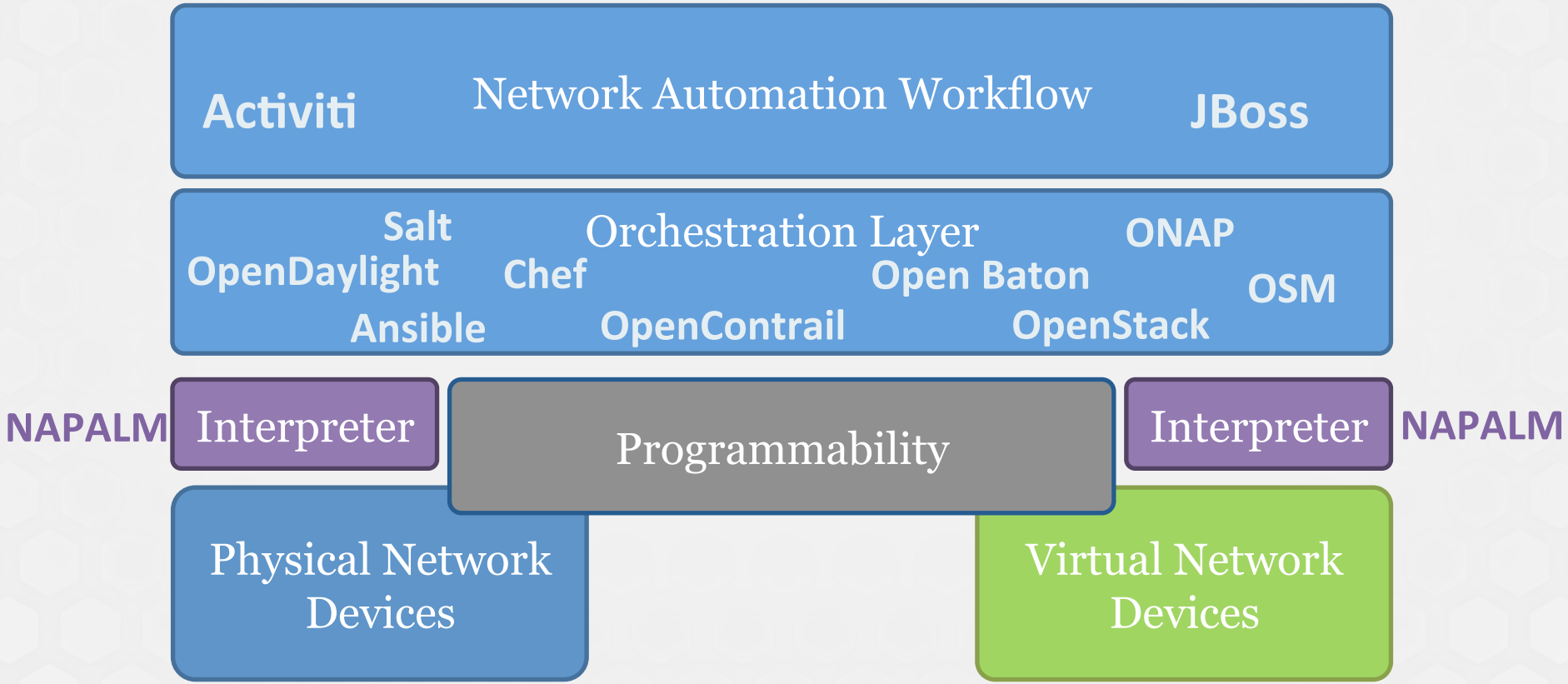
TOOLING NEEDS & OPTIONS

- Orchestration: provides modeling/templating capabilities and communicates to Network via Interpreters
  - Ansible
  - Open-O
  - OpenDaylight
  - Proprietary: Cisco NSO, Blue Planet, Affirmed Networks, etc.

TOOLING NEEDS & OPTIONS

- Automation Platform: Combines workflow, scripting, and API aggregation to provide ops automation applications
  - Activiti
  - Red Hat JBoss BPM
  - Proprietary: Pronghorn, ServiceNow, Remedy, Resolve, etc.

OPEN SOURCE OPTIONS



CONCLUSIONS

- Listen to what vendors say with a grain of salt, but use the information provided for inspiration
- Consider open source tools that can do what is promised
- Set goals for automation – you never hit a target if there isn't one to aim for
- Thoroughly evaluate your need versus vendor and open source possibilities

QUESTIONS?

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- Network to Code Slack Channel: https://networktocode.herokuapp.com/