Network Device Properties As Code

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ROBLOX

Agenda

1. Introduction / Roblox
2. Network device properties definition
3. How are we managing device properties today ?
4. How to manage Network device properties as code
5. Questions

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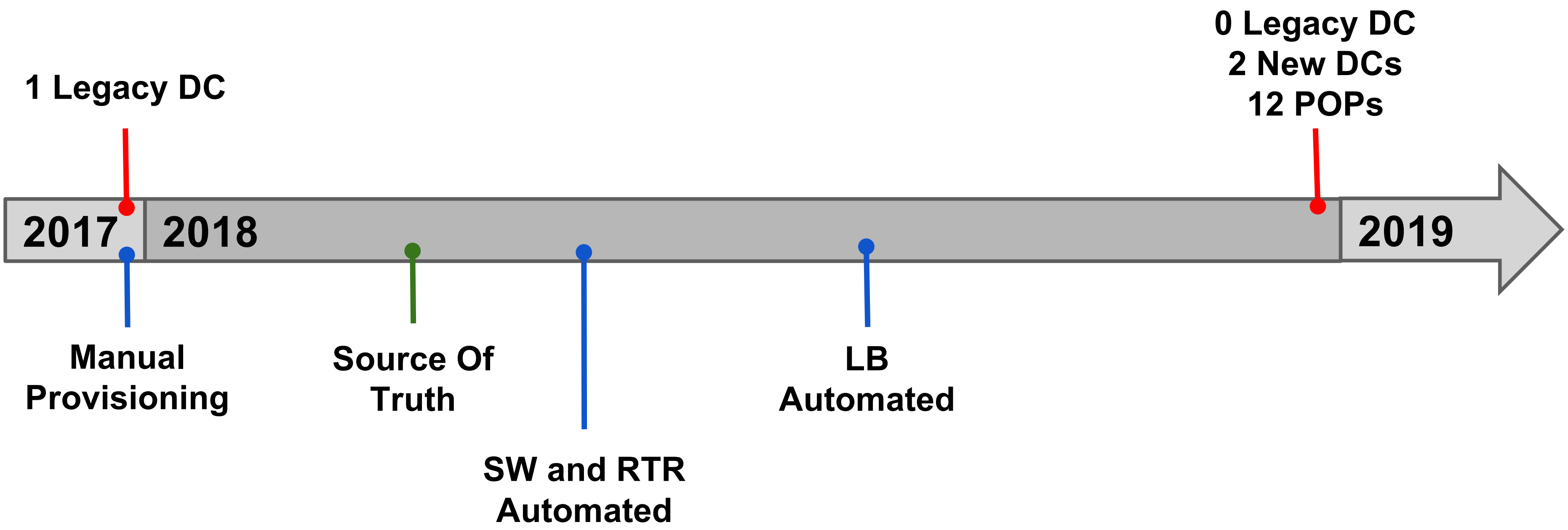
Introduction / Roblox

What is Roblox ?

- Educational platform for young software developers
- Gaming and Social platform
- Core audience for player is kids ages 9-12
- 2 Million Active developers
- 80+ Million monthly active users
- AS 22697

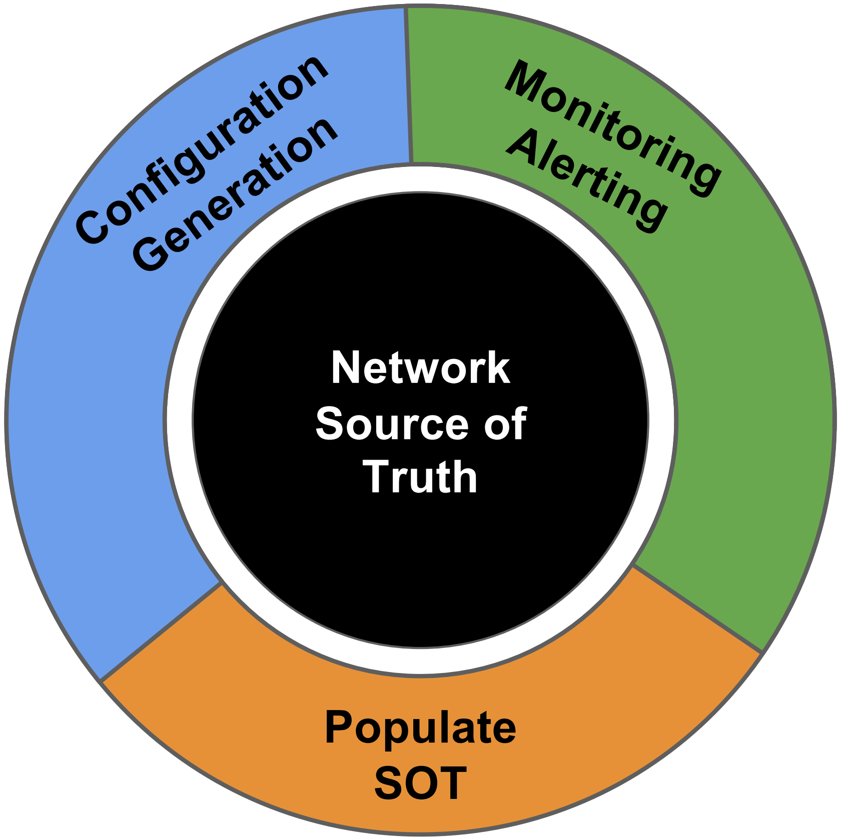
ROBLOX

Rebuilt everything in 2018



- Couldn’t have done it without a proper Source of Truth
- The Source Of Truth is the Network Property Store

Start with the Source of Truth

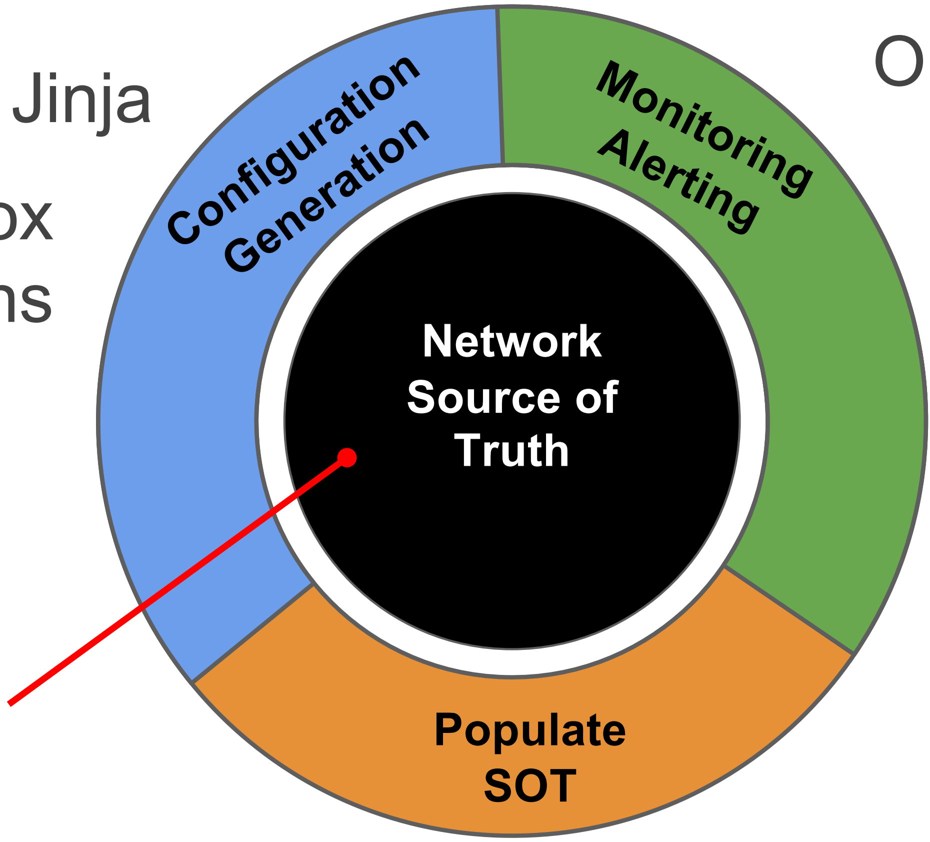


- Integrate everything with it
- Your Source Of Truth is only as good as the quality of the data it contains

Vendors don’t tell you to deploy a Source of Truth because it introduces dependencies and requirements.

But it’s the most important part.

Automation Stack @ Roblox



Ansible / Jinja

Netbox
Extensions

Netbox
Git

Observium

Influxdb / Grafana

Custom Collector
(REST / Netconf)

Custom
Alert Manager

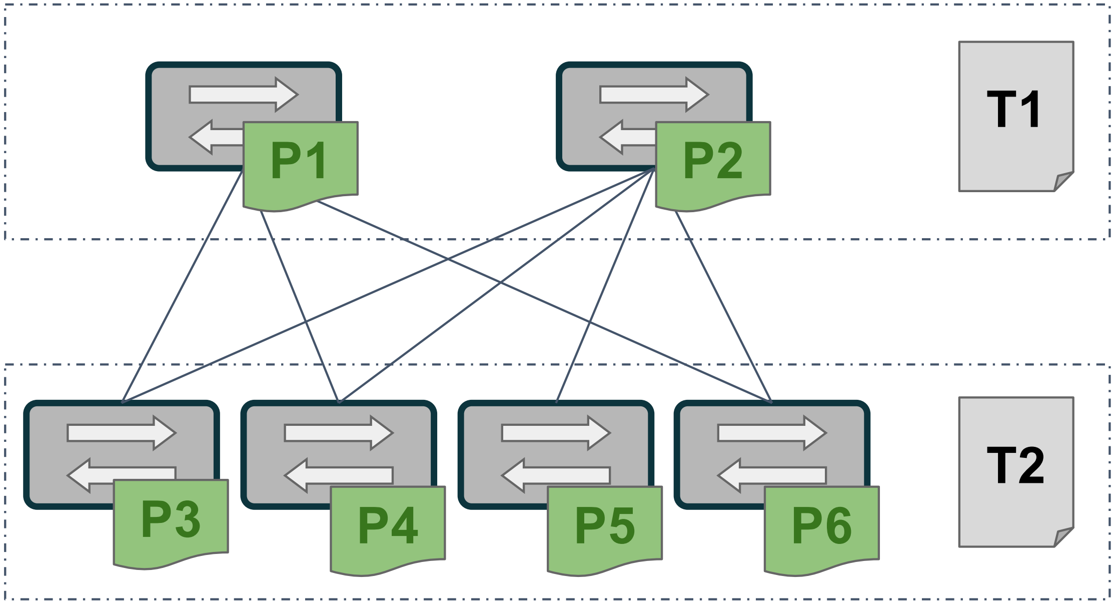
2

Network device properties

Network device properties

- Name
- IP addresses
- Cabling information / Peer properties
- Vlans
- BGP Peering
- Device specific info (ASN, etc..)

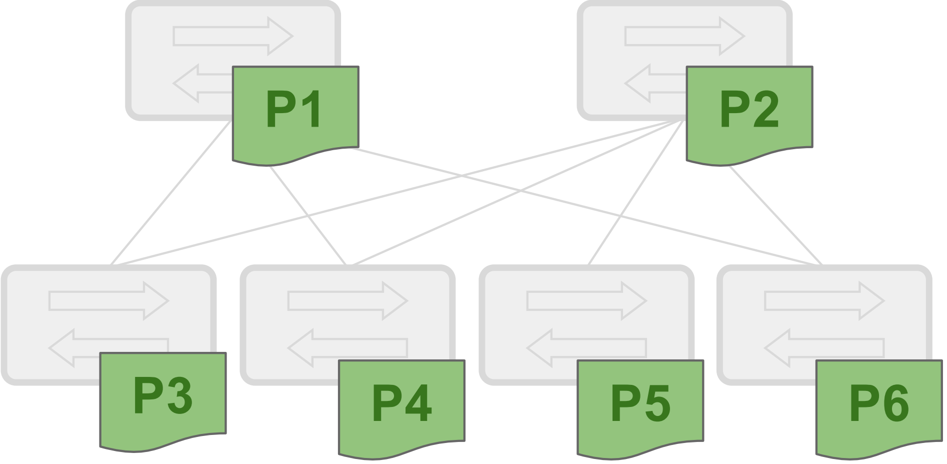
Each device has a unique set of properties



- 1 template per role
- Unique set of properties per device

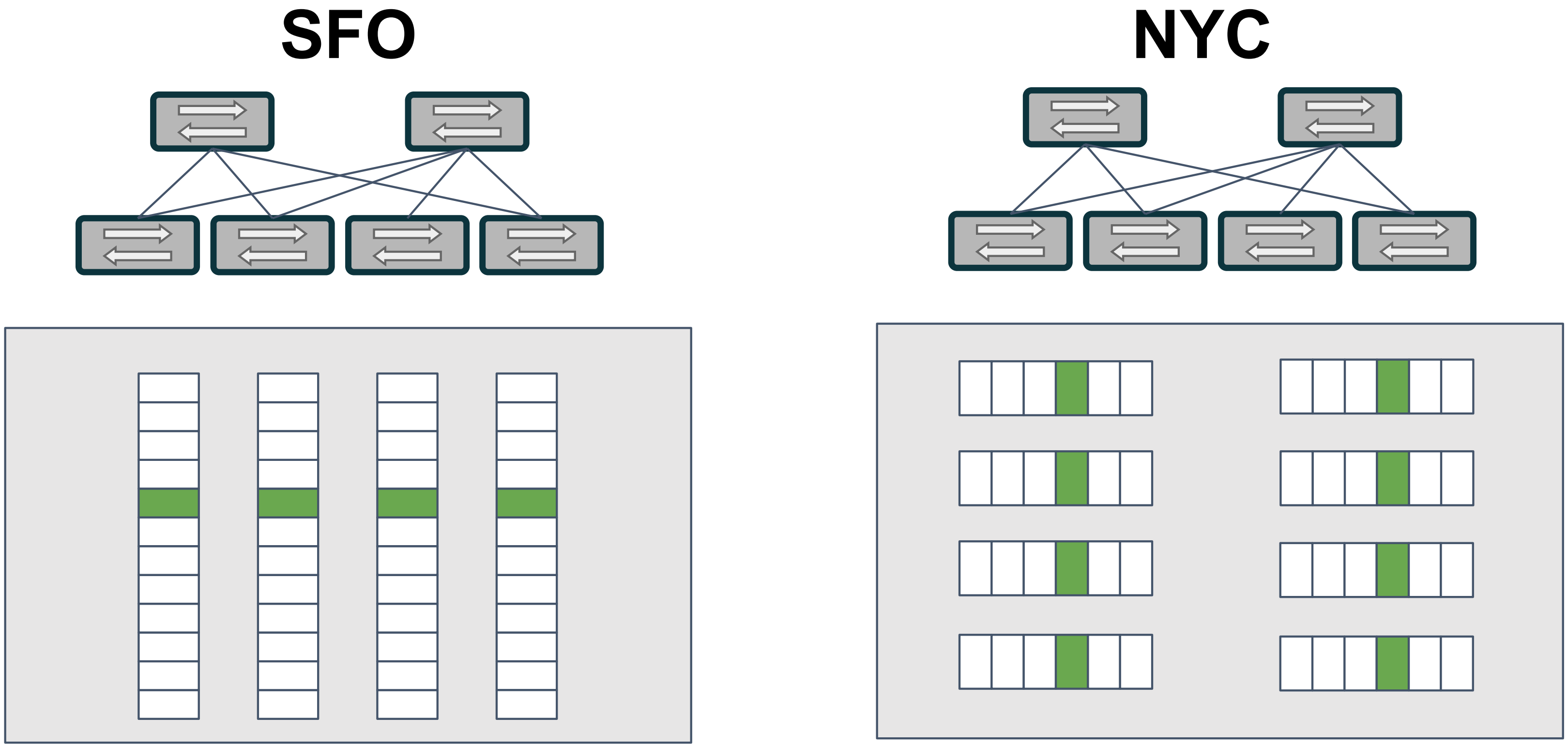
Your properties reflect your network design

Network Design
Naming Convention
Cabling Convention
Datacenter Layout
Vendor Specific Information



People are failing to automate their network because they simplify the problem and assume that everything is homogeneous

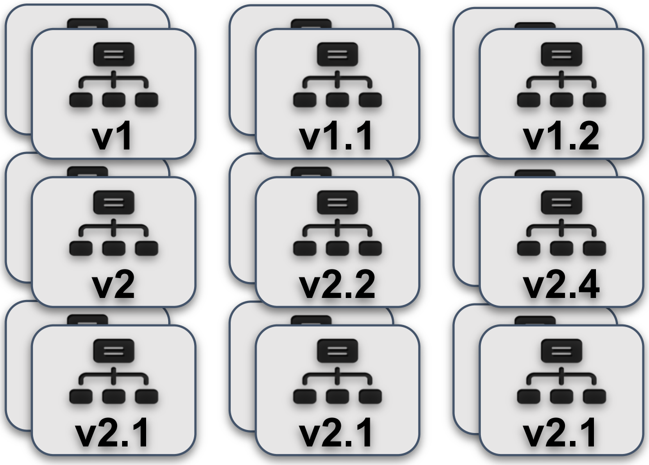
Example



🟩 Console server

Be prepared to manage MANY version of your properties

Network Design
Naming Convention
Cabling Convention
Datacenter Layout
Vendor Specific Information



For every rule, there is an exception.

So you always follow the rule,
except when there is an exception

In which case you follow a new rule
based on that exception.

ROBLOX

Be prepared to manage MANY version of your properties

Network Design
Naming Convention
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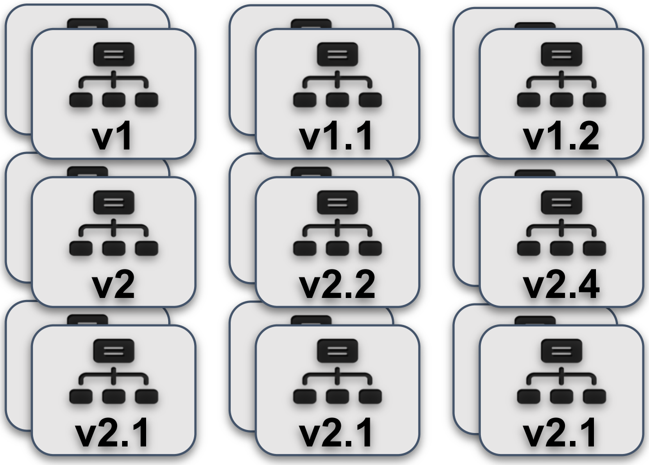
Datacenter Layout
Vendor Specific Information



Properties @ Roblox

In 12 months we had to manage

- 42 different design revision just for the network
- Up to 9 versions for a given network device role

We also added

- 1 000 Network Devices
- 26 000 IP addresses
- 4 500 Prefixes

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3

How are organizations managing Network device properties today ?

What are the ways to generate these properties?

By Hand

By Script / Code

Pros / Cons with Script / Code approach

Pros

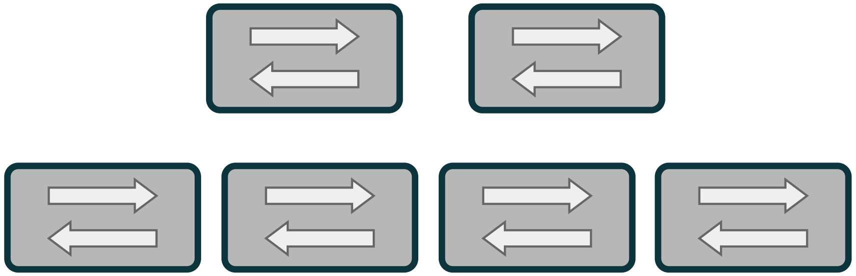
- Can generate large number of properties quickly
- Very flexible

Cons

- Hard to support multiple version of properties
- Need to “Write code” to adapt the design
- Hard to maintain

What are the ways to store these properties?

Source of Truth
Database
Git
All of the above



Network devices configuration

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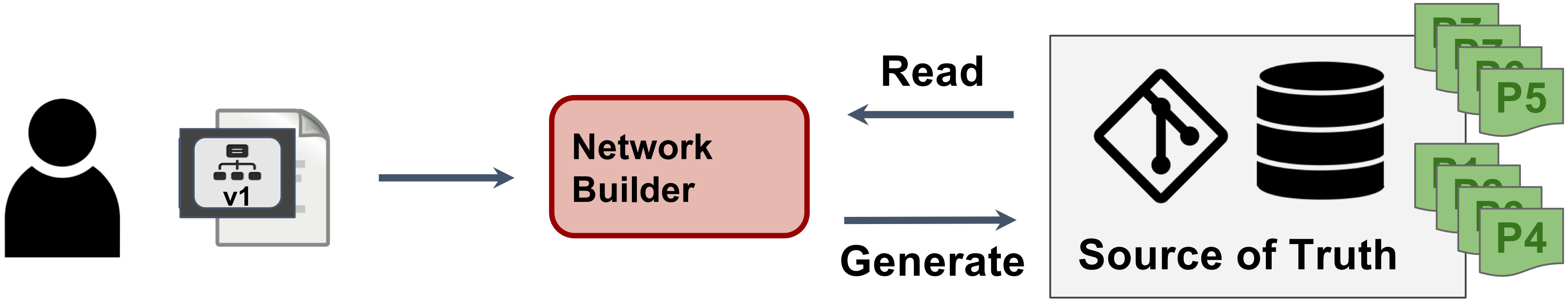
How to manage network device properties as Code ?

Infrastructure as Code principles

- **Idempotent** > Always the same results
- **Version Control Friendly** > Input as text file, peer review
- **Safe & Predictable** > Plan everything before, know what changes will be made before you run it.

High level workflow



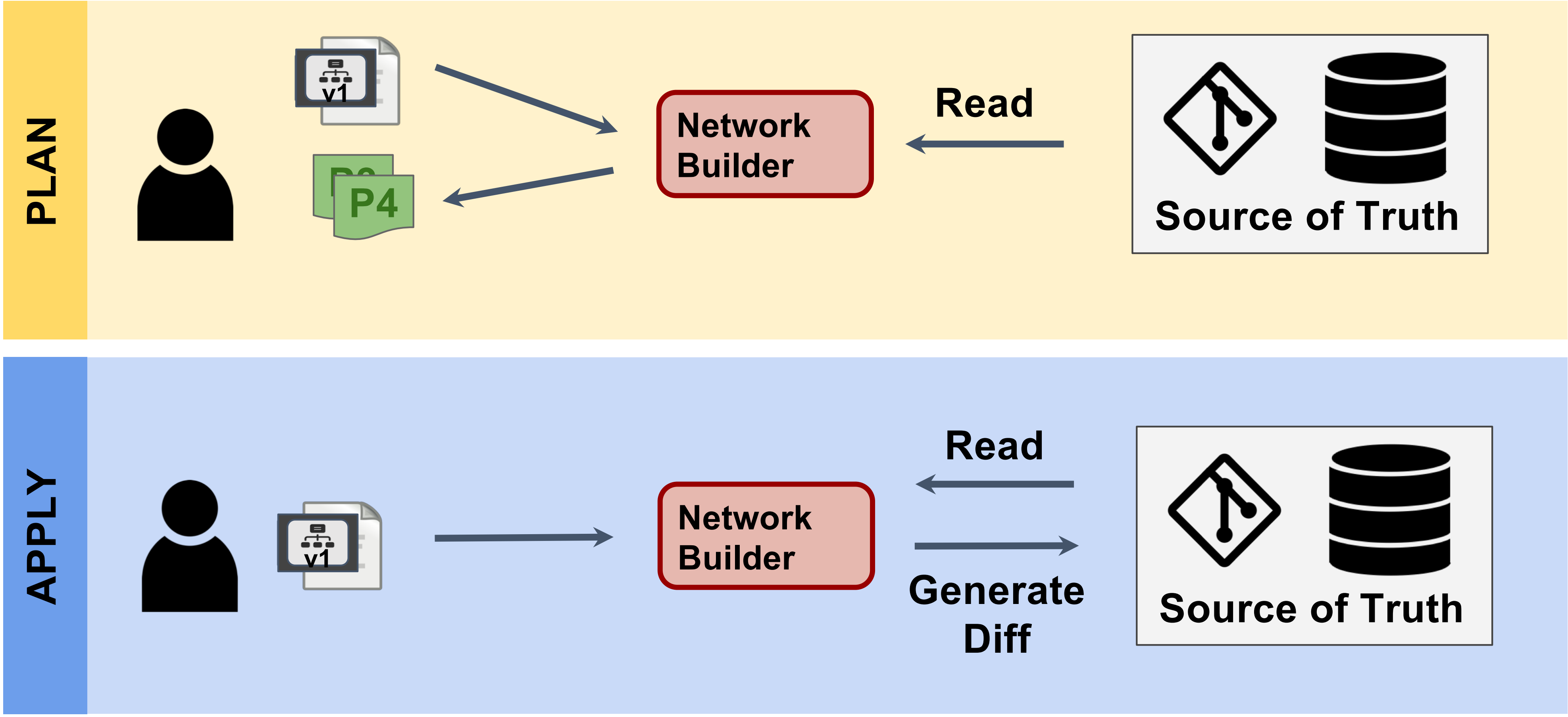
Network Builder

Read

Generate

Source of Truth

High level workflow - Plan & Apply



PLAN

Network Builder

Read

Source of Truth

APPLY

Network Builder

Read

Generate Diff

Source of Truth

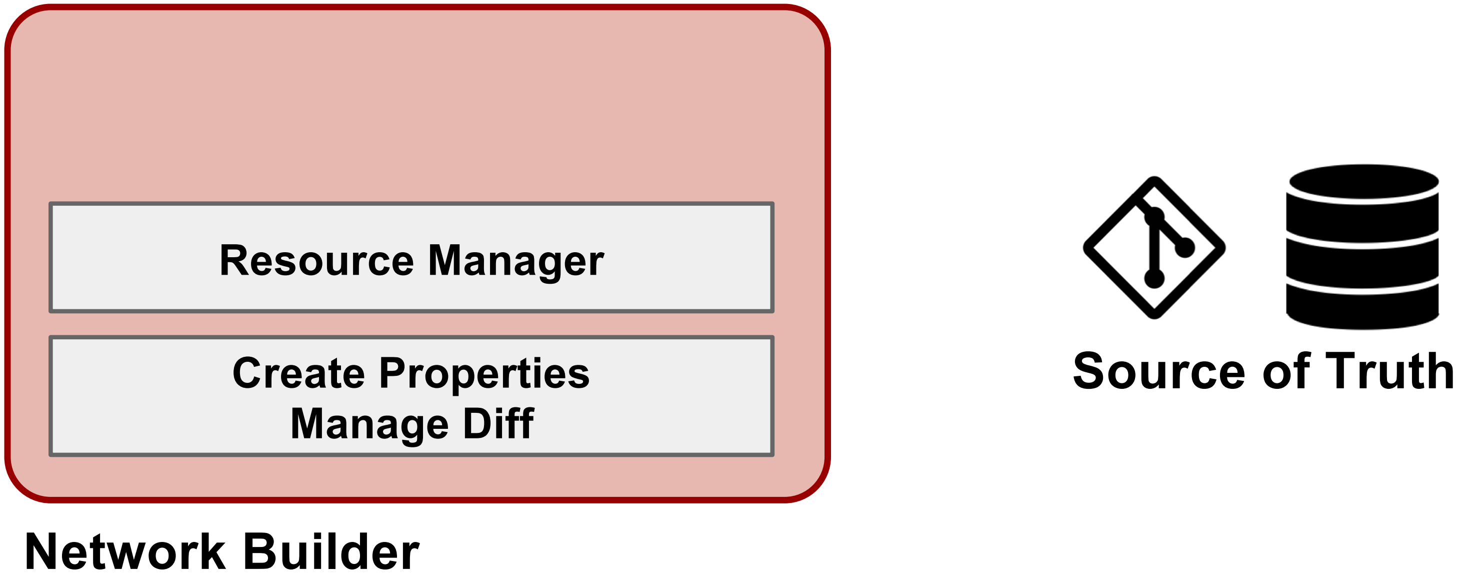
Infrastructure as Code principles

- **Idempotent** > Always the same results
- **Version Control Friendly** > Input as text file, peer review
- **Safe & Predictable** > Plan everything before, know what changes will be made before you run it.

How to capture your design for a rack switch ?

Name	rsw, id of the cluster, name of the site separated by dashes
Loopback	Any IP from the management network of the site
Uplinks	1x100G interface connected to each aggregation device 1 /31 allocated per interface from the /22 block reserved for point to point links
Console port	Any port on the the nearest console server
Server ports	A /24 network allocated from the /16 block reserved for server

Network Builder - Building blocks



Resource Manager

Create Properties
Manage Diff

Network Builder

Source of Truth

Resource Manager

Manage all your resources as you manage IPs with DHCP

1. Possible to reserve resource in advance
2. Each resource allocated is associated with an ID
3. Same ID always get the same response.

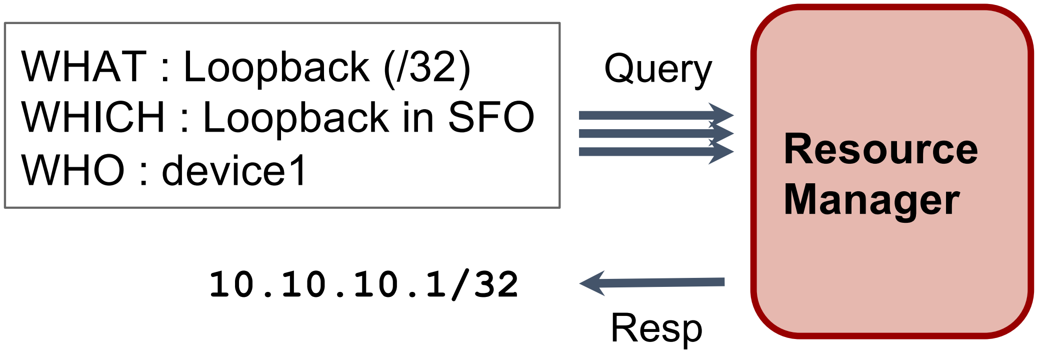
Resource Manager - Example

- Create pools of resource
  Identifiable with name or roles

Site SFO

```
asn: [ 65100, 65200 ]
prefixes:
   loopback: 10.10.10.0/24
   point-to-point:10.128.0.0/22
```

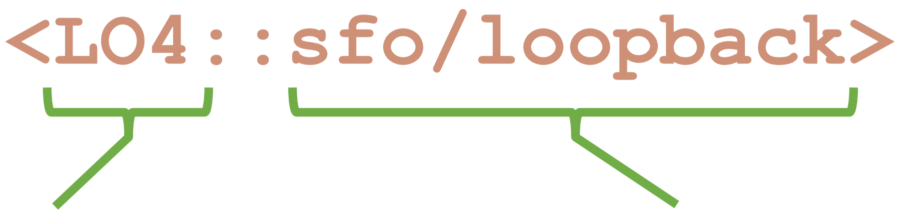
- Query resources by defining
  - WHAT type of resource
  - From WHICH pool
  - WHO is requesting



WHAT : Loopback (/32)
WHICH : Loopback in SFO
WHO : device1

```
10.10.10.1/32
```

Represent a property in a compact way



`<LO4::sfo/loopback>`

Variable Type

ASN LO4

NET_IP

INT VLAN

WHAT

Pool Name / Path

Can be different per Variable Type

WHICH

WHO is determined based on when this query is invoked

Define your device properties with variables

```
name: "rsw1-1-sfo"
elevation: 30
type: qfx5100
role: rack-switch
ASN: "<ASN::sfo/private>"
network:
  lo0.0:
    ips:
      - addr: "<LO4::sfo/internal-loopbacks>"
      - addr: "<LO6::external-loopbacks>"
p2p:
  et-0/0/48:
    peer: "<DEV_INT::psw1-sfo/rack-switch>"
    ips:
      - addr: "<NET_IP4::sfo/point-to-point/31>"
  et-0/0/49:
    peer: "<DEV_INT::psw1-sfo/rack-switch>"
    ips:
      - addr: "<NET_IP4::sfo/point-to-point/31>"
```

Define your device properties with variables

```
name: "rsw1-1-sfo"
elevation: 30
type: qfx5100
role: rack-switch
ASN: 65100
network:
  lo0.0:
    ips:
      - addr: 10.10.10.1/32
      - addr: 2020:1234:beef::756/128
p2p:
  et-0/0/48:
    peer: psw1-sfo::et-0/0/1
    ips:
      - addr: 10.128.195.124/31
  et-0/0/49:
    peer: psw2-sfo::et-0/0/1
    ips:
      - addr: 10.128.195.126/31
```

Create template of design

```
rack_switch_v1:
   name: "rsw{{id}}-1-sfo"
   elevation: 30
   type: qfx5100
   role: rack-switch
   ASN: "<ASN::sfo/private>"
   network:
     lo0.0:
       ips:
         - addr: "<LO4::sfo/internal-loopbacks>"
         - addr: "<LO6::external-loopbacks>"
   p2p:
     et-0/0/48:
       peer: "<DEV_INT::psw1-sfo/rack-switch>"
       ips:
         - addr: "<NET_IP4::sfo/point-to-point/31>"
```

Reuse templates across site and rack

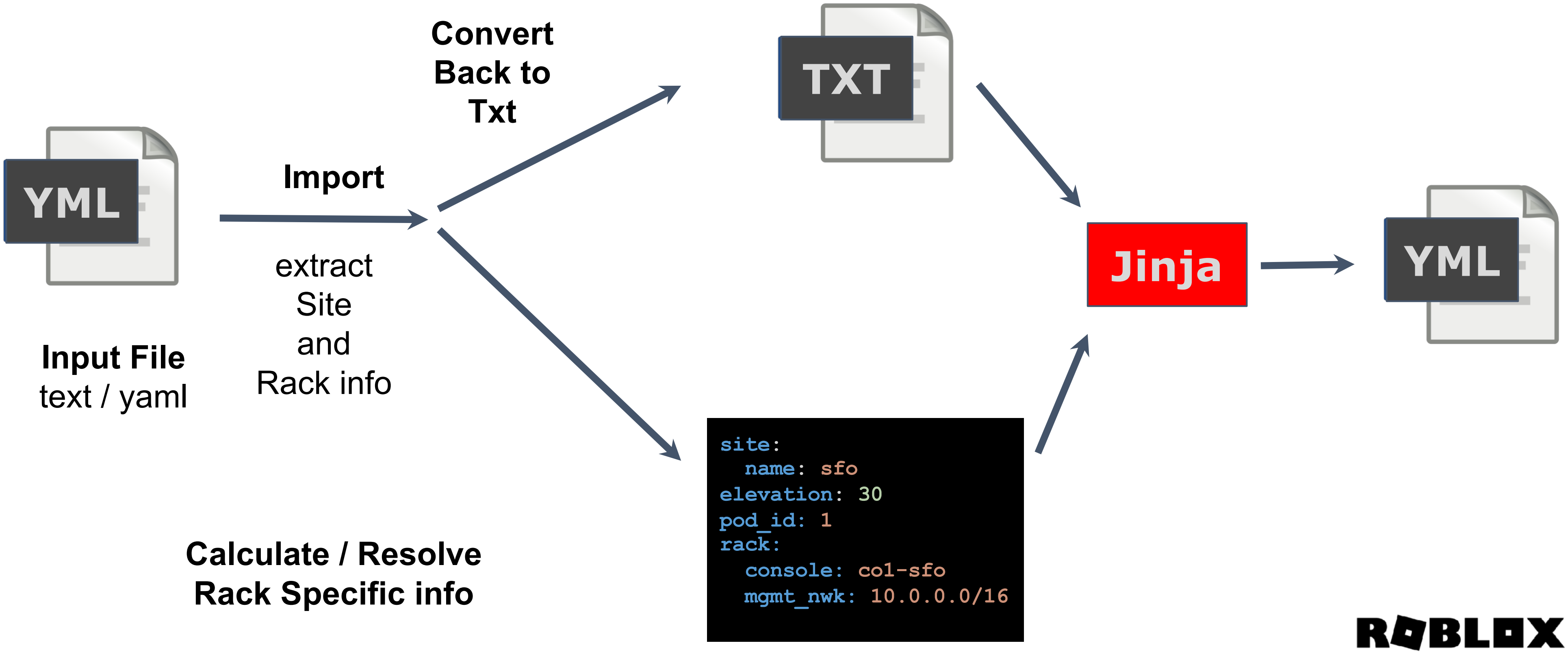
```
site: sfo
racks:
 101:
  racks: rack_switch_v1
  id: 1
 102:
  racks: rack_switch_v1
  id: 2
 103:
  racks: rack_switch_v1
  id: 3
```

```
site: sfo
racks:
 101:
  name: rsw1-1-sfo
    ASN: 62100
    [ .. ]
 102:
  name: rsw2-1-sfo
    ASN: 62101
    [ .. ]
 103:
  name: rsw3-1-sfo
    ASN: 62102
    [ .. ]
```

Design is often dependent on the location

- Which Console Server should I connect to ?
- Which Cluster / Pod is this rack part of ?
- Which out-of-band device should I connect to ?
- What is the out-of-band network for this rack ?
- ...

Context Resolution



Input File
text / yaml

Import

extract
Site
and
Rack info

**Convert
Back to
Txt**

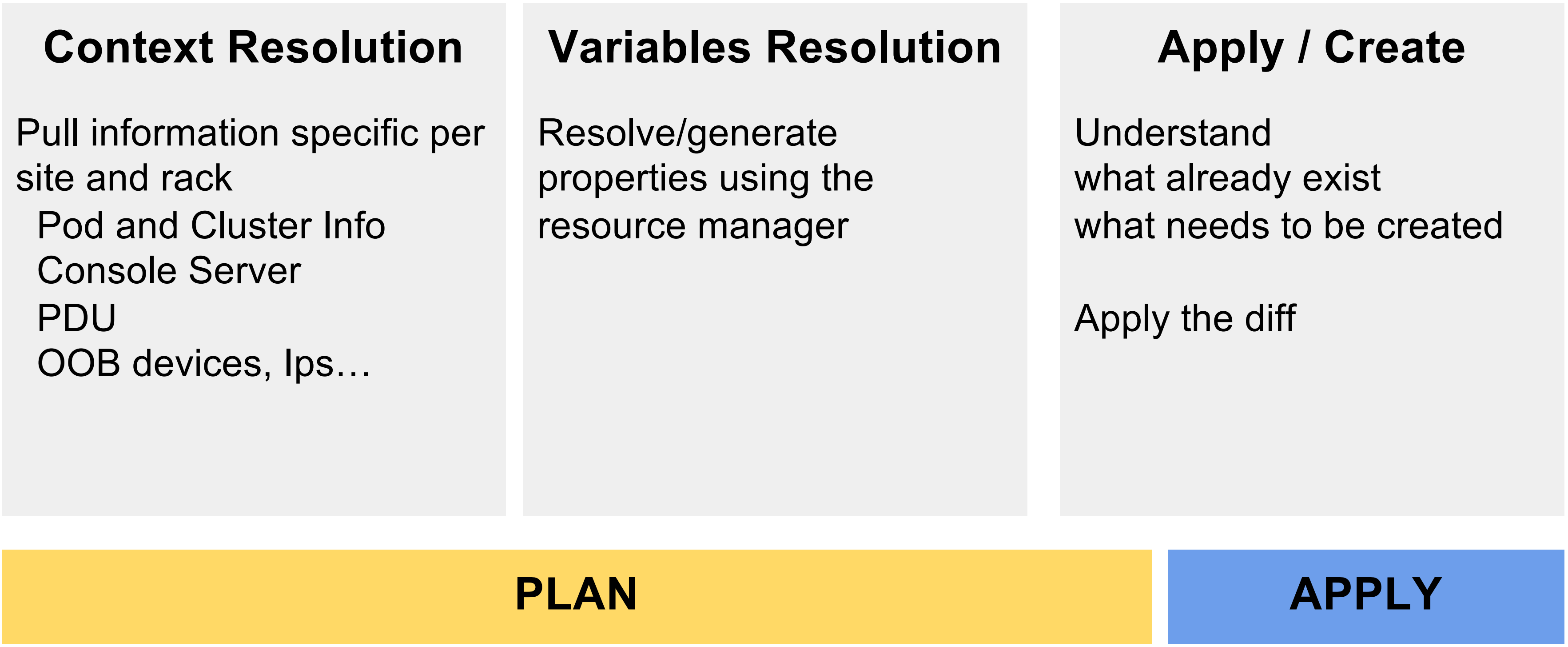
**Calculate / Resolve
Rack Specific info**

```
site:
  name: sfo
elevation: 30
pod_id: 1
rack:
  console: co1-sfo
  mgmt_nwk: 10.0.0.0/16
```

Use Jinja to add contextual information

```
name: "rsw{{ id }}-{{rack.pod_id}}-{{site.name}}"
elevation: 30
rack_face: front
type: qfx5100
nb_role: rack-switch
ASN: "<ASN::{{site.name}}/private>"
network:
  lo0.0:
    ips:
      - addr: "<LO4::{{site.name}}/internal-loopbacks>"
      - addr: "<LO6::external-loopbacks>"
p2p:
  et-0/0/48:
    peer: "<DEV_INT::psw1-{{site.name}}/rack-switch>"
    ips:
      - addr: "<NET_IP4::{{site.name}}/point-to-point/31>"
  et-0/0/49:
    peer: "<DEV_INT::psw1-{{site.name}}/rack-switch>"
    ips:
      - addr: "<NET_IP4::{{site.name}}/point-to-point/31>"
```

Network Builder - 3 main components



Context Resolution

Pull information specific per site and rack

- Pod and Cluster Info
- Console Server
- PDU
- OOB devices, Ips…

Variables Resolution

Resolve/generate properties using the resource manager

Apply / Create

Understand
what already exist
what needs to be created

Apply the diff

Next steps

- Get feedback on this approach
- Open Source the resource manager
- Open Source the network builder

Thank You

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Powering Imagination