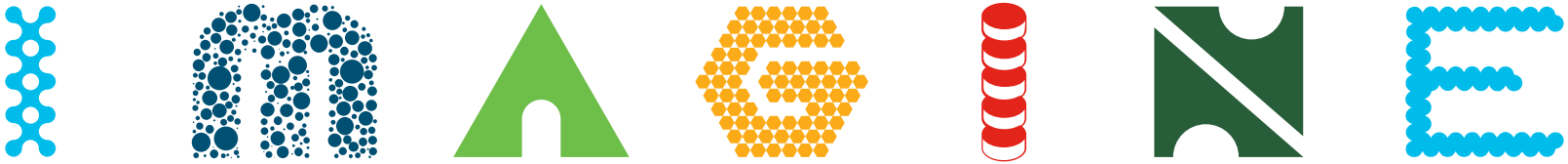

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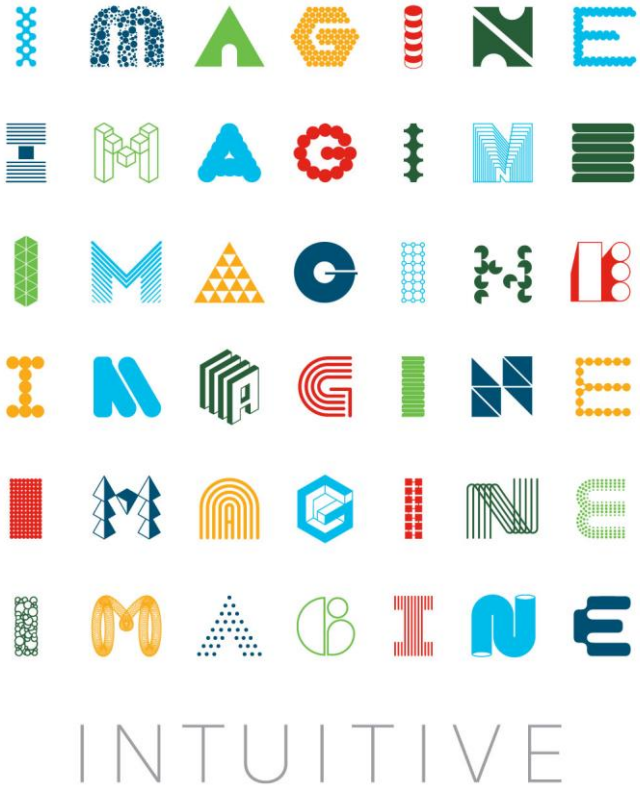
#CLUS

Network Operational Simplicity with Zero Touch Deployment

Ahmed Abeer, Technical Marketing Engineer

Kashif Islam, Solution Architect

BRKSPG-2201

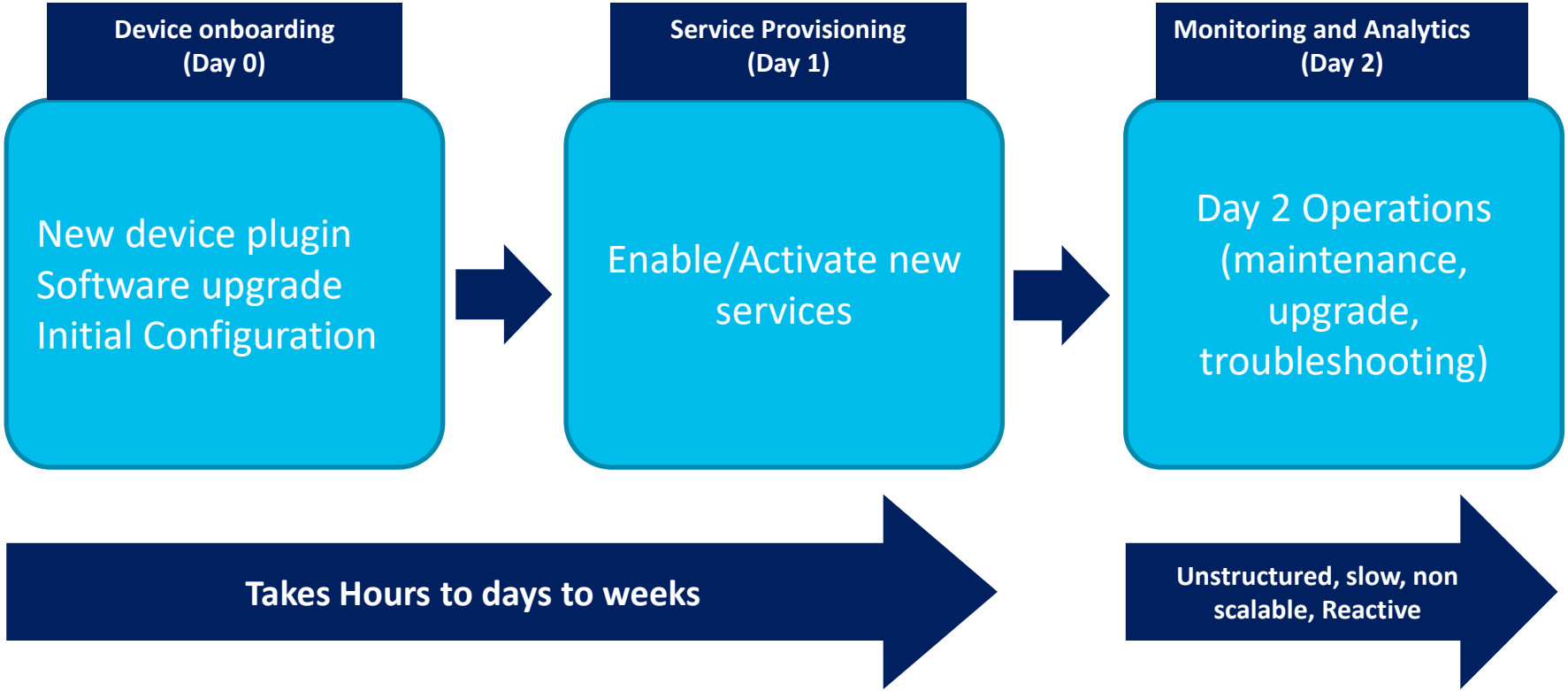


Agenda

- What is Zero Touch Deployment (ZTD)
- ZTD Deployment Scenarios
- Solution Components
- Step by Step Flow
- Use Cases

Introduction

Life of a Device - Yesterday

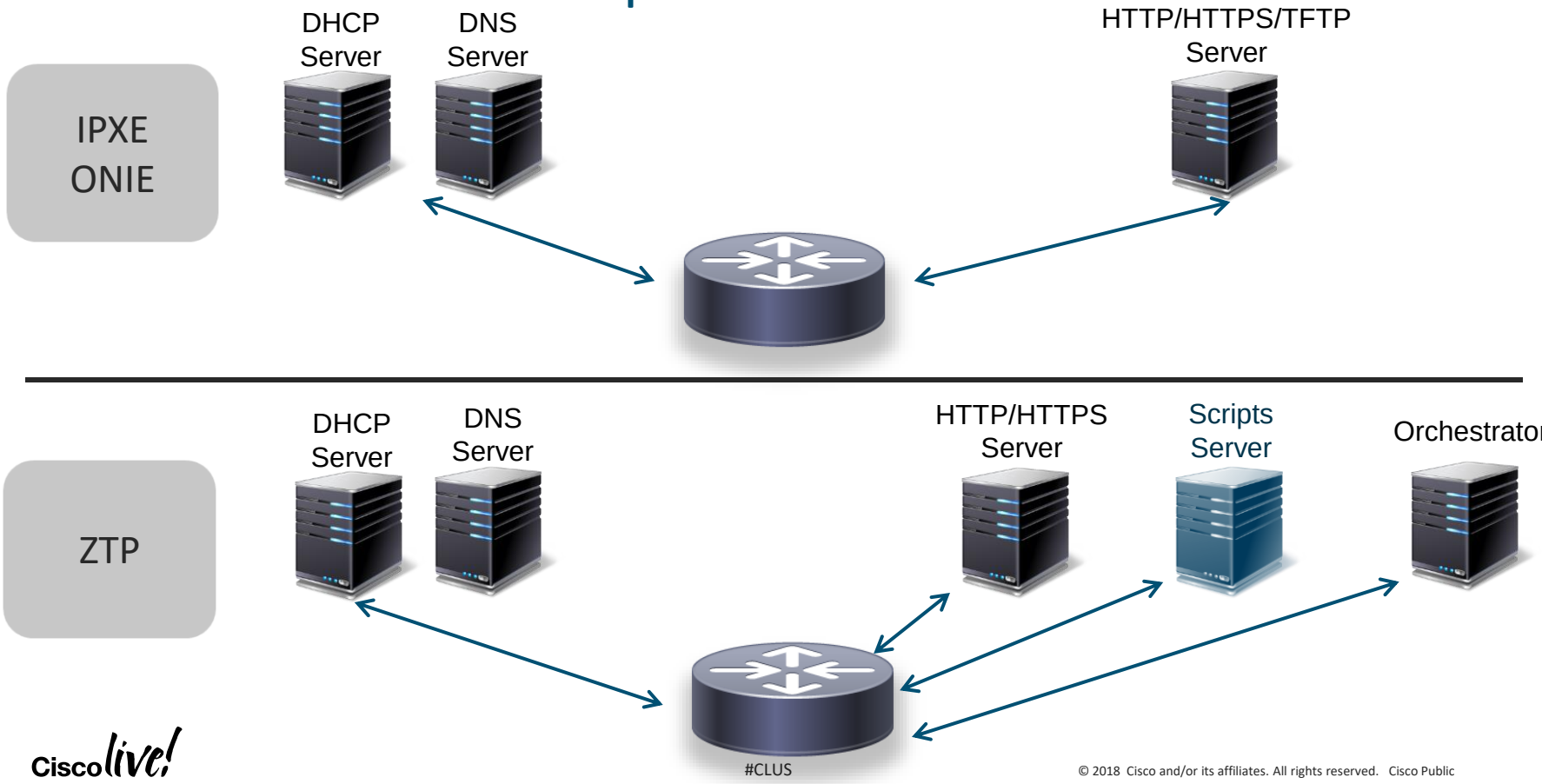


Modernizing the Life of a Device

	Device Onboarding (Day 0)	Service Provisioning (Day 1)	Monitoring & Analytics (Day 2)
Yesterday	Manual, Lengthy, Skilled Worker, Costly Device Bring-up	High Maintenance, Inflexible, Custom Scripts for Service Bring-up	Unstructured, Non scalable, Pull Mechanism, Non Machine Readable Format
Today	Orders of Magnitude Quicker, Automated Device Bring-up	Automation Friendly, Flexible, Predictable, Vendor Neutral Model Driven Service Bring-up	Push mechanism, consistent, machine readable, high performance, real time

ZTD Components

ZTD Architectural Components



Boot Process - iPXE

#!iPXE

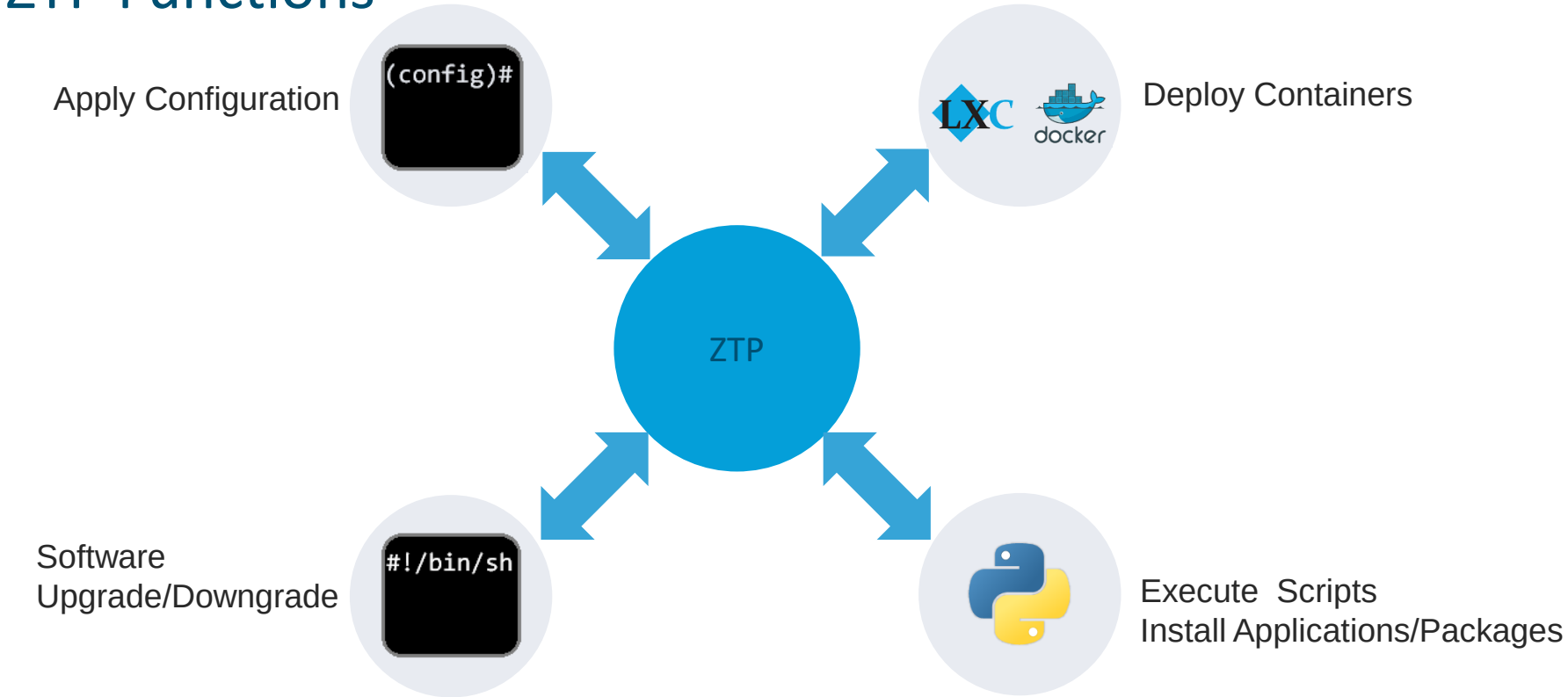
- iPXE is an open source boot firmware.
- Provides an environment for installing any NOS
- iPXE is supported on the management interfaces (IPv4 and IPv6)
- Fully backward compatible with PXE with several enhancements.
  - Boot from a web server via HTTP
  - Boot from locally attached storage, (USB memory stick)
  - Control the boot process with scripts and menus.
  - DNS support.

Boot Process - ONIE

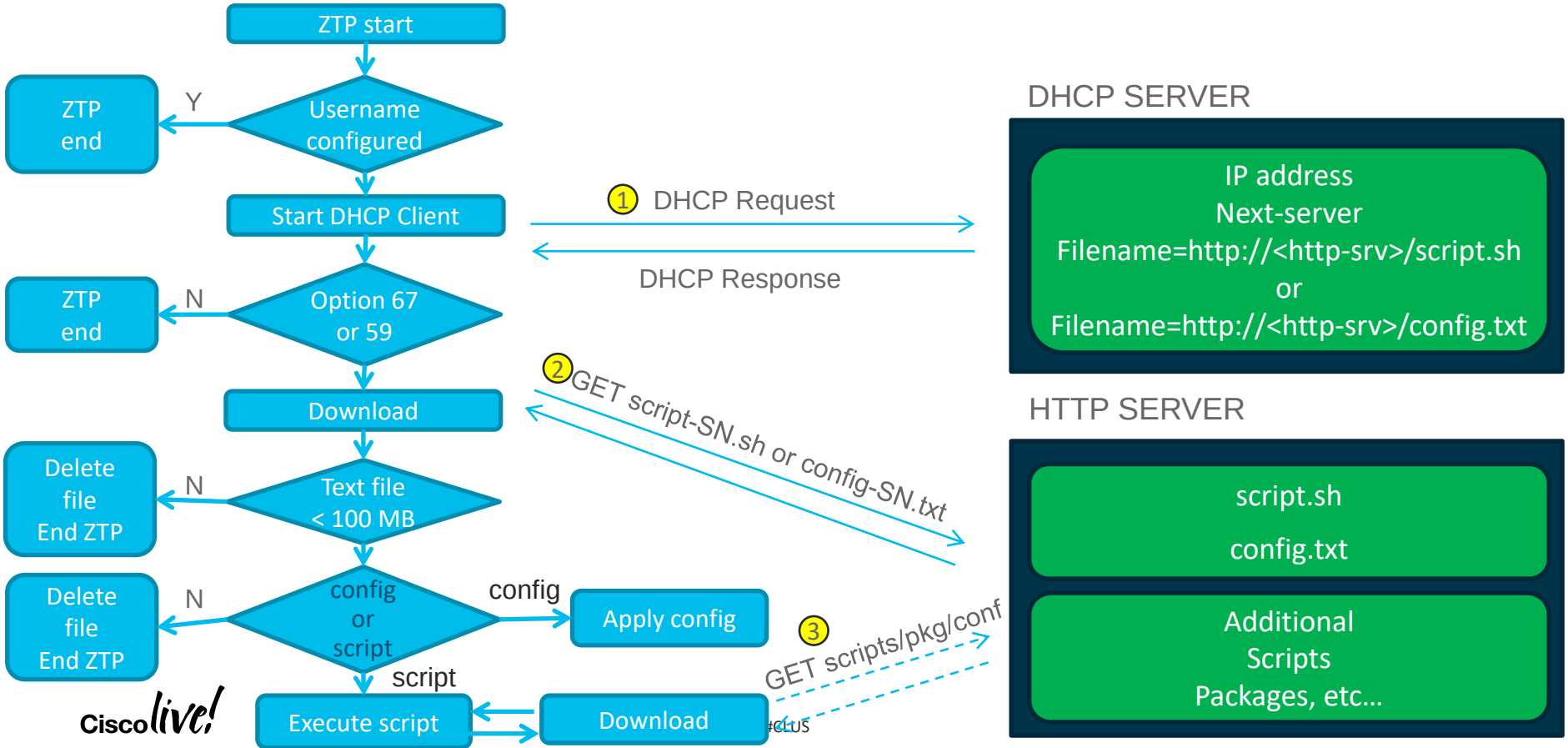
- ONIE is a small operating system, pre-installed on bare metal network switches, that provides an environment for automated provisioning.
- Combines a boot loader with a Linux kernel and BusyBox.
- Provides an environment for installing any NOS.
- Supported on the management interfaces (IPv4 and IPv6).
- Aggressive Image discovery
  - Statically configured from the boot loader
  - Locally attached storage, (USB memory stick)
  - Bootfilename from DHCPv4 / DHCPv6
  - IPv4 / IPv6 link local neighbors
  - mDNS / DNS-SD
  - PXE-like TFTP and HTTP waterfalls

ZTP

ZTP Functions



ZTP Flow of Operations



ZTD via NETCONF/YANG

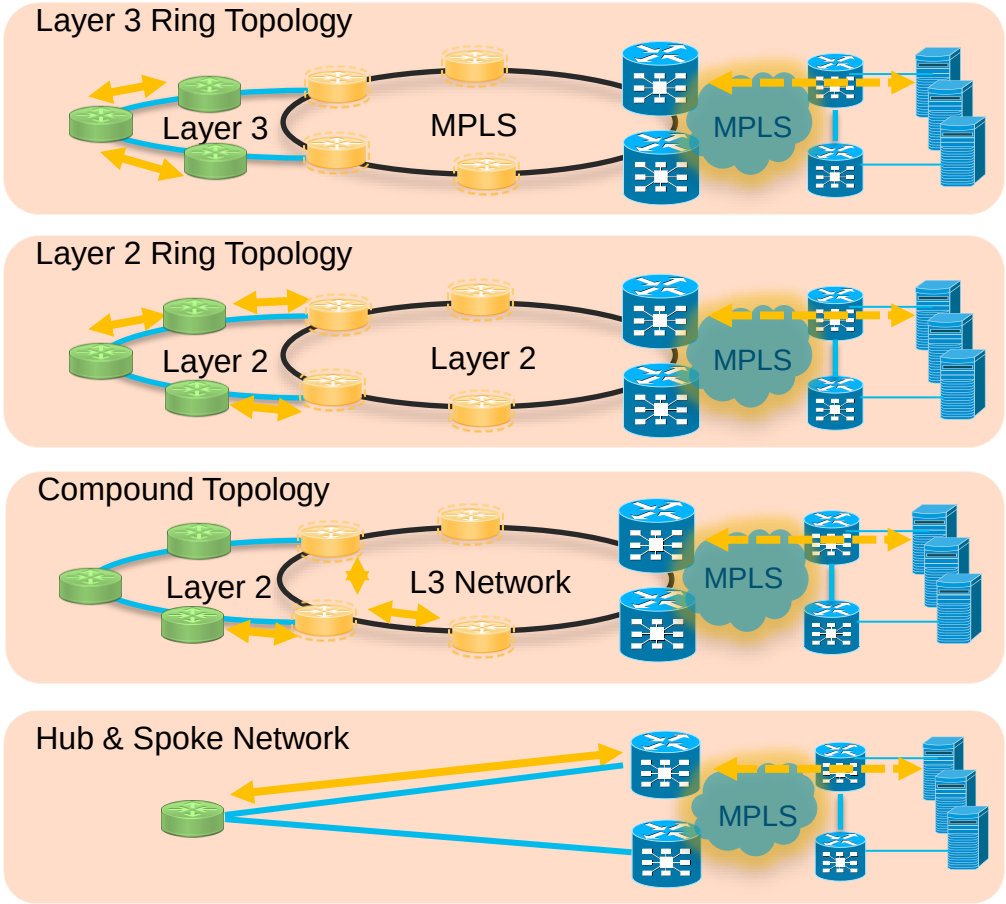
ZTP Requirements

Baseline requirements across deployment scenarios

- No pre-staging required
- DHCP for management IP address
- Configuration download
- Image upgrade/downgrade
- Docker/LXC install
- Connection to the NMS

Baseline requirement for “in-band management” deployment scenario

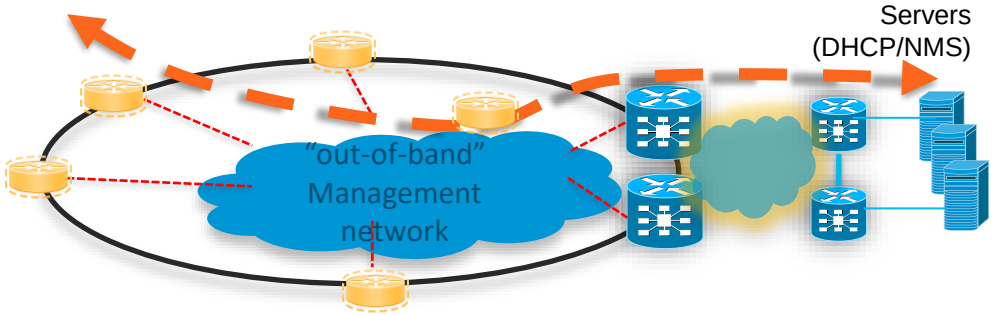
- Auto L3 adjacency configuration in any topology
- L2 VLAN auto-discovery



ZTP – Two Different Deployment Scenarios

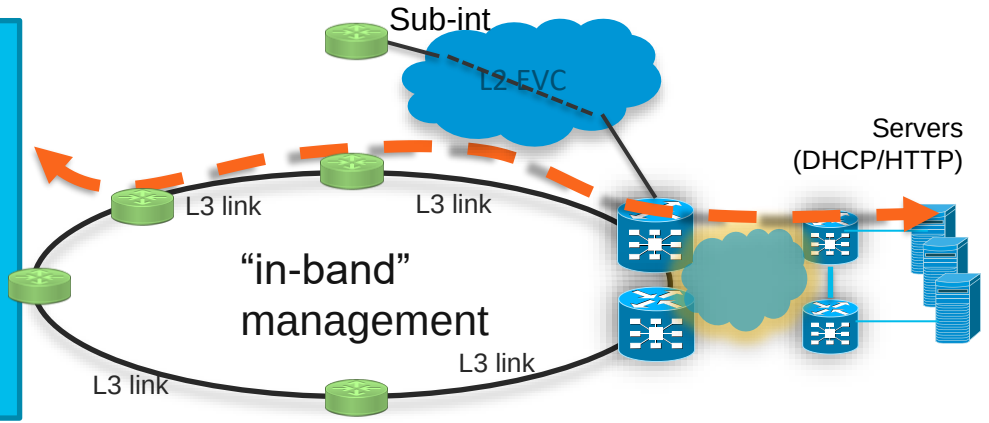
1

- Routers are connected to a management network via out-of-band management port
- Popular in Data Center, Enterprise, and Web customers



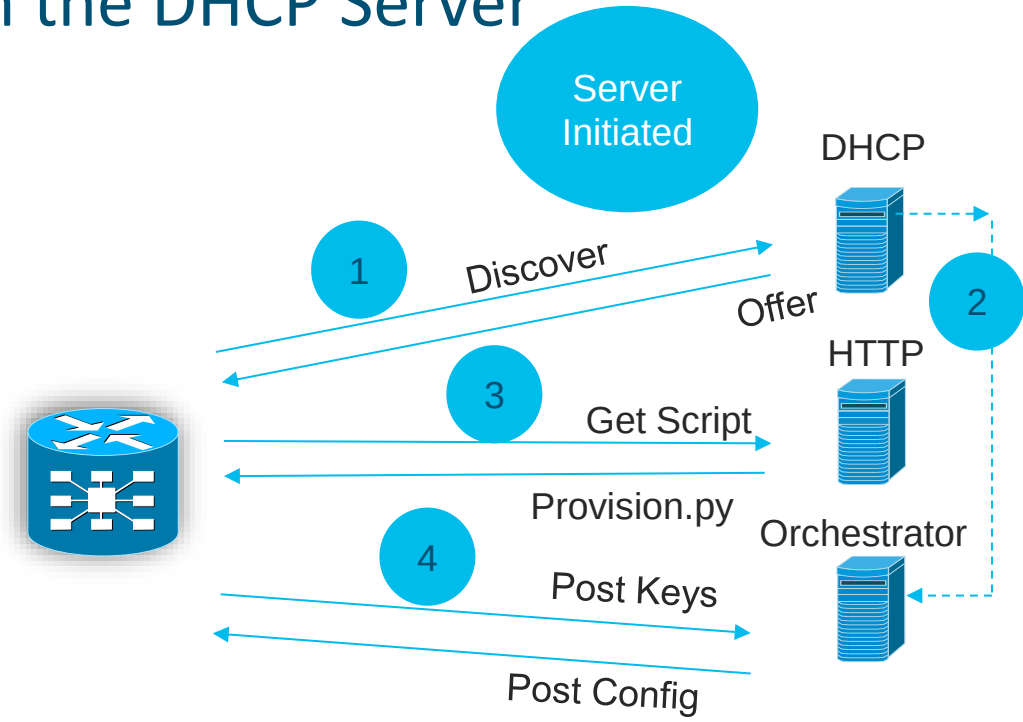
2

- There is no dedicated management network.
- Routers are managed via in-band, the same as user data network
- Typical deployment in the SP Access/Metro



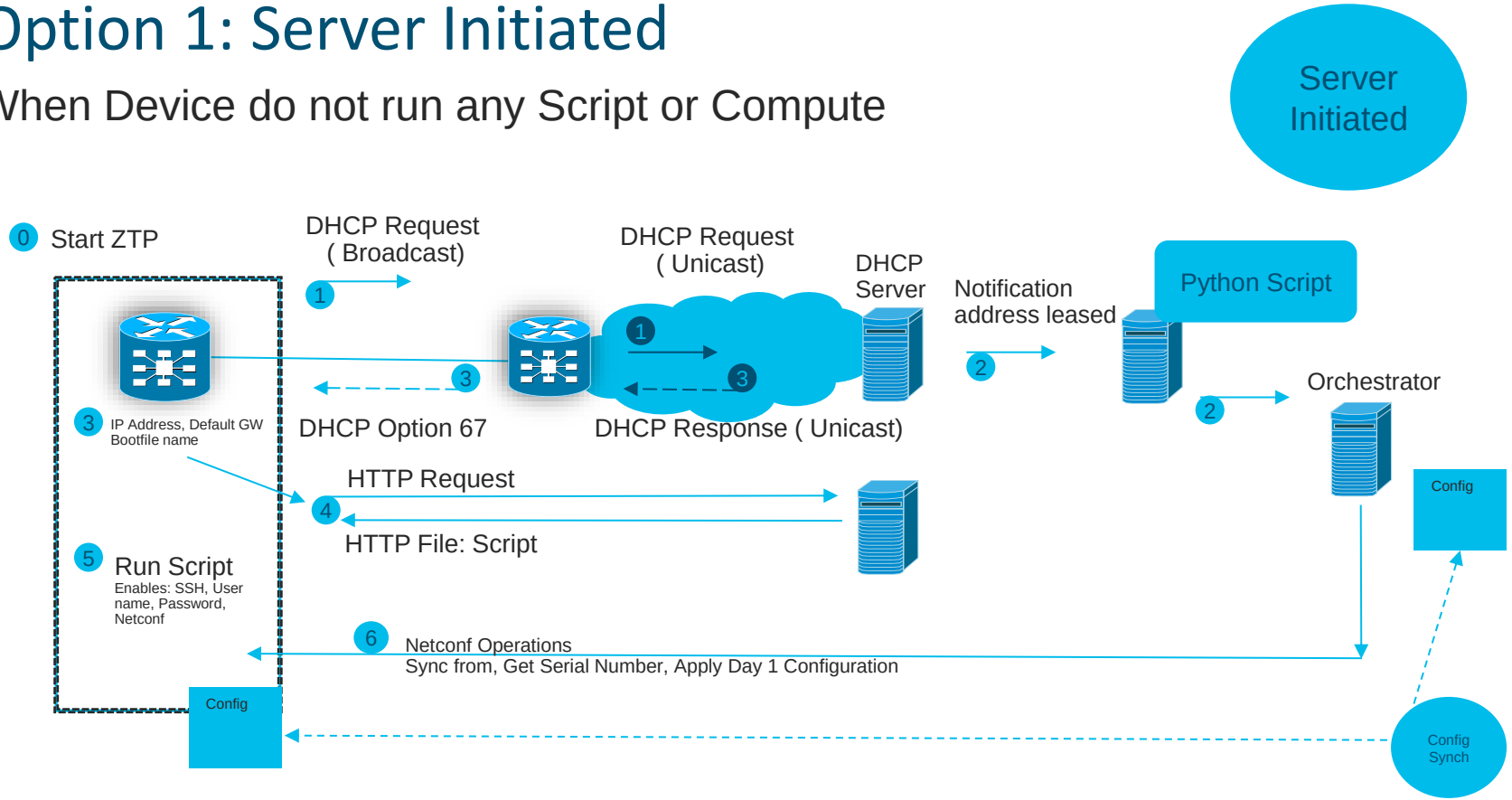
Option 1: Provisioning from the DHCP Server

1. Device boot up and initiate a **DHCP Discover**
   - DHCP server provides a script using “bootfilname” (option 67)
2. Upon commit DHCP server:
   - Registers device to Orchestrator using REST
   - Asks Orchestrator to retrieve RSA keys from device
3. Device Downloads scripts from HTTP server.
   - Scripts is executed on the device.
4. Once registered, the script perform a sync from the Orchestrator server



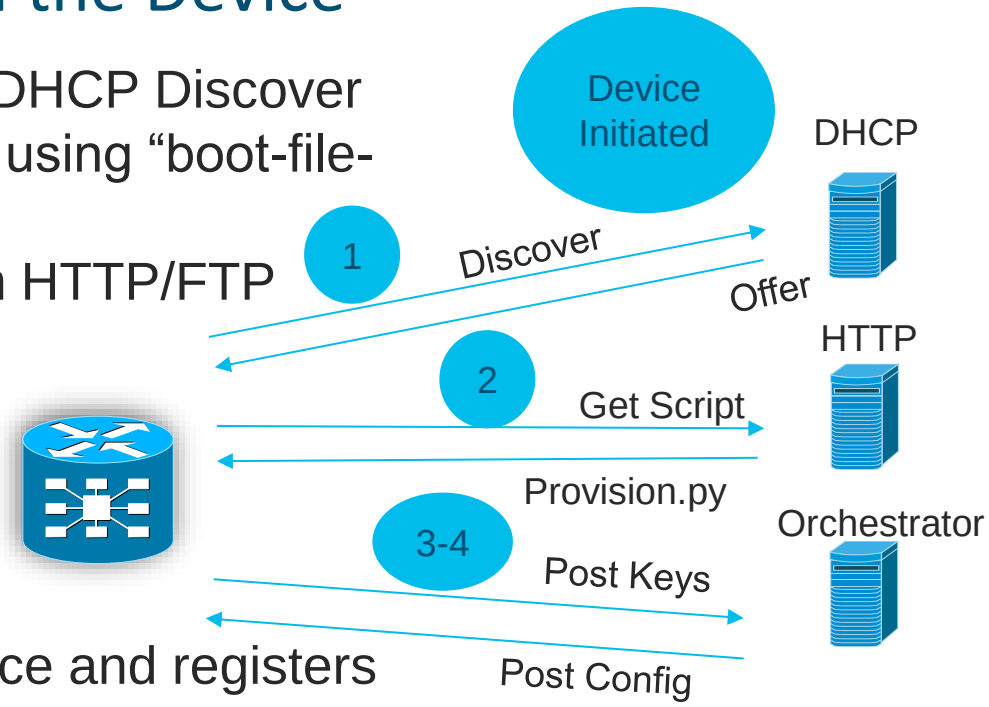
Option 1: Server Initiated

When Device do not run any Script or Compute



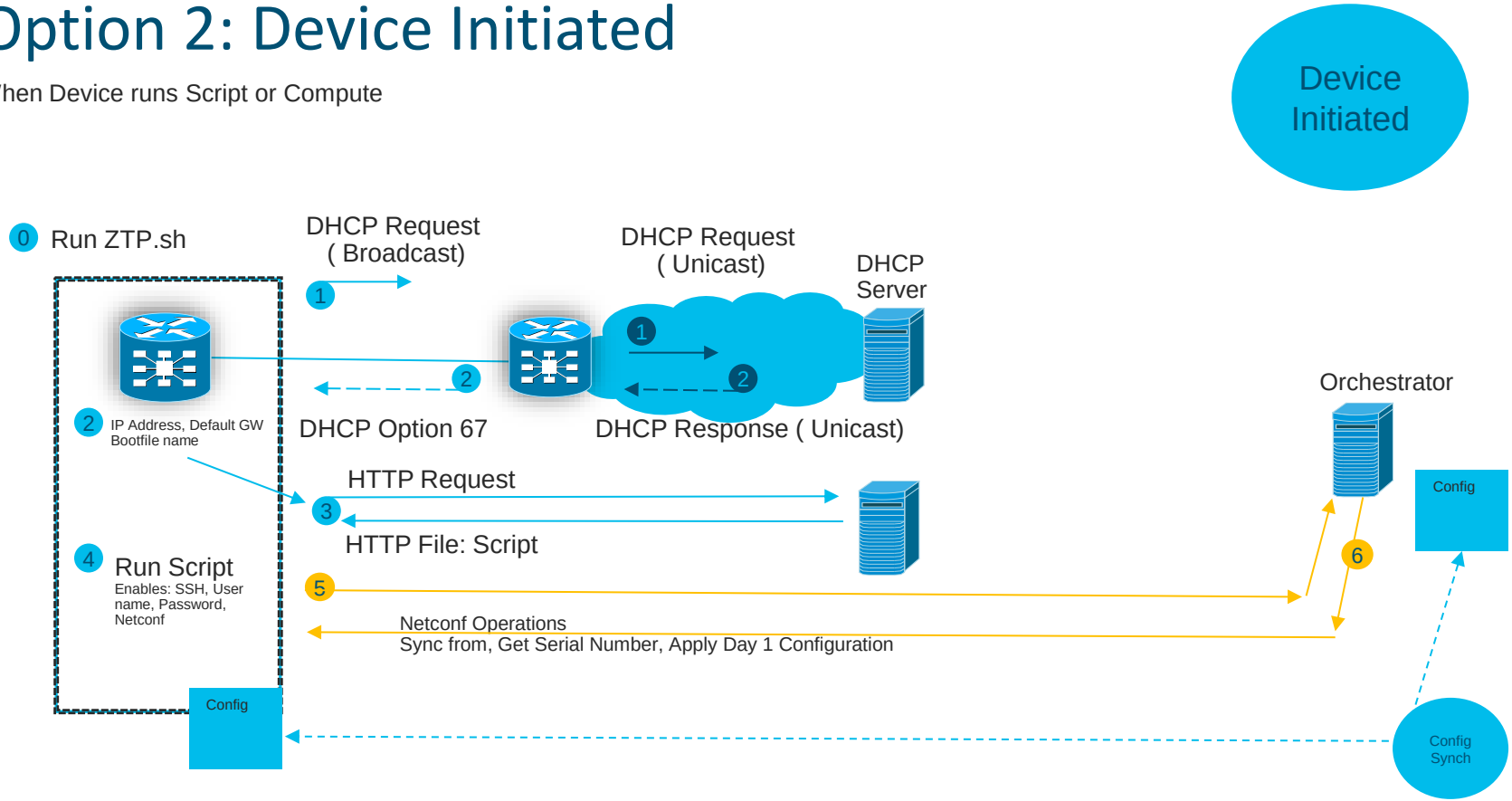
Option 2: Provisioning from the Device

1. Device boot up and initiates a DHCP Discover DHCP server provides a script using “boot-file-name” (option 67)
2. Device Downloads scripts from HTTP/FTP server
3. Scripts is executed on the device and registers to Orchestrator using REST/RESTCONF API
4. Once registered, the script perform a sync from the Orchestrator server



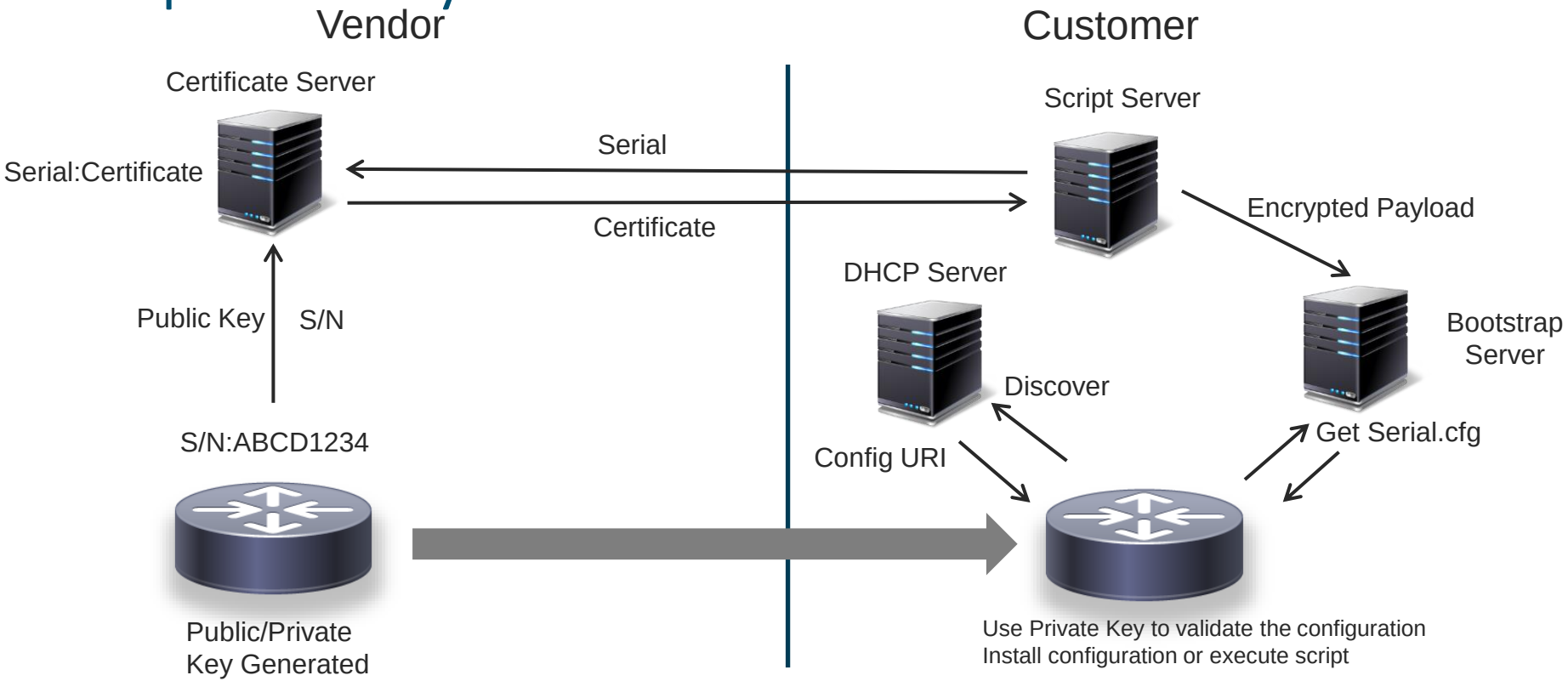
Option 2: Device Initiated

When Device runs Script or Compute



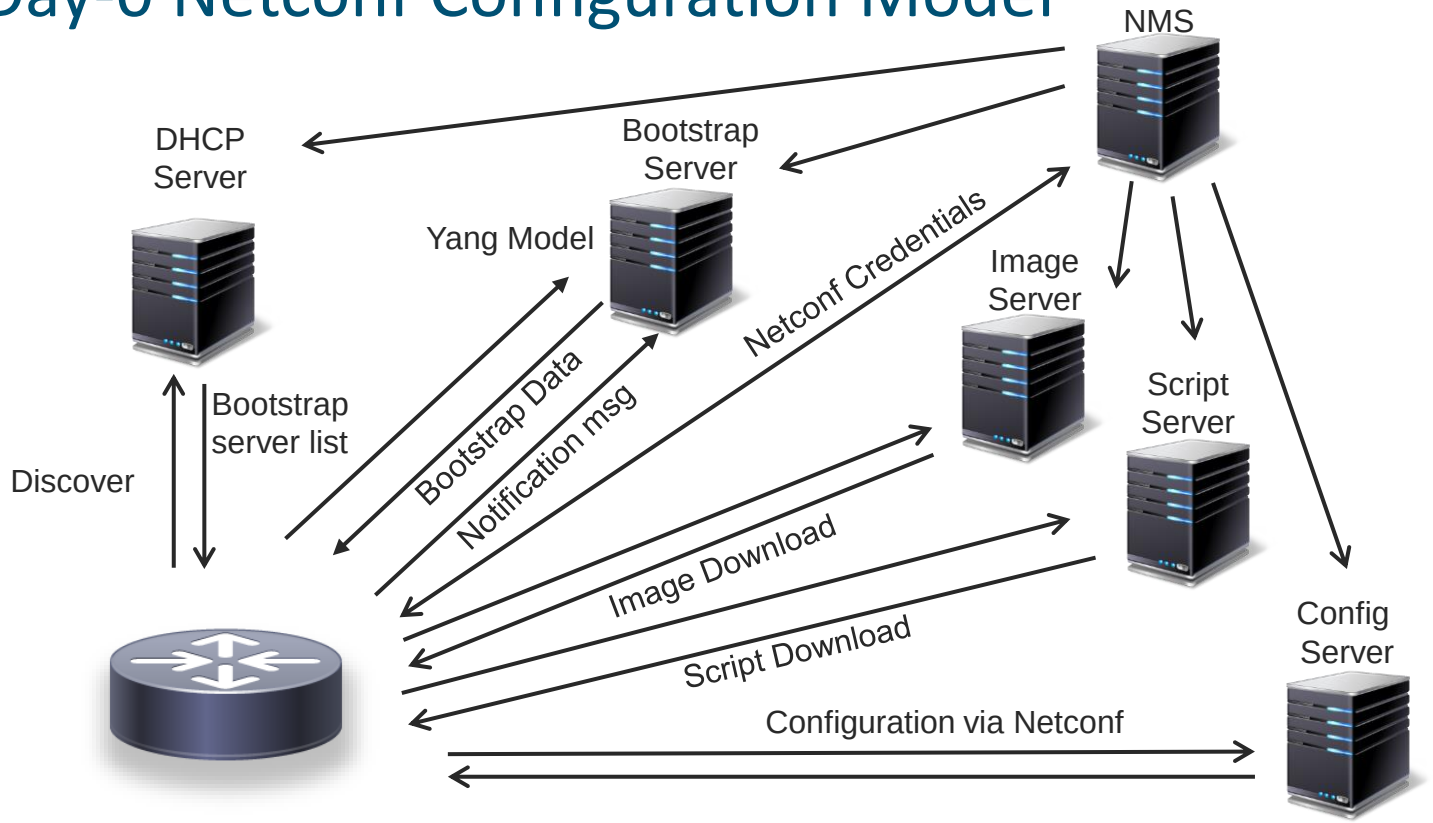
Enhancements

Simple Security



From https://www.ietf.org/archive/id/draft-wkumari-opsawg-sdi-01.txt

Day-0 Netconf Configuration Model



https://tools.ietf.org/html/draft-ietf-netconf-zerotouch-19

Day-0 Bootstrap Data using Yang Model

```
yang-data zerotouch-information:
      +---- (information-type)
      +--:(onboarding-information)
          +---- onboarding-information
            +---- boot-image
            |  +---- os-name              string
            |  +---- os-version           string
            |  +---- download-uri*        inet:uri
            |  +---- image-verification* [hash-algorithm]
            |     +---- hash-algorithm    identityref
            |     +---- hash-value?       yang:hex-string
            +---- configuration-handling?     enumeration
            +---- pre-configuration-script?   script
            +---- configuration?              <anydata>
            +---- post-configuration-script?  script
```

Name of the NOS required

Released version of NOS required

List of URIs providing bootstrapping data

e.g.: merge, replace

Agnostic of programing language
Executed before configuration is applied
Exit 0 : success
Exit > 0 : Soft error -> proceed
Exit < 0 : Hard error -> reset

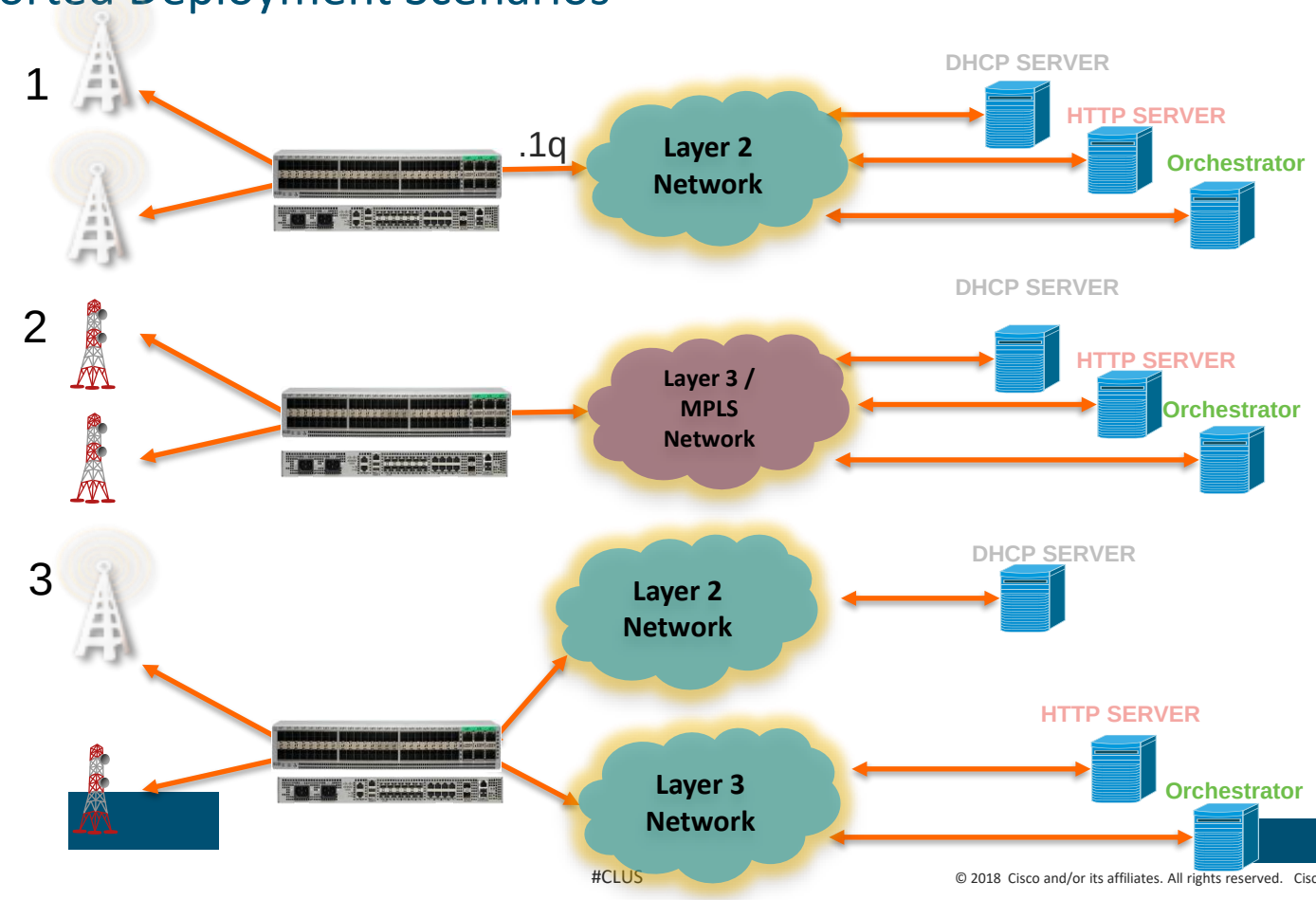
Any model supported by the device

Agnostic of programing language
Executed after configuration is applied
Exit 0 : success
Exit > 0 : Soft error -> proceed
Exit < 0 : Hard error -> reset

From draft-ietf-netconf-zerotouch-19

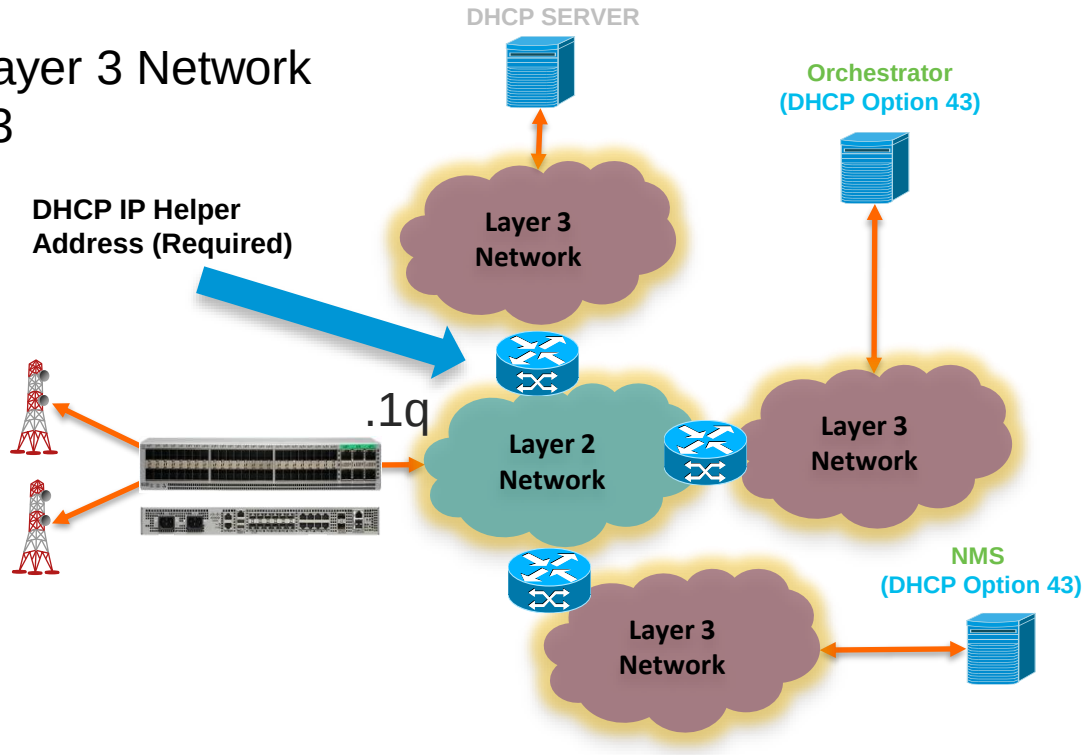
ZTD Use cases

ZTP Supported Deployment Scenarios



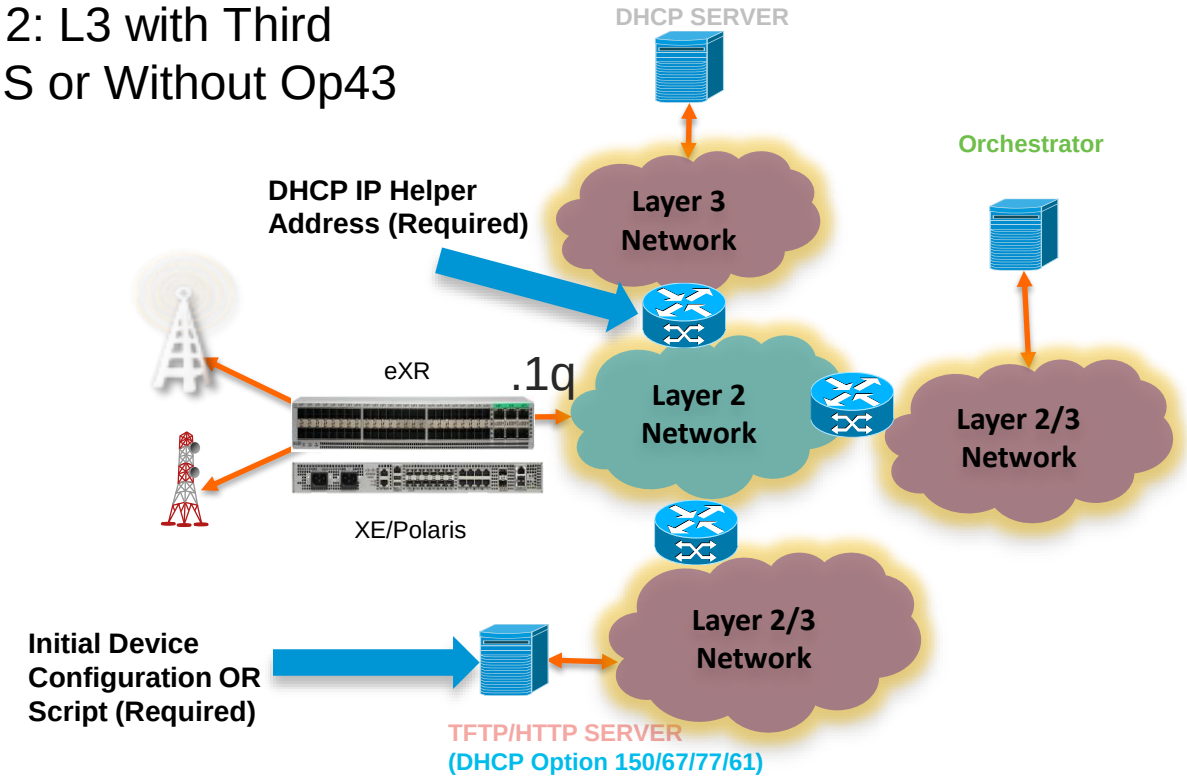
ZTP Supported Deployment Scenarios

Scenario 2: Layer 3 Network with Option 43



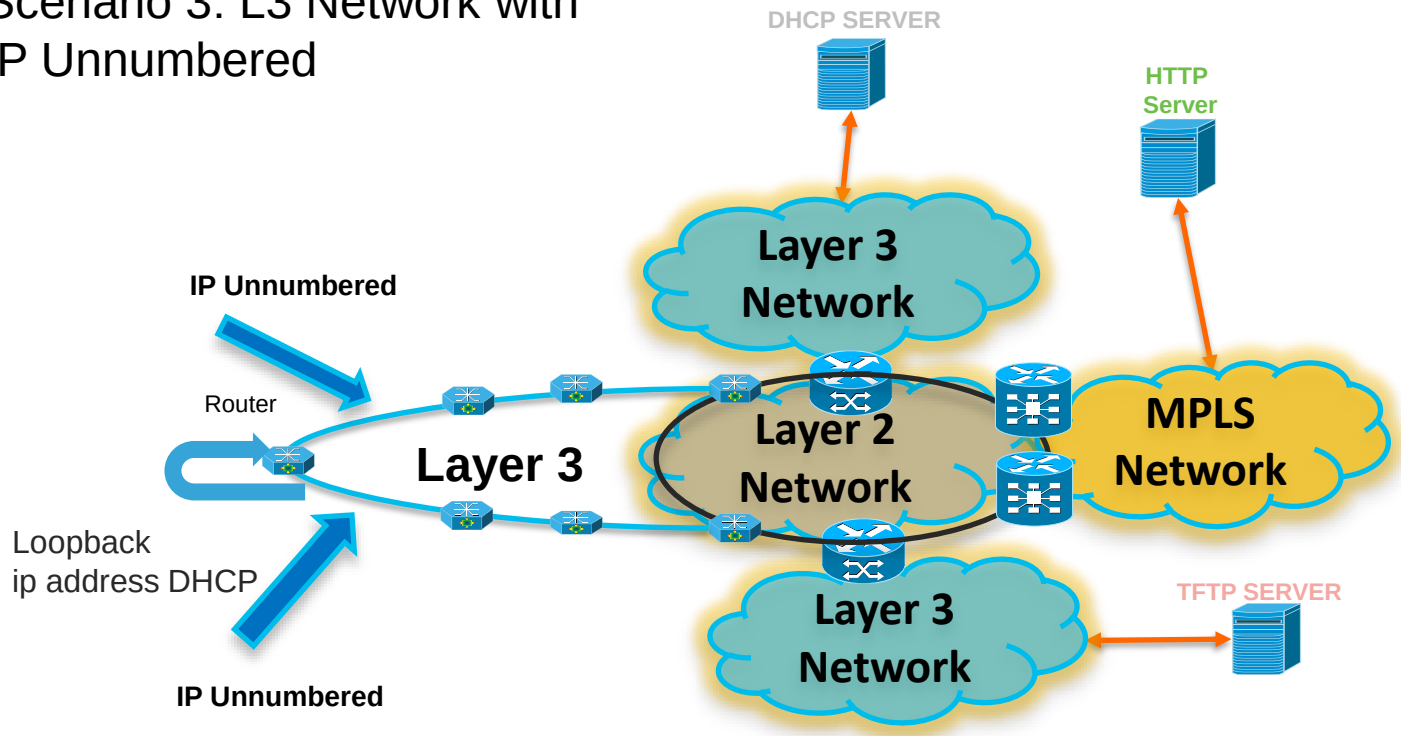
ZTP Supported Deployment Scenarios

Scenario 2: L3 with Third Party NMS or Without Op43

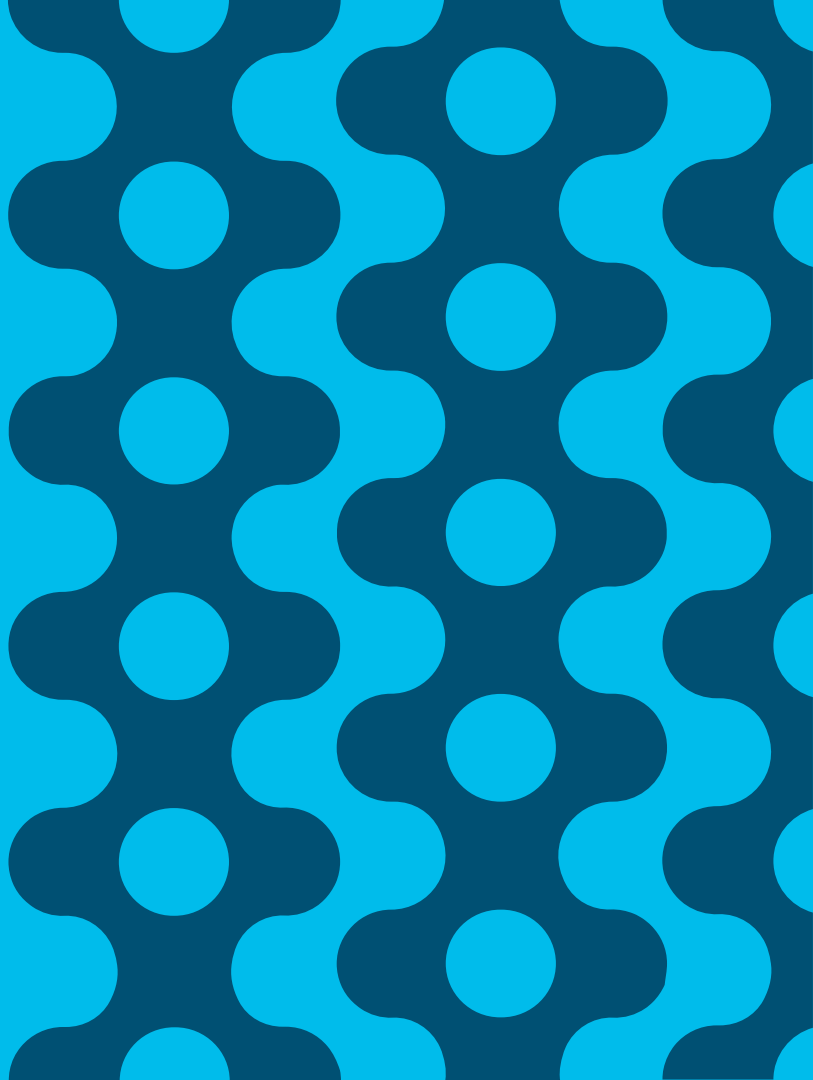


ZTP Supported Deployment Scenarios

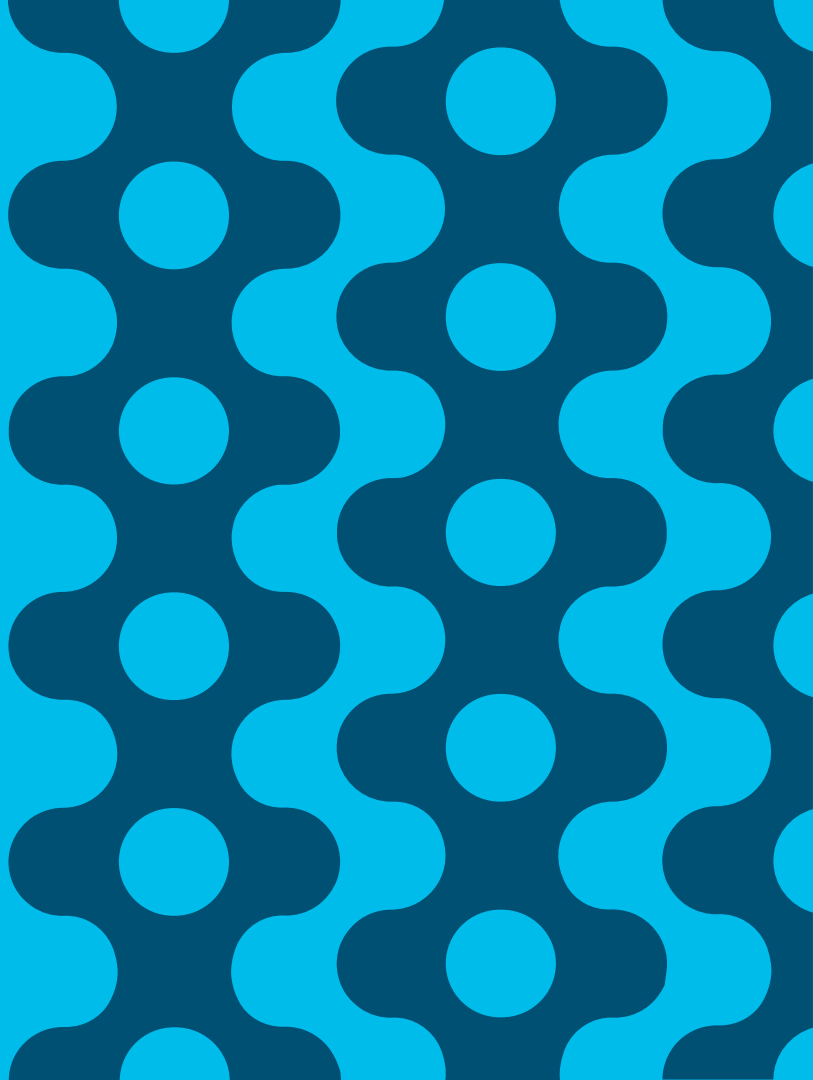
Scenario 3: L3 Network with IP Unnumbered



Deployment Usecase
Tier 1 SP



ZTD Case Study
Tier 1 Service Provider



Project Details and Objectives

- Cell Site Router Deployment/Migration
- Approx 3000 Cell sites in Phase 1
- ASR-920 as Cell Site Router
- Cisco NSO as the Orchestrator

- Zero Touch Provisioning goals:
  - Reduce Cost
  - Minimize errors
  - Adopt automation as normal operating procedure

Network Topology

ZTD Components

ZTD Workflow

Challenges and Solutions

Summary

- Parallel process, multiple system can be configured at the same time.
- Dramatically reduce deployment time
- Reduce the chance of configuration errors.
- Tutorials, Blogs, Examples
  - https://xrdocs.github.io/software-management/
  - https://github.com/ios-xr/iosxr-ztp-python
  - Network Field Day 17:
    - https://vimeo.com/253197077
    - https://vimeo.com/253197037
    - https://github.com/akshshar/nfd17

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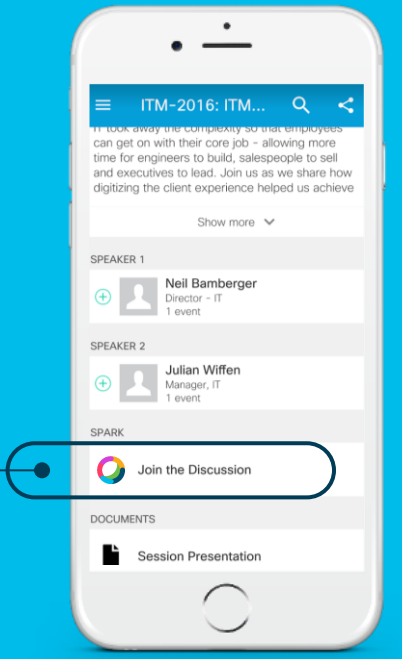

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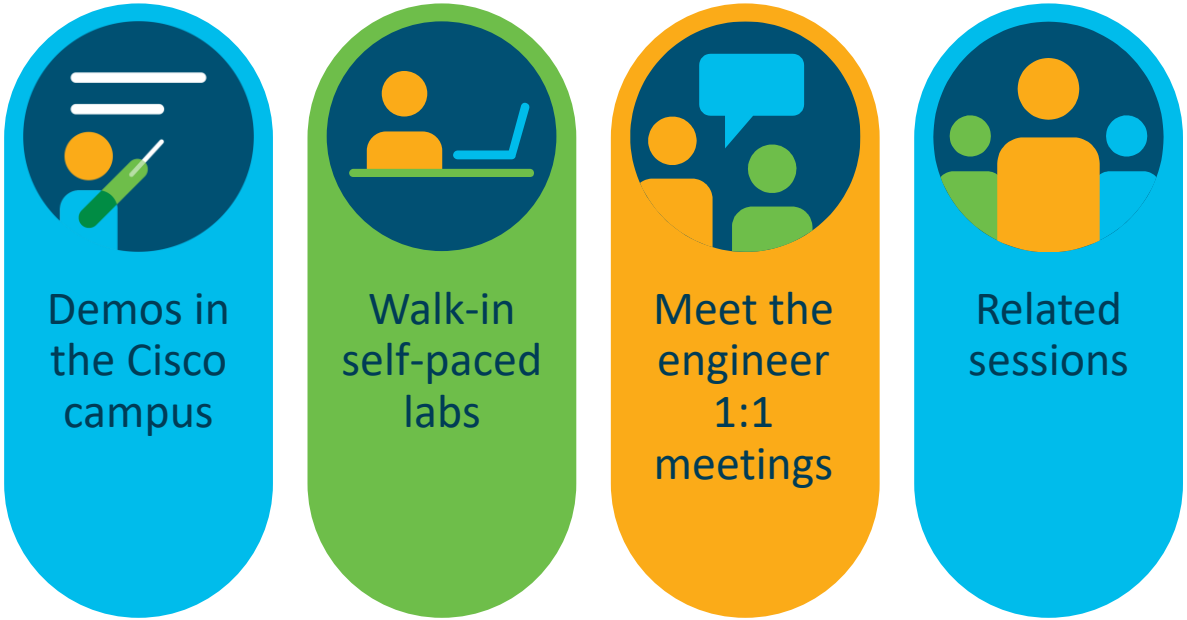

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