aruba
a Hewlett Packard Enterprise company

AOS-CX & IP-SLA POC

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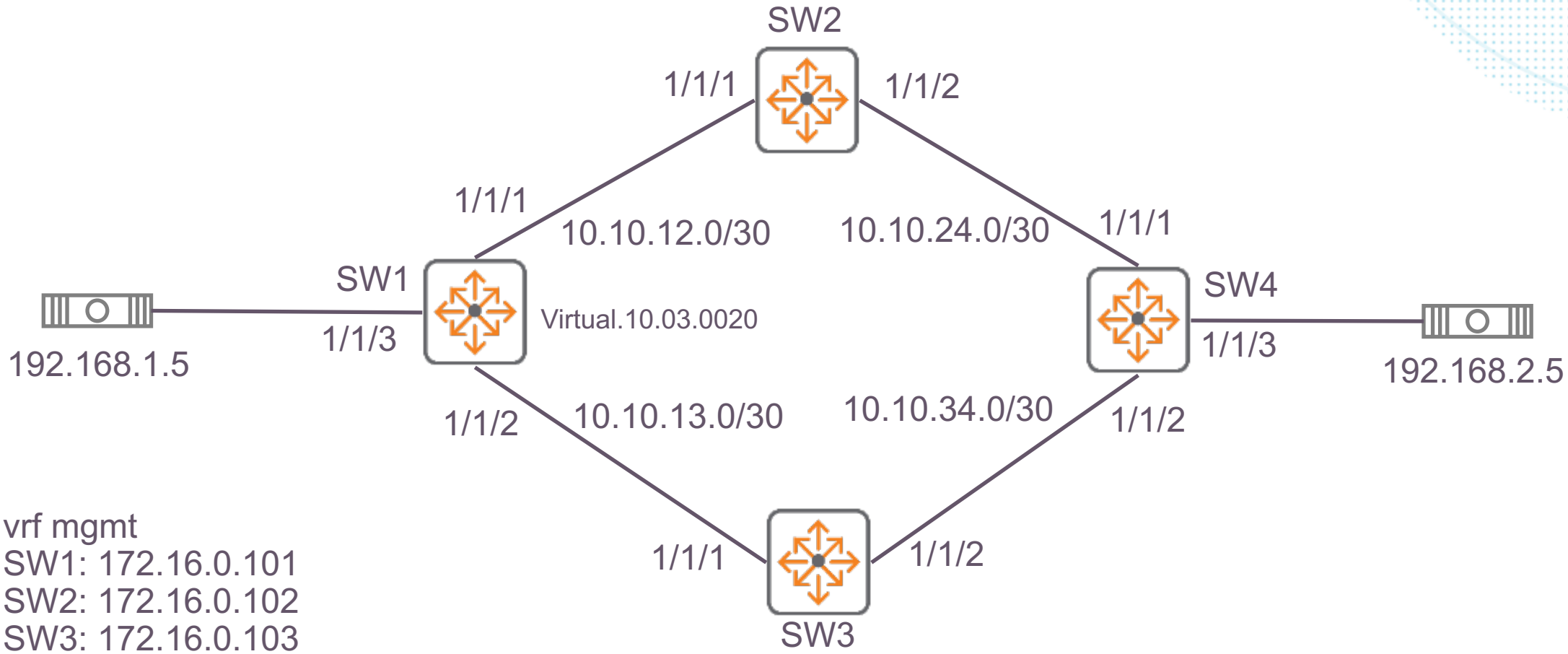
MAY 2020

Customer Requirements

- Two path:, Active – Standby links
- NQA or IP-SLA must be used to select the path.
  - Switch detects failure -> Change to standby link automatically.
  - Automatic fallback to ppal link (when available).
- Dynamic routing cannot be used.

Topology



vrf mgmt
SW1: 172.16.0.101
SW2: 172.16.0.102
SW3: 172.16.0.103
SW4: 172.16.0.104
PC1: 172.16.0.108
PC2: 172.16.0.109

SW1 configuration

```
clock timezone america/bogota
!
logging 172.16.0.80 severity debug vrf mgmt
ssh server vrf mgmt
!
```

Syslog server

```
vlan 1
interface mgmt
    no shutdown
    ip static 172.16.0.101/24
    default-gateway 172.16.0.11
interface 1/1/1
    no shutdown
    ip address 10.10.12.1/30
interface 1/1/2
    no shutdown
    ip address 10.10.13.1/30
interface 1/1/3
    no shutdown
    ip address 192.168.1.1/24
ip route 10.10.24.0/30 10.10.12.2
ip route 10.10.34.0/30 10.10.13.2
ip route 192.168.2.0/24 10.10.13.2 distance 10
ip route 192.168.2.0/24 10.10.12.2
ip dns server-address 8.8.8.8 vrf mgmt
https-server rest access-mode read-write
https-server vrf mgmt
```

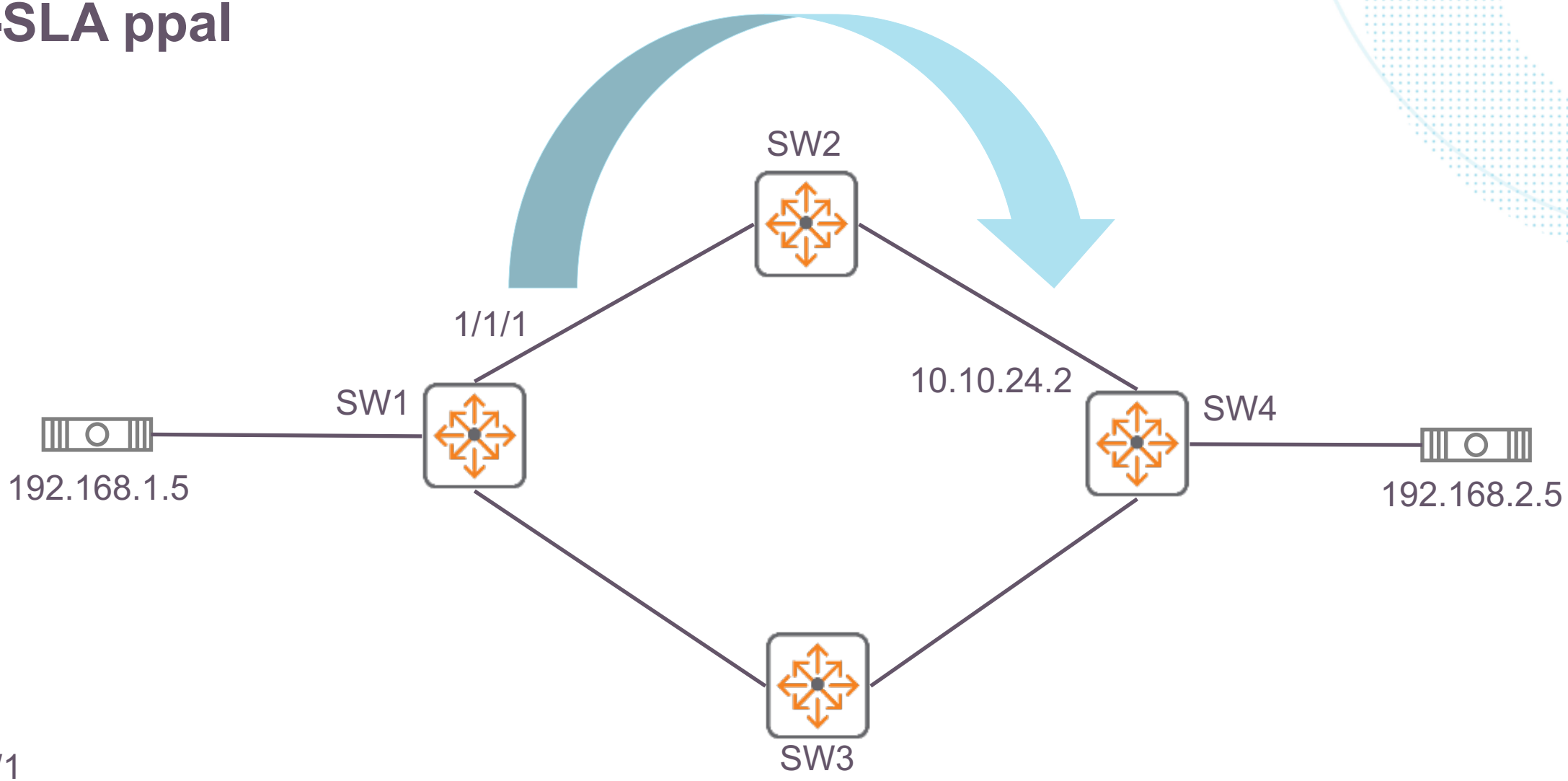
WAN - ppal

WAN - backup

backup route

Main route

IP-SLA ppal

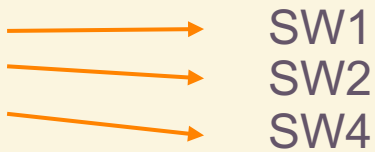


SW1
ip-sla ppal
icmp-echo 10.10.24.2 source 1/1/1 payload-size 400 probe-interval 10
start-test

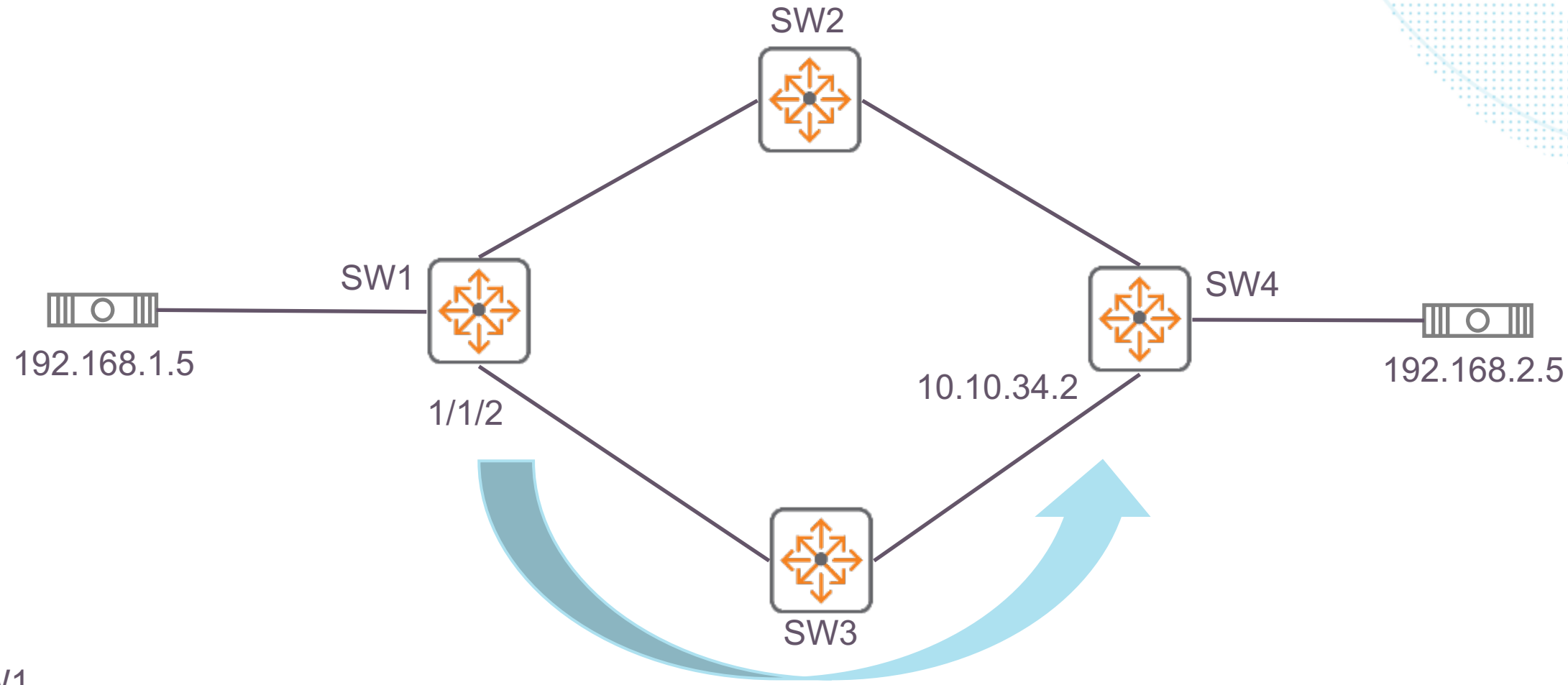
Test connectivity between PC1 and PC2 – ppal link

```
PC1# traceroute 192.168.2.5 vrf default
traceroute to 192.168.2.5 (192.168.2.5), 1 hops min, 30 hops max, 3 sec. timeout, 3 probes
  1   192.168.1.1  1.403ms  1.235ms  1.021ms
  2   10.10.12.2  2.357ms  1.822ms  1.819ms
  3   10.10.24.2  2.521ms  2.146ms  2.161ms
  4   192.168.2.5  2.976ms  2.996ms  2.818ms
PC1#
PC1# ping 192.168.2.5
PING 192.168.2.5 (192.168.2.5) 100(128) bytes of data.
108 bytes from 192.168.2.5: icmp_seq=1 ttl=61 time=3.46 ms
108 bytes from 192.168.2.5: icmp_seq=2 ttl=61 time=2.73 ms
108 bytes from 192.168.2.5: icmp_seq=3 ttl=61 time=2.98 ms
108 bytes from 192.168.2.5: icmp_seq=4 ttl=61 time=3.79 ms
108 bytes from 192.168.2.5: icmp_seq=5 ttl=61 time=3.26 ms

--- 192.168.2.5 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4088ms
rtt min/avg/max/mdev = 2.732/3.248/3.792/0.369 ms
PC1#
```



IP-SLA backup



SW1
ip-sla backup
icmp-echo 10.10.34.2 source 1/1/2 payload-size 400 probe-interval 10
start-test

Test connectivity between PC1 and PC2 – backup link

```
SW1# conf t
SW1(config)# no ip route 192.168.2.0/24 10.10.12.2
```

```
SW4# conf t
SW4(config)# no ip route 192.168.1.0/24 10.10.24.1
```

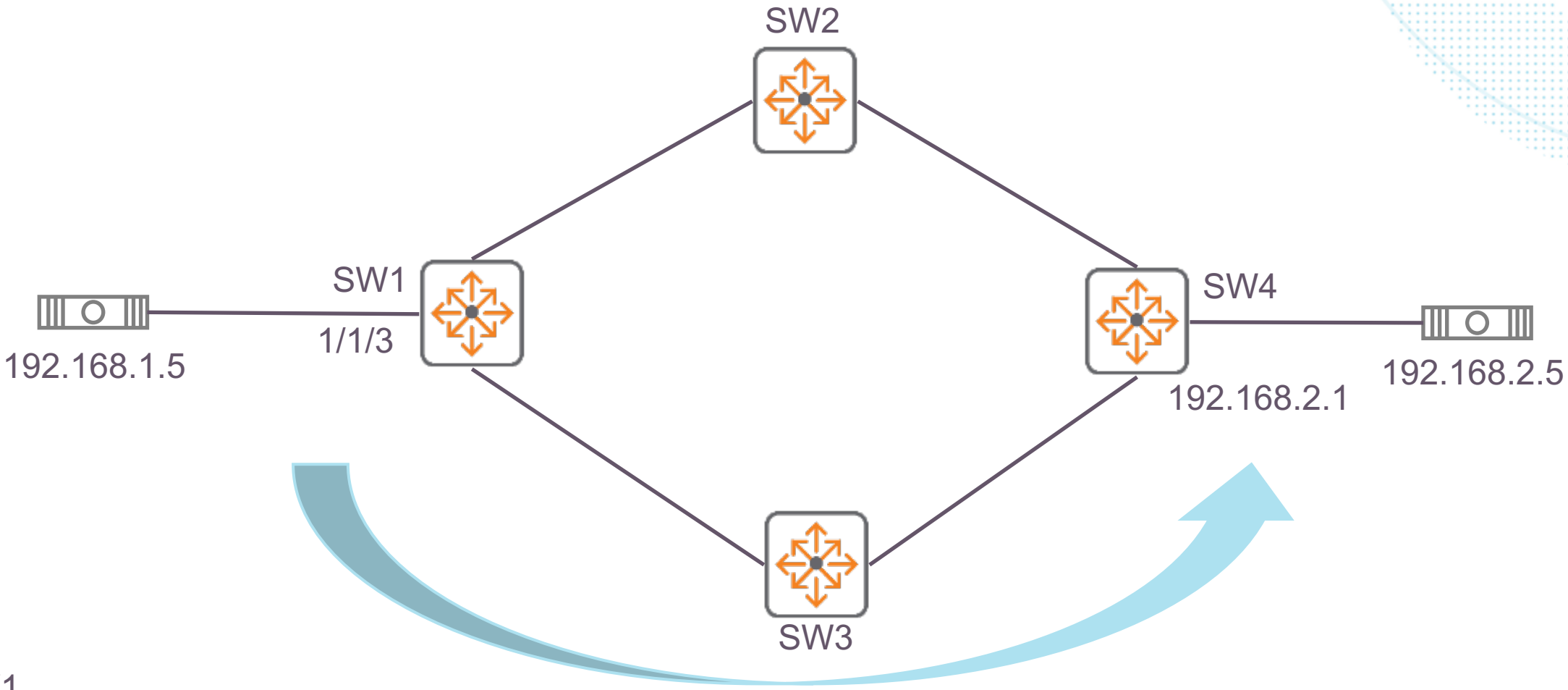
Manual config change to backup link

```
PC1# traceroute 192.168.2.5
traceroute to 192.168.2.5 (192.168.2.5), 1 hops min, 30 hops max, 3 sec. timeout, 3 probes
  1   192.168.1.1  1.766ms  1.225ms  1.313ms
  2   10.10.13.2  3.202ms  2.508ms  2.194ms
  3   10.10.34.2  3.228ms  2.652ms  2.833ms
  4   192.168.2.5  3.944ms  3.735ms  3.431ms
PC1#
PC1# ping 192.168.2.5
PING 192.168.2.5 (192.168.2.5) 100(128) bytes of data.
108 bytes from 192.168.2.5: icmp_seq=1 ttl=61 time=3.78 ms
108 bytes from 192.168.2.5: icmp_seq=2 ttl=61 time=3.97 ms
108 bytes from 192.168.2.5: icmp_seq=3 ttl=61 time=3.90 ms
108 bytes from 192.168.2.5: icmp_seq=4 ttl=61 time=3.46 ms
108 bytes from 192.168.2.5: icmp_seq=5 ttl=61 time=3.64 ms

--- 192.168.2.5 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4005ms
rtt min/avg/max/mdev = 3.465/3.752/3.970/0.189 ms
PC1#
```

SW1
SW3
SW4

IP-SLA LAN2LAN



SW1
ip-sla LAN2LAN
icmp-echo 192.168.2.1 source 1/1/3 payload-size 400 probe-interval 10
start-test

IP-SLA Guidelines – AOS CX v10.4

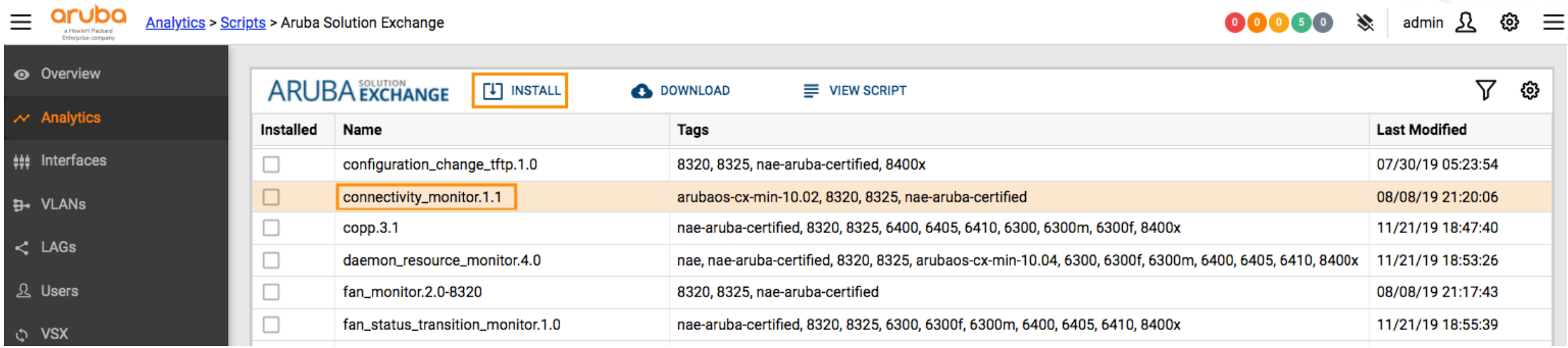
- “ArubaOS-CX supports only SLA configuration through CLI and thresholds can be configured using NAE agents using WebUI/REST.”

- “ArubaOS-CX supports only forever test.”

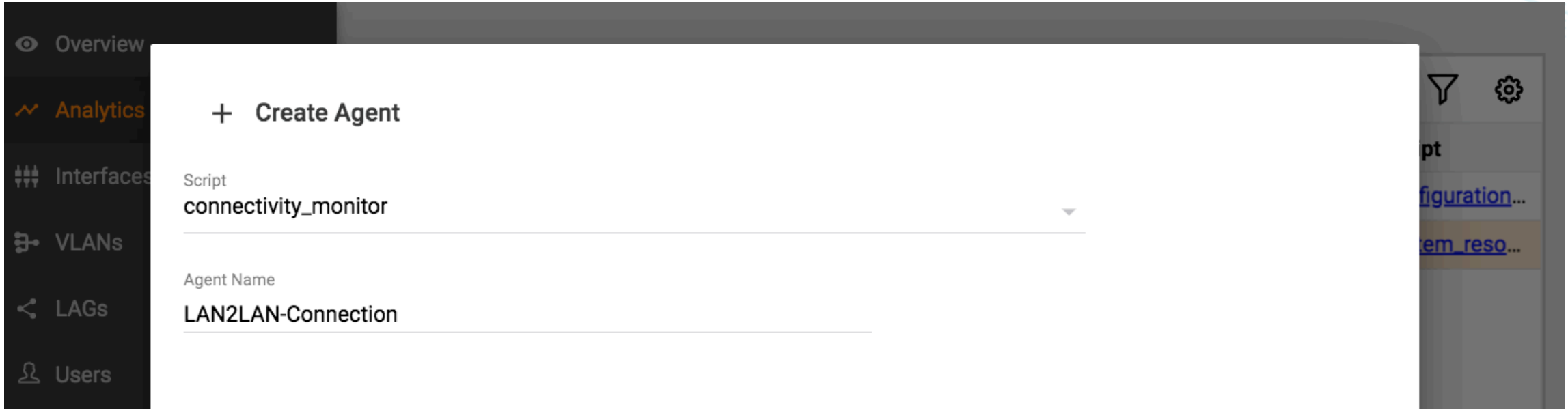
- “NAE agents must be triggered for each IP-SLA test on every switch.”

- “Predefined actions are action functions that are built in to the Aruba Network Analytics Engine framework. These functions enable the agents of a script to:
  - Execute CLI commands in the ArubaOS-CX network operating system ().
  - Send messages to the system log.”

Install the conectivity_monitor script



LAN2LAN IP-SLA Agent



LAN2LAN IP-SLA Agent

Parameters

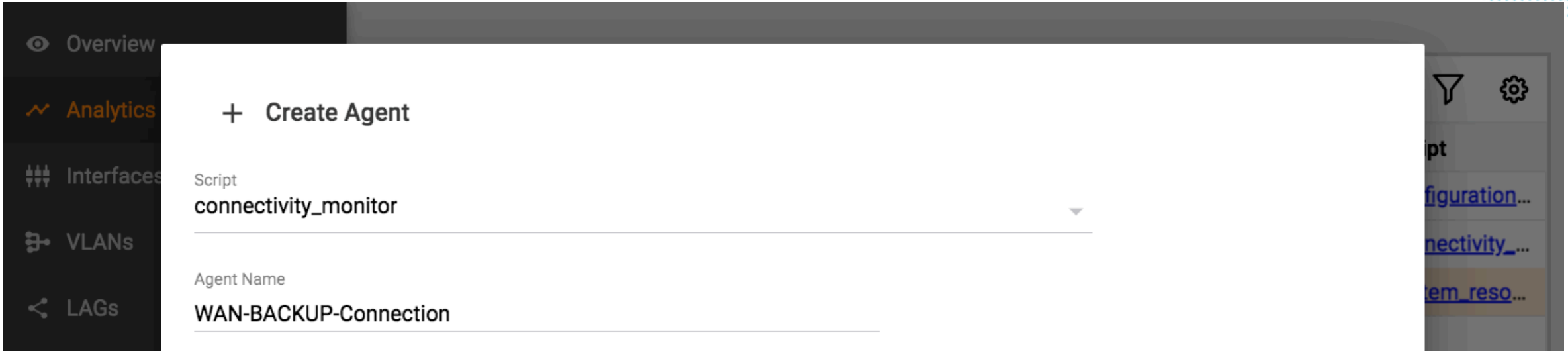
Type	Name	Description	More Info	Value
INTEGER	connectivity_check_rate	Connectivity Check Rate (in minutes)	Default: 1	1
STRING	ipsla_session_name	IP-SLA Session Name	Default:	LAN2LAN

Save running config to startup

CREATE

CANCEL

WAN-Backup IP-SLA Agent



WAN-Backup IP-SLA Agent

Parameters

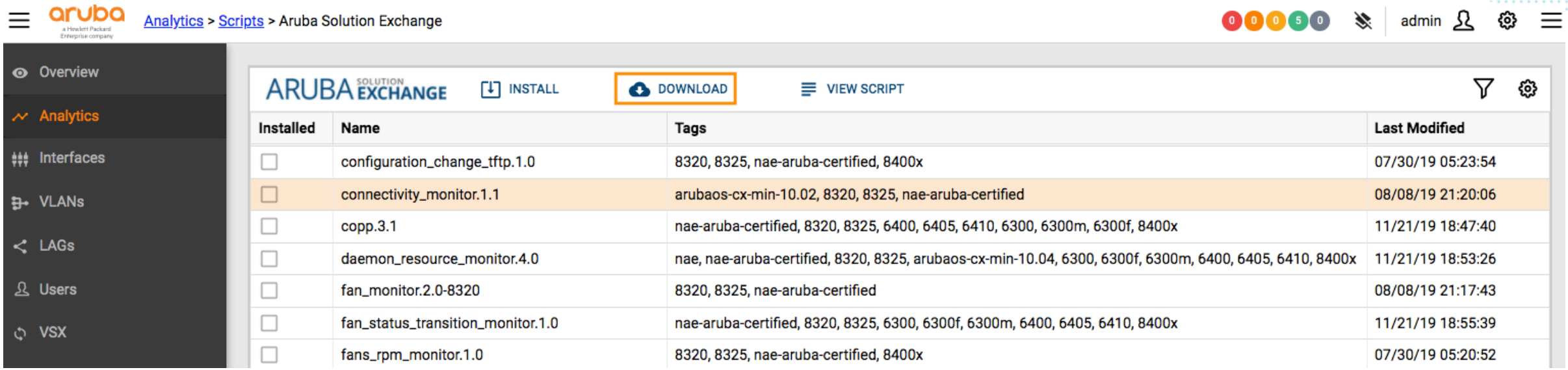
Type	Name	Description	More Info	Value
INTEGER	connectivity_check_rate	Connectivity Check Rate (in minutes)	Default: 1	1
STRING	ipsla_session_name	IP-SLA Session Name	Default:	backup

Save running config to startup

CREATE

CANCEL

Download the conectivity_monitor script



Edit the conectivity_monitor script, rename it

~/Desktop/connectivity_monitor_ppal.py action_call_back

```
# (c) Copyright 2018-2019 Hewlett Packard Enterprise Development LP
#
# Confidential computer software. Valid license from Hewlett Packard
# Enterprise required for possession, use or copying.
#
# Consistent with FAR 12.211 and 12.212, Commercial Computer Software,
# Computer Software Documentation, and Technical Data for Commercial Items
# are licensed to the U.S. Government under vendor's standard commercial
# license.

import requests

Manifest = {
    'Name': 'connectivity_monitor_ppal'
    'Description': 'This script monitors the reachability between two '
                   'devices given the IP-SLA session'
                   'The IP-SLA session has to be configured in the switch'
                   'before using this script to monitor the '
                   'connectivity/rechability between two devices.',
    'Version': '1.1',
    'Author': 'Aruba Networks'
}

ParameterDefinitions = {
    'connectivity_check_rate': {
        'Name': 'Connectivity Check Rate (in minutes)',
        'Description': 'the rate at which, status of the connectivity is '
                       'checked. The value should be (at the least) twice '
                       'the probe-interval of the IP-SLA session.\n'
                       '{measured in minutes}\nDefault value is 1 minute '
                       '(assuming the min probe-interval as 5 seconds.)'
                       '\nMANDATORY FIELD',
```

New name

Edit the conectivity_monitor script, save it

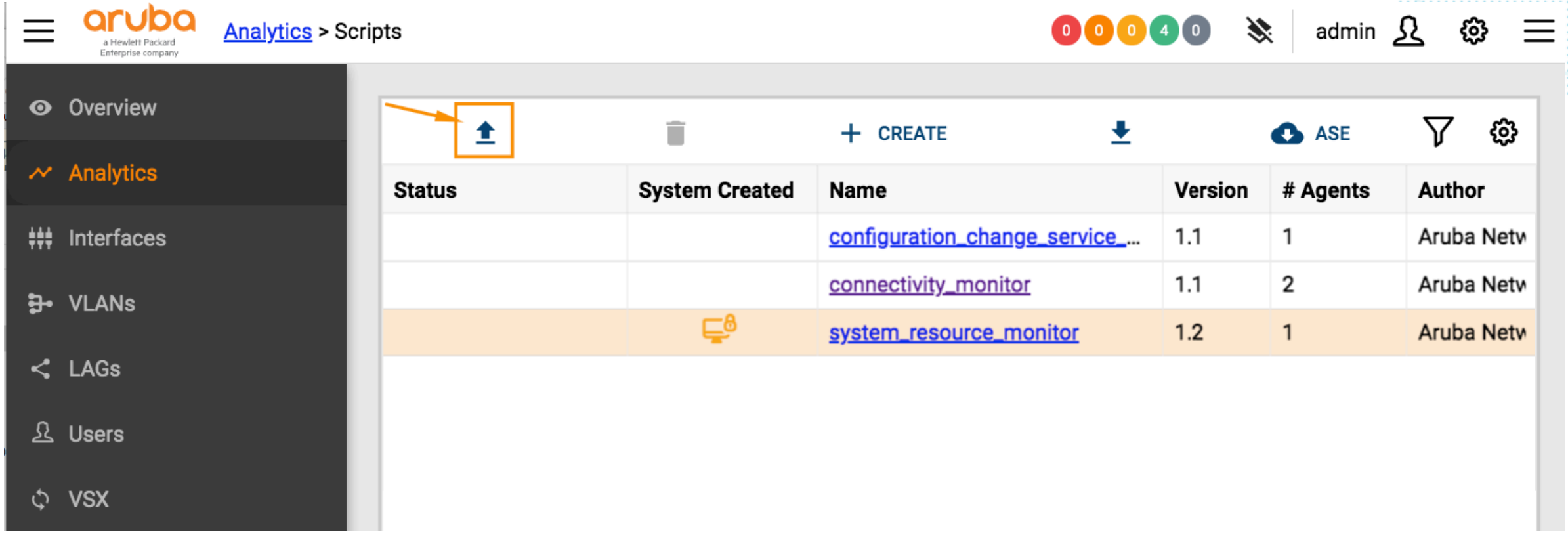
~/Desktop/connectivity_monitor_ppal.py — action_call_back

```
114
115     def remove_alert(self):
116         alert_level = self.get_alert_level()
117         if (alert_level == AlertLevel.CRITICAL) or \
118                 (alert_level == AlertLevel.MINOR):
119             self.remove_alert_level()
120             #Action No 1
121             ActionCLI("config\nip route 192.168.2.0/24 10.10.12.2\nexit")
122             ActionSyslog('Monitored remote IP is reachable, received '
123                          'response Rx-packets for the IP-SLA '
124                          'session {}.'.format(
125                              self.params['ipsla_session_name'].value))
126
127     def error(self, message):
128         err_msg = ('IP SLA Agent Source={}. '
129                    'Error: {}').format(
130             self.params['ipsla_session_name'].value,
131             message)
132         raise Exception(err_msg)
133
134     def create_cli_syslog(self):
135         session_name = self.params['ipsla_session_name'].value
136         ActionCLI('show ip-sla ' + session_name + ' results')
137         ActionSyslog('Monitored remote IP is not reachable, response '
138                      'Rx-packets were not received for the IP-SLA '
139                      'session {}.'.format(
140                          self.params['ipsla_session_name'].value))
141
142     def create_alert(self):
143         alert_level = self.get_alert_level()
144         if alert_level is None:
145             self.set_alert_level(AlertLevel.MINOR)
146             self.create_cli_syslog()
147         elif alert_level == AlertLevel.MINOR:
148             self.set_alert_level(AlertLevel.CRITICAL)
149             self.create_cli_syslog()
150             #Action No 2
151             ActionCLI("config\nno ip route 192.168.2.0/24 10.10.12.2\nexit")
152
153     def action_call_back(self, event):
154         try:
155             uri = '/rest/v1/system/ipsla_sources/' + \
```

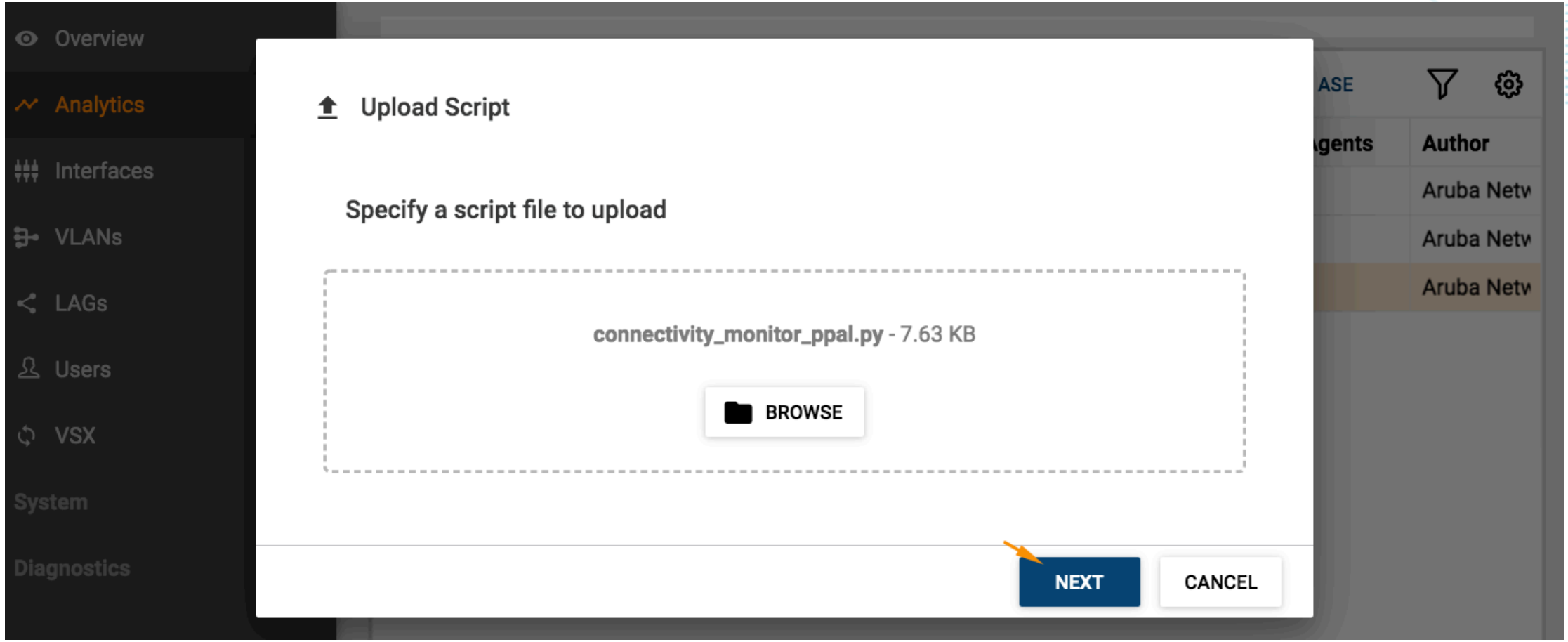
When alert is removed, enter the static IP route

When alert changes to critical, remove the static IP route

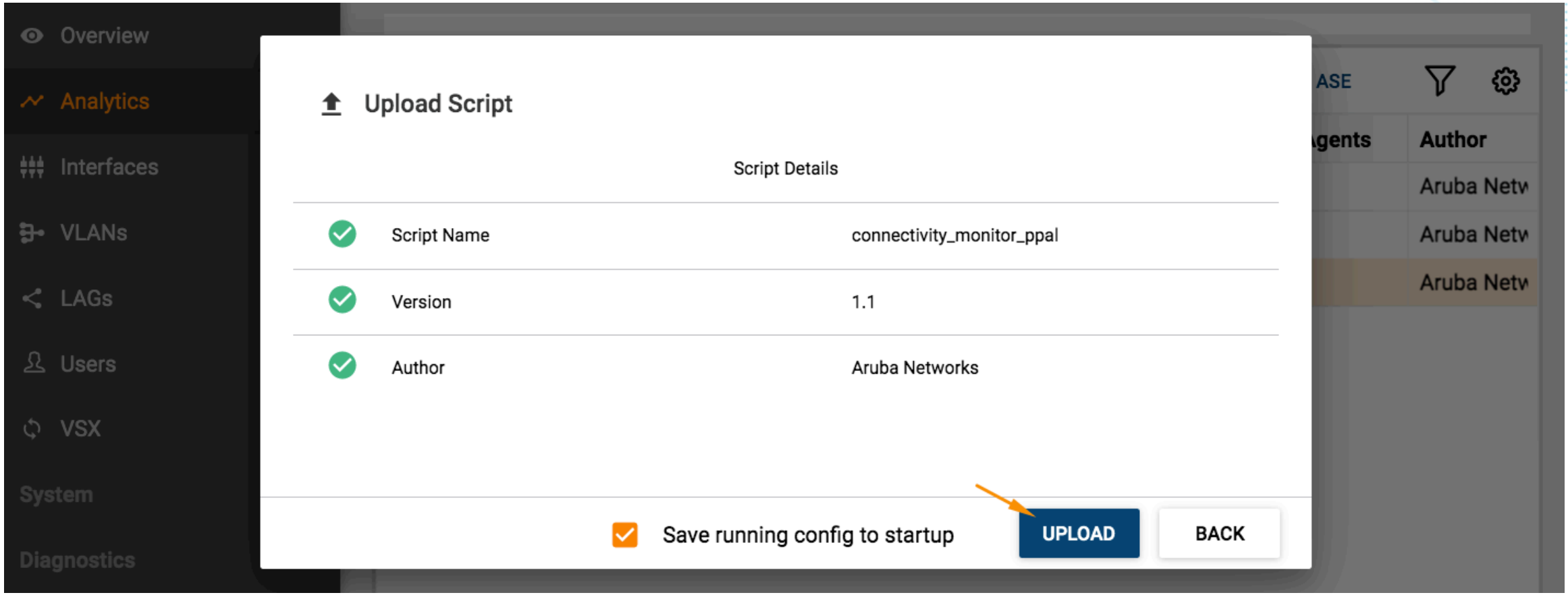
Click to upload a script

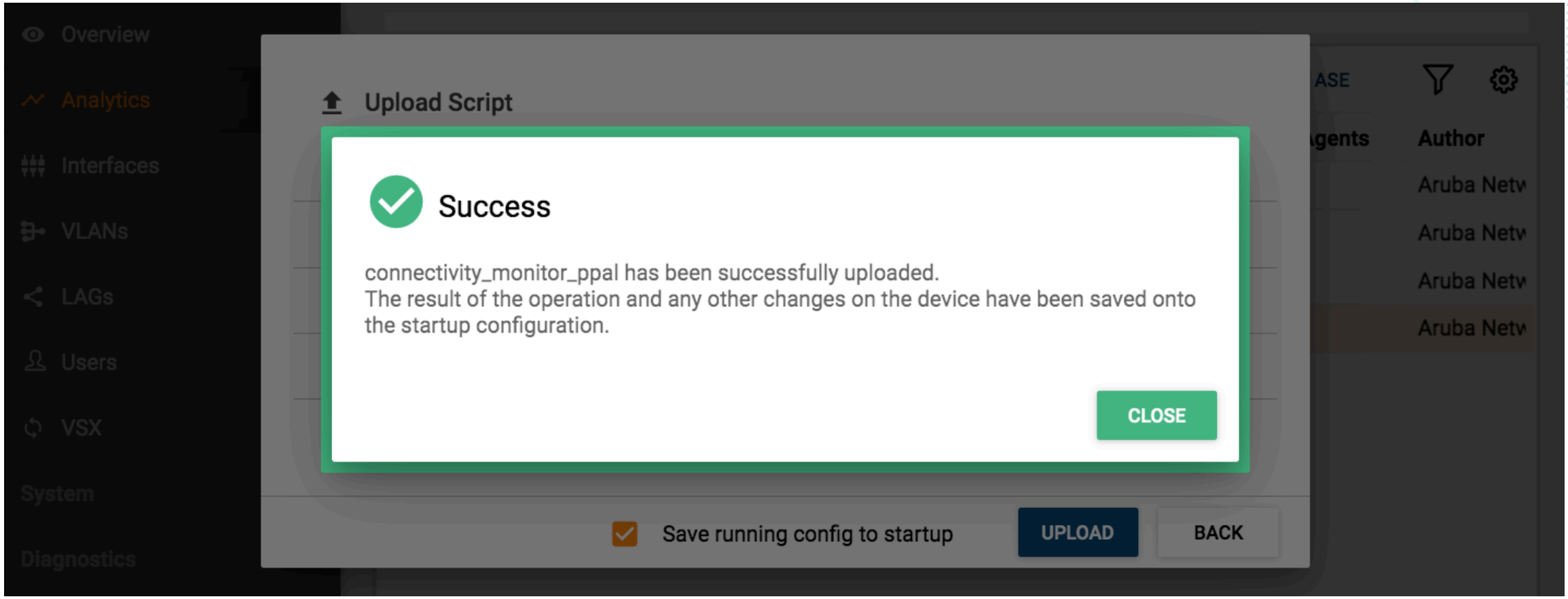


Select the script

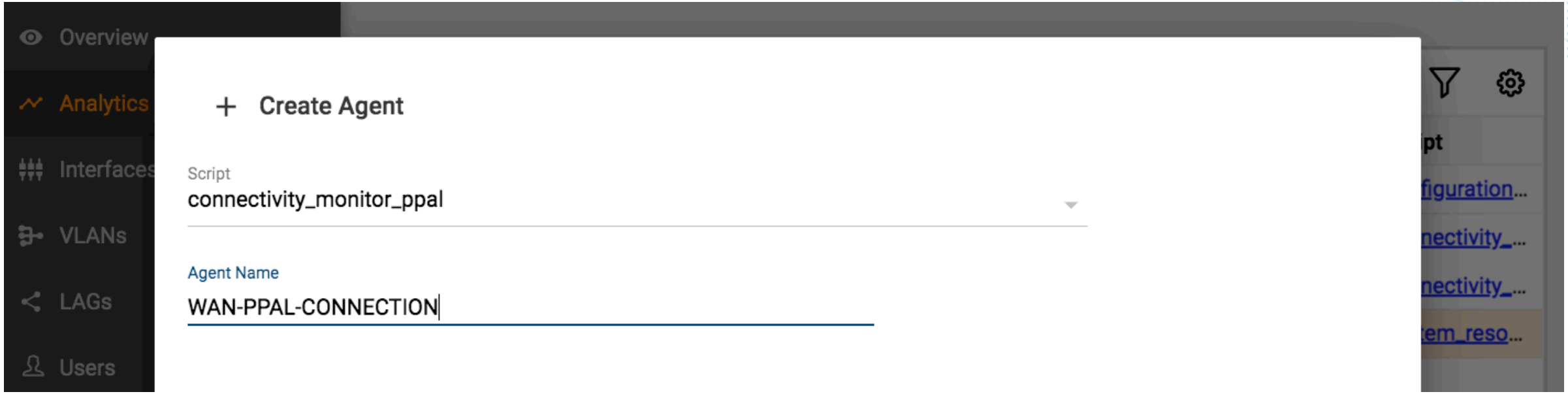


Click on “upload”




Overview
Analytics
Interfaces
VLANs
LAGs
Users
VSX
System
Diagnostics
Upload Script
Success
connectivity_monitor_ppal has been successfully uploaded.
The result of the operation and any other changes on the device have been saved onto the startup configuration.
CLOSE
Save running config to startup
UPLOAD
BACK
ASE
Author
Aruba Netv
Aruba Netv
Aruba Netv
Aruba Netv

WAN-PPAL IP-SLA Agent



WAN-PPAL IP-SLA Agent

WAN-PPAL-CONNECTION

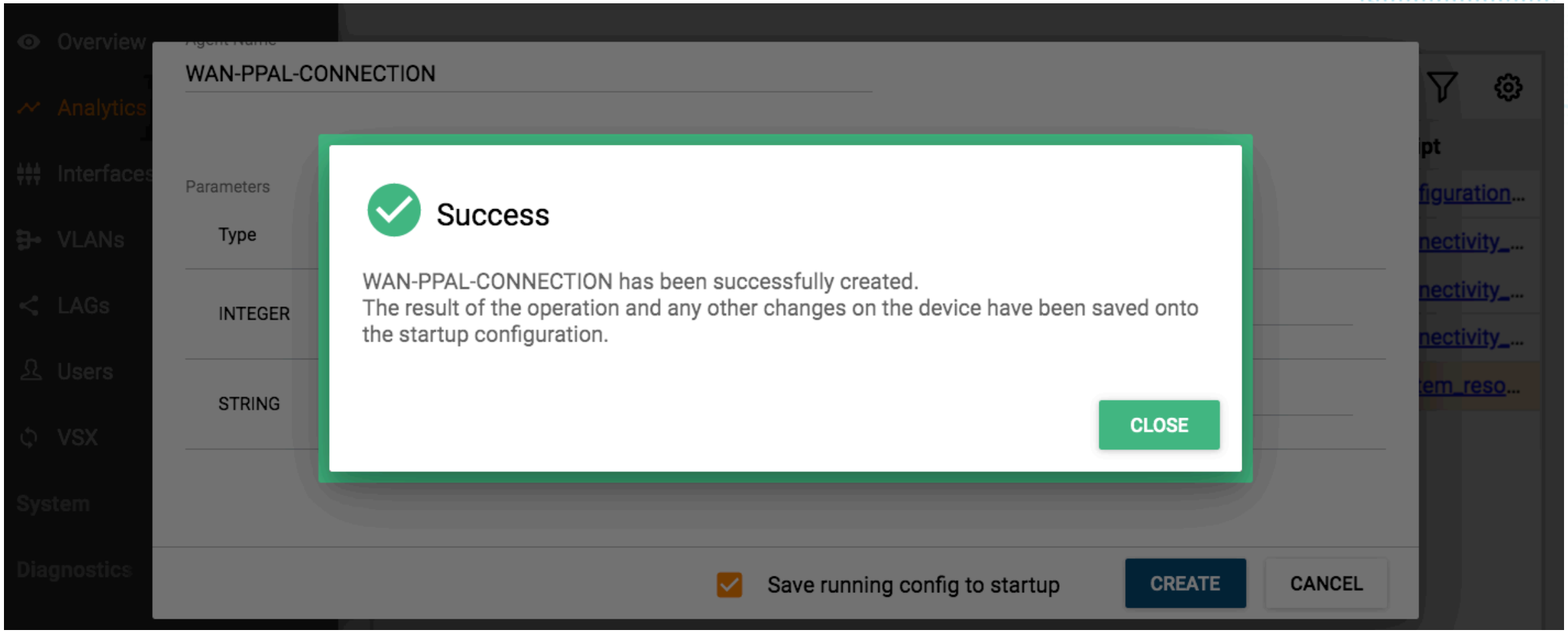
Parameters

Type	Name	Description	More Info	Value
INTEGER	connectivity_check_rate	Connectivity Check Rate (in minutes)	Default: 1	1
STRING	ipsla_session_name	IP-SLA Session Name	Default:	ppal

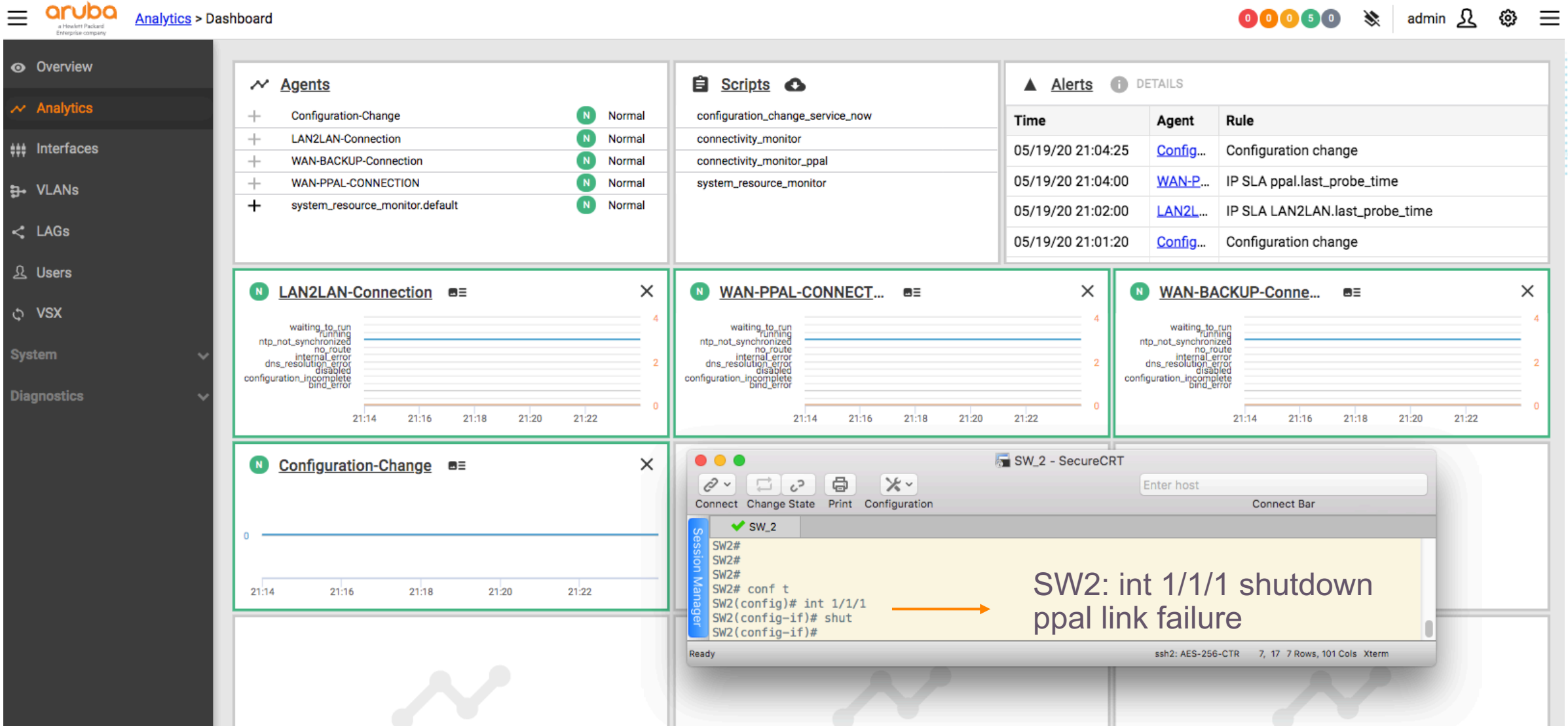
Save running config to startup

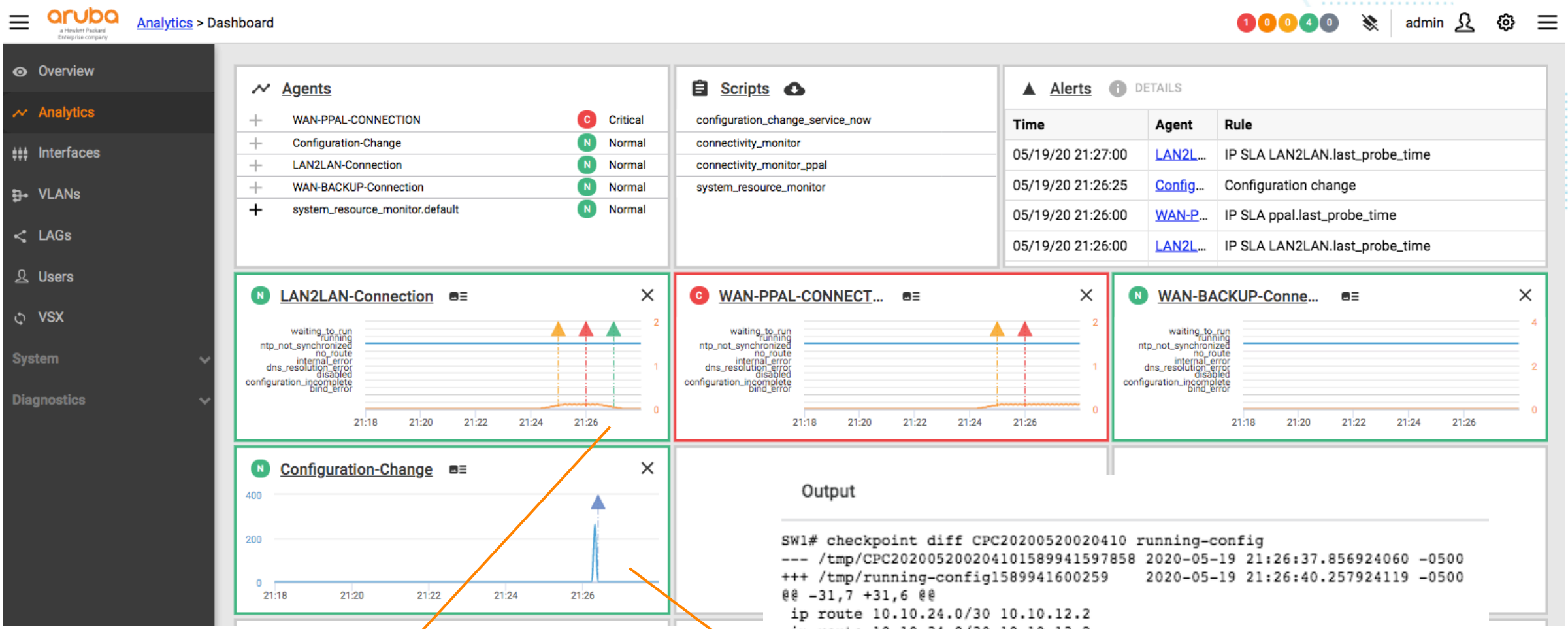
CREATE

CANCEL


Overview
Analytics
Interfaces
VLANs
LAGs
Users
VSX
System
Diagnostics
WAN-PPAL-CONNECTION
Parameters
Type
INTEGER
STRING
Success
WAN-PPAL-CONNECTION has been successfully created.
The result of the operation and any other changes on the device have been saved onto the startup configuration.
CLOSE
Save running config to startup
CREATE
CANCEL

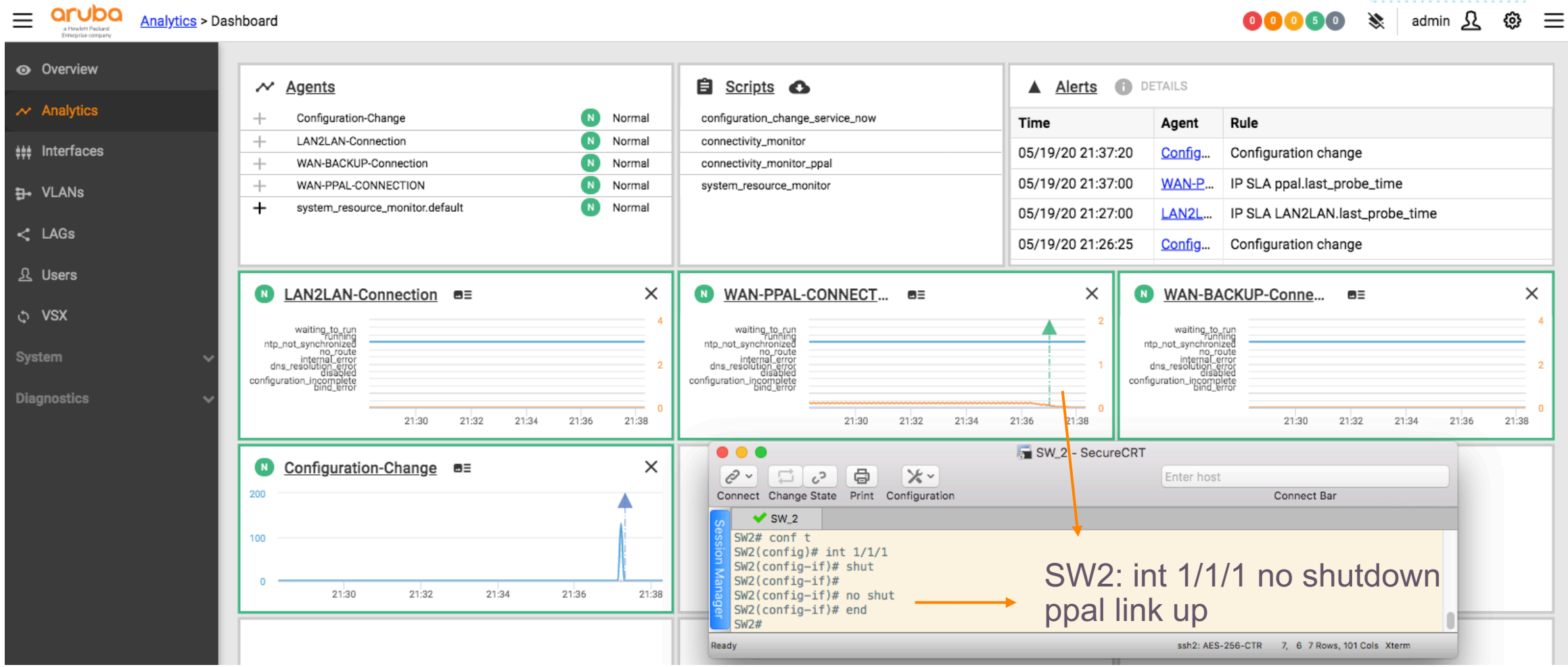
Test configuration

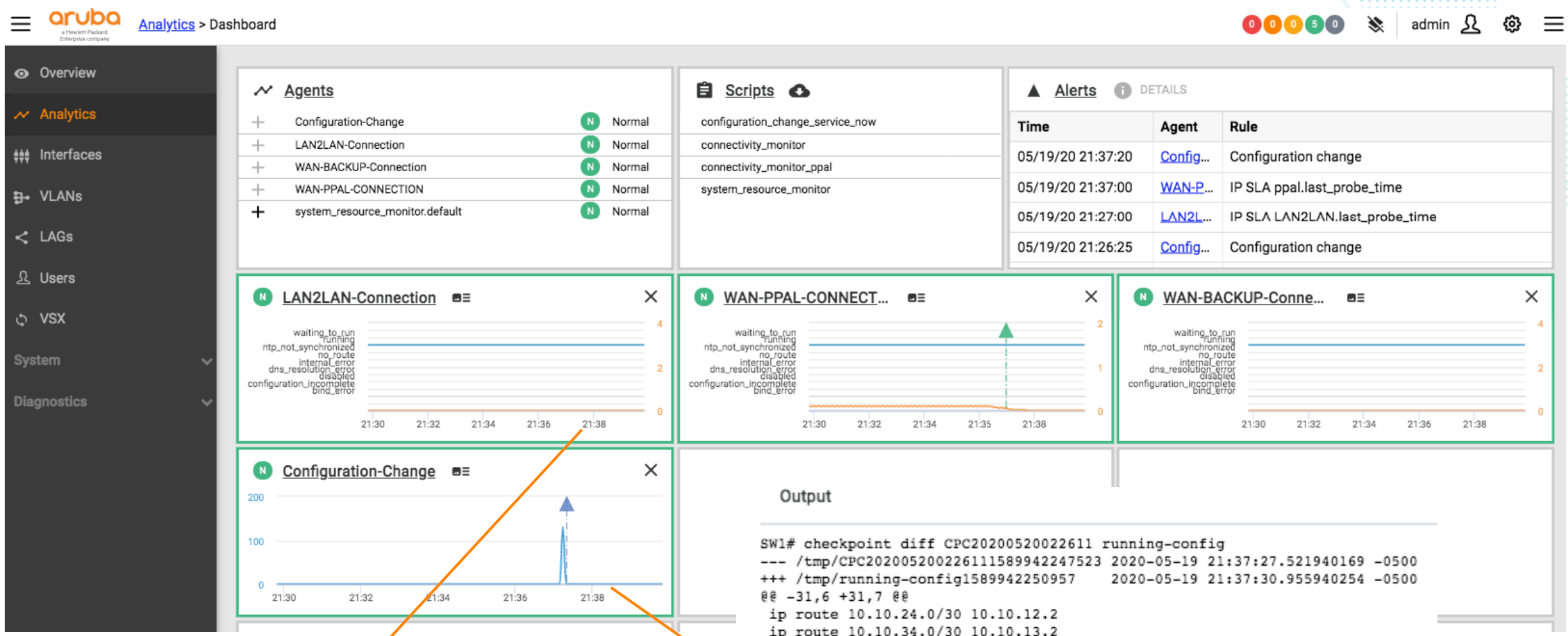

Analytics > Dashboard
admin
Overview
Analytics
Interfaces
VLANs
LAGs
Users
VSX
System
Diagnostics
Agents
Configuration-Change Normal
LAN2LAN-Connection Normal
WAN-BACKUP-Connection Normal
WAN-PPAL-CONNECTION Normal
system_resource_monitor.default Normal
Scripts
configuration_change_service_now
connectivity_monitor
connectivity_monitor_ppal
system_resource_monitor
Alerts
DETAILS
Time
Agent
Rule
05/19/20 21:04:25
Config...
Configuration change
05/19/20 21:04:00
WAN-P...
IP SLA ppal.last_probe_time
05/19/20 21:02:00
LAN2L...
IP SLA LAN2LAN.last_probe_time
05/19/20 21:01:20
Config...
Configuration change
LAN2LAN-Connection
WAN-PPAL-CONNECT...
WAN-BACKUP-Conne...
waiting_to_run
running
ntp_not_synchronized
no_route
internal_error
dns_resolution_error
disabled
configuration_incomplete
bind_error
21:14
21:16
21:18
21:20
21:22
Configuration-Change
SW_2 - SecureCRT
Connect
Change State
Print
Configuration
Enter host
Connect Bar
SW_2
Session Manager
SW2#
SW2#
SW2#
SW2# conf t
SW2(config)# int 1/1/1
SW2(config-if)# shut
SW2(config-if)#
SW2: int 1/1/1 shutdown
ppal link failure
Ready
ssh2: AES-256-CTR
7, 17 7 Rows, 101 Cols Xterm



Backup link being used

Config change applied


Analytics > Dashboard
admin
Overview
Analytics
Interfaces
VLANs
LAGs
Users
VSX
System
Diagnostics
Agents
Configuration-Change Normal
LAN2LAN-Connection Normal
WAN-BACKUP-Connection Normal
WAN-PPAL-CONNECTION Normal
system_resource_monitor.default Normal
Scripts
configuration_change_service_now
connectivity_monitor
connectivity_monitor_ppal
system_resource_monitor
Alerts
DETAILS
Time | Agent | Rule
05/19/20 21:37:20 | Config... | Configuration change
05/19/20 21:37:00 | WAN-P... | IP SLA ppal.last_probe_time
05/19/20 21:27:00 | LAN2L... | IP SLA LAN2LAN.last_probe_time
05/19/20 21:26:25 | Config... | Configuration change
LAN2LAN-Connection
WAN-PPAL-CONNECT...
WAN-BACKUP-Conne...
Configuration-Change
SW_2 - SecureCRT
Connect
Change State
Print
Configuration
Enter host
Connect Bar
Session Manager
SW_2
SW2# conf t
SW2(config)# int 1/1/1
SW2(config-if)# shut
SW2(config-if)#
SW2(config-if)# no shut
SW2(config-if)# end
SW2#
SW2: int 1/1/1 no shutdown
ppal link up
Ready
ssh2: AES-256-CTR 7, 6 7 Rows, 101 Cols Xterm



Main link being used

Config change applied

Syslogs collected

```
ubuntu@ubuntu:~$ cat /var/log/syslog | grep 21:2
May 19 21:25:05 SW1 hpe-policyd[1867] Event|6901|LOG_INFO|AMM|-|An action has been triggered by the NAE agent WAN-PPAL-CONNECTION
May 19 21:25:05 SW1 hpe-policyd[1867] Event|5507|LOG_INFO|AMM|-|Monitored remote IP is not reachable, response Rx-packets were not received for the IP-SLA session ppal.
May 19 21:25:08 SW1 hpe-policyd[1867] Event|6901|LOG_INFO|AMM|-|An action has been triggered by the NAE agent LAN2LAN-Connection
May 19 21:25:08 SW1 hpe-policyd[1867] Event|5507|LOG_INFO|AMM|-|Monitored remote IP is not reachable, response Rx-packets were not received for the IP-SLA session LAN2LAN.
May 19 21:25:40 SW1 lldpd[809] Event|106|LOG_INFO|AMM|-|LLDP neighbor 08:00:09:18:ec:5f deleted on 1/1/1
May 19 21:26:04 SW1 hpe-policyd[1867] Event|6901|LOG_INFO|AMM|-|An action has been triggered by the NAE agent LAN2LAN-Connection
May 19 21:26:04 SW1 hpe-policyd[1867] Event|5507|LOG_INFO|AMM|-|Monitored remote IP is not reachable, response Rx-packets were not received for the IP-SLA session LAN2LAN.
May 19 21:26:08 SW1 hpe-policyd[1867] Event|6901|LOG_INFO|AMM|-|An action has been triggered by the NAE agent WAN-PPAL-CONNECTION
May 19 21:26:08 SW1 hpe-policyd[1867] Event|5507|LOG_INFO|AMM|-|Monitored remote IP is not reachable, response Rx-packets were not received for the IP-SLA session ppal.
May 19 21:26:31 SW1 hpe-policyd[1867] Event|6901|LOG_INFO|AMM|-|An action has been triggered by the NAE agent Configuration-Change
May 19 21:26:31 SW1 hpe-policyd[1867] Event|5507|LOG_INFO|AMM|-|Configuration change happened
May 19 21:27:05 SW1 hpe-policyd[1867] Event|6901|LOG_INFO|AMM|-|An action has been triggered by the NAE agent LAN2LAN-Connection
May 19 21:27:05 SW1 hpe-policyd[1867] Event|5507|LOG_INFO|AMM|-|Monitored remote IP is reachable, received response Rx-packets for the IP-SLA session LAN2LAN.
ubuntu@ubuntu:~$
```

References

- https://community.hpe.com/t5/comware-based/policy-based-routing-with-tracking-nqa/td-p/7008226#.XrnmKhNKjq0

- conectivity_monitor v1.1 https://ase.arubanetworks.com/solutions/id/247

- ArubaOS-CX 10.04 Monitoring Guide 8320, 8325 Switch Series.

- ArubaOS-CX 10.04 Network Analytics Engine Guide
  6200, 6300, 6400, 8320, 8325, 8400 Switch Series

Thanks!