



# N9K/ACI Programmability Use Case

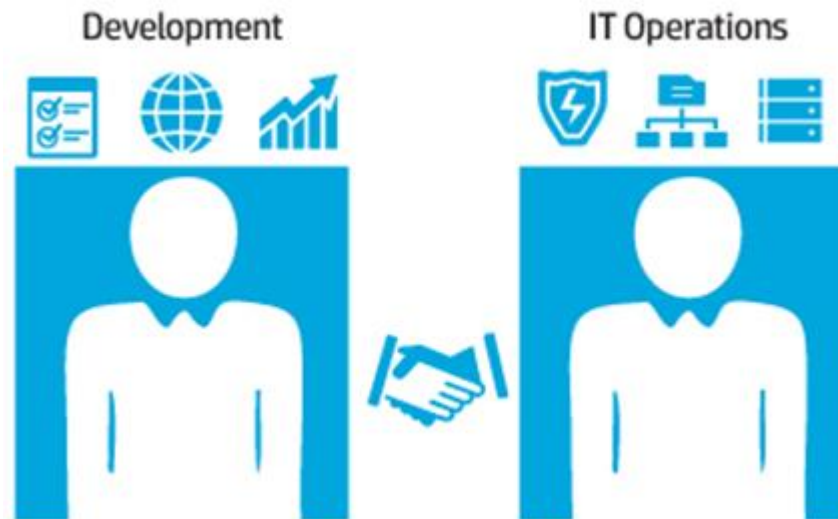
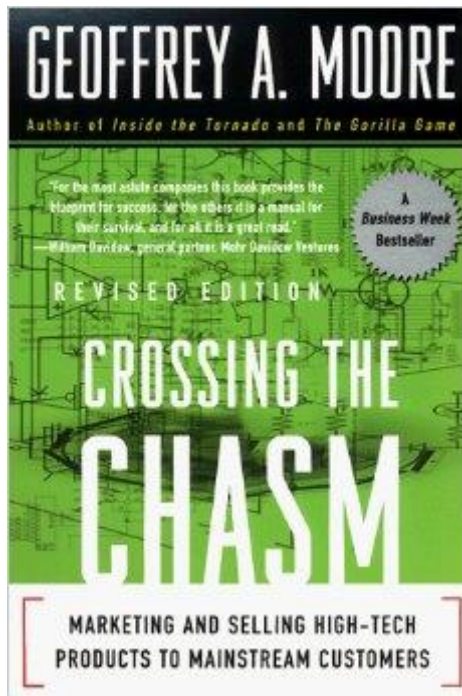
Version 1.0

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DC CSE (DataCenter Consulting Systems Engineer)

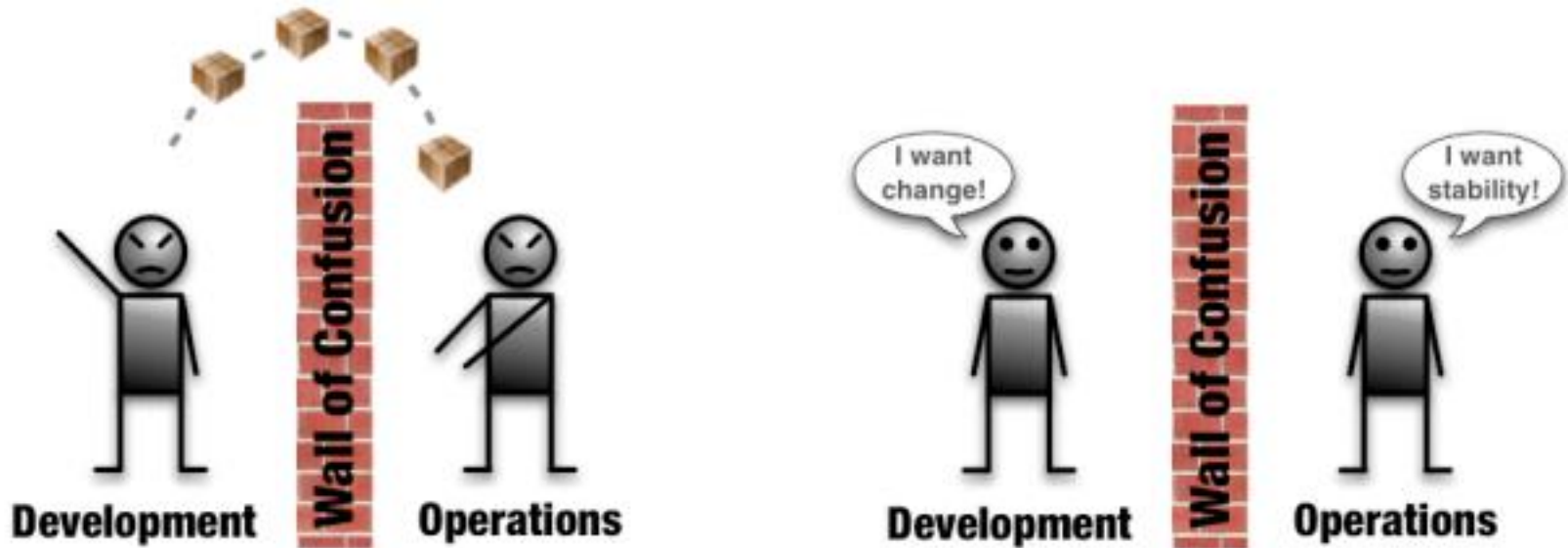
# 01. 시작에 앞서

# 당신은 누구십니까?



# Crossing The Chasm (DevOps) – 소통의 벽

“ 목표와 방향이 다른 두 조직...”

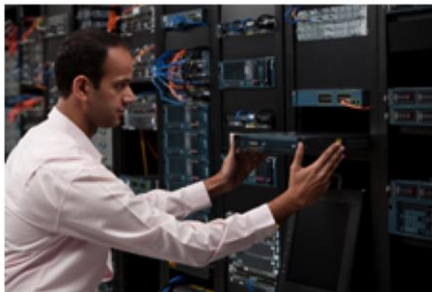


# Crossing The Chasm (DevOps)

“ 서로가 상생한다면, 훨씬 더 강력한 효과를 누릴 수 있습니다. ”

## Ops (운영팀)

- CLI config
- Scalability
- Resiliency
- Stability
- Availability
- 데이터센터 안에서 해결....



## Dev (개발팀)

- Code
- Agility
- Automation
- Testing
- Advanced Tools
- 언제 어디서나 Coding



# 오늘 시간의 준비 내용과 과제

- 프로그래밍 관련 어떠한 선수지식도 필요없음.
- GitHub 기반의 공개 Python 활용
- 편리한 운영을 위한 첫걸음과 활용법
- DevOps로 거듭나기 위한 IT 운영자를 위한 시간

## Nexus Programmability



# 현재 데이터센터 네트워크 운영 방법

“ 네트워크 엔지니어가 너무도 사랑하는 CLI (Command Line Interface) “

```
Wed Jan 28 12:16:19.938 UTC
Building configuration...
!! IOS XR Configuration 5.1.1.53U
!! Last configuration change at Wed Jan 28 07:29:19 2015 by CVAC
!
! IOS-XR Config generated on 2014-10-29 16:02
! by VIRL Configuration Engine 0.9.9
hostname iosxrv-1
service timestamps log datetime msec
service timestamps debug datetime msec
telnet vrf default ipv4 server max-servers 10
domain lookup disable
line template vty
  timestamp
  exec-timeout 720 0
!
line console

!
interface GigabitEthernet0/0/0/1
  circuit-type level-2-only
  point-to-point
  address-family ipv4 unicast
    metric 1
  !
!
!
router bgp 64496
  bgp router-id 192.168.0.1
  address-family ipv4 unicast
    network 192.168.0.1/32
  !
```

# 현재 데이터센터 네트워크 운영 발전사

“그래도 운영 및 구성방법은 발전해 왔습니다.”

```
change.txt - Notepad
File Edit Format View Help

NYC-RTR01A:

int gi0/2
 shutdown
int gi1/3
 switchport
 no shut
router bgp 65000
 redistribute ospf 1 route-map REDIST
 neighbor 1.2.3.4 remote-as 65000
 network 192.168.2.0 mask 255.255.0
end
```

```
R1_out - Notepad
File Edit Format View Help

Last configuration change at 17:41:34 EST Sat May 4 2013 by admin
NVRAM config last updated at 17:42:05 EST Sat May 4 2013 by admin

version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec localtime show-timezone
no service password-encryption
!
hostname R1
!
boot-start-marker
boot-end-marker
!
logging buffered 4096 notifications
!
no aaa new-model
clock timezone EST -5
dot11 syslog
ip cef
!
no ip dhcp use vrf connected
ip dhcp excluded-address 192.168.1.1-192.168.1.254
!
ip dhcp pool mypool
 network 192.168.1.0 255.255.255.0
 default-router 192.168.1.254
 dns-server 8.8.8.8
```

```
17
18 For Each objFile In objFolder.Files
19 Set objReadFile = objFSO.OpenTextFile(objFile.Path, ForReading)
20 Do Until objReadFile.AtEndOfStream
21 strLine = objReadFile.ReadLine
22 If left(strLine,8) = "hostname" Then
23 strHostName = Mid(strLine, 10)
24 ElseIf left(strLine,9) = "interface" Then
25 strIntName = Mid(strLine, 11)
26 If left(strIntName,2) = "Fa" or left(strIntName,2) = "Te" Then
27 intRow1 = intRow1+1
28 strIntCfg = " shutdown"
29 strTrunk = ""
30 strLine = objReadFile.ReadLine
31 Do Until objReadFile.AtEndOfStream or (left(strLine,1)<>" ")
32 If strLine = " switchport mode trunk" Then
33 strTrunk = " trunk"
34 ElseIf strLine = " spanning-tree portfast" Then
35 strLine = " spanning-tree port type edge"&strTrunk
36 End If
37 If strLine <> " no ip address" Then
38 strIntCfg = strIntCfg&Chr(10)&strLine
39 End If
40 strLine = objReadFile.ReadLine
41 Loop
42 strIntName=Replace(strIntName,"FastEthernet","")
43 strIntName=Replace(strIntName,"GigabitEthernet","")
44 strIntName=Replace(strIntName,"TenGigabitEthernet","")
45 objSheet.Cells(intRow1,1).Value = strHostName
46 objSheet.Cells(intRow1,2).NumberFormat = "0"
47 objSheet.Cells(intRow1,2).Value = strIntName
48 objSheet.Cells(intRow1,3).Value = strIntCfg&Chr(10)&"!"
49 ElseIf left(strIntName,4) = "Port" Then
50 intRow2 = intRow2+1
51 strIntCfg = ""
52 strLine = objReadFile.ReadLine
53 Do Until objReadFile.AtEndOfStream or (left(strLine,1)<>" ")
54 strIntCfg = strIntCfg&strLine&Chr(10)
55 strLine = objReadFile.ReadLine
56 Loop
57 objSheet2.Cells(intRow2,1).Value = strHostName
58 objSheet2.Cells(intRow2,2).Value = strIntName
59 objSheet2.Cells(intRow2,3).Value = strIntCfg
60 End If
61 End If
```

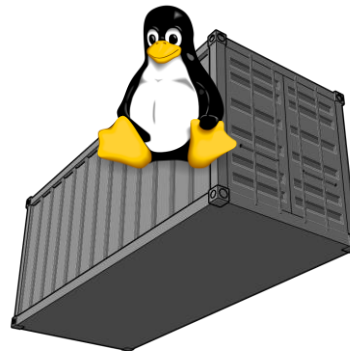
```
IP Range.bat - Notepad
File Edit Format View Help

@echo off
SET t=0
:start
SET /a t=t+1
ping -n 1 -l 1 192.168.1.%t% > nul
if %errorlevel%==0 echo Host %t% is UP! >> 192.168.1.%t%-up.txt
if %errorlevel%==1 echo Host %t% is DOWN! >> 192.168.1.%t%-down.txt
IF %t%==999 Exit
Goto start
```



# 02. 넥서스 프로그래밍

# Nexus 9000 Programmability Capabilities



# NX-OS NX-API

- Open RPC API, XML, JSON 지원
- Programmability Oriented 기반
- NX-API Developer Sandbox 지원
- CLI 기반 Input / Output에 대한 JSON/XML 결과값 도출 가능
- 개발자들을 위한 강력한 도구
- 지원 제품군
  - Nexus 9K 지원
  - 기존 Nexus 제품군 (NXOS 7.2 부터 지원)

The screenshot displays the NX-API Developer Sandbox interface. At the top, it features the Cisco logo and the title "NX-API Developer Sandbox", along with "Quick Start" and "Logout" links. The main area contains a text input field with the command "show interface brief". To the right of the input field, there are two dropdown menus: "Message format:" with options for "json-rpc", "xml", and "json"; and "Command type:" with options for "cli" and "cli\_ascii". Below the input field are "POST" and "Reset" buttons. The bottom section shows the "Request" and "Response" in JSON format, each with a "Copy" button.

```
Request:
{
  "jsonrpc": "2.0",
  "method": "cli",
  "params": {
    "cmd": "show interface brief",
    "version": 1
  },
  "id": 1
}

Response:
{
  "jsonrpc": "2.0",
  "result": {
    "body": {
      "TABLE_interface": {
        "ROW_interface": [
          {
            "interface": "mgmt0",
            "state": "up",
            "ip_addr": "10.201.30.194",
            "speed": "100",
            "mtu": 1500
          },
          {
            "interface": "Ethernet2/1",
            "vlan": "1",
            "type": "eth",
            "portmode": "trunk",
          }
        ]
      }
    }
  }
}
```

# 03. GitHub 기반의 활용



# Who-moved-my-cli python 받기

<https://github.com/datacenter>

[who-moved-my-cli](#)

Python ★ 26 🍴 29

A collection of simple Python scripts to help convert network engineers into programmer network engineers

Updated 26 days ago

1

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datacenter / who-moved-my-cli Watch 93 Star 26 Fork 30

A collection of simple Python scripts to help convert network engineers into programmer network engineers

40 commits 2 branches 0 releases 2 contributors

branch: master who-moved-my-cli +

Commit	Message	Time
minor tweaks		
paullesiak authored on 2 Feb	latest commit eF5b805ea9	
NexusConfigToEPGasVLAN.py	minor tweaks	2 months ago
README.md	Update README.md	8 months ago
bcmnxosintcompare.py	Fixed duplicated code	a year ago
cdp2desc.py	New changes for BRKDCT-1302	a year ago
cdp2descv2.py	New changes for BRKDCT-1302	a year ago
easy-ofa.py	Updated platform search logic; Added controller IP input validation	11 months ago
httpserver.py	New changes for BRKDCT-1302	a year ago
interface_rate.py	Replace cli() decorator; minor PEP8 fix	8 months ago
nxapicdp2desc.py	Update to support running both onbox and offbox	7 months ago
nxapicompare.py	New changes for BRKDCT-1302	a year ago
pingrange.py	Updated 'cli' usage to work on all Nexus platforms	a year ago
servermon.py	New changes for BRKDCT-1302	a year ago
supercommand.py	Injected with HGH.	8 months ago

Code Issues 0 Pull requests 1 Pulse Graphs

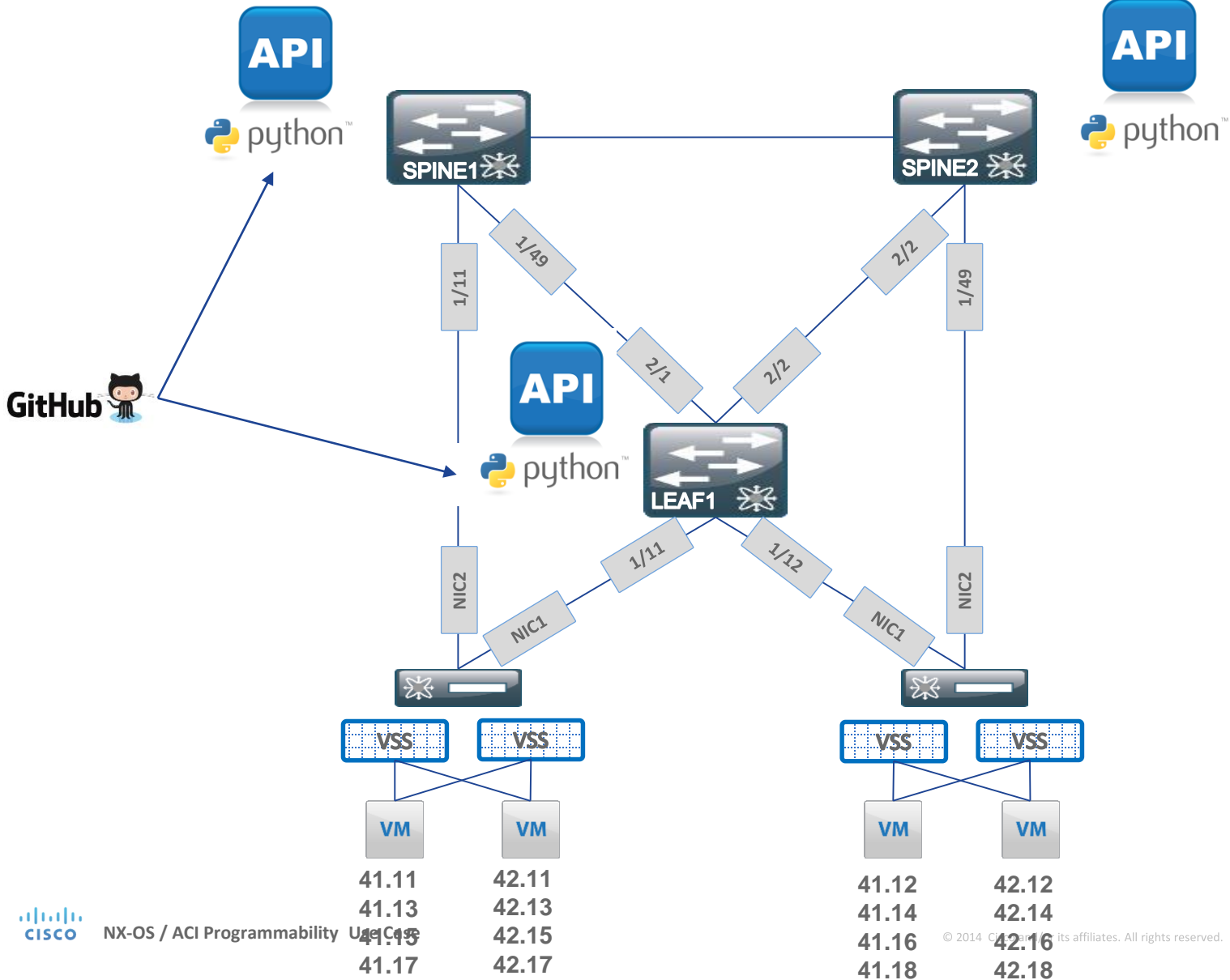
HTTPS clone URL <https://github.com/datacenter/who-moved-my-cli>

You can clone with HTTPS or Subversion

Clone in Desktop Download ZIP

Python Download

# 시험 환경 (Nexus 9K & ESX)



# Who-moved-my-cli python Loading

## 1.nxapi Feature enable

```
LEAF-1-N9396(config)# feature nxapi
LEAF-1-N9396(config)# show feature | inc nxapi
nxapi                1                enabled
```

## 2.who-moved-my-cli python script uploading

```
LEAF-1-N9396# copy ftp://root:root@64.104.105.89/supercommand.py bootflas
h:whchoi/who-moved-my-cli
Enter vrf (If no input, current vrf 'default' is considered): management
Password:
***** Transfer of file Completed Successfully *****
Copy complete, now saving to disk (please wait)...
```

## 3.새로운 명령어 만들기

```
LEAF-1-N9396(config)# cli alias name supercommand python bootflash:whchoi/who-moved-my-cli/supercommand.py
LEAF-1-N9396(config)# sh cli alias
CLI alias commands
=====
alias          :show cli alias
supercommand  :python bootflash:whchoi/who-moved-my-cli/supercommand.py
```

# Supercommand

“ 데이터센터, 캠퍼스에서 접속자 추적 하기 “

## Show ip arp

```
LEAF-1-N9396# sh ip arp 192.168.41.131

Flags: * - Adjacencies learnt on non-active FHRP router
+ - Adjacencies synced via CFSOE
# - Adjacencies Throttled for Glean
D - Static Adjacencies attached to down interface
```

```
IP ARP Table
Total number of entries: 1
Address      Age      MAC Address      Interface
192.168.41.131  00:12:30  0050.5602.0131  Vlan41
```



## Show mac address-table

```
LEAF-1-N9396# sh mac address-table address 0050.5602.0131
Legend:
* - primary entry, G - Gateway MAC, (R) - Routed MAC, O - Overlay MAC
age - seconds since last seen,+ - primary entry using vPC Peer-Link,
(T) - True, (F) - False
```

VLAN	MAC Address	Type	age	Secure	NTFY	Ports
* 41	0050.5602.0131	dynamic	0	F	F	Po11

```
LEAF-1-N9396# supercommand 192.168.41.131
Here is some information on 192.168.41.131:
MAC address: 0050.5602.0131
L3 gateway: Vlan41
Local interface: Ethernet1/1
VLAN: 41
CDP Platform: N9K-C9396TX
CDP Device ID: LEAF-3-N9396TX(SAL18370NX3)
CDP Remote Port ID: Ethernet1/1
```

## Show cdp neighbor

```
LEAF-1-N9396# sh cdp neighbors interface port-channel 11
Capability Codes: R - Router, T - Trans-Bridge, B - Source-Route-Bridge
S - Switch, H - Host, I - IGMP, r - Repeater,
V - VoIP-Phone, D - Remotely-Managed-Device,
s - Supports-STP-Dispute
```

Device-ID	Local Infrfce	Hldtme	Capability	Platform	Port ID
LEAF-3-N9396TX(SAL18370NX3)	Eth1/1	170	R S I s	N9K-C9396TX	Eth1/1



# autodescription

“ 한달에 한번 포트에 Description 달기 “

## Show cdp neighbor

## Interface description

```
N9504-A# sh cdp neighbors
Capability Codes: R - Router, T - Trans-Bridge, B - Source-Route-Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater,
                  V - VoIP-Phone, D - Remotely-Managed-Device,
                  s - Supports-STP-Dispute

Device-ID         Local Intrfce  Hldtme  Capability  Platform  Port ID
Mobile-00B-2     mgmt0         121     R S I       WS-C3750G-24P Gig1/0/8
ESXihost01       Eth1/41       171     S           VMware ESX  vmnic2
LEAF-3-N9396TX(SAL18370NX3)
Eth1/49          152          R S I s    N9K-C9396TX  Eth2/1
N9504-B(FOX1829G3FV)
Eth1/51          128          R S I s    N9K-C9504    Eth1/51
N9504-B(FOX1829G3FV)
Eth1/52          139          R S I s    N9K-C9504    Eth1/52

Total entries displayed: 5
N9504-A# conf t
Enter configuration commands, one per line. End with CNTL/Z.
N9504-A(config)# inter
interface interver
N9504-A(config)# inter ethernet 1/49
N9504-A(config-if)# description "ESX-SERVER-01"
```



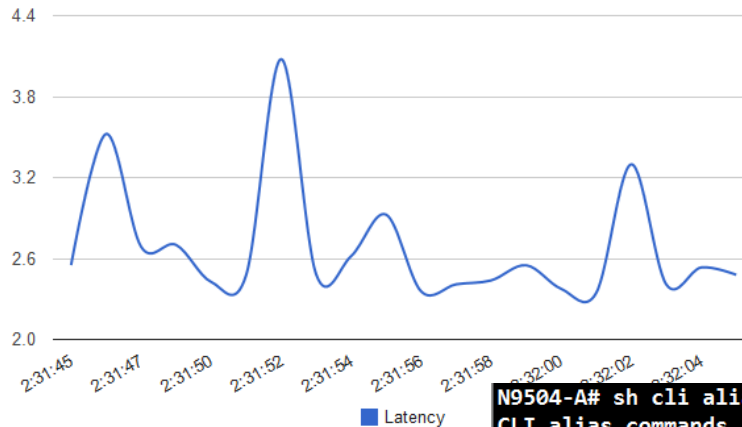
## autodescription

```
N9504-A# autocdpdec
conf t ; interface Ethernet1/41 ; description ESXihost01 vmnic2
conf t ; interface Ethernet1/49 ; description LEAF-3-N9396TX(SAL18370NX3) Ethernet2/1
conf t ; interface Ethernet1/52 ; description N9504-B(FOX1829G3FV) Ethernet1/52
conf t ; interface mgmt0 ; description Mobile-00B-2 GigabitEthernet1/0/8
conf t ; interface Ethernet1/51 ; description N9504-B(FOX1829G3FV) Ethernet1/51
```

# 응답시간 httpserver

“ httpserver 올려서 응답시간 점검하기 ”

## httpsever



```
---- addrf: ipv4
----- uptime: PT13H5M47S
----- pref: 1
----- metric: 0
----- ubest: true
----- clientname: static
----- attached: false
----- mcast-nhops: 0
----- ucast-nhops: 1
----- ipprefix: 0.0.0.0/0
-- vrf-name-out: management
```

```
N9504-A# sh cli alias
CLI alias commands
=====
alias          :show cli alias
autocdpcdec    :python bootflash:whchoi/who-moved-my-cli/nxapicdp2desc.py
interver       :python bootflash:whchoi/who-moved-my-cli/get_all_internal_versions.py
intrate        :python bootflash:whchoi/who-moved-my-cli/interface_rate.py
pingrange      :python bootflash:whchoi/who-moved-my-cli/pingrange.py
servermon      :python bootflash:whchoi/who-moved-my-cli/servermon.py
showtrans      :python bootflash:whchoi/who-moved-my-cli/showtrans.py
supercommand   :python bootflash:whchoi/who-moved-my-cli/supercommand.py
webserver      :python bootflash:whchoi/who-moved-my-cli/httpserver.py
N9504-A# webserver
10.139.4.65 - - [14/May/2015 01:30:01] "GET /latency HTTP/1.1" 200 -
10.139.4.65 - - [14/May/2015 01:30:01] "GET /latency HTTP/1.1" 200 -
10.139.4.65 - - [14/May/2015 01:30:01] "GET /latency HTTP/1.1" 200 -
10.139.4.65 - - [14/May/2015 01:30:01] "GET /latency HTTP/1.1" 200 -
10.139.4.65 - - [14/May/2015 01:30:01] "GET /latency HTTP/1.1" 200 -
10.139.4.65 - - [14/May/2015 01:30:01] "GET /latency HTTP/1.1" 200 -
```

# Interface\_rate 기반 트래픽 전체 점검

“intrate 으로 한방에 인터페이스 모니터링”

```
N9504-A# sh interface ethernet 1/1
Ethernet1/1 is down (XCVR not inserted)
admin state is up, Dedicated Interface
Hardware: 1000/10000 Ethernet, address: 1c6a.7a1f.13ff (bia 1c6a.7ac1.caa8)
MTU 1500 bytes, BW 10000000 Kbit, DLY 10 usec
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, medium is broadcast
auto-duplex, auto-speed
Beacon is turned off
Auto-Negotiation is turned on
Input flow-control is off, output flow-control is off
Auto-mdix is turned off
Switchport monitor is off
EtherType is 0x8100
EEE (efficient-ethernet) : n/a
Last link flapped never
Last clearing of "show interface" counters never
0 interface resets
5 seconds input rate 0 bits/sec, 0 packets/sec
5 seconds output rate 0 bits/sec, 0 packets/sec
Load-Interval #2: 5 minute (300 seconds)
input rate 0 bps, 0 pps; output rate 0 bps, 0 pps
RX
0 unicast packets 0 multicast packets 0 broadcast packets
0 input packets 0 bytes
0 jumbo packets 0 storm suppression packets
```

개별 인터페이스 모니터링



Interface\_rate

```
N9504-A# sh cli alias
CLI alias commands
=====
alias          :show cli alias
autocdpdec    :python bootflash:whchoi/who-moved-my-cli/nxapicdp2desc.py
interver      :python bootflash:whchoi/who-moved-my-cli/get_all_internal_versions.py
intrate       :python bootflash:whchoi/who-moved-my-cli/interface_rate.py
pingrange     :python bootflash:whchoi/who-moved-my-cli/pingrange.py
servermon     :python bootflash:whchoi/who-moved-my-cli/servermon.py
showtrans     :python bootflash:whchoi/who-moved-my-cli/showtrans.py
supercommand  :python bootflash:whchoi/who-moved-my-cli/supercommand.py
webserver     :python bootflash:whchoi/who-moved-my-cli/httpserver.py
N9504-A# intrate
Collecting and processing interface statistics ...

-----
Port          Intvl   Rx Mbps  Rx %    Rx pps  Tx Mbps  Tx %    Tx pps
-----
Ethernet1/1   5/5    0.0      0.0%    0        0.0      0.0%    0
Ethernet1/2   5/5    0.0      0.0%    0        0.0      0.0%    0
Ethernet1/3   5/5    0.0      0.0%    0        0.0      0.0%    0
Ethernet1/4   5/5    0.0      0.0%    0        0.0      0.0%    0
```

# Showtrans - Transceiver 정보를 한번에...

“showtrans로 한방에 transceiver 정보를...”

```
N9504-A# sh interface ethernet 1/41 transceiver
Ethernet1/41
transceiver is present
type is SFP-H10GB-CU3M
name is CISCO-TYCO
part number is 1-2053783-2
revision is T
serial number is TED1849B4HC
nominal bitrate is 10300 MBit/sec
Link length supported for copper is 3 m
cisco id is --
cisco extended id number is 4

N9504-A# sh interface ethernet 1/41 status
-----
Port          Name                Status      Vlan    Duplex  Speed  Type
-----
Eth1/41      ESXihost01 vmnic2  connected  trunk  full    10G    SFP-H10GB-CU3M

N9504-A# sh interface ethernet 1/41
Ethernet1/41 is up
admin state is up, Dedicated Interface
Hardware: 1000/10000 Ethernet, address: 1c6a.7ac1.cad0 (bia 1c6a.7ac1.cad0)
Description: ESXihost01 vmnic2
MTU 1500 bytes, BW 10000000 Kbit, DLY 10 usec
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, medium is broadcast
Port mode is trunk
```

Show interface 관련 명령어



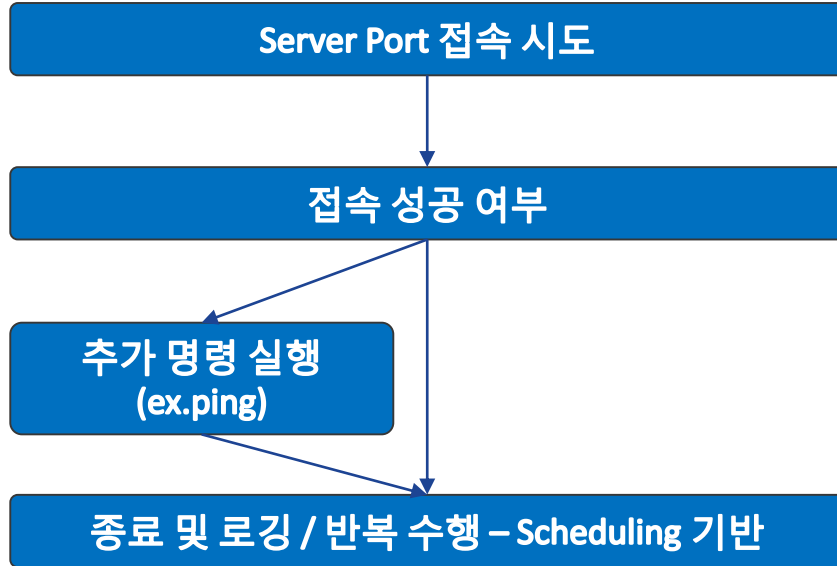
showtrans

```
N9504-A# showtrans
```

Interface	Model	Type	Name	Part	Speed	Len	CDP Neighbor
Eth1/41	N9K-X9564PX	SFP-H10GB-CU3M	CISCO-TYCO	1-2053783-2	1000,10000	3	ESXihost01@vmnic2
Eth1/49	N9K-X9564PX	QSFP-H40G-AOC3M	CISCO	AFBR-7QER03Z-CS1	40000	3	LEAF-3-N9396TX(SAL18370NX3)@Ethernet2/1
Eth1/51	N9K-X9564PX	QSFP-H40G-AOC5M	CISCO	AFBR-7QER05Z-CS1	40000	5	N9504-B(FOX1829G3FV)@Ethernet1/51
Eth1/52	N9K-X9564PX	QSFP-H40G-AOC5M	CISCO	AFBR-7QER05Z-CS1	40000	5	N9504-B(FOX1829G3FV)@Ethernet1/52

# Servermon으로 서비스 포트별 상세 모니터링

“servermon으로 서비스 포트별 모니터링”



```

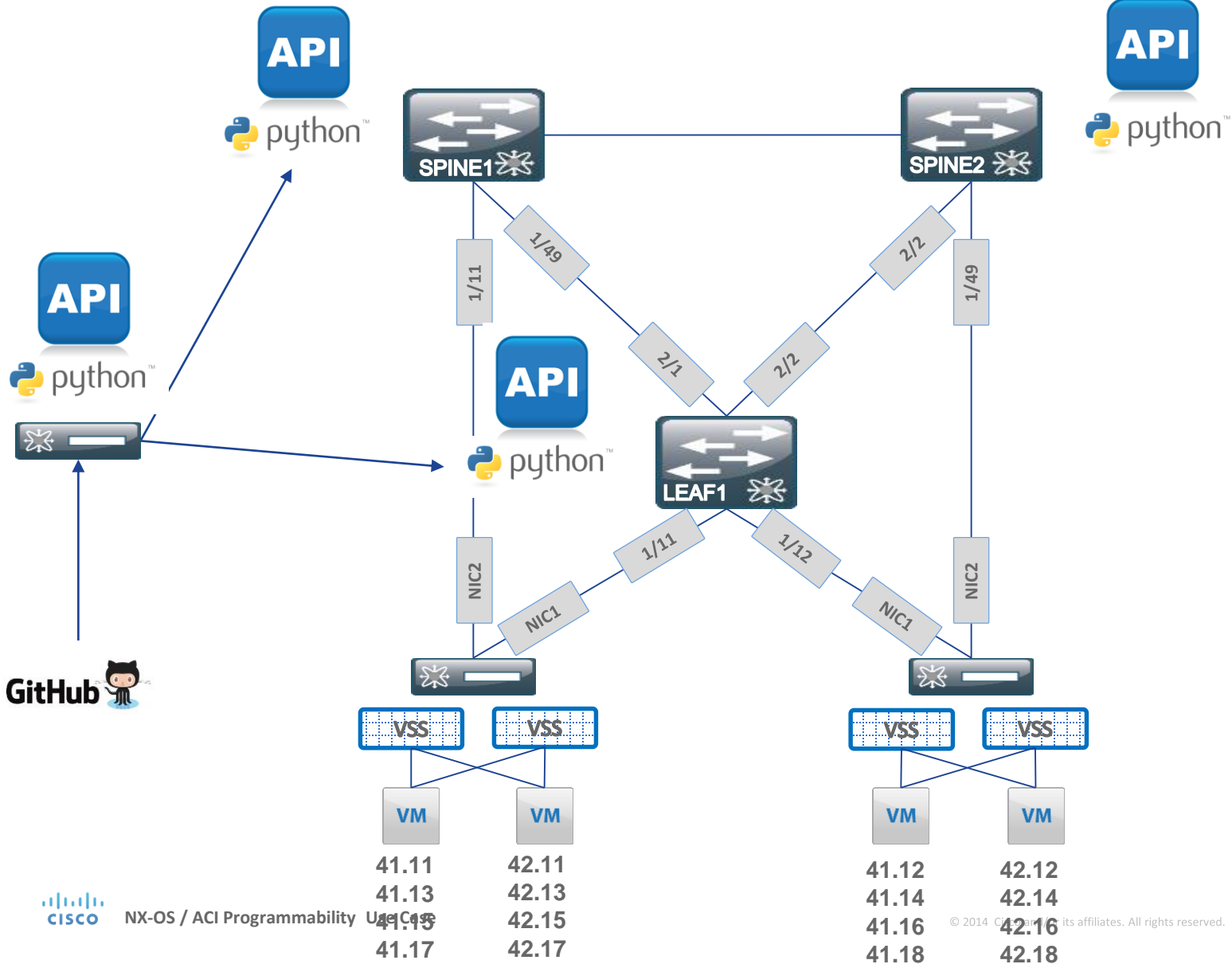
scheduler job name servermon
python bootflash:/whchoi/who-moved-my-cli/servermon.py -s 192.168.41.11 -p 80 ping 192.168.41.11 count 1

end-job

scheduler schedule name servermon
job name servermon
  
```

# 03. Nexusdash 보드 활용

# 시험 환경 (Nexus 9K & ESX)



# Nexusdash 기반 활용

The screenshot shows the GitHub interface for the repository `datacenter/nexus9000`. The current branch is `master`. The commit history table is as follows:

File	Commit Message	Time
Update README.rst	Update README.rst	9 months ago
..	..	..
dashboardperdevice	Adding nexusdash to nexus9000	9 months ago
hostnames	Adding nexusdash to nexus9000	9 months ago
nexusdash	Adding nexusdash to nexus9000	9 months ago
screenshots	Adding nexusdash to nexus9000	9 months ago
utils	Adding nexusdash to nexus9000	9 months ago
.gitignore	Adding nexusdash to nexus9000	9 months ago
LICENSE.txt	Adding nexusdash to nexus9000	9 months ago
README.rst	Update README.rst	9 months ago
manage.py	Adding nexusdash to nexus9000	9 months ago
requirements.txt	Adding nexusdash to nexus9000	9 months ago

The README.rst content is as follows:

## NexusDash

### Program

Nexus Dash

- A Django based monitoring web dashboard for Nexus machines. Simply drop-in the app and go!



# 오늘 시간의 준비 내용과 과제

- 프로그래밍 관련 어떠한 선수지식도 필요없음.
- GitHub 기반의 공개 Python 활용
- 편리한 운영을 위한 첫걸음과 활용법
- DevOps로 거듭나기 위한 IT 운영자를 위한 시간

## Nexus Programmability



# 04. ACI Overview

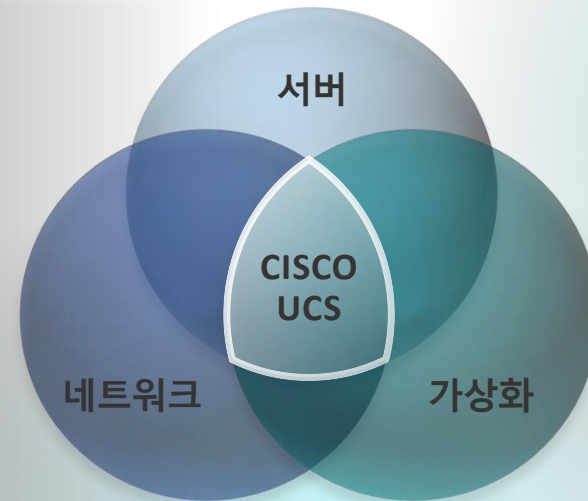
# ACI 기술 배경

## Cisco UCS로 부터의 출발

### 2009년 고객의 x86에 대한 요구사항

#### Help Me:

- 최적의 OpEx : 운영의 편의성
- 최적의 가상화 플랫폼
- 신속성 : 자동화, 빠른 배치
- 확장성과 보안



### 2009: x86의 혁신, UCS

Service Profile

Nexus 5K  
+  
FEX

개방형 API  
에코 시스템

# ...Network Transforming 을 위한 새로운 혁신

**ANY NETWORK 환경 수용**

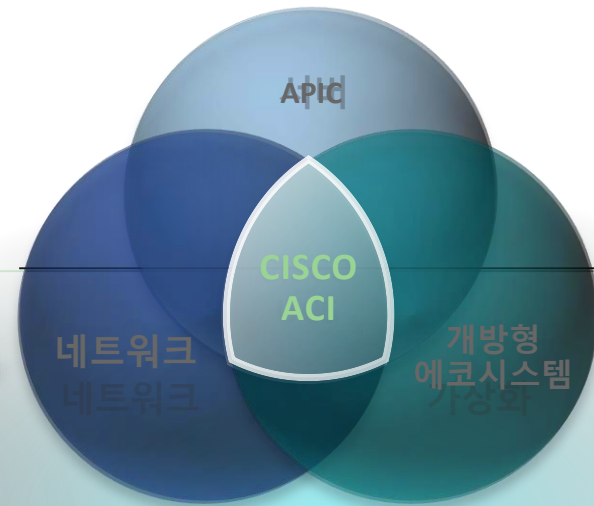
서버

- 1 개방형 Northbound & Southbound 인터페이스 구현
- 2 멀티 벤더 / 멀티 하이퍼바이저 환경 수용
- 3 물리적 & 가상화 환경 수용

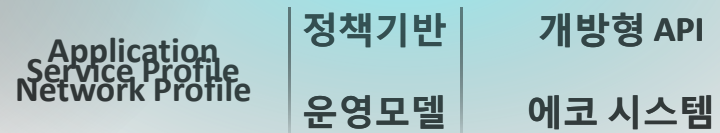
2009

정책기반 가상형 API

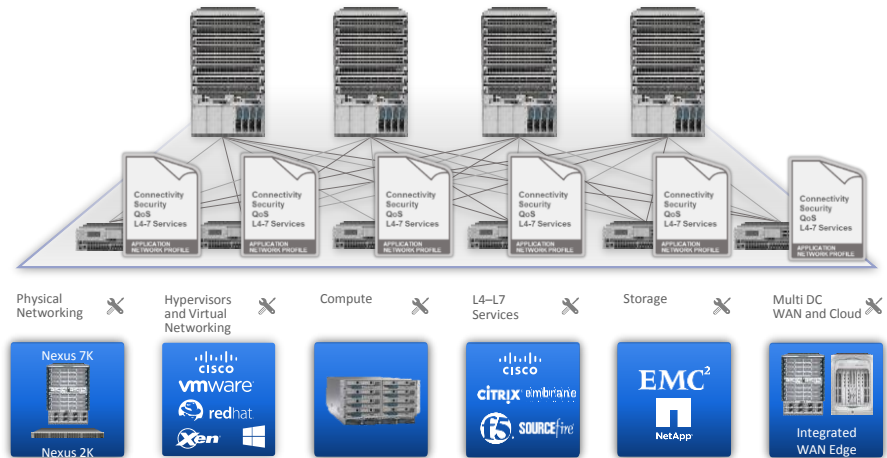
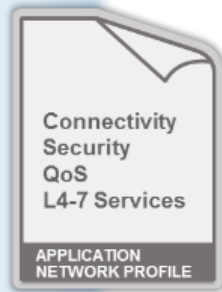
Service 운영모델 에코 시스템



## 2014: ACI INNOVATIONS



# Cisco Application Centric Infrastructure: UCS 기반의 검증된 기술 아키텍처 적용



**1** Application 중심의 정책 적용

**2** Application Network Profile Templates 생성

**3** ACI 인프라 전체 일괄 배포 및 적용

**4** 운영환경에 최적화된 구성 및 운영

**SYSTEMS APPROACH:**  
확장성/보안/가시성을 겸비한 어플리케이션의 신속한 배포 및 구성

# ACI 아키텍처의 혁신



## 1 어플리케이션 중심 정책 기반 운영 모델

- 운영의 단순화
- 최적의 TCO
- 제로 Touch 프로비저닝



## 2 물리적 + 가상화 환경

- 서비스별 Health Score
- 가시성 & 분석
- 트러블 슈팅



## 3 개방형 & 보안

- 개방형 API / 오픈 소스
- 강력한 보안
- 네트워크 서비스 융합

# Cisco ACI 아키텍처 – 정책기반의 운영모델

## 데이터센터 제어 시스템의 2가지 모델

### IMPERATIVE 제어 모델



수하물 담당자 – Simple/ Basic 구조 처리

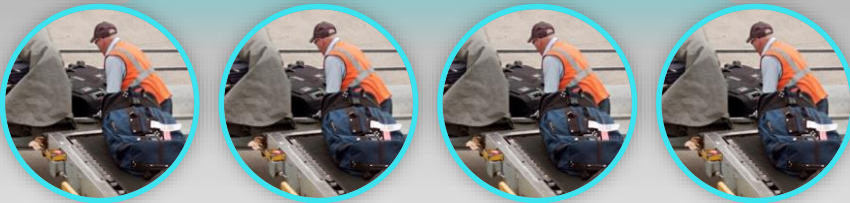
### DECLARATIVE 제어 모델



관제탑 – 이/착륙에 대한 제어  
(실제 비행기 운항에 대한 제어에는 관여하지 않음)

# Cisco ACI 아키텍처 - 1. 정책기반의 운영모델 데이터센터 제어 시스템의 2가지 모델

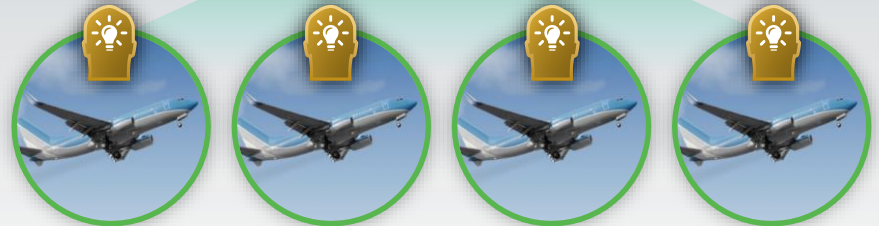
## IMPERATIVE 제어 모델



### How Model

수하물 담당자 - Simple/ Basic 구조 처리  
(하지만...모든 상세한 동작과정에 개입)

## DECLARATIVE 제어 모델



### What Model

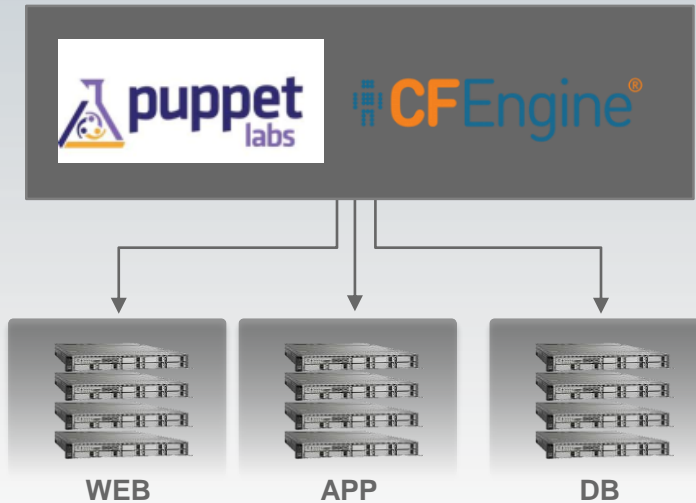
관제탑 - 이/착륙에 대한 제어  
(실제 비행기 운항에 대한 제어에는 관여하지 않음)



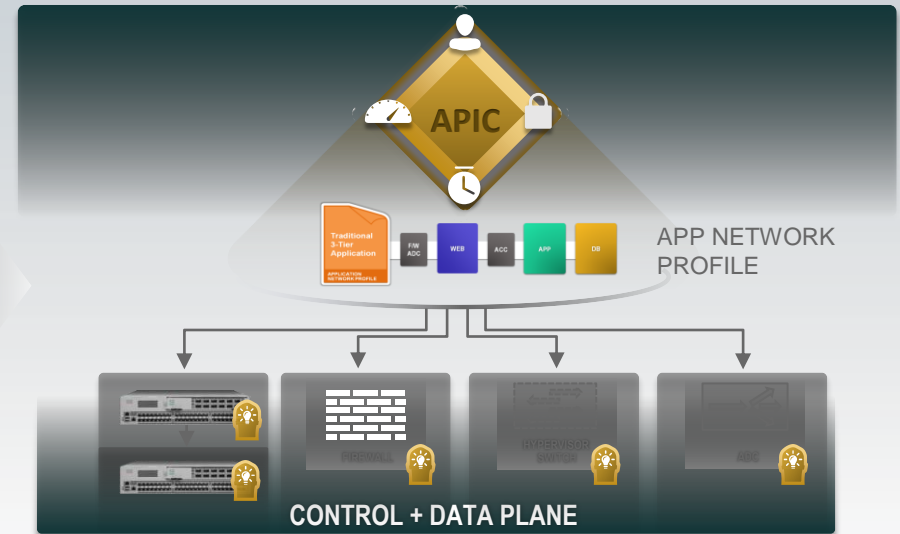
# Cisco ACI 아키텍처 - 1. 정책기반의 운영모델

## ACI POLICY 는 DevOps 모델

[ DEVOPS ]  
DECLARATIVE 제어 모델



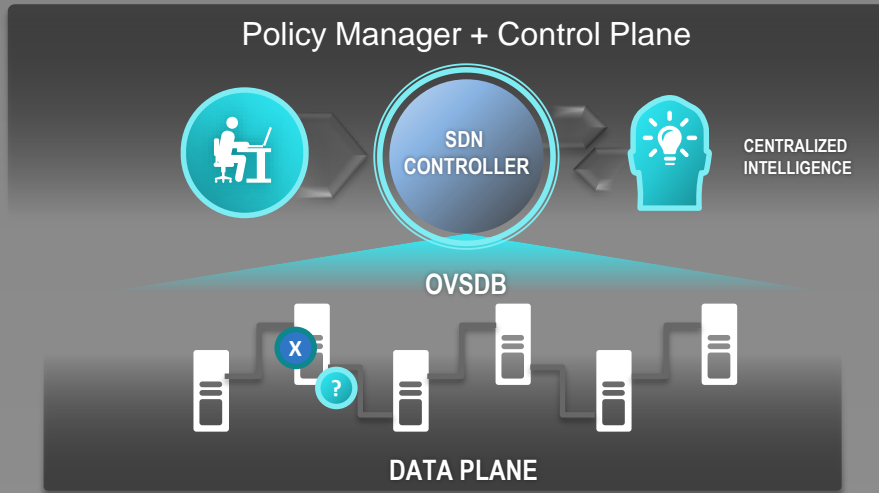
[ ACI ]  
DECLARATIVE 제어 모델



CISCO는 동일한 방식의 네트워크 환경 변화를 구현

# 데이터센터 제어 시스템의 2가지 모델 비교

## IMPERATIVE 제어모델 : 일반적인 SDN Model



개발, 운영, 인프라팀은  
Network Config를 이해해야 함.

Controller 가 병목현상 발생  
관리 Overhead 발생

개발자는 Low Level 구조를 이해하고 접근해야 함.

상호호환성에 대한 걸림돌이 많음.

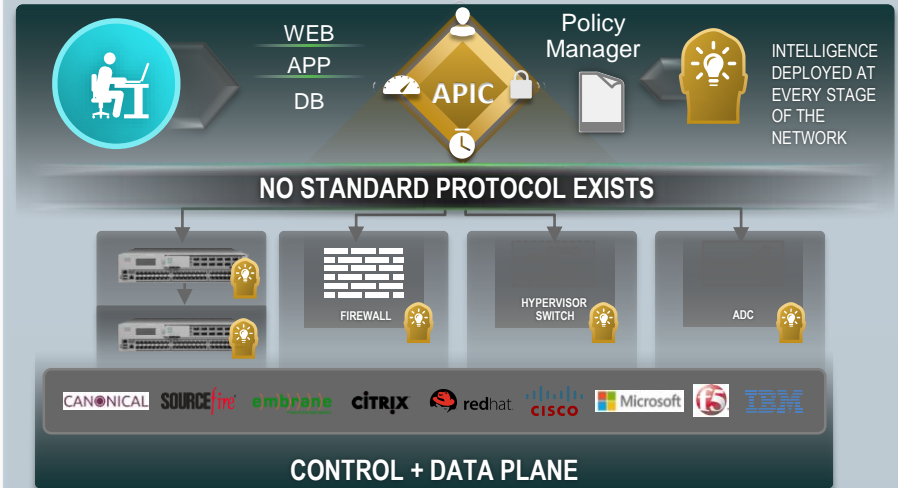
**Automation / Speed**

**Scalability and Resiliency**

**Ease of Use**

**Interoperability**

## DECLARATIVE 제어 모델 : ACI MODEL



개발, 운영, 인프라팀은 기존 R&R을 유지  
간편하고, 신속성 겸비

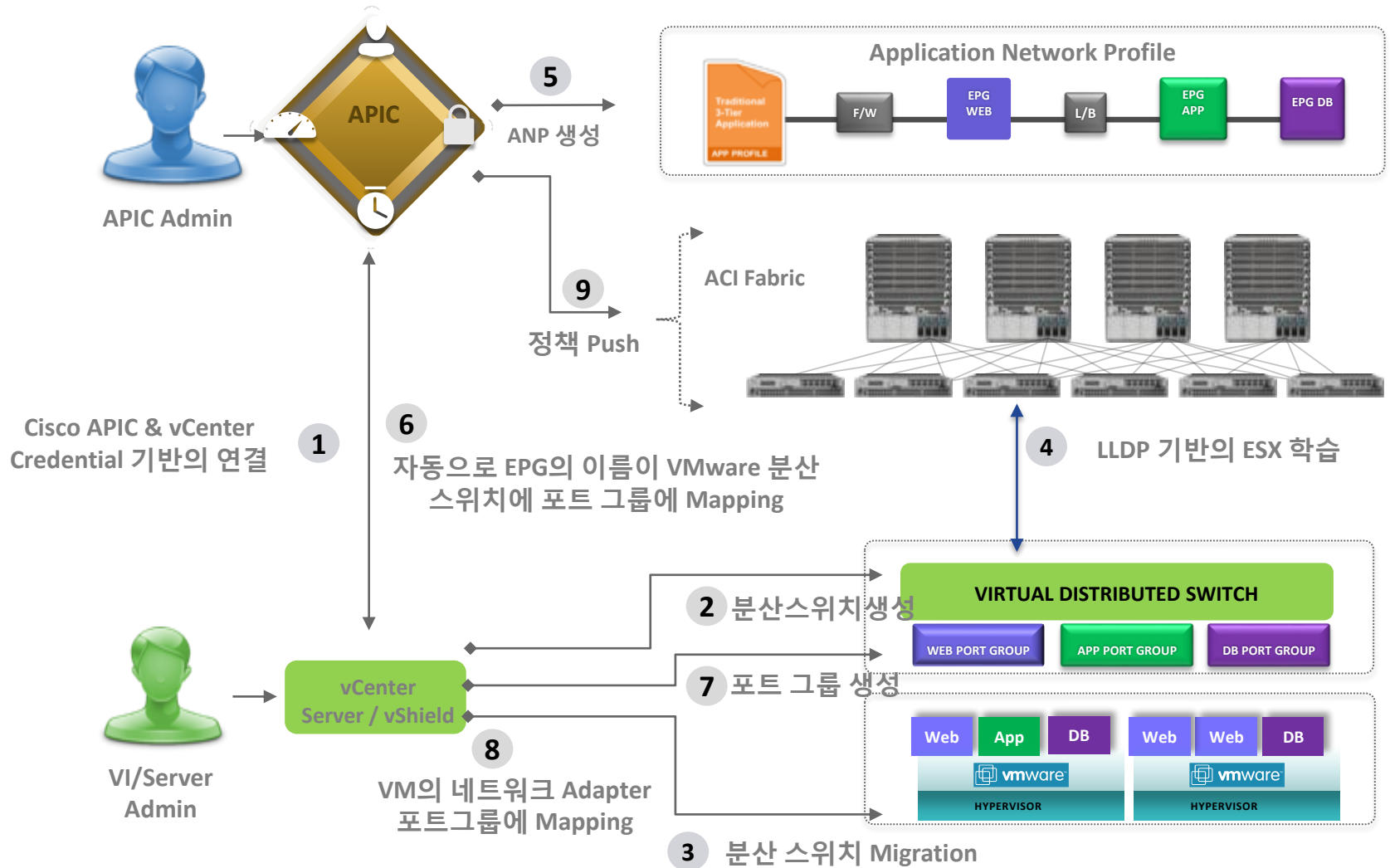
정책만 제공  
Controller는 분산되어 장애시 안정성 확보

정책에 대한 구조만 이해

상호호환성 없이,  
혁신적 기능을 모두 사용할 수 있음.

# 05. VMM Integration

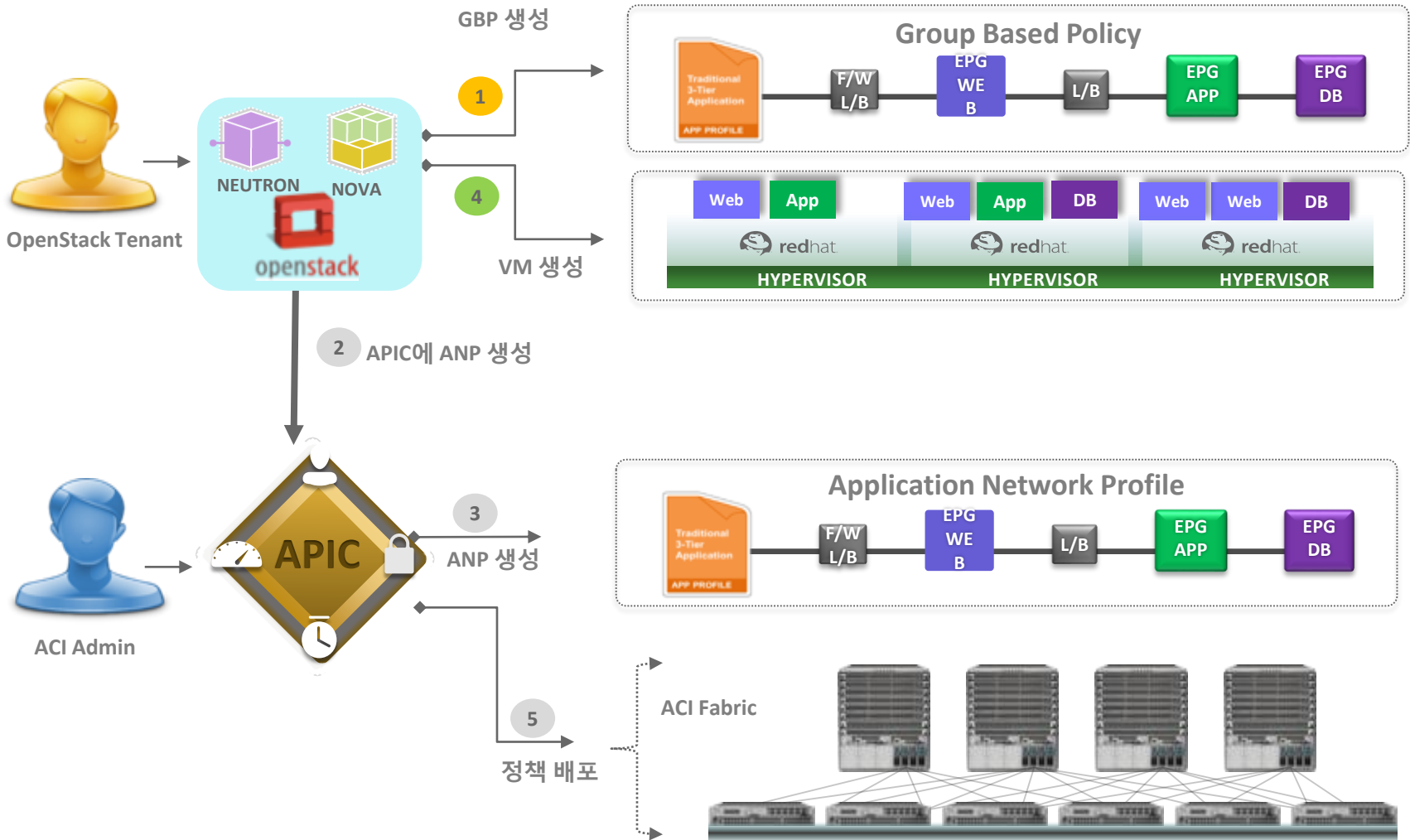
# ACI Hypervisor Integration – VMware DVS/vShield





Demo

# ACI OpenStack Integration – Phase 2 (Group-based policy-Juno)



# ACI OpenStack Integration – Phase 2 (Group-based policy-Juno)



Demo

# 06. ACIToolkit



# ACIToolkit 받기



<https://github.com/datacenter/acitoolkit>

datacenter / acitoolkit Watch 102

A basic toolkit for accessing the Cisco APIC

742 commits   4 branches   1 release   13 contributors

branch: master   acitoolkit / +

Merge branch 'master' of https://github.com/datacenter/acitoolkit

michsmit99 authored an hour ago   latest commit 804bbfe482

acitoolkit	Cleaned up populate deep	14 hours ago
applications	more test coverage and fixes for multisite	an hour ago
docs	Initial release of report GUI	29 days ago
samples	Updated import	12 days ago
scripts	Added auto update script for VM based installs	2 months ago
tests	Moved check of number of children_types to make test more informative	14 hours ago
.gitignore	Added sqlite	2 months ago
Dockerfile	added Dockerfile	3 months ago
LICENSE	Update copyright statement to year 2015 and add a better looking ASCII...	2 months ago
NOTICE	Added files	8 months ago
README.md	Update README.md	2 months ago
contributors.txt	more cleanup	4 months ago
pylintrc	Added fix for urllib3 warning found in Ubuntu 15.04	a month ago
setup.py	Incrementing version to 0.2	5 days ago
shippable.yml	Fix shippable.yml	3 months ago

Application

# ACIToolkit 맛보기

<https://github.com/datacenter/acitoolkit>

branch: **master** **acitoolkit / applications / +** ☰ 🔄

more test coverage and fixes for multisite

**michsmit99** authored an hour ago latest commit 258397121c

..

<a href="#">aci-diagram</a>	pep8 cleanup	2 months ago
<a href="#">cableplan</a>	updated import	12 days ago
<a href="#">cli</a>	Add check for password to CLI	a month ago
<a href="#">endpointtracker</a>	Refactor Endpoint Tracker GUI for cleaner pylint results	2 months ago
<a href="#">lint</a>	Changed snapshotfile option to avoid conflicts	2 months ago
<a href="#">multisite</a>	more test coverage and fixes for multisite	an hour ago
<a href="#">object_browser</a>	Initial release	19 days ago
<a href="#">reports</a>	updated import	12 days ago
<a href="#">snapback</a>	Fixed bug in scheduler on minutes close to 60	a month ago
<a href="#">visualizations</a>	Adding the ability to change the ip address and port of the server. N...	23 days ago

# ACIToolkit 맛보기 – Endpoint Tracker

<https://github.com/datacenter/acitoolkit>

Endpoint Tracker



## 시스코 코리아 데이터센터 IP-MAC 관리 웹서비스

Show 50 entries

Search:

Mac	IP	Tenant	App	EPG	Interface	Time Start	Time Stop
00:00:0C:07:AC:C8	0.0.0.0	AADC-OTV	AADC-OTV	AADC-OTV-61	vPC01	2015-06-04 21:49:29	2015-06-05 07:57:33
00:00:0C:07:AC:C8	192.168.41.1	AADC-OTV	AADC-OTV	AADC-OTV-61	vPC01	2015-06-04 21:49:29	2015-06-05 07:57:33
00:00:0C:07:AC:C8	0.0.0.0	AADC-ACT	AADC-ACT-1	AADC-EPG-1	vPC01	2015-06-04 21:31:36	2015-06-05 07:39:40
00:00:0C:07:AC:C8	192.168.41.1	AADC-ACT	AADC-ACT-1	AADC-EPG-1	vPC01	2015-06-04 21:31:36	2015-06-05 07:39:40
00:0D:EC:F6:D6:CC	0.0.0.0	CisKo-DC1	ERP	ERP-WEB	vPC01	2015-06-06 07:49:28	2015-06-06 17:57:39
00:0D:EC:F6:D6:CC	0.0.0.0	CisKo-DC2	ERP	ERP-WEB	vPC01	2015-06-06 07:49:28	2015-06-06 17:57:39
00:0D:EC:F7:0B:0C	0.0.0.0	CisKo-DC1	ERP	ERP-WEB	vPC02	2015-06-05 17:59:58	2015-06-06 04:08:06
00:0D:EC:F7:0B:0C	0.0.0.0	CisKo-DC1	ERP	ERP-WEB	vPC02	2015-06-05 18:01:04	2015-06-06 04:09:12
00:0D:EC:F7:0B:0C	0.0.0.0	CisKo-DC1	ERP	ERP-WEB	vPC02	2015-06-05 18:01:19	2015-06-06 04:09:27
00:0D:EC:F7:0B:0C	0.0.0.0	CisKo-DC1	ERP	ERP-WEB	vPC02	2015-06-05 18:42:53	2015-06-06 04:51:01
00:0D:EC:F7:0B:0D	0.0.0.0	CisKo-DC1	ERP	ERP-APP	vPC02	2015-06-06 10:57:00	2015-06-06 21:05:12
00:0D:EC:F7:0B:0D	0.0.0.0	CisKo-DC2	ERP	ERP-WEB	vPC02	2015-06-06 10:58:23	2015-06-06 21:06:34
00:0D:EC:F7:0B:0D	0.0.0.0	CisKo-DC1	ERP	ERP-WEB	vPC02	2015-06-06 10:57:56	2015-06-06 21:06:08
00:0D:EC:F7:0B:0D	0.0.0.0	CisKo-DC1	ERP	ERP-APP	vPC02	2015-06-06 10:58:02	2015-06-06 21:06:14

# ACIToolkit 맛보기 – Visualization

<https://github.com/datacenter/acitoolkit>

## Visualization

### 시스코 코리아 데이터센터 서버(EP) 위치 웹서비스 (Force Diagram)

서버(EP)-네트워크 스위치 연동 위치 서비스를 제공하여 드립니다.

### 시스코 코리아 데이터센터 태넌트당 서버 분포 (Pie Chart)

Pie Chart 기반으로 태넌트당 서버 분포를 제공해 드립니다.



시스코 코리아 데이터센터 ACI 네트워크 관리 웹서비스

### 시스코 코리아 데이터센터 태넌트 관리 웹서비스 (Tree Diagram)

태넌트-서비스그룹(EPG)-서버 연동 관계를 Tree 구조로 제공해 드립니다.

### 서비스 그룹(EPG) - 서버(EP) 방사형 다이어그램 (Radial Diagram)

서비스 그룹(EPG)과 서버간(EP)의 연동관계를 방사형 다이어그램으로 제공해 드립니다.

### 서비스 그룹(EPG) - 서버(EP) 선버스트 다이어그램 (Sunburst Diagram)

서비스 그룹(EPG)과 서버간(EP)의 연동관계를 선버스트 다이어그램으로 제공해 드립니다.

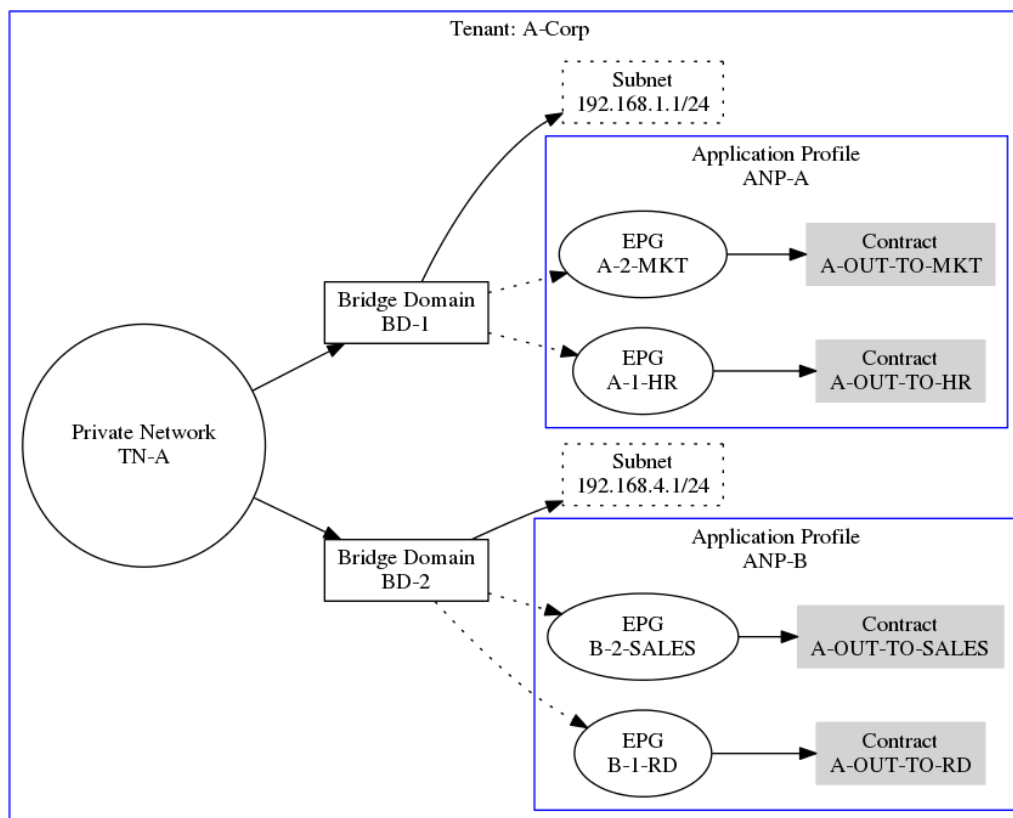
### 서비스 그룹(EPG) - 서버(EP) 계층 구조 다이어그램 (Hierarchical Bundling Diagram)

서버(EP)들의 Contract 연관 구조에 따른 계층 구조를 다이어그램으로 제공해 드립니다.

# ACIToolkit 맛보기 – Diagram 생성기

<https://github.com/datacenter/acitoolkit>

## ACI-Diagram



# ACIToolkit 맛보기 – ACI CLI

<https://github.com/datacenter/acitoolkit>

ACI-CLI

```
whchoi@ubuntu:~/acitoolkit/applications/cli$ sudo python acitoolkitcli.py -l admin -p 1234Qwer -u http://10.72.86.21

Cisco ACI Toolkit Command Shell
Copyright (c) 2015, Cisco Systems, Inc. All rights reserved.
fabric# show
%% Unrecognized command
fabric# show interface
Interface      Type      Status  Speed  MTU
eth 1/102/1/33 leaf      up      10G    9000
eth 1/102/1/34 leaf      up      10G    9000
eth 1/102/1/35 leaf      up      10G    9000
eth 1/102/1/36 leaf      up      10G    9000
eth 1/102/1/37 leaf      up      10G    9000
eth 1/102/1/38 leaf      up      10G    9000
eth 1/102/1/39 leaf      up      10G    9000
eth 1/102/1/40 leaf      up      10G    9000
eth 1/102/1/41 leaf      up      10G    9000
eth 1/102/1/42 leaf      up      10G    9000
eth 1/102/1/43 leaf      up      10G    9000
eth 1/102/1/44 leaf      up      10G    9000
eth 1/102/1/45 leaf      up      10G    9000
eth 1/102/1/46 leaf      up      10G    9000
eth 1/102/1/47 leaf      up      10G    9000
eth 1/102/1/48 leaf      up      10G    9000
```

# 07. Arya

# Arya기반의 ACI 백업과 신속한 적용

<https://github.com/datacenter/arya>

Arya

datacenter / arya

Watch 66

APIC Rest to pYthon Adapter

16 commits     
 1 branch     
 4 releases     
 2 contributors

branch: master ▾ arya / +

Update usage in README

paullesiak authored 18 hours ago latest commit [fe2a1d5f25](#)

arya	Add --brief option to arya. Bump to version 1.1.4	19 hours ago
tests	Add --brief option to arya. Bump to version 1.1.4	19 hours ago
LICENSE.txt	Initial commit of arya to its own repo	3 months ago
Manifest.in	Update README in manifest	3 months ago
README.md	Update usage in README	18 hours ago
confest.py	Initial commit of arya to its own repo	3 months ago
setup.py	Rename README in setup.py to README.md	3 months ago



# ACI 아키텍처의 혁신



## 1 어플리케이션 중심 정책 기반 운영 모델

- 운영의 단순화
- 최적의 TCO
- 제로 Touch 프로비저닝



## 2 물리적 + 가상화 환경

- 서비스별 Health Score
- 가시성 & 분석
- 트러블 슈팅



## 3 개방형 & 보안

- 개방형 API / 오픈 소스
- 강력한 보안
- 네트워크 서비스 융합



**CISCO**

*TOMORROW starts here.*