



Архитектура цифровых сетей – Cisco DNA

Евгений Лысенко
системный инженер
CCNP, CCDP, CCNP DC, CCNA Sec,
CCNA Wireless

IT.Integrator

Решения, лежащие в основе архитектуры



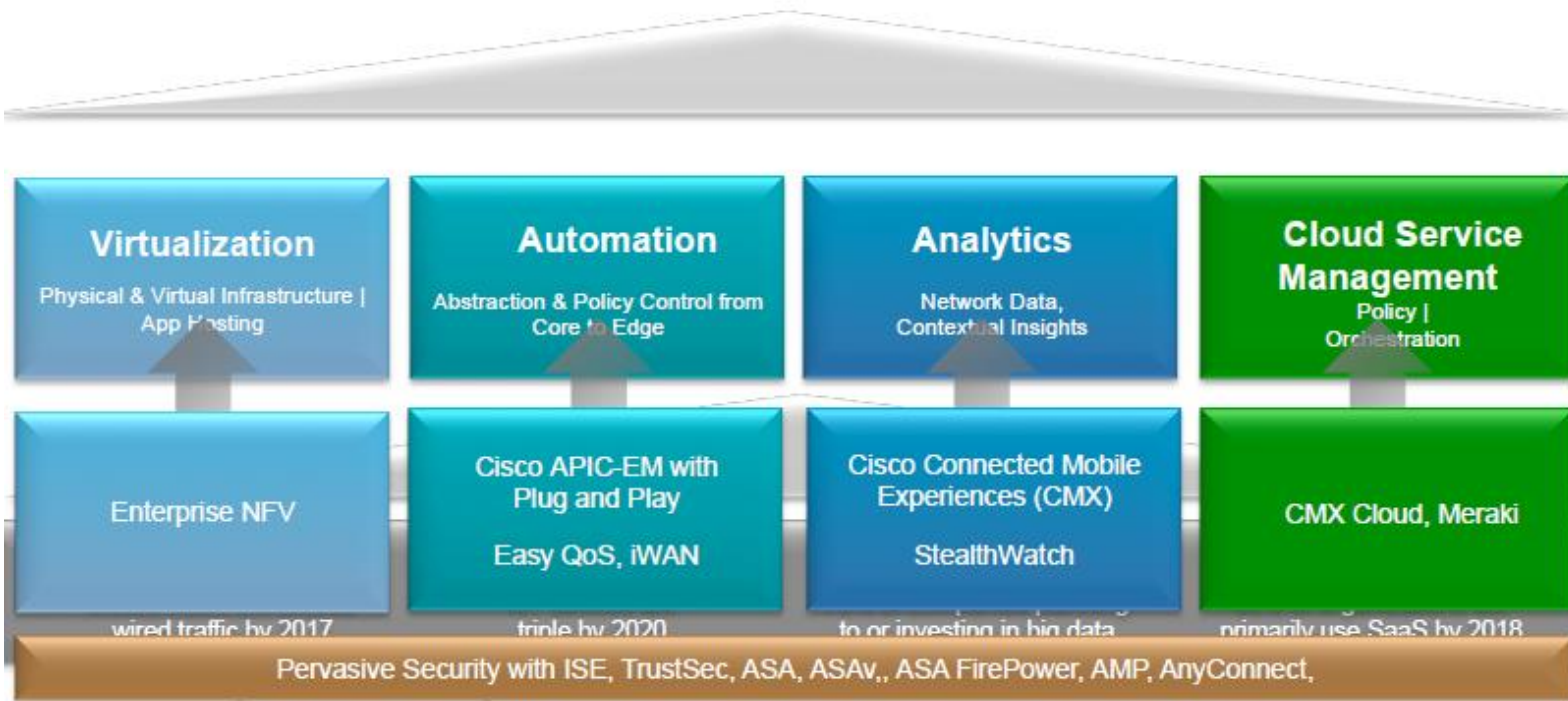
Insights &
Experiences



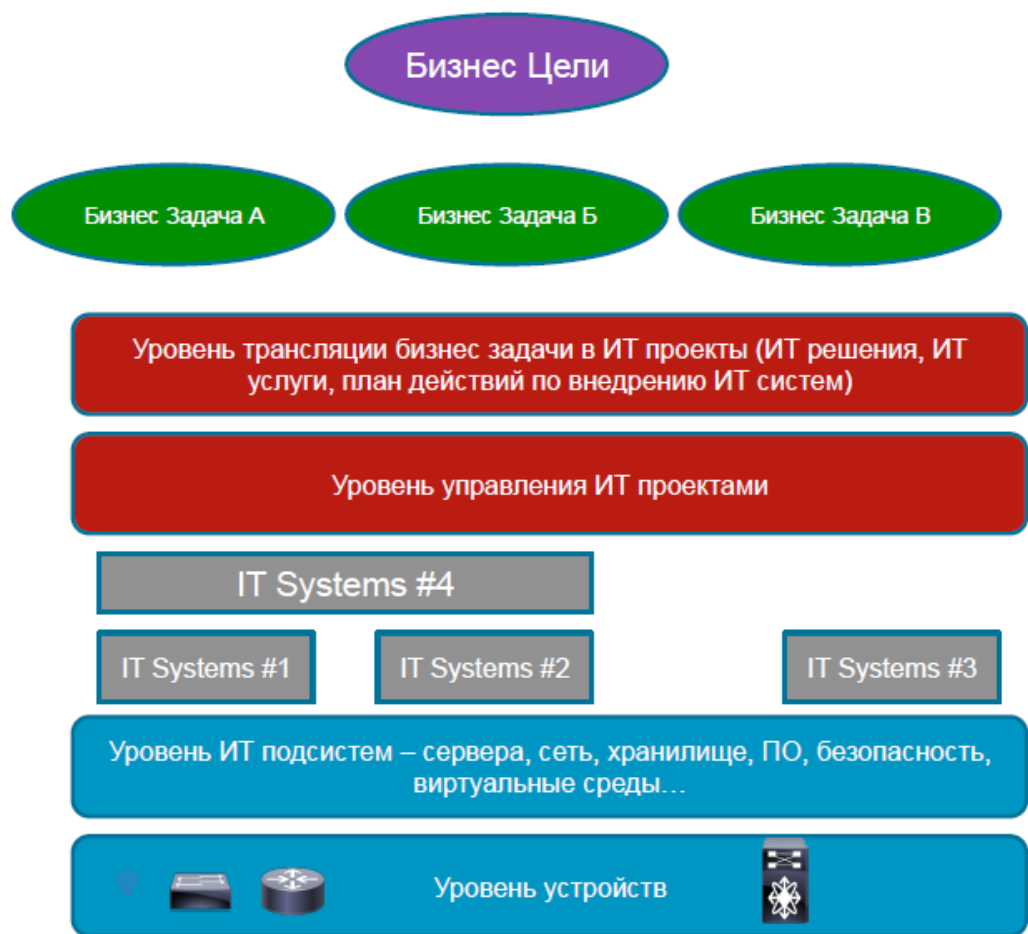
Automation
& Assurance



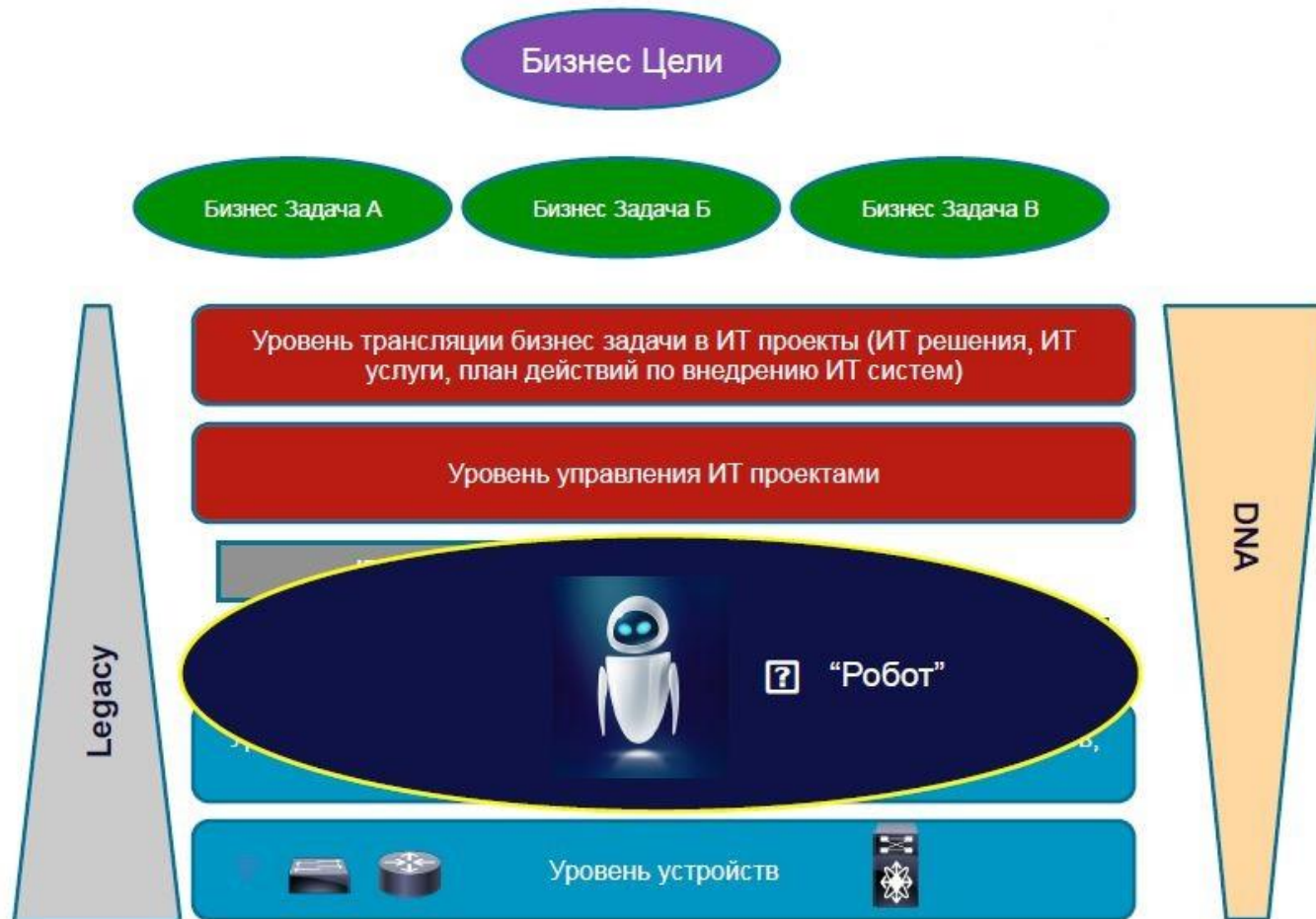
Security &
Compliance



«Стандартная модель взаимодействия Бизнеса и ИТ»

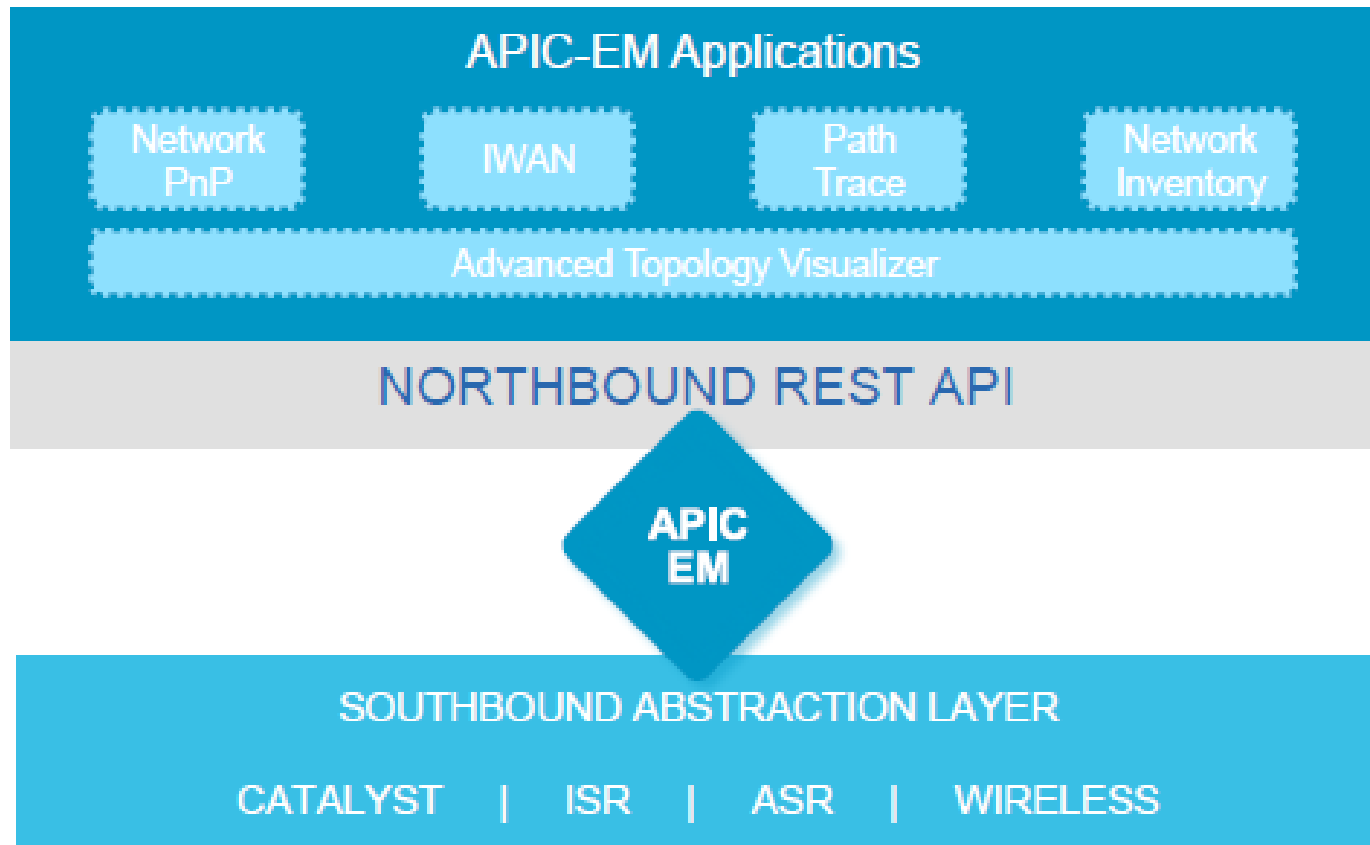


Модель при применении DNA архитектуры

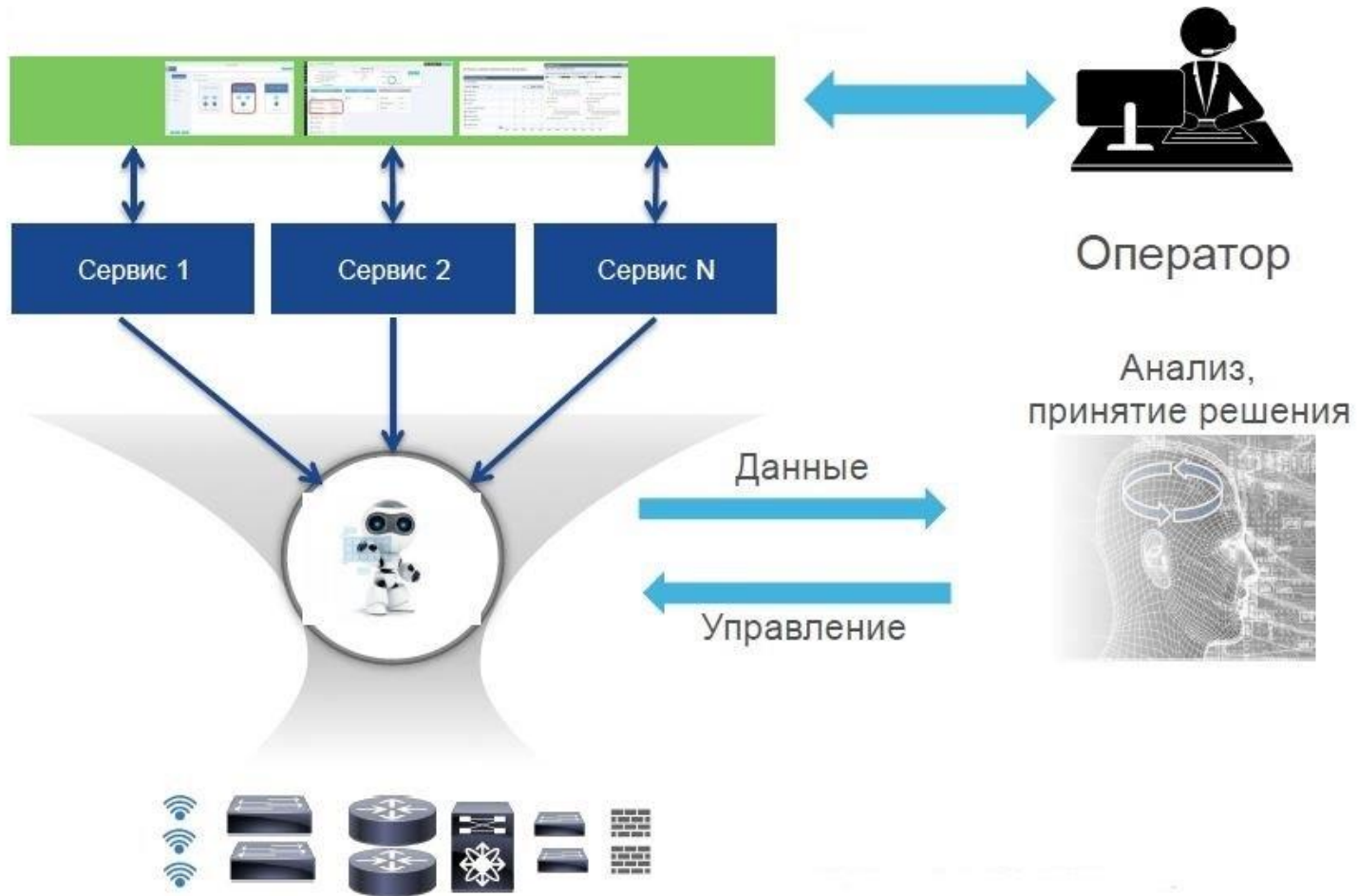


Архитектура платформы APIC-EM

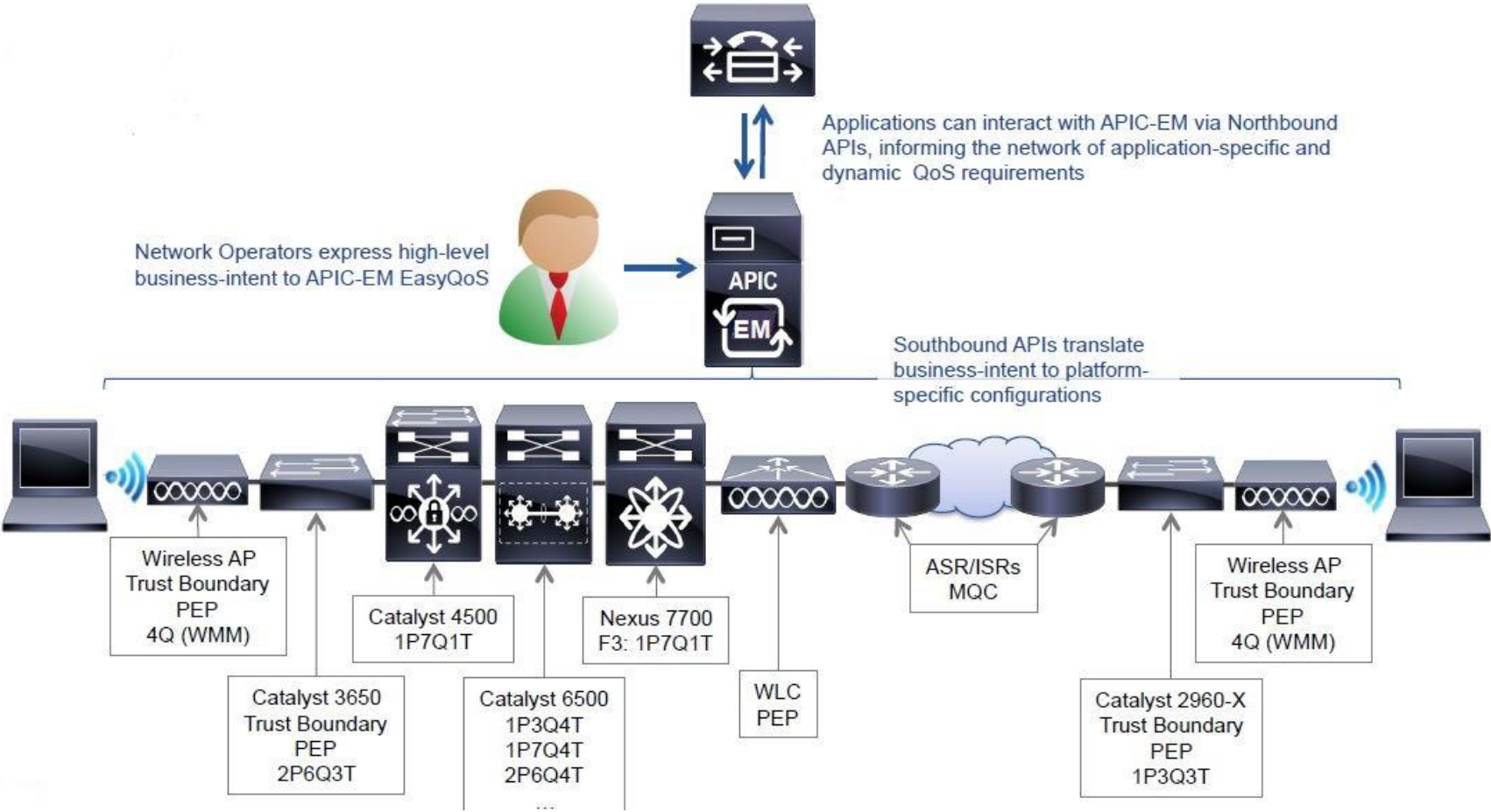
EN TECHNOLOGY DIFFERENTIATION



Автоматизация – основа для аналитики и самоорганизуемой инфраструктуры

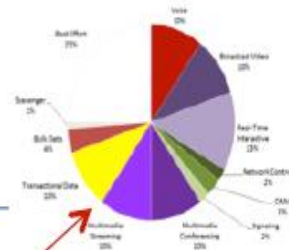


APIC-EM App: EasyQoS

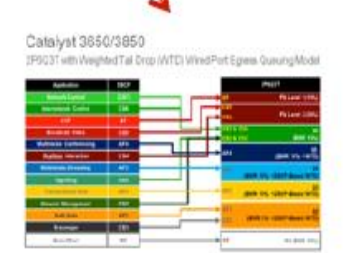
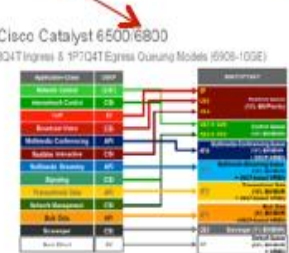
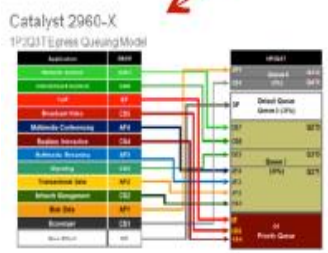
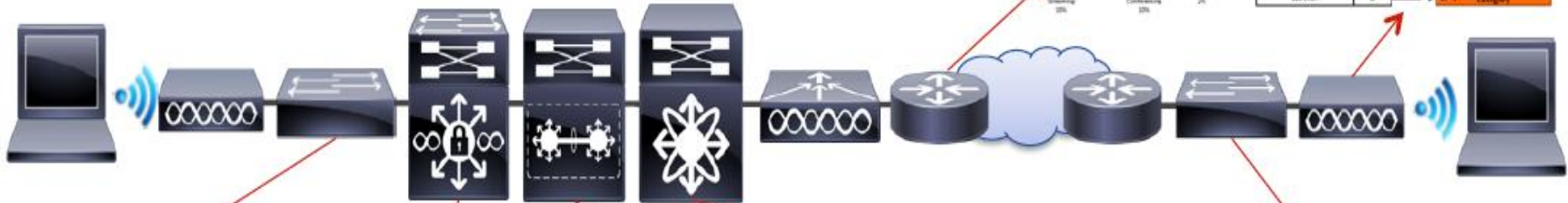


APIC-EM App: EasyQoS

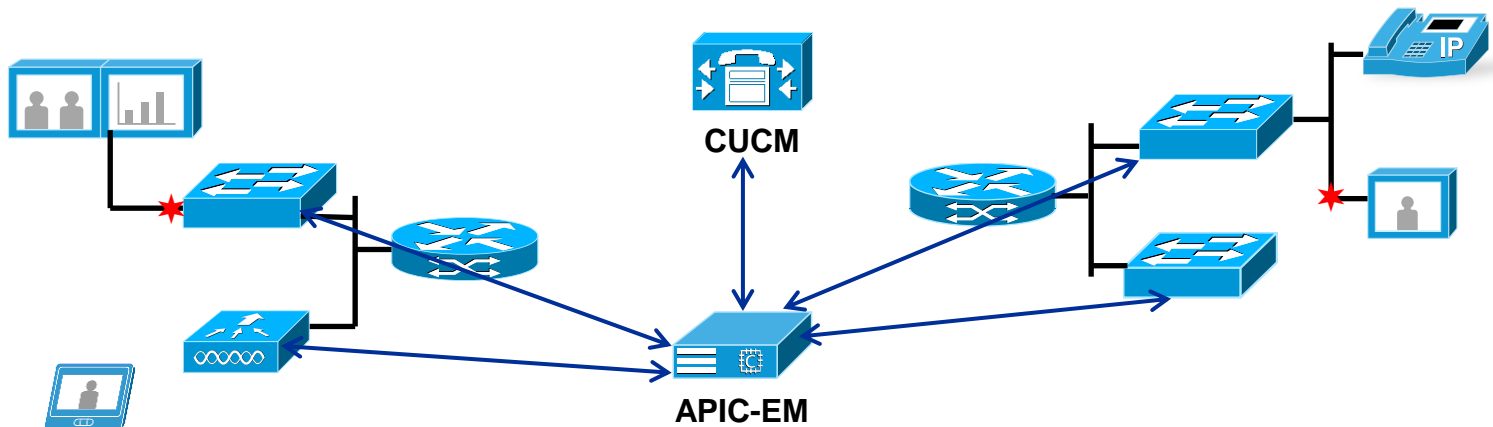
EasyQoS will *seamlessly interconnect all types of hardware and software queuing models* to achieve consistent and compatible end-to-end treatments aligned with the expressed business-intent



Queue	Model	Priority	Category
Best Effort	WFQ	1	Background Access Category
Best Effort	WFQ	2	Background Access Category
Best Effort	WFQ	3	Background Access Category
Best Effort	WFQ	4	Background Access Category
Best Effort	WFQ	5	Background Access Category
Best Effort	WFQ	6	Background Access Category
Best Effort	WFQ	7	Background Access Category
Best Effort	WFQ	8	Background Access Category
Best Effort	WFQ	9	Background Access Category
Best Effort	WFQ	10	Background Access Category
Best Effort	WFQ	11	Background Access Category
Best Effort	WFQ	12	Background Access Category
Best Effort	WFQ	13	Background Access Category
Best Effort	WFQ	14	Background Access Category
Best Effort	WFQ	15	Background Access Category
Best Effort	WFQ	16	Background Access Category
Best Effort	WFQ	17	Background Access Category
Best Effort	WFQ	18	Background Access Category
Best Effort	WFQ	19	Background Access Category
Best Effort	WFQ	20	Background Access Category



QoS Marking Via APIC-EM



1. Endpoints signal call setup to CUCM
2. CUCM extracts media addresses from call signaling
3. CUCM requests QoS setting policy on flows from APIC EM
4. APIC EM instructs switch to apply DSCP according to policy

APIC-EM App: Path Trace – Application Flow Visibility

The screenshot displays the Cisco APIC-EM Path Trace interface. At the top, the breadcrumb navigation shows "APIC - Enterprise Module" and the user "admin". The main header indicates the path trace for IP range "65.1.1.83 → 210.1.1.1".

The "Trace Results" section contains several controls: "View Small", "Show Reverse" (highlighted with a red arrow), "Scroll Lock", "Show Duplicate Devices", and "View in Topology".

The trace path is visualized in two directions:

- Forward Path:** 65.1.1.83 (Wireless) → Switched → AP7081.059f.19ca (Unified AP) → Switched → CAPWAP Tunnel → Switched → CAMPUS-Access1 (Switches and Hubs) → Switched → CAMPUS-Dist1 (Switches and Hubs) → Switched → Campus-WLC-5508 (WLC) → Switched → CAMPUS-Dist1 (Switches and Hubs) → OSPF → CAMPUS-Core1 (Switches and Hubs) → CONNECTED → CAMPUS-Router1 (Router).
- Reversed Path:** CAMPUS-Router1 (Router) → OSPF → CAMPUS-Core1 (Switches and Hubs) → Switched → CAMPUS-Dist1 (Switches and Hubs) → Switched → Campus-WLC-5508 (WLC) → Switched → CAMPUS-Dist1 (Switches and Hubs) → Switched → CAMPUS-Access1 (Switches and Hubs) → Switched → AP7081.059f.19ca (Unified AP) → Switched → 65.1.1.83 (Wireless).

Below the trace, detailed information is provided for three key nodes:

- 65.1.1.83:** IP: 65.1.1.83, Type: wireless, Link Source: Switched.
- AP7081.059f.19ca:** IP: 55.1.1.3, Type: Unified AP, Link Source: Switched, Tunnels: CAPWAP Tunnel.
- CAMPUS-Access1:** IP: 212.1.10.1, Type: Switches and Hubs, Link Source: Switched, Tunnels: CAPWAP Tunnel, Ingress Interface: GigabitEthernet1/0/26, Egress Interface: GigabitEthernet1/0/1.

APIC-EM App: Path Trace – Easy Network Troubleshooting

The screenshot displays the Cisco APIC-EM Path Trace interface. At the top, the path is defined by Hosts: 172.16.11.11 → 172.16.21.21, Source Port: 44444, Destination Port: 8888, and Protocol: TCP. A red banner indicates: "Unable to find full path. Loop detected at device R22.testlab.com".

The path trace shows the following sequence of hops:

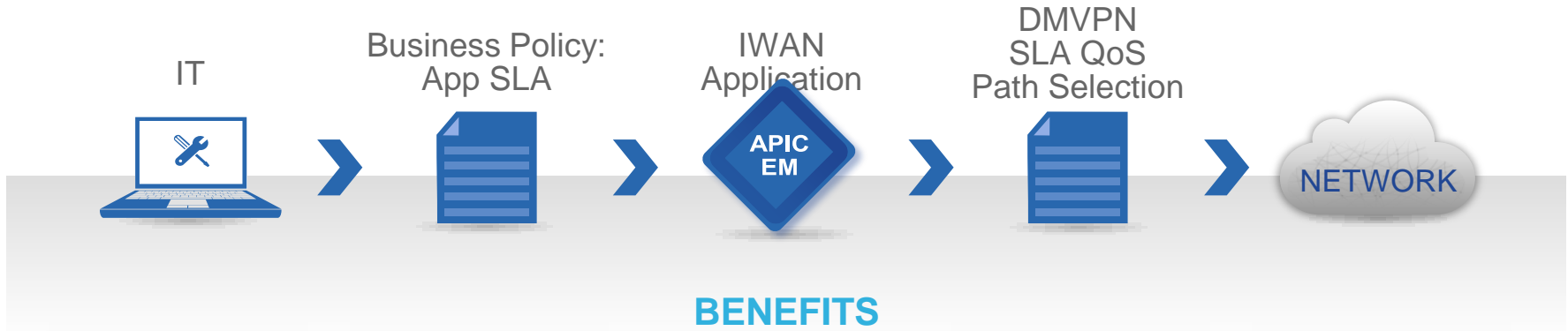
- R11.testlab.com (10.10.21.111) → R01.testlab.com (10.10.21.11) via OSPF
- R01.testlab.com (10.10.21.11) → PE1.testlab.com (10.10.21.51) via OSPF
- PE1.testlab.com (10.10.21.51) → PE2.testlab.com (10.10.21.51) via ECMP
- PE2.testlab.com (10.10.21.51) → PE4.testlab.com (10.10.21.64) via ECMP
- PE4.testlab.com (10.10.21.64) → PE2.testlab.com (10.10.21.51) via IS-IS
- PE2.testlab.com (10.10.21.51) → R02.testlab.com (10.10.21.22) via EIGRP
- R02.testlab.com (10.10.21.22) → R11.testlab.com (10.10.21.22) via EIGRP

The "Reversed" path shows a return path from R11 (10.10.21.22) through R02 (10.10.21.22), R01 (10.10.21.11), and R11 (10.10.21.111) via EIGRP. A question mark is present at the start of the reversed path.

Device details for the path:

- R11.testlab.com** (10.10.21.111): OSPF, Egress Interface: GigabitEthernet2
- R01.testlab.com** (10.10.21.11): OSPF, Ingress Interface: GigabitEthernet3, Egress Interface: GigabitEthernet2
- PE1.testlab.com** (10.10.21.51): ECMP, Ingress Interface: GigabitEthernet0/1, Egress Interface: GigabitEthernet0/2
- R22.testlab.com** (10.10.21.22): Ingress Interface: GigabitEthernet2
- R21.testlab.com** (10.10.21.21): EIGRP, Ingress Interface: GigabitEthernet2, Egress Interface: GigabitEthernet2
- R22.testlab.com** (10.10.21.22): EIGRP, Ingress Interface: GigabitEthernet2, Egress Interface: GigabitEthernet2

APIC-EM App: IWAN



BENEFITS



Simple Workflow



Zero Touch Provisioning



Network, Applications Monitoring



Business Level Policies



Open Architecture

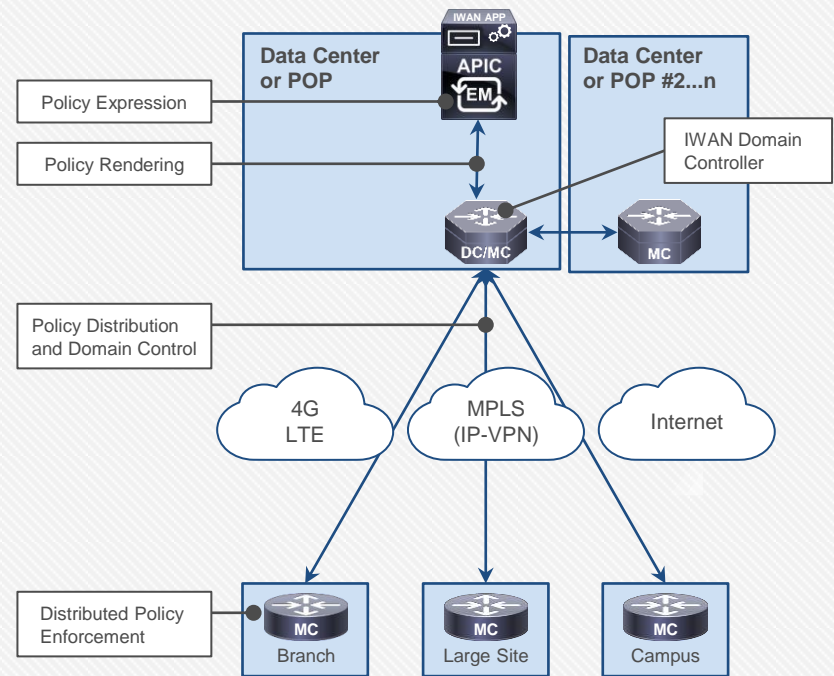
From Weeks to Minutes

Over 1000 CLI commands reduced to 10 GUI Clicks

Note: IWAN App Release 1 targets less than 500 sites, 2 links per Branch with ISR4000.

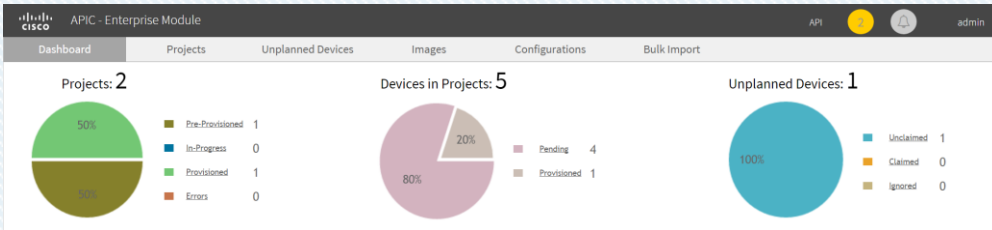
APIC-EM App: IWAN

- Cisco® APIC-EM centralized policy expression and distribution
- Distributed policy enforcement
- Automated application and topology discovery
- Application and network performance monitoring
- Adaptive path selection and QoS to sustain policy
- Performance analytics collected network-wide and reported centrally



APIC-EM App: Plug and Play (PnP)

APIC-EM PnP Dashboard



APIC-EM Bulk Import/Export

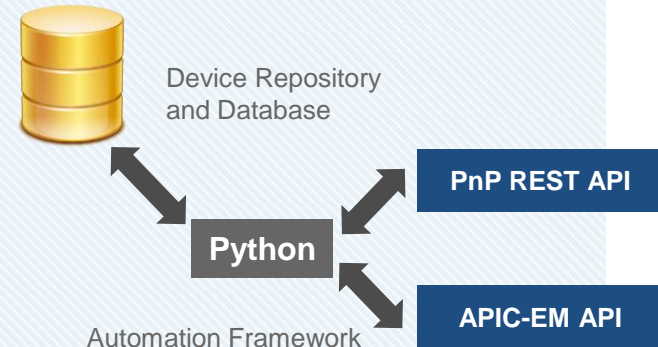
The interface shows a table for bulk import/export operations:

Date	User	Filename	Status
2015-10-26 18:54	admin	prp-service-bulk-template.csv	Completed

Below the table is a detailed log of the import process, including system messages and a table of device details.

ID	Site Name	IP	MAC	Serial Number	Device Name	Product ID	Config Name	Bootstrap	Image Name	Device Certificate
13	WS-C3850	0.0.0.0	/	FC01340226	example_switch	WS-C3850C	demo	demo	demo	FALSE
14	WS-C3850	0.0.0.0	/	BA01121806	example_router	CR013-49	demo	demo	demo	FALSE
15	WS-C3850	0.0.0.0	/	30C1340226	example_router2	CR013-49	demo	demo	demo	FALSE
16	WS-C3850	0.0.0.0	/	30C1340226	example_switch_2	WS-C3850C-2T	demo	demo	demo	FALSE

APIC-EM PnP REST API Support



Customer's Existing Automation Frameworks



Switches (Catalyst)

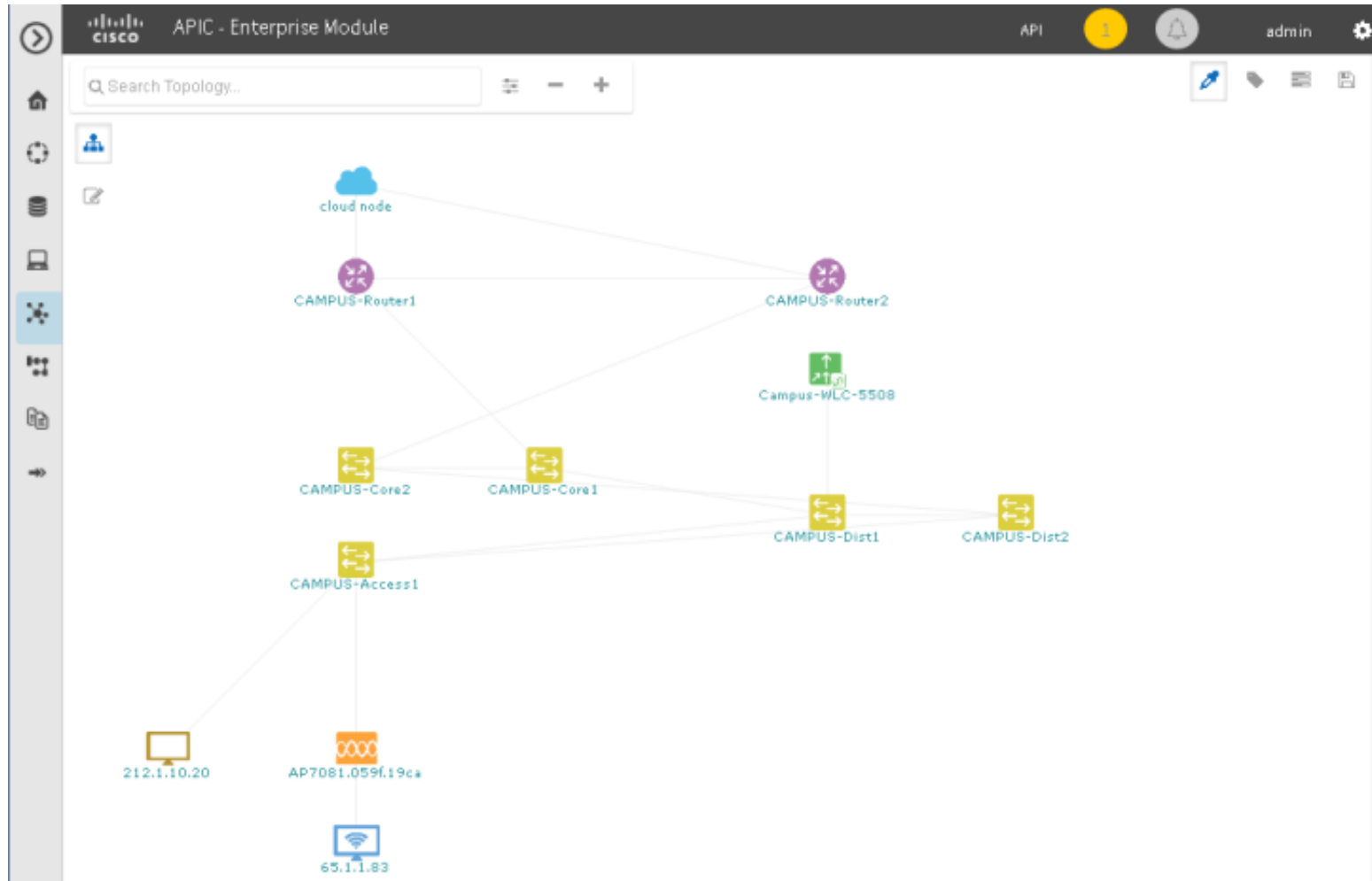


Routers (ISR/ASR)



Wireless AP

APIC-EM App: Network topology Visualization



APIC-EM: Device Inventory

APIC - Enterprise Module													
Device Status	Device Name	MAC Address	IP Address	IOS/Firmware	Platform	Serial Number	Up Time	Config	Device Role	Location	Tag	Last Updated Time	
<input type="checkbox"/>	Reachable	CSCD-HICS	C8.9C.1D.AE.BD.91	10.85.176.62	15.1(3)T	CISCO2951/K9	FTX1515AMVE	13 weeks, 1 day, 23 hours, 49 minutes	View	Border Router	Toronto - Experience Centre	3	12 days ago
<input type="checkbox"/>	Reachable	TOR-APICEM-GW	B8.38.61.34.CD.82	10.85.176.193	15.2(4)M5	C3900-SPE250/K9	FTX1801AJ1J	2 weeks, 6 days, 3 hours, 24 minutes	View	Border Router	Toronto - APIC	2	12 days ago
<input type="checkbox"/>	Reachable	TORCBC-A06-SW	00:11:21:EC:A2:41	10.85.176.24	12.2(35)SE5	WS-C3750-24P	CAT0822Z201	19 weeks, 1 day, 1 hour, 53 minutes	View	Distribution	Toronto - Experience Centre	3	12 days ago
<input type="checkbox"/>	Reachable	TORCBC-APICEM-ACCESS1	F8.C2.88.E7.C3:41	10.85.153.226	03.06.00.E	WS-C3650-48PD	FDO1823Q0Y0	2 weeks, 6 days, 3 hours, 14 minutes	View	Access	Toronto - APIC	2	12 days ago
<input type="checkbox"/>	Reachable	TORCBC-APICEM-ACCESS2	F8.C2.88.E7.CA:41	10.85.153.227	03.06.00.E	WS-C3650-48PD	FDO1823Q0YJ	2 weeks, 5 days, 21 hours, 4 minutes	View	Access	Toronto - APIC	2	12 days ago
<input type="checkbox"/>	Reachable	TORCBC-APICEM-CORE	6C.99.89.9A.9C.F6	10.85.153.129	03.06.00.E	WS-C3650-48U	FOC1824X0GX	2 weeks, 5 days, 21 hours, 36 minutes	View	Distribution	Toronto - APIC	2	12 days ago
<input type="checkbox"/>	Reachable	TORCBC-R03-SW	10.F3.11:DF:ED:41	10.85.176.3	15.2(1)E1	WS-C3560X-48P	FDO1708P0P6	7 weeks, 1 day, 2 hours, 59 minutes	View	Access	Toronto - Experience Centre	3	12 days ago
<input type="checkbox"/>	Reachable	TORCBC-BIR	7C.AD.74.AC.3F:80	10.85.176.59	15.4(2)T1	C3900-SPE150/K9	FTX1717ALXW	10 weeks, 2 days, 21 hours, 58 minutes	View	Border Router	Toronto - Experience Centre	3	12 days ago
<input type="checkbox"/>	Reachable	TORCBC-CORE	D8.67.D9.F9.1C.C1	10.85.176.1	15.2(2)E	WS-C3750X-48P	FDO1623R0DY	7 weeks, 1 day, 17 hours, 7 minutes	View	Access	Toronto - Experience Centre	3	12 days ago
<input type="checkbox"/>	Reachable	TORCBC-CORE-SW	54.78.1A.98.CF:41	10.85.176.58	12.2(55)EX2	WS-C360CG-8PC-S	FOC1638Y01X	1 year, 12 weeks, 6 days, 22 hours, 38 minutes	View	Distribution	Toronto - Experience Centre	3	12 days ago

10 15 Devices First Previous 1 4 Next Last

- CDP
- LLDP
- ICMP v2/v3
- SSH
- IP Tracking

APIC-EM: Поддержка устройств

LAN

Device Series	
Catalyst 2960-X/XR Series Switches	Catalyst 4500x Series Switches
Catalyst 2960-S Series Switches	Catalyst 4900 Series Switches
Catalyst 2960 Series Compact Switches	Catalyst 6500 Series Switches
Catalyst 3560 Series Compact Switches	Catalyst 6800 Series Switches
Catalyst 3650 Series Switches	Cisco Nexus 5000 Series Switches
Catalyst 3850 Series Switches	Cisco Nexus 7000 Series Switches
Catalyst 3750-X Series Switches	EtherSwitch Modules for Integrated Services Routers: SM-E22-16-P, SM-ES2-24-P, SM-D-ES2-48, SM-ES3-16-P, SM-ES3-24-P, SM-D-ES3-48-P
Catalyst 3560-X Series Switches	Industrial Ethernet 2000 Series Switches
Catalyst 4500 Series Switches	Industrial Ethernet 3000 Series Switches

WAN

Device Series
4000 Series Integrated Services Routers
Integrated Services Routers Generation 2
ASR 1000 Series Aggregated Services Routers
ASR 9000 Series Aggregated Services Routers
Cisco Cloud Services Router 1000v

WLAN

Device Series
Wireless LAN Controllers (IOS XE & AireOS)

Enterprise NFV - Network Function Virtualization

Cisco Enterprise Service Automation (ESA) on APIC-EM



Virtual Router
(ISRv)



Virtual Firewall
(ASAv)



Virtual WAN
Optimization (vWAAS)



Virtual Wireless LAN
Controller (vWLC)



Third-Party VNFs

Network Functions Virtualization Infrastructure Software (NFVIS)

Cisco 4000 Series ISR +
Cisco UCS® E-Series

Cisco® UCS C-Series

ENCS

Сервисы от Cisco, функционально идентичные с аналогами в аппаратном исполнении



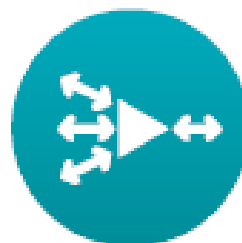
ISRV

- High Performance
- Rich Features
- End-to-end Support
- Proven Software



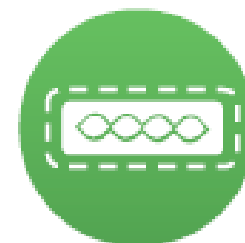
ASA/FTD*

- Comprehensive Protection
- Full DC-class Featured Functionality
- Designed for NFV
- Cost-effective with NFV



vWAAS

- Application Optimization
- Superior Caching with Akamai Connect



vWLC

- Survivability & Scale
- Consistency across the Data Center and Switches
- Built for small and medium branches

Поддержка Windows 2012 и Linux Server

NFVIS

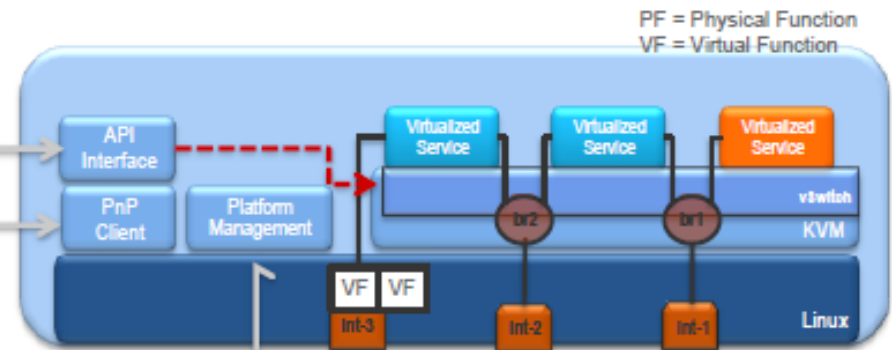
REST (HTTPS) and NETCONF (SSH)

- Register and deploy services
- Configure platform
- Gather monitoring statistics

PnP client for ZTD

Platform Management

- Controlling hardware specifics such as storage, memory, network interface connectivity
- Hardware performance such as SR-IOV



Network Function Virtualization Infrastructure Software

Варианты аппаратных платформ Cisco Intelligent Branch

Классический

Маршрутизатор



Cisco® 4000 Series ISR

Централизованные сервисы
Фиксированные встроенные сервисы
Классика

Маршрутизатор и виртуализованные сервисы



4000 Series ISR +
UCS® E-Series



Обновляемое HW
Предсказуемая производительность

Enterprise NFV

Виртуализованный маршрутизатор и сервисы



Enterprise Network
Compute System (ENCS)



Эластичность сервисов
Гибридный вариант

Виртуализованный маршрутизатор и сервисы

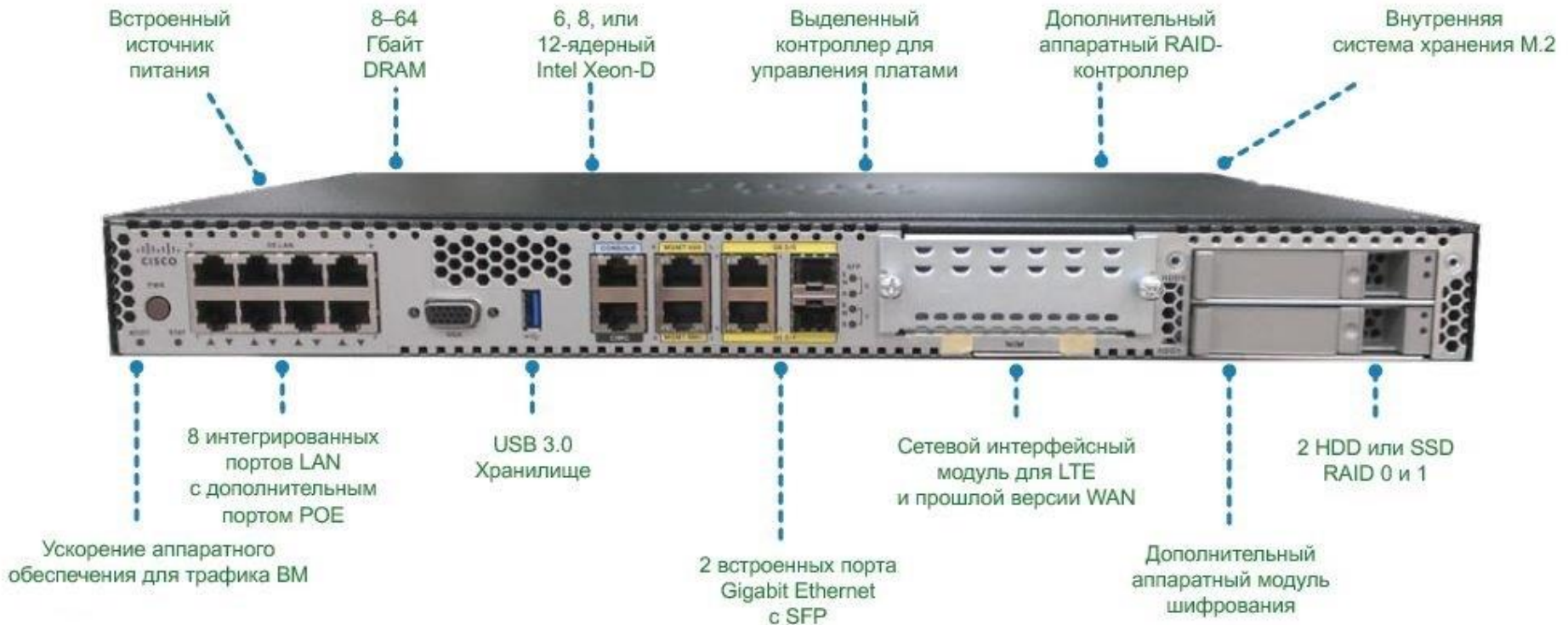


UCS C-Series

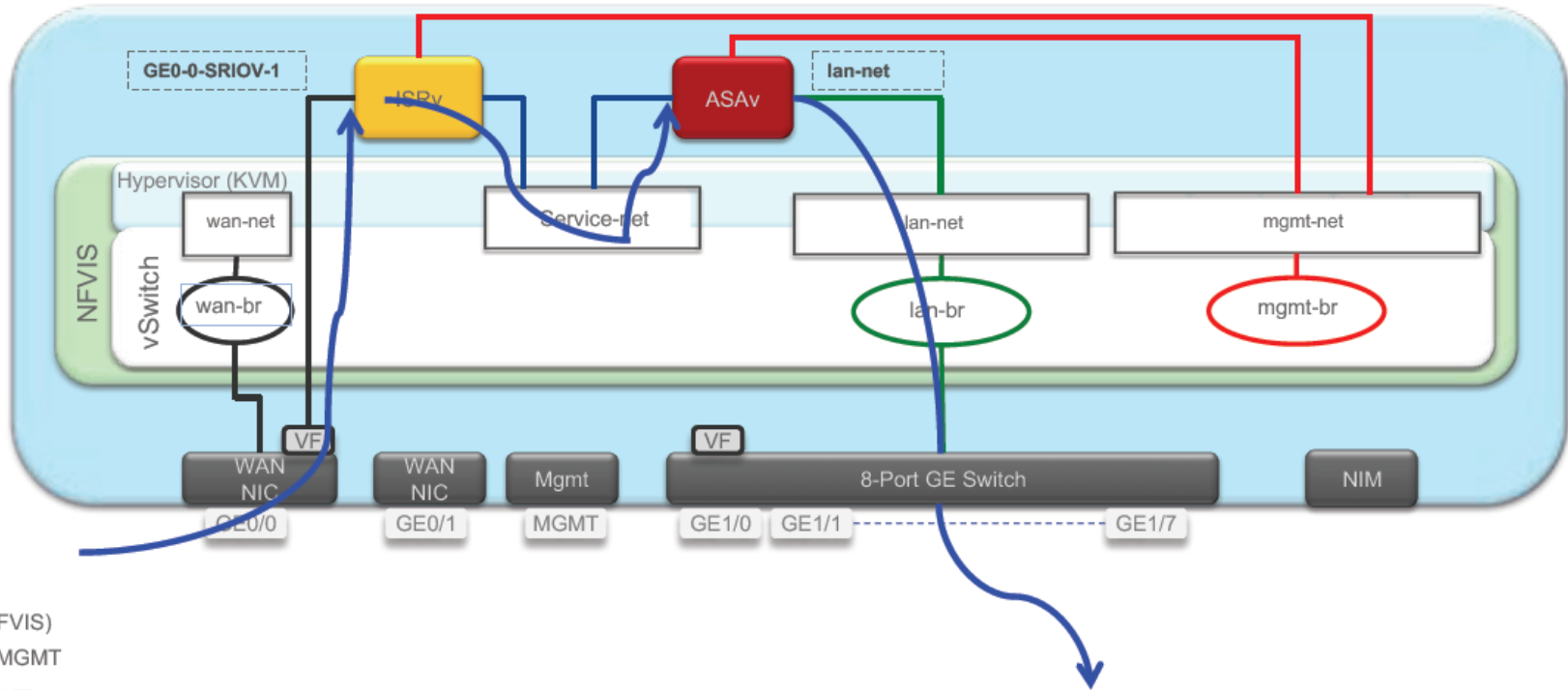


Эластичность сервисов
Производительность
Первопроходцы

ENCS 5400 Series

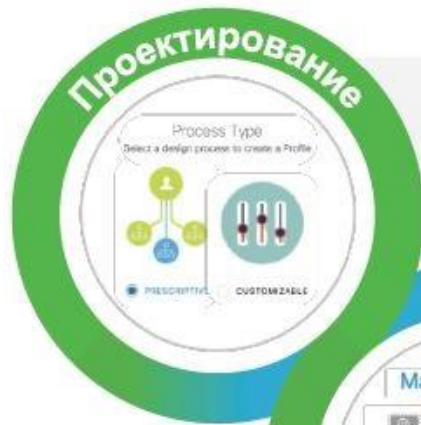


ENC5400 ISRv and ASA v



- LAN Side (NFVIS)
- Out of band MGMT
- - - Optional MGMT
- Services Side (NFVIS)
- WAN Side (NFVIS)

Автоматическая оркестрация, управление, применение политик Enterprise Service Automation (ESA)



- Стандартные шаблоны для разных типов филиалов
- Определение политик на основании приоритетов для бизнеса
- Пользовательские или предписывающие дизайны

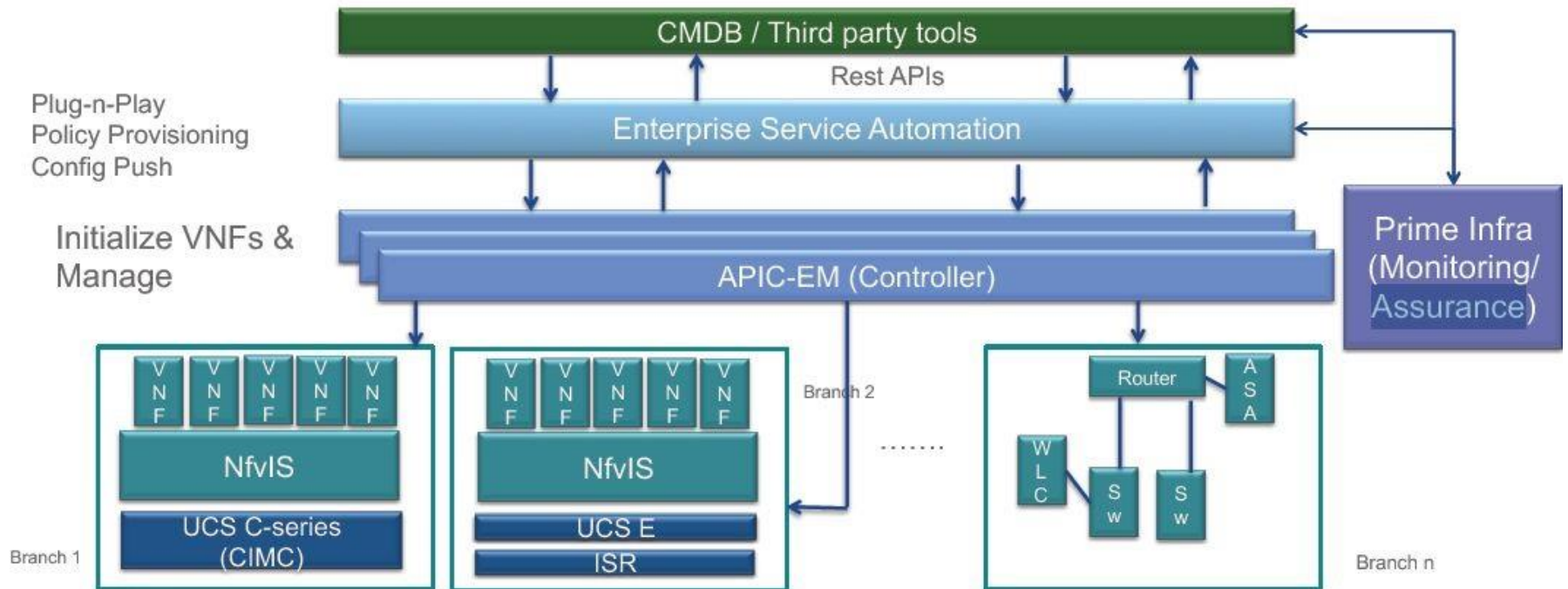


- Автоматическое развертывание
- Автоматическая оркестрация платформы и функций VNF
- Объединение сервисов и их лицензирование



- Мониторинг работоспособности
- Динамическое масштабирование сервисов по требованию
- Оперативное управление соглашениями об уровне обслуживания (SLA)

Enterprise NfV Automation



DNA - ИТОГИ



Insights &
Experiences



Automation
& Assurance



Security &
Compliance

