Application Hosting in the Intelligent WAN

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Agenda

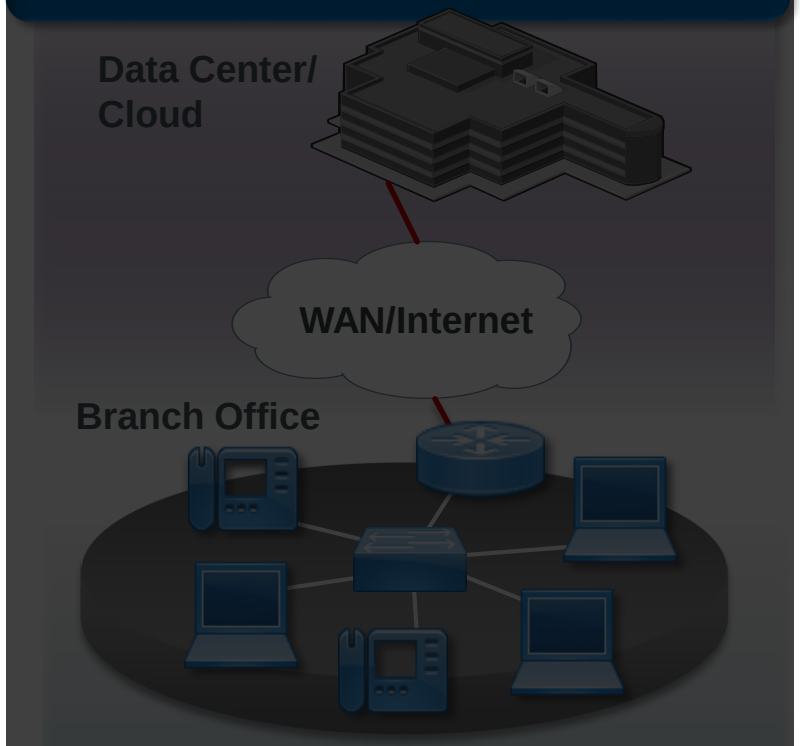
- Branch Service Virtualization Technologies
- Today: UCS E-Series
- Tomorrow: Open Service Containers

Branch Service Virtualization Technologies

The Lean Branch Office

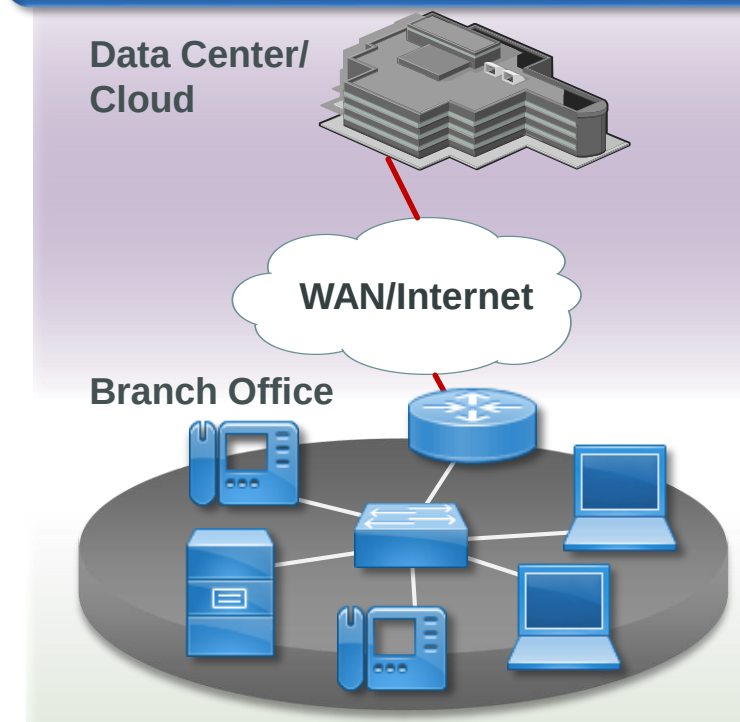
Balancing IT Efficiency and User Experience

Serverless Branch



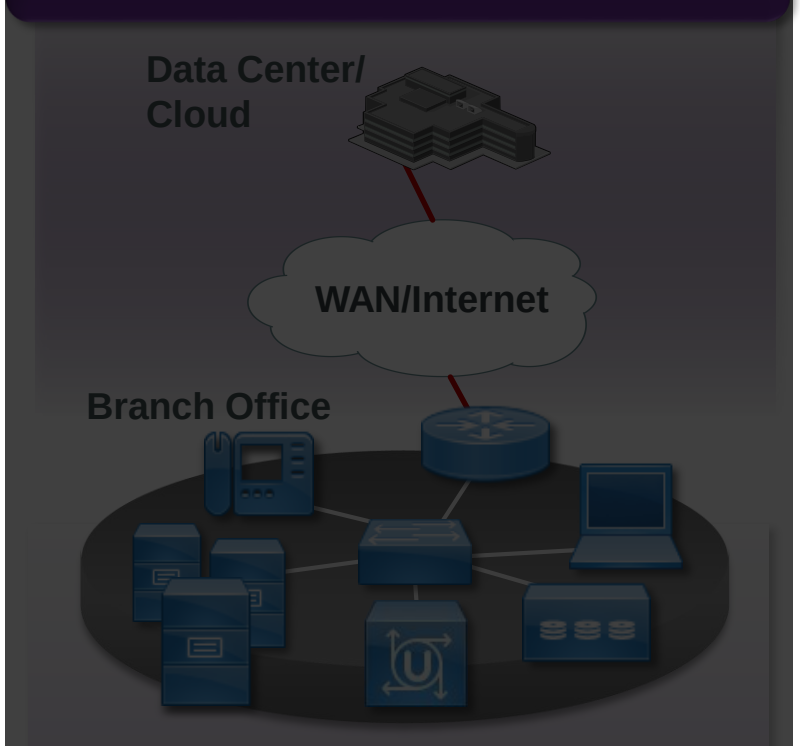
- No local servers
- Full reliance on WAN
- Simplicity, low cost
- No service guarantees

Lean Branch



- 4-5 local servers
- Full reliance on WAN except for mission-critical applications

Full-Service Branch



- All servers local
- No reliance on WAN
- Complexity, high cost
- Service guarantees

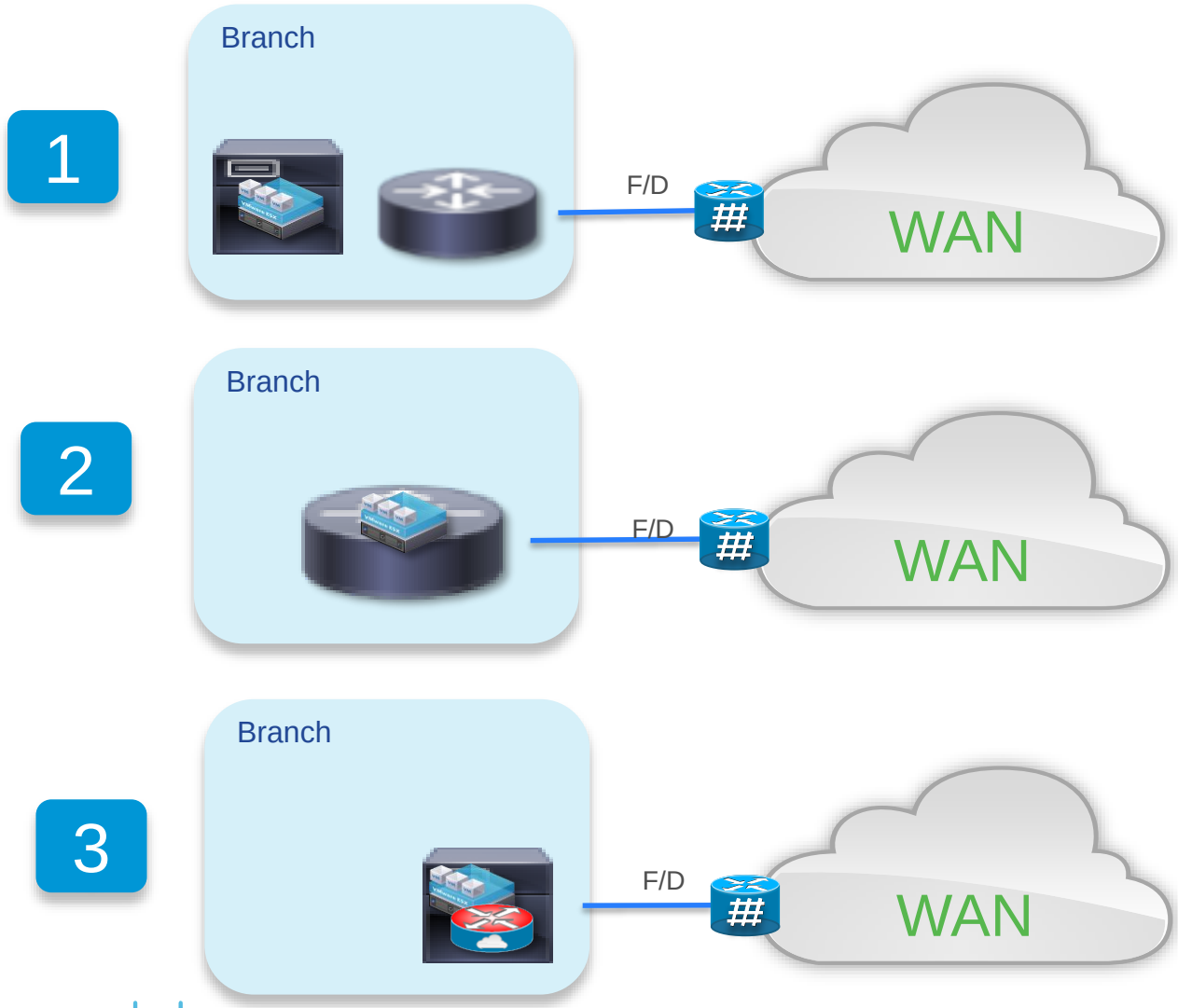
Virtualization of Branch Network Functions

Branch Appliances

- Router: Routing, ACL, NAT, SNMP..
- Switch: port aggregation
- Services realized with appliances
- Full redundancy
- Could be multi-vendor (Best of breed)

- Current Branch infrastructure often contains physical appliances that complicate architecture
  - Purpose built devices consume space and complicate deployments
- Costly to operate
  - Upgrades / service extensions often require branch visits to install / swap equipment
- Difficult to manage
  - Adding services requires new hardware and an expensive truck-roll

Branch Virtualization – On premise Options



Physical Router + virtualized L4-7 service on server

- E.g ISR4K + UCS-E
- Router performs transport functions (Routing, ACL, NAT, SNMP..)
- Services and Applications virtualized on server
- VNFs Could be multi-vendor (Best of breed)
- Flexible compute options for service and application needs

Router + integrated L4-7 services

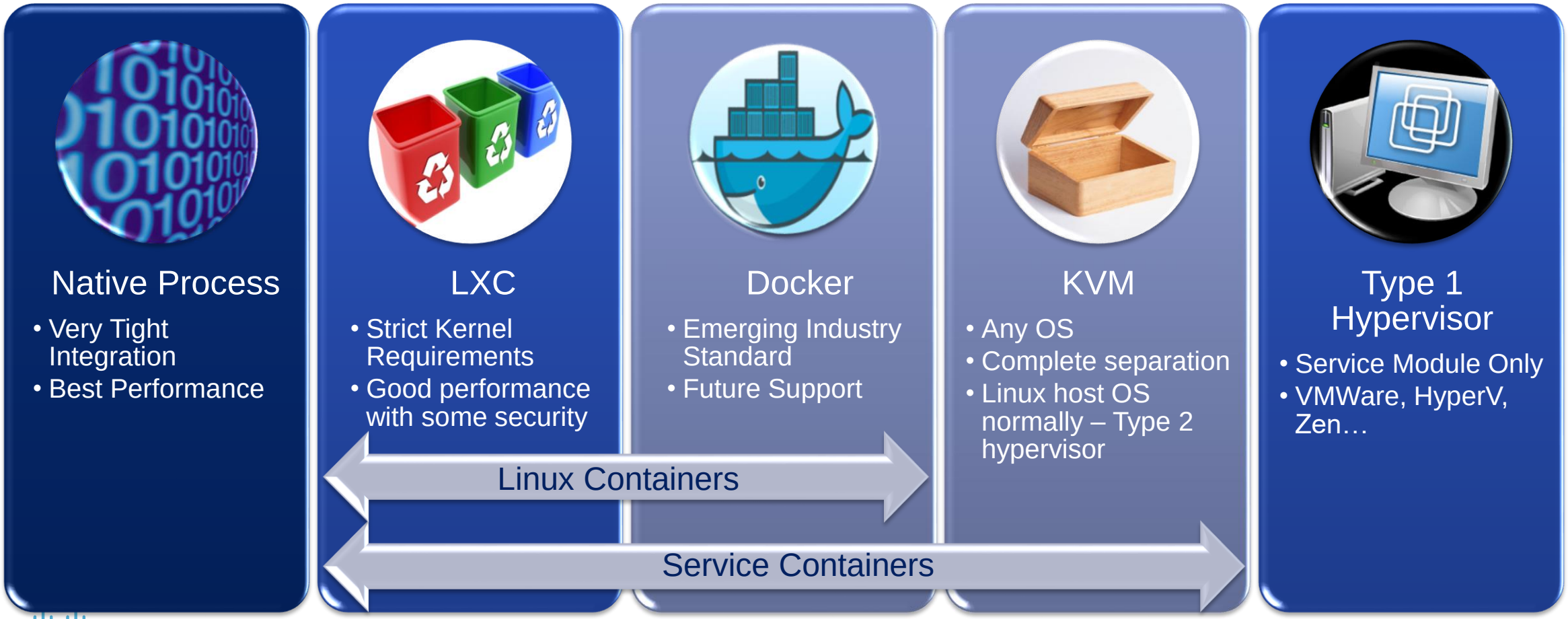
- E.g. ISR + Service Containers
- Router performs transport functions
- Services (WAAS, AD, Probes..) virtualized internally
- Best-of-Breed options for Services

Fully virtualized Branch

- Physical router replaced by x86 compute
- E.g UCS , CSX
- Both transport and network services virtualized
- VNFs could be multi-vendor (Best of breed)

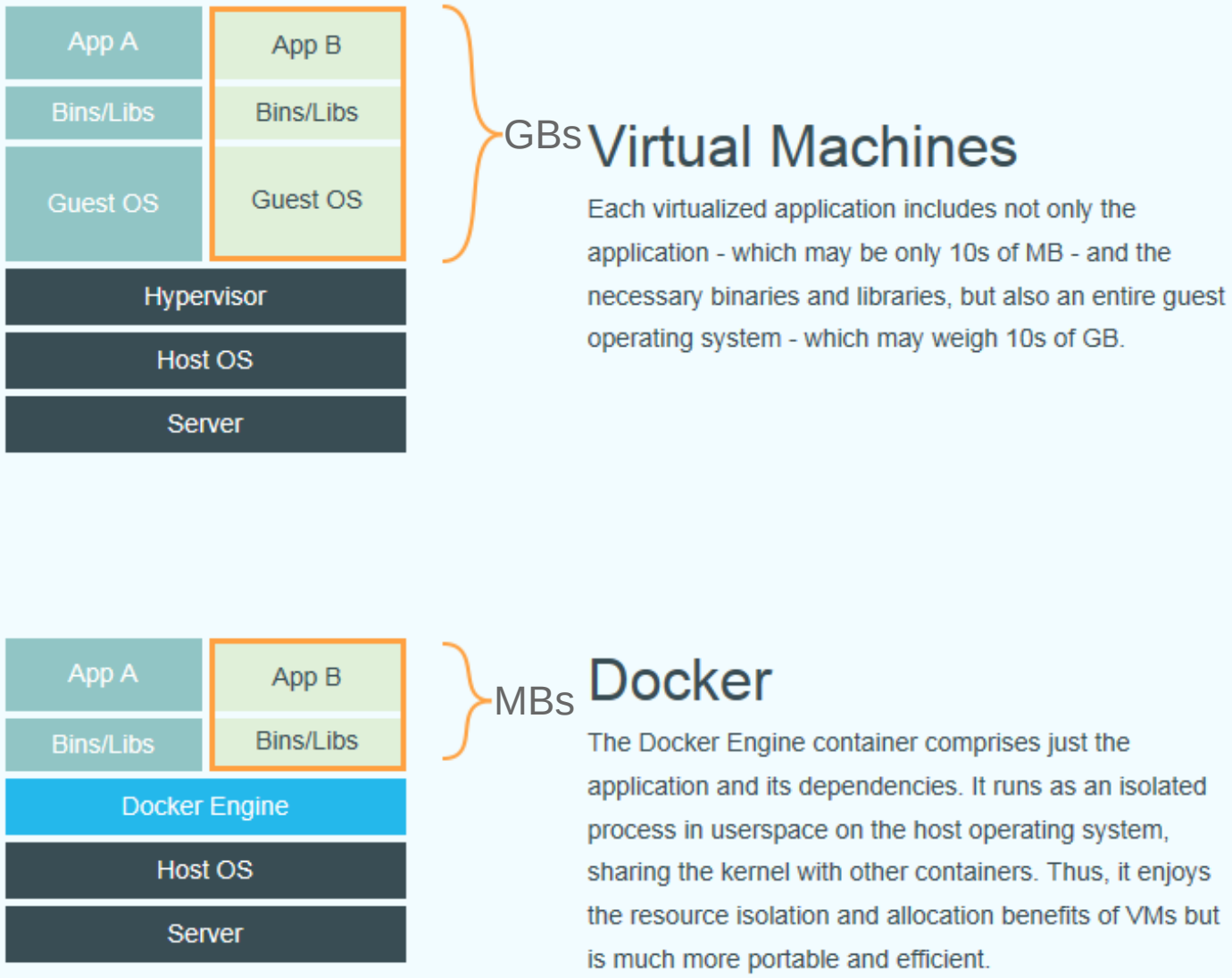
Application Hosting Spectrum

Different models for different application needs.



What are Containers - Basics & Terminology

- **Virtual Machine** - Includes not only the application, binaries & libraries, but also an entire guest OS.
- **Linux Container (LXC)** - OS level virtualization method for running multiple isolated Linux systems (containers) on a single control host.
- **Docker Container** – Is a format for Linux containers that makes the process of creating and maintaining containers easier.



What are Cisco platforms doing?

IOS XR

Support RPM package installation directly to the system.

Nexus OS

Support for 3rd party LXC containers. Support for Guest Shell LXC. Future support for Docker containers.

IOS XE

Open to any 3rd party or custom KVM application on routing platforms. Future plans for Docker support and alignment with IOX. Ultimate flexibility with UCS-E module.

Classic IOS

IOX program provides an IOT focused “app store” for KVM applications as well as Fog Director GUI manager.

UCS E-Series

Cisco End-to-End Solution

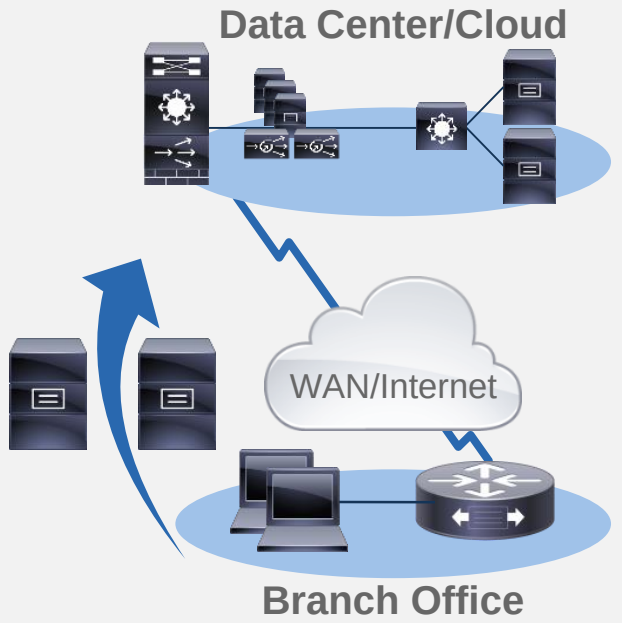
Cisco UCS B-Series and C-Series for Data Center; UCS E-Series for Branch

Cisco UCS® B- and C-Series

This unified compute platform offers infrastructure consolidation in the data center. These servers offer innovative virtualization, memory, provisioning, I/O, and management capabilities.

Cisco® UCS E-Series Servers

This residual compute platform offers all-in-one device convergence that facilitates centralization of branch applications into the data center.



Consolidate Infrastructure

Centralize Applications

Support User Experience

Address WAN-induced performance, availability, and compliance challenges.

Location-Suitable Form Factors, Consistent Device Management

Cisco UCS E-Series DC-class Servers

Scalability

Performance

Cisco UCS® E140S

- Service module
- VMware, Hyper-V, Citrix certified
- Intel E3 4 core processor
- vNGIPS, vWLC, vWAAS, physical security

Cisco® UCS E160D

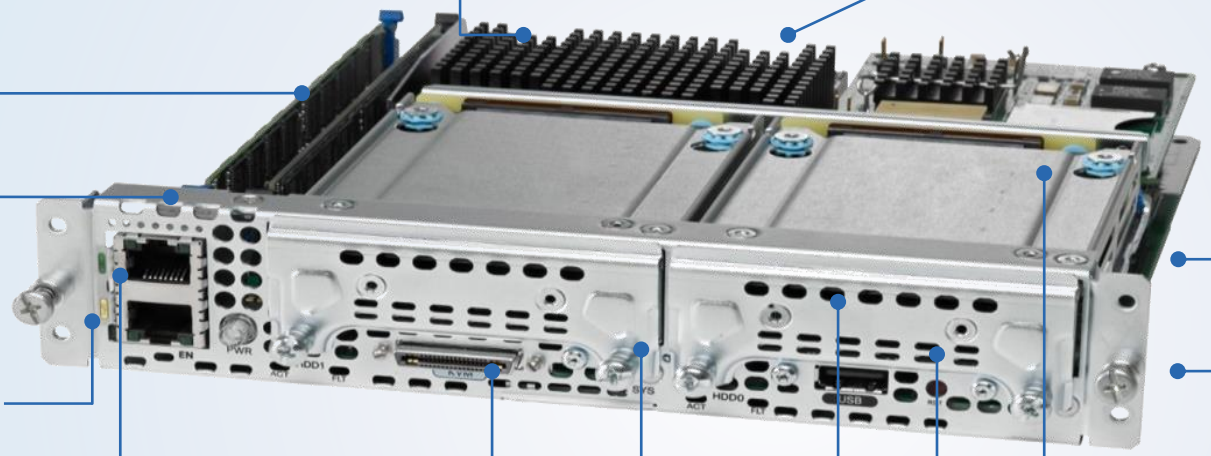
- Service module
- VMware, Hyper-V, Citrix certified
- Intel E5 6 core processor
- vNGIPS, vWLC, vWAAS, virtual desktops, physical security

Cisco UCS E180D

- Service module
- VMware, Hyper-V, Citrix certified
- Intel E5 8 core processor
- vNGIPS, vWLC, vWAAS, virtual desktops, physical security, security applications

Cisco UCS E-Series Single-Wide Blade

Compact Blade Housed in Cisco ISR G2 and 4000 Series ISR Chassis - Cisco UCS E140S M2



8, 12, and 16 GB DRAM options

Maximum 65 W power draw
80 percent less than server

Intel® Xeon® E3 family quad-core processor

Remote and schedulable power management

Configuration and management through CIMC/IMC SUP or UCSD

One external and two internal GE ports

Two SD cards: One for the CIMC and temporary storage of OS and one as a blank virtual drive

10/100 Ethernet management port

Up to 2 SATA, SAS, or SSD hard drives

KVM console connector

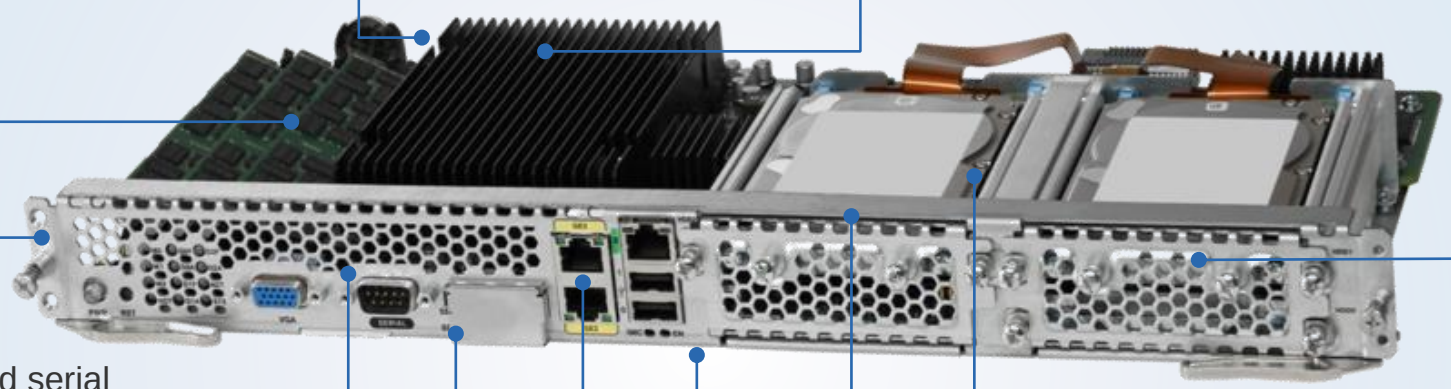
USB 2.0 port for external device connectivity

Wire-free, plug-and-play modularity, low shipping weight (2.5 lb/1.1 kg)

Onboard hardware RAID 0/1 with hot-swappable capability

Cisco UCS E-Series Double-Wide Blade

Powerful Blade Housed in ISR G2 and 4000 Series ISR Chassis - UCS E160D M2, UCS E180D M2



8 GB - 96 GB DRAM options

Maximum 130 W power draw, 80 percent less than server

Intel® Xeon® E5-2400 6-core, 8-core processor

Remote and schedulable power management

Front-panel VGA, 2 USB, and serial console connectors

Two SD cards: One for the CIMC and temporary storage of OS and one as a blank virtual drive

Two external and two internal GE ports with TCP/IP acceleration

Out-of-band configuration and management through CIMC/ IMC Sup or UCSD

Up to 3 SATA, SAS, SSD hard drives

Onboard hardware RAID 0, 1, and 5 configuration options with hot-swappable capability

Wire-free, plug-and-play modularity, low shipping weight (7 lb/3.2 kg)

Hardware Comparison Matrix (Cisco UCS E-Series)

Reference

	UCS E140S M2	UCS E160D M2	UCS E180D M2
Processor	Intel® Xeon® E3-1105C v2 (1.8 GHz)	Intel Xeon E5-2418L v2 (2.0 GHz)	Intel Xeon E5-2428L v2 (1.8 GHz)
Core/vCPU	4/8	6/12	8/16
Memory	8 - 16 GB	8 - 96 GB	8 - 96 GB
Storage	Up to 3.6 TB (2 HDD bays) SATA, SAS, SED, SSD	Up to 5.4 TB (3 HDD bays) SATA, SAS, SED, SSD	Up to 5.4 TB (3 HDD bays) SATA, SAS, SED, SSD
RAID	RAID 0 and RAID 1	RAID 0, RAID 1, and RAID 5	RAID 0, RAID 1, and RAID 5
Network port	Internal: 2 GE ports External: 1 GE port	Internal: 2 GE ports External: 2 GE ports	Internal: 2 GE ports External: 2 GE ports
Platforms	4451-X, 4351, 4331, 2911, 2921, 2951, 3925, 3945, 3925E, 3945E	4451-X, 4351, 2921, 2951, 3925, 3945, 3925E, 3945E	4451-X, 4351, 2951, 3925, 3945, 3925E, 3945E

Cisco UCS E-Series Network Compute Engine

Scalability

Performance

Cisco UCS® EN120E

- Enhanced HWIC
- Virtualization enabled
- Network compute applications - FirePower, vWAAS

(Supported on ISR-G2 only)

Target FCS Oct15'

Cisco® UCS EN140N

- NIM network compute module
- Virtualization enabled
- Network compute applications - FirePower, vWAAS

(Supported on ISR4000 only)

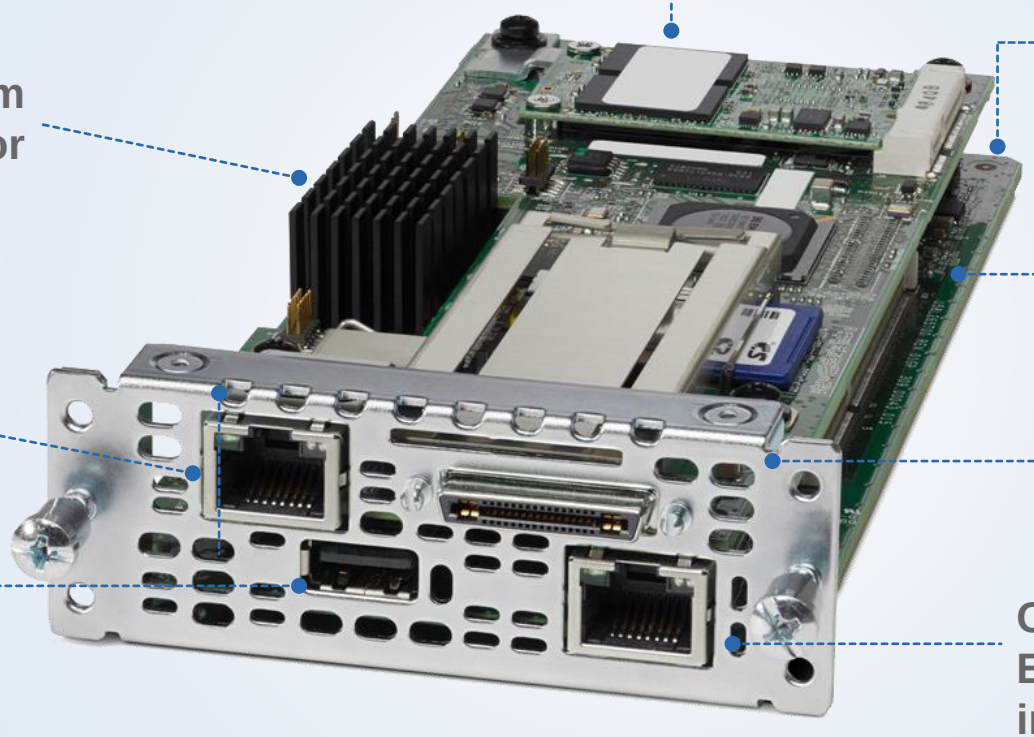
Cisco UCS EN120S

- Service module
- VMware and Hyper-V certified
- Network compute applications - FirePower, vWAAS

Cisco UCS E-Series Network Compute Engine

Compact, Multipurpose Blade Housed in 4000 Series ISR - Cisco UCS EN140N M2

Target FCS Oct15'



Hardware Comparison Matrix (Cisco UCS E-Series NCE)

Reference

	UCS EN120S M2	UCS EN140N (4000 ISR Only)	UCS EN120E (ISR G2 Only)
Processor	Intel Pentium B925C (2.0 GHz)	Intel Atom C2518 (1.7 GHz)	Intel Atom C2358 (1.7 GHz)
Core/vCPU	2/4	4/4	2/2
Memory	8 - 16 GB	8 GB	8 GB
Storage	500 GB- 2 TB (2 HDD) SATA, SAS	50 GB – 200 GB	50 GB – 200 GB
RAID	RAID 0 and RAID 1	NA	NA
Network port	Internal: 2 GE ports External: 1 GE port	Internal: 2 GE ports External: 1 GE port	Internal: 2 GE ports External: 1 GE port
Platforms	2911, 2921, 2951, 3925, 3945, 3925E, 3945E, 4451-X, 4351, 4331	4451, 4431, 4351, 4331, 4321	1921, 1941, 2901, 2911, 2921, 2951, 3925, 3945, 3925E, 3945E

Cisco UCS E-Series Server Hypervisor and OS Support

- VMware vSphere Hypervisor™ 5.0, update 1
- VMware vSphere Hypervisor™ 5.1
- VMware vSphere Hypervisor™ 5.5
- VMware vSphere Hypervisor™ 6.0

- Hyper-V (Windows 2008 R2, 2012 R2)
- Citrix XenServer 6.0

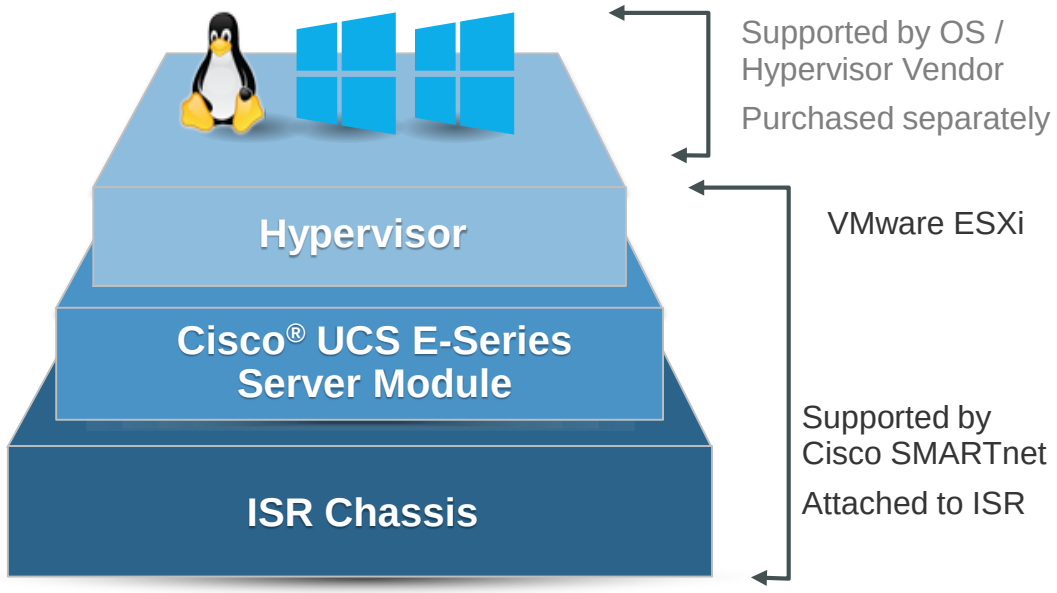
- Windows Server 2008 R2 Standard 64-bit
- Windows Server 2008 R2 Enterprise 64-bit
- Windows Server 2012, 2012 R2

- Red Hat Enterprise Linux 6.2
- SUSE Linux Enterprise 11, service pack 2
- Oracle Enterprise Linux 6.0, update 2

Hardware Support Provided by Cisco®

UCS E-Series hardware supported under ISR SMARTnet at no additional cost

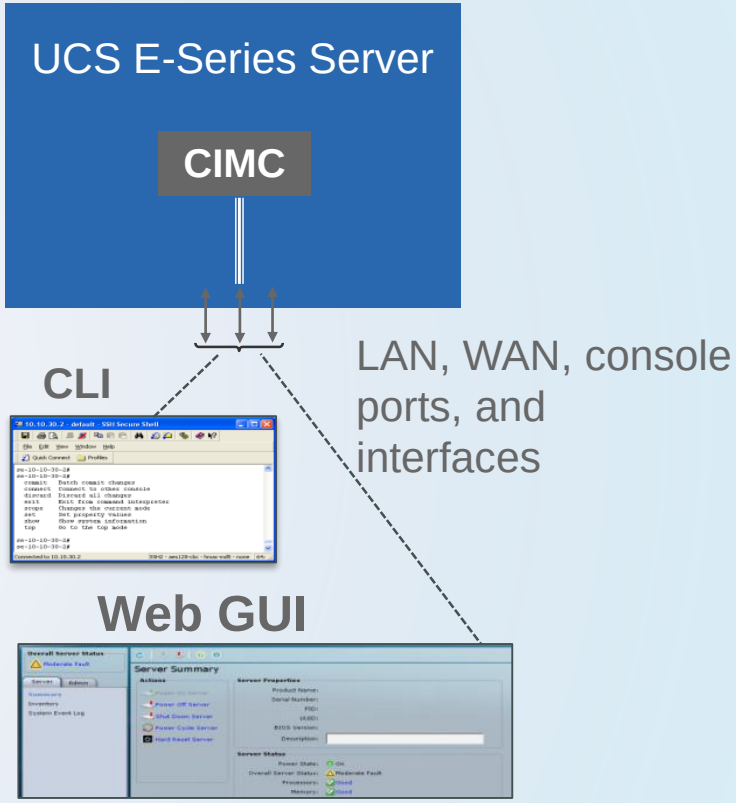
VMware Embedded Software - ESX and Foundation supported by ISR SMARTnet



Cisco UCS E-Series Blade Management

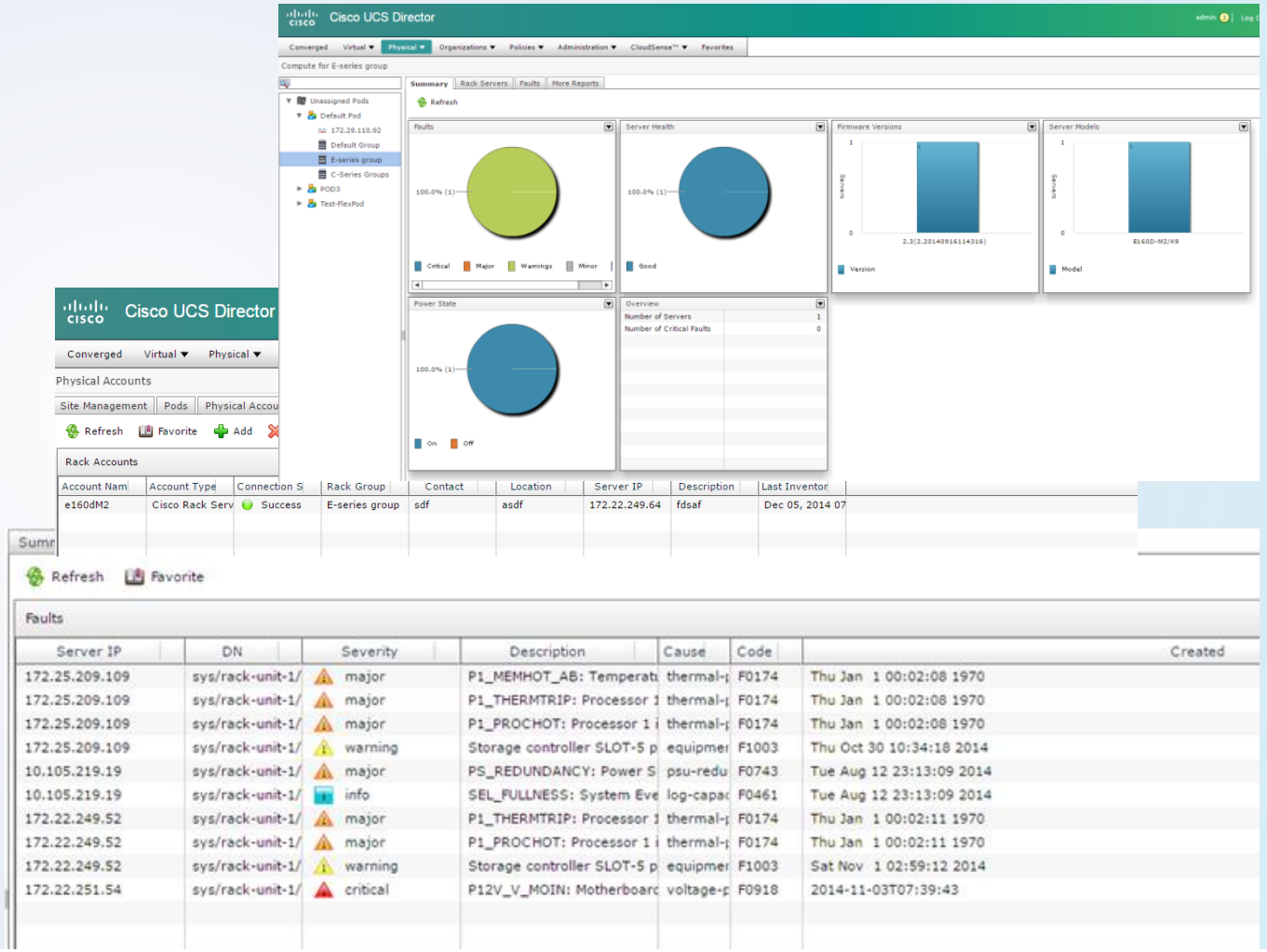
Cisco Integrated Management Controller

- Out-of-band management
- Management access hosted on dedicated baseboard management controller (BMC) chip on each Cisco UCS® E-Series Server
- 10/100 Ethernet out-of-band management interface •
- Lights-out management
- Virtual KVM and Virtual media support
- Consistent CLI and GUI look and feel
- Same user interface as UCS C-Series rack server CIMC
  - UCS E-Series CIMC XML API http://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/e/api/guide/b_cimc_api_book/b_cimc_api_book_chapter_01.html#topic_B19A7BEBFBAB4DDFB90B9456709C6402
  - Cisco® IMC PowerTool - Configure and download CIMC settings using cmdlet and scripts https://communities.cisco.com/docs/DOC-51321



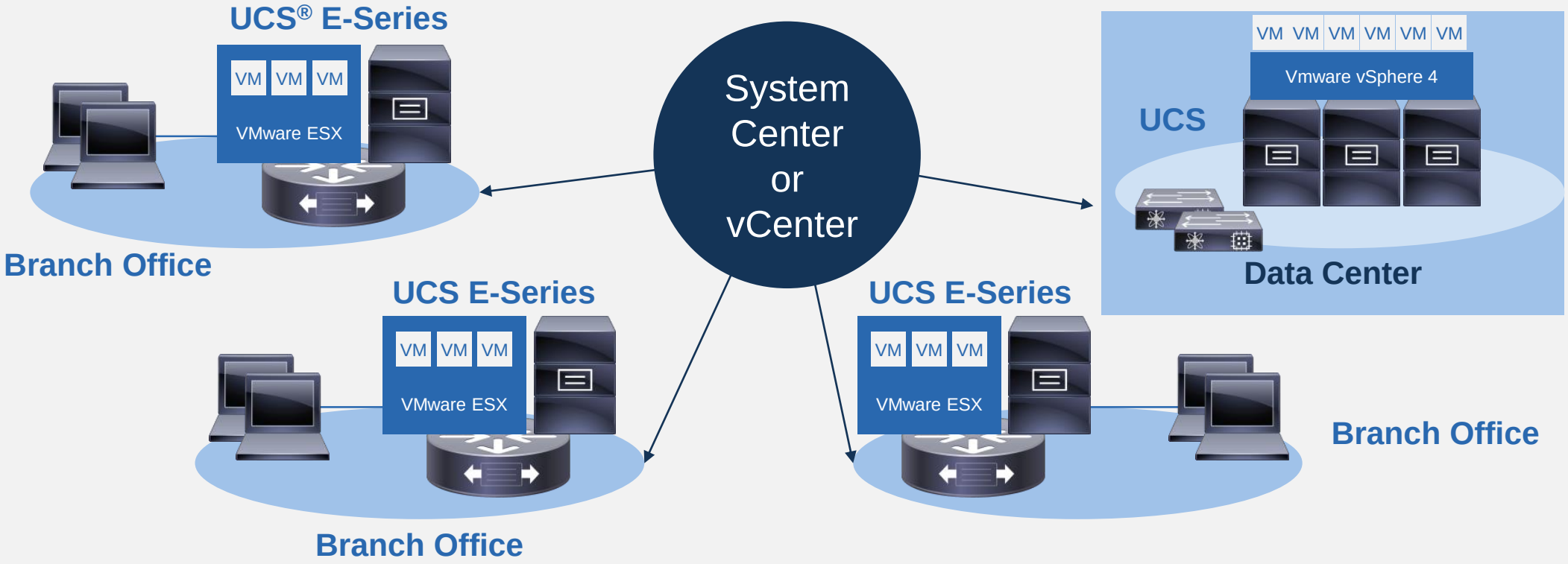
IMC Supervisor 1.1

- Delivered as a virtual machine, runs on VMware
- Eval license pre-installed, for 60 days up to 50 servers
- Centrally manage distributed UCS® E-Series
- Platform hardware inventory
- Firmware inventory
- Enhancements to Managing Firmware
- Hardware health status
- Detailed fault logging and history
- vKVM launch
- Server Configuration through Policy-Based Management (Requires Advanced License)
- Email Alert Enhancements
- Read-Only User
- Advanced Licensing Option



Unified Virtualization Management

Central Management with VMware vCenter or Microsoft System Center

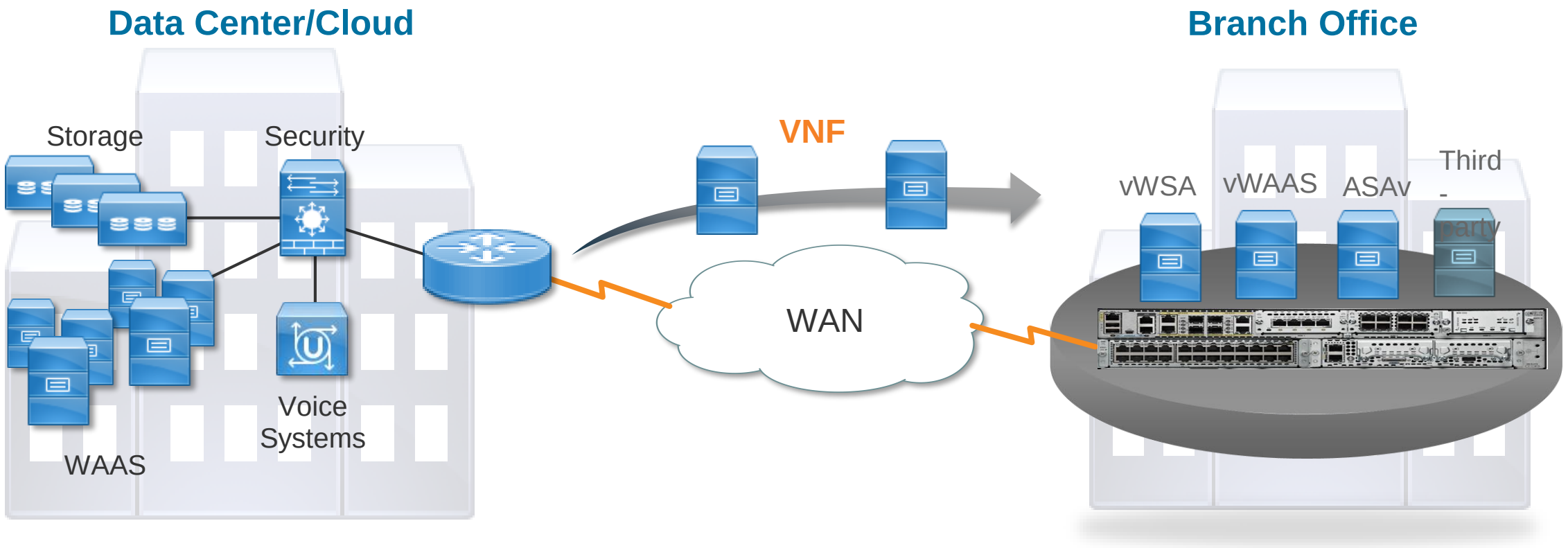


A single console for all VMs and hypervisor administration

- Extend virtualization management from the data center to the branch
- Centralize control and visibility at every level of the virtual infrastructure
- Simplify, standardize, and automate remote server infrastructure

Nimble Delivery of WAN Services

Improves IT operations and efficiency



Network virtualization convergence reduces Physical Appliances

Open Service Containers for IOS-XE

What is a Service Container?

Service Containers use virtualization technology (LXC and KVM) to provide a hosting environment on Cisco routers/switches for applications which may be developed and released independent of platform release cycles.

Virtualized environment on a cisco device.

Use Case Cisco Virtual Services:

- Work/Appliance Consolidation
- Lightweight Application Hosting
- Example: ISR4451X-WAAS

Use Case Third Party Services:

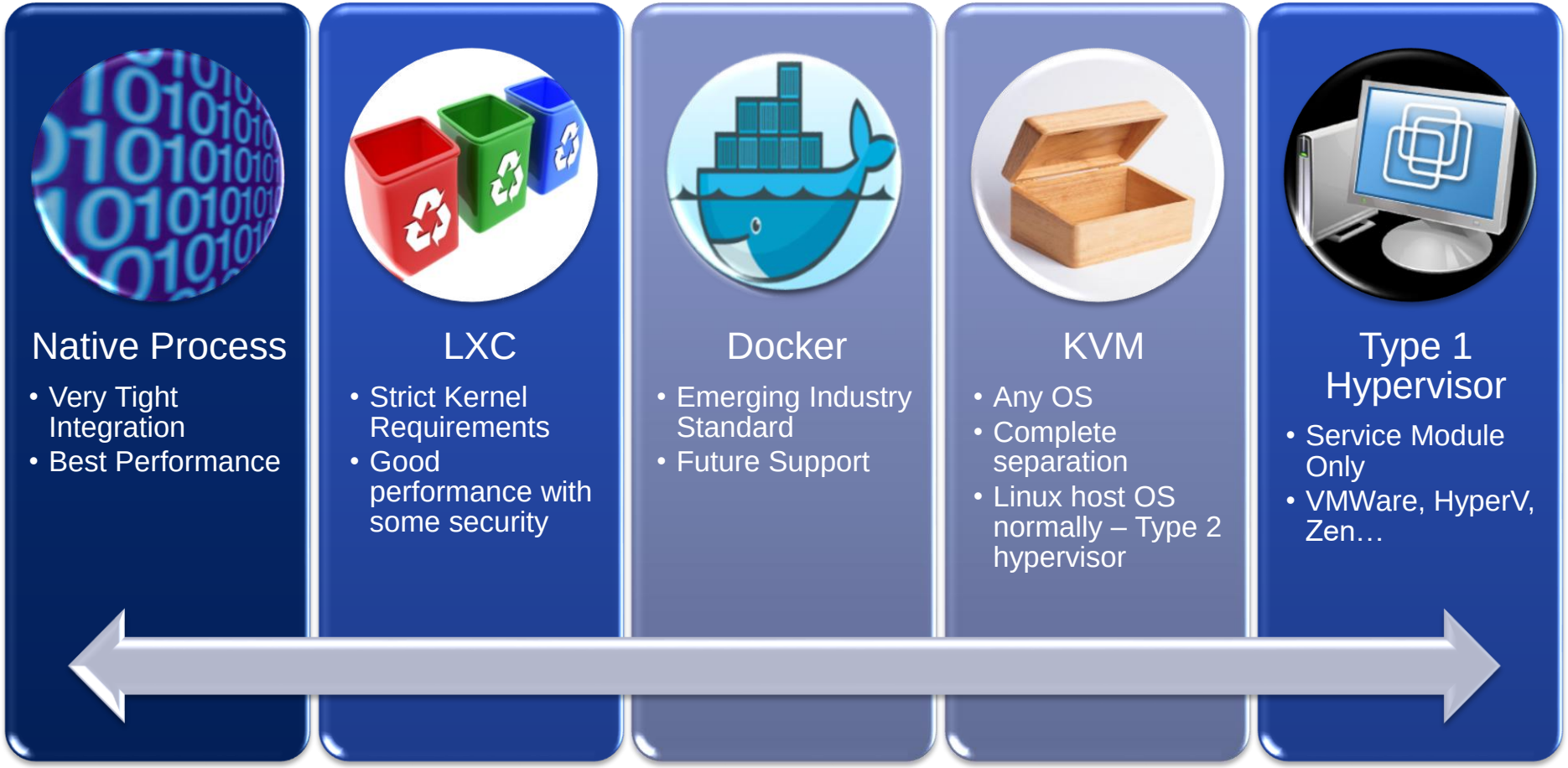
- Process Hosted Applications

WAY MORE INFO:

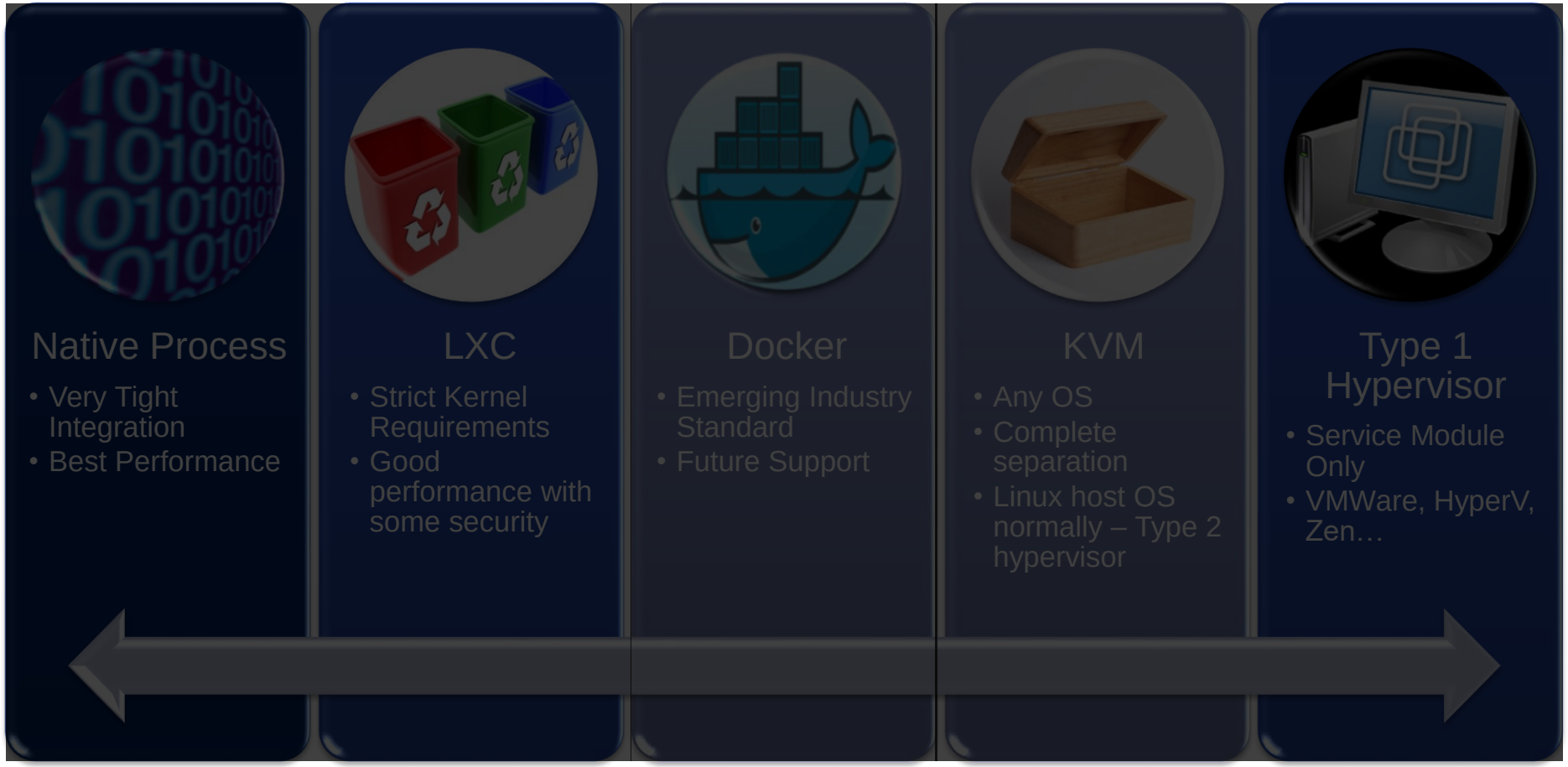
What the Heck is a Service Containers? (blog)
An Introduction to Service Containers (Presentation)
Fundamentals of Service Containers (Techwise Video)
Wireshark on the Catalyst 4500
Virtual Service Container Config Guide (NXOS &IOSXE)

Application Hosting Spectrum

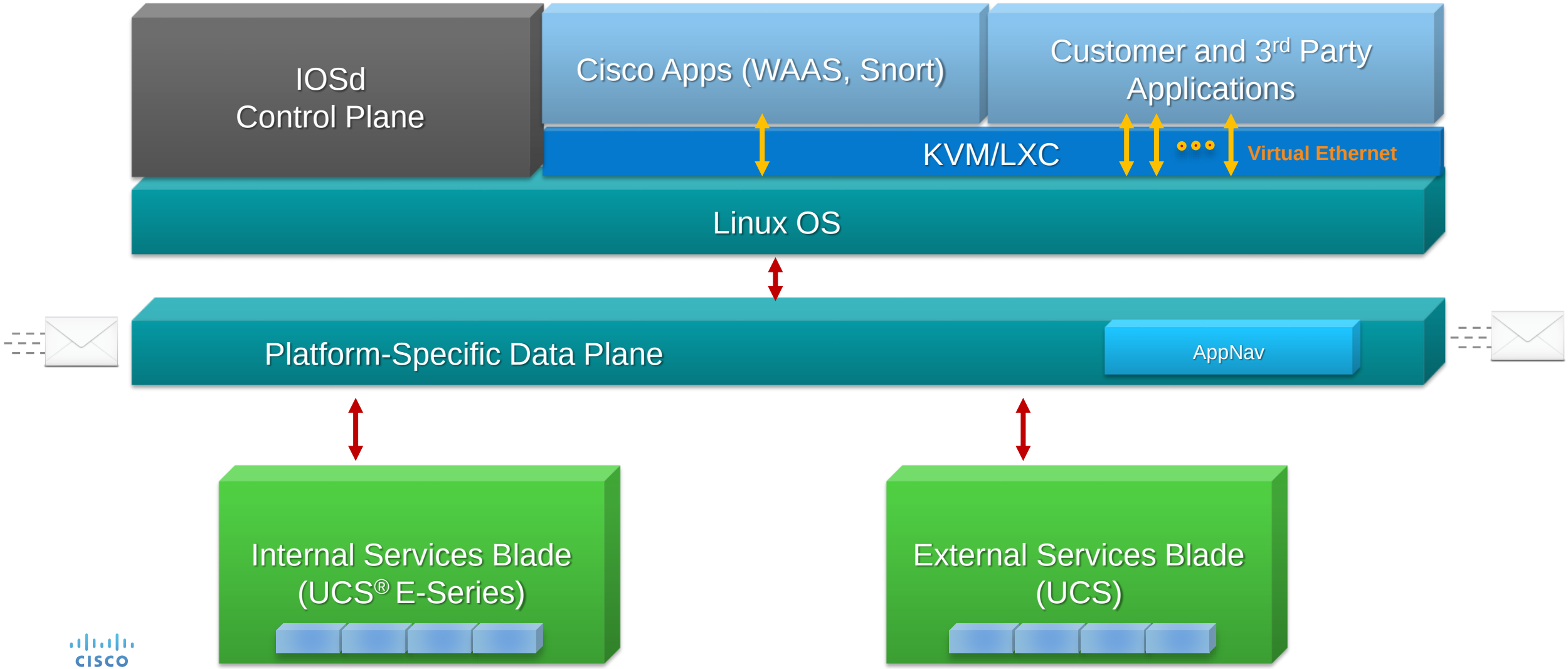
Different models for different application needs.



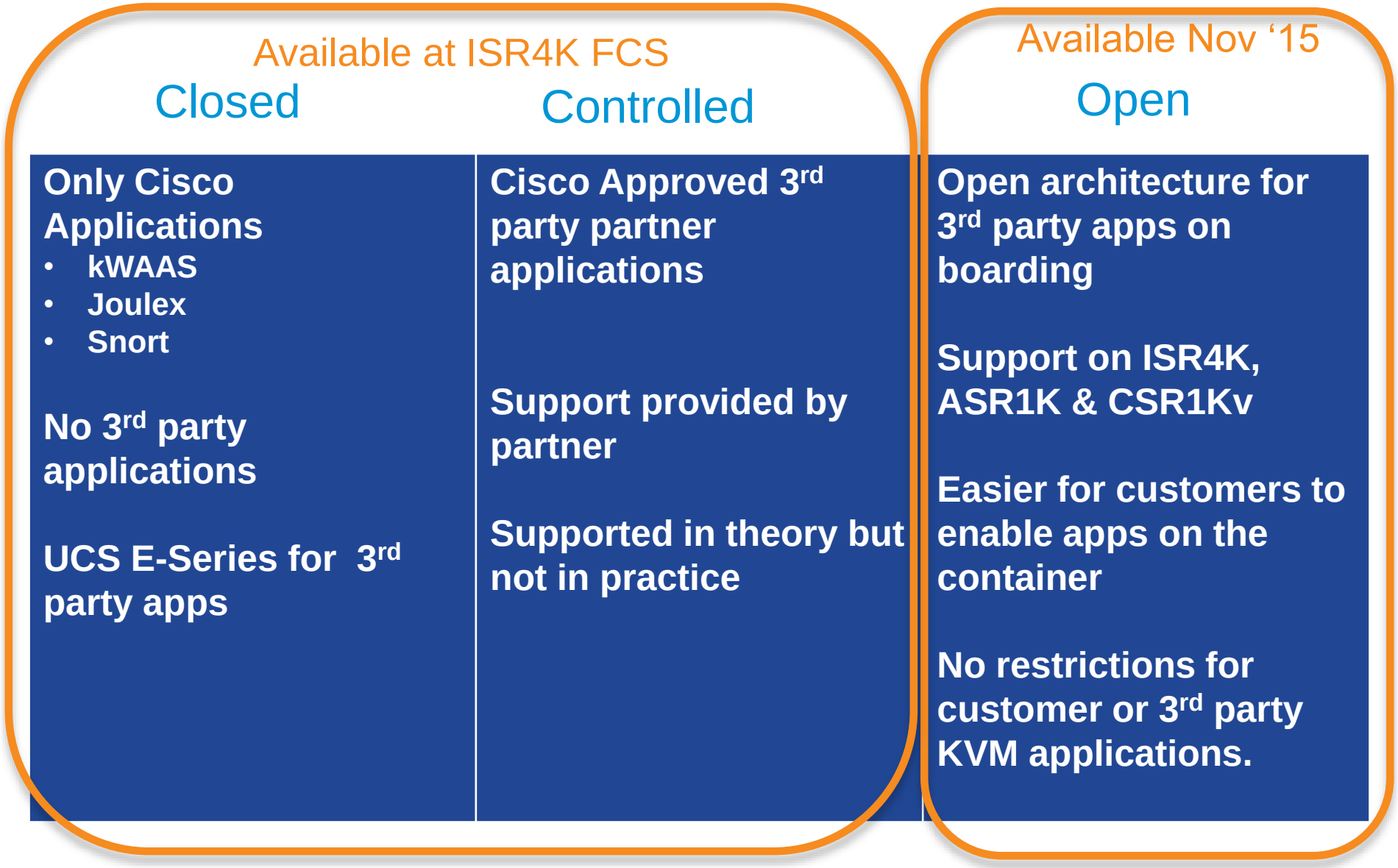
Application Hosting Spectrum



IOS-XE Software Architecture



Services Container Options



Common Service Container Use Cases

Troubleshooting VM

General purpose virtual machine with custom and open-source troubleshooting tools. (Wireshark, Speedtest, etc.)

Network Functions

Common network functions such as Print Server, Domain Controller, File Storage, etc.

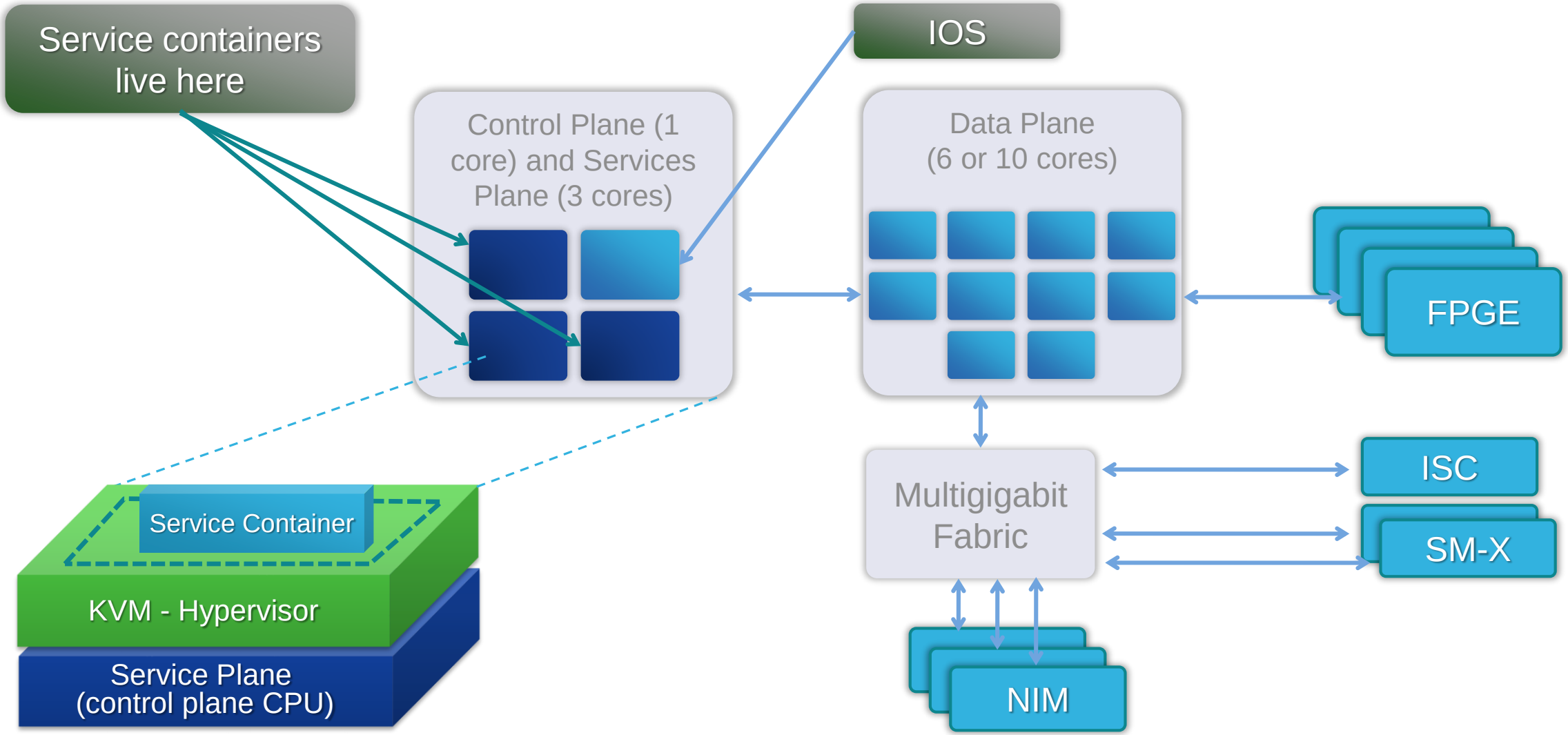
Analytics

Network Analysis and Application Performance Monitoring without a dedicated probe.

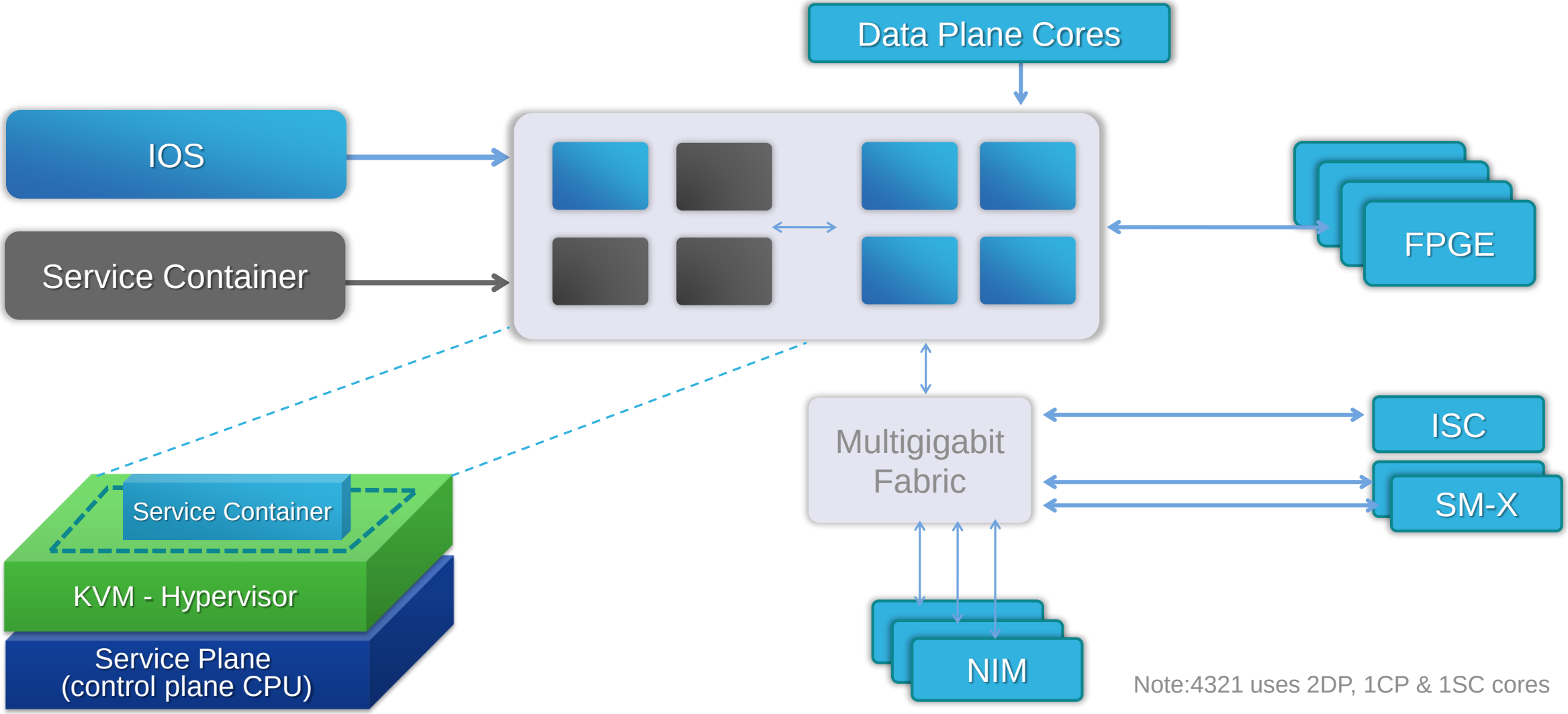
Device Customization

Augment the capabilities of the host platform in some way. (Custom encryption, business-based routing, specialized API interface)

Cisco ISR 4400 Series Architecture



Cisco ISR 4300 Series Architecture



Note:4321 uses 2DP, 1CP & 1SC cores

ISR4K Services Core Specifications

Platform	Service Cores	Speed (GHz)	Relative Compute Power	Min Additional DRAM	Min Additional SSD	Min Additional HDD
ISR4451 (Gladden)	3	2	6P	4GB	200GB	1TB
ISR4431 (Gladden)	3	1	3P	4GB	200GB	1TB
ISR4351 (Rangeley)	3	2.4	3 P	4GB	50GB	1TB
ISR4331 (Rangeley)	3	2.0	2.5 P	4GB	50GB	1TB
ISR4321 (Rangeley)	1	2.4	P	4GB	50GB	1TB
UCS-E NIM	4	1.6	2.6 P	N/A	N/A	N/A
UCS-E EHWIC	2	1.6	1.3 P	N/A	N/A	N/A

Normalize to Rangley 2.4 GHz core = 1P
Gladden 1GHz = Rangley 2.4 GHz

What do I need to add to an ISR4K system?

Memory

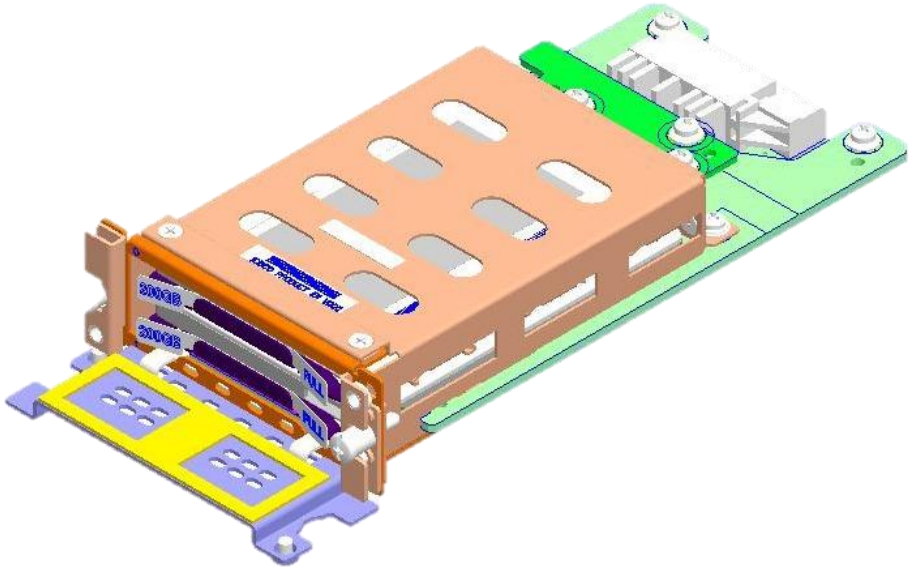
- Service Containers (currently) REQUIRE additional DRAM beyond the 4GB system default
- Additional DRAM beyond 4GB will be available to a KVM application
  - Example: 8GB DRAM will have 4GB available to Service Containers
  - Example: 16GB DRAM will have 12GB available to Service Containers

Storage

- No storage is included by default and applications do not have access to bootflash.
- Options include internal MSATA SSD on 4300 Series, NIM-SSD or NIM-HD on all ISR4K.
- Smaller sizes and lower reliability SSD options at lower price will be available in late CY15.

Note: ASR1K/CSR requirements will be different.

Storage Options



NIM-SSD:

- 1 or 2 hot-swappable 200GB SSD drives
- 400GB option in CY15

NIM-HD:

- 1 hot-swappable 1TB drive
- Available late 2015

SSD-MSATA-200G:

- Doesn’t consume a NIM slot!
- Embedded 50GB or 200GB SSD storage
- Not available on 4431/4451

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Unique Requirements for IOS XE Service Containers

- YAML (derived from LibVirt XML) header file(s) within the OVA
  - Outlines the resource requirements for the application so the system knows what to do with it.
  - Memory, storage, CPU shares, CDROM ISO, etc.
- Properly formatted disk image
  - Supported formats are qcow2, raw and raw with Cisco capacity XML tag
- IDE virtio driver within the VM kernel for disk access
- Optional TTY0 and TTY1 specification for console/aux connection

Mandatory Service Container OVA Contents

- YAML Descriptor File Defining:
  - Number of VCPUs and Share of CPU cycles
  - Memory
  - Disks including size and source image if applicable
  - Virtual NICs
  - Console/Aux connectivity

- Disk Image – One or more disk image files.
  - ISO: Supported for read-only file systems like a CDROM.
  - RAW: Supported for read-write file systems.
  - QCOW2: Supported for read-write with compression. Longer initial install time but much smaller disk images as a result of compression. Generally the recommended format for standard disk images.
- Manifest File – Simple text file with the SHA1 hash for all files in the OVA.
- Version File – Simple text file with application version number.

Useful Open Source Tools for Developers

virt-manager – GUI Linux tool for creating and managing VMs.

qemu-img – Useful tool for converting disk images

Example: qemu-img convert -p -c -f raw -O qcow2 <raw.img> <qcow2.img>

openssl – Generates manifest file.

Example: openssl sha1 *.qcow2 *.ver *.yaml > vm.mf

tar – An OVA is nothing more than a tar file with a fancy name.

Example: tar -cvf VM.ova vm.qcow2 platform.xml 4300.xml 4400.xml vm.mf

packaging.yaml.sh – Cisco script to help build an ova in one step.

Example YAML File

```
manifest-version: 1.0

info:
  name: kvm_prof_2
  description: "KVM Montavista Test Distro
  version: 1.0
  author-name: Cisco Systems, Inc.
  author-link: "http://www.cisco.com"

app:
  # Indicate app type (vm, paas, lxc etc.,)
  apptype: vm

  resources:
   cpu: 6
   memory: 262144
   vcpu: 1
```

App Info & Definition

Memory/CPU Reservation

```
disk:
   - target dev: hdc
     file: montavista.iso
   - target dev: sda
     file: kvm_storage_4000MB.img
     upgrade-model: ha-sync

 interfaces:
  - target-dev: net1
    alias: net1
  - target-dev: net2
    type: management

 serial:
  - serial
  - console

 # Specify runtime and startup
 startup:
   runtime: kvm
   boot-dev: cdrom
```

Disk(s) Definition

Ethernet Interfaces

Serial Devices

Boot Details

Service Container Install/Monitor Commands

Virtual-Service Install/Monitor:

```
ISR4K# virtual-service install name testapp package bootflash:testapp.ova
ISR4K# show virtual-service list
ISR4K# show virtual-service detail name testapp
ISR4K# virtual-service connect name testapp aux|console
```

Install an OVA to disk

Show current status including application install progress

Connect a virtual terminal to the application serial port (if supported)

Service Container Configure & Activate Commands

Virtual-Service Configuration:

```
virtual-service
 signing level unsigned
!
interface virtualportgroup 1
 ip address 10.0.0.1 255.255.255.0
!
virtual-service testapp
 vnic gateway virtualportgroup 1
  guest ip address 10.0.0.2
 activate
```

New Global-Level Structure

Single command to disable signing

Up to 32 virtual interfaces to OVS

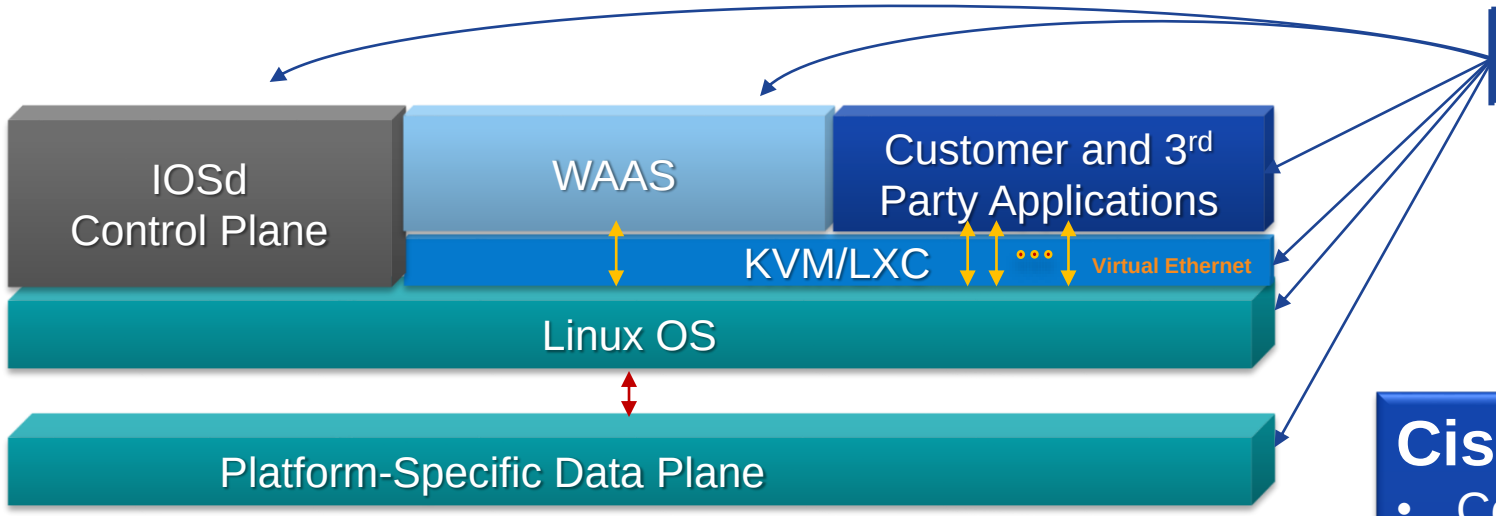
Application Instance Configuration

One or more interfaces per application

Optional guest interface configuration

Activate an installed & configured App

Open Service Container Support Model



Third Party & Community Support:
Call TAC and they'll help you out.

Cisco Devnet Provides:

- Community support for developers
  - Documentation
  - Developer Tools
  - Access to Cisco Engineers
- Sample open source VMs
  - Share open source projects
  - Examples from Cisco Engineers

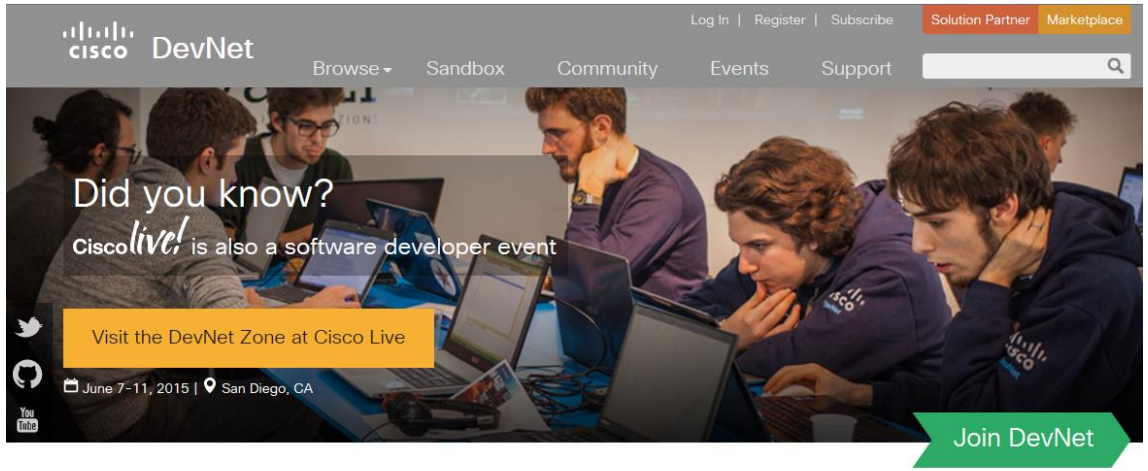
Future Development

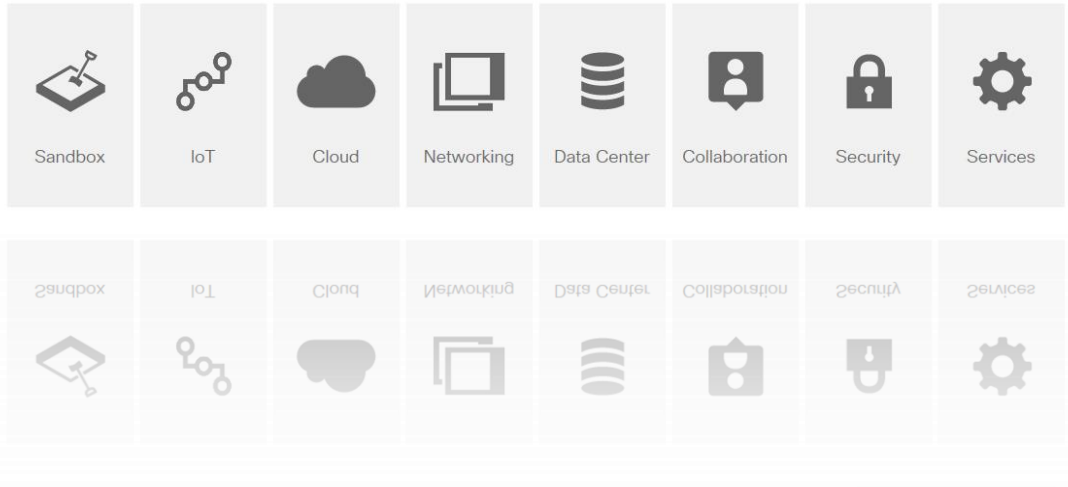
- RAM Disks – will allow apps with low storage requirements to keep their disk images on bootflash
- Default DRAM – Support for lightweight applications in default 4GB memory.
- VM Configuration – User can overwrite the VM specifications from the YAML file (CPU, DRAM, NICS, etc) through configuration commands.
- Docker – Support standard Docker containers in addition to KVM.
- Fog Director – Support the same app-store model and deployment GUI as IOX applications.
- VBO/NSO Orchestration – Integration with Elastic Service Controller and NSO for consistent orchestration with other Cisco NFV products.
- Layer 2 Redirect/Chaining – Bridging/Redirect from data plane interfaces as well as L2 VLAN switching between Service Containers.

More Information

Cisco DevNet

- Online community for developers
- Direct access to Cisco Engineers and Product Teams
- Repository of how-to guides, best practices and sample code
- This will be the primary source for Service Container information and sample OVAs
- Due to Cisco support requirements, VMs will not be posted to Cisco.com directly.
- Keep an eye out for a Service Container Hackathon with fabulous prizes!





Early Access: http://cs.co/9007BngmL

Links

WAY MORE INFO:

What the Heck is a Service Containers? (blog)

http://cs.co/9006BnlDC

An Introduction to Service Containers (Presentation)

http://cs.co/9005BnlD7

Fundamentals of Service Containers (Techwise Video)

http://cs.co/9004BnlDA

Wireshark on the Catalyst 4500

http://cs.co/9002BnlD4

Virtual Service Container Config Guide (NXOS &IOSXE)

http://cs.co/9001BnlDN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Lab Environment