TOMORROW starts here.

CISCO

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Evolution of the Network Engineer Job Role

BRKCRT-2001

David Mallory

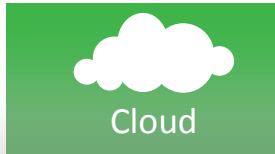CTO, Learning@Cisco

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Agenda

- Challenges and Opportunities
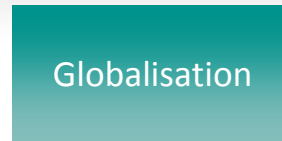- New Skills
- Certification Roadmap
- Questions & Answers

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Major Transitions are Unfolding
Talent and Capabilities Will be the Differentiator

Technology Transitions

Mobility/Video	Cloud	New Breed of Apps	Internet of Things	Big Data & Analytics

New Model of IT Simple. Smart. Secure.

Growth and Productivity Opportunities	New Business Models	User Experience/ Expectations	Globalisation	Security and Regulatory Compliance

Business Implications

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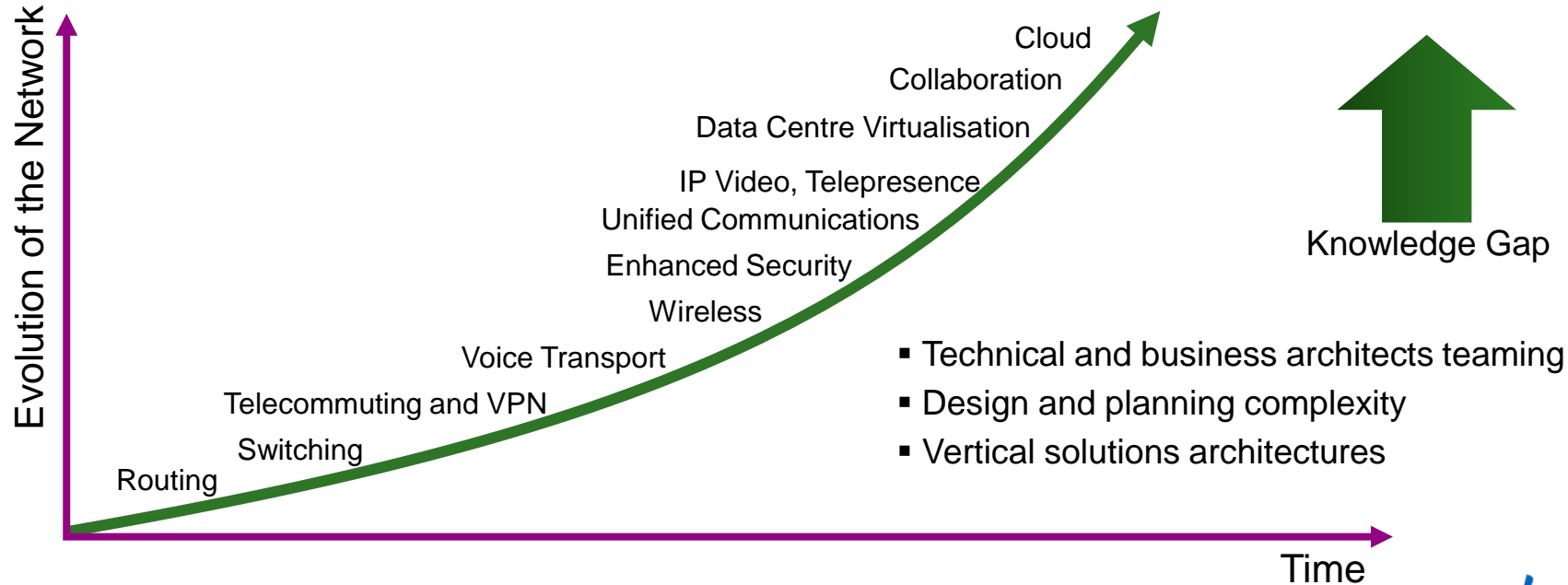
Challenges And Opportunities

IT Solutions Evolution path: *New Challenges for Talent*

The Role of the Network Grows
iOT, Open Infrastructure, Application Integration

Cloud

Collaboration

Data Centre Virtualisation

IP Video, Telepresence

Unified Communications

Enhanced Security

Wireless

Voice Transport

Telecommuting and VPN

Switching

Routing

Evolution of the Network

Time

Knowledge Gap

- Technical and business architects teaming
- Design and planning complexity
- Vertical solutions architectures

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What Will Happen Between 2012–2017

More Devices
> 19 Billion Connections

Faster Broadband Speeds
3.5-Fold Speed Increase

Growth Catalysts

More Internet Users
3.6 Billion Internet Users

More Rich Media Content
2 Years of Video Minutes/Second

Source: Cisco VNI Global Forecast, 2012–2017

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Internet Growth

Connected Devices

500M	5B	10B	25B	50Billion	

~10M

550K · 1M · 1.5M · 2M · ~5M

Certifications

2003 · 2007 · 2010 · 2013 · 2015 · 2020

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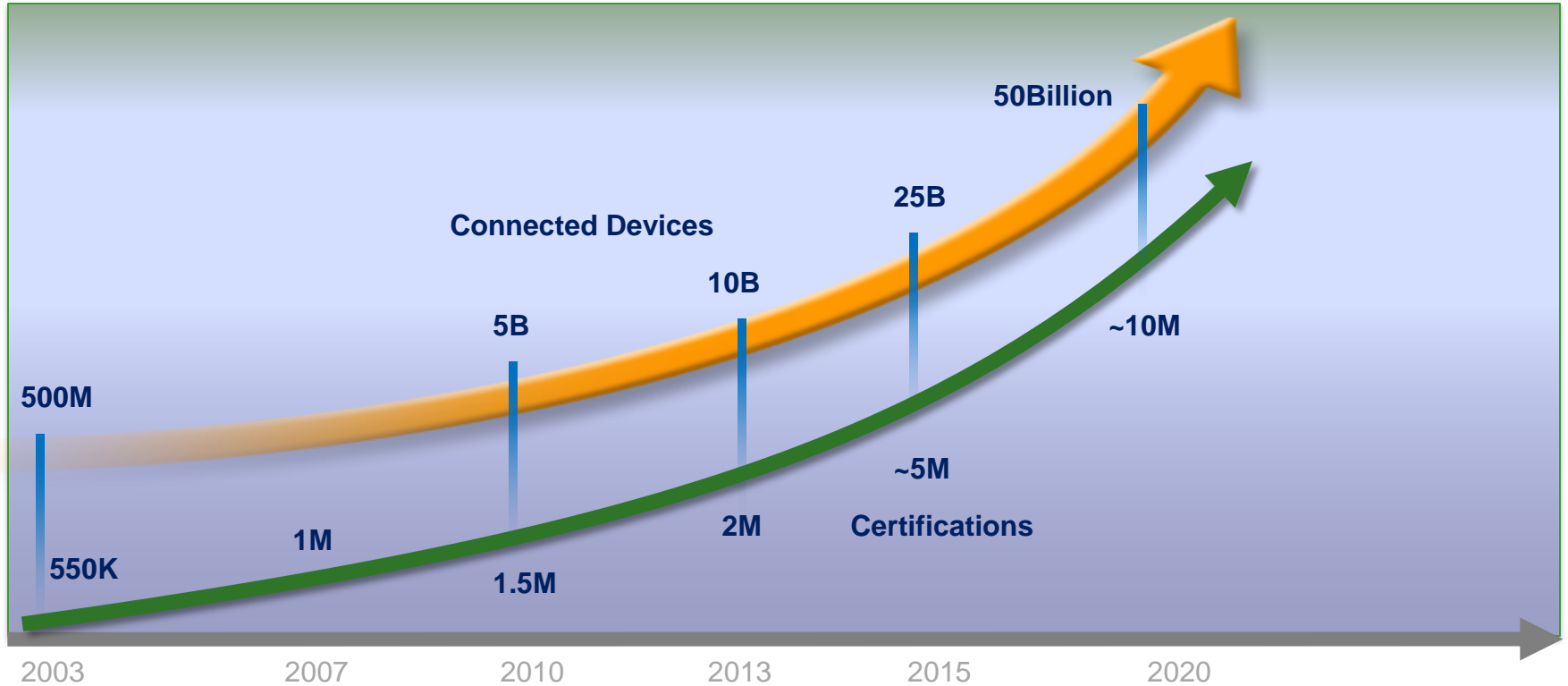
How Will We Keep Up With Our Networks?
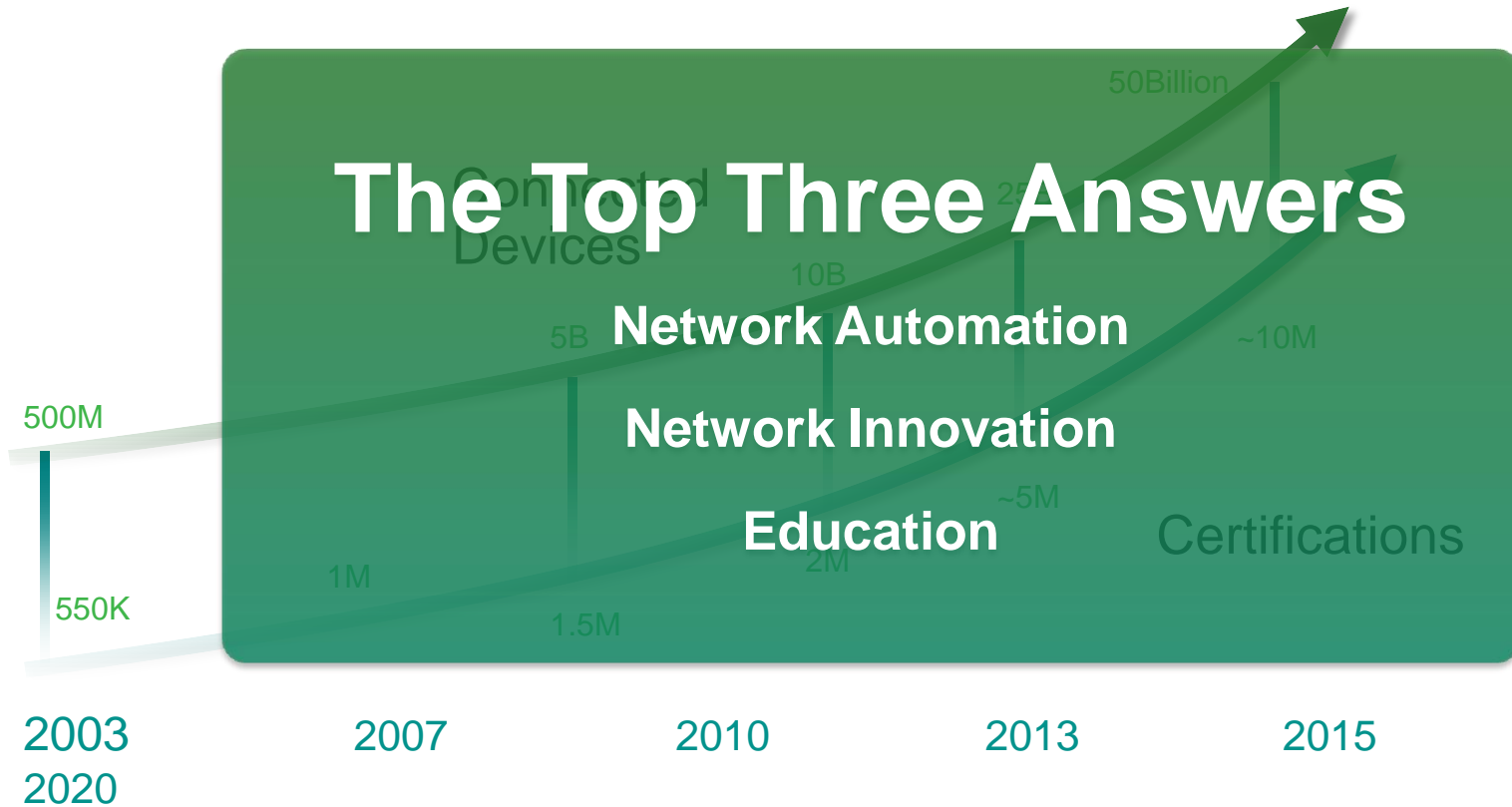
The Top Three Answers

Network Automation

Network Innovation

Education

Connected Devices

50Billion

10B

5B

~10M

~5M

2M

1M

1.5M

500M

550K

Certifications

2003
2020

2007

2010

2013

2015

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Web Developer
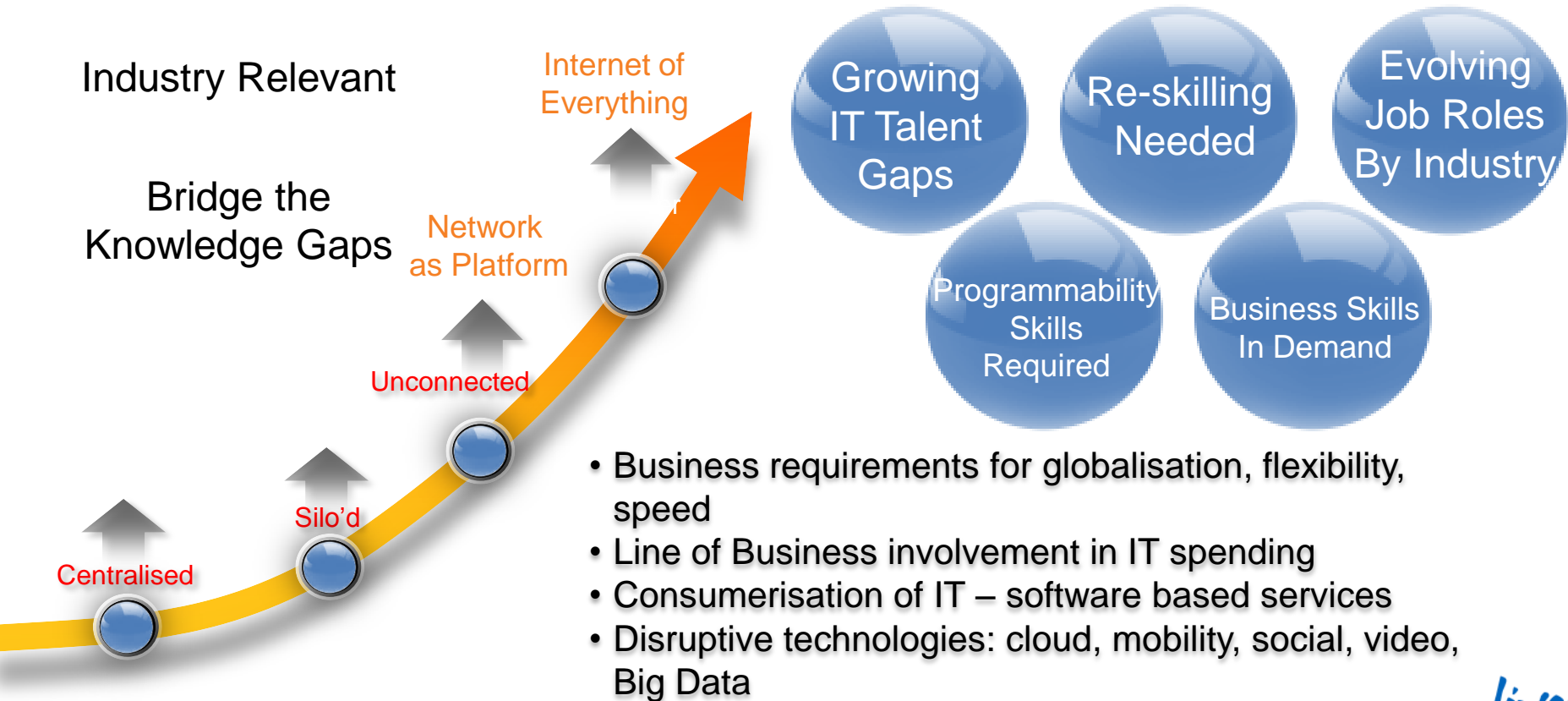

Top Jobs for 2014 (USA)

- #1 – Software Developers
- #3 – Training & Development Specialists
- **#6 – Web Developers**
- #12 – Information Security Analysts

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The Network at the Centre of Every Evolution Step
Managing Your Career Through Key Market Transitions

Industry Relevant

Bridge the
Knowledge Gaps

Internet of
Everything

Network
as Platform

Unconnected

Silo'd

Centralised

Growing
IT Talent
Gaps

Re-skilling
Needed

Evolving
Job Roles
By Industry

Programmability
Skills
Required

Business Skills
In Demand

- Business requirements for globalisation, flexibility, speed
- Line of Business involvement in IT spending
- Consumerisation of IT – software based services
- Disruptive technologies: cloud, mobility, social, video, Big Data

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# Disruptive Technologies

Disruptive Technologies

- Cloud
- Mobility
- Social
- Video
- Big Data
- **Software Defined Networking**
- **Autonomic Networking**

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What is SDN?
(per Wikipedia definition)

Software defined networking (SDN) is an approach to building computer networks that separates and abstracts elements of these systems
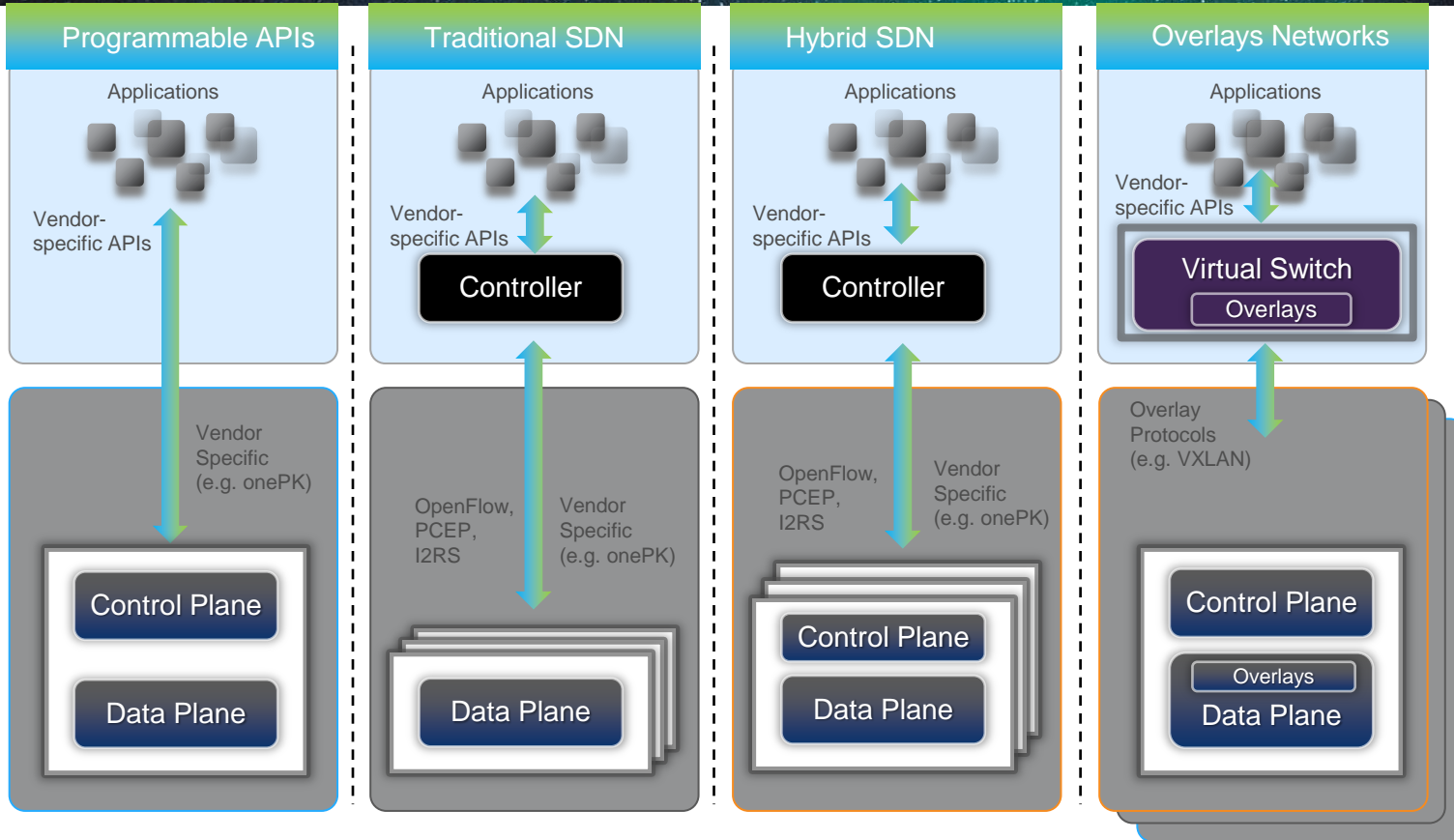
Separate Control Plane

Control Plane

Control Plane

Data Plane

Control Plane

Data Plane
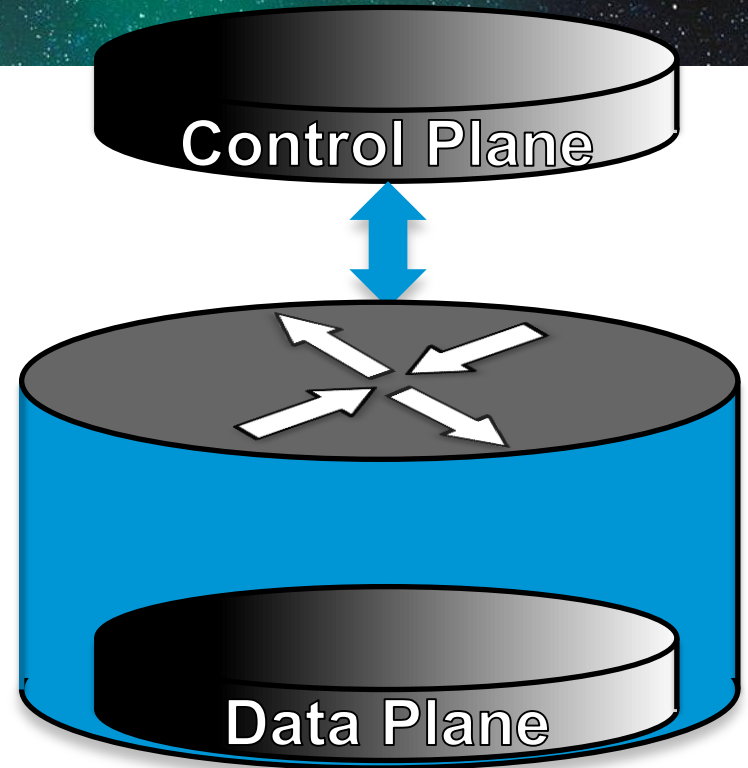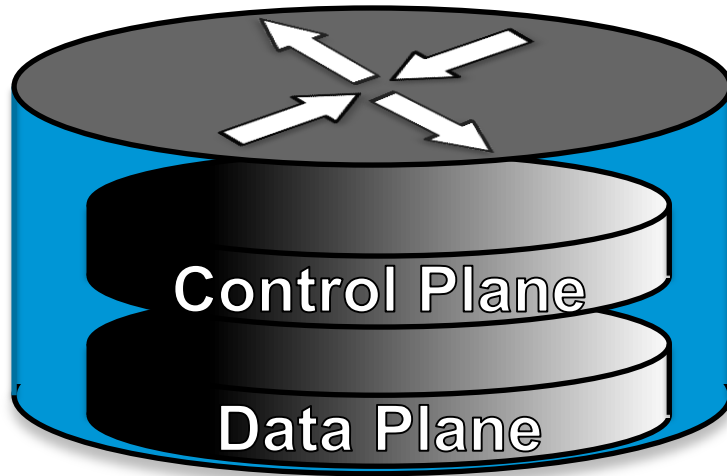
In SDN paradigm, not all processing happens inside the same device
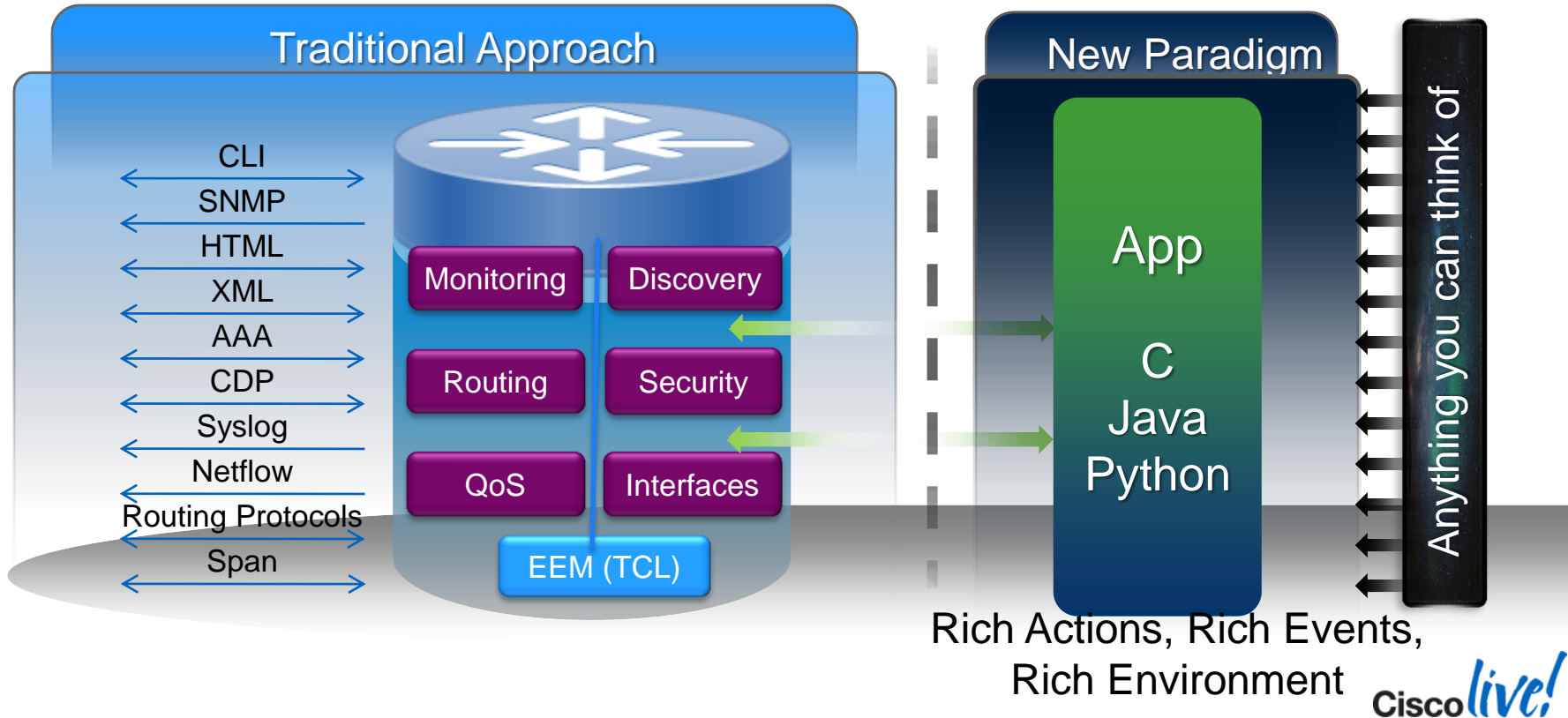
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More Likely…
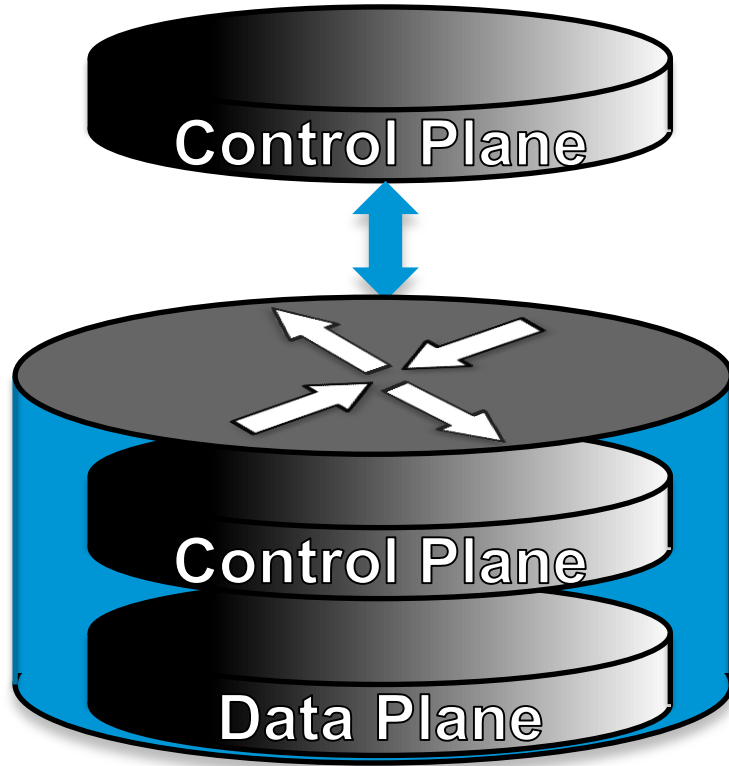
Control plane is separated from the physical device, but it is likely to also have local control plane

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More "Complete" View of SDN

Programmable APIs	Traditional SDN	Hybrid SDN	Overlays Networks

Programmable APIs
- Applications
- Vendor-specific APIs
- Vendor Specific (e.g. onePK)
- Control Plane
- Data Plane

Traditional SDN
- Applications
- Vendor-specific APIs
- Controller
- OpenFlow, PCEP, I2RS
- Vendor Specific (e.g. onePK)
- Data Plane

Hybrid SDN
- Applications
- Vendor-specific APIs
- Controller
- OpenFlow, PCEP, I2RS
- Vendor Specific (e.g. onePK)
- Control Plane
- Data Plane

Overlays Networks
- Applications
- Vendor-specific APIs
- Virtual Switch
- Overlays
- Overlay Protocols (e.g. VXLAN)
- Control Plane
- Overlays
- Data Plane

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Evolving How We Interact With Network Devices

Traditional Approach

CLI
SNMP
HTML
XML
AAA
CDP
Syslog
Netflow
Routing Protocols
Span

Monitoring Discovery

Routing Security

QoS Interfaces

EEM (TCL)

New Paradigm

App

C

Java

Python

Anything you can think of

Rich Actions, Rich Events,
Rich Environment

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Python Examples

- Get Interface Properties

```
intf = tutorial.get_an_interface()
if intf == None:
    logger.error("No interfaces are available.")
    sys.exit(1)
intfProperty = NetworkInterface.get_property(intf)
print "\t" + intf.name + "\t Port" + str(intfProperty.port) + "\t Slot" + str(intfProperty.slot)
```
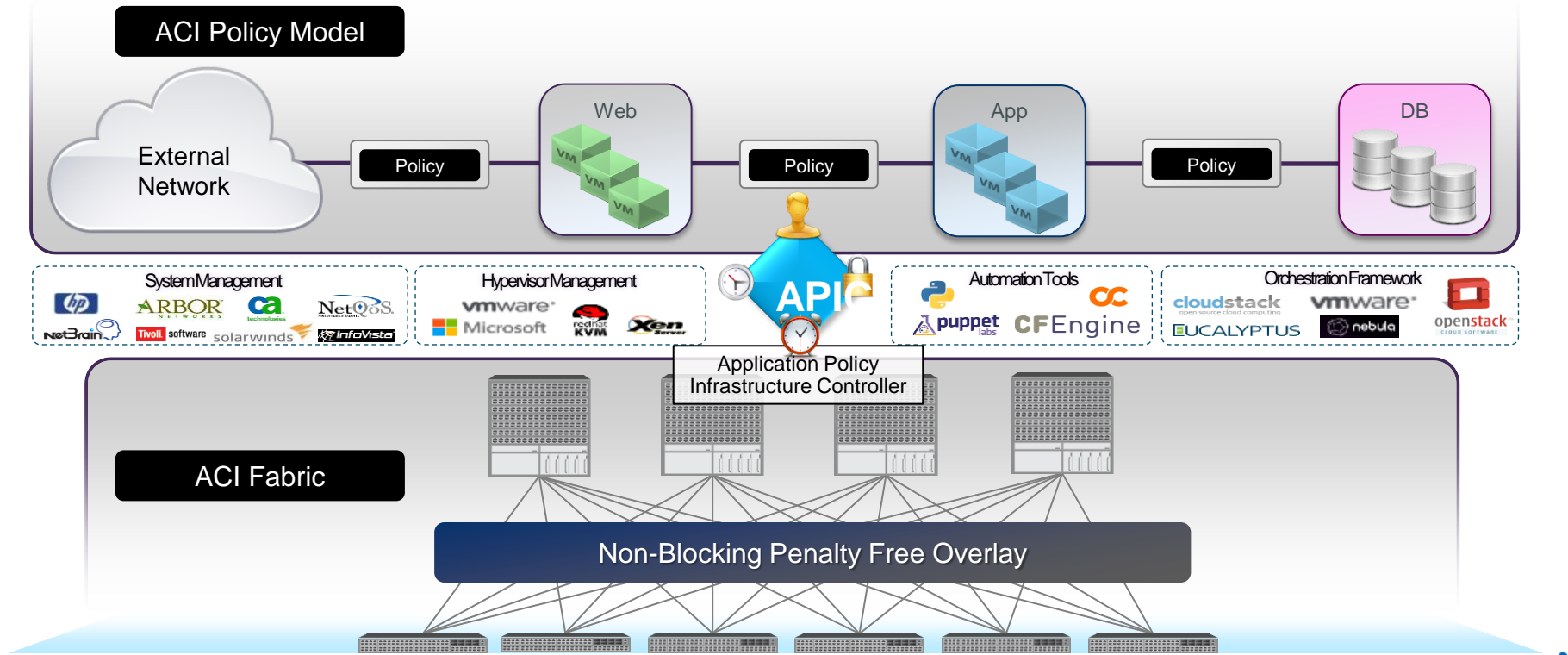
- Get Interface Status

```
print "\t Interface " + intf.name + " status is " + str(intf.get_status())
```

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ACI: A Complete System's View

ACI Policy Model

External Network — Policy — Web — Policy — App — Policy — DB

System Management | Hypervisor Management | APIC — Application Policy Infrastructure Controller | Automation Tools | Orchestration Framework

ACI Fabric

Non-Blocking Penalty Free Overlay

User-Driven, Policy-Based IT Infrastructure

Application/Workload Orchestration and Scheduler

Unified Information Model and API

Policy Controller Compute	Policy Controller Network Fabric	Policy Controller Storage

Application Graph
(EP, EPG, graph
edges)

Endpoint Group (EPG)

Endpoint Group
(EPG)
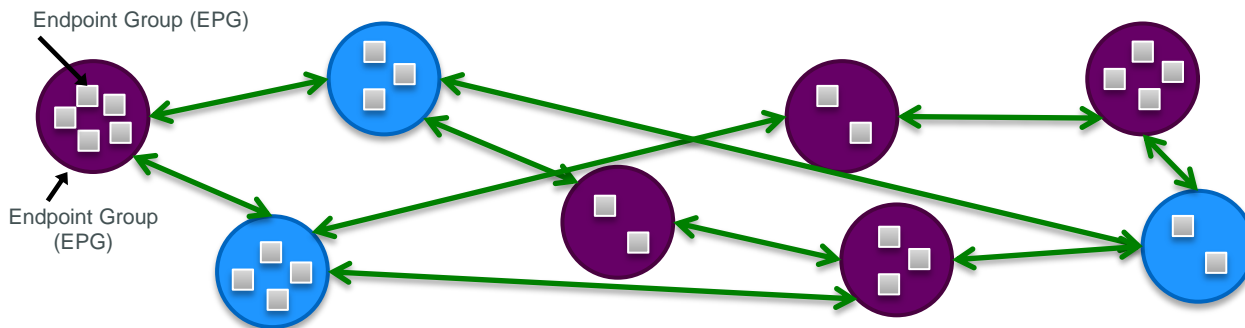
Application Profile	=	Compute Service Profile	+	Network Profile	+	Storage Service Profile

Designed from Its Foundation to Be Application-Centric

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Extending API Controller to WAN and Access

ONE DevKit (Northbound API) **NEW**

Cisco Application Policy Infrastructure Controller (APIC)

Enterprise Network Module **NEW**

ONE PK (Southbound API's)

DC	WAN	ACCESS
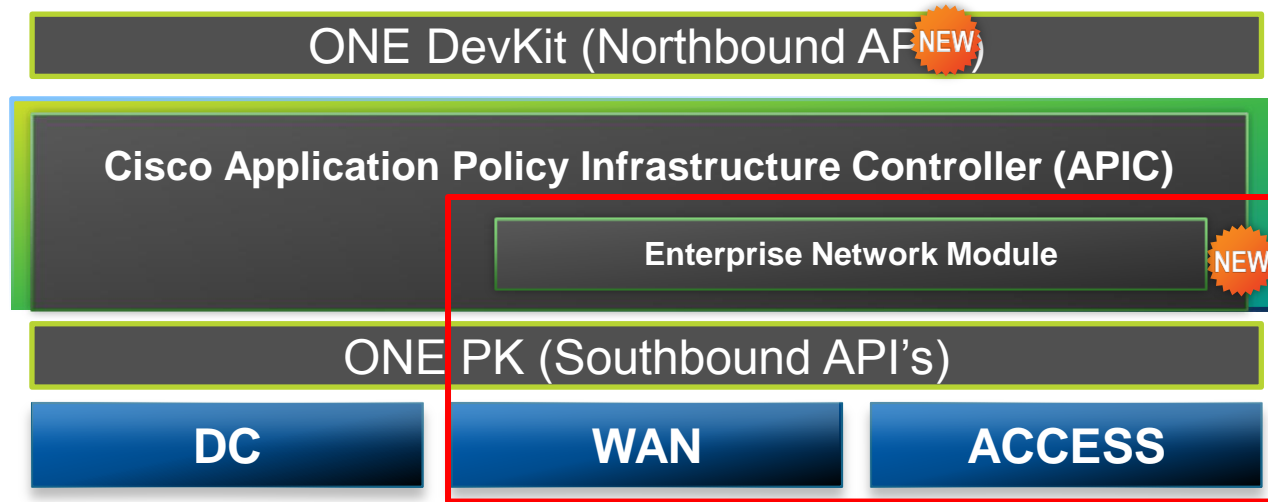
Physical and Virtual
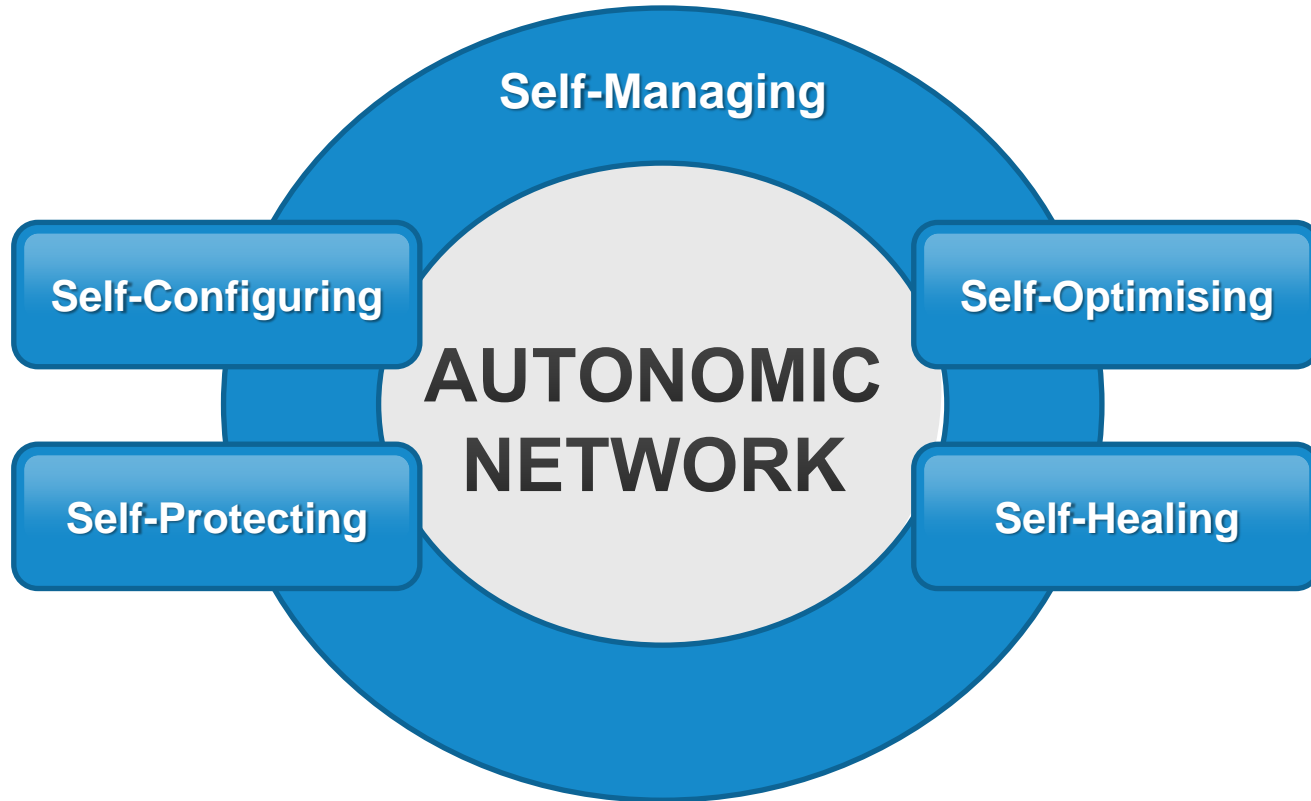
Common Policy Engine

Network Wide Security and Services

Investment Protection

Flexible Licensing

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Autonomic Networking : The Vision

Self-Managing

Self-Configuring

Self-Optimising

AUTONOMIC NETWORK

Self-Protecting

Self-Healing

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Autonomic Networking – The Vision

- The Network is "Self-Managing"
  - Devices automatically form a Cisco Validated Design
- Management on abstract, network-wide view
  - Based on human Intent, e.g.,: "This network has guestnet"
- Secure by default
- Domain identity based

Simple management tools

Abstract, Global Network View

Process
Device
OS

Process
Device
OS

See: http://tools.ietf.org/html/**draft-behringer-autonomic-network-framework**
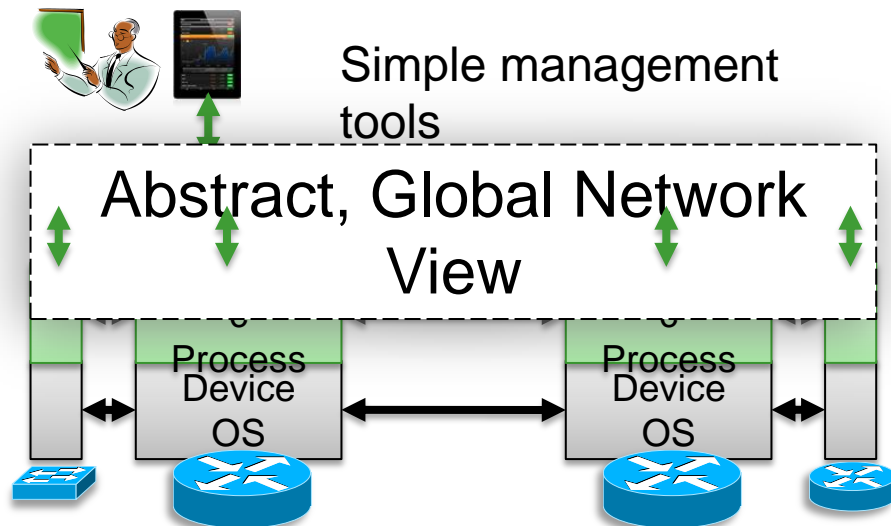
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New Skills

Job Roles Are Shifting for the Networker

Do **LESS** of…

- Device configurations
- Continuous operations
- Problem resolution
- Hardware deployments
- Monitoring and reporting
- CLI entries and scripting
- Hands-on repairs/deployments
- Reactive management tasks

Do **MORE** of…

- Business/IT innovation
- Architectural (End-to-End) design
- Network analytics & optimisation
- Programming – API versus CLI
- Software administration
- Comprehensive policy mgmt
- Systems Integration/validation
- Proactive management tasks

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So Are Requirements for IT Hiring Managers

Looking for LESS…

- Narrow design/deployment skills
- Strict operational focus
- Basic troubleshooting experience
- Network-only interests/intelligence
- Hardware-centric expertise
- Limited integration/test skills
- Constrained private network view
- Reactive management approach

Looking for MORE…

- Business-IT-network analysis
- "System" design expertise
- Network optimisation focus
- Top-down application perspective
- Technology innovation
- Software best practice experience
- Cloud integration or provisioning
- Proactive IT/business interaction

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Remember This Inflection Point?

Telephony in 1998
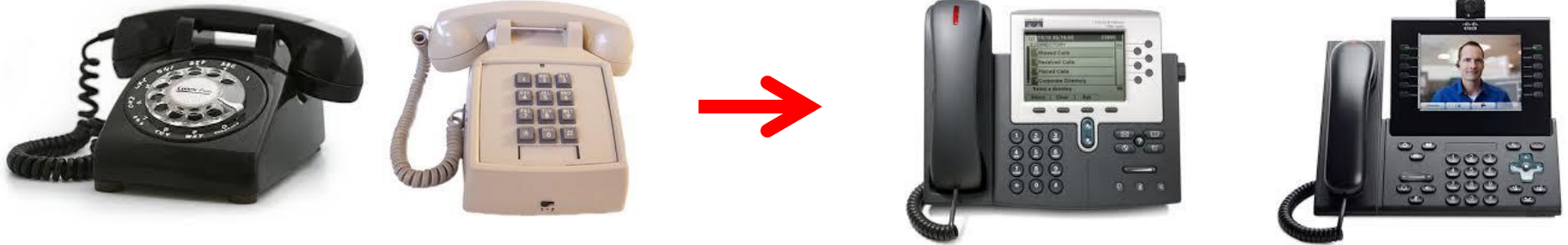
- IP Telephony struggled until we got 'hybrid engineers' to translate between the
  Circuit Switch 'Tip & Ring' and Packet Switch 'Bits & Bytes' camps

- Likewise, now, we need the next generation of 'hybrid engineers' to translate between traditional network domain engineers and software/application developers

The Hybrid Engineer

- DevOps Mindset

- Some Programming Skills (C, Java, Python) – Not Necessarily an Expert

- Virtualisation, Hypervisors, Operating Systems, Applications, Databases

- Can Advise Dedicated Programmers on Networking

- Not Stuck on 1:1 CLI – Interacts at Scale

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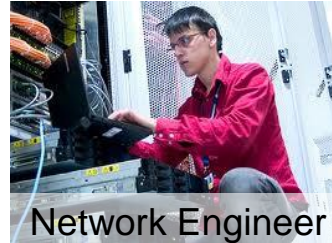
Who Will be the Network Programmer?

Applications That WHO Creates?

onePK

Network Engineer

Developer

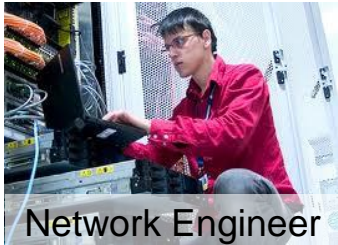|	Network Engineer	Developer
Network, IOS Skills	████████	█░░░░░░░
Scripting Skills	████░░░	██████░░
Programming Skills	█░░░░░░░	████████
Expertise	Network-centric use cases Scripts, PoCs, HA networks	Application-centric use cases Scalable, HA applications

Define Use Cases

Generate Specs

Test/Validate

Team Effort
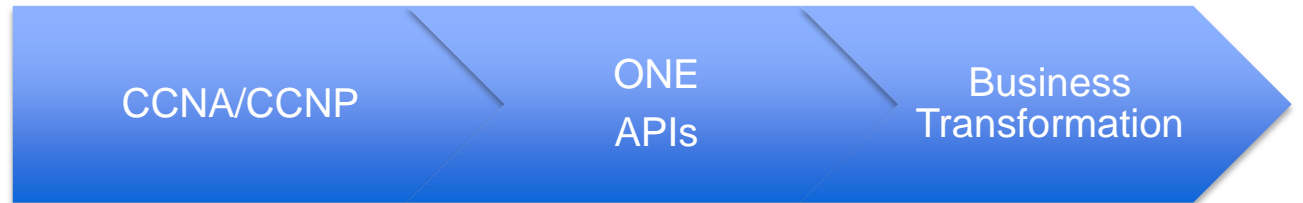
App Design

Code

Test/Validate

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Building Skills

Existing Skills

Network Engineer

CCNP/CCIE

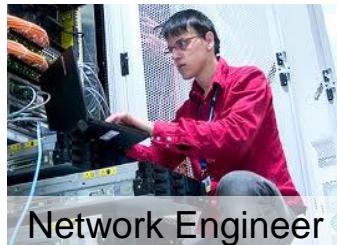| ONE APIs, Python | Sw Dev Life Cycle | Business Transformation |

Developer

C, Java, Python

REST, JSON

| CCNA/CCNP | ONE APIs | Business Transformation |

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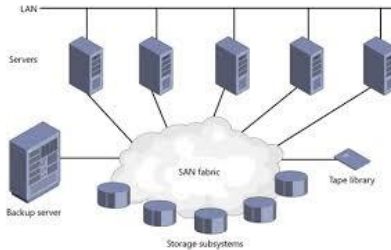
Moving Towards a Unified IT System… and Team

Traditional IT Model   Unified IT Model   Unified IT Team
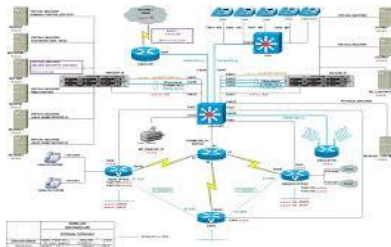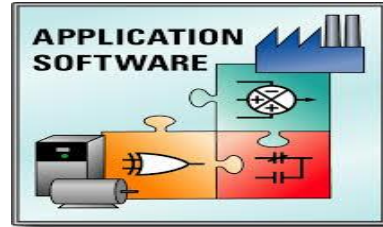
App Developer

Data Centre Mgr

Network Engineer

Applications

Compute

Storage

Network

Development

Operations

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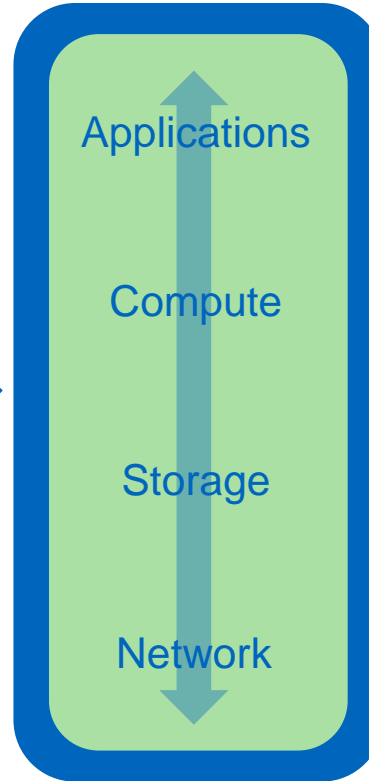
Moving Towards a Unified IT System… and Team

Unified IT Team

TASKS   **SKILLS**

Analyst
- Business operations
- Systems analysis
- Process optimisation

- Business transformation
- IT innovation/best practices
- Industry best practices
- Specialisation → BT, IoT…

Architect
- System design
- Cyber Security
- Resource optimisation

- End-to-end analysis/design
- Analytics and optimisation
- Cloud integration
- CCDn/CCAr

Developer
- Application design
- Network programming
- Application optimisation

- Outcome and data analysis
- Network SW tools – APIs…
- Performance test/tuning
- CCENT/CCNA

Operator
- System integration/test
- HW/SW deployments
- Continuous operations

- Comprehensive policy mgmt
- Automation and orchestration
- Enhanced SW administration
- CCNP/CCIE

Development

Operations

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Roadmap

How Virtualisation has Changed the Way People Operates in the Data Centre

Career Certifications	Specialist Certifications	Product Training

PEOPLE, PROCESS TECHNOLOGY

CCNA Data Centre*	Cisco Unified Fabric Design Specialist*	Nexus 1k, 2k/5k, 7k
CCNP Data Centre*	Cisco Unified Fabric Support Specialist*	MDS 9000
CCIE Data Centre*	Cisco Unified Computing Design Specialist*	UCS B and C series
	Cisco Unified Computing Support Specialist*	

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Role-Based Certifications for Cloud

Cloud Administrator Skillset

- Technical, hands on

- Ability to do orchestration, automation using tools

- Ability to troubleshoot Computing, Fabric, and storage technologies leveraging Infrastructure Management tools as well as element managers and CLI

- Moving workloads, underlying topology, L2 across DCs

- DC veteran with 10 yrs experience across network, compute, WAN + server virtualisation

Cloud Manager / Analyst

- Business acumen: ROI, TCO, financial skills, business transformation

- Grasp of technology, value and implications but not hands on

Cloud Architect Skillset

- Technical role: needs to know design and size in depth
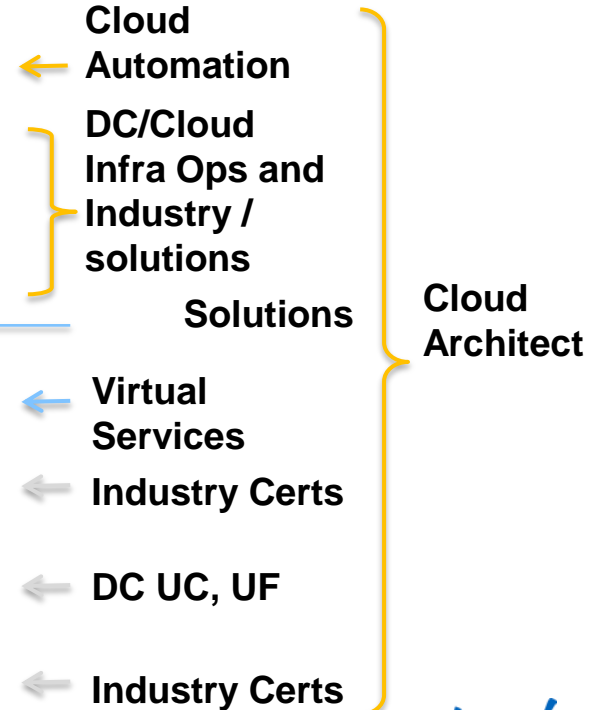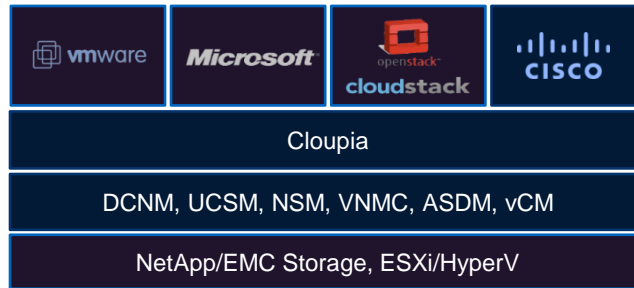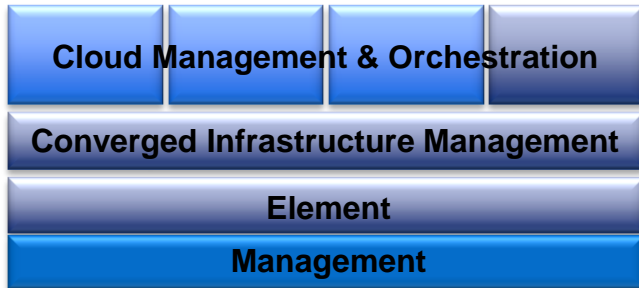
- Breadth of hands-on knowledge/experience across the entire technology stack (storage, compute, network, orchestration, automation, …), understand architectures, how to put everything together

- Ability to deploy Clouds based on customer requirements using automation tools

- + Business consultant: ability to position the value of cloud services to business decision makers

DC & Virtualisation: Evolution to Cloud

Technology Stack

Cloud Management & Orchestration

Converged Infrastructure Management

Element

Management

DC / Cloud Solutions

- Virtual Network Infrastructure
- Hypervisor
- DC Infrastructure (Compute & Physical Network)
- Storage Platform

Products & Solutions

vmware | Microsoft | openstack cloudstack | CISCO

Cloupia

DCNM, UCSM, NSM, VNMC, ASDM, vCM

NetApp/EMC Storage, ESXi/HyperV

VBlock, FlexPod, VMDC, VDI, HCS, Cross-DC Mobility

ASA 1KV, vNAM, VSG, vWAAS, CSR 1KV, Nexus 1KV InterCloud

vmware | Microsoft | openstack cloudstack | vmware openstack Microsoft

UCS, Nexus 2K-7K, MDS ASR 9K (Edge)

EMC² | NetApp | HITACHI

Roles and Focus Areas

Cloud Automation

DC/Cloud Infra Ops and Industry / solutions

Solutions

Cloud Architect

Virtual Services

Industry Certs

DC UC, UF

Industry Certs

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Network Programmability Industry Job Role Evolution

Business App Dev → Business Application Developer – network Programmability aware

New

Network Programmability Developer

System Engineer/Network Designer → Network Programmability Designer

Networking Engineer →

Network Programmability Engineer

Support Engineer →

Traditional Networking Infrastructure

Software Enabled Network Roles

Network Programmability Fundamentals Curriculum

Development Curriculum

Design Curriculum

Operations Curriculum

Network Programmability Certifications and Curriculum

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Network Programmability Design: An Example

Cert Pre-req

NP Fundamentals Phase 0 Exam

NP Fundamentals Phase 0 Training

Design Open Networking

Design Open Networking Training

Programming Languages Pre-req

Design Open Infrastructure

Design Open Infrastructure Training

November 2013

July 2014 or beyond
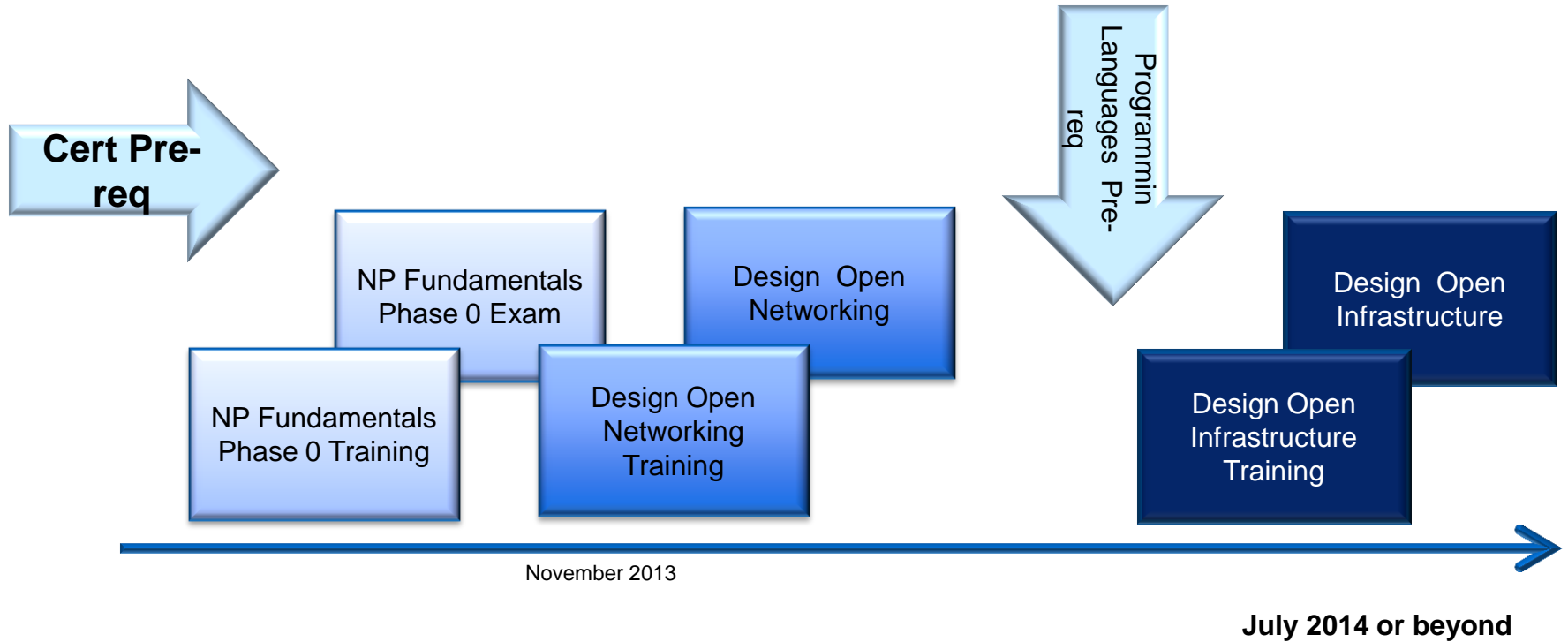
Q & A

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