



IPv6 Deployment and Operations Considerations



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Agenda

- **How to get started**
- Deployment Considerations
- Assessment
- Phased IPv6 Approach
- Operations Considerations
- Back End Systems
- Cisco on Cisco
- Summary



How Do we Get There from Here?

- IPv4 & IPv6 will coexist for the foreseeable future
 - No D-Day / Flag Day.
- Education & Careful Planning are crucial.
 - How long does it take in your environment?
 - What impacts are there to the existing network?
- IPv4 & IPv6 implementations must be scalable, reliable, secure and feature rich.



Strategy that reflects this ...

Starting with Edge upgrades enable IPv6 service offerings now

Enterprise Adoption Stages and Considerations

Certifications (USGv6, JITC UCR2008)

IPv6 Pilot and Basic Infrastructure

IPv6 Internet Presence (websites, remote users, B2B ...)

IPv6 Islands (Wireless/Consumer devices, Labs ...)

Internal Data Center, Enterprise Apps

Ubiquitous Dual-Stack

IPv4 EOL

Getting started

- Assessment
- IPv6 in refresh policy
- Pilot deployment
- Addressing plan and allocation
- ISP connectivity
- Education and Training

Network Design Choices and Deployment

- Host configuration (DHCPv6 vs. SLAAC)
- Routing (OSPFv3, IS-IS, EIGRP)
- DNS (ipv6.company.com vs. www.company.com)
- Tunneling and Overlay networks (GRE, ISATAP, etc)
- Native or dual stack
- NAT
- Security (Firewalls, Antispoofing)
- Peering/Transit
- Network Management

Applications

- Web applications
- Collaboration (Voice, Video, etc)
- Enterprise Software
- Custom Applications
- IPv6-Only Applications

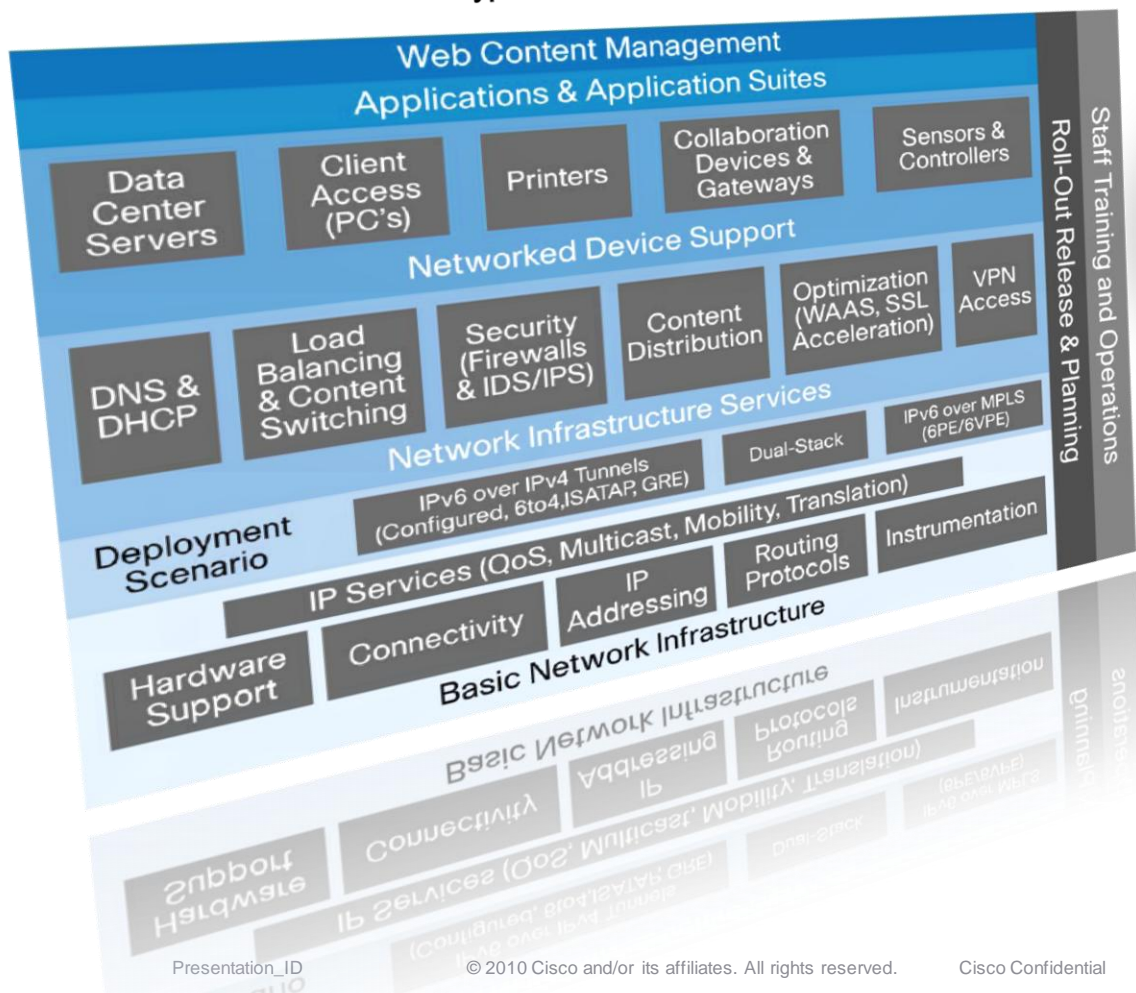
Requirements for any IPv6 Transition Strategy

- Must be low-cost and low-risk
- Must co-exist with existing IPv4 infrastructure
- Must allow access to public IPv4 Internet
- Must be incrementally deployable
- Must understand the cost of adding a new services
- Must not impact existing services.
- Seamless should be transparent to end user.

IPv6 integration should be managed from a broad architectural / 'systems-wide' perspective...

IPv6 integration is not 'just a network upgrade' but complex endeavour, involving many elements and capabilities which evolve over time, rather than changing all at once.

Typical IPv6 Integration Elements



Planning and coordination is required from many across the organisation, including ...

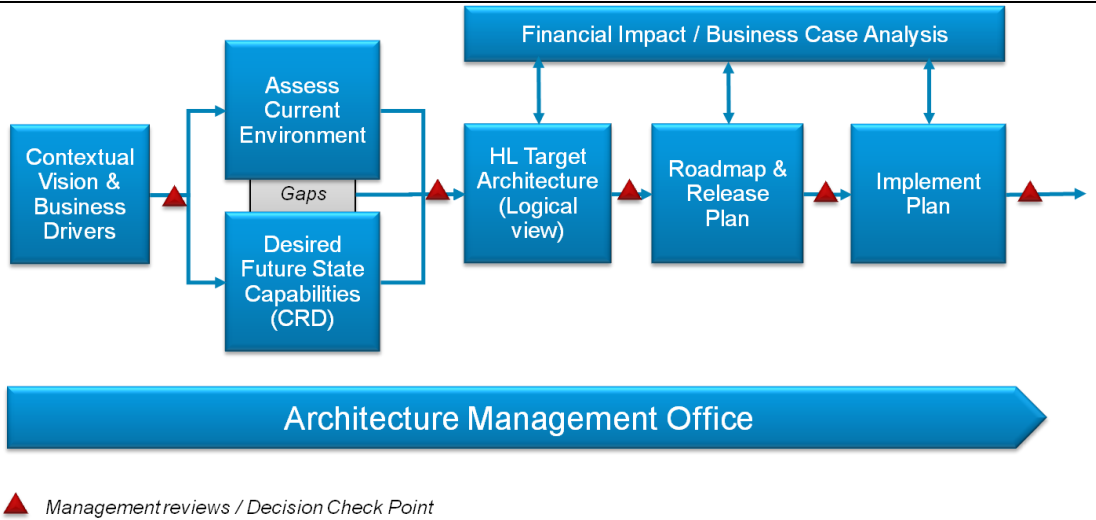
- ✓ Network engineers & operators
- ✓ Security engineers
- ✓ Application developers
- ✓ Desktop (Office Automation) / Server engineers
- ✓ Web hosting / content developers
- ✓ Business development managers
- ✓ ...


Moreover, training will be required for all involved in supporting the various IPv6 based network services

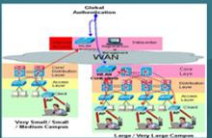
Process is Critical


- If you think it is just about technology, you are mistaken
- If you think it is just about the services, you are mistaken
- It is about active support throughout the organization
 - From executive to individual contributor level
 - From purchasing to development
 - From design to deployment
 - From network infrastructure to Application deployment
- The process focus helps minimize costs, properly orchestrate alongside inflight projects, achieve goals
- **Create a virtual team of IT representatives from every area of IT to ensure coverage for OS, Apps, Network and Operations/Management**

Cisco Services approach delivers a full transformation journey ...




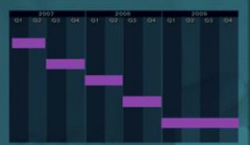
Business Requirements


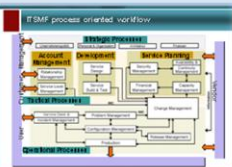
Next Generation Architecture


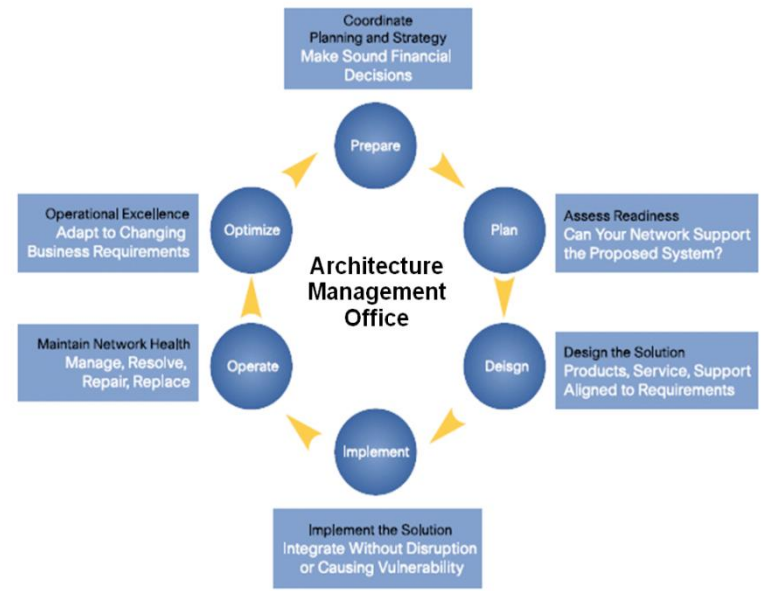
Business Case


Architecture Management Office

Release Plan


Implementation Plan


Operational Model




Issues for the IT Organization

- Business driver
- Cost
- Staff training
- Develop an addressing plan
- Certify hardware & software configurations
- Enable Routing
- Internal infrastructure services (DNS, NTP, DHCP, ...)
- Network management infrastructure
- Security
- Operational experience
- Deploy some IPv6-only systems to find the IPv4-dependencies
- Peering
- Develop a plan for encouraging a migration over time
 - Costs for maintaining IPv4 will skyrocket due to space fragmentation
- Enable public facing services



IPv6 Deployment Considerations



IPv6 in the Data Center

Biggest Challenges Today

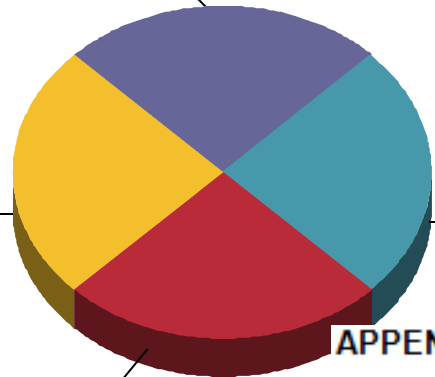
- Network services above L3
 - SLB, SSL-Offload, application monitoring (probes)
 - Application Optimization
 - High-speed security inspection/perimeter protection
- Application support for IPv6
 - If an application is protocol centric (IPv4):
 - Needs to be rewritten
 - Needs to be translated until it is replaced
- Growing DC complexity
 - Virtualization should make large DCs simpler and more flexible
 - Lack of robust DC/Application management is often the root cause of all evil
 - Ensure management systems support IPv6 as well as the devices being managed

Is my network IPv6 ready ?

IPv6 Assessment Tool provides clear answer

Devices Capable of running IPv6 with SW/HW upgrades

Devices Not Capable of running IPv6



Devices Capable of running IPv6

Further Analysis Required

APPENDIX J- Device capability based on CPU and Memory

The following table lists the devices identified as capable to support IPv6 but have high CPU usage or have low free memory.

Device Name	Product Name	Total Memory	Free Memory	CPU usage
Device60	CHAS-7507=	264	43	15
Device61	GSR10/200-AC	2048	928	72
Device62	CISCO7609	1024	100	22
Device63	GSR10/200-AC	2048	200	32
Device64	GSR10/200-AC	2048	800	52

Don't forget the applications

IPv6 Address Considerations

- Develop an addressing plan and corresponding network architecture
- Understand IPv6 addressing at micro level (subnet assignment)
- Take into consideration aggregation/summarization for scalability. Design network prefixes as it were native/dual stack environment
- Establish policies for using the IPv6 prefix and decide which mechanisms to use to assign addresses
 - Dynamic Host Configuration Protocol v6 (DHCPv6)
 - Stateless Auto Configuration (SLAAC)
 - cryptographically generated addresses (CGA).
 - Interface assignment format ?? MAC address based etc ?
 - Some might use multiple mechanisms – for example, manually assigning addresses to critical servers and networking devices and using DHCPv6 to assign addresses to others.
- Cisco IPv6 Addressing White paper:
 - http://www.cisco.com/web/strategy/docs/gov/IPv6_WP.pdf

IPv6 Routing Protocol Considerations

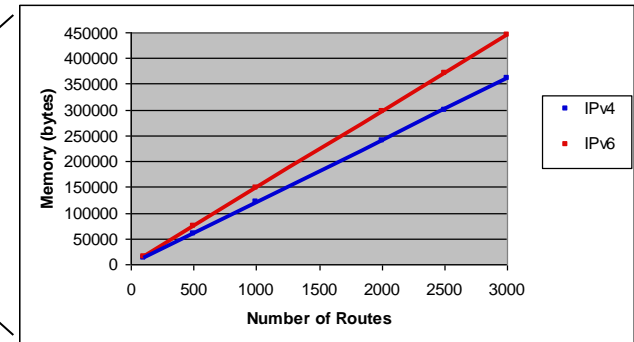
Question to ask yourself

- Are the topologies going to be congruent?
- Separate routing process or the same ?
 - EIGRPv6 OSPFv3, RIPng Separate Process
 - ISIS one process today however supports Multi-Topology (what is the impact to flooding in your network) in either mode.
- What are the High Availability requirements ?
- What are the fast convergence needs i.e application needs, network convergence. Does the protocol support it yet ?
- If both IPv4 and IPv6 timers are tweaked what are the affects on convergence and the Platforms.
- BGP peering consideration
 - should I use separate peers ?
 - route-maps separate policies ?
 - Link local peering for EBGP ? Or global ?
 - Route Reflector design separate RR's, ?

Understanding co-existence implications

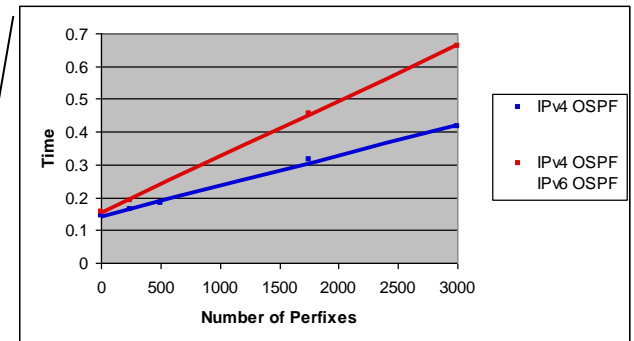
■ Resources considerations

- Memory (storing the same amount of IPv6 routes requires less memory than might be expected)
- CPU (insignificant increase in the case of HW platforms, additive in the case of SW platforms)



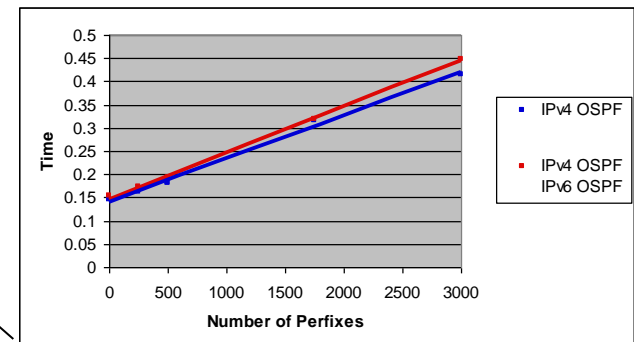
■ Control plane considerations

Balance between IPv4/IPv6 control plane separation and scalability of the number of sessions



■ Performance considerations

- Forwarding in the presence of advanced features
- Convergence of IPv4 routing protocols when IPv6 is enabled



IPv6 Testing Considerations

- Test/identify application software and services
 - Establish a lab for testing applications and services
 - Should IPv6 RA's be disabled how do devices re-act to that ?
 - IPv6 routing protocol design, convergence,
 - IPv6 QOS and Security features
 - Test Co-existence IPv4 and IPv6. Based off IPv4 base line i.e take worst case IPv4 scenarios and build IPv6 on top of that.
 - DHCPv6, DHCPv6-prefix delegation
 - How do devices re-act with A and AAAA DNS records
 - What happens to the application or the operating system when I have multiple address on a interface
 - NMS polling.

Service Provider Connectivity Considerations

Question to ask

- **SP Deployment Type**

 - Dual Stack, Native or Overlay (if so what kind of overlay)

 - What kind of SLA are provided for the services

- **What kind of services are offered**

 - Internet Services

 - Layer 2 or Layer 3 VPN's

 - IPv6 Multicast support or plans ?

- **Visibility and footprint to the IPv6 Internet.**

 - Understanding Peering arrangements

- **Understand Addressing Policy and acceptance**

 - Prefix length acceptance

 - Provider Independent or Provider Assigned acceptance

- **Provisioning**

 - Is there a self service portal ?

 - Routing add and deletes, updating policies how does that work

- **Charging model do you charge for IPv6 ?**

- **NAT services do you have any ?**

- **IPv6 Hosting Services ?**



IPv6 Network Management and Operations



IPv6 Transition: Network Management Considerations

1. Planning the transition process
2. Requirements for institutional knowledge of IPv6
3. Managing network element transitions to IPv6 operation
4. Management and design strategies for IPv6 addressing model, policies and operation
5. Introduction of extended IP services: DHCP, DNS, IPAM
6. Managing security infrastructures: Firewall, IDS, NAC, AAA
7. Tool visibility, insight and analysis of IPv6 traffic Netflowv9, IPSLA
8. Troubleshooting, IPv4-IPv6 interaction. Many new things to learn here. Different mind set for operations team.
9. Operational Readiness People, Process, Tools, Documentation

IPv6 impacts 4 areas of Network Management

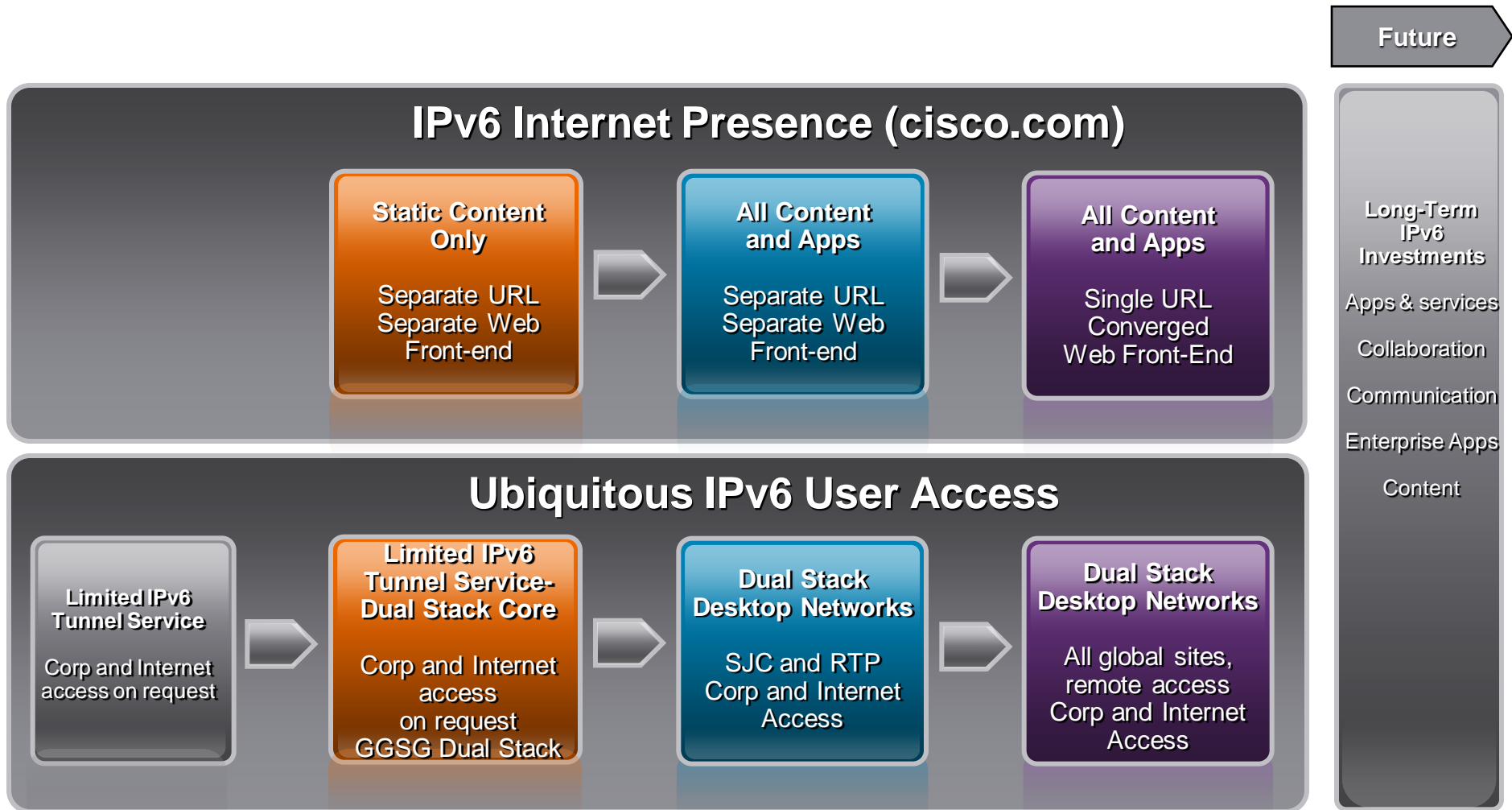
1. Instrumentation (MIBs, Netflow, IPSLA,...)
Updated IP MIBs, RFC 4001 compliancy,...
2. Management protocols running over IPv6 (SNMP, TFTP, Syslog, Telnet, SSH, NTP, Radius/Tacacs, DNS, CDP, ..)
3. Instrumentation running over IPv6 (CNS Agents, Config logger, HTTP, Netconf)
4. Network Management tools and applications:
Ciscoverks LMS, Network Analysis Module (NAM), Cisco Network Registrar (CNR)



Cisco IT – IPv6 Integration Strategy



Cisco IT's IPv6 Strategy



A Phased, Iterative Approach to Successful IPv6 Adoption

Start with a Phased Plan Aligned with Your Business Strategy

1

Identify the highest priority IPv6-critical areas in your network

2

Perform IPv6 Assessment on highest-priority areas to determine scope of design

3

Develop an IPv6 design that enables IPv6 to be introduced without disrupting your IPv4 network

4

Begin IPv6 testing and implementation in pilot mode, then extend over time into production deployment

Repeat for the Next IPv6-Critical Area in Your Network

An Iterative Approach to IPv6 Adoption

Addressing Critical Areas in Priority Order

Plan

Build

Run

Business Value

IPv6
Discovery

IPv6 Device
Readiness
Assessment

IPv6
Architecture
Assessment

IPv6
Planning and
Design

IPv6
Implementation

Network
Optimization

- A phased plan is created during discovery
- The most business-critical areas are assessed, planned, designed, and implemented first
- Network optimization provides ongoing design support for incremental IPv6 changes and helps your staff succeed

Architectural
Services Approach

Architecture
Assessment

Architectural
Blueprint

Absorb, Manage,
and Scale

Summary

- IPv4 exhaust is about business continuity
- IPv6 has some winning economic, technical and service arguments
- IPv6 architecture choices will define business opportunities for many years
- Expect innovation in applications as characteristics of IPv6 are understood
- Create a plan and Strategy with time lines
- Put IPv6 into your procurement process for tech refresh cycles
- Understand Network Readiness today
- Don't get left behind