Migrating an Organization to IPv6

Agenda

- IPv6 adoption – The steps

- Case study of IPv6 adoption

IPv6 Adoption
Everyone will Take Off Like This

IPv6 Adoption Strategy

IPv6 Adoption Strategy

IPv6 Awareness
- Educate on importance of IPv6 and impact of non-adoption
- Inform staff of timelines and budgets required for IPv6 adoption
- Assess Products/Services which have dependency on IP addresses

IPv6 Adoption Business Strategy
- IPv6 Adoption – Governance team
- Identify key goals and drivers
- Establish broad timelines and milestones

IPv6 Skill Building
- Senior Technical Architects
- Engineering Management
- Software Developers
- Support Staff
- Sales Staff

IPv6 Adoption Project Plan
- IPv6 Readiness Assessment
- IPv6 Services roadmap
- Estimate the budgets required and Return on Investment

IPv6 Solution Validation Lab
- Validation of Network, Application and Services Solutions

Quick Wins
- IPv6 Enable external-facing websites
- Participate in Technology trials and Testbeds

IPv6 Awareness

IPv6 Awareness	
Overall Aims	Raise IPv6 awareness across all Key Stakeholders within the organization to educate them on the importance of IPv6 adoption, the scope of activities to be accomplished and the likely timelines
Approx duration	1-2 months
Key Tasks	The Awareness program must be targetted at multiple segments: **Senior Management** -Importance of IPv6 and Business impact of non-adoption - Timelines and cost of IPv6 Adoption **Engineering Management** - Various aspects of Network, Application and Services that would be affected as a result of IPv6 adoption **Engineering Staff** -IPv6 Technology basics -Mechanisms for transition to IPv6 -Guidelines for operating and maintaining IPv6 enabled networks
Stakeholders	Senior Management, Engineering Management, Training Dept
Dependencies	None

IPv6 Adoption Business Strategy

IPv6 Adoption Business Strategy	
Overall Aims	Identify Business roadmap, covering business goals and drivers, identifying service offerings to be delivered
Approx duration	2-3 months
Key Tasks	The IPv6 Business Services plan needs to: **Identify IPv6 Adoption Governance team -** that will Guide, Plan, Manage and monitor IPv6 Adoption **Identify key Services that should support IPv6 -** In line with the organization priorities and goals, **Establish broad timelines and milestones –** covering people, process and technology
Stakeholders	Senior Management, CTO, CIO
Dependencies	An IPv6 awareness Program should have been conducted before the adoption strategy is planned

IPv6 Governance team

IPv6 Adoption Governance team

Outreach

Technology
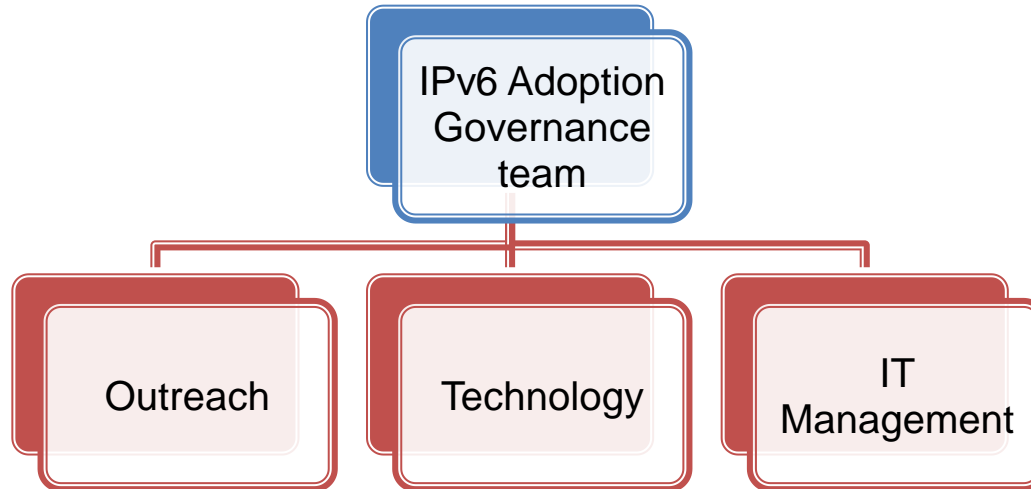
IT Management

Function	Role
Outreach	Collaboration, Training, Media and Education
Technology	Network Architectures, Security, Tools and Testing
IT Management	Project Planning/Milestones, Procurement, Acquisition and Vendor Integration

IPv6 Skill Building

IPv6 Skill building	
Overall Aims	Ensure that IPv6 skills are builtacross the various levels of the organization, so that they participate and contribute to the IPv6 adoption process
Approx duration	2-3 months
Key Tasks	The IPv6 Skill building program encompasses the various layers of the organization: **Senior Technical Architects/Engineering Management** **Program and Project Management** **Implementation and troubleshooting** **Software Development**
Stakeholders	Senior Management, CEO,CTO, CIO, Governance team
Dependencies	An IPv6 awareness Program should have been conducted before the adoption strategy is planned though it can be started in advance or full completion of the IPv6 awareness program

Project plan for IPv6 adoption

Project plan for IPv6 adoption

Overall Aims	Establish the organizations current portfolio that requires that requires some form of action to enable them to be IPv6 compatible Draw up a detailed project plan , including the various sub-activities required for each component to be IPv6 ready
Approx duration	2-3 months
Key Tasks	Estbalish an IPv6 governance team – encompassing key stakeholders Review government mandates dates and deadlines Draw a detailed project plan with milestones and dates
Stakeholders	Senior Management, CEO,CTO, CIO, Governance team
Dependencies	An IPv6 awareness Program should have been conducted, wherein stakeholders understand the importance of readiness assessment and are willing to participate in the same

IPv6 Readiness Assessment Checklist

Conduct an IPv6 Readiness Assessment before drawing a detailed IPv6 adoption Project Plan

IPv6 Readiness Assessment

Catalogue IPv6 readiness across the following areas

Internal/external IPv6 adress space

Corporate network support for IPv6

Development or updating of policies for the use of IPv6 on corporate networks

Internal/external IPv6 addressing schemes/plans

Internal/external DNS servers (including DHCP servers)

Authentication systems (such as Radius servers)

Use of peering, transit, relays, or tunnels for external connectivity

Management tools for network devices (routers, switches, etc.)

Physical hardware of network devices (routers, switches, etc.)

Service load balancers

Corporate firewalls and VPN concentrators/clients

Corporate storage systems

Corporate video conferencing systems

Corporate VoIP systems

Corporate UPS systems

Client OS deployments

Server OS deployments

Corporate applications

CALEA Support (for carriers)

Security policies and support in network devices & servers

Operations readiness including management systems, troubleshooting & monitoring tools, testing tools

Outsourced (SaaS) applications, including, but not limited to, CRM, HR/talent management, financials, etc.

Associated broadband CPE, such as cable modems, DSL modems, and router/wireless access points

- Purchase Department

- IT Department

- Software Developers

- Website Team

- Facilities Department

- Product Management

- Customer support

Verifying IPv6 Readiness

Purchase Department

- Ensuring that all new network service providers the company contracts with provide documented support for IPv6
- Ensuring that all new network hardware vendors provide documented support for IPv6
- Ensuring that all new application platform vendors provide documented support for IPv6
- Ensuring that all new software/SaaS/application vendors provide documented support for IPv6
- Ensuring the all new vendors/providers be able to provide QA results for IPv6 support, as required/necessary

Software Developers

- Identify embedded/hard-coded reliance on IPv4 connectivity and IPv4 addresses
- Identify latency-sensitive or port-intensive applications that would be impacted by NAT implementation outside the company's control
- Ensure appropriate handling of IPv6 addresses within logging, access control, and other relevant subsystems

Facilities Management

- Identification of IP-connected embedded devices or systems (microcontrollers, HVAC, etc.) not under the control or management of the technical staff/IT team

Verifying IPv6 Readiness

Website Managers

- Documented support for IPv6 by Web hosting provider, if relevant
- IPv6 support within underlying Web Server OS
- IPv6 support within Web Server software
- Can log analysis software handle IPv6 addresses?
- Can 3rd party analytics vendor(s) handle IPv6 addresses?

Product manager

- Development of internal and externally-facing plans and timelines for the support of IPv6 within relevant products and services
- Ensure that all software/hardware (as relevant) supportrs IPv6 at parity with IPv4, or is ready to
- Document relevant performance metrics

Customer support

- Identify requirements for documentation, troubleshooting processes & tools, escalation paths, etc. related to IPv6 support

IPv6 Ready Hardware and Software

Hardware

- Procurement Dept – Please purchase equipment only with - IPv6 Ready Logo Certification
- List of IPv6 Ready Logo Certified Equipment - https://www.ipv6ready.org/db/index.php/public/

Software

- There is no IPv6 Forum Logo certification Program for software
- Verify and validate IPv6 features and capabilities in your lab
- Request for IPv6 Test Results for the software from the vendor

IPv6 Adoption Project Plan

- Stakeholders

- Milestones

- Metrics

IPv6 Adoption Timelines

| Planning Phase (2-3 months) | → | Implementation Phase (20-30 months) | → | Support Phase Continuous |

Planning Phase:
- IPv6 Awareness
- IPv6 Skill building
- IPv6 adoption planning
  - •IPv6 adoption Project plan
  - •IPv6 Readiness Assessment
- IPv6 Pilot projects

Implementation Phase:
- IPv6 Architecture and Design
- IPv6 rollout and implementation
- IPv6 Test and validation
- IPv6 Trials
- IPv6 Services Live

Support Phase:
- IPv6 Services Support

It takes about 2-4 years for an organization to complete the IPv6 adoption

IPv6 Security

- You may already be using IPv6 !!
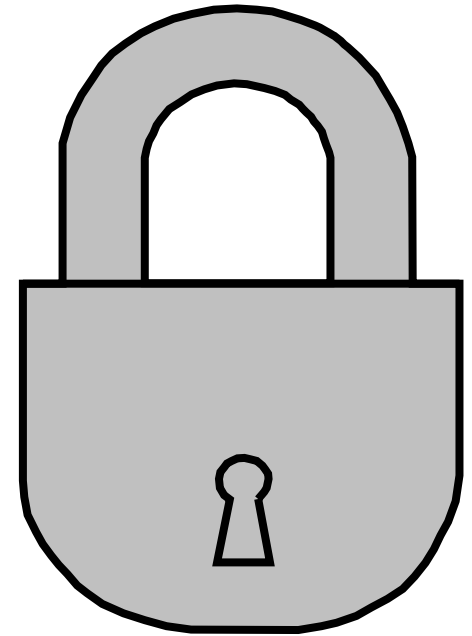
- Please secure your network today

- Configure Firewall, IDS/IPS policies

- Configure security on all perimeter devices

- Security Best Practices shared in the Security slide deck

Acquire IPv6 address

- Acquire an IPv6 address block from APNIC – Provider independent address

- Or acquire IPv6 block from your Internet Service Provider

- By default provided /48, but in case you can justify , you get a higher address space

IPv6 Connectivity

- Order IPv6 connections

- Ensure that IPv6 across various technologies are supported – MPLS, Broadband, Mobile

- Ensure performance SLA's from your Service Provider – IPv4 and IPv6 together can impact your Network/Service SLA's
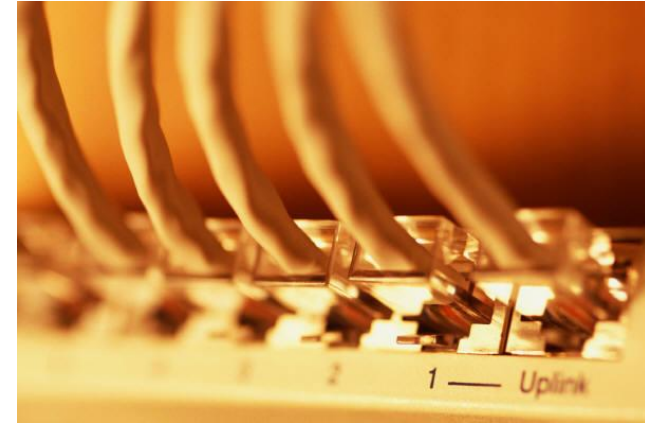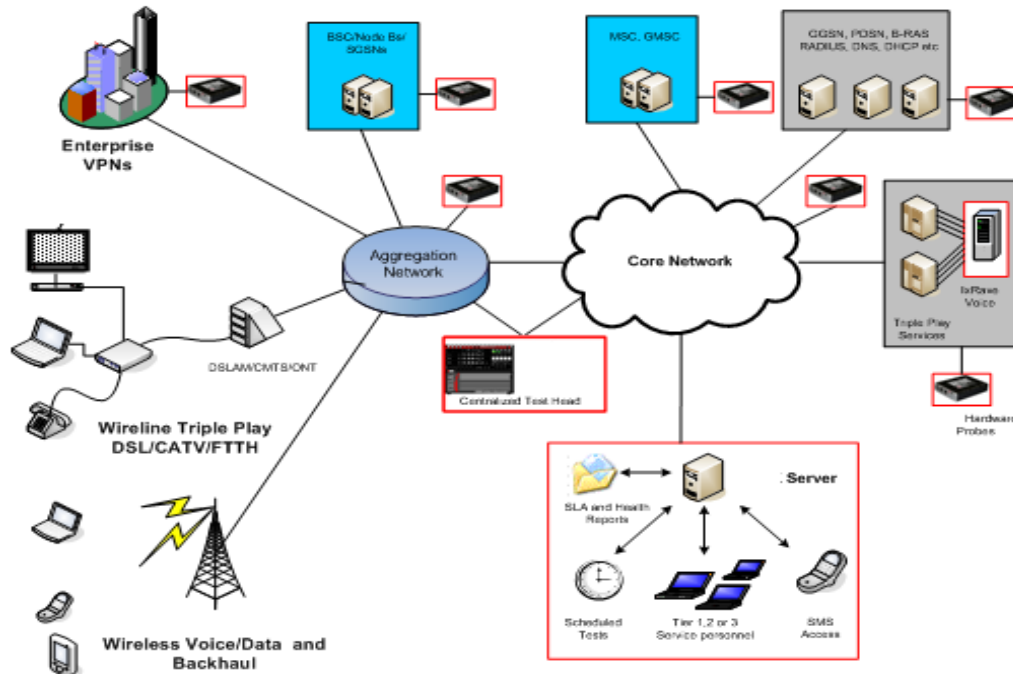
- Verify IPv6 Solutions before deployment in Production Network
  - Network
  - Applications
  - Services
- Verify IPv6 Capabilities across Devices and Applications, before purchase
- Diagnose Faults across a segment of the network in the SWAN – IPv6 or IPv4

Set your – Business Priorities

- Identify areas of:
    - New Technology Programs

    - Expansions in the current Programs

    - Customer facing Web Portals

    - Areas where your customers/providers are moving to IPv6
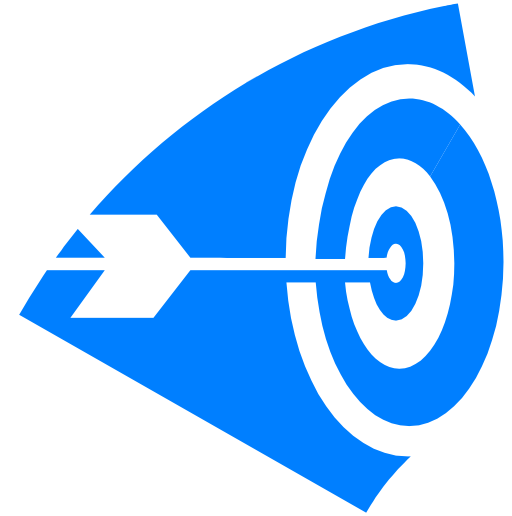
    Plan and prioritise IPv6 adoption across these areas

Design your address scheme

- L- Location

- G- Role

- B – VLAN or Sub-netting or your identifiers
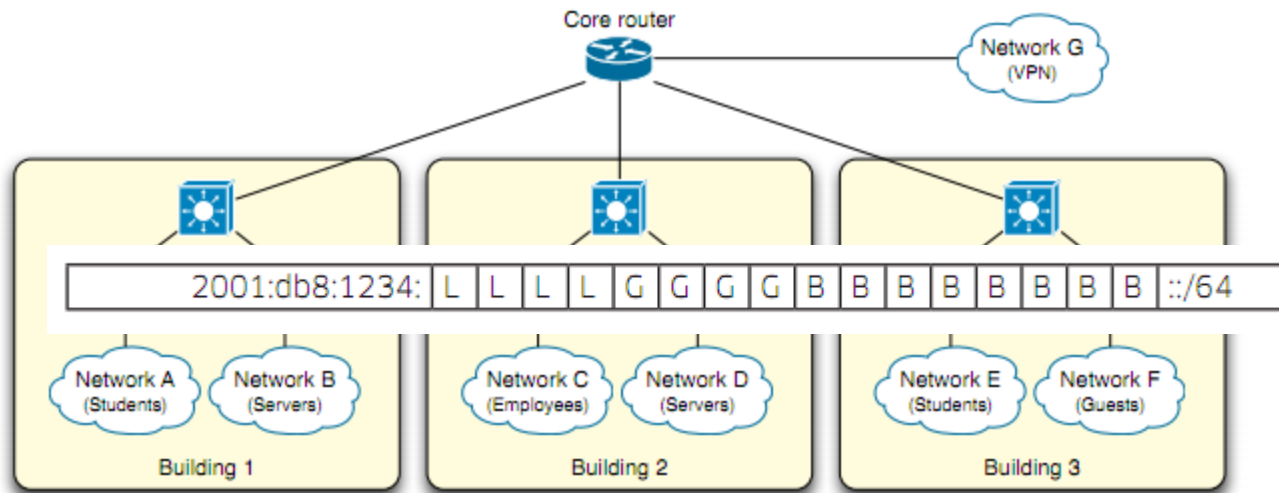
- Right Address Design can help you to assign policies based on address scheme:
    - Security Policies
    - Network Management Policies

Design your IPv6 Adoption Architecture

Routing	COTS Applications
Transition Mechanisms	Proprietary Applications
Security	Web Servers
QoS	Windows
DNSv6	Unix/Linux
IP Address Management	Performance Management
IPv6 Network Management	Fault Management
Multi-Homing	Diagnostics
NAT Considerations	Service Provisioning
Many more …	Many more …

IPv6 Solution Validation Lab

Project plan for IPv6 adoption

Overall Aims	Verify and validate the proposed IPv6 based solution (Architecture, Design and Services) before they are rolled out in a live environment
Approx duration	2-3 months
Key Tasks	The IPv6 Solution validation lab should ensure that the IPv6 migration architecture included in the project plan must be validated in terms of it's ability to support the required services: **IPv6 Network Solution** - the network solution proposed in the project plan needs to be tested for functional, performance guidelines and adherence to SLA's in the organization **IPv6 Application Solution** - the various commercial and proprietary applications need to be validated for their ability to function under the IPv4/IPv6 solution. **IPv6 Services** - the services are planned to be IPv6 enabled need to be validated in terms of functional and reliability aspects in the network and application environment.
Stakeholders	Technical Architects, Governance team
Dependencies	The skill building program should have been completed and the key IPv6 business priorities should have been finalised, so that the related services and architectures can be validated

IPv6 Lab
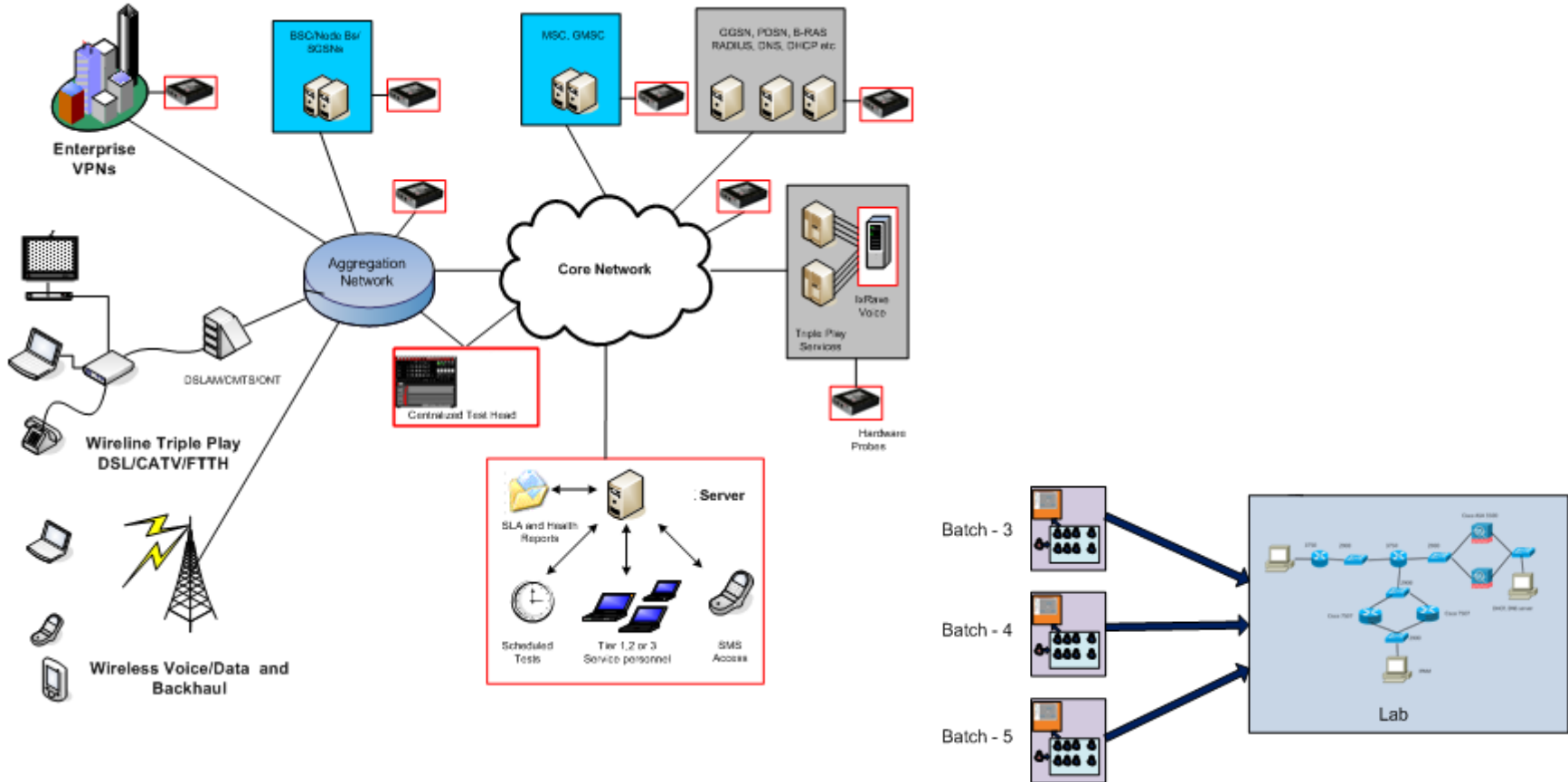
IPv6 Lab – Requested under IPv6 Pilot Project Program

IPv6 Diagnostics – Network, Application verification and validation lab

IPv6 Training Lab

Quick wins

Quick wins	
Overall Aims	Identify and implement initial quick win projects
Approx duration	2-3 months
Key Tasks	Encourage early adopt teams to take part in IPv6 trials , so that experience can be gained, which would have a "Snowball" effect, whereby interest is simulated across the organization
Stakeholders	Governance team, Technical teams
Dependencies	An IPv6 awareness Program and Technical skill building programs should have been completed before starting this activity.

A few quick wins:
- IPv6 enable the external facing web sites
- Trial of IPv6 solutions in your lab
- IPv6 enable new solutions being rolled out
- So forth …

IPv6 Adoption Costs

IPv6 adoption costs
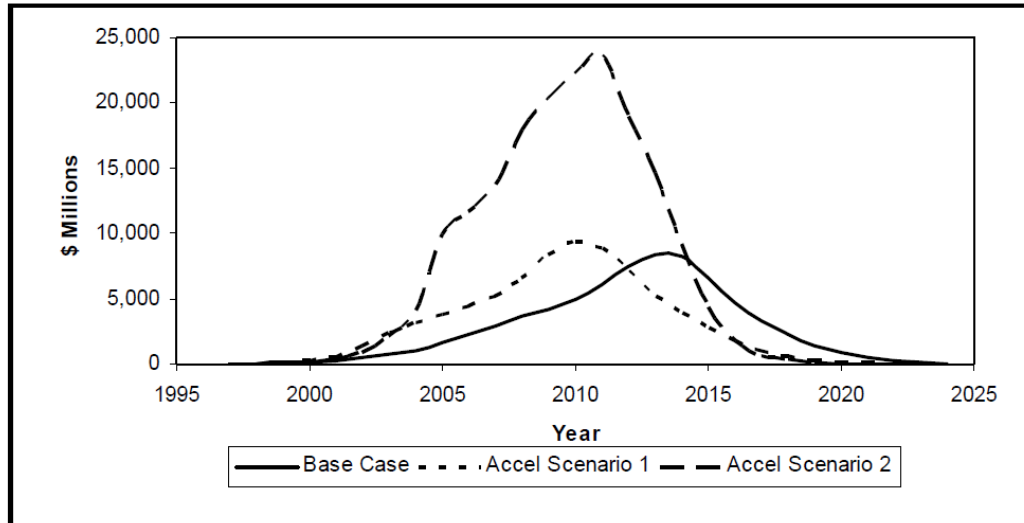
Source: IPv6 Economic Impact Assessment Published by NIST Oct 2005
The above costs are based on US costs in 2005
Please consider respective cost increase towards 2012, in your respective country

Scenario	Details	Cost implications
Base Scenario	H/W & S/W upgrade as part of normal refresh cycle IPv6 enabled based on IPv6 application availability and needs	Base line minimal costs
Scenario 1	Adoption Time line accelerated by 3 years Labour costs increased by 5%	25 percent increase in the present value (PV) of U.S. deployment costs
Scenario 2	H/W & S/W IPv6 enablement increased by one year 4 year acceleration of IPv6 enablement	285 percent increase in the PV of U.S. deployment costs

Components of IPv6 adoption

Component	Details
IPv6 Adoption Strategy & Plan	• IPv6 Business plan • IPv6 budgets and costs
IPv6 Adoption Team and Project Plan	• IPv6 adoption – Governance team • IPv6 Readiness Assessment • IPv6 adoption – Project plan
IPv6 Pilot and Training lab	• IPv6 Training lab • IPv6 Pilot projects

People	• Skill building - IPv6 Training
	    • IPv6 Architecture and Design
	    • IPv6 Implementation and troubleshooting
	    • IPv6 maintenance and support

IPv6 adoption – Network	• Core network • Distribution network • Access network • Enterprise network
IPv6 adoption – Applications	• Network management • Commercial Off the Shelf products • Proprietary product
IPv6 adoption - Services	• IPv6 across current services • IPv6 based new services

IPv6 adoption
Cost components

| IPv6 adoption - Areas	Planned Adoption cycle 3-4 years	Acceleration by 1 year IPv6 in ~ 2 Years	Acceleration by 3 years IPv6 in ~ 1 Year
Project Management	Low	Low	High
H/W & S/W Product Procurement	Low	Medium	High
Proprietary software – IPv6 adoption	Low	Medium	High
Security products procurement	Low	High	High
Network testing	Low	Medium	High
Staff costs - Deployment and rollout	Low	Medium	High
Staff costs - Maintaining network Performance	Low	Medium	High
Training (sales, marketing, and technical staff)	Medium	Medium	High
Cost Implications	**Base line minimal costs**	**25 percent increase in the deployment costs**	**285 percent increase in the deployment costs**

Start planning your IPv6 adoption now to minimize the IPv6 adoption costs

Case Study

Walk-through of IPv6 adoption for an organization

IPv6 Migration for NAV6

- IPv6 Adoption spread over 2 years

- Hardware and Software costs are medium

- Spend on Skill building and Manpower high
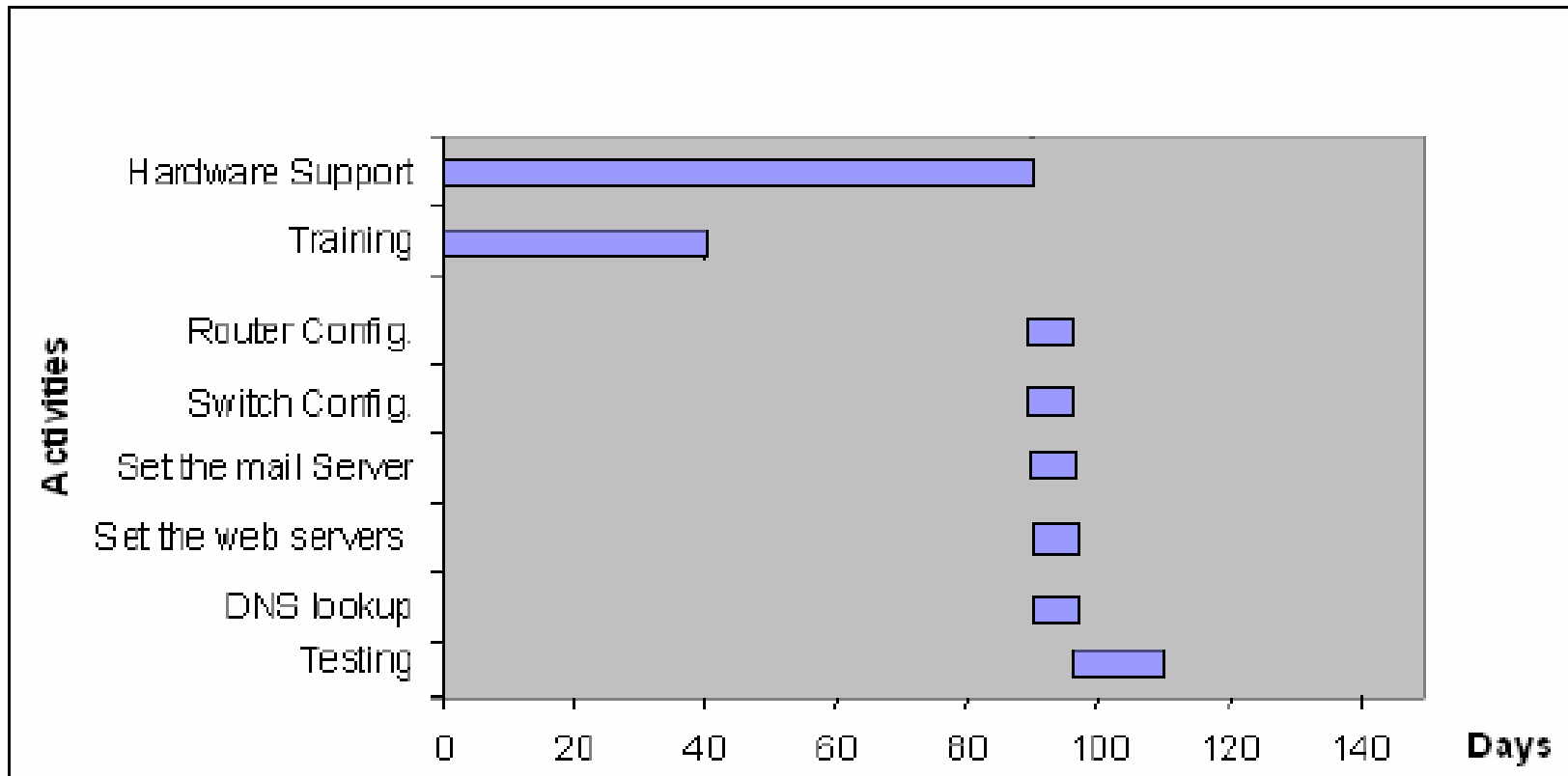
IPv6 Adoption Timelines

Item	University's cost
Hardware	
Replace router	Medium
Replace firewall	Medium
Replace interface cards	Medium
Software	
Upgrading network monitoring/ management	High
Operating system	Low
Upgrading DNS server and web server	Low
Upgrading databases software e.g. oracle, SAP	High
Labor	
Train networking staff	Medium
R & D	Medium
Other	
Unexpected threat e.g. security intrusion	High

IPv6 Adoption costs incurred

Item	University's cost	Cost Range
Hardware		
Router (WAN)	RM 10,000 – 20,000 per router	Medium
Firewall (Intrusion Detection/Prevention)	Few hundreds thousands	High
Core switches	RM 400,000 per switch	High
Normal switches	RM 2000 – 5000 per switch Multiply by 500 units switch	High
Cabling	RM 200 multiply by 50,000 fiber optic and 55K UTP	High
Software		
Upgrading network monitoring/management	IDP software	High
Operating system	Linux	Low
Upgrading DNS server and web server	Linux	Low
Upgrading databases software	Sybase System	High
Labor		
Networking staff training	RM 5000 per person	High
Normal user training	Handled internally	Low
Other cost		
Unexpected threat e.g. security intrusion	Affect students and univerty reputation	High
Management Cost	Descision of upgrading takes around 6 months	High

IPv6 Adoption cost overview

Item	Description	University's cost
Hardware		
Router (WAN)	**Fixed cost**	Low
Firewall (Intrusion Detection/Prevention)	**Few hundreds thousands**	**Medium**
Core switches	**Fixed Cost**	Low
Normal switches	**Fixed Cost**	Low
Cabling	**Fixed Cost**	Low
Software		
Upgrading network monitoring/management	**IDP software**	Medium
Operating system (Linux)	**Open Source**	Low
Upgrading DNS server and web server (Linux)	**Open Source**	Low
Upgrading databases software	**Sybase System**	High
Labor		
Networking staff training	**RM 5000 per person**	High
Normal user training	**Handled internally**	Low
Other cost		
Unexpected threat e.g. security intrusion	**Affect students and university reputation**	High
Management Cost	**Decision of upgrading takes around 6 months**	High

Thank you