

# IPv6 Implementation Case Study

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# Goal of Implementation

Go with the world

?????

Adopt the new IP communication

# Implementation Mechanism

- » Dual stacks
  - » Ability to support both IPv4 and IPv6 in the same interface simultaneously
- » Tunnels
  - » Either manual or automatic
  - » Ideal for interconnecting IPv6 sites over an IPv4 network
- » Translators
  - » AN IPv4/IPv6 translator completely replaces the header of one protocol with the header of another protocol
  - » NAT-PT(Network Address Translation with Protocol Translation )

# Implementation Methodology

## ❧ Core to Edge

- ❧ IPv6 is implemented first in the routers forming the core of the network, usually using dual stacked interfaces, and progressively expanded toward the edge of the network.

## ❧ Edge to Core

- ❧ IPv6 is implemented first at the edge of the network and then expanded toward the core

## ❧ IPv6 Island

- ❧ Network segment directly connected by IPv6 routers
- ❧ Tunnels are used to connect the islands together

# Implementation Approach – BDCOM

## » Dual Stack

- » Announce own IPv6 to IPv6 world
- » No additional cost for the IPv6 Transit
- » Will have no impact on IPv4 network

## » Core to Edge

- » Deploy the technology incrementally
- » Announce own IPv6 to connect IPv6 World
- » Implement on the backbone
- » Gradually Implement on core server like DNS, Mail, Web etc.
- » Provide Customer

# Implementation Plan

- ⌘ Setting up IPv6 Infrastructure
- ⌘ Testing of Operating System
  - ⌘ Router IOS, Computer OS etc.
- ⌘ Adding IPv6 functionality into Services
  - ⌘ DNS, SMTP, SSH, IMAP, HTTP etc.

# Implementation - Consideration

- ❧ Infrastructure
- ❧ Security Aspect
- ❧ Hardware compatibility
- ❧ Software compatibility

# Implementation – Infrastructure

- ❧ IPv6 Address Planning
- ❧ Configuring Routers
- ❧ Testing IPv6 announcement & connectivity
- ❧ Configuring Servers
- ❧ Testing the services



# IPv6 Allocation of BDCOM

## » APNIC allocation for BDCOM

» 2403:4000::/32

## » Transit Providers

» BTCL

» Fiber@Home

» Mango

# BDCOM Prefix For MultiHoming

**2403:4000::/32**

2403:4000::/33  
**Fiber@Home**

2403:4000:8000::/33  
**BTCL**

2401:1900:C000::/34  
**Mango**

# Address Planning - Infrastructure

- » Use first /48 from /32 for Infrastructure
  - » Loopback, point to point IP, server etc.
- » Loopback interface address block
  - » Pick first /64 from first /48 for Loopback Address
  - » All loopback address out of one /64
  - » Per loopback provide /128
- » Point to Point Link
  - » Provide /126 for point to point IP
  - » reserve /64 for each
- » PoP
  - » Reserve /48 or /44 each PoP
- » LAN
  - » /64 for Each LAN

# Address Planning

- 2403:4000::/32 is allocated for BDCOM
- Loopback Address of routers

Router Name	Loop Back Address
Core Router 1	2403:4000::1/128
Core Router 2	2403:4000::2/128
Motijheel	2403:4000::7/128

- Point to Point IPv6 Address

Router Name	Router Name	Point to Point Address
Core Router_1	Core_Router_2	2403:4000:1:2::/126
Core Router_1	Motijheel	2403:4000:1:3::/126

# Address Planning

- ❧ Announce /44 from each PoP
- ❧ First /48 is reserved for the point to point for customers

PoP Name	Address Allocation
Dhanmondi	2403:4000:10::/44
Motijheel	2403:4000:20::/44
Gulshan	2403:4000:30::/44

- ❧ Depending on customers requirements customer , assignment to the customer will be either /64 or /60 or /56

# Address Planning – Core Server

- Second /64 is used for server LAN
- Examples:

Serial	Server Name	IPv6 Address
1	dns1.bdcom.com	2403:4000:0:2::3
2	dns2.bdcom.com	2403:4000:0:2::4
3	dns3.bdcom.com	2403:4000:0:2::5

# Address Planning – Customer

- » Announced 2403:4000:30::/44 from Motijheel
- » Customer A and Customer B needs /64 and /60 respectively
  - » Customer A point to point IPv6 address 2403:4000:30:1::/126
  - » Customer A LAN IPv6 address 2403:4000:30:100::/64
  - » Customer B point to point IPv6 address 2403:4000:30:2::/126
  - » Customer B assignment is 2403:4000:30:1000::/60

# Implementation - Security

## » Router

- » Same as IPv4 but
- » IPv6 prefix filter list command start with *ipv6 prefix-list*
- » For as-path filter list, use IPv4 as-path access-list

## » Linux box

- » Use ip6tables
- » Commands are same as iptables



# OSPF configuration

- » To configure the OSPF for IPv6
  - » OSPFv3 is needed
- » OSPF configuration

```
ipv6 router ospf 24122  
log-adjacency-changes detail  
passive-interface default  
no passive-interface GigabitEthernet0/1  
no passive-interface FastEthernet2/0  
interface Loopback0  
ip address 210.4.79.254 255.255.255.255  
ipv6 address 2403:4000::1/128  
ipv6 ospf 24122 area 0
```

# BGP Configuration

- » We were very much careful while putting the point to point IPv6 address while configuring BGP
  - » BGP session will not be established if we provide wrong point to point IPv4
  - » BGP session will be established if we provide wrong point to point IPv6 address
  - » Link local address will up the BGP session

# BGP Configuration

```
router bgp 24122
  bgp router-id 210.4.79.254
  neighbor ibgpv6-peers peer-group
  neighbor ibgpv6-peers remote-as 24122
  neighbor ibgpv6-peers update-source Loopback0
  neighbor 2403:4000::7 description Peering_DHANMONDI_To_JHEEL
  neighbor 2403:9300:80:7::1 remote-as 58587
  neighbor 2403:9300:80:7::1 description eBGP_v6_Fiber@home
  address-family ipv6
    neighbor 2403:4000::7 activate
    neighbor 2403:9300:80:7::1 activate
    neighbor 2403:9300:80:7::1 prefix-list fiber@home-v6-out out
    neighbor 2403:9300:80:7::1 route-map fhl-v6-in in
    neighbor 2407:5000:11:1::1 activate
    neighbor 2407:5000:11:1::1 prefix-list bttb-v6-in in
    neighbor 2407:5000:11:1::1 prefix-list bttb-v6-out out
    distance bgp 200 200 200
    network 2403:4000::/32
    network 2403:4000::/33
    no synchronization
    exit-address-family
  ipv6 prefix-list fhl-v6-in seq 5 permit ::/0
  ipv6 prefix-list fhl-v6-in seq 10 deny ::/0 le 128
  !
  ipv6 prefix-list fiber@home-v6-out seq 10 permit 2403:4000::/33
  ipv6 prefix-list fiber@home-v6-out seq 20 permit network 2403:4000::/32
  ipv6 prefix-list fiber@home-v6-out seq 100 deny ::/0 le 128

  ipv6 route 2403:4000:1::/64 2403:4000:0:2::2 unicast
  ipv6 route 2403:4000:2::/64 2403:4000:0:2::17 unicast
  ipv6 route 2403:4000::/32 Null0
  ipv6 route 2403:4000::/32 Null0
```

# BDIX Connectivity

## BGP Configuration

```
router bgp 24122
  neighbor 2001:DE8:B:2900::1 remote-as 65534
  neighbor 2001:DE8:B:2900::1 description IPv6 Peering with BDIX
address-family ipv6
  neighbor 2001:DE8:B:2900::1 activate
  neighbor 2001:DE8:B:2900::1 prefix-list bdix_out out
  ipv6 prefix-list bdix_out seq 10 permit 2403:4000::/32
  ipv6 prefix-list bdix_out seq 100 deny ::/0 le 128
exit-address-family
```

# F-Root-Server

- ❖ BDCOM is the transit provider of F-root server.

- ❖ Received IPv6 prefix 2001:dd8:1d::/48

- router bgp 24122

- neighbor 2403:4000:20:1::100 remote-as 24050

- neighbor 2403:4000:20:1::100 description F-root-server

- address-family ipv6

- neighbor 2403:4000:20:1::100 activate

- neighbor 2403:4000:20:1::100 prefix-list from-root-server in

- exit-address-family

- ipv6 prefix-list from-root-server seq 10 permit 2001:dd8:1d::/48

- ipv6 prefix-list from-root-server seq 100 deny ::/0

# DNS Configuration

## Assigned IPv6 Address Block for servers

2403:4000:0:2::/64

Serial	Server Name	IPv6 Address
1	gw.bdcom.com	2403:4000:0:2::1/64
2	dns1.bdcom.com	2403:4000:0:2::3/64
3	dns2.bdcom.com	2403:4000:0:2::4/64
4	dns3.bdcom.com	2403:4000:0:2::5/64
5	mail.bdcom.com	2403:4000:0:2::7/64
6	smtp.bdcom.com	2403:4000:0:2::9/64
7	nmsgw.bdcom.com	2403:4000:0:2::10/64

# named.conf for IPv6

Added the following entry in existing named.conf file

```
zone "0.0.0.4.3.0.4.2.ip6.arpa" {  
    type master;  
    file "2403.4000.rev";  
    allow-transfer {  
        210.4.77.180;  
    };  
};
```

# Forward Zone Entry

**Additionally we need to add the following AAAA record entries in forward zone file of respective domain**

;IPv6 host

gw.bdcom.com.	IN	AAAA	2403:4000:0:2::1
offgw.bdcom.com.	IN	AAAA	2403:4000:0:2::2
dns1.bdcom.com.	IN	AAAA	2403:4000:0:2::3
dns2.bdcom.com.	IN	AAAA	2403:4000:0:2::4
dns3.bdcom.com.	IN	AAAA	2403:4000:0:2::5
ipv6.bdcom.com.	IN	AAAA	2403:4000:0:2::5
hardy.bdcom.com.	IN	AAAA	2403:4000:0:2::6
mail.bdcom.com.	IN	AAAA	2403:4000:0:2::7
smtp.bdcom.com.	IN	AAAA	2403:4000:0:2::9
nmsgw.bdcom.com.	IN	AAAA	2403:4000:0:2::10
nms.bdcom.com.	IN	AAAA	2403:4000:0:2::11
srv7.bdcom.com.	IN	AAAA	2403:4000:0:2::12
gateway.bdcom.com.	IN	AAAA	2403:4000:0:2::15
dhcpv6.bdcom.com.	IN	AAAA	2403:4000:0:2::17



# Reverse Zone File

```
; 2403:4000::/32
$TTL 3d
@ IN SOA 0.0.0.4.3.0.4.2.ip6.arpa. postmaster.bdcom.com. (
;@ IN SOA dns1.bdcom.com. postmaster.bdcom.com. (
    201106088 ; Serial number (YYYYMMdd)
    24h ; Refresh time
    30m ; Retry time
    2d ; Expire time
    3d ; Default TTL (bind 8 ignores this, bind 9 needs it)
)
```

```
; Name server entries
```

```
IN NS dns1.bdcom.com.
IN NS dns2.bdcom.com.
```

```
; IPv6 PTR entries
```

```
; Subnet #1
```

```
$ORIGIN 2.0.0.0.0.0.0.0.0.0.4.3.0.4.2.ip6.arpa.
```

```
1.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0 IN PTR gw.bdcom.com.
2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0 IN PTR offgw.bdcom.com.
3.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0 IN PTR dns1.bdcom.com.
4.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0 IN PTR dns2.bdcom.com.
5.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0 IN PTR dns3.bdcom.com.
```

```
; Subnet #2
```

```
$ORIGIN 0.0.0.0.1.0.0.0.0.0.0.4.3.0.4.2.ip6.arpa.
```

```
1.0.3.0.0.0.0.0.0.0.0.0.0.0.0.0 IN PTR mail.gzworld.net.
```

```
; Subnet #3
```

```
$ORIGIN 1.0.0.0.5.1.0.0.0.0.0.4.3.0.4.2.ip6.arpa.
```

```
2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0 IN PTR ns1.bdcom.com.
2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0 IN PTR whm.bdcom.com.
```

# Customer – Prothom-alo

- ❧ BDCOM is providing the colocation web server of prothom-alo.
- ❧ The ns record for [www.prothom-alo.com](http://www.prothom-alo.com) is
  - ❧ 119.40.80.106 for A record
  - ❧ 2403:4000:15:5::2 for AAAA record
- ❧ Using open ipv6 dns checking the ptr for 2403:4000:15:5::2

```
awahhab@offgw:~$ nslookup
```

```
> server 2620:0:ccd::2
```

```
Default server: 2620:0:ccd::2
```

```
Address: 2620:0:ccd::2#53
```

```
> 2403:4000:15:5::2
```

```
Server:      2620:0:ccd::2
```

```
Address:     2620:0:ccd::2#53
```

```
Non-authoritative answer:
```

```
2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.5.0.0.0.5.1.0.0.0.0.0.4.3.0.4.2.ip6.arpa      name = www.prothom-alo.com.
```



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