



Students led IPv6 Deployment at NITK Campus

Centre for Open-source Software and Hardware (COSH)

National Institute of Technology Karnataka, Surathkal

Mangalore, Dakshina Kannada, India

Speakers:

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Outline of the presentation

1. Project overview

- Team
- \circ Plan of action
- \circ Current network
- 2. Project status
 - Advertisement of IPv6 address block
 - \circ $\,$ Testbed setup at NITK $\,$
 - \circ IPv6 deployment workshop at NITK
 - \circ Migration of applications to IPv6 and enabling IPv6 support for VPNs used at NITK
- 3. Next steps
 - Performance evaluation of migrated applications and VPN
 - \circ $\;$ Statistics analysis and investigating observations $\;$
 - \circ Migrate internal network services and devices to IPv6

Project Overview: Team

- 1. Faculty members from NITK Surathkal
 - Mohit P. Tahiliani and Saumya Hegde
- 2. Members from India Internet Engineering Society (IIESoc)
 - Dhruv Dhody
- 3. Network Engineers from NITK Surathkal
 - Deepa Kumari
- 4. Students from NITK Surathkal
 - \circ Kavya Bhat and Vanessa Fernandes
- 5. Advisory Team
 - Nalini Elkins
 - Michael Ackermann
 - Akshay Revankar and Sushanth S. Rao

Project Overview: Plan of action

- 1. Setup a testbed at NITK and test the basic functionality of IP_{V6}
 - \circ Gain insights into the working of DHCPv6, DNS and IPAM solutions
- 2. Migrate network services at NITK to IPv6
 - \circ $\,$ DHCP, DNS and IPAM $\,$
- 3. Dual-stack deployment at NITK
 - Enable dual-stack functionality in routers, firewalls, L3 switches and terminals
- 4. Update the web services and applications at NITK to support IPv6
 - Custom applications developed at NITK (for example, IRIS)
 - \circ ~ Enable VPNs to work with IPv6 ~
- 5. Detailed documentation of migrating NITK campus to IPv6
 - \circ Capture the process of migrating NITK to IPv6

Project Overview: Current Network

- 1. Current Status:
 - 45,000+ terminals connected to the Internet
 - Upcoming campus expansion within 40 km

2. Infrastructure Overview:

- \circ 350+ switches
- 1,200+ indoor/outdoor WiFi access points
- Dedicated data center hosting:
 - Firewalls
 - Core switches
 - Web and application servers
 - Servers for DHCP, DNS, IPAM, NAT, Network management and monitoring

Project Status: Advertisement of IPv6 block

- 1. NITK Surathkal has its own IPv6 address block leased from NIXI
 - 2400:4F20::/32
- 2. NITK's Internet Service Provider is: Bharat Sanchar Nigam Limited (BSNL)
 - Supports IPv6
- 3. Step 1: Took permission from BSNL to use their ASN and advertise our IPv6 block
 - Obtained ASN and got the permission to create a ROA
- 4. Step 2: Requested NIXI to setup a ROA
 - Completed!
- 5. Step 3: Provided the ROA details to BSNL to advertise the IPv6 address block
 - Advertised IPv6 block is: 2400:4F20::/36
- 6. Summary
 - \circ Chose to use ISP's ASN instead of running our own BGP instance

Project Status: Advertisement of IPv6 block

Registered to

A923DA91 (APNIC)

Going Native Contact Us

2400:4f20::/36

Originated by <u>AS9829</u> AS Name: **BSNL (Bharat Sanchar Nigam Ltd)**

Overview Connectivity Whois Validation

Registered on 18 Jan 2022 (18 months old)

Prefix status Active, Allocated under APNIC

Size of prefix 4096 /48's

Upstreams

- <u>AS6453</u> TATA COMMUNICATIONS (AMERICA)
- INC
- AS9498 BHARTI Airtel Ltd.
- AS3257 GTT Communications Inc.

Quick Links	Home	
BGP Toolkit Home BGP Prefix Report	Welcome to the Hurricane Electric BGP Toolkit.	
BGP Peer Report Exchange Report	You are visiting from 2400:4f20:70:1000:10:200:200:20	
Bogon Routes World Report	Announced as 2400:4f20::/36 (NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA)	
Multi Origin Routes DNS Report	Your ISP is AS9829 (BSNL (Bharat Sanchar Nigam Ltd))	
Top Host Report Internet Statistics	Updated 04 Aug 2023 14:17 PST © 2023 Hurricane Electric	
Network Tools App		
Pree IPv6 Tunnel IPv6 Certification		
IPv6 Progress		

Project Status: Testbed Setup at NITK



All VLANs are local to Machine 1 router

Project Status: IPv6 deployment workshop at NITK

92 participants attended the workshop from March 20–22, 2023

• Participants belonged to industries, Government organizations, students and faculty members





Project Status: Migration of applications to IPv6

- 1. Integrated Resource and Information Sharing (IRIS): most widely used at NITK
 - $\circ~$ It is a MIS + ERP of NITK that has automated 40+ processes at NITK Surathkal
 - Most widely used web and mobile application at NITK: 7000+ students and 600+ staff use it everyday!
 - API based integrations with Moodle, BigBlueButton, Jitsi Video Conferencing and others
 - Link: <u>https://iris.nitk.ac.in/</u>
- 2. What has been achieved so far?
 - Support for IPv6 has been enabled for IRIS!
 - IPv6 support for integrated applications, such as Moodle, BigBlueButton and others is pending
 - Total hits from IPv6 on IRIS: 3897173
 - Total hits from IPv6 after adding AAAA record for <u>https://iris.nitk.ac.in/</u>: 3773200
 - Majority of IPv6 requests are from mobile devices, with the maximum coming from IRIS app: 1200956
 - \circ Total number of unique IPv6 addresses accessed (after addition of AAAA record): 210533
 - \circ Ongoing work: performance evaluation and testing in terms of latency and resiliency (IPv4 vs IPv6) 10

Project Status: IPv6 Statistics from IRIS (40 days)



Project Status: IPv6 Statistics from IRIS (40 days)

Distribution of platforms for IPv6 users only



<u>Project Status:</u> Possible Impact of Happy Eyeballs?

1. Observations

- IPv6 usage surpasses IPv4 on iOS, macOS, and Linux.
- Significant IPv4 usage on Windows (1,849,340 hits) compared to IPv6 (650,571 hits).
- 2. Future analysis:
 - What kind of network are the end-users on? Is it IPv4-only, or dual stack setups?
 - Does Happy Eyeballs play a role in the preference for IPv4 on Windows?
 - Investigate the role of DNS, if any.

Project Status: Enabling IPv6 support for VPNs

- 1. NITK Surathkal uses two VPNs:
 - L2 VPN: OpenVPN
 - L3 VPN: Wireguard
- 2. Status on migrating VPN services to IPv6
 - L2 VPN service migration: Completed!
 - L3 VPN service migration: Completed!
- 3. Ongoing work . . .
 - \circ $\,$ Performance evaluation and testing with both, L2 and L3 VPN $\,$
 - Measurement studies
 - Packet losses, latency and other parameters
 - VPNs on IPv4 vs VPNs on IPv6

Next Steps (next 2-3 months):

- 1. Wrap up testbed experiments
 - \circ Stateful and Stateless DHCPv6, DNS and IPAM
 - Firewall rules to be setup on Opnsense router
 - Neighbor Discovery in intermediate switch
- 2. Migrate all integrated services of IRIS to IPv6
 - Moodle
 - BigBlueButton, Jitsi Video Conferencing, and many others
- 3. Prepare a thorough documentation of the migration process
 - Documentation of testbed experiments is in process
 - \circ $\,$ Documentation on migration of IRIS is in process
 - Documentation on migration of VPN services is in process
 - Technical and financial report submission to ISIF Asia





Funded by:



Thank you!