

Implementation of IPv6 in Sudatel



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Sudan Telecom Company ,



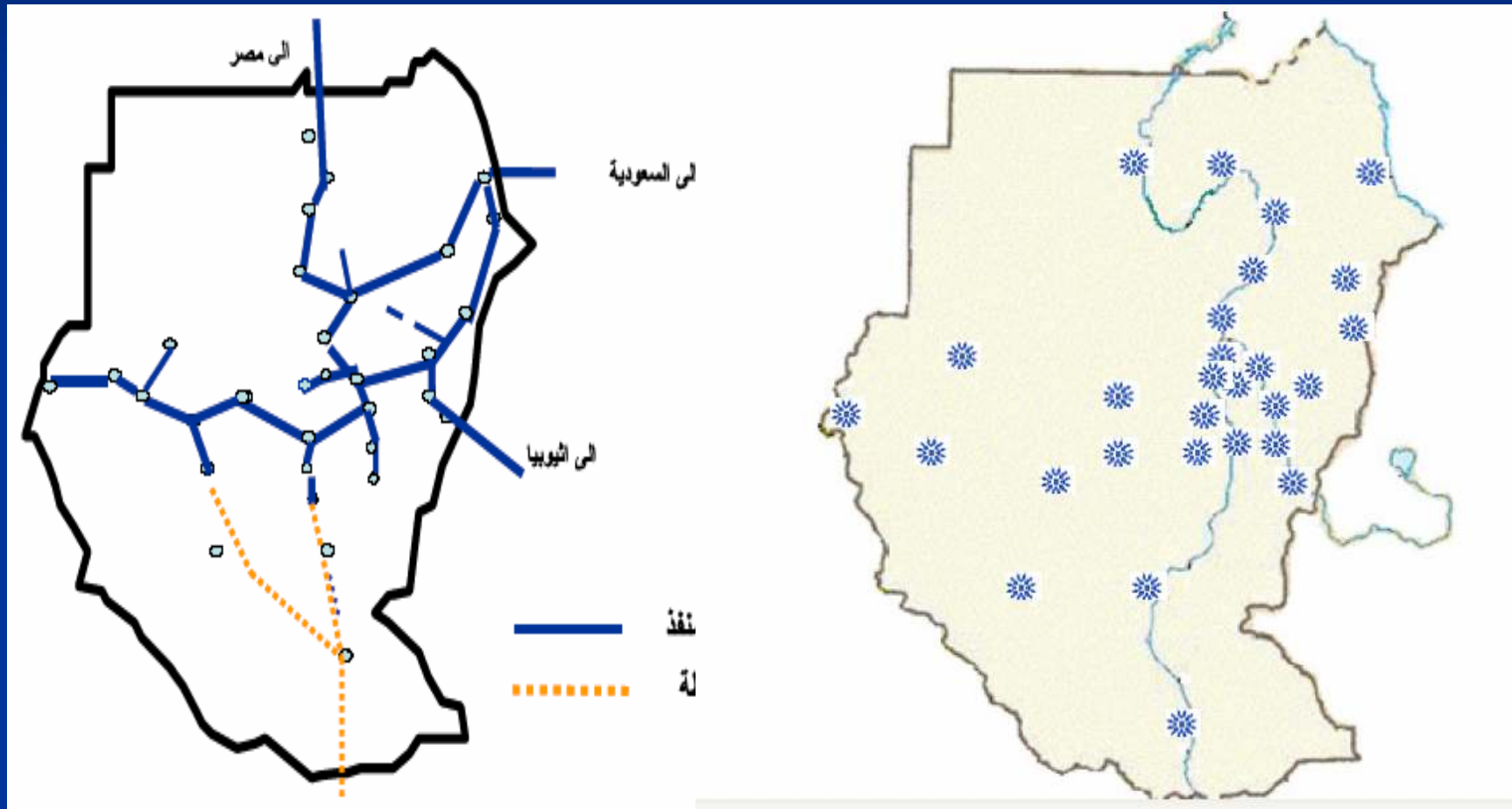
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About Sudatel

- Sudatel is Sudan Telecom company, the biggest Telecom Operator in Sudan.
- Sudatel provide fixed and mobile telephony services , as well as Internet service over DSL , and leased lines .
- Sudatel owns a fibre backbone that covers most of the country regions and expand up to some of its neighbour countries .
- Sudatel Has built a new National IP backbone and an NGN network to provide NGN services .
- Website : www.sudatel.net

Fibre & CDMA Networks



Why IPv6 for Sudatel :

- Exponential growth in IPv4 Address requirements due to the following :
 1. New CDMA mobile network that supports internet service using CDMA 1x and EVDO for a hug number of users
 2. New expansion of xDSL network for broadband internet and data access applications.
 3. New National IP backbone (curry data & voice traffic) .
 4. Growth in the demand of Internet service by ISP and other mobile operators .
- Its core networks already support IPv6 .
- To be Ready for the Next Generation of Internet Services .
- to try and then to set up in a production way a set of IPv6 services and applications such as IPv6 connectivity and transit .
- The final goal is to provide key IPv6 services to Sudatel customers .

Steps of IPv6 Implementation

- Getting IP Prefix from AfriNIC
- Negotiations with Upstream Providers
- Preparing the Configurations
- Address Distribution Policy

Getting the IPv6 prefix from the AfriNIC

1. Filling the IPv6 First Allocation Request Form (available in AfriNIC website):

- Describing what IPv6 services we expect to offer .
- description of IPv6 network topology .
- IPv6 requirements for the next 2 years .
- Initial_Prefix_Length_Requested: /32
- provide a network name for the allocation netname:
SD-SUDATEL-IPV6-1 .
- AfriNIC DATABASE TEMPLATE(S).

Getting the IPv6 prefix from the AfriNIC

AFRINIC DATABASE TEMPLATE(S)

- inet6num:
- netname: SD-SUDATEL-IPV6-1
- descr: Sudatel
- descr: Sudatel Telecom Co
- country: SD
- org: ORG-SA54-AFRINIC
- admin-c: HMO2-AFRINIC
- admin-c: AsaK1-AFRINIC
- admin-c: mat19-AFRINIC
- admin-c: MHA7-AFRINIC
- tech-c: AsaK1-AFRINIC
- status: ALLOCATED-BY-RIR
- mnt-by: AFRINIC-MNT
- mnt-lower: SUDATEL-MNT
- notify: aliaasa@sudatel.net
- changed: hostmaster@afriNIC.net
- source: AFRINIC

Getting the IPv6 prefix from the AfriNIC

2. Questions from AfriNIC :

- We have been asked about Sudatel's external networks and Sudatel's partners in tests networks
- To provide a list of some of our customers and the type of services that we offer to these customers

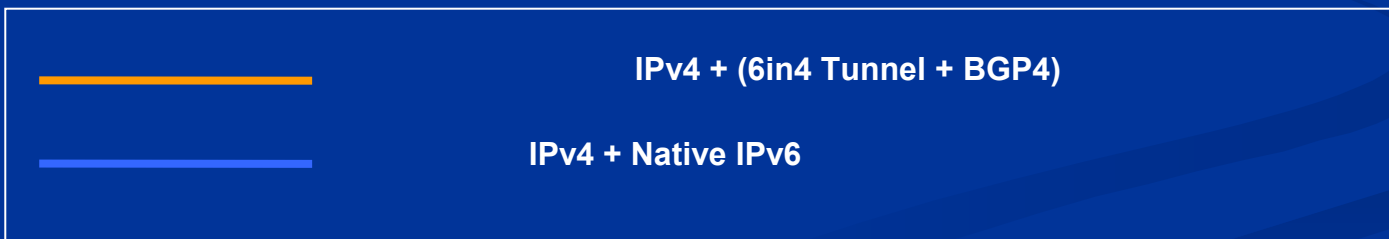
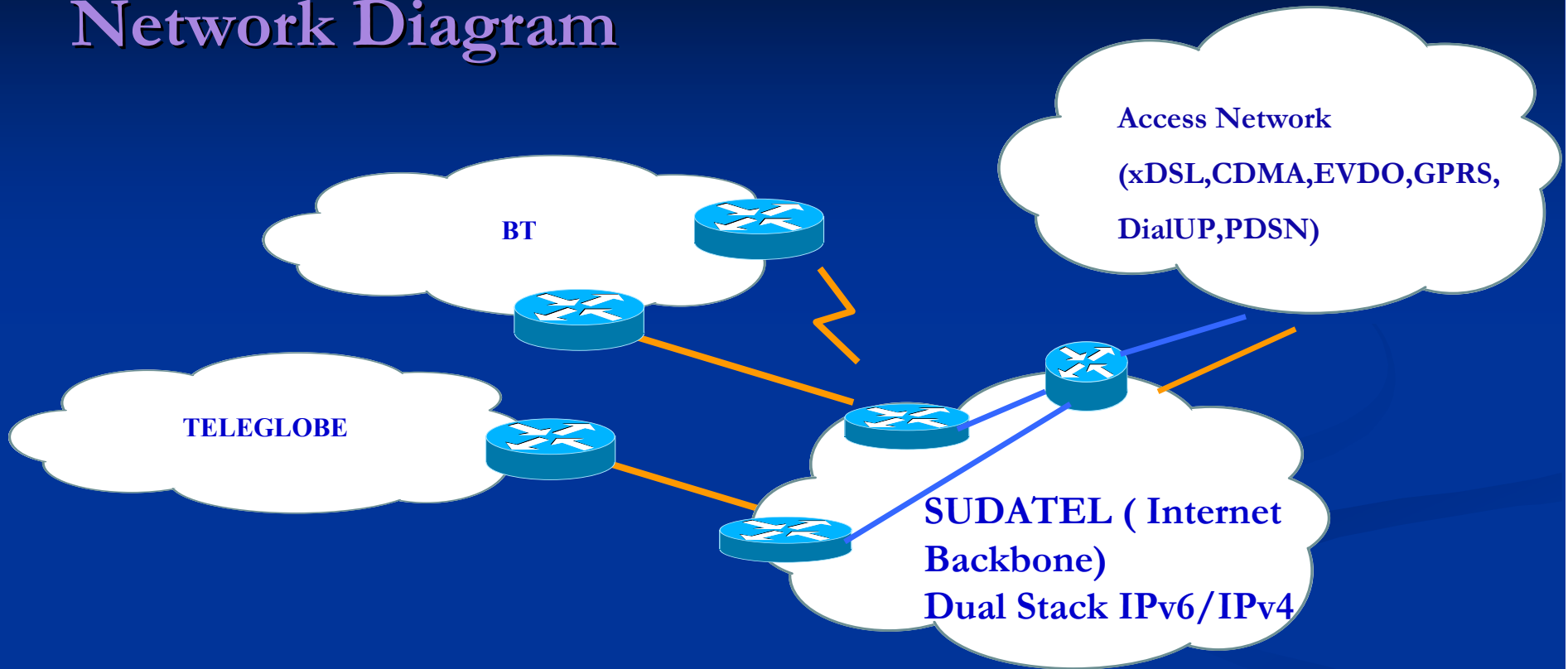
3. Request Approval:

- And finally The AfriNIC approved our request and allocated **2001:4228::/32** IPv6 address space to Sudatel .

Negotiations with Upstream Providers

- Sudatel Discussed with Upstream providers different choices for Connecting Sudatel Internet Links .
- It was Not possible to have a native IPv6 connections because Sudatel links were not connected directly to the upstream providers IPv6 routers .
- Sudatel and its upstream providers agreed to have an IPv6-in-IPv4 Tunnels .
- Sudatel filled some applications form requested by its upstream providers to enable IPv6-in –IPv4 tunnels .

Preparing the IPv6 Configurations Network Diagram



Preparing the IPv6 Configurations (Cont ..)

Required Configurations Parameters

Tunnel Addresses:

IPv6:

- Upstream Provider Side : 2001:4228:400::35/126
- Sudatel Side: 2001:4228:400::36/126

IPv4

- Upstream Provider Side : 207.45.216.253
- Sudatel Side: loopback IP

AS Numbers:

- Upstream Provider AS : : 6453
- Sudatel AS : :15706

Preparing the IPv6 Configurations (Cont ..)

Required Configurations Parameters

IPv6 Routing Policy:

- Upstream Provider : Full transit
- Sudatel: announce 2001:4228::/32
- Incoming policy : Accept the full table
- Outgoing Policy : Advertise Local Only

Preparing the Configurations

- Router Specifications
- IPv6-in-IPv4 Tunnel Configuration
- BGP configurations
- Traffic Monitor

Router Specifications

- Vender : Huawei
- Quidway NetEngine 40-8 Universal Switching Router
- Software Version : VRP software, Version 5.30 RELEASE 0215
- 512M bytes SDRAM
16384K bytes Flash Memory

IPv6 configurations in Huawei Routers

IPv6-in-IPv4 Tunnel Configuration

<to enable IPv6 >

```
ipv6
```

<Tunnel Configurations >

```
interface Tunnel4/0/0  
  ipv6 address 2001:4228:400::36/126  
  tunnel-protocol ipv6-ipv4  
  source LoopBack0  
  destination 207.45.216.253  
  description Tunnel to Teleglobe  
  undo shutdown
```

IPv6 configurations in Huawei Routers

BGP configurations

```
bgp 15706  
peer 2001:4228:400::35 as-number 6453
```

```
ipv6-family  
undo synchronization  
network 2001:4228:: 32  
peer 2001:4228:400::35 enable  
peer 2001:4228:400::35 route-policy Teleglobe-out export  
peer 2001:4228:400::35 route-policy Teleglobe-in import #
```

<Outgoing Route Policy >

```
route-policy Teleglobe-out permit node 10  
if-match ipv6 address prefix-list SUDATEL_Prefix  
if-match as-path-filter 10
```

<Multihoming links , not work as a transit >

IPv6 configurations in Huawei Routers

BGP configurations (cont)

< Incoming Route Policy >

```
route-policy Teleglobe-in permit node 10  
if-match ipv6 address prefix-list global_ipv6
```

<to inject Sudatel's prefix into the ip route table >

```
ipv6 route 2001:4228:: 32 NULL0
```

IPv6 configurations in Huawei Routers

IPv6 Filter List

<Incoming Route Filter>

```
ip ipv6-prefix global_ipv6 index 5 deny 2001:DB8:: 32 greater-equal 32 less-equal 128
```

```
ip ipv6-prefix global_ipv6 index 10 permit 2002:: 16
```

```
ip ipv6-prefix global_ipv6 index 15 deny 2002:: 16 greater-equal 16 less-equal 128
```

```
ip ipv6-prefix global_ipv6 index 20 deny :: 8 greater-equal 8 less-equal 128
```

```
ip ipv6-prefix global_ipv6 index 25 deny FE00:: 9 greater-equal 9 less-equal 128
```

```
ip ipv6-prefix global_ipv6 index 30 permit FF00:: 8 greater-equal 8 less-equal 128
```

```
ip ipv6-prefix global_ipv6 index 35 permit :: 0 less-equal 48
```

```
ip ipv6-prefix global_ipv6 index 40 deny :: 0 less-equal 128
```

IPv6 configurations in Huawei Routers

IPv6 Filter List(cont..)

<Outgoing Route Filter>

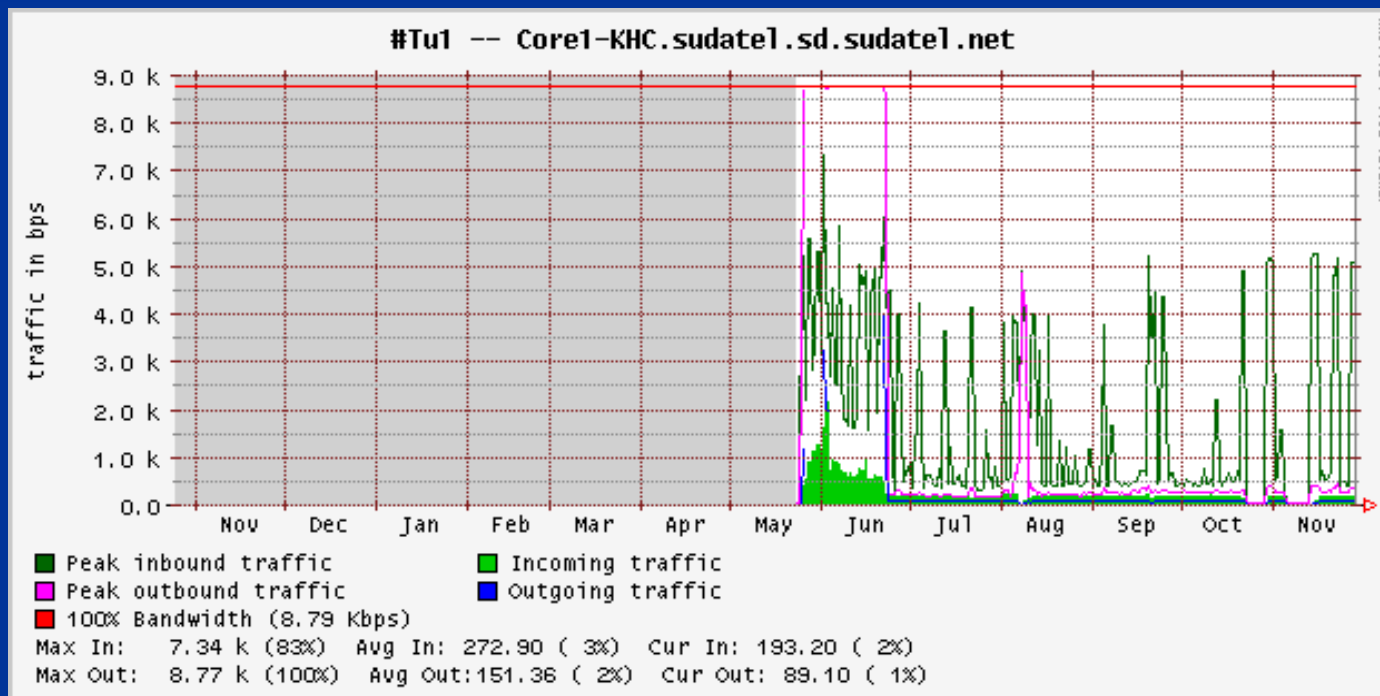
```
ip ipv6-prefix SUDATEL_prefix index 5 permit 2001:4228:: 32
```

<AS PATH Filter>

```
ip as-path-filter 10 permit ^$
```

IPv6 Traffic Monitoring

- MRTG is used to monitor the traffic of the tunnels .



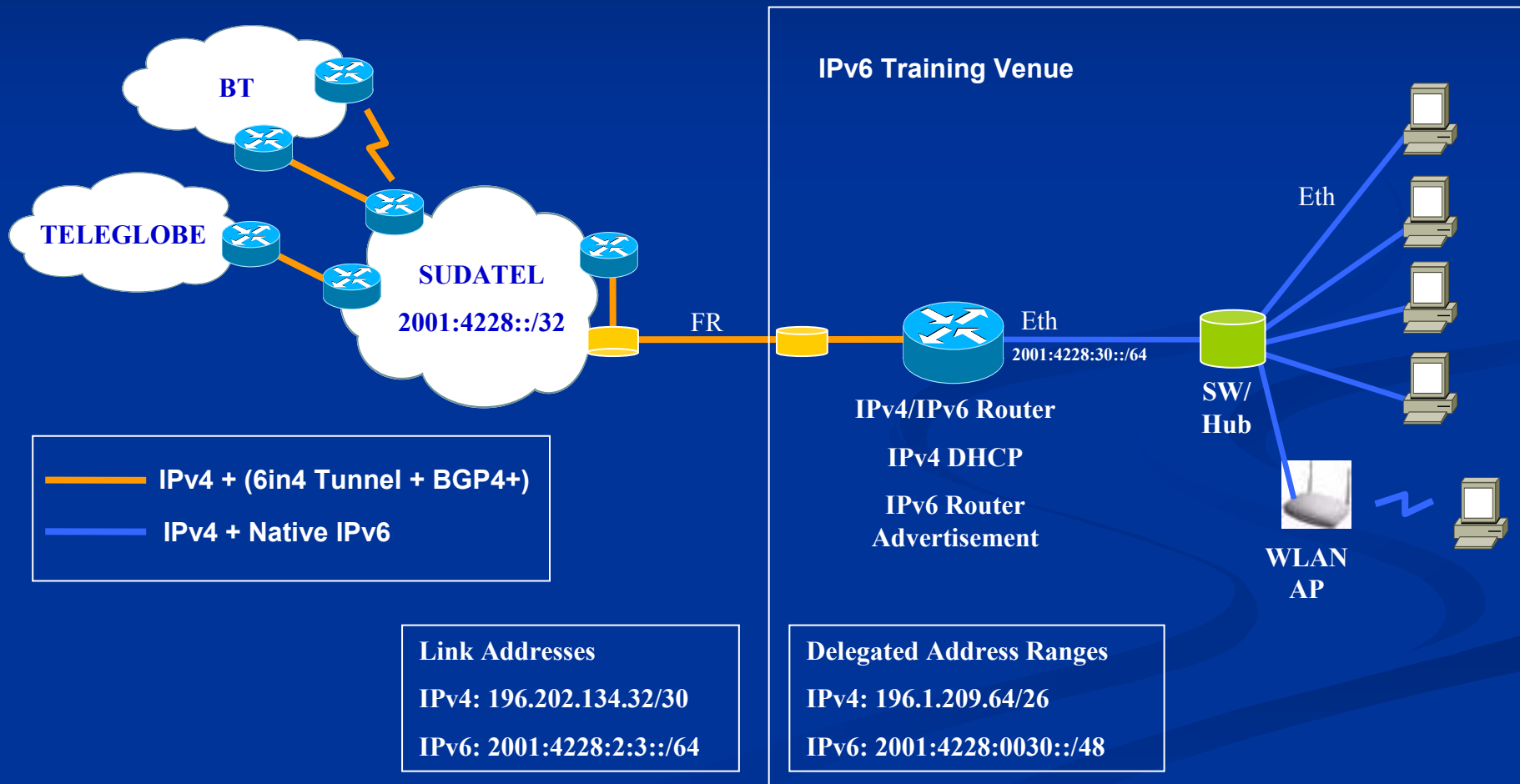
IPv6 Address Distribution Policy

Sudatel Backbone	/38	Delegating /48 and /64 For Sudatel's internal network
Sudatel Partners	/40	Delegating /48 and /64 For Sudatel's partners in tests networks
CDMA Customers	/38	Delegating /48 and /64
Leased L Customers	/38	Delegating /48 and /64
xDSL Customers	/38	Delegating /48 and /64

Current Situation

- Internet Backbone supports IPv6 & IPv4(Dual Stack).
- 6 in 4 Tunnels are used to connect to upstream providers
- Access users can have ether tunnel or native ipv6 connectivity .
- Some of Sudatel Internet staff have tunnels to their homes for test .
- No demand is coming from the users or the other operators.
- IPv6 is not enabled yet in the National IP/MPLS backbone .

Network for IPv6 to Training Lab



Network for IPv6 to Training Lab

- 1- A network was built for the IPv6 training workshop.
- 2- We looked for a Cisco router with an IPv6 enabled image.
- 3- We found Cisco 1751 router with the image c1700-sv8y-mz.122-11.T2.bin build in.
- 4- We upgrade the image to c1700-sv8y7-mz.123-9.bin although the Both images supports IPv6 but the support in the second image is better.
- 5- Then we think of frame relay link between our network and the meeting room where we did the training.

Network for IPv6 to Training Lab configuration of the 1751 router .

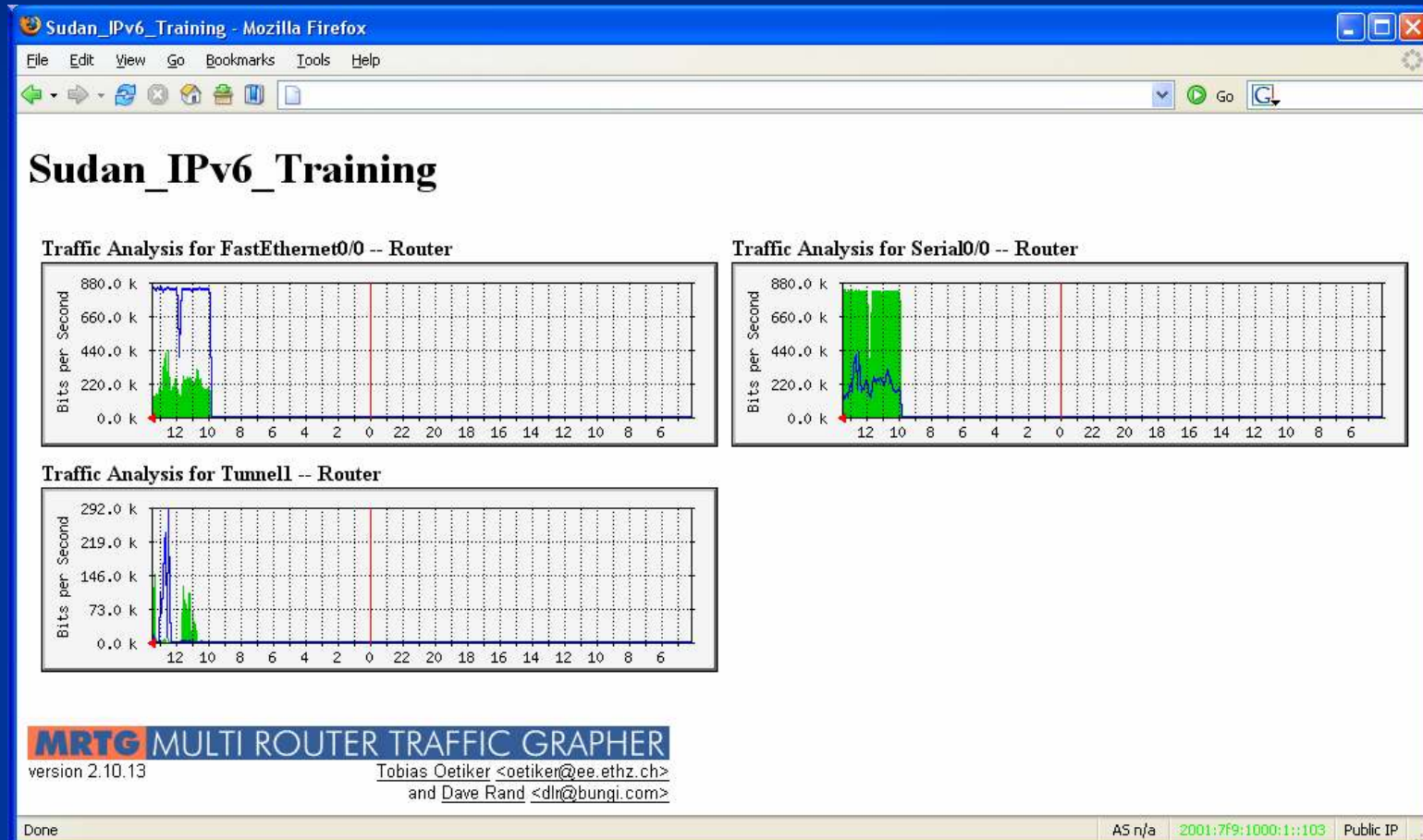
- `ipv6 unicast-routing`
- `!`
- `interface Tunnel1`
- `no ip address`
- `ip route-cache flow`
- `ipv6 address 2001:4228:2:3::3/64`
- `ipv6 enable`
- `tunnel source 196.202.134.34`
- `tunnel destination 196.202.134.33`
- `tunnel mode ipv6ip`
- `!`

configuration of the 1751 router

- interface FastEthernet0/0
- ip address 196.1.209.129 255.255.255.128
- ip route-cache flow
- speed 100
- full-duplex
- ipv6 address 2001:4228:30::/64
- ipv6 enable
- !
- interface Serial0/0
- ip address 196.202.134.34 255.255.255.252
- encapsulation frame-relay IETF
- frame-relay interface-dlci 16 IETF
- !
- ip classless
- ip route 0.0.0.0 0.0.0.0 196.202.134.33
- ipv6 route ::/0 2001:4228:2:3::

Network for IPv6 to Training Lab


Traffic Statistics



Sudan IPv6 Task Force

- Created by Sudan Internet Society
- The Group main task is to raise the awareness of implementation of IPv6 in Sudan, conduct seminars and training sessions .
- Members are government , telecom operators , ISPs and Local Internet Community.
- To study options for implementation of IPv6 in Sudan .
- Increase the Knowledge of IPv6 and its applications .
- Migration scenarios
- Coordinate with Regional and International IPv6 Societies .
- Creating Test networks for training purposes .

Thanks

- Thanks to  who supported us in all the Implementation steps .

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