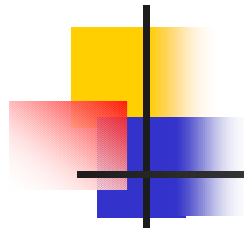




Open 6to4 Relay Router Operation

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KDDI R&D Laboratories, Inc.



Contents

- Background
- 6to4 overview
- Network configuration
- Obtained data and its analysis
- Consideration and future work



Background

- IPv6 over IPv4 tunnel is widely used to obtain IPv6 connectivity.
- “6to4” is a kind of automatic tunneling mechanism.
 - easy
 - useful tool in the early stage of IPv6 deployment/transition.
- Connect to the IPv6 Internet via “6to4 relay routers”.
- No open 6to4 relay router in Japan
 - Performance problems for Japanese users, e.g. long RTT



We installed an open 6to4 relay router in Japan and started the 6to4 experiment mainly for Japanese users in March 2002.



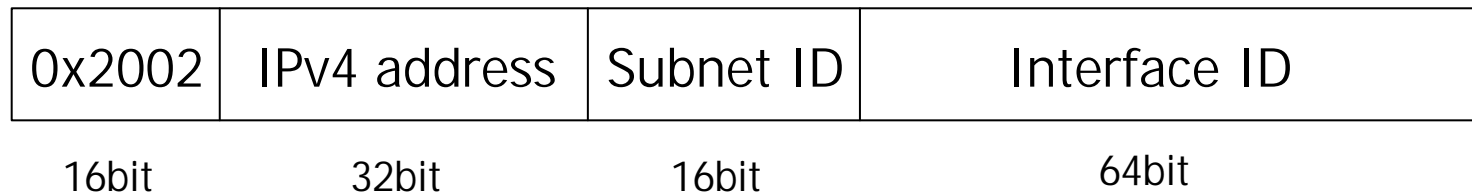
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6to4 Address

- Address format



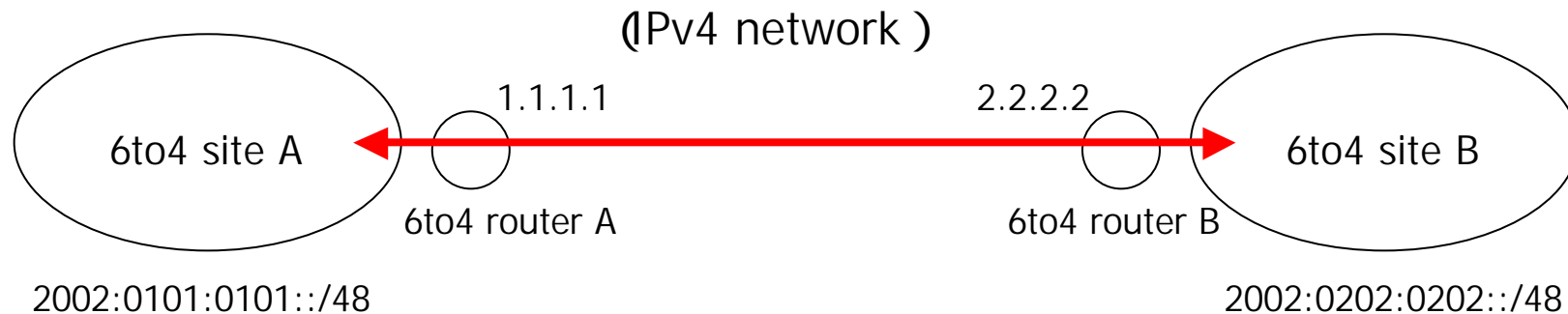
- 2002::/16 is an IPv6 prefix for 6to4
- Global IPv4 address is embedded in IPv6 address



If you can use a global IPv4 address, you can have a /48 IPv6 prefix.

Communication using 6to4(1)

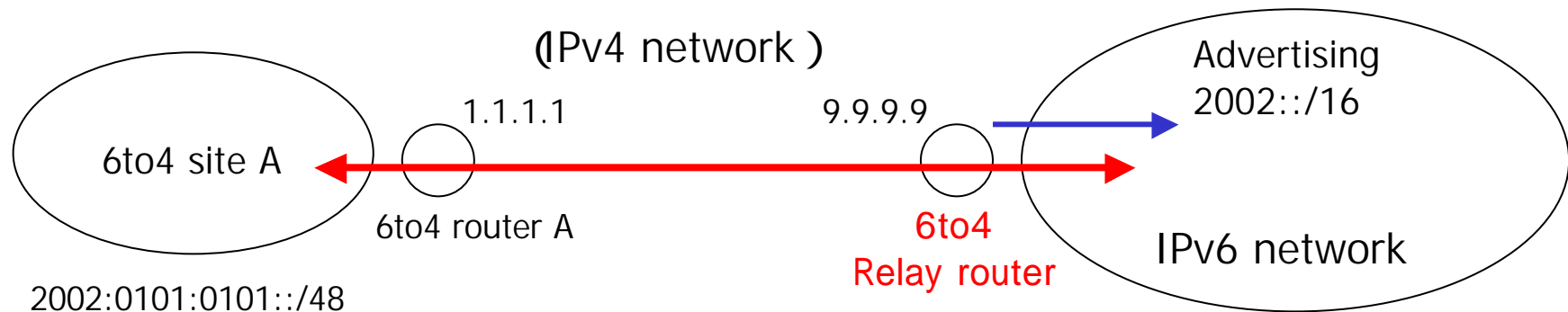
- Communication between 6to4 sites



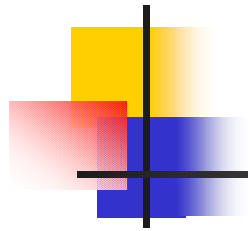
- Destination address is a 6to4 address
6to4 router can derive the IPv4 address of the tunnel endpoint from the 6to4 address
Tunnel is configured automatically between 6to4 routers

Communication using 6to4(2)

- Communication between 6to4 site and native IPv6 network



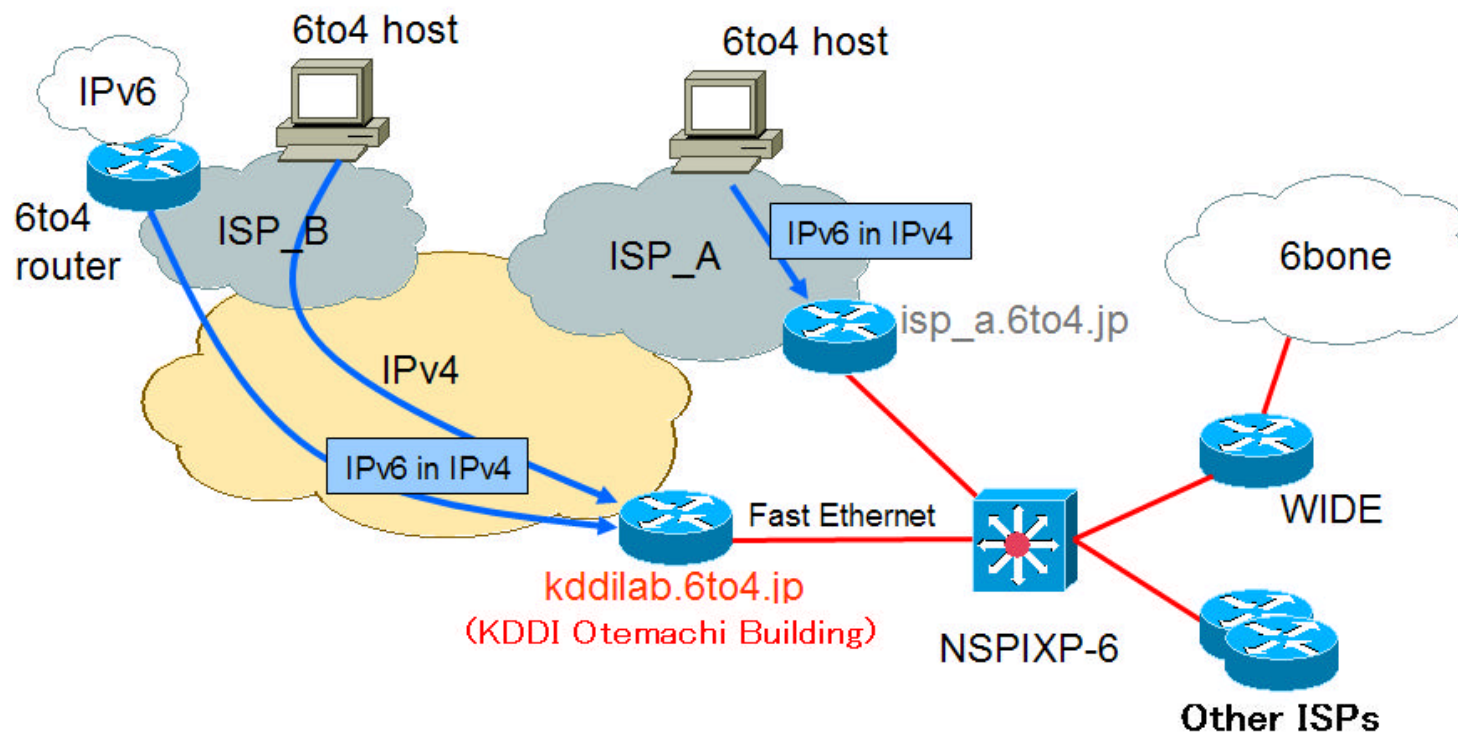
- Communication via 6to4 relay routers
- 6to4 relay routers advertise 2002::/16 to IPv6 network
(Must not advertise more specific prefixes than 2002::/16)
They relay packets from IPv6 network to a 6to4 site



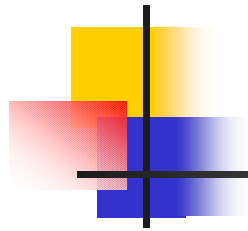
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Network configuration



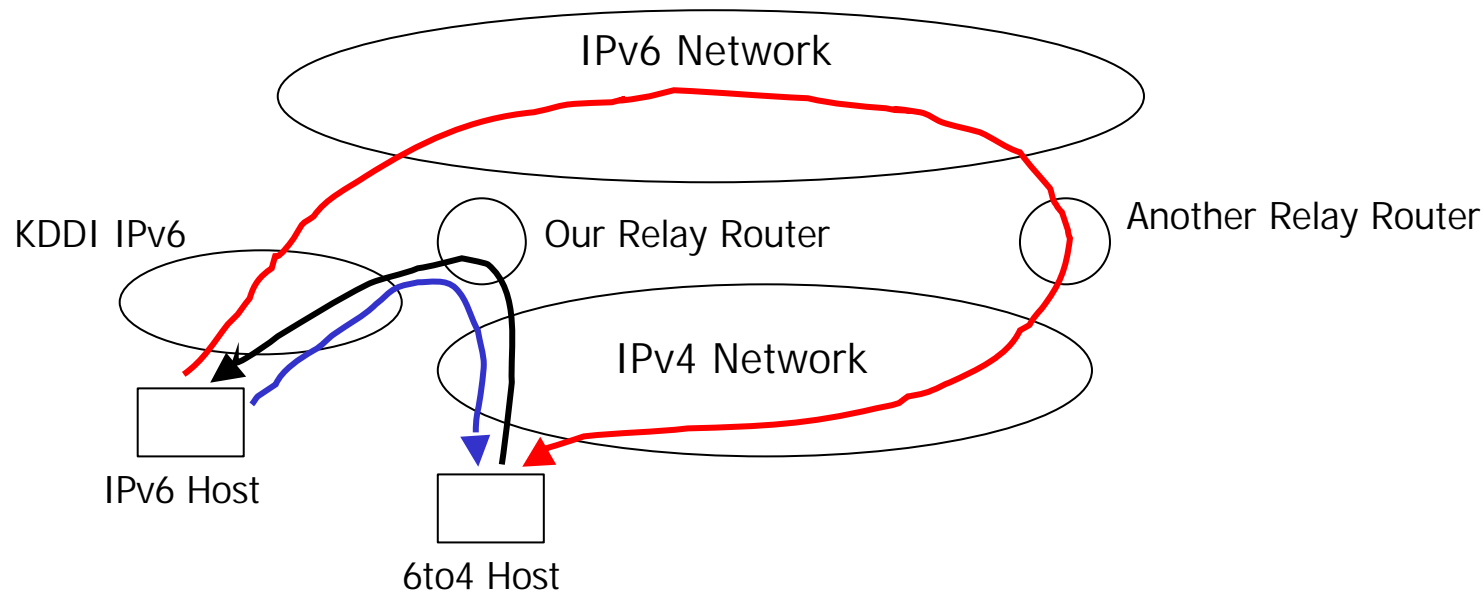
- Our router is Cisco7206VXR
- Advertising 2002::/16 to 20 AS (2003.1)
- No user registration and restriction – anyone can use our relay router



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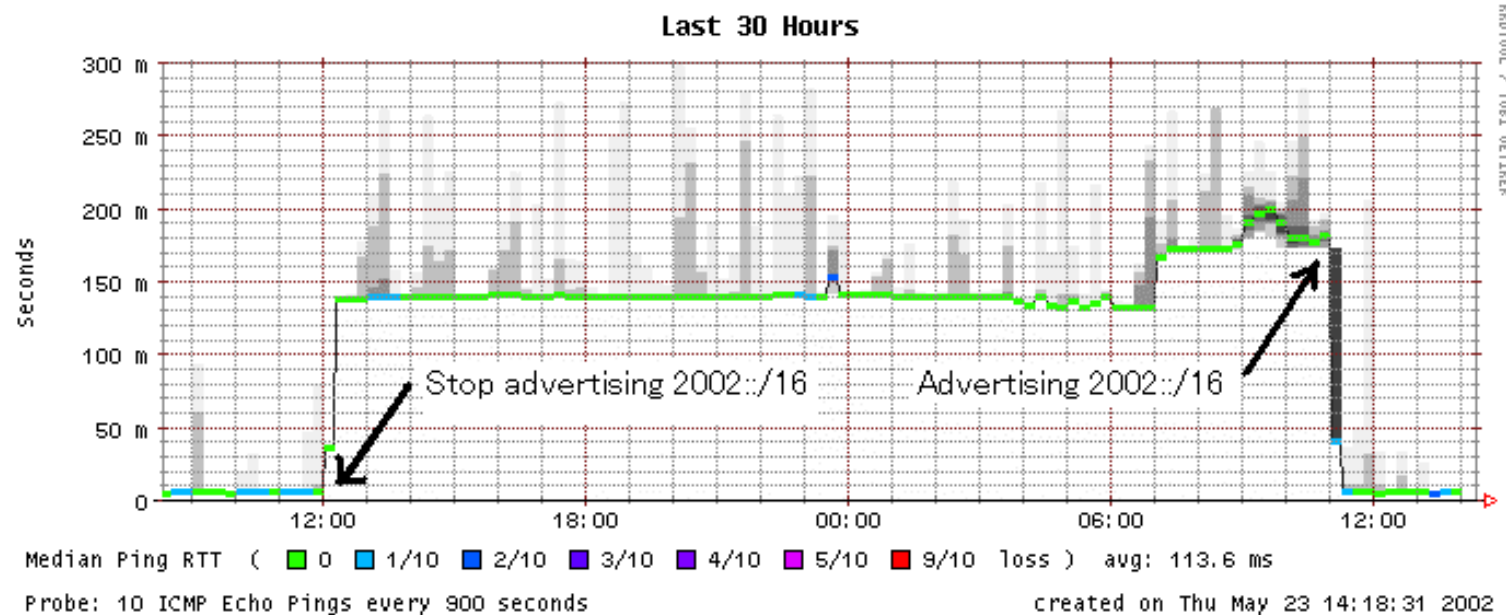
Decrease of RTT



- Above figure shows the path between 6to4 host and IPv6 host in KDDI
- Return path
 - Red line --- not advertising 2002::/16 to KDDI, so packets to the 6to4 host may be routed to another relay router (which is not in Japan)
 - Blue line --- advertising 2002::/16 to KDDI
 - > RTT decreases when compared with the red line case

Decrease of RTT(2)

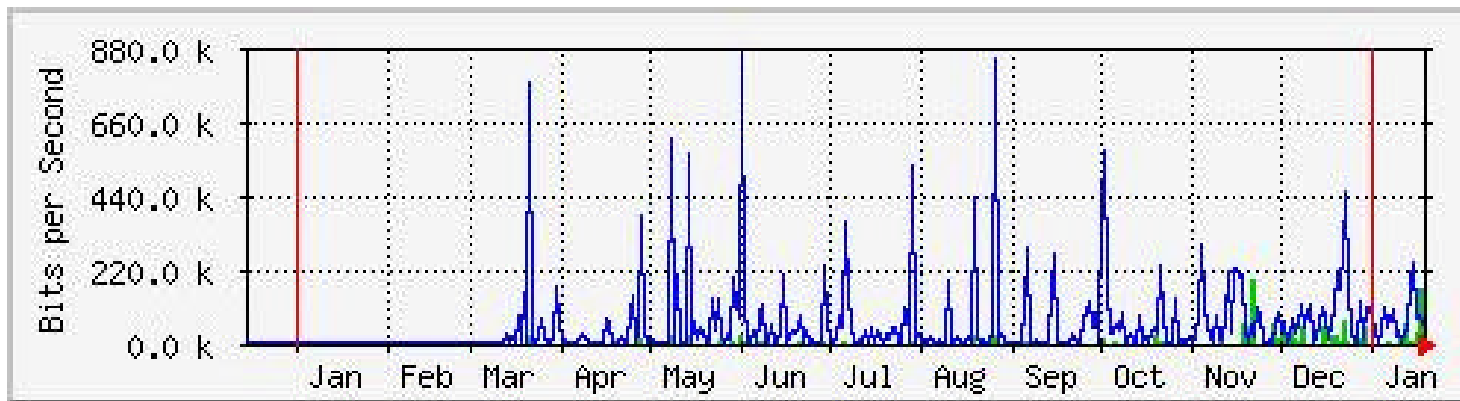
- RTT between KDDI IPv6 host and KDDI Laboratories 6to4 host



- Not advertising 2002::/16 to KDDI --- 140ms
- Advertising 2002::/16 to KDDI --- 5ms

Traffic

- MRTG “Yearly” graph on the 6to4 pseudo interface of our 6to4 relay router



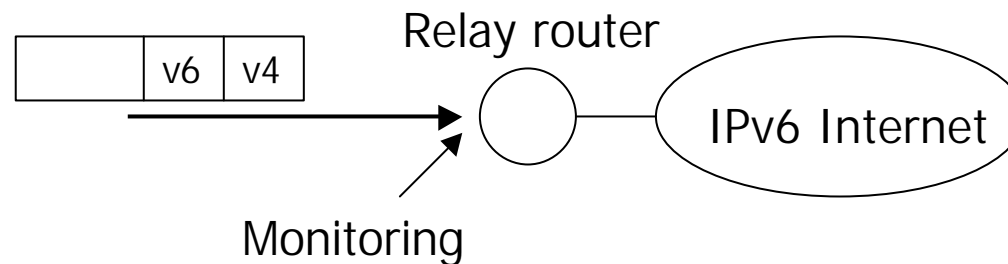
Blue – the one-day average outgoing traffic from the IPv6 Internet to 6to4 sites
Green – the one-day average incoming traffic from 6to4 sites to our relay router

- Most traffic is outgoing traffic
- Average from the start
 - In : 7.6kbps
 - Out : 64.8kbps

Estimating the number of 6to4 users

- No user registration difficult to count the number of users accurately
- To estimate the approximate number of users ...
 - Recording the source IPv4 addresses of the IPv4 encapsulated packets coming into our relay router by Cisco ACL

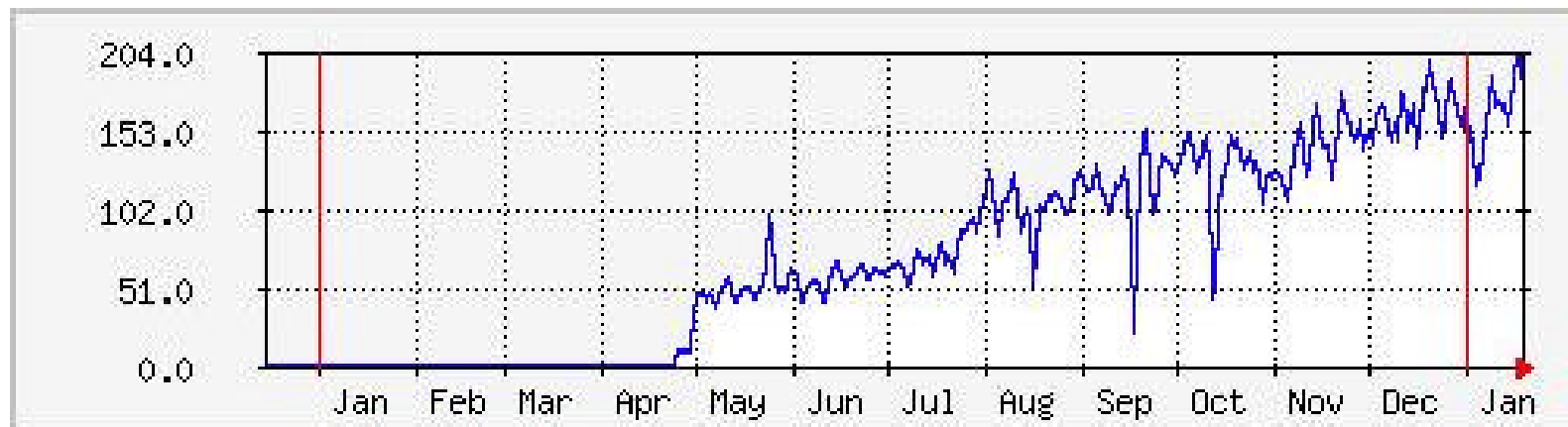
e.g. `access-list 100 permit 41 any host 202.255.45.5 log`



- And counting the number of IPv4 addresses by 1 day units
-> take this number as the approximate number of users

Estimating the number of 6to4 users (2)

- Result



- The number of 6to4 users(sites) seems to increase gradually.



Estimate the number of 6to4 users (3)

Period \ Days	1	2	3	4	5	6	7
22 Dec. – 28 Dec.	387	50	22	26	20	12	47
29 Dec. – 4 Jan.	327	58	21	14	12	11	42
5 Jan. – 11 Jan.	371	59	26	18	14	18	55
12 Jan. – 18 Jan.	379	60	32	26	25	14	47

- Above table summarizes how many days the source IPv4 address coming into our relay router was observed in a one-week period.
 - 7 Days -- the number of IPv4 addresses that were observed every day in a one-week
- Many 1 Day
 - There may be many users that the IPv4 address is assigned dynamically.
 - So their IPv6 addresses are also dynamic.



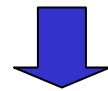
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Applicability of 6to4 service

- Advantage
 - Easy to set up the service and provide the IPv6 connectivity for any user
- Disadvantage
 - Difficulty of user access control
 - Asymmetric route – return path may not pass the service provider's IPv6 network

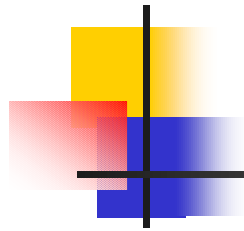


not suitable for commercial service
but effective to promote the IPv6 deployment



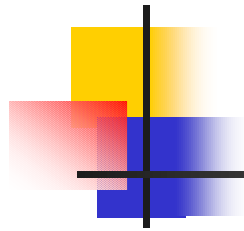
Security

- more likely to be used as a footstool in a DoS attack against IPv4 and IPv6 hosts
 - open relay
 - the use of the IPv6 address that the IPv4 address is embedded
- careful operation is required
 - setting appropriate packet filters
 - monitoring traffic status
 - logging IPv6 and IPv4 headers
- should check whether the source IPv4 address matches the IPv4 address embedded in the source IPv6 address when decapsulating in IPv4 packets



Future plan

- Install one more relay router in U.S.
 - near our U.S. office (Palo alto)
 - more specific prefix exchange between our Japan and U.S. relay routers
 - wide area load balancing
 - security



Summary

- 6to4 overview
 - Introduction of our 6to4 experiment and some statistical data
 - some considerations and future work
 - URL
 - <http://www.6to4.jp>
- (Sorry but contents are Japanese only)