

6to4: Connecting IPv6 Sites over the IPv4 Internet

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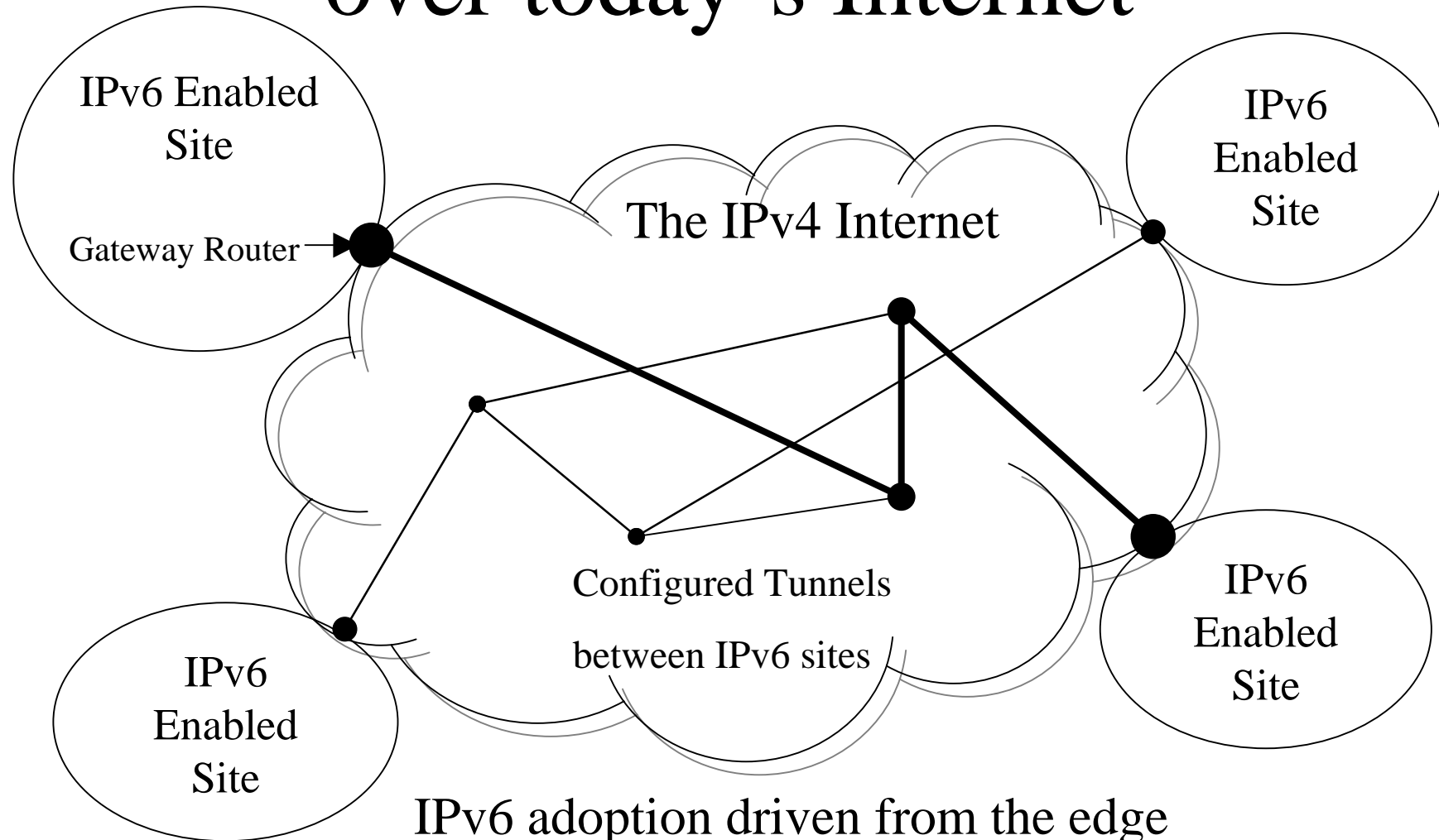
Microsoft

January 30th, 2001

Outline

- Why do we need 6to4?
- How does it work?
- What are the key advantages?
- Our operational experiences...

Connecting IPv6 Sites over today's Internet



The 6bone Approach

- Configured tunnels between sites
 - Topological inefficiencies
 - BGP separately configured & administered
- Consequences
 - 500ms latency & 20% loss (6bone) vs
150ms & 2% loss (v4 Internet, same host)
 - Frequent routing loops, blackholes, etc.

The 6to4 Solution

- Method for automatic tunneling
- Uses special 2002::/16 prefix
- Each site derives a /48 IPv6 prefix from its gateway router's IPv4 address:

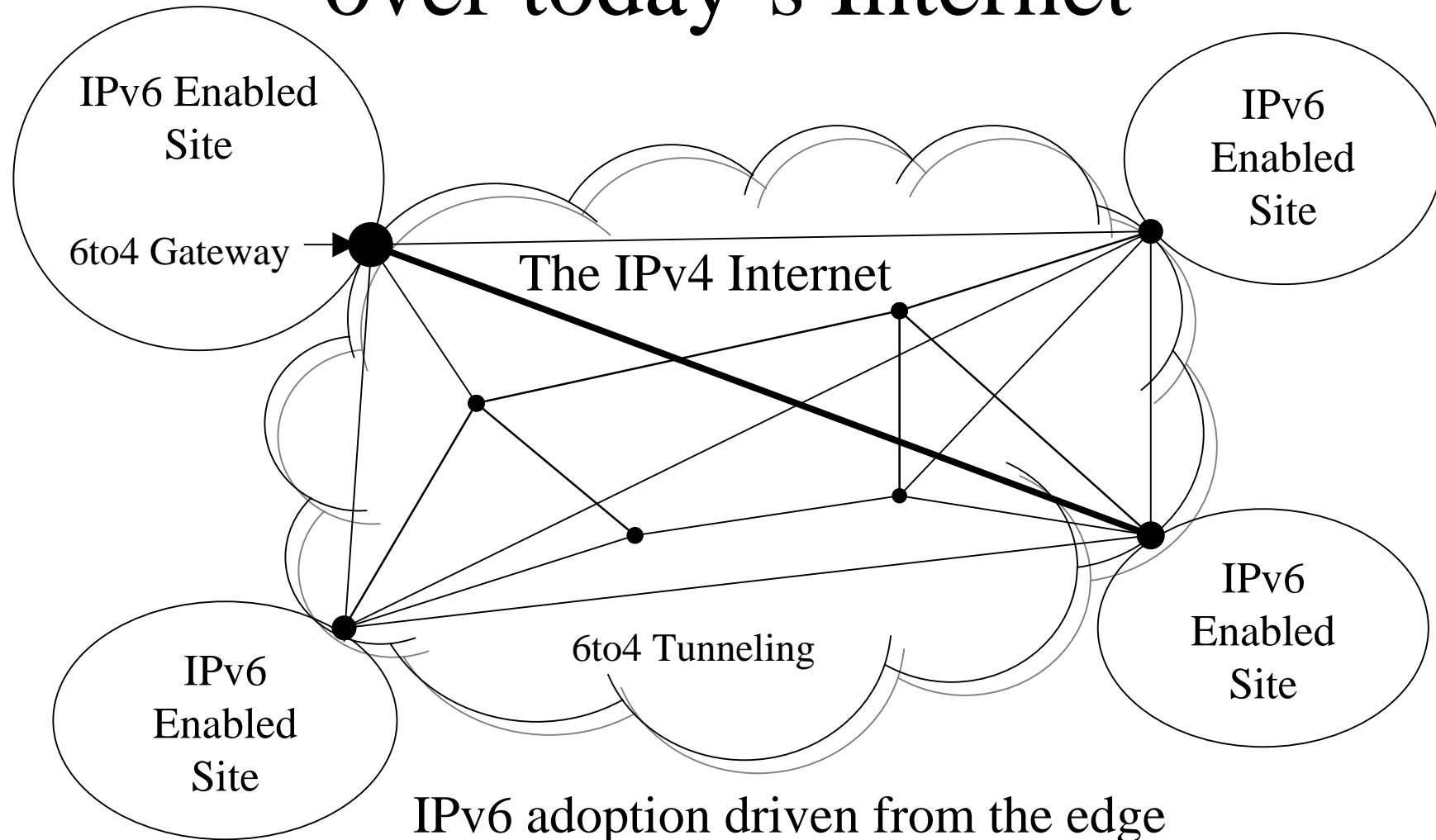
2002	131.107	.65.121
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- This prefix is then used to create addresses for all the nodes at that site

The 6to4 Solution

- 6to4 site gateway routers implement a special forwarding rule:
 - If IPv6 destination has 2002::/16 prefix, extract IPv4 address and tunnel the packet to that address

Connecting IPv6 Sites over today's Internet



6to4 Advantages

- Same efficiency & reliability as the underlying Internet
 - No performance degradation relative to IPv4
 - No separate BGP configuration/administration
- No coordination with ISP required
 - Only one global IPv4 address needed per site

6to4 Advantages

- No state in the network
 - Important for scalability
- Zero-configuration for the site
 - Windows will automatically configure 6to4 correctly in home/small-business scenarios

Coexistence with Native IPv6 Service

- Sites can simultaneously use a 6to4 address prefix and a native IPv6 address prefix
 - Source/destination address selection rules pick the appropriate address
 - Makes transition from 6to4 to native IPv6 easy
- 6to4 relays forward between 6to4 sites and other IPv6 networks
 - Communication between 6to4 sites does not use a relay

6to4 Relays

- On the 6to4 site gateway:
 - 2002::/16 -> forward via 6to4
 - ::/0 -> forward to 6to4 relay
- On the 6to4 relay:
 - Advertise 2002::/16 into the native IPv6 internet
- How does a 6to4 site discover a relay?
 - DNS name: 6to4.ipv6.org
 - IPv4 anycast

Operational Experiences

- 6to4 operational since May 1999
 - MS had one of the first implementations
 - MS is operating the first 6to4 relay
- There are currently multiple independent 6to4 relays advertising 2002::/16 into the 6bone
- It just works!
 - Today: Just run 6to4cfg.exe
 - Ultimately: Completely auto-configured

Work In Progress

- Anycast Discovery of 6to4 Relay
 - draft-ietf-ngtrans-6to4anycast-00.txt
- 6to4 Relay Scalability
 - Allowing tens/hundreds of millions of 6to4 sites
 - draft-hain-6to4-scaling-01.txt
- Multicast
 - Allowing 6to4 sites to participate in global multicast groups
 - draft-thaler-ngtrans-6to4-multicast-01.txt