

Deploying IPv6, Now

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Agenda

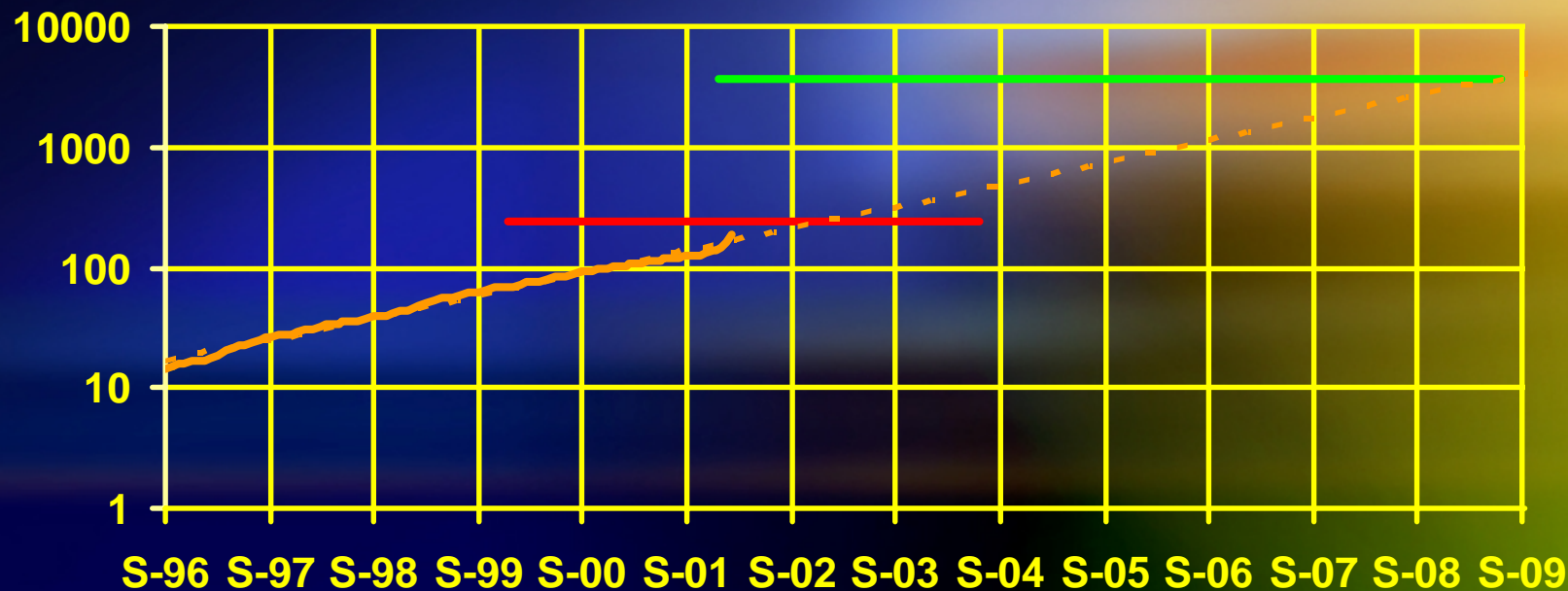
- **The Opportunity**
- **Key Problems**
- **The Promise of IPv6**
- **What is Microsoft doing**
- **Call to Action**

The Opportunity



Key Problems

Address Shortage



Extrapolating the number of DNS registered addresses shows **total exhaustion in 2009**. But the practical maximum is about **240 M addresses**, in **2002-2003**.

Key Problems

Address Shortage

- **Peer to Peer applications require**
 - Addressability of each end point
 - Unconstrained inbound and outbound traffic
 - Direct communication between end points using multiple concurrent protocols
- **NATs are a band-aid to address shortage**
 - Block inbound traffic on listening ports
 - Constrain traffic to “understood” protocols
 - Create huge barrier to deployment of P2P applications

Key Problems

Lack of Mobility

- Existing applications and networking protocols do not work with changing IP addresses
 - Applications do not “reconnect” when a new IP address appears
 - TCP drops session when IP address changes
 - IPSEC hashes across IP addresses, changing address breaks the Security Association
- Mobile IPv4 solution is not deployable
 - Foreign agent reliance not realistic
 - NATs and Mobile IPv4? Just say NO

Key Problems Network Security

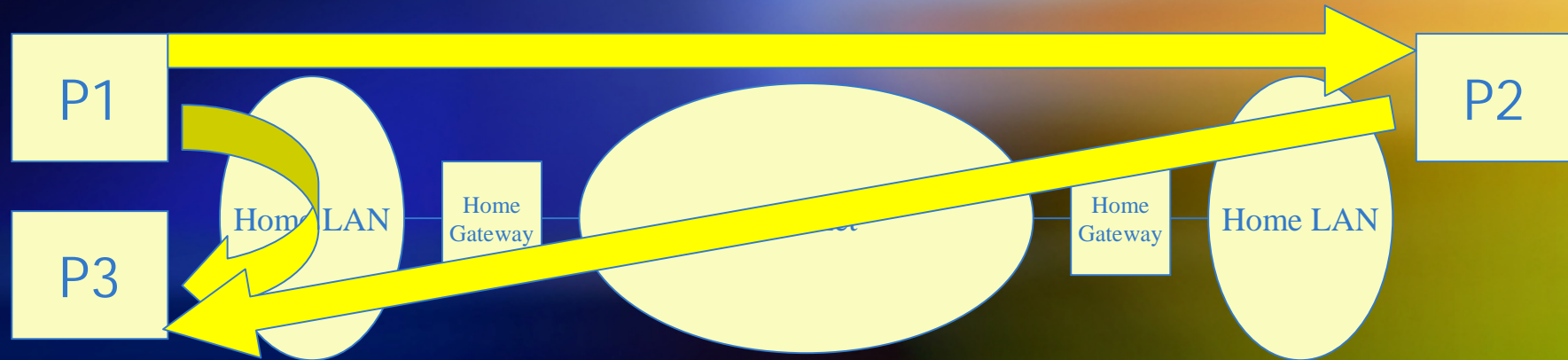
- **Always On == Always attacked!**
 - Consumers deploying NATs and Personal Firewalls
 - Enterprises deploying Network Firewalls
- **NATs and Network Firewalls break end-to-end semantics**
 - Barrier to deploying Peer to Peer applications
 - Barrier to deploying new protocols
 - Block end-to-end, authorized, tamper-proof, private communication
- **No mechanisms for privacy at the network layer**
 - IP addresses expose information about the user
- **No transparent way to restrict communication within network boundaries**

The Promise of IPv6

- **Enough addresses**
 - 64+64 format: $1.8E+19$ networks, units
 - assuming IPv4 efficiency: $1E+16$ networks, 1 million networks per human
 - 20 networks per m² of Earth (2 per sqft)
 - Removes need to stretch addresses with NATs
- **True mobility**
 - No reliance on Foreign Agents
- **Better network layer security**
 - IPSec delivers end-to-end security
 - Link/Site Local addresses allow partitioning
 - Anonymous addresses provide privacy

The Promise of IPv6

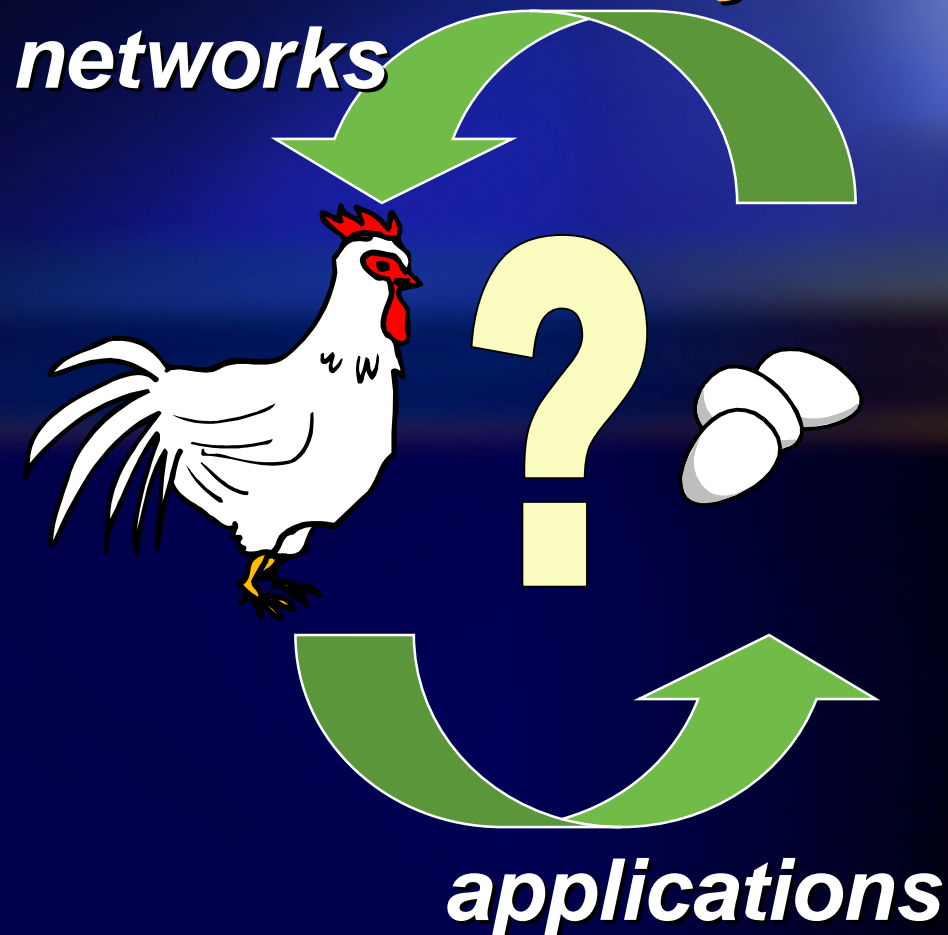
Example:
Multiparty Conference, using IPv6



- **With a NAT:**
 - Brittle “workaround”.
- **With IPv6:**
 - Just use IPv6 addresses

The Promise of IPv6

If IPv6 is so great, how come it is not there yet?



■ Applications

- Need upfront investment, stacks, etc.
- Similar to Y2K, 32 bit vs. “clean address type”

■ Network

- Need to ramp-up investment
- No “push-button” transition

What is Microsoft doing

- **Building a complete IPv6 stack in Windows**
 - Technology Preview stack in Win2000
 - Developer stack in Windows XP
 - Deployable stack in .NET Server & update for Windows XP
 - Windows CE planned
- **Supporting IPv6 with key applications protocols**
 - File sharing, Web (IIS, IE), Games (DPlay), Peer to Peer platform, UPnP
- **Building v4->v6 transition strategies**
 - Scenario focused tool-box

What is Microsoft doing IPv6 deployment tool-box

- **IPv6 stateless address auto-configuration**
 - Router announces a prefix, client configures an address
- **6to4: Automatic tunneling of IPv6 over IPv4**
 - Derives IPv6 /48 network prefix from IPv4 global address
- **Automatic tunneling of IPv6 over UDP/IPv4**
 - Works through NAT, may be blocked by firewalls
- **ISATAP: Automatic tunneling of IPv6 over IPv4**
 - For use behind a firewall.

What is Microsoft doing Recommended Strategies

- **In the home**
 - Use IPv6 if available,
 - Or use 6to4 if global IPv4 address,
 - Or use IPv6 over UDP
- **In the enterprise**
 - Use IPv6 ISP or 6to4 for external access,
 - Use ISATAP while upgrading the network

What is Microsoft doing

Addressing hard problems

- **Domain Names and IPv6 have issues**
 - Peer to Peer applications require dynamic registration of IPv6 address
 - DDNS is hard to deploy securely on the internet
 - Workarounds require building alternate namespaces or avoiding names altogether
- **Ease of use is a must**
 - Need an easy way to get Mobile IPv6 addresses
 - Need an easy way to resolve names in a IPv6 Ad-hoc network (DNS Server not reachable)

In Summary

... We Build Together

- Microsoft is moving quickly to enable Windows platforms for IPv6
 - Up to date information on:
<http://www.microsoft.com/ipv6/>
 - Send us feedback and requirements
<mailto:ipv6-fb@microsoft.com>
- We need your help to move the world to a simple ubiquitous network based on IPv6

Call to Action

- **Network Providers: Build it and they will come**
 - **Do not settle for NATs for new designs**
 - **Demand IPv6 support on all equipment**
 - **Offer native IPv6 services**
- **Device Vendors: Design for the simpler, ubiquitous IPv6 internet**
- **Application Writers: Don't wait on the above**
 - **Use Windows XP and Windows .NET Server NOW!**

Microsoft Vision

**Empower people
through great software
anytime, anyplace,
and *on any device***

Where do you



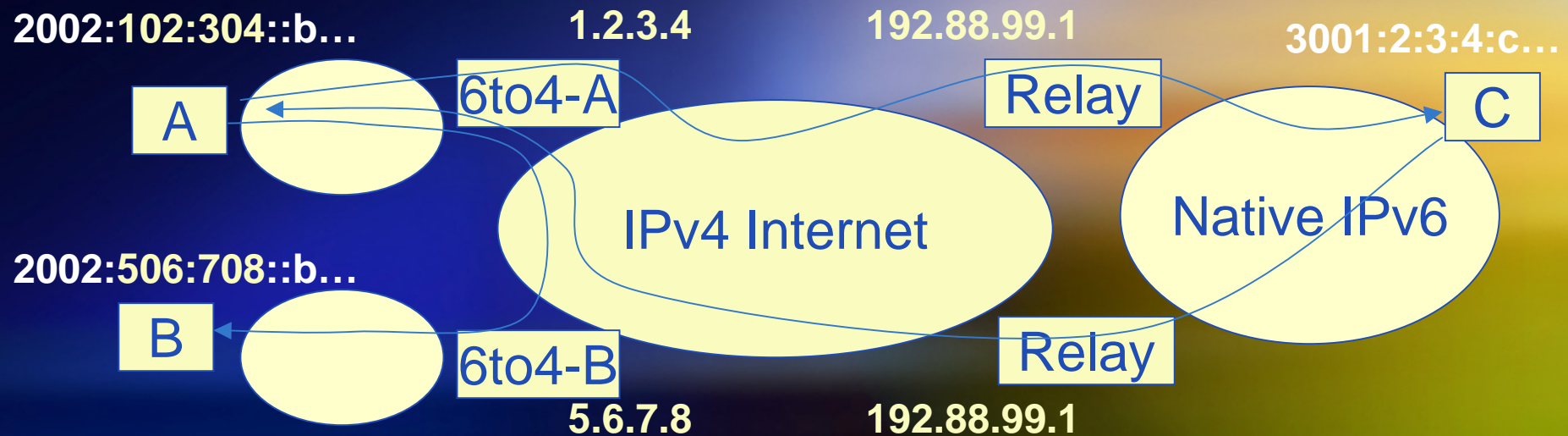
want to go

today?

Microsoft®

Background Material

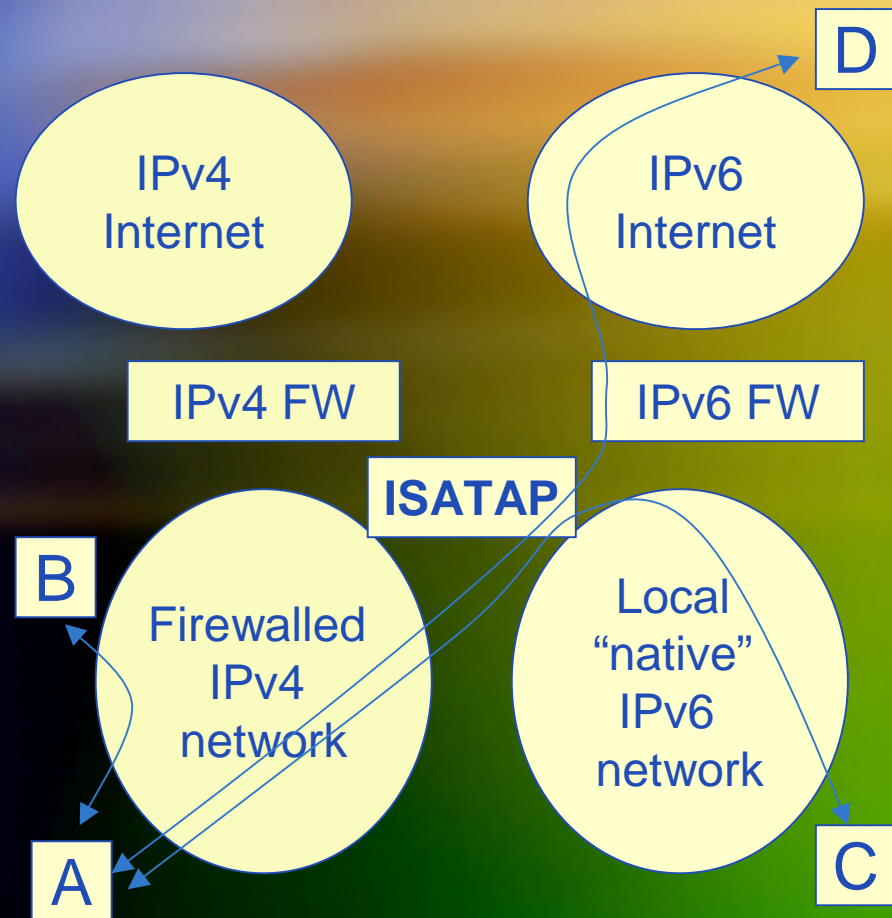
6to4: tunnel IPv6 over IPv4



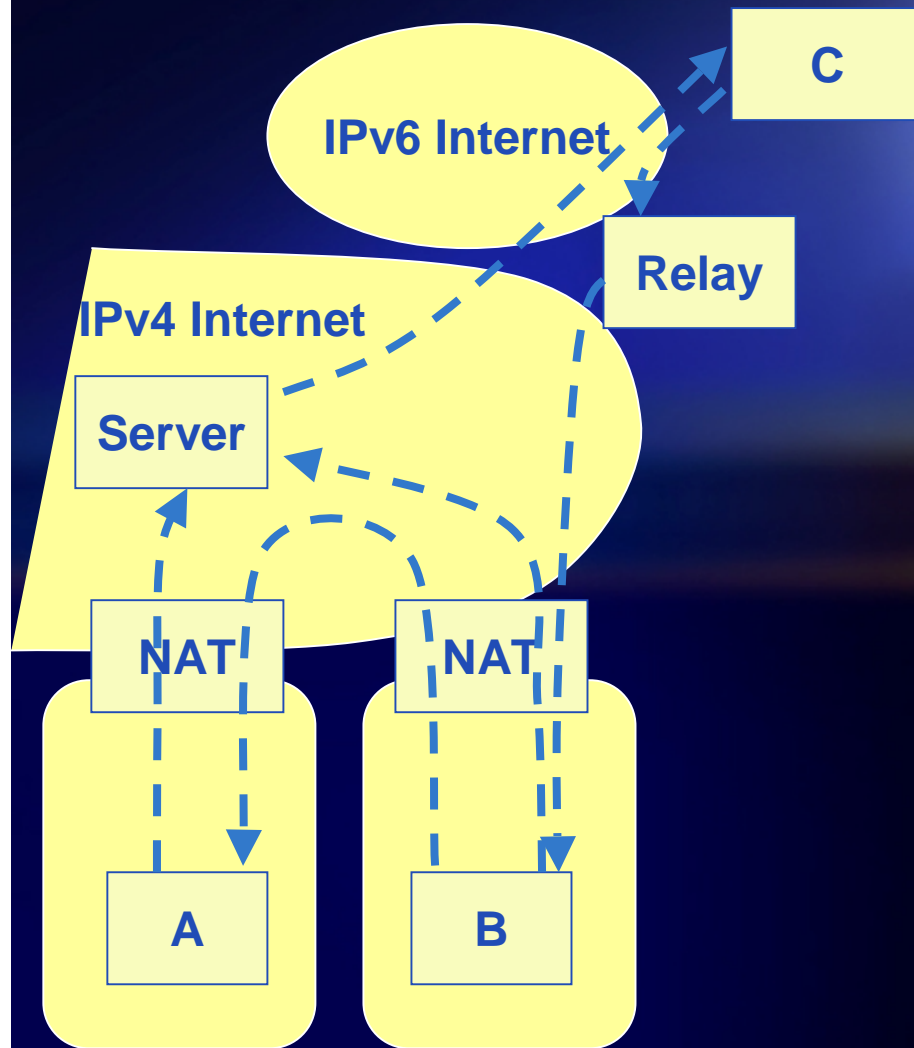
- 6to4 router derive IPv6 prefix from IPv4 address,
- 6to4 relays advertise reachability of prefix 2002::/16
- Automatic tunneling from 6to4 routers or relays
- Single address (192.88.99.1) for all relays

ISATAP: IPv6 behind firewall

- ISATAP router provides IPv6 prefix
- Host complements prefix with IPv4 address
- Direct tunneling between ISATAP hosts
- Relay through ISATAP router to IPv6 local or global



IPv6 over UDP through NAT



■ IPv6 / UDP

- IPv6 prefix: IP address & UDP port

■ Servers

- Address discovery
- Default “route”
- Enable “shortcut” (A-B)

■ Relays

- Send IPv6 packets directly to nodes

■ Works for all NAT