# Simple SIPP Transition (SST)

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# History

- Based on IPAE proposal
- Complex features removed
- Developed with Erik Nordmark and Bob Hinden (Sun)
- Changes based on feedback from reviewers

# Changes from IPAE

- Address mapping eliminated
- C-bit changed to C-prefix
- More use of “dual stack” techniques

# Goals and Objectives

- Provide interoperability between IPng and IPv4 hosts
- Allow incremental upgrade of IPv4 hosts and routers to IPng
  - Allow upgrade to happen “one at a time”
- Few or no “upgrade dependencies”
  - Avoid “step X before step Y”
- Make transition as easy as possible for users, system administrators, and network operators
- Non-goal: fixing IPv4 routing

# Fundamental Assumptions/ Constraints

- IPng hosts need an IPv4 address to interoperate with IPv4-only hosts
- Interoperability between IPv4-only and IPng-only hosts requires header translation
  - ISSUE: Do IPng-only hosts need to interoperate with IPv4-only hosts?

# General Transition Model

**IPv4-only --> IPng/IPv4 --> IPng-only**

**(first phase) (second phase)**

**(begins soon) (begins later)**

**(optional)**

# New Terminology

- **IPv4-only node: host or router that speaks only IPv4**
- **IPng/IPv4 node: host or router that speaks both IPng and IPv4 plus implements IPng-in-IPv4 tunneling**
- **IPng-only node: host or router that speaks only IPng**

# Transition Mechanisms/ Techniques

- **IPv4-compatible addresses**
  - **IPv4 address embedded within IPng address**
- **IPng-in-IPv4 encapsulation**
  - **Tunnel IPng packets across IPv4 topologies**
- **IPng/IPv4 header translation**
  - **OPTIONAL mechanism - to support interoperation between IPv4-only and IPng-only hosts**

# IPv4-compatible addresses

- 0:0:0:0:0:0:<IPv4-address>
  - Addresses of IPv4-only hosts mapped into IPng address space
  - Listed in DNS with only "A" records
- 0:0:0:0:0:1:<IPv4-address>
  - Assigned to IPng hosts that wish to interoperate with IPv4-only hosts
  - Listed in DNS with both "A" and "ASEQ" records
- 0:0:0:0:0:2 through ffff:ffff:ffff:ffff:ffff:ffff
  - Assigned to IPng hosts that do not wish to interoperate with IPv4-only hosts
  - Listed in DNS with only "ASEQ" records

# IPng-in-IPv4 Encapsulation

- Allows IPng hosts to exchange IPng packets over IPv4 infrastructure
- "Sending rules" tell hosts and routers when to encapsulate
- Mostly used "host-to-host" and "router-to-host"
  - Use "host-to-router" and "router-to-router" allowed, but requires configuration
- Embedded IPv4 address allows "automatic configuration" of IPv4 "tunnel endpoint"
- IPv4 source addr is encapsulating node
  - So that IPv4 ICMP errors return to the right place

# IPng/IPv4 Header Translation

- "Translating IPng/IPv4 routers" translate:
  - Packets between IPng-only and IPv4-only hosts
  - IPv4 packets transiting IPng-only area
- IPv4-only and IPng-only hosts speak their "native" protocol
- Address mapping completely algorithmic
  - 0:0:0:0:0:0:<IPv4-addr> ==> <IPv4-addr>
  - <IPv4-addr> ==> 0:0:0:0:0:0:<IPv4-addr> OR
  - <IPv4-addr> ==> 0:0:0:0:0:1:<IPv4-addr>
- Translating routers must be positioned between IPng-only areas and IPng/IPv4 areas

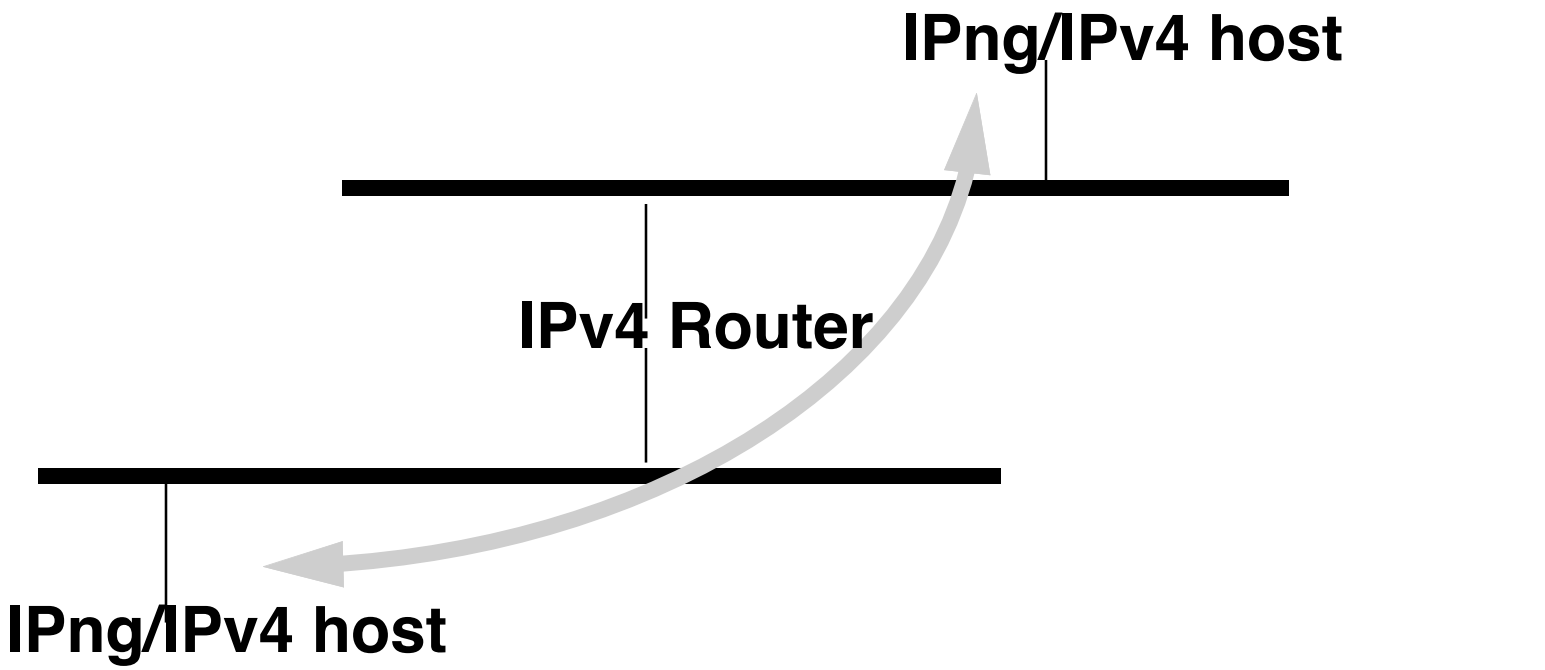
# Upgrade Process

- **First phase: IPv4-only to IPng/IPv4**
  - **IPv4-only hosts and routers can be upgraded to IPng/IPv4 at any time**
  - **IPng routing grows as deployed**
  - **Must continue to route IPv4 completely**
- **Second phase: IPng/IPv4 to IPng-only (optional)**
  - **Install translating routers at borders**
  - **De-comission all IPv4-only nodes**
  - **Turn off IPv4 routing in IPng/IPv4 routers**
  - **Upgrade IPng/IPv4 hosts and routers to IPng-only**

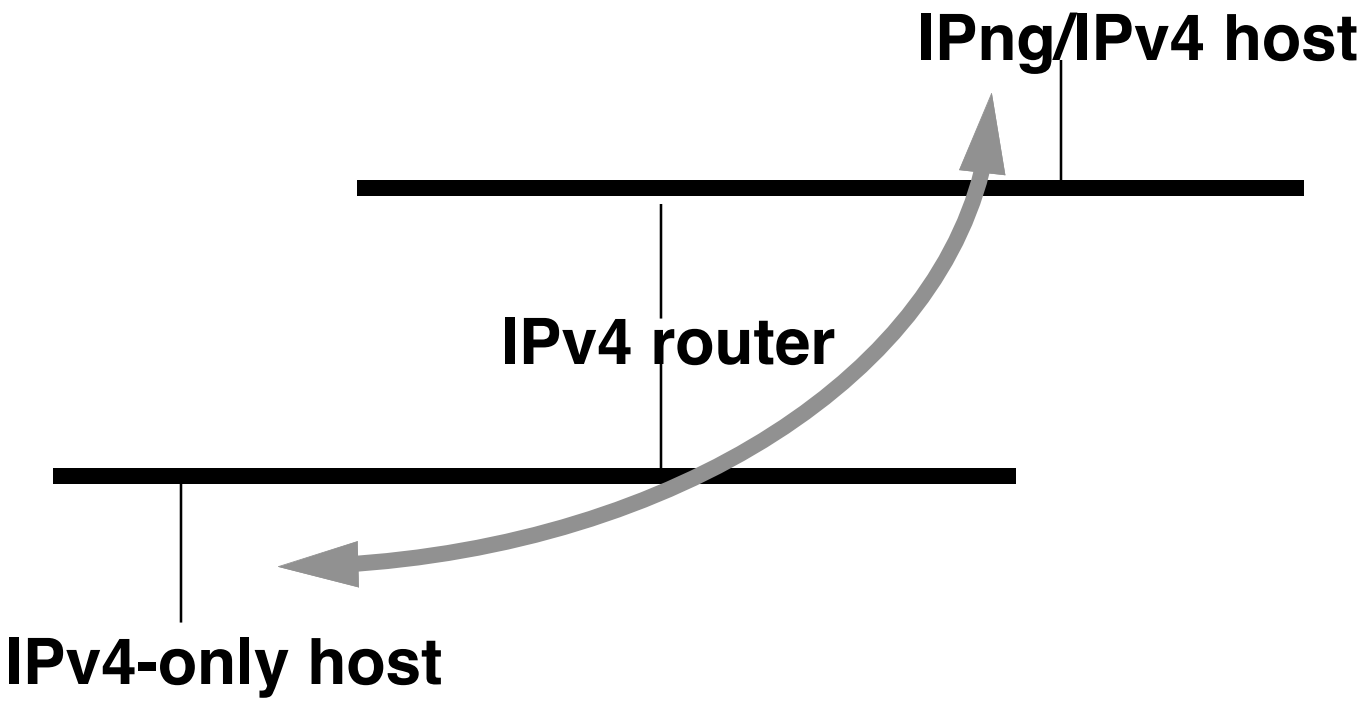
# Upgrade Dependencies

| Transition Step | Depends On |
| --- | --- |
| Upgrade IPv4 host or router to IPng/IPv4. | Upgrade DNS to support ASEQ records. |
| Upgrade IPng/IPv4 host or router to IPng-only. | Install translating router at area border.<br>Upgrade all routers in area to IPng/IPv4. |

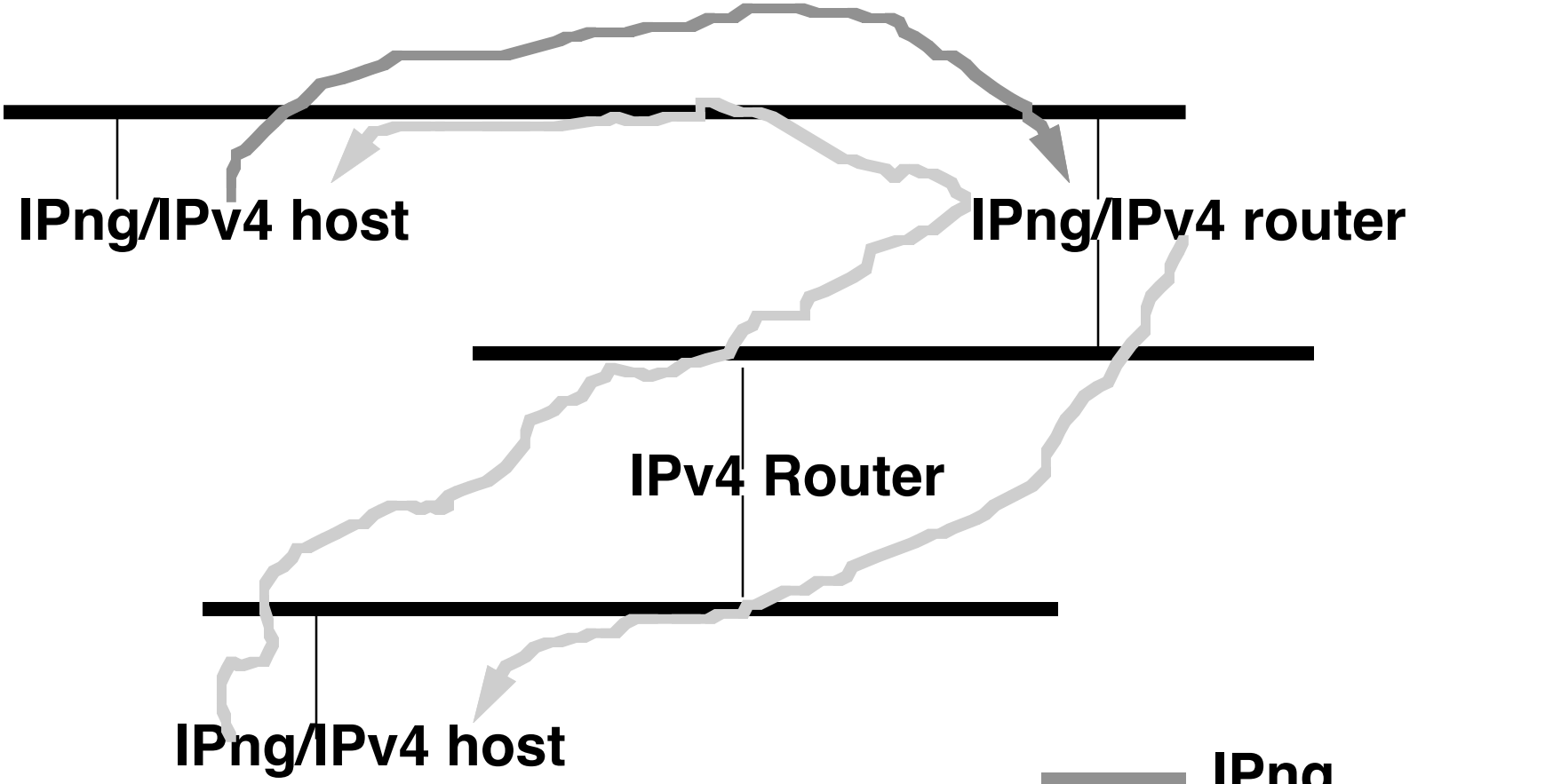
# Example - Tunneling over IPv4



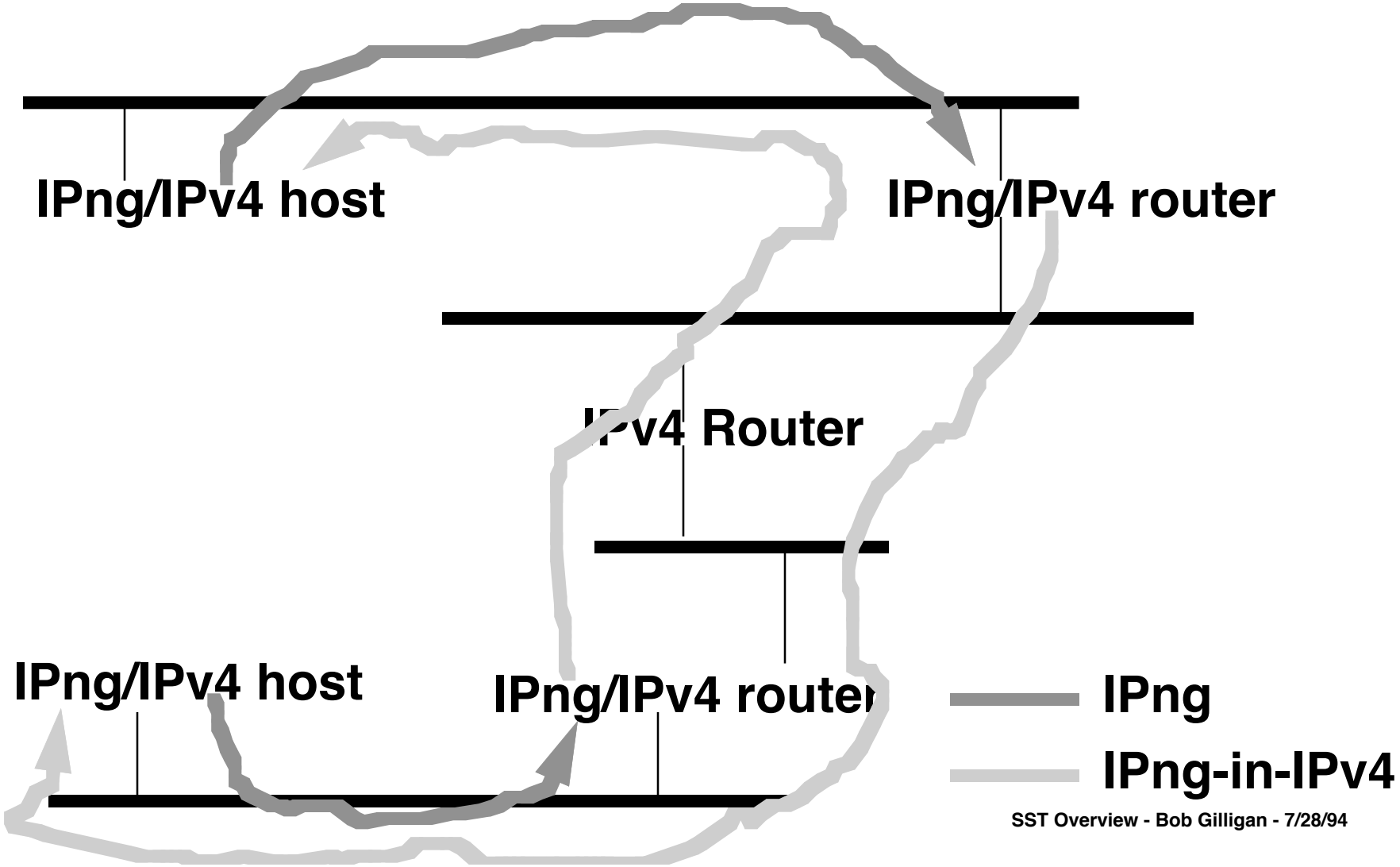
# Example - Interoperating with IPv4



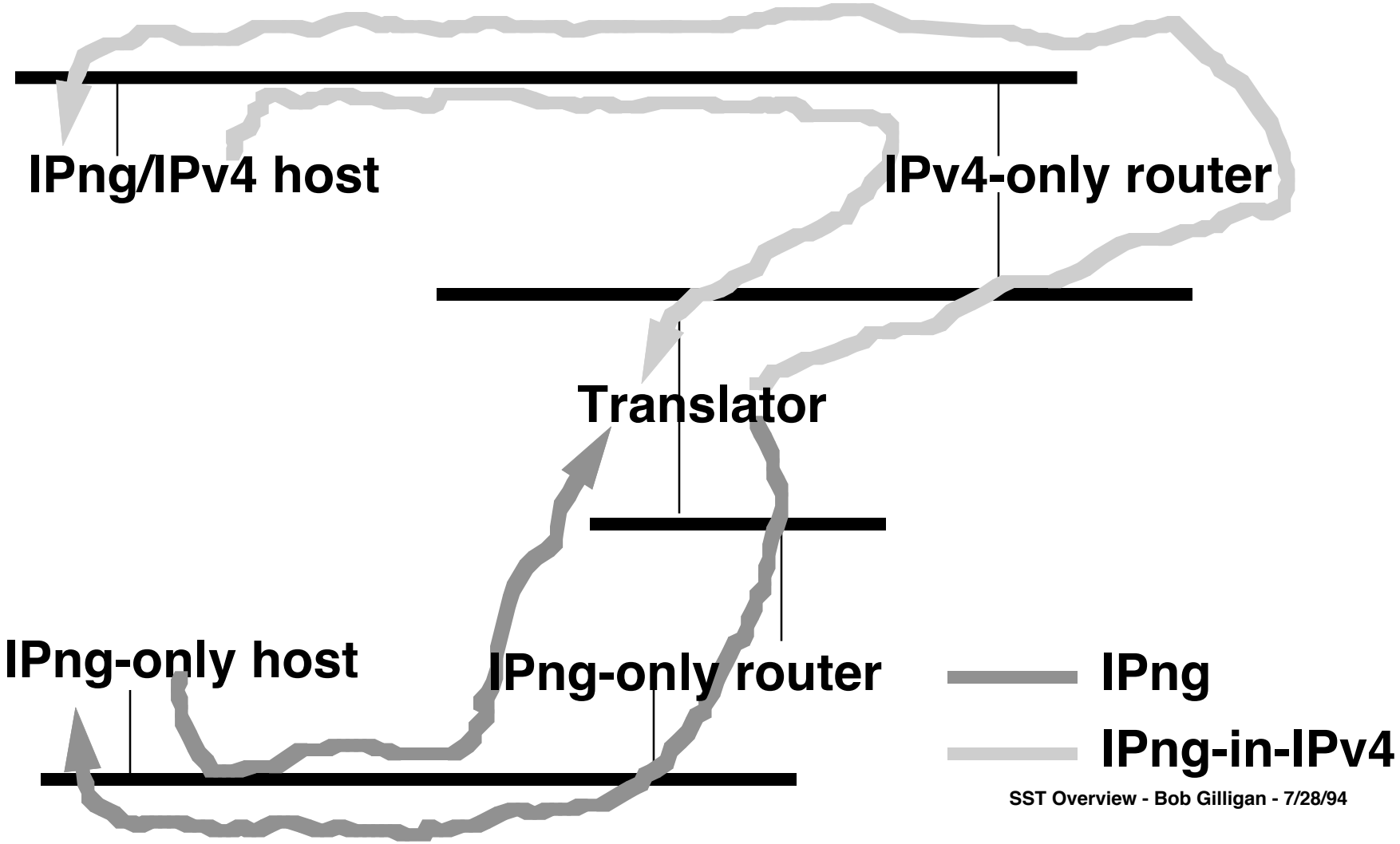
# Example - Tunneling and raw IPng



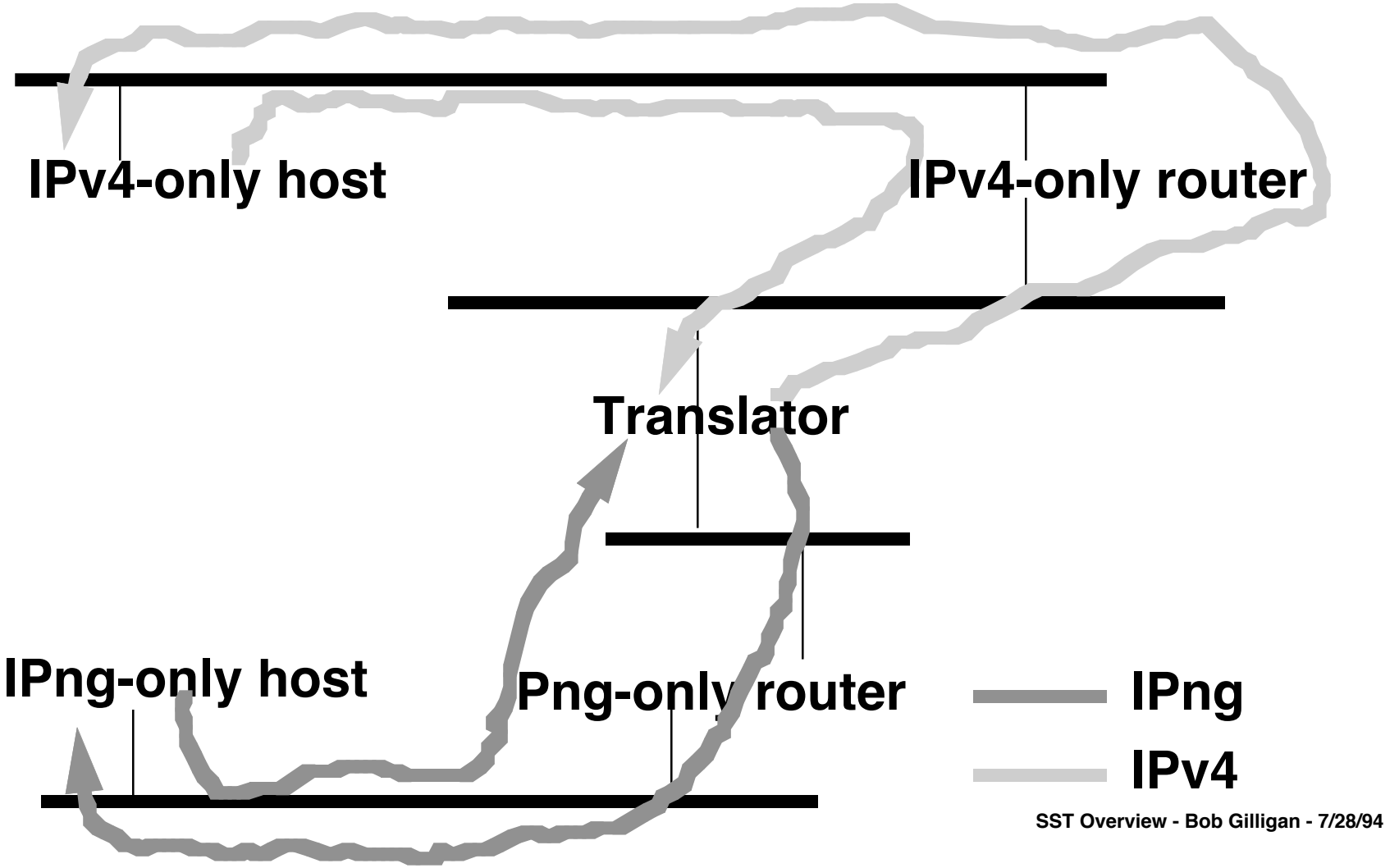
# Example - Tunneling - IPv4 in the middle



# Example - Translation to IPng host



# Example - Translation to IPv4 host



# Documents

- **SST Overview**
  - **Basic overview/introduction**
  - **Current draft: draft-ietf-sipp-sst-overview-00.txt**
- **Transition Mechanisms for Hosts and Routers**
  - **Detailed requirements spec (MUST/SHOULD/MAY)**
- **Transmission Mechanisms for Translating Routers**
  - **Detailed requirements spec (MUST/SHOULD/MAY)**
- **IPng Transition Plan**
  - **Detailed schedule of transition actions**

# Open Issues

- 0:0:0:0:0:ffff prefix instead of 0:0:0:0:0:1
  - To simplify pseudo-header checksum rules on hosts
- Encode IPng/IPv4 sense in low-order bits to right of <IPv4-addr>
  - For better agregation of IPv4-compatible addresses
- Integration with system discovery
- Bill Simpson's ideas
- Always map to 0:0:0:0:0:0 prefix
  - Simpler translation rules; more complex host processing