IP Next Generation (IPng)

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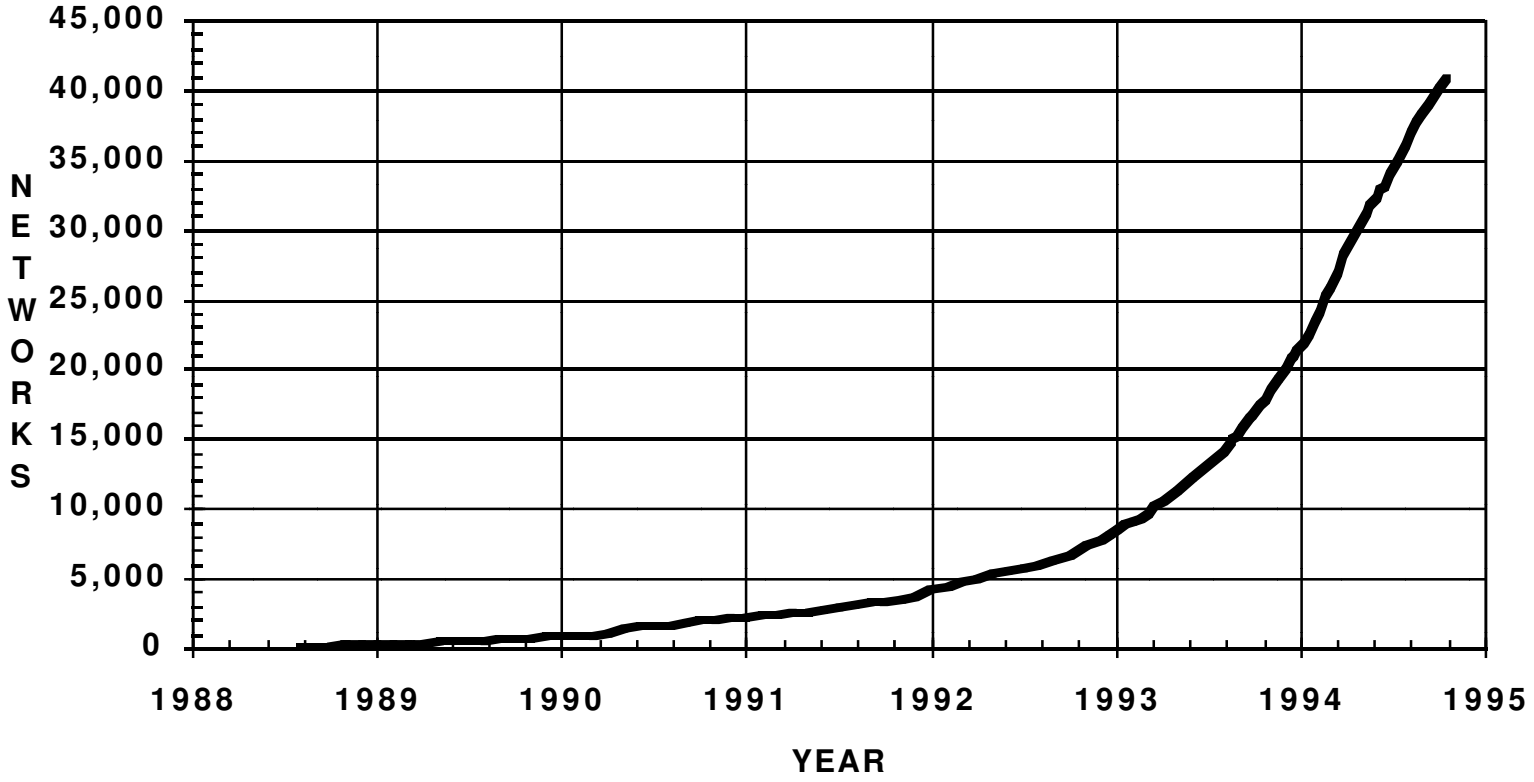
TALK OVERVIEW

- Background
- IPng Protocol
- Addressing
- Transition

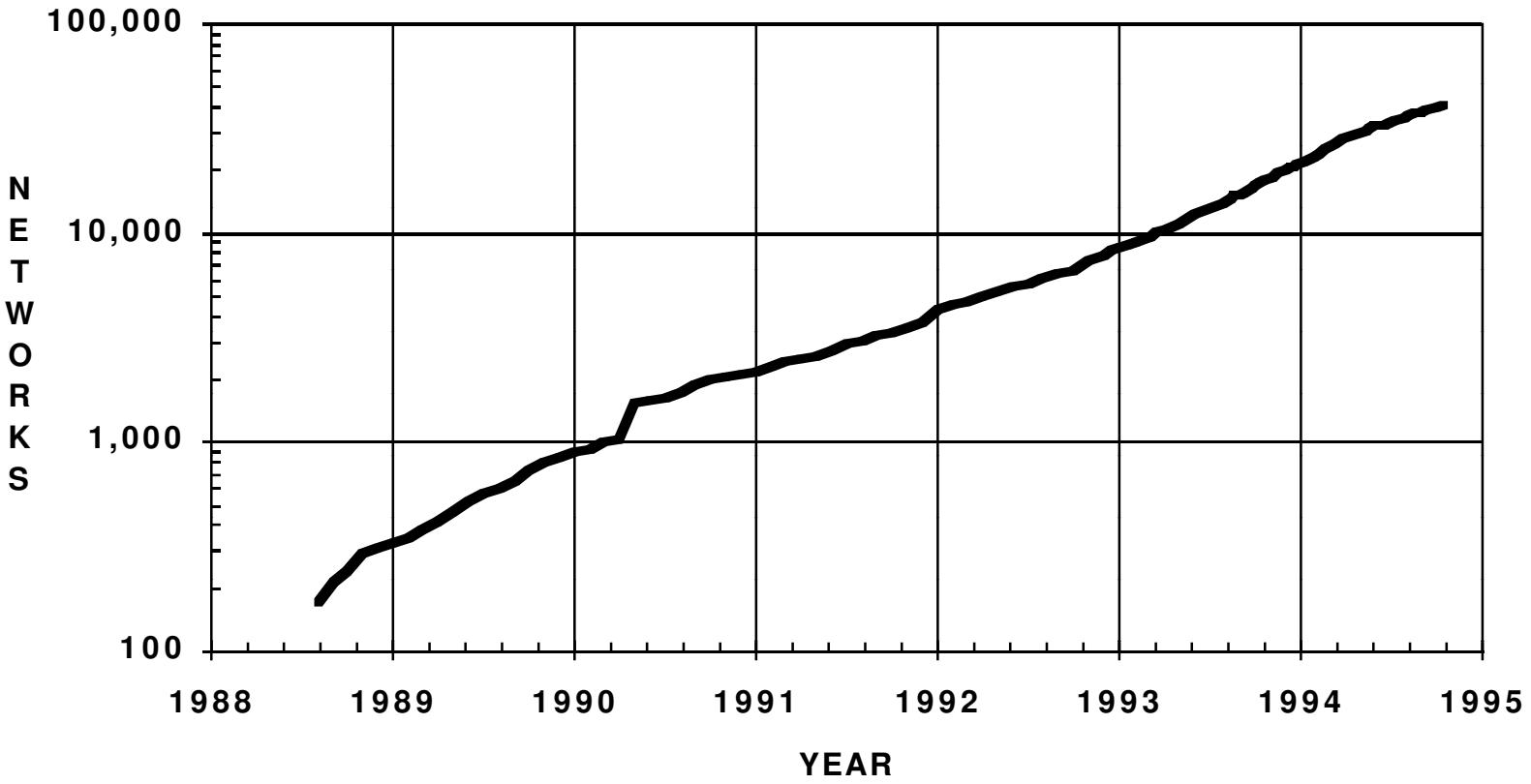
WHY IS A NEW IP NECESSARY

- **The Internet is Growing Exponentially**
  - **Currently Doubling Every 12 Months**
  - **Now about ~ 40,000+ Networks, ~ Millions Hosts**
- **Problem is in Two Areas**
  - **Routing Table Size and Computation**
  - **IP Address Exhaustion**
- **IPng Provides for Expanded Addressing and Scalable Routing**

INTERNET GROWTH



INTERNET GROWTH (LOG SCALE)



IP NEXT GENERATION

- New Version of the Internet Protocol
  - Assigned Version 6 (IPv6)
- Expands Scope of Routing and Addressing to Meet Internet Growth
- Solves Next Set of Pressing Problems
- May Facilitate Migration of IPX and OSI Internetworking to IPng
- Good Example of Internet Technology Evolution

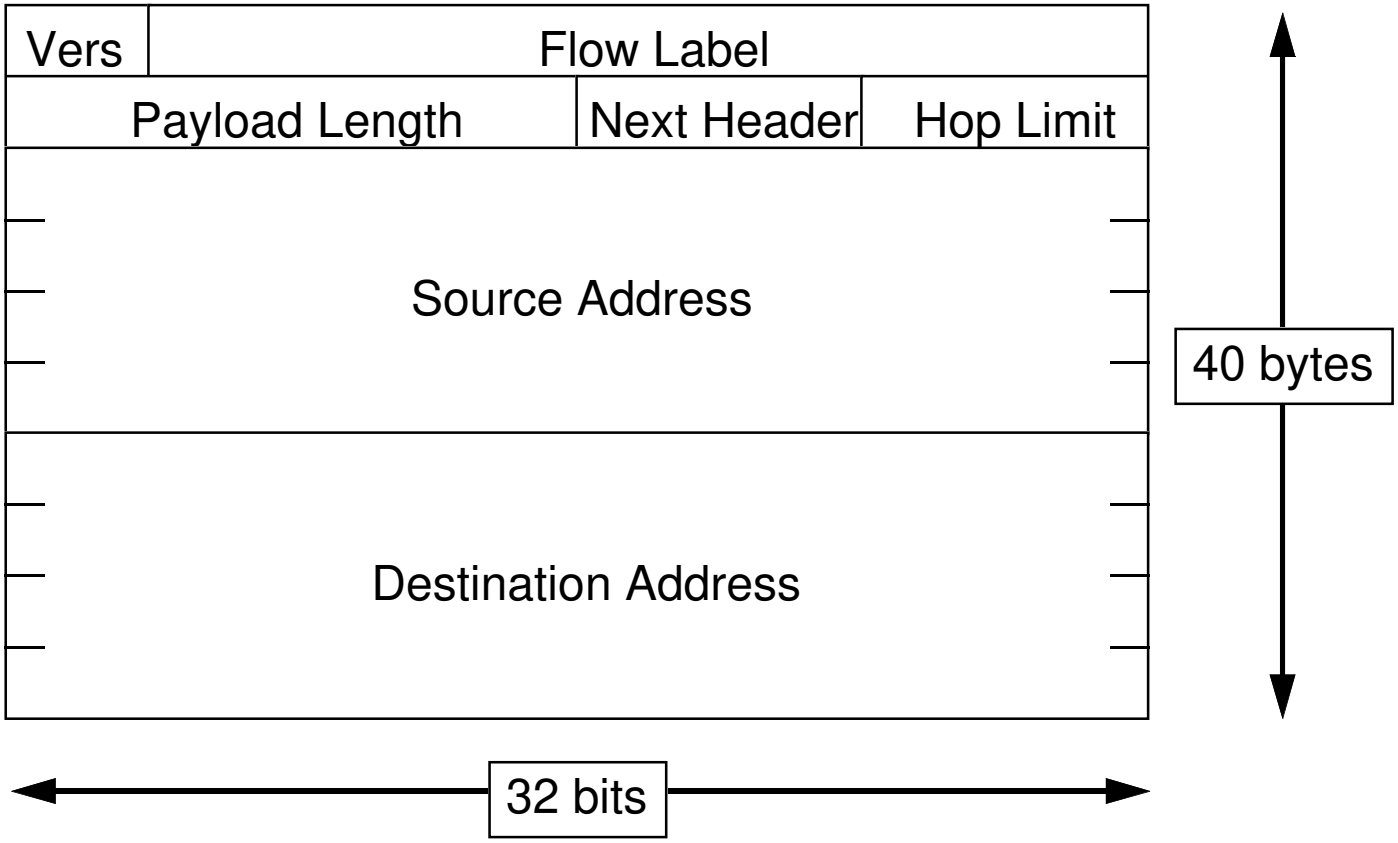
CHANGES FROM IP

- **Larger 128-bit Hierarchical Addresses**
  - **Supports Much Larger Internet**
  - **Allows Embedded IEEE 802 MAC Address for Auto Configuration**
- **Simplified Header w/ 64bit Alignment**
- **Flow Label for Real Time Support**
- **Flexible Extension Header Mechanism**
  - **Security**
  - **Route Selection**

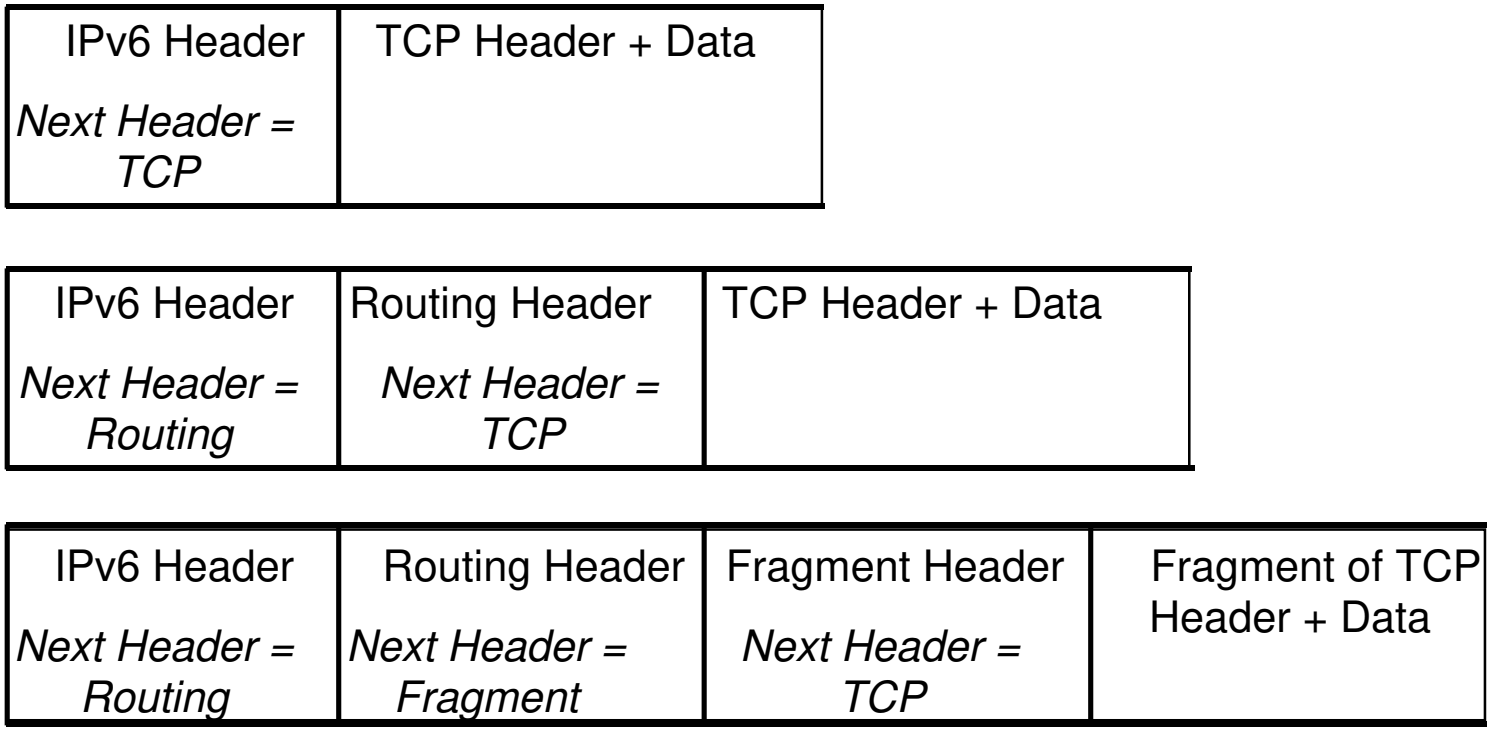
NEW FEATURES

- **Flow Label Used to Identify Real Time Traffic for Special Handling**
- **Authentication and Privacy Extensions**
- ***Plug and Play* Auto Configuration**
- **Multicast Improved and Made Standard**
- **Routing Supports Generalized Route Selection**
  - **Allows Selection of Specific Network Providers**

IPng HEADER FORMAT



EXTENSION HEADERS



IPng ADDRESSING

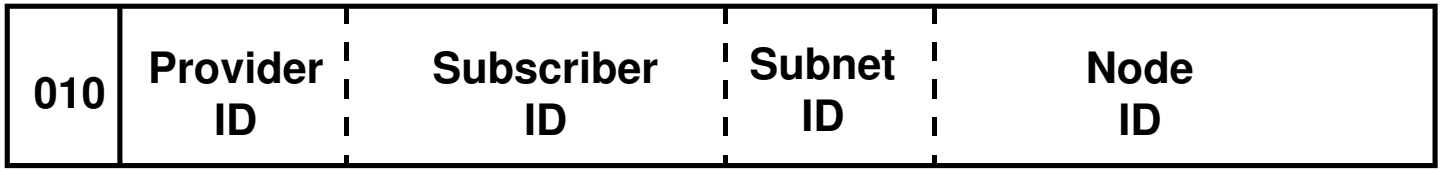
- **128 Bit Addresses can Identify Large Number of End Points**

  340,282,366,920,938,463,463,374,607,431,768,211,456

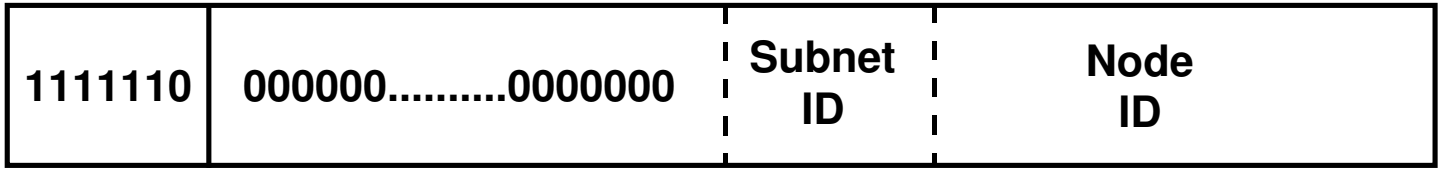
- **Address Space Initially Allocated**
  - **Provider Based Unicast**
  - **ISO NSAP**
  - **IPX**
  - **Multicast**
  - **Space Reserved for Geographic Addresses**
- **15% Initially Assigned, 85% Reserved for Future Growth**

ADDRESS FORMATS

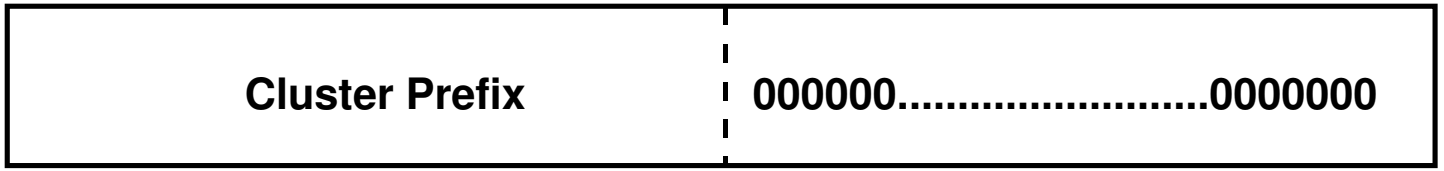
- **Provider Address**



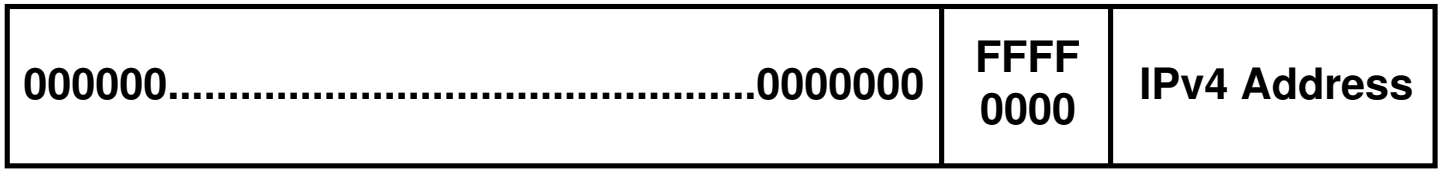
- **Local Use Address**



- **Cluster Address**



- **IPv4 Compatibility Address**



IPng TRANSITION

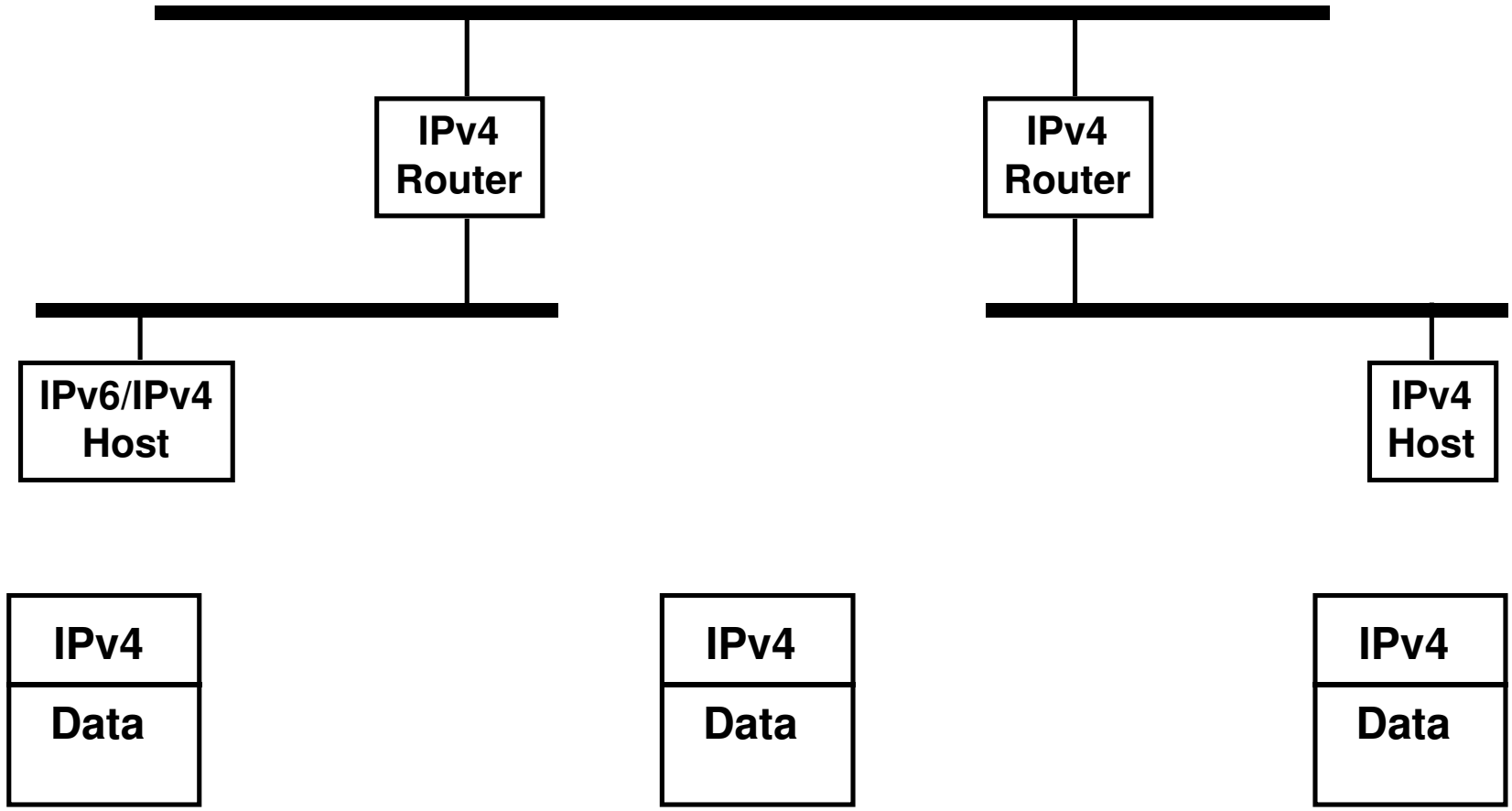
- Philosophy
  - Make IPv6 Implementations Compatible with IPv4
  - Make it Easy to Deploy
  - Get Experience Early in Transition
- Goals
  - Allow Incremental Upgrade of Hosts and Routers to IPv6
  - Few or No Upgrade Dependencies
  - Complete Transition before IPv4 Addresses Run Out

GENERAL TRANSITION MODEL

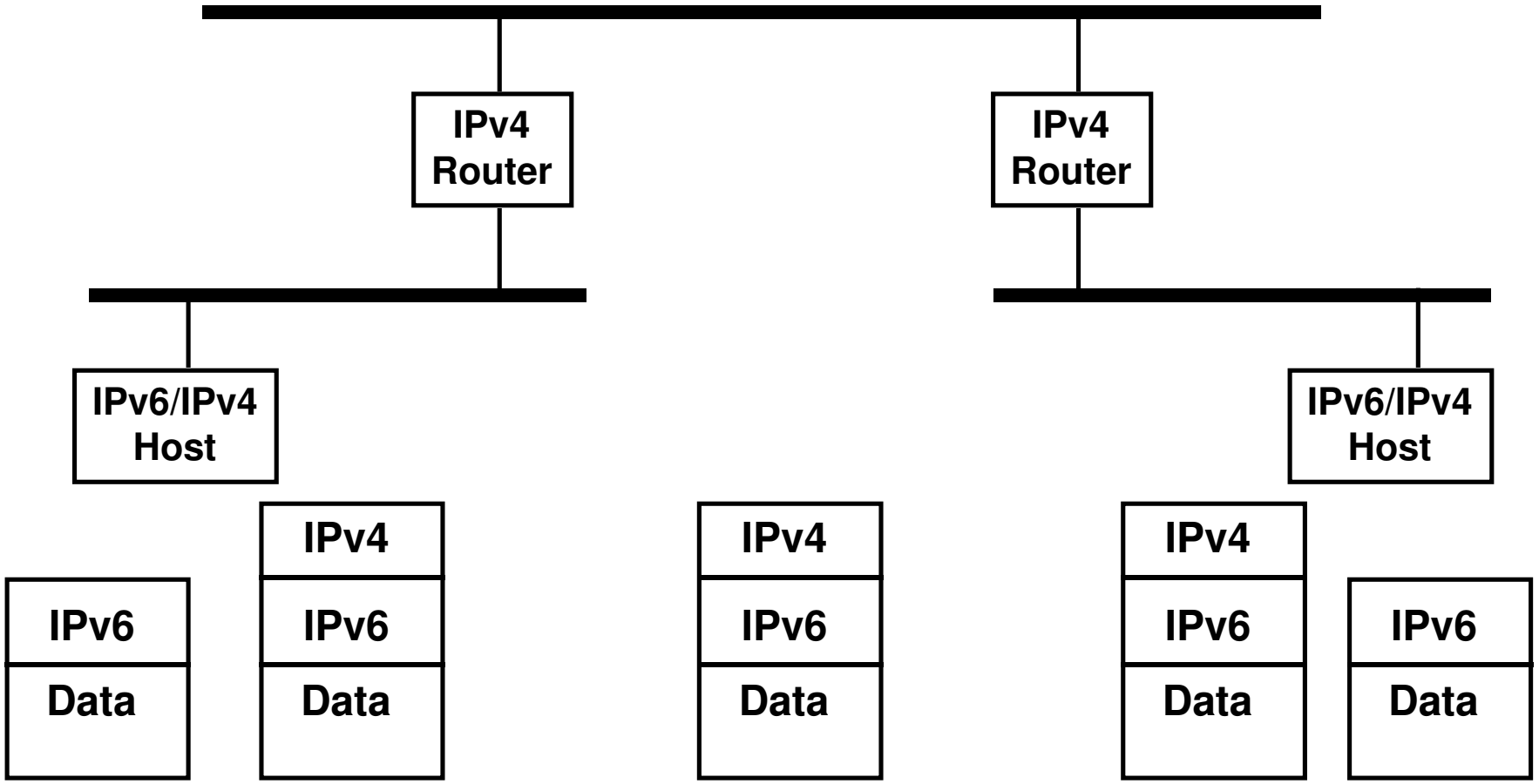
TRANSITION TECHNIQUES

- **Dual IP Layer**
  - **Nodes Support IPv4 and IPv6**
- **IPv4 Compatibility Addresses**
  - **IPv4 Addresses Embedded within IPv6 Address**
- **IPv6 in IPv4 Encapsulation**
  - **Tunnel IPv6 Datagrams across IPv4 Infrastructure**
- **IPv4 <-> IPv6 Header Translation (Optional)**
  - **Support Interoperation between IPv4-Only and IPv6-Only Hosts**

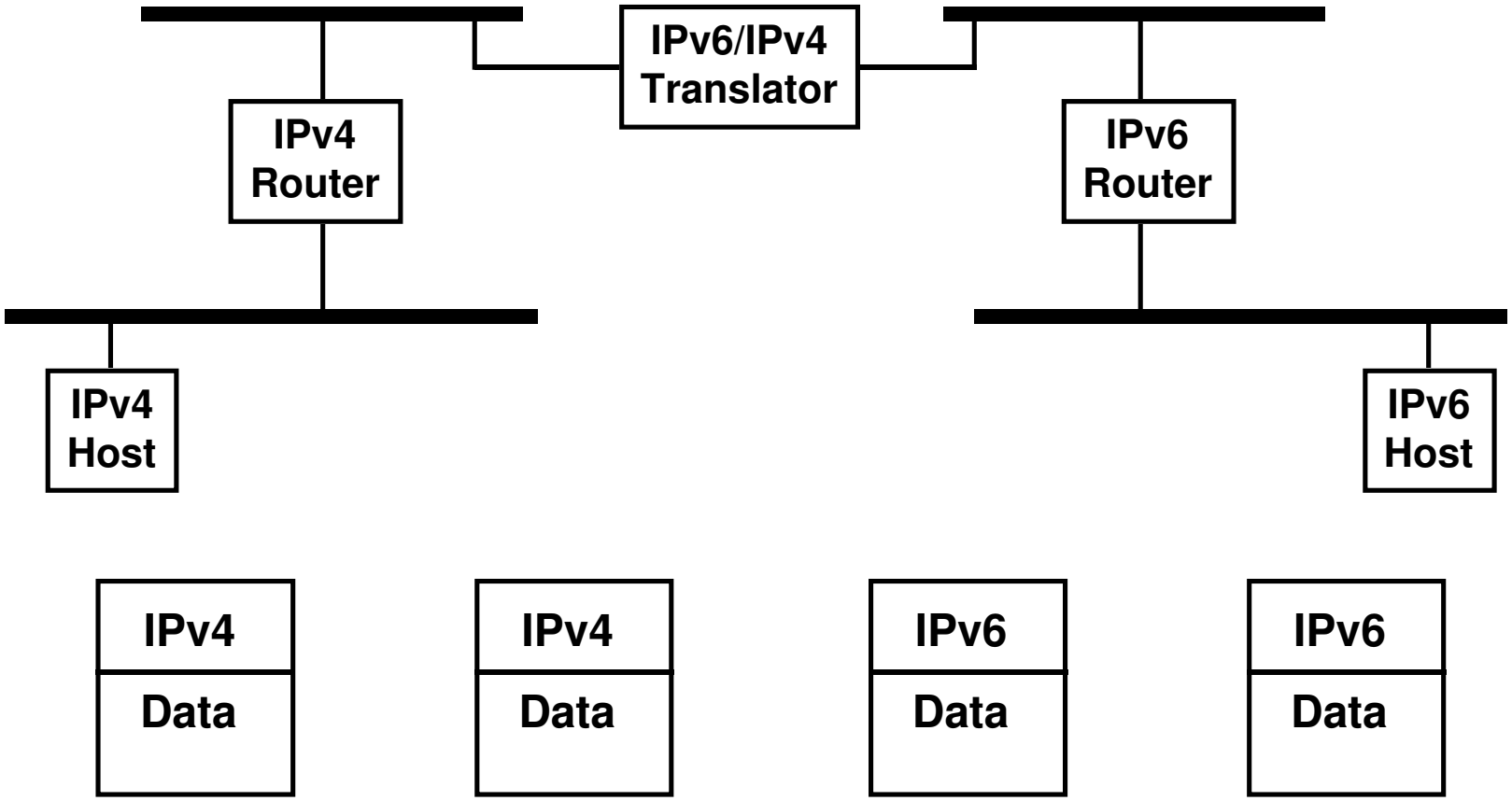
INTEROPERATION WITH IPv4



TUNNELING OVER IPv4



TRANSLATION BETWEEN IPv6 and IPv4



SUMMARY

- **IPng is a New Version of IP**
- **Solves Critical Current Problems**
- **Compatible with IPv4**
- **Improves IP in Many Areas**
- **Builds a Strong Base for the Future**