IPng PROTOCOL

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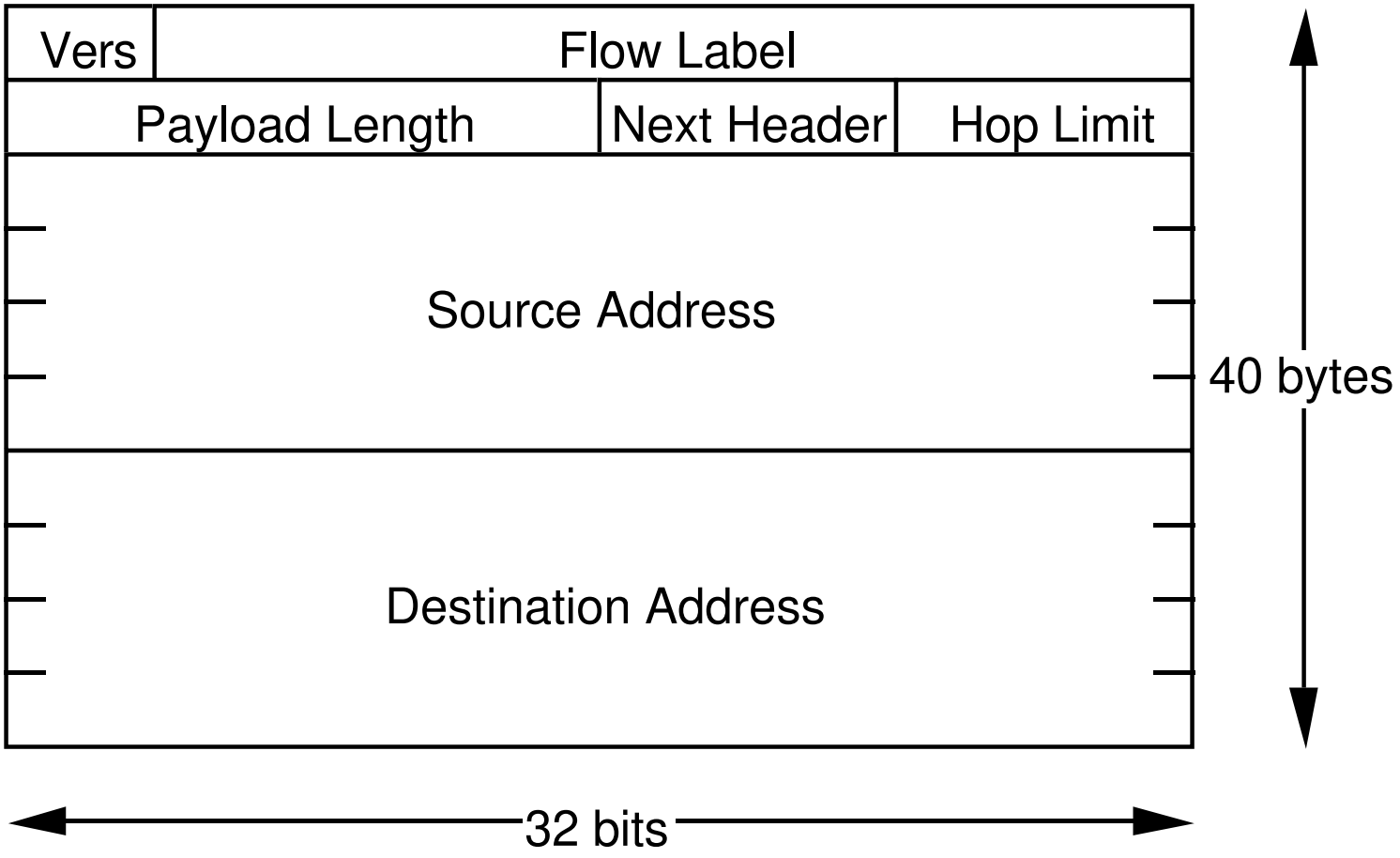
A NEW VERSION OF IP

- Assigned Version 6 (IPv6)
- Expanded Addressing Capabilities
- Streamlined Header Format
- Improved Support for Options / Extensions
- Flow Labeling Capabilities

IPv6 HEADER


Vers
Flow Label
Payload Length
Next Header
Hop Limit
Source Address
Destination Address
40 bytes
32 bits

HEADER CHANGES FROM IPv4

- Addresses increased from 32 to 128 bits
- Fragmentation Fields Moved out of Base Header
- Header Checksum Eliminated
- Header-Length Field Eliminated
- Length Field Excludes IPv6 Header
- Time-to-Live —> Hop Limit
- Protocol —> Next Header
- TOS Replaced by Flow Label
- Alignment Changed from 32 to 64 bits

EXTENSION HEADERS

IP6 Header	TCP Header + Data
Next Header = TCP	

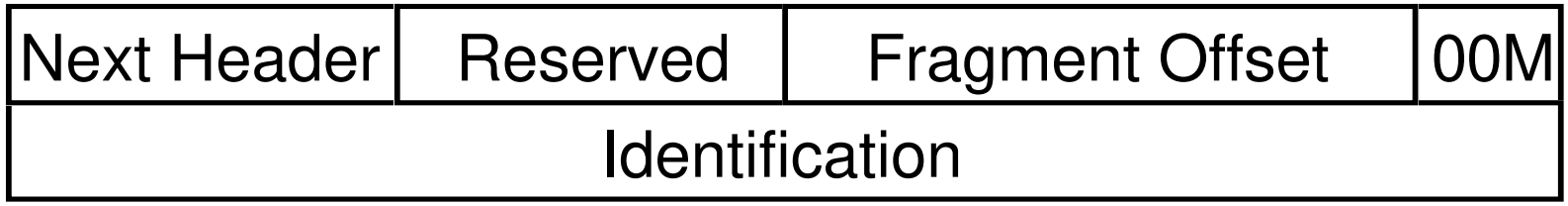
IPv6 Header	Routing Header	TCP Header + Data
Next Header = Routing	*Next Header = TCP*	

IPv6 Header	Routing Header	Fragment Header	Fragment of TCP Header + Data
Next Header = Routing	*Next Header = Fragment*	*Next Header = TCP*	

EXTENSION HEADERS

- Processed Only by Node Identified in IPv6 Destination Field
  - Much lower overhead than IPv4 options
  - Exception: Hop-by-Hop Options header
- Eliminated IPv4's 40-byte Limit on Options
  - IPv6's Limit is Total Packet Size
- Currently Defined Extension Headers:
  - Hop-by-Hop Options
  - Routing
  - Fragmentation
  - Authentication & Encryption
  - End-to-End Options

FRAGMENTATION HEADER

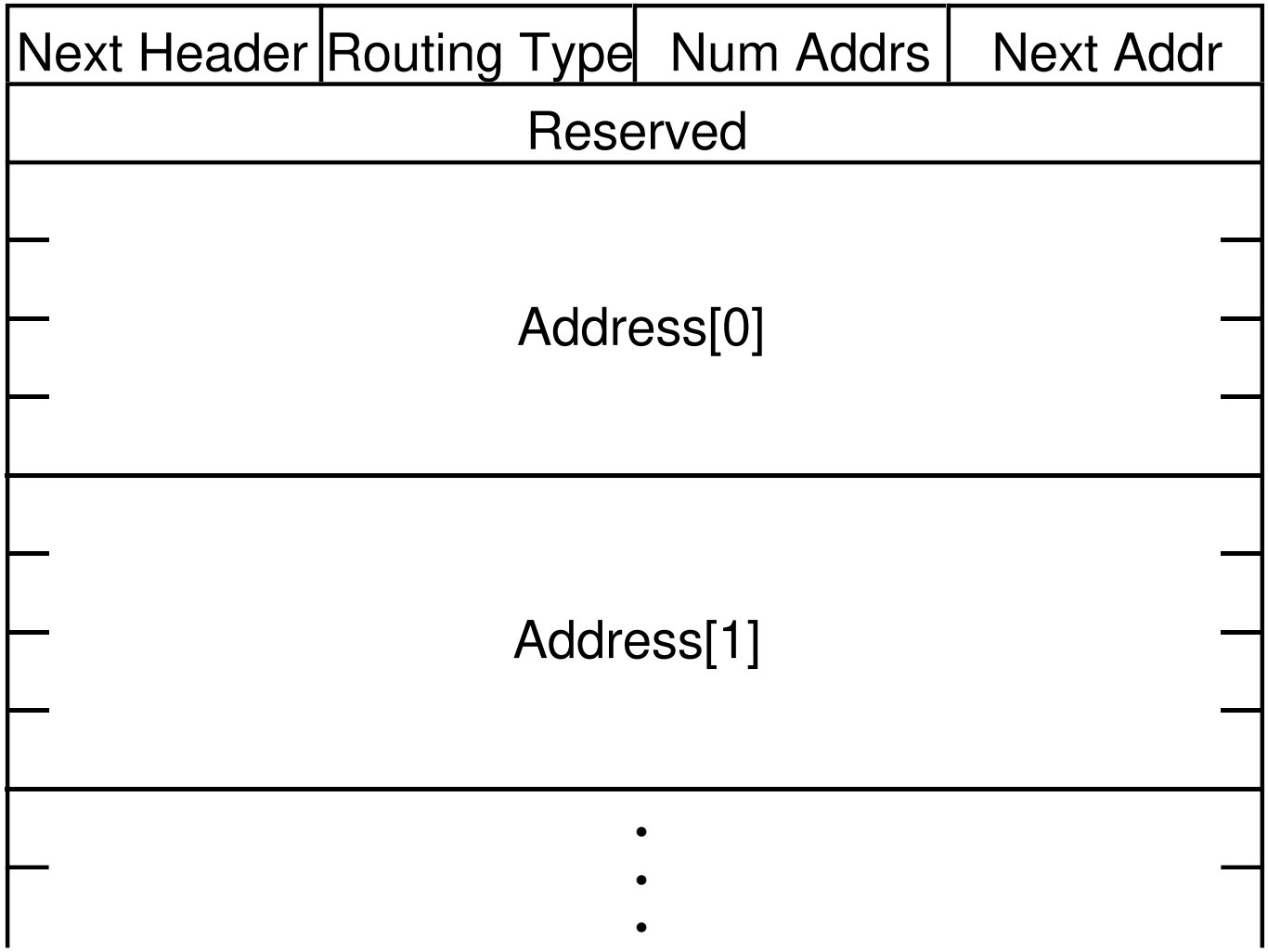


- Same Fragmentation Algorithm as IPv4 (e.g., Fragment only on 8-byte boundaries)
- Longer Identification Field handles more Packets in Transit
- All IPv6 Nodes perform Path-MTU Discovery
  - Fragment Header Present Only when Needed
  - Fragmentation is End-to-End
  - Routers Never Fragment a Packet in Transit

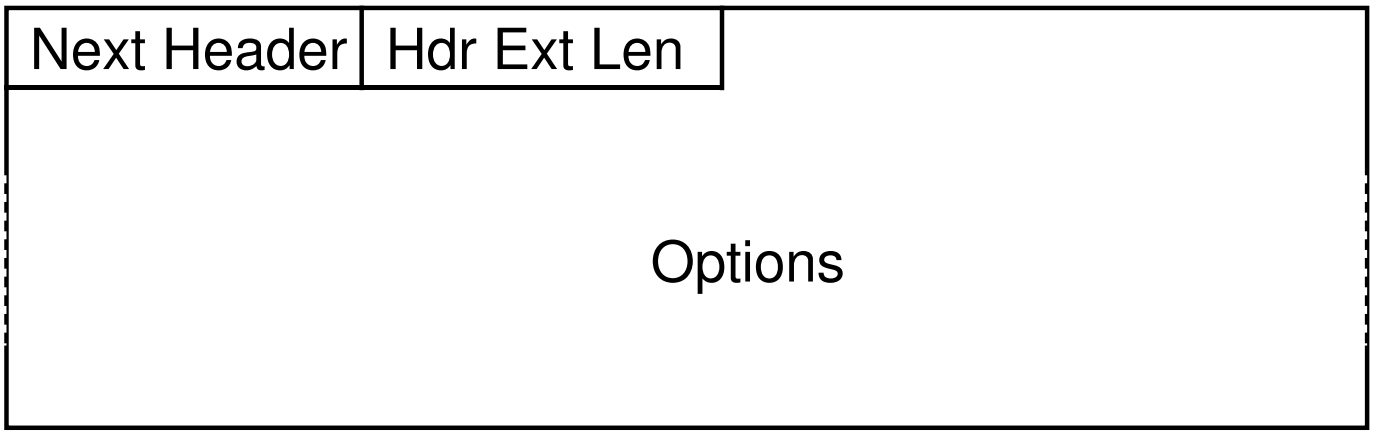
PACKET SIZES

- Minimum Link MTU Increased from 68 to 576 bytes
- Links with MTU < 576 (if there are any) must do link-layer Fragmentation and Reassembly
- Minimal IPv6 Implementations may Omit Path MTU Discovery and Fragmentation code by Limiting all packets to ≤ 576 bytes
  - Good for Boot PROMS
- Default Minimum Reassembly Buffer Increased from 576 to 1500
  - Good for DNS

ROUTING HEADER



HOP-BY-HOP & END-TO-END OPTIONS HEADERS



Act as Containers for TLV-Encoded Options:

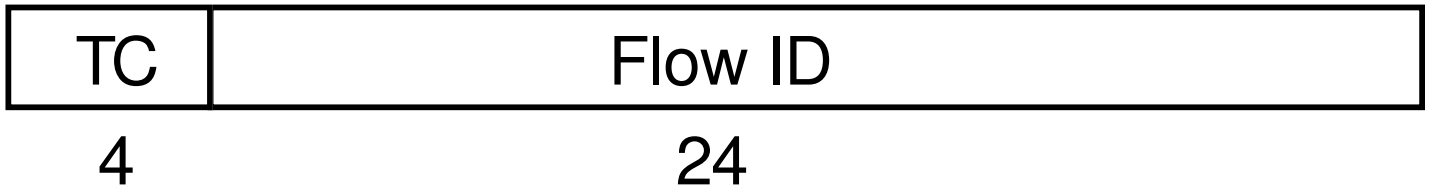
OPTIONS

- High-order bits of Option Type Encode Required Action if not Recognized:

  00 Skip over option
  01 Discard packet
  10 Discard packet & send ICMP Unrecognized Type to source
  11 Discard packet & send ICMP Unrecognized Type to source **only if** destination was not multicast

- Eases Introduction of Future Options
- Only currently-defined Options are Pad options, for internal and external alignment

FLOW LABEL



- TC (traffic class)
  - 0-7 are Time-Sensitivity of Flow-Controlled Traffic
  - 8-15 are Drop Priority for Non-Flow-Controlled Traffic
- Flow ID is Random Value
  - When Combined with IPv6 Source Address, Uniquely Identifies Traffic Flow
  - Random Value (Hash) Facilitates Fast Lookup of Flow State in Router

FOR MORE INFORMATION

- Documents
  - Overview: draft-hinden-ipng-overview-00.txt
  - Protocol: draft-hinden-ipng-spec-00.txt
- Document Archive
  parcftp.xerox.com in pub/ipng/
- Mailing List
  ipng@sunroof.eng.sun.com
- To Join Working Group Mailing List Send Message to:
  majordomo@sunroof.eng.sun.com
  with
  subscribe ipng
  in the body of the message.