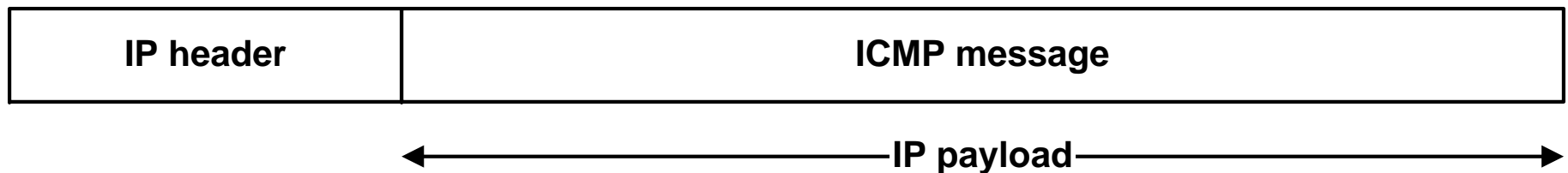


# Overview

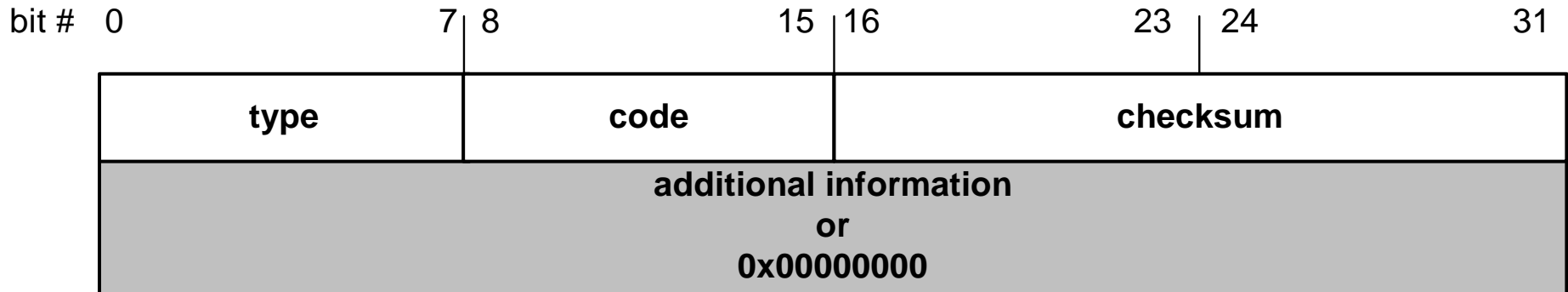
---

- The **Internet Control Message Protocol (ICMP)** is a helper protocol that supports IP with facility for
  - Error reporting
  - Simple queries
- ICMP messages are encapsulated as IP datagrams:



# ICMP message format

---



## 4 byte header:

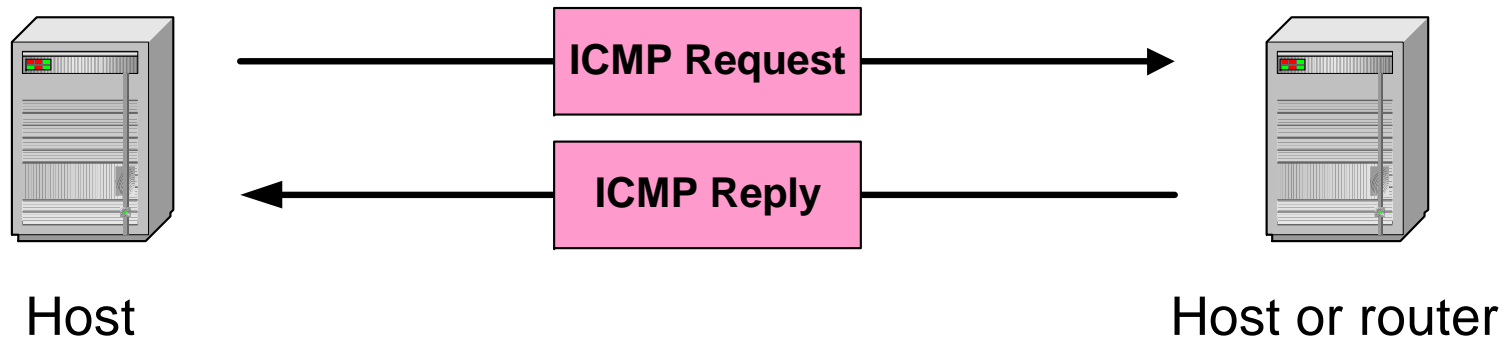
- **Type (1 byte):** type of ICMP message
- **Code (1 byte):** subtype of ICMP message
- **Checksum (2 bytes):** similar to IP header checksum.  
Checksum is calculated over entire ICMP message

If there is no additional data, there are 4 bytes set to zero.

→ each ICMP messages is at least 8 bytes long

# ICMP Query message

---



## ICMP query:

- **Request** sent by host to a router or host
- **Reply** sent back to querying host

# Example of ICMP Queries

---

Type/Code:	Description
------------	-------------

8/0	Echo Request
-----	--------------

0/0	Echo Reply
-----	------------

} The ping command  
uses Echo Request/  
Echo Reply

13/0	Timestamp Request
------	-------------------

14/0	Timestamp Reply
------	-----------------

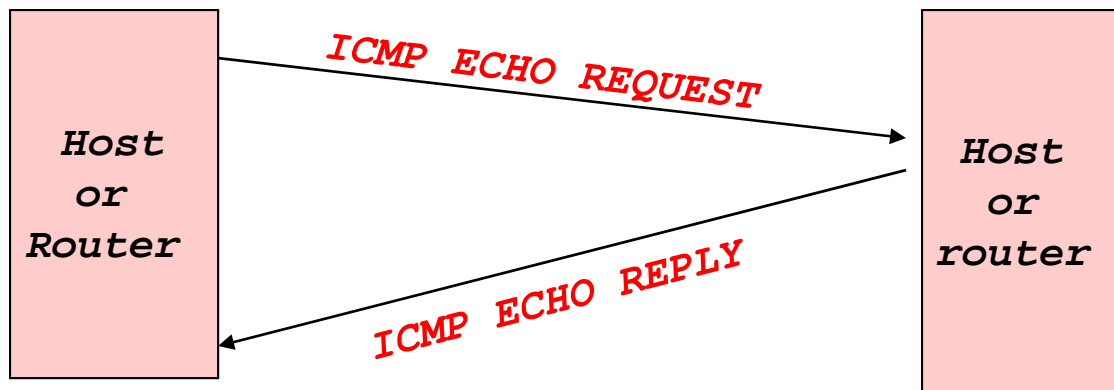
10/0	Router Solicitation
------	---------------------

9/0	Router Advertisement
-----	----------------------

## Example of a Query: Echo Request and Reply

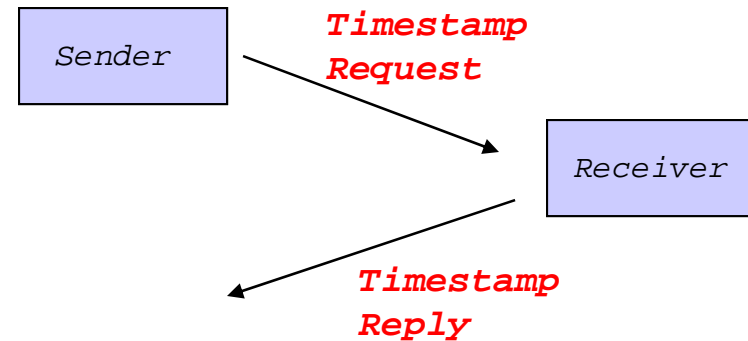
---

- Ping's are handled directly by the kernel
- Each Ping is translated into an **ICMP Echo Request**
- The Ping'ed host responds with an **ICMP Echo Reply**



# Example of a Query: ICMP Timestamp

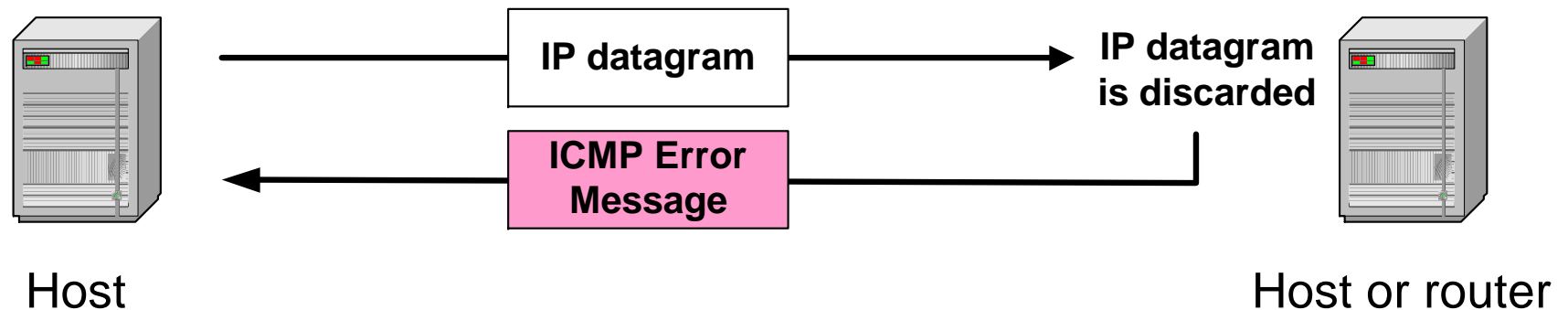
- A system (host or router) asks another system for the current time.
- Time is measured in milliseconds after midnight UTC (Universal Coordinated Time) of the current day
- Sender sends a **request**, receiver responds with **reply**



Type (= 17 or 18)	Code (=0)	Checksum
identifier		sequence number
32-bit sender timestamp		
32-bit receive timestamp		
32-bit transmit timestamp		

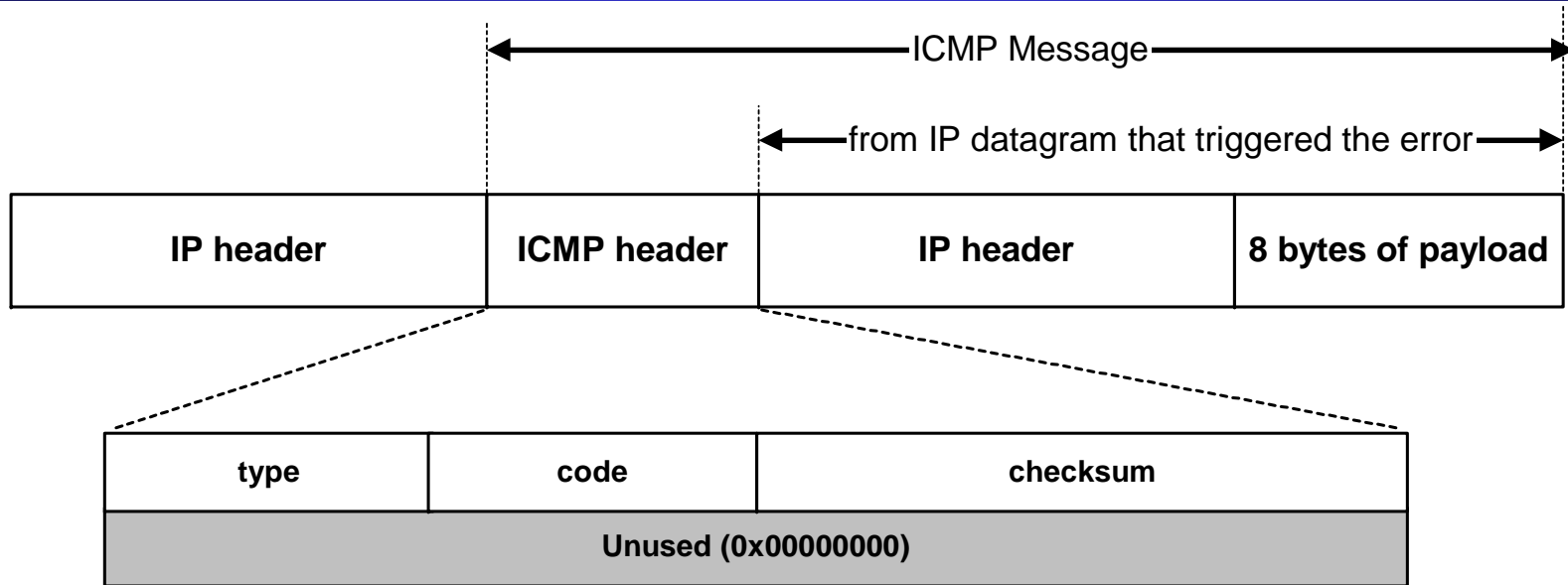
# ICMP Error message

---



- **ICMP error messages report error conditions**
- **Typically sent when a datagram is discarded**
- **Error message is often passed from ICMP to the application program**

# ICMP Error message



- ICMP error messages include the complete IP header and the first 8 bytes of the payload (typically: UDP, TCP)



# Frequent ICMP Error message

---

Type	Code	Description	
3	0–15	Destination unreachable	Notification that an IP datagram could not be forwarded and was dropped. The code field contains an explanation.
5	0–3	Redirect	Informs about an alternative route for the datagram and should result in a routing table update. The code field explains the reason for the route change.
11	0, 1	Time exceeded	Sent when the TTL field has reached zero (Code 0) or when there is a timeout for the reassembly of segments (Code 1)
12	0, 1	Parameter problem	Sent when the IP header is invalid (Code 0) or when an IP header option is missing (Code 1)

# Some subtypes of the “Destination Unreachable”

---

Code	Description	Reason for Sending
0	Network Unreachable	No routing table entry is available for the destination network.
1	Host Unreachable	Destination host should be directly reachable, but does not respond to ARP Requests.
2	Protocol Unreachable	The protocol in the protocol field of the IP header is not supported at the destination.
3	Port Unreachable	The transport protocol at the destination host cannot pass the datagram to an application.
4	Fragmentation Needed and DF Bit Set	IP datagram must be fragmented, but the DF bit in the IP header is set.