Internet Control Message Protocol

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Overview

q What is ICMP?

q ICMP Messages

q ICMP applications: Ping, Traceroute, Path MTU discovery

ICMP Features

q ICMP: Used by IP to send error and control messages

q ICMP uses IP to send its messages (Not UDP)

q ICMP does not report errors on ICMP messages.

q ICMP message are not required on datagram checksum errors. (Some implementations still do)

q ICMP reports error only on the first fragment

ICMP Header	ICMP Data

IP Header	IP Data

Datalink Header	Datalink Data
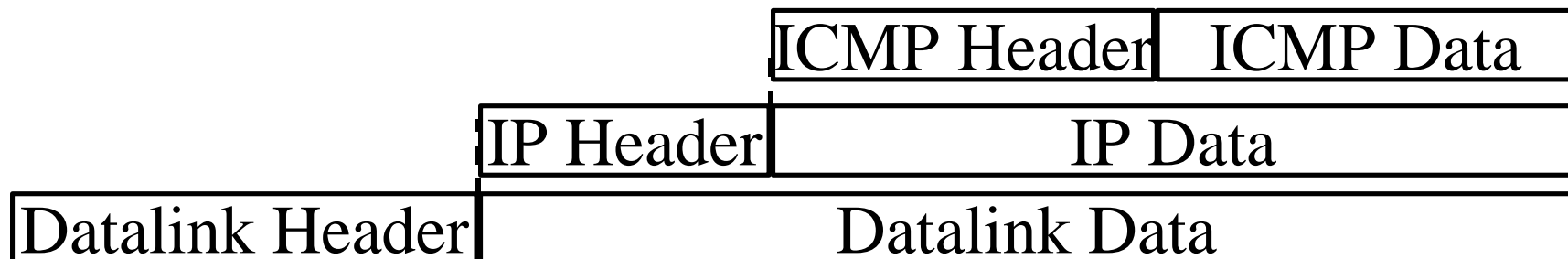
ICMP Message Format

IP Header	
Type of Message	8b
Error Code	8b
Checksum	16b
Parameters, if any	Var
Information	Var

ICMP: Message Types

Type	Message
0	Echo reply
3	Destination unreachable
4	Source quench
5	Redirect
8	Echo request
11	Time exceeded
12	Parameter unintelligible
13	Time-stamp request
14	Time-stamp reply
15	Information request
16	Information reply
17	Address mask request
18	Address mask reply

ICMP Messages

q   Source Quench: Please slow down! I just dropped one of your datagrams.

q   Time Exceeded: Time to live field in one of your packets became zero." or "Reassembly timer expired at the destination.

q   Fragmentation Required: Datagram was longer than MTU and "No Fragment bit" was set.

q   Address Mask Request/Reply: What is the subnet mask on this net? Replied by "Address mask agent"

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Destination Unreachable

Code	Meaning
0	Network unreachable
1	Host unreachable
2	Protocl unreachable
3	Port unreachable
4	Fragmentation need and don't fragment bit set
5	Source route failed
6	Destination network unknon
7	Destination host unknown
8	Source host isolated
9	Communication with dest net administratively prohibited
10	Communication with dest host administratively prohibited
11	Network unreachable for type of service
12	Host unreachable for type of service

Other ICMP Messages

q Redirect: Please send to router X instead of me.
   0 = Redirect datagrams for the network
   1 = Redirect datagrams for the host
   2 = Redirect datagrams for the type of service and net
   3 = Redirect datagrams for the type of service and host

q Time Stamp Request/Reply:

0	8	16	31
Type	Code	Checksum	
Identifier		Sequence Number	
Originate Timestamp			
Receive Timestamp			
Transmit Timestamp			

Other ICMP Messages (Cont)

q Information Request/Reply:
Set source and destination addresses to 0 in the request and broadcast
Server replies back with your IP address
(Not used. Replaced by RARP and BOOTP)

Ping

q   Sample Output

Wed, 05 Feb 1997 15:21:37
  Pinging snoopy.cis.ohio-state.edu [164.107.144.3] with 48 data
    bytes
  Reply from 164.107.144.3: 48 bytes in 47 msec. TTL: 253
  Reply from 164.107.144.3: 48 bytes in 46 msec. TTL: 253
  Reply from 164.107.144.3: 48 bytes in 47 msec. TTL: 253
  Reply from 164.107.144.3: 48 bytes in 46 msec. TTL: 253
  Reply from 164.107.144.3: 48 bytes in 47 msec. TTL: 253
  PING Statistics for snoopy.cis.ohio-state.edu
  5 packets transmitted, 5 packets received, 0% packet loss
  round-trip (ms) min/avg/max = 46/46/47

q   Uses ICMP Echo request/reply messages

Traceroute: Sample Output

164.107.61.200   164.107.61.1   164.107.120.1   164.107.144.3

Wed, 05 Feb 1997 14:57:33

Sending 48 data bytes to snoopy.cis.ohio-state.edu
[164.107.144.3]

1:Received echo from ? [164.107.61.1] in 110 msec.

2:Received echo from avon-120.cis.ohio-state.edu
[164.107.120.1] in 45 msec.

3:Received 48 bytes from snoopy.cis.ohio-state.edu
[164.107.144.3] in 49 msec.

TraceRoute Statistics for snoopy.cis.ohio-state.edu

3 packets transmitted, 3 packets received, 0% packet loss

round-trip (ms) min/avg/max = 45/68/110

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Traceroute Mechanism

q   Send the packet with time-to-live = 1 (hop)

q   The first router discards the packet and sends an ICMP "time-to-live exceeded message"

q   Send the packet with time-to-live = 2 (hops)

q   The second router discards the packet and sends an ICMP "time-to-live exceeded message"

q   This is repeated until the response is received from the destination.

Path MTU Discovery

q Send a large IP datagram with "No fragment" bit set.

q Reduce size until success (No ICMP message received)

Summary
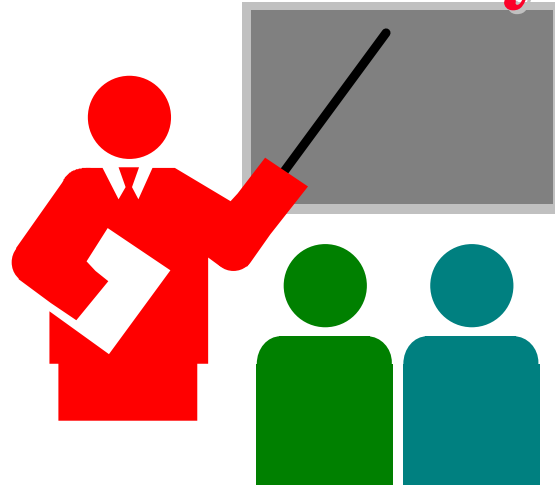
q ICMP is the control sibling of IP

q ICMP is used by IP and uses IP as network layer protocol

q ICMP is used for ping, traceroute, and path MTU discovery.