

# Computer Networks

## Error Handling with ICMP (§5.6.4)



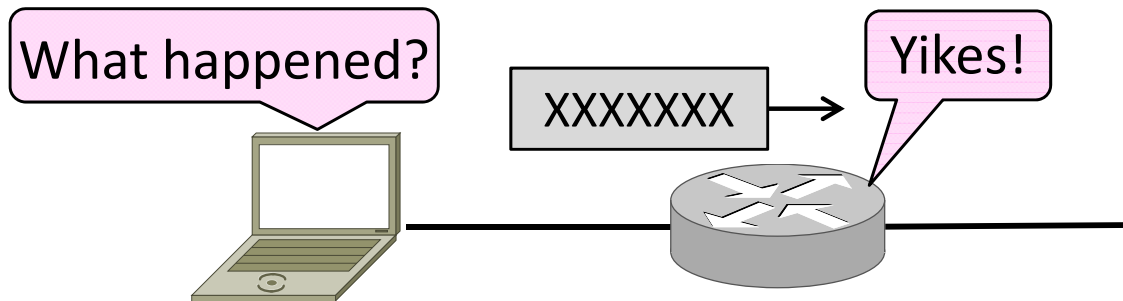
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# Topic

- What happens when something goes wrong during forwarding?
  - Need to be able to find the problem

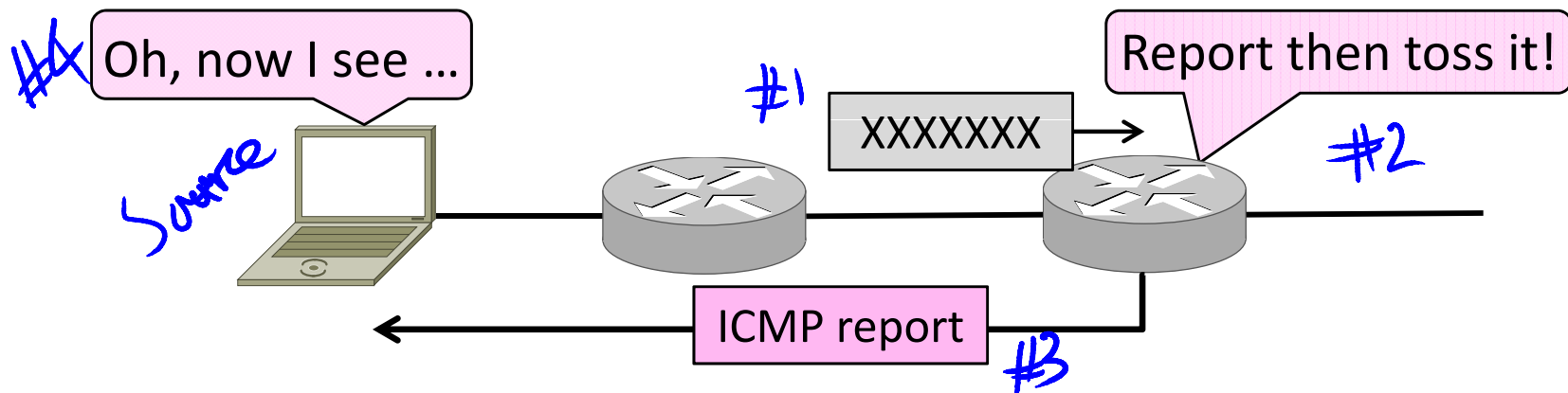


# Internet Control Message Protocol

- ICMP is a companion protocol to IP
  - They are implemented together
  - Sits on top of IP (IP Protocol=1)
- Provides error report and testing
  -  Error is at router while forwarding
    - Also testing that hosts can use

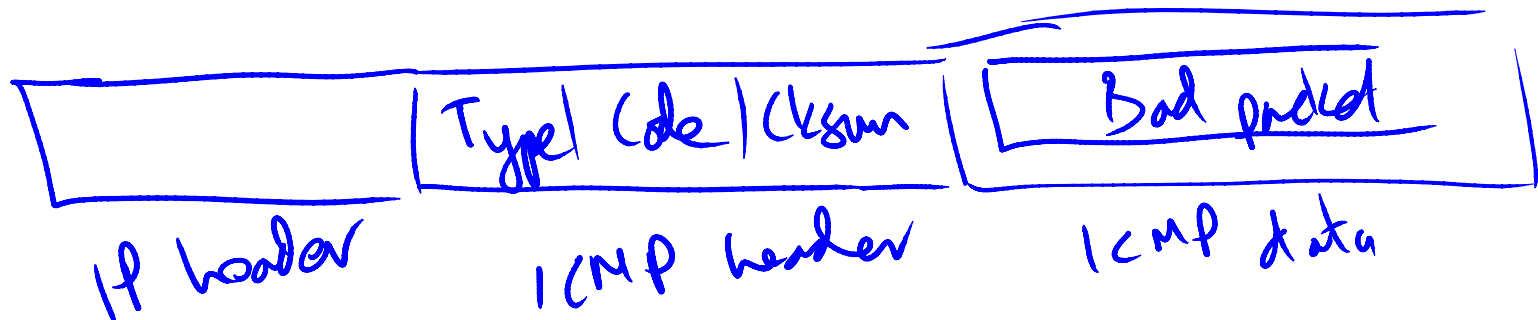
# ICMP Errors

- When router encounters an error while forwarding:
  - It sends an ICMP error report back to the IP source address
  - It discards the problematic packet; host needs to rectify



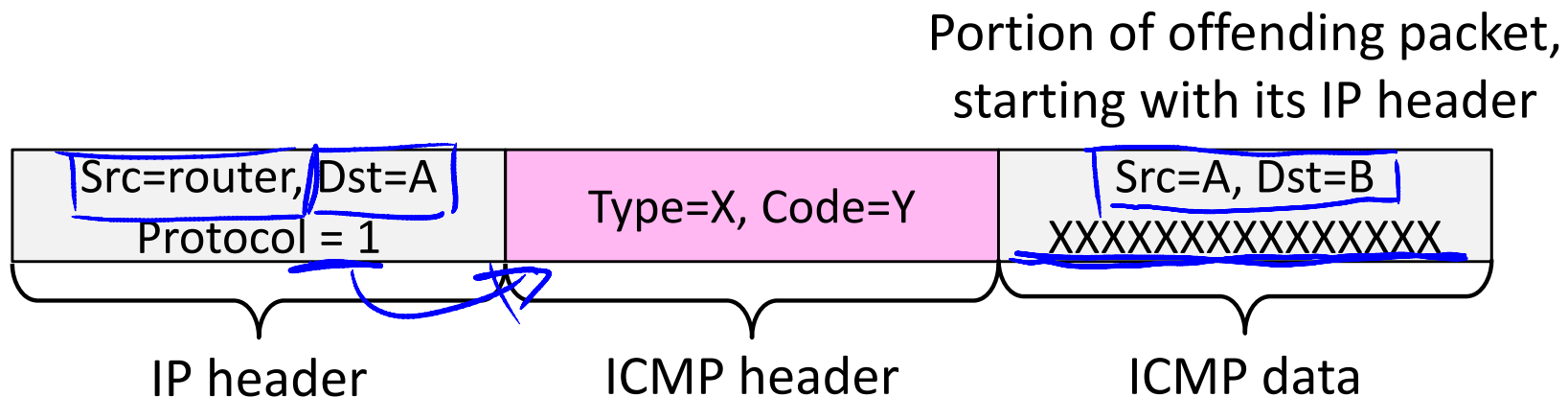
# ICMP Message Format

- Each ICMP message has a Type, Code, and Checksum
- Often carry the start of the offending packet as payload
- Each message is carried in an IP packet

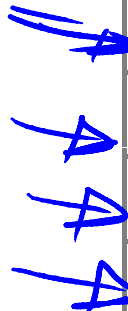


# ICMP Message Format (2)


- Each ICMP message has a Type, Code, and Checksum
- Often carry the start of the offending packet as payload
- Each message is carried in an IP packet



# Example ICMP Messages



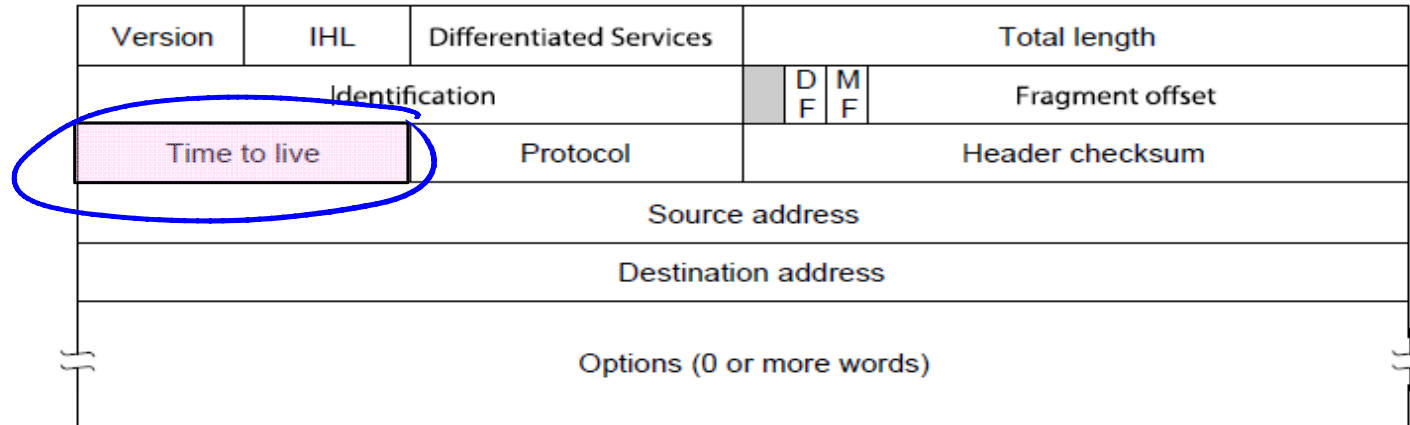
Name	Type / Code	Usage
Dest. Unreachable (Net or Host)	3 / 0 or 1	Lack of connectivity
Dest. Unreachable (Fragment)	3 / 4	<u>Path MTU Discovery</u>
Time Exceeded (Transit)	11 / 0	Traceroute
Echo Request or Reply	8 or 0 / 0	Ping



Testing, not a forwarding error: Host sends Echo Request, and destination responds with an Echo Reply

# Traceroute

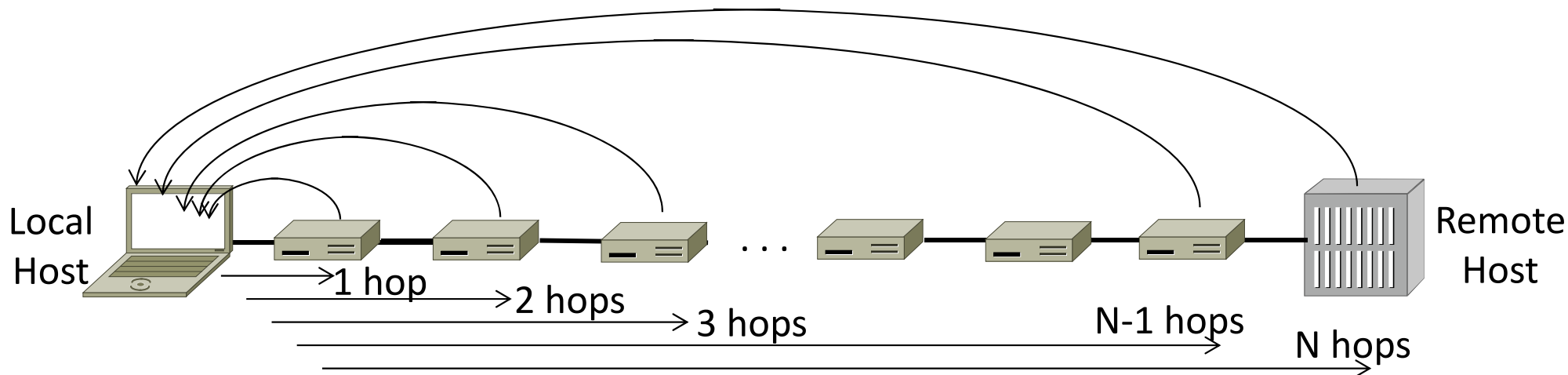
- IP header contains TTL (Time to live) field
  - Decrement every router hop, with ICMP error if it hits zero
  - Protects against forwarding loops





# Traceroute (2)

- Traceroute repurposes TTL and ICMP functionality
  - Sends probe packets increasing TTL starting from 1
  - ICMP errors identify routers on the path



# END

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