Relationships among Protocols

What’s with all these protocols?

- PPP
- ICMP
- IP
- Ethernet
- TCP
- ...ETC
Protocols

- have published, characteristic packet structure
  - “payload” section to hold data carried
  - “overhead” section (header and/or trailer)
- header usually holds indicator of payload
  - number
  - type
  - port
  - code

Packets have detailed header structure
Here’s where headers fit in*

* You can see why they’re called “headers”

IP packet structure

Source Address | Destination Address | Protocol Number
---------------|---------------------|-------------------

IP’s Data Payload
Ethernet frame structure

<table>
<thead>
<tr>
<th>Source HWaddress</th>
<th>Destination HWaddress</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ethernet’s Data Payload

Packet Checksum

PPP frame structure

<table>
<thead>
<tr>
<th>flag</th>
<th>address</th>
<th>control</th>
<th>protocol</th>
<th>PPP’s data payload</th>
<th>check</th>
<th>flag</th>
</tr>
</thead>
<tbody>
<tr>
<td>01111110</td>
<td>11111111</td>
<td>00000011</td>
<td>11111111</td>
<td>01111110</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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### TCP segment structure

<table>
<thead>
<tr>
<th>Source Port</th>
<th>Destination Port</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TCP’s Data Payload</td>
</tr>
</tbody>
</table>

### ICMP packet structure

<table>
<thead>
<tr>
<th>ICMP-type</th>
<th>Code</th>
<th>Checksum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ICMP’s data payload</td>
</tr>
</tbody>
</table>
Q: So how do protocols relate?

A: their payloads are each other
Example exchanges (following)

- browsing a website using a modem
- pinging another host on a common LAN
- making a DNS query using a modem
pinging another host on a common LAN

- a ping implementation
  - an ICMP
    - TCP exchange
  - an IP implementation
    - IP exchange
  - an ethernet
    - ethernet exchange
  - a cat5/10BaseT cable
    - baseband signaling

making a DNS query using a modem

- a DNS implementation
  - DNS request
  - a UDP implementation
    - UDP packet
    - UDP exchange
  - an IP implementation
    - IP packet
    - IP exchange
  - a PPP implementation
    - PPP frame
    - PPP exchange
  - a phone cable
    - analog signaling

- a DNS server
  - DNS request
  - a UDP implementation
    - UDP packet
  - an IP implementation
    - IP packet
  - a PPP implementation
    - PPP frame
  - a phone cable
    - physical layer