Binding Protocol Addresses (ARP)

Chapter 19

Hardware Address vs. IP Address

- IP addresses are used when forwarding packets.
- Hardware addresses are reachable by a LAN.
- Physical network hardware, LAN, does not know how to locate a computer by its protocol, IP, address.
- IP addresses are an abstraction to the LAN and are not reachable without Address Resolution.
- Address Resolution maps a hardware address to an IP address on a LAN.

Address Resolution

- One computer can resolve the address of another only if they are on the same physical network.
- Software on a computer never resolves the address of a machine on a different LAN.
- Instead it sends the packet to the router.

Three Types of Address Resolution

- TCP/IP can use any of these three types.
- Table Lookup
  - Typically used across a WAN.
- Computation
  - Not used very much. Only useful when both protocol addresses and hardware addresses are changeable.
- Dynamic Message Exchange
  - Typically used in LAN’s.

Address Resolution Protocol (ARP) Message Delivery

ARP Message Format

When originally sent, the TARGET HADDR field is filled with zeros because the hardware address of the target host is not known.
Sending an ARP Message

• The entire ARP message fits inside a frame as shown.

ARP Frame Type

<table>
<thead>
<tr>
<th>Dest. Address</th>
<th>Source Address</th>
<th>Frame Type</th>
<th>Data in Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>806</td>
<td>complete ARP message</td>
</tr>
</tbody>
</table>

• The TYPE of an ARP request is the same as that of an ARP response.
• The receiver must examine the OPERATION field in the message.

Caching ARP Responses

• Cache stores the bindings between IP addresses and hardware addresses.
• Cache has a limited number of entries.
  – A new entry causes the oldest entry to roll off.
• Cache has a timeout period.
  – An entry is deleted after a timeout period (for example 20 minutes).
  – When should this time be adjusted for improved performance?

ARP Processing

• Receive ARP message
• Extract senders address binding and check the cache
• If binding is present in cache, replace it
  – This restarts the timeout clock for the binding
  – Also updates any changes
• Read OPERATION field to determine if Request (1) or Response (2)
• If Response, then proceed with function that needed binding
• If Request, then compare TARGET PADDR with the local IP address
• If match, then Respond

ARP Processing (continued)

• Reverse Sender’s and Target’s bindings
• Insert hardware address in SENDER HADDR
• Change OPERATION field to 2
• Store Senders Binding in Cache

Layering, Address Resolution, Protocol Addresses

• Address resolution is associated with the network interface layer.
• Address resolution software hides the details of physical addressing, allowing software in higher layers to use protocol addressing.
ARP Example

C:\> ping ecenet1
Pinging ecenet1 [138.26.80.5] with 32 bytes of data:
Reply from 138.26.80.5: bytes=32 time=10ms TTL=128

C:\> arp -a
Interface: 138.26.80.46 on Interface 0x2
Internet Address      Physical Address      Type
138.26.80.61          00-aa-00-38-82-4a     dynamic
138.26.81.254         00-e0-52-99-c3-03     dynamic
138.26.84.2           00-00-c0-0f-e5     dynamic
138.26.84.12          00-a0-c9-0d-b4     dynamic

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