TCP/IP for Linux

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Internet

☞ Origin:
  ☞ ARPANET (1970's - 1988)
  ☞ NSF NET (no longer exist?) and Internet.
☞ World Wide Web (WWW)
  ☞ Utilize TCP/IP over ARPANET/Internet.
  ☞ Linux adopts Unix 4.3BSD sockets and supports TCP/IP.

• Definition of "Intranet": roughly speaking for any network under one authorization, e.g., a company or a school.
  • Often in a Local Area Network (LAN), or connected LAN's.
  • Having one (or several) gateway with the outside world.
  • In general, it has a higher bandwidth because of a LAN.

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TCP/IP

- ✍ IP Address:
  - ✍ 140.123.101.1
    - ✍ 256*256*256*256 combinations
      - ✍ 140.123 -> Network Address
      - ✍ 101.1 -> Host Address
    - ✍ Subnet:
      - ✍ 140.123.101 and 140.123.102
  - ✍ Mapping of IP addresses and host names
    - ✍ Static assignments: /etc/hosts
    - ✍ Dynamic acquisition: DNS (Domain Name Server)
      - ✍ /etc/resolv.confg
    - ✍ If /etc/hosts is out-of-date, re-check it up with DNS!
  - ✍ Domain name: cs.ccu.edu.tw as a domain name for 140.123.100, 140.123. 101, and 140.123.103

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Name Resolution in TCP/IP Network

- ✍ Name Resolution
  - ✍ A hierarchical host name
    - ✍ bob.csie.ntu.edu.tw
  - ✍ A 32-bit Internet Number (host id)
    - ✍ 140.112.101.32
- ✍ How it works?
  - ✍ The sending system checks its routing table to locate a router. The routers use the network part of the host-id to transfer the packet to the destination network.

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Name Resolution in TCP/IP Network

? Mapping of Ethernet (IEEE 802.3) physical addresses and IP addresses

? Each Ethernet card has a built-in Ethernet physical address, e.g., 08-01-2b-00-50-A6.

? Ethernet cards only recognize frames with their physical addresses.

? Linux uses ARP (Address Resolution Protocol) to know and maintain the mapping.

? Periodically broadcast requests over Ethernet for IP address resolution over ARP.

? A UDP packet with the host-id and Ethernet address

? Machines with the indicated IP addresses reply with their Ethernet physical addresses.

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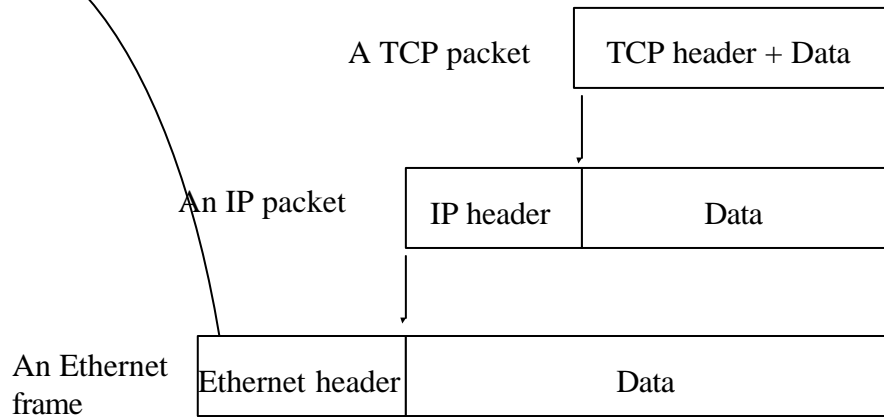# Name Resolution in TCP/IP Network

? Within a network,

? Each host caches the info in its ARP cache with aging.

? When a process specifies a host to communicate.

? The kernel determine the host's in using domain name server (DNS) lookup.

? Pass all layers with Ethernet address in the packet.

? The Host receives the packets and pass all layers.

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TCP/IP

A TCP packet		TCP header + Data

An IP packet	IP header	Data

An Ethernet frame	Ethernet header	Data

• Each IP packet has an indicator of which protocol used, e.g., TCP or UDP

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Routing

- ?Def:
  - ?How are msgs sent through network?
- ?Common routing scheme
  - ?Fixed routing
    - ?A path is specified in advance & does not change!
  - ?Virtual routing
    - ?A path is fixed for a session, e.g., a file transfer or remote login!
  - ?Dynamic routing
    - ?A path is chosen only when a msg is sent.
    - ?Wrong sequence order!

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TCP/IP

- ? Router
  - ? With a Routing table
    - ? Use some routing protocol, e.g., to maintain network topology by broadcasting.
  - ? Connecting several subnets (of the same IP- or-higher-layer protocols) for forwarding packets to proper subnets.
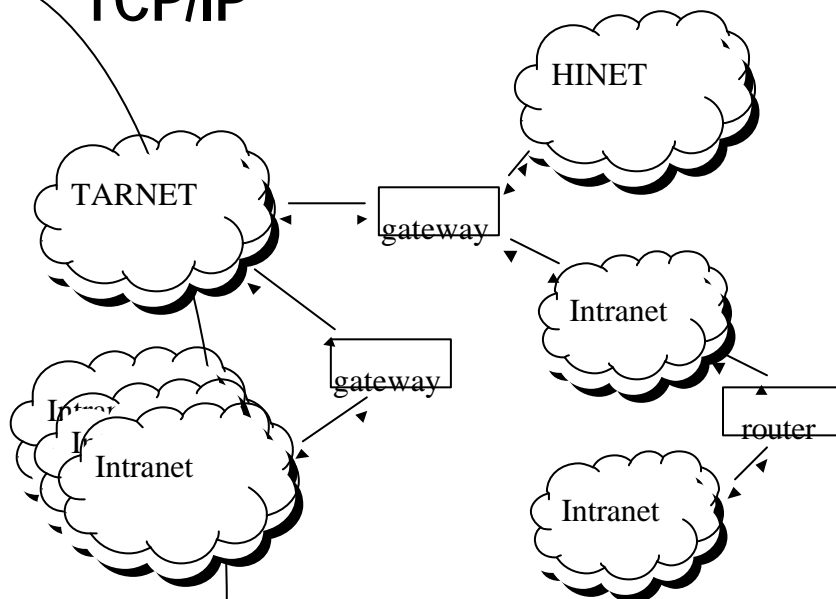- ? Gateway
  - ? Functionality containing that of routers.
  - ? Connecting several subnets (of different or the same networks, e.g., Bitnet and Internet)for forwarding packets to proper subnets.

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TCP/IP

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Network Layers in Linux

applications	Applications

Kernel

BSD sockets

INET sockets

TCP   UDP

Internet Protocol (IP)   ARP

Transport Layer

PPP   SLIP   Ethernet
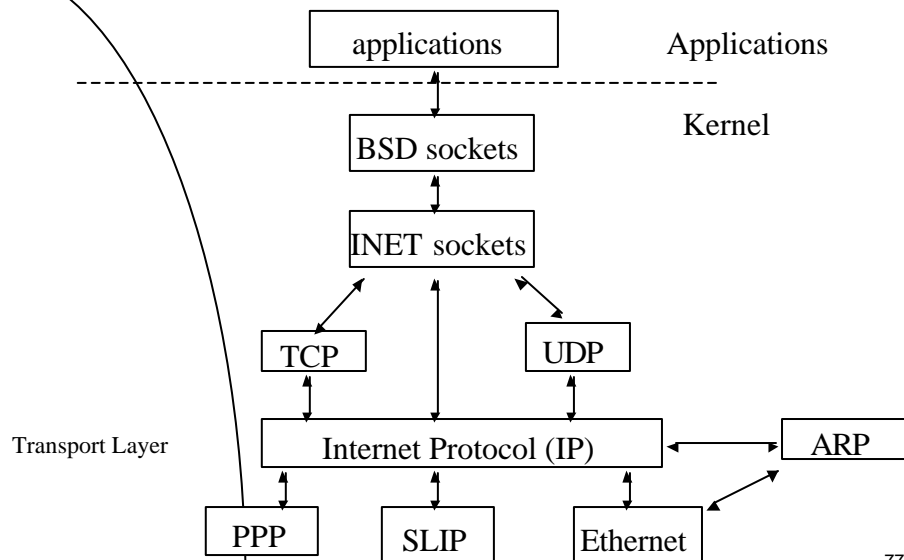
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TCP/IP

- ✎ Transmission Control Protocol (TCP)
  - ✎ Reliable point-to-point packet transmissions.
  - ✎ Applications which communicate over TCP/IP with each another must provide IP addresses and port numbers.
    - ✎ /etc/services
    - ✎ Port# 80 for a web server.
- ✎ User Datagram Protocol (UDP)
  - ✎ Unreliable point-to-point services.
- ✎ Both are over IP.

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