DG Forwarding Algorithm

- Host or Router first check if destination on same Network
  - Router multiple interfaces
  - Match found deliver to that Network
- If not found default router
- for every router – a default router MUST be defined

Routing Packets

Routing table:

<inlink, in id, outlink, out id>

- for every VC through router

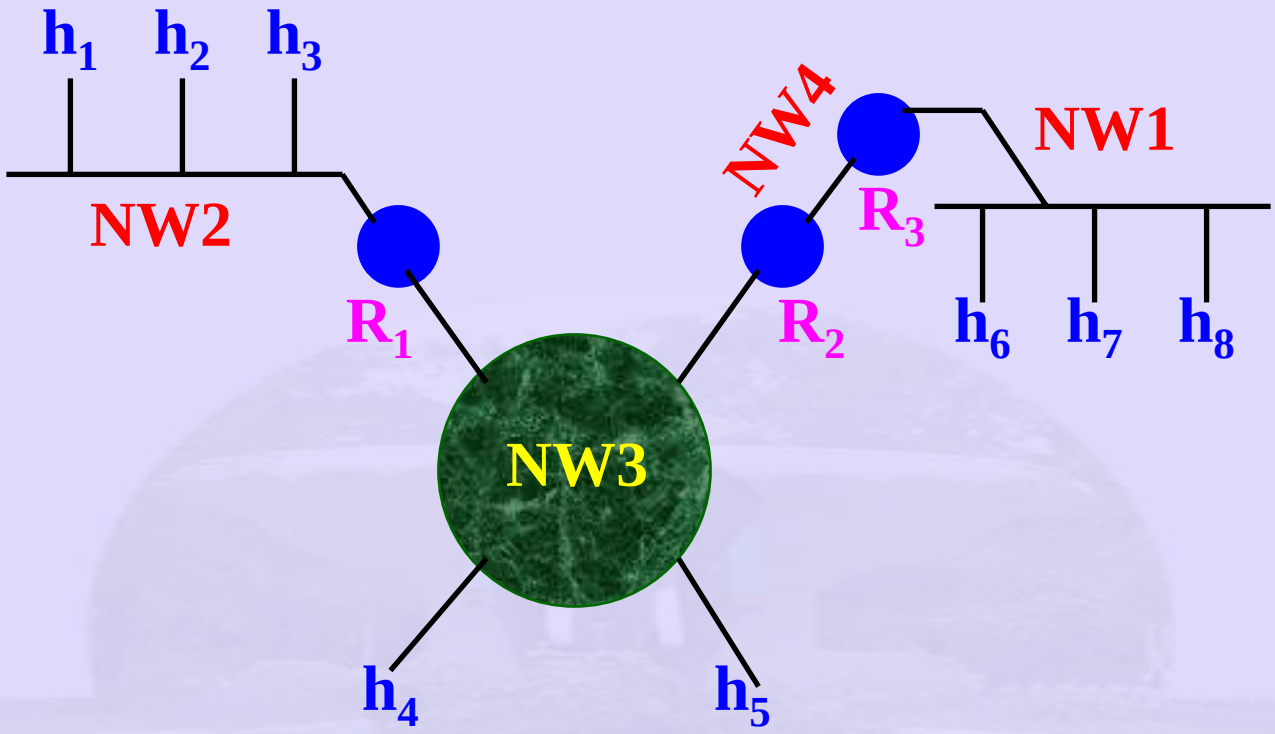
Upper layer	DG	VC
CL	UDP over IP	UDP over IP over ATM
CO	TCP over IP	ATM AAL over ATM

Host Forwarding Algorithm

- If (NetworkNumber of Destination = NetworkNumber of given Destination) then
  - deliver packet directly
- Else
  - deliver packet to default router
- endif

Router Forwarding Algorithm

- If (NetworkNumber of Destination = NetworkNumber of given routing interfaces) then
  - deliver packet over that interface
- else
  - deliver packet to default router
- endif



Forwarding table at Router R_2

Network	Next hop
1	R_3
2	R_1

Router Forwarding Algorithm

$h_1 – h_2$ data same Network number therefore deliver data directly! over Ethernet

h_1 has to find h_2's correct Ethernet address

- ARP

$h_1 – h_8$ – different Physical Network

R_1's default router R_2

R_1 – sends DG to R_2 over token Ring

R_2 table

Network	Next hop
1	R_3
2	R_1
2	Interface 1
2	Interface 0

Information in Routing Table

- Directly connected Networks
- Reachable via some hop router
- Forwarding table can be manually configured
  - Usually done by running a routing protocol
- Routers only have address of Networks –
  - rather than complete hosts
  - scalability - hierarchical aggregation

The Internet

- Collection of subnetworks of Autonomous System (ASes) connected together
  - No real structure
  - High bandwidth backbones
  - Attached to Backbone several middle level Networks
    - Attached to which are various LANs
  - Glue all this using IP
  - Best effort way to transmit DGs from source to destination

Routing

(Network, 0), (thisnetwork, host)

Distant LANs **Host on this LAN**

Routing

- When packet arrives:
  - Lookup table
    - For distance LAN forward to next router on the interface given in the table
    - If local host on router's LAN send to host
    - If network not found – forward to a default router with more extensive tables

Subnetting

- All host in a network must have the same network number
  - Problem:
  - Class C – 254 addresses
  - Needs new Class C network address
  - Multiple LANs – its own router?

Subnetting

- Alternatively:
  - Class B network address
  - Split 16 bit host into
    - 6 bits for subnet
    - 10 bits for host
    - $2^{10} - 2$ Hosts
    - $2^{6} - 2$ LANs

Subnetting

- Router must know subnet mask
  - To determine route for
  - 144.16.251.25
  - AND with 255.255.0.0 (subnet mask)
  - Gets rid of host in class B
  - AND with 255.255.255.0
  - Gets rid of host in Class C

Subnetting

- Router
  - Needs Subnet mask table
  - To ensure proper delivery
- **Destination Address:**
- **130.50.15.6 arrives at a router on Subnet 5**
- **130.50.000101.0 – subnet address AND with**
- **255.255.252.0**
- **255.255.11111100.0**
- **Gets rid of host**
- **Two results 130.50.12.0**
- **130.50.00001100.0 which is subnet 3**

Subnetting

- Outside world:
- Appear a single LAN
- To the corporate LAN
  - Multiple subnetted LANs
- Modify routing Tables to include:
- (this-network, subnet, 0)
- (this-network, this-subnet, host)
- Router on subnet
  - needs information about hosts on subnet
  - needs information about how to get to other subnet