**Routing and Packet Forwarding:**

**Note:** There are **lot of protocols** in the Network layer that’s why there is field called **protocol number** to identify the protocol it should use.

**Routing** which refers to choosing path for a packet.

**Packet Forwarding** refers to the actual delivery of the packet.

Routing can either happen automatically using an algorithm or manually by the administrator, Its result is saved in **Routing-Tables.**

If the destination address of an incoming IP packet is the interface’s IP, then it is delivered to the transport layer. Otherwise it is forwarded using the information of **the routing table**.

If the packet’s delivery address **is not found** in the **routing table**, it is delivered to a default gateway. **The TTL-mechanism** prevents an **infinite packet forwarding**. Infinite packet forwarding could happen if there is an error **in the routing tables** and the routing tables would imply a **circle**. Then the packet is send around in this **circle** until its **TTL-entry** is zero and an ICMP-message is created.

**Routing Protocols:**

A router is always configured with some default route. A default route tells the router where to forward a packet if there is no route found for specific destination. In case there are multiple path existing to reach the same destination, router can make decision based on the following information:

* Hop Count
* Bandwidth
* Prefix-length
* Delay

Routes can be statically configured or dynamically learnt. One route can be configured to be preferred over others.

There are two kinds of routing protocols available to route unicast packets:

* Distance Vector Routing Protocol

Distance Vector is simple routing protocol which takes routing decision **on the number of hops** between source and destination. A route with less number of hops is considered as **the best route**. Every router **advertises its set best routes to other routers**.

For example Routing Information Protocol (RIP).

* Link State Routing Protocol

Link State protocol is slightly complicated protocol than **Distance Vector**. It takes into account the **states of links of all the routers** in a network. for example, Open Shortest Path First (OSPF).

## **Routing Algorithms**

### Flooding

Flooding is simplest method packet forwarding. When a packet is received, the routers send it to all the interfaces except the one on which it was received. This creates too much burden on the network.

### Shortest Path

Routing decision in networks, are mostly taken on the basis of cost between source and destination. Hop count plays major role here. Shortest path is a technique which uses various algorithms to decide a path with **minimum number of hops**.

Common shortest path algorithms Is:

* **Dijkstra's algorithm**

**Example:**

Source node is s=1







