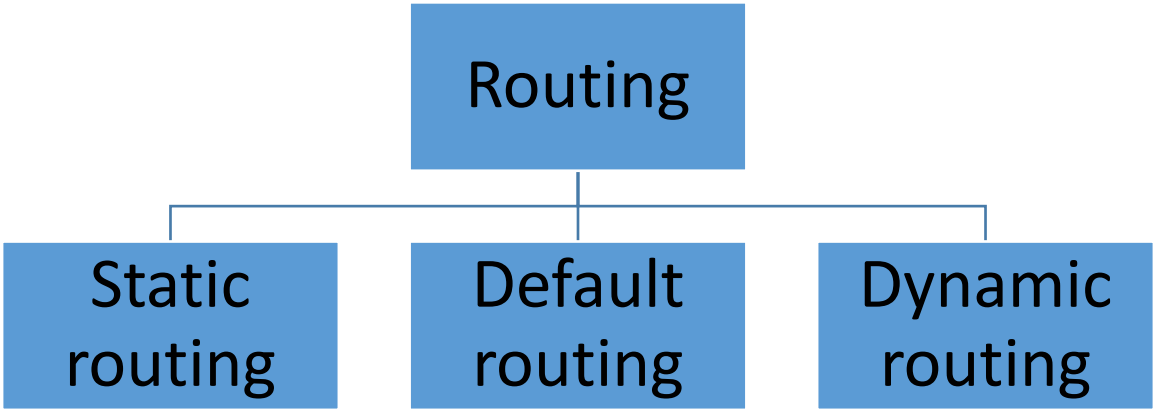
Routing is the process of selecting a path for traffic in a network, or between or across multiple networks. Broadly, routing is performed in many types of networks, including circuit-switched networks, such as the public switched telephone network (PSTN), and computer networks, such as the Internet.

In packet switching networks, routing is the higher-level decision making that directs network packets from their source toward their destination through intermediate network nodes by specific packet forwarding mechanisms. Packet forwarding is the transit of network packets from one network interface to another. Intermediate nodes are typically network hardware devices such as routers, gateways, firewalls, or switches. General-purpose computers also forward packets and perform routing, although they have no specially optimized hardware for the task.

The routing process usually directs forwarding on the basis of routing tables, which maintain a record of the routes to various network destinations. Routing tables may be specified by an administrator, learned by observing network traffic or built with the assistance of routing protocols.

Routing, in a narrower sense of the term, often refers to IP routing and is contrasted with bridging. IP routing assumes that network addresses are structured and that similar addresses imply proximity within the network. Structured addresses allow a single routing table entry to represent the route to a group of devices. In large networks, structured addressing (routing, in the narrow sense) outperforms unstructured addressing (bridging). Routing has become the dominant form of addressing on the Internet. Bridging is still widely used within local area networks.



## Static routing

Static routing is a form of routing that occurs when a router uses a manually-configured routing entry, rather than information from a dynamic routing traffic. In many cases, static routes are manually configured by a network administrator by adding in entries into a routing table, though this may not always be the case. Unlike dynamic routing, static routes are fixed and do not change if the network is changed or reconfigured. Static routing and dynamic routing are not mutually exclusive. Both dynamic routing and static routing are usually used on a router to maximize routing efficiency and to provide backups in the event that dynamic routing information fails to be exchanged. Static routing can also be used in stub networks, or to provide a gateway of last resort.

Static routing may have the following uses:

- Static routing can be used for small networks that require only one or two routes. This is often more efficient since a link is not being wasted by exchanging dynamic routing information.
- Static routing is often used as a complement to dynamic routing to provide a failsafe backup in the event that a dynamic route is unavailable.
- Static routing is often used to help transfer routing information from one routing protocol to another (routing redistribution).

Static routing, if used without dynamic routing, has the following advantages:

- Static routing causes very little load on the CPU of the router, and produces no traffic to other routers.
- Static routing leaves the network administrator with full control over the routing behavior of the network.

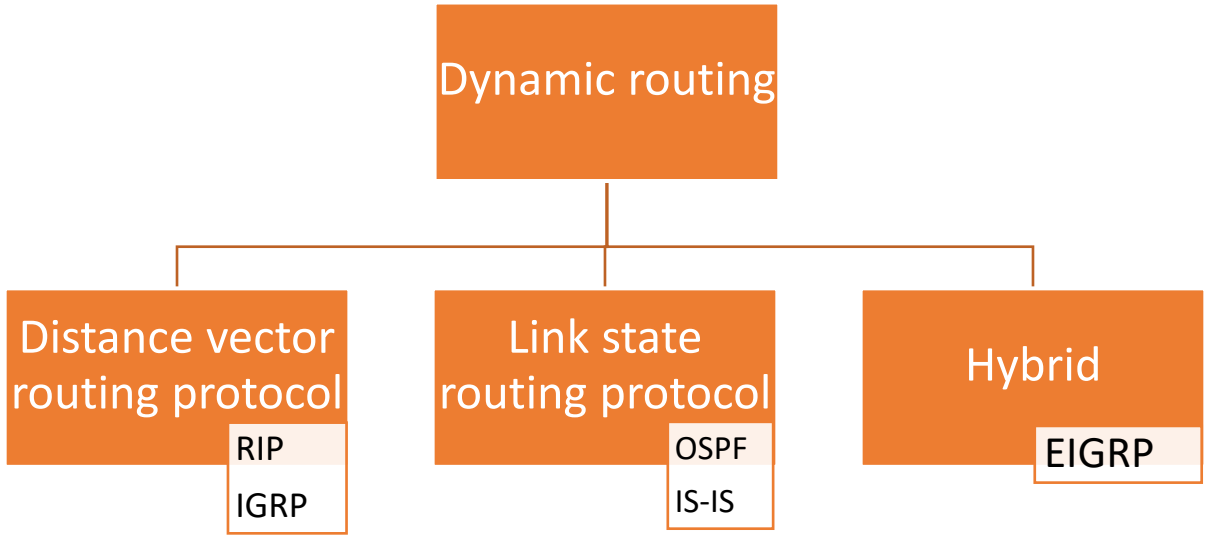
Static routing can have some potential disadvantages:

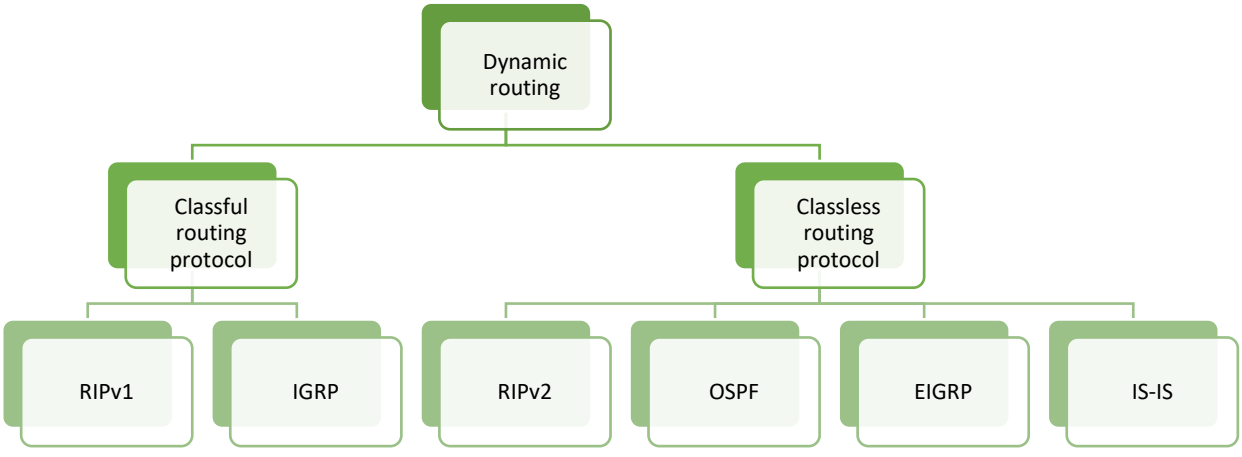
- Human error: In many cases, static routes are manually configured. This increases the potential for input mistakes. Administrators can make mistakes and mistype in network information, or configure incorrect routing paths by mistake.
- Fault tolerance: Static routing is not fault tolerant. This means that when there is a change in the network or a failure occurs between two statically defined devices, traffic will not be re-routed. As a result, the network is unusable until the failure is repaired or the static route is manually reconfigured by an administrator.
- Administrative distance: Static routes typically take precedence over routes configured with a dynamic routing protocol. This means that static routes may prevent routing protocols from working as intended. A solution is to manually modify the administrative distance.
- Administrative overhead: Static routes must be configured on each router in the network(s). This configuration can take a long time if there are many routers. It also means that reconfiguration can be slow and inefficient. Dynamic routing on the other hand automatically propagates routing changes, reducing the need for manual reconfiguration.

## Dynamic routing

Dynamic routing, also called adaptive routing, is a process where a router can forward data via a different route or given destination based on the current conditions of the communication circuits within a system. The term is most commonly associated with data networking to describe the capability of a network to 'route around' damage, such as loss of a node or a connection between nodes, so long as other path choices are available. Dynamic routing allows as many routes as possible to remain valid in response to the change.

Systems that do not implement dynamic routing are described as using static routing, where routes through a network are described by fixed paths. A change, such as the loss of a node, or loss of a connection between nodes, is not compensated for. This means that anything that wishes to take an affected path will either have to wait for the failure to be repaired before restarting its journey, or will have to fail to reach its destination and give up the journey.



## Distance-vector routing protocol

A distance-vector routing protocol in data networks determines the best route for data packets based on distance. Distance-vector routing protocols measure the distance by the number of routers a packet has to pass, one router counts as one hop. Some distance-vector protocols also take into account network latency and other factors that influence traffic on a given route. To determine the best route across a network routers, on which a distance-vector protocol is implemented, exchange information with one another, usually routing tables plus hop counts for destination networks and possibly other traffic information. Distance-vector routing protocols also require that a router informs its neighbors of network topology changes periodically.

Distance-vector routing protocols use the Bellman–Ford algorithm and Ford–Fulkerson algorithm to calculate the best route. Another way of calculating the best route across a network is based on link cost, and is implemented through link-state routing protocols.

The term distance vector refers to the fact that the protocol manipulates vectors (arrays) of distances to other nodes in the network. The distance vector algorithm was the original ARPANET routing algorithm and was implemented more widely in local area networks with the Routing Information Protocol (RIP).

## Link-state routing protocols

Link-state routing protocols are one of the two main classes of routing protocols used in packet switching networks for computer communications, the other being distance-vector routing protocols. Examples of link-state routing protocols include Open Shortest Path First (OSPF) and Intermediate System to Intermediate System (IS-IS).

The link-state protocol is performed by every switching node in the network (i.e., nodes that are prepared to forward packets; in the Internet, these are called routers). The basic concept of link-state routing is that every node constructs a map of the connectivity to the network, in the form of a graph, showing which nodes are connected to which other nodes. Each node then independently calculates the next best logical path from it to every possible destination in the network. Each collection of best paths will then form each node's routing table.

This contrasts with distance-vector routing protocols, which work by having each node share its routing table with its neighbors, in a link-state protocol the only information passed between nodes is connectivity related. Link-state algorithms are sometimes characterized informally as each router, "telling the world about its neighbors."

**Hybrid Routing**

Hybrid Routing, commonly referred to as balanced-hybrid routing, is a combination of distance-vector routing, which works by sharing its knowledge of the entire network with its neighbors and link-state routing which works by having the routers tell every router on the network about its closest neighbors. Hybrid Routing is a third classification of routing algorithm. Hybrid routing protocols use distance-vectors for more accurate metrics to determine the best paths to destination networks, and report routing information only when there is a change in the topology of the network. Hybrid routing allows for rapid convergence but requires less processing power and memory as compared to link-state routing.

## Default routing

In computer networking, the default route is a setting on a computer that defines the packet forwarding rule to use when no specific route can be determined for a given Internet Protocol (IP) destination address. All packets for destinations not established in the routing table are sent via the default route.

The default route generally points to another router, which treats the packet the same way: if a route matches, the packet is forwarded accordingly, otherwise the packet is forwarded to the default route of that router. The route evaluation process in each router uses the longest prefix match method to obtain the most specific route. The network with the longest subnet mask that matches the destination IP address is the next-hop network gateway. The process repeats until a packet is delivered to the destination. Each router traversal counts as one hop in the distance calculation for the transmission path.

The device to which the default route points is often called the default gateway, and it often carries out other functions such as packet filtering, firewalling, or proxy server operations.

The default route in Internet Protocol Version 4 (IPv4) is designated as the zero-address 0.0.0.0/0 in CIDR notation, often called the quad-zero route.[citation needed] The subnet mask is given as /0, which effectively specifies all networks, and is the shortest match possible. A route lookup that does not match any other route, falls back to this route. Similarly, in IPv6, the default route is specified by ::/0.

In the highest-level segment of a network, administrators generally point the default route for a given host towards the router that has a connection to a network service provider. Therefore, packets with destinations outside the organization's local area network, typically destinations on the Internet or a wide area network, are forwarded to the router with the connection to that provider.