**Supernetwork**

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"Supernet" redirects here. For the broadband network in the province of Alberta, see [Alberta SuperNet](https://en.wikipedia.org/wiki/Alberta_SuperNet).

A **supernetwork**, or **supernet**, is an [Internet Protocol](https://en.wikipedia.org/wiki/Internet_Protocol) (IP) network that is formed by combination of multiple networks (or [subnets](https://en.wikipedia.org/wiki/Subnetwork)) into a larger network. The new [routing prefix](https://en.wikipedia.org/wiki/Routing_prefix) for the combined network represents the constituent networks in a single [routing table](https://en.wikipedia.org/wiki/Routing_table) entry. The process of forming a supernet is called **supernetting**, **prefix aggregation**, **route aggregation**, or **route summarization**.

Supernetting within the [Internet](https://en.wikipedia.org/wiki/Internet) serves as a strategy to avoid topological fragmentation of the [IP address](https://en.wikipedia.org/wiki/IP_address) space by using a hierarchical allocation system that delegates control of segments of address space to regional network service providers.[[1]](https://en.wikipedia.org/wiki/Supernetwork#cite_note-1) This method facilitates regional route aggregation.

The benefits of supernetting are conservation of address space and efficiencies gained in [routers](https://en.wikipedia.org/wiki/Router_(computing)) in terms of memory storage of route information and processing overhead when matching routes. Supernetting, however, can introduce interoperability issues and other risks.[[2]](https://en.wikipedia.org/wiki/Supernetwork#cite_note-Le2011-2)



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**Overview**

In [Internet](https://en.wikipedia.org/wiki/Internet) networking terminology, a supernet is a block of contiguous [subnetworks](https://en.wikipedia.org/wiki/Subnetwork) addressed as a single subnet from the perspective of the larger network. Supernets are always larger than their component networks. Supernetting is the process of aggregating routes to multiple smaller networks, thus saving storage space in the routing table and simplifying routing decisions and reducing routing advertisements to neighboring gateways. Supernetting has helped address the increasing size of routing tables as the Internet has expanded.

Supernetting in large, complex networks can isolate topology changes from other routers. This can improve the stability of the network by limiting the propagation of routing traffic in the event of a network link failure. For example, if a router only advertises a summary route to the next router, then it does not need advertise any changes to specific subnets within the summarized range. This can significantly reduce any unnecessary routing updates following a topology change. Hence, it increases the speed of [convergence](https://en.wikipedia.org/wiki/Convergence_(routing)) resulting in a more stable environment.

**Protocol requirements**

Supernetting requires the use of routing protocols that support [Classless Inter-Domain Routing](https://en.wikipedia.org/wiki/Classless_Inter-Domain_Routing) (CIDR). [Interior Gateway Routing Protocol](https://en.wikipedia.org/wiki/Interior_Gateway_Routing_Protocol), [Exterior Gateway Protocol](https://en.wikipedia.org/wiki/Exterior_Gateway_Protocol) and version 1 of the [Routing Information Protocol](https://en.wikipedia.org/wiki/Routing_Information_Protocol) (RIPv1) assume [classful addressing](https://en.wikipedia.org/wiki/Classful_addressing), and therefore cannot transmit the subnet mask information required for supernetting.

[Enhanced Interior Gateway Routing Protocol](https://en.wikipedia.org/wiki/Enhanced_Interior_Gateway_Routing_Protocol) (EIGRP) is a classless routing protocol capable of support for CIDR. By default, EIGRP summarizes the routes within the routing table and forwards these summarized routes to its peers. This may have adverse impact within heterogeneous routing environments with discontiguous subnets.

The family of classless routing protocols are RIPv2, [Open Shortest Path First](https://en.wikipedia.org/wiki/Open_Shortest_Path_First), EIGRP, IS-IS and [Border Gateway Protocol](https://en.wikipedia.org/wiki/Border_Gateway_Protocol).

**Examples**

A company that operates 150 accounting services in each of 50 districts has a router in each office connected with a [Frame Relay](https://en.wikipedia.org/wiki/Frame_Relay) link to its corporate headquarters. Without supernetting, the routing table on any given router might have to account for 150 routers in each of the 50 districts, or 7500 different networks. However, if a hierarchical addressing system is implemented with supernetting, then each district has a centralized site as interconnection point. Each route is summarized before being advertised to other districts. Each router now only recognizes its own subnet and the other 49 summarized routes.

The determination of the summary route on a router involves the recognition of the number of highest-order bits that match all addresses. The summary route is calculated as follows. A router has the following networks in its routing table:

192.168.98.0

192.168.99.0

192.168.100.0

192.168.101.0

192.168.102.0

192.168.105.0

Firstly, the addresses are converted to binary format and aligned in a list:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Address** | **First Octet** | **Second Octet** | **Third Octet** | **Fourth Octet** |
| 192.168.98.0 | 11000000 | 10101000 | 01100010 | 00000000 |
| 192.168.99.0 | 11000000 | 10101000 | 01100011 | 00000000 |
| 192.168.100.0 | 11000000 | 10101000 | 01100100 | 00000000 |
| 192.168.101.0 | 11000000 | 10101000 | 01100101 | 00000000 |
| 192.168.102.0 | 11000000 | 10101000 | 01100110 | 00000000 |
| 192.168.105.0 | 11000000 | 10101000 | 01101001 | 00000000 |

Secondly, the bits at which the common pattern of digits ends are located. These common bits are shown in red. Lastly, the number of common bits is counted. The summary route is found by setting the remaining bits to zero, as shown below. It is followed by a slash and then the number of common bits.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **First Octet** | **Second Octet** | **Third Octet** | **Fourth Octet** | **Address** | **Netmask** |
| 11000000 | 10101000 | 01100000 | 00000000 | 192.168.96.0 | /20 |

The summarized route is 192.168.96.0/20. The subnet mask is 255.255.240.0.

This summarized route also contains networks that were not in the summarized group, namely, 192.168.96.0, 192.168.97.0, 192.168.103.0, 192.168.104.0, 192.168.106.0, 192.168.107.0, 192.168.108.0, 192.168.109.0, 192.168.110.0, and 192.168.111.0. It must be assured that the missing network prefixes do not exist outside of this route.

In another example, an ISP is assigned a block of [IP addresses](https://en.wikipedia.org/wiki/IP_address) by a regional Internet registry (RIR) of 172.1.0.0 to 172.1.255.255. The ISP might then assign subnetworks to each of their downstream clients, e.g., *Customer A* will have the range 172.1.1.0 to 172.1.1.255, *Customer B* would receive the range 172.1.2.0 to 172.1.2.255 and *Customer C* would receive the range 172.1.3.0 to 172.1.3.255, and so on. Instead of an entry for each of the subnets 172.1.1.x and 172.1.2.x, etc., the ISP could aggregate the entire 172.1.x.x address range and advertise the network 172.1.0.0/16 on the Internet community, which would reduce the number of entries in the global [routing table](https://en.wikipedia.org/wiki/Routing_table).

**Risks**

The following supernetting risks have been identified:[[2]](https://en.wikipedia.org/wiki/Supernetwork#cite_note-Le2011-2)

* Supernetting is implemented in different ways on different routers
* Supernetting on one router interface can influence how routes are advertised on other interfaces of the same router
* In the presence of supernetting, detecting a persistent [routing loop](https://en.wikipedia.org/wiki/Routing_loop_problem) becomes a difficult problem

**See also**

* [Provider-aggregatable address space](https://en.wikipedia.org/wiki/Provider-aggregatable_address_space)
* [Provider-independent address space](https://en.wikipedia.org/wiki/Provider-independent_address_space)

**References**

 [RFC 1338](https://tools.ietf.org/html/rfc1338), *Supernetting: an Address Assignment and Aggregation Strategy*, V. Fuller, T. Li, J. Yu, K. Varadhan (June 1992)

* 1.  *Franck Le; Geoffrey G. Xie; Hui Zhang (2011).* [*"On Route Aggregation"*](http://faculty.nps.edu/xie/papers/ra-conext11.pdf) *(PDF).* [*ACM*](https://en.wikipedia.org/wiki/Association_for_Computing_Machinery)*. Retrieved 2013-01-10.*
* Comer, Douglas E. (2006). Internetworking with TCP/IP, 5, Prentice Hall: Upper Saddle River, NJ.

**External links**

* [The Supernetting/CIDR Chart](http://www.firewall.cx/supernetting-chart.php)
* [IP Address Subnetting Tutorial](http://www.ralphb.net/IPSubnet/index.html)
* [Netmatics Supernet Calculator - A free web-based tool for route aggregation](http://www.netmatics.net/IPv4Calcs/SupernetCalculator.aspx)
* [Route Summarization Calculator](https://web.archive.org/web/20121021231719/http:/billatnapier.com/security/IP/routesum)
* [Supernet Examples and How to Calculate Supernets](http://subnet-calculator.org/supernets.php)