

Bandwidth management

Bandwidth management is the process of measuring and controlling the communications (traffic, packets) on a network link, to avoid filling the link to capacity or overfilling the link,^[1] which would result in [network congestion](#) and poor performance of the network. Bandwidth is described by [bit rate](#) and measured in units of bits per second (bit/s) or bytes per second (B/s).^[2]

Bandwidth management mechanisms and techniques

Bandwidth management mechanisms may be used to further engineer performance and includes:

- [Traffic shaping](#)^[3] ([rate limiting](#)):^[4]
 - [Token bucket](#)
 - [Leaky bucket](#)
 - TCP rate control - artificially adjusting TCP window size as well as controlling the rate of ACKs being returned to the sender^{[5][6]}
- [Scheduling algorithms](#):
 - [Weighted fair queuing](#) (WFQ)^[7]

- [Class based weighted fair queuing](#)
- [Weighted round robin \(WRR\)](#)
- [Deficit weighted round robin \(DWRR\)](#)
- [Hierarchical Fair Service Curve \(HFSC\)](#)
- Congestion avoidance:^[1]
 - [RED](#), [WRED](#) - Lessens the possibility of [port queue buffer tail-drops](#) and this lowers the likelihood of [TCP global synchronization](#)
 - Policing (marking/dropping the packet in excess of the committed traffic rate and burst size)^[8]
 - [Explicit congestion notification](#)
 - Buffer tuning - ^[9] allows you to modify the way a router allocates buffers from its available memory, and helps prevent packet drops during a temporary burst of traffic.
- Bandwidth reservation protocols / algorithms
 - [Resource reservation protocol \(RSVP\)](#) - is the means by which applications communicate their requirements to the network in an efficient and robust manner.^[10]
 - [Constraint-based Routing Label Distribution Protocol \(CR-LDP\)](#)
 - [Top-nodes algorithm](#)
- [Traffic classification](#) - categorising traffic according to some policy in order that the above techniques can be applied to each class of traffic differently

Link performance

Issues which may limit the performance of a given link include:

- [TCP](#) determines the capacity of a connection by flooding it until packets start being dropped ([Slow-start](#))
- Queueing in routers results in higher [latency](#) and [jitter](#) as the network approaches (and occasionally exceeds) capacity
- [TCP global synchronization](#) when the network reaches capacity results in waste of bandwidth
- [Burstiness](#) of web traffic requires spare bandwidth to rapidly accommodate the bursty traffic

- Lack of widespread support for [explicit congestion notification](#) and [quality of service](#) management on the Internet
- [Internet Service Providers](#) typically retain control over queue management and quality of service at their end of the link
- [Window Shaping](#) allows higher end products to reduce traffic flows, which reduce queue depth and allow more users to share more bandwidth fairly

Tools and techniques

- [Packet sniffer](#)^[11] is a program or a device that eavesdrops on the network traffic by grabbing information traveling over a network
- [Network traffic measurement](#)

See also

- [Bandwidth cap](#)
- Bandwidth management is a subset of [network management](#) and [performance management](#)
- Bandwidth management using [NetFlow](#) and IPFIX data
- [Bandwidth throttling](#)
- [Customer service unit](#) a device to balance the data rate on user's telecommunication equipment
- [INASP](#) runs bandwidth management training workshops and produces reports
- [Network congestion avoidance](#) lists some techniques for prevention and management of congestion on routers
- [Network traffic measurement](#) is a subset of [network monitoring](#)
- [Traffic shaping](#) and [rate limiting](#) are bandwidth management (traffic control) techniques

References

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- ["Deploying IP and MPLS QoS for Multiservice Networks: Theory and Practice"](#) by John Evans, Clarence Filisfil (Morgan Kaufmann, 2007, ISBN 0-12-370549-5)

External links

- [Bandwidth Management Tools, Strategies, and Issues](https://web.archive.org/web/20090824071644/http://net.educause.edu/ir/library/pdf/DEC0202.pdf) (<https://web.archive.org/web/20090824071644/http://net.educause.edu/ir/library/pdf/DEC0202.pdf>)
- [TechSoup for Libraries: Bandwidth Management](http://www.techsoupforlibraries.org/cookbook-3/networking-and-security/bandwidth-management) (<http://www.techsoupforlibraries.org/cookbook-3/networking-and-security/bandwidth-management>)
- [The True Price of Bandwidth Monitoring](http://netequalizernews.com/2009/07/16/the-true-price-of-bandwidth-monitoring/) (<http://netequalizernews.com/2009/07/16/the-true-price-of-bandwidth-monitoring/>)
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