Version: 1.0

Internet access

Definition

NET NOD

INTERNET STIFTELSEN

Preface

The effective operation of the internet is fundamental to all users in all locations. As things stand, momentary bandwidth is practically the only metric used to gauge the quality of internet connection. However, although it may be important, bandwidth unfortunately only measures some of the factors that affect user experience.

In Sweden, internet and other service providers offer internet solutions to companies and private individuals. Exactly what an open internet connection or internet access should include, and the quality a user can expect to receive, is not entirely clear for the parties on the market. Concepts relating to content and quality could include performance such as bandwidth, response time, availability, traffic control, operational functions or the support users can expect when errors occur. The objective of internet access is that, together with the market, we can define how these values are to be measured and determine a minimum standard. This creates conditions for a higher level of service.

In autumn 2016, Netnod and the Swedish Internet Foundation carried out a preparatory study in order to ascertain if there was a need or interest in Sweden to create a definition of internet access which builds on existing legislation. A total of 39 people from 24 different organizations were interviewed during the study, representing, among others, internet service providers, mobile operators, authorities, other companies, universities and private individuals. The results of the preparatory study underlined that a definition of internet access is of interest to many parties on the market.

Stockholm, April 2019

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Introduction

Background

The IT Commission's report entitled "General Specification of Internet Services" was published in the year 2000. Its stated objective was to facilitate the specification of requirements for procurement of internet services and make things easier for operators, who wanted to measure the quality of their services themselves. The report thereby laid the foundation for how internet services should be specified in Sweden. In spite of the broad distribution and development of technology that has taken place since, the specification has not been changed, and has therefore become outdated.

The need to specify internet services remains. In the new definition of internet access the stakeholders are the same as before: internet service providers and parties involved in procurement. End users and companies that develop services for the internet have also been added.

Purpose

The purpose of this definition is to create a common perception of what internet access is, and define key concepts which can therefore be applied consistently. The definition is intended to be used by all parties on the market. These may include, for example, private individuals, companies, authorities and internet service providers. The primary objective is to make things easier for internet service providers and their customers, as well as other users, by creating a common perception with regard to the performance that can be expected from an internet connection, and how it should be measured. As such, the definition may be used by internet service providers in order to, in a consistent manner, describe their services or, during procurement, to outline performance and quality requirements.

In order to fulfil this objective, terms are defined that are used to describe internet access and, in relevant cases, specific measurement values. These terms are subsequently used in order to define the minimum acceptable standard for internet access as a product.

Another purpose of the definition is to give organizations intending to procure internet services from operators an overview of the specifications which may be outlined when determining what is required from an internet service of a good standard. The definition can therefore be seen as a guideline within this process, and is not a requirement in itself. The definition may also be used by operators who wish to measure the quality of their own services.

It is hoped that the definition will be kept up to date on an ongoing basis with regard to technical advances as well as experiences relating to its use. The creation of an organization for this purpose is included as a task in subsequent phases of the project.

Sixty-six people from 40 different organizations took part in Phase 1 of Project Internet Access.

Limitations

Services such as Multicast, IPTV, IP telephony and quality standards relating to, for example, "the welfare internet" and "gaming access", among other things, are not included in the basic level of internet access, and classed as a supplement to this basic level that is declared by each internet service provider.

Definitions

The definitions outlined in the following sections describe various quality measures relating to an internet connection service. They are of two types: measurement values and declarations.

The measurement value is a quality metric which is directly measurable by the user. All definitions of the measurement values are included in a table which appears as shown below.

Designation:		Type:	Measurement value
Name:			
Definition:			
Measurement:			
Measurement unit:			
Limit value:			

Declarations are defined in a corresponding table. In general, these are facets of a service which are not directly measurable, but still have an impact on quality.

Designation:		Type:	Declaration
Name:			
Definition:			
Limit value:			

The fields have the following meanings:

Designation	A uniquely identifying designation for the definition. An assigned designation will always refer to the specific definition. Designations for withdrawn definitions are not reused.
Type	Specifies if the table defines a measurement value or declaration.
Name	A descriptive name for the quality measurement which is defined.
Definition	Definition of the quality measure.
Measurement	A description of how the value is measured. Using uniform measurement methods ensures the values are reproducible and comparable.
Measurement unit	Specifies the unit in which the measurement value is to be recorded. For measurements and tests with discrete response alternatives, for example, yes and no, the response alternatives are stated.
Limit value	The lowest acceptable value for the quality measure relating to an internet service. The expression "according to agreement" means the value is subject to agreement between the customer and supplier, and no general minimum requirement can be specified.

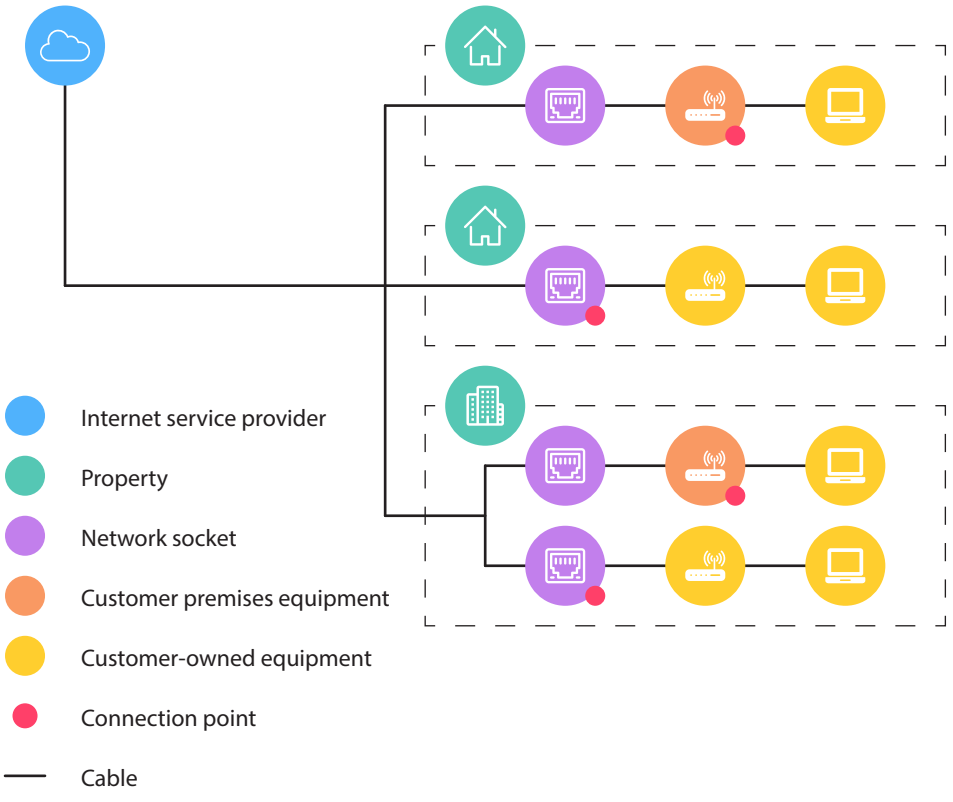
Connection point and customer premises equipment

The term "connection point" refers to the interface at which the user gains access to the internet service and can connect the equipment which is to have internet access. It is to the connection point that the provider undertakes to provide internet access at a specified standard.

If customer premises equipment (CPE), for example, a router or media converter, is included in the package, the connection point is the interface where the customer is expected to connect their own equipment. If customer premises equipment is not included in the package, or the customer decides to replace the customer premises equipment with their own, the connection point is the interface to the customer's equipment.

In concrete terms, a connection point may be constituted by a network socket in an apartment or a DSL or cable modem.

In cases where the customer premises equipment has more than one type of interface, it is sufficient for the agreed level of performance to be provided to one of these. This means, for example, that when customer premises equipment supports both a wired (Ethernet) and wireless (Wi-Fi) network connection, it is acceptable that certain levels of performance, such as the maximum transfer speed, are not achieved during measurement of the wireless interface.



Designation:	1.1	Type:	Declaration
Name:	Interface		
Definition:	The interface that constitutes the connection point is described here.		
Limit value:	According to agreement.		

Designation:	1.2	Type:	Declaration
Name:	Customer premises equipment included in the package		
Definition:	Here it is specified whether customer premises equipment (CPE) is included in the package. If customer premises equipment is included in the package, it must also be specified what type of equipment is involved, who is responsible for its operation and configuration and what changes to settings and configuration may be made by the customer.		
Limit value:	According to agreement.		

Designation:	1.3	Type:	Declaration
Name:	Whether or not customer premises equipment may be replaced		
Definition:	If customer premises equipment (CPE) is included in the package, this definition outlines whether or not this may be replaced with other equipment by the customer. If this is allowed, the technical requirements applicable to the equipment must be outlined, in addition to how this affects the provider's service level agreement (SLA) in relation to the customer.		
Limit value:	According to agreement (yes/no).		

IPv4 unicast transmission

The transmission of unicast packets is the most fundamental functionality on the internet. The provider transmits IPv4 packets to and from specified IP addresses. Transmission takes places via the provider's network on the basis of routing information that it exchanges with other network operators. Unicast packets have sender and recipient addresses ranging from 1.0.0.0 and 223.255.255.255, with the exception of the address spaces taken up in the IANA's IPv4 Special-Purpose Address Registry [1], with the value of "Globally Reachable" set to false. The transmission of packets is assumed to be transparent, insofar that the provider transmits packets regardless of the protocol used in overhead network layers.

Designation:	2.1	Type:	Measurement value
Name:	Transmission of TCP with IPv4 unicast		
Definition:	The provider transmits TCP with IPv4 unicast to and from the customer.		
Measurement:	Measured by testing transmission and reception of TCP packets between a testing server with a globally addressable IPv4 address placed outside of the internet service provider's network and the interface which has the customer's assigned IPv4 address. If the packets reach their destinations with the payload unchanged, the result is approved (Yes).		
Measurement unit:	Yes/No		
Limit value:	Yes		

Designation:	2.2	Type:	Measurement value
Name:	Transmission of UDP with IPv4 unicast		
Definition:	The provider transmits UDP with IPv4 unicast to and from the customer.		
Measurement:	Measured by testing transmission and reception of UDP packets between a testing server with a globally addressable IPv4 address placed outside of the internet service provider's network and the interface which has the customer's assigned IPv4 address. If the packets reach their destinations with the payload unchanged, the result is approved (Yes).		
Measurement unit:	Yes/No		
Limit value:	Yes		

Designation:	2.3	Type:	Measurement value
Name:	Transmission of ICMP with IPv4 unicast		
Definition:	The provider transmits ICMP with IPv4 unicast to and from the customer.		
Measurement:	Measured by testing transmission and reception of ICMP packets between a testing server with a globally addressable IPv4 address placed outside of the internet service provider's network and the interface which has the customer's assigned IPv4 address. If the packets reach their destinations with the payload unchanged, the result is approved (Yes).		
Measurement unit:	Yes/No		
Limit value:	Yes		

Designation:	2.4	Type:	Measurement value
Name:	Transmission of UDP with IPv4 unicast		
Definition:	The customer's assigned IPv4 address can be reached through TCP sessions initiated by another party on the internet.		
Measurement:	Measured by a testing server on the internet initiating a TCP session to a website by customer premises equipment, or the customer's equipment, and attempting to exchange traffic. If this is possible, the result is approved (Yes). If the customer's assigned IPv4 address is not globally addressable, the measurement is not applicable.		
Measurement unit:	Yes/No/Not applicable		
Limit value:	Yes/Not applicable		

Designation:	2.5	Type:	Measurement value
Name:	Reachability by UDP via IPv4 unicast		
Definition:	The customer's assigned Ipv4 address can be reached with UDP packets sent from another party on the internet.		
Measurement:	Measured by a testing server on the internet transmitting a UDP packet to the website by customer premises equipment, or the customer's equipment. The destination port may not have been used as a source port for traffic to the relevant server earlier during the measurement. If the packets are received with an unchanged payload, the result is approved (Yes). If the customer's assigned IPv4 address is not globally addressable, the measurement is not applicable.		
Measurement unit:	Yes/No/Not applicable		
Limit value:	Yes/Not applicable		

Designation:	2.6	Type:	Measurement value
Name:	Reachability with ICMP via IPv4 unicast		
Definition:	The customer's assigned Ipv4 address can be reached with ICMP packets sent from another party on the internet.		
Measurement:	Measured by a testing server on the internet transmitting the following ICMP packet to the website by customer premises equipment or the customer's equipment: echo request, echo reply, fragmentation required and time exceeded. If the packets are received with an unchanged payload, the result is approved (Yes). If the customer's assigned IPv4 address is not globally addressable, the measurement is not applicable.		
Measurement unit:	Yes/No/Not applicable		
Limit value:	Yes/Not applicable		

IPv6 unicast transmission

The transmission of unicast packets is the most fundamental functionality on the internet. The provider transmits IPv6 packets to and from stated IP addresses. Transmission takes place via the provider's network on the basis of routing information which it obtains from its subscribers and others with whom routing information may be exchanged. The transmission of packets is assumed to be transparent, insofar that the provider transmits packets regardless of the protocol used in overhead network layers. Unicast packets have recipient addresses in the address space designated for unicast traffic in accordance with RFC 3587 [2], with the exception of address spaces taken up in the IANA's "IPv6 Special-Purpose Address Registry" [3] with the value of "Globally Reachable" set to false.

Designation:	3.1	Type:	Measurement value
Name:	Transmission of TCP with IPv6 unicast		
Definition:	The provider transmits TCP with IPv6 unicast to and from the customer.		
Measurement:	Measured by testing transmission and reception of TCP packets between a testing server with a globally addressable IPv6 address placed outside of the internet service provider's network and the equipment which has the customer's assigned IPv6 addresses. If the packets reach their destinations with the payload unchanged, the result is approved (Yes).		
Measurement unit:	Yes/No		
Limit value:	Yes		

Designation:	3.2	Type:	Measurement value
Name:	Transmission of UDP by IPv6 unicast		
Definition:	The provider transmits UDP with IPv6 unicast to and from the customer.		
Measurement:	Measured by testing transmission and reception of UDP packets between a testing server with a globally addressable IPv6 address placed outside of the internet service provider's network and the equipment which has one of the customer's assigned IPv6 addresses. If the packets reach their destinations with the payload unchanged, the result is approved (Yes).		
Measurement unit:	Yes/No		
Limit value:	Yes		

Designation:	3.3	Type:	Measurement value
Name:	Transmission of ICMPv6 with IPv6 unicast		
Definition:	The provider transmits ICMPv6 with IPv6 unicast to and from the customer.		
Measurement:	Measured by testing transmission and reception of ICMPv6 packets between a testing server with a globally addressable IPv6 address placed outside of the internet service provider's network and the equipment which has one of the customer's assigned IPv6 addresses. If the packets reach their destinations with the payload unchanged, the result is approved (Yes).		
Measurement unit:	Yes/No		
Limit value:	Yes		

Designation:	3.4	Type:	Measurement value
Name:	Reachability with TCP via IPv6 unicast		
Definition:	The customer's assigned IPv6 addresses can be reached for TCP sessions initiated by another party on the internet.		
Measurement:	Measured by a testing server on the internet initiating a TCP session to a website by customer premises equipment, or the customer's equipment, and attempting to exchange traffic. If this is possible, the result is approved (Yes).		
Measurement unit:	Yes/No		
Limit value:	Yes		

Designation:	3.5	Type:	Measurement value
Name:	Reachability with UDP via IPv6 unicast		
Definition:	The customer's assigned IPv6 addresses can be reached with UDP packets sent from another party on the internet.		
Measurement:	Measured by a testing server on the internet transmitting a UDP packet to the website by customer premises equipment, or the customer's equipment. The destination port may not have been used as a source port for traffic to the relevant server earlier during the measurement. If the packets are received with an unchanged payload, the result is approved (Yes).		
Measurement unit:	Yes/No		
Limit value:	Yes		

Designation:	3.6	Type:	Measurement value
Name:	Reachabiilty with ICMPv6		
Definition:	The customer's assigned IPv6 addresses can be reached with ICMPv6 packets sent from another party on the internet.		
Measurement:	Measured by a testing server on the internet transmitting the following ICMPv6 packet to the website by customer premises equipment or the customer's equipment: echo request, echo reply, packet too big and time exceeded. If the packets are received with an unchanged payload, the result is approved (Yes).		
Measurement unit:	Yes/No		
Limit value:	Yes		

Address assignment

Address assignment refers to the addresses assigned by the customer for addressing to the provider's access network and out onto the internet. This also includes the methods used in order to assign addresses to the customer for protocol in the network layer. This usually applies to addresses and address assignment methods for IPv4 och IPv6. For other protocols transmitted in the network layer, the provider declares equivalent applicable information.

Designation:	4.1	Type:	Measurement value
Name:	Globally addressable IPv4 addresses		
Definition:	The customer's assigned IPv4 addresses are globally addressable.		
Measurement:	An IPv4 address is globally addressable if it falls within the range from 1.0.0.0 till 223.255.255.255, with the exception of the address spaces taken up in the IANA's IPv4 Special-Purpose Address Registry [1], with the value of "Globally Reachable" set to false. If this requirement is met, the measurement result is Yes		
Measurement unit:	Yes/No		
Limit value:	According to agreement.		

Designation:	4.2	Type:	Measurement value
Name:	Globally addressable IPv6 addresses		
Definition:	The customer's assigned IPv6 addresses are globally addressable.		
Measurement:	An IPv6 address is globally addressable if included in the address space designated for unicast traffic in accordance with RFC 3587 [2], with the exception of address spaces taken up in the IANA:s "IPv6 Special-Purpose Address Registry" [3] with the value of "Globally Reachable" set to false. If this requirement is met, the measurement result is Yes		
Measurement unit:	Yes/No		
Limit value:	Yes		

Designation:	4.3	Type:	Declaration
Name:	Maximum number of accessible IPv4 addresses		
Definition:	The maximum number of IPv4 addresses assigned to the customer.		
Limit value:	At least one assigned IPv4 address.		

Designation:	4.4	Type:	Declaration
Name:	Size of available IPv6 prefix		
Definition:	The maximum number of IPv6 addresses assigned to the customer expressed as the size of the available IPv6 prefix.		
Limit value:	At least one /56 prefix.		

Designation:	4.5	Type:	Declaration
Name:	Assignment of IPv4 addresses		
Definition:	The provider describes how IPv4 addresses are assigned.		
Limit value:	According to agreement.		

Designation:	4.6	Type:	Declaration
Name:	Assignment of IPv6 addresses.		
Definition:	The provider describes how IPv6 addresses are assigned.		
Limit value:	According to agreement.		

MTU

The MTU is the maximum size a transmitted packet in a network layer may be without being fragmented by routers in the provider's network.

Designation:	5.1	Type:	Measurement value
Name:	MTU with IPv4		
Definition:	The maximum size of the IPv4 packet that can be transmitted within the provider's network without fragmentation.		
Measurement:	IPv4 packets of different sizes with the "Don't fragment" flag set are sent to a testing server placed on the internet. The MTU is equivalent to the maximum packet size that is successfully transmitted.		
Measurement unit:	Bytes		
Limit value:	Greater than or equal to 1,500 bytes.		

Designation:	5.2	Type:	Measurement value
Name:	MTU with IPv6		
Definition:	The maximum size of IPv6 packets that can be transmitted within the provider's network.		
Measurement:	IPv6 packets of different sizes are sent to a testing server placed on the internet. The MTU is equivalent to the maximum packet size that is successfully transmitted.		
Measurement unit:	Bytes		
Limit value:	Greater than or equal to 1,500 bytes.		

DNS

The primary objective of the DNS system is to perform translation of domain names to IP addresses. In practical terms, the DNS system is a hierarchically organized distributed database that can also contain a significant amount of other information of benefit to the functionality of the internet.

To ensure each unit in a network is not required to contact multiple servers in the hierarchy during each DNS lookup, there is generally what is known as a DNS resolver which performs this function instead of the unit. This facilitates configuration and improves performance within the network. In most cases, the IP address for the DNS resolver in the network is obtained in conjunction with automatic address assignment. Many large companies and organizations also provide DNS resolvers on the internet that are intended for end users and free for all to use. The internet service provider supplying or assigning a DNS resolver service is a generally accepted prerequisite for the provision of internet services.

Designation:	6.1	Type:	Declaration
Name:	Assignment of DNS resolvers		
Definition:	Here it is described how the addresses to the provider's specified resolver services are assigned (statically or dynamically). If the addresses are assigned dynamically, the protocol used for assignment must also be specified.		
Limit value:	According to agreement.		

Designation:	6.2	Type:	Measurement value
Name:	DNSSEC		
Definition:	Whether or not the provider's specified DNS resolvers use the correctly implemented DNSSEC validation.		
Measurement:	Testing of DNS lookups for known DNSSEC domains, and for domains with incorrect or missing signatures. If the DNS resolver assigned by the provider performs the correct DNSSEC validation in accordance with RFC 4033-4035 [4], the result is approved (Yes).		
Measurement unit:	Yes/No		
Limit value:	Yes		

Designation:	6.3	Type:	Measurement value
Name:	Support for IPv6-data in DNS		
Definition:	Whether or not the provider's specified DNS resolvers support IPv6 data.		
Measurement:	DNS lookups of IPv6 addresses (AAAA records) for a number of test domains that have AAAA records. If the response of the DNS resolver contains AAAA records with correct IPv6 addresses, the result is approved (Yes).		
Measurement unit:	Yes/No		
Limit value:	Yes		

Designation:	6.4	Type:	Measurement value
Name:	Support for IPv6 transport of the DNS protocol		
Definition:	Whether or not the provider's DNS resolvers handle DNS queries transported across IPv6.		
Measurement:	DNS lookups over IPv6 transport of DNS entries for a number of test domains, and DNS lookups of entries in special test domains, whose authoritative servers may only be reached over IPv4 or only IPv6. If the entries returned by the DNS resolver are correct, the result is approved (Yes).		
Measurement unit:	Yes/No		
Limit value:	Yes		

Designation:	6.5	Type:	Measurement value
Name:	Support for IPv6-data in DNS		
Definition:	In some cases, DNS operators block or re-write certain DNS queries and responses, that is, the information they transmit is not the same as that received from the client or other DNS servers. This is not consistent with best practice on the internet and may give rise to unexpected issues.		
Measurement:	DNS lookups for domains with known values in order to check whether queries are re-written or blocked, and lookups of non-existent domains in order to check whether NXDOMAIN is re-written. If the provider blocks or re-writes DNS queries and responses where this is not required by law or agreement, the result is failed (No). Otherwise, the result is approved (yes).		
Measurement unit:	Yes/No		
Limit value:	Yes		

Designation:	6.6	Type:	Measurement value
Name:	DNS queries not truncated		
Definition:	DNS queries to DNS resolvers other than those specified by the provider must not be re-directed.		
Measurement:	DNS lookups are performed to special test DNS resolvers. If DNS queries and responses reach their destinations unchanged, the result is approved (Yes).		
Measurement unit:	Yes/No		
Limit value:	Yes		

Availability

The customer has internet access when they can access and are accessible from the internet via the protocols in the network layer supplied by the provider, and have access to other specified services with acceptable performance in accordance with this definition.

Designation:	7.1	Type:	Declaration
Name:	Expected availability of service		
Definition:	The expected availability of service is declared here, that is, the proportion of time during which the service is guaranteed to be available and whether, and in what way, the customer is compensated when the guarantee is not fulfilled.		
Limit value:	According to agreement.		

Designation:	7.2	Type:	Declaration
Name:	Notification about scheduled interruption		
Definition:	How scheduled interruptions are notified to the customer, and the period of time before the interruption when this takes place, are outlined here.		
Limit value:	According to agreement.		

Designation:	7.3	Type:	Declaration
Name:	Information about interruptions in progress		
Definition:	How the customer can obtain information about interruptions in progress, and the time until resolution, are described here.		
Limit value:	According to agreement.		

Performance

The performance of an internet connection can be measured in a number of ways, and no single measurement value alone can specify the quality of the service provided. The quantitative measures of performance outlined here make it possible to measure the parameters that impact on user experience for the majority of the services used on the internet. These performance requirements must be met, irrespective of whether measurement takes place over IPv4 or IPv6.

Designation:	8.1	Type:	Declaration
Name:	Highest download speed		
Definition:	The maximum agreed transfer speed for downloads is declared here. This is specified in Mbit/s in the data link layer, where 1 Mbit = 1,000,000 bits.		
Limit value:	According to agreement. The difference between the maximum declared transfer speed under this item and the theoretical maximum transfer speed for payloads in the application layer (items 8.5 and 8.7) may not exceed 10%.		

Designation:	8.2	Type:	Declaration
Name:	Maximum upload speed		
Definition:	The maximum agreed transfer speed for uploads is declared here. This is specified in Mbit/s in the data link layer, where 1 Mbit = 1,000,000 bits.		
Limit value:	According to agreement. The difference between the maximum declared transfer speed under this item and the theoretical maximum transfer speed for payloads in the application layer (items 8.6 and 8.8) may not exceed 10%.		

Designation:	8.3	Type:	Declaration
Name:	Minimum download speed		
Definition:	The minimum guaranteed transfer speed for downloads is declared here. This is specified in Mbit/s in the data link layer, where 1 Mbit = 1,000,000 bits.		
Limit value:	According to agreement.		

Designation:	8.4	Type:	Declaration
Name:	Minimum upload speed		
Definition:	The minimum guaranteed transfer speed for uploads is declared here. This is specified in Mbit/s in the data link layer, where 1 Mbit = 1,000,000 bits.		
Limit value:	According to agreement.		

Designation:	8.5	Type:	Measurement value
Name:	Current download speed with TCP		
Definition:	A metric of the volume of data that can be transferred from the internet with TCP per time unit. Depending on the current load in the provider's network, the available transfer capacity may vary.		
Measurement:	The download speed is measured as the number of bits transferred (the payload) over TCP, per second, in the transport layer. The transfer takes place from several geographically distributed reference servers on the internet. Since the measurement takes place in the transport layer, the download speed measured is typically lower than what is declared.		
Measurement unit:	Megabit per second (Mbit/s) where 1 Mbit = 1,000,000 bits. In addition to the momentary value, the values for the 90th, 95th and 98th percentiles of all measurement values during a period are recorded.		
Limit value:	The transfer speed corresponding to the 95th percentile during a month may not fall lower than 60% of the service's declared maximum download speed according to 8.1.		

Designation:	8.6	Type:	Measurement value
Name:	Current upload speed with TCP		
Definition:	A metric of the volume of data that can be transferred to the internet with TCP, per time unit. Depending on the current load in the provider's network, the available transfer capacity may vary.		
Measurement:	The upload speed is measured as the number of bits transferred (the payload) over TCP, per second, in the transport layer. The transfer takes place to several geographically distributed reference servers on the internet. Since the measurement takes place in the transport layer, the upload speed measured is typically lower than what is declared.		
Measurement unit:	Megabit per second (Mbit/s) where 1 Mbit = 1,000,000 bits. In addition to the momentary value, the values for the 90th, 95th and 98th percentiles of all measurement values during a period are recorded.		
Limit value:	The transfer speed corresponding to the 95th percentile during a month may not fall lower than 60% of the service's declared maximum upload speed according to 8.2.		

Designation:	8.7	Type:	Measurement value
Name:	Current download speed with UDP		
Definition:	A metric of the volume of data that can be transferred from the internet with UDP, per time unit. Depending on the current load in the provider's network, the available transfer capacity may vary.		
Measurement:	The download speed is measured as the number of bits transferred (the payload) over UDP, per second, in the transport layer. The transfer takes place from several geographically distributed reference servers on the internet. Since the measurement takes place in the transport layer, the download speed measured is typically lower than what is declared.		
Measurement unit:	Megabit per second (Mbit/s) where 1 Mbit = 1,000,000 bits. In addition to the momentary value, the values for the 90th, 95th and 98th percentiles of all measurement values during a period are recorded.		
Limit value:	The transfer speed corresponding to the 95th percentile during a month may not fall lower than 60% of the service's declared maximum download speed according to 8.1.		

Designation:	8.8	Type:	Measurement value
Name:	Current upload speed with UDP		
Definition:	A measurement of the volume of data that can be transferred to the internet by UDP, per time unit. Depending on the current load in the provider's network, the available transfer capacity may vary.		
Measurement:	The upload speed is measured as the number of bits transferred (the payload) over UDP, per second, in the transport layer. The transfer takes place to several geographically distributed reference servers on the internet. Since the measurement takes place in the transport layer, the upload speed measured is typically lower than what is declared.		
Measurement unit:	Megabit per second (Mbit/s) where 1 Mbit = 1,000,000 bits. In addition to the momentary value, the values for the 90th, 95th and 98th percentiles of all measurement values during a period are recorded.		
Limit value:	The transfer speed corresponding to the 95th percentile during a month may not fall lower than 60% of the service's declared maximum upload speed according to 8.2.		

Designation:	8.9	Type:	Measurement value
Name:	Response time by TCP		
Definition:	The response time is the time it takes for a package sent from the customer's connection to another destination on the internet to reach its destination, and for a response to take the corresponding route back.		
Measurement:	The response time for TCP is measured without load, that is, with no other transfers in progress, and through a measurement flow with low transmission speed. The measurement takes place at the same testing servers used to gauge the download speed.		
Measurement unit:	Milliseconds (ms). In addition to the momentary value, the values for the 90th, 95th and 98th percentiles of all measurement values during a period are recorded.		
Limit value:	No limit value.		

Designation:	8.10	Type:	Measurement value
Name:	Response time when downloading with TCP		
Definition:	The response time is the time it takes for a package sent from the customer's connection to another destination on the internet to reach its destination, and for a response to take the corresponding route back. If a large proportion of the available transfer speed is being used, this may lead to an increase in the response time.		
Measurement:	The response time when downloading with TCP is measured in the same way as in 8.9, at the same time as measurement of the download speed according to 8.5. The measurement takes place at the same testing servers used to gauge the download speed.		
Measurement unit:	Milliseconds (ms). In addition to the momentary value, the values for the 90th, 95th and 98th percentiles of all measurement values during a period are recorded.		
Limit value:	No limit value.		

Designation:	8.11	Type:	Measurement value
Name:	Response time with UDP		
Definition:	The response time is the time it takes for a package sent from the customer's connection to another destination on the internet to reach its destination, and for a response to take the corresponding route back.		
Measurement:	The response time for UDP is measured without load, that is, with no other transfers in progress, and through a measurement flow with low transmission speed. The measurement takes place at the same testing servers used to gauge the download speed.		
Measurement unit:	Milliseconds (ms). In addition to the momentary value, the values for the 90th, 95th and 98th percentiles of all measurement values during a period are recorded.		
Limit value:	No limit value.		

Designation:	8.12	Type:	Measurement value
Name:	Response time when downloading with UDP		
Definition:	The response time is the time it takes for a package sent from the customer's connection to another destination on the internet to reach its destination, and for a response to take the corresponding route back. If a large proportion of the available transfer speed is being used, this may lead to an increase in the response time.		
Measurement:	The response time for UDP is measured at the same time with measurement of the download speed according to 8.7. The measurement takes place at the same testing servers used to gauge the download speed.		
Measurement unit:	Milliseconds (ms). In addition to the momentary value, the values for the 90th, 95th and 98th percentiles of all measurement values during a period are recorded.		
Limit value:	No limit value.		

Designation:	8.13	Type:	Measurement value
Name:	Packet loss during unloaded connection		
Definition:	Ordinarily, when none or a very small proportion of the connection's available transfer speed is being used, no packets are lost.		
Measurement:	Measurement takes place over TCP, UDP and ICMP at testing servers outside of the provider's network.		
Measurement unit:	Percent (%)		
Limit value:	Ninety-nine percent of the measurements carried out during a month should record no packet loss.		

Support functions

Designation:	9.1	Type:	Declaration
Name:	Technical support		
Definition:	Methods of contacting technical support and obtaining operating information provided as part of the service are declared here, including contact details and opening times as well as anticipated waiting periods for response.		
Limit value:	According to agreement.		

Security

The provider's security work is a key aspect of its service. Security deficiencies among providers can give rise to consequences over and above the availability and technical quality of the service. Examples include customers' information assets being lost or disclosed to unauthorized parties.

Designation:	10.1	Type:	Declaration
Name:	Policy for systematic network and information security work		
Definition:	The provider declares the policy for its systematic network and information security work. These includes methods of handling what are known as abuse cases and how it will ensure information in databases held by RIPE, for example, is kept up to date.		
Limit value:	The provider must have declared a policy for its systematic network and information security work.		

Designation:	10.2	Type:	Declaration
Name:	CERT/CSIRT		
Definition:	How the provider's CERT/CSIRT function is organized, and which standards it adheres to (for example, BCP 21/RFC 2350 [5]), are outlined here.		
Limit value:	The provider must have outlined its CERT/CSIRT function. If the provider does not have such a function, this must be specified.		

Designation:	10.3	Type:	Declaration
Name:	Prevention of incorrect routing information		
Definition:	How the provider prevents propagation of incorrect routing information in its network, and those of others, is declared here. For example, this may take place through implementation of the MANRS standard [6].		
Limit value:	The provider has implemented MANRS or adopted equivalent measures in order to ensure sound routing security within its network.		

Designation:	10.4	Type:	Declaration
Name:	Secure customer connection		
Definition:	The Secure Enduser Connection standard [7] outlines how an internet service provider shall configure the equipment in its access network in order to prevent various types of security issues which may otherwise affect users.		
Limit value:	The provider must have implemented the standard in its access network, or adopted measures to ensure security in the access network is provided at the same level, at a minimum.		

Designation:	10.5	Type:	Declaration
Name:	Security in customer premises equipment (CPE)		
Definition:	In the same way as all other network equipment, customer premises equipment supplied by the provider must be continually maintained in order to ensure network users are not at risk from various network issues, including breaches. Among other things, this comprises maintenance of configurations and continual security updates for the software.		
Limit value:	If the service involves customer premises equipment, the provider must outline how it will maintain the security of the equipment.		

Designation:	10.6	Type:	Measurement value
Name:	Reachability across customer premises equipment		
Definition:	The customer premises equipment supplied by the provider that transmits traffic at network layer level shall protect the equipment that it connects to the internet. As standard, this is achieved by preventing reachability to the connected equipment from the internet.		
Measurement:	Measured using the same methods outlined under 2.4, 2.5, 2.6, 3.4, 3.5 and 3.6.		
Measurement unit:	Yes/No/Not applicable		
Limit value:	No		

Glossary

BCP	Best Current Practice Additional designation for certain RFC documents published by the Internet Engineering Task Force (IETF) which outline current technical best practice on the internet within an area.
CERT	Cyber Emergency Response Team
CPE	Customer Premises Equipment Customer premises equipment
CSIRT	Computer Security Incident Response Team
DNS	Domain Name System
DNSSEC	Domain Name System Security Extensions Extension to the DNS system for cryptographic verification of the information it contains.
ICMP	Internet Control Message Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
MTU	Maximum Transmission Unit
Multicast	A mode of traffic whereby a transmitting computer can reach several other computers with the same traffic.
Percentile	The value of a variable when it is worse than a certain proportion of all observations. For example, the value of the 90th percentile means 90% of the observations are better than that value.
RFC	Request for Comments Series of documents published by the IETF outlining protocol or other phenomena on the internet. Some RFCs are technical standards.

SLA	Service Level Agreement Serviceåtagande
TCP	Transmission Control Protocol
UDP	User Datagram Protocol

References

[1] IANA IPv4 Special-Purpose Address Registry. https://www.iana.org/assignments/iana-ipv4-special-registry/iana-ipv4-special-registry.xhtml

[2] IPv6 Global Unicast Address Format, RFC 3587. https://tools.ietf.org/html/rfc3587

[3] IANA IPv6 Special-Purpose Address Registry. https://www.iana.org/assignments/iana-ipv6-special-registry/iana-ipv6-special-registry.xhtml

[4] DNS Security Introduction and Requirements, RFC 4033. Resource Records for the DNS Security Extensions, RFC 4034. Protocol Modifications for the DNS Security Extensions, RFC 4035. https://tools.ietf.org/html/rfc4033 https://tools.ietf.org/html/rfc4034 https://tools.ietf.org/html/rfc4035

[5] Expectations for Computer Security Incident Response, BCP 21. https://tools.ietf.org/html/bcp21

[6] Mutually Agreed Norms for Routing Security https://www.manrs.org/

[7] Secure Enduser Connection https://secureenduserconnection.se/

Organizations taking part in preparatory study

Bahnhof

The Swedish Broadband Forum

Com Hem

Deutsche Telecom

The Swedish Chamber of Commerce

The Swedish Internet Foundation

Part of the Swedish Internet Foundation board

IP-Only

The Legal, Financial and Administrative Services Agency

Karlstad University

The Swedish Agency for Participation

Netnod

Part of the Netnod board

The Swedish Association of Local Authorities and Regions

The Swedish Local Fibre Alliance (SSNf)

Sunet

Svenska Spel

Tele2

Telenor

Telia

Telekområdgivarna

Tre

Organizations involved in creating definition

Agcom, Italy
Brainmill
The Swedish Broadband Forum
Caracolias & co
CERT-SE, MSB
Com Hem
Deutsche Telecom
The Swedish National Digitalisation Council
DIK
Dreamhack
Företagsmakarna
GavleNet
Getgeek
The Swedish Internet Foundation
Interlan
IP-Only
The Legal, Financial and Administrative Services Agency
Karlstad University
KTH Royal Institute of Technology
Landskrona Energi
Nordic Entertainment Group
Netnod
Nordunet
Nossebro energi
Phaze
Rala
SICS-RISE
The Swedish Association of Local Authorities and Regions
The Swedish Local Fibre Alliance (SSNf)
Sunet
Tele2
Telekområdgivarna
Telenor
Teleservice
Telia
The Swedish Transport Administration
Tre
Utsikt
Viasolution

NET NOD

INTERNET STIFTELSEN