European Commission

Broadband: Technology comparison

A comparison of broadband technologies presents features of each solution and helps decisions on the best solution for different regions.

Full FTTH coverage for three rural villages in Drnje, Croatia
fix-empty
Page Contents

With DSL, cable access, the optical fibre technology, radio broadcasts and new mobile standards, a variety of broadband technologies are available on the market that ensure reliable broadband services. However, it is important to choose a technology that is suitable for the individual region. Below, the main characteristics of each technology are summarised. An overview table allows for quick comparison at a glance.

Wired Broadband Technologies

ADSL, ADSL2, ADSL2+

Downstream/Upstream rate: 24/3 Mbps

Efficiency range: 5 km

Infrastructure Architecture: internet access by transmitting digital data over the wires of a local telephone network copper line terminates at telephone exchange

Suitability: use of existing telephone infrastructure; fast to install; small efficiency range due to the line resistance of copper connection lines

VDSL, VDSL2, Vectoring, 35b Supervectoring

Downstream/Upstream rate: 250/40 Mbps

Efficiency range: 1 km

Infrastructure Architecture: internet access by transmitting digital data over the wires of a local telephone network copper line terminates at street cabinet (VDSL); Vectoring allows elimination of cross talks for higher bandwidths.

Suitability: use of existing telephone infrastructure; fast to install; small efficiency range due to the line resistance of copper connection lines

Future of the technology: further speed and range improvements by enhancing and combining new DSL-based technologies (phantom mode, bonding, vectoring); bridge technology towards complete fibre optic cable infrastructure

G.Fast

Downstream/Upstream rate: Gbps bandwidths possible

Efficiency range: 100 m

Infrastructure Architecture: G.Fast: Frequency increase up to 212 MHz to achieve higher bandwidt

Suitability: use of existing telephone infrastructure; fast to install; small efficiency range due to the line resistance of copper connection lines

Future of the technology: further speed and range improvements by enhancing and combining new DSL-based technologies (phantom mode, bonding, vectoring); bridge technology towards complete fibre optic cable infrastructure

CATV & DOCSIS

Downstream/Upstream rate: 1 Gbps/200 Mbps

Efficiency range: 2-100 km

Infrastructure Architecture: coaxial cable in the streets and buildings; fibre at the feeder segments. Network extensions to provide backward channel functionality

Suitability: use of existing cable television infrastructure; fast to install; high transmission rates

Future of the technology: Further implementation of new standards (DOCSIS 3.1 & 4.0) allow provisions of higher bandwidth to end-users

Optical Fibre Cable

Downstream/Upstream rate: 10/10 Gbps (and more)

Efficiency range: 10-60 km

Infrastructure Architecture: signal transmission via fibre; distribution of signals by electrically powered network equipment or unpowered optical splitters

Suitability: highest bandwidth capacities; high efficiency range; high investment costs; bandwidth depends on the transformation of the optical into electronic signals at the curb (FTTC), building (FTTB) or home (FTTH)

Future of the technology: Next generation technology to meet future bandwidth demands

Wireless Broadband Technologies

LTE (Advanced) (4G)

Downstream/Upstream rate: 300/75 Mbps

Efficiency range: 3-6 km

Infrastructure Architecture: mobile devices send and receive radio signals with any number of cell site base stations fitted with microwave antennas; sites connected to a cabled communication network and switching system

Suitability: highly suitable for coverage of remote areas (esp. 800 MHz); quickly and easily implementable; shared medium; limited frequencies

Future of the technology: commercial deployment of new standards with additional features (HSPA+, 5G) and provision of more frequency spectrum blocks (490 - 700 MHz); meets future needs of mobility and bandwidth accessing NGA-Services

HSPA/HSPA+ (3G)

Downstream/Upstream rate: 42,2 / 5,76 Mbps, 337 Mbps / 34 Mbps

Efficiency range: 3 km

Infrastructure Architecture: mobile devices send and receive radio signals with any number of cell site base stations fitted with microwave antennas; sites connected to a cabled communication network and switching system

Suitability: highly suitable for coverage of remote areas (esp. 800 MHz); quickly and easily implementable; shared medium; limited frequencies

Future of the technology: commercial deployment of new standards with additional features (HSPA+, 5G) and provision of more frequency spectrum blocks (490 - 700 MHz); meets future needs of mobility and bandwidth accessing NGA-Services

5G

Downstream/Upstream rate: 10/1 Gbps

Efficiency range: 3-6 km

Infrastructure Architecture: mobile devices send and receive radio signals with any number of cell site base stations fitted with microwave antennas; sites connected to a cabled communication network and switching system

Suitability: high achievable data rates; low latency; high reliability; higher frequency bands; advanced multi-antenna transmission; handling of extreme device densities; flexible spectrum usage

Future of the technology: meets future needs of mobility and bandwidth accessing NGA-services; enables connectivity for a wide range of new applications

Satellite

Downstream/Upstream rate: 30/10 Mbps

Efficiency range: High

Infrastructure Architecture: mobile devices send and receive radio signals with any number of cell site base stations fitted with microwave antennas; sites connected to a cabled communication network and switching system

Suitability: highly suitable for coverage of remote areas; quickly and easily implementable; run time latency; asymmetrical

Future of the technology: 30 Mbps by 2020 based on next generation of high-throughput satellites

Leo Satellites

Downstream/Upstream rate: Signal distribution to user via WiFi/LTE/HSPA

Efficiency range: --

Infrastructure Architecture: mobile devices send and receive radio signals with any number of cell site base stations fitted with microwave antennas; sites connected to a cabled communication network and switching system

Suitability: reduced latency; affordable internet access possible; controlling by the necessary ground

stations of non-stationary flying satellites is very challenging

Future of the technology: internet service for very rural and remote areas possible

INTERNET balloons

Downstream/Upstream rate: Signal distribution to user via WiFi/LTE/HSPA

Efficiency range: --

Infrastructure Architecture: mobile devices send and receive radio signals with any number of cell site base stations fitted with microwave antennas; sites connected to a cabled communication network and switching system

Suitability: currently in a testing phase; challenging controlling; controlling by the necessary ground stations of non-stationary flying balloons is very challenging

Future of the technology: internet service for very rural and remote areas possible

Wi-Fi (802.11n) (IEEE 802.11ad)

Downstream/Upstream rate: 600/600 Mbps (802.11n); 6.7 Gbps (IEEE 802.11ad)

Efficiency range: indoor 70/ outdoor 250 m (802.11n); 3.3 m (IEEE 802.11ad)

Infrastructure Architecture: mobile devices send and receive radio signals with any number of cell site base stations fitted with microwave antennas; sites connected to a cabled communication network and switching system

Suitability: inexpensive and proven; quickly and easily implementable; small efficiency range; shared medium

Future of the technology: increased use of hotspots at central places

WiMAX (IEEE802.16e)

Downstream/Upstream rate: 6/4 Mbps; 70 Mbps (IEEE802.16e)

Efficiency range: 60 km

Infrastructure Architecture: mobile devices send and receive radio signals with any number of cell site base stations fitted with microwave antennas; sites connected to a cabled communication network and switching system

Suitability: inexpensive and proven; quickly and easily implementable; small efficiency range; shared medium

Future of the technology: gets continually replaced by Wi-Fi and LTE and plays therefore no significant role anymore; further developments are therefore not expected

Lifi

Downstream/Upstream rate: max. 224 Gbps

Efficiency range: several meters

Infrastructure Architecture: mobile devices send and receive radio signals with any number of cell site base stations fitted with microwave antennas; sites connected to a cabled communication network and switching syste

Suitability: only delivers communication over short ranges; low reliability; high installation costs; cheaper than Wi-Fi; only effective and permanent within closed rooms

Future of the technology: useful in electromagnetic sensitive areas such as in aircraft cabins, hospitals and nuclear power plants without causing electromagnetic interference

Follow the latest progress and learn more about getting involved.

-

@connectivityEU

Latest

PRESS RELEASE | 15 September 2021
State of the Union: Commission proposes a Path to the Digital Decade to deliver the EU's digital transformation by 2030

The Commission has proposed this week a Path to the Digital Decade, a concrete plan to achieve the digital transformation of our society and economy

by 2030. The proposed Path to the Digital Decade will translate the EU’s digital ambitions for 2030 into a concrete delivery mechanism. It will set up a governance framework based on an annual cooperation mechanism with Member States to reach the 2030 Digital Decade targets at Union level in the areas of digital skills, digital infrastructures, digitalisation of businesses and public services. It also aims to identify and implement large-scale

PRESS RELEASE | 12 March 2021
Commission welcomes agreement on the Connecting Europe Facility to fund greener, more sustainable transport and energy networks, and digitalisation

The European Commission welcomes the agreement reached by the European Parliament and the Council on the Connecting Europe Facility (CEF) proposal, worth €33.7 billion, as part of the next long-term EU budget 2021-2027.

PRESS RELEASE | 09 March 2021
Europe's Digital Decade: Commission sets the course towards a digitally empowered Europe by 2030

The Commission recently presented a vision, targets and avenues for a successful digital transformation of Europe by 2030. This is also critical to achieve the transition towards a climate neutral, circular and resilient economy. The EU's ambition is to be digitally sovereign in an open and interconnected world, and to pursue digital policies that empower people and businesses to seize a human centred, sustainable and more prosperous digital future. This includes addressing vulnerabilities and dependencies as well as accelerating investment.

PRESS RELEASE | 02 December 2020
Commission launches public consultation to gather views on improving fast broadband network rollout

Earlier this week, the Commission opened a public consultation, as part of the review of the Broadband Cost Reduction Directive, to collect views, until 2 March 2021, on incentivising the rollout of fast broadband networks, including fibre and 5G. The Directive, introduced in 2014, aims to enable fast electronic communications networks for people across the EU by reducing the related costs.

Browse Broadband Europe

Related Content

Big Picture

Broadband project planning

The Broadband planning section helps municipalities and other entities in their planning of successful broadband development projects.

See Also

Broadband: Financing public-private and private-run deployments

Investment efforts to finance public-private and private-run networks are made in cooperation between private actors who own existing infrastructure, and public authorities.

Broadband: Carrier models

Municipalities, municipal companies, joint ventures, and private companies can be involved in one, two or all three stages of broadband development.

Broadband: Actors in the value chain

The basic roles of Physical Infrastructure Provider (PIP), Network Provider (NP) and Service Provider (SP) can be taken by different actors.

Broadband: Access to infrastructure & service-based competition

Access to the broadband infrastructure is possible via different network nodes on the infrastructure and application level.

Broadband: Plan definition

The key to successful regional broadband development lies in defining a plan that includes goals, collaborations, and specific needs and stakeholders.

Broadband: Action plan

Broadband project plans help you map infrastructure needs, plan financing and deployment, monitor progress, find stakeholders, make the right choices and more.

Broadband: Technology overview

An overview of different wired, wireless and upcoming broadband technologies and a description of their advantages, disadvantages and sustainability.

Broadband: Basic business models

Choosing the right business model depends on the roles of the market actors in the broadband value chain.

Broadband: Investment models

Investment models present interesting involvement opportunities for a public authority that engages in regional broadband development.

Broadband: Main financing tools

The European Commission has a range of financing tools for high-speed broadband development projects across the EU.

Broadband: State aid

State aid for broadband may be necessary in some places where the market does not provide the necessary infrastructure investment.

Broadband: Network and topology

A broadband network consists of geographical parts. The topology of a network describes how the different parts of a network are connected. The most relevant topologies for the backbone and area networks are tree topologies, ring topologies and meshed topologies. For the first...

Broadband: value chain, actors & business models

Different business models are available to public authorities and other market actors in broadband development.

Broadband: Choice of infrastructure

Broadband networks require different infrastructure types based on different logistic, economic or demographic conditions. Use the questions to help choose.
