# Network and infrastructure expansion

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<th>80 percent</th>
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<td>Around 80 percent of the population in Germany had access to LTE by the end of 2014.</td>
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<td>Find out more</td>
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<td>By 2018 progress of the fiber-optic network rollout should allow VDSL vectoring lines with bandwidths of at least 50 Mbit/s for around 80 percent of all households.</td>
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<th>100 Mbit/s</th>
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<td>Our fiber optic-based technology, VDSL vectoring, speeds up download data transmission rates to up to 100 Mbit/s.</td>
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<td>More than 35 percent of our mobile base stations throughout the EU had been equipped with LTE technology by the end of 2014.</td>
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| |
| We achieved a new speed record of 580 Mbit/s in the LTE network in a field test conducted under real conditions. |
| Find out more |
Many people today consider fast, secure, full-coverage telecommunications networks to be an indispensable part of their everyday lives. These networks make new forms of communication and collaboration possible, make it easier for people to get involved, and boost economic development. They also facilitate the emergence of new business models. Production processes and services become more efficient and decision-making processes are enhanced due to the wide range of information available on the Internet. Our response to this increasing demand is to provide attractive offers. That is why we continue to push the expansion of our infrastructure and increase data transmissions speeds in both our mobile communications and fixed-line networks.

Management approach

The globally generated data volume will increase tenfold by 2020 compared to 2013,
according to a study conducted in 2014 by US-based IT company EMC. That would mean 44 billion gigabytes in the networks a year instead of 4.4 billion. The amount of digital data being produced in Germany alone is expected to grow from a current 230 billion gigabytes to 1,100 billion. Networks need to be continually expanded to be able to handle this volume.

Deutsche Telekom has been the largest investor in this area in Germany for years now and will continue to drive network expansion. The main objectives of our pan-European integrated network strategy (INS) form the basis for these activities: growth, efficiency and quality. We will continue to expand our networks, increase the efficiency of our systems and further strengthen our role as a leader in network quality. Our integrated network strategy is in line with the network expansion goals specified by the EU Commission and the German federal government [Digital agenda and Broadband strategy].

Network expansion based on four pillars
Deutsche Telekom's integrated network strategy (INS) for Europe is based on the four pillars LTE, fiber optics, VDSL vectoring and hybrid. In addition to expanding the LTE mobile network, fiber-optic expansion in combination with VDSL vectoring technology is the short and medium-term focus of Deutsche Telekom's INS for Germany. In March 2015 we launched our integrated hybrid offer, a combination of LTE and fixed-network line, thereby considerably increasing bandwidths throughout Germany.

We have defined two goals as part of our INS in Germany that we plan to achieve by 2018: Firstly, we plan to be able to offer LTE connections to 95 percent of the population. Secondly, progress of the fiber-optic network rollout should allow VDSL vectoring lines with bandwidths of up to at least 50 Mbit/s for around 80 percent of all households. This is subject to regulatory changes.

Upgrading and simplifying our network architecture
We intend to make our networks faster and more efficient. In order to achieve this, we are going to deactivate all analog PSTN (public switched telephone network) platforms that we no longer need and switch our entire telephone network to IP-based lines by 2018. Thanks to this switch, Deutsche Telekom will reduce the carbon footprint of its fixed and mobile networks in Germany by around 40 percent by 2020 compared to 2008. The switch to IP technology, which requires considerably less energy compared to earlier network technologies, will contribute significantly to the overall reduction of CO₂ emissions.

Further, we will rely on fiber optics when updating our network architecture in order to meet our customers' demands for fast network connections. Using VDSL vectoring technology, which is based on fiber optics, [Implementing our INS strategy in the fixed network] will increase download speeds up to 100 Mbit/s, and upload speeds even up to 40 Mbit/s. But vectoring requires more energy. To reduce this need for energy, we are working on control solutions for energy-efficient operation of our systems when data traffic is low. The combination of IP technology and VDSL vectoring is already considerably more energy-efficient than conventional PSTN technology.
And by simplifying our network architecture, we will also reduce energy consumption significantly, for example by introducing a broadband access server. The server assumes the role of several conventional network elements, e.g., routers, which can then be deactivated.

Implementing our network strategy in the fixed network (FTTH & FTTC)

Mobile workplaces, multimedia applications and high-quality online services continually boost the demand for higher bandwidths. We are taking fiber optics closer to our customers in order to ensure the long-term success of our business.

With our network rollout we plan to make ultra-high-speed Internet available to 80 percent of the German population by 2018. This is subject to regulatory changes. This means that we will considerably expand the fiber-optic network using FTTC, or fiber to the curb. For FTTC, fiber-optic cables are installed in the main cable up to the cable distribution box (the gray street cabinets found on sidewalks in German cities). From there, customers can be provided with large bandwidths via VDSL vectoring using the existing copper cable.

With FTTH, or fiber to the home, the fiber-optic cables are taken into the home. This will enable products with up to 200 Mbit/s for downloads and up to 100 Mbit/s for uploads, for example. FTTC alone already provides download speeds of 50 Mbit/s, which doubles to up to 100 Mbit/s when FTTC is combined with vectoring. Upload speeds are even quadrupled to up to 40 Mbit/s through vectoring.

We have been driving our vectoring infrastructure rollout since November 2013. Expanding the fiber-optic network, however, involves a great deal of time and financial expense. That is why expansion is currently not economically feasible in some regions and will only be possible through close collaboration between politics and business.

Implementing our network strategy in the mobile network (LTE)

All of the Deutsche Telekom Group's national companies made considerable investments in 2014 in expanding their LTE networks and continue to make rapid progress in network rollout: More than 35 percent of our mobile base stations were equipped with LTE technology in the Europe segment (12 European countries besides Germany) by the end of 2014. That means that 62.5 million people could theoretically use LTE to make mobile calls in their hometown as long as they have signed a contract for these services and have an LTE-capable device. Depending on the region, our national companies provide between 30 and 79-percent coverage. We are planning to increase this to between 75 and 95 percent by the end of 2018.

LTE expansion has been well on track in Germany too. We achieved approx. 80-percent coverage by the end of 2014 and plan to increase this to 95 percent by the end of 2018.
We are also making considerable progress with transmission speeds in mobile communications. We set the standard throughout Germany in early 2014 with LTE Plus, a service based on the Cat 4 standard. The service in the LTE 1.800 network attains download speeds of up to 150 Mbit/s, 50 Mbit/s more than conventional LTE networks. More than 150 German cities benefit from this service. Speeds of up to 300 Mbit/s have even been possible since fall 2014 with LTE Advanced based on the Cat 6 standard. Radio antennas have also been set up in many rural regions to enable LTE via the 1,800 MHz frequency. In trade journal connect’s network test, readers voted our mobile communications network the "best network" for the third time in a row.

As an innovation leader, we continue to advance our products and services. We achieved a new speed record of 580 Mbit/s in the LTE network in early 2014 in a field test conducted under real conditions. These speeds are made possible thanks to a new type of interplay between frequency bundling and MIMO (multiple input multiple output) technology.

One router, two networks: the hybrid connection

The hybrid connection is another pillar of our integrated network strategy that literally integrates networks. In fall 2014 we began offering our customers in Germany a combination of IP fixed-line and LTE mobile communications in a single fixed-line product thanks to hybrid technology. When customers require more bandwidth for their DSL connection, our hybrid service automatically activates LTE using a special hybrid router. This means that the transmission rates of both networks are added together. This is particularly useful in areas where we have only been able to offer limited Internet bandwidths via the fixed network.

In 2014 we became the first mass-market provider worldwide to offer this type of hybrid solution. Hybrid connections have been available in selected German states since fall 2014. We expanded the offer to customers throughout all of Germany in spring 2015.

Collaboration for broadband expansion

Deutsche Telekom collaborates with a number of local governments in its efforts to expand the fiber-optic broadband network. We signed our five-thousandth collaboration agreement in May 2014 within the scope of the More Broadband for Germany project. Since the project first started in 2008, we have extended broadband coverage to almost two million additional households alongside our regular broadband network expansion in this way. Rural communities in particular benefit from our partnership approach in which we work with them to come up with shared solutions.

CR-Report 2013
Migration to IP technology

All signs point to IP\textsuperscript{\textregistered}, the universal code of the 21st century. Thanks to IP\textsuperscript{\textregistered} technology phone calls are no longer transmitted via analog channels or using ISDN technology but in the form of data packets, a method that has been the standard in online and mobile communications services for some time now.

By setting up a pan-European IP\textsuperscript{\textregistered} fixed network we converge the previously separate networks and make them more efficient and higher-performing at the same time.

We had switched around 5.8 million households in Germany to IP\textsuperscript{\textregistered} technology by the end of 2014. In the other EU countries we increased the share of IP\textsuperscript{\textregistered} connections from 27 percent to 39 percent over the course of 2014. IP\textsuperscript{\textregistered} technology is also a requirement for VDSL vectoring with download data rates of up to 100 Mbit/s and upload rates of up to 40 Mbit/s.

Award for mobile network in Germany

connect (01/2015): Network test passed with top score fourth year in a row

- The testers from the connect trade journal put Deutsche Telekom in first place when it comes to speed (telephony and mobile Internet). We were the only provider to be rated "very good." Around 150,000 separate measurements were conducted and evaluated along 45,000 kilometers for the test.

connect (08/2014): Deutsche Telekom is industry leader with best service

- connect magazine conducted its fifth major network test in August 2014. They tested the quality and performance of DSL and broadband cable connections. Based on roughly 1.6 million measurements of voice and data traffic, Deutsche Telekom received 454 out of 500 points and received an overall score of "very good."

Stiftung Warentest (06/2014): First place for Deutsche Telekom two years in a row

- According to Stiftung Warentest, Deutsche Telekom's test-winning network provides the best coverage, reliable connection set-up and good voice quality. The jury was also impressed with our mobile Internet coverage and fast load times. The test comprised a tour of Germany using eight smartphones hooked up to a measurement system. Voice and data connections were constantly evaluated on freeways, highways and in city centers.

Chip network test (2014/2015): Telephony and mobile Internet outdistance competitors

- First place despite tighter evaluation criteria and an even greater distance between us and our competitors according to the results of the 2014/2015 Chip network test. After undergoing extensive measurements, Deutsche Telekom's mobile communications network was at the head of the pack in almost all categories tested, receiving an overall
score of 1.7 (with 1 being the highest). Deutsche Telekom was the only provider to receive a score better than 2.

Telecom Handel reader's choice 2014: Best mobile provider of the year for third time in a row

- Retailers and partner store owners rated mobile communications providers in 23 disciplines. The focus was placed on the most important factors for retail such as involvement in the contract renewal process, commission rates and accessibility of the retailer hotline. The result: Deutsche Telekom is the best mobile communications provider of 2014.