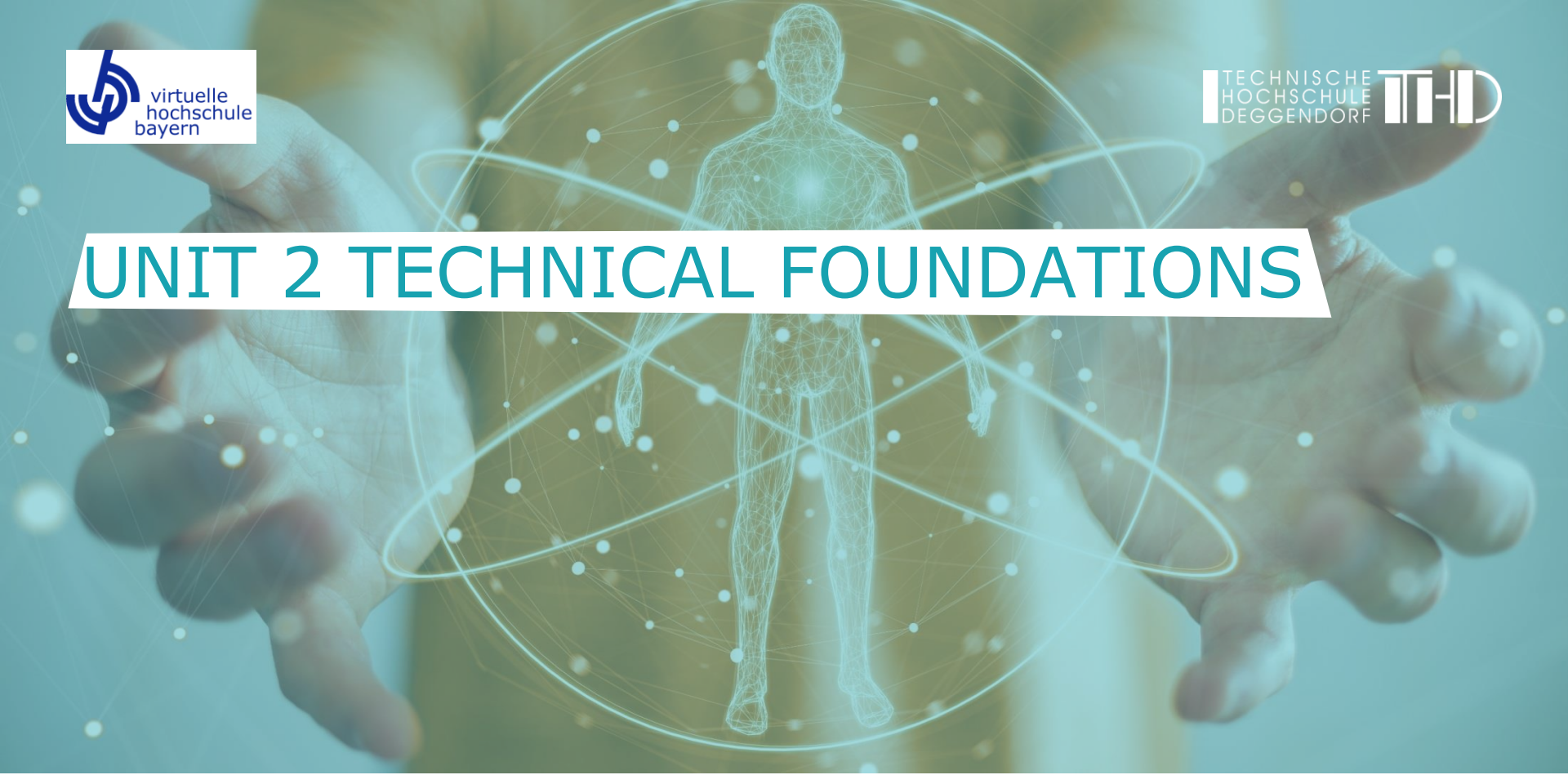
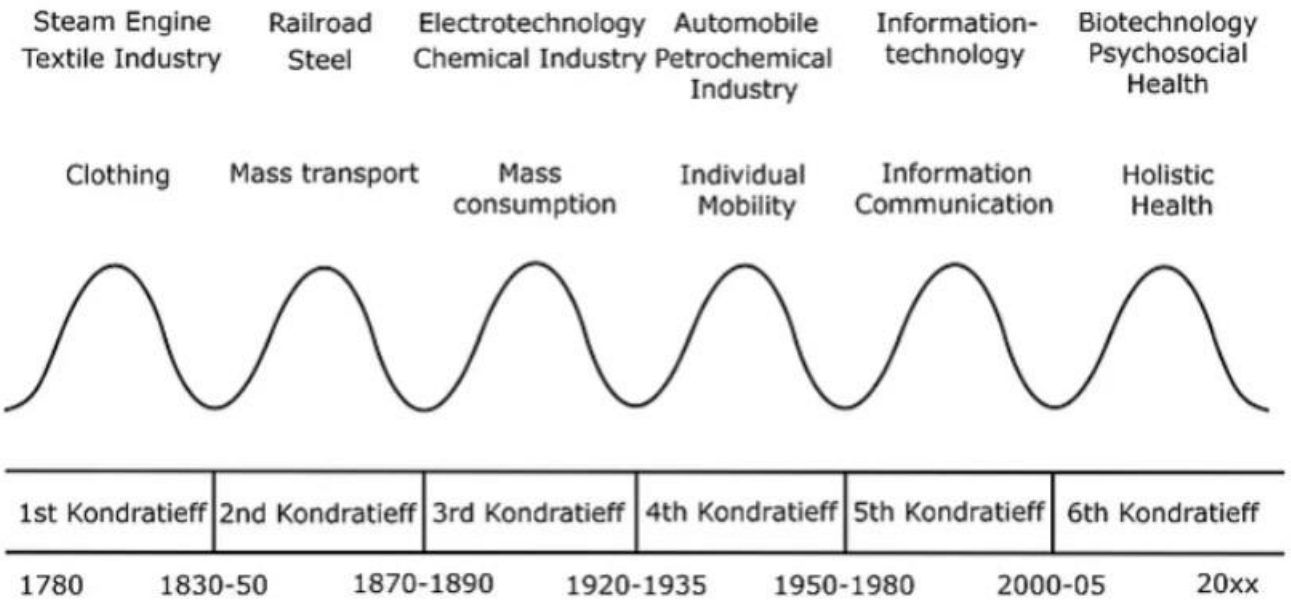


UNIT 2 TECHNICAL FOUNDATIONS

Prof. Dr. Horst Kunhardt,THD

2.1 RELEVANCE OF TECHNOLOGY IN HEALTHCARE



Source: https://www.kondratieff.net/kondratieffcycles (Retrieved on 25.03.2021)

2.1 RELEVANCE OF TECHNOLOGY IN HEALTHCARE

In the 1920s, the Soviet economist Nikolai Kondratieff developed the theory of the "long waves of the business cycle

- In the market economy, there is no uniform course, but a regular upswing and downswing (cycles)
- The long waves of a period have a time span of about 40 to 60 years. During this period, particularly groundbreaking inventions (basic innovations) play a role, which have longer-term effects on the market economy

2.1 RELEVANCE OF TECHNOLOGY IN HEALTHCARE

The 5th and 6th Kondratieff cycles are particularly significant for the development of healthcare telematics:

- In the 5th cycle, information technology continued to grow and has since provided the basis for globalized communication.
- The 6th cycle describes the growing importance of health as an economic good.
- These two development cycles thus paved the way for new techniques and procedures in medicine and are the "foundation" of new and modern fields such as health telematics.

2.1 RELEVANCE OF TECHNOLOGY IN HEALTHCARE

- Quality assurance of medical care
- Improvement of diagnosis and therapy options
- Reduction of costs by shortening the duration of illness and hospital stays (economic benefits)
- Improving the productivity of healthcare providers
- Fulfillment of process and outcome quality in the healthcare system

2.2 BASIS OF COMMUNICATION
DATA TRANSFER RATES

= Transmission of possible amount of digital data, in a certain time unit over the respective transmission channel.

- Smallest unit: bit per second (b/s)
- Usual speeds for Internet connections for business customers: from 100 Mbit/s, or 250 Mbit/s up to 1,000 Mbit/s (fiber optic connection)

Formula for calculating the size of a digital image:

File width (inches) x file height (inches) x image resolution (in dpi).

= file size in bytes

2.2 BASIS OF COMMUNICATION

EXERCISE EXAMPLE: Calculating the speed of data transmission in networks

Depending on the file size, the transfer over the Internet takes a certain time. Use the following link to determine the speed of a data transfer in different connection types, e.g. for a file with the size 100 MB. (LINK)

Depending on the examination method, med. image data have from a few MB up to a few GB.

EXERCISE EXAMPLE: Calculating the speed of data transmission in networks

Result:

For example, for a file size of 100 MB, a download using fiber optic lines takes 8s and an upload takes 16s.

2.2 BASIS OF COMMUNICATION
DATA TRANSMISSION

Digital Subscriber Line (DSL)

- High download and upload rates
- Residential customer segment

2.2 BASICS THE COMMUNICATION
GPRS / UMTS / LTE

-> Mobile radio as a common basis

General Packet Radio Service (GPRS)
Extension of the second-generation mobile communications standard, enables a transmission rate of up to 50 kBit/s.

Permanent virtual Internet connection that only occupies free radio space when the user is actually transmitting data

2.2 BASICS THE COMMUNICATION
GPRS / UMTS / LTE

Universal Mobile Telecommunications System (UMTS)

- Data transmission standard
- Third-generation (3G) mobile communications standard
- Transmission rates of up to 384 kBit/s
- Conversion and transmission of voice into data packets

Long Term Evolution (LTE)

- Fourth generation mobile communications standard (4G)
- Extremely high data transmission volume of up to 300 MBit/s
- LTE Advanced (4.5G)

2.2 BASICS THE COMMUNICATION

5G NGMN

5G Next Generation Mobile Network (5G NGMN)

- Fifth generation mobile communications standard
- More than 1 Gbit/sec. maximum download and upload rate

2.2 BASICS THE COMMUNICATION
BLUETOOTH

- Radio technology for data transmission in the near field range
- Especially for mobile devices (e.g. laptops or cell phones)
- Frequency hopping: the terminal changes the transmission frequency each time a data packet is sent by converting the narrowband signal into a signal with a larger bandwidth

2.2 BASICS THE COMMUNICATION

LAN / WLAN

Local Area Network (LAN)

= Limited network (limited to a company, private household or hospital complex) to which individual clients are connected by cable to a switch or router.

- Data transfer rate between 10 mbit/s and max. 10 gbit/s
- Integration of e.G. Computers, printers, fax machines

2.2 BASICS THE COMMUNICATION

LAN / WLAN

Wireless Local Area Network (WLAN)

= Wireless local area network, using radio standards. Connection of network or Internet-enabled devices (computers, laptops, printers, cell phones, tablet PCs, etc.) wirelessly to an existing network.

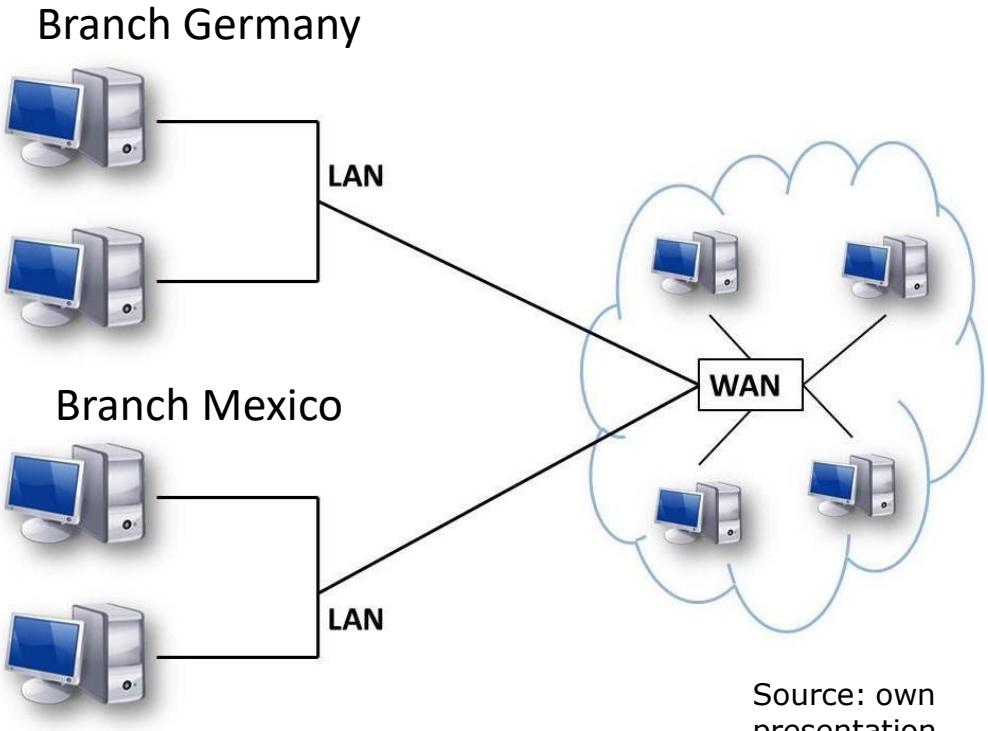
2.2 BASICS THE COMMUNICATION
WIDE AREA NETWORK (WAN)

WAN=Computer network of a large geographical area

- Extension up to 10.000 km
- Connection of e.g. several LANs with each other
- Transmission rates between 64 kBit/s and up to 622 Mbit/s

2.2 BASICS THE COMMUNICATION
WIDE AREA NETWORK (WAN)

Networking of multiple LANs with one WAN



Source: own presentation

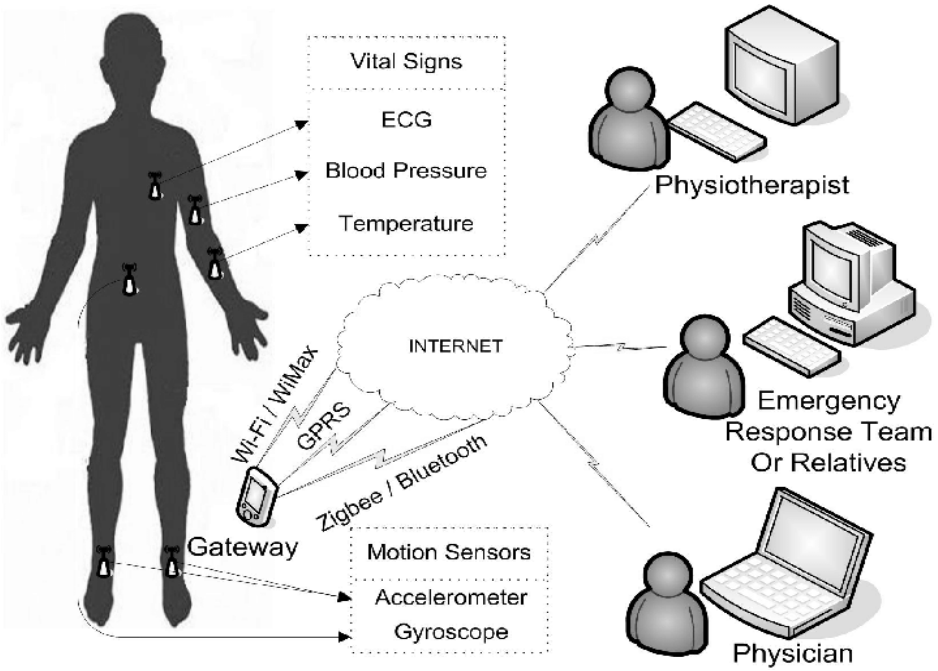
2.2 BASICS OF COMMUNICATION
BODY AREA NETWORK (BAN)

BAN= networks consisting of sensors

- Transmission of personal (vital) data for medical or sports monitoring of the wearer
- Sensors and actuators belonging to the network transmit the recorded values to a so-called body gateway
- The wireless BAN is based on the personal area network standard and uses transmission technologies such as bluetooth

2.2 BASICS OF COMMUNICATION
BODY AREA NETWORK (BAN)

BANs are often used in the context of telemedical applications (e.g. tele-monitoring)



Source: https://www.researchgate.net/figure/Example-of-a-Body-Area-Network_fig4_255358241 (retrieved on 03.11.2020)

Internet Protocol (IP-Protocol)

IP= Internet protocol

- Represents the worldwide network standard in LAN and WAN
- Addressing (routing) and transmission (forwarding) of data packets between sender and receiver across different networks

Internet Protocol (IP-Protocol)

- The basis for the transmission of data packets by means of IP protocols are IP addresses (= addresses in computer networks that are assigned to corresponding devices that are connected to a network).
- Example of an IPv4 address: 205.012.356.246

2.2 BASICS OF COMMUNICATION
DOMAIN NAME SYSTEM (DNS)

DNS = online distributed database system which translates IP addresses of computers into domain names

- Can also convert domain names (i.e. www.th-deg.de) into IP addresses
- When a name query is made for a particular IP address, the domain name server uses the domain address to establish a connection to the next higher or lower name server within a domain

2.2 BASICS OF COMMUNICATION
HYPERTEXT TRANSFER PROTOCOL (HTTP)

HTTP= Data transfer protocol in the context of the Internet

In addition to general data transmission, Internet addresses (hypertext documents) are addressed from the Internet (World Wide Web) and loaded into a browser

2.2 BASICS OF COMMUNICATION
HYPERTEXT TRANSFER PROTOCOL (HTTP)

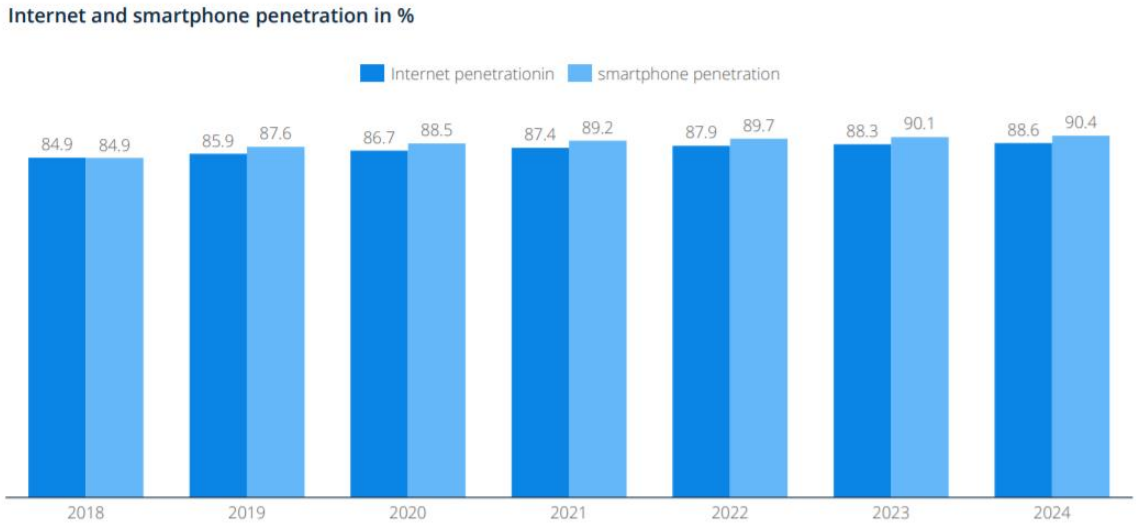
The addition "S" of the HTTP stands for secure and provides encryption of the HTTP by means of a so-called SSL protocol.

This additional encryption of the protocol enables a secured transaction of the requests as well as authentication

2.2 BASICS OF COMMUNICATION

German internet penetration is expected to grow slowly

Digital infrastructure: technology penetration (1/2)

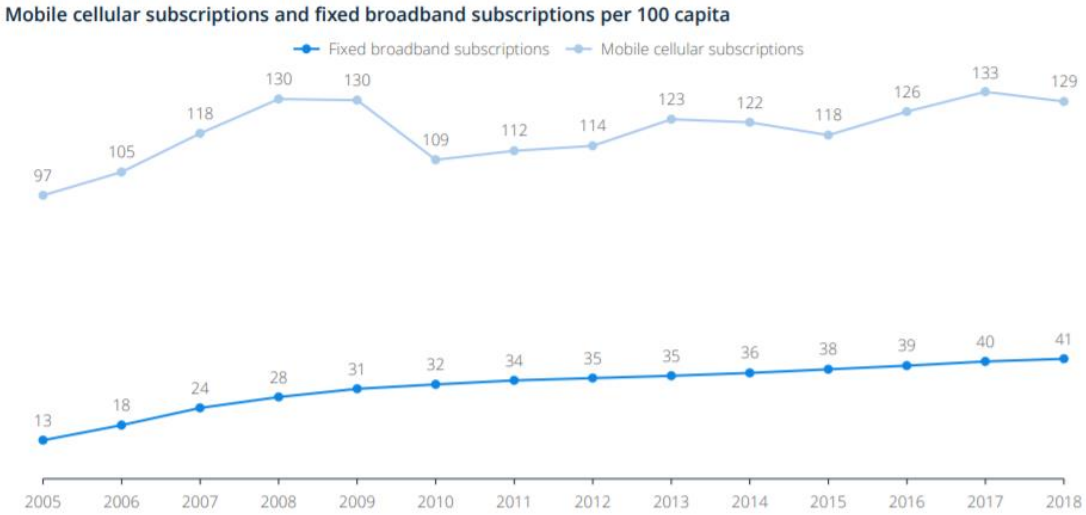


Source: https://de.statista.com/statistik/studie/id/50712/dokument/ehealth-market-report-germany/, retrieved on 11.03.2021

2.2 BASICS OF COMMUNICATION

People in Germany have more than one cellular subscription

Digital infrastructure: technology penetration (2/2)



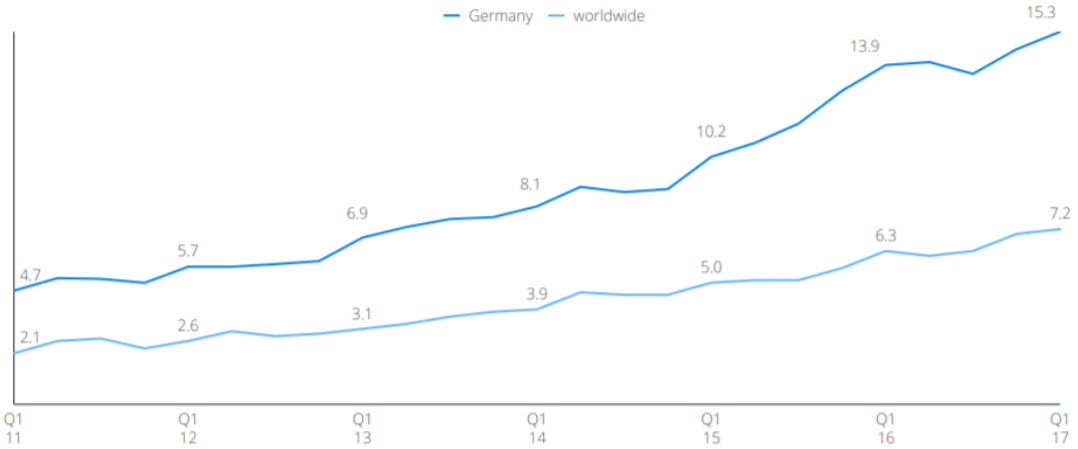
Source: [https://de.statista.com/statistik/studie/id/50712/dokument/ehealth-market-report-germany/,](https://de.statista.com/statistik/studie/id/50712/dokument/ehealth-market-report-germany/) retrieved on 11.03.2021

2.2 BASICS OF COMMUNICATION

Germany's internet connection speed is rising and surpassing 15 Mbit/s

Digital infrastructure: connectivity

Average transmission speed of internet connections in Mbit/s



Source: https://de.statista.com/statistik/studie/id/50712/dokument/ehealth-market-report-germany/, retrieved on 11.03.2021

2.3 SECURITY MECHANISMS
REQUIREMENTS

Confidentiality
Only authorized users can access secured data through authorization or identification.

Integrity
Used data must be intact and the operation of the requested service must be correct.

Availability
A service must always be available when it is needed.

2.3 SECURITY MECHANISMS

Encryption method:

- Encryption of data to transmit it over an insecure line
- Encryption of data in a particular system to protect it from unauthorized access using decryption access key.
- Encrypted data is referred to as cipher text.

Electronic signature:
= electronically generated, personal confirmation/identification.

2.3 SECURITY MECHANISMS

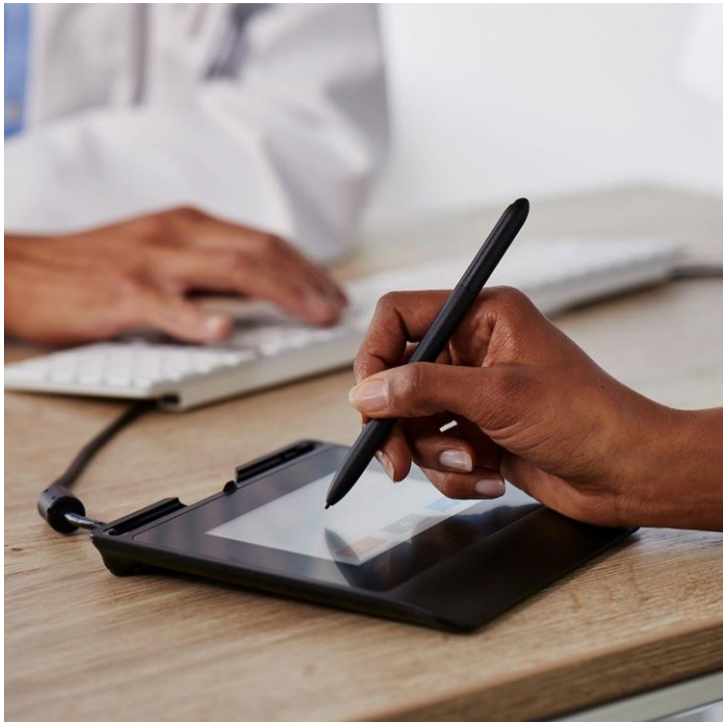
Digital certificates:

= digital certificates of identity to be able to guarantee a secure exchange of the respective keys.

- Identifiability of persons or objects
- Unambiguous authenticity as well as integrity of data third parties

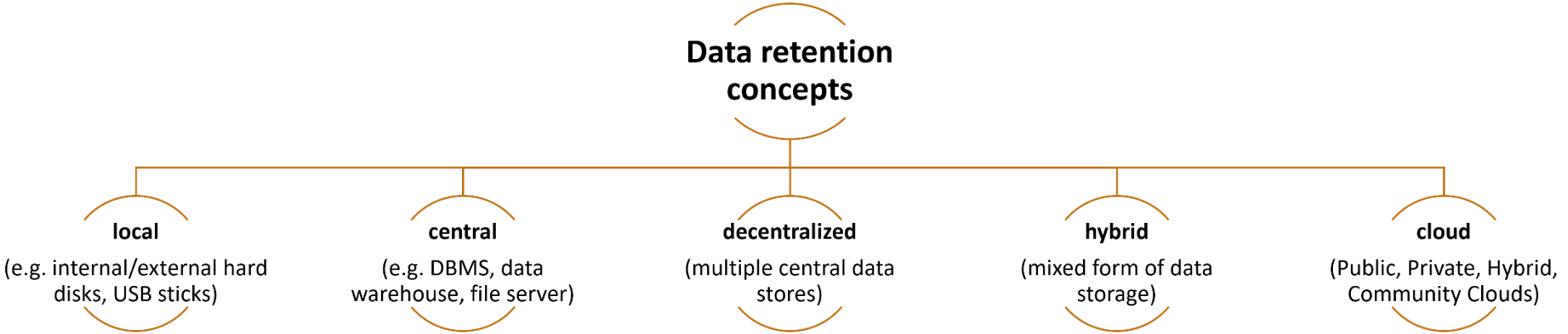
2.3 SECURITY MECHANISMS
BIOMETRIC SIGNATURES

- Authentication of users through the recognition of certain physical characteristics.
- e.g. fingerprints, iris patterns, or digital signatures.
- In the clinical area, so-called signature pads are increasingly used



Source:https://www.wacom.com/de-de/for-business/products/signature-pad-stu-540-541 (retrieved on 07/29/2020)

2.4 DATA RETENTION
OVERVIEW



Source: own presentation

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