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Knowledge



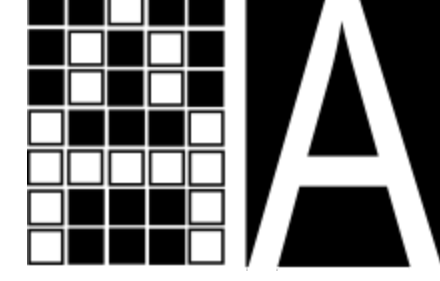
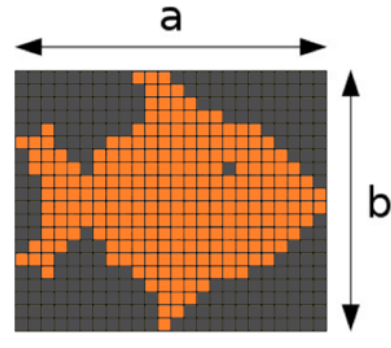
Displays



Displays are used in a multitude of devices, in a television screen, in a screen of a computer and in a smartphone, among others. There are huge differences in quality that should be evaluated before making a buying decision. But what exactly determines the quality of a display? When do we speak of a very good display? The answer to these questions depends on several factors. We compiled some of the most important factors for you.

Resolution

The **resolution** of a display is the product of the amount of portrayable pixels in the horizontal (a) and vertical (b) direction (pixels horizontal x pixels vertical = resolution). For example, if we have 1200 pixel in the horizontal direction and 700 pixel in the vertical direction, we would talk about a resolution of 1200 x 700, or 840 000 pixels. This is equivalent to 0.8 megapixels. When talking about displays we usually use the horizontal and vertical measurements, without calculating the product. In Full HD, for example, it is 1920 x 1080. We have listed some more examples in the table below.



To make it simple, we can say that the higher the resolution the better the portrayable image. To illustrate the difference between a good and a bad resolution we have added these images of the letter A. In the image with less resolution we notice the pixels and do not see the letter clearly, while in the one with a higher resolution we can clearly see the A, as more pixels are available to form the picture. The resolution is not the only factor influencing the quality of the image. You can find additional factors in the following sections.

FORMAT	WIDTH X HEIGHT	RATIO	PIXELS
PAL (VCD)	352 X 288	4:3	92,160 (0.09 MP)
VGA	640 X 480		300,000 (0.3 MP)
PAL (DVD)	720 X 576	BOTH	414,720 (0.41 MP)
SVGA	800 X 600		480,000 (0.48 MP)
XGA	1024 X 768		790,000 (0.79 MP)
HDTV 720P	1280 X 720	16:9	921,600 (0.92 MP)
WXGA	1280 X 800		1,020,000 (1.02 MP)
SXGA	1280 X 1024		1,310,000 (1.31 MP)
HD READY	1366 X 768		
FULL HD	1920 X 1080	16:9	2,073,600 (2.07 MP)
4K	4096 X 3072	4:3	12,582,912 (12.58 MP)

DPI

DPI or 'dots per inch' is a unit that represents how many dots will be printed in an area of 2,54 centimeters. It is a measurement of **pixel density**. In case of displays we talk about PPI or 'pixel per inch'. But, colloquially, people still mention DPI when talking about displays.

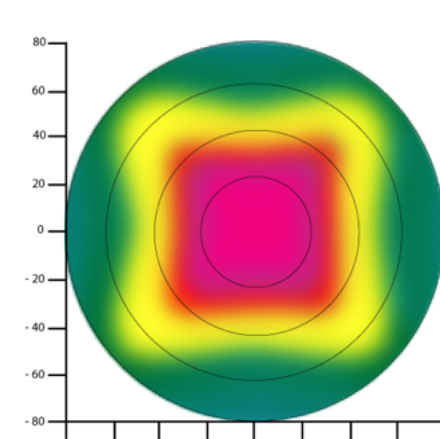
If the pixel density is reduced the picture looks increasingly grainy. To illustrate the effects of a reduced pixel density we incorporated the following flexyPage logo from high to low pixel density.



Comparison of current consumer devices

iPhone 6	Samsung Galaxy Note 4	Samsung Gear S
2208x1242 5,5 inch 500 ppi	2560x1440 5,7 inch 515 ppi AMOLED	360x480 2 inch 70 ppi OLED

Angle



The angle is the perspective with which the display is viewed. In a lift this can be from many different perspectives. In an office the monitor is always viewed directly, in an angle of 90 degrees. For example, while editing images there is just one person sitting in a direct angle in front of the display. In a lift or in digital signage applications the display is also viewed from the side or from below. People are not equally tall, nor can they always freely choose the point at which they stand in a lift. This means it is necessary for the display to have a perfect view from the left, the right, from above and from below, since lift displays are mostly attached above the doors or in the edges. The display content has to be seen by children, sitting wheelchair drivers, and from users who stand to the side of the display. The displays needed for this kind of work are displays who have a great viewing angle, that means they do not have a loss of brightness or contrast. A few of the new generation of displays offer a great angle, see 'Technology'.

Using a Twisted Nematic - Display (see. Technology) the contrast declines faster if the display is viewed from below. The axis in the picture describe the angle, pink means ideal contrast, while the contrast from red to green declines. For the use of such a display in a lift this would constitute a problem. Children and wheelchair drivers would probably be less able to read everything on the display.

Brightness

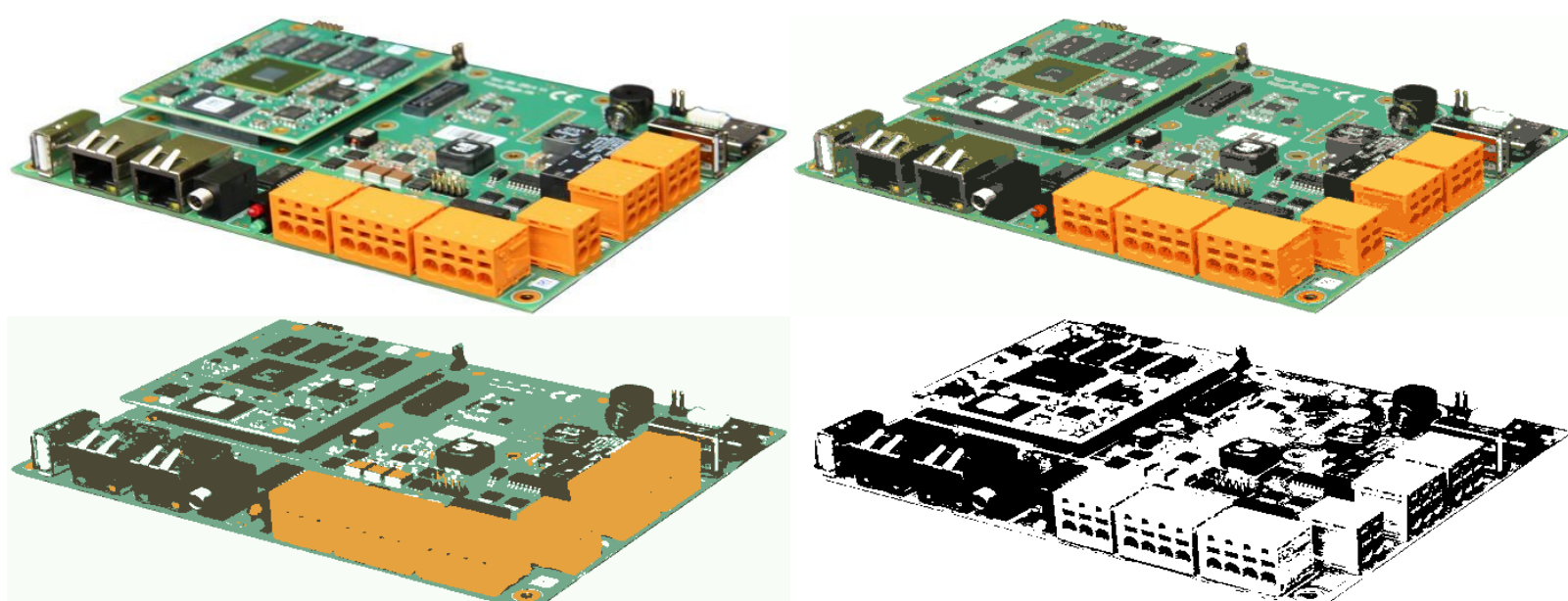
In Liquid Crystal Displays (LCD) and Active-Matrix-Displays (TFT) brightness is determined by the light source behind the liquid crystal. The light source is usually a LED light or CFL tubes. If the lights are brighter, the display will be brighter. Brightness in displays is indicated in Cd/m². Typical values that are achieved range from 350 to 400 Cd/m² in the office. Outside, with Digital Signage or in lifts with direct sunlight exposure, brightness of 1000-1300 Cd/m² is necessary in order to view everything on the display. There are different lighting conditions throughout the day, which is why displays should ideally adjust their brightness accordingly. The 1300 Cd/m² necessary at times are much to bright for night times or even winter days.

CFL-tubes are increasingly being replaced with LED as light source. This is because tubes have a higher energy demand and age faster. Their brightness decreases up to 50% in 18 months.

Colors



Beside the dot density, the **color depth** is another important factor for the quality of the display. The amount of gradation in a color channel is measured in bits, with one bit equivalent to two gradations. The higher the gradation the more degrees of brightness can be represented on the display. For example, with a color depth of 24 bit we can display over 16 million colors, as many colors as are distinguishable by the human eye. Therefore, this color depth is called 'true color'.



Technology

LCD means 'Liquid Crystal Display', a display containing liquid crystals. Behind this liquid crystals is a light source. If a current is applied the crystals turn and by doing so control the kind of lightwaves that can pass through. This way, an image is created on the display.

LCD are distinguished by the arrangement of the pixel (Twisted Nematic, Vertical Alignment and In-Plane Switching), the background lighting, triggering of the pixels (Passive Matrix or Active Matrix) and the pixel material.

Twisted Nematic (TN)

If there is no current on the Twisted Nematics Display, polarized light passes the 90° turned liquid crystals and the display appears white. In proportion to the voltage applied, the liquid crystals turn and change the polarization of the light. Twisted Nematic is the most common technology and also the oldest. It is very inexpensive to produce. A TN display possesses a smaller viewing angle and a worse representation of the color black than a VA display.

Vertical Alignment (VA)

In a Vertical Alignment display the liquid crystals are aligned vertically and the display is black if no current is applied. If a voltage is applied the crystals change their alignment and light from the background can pass. Displays with Vertical Alignment Technology possess a darker black background, better contrast, a better viewing angle and greater temperature compatibility than a TN display.

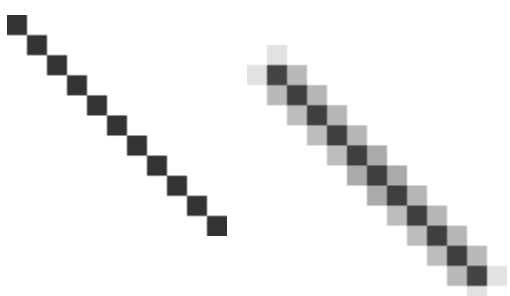
In-Plane Switching (IPS)

Displays with IPS have a good viewing angle, a fast reaction time and a good representation of colors. But IPS displays are also using much more energy and are more expensive to produce.

Organic Light Emitting Diodes (OLED)

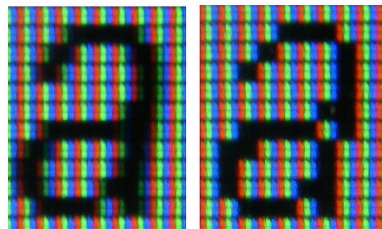
OLED consist of ultra-thin organic layers, that emit light when voltage is applied. OLED are a special case since they are not LCD. They don't necessitate background lighting and therefore possess an extraordinarily good contrast.

Anti-Aliasing



Since pixels are coloured squares, a line that is not completely aligned to the pixels (horizontal or vertical) will appear 'jagged' - as in our image. As it is, this line looks more like a staircase. Anti-aliasing exists to eliminate this problem. With anti-aliasing similar-coloured pixels are added between the 'steps' of the staircase.

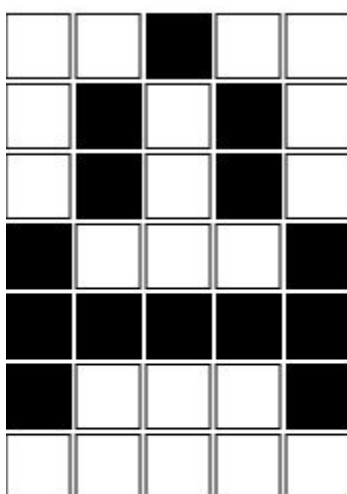
After adding the pixels the image looks better and smoother to the human eye from a certain distance. Anti-aliasing is also used for type fonts. In the following we will show you the letter A on a white display. The left image is with anti-aliasing, the right one is without anti-aliasing.



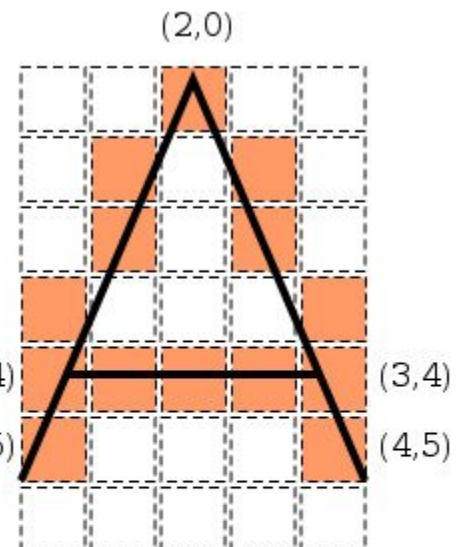
Vector fonts

Bitmap-Fonts are saved as pixels on a matrix. A vector font is different from a bitmap font. Here, not the arrangement of pixels is saved, but signs that are characterized by starting and end coordinates of a line. This way, vector-fonts are randomly scalable. Vector fonts can be divided further into two types, the outline fonts and the stroke fonts. In outline-fonts the outlines of the letters are defined, the stroke fonts save the size of the strokes. Outline-fonts are the most commonly used vector fonts.

Examples of vector fonts are, among others, True Type fonts (*.ttf), OpenType fonts (*.otf) and Google Fonts.



Bitmap-Darstellung des Buchstaben "A"



Vektor-Darstellung des Buchstaben "A" (mit unterlegter Bitmap-darstellung)

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Access Restriction



As an alternative for the old-fashioned use of keys there are multiple access restriction systems available today. In a lift such an access control system makes sense if specific floors or areas are to be accessible only for selected persons. These floors would appear on the display only after activation with a card, a tag, or a fingerprint scan. If a passenger without identifier enters the lift and wants to visit the doctor on the second floor, the third floor with private apartments remains invisible on the display and therefore inaccessible.

Sensors

For the authentication of the users sensors are necessary. Depending on the type of authentication they can be very different. Additional functions can become possible with the evaluation of other sensors. For example, in a hospital the approval to enter a certain floor could occur only after a sensor in the lift has detected a bed or the load measuring sensor registers certain values.

Via different ports different sensors can be connected. The flexyPage displays can be equipped with a touch sensor for PIN input, for example, and access the data of load measuring sensors, RFID readers and similar devices.

PIN-Input

If the display is equipped with a touch sensor the authentication can be realized via a PIN number. In order to do so a numeric keypad can be portrayed on the display. Only after succesfully entering a PIN a predetermined output signal or button on the display will be unlocked. A disadvantage of this procedure is that the PIN number can be spied upon by third persons during the input.

If the displays are connected the management of the PIN numbers and functions can occur via a central database.

Tags

Another procedure to authenticate users or to unlock functions is the use of tags in combination with the respective readers. There are a multitude of varieties, for example, RFID tags with a fixed unambiguous number, or tags where data can be saved. The communication protocols to evaluate or write on the tags differ a lot between the varieties as well.

Unambiguous Number

An easy procedure is the use of RFID-Tags, which only contain an unambiguous number. This number will be read by the reader and, by assigning it to a specific person or function, a specific action can occur. The advantage of this procedure is the low price of the tag, and the fact that it only has to be deleted from the target system if lost, to remain safety.

Programmable Tags

Programmable tags provide a storage space in which individual data can be saved. This way a specific authorization can be saved on the tag as well. However, if the tag gets lost the new "user" can use it as well.

Often combinations of both procedures are used. An unambiguous number for identification and the programmable area, for example, for reloadable payment systems.

The flexyPage displays can evaluate external sensors that provide the tag data via CANopen-Lift protocol or via TCP/IP. After receiving the tag data programmed outputs can be set or defined widgets or buttons can be unlocked on the display.

Fingerprints

Fingerprint sensors are increasingly inexpensive and also increasingly common. Many laptops and the first smartphones are already equipped with such a sensor for quick authentication.

The fingerprint sensors evaluate the fingerprint and compute an unambiguous hash value. This value is comparable to the unambiguous number as used in RFID tags. A definite assignment of a user can be realized this way. The advantage of this solution is the fact that nobody can 'forget' his fingerprint somewhere or lose it, and therefore it is always 'at hand'. The disadvantage is the slower speed of reading it, when compared to RFID tags, as well as the fact that the sensors are contact-based and can become dirty or can be destroyed by vandalism. A certain trust in the manufacturer is also a prerequisite, to feel assured that the fingerprints or hash values are only used for the intended purpose.

Connection

By using a well planned connection the access control can be made even better. By connecting various systems the same tags can be used for different applications. The reloadable payment card can be used for access control in a building, for login with a PC and for access to the lifts.

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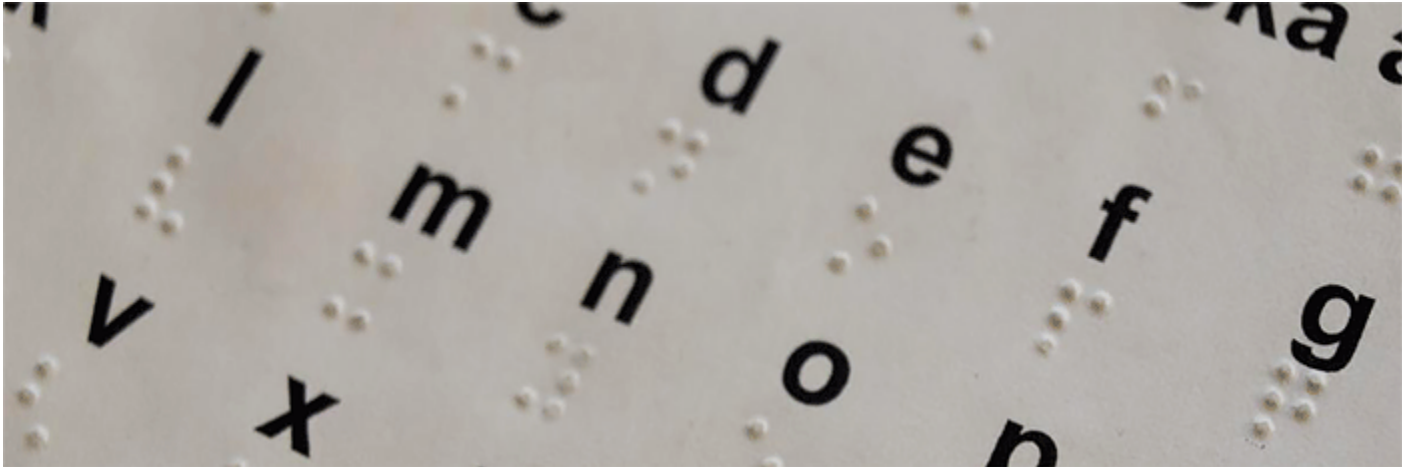
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Accessibility



A display is a tool for communicating with the user. The user should gain additional value from the information displayed there or from the easy operation. For a communication without problems to occur the displays have to correspond to the needs of the user. The users, however, are diverse and the seven senses, as well as the physical and mental abilities, are different from person to person. When choosing the right display various disabilities of the user have to be considered to guarantee optimal operation. The special factors here are size, resolution, viewing angle, contrast, layout and the functions of the display.



Visual Impairment

Displays transmit a large amount of information on a relatively small space in visual form. Especially users with visual impairment can be limited in their use. Not only complete blindness has to be considered here, but also problems resulting from poor eyesight because of age or red/green-color blindness.

When designing the layout the size of the individual elements has to be considered, as well as their contrast with the background, which have to meet minimum requirements. For people with red/green-color blindness elements that only differ in these two colors should not be used.

So-called Screen Reader offer help for people with visual impairment as well. These are text-to-speech-applications that describe the content of the screen and thus enable blind people to use the display as well.

Hearing Impairment / Deafness

The causes of hearing impairment are diverse, whether related to old age, as a result of an illness or as a result of noise. As a result the person in question loses part of his ability to hear or becomes completely deaf.

During an emergency call it is important to help people with hearing impairment in particular. Current emergency call devices possess outputs to control pictograms, which can signal the connection buildup and the established connection. By using a display explaining texts can also be used besides the pictograms. If the displays are equipped with a touchscreen the user can switch the language as well.

Dyslexia or Foreign Language



Foreign language users of the display and people with dyslexia are not able, or able in a limited way, to recognize the content of written text on a display. The use of pictograms can help to understand the content here. For users of foreign languages there is the possibility to choose the language of the user interface, for example, by selecting the flag of the respective country.

Size and Angle

Not only people in a wheelchair have a different viewing anlge towards the displays in a lift. Children using the lift need displays to portray the image accurately from a 6 o'clock - position as well. The display must not have strong color changes or changes in contrast when viewed from below or from the side.

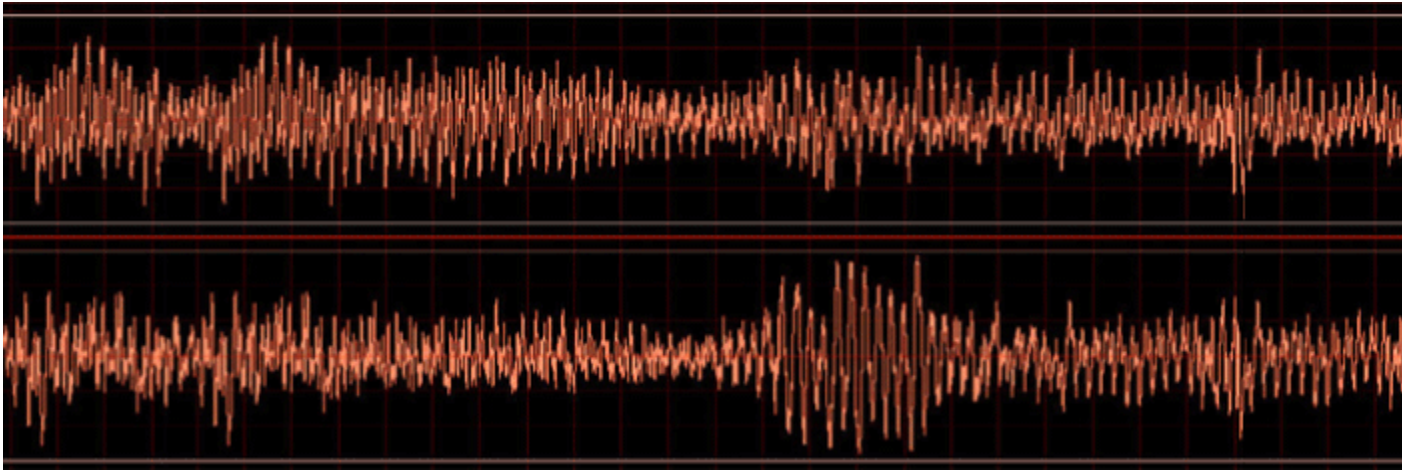
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Audio and Video



Everyone knows about MP3s by now, and almost everyone uses YouTube. Whereas in the past one had to wait for a song to be played on the radio, it is now possible to find the whole history of music only one click away. Be it by buying MP3s or using a streaming service. But what other files exist besides MP3s and how do they differ? And how are videos saved, given that they include sound as well as images?

Audio File Formats

Audio files can be saved in different formats on a storage medium. Uncompressed audio files take up a lot of space. Therefore audio information is often saved in a compressed format. The typical uncompressed format is PCM, which is saved as .wav under Windows and as .aiff under OS. These file formats contain the unedited original information. The compressed formats are divided into lossy and lossless formats. The lossless formats decrease the data by means of compression measures that allow for the restoration of the original data. Examples are MPEG-4 SLS, MPEG-4 ALS, Windows Media Audio Lossless (WMA Lossless) and Shorten (SHN). To create lossy formats the measures of compression will be accompanied with measures to reduce the amount of data. Tones that are not recognizable by human ears are deleted from the audio files. This way, it is possible to create even smaller files, while reducing the quality of the audio signal. In most cases, however, this is reasonable, for example, with telephony, where the transmission of the message is important and not the sound, or in environments where this a lot of ambient noise. Examples for lossy file formats are MP3, AAC, or Windows Media Audio Lossy (WMA Lossy).

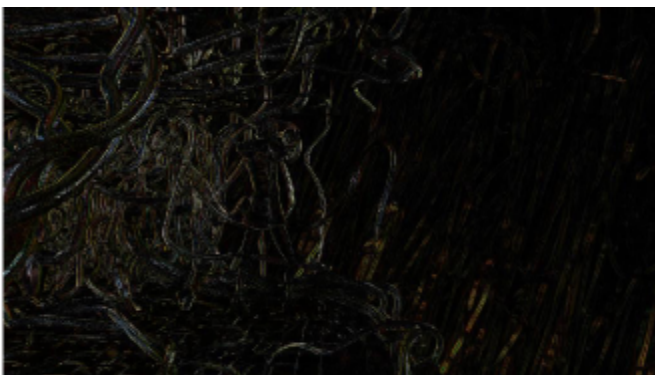
Video File Formats

Recording video data creates data volume that is a lot higher than the volume of audio data. Effective compression measures are even more important here, to make the data easier to save and to transmit. Achievable rates of compression are between 1:5 and 1:200.

Among the common video file formats are WMV (Windows Media Video), MPG (Moving Pictures Experts Group I und II) and MP4 (Moving Pictures Experts Group 4), AVI (Audio Video Interleaved), FLV (Flash Video), MOV (Apple Quicktime Movie) or RM (Real Media). These file formats are usually proprietary container formats, in which the data is saved by using several different codecs or the same codec.



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Audio Codecs

An Audio-Codec is a device or computer program that codes and decodes a digital data stream in bits to save audio-information. Most codecs contain both an ADC (Audio-to-Digital Converter), as well as a DAC (Digital-to-Audio Converter). They also contain measures to reduce data size.

Video Codecs

A video codec is a program or device that codes and decodes video information. To code and decode the same codec has to be used. A popular video codec is H.264, whose efficiency is up to three times that of his predecessor MPEG-2 (H.262) and which is able to compress videos in HD. As a result of this efficient compression the space is reduced, but the computing power has to increase accordingly.

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CANopen



CAN means Controller Area Network, a message protocol which has originally been developed for automobiles. Modern automobiles possess a great number of component parts that have to communicate with each other. With CAN it is possible for them to communicate without the detour via a central processor. CAN is extremely robust and quick, at low costs. This makes CAN attractive for other applications as well.

CANopen is an open protocol that has been internationally standardized, it determines how systems of lifts, automobiles, and others, send and receive data. CANopen is being developed and maintained by the [CiA \(CAN in Automation\)](#), an organization of users and manufacturers. Instituted mainly by German medium-sized businesses, CANopen is common in Europe, but the rest of the world shows growing interest in it as well.

Profiles

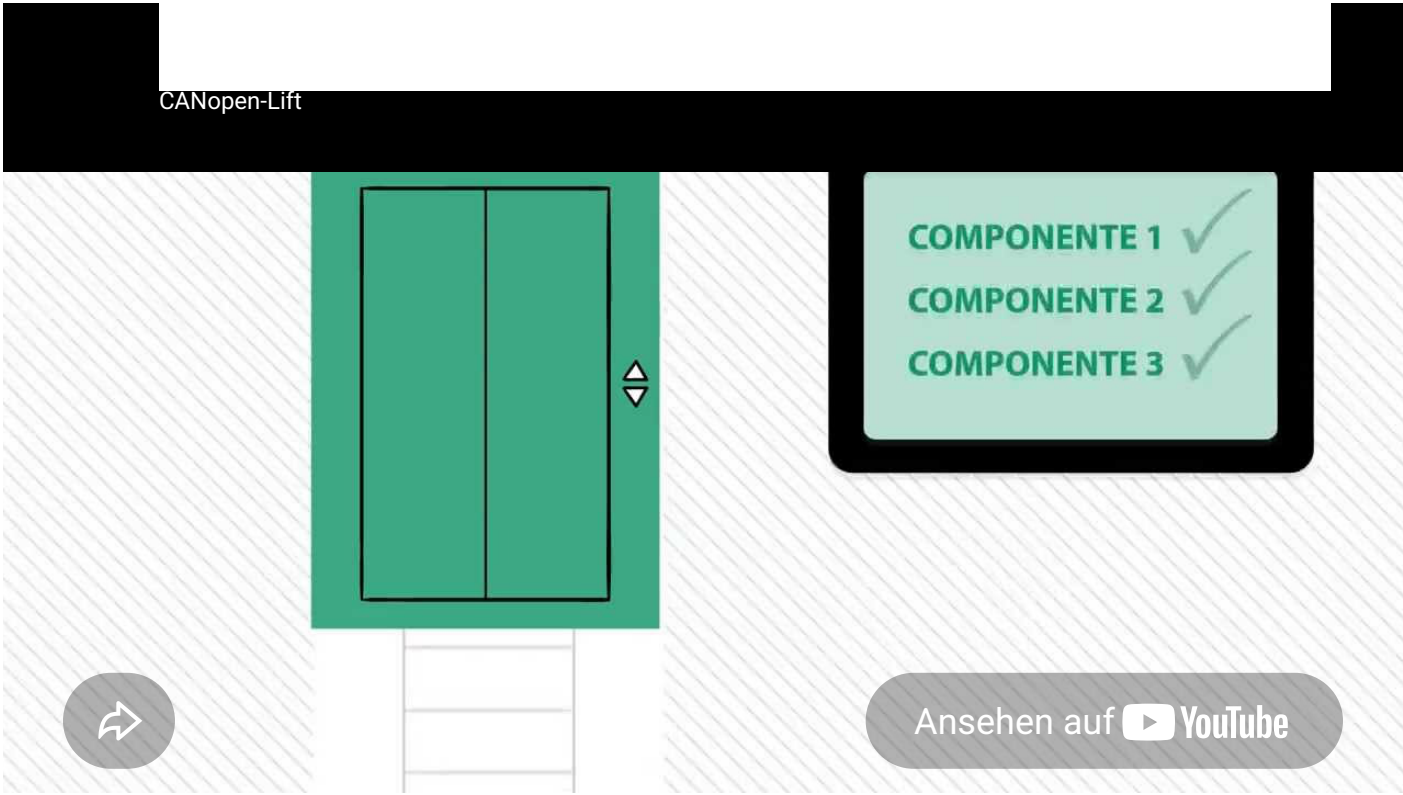
An application profile describes objects of an application. This is in contrast to a device profile, where the objects of a device class (e.g. encoder) are described. Device profiles are meant to make devices exchangeable as much as possible and to make them work as plug & play. But while users want devices that are as exchangeable as possible, some manufacturers want them to be less exchangeable because dependence of the users seems to be better for them. Additionally, manufacturers can find measures to protect their work on the basis of patent law.

New profiles are always under development. For them, as well as for all other profiles, the CiA assigns a number, which can be found in this list: [CiA - CANopen-profiles](#).

Advantages of CANopen

The manufacturer-independent components that use CANopen are compatible because of the standard they share. This way, you are not tied to a single manufacturer, as is the case with complete solutions, and you can avoid high life cycle costs. Another important factor is the speed of transmission of CANopen. With some devices a transmission inside a millisecond is possible. Furthermore, the error diagnosis with CANopen is quick and comfortable, the price performance exceptionally and the number of applications increasing.

You can find more information about the open standard CANopen-Lift in the wiki at [CANopen-Lift.org](#). The advantages of CANopen CiA-417 for the user are explained in the following image video by CANopen-Lift.



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Energy Demand



Human energy consumption is significantly too high. The burden on our environment as a result of our ever increasing demand for energy is getting higher and significant signs of global warming are already visible. In the interest of the following generations it is important that we use our resources more sparingly. Politicians have come to see this as well and released normative guidelines.

VDI4707

The guideline VDI4707 describes a certificate for the energy efficiency in lifts. Here the energy efficiency of lifts is graded from A to G, similar to the system users know from refrigerators. For the determination many factors, such as different conditions of use, transport heights and nominal loads, were considered. This makes the VDI4707 an ideal indicator for the energy demand of a lift.

CANopen-Lift Energy Management

With lifts it is important to distinguish basic demand, standby-demand, and demand for a drive. Basic demand involves all devices that have to be permanently in operation, for example, emergency call devices. Standby-demand occurs when the lift is waiting for a user. In the VDI4707 the standby demand is determined 5 minutes after the last run. The demand for a drive describes the demand while the lift is active and opening the doors or closing them, or when a drive through the shaft is occurring.

The highest energy demand (app. 60%) of modern lifts occurs in times of rest, when the lift is not used. In the standard CANopen-Lift a highly complex energy management system has been integrated to regulate the energy demand of components in times of rest. This way the standby demand can be reduced by up to 80%.

[learn more: Energy Management CANopen-Lift >>](#)

Sensors

To reduce the standby demand of a lift the components have to be switched to an energy savings mode or switched off completely during rest. In order to do so it has to be made sure that no passengers are in the cabin when the lighting is to be switched off.

By evaluating a high number of sensor data, which are available via the CAN bus of the lift, it can be determined whether there are passengers in the cabin with the help of complex algorithms. If the cabin is empty the cabin light, displays, voice prompt and others can be deactivated. All encompassing sensors therefore offer the possibility to reduce energy demand without restricting use of the lift.

Dynamic Computing Power

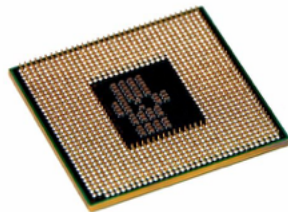
The energy demand of a microprocessor largely depends on the clock frequency and the utilization of the processors. Modern processors offer many energy saving modes that can be activated, to reduce energy demand and heat generation. In multi-core processors whole kernels can be set into sleeping mode, if there are only few computations at the time.

In the flexyPage displays modern quadcore processors are used and the software uses extensive energy saving options to dynamically reduce the energy demand up to the complete deactivation of unused kernel.

These procedures are also used in current PCs and notebooks. The manufacturers distribute the integrated procedures under various brand names. Whether **PowerNow!**, **Cool'n'Quiet** or the **SpeedStep** technology of Intel - all these procedures use similar functions to reduce energy demand in times of reduced computing power.

Processor Architecture

Regarding the energy efficiency of processors several factors play an important role. Among them the so-called Thermal Design Power (TDP), the production process, clock speed and integrated energy saving modes. The TDP indicates how much power is consumed by the processor during maximum workload. The value of the TDP should therefore be as low as possible. Clock speed is an indication of performance that has a significant effect on the energy use of the processor. Here a compromise between performance and energy demand has to be found. The production process should be as little as possible, because in smaller structures there is less energy lost in the form of heat.



x86 Architecture

The x86 architecture is a microprocessor architecture and the instruction sets involved, as they are being developed by Intel and AMD. Processors with a x86-architecture are used in almost every PC or notebook.

Monitors with an integrated PC functionality are called Panel PCs. They usually use industry computers, which are often equipped with a touchscreen and specialized for a certain application. Panel PCs are usually fitted for 24-hour-use and possess high electromagnetic compatibility. So far Panel PCs have usually been equipped with x86 processors and standard operating systems, such as Windows CE, have been used.

ARM Architecture

ARM means Advanced RISC Machines. The ARM-architecture has been developed by the British company Acorn in 1983. Although its name is not well known outside of IT circles this type of microprocessor is among the most used processors worldwide.

In relation to computing power processors of the ARM architecture are very energy sparing and have low cooling requirements. As a result these processors are used in almost every smartphone and tablet PC. The newest generation of ARM processors achieves the computing power of x86 processors and there are already first servers with ARM architecture.

In the flexyPage displays powerful quadcore processors with ARM architecture are used. Therefore flexyPage displays are ideally suited for industrial use. As a result of the low waste heat active cooling is not necessary, which results in very small sizes.

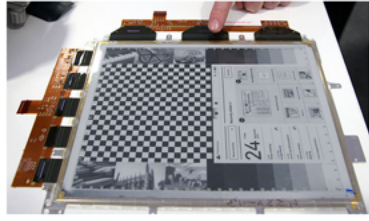
Background Lighting: CFL and LED



Modern LED use significantly less energy than older CFL tubes. For the background lighting in modern displays the use of LED backlights is now common. They offer, besides high energy efficiency, a significantly higher longevity. In combination with automatic brightness control and automatic deactivation of background lighting during rest this results in maximum energy efficiency.

ePaper

The so-called ePaper is a special form of display. It imitates the properties of natural paper. Displays of this kind do not emit light themselves but reflect the incoming light. To portray distinct colors (currently only white, black and red) small pellets that represent one pixel are appropriately aligned. In order to do so a voltage has to be applied briefly. After that the pellets remain in their state, even if the display is completely switched off. Besides the energy savings as a result of non-existing background lighting there is no energy demand for the maintenance of the written word, but only for the rearrangement of the picture. The ePaper is currently too slow to portray dynamic processes.



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Environmental Conditons



Displays can be damaged in adverse environmental conditions. Like most electronical devices their expected life span can be reduced by extreme temperatures, humidity or cleaning products, among others. Therefore it is important to choose a high-quality product and keep it in an adequate environment. Below we have listed environmental conditions that we should bear in mind when choosing, installing, using and maintaining our display.

Heat

Electronic devices in general react sensitively when facing temperatures that are too high. This can lead to the complete destruction of the electronic device, and displays are not an exemption. How displays react to heat depends on various factors. These are, for example, the materials used, the quality of components, the cooling system and the brightness of the background lighting.

Most displays for industrial use have a proper temperature range from -20° C to 70° C. Since they are built into a housing and emit waste heat themselves the maximum possible ambient temperature is lower, however. To dissipate the heat occuring in the housing a cooling system is needed. Cooling systems are divided into passive and active cooling systems. In passive systems the heat is dissipated via the housing or via ventilation slots. Cooling elements can be used as well, which enlarge the surface of the housing.

Among passive systems we find heat sinks, which are thermal conductor metals that conduct heat away from the source and dissipate it to the air, and heat spreaders which are metal plates sometimes placed between the heat source and the heat sink as a way to avoid heat concentration in a concrete point and finally heat pipes, sealed tubes filled with liquid connected with the heat source at one end and the heat sink at the other, the cooling power of this liquids is very high.

Sometimes using passive cooling systems is not enough to cool our systems. In this case we need to complement them with an active cooling system. The most widely known active cooling system is probably the fan, which is used to accelerate air flow in many electronic systems, since natural convection is not enough for most of them. However, among active cooling systems we also find liquid cooling systems, consisting in open- or closed-loop circuits where liquid is pumped. This systems are usually used in high performance electronics.

In a lift high ambient temperature does not only occur at southern latitude. In a glass lift exposed to direct sunlight temperatures above 60°C can easily occur as well.

Cold

Extremely low temperatures can also cause damage to displays. If the display is used in ambient temperatures of less than -20°C the scren liquid can freeze and components can become rigid and brittle or even burst.

A temperature fluctuating from minus to plus temperatures close to 0°C can be problematic as well. At this temperature surrounding moisture condensates, causing problems in all electronic circuits in the display.

In general LCDs react more sensitively to lower temperatures when compared to TFTs. In LCDs the screen build-up is significantly slower.

Humidity

Humidity is evaporated water contained in the air. There are two ways humidity can occur: absolute humidity, is the objective amount of water in the air in a concrete moment, and relative humidity is the percentage of absolute humidity compared to the possible maximum for a concrete temperature.

Both, very low and high humidity levels can destroy a display. In the first case, relative humidity levels under 35%, static electricity can occur, resulting in electrical discharges to the display and destruction of the whole system.

High relative humidity levels, over 80%, increase the risk of water condensation on the display components' surfaces, this leads to corrosion and, in extreme cases, to short circuits on the device. Destruction of the electronic systems can hardly be avoided.

Salty environment

Salt concentration increases the problems with and the effects of humidity. This means if condensation occurs in a display used close to the sea, for example on a ship, oxidation and corrosion will appear faster than in a non-salty environment. Short circuits are favoured by salt as well, since this element is a good electricity conductor.

Cleaning and sterility



A beautiful display should be perfectly clean at all times. Especially if the display is equipped with a touch sensor greasy fingers will occur very fast and will worsen the optical appearance. We are therefore always anxious to keep our display clean and usually use common cleaning agents. But many cleaning products can harm our display. Many cleaning agents contain acids, alcohol or corrosive liquids, which may attack the screen, the housing or internal components. In some monitors the display is protected by a plexiglas pane and sometimes the housing itself consists of synthetic materials. These materials react especially sensitive to chemical cleaning products. Before cleaning it is essential to read the information regarding the cleaning of monitors.

In some places sterility is especially important, such as in medical areas. Here the surfaces have to be sealed, and must not have holes or joints in which germs might accumulate and they have to be especially resistant to various chemical cleaning agents.

Vibration

Mechanical vibrations can influence the longevity of electronic devices as well. There are two types of transmission of vibrations. Airborne sound, which is transmitted via vibrating airflow, and mechanical vibrations, which are transmitted via the structure in which the display is placed.

Mechanical vibrations can destroy displays. Relevant here is the strength of the vibrations, the duration and the frequency. Through resonances the vibrations in a system can amplify. After some time this can lead to electronic components being shaken off and therefore to the destruction of the device.

If monitors are to be used aboard ships, where the main engine is constantly shaking, many measures are taken into account while designing the electronics, to counter mechanical stress. Additionally, the mounting of the monitors can occur 'swimming' in a dampening material that reduces the transmission of vibrations.

Sunlight exposure

If a display is exposed to immediate sunlight the display content is harder to recognize. The background lighting has to be significantly increased and additional measures, such as glass with anti-reflection coating, as well as optical bonding, should be used.

A monitor that is exposed to direct sunlight for a longer period of time this can also develop high temperatures in the housing. When the monitor is built into a glass lift the sunlight exposure can result in a high ambient temperature.

If a monitor with glass made of synthetic materials or a plexiglas pane is exposed to direct sunlight the synthetic materials can fade and become brittle.

Vandalism

Vandalism is the wilful destruction of property. This means, not only graffiti, breaking glass, wall or metal scratches, but also computer viruses have to be classified as vandalism.

Sensitive electronic devices, such as monitors, have to be particularly protected in public spaces. In monitors a special safety glass is used, which is mounted before the display to protect it. The mechanic of the monitor and the supporting housing has to be stable enough to absorb hard impacts.

To resist destruction by means of fire no plastics should be accessible.

Contamination as it may occur with graffiti has to be removed using strong chemical cleaning agents. The monitors should not be harmed by this either.

If electronic devices are directly connected to the internet, or if programs or files can be uploaded by the the users, various measures to protect the system are to be planned. This includes a firewall, encrypted data transmission and a rigorous rights management system, which save the electronics from manipulation.

EMC and noise emission

All electronic devices emit electro-magnetic signals and are influenced by electric or electro-magnetic disturbances. Electromagnetic compatibility (EMC) is the ideal state when electromagnetic fields, that are emitted by the devices, disturb neither other devices nor the device itself.

The requirements for a device to be sold in the EU are described in the normative guideline 2004/108/EG of the European Parliament and in various other norms and normative guidelines ([see Wikipedia](#)) [🔗](#). Summing up, the guideline defines a device to have a high degree of compatibility in order to avoid disturbances to other devices.

Electromagnetic disturbances can be prevented in the emitter or the receiver. When designing electronic components many things have to be considered that can reduce the emission of electro-magnetic signals and that make the devices less sensitive regarding influences from the outside. Further measures can occur in the design of the housing or running of the wires.

In displays poor EMC is easily recognizable by poor image quality. Especially capacitive touch sensors are very sensitive towards disturbing signals from the outside.

Among the main causes of electromagnetic disturbances are unconnected inductive loads, frequency inverters, as well as the now very common wireless transmitters, such as Wi-Fi antennas.

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Future Viability



Our world has changed dramatically in the last 10 years. What it might look like in 20 years is hard to tell. And yet, it is necessary in many technical areas to choose solutions today, hoping that those solutions will be supported for a long time. Especially in the industrial sector new developments are associated with high levels of investment, which can only be profitable after a long period of time. By connecting technologies from the extremely fast-paced IT sector with the industrial systems and systems for automobiles and building management, designed for long-term use, new areas of tension come into existence. We will give a short overview of the history and future of storage media, file formats and regarding the availability of displays.

Storage media

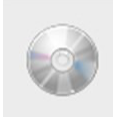
In computing, storage media are reading and writing devices meant to save digital information. Below you find a short history of how this technology has evolved in the last few decades and what future trends can be expected.

Floppy Disk



The Floppy Disk was the first widely extended storage device for personal computers. It was released in 1996 by [Shugart Associates](#) with a capacity of 360 kb, reaching up to 1,44 MB in later versions. Floppy disks, diskettes and superfloppies (modern versions of the first one) took over the market until the early 90s, with billions of units sold, until they were displaced with newer technologies.

CD-ROM



First versions of the CD-ROM have been offered by [Philips](#) and [Sony](#) in 1994 and had a capacity of 600 MB. This made them quickly popular and they started to substitute the aforementioned floppy disks, even though they were not re-writable. Their market share during the 90s was significantly large, but they have been progressively substituted by USB flash memories, SD cards and external hard disks.

External hard disks



External hard disks first showed up in the 80s. However, they were not commonly used because of their size (some of the first models were as big as an oven) or low storage capacity. In the last few years they have become more and more popular due to the large storage capacity that they now possess, measured in terabytes already, and due to their manageable size. They offer a good price-performance ratio with regards to their storage capacity.

USB flash drive



Since 2000 almost everybody carries a USB stick in their pockets. First models of this device, commercialized by [IBM](#) and [Trek Technology](#), stored 215 MB of information. Nowadays we can easily find 2 TB capacity USB sticks in any computer shop. Its big advantage when compared to previous storage systems is the large amount of data that can be stored in a few grams and the resistance against mechanical impacts.

CF cards



CompactFlash cards (CF) were the predecessors of SD cards. They have been predominantly used in movable electronic devices. CF cards have been almost completely substituted by SD cards.

SD cards



Secure digital cards, or SD cards, appeared on the market in 1999. By 2005 they became the standard in the market to store and transfer information to portable devices, such as cameras, mobile phones or laptops, mainly due to their compact size. Their capacity is growing continually. The biggest SD cards are now offered with a capacity of 256 GB. Its later versions, the mini- and micro-SD, have become a standard as a storage medium in smartphones as well. With the help of adapters these cards can be used in larger card readers, too.

File formats

The file format describes how the information in a file is stored and deposited on the storage medium. Several text formats or binary formats are used. The formats can be further distinguished into proprietary formats or open formats. Plain text formats are the easiest to manage, as they can be opened with almost any text editor. However, this makes them unsafe, as everybody has the tools to open them, and they take more space than their alternative. Binary formats are especially suitable to store programs, audio, video and images.

The difference between private and open format is that the first one is owned by a property holder who may demand royalties, while open format guarantees royalty free rights.

File formats are not static but are continually developed further. If this development is not open we might not be able to open the files in the future, or we might have to use special programs to do so. Some file formats might as well save more than we expect at first. Everybody knows the .Doc-format used to save text formats in MS Word. But these files can incorporate more than just the text. They can also transmit so-called macro viruses, which makes this file format less than ideal to exchange data.

Another important point regarding file formats is long-term availability. Open file formats have a clear advantage here, since there will always be tools offered that can read this formats. So besides storage media that are available for a long time, long-term available file formats are needed. For documents, for example, the use of PDF and PDF/A is very much recommended, since these formats are continually in further development (.pdf - 2.0 is expected for 2015). Other future-viable formats are, for example, .png for images; .flac and .mp3 for music and .vp8 for videos.

You can find a list of common file formats under [fileinfo.com](#).

The Cloud

Nowadays, we have all heard about the cloud. We know that there are some programs and apps such as Google docs, running on the cloud. Some use Dropbox or Google Drive as storage services in the cloud and we have all heard something like “the cloud is the future”. But what is the cloud? How does it work? And how will it change our way of working with our computers and displays? Why is it the future?

The cloud is a group of servers that allows their users to exchange or save data, run their applications on their servers, or use the service of programs via an existing internet connection. Thus, a device-independent exchange of data and services is possible. This makes cloud-applications so interesting.

Many cloud services are offered for free. After registration with the provider it is possible to use the service with various devices worldwide. But it should be a concern for the user where the storage of data takes place and whether they will be analyzed by the provider or even passed on to third parties. If one wants to be absolutely secure only European cloud services should be used, as these services are subject to European data protection laws. Alternatively, it is possible to use encryption software, such as [Boxcryptor](#).

All the advantages and the possibilities that are enabled by the cloud make it a technology for the future, that will see continuing strong growth.

Displays

Most displays are now being manufactured in Asia. Often a special construction type for a specific consumer product will be developed and then manufactured in a quantity in which this product is offered on the market. With the disappearance of the product the display production ceases, too. Therefore a hard to grasp supply of displays in different construction types occurs, without them being available for a longer period of time. If such a display is replaced by a successor product small changes in measurements, in the electric connection, in the control interface, the brightness and contrast and many parameters more, might occur. This is makes it very hard to guarantee long deliverability for displays.

Especially in the industrial sector and in building automation there are investment goods that are construed for long-term use. Suppliers of displays for these markets have to check the availability of the displays when choosing a display and include special constructive measures to guarantee an exchange.

◀ Environmental Conditions

up

Glass ▶

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Glass



Display monitors are always set behind a glass panel to protect its touch sensors. The most commonly used glasses for this purpose are trademarks. Among them we find Gorilla Glass, The Xensation Glass Series and Sapphire Glass.

It is increasingly important to produce resistant, stable and strong types of glass. The rule is maximum protection with minimum thickness.

Types of glass for displays

Gorilla Glass

Gorilla Glass is a product of the US company [Corning Inc.](#) It is a synthetic pre-stressed aluminosilicate glass, outstandingly light and thin.

In 2010, 20% of mobiles had Gorilla Glass among its components. Currently there are two newer versions of the product (Gorilla Glass 2 and 3) which are thinner and lighter.

Xensation Glass Serie

Xensation Glass belongs to the German company [Schott](#). There are three models of this glass: Xensation Cover which is a synthetic aluminosilicate glass, like Gorilla Glass, it is especially flexible and resistant to impacts and it is designed for capacitive sensors, Xensation Touch is a version for resistive sensors and Xensation Look is thought for optical touch sensors.

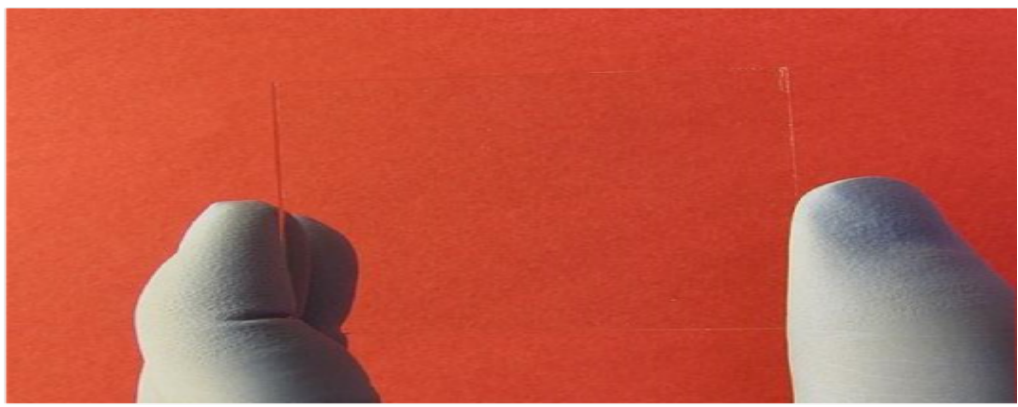
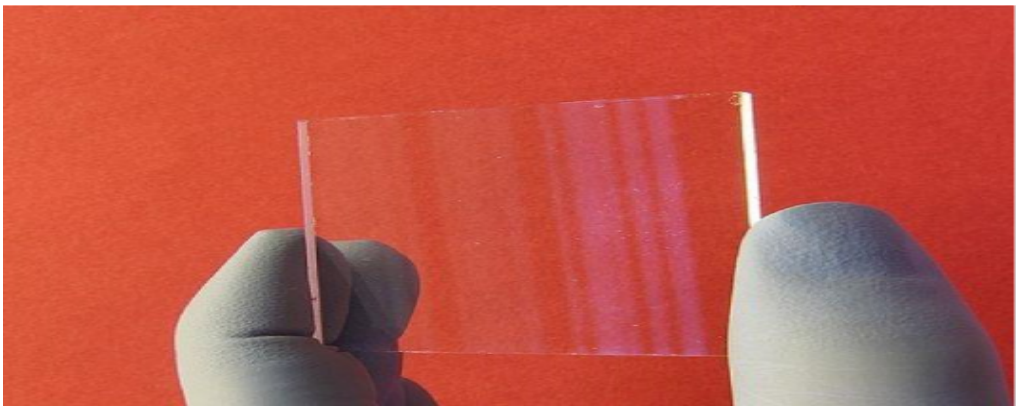
Sapphire Glass

Sapphire Glass produced by [GT Advanced Technologies](#), USA, is currently only used by Apple in its iPhone 5s camera sensors. It is extremely resistant to scratches and shattering, therefore is for example used in high-quality watches. The fact that holds it from being the standard glass for tablets and smartphones is its expensive production costs.

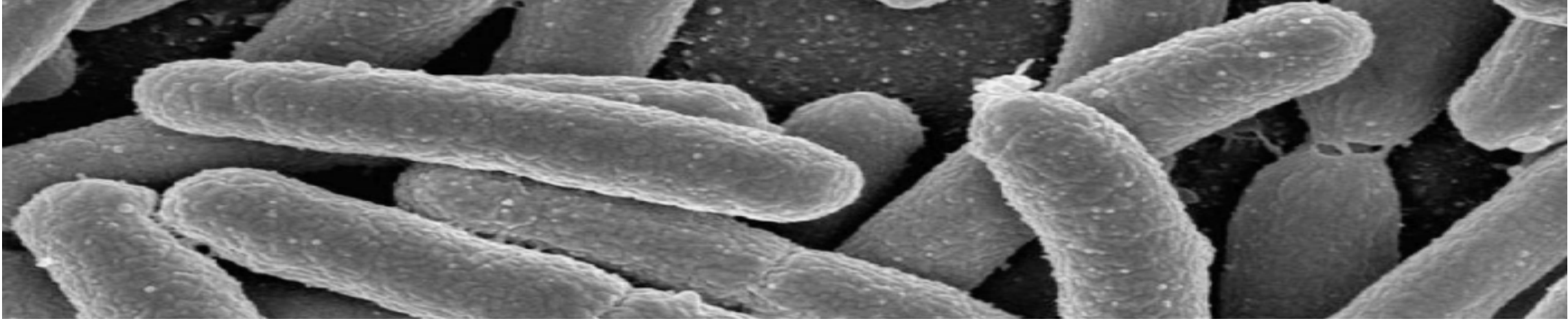
According to rumors the new iPhone 6 will be equipped with Sapphire Glass. The bloggers Dickson and Brownlee claim to be in the possession of the cover of the new iPhone and they rigorously tested it. In the test it was not possible to leave traces on the material or to destroy it.

Antireflection coating

Displays under sunlight or strong illumination need a special antireflection coating. These kind of coating evolves constantly over time. The company Corning, for example, has developed a kind of glass that reflects light only 1% stronger than air particles in 2013. Normal glass reflects about 5% stronger than air particles.



Resistance to bacteria



When a display is used by many people bacteria can be spread. In the medical field this is especially problematic, therefore displays are constantly cleaned with harsh chemicals. The surface of touchscreens has to endure this. Additionally, they have to be waterproof ([IP64](#)) and resistant to chemical cleaning agents (oil and acid).

Corning is also planning to optimize their glasses in this sense, applying an ionic silver covering to prevent the transmission of germs and bacteria.

News about Glass

Kyocera plans the production of Sapphire glass displays

For several months there have been rumors about Apple switching from Gorilla to Sapphire glass to produce the iPhone 6 and iWatch. This new material will make the devices even more resistant to scratches and cracks. While Apple has opened a factory together with GT Advanced for the production of Sapphire Glass in Arizona, surprisingly, another company seems intent on producing Sapphire glass independently.

You can read more in the following [article](#).

Sapphire glass for further portable devices?



According to Technology Review GT Advanced Technologies is working on a new production method for sapphire glass, which could reduce the costs significantly. While the costs have been too high so far this new method could help sapphire glass become ready for mass use.

You can read more in the following [article \(German\)](#).

Tags: [glass](#) [knowledge base](#)

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Internet



A world without the internet is unimaginable today. The use of the internet started to expand in the beginning of the 1990s and has been continuously increasing in the last two decades. A complete overview concerning the number of users and internet technologies over the years can be found under [evolutionoftheweb.com](#), created by members of the Google Chrome team.

Remote Configuration

The technological trend of the last years is the so-called "Internet of Things". It is also called Web 4.0 and described as the next revolutionary step of industrialisation. Since 2008 the amount of devices connected to the internet has been exceeding the amount of people online. The autonomous communication of devices with each other is also called M2M (machine to machine) communication. It is believed to have the greatest potential for a rationalisation of the means of production in the future. It is said to open whole new possibilities. For example, it is possible to not only configure the displays of a lift from afar using a smartphone, but also for the displays to recognize whether there are persons in the cabin and to share this information with a fire alarm central via the internet.

Security



Viruses, spamming, worms, trojans, adware... there is a never-ending list of [threats](#) for our Internet-connected devices nowadays. The damage caused by them goes from just annoying the user to completely crashing the system or stealing personal information, but what they have in common is that all of them are undesired. Thus, information security has become a more and more important issue over the years has to remain in the focus for technical appliances, for example in a lift, as well.

The first documented virus appeared in 1988. Called the Morris Worm, it threatened several institutions in the USA, from Stanford to NASA. This was the starting point of IT security as we know it today, the users started to set up mailing lists to track security threats, the first firewalls appeared and the Computer Emergency Response Team ([CERT](#)) was created. From then on, computer viruses have evolved in form and way of infecting the computers and nowadays our devices could be infected only by opening an e-mail or accessing a compromised site.

As the undesired software evolved, so did the computer security. Nowadays, there are powerful systems to protect our laptops, displays and smartphones and every IT supplier includes them in the developing process of their products. However, when acquiring a new product we should make sure that it includes a complete and updated security software.

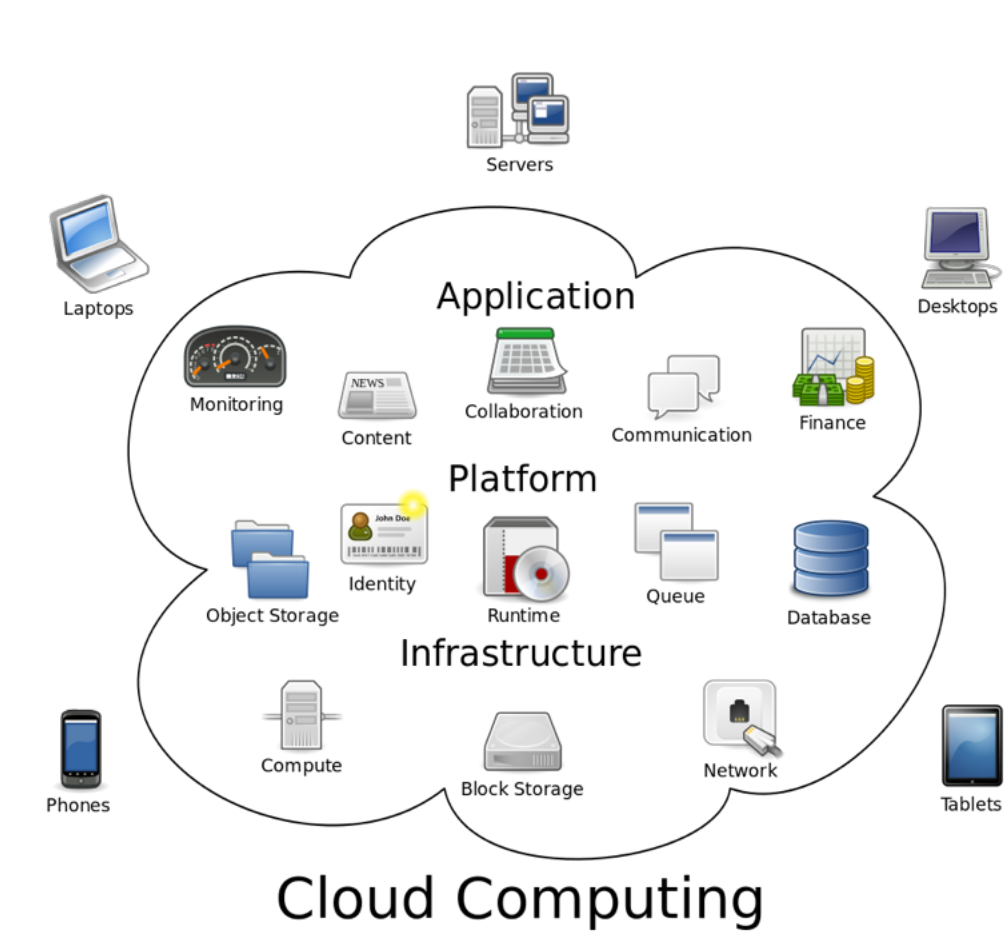
A new level of threat results from the connection of things with the internet. They can be attacked and manipulated as well and here the potential danger can be higher than with a normal office computer. The ever increasing connection even of everyday objects, and critical appliances like cardiac pacemakers, makes security on the internet the main topic for the next years. As early as 2013 a refridgerator made news because it sent spam mails. What sounds like a joke at first shows us the great weak spot of a global internet of things which is vulnerable to hackers and criminals.

Access

Besides the security in the internet of things, the rights management plays an important role as well. The access to the devices in the internet of things has to be limited to specific persons, groups or devices. Therefore, highly complex rights management systems have to be used.

In a lift display, for example, there are technicians who setup and maintain the system. Other users are responsible for the design of the layout, and even others for the selection of the content that is to be displayed. Here, it should not be allowed for a layouter to change settings regarding the connection with the lift or the internet.

Cloud



Our data is increasingly saved in the cloud. That means it is saved online by a service provider instead of locally on the user's PC or smartphone. Because servers of cloud providers are usually sitting outside of Europe and do not confirm to European laws, we often find privacy protection questionable.

Portal



In the general use of the word a "portal" is a web application which was used as an entry point to the world wide web by internet providers, web directories, browsers and search engines in the late 1990s (for example Yahoo, AOL, Lycos).

Today, a portal is an application that provides central access to personalized content, as well as to processes if demanded. The ideal portal opens shared, personalized access to data, expertise and applications, mostly regarding a specific topic or as an individual compilation of information of different sources for a group or a person.

An example for such a topic-oriented web portal is the wiki [CANopen-Lift.org](#) ([link is external](#)), which portrays information about CANopen in lifts centrally.

Status Information

Thanks to the connection via the internet, it is possible to get status information about the state of the system from any point at any time. For example, it is possible to set up an automatic SMS or E-Mail that will be sent in cases of a defect. If a lift is jammed and between floors this will not only be displayed on the floor displays, but an immediate notice to the maintenance/repair service is sent, wherever its location. The same applies to any other kind of disruption or unusual events.

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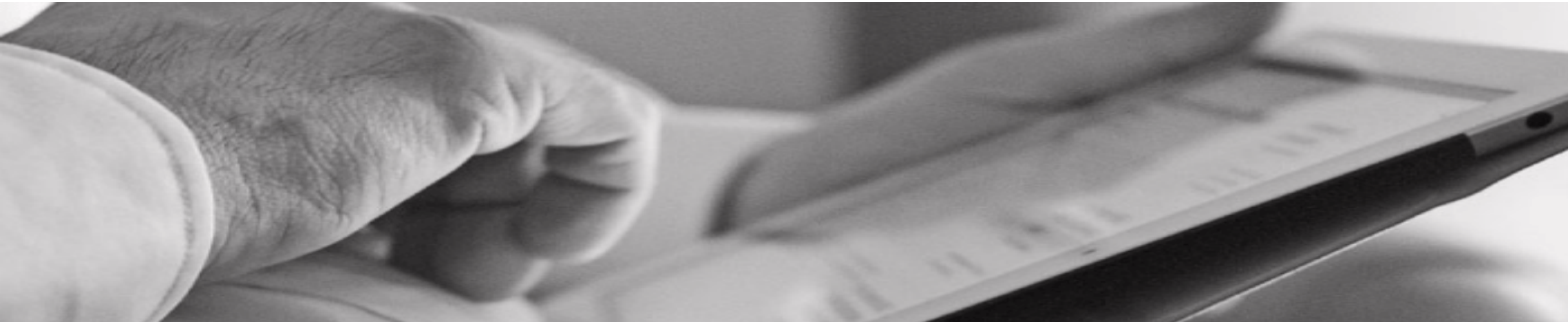
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Intuitive Use



When people get in contact with a new technology it is important for them to quickly get to understand it. They should use it intuitively without having to read manuals or having to contact the support. This way they can get access to the new technology easily and immediate use of the device is possible. Intuitive use is best achieved by using simple, universal layout for the user interface. For example, it is possible to complement buttons or menu items with icons that are either known from other applications or where the meaning can be inferred from the icons' design. The widget for news, for example, can be represented by a newspaper icon. On [this Apple Developer Site](#)  you can find everything that should be considered when creating a user interface.

Older Users

The development of the modern world is fast-paced. New technologies are spreading fast and are quickly perceived as a standard and then used in devices that are used in public spaces.

But not everyone adapts to the new technology. Especially older users have trouble to get used to new technology at times. Although almost anyone has had contact with a smartphone or a tablet, that does not mean that everyone immediately understands the usage of a ticket machine with touchscreen. Often older users recognize displays as output, but not as input devices. As a result of the widespread use of touchscreens at train stations this is slowly changing. An intuitive user interface is decisive here as well.

A problem, that does not only affect older users, is the problem of impaired vision. For this cases the display should be able to adapt as well (see 'Accessibility').

Buttons vs Touch in a Lift

A large display with a touchscreen in a lift is chic, modern, and enables a multitude of new functions. Realizing the input of calls and commands completely via the touchscreen, however, is not always the best solution. Often complementing options with a combination of touchscreen and traditional buttons is a good alternative.

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Layouts



A user friendly design needs a suitable layout. The choices of font types as well as colors have to be harmonized to guarantee an optimal appearance. But how do type fonts differ? How will the colors look like on the display? Below, you can find a short overview.

Typography

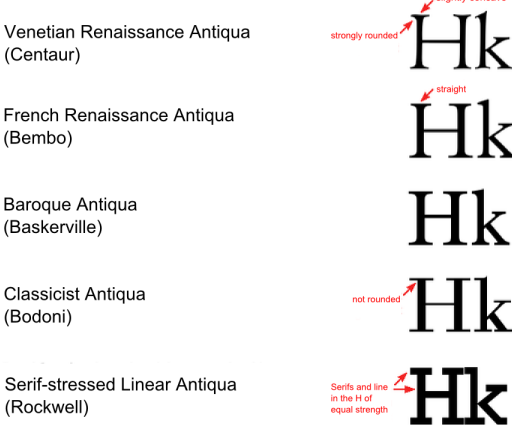
Typography is the art of printing or typesetting. By choosing the right typesetting texts are easier to read. The typeface appears more pleasant. Besides the microtypography, which looks at the form of the letters, typography also entails the space between the letters, the space and lengths of a line and much more.

When creating texts it always has to be evaluated whether serif font types or sans serif font types (grotesque) are to be used. Serifs are strokes to emphasize the letter, to give a horizontal orientation for the eye. They enable a more pleasant reading experience, especially in longer continuous text. An example of a sans serif font is Arial, a font with serifs is Times New Roman. Since there is no long continuous text on the displays in digital signage or in lifts sans serif font types should be used.

Furthermore, we differentiate between proportional and monospaced font types. Proportional fonts set different widths for each letter, while letters in monospaced fonts are all the same width. Nowadays, most users choose proportional font types. Monospaced font types are sometimes found in advertising.

Font types are normed in Germany. The DIN has been issued in 1964 and distinguishes 11 different font groups. We portray the first five in our following image. They are ideally suited to show differences in serifs.

Types of Serifs in different font types



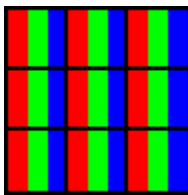
Colors



Color is a property of the light that people perceive. The threshold of perception is between 380 nanometers (purple) and 750 nanometers (red).

COLOR	WAVELENGTH
PURPLE	380-420 NM
BLUE	420-490 NM
GREEN	490-575 NM
YELLOW	575-585 NM
ORANGE	585-650 NM
RED	650-750 NM

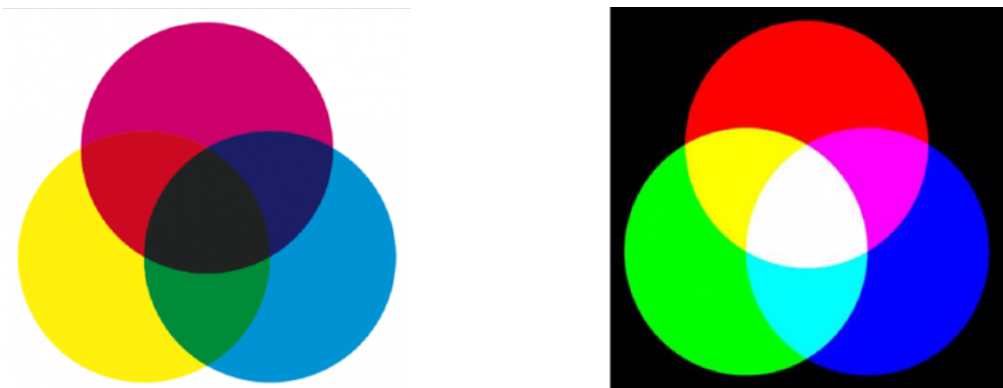
Colors usually occur not as pure colors but in mixed form. Displays use an additive color mix. At the subpixel level red, green and blue are combined. These colors are perceived in their sum because the human eye cannot distinguish between them at this size. It was possible to see the RGB colors in earlier TV models when watching from a very low distance. With the introduction of FullHD resolution the subpixel decreased significantly in size. But the screen diagonal increased. With the upcoming 4K-displays the pixels are too small to be seen by the human eye. As with smartphones and notebooks this is called retina resolution.



When we speak about the color of an object that does not emit light, we always speak about the light that has not been absorbed by the object. If light strikes a lemon the surface of the fruit absorbs the blue light. The red and green light is reflected and perceived as yellow by our senses.

In ink-jet printers we have a different type of color mixing. Here we talk about a subtractive color mix. Since with every new mixing of color the object absorbs more and more light, the mixed colors are increasingly dark. In the additive color mix they are lighter after every mixing.

For print material the colors cyan, magenta, yellow and black (key) are used - the CMYK color system.



The CMYK, a subtractive color mix, on the left. The additive RGB color mix on the right.

Choice of color

Besides an easy handling, the right choice of colors is crucial to set a user friendly interface. Color combinations determine attention points and have a potential impact on viewers' emotions. For example, blue colors are considered cold, red colors give a feeling of warmth. Green colors seem to possess calming properties, which might be a result of evolution, as the color has always been linked to the absence of drought and a vivid environment.

We should also keep cultural differences in mind regarding the interpretation of colors. White, for example, represents sorrow in Japan.

Finally, it has to be said that individual tastes with regards to colors vary as well and corporate design has to be part of the equation when choosing a color in business.

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Networks

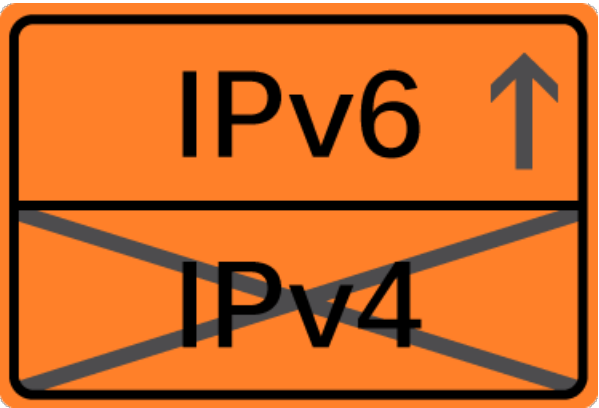


Networking in information technology means the infrastructure between electronic devices, the wiring and the protocols for information exchange. Nowadays most devices are connected. This can occur locally, such as in a lift between control and drive, or via the internet, such as with a fitness bracelet.

Today most computers are permanently connected to the internet and communicate with servers or directly with other computers. The internet does not stop at the national border. We talk about global networking. The connected computers use IP addresses for addressing. These will be switched from IPv4 to IPv6 gradually. Here we explain, among other things, what an IPv6 is. Security plays an important role in the internet. We therefore also want to explain the possibilities of encryption via VPN. What VPN is and how it can be used can be found further down on this page.

IPv6

Via IP-addresses it is possible to unambiguously address a single device. Every device connected to an IP network receives an address that is unambiguous in the network. IP addresses are like postal addresses for computers and regulate the addressing of data. In the current, old form, the IPv4, IP addresses consist of four numbers from 0 to 255 (for example: 192.168.1.1). With the conversion to the protocol IPv6, which has been defined 10 years ago and is currently in its introductory phase, addresses of eight numbers in hexadecimal counting are introduced (for example: 2001:0db8:85a3:08d3:1319:8a2e:0370:7344). This is necessary because the old IPv4 protocol does not offer enough addresses anymore ('only' 4.3 billion) in order to assign an IP address to every device that is connected in the future. The conversion to IPv6 does not only offer more IP addresses, but also allows for the implementation of many services that rectify the disadvantages of the IPv4 network. More on the subject can be found at [Wikipedia](#).



Gateways

Gateways are components meant to connect several networks that use different languages (protocols). They assume the role of mediation and translation of the messages between those networks. A WLAN router as used at home is a common example of a gateway. It mediates and translates protocols from the internet, such as they are transmitted via an ADSL transmission line, into the TCP/IP-protocol used in the home network or the USB protocols by which the connected printer is controlled. Another example would be an E-Mail-to-SMS gateway, which connects these two otherwise incompatible protocols with each other.

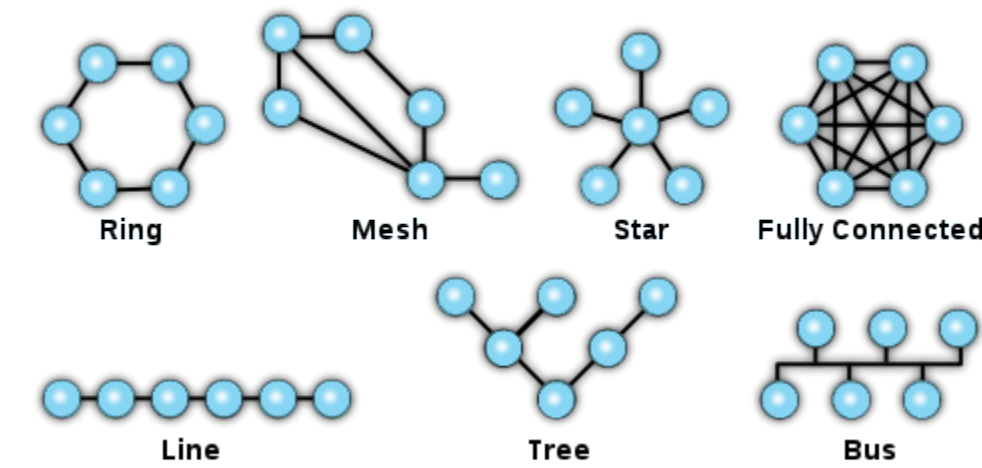
If a gateway translated the language of a network into the language of another it can occur that this information is lost, if the original information cannot be transported in the new network. In a lift the protocol CANopen-Lift is used on the internal field bus. This protocol provides information and control signals to the components in real time. A CANopen-Internet-Gateway establishes a connection to the internet and enables, for example, the remote diagnosis or configuration of the lift. To do so not all information has to be necessarily in real time, thus the loss of information is not relevant.

VPN

A VPN is a virtual private network. It enable the transport of data in a network that uses the infrastructure of another network. The data is tunneled through this other network. Since the data is transmitted with encryption a VPN is good procedure to access a distant network from a computer via the unsafe internet. With the help of VPN it is possible, for example, to log into a company network from the home office. The connection is made in encrypted form via the public internet. The setup of a VPN is not completely trivial, which leads to the abandonment of security concerns at times and the data will be imprudently transmitted unencrypted via the internet. What dangers are possible, especially in industrial plants can be found in this article at [heise.de](#).

Mesh Networking

In a meshed network every node is connected one or more other nodes. The information is passed from one node to next until it reaches its destination. If every participant is connected to every other participant we talk about a fully meshed network. Meshed networks are usually self-healing and therefore very reliable. If a node or a connection is blocked or or fails the network around it can rebuild. Data will be redirected and the network remains operational. It is also easy to add new accounts or delete existing accounts without interrupting the transport of data.



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Optical Bonding

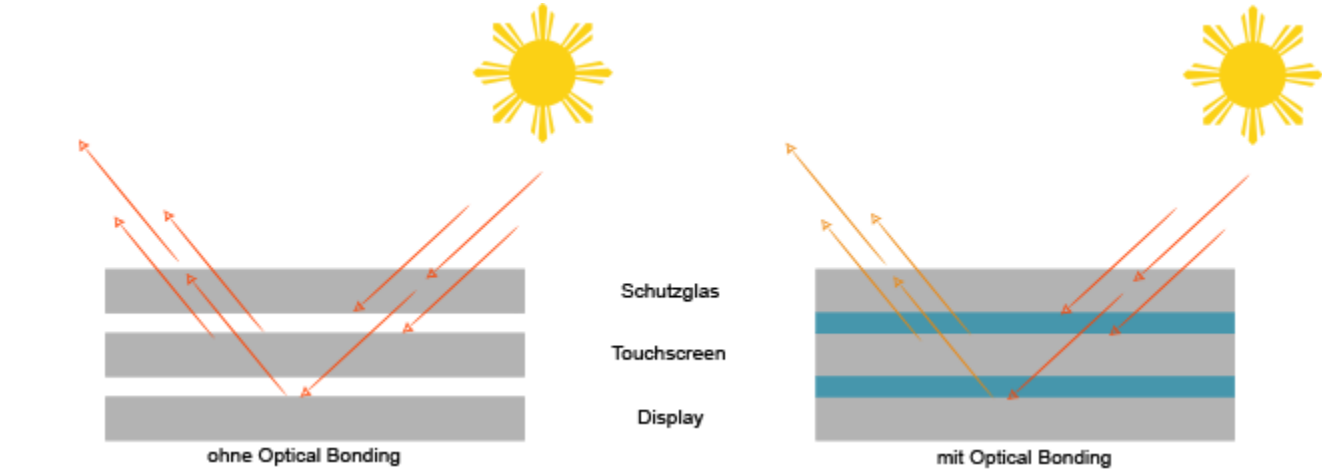


Optical Bonding significantly increases image quality and readability of displays. As a special technology to avoid reflections optical bonding creates a better contrast. But why is that the case and how does it work? We compiled some information in the following paragraphs.

Extrinsic Contrast

To make a display visible in daylight the background lighting will be increased in most cases. As a result, both black and white pixels appear brighter. Displays with an especially strong background lighting usually possess a lower contrast. Another factor lowering the contrast of the display is the incidental light that is reflected by the display. Here we are talking about extrinsic contrast, which is to be seperated from the contrast in dark environments mentioned in a manual. The extrinsic contrast is calculated considering the ambient lighting. To reduce it, the reflections of the display and the glass have to be reduced.

Functionality of Optical Bonding



The strongest reflections occur at the spaces between glass and touchscreen, as well as between touchscreen and display, which are usually filled with air. Optical Bonding eliminates the air completely and thus eliminates the main reason for bad contrast in ambient light as well. This increases contrast significantly. As an additional benefit, optical bonding increases the resilience of the display. This is because the whole construction is less susceptible to damage by vandalism and vibrations or stress as a result of differences in temperature.

Advantages of Optical Bonding at a glance

Better readability without higher energy demand

Glueing together the glass and the display, or vaccuumizing the space in between, the light refraction is reduced significantly. This increases contrast. The intensity of the background lighting can be reduced. The energy demand decreases. This decreases costs as well and helps our environment.

No condensation or fog production

By eliminating all air between the glass and the display it is impossible for harmful liquids to enter and permanently settle there.

No contamination

It is also impossible for dust particles and dirt to enter in between the display and the glass.

High resistance to vibrations and shock

A bonded display is more stable and resilient against mechanical strain. The special glue used in Wet Bonding works against resonance phenomena and transmits pressure from the front towards the sides.

Improved heat dissipation (up to factor 8)

By closing the insulating air gap the heat of the display can be dissipated more easily through the front glass. This increases performance as well as longevity of the display.

Process

In Optical Bonding there is a distinction between Vacuum Bonding and Wet Bonding, which have different effectiveness depending on the size of the display. In Vacuum Bonding the usually air-filled gap is vacuumized, in Wet Bonding a type of glue is inserted into the gaps. The process takes place in a cleanroom, to prevent the inclusion of dust and other contaminants. In Wet Bonding, however, an inclusion of air bubbles can never be ruled out completely. This increases production costs.

Tags: [Wissen](#) [Optical Bonding](#)

◀ Networks

up

Smartphones ▶

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Smartphones



As early as in the 1990's the first smartphones appeared. But only with the iPhone by Apple in the year 2007 the all-rounder mobiles came out big. Since then it is hard to imagine a world without them. But how do they communicate with the internet? What is to be considered regarding their display resolution? And what do webmasters have to do to make a page visible on a smartphone?

Interfaces

One hears time and again of the difference between 2G, 3G, and 4G. The "G" in this case is for "generation". The matter is the mobile phone networks of the second, third and fourth generation. The normal talk on telephone is transmitted via the first generation network. The second generation (2G) is also called GPRS or EDGE. Those who want to stream videos should have a 3G network at most. It is also called UMTS, HSDPA or HSDPA+. The fourth generation, the LTE network, is currently under construction. In the future a speed of up to 300 Mbit/s is said to be possible with LTE.

Besides these mobile phone networks connections, mobiles can connect to the internet via WLAN or with other devices via bluetooth. WLAN means Wireless Local Area Network. With WLAN wireless interenet connections are possible. With Bluetooth data connection is possible, but the distances at where it can be used are lower. Bluetooth was especially developed for contiguous devices and it also saves a lot of energy when compared to WLAN.

Display Resolution

With smartphones the display resolution moves into spheres where differences are hardly detectable with the human eye. This limit at a distance of 30 cm is said to be at 300 ppi. The next generation of smartphones will be a lot better than that. The HTC One already has a resolution of 468 ppi, 1280 x 720 pixel at 4.7 inches.

You can find a good overview of smartphone brands and their display resolution [here](#) .

Responsive Operation

A responsive website reacts to the devices that are used to diplay the website. If one uses a smartphone to access the website, the website changes its design so as to best display on the smaller screen and to be easier to operate with touchscreens. There is a difference between a responsive website and a website built for smartphones that is written seperately and that sends the user to a specific site according to device.

You can find good examples of responsive webdesign [here](#) .



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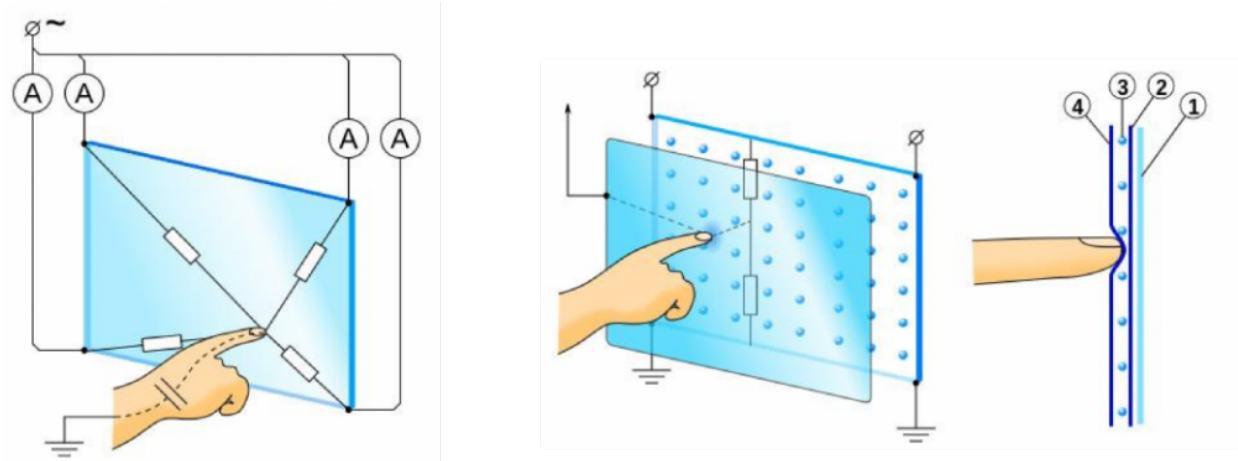
Touch



A touch screen is a monitor with touch sensors, which enables it to be used as an input device. The user is thus able to control the computer with his finger. The technology is nowadays widely used in tablets or smartphones, but also in automats. In these cases resistive or capacitive touch sensors are most commonly used. But what is a capacitive or resistive sensor? And which one should be used?

Technology

There are two kinds of touch sensors, resistive and capacitive. Resistive touchscreens react to pressure, we find this kind of displays in most of train stations, while capacitive screens react to differences in the electrostatic field, Apple uses this technology for its [iPhone](#) .



The capacitive touch sensor (left) reacts to the electromagnetic field of a finger. The resistive touch sensor (middle) reacts to its pressure. The two electrically conductive layers connect at that point (right).

Beyond those we can find infrared sensors, which are resistant to vandalism as they can be used behind an armored glass. They are, however, more sensitive than other types and can be easily triggered by near contact. This makes them less than ideal for usage in lifts.

Touch sensors with surface acoustic wave are possible as well. In this case ultrasound waves are sent from the x and y coordinates, when touching the differences in the waves' motions will be registered.

Comparison

Displays with resistive sensors reflect more sunlight and, therefore, are difficult to see outside. However, they are more accurate and enable the user to work at pixel level (for example, with a pen).

Capacitive displays react to the slightest contact with the finger, but not to contact with an object or fingernails. This makes them less accurate than resistive touchscreens, as it is difficult to reach pixel accuracy with the finger. Besides, they are more expensive than resistive sensors in general. They can be used behind a sturdy glass, however, which makes them ideal for displays used in public places, as in lifts.

Interface

Earlier, touch sensors were connected to the device via a serial connection. The term serial comes from the fact that bits are sequentially sent by the connection. The connection via I²C was common as well. An I²C, IIC, or Inter Integrated Circuit, is a bidirectional connection between two integrated circuits. Nowadays, serial connection and IIC have been largely replaced by USB.



USB, or Universal Serial Bus, is the most widely used interface between computers and peripheral devices used today. It is easy to handle and swift. USB 2.0 achieves a speed of up to 480 MB/s



Installation

We advise to install capacitive displays in places where vandalism is an issue, as they can be installed behind a thick, armored [glass](#). Resistive displays are not suitable for places with these issues as the sensors are in the first layer and can be easily damaged.

In places where optimal electromagnetic compatibility is needed, for example in the MRI unit of a hospital, a resistive display would be the right choice.

Single- or Multi-Touch

Some capacitive touch sensors are able to register several touches at the same time, this is called multi-touch technology. It enables the user to zoom in or turn a picture using more than one finger. This technology is already used in most of smartphones and tablets, however, it is not necessary in easy-to-operate devices. For example, in a lift where a single-touch display would be enough.



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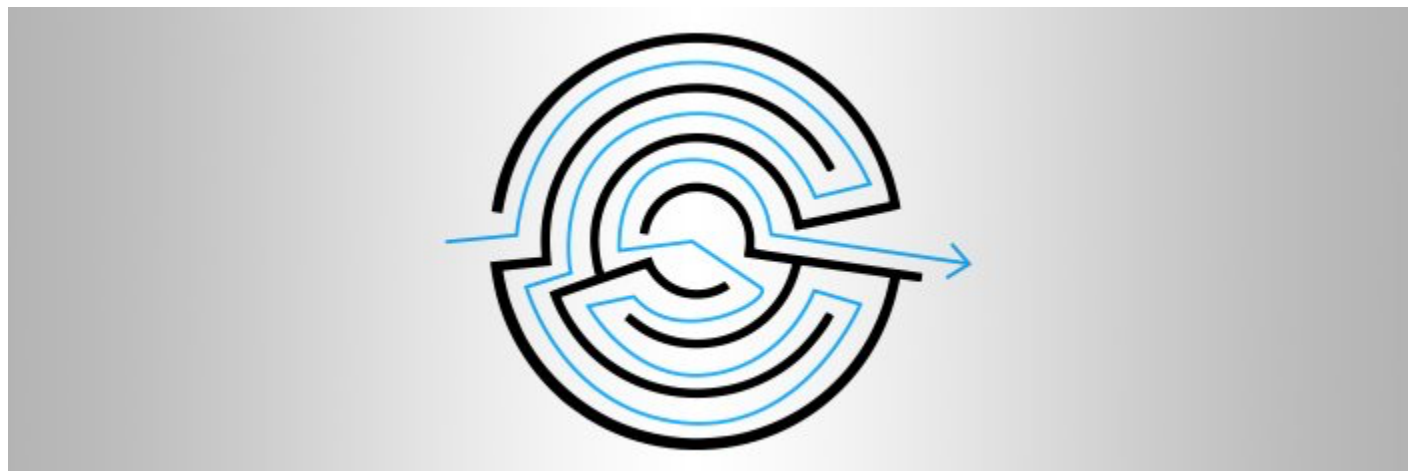
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User Guidance

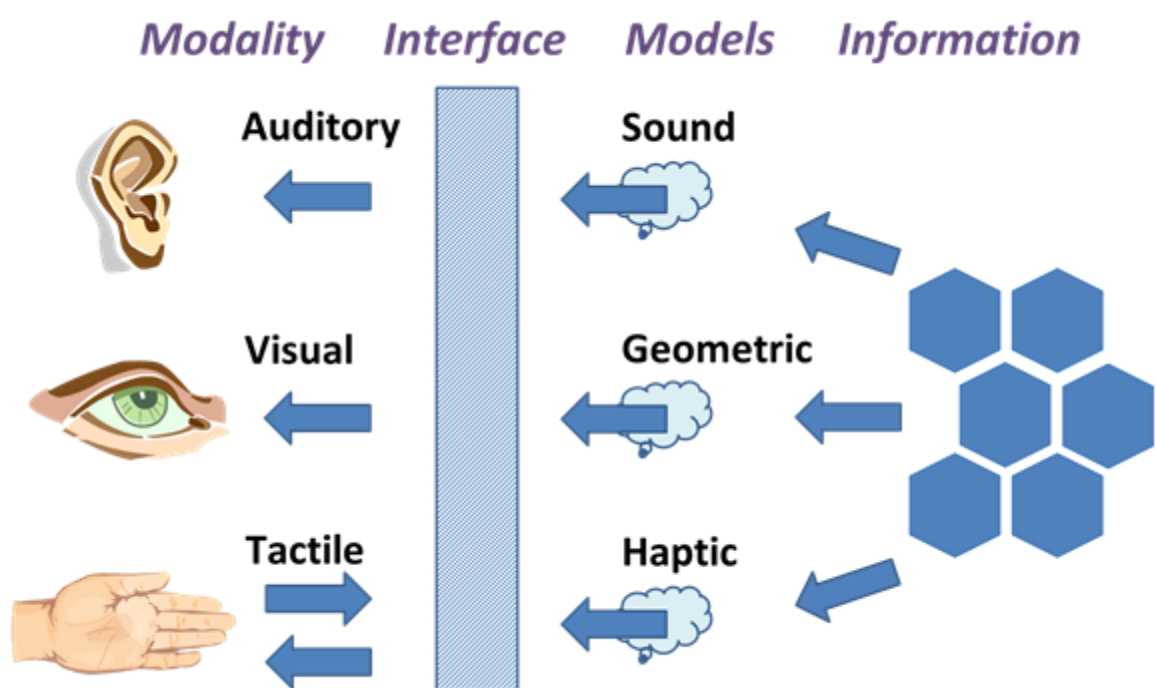


Only people who immediately find their way on a website will stay on this website for a longer period of time. This principle of user guidance touches other areas as well. In general, all aspects of a website should accommodate the needs of the user. Design and layout have to submit to this purpose. Some principles of user guidance are explained in the following paragraphs.

Human Machine Interface

A Human Machine Interface is the interface between man and machine. It has to be adapted to the needs and abilities of humans. For a lift display this means that it has to be easy to understand and easy to be operated. Besides the fact that a new technology should function it is also important that it can be operated intuitively and that it does not confuse its users.

The Human Machine Interface provides various ways of interaction between human and machine: Firstly, with sound output and output of visual information which provide information for the user. Secondly, it often reacts haptically to input via your hand, and can in some cases give feedback using vibration.



Nesting Levels

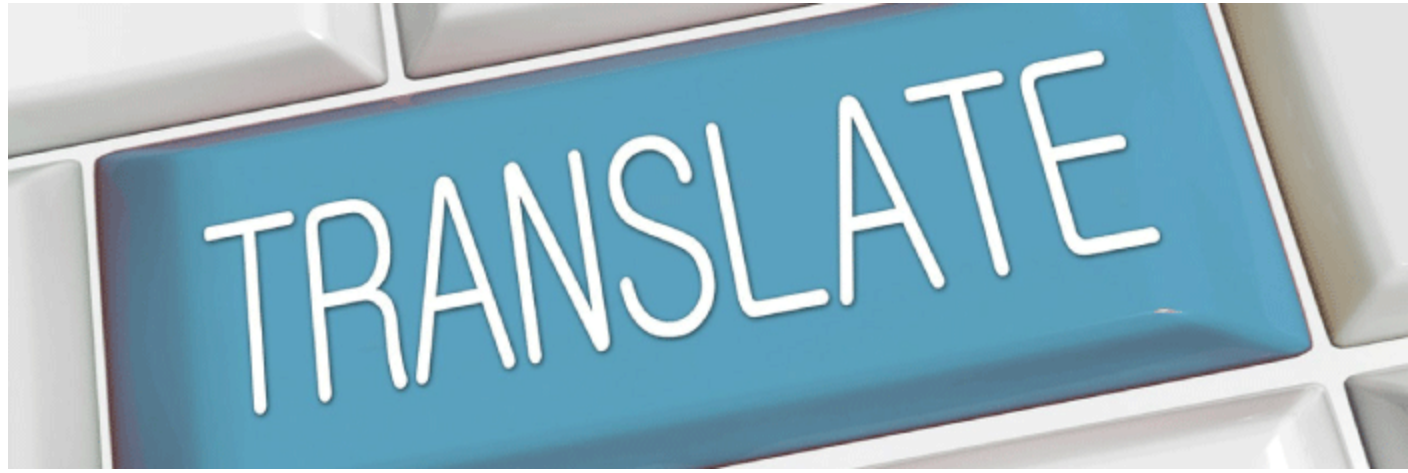
Regarding the nesting levels in a menu there has to be a compromise between too many levels and too many menu entries. Having too many levels would be too complex to handle, having too many entries would be confusing for the user. At the same time, one has to reach earlier levels from each page, which is manageable via so-called "breadcrumbs".

[Startseite](#) / [Wissen](#) / [Benutzerführung](#)

We decided to have all our articles in the category "knowledge" on one level. By using alphabetic sorting (except for "Displays") they are easier to find. Besides the breadcrumbs, which can lead you back to the main page of the category, we also included a link to the previous and next article at the bottom of each page. This way it is possible to click through all articles in one session. We included all subpages of a category of flexypage.de on the right side as well, to navigate even easier.

There is also the possibility to provide a sitemap for the visitor. Here you could find a hierarchical listing of all sites of a website. It is even better when the visitor finds his way without a sitemap. This saves time and reduces stress.

Language



For a lift display it is also important that it does not work in only one language. When guests of a foreign country enter the lift they have to find their way as well. The function to change the language of the lift display has therefore to be found intuitively. This also applies to websites. And you can try it out - click on "English" at the end of this page!

But not only switching to the appropriate language can be a problem. Especially older users often encounter problems when English terms are used. Words like "next" might be understandable, but "previous" is hard to understand for Germans. Good that such a concept is easily representable using arrows.

Pictograms

With alphabets it is not sufficient to switch to a different language to ensure an intuitive usage. Here, an effort should be made to use pictograms instead. Pictograms, if they are well chosen, are very easy to understand and it is possible to use them across language barriers.

Did you recognize the pictogram on the right? It is the pictogram for "hearing-impaired".



WYSIWYG

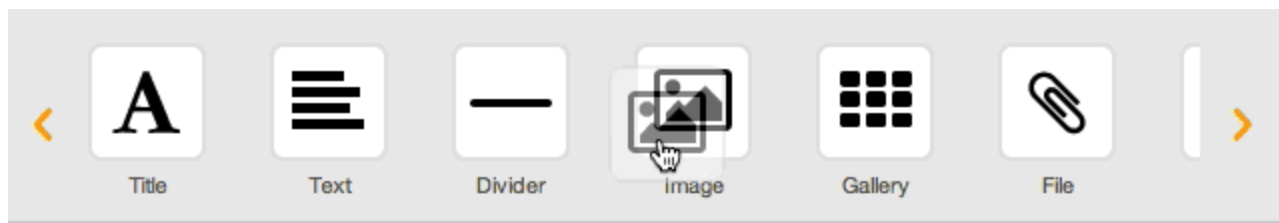


WYSIWYG means "what you see is

what you get". It is the principle that you see an object of the screen exactly as it will be on other output devices. An example for WYSIWYG is a content management system, with which it is possible to edit websites while seeing the results. This way it is possible to edit the websites without prior knowledge of most of HTML.

Drag'n'Drop

Drag and Drop is the dragging of objects on the screen via a mouse, and the dropping of said objects at a different point on the screen. By this, the file will be copied or shifted from its original place to a new one.



ImpressPages 4.0 prerelease

[Home](#) [Lorem ipsum](#) [EN](#)

Place for artisans

With the world's most artistic masterpieces per square kilometre, you'd think the city would take it easy, maybe rest on its laurels. But Venice refuses to retire from the inspiration business. In narrow calli (alleyways), you'll glimpse artisans hammering out shoes crested like lagoon birds, cooks whipping up four-star dishes on single-burner hotplates, and musicians lugging 18th-century cellos to riveting baroque concerts played with punk-rock bravado.

Theme "Air"

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Widgets



Nowadays everyone uses apps and widgets on his or her smartphone. But how are apps different than widgets? And why are they useful?

Widgets are small helpful applications that can be used anywhere on the user interface. This way it is possible to attach a calendar or the current weather to the home screen and gather all information at once everytime it is needed. This is possible without opening another program. Widgets don't work alone but need the appropriate user interface to which they can be attached. You can attach several widgets to the user interface. That is also where they differ from apps.

Widgets and Apps



The term "app" comes from application, a small application program, for example for the smartphone. Usually apps have to be downloaded, if they are not pre-installed by the provider. They are available in free versions (usually light versions) or to-buy. Additional costs, however, can occur even with "free" ones. Since apps often necessitate quasi permanent internet connection, not having a flatrate can result in high connection costs. To download an app just go to the App Store (Apple) or to Google Play (Android).

Apps possess a user interface of their own, widgets are, however, integrated into the home screen user interface. While a widget is permanently running and visible at a glance, apps are programs that have to be started. Some apps come right with their own widgets, so you can attach them to the home screen.

Widgets und Apps both share the characteristics of being very small programs that offer only a limited delineated function. In contrast to most PC programs they do not offer great complexity. Varying tasks are realized by using various apps or widgets, which can be freely combined. This makes it possible to compile the optimal system for one's own application in a flexible and inexpensive way.

[◀ User Guidance](#)

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