Digital and analog comparison

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Digital and Analog Comparison Team C January 30, 2012 University of Phoenix NTC 362 Mathew Mower Technology is constantly changing in communications. The analog signal was used for several years and was limited in number and did not have the ability to handle the amount of data interchange used today, because of the size requirements. Analog signals are still used today, but are more complex and are in most circumstances converted to a digital signal. This paper will compare the different types of analog and digital technology we used and are currently using today. Telecommunication: Analog/Digital Conversions

In the data communication world, there are two basic types of signals that are used in transmitting media: analog and digital. One form of data is captured is referred to as analog signal that can vary in amplitude (strength) and frequency (distance between wave-like peaks). The distance can be measure between the peaks in cycles per seconds, referred to as Hertz (Hz). Additionally, with digital signals, there are two states: ‘ off’ or ‘ on’ that occur when there is a change in light levels. These signals are sent in a continuous flow and are measured in megahertz per second.

This is similar in concept of the two hands of a clock that are constant in motion and represent time. 1 Both frequency and amplitude can be used to encode data. 2 An example of analog to digital is the process of faxing. The user starts with a piece of paper (analog), and inserts it into a fax machine. The fax machine converts the text on the paper to a digital form. The modem in turn, converts it to analog. The Class 5 switch at the local exchange converts it to analog. At the other end, his friend via the receiving Class 4 switch converts it to digital.

The Class 5 switch at the receiving end local exchange, converts it to analog. . The friend's modem converts it to digital, and finally the receiving friend's fax machine prints it out onto paper which is analog. Today, most networks are part digital and part analog. This requires the data to be converted into different forms. Codecs and modems perform the conversion between these different signal types. Another step is to convert the digital we want to transmit in an analog RF signal, which is accomplished via quadrature amplitude modulation (QAM).

This was found to be an important step due to field tests that indicated leakage from the digital network, which requires 3 the use of an analog TV channel or CW carrier on the AGC pilot frequency in order for the older amps AGC to work properly. By raising RF level, improvement was noted in the carrier-to-noise ratio. Amplitude Modulation & Frequency Modulation Amplitude modulation (AM) is a method used most commonly for transmitting information through a radio carrier wave. It works by adjusting the strength of the broadcasted signal relative to the information being sent.

The final modulation consists of three components: carrier, lower side band, and upper side band. Various combinations of these components create different types of AM with different properties for information transfer. Also, modulation depth has a big influence on modulation properties. Amplitude modulation is inefficient in power usage; at least two-thirds of the power is concentrated in the carrier signal, which carries no useful information. In frequency modulation (FM), the amplitude of the wave is constant, and the frequency is manipulated to produce the information being sent.

One of the advantages to manipulating the frequency is the ability to adjust for travel distance. Low frequency has the benefit to travel much farther distances than high frequency before i The modulation techniques are all analog for the 56k modem, Asymmetrical Digital Subscriber Line (ADSL), and Wireless Fidelity Wi-Fi. However, they are being moved to digital as technology advances. Modulation technology-56K modem, Asymmetrical Digital Subscriber Line, and Wi-Fi The 56K modem modulation uses the same land line that is already installed into ones home for telephone use (voiceband modems).

The ability to run off the same line is an advantage to the user because there are not additional installation charges. The download speed of the 56kmodem tops at 56 kbit/s, which in the 90's was the fast. The local telephone systems used a local loop that was digital, so tapping the 56k modem into these lines was ideal. The use of the 56k modem has declined due to the broadband technologies such as ADSL and DSL were developed and were available to the home user. Asymmetrical Digital Subscriber Line (ADSL) is an asymmetrical service used over one twisted-pair of wire. The bandwidth is used in the downstream direction with a small return.

ADSL has limited capability of about 3 miles. The shorter distance the twisted-pair is deployed the greater return and faster service one will have. This is called the single carrier modulation. The twisted-pair was the foundation of the evolution of communications as was the telephone line which this utilizes. More users are moving to wireless due to the availability of being able to have service anywhere. Wi-Fi is a much faster and cost effective route than a 56k modem or ADSL as there are no cables involved.

Many users have switched to wireless in the home, office, and personal use settings.

Wireless can be advantageous when there are not any building structures around. However, there are outside disabling features as weather, structures, and reliability of the area one is in. Wireless does have lower data rates then common ADSL or DSL or any wired land line area. The modules of Wi-Fi are Binary Phase Shift Keying (BPSK) and Quadrature Phase Shift Keying (QPSK). Phase Modulation & Quadrarture Amplitude Modulation Phase modulation is a complex analog radio signal. It is not used in many radio applications due to the complex decoding; a more complex decoding hardware is needed to interpret the PM radio signal.

In data transmission phase have the ability to transmit more data than other forms of analog modulation, it is widely used in digital synthesizers. Phase modulation is very similar to amplitude modulation in that it lacks efficiency and doubling of baseband bandwidth. Phase modulation is more closely relation to frequency modulation (FM) in that it changes the carrier signal and then is reconstructed by the receiver. PM can be a special consideration of frequency modulation (FM). Phase modulation has superior noise and interference rejection.

The inherent problems with PM are the cost of the equipment, due to the complexity of decoding the signal. The signal operates on 90, 180, and 270 degrees signals and there can be ambiguity problems in determining whether it for example 180 degrees or -180 degrees. QAM or Quadrature Amplitude Modulation uses both analog and digital signals to send data. The signals are combined at the point of transmission, and then sent separately. The two signals are then received and data is taken from both signals and then combined. QAM states are closely paired together, this allows multiple and large amounts of data to be sent very quickly.

Since QAM signals are combined from two analog and two digital signals, even in a 16 bit circular QAM, you can see the square pattern. Although QAM can send data very efficiently, it has two major drawbacks. Since QAM points are spaced so closely together, a lower amount of noise is needed to move the signal between the points. Amplitude and frequency modulation are able to use limiting amplifiers, which greatly reduce the noise level; QAM signals are unable to, and since they incorporate an amplitude signal, noise interference is a continuing problem.

The other limitation of the QAM signal also has to do with the use of the analog amplitude signal. When a FM or PM signal is amplified, there is no need to use a linear amplifier, but since the QAM uses a amplitude signal, linearity must be consistent and maintained. Linear amplifiers consume large amounts of power and are not very efficient, this makes using a QAM signal less applicable for mobile uses. QAM is widely used in modems and cable television. SONET Digital Hierararchy SONET was developed to multiplex circuit switches traffic such as T-1, E-1, T-3, and slower rates of data from different sources on fiber-optic lines.

SONET transports traffic at high speeds called Optical Carrier, abbreviated as OC. The international version of SONET is called synchronous digital hierarchy, abbreviated as SDH. Equipment interfaces make SONET and SDH speeds compatible with each other. The switching equipment used for SONET applies to both OC and SDH speeds as well. The picture below is a small diagram of SONET hierarchy. The newer telecommunication technology used is complex and somewhat confusing. The new technology has increased the amount of data flow and created several different ways we communicate today.

The type of communication technology we use greatly depends on the application. The technologies all have advantages and limits, but with new advancements coming every day, we may find one that will replace them all. References The SONET and SDH Signal Hierarchy: How many T-1s are in an OC-1, OC-3, OC-12, or OC- 48?. (2009). Retrieved from http://hubtechinsider. wordpress. com/2009/05/10/the-sonet-sdh-signal-hierarchy-how-many-t-1s-are-in-an-oc-1-oc-3-oc-12-or-oc-48/ http://wiki. answers. com/Q/What_are_the_advantages_and_disadvantages_of_the_8-qam Goleniewski, L. , & Jarrett, K. 2007). Telecommunications Technology Fundamentals . : Pearson Education loses power. Amplitude Modulation. (2012). Retrieved from http://demonstrations. wolfram. com/AmplitudeModulation/ Goleniewski, L. , & Jarrett, K. W. (2007). Telecommunications Essentials. The Complete Global Source (2nd ed.). http://www. thefreedictionary. com/analog. Collins English Dictionary—Complete and Unabridged (copyright) HarperCollins Publishers 1991, 1994, 1998, 2000, 2003. MCSE Training Guide, Second Edition, Network Essentials Exam 70-058, 2nd Edition, Copyright 1998 by New Riders Publishing.