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Chapter 1 : Communication Models

The number of communication channels may well turn out to be a major building block in constructing quantitatively predictive logical models in social sciences. This number does determine representative assembly sizes and mean durations of cabinets.

Entropy-the measure of uncertainty in a system. In the case of a two-headed coin, there can be neither any freedom of choice nor any reduction in uncertainty so long as the destination knows exactly what the outcome must be. In other words, the value of a specific bit of information depends on the probability that it will occur. In general, the informative value of an item in a message decreases in exact proportion to the likelihood of its occurrence. Redundancy-the degree to which information is not unique in the system. Perfect redundancy is equal to total repetition and is found in pure form only in machines. In human beings, the very act of repetition changes, in some minute way, the meaning or the message and the larger social significance of the event. Zero redundancy creates sheer unpredictability, for there is no way of knowing what items in a sequence will come next. As a rule, no message can reach maximum efficiency unless it contains a balance between the unexpected and the predictable, between what the receiver must have underscored to acquire understanding and what can be deleted as extraneous. Noise-the measure of information not related to the message. In electrical apparatus noise comes only from within the system, whereas in human activity it may occur quite apart from the act of transmission and reception. Interference may result, for example, from background noise in the immediate surroundings, from noisy channels a crackling microphone , from the organization and semantic aspects of the message syntactical and semantical noise , or from psychological interference with encoding and decoding. Noise need not be considered a detriment unless it produces a significant interference with the reception of the message. Even when the disturbance is substantial, the strength of the signal or the rate of redundancy may be increased to restore efficiency. Channel Capacity-the measure of the maximum amount of information a channel can carry. Suppose you wanted to know where a given checker was located on a checkerboard. If you start by asking if it is located in the first black square at the extreme left of the second row from the top and find the answer to be no, sixty-three possibilities remain-a high level of uncertainty. On the other hand, if you first ask whether it falls on any square at the top half of the board, the alternative will be reduced by half regardless of the answer. By following the first strategy it could be necessary to ask up to sixty-three questions inefficient indeed! Provided an influential yet counter-intuitive definition of communication. From Littlejohn, Stephen W. Theories of Human Communication. Wadsworth, , p Information is a measure of uncertainty, or entropy, in a situation. The greater the uncertainty, the more the information. As used by the information theorist, the concept does not refer to a message, facts, or meaning. We have said that information is the amount of uncertainty in the situation. For example, your friend is about to flip a coin. Will it land heads up or tails up? You are uncertain, you cannot predict. This uncertainty, which results from the entropy in the situation, will be eliminated by seeing the result of the flip. In other words, you could not receive any message that would make you predict any better than you already have. University of Illinois Press, For a number of excellent brief secondary sources, see the bibliography. Broadhurst and Donald K. Addison-Wesley, ,

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Chapter 2 : Data Communications Basics | A Reference Guide

Constraint-based concurrency is a simple and elegant formalism of concurrency with monotonic mobile channels, whose history started in early 's as a subfield of logic programming.

Tarde attempted to explain why some innovations are adopted and spread throughout a society, while others are ignored. At the beginning of the twentieth century, Tarde was witness to the development of many new inventions, many of which led to social and cultural change. In his book *The Laws of Imitation*, Tarde introduced the S-shaped curve and opinion leadership, focusing on the role of socioeconomic status for example, a cosmopolitan individual is more likely to adopt new products. Even though he did not specify and clarify key diffusion concepts, his insights affected the development of many social scientific disciplines such as geography, economics, and anthropology. The basic research paradigm for the diffusion of innovations[edit] The fundamental research paradigm for the diffusion of innovations can be traced to the Iowa study of hybrid seed corn. Bryce Ryan and Neal C. Gross investigated the diffusion of hybrid seed corn among Iowa farmers. According to Lowery and DeFleur, the background of rural sociology should first be understood before one can discuss how and why the hybrid seed corn study was conducted. After World War II, rural sociologists changed their research focus on human problems among farmers because new agricultural technology such as new pesticides, new farm machine, and hybrid seed corn appeared. But in spite of these developments, some farmers ignored or resisted these new innovations. Rural sociologists at land-grant universities in the Midwestern United States such as Iowa State, Michigan State, and Ohio State Universities, performed many diffusion studies to find out the causes of adoption of innovations. One of these efforts was the hybrid seed corn study conducted by Ryan and Gross. These researchers attempted to explain why some farmers adopted the hybrid seed corn, while others did not. Gross[edit] Bryce Ryan earned a Ph. D in sociology at Harvard University. During his doctoral studies, Ryan was required to take interdisciplinary courses in economics, anthropology, and social psychology. This intellectual background helped him conduct the diffusion studies. In , Ryan became a professor at Iowa State University which is known for its agricultural focus. At that time, Iowa State administrators were worried about the slow rate at which the hybrid seed corn was being adopted. Despite the fact that the use of this new innovation could lead to an increase in quality and production, an advantageous adoption by Iowa Farmers was slow. Contrary to previous research, which employed anthropological style approaches using qualitative methods, Ryan employed a quantitative survey method in his study. Ryan asked him to conduct interviews with Iowa farmers through survey research. Gross gathered the data from the Iowa communities of Jefferson and Grand Junction. It is also interesting to note that Rogers earned a Ph. However, there were some barriers to prevent Iowa farmers from adopting the hybrid seed corn. One problem was that the hybrid seed corn could not reproduce p. This meant that the hybrid seed was relatively expensive for Iowa farmers, especially at the time of the Depression. Therefore, it is reasonable to assume that, despite the economic profit that the hybrid seed corn brought, its high price made a adoption among Iowa farmers remain slow. According to Lowery and DeFleur, Ryan and Gross sought to explain how the hybrid seed corn came to attention and which of two channels i. They found that each channel has different functions. Ryan and Gross also found that the rate of adoption of hybrid seed corn followed an S-shaped curve, and that there were four different types of adopters. According to Rogers, Ryan and Gross also made a contribution by identifying the five major stages in the adoption process, which were awareness, interest, evaluation, trial, and adoption. Diffusion of a medical drug among doctors[edit] According to Rogers, diffusion theory became more widely accepted after James S. Coleman, Elihu Katz, and Herbert Menzel conducted a study on the diffusion of tetracycline, a new medical drug, in . The Pfizer drug company invented this successful new drug and wanted to investigate the effectiveness of their tetracycline advertisements, which were placed in medical journals. The company asked three professors at Columbia University to find out how physicians adopted the new innovation and how mass communication influenced this adoption

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process. They conducted a survey to gather accurate and reliable data. In addition to this, Coleman et al. The result shows that the percentage of adoption of the new drug followed an S-shaped curve, but that the rate of tetracycline adoption was faster than the rate of other innovations adoption. The researchers also found that doctors who are cosmopolite were likely to adopt the new drug. One of the most important findings was that doctors who had more interpersonal networks adopted the new medical drug more quickly than those that did not. This meant that interpersonal communication channels with peers had a strong influence on the adoption process. In fact, Rogers mentioned that even though the study of Ryan and Gross became a milestone in diffusion paradigm, they did not measure the interpersonal network links among farmers. In this case, the Columbia University Drug Study made a contribution to identify the importance of social networks in the diffusion process. Rogers[edit] Rogers was born in Carroll, Iowa in . He earned his B. For two years during the Korean War, he served in the U. Interestingly, in , he worked on some family planning communication projects in Korea. The experience there led Rogers to dive into the research about why some innovations are adopted while others are ignored. Employed by Michigan State University in , Rogers obtained opportunity to study diffusion in developing countries of Asia, Latin America, and Africa. Meanwhile, he published the book, *Diffusion of Innovations*, which earned him his academic reputation. The book has become the standard textbook on diffusion theory and it creates applications of diffusion theory in such fields as geography, economics, psychology, political science, and, as previously mentioned, communication. Rogers retired from University of New Mexico in because he was suffering from kidney disease. He died on October 21, . An Innovation is an idea, practice or object perceived as new by an individual or other unit of adoption. That is, by sharing communication channels such as interpersonal communication or mass communication people can get information of an innovation and perceive its innovation as useful. Lasswell presented a well-known model of communication that is analyzed as five parts, S-M-C-R-E e. Most innovations have an S-shaped rate of adoption. Diffusion research has attempted to explain the variables that influence how and why users and audience adopt a new information medium, such as the Internet. According to evolution of media technology, interpersonal influences are important even though in the past the individual is usually the unit of analysis. Also, critical mass becomes an important factor in adopting new media because new media are interactive tools and thus are required by many users to gain efficiency. That is, the more people use, the more people get benefits. In this sense, diffusion theory not only can apply to practical things, but also can be related to digital divide. There are five different types of adopters in the diffusion process, according to Innovativeness: Figure 1 shows the relationships between types of adopters divided by innovativeness and their place on the adoption curve. Also, these categories follow a standard deviation curve which is bell-shaped. However, as noted above, different types of innovations e. Shapes of curves of diffusions for innovations Source by: Based on these five criteria, individuals perceive an innovation as new or useful and decide to adopt it. When an individual decides to adopt new media or switch old media with new media, the perceived characteristics of innovations play an important role in reducing some uncertainty about the innovations. Unit of analysis on diffusion theory[edit] Diffusion of innovation theory attempts to explain how an innovation is spread and why it is adopted at both the micro and macro levels of analysis. This characteristic of unit of analysis is due to research methods, such as utilizing a survey to study diffusion. Many studies have focused on individual decisions or adoption. In contrast, diffusion theory considers analysis at both the micro-individual and macro-social levels. This is because studies of diffusion include both an innovation at the micro level, as well as its influence, such as social change, at the macro level. Rogers suggested that the four main elements in the diffusion of innovation process were innovation, communication channels, time, and social system. In terms of communication channels, diffusion of an innovation involves both interpersonal channels micro and mass communication channels macro. By utilizing both mass and interpersonal communication channels, people can get information about an innovation and perceive its usefulness. Therefore, diffusion theory requires both micro-individual and macro-social analysis. Table 1 Needs to be cleaned up using piping! Adoption, diffusion and use of new media. The diffusion tradition has classified people, in terms of demographics, in explaining

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the variables that influence the adoption of an innovation. For that reason, some scholars often criticize that this theory may not provide a causal explanation of why and how people adopt certain technologies. Nevertheless, when it comes to the use and choice of old and new media, diffusion theory will be suited for explaining why some people prefer to use the old media or new media, because this theory provides some conceptual guidance for understanding the adoption of some technologies or innovations. According to evolution of media technology, interpersonal influences or channels are important even though in the past the individual is usually the unit of analysis. Also, critical mass becomes an important factor in adopting new media because new media are interactive tools and thus are required to many users for getting efficiency. Markus proposed that the value of an interactive communication medium is associated with the number of other users. For example, in the case of the mp3, a social influence such as peer pressure that interacts with young generation needs to be cool or to gain status drives young people to adopt the mp3 as an innovation. When it comes to the future of diffusion theory, we expect that the popularity of diffusion research will increase because as in recent years, new communication technologies have increased and proliferated. The study showed that interpersonal channels, such as opinion leaders, are more important than the mass media. Unlike magic bullet theory, both of these studies emphasized the role of the opinion leaders and interpersonal communication, such as face-to-face interactions influencing decision-making. References[edit] Alexander, P. Entry barriers, release behavior, and multiproduct firms in the music recording industry. *Review of Industrial Organization*, 9, Network externalities and critical mass. *Telecommunications Policy*, 12, University of Chicago Press. Diffusion of a medical drug among doctors. A proposed integration among organizational information requirements, media richness, and structural design.

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Chapter 3 : Communication Theory/Diffusion of Innovations - Wikibooks, open books for an open world

9 Geometric Means and Lognormal Distributions 10 Example of Interlocking Models: Party Sizes and Cabinet Duration
11 Beyond Constraint-Based Models: Communication Channels and Growth Rates.

Nonverbal communication Nonverbal communication describes the processes of conveying a type of information in the form of non-linguistic representations. Examples of nonverbal communication include haptic communication , chronemic communication , gestures , body language , facial expressions , eye contact , and how one dresses. Nonverbal communication also relates to the intent of a message. Examples of intent are voluntary, intentional movements like shaking a hand or winking, as well as involuntary, such as sweating. It affects communication most at the subconscious level and establishes trust. Likewise, written texts include nonverbal elements such as handwriting style, the spatial arrangement of words and the use of emoticons to convey emotion. Once proximity has formed awareness, living creatures begin interpreting any signals received. However, non-verbal communication is ambiguous. There are several reasons as to why non-verbal communication plays a vital role in communication: To have total communication, all non-verbal channels such as the body, face, voice, appearance, touch, distance, timing, and other environmental forces must be engaged during face-to-face interaction. Written communication can also have non-verbal attributes. Such non-verbal signals allow the most basic form of communication when verbal communication is not effective due to language barriers. Verbal[edit] Verbal communication is the spoken or written conveyance of a message. Human language can be defined as a system of symbols sometimes known as lexemes and the grammars rules by which the symbols are manipulated. The word "language" also refers to common properties of languages. Language learning normally occurs most intensively during human childhood. Most of the thousands of human languages use patterns of sound or gesture for symbols which enable communication with others around them. Languages tend to share certain properties, although there are exceptions. There is no defined line between a language and a dialect. Constructed languages such as Esperanto , programming languages , and various mathematical formalism is not necessarily restricted to the properties shared by human languages. As previously mentioned, language can be characterized as symbolic. Charles Ogden and I. A Richards developed The Triangle of Meaning model to explain the symbol the relationship between a word , the referent the thing it describes , and the meaning the thought associated with the word and the thing. The properties of language are governed by rules. Language follows phonological rules sounds that appear in a language , syntactic rules arrangement of words and punctuation in a sentence , semantic rules the agreed upon meaning of words , and pragmatic rules meaning derived upon context. The meanings that are attached to words can be literal, or otherwise known as denotative; relating to the topic being discussed, or, the meanings take context and relationships into account, otherwise known as connotative; relating to the feelings, history, and power dynamics of the communicators. There are however, nonverbal elements to signed languages, such as the speed, intensity, and size of signs that are made. A signer might sign "yes" in response to a question, or they might sign a sarcastic-large slow yes to convey a different nonverbal meaning. The sign yes is the verbal message while the other movements add nonverbal meaning to the message. Written communication and its historical development[edit] Over time the forms of and ideas about communication have evolved through the continuing progression of technology. Advances include communications psychology and media psychology, an emerging field of study. The progression of written communication can be divided into three "information communication revolutions": The pictograms were made in stone, hence written communication was not yet mobile. Pictograms began to develop standardized and simplified forms. The next step occurred when writing began to appear on paper , papyrus, clay, wax, and other media with commonly shared writing systems, leading to adaptable alphabets. The final stage is characterized by the transfer of information through controlled waves of electromagnetic radiation i. Communication is thus a process by which meaning is assigned and conveyed in an attempt to create shared understanding. Gregory Bateson called it "the replication

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of tautologies in the universe. Business communication Business communication is used for a wide variety of activities including, but not limited to: Companies with limited resources may choose to engage in only a few of these activities, while larger organizations may employ a full spectrum of communications. Since it is difficult to develop such a broad range of skills, communications professionals often specialize in one or two of these areas but usually have at least a working knowledge of most of them. Political[edit] Communication is one of the most relevant tools in political strategies, including persuasion and propaganda. In mass media research and online media research, the effort of the strategist is that of getting a precise decoding, avoiding "message reactance", that is, message refusal. The reaction to a message is referred also in terms of approach to a message, as follows: In "radical reading" the audience rejects the meanings, values, and viewpoints built into the text by its makers. In "dominant reading", the audience accepts the meanings, values, and viewpoints built into the text by its makers. In "subordinate reading" the audience accepts, by and large, the meanings, values, and worldview built into the text by its makers. The modern political communication field is highly influenced by the framework and practices of "information operations" doctrines that derive their nature from strategic and military studies. According to this view, what is really relevant is the concept of acting on the Information Environment. The information environment is the aggregate of individuals, organizations, and systems that collect, process, disseminate, or act on information. This environment consists of three interrelated dimensions, which continuously interact with individuals, organizations, and systems. These dimensions are known as physical, informational, and cognitive. Open and honest communication creates an atmosphere that allows family members to express their differences as well as love and admiration for one another. It also helps to understand the feelings of one another. Family communication study looks at topics such as family rules, family roles or family dialectics and how those factors could affect the communication between family members. Researchers develop theories to understand communication behaviors. Family communication study also digs deep into certain time periods of family life such as marriage, parenthood or divorce and how communication stands in those situations. It is important for family members to understand communication as a trusted way which leads to a well constructed family. Interpersonal[edit] In simple terms, interpersonal communication is the communication between one person and another or others. It is often referred to as face-to-face communication between two or more people. Both verbal and nonverbal communication, or body language , play a part in how one person understands another. In verbal interpersonal communication there are two types of messages being sent: Content messages are messages about the topic at hand and relational messages are messages about the relationship itself. Audiovisual Perception of Communication Problems. It also explores the concept that stuttering during speech shows the audience that there is a problem or that the situation is more stressful. Emotional Intelligence and Triggers. Emotional Triggers focus on events or people that tend to set off intense, emotional reactions within individuals. The Power of Words Verbal communications. It takes into consideration tone, volume, and choice of words. It focuses heavily on the setting that the words are conveyed in, as well as the physical tone of the words. Ethics in Personal Relations. This theory is explored by Dawn J. Liphrott in the article What IS Relationship? What is Ethical Partnership? Ten Lessons for Negotiators Conflict in Couples. This theory is explored by Amanda Lenhart and Maeve Duggan in their paper Couples, the Internet, and Social Media Barriers to effectiveness[edit] Barriers to effective communication can retard or distort the message or intention of the message being conveyed. This may result in failure of the communication process or cause an effect that is undesirable. These include filtering, selective perception, information overload, emotions, language, silence, communication apprehension, gender differences and political correctness [23] This also includes a lack of expressing "knowledge-appropriate" communication, which occurs when a person uses ambiguous or complex legal words, medical jargon, or descriptions of a situation or environment that is not understood by the recipient. Physical barriers- Physical barriers are often due to the nature of the environment. An example of this is the natural barrier which exists if staff is located in different buildings or on different sites. Likewise, poor or outdated equipment, particularly the failure of management to introduce new technology, may also cause

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problems. Staff shortages are another factor which frequently causes communication difficulties for an organization. System design- System design faults refer to problems with the structures or systems in place in an organization. Examples might include an organizational structure which is unclear and therefore makes it confusing to know whom to communicate with. Other examples could be inefficient or inappropriate information systems, a lack of supervision or training, and a lack of clarity in roles and responsibilities which can lead to staff being uncertain about what is expected of them. Attitudinal barriers- Attitudinal barriers come about as a result of problems with staff in an organization. These may be brought about, for example, by such factors as poor management, lack of consultation with employees, personality conflicts which can result in people delaying or refusing to communicate, the personal attitudes of individual employees which may be due to lack of motivation or dissatisfaction at work, brought about by insufficient training to enable them to carry out particular tasks, or simply resistance to change due to entrenched attitudes and ideas. Hence the communicator must ensure that the receiver receives the same meaning. It is better if such words are avoided by using alternatives whenever possible. Individual linguistic ability- The use of jargon , difficult or inappropriate words in communication can prevent the recipients from understanding the message. Poorly explained or misunderstood messages can also result in confusion. However, research in communication has shown that confusion can lend legitimacy to research when persuasion fails. Bypassing-These happens when the communicators sender and the receiver do not attach the same symbolic meanings to their words. It is when the sender is expressing a thought or a word but the receiver takes it in a different meaning. For example- ASAP, Rest room Technological multi-tasking and absorbency- With a rapid increase in technologically-driven communication in the past several decades, individuals are increasingly faced with condensed communication in the form of e-mail, text, and social updates. This has, in turn, led to a notable change in the way younger generations communicate and perceive their own self-efficacy to communicate and connect with others. Though perhaps too new of an advancement to yet see long-term effects, this is a notion currently explored by such figures as Sherry Turkle. If we exercise simple practices to improve our communication skill, we can become effective communicators. For example, read an article from the newspaper or collect some news from the television and present it in front of the mirror.

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Chapter 4 : Beyond Constraint-Based Models: Communication Channels and Growth Rates - Oxford Sc

growth in the number of communication channel requires the use of higher frequencies above 3GHz where contiguous spectrum can be found to support wider communication channels. New mobile generations are typically assigned new frequency bands and wider spectral bandwidth per.

Next Topic TOC The distance over which data moves within a computer may vary from a few thousandths of an inch, as is the case within a single IC chip, to as much as several feet along the backplane of the main circuit board. Over such small distances, digital data may be transmitted as direct, two-level electrical signals over simple copper conductors. Except for the fastest computers, circuit designers are not very concerned about the shape of the conductor or the analog characteristics of signal transmission. Frequently, however, data must be sent beyond the local circuitry that constitutes a computer. In many cases, the distances involved may be enormous. Unfortunately, as the distance between the source of a message and its destination increases, accurate transmission becomes increasingly difficult. This results from the electrical distortion of signals traveling through long conductors, and from noise added to the signal as it propagates through a transmission medium. In this case, distortion and noise can become so severe that information is lost. Data Communications concerns the transmission of digital messages to devices external to the message source. As a rule, the maximum permissible transmission rate of a message is directly proportional to signal power, and inversely proportional to channel noise. It is the aim of any communications system to provide the highest possible transmission rate at the lowest possible power and with the least possible noise. It may be defined by a physical wire that connects communicating devices, or by a radio, laser, or other radiated energy source that has no obvious physical presence. Information sent through a communications channel has a source from which the information originates, and a destination to which the information is delivered. Although information originates from a single source, there may be more than one destination, depending upon how many receive stations are linked to the channel and how much energy the transmitted signal possesses. In a digital communications channel, the information is represented by individual data bits, which may be encapsulated into multibit message units. A byte, which consists of eight bits, is an example of a message unit that may be conveyed through a digital communications channel. A collection of bytes may itself be grouped into a frame or other higher-level message unit. Such multiple levels of encapsulation facilitate the handling of messages in a complex data communications network. Any communications channel has a direction associated with it: The message source is the transmitter, and the destination is the receiver. A channel whose direction of transmission is unchanging is referred to as a simplex channel. For example, a radio station is a simplex channel because it always transmits the signal to its listeners and never allows them to transmit back. A half-duplex channel is a single physical channel in which the direction may be reversed. Messages may flow in two directions, but never at the same time, in a half-duplex system. In a telephone call, one party speaks while the other listens. After a pause, the other party speaks and the first party listens. Speaking simultaneously results in garbled sound that cannot be understood. A full-duplex channel allows simultaneous message exchange in both directions. It really consists of two simplex channels, a forward channel and a reverse channel, linking the same points. The transmission rate of the reverse channel may be slower if it is used only for flow control of the forward channel. Because it is neither practical nor economic to transfer all bits of a long message simultaneously, the message is broken into smaller parts and transmitted sequentially. Bit-serial transmission conveys a message one bit at a time through a channel. Each bit represents a part of the message. The individual bits are then reassembled at the destination to compose the message. In general, one channel will pass only one bit at a time. Thus, bit-serial transmission is necessary in data communications if only a single channel is available. Bit-serial transmission is normally just called serial transmission and is the chosen communications method in many computer peripherals. Byte-serial transmission conveys eight bits at a time through eight parallel channels. Although the raw transfer rate is eight times faster than in bit-serial

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transmission, eight channels are needed, and the cost may be as much as eight times higher to transmit the message. When distances are short, it may nonetheless be both feasible and economic to use parallel channels in return for high data rates. The popular Centronics printer interface is a case where byte-serial transmission is used. As another example, it is common practice to use a bit-wide data bus to transfer data between a microprocessor and memory chips; this provides the equivalent of 16 parallel channels. On the other hand, when communicating with a timesharing system over a modem, only a single channel is available, and bit-serial transmission is required. This figure illustrates these ideas: The baud rate refers to the signalling rate at which data is sent through a channel and is measured in electrical transitions per second. In the EIA serial interface standard, one signal transition, at most, occurs per bit, and the baud rate and bit rate are identical. If two electrical transitions were required for each bit, as is the case in non-return-to-zero coding, then at a rate of baud, only bits per second could be conveyed. The channel efficiency is the number of bits of useful information passed through the channel per second. It does not include framing, formatting, and error detecting bits that may be added to the information bits before a message is transmitted, and will always be less than one. The data rate of a channel is often specified by its bit rate often thought erroneously to be the same as baud rate. However, an equivalent measure channel capacity is bandwidth. A communications protocol is an agreed-upon convention that defines the order and meaning of bits in a serial transmission. It may also specify a procedure for exchanging messages. A protocol will define how many data bits compose a message unit, the framing and formatting bits, any error-detecting bits that may be added, and other information that governs control of the communications hardware. Channel efficiency is determined by the protocol design rather than by digital hardware considerations. Note that there is a tradeoff between channel efficiency and reliability - protocols that provide greater immunity to noise by adding error-detecting and -correcting codes must necessarily become less efficient. Instead, there is usually a burst of regularly spaced binary data bits followed by a pause, after which the data flow resumes. Packets of binary data are sent in this manner, possibly with variable-length pauses between packets, until the message has been fully transmitted. In order for the receiving end to know the proper moment to read individual binary bits from the channel, it must know exactly when a packet begins and how much time elapses between bits. When this timing information is known, the receiver is said to be synchronized with the transmitter, and accurate data transfer becomes possible. Failure to remain synchronized throughout a transmission will cause data to be corrupted or lost. Two basic techniques are employed to ensure correct synchronization. In synchronous systems, separate channels are used to transmit data and timing information. The timing channel transmits clock pulses to the receiver. Upon receipt of a clock pulse, the receiver reads the data channel and latches the bit value found on the channel at that moment. The data channel is not read again until the next clock pulse arrives. Because the transmitter originates both the data and the timing pulses, the receiver will read the data channel only when told to do so by the transmitter via the clock pulse, and synchronization is guaranteed. Techniques exist to merge the timing signal with the data so that only a single channel is required. This is especially useful when synchronous transmissions are to be sent through a modem. Two methods in which a data signal is self-timed are nonreturn-to-zero and biphase Manchester coding. These both refer to methods for encoding a data stream into an electrical waveform for transmission. In asynchronous systems, a separate timing channel is not used. The transmitter and receiver must be preset in advance to an agreed-upon baud rate. For the most common serial protocol, data is sent in small packets of 10 or 11 bits, eight of which constitute message information. The start bit triggers an internal timer in the receiver that generates the needed clock pulses. Following the start bit, eight bits of message data are sent bit by bit at the agreed upon baud rate. The packet is concluded with a parity bit and stop bit. One complete packet is illustrated below: The packet length is short in asynchronous systems to minimize the risk that the local oscillators in the receiver and transmitter will drift apart. When high-quality crystal oscillators are used, synchronization can be guaranteed over an bit period. Every time a new packet is sent, the start bit resets the synchronization, so the pause between packets can be arbitrarily long. Note that the EIA standard defines electrical, timing, and mechanical characteristics of a serial

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interface. However, it does not include the asynchronous serial protocol shown in the previous figure, or the ASCII alphabet described next. This standard relates binary codes to printable characters and control codes. Most modern character-oriented peripheral equipment abides by the ASCII standard, and thus may be used interchangeably with different computers. Parity and Checksums Next Topic Previous Topic TOC Noise and momentary electrical disturbances may cause data to be changed as it passes through a communications channel. If the receiver fails to detect this, the received message will be incorrect, resulting in possibly serious consequences. As a first line of defense against data errors, they must be detected. If an error can be flagged, it might be possible to request that the faulty packet be resent, or to at least prevent the flawed data from being taken as correct. If sufficient redundant information is sent, one- or two-bit errors may be corrected by hardware within the receiver before the corrupted data ever reaches its destination. A parity bit is added to a data packet for the purpose of error detection. Upon receipt of the packet, the parity needed for the data is recomputed by local hardware and compared to the parity bit received with the data. If any bit has changed state, the parity will not match, and an error will have been detected. In fact, if an odd number of bits not just one have been altered, the parity will not match. If an even number of bits have been reversed, the parity will match even though an error has occurred. However, a statistical analysis of data communication errors has shown that a single-bit error is much more probable than a multibit error in the presence of random noise. Thus, parity is a reliable method of error detection. Another approach to error detection involves the computation of a checksum. In this case, the packets that constitute a message are added arithmetically.

Chapter 5 : Geometric Means and Lognormal Distributions - Oxford Scholarship

Constraint-based modelling can be used to interpret and augment omic data sets by using an underlying cellular network that has been biochemically validated.

Chapter 6 : Communication - Wikipedia

86 IEEE Communications Magazine â€¢ January arrivals. Note that a ray traveling over a longer path may do so at a higher speed, thus reaching the receiver before a direct stronger ray.

Chapter 7 : Beyond the Zero-Based Budgeting buzz | Accenture Strategy

That means moving toward a more comprehensive Eliza-type model, which includes analytics and engagement and utilizes multiple communications channels to reach plan participants.