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Sustainability Management Business School Switzerland

Spring Semester 2024 - Global Communication Strategies

Professor: Joe Di Donna, Ph.D.

Goovi Company

Emilia Reichardt, Zlata Timofejeva, Jasmina Badic

Mai 18th, 2024

Word Count: 2264

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Contemplating on the relevance of the State of the Art of Digital Communication

Introduction

The term “digital communication…” however does have different connotations when referring to different traffic volumes. If it concerns the interchange of a number of extensive texts and other messages at a computer network or the interchange of small quantities through a separate central computer, which only serves this particular purpose, the terms “computer communications” or “data transmission” are usually applied. It would seem that the term “digital communication” only applies to the connections of character terminals and block terminals in one hand and central computer in the other. Such connections mean the personnel receives references to files containing pre-processed data, databases, or the software stored in the central computers, and the terminals are only isolated points for further individual connection requests. But, regardless of which term is used, such communications have the common channels of transmission and kind are of the connection, of the terminal or the session management.

As the computer networks expand, computer related means of communicating information for humans is set through developmental experience. These techniques can be grouped together under the general term “digital communication.” These techniques are used solely for the purpose of transmitting messages, texts, and other forms of digital information. The least complex in the list of digital communication media is the computer monitor and its most advanced applications are obtained by the connection of several monitors or of master computers. In addition, the term digital communication can also cover the procedures of connection, chiefly by telephone, of the terminals which are likely to be directly operated by people. These terminals assume either one of two main forms, in both the form of an enhanced typewriter: the character terminal, an equipment that is identical to the modern keyboard operated teletypes, if developed to its maximum potentiality, and the block terminal which transfers messages as a rule prepared, off-line, by any possible method.

2. Core Areas of Analysis:

Coding Theory Efficient data transmission is essential in digital communication, and coding theory aims in the creation of proper ways in which information can be encoded in order to be transmitted appropriately in channels that have a high probability of intercepting the messages. It has been observed lately that the development of coding schemes and coding technologies such as low-density parity-check (LDPC) and polar codes have enhanced the capability of error correction and data transfer. These codes are very helpful in minimizing errors as data is transmitted and plays a very important role in the case where the quality of the transmission is not well-received and is full of interference and noise.

Information Theory Information theory is a set of concepts where Claude Shannon holds a prominent position today and includes entropy as well as the channel capacity that defines the possibilities of data compression and transmission. Entropy quantifies the amount of disorder or information in the source of a stream, whereas channel capacity informs on the limit to the rate of communication of data through a channel.

The modern advancement of information theory has been towards improving the data compression algorithms which helps to store and transmit larger data sets at improved data rates crucial in today's applications such as video streaming or cloud computing.

Network Theory Network theory focuses on the analysis of traffic patterns and of the functions of route-finding algorithms regarding networks. Routing mechanisms work to ensure that this data is transmitted through the shortest and fastest way possible to enhance the overall network's performance. These focal areas of present-day research include software defined network (SDN) process and designing network functions through virtualization which offer enhanced variability and command on network administration, thus giving rise to progressive and more adaptable media of communication.

Transmission and Reception Techniques of Communication Signals: Communication signal processing includes the method that helps in transmission or reception of any signal. In recent research studies, the emphasis has been placed on the need to implement enhanced data rates and signal quality. Other features that have enabled better capacity and reliability in wireless communication networks include such as the multiple-input, multiple-out systems, and advanced modulation techniques. These developments are paramount important to provide new level of internet connectivity as well as for upcoming applications such 5G & beyond.

Social Network Theory Many authors define the social network theory as the study of the structure and function of social media technologies to understand how communities can be informed and influenced. The analysis of social networks gives understanding of how information circulates and how communities are constructed, seeking the presence of key players (opinion leaders). Other emerging research has dealt with the impact of algorithms on consumption and sharing of content to show how much and how beneficial or even pernicious social media can be as instruments that form public opinion and trends.

3. Emerging Trends

Implementation of Machine Learning in Adaptive Networks & Traffic Analysis Machine learning has been widely adopted for improving network performance, traffics forecasting, and abnormality detection. With the help of big data analytics, machine learning algorithms can make real-time decisions to manage increasing network traffic and possible threats. It can be used in such areas as dynamic resource control, condition-based maintenance, and self-healing networks, which brings about improved and effective communication systems.

Cognitive Radio Cognitive radio technology is one that enables the wireless communication systems to have the capacity of detecting open spectrum in the communication environment and also make dynamic changes of the transmission parameters in the available spectrum. This applies to the issue of scarcity because spectrum can now be used more efficiently which means that the networks can be made to hold more capacity and at the same time the interferences can be overcome. Cognitive radio is likely to bring significant changes in the existing limited options in wireless communication by more efficiently using available bandwidth space especially in heavily populated areas.

Internet of Things (IoT) The circumstances surrounding IoT devices and technologies, and the communication protocols required for connecting Low Power Wide Area Networks (LPWAN) are relevant. The interconnectivity of billions of devices does necessitate that there are certain standards and protocols in place to guarantee a dependable and efficient ability to communicate. Developments in IoT communication over the last years include the emergence of the low power wide area networks (LPWANs) as well as the use of edge computing which filters data closer to the origin hence minimizing latency and the required bandwidth. These technologies are extremely important for the IoT devices to work harmoniously in conjunction with each other and with other systems in residential, commercial and industrial applications.

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