What are the components of a communication channel? What are the components of a communication protocol? Discuss.

A communications protocol includes message content, which is composed of data and command content, message transmission, which is composed of media, which is composed of bit encoding and transmission, channel organization, which is composed of simplex/half-duplex/duplex modes, parallel/serial transmission, and channel sharing, and coordination, which includes clock synchronization, error detection and correction.

In order for communications to take place, there must be message content to communicate, which includes the data to be communicated as well as command content, which includes instructions such as device control, addressing, and routing as well as information about the size, content, and format of the data. Message transmission takes place over media, where bits are transmitted via sine waves, where variations in amplitude and frequency of the wave encode the true/false values of the bits.

Transmission requires channel organization to prevent conflicts along media. Modes of channel organization includes simplex mode, where messages flow in only one direction, half-duplex mode, where nodes take turns transmitting and receiving along the same line, and full-duplex mode, where simultaneous transmission can occur between nodes using a second transmission line. Parallel transmission is a type of medium that uses a separate line for each bit position, while serial transmission sends bits sequentially through a transmission line, where the receiving device reassembles them. Channel sharing involves using techniques such as circuit switching, packet switching, and frequency/wavelength-division multiplexing that negotiate multiple devices or people using the same channel.

Transmission also requires coordination between communicating devices. Clock synchronization involves keeping the sending and receiving device's clocks in synch during transmissions through strategies such as sending continuous data streams to ensure synchronous transmission or using start bits to synchronize clocks only when messages are sent in asynchronous transmission. Error detection and error correction relies on sending redundant transmission data for evaluation on the receiving device using parity checking, where a parity bit is used to evaluate the integrity of each character, block checking, where blocks of eight bytes are evaluated with eight-bit parity strings at once, and cyclic redundancy checking, where a more advanced form of block-checking is used to evaluate blocks up to 128 bits in size.

A communications channel involves the physical devices conducting the communications, includes both a sending and a receiving device and a medium to connect them. The sending and receiving devices can be a telephone, modem, network card, or two people talking in a room. The medium can be copper wires carrying electrons, optical wire carrying photons, air carrying sound waves, or empty space carrying radio waves (Ciccarelli, 2003).

Patric Ciccarelli and Christina Faulkner, *Networking Foundations,* SYBEX Inc, 2003.