# ITS323 – Definitions and Concepts

## 1 Acronyms

Many of the acronyms used in the course are defined below. The name in [square brackets] is not part of the definition, but classifies the acronym to the part of the course it is first mention (usually a lecture or chapter, although there are others such as *standards* and *wans*).

| | |
|---|---|
| ADSL | Asymmetric Digital Subscriber Line [multiplexing] |
| AM | Amplitude Modulation [signals] |
| AMI | Alternate Mark Inversion [signals] |
| ANSI | American National Standard Institute [standards] |
| ARP | Address Resolution Protocol [network] |
| ARQ | Automatic Repeat Request [data link] |
| ASCII | American Standard Code for Information Interchange [standards] |
| ASK | Amplitude-Shift Keying [signals] |
| ATM | Asynchronous Transfer Mode [wans] |
| BER | Bit Error Rate [transmission] |
| BGP | Border Gateway Protocol [routing] |
| CA | Collision Avoidance [lans] |
| CBR | Constant Bit Rate [multiplexing] |
| CD | Collision Detection [lans] |
| CMI | Coded Mark Inversion [signals] |
| CRC | Cyclic Redundancy Check [encoding] |
| CSMA | Carrier Sense Multiple Access [lans] |
| FCC | Federal Communications Commission [standards] |
| FCS | Frame Check Sequence [encoding] |
| FDM | Frequency-Division Multiplexing [multiplexing] |
| FSK | Frequency-Shift Keying [signals] |
| FTP | File Transfer Protocol [apps] |
| FM | Frequency Modulation [signals] |
| GPS | Global Positioning System [media] |
| HDLC | High-Level Data Link Control [data link] |
| HTML | Hypertext Markup Language [apps] |
| HTTP | Hypertext Transfer Protocol [apps] |
| ICMP | Internet Control Message Protocol [network] |
| IEEE | Institute of Electrical and Electronics Engineers [standards] |
| IETF | Internet Engineering Task Force [standards] |
| IP | Internet Protocol [network] |
| IRA | International Reference Alphabet [standards] |
| ISDN | Integrated Services Digital Network [wans] |
| ISO | International Organization for Standardization [standards] |
| ITU | International Telecommunications Union [standards] |
| LAN | Local Area Network [lans] |
| LLC | Logical Link Control [data link] |

| | |
|---|---|
| MAC | Medium Access Control [data link] |
| MAN | Metropolitan Area Network [wans] |
| MIME | Multi-Purpose Internet Mail Extension [apps] |
| MPLS | Multipprotocol Label Switching [wans] |
| NRZI | Nonreturn to Zero, Inverted [signals] |
| NRZL | Nonreturn to Zero, Level [signals] |
| OSI | Open Systems Interconnection [standards] |
| OSPF | Open Shortest Path First [routing] |
| PCM | Pulse Code Modulation [signals] |
| PDU | Protocol Data Unit [protocols] |
| PSK | Phase-Shift Keying [signals] |
| PM | Phase Modulation [signals] |
| QAM | Quadrature Amplitude Modulation [signals] |
| QoS | Quality of Service [network] |
| QPSK | Quadrature Phase Shift Keying [signals] |
| RF | Radio Frequency [media] |
| SDH | Synchronous Digital Hierarchy [wans] |
| SMTP | Simple Mail Transfer Protocol [apps] |
| SNMP | Simple Network Management Protocol [apps] |
| SONET | Synchronous Optical Network [wans] |
| SS7 | Signalling System Number 7 [wans] |
| STP | Shielded Twisted Pair [lans] |
| TCP | Transmission Control Protocol [transport] |
| UDP | User Datagram Protocol [transport] |
| UTP | Unshielded Twisted Pair [lans] |
| VLAN | Virtual LAN [lans] |
| WWW | World Wide Web [apps] |

# 2 Units and Prefixes

Some commonly used units are given in Table 1. Further units can be derived from those listed, e.g. bits per second (b/s) and metres per second (m/s). Prefixes, which when combined with the unit produce a multiple of the original unit, are listed in Table 2.

Table 1: Commonly Used Units

| *Unit* | *Symbol* | *Quantity* |
|---|---|---|
| second | s | time |
| metre | m | length |
| bit | b | information |
| Hertz | Hz | frequency |
| radian | rad | angle |
| Watt | watt | power |
| decibel | dB | ratio of power quantities |

*bits and Bytes*: we assume 8 bits is equivalent to 1 Byte. Lowercase $b$ is the symbol for bits, while uppercase $B$ is the symbol for Bytes. Unless otherwise stated, the standard prefixes in Table 2 are used with bytes, i.e. 1kB = 1000B = 8000b. (In some computing literature, especially related to disk sizes, the prefix k is $2^{10} = 1024$, M is $2^{20}$ and so on.

Table 2: Commonly Used Prefixes

| *Prefix* | *Symbol* | $10^n$ |
|---|---|---|
| tera | T | $10^{12}$ |
| giga | G | $10^9$ |
| mega | M | $10^6$ |
| kilo | k | $10^3$ |
| milli | m | $10^{-3}$ |
| micro | $\mu$ | $10^{-6}$ |
| nano | n | $10^{-9}$ |
| pico | p | $10^{-12}$ |

This is NOT the case in this course; use the more common and simpler k $= 10^3 = 1000$, M $= 10^6$).

# 3 Logarithms

Some useful properties of logarithms:

$$a = \log_n(x)$$

$$n^a = x$$

$$\log(x \times y) = \log(x) + \log(y)$$

$$\log\left(\frac{x}{y}\right) = \log(x) - \log(y)$$

$$n^a \times n^b = n^{a+b}$$

$$\frac{n^a}{n^b} = n^{a-b}$$

$$\log_m(x) = \frac{\log_n(x)}{\log_n(m)}$$

# 4 Decibels and Signal Strength

In a transmission system a signal is attenuated as it propagates along a transmission medium. That is, there is a *loss* of signal strength. To compensate, amplifying components may be used, producing a *gain* in signal strength. *Decibels* are commonly used to express gaines and losses in a transmission system.

A decibel is a measure of the ratio between two signal levels:

$$G_{\text{dB}} = 10 \log_{10} \frac{P_{out}}{P_{in}}$$

where:

- $G_{\text{dB}}$ is the gain, in decibels
- $P_{in}$ is the input power level

- $P_{out}$ is the output power level

As an example, if an amplifer takes a 10 mW input and produces a 1 W output, then it has a gain of 20 dB. The absolute ratio of the two power levels is 100.

If the output power is greater than the input power, then the gain is positive. However if the output power is less than the input power, then the gain is negative. A negative gain is also called a loss, e.g. a gain of –3 dB is a loss of 3 dB. An equation for loss can easily be derived.

Decibels are a measure of relative, not absolute, difference. Sometimes it is convenient to refer to an absolute level.

The dBW (decibel Watt) is the gain of some power level relative to 1 Watt.

$$Power_{\text{dBW}} = 10 \log_{10} \frac{Power_W}{1 \text{ W}}$$

Similarly, dBm (decibel milliwatt) is relative to 1 mW:

$$Power_{\text{dBm}} = 10 \log_{10} \frac{Power_{mW}}{1 \text{ mW}}$$

As an example, $P = 2$ W $\approx 3$ dBW $\approx 33$ dBm.

There are other units that you may come across including dBmV and dBi.