

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	Multiprotocol 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

<i>Unit</i>	<i>Symbol</i>	<i>Quantity</i>
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. $1\text{kB} = 1000\text{B} = 8000\text{b}$. (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

<i>Prefix</i>	<i>Symbol</i>	10^n
tera	T	10^{12}
giga	G	10^9
mega	M	10^6
kilo	k	10^3
milli	m	10^{-3}
micro	μ	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 gains and losses in a transmission system.

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

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

where:

- G_{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 amplifier 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.

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

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

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

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

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