Table 7.1 The International Reference Alphabet (IRA)

bit position															
b_7				0		0		0		0		1		1		1		1	
	b_6			0		0		1		1		0		0		1		1	
		b_5		0		1		0		1		0		1		0		1	
b_4	b_3	b_2	b_1																
0	0	0	0	NUL		DLE		SP		0		@		P		`		p	
0	0	0	1	SOH		DC1		!		1		A		Q		a		q	
0	0	1	0	STX		DC2		"		2		B		R		b		r	
0	0	1	1	ETX		DC3		#		3		C		S		c		s	
0	1	0	0	EOT		DC4		$		4		D		T		d		t	
0	1	0	1	ENQ		NAK		%		5		E		U		e		u	
0	1	1	0	ACK		SYN		&		6		F		V		f		v	
0	1	1	1	BEL		ETB		'		7		G		W		g		w	
1	0	0	0	BS		CAN		(		8		H		X		h		x	
1	0	0	1	HT		EM		)		9		I		Y		i		y	
1	0	1	0	LF		SUB		*		:		J		Z		j		z	
1	0	1	1	VT		ESC		+		;		K		[		k		{	
1	1	0	0	FF		FS		,		<		L		\		l		|	
1	1	0	1	CR		GS		-		=		M		]		m		}	
1	1	1	0	SO		RS		.		>		N		^		n		~	
1	1	1	1	SI		US		/		?		O		_		o		DEL	

Table 7.2 IRA Control Characters (page 1 of 2)

Format Control

BS (Backspace): Indicates movement of the printing mechanism or display cursor backward one position.

HT (Horizontal Tab): Indicates movement of the printing mechanism or display cursor forward to the next preassigned 'tab' or stopping position.

LF (Line Feed): Indicates movement of the printing mechanism or display cursor to the start of the next line.

VT (Vertical Tab): Indicates movement of the printing mechanism or display cursor to the next of a series preassigned printing lines.

FF (Form Feed): Indicates movement of the printing mechanism or display cursor to the starting position of the next page, form, or screen.

CR (Carriage Return): Indicates movement of the printing mechanism or display cursor to the starting position of the same line.

Transmission Control

SOH (Start of Heading): Used to indicate the start of a heading, which may contain address or routing information.

STX (Start of Text): Used to indicate the start of the text and so also indicates the end of the heading.

ETX (End of Text): Used to terminate the text that was started with STX.

EOT (End of Transmission): Indicates the end of a transmission, which may have included one or more 'texts' with their headings.

ENQ (Enquiry): A request for a response from a remote station. It may be used as a 'WHO ARE YOU' request for a station to identify itself.

ACK (Acknowledge): A character transmitted by a receiving device as an affirmation response to a sender. It is used as a positive response to polling messages.

NAK (Negative Acknowledgment): A character transmitted by a receiving device as an negative response to a sender. It is used as a negative response to polling messages.

SYN (Synchronous/Idle): Used by a synchronous transmission system to achieve synchronization. When no data is being sent a synchronous transmission system may send SYN characters continuously.

ETB (End of Transmission Block): Indicates the end of a block of data for communication purposes. It is used for blocking data where the block structure is not necessarily related to the processing format.

Table 7.2 IRA Control Characters (page 2 of 2)

Information Separator

FS (File Separator)
GS (Group Separator)
RS (Record Separator)
US (United Separator)

Information separators to be used in an optional manner except that their hierarchy shall be FS (the most inclusive) to US (the least inclusive)

Miscellaneous

NUL (Null): No character. Used for filling in time or filling space on tape when there are no data.

BEL (Bell): Used when there is need to call human attention. It may control alarm or attention devices.

SO (Shift Out): Indicates that the code combinations that follow shall be interpreted as outside of the standard character set until a SI character is reached.

SI (Shift In): Indicates that the code combinations that follow shall be interpreted according to the standard character set.

DEL (Delete): Used to obliterate unwanted characters; for example by overwriting.

SP (Space): A nonprinting character used to separate words, or to move the printing mechanism or display cursor forward by one position.

DLE (Data Link Escape): A character that shall change the meaning of one or more contiguously following characters. It can provide supplementary controls, or permits the sending of data characters having any bit combination.

DC1, DC2, DC3, DC4 (Device Controls): Characters for the control of ancillary devices or special terminal features.

CAN (Cancel): Indicates that the data that precedes it in a message or block should be disregarded (usually because an error has been detected).

EM (End of Medium): Indicates the physical end of a tape or other medium, or the end of the required or used portion of the medium.

SUB (Substitute): Substituted for a character that is found to be erroneous or invalid.

ESC (Escape): A character intended to provide code extension in that it gives a specified number of continuously following characters an alternate meaning.

Table 7.3 I/O Techniques

	No Interrupts	**Use of Interrupts**
I/O-to-memory transfer through processor	Programmed I/O	Interrupt-driven I/O
Direct I/O-to-memory transfer		Direct memory access (DMA)

Table 7.5 InfiniBand Links and Data Throughput Rates

Link	Signal rate (unidirectional)	Usable capacity (80% of signal rate)	Effective data throughput (send + receive)
1- wide	2.5 Gbps	2 Gbps (250 MBps)	(250 + 250) MBps
4-wide	10 Gbps	8 Gbps (1 GBps)	(1 + 1) GBps
12-wide	30 Gbps	24 Gbps (3 GBps)	(3 + 3) Gbps