Powers of Two

With the rapid growth of computing, we often need to specify very large powers of 2.

Note: The standard prefixes such as kilo-, mega-, and giga- mean different things in different contexts. In the SI system, they mean powers of $10^3 = 1000$. When talking about computer-related quantities, they often refer to powers of $2^{10} = 1024$. To avoid this confusion, IEC prefixes have been defined to unambiguously refer to powers of 1024.

The following table is taken from http://en.wikipedia.org/wiki/Binary_prefix:

Prefixes for **bit** and **byte** multiples

Decimal (SI)			Binary (IEC)		
Value	**Symbol**	**Full**	**Value**	**Symbol**	**Full**
1000	k	kilo	1024	Ki	kibi
1000^2	M	mega	1024^2	Mi	mebi
1000^3	G	giga	1024^3	Gi	gibi
1000^4	T	tera	1024^4	Ti	tebi
1000^5	P	peta	1024^5	Pi	pebi
1000^6	E	exa	1024^6	Ei	exbi
1000^7	Z	zetta	1024^7	Zi	zebi
1000^8	Y	yotta	1024^8	Yi	yobi

The names come from shortened versions of the original SI prefixes and "bi" is short for "binary," but pronounced "bee." Because the binary prefixes are powers of 2^{10}, we can convert as follows:

2^{XY} means…

$Y = 0 \Rightarrow 1$
$Y = 1 \Rightarrow 2$
$Y = 2 \Rightarrow 4$
$Y = 3 \Rightarrow 8$
$Y = 4 \Rightarrow 16$
$Y = 5 \Rightarrow 32$
$Y = 6 \Rightarrow 64$
$Y = 7 \Rightarrow 128$
$Y = 8 \Rightarrow 256$
$Y = 9 \Rightarrow 512$

$+$

$X = 0 \Rightarrow 0$
$X = 1 \Rightarrow$ kibi
$X = 2 \Rightarrow$ mebi
$X = 3 \Rightarrow$ gibi
$X = 4 \Rightarrow$ tebi
$X = 5 \Rightarrow$ pebi
$X = 6 \Rightarrow$ exbi
$X = 7 \Rightarrow$ zebi
$X = 8 \Rightarrow$ yobi

$+$ bits/bytes

Examples: 2^{33} bits is 8 gibibits!

To hold 13.2 TiB of memory, you would need a 44-bit address space ($2^{44} = 16$ TiB).

For possible mnemonics to help you remember the order of these prefixes, see:
http://inst.eecs.berkeley.edu/~cs61c/fa06/mnem.html