ELEC3020: Lecture 1-3

Buses and point-to-point connections

- Buses provide a rather uncontrolled signal environment.
- The (unpredictable) capacitance associated with plug-in modules lowers the characteristic impedance (costing increased power consumption) and the signal propagation speed.

Equation

- $Z = \sqrt{(l/c)}$
- $v = 1/\sqrt{(l\,c)}$

- Z = impedance
- v = velocity
- l = inductance/metre
- c = capacitance/metre
- In free space (no dielectric, no extra capacitive loading), $v = c$ (speed of light).

Disadvantages

- It becomes difficult to treat the bus as a properly terminated transmission line, even if termination resistors are provided at each end.
- Transient mismatches during output switching can be particularly insidious; the overall result is long bus settling times.
- Parallel buses add additional problems caused by relative skew between the clock and various strobe and data lines, slowing things further.

Serial Interconnects

- While serial interconnect has none of these disadvantages, it does of necessity, require higher signal bandwidths and requires routing/enabling mechanisms to be implemented on-chip.
- There is also a potential problem known as *dispersion* - If $\boldsymbol{l}$ or $\boldsymbol{c}$ vary with frequency (this is likely if $\boldsymbol{c}$ is influenced by a dielectric), then the different frequency components of a signal pulse will propagate at different speeds, causing the pulse to spread out and making the signal hard to recover.