

Big Idea (Week 1): World of Bits

Today's smart phones are a marvel of capability, providing rich connectivity and entertainment in a conveniently portable device at affordable, mass-market prices. These devices represent the convergence of decades of innovation by electrical and computer engineers. At the same time, continued miniaturization and cost reduction suggests we can anticipate greater capabilities to come. These devices are ubiquitously deployed and integrated into our culture, and an understanding of how they work under the covers is not necessary to harness their powers. Nonetheless, as students and engineers in computer and electrical engineering, we can understand how these things work. Delving into their inner workings gives us context for much of disciplinary expertise and course work in computer engineering.

Key trends in this convergence include:

- Digital representation of most everything, including sound
- Cheap digital processing, enabled by Moore's Law (geometric scaling of mass produced integrated circuits), that allows us to transform and process our digital representations
- Cheap mass storage, also enabled by Moore's Law, that allows us to store, transport, and retrieve the digital representations
- Cheap digital bandwidth, allowing us to transport and retrieve data electronically and optically around the world

The scaling trends in storage, processing, and bandwidth have all crossed key inflection points within your lifetime, enabling these audio (and video) applications to cross from inconceivable to common place. Putting these together, the operation of today's smart phones exploit the fact that sound can be captured as voltages, digitized into binary numbers, processed, stored compactly digitally, transmitted from point-to-point, and reproduced back into sound.