

Chapter 1

Data Compression Systems

One of the paradoxes of modern computer systems is that despite the spiraling decrease in storage costs there is an ever increasing emphasis on data compression. We use compression daily, often without even being aware of it, when we use facsimile machines, communication networks, digital cellular telephones, world-wide web browsers, and DVD players. Indeed, on some computer systems, the moment we access a file from disk we make use of compression technology; and not too far in the future are computer architectures that store executable code in compressed form in main memory in lines of a few hundred bytes, decompressing it only when brought into cache.

1.1 Why compression?

There are several reasons for the increasing reliance on compression. Most obvious is that our demand for on-line storage is insatiable, and growing at the same fast rate as is storage capacity. As little as five years ago a 100 MB disk was an abundance of storage; now we routinely commit 100 MB of storage to a single application, and expect that the system as a whole will have storage capacity measured in gigabytes. A few years ago home computers were used primarily for text-based applications; now, with the advent of digital still and movie cameras, and on-line sources for high-quality sound data, we routinely expect to be able to hold large collections of personal multi-media documents.

A second driving force for the increase in the use of compression is the strict boundedness of some communications channels. A good example of this phenomenon has been the flooding of the fax machine into every far reach of the telephone network over the last twenty years. The most obvious cause of this pervasiveness and acceptance is that no special communications link is required, as an ordinary twisted pair telephone connection suffices. But no