Technology Scarcity and Surplus

By Barry Blesser ©2005

The popular and professional literature is so saturated with discussions about technological changes in broadcasting and communications that the average reader cannot make much sense out of their implications. While futurists, pundits, cynics and opportunists just love the topic, the rest of us treat articles on innovative technology as a diversion, alternately producing excitement and anxiety. Interpreting this massive quantity of data is impossible without carefully framed questions, which reflects how we view our world.

The concept of scarcity and surplus, which is usually applied to commodities and natural resources, is a revealing way to examine the paradigm shifts in the broadcast industry.

I first observed this concept while following the evolution of the computer industry. In its early days, computational power was scarce. Users and designers optimized this scarce resource by restricting applications. Somewhat later, with dramatic advances in processing power, memory became the scarce resource that limited performance. Then, when memory became very inexpensive, communication bandwidth became the bottleneck.

Now, at the beginning of the 21st century, the major attributes of computers are all in surplus, and the heaviest individual users are those who play video games. The computer has become a commodity, not unlike potatoes, coffee, and pork bellies. The transformation of computer resources from scarcity to surplus is a paradigm shift. And because of this shift, computers now permeate every aspect of our culture, from toys to management tools, from washing machines to audio editing.

There is also a less obvious manifestation of this same shift. When I began my electrical engineering career in the 1960's, the design of systems for audio and broadcasting was mostly a small-scale craft industry. For example, over a hundred companies produced high-quality turntables for local audiophile markets, each with a staff of a few hundred. The ratio of large engineering effort to low production volume resulted in high prices, that is, scarcity. In contrast, the core component of the CD player, including the precision cast iron frame, three servos, and laser sensors, is manufactured by only a few companies for a worldwide global market. The cost is less than $10. Similarly, expensive pressing plants for vinyl records have been replaced by millions of computers that can each burn CD's. By increasing the sales volume by many orders of magnitude, globalization made playback technology a surplus commodity.

To be successful with technology surplus, one must embrace its properties rather than dream about the "good-old days" of scarcity. As an example, consider our newest product

at 25-Seven Systems, Inc. We buy the motherboards, the operating system, the display, the audio chipsets, the flash memory, and the power supply. In fact, creating this product would only be a packaging exercise except for two scarce components in this soup of commodities: a specialized algorithm for transparent time compression, and a carefully crafted user interface that matches the needs of the broadcast market. A product's value is only determined by those components that are still scarce.

Fifty years ago, designing a product using resistors and transistors was a scarce skill. It is a useless skill because circuit creation is now a narrow specialty rooted in the design of integrated circuits. In this sense, most products for audio and broadcasting use highly integrated commodity components from companies supporting markets of hundreds of millions, like Microsoft, Intel, Texas Instruments, and numerous others. The rest of us ride those elephants, being careful not be trampled by walking in front (being too early), or getting dirty by walking behind (being too late).

The laws of scarcity and surplus also apply to the broadcast industry, which is a subset of the media delivery business. Traditionally, the scarcest commodity for broadcasting was the limited number of licensed frequency channels.

A good metric for measuring the amount of a resource used by an audio delivery system is the geographic area multiplied by occupied bandwidth, which I call the area-bandwidth product. It corresponds to the quantity of listeners at a given audio quality level for a specific number of program choices. Centralized high-power transmitters in a restricted frequency band use a large amount of this scarce resource. With the historic rules for auctioning large quantities of this resource to only a few commercial users, scarcity resulted.

Technology has recently created numerous other audio delivery mechanisms, which dramatically increasing the available area-bandwidth product. As an indirect consequence of the dot.com mania during the last decade, the Internet's hard-wired backbone has a surplus of bandwidth that will take decades before it is fully utilized. Local telephone companies are now installing fiber cable directly to the homes in selected metropolitan areas. Networks using WiFi will shortly spawn WiMax, a wireless wide-band DSL over a 10 mile radius. The proliferation of cell telephone towers produced a multiplicity of radio network. Satellite broadcasting opens up yet more bandwidth. The amount of surplus bandwidth continues to grow because it is inexpensive and in high demand, just as roads provide transportation for millions of trucks, buses, bicycles, motorcycles, ambulances, and automobiles.

When one resource shifts from scarcity to surplus, the scarcity of the next resource in the chain dominates. What is now scarce?

The answer is obvious: mental bandwidth. Each new media delivery system competes with every other delivery system, be it for listening to music, playing with computer games, watching video on television, attending a party, or conversing with friends. Commodization of technology allows anyone to distribute music. But with so many

thousands of media sources, name recognition is limited by finite headspace, which is ultimately the scarcest resource. As a measure of mental bandwidth, time and attention are a finite resource.

The scarcity of headspace is a widespread phenomenon in a culture that engages in hyper-stimulation for all its citizens, including broadcast engineers. They do not have the time to study the manual of their equipment and they expect the user interface to be intuitively obvious: plug-and-go, thereby preserving mental bandwidth. A good designer will invest in optimizing this scarce resource by focusing on stability and predictability, while ignoring such lofty, but irrelevant goals as raising the signal-to-noise ratio from 90 dB to 130 dB.

As a paradox of technical change, progress is actually more circular than linear. We first moved from craft industries, with limited niche markets, to a single homogenized global market, where one size fits all. That same surplus technology, however, also allows us to return to niche markets: customizing products for small groups. Using his computer for audio editing and program distribution, any teenager can create specialized entertainment for his personal Internet broadcasting station. Commoditized technology can accommodate small groups with their unique needs, like specialty restaurants that transform food commodities into gourmet dining with signature recipes.

To avoid failure, individuals and companies must remake themselves to match this paradigm shift. Survival depends on wisely using those commodities that are currently in surplus while adding scarce resources that are still valued by the market. A scarce resource can be an algorithm, a design patent, a professional skill, a recognized personality, or a unique sound. The concepts of scarcity and surplus are not new, but only in the last decades have they become applicable to high technology. Engineers now harvest the technical equivalent of the farmer's potatoes and pork bellies.