

treacherous a commodity to be widely disseminated with ineffectual controls. Even a little information improperly used can do irrevocable harm. Information is readily counterfeited. It can be quickly reproduced and widely transmitted very cheaply.

Today we can see the independent, private automated information systems being interconnected to form larger growing systems. The direction of growth is clear.

My thesis is this: Today we are already building the bits and pieces of separate automated information systems in both the private and government sectors that so closely follow the pattern to the present integrated communications structure that a de facto version of the system you are now pondering is already into the construction phase. It is in many ways more dangerous than the single data bank now being considered.

There is no culprit. No one set out to build our system. It's like little Topsy in Uncle Tom's Cabin who said, "Never was born. I s'pect I grow'd."

Mr. ROSENTHAL. Is it your point that these pieces are just being independently developed by various agencies and various groups, and, all of a sudden, they will merge by alleged necessity?

Mr. BARAN. Yes. We see this with independent credit systems built to cover small areas and then they find it is economic to cross-connect. We see this with airline systems; systems built for individual airlines are interconnected to swap information back and forth to get people reservations on other systems.

Mr. ROSENTHAL. So, the point you make is that even though the Government has not put their stamp of approval on building this system it is growing on its own because various groups are independently developing its starting points.

Mr. BARAN. Precisely.

THE CHANGING COMPUTER

Once when we spoke about a computer we meant a large room full of equipment. It was used by scientists to perform complex calculations and by businessmen to prepare payrolls, store inventory data, and similar generally repetitive tasks.

Both the form and the uses of computers are now undergoing radical changes. They have become so powerful, can store so much data, and process this data so quickly that it becomes possible to "time-share" a simple computer. You will be hearing more of this word "time-sharing" in the future. Time sharing means literally that. Many people have access to the single computer installation. The computer has so much capability and is so fast that it creates the illusion that each user has his own computer.

Users time-sharing a computer need not be in the same room or even the same building. They can be hundreds or even thousands of miles away. All it takes is a telephone connection to a remote electric typewriter-like device. Early examples of such systems include the local stock brokerage "systems" and airline reservation systems. In one system, over 3,000 separate stockbrokers around the country can push a few buttons to display the latest prices on any selected stock. Making and checking an airline reservation in a matter of seconds is