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INTERFACING AN ILLINOIS PLASMA TERMINAL TO THE ARPANET

INTRODUCTION

The PLATO IV System based at the University of Illinois at Urbana is a highly sophisticated and very powerful approach to Computer Aided Instruction. The PLATO IV System makes use of a plasma display terminal that is a unique device with capabilities not presently found on computer terminals. A number of ARPA supported projects intend to use the plasma terminal on local connection to computer resources or by long-distance connection to the PLATO IV System.

One problem in using the PLATO System from any appreciable distance, is the communications costs involved (i.e. long-distance telephone rates for many consecutive hours). Also, use of the plasma terminal in other applications is hampered since the communications scheme employed in the PLATO System is non-standard.

One approach to reducing the communications cost is to use the ARPANET for the long-distance connection, since the Network is potentially one of the most reliable and cost effective means of transmitting computer data. This approach is reasonable because there is a Network node near the PLATO System, (the PDP-11/ANTS system at the Center for Advanced Computation at the University of Illinois at Urbana) and with the increasing number of TIPS and IMPS on the ARPANET access is becoming easier and more widespread.

The plasma terminals are designed to be connected directly to telephone lines using Frequency Shift Keying (FSK) modulation. Using dedicated telephone lines, the plasma terminal may be run with a data rate of 1200 bits/sec in full-duplex operation. Using dial-up lines, the terminal may

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be run with display information being received at 1200 bits/sec and data to the computer being transmitted at 120 bits/sec using a reverse channel scheme.

The data and command words used by the plasma terminal differ for input and output. Input received from the computer arrives in 20-bit words plus one start bit. Data transmitted to the computer is sent in 11-bit words plus one start bit.

In order to make the plasma terminal more generally applicable for standard communication, and specifically adapted to ARPANET connection by way of a TIP, the terminal must be interfaced in such a way as to communicate using Teletype-like codes. In addition, if the PLATO System is to be linked by way of the Network with no changes to the system, then a special interface must be provided to allow the Network to communicate with the PLATO System using the FSK communication scheme.

APPROACH

So that the plasma terminal would communicate like a Teletype when tied to a TIP, and still be able to work with the PLATO System through the Network, it was decided to build an interface that could be operated in two modes. There would be an "ASCII" mode to send and receive Network oriented data (such as TIP log-on or running at some arbitrary Network site); and a "PLATO System" mode to allow data, imbedded in 8-bit codes, to pass transparently through the Network.

Since there is a possibility that when in the PLATO mode, re-formatted codes can appear to be standard ASCII characters that will be seized upon by intervening TIPs or HOSTs, the interface must insure that no recognizable codes be sent. For example, the @ is recognized by a TIP as the beginning of a

TIP command string. Therefore the interface must either "double-up" this code (@@) or not send it at all.

With the above requirement, and with other limitations, the proto-type interface, now in use at UCSB, operates as follows:

1. In ASCII mode, the plasma terminal has been made to send and receive 8-bit ASCII codes. In this mode, there is no graphics capability. The keyboard that is provided can only send 124 codes, therefore 4 seldom used ASCII codes have been excluded, and certain ASCII characters cannot be displayed.

2. In PLATO mode, PLATO data is embedded in 8-bit codes. The capability of running the keyboard in ASCII mode while the display remains in PLATO mode has also been provided.

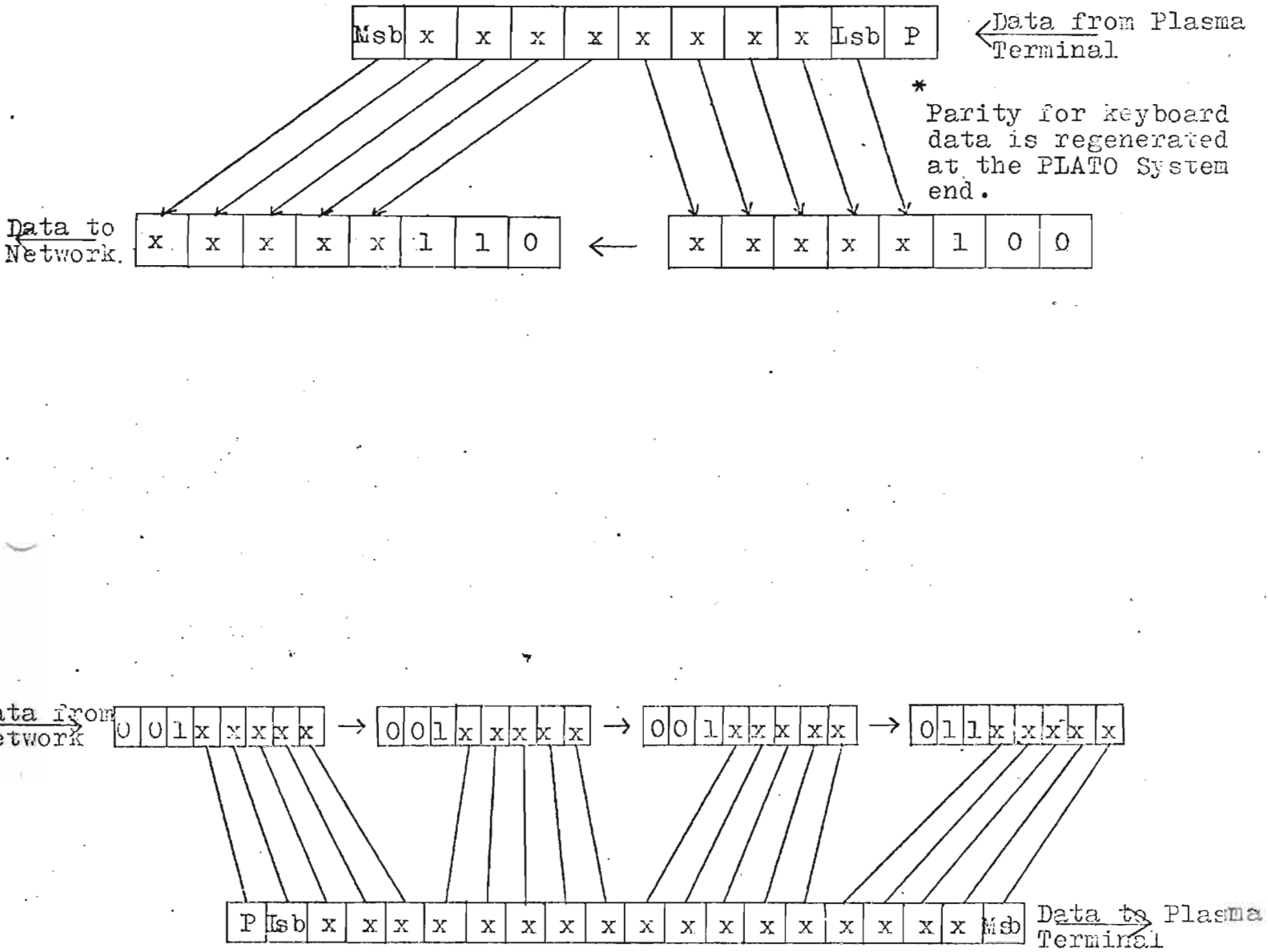
BOO!

SUBSEQUENT WORK

After discussion, it became clear that the flexability of the interface to do such things as emulate standard graphics terminals, implement a cursor, and to respond to Network Graphics Protocols, will be highly desirable. So it has been decided that the original hardware will be re-packaged using a micro-computer with a ROM for the control program. With the addition of more RAM and/or ROM, the micro-computer will have the capability of being programmed to allow the plasma terminal to do a wide variety of tasks. Work on developing this interface has begun at UCSB.

Figure 1 shows the planned version of plasma data format for Network use.

PACKING SCHEME FOR PLASMA TERMINAL DATA



NOTE: NO-OP codes are removed from the data stream at the PLATO System end by the hardware.

Fig. 1