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## Brooktrout Technology Whitepapers

### The Why and How of T1\* in the LAN Fax Environment

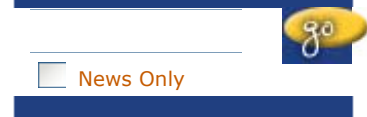
\* **Note:** In this document, "T1" refers to "robbed-bit" T1 service.

The most common type of subscriber telephone line is the analog loop start line (commonly referred to as a "POTS" line, for Plain Old Telephone Service). This service utilizes a single pair of twisted copper wires to provide one telephone channel. This type of phone line allows analog voice signals, and DTMF or pulse signals, to travel between a user's telephone and the telephone company's central office. Fax machines and computer-based fax servers can use one or more of these simple analog lines (including analog DID lines for inbound routing) to send and receive faxes to and from anywhere in the world.

When multiple lines are required, it often makes sense to utilize a T1 subscriber line instead of multiple analog loop start lines. With a T1 line, you may get up to 24 virtual phone lines, or "channels", on one single physical line made up of *two pairs* of twisted copper wires; this is possible because T1 lines utilize digital signals, instead of the analog signals that are utilized by the common loop start line. Digital signals are multiplexed over time slots, allowing multiple channels to share the same physical line.

There are three clear advantages to using a T1 line over analog loop start or DID lines: *cost*, *inbound routing flexibility*, and *channel density*.

**Cost.** T1 becomes more cost effective than multiple analog loop start lines at some number of lines. The specific number of lines where T1 becomes less costly depends upon the volume of calls you make over the lines and how the T1 is tariffed (priced) by your phone company or long distance provider. A T1 line can support less than the full 24 channels, which means you don't pay for all 24 channels if you need less. This is referred to as a "fractional T1 line" (which Brooktrout T1 boards will work with). Your T1 service provider can help you determine the cost effectiveness of T1 for your fax requirements. Make sure the phone company details all the options and costs, including installation and any special equipment, such as a Channel Service Unit (CSU); most phone companies will require that you place a CSU between the T1 network and the fax/voice system to recondition the T1 line,



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and also provide diagnostic and loop-back capabilities. (Note: the Brooktrout TRNIC is *not* approved as a CSU.)

**Inbound routing flexibility.** T1 service can also be used to support inbound routing of fax messages on LANs, which is typically accomplished on an analog line with DID telephone service. The T1 equivalent to DID service is called DNIS (Dialed Number Identification Service).

DNIS offers two distinct advantages over DID service:

1. DID lines are restricted to inbound calls; therefore separate loop start lines are required for outbound transmissions, whereas T1 lines may support inbound routing with DNIS and perform outbound transmissions on the same channel (though the same channel can't be used simultaneously for an inbound and an outbound call--one needs to finish before the other can begin).
2. DID lines are expensive, and difficult to support through corporate PBX systems, which means that DID lines used for inbound faxing typically circumvent the PBX and its goal of centralized telecommunications management; in contrast, T1 is supported through most of today's large PBX systems.

**Channel density.** When configuring systems requiring more than, say, 8 to 12 channels, the cost and number of system slots required can be reduced by using digital TR114 fax/voice boards instead of analog TR114 boards. This results from the greater maximum channel density of digital boards (up to 16 channels per board) versus analog boards (up to 4 channels per board). Keep in mind however, that an 8, 12 or 16-channel digital TR114 board has significantly greater cooling requirements than a 4-channel analog TR114 board, thus requiring an enclosure with greater airflow than a typical "tower" enclosure provides. (This is a significant reason why we recommend that our boards, particularly our digital boards, be put in "servers" rather than "PCs".)

A LAN fax server system is configured differently when interfaced to a T1 line as opposed to loop start lines. With loop start, the phone lines are connected directly to the TR114 board. Up to four loop start lines can be connected to a single TR114 board (e.g. TR114+I4L). With our digital boards, the server must contain a T1 Network Interface Card, such as the Brooktrout TRNIC, which serves as the interface between the T1 line and the TR114 boards. In a T1 LAN-fax server configuration, digital TR114 boards are used instead of analog TR114 boards. Digital TR114 boards are available with 2, 4, 8, 12 or 16 channels per board, and communicate with the TRNIC across a digital telephony bus. (We also have two boards available, the TR114+I8V-T1 and TR114+P8V-T1--which are an ISA board and a PCI board, respectively--that put an 8-channel digital TR114 board and a TRNIC board together, and form one board out of them.) The physical connection among the digital TR114 boards and the TRNIC is a flat ribbon cable with connectors or "drops" to connect the boards.

The Brooktrout TRNIC is both inexpensive and easy to use with digital TR114 boards. Figure 1 illustrates a 24 channel LAN FAX server using a TR114+P8V-T1 and a TR114+P16V.

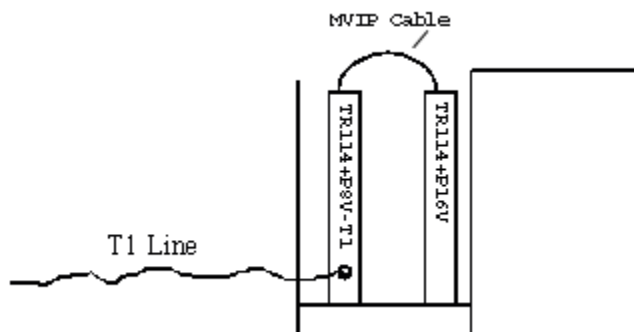


Figure 1

The installation and set-up of a TRNIC is simple - requiring only the setting of jumpers on the card itself. There are no drivers to install or software to program other than those required for the installation of the TR114. All major LAN-fax application packages can be used with digital TR114s connected to a T1 line through the TRNIC.

For more information on the TRNIC, you may see the manual for that board [here](#); signaling requirements for the board are [here](#).

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Brooktrout, Inc. 250 First Avenue, Needham, MA 02494-2814, U.S.A. Phone: +1 781 449-4100 Fax: +1 781 449-9009

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