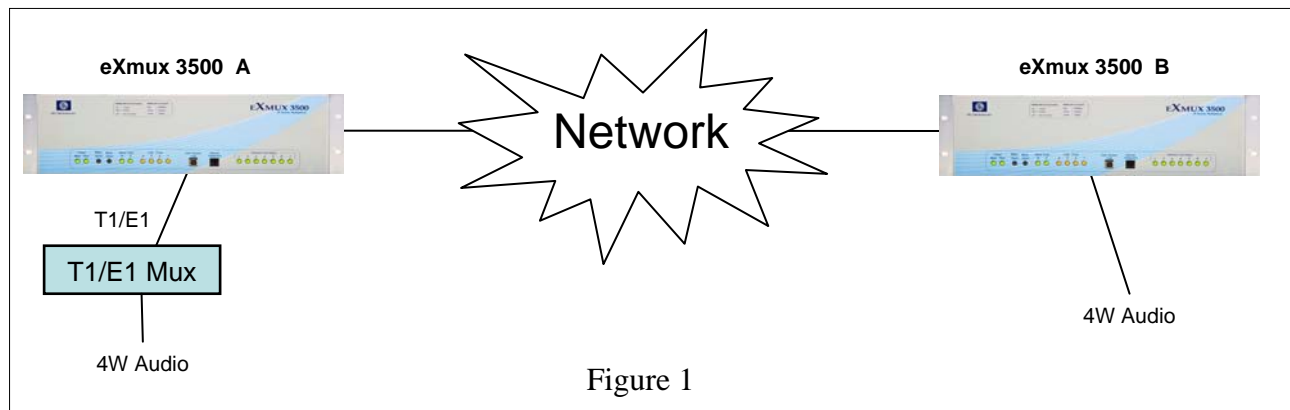


**DS0 Grooming with the
RFL eXmux 3500 IP Access Multiplexer**

The RFL eXmux 3500 is a hardened IP Access Multiplexer engineered for mission critical infrastructures that seamlessly transport voice, serial, video and Ethernet data communications over Ethernet/IP or MPLS networks. The eXmux 3500 is a Layer 2 device with an integrated managed Ethernet switch which allows the eXmux 3500 to be used either in a private network with other eXmux 3500's or as part of a larger Ethernet/IP/MPLS network. Both fiber (using SFPs) and RJ-45 connections are available for the eXmux 3500; uplink speeds of up to a Gigabit are possible.

Figure 1 below depicts the eXmux 3500 as the communications system providing a point-to-point 4W Audio channel between a T1/E1 Multiplexer and an eXmux. The network cloud is a general representation of an IP network and does not imply a direct point-to-point connection. The example shown below shows an 4W Audio channel being groomed through the T1/E1 port of eXmux A and dropped from the 4Wire IU of eXmux B. This application note is valid for any number and type of DS0 channels.



Network Performance Consideration

Specific channels that are transported over the T1/E1 Mux and eXmux 3500 may be sensitive to communication channel delay which can affect performance. Latency issues should always be considered when installing a channel over any kind of multiplexer. The eXmux 3500 when applied over direct fiber connection with minimum jitter buffer delay settings (also referred to as Packet Delay Variation (PDV)) of 1-2ms, will yield a back-to-back communication channel delay of <5ms. This is in addition to the inherent delay of the T1/E1 Mux itself. In addition to the low latency, when setup in a redundant path configuration the eXmux 3500 has a unique Hitless Switching feature that guarantees no data is lost during any single path failure. For a network with anticipated traffic usage beyond 90% of bandwidth capacity, Quality of Service (QoS) features can always be used to ensure that TDM data has the highest priority.

When connecting eXmux 3500's over an IP network, the following information can be used as part of the overall network design to determine communication channel delays. The network topology should be designed with a minimum number of nodes between the two ends of any channel to minimize the packet-delay variation (PDV) settings; this will minimize the overall latency. By using the VLAN capability of the eXmux 3500, a secure and direct bidirectional communications channel can be created for this channel.

Product Latency:

- eXmux 3500 interface inherent back to back channel delay – 2.5ms
- eXmux 3500 interface asymmetric back to back channel delay – 0.2ms
- eXmux 3500 through node delay – 0.003ms
- eXmux 3500 programmable packet-delay variation (PDV) settings – 1 to 500ms

eXmux 3500 Interface Unit Settings:

This application note assumes familiarity with the operation of the eXmux 3500 and the T1/E1 Multiplexer. The appropriate eXmux port to be used for this circuit should be programmed before mapping. Refer to the eXmux 3500 manual for mapping procedures and specific interface wiring information for the T1/E1 and 4Wire port.

eXmux 3500 A T1/E1 settings

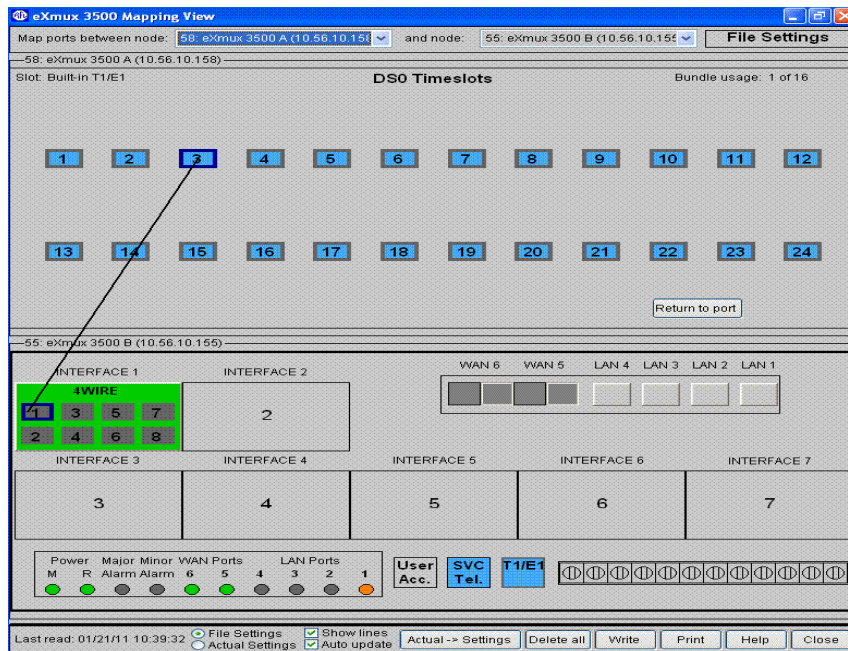
1. On General tab, **ENABLE** port. Set Framer Mode to **GROOMED**. Set Port Framer Mode to **T1** or **E1** as desired. Set TX Clock Source to **SYSTEM**. Set Loopback to **DISABLE**.
2. On T1/E1 tab, choose T1 or E1 settings as required.
3. On T1 Signaling tab, enable Robbed Bit Signaling (RBS) if required for audio channel.

If the Framer Mode is set for GROOMED the TX Clock Source setting must be set for System Clock since all groomed DS0's must use the same clock.

eXmux 3500 B 4Wire IU settings

4. On desired Port tab, **ENABLE** port. Set **TX** and **RX** levels, choose **SIGNALING** type if required.

Choose **MAPPING VIEW** from **NETWORK** pull down menu and display both eXmux A and eXmux B. Right click on T1/E1 port of eXmux A. Choose **MAP DS0 (GROOMING)**. Mapping View screen should now be displayed as shown below. Right click on DS0 channel to be mapped. Choose **MAP THIS DS0**. Then click on desired 4Wire port on eXmux B. A map should be created between these 2 points. Mapping View screen should now be displayed as shown below. Be sure to **WRITE** this map at bottom of **MAPPING VIEW** screen. This 4Wire channel should now be created.



This application note may not apply to all T1/E1 Multiplexers as some settings may be different. Check with the vendor of the multiplexer you are using to determine the required eXmux 3500 settings. Contact RFL at 973-334-3100 for further assistance.