

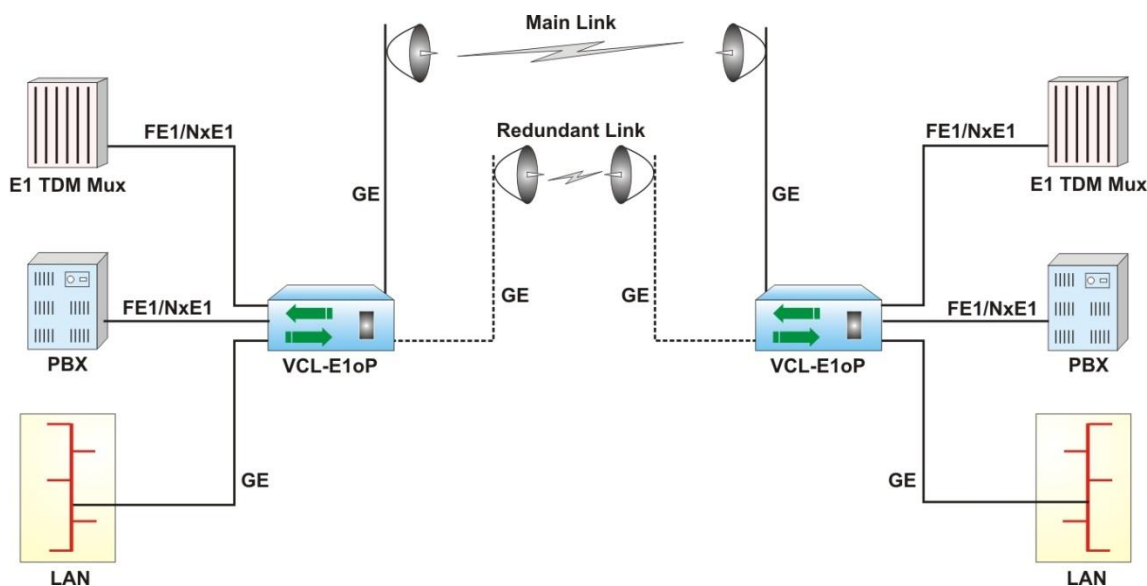
**1+1 Ethernet Link Protection / Ethernet Link Redundancy**

Our TDM over IP equipment is designed to provide 1+1 Ethernet link protection / 1+1 Ethernet link redundancy. There are two methods to provide Ethernet link redundancy using our equipment.

**1. Port Trunking**

The first method of providing Ethernet link redundancy would be to use Ethernet Port Trunking / Ethernet Port Bonding on the Ethernet links.

**Typical Application in Wireless Network - 1+1 Link Redundancy (Port Trunking)**



**Figure # 1**

# Port Trunking and Spanning Tree Protocol for TDM over IP / TDM over Packet / TDM over MPLS

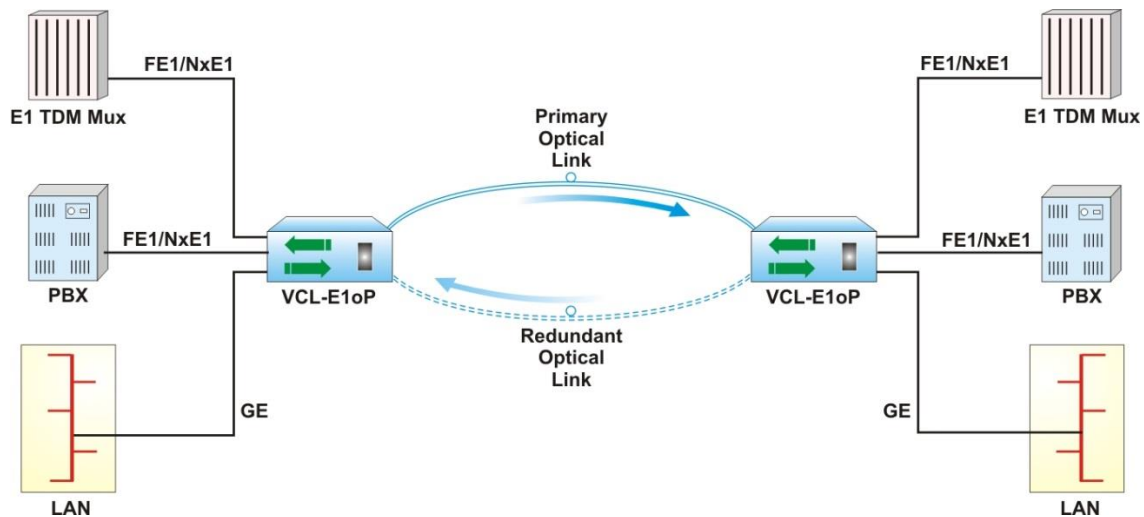


Figure # 2

Ethernet Port Trunking / Ethernet Port Bonding on the Ethernet links may only be used in a point-to-point configuration where the two TDMoIP elements are directly connected to each other (through copper, or transparent Ethernet radio or optical fiber links), without any intermediate hops or switches. Ethernet Port Trunking / Ethernet Port Bonding on the Ethernet links used in a point-to-point configuration would provide near "hitless" switching / near "hitless link recovery" of less than 50ms in the event that any one Ethernet links fails, since both Ethernet links are always active and share the Ethernet data / traffic load at all times during the time that they are operational.

## 2. Spanning Tree Protocol

The second method of providing Ethernet link redundancy would be to use Spanning Tree Protocol on the Ethernet links.

### Typical Application - 1+1 Link Redundancy (Rapid Spanning Tree Protocol)

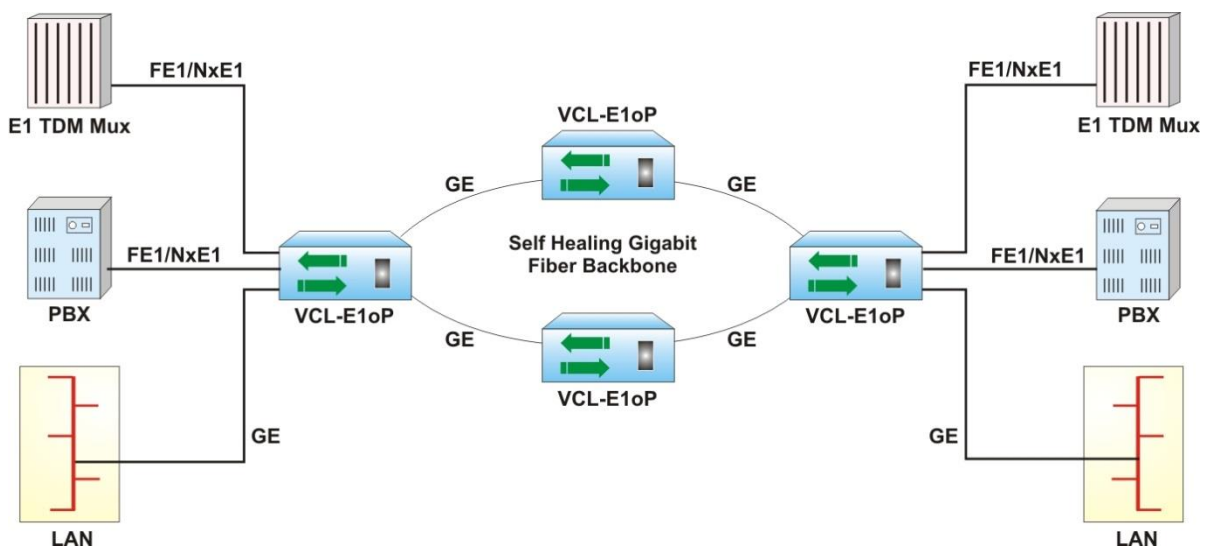


Figure # 1

Spanning Tree Protocol on the Ethernet links may be used in a Ring or in a complex network topology where the two TDMoIP elements are not directly connected to each other and are separated by a number of intermediate hops, switches, routers or other intermediate Ethernet interface devices. In such an application, the user defines the primary link and the secondary link. Should the primary link fail, the Ethernet / IP traffic is "re-routed" through the secondary link. If the 1+1 Ethernet link redundancy is implemented using Spanning Tree protocol, the Ethernet traffic is likely suffer a link loss for a short period of time when ever Ethernet data traffic is rerouted from the "primary" Ethernet link to the "secondary" Ethernet link (or vice versa). Spanning Tree Protocol, when used on the Ethernet links to provide link redundancy would normally have a link recovery time of 30 to 40 seconds (depending on the size of the network and the hops / switches that separate the two TDMoIP elements).

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