



E1 Over IP for Voice and Data



E1 Circuit Extension Over IP

- ROI Measured in Weeks
- Exploits Efficiency of IP/Ethernet
- Supports Legacy Switches/PBX
- Straightforward Configuration

E1 Voice & Data Over IP

The **IP•Tube GE1** encapsulates full and fractional E1 and TDM circuits, along with their framing and signaling bits, into IP packets. The **IP•Tube GE1's** E1 Over IP, E1 Over Ethernet connection provides for the transparent interconnection of PBXs, Telecom Switches and E1 based communication systems via LANs, WANs, MANs, Satellite and Wireless Ethernet.

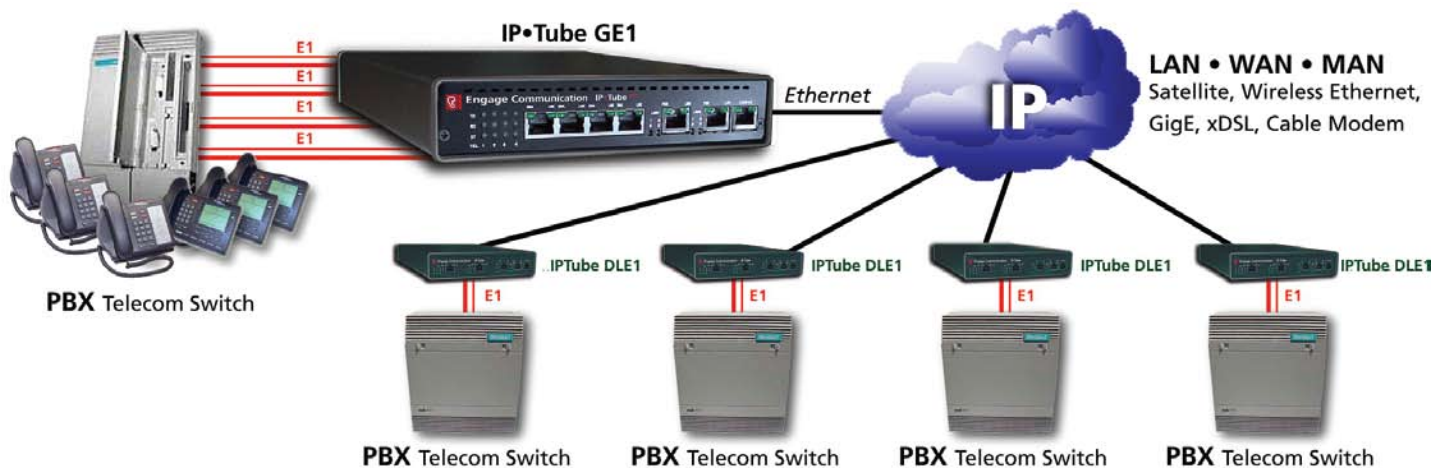
Transparent Interconnect

The **IP•Tube GE1's** transparent operation maintains the proprietary signaling required to support PBX features such as call conferencing, call forwarding, caller ID and SS7.

Legacy phone equipment investment is preserved. Transparent support for Modem, Fax, or Data circuits. Voice quality is not compromised.

Enable One to Four E1 interfaces

The **IP•Tube GE1** is available with one to four E1 interfaces and a 10/100 BaseT Full/ Half Duplex Ethernet Interface. The E1 interfaces have configurations that provide for independent protocol, compression, packet sizing, buffering, clocking, framing, coding and channel settings. Enable additional E1 Ports as needs expand using a software-based license key. The protocols supported are IPTube, CESoIP, and HDLCoIP.



E1 PRIVATE LINE SERVICES OVER IP

Multi-Site Enterprises, Cellular Service Providers, Education Districts, Universities, National, State and Local Government, and Municipalities incur significant recurring monthly costs for rigid-bandwidth leased lines used only for the interconnection of PBXs and Telecom switches.

The **IP•Tube GE1** provides organizations with the ability to interconnect their existing phone systems over flexible bandwidth lines that are used to carry data, voice, and video. The Voice Only Leased Line Toll charges assessed by long distance and local carriers are eliminated or dramatically reduced by transporting voice traffic across:

LANs

The most compelling option for the interconnection of E1 based systems is when it can be accomplished over a Local Area Network. The deployment of Fiber based LANS such as FDDI and Gigabit Ethernet, provides organizations with high performance and high quality bandwidth that is especially well suited for the interconnection of PBXs and Switches.

WANs

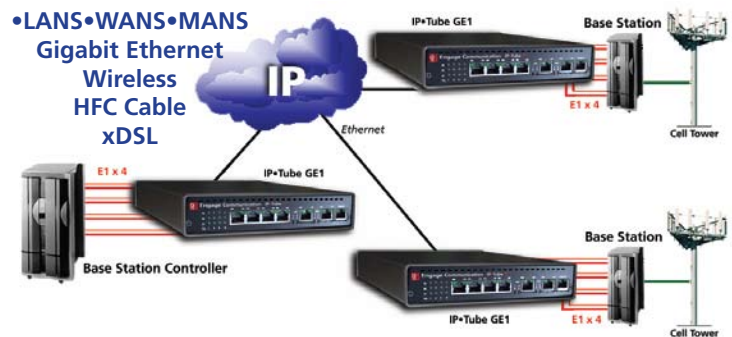
Wide Area Networks that have sufficient bandwidth and Quality of Service provisioning result in very significant cost savings especially for Multinational Corporations. The **IP•Tube GE1-C** with lossless data compression, detects idle and redundant data within each voice circuit resulting in a 40 to 1 bandwidth savings.

CELLULAR BASE STATION BACKHAUL

IP Cellular Backhaul

IP•Tube GE1s provide transparent interconnection of Base Stations, Base Station Controllers and Mobile Switching Centers over IP Ethernet packet-switched networks.

Cellular service providers save substantially by converting to a packet switch network. The Lossless Data compression option, which is especially well suited to Cellular communication links, minimizes the bandwidth required to interconnect.



E1 Over Broadband Networks

Broadband Service Providers

Provide IP Ethernet access networks that generate revenue by transporting E1 leased lines.

Metropolitan Area Networks

Carriers are refocusing investment on the access portion of their network. Ethernet is the access protocol of choice.

MSO Cable Operators

Cable operators connect traditional E1 leased line services over their hybrid fiber coax (HFC) cable networks. MSOs are deploying Gigabit Ethernet backbone based service offerings

Utilities

Utilities generate new revenue by offering traditional E1 leased line over their fiber or power line networks. The IPTube's Assured Delivery Protocol makes it possible to reliably connect Cellular Base Stations over Broadband over Power Lines.

Competitive Local Exchange Carriers

Competitive Local Exchange Carriers are able to offer a very economical alternative by backhauling a customer's phone systems over their Broadband connection.

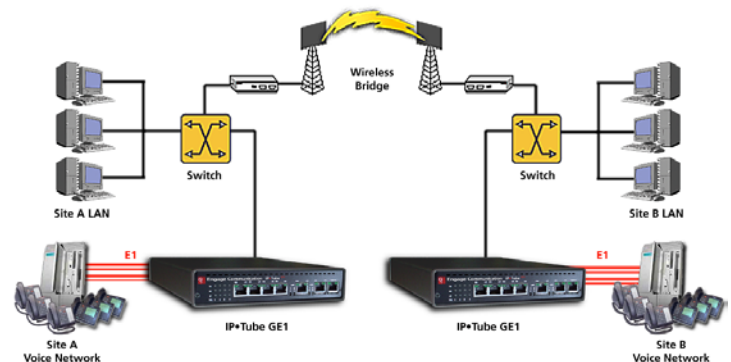
E1 Over Wireless Ethernet

Wireless Ethernet

The IPTube has proven itself around the world as an effective method for using Commercial Off the Shelf Wireless Ethernet Bridges to interconnect E1 circuits with a return on investment that is measured in weeks.

Interconnection of E1 based data communication systems over wireless as a primary or back up connection is a major application.

The IPTube's Assured Delivery Protocol has the sophistication required for solid performance across a wide range of wireless connections.



IP•Tube GE1 Standard Features

Dual LAN Interfaces

All IP•Tube GE1 models ship with dual 10/100BaseT Ethernet LAN ports. The dual Ethernet interfaces provide for:

- Management interface on LAN port 2 when LAN port 1 is connected to a VPN tunnel
- The LAN ports can be configured to support connections over 2 Asymmetrical bandwidth links
- Alternator Option for load balanced SDSL interconnects
- Protector Option for Redundant Packet Path connections with Constant or Switch Over Criteria

Assured Delivery Protocol

In order to assure high quality communications over links with intermittent or noisy performance, such as Wireless or Broadband over Power Line, the IP•Tube GE1 employs Engage's robust Assured Delivery Protocol with the following benefits:

- Packet out of sequence detection and re-sequencing
- Duplicate skipping,
- Lost packet retransmission with configured delay.

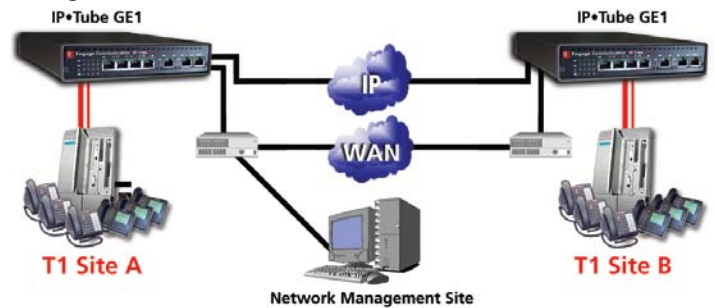
Service Quality Packet Prioritizing

The IP•Tube GE1 uses the Type of Service byte in the IP packets or 802.1p/q mac levels for prioritization of the encapsulated E1 frames.

Virtual Private Network Support

Interconnecting the IP•Tube GE1 through a Virtual Private Network with sufficient real time committed information rate ensures that the required quality of service is provisioned.

The second Ethernet interface provides a management port. Each LAN interface features independent IP network configurations.



Full E1 Connection Across Two ADSL Lines

The IP•Tube GE1's two Ethernet interfaces are able utilize two ADSL Ethernet Modems, that have opposite high speed direction, to transport a E1's symmetrical bandwidth

Management Interface

Management of the IP•Tube GE1 is accomplished with a Command Line Interface that is accessed through a Console or Telnet connection. Templates of the most common configuration provide for an Edit and Paste configuration. SNMP MIB I and II support, with traps, is a standard feature.

IP•Tube GE1 Optional Features

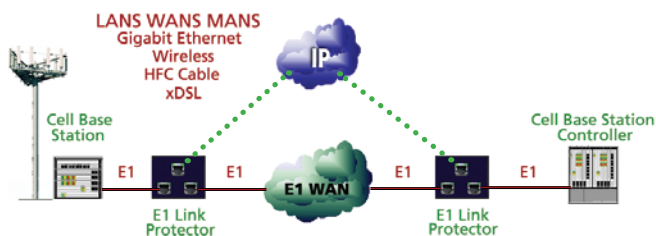
Lossless Data Compression OPTION -C

The IP•Tube GE1-C continuously detects idle/redundant data within each E1 Voice circuit resulting in as much as a 40 to 1 bandwidth savings. The compression works from the lowest latency setting of 8 E1 frames to the highest setting of 40 E1 frames per packet.

E1 Link Protector OPTION -LPT

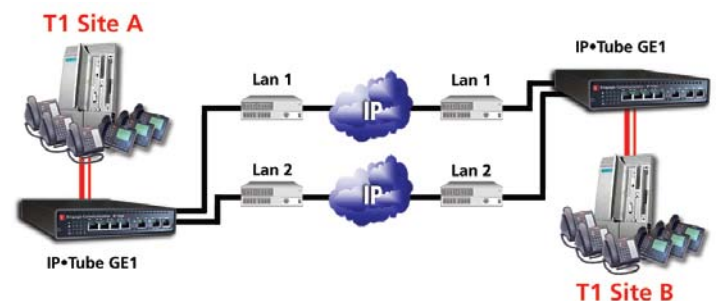
The E1 Link Protector provides an automatic backup for E1 circuits with E1 Over IP connecting via Wireless Ethernet, Gigabit Ethernet, IP Satellite Services, xDSL,...

- Automatic Protection Switch for E1 Circuits
- Deliver on Stringent Service Level Agreements
- Back Up for Mission Critical Connectivity
- Disaster Recovery for Public Safety Networks



Protector OPTION -PRO

The protector option utilizes the second LAN interface as a redundant path for the interconnection of the IP encapsulated E1 data. The extension of the E1 circuit has a fault tolerant link that is configured to always on, or with switch over criteria.



Alternator Option -ALT

The IP•Tube GE1-ALT Alternator option alternatively sends the IP packetized E1 frames on LAN 1 and LAN 2. The Alternator option enables fractional and full E1 circuits to be split over two IP WAN connections such as xDSL. The cost of interconnecting E1 communication systems across packetized xDSL is a fraction of long distance leased E1 circuit costs.

Pay-As-You-Grow Field Upgrades

The **IP•Tube GE1s** are designed for Pay-As-You-Grow growth from 1 E1 thru 4 E1s per **IP•Tube GE1**. Customers can elect to economize initial network installations, by purchasing their **IP•Tube GE1** with a single active E1 port. As the network grows enable additional E1 Ports via a software-based license key.

Technical Specifications

LAN Network Interface:

- Two 10/100BaseT Full/Half Ethernet
- Auto negotiation or Configurable Speed and Duplex

LAN Network Protocols Supported:

- IP, TCP, UDP, ICMP, ADP
- DHCP • DNS Address Discovery • Dynamic DNS
- Transparent Ethernet Bridge: LAN1 to LAN2 -RLM Option

1 to 4 Duplicate Packet Transmission:

- Resilient performance through a lossy interconnect.

E1/Fractional E1 Specifications:

- One to Four Port Models • Connects directly to E1 or DS1
- Framing - CRC4, FAS or UNFRAMED • Coding - HDB3 or AMI
- Complies with ITU-T G.703, G.704 and G.823 standards
- Rate 2.048 Mbps +/- 50 ppm
- Jitter: complies with ITU-T G.823
- Supports DS0 assignments from 1 to 31
- Not Contiguous Configuration x,y,z Supported

E1 Over IP Protocol:

- TDM Over IP • Circuit Extension Services Over IP • HDLC Over IP
- Frames Per Packet Configurable 8 to 40
- Low Latency Mode: 1 millisecond 8 E1 frames
- Max Payload Mode: 5 millisecond 40 E1 frames
- Comprehensive Clocking: Internal, Network, Adaptive

Field Upgrade benefits are extended to our Industry-Best **Lossless Data Compression**. Just as E1 ports are field upgrade able, so is **Lossless Data Compression**. At any time, each E1 port on the **IP•Tube GE1** can be upgraded to Lossless Data Compression with a software-based license key installation. If you determine that your **IP•Tube GE1s** are best deployed with Lossless Data Compression, your still in business with the per port field upgrade!

Lossless Data Compression Option:

- Detects idle and redundant data within each Voice Circuit (DS0)
- Interconnect bandwidth is not consumed by silent or redundant data
- Low Latency 8 to 1 Compression, settings from 8 to 1 to 40 to 1

TFTP Online Upgrade Capable (FLASH ROMs)

- IPTube is fully operational during upgrade

Quality of Service Support:

- IP Type of Service (TOS) CLI configured • IANA Registered UDP Port 3175
- 802.1p/q mac level prioritization

Regulatory:

- CE • Safety -IEC60950 • EMC - CFR 47 Part 15 Sub Part B:2002, EN55022:1994+A1&A2, EN55024, ICES-003 1997, CISPR 22 Level A
- Telecom TBR12, TBR13

Management:

- Telnet support with Edit and Paste Template Files
- Console Port for Out of Band Management
- SNMP support (MIB I, MIB II) • Remote config., monitoring, & reset

Power:

- 10-30 VDC, 1.0A. • Screw Locking Connector • Power Consumption 6W
- Universal Adapter 100/240 VAC 50/60 Hz
- Optional -48V 0.25 Amp • Hot Standby

Environmental:

- Dimensions: 9" (L) x 7.3" (W) x 1.50" (H)
- Operating Temperature: 0 to 45 degrees C
- Humidity: Up to 95% non-condensing

How to Order — IP•Tube GE1

Part No.	Description	Notes
300-2048-0x	IP•Tube GE1, xE1 (x=1 - 4 Ports)	Base Model Specify # of E1 Ports Enabled
300-2048-0x	IP•Tube GE1 E1 Port Upgrade	Enable Additional E1 Ports (up to 4)
302-2048-Cx	IP•Tube GE1-w/xE1 Compression	w/Lossless Data Compression Option
302-2048-Cx	IP•Tube GE1-Compression Upgrade	Enable Lossless Compression E1 (up to 4)
Base Options		Specify as Suffix
-LPT-x	Link Protector Option x=1,2 Ports1<>2,3<>4	Automatic E1 Circuit Backup with E1OverIP
-PRO	Protector Option	Fault Tolerant Network Interconnect
-ALT	IP•Tube GE1-Alternator Load Balancing	Enables Alternator Load Balancing
Power Options		Specify as suffix
-DCMOD	Power Supply Module 12/26 VDC ADP CON	Ships with Universal Adapter 90/240 50/60
-WIRED	Power Supply Module 12/26 VDC Screw Term	
-N48VDC	Power Supply Module Negative 48 Volt DC	Isolated Negative 48 Volt Power
	Hot Standby Configuration	Specify an additional Power Module Suffix
Rack Mount Option		
-RACKMNT	19" Wide Rack Mount Brackets	Enclosure Nut Serts Installed