Direct Access to T1 E1 DS0 on OC-3/12 STM-1/4 on Channelized LightSpeed1000™ (Legacy Product)

Software that transmits/receives SONET/SDH on one side and unframed T1/E1 on the other side, and internally multiplexes/de-multiplexes many T1 E1 streams into SONET/SDH frames.

Software that transmits/receives many unframed T1/E1s (28 T1s to 336 T1s) on one side and channelized DS0s per T1/E1 on the other side, and internally performs frame synchronization.
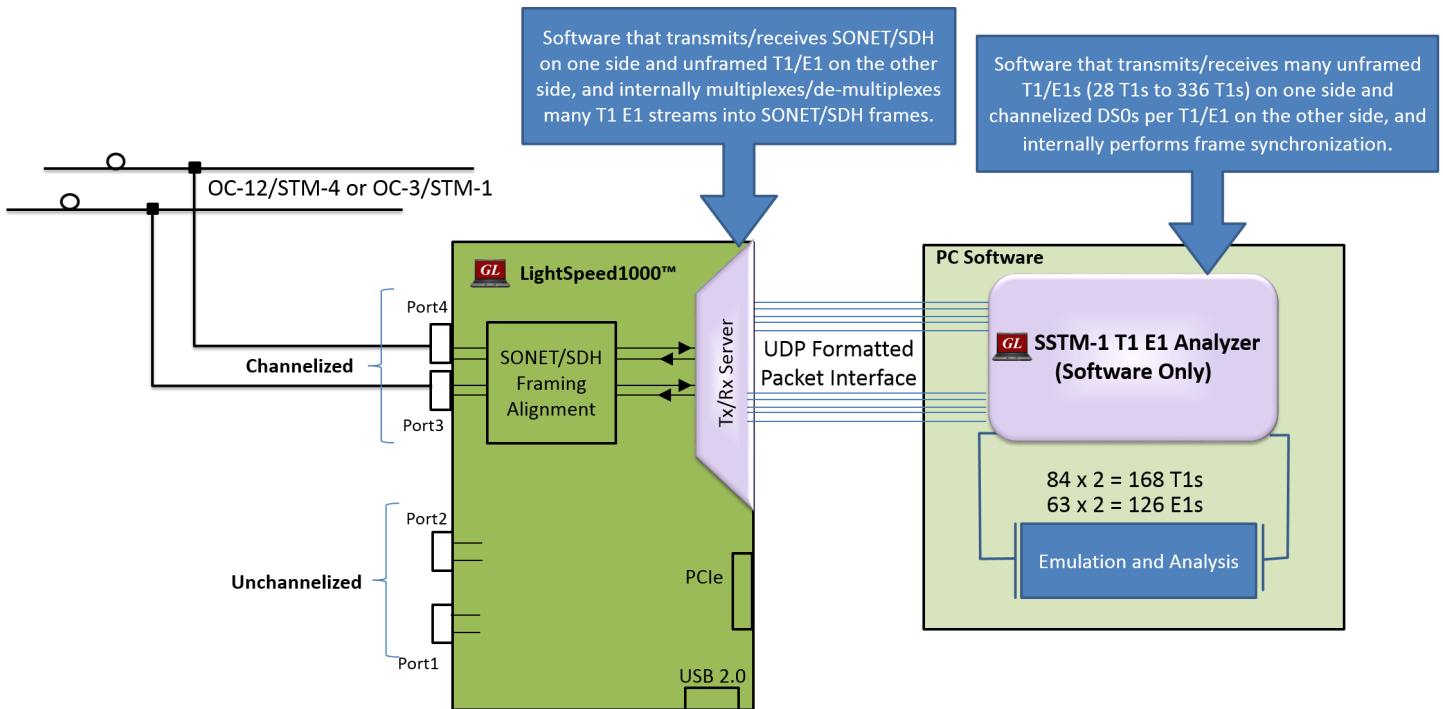
Overview

GL's **LightSpeed1000™** - with quad optical ports supports Channelized SONET and SDH mapping to T1/E1 framing modes. LightSpeed1000™ supports direct access to all 336 T1s (or 252 E1s) channels on an OC-12/STM-4 line per port for analysis and simulation – all within a single PC. Main advantage is that any of the T1/E1 or DS0 test requirements can be met without resorting to electrical access.

GL's LightSpeed1000™ hardware platform (PCIe Card and USB Pod) is capable of OC-3/12 and STM-1/4 wire-speed processing on quad optical ports for functions such as wire-speed recording and wire-speed playback of Unchannelized and Channelized ATM, PoS, and RAW Traffic.

For more details, refer Direct Access to T1 E1 DS0 on OC-3/12 STM-1/4 on LightSpeed1000™ webpage.

Main Features

- Allows to configure the number of T1 E1 channels to be Multiplexed or Demultiplexed to / from OC-3/12 STM-1/4
- 2 Channelized OC-3 STM-1/OC-12 STM-4 SONET/SDH interfaces per Lightspeed1000™ card
- 2 Unchannelized OC-3 STM-1/OC-12 STM-4 interfaces per Lightspeed1000™ card
- Compliance with Telcordia GR-253-CORE (SONET) and ITU-T G.707 (SDH) standards
- Allows direct access to anything and everything on SONET / SDH – Framing and Payload, including structured traffic (T1, E1, STS-1, DS3 etc) or unstructured traffic (ATM, PoS, etc)
- Supports all "basic applications" and "special applications" for T1 or E1 channels
- Supports Protocol Analysis of structured protocols – HDLC, ISDN, CAS, and more
- Direct access to any or all T1s and E1s
  - 336 T1's x 24 = 16,128 DS0s
  - 252 E1's x 30 = 15,624 DS0s
- Scans the received STM-4/STM-1 traffic and identifies the mapping, tributary type [T1/E1], equipped/unequipped status of the tributaries
- Broadcasts the selected T1/E1 channel data on all the 252 E1's or 336 T1's
- Supports any combination of DS0/64/56/16/8 kbps fractional T1/E1, and N x T1/E1 interface definitions (a total of 252 E1s or 336 T1s – in each port)
- Supports multiplexing multiple T1 or E1 channels to a single channelized OC-3/12 STM-1/4 line

Comparison of Channelized OC-3/STM-1 Test Solutions

The below image depicts 2 solutions for testing channelized OC-3/STM-1 lines. The first solution shows an external multiplexer and demultiplexer hardware providing the channelized information to multiple T1 E1 access cards such as GL's Octal T1 E1 cards for analysis and emulation. This solution requires an external hardware multiplexer, multiple PCs with T1 E1 access cards, and numerous cables adding to the cost and complexity of the entire solution.

A more simpler solution is provided by GL's Channelized LightSpedd1000™ board, which supports direct access to all or user-defined 2 x 336 T1s or 2 x 252 E1s per card for analysis and simulation – all within a one pc. With this hardware, any combination of DS0/64 kbps, fractional T-1/E-1, and N x T1/E1 interface definitions (a total of 126 E1s or 168 T1s – each port supporting 84 T1s or 63 E1s) can be accessed.
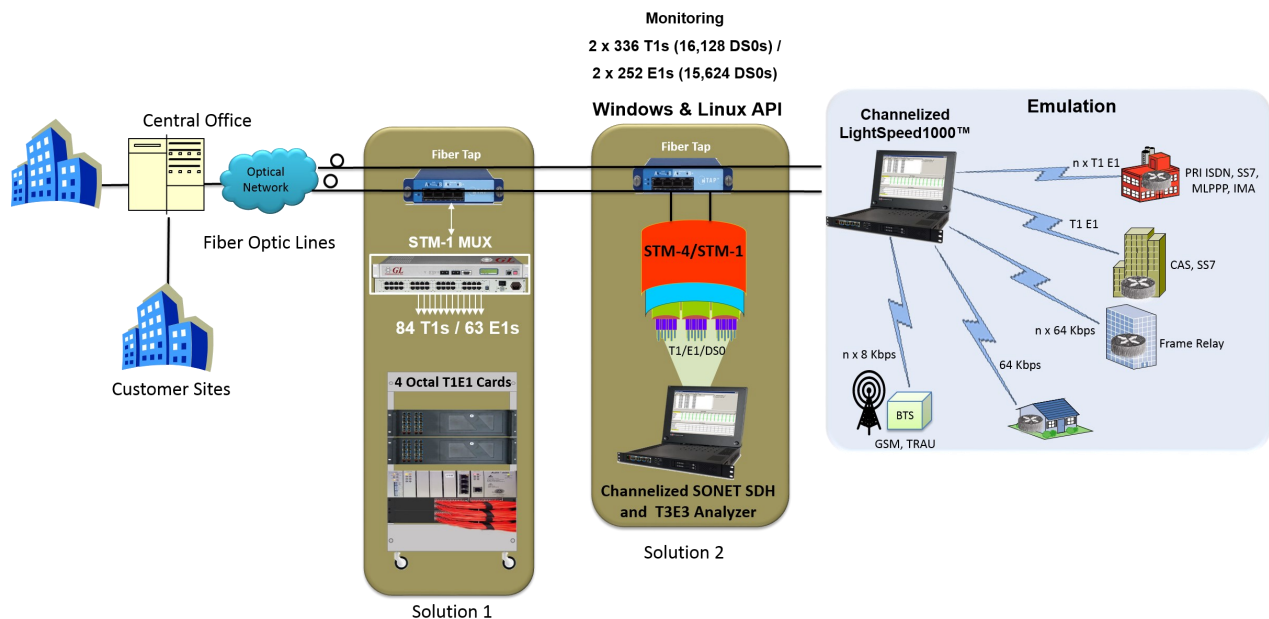

Figure: Channelized T1 E1 Emulation and Analysis

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Working Principle

STM-1/4 TxRx Server application within Channelized LightSpeed Analyzer acts as software based Multiplexer- Demultiplexer application that is capable of channelization of captured OC-3/12 STM-1/4 signals into 336 independent T1 channels and 252 independent E1 channels. The channelized streams are forwarded to STM-1 T1 E1 Analyzer software for analyzing frames per timeslot.
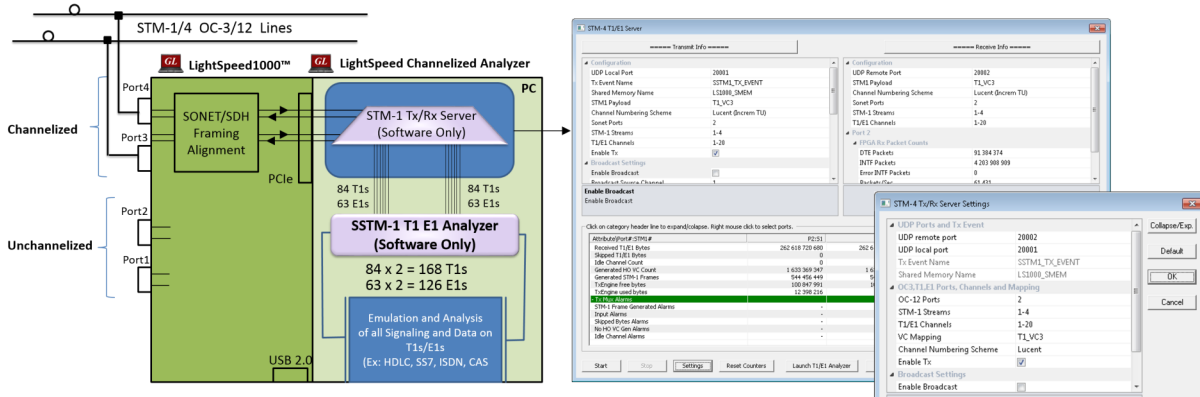

Figure: Working Principle of Channelized LightSpeed1000™

SDH Mapping in GL's LightSpeed1000™

The below diagram depicts various T1/E1 to STM-1 signal mapping possibilities in SDH. The paths colored in green are currently supported on the GL's LightSpeed1000™ hardware.

Various T1/E1 mappings in SDH:

- STM-4-> STM-1 --> AU-3 --> TUG-2 --> TU-12 --> E1
- STM-4-> STM-1 --> AU-4 --> TUG-3 --> TUG-2 --> TU-12 --> E1
- STM-4-> STM-1 --> AU-3 --> TUG-2 --> TU-11 --> T1
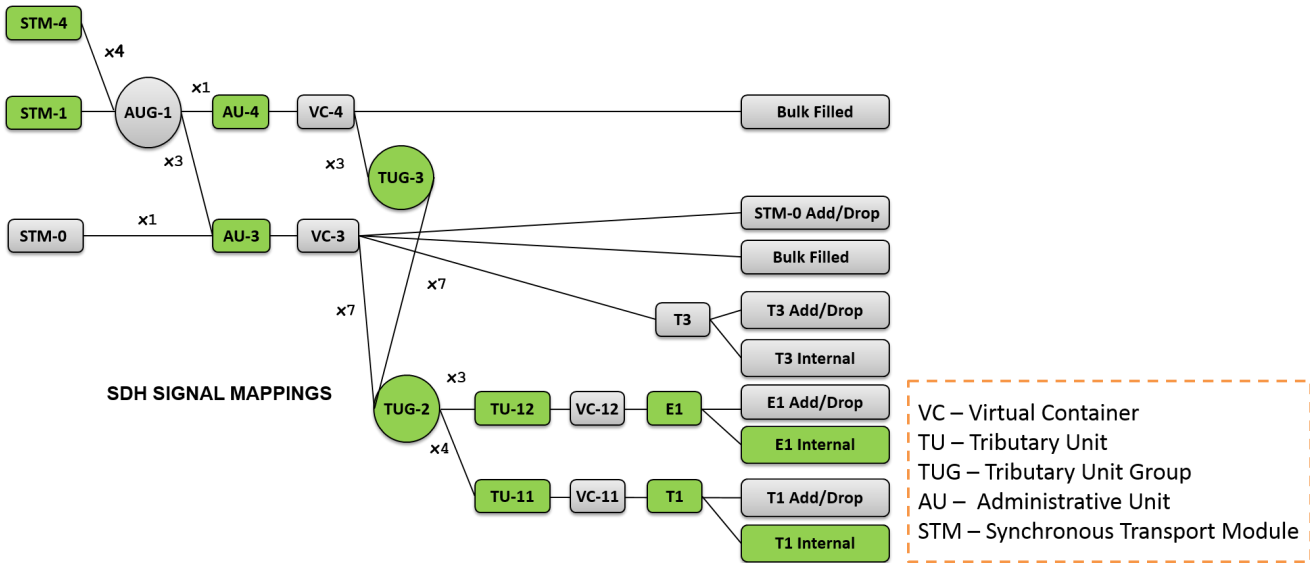- STM-4-> STM-1 --> AU-4 --> TUG-3 --> TUG-2 --> TU-11 --> T1

Figure: SDH Mappings

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SONET Mappings in GL's LightSpeed1000™

The below diagram shows various T1/E1 to OC-3/12 mapping possibilities in SONET. The paths colored in green color are supported on the GL's LightSpeed1000™ hardware.

The T1 and E1 mappings for OC-3/12 in SONET are as below:

- STS-12 --> OC-12 --> STS-3 --> STS-1 --> VT-Group --> VT2 --> E1
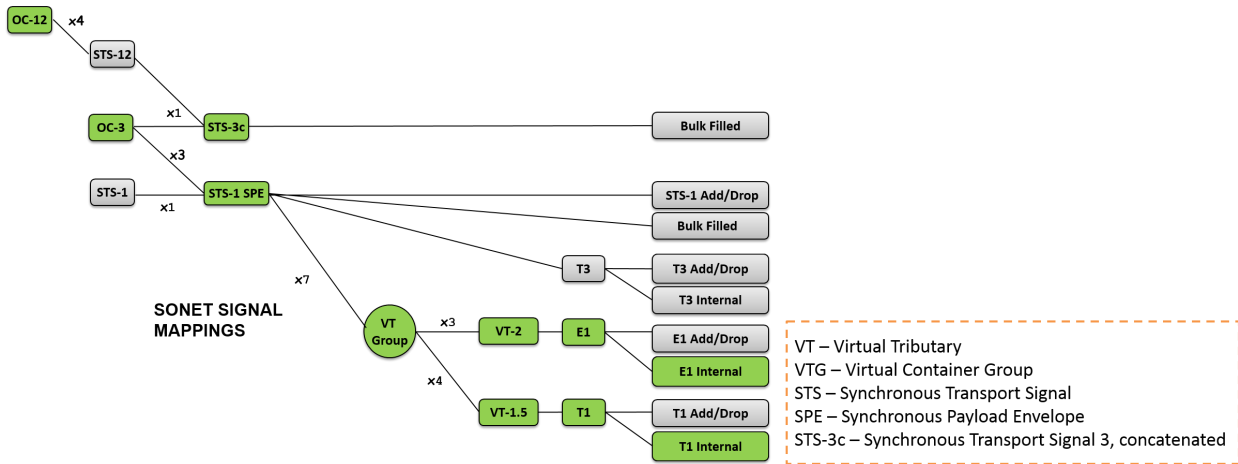- STS-12 --> OC-12 --> STS-3 --> STS-1 --> VT-Group --> VT1.5 --> T1

Figure: SONET Mappings

Applications of LightSpeed1000™

The solution offered by GL's LightSpeed1000™ for direct access to T1 or E1 channels on OC-3/12 STM-1/4 is by far the most simplest solution offered so far in the industry. Enterprise and service providers this can take advantage of this simplest solution to reduce cost and to provision new services to customers. Some of the applications are listed below—

- Test Transition of ATM to TDM in a 3G GSM Network
- Monitoring SS7 Signaling and Bearer Channels over OC-3/12 STM-1/4
- Monitoring Abis over OC-3/12 STM-1/4

Accompanying Basic Software / Features

Almost all the basic applications and optional applications supported by T1 E1 analyzers are also supported by Channelized LightSpeed1000™. For example, capturing and transmitting an entire raw OC3 / STM1, and OC12 / STM4 RAW signals simultaneously, or performing ISDN, or SS7 analysis, can be performed using the software accompanying the channelized LightSpeed1000™.

Basic Applications

Configuration

Allows to switch between μ-law and a-law encoding formats. Provides options to set the WCS Server to start with default values at analyzer start-up.

Monitoring Applications

Multiple applications are offered to monitor information received over T1/E1 lines. They cover information such as Byte Values, Binary Byte Values, Signaling Bits, DC Offset, Frequency, Power Level, Multi-frame Data, Timeslot Displays, ASCII Timeslot Display, Oscilloscope, Power Spectral, Audio (VF), and Active Voice Level Monitoring. Oscilloscope and Spectral Displays provide graphical analysis of signals.

Intrusive Test Applications

The analyzers use a variety of intrusive testing applications to verify the working of T1/E1 lines such as Transmit Tone, Transmit Gaussian Noise, Transmit Multiframe, Transmit Signaling Bits, and Rx-to Tx loopback.

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Optional Applications

Capture/Transmit Dialed Digits application permits capturing & transmitting DTMF and MF (along with MFR2-forward and MFR2-backward) digits on one or more time slots. The application displays the various digits, and transmit/ receive events.

Transmit (Playback) and Record application allows transmitting & recording the voice files. Files of any length can be transmitted continuously (without loss) in user selected contiguous timeslots, including repeated transmission of a single file.

Automated Record/Playback (ARP) is an extremely versatile application that runs several transmit or receive operation tasks simultaneously.

Automated Continuous Capture (ACC) application allows to capture seamless chunks of data in files of the same size.

Call Capture and Analysis application non-intrusively records calls directly from T1/E1 lines. Captures can be triggered with signaling, tone, ISDN with NFAS messages, SS7 messages, and traffic such as fax, modem, voice, and any signal based on power.

Multiple Call Capture and Analysis (Multi-CCA) is an analysis tool used to monitor hundreds of calls, capture the bidirectional data, signaling and traffic, simultaneously from multiple T1/E1 lines, based on the user-defined trigger configurations.

Call Data Records works with CCA and VBA (optional) to provide detail call records that contain call summary data, progression of supervisory and in-band events during the call and an overall summary of in-band measures for each direction.

Voice Band Analyzer (VBA) is an analysis tool for monitoring voice band traffic over VoIP, TDM and wireless networks. Built-in algorithms include ITU-T P.56 Active Voice Level analysis, Line Echo (Hybrid) analysis, and Traffic Classifier. It supports A-Law, μ-Law, 16-bit PCM (Intel), 16-bit PCM (Motorola) and MS Wave file formats. FaxScan™ module within VBA can be used to decode both 2-wire and 4-wire voice band captures to produce the Fax TIF image and other transmission information.

Protocol Analysis and Emulation

Various TDM and wireless protocols can be analyzed in real-time / remote / offline. The following are the available protocol analyzers:

- HDLC, SS7, ISDN, CAS, GSM, TRAU, SS1
- Sa Bits HDLC, SSM, V5.x, DCME
- FDL (T1 Interface only)
- ML-PPP, ML-Frame Relay
- ATM IMA
- GPRS (Gb and IP Gx)
- UMTS

Also available are the protocol emulators such as TRAU, ISDN, SS1, ISUP, MAP, CAS, GSM, HDLC, and MC-MLPPP for real-time simulation of corresponding networks.

Message Automation and Protocol Simulation (MAPS™) is GL's general purpose platform for emulation of communication protocols A wide range of protocols has been added to its wide framework, including ISDN, SS7, MAP, CAS, GSM, UMTS, CAP, INAP, and PPP. The **MAPS™** is a scripted automation tool designed for complete protocol analysis and simulation.

Protocol Identifier is capable of detecting various protocols and identifying their location within T1/E1 timeslots or sub channels.

Signaling Transitions records all signaling bit changes along with the time-stamped indications for each bit.

Echo Test Solutions are a set of applications that measure and test line and acoustic echo in TDM and VoIP networks. Various applications are included to help users measure Loop Delay/ERL and echo return loss (ERL) on one or more time slots, apply delay, attenuation, and/or filtering to a received signal, and simulate a digital echo canceller. **Automated and Scripted G.168 and G.167 Compliance Test** solutions are also available.

Multi-channel Bit Error Rate Testing (MCBERT) measures correctness of data received on T1/E1 lines/timeslots with stored data in a reference file.

Real-time Multi-Channel Audio Bridge audio streams between T1/E1 timeslots and a sound card. The sound-card aware applications such as Goldwave, Matlab, and so on can send and receive data to/from a T1/E1 timeslot.

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Optional Applications (*Contd.*)

Real-time Strip Chart application is used for analysis of CAS signaling, non-intrusive capturing of PCM data and signaling, and subsequent plotting of the same onto a strip chart format.

Multiplex/Demultiplex application provides the ability to multiplex files on different timeslots (up to 32 files) into one aggregate output file and to demultiplex one aggregate file into individual timeslots.

WCS Modules

With additional licenses, WCS also supports transmission/reception of files/digits, CAS Emulation, DSP operations, Dynamic DSP capability, Emulation of SA Bits, FDL, HDLC, TRAU, MC-MLPPP, SS7, ISDN, Multilink-Frame Relay, and ATM to name just a few. A separate brochure provides an overview of the server applications.

Fax Emulation and Analysis software can transmit and receive the fax information as electrical signals over the T1/E1 lines. The contents (text or images) are sent as a graphic image.

In order to fully support Fax Analysis, GL's GLInsight™ or GL FaxScan™ applications provides the ability to further analyze the fax sessions saved as PCM files. FaxScan™ application can decode fax image as TIFF files and produce detail call logs

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Buyer's Guide

Item No	Product Description
LTS100	Lightspeed1000™ - Dual OC-3/12 STM-1/4 PCIe Card
LTS105	Lightspeed1000™ - Portable Dual OC-3/12 STM-1/4 USB Unit

Item No	Related Software
LTS501	OC-3 / STM-1 RAW
LTS502	OC-12 / STM-4 RAW
LTS503	Record Playback for OC-3 / STM-1 RAW
LTS504	Record Playback for OC-4 / STM-4 RAW
LTS108	Any 16 Ports Channelized License for OC-3 / STM-1
LTS116	Any 32 Ports Channelized License for OC-3 / STM-1
LTS124	Any 48 Ports Channelized License for OC-3 / STM-1
LTS132	Any 64 Ports Channelized License for OC-3 / STM-1
LTS164	All Ports Channelized Licenses for OC-3 / STM-1 (84x2 for T1, 63x2 for E1)

Note: PCs which include GL hardware/software require Intel or AMD processors for compliance.

For more details, refer Direct Access to T1 E1 DS0 on OC-3/12 STM-1/4 on LightSpeed1000™ webpage.