

**Product Bulletin**

# VoIP Customer Premises Gateway Solutions

Texas Instruments (TI) offers a broad family of scalable VoIP solutions based on TMS320C54x™ and TMS320C55x™ DSP core technology and Telogy Software® for both residential/SOHO and enterprise gateway applications.

TI's full range of VoIP solutions offers optimized solution density and faster time to market for manufacturers. With the largest installed base and field-hardened solutions, TI's VoIP solutions reduce risk and offer a field-proven technology.

VoIP gateway solutions are available in two platform architectures to meet the needs of all gateway devices. TI offers several highly integrated solutions where voice

processing and host processing are integrated into a single device (access communications processor):

- TNETV1010
- TNETV1060
- TNETV2021

These solutions not only increase system integration and performance but also reduce power consumption and application space.

When packet processing (host) is not needed on the same device as voice processing (DSP), TI offers stand-alone DSP-only solutions:

- TNETV2402
- TNETV2409
- TNETV2510
- TNETV2840

**Key Features**

- Highly scalable solutions for residential and enterprise applications
- Field-proven software with emphasis on QoS, interoperability and remote monitoring
- Most comprehensive range of features
- Largest installed base of solutions
- Industry leader in DSP
  - Committed roadmap support
  - Code compatibility
  - Process technology
  - Production facilities
- World class technical support
- Industry leader in indemnification with broad patent portfolio

These DSP-only solutions give manufacturers the flexibility needed to design the right product for their market.

		Residential/SOHO		Enterprise Gateways			
		Terminal Adapter	Gateways and IADs	IP PBX	Switch/Router	Media Access Gateway	Channel Density
TNETV1010	I						1-2
TNETV2402	D						1-2
TNETV2409	D						3-4
TNETV1060	I						2-4
TNETV2510	D						8
TNETV2021	I						10
TNETV2021+ TNETV2840	I						T1/E1
TNETV2840	D						20

I = Integrated DSP and RISC    D = Discrete DSP

## Gateway Applications

The customer premises gateway market can be divided into four major subdivisions, each with its own requirements and features.

### Terminal Adapters:

- Low-end solution
- Typically for residential VoIP service
- Single packet network interface (Ethernet)
- Connects to an external cable or DSL modem

### Residential Gateways:

- Two or more packet network interfaces
- Provides routing of data packets between LAN and WAN
- Connects to an external cable or DSL modem

### Integrated Access Devices:

- Two or more packet network interfaces
- Provides routing of data packets between LAN and WAN
- Integrates cable or DSL modem functionality

### Enterprise Gateways (IP PBX, Switch/Router, Media Access Gateway):

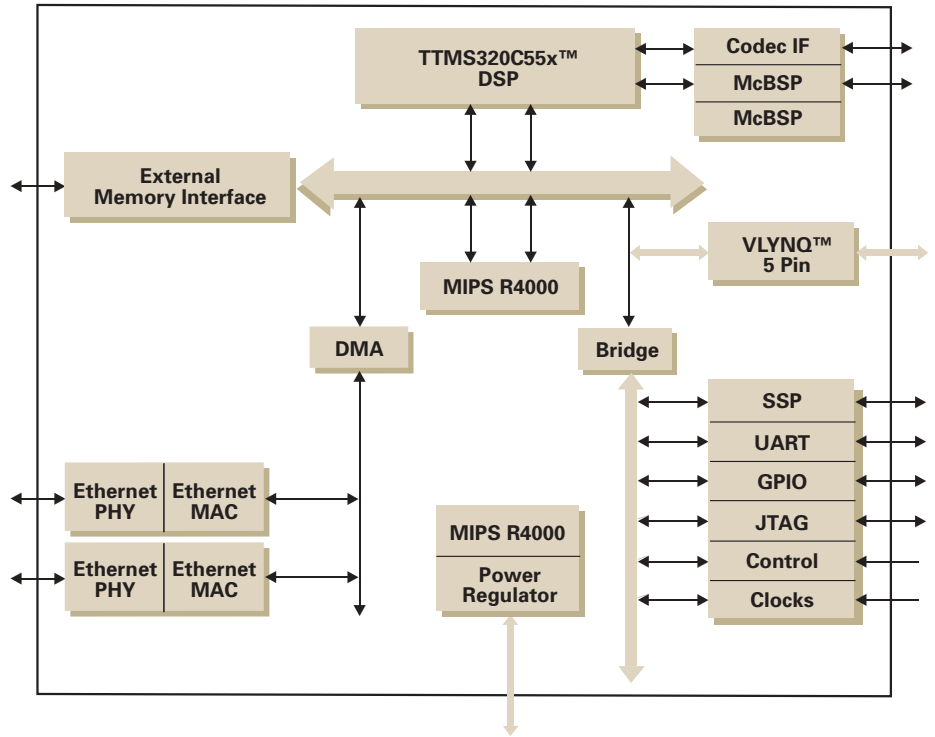
- Typically provides 8-60 channels per card
- Includes traditional gateway components geared toward VoIP

## TNETV1010 VoIP Gateway Solution

TI's TNETV1010 Residential and SOHO VoIP Gateway Solution integrates Tely Software products with TI's DSP-based access communications processor to provide a cost-effective, low-density platform for residential terminal adapter applications and new generation Internet appliances.

TI's integrated access communications processor includes a C54x™ DSP core and ARM7 RISC processor, memory and common

TNETV1060 Block Diagram

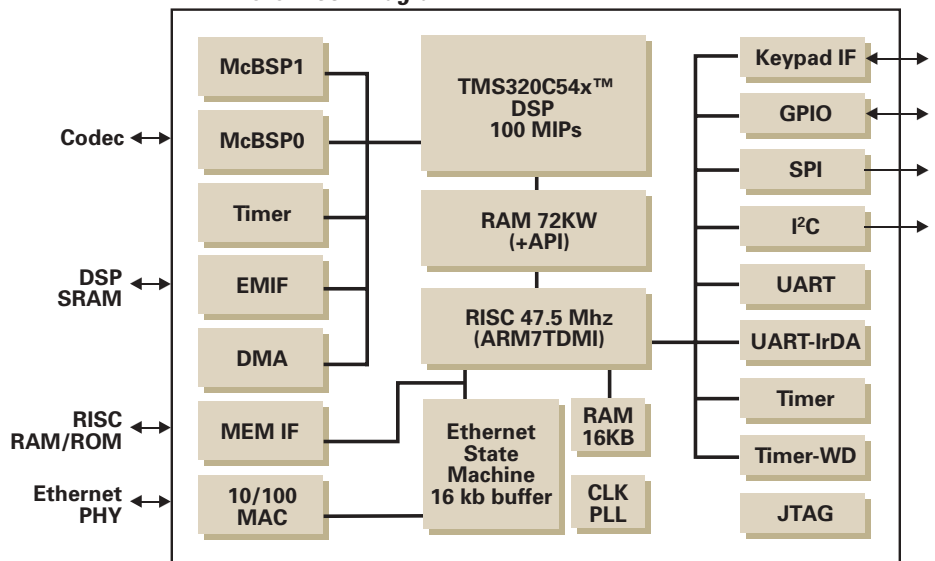


system functions (including Ethernet switch), system interfaces and two Ethernet MACs. The TNETV1010 can support up to two channels of low bit rate (LBR) vocoders or Fax Relay T.38 along with a 16 ms echo canceller tail. Supported codecs include G.711, G.726, G.723.1A and G.729AB.

## TNETV1060 VoIP Gateway Solution

TI's TNETV1060 VoIP Gateway Solution integrates Tely Software products with TI's DSP-based access communications processor to provide a cost-effective, highly integrated platform for customer premises equipment gateways.

TNETV1010 Block Diagram



TI's integrated access communications processor includes a C55x™ DSP core and a MIPS RISC processor, memory and common system functions, system interfaces and two Ethernet MACs/PHYs. The TNETV1060 can support up to four channels of LBR vocoders or Fax Relay T.38 along with a 32 ms echo canceller tail. Supported codecs include G.711, G.726, G.723.1A and G.729AB.

### TNETV2021 VoIP Gateway Solution

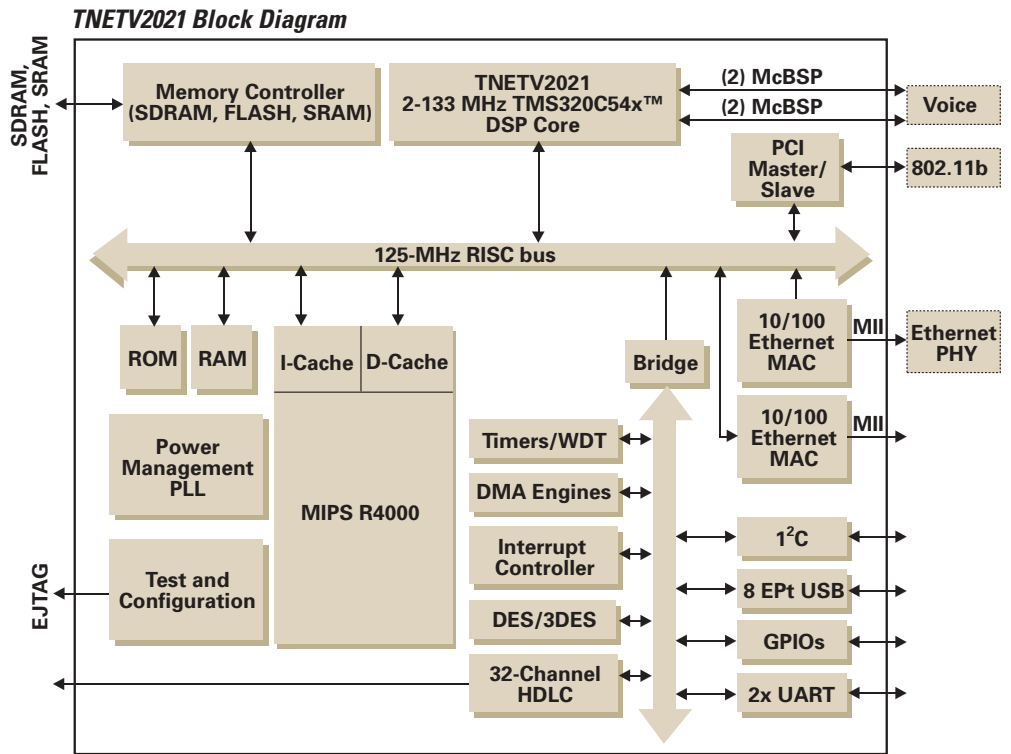
TI's TNETV2021 Enterprise VoIP Gateway Solution integrates Telogy Software products with TI's DSP-based access communications processor to provide a scalable and cost competitive single-chip solution for integrated access devices (IAD) and gateways for SOHO and enterprise applications. TI's Enterprise VoIP Solution supports up to T1/E1-based gateways.

The TNETV2021 access communications processor includes an integration of two C54x DSP cores and a MIPS RISC processor, memory and common system functions and system interfaces. Key features also include two 10/100 Ethernet MACs, PCI and USB. The TNETV2021 can support up to 10 channels of LBR vocoders along with a 64 ms echo canceller tail. Supported codecs include G.729AB, G.723 and G.711.

Channel densities of up to T1/E1 can be achieved by combining the TNETV2021 with the TNETV2840. The RISC processor in the TNETV2021 provides the host (packet) processing for channels on both devices.

### TNETV2840 VoIP Gateway Solution

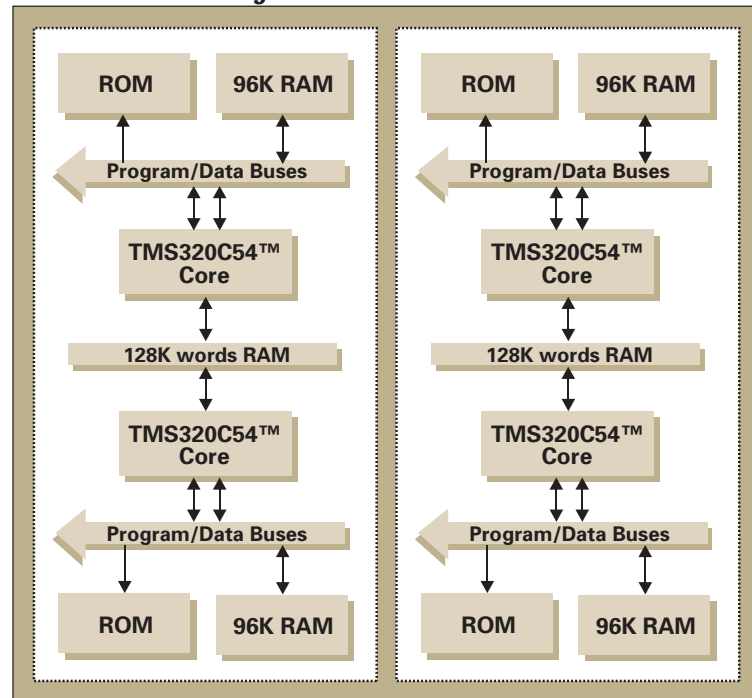
TI's TNETV2840 VoIP Gateway Solution integrates Telogy Software products with four TI DSP cores to provide an ideal solution for enter-



prise and high density VoIP/FoIP gateway applications. By integrating four C54x DSP cores, the TNETV2840 provides up to 48 PCM channels and supports up to 128 ms echo cancellation. In addition, this

gateway solution can be used to support modem and fax termination in combination with an external RISC processor for the controller functions. Supported codecs include G.711, G.729AB and G.723.

**TNETV2840 Block Diagram**



## TNETV2510 VoIP Gateway Solution

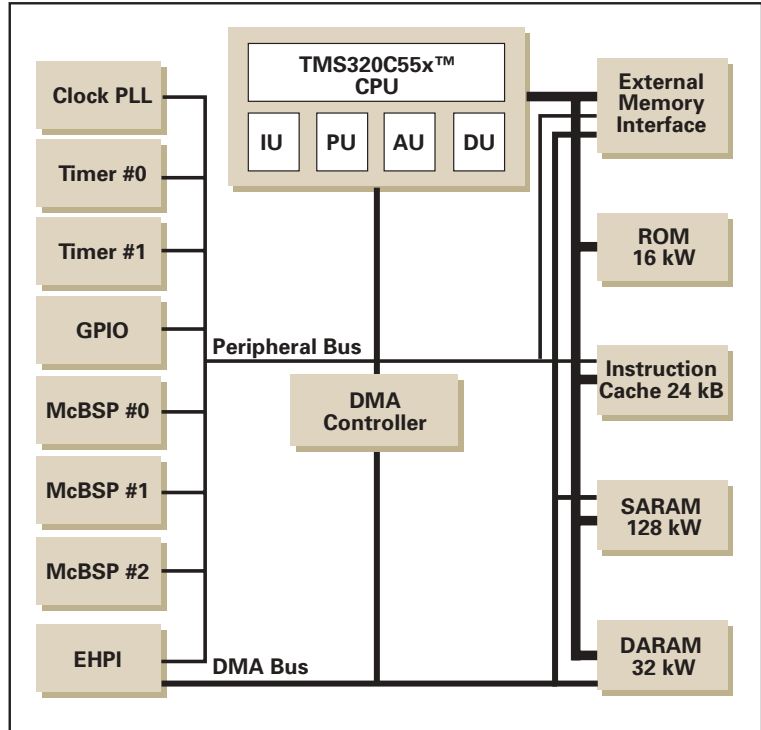
TI's TNETV2510 VoIP Gateway Solution integrates Telogy Software products with a DSP-only architecture to provide a flexible solution for residential and enterprise gateway applications. With complex features suite support and increased channel density, the TNETV2510 is ideal for voice add-on modules. This C5510 DSP-based solution supports up to eight channels of LBR vocoders along with a 128 ms echo canceller tail. Supported codecs include G.711, G.726, G.729AB, G.723.1A and GSM.

## TNETV2402 and TNETV2409 VoIP Gateway Solutions

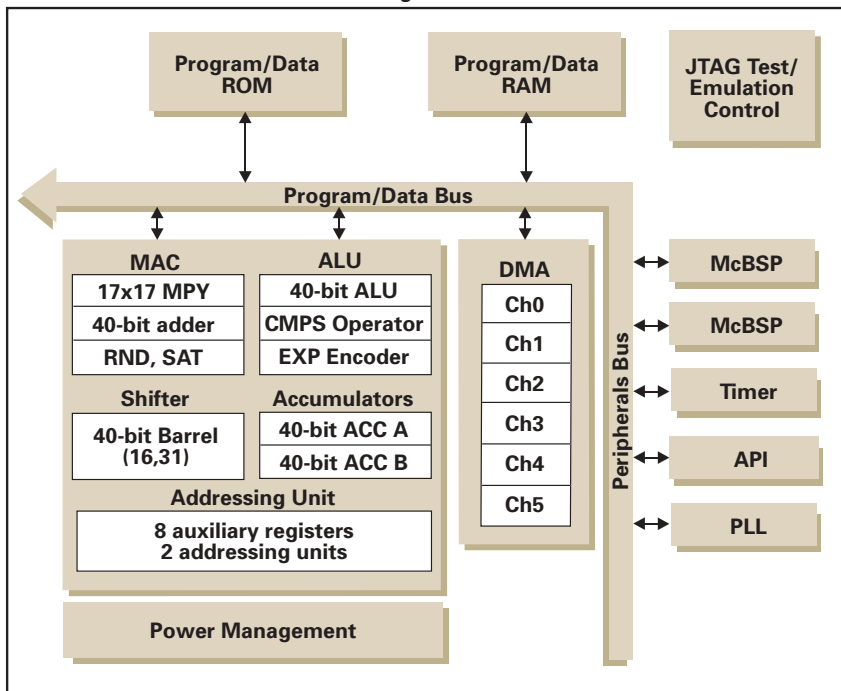
TI's TNETV2402 and TNETV2409 VoIP Gateway Solutions integrate Telogy Software products with a DSP-only architecture to provide a voice add-on solution for cost-sensitive residential applications. The C5402 DSP-based solution supports up to two channels of LBR vocoders along with an 8 ms echo

canceller tail. The C5409 DSP-based solution supports up to four channels of LBR vocoders along with a 16 ms echo canceller tail. Supported codecs include G.711, G.726, G.729AB and G.723.1A.

TNETV2510 Block Diagram



TNETV2402 and TNETV2409 Block Diagram



## Telogy Software

Telogy Software provides the broadest range of VoIP features available. Key Telogy Software capabilities include:

- Voice over IP
- Fax Relay
- Signaling
- Network Management

With the largest installed base of field-hardened gateway specific solutions since 1995, Telogy Software provides world-class VoIP software solutions that industry giants rely on.

## Voice

Voice over IP (VoIP) software processes voice samples for transmission over a data network. There are many functions included in good quality VoIP software. Its sub-components perform echo cancellation, voice compression (to conserve bandwidth), voice-activity detection, jitter removal and voice packetization. VoIP consists of the following functions:

- Voice Codec Support: including G.711 (PCM), G.723.1A, G.726 (ADPCM), G.728, G.729AB, G.729E, GSM, etc.
- Line Echo Cancellation: G.165/G.168
- Voice Activity Detection (VAD)
- Comfort Noise Generation (CNG)
- Packet Play-Out: delay, jitter, and lost packet compensation
- In-band tone detection and generation
- Packet Encapsulation: RTP (TCP/IP), AAL2 (ATM)

### Fax Relay

Fax relay provides reliable real-time fax service between two analog fax machines over a packet network. The equipment at both ends of the packet network spoofs the analog fax machines such that they operate as if directly connected over a PSTN connection.

The equipment performing fax relay functions must handle the effects of network delay, jitter (variable delay) and lost packets while preventing the fax machines from timing out.

Standard protocols such as T.38 support fax relay over packet networks. Proprietary techniques are often used to improve the interoperability between different fax machines that are subjected to long delay and other packet-network effects.

Fax relay, as part of this gateway solution, is T.38 compliant. In addition, forward error correction and advanced error concealment techniques are employed to improve document quality.

Fax relay consists of the following functions:

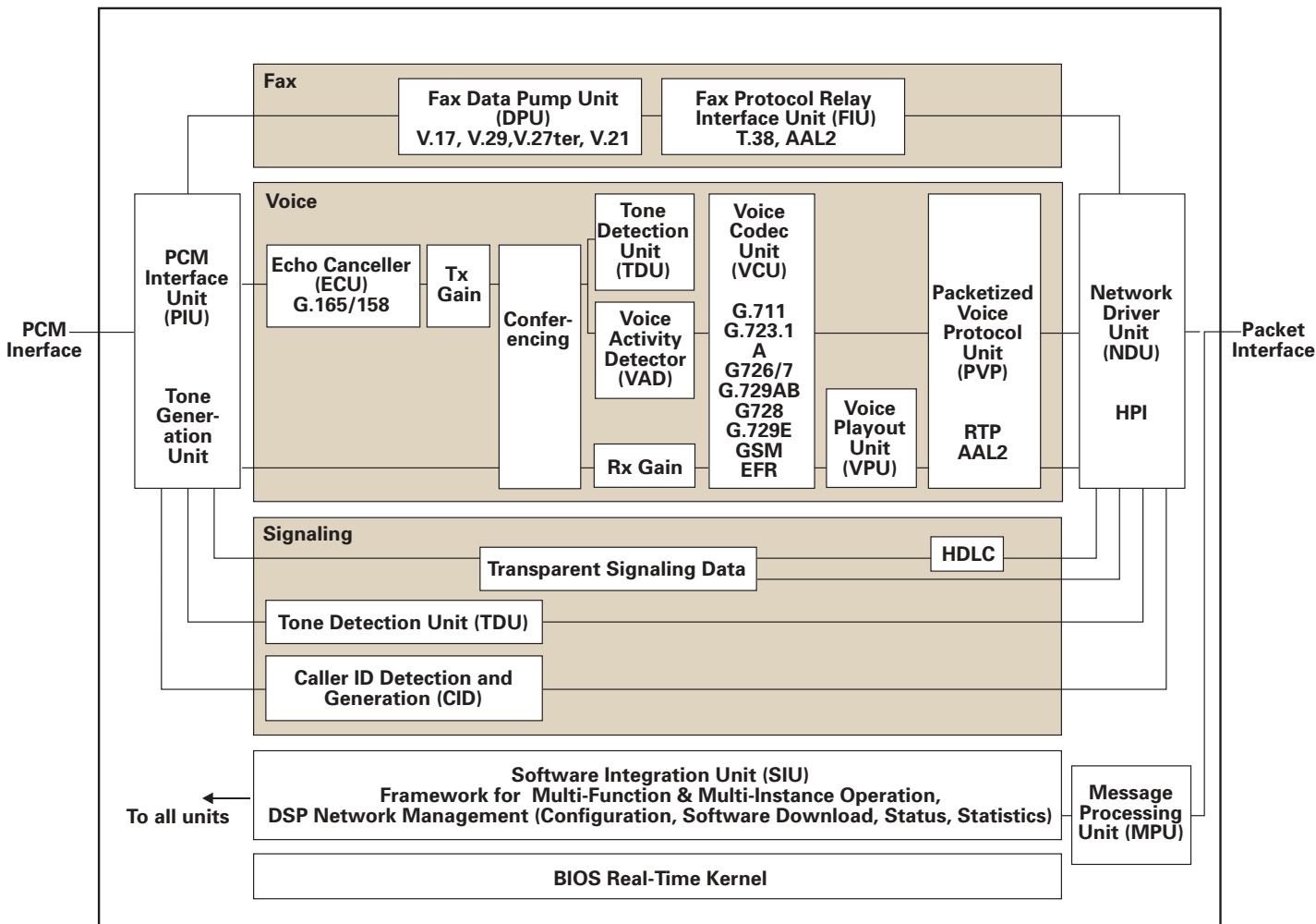
- Fax Modem Pumps: V.17, V.29, V.27ter, V.21
- Fax Relay Protocol: T.38 (TCP/IP)
- Fax Machine Spoofing Protocols: Proprietary
- T.30 protocol support

### Signaling

Gateway platforms must support signaling for call establishment, in-band signaling and call termination. Both Channel Associated Signaling (CAS) and Common Channel Signaling (CCS) are employed by networks and must be supported.

The following signaling functions are supported and run on a combination of the DSP and an external RISC processor:

Figure 1: Telogy Software Architecture



- Tone Detection and Generation, e.g., DTMF, MF, Call Progress, etc.
- Caller ID Detection and Generation (Bellcore, ETSI, NTT)
- Message-based signaling support, e.g., transparent, HDLC, ISDN, etc.

### Network Management

Fundamental to any communications system is the ability to discover, isolate and remedy problems as quickly as possible to minimize or eliminate the degree to which users are impacted.

Telogy Software provides APIs that enable a gateway system

provider to develop network management applications. Telogy Software APIs can be mapped to standard MIBs and include the following functions:

- Configuration on per channel basis including setable country code specific information
- Per channel statistics and status reporting
- Per channel real-time trace and diagnostics capabilities

### Telogy Software Architecture

Figure 1 describes the software architecture for gateway solutions. Each box represents a software

component required to implement the features for voice, fax, modem, signaling, and network management functions.

Multiple instances of each software component can exist to facilitate support of concurrent, multi-channel operation. Each instance shares common program memory and has unique channel-specific data memory to maintain information regarding the state of the channel, including network management and diagnostic information. The software runs on TI's BIOS Real-Time Kernel.

## Features: Telogy Software for CPE Gateway Solutions

### Voice and Fax Features

- |   |  |  |
|---|--|--|
| <ul style="list-style-type: none"> <li>• G.711 PCM 64 Kbps</li> <li>• G.723.1 5.3/6.3 Kbps and Annex A (silence compression)</li> <li>• G.726 ADPCM 16, 24, 32, 40 Kbps</li> <li>• G.727 ADPCM</li> <li>• G.728 16 Kbps</li> <li>• G.729 8 Kbps</li> <li>• G.729 AB 8 Kbps (Annex A and B – VAD, CNG)</li> <li>• G.729 Annex E 11.8 Kbps</li> <li>• GSM Enhanced Full Rate</li> <li>• G.165/G.168 echo cancellation</li> <li>• Packet Payout Unit (de-jitter buffer, lost packet compensation)</li> </ul> | <ul style="list-style-type: none"> <li>• Voice Activity Detection (VAD) silence suppression</li> <li>• Comfort Noise Generation (CNG)</li> <li>• Comfort noise level control</li> <li>• RTP packet encapsulation for voice</li> <li>• DTMF Relay</li> <li>• DTMF detection during voice mode</li> <li>• Configurable call progress detection parameters</li> <li>• Configurable voice packetization rates</li> <li>• V.17 at 7200, 9600, 12,000 and 14,000 bps</li> <li>• V.27ter at 2400 and 4800 bps</li> <li>• V.29 at 7200 and 9600 bps</li> <li>• Fax Pass-Through (PCM)</li> </ul> | <ul style="list-style-type: none"> <li>• T.38 real time Fax Relay</li> <li>• In-band signaling</li> <li>• DTMF generation/detection</li> <li>• MF R1, R2 tone generation/detection</li> <li>• CP tone detection for T1 CAS</li> <li>• SS7 ring-back tone generation</li> <li>• SS7 COT</li> <li>• API support (management, event monitoring/reporting, statistics)</li> <li>• Telchemy VQmon support</li> <li>• Loopback test capabilities</li> <li>• Core dump facility</li> <li>• Memory read/write support</li> <li>• Trace messages</li> </ul> |
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For more information, please contact your TI sales representative or call 972-644-5580.

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