

Product Bulletin

TNETV3010 Infrastructure VOP Gateway Solution

Telogy Software® Products Integrated with TI's DSP-Based Access Communication Processor

Texas Instruments (TIs) carrier-class VOP gateway solutions include the TNETV3010 DSP. The TNETV3010 is a full-featured silicon and software solution that provides the highest solution density in the marketplace today.

Industry-Leading Silicon Architecture

The TNETV3010 has six fixed-point DSP cores based upon TI's TMS320C55x™ DSP (see figure 4). Each of these six DSP cores operates at 300 MHz and shares multiple on-chip resources. The TNETV3010 has been optimized for high density VOP applications.

Solution Density

TI's gateway solutions are designed with an emphasis on solution density and not a per DSP channel count. Solution density implies a system level approach that optimizes power, space and cost while targeting specific applications. Solution power, space and cost are kept low through the use of internal memory, the combination of the control and packet buses, and allowing for high channel counts on the TDM interface.

Channel Definition and Density

For traditional carrier class channels, the following features are provided by TI:

- 128 ms echo canceller
- Jitter buffer
- Comprehensive tone package
- Voice activity detection
- Caller ID generation
- Signaling (CAS/CCS)
- In-band signaling (AAL2 Type 3, RFC 2833)
- RTCP
- Network encapsulation
- Fax relay
- Any codec on any channel
- Variable packet sizes (5 ms to 80 ms, depending upon codec)
 - 10 ms - RTP
 - 5/5.5 ms - AAL2
- Full-featured diagnostics

Telogy Software® Products

True toll quality is achieved through a full implementation of carrier-class features that include PCM support, carrier-grade echo cancellation, wireless

Key Features:

- Industry-leading solution density with lowest power and space per channel
- Flexible, carrier-grade solution
- Field-proven Telogy Software® with over 120 million ports shipped
- Carrier-certified echo cancellation
- Complete system solution including backplane aggregation
- Single control/data plane minimizing board complexity
- Multi-use for wireline and wireless voice applications - extensive voice codec suite

features, carrier-class diagnostics, fax relay, low system latency, complete system flexibility, and many other features. This feature set allows the TI solution to exceed the quality levels expected in modern telephony systems.

Echo Cancellation

As VOP solutions are deployed, delay is added to the network. Once roundtrip delay exceeds 50 ms, individuals perceive echo.

Echo cancellation is a difficult problem to solve because

Solution Density

Comparing the TNETV3010 to Other Solutions

A complete solution density evaluation is a very complex process that includes many factors and is likely to become even more complex as technology advances. TI is the industry leader in solution density.

- What is the definition of a channel?
- What is the typical and maximum power rating for the DSP?
- How much space is required for the DSP?
- Is external memory required? If so, the space and power consumption for the external memory needs to be added in order to compare "apples to apples."
- What is the effect of low bit rate codecs on channel density?
- How does packet size affect density?

of constantly evolving networks with often extreme variations (signal levels, hybrids, non-linearities, etc.). G.168–2002 provides a limited set of prerequisites for a “good” echo canceller and assumes a telephony plant operating within a predefined set of standards, which is not always the case. The Telogy echo canceller is a field-hardened echo canceller that has successfully addressed the challenges of today’s networks.

Wireless Features

Wireless features are available with the standard Telogy Software product. These features include a full suite of wireless codecs as well as Voice Quality Enhancements (VQE) such as automatic level control, tandem free operation (TFO), acoustic echo control and noise reduction.

Carrier Class Diagnostics

Diagnostics are aided by an extensive set of statistics and remote, real-time tracing capability on a per-channel basis. Remote JTAG interfaces are available for real-time fault isolation without requiring a physical presence in the field.

Bellcore Test Line support for diagnostic testing is also available as well as a full complement of loopbacks.

Finally, Telogy Software is “redundancy aware” for fast, reliable switchovers.

Together these features reduce the amount of time required to effectively isolate and correct field problems.

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 public switched telephone network (PSTN) connection.

The equipment performing the fax relay functions must handle the effects of network delay, jitter (variable delay), and lost packets while preventing the fax machines from timing out. Fax relay, as a part of the TI solution, is T.38 compliant. In addition, forward error correction and advanced error concealment techniques are employed to improve document quality.

Low System Latency

Latency in a high density gateway degrades signal quality and can cause more serious issues. Latency is present in each network component and in the network itself and must be minimized in order to provide toll quality voice service.

Latency in the PSTN to network direction arises from the following areas:

- Sample frame collection
- VAD algorithmic delay (PCM, ADPCM only)
- Codec algorithmic delay
- Processing delay

Delay in the TI solution is minimized by staggered scheduling of processing.

Latency in the network to PSTN direction is affected by:

- Delay associated with playout buffer
- Processing delay
- Codec algorithmic delay

Effective DSP solutions should constantly strive to improve latency in order to maintain quality voice services.

System Flexibility

Telogy Software provides an extremely flexible solution that does not come at the expense of channel density. Examples of this flexibility include:

- Codecs may be assigned on a channel by channel basis without restrictions based upon DSP or DSP core
- Codec Frame Size
 - 5 ms to 30 ms (PCM)
 - 10 ms to 80 ms (low bit rate codecs)

Channel configurations and features can be mixed as required without impacting performance. This is accomplished by state-of-the-art MIPS and memory management.

Each DSP is autonomous, so that there are no master/slave relationships between DSPs in a design.

Echo Cancellation Challenges

Bad levels (IP or digital phones produce hot levels)
 Nonlinear hybrids
 Handset leakage (wireless/acoustic/electric)
 Extreme double-talk
 Dial tone breaking (talk-over)
 Tandem connections in VoIP
 Frame slips
 Hybrids with low ERL

G.168 does not address these real world challenges and is not a guarantee of acceptable performance.

Figure 2

Feature-Rich Software

Telogy Software contains many other features that provide a comprehensive solution:

- Signaling support
- Tone detection/generation
- Caller ID (NTT, ETSI, Canadian, and Bellcore)
- Voice activity detection with comfort noise generation
- Network channel switching
- Host offload
- Host control software
- Announcement playout

Reference Designs

TI's gateway solutions include a detailed reference design that allows OEMs to take advantage of TI's design expertise. TI also has evaluation platforms (a hardware implementation of the design) that can be used for feature evaluation, system software development and testing.

Three reference designs exist and are differentiated by aggregation architecture. An FPGA-based design, a network processor-based design, and a daughter card design based upon an rMII interface are available.

FPGA Based – This is the traditional approach for aggregation. The FPGA provides for the aggregation and protocol encapsulation of traffic for the packet network.

Network Processor Based – This approach provides a lower cost option and ensures programmability for future features such as IPv6.

rMII Daughter Card – This approach provides for an rMII interface and Ethernet-based designs.

The primary purpose of both the reference design and evaluation platform is to reduce time to market.

Frequently Asked Questions

Why doesn't TI use an internal RISC processor?

Internal RISC processors do not eliminate the need for aggregation or a Master Control CPU and they can increase latency when smaller packet sizes are used.

Why does TI use internal memory?

The use of internal memory decreases space and power requirements and ensures high throughput.

Why did TI combine the control and packet bus?

TI's solution is designed with a common Utopia bus for both control and data. This approach decreases the number of board layers required, resulting in a higher board yield and lower manufacturing costs.

What channel count is offered on the TDM interface?

Most competing solutions offer 128/256 channels versus 512 for TI. The higher port count allows for a decrease in the number of Time Slot Interchanges required, decreasing the cost, power and space requirements for the overall solution.

Figure 3

TNETV3010 Processor Architecture

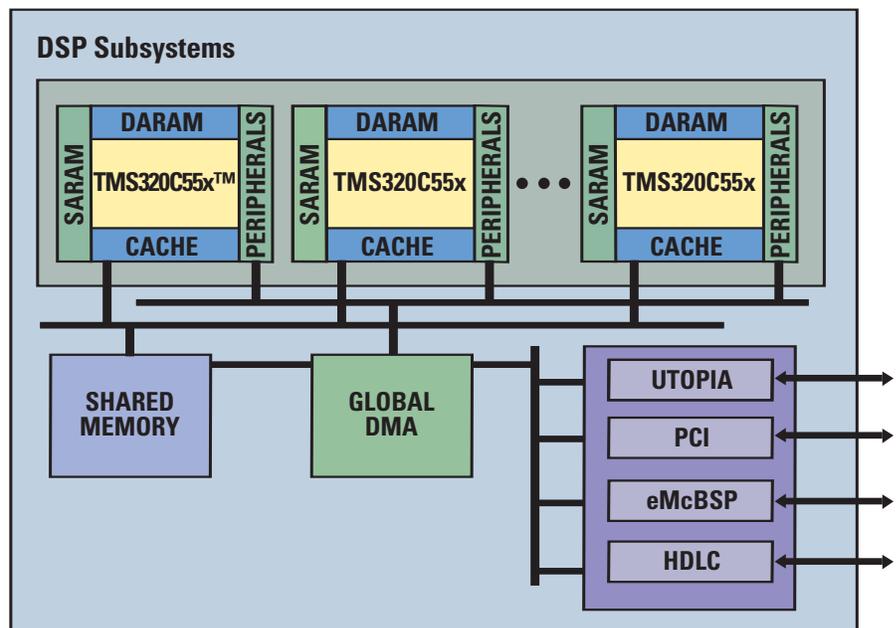


Figure 4

Support and Quality Assurance

When you base your communications products on TI's programmable DSPs and award-winning Telogy Software, you receive comprehensive technical services and support from our software and systems experts.

Telogy Software has been in continuous use in major carrier networks for over seven years. We protect your investments through updates, upgrades and customer input on our enhancement roadmap. In addition, we offer targeted support at key

milestones in the development process, such as hardware design review and onsite software/hardware integration.

TI offers the support and valuable assistance that can help you speed time to market and shorten time to profit.

**Features: Telogy Software® Products
TNETV3010 Access Communication Processor**

Cores	Six
Maximum Power Consumption	1.2 Watts (core*) at 1.2V core
Typical Power Consumption	1 Watt (core*) at 1.2V core
Memory	>1,500 KW (16-bit word) on-chip RAM
DMA Controllers	Global DMA Controller
Interfaces	512 Channel eMcBSP (qty 2) - TDM 32-bit, 33-MHz PCI Master/Slave or Enhanced 32-bit HPI 66-MHz HDLC Serial Utopia Level 2
Package	16x16 mm, 285-ball BGA
Operational Temperature Range	0°C to 85°C (case temperature)
Storage Temperature Range	-55°C to 150°C

**For power, core includes all CPUs, memory and peripherals.*

Global Feature List: Telogy Software® Products*

Voice Codecs

G.711 PCM 64 Kbps, G.723.1 5.3/6.3 Kbps, G.723.1 Annex A (silence suppression), G.726 ADPCM 16,24,32,40 Kbps, G.727 ADPCM, G.728 16 Kbps, G.729 8 Kbps, G.729 AB 8 Kbps (Annex A and B – VAD, CNG), G.729 Annex D 6.4 Kbps, G.729 Annex E 11.8 Kbps, GSM FR, GSM EFR, GSM AMR, EVRC, SMV, QCELP

Echo Canceller

G.165/G.168-2002 echo cancellation (up to 128 msec echo tail with multiple reflections cancellation)
VQE for wireless applications

VOP Feature Set

Packet playout unit (de-jitter buffer, lost packet compensation)	Auto-switch from G.7xx to G.711 upon fax or modem detection
Voice activity detection (VAD) silence suppression	DTMF detection during voice mode
Comfort noise generation (CNG) with level control	Configurable call progress detection parameters
AAL2 - BLES	Configurable voice packetization rates
ATM Forum Profiles 7 - 10	RTP/UDP/IP header compression
RTP packet encapsulation for voice	CALEA
DTMF relay	Encryption
	Network channel switching (support of packet-to-packet applications)

Fax Protocols

V.17 at 7200, 9600, 12,000 and 14,000 bps, V.27ter at 2400 and 4800 bps, V.29 at 7200 and 9600 bps, fax pass-through (PCM), T.38 real-time fax relay, fax relay on AAL2

In-band Signaling

DTMF generation/detection, MF R1, R2 tone generation/detection, CP tone detection for T1 CAS, SS7 ring back tone generation, SS7 COT, R2 signaling support (compelled, non-compelled, semi-compelled)

Digital Carrier Services, ISDN

Sync-mode PPP (ISDN) (HDLC-framed PPP)

HDLC Framing Service (required for V.120 host offloading)

V.110

56K Rate Adaptation

Management Services/Other

- API support (management, event monitoring/reporting, statistics)
- Configurable country code (per channel)
- Loopback test capabilities
- Core dump facility
- Memory read/write support
- Trace messages

* Please contact your TI sales representative for supported feature combinations. For more information, please contact your TI sales representative or call 972.644.5580 www.ti.com/voip

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