CEVA™
The DSP Powerhouse

CEVA-VoP

Voice-over-Packet (VoP) Application Platform

CEVA-VoP Target Markets

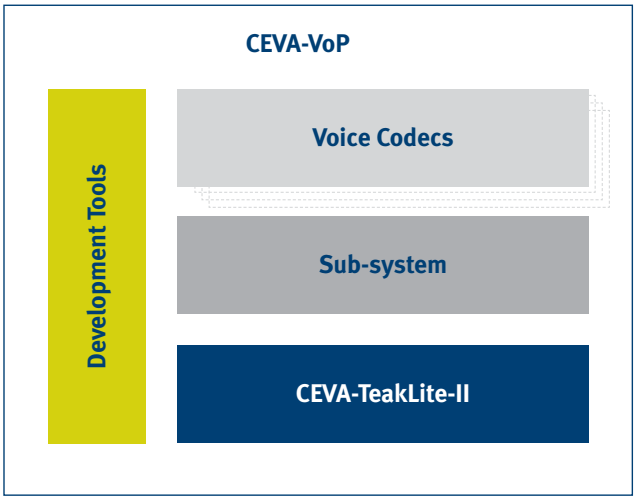
- Voice over DSL/Cable/FTTH
- Dual mode Cellular/Voice-over-WiFi Phones
- IP (LAN) Phones
- Residential gateways
- IP-PBX

With ever-increasing numbers of households and businesses benefiting from broadband connectivity, the required infra-structure is now in place for Voice over Internet Protocol (VoIP) services to finally reach critical mass. Responding to market demand, wireless communications carriers, software vendors and device manufacturers are striving to develop a range of products and services that exploit this technology. Cellphones that utilize WiFi connectivity to support VoIP services and residential broadband modems that offer voice capability are among a new breed of hybrid devices leveraging VoIP technology to offer consumers high quality voice communications at truly cost effective levels.

In order to address these changing dynamics, CEVA has created a comprehensive platform for enabling a wide range of cost-sensitive Voice-over-Internet Protocol (VoIP) products. CEVA-VoP™ is a full-featured semiconductor intellectual property (IP) package that enables product developers to incorporate VoIP functionality seamlessly into their system-on-chips (SoCs).

Based on CEVA's XpertTeakLite-II™, the CEVA-VoP platform is a complete hardware and software solution that can be deployed as a sub-system in an integrated networking-and-VoP SoC. The platform integrates the widely adopted, programmable CEVA-TeakLite-II™ DSP core, with added hardware peripherals capable of handling multiple, simultaneous, packet-voice channels on a single core. The solution includes all required DSP software, such as speech compression and decompression, echo cancellation, telephony functions, and signaling/networking. The software is open, allowing design licensees to add proprietary algorithms and broaden the use of the design for other markets or applications.

CEVA-VoP Platform



CEVA-VoP Building Blocks

The CEVA-VoP solution contains four key elements:

- **Programmable DSP**
  The 200MHz CEVA-TeakLite-II is a small die size, low power DSP core
- **DSP Sub-system**
  A highly integrated, compact XpertTeakLite-II sub-system, incorporating cache memory architecture to reduce cost, with small memory footprint and an AHB/APB bridges for easy system integration.
- **VoIP Software**
  The solution is based on an open, programmable platform and contains a complete suite of voice, telephony, RTP, and networking modules, integrated with an application framework and scheduler.
- **Complete development tools chain**
  Complete software development tool suite and system boards for customer support from initial design to final tape-out.

Technical Highlights

- A licensable Voice-over-Packet design
- Multiple, simultaneous voice and fax channels
- Multi-core design possible for higher channel density
- Embedded programmable CEVA-TeakLite-II core with proven field-tested VoP software
- Open architecture allows future upgradeability, feature enhancements and customer-specific proprietary features in software and hardware

Platform Benefits

- Scalable architecture
  - Configurable number of voice channels (1-8) using a single core
  - DSP capable of handling signaling and networking tasks, eliminating need for Host CPU
  - Extendible design supports multiple core solution
- Lowest comparable cost per channel in the market
- Power efficiency
  - Saves energy in mobile VoIP devices
- Open architecture
  - Enables easy configuration of the supported features
  - Includes Voice, Telephony, RTP and Networking software modules
- Complete set of development tools
  - Program, Compile and Debug capabilities with CEVA's test chip
  - Implement proprietary early-stage SoC version via FPGA
- Soft IP / Fully synthesizable
  - Applicable to any foundry, process and geometry of choice
  - Based on CEVA's industry leading DSP cores and sub-systems

Configurations

CEVA-VoP is a fully integrated, single DSP based VoP system, available in two configurations:

- **Voice Co-processor**
  providing maximum channel density when coupled with a host CPU
- **Voice Plus Networking Processor**
  providing voice and signaling/networking capability for a RISC-free design

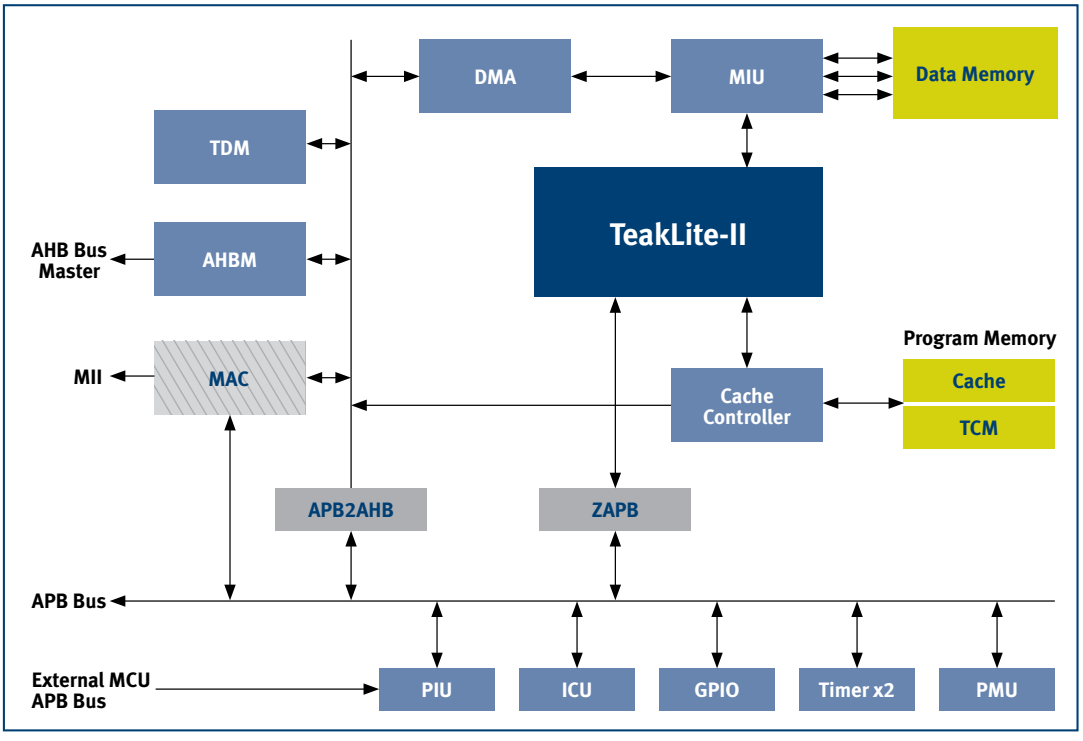
CEVA-VoP DSP Engine

The DSP engine incorporates a very low power, low-cost, fully synthesizable CEVA-TeakLite-II DSP core. Thanks to a small die size of 0.24mm^2 (at 90nm TSMC G process) and a 16-bit instruction width, the DSP engine ensures the production of low cost silicon solution with a small memory footprint. The DSP in-cludes a blend of DSP and CPU instructions and can operate at clock speeds of up to 245MHz, when implemented in 90nm TSMC G process. The CEVA-TeakLite-II core is binary-compatible with the CEVA-TeakLite™ DSP core.

DSP Sub-system Overview

Highly integrated, highly efficient DSP Sub-system

- Cache memory enables low cost solution
- 3 channel DMA reduces load from the DSP
- Ethernet MAC with MII (RMII, SMII, GMII) interface
- External interfaces
  - AHB Master interface
  - APB to add off the shelf APB peripherals
  - APB slave port for inter processor communications
- APB peripherals
  - Power Management Unit, Timers, GPIO, Interrupt controller, Processor Interface Unit
  - 2 TDM modules (codec interface)
- Configurable data and program memory and cache sizes



CEVA-VoP - DSP Subsystem

DSP Firmware

The CEVA-VoP is a highly integrated solution that incorporates an application framework, scheduler and the following software components:

- **Voice Processing**
  - G.726 ADPCM speech and audio codec
  - G.711 A-/m-law PCM speech codec
  - G.729AB CS-ACELP speech codec
  - G.723.1/A MP-MLQ/ACELP speech codec
  - Voice Activity Detection (VAD)
  - Comfort Noise Generation (CNG)
  - G.168 line echo cancellation (8-64ms)
- **Telephony Software**
  - Q.24 DTMF detection
  - Fax/modem detection
  - Tone generation
  - Bellcore/ETSI caller ID, types I & II
  - Caller ID modulation
  - Error mitigation and bad frame interpolation
  - Conference bridge
  - Adaptive jitter buffer
  - Q.323 MF(R1) detection
  - Q.422 MF(R2) detection
  - E.182 call progress detection
  - Automatic level control

All algorithms comply with applicable standards

CEVA-VoP Development Tools

CEVA has developed a suite of advanced software and hardware development environments, releasing several versions over the course of more than fourteen years of DSP licensing. The GUI-based development environment allows the programmer to follow the various processes comfortably, allowing greater efficiency within programming, compiling and debugging processes. The mature and completely field-proven tools are available for PC/Windows, UNIX/Solaris and Linux operating systems.

- Complete and integrated Software Development Tools
  - Advanced user friendly IDE
  - Optimizing C/C++ Compiler
  - Assembler, linker & utilities
  - Advanced GUI debugger
    - Scripting support (CLI/TCL)
    - Multi core Support
    - Interface to Verilog simulators (DBGVerifier)
    - Built in extendible simulator
    - Emulator I/F (PP/USB/JTAG)
    - MATLAB connection
  - Application Profiler
    - Performance measurement
- System Boards
  - Support for multiple RJ11 POTS lines
  - On-board Ethernet PHY
  - On-board SLICs
  - Easy integration with ARM development board

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