Solution Brief

IP Telephony Platforms

Intel® EP80579 Integrated Processor Product Line with Intel® QuickAssist Technology

Fonality* trixbox* Pro IP-PBX Software Solution

FONALITY communicate openly®

Designing Low Cost IP Telephony Platforms

System-on-a-chip (SOC) solution is well-suited for converged IP PBX solutions, converged access platforms, IP media servers and multi-service business gateways

Previously, many IP telephony solutions required a digital signal processor (DSP), a CPU to run Voice over IP (VoIP) and applications and a network processor to manage packet-based data flows. Today, small and medium businesses (SMBs) are looking for low cost systems that converge analog and digital networks and provide a variety of services, such as routing/switching, voicemail, multi-way conferencing and security, in addition to traditional IP-PBX functionality. To support all these functions, converged solutions must combine high-performance voice processing, packet processing and security acceleration capabilities.

Offering a solution for all these requirements, the Intel® EP80579 Integrated Processor with Intel® QuickAssist Technology is a system-on-a-chip (SOC) solution that can dramatically lower system cost. It runs so-called soft DSP algorithms for voice compression and echo cancellation on analog calls coming in on direct Foreign eXchange Subscriber/ Foreign eXchange Office (FXS/FXO) interfaces. Utilizing the Intel® Accelerated DSP Solution (Intel ADS) and Intel® Performance Primitive libraries, DSP algorithms execute directly on the Intel® architecture core with enough headroom for a complete SMB multi-service business gateway solution. These SOCs also include integrated security acceleration capabilities, so in total, they consolidate what was previously a six chip solution into a single device. These system-on-a-chip processors were architected with converged telephony and security applications in mind.

Converged Telephony Functions

The Intel EP80579 Integrated Processor with Intel QuickAssist Technology integrates TDM for analog phones and T1/E1 interfaces to the network, Ethernet MACs for VoIP SIP phones, and security accelerators, as shown in Figure 1. Voice signal processing and packet processing are performed by the Intel architecture processor core.

Phone and Network Connectivity

- Integrated TDM Acceleration
  - > HDLC channel and voice time slot management
  - > T1/E1 WAN connectivity for channelized packet or voice time slot connectivity
  - > Analog trunk or POTS connectivity
- Three 10/100/1000 Ethernet MACs

Signal Processing

- Telephony Call Stack (e.g., Tone Detection/Generation, Auto Gain Control, Jitter Buffer, Comfort Noise Generation, Voice Activity Detection and Caller ID)
- Echo Cancellation: (G.168 compliant)
- Pulse Code Modulation (PCM)
- Voice Compression and decompression (G.711, G.722, G.723.1, G.726, G.729AB compliant)
  - > All codec support is bit exact for ease of interoperability.

Packet Processing

- Protocol Conversion
  - > TCP/IP Forwarding

Security Functions

The Intel EP80579 Integrated Processor with Intel QuickAssist Technology contains a Security Services Unit that performs multiple functions utilizing on-chip hardware combined with Intel provided, security acceleration drivers, as shown in Figure 1.

- **Bulk Encryption:** Encrypts and decrypts user data, which might be VPN traffic or even discrete files using a security key.
- **Hashing:** Calculates an almost unique fixed-size message digest or 'signature' for a block of data of arbitrary length.
- **Public/Private Key Encryption:** Performs public key encryption/decryption, digital signature generation/verification and modular exponentiation.
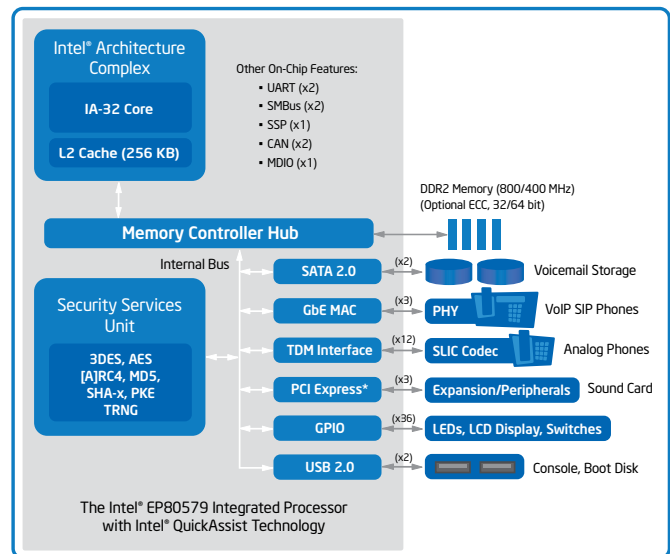

Figure 1. Converged IP PBX Example

- **True Random Number Generation (TRNG):** Creates a true random number derived from an on-chip pseudo-random noise source
- **Authentication:** Verifies the communication is from intended sender.

Since these security tasks are performed in hardware, the general purpose processor has more cycles for voice applications, like voice mail and interactive voice response (IVR) based application interaction.

General Purpose Computing Performance

This single-chip design includes an Intel architecture processor core based on the Intel® Pentium® M processor family, an integrated memory controller hub, an integrated I/O controller hub and various I/O interfaces. The CPU runs at up to 1.2 GHz, providing ample performance for voice and application services.

Application Possibilities

System engineers developing cost-effective, converged IP PBX solutions can design a very dense solution using the Intel EP80579 Integrated Processor with Intel QuickAssist Technology, as shown in Figure 1. The SOC supports a wide range of interfaces and peripherals, including gigabit Ethernet, PCI Express*, USB 2.0, SATA 2.0, UARTs, three TDM busses, IEEE 1588 time protocol support, CAN bus and general purpose I/O. This high level of integration reduces component count and power consumption, which in turn lowers unit cost and increases reliability.

Affordable Enterprise-Class Communication Systems

Challenge: Every small and medium-size business needs an affordable communication solution that provides a competitive edge. One such solution, called a converged application platform, is multi-functional and interfaces to a wide variety of devices and networks, as shown in Figure 2. It must deliver voice, data and video over a single IP network with good quality of service (QoS). OEMs developing converged application platforms need to integrate a variety of telephony, networking and security technologies.
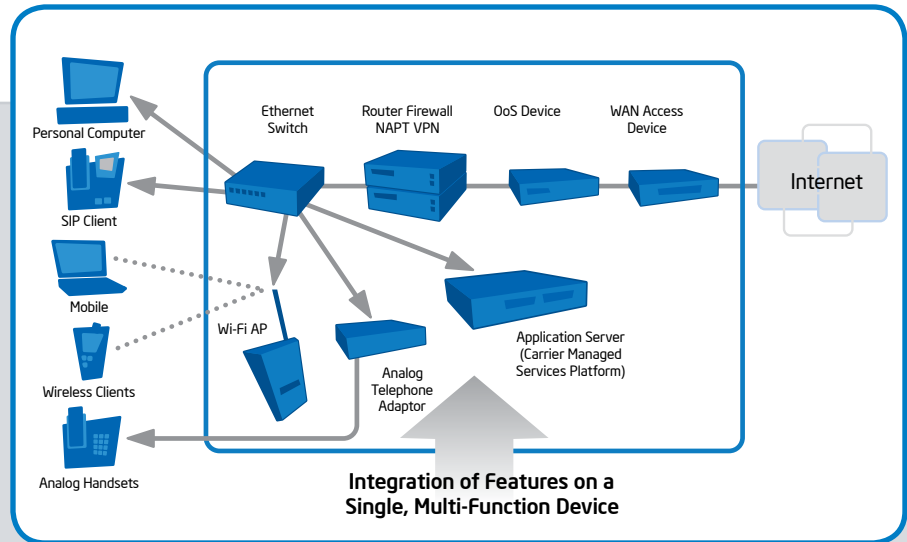

Integration of Features on a Single, Multi-Function Device

Figure 2. Converged Application Platform Diagram

Fonality Delivers an SMB Communications Solution:

Fonality*, a leading provider of communications solutions, creates products specifically for SMBs that are affordable, reliable and deliver enterprise-class features. Their PBX software, called trixbox* Pro, runs on a wide range of platforms, and they recently ported it to the Intel EP80579 Integrated Processor with Intel QuickAssist Technology. Combining Fonality software and Intel processors has yielded a low cost, low power device that is easy to deploy, use and manage.

The trixbox Pro family is compatible with analog and cordless telephones, IP telephones and is VoIP ready. It also offers dozens of features that allow businesses to route calls between remote telecommuters, link branch offices, receive and send voice and email messages and more. Some of the products and services provided by Fonality are listed in Table 1.

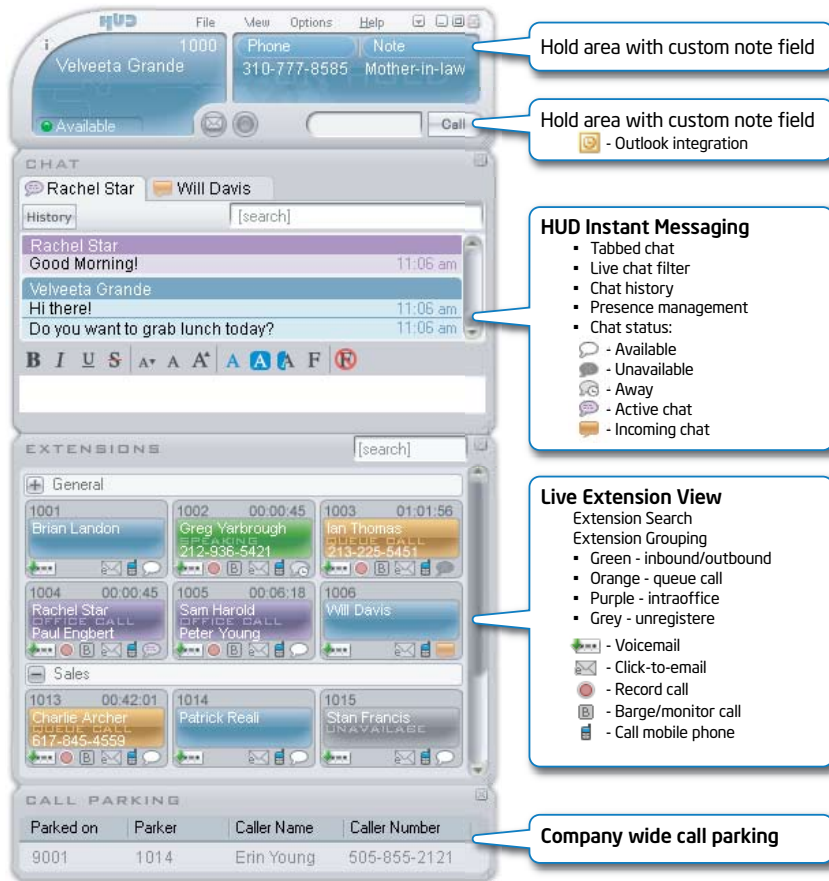| Products and Services	Capability
PBX System	The system is configurable as an IP or hybrid PBX, connecting callers to IP, analog (POTS) and digital (T1/E1) networks. It supports auto-attendant, music-on-hold, schedulers, enhanced voicemail, Microsoft Outlook* integration, CRM integration and "Find-Me" call routing, just to name a few capabilities.
Call Center System	Extending the capabilities of the PBX system, the call center includes full ACD functionality, call queues, agent call recording, skill-based routing, upload voice prompts, multiple auto-attendants, real time queue statistics and graphical queue reports.
Hosted Support	Critical support processes are hosted by Fonality: system monitoring and backup, report generation, automatic software updates, administration and user portals.
HUD (Heads Up Display)	A fully integrated Client Application Dashboard providing instant messaging, Presence, Click-to-Call, CRM and Outlook integration for "Desktop Unified Communications". A screen shot of this dashboard is shown in Figure 3.
VoIP Enabled Network Service	Fonality offers its customers access to a VoIP network, which allows businesses to save money on long distance call charges. Customers can make inter or intra-office telephone calls free of charge, so these VoIP services are particularly valuable to businesses with multiple locations.

Table 1. Products and Services Supported By Fonality*

Hold area with custom note field

Hold area with custom note field
🔲 - Outlook integration

HUD Instant Messaging
- Tabbed chat
- Live chat filter
- Chat history
- Presence management
- Chat status:
  - 💬 - Available
  - 💬 - Unavailable
  - 🕒 - Away
  - 💬 - Active chat
  - 💬 - Incoming chat

Live Extension View
Extension Search
Extension Grouping
- Green - inbound/outbound
- Orange - queue call
- Purple - intraoffice
- Grey - unregistere

- 📧 - Voicemail
- ✉ - Click-to-email
- 🔴 - Record call
- Ⓑ - Barge/monitor call
- 📱 - Call mobile phone

Company wide call parking

Figure 3. Screen Shot of the Heads Up Display

Porting Fonality trixbox* Pro to the Intel SOC

Fonality's trixbox Pro software platform runs on Intel processors, such as the Intel® Celeron®, Intel® Pentium®, and Intel® Core™2 Duo processor families, and likewise, it also operates well on the Intel EP80579 Integrated Processor with Intel QuickAssist Technology. Porting trixbox Pro to the Intel SOC was relatively straightforward, requiring the addition of Intel® processor specific drivers. To integrate FXO/FXS functionality (e.g., analog telephony interfaces), a channel driver was written that enabled communications between trixbox Pro and the processor's TDM infrastructure. The channel driver interacts with TDM infrastructure, which includes the analog FXO/FXS driver, HSS voice driver and framer library, as shown in Figure 4.

When the channel driver module is loaded, it initializes the HSS ports and configures FXO/FXS lines, as needed, to support the demand for voice channels. Since trixbox Pro is built on multi-threaded software architecture, it creates a thread for each new call, and its performance on the SOC has been shown to be very good. Fonality telephony solutions running on the Intel EP80579 Integrated Processor with Intel QuickAssist Technology offer a rich set of features, classic PBX functionality and advanced services that are often associated with high-end PBXs. The high level of integration offered by the Intel SOC offers businesses the opportunity to deploy small, low cost IP PBX systems.
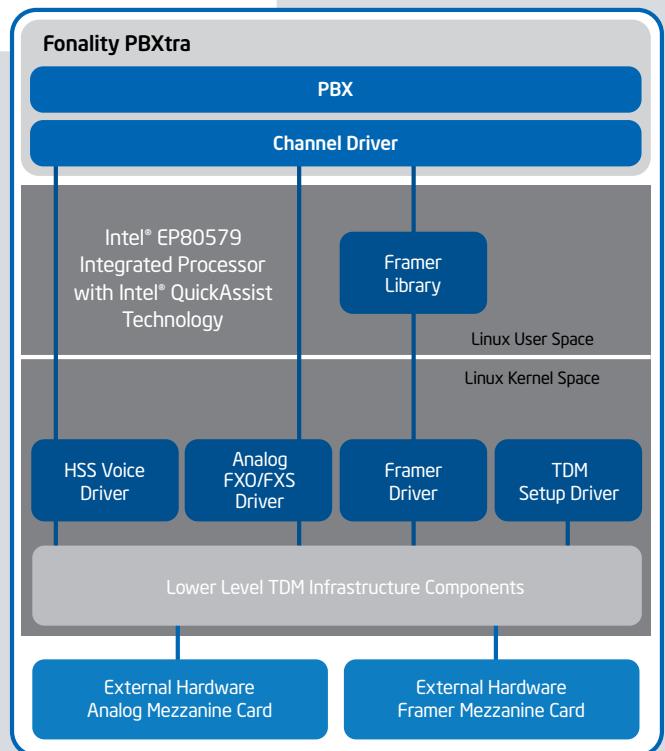

Figure 4. Channel Driver and Processor TDM Infrastructure

A Significant Leap in Architectural Design

The Intel EP80579 Integrated Processor with Intel QuickAssist Technology is enabling a new class of IP telephony platforms that benefit from the integration of DSP, general-purpose, security and packet processing. This SOC processor delivers an outstanding combination of performance, power efficiency, footprint savings and cost effectiveness compared to discrete, multi-chip solutions. Featuring embedded lifecycle longevity and industrial temperature range support, it's ideal for a broad range of applications such as SMB and enterprise appliances, including multi-service business gateway, converged PBX, media servers and media gateway solutions.

The complete SOC solution maintains full 32-bit Intel architecture instruction set compatibility, which protects software investment and allows OEMs to utilize an extensive ecosystem that offers hardware and software components and development tool support. With "legacy" support enabled on the SOC, solution developers can code on Intel processor-based PCs and then run their applications on the SOC with high confidence any porting issues will be minimal. This capability reduces development costs and time to market.

The Intel® EP80579 Integrated Processor Product Line delivers the cost/performance needed for price competitive telephony applications. The security accelerators within the Intel EP80579 Integrated Processor with Intel QuickAssist Technology implement the general cryptography, hash, authentication, random number generation and key exchange functions as well, including the encryption and decryption of packet payload. This frees up CPU cycles to support additional telephony features and capabilities.

Power and Area Savings

Compared to prior 6-chip communications processing systems, as shown in Figure 5[1], the Intel® EP80579 Integrated Processor with Intel QuickAssist Technology provides significant power and area savings without sacrificing performance. It boosts performance for smaller, more compact designs with a thermal design power specification ranging between 13W and 21W.

Maximize Performance and Power Efficiency

Many of these small form factor telephony workloads require security, packet, DSP and voice processing. Combining all these elements with the most programmed architecture in the world, the Intel Architecture, makes Intel's newest system-on-a-chip an obvious choice for small form factor, modular designs. This latest SOC, supporting Intel QuickAssist Technology, increases the effective data throughput and performance and reduces the power consumption of a given application. Simply put, it does much more of what you want, with less area, power and cost. Learn more about the Intel EP80579 Integrated Processor with Intel QuickAssist Technology product line at www.intel.com

About Fonality

Fonality is the leading provider of affordable hybrid IP-PBX systems for SMBs. Fonality's trixbox Pro product line comes VoIP-ready but also supports calling via the PSTN and PSTN-fallback. The trixbox Pro Standard and Call Center editions provide enterprise-class features at a fraction of the cost of traditional industry offerings. For more information, visit www.fonality.com.

Intel® Pentium® M
Processor at 1.8 GHz

Packet Processing
Network Processor

Digital Signal
Processor

Intel® I./O Controller
Hub 6-M

Intel® 915GME Graphics
& Memory Controller Hub

Time Division
Multiplexer (TDM) Chip

Intel® EP80579
Integrated Processor
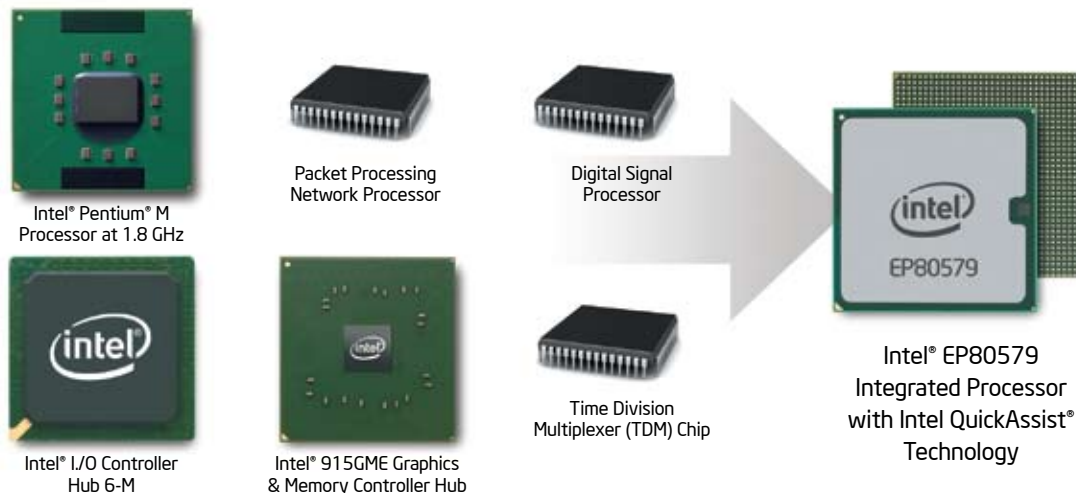with Intel QuickAssist®
Technology

Figure 5. The Intel® EP80579 Integrated Processor with Intel® QuickAssist Technology

[1] Compared to previous platform containing the Intel® Pentium® M processor, Intel® 915GME GMCH, Intel® ICH6-M and Intel® IXP465 network processor

Security Abbreviations:

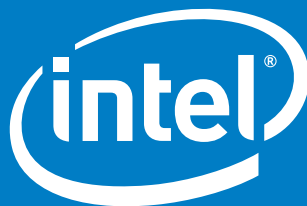|	
3DES:	Triple Data Encryption Standard
AES:	Advanced Encryption Standard
[A]RC4:	Rivest Cipher 4
IKE:	Internet Key Exchange
MD5:	Message-Digest Algorithm 5
PKE:	Public Key Encryption
SHA-x:	Secure Hash Algorithm
TRNG:	True Random Number Generation

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