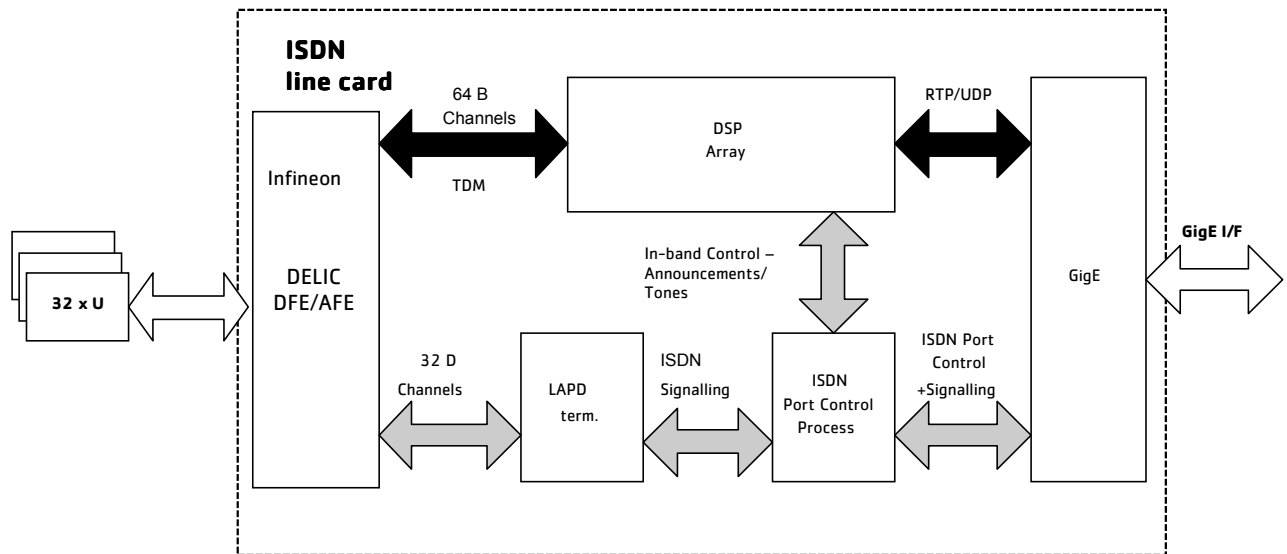


case study

ISDN line card development



Asidua is a strategic partner in the specification, design, implementation and validation of all real-time embedded software for a major telecom vendor's access technology portfolio. This client is a key supplier in the access domain, providing solutions to link BT's existing access network to the 21CN core IP-based network. Thanks to the client's DSL Access Multiplexer (DSLAM), multiple services can be delivered simultaneously, from fast Internet access and video-on-demand, to voice telephony using VoIP.

The multi-service capability of the DSLAM provides the support for ISDN-BA (Basic Rate Access) technology, offering this to many thousands of users on a single ATM/Ethernet network interface.

□ requirements

Asidua was tasked to develop the software for the client's DSLAM ISDN-BA Line Card which configures and manages 32 subscriber line pairs. The line card contains two Infineon DELIC devices providing a TDM traffic interface to each DELIC via IOM-2 bus providing ISDN on 32 subscriber pairs.

Each ISDN-BA subscriber line contains 2 bearer (B) channels (64Kbit/s) and 1 signaling (D) channel (16Kbit/s) (2B+D), thus the line card can support 64 simultaneous ISDN calls, carrying voice or data provided via RTP media streams.

The line card is required to terminate the Q.921/ messages from the user. Q.931/ messages are required to be passed transparently to/from line card via higher level sub-systems to a Call Server which will use these messages to route the ISDN calls.

□ development platform

The software was written in C and C++. The line card software is developed for the MontaVista Linux operating system running on a Wintegra network processor.

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□ **asidua's role**

The Asidua team provided a complete embedded software solution for ISDN-BA Line Card, providing the key interface to the Infineon DELIC and DFE/AFE devices. Asidua delivered expertise in Embedded Telecoms Integration by executing the below tasks:

- Asidua work closely with the client's hardware team and Infineon engineers to carry out the initial bring up of Infineon devices on the Line card. Prior to the real hardware delivery Asidua was able to debug much of the device driver by connecting an Infineon Evaluation board to an "in-house developed" Winterga processor board. This allowed the initial DELIC DSP firmware download and DELIC mailbox access to be tested, vastly accelerating the initial integration. Asidua engineers wrote software to fake ISDN calls and respond appropriately to Layer 2 and 3 messages received from an ISDN handheld tester. This allowed the line card to be exercised and conformance tested at an early stage.
- Asidua developed a Linux kernel module to interface to and configure the Infineon DELIC device to control the 32 ISDN U interfaces, required to control the activation of each line. The U interface control software also provides performance data collection, 8kHz resynchronisation and line powering of each ISDN line via control of line powering circuitry.
- Asidua was influential in driving the client's complete DSLAM management plane solution and defined the ISDN MIB parameters required to configure and maintain the U and LAPD functionality. Asidua worked closely with the client's software teams to carry out software integration of the management plane with the DSLAM's higher level sub-systems.
- Asidua developed software to interface to a LAPD Stack to implement the Layer 2 LAPD protocol in order to terminate the ISDN D Channel signalling information for each ISDN-BA port. The software implements key features such as fixed and automatic TEI assignment for each port in accordance with ETS 300 402 SAPI63 management procedures.
- Asidua developed software to provide the efficient transport of Q.931 messages through the line card and also provides the interface to the Voice DSP to play tones and connect media streams to a user as instructed by the ISDN Call Server. Asidua experience in ISDN protocols proved crucial during testing of multiple ISDN calls with the higher level sub-systems, providing the ability to decode the received messages and isolate the root cause of issues.
- Testing the line card is a difficult task as it relies on higher level sub-systems to connect an ISDN call. To remove the line card from these dependencies and de-risk the software development the Asidua team developed a "mini ISDN call server" process to run on the line card. Each ISDN line is allocated a telephone number so calls can be made between each port. This allows ISDN signalling from all lines to be terminated simultaneously, providing the ability to test constant call establishment and disconnection. It also controls the TDM and RTP interfaces, thus fully testing the card's traffic capabilities. An Abacus tester was employed to instigate calls to/from all ports and at different call rates stressing the software beyond the required limits.

□ **technology**

ISDN is an Integrated Services Digital Network that uses existing infrastructure for new digital voice and data services. ISDN-BA was introduced in the late 1980's and has the ability to deliver two simultaneous digital transmissions of voice and data over a conventional customer twisted-pair copper wire connection.

ISDN is a set of protocols for establishing and breaking circuit switched connections, and for advanced call features for the user. ISDN uses an ISO-7 Layer model protocol suite, with Layer 2 (Q.921 LAPD) and Layer 3 (Q.931 Call Control) the main protocols used to support voice and data calls.

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