Application-Enabled Softswitch Specification

CINC

Convergent Inter-Networking Controller

General Description

ILT's Application-Enabled Softswitch (CINC) is a high density, scalable and multi-purpose gateway and telephony server. When bundled with ILT's AECOS (Agile Enterprise Content and Communications Operating System) software modules, it provides all the functionality required of a PSTN-interfacing device for inbound and outbound calls. On its own, it can serve as a Media Gateway able to accept, packetize and route VoIP (Voice-over-IP) and real-time FoIP (Fax-over-IP) data calls using patented "Universal Port" Technology. CINC is also a platform for IP PBX, voice portal, call center, and fax gateway.

Product Highlights

Universal Port: A single port detects all voice, fax, and data.

Superior voice quality: Supports various voice formats - G.723.1 G.726, G.729A/B, G.711. G.168 Echo cancellation, jitter control, hardware implementation of RTP packetization enhances voice quality close to the level of PSTN.

Fax: Different fax modes, real-time (T.38) and store-and-forward (T.37) are supported.

Multi Format supported for Faxing: MS Office, PDF files are converted to fax format.

Scalable: Up to 14 T1/E1s are supported on cPCI. With quad-span board, up to 28 T1/E1s are possible. CINC's distributed, layered, and component-based software architecture is designed to handle massive call switching and control resources in the most efficient manner.

Interoperability: H.323 compliant CINC gateway works with Microsoft's NetMeeting. A variety of off-the-shelf telephony cards are supported.

Advanced Signaling Protocols: Supports major signaling protocols such as Q.931, PRI-ISDN, T1, E1, PBX connections, H.323. These are tested and used in US, Japan, Korea.

Management software: Network monitor with web browser interface.

CDR and Log: CDR for billing and log files for diagnostics and statistics.

Usage: VoIP Gateway, IP PBX, Voice portal, Call Center, Fax gateway.

Components

CINC consists of several hardware and software components put together in a modular and distributable fashion. These components are designed from the ground up to be scalable both in hardware and software over a wide range of different requirements.

A. Hardware

CINC uses off-the-shelf hardware components.

- Any PC chassis can be used but it is recommended to use industrial strength PC's or a compact PCI (cPCI) chassis. Recommends 1U-high chassis which offer good field replacement maintenance.
- Scalable from single T1/E1 to multiple ports.
- Supports non-proprietary telephony cards from Brooktrout, NMS Communications and also Dialogic. This guarantees no dependence on a single vendor and provides interoperability by design.

B. Software

The software on CINC is separated into different task modules. The module that interacts directly with the hardware is called the *Connection Layer.* This module is split into an *Outer Connection Layer* interfacing to the PSTN, and an *Inner Connection Layer* interfacing to the IP network. On top of the *Connection Layer* is the *Session Layer,* which is controlled by the *Call Management Layer.*

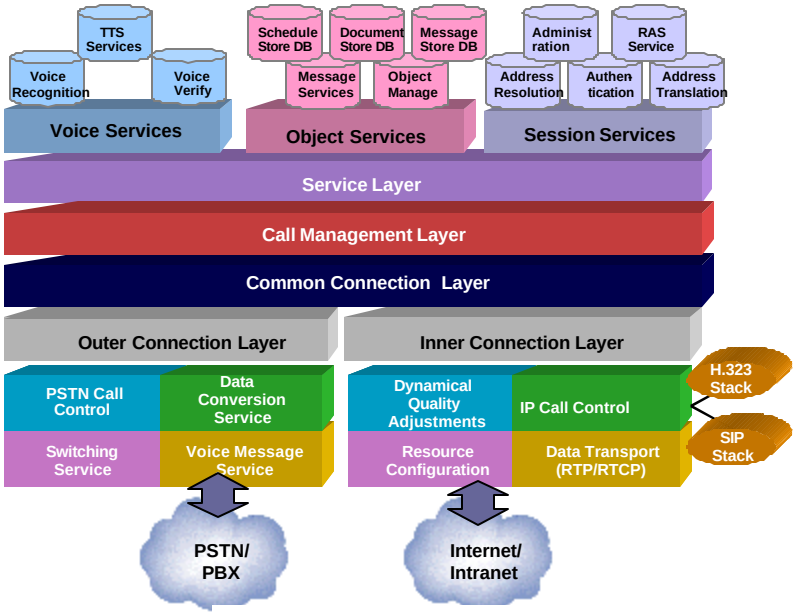


Figure 1. CINC Software Layers

Further, there is a *Service Layer* providing certain services to the call management whenever asked for, like *Voice Services* (text-to-speech, automatic speech recognition, voice verification), *Object Services* (messages, schedules, meta data, etc.), and *Session Services* (authentication, address translation, routing, etc.). This Service Layer is based on client-server interaction, i.e. the services themselves can potentially run on different machines allowing load reduction and balancing (Fig. 1).

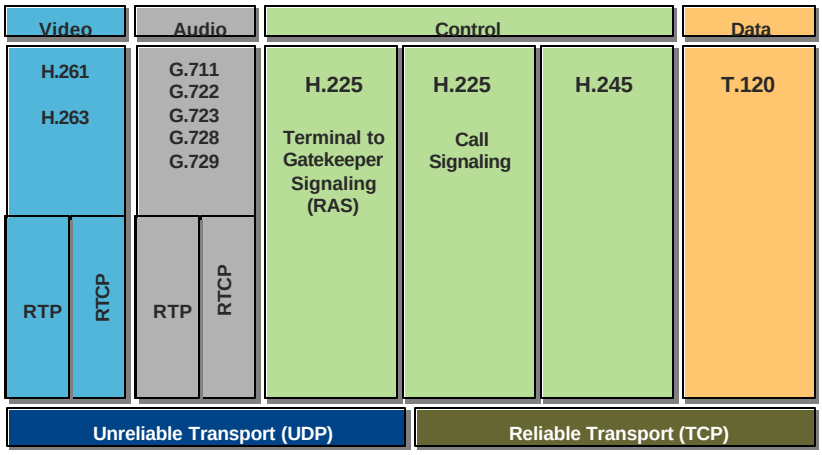
CINC also operates in both Unix and Windows NT environments.

Media Gateway

CINC can be a media gateway providing ingress and egress for VoIP and real-time FoIP calls, thus giving consumers a dial-tone experience virtually indistinguishable from the PSTN service. When bundled together with other CINC options like Universal Messaging or advanced calling features of the Unified Communication Suite, this experience can be even enhanced in many ways. This is where the power of CINC really lies. Further, CINC can automatically distinguish between incoming voice or fax call, i.e. it features Universal Port technology.

A. VoIP (Voice-over-Internet Protocol)

The implementation of VoIP depends heavily on the vendor of the DSP cards but in all cases open standards are observed. So far, CINC supports H.323 for Brooktrout cards using Brooktrout's H.323 stack and NMS cards using the RadVision H.323 stack. CINC will also support H.248 (Megaco) and SIP (Fig. 2).



Fully compliant with ITU H.323 standard

Figure 2. H.323 Protocol Support

- **InterAct ™ Module**
  InterAct is a software module that allows different cards based on VoIP gateway servers to work together in a common network environment. Further, service providers and companies who normally use "single vendor" VoIP gateway servers can now upgrade with different vendor's gateway servers without the need to replace their legacy set up.

  Most implementations of VoIP/FoIP use open standards like H.323 or T.38 but this does not guarantee that gateways using telephony cards and protocols from different vendors can interoperate. As a matter of fact, the standards are complicated enough that they lead to different interpretations such that implementations do not talk to each other.

- **QM™ Module**
  QM is a software module that sustains voice quality at its optimal level. This module provides dynamic jitter buffer management. Jitter buffering is a necessity of VoIP networks because of the nature of the network. In a packet network, the time of delivery of packet data is not guaranteed and can vary considerably. Without jitter buffers, there is a good chance that gaps in the data will be heard in speech.

On the other hand, since jitter buffers increase the latency, the brute force use of jitter buffers can diminish voice quality in an unacceptable manner.

QM software constantly monitors the quality of the packet transmission and adjusts the jitter buffer dynamically to prevent gaps in speech but minimally enough to avoid large latency over sizeable periods of time.

- **VoIP Features**
  CINC's VoIP features a Complete Compression Subsystem that includes:

1. Vocoder	**2. DTMF Detector/Generator**
3. Hybrid Echo Canceller	**4. Fax Tone Detector**
5. Voice Activity Detector	**6. Interact™ Module**
7. Comfort Noise Generator	**8. QM™ Module**

VoIP also handles support for multiple Vocoders including: G.723.1, G.729a, G.711.

B. FoIP (Fax-over-Internet Protocol)

CINC supports various modes of fax handling: Real-time Fax using T.38 Protocol and Store-and-Forward Fax.

- **Real-Time Fax Using T.38 Protocol**
  When customers send a fax from a fax machine to another remote fax machine using a FoIP network, they do not notice much difference compared to a fax transmission using the PSTN. CINC supports real-time fax according to the ITU T.38 standard under the umbrella of the H.323 standard. T.38 is an encoding format parallel to voice coders like G.723 and G.711. T.38 describes a mechanism for transferring facsimile documents in real-time using IP fax gateways and includes the following steps:

  1. Demodulating incoming T.30 fax signals at the sending (or emitting) gateway.
  2. Translating T.30 fax signals into T.38 Internet Fax Protocol (IFP) packets.
  3. Exchanging IFP packets between emitting and receiving T.38 gateways.
  4. Translating T.38 IFP packets back to T.30 signals at the receiving gateway.
  5. Modulating T.30 signals ad transferring them to the receiving fax machine.

- **Store-and-Forward Fax**
  CINC also supports Store-and-Forward Fax, this way fax termination and origination are completely controlled. This empowers customers by giving with more document management options; they may elect to have faxes sent at select times, they may save faxes into files and view them from the web or they may send faxes from the PC or via the web. CINC also offers a multimedia conversion that converts PDF and Microsoft Office files into fax compatible TIF files.

- **Outbound Fax**
  ILT's CINC currently offers three types of faxing service:

Platinum Plan: Able to receive and send faxes worldwide.
Gold Plan: Able to receive and send faxes to domestic destinations only.
Silver Plan: Able to receive only.

- **Inter-Active Customer™ Service Module**
  This module provides customers a complete breakdown of their costs prior to faxing. This service provides ongoing status of billing and faxing history as well as available credit allowance and is enabled via phone, mobile phone and web.

- **FoIP Features**

1. High performing point-to-point protocol for fast direct fax delivery.
2. Intelligent phone number to IPaddress directory service.
3. Scalable to 60 ports per server farmfield unit.
4. Fax store-and-forward (fax-to-fax) from fax machine to fax machine.
5. Fax- to- FMS Inbox (fax-to-email).
6. FMS Inbox- to- fax (email-to-fax), by forwarding incoming email/fax.
7. FMS- to- fax, by composing new fax message.
8. Always uses the cheapest routing across LAN, WAN, Intranet or Public Internet.
9. Load balancing (Outbound faxes are sent to gateways with the highest availability).
10. Scalable by adding new gateways and/or new clusters.
11. Centralized monitoring of status of gateways, web, and core servers.
12. International language support.

Application and Services Based on CINC

When CINC is bundled with our AECOS platform, CINC Softswitch facilitates the creation of many advanced applications and services using its VoIP and FoIP capabilities (Figure 3.).

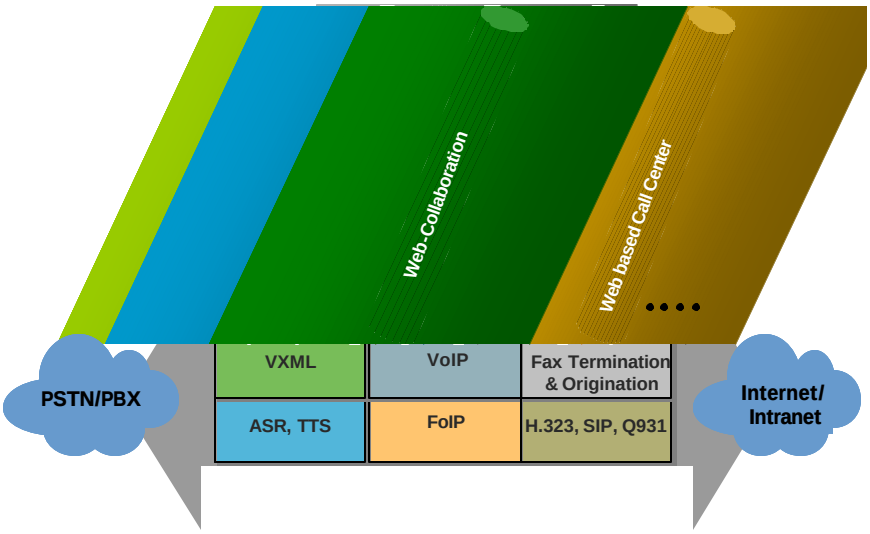


Figure 3. CINC Applications and Services

A. Applications

Universal Messaging
CINC can serve as a gateway for Universal Messaging. This way, consumers can access their inbox to check phone, email, voice or fax messages with almost the same convenience and functionality as from the web.

CINC facilitates easy navigation through IVR (Interactive Voice Response) menus and provides customers the opportunity to select and listen to messages by giving voice commands. These voice commands are processed with a versatile AST (Automated Speech Recognition) engine and the messages are relayed to the customer using a powerful TTS (Text-to-Speech) system.
The IVR is very flexible in that customers may manipulate messages i.e. listen, reply, forward, delete, in the ways comparable to the phone and web.

Unified Communications Suite
ILT's combined solution provides voice, e-mail, and fax on both a static and proactive basis. Proactive communication offers real-time management and notification services, allowing individuals and companies to send a variety of communications to designated recipients for immediate action or response. These features enable "virtual office" capabilities including a variety of robust data storage, retrieval, and distribution controls. This is ideal for pro-active eCRM, telemarketing or simple business relationships and puts an end to the frustrating "phone-tag".

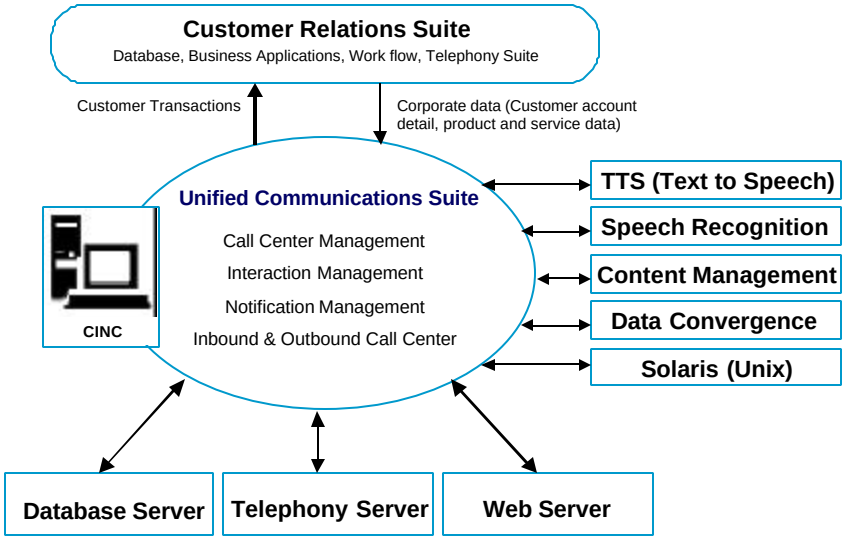


Figure 4. Unified Communications Suite

Web Based Call Center
Web Based Call Center facilitates live conversations with sales agents initiated by the customer clicking on a "call-me-back" icon embedded in the website. This link allows the customer, after inputting their phone number, to indicate a call back immediately or at a more convenient time. The customer then receives a call which connects to a live agent who may be on a phone or VoIP-client. In the call-me-back model, neither the customer nor the agent are forced to wait, maximizing agent efficiency and customer care. ACD (Automated Call Distribution) is enabled for the sake of familiarity and customer choice.

InterActive Call
Interactive call is similar to active messaging except that the called party gets an IVR (Interactive Voice Response) that the agent had composed. The IVR enables the customer to leave a message, connect back to the agent, or answer questions using the keypad.

Active Messaging
Active Messaging is a proactive mechanism for contacting customers with announcements or messages. It provides schedulable outbound email, fax or

phone calls using text messages (Text-to-Speech), multimedia for email, fax, and voice messages for phones.

Financial Alert

The customer may also receive automated stock alert notifications, or banking information via their mobile phone, PDA, email or fax. The IVR message allows the customer to connect back to a live broker or service provider, update their stock portfolio or change their banking relationship.

B. IP PBX Services

The IP PBX offers all of the services that a standard PBX offers plus some new features.

Store and Forward Voice and Fax Mail

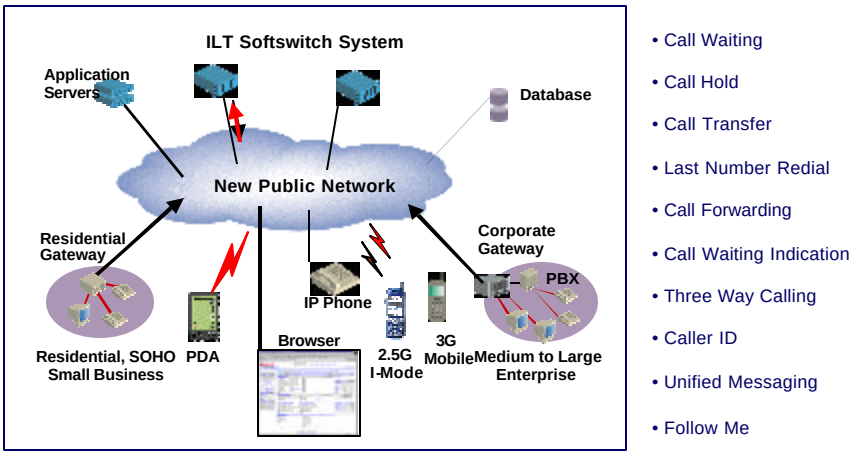
Voice and fax forwarding with voice annotation. The user is able to automatically connect back to the sender and can also fast forward, delete and rewind messages just like a regular answering machine.

Automatic Call Distribution (ACD)

Includes a dynamically defined operator and extension login and logout.

Advanced Call Features

Call features allow a customer to be mobile while still having the option to receive and send calls. This flexibility is shown is the abundance of call features labeled "Follow Me". Such features include, call forwarding, call screening, call transfer, call filtering, call hold, caller ID (Automatic Number Identification) etc (Fig 5)



Dynamic Call Forwarding

Figure 5. Advanced Calling Features

Hardware Specifications

Processors

CPU Type: 50 MHz PowerPC 401 or 233 MHz SA110 StrongArm
Local DRAM: 32 Mb
DSP Type: TMS32OC/54x Series
Quantity: 12 Baseboard (CPCI); 6 + 6 PCI
MIPS: 100
Local SRAM: 32K words internal/128K words external.
Shared SRAM: 128K words per 6 DSP's

PCI Platforms
Voice Sessions: Up to 48 T1 / 60 E1 per card.
Fax Sessions: Up to 24 T1 / 30 E1 per card
Physical: 1 full size PCI slot
CT Bus: ECTF H.100: T8105 (Lucent)
TDM Capacity: 4096 time slots
CT Bus: MVIP-90: FMIC chip (Mitel 90810)
TDM Capacity: 512 time slots
CT Bus: Scbus: SC-4000 ASIC (VLSI)
ISDN PRI: N.A., ETSI/Euro ISDN

CompactPCI (cPCI) Platforms
Voice Channels: Up to 96 T1 / 120 E1 per card.
Physical: 1 slot 6U Eurocard; NEBS Compliant; Hot Swappable; Passive Rear I/O
CT Bus: ECTF H.110: T8105 (Lucent)
TDM Capacity: 4096 time slots

T1 / E1 Interfaces & Signaling
Connector: RJ48; 2 or 4 CPCI; 1 or 2 PCI
T1 Robbed Bit, E1 CAS
ISDN PRI: N.A., ETSI / Euro ISDN

Power and Environmental
Base card: 12.4W CPCI; 1.5W PCI
Base card with Mezzanine: 2.54W PCI only
Operating Temperature: 0° - 50° C
Humidity: 10% to 95% non-condensing

Firmware Specifications
Voice Formats: G.711, G.723.1, G.729a
IP Networking Protocols: H.323 V2 stack provided, support for alternate protocols.
Voice/Telecom Features: Real time voice-stream processing, gain control, echo cancellation, voice play/record, DTMF detect/generate.
Telecom/Call Progress and Call
Control: DTMF, DNIS and ANI detection
Fax Protocols: Demod/Remod, Fax Relay T.38 and T.30.

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