Alcatel OmniPCX 4400

Networking

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The Alcatel OmniPCX 4400 is an enterprise voice communication system designed, from the beginning, to act as a network node. The model for the PBX came from the telephone central office. The model for the OmniPCX 4400 comes from the Internet. Alcatel has built networking software so powerful that a network of 100 nodes can deliver the same features as a single system, keeping the distributed architecture completely transparent to the user.

Alcatel has built software and hardware so powerful that voice can be networked in compressed, low-cost form, across a private IP network. And across frame relay. And across ATM. And across the public ISDN networks. Alcatel delivers radically new end user power, and radically new integration of voice and data applications, across any combination of wide area networks.

Alcatel has integrated its world-class voice networks with an equally powerful switched infrastructure: LAN switches, Gigabit Ethernet switches, layer-three switches, ATM switches, and policy routers. The Alcatel OmniPCX 4400 is optimized to use the advanced quality of service capabilities of Alcatel's OmniCore, OmniSwitch, and OmniStack.

► A powerful networking toolkit

The Alcatel OmniPCX 4400 runs on the ABC (Alcatel Business Communication) protocol. This protocol works with all topologies and transport infrastructures and is based on four modules offering the following services:

- **ABC-F: Telephone features**
  Provides complete telephone feature transparency; almost every feature available in a single system is available across the entire network of Alcatel OmniPCX 4400.

- **ABC-A: Applications**
  Offers enhanced network-wide applications, as both centralized and distributed solutions.

- **ABC-R: Routing**
  The core of the built-in routing protocol, ABC-R is based on a unique adaptive routing mechanism that optimizes the size of network links and improves security as a whole. This protocol is designed to reduce costs through the use of: least-cost routing, automatic route selection, forced on-net, break-in, break-out, and link optimization on transfer. And ABC-R delivers a high degree of network resilience.

- **ABC-M: Management**
  Guarantees consistency of databases among all Alcatel OmniPCX 4400. It uses broadcasting and audit mechanisms to inform the whole network about configuration changes, and safeguards the system with centralized alarms.

► Packet voice network

Fueled by the quick evolution of enabling technologies such as packet voice, it is now possible to deliver innovative services at reduced costs through a unified network. This unification leads to more network choices: voice over IP, voice over frame relay, voice over ATM networks, and even packet voice over traditional circuit networks.

► Voice virtual private network (VPN)

New carrier tariff policies create opportunities for networks using public operators' switched infrastructures. Alcatel's virtual private network solutions optimize both cost and performance and with the use of packet voice and compression technology, dramatically improve the cost effectiveness of existing voice networks. And Alcatel's advanced networking technologies, also integrate easily with existing ISDN carrier services.

► Heterogeneous network

Alcatel's ABC protocol is a superset of QSIG that increases the quality and performance of the Alcatel OmniPCX 4400 in an all-Alcatel network, and is completely compatible with other vendors existing systems in multi-vendor environments. The QSIG protocol can also be used to connect new applications to legacy PBXs; for example, mobile user groups, single-number dialing, ACDs, etc. And it is an important tool for migrating from older legacy PBXs to the capabilities of converged Alcatel OmniPCX 4400. The Alcatel OmniPCX 4400 also fully supports legacy DPNSS protocol.

Network concept

The Alcatel OmniPCX 4400 offers attractive and versatile options that reduce communication expenses while maintaining a consistent service level throughout the organization.

To address the needs of the whole organization, including very small locations, Alcatel provides substantial network capacity:
- 100 nodes
- 50,000 subscribers
- 60,000 phone book entries.

For both the campus and small branches Alcatel offers a distributed concept called "Remote shelve" and a product called "Voice Workgroup Switch". These products can be flexibly used to support a large distributed campus, and also to serve the needs of small remote sites.

Remote shelve

This is an Alcatel OmniPCX 4400 remote shelf connected to the main call processing server. The remote unit uses the existing structured cabling system for a distributed architecture on a large campus. It is also a cost optimized solution for small sites that need utmost homogeneity. Another use for the remote shelf is as an on-site cellular radio base station controller when extended coverage is required.

Remote shelve based on fiber optics:
- – full feature transparency
- – multimode and single mode fiber optic interface options
- – on-site cellular hand-over and roaming between shelves
- – up to four 8Mbps connections between the remote shelve and the main call processing unit.

Remote shelve based on copper cabling:
- – category 5 UTP copper cable
- – full feature transparency
- – on-site cellular hand-over and roaming between shelves
- – up to four 8Mbps connections between the remote shelf and the main call processing unit.

Remote shelve over public ISDN leased line
- – E1 or fractional E1 connection between remote and main shelve
- – local switching for Remote shelve Communications
- – full ABC networking feature
- – on-site cellular roaming between shelves.

Remote shelve over digital leased line
- – 6 communications plus ABC network signaling supported
- – 64Kb/s serial digital link or frame relay
- – full ABC networking feature
- – local switching for Remote shelve Communications
- – on-site cellular hand-over and roaming between shelves
- – overflow over ISDN with ABC services in case of link saturation
- – overflow over ISDN with ISDN services in case of link failure.

Voice Workgroup Switch

The Voice Workgroup Switch meets two goals. In a standard configuration, this product is a cost-optimized solution for networked small sites. With the optional patch panel, the Voice Workgroup Switch is similar to the data workgroup switch concept. It is a 9-inch rack-mounted device that fits in the wiring closet next to the data switch, and uses the same structured cabling system as data (copper and fiber optic). This architecture dramatically reduces installation, troubleshooting, and maintenance costs.

Packet voice network

Traditional voice networks are based on digital leased lines, including T1/E1 and fractional T1/E1. These are still useful, and are an important component of current networks. But organizations can now deploy additional networking and reduce costs. Thanks to the pocket voice technology and compression engine built-in the Alcatel OmniPCX 4400. These include: the digital public switched telephone network, using ISDN signaling; public and private IP networks; frame relay networks; and ATM networks.

Compressed Voice over ISDN

Traditional voice uses 64 Kbps for a single voice call. With the Alcatel OmniPCX 4400 advanced compression module, a single 64 Kbps channel can support up to six voice calls simultaneously.

- LIO P (E1 access): 30 B channels per LIO P for transmission; eight channels of compressed voice integrated to each LIO P; up to 180 channels of compressed voice per LIO P by combining the LIO P with one or more LIO X boards
- LIO B (ISDN BRI + serial data) four BRI "T" interfaces per board, plus one serial data interface per board, supporting X.24 / V.11 or V.36; eight channels of compressed voice integrated to LIO B. Each LIO B board, can support up to four access of compressed channels; each access can go to a separate direction.
- LIO X (auxiliary compression module) provides eight additional compressed voice channels per module.

Characteristics:
- Automatic fax detection
- Compression algorithm: G.729A and G.723.1
- Compression rate: 8 Kbps and 6.4 Kbps
- DTMF Q.23 codes interpreted, coded and regenerated
- End-to-end compression/decompression
- Fax G3 up to 4.8 Kbps
- Integrated echo cancellation
- Lost frame interpolation
- Mutual aid between compression resources
- Silence suppression and regeneration
- Voice encoding: G.711
- Voice frame fragmentation (reducing delay).

Voice over IP

The Alcatel OmniPCX 4400 provides a powerful compression capability across any IP network. But it does more than that. By sending the full ABC networking protocol across an IP network, almost every feature that works in a single OmniPCX 4400.
So you do more than reduce transmission costs; you create a single transparent network, of almost any size, across any part of the world. Or across all of it.

- Allocation of the compression algorithm:
  – static
  – per bundle between Alcatel OmniPCX 4400
- Automatic fax detection
- Call rerouting for new calls:
  – in case of IP network failure
  – QoS problems (call by call)
- Client RAS protocol with gatekeeper
- Compression algorithm: G.729A and G.723.1
- Compression rate: 8 Kbps and 6.4 Kbps
- DTMF Q23 codes interpreted, coded, and regenerated
- Dynamic jitter buffer
- Echo cancellation
- Ethernet connectivity
- Fax G3 up to 4.8 Kbps
- Inter-node transit
- LIO E board (one LAN interface per board)
- Lost frame interpolation
- Management fully integrated with management platforms.
- Multiple VoIP bundles
- Silence suppression and regeneration
- Thirty voice channels per board
- Up to 1500 channels per node
- Voice coding: G.711.

Voice over frame relay

Frame relay is a central element of many enterprise networks. It's efficient and cost-effective, and provides more deterministic performance than the Internet. The Alcatel OmniPCX 4400 provides optimized support for voice across frame relay networks.

The Alcatel OmniPCX 4400 can send voice across private and public frame relay networks. This is particularly useful for interconnecting sites with small to medium traffic loads.

- LIO B (ISDN BRI + serial data) four BRI "T" interfaces per board, plus one serial data interface per board, supporting X.24 / V.11 or V.36.
- interface speed 64 - 128 Kbps

Characteristics:
- Automatic fax detection
- Compression algorithm: G.729A, G.723.1
- Compression rate: 8 Kbps, 6.4 Kbps
- Data frame fragmentation (reducing delay)
- DTMF Q23 codes interpreted, coded, and regenerated
- Each LIO B board can support up to four bundles of compressed channels; each bundle can go to a separate destination
- Eight integrated compressed voice channels per board
- End to end compression/decompression
- Fax G3 up to 4,8 Kbps
- Integrated echo cancellation
- Lost frame interpolation
- Mutual help between compression resources
- Silence suppression and regeneration
- Six voice channels per PVC
- Voice coding: G711.

Voice over ATM

Today many campus networks use ATM as a backbone technology, and ATM is available from many carriers as an interface to a high-speed wide area network. Alcatel's OmniPCX 4400 supports native ATM connectivity, providing seamless integration of voice and ABC services over ATM networks.

- ATM adaptation layer 1 (AAL 1)
- ATM interface 155 Mbits OC-3/STM-1 for campus applications, as well as for drop-and-insert connection to an ATM switch
- Compliant with integrated compression auxiliaries (LIO X)
- Each ATM board can support up to eight bundles of compressed channels; each bundle is mapped into a PVC, and can go to a separate destination
- Multiplexing of E1 trunks in ATM cells
- Unstructured mode (CES 1.0) using permanent virtual circuits (PVCs).
- Up to 240 channels per board
- Up to four ATM boards per Alcatel OmniPCX 4400.

Virtual private network

Networking small sites with low or medium voice traffic does not always justify dedicated leased lines. As a result of deregulation and the technical evolution of their infrastructure, carriers can now offer an increasing number of switched network options, at increasingly attractive costs. The Alcatel OmniPCX 4400 supports versatile virtual solutions with real advantages.

ABC-VPN

With Alcatel's ABC-VPN capabilities, VPNs can be used as a complete solution, or as a way to handle peak overloads from leased line and other network alternatives. Leased lines can be sized based on the average – rather than peak – traffic loads. When the leased lines become saturated, additional calls are transparently routed across the public switched network, using integrated compression if desired. This reduces costs and increases network availability.

Another alternative is a full VPN architecture, which requires only one permanent connection, which can be low-speed, for signaling. All voice traffic is handled by public switched digital connections, using integrated compression if desired.

- Compliant with public networks QSIG and ISDN
- Integrated compression over QSIG and ISDN networks

The Alcatel OmniPCX 4400 uses a disassociated signaling concept. This means that calls can be routed over one path (for example, the PSTN) while inter-OmniPCX 4400 signaling is sent over another path:

- Analog link via modem
- Digital serial link
- Ethernet TCP/IP networks
- ISDN/QSIG B channel
- Leased line D-channel
- PLL X.25 in ISDN D-channel.

ABC on demand

This solution makes it possible to build a powerful private voice network over a public switched network without any permanent connection. It combines an integrated voice compression engine with signaling on demand.

When required, one B channel connection is set up between two nodes and functions as a "virtual leased line", transporting the network signals and the compressed voice. Up to six calls are carried in a single B channel. The "virtual leased line" is released when the call ends.

Analog ABC

Analog ABC uses analog leased lines for voice traffic. Analog ABC is cost-effective for international networks and countries with attractive tariffs for analog links. In addition, existing legacy networks based on analog lines can be optimized with full ABC feature transparency; the disassociated signaling is transported via:

- Analog link via modem
- Ethernet TCP/IP networks
- PLL X.25 in ISDN D-channel.

ISVPN

This service stands for ISDN based VPN uses a D-channel service of public networks called User to user Signaling (UUS1). ISVPN is a networking solution with implementation of all basic networking features.

ISVPN services:

- Basic call
- Call back request
- Call forwarding
- Centralized attendant
- Enquiry call
- Homogeneous-numbering plan (based on virtual DDI)
- Intrusion
- Name and number identification
- Overflow
- Path optimization
- Transfer on no reply and conversation.

Solutions

All networking solutions - using networks based on digital leased lines, analog leased lines, IP, frame relay, ATM, ABC-VPN, or VPN on demand - interwork perfectly and provide a consistent and unique level of service.

ABC-F: Telephone features

- Basic call
- Broker call
- Call back on busy links
- Call back on free or busy extensions
- Call by name
- Call deflection
- Call offer
- Call park
- Call waiting indication
- Camp on
- Conditional forwarding (forwarding on no reply, forwarding on busy)
- Conference
- Data communication
- DISA
- Distinctive ringing based on hierarchies
- Don't disturb
- Enquiry call
- Entity routing for muti company/department configuration
- Hold
- Individual call pick-up
- Intercom call
- Intrusion
- ISDN supplementary services
- Number and name identification
- Reading of personal charging pulse meters
- Retransmission of last number dialled
- Substitution
- Text mini-messaging
- Transfer
- Transparency in decade and Q 23 dialling
- Unconditional forwarding.

ABC-F: Distributed groupware features

- 3 party conference.
- 29 party conference
- Associate in network
- Conditional forwarding to associate
- Hunting group of subscriber
- Immediate forwarding to associate
- Manager/Secretary filtering team
- Object supervision: free, partially busy, totally busy, ringing

ABC-F: Mobility features

- On-site mobility in network: roaming, user rights and accounting allocated to home node number
- Paging services in networks
- Remote forwarding
- Substitution
- Ubiquity services.

ABC-A: Networking applications

Attendant services

- 3 party conference
- 29 party conference
- Broker call
- Bundle reservation
- Call by name
- Call distribution for decentralized and centralized attendants
- Call distribution in attendant groups parallel, cyclic, longest idle state
- Call offer
- Chained call
- Class of service identification
- Class of traffic indication on line keys (local call, external call, overflow)
- Do not disturb override
- Dynamic access to user communication resources (DECT, Voice mail, text mail etc)
- Enquiry call
- Entity or installation status management (day, night, fwd1, fwd2)
- Hold
- Intrusion
- Large busy lamp field supervision
- Multi-tenant services
- Number and name identification
- Overflow of unanswered external calls
- Reading of personal charging pulse meters
- Retransmission of last number dialled
- Routing and services for multi-company multi-department services
- Station reservation
- Status management (day/night/forwarding) for entity and attendant groups
- Text advertising message on busy user display
- Text mini-messaging
- Traffic overflow for attendant group or attendants based on caller waiting time
- Traffic overflow with look-ahead routing
- Transfer with or without presentation
- Transparency in decade and Q 23 dialling
- Trunk allotting with or without barring
- Trunk reservation
- User, abbreviated numbers and entities management.

Unified messaging/voicemail

- Centralized or shared messaging system distributed in network
- Message waiting in networks
- Voice mail management integrated in subscriber management.

ACD

- Centralized ACD supervisor in network with real time supervision
- Mutual aid between ACD groups in different nodes with look ahead call routing
- Virtual agent groups.

ABC-R: Routing mechanism

- Adaptive routing
- Automatic route selection
  - 1,000 route lists
  - 20,000 destinations
  - 100 weekly tables
  - access to alternative routes based on caller rights
  - ARS server centralized or distributed
  - ARS time dependent: day of the week, hour and minute of the day
  - cost limit barring per user/installation status
  - dialing command tables with add/delete digits for number
  - direct or indirect multi-carrier access
  - five daily tables per weekly table

  - five routes per direction
  - information (voice prompt) to callers if cheapest route is not available
  - information (voice prompt) to caller if he/she needs permission to use a more expensive route
  - one to thirty analyzed digits translation
  - up to thirty numbers in dialing command table
- Break-in
- Break-out
- Forced on net
- Homogeneous numbering plan
- Multiple call barring translators
- Multiple DDI translators
- Multi public translators
- Multi-tenant ARS
- Private network dialing plan (eight digit)
- Private to public overflow (according to user rights).

ABC-M: Management features

These management functions are integrated in the ABC networking protocol to facilitate and secure the administration of a system. Connection to the Alcatel OmniPCX 4400 is provided by an Ethernet 10BaseT connection using state-of-the-art protocol stacks on top of TCP/IP.

- Audit service
- Broadcast functionality
- Centralized alarms.

Heterogeneous networking

The Alcatel OmniPCX 4400 supports network signaling based on QSIG, a standard ITU protocol. This allows users to build networks with non Alcatel systems. It also eases the transition from traditional PBXs (most of which support at least some QSIG functions) to the new PCX architecture. Advanced capabilities such as IP phones, network-wide mobility, ACD, PC-based telephony, and others, can work across an entire network – even a network that still contains some legacy PBXs – because of the transparent signaling supported by QSIG.
It includes three QSIG functions:

QSIG Basic Call

This allows multi-vendor networks to be built, using basic telephony features:

- Calling line identification
- Connecting line identification
- Data calls bearer
- Malicious call identification
- Sub-address.

QSIG Generic Function Protocol

This part of the QSIG standard makes it possible to combine voice systems from multiple manufacturers in a single network, and yet still have full support for the advanced features offered by each supplier between that supplier's systems. This is important for working across new carrier services that support QSIG GF.

QSIG - Supplementary services

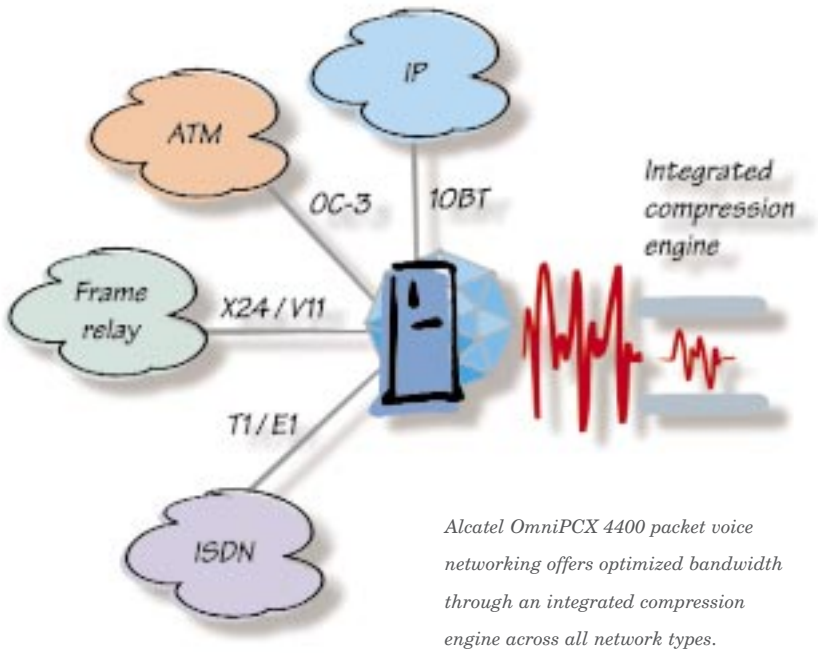
Alcatel always remains up to date with the latest QSIG upgrades and commits itself to testing these features with other major suppliers. Supplementary services available on the Alcatel OmniPCX 4400 (more available with ongoing standardization) include:

- Advice of Charge
- Call Completion on No Reply
- Call Completion to Busy Subscriber
- Call Forwarding - Busy
- Call Forwarding on No Reply
- Call Forwarding - Unconditional
- Calling/Connected Line Identification Restriction
- Calling/Connected Name Identification Restriction
- Calling Line Identification Presentation
- Calling Name Identification Presentation
- Call Transfer
- Call Offer
- Connected Line Identification Presentation
- Connected Name Identification Presentation
- Generic Functional Procedures
- Path Replacement.

DPNSS

The Alcatel OmniPCX 4400 support also legacy protocol DPNSS, which inter-works with the ABC protocol. The services supported are the following:

- Call back when free (call completion on busy set) (9)
- Call forwarding (11)
- Call offer (14)
- Call waiting (17)
- Centralised night service (25)
- Conference (13)
- Do not disturb (32)
- Enquiry call (13)
- Hold (12)
- Intrusion (10)
- Loop avoidance (37)
- Route optimisation (19)
- Service independent string (16) Name
- Transfer (13)
- Voice and data call (6 and 7).



Alcatel OmniPCX 4400 packet voice networking offers optimized bandwidth through an integrated compression engine across all network types.

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