

Clarent® Next Generation Network Solution

Next Generation Networks are finally arriving in force in the world of telecom service providers — and with them arrives the promise of new applications that will make life easier for consumers, and will also provide new revenue sources for carriers. The migration from circuit-switched networks to packet-based networks allows carriers to physically separate the revenue-generating part of the network — the applications — from the transport layer, or ports. The softswitch architecture that results from this separation gives carriers the flexibility to offer communications services that have not been possible in the circuit-switched world. It also empowers telecommunication service providers with the ability to maintain a competitive edge in the changing telecommunications marketplace.

Clarent's NGN solution provides the foundation for Next Generation Networks. It offers high-availability, high-capacity trunking gateways to carry voice traffic, and distributed softswitch architecture to control the network and provide advanced services through these gateways.





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Introduction

VoIP Demands Next-Generation Architecture

For some time now, telecommunication service providers have recognized the importance of Voice over IP (VoIP) as the technology that is leading migration from circuit-switched to packet-switched networks. Both established and next-generation telecom service providers are using this technology to build networks that will deliver voice, fax, data and other multimedia services over the same connections.

VoIP also provides many tangible and immediate benefits. First, using VoIP instead of switched trunks to create voice networks can reduce the cost of such services, thereby increasing the potential revenue margin. In addition, deploying softswitches allows for direct reduction of the support costs in the network. Softswitches are based on generic computing platforms (most frequently on UNIX servers), which are significantly less expensive and also much cheaper to support than traditional switches. The third, and arguably the most important strategic benefit: Basing your network on VoIP allows for rapid deployment of new services, which become far easier to develop on generic, vendor-independent, standardized programming interfaces. The ability to offer new services will become the critical requirement for a service provider's survival in the telecom market, where bandwidth and access will become a commodity, and services will become the key differentiator.

To stay abreast of their competitors, service providers around the world have been entering into trials and deployments of Next Generation VoIP equipment for the past two to three years. Initially, these trials and deploy-

ments have been focused on bringing the quality of service (QoS) of VoIP to a level that is acceptable. That stage has now passed, as the quality of service on the best VoIP networks has far surpassed the QoS of mobile service and is approaching traditional circuit-switched service. Service providers are now focusing on features and services that VoIP can bring to networks. Softswitch architecture is emerging as the current model for Next Generation Networks, and is being developed and tried by vendors and telecommunication service providers worldwide.

For companies looking to provide VoIP solutions, the first step is to adopt the Next Generation Network (NGN) architecture. Typical NGN architectures distribute across media gateways and softswitches. Such softswitches control carrier-grade, high-capacity gateways and provide the main call control and signaling elements of what is known in the industry as a Next Generation Network. The question then becomes, "What constitutes a carrier-grade, high-capacity gateway?" The global industry standard for sizing VoIP gateways is the number of simultaneous ports supported. This functionality translates to the number of simultaneous calls each respective gateway can support. This is typically mapped to logical DS0 channels carried over T1, T3 and OC3 lines between the gateway and the Central Office circuit switch.

Realizing the inevitable evolution towards VoIP — and the necessity for carrier-grade tandem switch functionality with the ability to handle many calls per gateway — Clarent is introducing the Clarent NGN Solution for Next Generation Networks.

The Three-Tiered Architecture

Clarent's Three-Tiered Approach

The Clarent approach to building integrated, full-featured VoIP networks is based on a three-tiered, modular vision of the network architecture. Each component has distinct roles within the network and is designed to integrate horizontally with other components in that layer, as well as vertically with the function-based components of the other layers.

The three layers of the Clarent VoIP architecture are:

- Transport (physical infrastructure)
- Call Control (signaling)
- Packet IN (applications, services and provisioning)

These layers work together to provide an integrated solution, addressing core market areas such as tandem (Class 4) TDM and Class 5 internet offload switch functionality, integrated access and enhanced applications — with specific detailed feature sets that address sub-segments, such as small business, wireless local loop, DSL, broadband, POTS and the inevitable migration from circuit-switched to packet-switched networks.

The Benefits of Three-Tiered Architecture

Clarent's three-tiered VoIP architecture offers many important advantages for telecommunication service providers running commercial voice and data services.

Flexibility

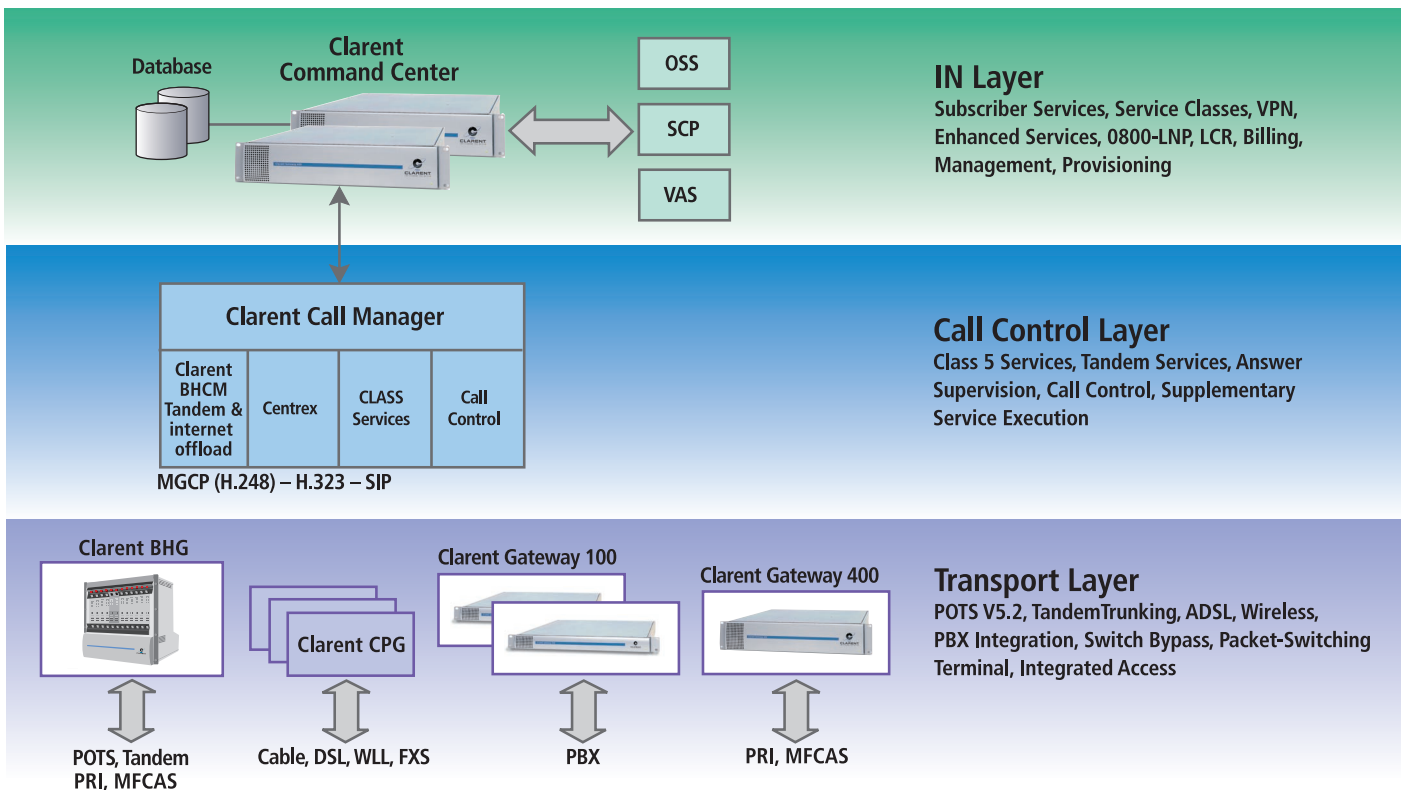
Service providers have the flexibility to offer customized, targeted service offerings to consumers in different markets, while retaining a single provisioning and service delivery mechanism at the core of the network.

Simplicity

Services are faster and easier to roll out, and leverage significant economies of scale from investments in value-added services and management platforms.

Increased Revenue Potential

Operators can build new, revenue-generating service offerings on the network over time. This ability springs from Clarent's architec-



The Three-Tiered Architecture

ture, which is based on open, industry-standard signalling protocols, seamless integration with existing PSTN and IP infrastructure, and a robust service creation and delivery environment.

Centralized Management

The architecture also provides centralized management and provisioning, while supporting PSTN and enterprise applications through a unified data network.

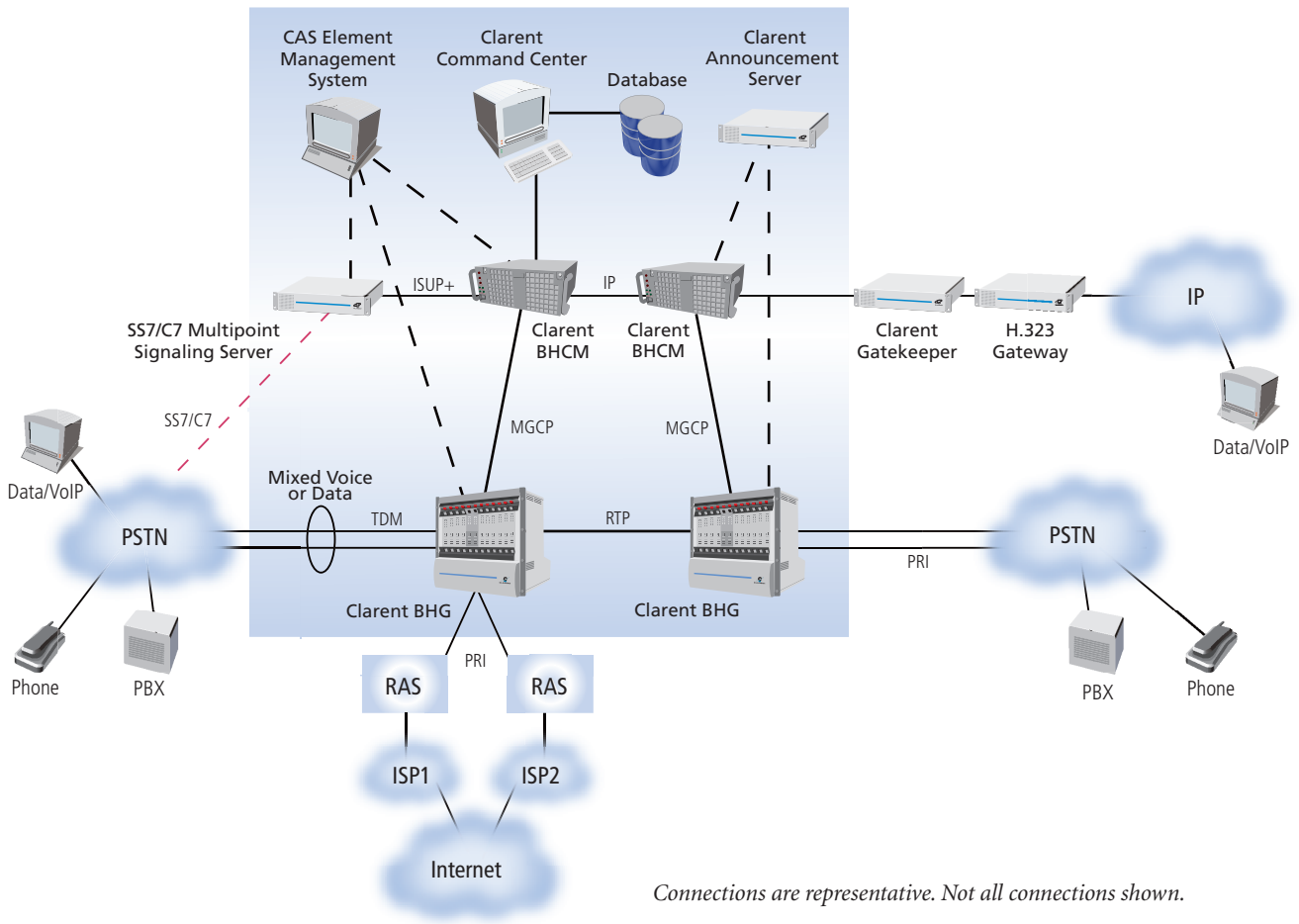
Intelligence Simplification

Clarent's architecture places transport at the network edge, where less intelligence is required for each packet (as most packets are media streams), and where transactions per second requirements are greatest.

Scalability

Port capacity is infinite, since capacity increases may be made individually for each network subsystem by chassis or rack, thus providing for all spectrums of growth demands, and accommodating the future growth needs of every service provider.

Clarent's Next Generation Network Solution Architecture





Elements of the NGN Solution

The Clarent BHG (Backbone High-Density Gateway)

The Clarent BHG is a media gateway controlled by Clarent's distributed softswitch solution.

The Distributed Softswitch of Clarent's NGN Solution

The Clarent CCC (Clarent Command Center)

The CCC is designed specifically to provide the intelligent network control of Clarent's distributed softswitch solution. The CCC accepts requests for authentication, routing and rating of calls from the Call Manager. It also stores call detail records.

The Clarent BHCM (Backbone High-Density Call Manager)

The Clarent BHCM is the strategically crucial central call control element of the Clarent NGN Softswitch. It performs VoIP signaling and call control for the Clarent BHG to deliver trunking services to the network. The Clarent

BHCM turns to Command Center for all network intelligence functions, including calling card authentication and call routing.

The SS7/C7 Clarent MPSS (Multipoint Signaling Server)

The SS7/C7 Clarent MPSS is the SS7 signaling gateway element of the Clarent softswitch. Its software provides an interface to the PSTN SS7/C7 network and delivers ISUP, TUP and TCAP signaling for the Clarent softswitch over IP.

The NGN Solution's Application Platform

The Clarent Announcement Server

The Clarent Announcement Server is a utility server that provides audio tones and Interactive Voice Response (IVR) capability streaming over IP.

The Clarent Application Server (CAS)

CAS is the key Operations, Administration, Maintenance and Provisioning (OAM&P) component for NGN.



Benefits of Clarent's Carrier-Class Products

Clarent's Carrier-Class Products

Clarent's NGN solution delivers the carrier-grade capacity, reliability and redundancy features required by even the most demanding VoIP network deployments.

High Port Density

Harnessed within the NEBS compliant BHG is superior density and scalability. Scalable from 240 to 1920 ports per chassis (80 T1s/64 E1s), and up to 7680 ports utilizing a seven-foot rack, customers selecting Clarent subsequently eliminate the need for future forklift upgrades.

System Redundancy

Clarent's softswitch supports redundancy on multiple layers, as the Command Center offers secondary fall-back and recovery. The

distributed nature of the softswitch also provides for simplified and inexpensive geographical redundancy, as the fall-back Command Centers can be located in disparate central offices.

NEBS Compliance

The BHG platform and the NGN softswitch hardware are NEBS Level III compliant. This US certification translates to an inherent guarantee of the highest levels of reliability and stability.

High Performance

In Clarent's distributed architecture, there is no single point of bottleneck in the softswitch. The softswitch is built around the tried-and-true Clarent Command Center, which has carried billions of revenue minutes since its inception.



Clarent NGN Solutions In-Depth

The Clarent BHG

(Backbone High-Density Gateway)

- The Clarent BHG supports toll-voice quality, with universal ports (i.e., voice, fax and data on all ports).
- The gateway supports E1/T1 trunk interfaces, and direct termination of E3/T3 lines is included in the architectural design. The gateway also complies with the G.168 standard for echo cancellation.
- Built-in support for a variety of signaling protocols is provided, such as ISDN and MFC-R2. Connection to SS7 networks deploys the Clarent MPSS, which can act as a full Signaling Transfer Points (STP) or Signaling End Points (SEP) (page 7).
- The Clarent BHG can also use the Clarent ThroughPacket compression technique, which allows for an additional bandwidth reduction in the Wide Area Network (compression up to 12:1).
- Redundancy is provided via N+1 power supplies.

The Clarent NGN Softswitch

Clarent Command Center and Database

The Clarent Command Center is the central intelligence node of Clarent's distributed softswitch solution. It stores all device and service information, as well as provides intelligence to the rest of the network. The Command Center works in conjunction with a central, relational database (Oracle and Microsoft SQL Server are supported) to provide subscriber authentication, network management of user accounts, dynamic call routing, flexible call rating and centralized billing for Clarent networks.

- Authentication distinguishes authorized users from non-authorized users with password protection or by CLI detection. The Clarent Command Center stores the user database and uses it to authenticate transactions. In addition to authenticating subscribers, the Clarent Command Center authenticates gateways, gatekeepers and Call Managers.
- Domain Identification allows service operators to create logical groups of gateways, subscribers, call routes, call rates, accounting codes and service classes in order to manage Clarent network resources. For example, a company with multiple offices can create a domain for its corporate sites and provide special call routes and call rates for intra-company calls.
- Dynamic Call Routing routes calls dynamically based on gateway or subscriber domain, user-defined dial

rules, pre-defined sub-city codes and many other factors. Dynamic Call Routing provides uninterrupted telephone service. Server groups provide for redundancy within a group of gateways, while secondary server groups provide redundancy for primary server groups — all contributing to the goal of continuous service coverage.

- Load Balancing balances traffic on each call route, making communication faster and more reliable.
- Flexible Call Rating enables both point-to-point rates and flat rates. Service providers can rate calls on a country-wide, region-wide or city-wide basis. The system distinguishes between calls placed within the network and those placed outside the network, and different inbound and outbound charges can be set for each route.
- Call Blocking sets free and blocked call options for individual destinations, allowing the Clarent Command Center to restrict calls to toll numbers or long-distance destinations, for example.
- Real-Time Billing tracks telephone calls, collects call detail information, and supports both prepaid phone cards and standard open-account billing. The Clarent Command Center also prevents duplicate and simultaneous account usage, reducing fraudulent calls.
- Accounts Grouping tracks sales or announces special messages and new features.
- Tracking manages gateway, gatekeeper, and Call Manager status and statistics.



Clarent NGN Solutions In-Depth

Clarent BHCM (Backbone High-Density Call Manager)

The central call control element of NGN's distributed softswitch is the Clarent BHCM. The Clarent BHCM is the call manager that can support Class 5 internet offload and tandem (Class 4) deployments, and its functions are:

- Call routing
- User authentication (processing transactions after Command Center clears authentication and establishes the account to be charged)
- Connection control (setup and tear down)
- Signaling
- The Clarent BHCM works in conjunction with the Clarent Command Center and the SS7/C7 Clarent MPSS to deliver Clarent's NGN complete softswitch solution.
- The core of the Clarent BHCM is the call state handler, which is under the control of the application that is stored in the Line Port Director (LPD) control database. The application in the LPD database contains the flow that a call traverses in terms of call states, events and network interactions (both in PSTN/ISDN and IP). The LPD file is easily customizable by the operator via the Clarent-provided Service Editor tool.
- The interface between the Clarent BHCM and gateway will be Clarent's globally accepted protocol, also accommodating MGCP (Media Gateway Control Protocol), plus the upcoming Megaco for control of third party gateways.

- The Clarent BHCM also uses the services of the Clarent Command Center (page 6), which ensures backward compatibility with all current Clarent products (low-density trunking gateways, Class 5 Call Manager). This allows for seamless interconnection and integrated networks for customers embarking on a phased migration strategy or who need to interconnect with other partners using previous versions of Clarent products.

SS7/C7 Clarent MPSS (Multipoint Signaling Server)

- SS7/C7 Clarent MPSS is an enabling technology, which provides interoperability for Clarent's NGN softswitch with the SS7 PSTN network. The carrier-grade demands for interfacing with large networks requires a highly reliable, redundant and high capacity SS7/C7 network to support it. Clarent has designed the Clarent MPSS to be the carrier-grade, robust solution with a NEBS level 3 compliant chassis based on POSIX compliant RTOS (Real Time Operating System).
- This UNIX-based server provides the signaling interface between the PSTN SS7 and IP networks. Its design is flexible in terms of distribution over geographically separated areas and load-sharing capabilities. It too is NEBS level 3 compliant.

The NGN Application Platform

Clarent Announcement Server

- This network element is in charge of providing tones and announcements to calling users, allowing for Interactive Voice Response (IVR) sessions such as Calling Card menus.
- The Clarent Announcement Server (AS) also is under the control of the Clarent BHCM, which will instruct the setup of a voice path between a gateway and the Clarent Announcement Server, if required. The voice path will be set up using RTP over the IP network.

Clarent Application Server

- As described earlier in this overview, the Clarent Application Server (CAS) is the key OAM&P component for NGN.
- The Clarent Application Server is a platform for Java-based network management applications accessible via the Web. Its purpose is to provide an integrated network management solution for customers with Clarent networks.
- With the proliferation of Clarent network elements (Clarent BHG, Clarent BHCM, SS7/C7 Clarent MPSS, Announcement Server, Clarent Command Center), the operational aspects of network management can be quite complex. The Clarent Application Server simplifies network management and provides a common point for managing these Clarent network elements, which often are both numerous and globally distributed.



Conclusion

Clarent is the Complete Solution

Clearly, with the combination of the aforementioned distributed architecture elements, Clarent's Next Generation Network solution is the complete product and service VoIP solution. Together, these elements deliver Clarent's feature-rich softswitch solution and create a solid base for building the next generation of services in evolutionary Next Generation Networks. Telecommunications service providers searching for the means to deliver revolutionary carrier-grade internet offload and tandem switching via NEBS-compliant, flexible, expandable and scalable services can only end their search with one company: Clarent.



About Clarent

Clarent Corporation (Nasdaq: CLRN) is a world leader in providing software-driven communications solutions that capitalize on the flexibility and ubiquity of Internet Protocol (IP) networks. Clarent solutions, comprised of both software and hardware, enable service providers to deliver simultaneous transmission of voice, fax and data over IP networks. The company's products integrate with legacy phone networks and also power new, independent networks and allow the two to work together seamlessly. Clarent's customers include telecommunications service providers, systems integrators, resellers and enterprises.



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