SOLUTION NOTE



The Lucent PacketStar™ PSAX 4500

Competitive Advantage for Dynamic Telecom Enviroments

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1. Executive Summary

The world of telecommunications is changing. Deregulation brought restructuring and introduced new competitive market forces. Now packet-based networking challenges service providers to re-evaluate their network architectures — and prepare for a future of tighter margins and increasingly intense competition.

To do this, ILECs (Incumbent Local Exchange Carriers), CLECs (Competitive Local Exchange Carriers), and interexchange carriers must invest in infrastructure solutions that can serve both short-term and longer-term strategies.

For the short term, these solutions should focus on making the best use of the existing infrastructure by:

- Enabling various strategies for relieving switch congestion, such as PRI Offload
- Supporting multiservice connectivity via both traditional and emerging transport technologies, from frame relay and ATM to IP
- Enabling convergence of voice, data, and video over the existing infrastructure, thereby facilitating rapid provisioning of new services, boosting immediate profits and reducing expenses.

Longer term, service-provider infrastructures should provide for major transitions away from traditional central office telephone switches to an all- packet voice-switching architecture..

Lucent Technologies' ***PacketStar*** PSAX 4500 Multiservice Media Gateway represents a key component in implementing these strategies. This high-performance, ultra-high-density mulitservice gateway combines with other Lucent products to help service providers quickly adapt to new technologies and deploy new revenue-generating services. At the same time, the PSAX 4500 system offers carrier-grade reliability — and a clear migration path to eventual Class 5 voice switch replacement.

2. The Multiservice Market: Presenting New Challenges

Ever since deregulation took place in the 80s, the telecommunications market has been a fast-changing, highly competitive environment. But never have service providers faced as many uncertainties — or technological challenges — as they do today.

ILECs are concerned with migrating to next generation voice-switching architectures, important because of the added pressures caused by surging Internet usage. At the same time, they must maintain support for existing customers — and maximize competitive advantages in a market that shows little loyalty to incumbent vendors.

By contrast, CLECs (Competitive Local Exchange Carriers) face the challenge of maximizing operating economies while introducing newer services to generate immediate revenues. In addition, since CLECs frequently co-locate with ILECs, CLECs must pay particular attention to making the most profit possible from every square foot of office (or equipment-rack) space.

Interexchange carriers and large corporate users have similar concerns, although their competitive pressures may not be as great as those of ILECs and CLECs. Still, as with other providers, interexchange carriers and large corporations are concerned with maximizing bandwidth and performance while maintaining effective migration paths to newer wide-area technologies.

3. Service Provider Needs

For all service providers, a multiservice gateway that sits at the edge of the carrier network represents a critical, strategic infrastructure component.

Such a gateway can take the place of multiple, single-purpose TDM, frame-relay or dedicated ATM switches. It can aggregate slower traffic from large numbers of users or enterprise customers onto high-speed ATM backbones. It can mix voice and data traffic, serving as a migration platform to help the service provider move from voice-only to hybrid voice/data networking.

The gateway should feature high switching performance, as well as wide-ranging connectivity options. Also, it should possess these qualities:

- High density channel packaging —Because central office real estate is expensive, the switch should feature an ultra-compact design, packing as many caller DS-0s as possible per rack space. Also, it should offer a broad range of network and user interfaces on one platform, reducing the need for added hardware investment.
- High reliability/availability — To ensure delivery of voice traffic with maximum QoS (Quality of Service) in increasingly non-TDM applications, and adequately support offload of Class 4 and Class 5 voice switches in the core network, a multi-access switch should feature redundancy and high reliability.
- High service flexibility — To help service providers compete through rapid provisioning of new customers and new value-added services, the gateway should offer maximum flexibility for changing services — and modifying protocol types — quickly.
- ATM-Based —Finally, the multiservice switch should be based on an ATM transport architecture. ATM alone has the ability to transport voice, video, and data traffic while maintaining the very different QoS `` level required by each traffic type. It can support both connection-oriented and connectionless traffic flows. As such, it is a natural transport technology for TDM, frame relay, and other related WAN protocols. At the same time, it represents a solid mechanism for overlaying data-centric, IP and Ethernet-based applications as well.

4. Lucent's PSAX 4500 System: Leading the PacketStar Family

The ***PacketStar*** PSAX 4500 Multiservice Media Gateway is specifically designed to answer these service provider needs. It extends Lucent's ***PacketStar*** PSAX family to new levels of channel density and reliability. Also, the PSAX 4500 system supports new ***PacketStar*** PSAX hardware and software interfaces that will help service providers leverage new, high-profit applications such as derived voice over DSL and PRI Offload.

High Density, High Reliability

The compact ***PacketStar*** PSAX 4500 Multiservice Media Gateway features channel capacities ranging from 24 ports of OC-12c to 120,000 CES DS-0s per 7-foot rack. It offers a high switching capacity — up to 10 Gbps.

Reliability comes from carrier-grade N:1 redundancy, achieved through an innovative midplane chassis design that protects high-performance multiport DS-3, E-3 and STS-1e modules in $N \leq 4$ configurations. Also, the switch implements Telcordia standard APS (automatic protection switching) trunking with an industry-leading switchover speed of 50 msec. Other reliability features include: redundant control, stratum and power functions; SVC protection; Dual Home PVC support; PNNI auto reroute capabilities— plus NEBS Level 3 compliance.

New Interfaces, New Applications

The ***PacketStar*** PSAX 4500 Multiservice Media Gateway also supports features that give service providers access to new applications:

GR-303/ voice and multimedia-over-ATM (VMoA)

The PSAX 4500 supports the ATM Forum recommendation, Voice and Multimedia Over ATM – Loop Emulation Service Using AAL2 (AF-VMOA-00145.000) and the Telcordia GR-303 interface specification, one of the interfaces required in a device that would act as a gateway for VMOA services. GR-303 is a Telecordia-defined interface between the central office switch and any system that provides network access to local loop telephone subscribers. GR-303 differs from its older relative, TR-08, in that it provides for flexible concentration of bandwidth into the CO switch for analog services and supports an ISDN oversubscription ratio of 4:1. It allows for up to 2048 subscribers to share between 2 and 28 DS1s, thus reducing the necessary switch hardware to support the subscribers. Four of the DS0s between the switch interface and the access equipment interface are dedicated, redundant control channels. GR-303 unbundles the interface between access equipment and the switch provider, allowing service providers to mix and match equipment and facilities to meet their needs. GR-303's flexible concentration of bandwidth into the switch for analog and ISDN services enables service providers to service additional customers with existing analog and digital media.

In particular, when used in VoDSL applications, GR-303 establishes a transparent pipe between the Class 5 switch and the phone for delivery of CLASS features such as caller ID, call waiting and call forwarding transparently through the VoDSL network. Together with support for VMOA LES over AAL2 protocol, GR-303 support allows the PSAX 4500 to be used for broadband services that feature delivery of multimedia services (voice, data, video) over DSL local loops.

Application Programming Interface (API)

Like the rest of the ***PacketStar*** CO products, the PSAX 4500 system features an applications programming interface (API) that supports various voice telephony-over-ATM (VToA) solutions requiring Integrated Services Digital Network (ISDN)-ATM and Signaling System 7 (SS7)-ATM interworking. The PSAX 4500 system's Connection Gateway API enables communication with the Lucent Softswitch and ***ConnectStar***™ call controllers and makes possible a variety of offload applications, including PRI Offload via the Softswitch Internet PRI Offload (IPO) solution.

5. Strategic Applications

These features give ***PacketStar*** PSAX 4500 Multiservice Media Gateway users access to wide-ranging converged services, from traffic aggregation and voice telephony over ATM to corporate ATM networking over leased lines. However, two relatively new applications represent especially strong strategic value — and profit potential — for service providers today. These are Derived Voice over DSL and PRI Offload.

Derived Voice over DSL

Derived voice over DSL is a high-value application with potential for earning revenue for CLECs and ILECs. DSL functions over existing copper telephone cabling. Simply by starting up a DSL service, the CLEC or ILEC can add value through data services; by adding voice capabilities, the service provider can bring in more revenue - and add more value - for each existing broadband circuit

Figure 1 shows the current method, which employs high/low splitters and standard PSTN technology. In contrast, using the PSAX 4500 with the GR-303/VMOA feature, carriers can implement a more cost-effective, forward-looking way of transporting voice as well as data over DSL.

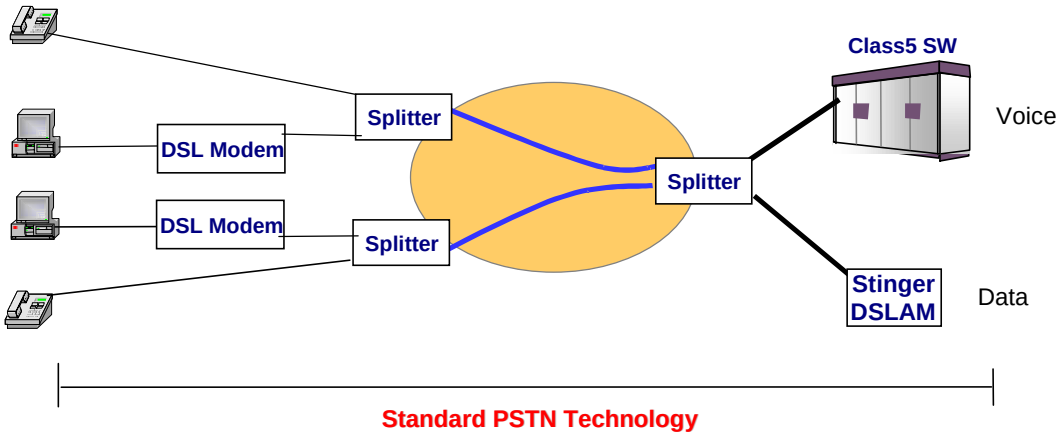

Figure 1 - VoDSL using High/Low Pass Splitter

In the application shown in Figure 2, for example, the PSAX 4500 combines with other Lucent products, such as the Stinger DSL access multiplexer (DSLAM) at the head end office and, perhaps, one or more CellPipe integrated access devices (IADs) located on the subscriber premises. On the subscriber's premises, as many as eight analog phone lines connect to the CellPipe unit, along with one or more PCs or workstations.

The CellPipe IAD routes voice and data traffic over ADSL or SDSL circuits. At the IXC central

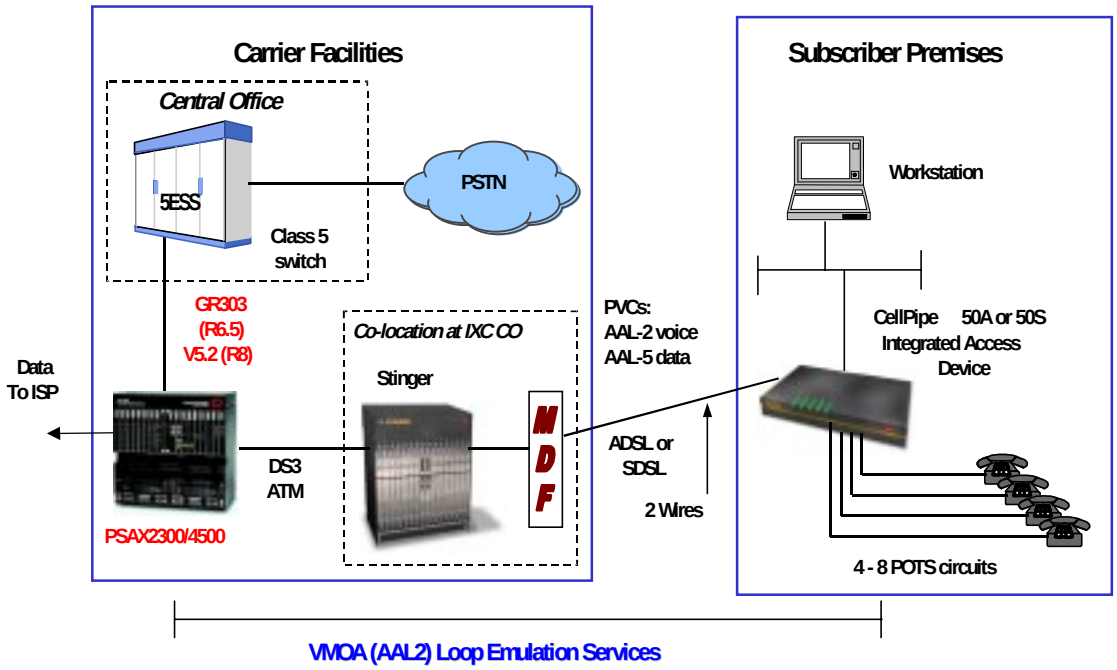

Figure 2 - VoDSL using PSAX 4500, Stinger, and Cellpipe

office the Stinger DSLAM aggregates traffic from multiple subscriber loops onto an ATM DS3 link using ATM Permanent Virtual Circuits (PVCs) . A PSAX 4500 system at the carrier network

edge strips off and sends the voice traffic to the central office Class 5 switch via GR-303 trunks and forwards the data traffic to the ISP.

This application results in substantial cost savings over conventional approaches that rely on telephone-line splitters and require dedicated PRI (Primary Rate ISDN) circuits. Solution benefits include:

- More efficient use of system resources - GR-303's support for dynamic call assignment allows service providers to assign more subscribers to the interface than can be off-hook at one time (oversubscription/concentration). Since relatively few subscribers are off-hook at any given time compared to the total number of subscribers, this scheme allows for more efficient use of system resources. This efficiency results in lower operating costs and greater profits for service providers
- Reduced PRI requirements - Oversubscription eliminates the need for dedicated PRI's located between the voice g/w (PSAX) and the 5ESS to handle all the cumulative BRI traffic from the IAD's.
- Cost savings through service aggregation - Before GR-303 was developed, service providers were unable to cost-effectively aggregate services from different remote sites into a common platform where the services could be combined before transmission over the GR-303 interface to the switch. The GR-303 gateway resolves this problem. The ability to aggregate services before transmission to the switch interface reduces the number of switch interface ports that service providers need to provide voice service to customers. This increased efficiency translates into cost savings for service providers.
- Because the GR-303 interface is integrated into the PSAX 4500, the service provider saves the cost — and the real estate — that would be required by separate dedicated GR-303 voice gateway hardware.

The PSAX VMoA/GR-303 feature can also be used in another derived voice application where consolidation of digital voice (from a PBX) and data is required. In this case, a PSAX 1250 gateway provides DS1/DS3 trunk aggregation and VMoA LES occurs between the PSAX 1250 and the PSAX 4500 systems. In both these derived voice applications, the Class 5 Switch accomplishes call control internally

PRI Offload

Another valuable application involves helping ILECs and CLECs to relieve the Class 5 switch "port exhaustion" caused by Internet users' modems tying up conventional phone lines.

In the implementation shown in Figure 3, the PSAX 4500 gateway combines with a signaling platform, the ***ConnectStar*** ™ Interworking Call Router (ICR), to intercept phone calls from the CLEC/ILEC head end to the Class 5 voice switches. Normally, all such calls would require expensive PRI lines, which are necessary for handling data traffic.

Instead, the PSAX 4500 gateway now merges its own intelligence with the ***ConnectStar***'s SS7-signaling capabilities to permit the ILEC to employ less costly Inter Machine Trunks (IMTs) for the voice traffic. At the same time, the PSAX 4500 collects Internet-bound traffic via IMTs from hundreds of ILEC switch sources and builds PRI trunks to the remote access servers at the ISP.

This application benefits the service provider: by relieving Class 5 switch port congestion and replacing and/or reducing the number of PRI trunks, CLECs gain the most flexible routing with the least ILEC provisioning dependency. In addition the solution's open archetecture allows these service providers to use ATM core switches and remote access servers from their choice of vendors.

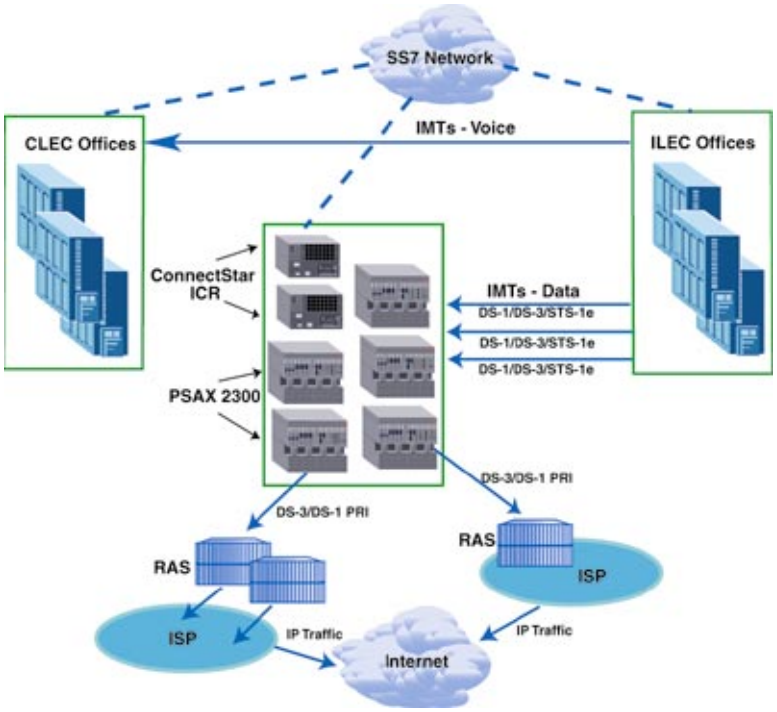

Figure 3 - Softswitch Internat PRI Offload Solution

6. The PacketStar Multiservice Media Gateway Family: Solutions for Today and Tomorrow

In addition to its own strengths, the ***PacketStar*** PSAX 4500 Multiservice Media Gateway also delivers the benefits of the ***PacketStar*** family. These include:

- Software definable ports, which support rapid provisioning by allowing service providers to provision different users with different services — such as frame relay, ATM and HDLC — that run on the same port at the same time;
- Interchangeability of interface modules, CPU modules and system software across the entire ***PacketStar*** line, which protects initial capital equipment investment, assures interoperability, and reduces operating costs;
- Support for all major services including circuit emulation, breakthrough voice technology, frame relay, LAN bridging and routing, and native ATM services
- Standards-based ATM connectivity and traffic management plus AqueMan traffic management for increased QoS assurance
- Element management via the AQueView Element Management system with planned migration to Lucent iNavis end-to-end network management

Perhaps most important, the Lucent ***PacketStar*** PSAX 4500 Multiservice Media Gateway, combined with Lucent's SoftSwitch and other Lucent products, serves as a migration platform to future telecommunications architectures that will rely ever more on packet-based services and less on traditional voice switching technologies. For some service providers, such a vision is wrought with uncertainty; for Lucent-equipped service providers, the vision — and the future — are rich with opportunity.