Making Sense of Broadband Access

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Introduction

As competition in the Internet access and telecommunications markets intensifies, service providers find themselves under growing pressure to deliver differentiated, highly competitive services and reduce network costs. In response to this challenge, a powerful class of access devices is increasingly gaining favor and acceptance among small and medium-size enterprises (SMEs) and the providers that serve them.

Integrated access combines voice, data, and Internet access onto a single broadband connection and also lets service providers cost-effectively optimize their local loop infrastructures for the benefit of end users. By consolidating multiple network devices, converging multiple services, and moving intelligence to the network's edge, integrated access lowers requirements for capital equipment, minimizes operational expenditures (OPEX), and maximizes service providers' and carriers' profits. The category of products also enables customers to buy integrated solutions without having to manage their own networks and positions service providers as a partner for providing a wide range of services. By using integrated access to merge legacy networks with evolving infrastructures, service providers can now also enable budget-constrained customers to leverage the power of wide-area networks (WAN) for competitive advantage. In particular, these new services allow SMEs, which often lack the resources to install and manage multiple communications devices, to compete effectively with their larger counterparts in the global marketplace.

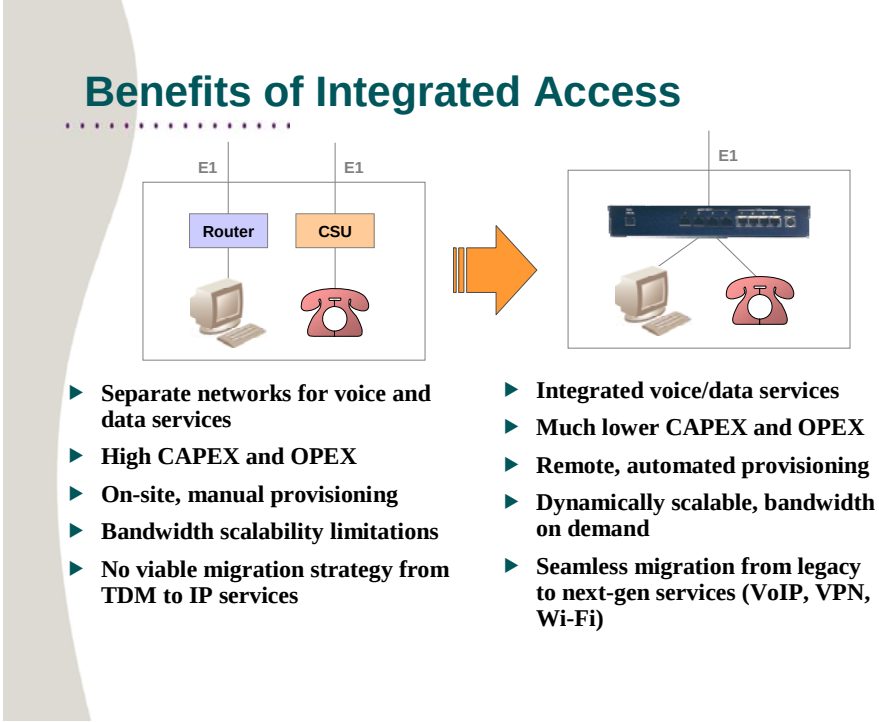

Figure 1: *Benefits of Integrated Access*

What Are Integrated Access Devices?

Integrated access devices (IADs) are compact, scalable access platforms that combine multiple network functions into a single device to lower costs and streamline operations. The same platforms also aggregate voice, data, and access to the Internet and use one broadband connection to replace multiple access lines, each dedicated to a different service.

IADs present service providers with a cost-effective solution that quickly provisions integrated voice, data, and Internet services to all their serving areas without forcing the carriers to overhaul or multiply their network infrastructures. Integrated access processes and routes multiple types of traffic from customer sites to a wide range of carrier services, including the public switched telephone network (PSTN), dedicated transmission services such as fractional T1 (Nx64kbps), leased lines and data services such as frame relay and Internet protocol (IP). Also, networks migrate to new standards; the devices support next-generation transmission protocols such as packet-switched asynchronous transfer mode (ATM) and IP. What's more, an emerging enhancement to IADs permits them to be remotely reconfigured through software keys. The resulting ability to automate the upgrades of installed devices gives carriers unprecedented flexibility in deploying broadband solutions and creates substantial opportunities for slashing capital and operational spending.

An IAD that supports time division multiplexing (TDM) and voice-over-packet (VoP) technologies gives service providers the best opportunity to broaden their service portfolios without immediately having to replace existing circuit-switched networks with their packet-based successors. Instead, service providers can deploy IADs in their current local loop infrastructures and continue to serve users with stable TDM–based voice and data services. Then, when carriers are ready, they can merge their networks toward newer services.

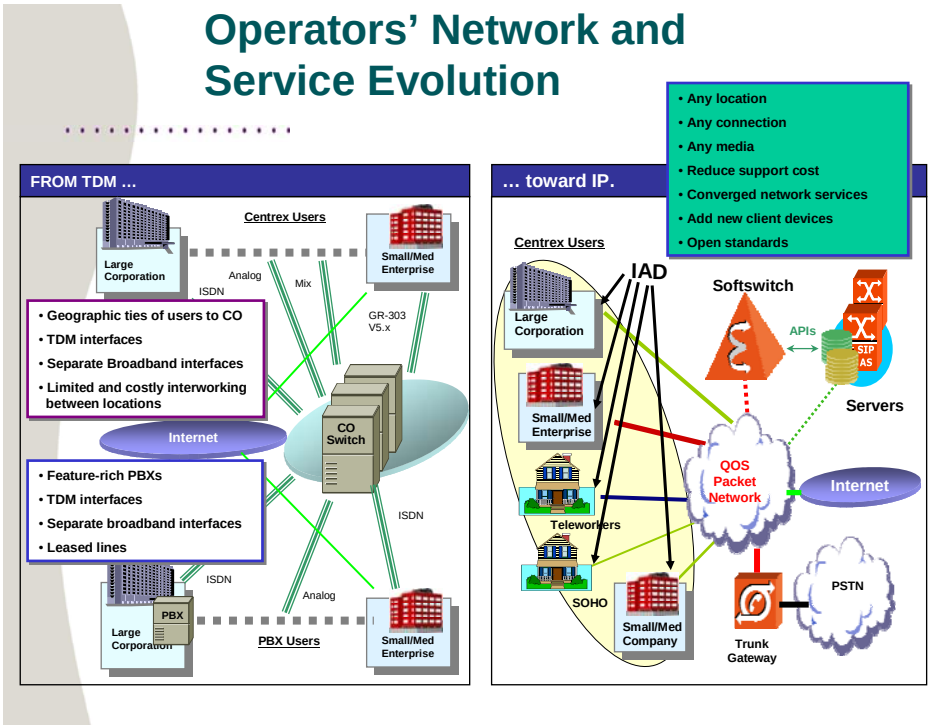

Figure 2: *Operators' Network and Service Evolution*

IADs for the Local Loop

Deployed at the customer's premises, IADs fall into one of the following three fundamental categories:

Basic Integrated Access Device

Performing the functions of a multiplexer, this type of device resides in legacy networks and exists primarily to aggregate a customer's outgoing voice and data traffic and to channelize onto a single network connection. For voice services, the device will operate as a channel bank and may head an existing private branch exchange (PBX) or key system to aggregate telephone traffic. A foreign exchange station (FXS) interface connects to an analog key system, while a digital system cross-connect (DSX-1) interface attaches to a digital PBX. On the data side, a basic IAD typically provides an Ethernet port and a fractional Nx64k interface for connection into the legacy data network, which can consist of routers, hubs, frame-relay access devices (FRADs), and similar devices.

Enhanced Integrated Access Device

This category of device takes service integration to the next level by providing an all-in-one solution for voice and data. In addition to supporting a channel bank, as basic devices do, an enhanced IAD permits remote management and features integrated routing and Internet firewalling, plus a channel service unit (CSU)/data service unit (DSU), FRAD, and dynamic host configuration protocol (DHCP) functionality. With the same class of integrated platform, service providers also gain the ability to add voice ports or data bandwidth from remote sites. Automated upgrades let carriers lower their operating outlays by eliminating expensive truck rolls, minimize spending for inventory by making one platform adaptable to many configurations, and fine-tune

their capacity to customers' requirements. Moreover, enhanced IADs free service providers to pursue new commercial markets; for example, in green-field opportunities, carriers can effectively implement a customer's voice and data network with the help of a single access device. In addition, when IADs further support value-added functions such as local voice switching and localized Centrex services, carriers can provide their subscribers with a complete "office-in-a-box" solution.

Next-Generation Integrated Access

Think of this product classification as a device that resembles enhanced IADs in every respect, including their automated upgrades, except that it also supports new value-added applications and gracefully migrates to voice-over-packet (VoP) services. For carriers that expect to move to new services and packet-based networks, next-generation (NG) IADs provide an ideal answer for the last mile. One of the biggest challenges that providers face when they graduate to new services and protocols is figuring how to make them compatible with—and thus protective of—investments in the existing infrastructure. NG IADs overcomes such difficulties by seamlessly fitting into legacy networks and then permitting them to migrate to new services and packet-based voice and data through downloaded software. Moreover, if NG IADs additionally function as a gateway, they translate all circuit-switched voice and data services to packet-based services and vice versa. Subscribers, therefore, retain all their previous network configurations, including telephone numbers.

IADs for Value-Added Services

Bundled services competitively differentiate carriers from each other and allow them to increase their market share and reduce their customer churn. Service bundles, for example, may include local and long-distance voice in combination with Internet service. What becomes even more compelling is the ability for carriers to distinguish themselves further by offering service packages with value-added functionality. Value-added services provide carriers with incremental revenues without the associated cost of sales or infrastructure. From the perspective of end users, the benefits of value-added services include cost savings, high quality of service (QoS), and increased productivity.

Given the capabilities of integrated access, service providers can effectively offer a portfolio of differentiated services, ranging from a bundle of voice and data services to a fully managed family of value-added services. A value-added voice service may include dedicated Centrex trunk lines for every phone extension in a customer's premise or the ability to deliver local Centrex services that displace a stand-alone phone system. Similarly, value-added data services may include bundled Internet services with e-mail, virtual private networking (VPN), security, and even Web-hosting support.

Managing a feature-rich, value-added service, however, can saddle carriers with operational and support burdens. For a local Centrex service, for example, service providers have to manage and operate all the specific voice features and frequently respond to requests from end users to configure their service. A solution to the challenge lies in giving SMEs access to certain IAD functions that enable subscribers to manage and customize their configurations to include specific features such as the option to turn three-way conference calling on or off. Armed with a capability for flexible management, service providers can own and administer their overall service, simplify day-to-day requirements for configuring end users' services, and minimize the associated operational overhead. *Figure 2* illustrates the process for rolling out value-added services.

Value-Added Services

Although integrated access that offers an all-in-one solution already exists, most qualify as server-based platforms. As such, many of the devices lack some of the key carrier-class attributes that enable IADs to participate in network infrastructures. The characteristics that are necessary for effective participation include the following:

- High reliability
- Resilience (network-equipment building standards)
- Robust, real-time operating system
- Remote management capability that integrates easily with a carrier's high-end operating system

Distributing Intelligence to the Network's Edge

By extending the local loop infrastructure to customer premises, IADs allow carriers to push much of their intelligence for managing services from the core of telecommunications networks to the edge. Localizing service intelligence provides a number of key benefits, including the following:

- Simplified networks and a resulting reduction in accompanying costs
- Increased flexibility in provisioning services and reduced time to market for deploying new services
- Improved ease in expanding networks to keep pace with growth and to enter new markets economically
- Increased reliability through distributed intelligence

To make good on their promised dividends, integrated access must meet the following three critical requirements:

- Local service and service management intelligence
- High reliability
- Centralized management and control of services from network operations centers (NOCs)

Migration to a Next-Generation Network

To compete effectively and to survive, service providers must pursue new market opportunities by creating differentiated services that add significant value. Competition, in turn, requires carriers to optimize the cost of their networks, shorten time to market and promote the flexible provisioning that will eventually lead to the convergence of voice and data services on next-generation networks (NGNs).

Figure 3: *Technology Trends*

For service providers, however, migrations to NGNs pose many challenges. Carriers cannot afford to scrap their existing infrastructure. Instead, they must somehow adapt their installed networks to support new standards or protocols and protect not only their investments in capital hardware, but also their established revenue streams. Providers, therefore, demand products that dovetail with legacy technology, even as they offer a migration path to packet-based voice and data with minimal operational overhead and impact on service.

By far, the most cost-effective means of migrating to NGNs involves the use of downloaded software, as opposed to truck rolls or forklift upgrades, which both disrupt service and consume lots of scarce resources. Managed remotely from NOCs, the software-based conversion to new technologies is indispensable to a graceful, large-scale migration to NGNs.

Conclusion

An ideal IAD works readily with existing telecommunications assets to meet the needs of end users and service providers alike. In its most basic form, the product category should act as a data multiplexer that integrates a customer's legacy voice and data network. An IAD should also optionally support integrated routing and value-added services. And it should permit software-based migration to packetized voice and data services as carriers see fit.

True integrated access make possible a new level of freedom for carriers that seek to diversify their sources of revenue, hasten the deployment of new services and improve the cost-effectiveness of their maintenance and operations.