



# INTERNET TELEPHONY

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## The VoIP Alternative:

Experience The Gain Without The Pain

By Larry Jacobs

Ethernet services are the rage in business today. Enterprises are attracted to Ethernet access due to its low cost per megabit, high speeds, inherent multi-point connectivity, affordability of access equipment, and their overall familiarity with managing Ethernet switches. Service providers also see numerous benefits in Ethernet services including standards-based multivendor interoperability, low cost of deployment, and low provisioning costs.

The rapid growth in Ethernet Services is sure to provide additional incentives for enterprises to use VoIP. By converging all voice and data onto a common Ethernet services connection, multilocation enterprises will reduce costs and increase operating efficiencies.

One obvious way to do this is to replace traditional TDM-based PBXs with native IP telephony. This is clearly the path many companies are taking. Within the next 10 - 20 years, most PBXs will likely have been replaced or upgraded to support VoIP. However, today's installed base of TDM PBXs remains huge. Billions of dollars have been invested in this equipment, much of which is still highly reliable and functional.

Telecom/networking managers face a challenging dilemma: On the one hand, They would love to get the “gains” associated with VoIP — lower inter-location communication costs and the efficiencies of a converged WAN infrastructure. On the other hand, many are properly concerned about the “pain” frequently inherent in a move to VoIP — stranding their investment in existing PBX equipment, the high costs associated with the preparation and rollout and elevated risk of reliability and quality issues. This requires a difficult choice, but fortunately, standards activity has recently gained the critical mass needed to provide a real alternative.

### Bridging Technologies

After several years in gestation, a new technology, called circuit emulation or pseudowires, has recently emerged that allows the convergence of TDM communications onto low-cost, Ethernet or IP infrastructures. In fact, Dr. Robert Metcalfe, the inventor of Ethernet, has identified TDM support as a critical attribute of carrier-class Ethernet. Pseudowires work by packetizing a TDM stream, transporting it across an Ethernet/IP network and then recreating the TDM stream at the other end. Importantly, the critical TDM

timing must be regenerated with great accuracy — a challenging task over a packet network (Figure 1).

Standards bodies have approved a number of different pseudowire/circuit emulation variations and vendor solutions are available. They fall into two main categories: those that provide pure circuit emulation (without regard to the type of voice or data being transported) and those that add specialized voice processing and protocol optimization to gain additional efficiencies for voice and data transport. RAD Data Communications uses an approach called TDMoIP that works in both modes. Similar solutions are available from other vendors as well.

In addition to lowering communications costs, use of a TDMoIP gateway brings the following benefits:

•**Investment Protection:** By interfacing with standard T1 ports, TDMoIP requires no need to change anything on PBX systems. As far as the PBX knows, it is connected to a normal T1 circuit.

•**Transparency:** TDMoIP supports any PBX protocol, whether standard or proprietary, and permits transparent communication across the network. Enterprises can retain all the features and functions of existing PBX networks, e.g., message waiting indications, busylamp fields, etc.

•**Efficiency:** TDMoIP provides greater efficiency and higher quality of service than VoIP. VoIP functions as a “switched virtual circuit” in that each packet sent by a VoIP system has its own address. On the other hand, circuit emulation or pseudowire technology functions more like a “permanent virtual circuit.” Packets always traveling from point A to point B are aggregated into a bundle and sent as a group to the same destination, such as a branch office. This results in TDMoIP being up to 60 percent more efficient than VoIP. TDMoIP also provides higher quality of service since each

bundle contains fewer samples of any one conversation making it more resilient to packet loss.

•**Voice Compression:** Using the same codecs as in VoIP, TDMoIP can achieve a better than 16:1 compression ratio for voice calls. For example, one can transmit the full 24 voice channels of a T1 line over as little as 128K of Ethernet bandwidth. Alternatively, the equivalent of 16 T1s can be transmitted over a single T1.

•**Security:** TDMoIP is more secure because it is of little interest to hackers and because encryption protocols can be applied more easily than with VoIP.

Pseudowire/circuit emulation technology is an alternative to VoIP that lets companies take advantage of a converged packet service for both voice and data transmission while protecting their investment in existing communications equipment and ensuring uninterrupted support of existing mission-critical services.

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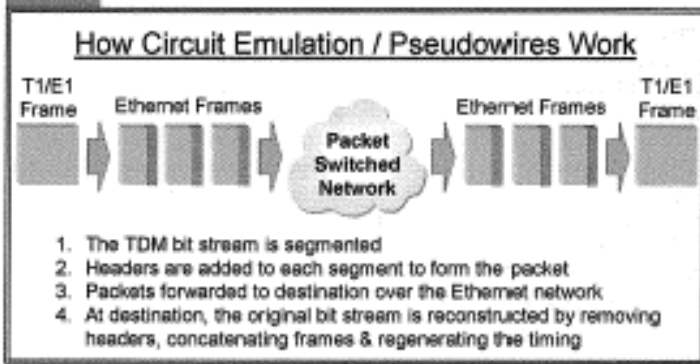
*—John Kohlmorgan*

### Applications: TDMoIP Gateways in Practice

Austin Independent School District, which serves about 77,000 students, decided to replace its ATM communications network with a pure IP environment designed to link all of its schools through a metropolitan area network. Rob Corley, the District’s Network Analyst, explains, “When our ATM equipment was beginning to reach the end of its life, we conducted substantial research and decided that our needs would be best met with WAN technology as the most cost-effective, scalable solution for transporting T1 circuits between PBXs at each of our campuses.”

About two years ago, the District deployed TDMoIP gateways at 13 super-node locations to provide tie trunks between their major PBXs. “We have a tree and node structure with a main PBX at the Network Operations Center, Distribution PBXs at five cities and access PBXs at each campus,” Corley explains. Plans include rolling out the solution to additional

Figure 1.



locations as well (Figure 2).

Why not just switch to VoIP? “While VoIP is a promising technology which we may acquire in the future,” says Corley, “it was not a near-term solution for us because we had a very large investment in traditional PBXs at each of our 125 cities.” John Kohlmorgan, the District’s WAN Manager, agrees. “The ability to transport the T1 voice circuits over IP allows the District to leverage its current investment in the existing PBX hardware,” he says.

“We were hoping to achieve the same functionality with IP as we did with ATM, but have now surpassed that,” states Corley. “We’ve had no failures in the two years since we acquired the technology. In fact, our PBXs appear to work better with this equipment than they did with the ATM circuits. If a fiber is cut between campuses, for example, the PBX is not affected, whereas before, there used to be a little ‘hiccup.’ The technology has proven very reliable,” he adds.

Another example of success comes from TeleperformanceUSA, a contact center solutions provider based in Salt Lake City, UT. The company uses RAD’s Vmux circuit emulation/pseudowire solution enhanced with voice optimization technology to slash their cost of transporting hundreds of simultaneous calls to their remote call center locations in Manila and Buenos Aires. With the cost of a single International Private Line E1 circuit between PBX/ACDs easily costing \$8,000 per month or more, TeleperformanceUSA had great incentive to use state-of-the-art technology to minimize their costs. While using end-to-end VoIP could have helped reduce their oper-

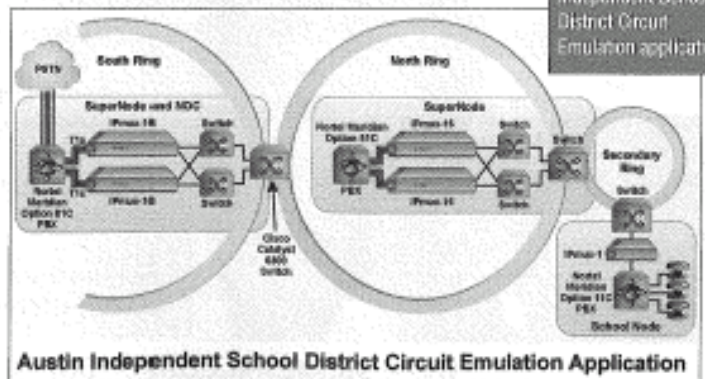
ational costs, TeleperformanceUSA realized greater savings by using circuit emulation and voice compression. Fortunately, the company avoided the large capital outlay that would have been required to upgrade or change out their PBX/ACD systems.

“RAD’s Vmux is ideal for customers like Teleperformance USA,” explained Michael Schmidlen, President of Advanced Datacom Solutions, a RAD VAR based in Highlands Ranch, Colorado who helped Teleperformance USA design the solution. “RAD is leading the industry with 16:1 compression without sacrificing voice quality. The Vmux also provides a robust set of backup and failover options to ensure critical network uptime,” he continued.

### Evolution

Ethernet has been one of the most successful technologies in history in terms of its speed and breadth of acceptance. It is used universally today for local area networks and is well on its way to global ubiquity for WAN application. While VoIP may be the way of the future, pseudowire/circuit emulation technology is today’s solution for enterprises seeking to evolve in the direction of converged packet transport — without the expense of replacing perfectly functional PBX equipment. It’s an evolutionary step that brings the best of both worlds: the quality of service and rich feature set of TDM technology combined with the cost-effectiveness and efficiencies of Ethernet/IP backbones. Who says you can’t get the gain without the pain?

Figure 2, Austin Independent School District Circuit Emulation application.





**data communications**

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### Maximize Investment Protection

Ethernet, MPLS and IP are changing the economics of data services delivery, bringing simplicity with lower cost to both carrier and enterprise users. TDM over IP (TDMoIP) takes advantage of this infrastructure to help both carriers and enterprises reduce network expenses without compromising functionality or service offerings. The TDMoIP evolutionary approach maximizes investment protection by running all TDM traffic—irrespective of protocols or signaling—transparently over Ethernet/MPLS/IP networks. You get the “gains” of VoIP without the “pains” commonly associated with its deployment.

### RAD's TDMoIP product solutions

RAD's primary TDMoIP offerings include the IPmux TDMoIP gateways and Vmux voice trunking gateways. The IPmux family handles full T1/E1, fractional T1/E1 and T3/E3 streams, supporting ToS (DiffServ) on the IP layer and VLAN on the Ethernet layer. Vmux voice trunking gateways implement TDMoIP with added voice compression and silence suppression. Vmux is used whenever it is vital to reduce bandwidth consumption, such as when connecting call centers, for cellular backhauling and in satellite applications. The excellent cost/performance ratio of the Vmux makes it suitable for delivering voice over private networks or the public Internet.



IPmux™ Family



Vmux™ Family

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