Pseudo-Wires:
The Full-Service Alternative to TDM Access

WHITE PAPER
Important Notice

This document is delivered subject to the following conditions and restrictions:

This document contains proprietary information belonging to Axerra Networks, Inc. Such information is supplied solely for the purpose of evaluating AXN Pseudo-Wire Gateways and Access Devices™.

Axerra Networks owns the proprietary rights to all information contained herein. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, magnetic, photocopy, recording, or otherwise, now or in the future, without prior written consent from Axerra Networks.

The text and graphics are for illustration and reference only. The specifications on which they are based are subject to change without notice.

Due to a policy of continuous development, Axerra Networks reserves the right to alter specifications and descriptions outlined in this publication without prior notice, and no part of this publication, taken separately or as a whole, shall be deemed to be part of any contract.


Axerra Networks™, AXN®, AXN Pseudo-Wire Gateways and Access Devices™, and AXNVision™ are trademarks or registered trademarks of Axerra Networks, Inc. All other product names are trademarks or registered trademarks of their respective owners.
Executive Summary

Telecommunications service providers are facing a major paradigm shift in both the services they provide and infrastructure they use. Today, legacy services such as Leased Lines (LL), Frame Relay (FR), ATM (Asynchronous Transfer Mode), and Circuit-Switched Voice dominate the telecommunications service market and generate the vast majority of providers’ revenues and margins. In fact, customer demand for these legacy services continues to grow around the world.

However, the explosive growth of the Internet has triggered exponential demand for IP (Internet Protocol) -based networks. In fact, analysts estimate that demand for these services continues to more than double each year. As a result, telecommunications carriers are investing heavily in IP/MPLS, Carrier Ethernet, and hybrid fiber coax (HFC) infrastructures. Advances in IP-based technology in the past few years have made it more cost-effective, higher-performance, and simpler to manage than the older technologies that were originally designed to support the legacy services. Additionally, advancements such as Differentiated Services (DiffServ) prioritization and MPLS enable IP networks to move beyond the “best effort” model for services, promising guaranteed levels of quality, security, and reliability.

The need to preserve existing legacy services while building the future infrastructure for emerging services is placing a heavy toll on service providers. Given this situation, the key to financial success hinges on a service provider's ability to put revenue growth and infrastructure growth on the same trajectory. Carriers and service providers need to do both — leverage their strategic IP networks by offering new services and support high-margin (legacy) services.

This paper looks at both the changes occurring in the telecommunications services marketplace as well as the need for service providers to expand their service offerings and smoothly migrate networks to a single converged network based on IP and MPLS without stranding any revenue streams from legacy services.

This document also describes Axerra Networks’ Pseudo-Wire solutions, which offer circuit emulation and service emulation over packet-based networks and provide a full-service alternative to TDM access. Axerra’s family of AXN Pseudo-Wire Gateways and Access Devices™ enable mobile wireless operators, cable MSOs, competitive service providers, and incumbent carriers to extend IP and legacy voice and data services in native format over Ethernet, IP, and MPLS networks.

Leveraging the most comprehensive set of service capabilities — including Leased Line, Frame Relay, ATM, Circuit-Switched Voice, transparent LANs, and Internet traffic — over unified packet-based networks enables providers to gain market share penetration and provide the most current services for their customers.

Pseudo-Wires are the first step in the evolution toward unified and full-service Carrier Ethernet, IP, and MPLS infrastructures and will accelerate carriers’ return on investment from their strategic networks.
Market Overview

The explosive growth of the Internet has had a dramatic impact on the telecommunications services market. Current studies show that IP traffic in the U.S. as well as internationally will continue to grow at a rate of 80% to 200% per year. The need for high-capacity, high-performance IP (Internet Protocol) networks to support this explosive growth in traffic has created a new class of telecommunications providers – the IP service provider. However, both retail Internet access and wholesale IP transit services have quickly become commoditized, low-margin services. This has led to the emergence of value-added voice and data services such as Voice over IP (VoIP) and IP Virtual Private Networks (IP VPNs).

Meanwhile, incumbent telecommunications service providers have long delivered voice services over the Public Switched Telephone Network (PSTN), and more recently Leased Line, Frame Relay, and ATM services over their ATM and SONET/SDH networks. Service providers rely on these “legacy” services for their high margins to generate revenue, and their business customers rely on the quality, predictability, reliability, and security of these legacy services for their mission-critical applications. The demand for these services continues to grow, and it is in the interest of incumbent service providers, who must show short-term profitability, to continue to provide these services to customers.

But, as the demand for IP services grows, incumbent service providers are also investing in new, high-speed IP-based networks for their customers. These new infrastructures are often added to, or overlaid on, their current networks – Public Switched Telephone Network (PSTN), ATM, Frame Relay, and SONET/SDH. These parallel networks require huge ongoing investments and pose complex maintenance problems.

Most providers (incumbent service providers, competitive service providers, Ethernet service providers, mobile wireless operators, as well as cable MSOs) now regard their IP-based networks as their most strategic asset. Spurred by the growing bandwidth demands of Internet traffic and enterprise data applications, providers continue to invest in new network implementations that leverage the performance and cost-effectiveness of new core IP switch/routers as well as Carrier Ethernet technologies.

All service providers in today’s challenging economic climate must balance ongoing investment against the need to maintain profitability. The equation is a troubling one to all service providers who are pouring more and more capital into a portion of their network that is increasing in size at a much faster rate than it is producing revenue.
The Challenge – Supporting the Current Environment While Investing in the Future

The issue at hand for all types of service providers is balancing investment in next-generation IP, MPLS, Carrier Ethernet, and HFC infrastructures to enable future revenue growth from emerging services, and investment in existing network implementations to ensure the continuation of legacy, high-margin revenue streams.

To date, addressing these multiple needs for service providers has resulted in implementation of several parallel networks to support traditional and emerging services: PSTN for voice, ATM and SONET/SDH for legacy services, plus IP/MPLS, Carrier Ethernet, and HFC for emerging services. These parallel overlay networks create several problems:

- Investment is split between various networks limiting the growth of, and strategic investment in, next-generation networks.
- Such split investment in disparate networks effectively prevents a service provider from making a “technology leap.” Alternatively, providers with IP-only networks have been required to forgo revenues from the legacy services.
- Cost of ownership (maintenance, operating expense, capital expenditure, etc.) for managing three separate networks is tremendous.
- Each of the individual networks is underutilized, creating a higher cost of transmission and bandwidth inefficiencies.

The challenge is to protect the continued growth of carriers’ revenue-producing legacy services (Leased Line, Frame Relay, ATM) while avoiding additional investments in ‘old’ technology. Service providers need a cost-effective way to support multiple services over unified IP/MPLS, Carrier Ethernet, and HFC networks to retain ongoing revenue from legacy services and to generate additional revenue from emerging services.

The Solution – Pseudo-Wires

The ultimate goal for service providers is clear: have a single, reliable, and unified IP-based network that will support both legacy and emerging services. An early innovator of Pseudo-Wire technology, Axerra Networks introduced the concept of Pseudo-Wires as Multiservice over IP, Circuit Emulation Service over IP, Frame Relay over IP, and ATM over IP. These capabilities are now part of Axerra Networks’ comprehensive Pseudo-Wire solutions.

The term “Pseudo-Wire” comes from the IETF’s Pseudo Wire Emulation Edge-to-Edge (PWE3) working group, which is chartered to define the mechanisms that emulate the essential attributes of services such as ATM, Frame Relay, Ethernet, or Circuit Emulation over a Packet Switched Network (PSN). The goals of Pseudo-Wires as defined by PWE3 are similar in many ways to what has been referred to as “multiservice.” The difference is that IP and MPLS have now replaced ATM as the fundamental switching and transport technology.

Axerra leads the industry in providing Pseudo-Wire solutions that, for the first time, enable all types of telecommunications providers to offer a full portfolio of voice and data services to customers. With Axerra’s AXN Pseudo-Wire Gateways and Access Devices™, revenue-driving legacy services, including voice, Frame Relay, and Leased Line can be integrated with in-
demand IP services such as Transparent LAN services, and be efficiently transported across high-speed, low-cost Ethernet, IP, and MPLS networks.

The major advantages of Axerra Networks’ Pseudo-Wire solutions include the following:

- Service providers can preserve their revenues from legacy services, while at the same time, increasing revenue through emerging (packet-based) services. The solutions allow providers to capture both markets with one infrastructure.
- Lower capital expenditures, maintenance, and management costs due to a unified network.
- Easy migration to the next-generation network without compromising the revenues from legacy services.
- Allows implementation of strategic investments in IP/MPLS and Ethernet infrastructures, freeing resources that are currently invested in maintaining legacy infrastructure. This ensures a quicker move towards the strategic goal of a unified IP network core.
- Better utilization of the network, lowering costs of transmission.

The Technology

AXN Pseudo-Wire Gateways and Access Devices from Axerra Networks are used to furnish circuit emulation and service emulation, as well as aggregation and concentration, in the access layer of the IP/MPLS, Carrier Ethernet, or HFC network. The AXN Pseudo-Wire Gateway is connected to provider edge (PE) routers, allowing multiple services over a unified IP network core. This concept is similar to that of ATM multiplexers, which were connected in the second tier to the ATM backbone switches as part of the ATM infrastructure.
AXN Pseudo-Wire Gateways and Access Devices (AXN1, AXN10, AXN100, AXN800, and AXN1600) furnish circuit emulation and service emulation, as well as aggregation and concentration, in the access layer.

Significantly, Axerra Networks’ Pseudo-Wire solutions do not require enterprise users to change or adapt their systems or networks. The AXN Pseudo-Wire Gateways and Access Devices interoperate with all types of Customer Premises Equipment (CPE) so that customers do not perceive any change in the reliability or quality of service they receive.

The Benefits to Providers

Forward-looking service providers who want a full-service alternative to TDM access over Carrier Ethernet, HFC infrastructures or Broadband wireless/WiMax are the beneficiaries of Axerra Networks’ Pseudo-Wire solutions. The main value for these providers is the ability to focus on building a next-generation infrastructure today that supports emerging services, without compromising the major revenue streams associated with legacy services.

There are five main categories of providers that will use the AXN Pseudo-Wire Gateways and Access Devices to support varying business needs:

Mobile Wireless Operators: These providers need to reduce the operating expenses of rapidly expanding Radio Access Networks (RANs) in order to enhance profitability. With Axerra Networks’ Pseudo-Wire solutions, backhaul expenses are dramatically reduced by enabling circuit-switched voice and packet-based data services to be aggregated for transport over new, faster, and more efficient packet-based infrastructures, including Carrier Ethernet, HFC, and broadband radio.

Cable MSOs: These carriers can profit from substantial revenue growth by expanding beyond their traditional residential market and tapping into the lucrative business market.
Axerra’s Pseudo-Wire solutions enable these providers to leverage their fiber/coax infrastructures and offer a full portfolio of carrier-class voice and data business services.

**Ethernet Service Providers:** These carriers are looking to offer services over an end-to-end Ethernet infrastructure. With Axerra’s Pseudo-Wire solutions, these carriers can provide not only new, emerging services such as transparent LAN VPNs, but also a complete service portfolio that generates additional revenue, resulting in a more attractive business model.

**Competitive Service Providers:** These providers need to use Pseudo-Wire solutions in order to better position themselves as true competitors to the incumbent carriers. Axerra’s solutions deliver a full portfolio of voice and data services over packet networks that can attract a larger customer base and create more immediate short-term revenue. At the same time, Axerra’s Pseudo-Wire solutions allow these providers to implement a single network, eliminating the need to invest in and manage multiple networks.

**Incumbent Carriers:** These carriers require ways to enhance their networks and offer new services without losing revenues from legacy services. Axerra Networks’ Pseudo-Wire solutions provide them with an opportunity to preserve revenue-generating legacy services and to expand their offerings while reducing inefficiencies associated with managing several separate networks.

**Conclusion**

Telecommunications service providers are currently under tremendous pressure. Not only do they have to build next-generation infrastructures that will enable them to remain competitive into the future, but they also need to demonstrate to investors and shareholders a viable business plan with strong short-term revenues. As a result, service providers are looking for ways to offer more services in a cost-effective and efficient manner that will enable them to preserve and enlarge their customer base.

Providing new and traditional services over Pseudo-Wire technology truly provides a “best of both worlds” solution for service providers. The strategic goal of implementing unified packet-based infrastructure can be pursued more aggressively without risking short-term revenue and customer retention targets.

Axerra Networks’ AXN Pseudo-Wire Gateways and Access Devices offer mobile wireless operators, cable MSOs, Ethernet service providers, as well as competitive and incumbent service providers a unique opportunity that will enable them to more effectively expand service offerings, optimize their networks, reduce expenditures, and enhance profits.