Vectoring

Highlights

- Deploy vectored DSL for high speeds over copper
- Accelerate the roll out of vectored services
- Easily support the coexistence of vectored and nonvectored lines
- Optimize lines and mitigate noise effectively

Deliver 100 Mbps over copper

Until now, a major obstacle to delivering very high-speed communications services over copper has been crosstalk interference among neighboring pairs. With the latest DSL technology advances, data rates in the order of 100 Mbps are now a reality. Network infrastructure and consumer hardware can be designed to perform crosstalk cancellation, and thereby enable dedicated speeds over twisted pairs that were previously considered possible only with fiber. This crosstalk-cancelling technology is called "vectoring," and is defined in the ITU-T recommendation G.993.5 (also known as G.vector).

Vectoring technology is a major milestone for broadband access and opens many opportunities for new services. Vectored DSL allows super-fast connections comparable to those of fiber-to-the-home installations. However, vectored DSL has the advantage of being dramatically more economical than any fiber-to-the-home investment by at least a factor of five, according to leading analysts.

ASSIA DSL Expresse includes the key features necessary to seamlessly deliver vectored DSL services to networks of all sizes. The required steps include:

- Planning the network upgrade to install vector-capable equipment
- Rolling out the vectored DSL services without disrupting legacy services
- Managing the vectored DSLs to achieve the highest performance with the lowest maintenance costs

Maximize vectoring ROI

The planning of a network upgrade to vectored DSL depends on reliable estimates of rates and services on a per-line basis. Such information is critical for choosing the sites, nodes or neighborhoods to upgrade to produce the highest return on investment.

With its Vectoring Predictor software module, DSL Expresse accurately estimates the rate that each line can achieve after upgrade to vectored DSL (see figure 1). Based on this estimate and other data collected from the network, DSL Expresse predicts the upgraded services that can be offered to the corresponding customers. These predictions can be

combined with marketing data on expected take-rate to produce a detailed cost-benefit analysis to guide the selection and prioritization of sites for upgrade.
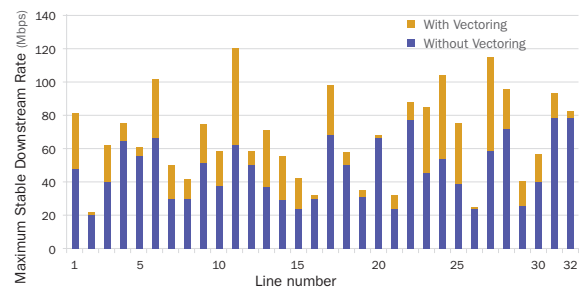

FIGURE 1. Example of DSL Expresse rate estimation for lines at a specific site

Expresse Solutions from ASSIA combine vectoring technology with expert professional services to provide an important guide to vectoring upgrades.

Roll-out vectoring seamlessly

A network upgrade to vectored DSL cannot take place overnight. There are several practical reasons why vectored DSLs are expected to share binders with non-vectored DSLs for a long time. Legacy DSL equipment at the customer site cannot be instantly replaced with vectored DSL equipment. A remote firmware upgrade is a preferred option, but may still fail for some of the lines. In addition, legacy and vectored DSL Access Multiplexer (DSLAM) hardware may share a cabinet, and so lead to cases of "coexistence" of vectored and non-vectored DSLs in the same binder (see figure 2).
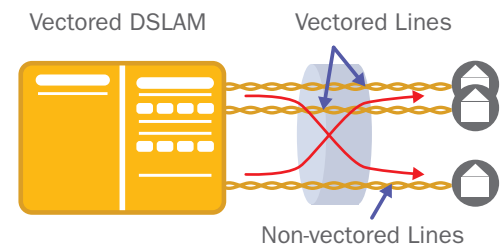

FIGURE 2. The coexistence of vectored and non-vectored lines in the same binder

Without proper spectrum management in place, even a single non-vectored DSL in the same binder with a group of vectored DSLs can eliminate most of the performance gains of vectoring. In such a situation, upgraded vectoring services cannot be offered until all non-vectored DSLs are upgraded or removed, adding delays and costs to the vectoring roll-out effort and possibly deterring some service providers from upgrading.

DSL Expresse solves the coexistence problem by optimally managing the power transmitted by the non-vectored legacy lines. Such management preserves the service levels enjoyed by existing customers on non-vectored lines and at the same time, allows for large performance gains on the vectored lines, even in the presence of non-vectored lines. Furthermore, these gains can be achieved regardless of the type of DSLAM deployed and amount of customer moves, adds and changes. This enables service providers to offer upgraded services almost as soon as the vectoring upgrade effort starts and to accelerate considerably the return on investment.

Figure 3 shows a plot of the downstream rates that can be achieved by vectored lines that share binders with non-vectored lines. DSL Expresse helps ensure a downstream rate of 45 Mbps on non-vectored lines, and maximizes the downstream rates of the vectored lines. In this case, each binder contains 24 vectored lines and 24 legacy lines. The plot shows that 100 Mbps vectored service is made possible for 99 percent of customers at a distance of 300m. In addition, 80 Mbps service is made possible for 99 percent of customers at a distance of 500m.
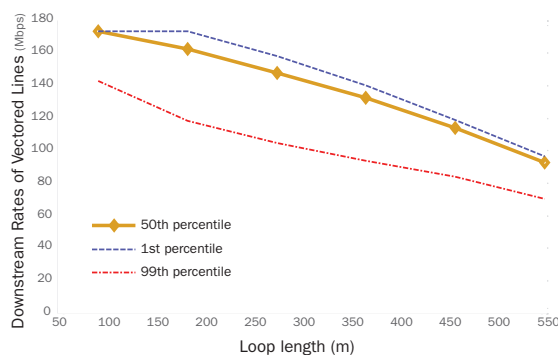

FIGURE 3. The performance of vectored lines coexisting with non-vectored lines when managed with DSL Expresse

Certain DSLAM models may include hardware-based features that improve the coexistence of vectored and non-vectored lines. However, this approach is limited in scale and lacks the seamlessness delivered by dynamic spectrum management. This approach cannot handle disruptions caused by events such the initialization of a non-vectored DSL. Such events happen fairly frequently, and for numerous reasons, including the addition of a new line, a modem reset, and so on. Relying solely on

this feature may result in inconsistent performance from the vectored lines and subsequent customer complaints and churn. DSL Expresse offers the most reliable solution, enabling the service provider to extract the maximum performance out of its VDSL and vectoring investment, with minimal delay.

Deliver very-high-speed service

All DSL networks experience constantly changing conditions that require dynamic management to optimize the lines continuously for exceptional performance. Without dynamic management, time-varying noise sources (often of an impulsive type) lead to errors on the DSL link. The quality of the service is degraded and the customer experiences low Internet throughput, slow download speed, IPTV artifacts, or even a connection loss. In a non-vectored DSL network without dynamic management, 10 percent to 20 percent of all lines may experience such poor quality.

The effects of time-varying noise become acute with higher speeds, and specifically with unmanaged vectored DSL. As vectoring technology cancels the crosstalk noise among the twisted pairs, it now exposes some previously hidden time-varying noise sources. Noise effects previously masked by the much stronger crosstalk now become the dominant source of noise and impair DSL connections. In situations where the service provider is transmitting at speeds close to the line's capacity, at low "margin," the connection can become even more susceptible to impairment.

A vectored DSL network operating at the highest nominal speeds, but without dynamic management, may have 50 percent to 75 percent of its lines experiencing poor quality or instability, according to expert analysis by ASSIA. Not only would operational and maintenance costs quickly become prohibitive, but the service provider would experience extremely high call-center volumes and an unsustainable churn rate.

DSL Expresse helps ensure that vectored DSL delivers the highest possible performance level on each line in a stable manner. Profile Optimization algorithms in DSL Expresse select the most suitable settings for the vectored DSL to maximize rates and stability. These settings include parameters for vectoring operation, and for selecting the optimal noise mitigation strategy. With such automated, dynamic management, the number of vectored lines experiencing poor quality can be significantly reduced.

DSL Expresse also provides further guidance through vectoring diagnostics that address lines experiencing quality issues even after profile optimization. Taking advantage of new data parameters reported by vectored DSLs, diagnostic algorithms accurately identify line faults and can often point directly to the underlying cause.

Deploy vectored DSL in your network. Contact ASSIA today

+1.650.654.3400
or email
sales@assia-inc.com

ASSIA®

333 Twin Dolphin Drive
Redwood City, CA 94065
Tel: +1-650-654-3400
Fax: +1-650-654-3404
www.assia-inc.com

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