White Paper

CIPHEROPTICS
Network security made simple

Securing data transmission on enterprise networks

Evolving networks create new security concerns

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CipherOptics

October 2004

Securing data transmission on enterprise networks

In the early days of the Internet, a concept of network security emerged that was based on a "crunchy shell around a soft, chewy center." This addressed the emerging threats created when opening up a door from the corporate network to the Internet by encouraging the hardening of the network perimeter. By focusing on the idea that the network is self-contained, and therefore safe, security meant mainly guarding that door.

Ten years ago, that was a sound concept. The Internet was in the early stages of becoming an extension of the corporate network, and preventing outsiders from getting in was the foundation of network security. During this time, firewalls, intrusion detection systems, virus protection and other perimeter security technologies were the first line of defense in network security.

Since that time, the nature of the corporate network has changed quickly, and dramatically. The main driver of the changing corporate network is the move to IP. The benefits of IP are obvious: interoperability, lower cost, flexibility, and the elimination of geographic limitations. The risks may be less overt, but can be sinister: exposure of sensitive data traveling over the network to unlawful interception, manipulation of data in transit, and threats to network availability due to Denial of Service (DOS) attacks. A hardened perimeter strategy of network security, while still necessary for protecting outsider attacks, fails to adequately address these risks. What is the best way to address securing data in transit?

According to Edward Allen, an independent consultant and retired FBI senior executive, "In today's world, information provides value if it is accurate, timely and shared appropriately. The sharing of information requires access and availability by authorized users regardless of their geographical location.

"Networks that facilitate information sharing can introduce unacceptable risk and exploitation if not properly designed and managed," he said. "Robust encryption technology for the transmission of data is an essential aspect of any viable information security strategy to mitigate these risks."

Government regulations, policies and directives on IT security

In addition to technological innovation, forces driving change in enterprise networks are regulations and mandates designed to ensure data integrity and confidentiality on those networks. Here are some of the directives requiring a new look at network security:

Gramm-Leach-Bliley Act (GBLA) includes provisions to protect consumers' personal financial information held by financial institutions. GLBA states that each financial institution "*has an affirmative and continuing obligation to respect the privacy of its customers and to protect the security and confidentiality of those customers' non-public personal information*."

California Senate Bill 1386 requires an agency, person or business that conducts business in California and owns or licenses computerized 'personal information' to disclose any breach of security (to any resident whose unencrypted data is believed to have been disclosed). Companies and organizations that fail to disclose computer security breaches become liable for civil damages or face class actions.

Health Insurance Portability and Accountability Act (HIPAA) sets standards for the exchange of medical information and requires health care providers to secure health records and personal information. HIPAA specifies the encryption of data as a part of protecting these records.

Sarbanes-Oxley Act ensures security is adequate to protect data against tampering. In the law there is a provision mandating that CEOs and CFOs attest to their companies' having proper "internal controls."

Basel II is fundamentally about improving risk and asset management to avoid financial disasters. Compliance requires all banking institutions to have sufficient assets to offset any risks they may face. In order to comply with Basel II, financial institutions need to have a full and in-depth understanding of all possible risks and their potential impact, including the security of customers' private information.

These policies and directives collectively advocate enterprises to act now to secure data on networks. But how do enterprises find the right security solution that fits with existing networks and budgetary constraints? By examining some common network vulnerabilities, enterprise IT managers can gain a better understanding of their own network exposure.

Network vulnerabilities: Looking beyond the perimeter

Enterprises must look at network security from a holistic perspective. Firewalls, intrusion detection systems (IDS), anti-virus software and other perimeter security technology do their part in preventing many outside threats from entering the network through an Internet gateway. But what about the data once it travels from one site to another over the core IP network, inside the perimeter?

The only way to protect that data is to encrypt it while in transit, because even private lines are vulnerable to people with access. Unauthorized access of data while it travels the network can result in one of two possibilities: unauthorized monitoring of data in transit, or unauthorized modification of data in transit. Either of these can have a devastating, effect on data integrity, confidentiality and network operations.

Unauthorized monitoring and access of data in transit
Network users take for granted that the data they send over government networks will be viewed only by the intended receiver. However, users never really know if someone else is listening, reading or even copying data as it passes over a network. For example, a financial institution could be using high-speed data replication over an IP network for redundant storage. If not properly secured, an intruder or unauthorized person could monitor or "eavesdrop" on transmission of that storage data.

Unauthorized modification of data in transit
A simple route traced between any two corporate networks may show myriad routers and service providers between two points. Each link provides an opportunity for an intruder to inconspicuously modify data. It is important to ensure that data is not altered as it goes across a network. Imagine the impact of an intruder modifying an organization's financial transactions in transmission as they are retrieved from a data center. Unauthorized users could also insert unauthorized information during transmission.

Protecting the core transport network is critical because there is a growing list of vulnerabilities that must be addressed beyond the perimeter:

Denial of service (DOS) attacks - type of attack on a network that is designed to bring the network to its knees by flooding it with useless traffic. Many DoS attacks, such as the *Ping of Death* and *Teardrop* attacks, exploit limitations in the TCP/IP protocols.

IP spoofing - In IP spoofing, an attacker gains unauthorized access to a computer or a network by masking a malicious message as a message from a trusted machine by "spoofing" the IP address of that machine.

Insider breaches – employees, contractors and others with legitimate network access can bypass perimeter security to access sensitive but unclassified (SBU) data on the network.

Social engineering – the process of deceiving people into giving away confidential information or access. In a survey of office workers in the Liverpool Street Station in London, 71% of employees will part with their password for a candy bar.

Man-in-the-middle attacks – also know as TCP Hijacking, where an attacker sniffs packets from the network, modifies them and inserts them back into the network.

Port mirroring -- Port mirroring is a method of monitoring network traffic that forwards a copy of each incoming and outgoing packet from one port of a network switch to another port where the packet can be studied. While this is used by network administrators as a diagnostic tool, in malicious hands it can be used for unauthorized data access.

IPSec – authentication, confidentiality and integrity

There is proven technology that dramatically diminishes the impact and occurrence of these network vulnerabilities. IP Security (IPSec), defined by the Internet Engineering Task Force (IETF), is the accepted standard for protecting data in transit over an untrusted network and provides three levels of security: confidentiality, authentication and integrity.

- Confidentiality – Keep your data private
  IPSec uses industry standard encryption algorithms (AES and 3DES) to keep data secret
- Authentication – Trust your sources
  Verify the identity of the peer IPSec gateway to verify the source of the data
- Integrity—Trust your data
  IPSec uses industry standard hashing algorithms (SHA1 and MD5) to ensure data has not been altered in transit

IPSec works on Layer 3, the network layer of the Open Systems Interconnection 7-layer networking model. By running on Layer 3, IPSec is able to function transparently to higher layer applications; the applications do not require any knowledge of IPSec in order to use it. Combined with Internet Key Exchange (IKE), IPSec users can exchange keys, authenticate one another, and securely tunnel encrypted data between peers.

CipherOptics network encryption appliances use IPSec and AES or 3DES to provide the highest level of encryption possible for high-speed networks.

Securing data in transit

Securing data in transit is critical to a "defense-in-depth" network security strategy, especially in protecting your core IP transport network. As enterprise networks become accessible to outsiders, including partners, customers and contractors, focusing on hardening the perimeter becomes much less effective, leaving your core network vulnerable. According studies by CERT, the FBI and InterGov, nearly 80% of security breaches are conducted by insiders. Encrypting data as it travels on the core network, as well as when it goes to remote sites, becomes the only way to effectively protect unauthorized access to data.

There are several ways to encrypt data as in travels on your network:

- Routers/switches with VPN blades
- Multi-purpose devices
- VPN appliances

Routers/switches with VPN blades
Usually available from router manufacturers, VPN blades are a server-based encryption solution. The drawbacks of VPN blades are that they add complexity to the network, meaning multiple IT hours in configuring the blade, and reconfiguring the routers and network. VPN blades also have a relatively slow encryption-decryption cycle that introduces latency, and can produce network bottlenecks, decreasing network performance.

Multi-purpose security devices
Also called "God boxes," these perimeter devices integrate several security functions into a single unit, usually including firewall, intrusion detection, encryption and virus protection. While often easy to manage, they offer varying degrees of the effectiveness of each function. These devices can also introduce significant latency, which can negatively affect applications like VOIP and storage networking, and can reduce throughput.

VPN appliances
CipherOptics is the leading provider of IPSec VPN appliances. Because they are purpose-built, these appliances have the advantage of not adding complexity to the network, latency to the applications or degradation of network performance. They are particularly well-suited for high-speed networks (100 Mbps – Gigabit) and for latency-intolerant applications like VoIP, IP storage networking and video conferencing.

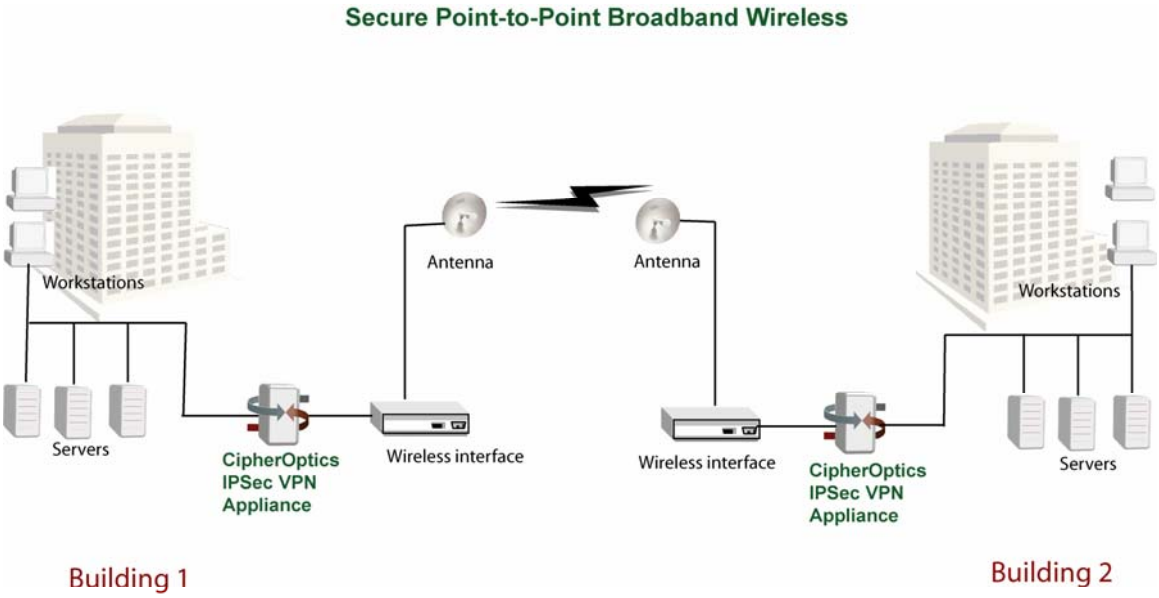
Common networks and their security vulnerabilities

Broadband wireless
Organizations sometimes use point-to-point wireless connections between buildings and in places where cable or fiber is not feasible. Point-to-point wireless can be implemented using licensed or unlicensed frequency bands or line-of-sight optical technology. However, the “air” that wireless network data goes across is not secure.

The insecure airspace expands geometrically beyond the wireless radio dishes to anywhere the wireless signal can be intercepted. This extra space for unauthorized interception leads to a significant additional risk placed upon network and security managers managing wireless wide-area networks.

In wireless transmissions, there is no sophisticated standard to enforce the overall protection of the headers and payload while the data is in transit. Additionally, the architecture of wireless networks influences the probability of theft. Since the size of the spectrum varies dependent on distance and location, transmission paths are vulnerable to unauthorized individuals with sensitive monitoring equipment designed to intercept the data.

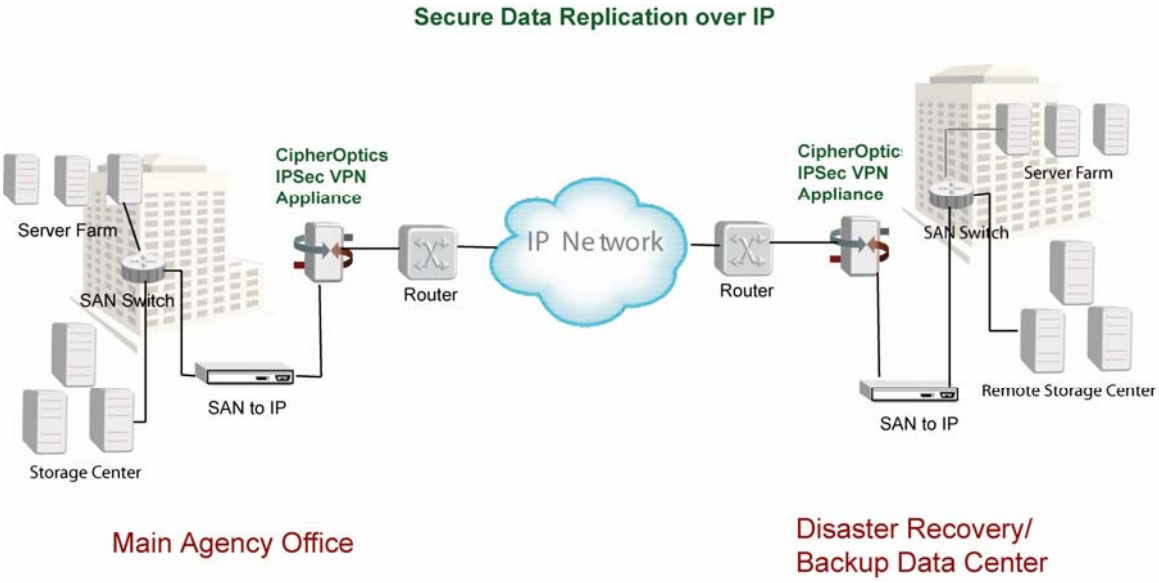
In point-to-point wireless data transmissions, this virtual communication link is inherently un-secure unless that data stream is encrypted.



Data replication over IP

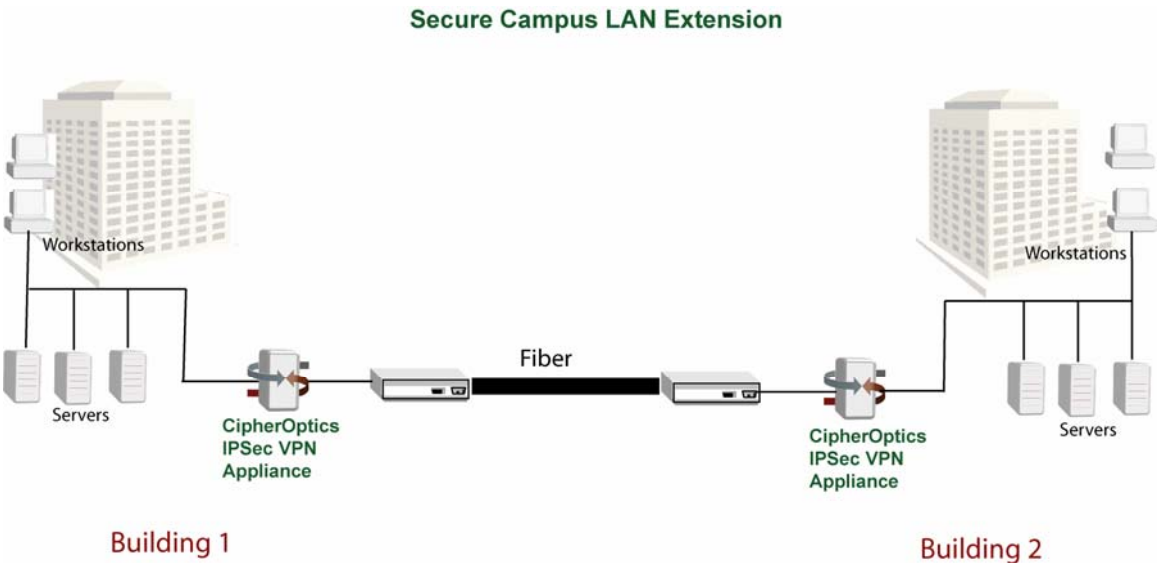
As organizations look for simple, affordable and effective technologies to ensure that they can replicate and back up their data, and implement effective disaster recovery strategies, more and more are turning to IP-based storage networking. Many have found that they can restore their application processes and resume their normal business practices as quickly as possible— even in the face of a major catastrophe— at a much lower cost when using IP-based storage networking. Network users take for granted that the data they send over government networks will be viewed only by the intended receiver. However, users never really know if someone else is listening, reading or even copying data as it passes over a network. If not properly secured, an intruder or unauthorized person could monitor or "eavesdrop" on transmission of that storage data. By encrypting data before it travels over an untrusted network, the originator can be assured that the data arrives securely at the back-up location.

When selecting a security solution for protecting storage data in transit it's important to note that storage networking is notoriously latency-intolerant and often uses jumbo frames in transporting data (greater than 1518 bytes). This means that any security solution must not introduce any discernable latency when deployed. CipherOptics network security appliances are uniquely able to provide robust AES or 3DES encryption without introducing latency, and provide jumbo frame support as well.



Campus LAN Extension
A campus LAN extension is often used by organizations that want to extend their LAN between buildings of close proximity. Common ways to connect LANs between such buildings is with a fiber connection, either a private connection on a contiguous campus or a dark fiber service from a local exchange carrier. While this provides a level of security since outsiders may not even know that it exists, data traveling on dark fiber is still vulnerable to insiders with knowledge about where the fiber is and what kind of data may be on it.

As with other site-to-site networks, CipherOptics network security appliances can provide the highest level of protection possible for data traveling on a campus LAN extension with little or no effect on applications or the network.



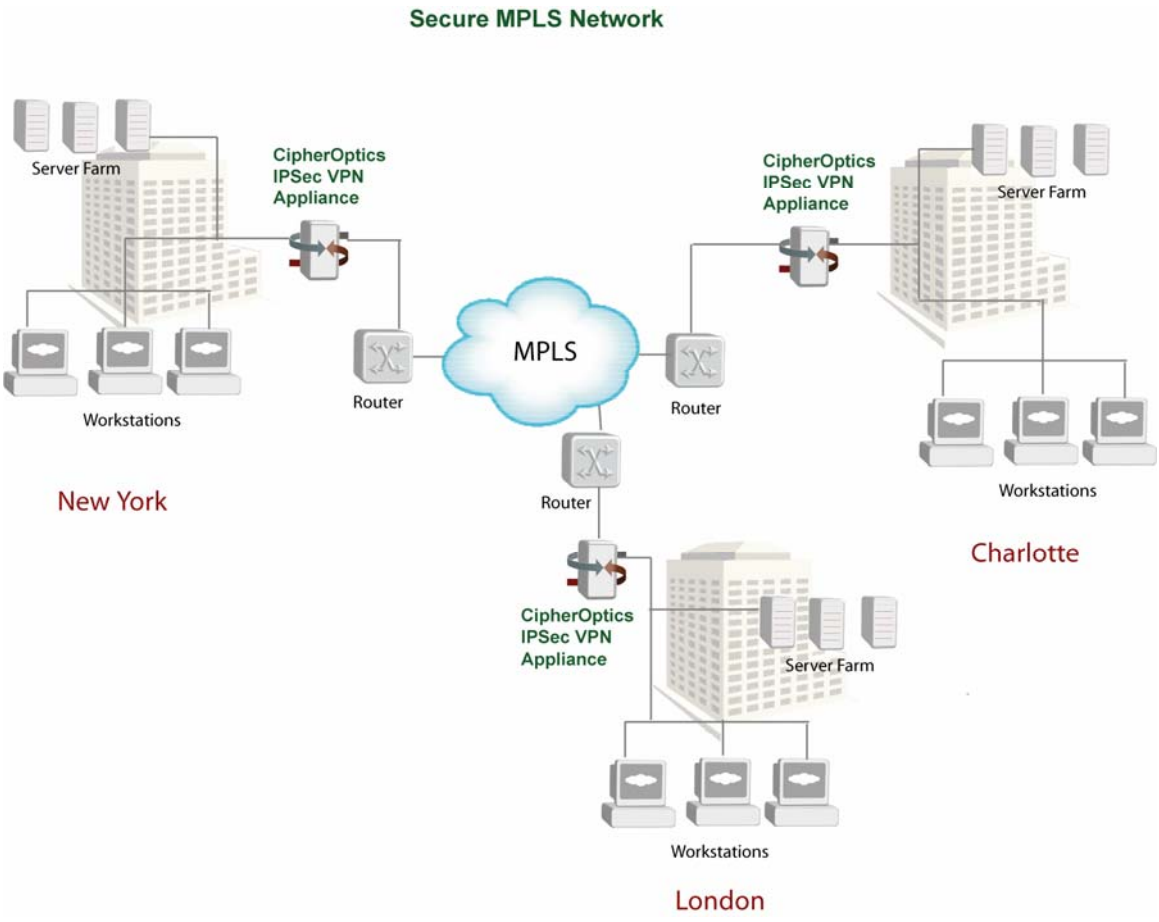
MPLS networks

Multi-Protocol Label Switching (MPLS) networks are becoming a preferred solution for many organizations. MPLS gives network operators a great deal of flexibility to divert and route traffic around link failures, congestion and bottlenecks. MPLS-based networks typically run over a carriers' private IP backbone, where service level guarantees and various classes of service can be provided.

It is often taken for granted that MPLS is inherently secure because it segregates data streams into private segments. Some will be surprised to learn that "*private is not secure*," especially when it comes to MPLS networks. MPLS, as a VPN technology, provides the same level of security as other virtual circuit alternatives such as ATM or Frame Relay. All three separate users, enabling organizations to be private. However, they are not secure because the data runs over a common IP infrastructure. Anyone with access can view or alter the data. For confidential data, the ideal solution is to run IPSec over an MPLS-VPN, encrypting the data in transit.

As with all enterprise networks, it is important to ensure that data is not altered as it goes across a network. Imagine the impact of an intruder modifying an organization's financial transactions in transmission as they are retrieved from a data center.

CipherOptics network security appliances provide an IPSec VPN that secures data on MPLS-based networks, without sacrificing any of the network availability and performance benefits of MPLS. This ensures that only data from trusted sources are accepted, regardless of how it is routed through the network. A network security appliance creates a unique fingerprint for each packet transmitted. Only the originator and intended recipient, who share a common key, are able to correctly calculate this fingerprint. The fingerprint, which is based on a mathematical computation involving the packet data and the key, becomes incorrect if data is altered in transit.



Characteristics of an optimal data transmission security solution

Given tight networking budgets and increasing government regulations, organizations must strive to provide maximum security with minimum investment. Here are the characteristics essential for an optimal network security solution:

Performance
An enterprise must evaluate the performance a security solution provides. With so many government applications being latency-intolerant (e.g., streaming video, voice over IP, storage replication, disk mirroring), a security solution must not impact network performance—it must introduce virtually no latency and have maximum throughput.

Transparency
A network security solution should be easy to deploy and not add complexity to the network. It should be simply inserted between a trusted and untrusted network. The installed device should have no impact on network design or network operation. Security should be achieved without sacrificing network performance.

Easy management
An optimal security solution should be easily managed from a central site through the use of industry standard management interfaces such as Simple Network Management Protocol (SNMP) and secure web access for security policy and configuration changes.
The network administrator should be able to quickly and easily build security policies, set filters and view system status. In general, the devices, once configured, should require very little day-to-day management. Administrators should receive alerts for potential security breaches such as unsuccessful log-ins.

FIPS validation
FIPS 140-2 Level 2 certification is awarded to products after thorough testing by an accredited independent laboratory. It is a benchmark used by government agencies as well as corporations implementing secure applications to determine which products offer robust, standardized protection.

Conclusion
Because enterprises rely heavily on data and networks to conduct their business, now is the time to act to secure this critical infrastructure. Organizations simply cannot afford to overlook the importance of confidential data transmission in the overall security process.

CipherOptics plays a key role in meeting organizational need for affordable security for the confidential transmission of data. CipherOptics SG100 and CipherOptics SG1001 IPSec VPN appliances are unmatched in performance, price and network transparency. Any organization with high-speed links and confidential data can be assured they are making a wise investment when purchasing CipherOptics.

About CipherOptics

CipherOptics, the leading innovator of gigabit-speed IPSec VPN appliances, protects data in transit as it travels over IP networks. With easy installation, virtually no latency and robust AES encryption capabilities, CipherOptics appliances outperform router and firewall add-on solutions in price, performance and network transparency.

The CipherOptics family of IPSec VPN appliances is field-proven in some of the most security sensitive networks in the world, and has received FIPS-140-2 Level 2 validation. CipherOptics appliances enable financial institutions, government agencies, and global enterprises to protect their sensitive information, mitigate risks and comply with security regulations.

Privately-held CipherOptics is based in Raleigh, North Carolina. In 2004, the company closed $10.3 million in Series C funding from Adams Capital Management, Kodiak Venture Partners, Origin Partners L.P. and Axiom Venture Partners L.P. For more information about CipherOptics visit the company website at www.cipheroptics.com.