

## **TRUFFLE BBNA Application Note:**

### ***Virtual Leased Line (VLL) for Enterprise to Branch Office Communications***

*Reliable high throughput data connections using low cost and diverse transport technologies.*

**Executive Summary:** The TRUFFLE™ Broadband Bonding Network Appliance (BBNA) enables enterprises with branch offices to have reliable high performance data connectivity from/to their main headquarter office facility to/from the branch offices. Each branch office is enabled with this fast Internet pipe by bonding multiple instances of low cost transport technologies such as DSL via TRUFFLE. The Internet lines to be bonded may be from different carriers for increased reliability. Additionally, leveraging the high bandwidth connectivity present at the main office of the enterprise, the TRUFFLE BBNA provides the branch office facility of a business with reliable, high performance Internet access at a fraction of the cost of single provider solutions. In this brief application note, we explain how the TRUFFLE BBNA can save enterprises with branch offices on their monthly Internet access cost, with a return on investment less than one year.



### ***The Problem: Data connections between an enterprise headquarters facility and branch offices***

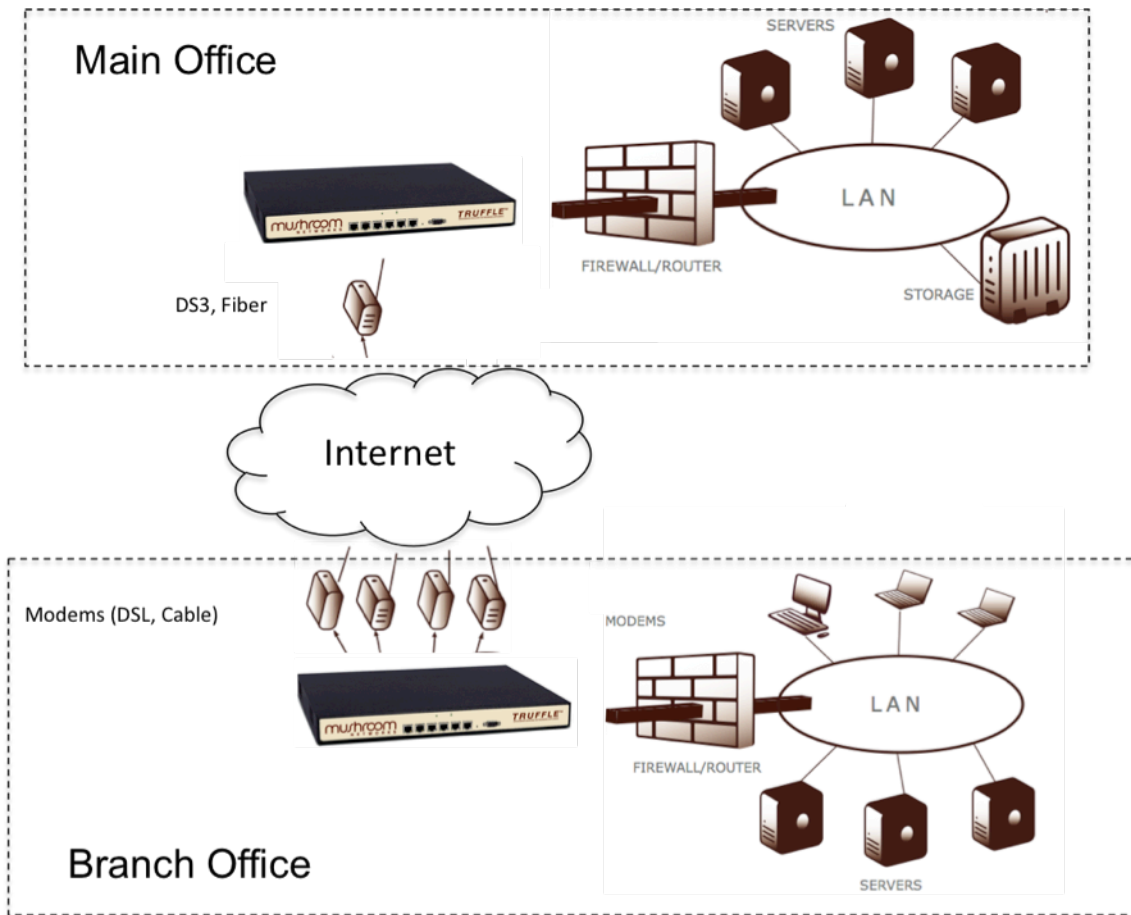
Enterprises who have a main headquarters facility and branch offices and employees within the main facility as well as the branch office need to electronically communicate with each other as well as with devices and servers on the Internet. Although it may be economically feasible to provide high bandwidth Internet connectivity to the main office, providing the same speed connections to each branch office can become prohibitively expensive since there may be many branch offices and each office may have only a small number of employees. Due to security considerations, typically all data communications at a branch office, including Internet access, is funneled through the main office facility. Thus, for the data connection between the main office and the branch office, it is desired to have as high throughput as possible.

### ***Legacy solutions for the data connections are expensive***

Generally speaking, if the branch office uses the Internet to communicate with the main office, and has only a single DSL or cable modem connection this will provide insufficient data throughput, particularly for uploading data from the branch office to the main office. For this reason, many businesses use a T1 line, which is provisioned from the branch office to the Central Office (CO) of the local telephone company to provide Internet access. The Internet connection that is provided by the T1 line is then used to access devices and servers in the main office. In many cases more data throughput than that is provided by a T1 line is needed between the main office and the branch office. Bonded T1 lines are often used in such cases, which may double, triple, or quadruple the throughput, with a commensurate increase in cost.

*Exploiting low cost asynchronous transport technologies and carrier diversity*

Mushroom Networks has developed a Virtual Leased Line (VLL) solution, which enables bonding of multiple Internet access resources such as DSL or Cable to provide reliable high throughput data channels. A TRUFFLE™ Broadband Bonding Network Appliance (BBNA) can be installed at the main office and at a branch office as illustrated below.



The two BBNA devices form a high-speed data tunnel between them by combining all access resources. To illustrate, suppose the enterprise has a DS3 connection that provides the business with a symmetric 45Mbps pipe to the Internet. This 45Mbps pipe is in the form of an Ethernet connection that is plugged into a WAN port of a BBNA device. At the branch office, suppose four ADSL lines are plugged into the WAN ports of the BBNA device installed there. Suppose each of the ADSL lines provides a 6Mbps pipe in the downlink direction and a 768kbps pipe in the uplink direction.

***Example: 24Mbps/3Mbps between Main office and branch office***

In this example, the four ADSL lines provide an aggregate capacity of 3Mbps (4 x 768Kbps) in the uplink direction. These lines are in fact aggregated by the BBNA device, and provide a 3Mbps pipe from the branch office to the main office. From the main office to the Internet there is 45Mbps connection, and from the Internet to the branch office there is an aggregate capacity of 24Mbps. In summary, the two BBNA devices create an asymmetric pipe between the main office and the branch office, which has a capacity of 24Mbps from the main office to the branch office, and a capacity of 3Mbps from the branch office to the main office.

***High Speed general Internet access at the branch office is a side benefit: 24Mbps / 3Mbps***

If desired, the branch office can use the 24Mbps/3Mbps pipe that connects it to the main office for general Internet access. On the other hand, the BBNA device at the office can leverage the 24Mbps aggregate download capacity for HTTP downloads directly rather than being routed through the main office. Thus, the users at the branch office facility can enjoy an Internet access with downloads up to 24Mbps and upload speeds of up to 3Mbps.

***Quick Return on Investment***

Compared to the approach of using a T1 line or a bonded T1 line, Mushroom Network's VLL solution provided by the TRUFFLE BBNA can save a business several hundred dollars per month. For example, a typical price for bonded T1 service is \$800 per month. Rather than using bonded T1, which has a throughput of 3Mbps in each direction, the business can use two TRUFFLE BBNAs and four 6Mbps/768kbps DSL lines. This provides the branch office with a faster 24Mbps/3Mbps data connection to the main office at a fraction of the cost. A typical price for business DSL is \$50 per month, so the cost of four DSL lines is approximately \$200 per month. This results in a savings of \$600 per month, a 75% savings on monthly fees.

Similarly, consider the case where a T1 line is used, which typically costs around \$400 per month. Instead, this could be replaced by 2 DSL lines resulting in a savings of approximately \$300 per month.

These calculations do not factor in the added value of high speed general Internet access at the branch office that is enabled by Mushroom Network's VLL solution. In the example above, a 24Mbps down / 3 Mbps up Internet access service is provided at a cost of \$200 per month. Nor do these calculations take into account that the VLL solution can provide more reliable service than otherwise possible, by combining different types of services from different carriers.

***Plug and play installation at branch office***

In situations where the branch office has an existing local network with a single WAN connection, the BBNA can be installed without any modification to the existing network,

including assignment of IP addresses and firewall configuration. This makes the installation of the VLL solution very fast, with minimal down time of an operational network during the installation process.

### ***Advanced Router Features***

The TRUFFLE BBNA has advanced features, which can be optionally enabled at no additional cost. A notable feature is the ***VOIP quality module***, to control congestion from inbound traffic to control QoS for real-time applications. Many company network administrators currently provision dedicated access lines that only carry VoIP traffic, to prevent QoS degradation. The VOIP module present on the TRUFFLE enables user defined rate limiting of non-real-time traffic so that real-time traffic, such as VOIP traffic, does not suffer unacceptable QoS degradation due to non-real-time traffic, for example video downloads.

The TRUFFLE includes a full function stateful ***firewall***, which can optionally be enabled. Flows can be defined by source IP address, destination IP address, source port, and destination port, and protocol number, and each such flow can be selectively blocked (outgoing) or selectively un-blocked (incoming).

The BBNA can be easily configured so that traffic to certain external public IP addresses and ports numbers can be forwarded to local servers and hosts with internal private IP addresses and ports, a feature called ***port forwarding***.

A ***DMZ*** feature is included so that all incoming traffic not matching certain criteria are sent to a “DMZ” server, to facilitate advanced security.

The TRUFFLE also supports a feature called ***Interface binding***, which allows an operator control to pin down certain types of traffic to a particular interface during normal conditions. This allows the operator maximum flexibility for configuring the BBNA for operation in many application environments.

The TRUFFLE BBNA can be configured to automatically send out ***email alarm messages*** after critical events. The BBNA is easily managed through an easy to use web-based graphical user interface, which can either be accessed locally, or remotely, via a password. SNMP support is included (MIB 2, read-only).

### ***Conclusion***

The TRUFFLE BBNA provides a unique fast, reliable and inexpensive data connectivity between the main office of an enterprise with its branch offices, by bonding low cost asynchronous transport technologies, such as DSL or cable. Compared to the alternative of using a T1 line or bonded T1 line, the VLL solution can save an enterprise several hundred dollars per month per branch office. As an added benefit, reliable general Internet access can be provided for the branch office through the Internet connection at the main office.