

## Sharedband Technology Briefing

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### Introduction

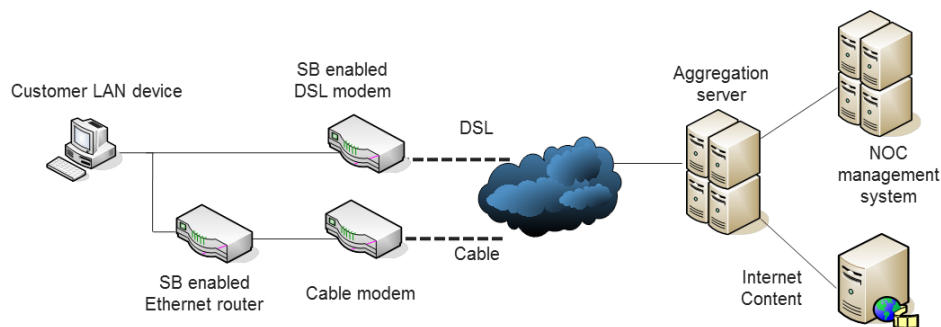
Sharedband seamlessly combines the upstream and downstream capacities of multiple Broadband connections to form a faster virtual Broadband connection. Taking lines from different service providers and different underlying access technologies (DSL, leased line / T1, cable, 4G) can enhance resilience as there is no longer a single line point of failure. Sharedband have deployed a managed service across North America and Europe (see map); end customers can purchase directly via the web, through a rapidly expanding network of resellers who white-label the service or via a larger reseller / ISP who deploy and operate their own Sharedband service. Sharedband's focus is on developing indirect channels to market.



### Architecture

There are 3 components in the Sharedband architecture; customer routers, aggregation servers and NOC.

Each Broadband connection requires a low-cost Sharedband enabled router be installed which are interconnected via Ethernet and collaborate to combine their Internet connections, just like peer to peer. Outgoing traffic is split across the lines and sent to an Aggregation Server (AS) which in turn sends the packets to their intended destination. Returning traffic is received by the AS then likewise split across the lines and re-constituted at the routers. The NOC is a web management system allowing ASs and customers to be managed.



Like technologies such as Skype, Sharedband has been designed to work across almost any type of network type (including MPLS). Provided the WAN connection on a Sharedband router can send / receive IP packets to the AS's IP address it will work as Sharedband acts like any other device using that Internet connection.

### Routers

Sharedband does not manufacture devices; rather it ports its software to commonly available routers and modems from the likes of D-Link, Netgear and Linksys. The advantages are (i) no single point of failure if a router fails (ii) no supply chain issues that are common with niche products (iii) very low cost hardware (iv) expandable - add another line and router for more capacity. Sharedband's software can be ported to most Linux based devices and is currently ported onto various Ethernet routers, DSL modems and wireless modems.

### **Virtual Router**

Customer routers collaborate and elect one to become the lead (virtual) router; taking responsibility for the virtual router IP address (e.g. 192.168.3.250) which all LAN devices configure as the default gateway and DNS. This makes deployment simple as devices on the LAN don't need to be aware of multiple Sharedband routers. If the virtual router hardware fails, one of the remaining routers will quickly take responsibility.

### **Dealing with different line characteristics**

Sharedband looks at individual line performance in real-time and adjusts how much traffic it sends down each to ensure the best customer experience. Where line latencies fluctuate or are different, Sharedband's packet re-sequencing technology places downstream packets back into the original order in real-time. In environments where the latency of a line is very high (such as 3G) it is recommended that these lines are placed in failover mode, whereby traffic will only be sent over that line when no other lines are available.

### **IP addressing**

Each customer site is issued 1 or more IP address at the AS and can be configured in 3 ways (i) *NAT mode* allows multiple LAN devices to share a single public IP (ii) *Routed mode* whereby an IP block, up to a /24, can be routed down to the LAN allowing LAN devices to have full public IP addresses (iii) *Fixed IP mode* whereby a public IP address is mapped down to a specific device on the LAN. In NAT mode individual ports and protocols can be mapped down to specific LAN devices. It is the public IP addresses on the AS that customers will need to specify as their mail server, web server or VPN end point IP address.

### **Management**

There are 3 levels of management on the Sharedband NOC; *admin* for managing customers and ASs which the Sharedband service provider will have access to, *reseller* which allows third parties such as VARs to manage and support their own customers (including remote firmware upgrade) in a secure environment, and *customer* whereby end customers can see real-time information on their Sharedband deployment. The customer web portal allows router status, router configuration, line latencies, line speeds, packet loss and up-time statistics from anywhere. IP address and port / protocol forwarding can also be controlled via the customer portal.

### **Aggregation Servers**

Sharedband's NOC and AS software installs on an x86 server running Debian 5.0 or above; no specific hardware is required. When using multi-core CPUs we recommend using VMWare ESXi to run one AS instance per core. This approach reduces costs and can allow very high customer densities to be achieved in a single rack (in excess of 1M lines). In the event that the hardware running an AS fails, the NOC will detect and quickly issue another AS instance with details so it can take over handling of the affected customers.

### **Sharedband versus load balancing**

A number of load balancing solutions are available on the market, allowing multiple Broadband connections to be combined. They typically balance sessions, whereby one of the lines is selected to download or upload a particular file, the next download uses the next line etc. Where customers only have small outgoing traffic transactions such as web usage, this is a great solution however where a single task (session) requires the full capacity of all lines, a true bonding solution such as Sharedband is required. Because each line will have a different IP address, incoming services such as VPNs, mail servers, web servers will need to be configured to switch between lines using DNS record updates or manually re-configure devices, in event of a failure.