



ALWAYS ONLINE WHEREVER AND WHENEVER NEEDED

EXECUTIVE SUMMARY

Today's business applications require 100% uptime driven by cloud computing, machine-to-machine interaction, voice and video communications, and the digital transformation of nearly all business processes. Business customers often rely on one service provider offering with a given service level agreement which determines bandwidth, availability, and reach. Unfortunately, like in real life, one size doesn't fit all business requirements. This is where Viprinet's WAN bonding technology comes in. Viprinet's WAN bonding architecture allows you to bond several physical links into one virtual high-speed connection which is virtually always on, which provides you the sum of all upstream and downstream bandwidths combined, and which provides high security due to the fact that single packets are fragmented across different provider networks.

INTRODUCTION

All businesses today have a common set of requirements: They need highly available connectivity with more and more bandwidth, highly secured to protect all business transactions and intellectual property in a cost-effective way. The reality, however, is very different. Customers often don't get the availability, reach, security, and bandwidth they need.

Bandwidth is determined by the service provider's infrastructure (e.g. copper or fiber) and services which they built on top of it. These services define the granularity and scale at which their connections' bandwidths can be fine tuned for the need of the customer. This is often dictated by standards such as SDSL, ADSL, VDSL, or SDH, so there is not a lot of granularity and scale. Each upgrade in bandwidth entails an upgrade in price, too.

Availability is defined by the overall redundancy of the system regarding access, distribution, and core networks. Redundancy has many building blocks such as power, link and hardware redundancy. The higher the availability requirement for a given link is, the higher the associated cost and complexity involved in delivering this service will be.

One common requirement is also reach. You need connectivity in places where there's only limited infrastructure (e.g. rural areas), no wired infrastructure at all, or only very limited wireless coverage. This is often true for businesses from the retail, finance, and governmental sector which operate their offices and stores as close to the citizen as possible.

In 2013, the world learnt that communication links couldn't be trusted anymore. Service provider networks are tapped by government agencies and virtually any communication worldwide can be intercepted. The world of trust turned into a world of distrust.

In summary, businesses are highly dependent on a service provider's offerings which serve the majority of customers but don't cater for individual needs in terms of bandwidth, reach, availability, and security.

SEVERAL APPROACHES

For meeting these demands, outage risks have to be spread across different service providers, access technologies, and backbone infrastructures. For this, there are several approaches: load balancing, performance-based routing and WAN bonding.

1. Load Balancing

With load balancing, you can balance your traffic across different network technologies. Thus, applications are distributed (e.g. in a round-robin approach) across different links, thereby utilizing the bandwidth of the individual links in parallel. So, application one travels on link one, application two on link two, and so on.

This approach has several shortcomings:

- The applications can only access the bandwidth of an individual link but not the sum of all links.
- If a link goes down, all applications which were transmitting data across the link are impacted.
- If a connection's quality gradually decreases (e.g. increase in latency or packet loss), it is impossible to route the application (e.g. IP telephony or SIP trunking) across a different link.

2. Performance-based Routing

Performance-based routing lets you transmit applications based on different criteria across parallel network infrastructures. These criteria include response time, packet loss, jitter, mean opinion score (MOS), availability, traffic load, and cost policies. It leverages regular routing protocols such as BGP, OSPF, and EIGRP. This technology is superior to load balancing since it takes into consideration the specific needs of the applications. Therefore, the technology is very CPU intensive and requires mid- to high-end router platforms.

Challenges of this technology are:

- The applications can only access the bandwidth of an individual link but not the sum of all links.
- If a link goes down, all applications which were transmitting data across the link are impacted – it takes some seconds to recover and start retransmitting the data across a different link.
- If a connection's quality gradually decreases (e.g. increase in latency or packet loss), it is impossible to route the application (e.g. IP telephony or SIP trunking) across a different link.

3. WAN Bonding

WAN bonding takes a very different approach: It creates a virtual high-speed connection based on a number of individual physical links. This means, all WAN links available are combined to form one high-speed connection which provides the sum of all individual bandwidths either for only a single (e.g. video conferencing, streaming, backup) or for several applications. With WAN bonding, you have several options such as bonding or latency based routing, depending on the unique needs of applications. The beauty of WAN bonding is that even if a connection goes down or the quality decreases, the router automatically transmits potentially lost packets over a different link.

The benefits of WAN bonding are:

- Full bandwidth available even for single applications
- Hardly any packet loss even in the most difficult application environments (e.g. live broadcasting from moving vehicles)
- Mix and match of different technologies to create 100% uptime by distributing the outage risk
- No loss of connectivity for an application if a link goes down as long as at least one link remains
- High level of security since packets are fragmented and sent across different links. Therefore, it is almost impossible to intercept several provider networks and correlate the fragments in order to rebuild the IP packet.

Viprinet is the inventor of WAN bonding and approved patents both in Europe and the US. Customers testify the high quality of our WAN bonding approach across different wireless and wired technologies, which delivers up to 100% uptime, sufficient cost-effective bandwidth, and high security.

Other companies also call their solution WAN bonding. But only Viprinet provides all of the functions that come with real aggregation of all available WAN links:

- Provision of the full summed-up bandwidth of all individual links
- Mixing technologies which have very different latencies (e.g. wired and wireless) since the Viprinet solution can differentiate between late and lost packets, leading to great performance (bandwidth, latency). Other solutions cannot differentiate and are thus creating re-transmissions which impacts performance.
- Built-in modems which gives you one device to manage with full insight into the quality of all links. With other solutions, you have to manage and troubleshoot N+1 devices in case of failure (N equals the number of links).
- Bonding diversity which enables packets to be sent across different links in parallel. This diversity enables the best latency – even under quickly changing environments – and eliminates packet loss.

- Investment protection because Viprinet’s solution is built upon hot-pluggable modules. You can simply swap one newer module for an older one (e.g. VDSL against ADSL) without any major forklift upgrade or replacement of your router.
- Highest level of security since Viprinet takes one packet, fragments it and transmits the fragments across different links. Therefore, it’s nearly impossible to reconstruct the IP packet without tapping different provider networks and correlating the data.

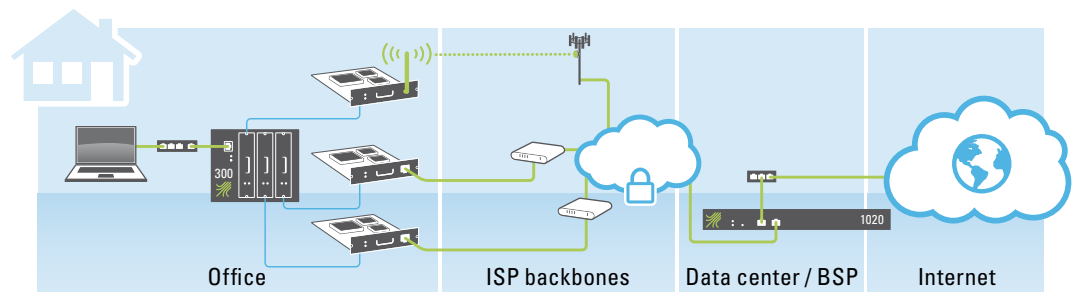
THE INNER WORKINGS OF VIPRINET

The Multichannel VPN Router is the core of the Viprinet technology. With this device, several broadband lines can be combined into a single, highly available joint line. Unlike load balancing which can only distribute load to several WAN links, real bonding of all connections available is realized here. Viprinet can combine all different types of access media, for instance, ADSL, SDSL, 3G/UMTS/HSPA+, or 4G/LTE. The LAN sees these connections as one single line providing the accumulated up- and downstream of the different links – even for single downloads.

The remote station (Hub) principle

Viprinet uses an exceptional VPN tunnel technique with a star topology for secure and fast site, facility, and vehicle connectivity. For this purpose, the integration of two different devices is needed:

- A Multichannel VPN Router establishes an encrypted VPN tunnel to a single central remote station, the Multichannel VPN Hub, via each Internet line available. These VPN tunnels are then bonded into one tunnel through which the data is transferred.
- The Multichannel VPN Hub is usually located in a highly reliable data center and acts as an exchange: Data targeted at another company site will be forwarded through the respective VPN tunnel; data targeted at the public Internet will be decrypted and forwarded to its destination. The VPN Hub provides secure and quick communication between different Multichannel VPN Routers but it also serves as pivotal exchange point between the encrypted VPN and the public Internet.



Viprinet customers have the highest requirements in terms of availability, bandwidth, and reach. Our solution is used to provide retail stores with 100% uptime, to enable 2-way audio broad-

casts in moving vehicles over several hours without any packet loss, to enable law-enforcement agencies to establish Internet connectivity at the point of need, to enable 100% uptime for cloud services, to achieve very reliable Internet connectivity over highly unstable links in high-speed trains and in many more scenarios. Viprinet delivers the connectivity, availability, and resiliency our customers count on.

BENEFITS FOR VIPRINET CUSTOMERS

- **Availability**

A retail customer migrated to Viprinet. They have realized 100% uptime over 18 months across 120 stores by leveraging a combination of DSL and 4G/LTE. This compares to 37 outages per year with the previous solution. A broadcaster has been transmitting 2-way audio from a moving bus over 30 hours across a territory of 50 square miles without losing more than 33 data packets.
- **Coverage**

Previously, customers had to rely on one service provider coverage. Today, they can rely on the combined coverage of many service providers, their SLAs and bandwidths. This enables communication even in the most remote areas.
- **Bandwidth**

Customers have realized 12 times the bandwidth at the same cost of previous solutions. By combining different providers, they could increase their bandwidth as well as availability significantly.
- **Cost**

Customers can realize cost efficiencies by leveraging consumer offerings instead of business offerings (e.g consumer DSL vs. SDSL lines) and at the same time improving the availability as well as bandwidth of their networks.
- **Flexibility**

Broadcasters have been utilizing satellite for transmission of audio and video signals and data traffic for the Internet. Today, they can send and receive wherever they are via 3G/4G bonding, even in moving vehicles and even without having line of sight.
- **Security**

Law enforcement agencies and mission-critical infrastructure providers trust Viprinet's technology which enables the fragmentation of one IP packet across different provider networks making it nearly impossible to compromise data.

CONCLUSION

In order to meet their connectivity demands, Viprinet customers take a very unique approach: They are able to bond various access technologies into one high-speed connection. This allows them to distribute their outage risk across different access technologies, different service providers, and different backbone infrastructures. And since Viprinet provides a virtual leased line out of several network links, users don't even notice the failure of one or even several links.

With Viprinet, you can connect your remote offices primarily with two wired access technologies like DSL and cable via two providers, and have a third provider supply a seamless upstream booster and seamless backup via 3G or 4G. This will allow you to achieve

- cost-effective 100% uptime for your offices
- with higher bandwidth
- in a secure fashion
- at a reasonable price.

GET STARTED TODAY!

We encourage you to prepare for the Viprinet way. You should go ahead and analyze your current availability and cost. Then take a look at your future bandwidth and availability requirements, and imagine what the bonding of different access technologies can do for you. With this data available, we'll be happy to sit down with you and create a strategy for more bandwidth, higher uptime, and less cost.