Intelligent Routing Platform

WHITE PAPER

Bring Intelligence to your Network
# Table of Contents

1. Executive Summary ................................................................. 3
2. The Challenge of a Multi-Homed Environment .......................... 4
3. Network Congestion and Blackouts .......................................... 4
4. Intelligent Routing Platform ..................................................... 5
   4.1 How It Works .......................................................................... 5
   4.2 Performance Improvements ................................................. 6
   4.3 Inbound Transit Traffic Optimization ..................................... 6
   4.4 Cost Improvements ............................................................. 7
   4.5 Commit Control ................................................................. 7
   4.6 Inbound Commit Control ...................................................... 8
   4.7 BMP Support ..................................................................... 8
   4.8 Circuit Issues Detection ....................................................... 9
   4.9 Comprehensive Analytics .................................................. 9
5. Conclusion .............................................................................. 10
6. About Noction ...................................................................... 10
1. Executive Summary

Service Providers as well as Enterprises deploying demanding, mission-critical applications, such as e-commerce, VoIP and media streaming across IP networks are facing unique networking challenges; customer demand for 100% network uptime, the potential negative economic impact from misrouting multiple gigabits of traffic, the low latency requirement and the complexity of configuration.

The Internet is a huge mesh of networks, which are interconnected by routers running BGP. Typically routers have multiple paths to the same destination. BGP calculates the best path by applying a complex algorithm. However, that algorithm doesn’t take into consideration any network performance and cost metrics, often routing traffic by congested or expensive paths. BGP chooses routes with the fewest number of networks to transit through.

Network administrators are trying to deal with these problems by adding additional providers, reactively creating and applying routing policies, and rerouting the traffic manually. This requires additional engineering time to be spent. Multi-homing avoids downtime by providing redundancy; however it does not address congestion-related problems that occur in the “middle-mile” backbone networks linking the Service Providers and Enterprises to end-users.

Noction IRP operates at the network edge and analyses traffic in order to detect network congestion and blackouts. The affected network routes are probed for a set of specific metrics such as latency and packet loss through all the available providers in order to reroute traffic to the best performing path. Additionally, IRP significantly reduces bandwidth bills by distributing outbound content flows over the less expensive provider links, while maintaining predictable traffic delivery performance.

The Intelligent Routing Platform adds intelligence to multi-homed routing decisions. It leverages the company’s existing infrastructure to deliver substantial network performance improvements, optimization of existing Internet connectivity and reduces the cost of operating the network. Noction IRP delivers these benefits in a painless and affordable way; improving network performance by 30-50%, reducing network latency by up to 50% and increasing network availability to 100%.
2. The Challenge of a Multi-Homed Environment

The performance and stability of the network is crucial to a Service Providers’ customers. Therefore the network should be intolerant to disruptions or outages, which may damage the company’s reputation and market position, or even have an irreversible effect on the business. Network architects can no longer mitigate risks by simply implementing the practice of over-engineering. They must instead deploy unique solutions, which are based on more intelligent routing versus brute force spending on resources.

Multi-homing (connecting to multiple providers), has become as necessary to Service Provider environments as the use of redundant power sources or multiple data centers. No business can afford prolonged outages. The first, and surprisingly the most effective way to maximize uptime, is through a sane and robust BGP implementation to multiple transit providers.

BGP utilizes a set of Autonomous System (AS) numbers that are assigned to individual networks or relatively large network segments. The assumption made by BGP is that for any given path, the route transiting the least number of ASes is preferable. In addition to these metrics, BGP4 allows administrators to define static path preferences using weights, local preferences and MEDs.

Unfortunately, BGP has no capability to discover any performance characteristics other than the number of ASes to be transited for a specific path. From the perspective of network performance, BGP routing information is largely based on the ASes the traffic has to pass through and manually configured static preferences. Thus performance metrics such as packet loss, latency, throughput, link capacity and congestion, historical reliability and other business characteristics are not addressed by this protocol. BGP lacks the ability to actively discover any of these characteristics; it therefore has no ability to make routing decisions based on them.

3. Network Congestion and Blackouts

Many network architects look at BGP as a way to failover from one possible path to a destination, to another candidate path to that destination in the event of an upstream failure.

Since BGP is focused on reachability and its own stability, traffic may only be rerouted due to hard failures or administrative policy changes. Only hard failures and total losses of reachability are classed as a cause to reroute, which means degradation isn’t taken into account. This means that even though the service may be so degraded that it is unusable for an end user, BGP will continue to assert that a degraded route is valid until and unless the route is invalidated by a total lack of reachability. BGP, as a dynamic routing protocol, is essentially reactive only in cases of total failure.

Network performance remains unpredictable as a result of network congestion and blackouts.
4. Intelligent Routing Platform

4.1 How It Works

When embed in a network, IRP gets a complete or partial copy of the traffic from port mirroring or a Netflow/Sflow feed from the router (depending on the mode it was configured to operate). IRP then passively analyses the traffic for specific network anomalies and actively measures relevant prefixes for packet loss, latency and jitter. The platform gathers these metrics by issuing active probing through all available provider links. It sends this actively gathered data to the platform Core, which computes a performance or a cost-improved routing policy for the network. The Noction IRP BGPd then announces the improved route to the networks’ edge routers via a typical BGP session.

IRP is non-intrusive and sits outside of the data path, so there is no possibility that it will impact network throughput or performance. If IRP gets turned off or fails, the routers will fall back to the standard BGP routes received from the providers. The platform can also operate in a BGP non-intrusive mode, where it only runs active probes, gathers data and reports on potential improvements, without applying them.
4. Intelligent Routing Platform

4.2 Performance Improvements

Noction IRP allows engineers to have a proactive approach with avoiding routing anomalies. An engineer trying to manually determine the best path must find a way to gather network performance data to thousands of destinations, and then perform a complex analysis to decide which of the multiple paths is the best. The engineer must repeat the process continuously, each time performing a difficult, error-prone router reconfiguration. Eventually, human errors during configuration processes may lead to painful network outages.

Noction comes with a proactive performance-based approach to routing decision making. IRP automatically determines which traffic needs to be rerouted, evaluates alternative routes based on metrics such as packet loss and latency, and then announces the best paths to the router. As a result, Noction IRP delivers optimized performance and enhanced service availability.

4.3 Inbound Transit Traffic Optimization

IRP has the ability to optimize inbound transit traffic by manipulating BGP advertisements for different upstream providers, thus influencing the selection of routes on the Internet and shaping the transit traffic entering the network. The feature allows for optimal control of the inbound transit traffic. It safeguards networks from incurring higher bandwidth prices at peak times by automatically distributing the load to alternative routes. The inbound solution allows a granular bandwidth management for customer-owned and transit prefixes.

Important options for the Inbound feature are:
4. Intelligent Routing Platform

4.4 Cost Improvements

IRP adds the ability to generate massive cost savings by intelligently leveraging inexpensive transit providers whenever possible, and more expensive operators only as necessary, to meet the application performance requirements, therefore driving down the overall bandwidth rate.

The cost delta between an expensive and a cheap provider may reach considerable levels. When multiplied by many Gbps of traffic, the cost savings could amount to millions of dollars in a single year.

The ability to tailor the cost and performance of an ISP to individual applications provides a unique competitive advantage for any company.

4.5 Commit Control

Actual providers rarely price bandwidth at a simple flat rate. A common pricing model is to offer tiered levels of bandwidth, with a minimum commitment and a higher burstable amount. Thus, companies pay the same amount regardless of usage up to a certain point, beyond which they would incur higher bandwidth prices at peak times. Burstable pricing means that transit costs are related to the amount of bandwidth a customer is actually using relative to its contract with the provider.

Noction IRP addresses this by incorporating billing structures into its policy models; the platform can then adjust and keep predefined bandwidth commit levels, for each provider connection.
4. Intelligent Routing Platform

4.6 Inbound Commit Control

Inbound bandwidth control reshapes the amount of traffic from different providers targeting your sub-prefixes.

IRP uses well known and proven BGP mechanisms to instruct your routers to adjust their advertisements of your network segments to upstream providers and subsequently to the World. The adjusted advertisements take advantage of existing BGP policies implemented by edge routers worldwide in order to increase or decrease the preference of your internal network segments as advertised by one or another AS to the world. This allows more traffic to lean towards some of your upstream providers and less towards others. In case of an incident that your multi-homed configuration is designed to be resilient against, the entire world still knows of the alternative routes towards your network and will be able to adjust accordingly.

4.7 BMP Support

IRP includes the BMP monitoring station, which can be used to collect data, diagnose and report the state of the BGP sessions between edge routers and providers, as well as network reachability through a specific provider. The BMP monitoring station supplies detailed routing data to other IRP components for even more intelligent decisions to be made. There are many benefits with passing BMP data to IRP:

- Possibility for IRP to evaluate and identify the best candidates among peers advertising both active and inactive routes on an Internet Exchange.
- IRP’s ability to revisit previously performed probes and improvements each time a route changes for active and inactive routes.
- Ability for IRP to maintain the supplied routes of partial providers in real time.
- Reduction of CPU overhead on routers in case of large queries, especially on those servicing very large IXs.
- Redundant and precise reconstruction of AS Path, as BMP allows this BGP attribute to be retrieved from actual (inactive) routes received from neighbors. This allows IRP to make even more accurate iBGP announcements when making improvements.
- The monitored router (supporting BMP) establishes a TCP connection and communicates with the IRP BMP monitoring station, which continuously listens and accepts fresh routing data as it becomes available.
4. Intelligent Routing Platform

4.8 Circuit Issues Detection

Circuit Issues Detection feature allows IRP to automatically disconnect a BGP session with a provider suffering from excessive levels of packet loss, after taking into account configurable preferences and rules set by network administrators.

Once the feature is enabled for a specific provider, IRP uses past probing data to detect when it starts to suffer from excessive levels of packet loss. To determine excessive loss IRP precisely compares a provider's average loss over an immediate past time horizon, number of probes and average loss difference from the other providers.

When a circuit issue is detected, IRP raises alerts that network engineers or an external network management systems can act upon. Moreover, it can be configured to automatically drop BGP sessions with the providers that suffer from excessive packet loss, further monitor the providers and restore BGP sessions.

4.9 Comprehensive Analytics

IRP reporting deepens the visibility of network performance and costs from a single command and control console. It provides real-time and historical insights into all network performance and traffic engineering activity. The platform can run in a non-intrusive mode exercising and reporting all measurements and potential improvements, without impacting the network. Therefore administrators can observe the potential benefits of running IRP without implementing any actual changes to the network.
5. Conclusion

Business competitiveness depends heavily on reliable internet connectivity, optimized network performance, consistency of throughput and quick troubleshooting. Multiple internet connections offer redundancy, but nothing more than that. BGP routing doesn’t consider latency, packet loss, or congestion when making routing decisions. Instead, the routes are selected based on reducing the number of networks that packets have to transit through on their way to the destination, regardless of performance.

Noction comes with an intelligent approach to routing. The Intelligent Routing Platform evaluates the performance of each available routing path and automatically chooses the best-performing one based on pre-defined performance and cost policies.

6. About Noction

Noction is a privately funded technology company with offices in the US, Europe and Asia. Founded in 2011, Noction is providing cutting edge network intelligence technologies, enabling enterprises to take full advantage of maximum network performance for business-critical applications such as e-commerce, VoIP and media streaming across IP networks.

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