Globalinternet

# Understanding Internet for SD-WAN & Cloud.

A whitepaper by Globalinternet.

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## Understanding internet for SD-WAN & Cloud.

# Introduction.

The best performing and best value enterprise network solution in 2020 is a combination of Internet, SD-WAN & Cloud – which isn't to say that achieving the desired outcomes is straightforward or that any combination or deployment of these will be a success.

In this whitepaper we discuss the critical role of the internet underlay, how to understand the options available, and how to make great choices that reflect and respond to your business needs.

# Understanding the role of the internet underlay.

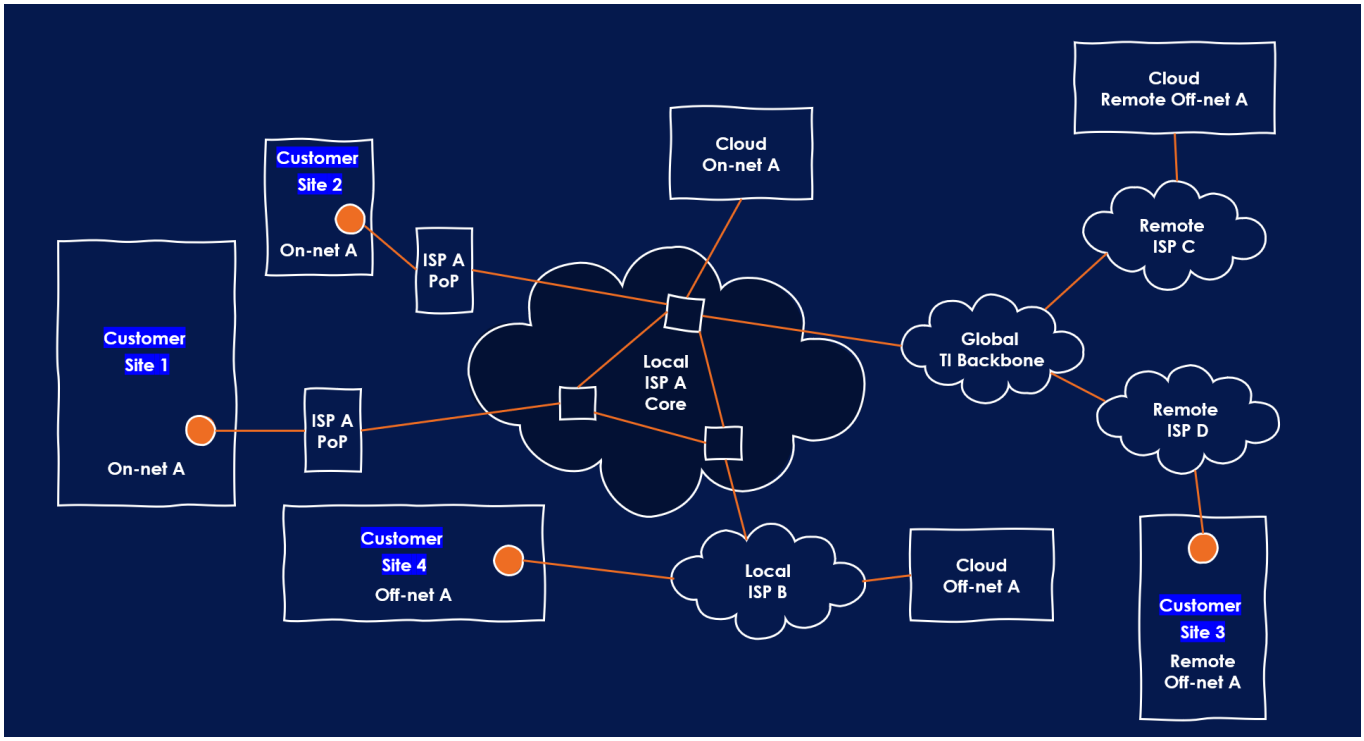
First, it's important to understand that there is no single 'internet' - the internet comprises thousands of interconnected networks operated by private and public organisations. These networks all operate to a set of internet standards so they can work together – but the performance and experience you will achieve for your specific business applications depends on many factors including:

- How you connect to the internet (the access technology).
- The scope, scale and quality of the specific local internet you connect to.
- The on-net connectivity of the local internet you have connected to (will you have direct access to e.g. local Microsoft Azure & AWS cloud).
- What connections your selected local internet has to the wider internet.
- The competence and responsiveness of the local internet provider.

SD-WAN solutions offer great options to optimise the performance of the connections you make towards

the cloud – but fundamentally, cannot overcome weaknesses made in the selection or deployment of the internet underlay itself.

**Simple schematic of an internet network.**



# Understanding what can go wrong so you can get it right.

## Service deliverability:

We will discuss internet access types below, but one of the key points to immediately highlight is that of **access type availability** – that is: can the service desired actually be delivered at a specific site? This is especially relevant for broadband type internet access where the very low price points are only enabled by high consumer demand.

The telcos build the infrastructure to match this. This means that whilst fast broadband might be suitable for many business sites and applications, it is often not available to order.

Locations that will encounter this challenge include high streets, business parks and remote (from housing) locations. This situation is improving year-on-year but the availability of fast fibre-based broadband remains a major challenge.

## Variability in bandwidth throughput:

A key— and less favourable—difference in internet solutions vs legacy enterprise network solutions is the variability in network performance, either as

bandwidth throughput or latency/packet loss (which we will discuss soon).

Bandwidth throughput varies from the following dimensions:

- **Contention (sharing) of the access line:** Typically this applies only to broadband where the overall access network bandwidth is shared across many users – mostly consumers. The busy period in internet is almost always in the evenings when the network is being utilised heavily for TV and gaming entertainment – analysis of peaks from business usage (such as home working in the 2020 COVID-19 crisis) shows peak utilisation at less than 50% of the evening consumer peak.
- **Congestion of the local internet core network:** With scale ISPs this is rare and is most likely to occur at times of major network incidents (faults). In fact, major telcos generally use the same core IP network for MPLS, 4/5G and for internet – with internet services shown by analysis to perform, at least, as well as MPLS across the core.
- **Congestion of gateways from the local to the wider internet:** This is probably the single most challenging area and needs to be understood during the design process of the Internet – SDWAN – Cloud solution. One option is to source from a tier 1* internet carrier as this ensures your traffic has to traverse the minimum number of networks and gateways.

** By tier 1, we mean the standard definition of an organisation that provides the backbone connectivity of the internet by peering with other tier 1s – connecting ISPs to ISPs. The term "Tier 1" is also sometimes used to refer to scale local ISPs – however there is no formally accepted definition of what this is or means.*

However, this brings its own problems, notably performance at a local level is highly likely to be compromised with higher latency & poor true-local on-net connectivity, plus a major cost increase over well sourced local internet. The most effective and efficient way to solve this challenge is at the design stage: understanding traffic patterns and careful selection of local internet access partners.

Additionally, middle-mile solutions are available that can fully remove this dependency/risk – as we will discuss below.

## Latency & packet loss:

Latency & packet loss principally occur on internet networks as a consequence of traversing multiple networks and passing through interconnection gateways that can become congested. BGP controls the flow between & across networks but, as a protocol, it does not manage the quality of the service. As with bandwidth congestion the solution to overcoming this is a good understanding of the required network paths and selection of internet services to match.

Middle mile solutions here in particular can be highly effective delivering MPLS-like global stability & predictability for internet traffic flows – but at 'internet pricing'. Middle mile services are available as stand-alone services and have also been integrated into a

number of SD-WAN and Cloud solution platforms.

## Break-fix repair:

There is one key factor with internet products that has nothing to do with the product technically or the quality of the network itself: the break-fix service wrap.

This is the response you will receive from the ISP in the event that an incident occurs. Providing helpdesk & field engineers that can respond to your needs is expensive for the provider – *very* expensive – and so it is common to see a range of service options. Often these will be matched to the product type, so business specific services like DIA will likely attract a higher level of response as standard, whilst broadband services will normally come with a lower level of standard response. Both DIA and broadband will often come with service level options though, and in the case of broadband, this can drive the price up by a factor of 2, 3—or even more. Break-fix service wrap is usually expressed in the following ways:

- **Service availability SLA:** for example 98%, 99.9%, 99.95% - this defines the average availability the ISP expects the service to be available. This will normally be over a minimum period of a month but may also be longer – up to annual.
- **Service repair SLA:** for example 4 hours, 8 hours, next business day, 3 business days or best effort.
- **Helpdesk availability:** Most services will have facility to

report incidents 24/7 – however for lower grade support this may be limited to automated portal interactions outside of local business hours.

- **Active response hours:** Even if the ISP will receive incidents 24/7, their active response to this will vary by service type – with the highest grade services getting immediate attention & others getting only business-hours response, or even a non-committal response for some consumer type options.

It is very important to understand though that what can go wrong here has two dimensions:

- *Under-specifying break-fix service levels vs business needs* will result in major trauma when incidents occur and the purchased response does not meet operational needs & expectations of your business.
- *Over-specifying break-fix service levels vs business needs* will result in an inflated cost base that will dilute the business case vs needs.

**Careful and balanced decision-making is needed in the light of what options are available, what real-life performance is likely to be achieved and what cost options there are.**

# Understanding & making good internet access selections.

Many different types of internet are available around the world. However, these can also be split into two distinct types **DIA & Broadband**. Selection between these is critical to achieve the right balanced combination of cost and performance vs your business objectives.

**Dedicated Internet Access:** As the name implies, these services (often known simply as DIA) offer a path to the internet that is dedicated to the customer that has bought it and will not be compromised by high usage of other business or consumer users. These services are also almost always symmetrical – offering the same speed uploading and downloading to/from the internet. So a 100M DIA service will always deliver 100M upstream and 100M downstream to the local internet PoP. The local internet PoP connection will also be dimensioned such that the customer is able to consume the full purchased speed, into and out, of the ISPs core network.

## DIA Access Types

| Access type | Bandwidth | Pros & Cons |
|---|---|---|
| **Fibre – Dedicated (ethernet or optical)** | Up to 10G | **(+)** Any speed up to 10G<br>**(+)** Most reliable option<br>**(+)** Options for diverse routing<br>**(-)** Higher cost than broadband options<br>**(-)** If not near-net or on-net build costs can be very high |
| **Copper – Leased line** | 1.5/2M | **(+)** Near ubiquitous availability (but being withdrawn)<br>**(-)** Limited bandwidth vs cost |
| **Copper – Ethernet** | Up to ~24M | **(+)** Cost effective ethernet access option<br>**(-)** Limited bandwidth, distance dependent |
| **Copper – SDSL** | Up to ~2M | **(-)** Very low speed vs typical application needs<br>**(-)** Legacy technology being phased out |
| **Fixed Wireless** | Up to 500M | **(+)** Available for otherwise hard to reach locations<br>**(-)** Performance may be weather dependent |

**Broadband Internet Access:** The term broadband derives from the early day transition from dial-up internet to first generation broadband. Whereas the frequency spectrum for dial-up was in a very narrow & audible 'band', the frequencies used on broadband were much wider and allowed far higher data flows.

Broadband internet critically differs from DIA in that it is contended, meaning bandwidth is shared across multiple lines and throughput will vary with demand placed on the network by local users. Broadband internet is also usually asymmetrical: upload speed will be lower than download speed.

**Broadband Access Types**

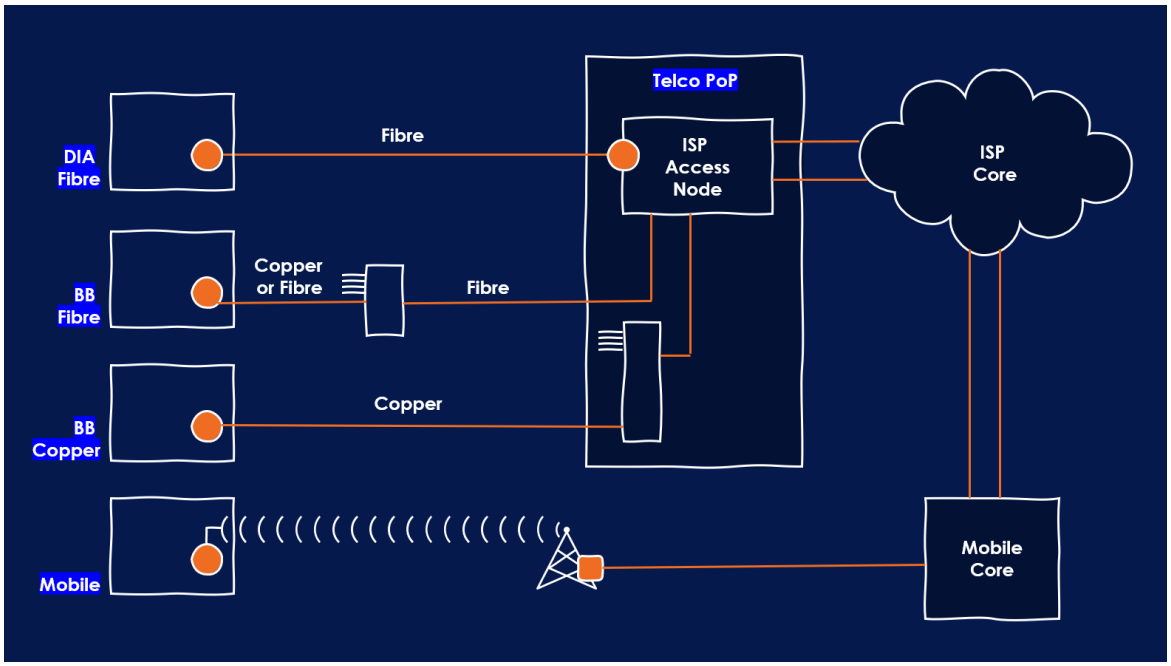
| Access type | Bandwidth | Pros & Cons |
|---|---|---|
| **Fibre – Shared**<br>**(PON)**<br>**(FTTH)**<br>**(FTTB)** | Up to 1G | **(+)** Highest speed broadband<br>**(+)** Speed is predictable – not distance dependent<br>**(+)** More reliable than old copper networks<br>**(-)** Limited availability in most countries (improving) |
| **Copper – VDSL** | Up to ~100M | **(+)** Wide availability, downstream up to ~100M (typical)<br>**(-)** Speed is heavily distance & copper quality dependant |
| **Copper – ADSL** | Up to ~16M | **(+)** Wide availability, downstream up to 16M (typical)<br>**(-)** Legacy technology starting to be phased out |
| **Cable (DOCSIS)** | Up to ~300M | **(+)** Reasonably wide availability<br>**(-)** Often limited to larger urban areas |
| **Mobile 4G** | Up to ~40M | **(+)** Wide availability<br>**(-)** Expensive for high data usage |
| **Mobile 5G** | Up to ~1G | **(+)** High future potential<br>**(-)** Very limited availability |
| **Satellite – VSAT** | Up to ~500M | **(-)** Expensive vs alternatives<br>**(-)** High latency |
| **Satellite – Low orbit** | Up to 1G | **(-)** Not yet available, unproven |

DIA and Broadband internet are available on a wide range of access technologies – each of which has key strengths and some limitations, as shown in the tables above.

## Table comparing DIA & Broadband

| | Options / attributes | DIA | Broadband |
|---|---|---|---|
| **Price** | Lowest cost | - | ✓ |
| | Higher cost | ✓ | - |
| **Bandwidth** | Low (<10M) | ✓ | ✓ |
| | Medium (>10 <100M) | ✓ | ✓ |
| | High (>100M <1G) | ✓ | ✓ (limited) |
| | Very High (1G+) | ✓ | - |
| | Symmetric/Asymmetric | Symmetric | Asymmetric |
| **Bandwidth quality** | Dedicated (1:1) | ✓ | - |
| | Shared - low contention (<4:1) | Limited options | Limited options |
| | Shared - standard contention | - | ✓ |
| | Packet loss (local internet) | Expected target ~0% | Expected target ~0% |
| | Availability | Expected target 99.9% | Expected target 99% |

## Internet Access Types



# Understanding on-net cloud connections to your internet matters.

An ever-increasing proportion of applications and data are being hosted by enterprises in public cloud facilities such as AWS, Azure & Google. Achieving best speed & quality (latency & packet loss) from your internet connections will require the cloud facilities being used to be **on-net** to your local ISP, or where applications are regionally hosted. This is for the connectivity of your local internet access to the destination cloud to be as direct as possible and scaled effectively.

**Achieving best speed & quality (latency & packet loss) from your internet connections will require the cloud facilities being used to be on-net to your local ISP, or where applications are regionally hosted.**

So the scale and on-net connectivity of your chosen ISPs matters to the performance of your internet solution – and not all ISPs are the same, so performance can be variable without knowledge and experience.

Some on-net & connectivity data will be publicly

available—however, much will not, and to understand the optimum solution requires a close and trusted relationship working with the ISPs.

It is also useful to explore, where possible, operational experience of actual performance, *especially* for more challenging regions such as China & Latin America.

Great cloud connectivity has another critical performance element in a new-generation enterprise WAN – that is for **high quality global reach**. In addition to the regular global internet routed core, the major scale cloud platforms link their cloud sites together with huge capacity links. This connectivity can enable enhanced performance to applications hosted remotely in the cloud, and can also fulfil a high-quality transit gateway function. Cloud vendors have commercial offerings for this and middle-mile solutions, such as Teridion, utilise these infrastructures to assure best performing global connectivity.

**Just keep this in mind: moving away from MPLS does not mean you need to lose quality or performance for your global connectivity.**

# Understanding how your internet is run matters.

When we move out of the (typically) Western European & North American comfort zones we find that the landscape of ISPs can be highly variable.

What passes for a 'normal' business service wrap in our own day-to-day experience may not be what is offered as standard in many global regions – and may not even be available.

When sourcing globally in particular it is necessary to pay attention to the service processes and wrap: what are the processes you will need to follow (including language and time zone), when is the ISP available for interaction, when will the ISP actively respond (e.g. rather than just accept tickets) and what will you have to provide or fulfil as part of that interaction (this can be particularly important for broadband services).

**What passes for a 'normal' business service wrap in our own day-to-day experience may not be what is offered as standard in many global regions – and may not even be available.**

# Understanding access resilience.

As a network, the internet is naturally resilient – dynamic routing ensures that connectivity is maintained irrespective of the availability of an individual route. Performance may change but connectivity will be maintained. But at the access level, if you rely on a single link, then your site connectivity is at risk. This is true, of course, both for MPLS and for internet.

**If you rely on a single link, then your site connectivity is at risk.**

What internet brings though is potential for much wider and more straightforward means of achieving resilience – so that if one connection to your site fails then you have a backup option. Or indeed, with internet and SD-WAN solutions, it is common to have two live (active-active) connections so that you get maximum performance advantage.

With businesses now critically dependent on their internet lines to be able to function, resilience has become a key topic. **Resilience means how resistant the service is to disconnection or disruption.** Virtually all core networks for broadband and DIA are built

with resilience by providers – meaning the connection from the provider's node to the wider internet is generally protected and resistant to outages from single equipment or line failures. The connection from the provider node to the customer site, however, is not normally protected – meaning that to achieve resilience multiple services are required.

The key types of resilience are outlined in the table on the next page. This is a complex area and a full discussion with a competent partner is essential to achieve your required objectives.

In addition to resilience or separacy, sometimes there is a requirement for details of the **physical routing of services,** either to assure that the required resilience ordered is being achieved or to assure diversity from a service procured from another provider. For broadband this is never available. For DIA this is sometimes available but often not – many providers have a policy not to share this data publicly as it is perceived that by doing so, it increases the risk through malicious attack. Additionally, no provider will fully commit to a fixed routing for the duration of a contract due to the regular need to maintain and update networks.

## Key types of resiliency

| Primary connection | Secondary connection | Use case |
|---|---|---|
| **Broadband** | Mobile broadband | Where always on-connectivity is key for a limited subset of applications. |
| | Fixed broadband – same technology | General lowest cost option. Will not protect against major local cable cuts but many faults in copper lines are specific to the individual line itself. Note that selecting multiple local providers does not materially improve the resilience achieved due to shared infrastructure. |
| | Fixed broadband – different technology | Good option where multiple broadband access types are available. Routing of copper telephone lines vs coax cable lines is likely to be different so provides a reasonable (but not guaranteed) level of protection. |
| **Fibre DIA** | Broadband | Where always on-connectivity is key for a limited subset of applications. |
| | Copper DIA | Where primary is fibre, copper secondary can be a good choice. |
| | Fibre DIA without separacy to primary | Not usually recommended as any failures are likely to be at the cable level so are likely to affect primary and secondary – note that selecting a different local provider does not guarantee separacy.. |
| | Fibre DIA with separacy | Through dialogue with local providers it is often possible to achieve various levels of separacy that will protect critical connections and avoid simultaneous primary/secondary failures. |
| | Fibre DIA with separacy & protection | Some local providers offer a managed protected service which offers guaranteed separacy end to end and resilient NTE connections – these are the best options when available but command a significant price premium. |

# Understanding the variability of internet services across the planet.

The table below shows a rough overview of the global internet landscape across 5 key dimensions that affect enterprises looking for solutions and the potential to meet business needs.

| | Internet products availability | Internet access cost | Regulatory complexity | Internet market structure | Ease of doing business* |
|---|---|---|---|---|---|
| **Western Europe** | High | Low & predictable | Low | Very competitive | Simple |
| **Eastern Europe (excl. Russia)** | High | Mostly low | Mostly low | Competition localised | Simple-moderate |
| **Russia** | High | Moderate | High (risk) | Competition localised | Moderate - difficult |
| **North America** | DIA – high<br>BB - variable | Variable | Low | Complex | Simple-moderate |
| **Latin America** | Mixed | Moderate - High | Variable High - Low | Highly complex | Difficult |
| **APAC (excl. China)** | High | Moderate - Low | Mostly Low | Competition localised | Moderate |
| **China** | High | High & Low | High | Highly com-plex | Difficult |
| **MEA** | Variable | High | Variable High - Low | Limited com-petition | Difficult |

** From PoV of a European/NA enterprise*

# Putting it all together.

As mentioned at the start of this paper: the best performing and best value enterprise network solution in 2020 is a **combination of Internet, SDWAN & Cloud.** Therefore, to truly get the maximum out of this requires a deep understanding and experience of the internet underlay.

Achieving this independently is challenging – a challenge that is viable for many enterprises that are sourcing internet in a few local and known markets, for example, for a European enterprise seeking internet connectivity in just, say, the UK, Netherlands and Germany, it is perfectly viable to select a provider/partner without high risk or cost attached.

But if that enterprise is sourcing and managing at scale and distributed globally then risk and costs to self-manage rise rapidly – and so, most enterprises will naturally seek a partner. Which partner to choose?

- **A global carrier?** For enterprises continuing with hybrid MPLS/internet networks and those looking for a fully end-to-end single managed service offer this can be a good solution – experience, scale and reach are unmatchable.
- **A managed service provider?** For enterprises that maybe are off the focus agenda of the global

carriers, or larger enterprises that are looking for something a bit more specialist or agile in the overlay and underlay, but still require a single assured managed service, then this can be a good solution - extra specialism and focus on the overlay is available in the market to meet specific needs.

- **A specialist internet aggregator?** For enterprises desiring greater control of the solution design and approach, internet aggregators are the obvious choice as they give the most direct access to internet access service options. True specialism and focus on the underlay is their key value proposition – assuring the best internet options are available at low prices but without the self-service headaches. Some of these parties will also offer full-transparency of service delivered, take-over support, and invoice payment for services already sourced by enterprises. Note also that these aggregators underpin a major part of the internet underlay offering of the carriers and MSPs.

## About the Author.

**Mike Lloyd** is Chief Portfolio Officer at Globalinternet overseeing Globalinternet's product strategy, procurement and marketing.

Mike is a global telecom's expert with wide experience creating successful Internet, SD-WAN & Cloud propositions. He has industry-recognised expertise and has participated from several forums and presentations around defining & sourcing connectivity (especially low cost & high performance internet) for SD-WAN & MPLS solutions.

## About Globalinternet.

Globalinternet leads the way in providing business-grade internet connectivity to Enterprises, Service Providers and Carriers – anywhere on the planet.

We partner with brilliant local Internet Service Providers and technology partners in over 190 countries to offer a best-in-class product portfolio with an unparalleled range of dedicated, broadband and mobile internet access services, coupled with around-the-clock assurance and support. **www.globalinternet.com**

# Why Globalinternet?

## We make it simple.

Avoid all complexity – the best ISPs and services, no time zone or language barriers, one simple bill, full accountability.

## Technology Agnostic.

Broadband, mobile or DIA, we're able to design, deploy and support the connectivity that best fits your requirements.

## Service Assurance.

Reliable connectivity and streamlined 24/7 support from our global service centres in Sao Paulo, Amsterdam and Manila.

## Automation & Control.

Visibility into real-time insights on your order status and services performance via GINius, Globalinternet's customer portal.

# Let's Talk.

Whether you are at a planning phase or well ahead in your network transformation projects, we'd like to discuss and explore together how we can help you simplify and succeed in your internet journey.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