

DAY ONE GREEN: USING THE GHG PROTOCOL FRAMEWORK TO EXAMINE TECHNOLOGY'S ROLE IN REDUCING EMISSIONS



Opening up the conversation on how to quantify the role IT products can play in reducing emissions.

By Paddy Berry

Day One Green

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Introduction

Every business and individual in the world needs to do more to reduce their impact on the environment either through more sustainable supply chains, ecological product choices, or any number of other means. Businesses are becoming more and more conscious and critical of their suppliers' statements and strategy when it comes to dealing with this global reality but are also seeking guidance on how to improve their own environmental agendas.

The challenge here is both quantification of the problem – how do we measure any of this if we haven't done so before – but also in the qualification of what constitutes direct impact versus an imported impact. In other words, what can be controlled by the party in question and what can be obfuscated by the suppliers of goods and services.

There are however standards and frameworks to hold ourselves and our suppliers accountable and put such goods and services under the lens of scrutiny.

One of these standards, which is now being commonly adopted by all major enterprises, is the GHG (greenhouse gas) protocol which defines emissions and energy consumption. Depending on how direct and indirect the impact of emissions might be they are separated into different *scopes*, as shown in Figure 1, from the *GHG Protocol Guidance Document*, page 26, October 17, 2022 (<https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf>).

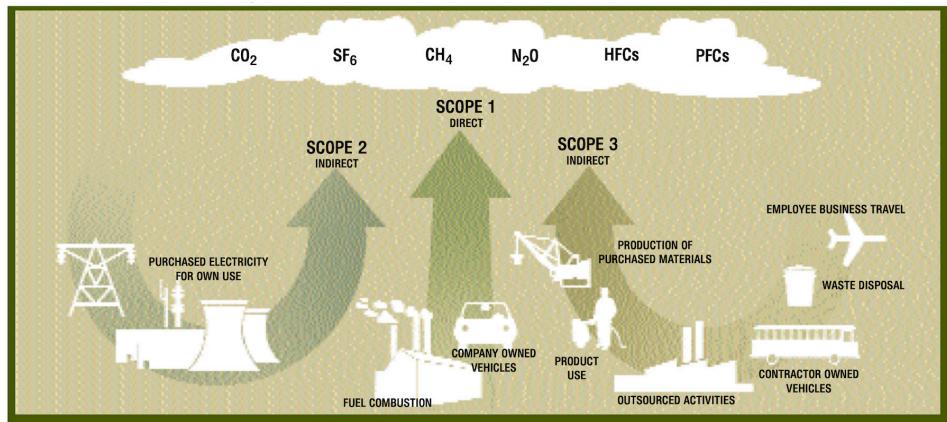


Figure 1

Overview of Scopes and Emissions Across a Value Chain

Scope 1 relates to direct combustion and consumption of fuels by company assets; such as company car fuel, gas in boilers in directly owned facilities, or, in industrial businesses, running production systems such as furnaces, chemical plants, and others. All of these either generate CO₂ or another gas which is recognized as a GHG pollutant under the Kyoto protocol.

Scope 2 relates directly to energy that is purchased by the business for use within their facilities and for which is relatively straight forward to account.

Scope 3 is the catch-all of anything that doesn't fall directly into the previous two scopes. It represents all the other emission related activities that a business might undertake, even those as indirect as employee commuting and products that are purchased from their suppliers.

NOTE This paper's intent is not to be a guide on how to interpret these sometimes elusive guidelines but rather aims to map the way our IT systems and processes can seek to reduce emissions both directly or indirectly through a technical lens. These are often my subjective opinions because I am passionate in our necessity and capability to do more and I hope they can be useful both in understanding the subject matter but also opening up and normalizing the conversation further.

For further information on the GHG protocol standard and some of the terminology used within this paper, please refer to the GHG website for more details at <https://ghgprotocol.org/>.

What Can Juniper Do?

Juniper provides a wide variety of network equipment and software which, when combined together, can facilitate some of the environmental IT outcomes which businesses are striving to deliver.

I will outline some of the latest technologies that Juniper provides and demonstrate how they can be used to either reduce emissions defined within the *scopes* or at least act as an enabler for said change. To reiterate, this is a subjective interpretation of the framework above and others might come to different suggestions or conclusions; something which this paper advocates in the spirit of discourse.

NOTE Advocating throwing a solution away that is working perfectly well and within a serviceable life goes against the whole purpose of defining these scopes and process since e-waste and product waste in general is something that generates emissions and is detrimentally impactful in other ways.

Let's look at a few key Juniper Networks solutions that can facilitate some of these favourable environmental IT outcomes.

AIDE/Mist

Mist is the engine behind Juniper's AI-Driven Enterprise (AIDE) solution and provides both proactive and intelligent troubleshooting with unprecedented scale out functionality all whilst being delivered with the minimal amount of on-premises footprint.

Traditionally, trying to troubleshoot client issues, especially on a wireless medium, has been both operationally expensive in terms of the business being impacted but also the opportunity cost and travel expenses that are accrued because of lack of datapoints to isolate problems.

The AIDE aims to alleviate such concerns by providing administrators with both the data they need and the guidance to perform remedial actions without having to understand the physics or dive into a controller debug.

These are some of intrinsic benefits of the Mist architecture as well as the enablers of the AIDE solution as a whole that could assist with some of the reductions in the defined scopes discussed previously. For further information about the technology and an expansion on some of these points below, please refer to [Day One Green: The Sustainable Benefits of AI Driven Enterprise Networks](#).

Mist Microservices

Juniper Mist is built from the ground up and is unique in the market for exploiting a truly microservices-based architecture in the public cloud and this means minimum energy waste as compute resources are only used when required and requested. This is more efficient than legacy IaaS-based platforms or physical controllers that need to retain spare capacity for onboarding new tenants and services.

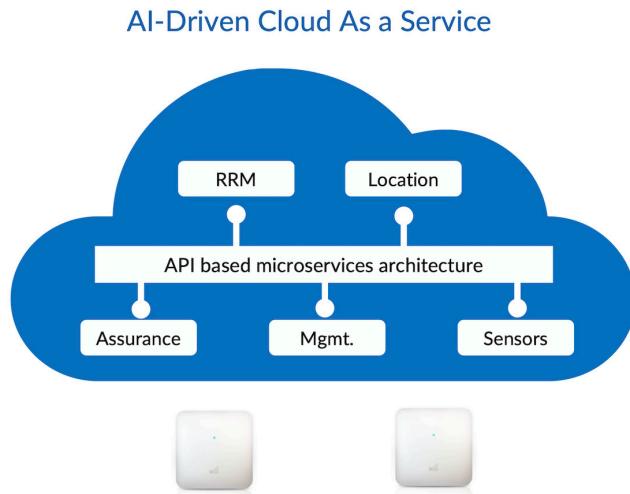


Figure 2

Each of the Mist Functions is a Micro-Service in the Cloud

Furthermore, a micro-services architecture brings advantages in terms of flexibility such as being able to add new services without having to think about controller software and hardware dependencies or scale considerations which come with older solutions. This reduces the need for events such as forklift upgrades which not only cause disruption during migration but require the hardware to be disposed of and new hardware to be purchased; all of which contribute to an emission and impact from both production of equipment and e-waste.

Although this might be attributed as an indirect saving, most green agendas are concerned with more than just Scope 1 models (direct emissions), and this relates to either a Scope 2 or 3 saving depending on how it is measured; either as an electricity-saving compared to physical infrastructures or a reduction in waste for operations.

Building Optimization Through Intelligent Location Services

Energy costs and the environmental impact of real estate including lights, heating/cooling, and IOT, has great potential for optimization and thus could have the biggest impact on a business' net CO₂ emissions.

The unique hardware design of the Juniper Mist APs with inbuilt hyper-accurate vBLE antenna array and software ecosystem is an enabler to wider building optimization through precise location services that can interface into a variety of smart building management software. This is relevant to current and future building planning and strategy by reducing utilization of traditionally always-on services and replacing it with point-in-time activation based on occupancy and activity.

We believe that Mist is the only infrastructure provider that provides the precision that is necessary, and the uptime required, for applications that enable use cases such as:

- Broader understanding of building use and occupancy for planning and consolidation
- Automated temperature management with built in sensors
- Automated power management of the wider IOT and smart device estate based on BLE
- Occupancy based lighting and power management automation

Juniper works in tandem with an ecosystem of vendors upstream in the software stack and provides a consolidation of sensor information that these platforms need. Many enterprises have built up many building management applications and hardware platforms which could benefit from such consolidation.

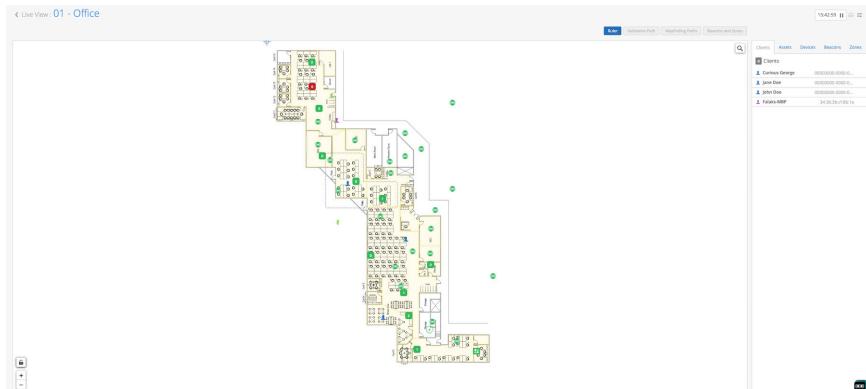


Figure 3
An Example of Office Monitoring

The consolidation is driven by reducing the demand for server appliances and removing the need for wasteful battery driven beacon systems for legacy location services: which has been one of the most compelling factors for large enterprises both from a green and ROI perspective.

Whereas other vendors are trying to sell location services as a nice-to-have feature to show client count, Juniper believes that this should form the foundation of truly transformational smart building and real estate rationalization as well as a way to engage future clients and retain existing workforce.

All of these use cases can inspire savings within Scope 1, 2, and 3; the Scope of which will depend on the way that businesses power, heat and cool their real estate. More importantly this is likely the area that can have the most direct effect but requires the largest amount of planning and cross collaboration from NetOps and facilities management.

Powerful Templating, More Consistency, Less Travel

The Mist platform with integrated AIOps can reduce GHG emissions through reducing the need for engineers to physically attend sites. Creating site templates, automated firmware upgrades and integrated packet capture means that non-IT based employees can simply just plug new devices in or assist with the troubleshooting process without needing to be a subject matter expert (SME). Where further investigation is required, Mist provides the data points to the teams that require it to correlate events to the fault conditions and can coordinate local resources rather than needing to travel themselves.

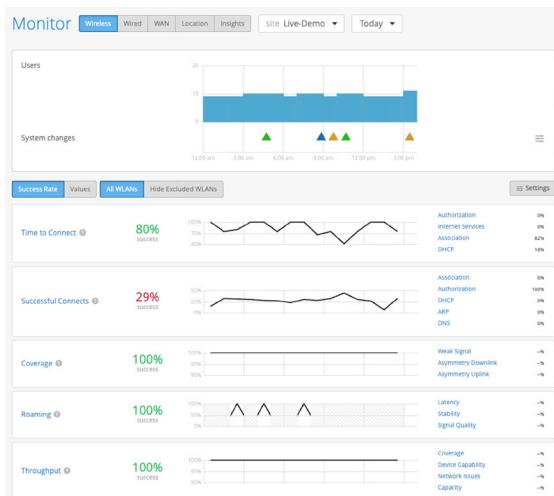


Figure 4

Mist Service Level Expectations

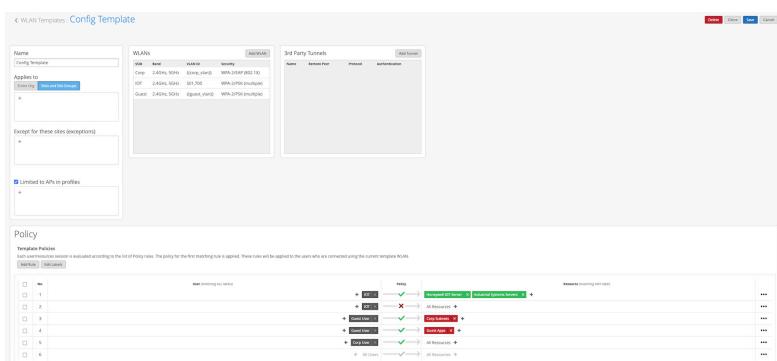


Figure 5

Mist Configuration Template with Security Policy

Depending on whether the transport assets are company-owned or leased rather than employee owned, this might represent either a Scope 1 or Scope 3 reduction. However, since the activities are to do with the company activities and employee transport may be used in lieu of available company transport, it might better represent a direct emission.

Cloud Metro 2.0

Juniper launched their new Cloud Metro portfolio in September 2022 with the purpose of providing security, performance, and efficiency enhancements to the previous generation.

However, it is becoming more common nowadays for service providers, especially those who are new to the marketplace in altnet or regional high-performance competitors, to require simple scale out as well as off the shelf products to manage and monitor their WAN estate. Whereas larger carriers have invested in OSS tools and processes for many decades, the ability to take a software product direct from the vendor, that can provide the majority of functions Day 1 is a significant benefit and allows these newer companies to remain competitive and agile against their larger competitors.

Paragon Automation as a Service (PAaaS)

Using the knowledge gained by the development of the Mist platform and the assurance capabilities therein, the Cloud Metro portfolio brings with it an evolution in the way network assurance and provisioning is delivered. Beforehand, our Paragon portfolio for WAN lifecycle was an on-premises offering comprising many different virtual machines or running physically. Not only does that require businesses to find a place to run these machines, which due to criticality would probably run on dedicated appliances or cluster, but the footprint is significant.

Evolving our offering makes this more accessible for businesses who want the capabilities delivered as-a-Service for an operational expenditure saving and being cloud-operated should help reduce inefficiencies.

Paragon provides the following benefits to service providers that could provide some form of emissions savings:

Paragon Device Onboarding

As new provider networks scale so does the need to install new hardware to connect consumers with the backbone. In the past, this may have required different skill sets of people; one team to design and plan, another to build out and cable the service, and lastly one to configure and check. Requiring more than one set of hands to be physically present at the onboarding and installation of an asset is an obvious inefficiency that grows greater as the scale increases. With Device Onboarding, a standardised configuration can be pushed to the device from a cloud and clear instructions provided regarding cabling and physical checks to be performed to on the ground teams. Those who need to perform post-installation checks can be remote within fewer operations centres and rely on the advanced telemetry streamed back to the cloud and provide teams on the ground further instruction if needs be.

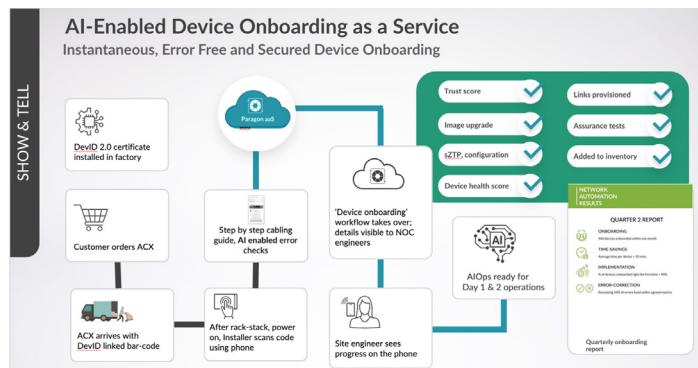


Figure 6

AI-Enabled Device Onboarding as a Service

This directly links to Scope 3 in terms of contractors travel emissions by right sizing the skills and the resources where they are required rather than sending groups of people around the globe for a task that could be made more efficient.

Paragon Network Optimization

Using some of the tools within the Paragon portfolio, network administrators can plan how best to optimise their network to cater to the needs of the consumers rather than investing in higher-speed circuits even when speed may not overcome the challenges and inefficiencies that are present. Furthermore, the healthier our networks are in terms of forwarding productivity, the less time the traffic spends traversing slower paths and investing CPU/ASIC cycles in unnecessary additional processing overhead.

Without the data points being fed back to a central location and being able to visualise all of this information, the only tools that most businesses have to go on is monitoring utilisation of individual ports or appliances which is a poor indicator of efficiency or a functioning system. Being fully apprised of conditions across the network, planning ahead for demand, and only bringing online what is required doesn't just make good commercial sense but also ensures that the network hardware is using the energy it requires in the most efficient way.

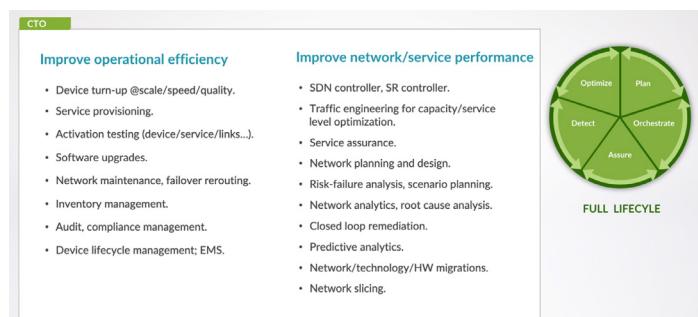


Figure 7

Paragon Automation Benefits

All of these benefits link back to both Scope 2 and Scope 3 savings. Scope 2 relates to ensuring that the energy that we do consume is effectively utilised, and Scope 3 relates to making a more efficient product that is sold to their customers as well as reducing the time to troubleshoot inefficiencies which all add up to wasted emissions.

There is an argument that could be raised relating to whether the business in question has a responsibility for the emissions related to the electricity consumed within colocation facilities, since they are a third party and outside of the direct or indirect control of the business. However, we need to be mindful that we should be regularly questioning the efficiency of all of the partners that we engage with and provide services to us and building the true cost of consumption which reflects an environmental agenda: therefore, that emissions should play some role in the commercial argument when it comes to procurement.

Connected Security (CSEC)

Many customers are considering how best to secure their assets within the public and hybrid cloud and for that you need a broad selection of technology tools. As much as people might want to completely re-design their software from the ground up as a disaggregated microservices block accessed using API gateways and other more modern security techniques, the fact is that IaaS infrastructure and diverse security controls are still necessary.

#1 in every test for the past two years

Proven security from client to workload



Figure 8

SRX Effectiveness

As an example, Juniper vSRX and CWP products provide a familiar look and feel of a high-performance firewall with a more modern dynamic application code recognition and remediation suite. Furthermore, the vSRX has been recognized as the most efficient and effective firewall for use within the public clouds from a software perspective as it makes the best use of the underlying cloud computing power that it runs on compared to our competition.

Any customer that is familiar with public cloud billing will know that right sizing and ensuring the most efficient underlying infrastructure for the performance it offers is key to a good cloud strategy; otherwise, costs tend to spiral out of control.

Now, advocating wholesale change from one piece of software to another, without design review and planning, can introduce short term complexity and inefficiency which will lead to more indirect emissions. So when considering new solutions or planning this move, you want to ensure that the advertised figures as promoted by the vendor deliver in the most efficient manner based on the cost paid and the emissions generated.

	JUNIPER NETWORKS	FORTINET
Security Effectiveness	100% Zero Block rate False positives	100% Zero Block rate False positives
Rated Throughput	974 Mbps	946 Mbps
TLS Throughput	948 Mbps	892 Mbps
SSL/TLS	13/13 Ciphers & use cases	12/13 Ciphers & use cases
TCO	\$56.66 per Protected Mbps	\$66.06 per Protected Mbps

Figure 9

CyberRatings Efficiency Sample

Returning to our GHG Scopes, we can see that this clearly falls within Scope 3 as anything run and purchased from a third party doesn't represent imported emissions through electricity or direct emissions. However, like the previous sections, we have to be mindful of outsourcing what was originally classed as an easily attributed indirect cost to the public clouds. We should still consider ourselves responsible for being efficient with the resources we contract through good control but also ensuring that whatever is running is right-sized and does what is advertised.

SSR (Session Smart Router)

SD-WAN originally entered the market with a clear goal in mind and that was around cost efficiency. Within all markets, MPLS was used as the defacto standard that securely interconnected offices with their hosted applications over a L2/L3VPN after replacing legacy technologies such as Frame Relay or ATM. Regardless of whether the applications were hosted via managed service providers, self-hosted, or collocated, they represented a simple way for businesses to connect what they needed without having to purchase dedicated circuits and manage their own WAN routing protocols.

However, with simplicity came cost and therefore the first SD-WAN products aimed to create the same secure experience over commodity circuits using IPSEC VPN between hubs and spokes. This certainly reduced the costs in the short term as commodity circuits were inherently cheaper at the time of launch but over time, especially in the EMEA region, MPLS was rarely significantly more expensive and therefore the cost argument started to wane. Vendors refocused on visibility to hold providers to account, however this only served to place the burden on the consumers to show back issues to the service providers.

Alongside this was the issue of performance for certain types of applications. For those more modern applications using either HTTP/HTTPS client-server models or those that were directly web accessible, there was little issue using circuits without a defined latency/jitter commitment as the protocol is inherently “tolerant” to such conditions. However, traditional voice applications and those applications which retained protocols which were both intolerant to latency or jitter, faced significant onboarding challenges. SD-WAN vendors weren't up to speed with looking at the user experience or requirements gathering sufficiently in the early design phases to account for these applications and their quirks.

Therefore, without significant application migration efforts or re-engineering, something that small-medium businesses were incapable of doing themselves and smaller application providers were not prepared for, MPLS was required and retained alongside some commodity service for general use. The nirvana of cost efficiency for removing MPLS and also performance and simplicity wasn't realised either.

Traditional Overlay and Analytics Burden

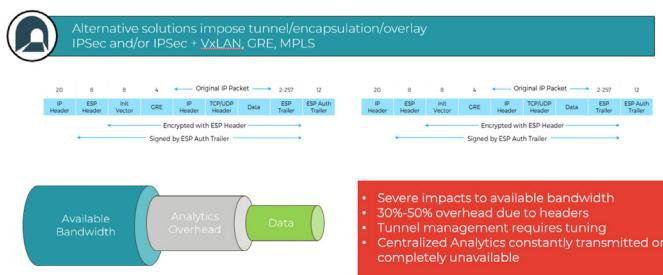


Figure 10

Traditional SD-WAN Inefficiencies

At the same time, a company called 128 Technologies was developing a new protocol and standards for the WAN which could ensure path and session quality for voice applications over commodity circuits. Instead of using IPSEC to secure between WAN endpoints which added even more latency and overhead to an already best effort service, 128T created session vector routing (SVR) which ensures a secure path across the WAN before transmission as well as calculating backup paths without the need for IPSEC end to end. Using these mechanisms meant for a significantly improved performance but also dramatically decreased the overhead and therefore the wasted bandwidth as a result of IPSEC.

Furthermore, aside from tunnel overhead the software can be configured to only encrypt those packets which are not encrypted as standard; there is no benefit to encrypting traffic which is already encrypted and represents even more overhead.

Zero Trust Tenant/Service Model

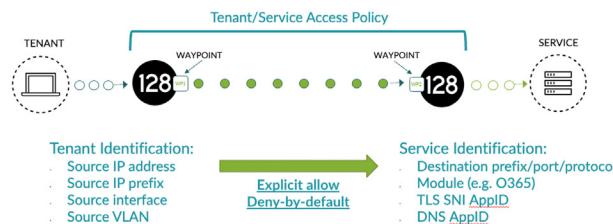


Figure 11 Per-Service, Per Waypoint Secured Transport

Juniper acquired 128T in October 2020 and it has since rebranded the platform as the *Session Smart Router* (SSR). Combining the no-overhead approach to SD-WAN alongside the MIST platform's rich data analytics and telemetry means that regardless of the application you are running or the circuit types that are used, you can be assured that the end-to-end experience is ensured on a per session basis and no other solution can claim to do the same.

But how is this important from an environmental standpoint? Well, it relates quite closely to the previous example but also more traditional understandings of efficiency.

From a Scope 3 perspective, we can quite clearly see that for the same performance across a given WAN there is a reduction in emissions both in terms of the overhead from a customer perspective but also throughout the WAN backbone and carrier; the further the session travels the broader the savings.

On the other side, if we take the same principle and apply it to the cloud, we get a different sort of savings. If we had a public cloud environment, you are generally limited to the amount of bandwidth you can effectively use once secured using legacy technologies. Additionally, the business is directly charged for ingress and egress traffic which is naturally more with IPSEC being used as an overhead. Therefore, here we can demonstrate more efficient use of the cloud onramp and therefore right sizing the circuit/service to reduce emissions through unnecessary waste but also a normal cost saving.

AWS Transit Gateway Connect integration

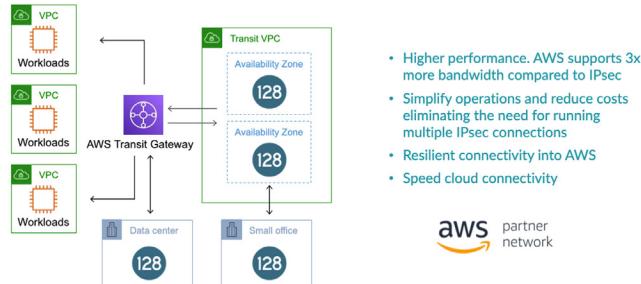


Figure 12

Integration of SSR into AWS Direct Connect and Transit VPC

Lastly, consolidating the management and analytics from SD-WAN and the rest of the campus means that there is both the inherent management efficiencies discussed previously in the Mist section, but also another SaaS/on-premises platform isn't running due to lack of integration. These both demonstrate Scope 3 reductions in emissions either through product/vendor selection or outsourced efficiencies.

Closing Statements

The aim of this paper has demonstrated how to qualify the role that our products can play on reducing emissions through intelligent uses of new technology and the efficiencies they provide. Once qualified, each business can quantify the savings they could make by examining how relatable the use cases are with any of the technologies discussed. Businesses are still getting to grips with how to define their green agendas with the ever-increasing necessity to provide a higher level of service and productivity to their consumers and end-users. There isn't a quick fix but rather a journey that must be followed.

As with all new initiatives, there is a requirement for subjective opinions to pave the way forward to a more universally held objective view on the role that vendors, and the consumers of their solutions, can play in the reduction of harmful emissions that continue to endanger the environment.

Although some of the conclusions that I have reached in the paper may be debatable, it is exactly this sort of debate that needs to be encouraged to bring the subject matter into the forefront of conversation when it comes to the decision-making process of future technology selection. Without asking the sort of questions raised herein, we will continue to be bound by traditional high-level cost-performance metrics which feed into current procurement processes.

To find out more about Juniper products and the benefits that they can bring to your business, please contact your account manager or reach out via your partner network for more information. Juniper is committed to assisting your navigation of this emerging and necessary reality and will continue to promote these and other ways of helping our customers along the road to net-zero or other environmental targets.

Further Reading

- [Juniper Day One Green](#)
- [Optimising Microsoft 365 with Juniper AI-Driven SD-WAN](#)
- [Juniper Smart Session Routing](#)
- [Juniper Smart Session Router SD-WAN Hero](#)
- [Paragon Automation as a Service](#)
- [Enabling the AI-Driven Enterprise](#)
- [Juniper Connected Security](#)
- [Juniper Cloud Metro 2.](#)