

White Paper

Increasing satellite link efficiency with Multi-Service Optimization

Satellite service providers are struggling with the radical change in the way applications and data are being delivered over the internet. With the proliferation of content delivery networks, anything-as-a-service clouds, data encryption, streaming services and other resource-intensive applications, traditional bandwidth management and optimization approaches are no longer viable. Remote locations where bandwidth is constrained suffer from intermittent application performance and poor user experience. BusinessCom delivers context-aware solution that enables to optimize network resource usage and significantly improve user experience, compared to legacy VSAT solutions.

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The Cloud over Satellite Challenge

The PC, the internet, our own lifestyles and work practices are changing rapidly. The point of execution and data storage of business applications has transitioned from big mainframes of the 1960s and 70s to personal computers and locally hosted servers in the 80s and 90s. Now, with the advent of SaaS clouds we observe the reversal of this trend – applications no longer run locally. Businesses now integrate SaaS solutions into their workflow: Google Workspace, Microsoft Office 365, Microsoft Teams, Zoom, Salesforce, DocuSign, and others. Leading business software vendors and solution providers, like SAP, have shifted from being primarily deployed on premises to a combination of on-premise and cloud a few years ago, and now, increasingly, to being cloud-only.

Today enterprise and government customers rely on database as a service (DBaaS) solutions like SAP HANA, Amazon DynamoDB, RDS, Oracle Database and IBM Db2. Data storage has moved from on-premise network attached storage (NAS) systems to clouds, with the rapid emergence of storage as a service (STaaS) solutions from Google, Dropbox, Amazon, Microsoft and others. We are witnessing the emergence of anything as a service (XaaS): business analytics and functions, data processing, software containers, authentication, even desktop operating environments – almost everything seems to move to cloud. All these modern applications rely on fast and reliable IP links to operate.

A parallel trend is the increased connectivity of household appliances, entertainment electronics, gadgets, social interaction platforms, personal planners and assistants and other entertainment and recreational appliances. In some cases, online platforms like YouTube, Netflix and Spotify are nearly completely replacing the TV and radio of our parents. In fact, recreational streaming traffic comprises dominant portion of the whole internet. As these services transition to HD resolutions, this results in enormous contention for bandwidth.

Specific Challenges with Satellite Services

One of the primary drivers of the cloud transition is the emergence of fast, reliable and affordable IP connectivity. Terrestrial network service providers (NSPs) and mobile network operators (MNOs), now delivering 100s and 1000s of Mbps of bandwidth to end users via fiber optic and 5G links, are the carriers of

this digital explosion. As different types of traffic contend with each other, this poses a challenge for end users on satellite links:

- **Constrained bandwidth:** Satellite capacity costs (per Mbps) usually lag behind and exceed terrestrial bandwidth costs by a factor about 10. In most of the networks connected via satellite business traffic contends for bandwidth with entertainment and streaming apps resulting in heavy congestion during peak hour periods.
- **Latency:** As cloud solution providers compete to be as close to the end user as possible, “long” links with satellite latency are simply not part of the design. Modern applications will experience performance degradation over satellite, especially if not all IP packets are arriving in time due to the bandwidth sharing.
- **Quality of Service (QoS):** The traditional set of technologies that is used to prioritize traffic and avoid congestion no longer works. As most of the cloud traffic relies on a single or few protocols like QUIC and a shared set of ports, standard QoS built into VSAT platforms is simply unable to prioritize modern applications.
- **Content Delivery Networks (CDNs):** Clouds now deliver services over their own PoPs or third party CDNs, like Cloudflare, Fastly, StackPath and Akamai. Prioritizing important traffic by an IP address or domain name is now difficult or nearly impossible. A single CDN server will stream all sorts of traffic, for many different apps and services.
- **Encryption:** As most of the traffic is now fully SSL-encrypted. next generation firewall solutions (NGFW), like those available from Palo Alto Networks, Juniper and Riverbed, are only partially successful in fingerprinting modern apps. External NGFW appliances are not integrated with VSAT platforms and are unable to partake in decisions of how the satellite bandwidth is allocated in the TDMA channels, thus limiting their efficiency.

All satellite networks are subject to this architectural weakness – those relying on Geostationary, Medium and Low Earth Orbit (MEO, LEO) satellites, and across all frequency bands. Even with the next generation LEO constellations like Starlink, OneWeb and Lightspeed, all the issues mentioned above, with the exception of latency, will remain because of the higher oversubscription ratios and, also, due to that the amount of satellite bandwidth typically available to a remote lags behind terrestrial links.

MSO – the New Quality of Service

BusinessCom has developed the Multi-Service Optimization (MSO) solution to address congestion problems mentioned above. The intention is to replace old, rudimentary QoS and bandwidth management capabilities embedded into VSAT hubs and remote satellite routers with a new system capable of supporting modern internet protocols and applications. The new system greatly improves performance of internet services and SaaS applications for business users in bandwidth constrained environments.

The MSO is a combination of bandwidth management and optimization policies implemented on multiple IP layers, from 3 to 7. It relies on a set of technologies ranging from traditional class-based shaping to deep packet inspection (DPI), intelligent session tracking and BusinessCom's proprietary IP traffic classification routines. MSO works in tandem with the VSAT network management system (NMS) and the protocol processor to achieve maximum efficiency of TDMA slot allocation to remote VSAT sites, hence its efficiency is above what can be implemented with typical NGFWs. MSO integrates with the satellite platform, however remains orbit-agnostic, capable of delivering significant performance enhancement with current and next-generation satellite networks.

The MSO can be implemented in a variety of scenarios. While the MSO core is located at the teleport network, the system can leverage edge routers running BusinessCom Sentinel PF™ operating system installed at the remote ends to achieve bidirectionality. The efficiency is further enhanced by BusinessCom SecureLink™ threat management solution. MSO can deliver performance enhancement for a single remote VSAT or operate with a private network consisting of multiple terminals, sharing the same pool of bandwidth in the Private Network environment, also sharing the same bandwidth optimization policy.

The immediate benefit of MSO is the improvement in bandwidth availability and reduction of congestion for modern business applications and services delivered via CDNs and SaaS clouds. In an average network environment, performance improvements are measured at about 40%. In some cases, especially where the legacy policies were weakly implemented, the real-life difference delivered by MSO can be phenomenal – the case of dangerously impaired business activity improving to a “full ahead” operation once MSO was implemented.

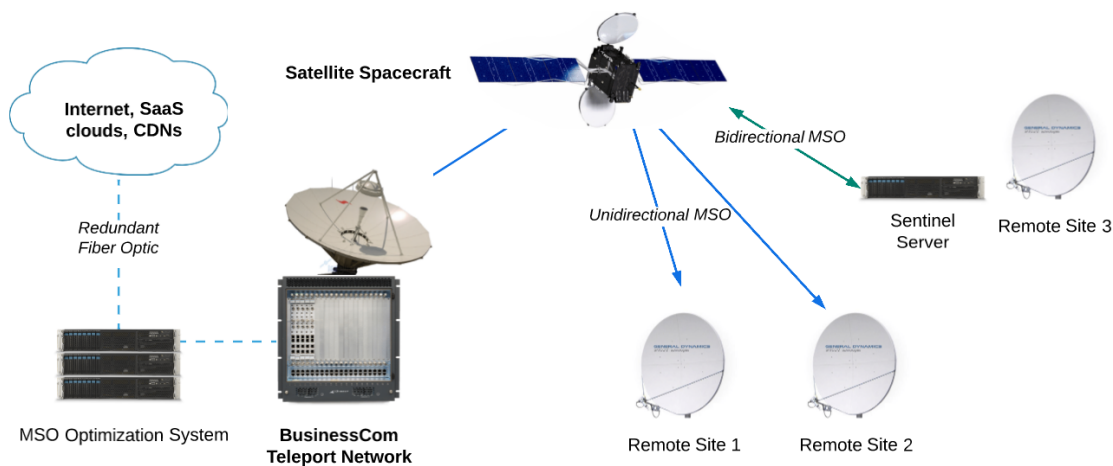
Provision Options

The MSO can be provisioned in a number of scenarios and configurations to address different challenges arising at the customer's end.

Directionality

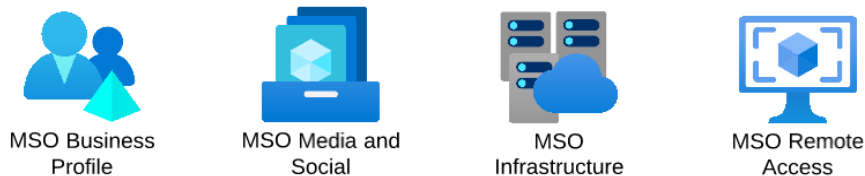
Unidirectional: MSO is implemented on the outbound direction for data coming from BusinessCom's teleport network and is fully managed by the Network Operations Center (NOC). No change to remote VSAT configuration or LAN is required.

Bidirectional: To optimize the return traffic, MSO relies on BusinessCom Sentinel router installed at the remote site. This allows to optimize inbound traffic coming from the remote VSAT site. Such bidirectional optimization is advantageous where a high degree of congestion occurs on the inbound (uplink) satellite channel. The Sentinel PF operating system must support the current BusinessCom MSO implementation package.



Optimization Profiles

Default Profiles: BusinessCom provides a set of optimization profiles customers can choose from depending on the actual requirements. The standard MSO Business profile optimizes delivery of standard business SaaS and on-premise applications, business clouds, online collaboration tools and traditional protocols, such as POP, IMAP and SMTP. The MSO Media and Social profile optimizes entertainment and recreational applications and traffic sources appreciated by non-business users. Switching to this profile at off-peak hour periods may boost morale and recreation of deployed personnel. The MSO Infrastructure profile optimizes delivery of IoT applications, telemetry, software updates and other M2M traffic that might be critical for infrastructure maintenance. The MSO Remote Access profile is targeting remote access protocols like VNC and RDP, and modern DaaS applications like Citrix. BusinessCom NOC is committed to maintaining an up-to-date database of applications, protocols and sources.

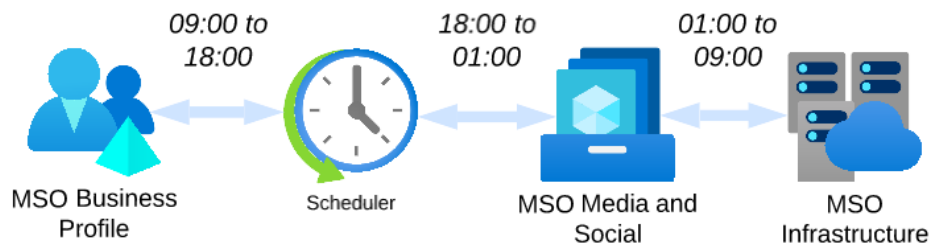


Exclusive Profiles: The MSO is configured on a per-site or a per-network basis with an exclusive optimization profile developed to optimize delivery of specific applications and protocols. Individual clouds, applications and traffic sources can be configured in such an exclusive profile. The configuration is implemented by BusinessCom's NOC in consultation with the customer or Value-Added Reseller (VAR) partner.

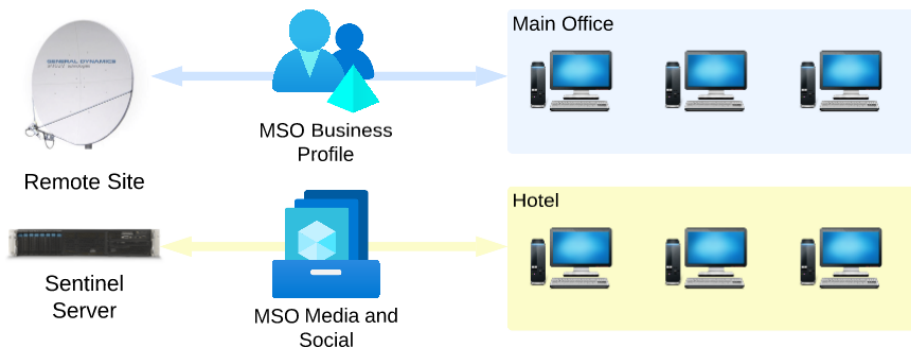
Targeting

Time-based Policy: Unidirectional and bidirectional MSO can be provisioned as time-based policies, switching between different optimization profiles depending on the time of day, day of week, month of year or other schedule, or switching between default and exclusive profiles. This is useful for connections serving

different goals at different times, for example a single satellite link providing connectivity to an office and a recreational camp at the same compound, or a maritime fleet that serves different types of customers depending on the season. Time-based policies can be applied to default and exclusive profiles – for a single site or a group of sites in the network.



LAN Granularity: If enhanced by the Sentinel router installed at the remote site, MSO can be implemented for the whole LAN connected to the router, or for a particular host or subnet in the LAN. Additionally, hosts or subnets in the LAN can be assigned different MSO profiles in case it might be required to segment the network to serve different goals and types of end users.



Benchmarks

MSO delivers an immediate improvement in SaaS application performance over satellite links – see figure below showing the decrease in page load times in a simulated LAN environment with 20 Mbps geostationary satellite connection and an average traffic profile¹.

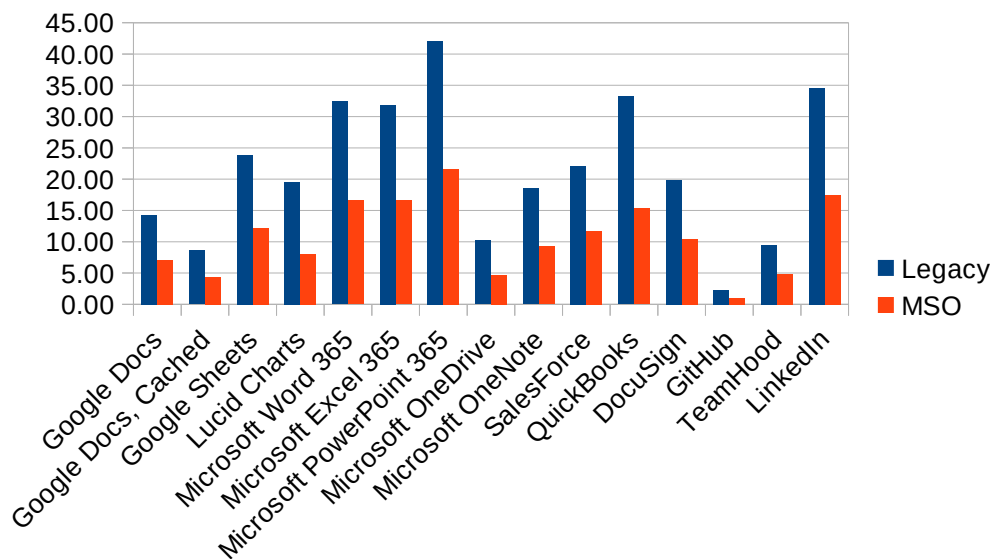


Figure 1 – Expected app load times in seconds (smaller is better) for legacy 20 Mbps geostationary satellite connection operating at near congestion levels, versus a similar MSO-enabled link.

As digital explosion continues, global average fixed broadband speeds are projected to reach 110 Mbps, and 44 Mbps for mobile connections². Video streaming will exceed 82% of total internet traffic at the same time, with Wi-Fi 6 targeting Gbps performance levels³. Future applications, like UHD and VR streaming will require hundreds of Mbps per session while multi-Mbps Full HD

¹ The actual real-life results will vary depending on the available bandwidth, committed information rate and the traffic profile. In the simulated environment, dedicated satellite bandwidth was assumed, with an average of 50 concurrent streams via HTTP/2 protocol and a clean cache. The cached Google Docs is an illustration of performance improvement with populated local cache.
² Cisco Annual Internet Report (2018-2023).
³ The Sustainable Future of Video Entertainment, a joint study by InterDigital, Inc. and Futuresource, 2020.

video becomes the norm not only in TV, but throughout social media and collaboration apps.

Our data⁴ shows that in average about 25% of satellite bandwidth is consumed by social media traffic, followed by 21% for video streaming. In case of a business location, assuming average profile distribution, an active MSO Business profile can steer at least 46% of priority bandwidth towards selected business applications, achieving near double performance improvement. As broadband speeds and streaming resolution continue to increase worldwide, this percentage will grow in future.

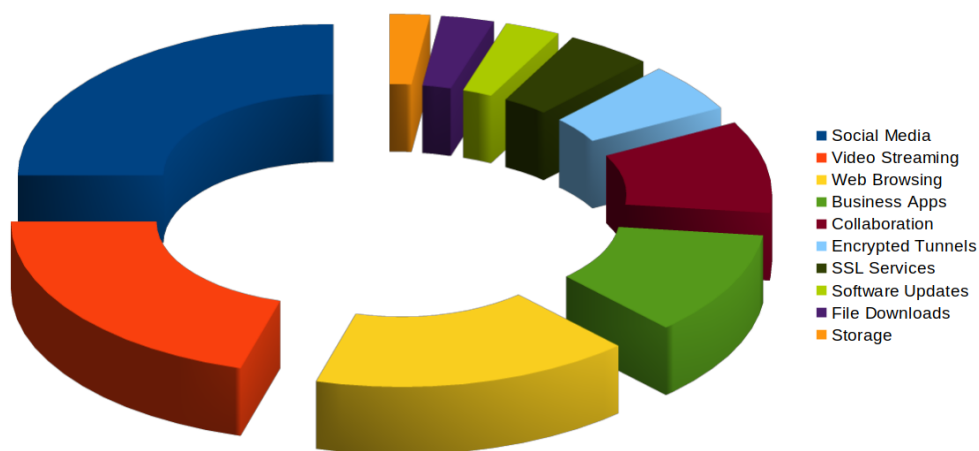


Figure 2 – Breakdown of average bandwidth allocation across applications for remote sites in a typical satellite network.

Conclusion

Bandwidth management and optimization plays a critical role in assuring trouble-free operation of remote business assets connected via satellite. Due to the advent of new SaaS clouds, CDNs and protocols legacy technologies, such as rudimentary QoS built into VSAT platforms, external IP traffic shapers and NGFWs, are no longer adequate to implement efficient bandwidth management policies. This results in bandwidth congestion and loss of performance that is projected to

⁴ BusinessCom DE1 teleport network traffic statistics, January 2023.

worsen as our work continues to move towards the cloud and streaming resolutions and bitrates increase.

BusinessCom offers MSO – a solution to address these challenges that works together with the VSAT platform NMS and the protocol processor. MSO is the most efficient bandwidth management and optimization technology available on the satellite market today. It can be deployed in a number of scenarios, optionally in conjunction with BusinessCom Sentinel routers at the remote sites and BusinessCom SecureLink threat management system. The MSO system is fully managed by BusinessCom NOC. This makes it rapidly deployable and sustainable in different situations, from a single VSAT to hundreds of remote sites in a Private Network scenario.

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