

Real-Time Latency:

**Rethinking
Remote Networks**

TELESAT[™]





**“You can buy your way out of
bandwidth problems.
But latency is divine”**

Executive summary

- ▲ **Latency is the time delay over a communications link**, and is primarily determined by the distance data must travel between a user and the server
- ▲ **Low earth orbits (LEO) are 35 times closer to Earth** than traditional geostationary orbit (GEO) used for satellite communications. Due to the closeness and shorter data paths, LEO-based networks have **latency similar to terrestrial networks**¹
- ▲ LEO's low latency enables **fiber quality connectivity**, benefiting users and service providers by
 - Loading webpages as fast as Fiber and ~8 times faster than a traditional satellite system
 - Simplifying networks by removing need for performance accelerators
 - Improving management of secure and encrypted traffic
 - Allowing real-time applications from remote areas (e.g., VoIP, telemedicine, remote-control machines)
- ▲ **Telesat LEO not only offers low latency but also provides**
 - High throughput and flexible capacity
 - Transformational economics
 - Highly resilient and secure global network
 - Plug and play, standard-based Ethernet service

30 – 50 milliseconds Round Trip Time (RTT)

Questions answered



- ▲ What is Latency?
- ▲ How does it vary for different technologies?



How does lower latency improve **user experience**?



What **business outcomes** can lower latency enable?



Telesat LEO - what is the overall value proposition?

What is latency?

Latency is time delay over a communications link, often measured as round trip time in milliseconds

On the Internet, user devices request data and servers respond to these requests

Latency determines how quickly the user begins to get a response from the server



Latency is determined primarily by the distance these requests and responses must travel, plus any processing time along the way

For high speed Internet services, it is often latency rather than bandwidth that determines the user experience

What is latency?

Understanding latency via an airplane analogy



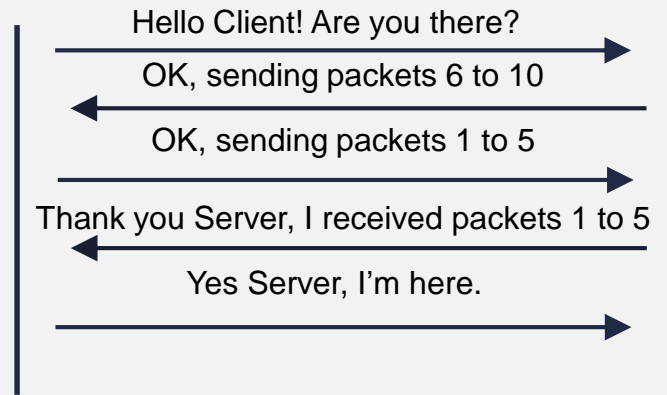
Only having high bandwidth (big plane) is not enough, low latency (shortest route) is critical to maximize output

Why latency matters on the internet

Internet protocols require low latency to run at speed



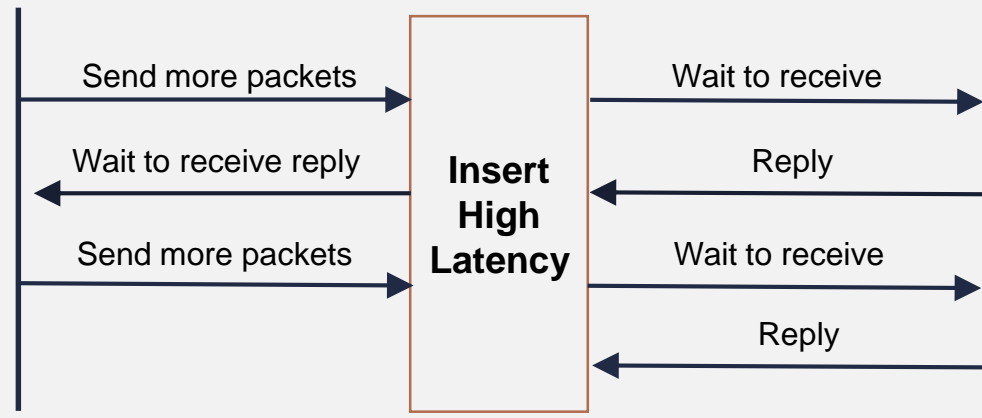
SERVER



Data packets flow quickly when latency is low



CLIENT



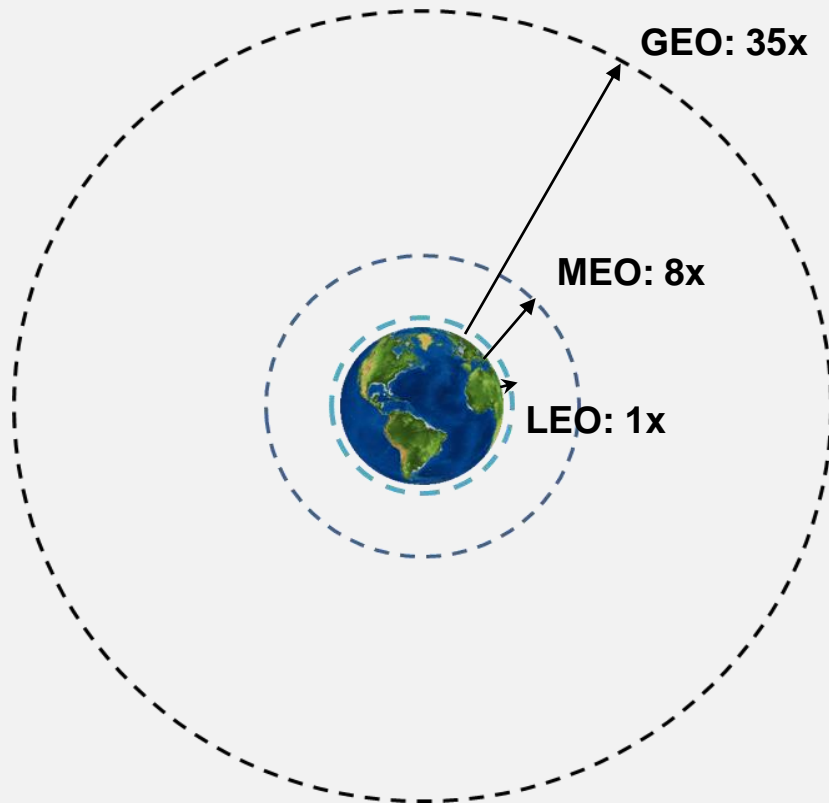
Latency slows the process dramatically regardless of data rate

Satellite latency

The further a satellite is from earth, higher the latency (round trip time)

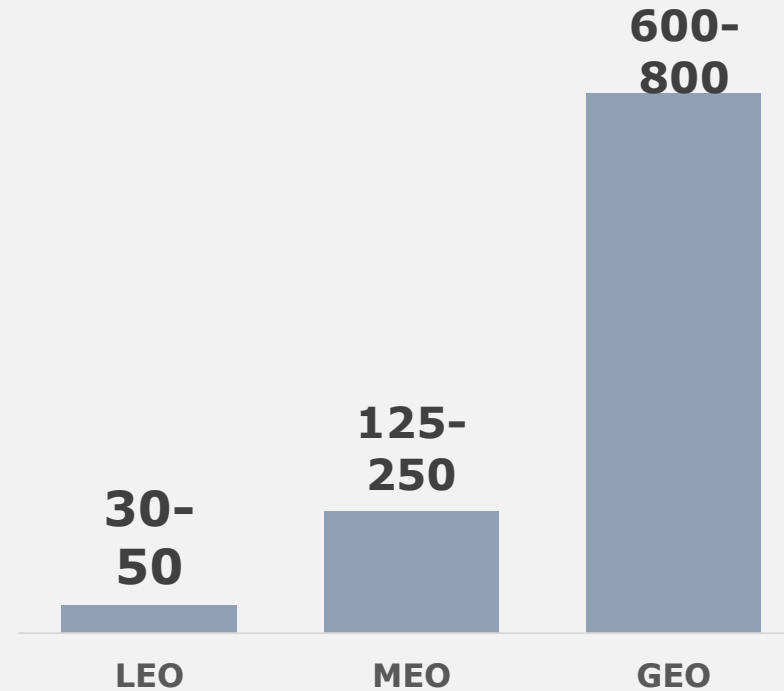
Relative distance of satellites from Earth

1x = 1,000 km



Round Trip Time

Milliseconds



Questions answered



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What **business outcomes** can lower latency enable?

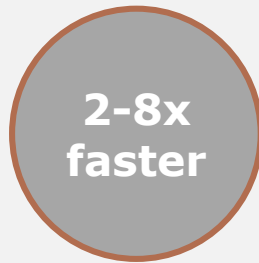


Telesat LEO - what is the overall value proposition?

Better user experience

LEO's low latency enables a superior Internet experience vs GEO/MEO

***Faster
web
pages***



***Real-time
comms and
control***



***Faster than
fiber over
long distance***



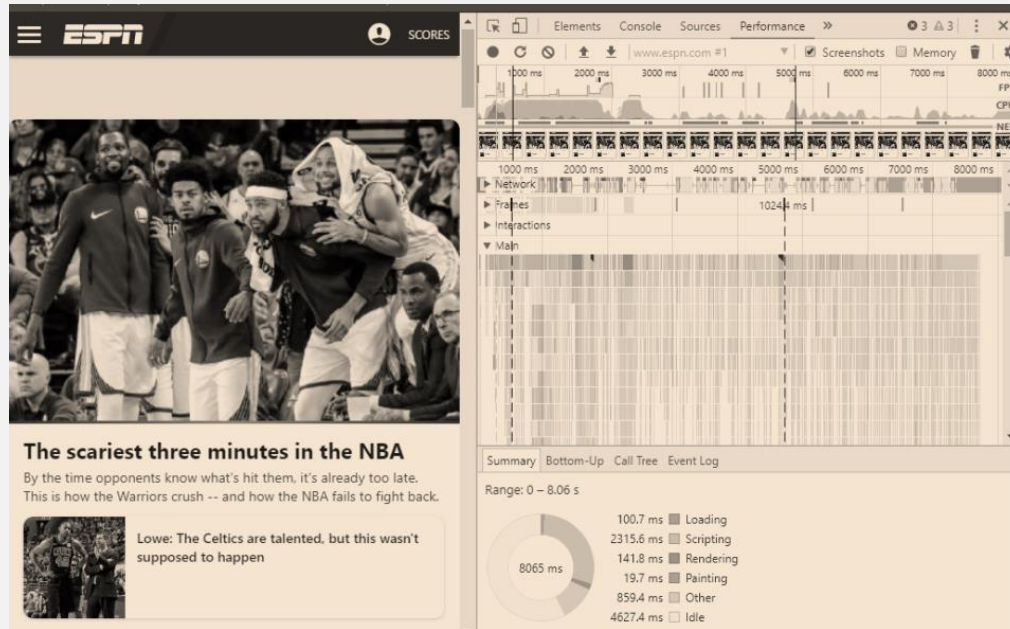
***Seamless
experience
with
encrypted
traffic***



Web and digital media

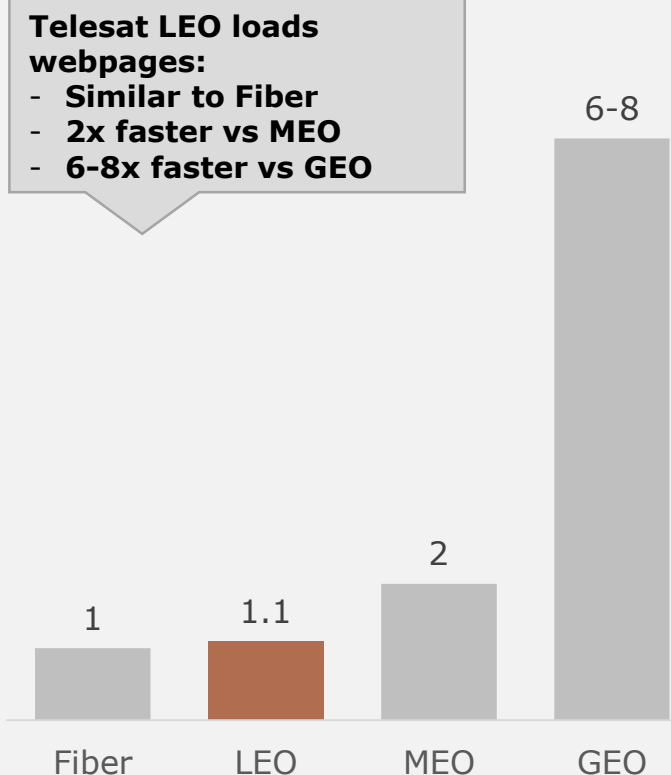
LEO's low latency enables fiber quality web experience

Faster web pages



Tests conducted in Telesat simulation lab with latency setup based on a Caribbean location to Miami: LEO=28-32 ms, MEO=150 ms, GEO=700 ms (no acceleration)
Each test repeated 5 times to record average results

Relative time to load website Ratio vs Fiber load time



Real-time comms and control

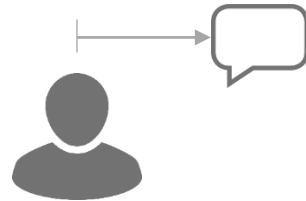
LEO's low latency enables real-time communication and control

Real-time communication

Traditional Satellites

High latency causes **buffering** before making a connection

Video and voice also become **out of sync**



LEO Satellites

Video and voice are **delivered in real-time** in low latency LEO systems



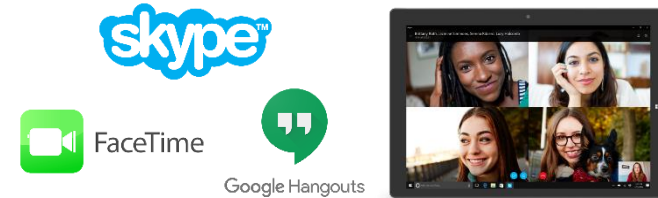
Real-time control

The low latency of the LEO system removes the delay between the sending and receiving of a signal

The LEO system enables real-time control of **latency sensitive applications**

Real-time consumer applications

Video Chat



Interactive Social Media



Real-time enterprise applications

Video Conferencing



Remote control



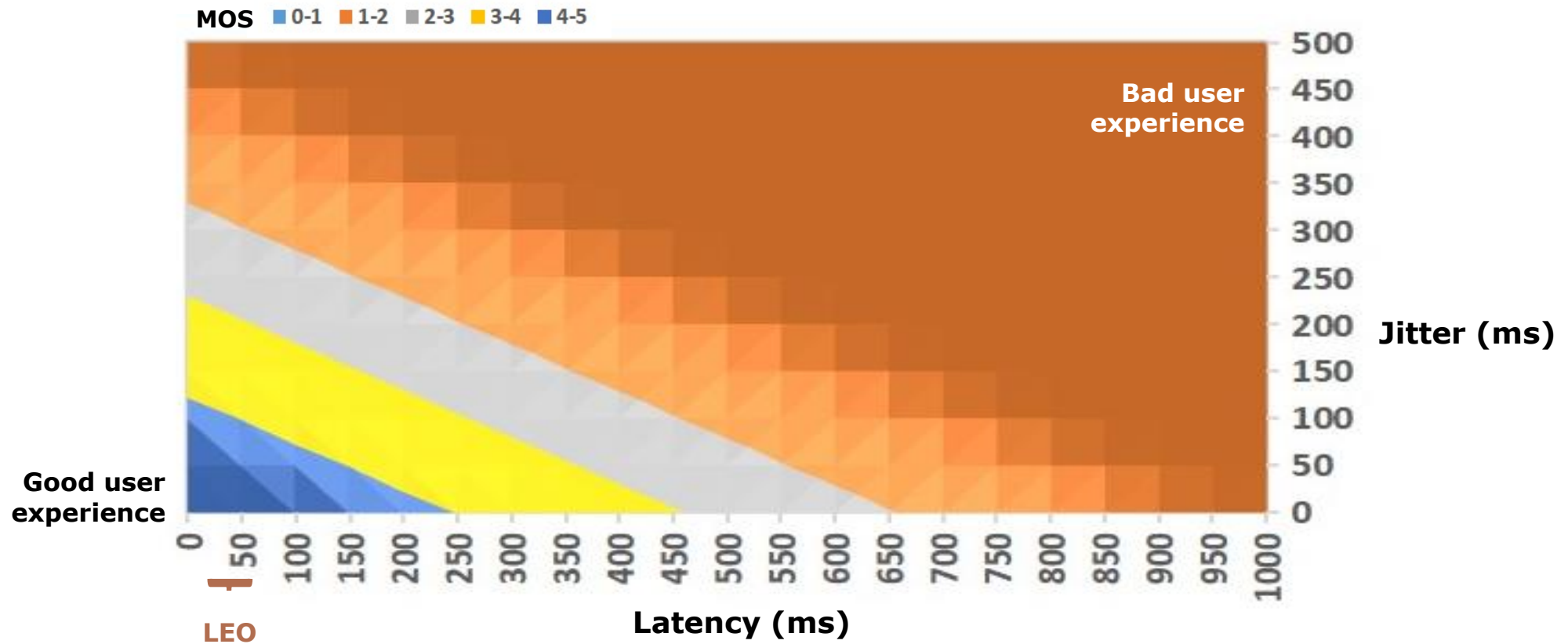
Telemedicine

VoIP

LEO latency delivers a good VoIP user experience

Impact of latency on VoIP

MOS^{1,2}

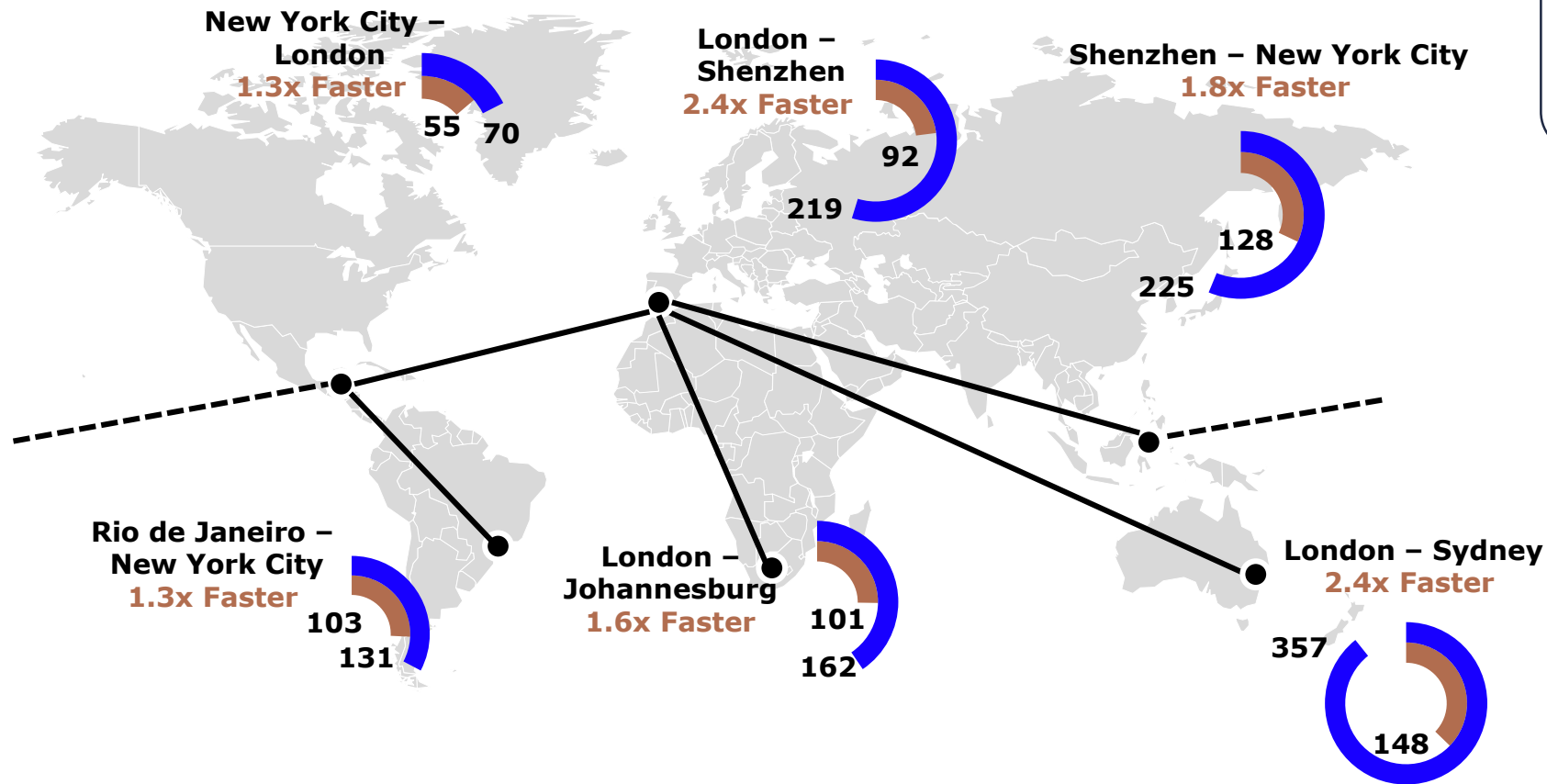


Long distance latency

Leveraging inter-satellite links, Telesat LEO can offer lower latency across long distances vs terrestrial networks

Round Trip Time – Telesat LEO Latency vs Terrestrial Latency

Milliseconds



LEO Latency based on Telesat LEO simulations of traffic moving over only inter-satellite links, Telesat LEO latency (round-trip time) is at network layer including processing latency for system and Inter-satellite links
Terrestrial data from <https://wondernetwork.com/pings>

Encrypted Traffic

LEO improves performance of unencrypted as well as encrypted traffic

In 2017 50% of internet traffic was encrypted – by 2019 it will be 75%¹



GEO systems use modified Internet protocols to accelerate unencrypted traffic to partially mitigate the impact of high latency

But encrypted traffic cannot be accelerated

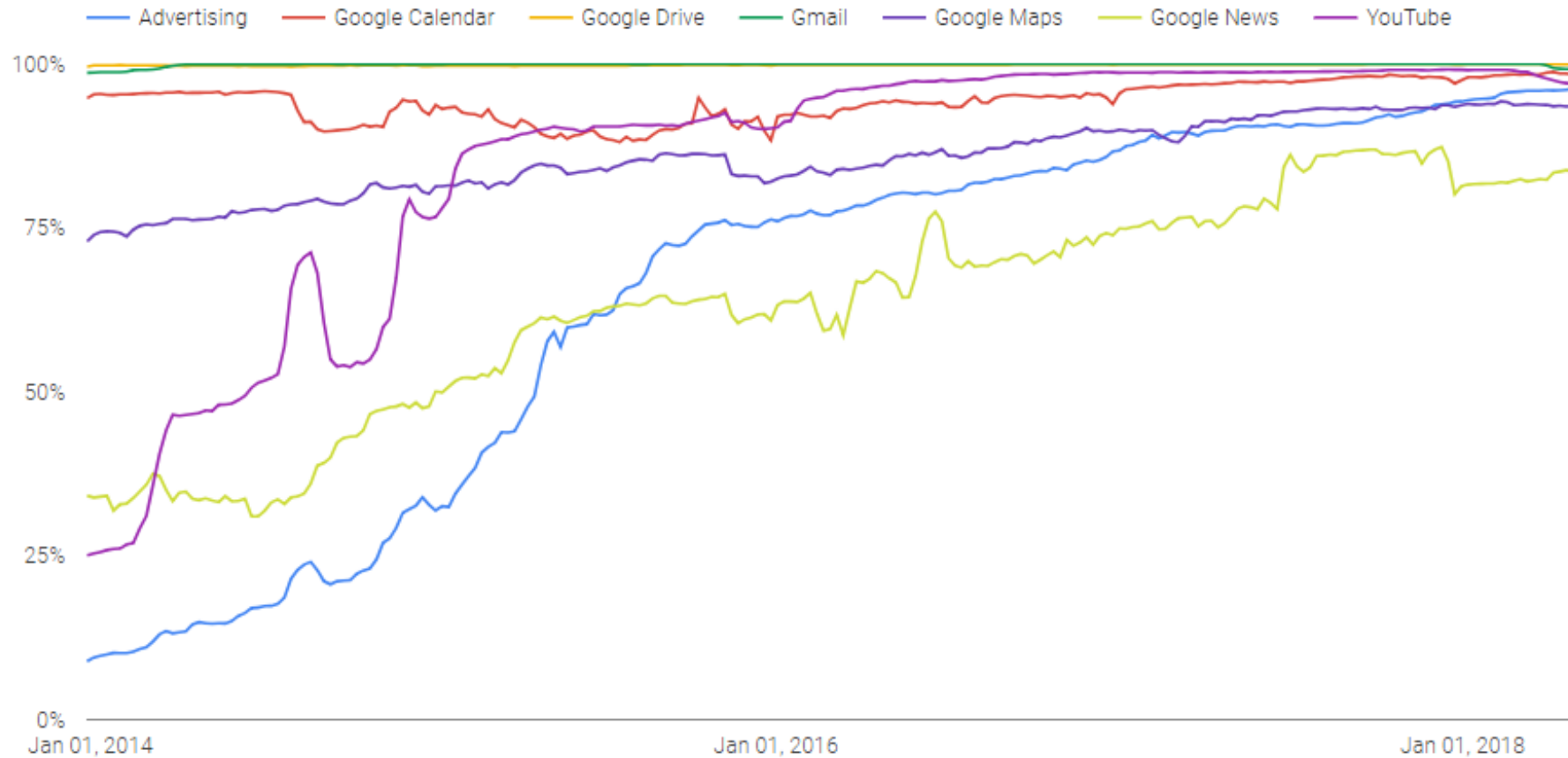
As share of encrypted traffic on the Internet grows, benefits of GEO acceleration will decline

LEO does not need acceleration thereby ensuring high performance even with encrypted traffic

Encrypted traffic

Consumer application traffic is mostly encrypted

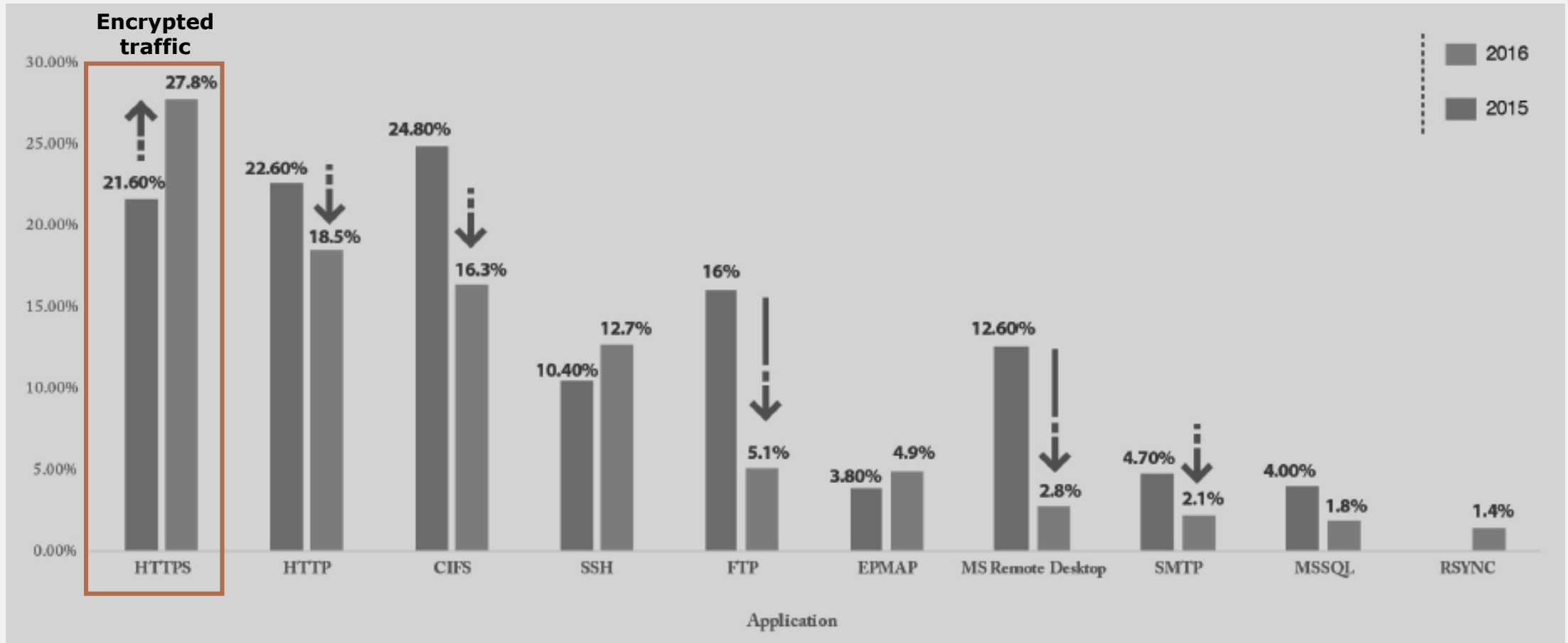
90+% of Google traffic is encrypted¹



Encrypted traffic

Enterprise application traffic is increasingly being encrypted

Percentage of Application WAN traffic, 2015 vs. 2016¹



Questions answered



- ▲ What is Latency?
- ▲ How does it vary for different technologies?



How does lower latency improve **user experience**?



What **business outcomes** can lower latency enable?



Telesat LEO - what is the overall value proposition?

Business benefits of LEO's low latency

Higher user satisfaction; improved efficiencies via real-time control



CELLULAR BACKHAUL

Lower churn and simplified network with no requirement for GEO accelerators



AVIATION

Terrestrial-like in-flight passenger connectivity and real-time applications for crew



MARINE

Responsive passenger Internet and better real-time vessel optimization (fuel savings)



REMOTE COMMUNITIES

Effective e-learning and telemedicine, urban broadband experience in remote and rural areas



GOVERNMENT

Highly responsive airborne ISR and better video/VoIP chats of personnel with family



ENERGY

Real-time management of production; improved crew welfare with responsive Internet

Cellular Backhaul - benefits of LEO latency

Increased end-user satisfaction and improved operational efficiency



End User

- No lag video chat, instant use of social media
- Improved user experience



Network

- Simplified network with no requirement for performance accelerators
- Fully compatible with true end-to-end encryption. No need for split encryption tunnels



Aviation - benefits of LEO latency

Browse the web at 35,000 feet like both feet are on the ground



Passenger

- No lag video chat and quickly load webpages
- Improves customer loyalty and bookings



Crew

- Real-time weather and navigation for pilots
- Enables use of satellite for operational communications



Aircraft

- Real-time engine monitoring and preparation for maintenance issues
- Lowers maintenance costs and increases aircraft uptime



Remote Communities - benefits of LEO latency

Enabling broadband experience in rural and remote communities



Home / Business

- Compelling Internet experience to consumers and small businesses



Hospital

- Real-time telemedicine and imaging
- Improved patient experience, reduced wait times and lower medical costs



Schools

- Remote teachers, quick loading web content for in-class applications
- Reduced digital divide from urban schools



Marine - benefits of LEO latency

At-home like connectivity for passengers; improved ship-shore collaboration



Passenger

- No lag video chat and quickly load webpages
- Quickly upload photos and video to social media
- Improves customer loyalty and bookings



Crew

- Real-time weather and navigation for crew
- VoIP and other latency sensitive communications



Ship

- Real-time engine monitoring and reaction to maintenance issues
- Fuel optimization
- Reduces maintenance costs and improves operational efficiency



Government - benefits of LEO latency

Highly responsive airborne ISR applications



Unmanned Platforms

- Accurate control and navigation
- Real time remote control for immediate response to steer, shoot, avoid collision, etc.



Morale, Welfare & Recreation

- Quickly load webpages
- VoIP applications without lag
- Improved personnel morale



Energy - benefits of LEO latency

Transforming remote operations with real-time applications



Operational Systems

- Real-time data between automated platforms and on shore control centers
- Automation of platforms increasing safety and reducing labor costs
- Improved production



Crew

- Communications with family on shore
- Remote learning
- Better crew satisfaction and retention



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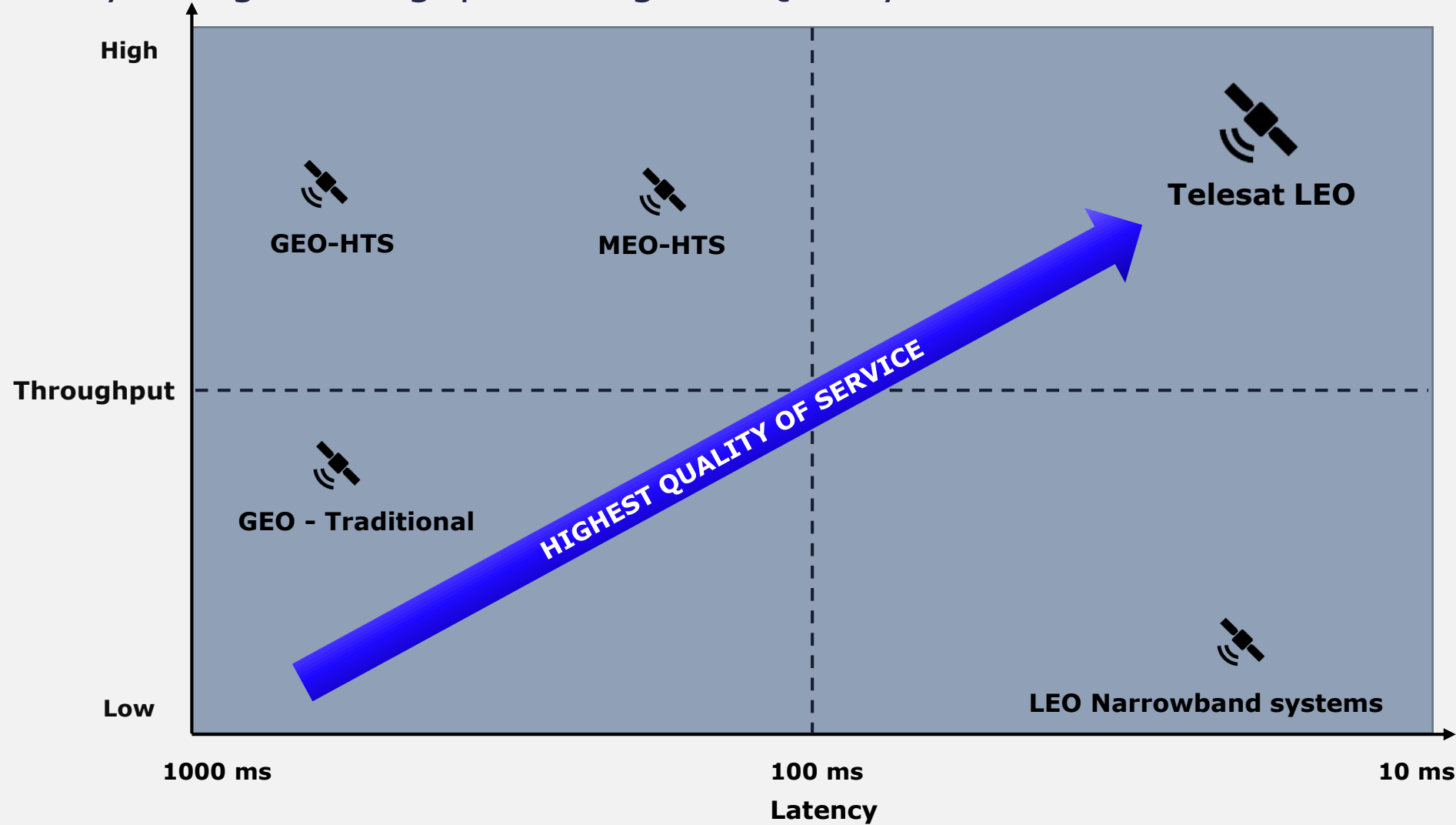
Telesat LEO - what is the overall value proposition?

Telesat LEO: more than low latency



Telesat LEO

Low latency + High throughput = Highest Quality of Service



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