# QMap®

IFC Experience Monitoring

IFC Passenger Experience: Quality Matters

Commercial aviation passenger expectations for quality inflight Internet access are growing—and influencing travel decisions. Inflight connectivity (IFC) service providers must meet or exceed these expectations. The first step is to know what passengers are experiencing. This requires measuring the actual in-seat connectivity experience, and using that information to understand, manage, and tune the IFC service to ensure the best possible experience. ®

QoE vs QoS

While vendor-defined Service Level Agreements (SLAs) may be helpful to set expectations between a vendor and a business aviation operator, SLAs only monitor the Quality of Service (QoS) of infrastructure along a portion of the overall path. In contrast, Quality of Experience (QoE) is measured at the seat level, and captures the passenger's end-to-end experience, encompassing the entire data path, not just the portion of the path between the aircraft and the ground station.
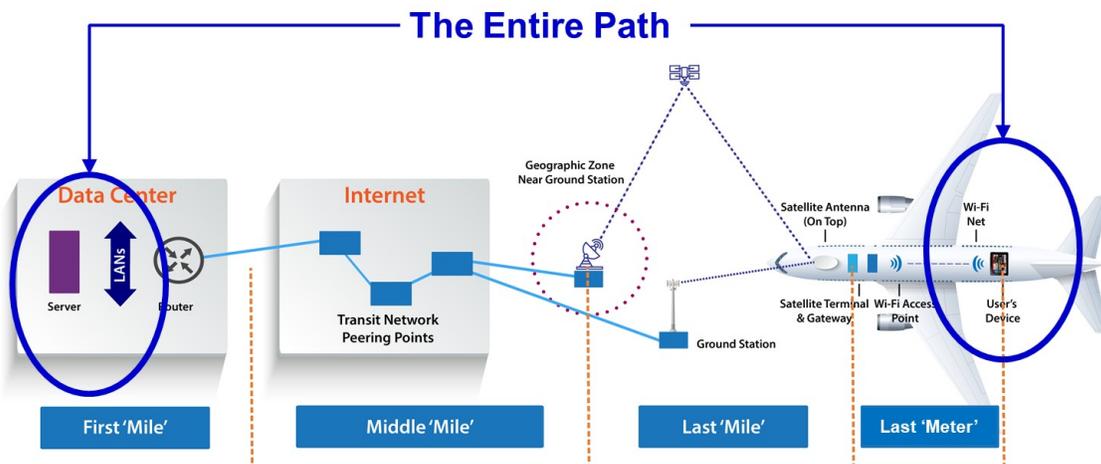
Measuring the Passenger Experience

Passenger quality of experience is best measured continuously, from end to end on regularly scheduled flights, and evaluated independently of the communications technology and vendors involved in delivering the IFC service.

That is what we do.

NetForecast®

QMap® IFC Experience Monitoring

NetForecast's QMap IFC Experience Monitoring performs active tests from an application installed on passenger or flight crew mobile devices, or on a hardware probe onboard the aircraft. The QMap application captures end-to-end latency, packet loss, DNS lookup time, and effective bandwidth data throughout each flight. When connected to the Internet, the QMap application continuously uploads performance and contextual data (e.g., flight position and altitude) to the QMap analytics engine, which creates near real-time reports of end-to-end IFC performance.

QMap reports provide visibility into massive amounts of user experience data, enabling operators, IFC providers, and system vendors to quickly locate and resolve performance issues.

NetForecast's QMap analytics engine documents the passenger's in-seat experience by application type and applies intelligence about the application type's sensitivity to network performance in order to rate the user experience. For example, a satisfying online game experience requires low network latency and high bandwidth, while file transfers and streaming applications can deliver an acceptable experience under high latency and low bandwidth conditions. Knowing this enables network service providers and system vendors to deliver the best possible performance for the applications that are typically important to passengers while in the air.
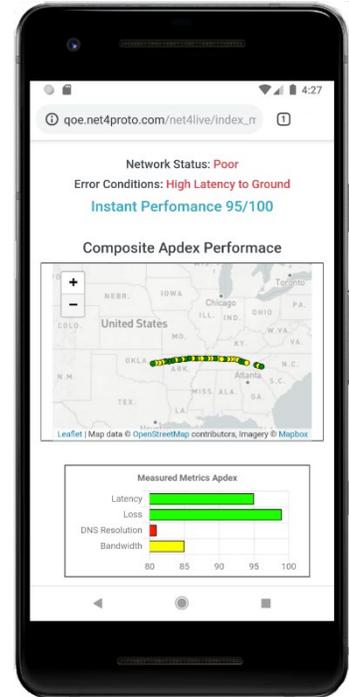
What We Measure

Four network performance metrics, latency, packet loss, domain name service (DNS) lookup time, and effective bandwidth, are critical to measuring application performance. Variations in each of these metrics affect the user experience within the application categories differently, and application types have varying degrees of sensitivity to changes in the metrics. For this reason, single metrics such as "speed" are insufficient to measure the true passenger experience. Here are descriptions of the four key network performance metrics.

Performance Metric	Description
Network Latency	Elapsed transit time from passenger device to server and back. Reported as round-trip-time (RTT).
Packet Loss	Data packets lost during an RTT event or within a TCP flow (reported as percent of packets lost relative to packets sent).
DNS Lookup Time	Time for domain name-to-IP address lookup by the DNS system (reported in milliseconds—ms).
Effective Bandwidth	Rate of information received by a single user (reported in Megabits per second—Mbps).

Why These Metrics Matter

The four metrics NetForecast measures are important because when they degrade, application performance can suffer, as the following chart shows.

Application Types	Examples	Impact on User Experience			
		Latency	Loss	DNS Response	Effective Bandwidth
Web Interactive	Shopping, Email, Browsing, Social Media	High	High	High	Low
Web Office	Office 365, Google Docs, VPNs	High	High	Low	Low
Gaming	Fortnite, Minecraft	High	High	Low	High
Videoconferencing	Zoom, Teams, Webex	High	High	Low	Low
File Transfer	Software Updates, Backups, Photo Uploads	Low	Low	Low	High
Streaming	Netflix, Hulu, Pandora, Spotify	Low	High	Low	Low

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