# Managing the IFC Experience

Aircraft broadband networks have traditionally focused on delivering data to and from the airplane. The users onboard compete for the network resources, and each aircraft competes with other aircraft for network resources. Fixed data rate provisioning can leave some aircraft underserved while other aircraft have capacity to share. The users suffer in the first instance and revel in the latter.

The traditional IFC model adjusts network resources against a service level agreement (SLA). The IFC experience is a limited by the available network resources but can be optimized by Quality of Experience (QoE) management, such as filtering or limiting service to specific applications, or by managing the user data rate in response to user demand. The QoE feedback provides an adjustment to network resources when QoE measures indicate a shortfall, even while QoS measures indicate compliance to an SLA. The quality level agreement (QLA) or experience level agreement (XLA) provides a basis to judge QoE measures.

Customer feedback, whether by their purchase decisions or by their complaints, can indicate dissatisfaction that may not be apparent even with sophisticated QoE measures. User feedback is applied to network resources as a long-term trend towards aligning resources to achieve good expectations.

Seamless Air Alliance Release 3 (SR3) defines the QoS, QoE, and User measurement and features necessary for managing the IFC Experience. The IFC transfer function portrays three feedback paths as they adjust network resources to meet customer expectations.
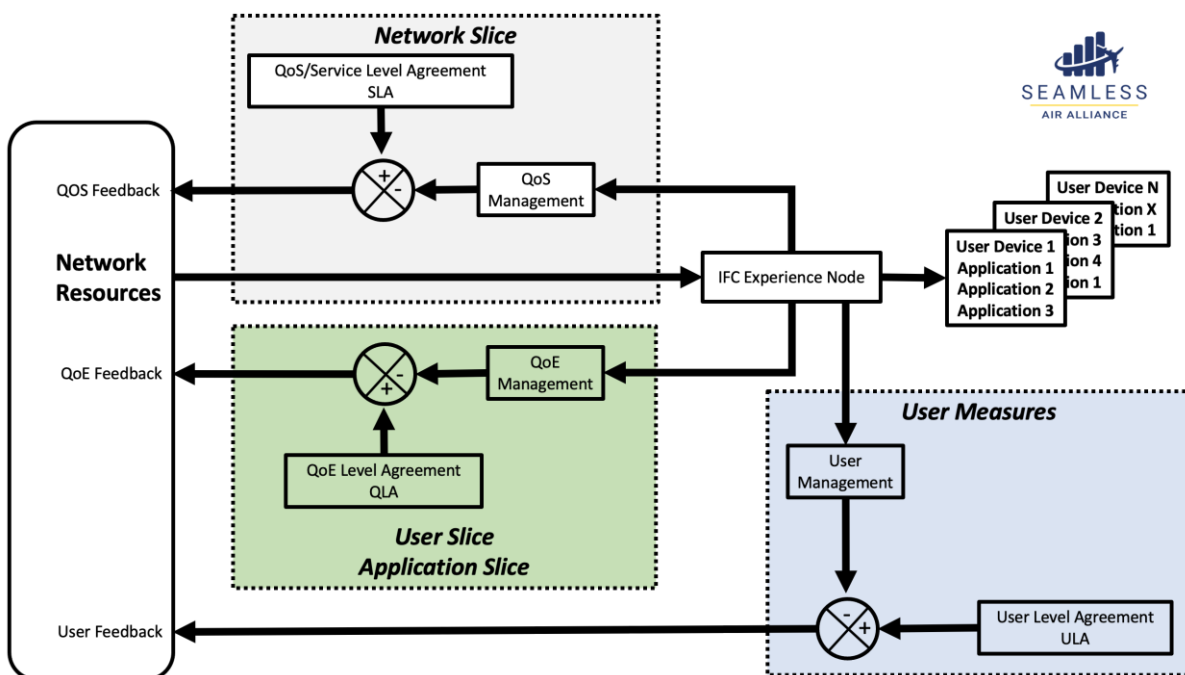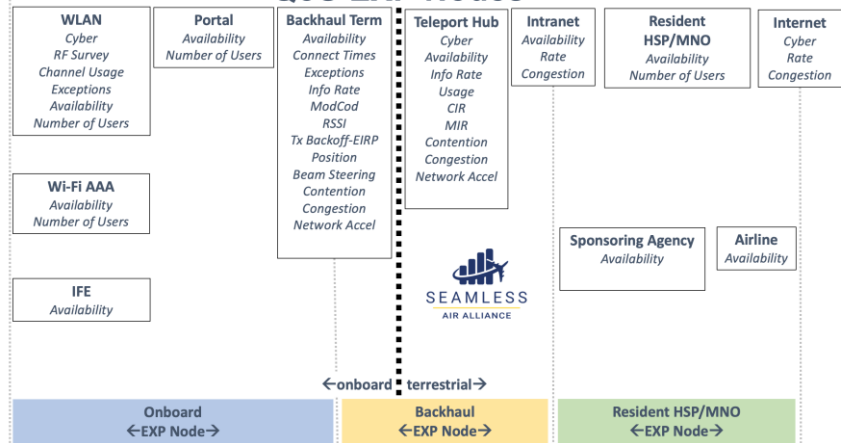

IFC Transfer Function

EXP Nodes

SR3 EXP nodes are distributed to three locations:
- Onboard
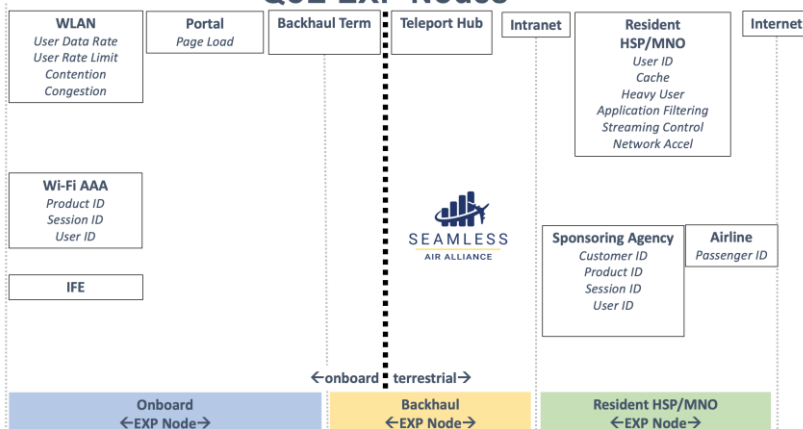- Backhaul teleport
- Resident HSP/MNO
-

Each EXP node includes measures and features relating to QoS, QoE, and to User.

EXP nodes may be software defined and installed on a generic hosted platform (SR4 Hosted Platform).

QoS EXP Nodes

WLAN
Cyber
RF Survey
Channel Usage
Exceptions
Availability
Number of Users

Portal
Availability
Number of Users

Backhaul Term
Availability
Connect Times
Exceptions
Info Rate
ModCod
RSSI
Tx Backoff-EIRP
Position
Beam Steering
Contention
Congestion
Network Accel

Teleport Hub
Cyber
Availability
Info Rate
Usage
CIR
MIR
Contention
Congestion
Network Accel

Intranet
Availability
Rate
Congestion

Resident HSP/MNO
Availability
Number of Users

Internet
Cyber
Rate
Congestion

Wi-Fi AAA
Availability
Number of Users

IFE
Availability

Sponsoring Agency
Availability

Airline
Availability

←onboard ┊ terrestrial→

| Onboard ←EXP Node→ | Backhaul ←EXP Node→ | Resident HSP/MNO ←EXP Node→ |

QoE EXP Nodes

WLAN
User Data Rate
User Rate Limit
Contention
Congestion

Portal
Page Load

Backhaul Term

Teleport Hub

Intranet

Resident HSP/MNO
User ID
Cache
Heavy User
Application Filtering
Streaming Control
Network Accel

Internet

Wi-Fi AAA
Product ID
Session ID
User ID

IFE

Sponsoring Agency
Customer ID
Product ID
Session ID
User ID

Airline
Passenger ID

←onboard ┊ terrestrial→

| Onboard ←EXP Node→ | Backhaul ←EXP Node→ | Resident HSP/MNO ←EXP Node→ |

QoE differs from QoS

QoE applies to one User ID, User Type, Application, or Application Type; at a time.

QoS applies equally to all users and applications within a single network slice.
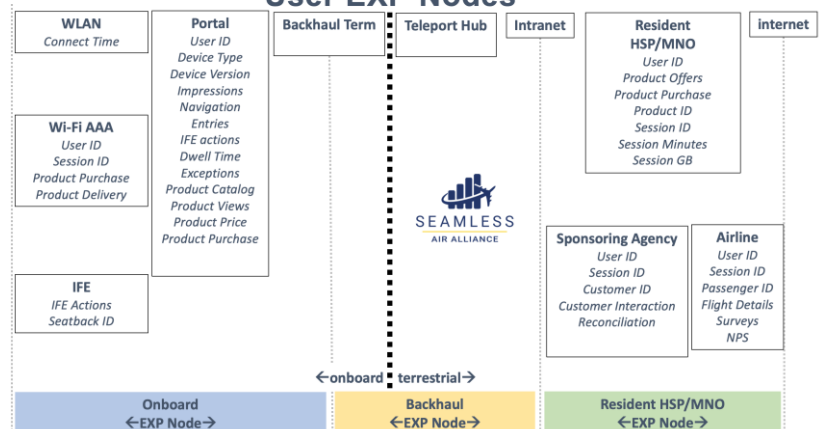
QoS does not differentiate between users within a network slice.

User

IFC User interaction outside of the internet data stream includes:

- product purchase history
- usage
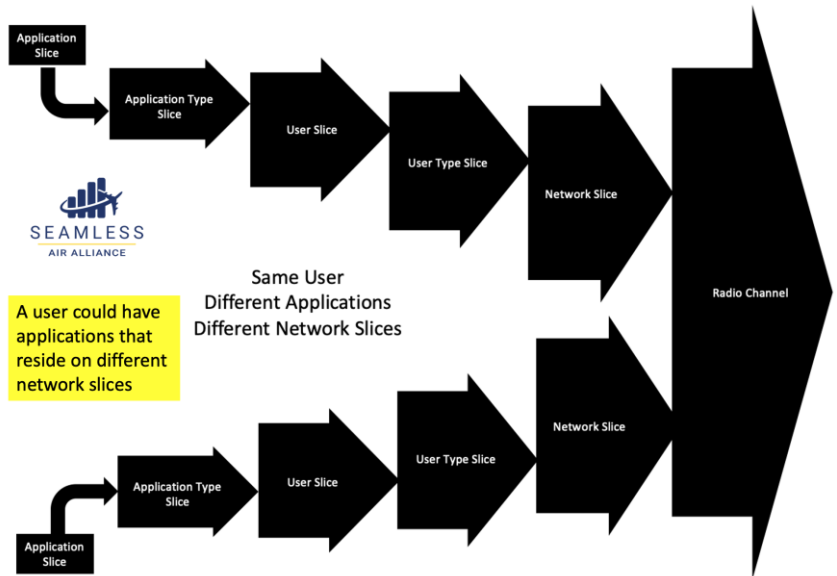- preferences
- feedback/complaint
- portal interactions.

User EXP Nodes

WLAN
Connect Time

Portal
User ID
Device Type
Device Version
Impressions
Navigation
Entries
IFE actions
Dwell Time
Exceptions
Product Catalog
Product Views
Product Price
Product Purchase

Backhaul Term

Teleport Hub

Intranet

Resident HSP/MNO
User ID
Product Offers
Product Purchase
Product ID
Session ID
Session Minutes
Session GB

internet

Wi-Fi AAA
User ID
Session ID
Product Purchase
Product Delivery

IFE
IFE Actions
Seatback ID

Sponsoring Agency
User ID
Session ID
Customer ID
Customer Interaction
Reconciliation

Airline
User ID
Session ID
Passenger ID
Flight Details
Surveys
NPS

←onboard ┊ terrestrial→

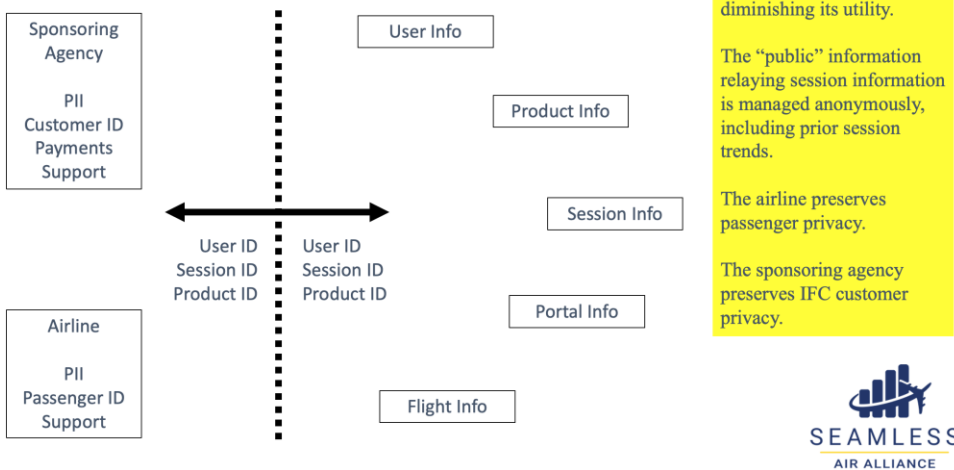| Onboard ←EXP Node→ | Backhaul ←EXP Node→ | Resident HSP/MNO ←EXP Node→ |

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QoE optimizes the IFC service within the constraints of QoS.

QoE features may redirect user slices or application slices to different network slices that may be most appropriate.

A user slice (a set of applications) refers to a QoE function that differentiates between users or commits resources to an individual

Application Slice

Application Type Slice

User Slice

User Type Slice

Network Slice

Radio Channel

Same User
Different Applications
Different Network Slices

A user could have applications that reside on different network slices

Application Type Slice

User Slice

User Type Slice

Network Slice

Application Slice

Sheltering privacy

Sponsoring Agency

PII
Customer ID
Payments
Support

User Info

Product Info

Session Info

Portal Info

Flight Info

User ID
Session ID
Product ID

User ID
Session ID
Product ID

Airline

PII
Passenger ID
Support

A "curtain" shelters personally identifiable information without diminishing its utility.

The "public" information relaying session information is managed anonymously, including prior session trends.

The airline preserves passenger privacy.

The sponsoring agency preserves IFC customer privacy.

Privacy

Personalization is a double-edged sword, the upside is unlimited, but users can become wary of being tracked.

PII, Personally Identifiable Information, cannot be revealed without permission.

Anonymous profiles allow free use of information by all parties and gives the individual the freedom to express themselves without worry or concern.

Quality of Experience involves deep packet inspection and correlation to recognized behavior through machine learning.

- Application filtering allows for allowing or blocking data flows and for applying application-specific features. The confidence level and breadth of application filtering, the more precise the experience can be managed.
- Onboard cache can accelerate content retrieval.
- Protocol acceleration reduces the time for content retrieval.
- Streaming management can provide for negotiated resolution rates by the serving provider, or brute force data rate limitations.
- Temporary access to a higher data rate (Turbo Mode) can speed web page retrieval.
- A fair use policy may levy a penalty by lowering the data rate for any user consuming more than their share of the available data rate.

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IFC Provisioning

SR3 creates the need to manage a user slice based on a minimum data rate related to throughput and a maximum data rate (Turbo Mode) related to responsiveness.

SR3 provides examples of how to scale a network slice based on the number of user and the product type.

Browsing Forward	User Slice		Network Slice	
Number of Users	Min kbps	Max kbps	CIR kbps	MIR kbps
1			150	1000
2	150	1000	300	1250
3			450	1500

Browsing Return	User Slice		Network Slice	
Number of Users	Min kbps	Max kbps	CIR kbps	MIR kbps
1			50	200
2	50	200	100	250
3			150	300

The values shown are for discussion only to demonstrate how a network slice can be defined by the number of users.

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SR4
Seamless Certified Experience Expert Group
Leader: Arnaud Tonnerre (Thales)

Developing standards to measure (certify) the IFC Experience for Messaging, Browsing, and Streaming products. Application specific measures account for diverse user behaviors and internet service, used for product acceptance, in-service monitoring, and customer support.

SR4
Personalization Expert Group
Leader: Mark Cheyney (Virgin Atlantic Airways)

Developing the information base for ancillary revenue and brand reinforcement. Allowing the passenger/customer to manage one or more anonymous travel profiles with trip history, product service history, loyalty status, interests, preferences, and demographics.

SR4
IFC EXP measurements Expert Group
Leader: Brian Kirby (Telesat)

Building a troubleshooting guide for IFC. Identifying every possible state an IFC session can encounter, the data necessary to recognize the situation, the data necessary to correlate system events to functional impact. The troubleshooting guide ensures all events can be identified and that all data collected is useful.

SR4
Hosting Platforms Expert Group
Leader: RJ McLaren (Kontron)

IFC systems are designed around onboard appliances. IFC experience measurements and personalization drive extra requirements that are not aligned to an existing LRU. A generic hosted platform can provide a foundation to build value-added services that enhance the IFC Experience and support virtualization and software-defined functionality.

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