



**SEAMLESS**  
AIR ALLIANCE

## **Introduction to SR1**

A New Era of Inflight Connectivity

TECHNOLOGY BRIEF – FEBRUARY 2020

## Seamless Release 1.0 (SR1)

### A New Era of Inflight Connectivity Has Taken Off



#### For Passengers

Seamless delivers a streamlined experience, providing a secure and easy to-access service, connecting passengers everywhere they travel.



#### For Airlines

Seamless component interchangeability empowers airlines to rapidly take advantage of new capacity and innovations at the lowest cost.



#### For Mobile Network Operators

Opening the next dimension of coverage, Seamless roaming unleashes new services to over 4.5 billion passengers per year.



#### For Technology Suppliers

Seamless Standards establish confidence that equipment can be upgraded as technology advances, unleashing a backlog of airline commitments.

#### About the Seamless Air Alliance

The Seamless Air Alliance (SAA) mission is to pioneer a new era of inflight connectivity by bringing industries and technologies together to make connectivity simple to access and delightful to use. Together the leading airlines and technology providers are defining open standards for inflight connectivity. These Standards will enable passengers to connect in a secure and simple manner, provide airlines with flexible systems for the future, and accelerate innovation and rapid upscaling within the aviation industry.



## Foreword

**Jack Mandala**  
Chief Executive Officer  
Seamless Air Alliance

High-quality connectivity is a driving factor in airline preference and one of the biggest ways that airlines can differentiate themselves from their competition. Keeping pace with increasing expectations for connectivity in the skies will be necessary to ensure future passenger loyalty.

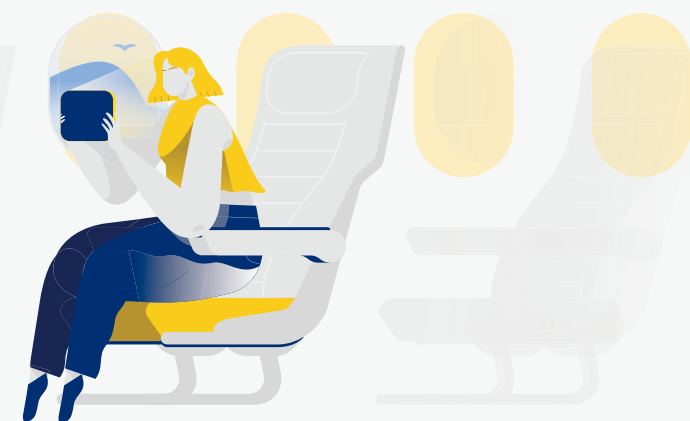
The Seamless Air Alliance is an open, international collaboration of airlines, technology leaders, service providers and suppliers, formed to improve the way airlines build out connectivity, to support continuous innovation, and to allow rapid upscaling within the aviation industry.

**Seamless Release 1.0** (SR1) was completed in January 2020 by the Seamless Air Alliance, establishing the world's first modular platform for inflight connectivity. The Standards enable long-term technical flexibility for airlines, a secure and easy-to-access service for passengers, and open the door to seamless roaming with mobile network operators.

Seamless Release 1.0 Standards enable the industry to take advantage of new capacity and innovations faster and more cost effectively than ever before, allowing airlines to continue satisfying passenger demands now and in the future.

**Seamless standards enable the industry to take advantage of new capacity and innovations faster and more cost effectively than ever before.**

A new wave of connectivity,  
Seamlessly surfing in the skies.



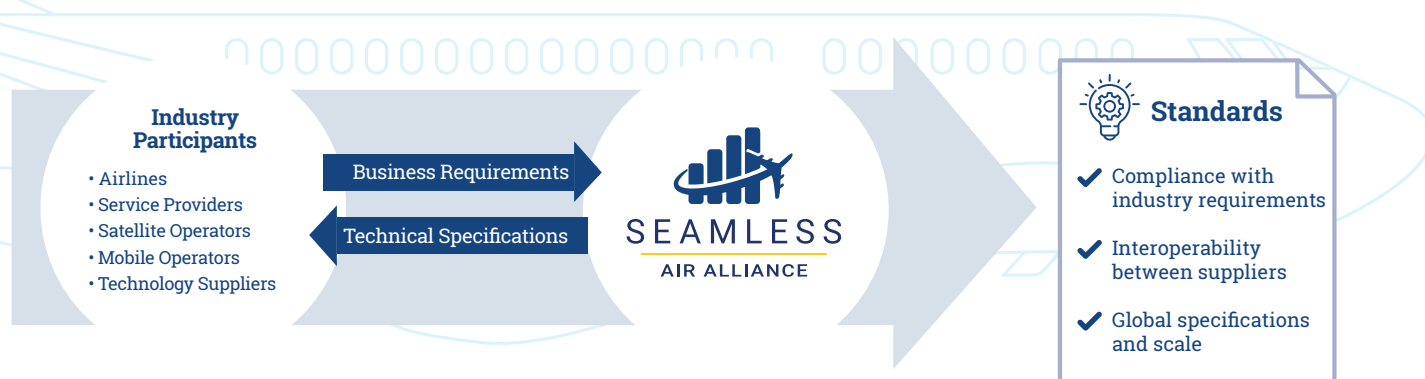


# World's First Modular Platform for Inflight Connectivity

Throughout a long history of technological developments, the critical inflection point that enabled success at scale has been the adoption of uniform standards. Standardization has been instrumental in the wireless industry, and even in the creation of the World Wide Web. Researchers and decision makers recognize standards as the most efficient means to drive scale and promote innovation.

**Seamless Release 1.0** was completed in January 2020 by the Seamless Air Alliance establishing the world's first Modular Platform for Inflight Connectivity. Seamless Release 1.0 breaks down inflight connectivity systems to provide specifications for individual functional components and defines a standardized system architecture. This provides the ability to integrate, deploy and operate inflight connectivity networks using components, subsystems and software sourced from multiple suppliers, connected over open interfaces.

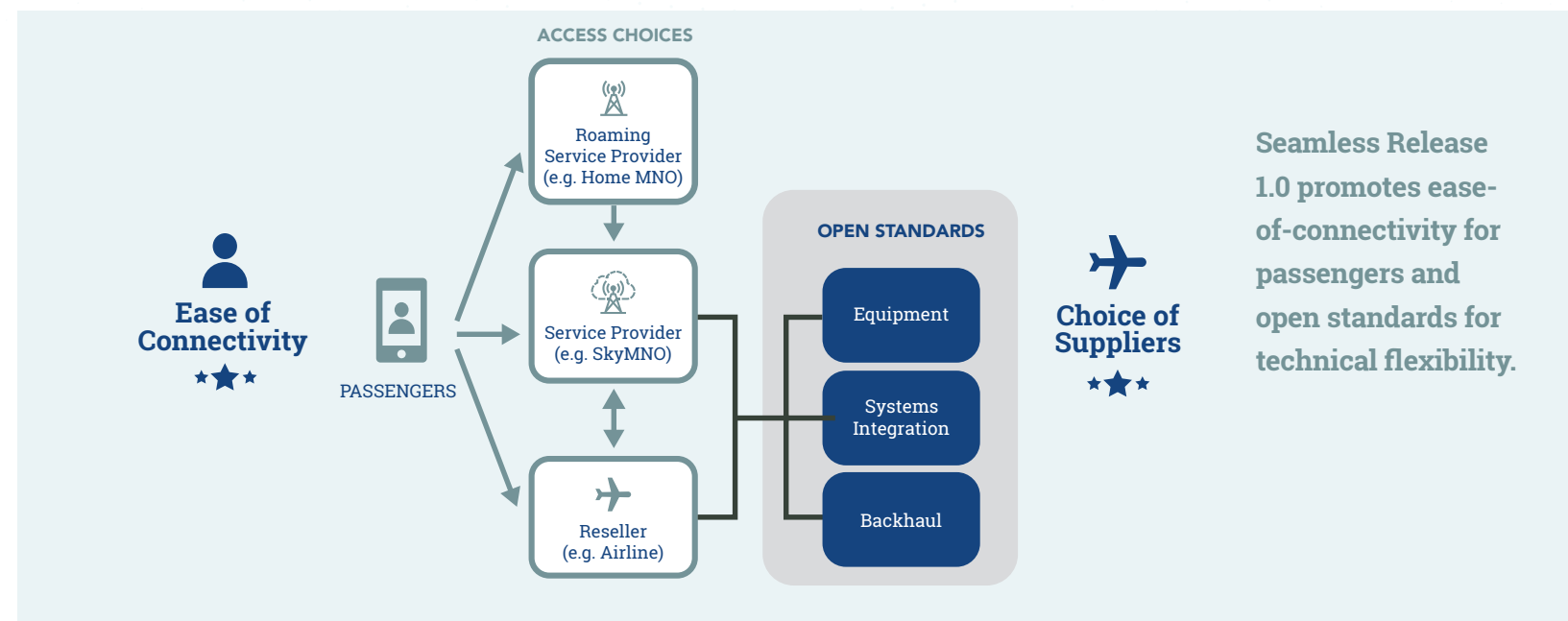
Global airlines, operators, and service providers, along with the leading technology suppliers have collaborated in intense Design Sprint workshops to develop Seamless Release 1.0. The resulting Standards will support ease-of-connectivity for the passenger, drive continuous innovation and rapid upscaling in the market, and unlock value across the entire industry.



**Seamless Air Alliance is a Global Collaboration of Airlines, Technology Leaders, and Suppliers**

Seamless Release 1.0 Standards enable the industry to implement new technologies faster and more cost-effectively than ever before. The system architecture, functional standards, and technical requirements utilize standard provisioning and installation definitions, and provide consistency in service and network design. Benefits include long-term technical flexibility, easy upgrade paths, a simplified cost structure, and global scale.

Additionally, Seamless Release 1.0 Standards create a common roaming framework for Airlines, Passengers, Suppliers, and Mobile Network Operators that will streamline the passenger experience and break through the take rate ceiling to deliver the highest level of passenger engagement.



**Seamless Release 1.0 promotes ease-of-connectivity for passengers and open standards for technical flexibility.**

The implementation of Standards will:

**Reduce wasteful and redundant product development**, freeing up resources to work on new, innovative advances (e.g. avoiding re-inventing the wheel)

**Allow the sharing of investment and reduction of risk** associated with the deployment of new technologies, promoting innovation through collaboration

**Establish and exploit network effects**, facilitating market development, economy of scale, increasing confidence and allowing markets to reach critical mass

**Help the commercial exploitation of new innovations**, providing the basis of an accepted framework within which patents can be filed

## Transforming Inflight Connectivity

**The Seamless interchangeable system enables rapid adoption of new technologies in a surgical manner without requiring customization to the aircraft or airline systems.**

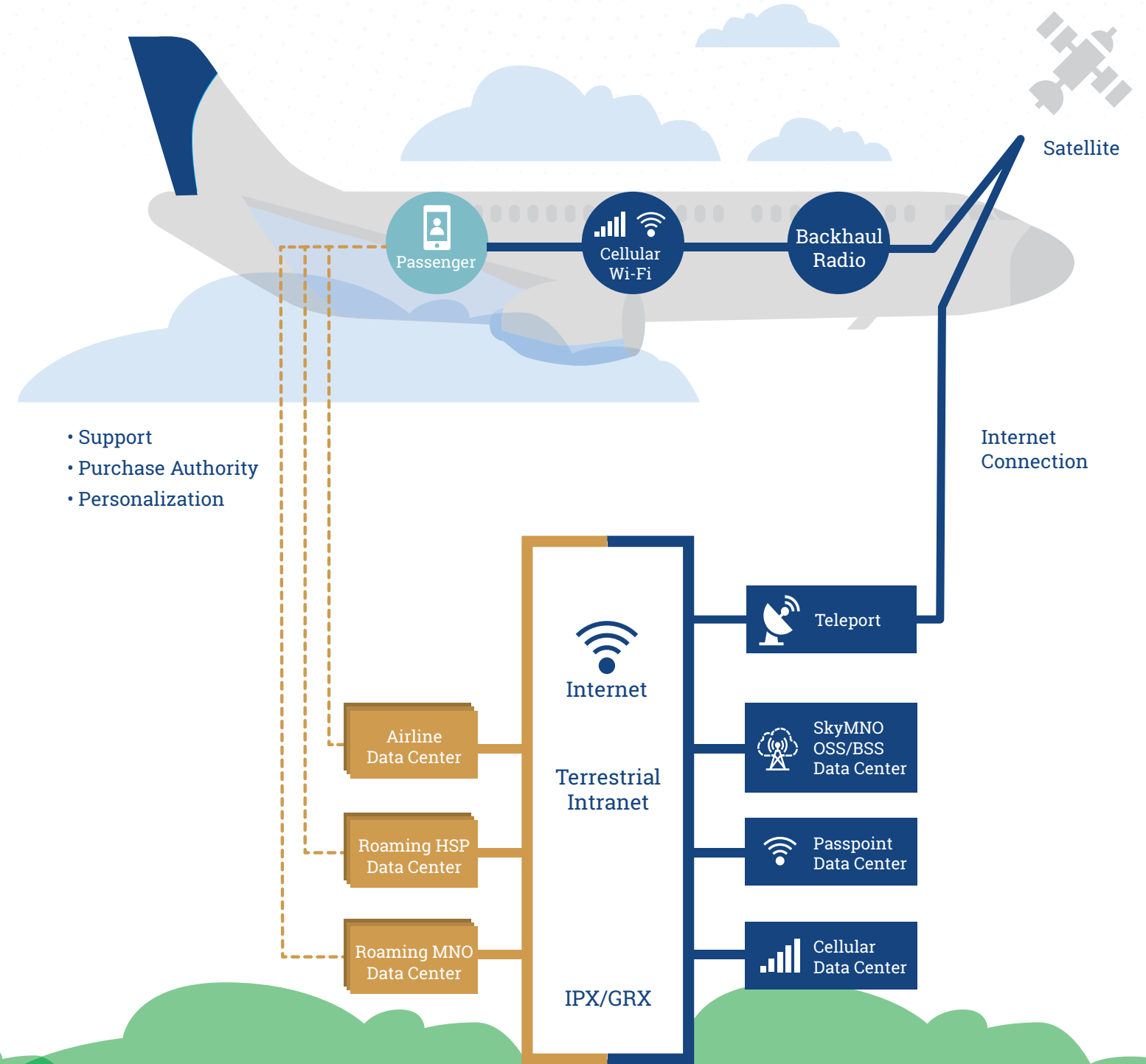
Over the past decade, we have witnessed IFC evolution through improvements in both ground and satellite-based services. The ability to roam over Wi-Fi has also evolved and is now integrated with cellular GSMA roaming. While staying connected on the ground has become a new world lifestyle, expectations for inflight connectivity continue to outpace the performance of systems, leaving passengers disconnected.

With each new leap in technology, the equipment onboard the aircraft becomes antiquated and soon obsolete. This leaves the airline with a decision to fall behind, or, face a substantial investment in the latest technologies. For an airline considering initial IFC adoption, it is a constant battle to decide when, and what, is the right technology to invest in when today's systems can be obsolete in as little as 3-5 years.

Fortunately, the next wave of performance enhancements is arriving right now. With advancements in antenna and modem technology, and multi-Tbps of new capacity coming online, airlines will have more options than ever before to super-charge connectivity and exceed the expectations of their passengers.

The Seamless Release 1.0 technical architecture breaks down inflight connectivity systems into modular components that are connected by open interfaces. This interchangeable system enables rapid adoption of new technologies in a surgical manner without requiring customization to the aircraft or airline systems. Interchangeability is a fundamental aspect that will result in substantial cost savings to airlines, while providing new opportunities for suppliers to upsell at the component level.

**The Seamless architecture ties together cellular and Wi-Fi systems.**





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## Simple, Flexible, and Scalable Standards

**Changes can be made with each Functional Component without risk of impacting the overall system integrity and interoperability.**

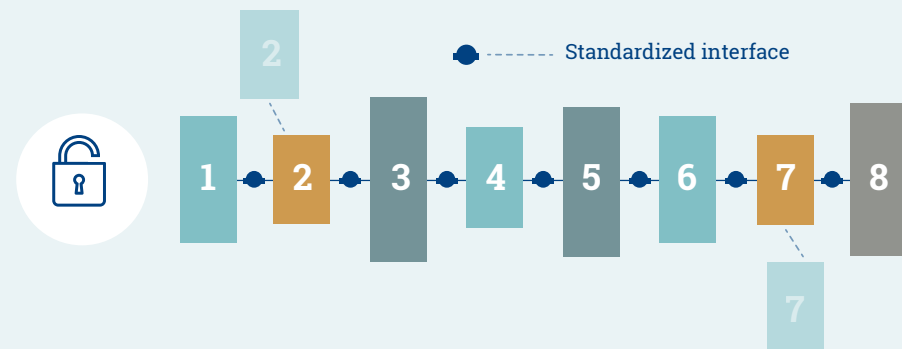
The Seamless Release 1.0 system architecture provides the ability to integrate, deploy and operate inflight connectivity networks using modular components, subsystems, and software sourced from multiple suppliers, connected over open interfaces.

The inflight connectivity system is divided into eight functional components with a detailed specification of interfaces between these functional components. Each interface has been defined to ensure the consistent transmission of data, the data format, and information to support the functions within each component.

This architecture provides airlines, suppliers, service providers and system integrators, with the flexibility to select components that optimize the capabilities and performance for each application. As new technology emerges, revisions can be made within each functional component, without the risk of impacting the overall system integrity and interoperability, providing incremental upgrade paths that have not been available to the industry until now.

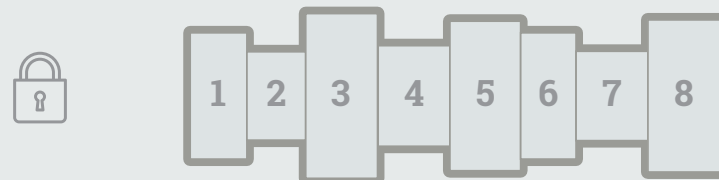
### Modular IFC

Plug-and-Play  
Scalable  
Incremental



### Legacy IFC

All or Nothing



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## Seamless Roaming

In order to accommodate as many device types as possible, Seamless Release 1.0 leverages the latest cellular and Wi-Fi connectivity using standards defined by the GSMA and Wi-Fi Alliance, along with roaming and inter-roaming frameworks developed by the GSMA and WBA. Seamless Release 1.0 defines an automatic, onboard connection utilizing secure authentication using SIM-based authentication with the passenger's cellular Mobile Network Operator and certificate-based authentication with the passenger's Passpoint Hotspot Service Provider.

Seamless Standards support **Hotspot 2.0**, which is widely used today. Hotspot 2.0 offers passengers an automatic and secure connection, compared to legacy public Wi-Fi hotspots where the passenger has to first manually connect to the Wi-Fi network without any additional security and then manually authenticate. Cellular subscribers of participating Mobile Network Operators are automatically authenticated to Hotspot 2.0 Wi-Fi networks at airports, subways, and other venues. Inter-roaming is enabled by a standard agreement between a Mobile Network Operator and a local Wi-Fi Hotspot Service Provider, enabling coverage and capacity in the most demanding locations.

In addition to making it easy for passengers to connect, Hotspot 2.0 provides a common provisioning methodology across suppliers and offers passengers a more secure connection than commonly used in Wi-Fi networks.

Seamless Release 1.0 also supports **native cellular roaming**. A future-proof, industry-standard configuration ensures simple integration of onboard RAN and core functions with any cellular operator.



### HOTSPOT 2.0

A passenger's device recognizes and authenticates a supported hotspot using a certificate.

The device immediately and **automatically attaches** to the hotspot without any user interaction.

The resultant session is **fully encrypted** over-the-air (WPA2, WPA3).

The user is identified by the **strong authentication** stored in the device which provides a reliable link to a specific passenger.

The authentication enables quick **personalization**.



### LEGACY SYSTEMS

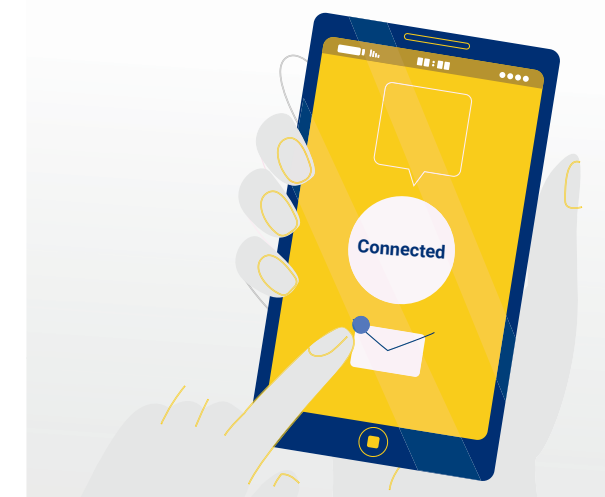
A passenger is presented with a public hotspot.

The passenger **must select the correct Wi-Fi SSID** trusting the name alone.

The passenger must then browse to the captive portal to **enter personal information**, which is sent in the clear over Wi-Fi, the session remains open to overhear by anyone in the vicinity.

The passenger then must **make a purchase decision onboard** and provide a form of payment from their seat – all barriers to increasing take rate.

The passenger is essentially **anonymous**.



## Unlocking Value Across the Industry



**With the flexibility offered by the Seamless modular architecture, airline executives are provided with greater control over their commercial and service destinies.**

### Airline Benefits

#### FUTURE-PROOFING IFC INVESTMENTS

Trapped between increasing passenger demands for connectivity and the high cost and complexity of deploying these systems, airlines face tough decisions on which technology type and service platform is right for their aircraft, routes, and passenger needs. Within this past year, we have seen stagnation in new IFC integration activity as some airlines await new LEO/MEO technology implementations. Airlines wanting to stay competitive risk installing a system that will be antiquated before the mid-point of their service contract.

Seamless Release 1.0 Standards eliminate the risks of near-term obsolescence by implementing a modular structure of components that are plug-and-play oriented in the same manner that many other aircraft systems operate today. Individual IFC functional components may be upgraded as technology advances, without heavy customization fees or needing to replace the entire onboard system. With the flexibility offered by the Seamless modular architecture, airline executives are provided with greater control over their commercial and service destinies.

#### DEVELOPING SOURCING REQUIREMENTS

Seamless Business and Technical Standards provide a complete and comprehensive set of unique and testable requirements for airlines to use when developing connectivity sourcing requests. This fixed template for responses enables a true “apples to apples” comparison between suppliers allowing the airline to focus on commercial and performance differences more readily.

In addition to saving the airline time and money to develop these requirements, standards eliminate the risk of trying to predict how future developments will impact their choice of systems, by enabling component interchangeability with future advancements.

#### IMPROVING NET PROMOTER SCORES (NPS)

Airlines have seen the impact that a poor connectivity experience has had on net promoter scores and recognize the growing importance of connectivity in airline preference. On the ground, consumers expect their cellular devices to stay connected everywhere they travel without interruption. The ability to meet ever-increasing expectations for connectivity in the skies has become a driving factor in airline preference.

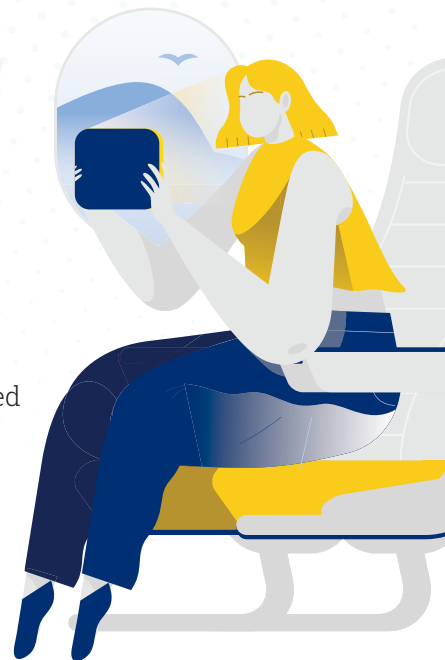
**High-quality connectivity is one of the biggest ways that airlines can help differentiate themselves from their competitors and drive passenger loyalty.**

#### UPGRADING LEGACY SYSTEMS

Through the cooperation of airlines, service providers, and technology partners, legacy installations can be adapted to support emerging features and functionality. Incremental upgrades to these systems to support Seamless connectivity creates a staircase toward improving passenger satisfaction at a reduced cost compared to wholesale system replacement.

#### CONTINUED SERVICE DIFFERENTIATION

Airlines that deploy open systems can focus their resources on meaningful differentiation of their service. In practice, the wireless industry has been competing for decades using standards-based equipment and airlines will compete in a similar manner.



**Meeting increasing expectations for connectivity in the skies will soon become a driving factor in airline preference.**

Airlines will differentiate themselves by making decisions on:

<b>Technology Providers</b>	Equipment and systems will vary in performance by supplier
<b>Third Party Partners</b>	Retail, music, commerce, and sponsorship opportunities
<b>Inflight Entertainment</b>	Premium and exclusive content per target demographic
<b>Service Rollout</b>	Fleet coverage and extension to airline partners
<b>Service Offering</b>	Service promotion, customer loyalty programs and other incentives



**Expanding the size of the market and opening up investment with additional new revenue opportunities driven by a more frequent refresh of modular components.**

## Technology Supplier Benefits

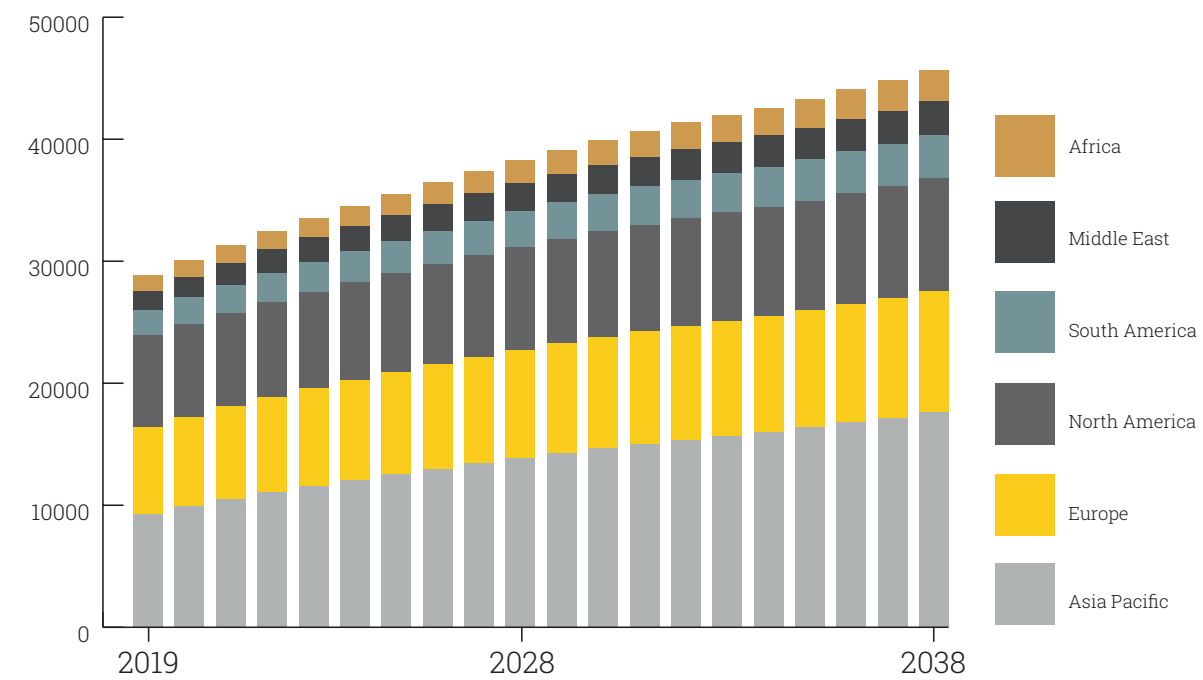
Standardization is set to open the IFC marketplace to a scale it has never seen before. Recasting the IFC system into modular functional components will be the catalyst for more efficient technology improvements and for faster implementations throughout the IFC marketplace.

The benefits of standardization extend beyond the potential savings for airlines, it will also allow the injection of new capital into the ecosystem, expanding the size of the market, and opening up investment and revenue opportunities driven by more frequent refresh of modular components.

IFC service providers are currently saddled with developing the entire onboard system to ensure component compatibility and performance. Seamless Standards reduce the cost, complexity and timelines of bringing new products and components to market. With compatibility between components, technology suppliers can specialize on an individual component (e.g. onboard service, system integration, backhaul, roaming) without the need to design, develop and produce the entire system.

The addressable market will grow with the worldwide fleet by more than 50% over the next 20 years.

**Worldwide Fleet of Passenger Aircraft 2019-2038**



Source: ICF

While Seamless Release 1.0 promotes innovation between suppliers, the importance of protecting intellectual property around the technologies has not been overlooked. By developing Technical Standards that identify the system at the functional component level, including inputs, outputs and interface requirements; the technology behind the internal function is fully protected.

A system architecture with flexibility, interchangeability, and an easy path for upgrades, is the foundation from which Seamless Release 1.0 reduces the risk in airline sourcing decisions and frees airlines to move forward with investments.





**Inflight roaming is a natural extension of the mobile network.**

### Mobile Network Operator Benefits

With over 4.5 billion annual passengers, the global airline industry represents the next dimension of coverage for mobile network operators.

Inflight roaming is a natural extension of the mobile network. Seamless Release 1.0 enables operators to broaden their footprint and offer differentiating inflight connectivity services to their subscribers.

Seamless Release 1.0 accommodates both cellular and Wi-Fi connectivity with roaming standards that have been defined by the GSMA and WBA.

Hotspot 2.0 enables cellular subscribers to seamlessly roam onto the onboard Wi-Fi network, even for aircraft that have not been outfitted with cellular equipment. This enables MNOs/MSOs/Telcos to cost effectively broaden their footprint and authenticate and attach, based on the subscription profile.

For aircraft equipped with cellular connectivity, Seamless Release 1.0 provides a future-proof, industry-standard configuration ensuring simple integration of onboard RAN and core functions with any cellular operator.

Seamless roaming provides an exciting convenience to passengers and a differentiating service for participating mobile network operators.



### Seamless Ready Approval Program

The Seamless Air Alliance formal conformance test and approval program is known as 'Seamless Ready'. This approval means that a product has been tested to validate its interoperability with Seamless Ready equipment from other suppliers.

The Seamless Ready approval sends a clear signal of trust to airline decision makers, indicating that they are purchasing a product that has met the Standard for interoperability; and the product will work as expected within the Seamless architecture.

#### This approval ensures:

- > **Appropriate utilization of Standards**
- > **Equipment portability and interoperability**
- > **Proper implementation of specifications**
- > **Interfaces and functions will work as expected**



Purchasing compliant solutions ensures that the IFC system is future-proofed, protecting the airline's capital investment from near-term obsolescence and minimizing future upgrade costs.

## Become a Part of the Future of IFC

Seamless Release 1.0 enables a secure and easy-to-access service for passengers, long-term technical flexibility for airlines, and opens the door to seamless roaming with mobile network operators.

By promoting open Standards and collaboration across the industry, the Seamless Air Alliance has enabled an improved way for airlines to build out connectivity and meet the needs of their passengers.

### SUMMARY

**Seamless Release 1.0 Standards create a common roaming framework** for Airlines, Passengers, Suppliers, and Mobile Network Operators to promote an exciting convenience to a broader passenger marketplace

**Seamless Standards define interchangeable functional components** within a scalable system architecture connected over open interfaces. The architecture is founded on configurability, standardized hardware, cloud-based components, and software-defined features; all sourced from multiple suppliers

**Seamless Release 1.0 includes a complete set of requirements for airlines to use when developing sourcing requests**, saving time and money to develop these requirements and ensuring component interchangeability with future technical advancements

**Passengers benefit from a streamlined experience**, allowing them to connect seamlessly through their current MNO, airline credentials, or onboard Wi-Fi, leading to increased take rates and higher passenger engagement

**Individual components can be swapped-out as technology advances**, without heavy customization or having to replace the entire onboard system eliminating the risk of trying to predict how future developments will impact a choice of systems



# Take the Next Step

Airlines, operators, service providers, along with the leading technology suppliers have all contributed to the development of Seamless Release 1.0.

Seamless is driving an environment that embraces continued technological evolution, promotes growth and innovation, mitigates risks of obsolescence, provides ease of use and improved performance to passengers, and will enable a new era of inflight connectivity.

Service suppliers and equipment providers are on board in a meaningful way in anticipation that airlines will soon adapt Seamless Release 1.0 requirements in their upcoming RFIs and RFPs.

Every Airline should be asking their suppliers...

**Are you Seamless Ready?**

SEAMLESS  
READY

SEAMLESS  
AIR ALLIANCE

Every Airline should be asking  
their suppliers...

## **Are you Seamless Ready?**

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and find out about opportunities to join.

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