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In-Flight Entertainment and Connectivity Innovations

Poised for takeoff

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Table of contents

In-Flight Entertainment and Connectivity Innovations

The first flight of airship Hindenburg offered passengers facilities like piano, lounge, dining room, smoking room and bar during a two and a half day flight between Europe and America.[1] It was in 1936 and since then, the Holy Grail for airlines and aircraft manufacturers has been to provide home like comfort and entertainment to passengers in the air. In-flight entertainment (IFE) has been an important component of this and has assumed an increasingly important role in recent times, in defining a passenger's overall flight experience. It is a crucial factor in reducing the psychological and physical stress caused due to the cabin environment when flying, especially long distances without stopovers.

The airline industry has recognized that IFE is one of the most important selection criteria for passengers while booking travel on a particular airline.[2] Recognizing this trend, airlines have been trying to continuously upgrade passenger's experience of in-flight entertainment, in terms of both content and how it is delivered to the passengers. While developing their IFE offerings, airlines have been striving to keep up with continuously evolving passenger expectations.

This paper discusses evolving passenger expectations and how aircraft manufacturers and airlines can enhance passenger experience through in-flight entertainment

1. http://www.airships.net/hindenburg/interiors

2. http://www.digecor.com/blog/2012/sneak-peak-2012-airline-passenger-survey-results/

IFE Evolution

To understand the current developments in the IFE world, it is worthwhile to look at evolution of IFE systems over the years. The evolution of IFE systems can be understood by broadly classifying it under four stages.

- **Embedded head-end centric v1**
  - Head end server for content, delivered to simple display device at the seat
  - Modeled on TV: multiple, limited content, allowing passenger to tune into the selected channel

- **Evolution: Embedded head-end centric v2**
  - Redundant head end server for HD content, delivered to display device at the seat over GigE or Fiber
  - Supporting Audio Video on Demand (AVOD), with large selection of varied content. May be prone to single-point-of-failure

- **Revolution: Embedded seat-centric**
  - Slimmed down IFE systems with content stored in the Seat Display Unit (SDU). Bulk content refreshes over the network in the background
  - Fault-tolerant design: A non-working SDU does not affect the entire system, and may even be replaced by crew easily in the air

- **Disruptive: Handheld**
  - Complete abolition of the SDU, or provisioned as an add-on to the SDU.
  - Wireless content update and/or streaming to airline provided on passenger's Personal Entertainment Devices (PEDs)

With connectivity being an important part of interaction with any device, the IFE system has also evolved to be an In-Flight Entertainment & Connectivity (IFEC) system. Driven by constant drive to enhance passenger experience, the In-flight entertainment and connectivity landscape is witnessing immense innovation. The "smart devices" paradigm has been well adopted and consumer electronics has made deep inroads into what once was a close, protected ecosystem, led by the twin trends of commoditization of hardware and on board broadband.

What do Passengers Want?

Passengers' expectations from airline IFE are benchmarked against their experience with consumer electronic devices and technologies that they have grown accustomed to. A great IFEC system must engage the passenger with a variety of infotainment options: audio, video, games, moving maps, flight info, terminal / connecting flights, chat, phone, SMS, shopping, destination info, attendant call, lavatory status, food menu… the possible options are endless.

However, today's discerning traveler wants still more. She wants an entertainment experience in the air that mirrors and seamlessly extends her experience on ground: high quality displays, content anywhere, social networking, and Bring-Your-Own IFE (BYO-IFE) while presenting a similar immersive HMI used on today's smart devices. Of course, the best IFE system is of no use if it does not work. Passengers dread being stuck with a non-working IFE, and so robustness of the IFE system is another must have criteria!

In a nutshell, this is the great consumerization of IFEC as never seen before. There is a massive opportunity for the players in this ecosystem to deliver the next generation IFEC experience to passengers.

Rethinking the Embedded IFE

One of the most exciting changes to the traditional IFE architecture is the move from head-end centric to seat-centric, to help deliver the innovative and robust experience to the passenger. Instead of storing the bulk content (video/audio) in the head end server, content is replicated at each individual seat display unit (SDU). This helps deliver a better user experience since Audio-Video on Demand (AVOD) HD content is served with extremely low latency and no jitter, with no effect of cabin network congestion if it occurs.

The storage of content at the seat produces various benefits:

- It allows the traditional moving map experience to become richer and user-interactive. Rather than have the moving map generated and streamed from the server, the map database is stored in the SDU and displayed based on the airplane flight coordinates sent by the server. This allows the passenger to interact with the map system, much like using interactive maps on the ground, e.g. zooming, POI, etc.

- It allows pre-recorded messages, safety videos, etc. to be stored at the SDU in different languages, with different language subtitles. Pre-Recorded Announcements and Music (PRAMs) are thus displayed in a language of the passenger's choosing.

- The seat-centric architecture also eliminates one of the key problems with the head-end centric architecture: single point media storage failure. Since the content is replicated, any media storage failure at a SDU is localized. The SDU seamlessly fetches content from the neighboring SDU, again ensuring that the user experience is unaffected.

- For the airline, the seat-centric architecture eliminates the need for redundant, expensive and heavy media servers at the head end and a high capacity expensive cabin network to ensure low latency, no congestion and minimal jitter when streaming AVOD HD video in

real time to all passengers simultaneously. This leads to savings in space, weight, cost, wiring, power, cooling and integration effort.

SMART SDU

At the heart of a seat centric architecture, is the concept of a "Smart SDU". The smart SDU, much like a smart phone or a smart TV, has a high resolution, capacitive touch screen, supporting touch gestures and icon driven interface, ability to play all formats of audio/video, with hardware decoding. It has a USB interface to allow the passenger to connect his own Personal Electronic Device (PED), and supporting a wealth of third party apps, from existing app stores.

Besides providing smartphone like features to passengers, the smart SDU also provides commercial benefits to the airlines. Being based on standard mobile or tablet chipsets and platforms, perhaps using an existing Android port, reduces the NRE as well as maintenance cost for the SDU, while creating a device that delays obsolescence for few years. A slimmed down smart SDU based on mobile/tablet platforms also allows easier integration into the seat, and immensely saves on power and TCO.

Wireless IFEC & BYO-IFE

Wireless technologies, notably Wi-Fi has been in use in aircraft cabins for many years, starting with Connexion. In recent times, it has found widespread acceptance for internet services within the aircraft cabin for passengers. Wireless networking can also be used in place of the wired network for the IFE system, either embedded or handheld. Using wireless in place of the wired network has some great advantages for the airline: weight saving due to elimination of cabling, and hence saving in fuel costs; simpler installation and maintenance.

It is not possible to use a wireless system to stream HD video to a large number of seats simultaneously. Using 802.11n, a single access point may be able to support no more than 20 simultaneous passengers watching full-HD video content (6 Mbps CBR), and in a wide body with close to 300 seats, a streaming wireless IFE solution may not be feasible. It is of course possible to have a wireless streaming solution with SD content, or with lower bitrate for HD content, or with fewer seats (e.g. single-aisle aircraft).

A more efficient solution is to use the wireless network with the seat-centric architecture for loading/refreshing of the bulk content to the SDUs. Current content is accessed by the passenger from the local store, while the content for the next refresh cycle is downloaded in the background using the wireless link. This scheme uses the wireless bandwidth as available, without relying on the wireless network to deliver a low latency, jitter free video streaming experience to the passenger.

Using an all wireless network for an embedded IFE is problematic since current regulations prohibit the use of wireless during take-off and landing. An embedded IFE system needs to interrupt the playing content to display announcements made by the flight crew, and play safety videos. During take-off and landing, without a network link to control the behavior of the SDUs, the SDUs would mandatorily need to be inaccessible to the passenger. A possible option is to use a wired network in addition to the wireless, e.g. power line communication, but that would largely defeat the intent of having an all wireless network.

Wireless networking really comes into its own when coupled with handheld devices: carrier-owned, or brought on board by the user, i.e. PEDs. As noted earlier, handheld devices cannot be currently used during take-off and landing, and hence the user experience suffers since the IFE is available only during level flight.

Delivering an IFE experience on PEDs, i.e. Bring Your Own IFE or BYO-IFE, is truly a disruption of the current IFE models. It relies on equipment brought on board by the passenger at no cost to the airline, and is usually a generation ahead of the installed, embedded IFE. It is available to the passenger at no cost to the airline, and can serve to keep the passenger entertained when there is no installed IFE in the aircraft.

Wireless IFE will serve as a complement to existing embedded IFE systems in the long-haul market, while it may be the perfect solution for the short-haul market which usually has no entertainment options.

Two Screens are Better than One!

The new age digitally connected consumer interacts with a plethora of screens simultaneously: e.g. multi-tasking between a smart phone and laptop, content being moved from a smaller display (phone) to a large display (TV), smart TV controlled by a tablet as remote. The consumer trend of using multiple screens is making its way into the IFE world.

In addition to the SDU screen, the passenger has a second device, a wired or wireless Passenger Control Unit (PCU). The PCU fully participates in the IFE experience by acting as an extension to the SDU, and provide an immersive, innovative dual touch screen user interface to interact with the IFE system. The dual screen paradigm lends itself to some remarkable use cases:

- Browsing through the media database on PCU or internet browsing, while watching content on SDU;

- Richer gaming experience

- Game control on PCU with gyroscope and accelerometer while display is on SDU

- Richer typing experience: touch QWERTY keypad on PCU, with text heavy (e.g. browser, chat, messaging) application display on SDU

The PCU can be a stand-alone smart device in its own right, built around a hardware platform, with a large touch screen, ability to provide in seat power, and USB connection for PEDs, sensors for gaming, and connected to the SDU using wired or wireless networking.

To save weight and cost, the PCU can even be just an LCD panel with touch screen wired to the SDU, borrowing the "extended desktop" paradigm from the PC world. This approach is even more revolutionary and splits the UI between the two screen, allowing applications to be displayed on either screen, with full touch/gesture interactivity !

Social Networking and Content Anywhere

Broadband connectivity is another disruption of the IFE experience. A stand-alone IFE system with the ability to only play stored content will not resonate with passengers in the near future. More and more airlines are providing internet services to passengers. Providing satellite backhaul on aircrafts is expensive currently, and bandwidth per passenger is limited. However, it is only a matter of time before bandwidth is plenty and cheap, and allows more content to be accessible on board an aircraft. The vast content available on private and public clouds and social networking options will be available to passengers. Pay TV subscribers are increasingly allowing consumers to view their content from anywhere and any device, and passengers can easily access their content from the IFE system on board an aircraft.

What Does the Brave New World of IFE Mean for the Eco-system?

The disruption and consumerization that the IFE industry is undergoing is shaking up the industry. It is clear that the very nature of IFE has been changed and for the better, however it is not clear what the future IFE system will look like, or whether one size will fit all. It does stand to reason that various hybrid IFEs will gain acceptance with passengers and airlines alike, and will have greater interoperability between them. Examples: BYO-IFE is being viewed as complementary to embedded IFE, rather than a replacement, and both Panasonic and Thales have started offering wireless IFE as an option to their mainstream IFE systems. Seat-centric and head-end centric will coexist, and Thales offers both options in its mainstream IFE system.

The basis of competition is changing in the IFE industry:

- Customers asking for off the shelf modular solutions rather than custom solutions, e.g. Lufthansa Systems ran trials of Q-streaming for Qantas, which now wants similar technology from

other suppliers of in-flight systems for a broader rollout across the 767 fleet.

- Existing customers start evaluating unexpected competitors: Boeing and Samsung partner together to "research and develop technologies that improve in-flight entertainment."

- New customer segment: Single aisle and no frills airlines using solutions from The IMS Company, Zodiac Aerospace and Bluebox Avionics.

Barriers to entry have been lowered for new players from the consumer and internet world. IFE system providers and content providers will probably be the first to be affected:

- With the commoditization of hardware, simpler, feature rich IFE systems from new vendors, and the disruptive BYO-IFE model, complex, extensive IFE systems will find few takers from airlines. For example, RAVE system from the IMS company has been extremely successful and The BoardConnect system from Lufthansa Systems has generated immense excitement.

- Broadband connectivity will reduce the power of traditional content providers to the airline industry since the source of content will either be free, or the passenger's own. Example: Unavailability of Hollywood early window content on BYO-IFE may not cause any heartache to passengers delighted with the internet pipe in the sky.

Nevertheless, it is to be noted that the incumbency of the established vendors is not going away soon. IFE systems from new vendors come with amazing innovation, price premium and weight savings to challenge IFE systems from established players. However the established vendors are innovating to compete with the new comers. Additionally, the established vendors have linefit status and a well-oiled ecosystem with multiple product lines and options, satellite connectivity, massive installed base, content tie-ups and Maintenance Repair and Operations (MRO) facilities.

Conclusion

With increasing frequency of travel and number of options available, the passenger will be more discerning in choosing an airline. Airlines will have to differentiate on the quality of experience they offer to passengers and IFEC systems will play a crucial role in this. Passengers will expect the IFECs to provide them the same experience as their smart devices. It is imperative for the suppliers of these systems to consistently innovate and keep pace with emerging technologies, to stay ahead.

About the Author

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