Aircraft interiors INTERNATIONAL

SEPTEMBER 2022

In this issue

Edge CACHING

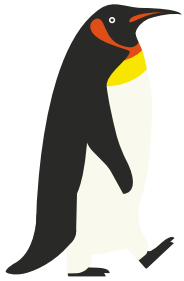
WHEN IFE AND CONNECTIVITY COMBINE TO ENABLE EDGE-CACHING OF CONTENT, A FANTASTIC OPPORTUNITY TO REDUCE COSTS IS CREATED

Up front

The latest ideas, thoughts and developments concerning the cabin space

Features

CONTENTS



082

084

086

THE TEAM

EDITOR Adam Gavine
adam.gavine@markallengroup.com

SENIOR ART EDITOR Anna Davie

DEPUTY ART EDITOR Louise Green

DESIGNERS Andy Bass, Julie Welby

CONTRIBUTORS: Guy Bird, Michael Childers, Jennifer Coutts Clay, Dr Nicola Davies, Natasha Edwards, Marisa Garcia, Seth Miller, Christine Negroni, Tomás Romero, John Walton

PRODUCTION Sejal Patel

CIRCULATION MANAGER Chris Jones

EDITORIAL DIRECTOR Tom Stone

PUBLISHER Simon Hughes
simon.hughes@markallengroup.com

COO Jon Benson
jon.benson@markallengroup.com

CEO Ben Allen
ben.allen@markallengroup.com

CHAIRMAN Mark Allen

Member of the Audit Bureau of Circulations
Average net circulation per issue for the period January 2021 to December 2021 was 14,038

Published by

MA Business
Part of Mark Allen

www.markallengroup.com

Business Jet Interiors International,
ISSN 1463-8932 (print), ISSN 2397-6446 (online),
(USPS 019-144) is published five times per annum by
MA Business Ltd,
Hawley Mill, Hawley Road, Dartford, Kent,
DA2 7TJ, United Kingdom.
Tel: +44 (0)1322 221144
Email: aircraftinteriors@markallengroup.com

The annual subscription price is £90/US$120.
Airfreight and mailing in the USA by agent named WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Periodicals postage paid at Jamaica, NY 11431. US Postmaster: Send address changes to Aircraft Interiors International, WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA

Subscription records are maintained at MA Business Ltd, Hawley Mill, Hawley Road, Dartford, Kent, DA2 7TJ, United Kingdom. Air Business Ltd is acting as our mailing agent.

Printed in the UK by Pensord, Pontllanfraith, Blackwood, NP12 2YA

MOVING ON?
If you change jobs or your company moves to a new location, please contact **circulation@markallengroup.com** to continue receiving your free copy of *Aircraft Interiors International*

Cover image: Tracy Worrall

The path to IFEC convergence

TRADITIONALLY, IFE AND CONNECTIVITY HAVE BEEN TWO SEPARATE SYSTEMS, WITH IFE DEPENDING ON CONTENT STORED LOCALLY ON THE AIRCRAFT, AND CONNECTIVITY DELIVERING CONTENT IN LIMITED AMOUNTS FROM OUTSIDE THE AIRCRAFT, CONSUMED IN REAL TIME. NEW SYSTEMS ARE EMERGING THAT INTEGRATE IFE AND CONNECTIVITY ON A SINGLE DIGITAL EXPERIENCE PLATFORM (DXP), EMPLOYING STANDARDISED 'EDGE CACHING' TO DELIVER OPTIMISED PASSENGER CONNECTIONS WHILE PRESERVING BANDWIDTH

Words by Michael Childers. Illustration by Tracy Worrall


Toilets

"Despite the rapid advances in broadband bandwidth, content delivery and adaptive streaming, there are still places where the internet doesn't work the way it's supposed to. Planes and trains are obvious examples ... "

NETSKRT SYSTEMS

Today, the principal method of storing content for IFE is locally on the aircraft; by the end of the decade, most experts agree that it will be in the cloud, delivered by connectivity. But architecting a path that involves – among other things – a migration from one method of storage to another, is no simple task.

In the broadcast world, traditional distribution methods like cable are yielding to direct-to-consumer (D2C) streaming services such as Disney+, HBO Max, Paramount+ and Peacock. In IFE, the work has been incremental; in 2015 APEX began the work of codifying the Common Media Application Format (CMAF) that constrains media encoding and packaging to allow interoperable adaptive delivery to different devices, over different networks. It was codified two years later.

Dynamic Adaptive Streaming over HTTP (MPEG-DASH) – first used in IFE by Lufthansa Systems in 2018 – is an adaptive streaming technique that enables streaming of content over the internet from conventional HTTP web servers, and is now emerging elsewhere in IFE.

ABOVE: JOE LEADER, CEO OF APEX, WELCOMING PARTICIPANTS TO THE APEX TECH CONFERENCE

ABOVE RIGHT: MICHAEL CHILDERS MODERATING A SESSION ON CONTENT ACQUISITION

Today, there is too little connectivity bandwidth available to the aircraft, and at too high a cost, to support a large volume of streaming of HD, 4K and HDR movies economically. But, with 17,000 new satellites coming

DOES EDGE-CACHING IMPACT LICENCE LIABILITY?

The day when the passenger provides content via personal D2C subscriptions, and the airline provides the pipe, suggests the burden of content licencing passing to the passenger. This raises some legal questions.

Currently, if a passenger uses standard connectivity to access subscription content from the ground, and if the content is not redistributed beyond that passenger, then no public performance licence fee attaches. If, however, the airline intercepts that stream, copies it to an aircraft file server and uses it to serve other passengers, a potential public performance liability emerges if this occurs without permission of the copyright holder.

In the Aereo decision (American Broadcasting Cos. v Aereo, 573 U.S. 431) in 2014, the US Supreme Court ruled that the service provided by Aereo, allowing its subscribers to view live and time-shifted streams of over-the-air television on connected devices, violated copyright laws.

The legal basis was that Aereo subverted the content delivery ecosystem to earn subscription revenue without the permission of the copyright owner. However, what if the airline received no revenue, only redistributed the content to verifiable subscribers to the copyright owner's D2C service, with the permission of the copyright owners? And what if the uCDN or dCDN were architected so the content owner controlled the network through, among other things, conditional access?

Netskrt president and CEO, Siegfried Luft, believes there is no airline liability in such a case. "The content licencing is on the passenger," he says. "Provided the onboard cache conforms to various SVA and industry standards, the decision to allow a passenger to decode the bits that make up a video rests entirely with the D2C provider."

"Consider a passenger watching Disney+," he adds. "Their subscription will be verified by terrestrial Disney servers through encrypted transactions. At that point, the passenger can select and request a title. Again, the terrestrial servers share digital certificates and will determine where the closest SVA-compliant cache can be found – ideally on the plane. At this point, the passenger's device will request chunks of data locally, decrypt them and present them as a video. It is entirely under the control of Disney, so the licencing is on the passenger.

"There are, of course, many complexities around SLAs between the D2C provider," he adds. "But, if the question is, can edge-caching deliver passengers what they want, then the answer is yes."

"The decision to allow a passenger to decode the bits that make up a video rests with the D2C provider"

Read the March 2021 issue of *Aircraft Interiors International* on our site to read more about D2C (p16)

BELOW RIGHT: ANDY ROSEN IS A CONTENT MANAGEMENT CONSULTANT AND WAS RECIPIENT OF APEX'S OUTSTANDING CONTRIBUTION AWARD IN 2021

online in the next 10 years , plus compression improvements that reduce digital file size, bandwidth will go up, costs will come down, new options will appear, and new content delivery opportunities will emerge – including those related to D2C.

Even so, traditional content delivery networks (CDNs) today do not reach far enough into areas of constrained bandwidth and smaller audiences – such as aircraft – and cloud-based data centres may be too far away for an optimal viewing experience. One of the challenges, then, is to position caching at the 'edge' of the network, closer to the passenger.

EDGE CACHING TECH IS ESTABLISHED

Caching popular Internet content at the edge of the network, closer to end users, is something of a standard ISP network management protocol. "Edge caching is an old and established technology," reminds Andy Rosen, a content management consultant who currently represents AerQ on the Streaming Video Technology Alliance (SVTA) and its Open Caching Working Group.

"Mature CDN providers such as Akamai and Limelight provide a foundation that supports the D2C industry with services that have made streaming egress a low cost and reliable commodity for studios across North America and Europe," says Rosen. "However, the pressure to deliver ad-supported entertainment to every corner of the earth, especially India and Asia-Pacific, has refocused attention on the utility of smaller and specialised deep-edge CDN providers such as picoNETS and Netskrt."

"The AerQ Digital Experience Platform (DXP) is being architected with the emerging path to convergence

Opening the door to content provider control over files being cached

Andy Rosen, a long-time contributor to every APEX content delivery specification since the formation of the first IFE working group in 1993, observes:

"The IFEC marketplace stands to benefit from recent web infrastructure changes originally intended to eliminate regional streaming media bottlenecks. Disney's thoughtfully engineered expansion into regions already being served by better-established ad-supported competitors has led to changes in the IETF CDNI standards. These tiny changes have oversized impact because they open the door to studio control over scheduling and prioritisation of the files being cached.

"A virtual trading floor of upstream and downstream content delivery networks (uCDN and dCDN) is choreographed by a plethora of previously underused web configuration management commands.

"We are beginning to see how effectively the feature-film publicists' science and skill predictively improve the placement of content onto the storage systems of third-party edge-delivery networks both large and small."

between IFE and connectivity in mind," says Jonas von Krüchten, head of strategy and business development at AerQ.

"We are also aware that D2C subscribers want to access their accounts onboard aircraft with a high-quality experience. We are working with the SVTA Working Group, APEX, Above [a joint venture between Touch Inflight Solutions and castLabs] and others to ensure that we are out in front of open-edge caching technology that provides the highest quality of video viewing, as well as legal considerations that enable airlines to access the most favourable business terms regarding the use of such content."

Siegfried Luft, president and CEO of Netskrt Systems, an edge software provider, observes, "Considering the unique constraints of the edge, conventional CDNs make too many assumptions to be effective or even functional. Truly solving this problem requires pushing and adapting CDN technology all the way to the absolute edge. In some cases, this means 30,000ft above the Earth."

ABOVE RIGHT: EDGE CACHING OPENS UP NEW OPPORTUNITIES AND STRATEGIES FOR AIRLINE IFE CONTENT DELIVERY

With the emergence of D2C streaming services, streaming has become a dominant application on the internet, and several providers of streaming services are looking to position cached content closer to the consumer. Disney+ has been a leader in adopting and developing this technology, working through the SVTA.

"Because Disney is an active participant in the SVTA," says Rosen, "they are pioneering the predictive placement of content onto the storage systems of edge delivery networks both large and small."

EXPERT VIEWS ON THE INTEGRATION OF IFE AND CONNECTIVITY

The APEX Tech Conference and Workshop in May also featured a session titled ''The Integration of IFE and Connectivity: On the Road to Convergence'. Among the memorable views were the following:

"I think we already have converged... at some level." Murphy described Delta's 'SkyPulse' that monitors IFE consumption on its A321 fleet at 15-minute intervals to, among other things, compare bandwidth consumption"

DAN MURPHY
DELTA FLIGHT PRODUCTS

"The Digital Experience Platform (DXP) could be a great next step." DXP refers to a single digital platform that hosts IFE, connectivity, and a range of apps"

CORINNE STEICHERT
IFECTIV

"Taking the burden off the pipe is crucial." As a co-chair of the APEX Technology Committee, along with Rich Salter and Michael Childers, Rogozinski will be involved in APEX's 2023 Tech Conferences"

MARY ROGOZINSKI,
NETFORECAST

"The Holy Grail eventually is that 'the pipe is the IFE'"

NEAL ROTHMAN
CONSULTANT

"The constraint is not the technology – it's the infrastructure to the aircraft"

MICHAEL VALDEZ
PANASONIC

PHOTOS COURTESY OF RICH SALTER

In IFE, where there are storage constraints, predictive analytics will enable rapid availability of new content which is the most likely to drive passenger engagement.

The SVTA Working Group has two objectives: first, to identify the critical components of a non-proprietary caching system; and second, to establish architectural guidelines for implementation of an open caching system.

BOTH BIG TECH AND IFEC IN SVTA

SVTA members include giants such as Adobe, Amazon, Cisco, Disney, NBCUniversal, and Paramount, while aviation members – looking to extend the edge another 30,000 feet – include AerQ, Hughes, Intelsat, Netskrt Systems, Panasonic, ST Engineering, Thales and Viasat.

Today, if a passenger wants to stream content from his/her D2C account onboard an aircraft via connectivity, the ability to do so is dependent upon the available bandwidth from the satellite provider, and the cost of that

THE EVOLVING BI-DIRECTIONAL

"New web protocols, initially introduced as SVA specifications, have rapidly become official updates to IETF CDNI standards. This effort is motivated by a desire to supplement the offerings of the big CDN providers by creating a vigorous new open marketplace of smaller, locally aware, agile delivery services that can respond to unique last-mile conditions all around the globe," says Andy Rosen, content management consultant.

Initially envisioned to support the expansion of the Disney+/Star service family, standardised web streaming now embraces the concept of continuous congestion management, orchestrating the large upstream content delivery networks (uCDN) with numerous smaller downstream content delivery networks (dCDN).

"The evolving bi-directional uCDN / dCDN control protocol API specifications have already made small, portable, third-party server implementations more practical and interoperable at scale," explains Rosen. "Looking forward, a new generation of consumer home gateway and ultra-local targeted personal devices are also being accommodated."

LEFT: GIVING PASSENGERS THE ABILITY TO STREAM THEIR OWN SUBSCRIPTION CONTENT TO DEVICES OR DISPLAYS IS AN EASY WIN FOR AIRLINES, BUT WITH A FEW CAVEATS

Viasat partners with FuboTV

Viasat, a Streaming Video Alliance member company, announced in February 2020 that it had partnered with FuboTV, a leading live-streaming content provider, to bring sports, news and entertainment content to in-flight passengers at no charge. In order to scale this offering and deliver a high-quality viewing experience in the most effective and efficient manner possible, Viasat built its solution using the Open Caching specifications developed by the Streaming Video Alliance (SVA)'s Open Caching Working Group.

The SVA is a not-for-profit technical association that provides a forum for companies in the streaming video industry to collaborate on improving streaming video interoperability.

www.streamingvideoalliance.org

Expert views on convergence and edge caching

Edge caching and the converge of IFE and connectivity were key themes at May's APEX Tech Conference and Workshop held in Irvine, California. Discussions included who controls D2C content onboard the aircraft; whether the D2C provider controls content when it is streamed to a paying subscriber; if airlines are willing to yield control; and if a geo-location for IFE can be established that responds to airlines' sensibilities. Interesting views arose:

- "Taking the burden off the pipe is crucial" – Mary Rogozinski, NetForecast and co-chair of the APEX Technology Committee.

- "Why can't we establish a geo-location for IFE?" – Andy Rosen, representing AerQ on the Streaming Video Alliance Open Caching Working Group.

"We are working with the SVA Working Group, APEX, Above and others to ensure that we are out in front of open edge-caching technology that provides the highest quality of video viewing ..." – Jonas von Krüchten, head of strategy and business development at AerQ.

- Phil Watson of Panasonic suggests that a geo-location of IFE D2C onboard aircraft might be possible, but observes that it does not exist today. "In 1998, APEX convinced the content community to authorise 'Region 8' DVDs. Can APEX get similar concessions to create an IFE-specific geo-location on aircraft?"

- Michael Stattmann of Above agrees that making the cabin into an IFE geo-location might be a way to address airlines' sensibilities as to content. If new, time-sensitive content can be cached at the edge, Above asserts that it can push fully encoded, fully encrypted content to the edge within 48 hours in most cases.

- "Edge caching is the right solution," said Dan Murphy of Delta Flight Products, but he believes that airlines must control any content that appears on the in-seat screen. But if airlines are no longer paying licence fees, and depend on passenger subscriptions, can they assert control over content viewing? PEDs are a different matter, Murphy believes. Delta's solution only offers D2C onboard on PEDs.

Recordings of the sessions are available on-demand on the APEX website.

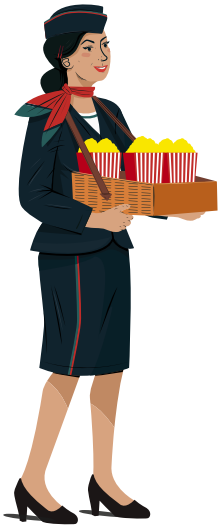
"I think we already have converged ... at some level"

DAN MURPHY, DELTA FLIGHT PRODUCTS

bandwidth to the airline is high. If a second passenger wants to watch the same movie a few minutes later, this doubles bandwidth consumption, and doubles the cost to the airline. A third viewer? Another stream, triple the bandwidth requirements, and triple the cost to the airline.

But what if the stream for the first viewer was captured on the aircraft and stored locally, so that the second, third, etc passengers were then streaming from the aircraft server? One-third the bandwidth, one-third the cost (and perhaps, in some cases, better quality).

This statement severely over-simplifies the challenge, however, as an optimal passenger experience in such a scenario will depend upon having a properly managed – and potentially unique – content delivery supply chain. This is particularly true when streaming to a passenger seat versus a PED. During the APEX Tech Conference and Workshop in May in Irvine, California, Luft stated Netskrt's intention to contribute a set of IFE requirements to the SVTA working group responsible for the Open Caching API Testbed.



A member of the SVTA since January 2022, and a member of APEX since April 2022, Canada-based Netskrt Systems has focused on this problem in rail markets, with a trial underway on three LNER electric Azuma trains running between London King's Cross and Edinburgh. While there are differences between rail and air, ultimately the challenge is the same.

"The more work you can do on the ground, the more effective the cache will be. D2C videos are comprised of numerous variants and bit rates," Luft comments. "Even if someone else watched a given scene in a video, the likelihood is very low that a second user is on the same device type or at the same bit rate. New algorithms are required to compensate for these environments."

The path to the convergence of IFE and connectivity must go through significant technological challenges, while carefully navigating the legal and business landscape. Easy answers are unlikely, but the APEX Technology Committee – that hosted a panel on this topic at its May Tech event in Irvine – plans to take it up again at a Tech conference and workshop again in the first quarter of 2023.

The portability of media has already enabled passengers to carry their content onboard the aircraft. In the future, they will be able to simply connect to it inflight.