WHITEPAPER

# Broadcast-as-a-Service

## How telcos can use 5G, edge and open standards to support broadcasters

Hewlett Packard Enterprise

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# Executive Summary

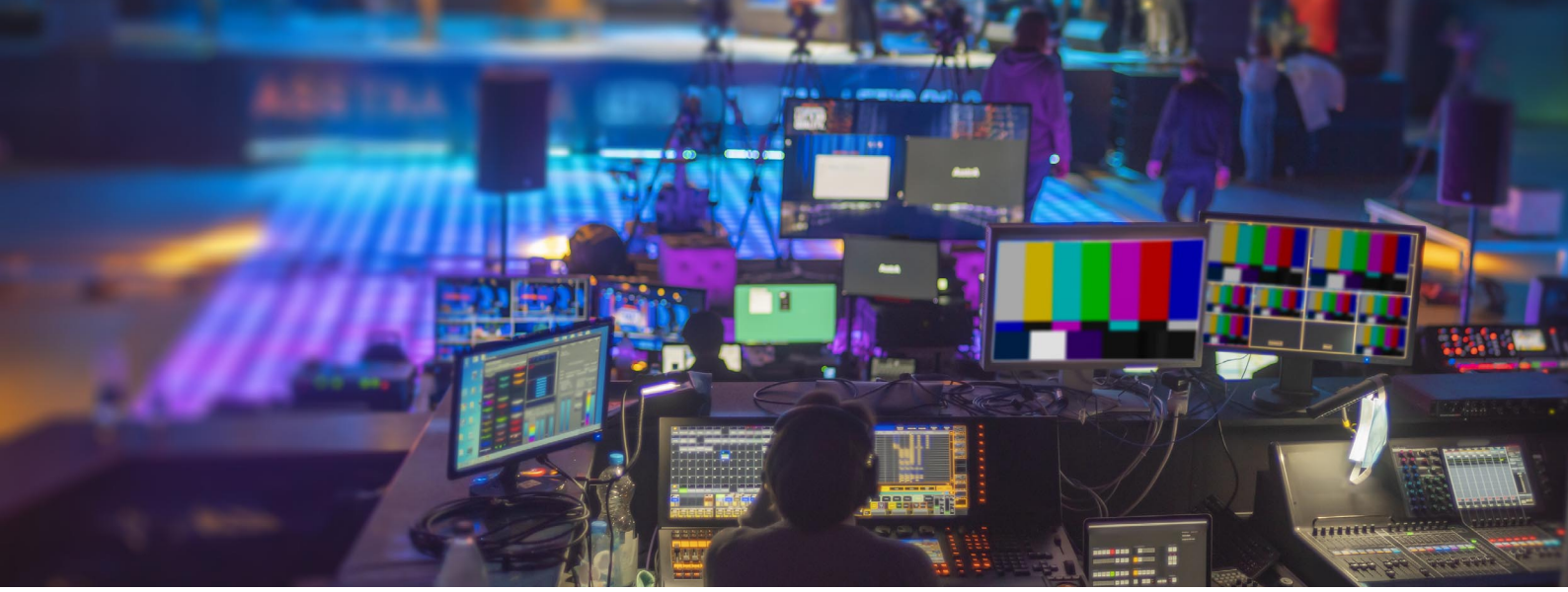
Broadcasters and mobile operators are employing their complementary networks and skillsets to create a compelling television experience that can compete with the growing raft of online entertainment. Thanks to the versatility of 5G and their edge computing assets, telcos can now support more of the broadcast value chain, including production and aggregation.

Developed in conjunction with Hewlett Packard Enterprise, this whitepaper explores how telcos can offer scalable and flexible broadcast production and transmission tools on-demand – a concept known as broadcast-as-a-service (BaaS). For the broadcaster, on-demand services could provide greater bandwidth at significantly lower cost than running its own infrastructure and applications.

For live broadcasts, a BaaS can dramatically reduce the amount of resources required on-site. A telco could provide a 5G connection to the cameras, thereby removing the need for an outside broadcast van with a producer. The 5G network would transmit the footage to an edge data centre, potentially using a dedicated network slice, where it can be edited by a remote producer. As well as lowering costs, BaaS could provide performance benefits, by dramatically reducing latency.

Telcos can also provide broadcasters with real-time audience analytics, which would flag when a specific live stream is either proving popular or, conversely, is prompting viewers to switch off.  This kind of real-time feedback can be used to improve the overall quality of the video footage, creating a more compelling experience for viewers and greater engagement with the event.

At the same time, broadcasters can alleviate congestion on telecoms networks by employing new broadcast standards, such as ATSC 3.0, to deliver high-volume content to large numbers of consumer devices simultaneously. For example, during the pandemic, one broadcaster in North America used ATSC 3.0 to distribute educational content to students who lacked a good broadband connection.  To support this kind of multi-casting, there needs to be some integration between the telco's core network and the broadcast network to orchestrate the delivery of the service.



## The building blocks for BaaS

To offer BaaS, a telco will need a media service/edge orchestrator to support the preparation of media content, including file transcoding, file moving and traffic direction, and live broadcasting functions. The latter would include the live transcoder, the radio frequency scheduler and a CDN (content delivery network) node to web cache the content and enable CDN distribution. All these functions would be managed through a live broadcast management virtual network function (VNF).

HPE anticipates that a telco will deploy the media service/edge orchestrator in a cloud architecture encompassing both the edge and the core network. "You can imagine multiple locations hosting these functions across the network," notes Ali Dernaika, Video Services Senior Architect in the Communications Technology Group at HPE. If any function has a problem or fails, the orchestrator could migrate that function from its existing edge location to an alternative edge location.

Although telcos aren't the only players targeting the BaaS market, their widely distributed assets could give them a key competitive advantage. "The proximity between the edge and the service creation in remote production, for example, is very important," notes Ali Dernaika. "The telco has the advantage of this network topology, which can deliver the low levels of latency broadcasters need."

# Introduction

While broadcast and telecoms convergence has been mooted for many years, it now appears to be happening in earnest. Multiple business and technical drivers are prompting broadcasters and mobile operators to work together to provide consumers with a compelling television experience that can compete with the growing raft of online entertainment.

Sponsored by Hewlett Packard Enterprise, this whitepaper explores how the versatility of 5G networks and edge infrastructure will enable telcos to offer broadcast-as-a-service (BaaS) – the provision of broadcast production and transmission tools on-demand. Designed to be both flexible and scalable, BaaS enables media companies to rent these tools as and when they need them, rather than having to deploy the necessary connectivity and computing power themselves.

The paper begins by describing the challenging competitive landscape faced by broadcasters and why they are looking to work with telecoms companies. It then explains the BaaS concept and outlines some sample use cases that demonstrate how telcos can add value, before considering the role of new broadcast standards, such as ATSC 3.0, which could alleviate congestion in cellular networks. Finally, the paper outlines the BaaS building blocks a telco will need to pursue this opportunity.

# How Broadcasting is Changing

Conventional broadcasting is facing intense competition as more and more companies roll out online entertainment propositions. Historically, broadcasters and satellite and cable operators had the TV market to themselves, but now major production companies are using the Internet to provide their content direct to consumers or through a new breed of intermediary.

Video-on-demand services, such as Netflix, Amazon Prime, Disney+, HBO Max and Apple TV, are all growing quickly. Netflix reported almost 208 million subscribers at the end of March 2021, up from 183 million a year earlier. Mordor Intelligence forecasts[1] the global video-on-demand market will grow 12% a year between 2021 and 2026.

At the same time, social media companies, such as YouTube, Facebook, Instagram and Twitch are providing consumers with vast amounts of user-generated video content. These platforms are also becoming major players in live content – the traditional sweet spot for broadcasters. In 2018, Fidji Simo, head of the Facebook app, wrote[2]: "There have been 3.5 billion [Facebook] Live broadcasts - and counting… Through Live, we learned how truly social the video experience on Facebook can be, generating 6x more interactions than regular video."

Live user generated content is proving to be particularly popular among gaming and music enthusiasts, with lockdowns during the pandemic fuelling further demand. The latest State of the Stream report[3] from Stream Elements noted: "the pandemic-driven shelter-in-place mandates have supersized the industry." The overall live streaming sector increased by 99% year-over-year, growing from 1.97 billion hours watched in April 2019 to 3.93 billion in April 2020, according to the report.

The strong demand for user generated content has prompted a large chunk of advertising revenue to shift from conventional television services to social media platforms, such as YouTube and Facebook/Instagram.

Expert commentators say these competitive pressures will prompt

[1] Source: https://www.mordorintelligence.com/industry-reports/video-on-demand-market
[2] Source: https://www.facebook.com/fidji.simo/posts/10155151078752063
[3] Source: https://www.digitaltveurope.com/2020/05/14/almost-4-billion-hours-watched-as-live-streaming-industry-benefits-from-lockdown/

broadcasters to seek partnerships, particularly with companies with technological expertise. Deloitte[4], for example, notes: "To secure their business models and future revenue streams, [broadcasters and content producers] must open themselves to cooperation and alliances, including with direct competitors. Joint production, joint distribution models, and even joint platforms are suitable ways of countering the threat from digital platform providers, such as Netflix, Amazon, Apple, or Google."

Noting that technology has become a core element of broadcasters' and content producers' business processes, Deloitte says they must constantly invest in their digital competence: "To produce attractive content in a future shaped by digitalisation and ultimately to reach the customer with it, first-class technological capabilities are a necessity."

## Broadcasting-telecoms convergence

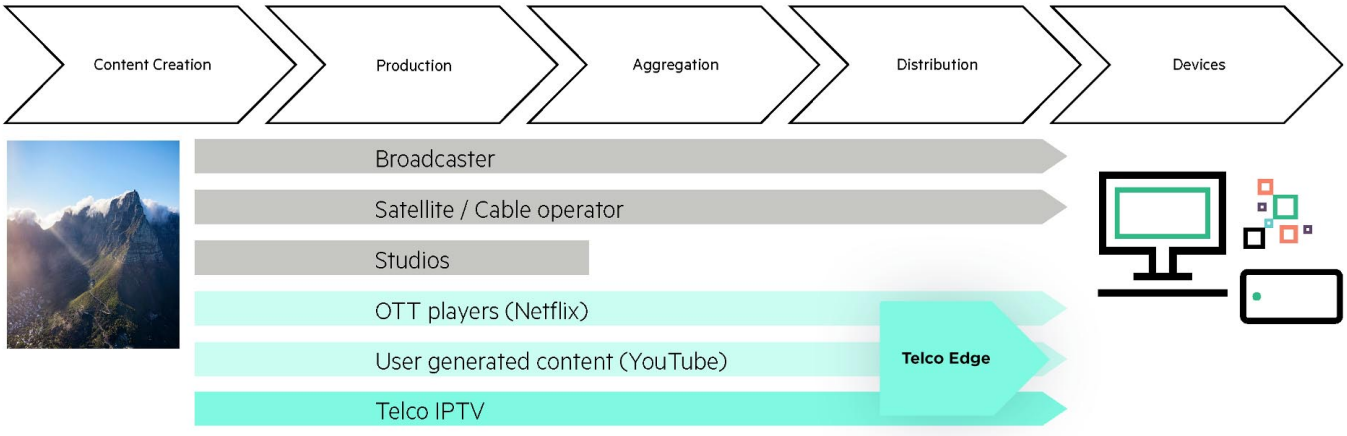
Although some telcos are competing with broadcasters, many recognise that they don't have the in-house skills and capabilities to produce compelling content. For many telcos, it makes sense to partner with broadcasters. Research firm GlobalData[5] notes BT, Tata Communications and Telstra, for example, have a dedicated business unit to support the broadcast and media industry and offer solutions beyond connectivity, including content creation, distribution, aggregation and user interfaces.

Although the concept of broadcast and telecoms convergence has been round a long time, new technologies and commercial drivers are now in play. Media companies that are adept at leveraging mobile, cloud, analytics and automation technologies will gain significant competitive advantages in terms of cost of business, ability to reach a wider audience and providing new ways of consuming content, according to GlobalData. In particular, telcos' 5G connectivity, expanding fibre networks and other facilities can reduce need for large on-site production crews and expensive equipment, potentially increasing coverage of live events.

As 5G evolves, analysts believe multi-access edge computing and network slicing will play a key role in enhancing broadcast and media experience across the value chain. "5G will become a key driver in enabling remote production," notes GlobalData research director Siow Meng Soh. "The technology can also be deployed at stadiums to enhance spectators' experience, including the use of augmented reality, connected devices to assist umpires, in-stadium streaming."

Building on their position as major distributors of content, telcos now have an opportunity to expand their role to support more of the broadcast value chain, such as production and aggregation, by utilising their edge computing assets (see Figure 1).

**Figure 1: Where telcos can add value to the broadcast industry value**




*Source: HPE*

[4] Source: https://www2.deloitte.com/global/en/pages/technology-media-and-telecommunications/articles/gx-future-of-tv-video.html
[5] Source: https://www.globaldata.com/telcos-can-help-broadcast-media-companies-transform-digitally-says-globaldata

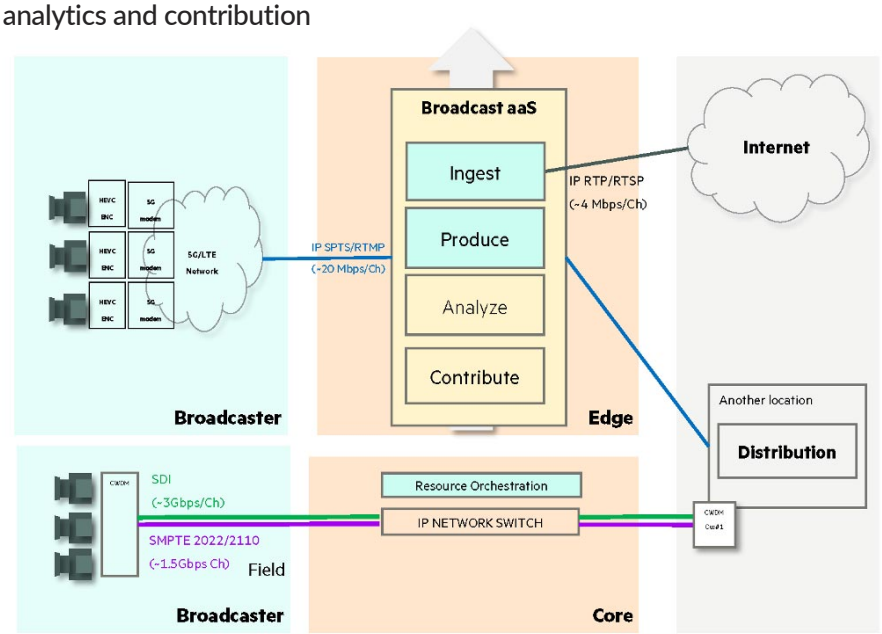
# How Broadcast-as-a-Service can Deliver Value

HPE anticipates that telcos will provide broadcasters with on-demand access to media-related resources – a concept known as broadcast-as-a-service (BaaS). The idea is the broadcaster will be able to rent media-related functions from the telco. Supported at both the edge and the core of the telco's network, these media functions could encompass content ingestion from cameras, production and analysis, as well as contribution[6] (see Figure 2).

For the broadcaster, on-demand services could provide greater bandwidth at significantly lower cost than running its own infrastructure and applications.

For telcos, meeting the demand for BaaS would enable them to further monetise their assets. With 5G, edge infrastructure and network function virtualisation (NFV), telcos are increasingly able to provide tailored connectivity and computing resources on demand. In locations without 5G coverage, telcos could provide a dedicated connection using dark fibre or MPLS (multiprotocol label switching), for example, to their data facilities.

**Figure 2: A BaaS proposition could encompass ingestion, production, analytics and contribution**




*Source: HPE*

[6] The technical term for the process that delivers live streams from a geographical location to a studio.

## EXAMPLE USE CASE

# Streamlining remote live production

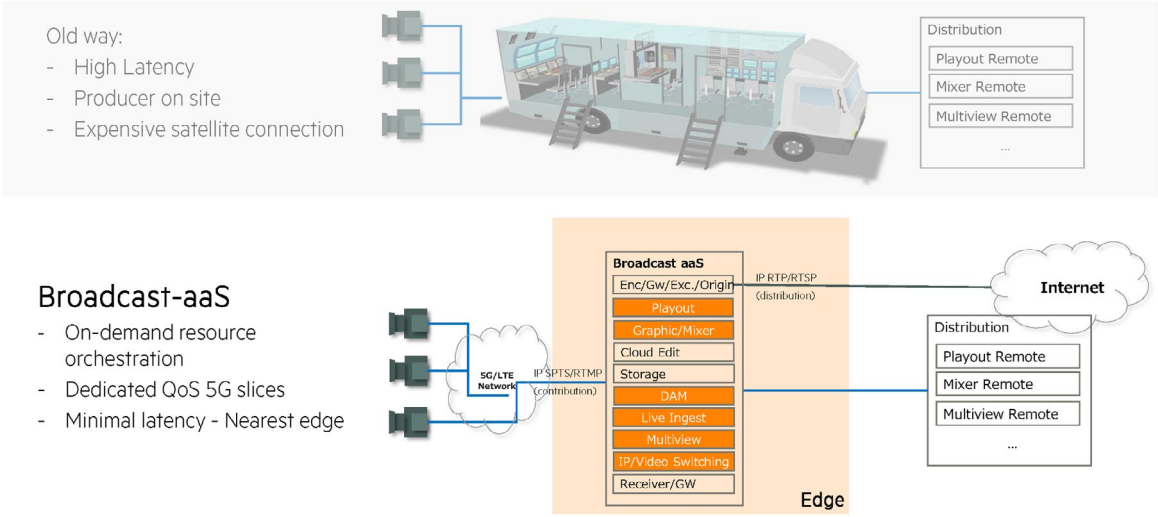
To provide live coverage of an event, such as a football match, a festival or a concert, a broadcaster typically deploys an outside broadcast (OB) van, loaded with production equipment, at the venue. The cameras distributed across the event will transmit the footage they are capturing to the OB van, where a producer will ingest this content and edit it. In most cases, the broadcaster will use a satellite connection to transmit the edited footage from the OB van to the broadcast network through which it is delivered to viewers, potentially via IPTV, OTT or a direct to home connection.

BaaS can streamline this process, dramatically reducing the amount of resources required on-site. To eliminate the need to deploy an OB van with a producer at the event, a telco could provide a 5G connection to the cameras deployed at the venue (see Figure 3). The 5G network would transmit the footage captured by the cameras to an edge data centre, potentially using a dedicated network slice to ensure a reliable connection. As the video arrives in the data centre, it can be edited by a remote producer using a network connection. The content can then be distributed to viewers using the real time streaming protocol (RTSP).

In the wake of the pandemic, BaaS tools are enabling broadcasters to limit the number of people on site, accelerating adoption. As well as lowering costs and streamlining production, BaaS could provide performance benefits. "Traditionally, the live communication is produced with high latency – 300 milliseconds or more," explains Ali Dernaika, Video Services Senior Architect in the Communications Technology Group at HPE. "Now, using this type of technology, this latency is reduced drastically. Of course, there is a little bit of overhead in terms of lightweight transcoding, but now with the new chipset, transcoding can be in a very few milliseconds."

"All-in all, this is an optimisation for the delivery and remote production of live content," adds Ali Dernaika. "The beauty of it is the operator can offer a specific quality of service, as they can, for example, create a 5G slice, while the real time streaming protocol allows for secure and reliable transport from different locations."

**Figure 3: An outside broadcast van can be replaced by BaaS to streamline live TV production**




*Source: HPE*

## EXAMPLE USE CASE

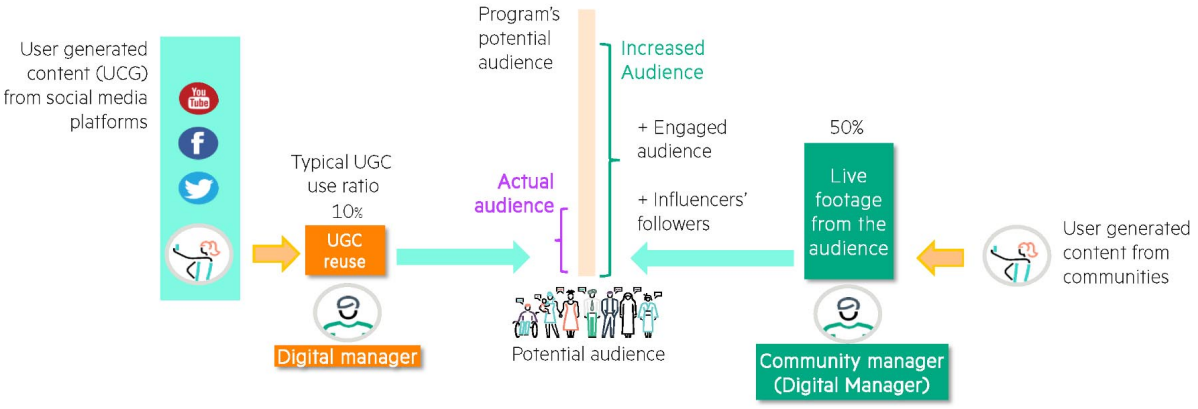
# Expanding the audience for user-generated content

Increasingly, organisers will promote their events by broadcasting live user generated content. To do this, they typically employ a digital manager to select a stream of user-generated content and then feed it through social media platforms, such as YouTube or Facebook.

A telco could enhance this service by providing the digital manager with real-time audience analytics, which would flag when a specific stream is either proving popular or, conversely, is prompting viewers to switch off. "With broadcast-as-a-service, the telco can provide a kind of analytic tool, which will allow a digital manager to have a better engagement, a more efficient way of engaging with the audience," explains Ali Dernaika. "They can filter to ensure they have the right content from the right contributor for their live broadcast."

By providing contributors of content with real-time feedback, the digital manager will be able to improve the overall quality of the video footage, creating a more compelling experience for viewers and greater engagement with the event.

**Figure 4: Real-time analytics can help to boost the audience for user-generated content**




*Source: HPE*

# The Role of New Broadcast Standards

New digital transmission standards are facilitating the convergence of broadcast and telecoms technology. Standardised by ETSI, Digital Video Broadcasting — Second Generation Terrestrial (DVB-T2) is now widely used in Europe to transmit HDTV signals for terrestrial TV channels. Meanwhile, the U.S. is adopting the Advanced Television Systems Committee's ATSC 3.0 standard (formally known as NextGen TV).

ATSC 3.0 supports higher resolution video, including 4K, and much better sound than its predecessors. Specifically designed for convergence with 5G networks, ATSC 3.0 can support a seamless handoff for receivers between the internet and the broadcast transmission, potentially providing a richer, more interactive experience for viewers. For example, programming can be broadcast and received over the air, while commercials, on-demand, and other premium content can be provided over the Internet.

First deployed at the end of 2018, adoption of ATSC 3.0 is growing internationally. Crucially, the standard could see broad adoption by broadcasters in India, which should help to generate economies of scale for equipment makers. In March 2021, the ATSC and the Telecommunications Standards Development Society of India (TSDSI) signed an agreement to enable adoption of ATSC standards to make broadcast services available on mobile devices in India.

"This agreement enables mobile operators to consider ATSC 3.0 adopted standards-based broadcast technologies to supplement their LTE/5G telecom deployments," ATSC President Madeleine Noland said in a statement. "The impact in terms of the large number of base stations and devices in India could be massive, even at current levels of one billion subscribers and approximately 250 million new devices being added every year."

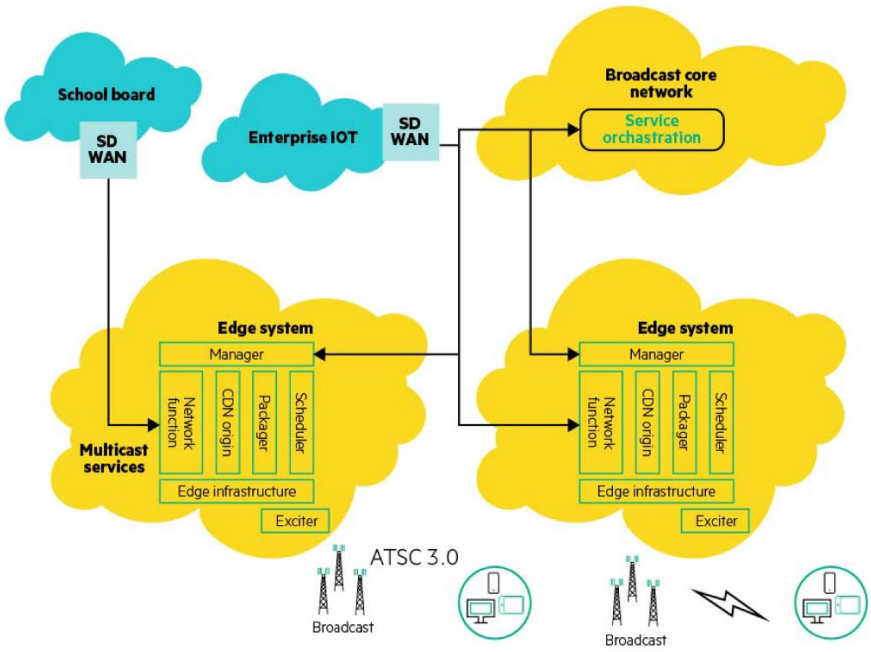
The TSDSI envisages the agreement could lead to tight integration in both core networks and devices between India's mobile operators and broadcast providers. "While there are still many steps to take to reach that goal, this agreement represents a first and necessary step that can open the path to these possibilities and more," added Pamela Kumar, Director General of TSDSI.

An increasing number of televisions and dongles now support ATSC 3.0 and the standard is beginning to make inroads into consumer electronics,

including mobile handsets. Various semiconductor companies are developing chip platforms that will support both cellular technologies and ATSC 3.0. In November 2020, Borqs India, a subsidiary of Borqs Technologies, announced it had successfully demonstrated an ATSC 3.0 smartphone (branded Mark One) to One Media 3.0, a subsidiary of Sinclair Broadcast Group (a U.S. media group).

HPE expects ATSC 3.0 to bring significant benefits for broadcasters and consumers. Broadcasters could see increased customer satisfaction, new revenue streams from targeted advertising and the ability to monitor services. For consumers, ATSC 3.0 promises better audio and video, deeper indoor reception, access to 4K content, advanced emergency alerts, automotive services and the efficient delivery of digital content – as described in the next section.

**Figure 5: Broadcasters can use their infrastructure and spectrum to deliver content beyond TV**




*Source: HPE*

## How broadcasters can use the new standards to support telcos

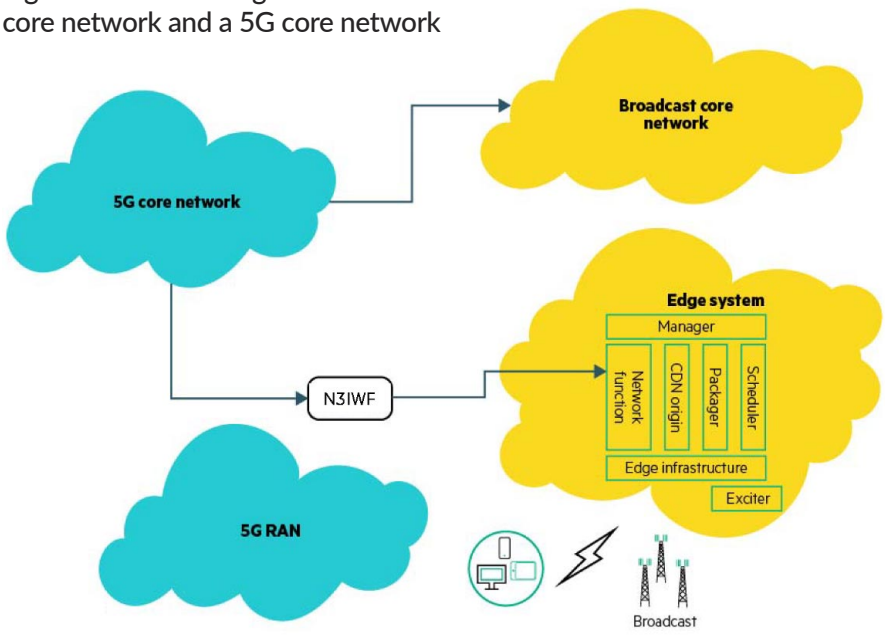
Whereas mobile operators generally have "low tower, low power" networks, broadcasters tend to employ a high tower, high power network – the transmitters tend to be much taller than a cellphone mast. When it comes to delivering content to consumers, these two networks can be complementary.

Given the competitive pressures facing broadcasters, they are keen to increase the revenue generated by their infrastructure and spectrum. One way to do that is to use ATSC 3.0 to multi-cast additional services and content beyond conventional television. For example, during the pandemic, one broadcaster in North America used ATSC 3.0 to distribute educational content to students who lacked a good broadband connection. "The content was in the form of PDF files and small video clips of learning material," explains Ali Dernaika. "The students were provided with ATSC dongles, which meant they were able to receive these files on their client devices and access this material. When you are talking about twenty thousand or thirty thousand students, a multicast delivery mechanism makes a lot of sense. It is saving a lot of bandwidth compared to using a broadband connection." The same approach could be applied in other scenarios in which the same content or data needs to be delivered to a large number of client devices.

To support this kind of multi-casting, telcos can provide hosting facilities at the edge of their networks, as close to the broadcasters' transmission antenna as possible, while orchestrating the service delivery. Telcos could also provide the connectivity needed to deliver the content from a school, an enterprise or another organisation to its edge infrastructure and then onto the transmission antenna (see Figure 5).

More broadly, telcos and broadcasters could work together to alleviate congestion on mobile networks. As partners, they could offload traffic from the cellular network on to ATSC 3.0 transmitters in cases where many different customers are downloading or streaming the same content. That would depend on some integration between the telco's core network and the broadcast network to orchestrate and to map the service into the required spectrum.

Figure 6: Interworking between a broadcast core network and a 5G core network




*Source: HPE*

Moreover, the user data would need to be integrated, via a N3IWF (a non-3GPP interworking function) interface, between the two networks (see Figure 6). This interworking would direct traffic to an edge location from where it could be broadcast via ATSC 3.0.

Broadcasters can adjust the parameters of ATSC-3 to enable transmissions to be tailored to the requirements of specific use cases or circumstances. The standard can, for example, be used to provide a SFN - a single-frequency network in which several transmitters simultaneously send the same signal over the same frequency channel to increase the robustness of the transmission or boost the bandwidth available.

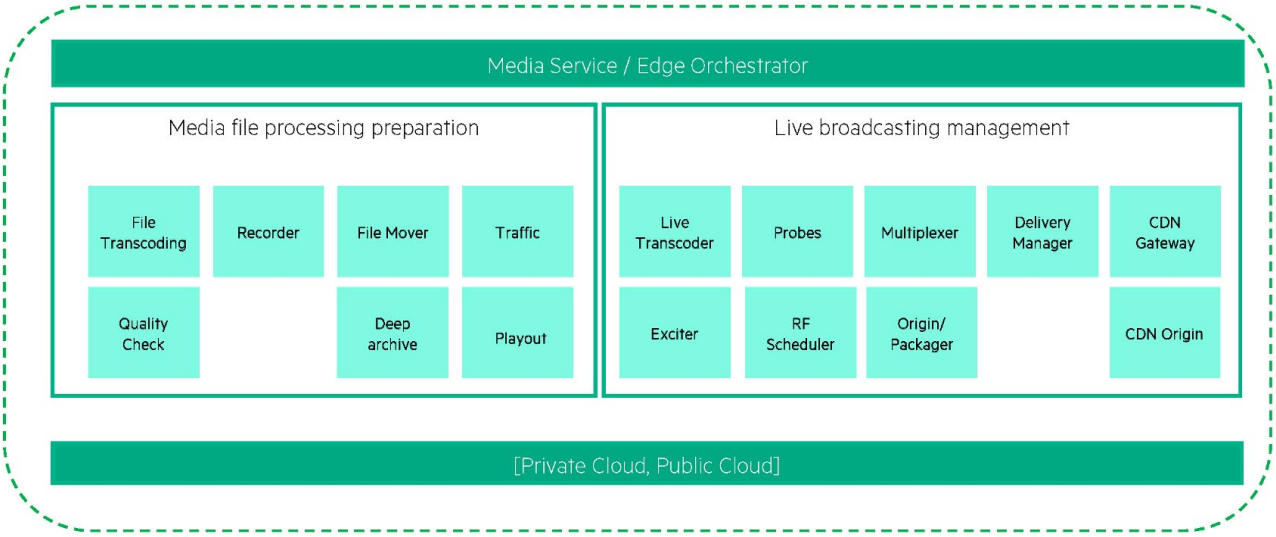
# The Building Blocks for BaaS

To offer BaaS, a telco will need a media service/edge orchestrator. The functions supported by this orchestrator can be divided into two main categories: The media file processing functions and the live broadcasting management functions (see Figure 7).

The processing functions perform the preparation of media content, including file transcoding, file moving and traffic direction, managing different play out servers, for example. "You would have a virtual network function (VNF) manager that manages the lifecycle of these functions, which can be deployed as a virtual machine or can be decomposed into microservices and activated as containers in different locations," explains Ali Dernaika.

The live broadcasting functions include the live transcoder, the radio frequency scheduler and a CDN (content delivery network) node to web cache the broadcast footage and enable CDN distribution. All these functions would be managed through a live broadcast management VNF.

**Figure 7: The building blocks a telco will need to provide a media cloud architecture**




*Source: HPE*

# Conclusions

With the rapid growth in online video services and the advent of new standards, the long-standing technical and commercial boundaries between telecoms and broadcasting are fading fast. By working together, the two industries can create a compelling proposition for consumers underpinned by high-capacity, low latency connectivity. In particular, mobile operators can harness 5G networks, edge computing and open standards to help broadcasters meet the surging demand for all kinds of video content from blockbuster films and live sport to educational programming and user-generated content.

Telcos are particularly well placed to streamline the production and distribution of live content, whether that be generated by professional TV cameras or by consumers' smartphones. At the same time, telcos and broadcasters can work together to employ new transmission standards to efficiently deliver popular content and data to tens of thousands or hundreds of thousands of smartphones or PCs.

To be sure, telcos aren't the only players targeting the BaaS market: The major public cloud providers have infrastructure-as-a-service and platform-as-a-service propositions that could be employed by broadcasters. But telecoms operators have key advantages. As well as extensive connectivity infrastructure, most operators have the assets to support edge computing, which will play a key role in enabling BaaS. "The proximity between the edge and the service creation in remote production, for example, is very important," notes Ali Dernaika. "The telco has the advantage of this network topology, which can deliver the low levels of latency broadcasters need."

Hewlett Packard Enterprise

HPE has over 30 years of experience in the telecoms industry, with more than 300 telco customers across 160 countries. In the core, more than 700 million subscribers across more than 80 carriers depend on HPE Mobile Core software. HPE's open telco solutions help operators evolve their networks and services to a 5G ready, cloudnative, servicebased architecture. As the edgetocloud platformasaservice company, our experience in hybrid cloud allows us to bring the cloud transformation and secure, carriergrade, standardsbased infrastructure to telecommunications networks.

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