



## WHITE PAPER

# MULTISCREEN ENCODING: TURNKEY VS. VIRTUAL VS. CLOUD FORM FACTORS

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**Introduction** With the heightened publicity for Cloud-based services, operators worldwide are re-evaluating their end-to-end architecture and associated cost structure looking for efficiencies, opportunities and competitive edges. Turnkey appliances, COTS-based virtualization (private Cloud) and 3rd-party commercial-Cloud based SaaS are the three form-factors that are being considered. [Hereon, we will use turnkey, virtual and cloud to refer to the three form factors.] As encoding/transcoding extends to over 80% of the processing power requirements of the entire multiscreen video delivery value chain, inevitably the focus is put on multiscreen encoders/transcoders. This white paper introduces a framework to guide the stakeholders in identifying the most appropriate encoding/transcoding form factor for their particular operations. A multitude of dimensions are presented and analyzed here—each operator is expected to weigh each dimension based on its own priorities and decide accordingly.

## Data Center Infrastructure

For operators that already have access to or own a data center infrastructure, the introduction or expansion of multiscreen encoding/transcoding presents a minimal incremental cost for ground or virtual form factors compared to the cloud-based one. Notable exceptions; when the services are of temporary nature (few weeks or months vs. over a year) or when the additional equipment load requires a substantial power, cooling or network expansion for the data center. Further, operators with data centers that are standardized on COTS equipment often benefit

from their reduced acquisition and maintenance cost, thus favoring a virtual versus turnkey encoder form factor.

**Content Acquisition** The ingress aspect of the encoding/transcoding workflow plays a substantial role to the form factor decision as well. Very high quality uncompressed feeds (over coaxial SDI or in SMPTE 2022-6,7 - SMPTE 2110 transports over IP) are clearly unsuitable for a cloud encoder and dictate the need for ground processing. Hybrid workflows, where the uncompressed content is being lightly encoded and pushed to the cloud for final processing, appear to introduce quality degradation, additional points of failure, latency, complexity and cost. This workflow has only proven suitable for sites with limited bandwidth (e.g. sports or concert venues, news gathering etc).

On the other hand, already compressed content, such as satellite feeds, is generally easier to transport. Aspects such as latency and packet loss protection determine the appropriate encoder form factor in this case, as low latency transport from ground to the cloud can be prone to packet loss or high costs.

In file transcoding or playout based linear services, a cloud-based transcoder is a sensible choice if certain synergies exist (i.e. the assets are already stored on the cloud).

Finally, one element that is often overlooked is that some cloud providers also charge for ingress traffic, and this can be prohibitive for 24x7 services.

**Service Life Time** Established and predictable business, such as 24x7 services, is by far more economical in a ground encoder form factor (turnkey or virtual) versus a cloud one. A virtualized OPEX-based encoding solution will likely cost 2-3 times that of a turnkey appliance one, over a 2-year period. Over a period of 2 years, a typical cloud-based encoding solution will cost 8-10 times more than that of a turnkey appliance based one on the ground. Even accounting for a 3 year turnkey appliance life time and an accelerated decrease in cloud services prices, the TCO gap between those two platforms for 24x7 operations is unquestionable.

However, short-term services (such as the Olympic Games) or temporary business (such as POCs or trials) can be better accommodated in a virtualized ground form factor, if the COTS infrastructure is available, or otherwise on the cloud. As temporary/uncertain projects mature to secured business, operators need to be able to migrate the workflows back to the ground (turnkey or virtual) and streamline their cost structure.

Finally, short-term event-based services, such as a sports match or a music concert, are often served by cloud encoding platforms. Content aggregators and event organizers that serve thousands of hours for live events per year, generally resort to virtualized, orchestrated encoding solutions that are as flexible but substantially more cost effective than the 3rd party cloud-based ones.

**CAPEX vs. OPEX Investment** Turnkey appliance-based encoding solutions expect an often sizable initial CAPEX investment, versus a more limited, balanced CAPEX/OPEX mix of a virtual based one and a pure OPEX one for cloud-based encoding solutions. OPEX related form factors are easier to model and price, and they tend to be favored by operators that sell popup channels or event-based services. CAPEX investments require more strategic planning but offer substantial savings in the mid and long-term. Operators should also inquire about more creative purchasing models such as lease-to-own turnkey appliances and perpetual licenses for virtual encoding platforms. Cloud

service providers also offer discounts for longer contracts and volume commitments.

Another important aspect of OPEX-related architectures is that the cash outflow for the expenditure is more closely aligned with that of the cash inflow of the revenue generated by the service. On the contrary, a CAPEX investment typically presents a substantial time gap between those cash flows—as big as 6 months in some cases—and warrants careful working capital management. In those cases, operators should negotiate more favorable payment terms with their turnkey appliance vendors.

**Agility and Scalability**

Agility is an essential ingredient of success for any market but especially in the multiscreen market segment where the technology and standards remain very fluid. Contrary to traditional broadcasting, over 90% of multiscreen encoding business worldwide is powered by IT/x86-based platforms rather than dedicated ASIC/SoC-based ones. This allows operators to easily update and upgrade their services as new technologies (codecs, protocols, screens) emerge and standards are solidified. Agility is not an attribute of the form factor, however, but directly related to the product development practices of the encoding vendor. Therefore, operators should evaluate the versatility and adaptability of their encoding solution. If/when it is not sufficient, virtual and cloud-based form factors make it easier for the operator to switch encoding vendors, as long as they are not locked in a closed ecosystem.

Cloud and, to some degree, virtual form factors present exceptional scalability as resources can be provisioned dynamically and in-line with the demand. Encoders however, regardless of form factor, are not tied to audience demand. Thus, contrary to streaming servers, CDNs, etc that need to scale dynamically according to the popularity of the service, encoders only need to scale based on the volume of the source content (live or file assets). Therefore, dynamic tasks, such as file-to-file transcoding or short-term events encoding, are typically run on a virtual or cloud form factor, while 24x7 linear encoding tasks do not need such scalability.

**Portability and High Availability**

Consumers have evolved their expectations for live and on-demand media as a persistent, instant supplement to services to which they have subscribed. High availability is gaining importance for high-profile live events (e.g. the Olympics or Super Bowl), as well as for 24x7 linear TV services (e.g. AT&T U-verse or BBC iPlayer). In both cases, the stakes are high in terms of maintaining operational efficiency without jeopardizing service uptime.

For video-on-demand transcoding, service reliability is less important as failed transcoding jobs can be easily re-run and rarely affect the end-user. Thus, relinquished control and relaxed high availability constraints are typical for such workflows, as long as video quality is not affected. Operators often choose to utilize a virtual or cloud infrastructure for such tasks and file transcoding-as-a-service became popular early on. The portability advantage of the Cloud and Virtual form factors contributes further here, as operations can be moved closer to where the respective assets are stored or being consumed.

For live encoding however, reliability is key as brand and customer loyalty are quickly diluted when sub-par performances of live streams are delivered. As such, tier-1 telcos, content providers and high-profile events are less likely to relinquish control and responsibility to a 3rd party, such as a cloud service provider, and generally favor turnkey or virtual form factors for their encoding needs. As much as cloud service providers claim high availability as an inherited feature of their architecture, their recent system-wide failures have scared tier-1 operators away from sole dependency on the cloud. Instead, such operators turn to a hybrid architecture based on a mix of turnkey or virtual encoding form factors, with a disaster-recovery 1:1 site on

virtual or cloud ones. Less strategic services, or tier-2/3 operators with lower uptime constraints, may try to avoid the additional CAPEX element for their disaster recovery site and rely on the cloud to dynamically provision services, in an N+M fashion, in case of a failure at their primary site.

In all cases, high availability is delivered and experienced end-to-end and not in isolation; thus, the optimal solution is dictated by the entire ecosystem and not just the encoding component. However, this does not mean that all components of the ecosystem need to have the same form factor.

**Human Factor** Finally, an aspect that is often overlooked or underestimated is the human factor. The history, culture and practices of the organization play a substantial role in the success of a project, especially as the three form factors that are being analyzed here expect diverse skill sets. The turnkey appliance form factor fits well with engineering teams that are video-oriented and/or organizations that prefer to focus on their core competences while maintaining ownership and control of their operations. The virtual form factor demands a strong IT-oriented engineering skill set and fits well with organizations that value flexibility and prefer tighter control of their operations. Finally, the cloud form factor typically fits with teams and organizations that are more comfortable delegating control (and responsibility) to 3rd parties, often for short-term or less strategic aspects of their operations.

**Conclusion** It is apparent that none of the three form factors is a panacea for multiscreen encoding. The operating, strategic and competitive practices of each organization are the ones to dictate the appropriate architecture. Furthermore, it is often fitting to consider a solution that spawns across multiple encoding form factors, either at the same time or as operations evolve. In order to deploy such hybrid and fluid architectures, choosing an encoding solution that is present, proven and seamless across all form factors is essential.

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