



TV 2 – COMPLETELY NEW PRODUCTION FLOW AND IP BASED PLAYOUT

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ABSTRACT

For the last three years, TV 2 Norway have implemented our largest and most complex technology project. By IBC 2019 we have achieved all our main goals. TV 2 have established a completely new workflow with an IP based playout. Our new architecture combines traditional purchased Broadcast systems with our own developed Service Bus giving us the ability to change our work methodology to support a more agile and flexible approach.

INTRODUCTION

The backdrop of this project was the most optimal circumstances for a project this size we could ever dream of. We had a scheduling system and a playout system that was end of life. At the same time, it was decided that TV 2 had to relocate to new locations, both at our main office and in Oslo where the other half of TV 2 is located. The project was given the mandate to change all infrastructure and produce new workflows for the entire production chain from planning to publication on all platforms with the purpose of combining workflows for traditional broadcast and OTT.

Business goals

The steering committee of the project issues several business goals for the project to respond to:

- A 30% cost reduction in staffing
- Faster publishing.
- Easier to scale, modify and replace systems.
- Combine and reduce several roles within the organization.
- Transparent business processes across the organization.
- Eliminate the possibility to perform workarounds
- Remove all duplicated work processes.
- Users with increased skills and more self-serviced.



Technical goals

The technical department issued itself several goals within the project. All these goals were issued to be more flexible towards rapid changes and thereby be more relevant to the business side within our own organization. These goals included:

- No direct integration between systems, even between scheduling and playout.
- Own developed Service Bus to control the deployment cycle.
- Agile methodology around development and deployment for our service bus.
- Lateral weighting of Technology aspects of solutions with other functionality, hereby well tested API's and the ability to notify Service Bus of changes within objects.
- Own developed adapters to control all communication from the service bus, to and from the purchased applications.
- No short turns by letting "certain important integration" move outside the Service Bus and thereby making the quality and required response time for the Service Bus secondary.
- Separate the playout island from the inventory and program archive.

We have reduced the Rights and procurement department by over 10 percent, and by combining the OTT and Linear workflows we have reduced the staff working within scheduling and publication by over 30 percent. Automating the media factory to automatically match incoming material with system created placeholders across the entire fabric, and also performing auto correction on incoming material, resulted in a reduction in media preparation by over 30 percent. All this was achieved by January 2017 after completion of the first phase of the project. Going on air the spring of 2019 with the IP based playout reduced the requirement for staffing in Continuity. By using monitoring by exception, reduced the media operations in the publication area and merging the continuity operator role from two separate (linear/OTT live) to one common, we have been able to reduce the number of operators by over 30 percent. We have implemented an organizational change, automating workflows and merging departments, looking at OTT and Linear publication in a common view, and by this reduced the overall staffing by approx. 30 percent.

In addition, the burden on the Technical Operation Department has been heavily reduced giving us increased capacity to perform other duties and tasks.

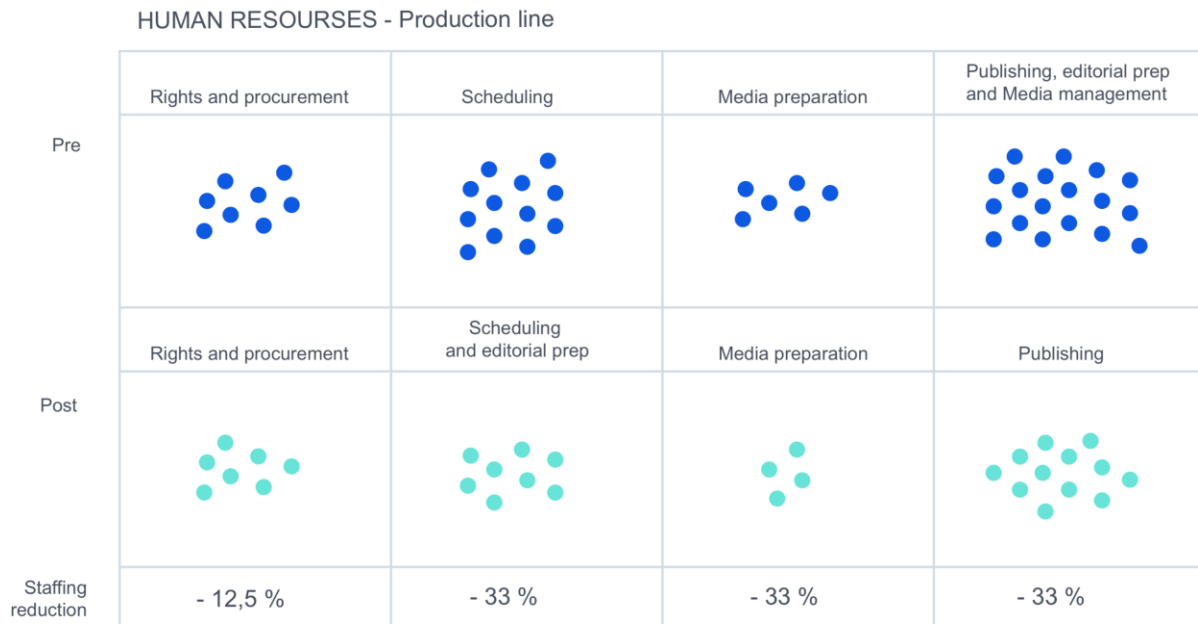


Figure 1: Illustration of approx. 30 % reduction in resource usage in the production line. Decreased and moved earlier in the chain.

RIGHTS MANAGEMENT SYSTEM

TV 2 was an early adopter of publishing content on digital platforms. Our OTT service, TV 2 Sumo was operational from early 2000 but as an independent platform separated from our linear publication.

Looking for a new rights and management system, led us into first defining the role of the Rights Management system. In traditional workflow, the scheduling, ad sales, rights, long term planning, Asset Management system are often separated into several systems where the linear right and SVOD/AVOD rights are kept separated. Looking for a new system, one of our most important priorities was to make sure that we register one object with a set of rights, independent of publication platform, and this object is the object used across all publications. After a thorough process we decided to replace our old schedule system with Provys TVoffice and Adsales. We also decided that all the information added in this system, should cover all requirements in the publication. For linear, this is straight forward. For OTT it is a bit more complex. By working closely with our vendor, we were able to establish a propriate right matrix and a set of metadata connected to the object, to control all aspects of publication upstream, in the planning and scheduling domain. Here are some of the most important dynamic values set:



Provys Field	Datatype	Area	Adopted in	Effect
Expected_tx_time	Timestamp	Linear Payout	Evertz Payout	Indicates when material is expected to be aired. 7 days prior to this date, a material request is issued from the payout to the program Archive in order to fetch the material.
Ready_to_expose	Checkbox	SVOD	Tv2sumo.no	When asset should become visible on TV 2 Sumo. Usually followed by "Available from" date indicating when the asset can be played
Ready_to_distribute	Checkbox	SVOD	Tv2sumo.no	When video will be distributed to TV 2 Sumo. This relies on video being available in the Archive, but does not indicate video can be played
Available_from	Timestamp	SVOD	Tv2sumo.no	When video can be played in TV 2 Sumo
Available_to	Timestamp	SVOD	Tv2sumo.no	When video is unpublished in TV 2 Sumo

Table 1: Rights Management settings automating publication and file transfer.

For linear payout, content is automatically transferred from our Program Archive to the payout 7 days before expected_tx_time if content is available. If it is not yet available, a task in the Program Archive Workflow Engine enables automatically transfer the material as soon as it is approved. Internally we often say that we have transformed from being schedule driven to content driven. For our OTT service, all the preparation, including



adding synopsis, connecting stills etc. are done in the Rights Management System. All these metadata represent the metadata of the episode page in our OTT service, where the episode, although not available for streaming, is available based on the ready_to_expose setting. Content are transferred from our Program Archive to the OTT service based on the ready_to_distribute. Based on Available_from the content is automatically made available for streaming.

The Rights and Management system also has another role. It contains the logical entities for all our Program Archive content. We often refer to it as the logical MAM of the Program Archive. The reason for calling it this, is that all the content checked into our Program Archive are automatically linked to tasks that originates from the Rights and Management system. So, all ingested material, connects to tasks in the workflow engine of the Program Archive, which again received this task from a version task in the Rights and Management System. This entire workflow is orchestrated by our Service Bus. If for any reason there exists any content in the Program Archive that does not originate from the Rights and Management system, it is considered an orphan and are purged from the Program Archive.

CONTENT SERVICE

Prior to this project, TV 2 had been in a process of purchasing a complete MAM system as part of having all high-resolution content available throughout the entire organization. The MAM system was considered an add-on to the Snell Morpheus playout we were running at that time. As we initiated the project, the scope and role of this “island” were changed. Internally, we refer to all media operations from traffic, QC, ingest, urgent editing and approval as a Content Service. For the media operation in Content Service, a set of goals were defined. These included:

- No more manual QC. Automatic QC based on Vidcheck and additional basic checks with FFMPEG.
- No more re-cutting or editing of subtitles. If wrong, production companies have to re-deliver.
- Content available for “everyone”.

Given our long-lasting relationship with Vizrt, and extensive use of their MAM products, we decided to purchase and implement Viz One with Mayam as workflow engine. We added feed ingest capacity to Content Service to support ingest of exclusive OTT content and to be able to scale out our ingest capacity for content with less time-criticality for publication. We use Harmonics WFS for transcoding, Vidfix for QC of video material and Mediamate for QC of subtitles.

Immediately after releasing Content Service, and in parallel to feeding the publication with content, we initiated a migration project with the goal of migrating our old content into Content Service. A list of 30 000 program titles and 30 000 commercials were marked for migration. The migration process consisted of generating the versions in the Rights and Management system and generating an ingest request of the version in the Content Service. Deliver the files to a third party for normalization of both video and audio. The normalization also consisted of stitching together hard segments of programs. Deliver it back to Content Service for automatically matching with the correct ingest request and



finally check in to the Program Archive. The migration process had a sophisticated priority queuing mechanism, where we process 200 programs every day, but could also prioritize certain programs in scope of publication, either for our linear channels or for the OTT service. The migration work was completed by the Autumn of 2018.

The streamlining of our media operation is best illustrated in the following example:

For our OTT service, we purchased rights to publish HayU content. We spent two weeks of processing and making available for publication 1000 hours of content into Content Service. It was all done with the normal staffing of 3 employees in Content Service which supervised the process, in addition to doing their normal day-to-day routine. In the old workflow it would require 5 employees in traffic, checking and naming all receiving content. In addition, it would require two employees from our OTT staff doing editorial preparation in our OTT service. The entire operation would have taken up to 8 months to complete.

PUBLICATION, LINEAR AND OTT

Our publication consists of nine linear channels, channels are transmitted by satellite and digital terrestrial network. These channels are also part of our OTT service in encoded formats on all digital platforms. We also have four fully equipped occasional channels, that are being used for playing out various OTT exclusive live content giving us a total of 40 OTT live channels. The playout redundancy scheme is 1+1 for our main channel (TV 2), and N+2 for the remaining linear channels.

Our OTT also consists of preview and catchup of the same content aired on our linear platform. In addition, we publish a lot of exclusive content on our OTT service. Our OTT service is subscription based.

Linear workflow

Our chosen vendor for the linear playout is Evertz. The linear playout is designed as its own island with content being delivered from Content Service and temporarily stored in the Mediator MAM.

Transmission schedules, live schedule data and metadata are being fed to/from the playout system via the Enterprise Service bus, which make these data available also to other systems connected to the bus.

We use Channel in a box (Overture) playout devices and uncompressed video-over-IP infrastructure using the Aspen protocol. There are no hardware control panels.

(VUE/Mediator/VistaLink). Magnum routers managing the software defined video Network with IP-distributed control surfaces and monitoring solutions enable the operator to handle live transmissions in an office environment. Fast turnaround live content is either ingested as playlist recording on Overtures or on Dreamcatcher.

Elemental encoders ensure that the transmission from our Overtures are transcoded to various OTT formats.

OTT workflow

The file-based OTT workflow is as described based on added metadata in the Rights Management system. Our Service Bus orchestrates the transfer of full quality material from Content Service to WFS based transcoding platform where the full quality XDCAM 50Mbit 4.2.2 is transcoded into various h.264 versions. The files are made available for streaming, but not published. Automated processes make sure the file is available for streaming at the correct time. An example: If an episode of Homeland is aired on TV 2 (the channel). It is transferred both to the Mediator MAM for linear playout on all platforms and transferred

Channel	Description	Hours
TV 2	Main channel, a mix of commercially purchased content, own produced content, live news and sport.	24/7
TV 2 Zebra	Channel with a masculine profile. Transmission plan consists of reality, documentary, series and live sports.	24/7
TV 2 Livsstil	Channel with a more feminine profile. Targeting women. Consists of reality, documentary and series.	24/7
TV 2 Humor	Entertainment channel with mostly purchased comedy shows.	24/7
Nyhetskanalen	News channel with live news, sports and weather every 30 minutes.	24/7
TV 2 Sport 1	Live sport.	24/7
TV 2 Sport 2	Sport- and sportsnews channel	24/7
TV 2 Sport Premium 1	Premium sportschannel. Live English Premier League	24/7
TV 2 Sport Premium 2	Premium sportschannel. Live English Premier League.	24/7

Table. 2: TV 2 linear channels



to the TV 2 Sumo for catchup and SVOD. In this example, the episode is scheduled to be aired linear at 21:45, after news and sports. In our SVOD service, the available_from is set to 21:45 according to planned publication. The news and sports are running over their timing and continues until 21:37 instead of 21:34. The commercial breaks will run its scheduled time, and the entire playlist is adjusted to the delay. However, since the SVOD version is a separate version, with its own publication period working independently from the simulcast version, users can choose to enter the SVOD version at 21:45 and watch the entire episode without commercial break and be finished 11 minutes before the live transmission ends.

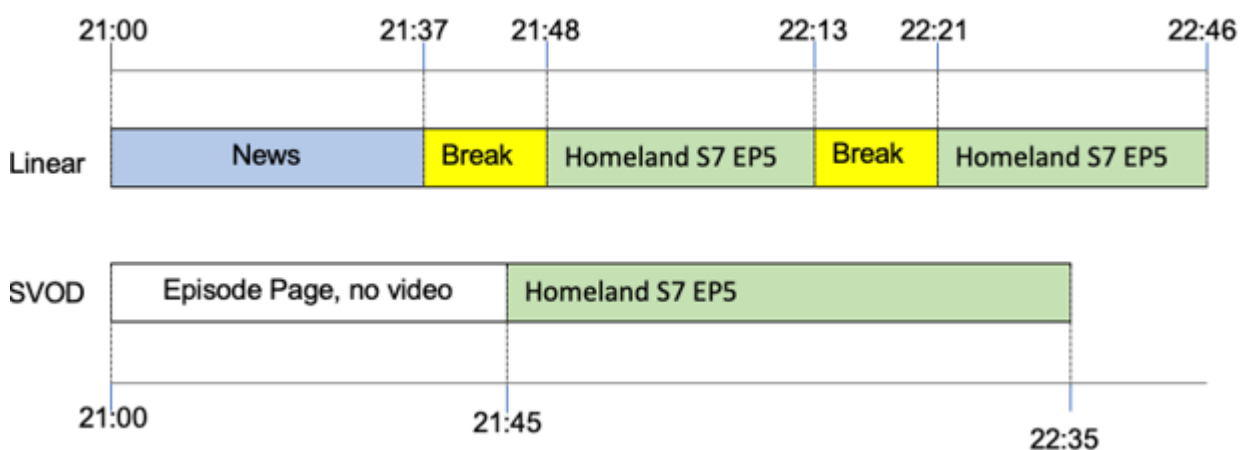


Figure 2: Publication timings across linear and OTT

ENTERPRISE SERVICE BUS

In early phases of the project, we evaluated several vendors with the purpose of taking the role of the orchestrator of workflows between the components in the solution. At the same time, we had a version 1 of a service bus mainly used in our web-based solutions. We felt it would be a good idea to develop this Service Bus further into supporting the broadcast domain and at the same time, have a higher grade of flexibility when it comes to new functionality across one or several parts of the solution. Also, it was important to us that if we implemented a Service Bus handling all integration between systems, we should stay true to this architecture despite that some of the work took longer time to complete than a direct integration would. By doing this we could also put requirements on the Service Bus when it comes to uptime, stability and performance that we do to all the other solutions in a broadcast facility.

Dataflyt – TV 2’s Enterprise Service Bus

The dataflyt team developing our service bus consists of 10 members covering both team lead, QA, DevOps and development. It handles all integrations and orchestrate workflows. For every connected system, dataflyt develops adapters that handles data transformation in a common framework. Dataflyt consists of several components including a common Java library for development, RabbitMQ for queuing, Elasticsearch for projections, and Eventstore for eventsourcing.



Global ID structure

One of the most significant achievements in the workflow is the Global ID structure. Global ID's, GMID and GPID are created inside Dataflyt based on notification of object creation from the various systems in any of the connected systems. When a new object is created in our Rights and Management solution, for instance a new season of Homeland, a notification is sent to the service bus. The service bus creates the object reference inside the Event Store which includes the Global Product ID (In this case a GPID since a new season of a series is a logical object). The GPID in this case references a LSID which is the Unique ID of the Homeland season in Provys, our Rights Management system. Further on, the SID identifies that this object reference resides in Provys. The same applies for episodes within seasons in Provys. When versions are created on the logical episode in Provys, GMID are brought into the equation.

ID Abbr.	ID Name	Description
GMID	Global Media ID	A unique ID, GUID based describing a physical Media or a placeholder for a physical media
GPID	Global Product ID	A unique ID, GUID based describing a logical object or a placeholder for a logical object
LSID	Local System ID	A unique ID within one of the systems in scope for the GPO project
SID	System ID	A Unique ID describing which system the LSID originates from

Table. 3: ID Structure

Causing the GMID to be stored alongside the LSID from Provys. This is again used to create ingest requests in our media operation facility, Content Service. The physical material received and stored inside our Content Service are not connected to the Rights and Management System in any way other than the fact that they share the same GMID inside our Service Bus. The same applies for our Mediator Playout PAM and for our OTT TV 2 Sumo service. Moving the physical file to publication, is done based on technical approval, editorial approval and contract rights in Provys. Content will not be pushed to our OTT service before editorial preparation is completed, and there are 7 days until it is legally and editorial available for publication. When a file is transferred from Content Service either to Linear Playout or OTT publication the following logic takes place.

- 1) The version in Provys should be published to OTT or linear playout.
- 2) The LSID in Provys for that version is used to identify the corresponding GMID in our Service Bus.
- 3) The GMID in our service bus is used to find the correct LSID in Content Service.
- 4) The physical file, that corresponds to the LSID in the service bus is transferred from our Content Service to our Playout PAM or to our OTT service.



GMID	LSID	SID
381dc4aa-5da8-4c75-8544-321f62c2064d	43232432	Provys
381dc4aa-5da8-4c75-8544-321f62c2064d	23434343	Content Service MAM
381dc4aa-5da8-4c75-8544-321f62c2064d	76876787	Mediator MAM
381dc4aa-5da8-4c75-8544-321f62c2064d	32424334	TV 2 Sumo OTT

Figure. 3: ID Structure Example

This ID based workflow is used for all resources in scope, from articles, synopsis for OTT, auto publication of content on OTT, stills for all platforms, branding, sponsorships, promotions, feed ingests etc. We are aware of the risk in putting the ID transformation between our scheduling system and playout system in the center of the operation. We have no fallback of transforming our schedule into “something” that can be used as a playlist for our playout operation. However, the benefits of keeping a global ID structure for the entire media management operation and auto publishing workflow, are simply most important to us.

When a playlist is finished in micro scheduling, transferring this playlist to playout is API based. Rights Management system playlist contains LSID with no meaning in the publication domain. It runs through our Service Bus, where every LSID from Provys is translated to Mediator LSID based on their reference to the GMID. After one broadcast day is closed, and the as-run is transferred from Mediator Playout back to Provys, the same procedure occurs. The LSID from Mediator are translated back to LSID from Provys based on the GMID:LSID:SID reference.

Data available real time.

One of the key benefits of handling integrations like this, is that all available data are available in real time. The schedule is available in early phases of the planning long before the playlist is set to broadcast ready. And the same applies with the as-run. Since the communication between the playout and the Service bus is event based, the finished segments within a broadcast day are available in real time before the broadcast day ends.

LEARNING POINTS

A project this size has given us some valuable learning points:

- Not only systems and workflows have to be changed, people’s mindset must be changed as well.
- We separated this project into three larger pieces. First Rights Management, Service Bus and OTT, then Playout, then Branding and Promo Postproduction. It could have been divided into smaller portions to increase speed.
- An agile approach might be difficult dealing with traditional broadcast vendors. Breaking the work into smaller portions might help.
- Developers must have knowledge on how broadcast works. It will be required for making solutions with appropriate timings and queuing.



- With sub projects running the various activities and priorities, the PM of the sub project must have some knowledge about broadcasting. There will be a lot of dependencies and required timings across sub projects. Without deep understanding at management level, it is easy to end up with misunderstandings and delays.
- Technology must be able to understand the business requirements and the business must understand both the technology aspect and the operational requirements.

ROAD AHEAD

By the time this article is read, TV 2 has completed all the above and are looking brightly at the future. However, this is just the beginning where we have made a foundation to build on. One of the first key topics that will be covered this autumn, is the ability to create dynamic promo breaks. In our linear channels where we have live transmission mixed with server events, there are no hard exits on live. We normally allow the live transmission to run over scheduled time. And since we have prescheduled commercials, the length of the break must be adjusted with dynamic promo transmission. We also use this automation to add promos automatically based on next line up.

We have, since the beginning of this project, had a goal of performing automatic housekeeping based on license data in our Rights Management system. Due to priorities this has not been completed. Our goal is to automatically delete all content across the entire chain of systems where the license is expired, including in our program Archive.

The business side wants to start testing AVOD and our goal is to have this ready by the fall. Some of the requirements to this solution is that it should be the same physical version but with different segmentations for commercials. Also, it should be possible to have a different publication time for the AVOD service than for the SVOD service. It should also be the same transcoded version to avoid transfer and transcode of full quality files from Content Service.

Further ahead we are in the process of looking into the News and Sports production. The idea is to use the same integration platform also in this domain. This will give us the ability to have the rundown from the various productions available downstream in the publication for graphical element insertion. This will require a connection between the rundown from the NRCS and the placeholder for the live event in the scheduling system.

It all boils down to the one portal vision where we have an overlay to our Service Bus giving us federated search across all are content and metadata across the traditional separated silos, linear playlist-based broadcast and Newsroom Compute System based production.