



Transforming Regional Production Operations into a Single Seamless Infrastructure Norwegian Broadcasting Corporation (NRK)

The Challenge

Norway's national broadcaster, NRK, has a reputation for implementing bold, innovative technical solutions. NRK already has completed its analog switch-off and now transmits three television channels over its digital terrestrial network, as well as via satellite. The broadcaster's DTT transmission uses MPEG-4 to deliver content to a new generation of set-top boxes, which means that NRK can offer HD content at any time on any of its channels.

In addition to providing television broadcasts, NRK also operates a number of radio stations and has established a strong online presence. The impetus from the top level of management is that there should be "one NRK" with television, radio and online collaborating closely rather than working in separate silos.

While taking on this challenge and working across multiple media platforms, NRK also must overcome the major obstacle presented by Norway's mountainous geography, which is cut through the middle by the Arctic Circle. The broadcaster has its headquarters in Oslo, with 12 other production centers serving regional interests and a service in the far north, operated in collaboration with Sweden and Finland, for the Sami peoples. Reaching across Norway, NRK broadcasts do a great deal in bringing the country together.

In 2006, broadcasting to multiple media platforms and multiple regions, NRK began planning a project to institute a tapeless, file-based, multiformat content management scheme. The solution is known as Programme Bank, and at its heart is one of the world's largest implementations of Omneon MediaGrid active storage systems.

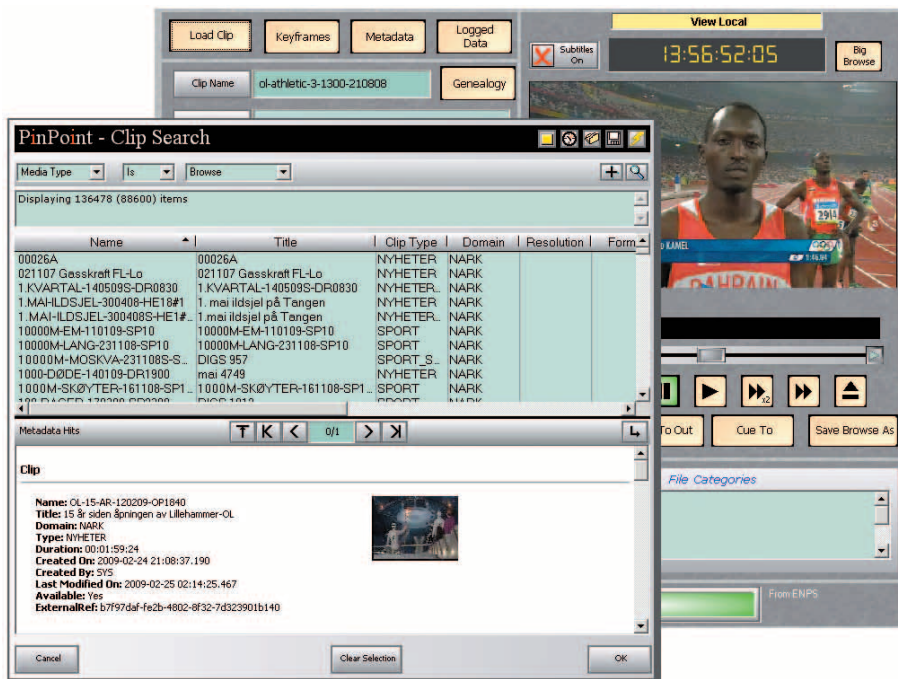
SOLUTION AT A GLANCE

Norwegian broadcaster NRK wanted to transform its production capabilities, both in its Oslo headquarters and in 13 regional centers. The requirement was for a free flow of content from location to location and producer to producer.

The solution is Programme Bank, probably the most comprehensive content management system ever built by a national broadcaster. It now handles every piece of content – from news rushes to imported programs – which appear or are produced for the three-channel broadcaster.

Enabling this remarkable power is a large Omneon file-based infrastructure, including what may be the largest Omneon MediaGrid installation in the world.

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The Solution

Prior to launching the Programme Bank project, NRK already had created two file-based islands. News is managed by a Quantel and ENPS system, and playout from Oslo is managed by Abit software and Omneon Spectrum video servers. The broadcaster's 13 regional centers also have the capability to broadcast autonomously, so each has its own independent playout facilities, originally using Grass Valley Profile servers and OmniBus software.

The principle aim of Programme Bank is to bring all production into a single infrastructure. That includes making all news content accessible via Programme Bank content management, although the ENPS/Quantel infrastructure remains in place for direct production. The result is that every single piece of content in NRK is touched, and in almost all cases totally managed, by Programme Bank.

The system is decentralized. Each of the 12 regions, plus the Sami service, has its own domain, including local storage, to service local news and regional production. While the regional bases already had content servers, the project is gradually replacing them. The software is capable of fully integrating third-party systems into Programme Bank, but the replacement of each with a local Omneon MediaGrid system will be completed by mid-2010.

The all-encompassing nature of Programme Bank made it necessary for NRK to build the largest Omneon MediaGrid network in Europe. The Oslo deployment of Omneon MediaGrid systems alone has 180 servers and the capacity for 6,400 hours (50 Mb/s MXF) with a replication factor of three. Across the whole of the Programme Bank network, the capacity of all the connected Omneon storage systems is around one petabyte.

The fundamental design of the Omneon MediaGrid active storage system is that content is sliced into packages of 2 MB, each of which is stored a number of times on different drives, not only to provide resilience, but also to provide reliably fast access. At NRK, each slice is stored on three different drives, each in a different frame, greatly minimizing the risk of content bottlenecks.

All Programme Bank content is archived via Front Porch Digital software with a StorageTek tape robot and disk cache. The 150-TB cache server is managed intelligently to minimize tape access. The StorageTek library has a current capacity of 46,200 hours with all content stored on two separate tapes for security. Each week, 25 TB of media is added to the archive.

Storage in Oslo is separated into four domains: news, breakfast television, production and the archive, making a total of 17 domains across NRK headquarters and regional sites. There is an 18th, operated by the engineering team implementing the system, which has access to the rest of the network but is not visible to other users. Each domain is fully autonomous, storing and managing its own content, and if a domain needs to be taken down for any reason, it does not affect the rest of Programme Bank.

The critical concept underpinning the system is that any user can search the local domain, or any other, or all domains for content. To make this possible, the networked Omneon MediaGrid storage systems are matched with a sophisticated custom control system based on the OmniBus Opus G3 platform and a Windows Media browse system from IPV.

The network infrastructure connecting Oslo with the 13 remote sites was developed by NRK. Rather than establish dedicated connectivity, which would have been underutilized much of the time, NRK chose a more efficient model, creating a high-capacity, high-availability network between regions. Within this network Programme Bank exists as a number of virtual LANs. During testing, engineers demonstrated 180 parallel streams of 50-Mb/s IMX video around the Oslo network without any performance degradation.

The Workflow

The in-house format for all NRK content is 50 Mb/s in an MXF wrapper (according to the Sony RDD9 standard). While the original system specification stipulated QuickTime, MXF was deployed instead because it allows access to content as it is being ingested. Thanks to the power of the IPV encoders, content can be browsed at any desktop within 12 seconds of a recording starting.

Final Cut Pro is NRK's preferred editor, and in this installation FCP can access MXF content directly via the Cinémon plug-in, which supports edit-in-place functionality on the Omneon storage systems. The broadcaster's regional centers typically have as many as 30 Final Cut Pro seats, all editing directly on a single Omneon MediaGrid.

All content for playout or production is recorded into Programme Bank. Ingest of externally produced content onto Omneon Spectrum servers is a separate process that takes place in the transmission area, with newly ingested content passed to Programme Bank as a background task.

News material in Oslo is ingested onto the Quantel system and then transcoded and transwrapped to be available in Programme Bank. Regional news production relies on Programme Bank directly, taking advantage of the ability to share content between local sites and Oslo immediately and seamlessly. The seamless interface is essential because about 25 percent of the content in national news programs comes from regional sites.

The Oslo domains are based on genres, and production content is recorded direct-to-disk according to this scheme. To support entertainment programming originated at the Oslo television studios, NRK developed additional functionality for Programme Bank.

Light entertainment producers quickly grasped the basics of the Programme Bank concept and realized that the technology would allow them to record an ISO feed of each studio camera separately. By adding more ports to the Omneon video servers, this model was easily accommodated.

Another important development, in conjunction with OmniBus, was the addition of live logging, particularly to meet the needs of the many sports fans in Norway. Templates for each event let operators add metadata simply by clicking buttons. The resulting tags reference not only individual players, but also the variety of action and even emotion displayed. The metadata is immediately converted to XML so that, when it is transferred to Final Cut Pro, each logging point appears as a marker. An editor tasked with creating, for example, a package that looks at all the funny moments in a game simply goes through the appropriate tags to collect all the required clips.

The screenshot displays two main control panels: 'Gang Record [Global]' and 'Line Ingest [Global]'. The 'Gang Record' panel features a central clock showing 18:03:51:10 and buttons for 'Seed Clips', 'Record', and 'Stop'. Below it are multiple 'KILDEGRUPE' (Source Group) sections, each with 'Enable/Disable' and 'Create Recording' buttons. The 'Line Ingest' panel shows a 'Link Items' section with a list of ingest control service resources, including details like 'Ingest Name', 'Source', 'Device', 'Duration', and 'Status'. A table below lists these resources with columns for 'Start Time', 'Item Name', 'Source', 'Device', 'Duration', and 'Status'. The interface is complex, with numerous buttons and status indicators for managing recording operations.

| Start Time | Item Name | Source | Device | Duration | Status | Error Details |
|------------|---------------|---------------|-----------------|----------|--------|---------------|
| 18:40:00 | DKOP9803010AA | MCRE MCRE ATM | OPROMCRESRV1-81 | 00:18:00 | Ready | |
| 18:40:00 | DKOP9803010AA | MCRE MCRE ATM | OPROMCRESRV1-82 | 00:18:00 | Ready | |
| 18:40:00 | DKOP9803010AA | MCRE MCRE ATM | OPROMCRESRV1-83 | 00:18:00 | Ready | |
| 18:40:00 | DKOP9803010AA | MCRE MCRE ATM | OPROMCRESRV1-84 | 00:18:00 | Ready | |
| 18:40:00 | DKOP9803010AA | MCRE MCRE ATM | OPROMCRESRV1-85 | 00:18:00 | Ready | |
| 18:40:00 | DKOP9803010AA | MCRE MCRE ATM | OPROMCRESRV1-86 | 00:18:00 | Ready | |
| 18:40:00 | DKOP9803010AA | MCRE MCRE ATM | OPROMCRESRV1-87 | 00:18:00 | Ready | |
| 18:40:00 | DKOP9803010AA | MCRE MCRE ATM | OPROMCRESRV1-88 | 00:18:00 | Ready | |
| 18:40:00 | DKOP9803010AA | MCRE MCRE ATM | OPROMCRESRV1-89 | 00:18:00 | Ready | |
| 18:40:00 | DKOP9803010AA | MCRE MCRE ATM | OPROMCRESRV1-90 | 00:18:00 | Ready | |

■ CASE STUDY

Once in Programme Bank, content can be accessed by any authorized user on the system. At the time of writing, some 3,200 desktop computers in NRK had the Programme Bank client, which enabled them to search for content and browse the results. NRK's development team has created a very comprehensive metadata structure that makes searching as easy and as accurate as possible for all researchers.

A core characteristic of the system is that users can search any or all domains, though each domain remains autonomous. So, a user in Stavanger can search the content stored in Tromsø, for example, and having found a likely match, can watch a browse version of the clip virtually instantaneously.

Authorized users have access to basic editing functionality on the desktop, and they can create complete packages using the browse editor. The EDL is then either conformed automatically inside the MediaGrid or handed on to a craft editor for further refinement.

If content needs to be transferred from one domain to another, this transfer is managed by the Omneon MediaGrid system. Priorities can be applied so that, for example, news content is always sent first, though the capacity of the high-speed network linking all NRK sites means that material can normally be moved faster than real time. Where transcoding needs to take place, this is handled automatically as part of the transfer.



NRK radio broadcast staff also has access to the system, which they use to pull audio tracks from television sound tracks. In this respect, journalists have developed new ways of cooperating. For instance, television reporters now explain scenes in more detail so that audio extracted from their reports can be used as sound bites in radio bulletins. Appropriate content can be transferred to the radio production system via Telestream FlipFactory.

Online producers use exactly the same tools, creating packages on desktop editors and putting the finished product into "drop boxes" for encoding at Web resolution.

The Result

NRK set out to transform its production operations into a single seamless infrastructure that encompassed all content and empowered all users. To overcome the difficulties of working with many regional centers across a large country, the broadcaster undertook the deployment of sophisticated networking and sharing solutions. The Programme Bank project is nearly complete, and it is a tribute to the close cooperation of the team led by NRK and strongly supported by Omneon and the other key development partners that the largest and most comprehensive content management system attempted anywhere in the world has been accepted with enthusiasm by its users. As Programme Bank is put into place and refined, producers are keen to get connected and already are contributing suggestions for the further evolution of NRK's innovative file-based multiformat content management system.

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