Broadcast Control System (BCS)

NRK 2023-1264

SSA-T Appendix 2 – Contractor solution specification

[Contractor name]

[Contractor logo]

Norwegian Broadcasting Corporation Ltd. (NRK)
Bjørnstjerne Bjørnsons plass 1
N-0340 OSLO, Norway
Switchboard: +47 23 04 70 00
Website: www.nrk.no
Norwegian Business Registration NO976 390 512

Table of Contents

1 INTRODUCTION

The Contractor shall in this Appendix provide solution specification of the BCS solution in accordance with the objectives, needs, requirements, and instructions as described and specified by the Customer in SSA-T Appendix 1.

Text inserted by the Contractor should be marked with blue font.

Note: the remaining descriptions of this Appendix will be clarified during the negotiation phase.

2 EXPLANATION TO THE REQUIREMENTS SPECIFICATION

The requirement specification tables provided in Appendix 2 consists of the columns shown in the table below. Please note that the requirements specification tables shall only be filled in as part of the Contractor's response in Appendix 2.

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1				
2				

#: Requirement ID – consecutive numbering of needs/requirements within each section.

Requirement: Textual description of the need/requirement.

Stage: The column refers to which MPP stage the requirement is expected to be delivered.

Compliance:

- Y: the requirement is fulfilled
- P: the requirement is partly fulfilled
- N: the requirement is not fulfilled

Contractor's response: The Contractor's detailed description of how the need/requirement is fulfilled as well as which part(s) of the requirement are possibly not fulfilled according to the applied compliance code. Please refer to chapter 3 below for instructions for completing Appendix 2.

3 INSTRUCTIONS FOR COMPLETING APPENDIX 2

The Contractor is required to document degree of fulfilment of and compliance with the specified objectives, needs and requirements in SSA-T Appendix 1 by completing the corresponding Appendix 2.

In Appendix 2, the Contractor must for each need and requirement provide an exhaustive elaboration of how the proposed BCS solution addresses the Customer's needs and requirements. The Contractor is encouraged to add illustrations and screenshots whenever this may help the Customer to get a better understanding of how the BCS solution addresses the requirement. References to general materials such as sales and/or product brochures, product magazines and web content is not sufficient. Any relevant supplementary information may be provided as attachment(s) to Appendix 2 with clear and unambiguous reference.

Where requirement tables are used, the Contractor must answer each requirement with a confirmation by marking an "Y", "P", or "N" in the relevant column(s) under the heading "Compliance":

- If the Contractor marks the Compliance column "P", an explanation must be given in the "Contractor's response" column. Otherwise, the requirement is not accepted as fulfilled. Based on the explanation, the Customer will consider if the requirement is fulfilled or not.
- If the Contractor has any reservations to the requirement, this must be explained in the "Contractor's response" column. If the Contractor will fulfil part of the requirement with one of the categories and another part with another category, then the Contractor may mark more than one category. In that case, the Contractor must be very explicit in their description in Appendix 2 about how each part of the requirement is fulfilled. The Contractor shall inform the Customer of the likely consequences of any customizations in terms of the complexity and price of any future maintenance of the standard system and customization.
- If the Contractor does not fulfil the requirement as intended by the Customer's requirement description, but the Contractor has a workaround solution, the Contractor must mark the Compliance column "P" and describe the workaround solution in the "Contractor's response" column.

The Contractor's response must be sufficiently exhaustive for the Customer to assess whether the solution meets the requirement and otherwise may be considered suitable, possibly adding value, and thus form a sufficient framework for any detail specification. If the column "Contractor's response" does not contain sufficient space for text and illustrations for certain requirements, the response may be included under each requirements table with clear and unambiguous reference to the applicable requirement ID.

Although alternative proposals are not allowed as such, this does not prevent the Customer from accepting a fulfilment of individual requirements that are not necessarily "according to the letter of the requirement" if the Customer has justified this in terms of increased performance, value, efficiency, safety, gain etc., or reduced risk and cost. Similarly, if the Contractor considers certain requirements to be particularly complex or cost-driving, the Contractor may justify this and propose and describe an alternative fulfilment.

It is the responsibility of the Contractor to ensure that all requirements are sufficiently addressed. If requirements are left unanswered or uncommented – they are to be considered as fulfilled unless otherwise explicitly stated by the Contractor.

Any limitations, demarcations, assumptions, or deviations must be clearly described in connection with the individual need and requirement in Appendix 2 to be invoked.

4 INSTRUCTIONS FOR COMPLETING OTHER APPENDICES

#	Instructions
1	The Contractor shall in SSA-T Appendix 4, in accordance with the structure and instructions provided in the Appendix, describe their overall project and progress plan for the delivery of the BCS solution.
2	The Contractor shall in SSA-T 5, in accordance with the structure and instructions provided in the Appendix, describe how testing and approval shall be conducted.
3	In SSA-T Appendix 6, the Contractor shall, in accordance with the structure and instructions provided in the Appendix, describe its organisation, governance and engagement model with the Customer as instructed.
4	The Contractor shall specify prices and the principles for pricing in SSA-T Appendix 7.
5	If the Contractor has any reservations to the general terms in the Agreement these shall be set forth in SSA-T Appendix 8, except for cases where the General Contract Terms refer to other documents.

6	Any licence terms and conditions for standard software and free software shall be included in SSA-T Appendix 10.

5 BACKGROUND AND PURPOSE

NRK is currently in the process of performing a business transformation from SDI and AES3 broadcast technologies to native AV over IP services (AVoIP). The AVoIP model will form the standard model for real-time broadcast activities at all sites.

This business transformation is being co-ordinated by a company-wide programme, referred to as MPP – Modernisation of the Production Platform (MPP). In addition to the transformation to AVoIP, the MPP programme aims to centralise production processing resources in external datacentres, and to lay the groundwork for integrating public cloud services into broadcast workflows.

The transformation was initiated by the decision to establish new headquarters in Oslo at Ensjø, due to outdated facilities at the current Oslo location at Marienlyst. In addition, several large projects have been added to the programme, including establishing a new WAN, and moving NRK's second largest facility in Trondheim to a new premises, making this the largest undertaking in NRK's history.

The objective of this RFP and the subsequent dialogue is to provide NRK with a Broadcast Control System (BCS) which is capable of meeting NRK's long-term strategic goals.

The BCS is a central component in a broadcast production platform. It is important to NRK to find both the right product and a long-term partner, with a product roadmap that aligns to the whole scope outlined as part of SSA-T Appendix 1. The BCS specification communicates the following NRK requirements to inform an RFP process:

- A vendor partner to supply, evolve and support a BCS product
- Specific foundational functionality for the first release of the NRK Modernised Production Platform (MPP v0.5)
- A BCS product with a roadmap that meets long term strategic objectives

The BCS requirements specification (this Appendix) should be read in the context of associated tender documentation and should give potential BCS suppliers a clear understanding of the product and partnership requirements to guide their RFP responses.

Please refer to Tender Provisions document for more information about tender background and purpose.

6 NON-DISCRIMINATORY SOLUTION

The Contractor shall here describe how the proposed BCS solution will meet the requirements regarding non-discriminatory solution provided in SSA-T Appendix 1.

Contractor's response to be inserted here:

7 TECHNICAL BCS SCOPE (CLAUSE 1.1)

The Contractor shall here describe in detail the proposed BCS solution in accordance with the technical BCS scope description provided in SSA-T Appendix 1.

If the Contractor is of the view that there are obvious errors or ambiguities in the Customer requirements specification, the Contractor shall point this out here.

If the Customer's technical platform needs to be upgraded in order to enable the Customer to utilise the deliverables, the Contractor shall point this out here.

The Contractor shall, here in Appendix 2, inform the Customer of the likely consequences of the relevant customisations in terms of the complexity and price of any future maintenance of the standard system and customisation.

Contractor's response to be inserted here:

8 TECHNICAL REQUIREMENTS

This section contains the Customers' requirements for the BCS solution. The technical requirements are identical to those provided in SSA-T Appendix 1.

8.1 Security

High public trust is essential for NRK, and safeguarding content production and delivery is vital. Therefore, NRK should always follow security best practices. Going forward, NRK expects vendors to adhere to security best practice, such as EBU Cybersecurity Recommendations for Media Vendors' Systems, Software and Systems (EBU R 143). The BCS is a critical production component and must employ adequate protection and security measures. The Contractor should comply with NRK's Supplier Security Requirements as specified in Attachment 2.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	The BCS should support single sign on using oauth2/openid and/or SAML.	v0.5		
2	The BCS can use either Active Directory or Azure Active Directory for users and groups. If the BCS has its own internal user and group database, the BCS should support provisioning users and groups using SCIM.	v0.5		
3	The BCS should support role-based access control.	v0.5		
4	Communication between the users and the BCS system should be encrypted using TLS1.3 or higher.	v0.5		
5	Security logs from the BCS should include the following information: • Log in information • Audit logs for changes done by users • Audit logs for changes done by administrators • Audit logs for changes done via API • User and group synchronization	v0.5		
6	The BCS should be able to send security logs to a remote SIEM (Security Incident and Event Management) system. Currently NRK uses Azure Sentinel.	v0.5		
7	The BCS should support API access using supplier specific access tokens or OAuth2.	v1.0		

8	The BCS should support RBAC for API access.	v1.0
9	The provider should provide a SBOM for the BCS.	v1.0
10	The provider has a responsible disclosure policy.	v1.0
11	The provider should have security.txt implemented.	v0.5
12	The provider should have a defined patch strategy with specific time frames for when patches is provided, differentiated by severity levels of the security issue.	v0.5

8.2 Standards

NRK endeavours to be a driving force in the utilization of a standards driven IT-centric production platform. To support this strategy the BCS should prioritise standards over vendor specific solutions.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	The BCS should support NMOS IS-04 for device registration.	v0.5		
2	The BCS should be able to act as a NMOS registry.	v0.5		
3	The BCS should support NMOS IS-05 for connection management.	v0.5		
4	The BCS should support NMOS IS-07.	v0.5		
5	The BCS should support NMOS IS-08.	v0.5		
6	The BCS should support NMOS IS-10.	v1.0		

8.3 Configuration

The BCS should be configurable using industry standards and APIs.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	The BCS should have a complete REST or GraphQL API for configuration of the BCS providing at a minimum: • Adding, removing, and updating devices • Adding, configuring/updating, and removing user interfaces • Configuring multicast orchestration integrations	v0.5		

2	The BCS should have support for configuration using Ansible or Terraform with a Ansible module or Terraform provider supported by the vendor.	v0.5
3	The BCS should support administrator-configurable webhooks to interact with other generic APIs (e.g., on status updates).	v0.5
4	The BCS should support sending and receiving events on a service bus using AMQP.	v1.0

8.4 Federation

The BCS high-level deployment model diagram below provides an overview of the MPP AVoIP federation architecture.

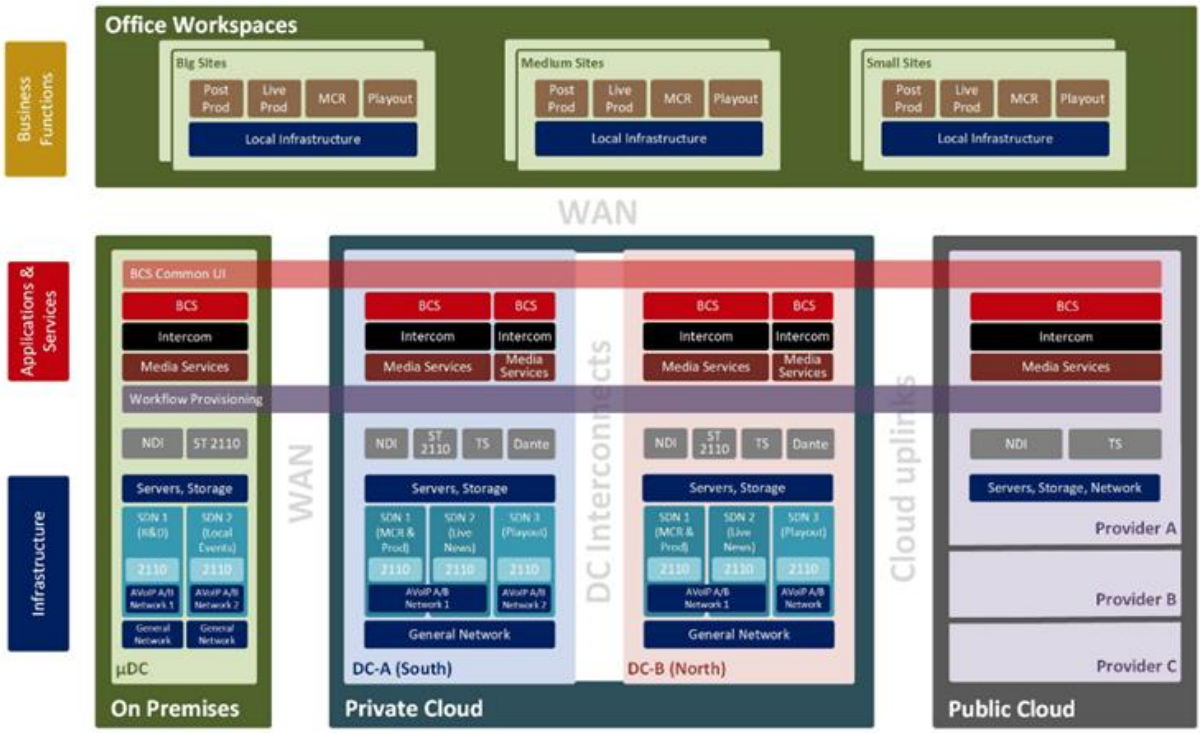

Figure 1 - The BCS high-level deployment model diagram

To preserve security of the operation, reliability of the platform and segment the system into manageable chunks, interconnected BCS instances will exist across NRKs locations and in places, across a campus or site.

Within each DC there will be two BCS instances. One assigned to Production and Master Control, the other to Playout and Distribution. Each BCS instance will communicate with associated Production and Playout SDN instances. Underneath the Production and Playout BCS /SDN instances with be a common, mirrored spine/leaf AVoIP network fabric. BCS instances must communicate with each other and their associated SDN instances to exchange ST 2110 multicast flows between Senders and Receivers. Flow exchange may be between systems within a location or between systems in different locations.

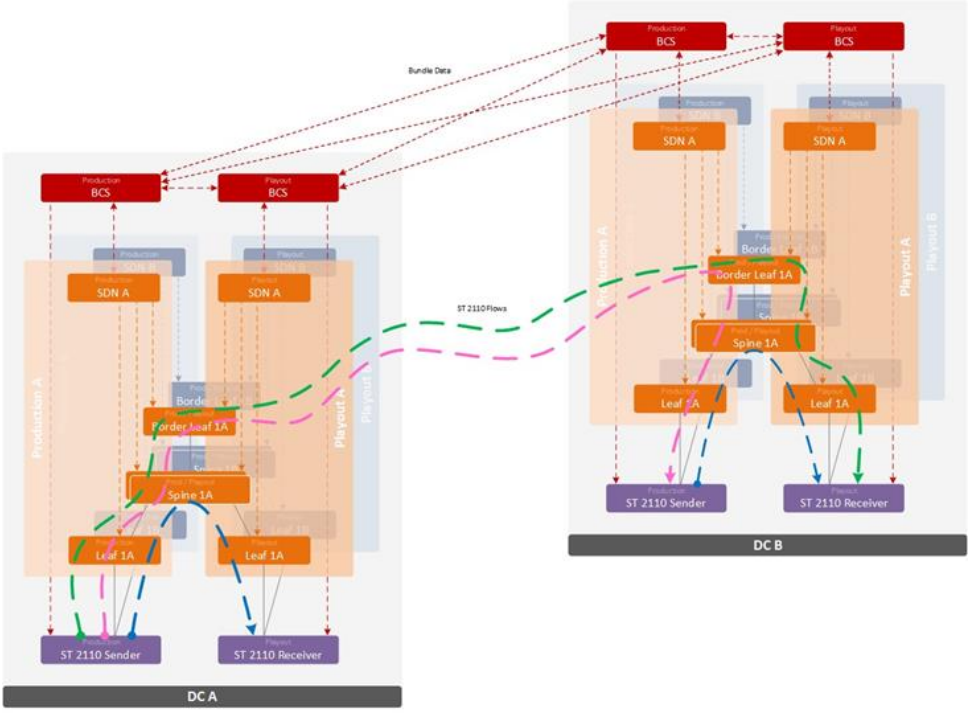

Figure 2 - DC A and DC B

Various flow exchange scenarios must be supported between the DCs. In summary:

1. Prod BCS/SDN DC A <--> Prod BCS/SDN DC B
2. Prod BCS/SDN DC A --> Playout BCS/SDN DC A
3. Prod BCS/SDN DC B --> Playout BCS/SDN DC B
4. Prod BCS/SDN DC A --> Playout BCS/SDN DC B
5. Playout BCS/SDN DC A --> Playout BCS/SDN DC A
6. Playout BCS/SDN DC B --> Playout BCS/SDN DC B
7. Playout BCS/SDN DC A <--> Playout BCS/SDN DC B

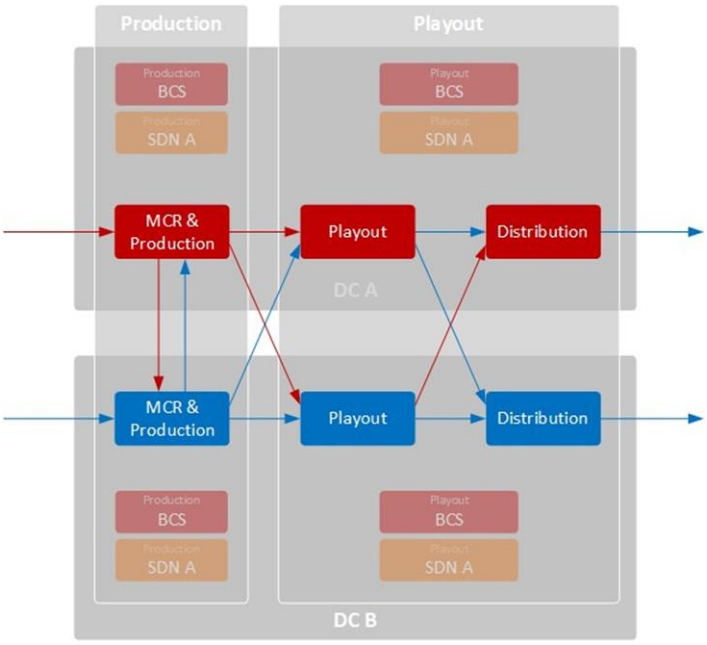

Figure 3 - Flow exchange between DC A and DC B

Added to this, BCS instances within the DCs must control equipment located within offices. For example, ST 2110 Receivers with control rooms (e.g., MCR, Playout, Production Control) which feed monitors.

To streamline the operation, the BCS must provide a mechanism to enable a single federated name space to work across NRKs facilities at our different locations.

The possibility exists that NRK could run their existing BCS system (VSM) alongside the MPP BCS system for a transition period to simplify migration. For example, VSM might be retained for radio production in the near term, whilst the MPP BCS project focuses on delivering core platform features for MCR as well as features for Playout and TV Studios. The two systems would hand-off audio flows via logical tielines and a media edge device.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	The BCS system should support a federated model with more BCS instances as described above.	v0.5		
2	Each of these BCS instances should communicate with each other to share resources (e.g., source and destination bundles) with human or system users with appropriate access privileges.	v0.5		

8.5 Resilience

NRK is obligated to ensure that information from the government reaches the population during times of emergency or war. Being a critical component in NRK's live production infrastructure, the BCS must be fully resilient and fault tolerant. Each BCS instance must also be able to operate autonomously, so that for instance if one data center is cut off, NRK can still produce and distribute content using the remaining data centers and locations.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	No single point of failure in system core.	v0.5		
2	No single instance of a database.	v0.5		
3	The BCS should be able to merge changes which will be applied without disrupting existing configurations, streams, and ongoing productions.	v0.5		
4	Driver architecture which ensures that large amounts of repetitive data from one, or many sources do not cause the system to fail to control inputs or to log data from other devices.	v0.5		
5	Driver architecture which supports seamless fail over between resilient driver instances.	v0.5		
6	Support for in-service partial and full system backup.	v0.5		
7	Support export of the system backup in order to support off-site backup.	v0.5		

8	Support roll-back to selected snapshot (partial backup) or full backup, with restoring the configuration, but keeping the live settings in the system such as routing of transport streams, etc.	v0.5
9	Support backup and restore with no overall impact to system availability.	v0.5
10	Each BCS instance should be able to function autonomously.	v1.0
11	Support setup of SMTPE 2022-7 redundant streams across two networks fabrics.	v0.5
12	Support re-establishing network connections after network failure.	v0.5

8.6 Networks and orchestration

To fulfil the needs of an IP-first BCS, there is a need for the BCS to be the point of co-ordination between Media Endpoint devices, the network fabric and its multicast orchestration system, a Configuration Registry (often referred to as a Source of Truth).

In NRK, the Configuration Registry is provided by Netbox. In addition to handling IP address management, a lot of other resource management throughout NRK is co-ordinated through this tool. There is a high-level goal to ensure that information in this tool is kept as up to date as possible.

Because of this, there is a need for an integration between the BCS and the network fabric control systems, as well as the Network Registry. These integrations may take the form of native integrations but can also be achieved by configuring a generic “web-hooks”-based event system.

In the cases where the BCS expects to poll, or otherwise receive information from external systems in order to display status, it is important that this is done in such a way that does not pose a significant toll on network equipment in terms of CPU usage.

8.6.1 Feature areas

There are three main areas of BCS to network integration, in decreasing order of criticality:

1. Integration with Multicast Orchestrator in a federated environment
2. Network Registry and Dynamic Multicast Allocation
3. NAT handling and “IP Tielines”

8.6.2 Target state

In NRK’s envisioned IP-based production platform, the BCS will do the following:

Provisioning multicast flows

- The Multicast Group (G) address of the multicast flow will be selected from a pre-determined multicast range, relevant to the site from which the flow originates, and the class of stream.
    - The multicast range may be allocated to the BCS in the Network Registry.
- The BCS can configure the media endpoint to start the flow towards the desired G address.
- The BCS can provide information about both the Source and the Group address of each flow it aims to establish, in addition to Label metadata, to help identify the origin of the flow.
    - To a target Multicast Orchestrator (e.g., Arista MCS or Cisco IPFM).

    - To a "generic" system for further accountancy (message queue or webhook).
- The BCS can populate an external multicast registry with:
    - The Origin Device Name.
    - Flow information (Source and Group address, and flow label).
- The BCS will receive a callback from the Multicast Orchestrator when the Orchestrator has confirmed a successful route establishment or failure; and make this information available in the BCS.

Subscribing endpoints to multicast flows

- The G address of the multicast flow, as well as further metadata about the device subscribing to the flow will be communicated to the endpoint, which will subscribe to the multicast flow.
- If the endpoint device provides a status callback, this information will be made available in the BCS.

Provisioning devices

- Maintaining Name Relationships
    - Devices that are configured in the BCS will have their name populated with the device FQDN as assigned in the Network Registry; or, failing this, update the Network Registry with a new IP address assigned to the same device.
    - Sub-devices and interfaces that have their own IP addresses will likewise have the same update mechanics.

8.6.3 Requirements – Level 1

The BCS must integrate with a Multicast Orchestrator.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	The integration must make the Multicast Orchestrator aware of the desired flows between senders and receivers.	v0.5		
2	The integration must receive callbacks from the Multicast Orchestrator regarding the successful establishment of flows.	v0.5		
3	The BCS must be able to integrate with multiple Multicast Orchestrator instances.	v0.5		
4	The BCS must be able to exchange flows between Multicast Orchestrator instances on the same physical network fabric.	v0.5		
5	The BCS must be able to exchange flows between Multicast Orchestrator instances on different physical network fabrics.	v0.5		
6	The BCS must be able to exchange flows between a locally controlled Multicast Orchestrator instance on a local physical network fabric and a remote Multicast Orchestrator instance on a remote network	v0.5		

	fabric, under the control of another BCS instance.		
7	The BCS must be able to exchange flows between an endpoint attached to a network under Multicast Orchestrator control and an endpoint attached to a non-orchestrated network.	v0.5	
8	The BCS must be able to exchange flows between an endpoint attached to a network under Multicast Orchestrator control and an endpoint attached to a non-orchestrated network, where the one of the endpoints has an affinity to another BCS instance.	v0.5	

8.6.4 Requirements – Level 2

The BCS should integrate with a Configuration Registry (Single Source of Truth), to enable dynamic multicast allocation. NRK has currently chosen Netbox as this single source of truth.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	When a sender is to be configured from the BCS, the integration should generate a query, containing parameters about the class of sender, and type of stream to a REST API, which will return the next vacant multicast address.	v1.0		
2	The BCS should configure the sender to use the multicast group address provided by the network registry.	v1.0		
3	The BCS should perform a callback to the network registry, updating the state of the multicast address allocation with relevant metadata, including but not limited to: the device ID, the device name, the sender interface, the flow group (e.g. if it belongs to a device-originated group), and the flow index.	v1.0		

8.6.5 Requirements – Level 3

When bridging disparate external IP networks, for instance from 3rd party contribution or occasional networks, NRK needs to be able to exchange multicast flows. It is not a given that NRK is able to define the addressing scheme of the 3rd party network – and as such, a multicast address translation is required (M-NAT). There are two primary approaches to this:

- M-NAT by means of Media Gateway
- M-NAT by means of generic IT switch, directly configured or via a Multicast Orchestrator

The BCS should be able to dynamically allocate multicast addresses for these use cases and configure the translation device to achieve flow exchange.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	The BCS can configure multicast NAT, using broadcast-specific devices, e.g., "translation gateways".	v1.0		
2	The BCS can configure multicast NAT by using the network vendors orchestrator via APIs.	v2.0		

8.6.6 Requirements – Vendor-specific requirements

NRK has not yet chosen the vendor for media network infrastructure, so the BCS should support the two major players for media networks, that is Arista and Cisco.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	The BCS should support establishing paths through with Cisco NBM-based fabrics via Cisco IPFM APIs.	v0.5		
2	The BCS should support handling events returned from Cisco IPFM.	v0.5		
3	The BCS should support establishing multicast paths through Arista fabrics, via Arista MCS APIs.	v0.5		
4	The BCS should support handling events returned from Arista MCS.	v0.5		
5	API calls made to multicast orchestration systems should be logged as events.	v0.5		
6	Received events / callbacks from multicast orchestration systems can be logged as events.	v0.5		

8.7 Logic engine

There are many occasions when it is necessary to apply business logic within the BCS using a built-in logic engine. These can be divided into two broad categories:

8.7.1 Control panel logic

Typical examples:

Destination list
On a routing panel, a control that produces an on-screen report that shows all the destinations to which the currently selected source is routed.

Monitor follow

On a routing panel, a control that watches for local operator's selection of source and routes that directly to a local monitoring destination, or it receives a destination index, and routes the source that is currently routed to that index to a local monitoring destination.

8.7.2 Background processes (always on)

Often, there is a requirement for logic to operate continuously, typical examples are:

Under monitor displays (UMD) and Tallies
A major example of background logic is the handling of UMDs and tallies. An automatic process watches the Package Routing, and any underlying XY routing, along with the tally states of all Vision Mixers and forwards UMD strings and tally states to devices that require them (Multiviewers, Physical UMDs, GPIs etc.) and continuously re-calculates values according to state and routing changes.

Camera control/Shading Touchdown Logic
As a camera control operator/shader presses down on a Camera RCP, the appropriate CCU output is routed to a local monitor. When the RCP is released, the monitor routing reverts to a preselected 'flyback' source. Multiple RCPs will result in a 'last press wins' and a logic that works out the appropriate releasing any RCP will result in the latest routing command to be executed.

8.7.3 Customer defined logic

The BCS solution should provide a mechanism for the customer to define and write scripts or applications to perform logical operations. This should be capable of processing large data sets in a timely manner, in which case compiled applications may be more appropriate than a scripted approach.

8.7.4 Requirements

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	The BCS should support the control panel logic.	v0.5		
2	The BCS should support the background processes to automatically update GPIO and UMD.	v0.5		
3	The BCS solution should provide a mechanism for the customer to define and write scripts or applications to perform logical operations. This should be capable of processing large data sets in a timely manner, in which case compiled applications may be more appropriate than a scripted approach.	v0.5		
4	The BCS should support a language that gives us the ability to develop custom logic scripts.	v1.0		
5	The BCS logic engine should be able to make actions based on all the states in the BCS.	v0.5		

8.8 Packaging

NRK will employ a "Package" routing concept, where senders and receivers, both real and virtual, on different routing planes are packaged together to form "virtually associated sources" or "virtually associated destinations". Routing of packages will be a process of making a series of connections between the items contained within a Source package with those in a destination package across one or more routing planes.

Packages may also contain pointers to logical constructs within other systems under control, such as the intercom.

For the purposes of commissioning, testing and emergencies, it must still be possible to 'make routes' (i.e., subscribe receivers to senders) on each individual routing plane.

8.8.1 Federation

The precise definition of how federation will work is, to a large extent, informed by the topology of the IP fabric and endpoint arrangements. However, some broad principles are that

- all Source Packages are visible and available to all Destination Packages
- availability (and thus visibility) of specific levels in a Package route are dictated by two factors:
    - IP Network topology/tieline availability (e.g., if there is no direct network path from sender to receiver)
    - Logical restrictions (e.g., preventing a TV Studio Camera being available to Playout, as that is not an expected or desired workflow)

8.8.2 Control Planes

The graphic below describes the scope and overlap between Senders, Receivers, Packaging and Bundling.

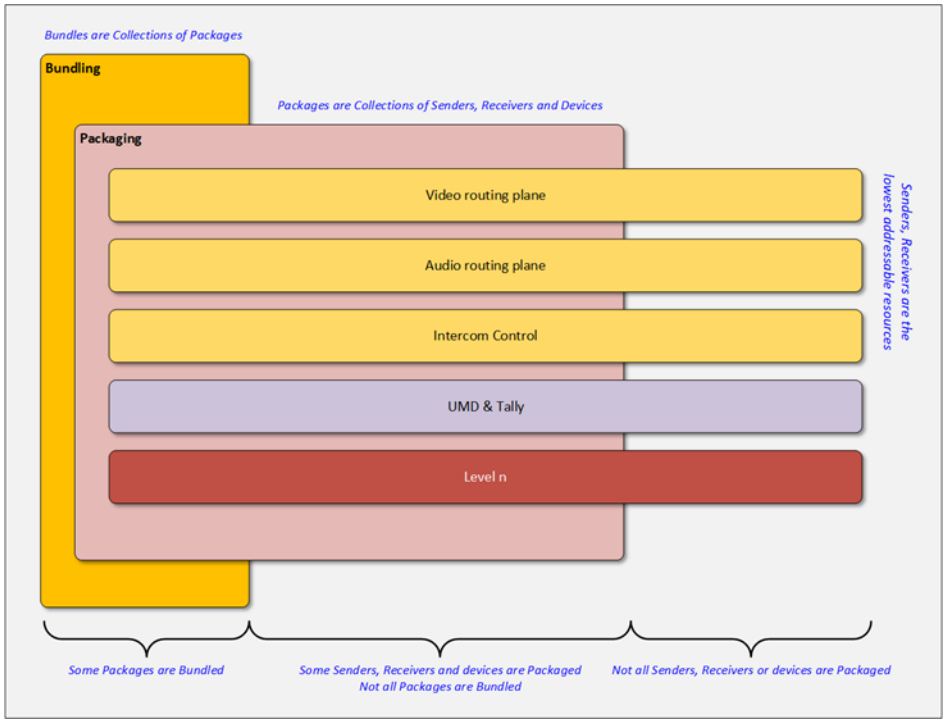

Figure 4 - Scope and overlap between Senders, Receivers, Packaging and Bundling

Senders and Receivers are the lowest level of granularity in the routing system, Packages contain Senders and Receivers, and Bundles contain one or more Packages.

Most routing is carried out at the Package Level, facilitating connecting multiple levels, in both directions in one atomic action (although this is by no means mandated - it must be possible to connect a subset of levels (e.g., Video or Video + Audio - without, say, intercom)

Operationally there are reasons why certain senders and receivers may be excluded from Packaging (e.g., unequipped senders or receivers in a studio that are treated as tielines with no predetermined use).

The package routing system within the facility is envisaged to have "levels" as listed in the following sections (not an exhaustive list).

8.8.3 Source Package

- Video Senders (none, one or several)
    - These may be the same content, via Main/Backup paths OR
    - Same content, different Video format (e.g., UHD 2160p50/HDRPQ & 1080p50 SDR)
- Video Receivers (none or one)
    - Typically used to feed return/cue vision to contributors
- Audio Senders (none, one or many in combination)
    - Content may be split across sender streams (e.g., International Sound on one stream, commentary on another)
    - Multiple channels of content may be encapsulated in a single stream (e.g., 16 ch, including multiple Stereo and/or Surround/Atmos channels)
- IFBs (none, one or two)
    - A pointer to an IFB construct within the intercom system and/or ports on the intercom system to which return audios to contributors/commentators are connected
    - Mix-minus signals from receiving control rooms will need to be routed according to a set of rules. This is likely to involve combinations of FIFO queues, simple routes, and additive mixing, depending on the circumstance
- Conferences [Party Lines] (None, one or several)
    - A pointer to a conference construct within the intercom system and/or ports on the intercom system to which conference audio is connected
- Metadata (multiple fields)
    - Additional operational data such as booking number, start/end times, contact names/numbers, production info
    - Video Standards/Resolutions/HDR Transfer Characteristics (implied or gathered from Video Sender(s)
    - Audio language, usage (Stereo/5.1/Mix/International Sound) tags which may be used to automate audio routing
    - UMD Text (none, one or several) – names which will be displayed on target equipment – e.g., whilst a multiviewer might handle >16 characters, an intercom panel might be limited to six characters, a Vision Mixer to four characters
    - GPIO
- Tally receivers
    - For devices such as CCUs that accept tally signals

8.8.4 Destination Package

- Audio Receivers (none, one or many in combination)
    - Content may be split across sender streams (e.g., International Sound on one stream, commentary on another)
    - Multiple channels of content may be encapsulated in a single stream (e.g., 16 ch, including multiple Stereo and/or Surround/Atmos channels

- Audio Senders [Mix-Minus] (none, one or two)
    - A sender that carries mix-minus from an audio console for onward routing to contributors via the IFB and return audio path defined in a Source Bundle
- Metadata (multiple fields)
    - Video Standards/Resolutions/HDR Transfer Characteristics (implied or gathered from Video Sender(s)
    - Audio language, usage (Stereo/5.1/Mix/International Sound) tags which may be used to automate audio routing
    - GPIO
- Tally senders
    - For devices such as Vision Mixers that generate tally signals. It must also be possible to generate a tally state from logical routing e.g., when a Source Bundle is routed to a Destination Bundle that represents a specific outgoing line.

8.8.5 Audio Package

Depending on the complexity of the eventual requirements, it is feasible that some levels (e.g., Audio Senders, IFB) are defined in separate Audio Package which themselves become levels in a Source Package.

8.8.6 Virtual Package

Virtual Package exist as both Source and Destination Package. Anything routed to a Virtual Destination Package is available (and maintained) as a Source Package. This simplifies the operational experience and allows resource substitution to take place, without the need for manual rerouting of multiple levels.

Both a Virtual Source Package and a Virtual Destination Package can contain pointers to real senders and receivers, which permits operational flexibility – the ability to override / tap off individual levels at points a routing chain.

8.8.7 Package Lifecycle

The majority of sources and destinations will be permanently represented by “Static” Packages. For day-to-day bookings, Packages will be populated and ‘cleared down’ as necessary.

As changes to a Source Package are committed, they will ripple through the system. Consider a faulty IRD which is swapped out for a working one. Any routes from the original IRD to the new one will be automatically replaced by the Packaging logic. The “ripple” effect must take account of all Virtual Packages in the routing chain.

8.8.8 Requirements

Contractor’s response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor’s response
1	The BCS should support the bundle and package concept as described above.	v0.5		
2	The BCS should support bundle and packages between federated instances.	v0.5		

8.9 Device control

BCS must communicate with a wide range of broadcast devices, such as baseband routers, multiviewers, processing devices and video/audio mixers.

Whilst the preferred (and predominant) connectivity for control and monitoring will be TCP/IP, it is anticipated that there will be a limited amount of serial and GPI control required.

Any devices requiring serial communications will use a Serial Device Server to keep legacy cabling to a minimum and allow fast replacement of controlling PCs.

There may also be a requirement to collect and originate physical GPIO signals within the NRK systems (e.g., CCU tally inputs). To facilitate this, the BCS will control and manage a distributed GPIO to IP interface devices, which will ideally present an NMOS IS-07 interface.

Devices that have both control and media (ST 2110 or AES67) Ethernet connections are anticipated to have multiple NICs with different NICs used for each purpose.

Control and monitoring communication will not be conveyed to a device by the media exclusive (AVoIP) network, even if the communication involves routing of signals to/from that device, unless there is no alternative.

Contractor's response to be inserted here:

8.9.1 Requirements

A list of key device integrations for each stage. Please list relevant integrations.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	Network Controller (Multicast SDN)	v0.5		
2	Intercom (Talkback, Comms)	v0.5		
3	Media Gateway Connection Management	v0.5		
4	Codecs (Video and Audio)	v0.5		
5	Assignable Signal Processing (Video and Audio)	v0.5		
6	Multiviewer	v0.5		
7	Under Monitor displays (Protocols for Label and Tally and User Levels)	v0.5		
8	Audio Monitoring Unit	v0.5		
9	Signal Analyser	v0.5		
10	Test Signal Generator	v0.5		
11	GPI Interface	v0.5		
12	Media Gateway Parameter Control	v1.0		
13	Vision Mixer (BCS tile hosted within mixer UI)	v1.0		
14	Audio Mixer (BCS tile hosted within mixer UI)	v1.0		
15	Workflow Provisioning	v1.0		

16	Resource Management	v1.0

8.10 Intercom

Integration between the BCS and the intercom & talkback (comms) system is fundamental to the live production workflow. The BCS shall provide close integration with the comms system, both locally and to any remote systems linked through trunking arrangements.

It must be able to perform the following functions, assuming the vendor specific API provides a suitable interface allows such actions and/or previously developed methods within the BCS.

The intercom vendor is yet to be chosen, please provide responses for your capabilities for the intercom systems that you currently support in any capacity.

Overall goals are:

- Automate the creation of intercom configuration items based on event requirements.
- Empower end users to make production required changes through a clear easy to use interface.

Clarifications/notes:

- Where a requirement states the need to work on local and remote systems, this infers that the intercoms Trunking system cannot manage the required functionality, therefore the BCS is required to manage it.
- Where a requirement is not possible directly via the API it is requested that responders detail any internal BCS logic that makes the requirements possible.

Contractor's response to be inserted here:

8.10.1 Ports

Requirements are for all port types; 4-wire & panel. Where a requirement is specific to 4-wire only it will be detailed in (brackets). Fill out one answer per provider you support.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	If more than one intercom system is supported, please specify in the Compliance column like shown here: Vendor A: Y Vendor B: P Vendor C: N			
2	Should be able to set Longname of ports.	v0.5		
3	Should be able to set Shortname of ports.	v0.5		
4	Should be able to set Aliases of ports.	v0.5		
5	Should be able to set Subtitle of ports.	v0.5		
6	Should be able to set Input gain control.	v0.5		
7	Should be able to set Output gain control.	v0.5		

8	Should be able to do Calculation of port usage - crosspoint routes, IFB, Group & Conference.	v0.5	
9	Should be able to set Vox on/off Threshold.	v0.5	
10	Should be able to do Virtual Key control.	v0.5	

8.10.2 Routing

Fill out one answer per provider you support.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	Should support crosspoint routing on local system.	v0.5		
2	Should support crosspoint routing on a remote system.	v0.5		
3	Should support crosspoint routing between federated instances.	v0.5		
4	Should support crosspoint Gain control.	v0.5		

8.10.3 Conferences

Fill out one answer per provider you support.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	Should be capable of setting labels of conferences.	v0.5		
2	Should be capable of setting aliases of conferences (on local and remote systems).	v0.5		
3	Should be capable of setting subtitle of conferences.	v0.5		
4	Should be able to add 4wire ports as Talker (always/vox).	v0.5		
5	Should be able to add 4wire port as Listener (always/vox).	v0.5		
6	Should be able to add 4wire port as Talker/Listener (always/vox).	v0.5		
7	Should be capable of setting priority of conference members individually.	v0.5		

8.10.4 IFBs

Fill out one answer per provider you support.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	Should be able to set key label of IFB.	v0.5		
2	Should be capable of setting subtitle of IFBs.	v0.5		
3	Should be able to set input port or group of IFB from local & remote systems.	v0.5		
4	Should be able to set mix minus port or group of IFB from local & remote systems.	v0.5		
5	Should be able to set output port or group of IFB from local & remote systems.	v0.5		
6	Should be able to set Dim level of mix minus.	v0.5		

8.10.5 Groups

Fill out one answer per provider you support.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	Should be able to set Key label of Group.	v0.5		
2	Should be able to set subtitle of Groups.	v0.5		
3	Should be able to add 4wire port from local & remote systems.	v0.5		
4	Should be able to add panel ports.	v0.5		
5	Should be able to set balancing of audio levels of group members.	v0.5		

8.10.6 Functions

Functions can be applied to intercom panel keys, virtual keys, and panel and 4wire virtual functions. This list represents all functions and parameters that are required to be applied by the BCS. Fill out one answer per provider you support.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response

1	Should be able to set all to port.	v0.5	
2	Should be able to listen to port.	v0.5	
3	Should be able to control call to conference.	v0.5	
4	Should be able to control call to IFB.	v0.5	
5	Should be ablet to control call to group.	v0.5	
6	Should support logic commands in the intercom system.	v0.5	
7	Should be able to support remote key in the intercom system.	v0.5	
8	Should be able to support send key string in the intercom system.	v0.5	
9	Should be able to support control audio patch in the intercom system.	v0.5	
10	Should be able to support route audio in the intercom system.	v0.5	

8.10.7 Intercom Panels

Fill out one answer per provider you support.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	Should be able to set available functions on keys, virtual keys, virtual functions and GPIO.	v0.5		
2	Should be able to set Key mode: Momentary, Latch, Auto.	v0.5		
3	Should be able to set Dim mode: Dim, No Dim.	v0.5		
4	Should be able to set key label.	v0.5		
5	Should be able to set key subtitle.	v0.5		
6	Should be able to set Monitoring state of individual keys.	v0.5		
7	Should be able to set Icons on keys.	v0.5		
8	Should be able to set group colours.	v0.5		
9	Should be able to control internal audio matrix crosspoints.	v0.5		
10	Should be able to set microphone parameters - type, gain.	v0.5		
11	Should be able to set dynamics - compressor, limiter.	v0.5		
12	Should be able to set stacking of functions on keys - up to the limit imposed by the intercom.	v0.5		

13	Should be able to set lock Function - Ability to set functions to remain in the event that a key is cleared.	v0.5		
14	Should be able to set Audio Input/Output - Where the intercom panel supports sendings and receiving audio as analog and/or AES67.	v0.5		

8.10.8 GPIO

Fill out one answer per provider you support.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	Should be able to query GPI/O States.	v0.5		
2	Should be able to set GPO State.	v0.5		

8.10.9 User Interactions

Fill out one answer per provider you support.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	Panel Copy/Paste - enable the user to copy an entire panels configuration to single/multiple panels.	v0.5		
2	Key Copy/Paste - enable the user to copy single or multiple keys to single/multiple panels.	v0.5		

8.10.10 Mixing

Fill out one answer per provider you support.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	Should be able to present a mix minus group with multiple members as a mixer that allows for adjustment of audio level to all "listeners" of the group.	v0.5		

8.11 User Interfaces

All functionality within the BCS must be available through the BCS user interfaces and give the users the ability to interact with the system based on their production role and their login privileges.

The user experience should be recognisable and consistent across user interfaces, e.g., across desktop interfaces, programmable hardware panels, touch screens. The industry best practice to achieve this is to build user interfaces using a design system – a shared design and code collection of reusable components, guided by clear standards. Origo (NRK's own design system for internal NRK systems) and Aksel (NAV's design system – the Norwegian abbreviation for the Norwegian Labour and Welfare Administration) are examples of well-established Norwegian design systems. An international (and best practice) example is Google's open-source design system Material Design.

The BCS interfaces should be possible to use by "as many as possible". BCS user interfaces and components in BCS design system should be built with accessibility in mind, trying to be as inclusive as possible, but meeting at least the minimum set of Web Content Accessibility Guidelines (WCAG).

In order for the designer to utilize the design system it should have a corresponding component library available in a design tool. Figma is an industry standard tool and is the design tool used by UX/UI designers at NRK.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	The BCS user interface must be accessible as a responsive web interface.	v0.5		
2	The BCS user web interface should follow proper HTML semantics (e.g., not using table for visual layout).	V1.0		
3	The BCS web interface should support the common browser versions from Edge, Chrome, Firefox, and Safari.	v0.5		
4	The user interfaces should have full UTF-8 or UTF-16 support in order to support all characters required for Norwegian, North Sami, South Sami and Lule Sami.	v0.5		
5	The BCS should have web components available to be used inside 3rd party solutions.	v0.5		
6	The BCS user interface should support role-based access control.	v0.5		
7	The users should have the ability to personalize the user interface into their needs in a flexible way based on their privileges.	v0.5		
8	The users should have the ability to use hard panels if needed, for both routing and parameter control.	v0.5		
9	All BCS user interfaces should be built using one common design system.	v0.5		
10	The BCS design system should have a corresponding Figma component library, for	v0.5		

	design collaboration between Contractor and NRK.		
11	The BCS should support replacing vendor branding with NRK branding, i.e., replace or remove vender logo, use NRK colour scheme, etc.	v0.5	
12	The BCS should meet the latest Web Content Accessibility Guidelines (WCAG) at levels A and AA. Currently, the latest version is WCAG 2.1.	v0.5	
13	Contractor should use the check list W3Cs WCAG-EM or a similar Accessibility Conformance Report (ACR) to document how the BCS matches the WCAG 2.1 requirements on levels A and AA.	v0.5	

8.12 Resource Scheduling

Resource Scheduling features may be an integral feature of the BCS or an external system with integration to the BCS using northbound APIs. This chapter describes the functionality desired for solving some of the workflows NRK have today.

8.12.1 Deliverables

Resource Scheduling for the BCS comprises four main deliverables:

- Time based connection management of pre-defined single endpoints or packaged connections
- Time based event execution
    - Device parameter control
    - Signalling
- Connection conflict detection
- Resource scheduling user interface

8.12.2 Time based connection management and event execution

Time based connection management is about being able to execute connection requests on a schedule and log what has happened.

Time based event execution is about doing scheduled device parameter control and signalling and log what has happened.

- All current and future schedules must have a start time and may have an end time
- All previous schedules must have a start time and an end time
- All future events must have an execution time
- All past events must have an actioned time

The scheduled connection event should update meta information in the destination about connection changes. This in order for an operator to see for instance when a destination was last used.

8.12.3 Real time connection management and event execution

Real time provisioning can be implemented by:

- user input from the BCS user interfaces
- external trigger from a third-party system (e.g., playout)

For endpoints or packages pre-defined as scheduled, manual connections, e.g., from a user interface, must be regarded as scheduled.

All real time connection management and event execution should be immediately represented in the user interfaces.

8.12.4 Scheduled connection management and event execution

Scheduled events can be entered by:

- input into a text-based list display
- a linear time-based graphical display
- external trigger from a third-party system

All scheduled connection management and event execution should be represented on the text and graphical displays in advance.

8.12.5 Connection conflict detection

The system should check and alert the users if there is a connection clash (conflict) whenever:

- a real time connection management event is requested
- a scheduled connection management event is requested
- a scheduled connection management event is edited

Scheduled connections have priority over real-time connections. By default, a real-time connection will be overridden by a scheduled connection.

When a connection conflict is detected, the BCS must present the user with a conflict resolution dialogue.

8.12.6 Resource scheduling user interface

The system should support both graphical and text-based display formats. In either format:

- previous, current, and new schedules should be represented and be visually distinct
- current and future schedules will appear as indefinite unless/until and end time is added, or the schedule is manually closed
- current schedules should be visually distinguishable from future schedules
- individual schedules in a concurrent series of the same connection must be distinguishable

The graphical display should be in the form of linear timelines relating to destination resources. The current time should be indicated on the timelines. It must be possible to:

- filter the visible destination resources by type (user defined)
- filter the visible destination resources by upcoming provisioning events
- zoom the visible time frame in/out
- scroll the visible time frame forward/back

The text display should be in the form of a sequential log of actual and scheduled provisioning events. The current time should be indicated in the text display. It must be possible to:

- filter the visible scheduled events by type and date (user defined)
- scroll the visible time frame forward/back
- add notes to a scheduled event in the log
- add notes to the log
- export the schedule log

8.12.7 Graphical display example (based on current workflow)

NRK's current scheduler UI used to perform and visualize:

- Connection/schedule connection/edit connections (set stop time on a current connection)
- Visualising scheduled items and the connected sources
- Destinations presented in a an "Outlook appointment planning" style visualisation showing scheduled items and the connected sources with adjustable timeline view.

Example of how a resource scheduling can be displayed:

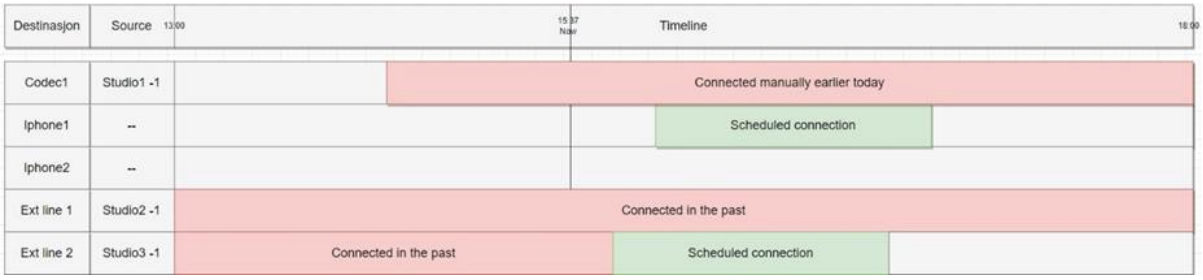

Figure 5 - Resource scheduling example

The scheduler can perform single/daily/Daily between dates connections. It can also suspend daily schedules for a period.

From the UI it is direct access and very easy and fast (few button clicks) to set up a scheduled connection.

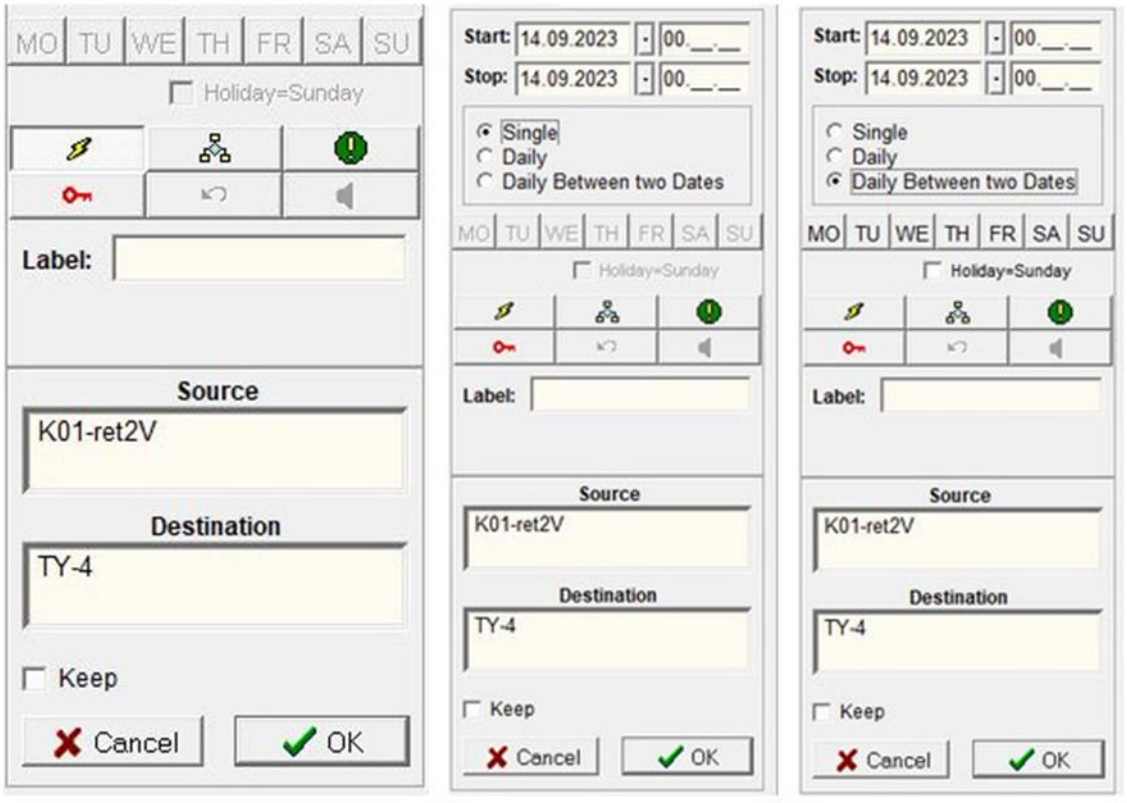

Figure 6 - Resource scheduling example

There is similar functionality for scheduling to a channel (input on a summing amp) and scheduling events like GPIO setting and signalling information to end user UI. In addition, there is also a text based rundown view.

8.12.8 Requirements

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	The BCS should comply to resource scheduling as described above.	v1.0		
2	In case the BCS do not comply to the above description: Is there an existing integration to an external scheduling tool which comply to the description in combination with the BCS?	v1.0		
3	If neither of the two requirements above comply to the description: Is there a preferred scheduling tool for developing an integration with the BCS?	v1.0		

8.13 Platform and operational environment

As part of the transition to an IT and standard driven approach for media production, all the systems used for the media production, including the BCS must adhere to common operational best practices. NRK has for many years been at the forefront of this and have been using container-based approach for many of our own applications, first with Mesos and since 2017 with Kubernetes.

We see many benefits from deploying applications on containers and using a container orchestration and runtime environment such as Kubernetes and we would like to see also the BCS, and the rest of the media broadcast system move in the same direction.

While we understand that a container deployment of the BCS can take some time, an alternative approach is to run the BCS as a fully orchestrated and managed service using configuration management. NRK currently uses Saltstack for Linux configuration management, but also uses Ansible some places and are well versed in both.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	The BCS must support one or more of these runtime environments in preferred order: • Running as a container • Running as a Linux service • Running as a Windows service Running as a Windows Gui application is not an acceptable runtime environment	v0.5		
2	If not running as a container, the BCS can run on a virtual machine.	v0.5		

3	The BCS should be able to be installed by configuration management tools, such as Saltstack, Ansible or SCCM and does not require manual operations for installation.	v0.5
4	The BCS should support the following log configurations based on the runtime environment: • When running as a container, writes logs to standard out/standard error • When running as a Linux service, writes logs either to standard out/standard error or directly to journal • When running as a Windows service, writes logs to the Windows event log	v0.5
5	The BCS should support providing runtime metrics using Prometheus. If Prometheus is not supported, describe the supported runtime metrics system(s).	v0.5
6	The BCS should support OpenTelemetry.	v1.0
7	The BCS should support patching and upgrades without downtime when run in a HA configuration.	v1.0
8	The BCS provides a northbound API using REST or GraphQL providing at a minimum: • The Ability to Make, Park, Request/Poll Package Routes, including registering for Asynchronous callbacks • The ability query state of connections within the system • The ability to update monitoring status within the system from an external PMCS	v0.5

8.14 Legacy transition support

The migration in to NRK's new centralized platform covered in the MPP high level architecture plan, will be a step-by-step approach over many years. VSM will still play an active role in most of NRK's facilities, until the last facility is moved to the new platform, many years from now. In all our production facilities we do live ingest into our MAM system, which currently is Tedial. We use Tedial Capture manager, from now on Tedial CM, locally in each production facility, as an ingest tool. Tedial CM use probel swp08 to talk to VSM, setting up live streams (today SDI) into Quantel SQ servers.

Tedial CM will be replaced by Sofie (an internally developed playout automation system), as an ingest tool, sending route requests into VSM, from Trondheim into new BCS, setting up 2110 transport streams into Black Magic Hyper Decks. Replacement of Tedial CM and Quantel SQ servers with Black Magic Hyper Decks and Sofie on all our region offices are work in progress. How this will be solved in our new HQ at Ensjø is not yet decided, this is work in progress just started up.

Contractor's response to be inserted here:

#	Requirement	Stage	Compliance Y/P/N	Contractor's response
1	The BCS must support Northbound control of Package Routing using a full implementation of the probel swp08 protocol over IP. The BCS must provide asynchronous state values for Package Routing using the same interface.	v1.0		
2	The BCS should support integration with the existing VSM BCS using Probel swp08, exchanging routing and labels.	v1.0		

9 INTERACTION WITH EQUIPMENT AND OTHER SOFTWARE (CLAUSE 2.3.2)

If the Contractor is to be responsible for the integration of software with other software described by the Customer, any assumptions made by the Contractor in respect of the integration work shall be stated here.

If the Contractor believes that the Customer's description of the integrations has not been specified well enough for them to be willing to take on responsibility for the progress and results of the integration, this shall be stated here.

Contractor's response to be inserted here:

10 IMPLEMENTATION METHOD (CLAUSE 2.3.3)

The Contractor shall describe the methods and tools that shall be used to implement the deliverables, as well as the environment, here.

Contractor's response to be inserted here:

11 DOCUMENTATION (CLAUSE 2.3.6)

The BCS solution including customisations and configurations must be documented so that the Customer has the necessary and correct documentation available in all areas of the BCS solution. The documentation shall facilitate effective use, training, further development, and service of the Solution. The BCS solution shall be provided at least with the following documentation:

Detailed specification - design documentation

The BCS solution is provided with a detailed specification document that is developed during the specification phase. This design document is a description of how the processes and requirements are to be fulfilled in the new solution. The document describes how to solve the desired functionality and the guide to those who will configure and complete the solution for NRK's use.

Training material

The Contractor will provide training material. The training material must be adapted to the individual user group and must be written in Norwegian or English.

User documentation

The BCS solution is provided with NRK-specific user documentation that is:

- Provided in a common electronic format.
- Adapted to different user groups, including advanced users, such as project managers, superuser, system managers, and end-users who will use the BCS solution in a limited way.

Documentation of integrations

The BCS solution is provided with technical documentation in English describing public API, integrations, and APIs specific to NRK (interfaces, methods, etc.).

Functional system documentation

The BCS solution is provided with functional documentation in English describing configurations and setup, including functional design for any customizations.

Technical system documentation

The BCS solution comes with a technical system documentation in English, describing logical service and information architecture, security, and access architecture (ADFS, etc.), provisioning and orchestration functionality and procedures.

Installation and maintenance documentation

The BCS solution comes with installation and maintenance documentation in English. This requirement applies only to on-premises-solutions.

Contractor's response to be inserted here:

12 TRAINING (CAUSE 2.3.7)

The Contractor shall plan and develop a training program, including training material, and train NRK in the use of the BCS solution. The training shall ensure that NRK can perform qualified testing of the BCS solution and start using the BCS solution properly and efficiently.

All user groups shall receive training. The training shall be designed appropriately for each specific user group. Training methods shall be described.

Contractor's response to be inserted here:

13 CONVERSION (CLAUSE 2.3.8)

If the Contractor shall convert the Customer's data, the Contractor shall describe the procedure here.

If the Contractor shall develop or deliver separate conversion utilities for extracting or inputting data, the solution specification for such conversion utilities shall be provided here.

The Contractor shall specify how it will ensure that the Customer has made backup copies of the Customer's data prior to the execution of the conversion.

The Contractor shall specify how the backup shall be stored until the Customer has confirmed that the conversion has been correctly executed.

Contractor's response to be inserted here:

14 SCOPE OF THE WARRANTY (CLAUSE 4.1)

If the Contractor stipulates detailed requirements in respect of the maintenance of equipment that must be performed in order for the warranty to be valid, this shall be specified here.

Contractor's response to be inserted here:

15 THE RESPONSIBILITY OF THE CONTRACTOR FOR ITS PERFORMANCE (CLAUSE 5.1)

To the extent that standard software that is included in the deliverables must be delivered with standard licence terms and conditions, this shall be stated here. Copies of the licence terms and conditions shall be appended as SSA-T Appendix 10.

Contractor's response to be inserted here:

16 RESPONSIBILITIES OF AND CONTRIBUTIONS BY THE CUSTOMER (CLAUSE 6.1)

If the Customer's technical platform needs to be upgraded, cf. clause 1.1, the Contractor shall specify this here.

Contractor's response to be inserted here:

17 GENERAL EXTERNAL LEGAL REQUIREMENTS AND MEASURES (CLAUSE 9.2)

The Contractor shall describe how the Contractor addresses any legal or party-specific requirements through its solution here.

Contractor's response to be inserted here:

18 GENERAL PROVISIONS PERTAINING TO FREE SOFTWARE (CLAUSE 10.7.1)

If free software is to be used in connection with the deliverables, the Contractor shall prepare an overview of the relevant free software. The overview shall be inserted here. Copies of the applicable licence terms and conditions for the relevant free software shall be appended in SSA-T Appendix 10.

Contractor's response to be inserted here:

19 EFFECTS OF DISTRIBUTING FREE SOFTWARE TO OTHERS (CLAUSE 10.7.4)

If distribution to others, or other ways of making the deliverables available, implies that also other parts of the deliverables than those that originally were free software will be governed by the terms of a free software licence, this shall be specified by the Contractor here.

Contractor's response to be inserted here:

20 THE CONTRACTOR'S RESPONSIBILITY FOR DEFECTS IN TITLE TO FREE SOFTWARE (CLAUSE 10.7.5)

The Contractor shall explain its assessment that the Contractor's utilisation of free software does not infringe on third-party rights here. The assessment shall take into consideration, inter alia, how well-established the relevant free software is in the market, the Contractor's knowledge, if any, of the history and origins of the software, and whether it is known in the relevant market that someone is arguing that the software infringes their rights.

Contractor's response to be inserted here:

21 LIABILITY OF THE CUSTOMER IF IT REQUIRES THE USE OF FREE SOFTWARE (CLAUSE 10.7.6)

To the extent that the Contractor is aware that free software that the Customer has requested be used as part of the deliverables, is unsuited to satisfying the Customer's requirements or, infringes, or is alleged by anyone to infringe, third party copyrights, the Contractor shall point this out here.

Contractor's response to be inserted here: