
# Joint Task Force on Networked Media (JT-NM)
# Phase 2 Interim Report for IBC 2014

**14 September, 2014**

For more info, go to tech.ebu.ch/JTNM or www.videoservicesforum.org/jt-nm

For any question, please e-mail: jt-nm-adm@videoservicesforum.org

# JT-NM Phase 2 Interim Report for IBC 2014

## What is JT-NM?

The Joint Task Force on Networked Media (JT-NM) was formed by the European Broadcasting Union, the Society of Motion Picture and Television Engineers and the Video Services Forum in the context of the transition from purpose-build broadcast equipment and interfaces (SDI, AES, crosspoint switcher, etc.) to IT-based packet networks (Ethernet, IP, servers, storage, cloud, etc.) that is currently taking place in the professional media industry

The Task Force was set up to foster a discussion among subject-matter experts to drive the development of an interoperable network-based infrastructure for live media production, encompassing file-based workflows. It brings together broadcasters, manufacturers, standards bodies and trade associations.

This is a critical activity for the industry as the dynamics of the industry are rapidly changing with new players vying for a share of the revenue pie and changing viewer consumption habits. Not only do media companies need to be more flexible to respond quickly to new opportunities to monetize content, but they are also seeking to take advantage of economies of scale by leveraging the massive R&D investments being made in IT. The JT-NM counts more than 290 participants from 165 organizations.

## Results of Phase 1

The Task Force has developed a number of fundamental principles that guide our work. Among these are the facts that, this effort must be user-driven, and that it must leverage IT technologies. To this end, the Task Force solicited 167 use cases from industry peers, and from these, it produced a superset of 16 generalized user stories. It issued a Request for Technology, seeking technologies that could be potentially employed to address user requirements. It then published a Gap Analysis Report, outlining the requirements, the submitted technologies, and noted areas where vendors claim to fulfill specific user requirements. This concluded Phase 1 of the JT-NM activities in December 2013.

## Goal of ongoing Phase 2

At the conclusion of Phase 1, it was not clear how the technologies offered could be used to create a coherent system that would meet the needs of the modern professional media industry. For that reason, the sponsors of the Task Force decided to initiate a second phase of work focused on resolving this issue. The goal of Phase 2 is to create a system reference architecture.

This will be a key tool to guide the industry towards interoperability. It will achieve this by providing a *template* based on a generalized solution. It will include a set of *patterns* that can be composed together to form a specific solution. It will also provide a *common vocabulary* with which to facilitate discussing implementations between the different levels (i.e. management, integrators, architects, developers, sellers, etc.) from the different domains (i.e. broadcast, IT) involved.

# Methodology of work

As an industry we do not know what a network-based professional media infrastructure will look like exactly. We do not know yet where all of the challenges will lie. This work requires innovative solutions and work methodology.

At the same time, because this technology evolution is built as a hybrid between traditional broadcast engineering and Internet Technology, the Task Force benefits from the contribution of experts from many different backgrounds. The Task Force has had participation from system engineers, network architects, software architects, developers, and end users. An important challenge of this effort is to bring all of the participants to a common level of understanding. However, the diversity of this group is also its strength when it is time to think “out of the box”.

For these reasons the group has taken an iterative approach that consists of exploring different avenues of solutions in small subgroups for a few weeks at a time. A report of the results is then given to the wider group. Depending on the progress of the sub-activity, the work is sometimes re-scoped, merged, or disbanded and new subgroups are started. By following this approach, the group is able to build a common understanding while continuously producing elements for the final solution along the way.

There are currently 3 subgroups working on different aspects:

- The **System Group** works on a high level overall view of a Networked Media system
- The **Modeling Group** is creating a UML model based upon an analysis of the user stories published in the Gap Analysis Report
- The **Minimum Viable Approach** Group is defining a minimum viable system that supports a known operational scenario of a live, in-studio, multi-camera sports commentary show

# Summary of current work

This section presents the progress of the work of the ongoing subgroups. By exposing this internal work, we want to inform the industry of the direction of the Task Force and also gather feedback for improvement and complement. It is important to stress this is work in progress and will evolve until the publication of the JT-NM Reference Architecture v1.0 during December 2014.

## Systems Subgroup Report

### Subgroup co-chairs:

Dr. Karl D. Schubert (TechNova Consulting) & Janet Gardner (Perspective Media Group)

### Participants:

Magnus Danielson (Net Insight), Subha Dhesikan (Cisco Systems), Brad Gilmer (VSF), Carl Ostrom (System Resource), Peter Brightwell (BBC), John Grant (Nine Tiles), Al Kovalick (Media Systems Consulting), Steve J. Posick (ESPN), Andy Rayner (Nevion), Bob Ruhl (VSF), Bettina Swynnerton (Real-Time Innovations), Bryn Balcombe (London Live), Chuck Meyer (Grass Valley), John Mailhot (Imagine Communications), Loic Barbou (Triskel), Martin Jacober (SRG SSR), Mike Bany (DVBLink), Paul Gardiner (Sony BPRL), Robert Wadge (BBC), Thomas Kernen (Cisco Systems), Thomas Edwards (Fox), Thomas Wahlund (Net Insight), Tim Claman (Quantel), Toshiaki Kojima (Sony), Yuan-Xing Zheng (BBC), Felix Poulin (EBU)

### Purpose and scope

Develop a high-level system view of a reference architecture for networked media.

This section of the report focuses on high-level processes and applications that need to be performed, and separates these from the technologies used. The system view also illustrates how vertically integrated media systems can benefit from migrating to layered implementations that more easily facilitate the transition to a packet-based media network environment.

The subgroup is also developing *Operational Scenarios* that enumerate the key capabilities required to perform media-specific processes. These scenarios may also be used to test the viability of the system view. If there is an additional phase of the JT-NM, then these scenarios may be used to develop a more detailed architecture. The first *Operational Scenario* used is “Live Production – Sports Half-Time Show.”

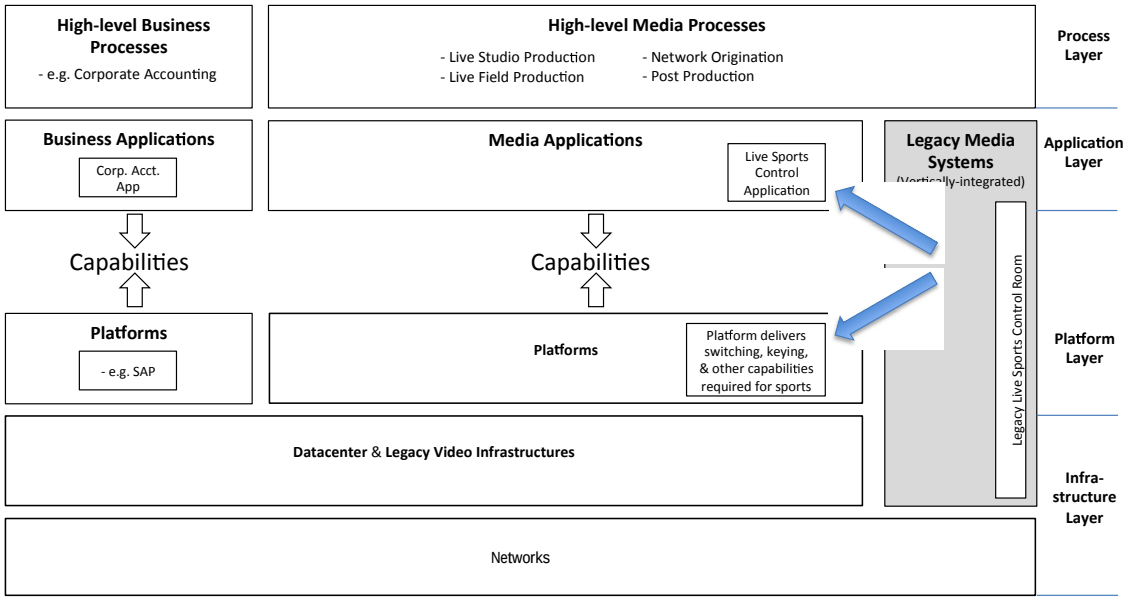
### Description

Following the Phase 2 kick-off in London, the subgroup began to work on the systems view diagram, taking as a starting point, a diagram produced by SRG SSR (Swiss National Broadcaster) as part of a business analysis project. In follow-up face-to-face meetings in Atlanta, and on subsequent conference calls, the subgroup continued to develop the diagram.

Traditional media system applications, shown in the diagram below as large, vertically integrated applications can be broken apart into separate components. A high-level

media process such as *Live Studio Production* will remain. However, new applications such as Live Sports Control will require capabilities such as the ability to switch between two stream sources without interruption. This capability will need to be supported by the Platform layer. And importantly, this capability may be reused by other media applications, such as 'network origination'.

The capabilities required for any media process will need to be fulfilled by a platform that is composed of a number of datacenter and workplace infrastructures, which rely on underlying network technologies. Exactly which technologies will be needed will depend on many things including the capabilities of the end-user viewing device.




*High-level system view diagram*

### Next steps

The subgroup will be working to define the capabilities required for other high-level media processes such as Network Origination, and the output of the MVA sub-group will be used to test the viability of the high-level diagrams. The subgroup also intends to develop a glossary to ensure consistency in terminology and use. This work will commence following IBC.

## Modeling Subgroup Report

### Subgroup Chair:

Dr. Richard Cartwright (Quantel)

### Participants:

Peter Brightwell (BBC), Mike Ellis (BBC), Yuan-Xing Zheng (BBC), Michael Bany (DVBLink), Steve Posick (ESPN), Thomas Edwards (Fox), Chuck Meyer (Grass Valley), Pat Waddell (Harmonic), John Mailhot (Imagine Communications), Bryn Balcombe (London Live), James Cain (Quantel), Tim Claman (Quantel), Bettina Swynnerton (RTI), Toshiaki Kojima (Sony), Loic Barbou (Triskel), Brad Gilmer (Gilmer & Associates, Inc), Richard Friedel (Fox)

### Purpose and scope

By modeling the elements of human experience that are monetized by content businesses, and by using a common language that is understood widely in the IT industry, a new breed of interoperable networked-media-systems can be designed and built. The result of the modeling activity will be a concise, reusable architectural framework that is captured both as:

- a few pages of paper;
- a computer-based model that can be automatically transformed into skeleton code.

As collated and published by the JT-NM activity[1], the set of user stories ask for capabilities that both replicate, and go far beyond those of current media facilities. This reflects the fact that the broadcasting industry is being disrupted by the changing behaviors of viewers; more and more frequently, they are consuming content over the Internet using a multitude of devices and applications. It is now possible to use commodity IT technology and infrastructure to perform professional media production and to deliver content directly to the consumer, with the potential to supersede traditional broadcast delivery. Commodity IT technology uses Internet standards to interconnect generic multi-processor systems with massive storage capacity over parallel network paths. Generic IT systems become media specific **only** by the software they run.

The software industry has developed the Unified Modeling Language (UML) as a means to represent and communicate software design without being specific about platform or programming language. Key to the UML and our design process is to identify common patterns or abstractions of human experience and system-to-system experience alongside reuse of existing elements; this facilitates best practice and cost savings.

### Description

The JT-NM Modeling group is building a set of UML models that express common patterns and concepts that will be relevant for all media applications connected to packet-based networks. The development of these models starts from conversations between industry experts about the JT-NM user stories.

#### Progress thus far by example

**Class diagrams** To develop UML class diagrams, the following questions were asked - from the nouns of the user stories (e.g. file, stream, video, etc.): what are the classifications of identified artifacts and entities? Can these classifications be unambiguously named and what is missing? What are the relationships between these classifications, including:

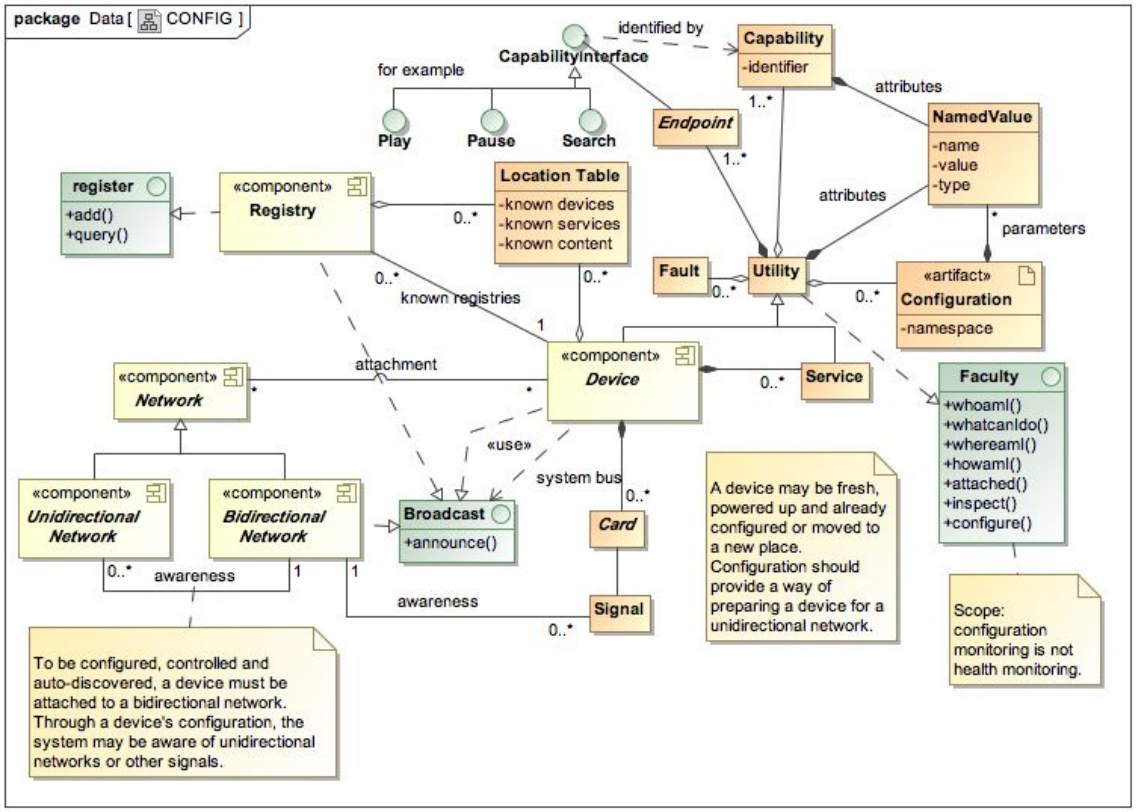
- Are two entities different kinds of the same thing?
- Is one entity a collection of other entities?
- Do entities have co-incident lifetimes or are they shared?

**Implementation diagrams** From the nouns and verbs of the user stories, what are the common system components (e.g. cameras, computer systems, services, classes of software applications) and what behaviors do they exhibit or require (e.g. media transform, device control, system monitoring)? Who uses these components (e.g.

[1] See JT-NM “Gap Analysis Report” on the referred websites

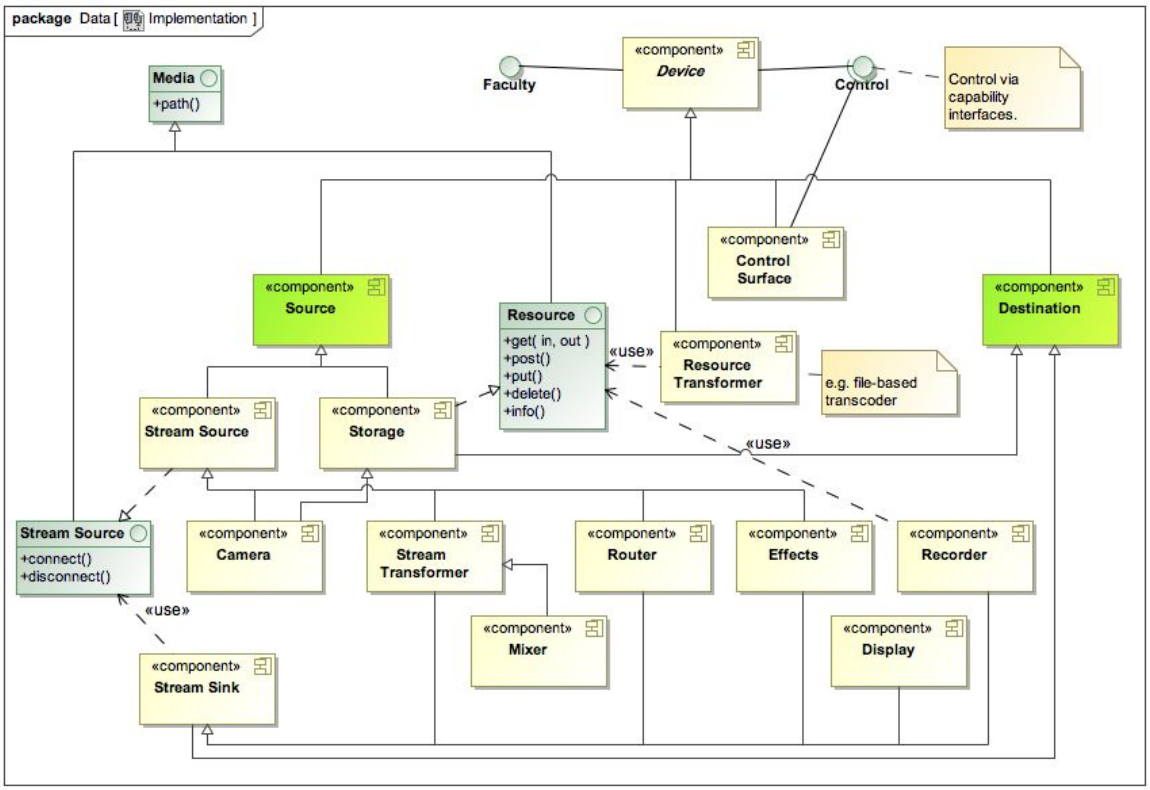
operators, editors)? How can those behaviors be organized into interfaces and what entities are the parameters of those interfaces (play clip with identity from frame in to frame out)?

At each stage, the modeling group may discuss a range of specific and known solutions. However, these discussions are then continued until the JT-NM models are as generalized and abstracted as remains useful, avoiding specific implementation details or deployment choices. In general, the group has focused on functional requirements (what is needed to do the work) rather than non-functional requirements (security, reliability, speed). The non-functional aspects are either cross-cutting attributes of the structured-layered-model (as developed by the System subgroup) or of specific deployment platforms. Different operational scenarios, including the one explored by the Minimum Viable Approach subgroup, will require either the same or different capabilities from a platform – such as strict timing in a studio. The modeling work provides a common means in which those capabilities can be described.




*Class Diagram – Attachment to one or more networks*

As an example of work in progress, the class diagram above shows the model for the attachment of any device to one or more networks. The device has capabilities and may have installed software services and hardware that change over time. The device has a configuration that needs to be installed on commissioning and managed over time. The device, its services and their capabilities need to be dynamically discoverable and remotely controlled. Some form of registry may be required to achieve this.




*Implementation Diagram – device classification into sources and destinations*

The example implementation diagram above shows how devices can be classified into sources and destinations for media. The provisioning, management, monitoring and control of the devices can be represented through a common set of operations provided by the interfaces of those components. Similarly, common content interfaces enable content to flow between devices, whether live, real-time, stream-based, file-based or transformed by compression.

### Next steps

The Modeling group has completed its conversation about the user stories and is in the process of producing the UML models. Once these models are completed, the group will review these models before they are tested against the operational scenarios and then released.

## Minimum Viable Approach Subgroup Report

### Subgroup Chair:

Thomas Edwards (Fox)

### Participants:

Merrick Ackermans (Turner Broadcasting System), Bryan Balcombe (London Live), Michael Bany (DVBLink), Peter Brightwell (BBC), Peter Chave (Cisco), Mike Ellis (BBC), Paul Gardiner (Sony), Rajive Joshi (RTI), Toshiaki Kojima (Sony), Al Kovalick (Media Systems Consulting), Eric Pohl (NTC), Steve Posick (ESPN), Pat Waddell (Harmonic), Robert Wadge (BBC).

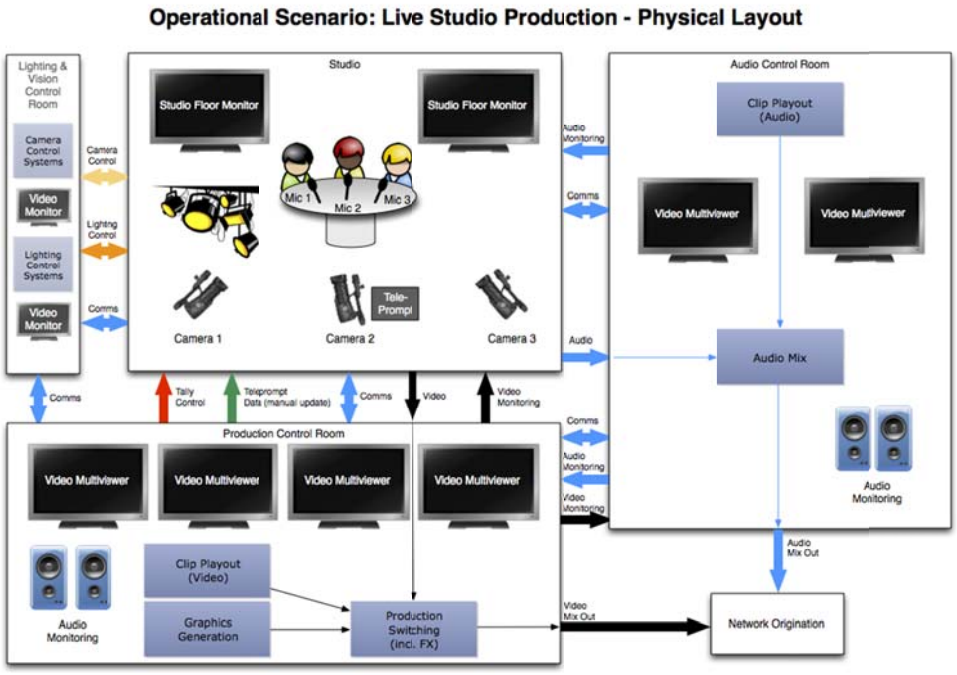
### Purpose and scope

A number of participants in the JT-NM expressed a desire to more rapidly develop and publish a set of requirements for professional media networking of a minimum scope to provide business value within a specific operational scenario.

### Description

**Operational Scenario**

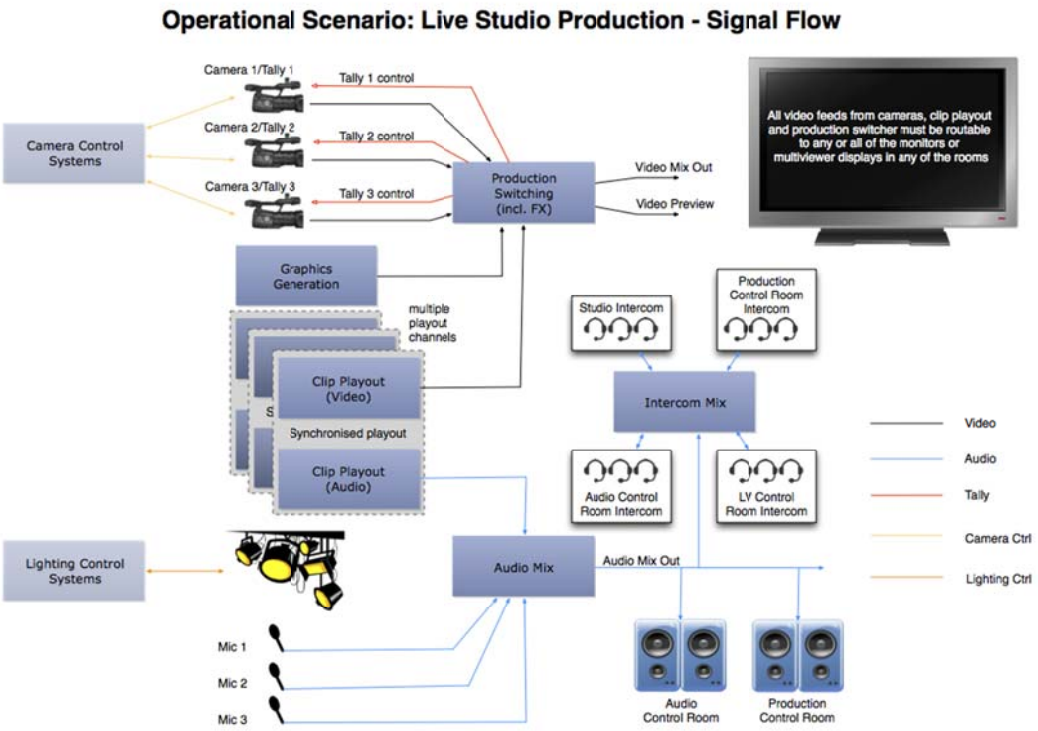
The operational scenario to be addressed is the transport of live media within the broadcast plant, to support a multi-camera, live studio production.




The scenario for this activity is a live, multi-camera sports commentary show being produced entirely within the four walls of a single facility. It involves switching between a number of cameras, video effects, graphics overlays, live audio production, the playback of pre-recorded pieces, video and audio monitoring, tally lights, intercom, IFB, production room monitoring, studio floor monitors, studio audio monitors, and teleprompter.

The scenario involves, initially, switching from a live incoming game feed to the studio show (no interaction with the field is required), and the show is fed live out to a network origination facility where it is transmitted nation-wide.

This scenario does not include interaction with talent in the field, interaction with other production facilities, either in the facility or at remote locations. It also does not include commercial integration – this is done in the network origination facility.




**First Iteration Functionality**

The first iteration of the MVA will address the movement of **Live Media** within the broadcast plant. Live Media shall be defined to include uncompressed video (including key & fill), uncompressed audio and Ancillary Data as defined by SMPTE.

The functionalities to be addressed shall be limited to:

1) **Payload** - Data representation and description of uncompressed Live Media for transport.

2) **Transport** - The protocol to carry the payload over network

3) **Identity** - Uniquely identify nodes (sources, processors, destinations), flows, and bundles

4) **Registration** - Registration of identities

5) **Discovery** - Mechanisms to discover nodes, flows, bundles

6) **Connection management** - Manage the establishment & tear down of flows

7) **Timing/clocks/sync** - Provide support for synchronization and time stamping of grains in flows

8) **Bundle description** - Provide a description for logical grouping of flows

Across all of these functionalities, the requirements shall identify **Network QoS** and **Security implications**, however the requirements will not address specific solutions to these issues.

It is clear that these eight functionalities are a small subset of all desired functionalities for professional networked media, however these should be enough to deliver some initial business value. They also are excellent targets for standardization to provide multi-vendor interoperability.

### Next steps

Requirements will be generated for each of the eight functionalities, with an eye towards their eventual use (by some organization) as part of a gap analysis against existing solutions. When complete (before the end of 2014), the requirements will be published to the public, and comments will be requested.

# Feedback and participation

This interim report has a goal to expose the status of the current work and to gather feedback from the industry. Please send your comments or questions to bob.ruhl1@verizon.net.

The Task Force is an open initiative, and all parties with a professional interest in the work of the Task Force are invited to join in the work. Those wishing to participate should send an email to Bob Ruhl, VSF Operations Manager (bob.ruhl1@verizon.net) and include their name, email address, affiliation and explain why they are interested in joining the Task Force.

# Next steps

The work effort for Phase 2 will conclude at the end of the year. Until December, the subgroups will continue to develop their components. In December 2014, a harmonization effort will take place to create the compete reference architecture v 1.0 If any additional relevant work is identified at the conclusion of Phase 2, the sponsoring organizations will evaluate whether to renew the group for an additional phase of work.

# JT-NM Administration Team

Brad Gilmer – VSF

Richard Friedel – FOX - co-chair for VSF

Felix Poulin – co-chair for EBU

Bob Ruhl – VSF

Alan Lambshead – co-chair for SMPTE

Dr. Hans Hoffmann – EBU

Peter Symes – SMPTE