Request for Proposals: ATSC 3.0 Broadcast Core Networking Facilities ATSC TG3/S43

1. INTRODUCTION

Advanced Television Systems Committee, Inc. is an international, non-profit organization developing voluntary standards and recommended practices for broadcast television and multimedia data distribution. ATSC member organizations represent the broadcast, professional equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries. ATSC also develops implementation strategies and supports educational activities on ATSC standards. ATSC was formed in 1983 by the member organizations of the Joint Committee on Inter-society Coordination (JCIC): the Consumer Technology Association (CTA), the Institute of Electrical and Electronics Engineers (IEEE), the National Association of Broadcasters (NAB), the Internet & Television Association (NCTA), and the Society of Motion Picture and Television Engineers (SMPTE). For more information visit www.atsc.org.

ATSC is soliciting technologies and complete system solutions to incorporate in extending broadcast core networking to the ATSC 3.0 next generation broadcast standard.

Unlike common RFPs, the goal of this Request for Proposals (RFP) is to develop specifications for standardization of a core network based on information gathered from submitted proposals. Upon completion of the RFP process, respondents are invited to participate in incorporating the proposed technologies and relevant system solutions into an eventual core network specification.

2. SCOPE OF WORK

The ATSC Specialist Group on Broadcast Core Network, TG3/S43, has been tasked with pursuing the addition of core networking capabilities as an integral part of the ATSC 3.0 broadcast system architecture. The aim is to facilitate efficient interconnect between broadcast towers to form one or more service networks, enabling new business opportunities that require efficient regional or national data delivery options. Sourcing content from multiple data networks, a broadcast core network holds potential to broaden the range of addressable use cases beyond those defined for linear television program delivery and extend the utility of the ATSC 3.0 broadcast facilities to untapped market areas, e.g., Broadcast (Virtual) Network Operator (BNO, BVNO), Regional or National Datacasting, enhanced Interactivity, and Data/Content Offload. The initial scope of work for TG3/S43 is as follows:

> "ATSC TG3/S43 develops and maintains Standards, Recommended Practices, and other documents relating to broadcast core network functions that enable current and future use cases (e.g., datacasting) efficiently at scale across a collection of broadcast facilities."

As presently conceived, ATSC 3.0 constitutes a connection-oriented transport delivering content from studio to tower within a DMA (or multiple towers in the case of an SFN deployment) permitting any receive devices tuned to the frequency assigned to a particular tower (or group of towers) to consume the delivered program content. Several use cases exist that might benefit from a more dynamic, service-based architecture with clear control/data plane separation delivering content sourced outside of conventional studio encoding, spanning multiple DMAs, and potentially taking part in a heterogenous network arrangement formed in cooperation with one or more broadband access technologies, e.g., Wi-Fi, 3GPP 4G/5G, satellite, etc. as shown in Figure 1.

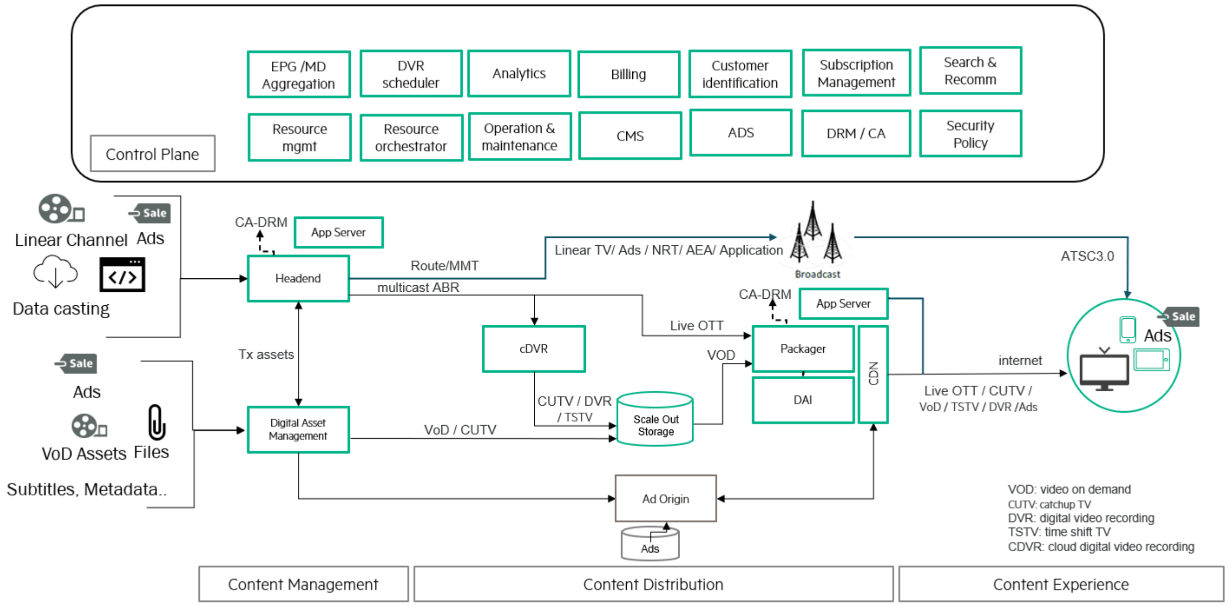

Figure 1 Core Network features.

Built on a native IP transport, ATSC 3.0 is particularly well-suited to carry internet traffic and other data content alongside traditional television programming. A broadcast operator can allocate one or more Physical Layer Pipes (PLPs), configured to ensure reliable fixed or mobile reception as prescribed by the content provider, expanding market access to include Internet of Things (IoT) datacasting, broadcast/multicast traffic offload, vehicular data download and software update alongside linear television program delivery. With the addition of core networking facilities, ATSC 3.0 broadcasts can be provisioned to render spare capacity on an as-needed basis to provide a complementary Broadcast Internet transport. This added capacity might be delivered from more than a single tower, across multiple frequencies spanning transmission coverage areas. Scalability inherent to a core network architecture has been deemed essential in enabling widespread distribution with minimal added overhead as compared to operating each tower (or group of towers) independently.

The ATSC Specialist Group on Broadcast Core Network, TG3/S43, will consider information pertaining to relevant core networking capabilities. Wherever practical, the group will consider utilizing and referencing existing standards that are found to be effective in meeting the full range of system requirements. With the addition of a broadcast core network, service provisioning for data/content delivery across multiple transmission coverage areas should be at least as efficient as that of provisioning for content delivery in a single coverage area as presently defined in ATSC 3.0. The respondent is invited to recommend a method for assessing the efficiency of service provisioning, indicating how their proposal might fare in accommodating use cases ranging from single to multiple transmission coverage areas and how performance can be measured and compared for different deployment scenarios.

Consideration will be given to technologies and proposals that enable a smooth transition from existing systems for both broadcasters and consumers.

Investigation of any new technology would involve assisting the group in forming a detailed understanding of the proposed network functions and features and evaluations of its ability to meet the performance requirements. If agreement is reached that the requirements have been met and the system would benefit from the proposed technology, the proposed capability may be incorporated into the suite of ATSC 3.0 standards, potentially as a new standard and/or an Amendment to an existing standard, via the standardization process described in ATSC's documented policies.

3. ACRONYMS

This section defines specific acronyms commonly used in discussions concerning core networking, which will be adapted as needed to extend its use in describing core networking facilities for the ATSC 3.0 broadcast system. The acronyms defined in Table 1 are common terms, and may, in some cases, map to alternative terms used by individual systems in other parts of ATSC 3.0.

Table 1 Core Networking Terms

Term	Description
3GPP	Third Generation Partnership Project
4G	Fourth-Generation mobile technology
5G	Fifth-Generation mobile technology
AMF	Access and Mobility Function
ATSC	Advanced Television Systems Committee
ATSSS	Access Traffic Steering, Switching and Splitting
AUSF	AUthentication Server Function
BVNO	Broadcast Virtual Network Operator
CAP	Common Alerting Protocol
CDN	Content Delivery Network
DTT	Direct Terrestrial Television
FLUTE	File Delivery over Unidirectional Transport
IoT	Internet of Things
IP	Internet Protocol
MFN	Multiple Frequency Network
NF	Network Function
NRT	Non-Real Time
OTA	Over the Air
PHY	Physical Layer
PLP	Physical Layer Pipe
RAN	Radio Access Network
RAT	Radio Access Technology
ROUTE	Real-time Object delivery over Unidirectional Transport
S/MIME	Secure/Multipurpose Internet Mail Extensions
SBA	Service Based Architecture
SFN	Single Frequency Network
SIM	Subscriber Identity Module
SMS	Subscriber Management System
UDR	Unified Data Resource

UE	User Equipment
UDM	User Data Management
Wi-Fi	Wireless Fidelity (802.11x)
WLAN	Wireless Local Area Network
XML	eXtensible Markup Language

4. EVALUATION

Respondents to this RFP are encouraged to provide thoughts on how any newly developed or developing core networking facilities might best be evaluated in comparison to other available core networking capabilities. There is interest in understanding whether it may be more effective to use subjective evaluation techniques or to apply mechanical, automatic, or computer-based evaluation tools and/or processes that are appropriate for the technology of interest. Definitions for terms used in the following subsections can be found in Appendix C.

4.1 Functional Requirements

Responses to this RFP must contain information about each of the below main functional requirements that a broadcast core network shall provide:

1) Identify each use case supported by the proposal and the network functions (NF) that are required to satisfy the use case.
2) Satisfy the datacasting use case.
3) For each use case, describe the functionality of the identified NFs.
4) Describe at a high level the mechanics of how legacy broadcast networks interface with the new NFs (e.g., identify the protocol stack, identify the application layer protocol operations and relevant error codes).
5) Describe the means by which the use cases and supporting NFs identified in #1 authenticate and authorize clients (i.e., broadcast networks) that request services from the core network.
6) Be capable of operating with or without consumer interactivity (client having a return channel to broadcast core), understanding that some use cases require a return channel that is always available or sometimes available while other use cases do not require a return channel.
7) For use cases that require a return or interactive channel, be capable of integration with multiple return path radio access technologies.
8) Enable coordinated service across multiple transmission facilities.
9) Identify any non-backward compatible elements with existing systems and receiving devices.
10) Define the general implementation of core network (i.e., Network function virtualization infrastructure):
    a) Type of infrastructure that hosts the network functions.
    b) On what network technologies are based.
    c) Security boundaries and characteristics:
        i) How external entities can interact securely with the broadcast core network to access its services and functions.

ii) How core network can securely communicate with broadcast elements within each transmission facility.

d) How to scale the core network with number of services and number of end users.

11) For each use case included in the proposal, define the following:
   a) The purpose of the use case.
   b) The user story, i.e., a simple description told from the end user perspective.
   c) To what extent it depends on a return path from the client (always, sometimes, or not required).
   d) If it will be impacted with geo-location.
   e) The NFs required to satisfy the use case.
   f) The traffic flow or flow chart for the use case.
12) For each NF define the following
   a) The name of NF.
   b) The purpose of NF.
   c) The interfaces of the NF that need to be exposed.
   d) How to access the NF by other NFs.
   e) How to secure the NF.
   f) How the NF can be scaled up/down with the number of services or number of users.

4.2 Design Considerations

Responses to this RFP are encouraged to address the below broadcast core network functions that may not be required, but may be highly beneficial:

1) Provide improvements in performance, functionality, and efficiency that are significant enough to warrant the challenges of a transition to a new system.
2) Design to be modular, flexible, and future proof, to the extent possible.
3) The core network architecture should be based upon SBA principles (Rest API, service-oriented architecture).
4) Minimize changes to the existing systems and devices. The addition of core networking capability should not preclude, harm, or in any way undermine critical existing services.
5) Enable user Geo-location/Roaming – restriction for the return channel enabled use cases; i.e., when a client is crossing the borders from one transmission area to another, roaming rules may apply. The core network will include policies that guide service deliveries according to business rules.
6) Define necessary NFs that allow interworking among broadcast cores.
7) Define necessary NFs that allow a station owner to share capacity resources to another core network.
8) Enable auto-discovery of services by receivers (UEs) either through an OTA control channel, or via a return channel when the ATSC receiver device is connected to the core network.
9) Describe the use case of inter-tower communication among transmission facilities from a core network perspective; please highlight any security measures to be considered.

10) Define the minimum requirement to establish a return path to the core network from the ATSC receiver device (i.e., bandwidth, latency) per use case.
11) Define how the core network will interface with each proposed return path technology.
12) Describe how the core network will interoperate with point-to-point communication facilities connection (i.e., for backhaul links).
13) Operation and maintenance:
    a) Describe how the core network allows service provisioning into one of multiple transmission facilities by means of orchestration NFs.
    b) Describe how NFs with the core network allow service monitoring and service failover should an issue arise.
    c) Describe how core network functions will provide the status of:
        i) Provisioned services.
        ii) Transmission facilities (online, offline, maintenance mode, etc.).
        iii) Spectrum used within each transmission facility.
        iv) Services allocated for each transmission facility.
        v) History of errors encountered within each transmission facility.

5. SCHEDULE

5.1 RFP Response Deliverables

Deliverables in response to this RFP are listed as follows:

- Respondent Information Form (Appendix A).
- Overview of the proposed solution.
- Statement regarding Bylaws and Procedures Review and agreement.
- Statement indicating intent to comply with the ATSC Patent Policy.
- Statement indicating intent to comply with the ATSC Copyright and Reference Policy.
- Statement Regarding Respondent Resources.
- Detailed Description of Proposal.
- Compliance Chart (Appendix B).

5.2 RFP Response Schedule

Responses to this RFP are due as follows:

- **31 December 2021**:
    1) Respondent Information Form (Appendix A).
    2) Overview of Proposal.
    3) Statement regarding Bylaws and Procedures Review and agreement.
    4) Statement indicating intent to comply with the ATSC Patent Policy.
    5) Statement indicating intent to comply with the ATSC Copyright and Reference Policy.
    6) Statement Regarding Respondent Resources.

- **31 March 2022**:
  1) Detailed Description of Proposal.
  2) Compliance Chart (Appendix B).

Work on standardization is expected to commence immediately upon completion of the RFP process.

Consideration of responses received after the dates above shall be at the sole discretion of ATSC.

6. FORM OF SUBMISSION

A submission of acceptable form responding to this RFP must include the following:

6.1 Respondent Information Form

Each submission in response to this RFP must include a completed Respondent Information Form, given in Appendix A.

6.2 Overview of Technology

In order for ATSC to properly consider the submission, the ideas should be described in as much detail as possible. Include the status of the work—e.g., concept only, simulation, or prototype. Provide a general description of the basic technologies used. An assessment of performance and complexity is desirable.

Respondents must further provide the following information:

- A broad, top-level description of the technology.
- Which areas of Sections 4.1 and 4.2 the proposal addresses.
- What specific trade-offs are involved in implementing the technology (i.e., efficiency versus perceived quality).
- A list of assumptions relating to the submission, especially made to any included simulation results.
- A list of existing standards from ATSC and other organizations that would need to be normatively or informatively referenced.

7. PROPOSAL EVALUATION PROCESS

7.1 Areas to be Considered

The following constitutes a partial list of considerations that may be used by ATSC to evaluate proposals as the project moves forward:

- Does the proposal adequately address the requirements identified in Section 4 of this RFP?
- If the proposal does not specify a complete core networking solution, can it be easily combined other required technologies?
- Is there, in the judgment of ATSC, a likelihood that the proposal will accomplish what the respondent has claimed?
- To what extent is the core network extensible for future services?
- What is the projected deployment complexity for broadcasters and network operators?

- In the judgment of ATSC, how feasible is it to reduce the proposal to final form (hardware and/or software) within a time consistent with the Project Schedule described in Section 5?

7.2 Combining Techniques

It is expected that some proposals submitted in response to this RFP may result in core network designs that are not mutually exclusive, and which may be combined to provide greater functionality than originally proposed by the respondents. Consideration of interchange of core networking elements among respondents is encouraged. ATSC reserves the right to combine various technologies into a final core network, which will then be documented as an ATSC Standard.

7.3 ATSC Due Process

Determination of whether a proposed methodology is incorporated into an ATSC Standard or other technical document shall be done in accordance with the due process of ATSC as described in the ATSC Bylaws and ATSC Procedures for Technology Group and Specialist Group Operation. Respondents to this RFP must state that they have reviewed and agree to abide by these and all other ATSC rules.

8. INTELLECTUAL PROPERTY

All respondents to this RFP must follow the guidelines detailed in the following sections.

8.1 ATSC Patent Policy

Respondents to this RFP must state that they will comply with the ATSC Patent Policy.

8.2 Copyright

Respondents to this RFP must provide ATSC with the right to publish, copy, and distribute their proposed specifications as required by Section 14 of the Operational Procedures for Technology Groups and Subcommittees (B/3).

8.3 Non-Disclosure

Consideration of proposals will take place in ATSC technical meetings. While these meetings are subject to the ATSC privacy policy, they are also open to individuals with a direct and material interest in the work. Therefore, ATSC cannot enter into non-disclosure agreements. Respondents must be willing to provide ATSC with enough technical detail to enable the development of standards without a non-disclosure agreement.

8.4 Information Sharing

ATSC reserves the right to share responses to this RFP with other organizations supporting the development of next generation DTV standards.

9. RESPONDENT RESOURCES

Respondents must provide statements that they have the financial ability and resources to participate in the ATSC evaluation process and, if selected, to develop their proposals into fully working systems. Respondents further agree to assist ATSC in assessing any impacts the proposed solutions might have on existing service delivery and reception. This will include, as deemed suitable, injecting resulting sample streams into a representative test environment to determine whether the proposed core network solution has caused any harm to existing service delivery and reception.

The objective of the work will be to produce one or more ATSC Standard(s). Accomplishing this goal might require testing. This testing process might involve certain costs to respondents that—at the date of issue of this RFP—could not be estimated. Please note that ATSC intends to define a test plan including test cases and criteria.

10. SUBJECT TO CHANGE

ATSC reserves the right to modify or withdraw this RFP without notice.

11. NO COMMITMENT

ATSC reserves the right not to revise existing standards and not to develop new standards based upon this RFP.

12. NO COMPENSATION

ATSC is a voluntary standards organization. ATSC will not provide compensation for responses to this RFP.

13. SUBMISSION OF RESPONSES TO RFP

All submissions should be made in electronic form. Send an electronic version (in Adobe Acrobat format) to:

Madeleine Noland, President, ATSC: mnoland@atsc.org

Jerry Whitaker, Vice President, Standards Development, ATSC: jwhitaker@atsc.org.

It is anticipated that respondents may have questions relating to this RFP. Questions relating to the work should be directed to Ms. Noland or Mr. Whitaker.

Appendix A

Respondent Information Form

Respondent Name:	
Primary Contact Name:	
Address	
Mail stop or internal designation	
City, State (or Province)	
Postal Code and Country	
e-mail address	
Voice phone number	
Fax number	
Secondary Contact Name:	
Address	
Mail stop or internal designation	
City, State (or Province)	
Postal Code and Country	
e-mail address	
Voice phone number	
Fax number	

Appendix B

RFP Compliance Chart

Respondent Name:		
Required Items	**RFP Section**	**Response**
Respondent agrees to support ATSC in its efforts to create and evaluate complete systems up to and including required implementation.	1.0	□Yes □No
Respondent Information Form Submitted	6.1	□Yes □No
Overview of Proposal Submission	6.2	□Yes □No
Detailed Proposal submission	6.2	□Yes □No
Submission of statement regarding Bylaws and Procedures Review and agreement	7.3	□Yes □No
Submission of statement indicating intent to comply with the ATSC Patent Policy	8.1	□Yes □No
Submission of statement indicating intent to comply with the ATSC Copyright and Reference Policy	8.2	□Yes □No
Submission of statement Regarding Respondent Resources	9.0	□Yes □No

Appendix C

Terms and Definitions

Access Traffic Splitting: The procedure that splits the traffic of a data flow across multiple access networks. When traffic splitting is applied to a data flow, some traffic of the data flow is transferred via one access and some other traffic of the same data flow is transferred via another access. Access traffic splitting is applicable between different access methods, e.g., ATSC 3.0, 3GPP.

Access Traffic Steering: The procedure that selects an access network for a new data flow and transfers the traffic of this data flow over the selected access network. Access traffic steering is applicable between different access methods, e.g., ATSC 3.0, 3GPP.

Access Traffic Switching: The procedure that moves all traffic of an ongoing data flow from one access network to another access network in a way that maintains the continuity of the data flow. Access traffic switching is applicable between different access methods, e.g., ATSC 3.0, 3GPP.

Control Plane: Controls how data packets are forwarded – meaning how data is sent from one place to another in the network. The process of creating a routing table, for example, is considered part of the control plane. Routers use various protocols to identify network paths which are then stored in routing tables.

Core Network: Establishes reliable, secure connectivity providing operator access to broadcast network services. Rather than physical network elements, a broadcast core comprises cloud native, virtualized software-based network functions agnostic to the underlying cloud architecture, enabling increased agility in managing existing broadcast services and added flexibility in deploying future service capability.

Data Plane: In contrast to the control plane, is responsible for forwarding packets on the network. The data plane is also referred to as the forwarding plane.

Network Function Virtualization (NFV): Embodies the method of decoupling network functions from proprietary hardware appliances and running them instead as software on virtual machines (VMs).

Network Function (NF): A functional building block with well-defined functional behavior and clearly specified external interfaces. Each NF offers one or more services to other NFs via Application Programming Interface(s) (APIs). The functional behavior provided by each NF is formed from a combination of self-contained software routines called as microservices. Microservices have potential to be reused by different NFs facilitating independent life-cycle management, which permits upgrades and new functionality to be deployed without impacting running services.

NOTE: A network function can be implemented either as a network element on dedicated hardware, as a software instance running on dedicated hardware, or as a virtualized function instantiated on an appropriate platform, e.g., on a cloud infrastructure.

Network Slice: Refers to the set of network functions assembled to enable a particular service, e.g., user authentication, access and mobility management, policy control, etc.

Network Slicing: Describes the mechanism by which an ATSC 3.0 service can be modeled on a slice manager platform capable of describing the service and associated component chain in terms of the available set of NFs.

Service Based Architecture (SBA): Provides a modular framework from which common applications can be deployed using components from various sources and suppliers. An SBA affords the flexibility to enable both near and long-term future service capabilities such as flash channel and on the fly service provisioning. Adopting a do-it-once-and-distribute-across-all-stations methodology, an SBA maximizes operational efficiency. Following an SBA, service deployment is decoupled from any specific infrastructure or transmitter locale, permitting resources to be allocated dynamically according to the characteristics of the intended service capability and underlying service needs.

Service Based Interface (SBI): Represents how a set of services is provided/exposed by a given NF.

OpenAPI Specification (OAS): defines a standard, programming language-agnostic interface description for HTTP APIs, which allows both humans and computers to discover and understand the capabilities of a service without requiring access to source code, additional documentation, or inspection of network traffic.

– End of Document –