

Resources for NMOS Implementers and Integrators

Introduction

There is a continued interest in building systems which use the NMOS specifications and implementing these developments. To make it easy, this document lists the important information that we currently have and where to find it.

It's organised by functional areas (which match those presented on the [NMOS Roadmap](#)):

- Core
- Security
- Compressed Streams
- Control & Monitoring
- Systems
- Testing

The document will be updated as information is added or changed.

General information

AMWA's main website has an NMOS Overview page <https://www.amwa.tv/nmos-overview> providing links to introductory information about NMOS.

The [Networked Media Systems - The Big Picture](#) article is an excellent place to start for those looking to get an initial view of how networked media systems work, and where NMOS plays a part.

https://specs.amwa.tv/nmos/branches/main/docs/Technical_Overview.html provides a more technical introduction.

Getting started quickly

There are a few resources that can get you up and running with NMOS relatively quickly. Two things you might want to explore are the [Easy NMOS tool from Nvidia](#) and the [nmos-cpp implementation from Sony](#). You can find more resources like these on the [NMOS Overview page](#) under "How Can I Use It?".

If you already have an initial NMOS implementation, be sure to look at the [NMOS Test Utilities](#) and [watch a video](#) on the NMOS Test Utilities as well.

Asking questions

AMWA members can post questions or comments on the appropriate Slack or Basecamp workspaces. Please contact Tina Lipscomb if you do not already have access.

Members and non-members are invited to post Issues and questions that have to do with the NMOS specifications, open source implementations or the Testing Tool on the relevant GitHub repo.

Non-members are welcome to post technical questions about NMOS on the [public AMWA Slack workspace](#). If you have questions about the AMWA, NMOS-related activities and presentations at upcoming events, etc., please use the [Contact Form](#) on the AMWA website.

You may also find answers to your questions on the #nmos channel on the [video-dev Slack workspace](#).

Specifications

The [NMOS Roadmap](#) provides a useful summary of the most important specifications, grouped by functional area, with a coloured indication of their status, and target completion date if appropriate.

A complete index of published, WIP and deprecated NMOS specifications is at <https://specs.amwa.tv/nmos>. The index is grouped by specification type (Interface Specifications, Data Model Specifications, etc) and sorted by specification id (IS-04, IS-05, etc), rather than grouped by functional area.

The Technical Overview also explains how to [find and navigate through](#) the specifications.

All NMOS specifications have their “source” on GitHub, for example <https://github.com/AMWA-TV/is-04>, which is automatically formatted and rendered to AMWA’s specification site, e.g. <https://specs.amwa.tv/is-04>, including documentation, APIs and examples, and access to particular versions of the specification (for example <https://specs.amwa.tv/is-04/latest> is the most recent IS-04 release, while <https://specs.amwa.tv/is-04/v1.2> is the latest release of IS-04 v1.2) and work-in-progress versions.

Informative Documents

AMWA Specifications with “INFO-” identifiers are “Informative Documents”, and are used to provide implementation guides and other non-normative information. While informative in nature, and not formal technical specifications, they provide much information on how to use NMOS and are good resources for someone just getting introduced to this ecosystem. For example, the article on [NMOS use of DNS-SD](#) provides helpful guidance for those looking to implement DNS-SD in a networked media environment. As with all Specifications, INFO documents may be found at <https://www.amwa.tv/specifications>.

Parameter Registers and Control Feature sets

Specifications often make use of defined parameter values in NMOS APIs, for example JSON representing a video Flow will include a `format` parameter with value `urn:x-`

`nmos:format:video`. The registers are at <https://specs.amwa.tv/nmos-parameter-registers>.

Similarly the NMOS Control & Monitoring specifications make use of “control feature sets” at <https://specs.amwa.tv/nmos-control-feature-sets>.

Implementations

The “[Buy NMOS here](#)” page provides links to lists of commercial NMOS-capable media nodes, registries and controllers. There is also a list of open source and free implementations.

There have been a number of excellent presentations on NMOS over the years made at the IP Showcase. You can find these on the [IP Showcase website](#) under “Resources”. Specifically, these presentations from [Amsterdam 2023 IP Showcase on the Water](#) should be helpful for those looking to get started with NMOS:

- AMWA NMOS: Powered by Open Source
- Bringing Up a NMOS-Capable ST 2110 Media Processing Node in 30 Minutes

If you have created an NMOS implementation, you will want to look at the section of this document detailing resources available for [NMOS Testing](#).

Resources related to the [NMOS Roadmap](#)

The following section describes resources which are related to specific areas of the NMOS roadmap.

NMOS Core

Specifications

- IS-04: Discovery & Registration
- IS-05: Device Connection Management
- IS-08: Audio Channel Mapping
- IS-11: Stream Compatibility Management
- IS-13: Annotation
- BCP-002-01: Natural Grouping
- BCP-002-02: Asset Distinguishing Information
- NMOS Parameter Registers (See [the AMWA GitHub site](#))

Informative Documents

- INFO-004: Implementation Guide for DNS-SD
- INFO-005: Implementation Guide for NMOS Controllers
- INFO-003: Sink Metadata Processing Architecture

Open source / free software resources

- Sony's [nmos-cpp](#): C++ registry and node. It supports NMOS core and many other specs and features and has been used as the basis of several manufacturers' implementations
- Sony's [nmos-js](#): Simple JavaScript (React) control application.
- Rich Hastie's [Easy NMOS](#): provides Docker Compose scripts to deploy Sony's open source tools. See <https://youtu.be/MXbepL2lmK4> for instructional videos.
- Riedel's NMOS Explorer (free, not open source) control application
- AMWA's [Device control mock application](#) (see below)

Presentations

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NMOS Security

Specifications

- IS-10: Authorization
- BCP-003-01: Secure Communications
- BCP-003-02: Authorization
- BCP-003-03: Certificate Provisioning

Informative Documents

- INFO-002: Security

Open source / free software resources

- nmos-cpp (see above)

Presentations

- Nextera Security Presentation: <https://youtu.be/X34Ytd-hJwY?si=Bn1DqdNLIRrb4Bdw>
- BBC Security Presentation: <https://ipshowcase.org/wp-content/uploads/2019/05/0930-Simon-Rankine-simon-rankine-nmos-security-nab-showcase.pdf>

NMOS Compressed Streams

Specifications

- BCP-006-01: NMOS With JPEG-XS
- BCP-006-02: NMOS With H.264
- BCP-006-03: NMOS With H.265
- BCP-007-01: NMOS With NDI

Open source / free software resources

Work is commencing on an open source sender-receiver framework, which will support H.264 and H.265.

NMOS Control & Monitoring

Specifications:

- IS-12: Control Protocol
- IS-14: Configuration Management
- MS-05-01: Control Architecture
- MS-05-02: Control Framework
- MS-05-03: Control Block Specs
- Control Feature Sets

Informative Documents

- INFO-006: Device Capabilities Control

Open source / free software resources

- AMWA's [Device control mock application](#), written in Typescript and running on the NodeJS stack. Supports much of NMOS Core as well as NMOS Control & Monitoring
- Nmos-cpp (details tbc)

Presentations

- [IP Showcase NAB 2023](#)
- [VSF New York 2023](#) (members only)

NMOS Systems

This term is used in the NMOS Roadmap to cover other useful NMOS areas that aren't part of the core.

Specifications:

- IS-07: Event & Tally
- IS-09: System Parameters
- MS-04: ID & Timing Model

NMOS Testing

Testing Tool

- AMWA's [open source tool](#) tests Node implementations for most NMOS specifications, and all new specifications are required to provide a test suite.
- Controller testing
- The testing tool is used to prepare for JT-NM workshops, and at the event ([this repo](#) documents the procedures used)
- It is also used in AMWA Incubator workshops
- Easy NMOS (see above) runs a testing tool

Cloud testbed

- Provides a cloud-hosted registry, DNS server, testing tool and other services
- Used by the AMWA Incubator during and between workshops
- Runs on AWS
- Accessed via WireGuard VPN
- Available to AMWA members
- Contact Peter Brightwell for access