NMOS Now and Next

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BBC R&D

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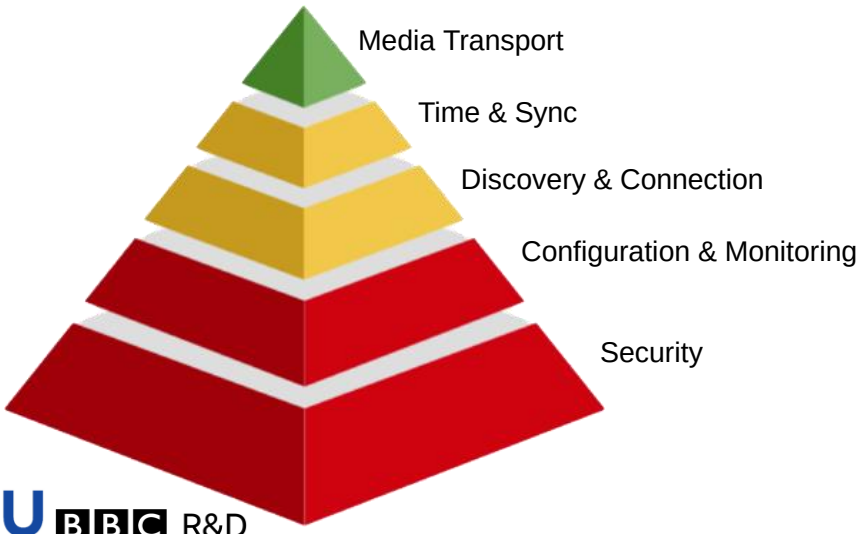
EBU Tech 3371
Technology Pyramid for Media Nodes



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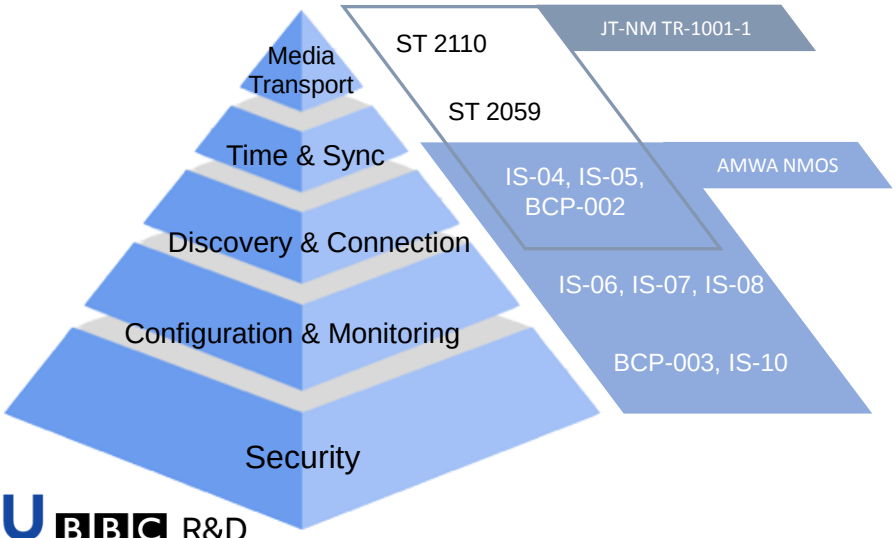
How NMOS and TR-1001 address the pyramid



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Networked Media Open Specifications

- Specifications for discovering, connecting and managing resources
- Developed by AMWA, published openly via GitHub
- Tested at Networked Media Incubator workshops
- Web-friendly: JSON, REST HTTP, WebSockets, message queues…

amwa-tv.github.io/nmos

- Specifications
- Documentation
- Developer resources
- Wiki

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AMWA NMOS Specifications

amwa-tv.github.io/nmos

ID	Name	Status
IS-04	Discovery and Registration	AMWA Specification (Stable)
IS-05	Device Connection Management	AMWA Specification (Stable)
IS-06	Network Control	AMWA Specification
IS-07	Event & Tally	AMWA Specification
IS-08	Audio Channel Mapping	AMWA Specification
IS-09	System	Work In Progress
IS-10	Authorization	Work In Progress
MS-04	ID & Timing Model	Work In Progress
BCP-002-01	Natural Grouping	AMWA Specification
BCP-003-01	API Security: Communications	AMWA Specification
BCP-003-02	API Security: Authorization	Work In Progress

AMWA IS-04
Discovery and Registration

What does it do?

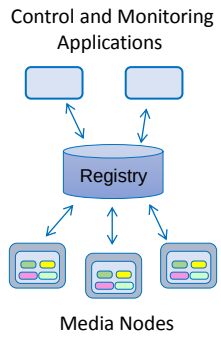
- Allows control and monitoring applications to find the resources on a network

Why does it matter?

- Enables for automation and reducing manual overhead
- Essential for dynamic deployment

How does it work?

- Media Nodes locate IS-04 registry using DNS-SD (unicast preferred)
- Media Nodes register their resource information with HTTP + JSON
- Applications query with HTTP and/or subscribe with WebSockets



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AMWA IS-05
Device Connection Management

What does it do?

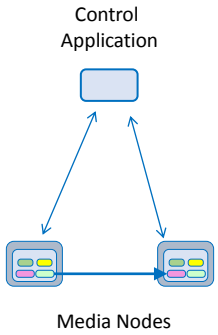
- Provides a transport-independent way of connecting Media Nodes
- Supports single + bulk connections, immediate + delayed connections

Why does it matter?

- ST 2110 does not specify how to do this
- Danger of multiple proprietary approaches
- Provides extensibility to other types of IP transport

How does it work?

- IS-04 provides information about Senders and Receivers
- Control application sends instructions to Media Nodes
- `transportfile` parameter conveys the connection information for ST 2110 streams



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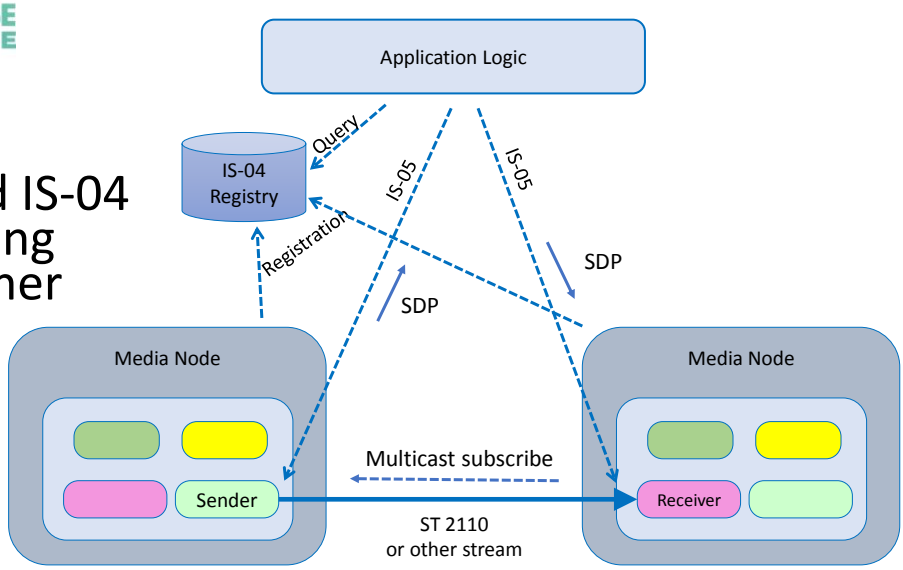
IS-05 and IS-04 working together



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AMWA IS-06 Network Control

What does it do?

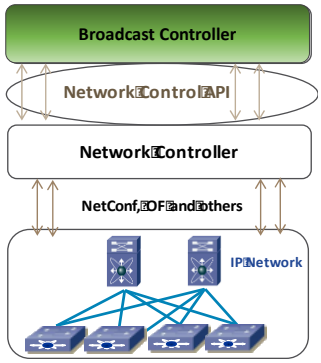
- Lets broadcast control applications manage what happens on the network itself

Why does it matter?

- Ethernet switch output ports might only support a limited number of media flows before they start dropping packets
  - This is different to what happens in a typical SDI router
  - Which means corrupted video and audio

How does it work?

- "Northbound" API from network fabric's controller
- Provides topology discovery, flow authorization and assurances of flow bandwidth



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AMWA IS-07 v1.0 Event and Tally

What does it do?

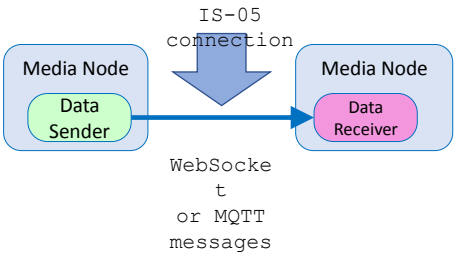
- Provides an IP-friendly mechanism to carry time-sensitive information
- For example: camera tally information, audio levels, control panel button presses and status

Why does it matter?

- ST 2110 does not provide an equivalent to GPI functionality
- Danger of multiple proprietary approaches
- Consistency with other NMOS specifications

How does it work?

- Media Nodes emit and consume state and state change info
- Lightweight messages sent using WebSockets or MQTT
- Message flows connected using IS-05



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AMWA IS-08 v1.0
Audio Channel Mapping

What does it do?

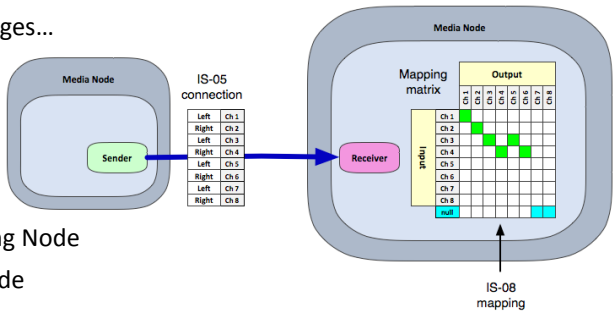
- Allows channel-level operations within NMOS environments
- For example: muting channels, swapping languages…

Why does it matter?

- Expected functionality for real world use
- Not included in IS-05's functionality

How does it work?

- Controller gets channel information from sending Node
- …and sends mapping matrix to the receiving Node
- Can also do sender-side matrixing



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AMWA BCP-002-01
Natural Grouping

What does it do?

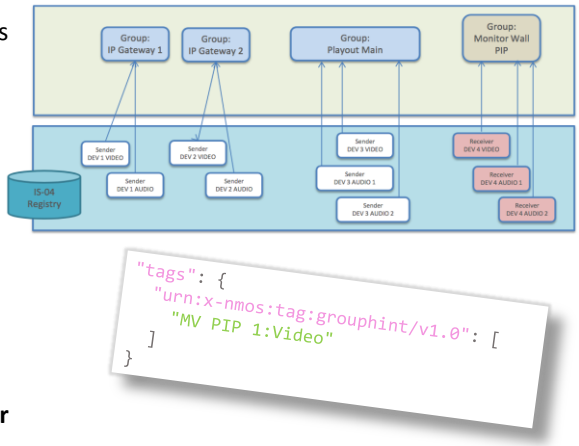
- Defines best practice for tagging groups of resources based on the function of a device, for example:
  - 2110-20, -30, -40 senders within a camera
  - 2110-20 receivers for multiviewer panes

Why does it matter?

- Can simplify "bulk" connections
- Not defined in IS-04 or IS-05
- Avoid different vendors taking different approaches

How does it work?

- Specifies a `grouphint` tag for NMOS JSON
- Types of tags are maintained in a **parameter register**



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AMWA MS-04
Identity and Timing Model

What does it do?

- Formalizes concepts such as Source, Flow, Time Value…
  - Re-examines the JT-NM reference architecture model taking into account many typical workflows
- Provides a basis for new specifications

Why does it matter?

- Increased content reuse means increased reliance on end-to-end models
- ST 2110's RTP timestamps are insufficient, so we need a model for future extensions

How does it work?

- Separate content with business value (Sources, Flows) from the systems that process it
- Explain through scenarios, formalize with UML

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AMWA IS-09
System API

What does it do?

- Provide Media Nodes with "global" information about their environment
  - e.g. PTP settings

Why does it matter?

- We need systems to start working asap after (re)connection or power-up
- DNS, DHCP, etc. provide a lot of what a Media Node needs… but not everything

How does it work?

- Read-only JSON resource, compatible with TR-1001 System Resource

```
{
    "id": "3b8be755-08ff-452b-b217-c9151eb21193",
    "version": "1441700172:318426300",
    "label": "ZBQ System",
    "description": "System Global Information for ZBQ",
    "caps": {},
    "tags": {},
    "is04": {
        "heartbeat_interval": 8
    },
    "ptp": {
        "announce_receipt_timeout": 2,
        "domain_number": 57
    },
    "syslogv2": {
        "hostname": "biglogger.ebu.ch",
        "port": 3477
    }
}
```

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Securing APIs

IP brings new cybersecurity risks,
including risks to the control plane

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BCP-003-01 API Security: Communications

Best practice for encrypting HTTP and WebSocket messages

- TLS 1.3 preferred, TLS 1.2 allowed
- Recommends appropriate cipher suites
- Recommendations for X.509 PKI

Encrypted IS-04 + IS-05 are now the default at AMWA workshops

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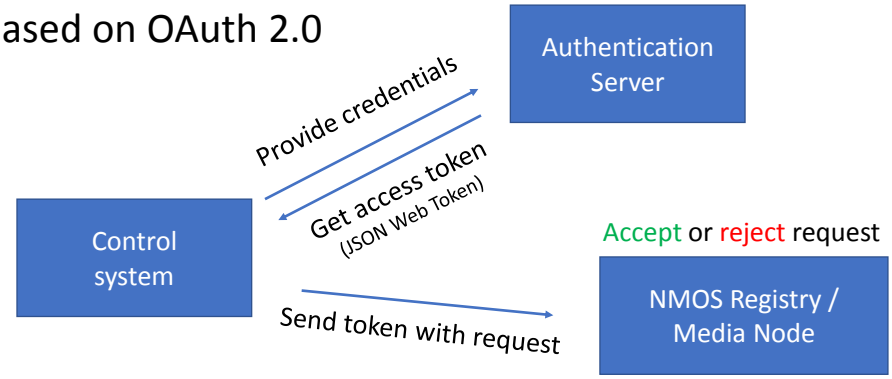
BCP-003-02 API Security: Authorization

- Enables API server to verify what client may access
- Based on OAuth 2.0



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State of specifications

Published
- IS-04 v1.0, v1.1, v1.2, v1.3
- IS-05 v1.0, v1.1
- IS-06 v1.0
- IS-07 v1.0
- IS-08 v1.0
- BCP-002-01
- BCP-003-01

Work In Progress
- MS-01 ID and Timing
- BCP-003-02 Authorization
- IS-09 System API
- IS-10 Authorization API

minimum required for TR-1001-1

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NMOS Resource Sharing

AMWA and VSF are looking at scenarios…

- Within a facility: federated IS-04 registries
- OB Truck delivery into broadcast centre
- Multi-campus workflows

VSF 2110-over-WAN project

- Defining a WAN side of gateway
- Feeds into ongoing NMOS work

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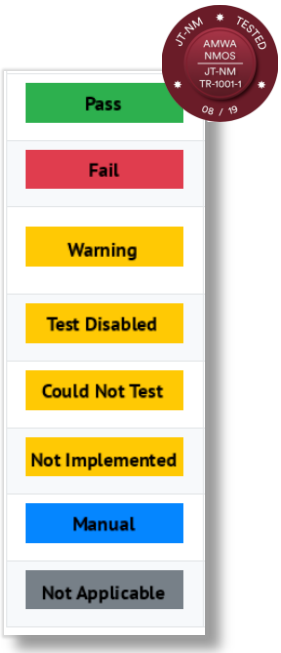
Testing

- New work Incubated at AMWA workshops
  - With VPN available for testing APIs in advance
- JT-NM Tested Event Wuppertal August
  - Significant participation in TR-1001-1 / NMOS tests
- AMWA testing tool: github.com/AMWA-TV/nmos-testing
  - Python, open source, extensible
  - Allows vendors to start testing in advance
  - Saves time at events



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NMOS Wiki

- Help with the specs and docs
- Information about available implementations and tools
- Resources for developers
- Resources for users

github.com/AMWA-TV/nmos/wiki

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Future Zone demonstration

- Managing video, audio, ANC and time sensitive data
- Control logic uses generic configurable components

AMWA
- NMOS IS-04
- NMOS IS-05
- NMOS IS-07
- BCP-002-01

SMPTE
- ST-2110-20
- ST-2110-30
- ST-2110-40
- ST-2022-7

JT-NM
- TR-1001-1

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Future Zone demonstration

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Feedback from user projects

BBC Cardiff

- NMOS required in tenders, much effort spent, has required proprietary workarounds

CBC Montréal

- NMOS required in tenders, workarounds with VSM, not a blocker

tpc Zürich

- Using NMOS alongside alternatives until market matures

Common comment: “chicken and egg”

- R&D incubates but previously not reflected in available product
- Importance not sufficiently communicated inside organisations (inc. to sales)

TR-1001 and JT-NM Tested should make a big difference for the future

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Stay right here for more…

10.30 Automated Testing

11.00 IS-07

11.30 Security

12.00 Resource Sharing for WAN

Thank you

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