



NMOS

Networked Media Open Specification

The Open AV over IP RESTful API

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I am...

- Andrew Starks
- Director of Product Management for

MACNICA
AMERICAS

- Formerly Co-Founder of Tightrope Media Systems (20 Years)
- *Extremely* happy to be here!



SMPTE ST-2110 / NMOS: Layered Architecture



Registration
Discovery
IS-04

Subscribe
IS-05

Network Control
IS-06

...

Networked Media Open Specification (NMOS)
Network-Transparent (RESTful) Application Programming Interface (API)

Timing and
Synchronization
-10

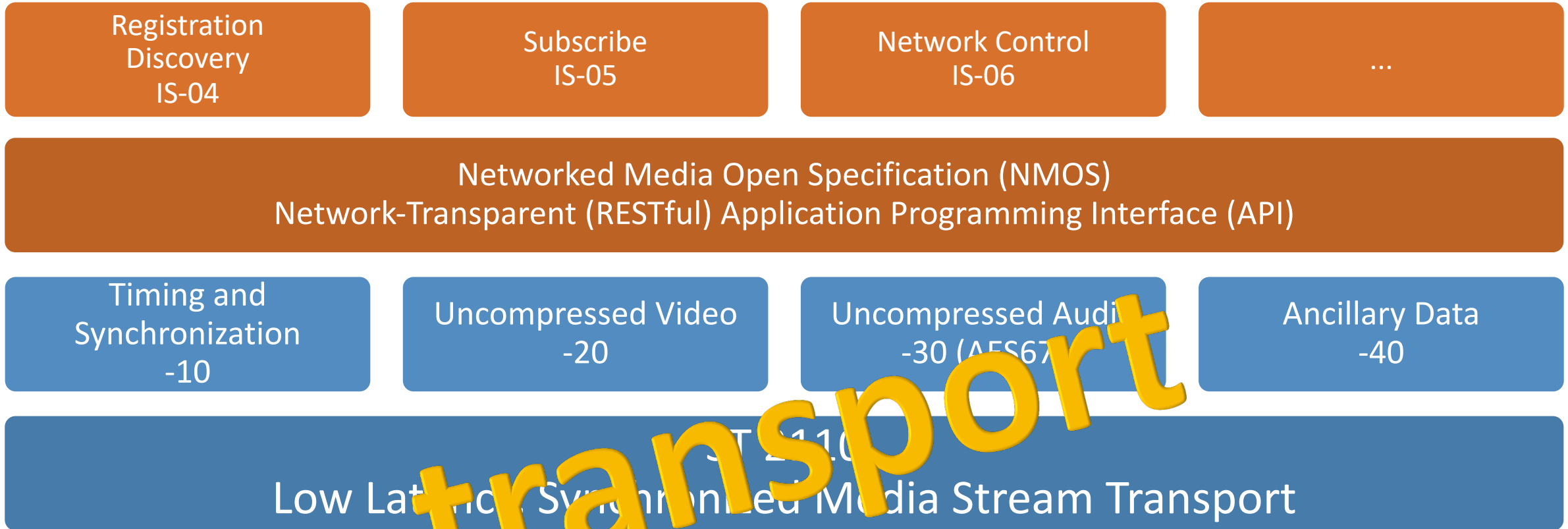
Uncompressed Video
-20

Uncompressed Audio
-30 (AES67)

Ancillary Data
-40

ST 2110
Low Latency, Synchronized Media Stream Transport

SMPTE ST-2110 / NMOS: Layered Architecture



transport

SMPTE ST-2110 / NMOS: Layered Architecture



API for transport

Registration
Discovery
IS-04

Subscribe
IS-05

Network Control
IS-06

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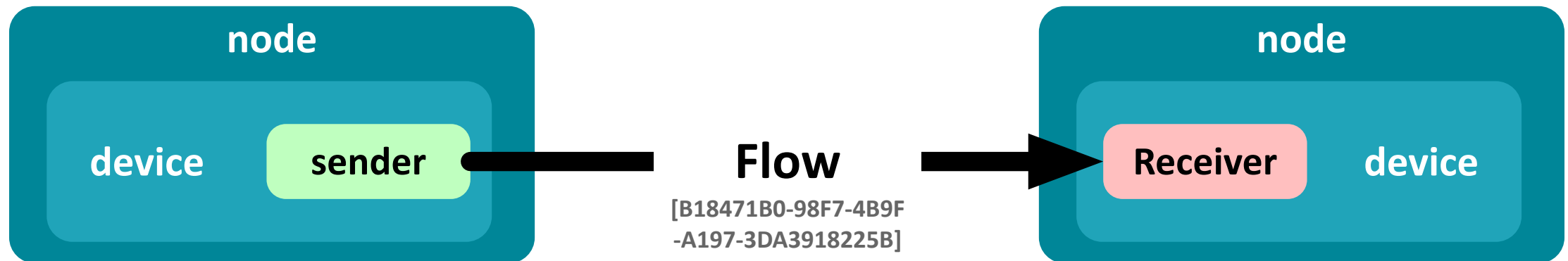
ST 2110
Low Latency, Synchronized Media Stream Transport

Stages

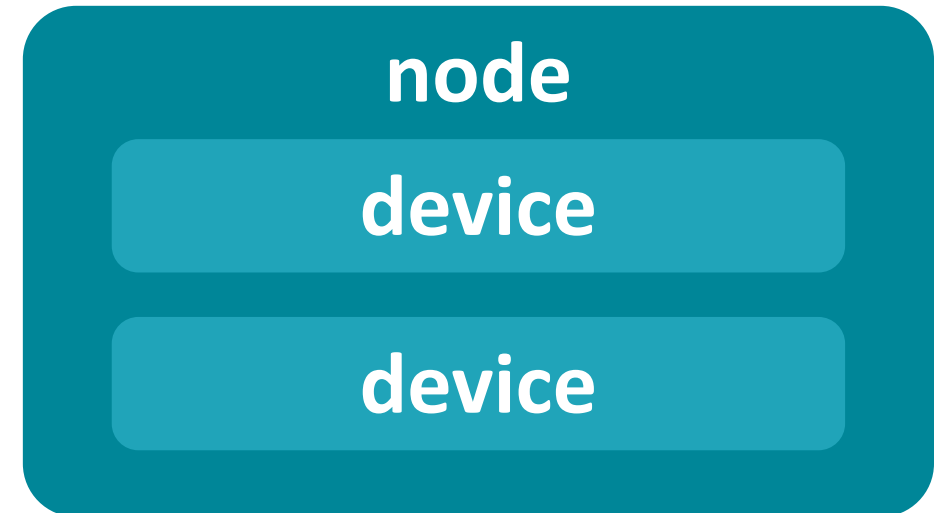
ID	Name	Status
IS-04	Discovery and Registration	Stable
IS-05	Device Connection Management	Stable
IS-06	Network Control	AMWA Specification
IS-07	Event & Tally	AMWA Specification
IS-08	Audio Channel Mapping	AMWA Specification
IS-09	System	Work in Progress
MS-04	ID & Timing Model	Finalized, Approved
BCP-002-01	Natural Grouping	Finalized, Approved
BCP-003-01	API Security: Communications	AMWA Specification
BCP-003-02	API Security: Authorization	Finalized
N/A	Parameter Registers	Continuing

- NMOS Node API
- NMOS Registration API
- NMOS Query API
 - m/DNS Search and Discovery
 - Peer-to-Peer Search and Discovery

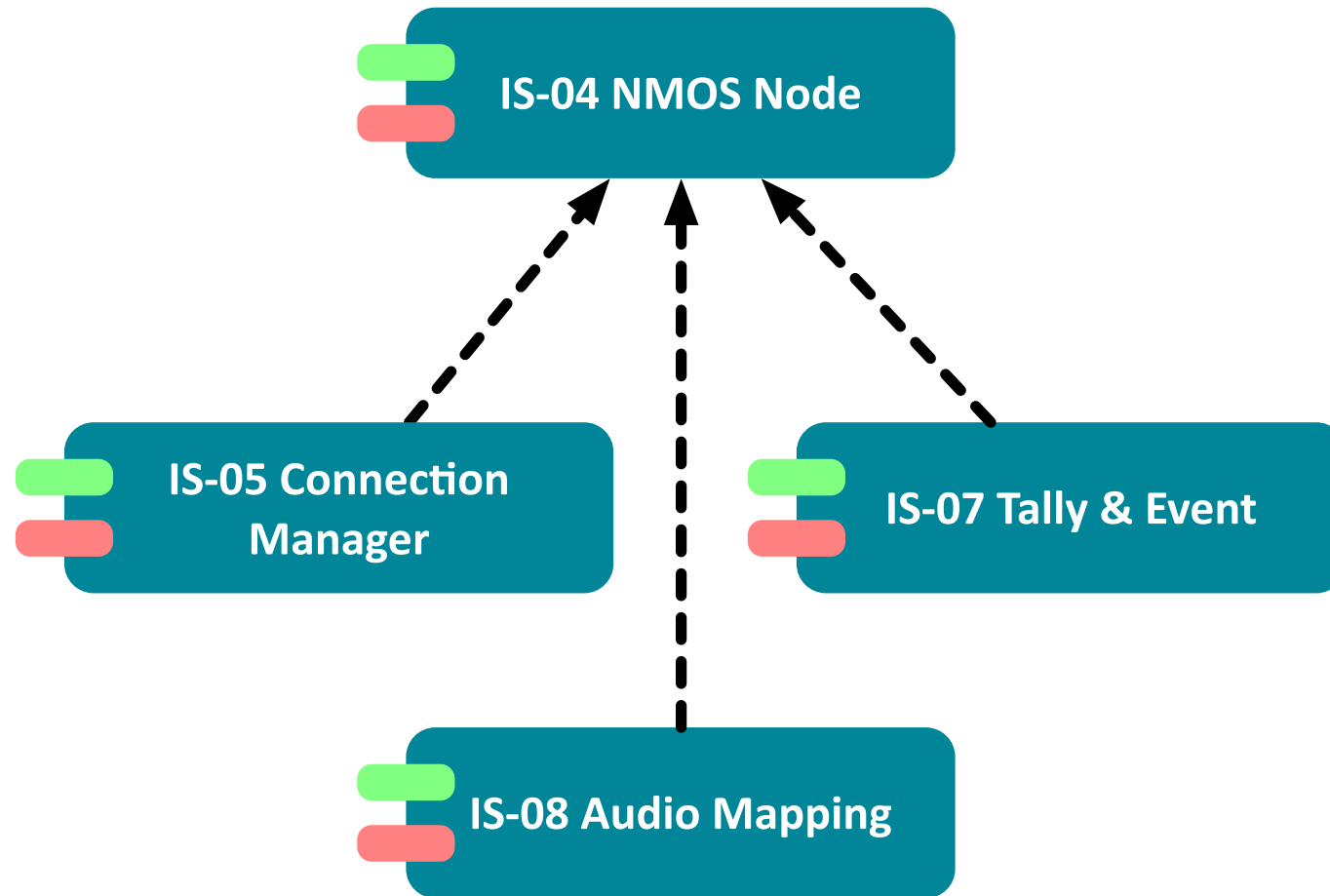
NMOS Node



- **Devices:** do things
 - Play, capture, transform, display, etc.
- **Nodes:** their logical hosts
 - Could be a server or other container

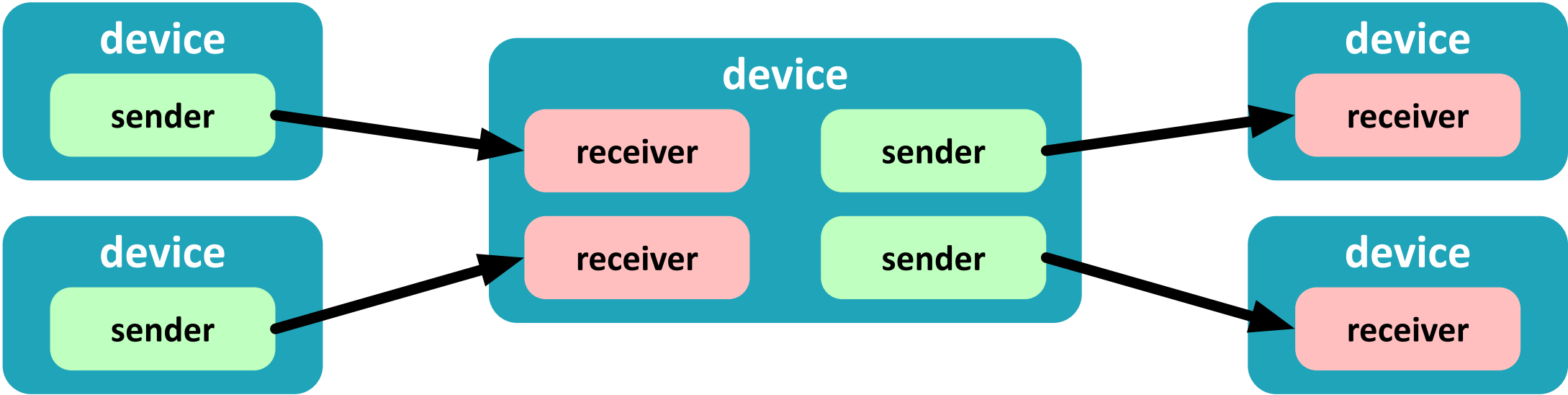


Other Specifications



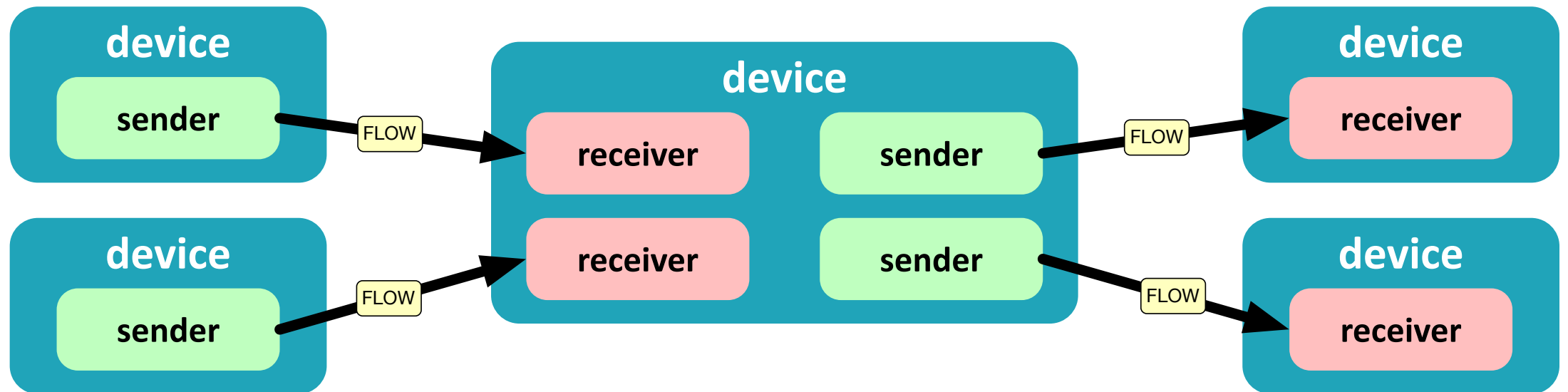
NMOS Model: Senders and Receivers

Devices can have Senders and/or Receivers which are **logical** inputs/outputs



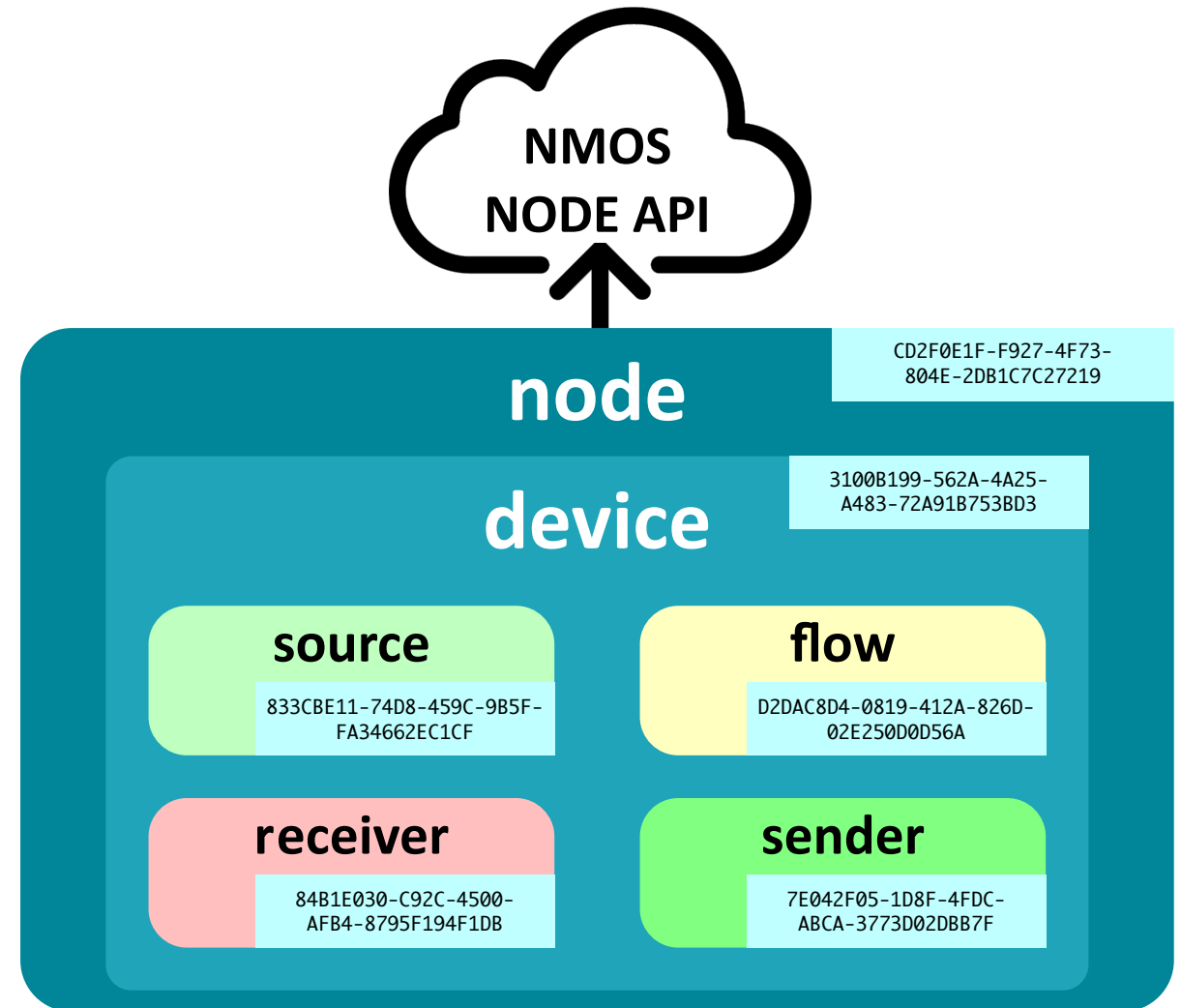
NMOS Model: Flows

Flows are time stamped (synchronous) **sequences of video/audio/ancillary** data that pass from a **Sender** to a **Receiver(s)**

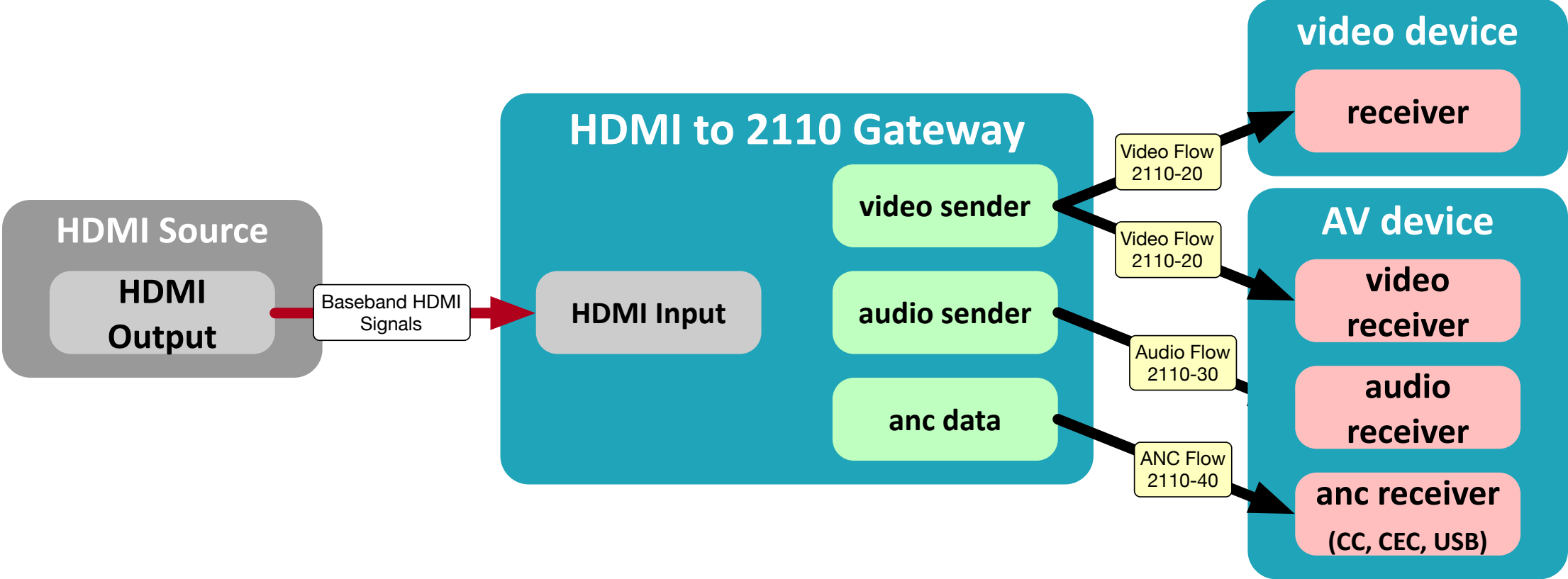


Devices, Sources, Flows, Senders, Receivers - they are **Resources**

- **Uniquely identified** and addressable parts of a NMOS environment
- A Node exposes its **Resources** via its IS-04 **Node API**



NMOS Example: HDMI Gateway



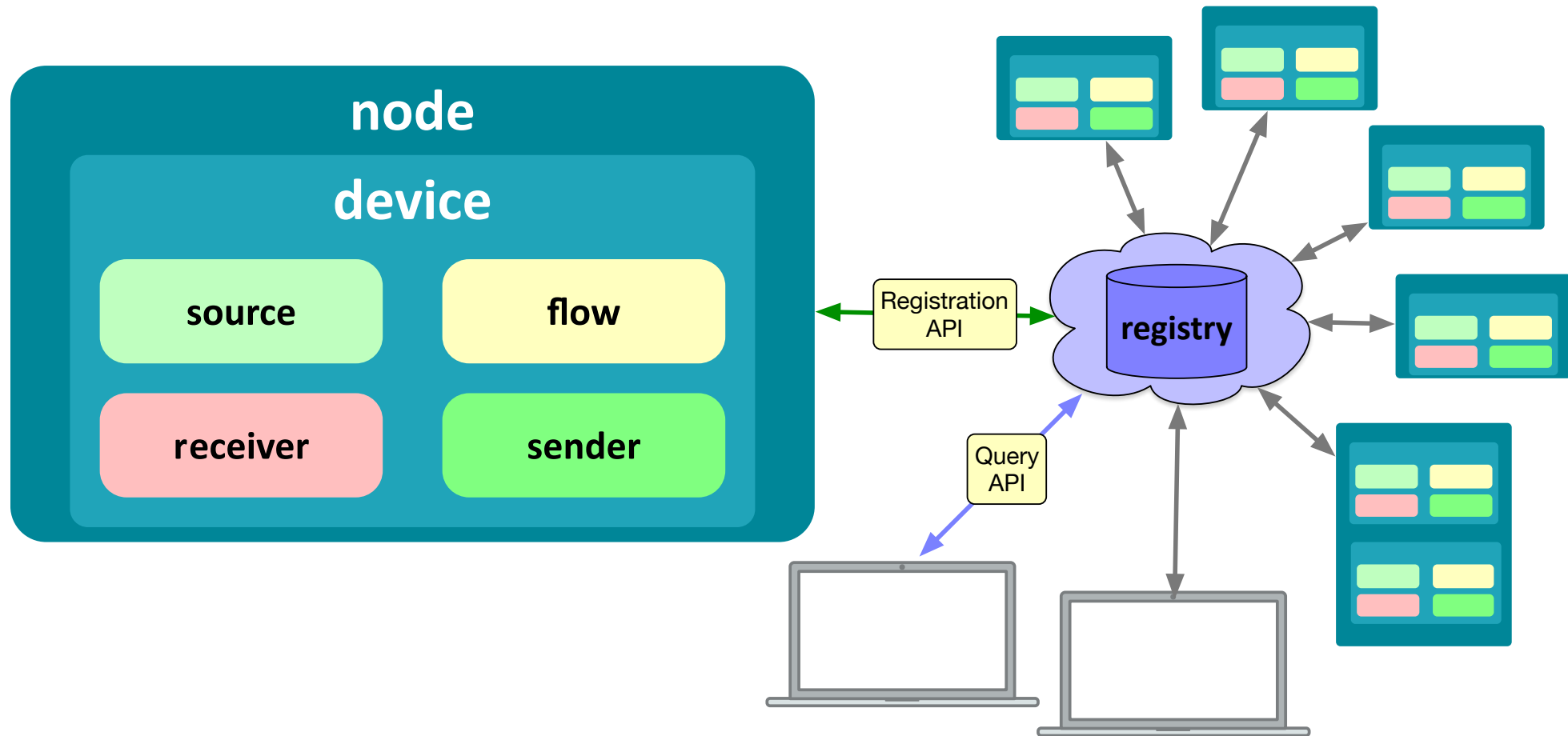
NMOS API: Web Friendly

- HTTP/S
- Websockets
- JSON
- UUIDs v4

```
{
  "id": "a370d258-69de-4422-860a-ee4cf32ee9f4",
  "node_id": "3a25a674-e6eb-4987-84ad-ef479fe4d527",
  "version": "1441723676:366608283",
  "type": "urn:x-nmos:device:mydevicetype",
  "description": "Multiviewer device",
  "label": "Multiviewer 1",
  "receivers": [
    "863532de-a97d-4597-989a-e79688f2d5f9",
    "632d7e6d-7357-44de-a425-a94fbe94974e",
    "95ef711b-564d-4655-a98b-5b9ccfb419d7",
    "9ee74607-f831-42f5-af08-a614ce0706df"
  ],
  "senders": [],
  ...
}
```

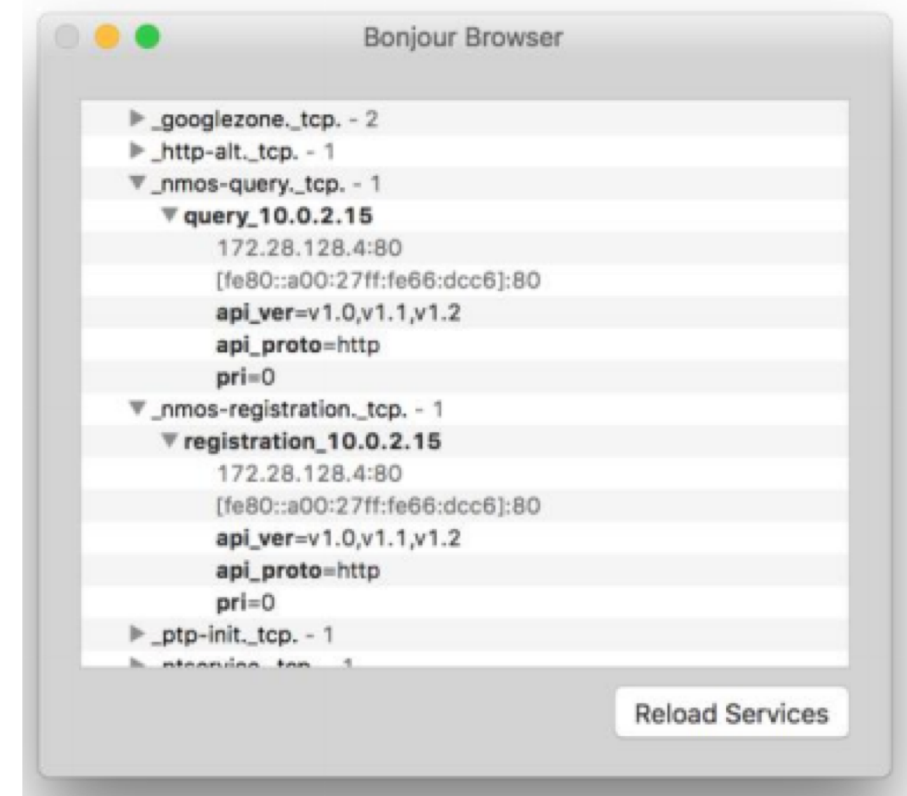
JSON representation of a Device resource

IS-04 Registration Service

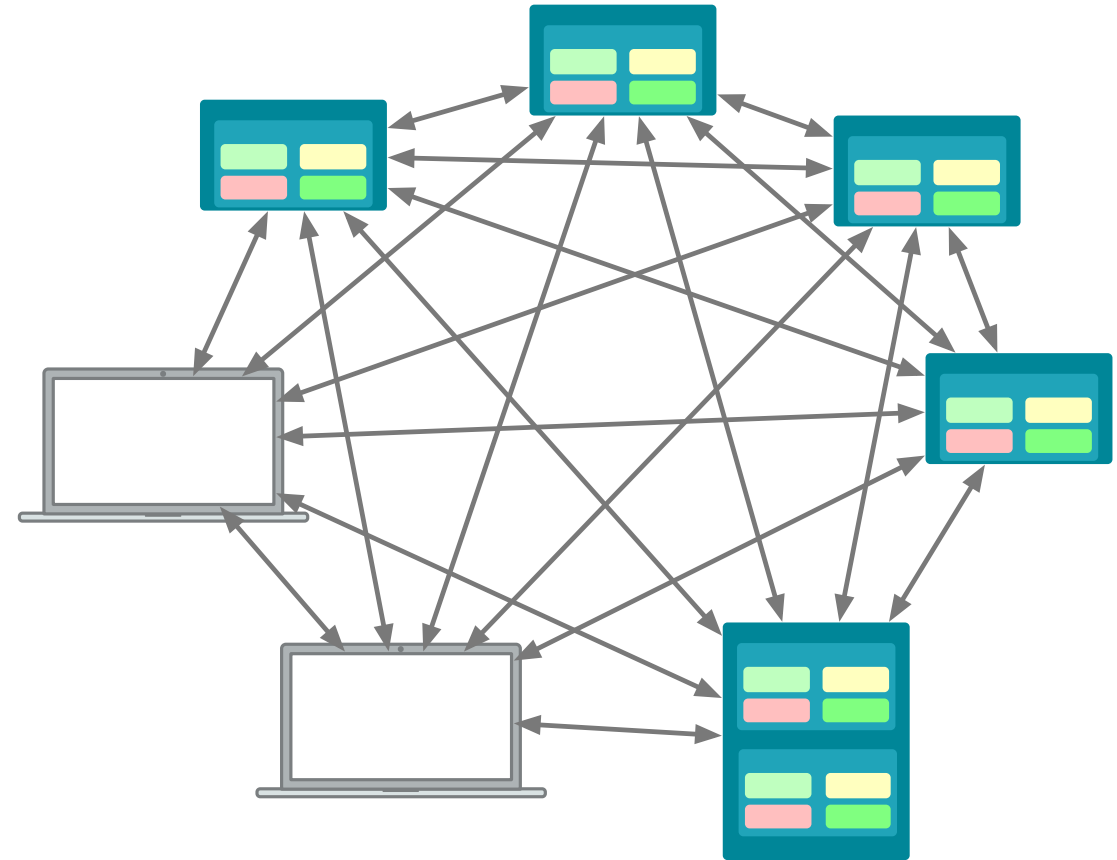


Discovery IS-04 Services

- Registration and Query: **mDNS announcements** (Bonjour, Avahi etc) or through **DNS entry**
- **Multicast / Unicast** supported
- Finding Registration service announcements:
 - Finds endpoint via **_nmos-register._tcp**
 - Register: **POST** request to a Registration API
 - Persist: **POST**ing time to Registration API / health endpoint every 5 sec
 - Register its Resources with further **POSTs** to the Registration API /resource



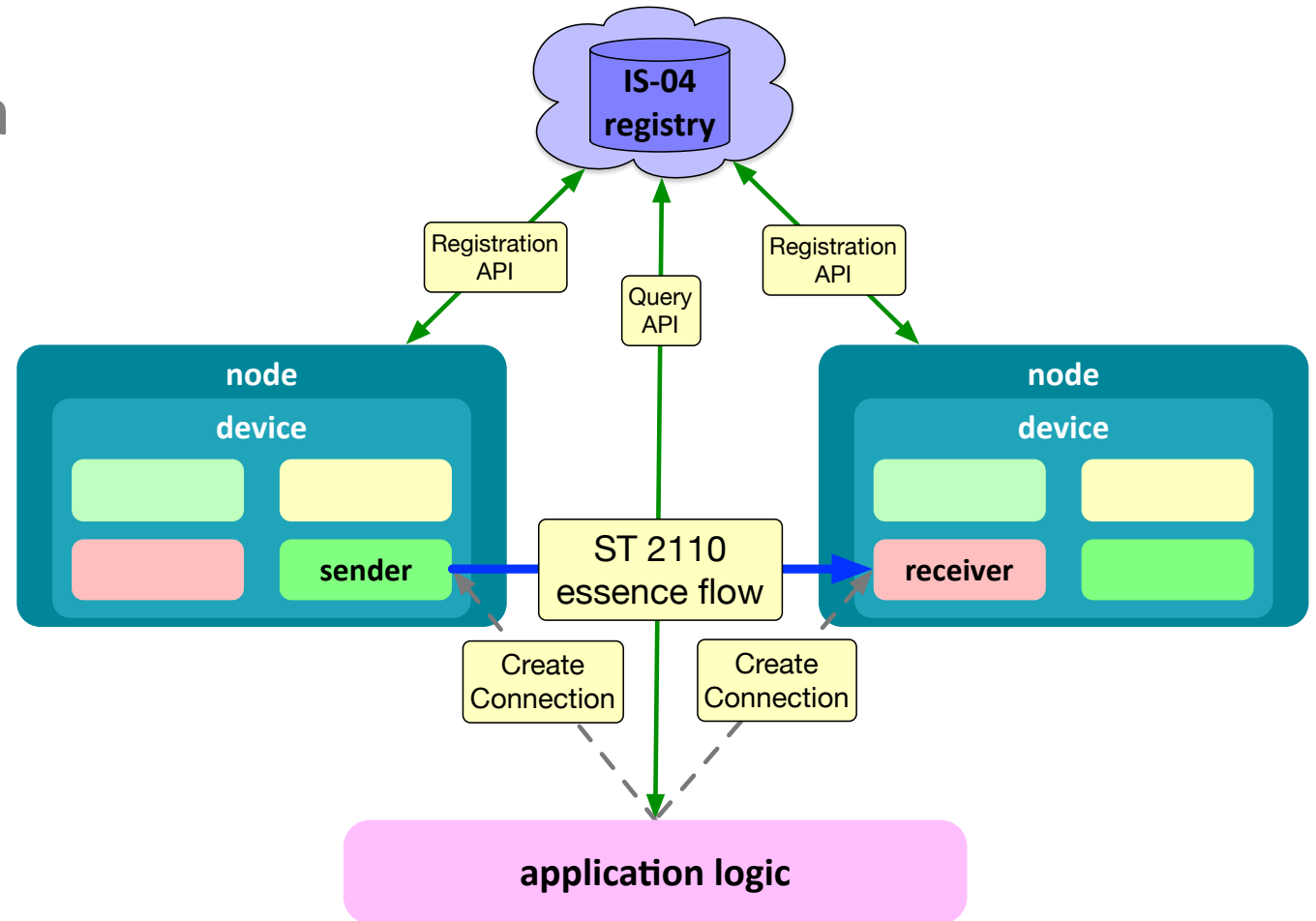
- The Node announces itself with `_nmos_node._tcp`
- Clients find its resources directly through the NMOS IS-04 Node API
- Continue to looking for Registry announcements and **use registry instead, if available! (it's better)**



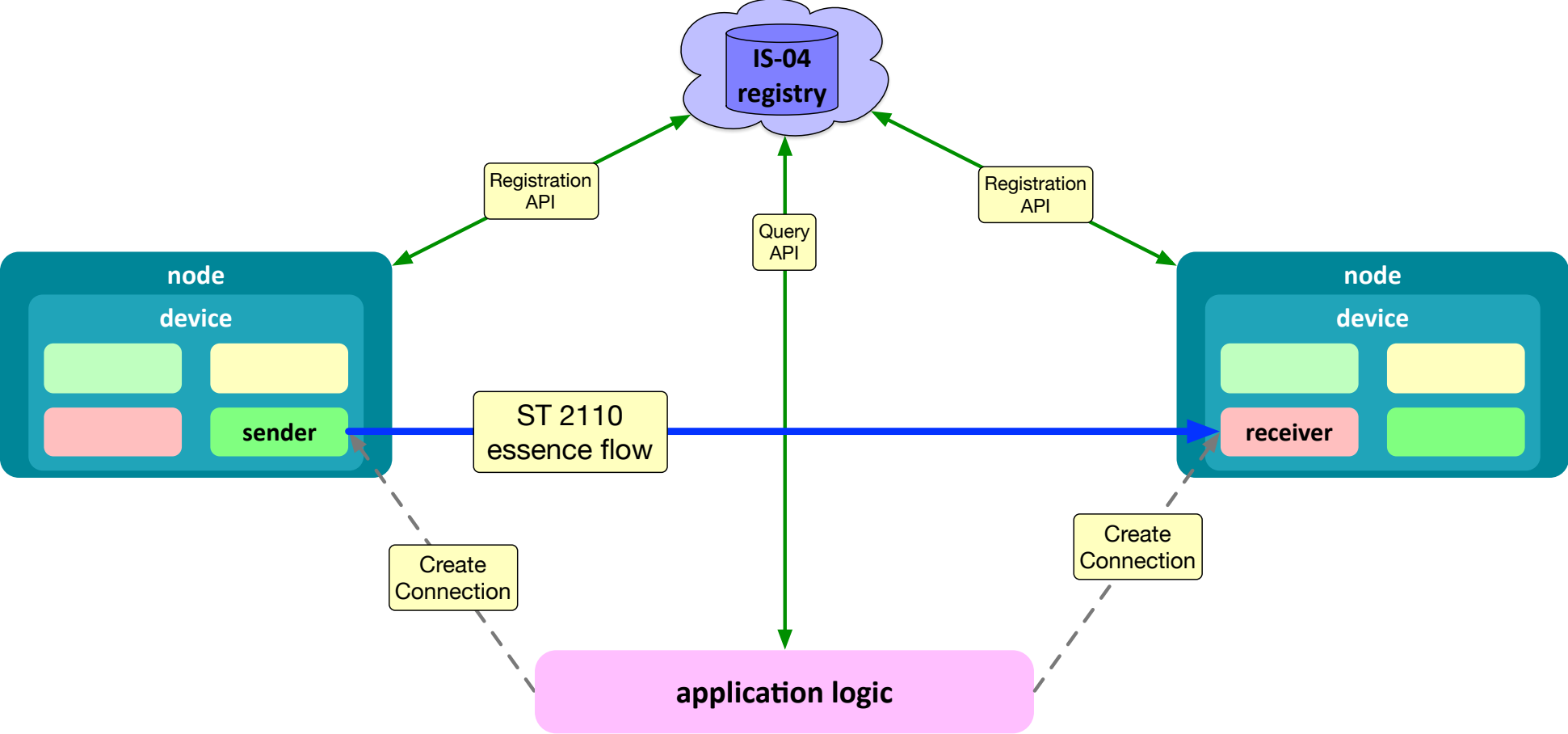
NMOS IS-05: Connections

Provides a general mechanism for connecting senders and receivers:

- Supports unicast/multicast
- Provides feedback on success/failure
- Best used in conjunction with IS-04



NMOS IS-05: Connections



- **NMOS IS-06:** Switch control API
- **Broadcast Controller:** Plays the role of routing switcher software
 - Touches IS-04/05/06
- **Timing:** PTP Clocks keep things source synchronized. Work being done to support destination synchronization.
- **Multicast & Unicast:** Fully Supported
- **MUCH MORE TO COME!**



Thank you