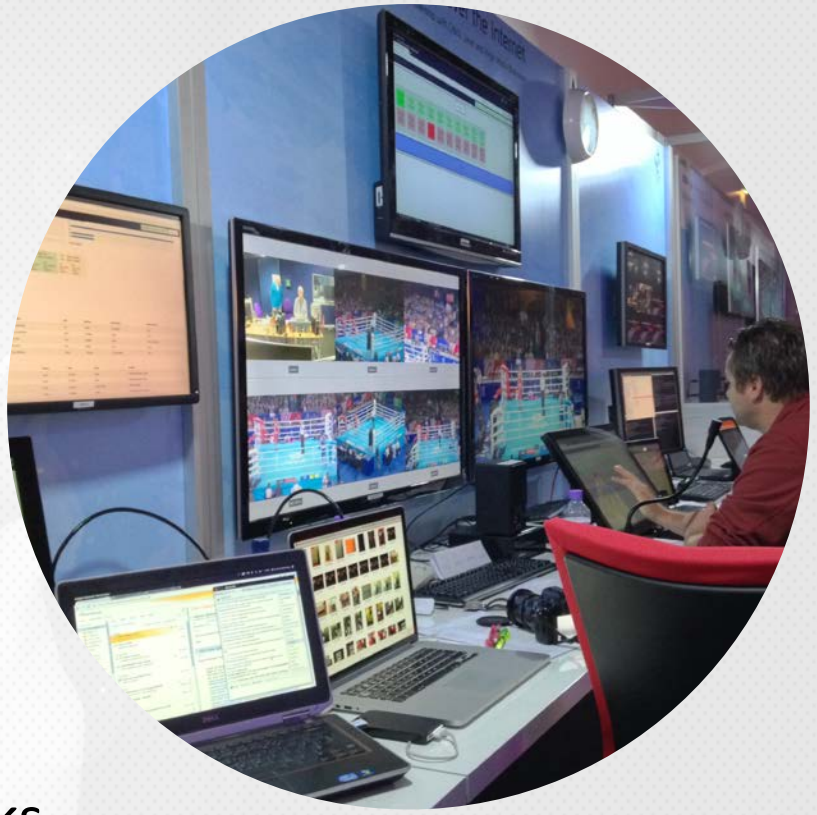
Climbing the Beanstalk: IP Studio and NMOS in the Cloud

Alex Rawcliffe, BBC Research & Development

BBC R&D's IP Studio

- 7 years software development
- C++/Python/Qt/JS… on Ubuntu Linux
- NMOS Node, Registration Query APIs
  - + Other IP Studio APIs
- Builds NMOS devices as pipelines of processors
- Early work used physical machines/physical networks



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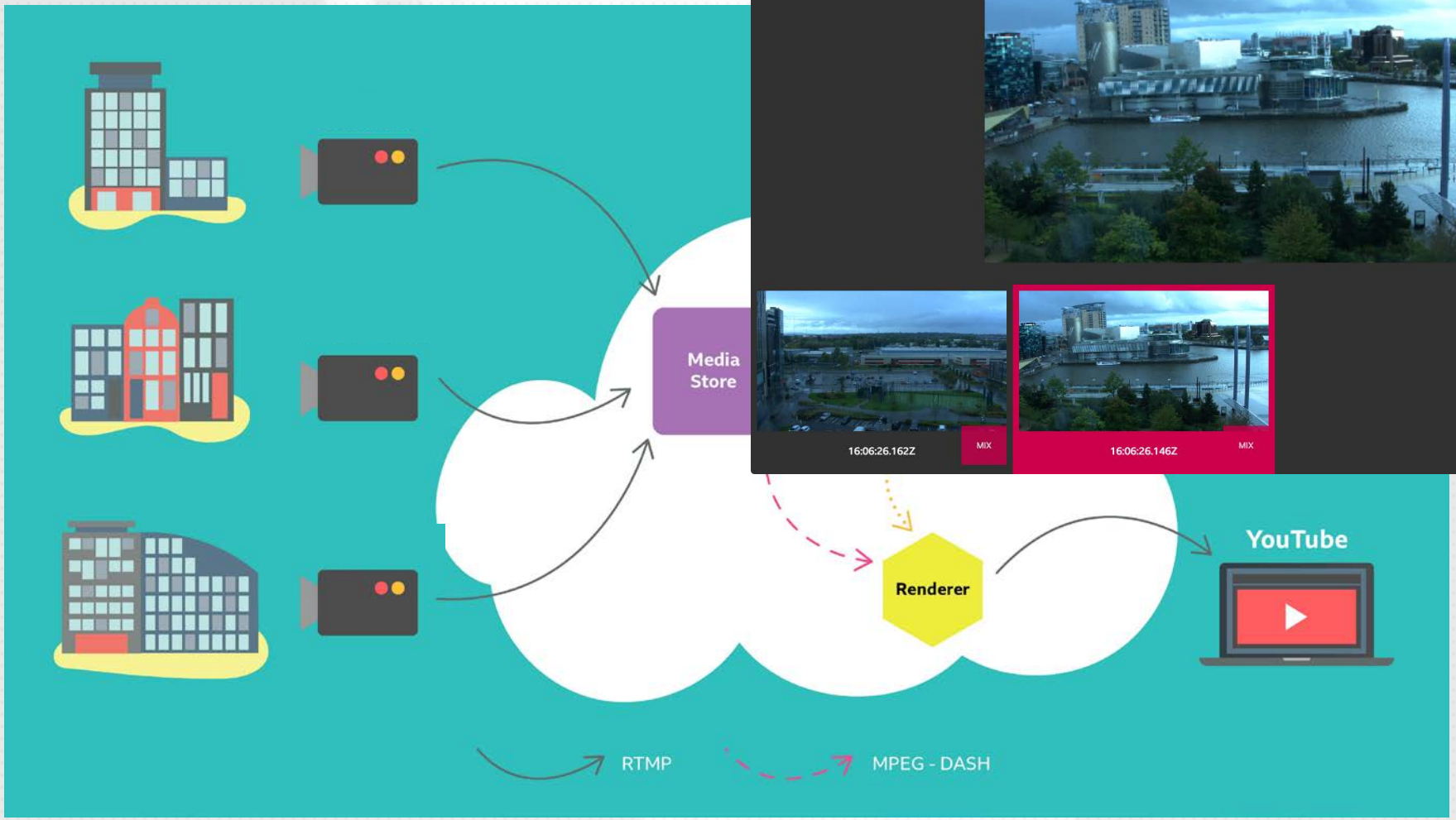
IP Studio



IP Studio in the Cloud

- **NMOS** IS-04 core
- **Browser-based** production tools
- Initial Target: **Lightweight OB**
- **Cloud-powered** remote rendering

Key Technical Benefits

- **Auto Scale Out** (and in)
  - easier to balance capacity/cost vs fixed infrastructure
- **Composable**
  - component-based infrastructure = easily adapted
- **Location agnostic** production
  - With NMOS end-to-end timestamping/identity

Business Drivers

- **Want to cover more events**
  - Which might not be cost effective with conventional OB
- **Physical infrastructure is a pinch-point**
  - E.g. during large events
- **Get talent on air quickly**
  - Scavenged connectivity/self-op production

Some Research Drivers

- **Test IP roadmap** in new context
- **Feed in to JT-NM** work on dematerialization
- **Understand opportunities**/similarities/differences

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Under the hood…

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Key Components

Media

Data

Load Balancing and Distribution Network

Production Application Server

Composition Metadata API

Management API

Media Access API

Media Input Gateway

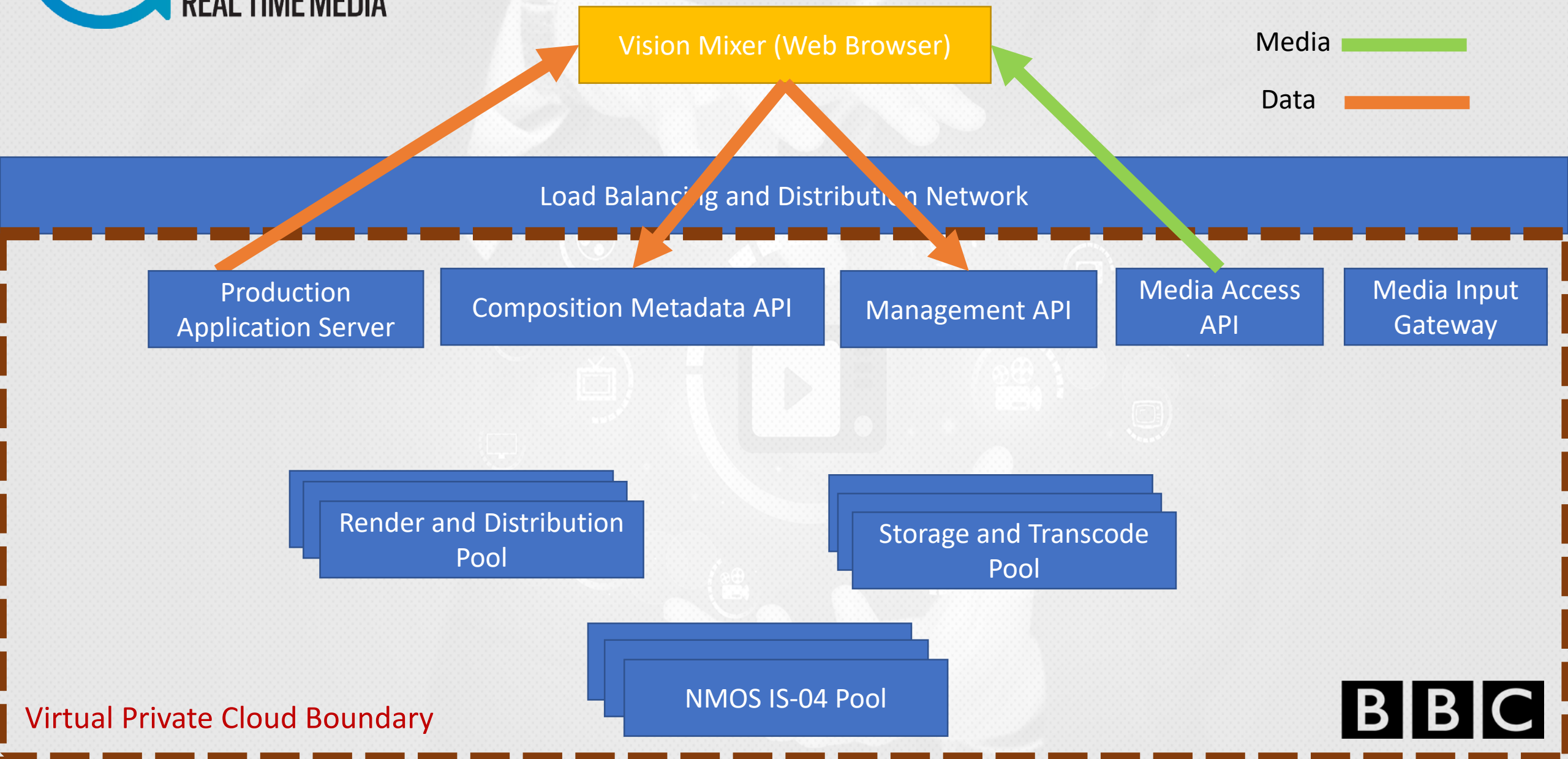
Render and Distribution Pool

Storage and Transcode Pool

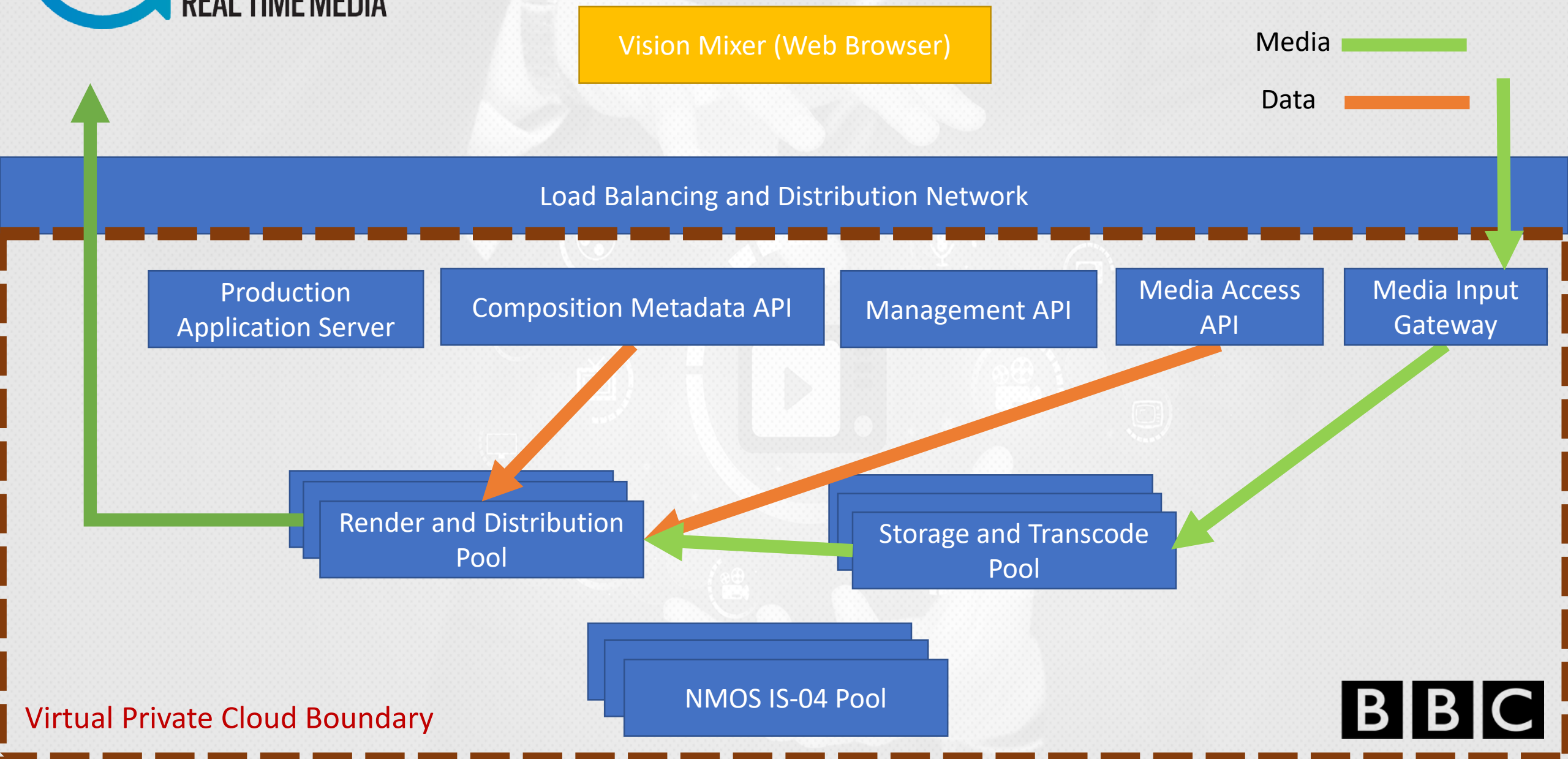
NMOS IS-04 Pool

Virtual Private Cloud Boundary

Tool Connectivity



Rendering Connectivity



Use of NMOS IS-04

- **Unicast Mode** of registration and discovery
  - E.g. DNS records for registration/query APIs
- **Easy logical addressing**
  - For processing Nodes and content (Sources and Flows)
- **Underpins other private APIs**
  - built on top of NMOS IDs / use Node service discovery

Building and Deploying

- **Infrastructure as Code**
  - Repeatable, versioned deployments
- **Automated builds**
  - Versioned, continously deployable software => Quick feature turnaround.
- **Modern, software-focused** tools:
  - **Ansible/Packer/Jenkins CI/Troposphere**

Some Technical Challenges

- **Synchronization**
- **Security**
- **Editing**
- **Content Transport**

Synchronization

- Embed timestamps at origin wherever possible
  - Sync when you need to (at render time)
- ‘Gold standard’ PTP+GPS synced NMOS Node
  - Other reference sources:
    - Stratum 2 NTP/ Native GPS on devices (e.g. Android phone)
- No ‘native’ NTP, PTP on most/any public cloud
  - Raises importance of origin timestamps.

Security Philosophy

- Isolate areas that don't need to talk (e.g subnets /routing)
- Minimize attack surface:
  - Most instances in private subnets.
  - Lock down instances with narrow security policies.
  - Lean public gateway APIs expose only what is necessary
- Certificate-based API access for users and applications

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Editing…

Decoupling Media, Editing and Rendering

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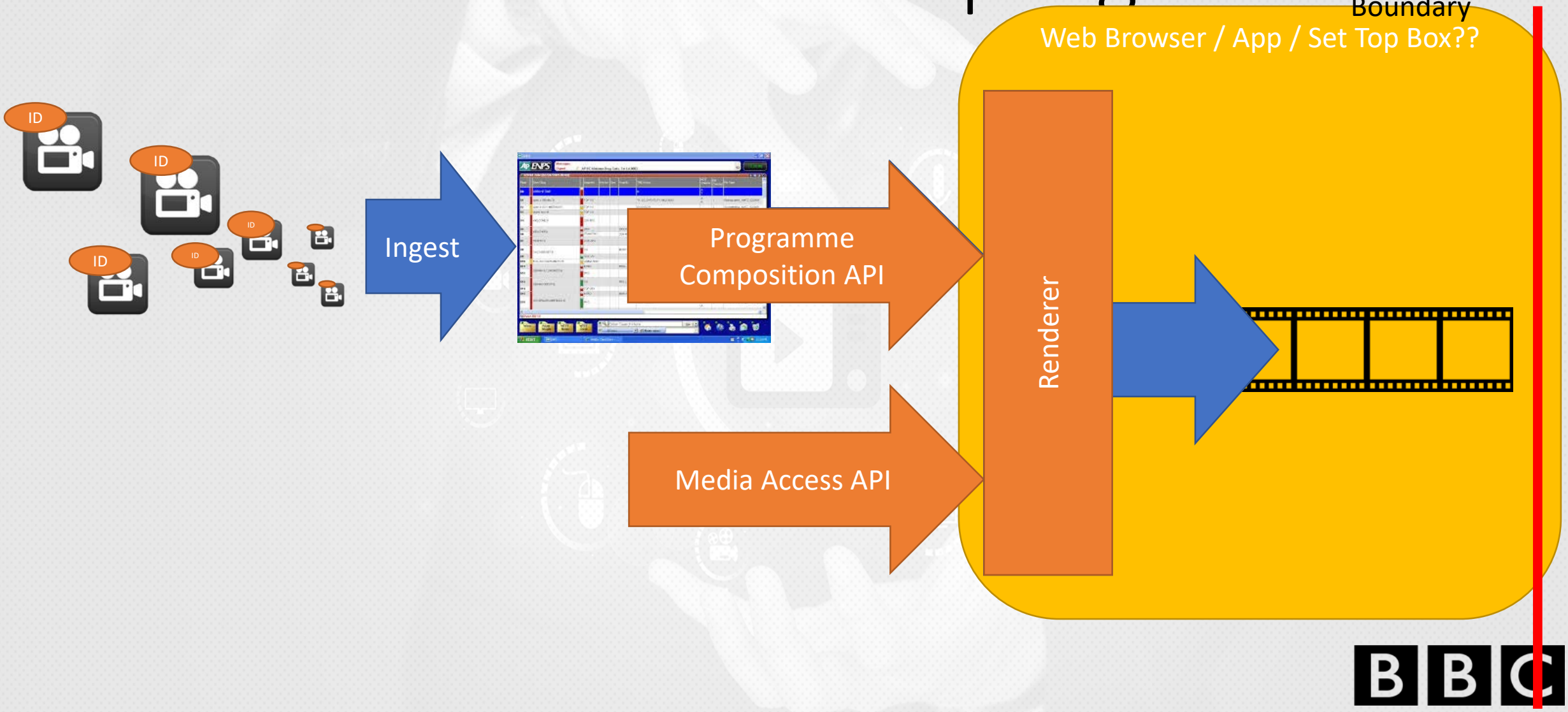
Conscious Uncoupling...



…Editing…

- BBC R&D **U**niversal **M**edia **C**omposition **P**rotocol (**UMCP**)
- Aim: Capture every user control surface action
  - Strongly linked to NMOS content IDs
- Use of NMOS identity and timing is <u>critical</u>:
  - Concrete handle for media user is interacting with
  - Facilitates accurate remote rendering (Sources←Flows)
  - Eliminates need to ‘re-ID’ content as it moves between tools

…Editing…

- UCMP: Graphs, Sequences, Grains


```
{
    "grain_type": "event",
    "source_id": "7c86fb79-f6d5-484a-b76a-fe1325145174",
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ipstudio:format:event.composition.sequence.media.video",
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    }}
```


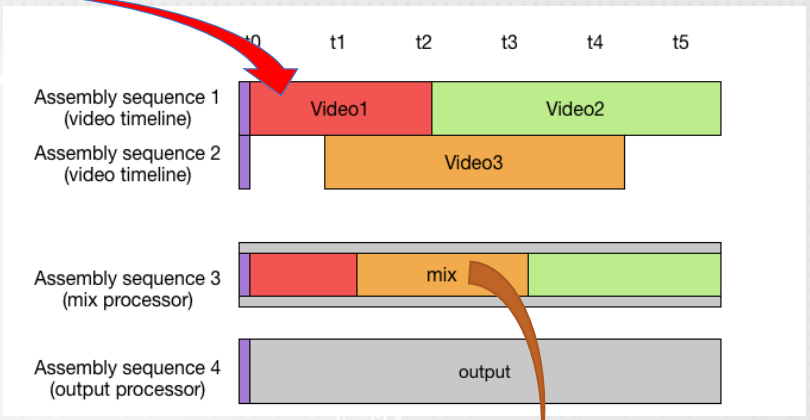

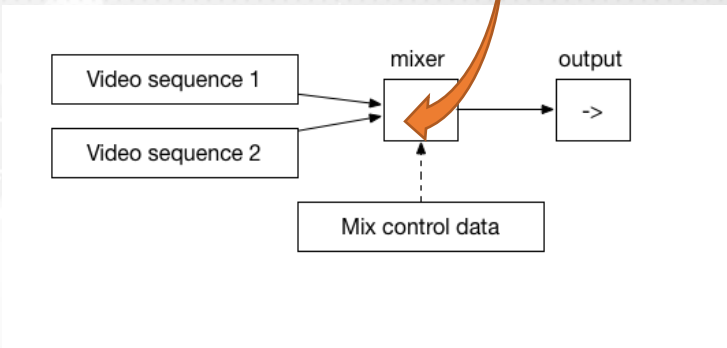

Content Transport

- **RTMP live input/output**
  - Mirror functionality on other web streaming platforms
  - Have developed simple in-stream NMOS timing/ID mapping

- **DASH to UI**
  - Simple network traversal
  - low complexity in client
  - NMOS timing and IDs mapped via API and manifest

Where Next?

- Add more resilience to some areas of infrastructure
- Cloud portability and hybrid environments
- Build more tools for different workflows
- Explore different implementations of processing (e.g. serverless)

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Find out more on the **BBC R&D** stand: Future Zone, 8.G10

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