Media Command™

END-TO-END SYSTEM & OPERATIONS GUIDE

Organization: Broadcast Management Group (BMG)

System Version: Media Command™ v0.91 · Dragonflight Architecture

Reference Data: 12,353 Indexed Broadcast Assets

Cluster Topology: 6-Node Distributed (dragon1 – dragon6)

Date: October 2026

PRODUCTION · TOOL-VERIFIED WITH REAL MEDIA

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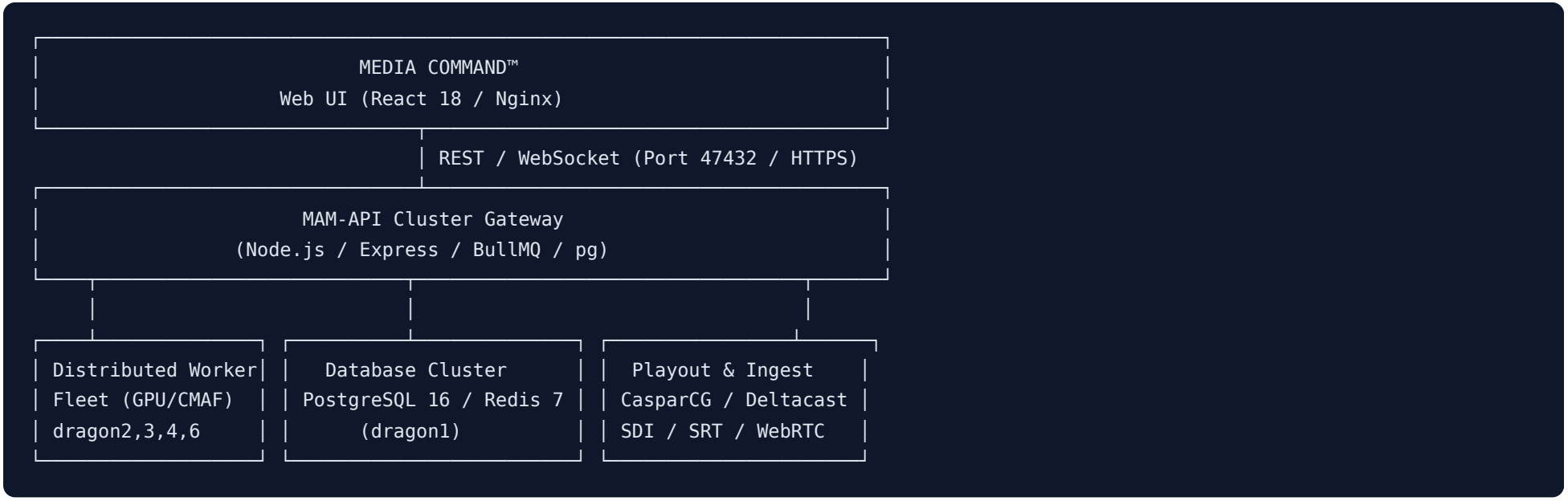
1. Executive Overview & System Architecture

Media Command™ is an enterprise-grade broadcast Media Asset Management (MAM), live capture, signal routing, and playout automation platform developed by Wild Dragon LLC for high-velocity broadcast environments.

System Architecture



Technology Stack

- **Frontend:** React 18 SPA with dark/light themes, HLS.js adaptive streaming, MediaPipe AI segmentation, WebRTC Adaptor for sub-second multiviewing, and SMPTE timecode parsers.
- **Backend:** Distributed Node.js/TypeScript microservices with express-session, PostgreSQL 16, Redis 7, and BullMQ worker queue orchestration.

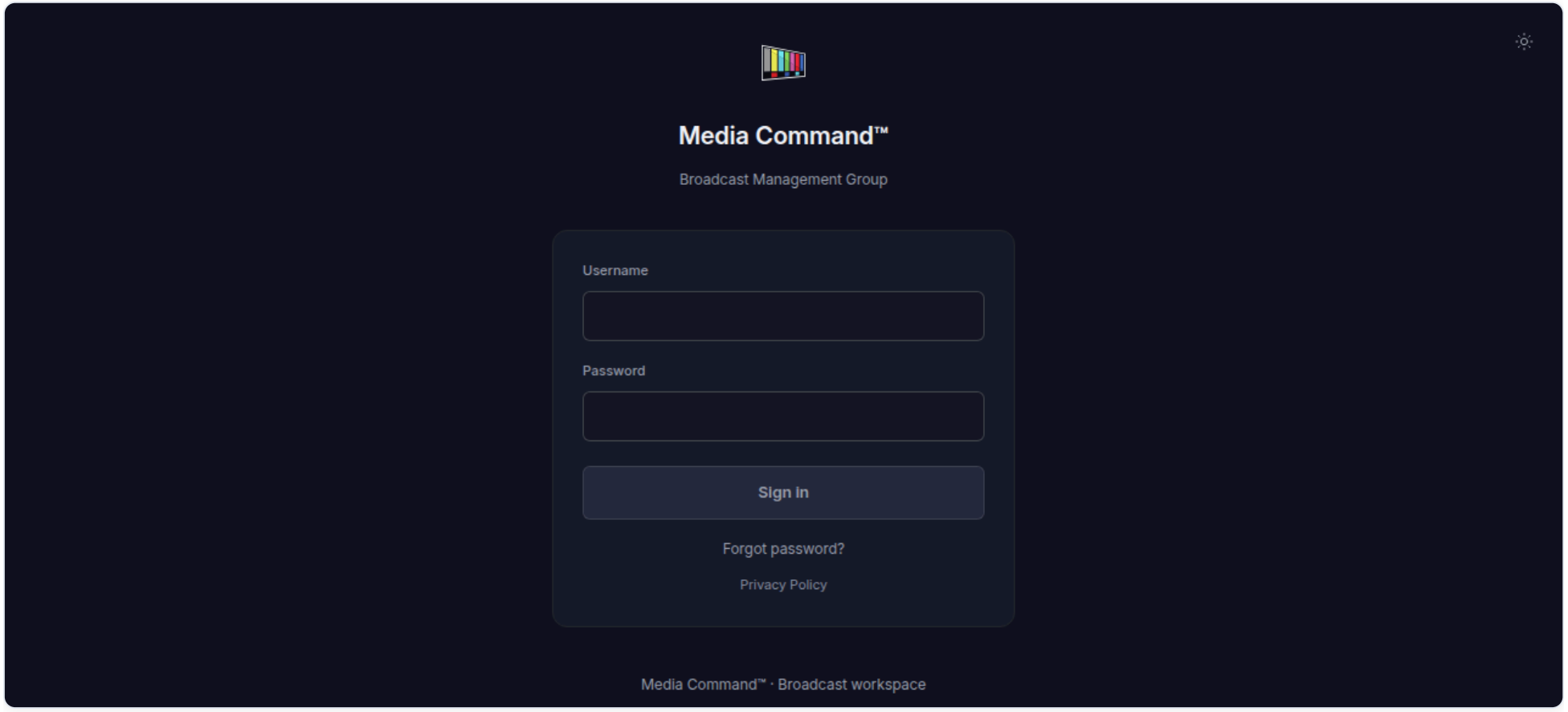
- **Worker Pipeline:** GPU-accelerated transcoding (NVIDIA NVENC/NVDEC) for stream-copying, proxy generation, audio waveform extraction, and HLS packaging.
- **Playout Engine:** CasparCG Server fork with custom NDI playout, HTML graphics overlays, and SW-P-08 / BCS router protocol bridges.

TAMS CMAF/fMP4 Master Flow Paradigm

Media Command uses **Fragmented MP4 (fMP4 / CMAF)** master flows for live ingest. Unlike traditional monolithic files that require finalization before reading:

- **Live Growing Ingest:** Segments are written to NVMe sequentially, allowing editors to scrub up to the live record edge seconds behind real-time.
- **Stream-Copy Efficiency:** H.264 and HEVC feeds bypass transcode stages, stream-copying directly into master containers.
- **Padded In/Out Trimming:** Non-destructive sub-clipping enables storage reclamation without re-encoding.

2. Authentication & Workspace Access



Media Command™ Login Screen — Broadcast Management Group tenant

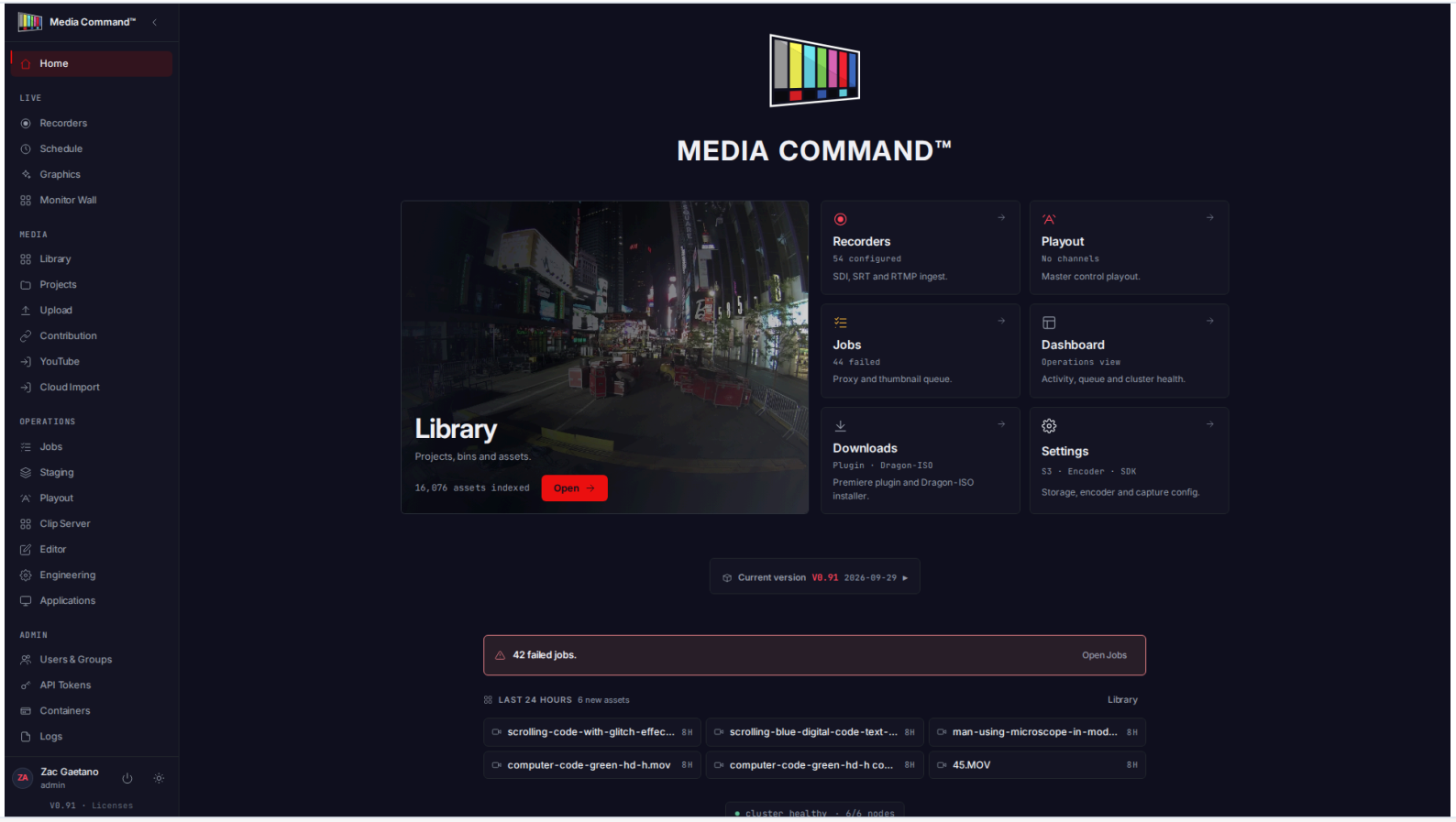
Authentication Channels

- **Local Credentials:** Secure PBKDF2/Argon2-hashed credential authentication.
- **Enterprise SSO (Authentik):** Federated OAuth2/OIDC brokering @broadcastmgmt.com (M365) and @bmgremi.com (Google Workspace) identities via `auth.broadcastmgmt.cloud`.
- **MFA/TOTP:** Time-based One-Time Password enforcement for administrative tiers.

Role-Based Access Control (RBAC)

Role	Scope & Permissions
Admin	Full cluster control, user/token provisioning, container restart, S3 and storage configuration.
Operator	Recorder control, schedule automation, playout queue manipulation, graphics triggering.
Editor	Library browsing, bin curation, rough-cut editor, NLE plugin connectivity, upload/import.
Viewer	Read-only access to metadata and proxy streams. Cannot modify content.

3. Global Operations Dashboard



Media Command™ Operations Dashboard — Real-time system overview

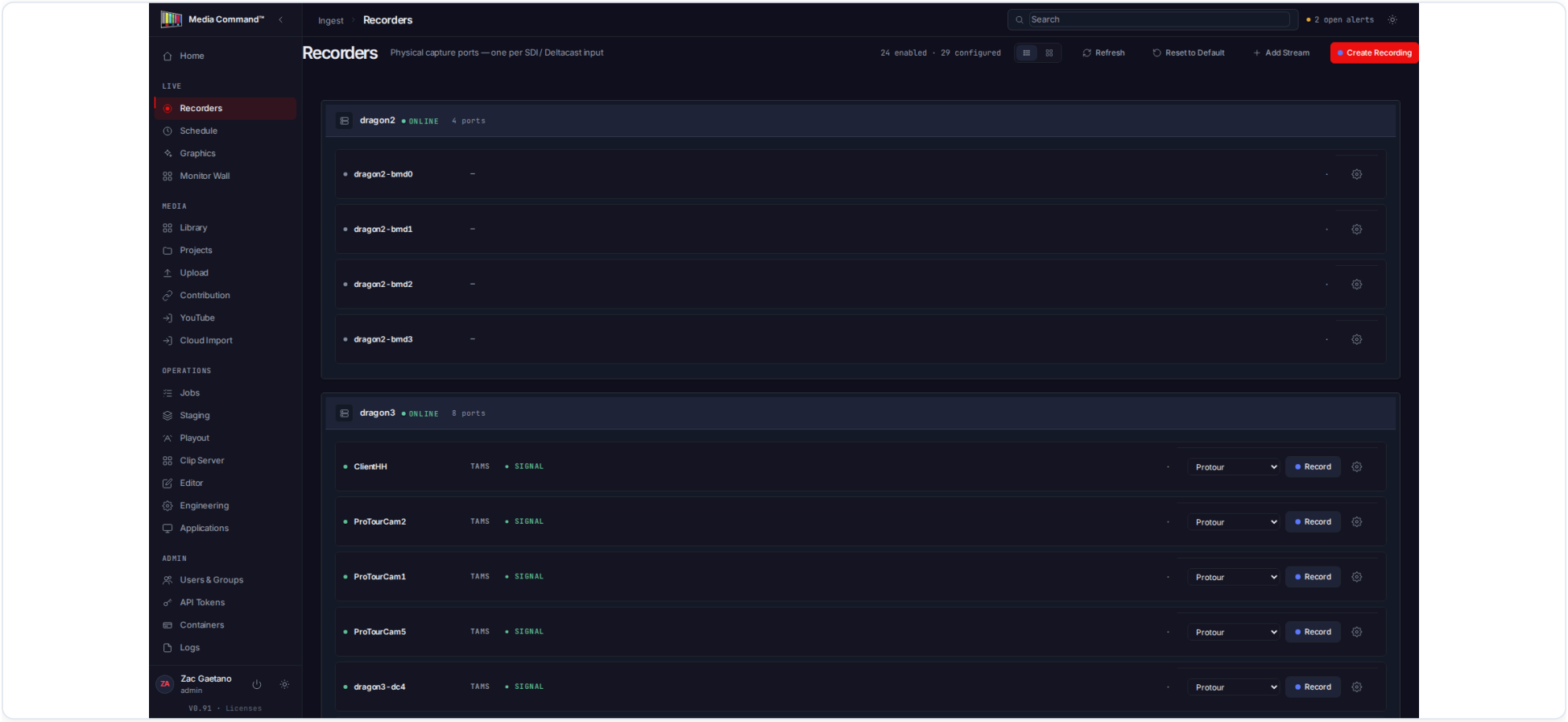
The **Operations Dashboard** is the command center, providing unified visibility into system vitals, recent activity, and quick access navigation.

Dashboard Components

- **Cluster Status:** Live aggregate node state (e.g., `cluster healthy · 6/6 nodes`).
- **Asset Indexing:** Real-time counter of all registered broadcast assets (`16,076 assets indexed`).
- **Active Queue Metrics:** Running and failed worker tasks (`42 running · 2 failed`).
- **Ingest Port Summary:** Online capture channels (`24 enabled · 29 configured`).
- **Last 24 Hours:** Stream of newly ingested files with format indicators and direct links.

Quick navigation tiles provide one-click access to Library, Recorders, Playout, Jobs, Downloads, and Settings.

4. Recorders

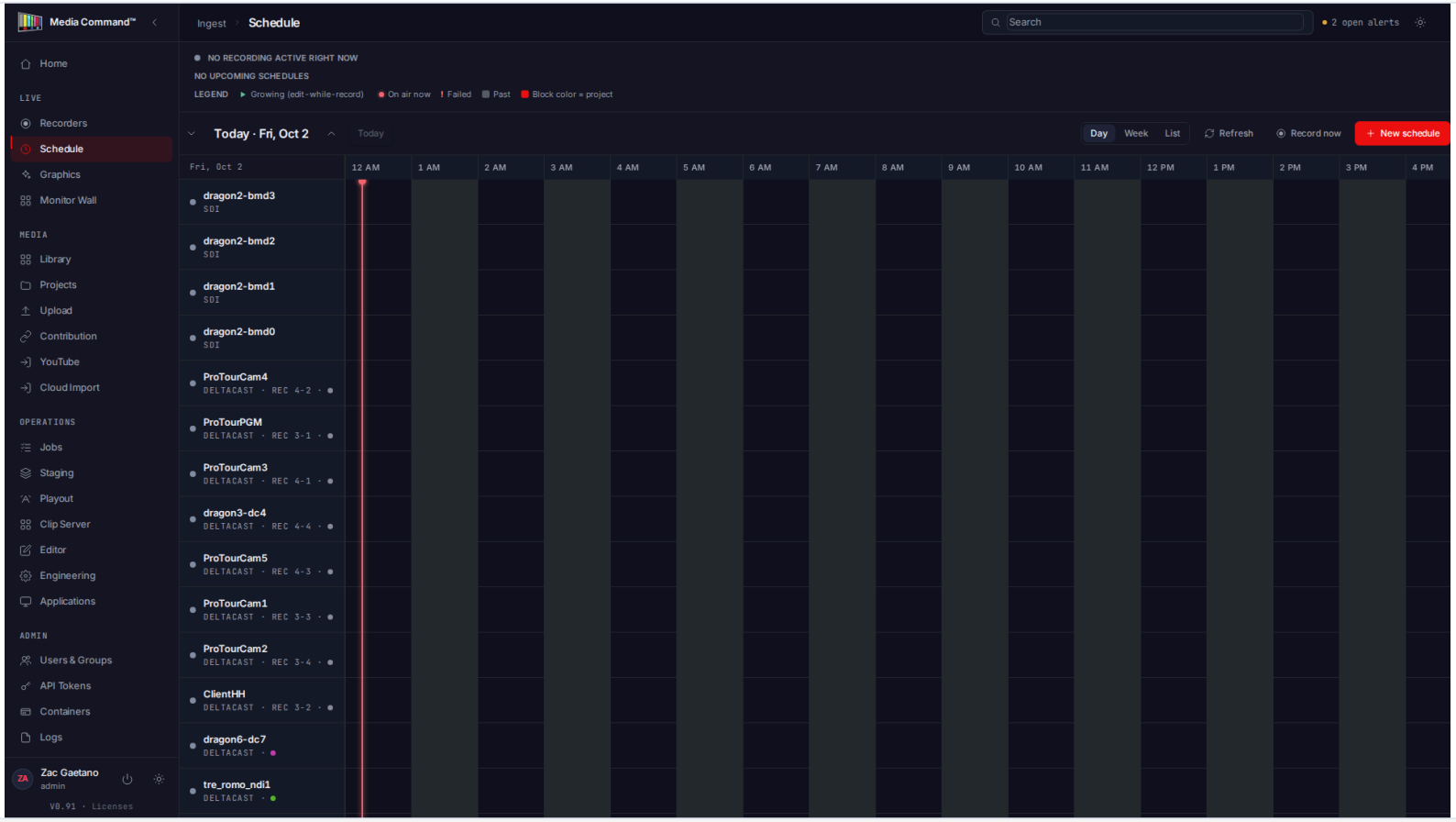


Recorders — Physical SDI capture ports and network ingest engines across the cluster

The **Recorders** interface controls physical SDI capture ports (Deltacast PCIe) and network ingest engines across the distributed cluster.

- **Port Matrix:** Each card represents a physical Deltacast SDI port or network stream receiver (e.g., `dragon4-dc0` through `dragon6-dc7`).
- **Signal Detection:** Real-time input format indication (`1080i59.94`, `1080p29.97`, `2160p59.94`).
- **Codec Selection:** Per-port independent codec profiles including ProRes 422/HQ, DNxHD/DNxHR, H.264, and HEVC (fMP4).
- **Actions:** `Create Recording` (immediate manual), `Add Stream` (SRT/RTMP/NDI provisioning), `Reset to Default`.

5. Schedule

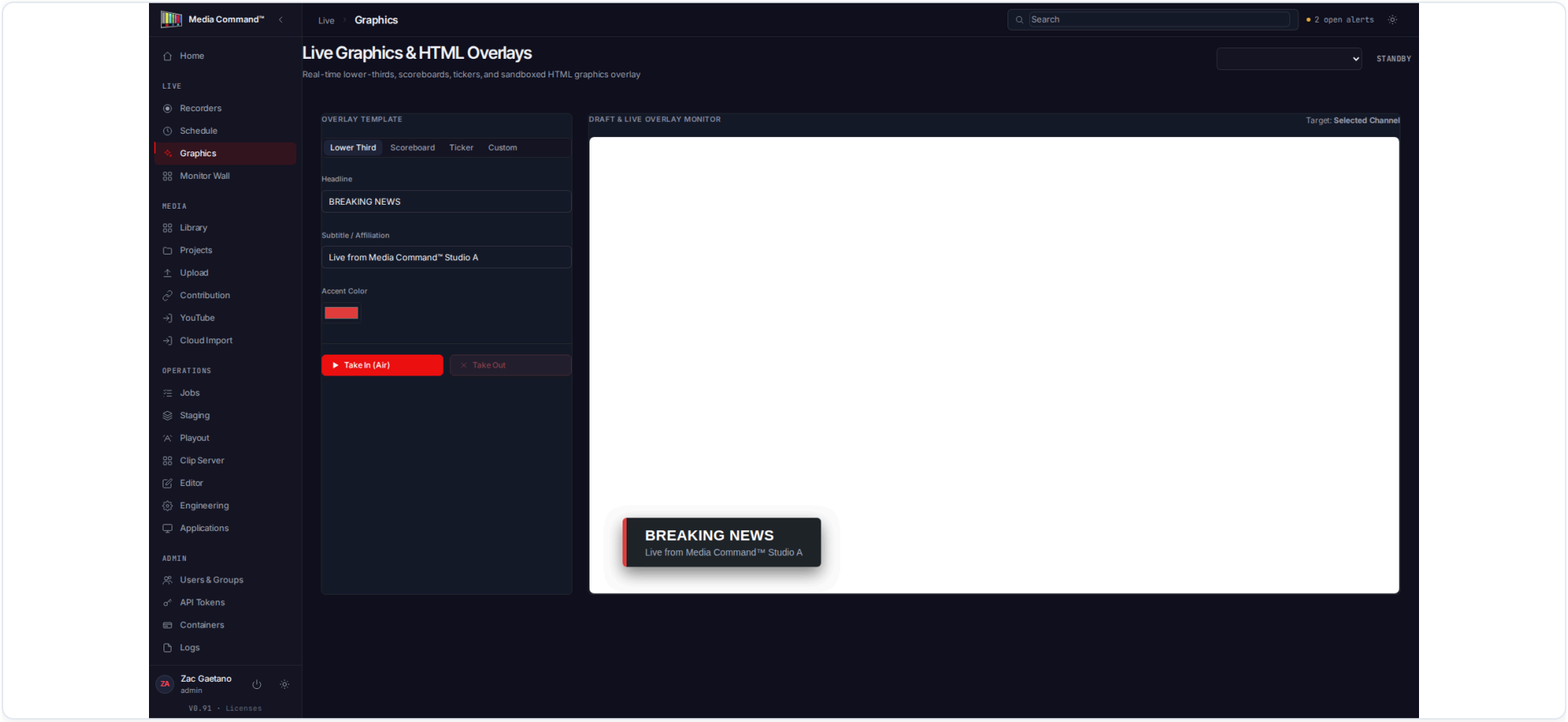


Schedule — Automated broadcast event capture calendar

The **Schedule** module automates recurring broadcast captures and satellite/fiber ingest events.

- **Event Calendar:** Grid-based timeline of upcoming scheduled recordings.
- **Traffic Import:** CSV run-sheet and broadcast traffic schedule imports.
- **Auto-Routing:** Matches events to available ports and target project bins.
- **Pre/Post-Roll:** Configurable safety buffer times around scheduled windows.

6. Live Graphics & HTML Overlays



Live Graphics — HTML5 broadcast overlay engine

- **Sandboxed HTML5 Engine:** Chromium-backed offscreen rendering for dynamic graphics packages.
- **DataLinq Integration:** Live XML/JSON data feeds (sports scores, lower-thirds, tickers).

- **DSK Layer Stacking:** Controls downstream keying (DSK 1-4) over playout or recorder previews.

7. Monitor Wall

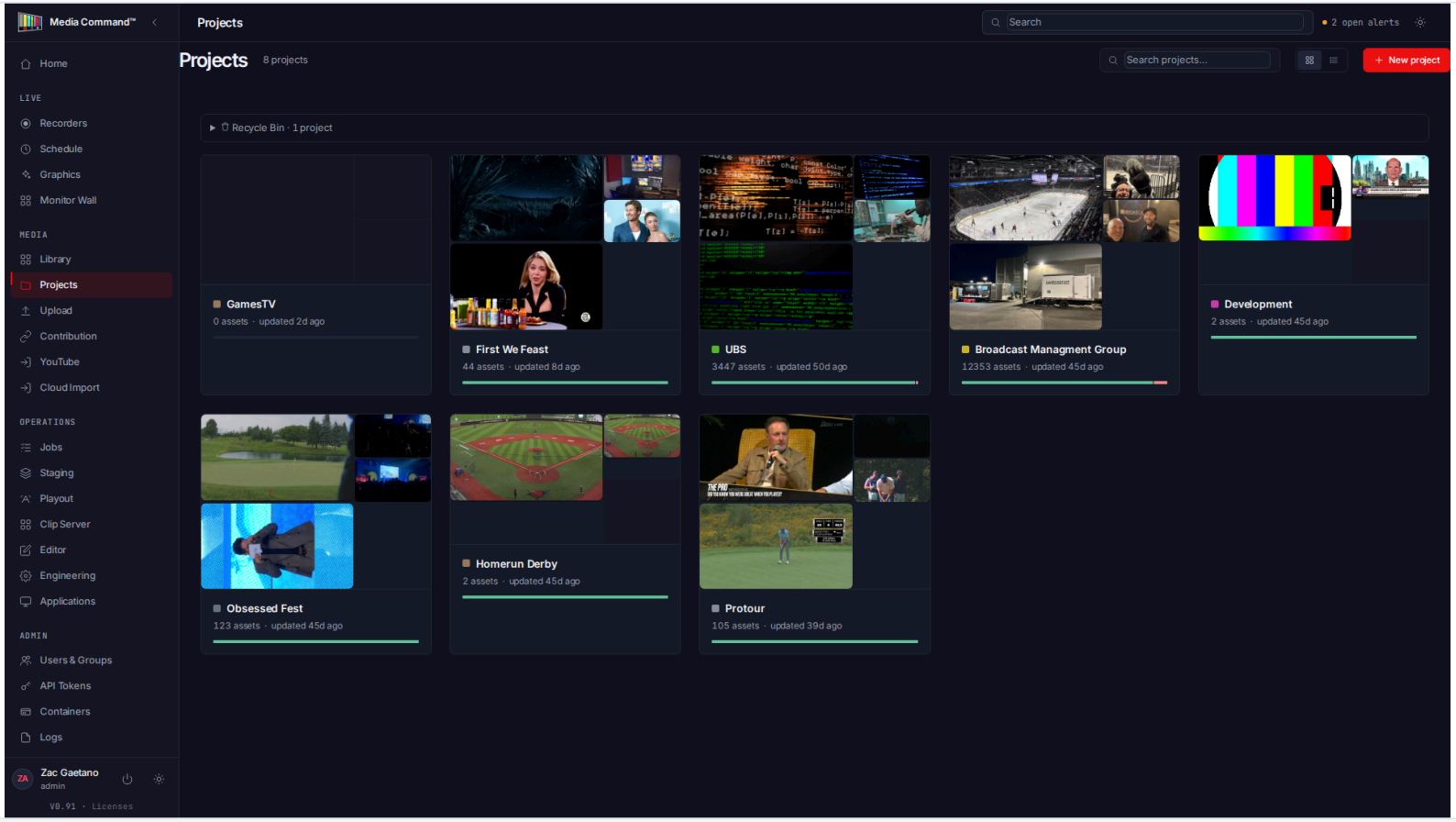


Monitor Wall — High-density WebRTC multiviewer for control rooms

- **Dynamic Grid Layouts:** `Auto`, `2×2`, `3×3`, `4×4`, `6×6`.
- **Feed Filters:** Recorders, WebRTC, Playout Channels, Live Feeds.

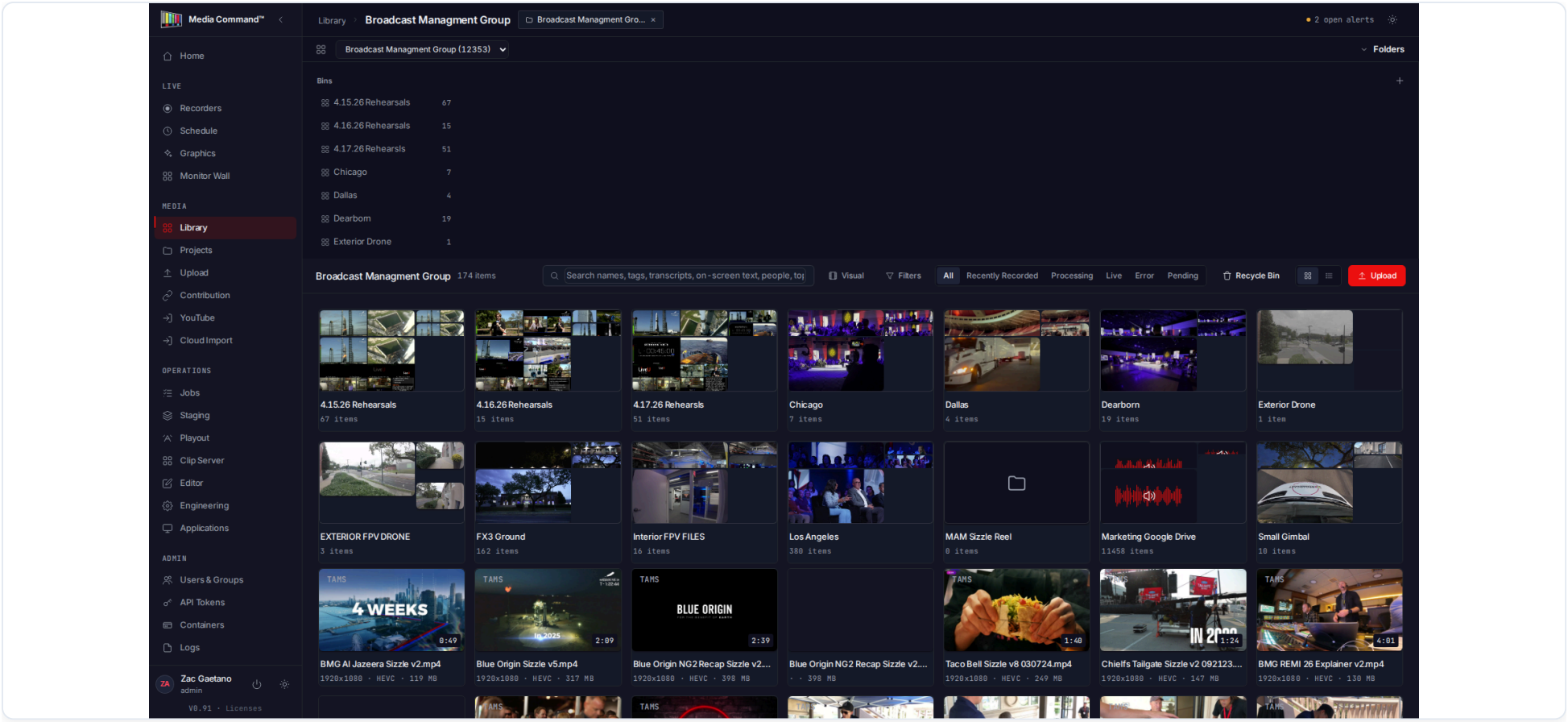
- **Sub-Second Latency:** WHEP/WebRTC streaming (<300ms) without plugins.
- **Audio Meters:** Multi-channel VU meters on active video tiles.

8. Projects Management



Projects — Workspace directory showing all active productions

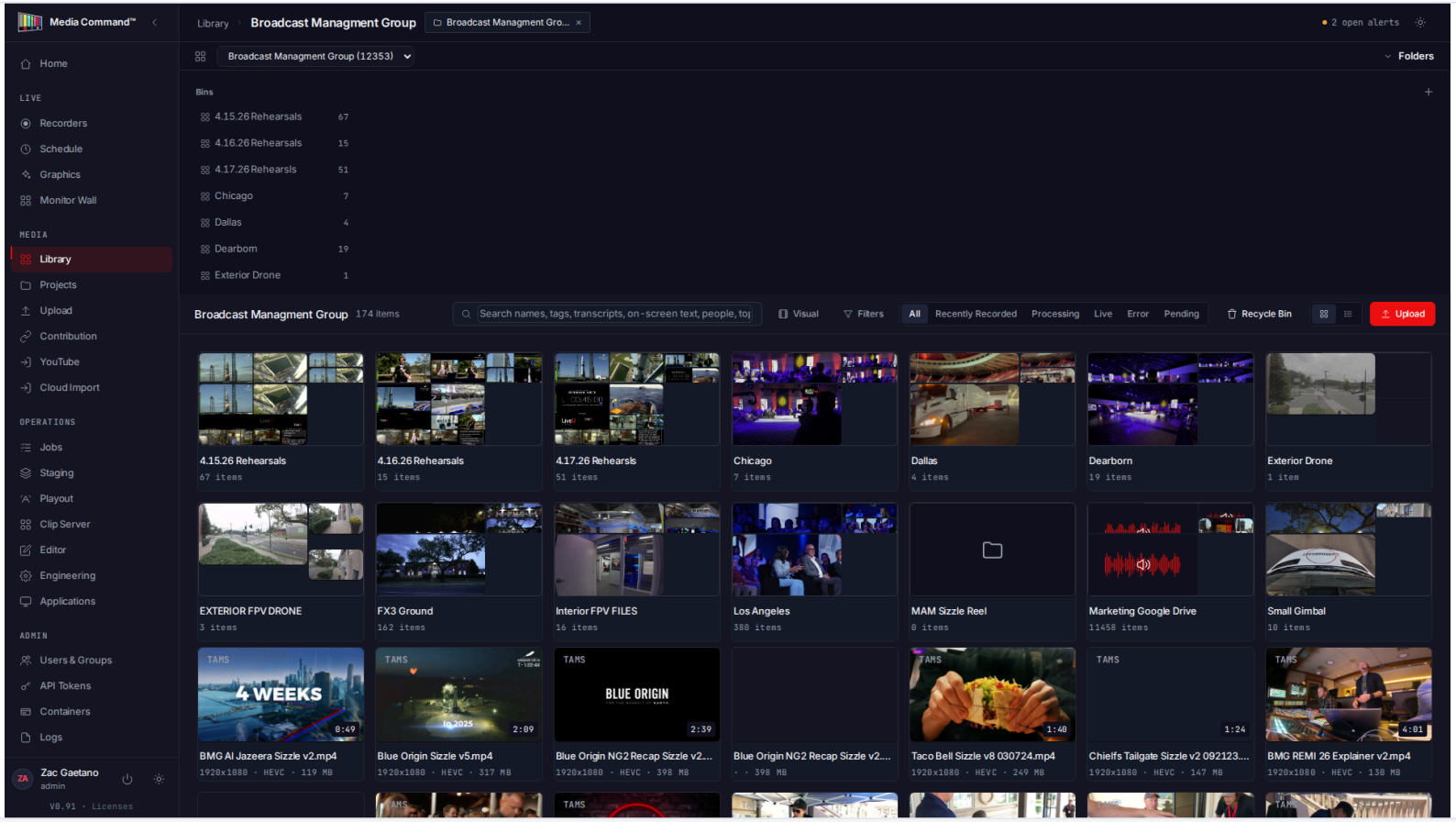
Projects are top-level workspaces isolating media, permissions, bins, and storage quotas. The BMG production environment hosts 8 active projects including **Broadcast Management Group** (12,353 assets), **UBS** (3,447 assets), **Protour**, and others.



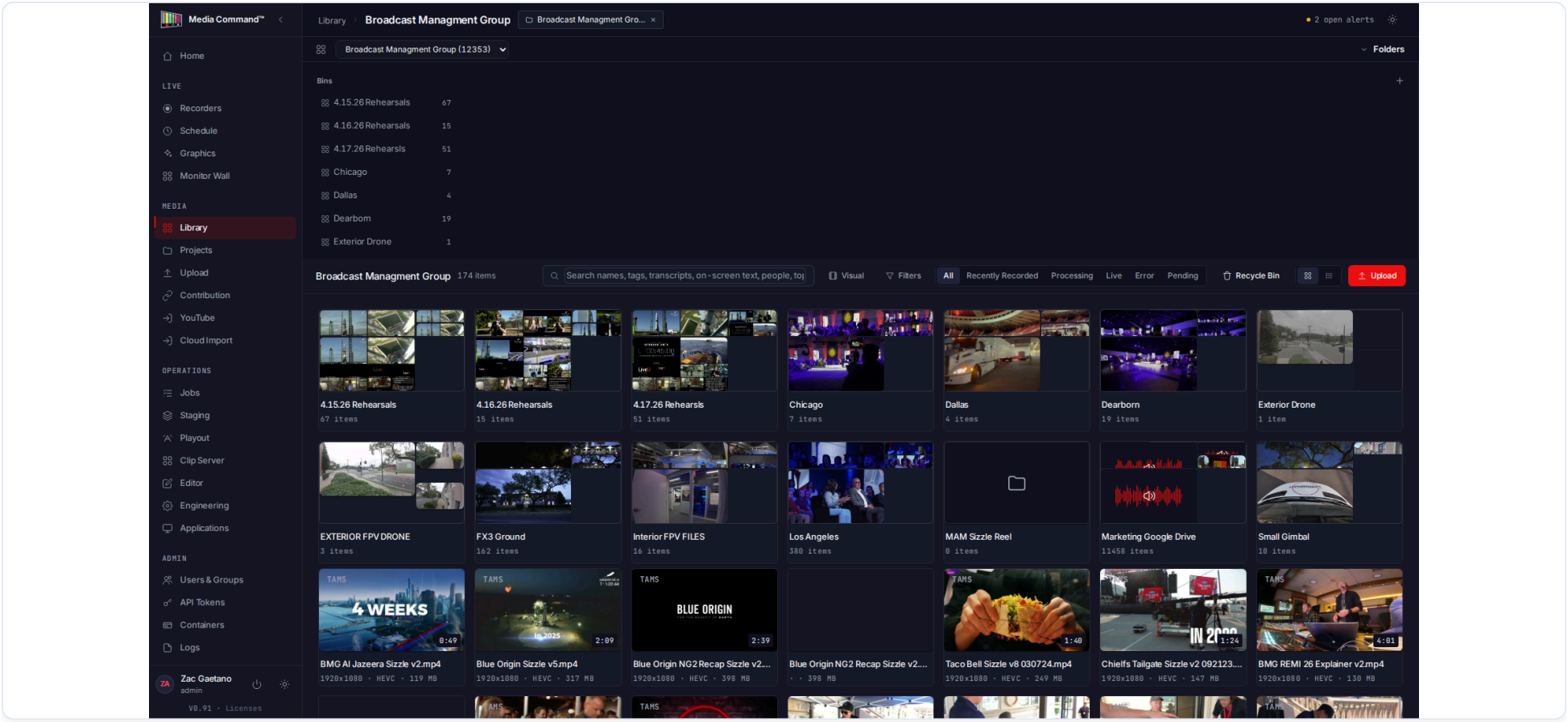
Broadcast Managment Group project opened — bins and folders (Marketing Google Drive 11,458 items, Los Angeles 380, FX3 Ground 162)

- **Project Creation:** Define name, storage allocation, default codec preset, and assigned user groups.
- **Recycle Bin Isolation:** Deleted assets quarantine separately per project.

9. Media Library



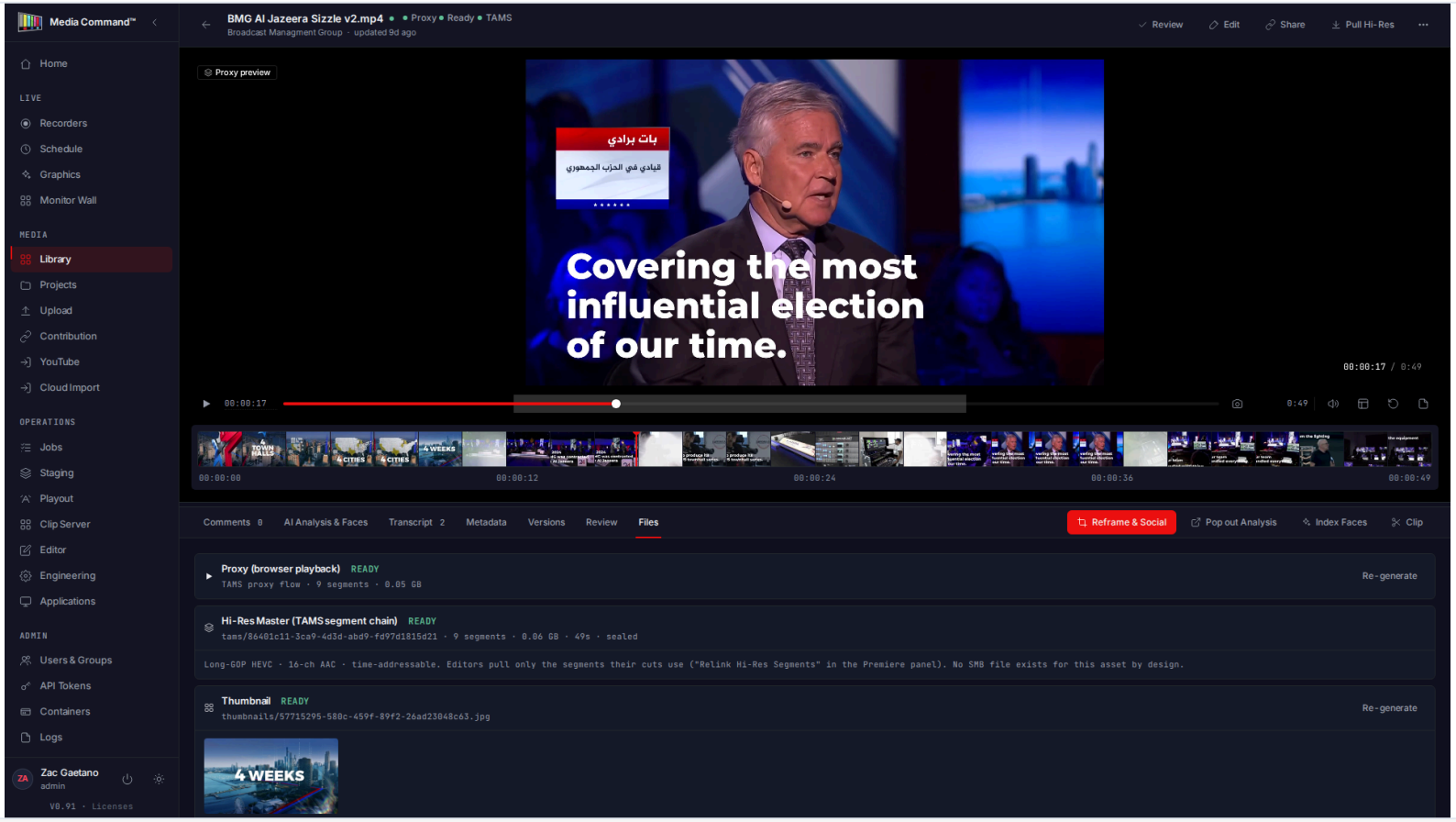
Media Library — Broadcast Managment Group: bins (4.15.26 Rehearsals, Chicago, Dallas, Dearborn, Exterior Drone) and folders



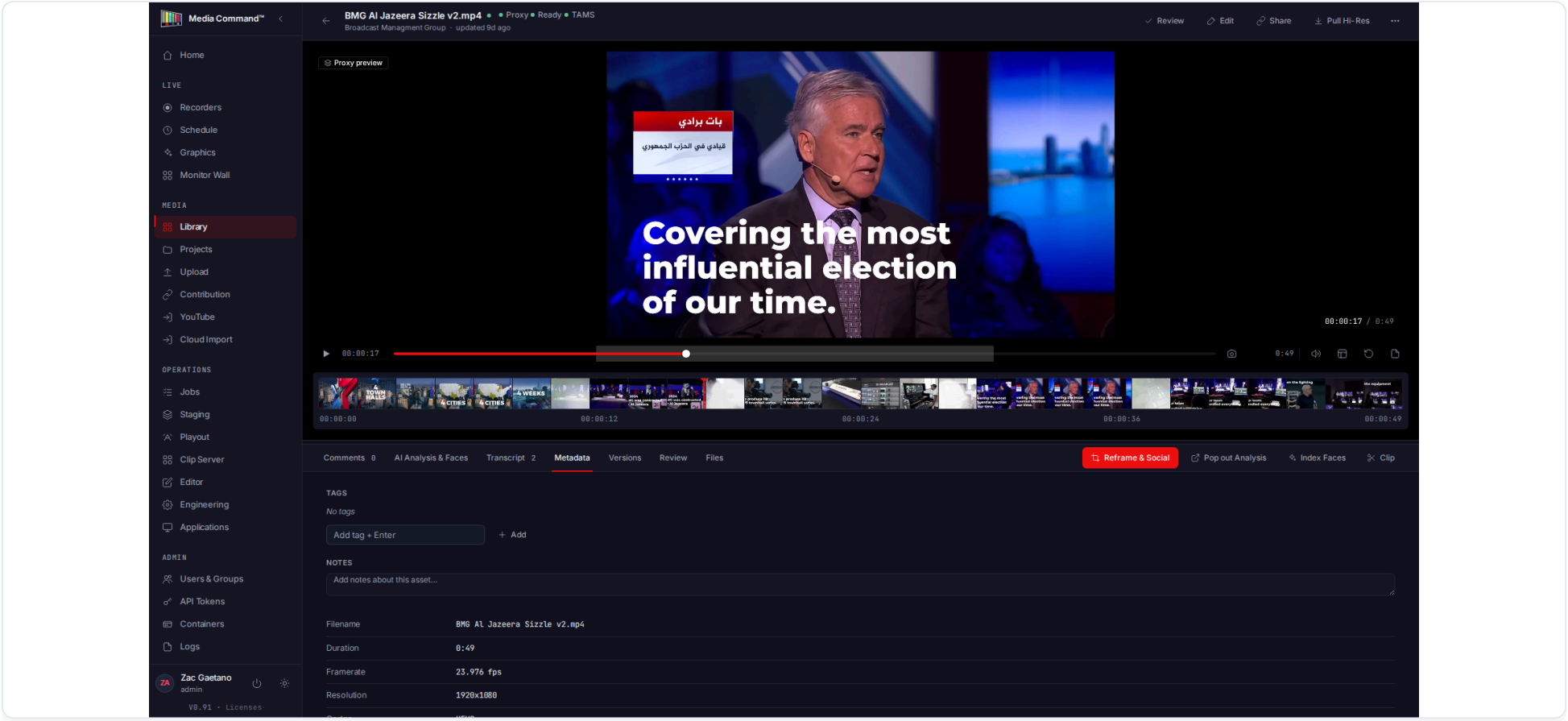
Media Library — folder grid with real thumbnails (FX3 Ground, Los Angeles, Marketing Google Drive)

- **Project Workspace Switcher:** Quick dropdown to toggle between projects or master `★ All Projects (Admin View)`.
- **Search & Filtering:** Full-text search across filenames, tags, tape IDs, and custom metadata. Faceted filters by file type, codec, resolution, and date range.
- **Display Modes:** List view, thumbnail grid, and filmstrip scrub view.
- **Bin Navigation:** Hierarchical folder and smart-bin tree organization.

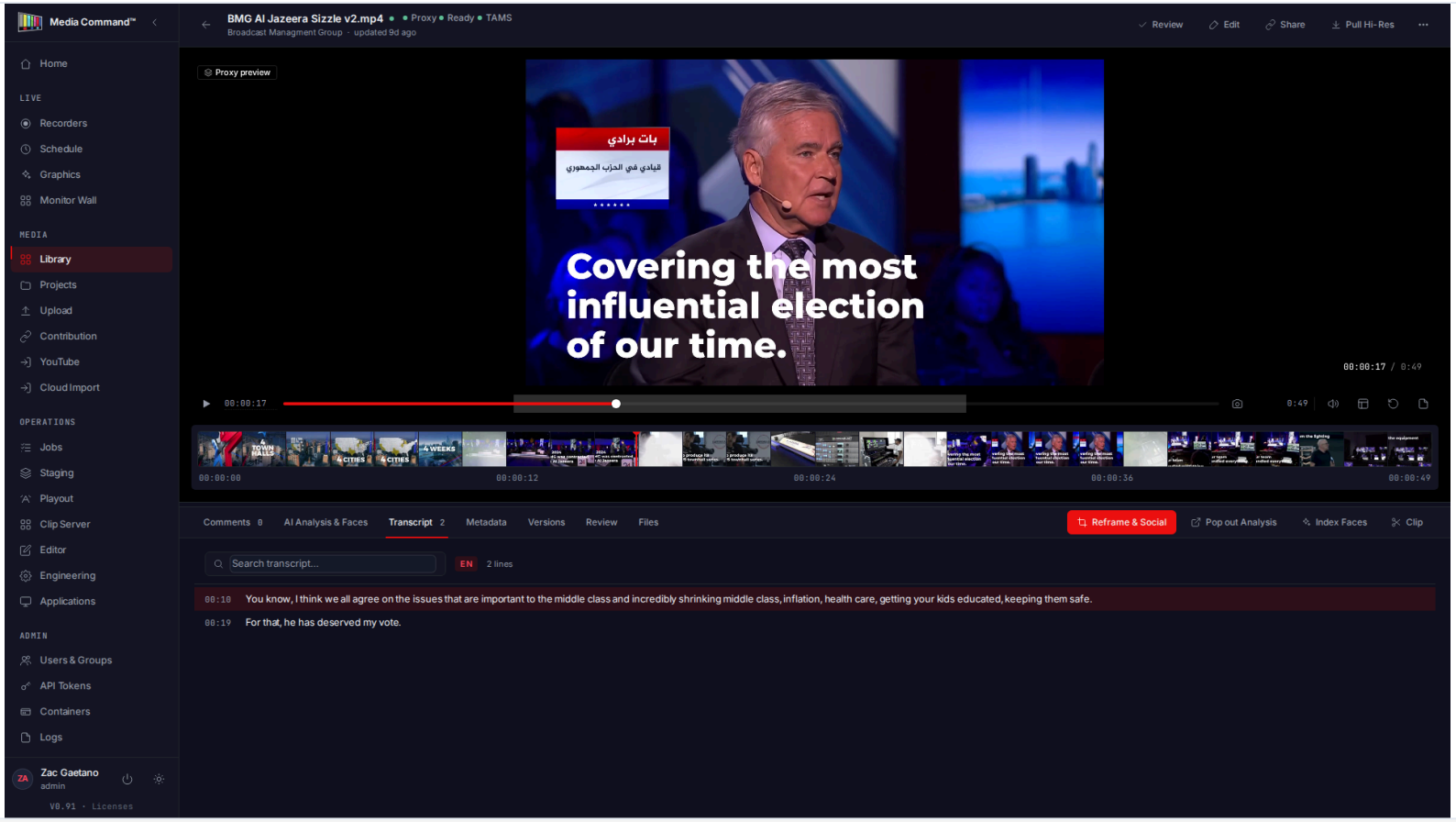
10. Asset Inspector & Player



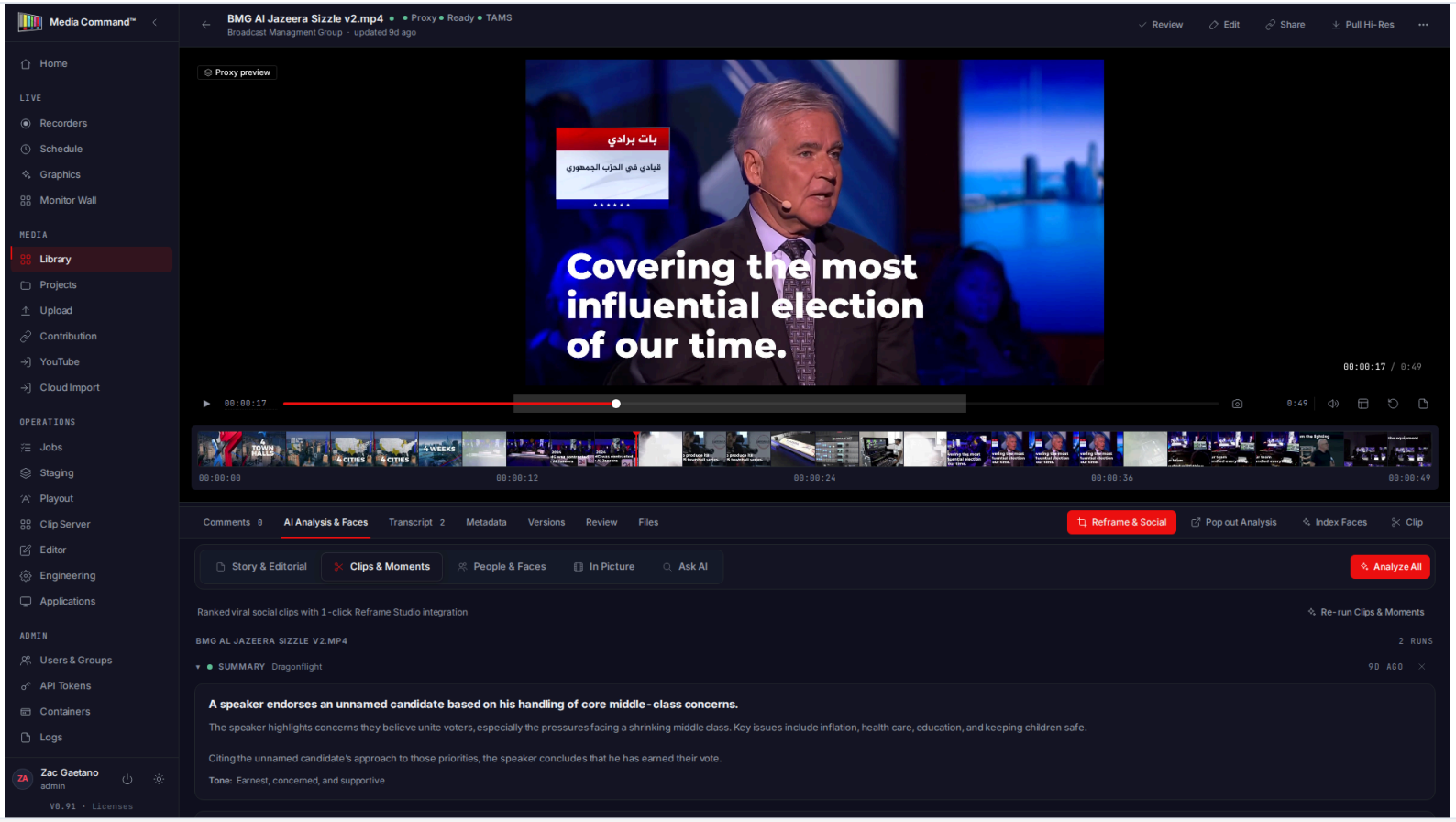
Asset Detail — BMG Al Jazeera Sizzle v2.mp4 (1920x1080 HEVC, 0:49) paused at 00:00:17; Proxy, Hi-Res Master (TAMS) and Thumbnail renditions READY



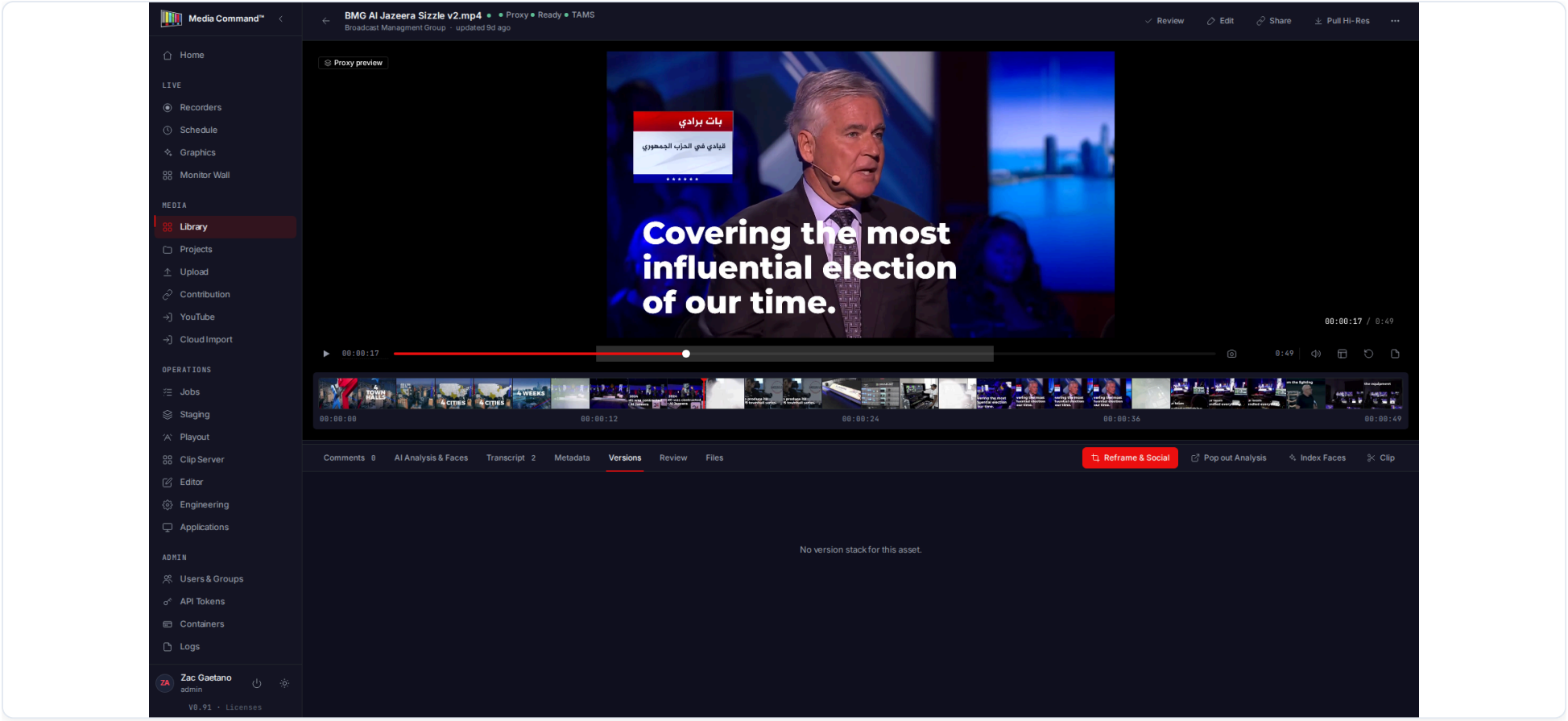
Asset Detail: Metadata tab — technical and descriptive metadata



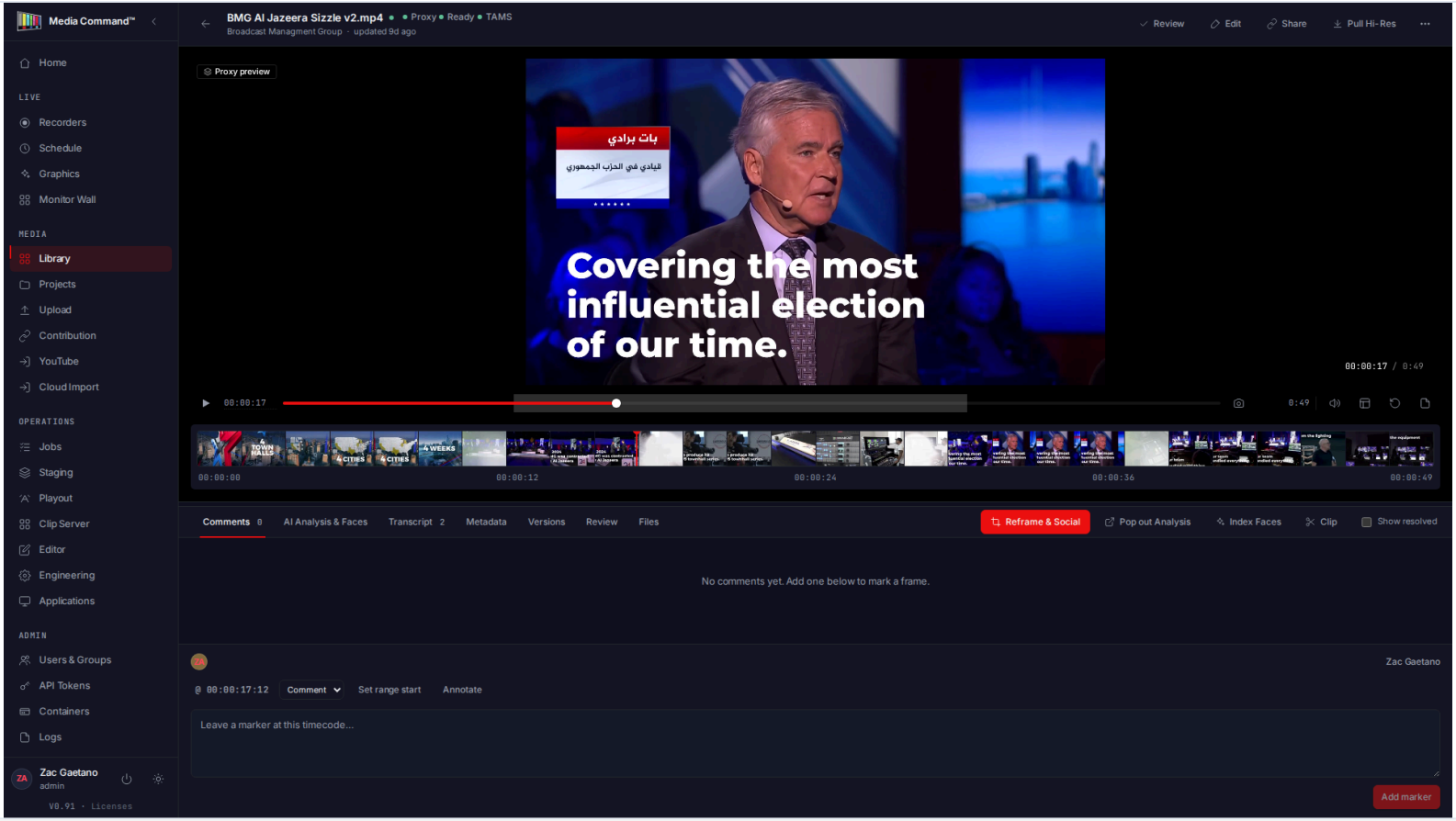
Asset Detail: Transcript tab — speech-to-text transcript



Asset Detail: AI Analysis & Faces tab



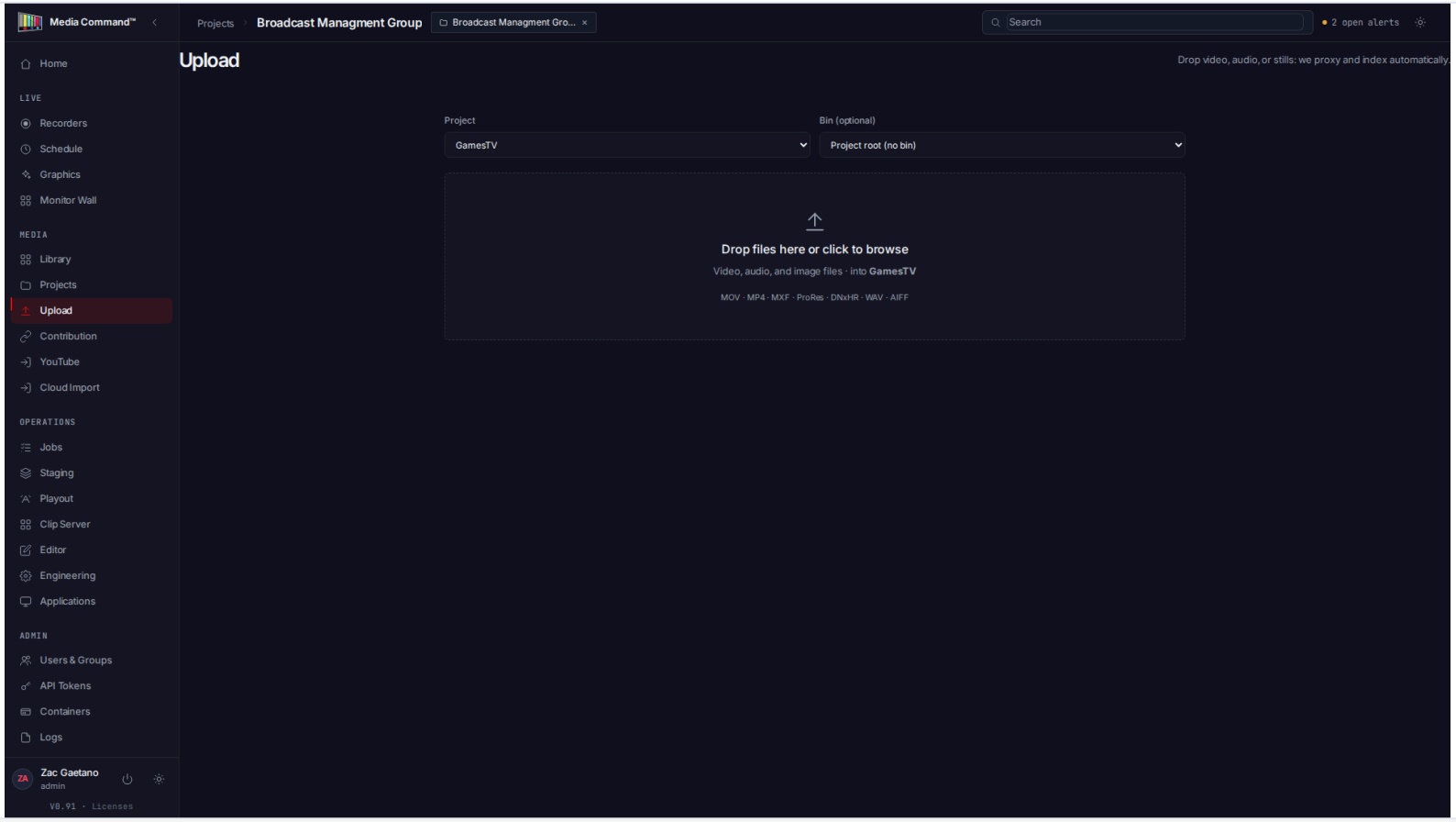
Asset Detail: Versions tab



Asset Detail: Comments tab — review annotations

- **Broadcast Timecode Player:** Frame-accurate scrubbing, J-K-L shuttle, SMPTE timecode readout.
- **TAMS Adaptive Playback:** Smooth scrubbing on multi-hour growing capture files.
- **Multi-Track Audio:** Visual waveform display with individual channel solo/mute (up to 16 discrete channels).
- **Technical Metadata:** Container, stream profile, resolution, frame rate, bit rate, color space, S3 object key, checksums.
- **Markers & Sub-clipping:** Set In/Out points (`I` / `O` keys) for subclip export or render job dispatch.

11. Media Upload

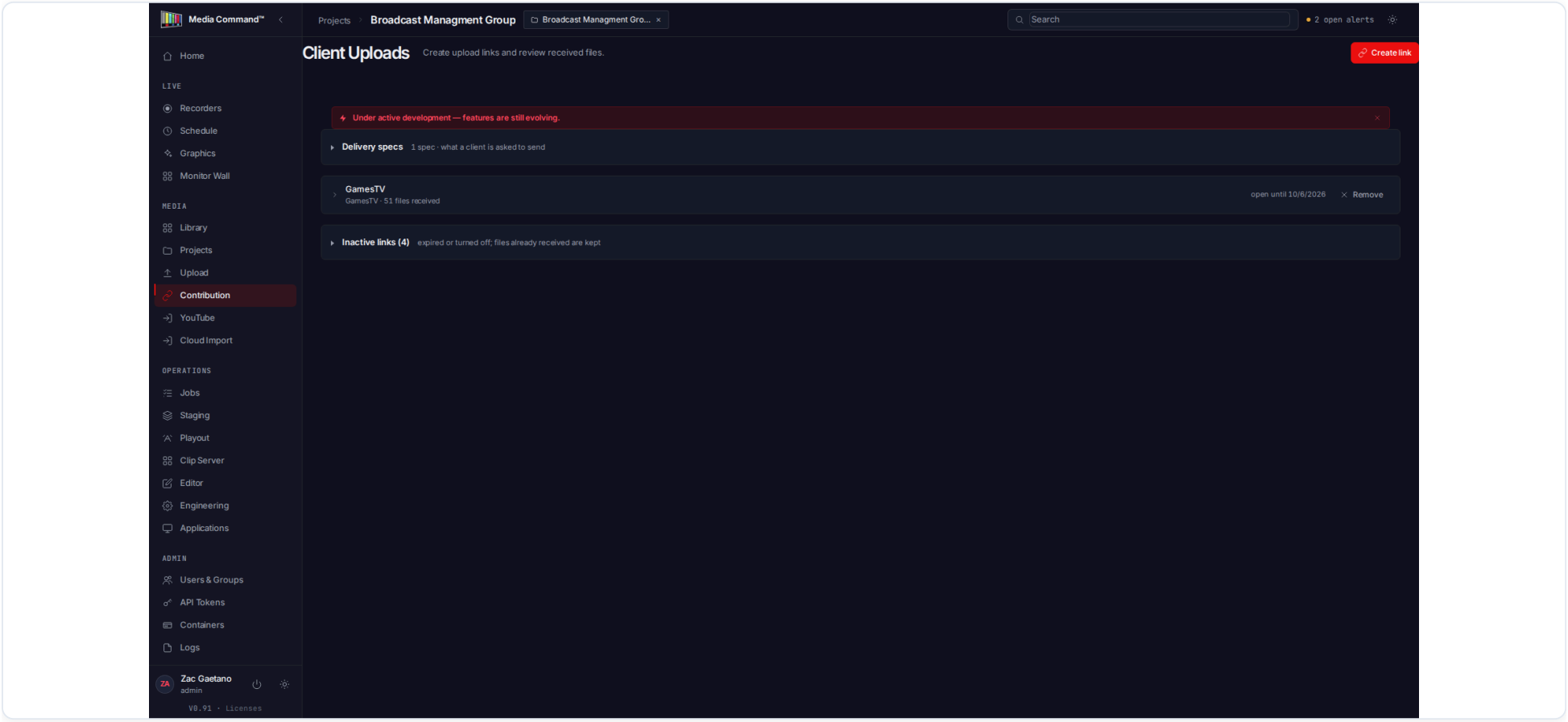


Media Upload — Chunked resumable web ingest into target project bins

- **Chunked Resumable Upload:** Pause/resume for 100GB+ files.
- **Target Bin Selector:** Direct assignment to project folders.

- **Automated Ingest:** Triggers proxy creation, thumbnail extraction, and waveform generation on completion.

12. Contribution Feeds

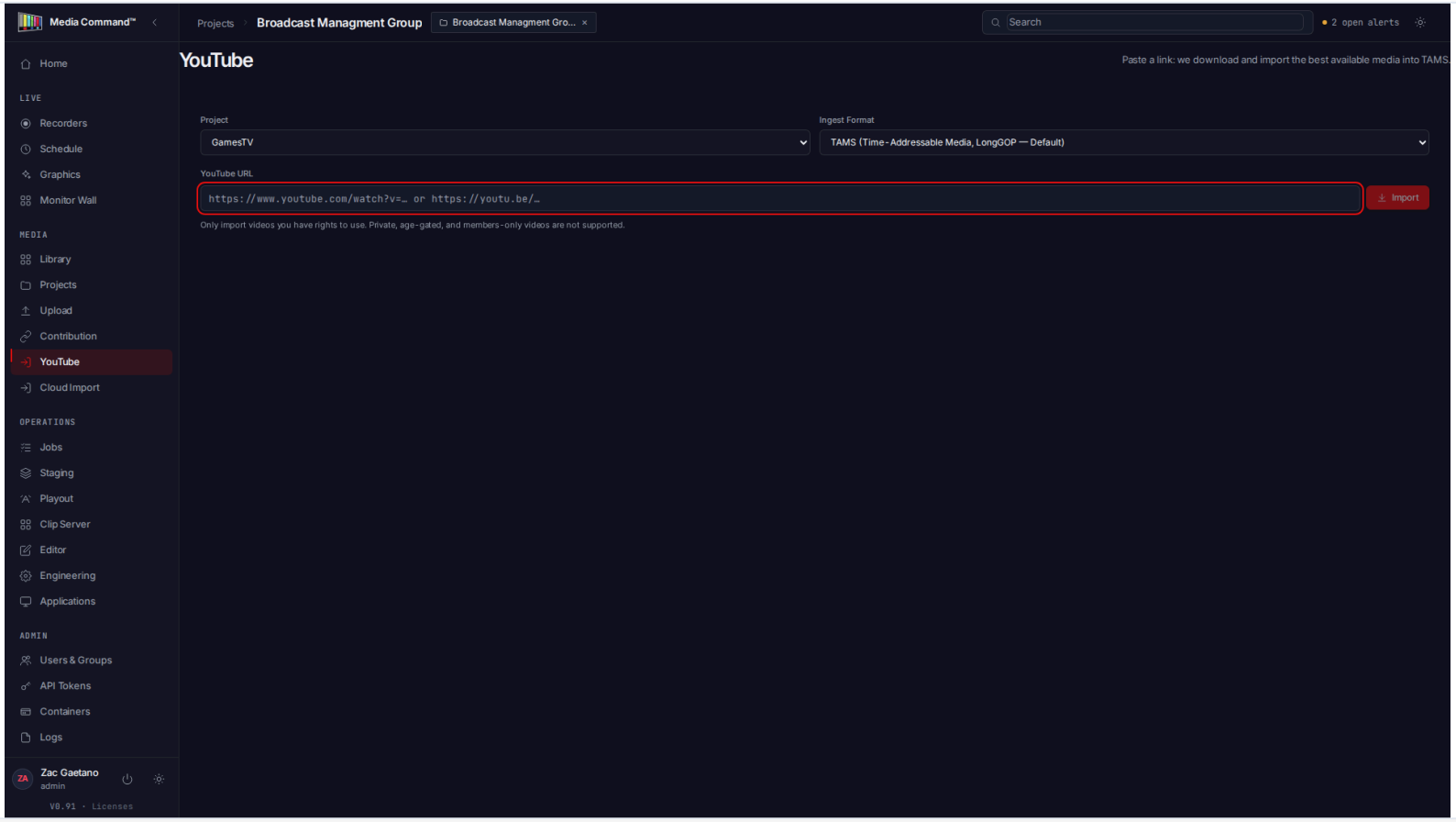


Contribution — SRT/RTMP caller/listener for remote broadcast feeds

- **SRT Caller/Listener:** Passphrase-protected low-latency streams (20ms – 2000ms).
- **RTMP/RTMPS Ingest:** Custom streaming keys for OBS, vMix, Wirecast.

- **Auto-Recording:** Automatically initiate TAMS recording on stream connect.

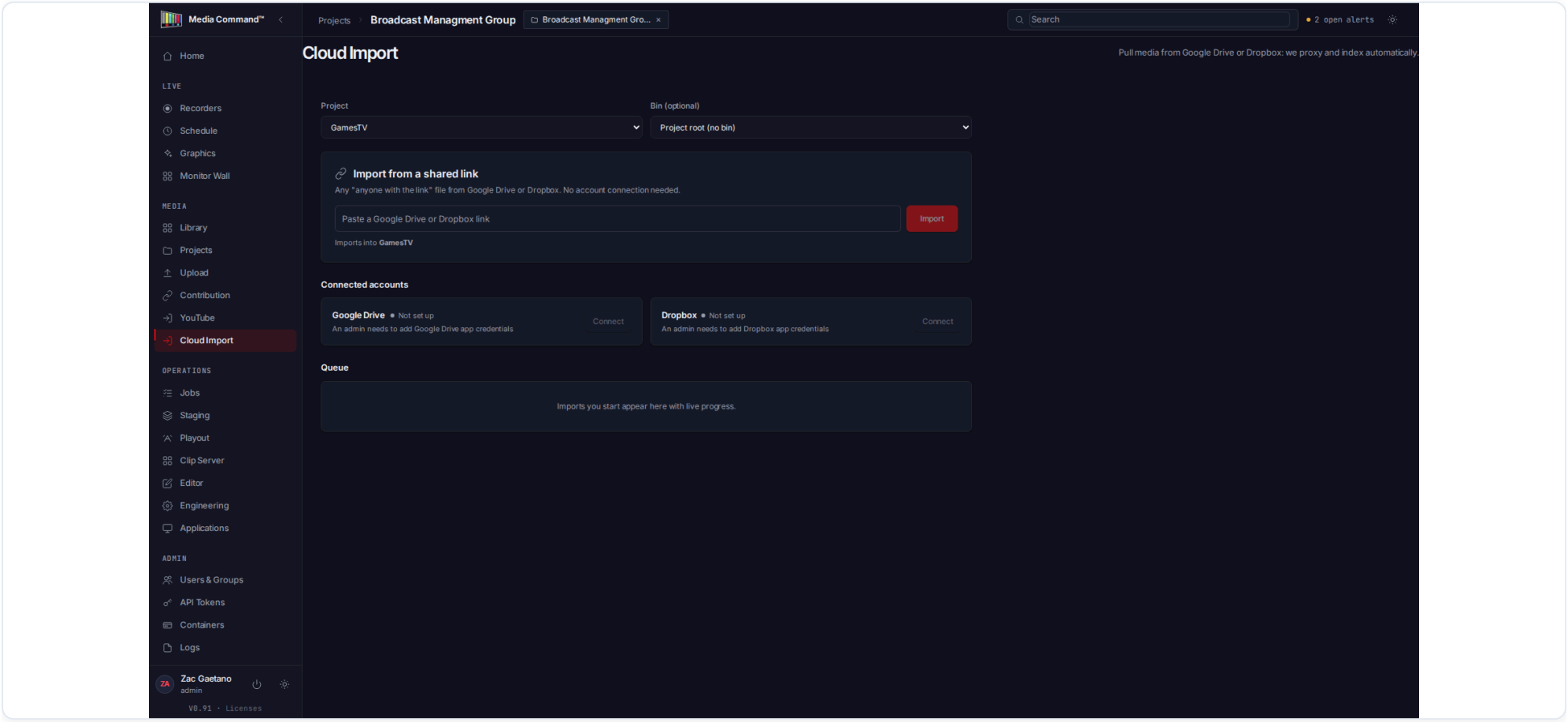
13. YouTube Direct Ingest



YouTube Ingest — Archive public/unlisted videos and live streams

- **URL Capture:** Paste any YouTube video or live broadcast URL for background download into the Library.
- **Live Stream Recording:** Records live YouTube feeds into TAMS fMP4 files for immediate editing.

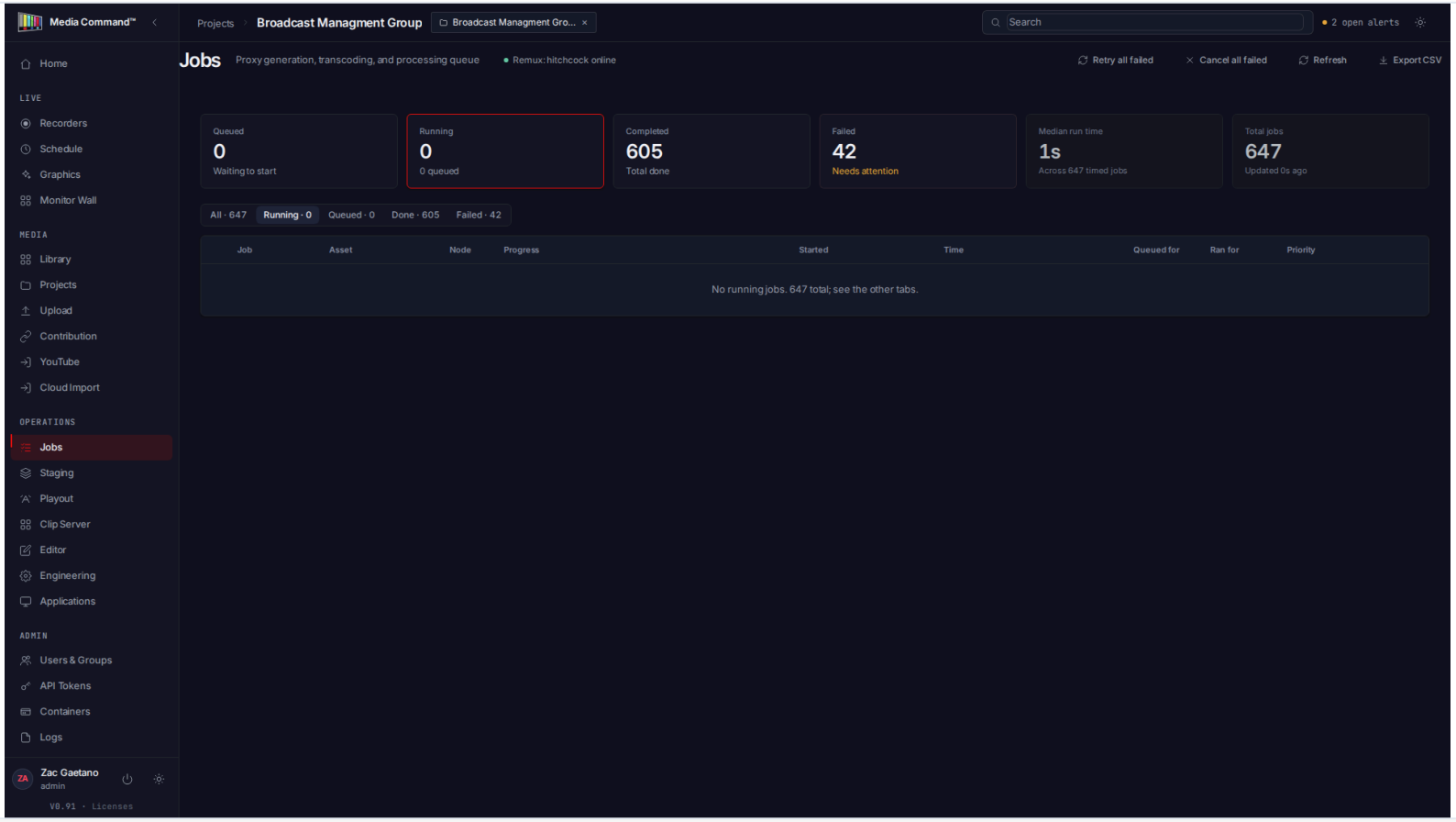
14. Cloud Import



Cloud Import — S3 bucket sync and Frame.io integration

- **S3 Bucket Sync:** Ingest from Amazon S3, Wasabi, Backblaze B2, or MinIO.
- **Frame.io Sync:** Import approved sequences, review comments, and dailies.

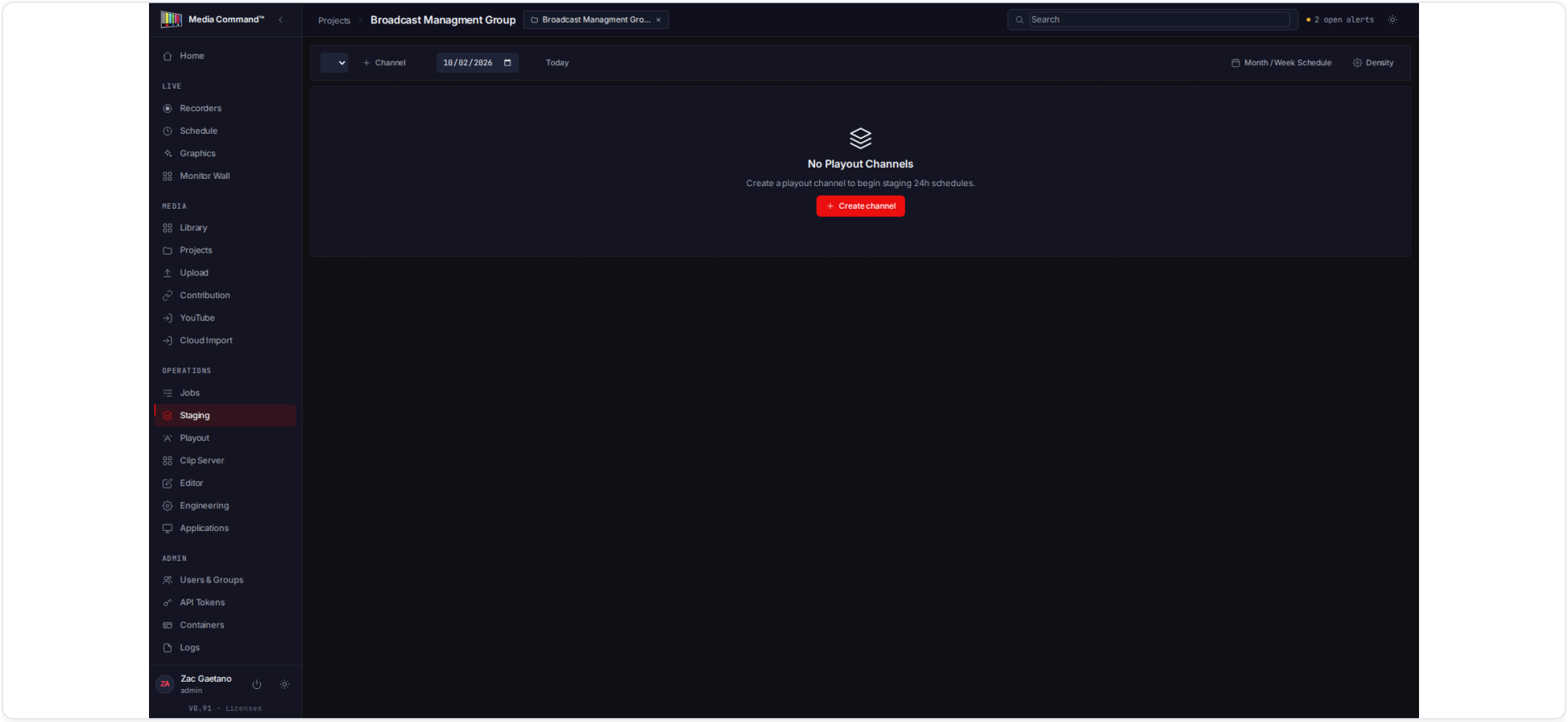
15. Background Jobs



Background Jobs — BullMQ distributed task pipeline monitoring

- **Queue Categories:** Transcode, Thumbnails/Waveforms, Conform/Export, Cloud Sync/Transfer.
- **Job Controls:** Live progress, error logs, retry, priority adjustment, failed job flushing.

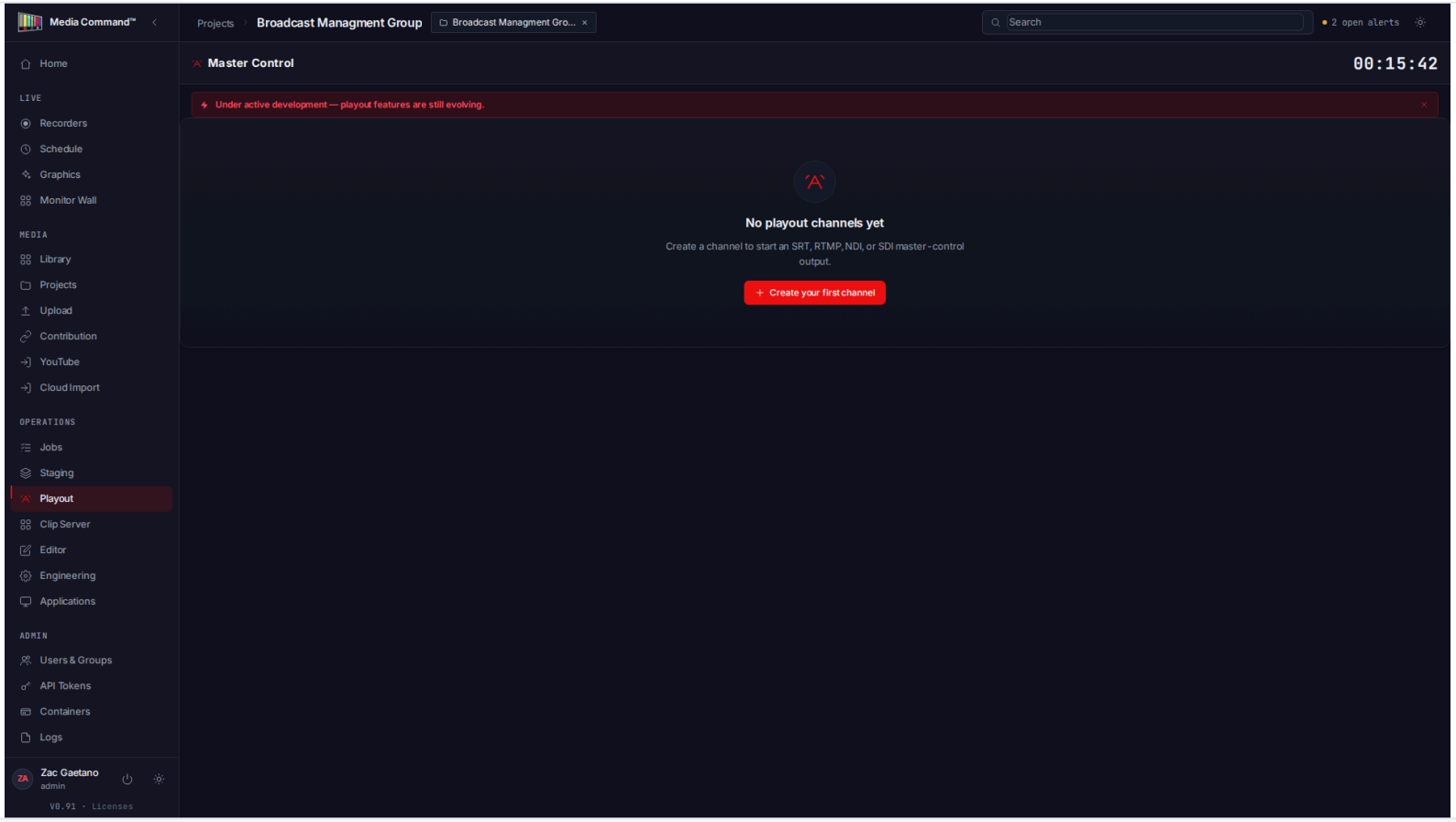
16. Staging



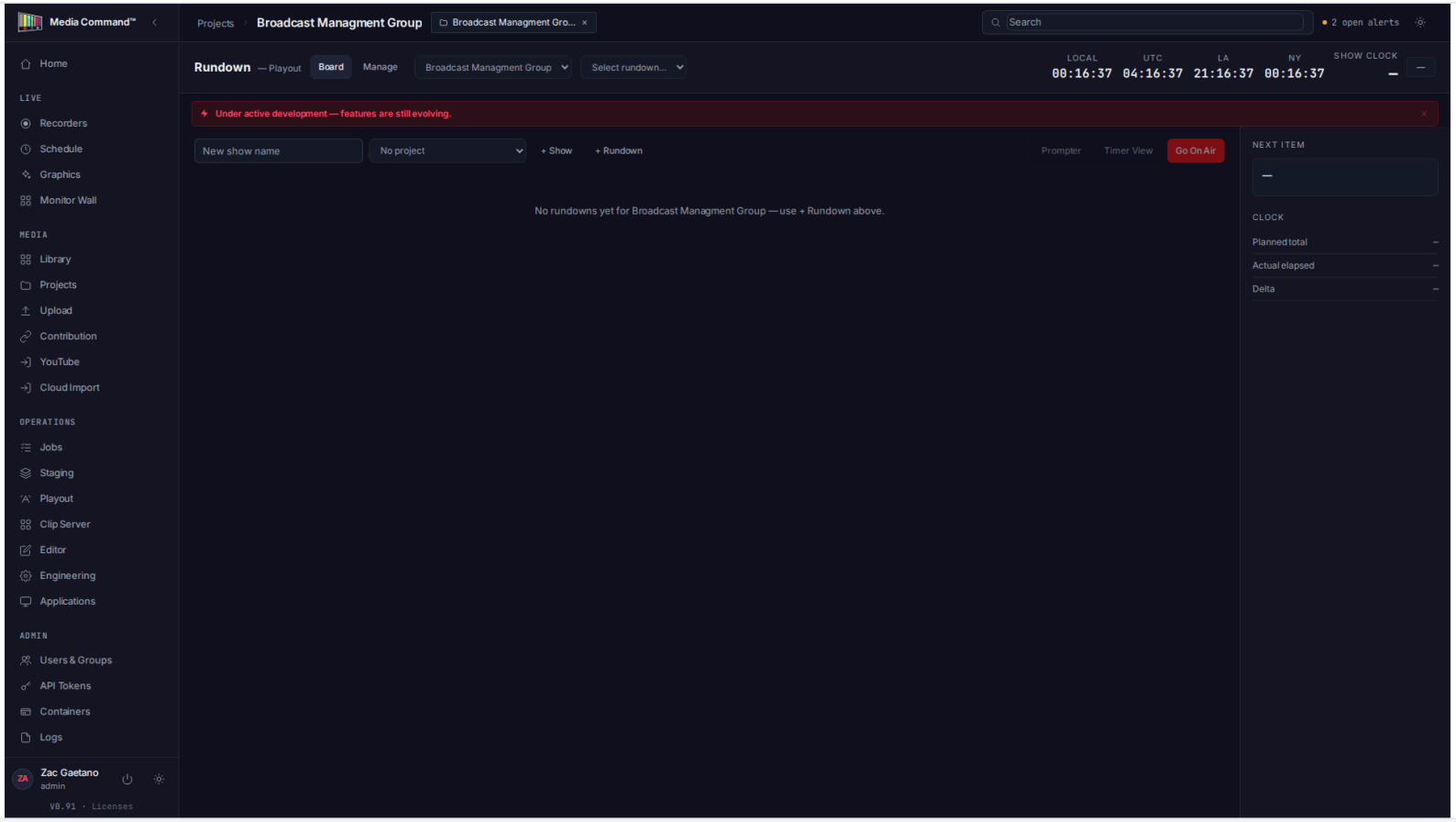
Staging — NVMe scratch storage monitoring and retention policies

- **Scratch Volume Utilization:** Tracks free space across cluster scratch disks.
- **Automated Retention:** Moves finalized assets to cold storage, purges temporary render artifacts.

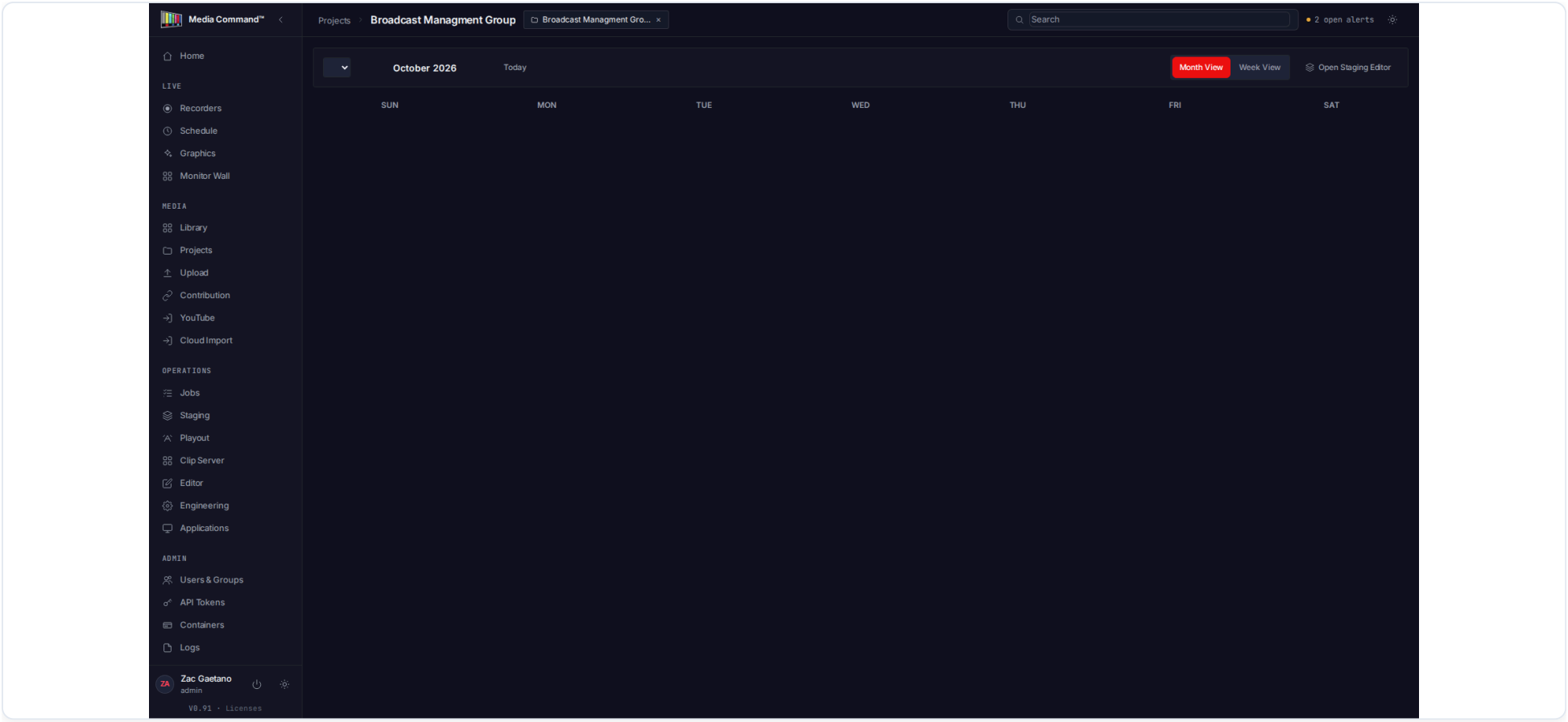
17. Playout



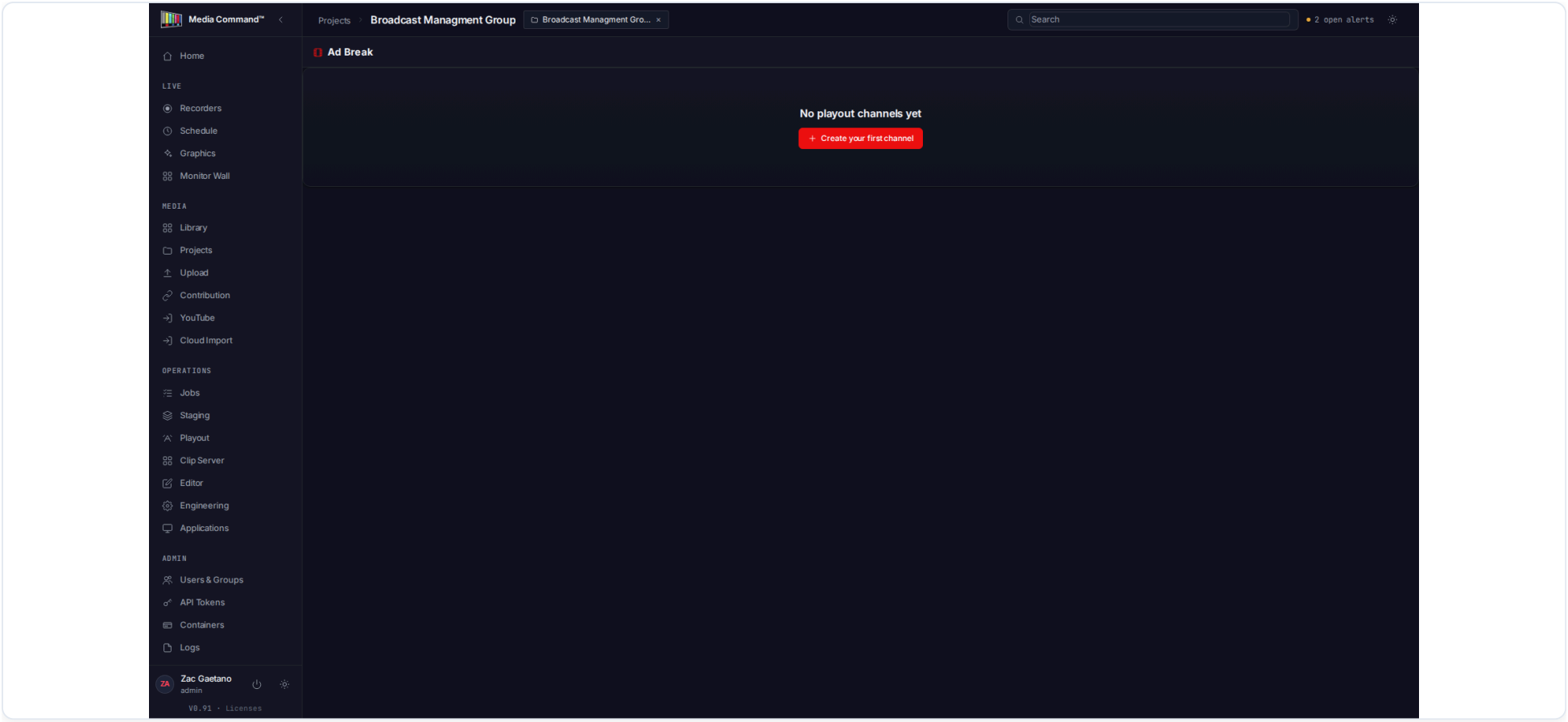
Playout — Master control channel automation and CasparCG NDI output



Playout: Rundown (#rundown)



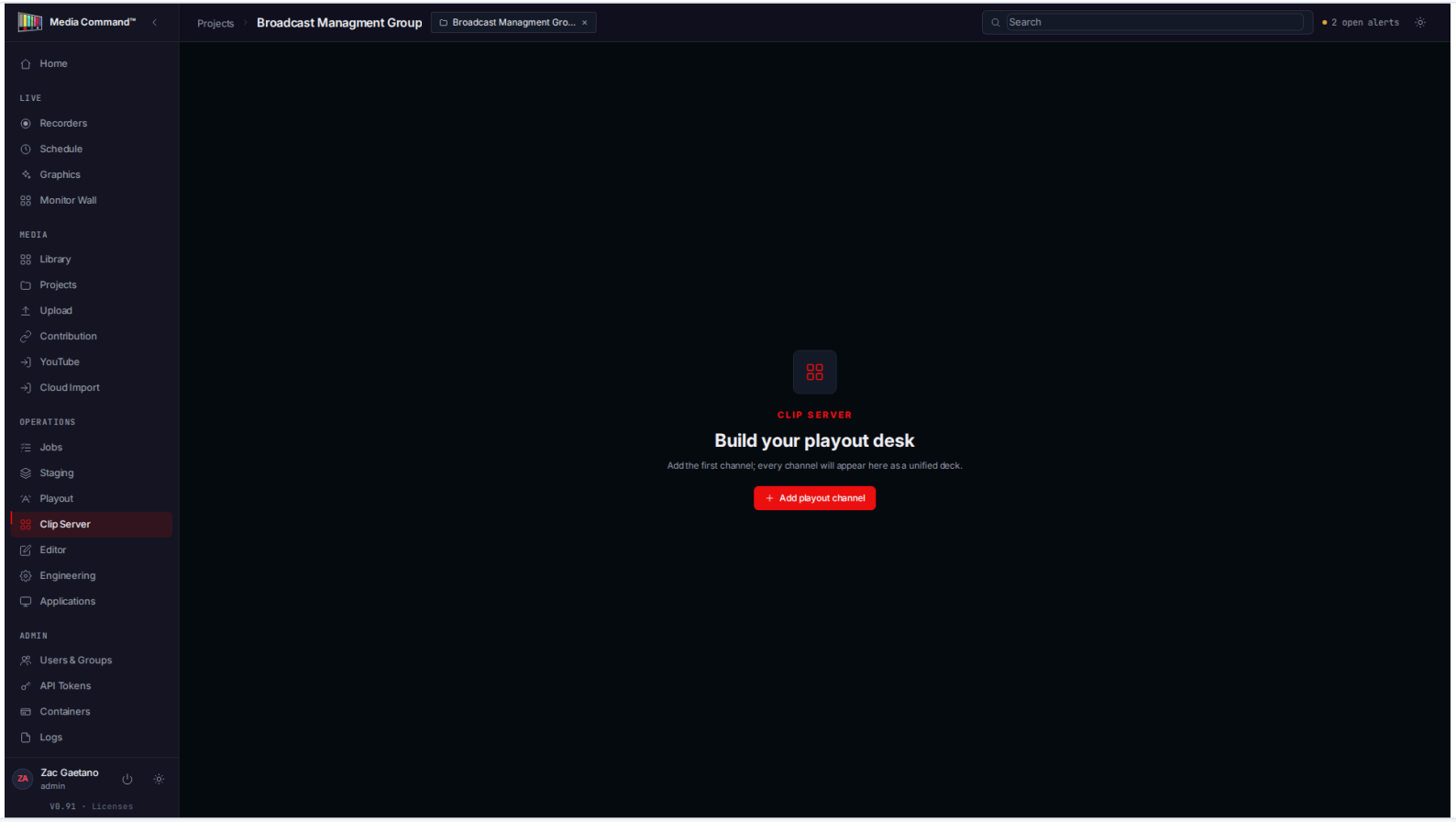
Playout: Playout Schedule (#playout-schedule)



Playout: Ad Break (#playout-ads)

- **Multi-Channel Playout:** CasparCG instances emitting SDI or NDI feeds.
- **Rundown Management:** Drag-and-drop playlist builder with CUE, PLAY, PAUSE, STOP, LOOP controls.
- **Confidence Monitoring:** Real-time program and preview return video monitors.

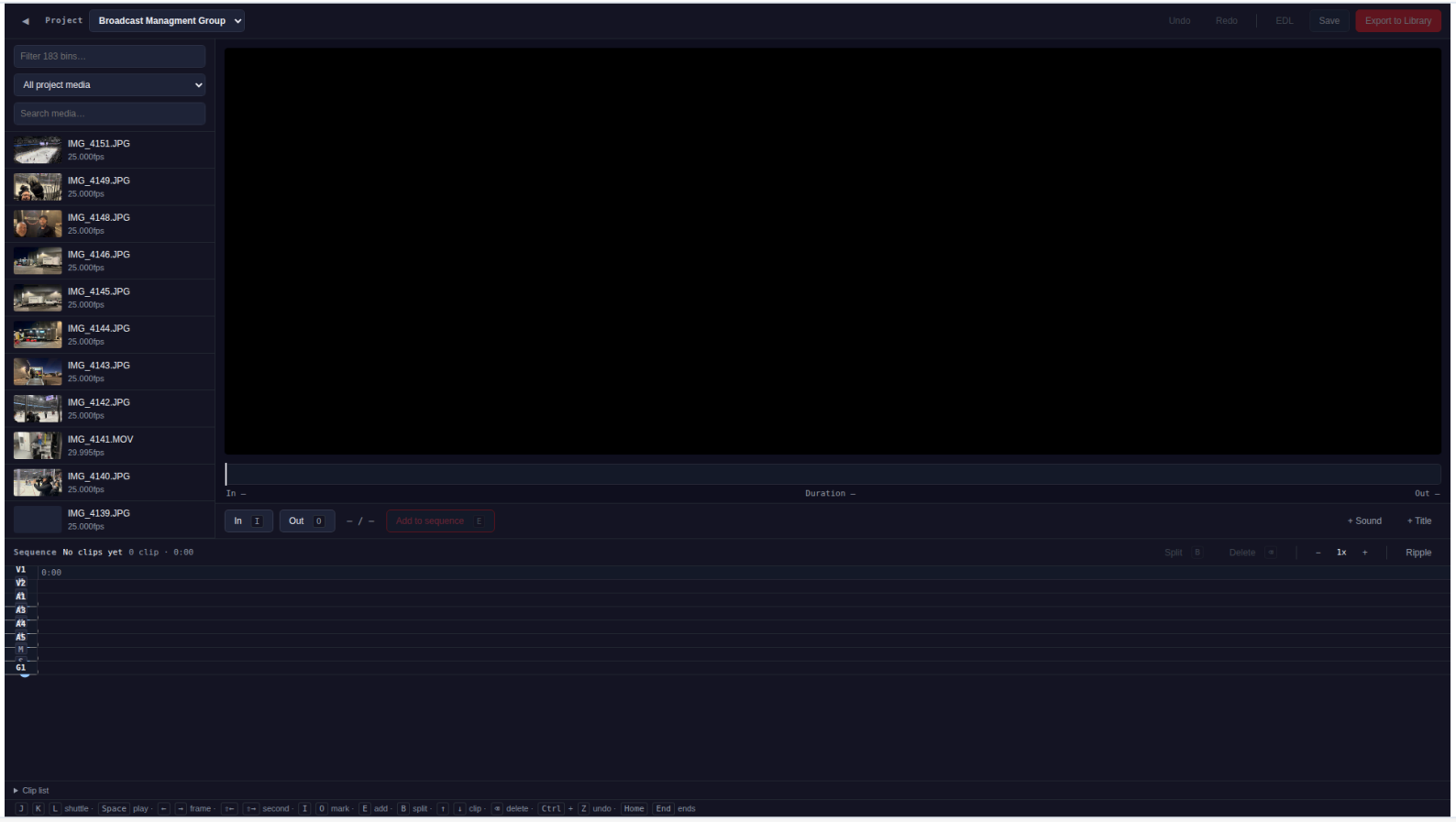
18. Clip Server



Clip Server — Instant-access cart wall for live studio replay

- **Cart Wall:** Configurable instant-trigger video clips, bumpers, stingers, and sound effects.
- **Zero-Latency Playback:** Pre-loaded frames in shared memory (`/dev/shm`) for frame-accurate firing.

19. Web Editor

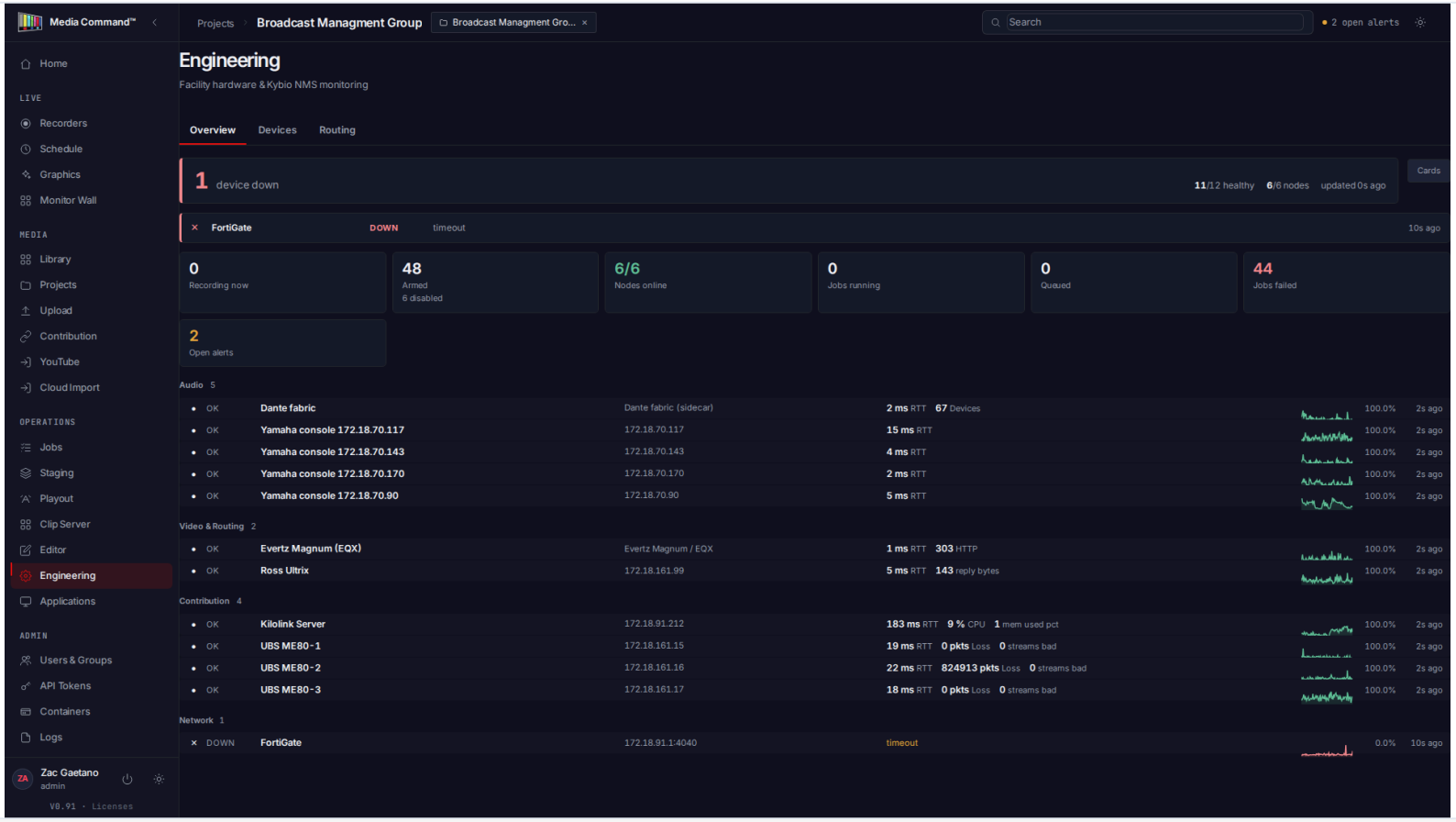


Web Editor (/editor.html) — BMG project media bin loaded; source monitor, V1-V2/A1-A5 timeline, EDL / Save / Export to Library

- **Multi-Track Timeline:** Video and audio tracks with ripple edit and razor tools.
- **Frame-Accurate Cuts:** GOP-boundary or smart-rendered trims on TAMS master flows.

- **Export Presets:** Social media presets (16:9, 9:16, 1:1) and MAM master bin publishing.

20. Engineering

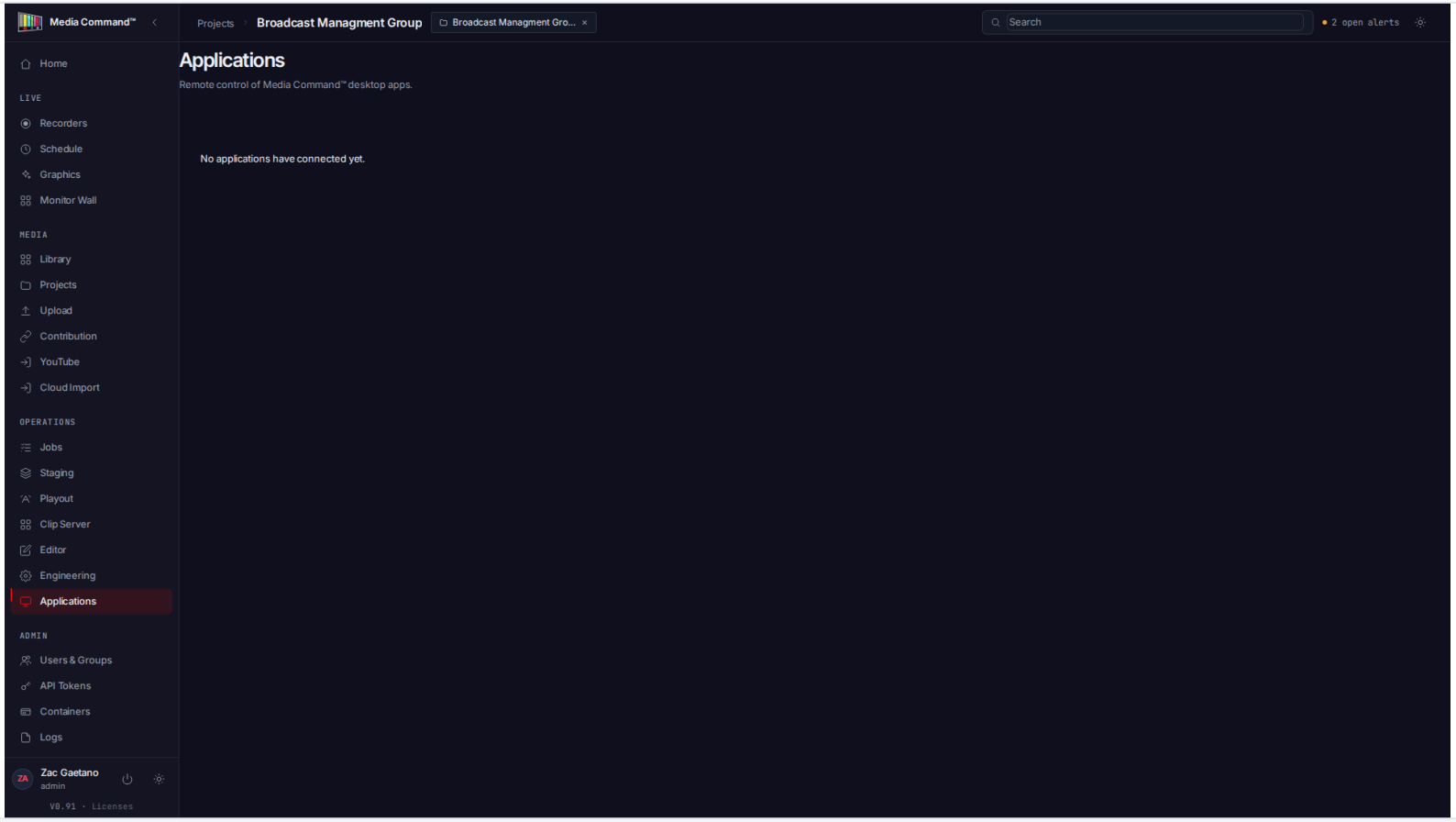


Engineering — Broadcast signal flow, GPU diagnostics, and timing infrastructure

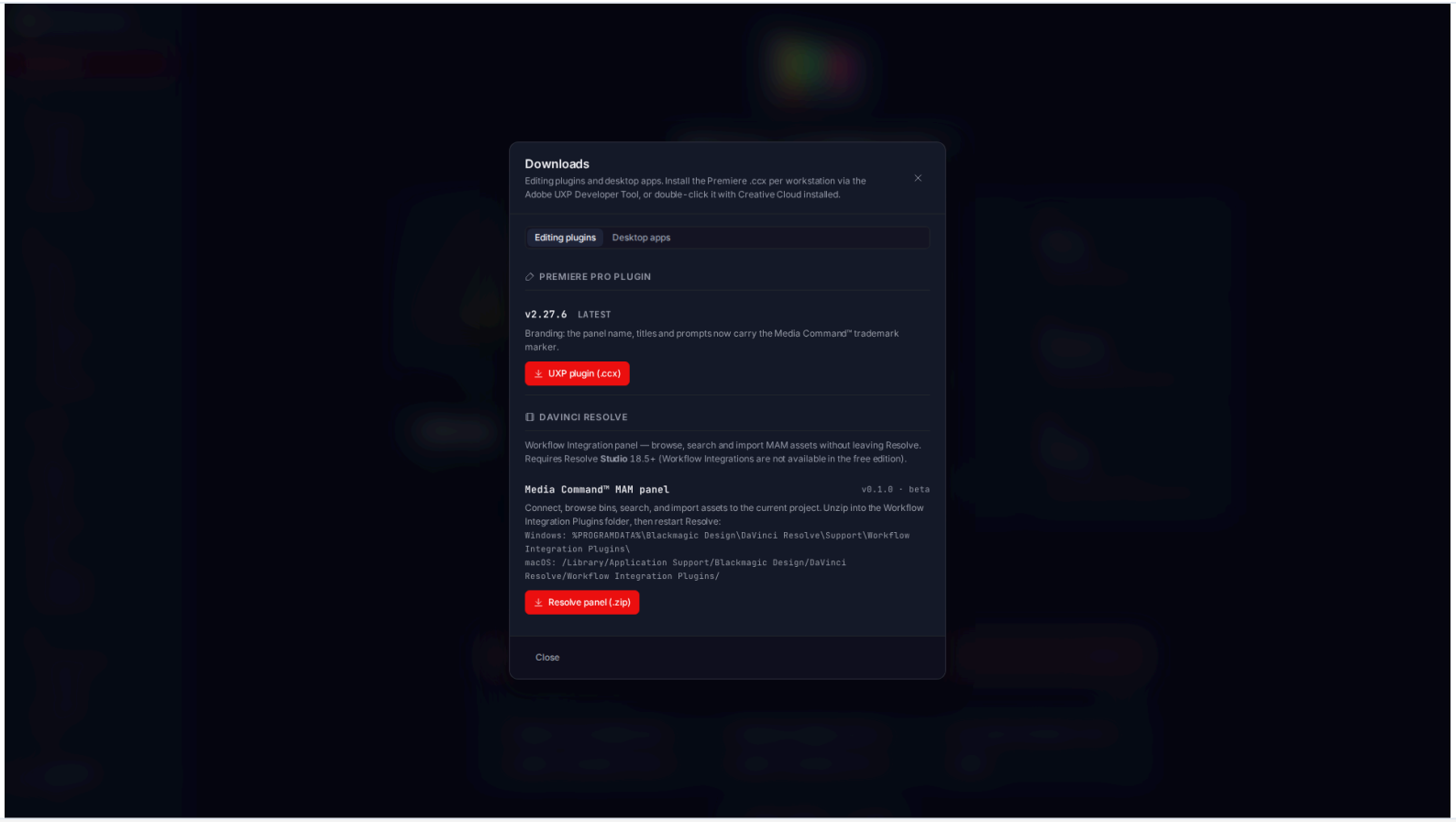
- **SDI Matrix & Frame Sync:** Deltacast PCIe status, genlock, and reference clock timing.
- **GPU Acceleration:** NVIDIA NVENC/NVDEC load, temperature, VRAM, and persistence mode status.

- **Network Statistics:** 10GbE throughput, PTP (IEEE 1588) timing, and Dante audio multicast.

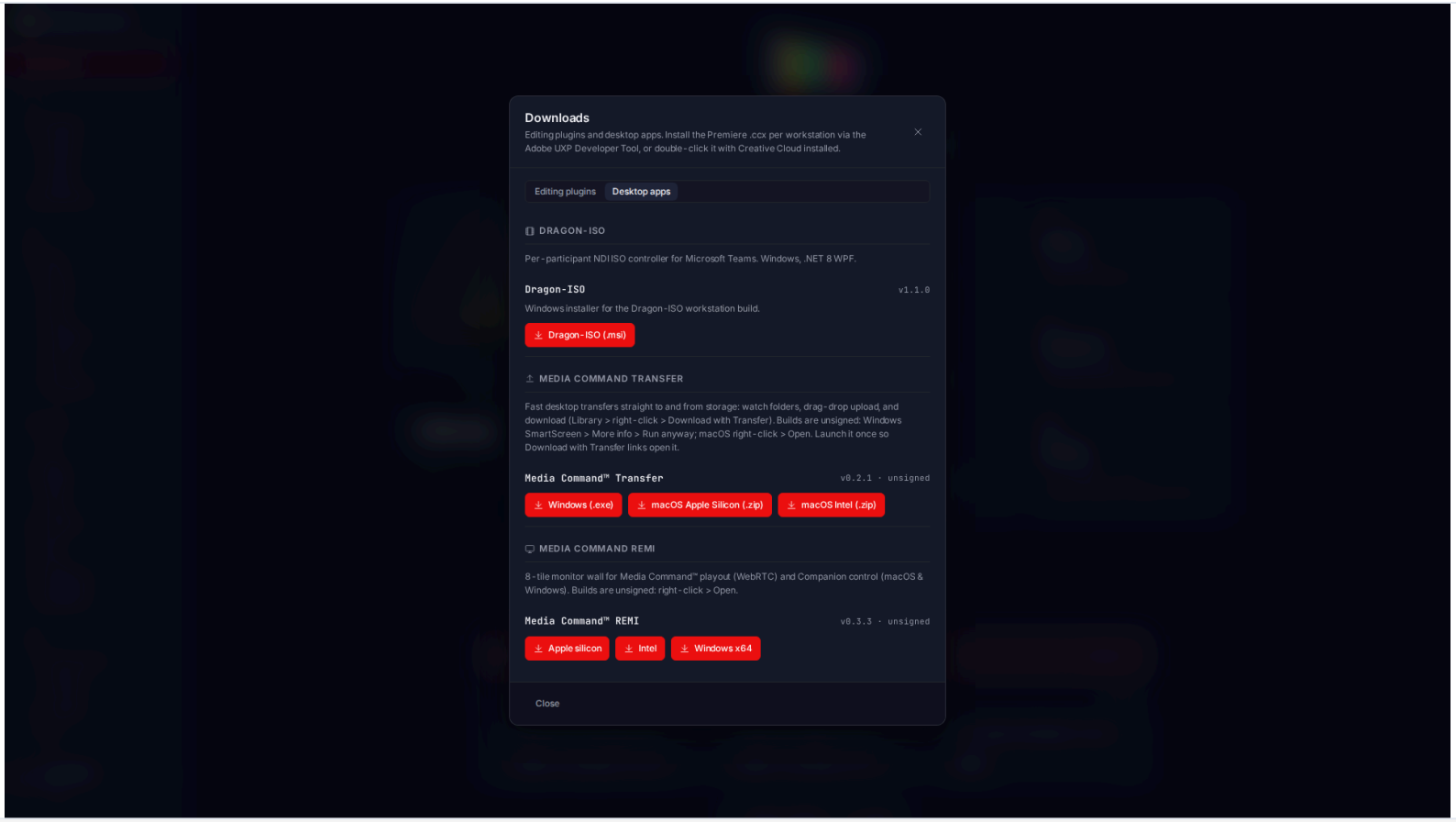
21. Applications & Downloads Hub



Applications — Central distribution portal for client tools and plugins



Downloads: Editing plugins tab — Premiere Pro UXP v2.27.6 and DaVinci Resolve panel v0.1.0 beta

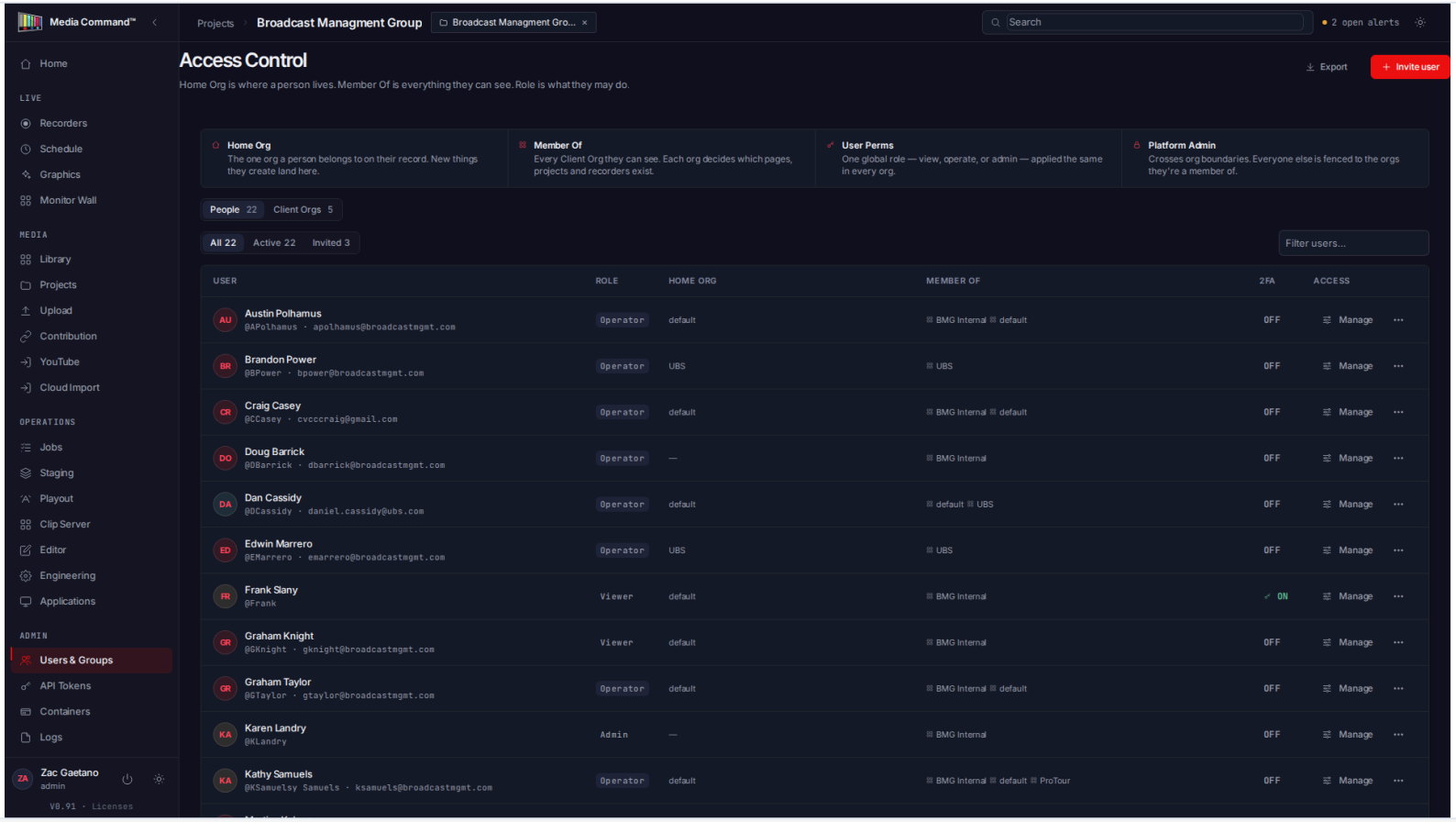


Downloads: Desktop apps tab — Dragon-ISO v1.1.0, Media Command Transfer v0.2.1, Media Command REMI v0.3.3 (Apple silicon, Intel, Windows x64)

Application	Platform	Installer
Adobe Premiere Pro UXP Plugin	macOS / Windows	`dragonflight-mam-2.27.6.ccx`
DaVinci Resolve Studio Plugin	macOS / Windows	`dragonflight-resolve-0.1.0.zip`
Media Command Transfer	macOS / Windows	`Media-Command-Transfer-0.2.1-{platform}.{ext}`
Media Command REMI	macOS / Windows	`Media-Command-REMI-0.3.3-{platform}.{ext}`

Dragon-ISO	Windows	`Dragon-ISO-Setup-1.1.0.msi`

22. Users & Groups

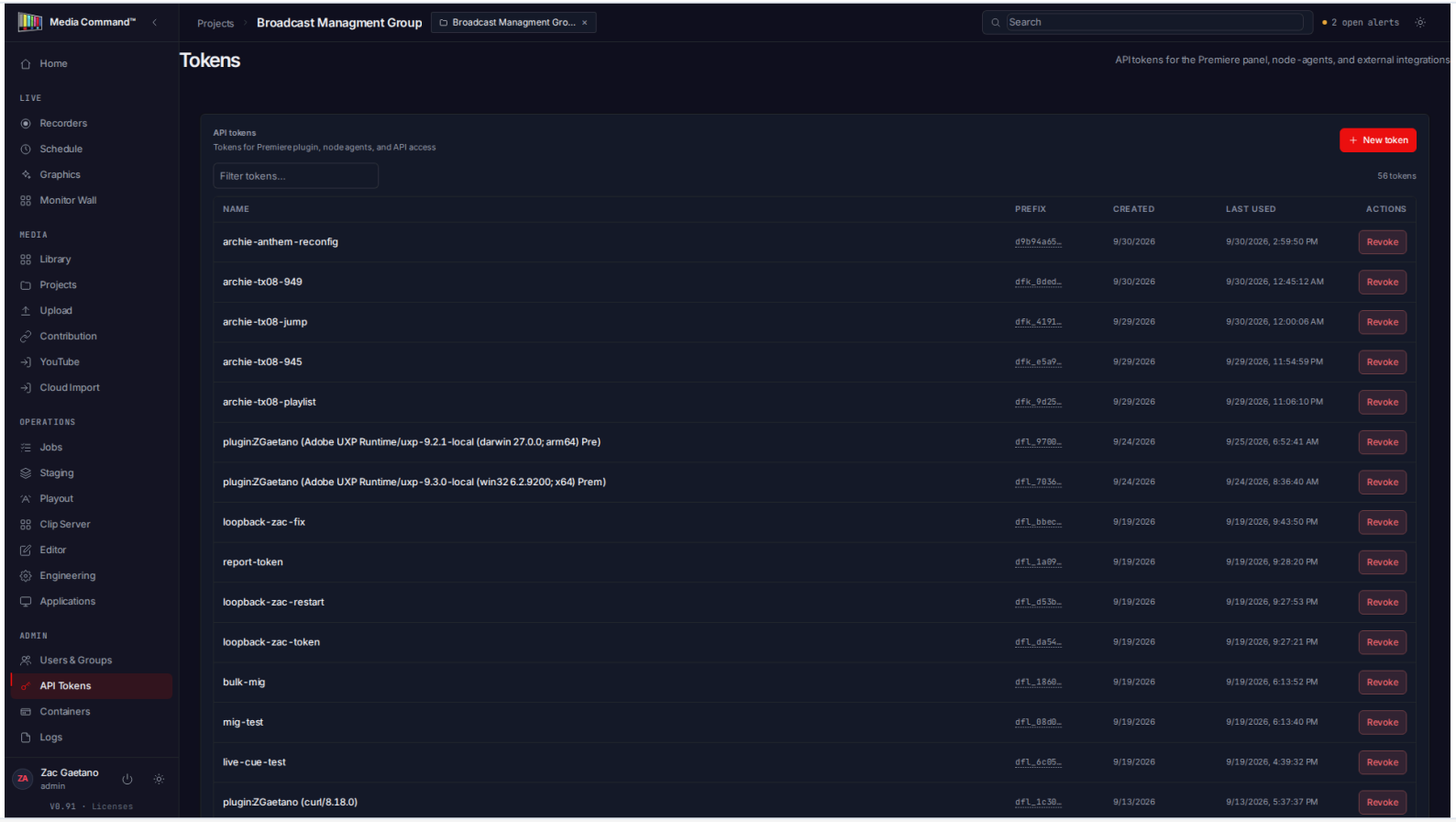


Users & Groups — Multi-tenant user provisioning with RBAC role enforcement

- **User Provisioning:** Create accounts, email invitations, password resets.
- **Group Assignments:** Functional production groups with project access boundaries.

- **Role Enforcement:** Global platform roles (Admin, Operator, Editor, Viewer).

23. API Tokens

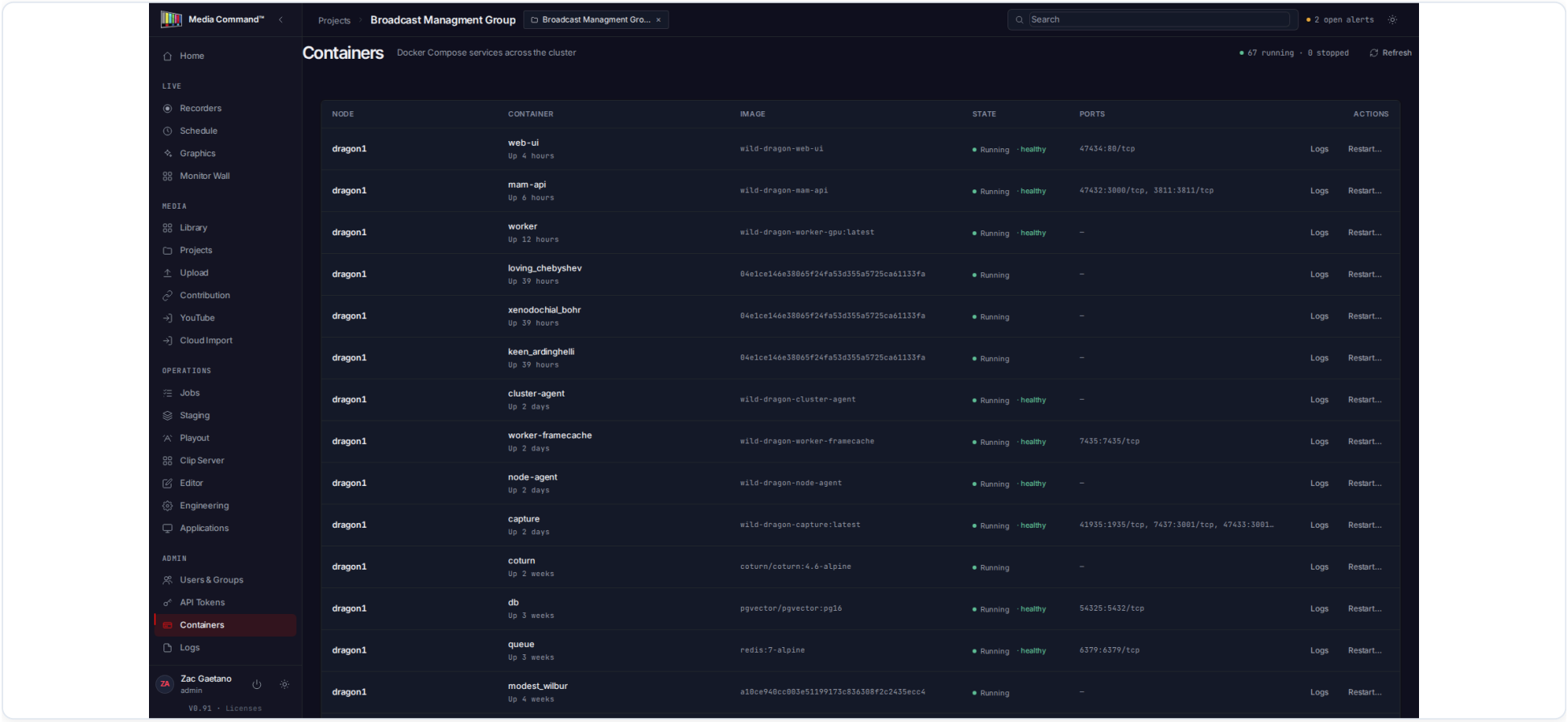


API Tokens — Scoped service automation keys with revocation controls

- **Service Tokens:** Scoped API keys for automated pipelines, external transcoders, and CI/CD.
- **Permission Scoping:** Restrict to specific actions (read-only, ingest-only, playout cueing).

- **Revocation & Expiry:** Automated expiration and instant revocation triggers.

24. Containers & Fleet Health

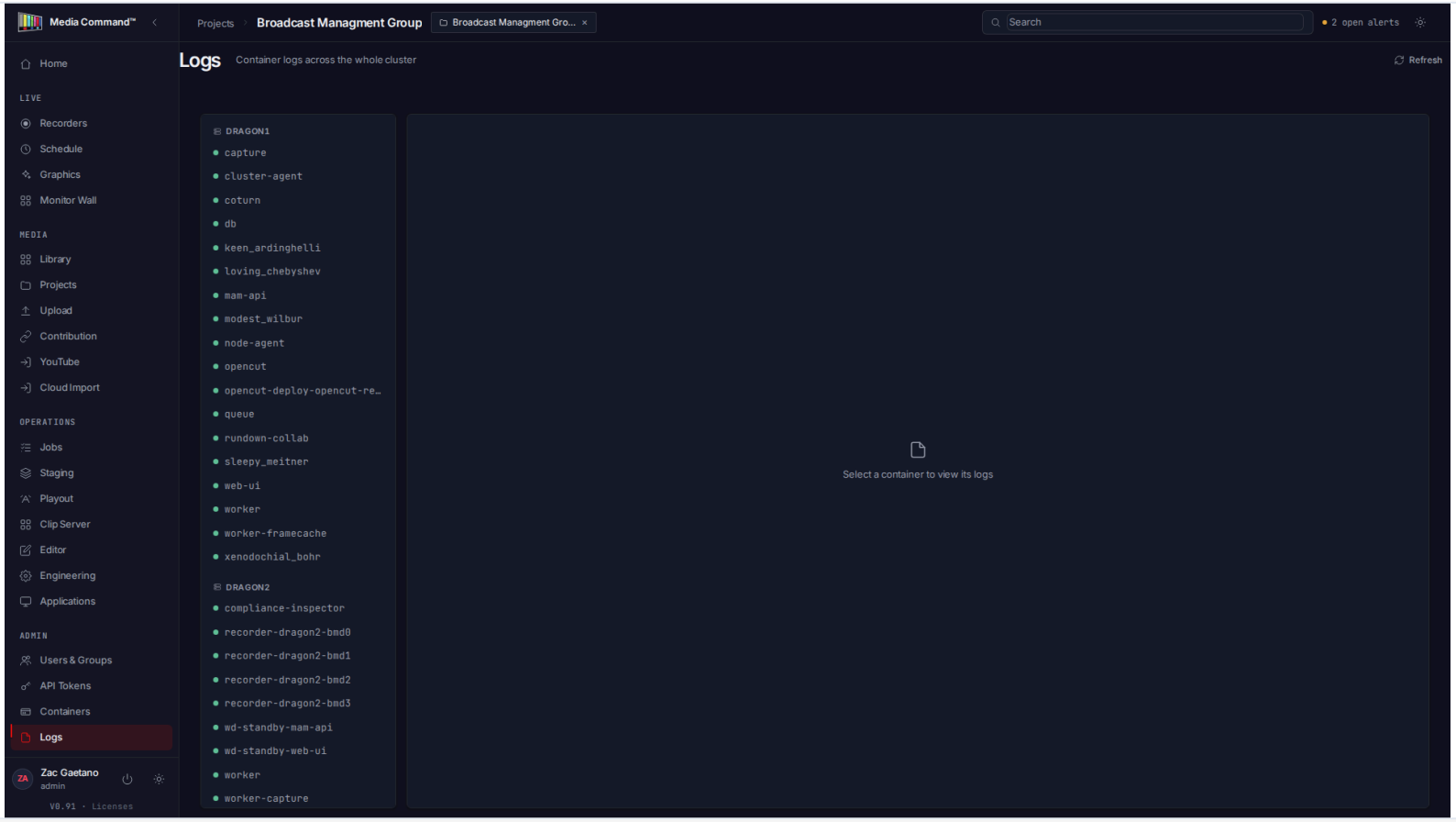


Containers — Docker fleet status across the 6-node cluster

- **Docker Fleet:** Real-time container status across all cluster nodes.
- **Resource Metrics:** CPU, RAM, and GPU memory per container.

- **Lifecycle Controls:** Graceful restart of worker queues and service daemons.

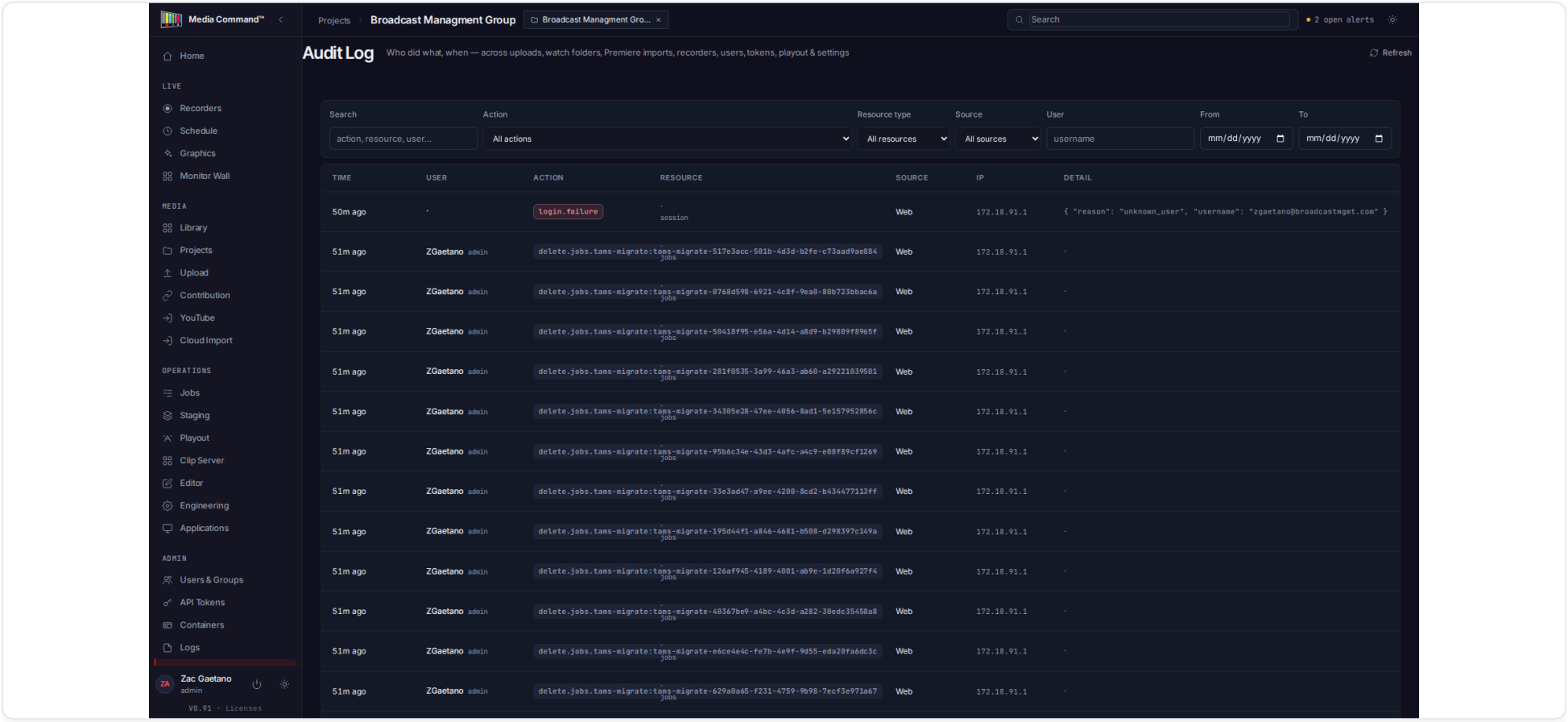
25. System Logs



Logs — Centralized log aggregation with severity filtering and regex search

- **Centralized Aggregation:** Live streaming logs from all nodes with severity filters.
- **Regex Search:** Instant query across millions of log entries.

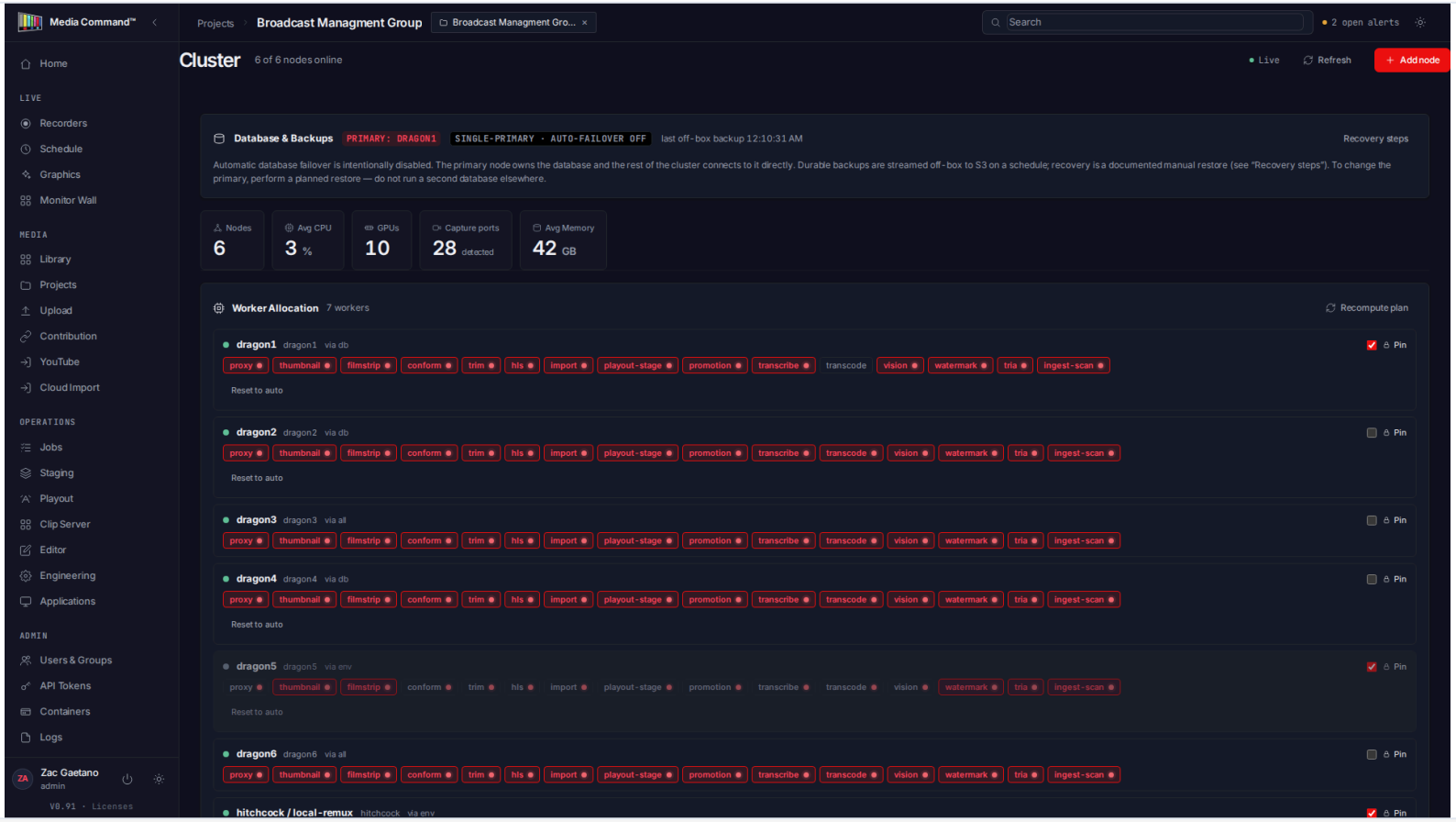
26. Audit Trail



Audit Log — Immutable record of all user actions for security compliance

- **Immutable History:** Every user action recorded: logins, deletions, metadata edits, permission changes, playout triggers.
- **Security Compliance:** User ID, IP address, timestamp, asset ID, and state changes.

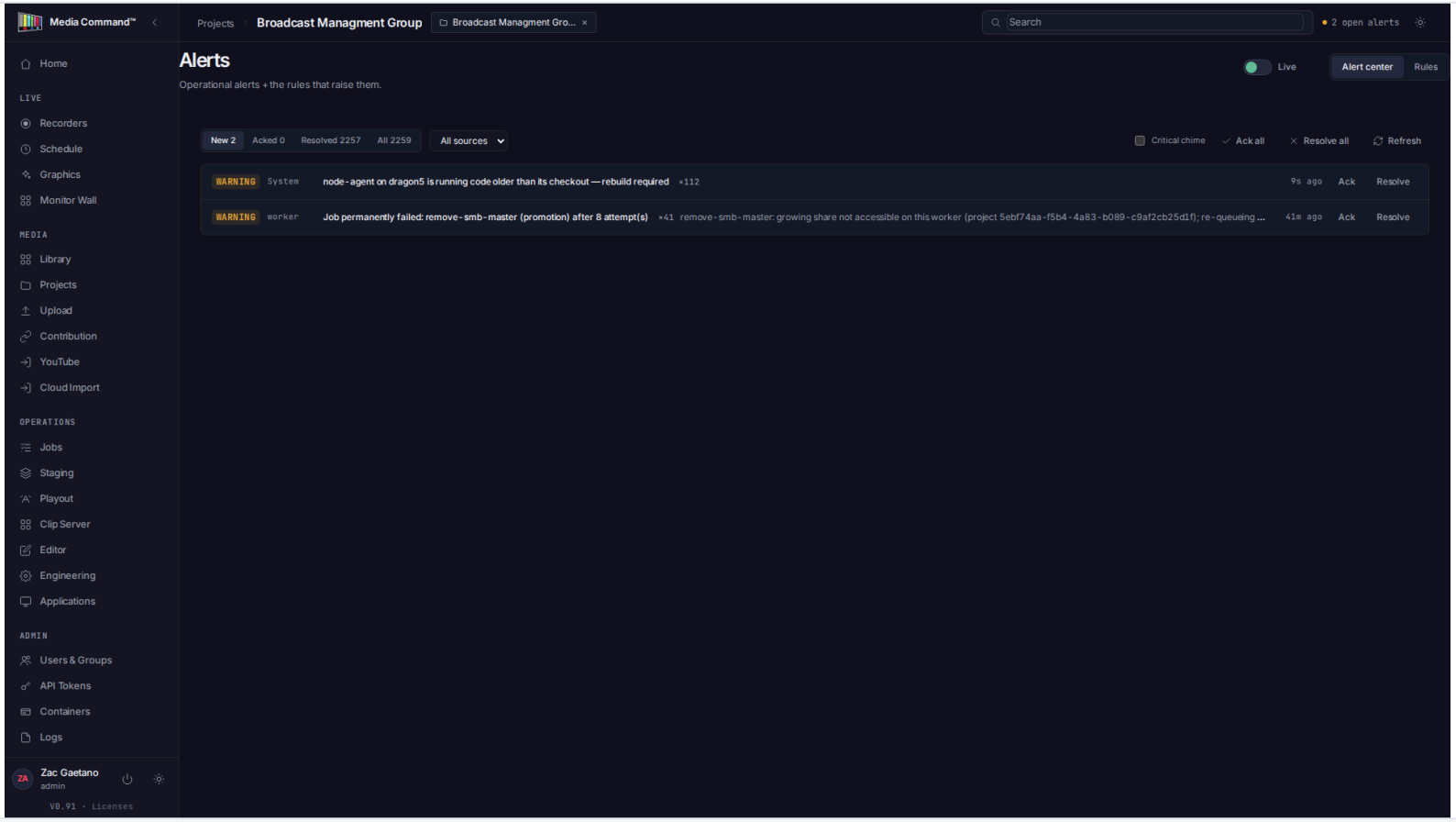
27. Cluster Topology



Cluster — Distributed 6-node topology visualizer with heartbeat monitoring

- **Multi-Node Map:** Graphical view of dragon1 (core) through dragon6 (GPU/capture workers).
- **Heartbeat Monitoring:** Inter-node latency, SSH connectivity, and cluster agent sync.

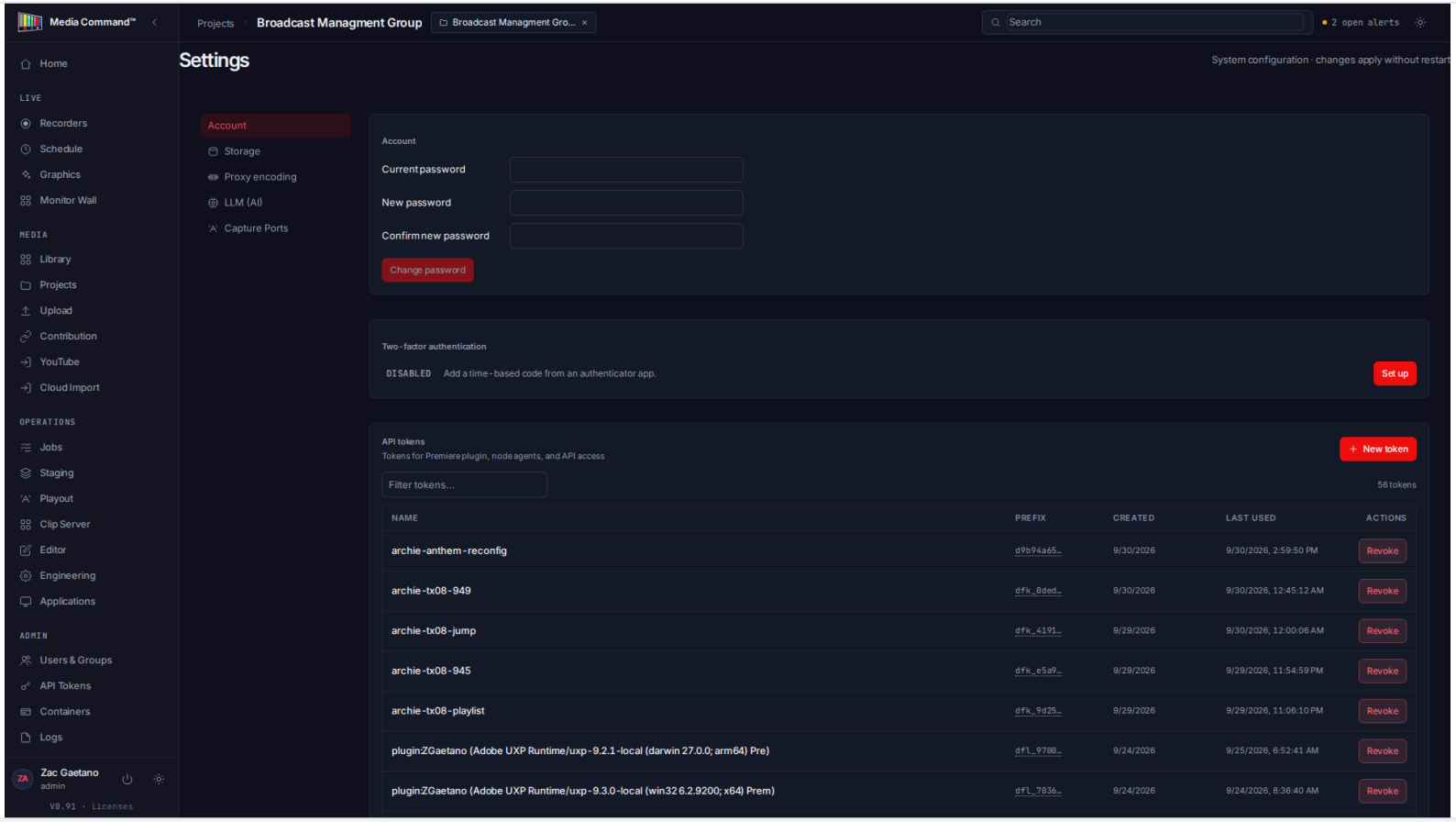
28. System Alerts



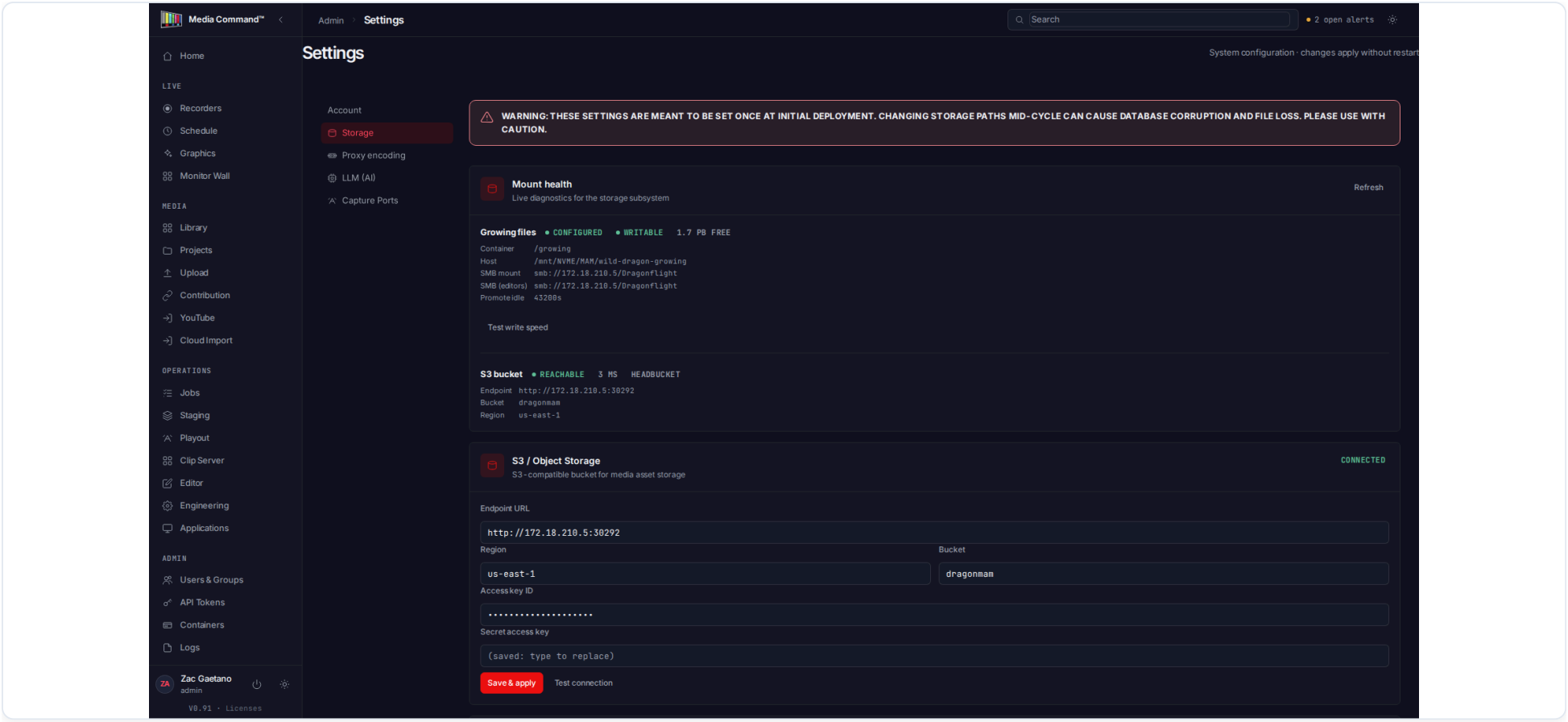
Alerts — Critical operational incident monitoring and webhook notification

- **Incident Monitor:** Storage capacity, SDI signal loss, worker heartbeat drops.
- **Notification Webhooks:** Discord, Slack, PagerDuty, and email dispatch.

29. System Settings



Settings — Central configuration for storage, encoders, and SDK bridges



Settings: Storage Tab — S3 endpoint credentials, NFS/CIFS mounts, scratch paths

- **Storage:** Local scratch paths, NFS/CIFS mounts, TrueNAS pools, and S3 endpoint credentials.
- **Transcoder Profiles:** GPU encoding presets, bitrate ladders, and proxy resolutions.
- **Playout Settings:** CasparCG channel topologies, NDI labels, and genlock timing.

30. Adobe Premiere Pro UXP Plugin

The **Media Command UXP Plugin** provides deep bidirectional NLE integration directly inside Adobe Premiere Pro 2026 (v26+).

Installation

1. Download `dragonflight-mam-2.27.6.ccx` from the Downloads menu in Media Command.
2. Double-click the `.ccx` file to install via Adobe Creative Cloud / UPI.
3. In Premiere Pro: **Window → Extensions → Media Command™**.

Key Capabilities

- **Connect Pane:** Username/password (with TOTP 2FA) or API bearer token.
- **Library & Search Browser:** Grid/list views with asset thumbnails, technical metadata, duration, and creation timestamps. Project, Bin, Collection, Live Ingest, and Uploads navigation.
- **Live Growing File Editing:** Mount active capture streams for editing while recording is in progress. The playhead scrubs up to the live record edge.
- **Proxy / Hi-Res Import & Relinking:** Edit with lightweight H.264 proxies, then one-click relink to full ProRes/DNxHR masters. Automatic batch relinking across project items.
- **Conform Timeline → MAM:** Render sequences to broadcast codecs (ProRes 422 HQ, Web H.264, Archive ProRes 4444, custom DNxHR/HEVC/PCM) and upload directly to MAM bins.
- **Direct Asset Uploader:** Drag external files or Premiere sequences into MAM folders from the panel footer.

31. DaVinci Resolve Studio Plugin

Native **DaVinci Resolve Studio 18.5+** Workflow Integration for browsing and importing media directly into the Resolve Media Pool.

Installation

1. Download `dragonflight-resolve-0.1.0.zip`.
2. Extract to the Workflow Integration Plugins directory:
   - **macOS:** `/Library/Application Support/Blackmagic Design/DaVinci Resolve/Workflow Integration Plugins/`
   - **Windows:** `%PROGRAMDATA%\Blackmagic Design\DaVinci Resolve\Support\Workflow Integration Plugins\`
3. In Resolve: **Workspace → Workflow Integrations → Media Command™ MAM**.

Key Capabilities

- **Asset Browser:** Instant debounced search with folder/bin tree navigation.
- **Media Pool Import:** One-click import via `MediaStorage.AddItemListToMediaPool()`.
- **Color-Managed Workflows:** Automatic project-level color tags and metadata application.

32. Media Command Transfer

High-speed desktop utility for bulk broadcast file ingest with accelerated multi-threaded transfers.

Platform	Package
macOS Apple Silicon	`Media-Command-Transfer-0.2.1-mac-arm64.zip`
macOS Intel	`Media-Command-Transfer-0.2.1-mac-x64.zip`
Windows x64	`Media-Command-Transfer-0.2.1-win-x64.exe`

Key Features

- **Watch Folders:** Map local directories to MAM project bins for automatic ingest with file stability detection.
- **Multi-Part S3 Transfer:** Direct presigned PUT uploads to S3 with configurable concurrency (2 parallel files, 8 chunks per file) and bandwidth throttling.
- **Deep-Link Protocol:** `mediacommand://download?asset=<id>&rendition=<type>` for instant download from web UI.
- **Checksum Validation:** Per-part MD5 ETag + full-file SHA-256 verification.
- **Pause/Resume:** Graceful cancel with server-side multipart abort cleanup.

33. Media Command REMI

Low-latency hardware-accelerated **broadcast multiviewer** and monitor wall application for remote control rooms.

Platform	Package
macOS Apple Silicon	`Media-Command-REMI-0.3.3-mac-arm64.zip`
macOS Intel	`Media-Command-REMI-0.3.3-mac-x64.zip`
Windows x64	`Media-Command-REMI-0.3.3-win-x64.exe` (portable, unsigned — SmartScreen: More info → Run anyway)

Key Features

- **Multi-Tile Grid (up to 8 tiles/window):** Layouts: 1×1, 2×1, 2×2, 3×2, 4×2. Single-tile fullscreen solo.
- **Proxy / QC Mode Toggle:** Switch between low-latency preview and full-quality NVENC streams for critical QC.
- **Audio Monitoring:** Dual-channel PPM/VU meters with peak-hold and dBFS scale. Channel pair selection (Ch 1-2 through Ch 7-8). Solo and mute toggles.
- **Broadcast OSD:** Tile labels, format indicators, tally badges, timecode, safe-area graticules, progress bars, center crosshairs.
- **Multi-Window Multi-Display:** Independent wall windows across up to 8 attached displays.
- **Automation API:** HTTP REST (`/api/tile/:n/source` , `/api/layout` , `/api/mute`) and WebSocket for Bitfocus Companion / Stream Deck integration.

34. Dragon-ISO

Enterprise automation tool for capturing individual **Microsoft Teams** and **NDI** participants into isolated broadcast feeds.

Platform	Package
Windows 10/11 x64	`Dragon-ISO-Setup-1.1.0.msi`

Key Features

- **NDI Participant Extraction:** Auto-discovers Teams meeting attendees, strips UI wrappers, isolates individual clean video/audio feeds.
- **Signal Normalization:** Re-clocks varied webcam streams to uniform broadcast standards (framerate, resolution, audio mapping).
- **Direct ISO Recording:** Simultaneous disk recording of raw streams with automated FFmpeg batch conversion.
- **Control Integration:** REST & WebSocket on `127.0.0.1:9755`, OSC server on UDP `127.0.0.1:9000` for Companion and TouchOSC.
- **Mobile Controller:** Responsive web controller at `http://localhost:9755/ui`.

35. Safety Protocols & Operational Runbooks

MEDIA DELETION SAFETY PROTOCOL — TRIPLE CONFIRMATION REQUIRED
Under no circumstances may raw media files, S3 objects, or database records be purged without explicit, multi-step authorization. Deleted assets first enter the project's isolated Recycle Bin. Permanent purging from physical storage requires administrative credentials and double confirmation dialogs.

Live Growing File Workflow

1. In **Recorders**, enable the target capture port and set container format to fMP4/CMAF (HEVC/H.264) or ProRes (Segmented).
2. Click **Create Recording** to begin the live feed.
3. Open Adobe Premiere Pro and launch the **Media Command UXP Plugin**.
4. Locate the active recording (tagged with red `LIVE` badge) and click **Mount Growing File**.
5. Edit immediately — new video segments are dynamically recognized without re-importing.