Burning Man Radio

Scrubbed with Liquidsoap

Liquidshop 1.0 — January 17, 2021
By David Cooper @dtcooper

Exploration on using Liquidsoap at the world's ***dustiest*** radio station during the pandemic

BMIR 94.5 fm
THE VOICE OF THE MAN

SHOUTING FIRE

About Me — David Cooper

- Staff at Burning Man Information Radio (BMIR)
- Wrote technical infrastructure for BMIR's 2020 online-only stream and Shouting Fire radio
- Radio personality and stand-up comic
- Been a software engineer + engineering manager in San Francisco for 10 years. ***Recently quit!***
- Pedal Steel guitar player + has an annoying cat
- Wears glasses
- Shook hands with the Fonz 20 years ago

How I’ve Used Liquidsoap in the Past

- Custom built 4 ***decentralized*** online stations in an ad-hoc way
  - BMIR 2020[1], Shouting Fire, 820hz, KTLC Lost Church Radio (to be launched)
- These stations emphasize ***live*** and ***pre-recorded*** (long format + scheduled) programming.
  - “Always playing” AutoDJ less important, but there’s need for station ID and ad rotators organized into stop sets
- Problems
  - Liquidsoap installed inconsistently (out-of-date Debian packages, opam, using `./configure`)
  - Difficult to re-install and upgrade, one-off scripts
  - Each station used the previous code as a starting point = technical debt and hard to manage
  - Was violating **DRY**: Don’t Repeat Yourself.
- Novel features. Common themes emerged. No out-of-the box solution fit needs.
  - Real-time stream management, status page, kick/ban DJ buttons
  - Zoom Room streaming + RTMP DJing
  - Treating silent DJs / Zoom rooms as if they weren’t connected at all
  - Long-format audio scheduling, uploading via SoundCloud / Mixcloud links
  - Google calendar-based scheduling: DJ authentication + tight DJ authorization windows
  - Zero listener downtime on Liquidsoap restart
  - Fine-grained permissions
- Why not put in the extra work and turn it into a free, open source project? Easy, right? ¯_(ツ)_/¯

[1] BMIR uses Wide Orbit in the desert on-air studio but Liquidsoap as part of the redundant archival process. (Thanks Andy!)

Enter: Crazy Arms Radio Backend — 🤪 💪 📻 👩‍💻[1]

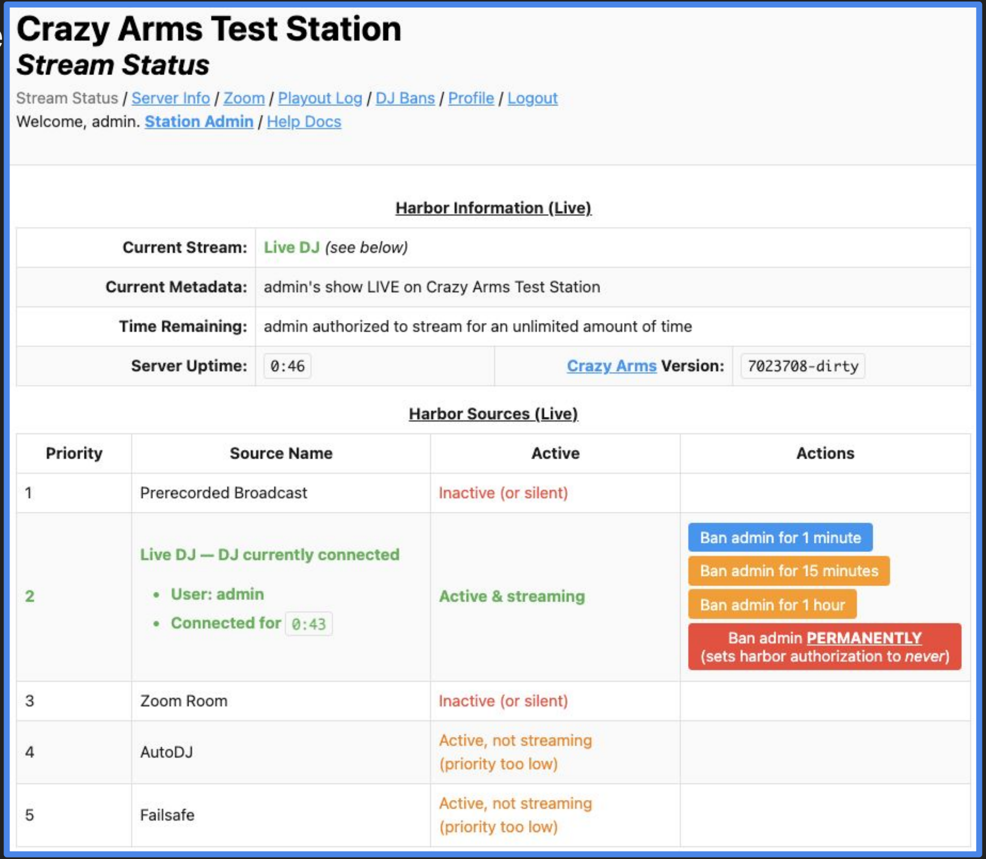
- I decided to abstract my learnings from these stations into a FLOSS project.

- Goals
  - Docker, docker, docker! (and docker-compose) Can set up in prod + dev in a couple cmds

  - Once installed, can be completely self managed by non-technical users

  - Straightforward UI for ***DJs and station managers only***
    - No listener UI included. Back-end only.
    - Leverages Django’s admin interface to save dev time.

- Liquidsoap scripts can be customized by advanced users



Crazy Arms Test Station
Stream Status

Stream Status / Server Info / Zoom / Playout Log / DJ Bans / Profile / Logout
Welcome, admin. **Station Admin** / Help Docs

Harbor Information (Live)

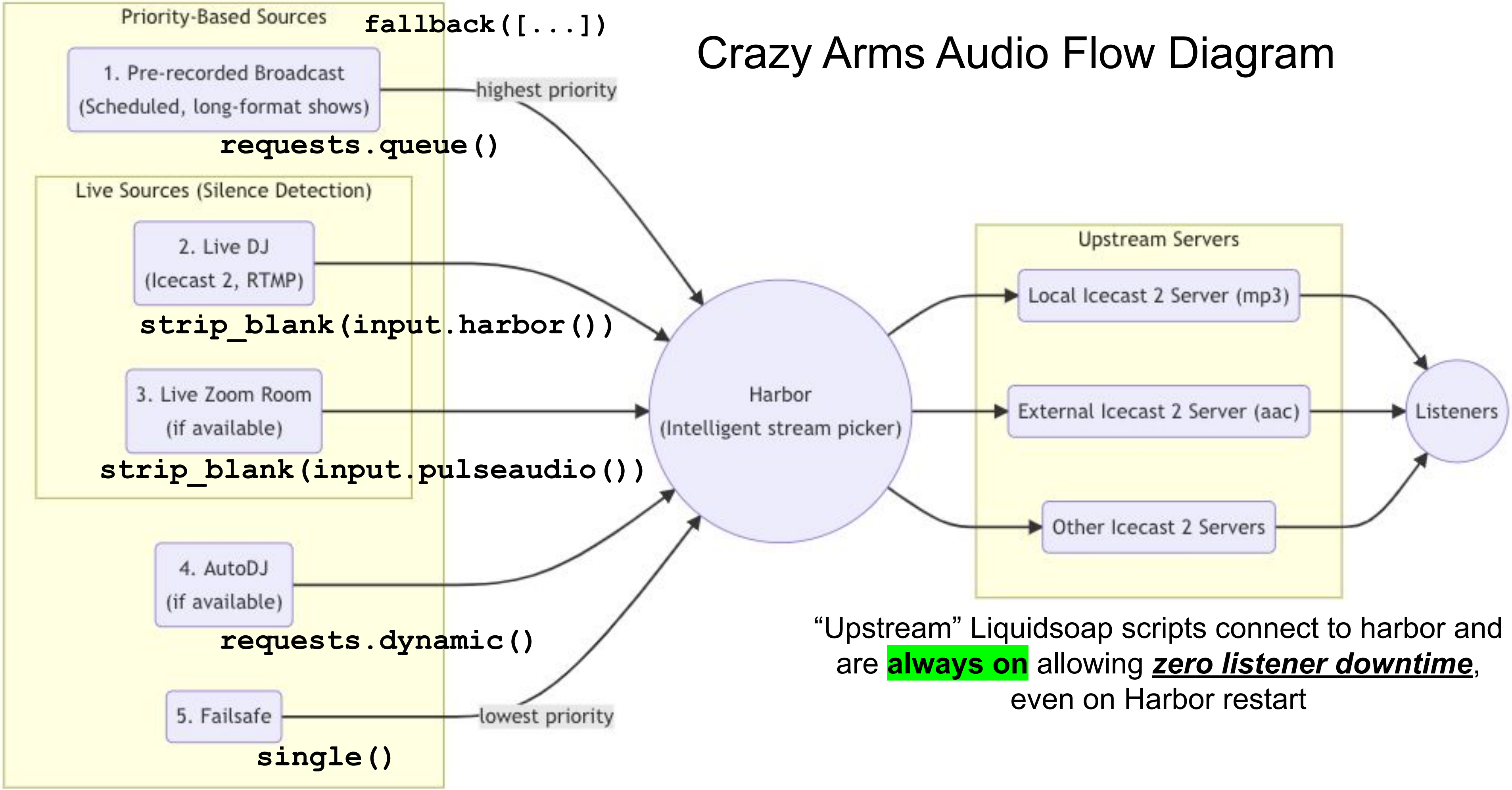
Current Stream:	Live DJ *(see below)*		
Current Metadata:	admin's show LIVE on Crazy Arms Test Station		
Time Remaining:	admin authorized to stream for an unlimited amount of time		
Server Uptime:	`0:46`	Crazy Arms **Version:**	`7023708-dirty`

Harbor Sources (Live)

Priority	Source Name	Active	Actions
1	Prerecorded Broadcast	Inactive (or silent)	
2	Live DJ — DJ currently connected • User: admin • Connected for `0:43`	Active & streaming	Ban admin for 1 minute Ban admin for 15 minutes Ban admin for 1 hour Ban admin PERMANENTLY (sets harbor authorization to *never*)
3	Zoom Room	Inactive (or silent)	
4	AutoDJ	Active, not streaming (priority too low)	
5	Failsafe	Active, not streaming (priority too low)	

[1] *Crazy Arms is in need of a logo*

Crazy Arms Audio Flow Diagram



Priority-Based Sources
1. Pre-recorded Broadcast (Scheduled, long-format shows)
highest priority
Live Sources (Silence Detection)
2. Live DJ (Icecast 2, RTMP)
3. Live Zoom Room (if available)
4. AutoDJ (if available)
5. Failsafe
lowest priority
Harbor (Intelligent stream picker)
Upstream Servers
Local Icecast 2 Server (mp3)
External Icecast 2 Server (aac)
Other Icecast 2 Servers
Listeners

```
fallback([...])
requests.queue()
strip_blank(input.harbor())
strip_blank(input.pulseaudio())
requests.dynamic()
single()
```

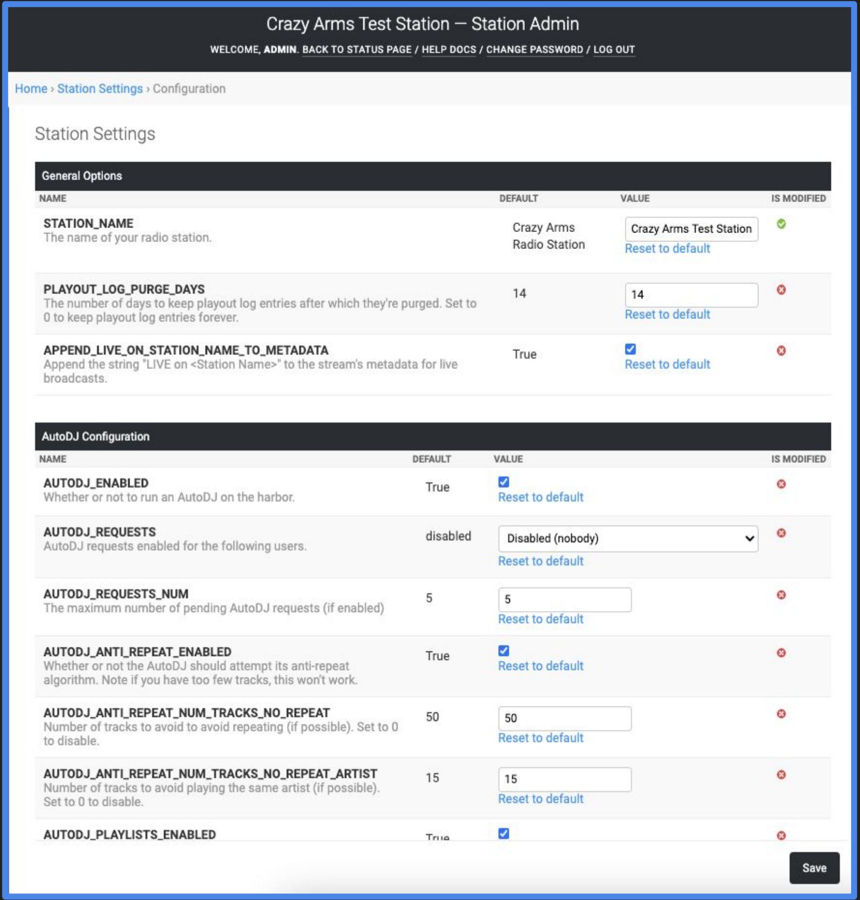
“Upstream” Liquidsoap scripts connect to harbor and are **always on** allowing ***zero listener downtime***, even on Harbor restart

Novel Features

Let’s go over some of the aforementioned novel features, and their technical approach

Feature: Non-Technical Station Management

- Station managers shouldn't have to use shell
- Able to add/remove/lock DJ user accounts
  - Fine-grained permissions with Django auth groups
- Configuration through a settings page
- Managing audio assets
  - AutoDJ and pre-recorded broadcasts
  - Implemented using Django Admin
- Real-time stream management / status page
  - Visualize what's going on in real-time using Server-Sent Events (like Websockets)
    - Uses nchan module for Nginx
  - DJ ban button
  - Skip track button
  - (Next slide)



Crazy Arms Test Station — Station Admin

WELCOME, **ADMIN**. BACK TO STATUS PAGE / HELP DOCS / CHANGE PASSWORD / LOG OUT

Home › Station Settings › Configuration

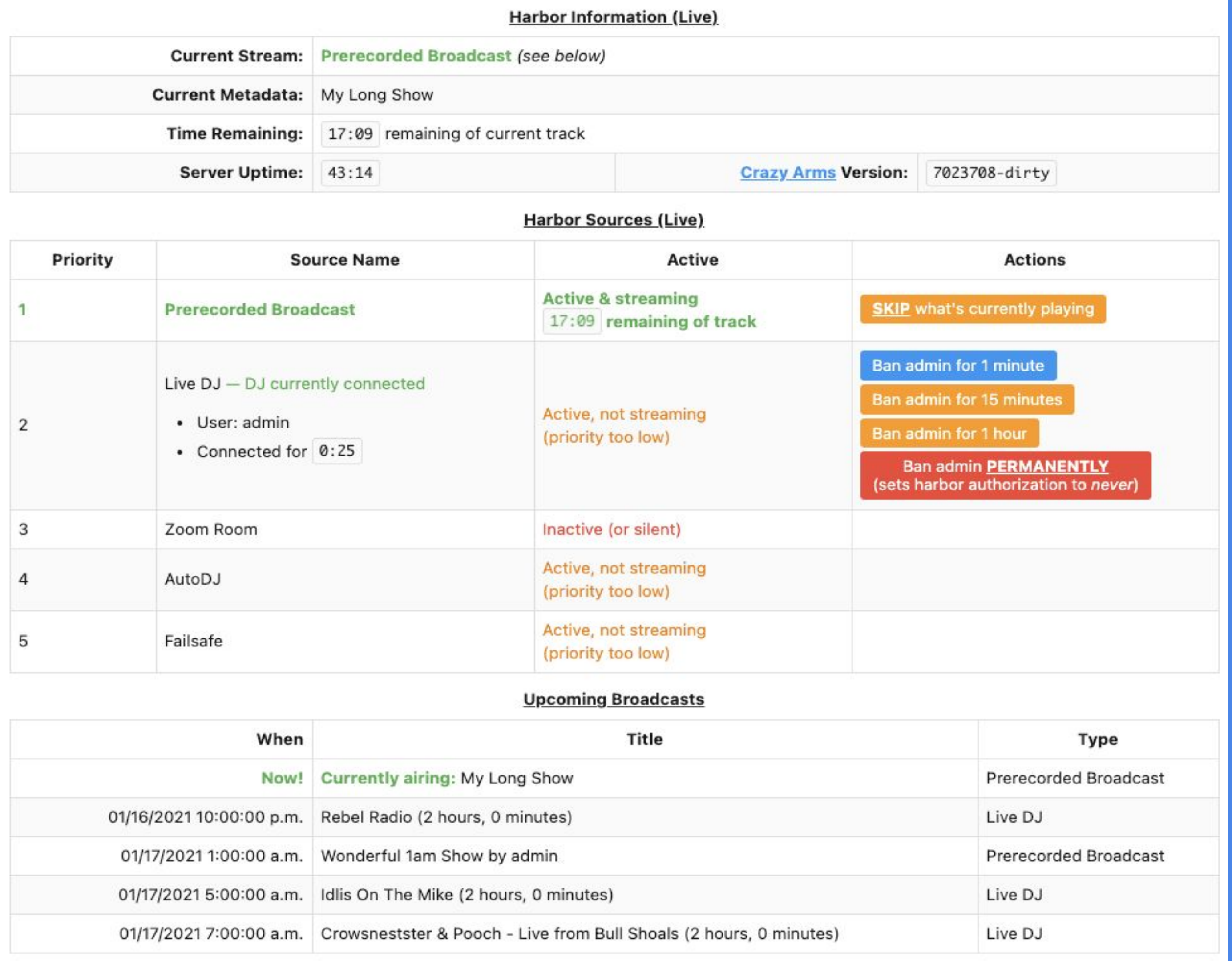
Station Settings

General Options

NAME	DEFAULT	VALUE	IS MODIFIED
STATION_NAME The name of your radio station.	Crazy Arms Radio Station	Crazy Arms Test Station Reset to default	✓
PLAYOUT_LOG_PURGE_DAYS The number of days to keep playout log entries after which they're purged. Set to 0 to keep playout log entries forever.	14	14 Reset to default	✗
APPEND_LIVE_ON_STATION_NAME_TO_METADATA Append the string "LIVE on <Station Name>" to the stream's metadata for live broadcasts.	True	☑ Reset to default	✗

AutoDJ Configuration

NAME	DEFAULT	VALUE	IS MODIFIED
AUTODJ_ENABLED Whether or not to run an AutoDJ on the harbor.	True	☑ Reset to default	✗
AUTODJ_REQUESTS AutoDJ requests enabled for the following users.	disabled	Disabled (nobody) Reset to default	✗
AUTODJ_REQUESTS_NUM The maximum number of pending AutoDJ requests (if enabled)	5	5 Reset to default	✗
AUTODJ_ANTI_REPEAT_ENABLED Whether or not the AutoDJ should attempt its anti-repeat algorithm. Note if you have too few tracks, this won't work.	True	☑ Reset to default	✗
AUTODJ_ANTI_REPEAT_NUM_TRACKS_NO_REPEAT Number of tracks to avoid to avoid repeating (if possible). Set to 0 to disable.	50	50 Reset to default	✗
AUTODJ_ANTI_REPEAT_NUM_TRACKS_NO_REPEAT_ARTIST Number of tracks to avoid playing the same artist (if possible). Set to 0 to disable.	15	15 Reset to default	✗
AUTODJ_PLAYLISTS_ENABLED	True	☑	✗



Harbor Information (Live)

Current Stream:	Prerecorded Broadcast *(see below)*		
Current Metadata:	My Long Show		
Time Remaining:	`17:09` remaining of current track		
Server Uptime:	`43:14`	Crazy Arms **Version:**	`7023708-dirty`

Harbor Sources (Live)

Priority	Source Name	Active	Actions
1	**Prerecorded Broadcast**	**Active & streaming** `17:09` **remaining of track**	**SKIP** what's currently playing
2	Live DJ — DJ currently connected • User: admin • Connected for `0:25`	Active, not streaming (priority too low)	Ban admin for 1 minute Ban admin for 15 minutes Ban admin for 1 hour Ban admin **PERMANENTLY** (sets harbor authorization to *never*)
3	Zoom Room	Inactive (or silent)	
4	AutoDJ	Active, not streaming (priority too low)	
5	Failsafe	Active, not streaming (priority too low)	

Upcoming Broadcasts

When	Title	Type
Now!	**Currently airing:** My Long Show	Prerecorded Broadcast
01/16/2021 10:00:00 p.m.	Rebel Radio (2 hours, 0 minutes)	Live DJ
01/17/2021 1:00:00 a.m.	Wonderful 1am Show by admin	Prerecorded Broadcast
01/17/2021 5:00:00 a.m.	Idlis On The Mike (2 hours, 0 minutes)	Live DJ
01/17/2021 7:00:00 a.m.	Crowsnestster & Pooch - Live from Bull Shoals (2 hours, 0 minutes)	Live DJ

Feature: *Idiot-Tolerant*™ DJing

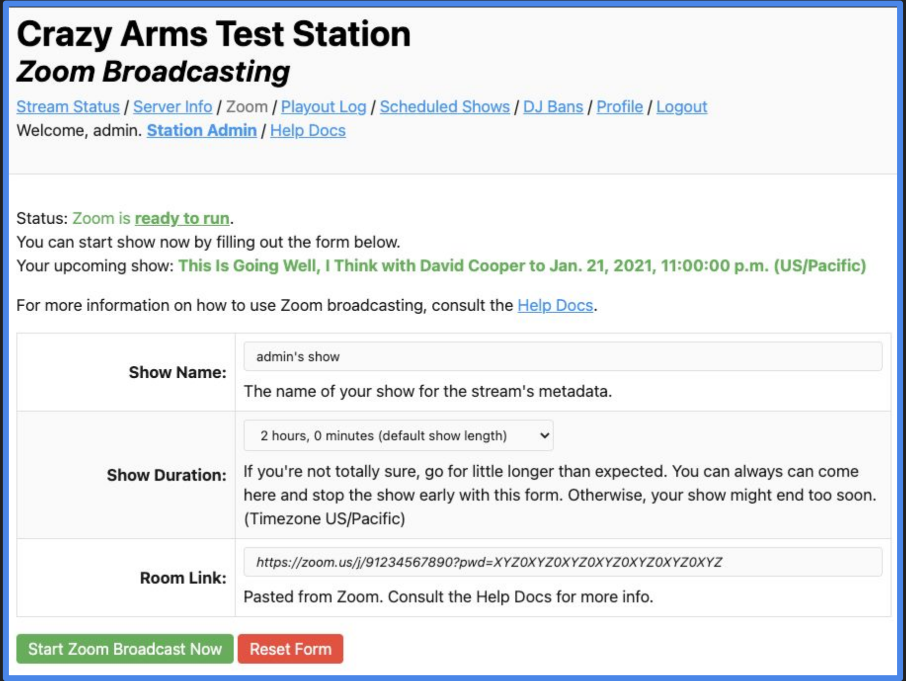
- Onboarding DJs is ***always*** a problem.
    - DJs can't figure out how to connect using Icecast 2
    - butt is hard to use, Audio HiJack is $59 and macOS only, they can't work a USB mixer.
    - DJs don't disconnect. Icecast 2 source clients left accidentally open.
        - Emergencies fixed by kick/ban button, tight scheduling described in later slide.
    - **DJs broadcast silence or come in too hot 🔥 / too cold 🥶**
        - Live sources use `strip_blank()`, output uses compression/normalization (optional)

- DJs understand Zoom. Icecast 2 is too difficult.
    - We don't want to preclude less technical people from being DJs.
    - We want to support talk live programming
        - Lord help us if they want to use a mix-minus to use Zoom + butt (🇬🇧 "clean feed")
    - ***Killer Feature: Share Desktop Audio, ie if you hear in your speakers, it's broadcasting***

- DJs understand OBS (or another RTMP client)
    - Some folks invested a lot of time in understanding OBS and ask about it when onboarding
    - I always say *"Icecast is different than the live streaming you're used to on Twitch"* and get shrugged off, only to have them call me right before their first show confused.

Feature: Zoom Broadcasting

- DJ submits their Zoom Room Link
- An dummy attendee joins their room, and leaves when their show is done



Crazy Arms Test Station

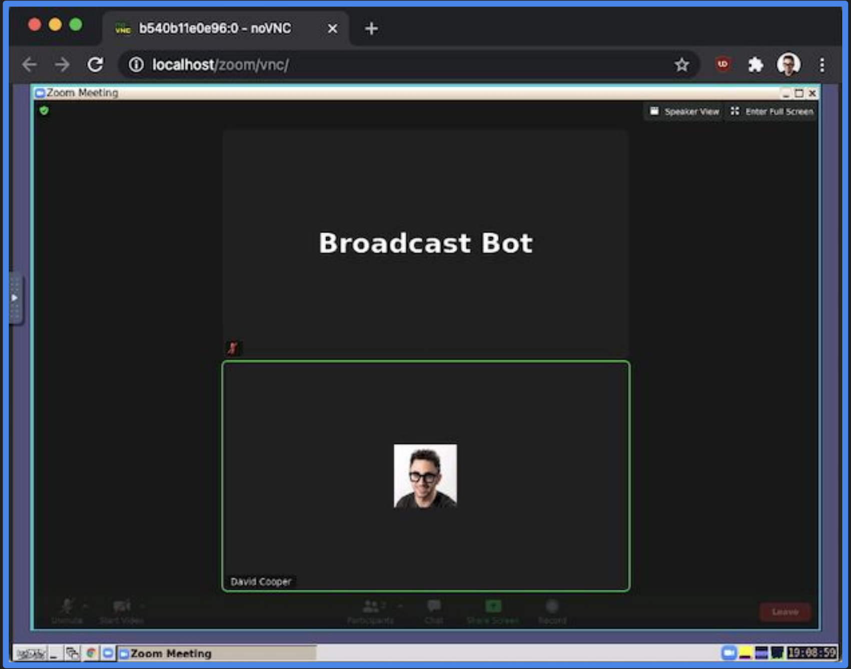
Zoom Broadcasting

Stream Status / Server Info / Zoom / Playout Log / Scheduled Shows / DJ Bans / Profile / Logout
Welcome, admin. **Station Admin** / Help Docs

Status: Zoom is **ready to run**.
You can start show now by filling out the form below.
Your upcoming show: **This Is Going Well, I Think with David Cooper to Jan. 21, 2021, 11:00:00 p.m. (US/Pacific)**

For more information on how to use Zoom broadcasting, consult the Help Docs.

Show Name:	admin's show The name of your show for the stream's metadata.
Show Duration:	2 hours, 0 minutes (default show length) If you're not totally sure, go for little longer than expected. You can always can come here and stop the show early with this form. Otherwise, your show might end too soon. (Timezone US/Pacific)
Room Link:	*https://zoom.us/j/91234567890?pwd=XYZ0XYZ0XYZ0XYZ0XYZ0XYZ0XYZ* Pasted from Zoom. Consult the Help Docs for more info.



- Admins can use web interface to configure and login to the broadcasting Zoom account
- (Optional, but a paid Zoom account allows for longer 3+ person rooms)

Feature: Zoom Broadcasting - Technical

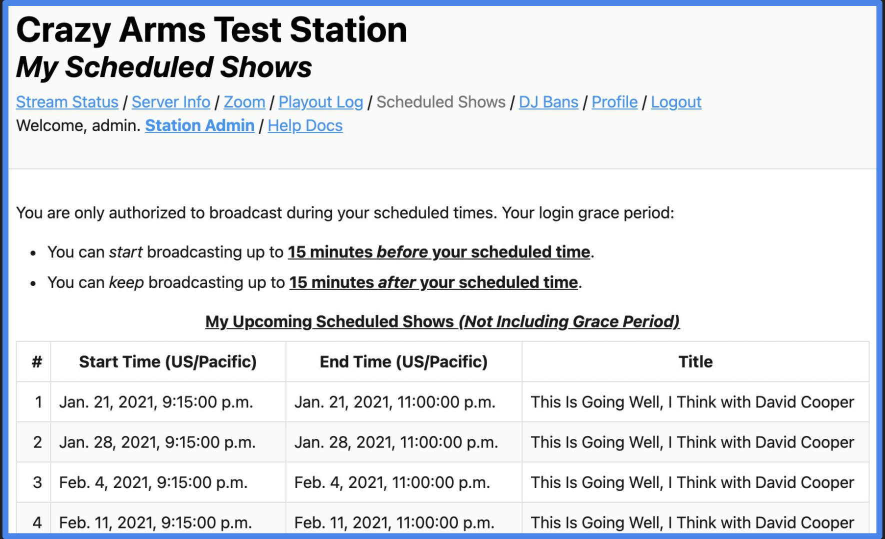
- Pulseaudio with always-sink + tcp-proto modules running in Harbor container
    - Zoom source in main `fallback()` — `strip_blank(input.pulseaudio())`
- Zoom for Linux runs in a separate Ubuntu Docker container
    - icewm desktop on top of fake X (virtual buffer) via Xvfb
    - Web administration: x11vnc + noVNC + websockify
    - Zoom starts and stops by shell script receiving variables from web app
        - Script uses `xdg-open` and `xdotool` to mechanize user interaction with Zoom
    - Audio forwarded to Harbor container by env var: `PULSE_SERVER=<addr-of-harbor-container>`
- *Simple as that!*
- Source: github.com/dtcooper/crazyarms/tree/master/zoom

Feature: Open Broadcaster Software (OBS) / RTMP

- DJ gets RTMP server address and stream key from app and pastes into OBS
- nginx-rtmp runs in a Docker container
- nginx-rtmp auths DJs stream key via the `on_publish` directive
- nginx-rtmp calls shell script on stream publish via the `exec_push` directive
- Shell script uses ffmpeg to transcode RTMP stream to `input.harbor()` as if DJ were a normal Icecast 2 source client
- *Simple as that!*
- Source: github.com/dtcooper/crazyarms/tree/master/rtmp

Feature: Google Calendar Scheduling

- Recurring events are hard. Time zones are hard. Google Calendar does it well.
  - All scheduling is handled by a shared Google Calendar.
  - The email address for your DJ account needs to be invited to the Google Calendar event



Crazy Arms Test Station

My Scheduled Shows

Stream Status / Server Info / Zoom / Playout Log / Scheduled Shows / DJ Bans / Profile / Logout
Welcome, admin. **Station Admin** / Help Docs

You are only authorized to broadcast during your scheduled times. Your login grace period:

- You can *start* broadcasting up to **15 minutes *before* your scheduled time**.
- You can *keep* broadcasting up to **15 minutes *after* your scheduled time**.

My Upcoming Scheduled Shows *(Not Including Grace Period)*

#	Start Time (US/Pacific)	End Time (US/Pacific)	Title
1	Jan. 21, 2021, 9:15:00 p.m.	Jan. 21, 2021, 11:00:00 p.m.	This Is Going Well, I Think with David Cooper
2	Jan. 28, 2021, 9:15:00 p.m.	Jan. 28, 2021, 11:00:00 p.m.	This Is Going Well, I Think with David Cooper
3	Feb. 4, 2021, 9:15:00 p.m.	Feb. 4, 2021, 11:00:00 p.m.	This Is Going Well, I Think with David Cooper
4	Feb. 11, 2021, 9:15:00 p.m.	Feb. 11, 2021, 11:00:00 p.m.	This Is Going Well, I Think with David Cooper

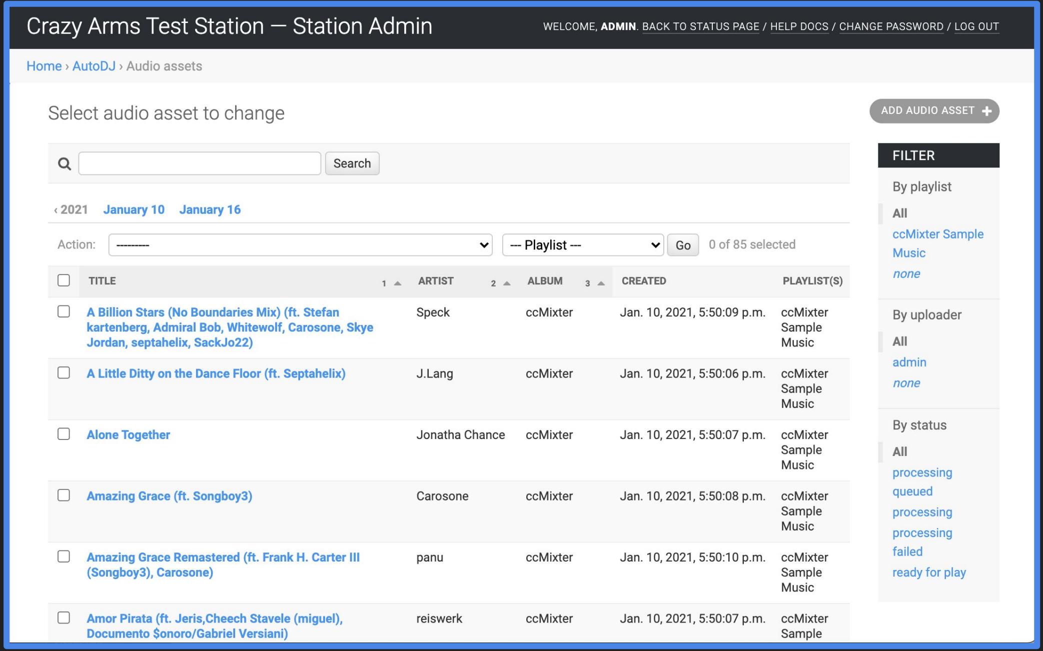
- DJs show times are **restricted** to GCal events *or* **always** authorized.

- Optional “entry” and “exit” grace periods

- Web app runs in the timezone settings of the logged in DJ account.

- When a restricted show time is up, DJ is kicked off. Any attempt to re-auth will be rejected. Uses `server.execute('<dj_source_id>.stop')`

Feature: AutoDJ and Pre-recorded Broadcasts



Crazy Arms Test Station — Station Admin

WELCOME, **ADMIN**. BACK TO STATUS PAGE / HELP DOCS / CHANGE PASSWORD / LOG OUT

Home › AutoDJ › Audio assets

Select audio asset to change

ADD AUDIO ASSET +

Search

‹ 2021 **January 10** **January 16**

Action: --------- — Playlist — Go 0 of 85 selected

☐	TITLE	ARTIST	ALBUM	CREATED	PLAYLIST(S)
☐	A Billion Stars (No Boundaries Mix) (ft. Stefan kartenberg, Admiral Bob, Whitewolf, Carosone, Skye Jordan, septahelix, SackJo22)	Speck	ccMixter	Jan. 10, 2021, 5:50:09 p.m.	ccMixter Sample Music
☐	A Little Ditty on the Dance Floor (ft. Septahelix)	J.Lang	ccMixter	Jan. 10, 2021, 5:50:06 p.m.	ccMixter Sample Music
☐	Alone Together	Jonatha Chance	ccMixter	Jan. 10, 2021, 5:50:07 p.m.	ccMixter Sample Music
☐	Amazing Grace (ft. Songboy3)	Carosone	ccMixter	Jan. 10, 2021, 5:50:08 p.m.	ccMixter Sample Music
☐	Amazing Grace Remastered (ft. Frank H. Carter III (Songboy3), Carosone)	panu	ccMixter	Jan. 10, 2021, 5:50:10 p.m.	ccMixter Sample Music
☐	Amor Pirata (ft. Jeris,Cheech Stavele (miguel), Documento $onoro/Gabriel Versiani)	reiswerk	ccMixter	Jan. 10, 2021, 5:50:07 p.m.	ccMixter Sample

FILTER

By playlist
- All
- ccMixter Sample Music
- *none*

By uploader
- All
- admin
- *none*

By status
- All
- processing queued
- processing
- processing failed
- ready for play

- Basic AutoDJ functionality
- Optional stop set support, ie groups of “jingles” that play at intervals, eg
  - Station ID / Ad / Ad / PSA / Station ID
- Optional weighted playlist support
- DJ’s web UI supports requests
- Admins can schedule long format, pre-recorded broadcasts for specific times
  - These get played at the ***exact*** right time using telnet server: `<prerecorded_source>.queue <uri>`
- Anti-repeat code on a per-track and per-artist basis
- Bulk importing via SFTP or command line, links like SoundCloud work with youtube-dl

What’s Next?

- *You can try it today! Preloaded with sample data!*
- Targeting first release: mid-February 2021
- We need a logo! If you want to help, reach out.
- What’s left?
  - Complete documentation
  - Improve front-end web app: jQuery to alpine.js - ***FOR SHAME!!!***
  - Freeze dependencies: Docker images, Python package versions
  - Release containers to Docker Hub
  - More complete unit testing
  - Test stream
  - There’s a TODO list in the repository
- Future Releases
  - Recorded archive of live shows (possibly as automatically published podcasts)
  - Better front-end visual design
  - Using S3 to store audio assets

Thanks

- AzuraCast, LibreTime - Several concepts come from them so **THANK YOU**
- The Liquidsoap Team
- *You for attending!*

Links

- Crazy Arms crazyarms.xyz / github.com/dtcooper/crazyarms
  - Link to this deck in the repo
- Me - david.cooper@burningman.org
  - github.com/dtcooper
- BMIR 94.5 FM / Shouting Fire
- Bonus: My terrible call-in radio show (NSFW) - www.jew.pizza
  This Is Going Well, I Think with David Cooper

Fin.

Questions / Comments