

# Assembling Freedom #11

By: 256 Foundation  
*A monthly newsletter*

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## **INTRODUCTION:**

Welcome to the eleventh newsletter produced by The 256 Foundation and supported by [Proto](#)! We are continuing to modify our newsletter content to make it as impactful as possible and make it aligned with everything we have going on at the 256 Foundation. That being said, the Freedom Tech News section now summarizes the content from POD256 throughout the month where we cover a wide range of Bitcoin mining and freedom tech topics. We are also dropping the State of the Network section to focus on more practical signal, also users can look up network stats easily and live anytime at the many resources we featured.

## **FREEDOM TECH NEWS:**

From [POD256 #89](#) on October 5, we dive into recent hardware developments, particularly the completion of the Ember One v5 PCB design. Key changes include a new, more modern voltage regulator with features like digital temperature monitoring, programmable over-temperature shutdown, and better performance for high-current applications. This upgrade addresses heat management challenges, as voltage regulators must sit close to ASIC chips and handle significant power, drawing comparisons to GPU designs and industrial miners. They discuss trade-offs, such as reducing maximum input voltage to 17v from 24v, and additions like breaking out pins for optional daughterboards to handle fan control, accommodating various setups like standalone, immersion cooling, or multi-board systems.

The conversation explores practical applications for Ember One hashboards, emphasizing open-source aspects where designs are shared on the [256 Foundation GitHub](#) for community validation and collaboration. We brainstorm system builds, noting compatibility with S9 chassis for up to six boards, integration with Libra control boards via USB, and potential for high-power setups using existing power supplies. Ideas for hash rate heating dominate, including fanless designs with massive heat sinks for passive room warming, firmware adjustments to target room temperatures via external sensors or Home Assistant integration, and fallback modes like hashing dummy blocks during network outages to maintain heat output without rewards. They highlight [Ryan's](#) work on Mujina firmware and shout-outs to contributors like [Schnitzel](#).

Shifting to software and broader Bitcoin topics, we discuss a [retweet](#) about IPv6 support for Bitaxe firmware,

explaining IPv4 address scarcity, dynamic IPs' challenges for IoT and home miners, and benefits of IPv6 for native adoption without centralized workarounds. Drama around Bitcoin Core's proposed changes to mempool and relay policies is unpacked, contrasting with Bitcoin Knots' more configurable approach to discourage spam while allowing permissiveness. We bring attention to a BIP for scriptable mempool policies for greater control, stress the importance of retaining "knobs" for node customization to counter potential censorship, and differentiate economic nodes (connected to miners/wallets) from non-economic ones, advocating for more decentralized setups.

Finally, we touch on upcoming TabConf in Atlanta, where they'll present on 256 Foundation projects amid growing mining interest at developer conferences. The bulk of the discussion centers on open source's value in hardware and software, citing examples like AWS and Microsoft's eventual embrace, benefits for rapid development and community contributions (e.g., Bitaxe's evolution since May 2022 without sole manufacturing burdens), and contrasts between permissive MIT licenses and copyleft (GPL/OHL) for ensuring user freedoms like inspection and modification. We emphasize providing editable CAD files (e.g., KiCad) over PDFs or Gerbers for true openness, debate enforcement via entities like [EFF](#), and argue open source spurs innovation even for commoditized products by accelerating adoption and preventing centralization. The episode wraps with light-hearted banter about haircuts and engagement photos.

From [POD256 #90](#) on October 15, we begin with light-hearted banter about taxes, financial advice disclaimers, and the challenges of non-KYC Bitcoin mining at home without seeking permission. Then transition into updates on the 256 Foundation's open-source Bitcoin mining projects, noting that several grantees are attending TabConf in Atlanta. [Eco](#) details the [Mujina firmware](#), developed by [Ryan](#) with his extensive embedded Linux background, built from scratch in Rust for modularity and flexibility. Key features include hot-swappable hashboards that auto-detect and load drivers, work distribution based on chip capabilities (e.g., rolling bits in nonce, time, or version fields), and broad compatibility beyond just BitAxe devices. The discussion emphasizes how [Mujina](#) addresses limitations in existing mining firmwares, enabling innovative setups like high-speed nonce exhaustion handling. We also cover Ember One v5 hardware iterations, including a modern voltage

regulator upgrade for better performance, reduced noise, I2C monitoring of power and temperature, and freed board space for add-ons like fan controllers, all shared openly on [GitHub](#) despite scope creep beyond initial grants.

The conversation shifts to [Hydra Pool](#), led by [Jungly](#) with his PhD in distributed systems and prior [P2Poolv2](#) work, aimed at lowering barriers for non-developers to run self-hosted pools via one-click deployment. Initial forks of CK Pool were tested during a telehash event but led to a Rust rewrite for modernity, with features like user-configurable coinbase payouts (breaking Bitcoin's 15-16 address limit), PPLNS mechanisms for proportional rewards, and an API endpoint for real-time share verification to avoid burdening operators with massive databases. We explore integration with P2Poolv2 for decentralized coordination and contrast it with Ocean's custodial nuances, where funds auto-payout after 100 blocks. Guests, Average Gary and [Skot](#) join from TabConf, discussing Stratum v2's advantages over v1, including binary protocols, end-to-end encryption via Noise (similar to Bitcoin nodes), and push-based block templates. Average Gary highlights his work packaging Stratum v2 for Start9, enabling hole punching for NAT traversal to allow peer-to-peer mining without public IPs, fostering local meetup pools and reducing centralization.

Average Gary elaborates on decentralizing mining further, proposing randomized coinbase addresses for privacy (eliminating pool signatures), eHash tokens as speculative shares backed by proof-of-work for variance mitigation, and integrations like BDK/LDK in Rust ecosystems. Comparisons arise between Stratum v2 and Datum, favoring Stratum v2 for open specs, Rust tooling, and non-custodial coinbase control. The group brainstorms real-world applications, such as dummy work for heat maintenance in hash rate heaters (e.g., greenhouses or homes), solar-powered mining with Home Assistant automation for free energy detection and mode switching (eco/high), and economic models where eHash enables marketplaces for block space or hardware loans. We touch on CPU optimizations for faster node syncing and the need for economic nodes with hash rate. The episode closes with shoutouts to hash rate contributors across pools like Lincoln, Solo CK, Public Pool, and Ocean, featuring creative worker names promoting businesses, and teases upcoming events like the Bitcoin Veterans Summit telehash. A brief firearms tangent covers building AR-15s from mil-spec parts and shooting experiences, underscoring the podcast's casual, community-driven vibe amid technical depth.

From [POD256 #91](#) on October 22, we open with hosts [Skot](#), [Tyler](#), and [eco](#) discussing trademark disputes surrounding the Bitaxe project. Skot explains how two Chinese entities are attempting to illegally register the Bitaxe trademark in the US, despite his prior use of the TM symbol for over two years. This involves perjury risks for the applicants, as they

must declare ownership under penalty. Skot, with legal assistance, is formally opposing the applications, applying for his own registration, and highlighting the bureaucratic hurdles, including fees and the lack of "public domain" trademarks. The conversation underscores the challenges of protecting open-source hardware from exploitation while avoiding centralization, noting similar issues in other countries like China, Germany, and the UK. They emphasize that open-source doesn't preclude profitability, citing examples like Arduino, and stress the importance of community-driven protection through copyleft licenses.

The discussion shifts to technical updates on 256 Foundation projects, including the [Ember One v5](#) PCB nearing production with features like impedance-matched traces for high-speed signals (e.g., USB and PCIe), automated by manufacturers for optimal performance. [Schnitzel](#) is finalizing the Libre Board design, while [Ryan's Mujina](#) firmware, built in Rust for modularity, supports hot-swappable hashboards, dynamic work distribution based on chip capabilities (e.g., rolling bits in nonce, time, or version fields), and avoids nonce exhaustion issues at high hash rates (>260-280 TH/s). They contrast Mujina's Linux-based approach with ESP Miner for low-power Bitaxe devices, noting tools like Bitaxe Raw for development passthrough. Tyler details his basement experiments with immersion-cooled S19/S21 miners (e.g., Fog Hashing C2) integrated into radiant floor heating, using separate loops, PID controls, and Home Assistant for automation based on solar excess, temperature sensors, and thermostats. Challenges include corrosion prevention, dynamic performance scaling (DPS) for thermal management, and the need for standardized APIs like [ASIC-RS](#) and [PyASIC](#) to unify miner communication across manufacturers.

Broader topics include educational initiatives, such as eco's proposed "Assembling Freedom" video series on KiCad, PCB assembly, and electronics unboxing, hosted on [Bitcoin.tv](#) to avoid YouTube censorship. They advocate for more manufacturers and community contributions to dismantle proprietary mining empires, criticizing misconceptions that open-source means nonprofit. Shoutouts are given to hashers on pools like Lincoln, Solo CK, Public Pool, and Ocean, with creative worker names promoting businesses (e.g., flute sheet music, refurbished nodes). The episode closes with a tangent on space-based mining, featuring Dyson Labs' plan to launch a Bitaxe CubeSat for low-Earth orbit, addressing challenges like radiative cooling, radiation hardening, and rideshare launches, potentially using miners as resistive heaters in vacuum conditions.

A brief firearms and CAD software sidebar touches on FreeCAD's usability issues, while the hosts reflect on Bitcoin's white paper anniversary and the untapped potential of hash rate heating, urging involvement in open-source efforts to commoditize mining tools.

From [POD256 #92](#) on October 29, we open with hosts [Skot](#), [Tyler](#), and [eco](#) engaging in casual banter about approaching episode 100 and the cold weather across their locations, contrasting Colorado's dry, sunny chill with Nashville's humid cold. They discuss Tyler's recent Forbes feature on "heat punk" projects, highlighting initiatives like Mint Green's community pool heating in Vancouver and Proto's open-source efforts, emphasizing how Bitcoin mining eliminates energy FUD by re-purposing waste heat. The conversation praises Canaan's home mining revenue (about a third from smaller units) and their efficiency (e.g., A16 at 12 J/TH), while critiquing Bitmain's dominance and proprietary practices, including rumors of pre-mining units during "break-in" periods for profit. Eco shares progress on [Libre Board](#) prototypes, delayed by customs destroying a shipment of components, and [Hydra Pool's](#) Docker-based release for easy self-hosting, tested with Bitaxe variants.

Technical deep dives include integrating Canaan miners (Avalon Q, Mini 3, Nano) into Home Assistant via Node-RED for automations like solar-optimized mining, real-time hash price adjustments, and thermostat-linked controls, bypassing proprietary APIs with shell scripts or [ASIC-RS](#) and [PyASIC](#). They explore RISC-V processors in Espressif's C6 chip for open-source benefits, Zigbee for low-power IoT (e.g., sensors lasting years), and Skot's single-board miner using an [Adit Board](#) and [Ant Hat](#) for a stealth enclosure, aimed at tobacco curing with heat reuse. Privacy concerns arise, advocating password managers (Bitwarden/KeePass), de-Googling (GrapheneOS), encrypted messaging (Signal), and self-hosting to avoid data harvesting by services like U-Haul or Ring, with anecdotes on invasive tech (e.g., car tracking, opt-out surveillance).

Broader topics critique Luke Dashjr's BIP-444 soft fork for implying legal risks and labeling non-adopters as supporting illicit content, contrasting it with open initiatives like Hydra Pool. Shoutouts go to hashers on pools like Lincoln, Solo CK, Public Pool, and Ocean, with creative names. The episode teases the 256 Foundation's Telehash in January on Hydra Pool, discusses hash rate as a prosperity metric over GDP (measuring energy efficiency/monetization), and ends with humor about network growth (1.12 Zeta hash) and Skot's kiln project.

## **FREE & OPEN MINING DEVELOPMENTS:**

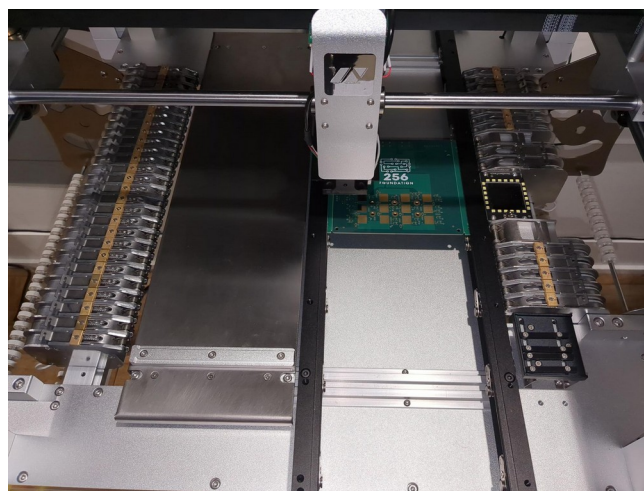
**October 28**, Home Assistant [docs](#) updated from Exergy, explaining how to send commands to Canaan Avalon Mini 3 miners in Home Assistant, using Node-RED and direct Canaan API calls. The documentation is rich in detail and extensive, enabling users to control a Canaan Avalon Mini 3 baseboard style miner/heater; from turning the device on/off to switching modes and power levels, this documentation will help you take your home mining setup to the next level of integration, control, and convenience.

**October 31**, [Satoshi Starter](#) launched by Reckless Systems is a project utilizing the Intel BZM2 ASIC chips donated by [Proto Mining](#) to the 256 Foundation and then disbursed to eager builders such as Reckless Systems. The project aims to deliver an open reference hardware design with supporting documentation. The documentation will provide all necessary information about how the ASIC chip works and how to interface and communicate with it so that no reverse-engineering is needed. The ability to develop and build with un-used ASIC chips and not have to un-solder them from existing miners and reverse engineer how they work is a massive step in the right direction. If this project interests you, you can support it through [Geyser Fund](#).

## **GRANT PROJECT UPDATES:**

### **Ember One**

Eco received printed circuit boards and the components needed to assemble the first five Ember One 00 v5 prototype boards. Once he has those assembled, then he can send them out to the devs for validation. Once validated and assuming no modifications are needed then he will do a small production run of about 100 units. In the picture below, the Ember One 00 v5 board is loaded in the Pick and Place machine and certain coordinates are being taken from the board's physical location relative to the placement bed of the machine, those values are saved in the machine's software and later used as references against the component placement coordinates that are exported from the kiCAD software.



[IMG-001] Ember One 00 v5 on the PnP Machine

### **Libre Board**

Schnitzel went on a Twitter Spaces with [@BuildaMinePod](#) to discuss the Libre Board project and home mining heat reuse applications. The discussion centered on democratizing Bitcoin mining, emphasizing how everyday individuals can participate without massive infrastructure investments. They explored the evolution of mining from industrial-scale operations to more inclusive models, highlighting barriers like high energy costs and hardware complexity. The host

opened by sharing insights on setting up affordable home nodes, stressing the importance of decentralization for Bitcoin's resilience.

A key segment focused on practical home mining setups, where Schnitzel detailed low-barrier entry points such as using consumer-grade ASICs or repurposed hardware. The conversation addressed common challenges like noise reduction, power efficiency, and pool selection, with tips on integrating mining with household energy systems. They discussed how recent advancements in firmware and open-source tools have lowered the technical threshold, allowing hobbyists to contribute to the network while earning modest rewards. The host emphasized running full nodes alongside mining to enhance security and sovereignty, arguing that accessibility strengthens Bitcoin against centralization risks.

The talk concluded with an in-depth look at waste heat utilization, a specialty of Schnitzel's Nakamoto Heating startup. He explained how miners can re-purpose excess heat for home heating, water warming, or even greenhouse applications, turning energy consumption into a dual-purpose benefit. Examples included real-world case studies of miners offsetting utility bills through heat recovery, promoting sustainability. The hosts wrapped up by encouraging listeners to start small, underscoring that widespread home mining fosters a more robust, decentralized Bitcoin ecosystem for the future.

### Mujina Firmware

Ryan has been preparing to release the Mujina Developers Preview, which will ship with the following disclaimer: "This software is under heavy development and not ready for production use. The code is made available for developers interested in contributing, learning about Bitcoin mining protocols, or evaluating the architecture. APIs, protocols, and features are subject to change without notice. Documentation is incomplete and may be inaccurate. Use at your own risk.". This initial public release will give developers a chance to see the foundations of Mujina and understand how it operates. They will also be able to test it out on Bitaxe hardware to hold them over until some Ember Ones are produced and/or until Mujina is able to run on other already existing hardware.

### Hydra Pool

On October 26 [Hydra Pool](#) was released and is now on v1.1.18. Hydra Pool is an open Source Bitcoin Mining Pool with support for solo mining and PPLNS accounting. We have an instance mining on mainnet at [test.hydrapool.org](https://test.hydrapool.org). But we hope you'll run a pool for yourself. The GitHub repo has instructions for running installing Hydra Pool and we will be producing a detailed step-by-step guide in the days ahead. We only accommodate up to 100 users at the moment for coinbase and block weight reasons, workers are limited by your hardware. Features include:

- 1) Run a private solo pool or host a PPLNS pool for your community of miners.
- 2) Payouts are made directly from the coinbase, meaning the pool operator doesn't custody any funds. No need to trust the pool operator.
- 3) Speaking of trusting the pool operator, users can download and validate the accounting of shares. We provide an API for the same. See API Server in GitHub.
- 4) Prometheus and Grafana based dashboard for pool, user, and worker statistics.
- 5) Use any bitcoin node that supports bitcoin RPC.
- 6) Implemented in Rust, for ease of extending the pool with novel accounting and payout schemes.
- 7) Open source with AGPLv3. Feel free to extend and/or make changes.

You can install Hydra Pool using the provided Docker files or you can build from source. We are working on packaging for [Start9OS](#) with the help of some pull requests which have already come in from the community.



[IMG-002] Hydra Pool Dashboard

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