

Infernet Protocol - ARCHITECTURE.md

Overview

This document outlines the planned technical architecture and implementation details for the Infernet Protocol, supporting CLI servers, desktop applications, and native mobile apps.

Supported Platforms

- **CLI / Server:** Node.js using vanilla JavaScript.
 - **Desktop:** Electron-based application using Svelte for UI.
 - **Mobile (Native):** React Native with Expo.dev for cross-platform mobile apps.
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Core Technologies

- **Communication:** WebSockets for real-time, bidirectional communication.
 - **Networking:** Decentralized discovery and peer-to-peer job distribution via DHT (Kademlia implementation).
 - **Backend:** PocketBase used as a local embedded backend for managing data, job metadata, reputation history, and local node configurations.
 - **Containerization:** Docker-based task execution for sandboxing and security.
 - **Data Transport:** Home-grown content addressing system for distributing models and large input data files.
 - **Styling:** Vanilla CSS across desktop and web interfaces for simplicity and consistency.
 - **Account and Reputation Management:** NOSTR protocol integration for decentralized identity, reputation tracking, and public key-based authentication.
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CLI (Server Nodes)

- Built on Node.js with vanilla JavaScript.
- Headless daemon process running:
 - Persistent DHT connections for discovery.
 - WebSocket server for receiving inference tasks.
 - Task execution engine using Docker.
 - PocketBase instance for local data management.
 - Result verification and submission.
 - Configuration file-based setup (JSON or YAML).

Desktop (Electron + Svelte)

- Electron wrapper for cross-platform desktop app (Windows, Mac, Linux).
- UI built with Svelte:
 - Node dashboard for monitoring jobs, GPU usage, reputation.
 - Aggregator interface for splitting and tracking jobs.
 - Client submission form.
- Embedded WebSocket client to communicate with the network.
- Home-grown content delivery system integration for uploading models and large datasets.
- PocketBase instance for local data and cache management.
- Local storage for logs and history.

Mobile (React Native with Expo)

- React Native app (expo.dev-based) for both iOS and Android.
 - Features:
 - Real-time job tracking for clients.
 - Push notifications for job completion and status changes.
 - Ability to submit small inference jobs (low-volume interfaces).
 - Display provider reputation and availability.
 - Communication via secure WebSocket clients.
 - Sync with PocketBase backend for local state management.
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Distributed Hash Table (DHT) Implementation

- **Protocol:** Kademlia-based DHT.
 - Peer discovery:
 - GPU providers register nodes with hardware specs.
 - Aggregators search for best-fit nodes by reputation and load.
 - Dynamic updates for provider uptime and status.
 - Gossip-based protocol for reputation dissemination.
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Payment Systems

- **Initial Release:**
 - Polygon stablecoin payments.
 - Bitcoin Lightning Network micro-payments.
 - **Future Payment Systems:**
 - Solana integration for high-throughput, low-fee payments.
 - Other L2 and cross-chain payment solutions.
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Task Workflow Summary

1. **Discovery:** Aggregator queries DHT for available providers.
 2. **Job Dispatch:** Aggregator distributes inference job shards via WebSocket.
 3. **Execution:** Provider executes job in a Docker container.
 4. **Result Submission:** Provider sends result hashes and data via WebSocket.
 5. **Verification:** Aggregator performs redundant checks or validator sampling.
 6. **Payment Settlement:** Upon verification, payments released via micro-payment systems.
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Security

- Container isolation (Docker).
 - End-to-end encryption for job payloads.
 - Validator sampling for result trust.
 - Use of NOSTR keys for identity verification and signing.
 - Potential use of secure enclaves (SGX/SEV) in future iterations.
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Logging and Monitoring

- CLI/Server: JSON-based structured logs.
 - Desktop: Visual logs with exportable summaries.
 - Mobile: Lightweight notifications and log snapshots.
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Next Steps

- Define schemas for discovery messages and job specifications.
- Define Docker execution templates.
- Create WebSocket communication spec (message types and formats).
- Finalize DHT node join/leave protocols and health checks.
- Begin design of home-grown content delivery and retrieval system.
- Integrate NOSTR protocol libraries for reputation and identity management.

Contact

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