IT LOG ANALYSER
SIH 1408

Team AlgoAllies

Our Team

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Problem Statement

- **IT SYSTEM LOG ANALYSER:** The CRPF has deployed units and personnel in diverse locations across the country. However, there is currently no centralized system in place for experts to analyze IT system logs, evaluate potential threats, and identify breaches.

- Log Analysis helps to discover many loopholes in networks that are opened intentionally by attackers or unintentionally because of misconfiguration, and bugs in the Software, Hardware, and Firmware.

Solution

- **IT SYSTEM LOG ANALYSER:** We have developed a log analyzer integrating blockchain, cloud computing, and machine learning for secure and tamper-proof log storage and efficient monitoring. Utilizing blockchain ensures the integrity of log records, making them immutable and resistant to manipulation or forgery.

  The system includes:-
  1. Log Generator Devices
  2. Local Log Servers for collection and processing
  3. Log Monitoring Clients for analysis
  4. Logging Cloud Server employing blockchain

  Updates to centralized log servers require consensus and valid approval from all participating network and sub-network nodes, ensuring a robust and secure logging infrastructure.

USP

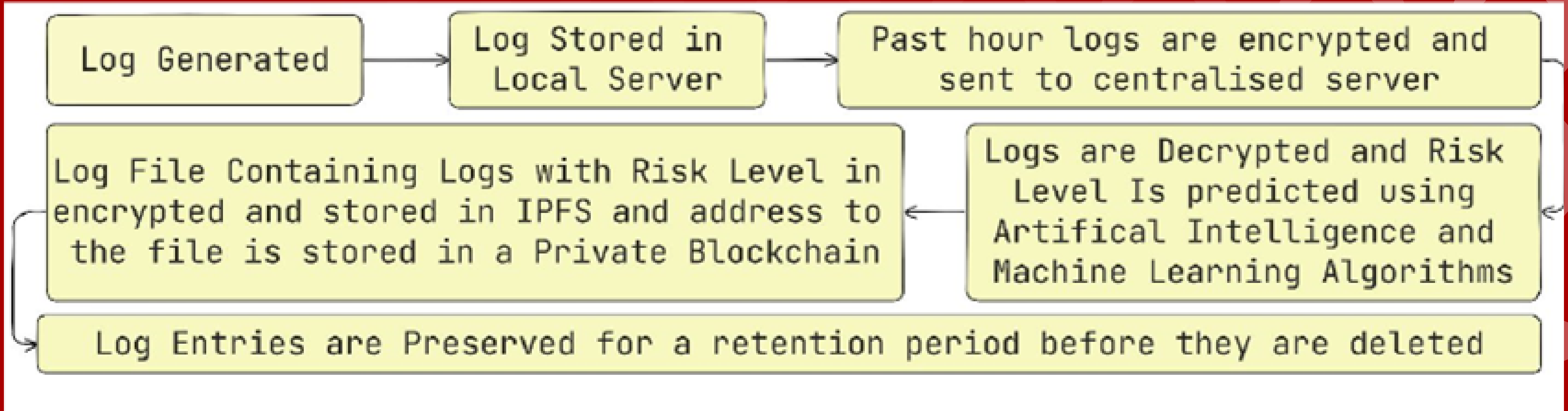
- Real-time analysis and customizable alerts: customizable alerts and notifications based on specific log patterns or security events, ensuring prompt response to potential issues.

- The system offers interactive data visualization tools, including graphs and charts, to help experts gain insights from log data more effectively.

- We employed InterPlanetary File System (IPFS) for decentralized storage in blockchain, eliminating failure points. Cryptographic hashes ensure data integrity, reducing redundancy and preserving decentralization for off-chain data.

- This can lead to high storage costs, especially for large datasets.

Flow Chart



Log Generated

Log Stored in Local Server

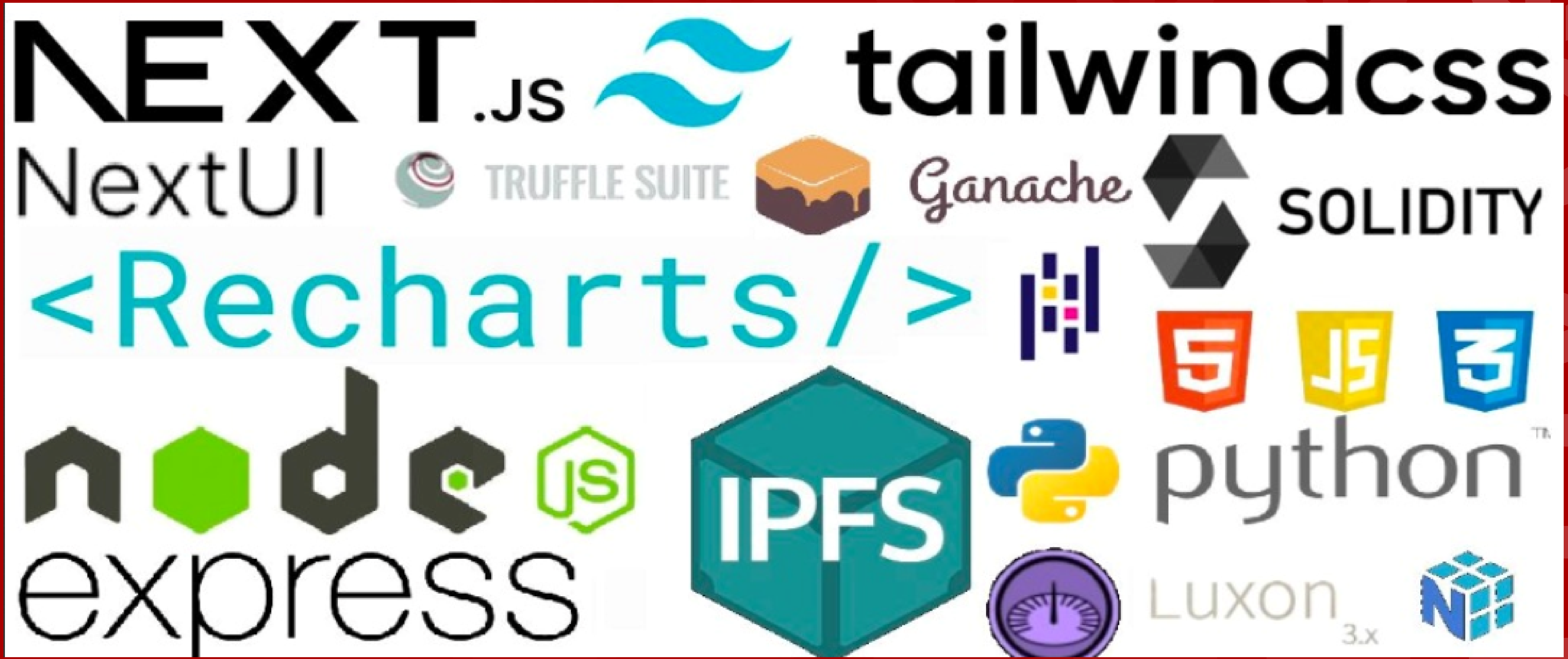
Past hour logs are encrypted and sent to centralised server

Logs are Decrypted and Risk Level Is predicted using Artifical Intelligence and Machine Learning Algorithms

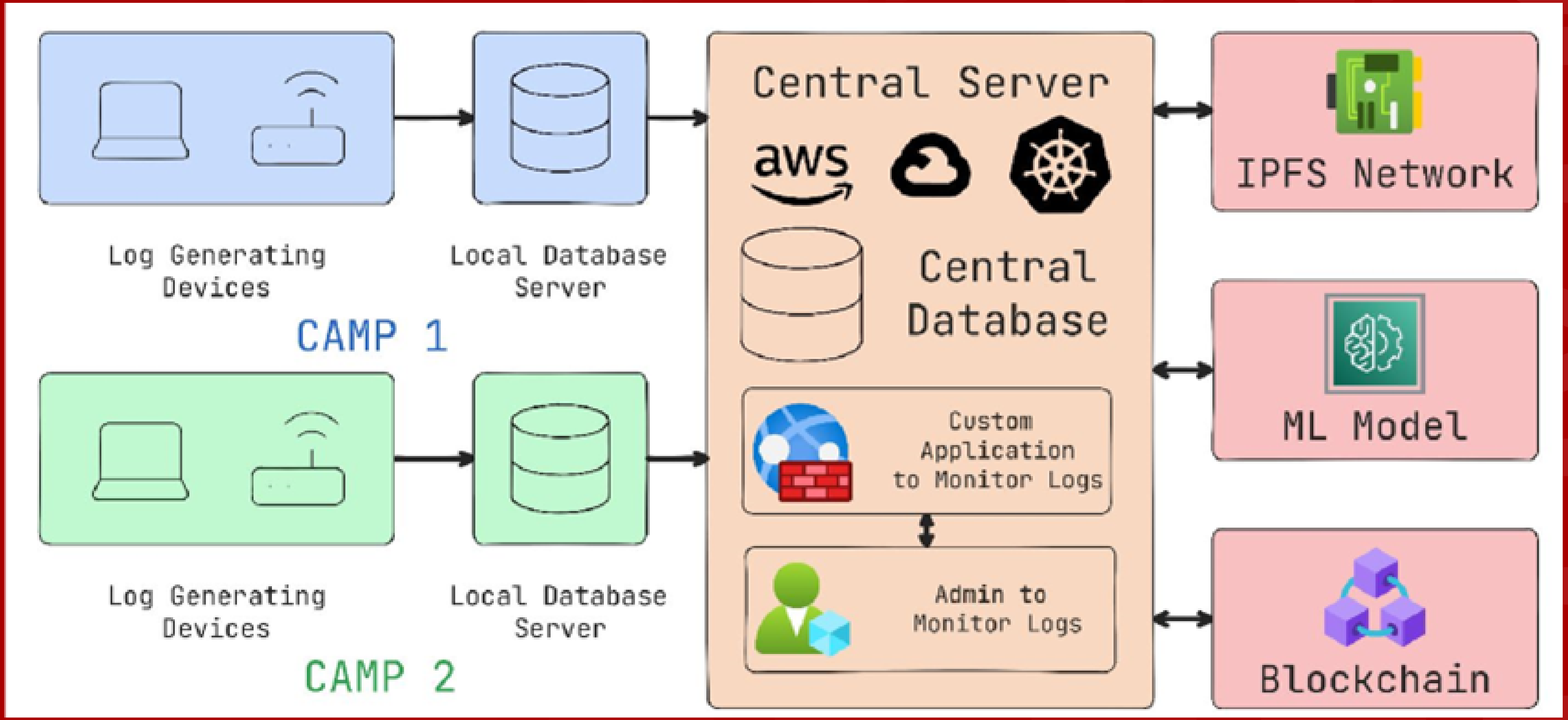
Log File Containing Logs with Risk Level in encrypted and stored in IPFS and address to the file is stored in a Private Blockchain

Log Entries are Preserved for a retention period before they are deleted

Tech Stack


NEXT.JS
tailwindcss
NextUI
TRUFFLE SUITE
Ganache
SOLIDITY
<Recharts/>
5
JS
3
node JS
express
IPFS
python™
Luxon 3.x
N

Infra (Diagram)



Why Not Just Blockchain

- Storing data on a blockchain can be expensive, as each node in the network must replicate and maintain a copy of the entire blockchain, including the stored data. This can lead to high storage costs, especially for large datasets.

- As the number of transactions and data stored on the blockchain increases, the network can become congested, leading to slower transaction processing times and higher fees.

- Executing operations on a blockchain, such as storing data or executing smart contracts, incurs gas costs.

What is IPFS

- IPFS is a open sourced modular suite of protocols for organizing and transferring data, designed from the ground up with the principles of content addressing and peer-to-peer networking.

- IPFS works by connecting computers in a network to enable them to share files. Each file and its contents are given a unique hash, and when someone requests a file, the network locates it based on that hash.

- Video on how data is stored in IPFS

- Idea behind IPFS

Why IPFS

- IPFS uses cryptographic hashes to uniquely identify content based on its actual data. This ensures that the address of a file is determined by its content, making it **tamper-evident** and **immutable.**

- IPFS provides faster access to data by enabling it to be replicated to and retrieved from multiple locations, and allowing users to access data from the nearest location using content addressing instead of location-based addressing.

- IPFS is an open, distributed and participatory network that reduces data silos from centralized servers, making IPFS more resilient than traditional systems

Why IPFS

- Failure of a single or even multiple nodes in the network does not affect the functioning of the entire network.

- IPFS is an open, distributed and participatory network that reduces data silos from centralized servers, making IPFS more resilient than traditional systems.

- Once a file is added to the IPFS network, the content of that file cannot be changed without altering the content identifier (CID) of the file. This feature is excellent for storing data that does not need to change .

- IPFS prevents vendor lock-in

ML Model

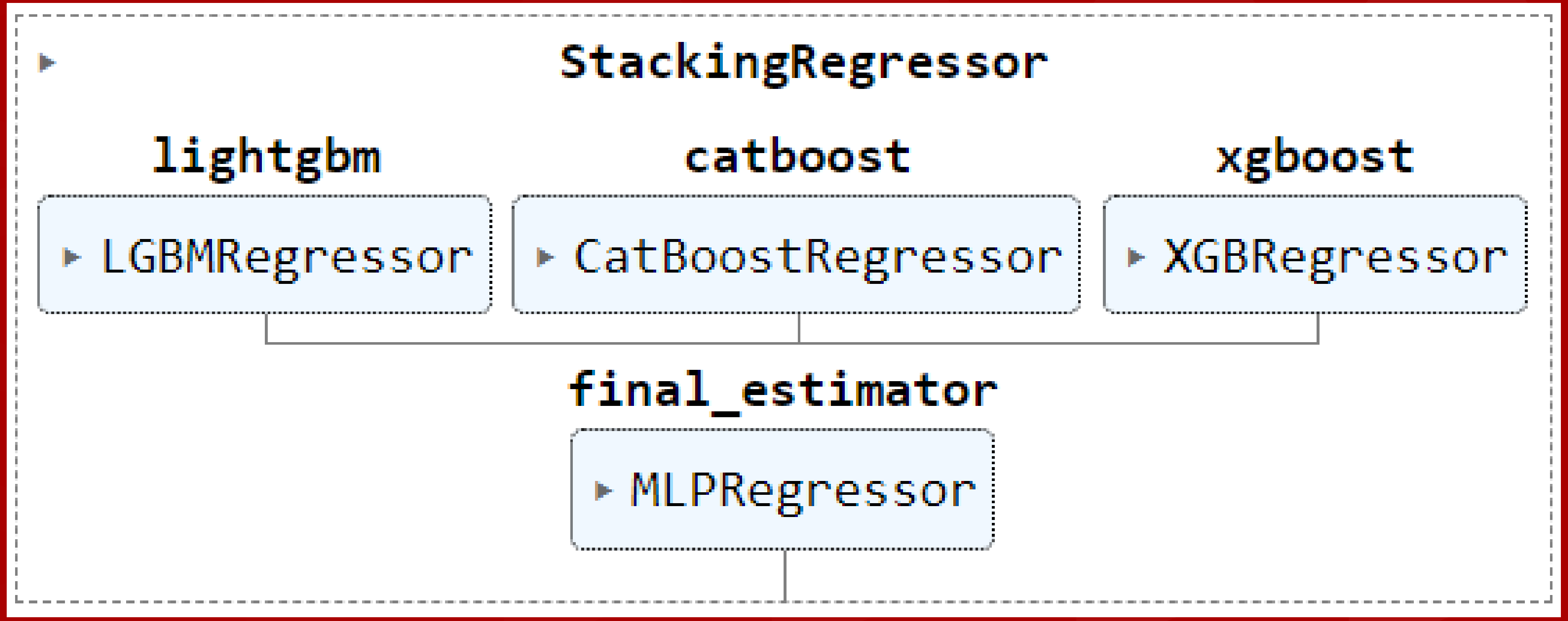
- An ML model is integrated into the project to predict the **risk percentage of entered logs.**

- The model is currently trained on a dummy dataset, and it will remain fully functional when replaced with a real dataset with the same features.

- We've compiled a dummy dataset with various features extracted from the logs.

- This is a **regression model** predicting a continuous output from 0 to 1 (1 being most risky, 0 being least) based on input features.

ML Model



- In this model, we employ the Stacking concept, combining three strong regressors - **XGBoost, CatBoost, and LightGBM.**
- A meta regressor, **MLPRegressor**, is used to finalize the model.
- Instead of a standard train-test split, we opt for **cross-validation** to mitigate overfitting risks.

ML Model

- Since we are using a dummy dataset it is difficult to predict how well the model will be in practice, but with techniques like stacking and cross validation we end up with a model that is **very well generalized.**

- With access to a real dataset, we can try **hyperparameter tuning, using different models, and feature engineering** to further improve our model.

Security Concerns

- If a gateway provider wants to limit access to requests with authentication, they may need to configure a reverse proxy, develop an IPFS plugin, or set a cache layer above IPFS.

- Configuring a reverse proxy is the most popular way for providers to handle authentication. Reverse proxy can also keep the original IPFS API calls which makes the gateway adaptable to all IPFS SDK and toolkits.

Security Concerns

- When sensitive files are stored using IPFS, they are broken into smaller pieces and distributed across multiple nodes. Retrieving the complete file requires consensus from most nodes, making it inherently more secure and resilient.

- We can store hashed references to sensitive data on the blockchain, ensuring that any changes to the data are immediately evident.

- Smart contracts can be programmed to execute access control logic and encrypting the data stored on IPFS ensuring that only parties with the appropriate permissions can retrieve or modify specific data stored on IPFS.

Architecture Safe from Hackers?

- The consensus mechanism plays a vital role in the security of a blockchain. Select a proven and secure consensus algorithm, such as Proof of Work (PoW) or Proof of Stake (PoS).

- Implement firewalls to control incoming and outgoing traffic, and use network segmentation to isolate different components of our blockchain network.

- IPFS has strict set of rules that does not allow unauthorised access of logs.

- Our System being accessible only to a private network logs can only be accessed by just authorised systems.

Architecture Safe from Hackers?

- We implemented Strong authentication mechanisms, such as multi-factor authentication (MFA), for accessing the systems
- Implement network segmentation to isolate the private network from external threats
- Configure firewalls to allow only necessary traffic to and from authorized systems. Restrict access to specific IP addresses and ports.
- Use Transit Encryption
- Make sure Employee Training is given priority.

What to do with Trillions of Logs?

- Periodically review and prune logs that are no longer essential for the integrity of the blockchain.

- Archived data can be stored more cost-effectively, while critical information remains on the blockchain.

- Larger datasets, represented by extensive logs, enable the application of advanced analytics and machine learning algorithms for predictive modeling.

What to do with Trillions of Logs?

- More logs provide a rich source of data for research, analysis, and optimization. Researchers and analysts can study historical patterns, trends, and user behaviors to derive insights.

- Storing logs on IPFS in expensive as duplication of file happens. We can delete logs from IPFS and store them in a traditional manner using compression techniques for efficient storage after some time

Minimizing Cloud Dependency

- We Plan to reduce the dependency on Cloud Providers like AWS by using On-Premises Data Center for storing data as they are cheaper to maintain and build.
- We can also take advantage of current infrastructure by adapting to a Hybrid or Private Cloud Model

Performance

Market readiness

Future scope

Business Model

- Customer Segments: Enterprise clients, with complex infrastructures, rely on robust log analysis. SMEs seek cost-effective solutions, while MSPs require log analysis for efficient client management.

- Revenue Streams: Subscription Plans generate revenue through tiered log analysis packages. Professional Services offer consulting and customization options.

Thank You !