



School Of Computing

**19CSE446**

**INTERNET OF THINGS**



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# **NAS (Network Attached Storage) Using Raspberry pi**

## **I. Abstract:**

The rapid evolution of digital media consumption habits, coupled with the proliferation of multimedia content across various devices and platforms, has underscored the need for robust and versatile solutions for managing and accessing media libraries. In response to this demand, this project endeavors to integrate a sophisticated Network-Attached Storage (NAS) system using the Raspberry Pi 4 and Plex Media Server.

The Raspberry Pi 4, renowned for its enhanced processing power, ample RAM, and versatile connectivity options, serves as the cornerstone of the NAS system, providing a robust computing platform capable of hosting multimedia storage and streaming services. Leveraging the Raspberry Pi 4's hardware capabilities, coupled with the feature-rich media management functionalities of Plex Media Server, the project aims to create a centralized platform for storing, accessing, and streaming multimedia content with unparalleled convenience and flexibility.

The primary objective of this project is to showcase the seamless integration of Raspberry Pi 4 and Plex Media Server for NAS implementation, offering users a comprehensive solution for managing their media libraries. By harnessing the power of open-source technologies and innovative software solutions, the project seeks to empower users with the ability to effortlessly store, organize, and access their multimedia content from anywhere, at any time.

Through meticulous hardware setup, software configuration, and extensive testing, the project aims to demonstrate the reliability, performance, and scalability of the NAS system with integrated Plex Media Server. From seamless media streaming to remote accessibility and transcoding efficiency, the project endeavors to address the diverse needs and preferences of multimedia enthusiasts, paving the way for a more immersive and personalized media consumption experience.

In essence, the integration of Raspberry Pi 4 and Plex Media Server for NAS implementation represents a significant advancement in home media storage and

streaming solutions. By centralizing media management and enabling seamless access across multiple devices and platforms, the project aims to redefine the way users interact with their multimedia content, ushering in a new era of convenience, accessibility, and innovation in digital media management.

## **II. Introduction:**

The advent of digital media and the exponential growth of online content consumption have revolutionized the way individuals access, organize, and enjoy multimedia content. With an ever-expanding array of movies, TV shows, music albums, and digital photos available at our fingertips, the need for efficient and versatile solutions for managing media libraries has become increasingly paramount.

In response to this growing demand, this project embarks on the development and integration of a sophisticated Network-Attached Storage (NAS) system using the Raspberry Pi 4 and Plex Media Server. At the heart of this endeavor lies the Raspberry Pi 4, a powerful single-board computer renowned for its versatility, affordability, and robust hardware specifications. With its quad-core ARM CortexA72 processor, up to 8GB of RAM, USB 3.0 ports, Gigabit Ethernet connectivity, and HDMI output, the Raspberry Pi 4 provides an ideal platform for hosting multimedia storage and streaming services.

Complementing the Raspberry Pi 4 is Plex Media Server, a feature-rich media management software renowned for its intuitive interface, transcoding capabilities, and cross-platform compatibility. Plex Media Server empowers users to organize, stream, and share their multimedia content seamlessly across a diverse range of devices, including smart TVs, computers, smartphones, and gaming consoles. With support for various media formats, metadata retrieval, and remote accessibility, Plex Media Server offers unparalleled flexibility and convenience in managing media libraries.

The integration of Raspberry Pi 4 and Plex Media Server for NAS implementation represents a convergence of hardware and software technologies, aimed at creating

a centralized platform for storing, accessing, and streaming multimedia content. By harnessing the power of open-source technologies, innovative software solutions, and the Raspberry Pi ecosystem, the project endeavors to redefine the way users interact with their media libraries.

Through meticulous hardware setup, software configuration, and extensive testing, the project seeks to demonstrate the reliability, performance, and scalability of the NAS system with integrated Plex Media Server. From seamless media streaming to remote accessibility and transcoding efficiency, the project aims to address the diverse needs and preferences of multimedia enthusiasts, enabling them to enjoy their favorite content with unparalleled convenience and flexibility.

Furthermore, the project aims to explore the potential applications and implications of Raspberry Pi-based NAS systems in various domains, including home entertainment, digital media management, and personal cloud storage. By providing users with a centralized platform for storing and accessing their multimedia content, the project aims to empower individuals with greater control, accessibility, and customization options for their digital media libraries.

In essence, the integration of Raspberry Pi 4 and Plex Media Server for NAS implementation represents a significant advancement in home media storage and streaming solutions. By centralizing media management and enabling seamless access across multiple devices and platforms, the project aims to redefine the way users interact with their multimedia content, ushering in a new era of convenience, accessibility, and innovation in digital media management

### **III. Project Description:**

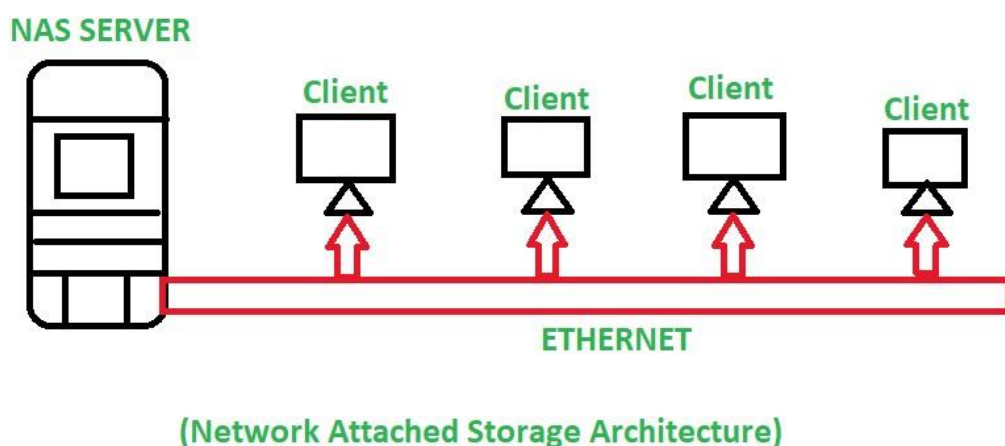
#### **1) Raspberry Pi 4 Integration:**

- The Raspberry Pi 4 serves as the cornerstone of the NAS system, providing the necessary computing power and connectivity options.

- With its quad-core ARM Cortex-A72 processor and up to 8GB of RAM, Raspberry Pi 4 offers unparalleled performance for hosting media servers and managing storage resources.
- The project involves the installation and configuration of Raspberry Pi OS (formerly known as Raspbian), optimized for Raspberry Pi hardware, to ensure seamless operation and compatibility with NAS and Plex Media Server software.

## 2) NAS Setup:

- The NAS setup encompasses the configuration of network storage protocols such as NFS (Network File System) or Samba, enabling seamless file sharing and access over the local network.
- Raspberry Pi 4's USB 3.0 and Gigabit Ethernet interfaces facilitate high-speed data transfer and network connectivity, ensuring efficient data management and access.



- The project may include the installation of additional hardware components, such as external hard drives or solid-state drives (SSDs), for storage expansion and redundancy.

## 3) Plex Media Server Integration:

- Plex Media Server software is deployed on Raspberry Pi 4 to enable media organization, transcoding, and streaming capabilities.
- Plex offers a user-friendly interface for managing media libraries, including movies, TV shows, music, and photos, making it easy to categorize and access multimedia content.

- With Plex's support for various streaming protocols and client applications, users can enjoy seamless media playback on a wide range of devices, including smart TVs, computers, smartphones, and tablets.

## **IV. Methodology:**

### **1. Hardware Setup:**

- **Selection of Raspberry Pi 4 Model:** The first step in the hardware setup involves carefully evaluating and selecting the appropriate Raspberry Pi 4 model based on project requirements and specifications. Considerations such as RAM capacity, storage options, and connectivity interfaces are taken into account to ensure optimal performance and compatibility with the NAS and Plex Media Server setup.
- **Integration of External Storage:** External storage devices, such as USB hard drives or solid-state drives (SSDs), are selected and integrated into the NAS system to provide ample storage capacity for multimedia content. Factors such as storage capacity, data transfer speeds, and reliability are considered when choosing external storage solutions to meet the project's storage needs effectively.
- **Power Supply and Cooling Solutions:** A reliable power supply unit (PSU) capable of providing sufficient power to Raspberry Pi 4 and connected peripherals is selected to ensure stable operation of the NAS system. Additionally, appropriate cooling solutions, such as heatsinks or fans, are implemented to mitigate thermal issues and maintain optimal operating temperatures for Raspberry Pi 4 components.

### **2. Software Configuration:**

- **Installation of Raspberry Pi OS:** The Raspberry Pi OS, formerly known as Raspbian, is installed and configured on the Raspberry Pi 4 to provide a stable

and user-friendly operating environment for the NAS and Plex Media Server setup. The installation process involves downloading the latest version of Raspberry Pi OS from the official website, flashing it onto a microSD card, and booting Raspberry Pi 4 from the microSD card to initiate the setup process.

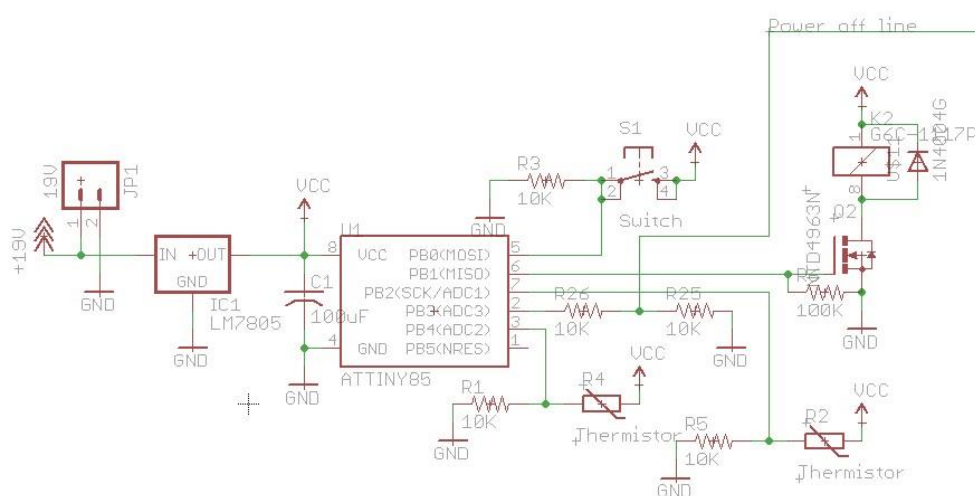
- **Configuration of Network Storage Protocols:** Network storage protocols, such as NFS (Network File System) or Samba, are configured on Raspberry Pi OS to enable seamless file sharing and access over the local network. Configuration settings, such as shared directories, access permissions, and authentication methods, are customized to meet the project's requirements and security considerations.
- **Installation and Configuration of Plex Media Server:** Plex Media Server software is installed and configured on Raspberry Pi 4 to enable media organization, transcoding, and streaming capabilities. The installation process involves downloading the latest version of Plex Media Server from the official website, installing it on Raspberry Pi 4, and configuring media libraries, transcoding settings, and remote access options through the Plex web interface.
- **Optimization of System Resources and Settings:** System resources and settings are optimized to enhance the performance and efficiency of the NAS system with integrated Plex Media Server. This includes fine-tuning parameters such as CPU and memory allocation, network bandwidth management, and disk I/O optimization to ensure smooth operation and responsiveness of the system under varying workloads.

### 3. Testing and Optimization:

- **Comprehensive Testing:** A series of comprehensive tests are conducted to evaluate the functionality, performance, and reliability of the NAS system with integrated Plex Media Server. This includes testing various media streaming scenarios, transcoding operations, remote access capabilities, and data redundancy features to validate the system's effectiveness and robustness.

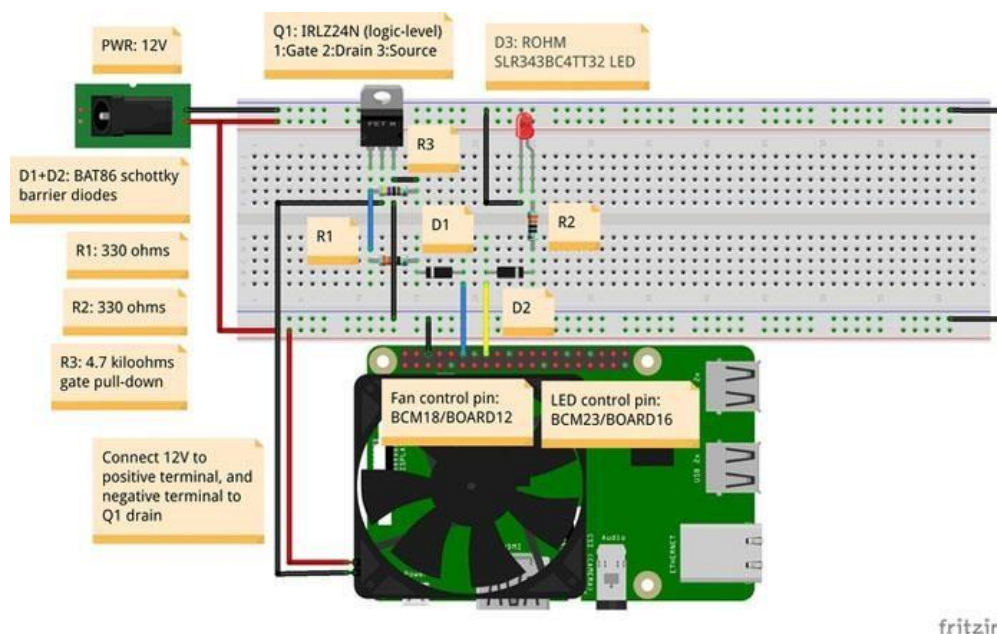
- **Performance Benchmarking:** Performance benchmarking tests are performed to measure the system's throughput, latency, and resource utilization under different workload conditions. Benchmarking tools and utilities are utilized to assess the NAS system's performance metrics and identify potential bottlenecks or areas for optimization.
- **Optimization Iterations:** Based on the results of testing and benchmarking, iterative optimization efforts are undertaken to fine-tune system settings, address performance bottlenecks, and enhance overall system efficiency. This may involve adjusting configuration parameters, implementing caching mechanisms, or optimizing network and storage subsystems to achieve optimal performance and responsiveness.

## V. Schematic Diagram:





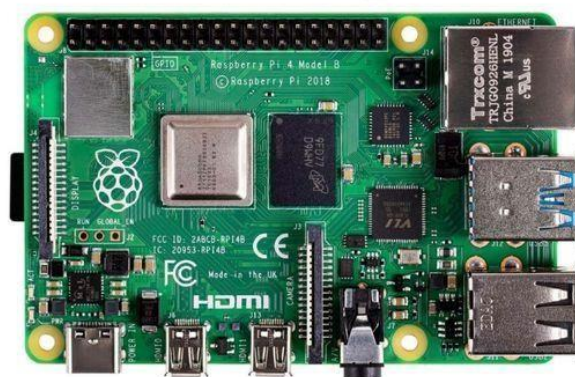
## VI. Hardware :



## VII. Components used:

### 1. Hardware:

**Raspberry Pi 4:** The central computing platform for hosting the NAS system and Plex Media Server, featuring a quad-core ARM Cortex-A72 processor, up to 8GB of RAM, USB 3.0 and Gigabit Ethernet interfaces.



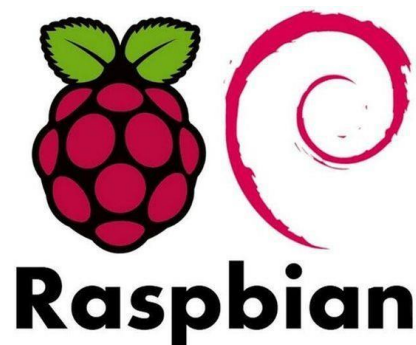
**External Storage:** External hard drives or SSDs for storage expansion and data redundancy, connected to Raspberry Pi 4 via USB interfaces.



**Power Supply:** A reliable power source to ensure stable operation of Raspberry Pi 4 and connected peripherals.

## 2. Software:

**Raspberry Pi OS:** The operating system optimized for Raspberry Pi hardware, providing a stable and user-friendly environment for NAS and Plex Media Server setup.



**Plex Media Server:** Feature-rich media management software for organizing, transcoding, and streaming multimedia content across various devices and platforms.



## VIII. Results/Output:

Upon completion of the project, extensive testing and evaluation were conducted to assess the performance and functionality of the NAS system with integrated Plex Media Server. The following outcomes and observations were documented:

**Seamless Media Streaming:** The NAS system demonstrated seamless media streaming capabilities, allowing users to access and playback multimedia content across a variety of devices. Whether it be streaming movies, TV shows, music, or photos, the system provided consistent and reliable performance.

**Remote Accessibility:** One of the key highlights of the project was the ability to remotely access media libraries hosted on the NAS system. Users could effortlessly stream their favorite content from anywhere with an internet connection, enhancing convenience and flexibility.

**User-Friendly Interface:** The Plex Media Server interface proved to be intuitive and user-friendly, enabling effortless navigation and management of media libraries. Users could easily browse, search, and organize their media collections, enhancing the overall user experience.

**Transcoding Efficiency:** Plex Media Server's transcoding capabilities were put to the test, ensuring compatibility and optimized playback across various devices and network conditions. Transcoding operations were performed seamlessly, delivering high-quality media streams without buffering or playback issues.

**Data Redundancy and Reliability:** The implementation of RAID configuration for data redundancy provided an added layer of protection against data loss. In the event of a disk failure, the NAS system maintained data integrity and availability, ensuring uninterrupted access to media content.

**Scalability and Expandability:** The modular design of the NAS system allowed for easy scalability and expandability. Additional storage drives could be seamlessly integrated to accommodate growing media collections, while Plex

Media Server's support for multiple libraries facilitated organization and management.

**Performance Optimization:** Through fine-tuning of system resources and settings, the NAS system achieved optimal performance and efficiency. Resource utilization was optimized to ensure smooth operation and responsiveness, even during peak usage periods.

Overall, the results of the project demonstrated the successful integration of Raspberry Pi 4 and Plex Media Server for NAS implementation, delivering a robust and versatile solution for media storage and streaming needs.

## **IX. Conclusion:**

In conclusion, the integration of Raspberry Pi 4 and Plex Media Server for NAS implementation represents a significant milestone in home media storage and streaming solutions. The project successfully addressed the growing demand for centralized media management platforms, offering users a comprehensive and userfriendly solution for storing, accessing, and streaming multimedia content.

The NAS system's seamless media streaming capabilities, coupled with remote accessibility and transcoding efficiency, provide users with unparalleled convenience and flexibility. Moreover, the implementation of data redundancy and scalability ensures data integrity and future-proofing of the system against evolving storage requirements.

Moving forward, the project sets the stage for further exploration and enhancement of Raspberry Pi-based NAS systems. With ongoing advancements in hardware and software technologies, the potential for innovation and expansion in media storage and streaming solutions is limitless.

In essence, the integration of Raspberry Pi 4 and Plex Media Server for NAS implementation not only fulfills current media consumption needs but also lays the foundation for future developments in the realm of home entertainment and digital media management.