White Paper

Actiphy Rapid Deploy

～TCP-SlideCast Technology: Enhancing Data Transfer Efficiency～

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An Actiphy White Paper

Introduction

In the evolving landscape of network-based data transfer, efficiency and speed are paramount, especially when disseminating large backup image files across multiple clients. TCP-SlideCast emerges as a revolutionary approach, addressing the limitations encountered in traditional data transfer methods. This white paper delves into the technical underpinnings and advantages of this technology, which we developed to optimize the distribution of backup image file data from a central server to multiple client machines.

Data Transfer Methodologies

Traditional Approaches

1. One-to-Many (1-N) Unicast Architecture

In the 1-N model, a single server either pushes data to multiple clients or multiple clients fetch data from a single server. This method's efficiency diminishes linearly with increased client count as the server's network interface card (NIC) becomes a bottleneck, leading to prolonged restore times.

2. One-to-Many (1-N) Multicast Architecture

This method utilizes UDP multicast, enabling the server to broadcast data to all clients simultaneously. Despite its theoretical efficiency, practical limitations such as UDP packet size restrictions and packet loss significantly hinder its viability for large-scale data transfers.

The TCP-SlideCast Approach

3. One-to-One (1-1…N) Slide Architecture

The TCP-SlideCast technology introduces an innovative 1-1…N slide architecture in which data is transferred sequentially from one client to the next, significantly reducing the load on the server's NIC and ensuring efficient utilization of network resources.

Implementation and Innovations

1. Efficient Data Handling

Leveraging TCP eliminates the custom transport layer implementation requirement, improving CPU utilization. This secure and closed network model also prevents the need for CPU-intensive encryption and decryption during transmission. Backup image data, pre-processed through deduplication and compression, is transmitted seamlessly.

2. FIFO Memory Pool

The FIFO (First In, First Out) memory pool facilitates low overhead and smooth data handling and transmission to subsequent clients. It can pause and resume data reception based on memory availability.

3. Optimized Data Flow

TCP-SlideCast dispatches configurable, fixed-size data blocks, efficiently transferring from the initial client to the last in the sequence before being discarded. This strategy guarantees a reduced memory footprint and enhances data transfer efficiency. Leveraging a zero-latency local area network further minimizes packet loss, presenting a significant improvement over the inherently lossy nature of multicast UDP.

Overview of the Process

1. **Initialization of ImageCast Server:** The ImageCast server begins operating by activating and listening on a designated UDP port for incoming client connections.
2. **Client Discovery:** Clients are initiated and broadcast signals to the UDP port to locate the ImageCast server. This discovery phase is crucial for establishing a communication link between clients and servers.
3. **Connection Establishment and Identification:** Clients establish a connection upon locating the ImageCast server. The server, in turn, identifies each client by its IP address and determines the network interface card (NIC) used for the connection.
4. **Client Grouping by NIC:** The server organizes clients into multiple casting groups based on the network interface card (NIC) through which they are connected. This grouping ensures efficient communication among clients connected through the same NIC. Each group forms a sequential chain of clients, optimizing the data transmission process within the group.
5. **Sequential Data Transmission:**
    a. **Initial Deployment:** The server commences the data deployment process by transmitting the image data to the first client in the chain.

b. **Chain Transmission:** Upon receiving the image data, each client forwards it to the next in the sequence. The server facilitates this by providing each client with the IP information of the subsequent client in the chain.

Data Optimization Techniques

Deduplication and Compression

Using deduplicated backup image files significantly reduces the data size, enhancing transfer speed. The system is optimized to handle deduplicated data effectively, leveraging a deduplication bitmap to manage data reuse and minimize redundancy intelligently.

Incremental Backup Image Files

TCP-SlideCast strategically approaches incremental backup image file restoration, prioritizing the latest incremental files. This method ensures that data is restored only once, regardless of its presence in multiple files, thereby streamlining the recovery process.

Conclusion

TCP-SlideCast technology represents a significant leap forward in network-based backup image file distribution. By addressing the limitations of traditional data transfer methods and introducing innovative solutions for efficient data handling, TCP-SlideCast stands poised to redefine the speed standards and efficiency in data transfer across multi-machine environments.

TCP-SlideCast Data Transfer Process

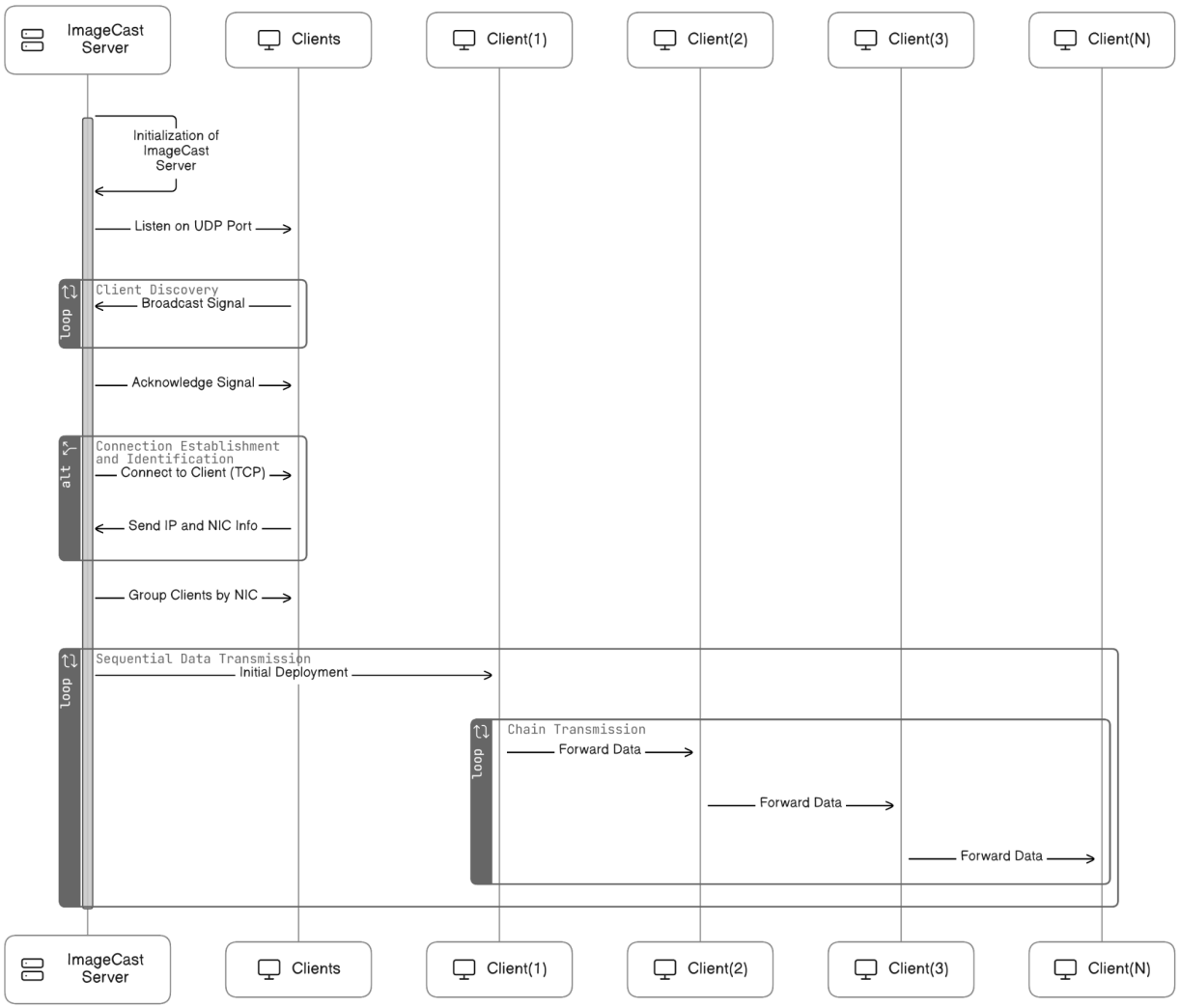

Figure 1.