Draft Design of DHCP Server Cluster

**1. Architecture Description**

The following functionalities will be implemented in this project:

* **DHCP service**: Implement DHCP protocol to provide IPV4 DHCP service.
* **Scalability&Usability**: Based on distributed file system, the architecture is easy to support expansion of nodes in cluster as needed. All new added DHCP server is not required to configure IP resource in advance, the cluster management module will dynamically allocate resource for this new added server.
* **IP Failover**: Automatically takeover IP and DHCP processing after DHCP server node in cluster goes down.
* **Persistence**: All IP resource will be recorded in sqlite database.
* **Web portal**: Administrator can use this portal to manipulate the IP resource and view the IP allocations.

DHCP is vulnerable to attack, since all solution to DHCP security is combining with LanSwitch, DHCP security issue in this project will not be took into account.

The Architecture of DHCPD is as below:



GlusterFS is a distributed file system and provide POSIX interface like traditional file system. GlusterFS is used to persist data across the cluster. (In windows, the DHCP cluster is put into its property fail-over cluster, which provides data persistence across multiple nodes.).

On top of GlusterFS, SQLite is introduced to act as an embedded SQL server for DHCPD to query and persist IP information, such as IP preservation, IP allocations and server register information. There are three major tables:

**IP allocation table :** Once IP address is allocated, insert one entry into this table, including ip, timestamp, timeout, dhcpd server ip, MAC address, state.

**IP Pool table**: Data specified by administrator, support multiple entries. For example, if administrator needs to reserve some IPs for static ip use, the administrator can explicitly write one entry into this table. The table includes start ip, end ip, count, allocation type, gateway, dns server.

**Active DHCPD table**: To avoid complexity in heartbeat checking across cluster, once DHCP server is up, update its related entry in this table each second, including dhcp server ip, heartbeat count, etc.

The following picture shows the interface to administrator.



The restriction of scalability is totally based on the capability of GlusterFS. According to documents from GlusterFS, it’s a right choice for clustered DHCP servers as the service has very small amount of data exchange with storage, so far, the throughput of GlusterFS is suitable for our requirements.

**2. Modules and brief description**

**The Modules in DHCPD:**



**The hierarchy of Web service:**



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| Module | Description |
| DHCP Stack | Handle dhcp request and implement dhcp potocol. Reuse DHCP server code of Linux, modification is required to adapt to this solution. |
| Automatic Registration | Register the new added DHCP server into cluster and allocate resource. |
| Server Takeover | takeover IP and DHCP processing once peer node failure detected. Gratuitous ARP will be applied. |
| IP Pool Mgmt | Interface for DHCP stack to query and reserve IP resource. |
| Cluster State Mgmt | Monitor peer server status through heartbeat and coordinate with peer to share the IP pool resource. |
| Log | provide log interface and store all debug info into local file |
| Sqlite(C) | C interface for database operations, define SQL sentence. |
| GlusterFS | install GlusterFS on DHCP server in advance. |
| WebAPP | Runs within Apache framework, responsible for updating IP resource and displaying current cluster state and IP allocations. |
| Sqlite(JAVA) | Java interface for database operations, define SQL sentence. |

**Module development Schedule:**

All major development will be done before 11.20, after that, we will spend one week on integrity test and bugfix, also, project report will be done before due date.

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| Module | Person | Schedule |
| DHCP Stack | Wei Zhong &  Manisha Savale | Now->10.31choose reusable open source for DHCP protocol implementation, Linux DHCP server is preferred.  11.01 – 11.20 modify part of code to adapt to our own architecture. |
| IP Pool Mgmt | Manisha Savale | 11.01 – 11.20 interface to DHCPD is ready |
| Automatic Registration | Ahmed Akram | Independent parts from other modules  10.23 – 11.20 code and functionalities ready |
| Server Takeover | Ahmed Akram |
| Cluster State Mgmt | Ahmed Akram |
| Log | Manisha Savale | Now->10.31 get ready before program development starts. |
| GlusterFS | Wei Zhong | Now->10.31 GlusterFS get ready, all team members get GlusterFS installed in their own VMs. |
| WebAPP | Tuo Lei | Now->10.31 Finalize the layout of webpage, Apache environment is ready. define tables in database.  11.1-11.20 all source code done |
| Sqlite(JAVA) | Tuo Lei |
| Sqlite(C) | Tuo Lei & Wei Zhong |