《运维社区 －LVS+Keepalived 集群》

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修订历史记录

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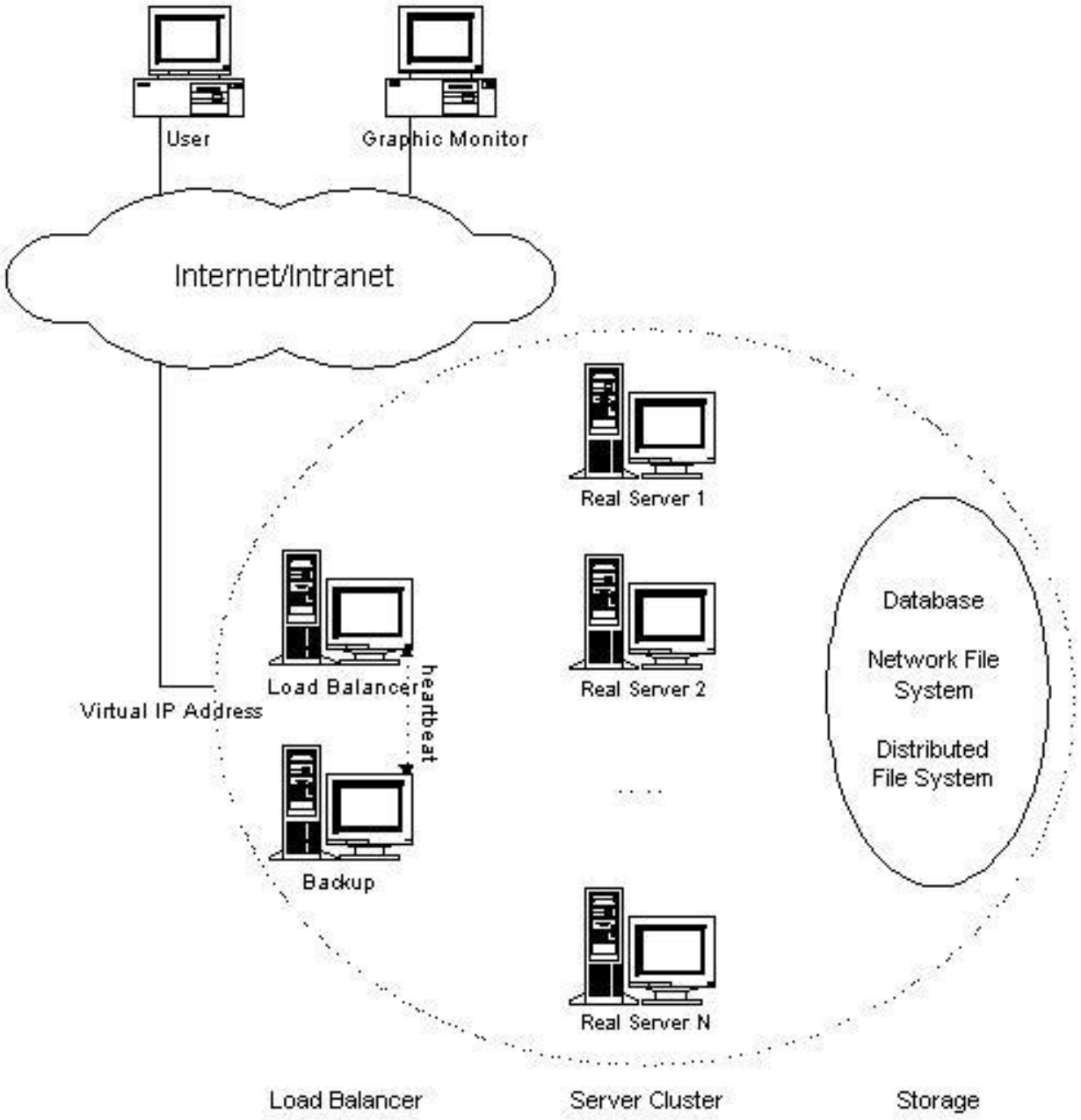
第 1 章 LVS 简介

LVS 是 Linux Virtual Server 的缩写，是由章文嵩博士开发的基于 Linux 内核的负载均衡技术。建议读者看本文档之前熟读 LVS 官方手册。

1.1 LVS 体系结构

LVS 建筑于实际的服务器集群之上，用户看不到提供服务的多台实际服务器，而只能看见一台作为负载平衡器的服务器。实际的服务器通过高速局域网或地理上分散的广域网连接。实际服务器的前端是一台负载均衡器，他将用户的请求调度到实际服务器上完成，这样看起来好像所有服务都是通过虚拟服务器来完成的。Linux 虚拟服务器能够提供良好的可升级性、可靠性和可用性。用户可以透明地增加或减少一个节点，可以对实际服务器进行监测，如果发现有节点失败就重新配置系统。



1.2 LVS 调度算法

LVS 提供了十种调度算法：

可以在这里查看：

```
[root@Web-node ~]# ls /lib/modules/2.6.18-164.el5/kernel/net/ipv4/ipvs/
ip_vs_dh.ko    ip_vs.ko        ip_vs_lblcr.ko  ip_vs_nq.ko  ip_vs_sed.ko  ip_vs_wlc.ko
```

ip_vs_ftp.ko ip_vs_lblc.ko ip_vs_lc.ko ip_vs_rr.ko ip_vs_sh.ko ip_vs_wrr.ko

1.轮叫（Round Robin RR）

调度器通过"轮叫"调度算法将外部请求按顺序轮流分配到集群中的真实服务器上，它均等地对待每一台服务器，而不管服务器上实际的连接数和系统负载。

2.加权轮叫（Weighted Round Robin WRR）

调度器通过"加权轮叫"调度算法根据真实服务器的不同处理能力来调度访问请求。这样可以保证处理能力强的服务器处理更多的访问流量。调度器可以自动问询真实服务器的负载情况，并动态地调整其权值。

3.最少链接（Least Connections LC）

调度器通过"最少连接"调度算法动态地将网络请求调度到已建立的链接数最少的服务器上。如果集群系统的真实服务器具有相近的系统性能，采用"最小连接"调度算法可以较好地均衡负载。

4.加权最少链接（Weighted Least Connections WLC）

在集群系统中的服务器性能差异较大的情况下，调度器采用"加权最少链接"调度算法优化负载均衡性能，具有较高权值的服务器将承受较大比例的活动连接负载。调度器可以自动问询真实服务器的负载情况，并动态地调整其权值。

5.基于局部性的最少链接（Locality-Based Least Connections LBLC）

"基于局部性的最少链接" 调度算法是针对目标 IP 地址的负载均衡，目前主要用于 Cache 集群系统。该算法根据请求的目标 IP 地址找出该目标 IP 地址最近使用的服务器，若该服务器是可用的且没有超载，将请求发送到该服务器；若服务器不存在，或者该服务器超载且有服务器处于一半的工作负载，则用"最少链接"的原则选出一个可用的服务器，将请求发送到该服务器。

6.带复制的基于局部性最少链接（Locality-Based Least Connections with Replication LBLCR

"带复制的基于局部性最少链接"调度算法也是针对目标 IP 地址的负载均衡，目前主要用于 Cache 集群系统。它与 LBLC 算法的不同之处是它要维护从一个目标 IP 地址到一组服务器的映射，而 LBLC 算法维护从一个目标 IP 地址到一台服务器的映射。该算法根据请求的目标 IP 地址找出该目标 IP 地址对应的服务器组，按"最小连接"原则从服务器组中选出一台服务器，若服务器没有超载，将请求发送到该服务器，若服务器超载；则按"最小连接"原则从这个集群中选出一台服务器，将该服务器加入到服务器组中，将请求发送到该服务器。同时，当该服务器组有一段时间没有被修改，将最忙的服务器从服务器组中删除，以降低复制的程度。

7.目标地址散列（Destination Hashing DH）

"目标地址散列"调度算法根据请求的目标 IP 地址，作为散列键（Hash Key）从静态分配的散列

表找出对应的服务器，若该服务器是可用的且未超载，将请求发送到该服务器，否则返回空。

8.源地址散列（Source Hashing SH）

"源地址散列"调度算法根据请求的源 IP 地址，作为散列键（Hash Key）从静态分配的散列表找出对应的服务器，若该服务器是可用的且未超载，将请求发送到该服务器，否则返回空。

9.最短期望延迟（Shortest Expected Delay Scheduling SED）

分配一个接踵而来的请求以最短的期望的延迟方式到服务器。

10.最小队列调度（Never Queue Scheduling NQ）

分配一个接踵而来的请求到一台空闲的服务器，此服务器不一定是最快的那台，如果所有服务器都是繁忙的，它采取最短的期望延迟分配请求。

1.3 LVS 负载均衡方法

LVS 提供了三种 IP 级的负载平衡方法：

Virtual Server via NAT 、Virtual Server via IP Tunneling、Virtual Server via Direct Routing。

Virtual Server via NAT 方法使用了报文双向重写的方法， Virtual Server via IP Tunneling 采用的是报文单向重写的策略， Virtual Server via Direct Routing 采用的是报文转发策略，这些策略将在以后的文章中详细描述。

1.4 常用术语介绍

DGW	公网 IP 地址的默认网关
VIP	客户端访问的公网 IP 地址，Director 的虚拟 IP 地址
DIP	Director 的真实 IP 地址
RIP	真实机的 IP 地址
CIP	客户端 IP 地址

1.5 相关资源

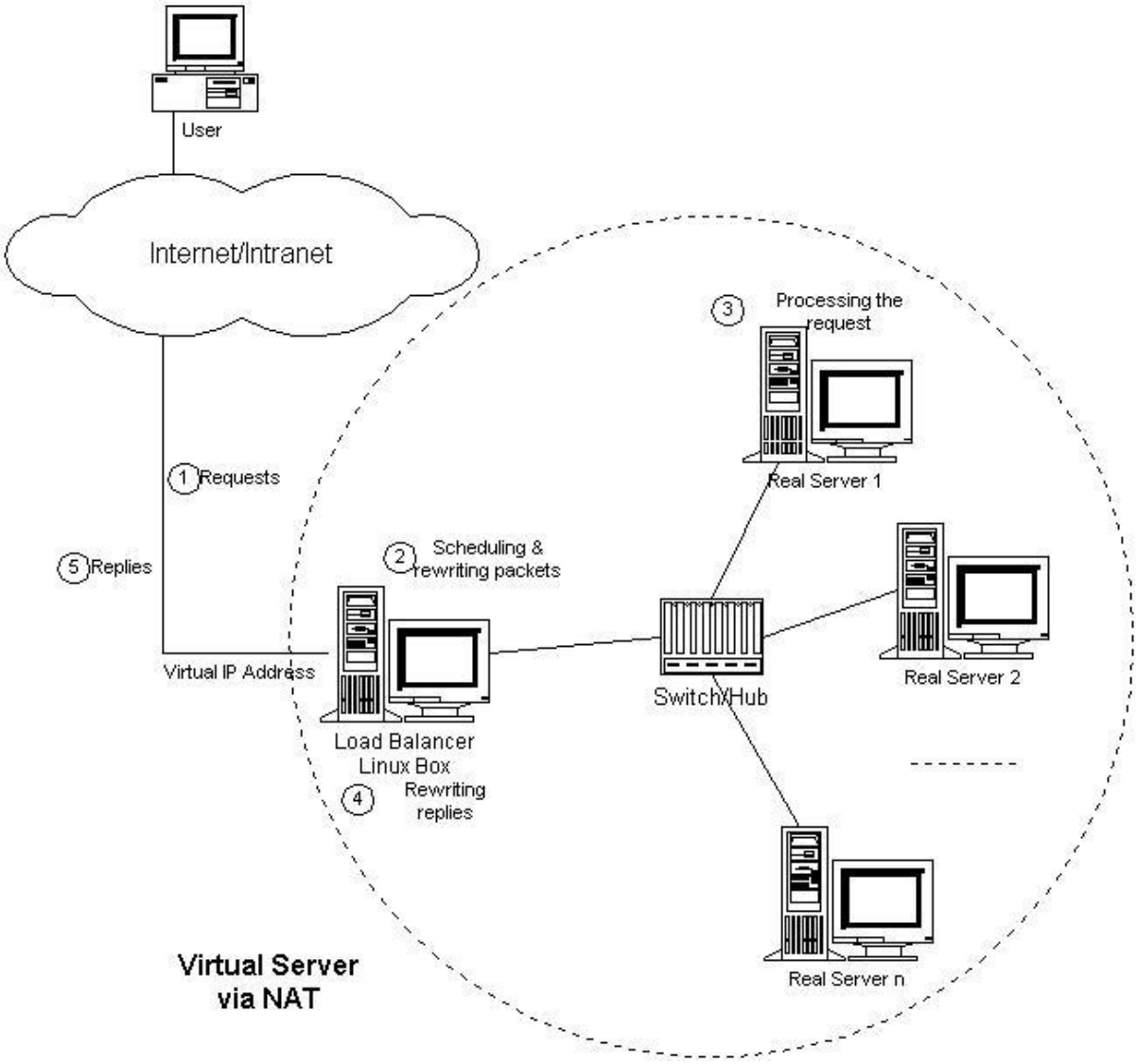
LVS 官方网站：http://www.linuxvirtualserver.org/

LVS 官方中文文档：http://www.linuxvirtualserver.org/zh/index.html

第 2 章 LVS-NAT 方式部署

2.1 LVS-NAT 方式体系结构

客户通过 Virtual IP Address（虚拟服务的 IP 地址）访问网络服务时，请求报文到达调度器，调度器根据连接调度算法从一组真实服务器中选出一台服务器，将报文的目标地址 Virtual IP Address 改写成选定服务器的地址，报文的目标端口改写成选定服务器的相应端口，最后将修改后的报文发送给选出的服务器。同时，调度器在连接 Hash 表中记录这个连接，当这个连接的下一个报文到达时，从连接 Hash 表中可以得到原选定服务器的地址和端口，进行同样的改写操作，并将报文传给原选定的服务器。当来自真实服务器的响应报文经过调度器时，调度器将报文的源地址和源端口改为 Virtual IP Address 和相应的端口，再把报文发给用户。我们在连接上引入一个状态机，不同的报文会使得连接处于不同的状态，不同的状态有不同的超时值。在 TCP 连接中，根据标准的 TCP 有限状态机进行状态迁移。在 UDP 中，我们只设置一个 UDP 状态。不同状态的超时值是可以设置的，在缺省情况下，SYN 状态的超时为1分钟，ESTABLISHED 状态的超时为15分钟，FIN 状态的超时为1分钟；UDP 状态的超时为5分钟。当连接终止或超时，调度器将这个连接从连接 Hash 表中删除。这样，客户所看到的只是在 Virtual IP Address 上提供的服务，而服务器集群的结构对用户是透明的。



2.2 部署前的准备工作

1> 服务器规划

IP 地址	主机名	描述
192.168.130.130	Web-Master	Director 分发器（VIP）
192.168.140.132	Web-Master	Director 分发器（DIP）
192.168.140.133	Web-node1	Real Server Web 节点 1
192.168.140.134	Web-node2	Real Server Web 节点 2

192.168.130.131	Web-Client	测试客户端

2 > 设置主机名解析和 ssh 验证

```
[root@Web-node ~]# vim /etc/hosts
# Do not remove the following line, or various programs
# that require network functionality will fail.
127.0.0.1       localhost.localdomain localhost
::1     localhost6.localdomain6 localhost6
192.168.140.132 Web-node
192.168.140.133 Web-node1
192.168.140.134 Web-node2
[root@Web-node ~]# ssh-keygen
[root@Web-node ~]# cp .ssh/id_rsa.pub .ssh/authorized_keys
[root@Web-node1 ~]# mkdir .ssh
[root@Web-node2 ~]# mkdir .ssh
[root@Web-node ~]# scp .ssh/authorized_keys Web-node1:/root/.ssh
[root@Web-node ~]# scp .ssh/authorized_keys Web-node2:/root/.ssh
[root@Web-node ~]# scp /etc/hosts Web-node1:/etc
[root@Web-node ~]# scp /etc/hosts Web-node2:/etc
```

2.3 在 Real Server 上的部署

1> Web-node1：

```
[root@Web-node1 ~]# mount /dev/cdrom /mnt
[root@Web-node1 ~]# rpm -ivh /mnt/Server/httpd-2.2.3-31.el5.i386.rpm
[root@Web-node1 ~]# echo Web-node1 > /var/www/html/index.html
[root@Web-node1 ~]# /etc/init.d/httpd start
[root@Web-node1 ~]# vim /etc/sysconfig/network-scripts/ifcfg-eth0
DEVICE=eth0
```

```
BOOTPROTO=static
IPADDR=192.168.140.133
NETMASK=255.255.255.0
GATEWAY=192.168.140.132 注意：默认网关设置为 DIP
ONBOOT=yes
HWADDR=00:0c:29:7c:cf:ba
[root@Web-node1 ~]# /etc/init.d/network restart
```

2> Web-node2

```
[root@Web-node2 ~]# mount /dev/cdrom /mnt
[root@Web-node2 ~]# rpm -ivh /mnt/Server/httpd-2.2.3-31.el5.i386.rpm
[root@Web-node2 ~]# echo Web-node2 > /var/www/html/index.html
[root@Web-node2 ~]# /etc/init.d/httpd start
[root@Web-node1 ~]# vim /etc/sysconfig/network-scripts/ifcfg-eth0
DEVICE=eth0
BOOTPROTO=static
IPADDR=192.168.140.134
NETMASK=255.255.255.0
GATEWAY=192.168.140.132 注意：默认网关设置为 DIP
ONBOOT=yes
HWADDR=00:0c:29:5d:2d:90
[root@Web-node2 ~]# /etc/init.d/network restart
```

请用浏览器访问两个 Web 几点，保证服务是正常运行。

2.4 在 Director 上的部署

1> 打开 IP_Forward

```
[root@Web-node ~]# vi /etc/sysctl.conf
net.ipv4.ip_forward = 1
[root@Web-node ~]# sysctl -p
```

2> 绑定 DIP 和 VIP

```
[root@Web-node ~]# vim /etc/sysconfig/network-scripts/ifcfg-eth0
DEVICE=eth0
BOOTPROTO=static
IPADDR=192.168.140.132
NETMASK=255.255.255.0
ONBOOT=yes
HWADDR=00:0c:29:17:39:9c
```

3> 安装 ipvsadm 软件包

```
[root@Web-node ~]# rpm -ivh /mnt/Cluster/ipvsadm-1.24-10.i386.rpm
```

4> 设置 ipvsadm

```
[root@Web-node ~]# modprobe iptable_nat
[root@Web-node ~]# ipvsadm -A -t 192.168.130.130:80 -s rr
[root@Web-node ~]# ipvsadm -a -t 192.168.130.130:80 -r 192.168.140.133 -m
[root@Web-node ~]# ipvsadm -a -t 192.168.130.130:80 -r 192.168.140.134 -m
[root@Web-node ~]# service ipvsadm save
Saving IPVS table to /etc/sysconfig/ipvsadm:                [  OK  ]
[root@Web-node ~]# chkconfig ipvsadm on
```

2.5 LVS -NAT 方式集群测试

1> 手动效果测试

[root@Web-Client ~]# elinks http://192.168.130.130 发现访问的是 Web-node1

[root@Web-Client ~]# elinks http://192.168.130.130 发现访问的是 Web-node2

2> 压力负载测试

在这里使用 Apache 自带的 ab 测试工具。

```
[root@Web-node ~]# ab -n 100 -c 100 http://192.168.140.133/
This is ApacheBench, Version 2.0.40-dev <$Revision: 1.146 $> apache-2.0
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Copyright 2006 The Apache Software Foundation, http://www.apache.org/
```

Benchmarking 192.168.140.133 (be patient).....done

Server Software: Apache/2.2.3 #服务器平台和版本
Server Hostname: 192.168.140.133 #服务器主机名
Server Port: 80 #服务器端口号

Document Path: / #测试的页面
Document Length: 10 bytes #测试的页面大小

Concurrency Level: 100 #并发数
Time taken for tests: 0.91990 seconds #整个测试持续时间
Complete requests: 100 #完成的请求数
Failed requests: 0 #失败的请求数
Write errors: 0
Total transferred: 27200 bytes #整个测试场景的网络传输量
HTML transferred: 1000 bytes #整个测试场景的 HTML 内容传输量（10X100）
Requests per second: 1087.07 [#/sec] (mean) #平均每秒处理的事务数
Time per request: 91.990 [ms] (mean) #平均事物响应时间
Time per request: 0.920 [ms] (mean, across all concurrent requests) #每个请求运行的平均时间
Transfer rate: 282.64 [Kbytes/sec] received
#平均每秒网络上的流 量，可以帮助排除是否存在网络流量过大导致响应时间延长的问题
Connection Times (ms)

	min	mean[+/-sd]	median	max
Connect:	1	19 9.3	21	33
Processing:	9	32 14.2	32	65
Waiting:	8	31 14.1	31	56
Total:	10	52 22.9	54	90

```
Percentage of the requests served within a certain time (ms)
  50%     54
  66%     66
  75%     71
  80%     75
  90%     83
  95%     87
  98%     89
  99%     90
 100%     90 (longest request)
```

测试图表

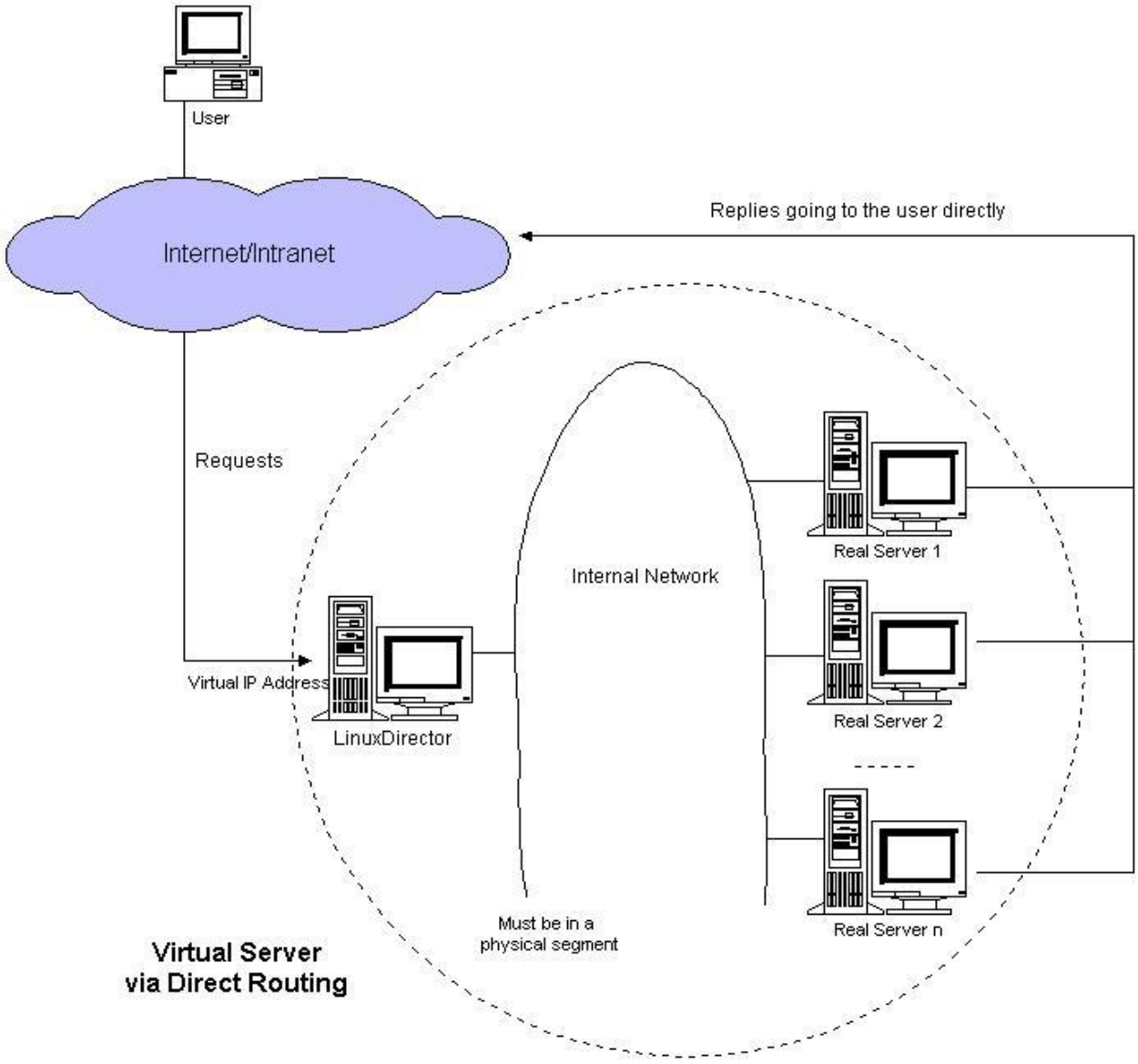
类　型	请求和并发数	每个请求平均处理时间
单个节点 Web-node1	100 个请求，每个请求 100 并发	0.961 [ms]
单个节点 Web-node2	100 个请求，每个请求 100 并发	0.950 [ms]
LVS 负载均衡	200 个请求，每个请求 200 并发	0.819

第 3 章 LVS-DR 方式部署

3.1 LVS-DR 方式体系结构

在 LVS-DR 中，调度器根据各个服务器的负载情况，动态地选择一台服务器，不修改也不封装 IP 报文，而是将数据帧的 MAC 地址改为选出服务器的 MAC 地址，再将修改后的数据帧在与服务器组的局域网上发送。因为数据帧的 MAC 地址是选出的服务器，所以服务器肯定可以收到这个数据帧，从中可以获得该 IP 报文。当服务器发现报文的目标地址 VIP 是在本地的网络设备上，服务器处理这个报文，然后根据路由表将响应报文直接返回给客户。

在 LVS-DR 中，根据缺省的 TCP/IP 协议栈处理，请求报文的目标地址为 VIP，响应报文的源地址肯定也为 VIP，所以响应报文不需要作任何修改，可以直接返回给客户，客户认为得到正常的服务，而不会知道是哪一台服务器处理的。



3.2 部署前的准备工作

1> 服务器规划

IP 地址	主机名	描述

192.168.140.128	Web-node	Director 分发器（VIP）
192.168.140.132	Web-node	Director 分发器（DIP）
192.168.140.133	Web-node1	Real Server Web 节点 1
192.168.140.134	Web-node2	Real Server Web 节点 2
192.168.140.130	Web-Client	测试客户端

在这里仅需要修改上个实验的 Direcoor 分发器的 IP 地址即可，使用 192.168.140.0 这个网段模拟公网地址。

2> 清除上个实验的配置

[root@Web-node ~]# echo "" > /etc/sysconfig/ipvsadm

[root@Web-node ~]# service ipvsadm restart

3.3 在 Real Server 上的部署

1> Web-node1

第一步：

[root@Web-node1 ~]# vim /etc/sysconfig/network-scripts/ifcfg-eth0

修改 GATEWAY 为 DGW：192.168.140.1

[root@Web-node1 ~]# /etc/init.d/network restart

第二步：

LVS-DR 方式中的 Real Server 需要忽略 ARP 解析，在这里用脚本实现

[root@Web-node1 ~]# vim /etc/sysconfig/network-scripts/arp.sh

```
#!/bin/bash
#===================================
# $Name:         RealServer.sh
# $Revision:     1.0
# $Function:     Config realserver lo and apply noarp
# $Author:       Shundong Zhao
# $organization: UnixHot
# $Create Date:  2010-08-10
```

```
#==================================

        WEB_VIP=192.168.140.140

        . /etc/rc.d/init.d/functions

        case "$1" in
        start)
                ifconfig lo:0 $SNS_VIP netmask 255.255.255.255 broadcast $WEB_VIP
                /sbin/route add -host $WEB_VIP dev lo:0
                echo "1" >/proc/sys/net/ipv4/conf/lo/arp_ignore
                echo "2" >/proc/sys/net/ipv4/conf/lo/arp_announce
                echo "1" >/proc/sys/net/ipv4/conf/all/arp_ignore
                echo "2" >/proc/sys/net/ipv4/conf/all/arp_announce
                sysctl -p >/dev/null 2>&1
                echo "RealServer Start OK"
                ;;
        stop)
                ifconfig lo:0 down
                route del $WEB_VIP >/dev/null 2>&1
                echo "0" >/proc/sys/net/ipv4/conf/lo/arp_ignore
                echo "0" >/proc/sys/net/ipv4/conf/lo/arp_announce
                echo "0" >/proc/sys/net/ipv4/conf/all/arp_ignore
                echo "0" >/proc/sys/net/ipv4/conf/all/arp_announce
                echo "RealServer Stoped"
                ;;
        *)
                echo "Usage: $0 {start|stop}"
                exit 1
        esac
```

```
        exit 0
[root@Web-node1 ~]# bash /etc/sysconfig/network-scripts/arp.sh
[root@Web-node1 ~]# ifconfig lo:0
lo:0      Link encap:Local Loopback
          inet addr:192.168.140.128  Mask:255.255.255.255
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
```

2> Web-node2

第一步：

```
[root@Web-node2 ~]# vim /etc/sysconfig/network-scripts/ifcfg-eth0
```

修改 GATEWAY 为 DGW： 192.168.140.1

```
[root@Web-node2 ~]# /etc/init.d/network restart
```

第二步：

```
[root@Web-node1 ~]#
scp /etc/sysconfig/network-scripts/arp.sh Web-node2:/etc/sysconfig/network-scripts/
[root@Web-node2 ~]# bash /etc/sysconfig/network-scripts/arp.sh
[root@Web-node2 ~]# ifconfig lo:0
lo:0      Link encap:Local Loopback
          inet addr:192.168.140.128  Mask:255.255.255.255
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
```

3.4 在 Director 上的部署

1> 绑定 VIP

```
[root@Web-node ~]# vim /etc/sysconfig/network-scripts/ifcfg-eth0:1
DEVICE=eth0:1
BOOTPROTO=static
IPADDR=192.168.140.128
NETMASK=255.255.255.0
ONBOOT=yes
```

HWADDR=00:0c:29:17:39:9c

2> 配置 ipvsadm

```
[root@Web-node ~]# ipvsadm -A -t 192.168.140.128:80 -s wrr -p 3600
[root@Web-node ~]# ipvsadm -a -t 192.168.140.128:80 -r 192.168.140.133:80 -g -w 10
[root@Web-node ~]# ipvsadm -a -t 192.168.140.128:80 -r 192.168.140.134:80 -g -w 20
[root@Web-node ~]# service ipvsadm save
```

3.5 LVS-DR 方式集群测试

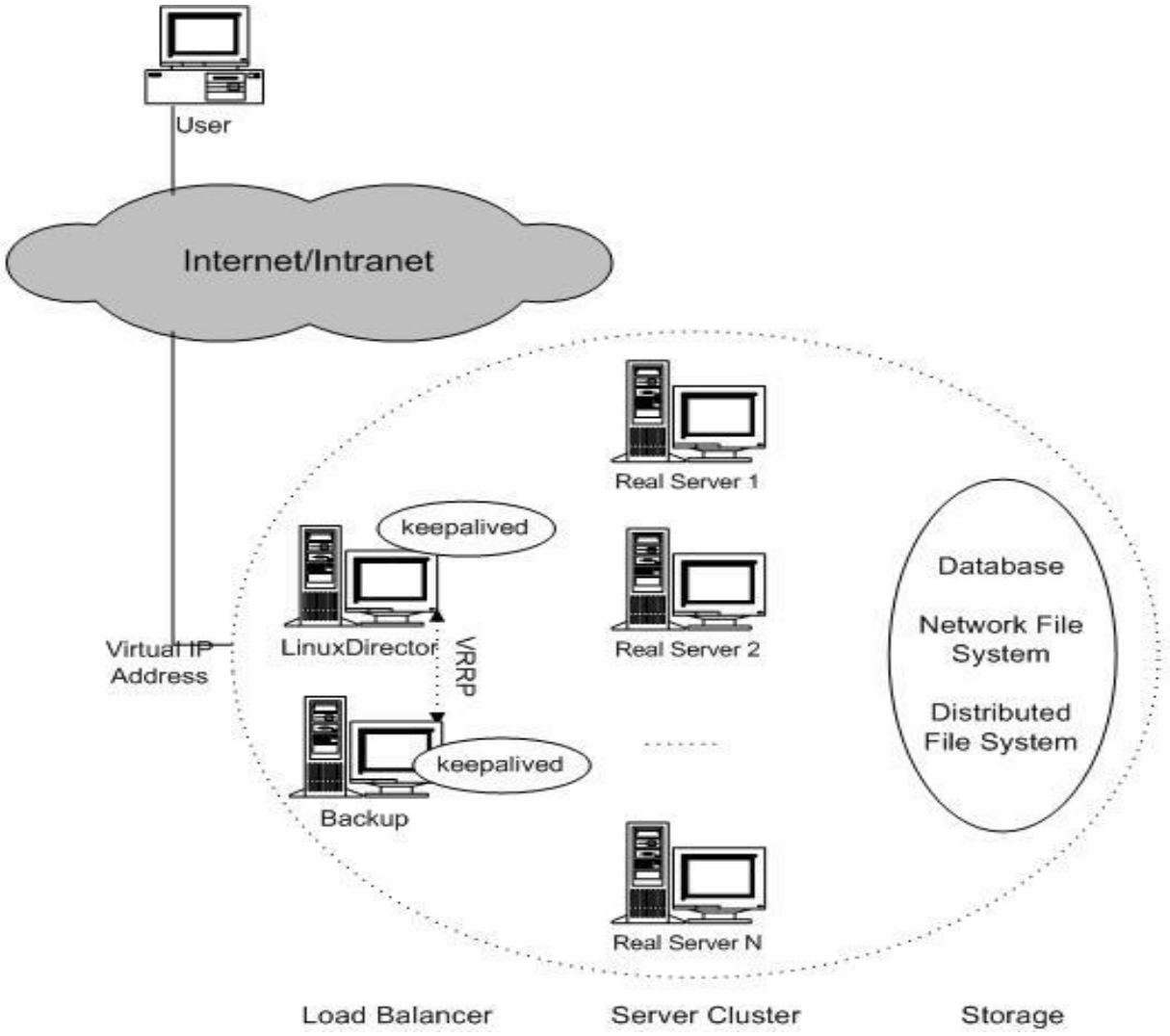
请读者用 ab 测试，模拟环境测试的性能指标可能区别不太明显（略）

第 4 章 LVS Keepalived 集群

4.1 LVS Keepalived 方案简介

LVS Keepalived 方案是和 LVS Heartbeat 一样的高可用加负载均衡方案，Keepalived 于 Heartbeat 相比在部署和管理方面都大大简化了。在多层负载均衡的架构中，它也是前段最好的选择，在下面会根据业务需求拓展架构，比如使用 Nginx 或者 Haproxy 做 Layer 7 的负载均衡，而前段仍使用 LVS+keepalived 来承载高并发的流量。

4.2 集群架构图



4.3 集群环境列表

IP 地址	主机名	说明
192.168.140.140		VIP
192.168.140.141	Web-Director	LVS Director
192.168.140.143	Web-Backup	Keepalived Backup
192.168.140.137	Web-node1	Web 节点
192.168.140.139	Web-node2	Web 节点

4.4 其它注意事项

1> LVS Keepalived 方案 ipvsadm 的管理有 keepalived 负责。

2> LVS 后端节点的监控检查也是 keepalived 进行。

3> 注意内核版本和 ipvsadm 版本的对应。

4> 注意 ip_vs 模块是否载入内核。

第 5 章 部署 LVS Keepalived

5.1 检查内核版本和模块

```
[root@LVS-node1 ~]# uname -r
2.6.18-194.el5
[root@LVS-node1 ~]# modprobe ip_vs
[root@LVS-node1 ~]# lsmod | grep ip_vs
ip_vs                 122113  0
```

5.2 下载软件包

```
[root@LVS-node1 ~]# ln -s /usr/src/kernels/2.6.18-194.el5-x86_64/ /usr/src/linux
[root@LVS-node1 ~]# cd /usr/local/src
[root@LVS-node1 src]# wget
http://www.linuxvirtualserver.org/software/kernel-2.6/ipvsadm-1.24.tar.gz
```

5.3 安装 ipvsadm

```
[root@LVS-node1 src]# tar zxvf ipvsadm-1.24.tar.gz
[root@LVS-node1 src]# cd ipvsadm-1.24
```

有关安装的相关信息，可以查看该目录下的 README 文件。

```
[root@LVS-node1 ipvsadm-1.24]# make && make install
```

安装完毕后会产生以下文件：

```
/sbin/ipvsadm
/sbin/ipvsadm-save
/sbin/ipvsadm-restore
/usr/man/man8/ipvsadm.8
/usr/man/man8/ipvsadm-save.8
/usr/man/man8/ipvsadm-restore.8
/etc/rc.d/init.d/ipvsadm
```

5.4 安装 Keepalived

```
[root@LVS-node1 src]# wget http://www.keepalived.org/software/keepalived-1.1.20.tar.gz
[root@LVS-node1 src]# tar zxf keepalived-1.1.20.tar.gz
[root@LVS-node1 src]# cd keepalived-1.1.20
[root@LVS-node1 keepalived-1.1.20]# ./configure --prefix=/usr/local/keepalived
Keepalived configuration
------------------------
Keepalived version       : 1.1.20
Compiler                 : gcc
Compiler flags           : -g -O2
Extra Lib                : -lpopt -lssl -lcrypto
Use IPVS Framework       : Yes
IPVS sync daemon support : Yes
Use VRRP Framework       : Yes
Use Debug flags          : No
```

如果出现以上输出，说明可以正常编译安装。

```
[root@LVS-node1 keepalived-1.1.20]# make && make install
[root@LVS-node1 keepalived-1.1.20]# cd /usr/local/keepalived/
[root@LVS-node1 keepalived]# cp etc/rc.d/init.d/keepalived /etc/rc.d/init.d/
```

```
[root@LVS-node1 keepalived]# cp etc/sysconfig/keepalived /etc/sysconfig/
[root@LVS-node1 keepalived]# /usr/local/keepalived/sbin/keepalived --help
```

如果你执行了 keepalived 命令，你会发现它默认去/etc/keepalived/keepalived.conf 找配置文件，所以我们要把配置文件创建到此处方便启动，当然，你也可以自己制定配置文件位置。

```
[root@LVS-node1 keepalived]# mkdir /etc/keepalived
[root@LVS-node1 keepalived]# cp etc/keepalived/keepalived.conf /etc/keepalived/
[root@LVS-node1 keepalived]# cp sbin/keepalived /usr/sbin/
```

第 6 章 LVS 配置

6.1 LVS Director 配置

LVS 配置是由 keepalived 依靠/etc/keepalived/keepalived.conf 来进行配置的，也就是说我们不需要手动配置 ipvsadm 程序，但是我们做为 LVS DR 模式运行，不能忘了对真实机的配置，对 RealServer 的配置参考“第 2 章 2.3.3 小节”。

6.2 RealServer 配置

```
[root@Web-node1 ~]# /sbin/realserver.sh start
RealServer Start OK
[root@Web-node2 ~]# /sbin/realserver.sh start
RealServer Start OK
```

在 RealServer 执行完 realserver.sh 后，一定要检查：

```
[root@Web-node1 ~]# ifconfig lo:0
lo:0      Link encap:Local Loopback
          inet addr:192.168.140.140  Mask:255.255.255.255
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
[root@Web-node2 ~]# ifconfig lo:0
lo:0      Link encap:Local Loopback
```

```
inet addr:192.168.140.140  Mask:255.255.255.255
UP LOOPBACK RUNNING  MTU:16436  Metric:1
```

第 7 章 Keepalived 配置

这是 LVS Keepalived 集群方案的核心，主要集中在/etc/keepalived/keepalived 文件上。

Keepalived 有两种状态，MASTER 和 BACKUP，配置大致相似，但也有不同的地方，在 MASTER 的配置时，会用红色将，MASTER 和 BACKUP 不同的地方标出。

7.1 Web-Director 配置

下面是一个配置好的 keepalived.conf 文件，对于每行用注释说明。

```
[root@Web-Director ~]# cat /etc/keepalived/keepalived.conf
! Configuration File for keepalived
global_defs {                          #全局定义块
   notification_email {
    admin@unixhot.com                  #邮件通知模块，定义通知邮件地址。
   }
   notification_email_from localhost  #
   smtp_server 127.0.0.1          #定义 SMTP Server
   smtp_connect_timeout 30        #SMTP 链接超时时间
   router_id LVS_MASTER           #运行 keepalived 机器的一个标识，注意：Web-Backup 应该不同，修改为 LVS_BACKUP
}

vrrp_instance VI_1 {
    state MASTER                   #实例状态，注意：Web-Backup 应该修改为 BACKUP
    interface eth0                     #指定对外服务的网卡。
    virtual_router_id 51
    priority 101                       #优先级，注意：Web-Backup 应该修改比这个值小
```

```
    advert_int 1
    authentication {
        auth_type PASS
        auth_pass 1111
    }
    virtual_ipaddress {
    192.168.140.140
    }
}

virtual_server 192.168.140.140 80 {
    delay_loop 6                        #健康检查的时间间隔
    lb_algo wrr                         #负载均衡的调度算法
    lb_kind DR                         #负载均衡转发模式
    nat_mask 255.255.255.0
    persistence_timeout 50              #会话保持时间，针对动态网站
    protocol TCP                        #转发的协议

    real_server 192.168.140.137 80 {       #真实机的设置
        weight 1                       #真实机的权重，在带有加权调度的调度算法中有用
    TCP_CHECK {                       #TCP 健康检查
        connect_timeout 10
        nb_get_retry 3
        delay_before_retry 3
        connect_port 80
        }
     }

    real_server 192.168.140.139 80 {
        weight 1
```

```
    TCP_CHECK {
        connect_timeout 10
        nb_get_retry 3
        delay_before_retry 3
        connect_port 80
        }
        }
    }
```

7.2 BACKUP 端配置

BACKUP 端配置和 MASTER 几乎一样，可以直接用 scp 从 MASTER 端复制一份过来，做以下修改即可：

```
    router_id LVS_MASTER
    state MASTER
    priority 101
```

第 8 章 LVS Keepalived 方案测试

8.1 启动 keepalived 服务

```
[root@Web-Director ~]# /etc/init.d/keepalived start
[root@Web-Backup ~]# /etc/init.d/keepalived start
```

8.2 VIP 切换测试

```
[root@Web-Director ~]# ip ad li eth0
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast qlen 1000
    link/ether 00:0c:29:57:04:db brd ff:ff:ff:ff:ff:ff
    inet 192.168.140.141/24 brd 192.168.140.255 scope global eth0
```

```
    inet 192.168.140.140/32 scope global eth0
    inet6 fe80::20c:29ff:fe57:4db/64 scope link
       valid_lft forever preferred_lft forever
```

可以发现，默认的 VIP 是绑定在优先级比较高的这台 MASTER 上，也就是 Web-Director 服务器。

```
[root@Web-Backup ~]# ip ad li eth0
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast qlen 1000
    link/ether 00:0c:29:45:5e:0e brd ff:ff:ff:ff:ff:ff
    inet 192.168.140.143/24 brd 192.168.140.255 scope global eth0
    inet6 fe80::20c:29ff:fe45:5e0e/64 scope link
       valid_lft forever preferred_lft forever
```

你可以手动来停掉 Web-Director 上的 keepalived 服务，VIP 就会自动切到 Web-Backup 上。

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