Apache 2.2 + Tomcat 6.0 + MySQL 5.0 + mod_jk 整合
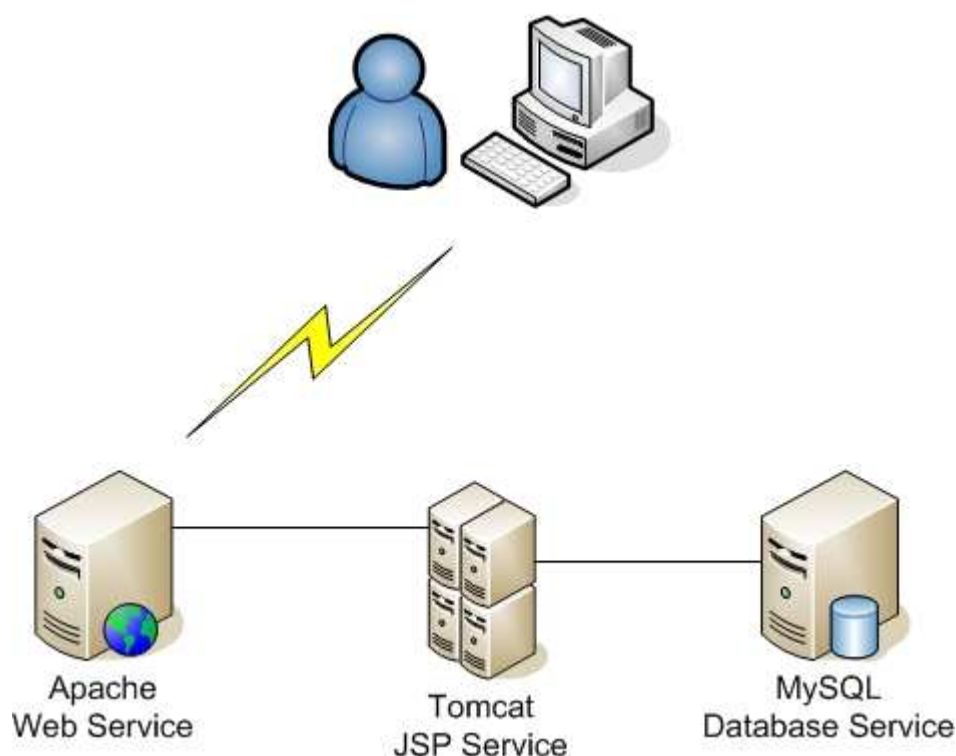
在前一篇 Apache 及 Tomcat 的結合 (New window) 的文件中，說明了使用 mod_jk2 把 Apache 與 Tocmat 相結合的實例。最近小弟遇到了主機的擴充案，重新調整了 Apche 的編譯，並且使用新版本的 Tomcat Connectors JK 1.2.26 版本來做兩者之間的溝通。

本篇文章同時也介紹了 Tomcat 6.0 的 MySQL Connection Pool 用法（同時適用於 Tomcat 5.5），實做中也提及如何測試資料庫的連線。

此文章與前一篇 Apache 及 Tomcat 的結合 (New window) 並不相容，Tomcat 3 和 Tomcat 5.5 的 Connection Pool 用法已不同；而 mod_jk2 也不再維護，Tomcat 組織以 mod_jk 為主要的發展對像，所以在這些改變之下，決定重新寫此篇文件以供大家參考，若有不明或有誤的地方請大家提出。

架構

Apache
Web Service

Tomcat
JSP Service

MySQL
Database Service

使用者在瀏覽網站時，是對應到 Apache Server，而 JSP 程式則是放在 Tomcat 主機上，當然了資料庫也是獨立的。使用這種架構可分散網頁檔案與程式之間的損失風險。

架構設計之初,應避免把 應用伺服器 與 資料庫伺服器 暴露在網路之中,可以選擇使用內部的虛擬 IP 或防火牆來防止使用者可任意尋找露洞的機會。當然了,安全性的研究不在本次的議題裡,大家可以參閱 查詢相關資料。

以下 IP 為本次的實例分配:

- Apache:192.168.1.205(Apache 2.2.9,Tomcat Connector 1.2.26)
- Tomcat:192.168.1.207(Tomcat 6.0.16)
- MySQL:192.168.1.204(MySQL 5.0.45)

Apache 服務

要完成整個 Apache 伺服器的設定，需要下例套件配合：

- Sun Java JDK（Java version 1.6.0_06）
- Apache（httpd 2.2.9）
- Tomcat（tomcat 6.0.16）
- Tomcat Connector（Tomcat Connector 1.2.26）

以下會逐一說明。

下載安裝 Apache

下載 Apache 並解壓縮

最新版本的 Apache 可以到 Apache 官方網站下載：http://httpd.apache.org/

```
root # wget http://apache.cdpa.nsysu.edu.tw/httpd/httpd-2.2.9.tar.bz2
root # tar -jxvf httpd-2.2.9.tar.bz2
```

編譯 httpd

若是採用此方式，在您的環境中必需要有 gcc 編譯器

```
root # cd httpd-2.2.9
root # ./configure --prefix=/usr/local/httpd --with-mpm=worker
> --enable-cache --enable-file-cache --enable-disk-cache
> --enable-mem-cache --enable-mime-magic --enable-headers
> --enable-ssl --enable-http --enable-cgi --enable-rewrite
> --enable-so --with-suexec-gidmin --with-suexec-logfile
root # make
root # make install
```

以上編譯到安裝的過程可能需要一段時間，結束之後 httpd 會安裝到 /usr/local/httpd 目錄，使用下例指可以啟動 http 服務，即可使用瀏覽器聯結。

```
root # /usr/local/httpd/bin/apachectl start
```

查看 httpd 是否有啟動並設定連接埠。

```
root # ps aux | grep httpd; netstat -ntulp | grep :80
```

```
root      3021  0.0  0.7   7908  2808 ?        Ss   18:55   0:00
/usr/local/httpd/bin/httpd -k start
daemon    3022  0.0  0.4   7512  1648 ?        S    18:55   0:00
/usr/local/httpd/bin/httpd -k start
daemon    3023  0.0  0.7 284680  2904 ?        Sl   18:55   0:00
/usr/local/httpd/bin/httpd -k start
daemon    3024  0.0  0.7 284680  2856 ?        Sl   18:55   0:00
/usr/local/httpd/bin/httpd -k start
daemon    3035  0.0  0.7 284680  2904 ?        Sl   18:55   0:00
/usr/local/httpd/bin/httpd -k start
daemon    3200  0.0  0.7 284680  2836 ?        Sl   18:57   0:00
/usr/local/httpd/bin/httpd -k start
root      3824  0.0  0.1   1820   484 pts/0    S+   22:16   0:00 grep httpd
tcp       0     0 :::80                        :::*
LISTEN    3021/httpd
```

下載安裝 Tomcat、Sun Java JDK 與 Tomcat Connector

Tomcat 可到 http://tomcat.apache.org/ 下載、Tomcat Connector 可到 http://tomcat.apache.org/download-connectors.cgi 下載，本例中 Java JDK 是採用 Sun 所發展的 Sun Java JDK，可至 http://java.sun.com/javase/downloads/index.jsp 下載 JDK 即可。

下載 Tomcat Connector

```
root # wget
http://apache.cdpa.nsysu.edu.tw/tomcat/tomcat-connectors/jk/source/jk
-1.2.26/tomcat-connectors-1.2.26-src.tar.gz
```

下載 Sun Java JDK

```
root # lynx
'http://cds.sun.com/is-bin/INTERSHOP.enfinity/WFS/CDS-CDS_Developer-S
ite/en_US/-/USD/VerifyItem-Start/jdk-6u6-linux-i586.bin?BundledLineIt
emUUID=fR9IBe.pEDAAAAEaAgAocbiQ&OrderID=YtFIBe.pnk8AAAEa9_8ocbiP&Prod
uctID=VXZIBe.ootIAAAEZTrBAkQve&FileName=/jdk-6u6-linux-i586.bin'
```

下載 Tomcat

```
root # wget
http://apache.stu.edu.tw/tomcat/tomcat-6/v6.0.16/bin/apache-tomcat-6.
0.16.tar.gz
```

搬移檔案至 /opt 目錄

```
root # mv apache-tomcat-6.0.16.tar.gz
tomcat-connectors-1.2.26-src.tar.gz jdk-6u6-linux-i586.bin /opt/
```

解壓縮檔案

```
root # tar -zxvf apache-tomcat-6.0.16.tar.gz ; tar -zxvf
tomcat-connectors-1.2.26-src.tar.gz ; chmod +x jdk-6u6-linux-i586.bin
```

設定與安裝 Tomcat、Tomcat Connector 與 Sun Java JDK

安裝 Sun Java JDK

```
root # ./jdk-6u6-linux-i586.bin
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```

```
corrections provided by Sun, and any user manuals,

programming guides and other documentation provided to you

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them.  Sun does not associate the data with personally

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```
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```
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* Special offers on Sun products, services and training

* Access to early releases and documentation


Product and system data will be collected. If your configuration
```

```
supports a browser, the Sun Product Registration form for

the JDK will be presented. If you do not register, none of

this information will be saved. You may also register your

JDK later by opening the register.html file (located in

the JDK installation directory) in a browser.


For more information on what data Registration collects and

how it is managed and used, see:

http://java.sun.com/javase/registration/JDKRegistrationPrivacy.html


Press Enter to continue.....



Done.
```

安裝 Tomcat

```
root # mv apache-tomcat-6.0.16 tomcat; mv jdk1.6.0_06/ java
```

設定環境變數

在安裝 mod_jk 之前，需先設定 tomcat 與 java 的目錄，可在 /etc/profile 設定。

```
JAVA_HOME=/opt/java
CATALINA_HOME=/opt/tomcat
CATALINA_BASE=/opt/tomcat
CLASSPATH=./:${JAVA_HOME}/lib:${JAVA_HOME}/jre/lib/ext:${CATALINA_HOME}/common/lib

export JAVA_HOME CATALINA_HOME CATALINA_BASE CLASSPATH
export PATH=${JAVA_HOME}/bin:${CATALINA_HOME}/bin:${PATH}
```

設定完成後可使用 source 指令或 . 指令讓修改的項目生效。

```
root # . /etc/profile
```

編譯安裝 mod_jk

完成以上設定後，即可開始編譯 mod_jk。

編譯 mod_jk

```
root # cd tomcat-connectors-1.2.26-src/native/
root # ./configure --with-java-home=/opt/java
--with-apxs=/usr/local/httpd/bin/apxs
root # make
```

安裝 mod_jk.so 至 httpd

```
root # cp apache-2.0/mod_jk.so /usr/local/httpd/lib/
```

以上完成編譯安裝之後，就可以開始設定 apache，讓 mod_jk 生效。apache 的
設定檔在 /usr/local/httpd/conf/ 目錄 下。

設定 Apche 與 mod_jk

編輯 httpd.conf

在 httpd.conf 中加入載入 mod_jk 模組與 mod_jk 設定檔項目。

```
LoadModule jk_module lib/mod_jk.so
# mod_jk settings
Include conf/mod_jk.conf
```

在 /usr/local/httpd/conf/ 目錄加入 mod_jk.conf

```
root # touch mod_jk.conf
```

在 mod_jk.conf 加入以下內容

```
#setup the workers.properties file path, default prefix path is httpd's
home (/usr/local/httpd)
JkWorkersFile conf/workers.properties
JkLogFile  /var/log/jk.log
JkShmFile  /var/log/jk-runtime-status
JkLogLevel error
JkLogStampFormat "[%a %b %d %H:%M:%S %Y] "
JkOptions +ForwardKeySize +ForwardURICompat -ForwardDirectories
JkRequestLogFormat "%w %V %T"

# Sample JkMounts.  Replace these with the paths you would
# like to mount from your JSP server.
# syntax: JkMount ${URL_DIR}/*.jsp worker_name
```

```
JkMount /project1/*.jsp jsp-ap207
JkMount /project2/*.jsp jsp-ap207
JkMount /project3/*.jsp jsp-ap207
```

增加 conf/workers.properties 檔案

```
root # touch /usr/local/httpd/conf/workers.properties
```

設定 workers.properties

```
# BEGIN workers.properties
# setting tomcat_home and java_home
workers.tomcat_home=/opt/tomcat
workers.java_home=/opt/java

# worker.list defined worker_name, used by mod_jk.conf
worker.list=jsp-ap207
worker.jsp-ap207.port=8009
worker.jsp-ap207.host=192.168.1.207
worker.jsp-ap207.type=ajp13
worker.jsp-ap207.lbfactor=1
```

重新啟動 Apache

經過了以上步驟後，在 Apache 的部份可說是已完成設定（當然細項目份還需要調整）。現在可重新啟動 Apache。

```
root # /usr/local/httpd/bin/apachectl stop
root # /usr/local/httpd/bin/apachectl start
```

Tomcat 服務

要完成整個 Tomcat 的設定，需要以下套件配合

- Tomcat（http://tomcat.apache.org/）
- Java JDK（http://java.sun.com/javase/downloads/index.jsp）
- jaf
  （http://java.sun.com/javase/technologies/desktop/javabeans/jaf/downloads/index.html）
- javamail（http://java.sun.com/products/javamail/downloads/index.html）

下載與安裝 Tomcat、Java JDK、jaf 與 javamail

下載 Tomcat

```
root # wget
http://apache.stu.edu.tw/tomcat/tomcat-6/v6.0.16/bin/apache-tomcat-6.
0.16.tar.gz
```

下載 Sun Java JDK

```
root # lynx
'http://cds.sun.com/is-bin/INTERSHOP.enfinity/WFS/CDS-CDS_Developer-S
ite/en_US/-/USD/VerifyItem-Start/jdk-6u6-linux-i586.bin?BundledLineIt
emUUID=fR9IBe.pEDAAAAEaAgAocbiQ&OrderID=YtFIBe.pnk8AAAEa9_8ocbiP&Prod
uctID=VXZIBe.ootIAAAEZTrBAkQve&FileName=/jdk-6u6-linux-i586.bin'
```

下載 jaf

```
root # lynx
'http://cds.sun.com/is-bin/INTERSHOP.enfinity/WFS/CDS-CDS_Developer-S
ite/en_US/-/USD/VerifyItem-Start/jaf-1_0_2-upd2.zip?BundledLineItemUU
ID=WoRIBe.m5QUAAAEaKzlGV8Li&OrderID=VYdIBe.mwygAAAEaHzlGV8Li&ProductI
D=J_vACUFBIFEAAAEYeEo5AXiq&FileName=/jaf-1_0_2-upd2.zip'
```

下載 javamail

```
root # lynx
'http://cds.sun.com/is-bin/INTERSHOP.enfinity/WFS/CDS-CDS_Developer-S
```

```
ite/en_US/-/USD/VerifyItem-Start/javamail-1_4_1.zip?BundledLineItemUU
ID=n7RIBe.mEw8AAAEavaVGV8Lk&OrderID=iOdIBe.mpdYAAAEarqVGV8Lk&ProductI
D=3v_ACUFBMTsAAAEYxBQ5AXuF&FileName=/javamail-1_4_1.zip'
```

解壓縮檔案

```
root # tar -zxvf apache-tomcat-6.0.16.tar.gz ;unzip jaf-1_0_2-upd2.zip ;
unzip javamail-1_4_1.zip; chmod +x jdk-6u6-linux-i586.bin
root # ./jdk-6u6-linux-i586.bin
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For more information on what data Registration collects and
how it is managed and used, see:
http://java.sun.com/javase/registration/JDKRegistrationPrivacy.html

```
Press Enter to continue.....



Done.
```

將檔案移動到 /opt 目錄

```
root # mv apache-tomcat-6.0.16 /opt/tomcat; mv jaf-1.0.2/ /opt/jaf; mv
javamail-1.4.1/ /opt/javamail; mv jdk1.6.0_06/ /opt/java
```

以上過程會把 Tomcat、jaf、javamail 與 Sun Java JDK 安裝完成,現在必需設定系統變數才可使 tomcat 順利啟動。

編輯 /etc/profile 檔案,並加入以下設定。

```
JAVA_HOME=/opt/java
CATALINA_HOME=/opt/tomcat
CATALINA_BASE=/opt/tomcat
CLASSPATH=./:${JAVA_HOME}/lib:${JAVA_HOME}/jre/lib/ext:${CATALINA_HOME}/common/lib:/opt/javamail/mail.jar:/opt/jaf/activation.jar

export JAVA_HOME CATALINA_HOME CATALINA_BASE CLASSPATH
export PATH=${JAVA_HOME}/bin:${CATALINA_HOME}/bin:${PATH}
```

完整的設定 /etc/profile 之後執行下列指令可立即生效。

```
root # . /etc/profile
```

完成以上項目後,即可開始設定 tomcat,讓 tomcat 接受處理 Apache 的請求。

設定 tomcat

以下說明的 tomcat 設定檔均指 /opt/tomcat/conf/server.xml 檔案,若您的 tomcat 安裝在不同路徑請自行更改。

處理 Apache 所指示的檔案,需要 tomcat 的配合,預設 tomcat 開啟 8009 連接埠的請求,因此只需要設定虛擬目錄即可。

設定 http://192.168.1.205/project1 目錄,設定時先先定議一個虛擬網站,再設定虛擬目錄,虛擬網站由 <Host></Host> 的 xml 標籤所包含,而目錄是以 <Context></Context> 所包含,其格式如下:

```
<Engine>
   <Host attrs ...>
      <Context attrs ...>
      </Context>
   </Host>
</Engine>
```

server.xml 修改過後的樣式如下:

```
    <Host name="192.168.1.205" debug="0" appBase="/default"
 unpackWARs="true" autoDeploy="true">
      <Context path="/project1" docBase="/projects/project1"
             debug="5" reloadable="true" crossContext="true">
      </Context>
     </Host>
```

以上 <Context> 標籤裡的 path 屬性是指 URL 的路徑,實際對應的目錄為 /projects/project1/。設定完成後,請先行建立 /projects/project1/ 目錄。

```
root # mkdir -p "/projects/project1"; cd /projects/project1
```

啟動 tomcat 服務。

```
root # /opt/tomcat/bin/startup.sh
Using CATALINA_BASE:   /opt/tomcat
Using CATALINA_HOME:   /opt/tomcat
Using CATALINA_TMPDIR: /opt/tomcat/temp
Using JRE_HOME:        /opt/java
```

測試

完成了以上 Apache 與 Tomcat 的設定,現在可進行測試,請先在 Tomcat 主機上的 /projects/project1/ 建立一個 hello.jsp 程式,內容如下。

```
<%@ page contentType="text/html;charset=big5" %>
<%
String str1="Hello World!";
```

```
out.println(str1);

%>
```

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hello.jsp 程式可點選 <u>此處</u> 下載。

現在，開啟您的瀏覽器，輸入 http://192.168.1.205/project1/hello.jsp 網址。

MySQL 設定

MySQL 設定的方式很簡單，基乎不需要任何的設定，只要確定可以連線到資料庫即可。

在 Tomcat 伺服器上，測試 MySQL 連線方如下：

```
steven $ mysql -u steven -p -h 192.168.1.204
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or g.
Your MySQL connection id is 443 to server version: 5.0.22-log


Type 'help;' or 'h' for help. Type 'c' to clear the buffer.


mysql>
```

以上若可順利連線到 MySQL 主機則表示成功。

若是連線失敗，請檢查防火牆設定與 MySQL 是否有啟動。

安裝 MySQL Connection/J

要使 tomcat 與 MySQL 可以做資源聯結，需要有 MySQL Connector/J 的配合才行，可到 MySQL 網站（<u>http://dev.mysql.com/downloads/connector/j/</u>）中下載。

本文編寫時，最新版本的 Connector/J 為 5.1.6 版。

```
root # lynx
'http://dev.mysql.com/get/Downloads/Connector-J/mysql-connector-java-
5.1.6.tar.gz/from/http://mysql.ntu.edu.tw/'
root # tar -zxvf mysql-connector-java-5.1.6.tar.gz
```

下載完後，把 mysql-connector-java-5.1.6-bin.jar 複製到 /opt/tomcat/common/lib/ 裡即可

```
root # cp
mysql-connector-java-5.1.6/mysql-connector-java-5.1.6-bin.jar
/opt/tomcat/common/lib/
```

編輯 Tomcat 設定檔

設定 Tomcat Database Connection Pool 的方式很簡單,只要在目錄裡加上 <Resource></Resource> 標籤即可,使用的方式如下:

```
<Engine>
   <Host attrs ...>
      <Context attrs ...>
          <Resource attrs ... />
      </Context>
   </Host>
</Engine>
```

把 <Resource> 標籤放在 <Context> 裡,則此目錄的程式都可以引用在此設定的資料庫連線資源,以下為實際修改方式:

```
    <Host name="192.168.1.205" debug="0" appBase="/default"
unpackWARs="true" autoDeploy="true">

      <Context path="/project1" docBase="/projects/project1"
            debug="5" reloadable="true" crossContext="true">

         <Resource name="jdbc/project1" auth="Container"
type="javax.sql.DataSource"

                  maxActive="100" maxIdle="30" maxWait="10000"

                  username="steven" password="pass"

driverClassName="com.mysql.jdbc.Driver"


url="jdbc:mysql://192.168.1.204:3306/project1?autoReconnect=true"/>


      </Context>

    </Host>
```

在 <Resource> 標籤裡的 name 是指資料庫資源名稱,username 與 password 為連線的帳號與密碼,而 url 裡設定了所要連結的資料庫主機與資料庫名稱。當然您必需把 project1 這個資料庫先建立起來並設定 steven 帳號可以存取才行。

注意:您可以同時設定多個 Resource 資源,只要 name 不重複即可。

設定完成後,需重新啟動 tomcat 伺服器。

關閉 tomcat

```
root # /opt/tomcat/bin/shutdown.sh
Using CATALINA_BASE:   /opt/tomcat
Using CATALINA_HOME:   /opt/tomcat
Using CATALINA_TMPDIR: /opt/tomcat/temp
Using JRE_HOME:        /opt/java
```

啟動 tomcat

```
root # /opt/tomcat/bin/startup.sh
Using CATALINA_BASE:   /opt/tomcat
Using CATALINA_HOME:   /opt/tomcat
Using CATALINA_TMPDIR: /opt/tomcat/temp
Using JRE_HOME:        /opt/java
```

測試 JSP 連線

請在 /projects/project1/ 裡建立 db_test.jsp，而 db_test.jsp 的內容如下：

```jsp
<%@ page import="java.sql.*"%>
<%@ page import="javax.sql.*"%>
<%@ page import="javax.naming.*"%>
<%@ page session="false" %>
<html>
<head>
<meta http-equiv="content-type" content="text/html; charset=big5">
<title>Test of mysql connection pool</title>
</head>
<body>
<%
out.print("start<br/>");
try{
Context initctx = new InitialContext();
Context ctx = (Context) initctx.lookup("java:comp/env");
Object obj = (Object) ctx.lookup("jdbc/project1");
javax.sql.DataSource ds = (javax.sql.DataSource)obj;
Connection conn = ds.getConnection();
out.print("mysql connection pool runs perfectly!");
conn.close();
}
catch(Exception ex){
```

```
out.print(ex.getMessage());

ex.printStackTrace();

}

%>

</body>

</html>
```

請注意，以上 jsp 裡 ctx.lookup 裡所指定的 jdbc 為 tomcat 設定檔裡的 <Resource> 名稱，與 name 屬性相對應。

以上 db_test.jsp 可以點選 此處 下載。

開啟瀏覽器，輸入測試程式的網址，若是連線成功則會出現 mysql connection pool runs perfectly! 字樣。

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作者：廖子儀 (Tzu-Yi Liao)

Certified：LPIC Level I、LPIC Level II、RHCE

E-mail：steven@ms.ntcb.edu.tw

Web site：Steven's Linux Note (http://www.l-penguin.idv.tw/)