

Deployment | Project Document

MSc in Web Technologies-part time

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Introduction

Deployment in large hosting services companies is now treated as part of a development process that supports the Operations of the company and its customers (DevOps). Where before deployment required building of physical servers and configuration of routers, these days, deployment is much about controlling the process programmatically.

This document will outline the processes involved in deploying an application. A simple sample web application will be cloned from a repository. The sample application will be a LAMP (Linux, Apache, MySQL and Perl) based site. This application has been deployed onto a virtual machine.

Scripts have been written to run a clean installs of both MySQL and Apache, build, integrate, test and deploy the site and also to log and monitor the site.

The MoSoCoW requirements have been used a guide for the delivery process. The V-Model SDLC (system development life cycle) and the ITIL framework have been integrated in an effort to adhere to best practice.

Approach

Approach for this assignment is to use V-Model as a best practice delivery process to guide the deployment structure.

Specification of the Delivery process

User requirements

No	M/ S / C	Description
Must Have		
1.	Must have	The <u>build</u> process must stop all existing process, if any, which are running in its environment.
2.	Must have	The <u>integration</u> process must install and start a new server and database environment.
3.	Must have	The <u>integration</u> process must be able to clone files required for the application from a third party, github in the case of this deployment instance.
4.	Must have	The <u>test</u> process must be able to update the application's content.
5.	Must have	The <u>deployment</u> process must have the ability to execute all of the above in a single command.
6.	Must have	The deployed content must be delivered through the browser.
7.	Must have	The <u>monitoring</u> process should report the status of processes within the deployed site and must log every minute.
Should have		
1.	Should have	Each of the <u>build</u> , <u>integration</u> , <u>test</u> and <u>deployment</u> processes should work from it's own directory.
2.	Should have	The <u>monitoring</u> process should make sure that processes like memory and I/O are within agreed stable thresholds, before the product is deployed.
3.	Should have	The <u>build</u> process should check that all components and resources are in place for testing.
4.	Should have	The <u>deployment</u> process should backup the content prior to deployment of new content. This should include the database.
5.	Should have	The <u>deployment</u> process should note and log the differences between the product versions, when a new version is being pushed live.
6.	Should have	The <u>deployment</u> process should keep the previous version of the product in place, if the new version fails to be deployed successfully.
7.	Should have	The <u>monitoring</u> process should report errors to selected users email, not just to log file.

Could Have		
1.	Could Have	The <u>build</u> , <u>integration</u> and <u>test</u> processes could run on a separate server from the server to which the server is deployed.
2.	Could Have	The <u>monitor</u> process could create additional data sets, which monitors items for crunching and analytics. This data could be sent weekly to the appropriate users. These analytics could be useful to share at a stakeholder meeting.

User stories

As an admin user / software developer, I want the build process to stop all existing process, so that I can ensure a clean build. *Related to Must Have 1.*

As an admin user/ software developer, I want the integration process to install and start a new server and database environment; so that I can ensure that I am building the application on settings that I have chosen. *Related to Must Have 2.*

As an admin user/ software developer, I want to be able to clone files required for the application from a third party, github in the case of this deployment instance. This is so I can keep my code base separate and traceable. *Related to Must Have 3.*

As a systems tester, I want be able to test if the application's content is updatable; so that I can verify that has the potential to be dynamic before I deploy it. *Related to Must Have 4.*

As a business owner, I want to deploy an application using command line, so that there is less room for human errors. *Related to Must Have 5.*

As a business user and own, I want to be able to view the deployed content through the browser. Related to Must Have 6.

As a systems tester, I want be able to monitor the status of processes within the deployed site at regular intervals; so that I can troubleshoot if an issue arises when exactly it occurred. *Related to Must Have 7.*

As a software developer, I want be the build, integration, test and deployment processes to work from separate directories. This is so I can split up the roles

further, causing them to be less dependent on each other and easier to debug and unit test. *Related to Should Have 1.*

As a systems tester, I want the build, integration, test and deployment processes to work from separate directories. This is so I can conduct integration testing on them. *Related to Should Have 1*

As a business owner, I want the processes like memory and I/O to be monitored in a strict manner. This is because if they go beyond a threshold agreed in the SLA (Service Level Agreement), the company may be liable to pay a fine. *Related to Should Have 2*

As a software developer, I want the build process to ensure that all components and resources are in place prior to testing. This is to avoid unnecessary testing. *Related to Should Have 3*

As a business owner, I want the content backed up prior to the deployment of new content. This is because a business we can quickly revert back to the previous version, if an unexpected issue occurs. *Related to Should Have 4*

As a software developer, I want a log of the differences between the product versions, a new record should be appended to the log each time a new version is deployed. *Related to Should Have 5*

As a business owner, I want the previous version of the product in kept place, if the new version fails to be deployed successfully. It is better for the business to have old content, then no content and risk losing customers. *Related to Should Have 6*

As a business owner, I want the monitoring process to report errors via email (as well as to log files). This is because no specialist knowledge is required to detect the error if it is flagged via email, which increases the likelihood of the error being spotted. *Related to Should Have 7*

As a business owner, I want the build, integration, test and deploy processes to all to run on separate servers. This is to help the company deal with disasters that may affect the server, as part a disaster recovery strategy. *Related to Could Have 1*

As a business owner, I want weekly data sets of the monitored items crunched and analyzed. This is to inform the company's decision makers about key metrics in the systems. In an effort to help them make well educated decisions in the future. *Related to Could Have 2*

Design of Delivery

Mapping to the V-Model

The deployment of this application will be lead by the V-Model. The V-Model enforces a segregation of duties, which gives rise to a robust system.

User Requirements

The main user requirement is that a user can deploy an application using a single command. A successful user acceptance test will verify that this requirement has been successfully satisfied.

Functional Specification

The script, which the user executes, should clean the environment on the server; install clean database and server environments.

Be able to clone and unzip documents from an online repository.

Content is delivered correctly and logging is functioning correctly.

Technical Specification

The process requires connecting from the machine to the UBUNTU VirtualBox server. The process requires a clean install of the required dependencies as outlined here:

- Apache2
- Mysql
- Perl
- HTML5
- CGI Bin
- Crontab script and configuration.

Apache2 is the server engine. It allows Dynamic server to be transformed and rendered into HTML content.

MySQL a Database system, which is typically paired with Apache as it is also Open Source.

Perl is the server side language, which this application will use.

Crontab will be set up to log and monitor assigned processes and unit tests.

Mapping to ITIL

Service Design

- **Service Level Agreement**

In an effort to ensure that the SLA is kept, it is important to log and monitor processes. It is vital that Apache is running and MySQL is listening. If either of these fail the SLA will be in void.

- **Capacity Management**

In terms of computational capacity management, it is important that vital processes do not exceed their capped threshold.

Analyzing past log records is important for future capacity management planning and modeling, as it may forecast where incidence may occur in the future.

- **Information Security**

Failure to implement a stringent information security structure within an organisation can lead to very adverse effects. Implementing a strict and robust MySQL password at build stage will lay a descent foundation for a secure deployment.

- **Supplier Management**

This application runs on the LAMP stack. There is many benefits in having an applications third party supplier, an open source one. This includes cost saving, greater adoption by developers and using LAMP ensures using wide well maintained system.

Service Transition

- **Change Management**

Any changes made to MySQL or Apache2 will be implemented when they are cleanly installed during the build.

- **Asset Management**

Asset management during the build stage can be a list of services, which the application requires.

- **Configuration Management**

Configuration Management during the build stage is dictated by the. config files in the code repository.

- **Knowledge Management**

It is important that documents detailing the above topics are consistent and readily available to the stakeholders in the organization that need them.

Service Operation

- **Incident Management**

Incident management aims to restore normal service operations as quickly as possible. Incidents will be logged to the logger and dealt with as quickly as possible. Most errors will not cause the system to fatally die, as a errors should prohibit the deploy from occurring.

- **Problem Management**

In an effort to avoid an 'incident' occurring, problem management needs to enforced.

Test Plan

Unit Test

Create a unit test called "UT1.sh", to test the functionality of the isRunning function.

```
testuser@ubuntu:~/project$ sudo pico UT1.sh
```

```
GNU nano 2.2.6
```

```
File: UT1.sh
```

```
#!/bin/bash
```

```
# Unit Test Script
```

```
# Level 0 functions
```

```
# create is isRunning function
```

```
function isRunning {
```

```
PROCESS_NUM=$(ps -ef | grep "$1" | grep -v "grep" | wc -l)
```

```
if [ $PROCESS_NUM -gt 0 ] ; then
```

```
    return 1
```

```
else
```

```
    return 0
```

```
fi
```

```
}
```

```
# Check if Unit Test isRunning on a known Level 0 function
```

```
# This should return true
```

```
echo "Unit Testing isRunning"
```

```
isRunning apache2
```

```
if [ $? -eq 1 ]; then
```

```
    echo "UT of isRunning Passed - Apache process found"
```

```
else
```

```
    echo "UT of isRunning failed - Apache process not found?????"
```

```
fi
```

```
# Check if Unit Test isRunning on fake Level 0 function
```

```
# This should return false
```

```
isRunning Dummy
```

```
if [ $? -eq 0 ];then
```

```
        echo "UT of isRunning passed - Did not find Dummy Process"
else
        echo "UT of isRunning failed - found Dummy process???"
fi
```

```
# \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\ end script \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
# verify in log that Unit Test works as expected
```

```
testuser@ubuntu:~/project$ cat UT1.out
```

```
Unit Testing  isRunning
```

```
UT of isRunning Passed - Apache process found
```

```
UT of isRunning passed - Did not find Dummy Process
```

Functional Tests

Run the script and see does the code appear on a browser.

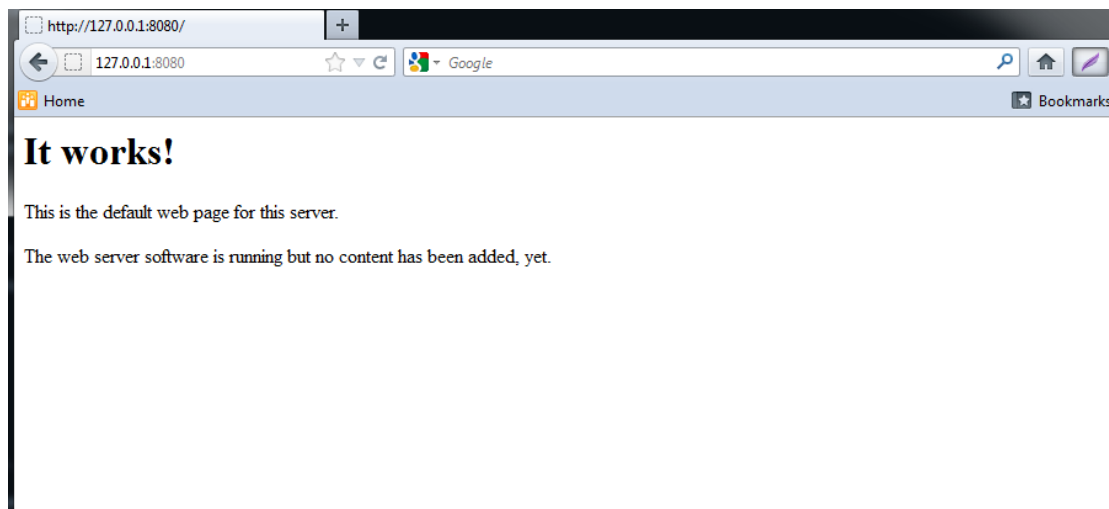


Figure 1 Demonstrates that static content is delivered through browser

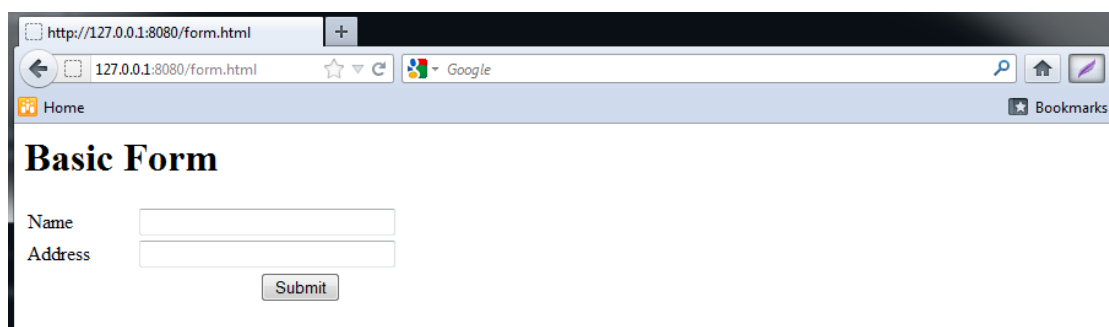


Figure 2 Demonstrates that dynamic content is delivered through browser

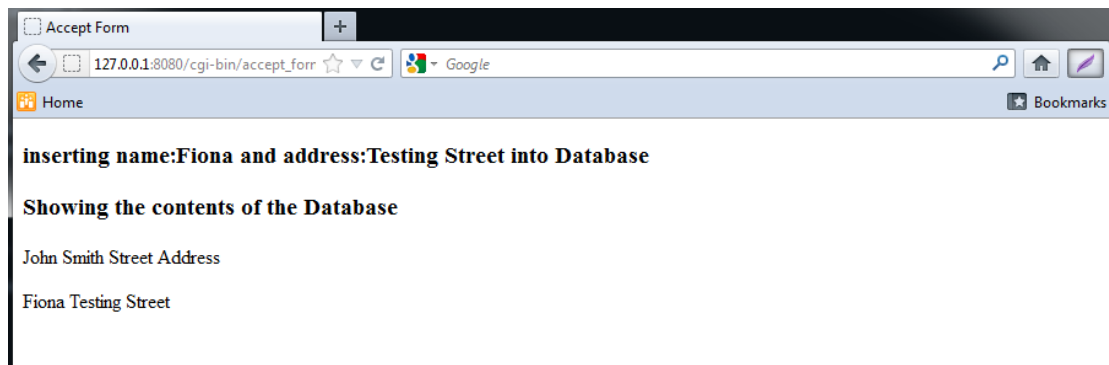


Figure 3 Demonstrates that dynamic content is delivered through browser

Acceptance Test

See completed execution plan for validation that the acceptance test was passed by a business user.

Execution plan

To execute the deployment script, I enlisted the help of a third party, Ewa Marciniak. Ewa was given a series of tasks to perform, beginning from running the deploy script to checking for errors.

The following is the execution plan. It conducted by Ewa and witnessed by Andrew.

Step	Topic	Verification Y/N
1	Clear Environment	Y
2	Run Deployment scripting	Y
3	Demonstrate static content is delivered through browser	Y
4	Demonstrate dynamic content is delivered through browser	Y
5	Demonstrate Logging is functioning correctly	Y
6	Run Deployment scripting again	Y
7	Demonstrate Content is delivered correctly and logging is functioning correctly	Y
8	Stop web server, verify logging of event in log	Y
9	Stop Database, verify logging of event in log	Y
10	Start web server, verify logging of even in log	Y
11	Start Database, verify logging of event in log	Y
12	Change the content in code repository. Run the deployment scripting. Verify that Content is delivered correctly and logging is functioning correctly.	Y

Executed by : Ewa Marciniak **Witnessed by:** Andrew B **Date :** 25/01/14

Record of demonstration

The following is the record of the processes completed in the execution plan.

```
login as: testuser
testuser@127.0.0.1's password:
Welcome to Ubuntu 12.04.2 LTS (GNU/Linux 3.5.0-23-generic i686)
 * Documentation:  https://help.ubuntu.com/
  System information as of Sat Jan 25 14:58:20 GMT 2014
    System load:  0.63               Processes:           75

    Usage of /:   24.5% of 7.38GB    Users logged in:     0

    Memory usage: 14%               IP address for eth0: 10.0.2.15

    Swap usage:   0%

  Graph this data and manage this system at
  https://landscape.canonical.com/

Last login: Thu Jan 23 14:41:43 2014 from 10.0.2.2

testuser@ubuntu:~$ ls

project  sendmail.pl  testdb.pl  test.pl  tmp

testuser@ubuntu:~$ cd project

testuser@ubuntu:~/project$ ls

log_and_monitor.sh  stop_start_updateDB.sh
```

1. *Clear Environment*
2. *Run Deployment Script*

#Clear Environment and Run Deployment Script - View Script

```
testuser@ubuntu:~/project$ sudo pico stop_start_updateDB.sh

#!/usr/bin/bash

SANDBOX=sandbox_$(RANDOM)

echo Using sandbox $SANDBOX

#

#Stop services

sudo /etc/init.d/apache2 stop

sudo /etc/init.d/mysql stop

#

apt-get update

#

apt-get -q -y remove apache2
```

```
apt-get -q -y install apache2

#

apt-get -q -y remove mysql-server mysql-client

echo mysql-server mysql -server/root_password password password |
debconf-set-selections

echo mysql-server mysql-server/root_password_again password password
| debconf-set-selections

apt-get -q -y install mysql-server mysql-client

# clone the project files from github

cd /tmp

mkdir $SANDBOX

cd $SANDBOX/

git clone https://github.com/FSlyne/NCIROL.git

cd NCIROL/

# change file locations

cp Apache/www/* /var/www/

cp Apache/cgi-bin/* /usr/lib/cgi-bin/

chmod a+x /usr/lib/cgi-bin/*

#Start services

/etc/init.d/apache2 start

/etc/init.d/mysql start

#

cat <<FINISH | mysql -uroot -ppassword
# drop database if exists

drop database if exists dbtest;

CREATE DATABASE dbtest;

GRANT ALL PRIVILEGES ON dbtest.* TO dbtestuser@localhost IDENTIFIED
BY 'dbpassword';

use dbtest;

drop table if exists custdetails;

create table if not exists custdetails

(

name VARCHAR(30) NOT NULL DEFAULT'',
```

```
address VARCHAR(30) NOT NULL DEFAULT''

);
# add content to table custdetails in database

insert into custdetails (name,address) values ('John Smith','Street
Address');

select * from custdetails;

# end script
```

#Clear Environment and Run Deployment Script – Run Script

```
testuser@ubuntu:~/project$ sudo bash stop_start_updatedB.sh
```

```
Using sandbox sandbox_26762
```

```
* Stopping web server apache2
apache2: Could not reliably determine the server's fully qualified
domain name, using 127.0.1.1 for ServerName
```

```
... waiting
[ OK ]
```

Rather than invoking init scripts through /etc/init.d, use the service(8)

utility, e.g. service mysql stop

Since the script you are attempting to invoke has been converted to an

Upstart job, you may also use the stop(8) utility, e.g. stop mysql

mysql stop/waiting

```
Ign http://ie.archive.ubuntu.com precise InRelease
```

```
Ign http://ie.archive.ubuntu.com precise-updates InRelease
```

```
Ign http://ie.archive.ubuntu.com precise-backports InRelease
```

```
Hit http://ie.archive.ubuntu.com precise Release.gpg
```

```
Hit http://ie.archive.ubuntu.com precise-updates Release.gpg
```

```
Hit http://ie.archive.ubuntu.com precise-backports Release.gpg
```

```
Hit http://ie.archive.ubuntu.com precise Release
```

```
Hit http://ie.archive.ubuntu.com precise-updates Release
```

```
Hit http://ie.archive.ubuntu.com precise-backports Release
```

```
Hit http://ie.archive.ubuntu.com precise/main Sources
```

```
Hit http://ie.archive.ubuntu.com precise/restricted Sources
```

```
Hit http://ie.archive.ubuntu.com precise/universe Sources
```

```
Hit http://ie.archive.ubuntu.com precise/multiverse Sources
```

```
Hit http://ie.archive.ubuntu.com precise/main i386 Packages
```

Hit http://ie.archive.ubuntu.com precise/restricted i386 Packages
Hit http://ie.archive.ubuntu.com precise/universe i386 Packages
Hit http://ie.archive.ubuntu.com precise/multiverse i386 Packages
Hit http://ie.archive.ubuntu.com precise/main TranslationIndex
Hit http://ie.archive.ubuntu.com precise/multiverse TranslationIndex
Hit http://ie.archive.ubuntu.com precise/restricted TranslationIndex
Hit http://ie.archive.ubuntu.com precise/universe TranslationIndex
Hit http://ie.archive.ubuntu.com precise-updates/main Sources
Hit http://ie.archive.ubuntu.com precise-updates/restricted Sources
Hit http://ie.archive.ubuntu.com precise-updates/universe Sources
Hit http://ie.archive.ubuntu.com precise-updates/multiverse Sources
Hit http://ie.archive.ubuntu.com precise-updates/main i386 Packages
Hit http://ie.archive.ubuntu.com precise-updates/restricted i386 Packages
Hit http://ie.archive.ubuntu.com precise-updates/universe i386 Packages
Hit http://ie.archive.ubuntu.com precise-updates/multiverse i386 Packages
Hit http://ie.archive.ubuntu.com precise-updates/main TranslationIndex
Hit http://ie.archive.ubuntu.com precise-updates/multiverse TranslationIndex
Hit http://ie.archive.ubuntu.com precise-updates/restricted TranslationIndex
Hit http://ie.archive.ubuntu.com precise-updates/universe TranslationIndex
Hit http://ie.archive.ubuntu.com precise-backports/main Sources
Hit http://ie.archive.ubuntu.com precise-backports/restricted Sources
Hit http://ie.archive.ubuntu.com precise-backports/universe Sources
Hit http://ie.archive.ubuntu.com precise-backports/multiverse Sources
Hit http://ie.archive.ubuntu.com precise-backports/main i386 Packages
Hit http://ie.archive.ubuntu.com precise-backports/restricted i386 Packages
Hit http://ie.archive.ubuntu.com precise-backports/universe i386 Packages
Hit http://ie.archive.ubuntu.com precise-backports/multiverse i386 Packages

Hit http://ie.archive.ubuntu.com precise-backports/main
TranslationIndex

Hit http://ie.archive.ubuntu.com precise-backports/multiverse
TranslationIndex

Hit http://ie.archive.ubuntu.com precise-backports/restricted
TranslationIndex

Hit http://ie.archive.ubuntu.com precise-backports/universe
TranslationIndex

Hit http://ie.archive.ubuntu.com precise/main Translation-en

Hit http://ie.archive.ubuntu.com precise/multiverse Translation-en

Hit http://ie.archive.ubuntu.com precise/restricted Translation-en

Hit http://ie.archive.ubuntu.com precise/universe Translation-en

Hit http://ie.archive.ubuntu.com precise-updates/main Translation-en

Hit http://ie.archive.ubuntu.com precise-updates/multiverse
Translation-en

Hit http://ie.archive.ubuntu.com precise-updates/restricted
Translation-en

Hit http://ie.archive.ubuntu.com precise-updates/universe
Translation-en

Hit http://ie.archive.ubuntu.com precise-backports/main Translation-
en

Hit http://ie.archive.ubuntu.com precise-backports/multiverse
Translation-en

Hit http://ie.archive.ubuntu.com precise-backports/restricted
Translation-en

Hit http://ie.archive.ubuntu.com precise-backports/universe
Translation-en

Ign http://security.ubuntu.com precise-security InRelease

Hit http://security.ubuntu.com precise-security Release.gpg

Hit http://security.ubuntu.com precise-security Release

Hit http://security.ubuntu.com precise-security/main Sources

Hit http://security.ubuntu.com precise-security/restricted Sources

Hit http://security.ubuntu.com precise-security/universe Sources

Hit http://security.ubuntu.com precise-security/multiverse Sources

Hit http://security.ubuntu.com precise-security/main i386 Packages

Hit http://security.ubuntu.com precise-security/restricted i386
Packages

```
Hit http://security.ubuntu.com precise-security/universe i386
Packages

Hit http://security.ubuntu.com precise-security/multiverse i386
Packages

Hit http://security.ubuntu.com precise-security/main TranslationIndex

Hit http://security.ubuntu.com precise-security/multiverse
TranslationIndex

Hit http://security.ubuntu.com precise-security/restricted
TranslationIndex

Hit http://security.ubuntu.com precise-security/universe
TranslationIndex

Hit http://security.ubuntu.com precise-security/main Translation-en

Hit http://security.ubuntu.com precise-security/multiverse
Translation-en

Hit http://security.ubuntu.com precise-security/restricted
Translation-en

Hit http://security.ubuntu.com precise-security/universe Translation-
en

Reading package lists... Done

Reading package lists...

Building dependency tree...

Reading state information...

The following packages were automatically installed and are no longer
required:

    apache2-utils libaprutil1-dbd-sqlite3 apache2.2-bin libapr1
libaprutil1-ldap apache2.2-common ssl-cert apache2-mpm-worker
libaprutil1

Use 'apt-get autoremove' to remove them.

The following packages will be REMOVED:

    apache2

0 upgraded, 0 newly installed, 1 to remove and 134 not upgraded.

After this operation, 29.7 kB disk space will be freed.

(Reading database ... 71825 files and directories currently
installed.)

Removing apache2 ...

Reading package lists...

Building dependency tree...

Reading state information...
```

The following NEW packages will be installed:

apache2

0 upgraded, 1 newly installed, 0 to remove and 134 not upgraded.

Need to get 0 B/1,496 B of archives.

After this operation, 29.7 kB of additional disk space will be used.

Selecting previously unselected package apache2.

(Reading database ... 71821 files and directories currently installed.)

Unpacking apache2 (from .../apache2_2.2.22-1ubuntu1.4_i386.deb) ...

Setting up apache2 (2.2.22-1ubuntu1.4) ...

Reading package lists...

Building dependency tree...

Reading state information...

The following packages were automatically installed and are no longer required:

libnet-daemon-perl libdbi-perl mysql-client-core-5.5 libdbd-mysql-perl mysql-server-5.5 libterm-readkey-perl mysql-common mysql-client-5.5 libplrpc-perl

mysql-server-core-5.5 libmysqlclient18

Use 'apt-get autoremove' to remove them.

The following packages will be REMOVED:

mysql-client mysql-server

0 upgraded, 0 newly installed, 2 to remove and 134 not upgraded.

After this operation, 231 kB disk space will be freed.

(Reading database ... 71825 files and directories currently installed.)

Removing mysql-client ...

Removing mysql-server ...

warning: Unknown type -server/root_password, skipping line 1

Reading package lists...

Building dependency tree...

Reading state information...

The following NEW packages will be installed:

mysql-client mysql-server

0 upgraded, 2 newly installed, 0 to remove and 134 not upgraded.

Need to get 0 B/22.2 kB of archives.

After this operation, 231 kB of additional disk space will be used.

Selecting previously unselected package mysql-client.

(Reading database ... 71819 files and directories currently installed.)

Unpacking mysql-client (from .../mysql-client_5.5.35-0ubuntu0.12.04.1_all.deb) ...

Selecting previously unselected package mysql-server.

Unpacking mysql-server (from .../mysql-server_5.5.35-0ubuntu0.12.04.1_all.deb) ...

Setting up mysql-client (5.5.35-0ubuntu0.12.04.1) ...

Setting up mysql-server (5.5.35-0ubuntu0.12.04.1) ...

Cloning into 'NCIRL'...

remote: Reusing existing pack: 86, done.

remote: Counting objects: 8, done.

remote: Compressing objects: 100% (6/6), done.

remote: Total 94 (delta 2), reused 6 (delta 0)

Unpacking objects: 100% (94/94), done.

* Starting web server apache2
apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1 for ServerName

[OK]

Rather than invoking init scripts through /etc/init.d, use the service(8)

utility, e.g. service mysql start

Since the script you are attempting to invoke has been converted to an

Upstart job, you may also use the start(8) utility, e.g. start mysql
mysql start/running, process 8325

name address

John Smith Street Address

Script finishes being executed here

3. Demonstrate static content is delivered through browser

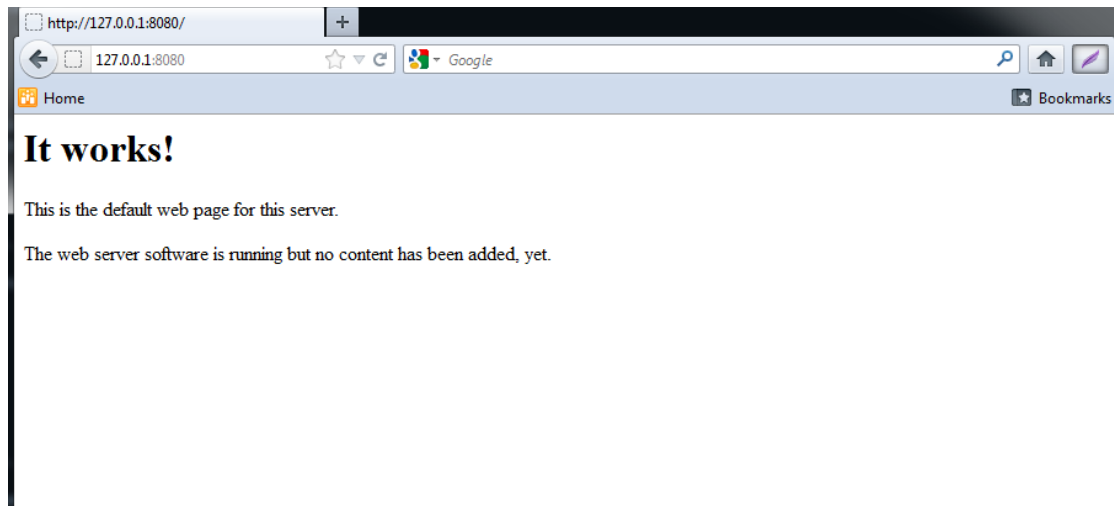


Figure 4 Demonstrate static content is delivered through browser

4. Demonstrate dynamic content is delivered through browser

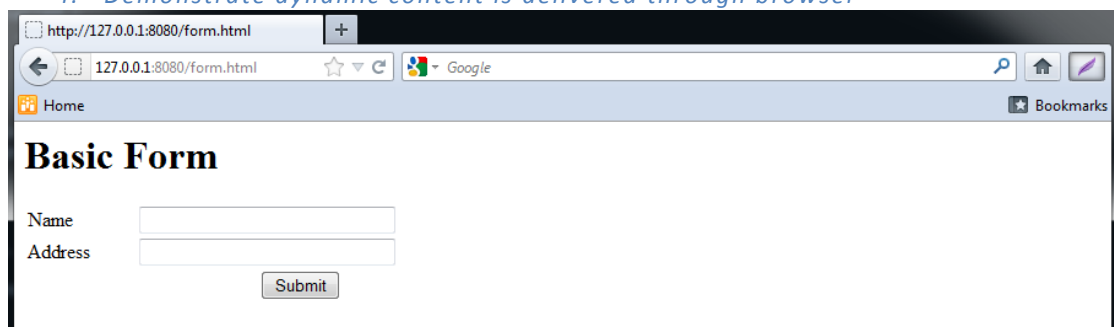


Figure 5 Demonstrate dynamic content is delivered through browser

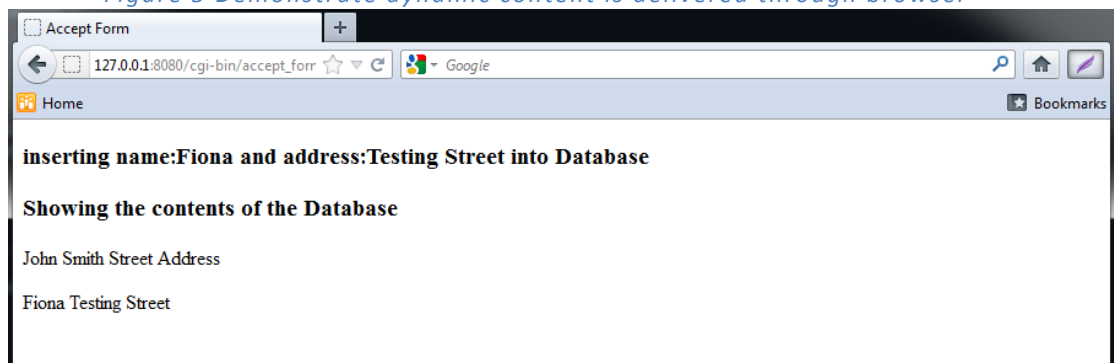


Figure 6 Demonstrate dynamic content is delivered through browser

5. Demonstrate logging is working correctly

Demonstrate logging is working correctly – View Script

```
testuser@ubuntu:~/project$ sudo pico log_and_monitor.sh
```

```
#!/bin/bash
```

```
# Fiona Mc Andrew | Deployment
```

```
# Level 1 functions <-----
```

```

function isApacheRunning {
    isRunning apache2
    return $?
}

function isApacheListening {
    isTCPListen 80
    return $?
}

function isMysqlListening {
    isTCPListen 3306
    return $?
}

function isApacheRemoteUp {
    isTCPRemoteOpen 127.0.0.1 80
    return $?
}

function isMysqlRunning {
    isRunning mysqld
    return $?
}

function isMysqlRemoteUp {
    isTCPRemoteOpen 127.0.0.1 3306
    return $?
}

# Level 0 functions <-----

function isRunning {
PROCESS_NUM=$(ps -ef | grep "$1" | grep -v "grep" | wc -l)
if [ $PROCESS_NUM -gt 0 ] ; then
    return 1
else
    return 0
}

```

```
fi

function isTCPlisten {
TCPCOUNT=$(netstat -tupln | grep tcp | grep "$1" | wc -l)
if [ $TCPCOUNT -gt 0 ] ; then
    return 1
else
    return 0
fi
}

function isUDPlisten {
UDPCOUNT=$(netstat -tupln | grep udp | grep "$1" | wc -l)
if [ $UDPCOUNT -gt 0 ] ; then
    return 1
else
    return 0
fi
}

function isIPalive {
PINGCOUNT=$(ping -c 1 "$1" | grep "1 received" | wc -l)
if [ $PINGCOUNT -gt 0 ] ; then
    return 1
else
    return 0
fi
}

function getCPU {
app_name=$1
cpu_limit="5000"
app_pid=`ps aux | grep $app_name | grep -v grep | awk {'print $2'}`
```

```
app_cpu=`ps aux | grep $app_name | grep -v grep | awk {'print
$3*100'}`

if [[ $app_cpu -gt $cpu_limit ]]; then
    return 0
else
    return 1
fi
}

ERRORCOUNT=0

# Functional Body of monitoring script <-----

isApacheRunning
if [ "$?" -eq 1 ]; then
    echo Apache process is Running
else
    echo Apache process is not Running
    ERRORCOUNT=$((ERRORCOUNT+1))
fi

isApacheListening
if [ "$?" -eq 1 ]; then
    echo Apache is Listening
else
    echo Apache is not Listening
    ERRORCOUNT=$((ERRORCOUNT+1))
fi

isApacheRemoteUp
if [ "$?" -eq 1 ]; then
    echo Remote Apache TCP port is up
else
    echo Remote Apache TCP port is down
    ERRORCOUNT=$((ERRORCOUNT+1))
```



```
fi

isMysqlRunning
if [ "$?" -eq 1 ]; then
    echo Mysql process is Running
else
    echo Mysql process is not Running
    ERRORCOUNT=$((ERRORCOUNT+1))
fi

isMysqlListening
if [ "$?" -eq 1 ]; then
    echo Mysql is Listening
else
    echo Mysql is not Listening
    ERRORCOUNT=$((ERRORCOUNT+1))
fi

isMysqlRemoteUp
if [ "$?" -eq 1 ]; then
    echo Remote Mysql TCP port is up
else
    echo Remote Mysql TCP port is down
    ERRORCOUNT=$((ERRORCOUNT+1))
fi

if [ $ERRORCOUNT -gt 0 ]
then
    echo "There is a problem with Apache or Mysql"
fi
```

Demonstrate logging is working correctly – Run Script

```
testuser@ubuntu:~/project$ cat log.out
```

```
# The following code block will log every minute and concatenate onto  
# the end of the "log.out" file and will alter if the state of the  
# processes alter.  
# Crontab set up can be found at the end of the document.
```

Apache process is Running

Apache is Listening

Remote Apache TCP port is up

Mysql process is Running

Mysql is Listening

Remote Mysql TCP port is up

6. Run Deployment Script again

```
testuser@ubuntu:~/project$ sudo bash stop_start_updatedB.sh
```

Using sandbox sandbox_32274

```
* Stopping web server apache2  
apache2: Could not reliably determine the server's fully qualified  
domain name, using 127.0.1.1 for ServerName
```

```
... waiting  
[ OK ]
```

Rather than invoking init scripts through /etc/init.d, use the
service(8)

utility, e.g. service mysql stop

Since the script you are attempting to invoke has been converted to an

Upstart job, you may also use the stop(8) utility, e.g. stop mysql
mysql stop/waiting

Ign http://ie.archive.ubuntu.com precise InRelease

Ign http://ie.archive.ubuntu.com precise-updates InRelease

Ign http://ie.archive.ubuntu.com precise-backports InRelease

Hit http://ie.archive.ubuntu.com precise Release.gpg

Hit http://ie.archive.ubuntu.com precise-updates Release.gpg

Hit http://ie.archive.ubuntu.com precise-backports Release.gpg

Hit http://ie.archive.ubuntu.com precise Release

Hit http://ie.archive.ubuntu.com precise-updates Release

Hit http://ie.archive.ubuntu.com precise-backports Release

Hit http://ie.archive.ubuntu.com precise/main Sources

Hit http://ie.archive.ubuntu.com precise/restricted Sources

Hit http://ie.archive.ubuntu.com precise/universe Sources

Hit http://ie.archive.ubuntu.com precise/multiverse Sources

Hit http://ie.archive.ubuntu.com precise/main i386 Packages

Hit http://ie.archive.ubuntu.com precise/restricted i386 Packages

Hit http://ie.archive.ubuntu.com precise/universe i386 Packages

Hit http://ie.archive.ubuntu.com precise/multiverse i386 Packages

Hit http://ie.archive.ubuntu.com precise/main TranslationIndex

Hit http://ie.archive.ubuntu.com precise/multiverse TranslationIndex

Hit http://ie.archive.ubuntu.com precise/restricted TranslationIndex

Hit http://ie.archive.ubuntu.com precise/universe TranslationIndex

Hit http://ie.archive.ubuntu.com precise-updates/main Sources

Hit http://ie.archive.ubuntu.com precise-updates/restricted Sources

Hit http://ie.archive.ubuntu.com precise-updates/universe Sources

Hit http://ie.archive.ubuntu.com precise-updates/multiverse Sources

Hit http://ie.archive.ubuntu.com precise-updates/main i386 Packages

Hit http://ie.archive.ubuntu.com precise-updates/restricted i386 Packages

Hit http://ie.archive.ubuntu.com precise-updates/universe i386 Packages

Hit http://ie.archive.ubuntu.com precise-updates/multiverse i386 Packages

Hit http://ie.archive.ubuntu.com precise-updates/main TranslationIndex

Hit http://ie.archive.ubuntu.com precise-updates/multiverse TranslationIndex

Hit http://ie.archive.ubuntu.com precise-updates/restricted TranslationIndex

Hit http://ie.archive.ubuntu.com precise-updates/universe TranslationIndex

Hit http://ie.archive.ubuntu.com precise-backports/main Sources

Hit http://ie.archive.ubuntu.com precise-backports/restricted Sources

Hit http://ie.archive.ubuntu.com precise-backports/universe Sources

Hit http://ie.archive.ubuntu.com precise-backports/multiverse Sources

Hit http://ie.archive.ubuntu.com precise-backports/main i386 Packages

Hit http://ie.archive.ubuntu.com precise-backports/restricted i386 Packages

Hit http://ie.archive.ubuntu.com precise-backports/universe i386 Packages

Hit http://ie.archive.ubuntu.com precise-backports/multiverse i386 Packages

Hit http://ie.archive.ubuntu.com precise-backports/main TranslationIndex

Hit http://ie.archive.ubuntu.com precise-backports/multiverse TranslationIndex

Hit http://ie.archive.ubuntu.com precise-backports/restricted TranslationIndex

Hit http://ie.archive.ubuntu.com precise-backports/universe TranslationIndex

Hit http://ie.archive.ubuntu.com precise/main Translation-en

Hit http://ie.archive.ubuntu.com precise/multiverse Translation-en

Hit http://ie.archive.ubuntu.com precise/restricted Translation-en

Hit http://ie.archive.ubuntu.com precise/universe Translation-en

Hit http://ie.archive.ubuntu.com precise-updates/main Translation-en

Hit http://ie.archive.ubuntu.com precise-updates/multiverse Translation-en

Hit http://ie.archive.ubuntu.com precise-updates/restricted Translation-en

Hit http://ie.archive.ubuntu.com precise-updates/universe Translation-en

Hit http://ie.archive.ubuntu.com precise-backports/main Translation-en

Hit http://ie.archive.ubuntu.com precise-backports/multiverse Translation-en

Hit http://ie.archive.ubuntu.com precise-backports/restricted Translation-en

Hit http://ie.archive.ubuntu.com precise-backports/universe Translation-en

Ign http://security.ubuntu.com precise-security InRelease

Hit http://security.ubuntu.com precise-security Release.gpg

```
Hit http://security.ubuntu.com precise-security Release
Hit http://security.ubuntu.com precise-security/main Sources
Hit http://security.ubuntu.com precise-security/restricted Sources
Hit http://security.ubuntu.com precise-security/universe Sources
Hit http://security.ubuntu.com precise-security/multiverse Sources
Hit http://security.ubuntu.com precise-security/main i386 Packages
Hit http://security.ubuntu.com precise-security/restricted i386
Packages
Hit http://security.ubuntu.com precise-security/universe i386
Packages
Hit http://security.ubuntu.com precise-security/multiverse i386
Packages
Hit http://security.ubuntu.com precise-security/main TranslationIndex
Hit http://security.ubuntu.com precise-security/multiverse
TranslationIndex
Hit http://security.ubuntu.com precise-security/restricted
TranslationIndex
Hit http://security.ubuntu.com precise-security/universe
TranslationIndex
Hit http://security.ubuntu.com precise-security/main Translation-en
Hit http://security.ubuntu.com precise-security/multiverse
Translation-en
Hit http://security.ubuntu.com precise-security/restricted
Translation-en
Hit http://security.ubuntu.com precise-security/universe Translation-
en

Reading package lists... Done
Reading package lists...
Building dependency tree...
Reading state information...

The following packages were automatically installed and are no longer
required:

  apache2-utils libaprutil1-dbd-sqlite3 apache2.2-bin libapr1
  libaprutil1-ldap apache2.2-common ssl-cert apache2-mpm-worker
  libaprutil1

Use 'apt-get autoremove' to remove them.

The following packages will be REMOVED:

  apache2
```

0 upgraded, 0 newly installed, 1 to remove and 134 not upgraded.

After this operation, 29.7 kB disk space will be freed.

(Reading database ... 71825 files and directories currently installed.)

Removing apache2 ...

Reading package lists...

Building dependency tree...

Reading state information...

The following NEW packages will be installed:

apache2

0 upgraded, 1 newly installed, 0 to remove and 134 not upgraded.

Need to get 0 B/1,496 B of archives.

After this operation, 29.7 kB of additional disk space will be used.

Selecting previously unselected package apache2.

(Reading database ... 71821 files and directories currently installed.)

Unpacking apache2 (from .../apache2_2.2.22-1ubuntu1.4_i386.deb) ...

Setting up apache2 (2.2.22-1ubuntu1.4) ...

Reading package lists...

Building dependency tree...

Reading state information...

The following packages were automatically installed and are no longer required:

libnet-daemon-perl libdbi-perl mysql-client-core-5.5 libdbd-mysql-perl mysql-server-5.5 libterm-readkey-perl mysql-common mysql-client-5.5 libplrpc-perl

mysql-server-core-5.5 libmysqlclient18

Use 'apt-get autoremove' to remove them.

The following packages will be REMOVED:

mysql-client mysql-server

0 upgraded, 0 newly installed, 2 to remove and 134 not upgraded.

After this operation, 231 kB disk space will be freed.

(Reading database ... 71825 files and directories currently installed.)

Removing mysql-client ...

```
Removing mysql-server ...
warning: Unknown type -server/root_password, skipping line 1
Reading package lists...
Building dependency tree...
Reading state information...
The following NEW packages will be installed:
  mysql-client mysql-server
0 upgraded, 2 newly installed, 0 to remove and 134 not upgraded.
Need to get 0 B/22.2 kB of archives.
After this operation, 231 kB of additional disk space will be used.
Selecting previously unselected package mysql-client.
(Reading database ... 71819 files and directories currently
installed.)
Unpacking mysql-client (from .../mysql-client_5.5.35-
0ubuntu0.12.04.1_all.deb) ...
Selecting previously unselected package mysql-server.
Unpacking mysql-server (from .../mysql-server_5.5.35-
0ubuntu0.12.04.1_all.deb) ...
Setting up mysql-client (5.5.35-0ubuntu0.12.04.1) ...
Setting up mysql-server (5.5.35-0ubuntu0.12.04.1) ...
Cloning into 'NCIRL'...
remote: Reusing existing pack: 86, done.
remote: Counting objects: 8, done.
remote: Compressing objects: 100% (6/6), done.
remote: Total 94 (delta 2), reused 6 (delta 0)
Unpacking objects: 100% (94/94), done.
* Starting web server apache2
apache2: Could not reliably determine the server's fully qualified
domain name, using 127.0.1.1 for ServerName

[ OK ]

Rather than invoking init scripts through /etc/init.d, use the
service(8)
utility, e.g. service mysql start
```

Since the script you are attempting to invoke has been converted to an

Upstart job, you may also use the start(8) utility, e.g. start mysql

mysql start/running, process 9400

name address

John Smith Street Address

#end of deployment script

7. Demonstrate that content is running correctly and logging is functioning correctly.

```
testuser@ubuntu:~/project$ cat log.out
```

```
....[content missing]....
```

```
Apache process is Running
```

```
Apache is Listening
```

```
Remote Apache TCP port is up
```

```
Mysql process is Running
```

```
Mysql is Listening
```

```
Remote Mysql TCP port is up
```

```
Apache process is Running
```

```
Apache is Listening
```

```
Remote Apache TCP port is up
```

8. Stop Web Server and verify logging of event in log

```
# Write command "/etc/init.d/apache2 stop" to stop server
```

```
testuser@ubuntu:~/project$ /etc/init.d/apache2 stop
```

```
# Verify that the server has stopped
```

```
testuser@ubuntu:~/project$ cat log.out
```

```
...[content missing] ....
```

```
Mysql process is Running
```

```
Mysql is Listening
```

```
Remote Mysql TCP port is up
```

```
Apache process is not Running
```

```
Apache is not Listening
```

```
Remote Apache TCP port is down
```

9. Stop Database and verify logging of event in log

```
# Write command "/etc/init.d/mysql stop" to stop database
```

```
testuser@ubuntu:~/project$ /etc/init.d/mysql stop
```

```
# Verify that the database has stopped
```

```
testuser@ubuntu:~/project$ cat log.out
```

...[content missing]

Mysql process is Running

Mysql is Listening

Remote Mysql TCP port is up

Apache process is not Running

Apache is not Listening

Remote Apache TCP port is down

mysql stops running here

Mysql process is not Running

Mysql is not Listening

Remote Mysql TCP port is down

testuser@ubuntu:~/project\$ ls -l

total 24

-rw-rw-r-- 1 testuser testuser 2893 Jan 22 13:33 log_and_monitor.sh

-rw-r--r-- 1 root root 5492 Jan 26 13:22 log.out

-rw-rw-r-- 1 testuser testuser 1222 Jan 22 20:22
stop_start_updateDB.sh

-rw-r--r-- 1 root root 131 Jan 26 13:22 UT1.out

-rwxr-xr-x 1 root root 672 Jan 25 15:33 UT1.sh

testuser@ubuntu:~/project\$

testuser@ubuntu:~/project\$ cat log.out

...[content missing]

Apache process is Running

Apache is Listening

Remote Apache TCP port is up

Mysql process is not Running

Mysql is not Listening

Remote Mysql TCP port is down

testuser@ubuntu:~/project\$

testuser@ubuntu:~/project\$ ls -l

```
total 24

-rw-rw-r-- 1 testuser testuser 2893 Jan 22 13:33 log_and_monitor.sh
-rw-r--r-- 1 root      root      5977 Jan 26 13:25 log.out
-rw-rw-r-- 1 testuser testuser 1222 Jan 22 20:22
stop_start_updateDB.sh
-rw-r--r-- 1 root      root      120 Jan 26 13:24 UT1.out
-rwxr-xr-x 1 root      root      672 Jan 25 15:33 UT1.sh

testuser@ubuntu:~/project$
```

10. Start Web Server and verify logging of event in log

Write command "/etc/init.d/apache2 start" to stop server

```
testuser@ubuntu:~/project$ /etc/init.d/apache2 start
```

Verify that the server has started

```
testuser@ubuntu:~/project$ cat log.out
```

...[content missing]

Apache process is not Running

Apache is not Listening

Remote Apache TCP port is down

Mysql process is not Running

Mysql is not Listening

Remote Mysql TCP port is down

apache starts running here

Apache process is Running

Apache is Listening

Remote Apache TCP port is up

11. Start Web Server and verify logging of event in log

Write command "/etc/init.d/mysql start" to stop database

```
testuser@ubuntu:~/project$ /etc/init.d/mysql start
```

Verify that the database has started

```
testuser@ubuntu:~/project$ cat log.out
```

...[content missing]

Apache process is not Running

Apache is not Listening

Remote Apache TCP port is down

Mysql process is not Running

Mysql is not Listening

Remote Mysql TCP port is down

Apache process is Running

Apache is Listening

Remote Apache TCP port is up

database starts running here

Mysql process is Running

Mysql is Listening

Remote Mysql TCP port is up

12. Change the content in code repository. Run the deployment scripting. Verify that Content is delivered correctly and logging is functioning correctly.

```
testuser@ubuntu:~/project$
```

```
testuser@ubuntu:/var$ cd /var/www
```

```
testuser@ubuntu:/var/www$ ls
```

form.html index.html

change content of code repository by deleting the "form.html"

```
testuser@ubuntu:/var/www$ sudo rm form.html
```

```
testuser@ubuntu:/var/www$ ls
```

index.html

```
testuser@ubuntu:/var/www$ cd ~
```

```
testuser@ubuntu:~$ cd project
```



Figure 7 127.0.0.1/form.html 404 due to file being removed

13. Create and log a unit test

create unit test

testuser@ubuntu:~/project\$ sudo pico UT1.sh

GNU nano 2.2.6

File: UT1.sh

#!/bin/bash

Unit Test Script

Level 0 functions

create is isRunning function

function isRunning {

PROCESS_NUM=\$(ps -ef | grep "\$1" | grep -v "grep" | wc -l)

if [\$PROCESS_NUM -gt 0] ; then

return 1

else

return 0

fi

}

Unit Test isRunning on known Level 0 function

This should return true

echo "Unit Testing isRunning"

isRunning apache2

if [\$? -eq 1]; then

echo "UT of isRunning Passed - Apache process found"

else

echo "UT of isRunning failed - Apache process not found?????"

fi

Unit Test isRunning on fake Level 0 function

This should return false

isRunning Dummy

if [\$? -eq 0];then

echo "UT of isRunning passed - Did not find Dummy Process"

else

echo "UT of isRunning failed - found Dummy process?????"

fi

\\\ end script \\\

verify in log that Unit Test works as expected

testuser@ubuntu:~/project\$ cat UT1.out

Unit Testing isRunning

UT of isRunning Passed - Apache process found

UT of isRunning passed - Did not find Dummy Process

testuser@ubuntu:~/project\$

Crontab set up

GNU nano 2.2.6 File: /tmp/crontab.nUt3ec/crontab

```
# The "log.out" file records the "log_and_monitor.sh" script, logs and  
# monitors the processes and appends the new content to the end of  
# the file.
```

```
*/1 * * * * sudo bash /home/testuser/project/log_and_monitor.sh >>  
/home/testuser/project/log.out
```

```
# The "UT1.out" file records Unit Test contained in the "UT1.sh"  
# script, it overwrites the previous record with the most recent one.
```

```
*/2 * * * * sudo bash /home/testuser/project/UT1.sh >  
/home/testuser/project/UT1.out
```