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Research paper



Automatic Backup Configuration of Routers using PERL Scripting

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Abstract

Network professionals are deeply challenged and interested with working on a large scale of network environment. The primary challenge to every professional is to maintain and manage a wide range of devices such as routers, switches, servers and firewalls. In line with maintaining a good infrastructure, doing a regular backup on each device is very essential. In the absence of backups, checks and updates of configuration shall be done manually for each of the relevant devices, which is unproductive and time consuming. In this study, automation is presented through a Perl script with Expect commands running on a Linux CentOS 7 accompanied by a MariaDB for the database. Upon running the script, information will be queried in the MariaDB and will thereof access the device to perform an automated backup that will be saved on the running operating system.

Keywords: *Linux, Network Engineering, Open Systems, PERL*

1. Introduction

The Open Systems Interconnection model or OSI is a conceptual model that characterizes and standardizes the communication of its 7 layers [1]. Network Engineers are mainly responsible for working on the first four layers [2]. The fourth layer, called the Transport Layer, is where Network Engineers check the handshake and the reliability of the sending party to the receiving end. The Network Layer comes third. This layer works around how packets are transmitted from one end to another. Routing protocols and principles such as the Open Shortest Path First (OSPF), Routing Information Protocol (RIP), and Border Gateway Protocol (BGP) are found in this layer. For the Layer 2, the Data Link layer, the MAC (Media Access Control) Address is present and some switching principles such as Spanning Tree Protocol, Virtual Local Area Network (VLAN), and Virtual Trucking Protocol (VTP) are part of the topic [3] . Finally, Layer 1 or the Physical Layer involves anything concrete that can be touched such as cables, hardware of the device, ports and interfaces. These are the layers commonly handled and managed by Network Engineers to achieve a sustainable, reliable and stable network [4].

A few of the major challenges in maintaining a network would be the continuous tracking, auditing and backing-up of configurations of a device [5]. In addition, each device has its own point of failure and needs to be replaced. In the event of such failure, configuration can be immediately transferred from the old device to a new one if backup is available. Backup of configuration is very essential and it saves a lot of time, especially for disaster recovery and unexpected incidents that may occur.

In this paper, a Perl Script will be utilized to generate and to automate backup configuration from each and every router and switch involved in a network. Automation of the said process can save time especially if a large scale of network devices is being handled. This process involves MariaDB, a database which stores the details of the devices involved upon query of the script for details on the database. Note that the device should be able to respond to telnet and is reachable in the network. After the query, the script will create the type of commands to be executed on a certain device, as these shall vary from device to device. However, this paper shall make use of Cisco Devices, specifically. After the standard steps mentioned, the Configuration Backup Generator will now execute the backup configuration script and will save it on a database.

2. Literature Review

Automating Network and Service Configuration is demonstrated using NETCONF and YANG by Stefan Wallin and Claes Wikstrom, they have shown that a standard-based approach for a network configuration based NETCONF and YANG can ease configuration management especially for operators [6]. YANG helps not only in scripting language but also in rendering of interfaces like command line interfaces and Web user interfaces. They have used Erlang as their database for implementation. As for the future research, they have started working on NETCONF SNMP adaptation solution which is critical to migrate in current implementation

In the paper about WWDC server software inventory management and automation by M. Thanjaivadivel and K. John Singh, they proposed a new automated technology server software configuration. The entire server configuration is maintained by this SSCMDB [7]. This system can save time and optimize use of resources by eliminating time consuming manual process. It is also used by servers running on HPUX, Linux [8] and Solaris. It is executed using the tools Perl, Shell, CGI, Java Script and MySQL. Using the help of WWDC server configuration inventory management, they can now automate the server inventory to reduce the human considerable amount of efforts and time. It is because many organizations are serious about inventory management or asset management in response auditing which is expensive.

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3. Conceptual Framework

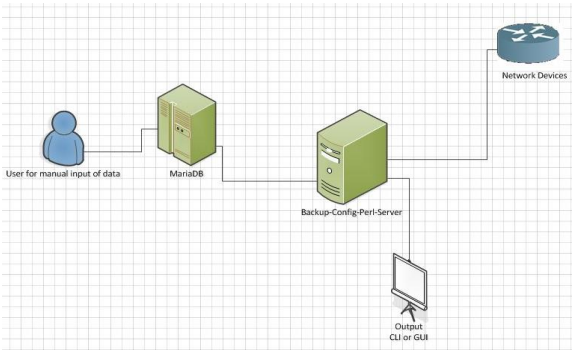

Fig. 1: Logical Diagram of the backup server

Figure 1 shows the flow of automations. The user will manually input the data and information on MariaDB [9]. These databases can be in the form of an Information System as shown in [10].
The Backup-config-Perl-Server contains the script to be queried on MariaDB. After the query, Perl will access the network devices using the information provided in the MariaDB. In this setup there are chances that there will be incomplete information. In this scenario the Rough Set Theory can be used [11,12,13, 14].

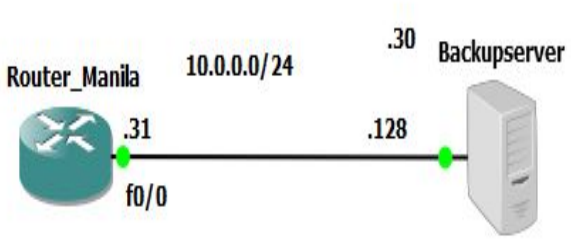

Fig. 2: Network setup for testing

Figure 2 shows the physical connectivity of the experiment using GNS3. The following are its specifications:

VMware v12
Network device information:
Hostname: Router Manila
IP address: 10.0.0.31/24
Interface fa0/0
Server information:
Hostname: Backupserver
IP address: 10.0.0.128/24
Interface: Eth0/3

These hostnames depend on the data transfer. One data transfer can be done using a USB Transfer Hub [15]. The data in these systems can be communicated in many ways. One way is through RFID [16] the disadvantage here is it might be slow. These backup servers can also be web based and can host Open Source Programs [17].

4. Methodology

The Configuration Management Database (CMDB) allows the mapping of the entire network topology. This involves entering physical and logical components in the database. It then creates a relationship between CI's and network components. For this paper, the following configuration items shall be used: Cisco router 7200 series, MariaDB and Configuration Backup Generator both running on a VMware.

On the CMDB, details of the network components involved shall be manually input. For this setup, the device model, IP address and hostname of devices shall be used accordingly and will be stored in MariaDB.
In Figure 1, it can be observed that the work flows from the CMDB, which is MariaDB for this paper, to the Configuration Backup Generator and to the Network device involved.
The Scheduler, Cron, schedules the backup process periodically on a given value. For this experiment, scheduler shall be set to run backup process every 30 minutes.
First the virtual server needs to be set up; this paper considers CentOS 7 as the running operating system. Next is to setup the MariaDB that will serve as the database and information of the network devices. These Databases are connected in a star configuration in a Neural Network form [18, 19].

After setting up the database, tables are created for information.
CREATE DATABASE devices;
use devices;

Steps to create table in MariaDB
CREATE TABLE IF NOT EXISTS equipment (hostnamevarchar(50) DEFAULT NULL,
IP varchar(50) DEFAULT NULL,
modelvarchar(20) DEFAULT NULL
);
To add details on your table equipment
INSERT into equipment (hostname,IP,model) values ('Router_Manila','10.0.0.30','cisco');
#to verify
select * from equipment;

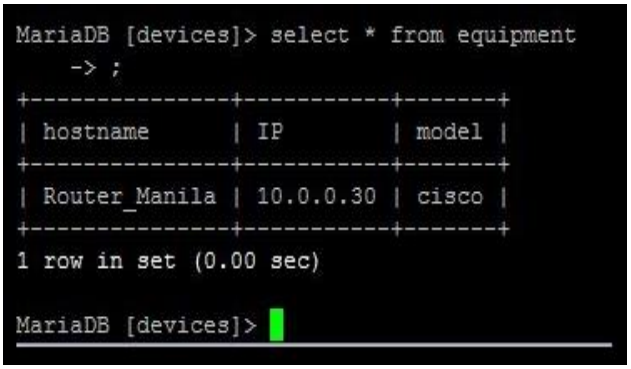

Fig. 3: MariaDB Setup

After setting up the tables in MariaDB, we need to create the script. After running the Perl script, configuration file will be saved on folder /root/script/backup/"device name and date"

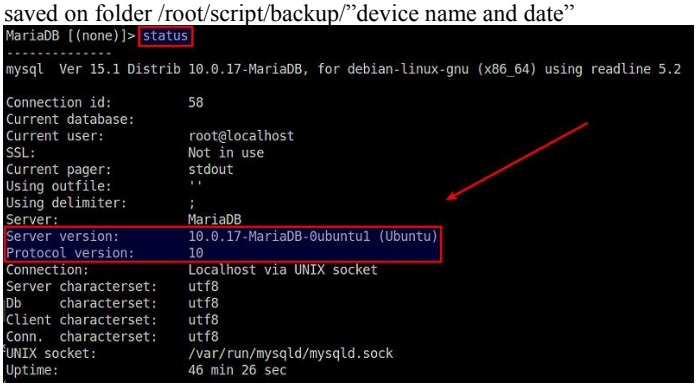

Fig. 4: Maria Db Hostname Setup



Fig. 5: Maria Db Hostname Setup metapackage

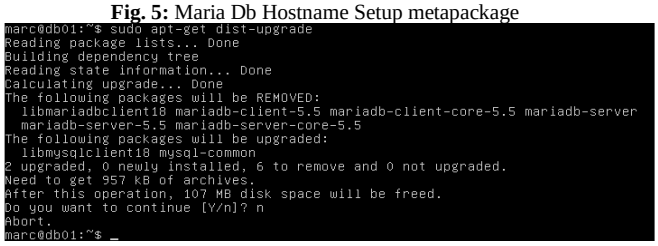

Fig. 6: Maria Db Stacking upgrade

```
#!/usr/bin/perl

use strict;
use warnings;
#################################
#Backup Script for routers     #
#################################
#Database info
my @devices;
my $today =`date +"%m%d%Y"`;
my $db_user='root';
my $db_pass='root';
my $db_info='devices';
get_devices();
process_backup();
#Process Backup
subprocess_backup {
foreach my $device_list (@devices) {
chomp $device_list;
my @device_field = split/;/, $device_list;
my $device_name  = $device_field[0];
my $device_ip    = $device_field[1];
my $device_model = $device_field[2];
system("/usr/bin/expect            /root/script/process_backup.exp            $device_ip>
/root/script/backup/$device_name.cfg.tmp");
system("sed      -n      '/^Building/,\$p'      /root/script/device/$device_name.cfg.tmp>
/root/script/device/$device_name.$today.cfg");
system("rm -rf /root/script/device/$device_name.cfg.tmp");
      }
}

#Query Devices
subget_devices {
     @devices =`mysql  -B  --column-names=0  -u  $db_user  -p$db_pass  $db_info  -e
"select * from equipment" | awk '{print \$1 ";" \$2 ";" \$3}'`;
}
```

Fig. 7: Screenshot of the script

The database created is powerful enough for different applications like spatial imaging techniques [20, 21, 22]. These database configurations are useful in many applications [23].

5. Conclusions and Future scope of the study

Linux is an open source operating system that will greatly help especially with scripting and automation related system. Basic Linux scripting can be used to develop tools in a shorter span of time and at lower costs. Backup configuration automation can help companies, more so those with a large scale of devices to maintain. Instead of manually doing a backup on every device, all which is required to do is to encode information on the MariaDB. This feature is very useful in saving information and easy backup

For future researchers, it is recommended to integrate GUI (Graphical User Interface) for both input of data and output of backup configuration. GUI will add the ease of managing the said system. In addition, it is handy for users who are not well-versed on the said operating system.

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