Technical sciences

UDC 004.42, 004.584

Rohovyi Denys
Student of the
Taras Shevchenko National University of Kyiv

Pogorilyy Sergiy
Doctor of Technical Sciences, Professor
Taras Shevchenko National University of Kyiv

TELEGRAM CHATBOT AS AN ADDITIONAL TOOL FOR LINUX AND UNIX SYSTEMS ADMINISTRATION

Summary. *Chatbot Telegram for managing Linux and Unix systems was created. This tool should help system administrators to manage Linux and Unix systems from any device that has access to Telegram messenger and the Internet.*

Key words: *chatbot Telegram, Python programming language, Linux OS, Unix OS, system administration.*

Introduction. Over the last few years, chatbots became extremely popular. Now, chatbots are not just entertainment for users, but it is an important tool for interaction between users and business representatives. For example, online stores use chatbots to promote and advertise their products, banks to make transactions, transport companies to sell tickets, courier services to notify about the delivery status, Internet providers to provide technical support for users, etc [1]. Chatbots can not only answer users' questions, but also they can do a lot of other things [2]. The only limitation is the developer's imagination. In this article chatbot which can control Linux and Unix based operating systems will be described. This chatbot is not a replacement for existing tools and applications for monitoring and controlling of Linux and Unix systems. It is an additional tool that is designed for administration of Linux and Unix systems.

Chatbots' comparison

There is a wide variety of messengers in the world. Facebook Messenger, Viber, Telegram, Snapchat, and WhatsApp messengers are among the most popular messengers in the world. Snapchat still does not have an API for chatbots [3]. Therefore, it is not possible to create a chatbot in Snapchat messenger. To create a chatbot in WhatsApp messenger with WhatsApp Business API developer needs to complete business verification (developer's identity and business will be verified) [4]. During the verification process developer needs to upload a government ID and enter business details. Target chatbot for Linux and Unix systems administration can be used for both personal and business needs, hence WhatsApp messenger is not suitable for the target chatbot.

Among the remaining messengers, Telegram messenger was chosen. All selected messengers have their own pros and cons. Chatbot for administration of Linux and Unix systems should satisfy two requirements:

- be able to validate user's email and phone number;
- be able to work from a private IPv4 address.

All these requirements are satisfied only by chatbots Telegram (see Table 1).

Table 1

Comparison of chatbots

Comparison criterion	Chatbots Telegram	Chatbots Viber	Chatbot Facebook Messenger
Support of long pooling method	✓	–	–
Support of Webhooks method	✓	✓	✓
A mechanism for obtaining verified user's phone number is URL	✓	✓	✓
A mechanism for obtaining verified user's e-mail is URL	✓	–	✓

Sources: [5: 6; 7]

Chatbots Telegram has more powerful and flexible method for users' authentication than other chatbots. This method is called Telegram Passport [9] and it allows to check user's phone number and email. Also, this method allows to receive encrypted documents from users, but this functionality is not used in the created chatbot. Moreover, chatbots Telegram support a long pooling method for receiving new messages from the users [7]. Thus, they can work using a private IPv4 address, without a SSL certificate and be situated behind the NAT. The facts listed above make it clear that Telegram chatbots are better suited for the task of Linux and Unix systems administration.

Created chatbot Telegram

Chatbot Telegram was created using Python programming language 3.6, Telegram Bot API 5.1 [7], pyTelegramBotAPI library 3.7.7 [8], SQLAlchemy ORM, and MySQL Database. Chatbot Telegram scheme is shown on Figure 1:

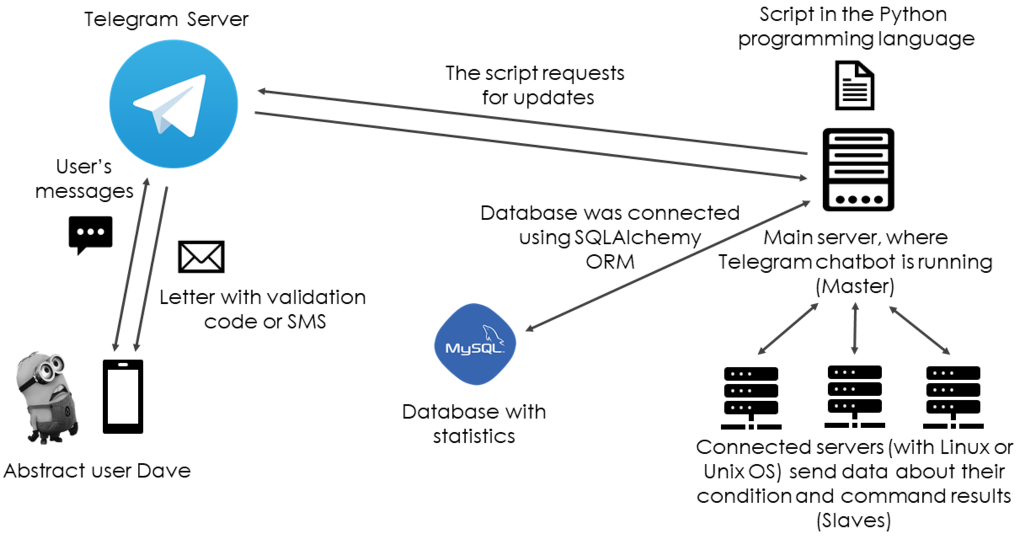

Telegram Server
Script in the Python programming language
The script requests for updates
User's messages
Database was connected using SQLAlchemy ORM
Main server, where Telegram chatbot is running (Master)
Letter with validation code or SMS
MySQL
Database with statistics
Abstract user Dave
Connected servers (with Linux or Unix OS) send data about their condition and command results (Slaves)

Fig. 1. The scheme of the Telegram chatbot

The logic of chatbot can be divided into 4 parts:

- Getting updates from Telegram server and sending answers to users' messages;
- Collecting statistics about using Telegram chatbot and servers downtimes into MySQL database using SQLAlchemy ORM;

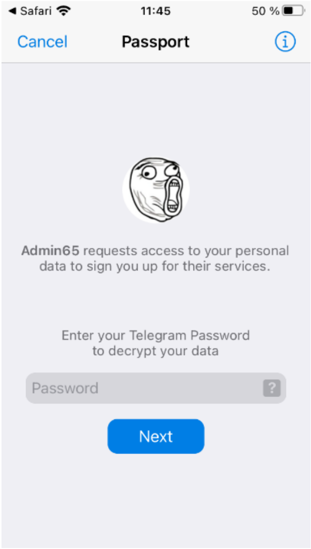
- Interaction with connected servers (executing users' commands and collecting statistics);
- Managing the master server (executing users' commands).

Created Telegram chatbot can be run in two modes:

- Standalone mode (in this mode chatbot manages only the master server and does not have any connected servers);
- Client-server mode (in this mode master server manages slave server or servers).

The Object-Relational Mapping approach allows to easily switch from one object-relational database system to another (for example, SQLAlchemy supports: PostgreSQL, MS SQL, MariaDB, SQLite, etc). Python programming language allows to run created chatbot on Linux and Unix systems. The only requirement is that Python interpreter 3.6 must be pre-installed on the target system.

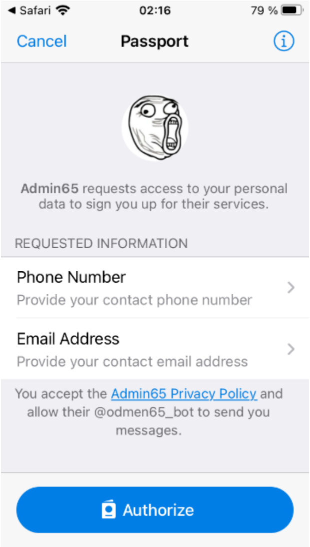
To authenticate in the personal account user must verify his or her phone number and email address with Telegram Passport [10].



Admin65 requests access to your personal data to sign you up for their services.

Enter your Telegram Password to decrypt your data

Fig. 2. User is opening Telegram Passport



Admin65 requests access to your personal data to sign you up for their services.

REQUESTED INFORMATION

Phone Number
Provide your contact phone number

Email Address
Provide your contact email address

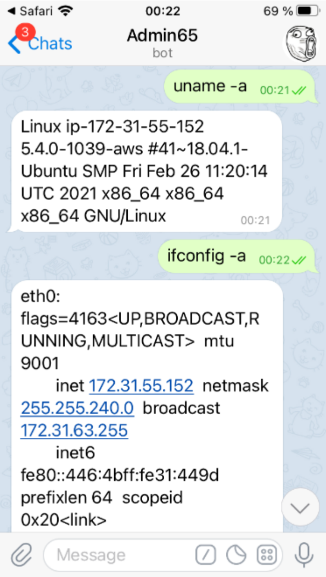
You accept the Admin65 Privacy Policy and allow their @odmen65_bot to send you messages.

Fig. 3. Telegram is requesting user's phone number and email

After user was successfully authenticated in the personal account, he or she can add another administrator or slave server, check servers’ status, and execute different commands. User can execute commands using two modes:

- Console mode (user enters commands in input field);
- Quick mode (user chooses command from the list of pre-defined commands).

Quick mode allows user to add up to 10 pre-defined commands and then use them multiple times. By default, user has 7 pre-defined commands. These commands can be modified or deleted by user.



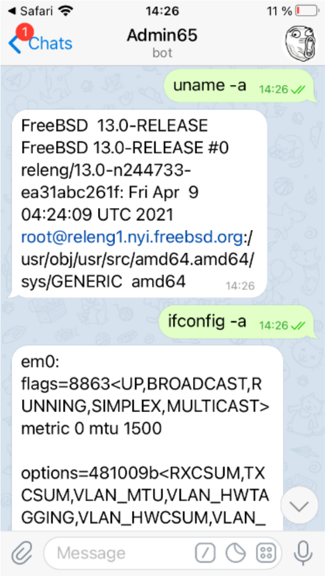
```
uname -a    00:21
```

```
Linux ip-172-31-55-152
5.4.0-1039-aws #41~18.04.1-
Ubuntu SMP Fri Feb 26 11:20:14
UTC 2021 x86_64 x86_64
x86_64 GNU/Linux    00:21
```

```
ifconfig -a    00:22
```

```
eth0:
flags=4163<UP,BROADCAST,R
UNNING,MULTICAST>  mtu
9001
      inet 172.31.55.152  netmask
255.255.240.0  broadcast
172.31.63.255
      inet6
fe80::446:4bff:fe31:449d
prefixlen 64  scopeid
0x20<link>
```

Fig. 4. Executing commands in console mode on the Ubuntu OS



```
uname -a    14:26
```

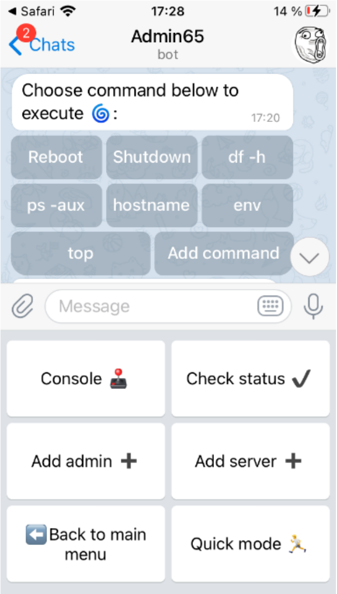
```
FreeBSD  13.0-RELEASE
FreeBSD 13.0-RELEASE #0
releng/13.0-n244733-
ea31abc261f: Fri Apr  9
04:24:09 UTC 2021
root@releng1.nyi.freebsd.org:/
usr/obj/usr/src/amd64.amd64/
sys/GENERIC  amd64    14:26
```

```
ifconfig -a    14:26
```

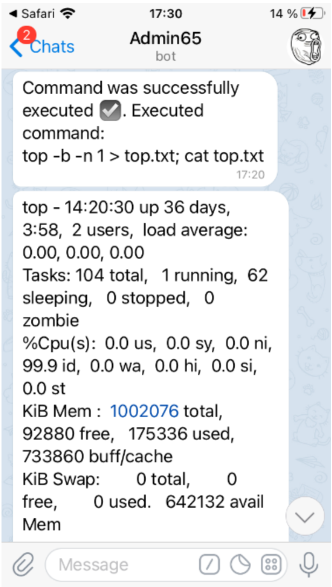
```
em0:
flags=8863<UP,BROADCAST,R
UNNING,SIMPLEX,MULTICAST>
metric 0 mtu 1500

options=481009b<RXCSUM,TX
CSUM,VLAN_MTU,VLAN_HWTA
GGING,VLAN_HWCSUM,VLAN_
```

Fig. 5. Executing commands in console mode on the FreeBSD OS

The maximum message length in Telegram messenger is 4096 characters. Thus, if the length of command’s result is more than 4096 symbols, the answer from the chatbot will be divided into several messages.



Choose command below to execute 🌀: 17:20



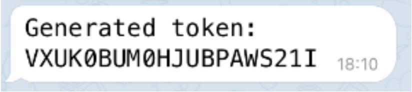
Command was successfully executed ☑. Executed command:
top -b -n 1 > top.txt; cat top.txt 17:20

```
top - 14:20:30 up 36 days,
3:58,  2 users,  load average:
0.00, 0.00, 0.00
Tasks: 104 total,   1 running,  62
sleeping,   0 stopped,   0
zombie
%Cpu(s):  0.0 us,  0.0 sy,  0.0 ni,
99.9 id,  0.0 wa,  0.0 hi,  0.0 si,
0.0 st
KiB Mem :  1002076 total,
92880 free,   175336 used,
733860 buff/cache
KiB Swap:        0 total,        0
free,        0 used.   642132 avail
Mem
```

Fig. 6. Quick mode commands and user's account menu

Fig. 7. Result of executed command "top"

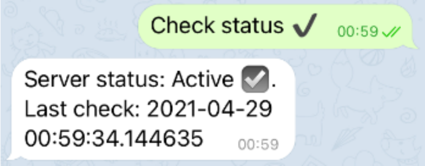
To add a slave server to chatbot user should enter generated token in client.py file, register client.py file as a service, and run this service on the slave server. After, successful connection slave server to master server user will receive a notification message and will be able to control slave server.



```
Generated token:
VXUK0BUM0HJUBPAWS21I
```

Fig. 8. Example of generated token

In addition, chatbot monitors state of slave servers. If slave server will become unURL user will receive an appropriate message.



Check status ✓ 00:59

Server status: Active ☑.
Last check: 2021-04-29 00:59:34.144635 00:59

Fig. 9. Checking server's status

Conclusion. Chatbot Telegram for controlling Linux and Unix systems was created. Created chatbot was tested on Ubuntu 18.04 and FreeBSD 13.0 OS. This chatbot should help system administrators and technical personal to administrate Linux and Unix systems. Analysis of chatbots showed that for this task Telegram chatbots suit better than other chatbots. Only Telegram chatbots have such powerful and flexible authentication tool as Telegram Passport and can be run behind the NAT [7]. This chatbot is not a substitution for existing monitoring and remote control tools. This chatbot should be used as an additional tool.

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