

# Scenario-based design for teaching Linux OS operations and maintenance

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**Abstract.** Linux operating system operation and maintenance is an important basic course for computer science majors in specialist and vocational education, and basic system administration commands are an important part of the course content. A scenario-based approach to teaching system management commands has been designed to address common problems such as difficulty in remembering, confusion and parameter confusion when students are faced with a large number of commands and parameters. By condensing a number of typical scenarios, students can better remember and differentiate commands and remember parameters through scenarios. The results of the course show that the scenario-based teaching method is easy to understand, rich and interesting, and facilitates students to learn better.

**Keywords:** Linux teaching; Linux commands; Scenario; Learning interesting.

## 1. Introduction

The development of new technologies such as Big Data, Cloud Computing, Internet of Things and Artificial Intelligence is driving a new round of technological revolution and industrial change, giving rise to new industries and new opportunities for innovation and development, and at the same time posing new requirements and challenges for cultivating excellent engineering and technology talents who can cope with economic transformation. The Ministry of Education is actively promoting the construction of "New Engineering", clarifying the positioning of talent cultivation in the new engineering, focusing on whether students have the ability to actively acquire knowledge, lifelong learning ability and critical thinking ability, and the curriculum construction under the background of new engineering not only emphasises the transmission of theoretical knowledge, but also focuses on the cross-fertilisation of engineering education and innovation education, the integration of curriculum content and practice, and the enhancement of digital thinking. The curriculum construction in the new engineering context emphasises not only the transfer of theoretical knowledge, but also the cross-fertilisation of engineering education and innovation education, the combination of course content and practice, and the enhancement of the cultivation of digital and computational thinking.

Linux operating system operation and maintenance is an important foundation course for specialist and vocational education computer science majors [1]. It introduces the basic use of the Linux operating system and system management knowledge, which includes hardware and software deployment, network management, application maintenance, security, capacity planning, fault repair, etc. Generally speaking, the teaching content includes basic system management commands, network configuration, program development, service configuration, system security and so on [2]. Among them, basic system management commands are one of the main contents of the course and are the basis for subsequent contents. Learning basic system management commands is crucial to learning the course well [3].

## 2. Basic System Management Commands

The basic system management commands are mainly divided into basic shell commands, file directory management, user management, package and disk management, process management, etc. When students first encounter Linux system management basic commands, they often have problems in many aspects such as easy forgetting, confusion, parameters not knowing how to use, etc. [4], which can be summarized as follows.

### 2.1 Commands are easy to forget

According to incomplete statistics, there are more than 100 Linux system administration basic commands commonly used, and about 50 of the most important basic ones. It is difficult for students to learn so many commands in a short time to remember them accurately. Although most of the commands are abbreviations of English words, the excessive number still makes it easy for students to forget them.

The 15 commonly used file and directory management commands are shown in Table 1.

Table 1. The 15 commonly used file and directory management commands

Commands	Functions
ls	List directories and file names
cd	Switching directories
pwd	Show the current directory
mkdir	Create a new directory
rmdir	Delete an empty directory
cp	Copy a file or directory
rm	Deleting files or directories
mv	Moving files and directories, or changing the names of files and directories
chmod	Modify user permissions
chown	Modify user and group affiliation
cat、tail、 find、touch	View, find and modify files
ln	Soft/hard links

### 2.2 Confusing commands

Many of the Linux system administration basic commands are very similar in form of command name.

- chmod command: changes the read, write or execute permissions of a file or folder
- chown command: changes the user to whom a file or folder belongs
- chgrp command: changes the group to which a file or folder belongs

All three commands start with "ch", so students can easily get confused when they first learn them.

Another representative example is the sudo and su commands. sudo requires the password of the current user and su requires the password of the root user. sudo allows only a single command to be run with elevated privileges, while su starts a new shell while allowing as many commands as possible to be run with root privileges until the login is explicitly exited.

### 2.3 Command parameters are hard to remember

Only a small number of Linux system administration base commands have no parameters, most of them do. The order in which the arguments are placed may vary from command to command or even in reverse order, e.g.

- cp A B: this command makes a copy of file A to file B
- tar zcvf A.tar.gz A: this command compresses the file A into A.tar.gz

In the above two commands, cp puts the source target of the copy in front and the destination target in the back, separated by spaces. The tar command, on the other hand, puts the compressed source target in the back and the compressed destination target in the front. They are the opposite of each other and students can easily get confused.

In addition, some commands have more parameters and contain keywords, such as the ip command, which adds an address of the specified network card in the following way

```
ip addr add 192.168.43.237 dev enp0s3
```

The above command is to add an ip address 192.168.43.237 to the network card enp0s3. 5 parameters are included, addr, add and dev are constant keywords. There are many more commands with more parameters like this, and students often have difficulty remembering the number of parameters and the location of the command.

### 3. Scenario-based teaching design

In response to the problems of beginners in learning Linux system management basic commands, the course team teachers analyse the characteristics of Linux commands, explore the connection between commands and design a scenario-based teaching method, which puts several commands in a scenario. A few representative scenarios are listed below.

#### A. Scenarios designed for basic file system command

Bob goes to play with Alice, who says I live on Alice Avenue in Home Street, and I have some toys, so I can make a copy of drawing A for you. Question: Assuming Alice is a user on a Linux system, what commands are used to see her file system address, what files she has, and how to copy them?

In this scenario, students will need to use the command pwd to determine Alice's location on the file system, use ls to view her files, and use the command cp A B to copy file A to B.

In this scenario, the teacher can expand part of the content. For example, you can further examine the use of ls parameters, ls -a can see all files including hidden files, and ls -l can see detailed attribute information of each file. You can add the command cd for examining file directory switching, the command mv for examining moving files, and the command rm for examining and deleting files.

#### B. Scenarios designed for file attributes

Alice wants to hand over a file to Bob. She needs to change the owner of file A to Bob, the class to Bob's class, and to make the attributes of file A readable, writable and executable for others to manage. Please ask: If Alice and Bob are two users on the file system, and you want to change Alice's file A's owner to Bob, the genus group to Bob as well, and the attributes to readable, writable and executable, which command should you use?

In this scenario, students need to use the commands chown, chgrp, chmod in turn to complete the corresponding requirements. It should be emphasized that students should pay attention to the parameter usage of these three commands. For chown and chgrp, the target user for file transfer should be the first parameter, and the file should be the second parameter. The source user will not appear on the command line. The parameter settings of chmod are relatively flexible. You can check the permissions of files set for users, groups, and others. Different permissions for reading, writing, and executing need to be represented by different symbols.

#### C. Compression and remote transfer scenario design

Alice wants to compress her file A into a zip file and then transfer it to Bob via the sftp protocol, with the server IP address 192.168.1.10 and the password Bob123.

In this scenario, students need to use the command tar to complete the compression first, then use the sftp command to open a remote file transfer session, and close the session after the transfer is complete. The first point to examine in this scenario is to use the parameters of the tar command.

If it is a compressed file, use the parameter `zcvf`, with the compressed file name as the second parameter and the compressed file as the third parameter. And if it is a decompressed file, the parameter `zxvf` is used, and the decompressed file is used as the third parameter. The second point of the scenario examination is the operation of the `sftp` session. First, use the `sftp` command with the user name and server address as parameters to establish a session, then use the `put` command to upload files, use the `get` command to download files, and finally use the `quit` command to end the session.

The teacher has the flexibility to design more scenarios depending on the level of mastery of the students.

#### 4. Summary

The teacher has used the scenario-based command teaching method, which has been practised with the last three classes of specialist students and students of the training course in our school, and obtained students' evaluation of the teaching effectiveness of the method through interviews and questionnaires. The results show that students generally find the method interesting and relevant, easy to remember and distinguish, and that they can master most of the basic Linux system administration commands in an easy learning process, which is a teaching method worthy of further promotion.

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