A Typical Commercial Application for Kylin Operating System
Jia-Qi Li\textsuperscript{1,a,*}, Xiang-Ke LIAO\textsuperscript{1,b} and Jun MA\textsuperscript{1,c}

College of Computer, National University of Defense Technology, Changsha, China
\textsuperscript{a}Email: lijiaqi@nudt.edu.cn, \textsuperscript{b}xkliao@nudt.edu.cn, \textsuperscript{c}majun@nudt.edu.cn

Keywords: Operating system, Desktop environment, High level architecture, Runtime infrastructure, Inquiry machine.

Abstract. For an operating system, it seems that the more functions the better, and the more beautiful desktop environment the better. However, this paper explains why the Kylin operating system is tailored to the project of credit inquiry system, and also describes how to tailor the operating system to meet the commercial application requirements. The customized operating system, without a common desktop environment, has very powerful capabilities of computation and communication.

Introduction
Kylin is an operating system developed by the National University of Defense Technology in China since 2001 \cite{1,2}. The early versions were based on FreeBSD. With version 3.0, Kylin became Linux-based in 2010. A separate project called Ubuntu Kylin as the Linux operating system was announced in 2013 \cite{3}. It is free to download the operating system \cite{4}. For more than 10 years, The operating system has been widely used in defense, government, energy, transportation, aerospace, telecommunication, finance, postal, education and many other industries and fields. One of the outstanding areas is the simulation of High Level Architecture (HLA) \cite{5}.

An operating system acts as an intermediary between the user of a computer and the computer hardware. Its purpose is to provide an environment in which a user can execute programs in a convenient and efficient manner \cite{6}. The Graphical User Interface (GUI) is such an environment in Linux, which is sometimes called a desktop \cite{7}. However, when we applied the Kylin operating system to the credit inquiry machine, the situation was completely different. An inquiry machine, similar to the Automatic Teller Machine (ATM), is designed for users to query their credits. Its graphical interface is rather simple, but it requires powerful background computing and communication capabilities. In the next section, the paper introduces the framework of the credit inquiry system, and the method of using this machine \cite{8}. In the third section, the desktop environment of the operating system is showed. The reason why the hardware and software involving the desktop environment can be tailed for the credit inquiry system is also stated. In the fourth section, we further compare the common desktop operating system with the customized for the credit inquiry system, and explain the specific work in the project. Finally, a brief summary is carried out.

Credit Inquiry Machine
At present, the personal credit records are essential to personal loans, credit card approval, qualification review, employee recruitment and so on. For the huge amount of inquiries, it is very necessary for the public to provide the credit report with convenient, quick and practical inquiry methods. So the unattended inquiry machine of credit report is very important, which can be placed in the bank hall, shopping malls and other places. The small machine is convenient as ATM.

As shown in Fig.1, a large number of inquiry machines, distributed in the country, are connected with the Identity Verification System and the Credit Reference Center via the private network \cite{9}. An individual's identity can be confirmed from the Identity Verification System. What's more, the personal credit data can be obtained from the Credit Reference Center.
It is easy for a user to operate the credit inquiry machine.
Step 1. Firstly, the user begins to read relevant instructions.
Step 2. The user places the second-generation identity card correctly.
Step 3. The machine automatically reads the identity card and submits the text and photo to the remote Identity Verification System for the legality.
Step 4. The process is ended if failed to confirm the identity. Otherwise, the photo is being taken and the features of the face are being captured.
Step 5. Compare the facial features with the photo of the second-generation ID card. The user can go to the next step if the score is greater than or equal to the threshold value. Otherwise, give a hint that the photo is out of line with that person and is not allowed to query further.
Step 6. Confirm the charges according to the prompt. Generally speaking, no charge is required for the first two inquiries.
Step 7. Continue to operate for no charge. Or enter the next page to charge through the money box.
Step 8. Connect with the remote Credit Reference Center to query and return the user's personal credit data.
Step 9. Print the credit report.
Step 10. End query.

![Credit inquiry system diagram](image)

**Figure 1. Credit inquiry system.**

**Tailor Operating System**
At the moment, the operating system used in the inquiry machine has changed from Microsoft Windows to Kylin. The second-generation inquiry machine can be designed specifically and plays its role better.

Fig. 2, much like Microsoft Windows, is the desktop environment of Kylin. It is very convenient for users to operate their computers.

The left icons in the desktop represent various applications and it is easy to click one to start a program. The bottom of the figure is a taskbar. The left three icons in it, respectively, are those of start, firefox and file browser. The components of Chinese input method, speaker and network are on the right. From the middle part of the taskbar, we know that four programs are started. The first is KY-RTI, an excellent Runtime Infrastructure (RTI) compatible with DMSO RTI-NG1.3 [10,11]. The RTI can run on a wide variety of 32 bit and 64 bit operating systems. From the prompt of KY-RTI, there are also two terminals for running programs $a$ and $b$, which are called federates in HLA. Another program is the file browser, which shows the partial directory structure of the RTI.

Nevertheless, everything in Fig. 2 must be cut out and the inquiry machine does not need the desktop environment at all. For the inquiry machine, it is enough to provide a single graphical program.
From the software programming environment, a simple graphical program based on GTK+ is developed for the inquiry machine and the others are developed by C programming language. Thus, the programming environment is relatively simple, and it is not necessary to integrate other programming languages and corresponding development tools.

From the hardware environment, it is feasible to remove the keyboard and mouse drivers because the touch mechanism is applied. But at the same time, we should increase more drivers for ID authentication, camera scanning, printer, and so on.

By the way, the CPU used by inquiry machine is FT-1500A [12]. This kind of CPU is compatible with ARMv8 ISA. As a result, the Kylin operating system must also be customized based on the CPU and the corresponding motherboard [13].

Customization Methods

Fig. 3 shows a comparison of the common desktop operating system with that customized for the credit inquiry system. The ISO size of the former is 2G, while the latter is only 800M.

In addition to the customization of the system functions, we have also improved, modified and enhanced the Kylin operating system. The main changes are as follows.

Case 1. Kernel.
1. Add USB_HIDDEV driver to support APC's UPS power.
2. Solve the problem that the machine can’t shut down and crash for copying large files to support the Hanwei industrial controlling computer [14].
3. Add the file system driver for snapshot.

Case 2. Fix the UPS service to resolve the UPS power problem.

Case 3. Customize the system session manager to enable the graphical program to run correctly and restart automatically after crashing.
Case 4. Modify the print service to improve the print speed of PDF documents.
Case 5. Prohibit USB devices.
Case 6. Redesign the boot loader.
Case 7. Set a fixed output resolution and a unique port for the screen of the inquiry machine.
Case 8. Add snapshot and restore from a certain status.
Case 9. Add a boot mode to upgrade the system.
Case 10. Design the style and sound of a soft keyboard.
Case 11. Disable mouse cursor.
Case 12. Disable screen off in a graphical environment.
Case 13. Disable all character terminals.
Case 14. Add basic running environment for certain 32 bit programs.
Case 15. Increase system configuration for the default sound card.

<table>
<thead>
<tr>
<th>A wide variety of applications</th>
<th>Credit program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background services</td>
<td>Task bar, Window manager, Desktop components…</td>
</tr>
<tr>
<td>General system services</td>
<td>Graphic services</td>
</tr>
<tr>
<td>General drivers</td>
<td>Many libraries</td>
</tr>
<tr>
<td>Basic runtime environment</td>
<td></td>
</tr>
<tr>
<td>Operating system kernel</td>
<td></td>
</tr>
<tr>
<td>Universal operating system</td>
<td>Operating system kernel</td>
</tr>
<tr>
<td></td>
<td>Customized operating system</td>
</tr>
</tbody>
</table>

Figure 3. Comparison of functions between a common operating system and a customized one.

Conclusion

The Kylin operating system can be applied to many types of machines, including servers and microcomputers. It can execute both on X86 and ARM CPUs. The operating system has a rich desktop environment like Microsoft Windows, which is very convenient for users. However, this paper introduces the commercial application for Kylin to be used to the credit inquiry system. The inquiry machine only needs a single graphical program, from the user's point of view, and it doesn't need a desktop environment at all. Therefore, after a brief introduction to the credit inquiry system, this paper explains why tailoring the Kylin operating system and how we have customized it in the specific project.

Acknowledgment

This work was supported by the National Natural Science Foundation of China (Grant No. 61303191).

References


