Advanced Science and Technology Letters
Vol.136 (ITCS 2016), pp.133-139
http://dx.doi.org/10.14257/astl.2016.136.32

# A Design and Implementation of Universal Container

Xin Li[1], Hee-Kyung Moon[1], Sung-Kook Han[1],

[1]Department of Computer Engineering, Wonkwang University
460 Iksandae-ro, Iksan, Jeonbuk, Republic of Korea
leexin0723@gmail.com, {ybnjcw, skhan}@wku.ac.kr

**Abstract.** This paper proposes an Android terminal mobile virtualization scheme based on the Linux Container technology. In this scheme, by changing the function of kernel adaptation to the tools in LXC user space in Android system, *Debian OS* is constructed in the SD card as the host environment of virtualization management. In this environment, through configuration of Android and various resources such as the document system, network and device in the container, we build a container environment that could operate the Android system, and he modified Android system can operate in it to realize the mobile virtualization scheme of operation system. Finally, through analysis of the result, we draw the conclusion that by applying the container technology, the Android system has the advantages of high efficiency and isolated phase balance.

**Keywords:** Mobile Virtualization; Operating System Level Virtualization; Container technology; Cgroup System; Namespace

## 1 Introduction

With the explosive growth in the number of mobile intelligent terminals and the rise in wearable devices, it have become a hotspot in current researches how to effective utilize terminal resources and apply them into different scenarios. For example, a new development direction - mobile virtualization - has occurred by combining the traditional virtualization technology and mobile intelligent terminal. Mobile virtualization can not only satisfy the requirement of different operation systems in single intelligent terminal, which can save the cost for different platform functional software, but also realize the separation of corporate system through the isolation of virtualization technology, in this way to provide higher security. From the market perspective, the virtualization technology has significantly reduce the cost of mobile phone, which makes it possible for low-performance mobile phone to carry more functions. In this paper, we will propose a new approach to universal container.

ISSN: 2287-1233 ASTL

The hardware resources on Android terminal are maintained as the same. On the hardware level, a modified Android kernel is operated, and this kernel supports the Cgroup system and Namespace mechanism. What has replaced the original ecological operation system is a system which supports using LXC's Linux system as the host system for virtualization management.

LXC interacts with the kernel through the Cgroup system and Namespace mechanism, and by dividing progress groups, it can operate in independent Namespace to form container. LXC provides a group of tools in the user space that the host system can create and management the operation in container through explicit command, which can also monitor the progress and operation within container at any time. Because Namespace has instantly created independent file system view for each container, therefore, if the operation of Android OS is realized in the Linux container, the root file system in Android system must makes corresponding transplantation and modification.

# 4 Adaptation of Android Kernel

At present, there is almost no kernel in market that supports the Cgroup system and Namespace mechanism as the basis of LXC, so we need to conduct related modification and configuration of the Android kernel to make it supports the Cgroup system and Namespace mechanism. The Android kernel version adopted in this paper is 2.6.29, the experiment terminal for simulation operation is Nexus, the busybox is also accurately allocated, and the CPU is Qualcomm series, so that the sound code can be directly obtained from the Android tree.

***$ git clone https://Android.googlesouree.com/kernel/msm.git***

Extract the branch kernel source code through the checkout instruction of git tool.

In the native Android kernel source code, if it lacks certain critical call, or some unpredictable bug have been generated when the Android OS is operated in the container, corresponding modification should be made on the kernel source code. In the following, we list several important places that require source code modification.

## 4.1 Increase the call of setns system

When the Namespace mechanism is added to the kernel, setns has not appeared in the kernel source code, and the role of this system call is to add progress into an existing Namespace.

## 4.2 Add the proc entrance and operation interface of Namespace

After initiating the Namespace mechanism in kernel, the location with no explicit formulation originally now has explicit formulation. By adding the Namespace entrance, it can convenient check the Namespace cases existing in the system, and various Namespace sub modules are used to realize related operation, including get add reference count, put reduced reference count and installing Namespace into specified *nsproxy* Namespace proxy instances.

### 5.2 Start scripting configuration

Once the new kernel becomes effective and starts the *Debian* system, because it is not connected to the network, and the *ssh* application software has not been installed, if there is no serial line to connect it to the mobile phone, the PC terminal will finally lose its connection to mobile phone, and we cannot operate the mobile phone, so after the system loading is completed, we should start the *adbd* program for the PC terminal to control the mobile phone through the *adb* protocol. On the common system start-up level, the system will execute commands in the */etc/rc.local* script. In this file, add the following command before the *"exit 0"* exit command.

***/sbin/adbd &***

Then, it will execute *adbd* after starting the system. The precondition is that the *adbd* in original system must be copied to corresponding directory. The configuration for */etc/fstab* is very important, and if the configuration of this file is wrong, the kernel will be unable to mount the root file system, which will make it impossible the execute the follow-up start-up procedure. For the Linux system, the device path of SD card is /dev/mmcblk0p2, which refers to the second partition of MMC device. In the *fstab* file, in addition to mounting common virtual file systems such as *proc* and *sysfs*, the Cgroup file system must also be mounted.

***none /cgroup cgroup defaults 0 0***

Of course, in order to conduct data interaction in the system partition and user data partition of original mobile phone system, corresponding *mtd* device can also be mounted [4].

### 5.3 Transplant LXC and implementation of Android container

In this way, after flashing into the modified start-up partition image *boot.img*, it will restart and enter pure Linux system. In the host system, the LXC user kit is used to create and configure the container environment, so that it can run the Android OS as a virtual machine.

### 5.4 Evaluation of Android container

The tester is Nexus One, the kernel version is Modified 2.6.35.7, and it is based on the *Debian* (armel) Host system built within SD in last section. After starting the machine, the tester enters the *Debian* system, which connects through the *adb* protocol at the PC terminal. We can check the Cgroup system and Namespace function start-up situation in current kernel through the LXC-check config tool.

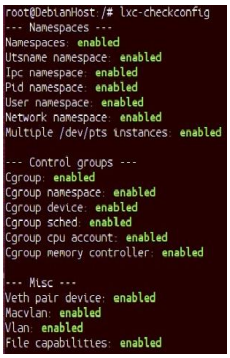


**Fig.3** Special function check in kernel

With the config file as the container configuration file, start the container through LXC-start command, and operate the Android system. After starting the container, the system operation interface will enter the Android system.


**Fig.4** Android container start-up completion interface

## 6 Conclusion

At present, cloud computing is a hotspot in the computer field, while virtualization technology is the basis of cloud computing. This paper tries to look for a balance point in the efficiency and isolation of virtualization technology, and the OS-level virtualization technology of Linux Container is adopted. Based on analysis of how Linux Container realizes progress resource restriction and data isolation, we provide specific scheme to realize mobile virtualization at Android intelligent terminal.

 

## References


1. Wikipedia https://en.wikipedia.org/wiki/LXC
2. Linux Containers https:/linuxcontainers.org/
3. Heiser, G.: The role of virtualization in embedded systems[C]. Proceedings of the 1st workshop on Isolation and integration in embedded systems. ACM, 2008 11-16.
4. Härtig, H., Roitzsch, M.: Ten years of research on L4-based real-time systems[C]. Proceedings of the Eighth Real-Time Linux Workshop,2006
5. Peng, S.: Research and Application of Smartphone Mobile Office based on Virtual Technology [D]. Fudan University, 2011.
6. OKL4 Microvisor[EB/OL].http://www.ok-labs.com/products/okl4-microvisor