Unikernel Linux (UKL)

Jakob Schmid

Abstract

This report discusses Unikernel Linux (UKL), an approach to introduce a unikernel target into the Linux kernel. The specialized demand of cloud services has recently given rise to a resurgence of library operating systems in the form of unikernels. The authors of the UKL paper want to show that the Linux kernel can be modified to include the benefits of unikernels, while maintaining the ecosystem of applications and maintainers of Linux.

1 Introduction

Modern cloud services are often highly specialised, to the point of a microservice, where an applications is split up into a collection of loosely coupled services, that communicate through lightweight protocols and each only fullfill a single purpose. These services share a few key demands. They need to be able to communicate efficiently with each other. Since they need to communicate with other services, they are exposed to the internet to some degree and thus should be as secure as possible. Due to the single purpose nature of the microservices they often execute as a single process. Lastly the image the service is executed with and the memory usage should be as small as possible. The services are often executed in a virtual machine on rented hardware, so lower requirements in memory and storage can improve the profitability of a service. These demands have caused a resurgence of research exploring the concept of a library OS and the emergence of unikernels.

In a library OS a target application is linked with a set of libraries that provide all the services a regular OS would usually provide. The resulting executable can then be deployed directly to hardware. In 2013 the term *unikernel* was first introduced for library OSs for cloud services and deployment to virtual hardware [3].

Since then multiple unikernels have been created. Some are written from scratch like ClickOS [4] and Unikraft [2]. Others borrow code from an existing OS like Drawbridge [5] that uses code from Windows.

UKL uses the Linux kernel as a base but tries to keep the changes minimal so that UKL can be maintained with the (general purpose) Linux kernel.

2 Background

Here you can include a sample figure. Use something like

`\includegraphics[scale=.8]{template}`

to include an encapsulated postscript figure. The *scale* argument can be used for scaling the picture, although it may scale the font incorrectly.

Figure 1: Sample Figure

```
/* code snippet */
while (!sleep)
        sleep++;
```

Listing 1: A sample code snippet

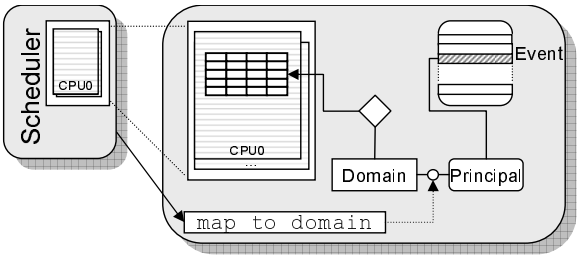

Figure 2: Sample figure automatically from Windows prn.

3 Related Work

Works [1] and [6] are relevant but different.

June 27, 2023, 16:34
Revision: 8b8d7aa

4 Approach

5 Conclusion

References

[1] P. Barham, B. Dragovic, K. Fraser, S. Hand, T. Harris, A. Ho, R. Neugebauer, I. Pratt, and A. Warfield. Xen and the art of virtualization. In *Proceedings of the 19th Symposium on Operating System Principles*, pages 164–177, Bolton Landing, NY, Oct. 19–22 2003.

[2] S. Kuenzer, V.-A. Badoiu, and H. Lefeuvre. Unikraft: fast, specialized unikernels the easy way. In *Proceedings of the Sixteenth European Conference on Computer Systems*, Apr. 2021.

[3] A. Madhavapeddy, R. Mortier, and C. Rotsos. Unikernels: library operating systems for the cloud. In *Proceedings of the eighteenth international conference on Architectural support for programming languages and operating systems*, Mar. 2013.

[4] J. Martins, M. Ahmed, and C. Raiciu. Clickos and the art of network function virtualization. In *Proceedings of the 11th USENIX Conference on Networked Systems Design and Implementation*, Apr. 2014.

[5] D. E. Porter, S. Boyd-Wickizer, and J. Howell. Rethinking the library os from the top down. In *Proceedings of the sixteenth international conference on Architectural support for programming languages and operating systems*, Mar. 2011.

[6] I. Pratt, K. Fraser, S. Hand, C. Limpach, A. Warfield, D. Magenheimer, J. Nakajima, and A. Malick. Xen 3.0 and the art of virtualization. In *Proceedings of the 2005 Ottawa Linux Symposium*, pages 65–85, Ottawa, Canada, July 2005.