

A Hypervisor for Manipulating Guest Screens

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A variety of methods exist for displaying notification messages on a screen. These include pop-up window dialogs and balloon-like taskbar notifications. They have certain limitations in that they often depend on a specific operating system or application, and often have limited display position and size. Moreover, users can often configure their software to suppress even critical messages.

This presentation introduces our own hypervisor that manipulates the screen of a guest operating system. Called ADvisor, it displays images for desktop messages, such as warning messages of disaster outbreaks or malware infections, companywide messages broadcast to employees, and guides for helping software users. ADvisor can display images at a specified time interval, or in response to a server command. It can also display images according to data the guest operating system handles. For example, when a process in a guest operating system saves a file containing a specific keyword, ADvisor can display an image associated with that keyword.

Figure 1 shows a screenshot of Ubuntu Linux running with an image displayed as a result of keyword matching. When the user extracts files from a software package and creates a file containing a string that characterizes a prohibited file sharing application, ADvisor displays a warning indicating that the use of the application is prohibited. Based on its configuration it can also black out the entire screen.

In a typical usage scenario, the administrator of an organization maintains the privileges of ADvisor and they are not provided to the user of a guest operating system. Such a user cannot prevent ADvisor messages from being displayed on the screen, even if the user has administrator privileges on the guest operating system.

We implemented ADvisor by modifying BitVisor [2]. ADvisor displays images by updating the frame buffer of the graphics hardware assigned to a virtual machine, independently of drawing operations the guest operating system performs. Although the display of images by ADvisor depends on the graphics hardware, it depends little on the guest operating system or the applications running on it.

ADvisor can be used to display messages on a screen at boot time. For example, it displays a notification of a scheduled power outage above the Windows logo on the boot screen (Fig. 2). To the best of our knowledge, all related

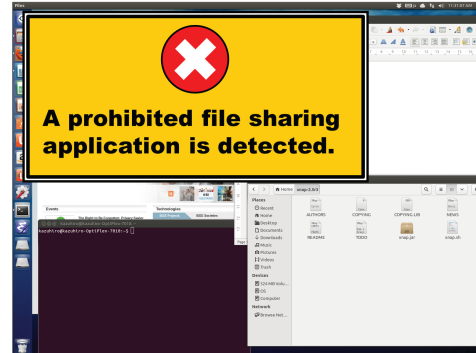


Figure 1. Screenshot of Ubuntu Linux running on ADvisor. The hypervisor is displaying an image related to the keyword contained in a newly created file.

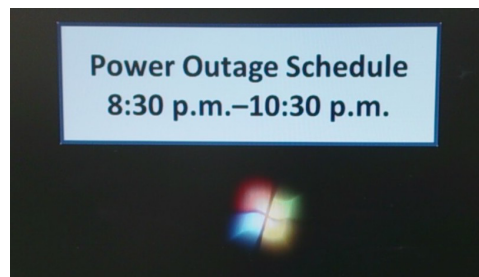


Figure 2. A Windows boot screen with the hypervisor showing a notification above the Windows logo.

notification systems show messages after completion of the boot process.

Our paper [1] describes ADvisor in more detail.

References

- [1] Y. Oyama, N. Ogawa, Y. Kawasaki, and K. Yamamoto. ADvisor: A Hypervisor for Displaying Images on a Desktop. In *Proceedings of 2014 Second International Symposium on Computing and Networking (CANDAR)*, IEEE, pages 412–418, 2014.
- [2] T. Shinagawa, H. Eiraku, K. Tanimoto, K. Omote, S. Hasegawa, T. Horie, M. Hirano, K. Kourai, Y. Oyama, E. Kawai, K. Kono, S. Chiba, Y. Shinjo, and K. Kato. BitVisor: A Thin Hypervisor for Enforcing I/O Device Security. In *Proceedings of the 2009 ACM SIGPLAN/SIGOPS International Conference on Virtual Execution Environments*, pages 121–130, 2009.