

Security of Distribution Mechanisms for Linux and BSD Operating Systems

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Abstract—The abstract goes here.

I. INTRODUCTION

An operating system is a piece of software that manages computer hardware resources and provides a variety of services for computer programs. The central core of an operating system, its kernel, is the first layer above hardware itself. Due to the depth of their functionality, compromised operating systems can potentially yield a great deal more power to an attacker than application software.

Operating systems can be compromised by malicious computer software, such as rootkits, in the course of normal operation. However, attacks can sometimes be launched more easily against the distribution process itself. This can be done in such a way that users unknowingly install a modified version of the expected operating system. If successful, attacks that result in the distribution of a compromised operating system can be both difficult to detect and powerful.

The open-source software model possesses a somewhat different attack surface than its closed- or shared-source counterparts. Open-source operating systems often have much smaller core development teams than popular commercial systems such as Windows and OS X. Open-source operating systems are rarely distributed using physical media, which is the primary distribution mechanism for Windows. The commercial interfaces that are requisite for online distribution of proprietary software also have advantages and disadvantages in security that are different from the security considerations that open-source distributors must account for.

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II. OPERATING SYSTEM DISTRIBUTION

The specific process by which a new version of an operating system travels from developer to end user differs between development teams. Operating system developers establish their own schedule standardizations, though the time between starting the release process and the anticipated release typically takes no more than 90 days. Teams may implement some steps less formally than others do, though the general procedures are ubiquitous enough they can be summarized by a few key steps.

1) *System Changes*: In an operating system's natural life-cycle, users tend to discover that the system exhibits certain unexpected behaviors. These bugs are reported, tracked, and hopefully fixed in code so that users will not experience them in future versions of the operating system. Users might request that entirely new features be added or that existing, intentional behaviors be modified. Even without user input, changes to the system inevitably originate from within the development team; design paradigms change and the world of security is ever-evolving.

No matter the cause, an operating system's codebase can change frequently. After enough changes are made to warrant a new release, or at certain milestones in a predetermined development schedule, developers stop making new changes in preparation for a code review. The most developers of different operating systems will "freeze" or "lock" the code so that no more changes can be made. Before the code freeze occurs, developers finish integrating their changes and merge the development branch into a stable, or production, branch. Of course, the naming of branches varies between projects. Once the code is frozen, the interested public and, in almost all cases, an internal body begin a code review.

2) *Code Review*: At this time, new features are tested for proper functionality, and bug fixes are tested for robustness. In general, the code is reviewed for proper practice and adherence to in-house standards. A beta image is built and distributed to testers. As necessary minor changes are made, such as those to update documentation, fix remaining bugs, and address any discovered security issues, additional beta images will be released for testing.

A. Release Building

Once the beta images are proven to meet quality standards, a branch for the new version is created. The most successful beta images will be included on the branch as "release candidates," a term for beta versions of software that have the potential to be a finished product.

1) *Pre-Distribution*: Body of text goes here...

B. Image Mirroring

Body of text goes here...

1) *Mirror Qualifications*: Body of text goes here...

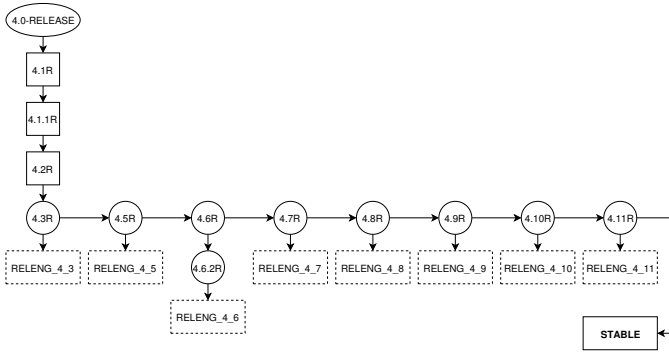


Fig. 1. FreeBSD's RELENG_4 (4.x STABLE Branch)

2) Fetching Release: Rsync, Zsync...

C. Distribution Methods

Body of text goes here...

- 1) *HTTP*: Body of text goes here...
- 2) *FTP*: Body of text goes here...
- 3) *BitTorrent*: Body of text goes here...
- 4) *Physical Media*: Body of text goes here...

III. ATTACKS ON DISTRIBUTION

Body of text goes here...

A. "Attack One"

Body of text goes here...

- 1) *Notable Usage*: Body of text goes here...
 - 2) *Countermeasures*: N operating systems currently implement these countermeasures, including Foo, Bar, Baz...
- Visual aid goes here

B. "Attack Two"

Body of text goes here...

- 1) *Notable Usage*: Body of text goes here...
 - 2) *Countermeasures*: N operating systems currently implement these countermeasures, including Foo, Bar, Baz...
- Visual aid goes here

IV. EXTERNAL RISKS

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A. Re-Hosting and Ownership Hijacking

Body of text goes here...

- 1) *SourceForge*: SourceForge is a hosting service for open-source software. In 2015, the website was accused of bundling malware with the binary project packages that it offered for users to download. This caused some large projects to abandon the site entirely [1]. While the company later announced a change to this policy [2], accusations have continued [3] and SourceForge can no longer be considered a trustworthy hosting platform.

Manjaro Linux was the sixth most-popular Linux distribution between March 2015 and March 2016 according to DistroWatch [4]. According to our research, SourceForge is the only download platform recommended and offered by

Manjaro. While downloads are available via torrent, the torrent links are hosted by SourceForge as well and so the original seed may be of a compromised image [5]. We were unable to locate any alternative download mechanism.

This means that there is a real possibility that as of this writing, image downloads of Manjaro are bundled with malware. We recommend that users avoid downloading, installing or running Manjaro Linux until the distribution maintainers review their practices and provide alternatives for downloading.

V. BEST CONSUMER PRACTICES

A. Choosing a Protocol

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B. Verifying Mirrors

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C. Building a Web of Trust

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D. "Soft" Risk Mitigation

Sometimes it is best to rely on proven-stable releases. It can be harmful to be on the bleeding edge of development, although it is a service to the industry.

VI. OUR IMPLEMENTATIONS

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VII. CONCLUSION

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