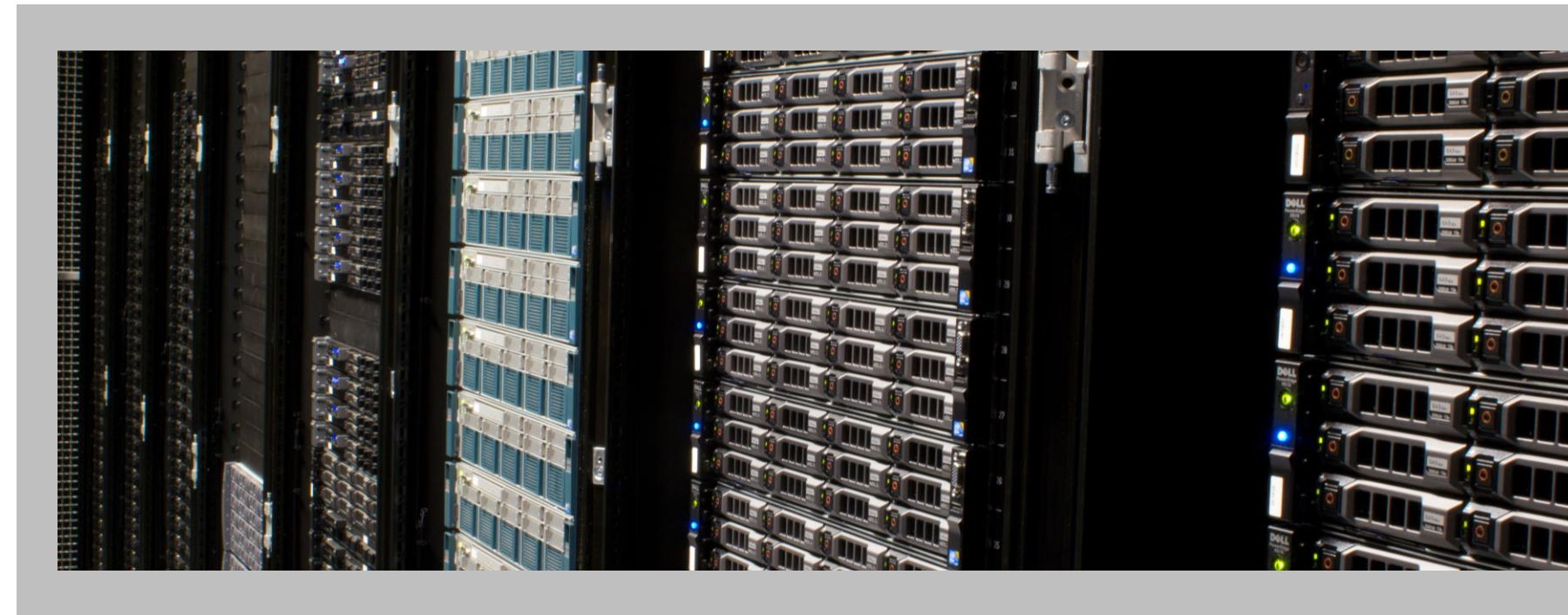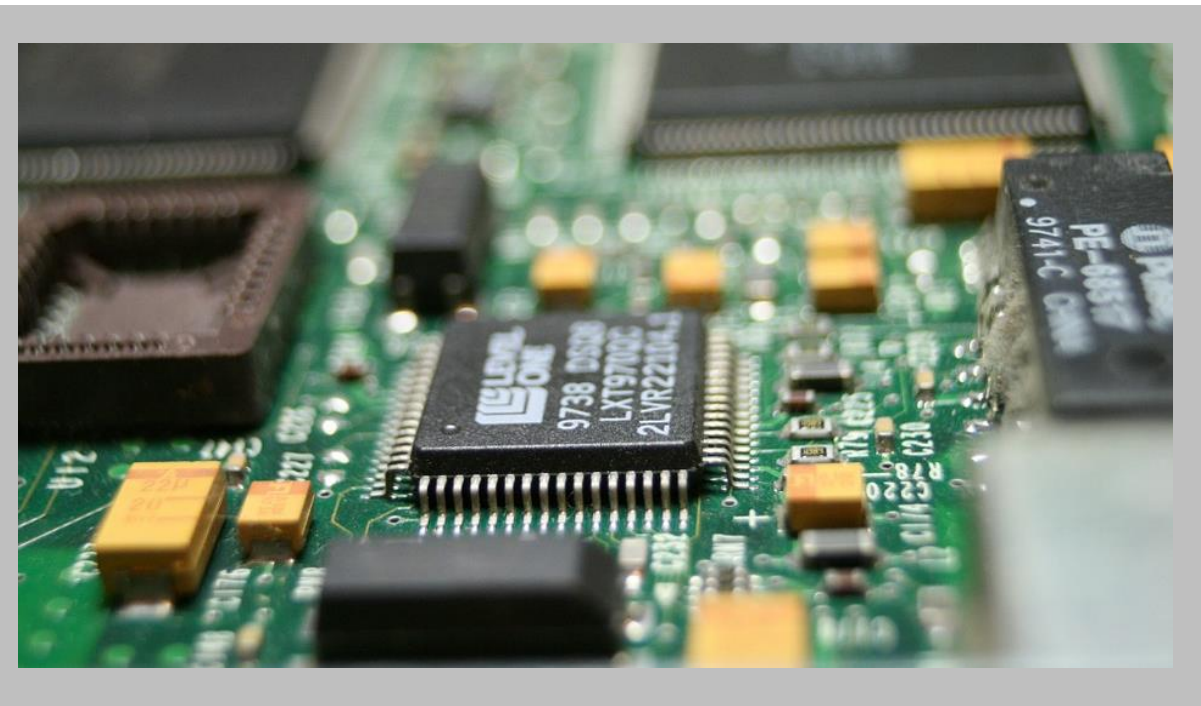*Exceptional service in the national interest*

Sandia National Laboratories

Disk Usage as an Indicator of Vulnerability in Software Products

Sandia National Laboratories has developed a methodology for assessing the risk associated with Information Technology (IT) purchases called SARA, the Supply Chain Acquisition Risk Assessment. The current SARA methodology estimates the risk of an IT product acquisition by studying the product's threat, vulnerability, and consequence. For software products, a contributor to vulnerability is the complexity inherent in the product. The current methodology captures this contribution in the Code Length factor. Previous studies have found that the number of lines of code is a good proxy for the complexity of software, and that the complexity of software is related to the number of vulnerabilities present.

However, the Lines of Code (LOC) of a software application is not a commonly documented or freely available statistic. LOC information is only readily available for open-source software products. For closed-source products, the only sources are press releases and news articles, which can be unreliable and sometimes conflict. A better metric is desired.

The vulnerabilities in a piece of software can instead be approximated by the disk space requirements of that software. Disk space requirements are published with the application as part of its hardware requirement specifications. This metric is more accessible to the SARA analyst and provides a vulnerability estimate that is as good as, if not better than the current methodology's.
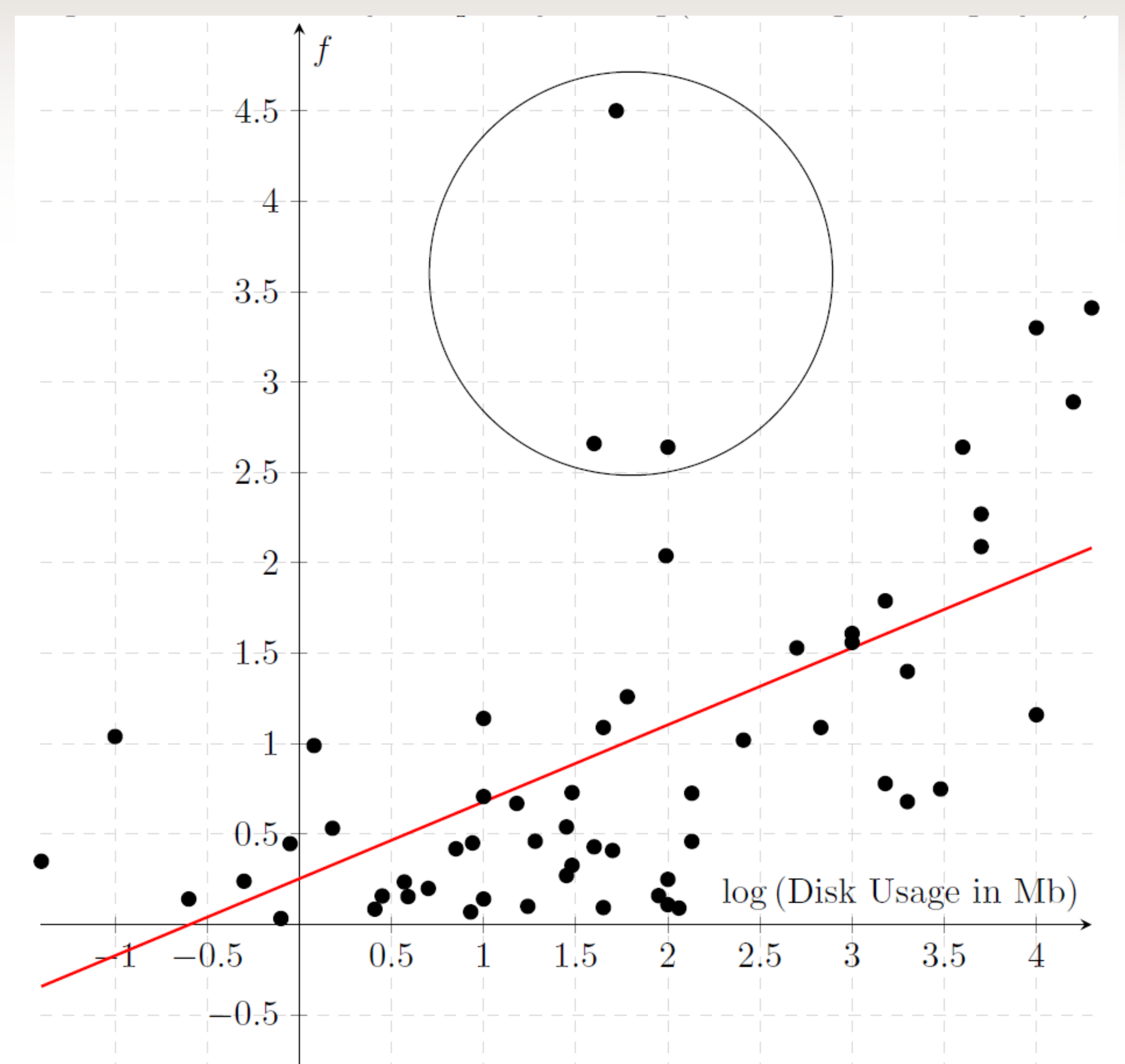
In this study, ~100 open source and closed source products with vulnerabilities listed on the National Vulnerability Database were studied. The disk space requirements for each product were compared to the rate at which vulnerabilities were reported for that product using the equation $ft = \sqrt{n}$, where $n =$ number of vulnerabilities discovered and $t =$ years the product has been available. Previous work on the SARA methodology has established this relation.

There does appear to be a relationship between disk usage and product vulnerability modeled by the equation:

$$f = 0.4257 * \log(d) + 0.254$$

$$d = \text{disk usage in megabytes}, r^2 = 0.33$$

The notable outliers were internet applications like Google Chrome, Firefox, and Thunderbird. Since these applications routinely process data from network sources, the large number of vulnerabilities associated with these products is not unusual. Removing these products from the dataset improves r^2 to 0.49, suggesting that this model underestimates the vulnerabilities present in browsers and network clients. Since there appears to be a moderate correlation between software size and vulnerability, disk space usage may supplement code length as a software vulnerability factor in the SARA methodology.

Sample of Dataset

Product	Vulnerability count	Year released	LOC (millions)	Install Size (MB)
mac_os_x	1573	2001	86	4000
linux_kernel	1462	1991	20.2	500
moodle	313	2002	2.94	60
vm_virtualbox	43	2007	7	30
samba	107	1992	1.67	40
windows_vista	677	2007	50	16000

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