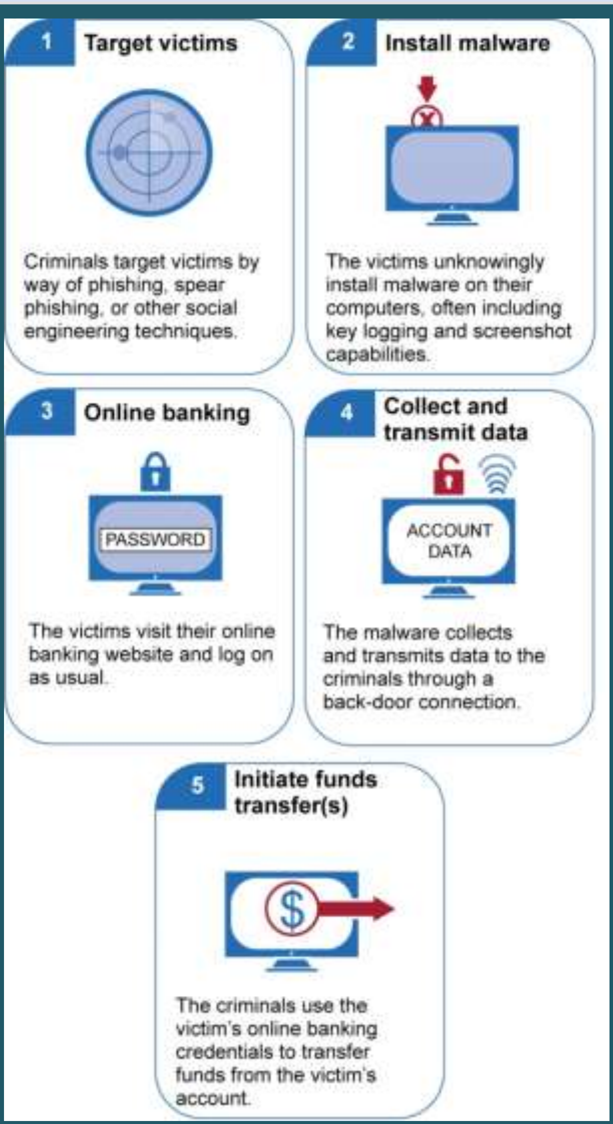
2015

U.S. Stock Brokerages Industry & Exchanges Cybersecurity



(**Source:** U.S. Congress GAO July 2015)

Homeland Security Research Corp.

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August 2015

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Table of Contents

List of Figures

1 U.S. Stock Brokerages Industry & Exchanges Cybersecurity Submarket -2016-2020

1.1 Stock Brokerages Industry & Exchanges Market Background

1.1.1 Overview

A stock exchange acts as a market where stock buyers connect with stock sellers. Stocks can be traded on one or more of several possible exchanges such as the New York Stock Exchange (NYSE). It is important to understand the relationship between exchanges and companies, and the ways in which the requirements of different exchanges protect investors.

The primary function of an exchange is to help provide liquidity; in other words, to give sellers a place to "liquidate" their share holdings. Stocks first become available on an exchange after a company conducts its initial public offering (IPO). In an IPO, a company sells shares to an initial set of public shareholders (the primary market). After the IPO "floats" shares into the hands of public shareholders, these shares can be sold and purchased on an exchange (the secondary market).

The exchange tracks the flow of orders for each stock, and this flow of supply and demand sets the stock price.

The following is a list of U.S. exchanges registered with the SEC under Section 6(a) of the Exchange Act as national securities exchanges:

1. NYSE MKT LLC (formerly NYSE AMEX and the American Stock Exchange)
2. BATS Exchange, Inc.
3. BATS Y-Exchange, Inc.
4. BOX Options Exchange LLC
5. NASDAQ OMX BX, Inc. (formerly the Boston Stock Exchange)
6. C2 Options Exchange, Incorporated
7. Chicago Board Options Exchange, Incorporated
8. Chicago Stock Exchange, Inc.
9. EDGA Exchange, Inc.
10. EDGX Exchange, Inc.
11. International Securities Exchange, LLC

12. ISE Gemini
13. Miami International Securities Exchange
14. The Nasdaq Stock Market LLC
15. National Stock Exchange, Inc.
16. New York Stock Exchange LLC
17. NYSE Arca, Inc.
18. NASDAQ OMX PHLX, Inc. (formerly Philadelphia Stock Exchange)

Certain exchanges are also registered with the SEC through a notice filing under Section 6(g) of the Exchange Act for the purpose of trading security futures.

- Board of Trade of the City of Chicago, Inc.
- CBOE Futures Exchange, LLC
- Chicago Mercantile Exchange
- One Chicago, LLC
- The Island Futures Exchange, LLC (formerly registered)
- NQLX LLC (formerly registered)

There are also two exchanges that the SEC has exempted from registration as national securities exchanges on the basis of a limited volume of transactions:

- Arizona Stock Exchange (formerly registered)
- SWX Europe Limited (f/k/a Virt-x)

1.1.2 Auction Exchanges – NYSE

The NYSE is primarily auction-based, which means specialists are physically present on the exchange's trading floors. Each specialist "specializes" in a particular stock, buying and selling the stock in the auction. These specialists are under competitive threat by electronic-only exchanges that claim to be more efficient (that is, they execute faster trades and exhibit smaller bid-ask spreads) by eliminating human intermediaries.

The NYSE is the largest and most prestigious exchange. Listing on the NYSE affords companies great credibility, because they must meet initial listing requirements and also comply annually with maintenance requirements. For example, for U.S. companies to remain listed, the NYSE companies must keep their price above $4 per share and their market capitalization (number of shares times price) above $40 million. Furthermore, investors trading on the NYSE benefit from a set of minimum protections.

1.1.3 Nasdaq (an Electronic Exchange)

The Nasdaq, an electronic exchange, is sometimes called "screen-based" because buyers and sellers are connected only by computers over a telecommunications network. Market makers, also known as dealers, carry their own inventory of stock. They stand ready to buy and sell Nasdaq stocks, and they are required to post their bid and ask prices.

Nasdaq has listing and governance requirements similar to the NYSE. For example, a stock must maintain a $4 minimum price. If a company does not maintain these requirements, it can be delisted to one of the OTC markets discussed below.

1.1.4 Electronic Communication Networks (ECNs)

ECNs are part of an exchange class called alternative trading systems (ATS). ECNs connect buyers and sellers directly. Because they allow for direct connection, ECNs bypass the market makers.

There are several innovative and entrepreneurial ECNs, and they are generally good for customers because they pose a competitive threat to traditional exchanges, and therefore push down transaction costs. Currently, ECNs do not really serve individual investors; they are mostly of interest to institutional investors.

There are several ECNs, including INET (the result of an early 2004 consolidation between the Instinet ECN and Island ECN) and Archipelago (one of the four original ECNs that launched in 1997).

1.1.5 Over-the-Counter (OTC)

Over-the-counter (OTC) refers to markets other than the organized exchanges described above. OTC markets generally list small companies, and often (but not always) these companies have "fallen off" to the OTC market because they were delisted from Nasdaq.

Some individual investors will not even consider buying OTC stocks due to the extra risks involved. On the other hand, some strong companies trade on the OTC. In fact, several strong companies have deliberately switched to OTC markets to avoid the administrative burden and costly fees that accompany regulatory oversight laws such as the Sarbanes-Oxley Act.

There are two OTC markets:

- ❑ Over-the-Counter Bulletin Board (OTCBB) is an electronic community of market makers. Companies that fall off the Nasdaq often end up here. On the OTCBB, there are no "quantitative minimums" (no minimum annual sales or assets required to list).

- Companies that list on the OTC Pink are not required to register with the SEC. Liquidity is often minimal. Also, keep in mind that these companies are not required to submit quarterly 10Qs.

1.1.6 Stock Brokers and Exchanges Cybersecurity Vulnerabilities

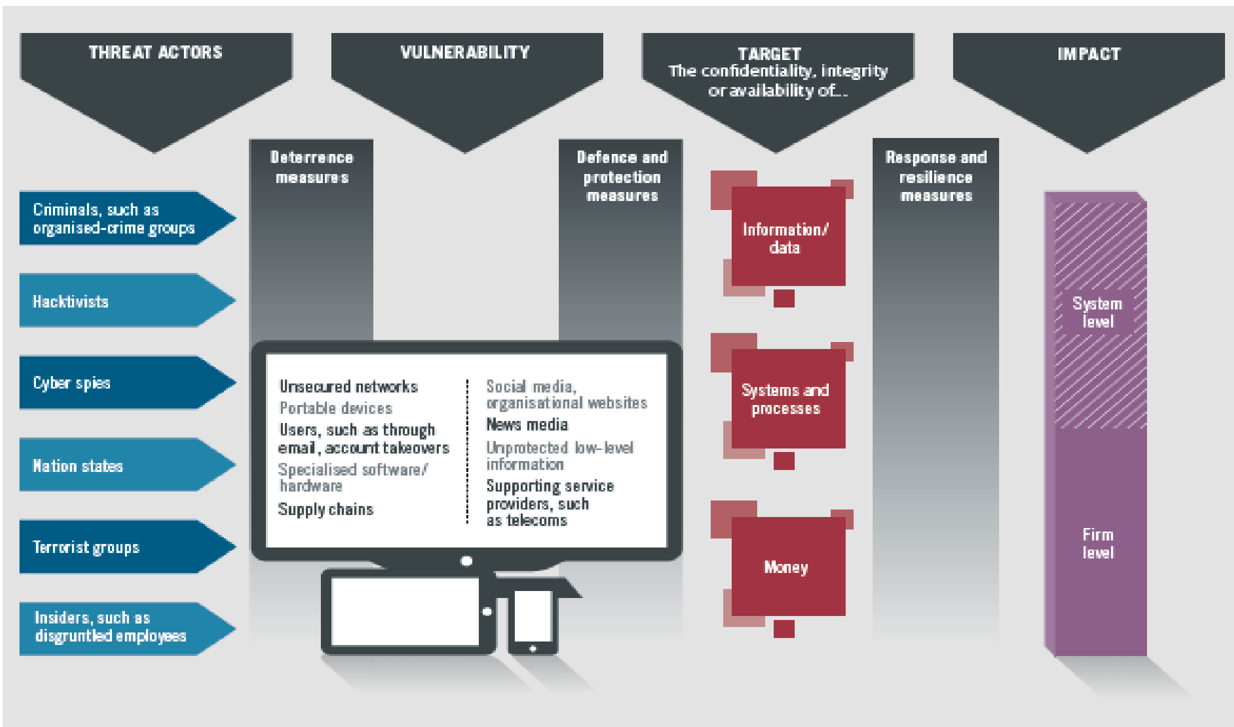
Stock exchanges are vulnerable to cyber-attacks, in particular since a successful attack can shut down markets with an enormous potential financial loss coupled with a loss of investor confidence:

- According to a paper based on a survey of 46 exchanges released in July, 2013, half of the world's securities exchanges were the target of cyber-attacks.
- Among exchanges, 89 percent said cybercrime should be considered a systemic risk.
- The prevalence of attacks along with the interconnected nature of the markets creates the potential for widespread impact.
- The most common forms were Denial of Service attacks, which seek to disrupt websites and other computer systems by overwhelming the targeted organizations' networks with computer traffic and viruses.
- Other forms of cyber-crimes reported by the exchanges included laptop theft, website scanning, data theft, and insider information theft. None of the exchanges reported financial theft as part of the attacks.
- In the United States, exchange operators Nasdaq OMX Group and BATS Global Markets said in February 2014 that they were targeted with denial of service attacks.
- In October 2011, NYSE Euronext's New York Stock Exchange's website was inaccessible for 30 minutes, according to an Internet monitoring company, but the exchange said there was no interruption of service
- In 2010, hackers who infiltrated Nasdaq's computer systems installed malicious software that allowed them to spy on the directors of publicly held companies, Reuters reported
- Although the exchanges said that the direct or indirect costs of the cyberattacks cost each of them less than $1M, a number of studies have looked at the costs of cyber-crime to society as a whole, with estimates ranging between $388 billion to $1 trillion
- The lack of widely available insurance against cyber-crime adds to the risk, as nearly four in five exchanges would have to bear the costs of a major attack themselves

1.1.7 Threat Profile for Securities Markets

During the IOSCO/WFE survey, a majority of exchanges, (about 90%) agreed that cybercrime in securities markets are a potential systemic risk. This is because some cyber-attacks have the potential to reap massive financial and reputational impact across whole sectors; can have debilitating effects on market availability and integrity through the manipulation of prices and by choking the provision of financial services; and can damage trust and confidence in the financial system.

Figure 1 - Threat Profile for Securities Markets



(**Source**: Securing the Cyberspace)

More information can be found at:
U.S. Financial Services: Cybersecurity Systems & Services Market – 2016-2020

