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What is Cybersecurity (or Cyber Security)? Answer [Still] Loading…

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Abstract

A quote attributed to Bertrand Russell states that, "In all affairs, it's a healthy thing now and then to hang a question mark on the things you have long taken for granted." Perhaps it is even healthier to regularly inquire about things that are yet unsettled. This paper reports on our search for the first use of the term cyber security, our analysis of the current preference of the one-word (cybersecurity) vs. two-word (cyber security) form of the term, and our investigation into literature from academia, government, and the business world to determine the current state of definitions. The best evidence we found indicates that the 1990 book Kaduna Memories by Jack McKinney (a pseudonym for authors James Luceno and Brian Daley) contains the first use of the term cyber security. Though use of the two-word version, cyber security, was first, we found that the one-word version has gained acceptance and is now ascendant. Unsurprisingly, though the 60 definitions we looked at have a common theme, there are sufficient differences among them that it seems consensus remains somewhere in the future. Synthesizing what we found, cybersecurity today might reasonably be considered *the practice of protecting digital data, computer systems, information technology, and networks against attacks, threats, and unauthorized access*. Conspicuously absent in this synthesis is the word risk, which seems likely to gain acceptance in future cybersecurity definitions as the domain continues to mature.

Keywords: Cybersecurity, Cyber Security, Literature Review, Definition

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1. INTRODUCTION

At the 4th annual Cybersecurity Symposium hosted by the North Carolina Partnership for Cybersecurity Excellence (NC-PaCE), 16-17 April 2025, an 11-person panel presented, "Hack the Gap: Shaping Tomorrow's Cybersecurity Workforce" (North Carolina Partnership for Cybersecurity Excellence, 2025). One panelist who worked in the private sector and who had hiring experience expressed some frustration with the lack of a common understanding of the word cybersecurity. He was unsure what a B.S. in Cybersecurity implied in terms of skills. In reaction, another panelist concisely and confidently stated that cybersecurity was the "application of risk management to digital assets" (K. Robinson, personal communication, April 17, 2025).

This discussion prompted us to wonder about the degree to which a definition of cybersecurity had converged, and made us curious about the origin of the term cybersecurity. A Google search of "who first coined the term cybersecurity" resulted in the Google-AI response: "The term 'cybersecurity' was first coined by William Gibson in 1983, in his novel Neuromancer" (Google, 2025). Temporarily gratified by this definitive result, we were subsequently a bit surprised when a search of an online copy of Gibson's novel revealed that while the word "cyberspace" shows up 24 times, neither "cyber security" nor "cybersecurity" is anywhere to be found (Gibson, 1984). Encountering this unexpected result provided the motivation for further exploration and, ultimately, the impetus to write this paper.

In this investigation, we set out to answer the following research questions (RQ):

RQ1: When was the term cyber security first used?
RQ2: Which form of the term is currently most accepted (cyber security or cybersecurity)?
RQ3: What is the current state of definitional consensus for the term cybersecurity?

Section 2 provides some background for our investigation; Section 3 provides our methods; Section 4 provides our results and some analysis; while Section 5 concludes.

2. BACKGROUND

Wrestling to understand and define the scope of an emerging field is neither new nor unique to cybersecurity. For example, the field of computer science has endured debate about its essence since the 1930s. All it seemingly takes to glimpse this continuing struggle is to ask a group of computer scientists what they think of the quote, popularly attributed to Edsger Dijkstra, that "computer science is no more about computers than astronomy is about telescopes" (Computer Science Is Not about Computers, Any More than Astronomy Is about Telescopes – Quote Investigator, n.d.). Practitioners have long argued about the heart of computer science – is it primarily about algorithms, the machines, information processes, or something else (Denning, 2008)? Perhaps the most famously useful, albeit general and somewhat circular, definition is, "Computer science is the study of the phenomena surrounding computers" (Newell et al., 1967).

Seeking a Cybersecurity Definition

We are not the first to seek clarification of the term cybersecurity, and do not expect to be the last. Craigen et al. (2014) conducted an in-depth literature review and led discussions with practitioners, academics, and graduate students to arrive at their definition: "Cybersecurity is the organization and collection of resources, processes, and structures used to protect cyberspace and cyberspace-enabled systems from occurrences that misalign de jure from de facto property rights" (p. 1).

The European Union Agency for Network and Information Security (ENISA) [Note: ENISA is now called the European Union Agency for Cybersecurity], responding to a recommendation to establish a "clear and common understanding of the scope of Cyber Security" (European Union Agency for Cybersecurity, 2015, p. 8), published a report in 2015. In it, they identified five different domains often included under cyber-security: communications security, operations security, information security, military security, and physical security. They ended up concluding that a definition is unnecessary for application to simple things like identity authentication and that

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"the problem is that Cybersecurity is an enveloping term and it is not possible to make a definition to cover the extent of the things Cybersecurity covers" (European Union Agency for Cybersecurity, 2015, p. 28).

In a 2016 search for an encompassing definition of cybersecurity, Bay opined that, "a very precise definition of the term cybersecurity that can be summed up in a few sentences seems quite elusive" (p. 23). Though some use other terms like computer security interchangeably with cybersecurity, he argued that while computer security and information security overlap with cybersecurity, they are not the same thing. He concluded that, "cybersecurity is a security matter which spans from the individual's security against cyber threats to all of society. As such, the concept of cybersecurity demands a multi-faceted theoretical approach" (Bay, 2016, p. 24).

Recent studies have recognized that, well-known knowledge frameworks interpret cybersecurity as encompassing many non-technical topics (Furnell & Collins, 2021) (Figure 1), that "simply put, there is no single universal understanding of cybersecurity" (Siudak, 2022, p. 1), and that have focused on exploring non-expert definitions of cybersecurity (Neil et al., 2023).

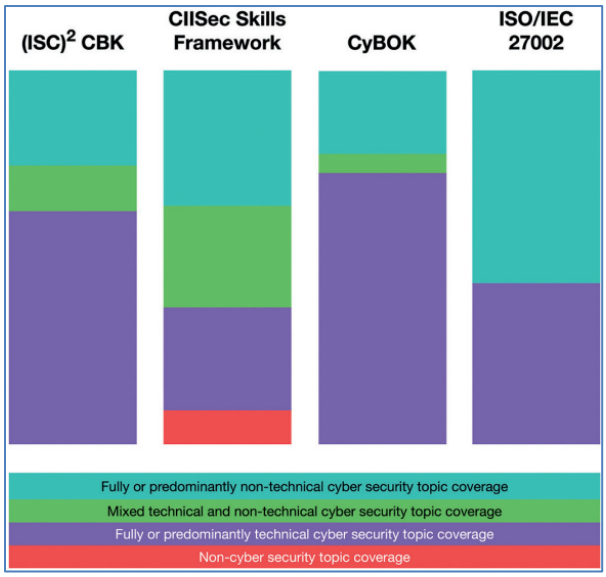

Figure 1: Part of Furnell & Collins' Figure 2 (2021) showing topic coverage for well-known knowledge frameworks (top portion represents non-technical topic coverage).

3. METHODOLOGY

For this investigation, we conducted a literature review and analysis to try to identify the first use of either "cyber security" or "cybersecurity," to determine which form is currently preferred, and to collect and analyze current definitions from multiple sources to assess the level of definitional consensus that has been reached.

Term Origin
While the activities related to cybersecurity have presumably been ongoing since nearly the beginning of the electronic computer age, we focused on trying to find the first use of the term. We conducted searches using Google and a collection of English-language archive databases available through our institution's library. While there were hundreds of potential databases we could search, we focused on well-known periodical sources, aggregation databases, and technical sources including: Association of Computing Machinery (ACM) Digital Library, Chicago Tribune, Christian Science Monitor, Institute of Electrical and Electronic Engineers (IEEE) Xplore, Los Angeles Times, New York Times, NIST publications, Wall Street Journal, and Washington Post archives.

Term Preference
Is it cyber security or cybersecurity? [Note: we decided to treat cyber security and the hyphenated, cyber-security, as the same form.] Of course, it is both, but as we searched for first uses of the term, we searched for both forms to see which showed up earlier for each source we examined. We also made use of the tools Google Trends and Google Books Ngram Viewer to examine the prevalence of the two forms of the term over time.

Definitions
We collected definitions for cybersecurity across several different collections – online dictionaries, governmental organizations, standards organizations, published academic papers, generative AI tools, and tech companies.

Dictionaries
We conducted Google searches to determine available, popular, and respected online dictionaries, and then collected definitions from eight (8): Cambridge, Collins, Dictionary.com, Merriam-Webster, Oxford English Dictionary (OED), Urban Dictionary, Wiktionary, and WordWeb Online.

Governmental and Standards Organizations
We collected definitions from eight (8) documents from six (6) sources: the Congressional Research Service (CRS), the Cybersecurity & Infrastructure Security Agency (CISA), the European Union Agency for Cybersecurity (ENISA), the

International Organization for Standardization (ISO), the Joint Task Force (JTF) on Cybersecurity Education [a collaboration of the Association for Computing Machinery (ACM), Institute of Electrical and Electronics Engineers (IEEE), Association of Information Systems (AIS), and the International Federation for Information Processing (IFIP)], and the National Institute of Standards and Technology (NIST).

Tech Companies
To gather cybersecurity definitions from the corporate world, we focused on large tech companies. We looked at the largest tech companies as determined by market capitalization (Companies Marketcap, n.d.). For each company, we prompted ChatGPT, "does company XXX have any official definition of cybersecurity. Provide a source." If no definition was found, we skipped the company. For the others, we visited the link provided by ChatGPT to verify the existence of the definition and copied it directly from the company's website. Definitions were copied from 10 companies: Microsoft, Google, Amazon, Broadcom, SAP, AMD, Cisco, Salesforce, IBM, and ServiceNow.

Cybersecurity Companies
To gather definitions from the corporate cybersecurity world, we followed the same methodology as for tech companies. We looked at the largest cybersecurity companies by market capitalization (Companies Marketcap, n.d.) and prompted ChatGPT with the exact same prompt, "Does company XXX have any official definition of cybersecurity. Provide a source." If no definition was found, we skipped the company. For the others, we visited the link provided by ChatGPT to verify the existence of the definition and then copied it directly. Definitions were collected from 10 companies: Palo Alto Networks, CrowdStrike, Fortinet, Cloudflare, Zscaler, Okta, F5, Akamai, SailPoint, and SentinelOne.

Academic Papers
Our entry point to this investigation began, after an initial Google Scholar search, with Bay's paper, "What is Cybersecurity?" (2016). From this paper, we looked backwards in time based on cited works and forward in time using Google Scholar's "cited by" feature, and followed a similar scheme for any works selected for inclusion in this category. We selected seven (7) sources that clearly presented a definition of cybersecurity. Each definition was extracted verbatim. Since Bay's paper concluded with, "a very precise definition of the term cybersecurity that can be summed up in a few sentences seems quite elusive" (2016, p. 23), we do not include a definition from his work.

Universities
To gather university definitions of cybersecurity, we conducted a web-based review targeting top cybersecurity institutions. We used EduRank's "Best Universities for Cyber Security in the World" to source definitions (2025). For each, we recorded the university name, URL, and quoted text. Definitions were collected from 10 of the top universities: the University of California, Berkeley, Stanford, MIT, Carnegie Mellon, the University of Cambridge, Georgia Tech, Harvard, the University of Illinois Urbana-Champaign, UT Austin, and NY University.

Generative AI
To gather definitions from Generative AI, we asked seven of the top Large Language Models (LLMs), "What is the best general, concise definition of cybersecurity?" After documenting the response, we then asked the LLM, "Did you make this definition up or was it collected from documents?" Most LLMs listed the sources used to generate the definition provided. Some required further questioning to get the sources used, for which we asked, "What sources did you use to construct your definition?" We consulted seven (7) LLMs: ChatGPT, Microsoft CoPilot, Google Gemini, Claude, DeepSeek, Meta AI, and Perplexity – only Claude was unable to provide a source used for its definition.

Term Frequencies
To find the frequently used words among the sections of definitions, we used WriteWords Word Frequency Counter (http://www.writewords.org/uk/word_count.asp). We gathered all definitions from each subsection and documented all words with two or more instances. Additionally, we removed redundant filler words such as, I, and, the, etc. For some sections, we combined words like system and systems into one word system(s) to provide better analysis. Lastly, we created a bar graph to visually depict the frequencies of words among the sections. For the graph depicting the frequencies among all the sections, we gathered every definition we collected and imported all of them into the frequency counter. We then took all words with two or more instances and added them to a bar graph. We also took a closer look at the top 30 among that group and created another bar graph to visually depict the top 30 most frequently used words.

4. RESULTS & ANALYSIS

Term Origin
In Table A-1, we provide examples of the earliest

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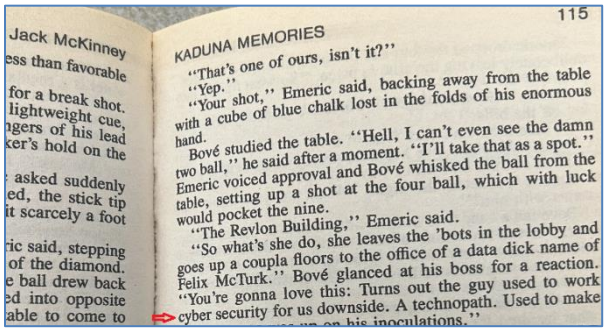
use of the term cyber security that we could find from a variety of different publicly available, English-language sources. None of the sources provided an earlier use of "cybersecurity," so only "cyber security" references are provided. The best evidence we could find indicates that "cyber security" was first used by McKinney (pseudonym) in the science fiction book, Kaduna Memories (1990) (Figure 2) [RQ1].


Jack McKinney
ess than favorable
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igers of his lead
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asked suddenly
ed, the stick tip
it scarcely a foot
ric said, stepping
of the diamond.
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ed into opposite
able to come to

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KADUNA MEMORIES

"That's one of ours, isn't it?"

"Yep."

"Your shot," Emeric said, backing away from the table with a cube of blue chalk lost in the folds of his enormous hand.

Bové studied the table. "Hell, I can't even see the damn two ball," he said after a moment. "I'll take that as a spot." Emeric voiced approval and Bové whisked the ball from the table, setting up a shot at the four ball, which with luck would pocket the nine.

"The Revlon Building," Emeric said.

"So what's she do, she leaves the 'bots in the lobby and goes up a coupla floors to the office of a data dick name of Felix McTurk." Bové glanced at his boss for a reaction. "You're gonna love this: Turns out the guy used to work cyber security for us downside. A technopath. Used to make

Figure 2: "cyber security" appears in Kaduna Memories (1990), p. 115.

Our search for the origin of the term was more difficult than anticipated. As indicated in the introduction, Google Search AI unequivocally attributed the first use of the term "cybersecurity" to William Gibson in his 1983 novel Neuromancer (Google, 2025), and this is not correct. Over the course of our search for the first use of the term, Google Search AI's answer evolved. The same search on June 5, 2025, provided this result:

> The term "cybersecurity" is often associated with William Gibson, a science fiction author, due to his use of the term "cyberspace" in his 1980s works like "Neuromancer". While Gibson's work popularized the concept of a virtual space and its associated risks, there's no conclusive evidence that he was the first to use the term "cybersecurity" in a technical context. (Google, 2025)

In response to the slightly different prompt, "Who first used the term cyber security or cybersecurity?" Microsoft's Copilot provided this response: "The term 'cybersecurity' was first recorded in 1989, according to linguistic and historical sources" (Copilot, 2025). Pulling the 1989 thread by following the Copilot-provided sources, we found websites that claimed the use of the term dates to 1989 (Gologanoff, 2023; Kinsella, 2022; Lal, 2023), but did not find any evidence of the actual use of the term in that year. The Merriam-Webster dictionary provides a self-referential citation under the Word History section: "First known use 1989, in the meaning defined above" (Merriam Webster, 2019).

One interesting story discovered in our search for the first use of cyber security involved Jamie Gorelick, former US Deputy Attorney General during the Clinton Administration. In a 2016 interview reflecting on her service, she stated, "By that point, we came up with a name for the threat, which was cyber security. We named it" (Jamie Gorelick Discusses the Birth of Cybersecurity, 2016). She was referencing the President's Commission on Critical Infrastructure Protection and their report that includes the term cyber security. As far as we found, this is the first official use of that term by the US Federal Government (President's Commission on Critical Infrastructure Protection, 1997).

We attempted to use Google Books' Ngram Viewer to find the first instance of cyber security in Google's English Corpus; however, it did not reliably map books to the correct published year. For example, the Ngram Viewer results indicate that there is a book from between 1952 and 1954 in which the term "cyber security" appears (Figure 3). The problem is that the books linked to this data are misdated, which is a known OCR problem for Google Books (Nunberg, 2009).

Cyber Security or Cybersecurity

It seems clear that the two-word form was initially more common, while the current trend is towards the single-word form [RQ2]. Google Trends' scores range from zero to 100 and do not represent absolute search volume. A line trending upwards means that a search term's popularity is increasing. Google Trends provides the following explanation:

> Numbers represent search interest relative to the highest point on the chart for the given region and time. A value of 100 is the peak popularity for the term. A value of 50 means that the term is half as popular. A score of 0 means there was not enough data for this term. (Google Trends, 2024)

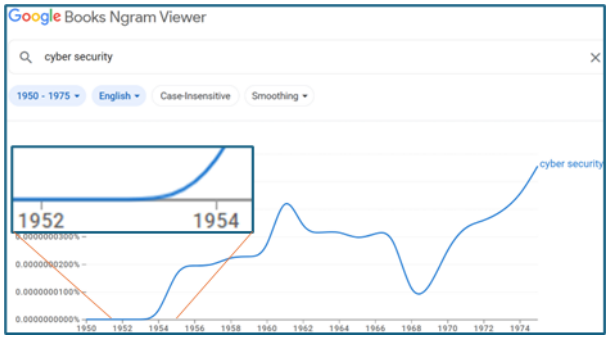

Figure 3: Google Books Ngram Viewer erroneously indicates the use of "cyber security" in books from the early 1950s.

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In Figures 4 & 5, we show the Google Trends search results comparing "cybersecurity" to "cyber security" across the entire time period supported both worldwide and within the United States. Worldwide, the terms are converging, while it appears that the single-word form has overtaken the two-word form in US searches since roughly September 2024.

Figure 4: Google Trends results worldwide for "cyber security" (red – top line) vs. cybersecurity (blue), Jan 2004 – Jun 2025.

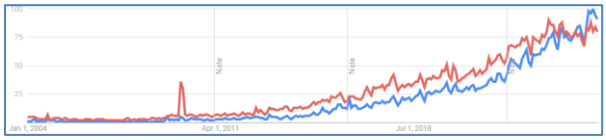

Figure 5: Google Trends results in the United States for "cyber security" (red) vs. cybersecurity (blue), Jan 2004 – Jun 2025.

Using the Google Books Ngram Viewer to compare instances of "cyber security" and "cybersecurity" across Google's English corpus of books published over the 20-year period 2002-2022, we see a much greater trend towards the single-word form of the word (Figure 6).

Figure 6: Google Books Ngram Viewer results for "cyber security" (red) vs. cybersecurity (blue), 2002 – 2022 (Google Books Ngram Viewer, 2025).

As acknowledged earlier, there are problems with the reliability of the dating of Google Books, but we consider this less of a concern when looking at the sheer volume of instances of both word forms across time. The movement matches what we see with Google Trends, but to a greater extent, which seems understandable given that book writers are likely to be more deliberate in the selection of their written words than the general population submitting web searches.

A final indication of the single-word form gaining ascendancy is the results of our online dictionary definition search. All eight of the dictionaries referenced recognized our search for "cybersecurity" but only three (Merriam-Webster, OED, and WordWeb) recognized "cyber security" as a valid term and jumped to the cybersecurity definition page when searching for cyber security.

Definitions

Across the various sources, 60 definitions were collected per Table 1. All definitions are provided in Appendix B tables. Word frequency graphs are depicted in Appendix B figures.

Dictionaries (online)	8
Governmental & Standards Organizations	8
Tech companies	10
Cybersecurity companies	10
Academic papers	7
Universities	10
Generative AI	7

Table 1: Definition source and number of definitions collected.

In the following tables, we provide three representative definitions from each source group and then follow with a brief analysis. Definitions from all sources are provided in tables in Appendix B.

Online Dictionaries
Cambridge Dictionary – "cybersecurity – things that are done to protect a person, organization, or country and their computer information against crime or attacks carried out using the internet" (Cambridge Dictionary, 2020)
Merriam Webster – "cybersecurity or cyber security – measures taken to protect a computer or computer system (as on the Internet) against unauthorized access or attack" (Merriam Webster, 2019)
Dictionary.com – "cybersecurity or cyber security – 1. precautions taken to guard against crime that involves the internet, especially unauthorized access to computer systems and data connected to the internet. 2. the state of being protected against such crime." (Definition of Cybersecurity | Dictionary.com, n.d.)

Table 2: Three example definitions from online dictionaries.

The word frequency analysis of the collected dictionary definitions (Figure B-1) shows that while no word was found across all eight dictionaries' definitions, the words *against*, *computer*, *internet*, *crime*, *system(s)*, and *attack(s)* were found in half or more. From these common words, it appears to us that online dictionaries most commonly view cybersecurity as defending against internet-based attacks and crime.

Governmental & Standards Organizations
Congressional Research Service (CRS) – "Cybersecurity is a risk management process rather than an end-state. It involves continuous work to (1) identify and (2) protect against potential cybersecurity incidents; and to (3) detect; (4) respond to; and (5) recover from actual cybersecurity incidents" (Jaikaran, 2021)
Cybersecurity and Infrastructure Security Agency (CISA) – "Cybersecurity is the art of protecting networks, devices, and data from unauthorized access or criminal use and the practice of ensuring confidentiality, integrity, and availability of information" (Cybersecurity and Infrastructure Security Agency, 2021)
NIST Glossary (cybersecurity) – "Prevention of damage to, protection of, and restoration of computers, electronic communications systems, electronic communications services, wire communication, and electronic communication, including information contained therein, to ensure its availability, integrity, authentication, confidentiality, and nonrepudiation" (National Institute of Standards and Technology, 2025b).

Table 3: Three example definitions from governmental and standards organizations.

The word frequency analysis of the collected governmental & standards organizations' definitions (Figure B-2) shows no word was found across all eight definitions. The words *information*, *cyber*, *communication(s)*, *cyberspace*, and *security* were found in half or more. Additionally, the words *risk*, *confidentiality*, *integrity*, and *availability* make a notable appearance, in contrast with the dictionary definitions. We infer from this word analysis that governmental & standards organizations take a larger or more high-level view of cybersecurity. Additionally, as *information* was the most common word, we conclude that the protection of information is central to these definitions.

Tech Companies
Microsoft – "Cybersecurity is a set of processes, best practices, and technology solutions that help you protect critical systems, data, and network from digital attacks." (Microsoft, n.d.)
Amazon – "Cybersecurity is the practice of safeguarding computers, networks, software applications, critical systems, and data from potential digital threats." (Amazon, n.d.)
Google – "Cybersecurity protects the data and integrity of computing assets belonging to or connecting to an organization's network. Its purpose is to defend those assets against all threat actors throughout the entire life cycle of a cyber attack." (Google, 2025)

Table 4: Three example definitions from tech companies.

The word frequency analysis of the tech companies' definitions (Figure B-3) shows no word was found across all 10 definitions. The words *systems*, *data*, *digital*, *practice(s)*, and *protect(ing)* were common to half or more. Other notable words include *network(s)*, *information*, and *application(s)*. Contrasted with the previous two groups, tech companies' definitions indicate concern about protecting data, networks, information, and applications.

Cybersecurity Companies
Palo Alto Networks – "Cybersecurity is the practice of protecting computers, servers, networks, devices, and sensitive data from malicious digital attacks and unauthorized access. It encompasses a comprehensive set of security measures, tools, and best practices to safeguard individual users and organizations from evolving cyber threats." (Palo Alto Networks, 2015)
CrowdStrike – "Cybersecurity is the act of defending digital assets, including networks, systems, computers and data, from cyberattacks." (Cranford, 2025)
Fortinet – "Cybersecurity is the combination of methods, processes, tools, and behaviors that protect computer systems, networks, and data from cyberattacks and unauthorized access. Although deeply rooted in technology, the effectiveness of cybersecurity also very much depends on people." (Fortinet, n.d.)

Table 5: Three example definitions from cybersecurity companies.

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The word frequency analysis of the cybersecurity companies' definitions (Figure B-4) shows, for the first time, that a word was found across all 10 definitions – *data*. The words *systems*, *networks*, *digital*, *unauthorized access*, *practice*, *threats*, and *protect* were common to half or more. Our analysis shows that cybersecurity companies look at cybersecurity as a practice similar to the spirit of law or medicine and have a core concern with the unauthorized access of data, systems, and networks.

Academic Papers
Craigen, Diakun-Thibault & Purse. Defining Cybersecurity – "Cybersecurity is the organization and collection of resources, processes, and structures used to protect cyberspace and cyberspace-enabled systems from occurrences that misalign de jure from de facto property rights." (Craigen, Diakun-Thibault, & Purse, 2014, p. 14)
Schatz, Bashroush, & Wall. Towards a More Representative Definition of Cyber Security – "The approach and actions associated with security risk management processes followed by organizations and states to protect confidentiality, integrity and availability of data and assets used in cyber space. The concept includes guidelines, policies and collections of safeguards, technologies, tools and training to provide the best protection for the state of the cyber environment and its users." (Schatz, 2017, p. 66)
Schiliro'. Towards a Contemporary Definition of Cybersecurity – "Cybersecurity is the collection and concerting of resources including personnel and infrastructure, structures, and processes to protect networks and cyber-enabled computer systems from events that compromise the integrity and interfere with property rights, resulting in some extent of the loss." (Schiliro', 2023, p. 2)

Table 6: Three example definitions from academic papers.

The word frequency analysis of the academic papers' definitions (Figure B-5) finds no common word across all seven definitions. The words *cyber* and *security* were common to more than half. What's interesting is that most of the time these words were used, they were not used as the term "cyber security." Our analysis indicates that academic definitions view cybersecurity as a term that incorporates a wide array of aspects, hinting at the term's overall ambiguity and currently unsettled definition.

Universities
Harvard University – "Cybersecurity is a branch of computer science focused specifically on detecting, responding to, and preventing cyber attacks. It requires a high level of technical skills to understand computer systems, networks, and data privacy." (Harvard University, n.d.)
Stanford University – "Cybersecurity means prevention of damage to, protection of, and restoration of computers, electronic communications systems, electronic communication services, wire communication, and electronic communication, including information contained therein, to ensure its availability, integrity, authentication, confidentiality, and non-repudiation." (Stanford University, n.d.)
MIT – "Cybersecurity is defined as the practice of defending cyber infrastructures such as computers, servers, mobile devices, and IoT devices; as well as the data itself, from attack." (Massachusetts Institute of Technology, n.d.)

Table 7: Three example definitions from universities.

The word frequency analysis of the academic institutions' definitions (Figure B-6) finds no common word across all 10 definitions. The words *information*, *cyber*, *data*, *computer(s)*, and *system(s)* are common to half or more. The top word, information, seems to indicate a view of cybersecurity more in common with that of governmental and standards organizations who are also concerned with information vice the tech and cybersecurity companies and their concern with data. Interestingly, within this group is the only repeated cybersecurity definition as the University of Cambridge directly uses one of the NIST definitions.

Generative AI
ChatGPT – "Cybersecurity is the practice of protecting systems, networks, and data from digital attacks, unauthorized access, and damage." (OpenAI, 2025.)
Microsoft CoPilot – "Cybersecurity is the practice of protecting systems, networks, and data from digital threats, such as cyberattacks, unauthorized access, and data breaches. It involves strategies, technologies, and best practices to ensure confidentiality, integrity, and availability of information. In short, it's the defense system for the digital world." (Microsoft, 2025.)

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Google Gemini – "Cybersecurity is the practice of protecting systems, networks, and data from digital attacks." (Google, 2025.)

Table 8: three example definitions from generative AI.

The word frequency analysis of the generative AIs' definitions (Figure B-7) finds not one, but four common words across all seven definitions. Every generative AI definition we collected used *digital*, *systems*, *protecting*, and *networks*. As well, all but one referred to cybersecurity as a *practice*, were concerned with *unauthorized access*, and mentioned *data*. From this analysis, it appears that the LLMs are prioritizing cybersecurity company definitions over other sources when synthetically aggregating information to create a definition.

Word Frequency Analysis – All

Word frequency analysis across all 60 collected definitions reveals the top 30 words displayed in Figure 8. The top 15 of these words are: *cybersecurity, protect(s,ing,ion), data, system(s), information, networks, cyber, security, practice(s), digital, technology(ies), unauthorized, computer, access, attacks.*

While there is a general consensus among the 60 collected definitions, no strong agreement exists on specific language [RQ3]. Drawing heavily on the definitions and evaluating the word frequency analysis of all 60, we might synthesize a current common definition of cybersecurity as *the practice of protecting digital data, computer systems, information technology, and networks against attacks, threats, and unauthorized access*.

5. CONCLUSION & FUTURE WORK

Reflecting on computer science, Alan Perlis wrote, "In trying to define our field I sometimes feel that we are too impatient, are in too much of a rush, to establish the core" (Perlis, n.d., p. 3). We approached this investigation of the term cybersecurity with patience, tracing its first verified use to Kaduna Memories (McKinney, 1990), noting the shift in preference from the two-word form, cyber security, to the one-word form, cybersecurity, and analyzing definitions across government, academia, and industry. Some are likely frustrated that cybersecurity does not yet have a more commonly established definition; however, the history of computer science seems to indicate that it takes time to flesh things out. We took what we found and synthesized a definition for cybersecurity as *the practice of protecting digital data, computer systems, information technology, and networks against attacks, threats, and unauthorized access*.

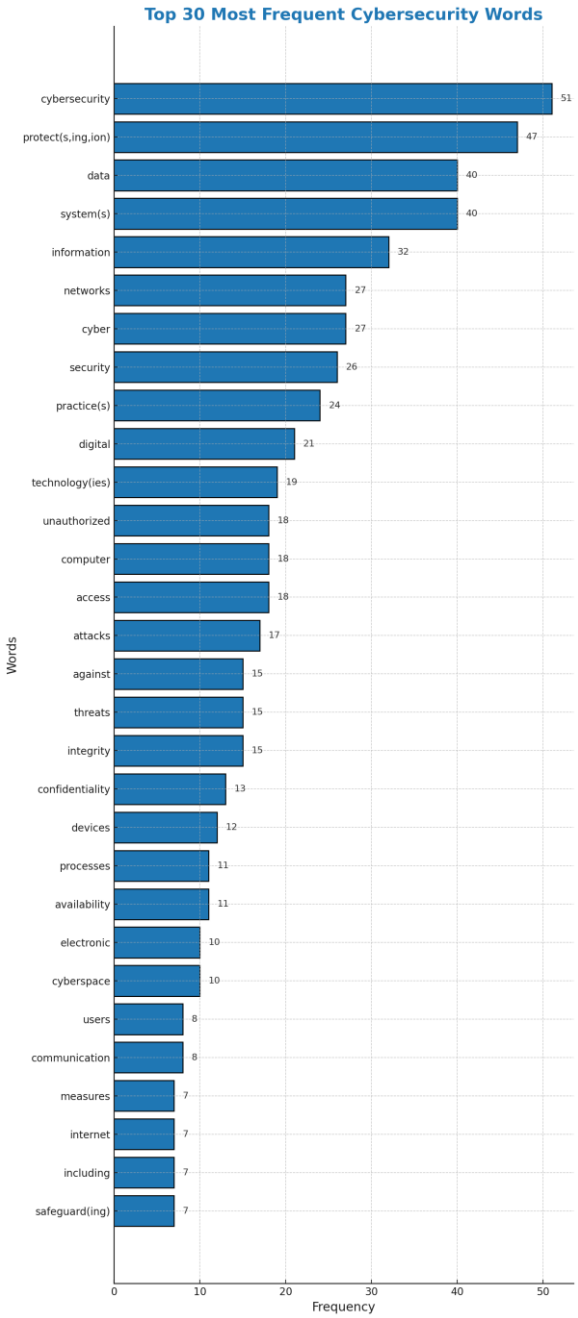

Figure 8: Top 30 words among our 60 collected definitions

While that captures the current state of things, it seems clear that our collective understanding is still evolving and will likely not be settled soon. It seems very likely to us that the word *risk*, and perhaps, *analysis* and *management*, will begin to be more commonly included in the near future.

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Future research should explore how these definitional differences shape policy, education, and the global cybersecurity workforce. As technology advances, the term itself may continue to evolve or be replaced.

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APPENDIX A

First Use of the Term Cyber Security

This table is sorted by date of the cited source. Items at the top are older than those at the bottom.

Kaduna Memories June 13, 1990	"Bové glanced at his boss for a reaction. 'You're gonna love this: Turns out the guy used to work **cyber security** for us downside. A technopath. Used to make sure SPARTOS was up on his inoculations.' SPARTOS was the Virtual Network AI in charge of OLD security." (McKinney, 1990)
The Dispatch-Argus April 10, 1994	"Currently, state laws guard the privacy of medical records. But their vast differences raise questions for **cyber security**" (Koch, 1994).
ABA Journal July 1995	"**Cyber-Security**. While loping down that ol' information superhighway, you ought to keep in mind that bandits come with the territory" (Husick et al., 1995, p. 67).
Los Angeles Times August 20, 1995	"There have already been some well-publicized cases involving the new demands of **cyber security**, such as that of computer security expert Tstutomo [sic] Shimomura, who helped nail hacker Kevin Mitnick" (Gest, 1995, p. SM26).
Christian Science Monitor July 18, 1996	"The US needs the equivalent of the "Manhattan Project'' - which developed the first atom bomb - for **cyber security**, the Clinton administration said" (Hanson & Zipp, 1996).
Washington Post September 6, 1997	"Panel Urges U.S. to Power Up **Cyber Security**" (Lardner, 1997, p. A3)
President's Commission on Critical Infrastructure Protection October 1997	"Their risk analysis weighs the cost of physical and cyber disruption against the cost of physical and **cyber security**." (President's Commission on Critical Infrastructure Protection, 1997, p. 27)
Wall Street Journal October 21, 1997	"U.S. Vulnerability on **Cyber-Security**, Is Cited by Report" (Simons, 1997, p. B6).
ACM Digital Library December 1997	"The commission's study of U.S. telecommunications systems, electric-power grids, transportation, oil and gas delivery, storage structures, water systems, emergency services, and government services recommended quadrupling the federal amount spent on **cyber-security** research to $1 billion during the next seven years" (Fox, 1997, p. 9).
New York Times May 12, 1999	"The new 'security czar' will be a senior official who will report directly to Mr. Richardson and will oversee all security-related functions, including offices handling **cyber-security**, nuclear material control and background checks on foreign visitors to the labs" (Risen, 1999).
Chicago Tribune May 23, 1999	"A government investigation into NASA's **cyber security** found it so vulnerable to attack that hackers could easily disrupt command and control operations, including the tracking of Earth-orbiting spacecraft" (Tribune News Services, 1999, p. C13).
IEEE Xplore October-December 1999	"Managing **Cyber Security** Vulnerabilities in Large Networks" (Chang et al., 1999)
NIST publications July 19, 2000	"CIO **Cyber Security** Notes" (Frye, 2000).

Table A-1: Earliest evidence of the use of the term cyber security from a variety of sources.

APPENDIX B

Cybersecurity Definitions

The following online dictionary definitions are ordered alphabetically by the dictionary name.

Online Dictionaries – Cybersecurity Definitions	
Cambridge Dictionary	"cybersecurity – things that are done to protect a person, organization, or country and their computer information against crime or attacks carried out using the internet" (Cambridge Dictionary, 2020)
Collins Dictionary	"cybersecurity - the state of being safe from electronic crime and the measures taken to achieve this" (Definition of Cybersecurity, 2025)
Dictionary.com	"cybersecurity or cyber security – 1. precautions taken to guard against crime that involves the internet, especially unauthorized access to computer systems and data connected to the internet. 2. the state of being protected against such crime." (Definition of Cybersecurity | Dictionary.com, n.d.)
Merriam-Webster	"cybersecurity or cyber security – measures taken to protect a computer or computer system (as on the Internet) against unauthorized access or attack" (Merriam Webster, 2019)
Oxford English Dictionary	"cybersecurity – security relating to computer systems or the internet, esp. that intended to protect against viruses or fraud" ("Cybersecurity, N. Meanings, Etymology and More | Oxford English Dictionary," 2023).
Urban Dictionary	"Cybersecurity is system of computer technology that protects and integrates global interconnected information technology infrastructure" (Urban Dictionary: Cybersecurity, 2015). "The illusion of preventing human mistakes by technical means"
Wiktionary	"cybersecurity – security against electronic attacks such as cyberwarfare or cyberterrorism" (Cybersecurity - Wiktionary, the Free Dictionary, 2025).
WordWeb Online	"cybersecurity – (computing) security against electronic attack or spying" (Cybersecurity- WordWeb Dictionary Definition, 2025)

Table B-1: Online dictionary definitions for cybersecurity.

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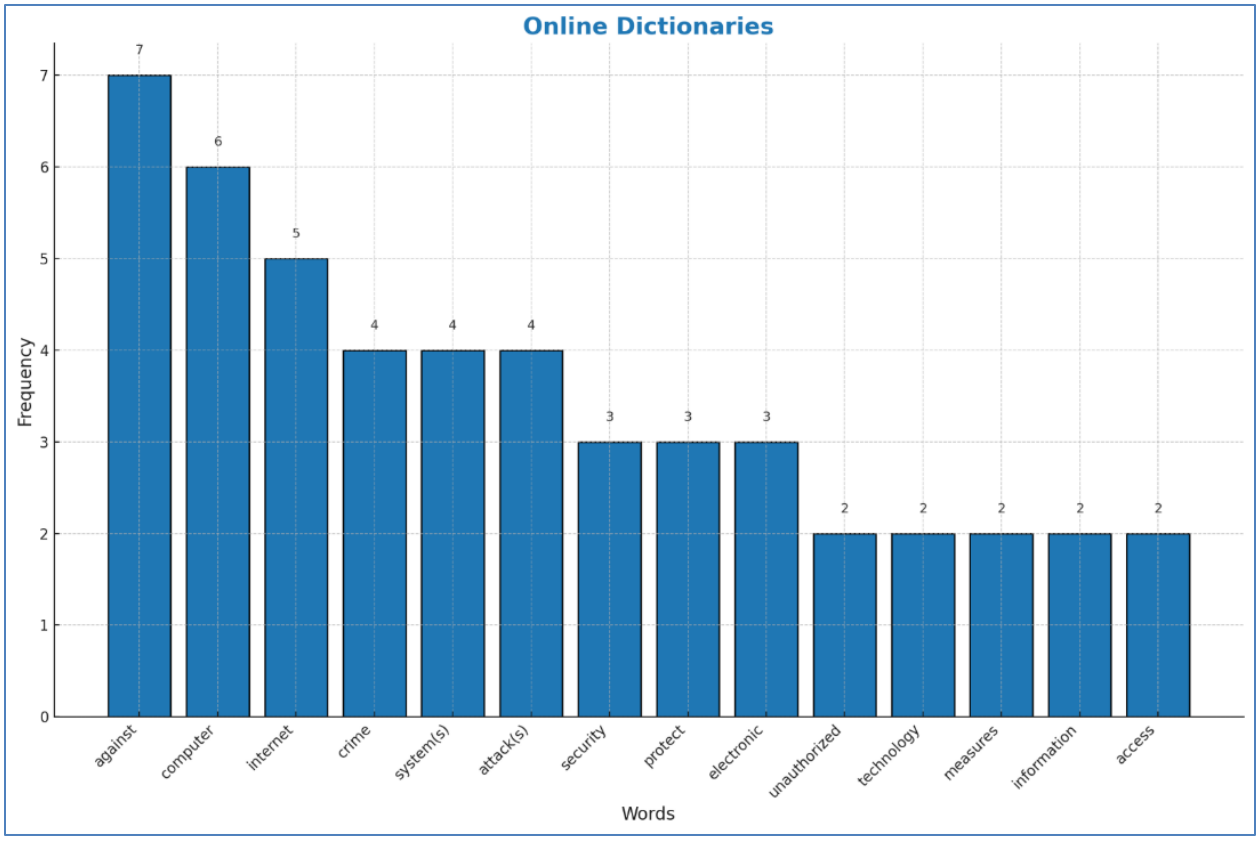

Figure B-1: Online dictionary word frequency bar graph

The following governmental / standards organizations' definitions are ordered alphabetically by the organization name.

Governmental / Standards Organizations – Cybersecurity Definitions	
Congressional Research Service (CRS)	"Cybersecurity is a risk management process rather than an end-state. It involves continuous work to (1) identify and (2) protect against potential cybersecurity incidents; and to (3) detect; (4) respond to; and (5) recover from actual cybersecurity incidents" (Jaikaran, 2021)
Cybersecurity and Infrastructure Security Agency (CISA)	"Cybersecurity is the art of protecting networks, devices, and data from unauthorized access or criminal use and the practice of ensuring confidentiality, integrity, and availability of information" (Cybersecurity and Infrastructure Security Agency, 2021)
European Union Agency for Cybersecurity (ENISA – formerly European Union Agency for Network and Information Security)	"Cybersecurity comprises all activities necessary to protect cyberspace, its users, and impacted persons from cyber threats" (European Union Agency for Cybersecurity, 2017, p. 6).
International Organization for Standardization (ISO) 2023	"safeguarding of people, society, organizations and nations from cyber risks; Note 1 to entry: Safeguarding means to keep cyber risk at a tolerable level" (International Organization for Standardization, 2023)
ISO 2012	"Cyberspace security. preservation of confidentiality, integrity and availability of information in the Cyberspace; Note 1 to entry: In addition, other properties, such as authenticity, accountability, non-repudiation, and reliability can also be involved; Note 2 to entry: Adapted from the definition for information security in ISO/IEC 27000:2009" (International Organization for

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	Standardization, 2012)
Joint Task Force (JTF) on Cybersecurity Education; collaboration among: Association for Computing Machinery (ACM), Institute of Electrical and Electronics Engineers Computer Society (IEEE CS), Association for Information Systems Special Interest Group on Security (AIS SIGSEC), International Federation for Information Processing Technical Committee on Information Security Education (IFIP WG 11.8)	"A computing-based discipline involving technology, people, information, and processes to enable assured operations in the context of adversaries. It involves the creation, operation, analysis, and testing of secure computer systems. It is an interdisciplinary course of study, including aspects of law, policy, human factors, ethics, and risk management" (Burley et al., 2017, p. 16)
National Institute of Standards and Technology (NIST) Glossary – cyber security	"The ability to protect or defend the use of cyberspace from cyber attacks" (National Institute of Standards and Technology, 2025a).
NIST Glossary – cybersecurity	"Prevention of damage to, protection of, and restoration of computers, electronic communications systems, electronic communications services, wire communication, and electronic communication, including information contained therein, to ensure its availability, integrity, authentication, confidentiality, and nonrepudiation" (National Institute of Standards and Technology, 2025b).

Table B-2: Governmental and standards organizations' definitions for cybersecurity.

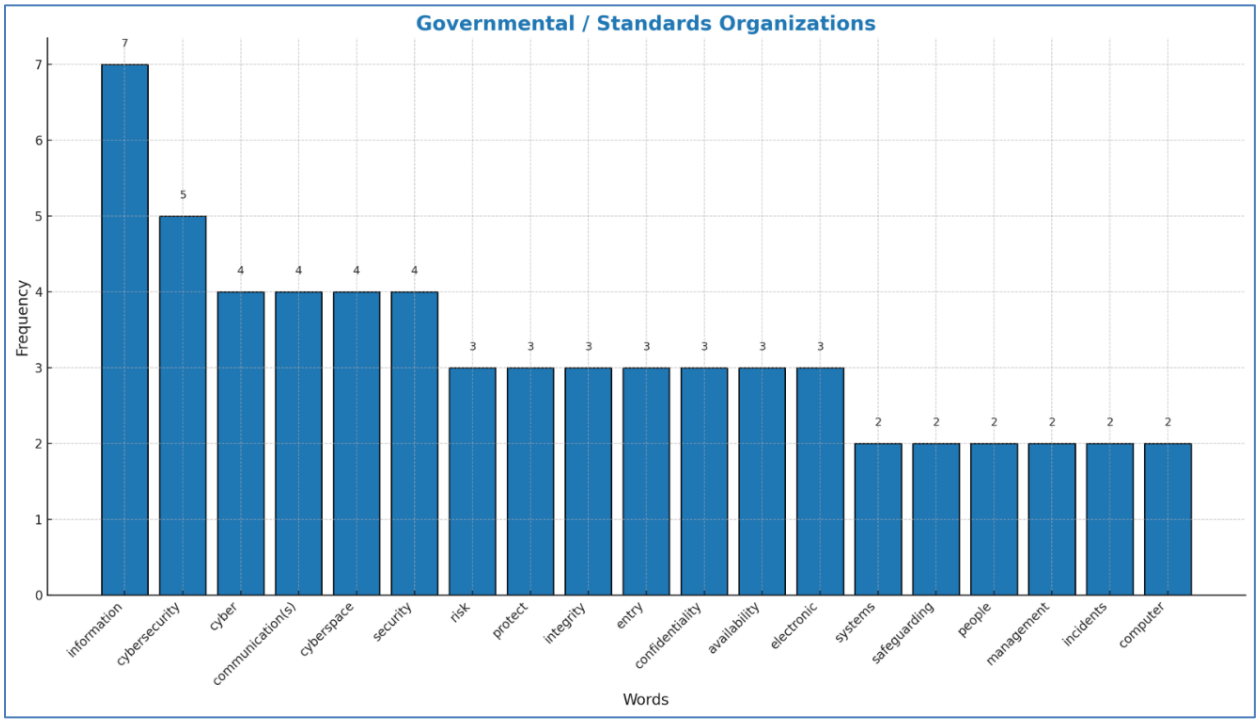

Figure B-2: Governmental / standards organizations word frequency bar graph

The following tech companies' definitions are ordered by company market cap.

Tech Companies – Cybersecurity Definitions	
Microsoft	"Cybersecurity is a set of processes, best practices, and technology solutions that help you protect critical systems, data, and network from digital attacks." (Microsoft, n.d.)
Google	"Cybersecurity protects the data and integrity of computing assets belonging to or connecting to an organization's network. Its purpose is to defend those assets against all threat actors throughout the entire life cycle of a cyber attack." (Google, 2025)
Amazon	"Cybersecurity is the practice of safeguarding computers, networks, software applications, critical systems, and data from potential digital threats." (Amazon, n.d.)
Broadcom	"Cybersecurity refers to any method used to protect computer systems, networks and programs from digital attacks. The increasing reliance on digital technologies and the interconnected nature of the internet, has made cybersecurity a critical factor in ensuring the confidentiality and integrity of information." (Broadcom, n.d.)
SAP	"Cybersecurity is the practice of protecting networks, devices, applications, systems, and data from cyberthreats." ("Cybersecurity: The Future of Financial Security")
AMD	"Cybersecurity focuses on protecting information in cyberspace. Therefore, in most application scenarios, cybersecurity is essentially a subset of information assurance." (AMD, n.d.)
Cisco	"Cybersecurity is the practice of protecting systems, networks, and programs from digital attacks. These cyberattacks are usually aimed at accessing, changing, or destroying sensitive information; extorting money from users through ransomware; or interrupting normal business processes." (Cisco, n.d.)
Salesforce	"Cybersecurity is an organization's defense against the constant ambush of digital threats. It serves as a shield against online criminals, manipulation, and deceit from both internal and external threats." (Salesforce, n.d.)
IBM	"Cybersecurity refers to any technologies, practices and policies for preventing cyberattacks or mitigating their impact. Cybersecurity aims to protect computer systems, applications, devices, data, financial assets and people against ransomware and other malware, phishing scams, data theft and other cyberthreats." (Lindemulder et al., 2025)
ServiceNow	"Cyber security describes the policies, tools, and roles associated with defending computer systems and data from unauthorized access or disruption." (ServiceNow, 2025)

Table B-3: Tech company definitions for cybersecurity.

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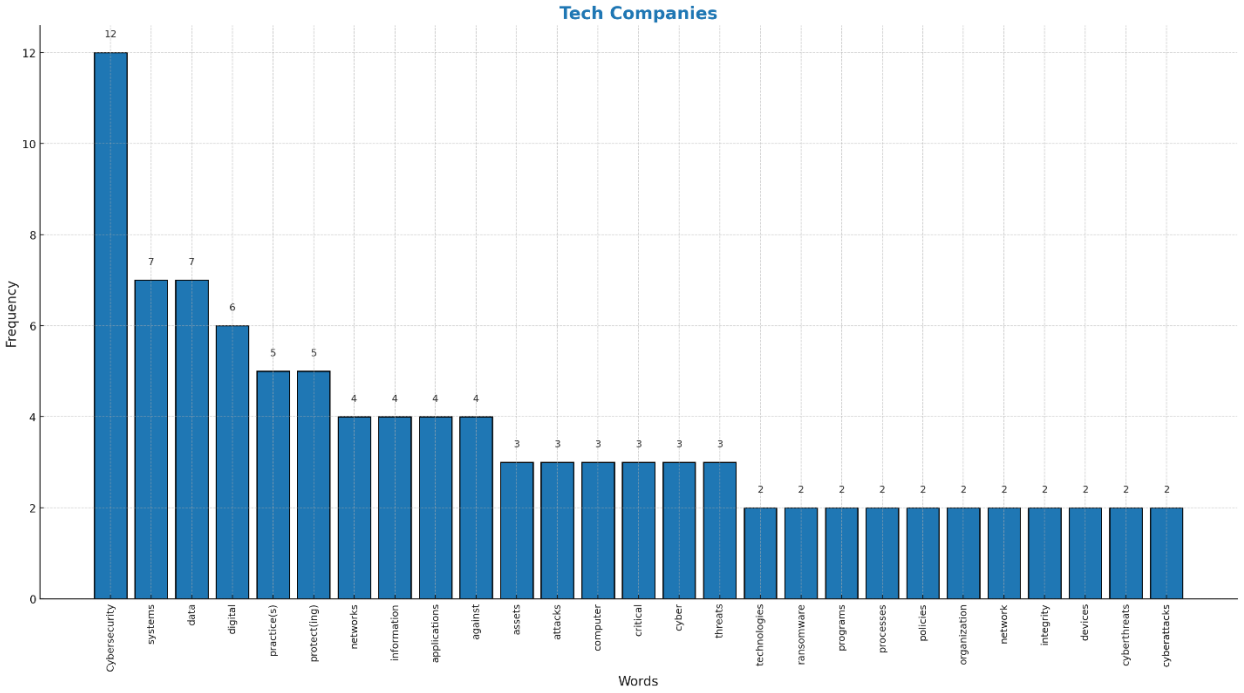

Figure B-3: Tech companies word frequency bar graph

The following cybersecurity companies' definitions are ordered by company market cap.

Cybersecurity Companies – Cybersecurity Definitions	
Palo Alto Networks	"Cybersecurity is the practice of protecting computers, servers, networks, devices, and sensitive data from malicious digital attacks and unauthorized access. It encompasses a comprehensive set of security measures, tools, and best practices to safeguard individual users and organizations from evolving cyber threats." (Palo Alto Networks, 2015)
CrowdStrike	"Cybersecurity is the act of defending digital assets, including networks, systems, computers and data, from cyberattacks." (Cranford, 2025)
Fortinet	"Cybersecurity is the combination of methods, processes, tools, and behaviors that protect computer systems, networks, and data from cyberattacks and unauthorized access. Although deeply rooted in technology, the effectiveness of cybersecurity also very much depends on people." (Fortinet, n.d.)
Cloudflare	"Cyber security is the practice of protecting networks, applications, confidential or sensitive data, and users from cyber attacks." (Cloudflare, n.d.)
Zscaler	"Cybersecurity is the state of being protected in cyberspace, including measures taken to protect computer systems against unauthorized access or attack. It refers to the policies, processes, and technologies to protect networks, devices, and data from cybercrime and data breaches. Today, at an enterprise level, cybersecurity is typically carried out through a security program, including continual risk assessment to see where an organization could be vulnerable." (Zscaler, n.d.)
Okta	"Cybersecurity, also known as information technology (IT) security, is the method of keeping digital systems and information safe from potential threats. Cybersecurity models often include layers of protection involving multiple domains. Cyber threats can come from inside or outside of an organization. As such, cybersecurity measures should be comprehensive and multifaceted. Cybersecurity needs to protect networks, devices, data, and communications from access to unauthorized users. It should strive to guarantee confidentiality and privacy, data integrity, and the availability of data when authorized." (Okta,

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	2024)
F5	"Cybersecurity is the practice of protecting computer systems, networks, applications, and data from digital threats, malicious attacks, and unauthorized access. It encompasses a range of strategies, technologies, and processes designed to safeguard digital environments from evolving cyber risks." (F5, n.d.)
Akamai	"Cybersecurity is the practice of protecting IT (information technology) networks, systems, data, applications, and devices from attacks. Cyberattacks are typically designed to disrupt business operations, gain unauthorized access to systems, take data or intellectual property, or steal or extort money from organizations. Strong cybersecurity requires a multilayered defense involving technologies, processes, policy, and security expertise to protect organizations from attacks that can result in loss of business and reputation." (Akamai, n.d.)
SailPoint	"Cybersecurity is the practice of using technology, controls, and processes to protect digital networks, devices, and data from unauthorized access by malicious attackers or unintentional activity. It protects the confidentiality, integrity, and availability of information." (SailPoint, 2025)
SentinelOne	"Cybersecurity is the practice of protecting internet-connected systems of hardware, software, and data, from cyber threats. These threats range from ransomware and data theft to phishing scams. Cybersecurity encompasses everything from keeping sensitive information safe to making sure IT systems work properly." (SentinelOne, 2025)

Table B-4: Cybersecurity company definitions for cybersecurity.

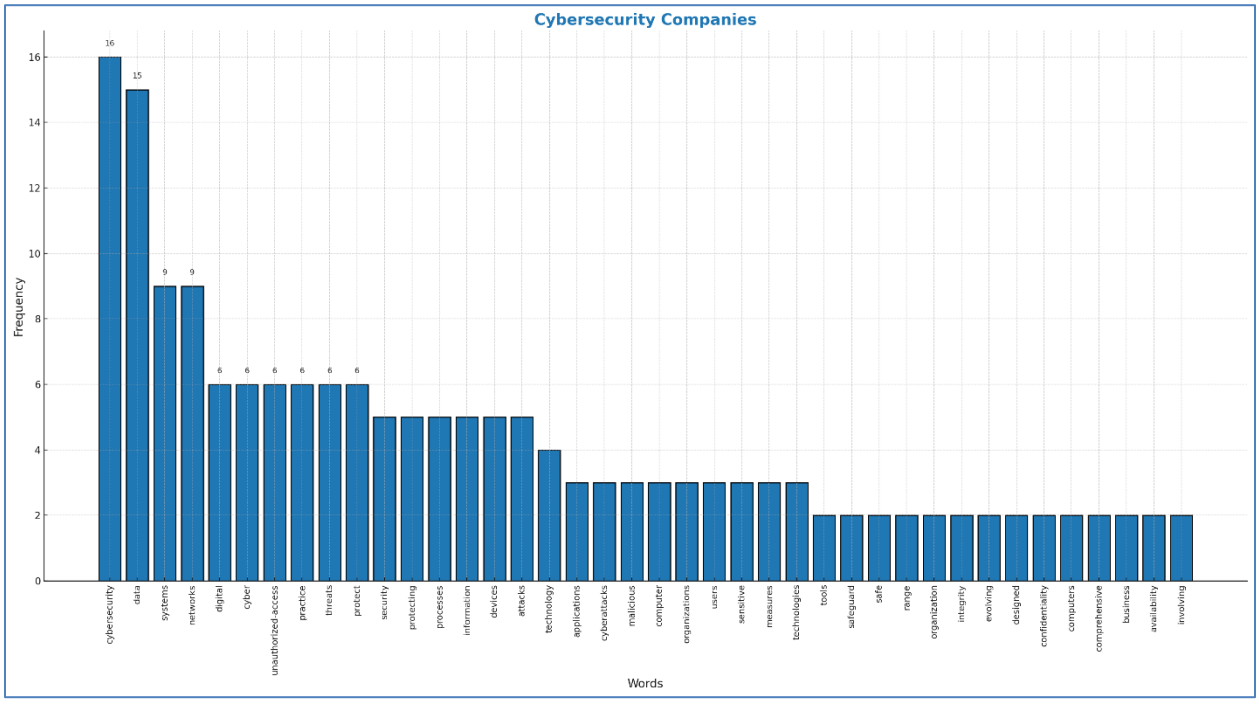

Figure B-4: Cybersecurity companies' word frequency bar graph.

The following academic paper definitions are ordered by publishing year.

Academic Papers – Cybersecurity Definitions	
Canongia & Mandarino (2014) Cybersecurity: The New Challenge of the Information Society	"The art of ensuring the existence and continuity of the Information Society of a nation, guaranteeing and protecting, in Cyberspace, its information assets and critical infrastructure." (Canongia & Mandarino, 2014)

Craigen, Diakun-Thibault & Purse (2014) Defining Cybersecurity	"Cybersecurity is the organization and collection of resources, processes, and structures used to protect cyberspace and cyberspace-enabled systems from occurrences that misalign de jure from de facto property rights." (Craigen, Diakun-Thibault, & Purse, 2014, p. 14)
Schatz, Bashroush, & Wall (2017) Towards a More Representative Definition of Cyber Security	"The approach and actions associated with security risk management processes followed by organizations and states to protect confidentiality, integrity and availability of data and assets used in cyber space. The concept includes guidelines, policies and collections of safeguards, technologies, tools and training to provide the best protection for the state of the cyber environment and its users." (Schatz, 2017, p. 66)
Li & Liu (2021) A comprehensive review study of cyber-attacks and cyber security; Emerging trends and recent developments	"Cyber-security includes practical measures to protect information, networks and data against internal or external threats." (Li & Liu, 2021, p. 8181)
Alexei & Alexei (2022) The Difference between Cyber Security vs. Information Security	"From the definitions presented above, it can be concluded that cyber security is an umbrella term, which includes several types of security, the common property of which is the connection to communication networks, the services provided to users are electronic services because cyber security does not exist outside cyberspace." (Alexei & Alexei, 2022, p. 78)
Cains, Flora, Taber, King & Henshel (2022) Defining Cyber Security and Cyber Security Risk within a Multidisciplinary Context using Expert Elicitation	"Cybersecurity is the iterative process of maintaining quantifiable levels of cyber system dependability and control over verifiable data provenance, confidentiality, integrity, and accessibility (CIA) via comprehensive system awareness, human factor and effects characterization, resource protection and management, accurate intrusion detection, threat prediction and prevention, resilient system functionality, and systemic solutions in a cost-limited environment of socio-technical interactions between diverse dimensions and factors, despite evolving security standards and variations in security competence." (Cains, et al., 2022, p. 1648)
Schiliro' (2023) Towards a Contemporary Definition of Cybersecurity	"Cybersecurity is the collection and concerting of resources including personnel and infrastructure, structures, and processes to protect networks and cyber-enabled computer systems from events that compromise the integrity and interfere with property rights, resulting in some extent of the loss." (Schiliro', 2023, p. 2)

Table B-5: Academic paper definitions for cybersecurity.

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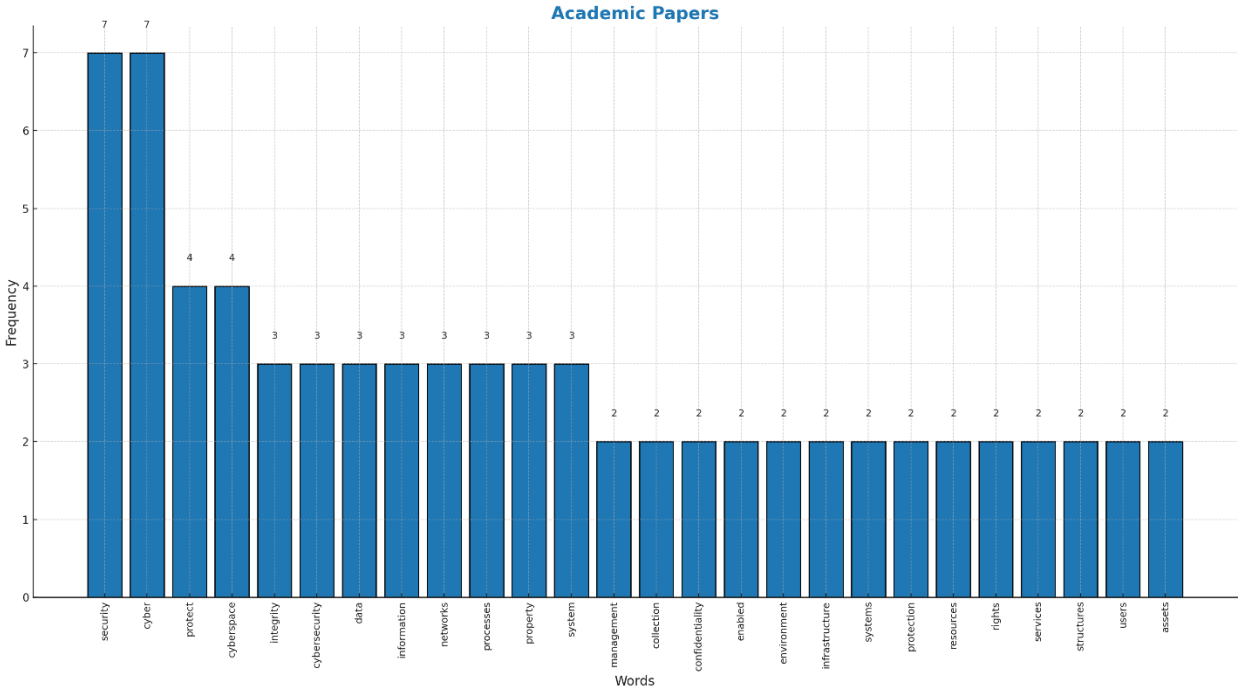

Figure B-5: Academic papers / reports word frequency bar graph

The following university definitions are ordered by the university's order in the Top 10 list.

Academic Institutions – Cybersecurity Definitions	
University of California, Berkeley	"Cybersecurity comprises a set of technologies and practices that ensure the availability, integrity, and confidentiality of information percolating through digital systems, networks, devices, and sensors." (University of California, Berkeley, n.d.)
Stanford University	""Cybersecurity" means prevention of damage to, protection of, and restoration of computers, electronic communications systems, electronic communication services, wire communication, and electronic communication, including information contained therein, to ensure its availability, integrity, authentication, confidentiality, and non-repudiation." (Stanford University, n.d.)
MIT – Massachusetts Institute of Technology	"Cybersecurity is defined as the practice of defending cyber infrastructures such as computers, servers, mobile devices, and IoT devices; as well as the data itself, from attack." (Massachusetts Institute of Technology, n.d.)
Carnegie Mellon University	"Cybersecurity is a set of principles and practices designed to safeguard your computing assets and online information against threats." (Carnegie Mellon University, n.d.)
University of Cambridge	"Cyber security is defined by the National Institute of Science and Technology (NIST) as the 'ability to protect or defend the use of cyberspace from cyber attacks'…" (University of Cambridge, n.d.)
Georgia Institute of Technology	"Georgia Tech Cyber Security works with campus units to identify and neutralize attacks on campus IT resources and data, educate users to cyber threats, and ensure compliance with information security laws and policies." (Georgia Institute of Technology, n.d.)
Harvard University	"Cybersecurity is a branch of computer science focused specifically on detecting, responding to, and preventing cyber

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	attacks. It requires a high level of technical skills to understand computer systems, networks, and data privacy." (Harvard University, n.d.)
University of Illinois Urbana-Champaign	"The Information Technology Security Policy (INFOSEC) establishes high-level information security requirements... and promotes information security in all its practices."(University of Illinois Urbana-Champaign, n.d.)
University of Texas at Austin	"It is the policy of the university to protect Information Resources based on risk... and assure the confidentiality, integrity, and availability of university data." (University of Texas at Austin, n.d.)
New York University	"Cybersecurity is a broader concept that encompasses the protection of computer systems, networks, and data from theft, damage, or unauthorized access. It involves safeguarding not only personal data but also the overall integrity, availability, and confidentiality of information and systems. Cybersecurity measures include implementing firewalls, encryption, antivirus software, and other technologies to prevent, detect, and respond to cyber threats." (New York University, n.d.)

Table B-6: Academic institution definitions for cybersecurity.

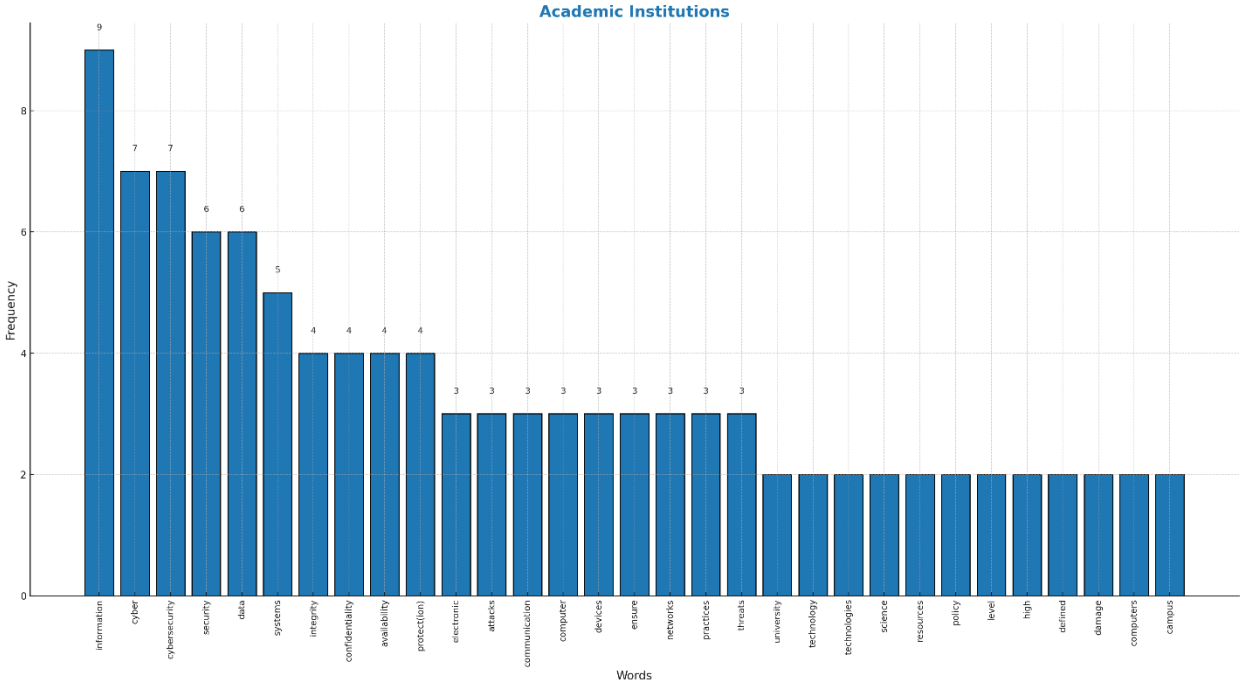

Figure B-6: Academic institutions word frequency bar graph.

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The following generative AI (GenAI) definitions are ordered alphabetically by the GenAI name.

Generative AI – Cybersecurity Definitions	
ChatGPT	"Cybersecurity is the practice of protecting systems, networks, and data from digital attacks, unauthorized access, and damage." (OpenAI, 2025.)
Claude	"Cybersecurity is the practice of protecting digital systems, networks, and data from unauthorized access, attacks, and damage." (Claude, 2025.)
DeepSeek	"Cybersecurity is the practice of protecting systems, networks, programs, and data from digital attacks, unauthorized access, or damage." (DeepSeek, 2025.)
Google Gemini	"Cybersecurity is the practice of protecting systems, networks, and data from digital attacks." (Google, 2025.)
Meta AI	"Cybersecurity is protecting digital information, networks, and systems from unauthorized access, use, disclosure, disruption, modification, or destruction." (Meta AI, 2025.)
Microsoft CoPilot	"Cybersecurity is the practice of protecting systems, networks, and data from digital threats, such as cyberattacks, unauthorized access, and data breaches. It involves strategies, technologies, and best practices to ensure confidentiality, integrity, and availability of information. In short, it's the defense system for the digital world." (Microsoft, 2025.)
Perplexity	"Cybersecurity is the practice of protecting systems, networks, devices, and data from unauthorized access, digital attacks, or criminal use." (Perplexity, 2025.)

Table B-7: Generative AI definitions for cybersecurity.

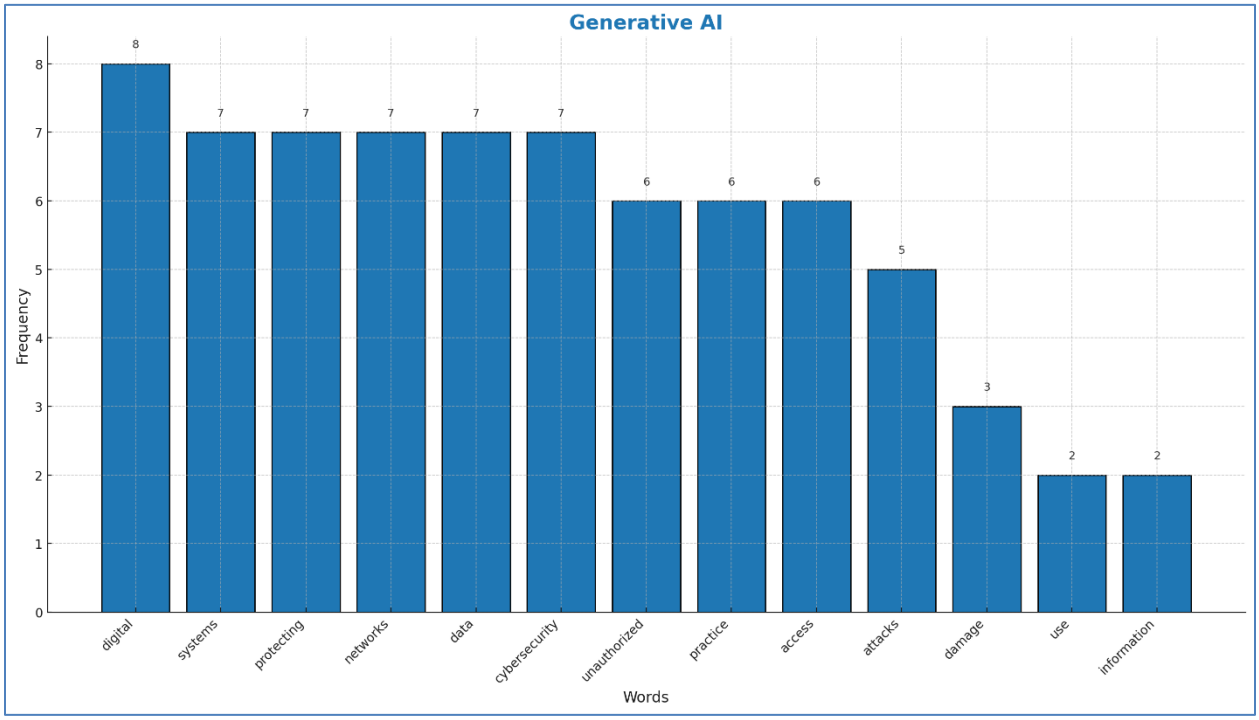

Figure B-7: Generative AI word frequency bar graph