MIT Libraries | DSpace@MIT

MIT Open Access Articles

The Cybersecurity Skills Survey: Response to the 2020 SIM IT Trends Study

The MIT Faculty has made this article openly available. ***Please share*** how this access benefits you. Your story matters.

Citation: Sumner, Mary, Mazzola, Dan and Pearlson, Keri. 2021. "The Cybersecurity Skills Survey: Response to the 2020 SIM IT Trends Study."

As Published: https://doi.org/10.1145/3458026.3462153

Publisher: ACM|Proceedings of the 2021 Computers and People Research Conference

Persistent URL: https://hdl.handle.net/1721.1/145966

Version: Final published version: final published article, as it appeared in a journal, conference proceedings, or other formally published context

Terms of Use: Article is made available in accordance with the publisher's policy and may be subject to US copyright law. Please refer to the publisher's site for terms of use.

Massachusetts Institute of Technology

The Cybersecurity Skills Survey: Response to the 2020 SIM IT Trends Study

Chris Maurer
McIntire School of Commerce
University of Virginia
Charlottesville, VA
csm9y@comm.virginia.edu

Mary Sumner
Computer Management & Information Systems
Southern Illinois University Edwardsville
Edwardsville, Illinois
msumner@siue.edu

Dan Mazzola
Information Systems
Arizona State University
Tempe, AZ
dan.mazzola@asu.edu

Keri Pearlson
Center for Cybersecurity Research
MIT
Cambridge, MA
kerip@mit.edu

Tim Jacks
Computer Management & Information Systems
Southern Illinois University Edwardsville
Edwardsville, IL
tjacks@siue.edu

ABSTRACT

The Cybersecurity Skills Survey was developed and implemented to respond to the high demand for cybersecurity professionals, noted by the findings of the 2017, 2018, 2019, and 2020 SIM (Society for Information Management) IT Trends and Issues Study. These findings were based upon input from over 1,000 IT leaders representing 37 SIM Chapters. The goals of the cybersecurity skills survey were to identify: (1) What technical skills are needed for entry-level professionals in cybersecurity jobs? (2) What professional skills are needed for entry level professionals in cybersecurity jobs? (3) What technical skills are needed for early-career professionals in cybersecurity jobs? and (4) What professional skills are needed for early-career professionals in cybersecurity jobs? The survey findings provide key insights into in-demand skills and "difficult-to-find" competencies. This paper reports on 99 responses captured from IT leaders representing the SIM Chapters in St. Louis, Austin, Milwaukee, and Phoenix, and is part of an ongoing data collection effort to include the Chapters in Tampa, Los Angeles, Houston, Chicago, and Boston. Dialogues between academic professionals and industry leaders in each of these professional communities are contributing to meeting the demand for talented cybersecurity graduates.

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the Owner/Author.
SIGMIS-CPR '21, June 30, 2021, Virtual Event, Germany
© 2021 Copyright is held by the owner/author(s).
ACM ISBN 978-1-4503-8406-3/21/06.
https://doi.org/10.1145/3458026.3462153

CCS CONCEPTS

•Professional topics, Computing education, IT education

KEYWORDS

Cybersecurity, IT workforce, Technical skills, Professional skills

ACM Reference format:

Chris Maurer, Mary Sumner, Dan Mazzola, Keri Pearlson, and Tim Jacks. 2021. The Cybersecurity Skills Survey: Response to the 2020 SIM IT Trends and Issues Study. In *Proceedings of the 2021 Computers and People Research Conference (SIGMIS-CPR '21), June 30, 2021, Virtual Event, Germany,* 3 pages. https://doi.org/10.1145/3458026.3462153

1. INTRODUCTION

SIM, the Society for Information Management, has 37 Chapters with over 5,000 IT Leaders and Chief Information Officers in the United States. In the 2020 SIM IT Trends Study, Cybersecurity remains the #1 concern for CIO's and IT Leaders within organizations for the 4th year in a row. The overwhelming importance of the cybersecurity issue is combined with the high demand for IT talent in cybersecurity roles. Recent data on IT workforce trends cited in Forbes magazine indicates a shortage of cybersecurity professionals in the order of magnitude of 3.5 million jobs globally by 2021 (Sayegh, 2020). This "talent gap" challenges academic professionals and IT industry leaders to work together to identify in-demand skills for cybersecurity jobs and to develop programs which meet industry needs for trained graduates.

In June, 2020, the SIM Academic Council organized a research group to identify research opportunities addressing the Key Trends and Issues identified in the SIM IT Trends Studies. The SIM Academic Council consists of academic professionals who are interested in developing research which is relevant to practice and which addresses the concerns of IT leaders and SIM members. The talent gap in cybersecurity represented a key issue for further investigation. The cybersecurity research group decided to develop a survey to determine the skills needed by cybersecurity professionals in order to better meet these needs.

3. RESEARCH QUESTIONS

1. What technical skills are needed for entry-level professionals in cybersecurity jobs?
2. What professional skills are needed for entry level professionals in cybersecurity jobs?
3. What technical skills are needed for early-career professionals in cybersecurity jobs?
4. What professional skills are needed for early-career professionals in cybersecurity jobs?

4. METHOD

In June, 2020, the cybersecurity research group developed an on-line survey to identify cybersecurity skills, knowledge, and competencies for both entry-level candidates and early-career professionals (with 3 – 5 years' experience). The survey includes an assessment of technical skills and soft skills. Between August and October, 2020, the cybersecurity research team rolled out the cybersecurity survey within SIM Chapters in St. Louis, Milwaukee, Austin, and Phoenix.

5. TECHNICAL SKILLS

The 99 respondents representing the St. Louis, Milwaukee, Austin, and Phoenix professional groups were both SIM and ISACA Chapter members. More than 15 industries were represented, with a range from $5 Million to more than $5 Billion in Revenue, and a range of fewer than 100 to more than 10,000 FTE's (full-time equivalent employees). The technical skills needed for entry-level and early-career personnel are:

Entry-Level %	Technical Skills	Early Career %
63.8%	Cybersecurity Frameworks	72.4%
41.9%	Risk assessment	44.8%
41.0%	Tools to detect/identify issues	37.9%
36.2%	Cloud technologies	41.5%
36.2%	Vulnerability assessment	42.5%
36.2%	Operating Systems	20.7%
31.4%	Incident Response	35.6%
27.6%	Regulatory/legal requirements	42.5%
24.8%	Networking / telecom	16.1%

6. PROFESSIONAL SKILLS

In terms of Professional Skills needed for entry-level and early-career cybersecurity roles, the top skill for both entry-level and early-career roles was Critical Thinking. This was followed by Attention to Detail and Problem-Solving Skills; Collaboration and Teamwork.

Entry Level Percent	Professional Skills	Early Career Percent
73.3%	Critical thinking	69.0%
61.9%	Attention to detail	35.6%
58.1%	Collaboration / teamwork	49.4%
54.3%	Problem solving	49.4%
41.0%	Written communication	42.5%
39.0%	Oral communication	44.8%
35.2%	Self-learner	26.4%
24.8%	Innovative thinking	33.3%
15.2%	Time/project mgmt	27.6%
12.4%	Customer relationship mgmt	21.8%

In the open dialogues between practitioners and academic professionals, there was a preference for individuals who are self-learners, or life-long learners. Communications skills, including oral and written communications, were considered important for both entry-level and early-career cybersecurity professionals. Time management and project management were more important skills for early-career professionals.

7. PRIMARY TAKEAWAYS

Entry-level positions rely more on operational skills/knowledge. Both technical skills and professional skills were difficult-to-find. These "difficult-to-find" skills included cloud technologies, cybersecurity frameworks, and vulnerability assessment at the entry-level, and both risk assessment and cloud technologies at the early-career level. Professional skills (critical thinking, problem-solving) are more difficult to find than tangible/operational skills. One of the biggest implications from both the data and from the discussion sessions is that curriculum must firmly embed professional skill development within technical skills development. While we see that understanding the fundamentals is important to landing early jobs in this field, we have evidence that employers find it just as difficult to find talent possessing strong professional skills that are contextualized to the field of cybersecurity. General writing courses in an undergrad curriculum are not enough – institutes of higher ed need to evaluate their curriculum on both their ability to meet

technical learning objectives as well as professional skill-related learning objectives throughout the entire curriculum. In addition, demonstrating understanding of cybersecurity roles and responsibilities is important.

8. REFERENCES

[1] Aasheim, Cheryl L; Williams, Susan; Butler, E Sonny. (2009). "Knowledge and Skill Requirements For IT Graduates," *The Journal of Computer Information Systems* 49:3, 48-53.

[2] Chia-An, Chao, Shih, Stephen C., (2005). "Organizational and End-User Information Systems Job Market: An Analysis of Job Types and Skill Requirements," *Information Technology, Learning, and Performance Journal* 23:2, 1-15.

[3] Gallivan, Michael, Truex, Duane, and Kvasny, Lynette, (2004). "Changing patterns in IT skill sets 1988-2003: a content analysis of classified advertising," *ACM SIGMIS Database*, 35:3, 64-87.

[4] Hawk, Stephen, Kaiser, Kate, Goles, Tim, Bullen, Christine, and Simon, Judith, (2012). "The Information Technology Workforce: A Comparison of Critical Skills of Clients and Service Providers," *Information Systems Management*, 29:1, 2.

[5] Kappelman, L., McLean, E., Johnson, V., Torres, R., Maurer, C., Snyder, M., Kim, K., and Guerra, K. (2020). "The 2020 SIM IT Trends Study. The 2021 Comprehensive Report: Issues Investments, Concerns, and Practices of Organizations and their IT Executives." http://www.simnet.org/IT-Trends.

[6] Lee, Kyootai and Mirchandani, Dinesh A. (2010). "Dynamics of the Importance of IS/IT Skills," *The Journal of Computer Information Systems*, 50:4, 67-78.

[7] Todd, Peter A; McKeen, James D; Gallupe, R Brent (1995). "The evolution of IS job skills: A content analysis of IS job," *MIS Quarterly*, 19:1, 1-27.

[8] Sumner, Mary and Niederman, F. (2019). "Resolving the IS Skills Paradox: A Content Analysis of a Jobs Database." Proceedings of the ACM SIG MIS 2019 Conference. ACM Digital Library.