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UNDERSTANDING THE CYBERSECURITY SKILLS SHORTAGE

An Analysis of Employer and Jobseeker Skills and Occupational Demographics

CISOs Seek Security Architects Who Are More Strategic and Possess Soft Skills

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EXECUTIVE SUMMARY

This report is part of a series that appraises various cybersecurity occupations using natural language processing (NLP).[1] This particular study examines the role of a security architect from the vantage point of both employers and jobseekers. Findings show that the security architect is seen as strategic, with employers seeking analytical and leadership soft skills and more generalist hard skills that point in the direction of strategic risk management.

Core takeaways from the analysis include:

EMPLOYERS

- **A wide variety of hard and soft skills are referenced** in security architect job ads, with no single skill appearing on as many as half of the listings analyzed. Employers cite almost twice as many hard skills versus soft skills.

- The hard skills employers include in job ads tend to be more strategic versus tactical (risk management and security standards versus Linux, Python, etc.), an indication that employers want security architects who possess a **bigger picture of the business** and architect security with **risk management** and **security standards** in mind.

- In terms of soft skills, the **Analytical** and **Communications/Interpersonal Quadrants** appear the most often. Analytical Quadrant skills comprise **3 of the top 6** and **7 of the top 20** soft skills. While **Communications/Interpersonal Quadrant** skills appear sparsely in half of job ads, they appear in a **high frequency in one-quarter.**

JOBSEEKERS

- Jobseekers list **three times** more hard skills than soft skills in their resumes. Not surprisingly, hard skills comprise **17 of the top 20** skills.

- The majority of hard skills cited by jobseekers are **tactical** (testing, firewall, windows, SQL, etc.). **Fewer than half** of jobseekers include **strategic hard skills** on resumes (integration, risk management, security architecture, etc.).

- **Leadership** and **planning** are the most commonly cited soft skills, appearing in more than 40% of resumes.

COMPARISON OF EMPLOYERS VS. JOBSEEKERS

- Jobseekers and employers **both list approximately 5 soft skills** in their resumes and job ads, but j**obseekers list twice as many hard skills** as employers (16 vs. 8), and the skills they list tend to be more tactical compared to strategic skills sought by employers.

- **Skills listed more by jobseekers** than employers almost entirely relate to familiarity with specific systems, experience with tactical processes, and knowledge of specific regulations and industry standards. **Skills listed in job ads but often omitted by applicants** include soft skills in the Analytical Quadrant and more high-level hard skills around security best practices.

DEMOGRAPHICS

- Employers request just **one college degree**, whereas **88%** of jobseekers claim a degree. Jobseekers list **four-plus certifications** on their resumes, whereas employers request an average of two. This is unlikely a representation that employers value certifications less, but rather only reference those that relate to their **specific business requirements.**

- Career tenure is longer than some other IT jobs, with an **average of 3.9 years per job.** However, the average currently posted resume shows **more than one job in the past year.** The typical resume depicts a midcareer professional with 19 years of experience who started out during the initial buildout of the Internet.

- Our analysis shows **almost twice as many female-gendered terms** in security architect job ads than male-gendered ones. This contrasts with job ads for most of the other cybersecurity positions we examined, and potentially indicates a desire for well-rounded individuals to fill this role.

> "[The cybersecurity skills shortage] is two things:
>
> • A lack of people working in and entering the cybersecurity industry (this gets talked about A LOT).
>
> • The people who are currently in the industry lack the required skills to perform roles effectively (this is generally forgotten about).[3]

The increasing complexity and importance of cybersecurity mean that skilled security architects are key contributors at almost any organization. Indeed, this role is a critical linchpin in an organization's security strategy, and the growing cybersecurity skills shortage means that competition for talent can be intense.

Overall, we examined hundreds of hard and soft skills found in job ads and resumes for security architect positions. Data reveals that jobseekers list twice as many skills, on average, in resumes as employers cite in job ads—24 and 12, respectively.

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WHAT SKILLS MATTER TO EMPLOYERS

Beyond "security architecture," a number of hard and soft skills were fairly evenly distributed in between 15% and 30% of listings. This diversity of skills listed from ad to ad is a likely indication that organizations customize their skills mix for the security architect position according to the individual organization's structure and culture. Employers list 82% more hard skills than soft skills in job ads—8.3 hard skills to 4.55 soft skills.

TOP SKILLS—HARD, SOFT, AND IN AGGREGATE

Among soft skills, leadership is the most common trait employers request, followed by analytical, planning, and research skills. These skills enable professionals to confidently and effectively build systems and processes to ensure optimal risk management.

The most commonly cited hard skills paint a picture of a well-rounded technologist with strategic as well as tactical skills. Broader, more strategic skills—security architecture, risk management, integration—were more frequently mentioned in job ads than more tactical skills such as encryption, firewall, and security controls.

RANK	TOP HARD & SOFT SKILLS COMBINED	TOP HARD SKILLS	TOP SOFT SKILLS
1	Security Architecture, 45%	Security Architecture, 45%	Analytical, 25%
2	Risk Management, 30%	Risk Management, 30%	Planning, 23%
3	Integration, 28%	Integration, 28%	Research, 23%
4	Security Standards, 28%	Security Standards, 28%	Interpersonal, 20%
5	Analytical, 25%	Encryption, 25%	Mentor, 20%
6	Encryption, 25%	Firewall, 23%	Problem Solving, 20%
7	Firewall, 25%	Security Controls, 23%	Collaboration, 18%
8	Planning, 23%	Testing, 23%	Integrity, 18%
9	Research, 23%	IdAM (Identity and Access Management), 20%	Leadership, 15%
10	Security Controls, 23%	Security Best Practices, 20%	Communications, 15%
11	Testing, 23%	Security Policies, 20%	Focused, 15%
12	IdAM (Identity and Access Management), 20%	Project Management, 18%	Business Process, 13%
13	Interpersonal, 20%	Security Systems, 18%	Assess, 10%
14	Mentor, 20%	DevOps, 15%	Coach, 10%
15	Problem Solving, 20%	Governance, 15%	Writing, 10%
16	Security Best Practices, 20%	Linux, 15%	Flexible, 8%
17	Security Policies, 20%	Python, 15%	Multitask, 8%
18	Collaboration, 18%	HIPAA, 13%	Prioritize, 8%
19	Integrity, 18%	Maintenance, 13%	Adaptable, 5%
20	Leadership, 18%	AWS, 10%	Change Management, 5%

TOP 20 HARD AND SOFT SKILLS FOR EMPLOYERS

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SOFT SKILLS QUADRANTS

Employers also commonly list a number of soft skills. This is consistent with research that shows that even for very technical positions, soft skills are crucial for employers in their search for the best candidate.[4] As part of the data analytics portion of this project, we logged a couple hundred different soft skills that appear in job ads and resumes. Then, based on a quadrant matrix, we broke them into four categories and placed each soft skill into one of the four quadrants: 1) Leadership, 2) Communications/Interpersonal, 3) Analytical, and 4) Personal Characteristics.

ANALYTICAL

1.55 Average Number of Skills Per Job Ad

68% Occurrence in Job Ads

0

1-3

4+
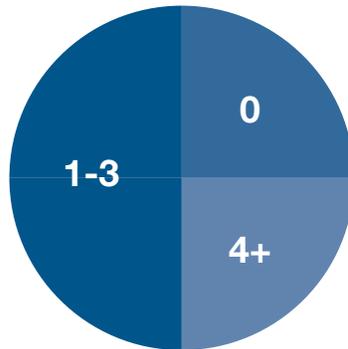
LEADERSHIP

1.12 Average Number of Skills Per Job Ad

55% Occurrence in Job Ads

1-2

3+

0
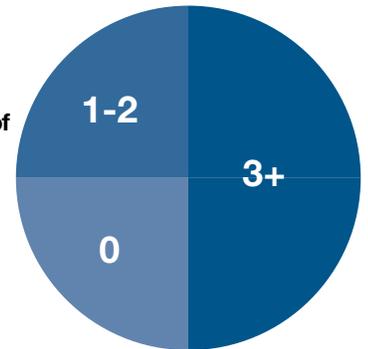
PERSONAL CHARACTERISTICS

0.68 Average Number of Skills Per Job Ad

43% Occurrence in Job Ads

3-4

0-2

5+
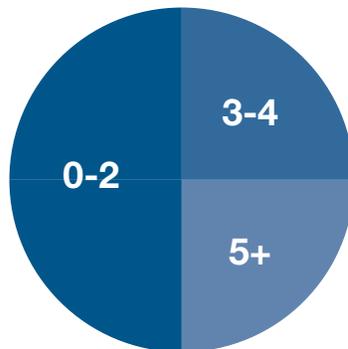
COMMUNICATIONS/INTERPERSONAL

1.2 Average Number of Skills Per Job Ad

45% Occurrence in Job Ads

3-4

0-2

5+
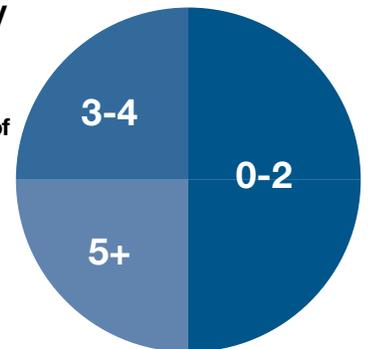
JOB AD SOFT SKILLS QUADRANT MATRIX

No single soft skill was found on more than one-quarter of security architect job ads, and the distribution was relatively even among the top 11 soft skills—all of which appeared on between 15% and 25% of listings. Those top 11 fall neatly into the four quadrants:

- 3 in Analytical (analytical, research, problem solving)
- 3 in Leadership (planning, mentor, leadership)
- 3 in Communications/Interpersonal (interpersonal, collaboration, communications)
- 2 in Personal Characteristics (integrity, focused)

Perhaps not surprisingly, analytical skills are the most commonly referenced soft skills—with 7 of the top 20 soft skills belonging to this category, including 3 of the top 6. The ability to analyze (25%), research (23%), and solve problems (20%) is critical to the role—and speed is often of the essence. Leadership skills are also cited in more than half of job ads, and represent 5 of the top 20 soft skills. Planning (23%) and mentoring (20%) are the most commonly cited skills in this quadrant.

While somewhat less prevalent, skills from the other two quadrants appear on nearly half of the listings reviewed. Interpersonal (20%), collaboration (18%), and communications (15%) were the most commonly requested skills in the Communications/Interpersonal category, while integrity (18%) and focus (15%) were the most common personal characteristics. Interestingly, resumes that included Communications/Interpersonal skills at all often included several, with one-quarter of the total including three or more such skills.

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This broad distribution of soft skills likely stems from the nature of the security architect role, which is both strategic and tactical in nature. With today's complex threat landscape, responding to incidents can easily eclipse important strategic tasks like security integration and automation, and the security architect is often called to "fix the bike while pedaling at the same time." The spread of soft skills in the ads we analyzed paints a picture of a well-rounded professional who is comfortable moving back and forth between the strategic and tactical realms.

EXAMINING THE CANDIDATE: SECURITY ARCHITECT RESUMES

Like the employers they are targeting, jobseekers for security architect roles tend to place more emphasis on hard skills than soft skills, though at a higher ratio—hard skills are cited more than three times more often than soft skills (15.75 to 5). With that in mind, it is no surprise that 17 of the top 20 skills listed on resumes are hard skills. That said, the vast majority of resumes include at least one soft skill.

TOP SKILLS—HARD, SOFT, AND IN AGGREGATE

The most commonly cited hard skills emphasize the tactical side of the security architect role—testing and maintenance of the security infrastructure and experience with specific systems. Fewer than half of applicants cite more strategic hard skills such as integration (45%), risk management (36%), and security architecture (33%). As noted above, the latter is the skill most often cited by employers.

No single soft skill was included on as many as half the resumes reviewed, but the two that come closest—leadership and planning—convey a more strategic approach.

| RANK	TOP HARD & SOFT SKILLS COMBINED	TOP HARD SKILLS	TOP SOFT SKILLS
1	Testing, 63%	Testing, 63%	Leadership, 44%
2	Firewall, 61%	Firewall, 61%	Planning, 42%
3	Windows, 57%	Windows, 57%	Research, 35%
4	Cisco, 53%	Cisco, 53%	Mentor, 26%
5	Linux, 47%	Linux, 47%	Collaboration, 23%
6	Integration, 45%	Integration, 45%	Communication, 23%
7	Leadership, 44%	Maintenance, 40%	Integrity, 18%
8	Planning, 41%	Encryption, 37%	Focused, 15%
9	Maintenance, 40%	Risk Management, 36%	Assess, 14%
10	Encryption, 37%	SQL, 35%	Change Management. 14%
11	Risk Management, 36%	Oracle, 35%	Analytical, 12%
12	SQL, 35%	Security Architecture, 33%	Liaison, 12%
13	Oracle, 35%	Security Policies, 32%	Business Process, 11%
14	Research, 35%	VPN, 31%	Writing, 11%
15	Security Architecture, 33%	Installation, 31%	Consistency, 8%
16	Security Policies, 32%	Project Management, 29%	Partnership, 8%
17	VPN, 31%	IdAM (Identity and Access Management), 28%	Negotiation, 7%
18	Installation, 31%	NIST, 27%	Customer Service, 6%
19	Project Management, 28%	Bro, 26%	Prioritize, 6%
20	IdAM (Identity and Access Management), 28%	SOX, 26%	Service Delivery, 6%

TOP HARD AND SOFT SKILLS FOR SECURITY ARCHITECT JOBSEEKERS

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SOFT SKILLS QUADRANTS

The soft skills listed on resumes most often belong in the Leadership Quadrant, with an average of nearly two skills per resume. A quarter of job ads list four or more Leadership Quadrant skills. In terms of frequency, leadership and planning skills are the most commonly cited soft skills, both appearing on more than 40% of resumes.

Interestingly, the Analytical Quadrant ranks behind the Communications/Interpersonal Quadrant in job ads for average number of skills listed in each resume. In the latter category, the important skills of collaboration and communication ranked above the others. Research is by far the most commonly cited Analytical Quadrant skill, appearing on 35% of resumes. Integrity and focus stand out in the Personal Characteristics Quadrant—but they were cited on only 18% and 15% of resumes, respectively. As with job ads, resumes that contained Communications/Interpersonal Quadrant skills tended to contain several such skills—three or more in 25% of resumes.

ANALYTICAL

1.19 Average Number of Skills Per Job Ad

65% Occurrence in Job Ads

3-4
0-2
5+
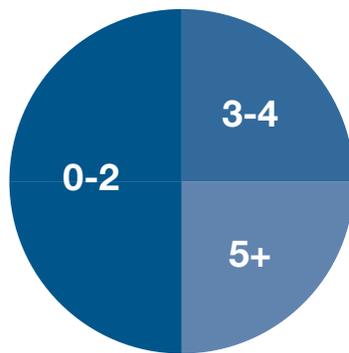
LEADERSHIP

1.93 Average Number of Skills Per Job Ad

72% Occurrence in Job Ads

4-7
0-3
8+
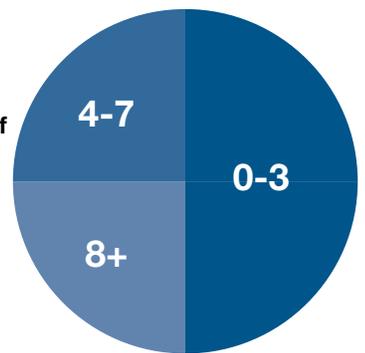
PERSONAL CHARACTERISTICS

0.55 Average Number of Skills Per Job Ad

35% Occurrence in Job Ads

2
0-1
3+
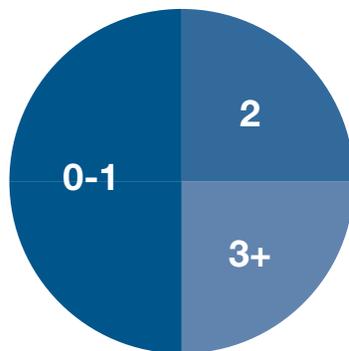
COMMUNICATIONS/ INTERPERSONAL

1.33 Average Number of Skills Per Job Ad

52% Occurrence in Job Ads

3-5
0-2
6+

JOB AD SOFT SKILLS QUADRANT MATRIX

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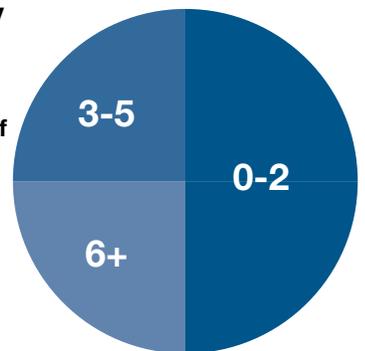
ANALYZING THE GAPS BETWEEN EMPLOYERS AND SECURITY ARCHITECT JOBSEEKERS

While employers and jobseekers both list about the same number of soft skills, applicants list almost twice as many hard skills on their resumes as employers cite in their listings. Despite the fact that jobseekers are listing many more skills, significant gaps exist between what the employers are asking for and what applicants are listing on their resumes—with both hard and soft skills.

Total Skills		Hard Skills		Soft Skills	
12.9	20.8	8.3	15.8	4.6	5.0
Per Job Ad	Per Resume	Per Job Ad	Per Resume	Per Job Ad	Per Resume
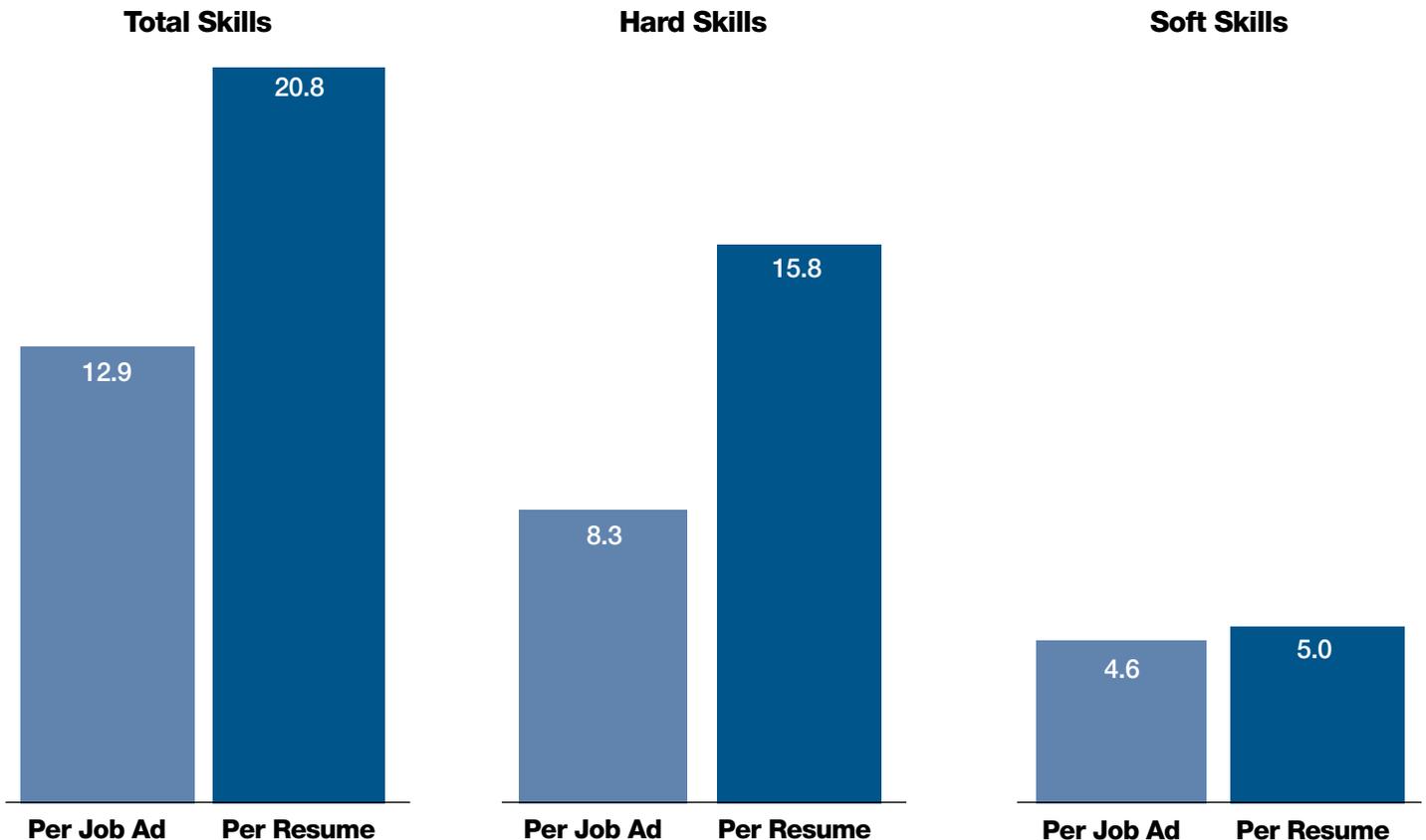
AVERAGE NUMBER OF SKILLS PER JOB AD AND RESUME

HARD SKILL DEVIATIONS

As noted above, jobseekers tend to list the systems with which they're experienced; Cisco, Windows, firewall, Oracle, SQL, and VPN skills appear high on the list of skills on resumes but rank well below the top 20 skills employers value the most. Similarly, tactical skills (testing, maintenance, installation) and industry standards (NIST, SOX, PCI) are more frequently cited on resumes than in job ads. The lack of attention to compliance-related issues likely is the result that security architecture is not seen as directly connected to compliance—namely, other job functions are tasked to manage compliance.

On that note, 19 of the top 20 skills overrepresented in resumes are hard skills, and most are in these more tactical categories. While experience with specific systems and tactical processes was important to many technical roles in the past, they have become less important as cybersecurity has integrated more with the business and the threat landscape requires more of a strategic approach.

It is notable that while many hard skills are overemphasized by jobseekers, many other hard skills are cited more frequently by employers than by jobseekers. Fully half of the top 20 skills that are cited by employers more often than by jobseekers are hard skills. These hard skills tend to be more general and strategic, with the implication that employers are looking for security architects who possess big-picture familiarity with how security works in an enterprise.

SOFT SKILLS DEVIATIONS

Jobseekers overuse the term "leadership" on resumes compared with job ads, perhaps because it is a general term that "sounds good" to include. However, applicants tend to miss other soft skills, particularly in the Analytical Quadrant. The ability to strategize, problem solve, and analyze are critical to a security architect role. And given the cross-functional stakeholders that are affected by changes in security infrastructure, skills in the Communications/Interpersonal Quadrant are key.

SKILLS CITED BY EMPLOYERS MORE OFTEN	SKILLS CITED BY JOBSEEKERS MORE OFTEN
Strategizes, 28%	Cisco, 51%
Interpersonal, 19%	Windows, 50%
Problem Solving, 19%	Testing, 40%
Security Best Practices, 13%	Firewall, 36%
Analytical, 13%	Oracle, 35%
IDS, 12%	Linux, 32%
Security Systems, 12%	SQL, 30%
Security Architecture, 11%	Maintenance, 28%
Security Controls, 9%	Leadership, 27%
Industry Standards, 9%	VPN, 23%
DevOps, 8%	Installation, 23%
Security Standards, 8%	NIST, 22%
Multitasking, 8%	SOX, 20%
Coaching, 6%	Planning, 19%
Flexible, 6%	Integration, 18%
Security Strategy, 6%	PCI, 17%
Python, 5%	IdAM, 16%
Adaptable, 5%	Endpoint Protection, 16%
Organizational Skills, 5%	Bro, 15%
Security Automation, 5%	UNIX, 15%

PERCENT DIFFERENCE IN TOP 20 SKILLS LISTED BY EMPLOYERS AND SECURITY ARCHITECT JOBSEEKERS

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EDUCATION AND CERTIFICATION

The assumption for both employers and jobseekers is that security architects will have one college degree (presumably a bachelor's degree). Rarely does an employer request more than one degree (average of 1.1 degrees requested per job ad). But not all security architect jobseekers hold degrees—12% do not list degrees on their resumes.

When it comes to certifications, the average number requested by employers is approximately two, while jobseekers list an average of 4.42 certifications. Jobseekers have an incentive to list all of their certifications to increase their odds for a match with an employer's requirements, while employers list only those certifications that relate to the open role.

Advanced Educational Degrees Listed

Employers	1.9%
Security Architects	1.5%
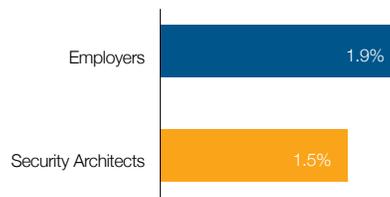
Number of advanced educational degrees listed by employees and security architects on average.

Certifications Listed

Employers	3.6%
Security Architects	6.8%
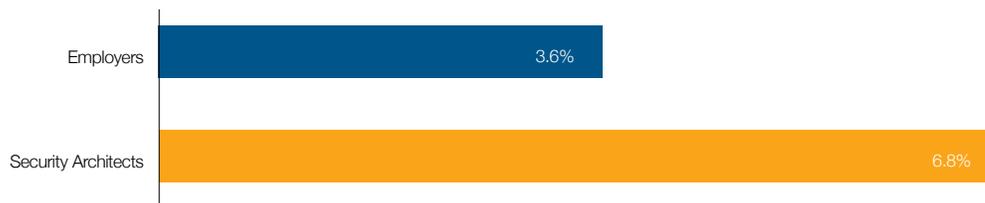
Number of certifications listed by employers and security architects on average.

CAREER TENURE AND JOB-HOPPING

With an average career length of 18.8 years, many of today's security architects are at midcareer and cut their teeth during the initial buildout of the Internet. Our resume analysis shows job-hopping continues to be an issue. The average resume cites nearly two jobs in the past two years, and 25% of the sample had between four and eight jobs over the past five years. In fact, job-hopping seems to be getting worse in recent years, with the average jobseeker having 1.8 jobs over the past two years, but only one additional job over the prior three years (a total of 2.8 jobs over five years).

While the data is mixed as to whether job-hopping is getting worse in the overall economy,[5] it is undoubtedly costly when it does happen. Given the cybersecurity skills shortage, security architects are certainly more of a target for other employers. CISOs do well to be as strategic about retention as they are with recruiting, and ensure that compensation levels remain competitive.


Average Years Since First Job — 18.8 Years
Number of Jobs Held Past 2 Years — 1.8
Number of Jobs Held Past 5 Years — 2.8
Number of Total Jobs on Resume — 6
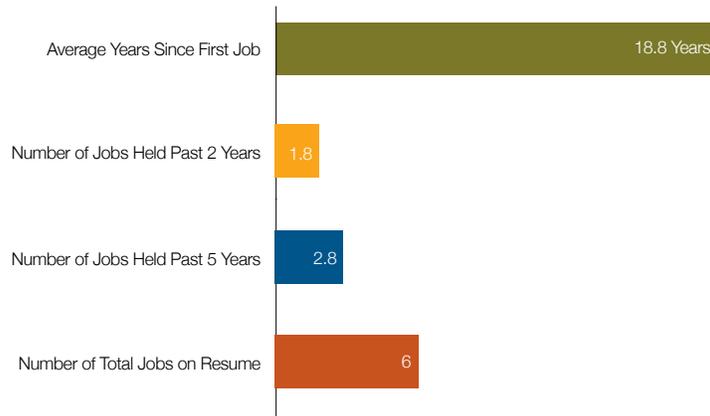
SECURITY ARCHITECT CAREER DEMOGRAPHICS

GENDER GAP

The gender gap in technology is widely noted with concern,[6] and cybersecurity is no exception. A recent study indicates that only 11% of global cybersecurity positions and 14% in North America are held by women.[7] This is unfortunate, because women as a group tend to excel at many of the soft skills that are now recognized as crucial in the field.[8]

Unfortunately, of the resumes we randomly selected and analyzed for security architect positions, only 2.6% belonged to women. Soft skills emphasized by women's resumes in our sample were heavily skewed toward the Leadership Quadrant, which tends to include many male-oriented terms such as "strong" and "leader." However, in job ads, female-oriented terms such as "collaborate," "support," "sensitivity," and "role model" occur at greater rates. This is unusual for the job roles we analyzed for the broader project and may indicate recognition that the security architect role should be held by a well-rounded individual. It also provides some hope that companies will attract more women to the field over time.

Male vs. Female Gendered Language in Job Ads

Male-Gendered Terms — 3.9 Average Per Job Ad
Female-Gendered Terms — 7.3 Average Per Job Ad
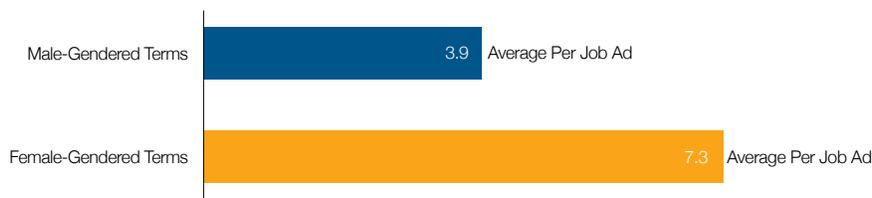
CONCLUDING THOUGHTS

As the threat landscape gets more complex, CISOs come to rely more on their security architects to vet solutions and to design and sustain an architecture that aligns with security, technology, and business requirements. As a result, the security architect role is growing in importance at many organizations, and moving from tactical to strategic in its orientation.

Our analysis shows that jobseekers may be lagging behind employers in this transformation—at least in terms of how they present themselves on their resumes. They will do well to identify strategic hard and soft skills and to highlight those in their cover letters and on their resumes. For employers, the challenge is to define these hard and soft skills carefully, to attract candidates that are a fit in terms of not only technical skills but also soft skills—including characteristics unique to their organizational culture.

In today's enterprise, the security architect will not be successful without a broad, integrated, and automated security architecture in place. The Fortinet Security Fabric enables security teams to focus on proactive threat prevention rather than reactive remediation. For more information on the Fortinet Security Fabric, check out the eBook, "Security Transformation Requires a Security Fabric."[9]

[1] "The CISO Ascends from Technologist to Strategic Business Enabler," Understanding the Cybersecurity Skills Shortage: An Analysis of Employer and Jobseeker Skills and Occupational Demographics, Fortinet, August 3, 2018.

[2] "2016 Cybersecurity Skills Gap," ISACA, January 2016.

[3] "Erin L. Jones, "The Cybersecurity Skills Shortage: What can Organizations Do to Tackle it?" InfoSecurity, February 5, 2018.

[4] Lisa Rabasca Roepe, "Why Soft Skills Will Help You Get The Job And The Promotion," Forbes, August 18, 2018.

[5] David Weedmark, "Career Tenure and the Myth of Job Hopping," The Balance Careers, August 4, 2018.

[6] Gillian Tans, "Why it's vital we close the tech gender gap," World Economic Forum, January 19, 2018.

[7] Elizabeth Weingarten, "The Gender Gap in Cybersecurity Jobs Isn't Getting Better," Slate, March 17, 2017.

[8] Patrick E. Spencer, "The State of the Female CISO, and What Can be Done About It," The CISO Collective, September 6, 2018.

[9] "Security Transformation Requires a Security Fabric," Fortinet, June 1, 2018.

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