

REPORT

# The Head of Network Engineering and Operations: A Highly Strategic and Integrated Technologist

## Understanding the Cybersecurity Skills Shortage

An Analysis of Employer and Jobseeker Skills and Occupational Demographics



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## Executive Summary

This report is part of a series that appraises various IT and cybersecurity occupations using natural language processing (NLP).<sup>1</sup> This particular study examines the role of vice president or director (head) of network engineering and operations from the vantage point of both employers and jobseekers. Findings show that the head of network engineering and operations 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

- Employers mention **a balanced variety of hard and soft skills** in job ads for head of network engineering and operations, with 11 of the 20 most-cited skills identified as soft skills—more than any other job title we surveyed.
- Hard skills referenced in job ads **tend to be strategic rather than tactical in nature**, such as design, software, and operations.
- Employers include **soft skills in the Leadership Quadrant** at double the rate of the other three quadrants. The spread of Leadership Quadrant soft skills indicates the need for skills in people management, program management, and infrastructure management.
- Two specific soft skills in the Communications/Interpersonal Quadrant—**Communications** and **Collaboration**—rank high among the most-cited skills in job listings.

### Jobseekers

- Resumes for candidates seeking network engineering and operations leadership roles **include just over half as many soft skills** on average as employers request in job ads, and only two of the 20 most commonly referenced skills are soft skills.
- The most commonly cited hard skills—design, software, services, and operations—can be construed as strategic, but **most of the other hard skills** commonly mentioned by jobseekers are **very tactical in nature**.
- Jobseekers correctly **emphasize soft skills in the Leadership Quadrant** over other quadrants, and the median resume contained at least one soft skill from each quadrant.

### Comparison of Employers vs. Jobseekers

- 19 of the 20 most overemphasized skills** in resumes for head of network engineering and operations are hard skills, and almost all of them are tactical in nature.
- Jobseekers most commonly fail to include **soft skills in the Leadership and Communications/Interpersonal Quadrants**. With employers emphasizing these in their job ads, this is a definitive gap.
- Resumes for head of network engineering and operations roles also tend to miss **hard skills with a more strategic orientation** such as network optimization and technical design.

### Demographics

- Employers prefer candidates with a post-baccalaureate degree**, while jobseekers strongly tend to have only one degree. Candidates and employers are closer together on job certifications, and the resumes we examined tend to reflect adequate numbers of certifications.
- Jobseekers typically had **just over two jobs in the past five years**, and average job tenure stands at more than four years. Thus, if the past five years is any indication, job-hopping is becoming a greater problem. The typical resume reflects a 22-year length of career to date, indicating candidates who are at midcareer.

### About This Series

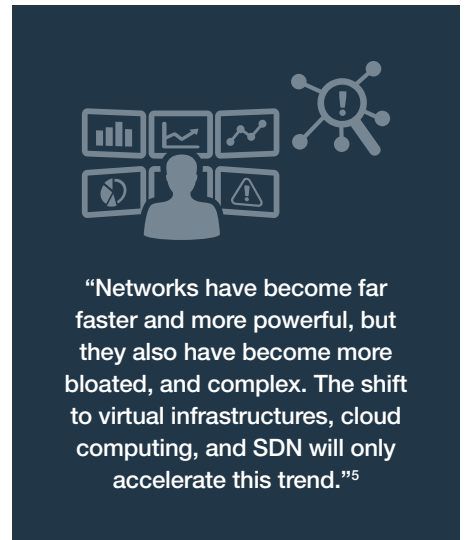
This report series is based on an analysis of thousands of job ads and resumes using natural language processing (NLP) to highlight skill-set gaps (including hard and soft skills), educational attainment and certifications, average career tenure, and gender breakdown. The focus of the series is on cybersecurity and most of the roles are specific to that function. However, in a few instances, such as the vice president or director of network engineering and operations, we included roles where cybersecurity is a part of their functional charter. In the case of the report series, the result is actionable insights for executive hiring leaders that can help them hone their recruiting approach and hire the most qualified candidates.

Network engineering roles are undergoing a transformation as corporate infrastructure moves into the cloud and network traffic flow is defined as much by software as by hardware.<sup>2</sup> At the same time, many network engineering teams are assuming more security responsibilities as the once-isolated functions of networking and security begin to converge.<sup>3</sup> Like their cybersecurity counterparts, network engineers are in high demand,<sup>4</sup> and the leaders of those teams may struggle to keep their teams staffed with top-notch talent.

- Just 1.3% of the resumes we studied belong to women, and job postings reflected a **2-to-1 ratio of male-oriented terms to female-oriented ones**. This is not good news for the effort to close the gender gap in network engineering and operations.

This report covers the leadership role that leads the design and evolution—and often the operation—of an organization’s corporate network. The job title for this role varies from company to company, as do the specific responsibilities. The positions we surveyed were all at the director, senior director, or vice president job grades. The analysis also included at least one of the following category terms: network engineering, network operations, or IT infrastructure. Accordingly, the resumes and job listings we surveyed describe senior IT infrastructure leaders for whom cybersecurity is likely a part of their job description.

We identified hundreds of distinct skills in the head of network engineering and operations resumes and job listings we analyzed. The median job listing included 23 unique skills, while the median resume referenced 32 unique skills. Interestingly, resumes show a larger disparity in the number of skills mentioned than job listings—ranging from fewer than 10 skills to more than 80. The middle 50% of resumes ranged from 18 to 48 skills.



“Networks have become far faster and more powerful, but they also have become more bloated, and complex. The shift to virtual infrastructures, cloud computing, and SDN will only accelerate this trend.”<sup>5</sup>

## What Skills Matter to Employers: Analysis of Job Listings

Network design and leadership tied for the top slot among job skills requested by employers in job ads, each appearing on 73% of those we studied. Communications and operations also appeared on more than two-thirds. Employers included two hard skills (design, operations) and two soft skills (leadership, communications) in their top four, indicating the need for a well-rounded individual in this leadership position.

Rank	Top Hard and Soft Skills Combined	Top Hard Skills	Top Soft Skills
1	Design (73%)	Design (73%)	Leadership (73%)
2	Leadership (73%)	Operations (68%)	Communications (70%)
3	Communications (70%)	Architecture (53%)	Planning (58%)
4	Operations (68%)	Software (48%)	Collaboration (45%)
5	Planning (58%)	Standards (48%)	Overseeing (45%)
6	Architecture (53%)	Services (45%)	Evaluation (38%)
7	Software (48%)	Emerging Technologies (43%)	Scheduling (38%)
8	Standards (48%)	Maintenance (35%)	Analytical (35%)
9	Collaboration (45%)	Reporting (35%)	Complexity (35%)
10	Overseeing (45%)	Procedure Management (35%)	Mentoring (35%)
11	Services (45%)	Training (33%)	Partnership (35%)
12	Emerging Technologies (43%)	Data Center (30%)	Vision (35%)
13	Evaluation (38%)	Hardware (30%)	Interpersonal (28%)
14	Scheduling (38%)	Network Engineering (30%)	Professional (28%)
15	Analytical (35%)	Cloud (28%)	Strategizing (28%)
16	Complexity (35%)	Disaster Recovery (28%)	Time Management (28%)
17	Maintenance (35%)	Networks (28%)	Consultation (23%)
18	Mentoring (35%)	Reliability (28%)	Recommendations (23%)
19	Partnership (35%)	Cisco (25%)	Business Units (18%)
20	Reporting (35%)	Network Operations (25%)	Efficient (18%)

Figure 1: Top 20 hard and soft skills for employers.

## Top Skills—Hard, Soft, and in Aggregate

Among specific soft skills, three were mentioned on more than half of resumes—leadership, communications, and planning. The next tier of soft skills includes collaboration and overseeing—both essential skills for a leadership position. The most commonly cited hard skills portray a big-picture thinker: design, operations, and architecture. Software, standards, services, and emerging technologies are also mentioned on more than 40% of resumes. Rather than specific technical skills, employers recognize the need for a broad and conceptual understanding about how a variety of systems work, and how they can be put together into a coherent whole.

### Soft Skills Quadrants

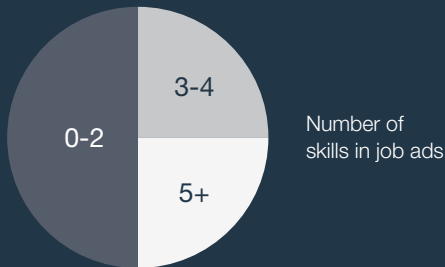
Soft skills account for five of the 10 most-cited skills, and 11 of the top 20. The head of network engineering and operations is the only occupation we surveyed for which the majority of the top 20 skills cited by employers are soft skills.

When soft skills are divided into four quadrants, it becomes apparent that skills in the Leadership Quadrant are most prominent. The median job ad listed five Leadership Quadrant skills, and many listed significantly more.

#### Analytical

**3.0** Average Skills Per Job Ad

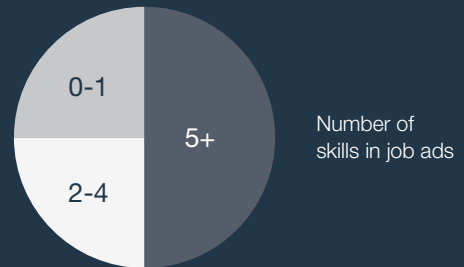
**90%** Occurrence in Job Ads



#### Leadership

**4.8** Average Skills Per Job Ad

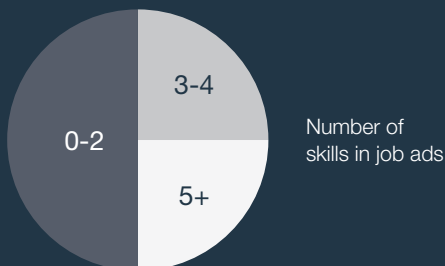
**90%** Occurrence in Job Ads



#### Personal Characteristics

**2.3** Average Skills Per Job Ad

**75%** Occurrence in Job Ads



#### Communications/Interpersonal

**2.9** Average Skills Per Job Ad

**80%** Occurrence in Job Ads

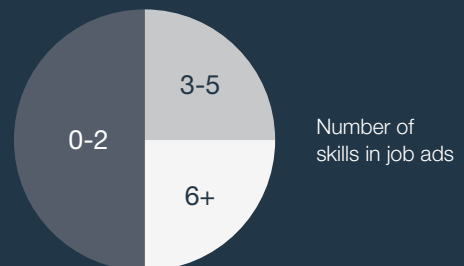


Figure 2: Job ad soft skills quadrant matrix.

That said, the other quadrants are certainly not ignored by employers. The median job listing included approximately two skills each in the Analytical, Personal Characteristics, and Communications/Interpersonal Quadrants—with some employers including a much higher number in one or more of the quadrants. The emphasis on leadership skills and balanced representation of the other categories makes sense for a senior-level position overseeing and developing an organization’s IT network.

The top 10 soft skills are distributed across the quadrants in a similar way in network engineering and operations leadership listings:

- 4 in Leadership (leadership, planning, overseeing, mentoring)
- 3 in Analytical (evaluation, analytical, complex)
- 2 in Communications/Interpersonal (communications, collaboration)
- 1 in Personal Characteristics (scheduling)

Among these top 10, specific skills in the Analytical and Personal Characteristics Quadrants are in the second tier, appearing on between 30% and 40% of job ads analyzed. Communications and collaboration (from the Communications/Interpersonal Quadrant) are in the top five alongside Leadership Quadrant skills.

The distribution of hard and soft skills in job ads is commensurate with a leadership position with multiple team members and broad responsibilities. The focus of both the hard and soft skills is on the strategic rather than the tactical, and the person ultimately hired for the position must possess a broad understanding of network technology, the vision to align that technology with business goals, and the interpersonal skills to lead a team and get organizational buy-in for her or his initiatives.

## Examining the Candidate: Head of Network Engineering and Operations Resumes

While employers list a balance of hard and soft skills in their job listings for head of network engineering and operations roles, jobseekers place heavy weight on hard skills. In fact, only two soft skills rank among the top 20 skills cited on resumes—planning (50%) and communications (37%).

Rank	Top Hard and Soft Skills Combined	Top Hard Skills	Top Soft Skills
1	Design 83%)	Design (83%)	Planning (50%)
2	Software (73%)	Software (73%)	Communications (37%)
3	Services (68%)	Services (68%)	Leadership (34%)
4	Operations (57%)	Operations (57%)	Research (34%)
5	Installation (56%)	Installation (56%)	Consultation (31%)
6	Cisco (55%)	Cisco (55%)	Vision (29%)
7	Hardware (55%)	Hardware (55%)	Analytical (23%)
8	Planning (49%)	Maintenance (48%)	Collaboration (23%)
9	Maintenance (48%)	Windows (43%)	Evaluation (23%)
10	Windows (43%)	Wireless (43%)	Professional (23%)
11	Wireless (43%)	Networks (42%)	Complex (22%)
12	Networks (42%)	Deployment (40%)	Overseeing (20%)
13	Deployment (40%)	Firewall (40%)	Strategizing (20%)
14	Firewall (40%)	Standards (39%)	Schedule (19%)
15	Standards (39%)	Testing (39%)	Customer Service (15%)
16	Testing (39%)	Architecture (37%)	Mentoring (15%)
17	Architecture (37%)	Cloud (37%)	Recommendations (15%)
18	Cloud (37%)	Disaster Recovery (37%)	Organized (14%)
19	Communications (37%)	Switching and Routing (37%)	Liaison (12%)
20	Disaster Recovery (37%)	Training (37%)	Negotiation (12%)

Figure 3: Top hard and soft skills for head of network engineering and operations jobseekers.

## Top Skills—Hard, Soft, and in Aggregate

The most common skill in head of network engineering and operations resumes is “design,” cited on 83% of resumes, which can be interpreted as a strategic skill. The next three most frequently mentioned skills—software, services, and operations—can also be seen in a more high-level sense. But many of the top 20 skills cited in resumes are very tactical:

- Tasks such as installation, maintenance, testing, and switching and routing
- Network elements such as firewall, cloud, and wireless
- Technical specifications such as Windows and Cisco

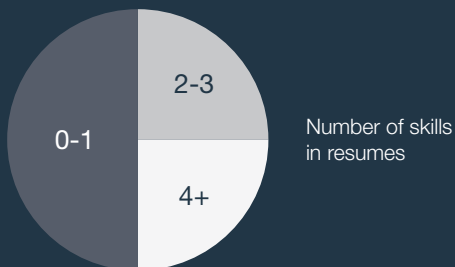
## Soft Skills Quadrants

Despite the emphasis on hard skills, jobseekers for network engineering and operations leadership positions do list some soft skills on their resumes. The median resume mentioned two unique skills in the Leadership Quadrant, and one each in the other three quadrants. Some resumes listed significantly more Leadership Quadrant skills than the median resume.

### Analytical

**1.5** Average Skills Per Resume

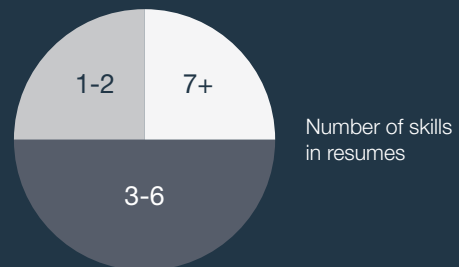
**72%** Occurrence in Resumes



### Leadership

**2.2** Average Skills Per Resume

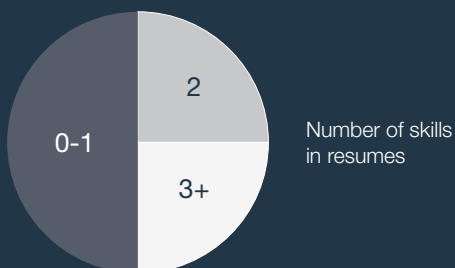
**80%** Occurrence in Resumes



### Personal Characteristics

**1.2** Average Skills Per Resume

**61%** Occurrence in Resumes



### Communications/Interpersonal

**1.6** Average Skills Per Resume

**72%** Occurrence in Resumes

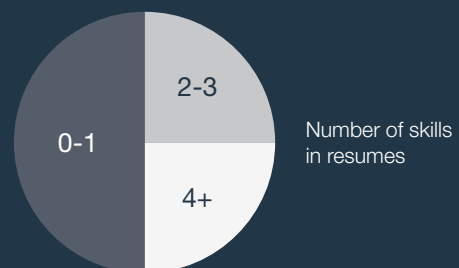


Figure 4: Resume soft skills quadrant matrix.

In addition to planning and communications—the two soft skills that ranked in the top 20 overall skills—more than 30% of resumes referenced leadership, research, and consultation. These skills are balanced across the Leadership, Analytical, and Communications/Interpersonal Quadrants. They also emphasize the strategic side of a senior IT role.



Figure 5: Average number of skills per job ad and resume.

## Analyzing the Gaps Between Employers and VP/Director of Network Engineering and Operations Jobseekers

The fact that employers and jobseekers list a similar number of total skills is actually unusual in our survey. For most of the occupations we surveyed, employers listed 30% to 50% more skills than jobseekers. Despite the similarity in number of skills, the nature of the skills listed by each party is quite different.

The most glaring gap between job listings and resumes for network engineering and operations leadership roles is the significantly lower number of soft skills in resumes than in job ads. Jobseekers place too little emphasis on soft skills in comparison with the job listings they are targeting. And for both hard and soft skills, jobseekers tend to focus more on tactical skills and less on strategic ones compared with employers.

### Hard Skills Deviations

The number of hard skills mentioned in both resumes and job ads is quite consistent, but the nature of the hard skills represented differs markedly. Nineteen of the top 20 skills overrepresented in resumes are hard skills, and virtually all of them are tactical in nature. Only hardware, software, and services could be construed at a more strategic level.

On the other hand, skills with emerging technologies are underrepresented by 40% in resumes compared with job ads. Among the 20 hard skills with the biggest deviations, this is the only one that is underrepresented rather than overrepresented in resumes.



Other hard skills underutilized in resumes include enterprise architecture, network optimization, critical components, and technical design—which all skew toward a more strategic orientation.

### Soft Skills Deviations

The soft skills most underemphasized by jobseekers are in the Leadership and Communications/Interpersonal Quadrants. It is striking that people seeking a senior-level role would not include skills like leadership, overseeing, and mentoring in their resume. Communications/Interpersonal Quadrant skills are important to almost any role—and certainly for a senior role such as head of network engineering and operations.

Skills Cited by Employers More Often	Skills Cited by Jobseekers More Often
Emerging Technologies (40%)	Installation (44%)
Leadership (39%)	Wireless (35%)
Communications (33%)	Windows (33%)
Partnership (28%)	Switching & Routing (32%)
Interpersonal (26%)	Active Directory (31%)
Overseeing (25%)	Cisco (30%)
Collaboration (22%)	Deployment (28%)
Mentoring (20%)	Routers (27%)
Schedule (19%)	VMware (27%)
Enterprise Architect (19%)	Configuration (27%)
Track Record (19%)	Troubleshooting (26%)
Network Optimization (18%)	Software (26%)
Time Management (16%)	VPN (26%)
Architecture (15%)	Firewall (25%)
Best Practice Processes (15%)	Integration (25%)
Critical Components (15%)	Hardware (25%)
Development of Technical Design (15%)	Services (23%)
Enterprise Communications (15%)	Testing (21%)
Future Business Needs (15%)	Research (21%)
Operational Objectives (15%)	LAN (20%)

Figure 6: Percent difference in top 20 skills listed by employers and head of network engineering and operations jobseekers.

### Education and Certification

Based on our analysis of job ads, employers see formal education as important to the head of network engineering and operations role. On average, they ask for candidates who have two college degrees—bachelor’s and master’s degrees. The jobseekers we surveyed, however, averaged only one degree. Of course, education level is one of many considerations, and some candidates can make up for the lack of a post-baccalaureate degree with life and job experience.

In terms of certifications, employers and jobseekers are in closer alignment: employers on average ask for 1.4 certifications and jobseekers average 2.

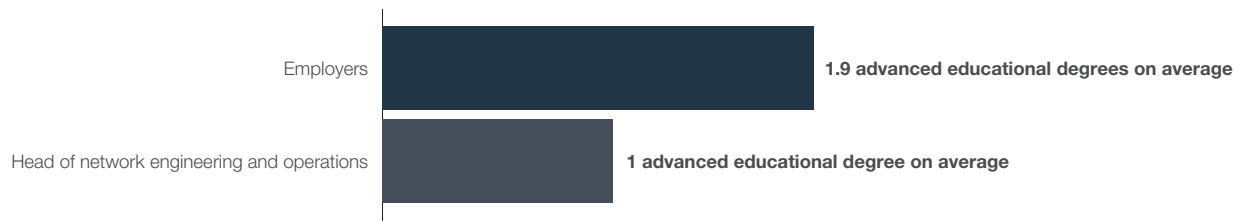


Figure 7: Number of advanced educational degrees listed by employees and head of network engineering and operations on average.



Figure 8: Number of certifications listed by employers and head of network engineering and operations on average.

## Career Tenure and Job-Hopping

Applicants for head of network engineering and operations roles started their careers an average of 23 years ago, when the initial buildout of the internet and corporate IT networks was in progress. They are now at midcareer, having held roles of increasing scope and responsibility over the years.

Jobseekers we analyzed have had an average of 1.6 jobs in the past two years and 2.3 jobs in the past five years. These numbers place the head of network engineering and operations role at the median among positions we surveyed, with half of the remaining job titles experiencing more job-hopping and half seeing less.

The data is mixed as to whether job-hopping is getting worse in the overall economy,<sup>6</sup> and there is some evidence that the problem decreases with age and tenure.<sup>7</sup> But job-hopping is undoubtedly costly to companies when it does happen, and those with IT and cybersecurity skills will be a target for competitors for the foreseeable future.

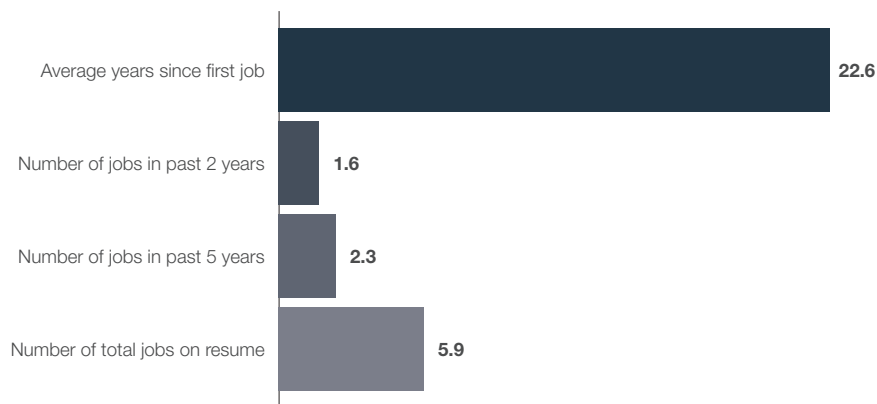


Figure 9: Job tenure in head of network engineering and operations resumes.

## Gender Gap

The gender gap in technology is widely noted with concern.<sup>8</sup> 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.

Unfortunately, of the resumes we randomly selected and analyzed for VP/director of network engineering and operations positions, only 1.3% belonged to women. Similarly, male-oriented terms are used twice as often in job listings for this role than female-oriented terms (an average of 8.4 male-oriented terms and 4.2 female-oriented terms per resume).

Employers will do well to include more female-oriented terms such as “collaborate,” “support,” “sensitive,” “mentor,” and “role model” alongside male-oriented terms such as “strong” and “leader.” And jobseekers can communicate a sense of well-roundedness by balancing the terminology in their resumes.

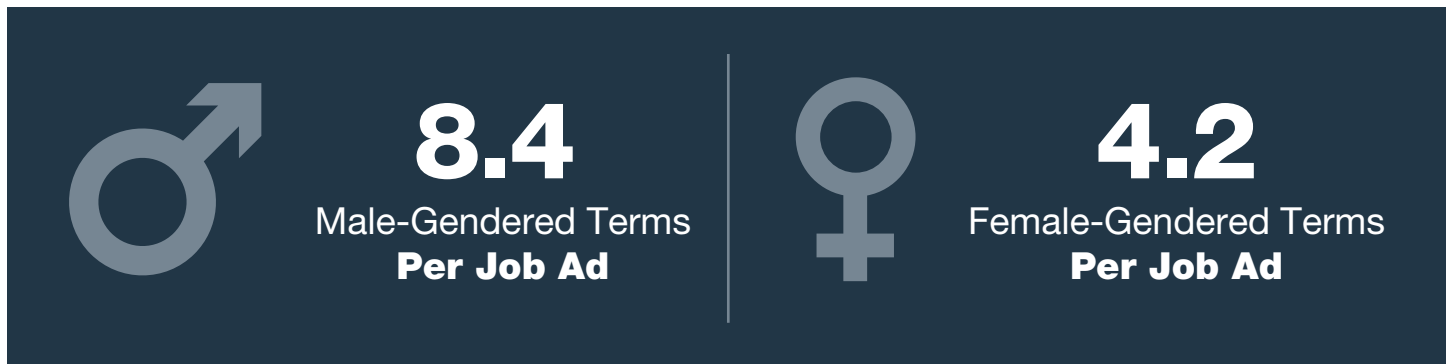


Figure 10: Gender-oriented language in job ads.

## Concluding Thoughts

As the threat landscape gets more complex, it becomes more important for network engineering and operations teams to be more proactive about security and work more in alignment with the network security function. In fact, the once-isolated functions of networking and security are starting to converge,<sup>9</sup> and security will be a growing part of the portfolio of the head of network engineering and operations. Companies will do well to seek well-rounded and broadly experienced technologists for this role, and jobseekers will do well to emphasize their strategic skills and the breadth of their experience.

In today’s enterprise, the network engineering and operations leader will not be successful without a broad, integrated, and automated security infrastructure. 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 white paper, “[Fortinet Security Fabric Powers Digital Transformation](#).”<sup>10</sup>

<sup>1</sup> “[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 15, 2018.

<sup>2</sup> Stephen Lawson, “[If software eats everything, are network engineers on the menu?](#)” Network World, April 28, 2017.

<sup>3</sup> Erin O’Malley, “[Driving the Convergence of Networking and Security](#),” SecurityWeek, May 15, 2018.

<sup>4</sup> Don Reisinger, “[Security Specialists, Network Engineers Top List of ‘Hottest’ IT Jobs](#),” eWeek, May 25, 2018.

<sup>5</sup> Grant Ho, “[The evolving role of the network engineer](#),” ITOps Times, January 18, 2018.

<sup>6</sup> David Weedmark, “[Job Tenure and the Myth of Job Hopping](#),” The Balance Careers, March 4, 2019.

<sup>7</sup> “[2018 Job Hopping Report: An Analysis of Job Ads & Resumes](#),” LiveCareer, accessed October 17, 2018.

<sup>8</sup> Gillian Tans, “[Why it’s vital we close the tech gender gap](#),” World Economic Forum, January 19, 2018.

<sup>9</sup> Erin O’Malley, “[Driving the Convergence of Networking and Security](#),” SecurityWeek, May 15, 2018.

<sup>10</sup> “[Fortinet Security Fabric Powers Digital Transformation](#),” Fortinet, February 22, 2018.



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