



## **Information Technology**

### **A Susquehanna Region Industry Brief**

**Submitted by:**

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**Submitted to:**

**The Susquehanna Workforce Network  
Harford County Office of Economic Development  
Cecil County Economic Development Department**

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## Executive Summary

- New Forms of Commerce & Warfare Translate into Demand for Workers

This Information Technology (IT)-focused report represents one of two industry focus reports authored by Sage and delivered to the Susquehanna Workforce Network and other key stakeholders in early 2017. Despite a U.S. and regional labor market that continues to provide new opportunities for jobseekers – slow wage growth, flat productivity, and general dissatisfaction with workforce preparedness continue to pervade discussions regarding labor market dynamics.

This report addresses the extent to which the Susquehanna regional economy is likely to create significant numbers of IT positions in the future, characteristics of that employment, and the skills and credentials necessary to access emerging opportunities. The report also focuses on existing resources that support workforce preparedness and supplies ideas regarding other ways in which to create better alignment between human capital demand and supply in IT segments.

This industry brief addresses the following questions:

1. What are the realistic growth prospects for IT & Cybersecurity employment in the Susquehanna Region?
2. To what extent is there evidence of inadequate human capital supply now and into the future with respect to regional IT & Cybersecurity?
3. What does an individual need to do to access IT & Cybersecurity opportunities and are those opportunities available within the confines of the Susquehanna Region?

Sage concludes:

- That the Susquehanna Region will be associated with significant numbers of IT job openings over the next several years;
- That employers will generally find filling job openings very difficult and will often have to recruit from beyond the region; and
- That there are not enough in-region opportunities for people to obtain relevant four-year degrees leading to gainful IT employment.

Accordingly, the response should be to induce Towson University and other institutions to upgrade their IT training opportunities within the region, including through aggressive advocacy at the State level. A recent visit to University Center in Harford County revealed some recent setbacks in terms of offered programming. This state of affairs must be reversed, with more four-year IT bachelor's degree opportunities offered within the region.

## I. Industry Overview

### The Overall “Tech” Sector

Different organizations have produced estimates regarding total U.S. technology employment based on varying interpretations of what constitutes the tech sector and its workforce. For instance, CBRE estimates that there were approximately 4.8 million tech workers in the U.S. across all occupational industries in 2015 based on their definition of the tech workforce, which includes 20 different occupations ranging from computer hardware engineers to information systems managers.<sup>1</sup>

CompTIA estimates that U.S. tech employment totaled 6.7 million in 2015 based their definition of technology, which encompasses a range of subsectors falling under five primary categories: 1) technology manufacturing; 2) telecommunications and internet services; 3) software, 4) IT services, and 5) R&D, testing, and engineering services. CompTIA’s definition of the tech workforce is broader than CBRE’s, encompassing 50 occupations. CompTIA reports that there are an additional 1 million tech workers that fall into the category of self-employed or sole proprietors.<sup>2</sup>

Exhibit 1. CBRE Estimate of U.S. Tech Talent Labor Concentration, 2015

Tech Talent Labor: Industry Breakdown		Tech Occupations as a % of All Occupations in Each Industry	
Industry	Industry % of Total Tech Talent Labor	Industry	Tech Talent as % of Total Industry Occupations
Core High-Tech*	37.3%	Core High-Tech*	49.9%
Professional, Scientific, and Technical Services (Excluding High-Tech)	10.5%	Information (Excluding High-Tech)	13.9%
Other	8.7%	Management of Enterprises	12.4%
Finance, Insurance and Real Estate	7.7%	Professional, Scientific and Technical Services (Excluding High-Tech)	7.6%
Information (Excluding High-Tech)	6.2%	Finance, Insurance and Real Estate	4.8%
Government	6.2%	Government	3.1%
Management of Enterprises	5.9%	Transportation, Warehousing and Wholesale	2.2%
Transportation, Warehousing, and Wholesale	5.3%	Manufacturing (Excluding High-Tech)	2.0%
Manufacturing (Excluding High-Tech)	4.7%	Education	1.8%
Education	4.8%	Other	0.8%
Healthcare	2.7%	Healthcare	0.7%
<i>Total Tech Talent</i>	<i>100.0%</i>	<i>Total U.S. Employment</i>	<i>3.5%</i>

Source: CBRE, “2016 Scoring Tech Talent”; U.S. Bureau of Labor Statistics (National), April 2016. \*Includes computer software and services and computer product manufacturing.

<sup>1</sup> CBRE, “2016 Scoring Tech Talent”.

<sup>2</sup> CompTia. “Cyberstates 2016”

The fact that there are varying interpretations of what constitutes the tech sector/tech workforce is not surprising. Technology is continuously evolving, resulting in differing interpretations of what constitutes the cutting edge.

- Information Technology (IT)

*Key Industries.* According to the Maryland Department of Commerce, the leading Information Technology employment subsectors in Maryland are computer systems design and related services (69,200 MD jobs in 2015), telecommunications (14,900 jobs), and computer and electronic product manufacturing (6,200 jobs).<sup>3</sup> The computer systems design and related services segments is of particular interest for purposes of this report, and comprises establishments that primarily engage in providing expertise through one or more of the following activities:

1. *Writing, modifying, testing, and supporting software to meet the needs of a particular customer;*
2. *Planning and designing computer systems that integrate hardware, software, and communication technologies;*
3. *On-site management and operation of clients' computer systems and/or data processing facilities; and*
4. *Other professional and technical computer-related advice and services.*<sup>4</sup>

*Key Occupations.* Most IT jobs fall under the category of computer and information technology occupations. Examples include Computer and Information Research Scientists, Computer Network Architects, Computer Programmers, Computer Support Specialists, Computer Systems Analysts, Database Administrators, Information Security Analysts, Network & Computer Systems Administrators, Software Developers, and Web Developers.<sup>5</sup>

From 2014 to 2024, computer and information technology occupations are expected to grow faster than the average for all occupations nationally. This anticipated growth stems from a variety of considerations, including the collection and storage of big data, greater emphasis on cloud computing, continued demand for mobile computing, and more everyday items becoming connected to the Internet (“Internet of things”).<sup>6</sup>

The median annual wage for computer and information technology occupations is much higher than the median annual wage for all occupations (\$81,430 vs. \$36,200 in May 2015). Most of these occupations require at least a bachelor’s degree.<sup>7</sup>

Because of extraordinarily positive growth prospects and much higher than average wages, economic and workforce development leaders across the nation are intensely focused on

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<sup>3</sup> Maryland Department of Commerce, “Cybersecurity Maryland”.

<sup>4</sup> North American Industry Classification System (NAICS); Maryland Workforce Exchange, Summary Industry Profile for Computer Systems Design and Related Services.

<sup>5</sup> U.S. Bureau of Labor Statistics. *Occupational Outlook Handbook*. “Computer and Information Technology Occupations”. <https://www.bls.gov/ooh/computer-and-information-technology/home.htm>.

<sup>6</sup> Ibid.

<sup>7</sup> Ibid.

helping IT expand within their communities. This is arguably of even greater import in the Susquehanna Region given that its largest employer, Aberdeen Proving Ground, is continuously recruiting IT talent in order to fulfill its various missions.

- Cybersecurity

*Cybersecurity Overview.* Cybersecurity is considered a subset of IT focused on securing and preventing intrusions into information systems. As is commonly known, the number of cyber attacks has increased dramatically in recent years and is expected to continue to threaten information systems in both the public and private sectors.<sup>8</sup>

PricewaterhouseCoopers' 2015 State of US Cybercrime Survey reported that a record 79 percent of survey respondents had detected a security incident in the past year. Many incidents go undetected suggesting the real count is probably much higher.<sup>9</sup>

Common responses to cyber-threats are antivirus programs, improved firewalls, and other intrusion detection systems.<sup>10</sup> The attempt to prevent database intrusion frequently implicates the services of third-party security firms in the computer systems design and related services industry. Demand for cybersecurity services represents a major driver of employment growth in this sector.<sup>11</sup>

*Key Industries.* According labor market analytics firm Burning Glass, the Professional Services, Finance, and Manufacturing & Defense sectors have the highest demand for cybersecurity jobs. Burning Glass also reports that the fastest growth in demand for cybersecurity workers is in industries managing increasing volumes of consumer data such as finance (+137% over the last five years), healthcare (+121%), and retail trade (+89%).<sup>12</sup>

*Key Occupations.* The cybersecurity workforce embodies a range of occupations and skills. Engineers, managers, and analysts dominate. Engineers and architects represent examples of more advanced cybersecurity positions, while auditors (usually concentrated in finance) and specialists are typically associated with lower entry-level requirements.<sup>13</sup>

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<sup>8</sup> U.S. Bureau of Labor Statistics. "Careers in the growing field of information technology services". Beyond the Numbers. April 2013. Vol. 2. No. 9. By Lauren Csorny.

<sup>9</sup> Burning Glass. "Job Market Intelligence: Cybersecurity Jobs, 2015". [http://burning-glass.com/wp-content/uploads/Cybersecurity\\_Jobs\\_Report\\_2015.pdf](http://burning-glass.com/wp-content/uploads/Cybersecurity_Jobs_Report_2015.pdf).

<sup>10</sup> "Defense Organizations to Ramp up Cybersecurity Spending," Infosecurity Magazine, July 3, 2012.

<sup>11</sup> U.S. Bureau of Labor Statistics. "Careers in the growing field of information technology services". Beyond the Numbers. April 2013. Vol. 2. No. 9. By Lauren Csorny.

<sup>12</sup> Burning Glass. "Job Market Intelligence: Cybersecurity Jobs, 2015".

<sup>13</sup> Ibid.

Cybersecurity employers generally require a highly educated and experienced workforce. According to analysis by Burning Glass, 84 percent of cybersecurity job postings require at least a bachelor's degree and 83 percent require at least 3 years of experience.<sup>14</sup>

Workers who are entering cybersecurity often begin as information security analysts.<sup>15</sup> These employees plan and carry out security measures to protect an organization's computer networks and systems and usually work for computer companies, consulting firms, or business and financial companies. Information security analyst positions almost always require a bachelor's degree in a computer-related field and some experience in a related occupation. Given aggressive increases in cyber-assaults, the responsibilities of these more junior workers are continuously expanding.<sup>16</sup> According to Burning Glass, cybersecurity jobs account for 11 percent of all IT employment.<sup>17</sup>

Cybersecurity job postings have grown faster than overall IT postings, expanding by 91 percent from 2010-2014. In 2014 Cybersecurity job postings advertised a higher salary and took longer to fill than IT positions overall.<sup>18</sup> According to Burning Glass, "Cybersecurity jobs are in demand and growing across the economy...we are also seeing multiple signs that demand for these workers is outstripping supply. Job postings for cybersecurity openings have grown three times as fast as openings for IT jobs overall and it takes companies longer to fill cybersecurity positions than other IT jobs. That's bad for employers but good news for cybersecurity workers, who can command an average salary premium of nearly \$6,500 per year, or 9% more than other IT workers..."<sup>19</sup>

Predictably, Maryland is a leading cyber-security state, as indicated by Exhibit 2. Cybersecurity jobs are geographically concentrated in government and defense hubs, but have been growing most rapidly in secondary markets. In 2014, Maryland ranked 6<sup>th</sup> in terms of total cybersecurity job postings according to an analysis by Burning Glass. Maryland ranked 3<sup>rd</sup> in terms of job openings on a per capita basis, just behind Virginia and Washington, D.C.<sup>20</sup>

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<sup>14</sup> Ibid.

<sup>15</sup> Morgan, Steve. "One Million Cybersecurity Job Openings in 2016". Forbes. 1/2/2016. <http://www.forbes.com/sites/stevemorgan/2016/01/02/one-million-cybersecurity-job-openings-in-2016/#29b42bd17d27>.

<sup>16</sup> U.S. Bureau of Labor Statistics. *Occupational Outlook Handbook*. "Information Security Analysts". <https://www.bls.gov/ooh/computer-and-information-technology/information-security-analysts.htm>.

<sup>17</sup> Burning Glass. "Job Market Intelligence: Cybersecurity Jobs, 2015".

<sup>18</sup> Ibid.

<sup>19</sup> Ibid.

<sup>20</sup> Ibid.

Exhibit 2. Cybersecurity Job Postings by State—Top States by Total Postings in 2014

Rank	State	Total Postings	Location Quotient	% Growth (2010-2014)
1	California	28,744	1.02	75%
2	Virginia	20,276	3.09	38%
3	Texas	18,525	0.92	113%
4	New York	14,089	0.97	104%
5	Illinois	11,428	1.16	163%
<b>6</b>	<b>Maryland</b>	<b>11,406</b>	<b>2.4</b>	<b>39%</b>
7	Florida	9,847	0.67	135%
8	Georgia	8,757	1.22	121%
9	New Jersey	8,268	1.21	80%
10	Massachusetts	7,911	1.45	92%
11	Colorado	7,688	1.77	111%
12	North Carolina	7,503	1.06	127%
13	Ohio	6,281	0.72	141%
14	Pennsylvania	5,745	0.59	69%
15	Arizona	5,502	1.18	87%

Source: Burning Glass. “Job Market Intelligence: Cybersecurity Jobs, 2015”. Note: A location quotient is the percentage of employment in a given sector relative to the percentage of employment in this sector at the national level. Values above 1.0 reflect a concentration greater than the national average. Values below 1.0 reflect a lesser concentration. For example, Las Vegas will have a location quotient greater than 1 in the Leisure and Hospitality industry because this industry makes up a larger share of the Las Vegas employment total than it does for the country as a whole.

## II. Tech Employment in the Susquehanna Region

- Regional Employment

Harford County dominates IT employment in the Susquehanna Region. For instance, within the computer systems design & related services category, Harford County represented more than 98 percent of regional employment in 2015, due primarily to the presence of Aberdeen Proving Ground. The fact that these jobs are in Harford County of course does not imply that they are not available to Cecil County residents.

Between 2011 and 2015 Harford County employment in the computer systems design and related Services sector expanded by 800 positions. Sectoral employment in Cecil County was essentially flat. Exhibit 3 supplies relevant statistical detail.

Exhibit 3. Recent Growth in Computer Systems Design & Related Services Employment (Private Employment), NSA

Comp. Systems Design & Related Services	Employment		2011 v. 2015	
	2011	2015	Net	%
Maryland	64,186	69,512	5,326	8.3%
Susquehanna WIA	1,204	2,004	800	66.4%
Cecil County, MD	38	37	-1	-2.6%
Harford County, MD	1,166	1,968	802	68.8%
Comp. Systems Design & Related Services	Employment		2015Q1 v. 2016Q1	
	2015Q1	2016Q1	Net	%
Maryland	68,003	68,844	841	1.2%
Susquehanna WIA	1,885	2,069	184	9.8%
Cecil County, MD	38	37	-1	-2.6%
Harford County, MD	1,847	2,032	185	10.0%

Source: U.S. Census Bureau, Longitudinal Employer-Household Dynamics (LEHD) program, Quarterly Workforce Indicators (QWI) Explorer application; Sage. Notes: 1. NSA: Not Seasonally Adjusted. 2. Annual figures are annual averages.



Exhibit 4 supplies data regarding private business establishment counts as of mid-year 2016. Cecil County is home to nearly 40 private establishments in listed technology segments, including 27 in the computer systems design and related services segment. Harford County is home to approximately 200 technology businesses in these segments, including 165 in the computer systems design and related services segment.

Exhibit 4. Susquehanna Region: Number of Private Business Establishments in Select Industries, 2016Q2

Industry	Cecil County	Harford County
Total Private Establishments (All Industries)	1,845	5,668
Computer and Electronic Product Manufacturing (NAICS 334)	1	11
Telecommunications (NAICS 517)	5	13
Data Processing, Hosting, and Related Services (NAICS 5182)	2	5
Computer Systems Design and Related Services (NAICS 5415)	27	165
Business, Computer and Management Training (NAICS 6114)	2	4

Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW) program-QCEW NAICS-Based Data Files.

- Wages

As indicated in a 2016 Sage labor market assessment of the Susquehanna Region, IT workers enjoy substantial incomes. This combined with the favorable cost of living in the region renders the community attractive for arriving technology workers. Focus groups conducted by Sage last year indicate that many technology recruiters fill available positions by recruiting nationally and sometimes internationally. This implies opportunities for local residents if they can properly train and credential themselves.

As indicated by Exhibit 5, the average annual wage for workers in the computer systems design services segment was nearly \$93,000 as of mid-year 2016. That is not quite double the average for all industries. Those who work in the data processing, hosting, and related services category earn approximately \$75,000/annum.

Exhibit 5. Average Weekly Wages in the Susquehanna Workforce Region for Select Industries, 2016Q2

Comp. Systems Design Services Wages	Avg. Hourly Wage*	Avg. Weekly Wage	Avg. Annual Wage*
All Industries	\$23.90	\$956	\$49,712
Computer Systems Design Services	\$44.65	\$1,786	\$92,872
Computer & Electronic Product Manufacturing	\$41.90	\$1,676	\$87,152
Telecommunications	\$36.13	\$1,445	\$75,140
Data Processing, Hosting, & Related Services	\$35.95	\$1,438	\$74,776

Source: Maryland Workforce Exchange, Labor Market Statistics, Covered Employment and Wages Program. \*Assumes a 40-hour week worked year round.

### III. Looking Ahead: Meeting Future Demands in Information Technology & Cybersecurity

This industry brief addresses the following questions:

1. What are the realistic growth prospects for IT & Cybersecurity employment in the Susquehanna Region?
2. To what extent is there evidence of inadequate human capital supply now and into the future with respect to regional IT & Cybersecurity?
3. What does an individual need to do to access IT & Cybersecurity opportunities and are those opportunities available within the confines of the Susquehanna Region?

Question 1. What are the realistic growth prospects for IT & Cybersecurity employment in the Susquehanna Region?

- Projected Employment Growth in Key Industries and Occupations

Industries that have high concentrations of information technology workers include federal government, information, and management of companies/enterprises, among others. For example, according to CBRE's analysis of the U.S. tech workforce, tech related occupations represented 12.4 percent of all occupations in the management of companies/enterprises industry in 2015. In the professional, scientific and, technical services industry, 7.6 percent of all occupations were tech-related.<sup>21</sup>

In the Susquehanna Region, it is obvious that considerations pertaining to the federal government and its activities dominate. Therefore, general growth as well as technology growth prospects will depend heavily upon activities at Aberdeen Proving Ground and with associated federal government contractors. The next several years should be associated with significant levels of fresh resources heading to the Proving Ground given the growing emphasis on defense and homeland security. The implication is that here will be significant growth in IT positions within the region over the next several years.

Exhibit 6 supplies relevant forecast detail from the Maryland Department of Labor, Licensing & Regulation. However, these projections could not have envisioned the emerging policymaking impetus emerging in Washington, D.C. Still, even these projections indicate significant expected job growth in technology worker-intensive categories through 2022.

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<sup>21</sup> CBRE, "2016 Scoring Tech Talent".

Exhibit 6. Susquehanna Region – Projected Employment Growth in Select Industries, 2012-2022

Sector	Industry	2012	2022	2012-2022	
				Change	% Change
<b>ALL INDUSTRIES</b>		120,694	133,592	12,898	10.7%
<b>SELECT INDUSTRIES LIKELY TO ENGAGE IN TECH OR EMPLOY TECH WORKERS</b>					
Information	Telecommunications	285	305	20	7.0%
Information	All Other Information (Excluding Telecommunications)	595	662	67	11.3%
Manufacturing	Computer & Electronic Product Manufacturing	478	512	34	7.1%
Finance, Insurance, & Real Estate	All Finance, Insurance, & Real Estate	3,557	3,717	160	4.5%
Government	Federal Government (Excluding Post Office)	13,658	13,868	210	1.5%
Management of Companies & Enterprises	All Management of Companies & Enterprises	302	323	21	7.0%
Professional, Scientific, & Technical Services	All Professional, Scientific, & Technical Services	9,438	10,117	679	7.2%

Source: Maryland Department of Labor, Licensing and Regulation, Division of Workforce Development and Adult Learning. Available: <http://www.dllr.state.md.us/lmi/iandoproj/>

As of early February 2017, the IT occupations with the most job openings in the Susquehanna Region were computer systems engineers/architects, computer programmers, and computer user support specialists. There were 34 openings for information security analyst positions, which typically pertain to cybersecurity.

Exhibit 7. Susquehanna Region Job Openings in Select IT Related Occupations, as of 2/1/2017

Occupation Title	2015 Est. Mean Annual Wage	Job Openings
Computer Systems Engineers/Architects	\$93,086	76
Computer Programmers	\$89,557	65
Computer User Support Specialists	\$41,420	63
Network and Computer Systems Administrators	\$93,932	48
Engineers, All Other	\$105,716	44
Software Developers, Applications	\$105,455	40
Electronics Engineering Technicians	\$76,022	35
Information Security Analysts	\$89,924	34
Software Developers, Systems Software	\$130,609	31
Computer Network Architects	\$92,432	26
Computer Systems Analysts	\$84,730	26
Software Quality Assurance Engineers and Testers	\$93,086	15
Web Developers	\$58,871	11
Computer Occupations, All Other	\$93,086	11
Computer Network Support Specialists	\$64,489	10

Source: Maryland Workforce Exchange: Labor Market Information (Wage Data Source: Labor Market Statistics, Occupational Employment Statistics & Wages Program; Candidate Source: Individuals with active resumes in the workforce system; Job Source: Online advertised jobs data). Notes: 1. The table shows the number of job openings advertised online in the Susquehanna Workforce Region on February 1<sup>st</sup>, 2017 (Jobs De-duplication Level 2). 2. Jobs De-duplication Level 2: high level de-duplication of advertised job openings (for statistical analysis).

Question 2. To what extent is there evidence of inadequate human capital supply now and into the future with respect to regional IT & Cybersecurity?

In focus groups conducted by Sage in 2016, there was significant discussion regarding the need to recruit highly qualified personnel from beyond the region. That comes as little surprise. Data indicate that many Susquehanna regional residents ended their formal education with high school. This is particularly true for Cecil County residents. IT positions typically require at least a bachelor's degree.

In this regard, the data presented in Exhibit 8 could be somewhat misleading. The data indicate that more than a quarter of those working in computer systems design and related services have a high school degree or less. However, many of these people are not engaged in the core technology activities of their enterprises and engage in supporting activities ranging from secretarial to security.

Exhibit 8. Characteristics of Computer Systems Design and Related Services Employees in the Susquehanna Region, 2016Q1

	# of Employees	% of Total
<b>TOTAL EMPLOYEES</b>	2,069	100.0%
<b>SEX</b>		
Male	1,421	68.7%
Female	647	31.3%
<b>AGE</b>		
<19	9	0.4%
19-24	70	3.4%
25-34	468	22.6%
35-44	577	27.9%
45-54	547	26.4%
55-64	327	15.8%
65+	71	3.4%
<b>RACE</b>		
White Alone	1,602	77.4%
Black or African American Alone	263	12.7%
All Other	204	9.9%
<b>ETHNICITY</b>		
Hispanic or Latino	84	4.1%
Not Hispanic or Latino	1,985	95.9%
<b>EDUCATION LEVEL</b>		
Less than high school	164	7.9%
High school or equivalent, no college	398	19.2%
Some college or Associate degree	565	27.3%
Bachelor's degree or advanced degree	864	41.8%
Educational attainment NA (2)	79	3.8%

Source: U.S. Census Bureau, LED Extraction Tool - Quarterly Workforce Indicators (QWI). Notes: 1. Figures shown are the total number of jobs on the first day of the reference quarter. Beginning-of-quarter employment counts are similar to point-in-time employment measures, such as the QCEW (see: [www.bls.gov/cew/](http://www.bls.gov/cew/)). 2. Educational attainment not available—workers aged 24 or younger.

Exhibit 9 supplies compelling evidence of human capital shortfalls facing Susquehanna regional technology employers. In many categories listed below, including in categories like computer programmers and computer systems engineers, there is less than one identified candidate per job opening. While it is likely that there are applicants who have not been captured in Maryland Workforce Exchange information, it is clear that there are opportunities for Susquehanna regional residents in IT. After all, it is also not clear how many of these candidates are actually ready to accept these job opportunities.

The data also stand for the proposition that the bulk of candidates are not firmly tied to the Susquehanna Region of Maryland. Most candidates are willing to work anywhere in Maryland. As an example, of the potential candidates for Susquehanna Region job openings in the category of information security analysts, 12 candidates were only looking for jobs in the Susquehanna Region. Another 56 candidates stated that they were willing to work anywhere in Maryland.

Exhibit 9. Susquehanna Region Job Openings and Candidates for Select Tech Related Occupations, as of 2/1/2017

Occupation Title	Job Openings	Potential Candidates		Candidates Per Job Opening	
		Only Looking in Susq.	Willing to Work Anywhere in MD	Only Looking in Susq.	Willing to Work Anywhere in MD
Computer Systems Engineers/Architects	76	6	21	0.08	0.28
Computer Programmers	65	13	29	0.20	0.45
Computer User Support Specialists	63	52	152	0.83	2.41
Network and Computer Systems Administrators	48	25	72	0.52	1.50
Engineers, All Other	44	12	18	0.27	0.41
Software Developers, Applications	40	19	60	0.48	1.50
Electronics Engineering Technicians	35	6	13	0.17	0.37
Information Security Analysts	34	12	56	0.35	1.65
Software Developers, Systems Software	31	10	23	0.32	0.74
Computer Network Architects	26	N/A	N/A	N/A	N/A
Computer Systems Analysts	26	16	49	0.62	1.88
Software Quality Assurance Engineers and Testers	15	9	24	0.60	1.60
Web Developers	11	4	13	0.36	1.18
Computer Occupations, All Other	11	3	18	0.27	1.64
Computer Network Support Specialists	10	16	49	1.60	4.90

Source: Maryland Workforce Exchange: Labor Market Information (Wage Data Source: Labor Market Statistics, Occupational Employment Statistics & Wages Program; Candidate Source: Individuals with active resumes in the workforce system; Job Source: Online advertised jobs data). Notes: 1. Jobs De-duplication Level 2: high level de-duplication of advertised job openings (for statistical analysis).

Question 3. What does an individual need to do to access IT & Cybersecurity opportunities and are those opportunities available within the confines of the Susquehanna Region?

- The Four-Year Institutional Barrier

The Susquehanna Region is not home to a four-year institution rooted in the region. While Towson University, Johns Hopkins University and other institutions have a presence in the region, it is to be expected that their most critical offerings would be delivered from main campus locations. As Exhibit 10 indicates, the bulk of IT positions require at least a bachelor’s degree, with web development representing one significant exception.

Exhibit 10. Education Requirements in IT (Computer and Information Technology Occupations)

Occupation	Entry-Level Education	2015 Median Pay
Computer and Information Research Scientists	Doctoral or professional degree	\$110,620
Computer Network Architects	Bachelor’s degree	\$100,240
Computer Programmers	Bachelor’s degree	\$79,530
Computer Support Specialists	Varies (from some computer related knowledge to a bachelor’s degree)	\$51,470
Computer Systems Analysts	Bachelor’s degree	\$85,800
Database Administrators	Bachelor’s degree	\$81,710
Information Security Analysts	Bachelor’s degree	\$90,120
Network and Computer Systems Administrators	Bachelor’s degree	\$77,810
Software Developers	Bachelor’s degree	\$100,690
Web Developers	Associate’s degree	\$64,970

Source: U.S. Bureau of Labor Statistics. Occupational Outlook Handbook. “Computer and Information Technology Occupations”.

There are also requirements for elevated managerial skills in addition to the computer-related skills often acquired in a four-year institutional setting. Labor market analytics firm Burning Glass researched thousands of job postings from August 2015-September 2016 and ranked the number of days it takes to fill IT positions. That analysis found that the top 2 jobs that took the longest to fill were both managerial positions.<sup>22</sup> According to Burning Glass CEO Matt Sigelman, “In IT, most mid- to senior-level folks currently in the market have advanced to where they are because of their technical skills, not based on their management and soft skills. What that means is that certain roles are incredibly hard to fill, as they need both the technical savvy, as well as domain- and industry-specific expertise and leadership skills... Whenever you’re asking a candidate to wear two different hats – in this case, technical and management – you’re inherently making these roles harder to fill as the pool of qualified candidates becomes smaller.”<sup>23</sup>

<sup>22</sup> Burning Glass. “Top 10 Hard-to-Find Tech Skills”. 10/26/2016.

<sup>23</sup> Florentine, Sharon. “10 most difficult IT jobs for employers to fill”, CIO from IDG Communications, Inc. 11/23/2016.

Exhibit 11. IT Positions/Skills Most Difficult to Find in Job Applicants

Hard-to-Fill IT Jobs			Hard-to-Find IT Skills		
Rank	Job	Average Time to Fill	Rank	Skill	Average Time to Fill
1	Technical Manager/Director	107 days	1	Cloud Security	96 days
2	SAP Manager	64	2	Jboss Application Server	77
3	Systems Analyst	63	3	Metadata Design	73
4	Java Architect	63	4	Integration Architecture	70
5	Salesforce/CRM Developer	54	5	Distributed Computing	69
6	Database Architect	54	6	Information Architecture	68
7	Cybersecurity Consultant	53	7	Apache Kafka	66
8	Embedded Software Engineer	52	8	Web Services Security	63
9	Data Manager	51	9	Salesforce Integration	62
10	Systems Integration Engineer/Specialist	51	10	Cloud Computing	62

Source: Burning Glass. "Top 10 Hard-to-Find Tech Skills". 10/26/2016.

*Education & Skills Required.* Cybersecurity jobs also typically require significant education, experience, and credentialing. Burning Glass reports that in 2014, 84 percent of cybersecurity job postings specify that candidates must have at least a bachelor's degree and 83 percent requested at least 3 years of experience.

Burning Glass' analysis also indicates that financial skills are especially in demand among cybersecurity workers. Indeed, in 2014, a year that preceded a period of subsequent major attacks on financial institutions across the nation, the positions that were most difficult to fill asked for financial expertise such as accounting or knowledge of regulations associated with the Sarbanes-Oxley Act, in addition to traditional networking and IT security skills.

However, finance and IT training are seldom provided jointly, creating a massive skills gap for this type of highly demanded hybrid position. Cybersecurity positions that call for a security clearance are also far more difficult to fill.<sup>24</sup>

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<sup>24</sup> Burning Glass. "Job Market Intelligence: Cybersecurity Jobs, 2015".



Exhibit 12. Cybersecurity Skills Most Difficult to Find in Job Applicants, 2014

Fastest-Growing Skills in Cybersecurity Job Postings			Hardest to Fill Skills in Cybersecurity Job Postings			
Rank	Skill	5-Year Growth	Rank	Skill	Posting Duration	Time to Fill Above Avg.
1	Python	309%	1	Management Information Systems	50 days	+10 days
2	HIPAA	248%	2	Information Assurance	47 days	+7 days
3	Risk Management	209%	3	Sarbanes-Oxley	47 days	+7 days
4	Internal Auditing	200%	4	Accounting	45 days	+5 days
5	Audit Planning	170%	5	Python	45 days	+5 days
6	Risk Assessment	169%	6	Dynamic Host Configuration Protocol (DHCP)	45 days	+5 days
7	ITIL	153%	7	Configuration Management	44 days	+4 days
8	Management Information Systems	132%	8	C++	44 days	+4 days
9	Accounting	121%	9	Public Accounting	43 days	+3 days
10	Configuration Management	106%	10	Internal Auditing	43 days	+3 days

Source: Burning Glass. “Job Market Intelligence: Cybersecurity Jobs, 2015”. Note: The jobs data reported by Burning Glass are drawn from Burning Glass’s database of online job postings, which includes nearly 100 million worldwide postings collected since 2007. Burning Glass visits close to 40,000 online jobs sites daily to collect postings. Using advanced text analytics, Burning Glass extracts more than 70 data fields from each posting including job title, occupation, employer, industry, required skills and credentials and salary. Postings are then duplicated and placed in a database for further analysis.

Cybersecurity positions are more likely to require more certifications than other IT jobs, with 35 percent of cybersecurity jobs requesting an industry certification compared to 23 percent of IT jobs overall. Proper certification also garners a salary premium.

Relevant entry-level certifications (less than 3 years experience required) include Security+, GIAC Security Essentials (GSEC), Certified Information Privacy Professional (CIPP), and Systems Security Certified Practitioner (SSCP). Advanced Certifications (which typically require at least 3-5 years of experience) include Certified Information Systems Security Professional (CISSP)\*, Certified Information Systems Auditor (CISA)\*, Certified Information Security Manager (CISM)\*, GIAC Certified Incident Handler (GCIH), and GIAC Certified Intrusion Analyst (GCI). \*Requires a minimum of 5 years of information security experience.<sup>25</sup>

<sup>25</sup> Burning Glass. “Job Market Intelligence: Cybersecurity Jobs, 2015”.



Predictably, demand for certificated cybersecurity talent is outstripping supply. In the U.S., employers posted 49,493 jobs requesting a CISSP, recruiting from a pool of only 65,362 CISSP holders nationally. Employers prefer to hire workers with cybersecurity certifications, but there can be three or more postings for every certificate holder. When one considers the fact that most of these certificate holders are already employed, the situation looks even better for workers. Even the large supply of Security+ holders is somewhat misleading. Security + is merely an entry-level certificate and many available positions require additional credentialing.<sup>26</sup>

Exhibit 13. Certification Requirements in Cybersecurity Job Postings, 2014

Certification*	% of All Cybersecurity Postings	Avg. Salary w/ Cert.	Premium over Security+ Avg. Salary	# of Postings (2014)	# of Holders	Ratio of Holders to Postings
Certified Information Systems Security Professional (CISSP)	21.0%	\$93,010	\$17,526	49,493	65,362	1.32
Certified Information Systems Auditor (CISA)	14.0%	\$86,238	\$10,754	34,167	33,640	0.98
Certified Information Security Manager (CISM)	7.0%	\$95,450	\$19,966	15,831	10,730	0.68
Security+	6.0%	\$75,484	\$0	15,452	353,634	22.89
GIAC Security Essentials (GSEC)	2.0%	\$81,631	\$6,147	5,882	11,750	2.00
Systems Security Certified Practitioner (SSCP)	2.0%	\$80,718	\$5,234	5,436	1,413	0.26
Certified Information Privacy Professional (CIPP)	2.0%	\$90,550	\$15,066	3,942	4,920	1.25
GIAC Certified Incident Handler (GCIH)	2.0%	\$92,759	\$17,275	3,733	8,400	2.25
GIAC Certified Intrusion Analyst (GCIA)	1.0%	\$84,392	\$8,908	2,202	3,600	1.63

Source: Burning Glass. "Job Market Intelligence: Cybersecurity Jobs, 2015". Note: \*Certification requirements are not mutually exclusive.

Importantly, the University of Delaware's College of Engineering offers Master of Science in Cybersecurity. The National Security Agency and the Department of Homeland Security have designated the University a National Center of Academic Excellence in Cyber Defense Education.<sup>27</sup> However, to access this and similarly structured programs, Susquehanna residents will need a four-year degree in a pertinent field, and many residents lack that background.

<sup>26</sup> Burning Glass. "Job Market Intelligence: Cybersecurity Jobs, 2015".

<sup>27</sup> University of Delaware. "Online Master of Science in Cybersecurity".

<http://www.ece.udel.edu/online/graduate/masters-in-cybersecurity-online.html>.

## Conclusion

The situation facing the Susquehanna Workforce Network and other stakeholders is easy to describe, but difficult to address. This report concludes that employers in the Susquehanna Region will collectively continue to create many IT job openings over the next several years, including many cybersecurity positions. Absent some proactive intervention, the bulk of these net new jobs will be filled by in-migrants to the Susquehanna Region.

Along certain dimensions, that is very positive. The in-migration of well-educated, highly skilled technology workers will boost the local tax base, improve housing market performance, and will provide additional support for local businesses, including retailers and restaurateurs. However, it will also mean that talented people who presently live within the region will not be able to access these same opportunities.

A primary barrier to accessing these opportunities is the lack of a four-year higher educational institution rooted in the Susquehanna Region. Accordingly, the response should be to induce Towson University and other institutions to upgrade their IT training opportunities within the region, including through aggressive advocacy at the State level. A recent visit to University Center in Harford County revealed some recent setbacks in terms of offered programming. This state of affairs must be reversed, with more four-year IT bachelor's degree opportunities offered within the region. As a final note, there is little information regarding the quality of online cyber-security bachelor's programs, including those offered by institutions such as the Southern New Hampshire University or the Colorado Technical University.