Maryland Cybersecurity Labor Force Analysis

Recommendations Report

TEDCO // Lightcast

Agenda

- Project Overview

- Approach & Methodology

- Key Findings

- Recommendations

- Next Steps

Project Overview

Lightcast is part of the National Cybersecurity Workforce and Education Strategy

Biden-Harris Administration's National Cybersecurity Strategy and Lightcast

"Lightcast will provide quarterly data announcements on the size of the cyber talent needs, providing a more comprehensive, up-to-date picture of the cyber labor market. In addition, Lightcast will develop a skills-based hiring toolkit for employers to help companies implement skills-based hiring best practices in developing their cyber workforce. In addition, Lightcast is on track to get up to 900,000 unique users on the CyberSeek website this year."

- White House National Cybersecurity Workforce and Education Strategy 2023 (Press Release)
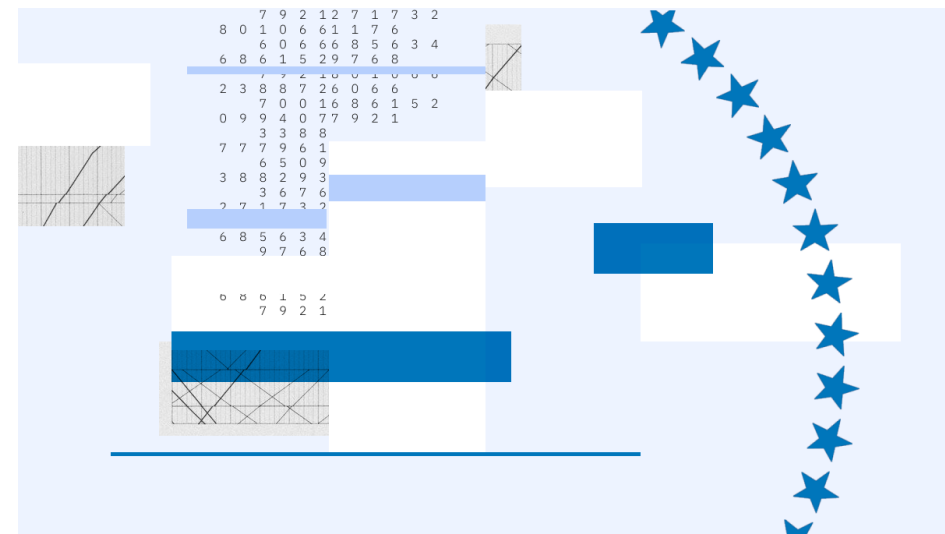
Project Overview

Find gaps in the Maryland cybersecurity labor market, then identify the training available to fill those gaps.

Labor Market Assessment

Detail of workforce needs by:
- Sector: private industry, public (state & local), and defense (public and private contractor)
- Level of certification in demand (CompTIA, ISC2, etc.)
- Level and types of degrees / non degree jobs
- Proportion of need requiring top secret clearance

Targeted engagement with industry to validate the needs assessment

Alignment with the direction of the National Cyber Workforce and Education Strategy

Asset Map

A baseline inventory of existing workforce development resources (Public, Private, Non-Profit)

Assessment of alignment between current assets and the direction of the National Cyber Workforce and Education Strategy

Ability of the current assets to meet employers needs for cybersecurity in the State of Maryland

Identification of gaps in the training landscape

Recommendations tailored to public and private partners

Recommendations to Policymakers

Recommendations to policymakers will cascade from the National Cyber Workforce and Education strategy:

- Identify opportunities to facilitate partnerships for new training and education programs to address workforce needs
- Recommendations for state alignment with the National Cyber workforce and education strategy
- Recommendations on metrics to measure success/impact of the Cyber Maryland Program
- Analysis of initiatives in other states
- Analysis of existing and potential Federal initiatives which may supplement the Cyber Maryland Program

Recommendations to Public-Private Partnerships

These recommendations will hue to the US Chamber Talent Pipeline Management (TPM) framework for upskilling and reskilling. This framework has 6 pillars:

1. Organize for Employer Leadership and Collaboration
2. Project Critical Job Demand
3. Alignment and Communicate Job Requirements (create a shared language for hiring requirements)
4. Analyze Talent Supply (current and future supply)
5. Build Talent Supply Chains (develop internal/external talent pipelines)
6. Engage in Continuous Improvement and Resiliency Planning

Project Timeline

		Week of...												
		1/1	1/8	1/15	1/22	1/29	2/5	2/12	2/19	2/26	3/4	3/11	3/18	3/25
Phase Zero	Present Preliminary Study to Board	■												
Phase One	Inventory of Cybersecurity Programming		■	■	■	■								
	Literature review on best practices		■											
	Map existing resources in MD			■	■	■								
Phase Two	Supply/Demand modeling					■	■	■	■	■				
	Core Cyber Occupations					■	■	■	■					
	Demographics						■	■	■					
	Skill-level trends							■	■					
Recommendations Report	Findings and recommendations report						■	■	■	■				
	Presentation to Cyber Maryland Board										■			
	Focus Groups										■	■	■	
Phase Three	Final report (data appendix + validated recommendations)										■	■		
Phase Four	Follow-on support											■	■	■

The Cyber Maryland board will be involved during the stages outlined in purple above.

Approach & Methodology

Millions of Labor Market Data Points

Highly Granular

3.4 million
Active unique jobs collected daily

50,000
Sources across the web - job boards and corporate sites

>1 million
Firms represented, from large corporations to SME's

Dynamic Labor Market Taxonomy

23 Career Areas
1700 Occupations
18,000 Skills
60,000 Skill Variants
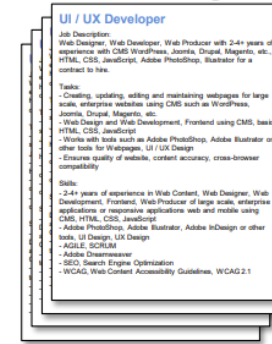
80%
Deduplication ensuring integrity and consistency

300 million
Resumes processed per annum
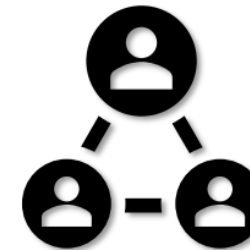
>1 billion
Historical job market records

Collect & Deduplicate Job Postings

UI / UX Developer

Collect and Clean Social Profiles

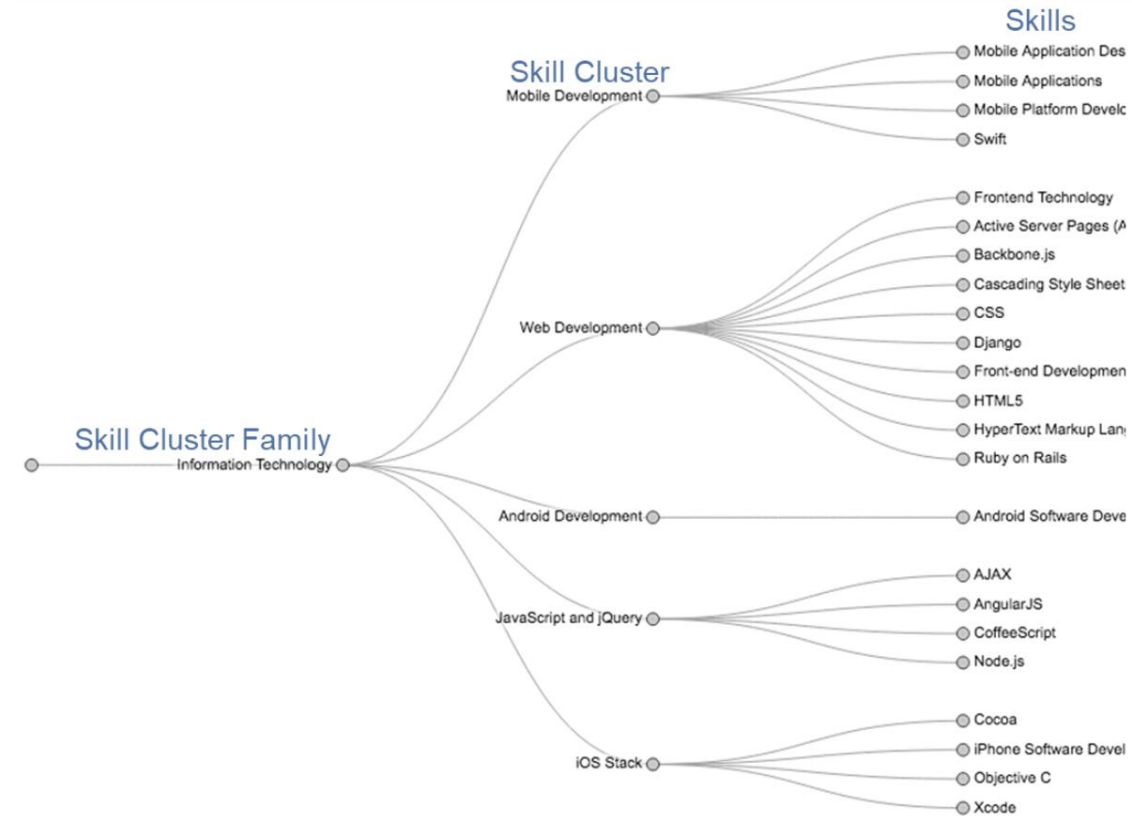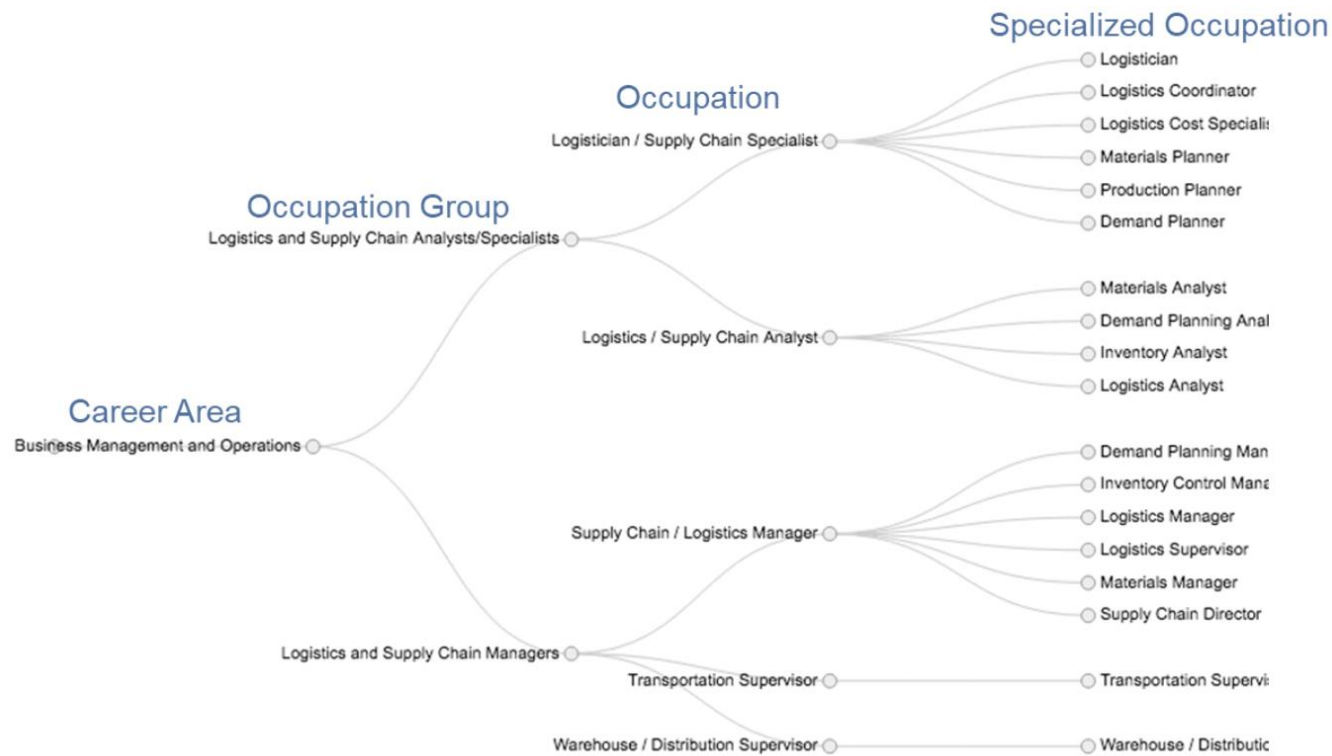**Parse Job Postings and Standardize Social Profiles to Generate Detailed Data**

- Job Title & Occupation
- Employer & Industry
- Technical Skills
- Foundational Skills
- Certifications
- Educational Requirements
- Experience Levels
- Salaries

Lightcast Data

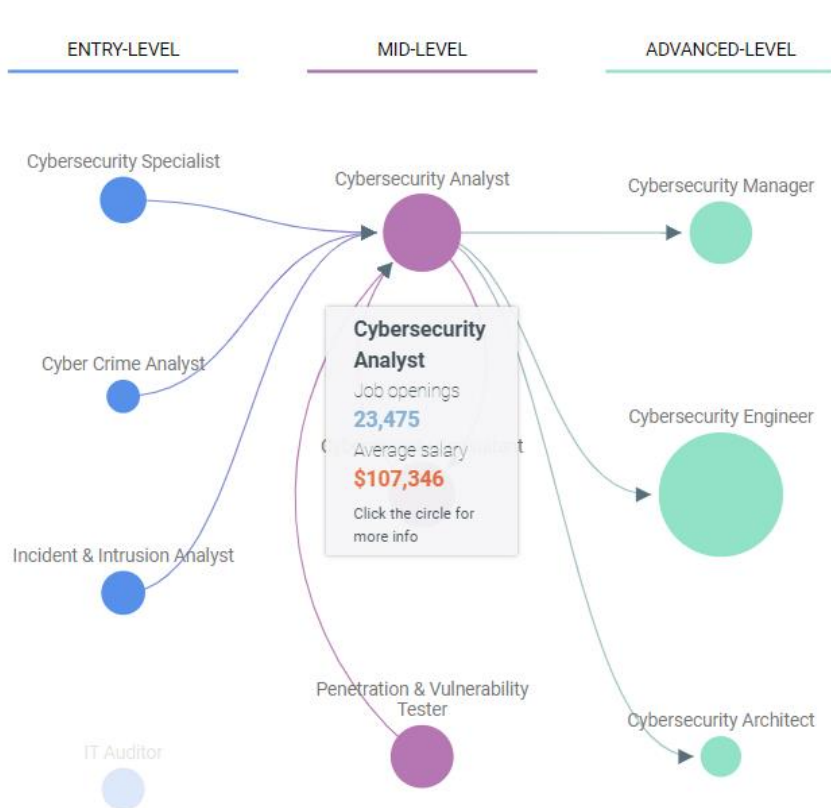## Comprehensive and Dynamic Data Taxonomies

Lightcast Cybersecurity Labor Market Expertise

Lightcast maintains Cyberseek.org

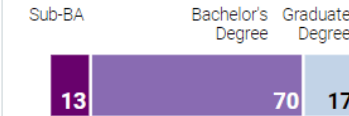# Lightcast Cybersecurity Labor Market Expertise

Industry Recognized Credentials
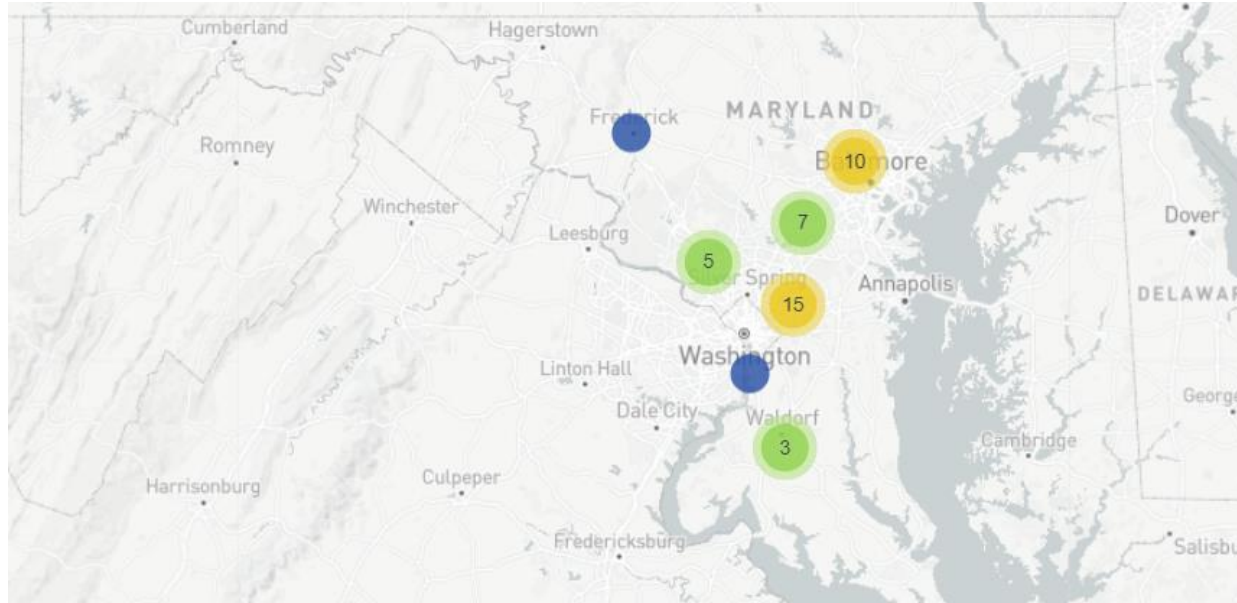
Cybersecurity Career Training
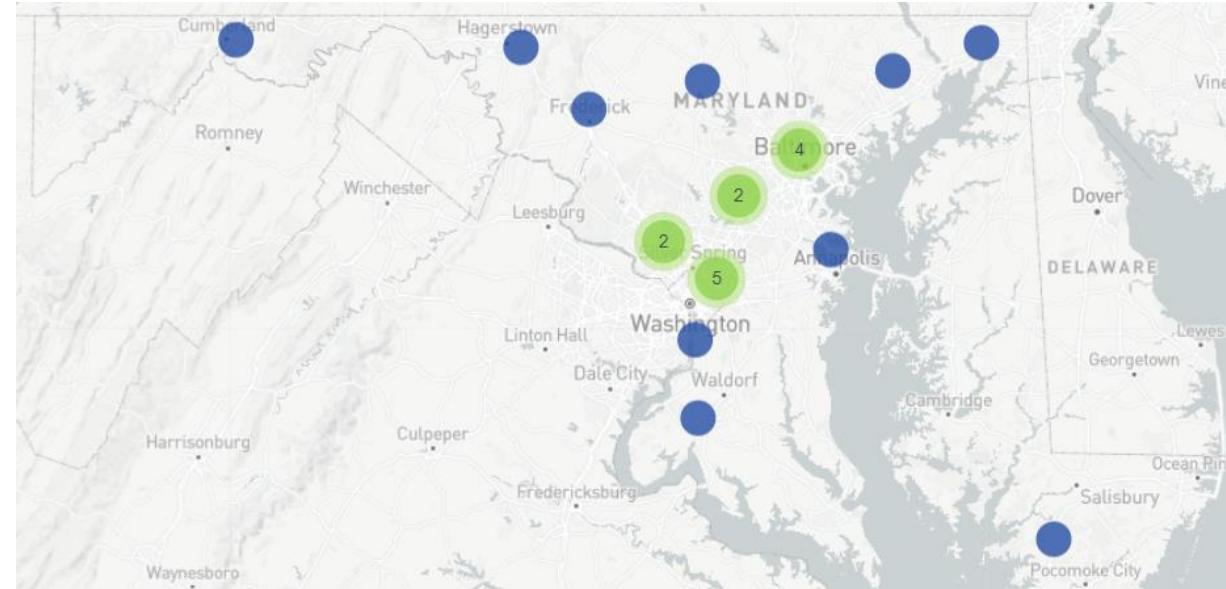
There are more than 50 providers of industry recognized credentials in cybersecurity and cybersecurity career training centers.

Key Findings

The Cyber Maryland region is the national epicenter of cybersecurity talent...

Second in Cyber Employment Concentration

State Name	LQ of Cyber Employment
Virginia	2.84
Maryland and DC	2.69
Idaho	2.31
Colorado	1.51
Hawaii	1.49
New Mexico	1.17
Georgia	1.17
Alabama	1.16
Alaska	1.15
Rhode Island	1.12
Washington	1.11
Wyoming	1.05
Utah	1.05
Montana	1.04
Massachusetts	1.02
North Carolina	1.02
Vermont	1.01
Delaware	1.01
Arizona	1.00

Fourth in Cyber Employment

State Name	Cyber Employment
California	166,648
Texas	125,506
Virginia	108,403
Maryland and DC	87,555
Florida	77,209
New York	73,619
Georgia	53,005
Illinois	47,902
North Carolina	46,141
Pennsylvania	42,735
Colorado	41,381
Ohio	38,935
Washington	37,585
New Jersey	37,307
Massachusetts	35,189
Michigan	30,293
Arizona	29,636
Missouri	23,063
Alabama	22,671
Minnesota	20,222

Second in Cyber Demand Concentration

State Name	LQ of Cyber Demand
Virginia	3.66
Maryland and DC	3.09
Idaho	2.06
Hawaii	1.74
Colorado	1.35
Alabama	1.32
Vermont	1.24
Delaware	1.12
Rhode Island	1.12
Georgia	1.08
New Mexico	1.04
North Carolina	1.02
Texas	1.01
Utah	1.00

Second in Cyber Demand

State Name	Active Cyber Demand
Virginia	13,448
Maryland and DC	9,781
California	9,238
Texas	8,843
Florida	5,282
Illinois	5,242
New York	4,238
Colorado	3,848
Pennsylvania	3,678
Georgia	3,669
Massachusetts	3,252
North Carolina	3,165
Ohio	2,954
New Jersey	2,469
Arizona	2,418
Alabama	2,338
Michigan	2,283
Washington	2,130
Missouri	1,968
Minnesota	1,410

...But it is less so a hub for the development of cybersecurity talent.

Seventh in Sub-BA Completions

State Name	Sub-BA Completions
North Carolina	4,521
Kentucky	3,778
California	3,456
Texas	3,296
Florida	2,317
Virginia	1,805
Maryland and DC	1,690
Arizona	1,649
New York	1,609
Utah	1,175
Pennsylvania	1,167
Georgia	1,070
Indiana	990
Illinois	931
Washington	929
Colorado	828
Ohio	785
Massachusetts	701
Alabama	679
Oklahoma	669

Tenth in Bachelor's Completions

State Name	BA Completions
California	11,905
Texas	7,058
New York	6,907
Florida	5,470
Pennsylvania	4,570
Massachusetts	3,856
Georgia	3,758
Utah	3,709
Virginia	3,659
Maryland and DC	3,647
Illinois	3,524
Michigan	3,301
North Carolina	3,144
Arizona	2,907
Ohio	2,788
Indiana	2,588
Washington	2,581
New Jersey	2,412
Colorado	2,321
Missouri	1,972

Fifth in Advanced Degree Completions

State Name	Advanced Degree Completions
California	5,274
New York	5,039
Georgia	2,945
Massachusetts	2,860
Maryland and DC	2,664
Texas	2,540
Illinois	2,353
Pennsylvania	2,244
Utah	2,101
Arizona	1,799
Missouri	1,549
Kentucky	1,507
Florida	1,499
New Jersey	1,374
Virginia	1,329
Ohio	1,062
Colorado	1,021
North Carolina	975
Michigan	832
Washington	804

This misalignment leads to the largest supply-demand gap for cybersecurity in the country.

Second in the Size of the Talent Gap

State Name	Talent Gap
Virginia	8,503
Maryland and DC	6,513
Illinois	2,625
Colorado	1,870
Massachusetts	1,595
Alabama	1,474
Pennsylvania	1,458
Florida	958
Missouri	922
Ohio	902
New York	729
Michigan	707
Minnesota	684
New Mexico	670
Arizona	658
Hawaii	635
Nebraska	571
Wisconsin	563
North Carolina	540
Georgia	518

Sixth to Last in the Ratio of Supply-Demand

State Name	Share of Demand Met by Supply
Vermont	23%
Alaska	24%
Rhode Island	30%
North Dakota	32%
Nebraska	33%
Maryland and DC	33%
South Dakota	33%
Wyoming	34%
Hawaii	35%
New Mexico	35%
Virginia	37%
Alabama	37%
Montana	40%
Iowa	44%
Arkansas	48%
Illinois	50%
Massachusetts	51%
Colorado	51%
Minnesota	51%
Wisconsin	52%

Cybersecurity demand in the region is driven by government contractors.

Demand for Cybersecurity, by Sector

Active Job Postings
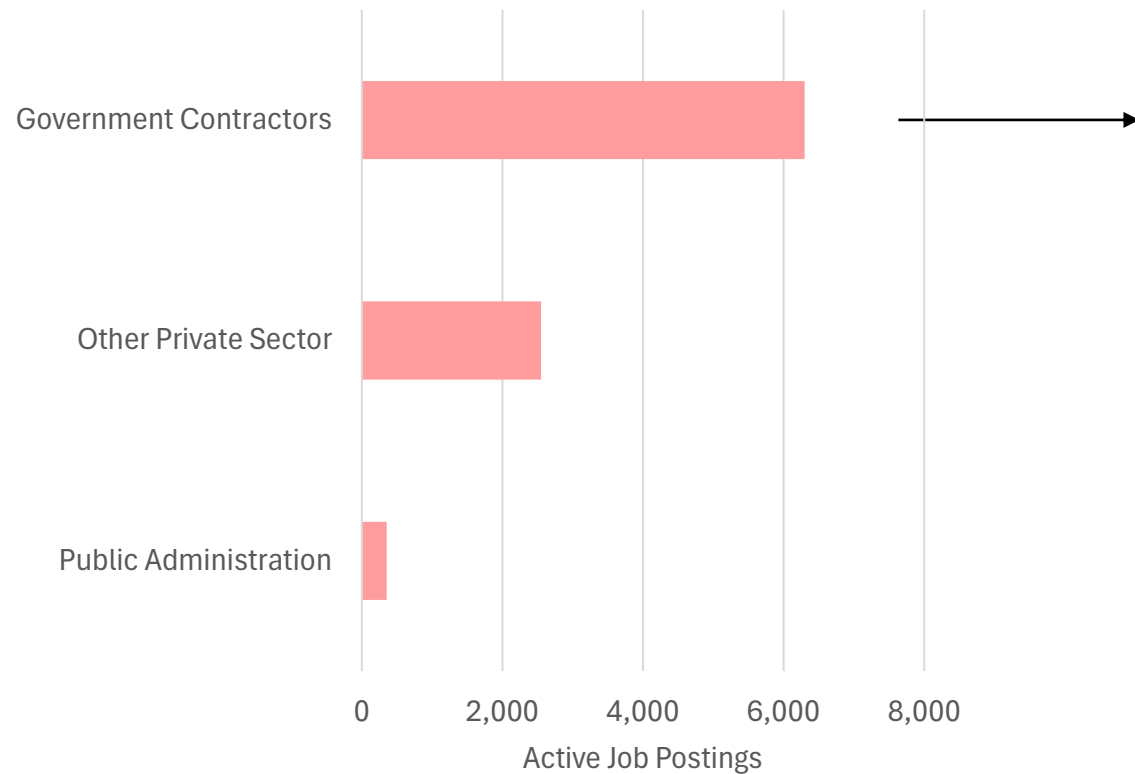
Postings (2019-2023) for cybersecurity, by Contractor Name

Employer Name	Demand (5yrs)
Leidos	10,704
General Dynamics	6,844
Booz Allen Hamilton	4,770
CACI International	3,179
Northrop Grumman	3,016
Deloitte	2,936
Guidehouse	2,765
SAIC	2,683
ManTech	2,581
Lockheed Martin	2,559
Kforce	1,454
Raytheon Technologies	1,374
Parsons	1,285
Accenture	1,283
Jacobs Engineering Group	1,223
IBM	1,110
Randstad	1,105
BAE Systems	945
Johns Hopkins	935
Mindpoint Group	853

The public sector is outsourcing many high-preparation roles to these contractors.

Demand for Cybersecurity, by Sector

Government Contractors

Other Private Sector

Public Administration

Active Job Postings
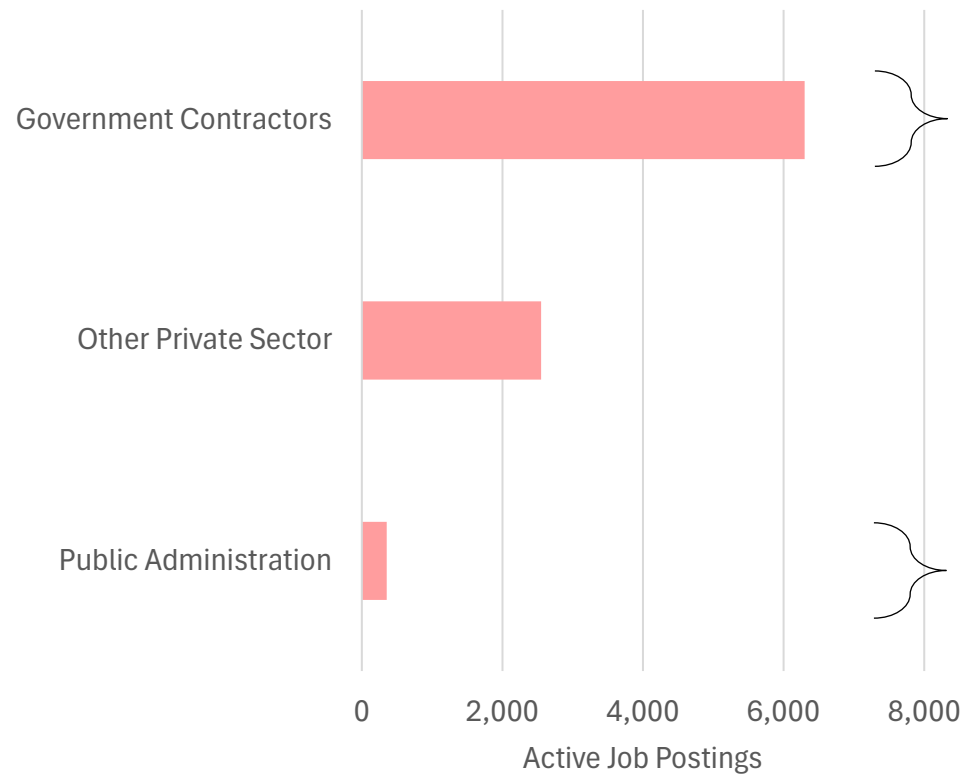
Across government contractors, there is a high diversity of occupations.

Across the public sector, demand is highly concentrated in one role.

Occupation Name	Share of Cyber Demand in Gov. Contractors Sector
Cyber Security Engineer	8%
Cyber Security Analyst	7%
Network Engineer / Architect	5%
Software Developer / Engineer	4%
Systems Engineer	3%
Cyber Security Manager / Administrator	3%
Systems Administrator	3%
Help Desk Technician / Analyst	2%
Other Occupations	65%

Occupation Name	Share of Cyber Demand in Public Sector
IT Specialist / Engineer	23%
IT Manager	6%
Cyber Security Analyst	4%
Cyber Security Specialist / Technician	4%
Cyber Security Manager / Administrator	4%
Cyber Security Engineer	3%
Security / Defense Intelligence Analyst	3%
Contracts Analyst	2%
Other Occupations	50%

Talent gaps are larger the more significant cyber is to the role – so cyber skills are the cause for talent shortages.

Lightcast classified occupations by how **significant** cybersecurity is to the role:
• Cyber-Forward Occupations develop cybersecurity tools or analyze cybersecurity data
• Downstream Cybersecurity Implementers are other tech roles that use the tools or data produced by cyber-forward occupations
• Diffuse Cybersecurity Users are non-tech jobs that must be aware of the cybersecurity discipline

Employment by Cyber-Significance Occupation Category
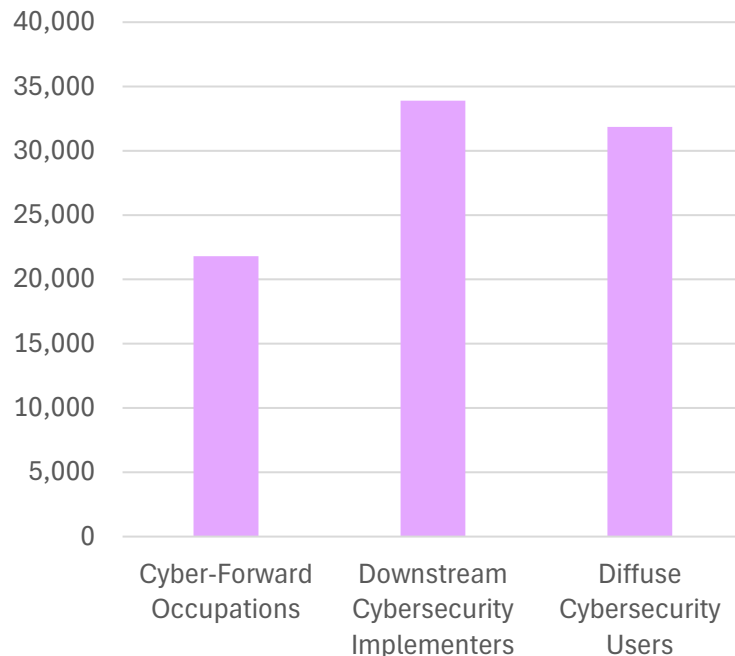
Supply and Demand by Cyber-Significance Occupation Category
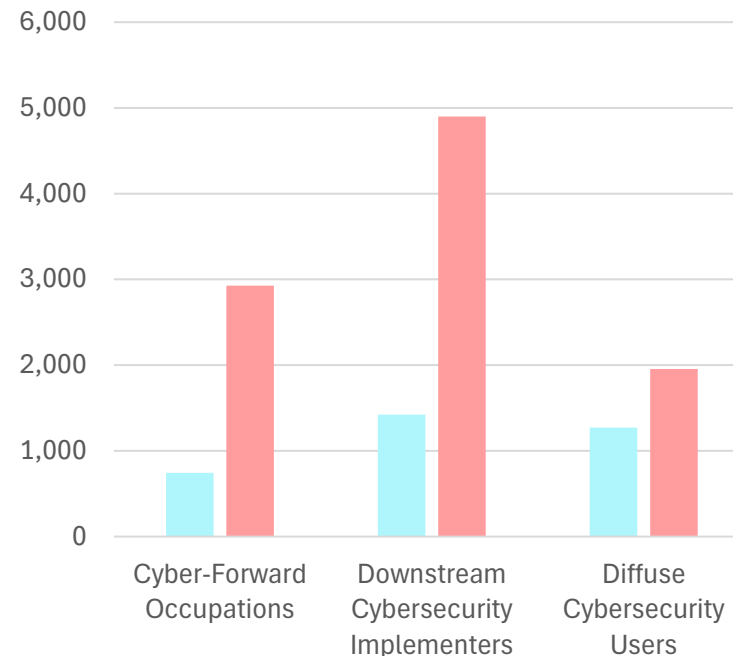
Percent of Demand that can be Met by Available Supply by Cyber-Significance
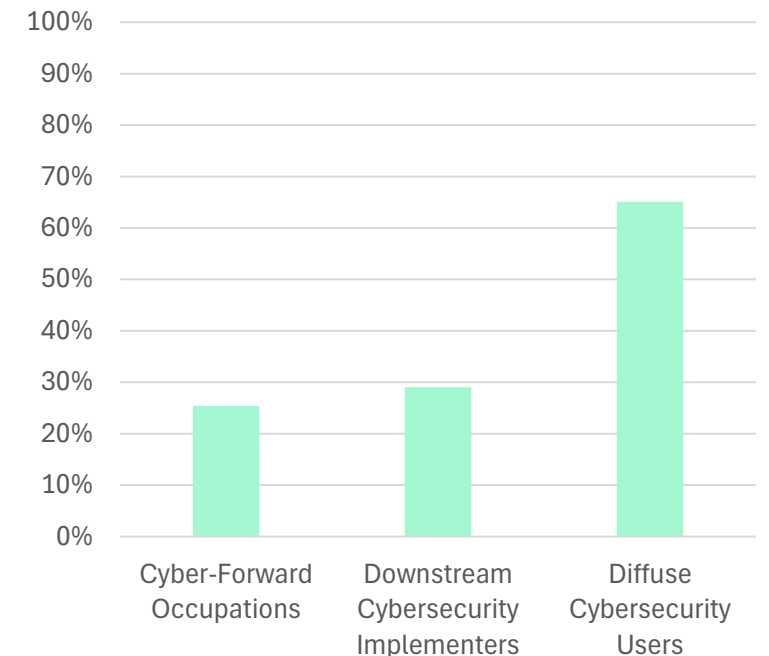
Fewer postsecondary programs in the region align to cyber-forward occupations, particularly at the sub-BA level.

Annual Cyber-Aligned Completions from the Postsecondary System, by Cyber-Significance Category

- Cyber-Forward Occupations
- Downstream Cybersecurity Implementers

29%, 1,814

71%, 4,356

Annual Cyber-Aligned Completions from the Postsecondary System, by Award Level

2%, 124

29%, 1,786

6%, 351

42%, 2,603

12%, 759

9%, 549

- Doctors degree
- Masters degree
- Post-baccalaureate / Post-master's Certificate
- Bachelors degree
- Associates degree
- Non-Degree Award
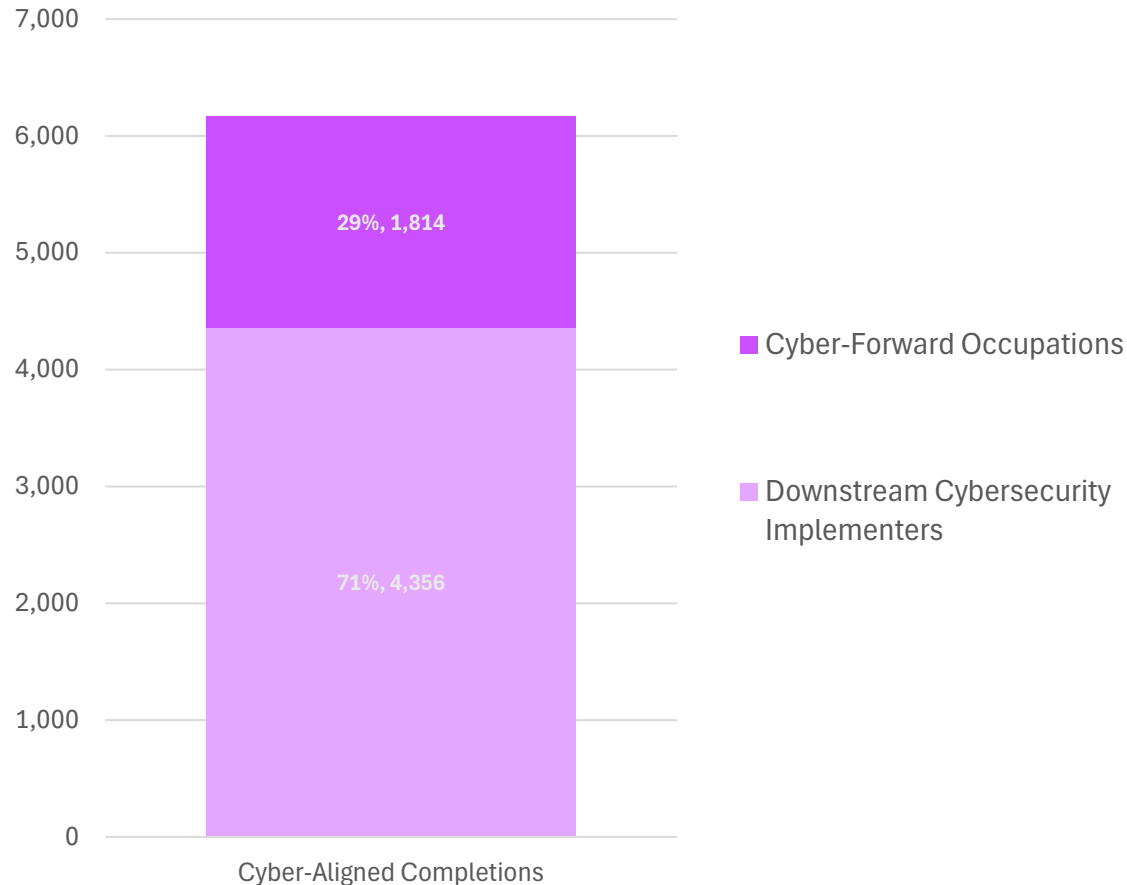
Cyber-Aligned Completions

Adult education programs boost the number of cyber-aligned completers but are small relative to the postsecondary system.

Annual Cyber-Aligned Completions from the Postsecondary System, by Cyber-Significance Category
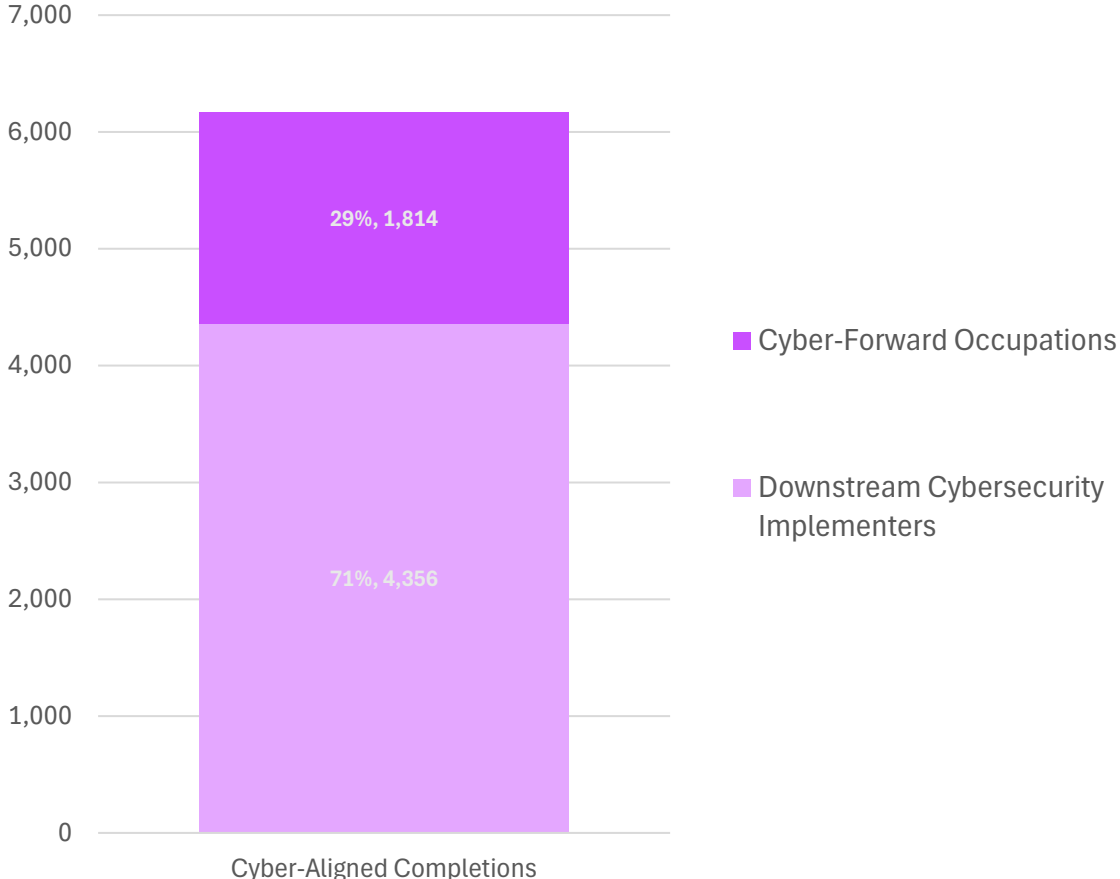
Annual Cyber-Aligned Completions from Adult-Education Training Organizations, by Cyber-Significance Category

Left chart:
- 29%, 1,814 — Cyber-Forward Occupations
- 71%, 4,356 — Downstream Cybersecurity Implementers
- x-axis: Cyber-Aligned Completions

Right chart:
- 60%, 815 — Cyber-Forward Occupations
- 40%, 535 — Downstream Cybersecurity Implementers
- x-axis: Cyber-Aligned Completions
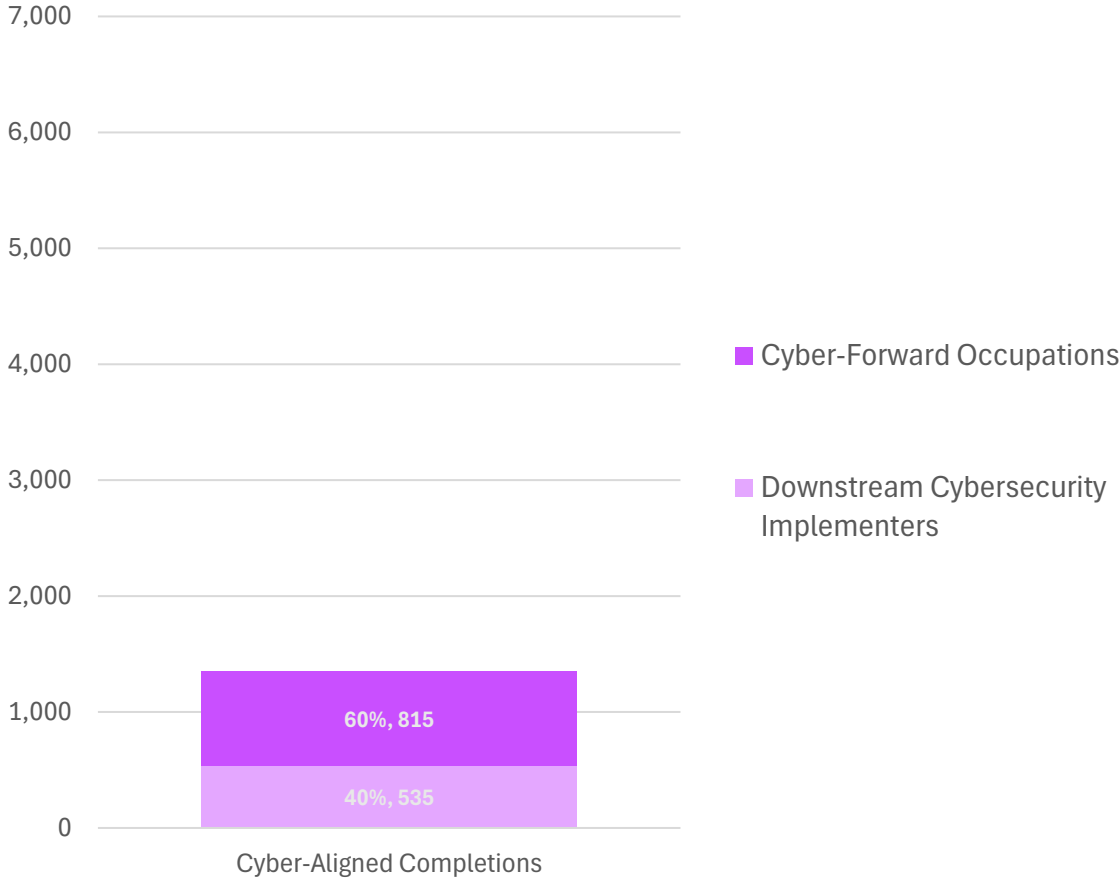
The cyber-forward occupations facing the greatest shortage are analysts, engineers, and specialists / technicians.

Employment by Cyber-Significance Occupation Category

Occupation	Employment
Cyber Security Analyst	~4,500
Cyber Security Engineer	~2,500
Cyber Security Manager / Administrator	~2,200
Security / Defense Intelligence Analyst	~2,100
Security Officer (General)	~2,100
Cyber Security Consultant	~1,800
IT Auditor	~1,700
Cyber Security Specialist / Technician	~1,250
Security Supervisor	~1,150
Security Manager	~1,000
Incident Analyst / Responder	~450
Cyber Security Architect	~450
Vulnerability Analyst / Penetration Tester	~400
Cyber Crime Analyst / Investigator	~150
Chief Information Security Officer	~50

Percent of Demand that can be Met by Available Supply

Occupation	Percent
Cyber Security Analyst	~20%
Cyber Security Engineer	~18%
Cyber Security Manager / Administrator	~40%
Security / Defense Intelligence Analyst	~13%
Security Officer (General)	~66%
Cyber Security Consultant	~67%
IT Auditor	~70%
Cyber Security Specialist / Technician	~19%
Security Supervisor	~43%
Security Manager	~45%
Incident Analyst / Responder	~22%
Cyber Security Architect	~27%
Vulnerability Analyst / Penetration Tester	~11%
Cyber Crime Analyst / Investigator	~39%
Chief Information Security Officer	~57%

These occupations – analysts, engineers, and specialists / technicians – show much higher education requirements in cyber than otherwise.

Share of Job Postings Requesting a Bachelor's Degree or Higher, When Hiring for Cyber vs. Non-Cyber Skills

Legend: ■ Cyber ■ Non-Cyber
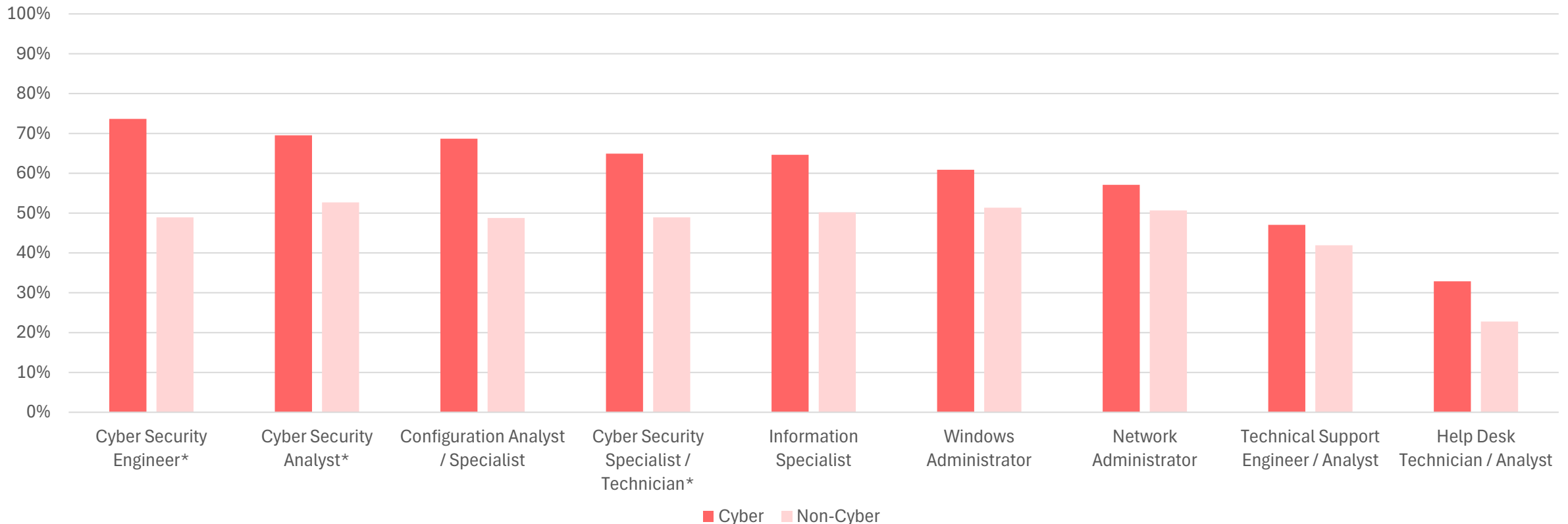
* The starred occupations *only ever* reference cybersecurity skills, as their job title suggests. For these occupations, an alternative non-cyber occupation was used for the comparison: Cyber Security Engineer used IT Specialist / Engineer, Cyber Security Analyst used ERP Analyst, and Cyber Security Specialist / Technician also used IT Specialist / Engineer. are *only ever* hiring for cybersecurity skills.

Certifications do a decent job of providing an alternative, non-degree entry point into cyber – except for in the public sector.

Share of Job Postings Requesting a Cyber or Other Professional Certification, by Sector and Certification Type

The low utilization of certs in the public sector is particularly surprising given industry recognition for IT Specialist certifications.

Share of Job Postings for IT Specialist / Engineer Requesting a Certification, by Sector and Certification Type

Security clearances, in turn, pose another barrier to entry within the sector.

Share of Job Postings Requesting a Security Clearance, by Sector
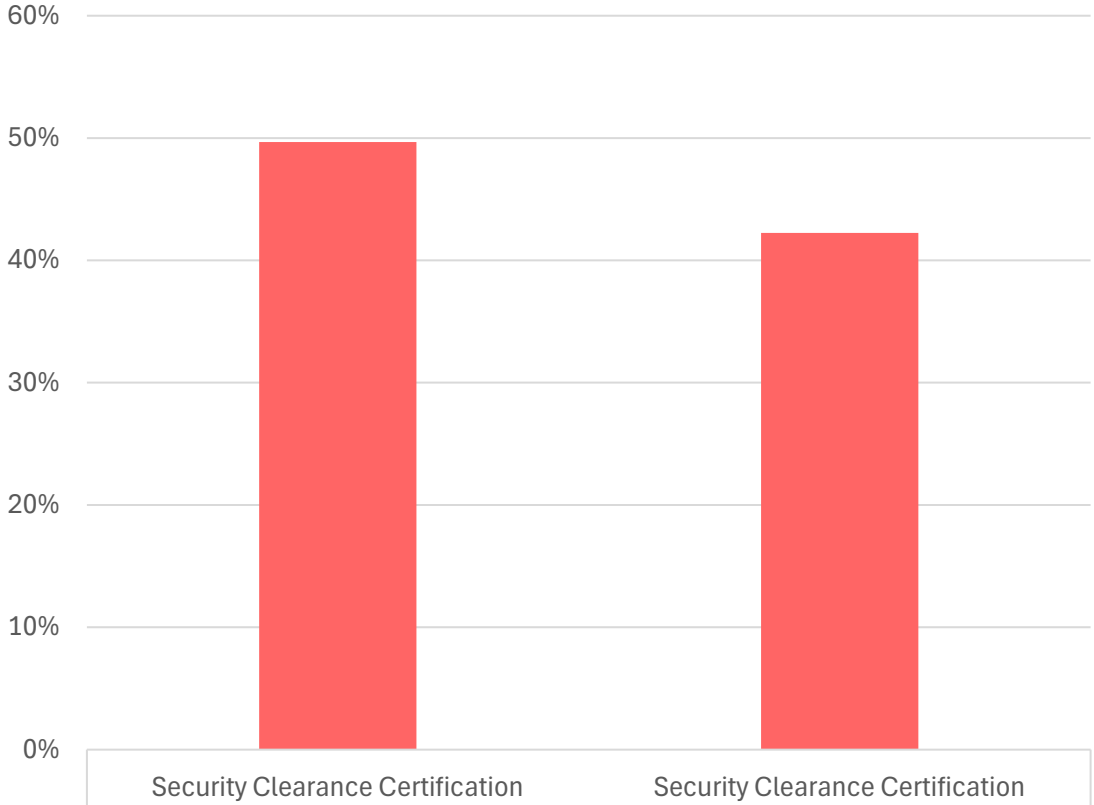
Requiring a BA or more has another issue for the Maryland region: cyber-aligned BA grads leave.

Grads Attracted from Elsewhere

Local Grads who Remained

Share of Current BA/BA+ Cyber Workforce

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

The MD/DC region is losing a lot of grads to other states. Retaining these grads could boost the supply by 50%.

Local Grads who Remained

Local Grads who Left

Share of BA/BA+ Cyber-Aligned Grads from Maryland Institutions

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
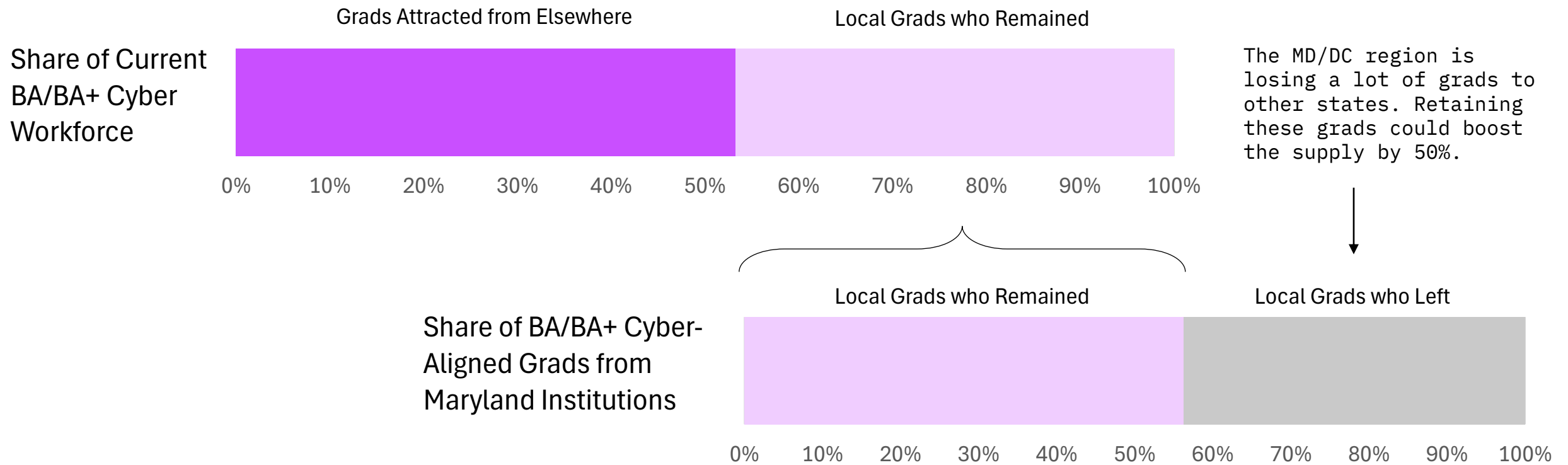
The Maryland and DC area does an impressive job of attracting cyber talent.

4th   Maryland / DC rank of *people attracted* to the local cyber sector

5th   Maryland / DC rank of *non-local share* of the local cyber sector

10th   Maryland / DC rank of *producing* cyber grads

24th   Maryland / DC rank of *retention rate* for cyber grads

Recommendations

Track key *workforce health improvement* metrics.

1. Supply/Demand Ratio for cyber-forward and cyber implementer occupations

2. Ratio of BA/BA+ to Sub-BA Job Postings for cyber-forward occupations

3. Share of Cyber Postings with Cyber Certification, disaggregated by public sector vs. private sector

4. Rate of Cyber-Aligned Completions vs Cyber Demand, year-on-year

5. Share of Cyber Demand Met by Postsecondary Completers, disaggregated to the sub-BA, BA, and BA+ levels

6. Race/Ethnicity Representation Ratio – percent of non-white/non-Asian cyber-forward workers to that population's share of the overall workforce

7. Gender Representation Ratio – percent women in cyber-forward workforce to that population's share of the overall workforce

Democratize cyber workforce industry data.

The Maryland and DC region may consider a state-specific instance of CyberSeek or a similar platform, available to jobseekers, career counselors, and other education and workforce stakeholders.
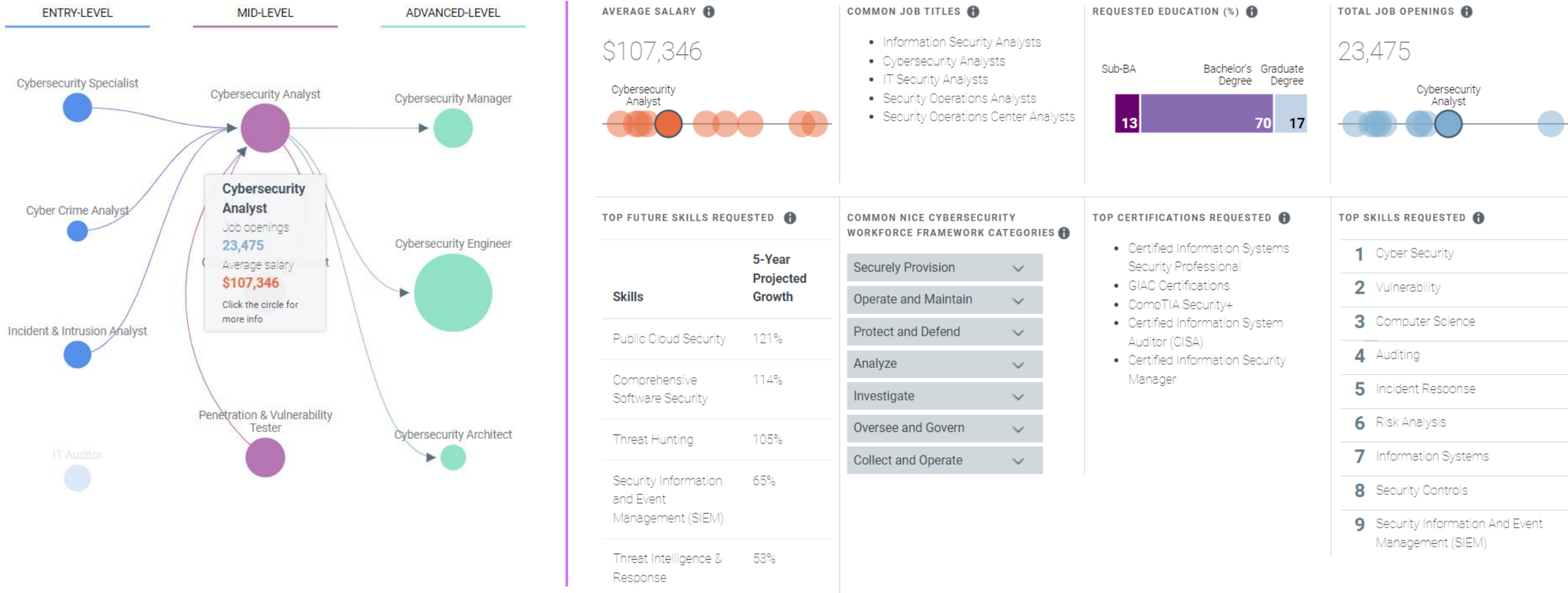
Tailor workforce, education, and industry engagement to occupation-level strategies using a data-driven and action-oriented framework.

Cyber-Forward Occupation Strategy Grid

Occupation Name	Throughput			Alignment			Non-Skill Barriers	
	Supply-Demand Gap	Postsecondary System	Adult Education Ecosystem	Occ Share in Cyber	Cyber Retention Rate	Overall Retention Rate	Percent of Demand BA/BA+	Percent Requesting Clearance
Red Flag:	*>100*	*<25%*	*<25%*	*<30%*	*<50%*	*> Cyber Rate*	*<75%*	*>50%*
Cyber Security Engineer	604	21%	24%	85%	46%	47%	74%	50%
Cyber Security Analyst	564	24%	38%	69%	67%	66%	70%	52%
Security / Defense Intelligence Analyst	208	0%	17%	29%	63%	56%	68%	59%
Cyber Security Manager / Administrator	160	14%	20%	85%	49%	48%	71%	30%
Vulnerability Analyst / Penetration Tester	159	9%	21%	84%	56%	61%	62%	48%
Cyber Security Specialist / Technician	153	19%	15%	91%	61%	59%	65%	51%
Incident Analyst / Responder	96	10%	20%	62%	56%	60%	63%	44%
Security Manager	53	0%	26%	41%	48%	50%	76%	47%
Cyber Security Architect	52	16%	20%	72%	38%	36%	73%	36%
Security Supervisor	45	0%	15%	22%	80%	82%	74%	57%

↑ All cyber-forward occupations could benefit from an expansion of targeted and aligned postsecondary programming

Existing skills-training organizations could expand their offerings to target the roles highlighted in red.

↑ Upskill these occupations in cyber skills

The Maryland / DC region has a retention issue with these occupations. Build out internships, apprenticeships, or earn-and-learn programs for these occupations to make learners sticky when they graduate.

↑ Engage employers and ind. assocs. on non-degree pathways into these roles.

At the BA/BA+ level, target retention efforts on the few institutions generating most grads.

Annual Cyber-Aligned Completions from the Postsecondary System, by Award Level and Institution [min. 25]

Award Level	Institution Name	Cyber-Forward Completions	Downstream Cybersecurity Implementers Completions	Total Completions [min. 25]
Bachelor's Degree	University of Maryland-College Park	38	860	898
	Towson University	23	315	339
	University of Maryland Global Campus	191	141	332
	University of Maryland-Baltimore County	13	303	316
	George Washington University	32	78	111
	Howard University	2	89	91
	United States Naval Academy	4	69	73
	Frostburg State University	14	48	62
	Georgetown University	2	46	48
	University of the District of Columbia	3	38	41
	Strayer University-Global Region	3	37	41
	Capitol Technology University	17	18	35
	Strayer University-Maryland	3	30	33
BA+ degree or cert.	George Washington University	94	233	327
	University of Maryland-College Park	13	181	195
	SANS Technology Institute	90	66	157
	Towson University	21	118	139
	University of Maryland-Baltimore County	3	75	78
	Capitol Technology University	39	39	78
	Johns Hopkins University	43	32	76
	Georgetown University	26	41	67
	Hood College	18	23	41

At the BA level, the University of Maryland-College Park is the completions leader by far. At the BA+ level, George Washington University holds that distinction.

At the Sub-BA level, regional institutions should instead focus on increasing completions.

Annual Cyber-Aligned Completions from the Postsecondary System, by Award Level and Institution Name [min. 25]

Award Level	Institution Name	Cyber-Forward Completions	Downstream Cybersecurity Implementers Completions	Total Completions [min. 25]
Sub-AA award	Anne Arundel Community College	97	83	180
	Frederick Community College	16	55	71
	SANS Technology Institute	36	27	63
	Baltimore City Community College	23	38	61
	College of Southern Maryland	21	27	48
Associate's Degree	Community College of Baltimore County	40	72	112
	Prince George's Community College	27	85	112
	Anne Arundel Community College	47	52	100
	Montgomery College	46	34	79
	Howard Community College	0	70	71
	Harford Community College	18	41	59
	Baltimore City Community College	17	41	58
	College of Southern Maryland	22	30	52
	Hagerstown Community College	13	22	34
	Carroll Community College	13	18	31

Annual Cyber-Aligned Completions from Adult-Education Training Organizations

Award Level	Cyber-Forward Completions	Downstream Cybersecurity Implementers Completions	Total Completions [min. 25]
Training Org. Cert.	815	535	1,350

Opportunity to expand Sub-AA non-degree throughput at Anne Arundel CC, Frederick CC, SANS, and Baltimore City CC.

Opportunity to expand AA degree throughput at Baltimore County CC, Prince George's CC, Anne Arundel CC, and Montgomery College, and Howard CC.

From 53 distinct orgs., including Per Scholas, NPower, Urban Geeks, Cybrary, National Cyber League, Practical IT, and more. Lightcast mapped their programming to occupations in the Cyber-Forward and Downstream taxonomies.

Occupations featured in the grid that could benefit from expanded programming at adult education training organizations.

→

Occupation Name	Supply-Demand Gap	Postsecondary System	Adult Education Ecosystem
Red Flag:	*>100*	*<25%*	*<25%*
Cyber Security Engineer	604	21%	24%
Cyber Security Analyst	564	24%	38%
Security / Defense Intelligence Analyst	208	0%	17%
Cyber Security Manager / Administrator	160	14%	20%
Vulnerability Analyst / Penetration Tester	159	9%	21%
Cyber Security Specialist / Technician	153	19%	15%

→ Skills Training Organizations that **do** have cyber programming but **do not** feature programming for these roles:

- NPower
- Practical IT
- Per Scholas Baltimore
- Right Direction Technology Solutions, llc
- Urban Geeks
- Officepro, inc
- Transmosis
- Harford Community College Certifications

- Per Scholas Silver Spring
- Howard Community College & Cybersecurity Association of Maryland, Inc. (CAMI)
- Byte Back
- National Cyber League
- Baltimore Cyber
- Cecil Community College Certifications
- I'm Still Standing Community Development Corporation

...And accelerate programming at others that already have aligned programming.

Occupations featured in the grid that could benefit from expanded programming at adult education training organizations.

Occupation Name	Supply-Demand Gap	Postsecondary System	Adult Education Ecosystem
Red Flag:	>100	<25%	<25%
Cyber Security Engineer	604	21%	24%
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Cyber Security Manager / Administrator	160	14%	20%
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Cyber Security Specialist / Technician	153	19%	15%

→ Skills Training Organizations that **already** have cyber programming for these roles:

- legends of tech
- traversed
- Anne Arundel Workforce Development Corporation
- visionary technologies, inc.
- beyond20
- o-line security
- bridging cyber
- captiva solutions
- trutek solutions, llc
- carter enterprise solutions
- aceotech llc. dba dod training center

- connsci, llc
- lka computer consultants inc.
- cybrary
- ops tech alliance
- cyloc solutions llc
- snva llc
- focal point academy
- trainace-academy of computer education
- gromanet consults, llc
- trutek academy
- gsa train
- umbc training centers