ICT & Cybersecurity

WORKFORCE central

Skills Gap Analysis & Sector Strategies

Commissioned by Workforce Central on behalf of the Pierce County Workforce Development Council

September 2016

EXECUTIVE SUMMARY

Background and Purpose

WorkForce Central (WFC) and the Pierce County Workforce Development Council (WDC) work closely together to support a strong economy by leading and overseeing our region's comprehensive workforce development system that prepares job seekers and workers with 21st century knowledge and skills required by businesses. WFC and WDC partner with leaders from the business community, philanthropic organizations, organized labor, education, government, community based organizations and other key stakeholders to shape and support workforce solutions.

Commissioned by WFC on behalf of the WDC, this study compares projected demand for specific occupations against labor supply to identify potential workforce gaps. This skills gap and sector strategy analysis, combined with feedback from industry stakeholders, will be used to plan for the changing needs of the industry and inform workforce preparation strategies. In addition, this study may be used to influence policy and investment decisions throughout and beyond the workforce development system.

Since 2010, Community Attributes Inc. (CAI) has produced multiple talent pipeline studies that examine various sectors. The studies compare projected demand for specific occupations against labor supply to identify potential workforce gaps.

Methods

Talent pipeline analysis draws from data published by the Washington State Employment Security Department, the Bureau of Labor Statistics (BLS) and the National Center for Education Statistics (NCES).

In addition to the talent pipeline analysis, in-depth interviews conducted with stakeholders in the ICT and cybersecurity industry inform findings. Interviews covered topics of hiring, recruiting, education and training as well as skills needs. Stakeholders interviewed included representatives from a variety of ICT and cybersecurity employers who provided a range of perspectives on the ICT and cybersecurity industry and "on-the-ground" realities.

Key Findings

Pierce County as a part of the larger Puget Sound Region is a hub for ICT and cybersecurity. **Although the industry in Pierce County is relatively smaller as an independent industry, ICT and cybersecurity skills are increasingly demanded throughout the Pierce County economy.** Employment in ICT and cybersecurity occupations is increasing.

Among ICT and cybersecurity core occupations employment is projected to grow 2.1 percent annually between 2013 and 2023. Occupational employment is projected to see net growth of 675 jobs per year. Employment among these core occupations is projected to grow from more than 14,200 in 2013 to more than 17,500 in 2023.

The **Talent Pipeline Dashboard** (*page vii*) shows occupations in the ICT and cybersecurity industry grouped by education level required for entry ranked by average annual openings within the industry from 2018 to 2023. The minimum education required for entry is defined by the Bureau of Labor Statistics and is not meant to indicate the education requirement defined by individual employers. In some cases, the actual education required by regional employers may be higher than the minimum education level category, and existing workers may have less education than shown. Supply is composed of two elements: the entry of new graduates into the workforce and the existing talent pool of qualified unemployment insurance (UI) claimants actively seeking employment.

Some overall findings include the following:

- The ICT and cybersecurity industry is expected to experience a surplus of 131 candidates annually. Total projected supply is estimated at 337 annual candidates from Pierce County, compared to total anticipated demand of 205 annual openings. Although there is a projected surplus of local talent it is important to note that within key occupations there are projected shortages of talent.

- ICT and cybersecurity occupations are increasingly demanded among industries across the county's economy. As evidenced by the relatively low concentration of ICT and cybersecurity occupational employment within the industry at 30 percent. As well as by high employment in other industries, with almost 10,000 workers in core occupations employed in other industries.

- Cybersecurity is a fast growing component of the industry. Among all core occupations, information security analysts are projected to see the strongest growth at 3.8 percent annually. Overall, occupational employment within the industry is projected to grow 1.8 percent annually between 2018 and 2023. As more and more industries and businesses implement networks and put their information online, there will be an increasing need for people with the skills to protect this information.

- Industry stakeholders noted that educational programs with similar names have inconsistent learning outcomes and rigor, confusing both potential students and employers.

- Stakeholders noted that they do not have difficulty finding workers qualified for entry-level occupations. However, positions requiring higher skill and experience levels are very difficult to fill.

- Potential workers, especially transitioning military, need to know which occupations are in demand, the wages associated with these occupations and a clearly defined path to get into the occupation. Although this information is available it can be challenging to find.

- Finding qualified candidates to fill open positions in cybersecurity and information security is particularly challenging. The skills required for this specialty cover a broad set of technical expertise and exceptional critical thinking skills to counter creative and constantly evolving security threats.

- Communications and soft skills are key in the ICT industry, but these are skills that are often lacking among applicants. New entrants into the ICT industry may not understand that writing and communications skills are vitally important to success within the industry. Educational programs often focus on required hard skills but do not ensure that graduates have the necessary soft skills required by the work environment.

Some initial recommendations include the following:

- Convene employers and colleges to improve alignment between education programs and employer needs.

- Develop and market career pathways maps that describe different career tracks, with their associated education, experience requirements and salary levels.

- Develop continuing education opportunities for current ICT workers focused on improving leadership, communication, soft skills and critical thinking.

- Data and employer feedback indicates that computer network support specialists may be in oversupply. Work with community colleges offering this training to build on efforts to add stackable certificates and articulations with baccalaureate-level programs. Ensure this additional education is available to working adults.

Blank.

Pierce County ICT & Cybersecurity Talent Pipeline

On-the-Job Training

Annual Average Demand and Supply — All Occupations by Education

- Demand: 85
- Supply: 96 (5 Graduates, 91 UI Claims)

#	Occupation (Ranked by Annual Openings 2018-2023)	Employment 2013	Employment 2023	CAGR 2013-2023	Demand	Supply	Gap
1	Customer Service Representatives	3,904	4,903	2.3%	43	50	7
2	Sales Representatives, Services, All Other	1,302	1,628	2.3%	10	22	12
3	Computer User Support Specialists	774	992	2.5%	8	1	(7)
4	Bill and Account Collectors	257	322	2.3%	5	12	7
5	Telemarketers	154	283	6.3%	5	3	(2)
6	Computer, Automated Teller, and Office Machine Repairers	171	209	2.0%	4	2	(2)
7	Order Clerks	524	654	2.2%	4	1	(3)
8	Telephone Operators	37	51	3.3%	3	0	(3)
9	First-Line Supervisors of Non-Retail Sales Workers	582	687	1.7%	2	1	(1)

Scale: 0 - 60 annual openings in sector

Associate Degree or Postsecondary Award

Annual Average Demand and Supply — All Occupations by Education

- Demand: 43
- Supply: 113 (76 Graduates, 37 UI Claims)

#	Occupation (Ranked by Annual Openings 2018-2023)	Employment 2013	Employment 2023	CAGR 2013-2023	Demand	Supply	Gap
1	Medical Transcriptionists	357	448	2.3%	11	4	(7)
2	Telecommunications Equipment Installers and Repairers, Except Line	380	439	1.5%	9	29	20
3	Web Developers	308	409	2.9%	8	9	1
4	Computer Network Support Specialists	242	288	1.8%	7	59	51
5	Medical Equipment Repairers	242	292	1.9%	5	2	(3)

Scale: 0 - 70 annual openings in sector

Bachelor's Degree

Annual Average Demand and Supply — All Occupations by Education

- Demand: 78
- Supply: 128 (105 Graduates, 23 UI Claims)

#	Occupation (Ranked by Annual Openings 2018-2023)	Employment 2013	Employment 2023	CAGR 2013-2023	Demand	Supply	Gap
1	Software Developers, Applications	721	1,004	3.4%	29	2	(26)
2	Network and Computer Systems Administrators	428	557	2.7%	6	10	4
3	Computer Hardware Engineers	161	153	-0.5%	6	4	(2)
4	Computer and Information Systems Managers	294	356	1.9%	5	36	31
5	Statistical Assistants	132	163	2.1%	4	20	15
6	Computer Programmers	334	444	2.9%	4	2	(3)
7	Information Security Analysts	181	257	3.6%	4	12	8
8	Computer Systems Analysts	432	533	2.1%	4	7	3
9	Mechanical Engineers	227	251	1.0%	4	3	(0)
10	Software Developers, Systems Software	204	219	0.7%	3	2	(1)
11	Architectural and Engineering Managers	215	253	1.6%	2	1	(2)
12	Electronics Engineers, Except Computer	72	77	0.7%	2	0	(1)
13	Computer Network Architects	89	108	2.0%	1	27	25
14	Sales Engineers	62	72	1.5%	1	0	(1)
15	Electrical Engineers	165	187	1.3%	1	1	(0)
16	Industrial Engineers	232	241	0.4%	1	0	(1)

Scale: 0 - 44 annual openings in sector

Sources: Washington State Employment Security Department, 2014; Bureau of Labor Statistics, 2016; National Center for Education Statistics, 2016; Community Attributes Inc., 2016.

CONTENTS

Blank.

INTRODUCTION

Background and Purpose

Employment in the ICT and cybersecurity industry is growing rapidly throughout the county, and the skills required in the industry are demanded throughout the region's industries, including construction and healthcare. The ICT and cybersecurity industry is projected to grow 1.3 percent annually between 2018 and 2023. However, employment in ICT and cybersecurity occupations is projected to grow 1.8 percent annually between 2018 and 2023. Through the skills gap analysis and strategies, WorkForce Central (WFC) can plan for the changing workforce needs of the ICT and cybersecurity industry in Pierce County.

Wages among ICT and cybersecurity occupations are much higher than the regional average wage. The average wage in the ICT and cybersecurity industry is more than $72,800 annually, compared to a regional average wage of $57,370. The minimum wage within the industry is a median wage of $26,870 among telemarketers. The highest median wage within the industry is more than $143,000 annually among architectural and engineering managers followed by computer and information systems managers at more than $142,900 annually. Out of 36 core occupations 25 have median wages in excess of $50,000 annually.

As one of Pierce County's core and growing industries, a strong understanding of the demand, supply and employer perceptions will allow WFC and industry leaders to help address the workforce challenges of the future. Workforce professionals, educators and employers can use this information to help ensure Pierce County's workforce programs are providing the appropriate mix of training opportunities to meet the needs of the ICT and cybersecurity industry.

Methods

WorkForce Central serves employers and workers within Pierce County, representing almost ten percent of Washington's total employment. CAI's analysis relies on data published by the state of Washington and federal agencies. Specifically, the following data sources form the foundation of the modeling:

- **Occupational estimates and forecasts from the Washington State Employment Security Department (ESD) and the Bureau of Labor Statistics.** This data provides current estimates and forecasted demand for occupations in Pierce County and associated educational requirements, as well as occupational wages. Occupational forecasts include openings created by retirements and separations, in addition to openings from newly created

positions. For this reason, average annual openings are larger than the average of net jobs created over a period of time.

- **Washington unemployment insurance claims.** This data, also published by ESD, provides monthly unemployment claims and the previous occupations of the claimant by occupation code.
- **Educational attainment data from the National Center for Education Statistics' Integrated Postsecondary Education System (IPEDS).** IPEDS provides the number of graduates by educational program for Pierce County's higher education institutions, defined according to the Classification of Instructional Programs, as well as a table of equivalence used to match educational programs to occupations.

Subsequent sections explain the details and limits of this data. In general, this data provides measures of demand and supply for a geographic region (i.e., Pierce County). The occupations are defined in accordance with the Bureau of Labor Statistics Standard Occupational Classification system and industries are delineated using definitions from the North American Industry Classification System.

To help provide context to the data, and capture rapidly evolving factors affecting employment patterns, in-depth interviews were also conducted as a part of this detailed ICT and cybersecurity talent pipeline analysis. Interviews were conducted with key stakeholders within the ICT and cybersecurity industry. These interviews were open-ended discussions and provided qualitative perspectives on workforce issues impacting the ICT and cybersecurity industry.

Organization of Report

- **ICT and Cybersecurity Industry Overview.** Provides an overview of the ICT and cybersecurity industry and the occupations that define the industry.
- **Demand Analysis.** Describes the composition of ICT and cybersecurity occupational demand in Pierce County.
- **Supply Analysis.** Breaks out the two elements of talent supply: new graduates entering the workforce and the existing pool of unemployment insurance claimants.
- **Supply and Demand.** Examines how local supply is expected to meet occupational demand in Pierce County.
- **Summary of Key Findings and Preliminary Recommendations.** Assesses in detail the results of the talent pipeline analysis and interview findings, focusing on key implications for Pierce County.

ICT & CYBERSECURITY INDUSTRY OVERVIEW

Assessing occupational gaps in an industry relies on a strict operational definition of which occupations compose that industry. Some occupations are present in nearly every industry and do not characterize the skills that define the industry specifically. Many administrative roles, for example, fit into this category. The first step in determining the core occupations that represent the primary set of skills within Pierce County's ICT and cybersecurity industry is developing an operable definition of the industry. The North American Industry Classification System (NAICS) groups industries in increasingly specific segments from the two-digit to the six-digit level. ICT and cybersecurity is a combination of specific 4-digit NAICS codes, with employment concentrated within wired telecommunications carriers, computer systems design and related services, and business support services. Other important ICT and cybersecurity industries include computer and peripheral equipment manufacturing, electronic shopping and mail-order houses, wireless telecommunications carriers, electronic equipment repair and maintenance, and data processing and related services.

Exhibit 1. Pierce County ICT & Cybersecurity NAICS by Employment, 2013[1]

Four Digit NAICS	Description	Employment, 2013
5171	Wired telecommunications carriers	1,480
5415	Computer systems design and related services	1,390
5614	Business support services	1,110
3341	Computer and peripheral equipment mfg.	820
4541	Electronic shopping and mail-order houses	520
5172	Wireless telecommunications carriers	320
8112	Electronic equipment repair and maintenance	240
5182	Data processing and related services	210
3332	Industrial machinery manufacturing	170
5191	Other information services	80
3345	Electronic instrument manufacturing	80
5112	Software Publishers	50
ICT and Cybersecurity Industry Total		**6,470**

Sources: U.S. Bureau of Labor Statistics, 2016; Washington State Employment Security Department, 2016; Community Attributes Inc., 2016.

The ICT and cybersecurity industry in Pierce County employs more than 6,470 people in Pierce County. The industry is primarily composed of

---

[1] The data in this analysis represents a base year of 2013. Although some employment datasets now have data available for 2014 and 2015, base year 2013 is used throughout this report for consistency. The occupational projections that are the source for the demand analysis and occupational employment are developed by the Washington State Employment Security Department and are updated annually. However, the projections lag available employment data by a year, and at the time of this analysis the projections had not yet been updated to reflect 2014 base year projections.

wired telecommunications carriers, computer systems design and related services and business support services, which represent 62 percent of total ICT and cybersecurity employment. (**Exhibit 1**)

Another method for defining the ICT and cybersecurity industry is to identify the core occupations that represent the primary skills within the industry. **Exhibits 2** and **3** lay out the core occupations that define Pierce County's ICT and cybersecurity industry. The process of assembling this list began with examining the structure of the occupation codes with employment within the ICT and cybersecurity industry. The Bureau of Labor Statistics defines occupations using the Standard Occupation Code system (SOC). These occupations have a two-digit prefix, grouping occupations of similar types, followed by a more detailed four-digit code, identifying each individual occupation. Occupations matching ICT and cybersecurity are first grouped by their concentration within the ICT and cybersecurity industry.

Occupations with fewer than 25 employees in the ICT and cybersecurity industry, or less than five percent concentration within the industry are excluded from the analysis as they are not considered core jobs within the industry. The core occupations identified represent only a portion of total employment within the ICT and cybersecurity industry. However, these occupations are highlighted in **Exhibits 2** and **3** because they represent the primary skills that define employment within this industry. Overall employment within the ICT and cybersecurity industry includes employment in other occupations that are not core to the industry. Additionally, core ICT and cybersecurity occupations are also present in industries other than ICT and cybersecurity throughout Pierce County, and are increasingly important within these industries as well.

Exhibit 2. Computer and Mathematical Occupations, Office and Administrative Support Occupations and Installation, Maintenance and Repair Occupations, Employment in Industry and Total Employment, Pierce County, 2013

SOC	Occupation	Employment in Industry ↓	Employment in Other Industries	Total Employment	Share in Industry
15-1132	Software Developers, Applications	481	240	721	67%
15-1152	Computer Network Support Specialists	175	67	242	72%
15-1151	Computer User Support Specialists	159	615	774	21%
15-1134	Web Developers	142	166	308	46%
15-1142	Network and Computer Systems Administrators	122	306	428	28%
15-1133	Software Developers, Systems Software	98	106	204	48%
15-1121	Computer Systems Analysts	93	339	432	22%
15-1131	Computer Programmers	67	267	334	20%
15-1122	Information Security Analysts	58	123	181	32%
15-1143	Computer Network Architects	30	59	89	34%
15-1199	Computer Occupations, All Other	6	408	414	1%
15-1141	Database Administrators	2	61	63	4%
15-2031	Operations Research Analysts	1	39	40	1%
	Computer and Mathematical Occupations Subtotal	**1,434**	**2,796**	**4,230**	**34%**
43-4051	Customer Service Representatives	838	3,066	3,904	21%
43-3011	Bill and Account Collectors	92	165	257	36%
43-9111	Statistical Assistants	84	48	132	64%
43-4151	Order Clerks	74	450	524	14%
43-9021	Data Entry Keyers	55	166	221	25%
43-2021	Telephone Operators	37	0	37	100%
	Office and Administrative Support Occupations Subtotal	**1,180**	**3,895**	**5,075**	**23%**
49-2022	Telecommunications Equipment Installers and Repairers, Except Line Installers	312	68	380	82%
49-9062	Medical Equipment Repairers	95	147	242	39%
49-2011	Computer, Automated Teller, and Office Machine Repairers	87	84	171	51%
49-2092	Electric Motor, Power Tool, and Related Repairers	26	58	84	31%
	Installation, Maintenance, and Repair Occupations Subtotal	**520**	**357**	**877**	**59%**

Sources: Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

Core ICT and cybersecurity occupations fall within a range of SOC codes. Employment in core ICT and cybersecurity occupations totals more than 14,200 workers. Employment within the industry is just 4,244 workers, thus occupational concentration within the industry is 30 percent. This low concentration within the industry is a strong indicator that the skills represented within these occupations are becoming central to many other industries throughout the Pierce County economy.

The highest concentration of occupations both in terms of employment and in terms of number of occupations are within the computer and mathematical occupation grouping, which represents 34 percent of total employment within the industry. The occupation with the greatest share of total employment are customer service representatives with total employment in Pierce County of 3,904. However, these occupations are only 21 percent concentrated within the ICT and cybersecurity industry. Telephone operators are 100 percent concentrated within the ICT and cybersecurity industry, however, employment within this occupation is

low. Applications software developers have high employment and additionally, are 67 percent concentrated within the ICT and cybersecurity industry. (**Exhibit 2**)

Exhibit 3. All Other ICT & Cybersecurity Occupations, Employment in Industry and Total Employment, Pierce County, 2013

SOC	Occupation	Employment in Industry ↓	Employment in Other Industries	Total Employment	Share in Industry
17-2061	Computer Hardware Engineers	156	5	161	97%
17-2141	Mechanical Engineers	73	154	227	32%
17-3023	Electrical and Electronics Engineering Technicians	69	133	202	34%
17-2072	Electronics Engineers, Except Computer	45	27	72	62%
17-2071	Electrical Engineers	27	138	165	16%
17-2112	Industrial Engineers	25	207	232	11%
	Architecture and Engineering Occupations Subtotal	**395**	**664**	**1,059**	**37%**
41-3099	Sales Representatives, Services, All Other	189	1,113	1,302	15%
41-9041	Telemarketers	69	85	154	45%
41-1012	First-Line Supervisors of Non-Retail Sales Workers	64	518	582	11%
41-9031	Sales Engineers	27	35	62	44%
	Sales and Related Occupations Subtotal	**349**	**1,751**	**2,100**	**17%**
11-3021	Computer and Information Systems Managers	115	179	294	39%
11-9041	Architectural and Engineering Managers	47	168	215	22%
	Management Occupations Subtotal	**162**	**347**	**509**	**32%**
31-9094	Medical Transcriptionists	206	151	357	58%
	All Occupations	**4,244**	**9,963**	**14,207**	**30%**

Sources: Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

Other important groupings of occupations include architecture and engineering occupations, sales and related occupations, and management occupations. (**Exhibit 3**)

Exhibit 4. ICT & Cybersecurity Occupations Median Wage and 90th Percentile Wage, Seattle-Tacoma-Bellevue MSA, 2014

SOC	Occupation	Employment in Industry	Median Wage ↓	90th Percentile Wage
	On-the-Job Training			
41-1012	First-Line Supervisors of Non-Retail Sales Workers	64	$75,440	$153,540
41-3099	Sales Representatives, Services, All Other	189	$54,520	$112,470
15-1151	Computer User Support Specialists	159	$53,170	$96,840
49-2011	Computer, Automated Teller, and Office Machine Repairers	87	$36,860	$62,540
43-4051	Customer Service Representatives	838	$36,270	$55,200
43-3011	Bill and Account Collectors	92	$36,170	$50,880
43-4151	Order Clerks	74	$35,560	$51,300
43-9021	Data Entry Keyers	55	$35,530	$51,520
41-9041	Telemarketers	69	$26,870	$37,400
43-2021	Telephone Operators	37 *	*	
	Associate degree or Postsecondary Award			
15-1134	Web Developers	142	$83,800	$137,190
15-1152	Computer Network Support Specialists	175	$70,790	$114,300
17-3023	Electrical and Electronics Engineering Technicians	69	$63,630	$89,830
49-2092	Electric Motor, Power Tool, and Related Repairers	26	$61,660	$92,240
49-2022	Telecommunications Equipment Installers and Repairers, Except Line Installers	312	$61,370	$82,940
49-9062	Medical Equipment Repairers	95	$51,460	$81,120
31-9094	Medical Transcriptionists	206	$43,040	$62,090
	Bachelor's degree			
11-9041	Architectural and Engineering Managers	47	$143,070	*
11-3021	Computer and Information Systems Managers	115	$142,920	*
15-1131	Computer Programmers	67	$119,070	$168,610
15-1132	Software Developers, Applications	481	$115,460	$160,810
15-1133	Software Developers, Systems Software	98	$115,330	$155,970
15-1143	Computer Network Architects	30	$113,780	$153,570
17-2072	Electronics Engineers, Except Computer	45	$108,100	$152,250
17-2061	Computer Hardware Engineers	156	$104,630	$166,730
17-2071	Electrical Engineers	27	$103,100	$149,460
15-1122	Information Security Analysts	58	$101,870	$127,860
15-1141	Database Administrators	2	$97,870	$129,400
15-1121	Computer Systems Analysts	93	$95,810	$144,600
17-2141	Mechanical Engineers	73	$91,350	$140,870
15-2031	Operations Research Analysts	1	$88,890	$121,480
15-1142	Network and Computer Systems Administrators	122	$86,790	$119,640
15-1199	Computer Occupations, All Other	6	$68,040	$114,630
43-9111	Statistical Assistants	84	$49,760	$67,670
17-2112	Industrial Engineers	25 *	*	
41-9031	Sales Engineers	27 *	*	

* indicates data is suppressed by the U.S. Bureau of Labor Statistics in order to comply with nondisclosure rules.

Due to data limitations median and 90th percentile wages are those for the matching occupation in the Seattle-Tacoma-Bellevue MSA, and are used as a proxy for Pierce County wages by occupation given data limitations for occupational wage data for Pierce County alone.

Sources: U.S. Bureau of Labor Statistics, 2014; Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

ICT and cybersecurity industry occupations pay high median wages within the Seattle-Tacoma-Bellevue MSA. Among the 36 core ICT and cybersecurity occupations, 18 pay median wages higher than $75,000 annually. There are high median wages even among occupations that require a minimum of on-the-job training, including first-line supervisors of non-retail sales workers, services sales representatives and computer

user support specialists. Each have median wages higher than $50,000 annually. The highest ten percent of wages within ICT and cybersecurity occupations are even higher, with 18 occupations with 90th percentile wages over $100,000 annually. (**Exhibit 4**)

On-the-job training, associate degree or postsecondary award and bachelor's degree are categories used to break core occupations into key groupings. These categories are based on Bureau of Labor Statistics minimum education required for entry. These education levels are set at a national level and may not be fully reflective of the hiring practices in Pierce County, or within individual companies. Additionally, actual openings for these occupations may have different requirements and the talent pool for these occupations may have different levels of education than indicated by the minimum educational level. These minimum education levels are used to group occupations by the relative level of training and education required for entry.

Exhibit 5. Comparative Average Wages, Pierce County and Seattle-Tacoma-Bellevue MSA, 2014

	Employment	Average Wage
Pierce County ICT & Cybersecurity Industry		
On-the-Job Training Occupations	1,663	$44,446
Associate Degree or Postsecondary Award Occupations	1,025	$63,661
Bachelor's Degree Occupations	1,557	$109,767
ICT & Cybersecurity Industry Total	4,244	$72,833
Seattle-Tacoma-Bellevue MSA	1,761,920	$57,370

Due to data limitations median and 90th percentile wages are those for the matching occupation in the Seattle-Tacoma-Bellevue MSA, and are used as a proxy for Pierce County wages by occupation, given data limitations for occupational wage data for Pierce County alone.
Sources: U.S. Bureau of Labor Statistics, 2014; Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

The average wage across the ICT and cybersecurity industry is more than $72,800 annually. Average wages in the industry range between $44,446 and $109,767 annually. As a whole the average wage in the industry is almost $15,500 more than the Seattle-Tacoma-Bellevue MSA average wage. (**Exhibit 5**)

Exhibit 6. ICT & Cybersecurity Occupational Employment in Other Industries by Industry, 2013

Industry	ICT Occupation Employment in Industry
Insurance carriers	993
Local government other	707
Electronic markets and agents and brokers	593
Federal government	483
Outpatient care centers	413
Education	319
Employment Services	260
Commercial equip merchant wholesalers	252
Aerospace	227
General medical and surgical hospitals	211
Building equipment contractors	196
Architectural and engineering services	194
State government other	186
General freight trucking	165
Depository credit intermediation	163
Services to buildings and dwellings	149
Electronics and appliance stores	144
Insurance agencies, brokerages, and related	143
Other general merchandise stores	130
Religious organizations	125
Offices of physicians	121
Lumber and const supply merchant wholesalers	118
Hardware and plumbing merchant wholesalers	116
Other Publishers	115
All Other Industries	3,439
Total	**9,962**

Sources: Washington State Employment Security Department, 2015; Community Attributes Inc., 2016.

More than 9,960 ICT and cybersecurity occupation workers are employed outside of the ICT and cybersecurity industry, representing 70 percent of the ICT and cybersecurity workforce. The largest portion of these workers are employed in the insurance carrier industry, followed by local government and electronic markets and agents and brokers. (**Exhibit 6**)

Exhibit 7. ICT & Cybersecurity Occupation Employment in Other Industries by Occupation, 2013

Occupation	Employment in Other Industries	Top Other Industry
Customer Service Representatives	3,066	Insurance carriers
Sales Representatives, Services, All Other	1,113	Electronic markets and agents and brokers
Computer User Support Specialists	615	Education
First-Line Supervisors of Non-Retail Sales Workers	518	Depository credit intermediation
Order Clerks	450	Electronic markets and agents and brokers
Computer Occupations, All Other	408	Federal Government
Computer Systems Analysts	339	Local Government Other
Network and Computer Systems Administrators	306	Education
Computer Programmers	267	Building equipment contractors
Software Developers, Applications	240	Outpatient care centers
Industrial Engineers	207	Aerospace
Computer and Information Systems Managers	179	Local Government Other
Architectural and Engineering Managers	168	State Government Other
Data Entry Keyers	166	Automobile dealers
Web Developers	166	Outpatient care centers
Bill and Account Collectors	165	Accounting and bookkeeping services
Mechanical Engineers	154	Architectural and engineering services
Medical Transcriptionists	151	Offices of physicians
Medical Equipment Repairers	147	Health and personal care stores
Electrical Engineers	138	Local Government Other
Electrical and Electronics Engineering Technicians	133	Federal Government
Information Security Analysts	123	Insurance carriers
Software Developers, Systems Software	106	Local Government Other
All Other Occupations	637	
Total	**9,963**	

Sources: Washington State Employment Security Department, 2015; Community Attributes Inc., 2016.

Customer service representatives are the bulk of ICT and cybersecurity industry employment in other industries. More than 3,000 workers are employed outside of the industry, representing 31 percent of total employment in other industries. Services sales representatives also have more than 1,000 workers employed outside of the industry. (**Exhibit 7**)

The low concentration of ICT and cybersecurity occupations indicates that these occupations and skills are increasingly demanded in other industries. Stakeholders confirmed this, noting that they face competition for qualified workers from other industries.

DEMAND ANALYSIS: PIERCE COUNTY ICT & CYBERSECURITY OCCUPATIONAL FORECASTS

Between 2018 and 2023 there will be an average of 675 openings annually[2] for ICT and cybersecurity occupations in Pierce County. Customer service representatives are projected to see the greatest number of average annual openings, with 201 across all industries and 43 within the ICT and cybersecurity industry. Although projections indicate relatively few annual average openings within the industry, these occupations are projected to see strong continued growth. Information security analysts are projected to see 3.8 percent annual growth between 2018 and 2023, suggesting that cybersecurity may be a fast growth field in Pierce County. Applications software developers are projected to grow 3.2 percent annually between 2018 and 2023. An additional 15 core occupations are projected to grow more than 2.0 percent annually between 2018 and 2023. (**Exhibit 8**)

Within the ICT and cybersecurity industry annual average openings are projected to be 205 each year. Total employment within these core occupations is projected to grow 1.8 percent annually, stronger than the county's total annual employment growth rate of 1.4 percent. (**Exhibit 8**)

Occupations used throughout the analysis are defined by the Bureau of Labor Statistics using a standardized code system. The code system allows for the analysis of data, however, the occupations defined may not capture some of the specializations that fall within each occupation. Additionally, the occupation title may not match the titles used by Pierce County employers.

Stakeholders noted that a single occupational title within the ICT industry may refer to several different specialty occupations, each requiring different levels of experience and training. They noted that although they do not have difficulty finding workers qualified for the entry level occupations, the positions requiring higher skill and experience levels are very difficult to fill. For example, one company stakeholder described three levels of computer systems administrators: Tier I requiring no previous experience; Tier II requiring five years of experience; and Tier III requiring ten or more years. Within the current supply of talent, this company does not have trouble filling a tier I level job, but experiences difficulty finding tier II and III applicants.

---

[2] Total demand, or total average openings, for occupations covers demand across all industries in Pierce County and includes but is not limited to the ICT and cybersecurity industry. Additionally, total demand may be underestimated as it is represented by average annual openings. Average annual openings are calculated by the Employment Security Department based on projections of employment by occupation. The employment projections only represent the point of equilibrium between demand and supply and therefore do not account for unmet demand or unfilled jobs. As a result, total demand may be underestimated.

Exhibit 8. Pierce County ICT & Cybersecurity Occupational Demand per Year, 2018 and 2023

SOC	Occupation	Estimated Employment 2018	Estimated Employment 2023	Average Annual Openings (2018-2023)	Average Annual Openings in Industry (2018-2023)	Estimated Employment CAGR (2018-2023)
43-4051	Customer Service Representatives	4,560	4,903	201	43	1.5%
41-3099	Sales Representatives, Services, All Other	1,491	1,628	71	10	1.8%
15-1132	Software Developers, Applications	856	1,004	43	29	3.2%
15-1151	Computer User Support Specialists	880	992	39	8	2.4%
43-4151	Order Clerks	616	654	25	4	1.2%
15-1142	Network and Computer Systems Administrators	496	557	21	6	2.3%
15-1131	Computer Programmers	391	444	21	4	2.6%
15-1121	Computer Systems Analysts	480	533	19	4	2.1%
31-9094	Medical Transcriptionists	398	448	19	11	2.4%
15-1134	Web Developers	357	409	17	8	2.8%
41-1012	First-Line Supervisors of Non-Retail Sales Workers	648	687	16	2	1.2%
43-3011	Bill and Account Collectors	289	322	15	5	2.2%
11-3021	Computer and Information Systems Managers	322	356	13	5	2.0%
49-9062	Medical Equipment Repairers	268	292	13	5	1.7%
15-1122	Information Security Analysts	213	257	13	4	3.8%
11-9041	Architectural and Engineering Managers	234	253	11	2	1.6%
17-2141	Mechanical Engineers	237	251	11	4	1.2%
41-9041	Telemarketers	253	283	11	5	2.3%
49-2022	Telecommunications Equipment Installers and Repairers, Except Line Installers	408	439	11	9	1.5%
15-1152	Computer Network Support Specialists	264	288	10	7	1.8%
	All Other Occupations (16)	2,383	2,515	75	30	1.1%
	Total	**16,044**	**17,515**	**675**	**205**	**1.8%**

Sources: U.S. Bureau of Labor Statistics, 2014; Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

SUPPLY ANALYSIS: AVAILABILITY OF REGIONAL TALENT AND EMPLOYABLE WORKFORCE

The local workforce supply is primarily composed of two elements: the entry of new graduates into the available talent pool and the existing talent pool of qualified unemployed workers actively seeking employment. Qualified graduates are drawn from the National Center for Education Statistics' Integrated Postsecondary Education System (IPEDS) data via a match of Classification Instructional Program (CIP) codes to the appropriate SOC codes. These are totaled by occupation code, including duplicates, and are then adjusted down controlled to total occupational employment. Unemployment insurance claimants are organized by their most recently reported occupation (i.e. SOC codes) and represent the second element of supply. It is important to note that workers from outside Pierce County can fill talent gaps, but are not assessed in this analysis.

Local Graduates

IPEDS standardizes educational curriculum with CIP codes. Each CIP code can match to several SOC codes because graduates from the same program can be qualified to be employed in a variety of occupations and industries. Similarly, each occupation may draw on graduates from several relevant CIP codes. For example, graduates from computer programmer/programmer programs may be qualified to work as computer network support specialists as well as applications software developers. The latter occupation also draws on graduates from computer science programs (**Exhibit 9**).

Exhibit 9. Other Occupational Matches for Graduates Qualified to Work as Computer Network Support Specialists

CIP	Description		SOC	Description
11.0201	Computer Programming/Programmer, General		15-1152	Computer Network Support Specialists
11.0501	Computer Systems Analysis/Analyst		15-1131	Computer Programmers
11.0701	Computer Science		15-1132	Software Developers, Applications
11.0901	Computer Systems Networking and Telecommunications		15-1133	Software Developers, Systems Software
11.1001	Network and System Administration/Administrator		15-1134	Web Developers
11.1002	System, Networking, and LAN/WAN Management/Manager		25-1021	Computer Science Teachers, Postsecondary
11.1003	Computer and Information Systems Security/Information Assurance		15-1121	Computer Systems Analysts
11.1006	Computer Support Specialist			

Sources: National Center for Education Statistics' Integrated Postsecondary Education System, 2014; Community Attributes Inc., 2016.

Accredited programs matching to one or more ICT and cybersecurity occupation(s) are summarized across educational institutions and programs located in the county in order to determine the number of

graduates that will be able to fill forecasted annual openings within the ICT and cybersecurity industry in Pierce County.

Graduation data is tied to the primary location of the educational institution providing the accredited program. Therefore, institutions located outside of Pierce County are not included as part of the local talent supply.

Within Pierce County institutions, 30 programs supply graduates qualified for core ICT and cybersecurity occupations. Within these programs accounting technology/technician and bookkeeping have 223 completions annually, computer and information sciences have 187 completions, computer and information systems security/information assurance have 150 completions and retailing and retail operations have 127 completions. (**Exhibit 10**)

Exhibit 10. Total Graduates by CIP Codes that Match to One or More ICT & Cybersecurity Occupation(s), Pierce County, 2014

CIP	Description	Graduates
52.0302	Accounting Technology/Technician and Bookkeeping	223
11.0101	Computer and Information Sciences, General	187
11.1003	Computer and Information Systems Security/Information Assurance	150
52.1803	Retailing and Retail Operations	127
11.0901	Computer Systems Networking and Telecommunications	79
11.1006	Computer Support Specialist	67
11.0103	Information Technology	46
11.0801	Web Page, Digital/Multimedia and Information Resources Design	43
52.1301	Management Science	34
11.0201	Computer Programming/Programmer, General	25
11.1001	Network and System Administration/Administrator	24
15.0401	Biomedical Technology/Technician	22
11.0701	Computer Science	21
14.1901	Mechanical Engineering	18
11.0803	Computer Graphics	17
15.1202	Computer Technology/Computer Systems Technology	14
14.1001	Electrical and Electronics Engineering	9
52.1804	Selling Skills and Sales Operations	8
47.0103	Communications Systems Installation and Repair Technology	7
11.0301	Data Processing and Data Processing Technology/Technician	6
11.1004	Web/Multimedia Management and Webmaster	5
47.0101	Electrical/Electronics Equipment Installation and Repair, General	4
14.0901	Computer Engineering, General	3
15.0399	Electrical and Electronic Engineering Technologies/Technicians, Other	2
15.0303	Electrical, Electronic and Communications Engineering	2
14.0701	Chemical Engineering	1
52.1201	Management Information Systems, General	1
51.2706	Medical Informatics	1
51.0708	Medical Transcription/Transcriptionist	1
52.0406	Receptionist	1
	Total	**1,148**

Sources: National Center for Education Statistics' Integrated Postsecondary Education System, 2014; Community Attributes Inc., 2016.

Examining the same completions by the institution from which they graduated shows the geographic source of qualified ICT and cybersecurity occupation candidates, and the institutions from which Pierce County residents graduate and move on to fill ICT and cybersecurity occupation openings. In total, eight local institutions have graduates that match to one or more ICT and cybersecurity occupation(s). Among these institutions Tacoma Community College has the largest share of annual completions at 43 percent (492 completions). In addition, the University of Washington-Tacoma Campus and Clover Park Technical College also graduate more than 150 candidates annually. In total Pierce County institutions have a total of 1,148 annual education program completions that are in programs that match to one or more ICT and cybersecurity occupation(s). (**Exhibit 11**)

Exhibit 11. Pierce County's Educational Institutions by Graduates Qualified for ICT & Cybersecurity Occupations, 2014

Institution	Graduates Qualified for ICT Occupations
Tacoma Community College	492
University of Washington-Tacoma Campus	280
Clover Park Technical College	161
Bates Technical College	92
Pierce College-Puyallup	46
Pierce College-Fort Steilacoom	39
University of Puget Sound	22
Pacific Lutheran University	16
Total	**1,148**

Sources: National Center for Education Statistics' Integrated Postsecondary Education System, 2014; Community Attributes Inc., 2016.

In order to determine the number of potential graduates that are likely to fill occupations within Pierce County's ICT and cybersecurity industry, qualified graduates are totaled by every possible combination of CIP and SOC codes. Each combination is adjusted to match the ratio of occupational employment to total occupational employment for all possible occupations matching to relevant CIPs. This method results in an estimate of how many graduates could potentially be employed in each available occupation. Each estimate is adjusted to account for the approximate share of local graduates who obtain work locally after graduation by multiplying the estimates by a 70 percent local retention rate. Lastly, the number of graduates expected to seek work locally is adjusted again to account for the number of local graduates who can be reasonably expected to fill positions within the ICT and cybersecurity industry.

This approach yields a total of 703 graduates in 2014 who are qualified for the needs of the ICT and cybersecurity industry (**Exhibit 12**).

IPEDS data is only available through the 2013-2014 academic year. Because the majority of completions occur at the end of the spring semester, students who complete programs during the 2013-2014 academic year are most likely to seek employment in 2014. Completions data provides a snapshot of what educational programs are expected to look like in future years if current conditions do not change.

IPEDS data only captures information on people who complete programs in postsecondary schools. This means that high school graduates, many of whom may be appropriately qualified for certain positions, are not counted in this analysis.

Industry stakeholders noted that educational programs with similar names lack consistency, creating confusion for both workers and employers.

Varying curriculum requirements result in different levels of preparation for graduates.

Exhibit 12. ICT & Cybersecurity Occupations by Total Graduates, Pierce County, 2014

SOC	Description	All Graduates	Graduates After 70% Retention	Graduates in Industry
41-3099	Sales Representatives, Services, All Other	34	24	3
15-1151	Computer User Support Specialists	10	7	1
43-4051	Customer Service Representatives	1	1	0
	On-the-Job Training Subtotal	**45**	**32**	**5**
15-1152	Computer Network Support Specialists	116	81	59
15-1134	Web Developers	28	20	9
17-3023	Electrical and Electronics Engineering Technicians	18	13	4
49-9062	Medical Equipment Repairers	8	6	2
49-2022	Telecommunications Equipment Installers and Repairers, Except Line Installers	1	1	1
49-2092	Electric Motor, Power Tool, and Related Repairers	2	1	0
31-9094	Medical Transcriptionists	1	1	0
	Associate degree or Postsecondary Award Subtotal	**174**	**122**	**76**
15-1143	Computer Network Architects	112	78	27
11-3021	Computer and Information Systems Managers	79	55	22
43-9111	Statistical Assistants	44	31	20
15-1122	Information Security Analysts	52	36	12
15-1142	Network and Computer Systems Administrators	52	36	10
15-1121	Computer Systems Analysts	46	32	7
15-1132	Software Developers, Applications	5	4	2
15-1133	Software Developers, Systems Software	5	4	2
15-1131	Computer Programmers	11	8	2
15-1141	Database Administrators	47	33	1
11-9041	Architectural and Engineering Managers	4	3	1
17-2072	Electronics Engineers, Except Computer	1	1	0
17-2141	Mechanical Engineers	1	1	0
15-1199	Computer Occupations, All Other	23	16	0
17-2071	Electrical Engineers	1	1	0
15-2031	Operations Research Analysts	1	1	0
	Bachelor's degree Subtotal	**484**	**339**	**105**
	Grand Total	**703**	**492**	**186**

Sources: National Center for Education Statistics' Integrated Postsecondary Education System, 2014; Community Attributes Inc., 2016.

In 2014, educational institutions in Pierce County conferred degrees to 703 graduates in ICT and cybersecurity related programs. Among these graduates 492 can be reasonably expected to remain within Pierce County. After accounting for the number of graduates that are projected to work in the ICT and cybersecurity industry, 186 graduates remain. Computer network specialists have the highest expected supply of graduates within the industry at 59. Additionally, the bulk of graduates fall within occupations requiring a bachelor's degree for entry, representing 57 percent of all graduates. Among all 36 core ICT and cybersecurity occupations 26 are expected to have local graduate supply and of these 26, 18 are expected to see graduates seek work within the ICT and cybersecurity industry. (**Exhibit 12**)

Unemployment Insurance

The second key element of the local talent supply is the pool of unemployment insurance (UI) claimants whose previous occupations match those in Pierce County's ICT and cybersecurity industry. Due to nondisclosure rules, not all UI data is available for every SOC.

There are a total of 550 UI claimants in Pierce County whose previous occupation matches to a core ICT and cybersecurity occupation. Among these 550 UI claimants, 151 can be expected to seek work within the ICT and cybersecurity industry. (**Exhibit 13**)

Among all core ICT and cybersecurity occupations 17 have UI claimant supply, and 16 have UI claimant supply within the ICT and cybersecurity industry. Customer service representatives have the highest UI claimant supply at 232 in total and 50 within the industry. This is followed by telecommunications equipment installers and repairers with 35 UI claimants in total and 29 within the industry. (**Exhibit 13**)

Exhibit 13. Unemployment Insurance Claimants by Previous SOC, Pierce County, 2014

SOC	Description	Total Qualified Unemployment Insurance Claimants	Unemployment Insurance Claimants in Sector
43-4051	Customer Service Representatives	232	50
41-3099	Sales Representatives, Services, All Other	128	19
43-3011	Bill and Account Collectors	34	12
43-9021	Data Entry Keyers	15	4
41-9041	Telemarketers	7	3
49-2011	Computer, Automated Teller, and Office Machine Repairers	4	2
43-4151	Order Clerks	5	1
41-1012	First-Line Supervisors of Non-Retail Sales Workers	5	1
	On-the-Job Training Subtotal	**430**	**91**
49-2022	Telecommunications Equipment Installers and Repairers, Except Line Installers	35	29
17-3023	Electrical and Electronics Engineering Technicians	11	4
31-9094	Medical Transcriptionists	6	3
49-2092	Electric Motor, Power Tool, and Related Repairers	4	1
	Associate degree or Postsecondary Award Subtotal	**56**	**37**
11-3021	Computer and Information Systems Managers	38	15
17-2061	Computer Hardware Engineers	4	4
17-2141	Mechanical Engineers	10	3
17-2071	Electrical Engineers	5	1
15-2031	Operations Research Analysts	7	0
	Bachelor's degree Subtotal	**64**	**23**
	Grand Total	**550**	**151**

Sources: Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

Total supply is defined as the sum of local qualified graduates and qualified unemployment insurance claimants. Pierce County has a projected supply of 186 local graduates and 151 unemployment insurance claimants who can reasonably be expected to fill the needs of the ICT and

cybersecurity industry within Pierce County. The sum of these sources of supply leads to a total projected supply of 337 candidates. (**Exhibit 14**)

Exhibit 14. Total Talent Supply, Pierce County, 2014

Source of Supply	Qualified Workers
On-the-Job Training	5
Associate Degree or Postsecondary Award	76
Bachelor's Degree	105
Graduate Subtotal	**186**
Unemployment Insurance Claimants	151
Grand Total	**337**

Sources: National Center for Education Statistics' Integrated Postsecondary Education System, 2014; Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

Stakeholders shared that they face significant competition for ICT talent from King County. Major employers in King County are highly visible and can offer higher wage rates. They believe talent gravitating toward these jobs may not have a strong understanding of the cost of living and quality of life impacts associated with working in King County.

Additionally, because ICT occupations are not limited to the ICT industry, the demand for skilled ICT workers is magnified by businesses outside of the core ICT clusters. Stakeholders shared that these businesses face challenges recruiting because there are perceptions that they offer fewer opportunities and pathways for career advancement.

SUPPLY AND DEMAND

The combined elements of expected supply and projected occupational demand yields a summary of annual occupational gaps within the ICT and cybersecurity industry. **Exhibit 15** summarizes graduate supply, total demand, UI claimant supply, and the expected gaps for each ICT and cybersecurity occupation.

ICT and cybersecurity stakeholders indicated that they expect to see high demand among core occupations, coupled with a high degree of competition for talent from other industries and counties. Stakeholders noted they do not have difficulty finding workers qualified for entry level, low skill positions. Those positions requiring higher skill and experience levels are very difficult to fill. The available data demonstrates the levels of supply and demand expected within each occupation; it does not demonstrate the quality or experience level of available candidates.

Stakeholders also mentioned that finding qualified candidates to fill open positions in cybersecurity is particularly challenging. The skills required for this cover a broad set of specialties. Because of the rapidly changing tactics used by criminals, qualified candidates for many of these types of positions require the critical thinking skills that come from experience. For example, conducting a full forensic study of an IT system requires the use of problem solving skills to identify evolving security risks. Additionally, demand for cybersecurity occupations will grow as more and more industries and businesses implement networks and put their information online. For example, the increasing use of electronic medical records has led to an increased need for security surrounding these sensitive records.

The 36 ICT and cybersecurity occupations fall within three general categories of preparation: on-the-job training; associate degree or postsecondary award; and bachelor's degree. Among the on-the-job training group, there is an annual surplus of 11 local candidates annually, largely due to the high number of UI claimants in this category. For occupations requiring an associate degree or postsecondary award there is a surplus of 70 candidates, driven largely by an annual excess of 51 computer network support specialists. Lastly, there is a surplus 50 candidates each year for occupations requiring a Bachelor's degree stemming from an excess of graduates of computer network architect and computer and information system manager programs. (**Exhibit 15**)

Exhibit 15. Annual Supply and Demand, Pierce County, 2018-2023

Occupation	Total Graduate Supply	Total Demand	Interim Gap	Total UI Claims Supply	Final Gap
Computer User Support Specialists	1	8	(7)	0	(7)
Telephone Operators	0	3	(3)	0	(3)
Order Clerks	0	4	(4)	1	(3)
Computer, Automated Teller, and Office Machine Repairers	0	4	(4)	2	(2)
Telemarketers	0	5	(5)	3	(2)
First-Line Supervisors of Non-Retail Sales Workers	0	2	(2)	1	(1)
Data Entry Keyers	0	0	(0)	4	3
Bill and Account Collectors	0	5	(5)	12	7
Customer Service Representatives	0	43	(43)	50	7
Sales Representatives, Services, All Other	3	10	(7)	19	12
On-the-Job Training Subtotal	**5**	**85**	**(80)**	**91**	**11**
Medical Transcriptionists	0	11	(11)	3	(7)
Medical Equipment Repairers	2	5	(3)	0	(3)
Web Developers	9	8	1	0	1
Electric Motor, Power Tool, and Related Repairers	0	0	0	1	1
Electrical and Electronics Engineering Technicians	4	2	2	4	6
Telecommunications Equipment Installers and Repairers, Except Line Installers	1	9	(8)	29	20
Computer Network Support Specialists	59	7	51	0	51
Associate degree or Postsecondary Award Subtotal	**76**	**43**	**33**	**37**	**70**
Software Developers, Applications	2	29	(26)	0	(26)
Computer Programmers	2	4	(3)	0	(3)
Computer Hardware Engineers	0	6	(6)	4	(2)
Architectural and Engineering Managers	1	2	(2)	0	(2)
Electronics Engineers, Except Computer	0	2	(1)	0	(1)
Sales Engineers	0	1	(1)	0	(1)
Software Developers, Systems Software	2	3	(1)	0	(1)
Industrial Engineers	0	1	(1)	0	(1)
Mechanical Engineers	0	4	(3)	3	(0)
Electrical Engineers	0	1	(1)	1	(0)
Operations Research Analysts	0	0	(0)	0	0
Computer Occupations, All Other	0	0	0	0	0
Database Administrators	1	0	1	0	1
Computer Systems Analysts	7	4	3	0	3
Network and Computer Systems Administrators	10	6	4	0	4
Information Security Analysts	12	4	8	0	8
Statistical Assistants	20	4	15	0	15
Computer Network Architects	27	1	25	0	25
Computer and Information Systems Managers	22	5	17	15	31
Bachelor's degree Subtotal	**105**	**78**	**28**	**23**	**50**
Grand Total	**186**	**205**	**(19)**	**151**	**131**

Sources: U.S. Bureau of Labor Statistics, 2014; Washington State Employment Security Department, 2014; National Center for Education Statistics' Integrated Postsecondary Education System, 2014; Community Attributes Inc., 2016.

Overall, the industry is expected to experience a surplus of 131 candidates annually. However, it is important to look at the detailed gaps for each occupation. Eighteen occupations are expected to experience annual shortages for local workers. The largest shortages are expected among applications software developers (26 per year), followed by computer user support specialists (7) and medical transcriptionists (7). (**Exhibit 15**)

Additionally, 18 ICT and cybersecurity occupations have no projected local graduate supply. Among occupations that require an associate degree or postsecondary award, or bachelor's degree for entry these occupations

include: medical transcriptionists; electric motor, power tool, and related repairers; computer hardware engineers; electronics engineers, except computer; sales engineers; industrial engineers; mechanical engineers; electrical engineers; operations research analysts; and computer occupations, all other.

It is important to bear in mind that not all occupations within an educational grouping are easily substitutable. A surplus in one occupation may not necessarily be countered by a shortage in another occupation. The skills required may not be the same between occupations. As such, a detailed account of the prospective supply and demand for each primary occupation can help organizations anticipate and plan for possible labor shortages and surpluses in the future.

Addressing surpluses among certain occupations includes examining other occupations in which workers could be qualified to work. One occupation with a large surplus is computer and information systems managers. Individuals qualified for this occupation may also seek work as software developers, and producers and directors, both of which are expected to see slight shortages in talent supply across the county. (**Exhibit 16**)

Exhibit 16. Job Transferability for Computer and Information Systems Managers

SOC	Occupation	Annual ICT Gap (2018-2023)	Annual Pierce County Gap (2018-2023)
11-3021	**Computer and information systems managers**	**31**	**80**
15-1133	Software developers, systems software	(1)	(3)
27-2012	Producers and directors	0	(1)
13-1081	Logisticians	0	7
15-1199	Computer occupations, all other	0	8
15-1121	Computer systems analysts	3	13
15-1122	Information security analysts	8	23
13-2099	Financial specialists, all other	0	24
11-3071	Transportation, storage, and distribution managers	0	61
15-1143	Computer network architects	25	74

Sources: O*NET Resource Center, 2016; Community Attributes Inc., 2016.

It is important also to keep in mind that each employer and worker needs to assess their unique skills and qualifications in order to determine which occupations for which they are truly qualified. The data can act as a guide for the available paths to be explored.

Computer network architects are also projected to have a large surplus in talent within Pierce County. A worker qualified to work as a computer network architect may also seek employment as an applications software developer, systems software developer, or an electronics engineer. Each

of these occupations are experiencing shortages in local talent. (**Exhibit 17**)

Exhibit 17. Job Transferability for Computer Network Architects

SOC	Occupation	Annual ICT Gap (2018-2023)	Annual Pierce County Gap (2018-2023)
15-1143	**Computer network architects**	**25**	**74**
15-1132	Software developers, applications	(26)	(40)
15-1133	Software developers, systems software	(1)	(3)
17-2072	Electronics engineers, except computer	(1)	(2)
17-2061	Computer hardware engineers	(2)	(2)
15-1199	Computer occupations, all other	0	8
15-1121	Computer systems analysts	3	13
15-1142	Network and computer systems administrators	4	15
15-1122	Information security analysts	8	23
15-1141	Database administrators	1	31
11-3021	Computer and information systems managers	31	80

Sources: O*NET Resource Center, 2016; Community Attributes Inc., 2016.

SUMMARY OF KEY FINDINGS AND PRELIMINARY RECOMMENDATIONS

Pierce County's ICT and cybersecurity industry is projected to have an annual supply of 337 local candidates between 2018 and 2023. This supply is split between new graduates and unemployment insurance claimants whose previous occupation matches to a core ICT and cybersecurity occupation. Interview feedback from industry stakeholders indicates that Pierce County employers can expect to experience continued strong competition for these candidates from other industries and from other counties, especially the strong ICT cluster in King County. (**Exhibit 18**)

Exhibit 18. Summary of Annual Pierce County ICT & Cybersecurity Talent Supply, 2018-2023

Projected Talent Supply (Annual)	
Unemployed	151
Newly-Trained Candidates	186

Sources: National Center for Education Statistics' Integrated Postsecondary Education System, 2014; Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

Comparing local supply with forecasted annual demand of 205 openings indicates a surplus of 131 local workers annually between 2018 and 2023 (**Exhibit 19**). The projected surplus represents approximately 3.1 percent of total core occupation employment in the industry. Although there is a projected surplus of local talent it is important to note that within key occupations there are projected shortages of talent. The occupation with the largest gap is applications software developers (a shortage of 26 positions annually). Other occupations with gaps include medical transcriptionists (7 positions), and computer programmers (also seven positions).

Exhibit 19. Summary of Annual Pierce County ICT & Cybersecurity Talent Supply and Demand, 2018-2023

Annual Surplus or (Shortage)	
Total Openings (Demand)	205
Total Supply	337
Surplus or (Shortage)	131

Sources: U.S. Bureau of Labor Statistics, 2014; Washington State Employment Security Department, 2014; Community Attributes Inc., 2016.

Industry stakeholders noted that educational programs with similar names have inconsistent learning outcomes and rigor. Individuals seeking a particular job may enroll in a program that does not prepare them for the position in which they are interested. Similarly, employers must delve deeper into program particulars in order to adequately screen resumes.

A single occupational title within the ICT industry may refer to several different specialty occupations, each requiring different levels of experience and training. **Stakeholders noted that they do not have difficulty finding workers qualified for entry-level occupations. However, positions requiring higher skill and experience levels are very difficult to fill.**

Potential workers, especially transitioning military, need to know which occupations are in demand, the wages associated with these occupations and a clearly defined path to get into the occupation. Although this information is available it can be challenging to find.

Communications and soft skills are key in the ICT industry, but these are skills that are often lacking among applicants. New entrants into the ICT industry may not understand that writing and communications skills are vitally important within the industry. Educational programs often focus on required hard skills, but do not ensure that graduates have the necessary soft skills required by the work environment.

Finding qualified candidates to fill open positions in cybersecurity and information security is particularly challenging. The skills required for this specialty cover a broad set of technical expertise and exceptional critical thinking skills to counter creative and constantly evolving security threats. Truly qualified candidates for these types of positions need to be able to do a full forensic study of an IT system, use problem solving skills to determine the security risks and identify solutions to mitigate these risks. Additionally, cybersecurity is a growing segment within the ICT industry overall. As more and more industries and businesses implement networks and put their information online, there will be an increasing need for people with the skills to protect this information. For example, the increasing use of electronic medical records has led to an increased need for security surrounding these sensitive records.

- *Recommendation* – Convene employers and colleges to improve alignment between education programs and employer needs. This could include helping to develop consistency between programs as well as deepening critical thinking, communication, and soft skills training and role playing opportunities.

- *Recommendation* – Partner with local colleges, universities and employers to develop career pathways maps that describe different career tracks, with their associated education, experience requirements and salary levels. Distribute this information broadly including in WorkSource centers, and with JBLM staff.

- *Recommendation* – Develop continuing education opportunities for current ICT workers focused on improving leadership, communication, soft skills and critical thinking.

- *Recommendation* - Data and employer feedback indicates that computer network support specialists may be in oversupply. Work with community colleges offering this training to build on efforts to add stackable certificates and articulations with baccalaureate-level programs. Ensure this additional education is available to working adults.

Pierce County employers face significant competition for ICT talent from King County. Major employers in King County are highly visible and can offer higher wage rates. The talent gravitating toward these King County jobs may not understand the cost of living and quality of life impacts associated with working in (and commuting to) King County.

- *Recommendation* – Partner with local employers of ICT talent to develop a marketing program aimed at keeping Pierce County ICT talent working in Pierce County.

As the ICT industry faces challenges finding qualified workers employers are using alternative sources for workforce talent. Regional employers have successfully recruited transitioning military to increase diversity. Transitioning military have technical skills through their experience with the military and they have experience with leadership, communication and project management, all needed skills within the industry. Increasing accessibility and diversity in the workplace also helps in recruitment of qualified candidates. People with physical disabilities, such as visual impairment, can be overlooked due to the challenges associated with increasing accessibility. However, these workers can be highly qualified source of talent.

- *Recommendation* - Seek funding to expand successful partnerships with JBLM to help transitioning service members gain required certifications and/or formal training to increase their competitiveness for ICT jobs.