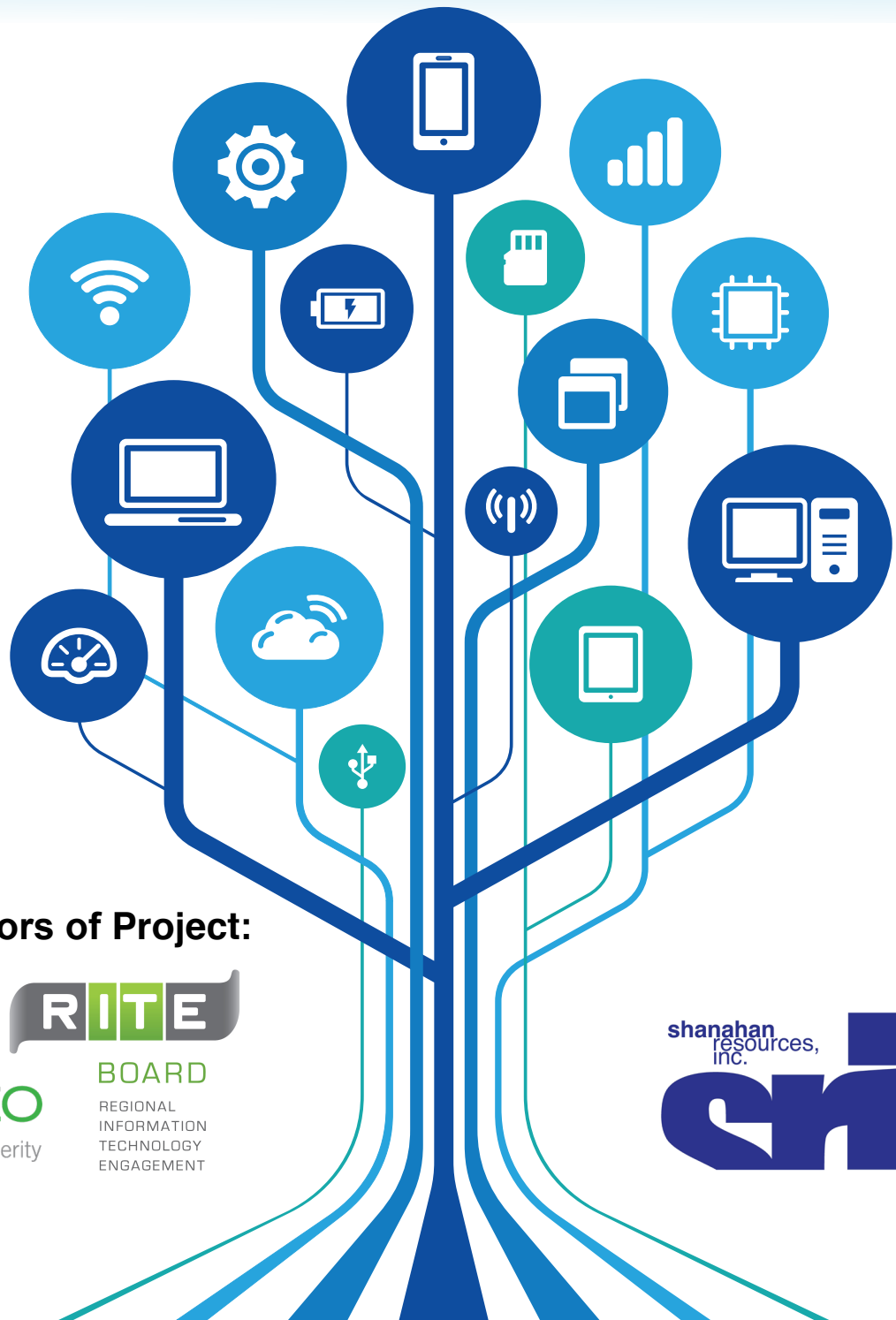


# Understanding the IT Skills Gap in Northeast Ohio

July, 2017



**Primary Coordinators of Project:**

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# Understanding the IT skills gap in northeast Ohio

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# Introduction:

## Quantifying NE Ohio's IT Skills Gap

### **Labor Market Data Analytics + Employers Feedback = Strategic Intelligence for Workforce Development Leaders**

This project is a collaborative effort of community colleges and industry intermediaries acting as co-funders of this research. The primary purpose of this investigation is to identify opportunities for greater alignment of IT postsecondary education and training as well as the need for more responsive delivery models like boot camps. Demand by employers is rapidly changing. IT workers now need the knowledge, skills, and work experiences that employers reveal in online job postings. This report documents the region's skills gap for IT new hires, including insight into the need for upskilling of industries current, experienced IT workers.

Shanahan Resources, Inc., was commissioned to document the nature and nuance of current gaps between demand and supply of IT workers in the regional labor market. From similar investigations in regions in other states, consistent findings reveal that while the gap is large:

- Not all IT occupations have a gap, and some have a more intense gap than others. Gap analysis is shown at two levels of education credentials: Bachelors and above, and Associates or other postsecondary credential.
- Not all IT programs (CIPs) are equally effective at preparing students for each IT occupation and career path.
- Using the methodologies developed by Burning Glass Technologies it is possible to determine which occupations are experiencing the most intense gaps and what education and training programs have the best potential to impact the gap by increasing the supply of completers with specific knowledge and skills employers now want; this varies among IT occupations.

This investigation applies the latest data analytics to quantify the Skills Gap for IT Workers in NE Ohio and gaps are pinpointed by breaking down IT gaps by occupation, level of education, and prior work experience. This provides hard data with which to sharpen discussions on actions.

Funding partners are:

Community Colleges: Cuyahoga Community College; Lorain County Community College; and Stark State College

Industry Intermediaries: ConxusNEO; Magnet; and RITE

This report is authored by Jim Shanahan, Ph.D., founder of Shanahan Resources, Inc. which was incorporated as a S-Corporation in the State of Florida January of 2012. He is available to discuss this work and can be reached at [shanahan.jim.l@gmail.com](mailto:shanahan.jim.l@gmail.com) or 727-631-8262.

## Summary: Conclusions and Recommendations

*Based on research findings and early discussions with employers and educators, it is now possible to visualize the IT Skills Gap, how to think about it, measure it, and more clearly consider the power of industry-led initiatives like RITE, ConxusNEO, and others. We now have actionable data needed to improve the alignment of demand and supply in NE Ohio.*

Now is the time to strengthen efforts in NE Ohio to deeply engage with employers and the eco-system of talent development interests that are determined to better align the resources of the workforce development, education, philanthropy, etc. with employer needs for workers. The region's primary infrastructure for improving an existing and emergent workforce are the very entities that make up our education and workforce systems: postsecondary education (colleges and universities, and vocation and technical training); the public workforce system (funded by federal and state resources); economic development organizations; and other major efforts to support talent development that addresses the region's skill gaps.

Greater alignment and partnership among these regional workforce development partners is vital to hastening the pace of improving workforce quality for the employer.

### Conclusions

- Employers look to the region's higher education system for job seekers emerging from IT programs as graduates. Yet few are confident of their ability to greater impact enrollment growth or program changes. The findings of this research suggest that we may be falling farther behind changes in demand for IT professionals to fill entry-level positions.
- Years ago, employers annually made visits to college campuses to search for pending graduates in business, engineering and other programs. For decades, this was an effective way for national and local employers and graduates to connect around hiring opportunities for entry-level positions. It still can be if IT program completers are prepared with the knowledge and skill sets employers now need.
- IT employer hiring demand has many more openings at the mid-level positions which are not likely to be found among those emerging from postsecondary education and training systems, but largely must be found among current IT workers with strong job experience. If postsecondary education and training—higher education in particular—are to help employers, new models are needed.
- Even at entry-level, only certain IT occupations have dramatic gaps between numbers of potential hires employers pursue and the number of completers emerging with the right level and focus from postsecondary credentials currently awarded within NE Ohio.

- Of course, the greatest deficiency is for Bachelors graduates, however, NE Ohio also is not producing sufficient numbers of jobs like Computer Support Specialists to keep pace with demand.
- There appears to be an oversupply of completers from Certificate and Associate programs preparing students to work with networking and computer systems and administration. Only a couple of sources of this training, however, account for this possible over-supply.
- Discussed in this report are the specific IT occupations and skills with the most intense gaps between supply and demand at the entry level, at the Bachelors and less than Bachelors level. Specific IT programs are identified for each occupation as well as where current supplies of completers falls short.
- Recommendations are provided on how to take these discoveries to the next level in search of concrete actions to improve supply over the next few years.

### **Recommendation at Entry-level: Better *Alignment* of IT Programs and Employer Demand for Entry-level Job Openings**

Findings show that the numeric gaps overall are daunting. It is as much a matter of lack of capacity to greatly expand numbers of completers by two-, or three-fold, as it is difficult to attract youth and young or transitioning workers into programs that prepare them for IT careers. This is not to imply that addressing the gap is hopeless.

The real opportunities to improve the ability of IT grads to meet employer demand is to lock-in on the IT occupations with the greatest gaps, and work with employers to improve the number of students entering, or add learning outcomes to, IT majors that best prepare students with the skills and proficiencies now needed.

There are nearly forty programs with differing learning objectives to prepare students for IT career employment. Concentrations or specializations vary widely with the broad disciplinary thrusts of Information Science or Management, Computer Science, and Computer Engineering. Based on content emphasis and purpose, however, none prepare students for all entry-level jobs no matter the occupation title or area of expertise. This depends on what each IT occupation now requires in knowledge and skills.

Example: what major do employers most prefer when hiring entry-level Developers? For Systems Analyst? Or, if Computer Science is still the preferred major, can curriculum and experiential learning be improved to boost learning systems design and modeling or OOAD theory, or working closely with engineers and business professionals? How can the education experience be enriched so that completers are prepared to fill positions regardless of which IT programs they enter?

Ongoing discussions with a group of IT leaders from industry potentially can answer questions such as: How do we balance employer preference for training in Computer Science with the emerging need to hire

individuals with more blended skill bases?

Pursuit of this approach will require deliberate efforts by employers and educators to engage deeply if they are to define where improvements should be focused and what actions taken will produce maximum benefit to the region.

## Suggestions for a More Targeted Approach:

We now know that the following IT occupations have large numeric gaps between supply and demand, and that in many cases it is not clear which IT programs best prepare students for these job assignments:

- **Systems Analysts:** In NE Ohio, this position ranks third in terms of numeric gap. Specific programs exist in NE Ohio with the primary focus on Systems Analysis as a core program at every level of completion. Completers at all levels emerged by the end of 2015: 78 with an Associates and 55 with a Bachelors. But, there were nearly 300 job postings for Analysts with a Bachelors. Baldwin Wallace and the main campus of Kent State University offer this degree. In 2015, Kent State's programs produced most of the grads.

Could employers agree on whether a concentration on Systems Analysis is preferred when hiring new analysts?

Could they work with either institution to quicken the pace of completers from these programs with modifications employers greatly value? Possibly this could be providing opportunities to their students in their other IT majors to acquire more Systems Analysis in their education, rather than simply rely on efforts to expand enrollment or transfers into the Systems major.

Undoubtedly, this could work best if interested employers are highly engaged with advising the institutions on how best to modify IT programs to the improve student knowledge and skills important to System Analysts and interact with students while in school, etc.

- **Cyber/Information Security Analysts/Managers:** This occupation ranks fourth in terms of numeric skills gap. Only 35 of the 564 grads with a Bachelors from IT programs were a strong match with the knowledge and abilities employers seek from job seekers. This relatively new occupation accounts for almost all jobs posted where the position has primary responsibility over the security of information and systems for an organization or business. While most postings for this position in NE Ohio are mid-level, requiring three to five years of prior work experience, there was 197 postings at the entry-level.

Again, how can IT program resources be shifted around to make special areas of expertise (data and system security in this case) to raise the number of grads measurably above 35?

There were only 19 grads from a Bachelors program in security in 2015 and those were from ITT and University of Phoenix. Not a single grad came from any of the public or private universities in NE Ohio.



This finding provides a case for convening a conversation among the universities and potentially employers with the greatest demand for this occupation to determine need and ideas for how to improve this situation without major additional resources in one to three years.

- **Software Developer/Engineers:** This occupation may present the most difficult case to resolve. In 2015, it had by far the largest numeric gap (976 at the entry-level) and the least number of grads (32) from IT programs determined to be well-prepared to apply for these jobs in general—yielding the result that was one grad for every 30+ postings during the year.

It is not clear which of the nearly 40 areas of study that are intended to prepare students to pursue IT careers are specifically aimed at placing grads into developer positions. The two majors most linked with software developers or engineers are Computer Programming and Software Engineering. Most of the completers of Computer Programming degrees are at the Associate level, not the Bachelors. Only employers can confirm if the preparedness of these grads or if a Bachelors is preferred. Baldwin Wallace has a Software Engineering program but only three grads from the Bachelors program in 2015. No others exist in the region.

Beyond the rise of new programs specializing in software applications for the web or mobile devices, few new education and training programs are specifically aimed to address this gap facing employers.

Most posts for developers or software engineers are not employed in firms where software products and services is the main purpose. Rather these workers are playing a role as a developer where software is a critical element of a larger problem.

The severity of the gap makes a case for convening a group of employers to discuss what might be done to addresses this problem.

- **Computer Support Specialist:** Finally, at the Associate level this is the occupation with the single largest gap. Combined, the region's education and training systems simply are producing too few completers of either Certificates or Associate degrees—Only 90 total in 2015 from majors judged to be strong preparation for this role. Completers from Computer Support Services programs are provided by the private for-profit technical training organizations, not the community colleges. There are no programs in Computer and Information Sciences and Support Services with grads with Associates degree in 2015.

## Recommendation at Mid-level: New Initiatives Focused on Attacking the Skills Gap for Mid-level IT Workers

Producing hard data on IT job seekers already in the workforce was well-beyond the scope of this investigation, but employers indicate that these positions are more difficult to fill than entry-level. There is no source of inclusive data on workers already employed and the likelihood they will apply for positions with other employers as they are posted.

By and large these individuals are not currently enrolled in IT education and training programs to prepare for a career in IT, or even to address IT skills they need to acquire or improve in order to stay current and advance in their career.

The best we have is information about those employed by occupation or industry. For example, NE Ohio IT professionals now working have some challenges when being considered as the potential pool for filling mid-level IT roles. Too few working in 2016 have a Bachelor's degree given current employer hiring preferences. Too few females currently are employed in IT jobs. Most jobs are held by White Males relative.

Lack of females and persons of color, relative to their overall presence in the workforce likely suggest barriers to entry into IT careers that need breaching if the region's industry is to make full use of NE Ohio's current working age population.

Many have tired of competing with one another for NE Ohio experienced workers and have increased efforts to [promote from within](#) by identifying high performing workers who started in entry level jobs and created ways to get them the additional skills required to succeed in mid-level openings.

Imagine what is possible if we had a regional approach to do the same thing, and employers to partner with each other and with higher education to tweak curriculum and the use of fast-track programs to provide workers added skills needed to advance in their careers. This can be through either additional education or work experiences built around shared employer needs.

The future is ripe with opportunities to change behaviors and address employer pain point through collaborative efforts and concrete action.

### **PROMOTING FROM WITHIN—DEVELOPING A REGIONAL MODEL**

Just as internships are used to develop a pool of potential applicants for entry-level positions, once hired, these employees can become a potential pool of talent for future mid-level openings within the company. Some employers site efforts to identify workers during their first few years at the company and uses ways to provide talent development opportunities to them to further prepare them for future openings within the company.

Sometimes the path ahead is within one of the four career orientations—Business Intelligence; Networks and Computer Systems; Development; and Internet Technology and Interactive Media. For example, recent grads are hired into entry-level developer positions and some eventually will be promoted into more responsible mid-level developer jobs as they gain skills and experience needed in advanced positions. However, depending on the organizations need, filling from within for some positions will target individuals originally hired in one of the other three IT areas of career/skill orientation, or even workers from another area of the company. Developers may be developed into Systems Analysts; Financial Analysts are developed into BI Analysts or Managers, or Forensics experts, etc.

Companies also rely on other companies, vendors, or community programs to help them provide training and development needed to move these employees along.

A recent convening of HR personnel responsible for filling employer needs for IT talent by RITE asked them to discuss with each other how they were meeting needs to fill mid-level positions in general and for software developers specifically.

This is occurring in different ways, using different approaches across the region, especially within the larger companies. However, overall success is constrained by the size of company, budgets, and the pool of internal workers that meet the criteria set for internal promotion.

While this is routinely occurring within NE OHIO within individual companies, imagine what a program at the level of the region to further develop entry-level workers for mid-level jobs.

For example, if employers generally experience problems filling mid-level developer job openings, what could be done to address this problem other than what individual employers are doing on their own?

What can industry-led intermediaries do to organize a regional initiative to build the capacity of the region to 'promote from within? How can they assist in preparing and placing lesser-experienced, high-performing IT workers to meet employer needs? What efforts can augment and coordinate with what employers already are doing.

*What is true for individual employers is true for the region over all.*

By understanding the career paths commonly taken by the region's IT workers as they move from job to job, employer to employer, or change positions with the same employer, we can gain insights into keeping employers and workers in synch with supply and demand.

Many of the recent initiatives to provide alternative education and training resources and to create more experiential learning opportunities in an effort to respond quickly and specifically to perceived employer needs at the mid-level as well as entry-level shortfall of IT workers in the region.

As important as these are, they are expensive alternatives to the public higher education system which often is faulted as neither responsive or specific in terms of the IT majors and students attracted into their programs.

Not all institutions are interested or positioned to play such a new role, but should not be left out of conversations that shape early efforts to determine what is possible to advance NE Ohio in solving the mid-level skills gap in IT.

After all, there are many accelerated degree programs for mid-level professional and technical workers in other disciplines.

The largest number of postings in the region is for mid-level Software Developers. These positions mask the diverse range of roles and assignments employers have for these workers. They vary by industry and over time as the problems posed to developers become more specialized and complex.

## **Recommendation for Further Research**

Proper validation and further perspectives and labor market insights can be best achieved by conducting a survey across the region of a representative cross-section of IT employers. The survey content should be structured around the findings, implications and recommendations addressed in this summary and technical report.

# Understanding the IT Skills Gap in NE Ohio

## LABOR MARKET DATA ANALYTICS + EMPLOYER FEEDBACK = STRATEGIC INTELLIGENCE FOR WORKFORCE DEVELOPMENT LEADERS

### PREAMBLE

*Since the early 1990s, NE OHIO leaders acknowledged the need to address the ‘skills gap’ for IT jobs. Regional leaders began launching studies of the demand for IT talent in the late 1990s and the first few years of the new century. By 2007, leaders again convened to address the IT skills gap. As part of Ohio Skills Bank, new research efforts were launched. NorTech and Team NE Ohio led a comprehensive study of both supply and demand for IT, and a major employer study was completed. At the same time the first data from online job postings were being quoted by economic development leaders: “The region suffers from thousands of jobs not filled” in IT. The inference was that employers found too few qualified applicants when hiring.<sup>1</sup>*

*Fast-forward to 2017 and this first definitive study of IT Skills Gap provided hard data sufficient to inform actions aimed to attack the shortage of talent within three to five years*

## I. Research Goals

This investigation is the first to comprehensively investigate the role of IT in supporting the northeast Ohio (NE Ohio) economy, past and future. It provides some wide-ranging, yet in-depth, insights based on an equally deep-dive into supply and demand of IT talent in the NE Ohio labor market. It also documents the region’s skills gap for IT new hires, including insight into the need for the upskilling of industries current, experienced IT workers.

The primary purpose of this investigation is to identify opportunities for greater alignment of postsecondary education and training programs as well as the need for more responsive delivery models like boot camps. Demand by employers is rapidly changing: IT workers now need to possess the knowledge, skills, and work experiences that employers reveal in online job postings.

**The challenge to providing actionable strategic information to quantify the skills gap has always been two-fold:**

- Need for a deeper understanding of skills in short supply for occupations in great demand; and,
- A clear path to dissect and quantify sources of job seekers for open positions.

Up to now, less attention has been devoted to quantifying supply than demand. Even less attention has

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<sup>1</sup> Shanahan, J: *Moving the Dial: Newly-Mined IT Labor Market Analytics to Drive Action*, Report Prepared for the RITE Board, February 2016. P. 1.

been given to acknowledging that skill gaps vary across IT occupations and that a large number of variants in IT education and training programs suggests that not all IT programs are equally effective in preparing students for jobs employers cannot easily fill. The 'Gap' has been assumed synonymous with large demand and anecdotal information from employers expressing difficulty in finding enough qualified applicants.

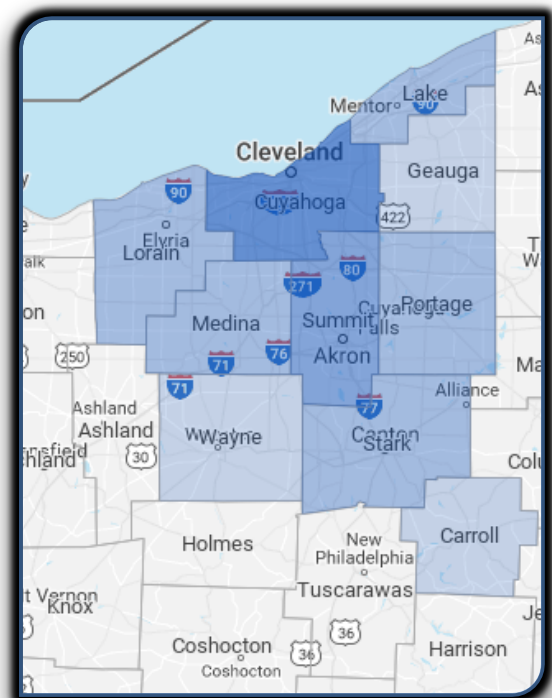
This report takes these challenges head-on.

First, some basics about the role of IT in the NE Ohio economy.

## II. Role of IT in the NE Ohio Economy

Information technology supports every industry sector of the economy, and is a small but critical part of every industry's workforce. The focus is on skills needed by IT and other occupations no matter the industry. The Information industry sector, of course, is a special instance in which IT workforce demand is keen and skills needed often differ from how other industry and meet their IT needs.

1. MSA's of Cleveland, Akron and Canton plus Wayne County employ nearly 38,000 IT workers out of total workforce of 1.7 million jobs.
2. Home of the three largest cities, Cleveland/Cuyahoga, Akron/Summit and Canton/Stark had the most jobs during 2016, in that order.
3. This geographic region was chosen because of the intense commute to work patterns where residents live in one county and work in another. Combined, these counties contribute most of the jobs for the larger northeast Jobs Ohio region.
4. Compared to the nation, the NE Ohio economy supports fewer IT jobs when expressed as a percentage of total jobs in the region. Based on size of economy, NE Ohio should employ 15% more IT workers.



## NE Ohio's industry requires fewer IT workers. Local firms are less technology-based.

The northeast Ohio economy is not San Jose; Seattle; or even Minneapolis/St Paul. With a capital goods manufacturing economic legacy and emerging technology-base that still is nascent, information technologies and the requisite workforce is simply not as critical to our global competitiveness as for the nation.

IT Jobs in the NEO Economy		
Occupation Summary for 19 Occupations		
Jobs (2016)	% Change (2016-2017)	Median Hourly Earnings
37,918	1.9%	\$34.14
15% below National average	Nation: 2.8%	Nation: \$39.49/hr
EMSI Analyst		

- NE Ohio continues to fall further behind the nation.
- Between 2016 and 2017, NE Ohio IT jobs increased only 1.9% in comparison to 2.8% for the nation.

In 2016, these IT jobs were only 2.3% of all jobs in NE Ohio.

## Where are IT jobs located and where do IT workers live?

The urban counties and the core cities have the largest number of jobs (all jobs as well as IT jobs): Cuyahoga, Summit, Stark and Lorain. Cuyahoga, despite decades of job decentralization, still has 46% of all jobs. Summit is second and Stark is third. The I-77 corridor links these three job centers.

Industries which employ the most IT workers are even more clustered along this corridor: Cuyahoga with 59% and Summit with 19% of IT jobs. The remaining 20% are primarily in Stark, Lorain and Lake Counties.

## Residence of IT Workers

Over the decades, the population has decentralized more so than industry. As a result, where employed persons live is more evenly distributed among the 10 counties. While Cuyahoga County has 46% of all jobs, it is home to only 38% of employed persons. This is more extreme for IT workers: Cuyahoga has 59% of the jobs but only 44% of IT workers live there.

In contrast, IT workers within NE Ohio more often live in Cuyahoga and Summit Counties than is the case for all jobs held by employed persons.

NEO: Location of All and IT Jobs, by County 2016		
	All Jobs	IT Jobs
County Name		
Cuyahoga County	46.3%	58.6%
Summit County	17.1%	18.8%
Stark County	10.3%	5.1%
Lorain County	6.5%	4.5%
Lake County	6.2%	4.3%
Medina County	3.9%	3.0%
Portage County	3.8%	3.2%
Wayne County	3.1%	1.0%
Geauga County	2.4%	1.5%
Carroll County	0.5%	0.1%
	100.0%	100.0%
Source: EMSI Analysis		

## Journey to Work to Counties Where Jobs Are

On net, just over 159,000 more workers commute into Cuyahoga County for a job than commute out. For IT workers, 5,848 more IT workers commute into Cuyahoga than commute out. They reside in one of the other nine counties.

Summit County, as well, has more NE Ohio workers commuting into the county than Summit residents commuting out to work. For IT this confirms that the two largest job bases in the region attract workers into their counties to find IT employment.

All other counties are net exporters of their IT workers to any of the other counties.

IT jobs are clustered in Cuyahoga and Summit while IT workers favor living in one of the other counties.

The importance of this information is that postsecondary education and training providers which tend to attract students close to where they are located need to be aware of the reality that the jobs are in Cuyahoga and Summit.

## What industries employ IT workers

In 2016, by far the most IT workers—almost 12,000 were employed in the Professional, Scientific, and Technology Industry group employed. Three in ten IT jobs were in this sector which includes a wide array of high-end services

- Legal Services
- Accounting, Tax Preparation, Bookkeeping, and Payroll Services
- Architectural, Engineering, and Related Services
- Specialized Design Services
- [Computer Systems Design and Related Services](#)
- Management, Scientific, and Technical Consulting Services
- Scientific Research and Development Services
- Advertising and Related Services

NEO: Residence of IT Workers by County 2016		
County Name	Residence of All Workers	Residence of IT Workers
Cuyahoga County	37.8%	43.9%
Summit County	15.7%	17.0%
Stark County	11.3%	7.2%
Lorain County	9.0%	8.1%
Lake County	7.7%	7.3%
Medina County	5.9%	6.2%
Portage County	5.3%	5.3%
Wayne County	3.6%	1.9%
Geauga County	3.0%	2.9%
Carroll County	0.6%	0.3%
	100.0%	100.0%
Source: EMSI Analyst		

NEO: Net Commuting of IT Workers into Each County 2016		
County Name	2016 Net Commuters	2016 Net Commuters
Cuyahoga County	159,604	5,848
Summit County	28,829	759
Stark County	(12,838)	(757)
Lorain County	(39,273)	(1,338)
Lake County	(22,732)	(1,075)
Medina County	(30,104)	(1,167)
Portage County	(24,480)	(769)
Wayne County	(6,930)	(316)
Geauga County	(8,872)	(516)
Carroll County	(2,567)	(61)
	40,637	608
Source: EMSI Analyst		

NEO: Industries with Most IT Jobs in 2016			
Industry	IT Jobs in 2016	% of All IT Jobs in NEO	IT Jobs as % of All Jobs in Industry
Professional, Scientific, and Technical	11,887	31.3%	13.7%
Management of Companies and Enterprises	4,613	12.2%	10.5%
Information	3,321	8.8%	16.0%
Government	3,292	8.7%	1.5%
Manufacturing	3,176	8.4%	1.5%
Finance and Insurance	3,125	8.2%	4.9%
Administrative and Support and Waste Management and Remediation Services	2,072	5.5%	2.2%
<b>Total</b>	<b>31,486</b>	<b>83.0%</b>	
Source: EMSI Analyst			



IT workers is a major part of the workforce for all these high-end services, mostly serving other industries as customers.

- [Computer Systems Design and Related Services](#) is home to firms providing IT services to customers.
- The second most IT workers are employed in NE Ohio are in holding companies, or discrete locations where administrative corporate functions are performed. No matter the nature of the business, employment associated with handling these functions for the firm is reported as [Management of Companies and Enterprises](#). Headquartered firms and divisions located in NE Ohio drive the demand for IT workers in this sector.
- Next are [Government](#); [Manufacturing](#); and [Information](#) industry sectors.

Two-thirds of all IT workers are employed in these five industry sectors. Not on this list is Healthcare Services and Information Industry (mostly Software Developers). While both industries are important to a study of IT demand, they currently do not account for a substantial share of the IT workforce. NE Ohio has major employers in both industries with customer reach well beyond the region.

## Industries expected to add the largest numbers of IT workers by 2022

Professional and business services sector, not surprising, are expected to add the most additional IT jobs by 2022. A partial explanation for why IT jobs are not more prominent in the NE Ohio economy when compared to the nation is because of a lack of overall job growth in several industry sectors which employ large numbers of IT workers. [Government](#) and [Manufacturing](#) are not likely to produce significant job growth overall or in IT jobs specifically.

IT jobs are 20.6% of all jobs in the [Information](#) industry which includes Software Developers. Only the [Professional and Business](#) Industry Sector (which includes firms supplying IT services to others) relies nearly as much on IT workers (17.1%). However, because of its relatively small size in the NE Ohio economy, [Information](#) employs only 8.3% of the region's employed IT workers.

## Location by County & Metro Area of Ads for IT Workers Even More Skewed

Online job postings announcing employer potential needs to hire are more skewed in favor of Cleveland/Cuyahoga and along the I-77 corridor down to Canton.

NEO: Location of IT Jobs Posted Last 365 Days	
Metropolitan Statistical Area	Job Postings
Cleveland-Elyria, OH	80.35%
Akron, OH	15.61%
Canton-Massillon, OH	4.04%
	100.00%
County	Job Postings
Cuyahoga, OH	73.05%
Summit, OH	14.30%
Stark, OH	3.98%
Lake, OH	2.47%
Medina, OH	2.31%
Lorain, OH	1.35%
Portage, OH	1.14%
Wayne, OH	1.11%
Geauga, OH	0.28%
Carroll, OH	0.01%
	100.00%
Source: Labor Insight Jobs (Burning Glass Technologies)	

- Seventy-three percent of all IT posts were for workplaces in Cleve/Cuyahoga County—the largest Workforce Area in NE Ohio, and 80% are within the Cleveland-Elyria MSA.
- Cuyahoga County alone is the location for 73% of all IT posts for NE Ohio.
- Summit and Stark account for most of the rest: 18%.

This reality makes the commute to work problematic for job seekers living in outlying areas of the region. Even Summit County is potentially the location for 6% of all jobs posted for IT positions.

Again, all interests attempting to determine how to address the skills gap problems in the region need to understand where the clustering of IT career employment opportunities is occurring. Regional thinking is needed. e dated axiom; ‘Think regionally, act locally, still applies’.

## Further Look at IT Jobs in Demand

Posts for Software Developer/ Engineer are about five times more prevalent than the next most posted job (System Analyst).

Several other occupations that are developer roles are found further down the list. These reflect a more specific role: Web Developer; UI/UX Developer; Mobile Applications Developer

Most occupations among the rest of the top ten most posted are roles dealing with data or network systems.

Only Burning Glass differentiates between an Architect/ Developer and an Analyst role for

NEO: Total Ads in IT Occupations during Last 365 Days as of June 26, 2017			
BGTOCC	BGTOCC	Job Postings	
		#	%
15113100	Software Developer / Engineer	4,549	26.3%
15115100	Computer Support Specialist	1,534	8.9%
15112100	Systems Analyst	1,393	8.0%
15119902	Network Engineer / Architect	1,083	6.3%
15114200	Network / Systems Administrator	908	5.2%
15114100	Database Administrator	838	4.8%
15119995	IT Project Manager	721	4.2%
15119901	Software QA Engineer / Tester	702	4.1%
15113300	Computer Systems Engineer / Architect	696	4.0%
15113492	Web Developer	672	3.9%
15112200	Cyber / Information Security Engineer / Analyst	666	3.8%
15113191	Computer Programmer	483	2.8%
15119994	Business Intelligence Architect / Developer	336	1.9%
15119993	Business Intelligence Analyst	317	1.8%
15119900	Technology Consultant	254	1.5%
11302100	Chief Information Officer / Director of Information Technology	227	1.3%
15113493	UI / UX Designer / Developer	196	1.1%
15119912	Document Control / Management Specialist	195	1.1%
27102400	Graphic Designer / Desktop Publisher	190	1.1%
15119907	Data Warehousing Specialist	183	1.1%
15113192	Mobile Applications Developer	180	1.0%
15115200	Network / Systems Support Specialist	161	0.9%
15204102	Clinical Data Systems Specialist / Manager	153	0.9%
27304200	Technical Writer	123	0.7%
15119906	Database Architects	110	0.6%
15111191	Data Scientist	101	0.6%
15114301	Telecommunications Engineering Specialists	77	0.4%
13119902	Security Management Specialists	76	0.4%
15119910	Search Engine Optimization Specialist	67	0.4%
15114191	Data Engineer	34	0.2%
43901100	Computer Operator	25	0.1%
27101400	Multimedia Designer / Animator	24	0.1%
15119903	Webmaster / Administrator	17	0.1%
15113491	Web Designer	16	0.1%
15111100	Computer Scientist	15	0.1%
	All IT	17,322	100.0%

Source: Labor Insight Jobs (Burning Glass Technologies)

Business Intelligence.

While O\*Net has 28 separate titles for IT occupations, Burning Glass has 34 for which there were job posts in the last 365 days in NE Ohio.

## Top Job Titles in IT Ads

Appearing most in job ads are titles with ‘Developer’ or ‘Engineer’ as the noun. ‘Analyst’ is next most frequently used noun in actual job titles.

This reflects the reality that Developer/ Engineer and Systems Analyst are two of the top three occupations linked to IT job ads.

Computer Support Specialists subsume many actual job titles with only a few among top 30. This occupation aggregates many job titles with smaller numbers of ads. This support-related occupation title includes a quite diverse set of job duties for support workers in different IT environments.

Together, these 30 job titles account for only 36% of all IT ads.

NE Ohio: Top IT Job Titles in Ads during Last 365 Days			
Title	Job Postings	Title	Job Postings
Software Development Engineer	657	Help Desk Analyst	161
Applications Developer	430	Database Administrator	154
Systems Engineer	369	Programmer/Analyst	150
Network Engineer	354	Network Administrator	144
Java Software Developer	323	Graphic Designer	138
Software Developer	321	Information Technology Business	131
Web Developer	309	Applications Analyst	121
.Net Developer	284	Information Technology Project	117
Systems Administrator	262	SQL Developer	116
Business Systems Analyst	246	Data Entry Specialist	109
Data Entry Clerk	232	Information Technology Analyst	104
Applications Engineer	199	Information Technology Manager	97
Quality Assurance Analyst	187	Oracle Developer	97
Systems Analyst	184	Data Entry	90
Solutions Architect	169	Applications Architect	87
Source: Labor Insight Jobs (Burning Glass Technologies)			

## Employers with the Most IT Job Postings Last 365 Days Ending June 26

- The employers with the most IT postings are familiar names and are from different industries.
- A few large employers each posted several hundred positions during 2015.
- Several of these are members of the RITE Board: Progressive Insurance; Cleveland Clinic; Sherwin-Williams; Eaton; and Hyland Software.
- This information can be useful for early engagement of employers to discuss improving their access to qualified talent.

NEO: Employers with Most Ads for IT Jobs Last 365 Days, as of June 26, 2017			
Note: 54% of records have been excluded because they do not include an employer.			
Employer	Job Postings	Employer	Job Posting
Deloitte	402	Best Buy	93
Accenture	391	Amtrust Financial Services Incorporated	92
The PNC Financial Services Group, Inc.	279	Progressive	78
Sherwin Williams	265	Diebold	77
Keycorp	175	Windstream Communications	73
Progressive Insurance	170	The J.M. Smucker Company	72
Cleveland Clinic	145	Endevis	58
Rockwell Automation Incorporated	117	Medical Mutual	58
University Hospitals	114	New York Community Bank	53
Amtrust North America	103	Hyland	51
		Eaton	47
Source: Labor Insight Jobs (Burning Glass Technologies)			

## Industries with Most IT Job Ads

Professional, Scientific, & Technical Services sector had 31% of all IT jobs in 2016 and 39% of all job ads in the last 365 days, dating back to July 2016.

Finance and Manufacturing sectors are next with 17% and 12% of all ads. This differs from the sectors with the second and third most IT jobs in 2016: Jobs in corporate headquarters and holding companies and the Information Sector which has only 4% of all job ads.<sup>2</sup>

NEO: Industries with Most IT Ads Last 365 Days	
66% of All Ads reveal Industry of Employers	
Industry	Job Postings
Professional, Scientific, and Technical Services (54)	38.64%
Finance and Insurance (52)	17.32%
Manufacturing (31-33)	11.81%
Administrative and Support and Waste Management	7.82%
Retail Trade (44-45)	6.20%
Health Care and Social Assistance (62)	5.94%
Information (51)	4.00%
	91.73%
Source: Labor Insight Jobs (Burning Glass Technologies)	

## III. Jobs In-Demand Outnumber Qualified Jobseekers = Skills Gap

Numeric skill gaps between supply and demand results in employers recruiting outside the region, or

<sup>2</sup> At this time, firms in these top three sectors are where the greatest demand to hire appears to be. Only 66% of all ads can be linked to a specific industry. Some ads are blind as to employer or industry and may be posted by recruiting businesses. It is not possible to know if these employers are more likely to be from a certain industry, so it is possible that the industry pattern observed has some bias. However, it is reflective of the majority of ads posted and is the best information we have about IT demand today in comparison to where it has been.

accepting less than preferred qualifications from the applicant pool. Ideally, employers should be able to satisfy hiring needs from job seekers already living in the region. Many employers report little difficulty filling positions when they expand their search to include recruiting from outside the local region. These workers either commute into, or relocate to, NE Ohio. It is possible for workers living in adjacent areas of NE OHIO to do so but the pool is limited in number and journey to work data reveal only limited numbers of all workers commuting into NE Ohio from adjacent areas. However, these recruiting methods can be quite expensive and time consuming.

*The goal of regional workforce (talent) development is to quicken the pace of efforts to attack skill gaps by increasing and improving the supply of NE Ohio workers. Can higher education and vocational and technical training providers in NE Ohio play a greater role in increasing the numbers of qualified job applicants with the skills and credentials employers want, and connect them with jobs in real time? What do we need to know about the skills gap for that to happen?*

This seminar study hopefully will inform strategies and actions that produce results within 2 to 4 years.

## IV. Methodology: An Innovative Approach Using Big Data Analytics

Three major sources of data are used to measure demand and supply: Burning Glass' Labor/ Insights<sup>3</sup> for labor analytics on demand; IPEDs<sup>4</sup> for the most comprehensive source of data on recent completers of post-secondary and vocational education and training; and proprietary data purchased from Burning Glass on postsecondary programs designed to prepare students for career employment in IT matched with detailed data on IT demand by occupation and data-based estimates of the numeric gap between annual job postings and annual completers from college and vocational programs. This calculation is done for each occupation: An AI models is used to compare the learning outcomes of each IT program against several sources of data on skills and knowledge required to perform the occupation well. If there is a strong degree of overlap between student learning outcomes and the occupations skill set then the program identified as one that generally prepares students well to do IT jobs assigned to the occupational title. Each of nearly 40 programs are assessed for each of nearly 40 IT occupations. The result is a much

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<sup>3</sup> A direct investigation of jobs employers post online provides a more complete picture of jobs in demand as they emerge and change. Burning Glass identifies employers with high demand for workers and occupations with the most openings and reveals details about employers' demand for skills and credentials. Burning Glass has compiled a database of over 150 million job listings, updated daily from roughly 40,000 websites nation-wide. The database includes listings from major job boards, newspapers, government agencies, and a broad array of small, medium, and large employers—so long as they are placed online. The sites captured include a strong representation of the small businesses driving economic recovery; 51 percent of sites mined produce 20 or fewer jobs. Most sites are employer sites. Also, Burning Glass leverages patented text mining to code 70-plus data elements to render detailed skills-level intelligence on who is hiring and where, what jobs are in demand, and what skills and credentials employers now require for those jobs.

<sup>4</sup> Integrated Postsecondary Education Data System is the primary source for information on U.S. colleges, universities, and technical and vocational institutions. The completion of all IPEDS surveys, in a timely and accurate manner, is mandatory for all institutions that participate in or are applicants for participation in any Federal financial assistance program authorized by Title IV of the Higher Education Act (HEA) of 1965. IPEDS responds to certain of the requirements pursuant to Section 421(a)(1) of the Carl D. Perkins Vocational Education Act. The data related to vocational programs and program completions are collected from postsecondary institutions known to provide occupationally specific vocational education.

more cross-matching of programs to occupations, and vice versa. Further, this analysis is performed for the two levels of educational attainment—Bachelors or more and Associates or shorter postsecondary program.

Using data purchased from Burning Glass provided a definitive matching of IT programs by Classification of Instructional Program (CIP) where students learn the core skills now required by employers when hiring for each occupation. This level of nuance has not been available before in discussions about poor alignment of supply with what employers need. The result: skills that a developer needs are not the same as for a Network Systems Administrator, for example.

***Nearly 40 different CIPs are matched against nearly 40 IT occupations to determine which programs prepare students for each occupation.***

Also, purchased from Burning Glass are the estimates of demand versus supply of workers for each IT occupation. This is based on the number of job openings posted and the supply of recent completers from programs. Combined, these two data analytics document the numeric gaps for NE Ohio.

These findings and implications formed a single source of hard data that provides a wellspring of information that employers, educators, workforce boards, and regional intermediaries can explore together and create agreement on actions to improve the alignment of demand and supply in the next three to five years.

## V. Skills In-demand & Implications for Job Seekers: What Job Seekers Need for Occupational Opportunities

### Top Skills Appearing Across All IT Online Postings

Most but not all job ads specify skills that employers seek from applicants. In fact, during 2015 only twenty-three percent of all online ads did not specify a single skill. These are for low-skill jobs, especially part-time or temporary positions in general. But IT occupations have the most skills listed of any occupational family, including Engineering and Scientists.

By isolating skills appearing the most in job postings, we gain insight into what skills job seekers must possess to compete. There are three ways to organize demand for skills that appear in job ads.<sup>5</sup>

1. Customized to specific occupations and the nature of job assignments. These are technical skills stipulated by employers. Examples: accounting; welding or machining (as skills not jobs); and patient care.
2. Software and Programming skills, which can be required in non-IT jobs as well. Most occupations today require some of these skills.

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<sup>5</sup> Burning Glass Technologies, Labor/Insight

3. Baseline or Employability skills, or what is often called ‘soft’ or non-technical skills. Jobs for the Future and others refer to these skills as Employability skills. These are not the typical ‘show up on time’ workplace attributes. Rather these are skills mentioned in job ads are more germane to successful performance on the job. These include communication, writing, problem solving skills, etc.

Knowing what skills appear most often in job ads enables productive discussion about required or core skills workers should acquire early on.

In IT specific software, languages, and programming tools appear as both Specific to an occupation and also as a Software & Programming Skill. These are highlighted in Specialized Skills listing.

NE Ohio: Top Skills/ Expertise Listed in Ads for All IT Postings last 365 Days					
Specialized Skills	Job Postings	Baseline (Employability) Skills	Job Postings	Software & Programming Skills	Job Postings
SQL	25.19%	Communication Skills	36.54%	SQL	25.19%
Project Management	17.00%	Troubleshooting	25.83%	JAVA	13.86%
Software Development	16.62%	Problem Solving	25.55%	Microsoft C#	12.94%
Customer Service	14.17%	Writing	24.74%	Microsoft Office	12.86%
JAVA	13.86%	Team Work/ Collaboration	17.16%	Oracle	12.18%
Technical Support	13.19%	Planning	16.73%	JavaScript	11.81%
Microsoft C#	12.94%	Research	12.82%	.NET Programming	10.82%
Microsoft Office	12.86%	Organizational Skills	11.53%	Microsoft Excel	10.48%
Oracle	12.18%	Detail-Oriented	10.73%		
JavaScript	11.81%				
.NET Programming	10.82%				
Microsoft Excel	10.48%				
Source: Labor Insight Jobs (Burning Glass Technologies)					

- SQL is the most common language needed across all IT occupations; the standard language for communicating with databases.
- Second most often listed are Project Management; Software Development; and Customer Service. Obviously, these three are not high on the list of abilities appearing in all the IT occupations reviewed earlier. Some require more of what is known as productivity digital skills: Microsoft Office applications; yet others need popular programming languages like Microsoft C#; JAVA; Java Script; or .NET Programming; etc.
- Baseline skills most identified important for IT workers to possess are: Communication; Troubleshooting; Problem Solving and Writing.

This information alone provides a starting point for clarifying the nature of learning outcomes that education and training programs should share, no matter what differentiates them. The top Baseline skills won't vary much across IT occupations and, yet, not often are embedded sufficiently into curriculum with measurable learning outcomes.

## VI. Skills Gap = Jobs In-Demand > Outnumber Qualified Jobseekers

As noted there were over 17,000 IT job postings in NE OHIO's labor market during the last 365 days.



Where do applicants come from? Skills in demand by employers are fluid, constantly changing and vary widely across occupations in demand. As a result, the occupations experiencing a talent or skills gap changes over time and region-to-region.

If NE Ohio postsecondary career education and training systems are to ***align technical programs with employer demand, it is important to have hard data on which occupations have a skills gap, what level of education and prior work experience employers seek, and what specific programs best prepare students to perform well on the job.***

Even for the same occupation, job ads might be seeking senior-level,

***Prior years of work experience is more important than level of education when determining where to look for qualified supply of job seekers.***

experienced mid-level, or less experienced entry-level applicants. This depends on the nature and level of responsibility of positions in which they

consider hiring.

In the last 365 days, there were over 17,000 online postings active at some point during the year. Not all result in new hires, and those that do occur over a variable time frame.

#### **Caveats when using job postings as indicator of employer hiring activity**

Not all job postings result in new hires, and those that do occur over a variable time frame.

- A portion of hires occur without a posting.
- Some postings are easy for employers to fill and some are extremely difficult. It all depends on job requirements set by employers and the ready supply of qualified applicants.
- Online ads for IT professionals have the most skills listed in ads of all occupations—typically over 20 per ad.

While employers intend to hire new workers for jobs they post, not all posted positions result in hires:

- Uncertainty in the market place results in applicants not being hired.
- How many of these are filled depends on several things: Finding the right applicants; budget needed to hire; need to fill positions remains firm; and more.
- Some employers use online postings simply to test the waters and get a read on the talent seeking new jobs.

- A portion of hires occur without a posting.
- Some postings are easy for employers to fill and some are extremely difficult. It all depends on job requirements set by employers and the ready supply of qualified applicants.
- Online ads for IT professionals have the most skills listed in ads of all occupations—typically over 20 per ad.

Hard data on hires **by occupation** is not centrally collected. We can assume that employers have an intent, or likelihood, of hiring when going to the expense of posting jobs. But, circumstances change and timelines slip.



## Aligning Demand with Potential Sources of Talent Supply

Quantifying shortages of IT supply to fill open positions is best understood, not by IT occupation alone, but by segmenting job openings by entry-level and mid-level demand. This is more important than the job alone. Experience of applicants is more important than education in the search to enumerate supply.

This starts with understanding more about demand measured by real-time online job postings.

### **BREAKING DOWN IT JOB ADS—AT THE POINT OF SOLICITING APPLICANTS, EMPLOYERS USE EDUCATION AND PRIOR WORK EXPERIENCE AS THE TWO BEST INDICATIONS OF APPLICANT QUALIFICATIONS.**

- In terms of education, they express preferences for majors and level of education credentials in job ads.
- In terms of work experience, most IT job ads seek experienced workers with at least three to five years of relevant job experience. Over half of all ads are seeking to fill these mid-level jobs. Ads to find senior personnel typically want to hire workers with six or more years in IT and/or the employers' industry—Fifty-nine percent of all Software Developer ads but 51% for all other IT Occupations.

- Even in IT, 25% of all ads invite applicants with no more than 2 years of relevant work experience. This percentage varies dramatically among IT occupations. [From 65% for Computer Support Specialists to 9% of Database Architects.](#)

NEO: Prior Work Experience and Demand for IT Workers-- Software Developers Vs All Others				
Experience Level	Software Developers		Other IT Occupations	
	#	%	#	%
9+ years	226	6.40%	701	7.01%
6 to 8 years	582	16.49%	1,648	16.48%
3 to 5 years	2,072	58.70%	5,113	51.12%
0 to 2 years	650	18.41%	2,539	25.39%
<b>Total Ads with Data</b>	<b>3,530</b>	<b>100.00%</b>	<b>10,001</b>	<b>100.00%</b>
Not Specified	1,832	34.17%	5,728	36.42%
<b>Total Ads</b>	<b>5,362</b>		<b>15,729</b>	

Source: Labor Insight Jobs (Burning Glass Technologies)

- Occupations are ranked top to bottom by the percent of posts requiring only 0 to 2 years of prior work experience.
- Overall, 24% of all IT posts qualify as entry level for job seekers with little prior experience.
- The first four occupations require the least proficiency with computer skills, generally no programming skills and only a basic ability to work with software applications.

- The opposite is true for the occupations highlighted in tan. A greater than average share of ads requiring no more than two years of experience, but, these occupations require more IT skills, greater competencies and most require a Bachelor's degree.
- The remainder are occupations requiring significant prior work experience and education, and are jobs carrying greater levels of responsibility.

### OCCUPATIONS WITH ***MOST*** ENTRY-LEVEL OPENINGS

- 42% of all jobs posted for entry-level job seekers are for Computer Support Specialist and Software Developer/Engineer.
- Systems Analyst, Data Entry Clerk, Network/ Systems Administrator, Cyber/ Information Security Engineer/Analyst, Software QA Eng./ Tester, and Database Administration Provide another 31% of all openings.

The four in ten IT ads that require no more than two years of prior work experience are either Computer Support Specialist or Software Developer/Engineer. Over 600 ads are for this developer position alone.

System Analyst ranks third with 262 ads for entry-level, inexperienced applicants.

NEO: Entry-Level Jobs Across All IT Occupations Most In-Demand, 2016				
Entry Level=0 to 2 Years of Prior Work Experience	Years of Experience		All Ads Listing Work Experience	
Total Jobs Posted=3,207	0 to 2			
BGTOCC	Job Postings		#	Entry-Level as % Of All
	#	%		
Data Entry Clerk	167	5.2%	200	83.5%
Computer Support Specialist	699	21.8%	1,072	65.2%
Computer Operator	12	0.4%	22	54.5%
Multimedia Designer / Animator	12	0.4%	22	54.5%
Clinical Data Systems Specialist / Webmaster / Administrator	76	2.4%	154	49.4%
Network / Systems Support Specialist	7	0.2%	16	43.8%
Mobile Applications Developer	44	1.4%	102	43.1%
Graphic Designer / Desktop Publisher	34	1.1%	84	40.5%
Data Engineer	40	1.2%	106	37.7%
Hardware Engineer	3	0.1%	8	37.5%
Web Designer	11	0.3%	33	33.3%
Telecommunications Engineering	3	0.1%	9	33.3%
Technology Consultant	22	0.7%	72	30.6%
Data Scientist	67	2.1%	224	29.9%
Software QA Engineer / Tester	15	0.5%	58	25.9%
Business Intelligence Analyst	135	4.2%	531	25.4%
UI / UX Designer / Developer	60	1.9%	241	24.9%
Cyber / Information Security Engineer / Systems Analyst	24	0.7%	103	23.3%
Network / Systems Administrator	146	4.6%	628	23.2%
Computer Programmer	262	8.2%	1,155	22.7%
Web Developer	159	5.0%	721	22.1%
Software Developer / Engineer	71	2.2%	358	19.8%
Security Management Specialists	94	2.9%	508	18.5%
Database Administrator	652	20.3%	3,602	18.1%
Computer Systems Engineer / Architect	11	0.3%	61	18.0%
Network Engineer / Architect	122	3.8%	695	17.6%
Data Warehousing Specialist	73	2.3%	600	12.2%
Business Intelligence Architect / Computer Scientist	95	3.0%	850	11.2%
IT Project Manager	13	0.4%	130	10.0%
Database Architects	16	0.5%	178	9.0%
Chief Information Officer / Director of Information Technology	2	0.1%	27	7.4%
Total	50	1.6%	736	6.8%
	5	0.2%	96	5.2%
	5	0.2%	194	2.6%
Total	3,207		13,596	23.6%

Source: Labor Insight Jobs (Burning Glass Technologies)

NEO: Entry-Level Jobs Across All IT Occupations Most In-Demand, 2016		
Entry Level=0 to 2 Years of Prior Work Experience	Years of Experience	
Total Jobs Posted=3,207	0 to 2	
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	#	%
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Systems Analyst	262	8.2%
Data Entry Clerk	167	5.2%
Network / Systems Administrator	159	5.0%
Cyber / Information Security Engineer / Analyst	146	4.6%
Software QA Engineer / Tester	135	4.2%
Database Administrator	122	3.8%

Likewise, ads vary in terms of education requirements: **Bachelors or more versus less than a Bachelors but more than high school credential**. From a low of 9% for Software Developers to a high of 65% for Computer Support Specialist in which employers specify that less than a Bachelor's degree is the minimum level of educational credential expected from applicants. For IT ads overall, 18% will accept less than a Bachelors.

To quantify the skills gap for IT talent, we must create a research design that dissects IT demand for each IT occupation by level of education credential and prior years of work experience.

"Individuals emerging from IT education and training programs" at is the best way to define a pool of potential job seekers with skills acquired through formal education rather than from work experience.

Guide to Identifying Labor Market Supply		
Prior Work Experience	Minimum Level of Education Credential	
	Bachelors and Above	Less than a Bachelors
Source of Supply		
0 to 2 Years	Recent Completers of Education & Training	
3 to 5 Years	Experience IT Workforce	

### Supply of IT workers for **entry-level jobs**

*Entry-level jobs are the best prospects for recent college grads, most of whom will not come with significant prior work experience.*

According to Will Markow at Burning Glass:

"Most employers specify 3-5 years because they do not want an entry-level worker. They are less likely to hire recent college grads with no prior work experience in which they honed these skills on the job. But, demanding new hires with related job experience constrains their traditional sourcing options to either churn in the local existing workforce – which from a regional perspective is a zero-sum solution – or hiring workers from outside the region. Some of the more forward-thinking employers will source workers from related, yet distinct, occupations or backgrounds and provide them with training (e.g. hiring a network administrator for a cybersecurity role). However, I think that is still the exception to the rule."

Most young people and transitioning adults who enter college IT programs do so in an effort to start or shift career paths. They lack significant, if any, prior work experience performing duties needed today by employers seeking to fill jobs. Upon completion of IT programs, these students, at best, meet employer demand for entry-level positions.

Churn is considered healthy for the economy—workers pursue career change or advancement by changing employers and firms can implement changes in job assignments and replace less-productive workers to improve firm competitiveness.

Because of workers vacating previous jobs: "The clear majority of hiring in the U.S. is driven by the need to replace workers who leave one job for another...this job to job movement is known as labor market

churn.”<sup>6</sup>

## VII. Nailing down an empirical definition of Skills Gap for entry-level jobs

So, the question is this: is the full spectrum of providers of NE Ohio postsecondary education and training producing enough badges, certificate and degree completers each year to meet the entry-level demand for IT professionals?

- The NE Ohio IT Skills Gap between demand and supply focuses on demand for entry-level IT new hires. To determine supply we analyze the annual supply of grads from programs that imbue completers with skills employers now demand. NE Ohio colleges and universities and other providers of technical education are the source of grads. The best single source of comprehensive data on completers by program is known as IPEDs. This requires submission of such data from all institutions and organizations, public or private, that have received designation as Title IV provider which permits them to access federal financial aid for qualifying students.
- As a result, the gap can be one of quantity (grads) or quality (specific major), or both.
- Analysis of supply will be understated to the extent that large numbers of current and future workers obtain enroll and complete the new, alternative delivery systems for their technical training; programs that do not need to report their data for inclusion in IPEDs.

### Improving the supply of IT talent is about talent development

- The region’s capacity for improving an existing and emergent workforce rests with the very entities that make up our education and workforce systems: postsecondary education (especially colleges and universities); the public workforce system (funded by federal and state resources); economic development organizations; and other major efforts to support talent development. The capacity to prepare future young and transitioning workers for career employment opportunities in demand is gauged by the aggregate production of completers from such programs.
- Greater alignment and partnership among these regional workforce development partners is vital to hastening the pace of improving workforce quality for employers.

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<sup>6</sup> Careerbuilder and EMSI, *The Pulse of U.S. Hiring Activity: Labor Market Churn by Occupation & Metro*, <http://www.economicmodeling.com/2014/12/02/the-slowdown-in-job-churn-explained-and-visualized/>

### Skills gap quantified

- Most recent college graduates have limited work experience applying the skills they just learned in college.
- Realistically then, only jobs posted where employers are willing to hire new workers with limited prior experience are truly available to recent college grads.
- For many skilled manufacturing jobs, however, it may be that employers expect to hire workers with job experience, over those just completing vocational or technical training.

## VIII. Detailed Findings: IT Occupations with Skills Gap

### Entry-Level IT job Openings in NE OHIO--those requiring no more than 2 years prior work experience

We researched the ability of NE Ohio higher education to produce IT grads in the same year as job ads are active (2015).

- A gap exists when breaking down demand and supply by Bachelors or more versus less than Bachelors.
- Separate gap analysis was provided by Burning Glass for IT postings that want a Bachelors or more and those accepting less than a Bachelors.
- A numeric gap in numbers of IT grads to job ads for entry level IT was extremely large. There are three to ten ads for every grad from IT programs, depending on the occupation. A gap exists for occupations if there are at least twice as many job postings as completers emerging from NE OHIO sources of IT education and training during 2015.

*There are three to ten ads for every grad from IT programs.*

#### **MOST INTENSE GAPS AT THE BACHELORS LEVEL:**

- Given the number of grads from majors with learning outcomes that generally prepare them for the top ten IT occupations with unmet demand, there is only one grad for every 5.8 postings for entry-level jobs.
- The shortage is even more dramatic for the four occupations: *Computer Support Specialists, Software Developer/ Engineer, Web Developer, and Database Administrator.*

- ✓ There were 30 job ads for Software Developer/Engineer positions during 2015 for every grad from an IT Bachelors program that emphasizes development of software (the primary job duty is design and implementation of software applications). This gap is on the extreme end of the continuum of supply shortage emerging from NE OHIO education and training systems.
- ✓ Systems Analyst job postings outnumber completers from matching IT programs by 4 to 1. The severity of the gap is less but important to resolve.

**The numeric gaps are too large to breach in a few years.**

- IT programs differ in nature and priority concerning learning outcomes. The nearly 40 distinct IT programs with varied learning objectives are not equally effective at developing skills employers now need when hiring. It depends on the specific needs and how they vary across IT occupations. For example, knowledge and abilities of programming languages and methods and applications are more important for the range of developer occupations than for jobs in networks and computer systems. There are other specific IT programs that emphasis learning how to work in this area of IT.

NEO IT Occupations: Entry-level Ads Are More Than Twice the Number of Grads for the Year 2015			
Entry-level = 0 to 2 Years of Work Experience			
Grads from IT Bachelors Programs in Ratio to Openings Preferring a Bachelors			
BGTOcc	BG Occupation Title	Numbers Gap	
		Jobs Postings for	Annual Grads from Bachelor's
Unmet Demand for Entry-level Demand for IT jobs			
15-1151.00	Computer Support Specialist	506	61
15-1131.00	Software Developer / Engineer	976	32
15-1121.00	Systems Analyst	329	76
15-1142.00	Network / Systems Administrator	187	40
15-1122.00	Cyber / Information Security Engineer / Analyst	197	35
15-1199.01	Software QA Engineer / Tester	187	31
15-1141.00	Database Administrator	161	22
15-1134.92	Web Developer	148	23
15-1131.91	Computer Programmer	107	32
15-1199.02	Network Engineer / Architect	102	43
15-2041.02	Clinical Data Systems Specialist / Manager	89	33
15-1133.00	Computer Systems Engineer / Architect	73	33
15-1199.00	Technology Consultant	83	20
15-1199.95	IT Project Manager	65	43
15-1143.01	Telecommunications Engineering Specialists	19	18
15-1199.94	Business Intelligence Architect / Developer	27	22
		3257	564
Source: Supply/Demand Calculator (Burning Glass Technologies)			

- The numeric gaps are too large to breach in a few years even if large new investments into postsecondary capacity to enroll and graduate additional supply were made. IT grad numbers have been flat over last five years for NE Ohio.
- New IT occupations with at least 100 ads are Computer Programmer and Network Engineer/ Architect

- For this set of 16 occupations, entry-level job ads outnumbered the number of grads six to one.

## SHORTAGE OF GRADS AT CERTIFICATE & ASSOCIATE LEVELS

The annual grads at Certificate and Associate levels fall short of demand for entry-level openings.

While a high school credential is minimally acceptable for many of these job ads, at least a relevant certificate is needed—this could be learned in a high school career academy or postsecondary institution. Computer Support Specialist tops the list and typically does not require a Bachelors.

Typically, the other occupations require a Bachelors; Ads for these positions are relatively small.

NEO IT Occupations: Entry-level Ads Are More Than Twice the Number of Grads for the Year 2015; Less Than Bachelor's				
Entry-level = 0 to 2 Years of Work Experience				
	Grads from IT Bachelors Programs in Ratio to Openings Less than Bachelor's			Accepting
BGTOcc	BG Occupation Title	Numbers Gap		
		Demand		Supply
		High School	Certificates/ Associate's	Total Certificates and Associates
	Under supply of Certificate or Associate Degrees			
15-1131.00	Software Developer / Engineer	48	66	17
15-1131.91	Computer Programmer	21	14	17
15-1133.00	Computer Systems Engineer /	5	15	7
15-1141.00	Database Administrator	32	14	5
15-1151.00	Computer Support Specialist	421	292	44
		527	401	90
Source: Supply/Demand Calculator (Burning Glass Technologies)				

## WHAT ABOUT THE REMAINING IT OCCUPATIONS?

Eight occupations have few job postings asking for a Bachelor's degree. In total 236 ads were posted during 2015 and 197 grads from IT programs that generally prepare students for these jobs. Mostly, for each of these occupations there are about an equal number of grads. Based on numbers alone, employers should not have difficulty finding qualified job seekers among recent graduates.

The one exception is for Mobile Application Developer, which like most developer jobs has nearly twice as many openings as grads.

### Too many grads with Bachelor's degrees?

Computer Scientists and Web Designer ads were very few and, consequently, programs specifically targeted these career jobs are graduating more than enough to meet employer demand.

NEO IT Occupations: Entry-level Ads Are Equal to or Less than Half the Number of Grads for the Year 2015			
Entry-level = 0 to 2 Years of Work Experience			
Grads from IT Bachelors Programs in Ratio to Openings Preferring a Bachelors			
BGTOcc	BG Occupation Title	Numbers Gap	
		Jobs Postings for	Annual Grads from Bachelor's
	Over Supply of Graduates		
15-1199.93	Business Intelligence Analyst	100	835
15-1111.00	Computer Scientist	5	10
15-1111.91	Data Scientist	16	1264
15-1134.91	Web Designer	16	59
		138	2168
	About Right Balance		
15-1134.93	UI / UX Designer / Developer	39	40
15-1199.03	Webmaster / Administrator	15	13
15-1199.07	Data Warehousing Specialist	16	13
15-1199.06	Database Architects	11	10
15-1131.92	Mobile Applications Developer	67	36
15-1152.00	Network / Systems Support Specialist	36	32
15-1134.93	UI / UX Designer / Developer	39	40
15-1199.03	Webmaster / Administrator	15	13
		236	197
Source: Supply/Demand Calculator (Burning Glass Technologies)			

The two other occupations with an estimated over-supply of Bachelor's degree is: *Business Intelligence Analyst* and *Data Scientist*. This finding is somewhat a misnomer. The large number of grads is because many business and science programs respectively are considered strong preparation for these occupations. What these overlooks is that for both occupations there is increasing need for sophisticated IT and statistical tools beyond the scope of most business or science programs.

### *Oversupply of Certificates or Associate degrees?*

- Computer Support Specialist tops the list yet typically does not require a Bachelor's degree. Specific programs designed to prepare workers to fill these positions with Certificates or Associate degrees are not a major emphasis for institutions in the region. Employers like Charter/Spectrum based in Canton cite difficulty recruiting workers to meet their needs.
- While a high school credential is minimally acceptable for many of these job ads, at least a relevant certificate is needed—this could be learned in a high school career academy or subsequently at a postsecondary institution or short-term training program.
- Typically, the other occupations require a Bachelors; Ads for these positions (Software Developer/ Engineer, Computer Programmer, and Database Administrator) are small and best addressed at the Bachelors' level.
- Equally surprising is that a few IT occupations where employers do accept applicants with less than a Bachelors are being oversupplied with completers from NE Ohio postsecondary system:

*There were in total 214 completers from programs that match knowledge and skill requirements of these IT occupations with only an annual number of 50 job ads.*

NEO IT Occupations: Entry-level Ads Are More Than Twice the Number of Grads for the Year 2015; Less Than Bachelor's				
Entry-level = 0 to 2 Years of Work Experience				
Grads from IT Bachelors Programs in Ratio to Openings			Accepting Less than	
BGTOcc	Bachelor's	Numbers Gap		
		Demand	Supply	
		High School	Certificate s/ Associate's	Annual Grads with Associates/ Certificates
Oversupply of Associate Degrees & Certificates				
15-1134.93	UI / UX Designer / Developer	2	12	30
15-1143.01	Telecommunications Engineering Specialists	13	18	50
15-1152.00	Network / Systems Support Specialist	17	17	86
15-1199.07	Data Warehousing Specialist	1	1	5
15-1199.93	Business Intelligence Analyst	5	9	270
15-1134.91	Web Designer	2	2	40
15-1111.00	Computer Scientist	0	0	3
		40	60	484
Neither Over or Under Supply at Certificate or Associate Level				
15-1199.02	Network Engineer / Architect	9	12	50
15-1199.00	Technology Consultant	2	1	4
15-1199.94	Business Intelligence Architect / Developer	0	3	4
15-1121.00	Systems Analyst	30	41	85
		41	57	143
Source: Supply/Demand Calculator (Burning Glass Technologies)				



- Networking and Computer Systems** appears to an area of IT expertise that is producing more completers than NE Ohio needs based on annual job postings. These programs and completers could potentially be better served by transferring into one of the IT programs where a gap exists.

NEO IT Occupations: Number of Grads for the Year 2015 is more than twice the number of job openings at Less Than Bachelor's				
Entry-level = 0 to 2 Years of Work Experience				
Grads from IT Bachelors Programs in Ratio to Openings			Accepting Less than Bachelor's	
BGTOcc		Numbers Gap		
		Demand		Supply
		High School	Certificates/ Associate's	Annual Grads with Associates/ Certificates
	Oversupply of Associate Degrees & Certificates			
15-1134.93	UI / UX Designer / Developer	2	12	30
15-1143.01	Telecommunications Engineering	13	18	50
15-1152.00	Network / Systems Support Specialist	17	17	86
15-1199.07	Data Warehousing Specialist	1	1	5
15-1134.91	Web Designer	2	2	40
15-1111.00	Computer Scientist	0	0	3
		35	50	214

## IX. Deeper understanding of NE Ohio postsecondary completers of IT programs

### Role of higher education to supply talent for IT entry-level jobs in demand

Employers look to the region's higher education system for job seekers emerging from IT programs as graduates. Years ago employers annually made visits to college campuses to search for pending graduates in business, engineering and other programs. For decades, this was an effective way for national and local employers and graduates to connect around hiring opportunities for entry-level positions.

The distinct mix of education and training providers in NE Ohio is a mix of providers offering IT programs at every level of completion.

- Public and Private/ non-profit institutions provide the most graduates with Bachelor's degrees—193 and 156, respectively, in 2015.
- For-profits generally do not offer Bachelor's-level programs on any scale.
- It appears that NE Ohio Adult Career and Technical Education providers are not reporting IT program data at the federal level since no data of completions are recorded in any year studied. Fifteen institutions appear in the data reported.

These institutions produced a total of 374 Bachelors grads in 2015.

- Number of completers has been relatively flat over the last few years despite the heightened level of engagement between the higher education system and industry around the need for more IT grads.
- The region's three public universities produced 193 grads in 2015,

Higher Education Institutions Providing IT Bachelor's Degrees in the 10 County NEO, 2011 to 2015						
Total Degrees Conferred 2015	Number of Institutions					
374	15					
Percent Change since 2011						
65.49%						
Institution	Type	2015	2014	2013	2012	2011
Kent State University at Kent	Public	120	113	88	110	56
University of Akron Main Campus	Public	46	53	53	84	48
Cleveland State University	Public	27	22	29	12	23
		193	188	170	206	127
Case Western Reserve University	Private	47	44	45	44	26
Oberlin College	Private	37	21	18	9	11
Baldwin Wallace University	Private	20	17	21	20	16
University of Mount Union	Private	18	17	10	13	13
John Carroll University	Private	18	11	16	9	10
Malone University	Private	6	7	7	3	2
Walsh University	Private	6	1	3	1	7
Hiram College	Private	4	6	5	3	7
		156	124	125	102	92
ITT Technical Institute-Strongsville	For-Profit	17	12	15	14	0
Akron Institute of Herzog University	For-Profit	4	0	0	0	0
University of Phoenix-Cleveland Campus	For-Profit	3	6	1	4	4
South University-Cleveland	For-Profit	1	0	0	0	0
ITT Technical Institute-Warrensville Heights	For-Profit	0	1	3	3	0
Chancellor University	For-Profit	0	0	0	1	3
ITT Technical Institute-Akron	For-Profit	0	0	0	0	0
Total For-Profit		25	19	19	22	7
Region Total		374	331	314	330	226
Source: Labor Insight Jobs (Burning Glass Technologies)						

followed closely by the array of private institutions, which includes Case-Western, that graduated 156. For-profit education in NE Ohio does not focus on four-year programs.

## IT Programs in NE Ohio with the Most Completers

Including all levels of award, NE Ohio produced 1,115 completers in 2015 from IT programs. By award level, there were 136 Certificates; 473 Associate and 506 Bachelor degrees. Obviously, the relative mix of Associate vs Bachelor awards to prepare students for IT careers seems disproportionately tilted toward community colleges; universities are under-producing given industry needs for IT professionals with four-year degrees.

Moreover, the collective outcome for total awards by IT program content is heavily weighted to five program areas. The largest number of completers is in *Computer and Information Sciences* programs which is the most general preparation of all programs. The equally large numbers from *Computer Science* and *Systems Analysis* may reflect sensitivity to employer preferences.

However, the dearth of completers from programs focused on Computer Engineering or Security of IT systems helps to explain why Software Developer/Engineer and Network/Information Security Analysts are prominent among the IT occupations with the most intense skills gap.

IT and Related Majors That Generally Prepare Students for this Job: 2015 for NEO						
CIP Code	CIP Title	DegreeLevel				
	Level of Attainment	Cert.	Assoc	Bach.	Mas.	Phd
	<b>Computer and Information Sciences</b>					
11.01	Computer and Information Sciences, General.	67	5	92	62	
11.01	Artificial Intelligence.					
11.01	Information Technology.	9	2			
11.02	Computer and Information Sciences, Other.		3			
	<b>Computer Programming.</b>					
11.02	Computer Programming/Programmer, General.	2	10	10		
11.02	Computer Programming, Specific Applications.	14	33			
11.03	Computer Programming, Other.		2			
	<b>Data Processing and Technology/ Technician</b>					
11.03	Data Processing and Technology/ Technician	9				
	<b>Information Science/Studies.</b>					
11.04	Information Science/Studies.	5	61	1	64	
	<b>Computer Systems Analysis.</b>					
11.05	Computer Systems Analysis/Analyst.	3	78	55		
	<b>Computer Science</b>					
11.07	Computer Science.	1		137	121	12
	<b>Computer Software and Media Applications.</b>					
11.08	Web Page, Digital/Multimedia and Information Resources Design	8	46	4		
11.0802	Data Modeling/Warehousing and Database Administration	3	1			
11.08	<b>Computer Graphics</b>		23			
11.08	Modeling, Virtual Environments and Simulation.					
11.09	Computer Software and Media Applications, Other.					
	<b>Computer Systems Networking and Telecommunications</b>					
11.09	Computer Systems Networking and Telecommunications	14	72	48		
	<b>Computer and Information Systems Security/Information Assurance.</b>					
11.1	Computer and Information Systems Security/Information Assurance.			19		
	<b>Network and System Administration/ Administrator</b>					
11.1	Network and System Administration/ Administrator		4	4		
11.1	System, Networking, and LAN/WAN Management/Manager		98			
11.1003	Computer and Information Systems Security/Information Assurance		3	19		
	<b>Computer and Information Sciences and Support Services</b>					
11.101	Computer Support Specialist	1	27			
11.11	Computer/ Information Technology Services, All Other			8		
	<b>Computer Engineering</b>					
14.09	Computer Engineering, General.			56	18	4
14.09	Computer Software Engineering.			3		
	<b>Management Information Systems and Services</b>					
52.12	Management Information Systems, General.		5	50		

These data provide insight into opportunities for better alignment of actual IT curriculum with the emerging directions of skill and occupational needs of IT employers in the region, and possible avenues for engaging employers and educators around where and how to achieve a better and improved supply of completers.

This discussion is further pursued in the Conclusions and Recommendations section.

## X. Speculating on NE Ohio's IT skills gap for mid-level positions

As daunting as the gap is for even entry-level jobs for everything from developers to computer support specialists, there is an equally challenging short-fall cited by employers when trying to fill the mid-level jobs where experience matters. While not an objective of this investigation, we now better understand the nature of demand for these IT workers and the need to assess the potential for the region's workforce development eco-system to assist industry in addressing skill gaps of those already working in IT.

*If soliciting recent grads with the right education is the best way to find these applicants, where do employers turn to fill jobs for experienced workers?*

- The supply of experienced workers with the appropriate educational credentials and evidence of needed skill sets is largely met by those already employed—employers primarily seek to hire from pool of IT workers already employed although for someone else.
- Supply is augmented by the ability of employers to search for workers outside of the region.

Why can't employers find enough workers within the region's incumbent IT workforce?

1. If the region's demand for mid-level IT workers is growing, by definition, employers in total cannot satisfy their hiring needs by simply trading current IT workers. Numerically, there is shortage of supply.
2. More likely, the rapid pace of change in information technology is impacting job duties and skills sets employers now need. Current workers likely will lack some of what now is required and need to be up-skilled before entering the new job with a new or same employer.
3. Employers attempt to create additional IT workers by attracting workers with business, engineering, and other occupations to fill IT openings. The opposite is true as well: employers attract IT workers into other occupations based on the emerging trend where many positions in IT, Engineering, etc. post ads seeking the core areas of skill and knowledge are IT, Engineering, and Business/ Industry.

On balance, employer opinion is that other methods are necessary if they are to fill critical vacancies.

The second and third explanations are most likely why many employers launch programs to promote

from within. At the same time employers that can afford to do so heavily pitch their openings to experienced IT workers elsewhere in Ohio and beyond.

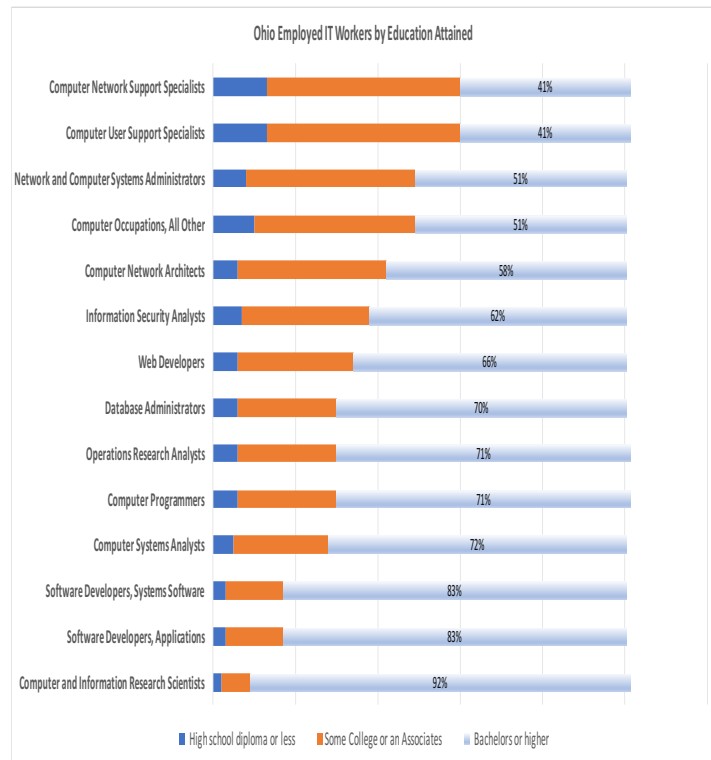
Producing hard data on IT job seekers already in the workforce was well-beyond the scope of this investigation, but employers indicate that these positions are more difficult to fill than entry-level. There is no source of inclusive data on workers already employed and the likelihood they will apply for positions with other employers.

By and large these individuals are not currently enrolled in IT education and training programs to prepare for a career in IT, or even to address IT skills they need to acquire or improve to stay current and advance in their career.

The best we have is information about those employed by occupation or industry. For example, NE Ohio employed as IT professionals present some challenges when considered as the potential pool for filling mid-level IT roles with the skills mix employers now need. Too few working in 2016 have a Bachelor's degree. Too few females currently are employed in IT jobs. Most jobs are held by white males relative to persons of color.

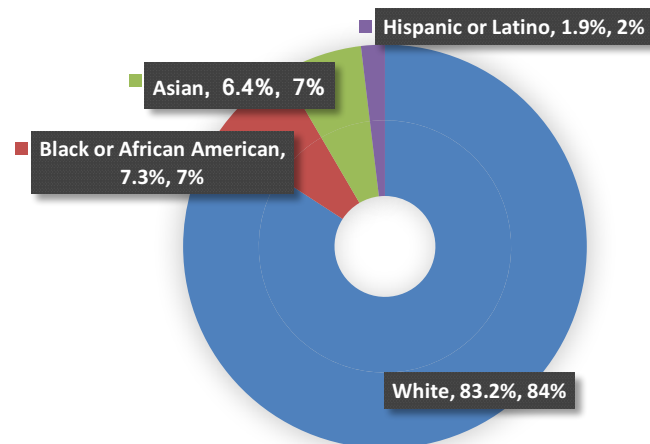
Lack of females and persons of color, relative to their overall presence in the workforce likely suggest barriers to enter IT careers that need breaching if the region's industry is to make full use of NE Ohio's current working age population.

Many employers have tired of competing with one another for NE Ohio experienced workers and have increased efforts to [promote from within](#) by identifying high performing workers who started in entry level jobs and have created ways to get them the additional skills required to succeed in mid-level openings.



## LACK OF DIVERSITY AND INCLUSION IN IT WORKFORCE

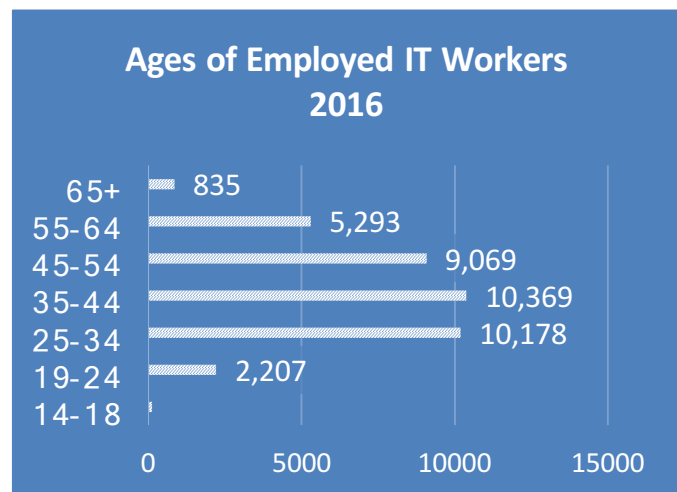
NE Ohio's employed IT workers are 83% White and only 7% African American or Asian; 2% are Hispanic. The IT workers are slightly made up more of White and Asian employed persons. Blacks and Hispanics are less often employed in IT occupations.



NE OHIO: Race/ Ethnicity of IT Workers 2016

## AGES OF IT WORKERS

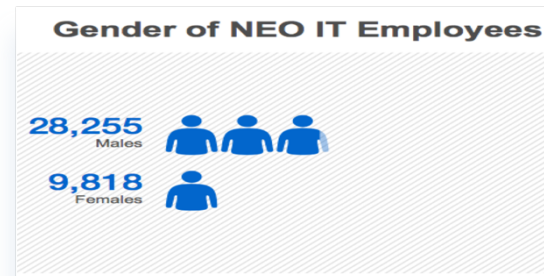
IT workers are slightly younger than all employed persons in NE OHIO. Over half of all persons employed in IT jobs in the region are between ages 25 and 44. This potentially represents a very large pool of workers who will need up-skilled if they are to advance in their IT careers with the same or different employer or industry.



The gender gap among workers employed in IT jobs is telling: Females are 49.7% of all persons employed but only 26% of IT jobs are held by females.

## XI. Conclusions

Greater alignment and partnership among regional workforce development partners is vital to hastening the pace to improve workforce quality for employers.



- Employers look to the region's higher education system for job seekers emerging from IT programs as graduates. Yet few are confident of their ability to greater impact enrollment growth or program changes. The result is the findings of this research suggest that we may be falling farther behind changes in demand for IT professionals to fill entry-level positions.
- Years ago, employers annually made visits to college campuses to search for pending graduates in business, engineering and other programs. For decades, this was an effective way for national and local employers and graduates to connect around hiring opportunities for entry-level positions. Today, IT employer hiring needs are driven by the need to fill mid-level positions which as already stressed are not among those emerging from postsecondary education and training systems.

## XII. Recommendation at Entry-level: Better *Alignment* of IT Programs and Employer Demand for Entry-level Job Openings

Again, the numeric gaps overall are daunting. It is as much a matter of lack of capacity to greatly expand numbers of completers by two-, or three-fold, as it is to attracting youth; young adults and transitioning workers into programs that prepare them for IT careers. This is not to imply that addressing the gap is hopeless.

*The real opportunities to improve is to lock in on the IT occupations with the greatest gaps, and work with employers to improve the number of students entering, or adding learning outcomes to, IT majors that best prepare students with the skills and proficiencies now needed.*

There are nearly forty programs with differing orientations to prepare students for IT career employment. Concentrations or specializations vary widely with the broad disciplinary thrusts of Information Science or Management, Computer Science, and Computer Engineering. Based on content, emphasis and purpose, none prepare students for entry-level jobs no matter what the occupation title or area of expertise.

Are all these majors equally effective at developing grads capable of handling the responsibilities of the

job—at the entry level?

Example, what major do employers most prefer when hiring entry-level developers? For Systems Analyst? Or, if computer science is still the preferred major, can curriculum and experiential learning be improved to boost learning of systems design and modeling or OOAD theory, or working closely with engineers and business professionals?

Ongoing discussions with a group of IT leaders from industry can potentially answer questions such as: How do we balance employer preference for training in Computer Science with emerging needs to hire individuals with a more blended skill base?

Pursuit of this approach will require deliberate efforts by employers and educators to work together if they are to define where improvements should be focused and what actions can be taken with maximum benefit to the region.

### **SUGGESTIONS FOR A MORE TARGETED APPROACH:**

We now know that the following IT occupations have large numeric gaps between supply and demand, and that in many cases it is not clear which IT programs best prepare students for these job assignments:

- **Systems Analysts:** In NE Ohio this position ranks third in terms of numeric gap. Specific programs exist in NE Ohio with the primary focus on systems analysis as a core program at every level of completion. Completers at all levels of attainment emerged by the end of 2015: 78 with an Associates and 55 with a Bachelors. But, there were nearly 300 job postings for Analysts with a Bachelors. Baldwin Wallace and the main campus of Kent State University offer this degree. In 2015, Kent State's programs produced most of the grads.

Could employers agree on whether a concentration on systems analysis is preferred when hiring new analysts?

Could they work with either institution to quicken the pace of completers from these programs with program modifications employers greatly value? Possibly this could be providing opportunities to their students in their other IT majors to acquire more systems analysis in their education, rather than simply rely on efforts to expand enrollment or transfers into the Systems major.

Undoubtedly, this could work best if interested employers are highly engaged with advising the institutions on how best to modify IT programs to improve student knowledge and skills important to hiring of System Analysts.

- **Cyber/Information Security Analysts/Managers:** This occupation ranks fourth in terms of numeric skills gap. Only 35 of the 564 grads with a Bachelors from IT programs were a strong match with the knowledge and abilities employers seek from job seekers. This relatively new occupation accounts for almost all jobs posted where the position has primary responsibility over the



security of information and systems for an organization or business. While most postings for this position in NE Ohio are mid-level, requiring 3 to 5 years of prior work experience, there was 197 postings at the entry-level.

Again, how can IT program resources be shifted around to make special areas of expertise (data and system security in this case) in an efficient, yet effective way and raise the number of grads measurably above 35?

There were only 19 grads from a Bachelors program in security in 2015 and those were from ITT and University of Phoenix. Not a single grad came from any of the public or private universities in NE Ohio.

This finding provides a case for convening a conversation among the universities and potentially employers with the greatest demand for this occupation and attempts to determine the need and develop ideas on improving this situation without major additional resources. What can be addressed in one to three years?

- **Software Developer/Engineers:** This occupation may present the mostly difficult case to resolve. In 2015, it had by far the largest numeric gap (976 at the entry-level) and the least number of grads (32) from IT programs. Not all IT majors equally prepare students for developer roles; yielding the result that there was one grad for every 30+ postings during the year.

It is not clear which of the nearly 40 IT programs of study are specifically aimed at placing grads into developer positions. The two majors most linked with software developers or engineers are Computer Programming and Software Engineering. Most of the completers of Computer Programming degrees are at the Associate level, not the Bachelors. Only employers can confirm the preparedness of these grads. Are they likely to be hired if a Bachelors is preferred? Baldwin Wallace has the only Software Engineering program but only three grads from the Bachelors program in 2015. No others exist in the region.

Beyond the rise of new programs specializing in software applications for the web or mobile devices, few new education and training programs are specifically aimed to address this gap facing employers.

Most posts for developers or software engineers are not from firms producing software products and services as their main purpose. Rather these workers are playing a role as a developer where software is a critical element of a larger problem.

The severity of the gap makes a case for convening a group of employers to discuss what might be doable.

- **Computer Support Specialist:** Finally, at the Associate level this is the occupation with the single largest gap. Combined, the region's education and training systems simply are producing too few completers of either Certificates or Associate degrees—Only 90 total in 2015 from majors judged to be strongly prepared for this role. Completers from Computer Support Services programs are

provided by the private for-profit technical training organizations, not the community colleges. There are no programs in Computer and Information Sciences and Support Services with grads with Associates degree in 2015.

During the employer engagement session, one employer from a software firm raised the issue of Object-Oriented paradigm for learning about the complexities of software design and the reality of specific programming languages that are ever-evolving.

He posed the opinion that what new hires need is a better understanding of Object-Oriented methodology (a phrase found in all their developer ads) and suggested that IT programs should have more emphasis, and earlier, in curriculum.

As is explained below, this is a discussion limited to developers, and is likely most important to businesses involved with developing or adapting sophisticated software applications to meet needs of other industry.

NEO: Occupations with Ads Listing OOAD as Specialized Skill 2016		
BGTOCC	Job Postings	
<b>Software Developer / Engineer</b>	<b>720</b>	<b>70.0%</b>
<b>Web Developer</b>	<b>113</b>	<b>11.0%</b>
<b>Mobile Applications Developer</b>	<b>37</b>	<b>3.6%</b>
Computer Programmer	28	2.7%
Computer Systems Engineer /	28	2.7%
Systems Analyst	23	2.2%
Software QA Engineer / Tester	21	2.0%
Network Engineer / Architect	15	1.5%
IT Project Manager	10	1.0%
Source: Labor Insight Jobs (Burning Glass Technologies)		

Object-oriented Analysis and Design (OOAD) appears in Burning Glass skills as a Specialized Skill, to announce employer demand for general knowledge and expertise of an area of IT theory or application. It is a concept that Burning Glass AI has been pulling from job ads.

NE Ohio, like the nation, employer demand for OOAD understanding only appears in 13% of all ads for Software Developers/Engineers. Likewise, this is the case for San Jose, CA, home to the world's largest IT development giants.

As is evident from the table, the only other occupations with significant demand for OOAD are Web Developer and Mobile Applications Developers. These three occupations accounted for 85% of all such notices of demand. In fact, Mobile Application ads have the greatest share of ads requesting OOAD (22%).

A detailed profile of these 720 ads in NE OHIO during 2016 for Software Developer/Engineers in the next table separates employer preferences in terms of skills: Specialized; Baseline or Employability; and Software & Programming.

JAVA is still the most often used language within the Object-oriented paradigm for software programming. It is the top programming language mentioned in these ads.

NEO: Skills Included in Ads for Software Developer/Engineer that Included OOAD as Specialized Skill 2016											
Specialized Skills		Job Postings		Baseline (Employability Skills		Job Postings		Software and Programming Skills		Job Postings	
	#	%		#	%		#	%		#	%
Object-Oriented Analysis and Design (OOAD)	720	100.0%	Object-Oriented Analysis and Design	720	100.0%	Object-Oriented Analysis and Design (OOAD)	720	100.0%	Object-Oriented Analysis and Design (OOAD)	720	100.0%
Most Often Listed			Most Often Listed			Most Often Listed			Most Often Listed		
JAVA	376	52.2%	Problem Solving	224	31.1%	JAVA	376	52.2%	JAVA	376	52.2%
Software Development	374	51.9%	Communication Skills	216	30.0%	SQL	334	46.4%	SQL	334	46.4%
SQL	334	46.4%	Team Work/ Collaboration	200	27.8%	Microsoft C#	330	45.8%	Microsoft C#	330	45.8%
Microsoft C#	330	45.8%	Writing	143	19.9%	JavaScript	272	37.8%	JavaScript	272	37.8%
JavaScript	272	37.8%				.NET Programming	264	36.7%	.NET Programming	264	36.7%
.NET Programming	264	36.7%				C++	192	26.7%	C++	192	26.7%
Software Engineering	255	35.4%				ASP	182	25.3%	ASP	182	25.3%
C++	192	26.7%				jQuery	144	20.0%	jQuery	144	20.0%
ASP	182	25.3%									
Web Application Development	146	20.3%									
jQuery	144	20.0%									
Selectively Listed			Selectively Listed			Selectively Listed			Selectively Listed		
Agile Development	140	19.4%	Troubleshooting	138	19.2%	Oracle	133	18.5%	Oracle	133	18.5%
Relational Databases	135	18.8%	Research	125	17.4%	SQL Server	133	18.5%	SQL Server	133	18.5%
Oracle	133	18.5%	Planning	95	13.2%	Git	131	18.2%	Git	131	18.2%
SQL Server	133	18.5%				Extensible Markup	122	16.9%	Extensible Markup	122	16.9%
Git	131	18.2%				Java Server Pages (JSP)	105	14.6%	Java Server Pages (JSP)	105	14.6%
Extensible Markup Language (XML)	122	16.9%				Unified Modeling Language	97	13.5%	Unified Modeling Language	97	13.5%
Java Server Pages (JSP)	105	14.6%				Visual Studio	92	12.8%	Visual Studio	92	12.8%
Web Development	105	14.6%				AJAX	80	11.1%	AJAX	80	11.1%
Source: Labor Insight Jobs (Burning Glass Technologies)						Eclipse	76	10.6%	Eclipse	76	10.6%

## Recommendation at Mid-level: New Initiatives Focused on Attacking the Skills Gap for Mid-level IT Workers

Imagine what is possible if we had a regional approach where employers partner with each other and with higher education to agree on ways to tweak curriculum and the use of fast-track programs to provide workers added skills needed to advance in their careers. This could be through either additional education or work experiences built around shared employer needs.

The future is ripe with opportunities to change behaviors and address employer pain point through collaborative efforts and concrete action.

### PROMOTING FROM WITHIN—DEVELOPING A REGIONAL MODEL

Just as internships are used to develop a pool of potential applicants for entry-level positions, once hired, these employees can become a potential pool of talent for future mid-level openings within a company. Some employers site efforts to identify workers during their first few years at the company and program talent development opportunities to further prepare them for future openings.

Sometimes the path ahead is within one of the four career orientations—Business Intelligence; Networks and Computer Systems; Development; and Internet Technology and Interactive Media. For example,

recent grads are hired into entry-level developer positions and some eventually will be promoted into more responsible, mid-level developer jobs as they gain skills and experience needed in advanced positions. However, depending on the organization's need, filling from within for some positions will target individuals originally hired in one of the other three IT areas of career/skill orientation, or even workers from another area of the company. Developers may be developed into Systems Analysts; Financial Analysts are developed into BI Analysts or Managers, or Forensics experts, etc.

Companies also rely on other companies, vendors, or community programs to help provide training and development needed to move these employees along. A recent convening of HR personnel responsible for filling employer needs for IT talent by RITE asked them to discuss with each other how they were meeting needs to fill mid-level positions generally and for software developers specifically.

This is occurring in different ways, using different approaches across the region, especially within larger companies. However, overall success is constrained by the size of company, budgets, and the pool of internal workers that meet the criteria for internal promotion.

While this is routinely occurring in NE Ohio within individual companies, imagine what a program at the regional level might do to further develop entry-level workers for mid-level jobs.

For example, if employers generally experience problems filling mid-level developer job openings, what could be done to address this problem other than what individual employers are doing on their own?

What can industry-led intermediaries do to organize an initiative to build the regional capacity to 'promote from within'? Efforts that augment and coordinate with what the larger employers already are doing.

***What is true for individual employers is true for the region overall.***

By understanding the career paths commonly taken by the region's IT workers as they move from job to job, employer to employer, or change positions with the same employer, we can gain insights into keeping employers and workers in synch with supply and demand.

Many of the recent initiatives to provide alternative education and training resources and to create more experiential learning opportunities are an effort to respond quickly and specifically to perceived employer needs at the mid-level as well as entry-level shortfall of IT workers in the region.

As important as these are, they are expensive alternatives to the public higher education system which often is faulted as neither responsive or specific in terms of the IT majors and students attracted into their programs.

Not all institutions are interested or positioned to play such a new role, but should not be left out of conversations that shape early efforts to determine what is possible in solving the mid-level skills gap in IT.

After all, there are many accelerated degree programs for mid-level professional and technical workers in

other disciplines.

The largest number of postings in the region is for mid-level Software Developers. These positions mask the diverse range of roles and assignments employers have for these workers. They vary by industry and over time as the problems posed to developers become more specialized and complex.

### **Recommendation for Further Research**

Proper validation and further perspectives and labor market insights can best be achieved by conducting a survey across the region of a representative cross-section of IT employers. The survey content should be structured around the findings, implications and recommendations addressed in this summary and technical report

# Attachments

## I. Four Career Pathways for IT Professionals

### Business Intelligence/ Integration (BI)

Dating back to 2000 and before, this pathway was Data Administration. It simply referred to the inherent need to store, organize and retrieve data about an enterprise, organization or system of entities. This was before the digitization revolution. Today, IT workers are challenged with handling Big Data and determining how to integrate and analyze stored data as intelligence in making business decisions. As a result, job assignments and skills needed by teams of IT workers reflect the need to build, secure, and manage Big Data; Integrate sources of data into a warehouse to analyze the data, and then interpret the data via the BI tools in order to answer questions germane to business decisions.

Today, this pathway is titled Business Intelligence (BI), and, according to Thomas Lucas, a founding member of the RITE Board: “Business Intelligence is the useful insight that comes from the Data Analytics process whereby large amounts of data are analyzed to identify meaningful patterns or characteristics that can provide business insight to support decision-making. Data Integration is part of the Data Analytics process where data from several sources is combined to provide a unified view of the data.”

- BI tools are often called Decision Support Systems (DSS) or fact-based support systems as they provide business users with tools to analyze their data and extract information.
- Often data is sourced from data warehouses. The reason is straightforward. A data warehouse already has data from various production systems within an enterprise. The data is cleansed, consolidated, conformed and stored in one location.

#### Data Integration

- Data integration is the first step in creating a data warehouse. It involves combining data from several disparate sources and is processed into a unified view of the data. Data integration becomes increasingly important in cases of merging systems of two companies or consolidating applications within one company to provide a unified view of the company's data assets and is stored in a data warehouse.

#### Data Analytics

- Analytics is a data science and allows us to ask questions of the data. Analytics tools are deployed when a company wants to try and forecast what will happen in the future, whereas BI tools help to transform those forecasts and predictive models into common language.
- Data Analytics should be thought of as the question-answering phase leading up to the decision-making phase in the overall scheme of Business Intelligence.

### Business Intelligence

This is the final step in ‘putting it all together’; grounding analysis into the context of the business language and decision-making process where technical information is translated into non-technical language. In most cases the workers providing this expertise are not the same ones performing earlier tasks.

The array of job titles, occupational grouping and roles are involved in BI. BI typically requires a team of IT professionals—from entry-to-senior level responsibilities to deal with the complexity of assignments as described.

In this portion of the Career Pathway, IT occupations often linked with BI; Bid Data; Data Integration and Analytics are identified. Using job posting analytics accessed from Burning Glass Labor/Insight and other sources, skill sets, education, and IT certifications most often required to perform well on the job are also included. This profile is for this set of occupations as a group. Complementary data on these requirements for each of these occupations, including a description of each occupation is available.

## **Networks, Computer Systems, Security of Information, and Administration**

This path is for IT professionals advancing their expertise and skills in one of the following: networking of computers together within an organization and securing information shared within and between networks; Design and building of Computer Systems to meet needs of an organization and securing against outside breach; and administration of one of these distinct functions. Expertise working with computer hardware and software applications, as well as networks and internet security are most important for the design and administration of computer and network systems.

Security of Big Data, especially as stored on Cloud Solutions or proprietary networks of computers, has intensified the need for jobs designed to protect against breaches of security.

## **Development**

Developers create software programs or are involved in creating the digital infrastructure for a company. Many IT developers work as consultants and do projects for a variety of different organizations. In today’s information age, developers in any area of technology need to understand their market, and many developers specialize in a specific area.

Every industry today is in some way affected by technology, and companies large and small need knowledgeable tech developers to help them build and maintain a useful infrastructure. Additionally, as technology grows and expands, each industry needs new software to help them keep up with a changing marketplace.

**Software Development:** According to Wikipedia, software development is the process of computer programming, documenting, testing and bug-fixing involved in creating and maintaining applications and frameworks resulting in a software product. It involves writing and maintaining source code, but in a broader sense, it includes every step from conception of the desired software through to the final manifestation of the software. Therefore, software development may include research, new development, prototyping, modification, reuse, re-engineering, maintenance, or any other activities that result in software products.

Development employs most IT professionals, and in many cases developers are significant parts of IT solution teams whether focus is on Computer Systems, Cyber-security, Cloud Solutions, etc. Developers are the largest component of currently IT jobs and is over-whelming the largest source of online ads for new hires. New occupational titles emerge to capture the demand for specific applications of software solutions such as developing software for mobile devices. Specific tools, shifting paradigms of programming, etc. constantly evolve making it difficult for current workers to stay current, and for educators to stay abreast of shifting employer applications and tools in use.

Again, there are an array of different roles played by IT professionals implied in the list of Job Titles and Roles within this career path. More detailed information for each occupation is available.

### Internet and Interactive Media

These careers are two distinct but related IT fields: Internet development and maintenance and interactive media products often shared via the internet.

Internet technology covers careers that deal with computer networks and the web. Popular career titles in Internet technology include web design and development. However, because the functionality of the internet depends on computer and network systems some of the same occupations specifically linked to Networking and Development are relevant. System Analyst, information technology (IT) specialist, programmer, and computer security specialist. In terms of career orientation, though, IT jobs in this pathway focus on the web itself not the computer and network systems that enable it to grow and expand.

Interactive media normally refers to products and services on digital computer-based systems which respond to the user's actions by presenting content such as text, moving image, animation, video, audio, and video games.

In the diagram, job titles, roles and skills/ credentials are a composite of what is involved in both related fields.

Again, there are an array of different roles played by IT professionals implied in the list of Job Titles and Roles within this career path. More detailed information for each occupation is available.



## II. Advanced digital skills largely involve applying software applications on the job

Advanced digital skills increasingly are needed in a range of applications. Within the context of application, they are needed in a variety of occupations. Most of them involve using computers and software applications that are more specific and advanced.

Top advanced digital skills in demand differ based how they are used:

- Customer Relations
- Computer & Network Support
- Digital Media & Design
- Social Media & Search Engine Analysis

All but Customer Relations need IT workers from a cross-section of IT occupations. For some, the occupation is directly focused on delivery of the service.

NEO: Demand for Advanced Digital Skills in IT Occupations During Last 365 Days (End June 28, 2017)				
Microsoft CRM; Microsoft Powerpoint; Microsoft Outlook; SQL; SQL Server; Salesforce; Adobe Photoshop; Adobe Indesign; Adobe Illustrator; SAP; Adobe Creative Suite; CRM software )				
BGTOCC Code	BGTOCC	Job Postings		
		Ads Listing Advanced Digital Skills	All Ads	Ads for Advanced Digital as % of All Ads
		#	#	%
15111191	Data Scientist	91	101	90.1%
15114191	Data Engineer	29	34	85.3%
27102400	Graphic Designer / Desktop Publisher	137	190	72.1%
15119900	Technology Consultant	182	254	71.7%
15119994	Business Intelligence Architect / Developer	234	335	69.9%
15114100	Database Administrator	547	838	65.3%
15119993	Business Intelligence Analyst	197	316	62.3%
15113492	Web Developer	325	671	48.4%
27304200	Technical Writer	52	123	42.3%
11302100	Chief Information Officer / Director of Information Technology	94	227	41.4%
15113493	UI / UX Designer / Developer	79	196	40.3%
15113192	Mobile Applications Developer	59	180	32.8%
15113491	Web Designer	4	15	26.7%
15119903	Webmaster / Administrator	4	17	23.5%
15114200	Network / Systems Administrator	179	908	19.7%
15119910	Search Engine Optimization Specialist	13	67	19.4%
15115100	Computer Support Specialist	285	1,533	18.6%
15119912	Document Control / Management Specialist	33	195	16.9%
15115200	Network / Systems Support Specialist	27	161	16.8%
Source: Labor Insight Jobs (Burning Glass Technologies)		2,571	6,361	40.4%

Most of these needs and skills are not new but are now used more widely across businesses and industries. Not all IT workers need possess many of these skills; it depends on the role of IT occupations within each of these applications.

While advanced, these skills do not imply coding skills are also required for workers in the IT occupations.

Illustration of Advanced Digital Skills Linked to Occupations				
Advanced Digital Skills	Top Occupations			Top Skills
Customer Relationship Management	Sales Representative	Account Manager / Representative		<ul style="list-style-type: none"><li>• Salesforce CRM</li></ul>
		Sales Manager		<ul style="list-style-type: none"><li>• SAP CRM</li><li>• Siebel CRM</li></ul>
Computer & Network Support	Computer Support Specialist	Network / Systems Administrator	Network / Systems Support Specialist	<ul style="list-style-type: none"><li>• SQL</li><li>• Linux</li><li>• Cisco</li></ul>
Digital Media & Design	Graphic Designer / Desktop Publisher	Marketing Coordinator / Assistant	Multimedia Designer	<ul style="list-style-type: none"><li>• Adobe Photoshop</li><li>• Adobe Acrobat</li><li>• InDesign</li></ul>
Social Media Tools & Search Engine Analysis	Recruiter	Graphic Designer / Desktop Publisher	Search Engine Optimization Specialist	<ul style="list-style-type: none"><li>• Social Media Platforms</li><li>• Blogging</li><li>• Google Analytics</li></ul>
Burning Glass Technologies, Crunched by the Numbers: The Digital Skills Gap in the Workforce, March 2015, p. 5				

Burning Glass Technologies, Crunched by the Numbers: The Digital Skills Gap in the Workforce, March 2015, p. 5

- Within Computer and Network support, the majority of all ads for several IT occupations had high demand for some combination of these digital tools: Database Administrator and Web Developer in particular.
- Database Administrator definitively would need specific skills associated with Computer and Network Support.
- Web Developer would also need some of Digital Media and Design and search engine analysis; perhaps even digital media.

### III. Coding Skills in Demand are emerging as a path to higher-skill jobs

Demand for programming skills is large, growing, and not just for IT jobs. Coding skills are needed to work with data, to create websites, to build products and technologies, and to conduct research.<sup>7</sup> How do you define coding skills? Coding skills is the use of a computer program to write instructions to a computer as opposed to using pre-written applications to perform pre-structured tasks. The programming languages studied include JavaScript and HTML for building websites, statistical programs such as R and SAS, AutoCAD programs for engineers, and general purpose computer programming languages such as Java, Python, and C++.

Burning Glass Technologies researched its database of online job ads to find:

- Coding skills are now in demand for more than IT professionals. Engineers, Designers, Scientists, and Marketing Analysts are asked to perform coding among their job duties.
- Coding skills are most important for higher-skill jobs. Middle-skill jobs require more basic digital skills.
- Acquiring coding skills opens career advancement opportunities for many middle-skill workers.
- Jobs in occupations requiring coding skills today are growing faster and pay better than jobs in occupations that do not.

#### Economic Growth is linked to use of new technologies

The growing importance of programming skills for workers in these occupations is the result of impact of industry adopting disruptive technologies to gain market share.

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<sup>7</sup> Burning Glass & Oracle Academy, *Beyond Point and Click: Expanding Demand for Coding Skills*, June 2016

What evidence exists of increased demand for these skills in northeast Ohio?

According to Burning Glass, there are five distinct areas of business operations and occupational focus where coding skills prevail in industry:

1. IT operations
2. Data Analytics
3. Engineering software
4. Science and the need for workers to write code to guide programming
5. Art & Design

Different Ways Programming Skills Are Used & Job Titles		
Common Jobs	Role Type	Description
Business Analyst; Financial Analyst; Data Analyst	Data Analysis	Data Analysts use computer programming to analyze data and solve problems in business and finance. Coding needs: estimating how a company will earn or how many of an item a store to put on shelves.
Graphic Designer User Experience Designer; Web Designer	Arts & Design	Designers use digital tools to create websites and design the physical products we buy.
Mechanical Engineer Civil Engineer Engineering Technician	Engineering	Engineers use programming to design and test new products and conduct research on how to solve practical technology problems.
Software Developer; Network Administrator; Mobile Applications Developer	Information Technology (IT)	Computer programmers and IT professionals write software which can be used to create websites, build computer networks, help doctors treat patients, or even drive a car.
Medical Researcher Chemist Environmental Scientist	Science	Scientists use computer programming to analyze the results of their experiments and create simulations of real world events.
Burning Glass & Oracle Academy, Beyond Point and Click: Expanding Demand for Coding Skills, June 2016		

In each of these distinct areas, online job ads posted are huge and job growth nationally is expected. Skills sets involved in each of these areas are distinct, and each is expected to grow jobs over the next decade.

## How are these skills emerging in Northeast Ohio's Labor Market?

Demand for programming skills impacts over 17,000 of the more than 200,000 job postings in the last 365 days.

- Demand for Programming Skills (code-writing skills) is most intensive in specific occupations. All but two are IT Professional occupations. IT occupations had 60% to 70% of all online posts requiring specific programming skills.

- IT developer job postings include programming skills more than half the time.
- Web Developer and UX/UI Developer are jobs in which over 70% of all job ads specify program skills.
- Business analyst positions tend to require programming skills. Demand for code writing skills varies among job responsibilities

IT Professionals have the highest responsibility for improving and developing new software. Web development, UI/UX, and Mobile Applications are distinct specializations within developing software. For example:

- Specific needs and skills are needed to address Big Data Access and Management needs.
- Arts & Design workers must excel at design software and web development.

For most occupations, explicit demand for programming skills occurs for only a portion of all posts for these jobs.

However, for the occupations shaded in the next table, from 60% to 93% of all postings for the occupation list specific programming skills as needed.

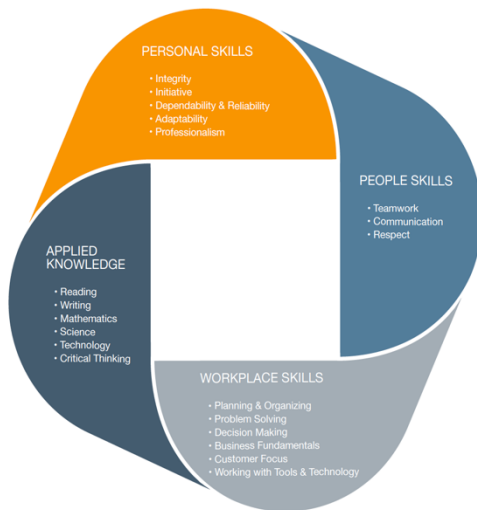
Not all IT jobs require programming skills in a majority of the ads: System Analyst and network and support jobs list programming skills less than half the time.

NEO: IT Occupation Postings Seeking Specific Programming Skills & Percent of All Ads, During Last 365 Days Ending July 2						
Application Programming Interface (API); Extensible Languages; JavaScript and JQuery; Other Programming Languages; Programming Principles; C# Programming; Web Programming; .NET Programming; Basic Programming; Windows Programming; Library Programming; Database Programming; Clinical Programming; Computer Programming; Structured Programming; C Programming Language; Functional Programming; Online Game Programming; AC/DC Drive Programming; Object-Oriented Programming; Jackson Structured Programming; Mobile Application Programming; Programming Language One (PL/I); Application Programming Interface; or Advanced Business Application Programming (ABAP)						
BGTOCC Code	BGTOCC	Job Postings				Programming Vs All
		Requests Programming		All Ads		
		#	%	#	%	
15113100	Software Developer / Engineer	2,314	52.9%	4,520	25.6%	51.2%
15113492	Web Developer	538	12.3%	671	3.8%	80.2%
15113192	Mobile Applications Developer	108	2.5%	179	1.0%	60.3%
15113493	UI / UX Designer / Developer	88	2.0%	195	1.1%	45.1%
15114191	Data Engineer	17	0.4%	34	0.2%	50.0%
15113491	Web Designer	10	0.2%	16	0.1%	62.5%
15113191	Computer Programmer	170	3.9%	479	2.7%	35.5%
15119994	Business Intelligence Architect / Developer	111	2.5%	335	1.9%	33.1%
15119901	Software QA Engineer / Tester	160	3.7%	703	4.0%	22.8%
15113300	Computer Systems Engineer / Architect	112	2.6%	689	3.9%	16.3%
15119993	Business Intelligence Analyst	38	0.9%	313	1.8%	12.1%
15112100	Systems Analyst	169	3.9%	1,396	7.9%	12.1%
15114100	Database Administrator	96	2.2%	828	4.7%	11.6%
15119906	Database Architects	12	0.3%	112	0.6%	10.7%
15119907	Data Warehousing Specialist	19	0.4%	185	1.0%	10.3%
15119902	Network Engineer / Architect	108	2.5%	1,079	6.1%	10.0%
15119995	IT Project Manager	64	1.5%	711	4.0%	9.0%
27102400	Graphic Designer / Desktop Publisher	15	0.3%	190	1.1%	7.9%
15114200	Network / Systems Administrator	61	1.4%	907	5.1%	6.7%
15115100	Computer Support Specialist	57	1.3%	1,506	8.5%	3.8%
15119900	Technology Consultant	9	0.2%	247	1.4%	3.6%
11302100	Chief Information Officer / Director of Information Technology	8	0.2%	220	1.2%	3.6%
15112200	Cyber / Information Security Engineer / Analyst	21	0.5%	666	3.8%	3.2%
15115200	Network / Systems Support Specialist	2	0.0%	159	0.9%	1.3%
Source: Labor Insight Jobs (Burning Glass Technologies)						
Total		4,307		16,340		26.4%

## IV. Baseline, or Non-technical, Skills

A broad view of employability skills—Personal, People, Applied Knowledge, and Workplace—capture the array of issues that employer comments on skills other than technical or Computer/ IT skills specifically. A new network of interests has produced a body of information for each of these and inter-connections among them.<sup>8,9</sup>

Burning Glass provides a different way to organize the broad range of soft or foundational skill sets into six clusters that are required for some occupations and industries.<sup>10</sup>



- Customer Service
- Presentation and Persuasion
- Detail Oriented
- Supervision
- Positive Disposition
- Project Management, Research & Strategy

The National Network has identified the Common Employability Skills for all jobs that benefit:

- Employers, who can now identify the common skills that all their employees should exhibit
- Potential employees, who know what basic skills employers expect them to have for any job in the workplace, and can better communicate their skill levels to employers
- Educators and other learning providers, who know what foundational skills to emphasize

The relative number of baseline vs technical skills appearing in ads varies greatly across occupations; the

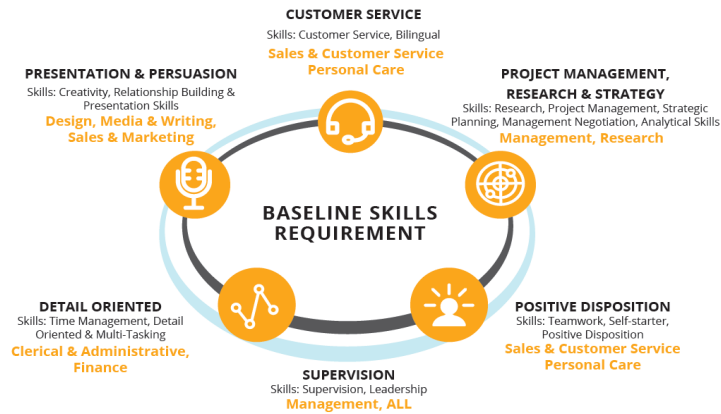
<sup>8</sup> National Network of Business and Industry Associations *A Foundation for Success in the Workplace: The Skills All Employees Need, No Matter Where They Work*, March 2015, p 1.

<sup>9</sup> The National Network represents major business sectors and is funded through a collaborative partnership of Business Roundtable (BRT), ACT Foundation, The Joyce Foundation, Lumina Foundation and Walmart Foundation. Members include leaders in the manufacturing, retail, health care, energy, construction, hospitality, transportation and information technology sector.

<sup>10</sup> Burning Glass, *The Human Factor: The Hard Time Employers Have Finding Soft Skills*, November 2015, p 7.

higher the skill level of the job, the greater the emphasis on technical rather than baseline or soft skills that employers place in the ads.

Baseline skills appearing in job posts are ones that employers often find missing from applicants and are the hardest to find. These vary among occupations and industries. For example, math is often listed for production jobs in manufacturing because applicants often do not have good math skills. Math is seldom mentioned in ads for science, engineering or IT jobs because it is assumed they will have these skills.



A few baseline skills are important to employers no matter the occupation—Writing, Communications, and Organization.

- Burning Glass finds that the mix of baseline skills, like technical skills, varies across occupations—even within broad occupational families. “Baseline skills are most emphasized in roles that involve higher levels of personal interaction relative to technical activities. In Customer Support roles, over half of all requested skills are baseline skills.”<sup>11</sup>
- Communication Skills was included in 37% of all IT job posts during 2015, topping the list by a large margin.

Many of these are what we refer to as soft skills or 21st Century Skills. From Detailed-Oriented to Communication, at least one in ten job ads include one or more of these skills as important to making hires.

As important as these appear to be for employers in making hiring decisions, postsecondary students and job seekers need to assess themselves for baseline skills in preparation for employment.

NEO: Most Listed Baseline Skills for IT Job Ads during 2016	
Baseline or Employability Skills	Job Postings
Communication Skills	36.85%
Troubleshooting	26.47%
Problem Solving	26.05%
Writing	25.53%
Team Work/ Collaboration	17.52%
Planning	17.17%
Research	13.13%
Organizational Skills	11.15%
Detail-Oriented	9.71%
Source: Labor Insight Jobs (Burning Glass Technologies)	

**Conclusion:** It is no longer confusing what employers mean by ‘soft’ skills. These are definitive and can be incorporated into curriculum and experiential learning within education and training programs and client services.

<sup>11</sup> Ibid, p 8.

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## Understanding the IT Skills Gap in NE Ohio

SHANAHAN RESOURCES, INC.

