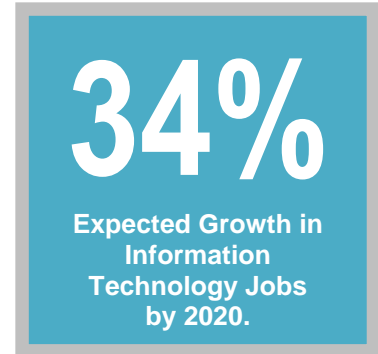# INFORMATION TECHNOLOGY IN VIRGINIA

Welcome to the Information Technology (IT) in Virginia Career Cluster Brief. Jobs in information technology frequently intersect with opportunities across career clusters, thanks to the rapidly growing use of technology in all fields. Furthermore, Virginia has a particularly strong commitment to the technology industry, demonstrated not only by its high concentration of technology workers, but also by the prominence of technology investment in Governor McAuliffe's *100 Days of Action*. As a result, opportunities for careers with a strong focus on IT are widely available across the Commonwealth.

34%

Expected Growth in Information Technology Jobs by 2020.

As mentioned in our report on STEM, technology instruction remains a high priority for all high school CTE programs in Virginia. Technological competence and confidence will only become increasingly important for today's young job-seekers, no matter what fields they pursue. This Career Cluster Brief highlights information about IT in Virginia, reveals important statistics about IT employment, and addresses ways to engage students in this rapidly growing and changing industry.

IT IN VIRGINIA: VIBRANT AND GROWING

Information technology is a key part of Virginia's economy. In 2012, the Commonwealth had the highest concentration of technology workers and the second largest computer systems design and related services industry among the 50 states, according to *Cyberstates: The Definitive State-by-State Analysis of the U.S. High-Tech Industry*. In other words, in Virginia more jobs are dedicated to IT than in any other state in the US.

Furthermore, the Commonwealth sees continued growth in IT as crucial to its future economy. "To keep Virginia moving forward," Governor McAuliffe has stated, "I have directed my administration to focus on policies that place us at the forefront of new technologies, creative entrepreneurship, and smarter security." For example, Virginia's Center for Innovative Technology has recently invested $700,000 in technology start-up companies as part of the Governor McAuliffe's *100 Days of Action*.

In the digital age, many IT workers are employed in sectors such as banking, government, manufacturing, and retail. They work on projects that allow Virginians to renew a driver's license online or monitor their credit score from an app on their smartphones. Additionally, Virginia is a national leader in two IT-specific industries: data centers and cybersecurity.

Data Centers

Northern Virginia is a major hub of the internet, with "up to 70 percent of all internet traffic" for the world passing through the 56 data centers in Loudoun County's Data Center Alley every day, according to Loudoun County's Department of Economic Development. Data centers–the libraries that catalog and deliver webpages over the internet—are a critical part of the infrastructure that makes it possible to shop and bank online, stream movies and TV shows, and store vast troves of information "in the cloud." The Virginia Economic Development Partnership reports the Commonwealth is home to 650 data processing and hosting locations that employ more than 10,000 workers.

Low energy prices and strategic tax incentives continue to encourage the development of internet infrastructure in Virginia. These centers need employees trained in information support and services as well as network systems.

Cybersecurity

Another growing area for technology workers is cybersecurity. As people continue to shop, learn, and store information online, they are increasingly vulnerable to cyber attacks – criminal activity committed over the internet. CNN Money estimates that nearly half of American adults had their personal information "exposed" as a result of cyber attacks between May 2013 and May 2014. On the corporate side, large U.S.-based companies had, on average, two cyber attacks per week in 2013, and spent an average of $11.6 million over the course of the year to resolve them, according to the *2013 Cost of Cyber Crime Study: United States* prepared by the Ponemon Institute.

Cybersecurity is important beyond just consumer activities: The financial industry, traffic lights and traffic systems, and water treatment plants, in addition to military applications are all susceptible to cyber attacks. According to a recent report from the Office of Virginia's Secretary of Technology, the Virginia government IT system fields 10 million attacks each month, and the US Department of Defense repels over 6 million attacks each day. In light of this, President Obama has identified cybersecurity as a key funding priority of his 2015 budget proposal.

Virginia is uniquely poised to benefit from federal allocations for cybersecurity. According to *Virginia Business*, the Commonwealth is home to "more than 300 cybersecurity-focused companies" in addition to a number federal agencies tasked with cyber defense for national and military systems. To expand this, Governor McAuliffe has launched the Virginia Cyber Security Commission, charging this group with providing recommendations to capitalize on federal funding, to encourage economic development for cybersecurity firms, and to develop a cybersecurity-trained workforce.

A robust cybersecurity sector requires workers trained in programming and software development, who have a thorough understanding of the intricacies of the internet. Equally as important, these employees need creativity and strong problem-solving skills to anticipate, identify, and defend against highly sophisticated cyber attacks.

EDUCATION, EMPLOYMENT & EARNINGS: ANALYZING DATA FROM INFORMATION TECHNOLOGY

Information Technology comprises close to 5 percent of jobs in Virginia and is expected to grow by 34 percent through 2020, providing employment for about 250,000 workers. With growing demands on internet resources and advanced computing, professionals in the IT sector have excellent potential for growth in all the career pathways, with occupations in Software Development growing at 54 percent and opportunities for Database Administrators growing by 39 percent.

The IT career cluster has 4 primary pathways: Network Systems, Information Support and Services, Web and Digital Communication, and Programming and Software Development. The following sections analyze data for the different occupations within Information Technology in terms of the 3 E's: **education**, **employment** and **earnings**.

GROWTH by 2020

Software Developers: 54%
Computer and Information Systems Managers: 28%
Database Administrators: 39%
Computer Support Specialists: 25%

Education

Educational attainment within the information technology cluster does not show a large amount of variation; majority of IT occupations need advanced academic degrees. Figure 1 shows the predominant level of education for the various information technology pathways. All Programming and Software Development occupations typically require at least a Bachelor's degree while some under Network Systems as well as Web and Digital Communications are expected to have additional qualifications. Within each of the pathways, majority of the jobs for Database Administrators, and Computer and Information Systems Managers have been reported to need prior work experience. Computer Support Specialists appear to have fewer educational requirements, with most of the workers here having some college or an associate's degree, along with extra training and certification.

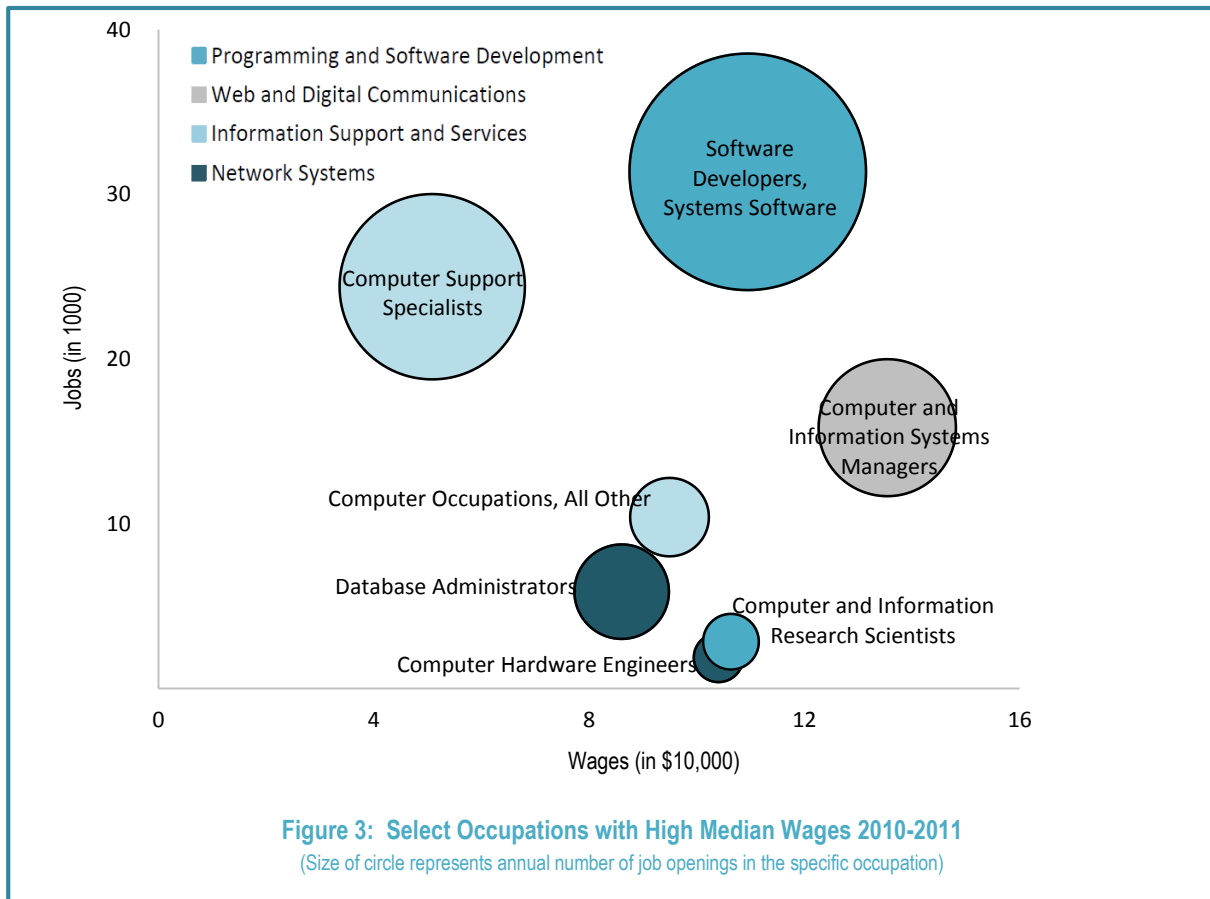**Figure 1: Predominant Education Level for IT pathways**
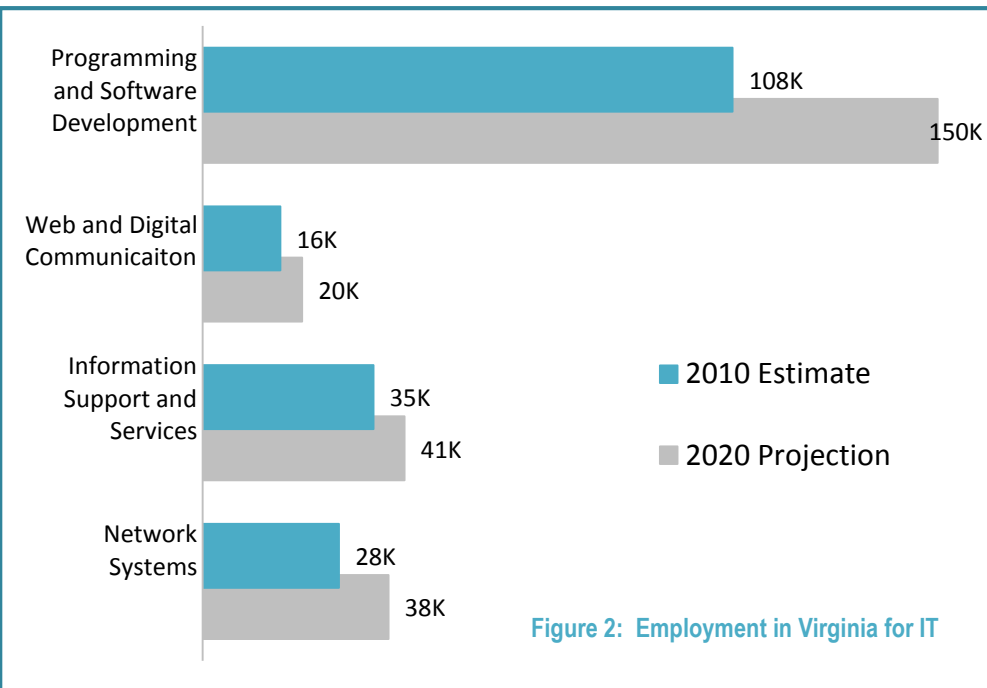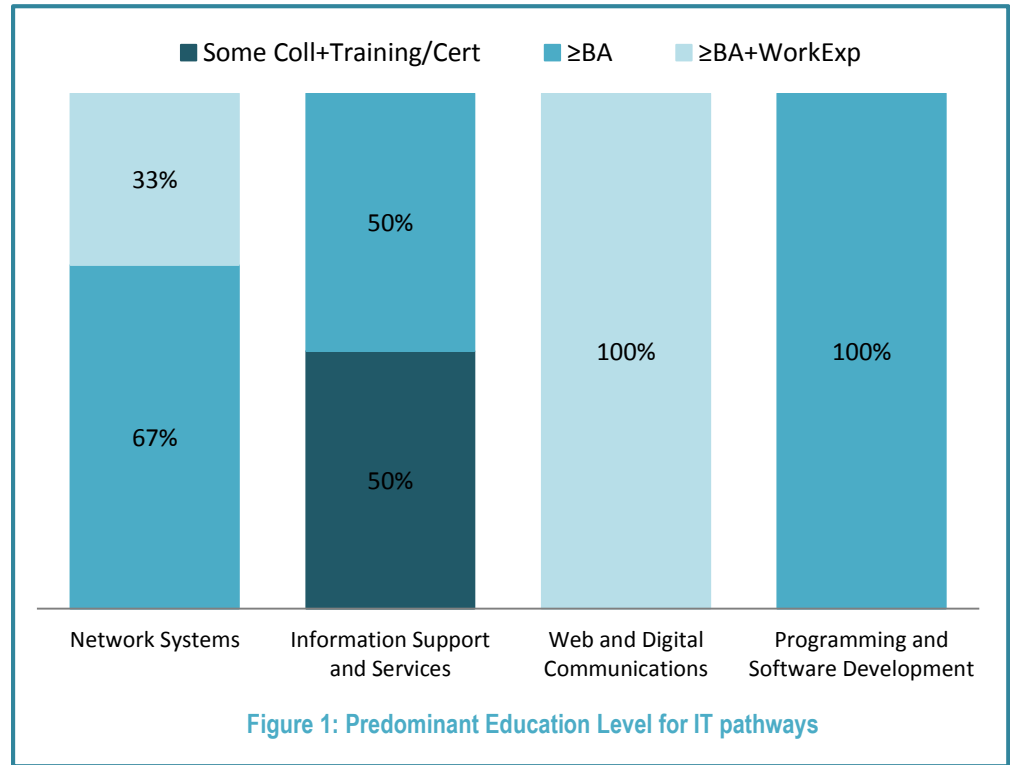
Employment

Employment for all four IT pathways is expected to grow over the next several years, as per Figure 2. Programming and Software Development will employ nearly 150,000 workers; it is also projected to have the fastest growth rate among all pathways, at 39%. Across specific occupations within the pathway, over 48,000 jobs in systems software development are expected.

Figure 2: Employment in Virginia for IT

Earnings & Growth

Earnings among IT workers tends to be toward the higher end of the spectrum with median wages over $72,000 for all but one occupation. Comparing the top wage-earning occupations for each IT pathway in Figure 3, Computer and Information Systems Managers earn the highest median wage of $135,000; followed by Computer Hardware Engineers, Computer and

Figure 3: Select Occupations with High Median Wages 2010-2011
(Size of circle represents annual number of job openings in the specific occupation)

Information Research Scientists, and Software Developers for Sytems Software—all with median salaries ranging between $104,00 and $110,000. With nearly 6000 annual job openings, Programming and Software Development has the most prospective employment oportunities per year. All occupations are expected to expand and the overall sector will have more than 9000 annual job openings in the years through 2020.

BROADENING STUDENTS' UNDERSTANDING OF THE IT SECTOR

Information technology is a title for a field so broad that students—though familiar with the term—may be unable to identify specific careers within it. While students interested in technology may be encouraged to pursue IT, without concrete understanding of the real occupations it encompasses, these students may not be able to translate their classroom experiences into career goals. In order to promote enthusiasm for IT, and to motivate students to invest in IT-related certifications, educators would do well to spend time focusing on not teaching only the broad skills IT requires, but also sharing information about the wide variety of specific job descriptions available under the label "IT".

That said, IT—perhaps more than any other career cluster—is rapidly changing and redefining itself. IT jobs of 10 years ago may bear little resemblance to the IT jobs of today in terms of their content-specific work. (Consider the rapidly growing field of mobile application developers, and then remember that the first commercially available versions of iOS and Android did not appear on the markets until 2007 and 2008.) IT jobs of today will evolve over the next 10 years. Careers in information technology are rarely static, as new technologies require adaptation.

How can educators prepare students for jobs in this rapidly evolving industry? Two important approaches include:

(1) Educate students in broadly applicable techniques of problem solving, creative thinking, and logic—all of which are invaluable skills in technological careers, no matter what the specific content.
(2) Connect students to industry professionals, especially through work experience programs, thereby allowing them to see examples of current IT jobs, and to get a sense of where the technology industry may be headed.

Broadly applicable skills

As in the Science, Technology, Engineering and Mathematics career cluster, effective Information Technology education will benefit from a focus on applied, collaborative, and problem-solving-based learning; strong school technology support systems; and the intentional cultivation of technology "ownership" among students. For more information on these three aspects to STEM—and IT—education, please see the *STEM in Virginia* career cluster brief.

IT and internships

At Deep Run High School in Henrico County, the Center for Information Technology is a program designed for students with a particular interest in IT-related careers. As part of its core curriculum, students are required to participate in an IT-focused internship. Though the program permits flexibility for students who need to complete this requirement during the academic year, the internship is typically completed over the summer between students' junior and senior years, and paired with related summer course work: weekly meetings over the course of the summer during which time students discuss aspects of business and professionalism, such as ethics or best business practices.

It is not a simple task to line up internship opportunities for dozens of rising seniors, and requires dedication and relationship-building on the part of both school personnel—particularly CIT Chairperson, Lynne Norris—and students themselves. The months preceding students' internships are filled with mock interviews, resume-writing, instruction in how to write professional emails, and a fair amount of cold-calling. Fortunately, capital-area organization RichTech provides a place for business and schools to meet, and many CIT students have obtained internship opportunities through the connections made at this center.

However, strong school-industry relationships are at the foundation of CIT's successful internship program. Close communication between teachers and employers not only assures the high quality of the internship experience, but also helps to reinforce student accountability.

More information on work-based learning and its benefits for career and technical education students may be found in the 2014 Virginia Department of Education publication entitled *A Strategic Review of Work-Based Learning in Virginia: Expanding Opportunities for Students*, which is available at http://www.doe.virginia.gov/instruction/career_technical/work-based_learning/stretegic_review_of_work-based_learning.pdf.