Program Description and Scope:

1. **Program Review Title:** Computers, Networks, and Emerging Technology

2. **Academic year:** 2013/2014

3. **Review Type:** Instructional Disciplines

4. **Program/Departments:** Computer Networks Emerging Technologies (07081)

5. **Authority Code:** 53-Dean, Business, Technology, and Learning Resources

6. **External Regulations:** Yes X No

   Describe: Industry Academy contracts with Microsoft, Cisco, Oracle, CompTIA, and VMware

7. **Provide a brief narrative that describes the instructional program/discipline.**

Ohlone’s Computers, Networks, and Emerging Technology A.S. Degrees and Certificates prepare students for employment in the field of Information and Communication Technologies (ICT) as database administrators, system administrators, desktop support technicians, network technicians, network administrators, network engineers, web developers, or related positions. Students may also prepare for a variety of industry certifications, such as Cisco Certified Entry-level Network Technician (CCENT), Cisco Certified Network Associate (CCNA), Cisco Certified Network Professional (CCNP), CompTIA A+, Network+, and Linux+, Microsoft Certified IT Professional (MCITP), Oracle Certified Professional (OCP), and VMware Certified Professional (VCP). New preparatory courses for Citrix, EMC and Linux Professional Institute (LPI) certifications have been developed.

In the information, knowledge and innovation economies of the 21st century, we increasingly depend on information and communications technologies and the increased connectivity and productivity they enable.

Information and Communication Technologies (ICT) is an umbrella term, widely used outside the U.S. and in the United Nations, to encompass all rapidly emerging, evolving and converging computer, software, networking, telecommunications, Internet, programming, information systems and digital media technologies.

8. **Describe how the program specifically serves students, faculty and staff.**

One in twenty jobs in California is related to Information and Communication Technology (ICT). The CNET program provides key core and advanced training for students who desire to learn key ICT skills and technologies. This data information was obtained from the “2011 ENVIRONMENTAL SCAN ICT INFORMATION & COMMUNICATIONS TECHNOLOGIES” in California, Centers of Excellence, Economic and Workforce Development.

(URL link: http://www.coeccc.net/Environmental_Scans/ICT_scan_sw_09.pdf)
Community demand for ICT training is growing. The ICT industry cluster is the largest, and among the fastest growing, sectors in the Bay Area. The cluster provided 381,364 jobs as of fiscal year 2011-2012.

9. Describe how the program addresses current needs and applies current technologies.

Demand for ICT skills is high. ICT jobs can be found in all employment areas. CNET department staff members have incorporated a variety of training formats to help provide flexibility and accessibility for students. Ohlone’s CNET department faculty members “flipped” their classes 15 years ago. Long-time hybrid delivery techniques incorporating online learning, open lab, remote lab, and simulation have help to build enrollment and provide variety and depth in our course offerings.

The CNET program offerings have scope and depth that is greater than what most community colleges in the Bay Area offer. Strong adjunct faculty in key ICT technology areas of desktop support, Linux and Microsoft operating systems, database administration, networking, and virtualization have helped to provide this scope and depth. Direct relationships with ICT companies through partnership Academies have also helped to keep course offerings current, meaningful, and timely.

The fact that the CNET program is forever updating and aligning itself with industry needs allows for it to meet the requirements for students to recertify themselves. ICT industry certifications typically have a three-year life span, requiring certificate holders to recertify every three years. Community Colleges play an important role in providing these training and retraining opportunities. CNET students often return five and ten years later to prepare, once again, for re-certification.

10. Discuss the impact of the program on the college and/or other programs.

CNET continues to be Ohlone's largest Career Technical Education (CTE) program.
Student enrollment rates in California’s community colleges have dropped to a 20-year low in the wake of unprecedented cuts in state funding. Colleges have reduced staff, cut courses, and increased class sizes—all of which have led to declines in student access. Hence the comparison numbers of section changes seen in the table below. In 2012FA there were 46 CNET sections but the following Spring only 43 sections were offered.
Despite continued cuts in overall student enrollment at the College over the past couple of years, the CNET department has maintained a strong WSCH/FTEF ratio:

<table>
<thead>
<tr>
<th>Enrollment Trends</th>
<th>2010-2011</th>
<th>2011-2012</th>
<th>2012-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010FA</td>
<td>2011SP</td>
<td>2011FA</td>
<td>2012SP</td>
</tr>
<tr>
<td>Unduplicated Headcount</td>
<td>422</td>
<td>458</td>
<td>372</td>
</tr>
<tr>
<td>Enrollment</td>
<td>699</td>
<td>791</td>
<td>623</td>
</tr>
<tr>
<td>Sections Offered</td>
<td>56</td>
<td>56</td>
<td>55</td>
</tr>
<tr>
<td>WSCH</td>
<td>3796.07</td>
<td>3971.92</td>
<td>2933.01</td>
</tr>
<tr>
<td>FTES</td>
<td>118.56</td>
<td>124.08</td>
<td>91.63</td>
</tr>
<tr>
<td>FTEF</td>
<td>5.04</td>
<td>5.81</td>
<td>4.27</td>
</tr>
<tr>
<td>Productivity (WSCH/FTEF)</td>
<td>753</td>
<td>684</td>
<td>687</td>
</tr>
<tr>
<td>Program Awards</td>
<td>2008</td>
<td>2009</td>
<td>2010</td>
</tr>
<tr>
<td>Degrees</td>
<td>4</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Certificates</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

Current data found at [http://www.ohlone.edu/org/research/programreviewdata.html](http://www.ohlone.edu/org/research/programreviewdata.html)

A move to more “hybrid” (mixed face-to-face, online, and remote lab) delivery of courses and a flexible schedule has contributed to our department’s healthy WSCH/FTES ratio. Our industry partnerships with Cisco, Microsoft, Oracle, VMware, EMC, and LPI and yearly subscriptions to software, online courseware, and remote lab access, have helped us become more flexible in the way we offer training. Our hybrid approach would not be possible without these partnerships.

Productivity has decreased recently with adjustments in staffing and changes in our delivery of Lab. This should improve once we make the move to the Newark Center, establish our learning centers, and update our remote lab delivery system – NetLAB+. NetLAB+ is a server appliance with software tools preloaded for academic institutions to host locally, real lab equipment, virtual machines and lab content for trainees to complete labs.

Ohlone’s remote lab equipment provided through a subscription with Network Development Group (NDG): Our NetLAB system is an increasingly critical component of our program. All of these courses will have labs available remotely. All labs taken by students are tracked by using software tracker tools built inside the NetLAB program software and the Blackboard/Canvas course Management Systems. Effective Contact between instructors and students, and student to students where applicable is met by the use of email, chat rooms, discussion boards and live video lecture classrooms*. Video lectures are archived for up to six months.

* CNET-156A recorded lectures.
  (Video link that shows students how to access the recorded lectures).
  [http://www.youtube.com/watch?v=26NYca7uf6g](http://www.youtube.com/watch?v=26NYca7uf6g) comes with transcript download.
11. Discuss the impact of the program on the community and the impact of the community on the program.

The CNET department completed its first year serving as the Support and Training Center for all Cisco Academies in the states of California, Nevada, and Arizona. Currently support is provided to over 128 Cisco academies. The support and training center is Western Academy Support and Training Center (WASTC; http://www.wastc.org). Over the past year WASTC has provided training for over 200 individual instructors and during 2012-2013, approximately 30 instructors were trained in varying levels of CCNA and CCNP curriculum WASTC training is being conducted in hybrid and fully online methods using a variety of web-conferencing tools including CCC-Confer and Cisco’s WebEx.

Over the past six years, staff of the CNET department has built an exceptional IT pathway from K-12 to college in its region. Among many successful pathways elements, we have developed middle school summer camps, a 9th grade introductory course, high school CTE courses, summer boot camps, a computer recycling program, field trips in Silicon Valley and opportunities for high school students to take community college classes. This effort has led to state-wide recognition, presentations at the annual CTE Pathways Conference, AACC workforce development Conference, and the MPICT Winter Conference. As a result of this work, CNET faculty was asked to participate on the writing team for the new Career Technical Education Model Curriculum Standards for the IT sector for K-12 education in the State of California. At this time there is currently no way to track high school students who come to Ohlone from these pathways. Feedback about the program is doing is met by CNET faculty keeping open communication channels between K12 partners and at all Pathways conferences and MPICT.

College Mission

1. Mission Statement

The mission of Ohlone College is to serve the community by offering instruction for basic skills, career entry, university transfer, economic development, and personal enrichment for all who can benefit from our instruction in an environment where student learning success is highly valued, supported and continually assessed.

2. Vision Statement

Ohlone College will be known throughout California for our inclusiveness, innovation and superior rates of student success.

3. Core Values, Goals & Objectives:

College Core Values

- We provide life-long learning opportunities for students, college personnel and the community.
- We open access to higher education and actively reach out to under-served populations.
- We promote diversity and inclusiveness.
- We maintain high standards in our constant pursuit of excellence.
- We value trust, respect and integrity.
• We promote team work and open communication.
• We practice innovation and actively encourage risk-taking and entrepreneurship.
• We demonstrate stewardship for our human, financial, physical and environmental resources.

College Goals/Objectives

The CNET department faculty members have identified two goals and accompanying objectives from the published 2010-15 Strategic Plan with Goals and Objectives: (updated February 26, 2013):

http://www.ohlone.edu/org/planning/docs/20102015goalsandobjectives.pdf

that CNET department faculty and staff have endeavored to meet.

Goal 1. Through innovative programs and services, improve student learning and achievement.

(Objectives 1 & 7)
1. By fall 2013, have in place an ongoing system for identifying and assessing student learning outcomes at the program and course levels, which includes faculty dialogue and appropriate improvement plans.

7. By fall 2013 increase the number of students receiving certificates of accomplishment and certificates of achievement to a rate at or above the peer group average.

Goal 2. Support the economic vitality of the community through educational programs and services that respond to identified employment needs.

(Objectives 1, 2, 3 & 4)
1. By 2011, produce a local strategic plan for Career Technical Education to include an inventory and assessment of our current programs, environmental scan data, a SWOT analysis, and a five-year set of goals, objectives and action plans.

2. Within the context of the CTE Strategic Plan, by 2012, identify needs of local employers and create responses through our existing programs, contract education, and new program development.

3. By 2013 create a curriculum which enhances the availability of programs that focus on emerging industries including green technologies and those identified by the Alameda County Workforce Investment Board and Department of Labor’s high growth, high demand job training initiative.

4. By 2014 provide opportunities across the curriculum for students to acquire key skill sets and concepts that will help them succeed in the workplace.

12. Briefly describe how the program supports the college mission, vision selected college values.

The Computers, Networks, and Emerging Technology (CNET) program directly supports the College's mission of providing career-entry training and education and economic development. CNET provides Information and Communication Technologies (ICT) training and course work. As stated
earlier, (in answer to question 8), over the next five years, 1 in 20 jobs in California and nation-wide will be related to ICT. Local community demand for ICT training is growing. The ICT industry cluster is the largest, and among the fastest growing, sectors in the Bay Area. The cluster provided 381,364 jobs as of fiscal year 2011-2012.

13. Briefly describe how the program supports selected college goals.

The CNET department staff has adopted innovative practices within the department's programs and services to improve student learning and achievement and meet Goal 1. These practices include:

- Short and late-start classes to provide additional training entry opportunities.
- Hybrid course delivery
- Computer assisted instruction
- Remote Lab for 24x7 student access
- ICT industry partnerships (Cisco Academy, Microsoft IT Academy, CompTIA Academic Partnership Program, Oracle Academic, VMware Academy, EMC Academy, Citrix Academy, and the Linux Professional Institute)
- Combined course offerings to ensure delivery of the more advanced and typically low-enrolled ICT course offerings.
- Close relationship with the Community Education department.

The department has kept abreast of the ICT needs within our community and has continually offered up-to-date and timely course offerings in ICT related areas.

14. Briefly describe how the program supports selected college objectives.

The CNET department’s relationship with ICT industries via the various Academy programs has facilitated the completion of the assessment of student learning outcomes for all courses and programs. Each course has hands-on labs, simulated activities, and skills-based assessments.

The CNET department will play a large role in increasing the number of students receiving Certificates of Achievement and Accomplishment. The department currently offers 12 separate certificates in ICT related areas. All CNET program offerings provide opportunities for students to acquire key skill sets and concepts that will help them succeed in the ICT workplace.
Over the past year all CNET courses have gone through major revisions and have been, or will be, approved for offering during the spring and fall 2014 semesters. New courses have been created to address the new ICT technologies (virtualization, cloud, mobility, collaboration) and prepare students for the required skills to work with these new technologies. AS degrees in seven different content areas (developed in 2000/2001) have been revised and pared down to four AS degree concentrations. Several outdated courses have been deactivated. (see attached CNET_Program_Review_Worksheet.pdf).

Formal course and program assessment will be conducted once the revised courses and programs are available to students (Spring and Fall 2014 semesters). Initial assessment and analysis of the results can begin in 2015.

15. Program SLOs from the Current Ohlone Catalog (answers below matrix table).
   
   a. Indicate program assessment strategies used.
   
   b. Describe the criteria and standards used to appraise student work.
   
   c. Enter assessment results and analyze student success in achieving this program SLO.
   
   d. Describe revisions in curriculum or teaching strategies implemented to promote student success.
   
   e. Future Action (Improvements)

16. SLO Matrix

Key: I-Introduced, P-Practiced with Feedback, M-Demonstrated at the Mastery Level

<table>
<thead>
<tr>
<th>Program</th>
<th>PLO-1</th>
<th>PLO-2</th>
<th>PLO-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNET 105</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>CNET 108</td>
<td></td>
<td></td>
<td>P</td>
</tr>
<tr>
<td>CNET 114</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>CNET 120</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>CNET 122A</td>
<td>I</td>
<td>I</td>
<td>P</td>
</tr>
<tr>
<td>CNET 122B</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>CNET 124A</td>
<td>I</td>
<td>I</td>
<td>P</td>
</tr>
<tr>
<td>CNET 124B</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>CNET 135</td>
<td>I</td>
<td>I</td>
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<td>CNET 146</td>
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<td>P</td>
</tr>
<tr>
<td>CNET 147</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
</tbody>
</table>
• **PLO Matrix Comments**

The PLO Matrix and accompanying choices of levels (I-Introduced, P-Practiced with Feedback, M-Demonstrated at the Mastery Level) works well for the CNET program's first three PLOs. There are CNET courses that do each of the following: introduce, allow for practice, and provide for mastery. Many of our individual certificates of accomplishment include courses which help to prepare students for all three levels. All of our courses allow for AS degree-seeking students to practice their oral and written communication.

Our program adapts and reflects the changes that occur in the industry. Required skills and knowledge within the Information and Communication Technology (ICT) sector changes frequently. Industry certifications (of which nearly all CNET courses/programs serve as preparation for these certifications) are most typically good for only three years. Certificate holders must renew their certification by retesting. Many of our CNET courses/programs are updated on this three year cycle in order to stay current with industry certification. Former students who are working in the field must review, learn new technologies, and re-certify to keep up and to remain current.

• **Course SLO & Assessment**

Indicate planned course assessment strategies used.

Formal course assessment will be conducted once the revised courses are delivered and the sufficient results can be collected and analyzed.
17. **Student Achievement:** A series of measures including course completion, course retention, persistence, program completion, and others.

i. **List expected student achievement outcomes.**

ii. **Analyze changes in data, identify trends, and provide possible contextual explanations for each measure used. (Example measures include: course completion, course retention, persistence, and program completion).**

The CNET program focuses on delivering curriculum targeted toward the vocational student who is either seeking industry employment or is already working in the field and who needs to update their professional skills. Because of this focus, student success with Student Learning Outcomes (and where applicable Program Learning Outcomes) are mostly measured by completion of interactive labs and industry awarded certification exams. Not all students wish to complete an entire program at Ohlone. Participants in the program often have higher-level degrees and only come to Ohlone to take a few CNET courses to upgrade their skills. Even by taking just a few courses, one may receive certificates that are good enough for the student to be placed in an entry level position in industry or gain a promotion. The Certificates may be issued by the Ohlone CNET department, or where applicable, be industry awarded. An example of this would be the A+ Desktop Technician certificate award.

Examples of assessment study can be found at this link: [http://www.ohlone.edu/org/sloacomm/sloassessments.html#c](http://www.ohlone.edu/org/sloacomm/sloassessments.html#c)

The following study listed here shows the Course in a Box (CIB) study for VMware CNET-120, Fall 2012 class found at this link. The instructor writes:

**CNET 120- VMware: Install, Configure, Manage**

The student has a series of 20 labs that apply the material presented in class and prepare the student for the VMware Certified Professional (VCP) exam. The student will also take a daily quiz and a final exam that are part of the grading process. The students work in teams of two for lab purposes. They submit paperwork to the instructor when a lab is completed so both the instructor and the student can review where they are in the classwork at any given point in time.

SLO’s being assessed, the student will;
1. Install and configure ESX and vCenter Server
2. Configure and manage ESX networking and storage using vCenter Server
3. Deploy and manage virtual machines
4. Manage user access to the VMware infrastructure
5. Increase scalability, monitor resource usage and manage higher availability and data protection using vCenter Server
6. Apply patches using VMware vCenter Update Manager

**Assessment Strategy:**
There are two goals for the student: pass the class and complete enough of the labs to become eligible for the VCP exam. The student becomes eligible for the VCP exam by completing 85% of the labs. The letter grade is computed from the number of labs completed and the scores achieved on the quizzes and final exam. It is possible for the student to pass the course without
having done enough lab work to become eligible for the VCP exam.

(This is for those students who take the course to refresh their skillsets rather than take the course to pass an exam which they may have passed and taken elsewhere already).

As of Fall 2011, approximately 2 people per class of 20, have taken and passed the VCP. It is a very challenging exam. According to the instructor for CNET-120, he states “in my estimation most who take the class don’t take it to get the VCP but just to enhance their current job situation, approximately of those asking about the discounted exam voucher, it's less than 5 who really care, per class to attempt the exam.”

Certificate Award Data from Data Dashboard 2013, labeled “Enrollment trends” (page 4) shows an increase from 8 to 16 certificate awards for CNET Programs overall. This is good news because the economy (Fall 2013) is currently recovering and firms are beginning to hire (see end of document that shows links to industry needs e.g. http://www.roberthalf.com/technology/it-salary-center. Students who have obtained these certificates and who are not already employed are strategically positioning themselves to be in a more marketable position then their counterparts who may not have taken courses in the latest technology (e.g. VMware and EMC, Storage Cloud), or passed recent exams successfully can be hired.

iii. Analyze program budget trends and expenditures. Comment on how the program can best use budget resources.

Computer Science (CS) and CNET fall under the umbrella of Computer Studies, yet both programs have individual budgets. CNET’s budget $312,447 and CS, $526,724. However on occasion funds from CS have been used to support CNET. For example this year CS, was allocated $850 for instructional supplies, $400 of this was given to CNET to pay for items that were needed. Usually the CISCO academy fund, (allotment FA 2013, $16,000) covers materials that otherwise CNET would not be able to purchase under FUND 10. There are several academies under the CNE program, one of them is funded by CISCO for use to supplement the CISCO Academy Training program. It allows for student tutors and this academic year we were awarded $6000, instructional supplies $5000 (Used to purchase needed software upgrades for CISCO integration) and travel and other for the CNET faculty to travel to other academies to train faculty on CISCO software and hardware.
Additional funds for Tutors to serve for CNET (and CS) were taken from the Larry Weiner Endowment ($4000) and STEM Donation ($4000) from EMC Storage Company made through the Ohlone College Foundation.
Department Meetings were hosted using Larry Weiner funding to buy refreshments and lunch for attendees. Advisory Meetings if held at Ohlone College were funded by the endowment. General operations costs are low as most of the course offerings are mostly in hybrid and online format. Use of technology along with the Blackboard Course Management system and CISCO Canvas Course Management system, allow this program to maintain interactivity and sustainable program offerings.
During the years 2012-13 the SVICT grant helped support ICT pathways CNET outreach program and travel expenses for WEX faculty for CNET WEX students. It is also providing $12,000 to make
two promotional videos for the Computer Studies programs. One for CS and the other for CNET. Filming will take place in Spring Semester, March 2014. Office supplies needed for the CNET program are minimal.

iv. **Analyze the program’s current use of staff, equipment, technology, facilities, and/or other resources. Comment on how the program can best use these resources.**

Currently there are 2 full-time faculty members and 8 Adjunct faculty who serve to teach program offerings. One of the full-time faculty members, Richard Grotegut, assists with supporting the CNET portion of the Work Experience program (WEX).

v. **Describe any additional notable program achievements (optional).**

As mentioned earlier (page 5), the success of the CNET program resulted in Richard Grotegut, being asked to participate on the writing team for the new Career Technical Education Model Curriculum Standards for the IT sector for K-12 education in the State of California.

The department also received a CISCO honoree award, for its service as the CISCO ACADEMY SUPPORT TRAINING CENTER Spring 2013.

vi. **Addtion Program Table Data:** n/a

vii. **Future Action:** Current levels or student achievement indicators will be maintained.

- **Program Analysis**

  Formal program analysis will be conducted once the newly revised programs (AS degrees, Certificates of Achievement and Accomplishment) and accompanying courses are delivered and the sufficient results can be collected and analyzed. The implementation of new curriculum commences Fall 2013.

- **Program Improvement Objectives:**

  PIOs are posted on the Curricunet Program Review Module

1. List each team members name and title.

   The CNET Department includes two full-time faculty members Richard Grotegut and Danijela Bedic-Babic along with many highly qualified and dedicated adjunct faculty members, List of adjunct faculty and their area of expertise:

   Carrie Huang - Microsoft System Administration, Citrix;
   David Patrick - Linux System Administration, VMware, EMC SAN/Cloud;
   Faysal Shaarani - Oracle database developer and data base administration;
   Dennis Smith - Desktop Support; Windows Client Operating Systems, CompTIA Net+;
   Lily Swift - CNET 144 How Technology Works;
   George Wong - PC Hardware and Software CompTIA A+;
   Wallace Wong - Cisco Network Security, Brocade; EMC SAN/Cloud;
   Francis Yakin – Linux System Administration;
Ohlone College has been a Regional Partner and participant in the successful Regional Leadership Council (RLC) for the Mid-Pacific Information and Communication Technologies (MPICT) ATE Center located in CCSF over the past five years. MPICT includes Regional Partner relationships in Hawaii and Nevada and a Business and Industry Advisory Panel with 70+ members.

Video recordings of the past two Advisory meetings can be found here:


Meeting for 2013 (TBA)

2. Discuss key feedback provided by team and how it was incorporated into the report.

Information and Communication Technologies (ICT) industries are a big and important economic development sector for the California economy, representing:

- About 46,000 companies
  - 4% of all companies
  - Ranked 12th of CA industries by firm count
- Almost $172 billion in revenue
  - 6% of CA private sector revenues
  - 6th of CA industries by revenues
- About a million California workers
  - 4% of the workforce
  - 12th of CA industries by employee counts
- About $76 billion in wages
  - 12% of private sector wages
  - 2nd of private sector industries wages paid
  - Wages per employee 2X the state average

*Source: MICT/COE Phase 2 Environmental Scan*

However, ICT employment is not limited to ICT industries. Rather, ICT and ICT workforce are increasingly strategically important to all kinds of organizations in every California industry:

- Almost 1.2 million Californians in ICT Workforce Q1 ‘11
  - 5% of all current jobs, about 1 in 20 jobs in the California economy
  - Projections of 12% employment growth, or 130,000 new jobs between 2006 and 2016
- Median ICT Workforce wage about 2X median wage for all California jobs
• 8th largest occupational cluster by number of jobs
• Many requiring no more than an AS degree

*Additional Source: MPICT/COE Phase 3 Environmental Scan*

MPICT/COEs 2010 Phase 2 study found roughly half of California employers reporting difficulties finding appropriately skilled ICT workforce, even in a period of high unemployment. Since then, ICT has become even more recognized as strategically important to California organizations, and ICT workforce demand has increased.

IBM quotes U.S. Department of Labor data publicly stating the U.S. is currently 1.5 million workers short in IT and a shortfall of 32 million IT workers globally through 2020.

2012 *Bluewolf* and 2013 *Robert Half* salary guides, show strong increases in salaries for ICT related occupations. In fact, year-to-year compensation is up significantly for each ICT related occupation in the Robert Half guide, indicating that demand exceeds supply throughout the ICT sector.

More than a third of Forbes’ Top Jobs for 2013 are ICT related.

Documenting economic development importance of ICT, a December 2012 *Bay Area Council Economic Institute* report stated:

“The growing income generated by the high-tech sector and the strong employment growth that supports it are important contributors to regional economic development. This is illustrated by the local multiplier, which estimates that the creation of one job in the high-tech sector of a region is associated with the creation of 4.3 additional jobs in the local goods and services economy of the same region in the long run. That is more than three times the local multiplier for manufacturing, which at 1.4, is still quite high.”

• Attached Files