Expanding Capacity in Computer Science & Engineering at the University of Washington

Executive summary

The Puget Sound region has arguably the most vibrant and innovative software industry in the nation – an industry that is powering our economy.

The companies that comprise this industry have one thing in common: they are *desperate* for software engineering talent. The availability of this talent is the number one factor governing their growth and their success.

Expansion of UW Computer Science & Engineering is critical to addressing this need, and to providing opportunity for kids who grow up here to be first-tier participants in our innovation economy.

Our software industry

The Puget Sound region has arguably the most vibrant and innovative software industry in the nation – an industry that is powering our economy.

We created entire sectors of the industry, including PC software (Microsoft), Desktop Publishing (Aldus, now Adobe), streaming media (RealNetworks), e-tailing (Amazon.com), and cloud services (Amazon Web Services). We have extremely strong positions in "big data" analytics and applications, console and mobile games, software-as-a-service, and many sub-sectors of e-tailing (travel, real estate, jewelry, digital imagery, …).

Our leadership is based on many hundreds of companies of all shapes and sizes: giants (Amazon.com, Microsoft, …), mid-size (EMC Isilon, F5 Networks, …), smaller but rapidly expanding (Tableau Software, Zillow, …), thriving startups (SNUPI Technologies, Zulily, …), major engineering offices of companies headquartered elsewhere (Facebook, Google, …).

The workforce gap

These companies have one thing in common: they are *desperate* for software engineering talent. The availability of this talent is the number one factor governing their growth and their success. They compete for the strongest graduates from the strongest computer science programs in the nation, at the Bachelors, Masters, and Doctoral levels.

Additionally, companies that you don't think of as "information technology companies" are increasingly in need of similar talent: Boeing, Nordstrom, and PACCAR, for example, employ many thousands of information technology professionals among them, doing a growing amount of leading-edge work.

As a result, both regionally and nationally there is an enormous workforce gap in computer science. Regionally, computer science is one of only four fields with a gap between degrees granted and jobs available at the Baccalaureate level and above, and the gap in computer science is greater than the total of the gaps in the other three fields (see Fig. 1). Nationally, 57% of all job openings in all STEM fields in the current decade are projected to be in computer science (see Fig. 2).

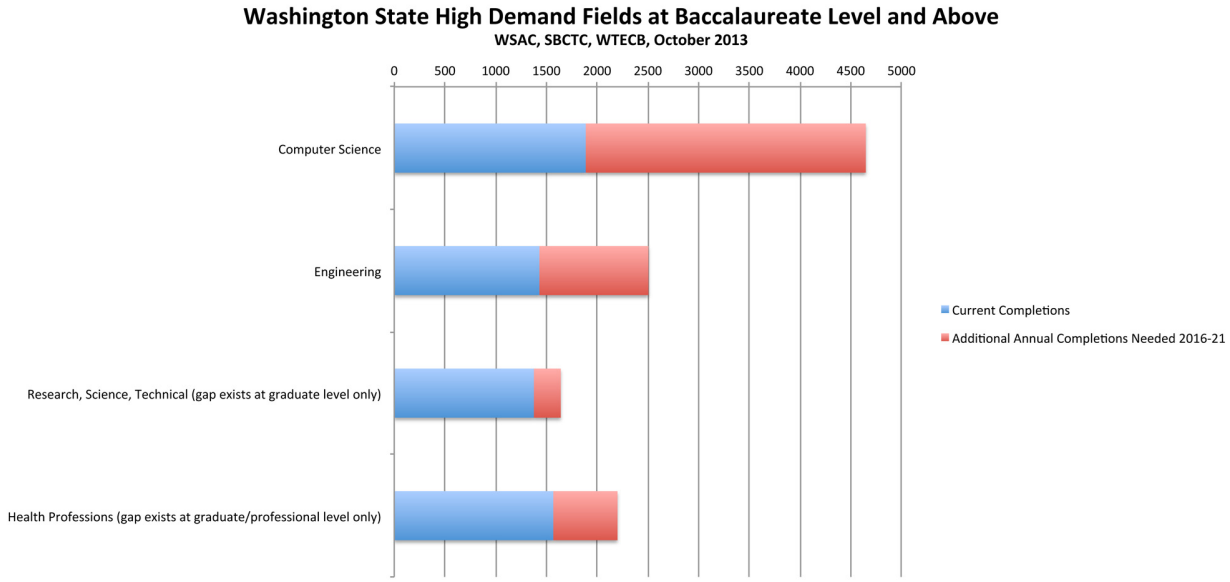

Fig. 1

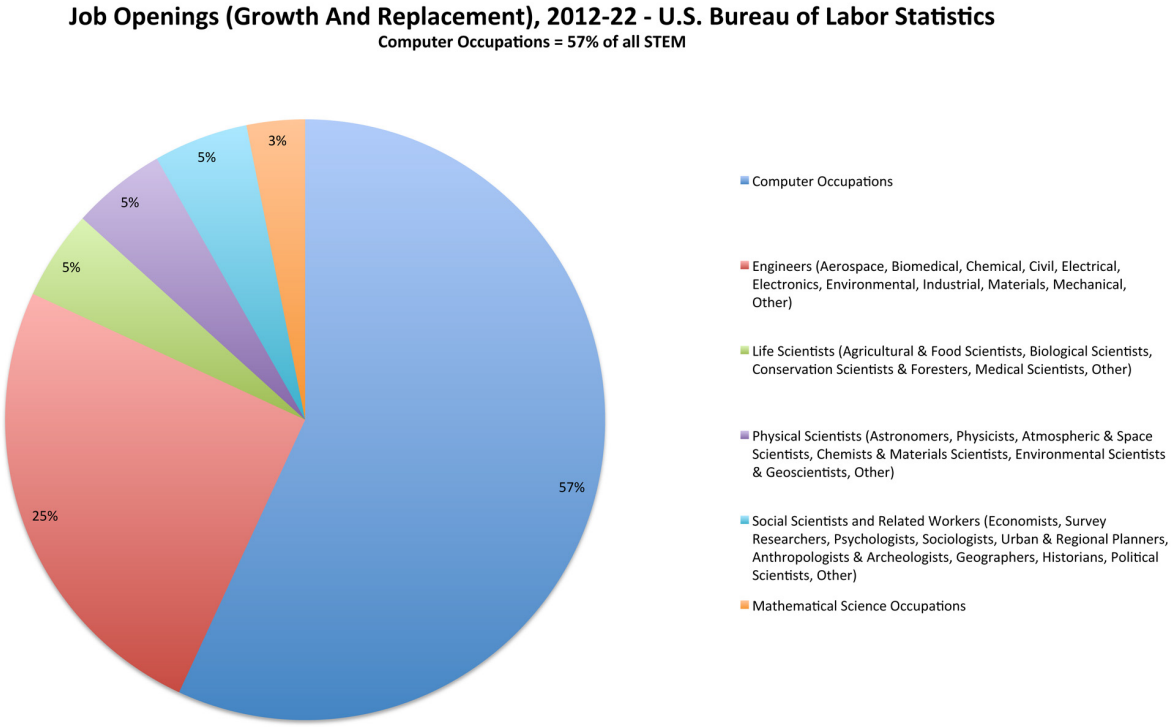

Fig. 2

UW Computer Science & Engineering

UW Computer Science & Engineering is ranked among the top ten computer science programs in the nation. In terms of workforce, UW CSE is among the top 5 suppliers of talent to Amazon.com, Microsoft, and Google (along with Carnegie Mellon, MIT, Stanford, and UC Berkeley), and the predominate supplier to our region's smaller companies and startups.

Student demand for UW CSE – and, indeed, for computer science education at top colleges and universities across the nation – is booming. This includes demand for introductory courses, for the major, and for upper-division courses by students majoring in other fields.

In the most recent year, 2,700 students took UW CSE's first introductory course (CSE 142) and 1,800 students took UW CSE's second introductory course (CSE 143) – up by factors of 2.25 and 2.5, respectively, from a decade earlier (see Fig. 3).

Of course, most of these students do not want to become CSE majors – they simply recognize the growing importance of computer science and "computational thinking" for *all* careers.

Many *do* want to become CSE majors, however. And unfortunately, for reasons that will be described shortly, only about 1/3 of the students who successfully complete prerequisite courses and apply to the CSE major can be accommodated – 2/3's must choose a different major. Recent growth in the number of UW freshman applicants and confirmed incoming students who want to major in CSE, compared to other engineering majors, is dramatic (see Fig. 4).

An even greater number desire access to upper-division CSE courses – something beyond the two introductory courses, but less than a full major. This demand, too, cannot be met.

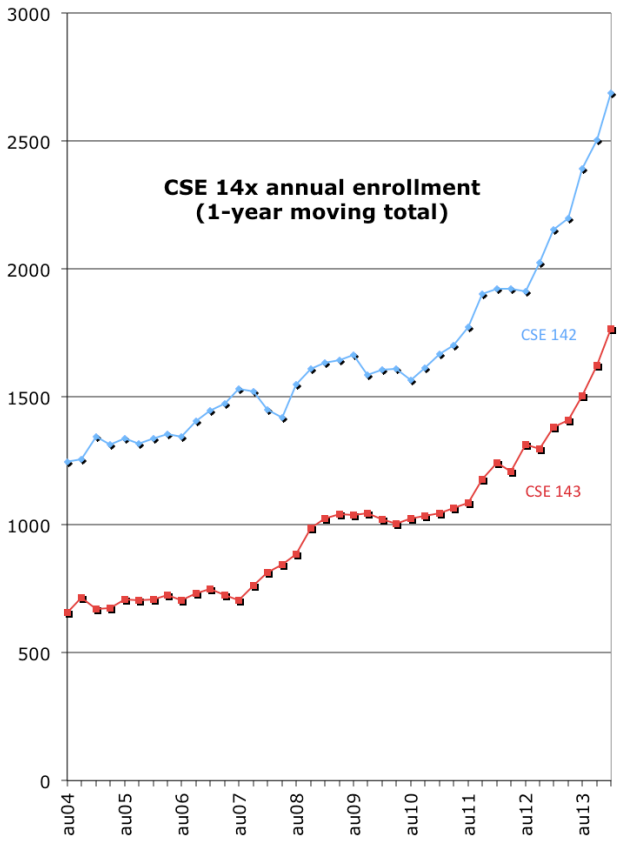

Fig. 3

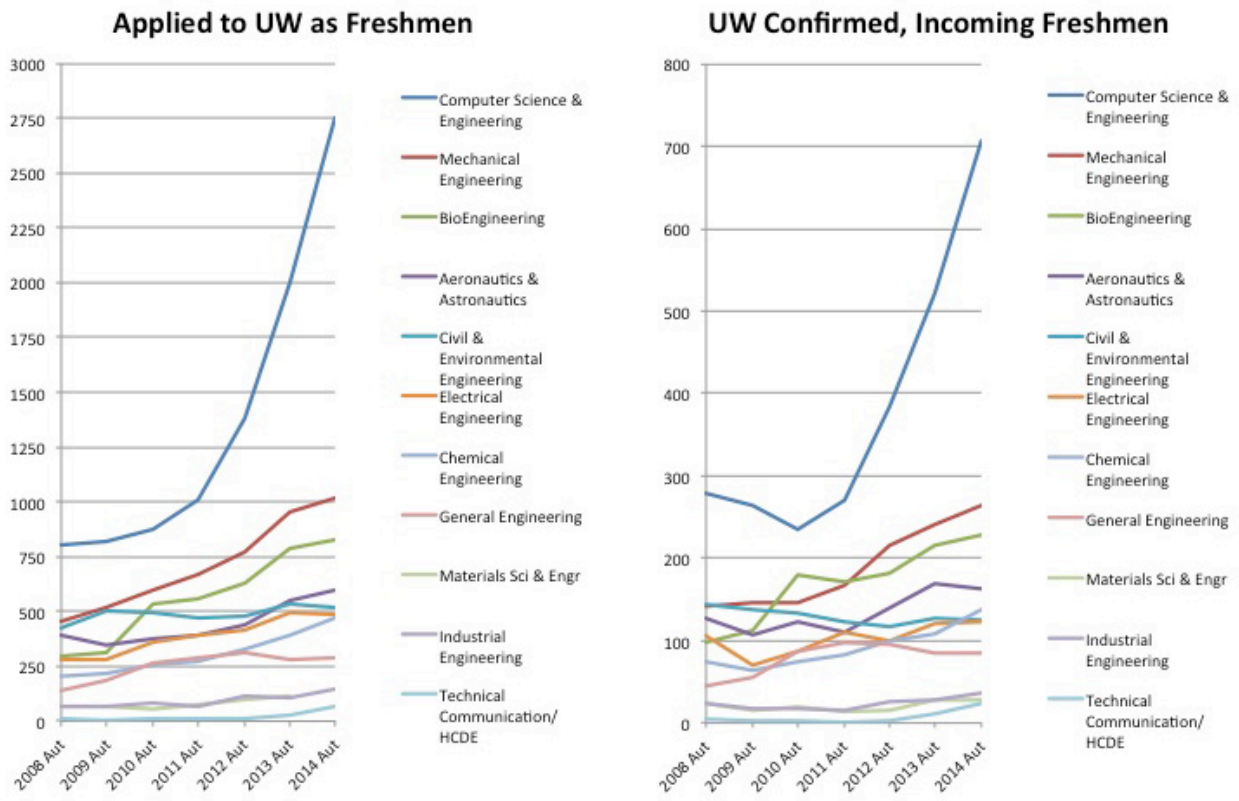

Fig. 4

Limits to growth

Growth in CSE requires two things: funding from the state (because tuition falls far short of meeting the costs of intensive engineering-oriented programs such as CSE), and facilities.

Eleven years ago – in October 2003 – UW dedicated the Paul G. Allen Center for Computer Science & Engineering, funded through a public/private partnership. Coupled with investments by the state since that time, the Allen Center has enabled remarkable strides by UW CSE.

State-of-the-art laboratory space has changed the nature of CSE's research. CSE's annual research funding has tripled – from $7 million in the year prior to occupancy, to more than $20 million as of the 10th anniversary. (Faculty increased by only 24% during this period – from 38 to 47.) The number of technical staff supporting research has more than doubled – from 23 to 58. CSE had only 2 postdoctoral research fellows in 2003 – there are 27 today. Interdisciplinary collaborations have flourished, reflecting the broad impact of the field in the modern university and the modern world.

Enrollments have increased, providing greater opportunity for Washington State students and driving the region's economy. From the year prior to occupancy to the 10th anniversary, undergraduate majors increased from 430 to 650 (+50%); full-time graduate

program majors from 142 to 222 (+55%); part-time professional masters program majors from 120 to 160 (+33%); and annual enrollment in CSE's two introductory courses from 2,000 to 4,500 (+125%) in the most recent year.

The state has funded additional growth for UW CSE, and we hope for further investments. However, *the Allen Center is filled to capacity*. Additional facilities are necessary if additional growth – demanded by students, by industry, and by our economy – is to be accommodated.

What will this enable?

Construction of this facility will enable (assuming continued state funding for enrollment increases):

- Doubling the number of CSE degrees granted annually, from roughly 300 to roughly 600. More in the long term.
- Continued growth in introductory course enrollment; extrapolating recent trends and examining some of our national peers suggests that demand could grow by 50-100% in the next 5 years, easily to more than 6,000 students/year.
- Dramatic expansion in the availability of current and newly-designed upper-division CSE courses to non-majors. These students will then be positioned for far greater success in whatever career they may choose (because *every* field is becoming an information field!), and additionally will be well qualified for employment at the many hundreds of companies in the region that are challenged in competing with the Amazons, Microsofts, Facebooks, Googles, and hot startups for top computer science majors.
- Continued growth in research activities and funding, and in the technology transfer and startups that are a byproduct of CSE's research activities. (CSE's annual research funding increased from $7 million in the year prior to the dedication of the Allen Center, to $20 million as of the 10th anniversary. In recent years, UW CSE startup companies have raised more than $200 million in venture funding; they employ hundreds of people in the region.)

Expansion of UW Computer Science & Engineering an essential investment in the future of our region, and will provide a dramatic increase in the opportunity for kids who grow up here to be first-tier participants in our innovation economy.