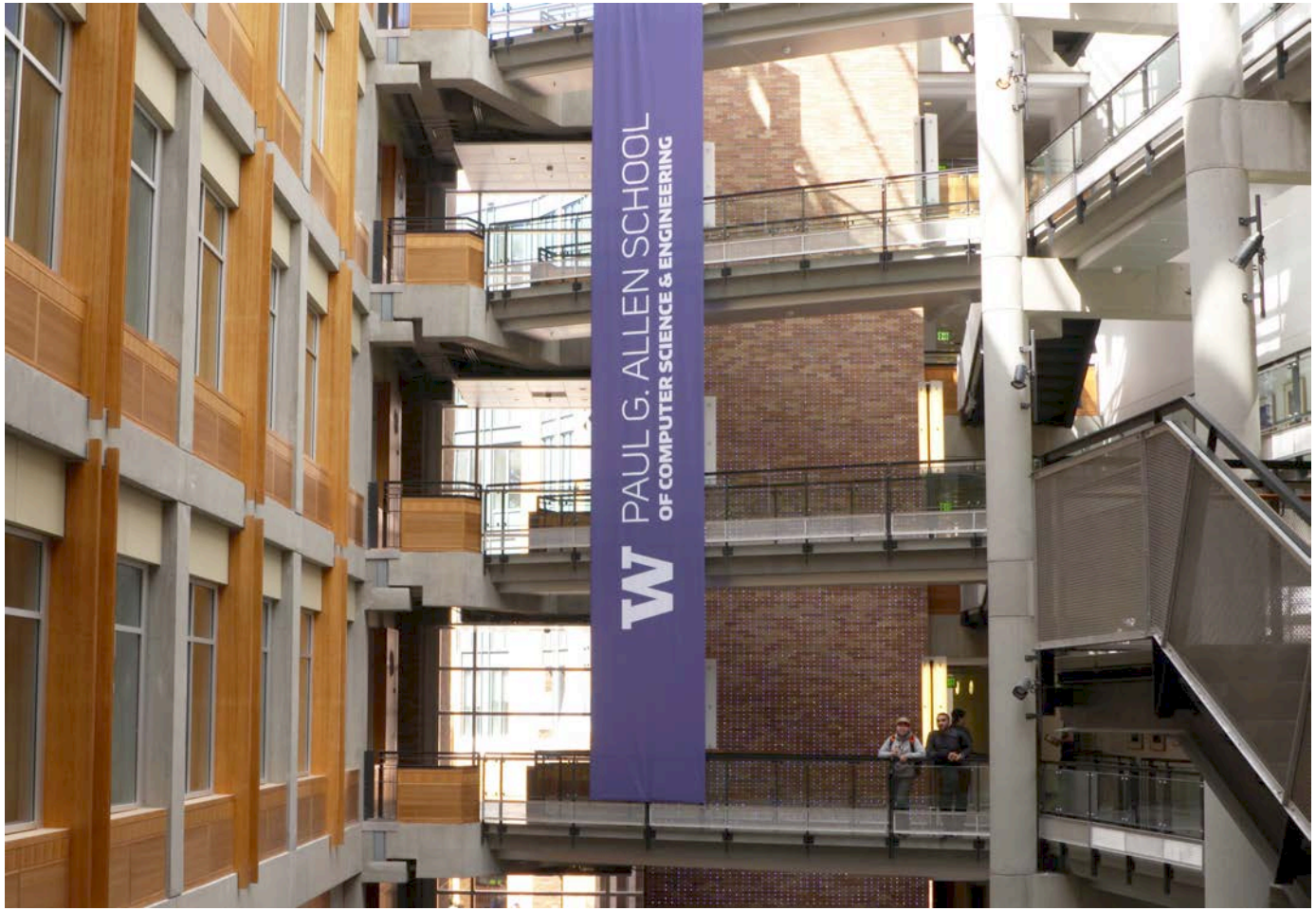
PAUL G. ALLEN SCHOOL
OF COMPUTER SCIENCE & ENGINEERING

Welcome!

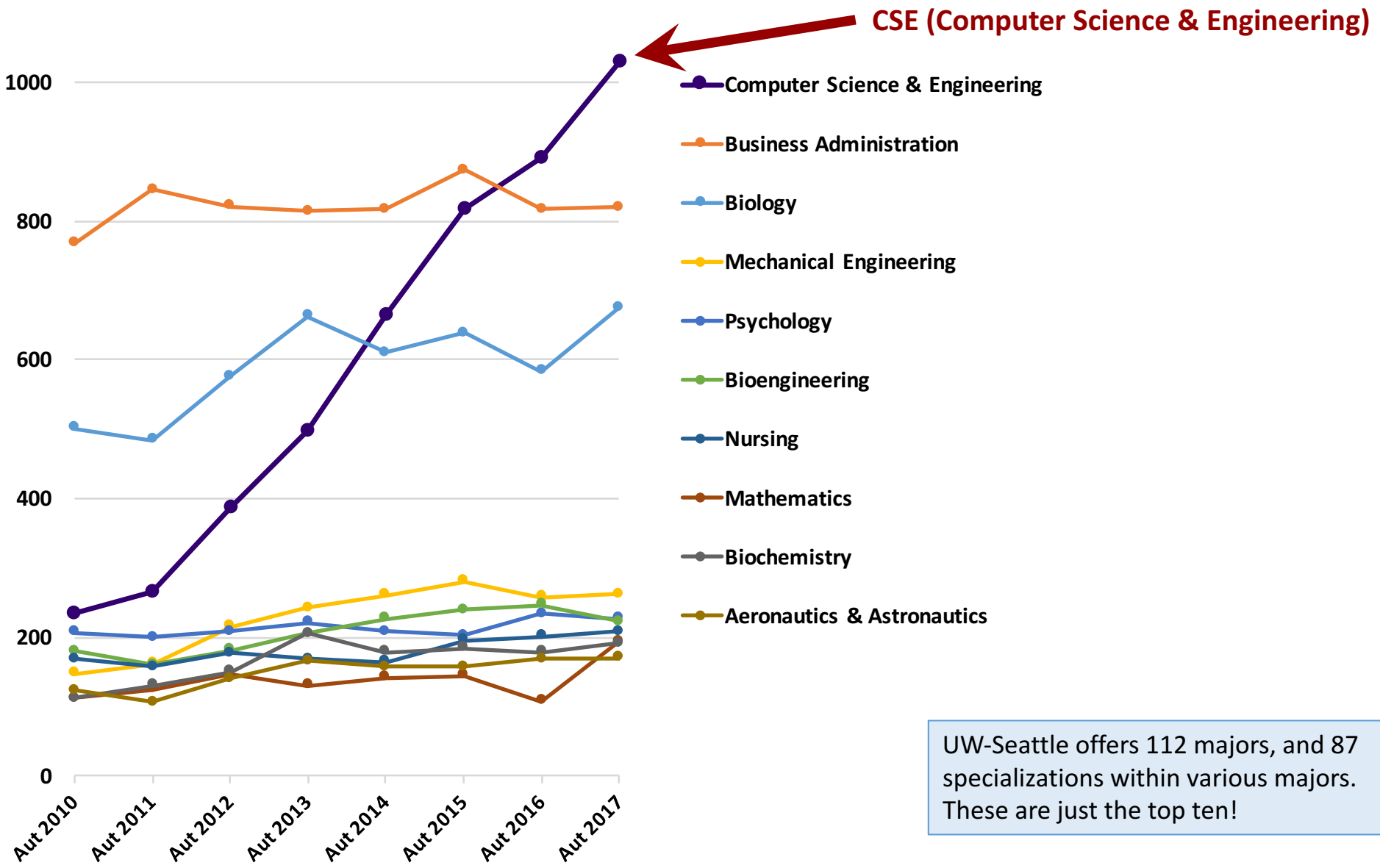
http://lazowska.cs.washington.edu/Overview.pdf, pptx

Today …

- Student demand
- Workforce demand
- What's going on?
- The changing nature of the field
- The expanding role of the Allen School at the University of Washington
- Our role in the state
  - Education
  - Research
  - Entrepreneurship
- Growing to meet the need
  - Degree capacity
  - Space
  - The Paul G. Allen School
  - The Global Innovation Exchange
- The case for continued investment

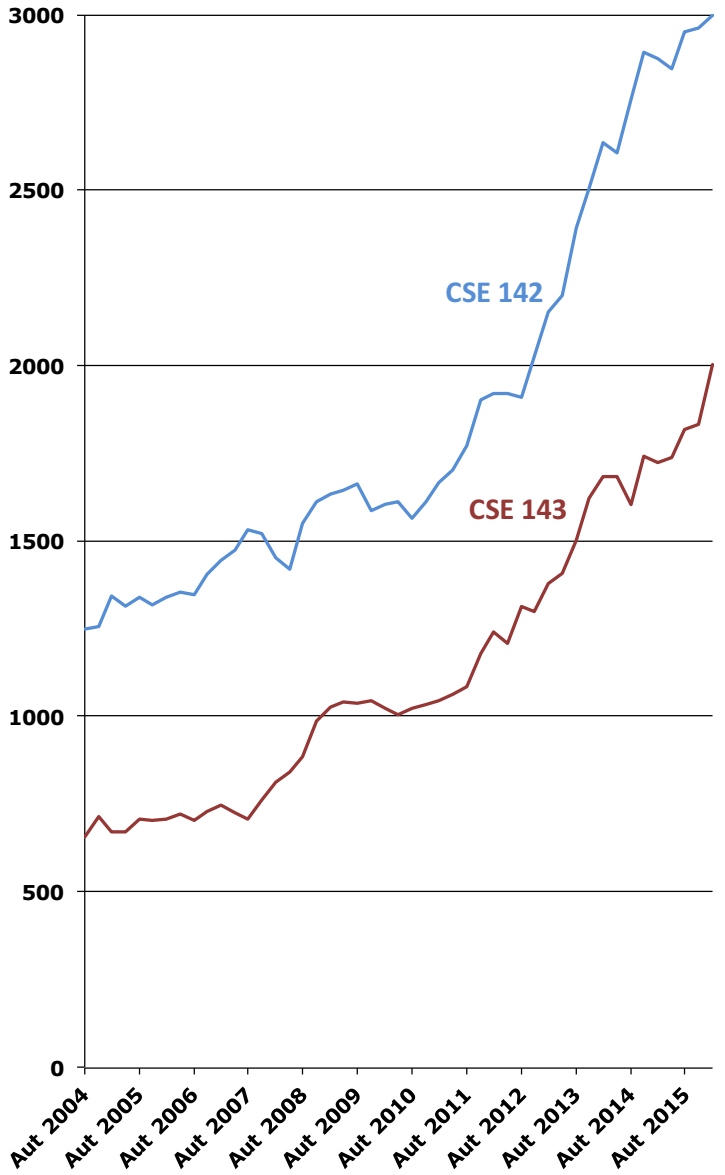


Student demand: Top 10 first-choice majors of UW confirmed incoming freshmen



UW-Seattle offers 112 majors, and 87 specializations within various majors. These are just the top ten!

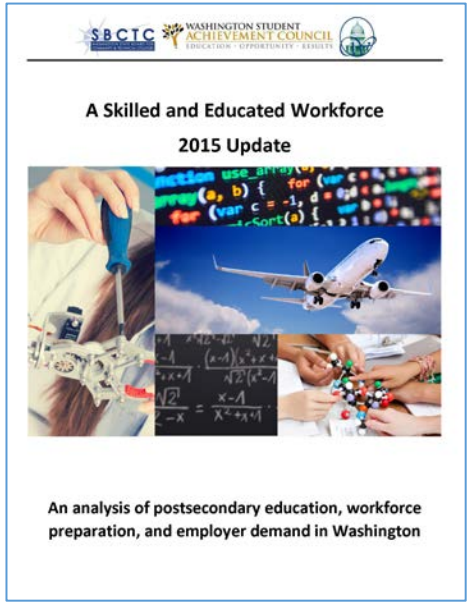
Student demand: Allen School introductory course annual enrollment (1-year moving total)

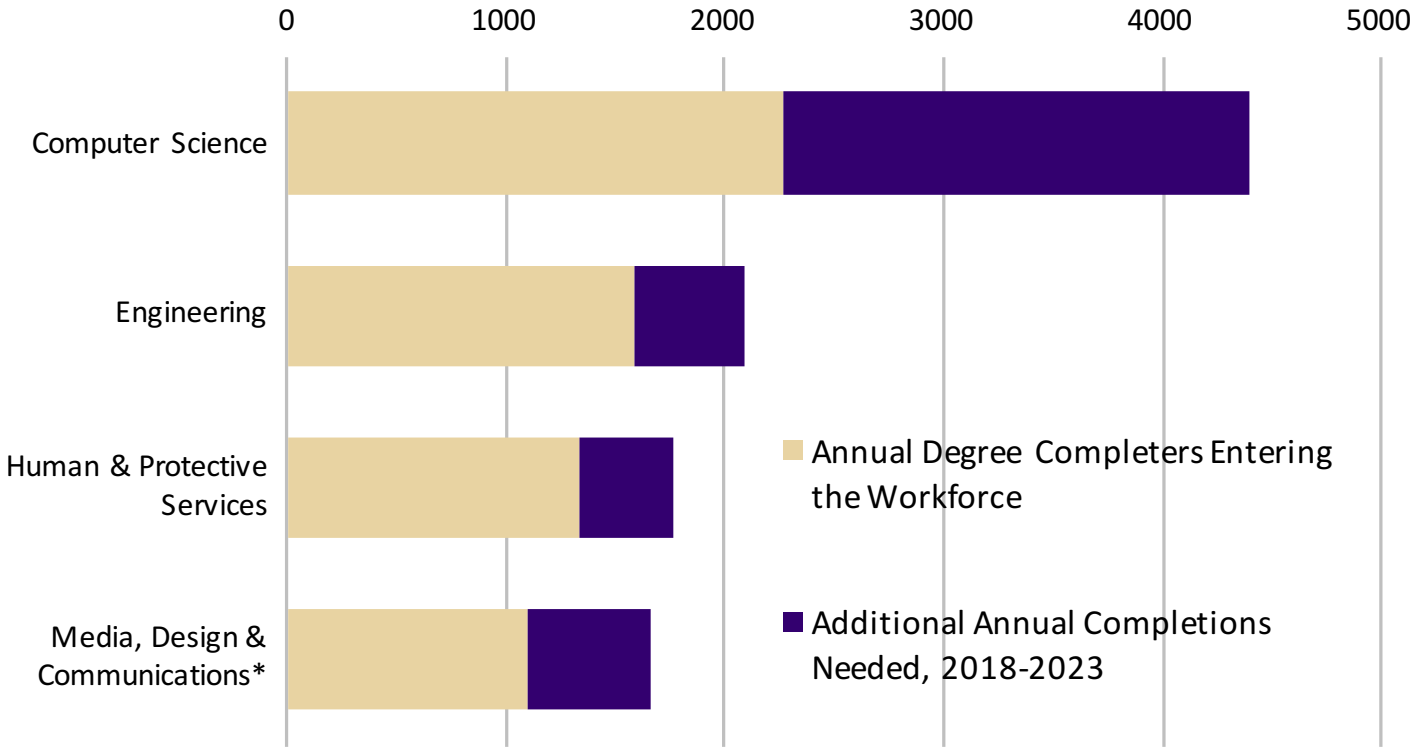


Computer Science is not just for computer scientists! It's a pillar of a 21st century liberal education!

Employer demand: Fields with Bachelors-level workforce gaps in Washington state, 2018-23

Washington Student Achievement Council / State Board for Community & Technical Colleges / Workforce Training & Education Coordinating Board, 2016





**Driven by the technology sector*

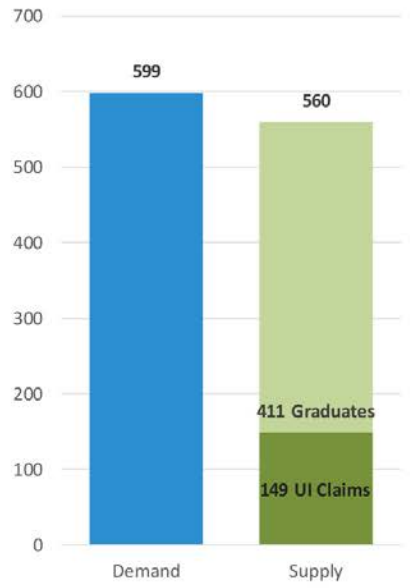
Our state's workforce gap in Computer Science is 4X as great as the workforce gap in all other fields of Engineering combined!

Employer demand: King County WA's aerospace workforce

King County Aerospace Talent Pipeline

Bachelor's Degree

Annual Average Demand and Supply
All Occupations by Education



	Occupation (Ranked by Annual Openings (2018-2023))	Employment 2013	Employment 2023	CAGR 2013-2023	Annual Demand and Supply, 2018-2023 (Scale: 0 - 162 annual openings in sector) Demand	Supply	Gap
1	Computer systems analysts	11,311	15,459	3.2%	135	22	(113)
2	Industrial engineers	3,175	3,289	0.4%	77	10	(67)
3	Aerospace engineers	2,942	2,899	-0.1%	65	126	61
4	Computer network architects	2,611	3,027	1.5%	38	62	25
5	Budget analysts	1,162	1,247	0.7%	37	57	20
6	Mechanical engineers	2,472	2,846	1.4%	34	15	(19)
7	Logisticians	2,730	2,673	-0.2%	30	14	(17)
8	Electrical engineers	2,521	2,963	1.6%	28	16	(12)
9	Operations research analysts	1,305	1,546	1.7%	25	10	(14)
10	Engineers, all other	2,039	2,356	1.5%	23	10	

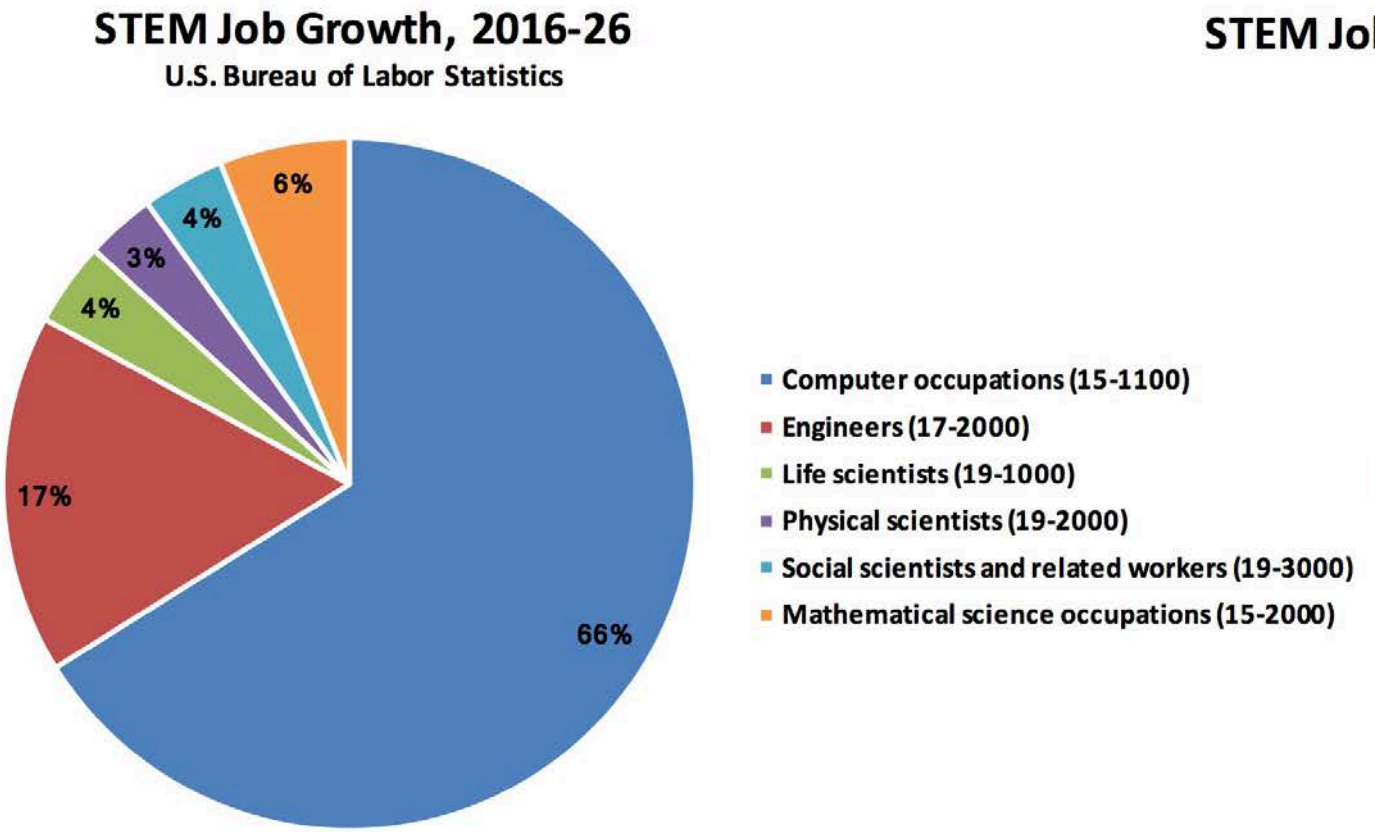
Computer Science is not just for the software industry – our aerospace industry is dominated by computer specialists!

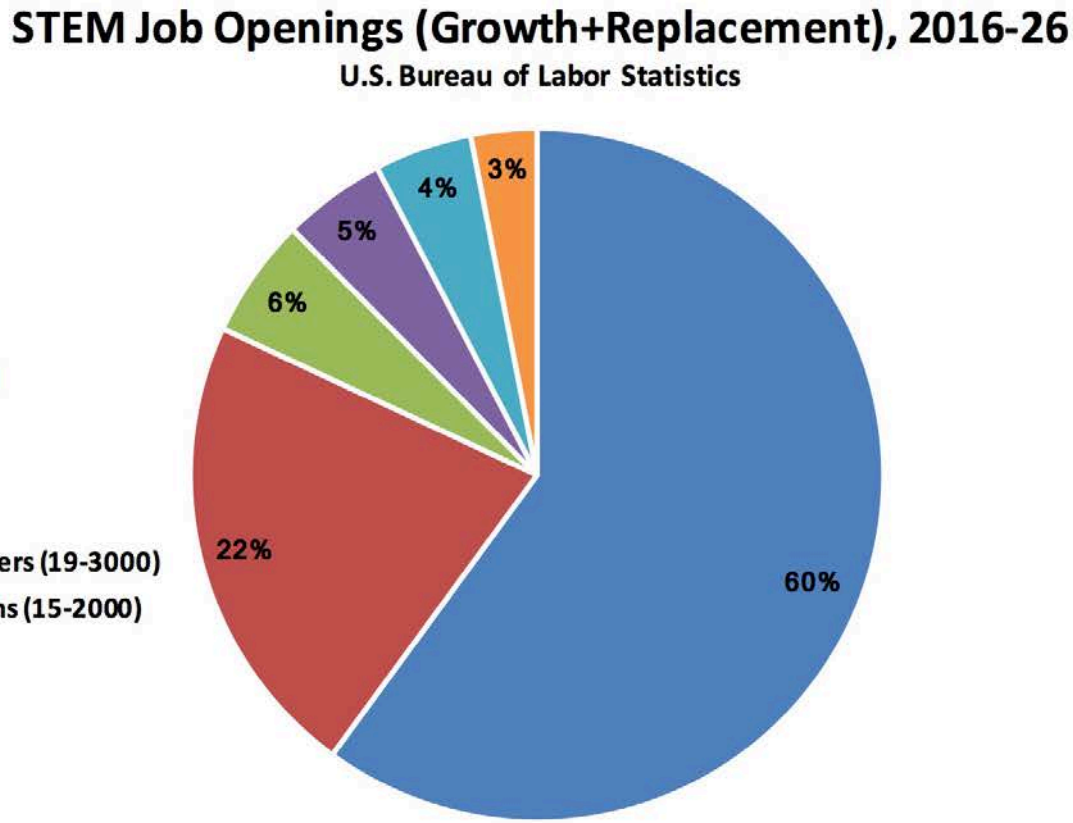
Q: At the Bachelors level …

- What field has the largest total number of current employees in King County's aerospace industry?
- What field has the greatest predicted number of new employees needed by King County's aerospace industry from 2013-2023?
- What field has the greatest predicted compound annual growth rate for King County's aerospace industry from 2013-2023?
- What field has the greatest predicted annual gap between supply and demand for King County's aerospace industry from 2013-2023 (where "supply" is not "degrees granted" but rather the industry's current ability to hire)?

A: Computer Science

Employer demand: National STEM job growth, 2016-26 (US Bureau of Labor Statistics)





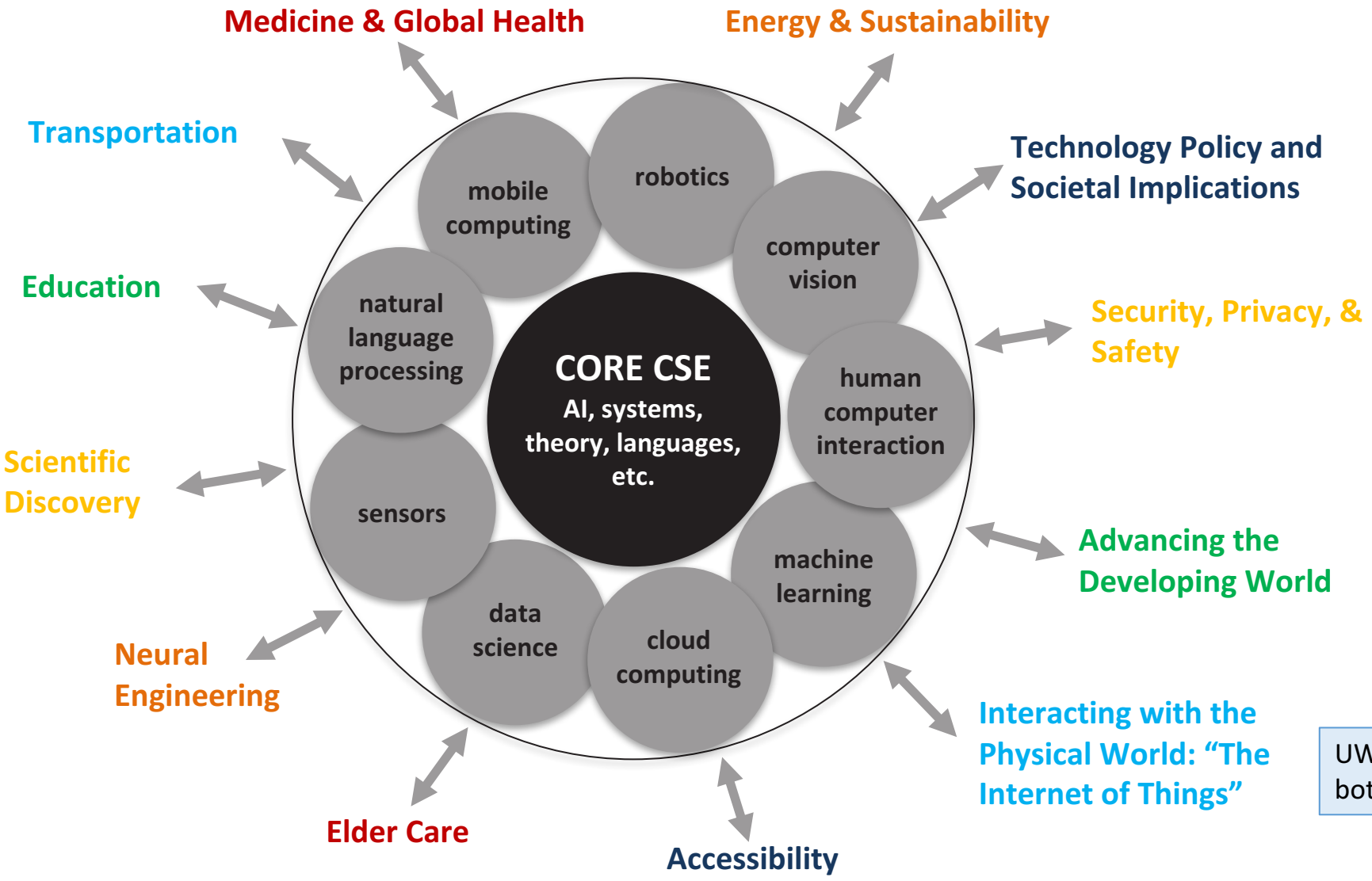
Nationally, just as in Washington, "it's all about computer science"

Data from the spreadsheet at http://www.bls.gov/emp/ind-occ-matrix/occupation.xlsx

What's going on?

- Every 21st century citizen requires fluency in "computational thinking"
  - This is driving introductory course enrollment
- Many fields require more than this – more than an introductory course sequence
  - This is driving demand for upper-division courses by students majoring in other fields
- Computer Science is great preparation for a vast range of fields – not just for work in the software industry
  - This is driving demand for the major, and also improving diversity
- Work in the software industry is no longer the Dilbert stereotype
  - Ditto

The changing nature of the field: From smaller/faster/cheaper to tackling societal challenges



UW has led this modern view of the field – both in concept and in implementation

The expanding role of the Allen School at the University of Washington

- The **Center for Sensorimotor Neural Engineering**, an NSF Engineering Research Center
- The **Center for Game Science**, funded by the Gates Foundation and DARPA to create revolutionary games for scientific discovery and for learning
- The **eScience Institute**, funded by the Moore, Sloan, Washington Research, and National Science Foundations to bring advances in data-intensive discovery to researchers campus-wide
- **dub** – "design-use-build" – a campus-wide collaboration that has made UW one of the top institutions in the world in human-computer interaction
- **Urban@UW**, a campus-wide urban science collaboration

- The **Taskar Center for Accessible Technology** develops and deploys technologies that increase independence and improve quality of life for individuals with motor and speech impairments

- **Change**, a campus-wide collaboration exploring how technology can improve the lives of underserved populations in low-income regions

- The **Tech Policy Lab**, a joint effort of the Allen School, the School of Law, and the Information School, funded by Microsoft

- **GIX** – the Global Innovation Exchange – a new kind of education that is global, project-based, and integrates technology, design, and entrepreneurship

Integral to major interdisciplinary initiatives in research and education

Our role in the state: Education

- There is an insatiable demand for graduates with a broad range of backgrounds – there is an important role for every educational institution to play
  - There is a wide variety of tech positions – from tech support to high-end software engineer, with much in between
  - The tech industry employs many people in non-tech positions
  - Non-tech companies employ many people in tech positions
  - Just about every field requires tech fluency
- What's driving our economy, though, are the leading-edge tech companies of all ages and sizes
  - Our home-grown companies, from Microsoft and Amazon, to Zillow and Redfin, to the hot startups
  - The nearly 100 engineering offices of companies headquartered elsewhere, some of which have many thousands of employees (Google, Facebook)
- The people who power these companies – and who create the jobs for others – are highly capable software engineers
- UW CSE – the Paul G. Allen School – is *by far* the leading in-state producer of these people

Preparing Washington's students for Washington's leading-edge jobs driving Washington's economy

Our role in the state: Research

- Ranked among the top half dozen of more than 200 research-oriented computer science programs
  - Stanford, Berkeley, MIT, Carnegie Mellon, UW, Cornell, Illinois, …
- This pays off for undergraduates as well as graduate students
  - They are in the labs with us, pushing the state-of-the-art – that's what makes them so highly prized
- Tight partnerships with many leading companies of all ages and sizes
- Note: Most of our graduate program alums do not head off to academic positions – they take positions at leading-edge tech companies in Washington
  - Microsoft and Google Seattle are by far the leading employers of our graduate program alums

Massachusetts Institute of Technology

Carnegie Mellon University

Stanford University

UNIVERSITY of WASHINGTON

ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Berkeley
UNIVERSITY OF CALIFORNIA

Cornell University

A few examples …

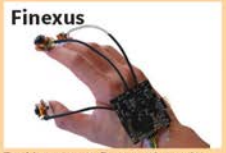
ubicomplab
UNIVERSITY OF WASHINGTON

Professor Shwetak N. Patel
http://ubicomplab.cs.washington.edu

Mobile, Virtual Reality, and Wearable Interaction

EyeContact

High accuracy scleral coil eye tracking for virtual reality

Finexus

Tracking accurate finger motions using magnetic sensing

MagnifiSense

Wrist-worn magnetic sensor that monitors daily activity

SideSwipe

Detect in-air gestures using unmodified GSM signals

GripSense

Using built-in sensors to detect hand posture and pressure on phones

PaperID

Paper interfaces based on long-range, passive RFID

SwitchBack

Using gaze tracking on smartphones to guide attention for task resumption

Tongue-in-Cheek

Wireless signals to enable non-intrusive and flexible facial gesture detection

SurfaceLink

Impromptu multi-device interactions on a surface

Static E-Field Sensing

Ultra-low power human body motion sensor using static E-field sensing

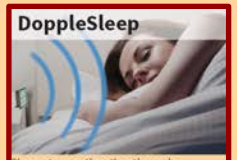
Health Technologies

SpiroSmart

Spirometery from a mobile phone

BiliCam

Using mobile phones to monitor newborn jaundice

DoppleSleep

Sleep stage estimation through non-contact physiological signal sensing

CoughSense

Automatic, ambulatory cough monitoring from a mobile phone

OsteoApp

Screening for osteoporosis on a smartphone using vibration

iPressure

A smartphone-based system for assessing intraocular pressure

WiBreathe

Sensing breathing in natural settings using 2.4GHz wireless signals

HemaApp

Noninvasive screening of hemoglobin concentration using a smartphone camera

BPSense

Monitor changes in blood pressure using an unmodified smartphone

PupilScreen

Using smartphones to assess significant head trauma

Sustainability and Low-power Sensing

ElectriSense

Whole-home, single-point sensing of disaggregated electricity usage

HydroSense

Whole-home, single-point sensing of disaggregated water usage

SNUPI

Ultra-low-power wireless sensor nodes utilizing powerline infrastructure

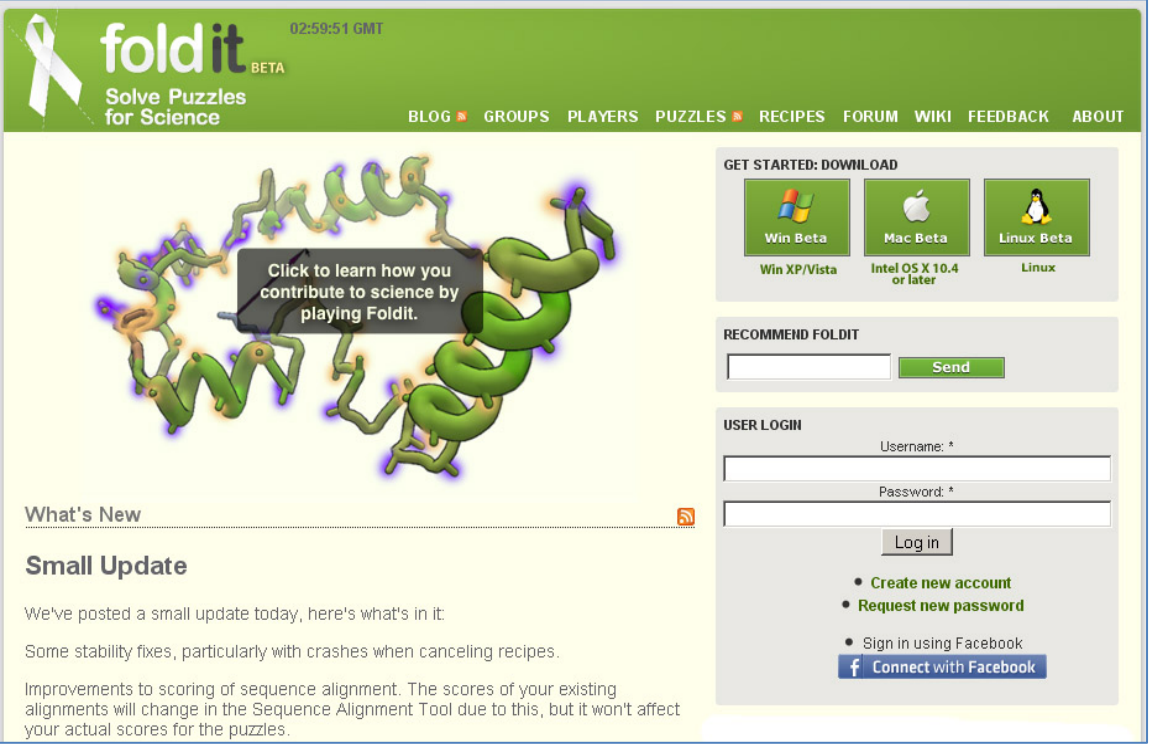
BANDAIDS

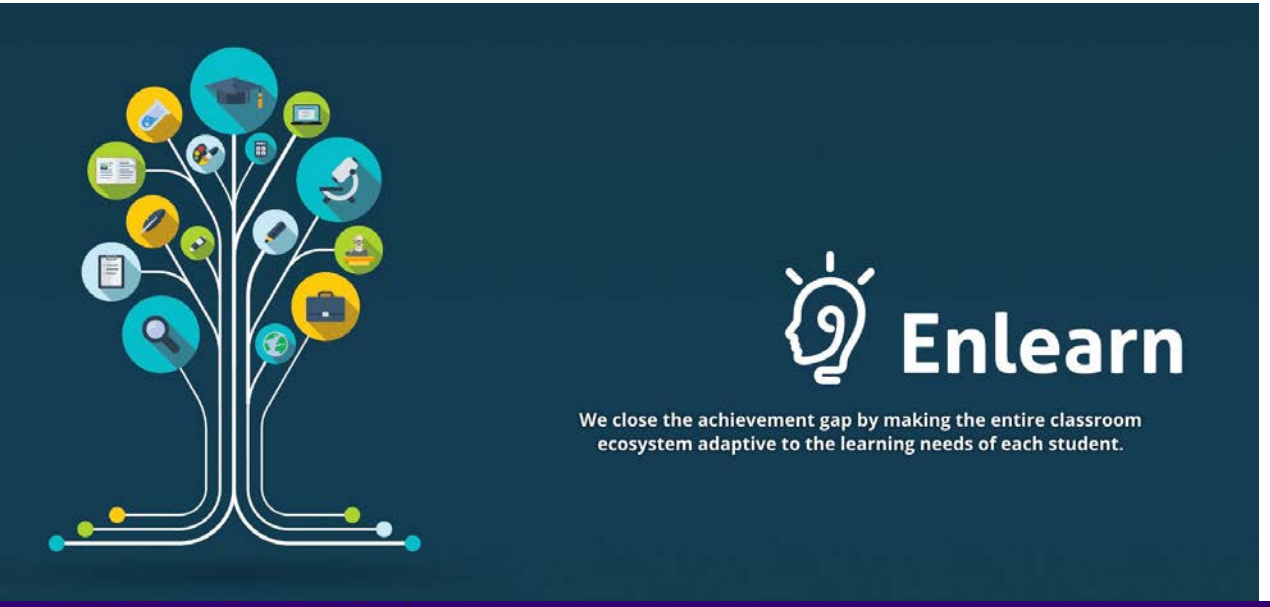
Power transfer through the body with NFC

DOSE

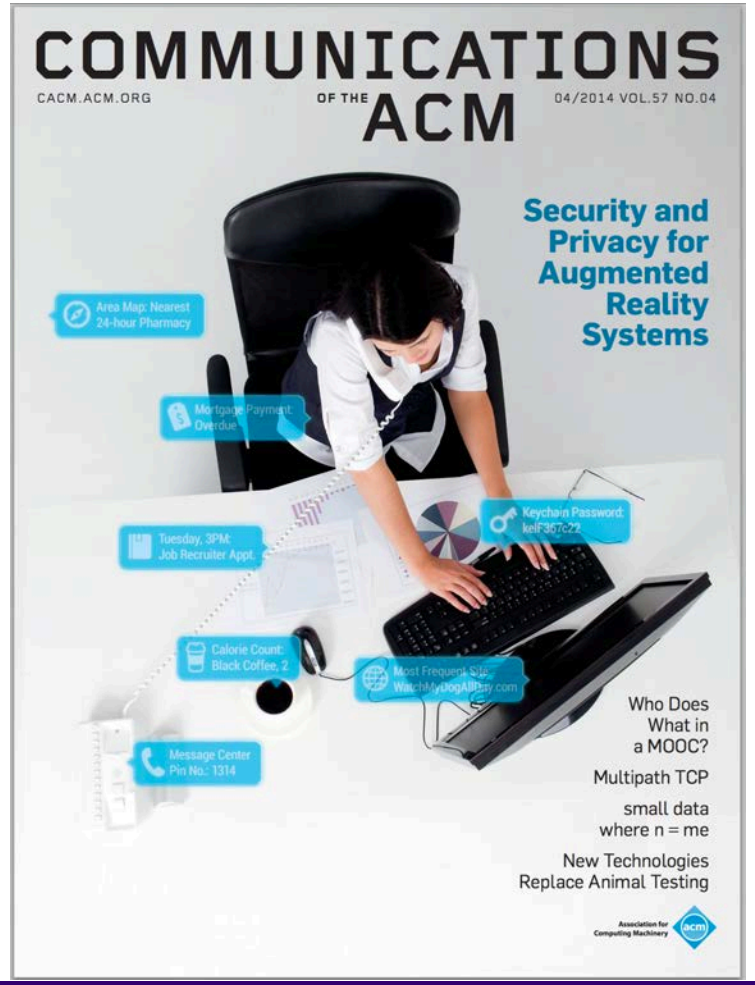

Sensing operating states of home electronic appliances from EMI


Shwetak Patel





Zoran Popovic



Franzi Roesner

Yoshi Kohno

GoPro
Be a HERO.
Odyssey

Steve Seitz

Google

The New York Times

SCIENCE

Data Storage on DNA Can Keep It Safe for Centuries

By JOHN MARKOFF DEC. 3, 2015

From left, Luis Ceze, one of the designers of the new DNA storage system; Douglas Carmean, a designer of computers at Microsoft; and Karin Strauss, a Microsoft computer architect, at the University of Washington in Seattle. David Ryder for The New York Times

Email

Share

SEATTLE — Computer data has been depicted as microscopic magnetic smudges, electric charges and even Lilliputian patterns of dots that reflect laser beams. It may ultimately move into the fabric of life itself — encoded in the organic molecules that are strung together like pearls to form strands of DNA.

Menu The Seattle Times Microsoft Log In | Subscri

LOCAL BIZ/TECH SPORTS ENTERTAINMENT LIFE TRAVEL HOMES OPINION | JOBS AUTOS SHOP All Sec

Boeing & Aerospace Amazon Microsoft Technology Economy Real Estate

Business | Microsoft | Science | Technology

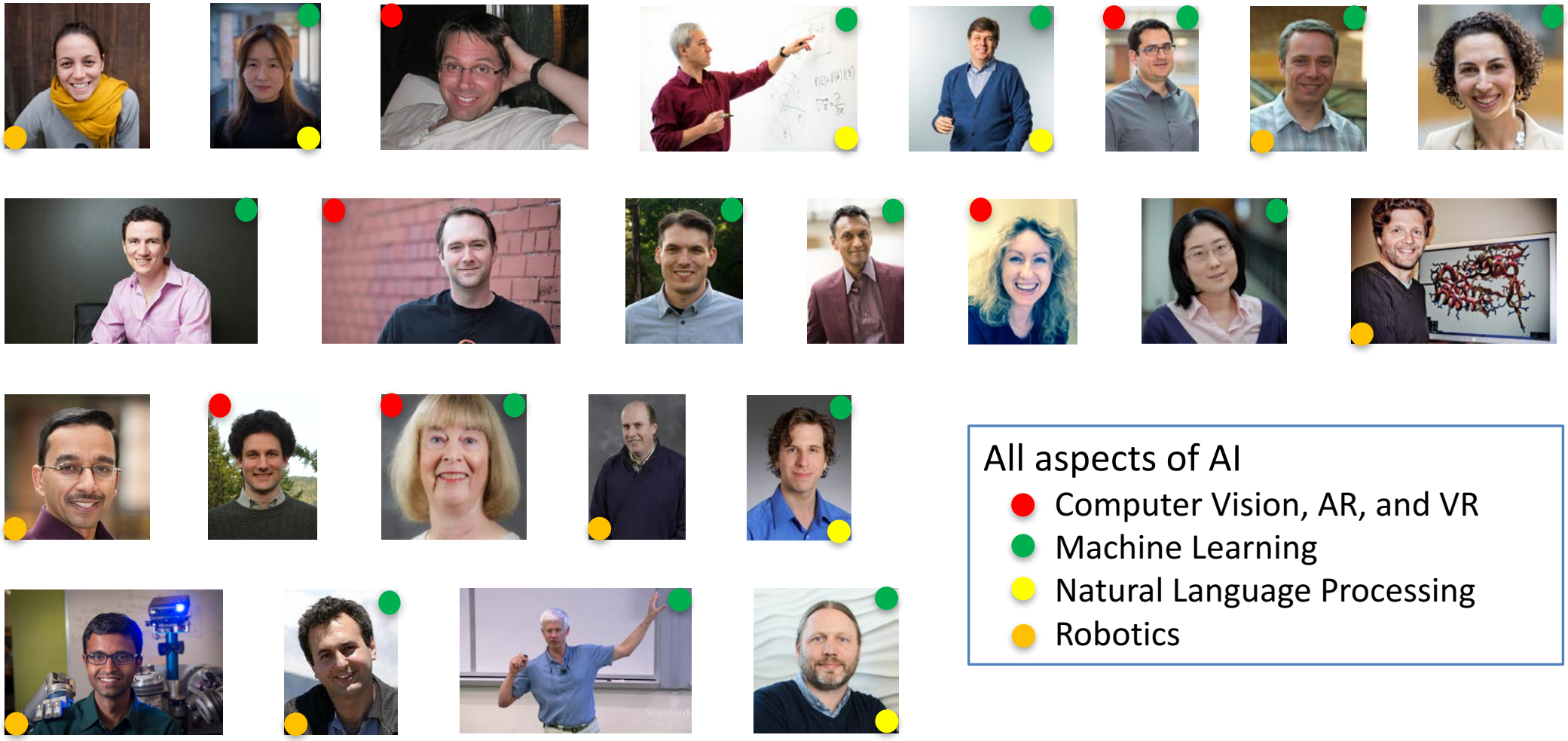
UW, Microsoft claim big breakthrough with data storage using DNA

Originally published July 7, 2016 at 5:30 am | *Updated July 7, 2016 at 5:55 am*

1 of 3 *Luis Ceze, UW Computer Science & Engineering professor, and research scientist Lee Organick prepare DNA containing digital data for sequencing, which allows them to retrieve the original files. (Tara Brown)*

Karin Strauss

Luis Ceze



All aspects of AI

- Computer Vision, AR, and VR
- Machine Learning
- Natural Language Processing
- Robotics

In partnership with …

Our role in the state: Entrepreneurship

- While education and research come first, entreprenuership is alive and well

GeekWire NEWS JOBS EVENTS RESOURCES DEALS ABOUT Search

RFID tag maker Impinj prices IPO at $14, shares soar in rare public offering

BY JOHN COOK on July 21, 2016 at 9:34 am

Post a Comment | Share 4 | Tweet | Share 128 | Reddit | Pin

Impinj's Monza chip

Wall Street likes what they see in Impinj, a 16-year-old Seattle-based maker of Radio Frequency Identification technology that today went public on Nasdaq at $14 per share. That was the upper end of the range for the company, which makes RFID chips that allow retailers to track inventory or manufacturers to track parts.

It marks the first initial public offering for a Seattle-based technology company this year. Impinj sold 4.8 million shares, raising $67.2 million. It also granted underwriters the option to buy 720,000 shares at the offering price.

Impinj, which is trading under the ticker PI, is doing well in its debut. The stock shot up more than 20 percent, and it is now trading around $17.17.

The company, which expects to post a net loss this year, is backed by ARCH Venture Partners, Intel Capital, Polaris Partners, Madrona Venture Group and GF Private Equity. But revenues are on the rise. It is led by founder Chris Diorio, an affiliate professor of computer science and engineering at the University of Washington.

The company posted revenue of $78.5 million last year, up from $63.8 million in 2014. It first turned a profit in 2013, and showed net income of $900,000 in 2015. Even so, it has accumulated a deficit of $187.6 million over the years.

GeekWire NEWS JOBS EVENTS RESOURCES DEALS ABOUT

Exclusive: Apple acquires Turi in major exit for Seattle-based machine learning and AI startup

BY TODD BISHOP & TAYLOR SOPER on August 5, 2016 at 12:56 pm

7 Comments | Share 1.3k | Tweet | Share 996 | Reddit | Pin


Photo Illustration by Monica Nickelsburg, GeekWire, original photo by Dan Hershman, via Flickr.

Machine learning and artificial intelligence startup Turi has been acquired by Apple in a deal characterized as a blockbuster exit for the Seattle-based company, formerly known as Dato and GraphLab, GeekWire has learned.

The acquisition reflects a larger push by Apple into artificial intelligence and machine learning. It also promises to further increase the Cupertino, Calif.-based company's presence in the Seattle region, where Apple has been building an engineering outpost for the past two years.

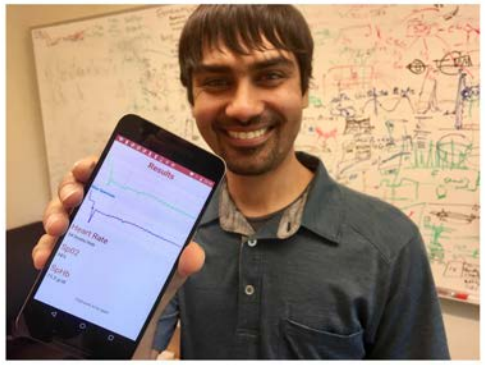
FOLLOW-UP: Why Apple bought Turi: Acquisition reflects tech giant's broader push into AI and machine learning

GeekWire NEWS JOBS EVENTS RESOURCES ABOUT Search

Exclusive: Google buys Seattle health monitoring startup Senosis, bolstering digital health push

BY JOHN COOK on August 13, 2017 at 4:39 pm

3 Comments | Share 1000 | Tweet | Share 2.8k | Reddit | Email


Computer scientist and electrical engineer Shwetak Patel. His most recent venture, Senosis, developed apps for smartphones that can help diagnose disease. (GeekWire Photo / Todd Bishop)

Shwetak Patel has struck again.

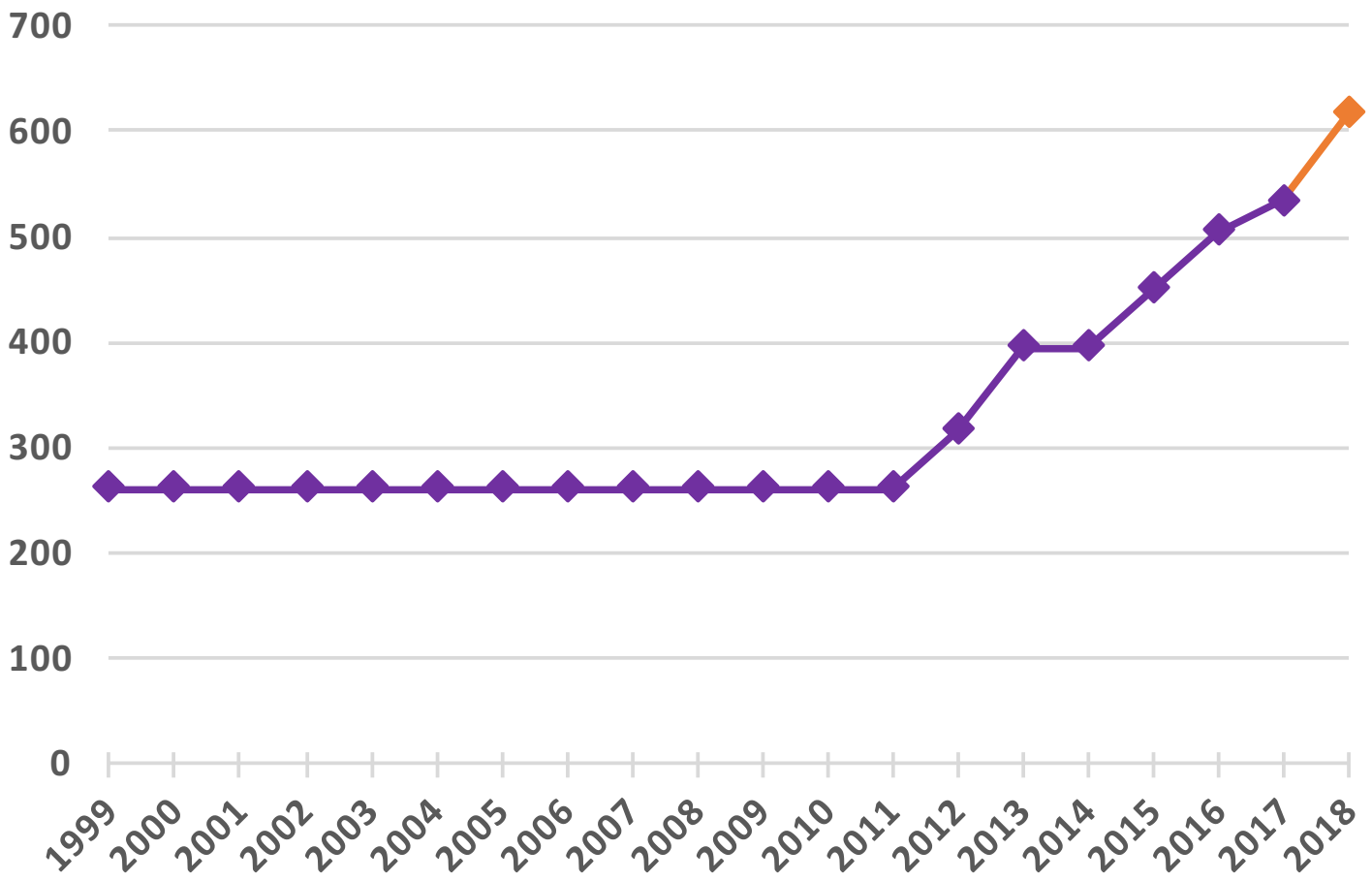
The University of Washington computer scientist has sold his newest Seattle startup company, Senosis Health, to Google, according to sources familiar with the deal.

It marks the latest acquisition for Patel, whose past startup ventures have landed in the hands of companies such as Belkin International and Sears.

Patel, who founded Senosis Health with four other clinicians, researchers and tech transfer experts from the University of Washington, won a MacArthur genius grant in 2011 and his past innovations have ranged from energy meters to air quality sensors.

With Senosis, Patel and his team of about a dozen engineers and physicians took on a bigger challenge: Turning smartphones into monitoring devices that collect health metrics to diagnose pulmonary function, hemoglobin counts and other critical health information.

Growing to meet the need: Funded degrees per year



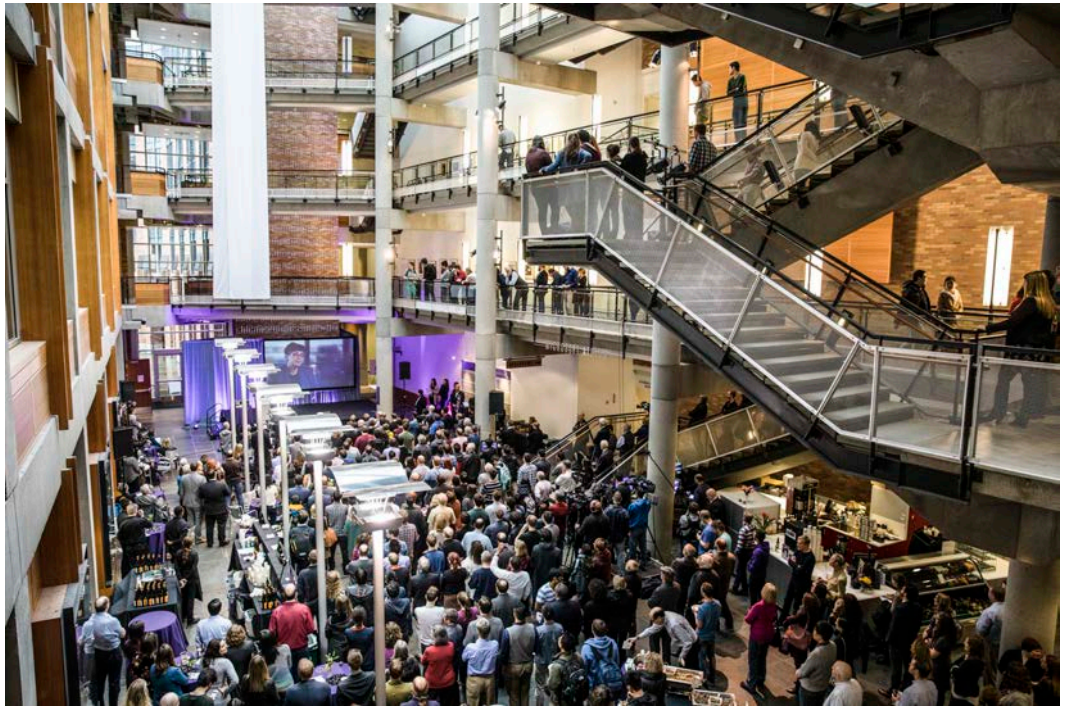
Growing to meet the need: A second building for UW's world-class Computer Science & Engineering program

- Will provide the space to double CSE's student capacity
- Vastly improved undergraduate facilities
- Vastly improved laboratory capabilities (e.g., a 3500 sf robotics lab)
- Architect: Seattle's LMN Architects, architects for the Paul G. Allen Center
- General Contractor: M.A. Mortenson Company, general contractor for the Paul G. Allen Center
- Construction began in January 2017; completion slated for December 2018
- $74 million in private funds, including unprecedented levels of support from Microsoft, Amazon, Zillow, and Google – plus $17.5 million in state capital funds, $4 million in central UW funds
- An extraordinary campaign committee, led by Microsoft President Brad Smith

The Bill & Melinda Gates Center for Computer Science & Engineering

Growing to meet the need: The Paul G. Allen School of Computer Science & Engineering

- A $50 million endowment ($40 million from Mr. Allen, $10 million from Microsoft), to be funded over a number of years
  - Will provide critical <u>seed funding</u> to catalyze new initiatives in education and research, keeping UW CSE at the forefront, to the benefit of students, UW, and the region
    - Does not fund enrollment growth
    - Does not fund the new building



FRIDAY, MARCH 10, 2017

The Seattle Times

CLOUDS, RAIN
High, 52. Low, 39. > 88
seattletimes.com/weather

WINNER OF 10 PULITZER PRIZES

$1.50

INDEPENDENT AND LOCALLY OWNED FOR MORE THAN 120 YEARS

SEATTLETIMES.COM

'Game-changer': Allen gives UW $40M to create school

DEAN RUTZ / THE SEATTLE TIMES

Armed with a T-shirt cannon, Paul Allen joins with regents and officials Thursday at the University of Washington in celebrating the creation of the Paul G. Allen School for Computer Science and Engineering.

COMPUTER-SCIENCE SCHOOL NAMED AFTER BILLIONAIRE

Microsoft co-founder speaks about field's growing potential

By KATHERINE LONG
Seattle Times higher education reporter

He's the co-founder of Microsoft, the owner of the Seahawks, a philanthropist who has given millions toward brain science, cell science and artificial-intelligence research, and the founder of a museum devoted to pop culture and science fiction.

On Thursday, the Seattle billionaire announced he is donating $40 million to the University of Washington's computer-science efforts, and Microsoft kicked in another $10 million in Allen's honor, giving the new school a $50 million endowment.

In turn, the UW Board of Regents on Thursday elevated the computer-science department to the status of a school and named it the Paul G. Allen School for Computer Science and Engineering after the Seattle billionaire.

"It's a game-changer for us," said computer-science professor Ed Lazowska.

Allen spoke at a reception in his honor Thursday at the building. Several hundred alumni and students packed the atrium, and the guests included Brad Smith, president of Microsoft.

Allen shared stories of why he and his cadre of Lakeside School students got kicked out of the graduate computer-science lab as high-school students. The professor in charge "looked the other way until we were out our welcome," he said, telling them they were being too noisy, using all of the computers, and taking an acoustic coupler from a professor's office without leaving a note.

On a serious note, he urged the students and faculty to go forward and do great things with the endowment he has left.

"You young computer scientists, I envy you, I really do," Allen said. "The amount of computing power you have at your fingertips far exceed anything we had back then." That

See > ALLEN, B12

Some highlights of Paul Allen's giving:

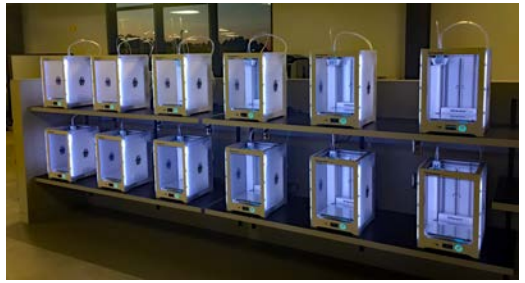
- $14 million to the University of Washington to build the Paul G. Allen Center for Computer Science and Engineering.
- More than $500 million to the Allen Institute for Brain Science "to accelerate understanding of the human brain in health and disease."
- $26 million to build the Paul G. Allen School of Global Animal Health at Washington State University.
- $100 million to start the Allen Institute for Cell Science.
- $10 million toward the Smart City Challenge, an initiative by the Department of Transportation with the stated goal of making urban areas greener and more efficient. A total of $50 million in prize money will be awarded.

CNN and Vulcan

Growing to meet the need: The Global Innovation Exchange

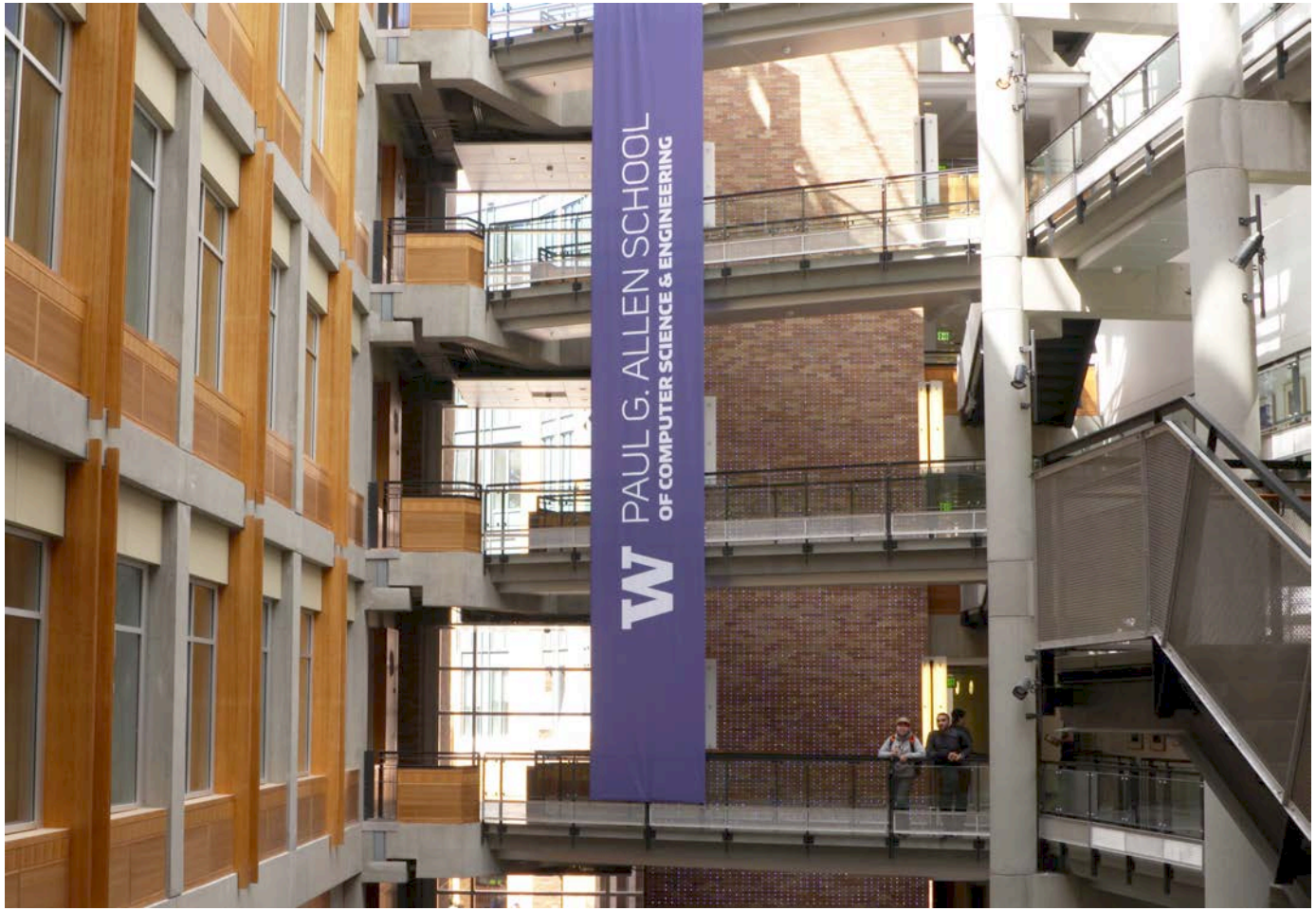
GLOBAL INNOVATION EXCHANGE

- A global partnership, envisioned by Microsoft President Brad Smith
  - **University of Washington**, **Tsinghua University**, École Polytechnique Fédérale de Lausanne, Hong Kong University of Science and Technology, Indian Institute of Science, Korea Advanced Institute of Science & Technology, National Taiwan University, Technion - Israel Institute of Technology, Tecnológico de Monterrey, University of British Columbia
  - **Microsoft**, Arm, Baidu, Boeing, HorizonX, T-Mobile
- Project-based Masters degrees combining technology, design, and entrepreneurship in a global context
- GIX's home – the Steve Ballmer Building – opened on September 14 in Bellevue's Spring District
- Curriculum design and laboratory design led by Shwetak Patel (Paul G. Allen School + EE)



The case for continued investment

- One of the nation's top programs, and a program with tremendous momentum
- Extraordinary student demand
- Extraordinary employer demand
- A leader in envisioning an outward-looking 21st century role for the field
- Impact all across the University of Washington – and the state, and the nation, and the world
- A leader in diversity and outreach – recipient of the first annual award from the National Center for Women & Information Technology
- An exemplary track record of fulfilling our commitments



The Gates Center will provide the space – we need to fill it with Washington students