Schwarzman College of Computing (SCoC) Structure Working Group Report
Organizational Structure Working Group

- Asu Ozdaglar and Nelson Repenning (cochairs)
- Saman Amarasinghe (EECS)
- Dimitris Bertsimas (ORC)
- Cynthia Breazeal (MAS)
- Craig Carter (DMSE)
- Jim DiCarlo (BCS)
- Ken Goldsmith (SA+P, Assistant Dean)
- Munther Dahleh (IDSS)
- Nicolas Hadjiconstantinou (MechE, CCE)
- Richard Zhang (PhD student, Math)

- Dina Katabi (EECS)
- Aleksander Madry (EECS)
- Ankur Moitra (Math)
- Eileen Ng (SoE, Assistant Dean)
- Daniela Rus (EECS, CSAIL)
- Susan Silbey (SHASS)
- Rohil Verma (UG student, EECS)
- Joel Voldman (EECS)
Process

- The committee had **weekly meetings** throughout the Spring term.
- The chairs met with several key individuals (internal and external) and attended meetings to collect input, including Engineering Council, Science Council, EECS, EE, CSAIL faculty meetings and Institute faculty forums.
- The committee discussed structure of existing units that support computing at MIT, including EECS, CSAIL, CCE, Media Lab, BCS, ORC, and IDSS.
- Investigated interesting structural examples from outside the Institute, including CMU, Gatech and Stanford.
- We have extensively discussed and evaluated **different design options** for the College.
Overview

• Computing generally and computer science specifically have grown significantly in the last two decades.

• At MIT, a growing set of the faculty use computational methods in their research and more than 25% of our undergraduates major in computer science (40% major in EECS).

• Launching the SCoC constitutes a critical opportunity to rethink and re-organize the ways in which computation is studied, taught, and used at MIT.
Outline

• State of computing and computer science at MIT.
• **Key issues** with our current structures.
• **Proposal of a new structure** :
  • Different ways in which faculty might interact with (or be members of) SCoC
  • A new configuration “**Common Ground**” that details how delivery of teaching might be organized.
  • Staffing this new teaching structure and relation of EECS to SCoC.
Computing within EECS

• EECS is the largest department at MIT:
  • 129 faculty members, 1347 students in its five majors, 737 SM and PhD students, and 331 MEng students

  • Organized as a matrix with labs—RLE, MTL, CSAIL and LIDS—providing space and research support and department handling teaching programs and hiring and promotion of faculty.

  • Covers the “full computing stack”:
    • Algorithms, theory of computing, systems, AI, machine learning, information science and hardware of computation.
Computing within EECS

EECS system now suffers from 2 major problems:

1. Demand for computing related courses significantly exceeds department’s ability to supply them.
   - Department has responded to this challenge by directing its resources to computer science.
   - Led to significant reductions in the resources dedicated to the electrical engineering side.

2. While majority of faculty value synergies across the department, department increasingly split with a binary characterization of EE and CS:
   - The current lab structure has created boundaries.
   - Leads to inefficiencies and problems for areas that straddle the EE and CS divide (most notably in machine learning and data science).
   - Limits interactions and collaborations that being in the same department would provide.
Computing outside EECS

• Use of computational methods outside of EECS also has grown considerably.
  • Many of the departments search for faculty who make significant use of computing in their research.

• Challenges:
  • Although faculty from other departments extensively involved with research on computer science, not all of these faculty are engaging with or being engaged by the EECS department in jointly delivering core computer science courses with overwhelming demand.
  • We are not creating opportunities for bringing people together to foster research that combines computing with other disciplines.
  • Explosive growth of computing technology has not been accompanied by a sufficiently critical evaluation of the societal impacts.
A Proposed Structure - Membership

• **Single vs Multi-Community faculty members (SCF and MCF):**
  • SCF have their main or only appointment in the SCoC.
  • MCF represent scholars who cross the boundary between another MIT department and the SCoC.

• MCF appointments based on a **fixed division of teaching effort** between an existing department and the SCoC (e.g., 50/50).

• The suitability of existing MIT faculty for MCF positions would be decided by an inter-disciplinary Computing Council.
  • Search for an MCF line would originate in an existing department, but the SCoC would provide one member for each MCF search committee.
  • MCF would satisfy their SCoC teaching commitments via co-teaching with a senior member of the SCoC.
  • SCoC also would provide each junior MCF with a mentor.
  • Promotion and tenure would happen within the home discipline with input from SCoC.
A Proposed Structure - Membership

• Incubator Groups:
  • SCoC offers groups of faculty the opportunity to apply for support and space to incubate new research topics and teaching opportunities.
  • Interested groups submit proposals to an inter-disciplinary faculty committee charged with making awards.
  • Incubation grants should be of a finite duration, perhaps two to three years.
    • At the end of that period, the activity in question should either become self-sustaining (in the form of a fundable research program or sustainable course) or it should end.

• Faculty Fellows:
  • These fellowships would allow interested faculty the opportunity to sit in the SCoC for a year or so.
  • These slots could be dedicated either to faculty who wish to contribute to computing or those wishing to infuse their current research with computational methods.
Common Ground for Teaching

**Key Idea:** Decouple the delivery of teaching from the traditional departmental structure by creating a Common Ground (course Σ) composed of several cross-departmental teaching groups.

**Benefits:**
- Potential to meet the target of producing bilingual students
- Expand the number of faculty who can teach critical computation courses in a coordinated fashion
- Together with the incubation structure, creates a more dynamic and adaptable structure than our traditional departmental structure.
Staffing of Teaching Groups/SCoC and EECS

Three models:

- **SCF Only**: SCoC becomes a college of CS and Computer Engineering
  - Excellent for maintaining high scholarly standards of CS
  - Do little to ensure computing is infused across campus.
  - Rejected by our group.

- **MCF Only**: SCoC has no permanent members, EECS outside SCoC
  - **Benefits**: Large number of connections to the rest of the campus
  - **Costs**:
    - Diffusion of responsibility
    - CS faculty on our working group do not support this model: Confusing to have a College of computing that is not the primary home to the Institute’s CS faculty.

- **MCF/SCF Hybrid**: Despite the costs, several members of the WG initially supported this model.
  - Necessity of clearly signaling our commitment to a new and dynamic approach to research and teaching in computing at MIT.

The models are:

- SCF Only (SCoC=EECS)
- MCF Only (SCoC∩EECS = ∅)
- MCF/SCF Hybrid (SCoC⊃ EECS)
In this setup:

- EECS faculty also MCF from the perspective of the Common Ground.

- An opportunity for EECS to reorganize and refocus, especially to go beyond its binary structure:
  - Electrical and Computer Engineering (ECE)
  - Computer Science (CS)
  - Artificial Intelligence and Decision Making (AI+D)

- **ECE unit also part of SoE**

**Major risk:**

- Striking the balance between the two constituent parts of the SCoC, Common Ground and EECS.
Implementation - EECS

• Most immediate challenge related to how EE will stay connected to SoE.
• One solution:
  • Course 6 remains in the SoE, creating a new course number for those who wish to be in the college, then allowing existing EECS faculty to self-select.
  • Creates a pathological sorting problem:
    • Splitting the department between the SCoC and SoE will likely result in the mathematics and computational side of EE joining the SCoC, leaving EE as an applied physics department that is well below critical mass.

• We propose that, at least for now, the entire department and all its courses be temporarily sitting both in SoE and SCoC.

• Our hope is that the reorganization of EECS into ECE, AI+D, and CS will:
  • Represent vibrant activities in increasingly active areas and fit well with the vision of the SCoC.
  • Lead to productive interactions across the EE/CS divide.

• Having developed a more productive set of intra-departmental interactions, any subsequent sorting or labeling would likely be more productive and less contentious.