

On the Diminishing Prospects for an Engineering Discipline of Requirements

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Agenda

- What do I mean by “requirements,” and what do I mean by “engineering”?
- Why does it matter?
- Why are prospects diminishing?
- Suppose you believe the argument – what should we do differently?

Requirements

- Part of the development process – interacting with stakeholders and producing representations that are used by implementers as the description for the intended functionality of a system under development
- So,
 - If I build something for myself, for example, without the intermediate requirements step, I don't consider that my intentions were “requirements”
- Requirements always has the flavor of a translation from the stakeholders' domain(s) to the developers' domain(s)

What Is Engineering?

- Creating cost-effective solutions
 - Engineering is not just about solving problems; it is about solving problems with economical use of all resources.
- to practical problems
 - Engineering deals with practical problems whose solutions matter to people outside the engineering domain-the customers.
- by applying scientific knowledge
 - Engineering solves problems in a particular way: by applying science, mathematics, and design analysis.
- to building things
 - Engineering emphasizes the solutions, which are usually tangible artifacts.
- in the service of mankind.
 - Engineering not only serves the immediate customer, but it also develops technology and expertise that will support the society.

What is Engineering?

- “The creative application of scientific principles to design or develop . . .”
 - American Engineers' Council for Professional Development
- “. . . applying technical, scientific and mathematical knowledge to design and implement . . .”
 - Wikipedia
- “Engineering is the practical application of science and math to solve problems . . .”
 - School of Electrical and Computer Engineering, Georgia Tech
- “the practical application of science to commerce or industry”
 - Princeton Wordnet

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- Engineering is a London-based fortnightly magazine
- Engineering - one of the four temperaments defined by David Keirsey's Myers-Briggs
- Engineering – Role assigned to playable characters in the Final Fantasy series of role-playing games by Square Enix
- Engineering is a Tamil language film slated to be released in 1999

Why Does it Matter?

- Aspirations and expectations that can't – and maybe shouldn't – be fulfilled
- Hides alternatives or forces them into the background
- Locks in one way – maybe not the best way – of factoring expertise

Why Are Prospects Diminishing?

- Two factors combine to create the problem:
- Software
 - Software is in everything
 - Software enables/encourages complexity
- More of life is lived in and through computers



Computation





Individual work applications





Networks
Communication
Group applications





Talking to friends

Texting

Sharing photos

Purchasing and listening to music

On and on . . .



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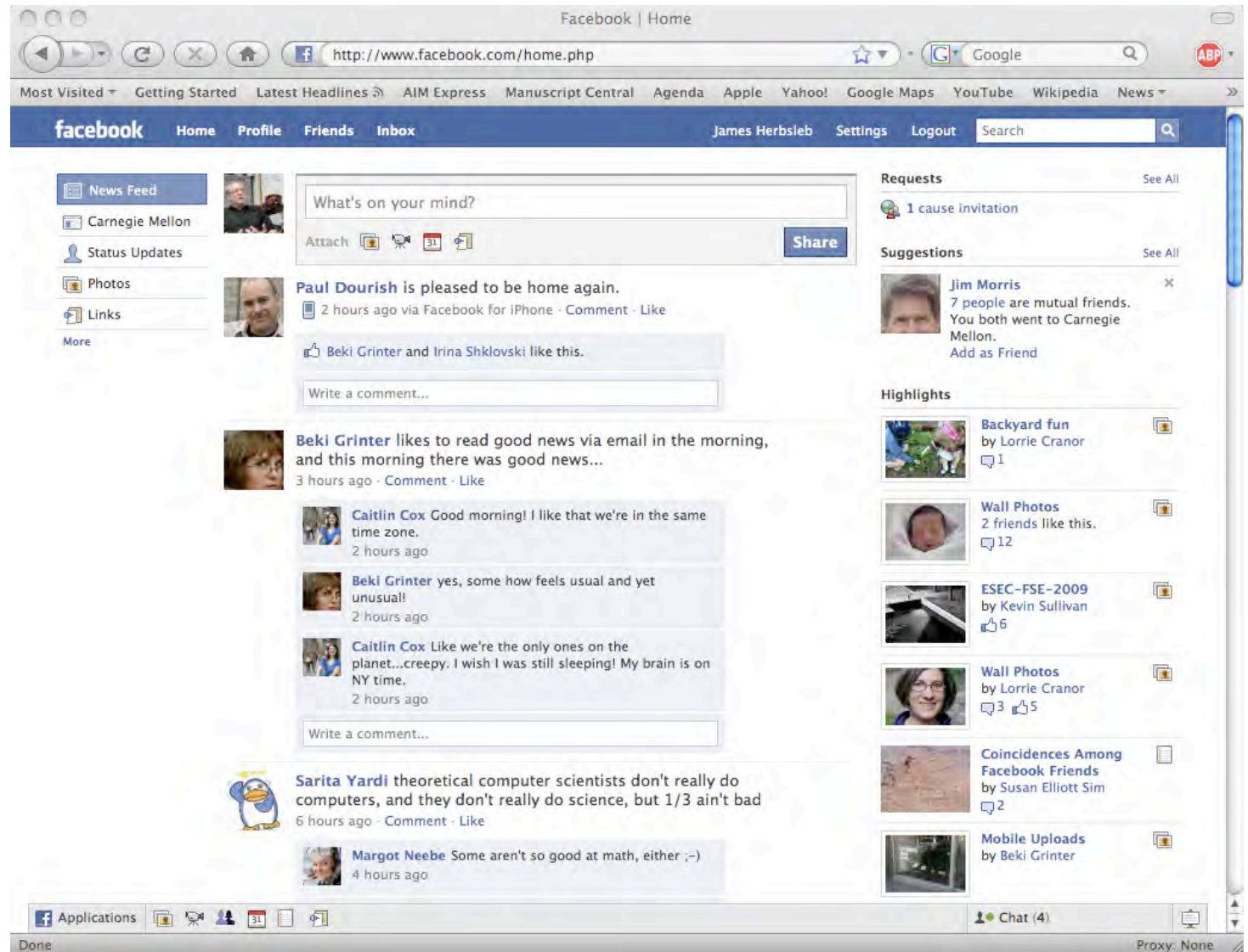
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Done Proxy: None

Mating

Gossip, Pictures, Updates



Sports

Madden NFL 10 : Football Video Game for Wii™, Xbox 360®, PLAYSTATION®3, PlayStation®2, PSP® (PlayStation®Portable) : EA SPORTS

http://maddennfl.easports.com/home.action?sourceid=madden_Broad

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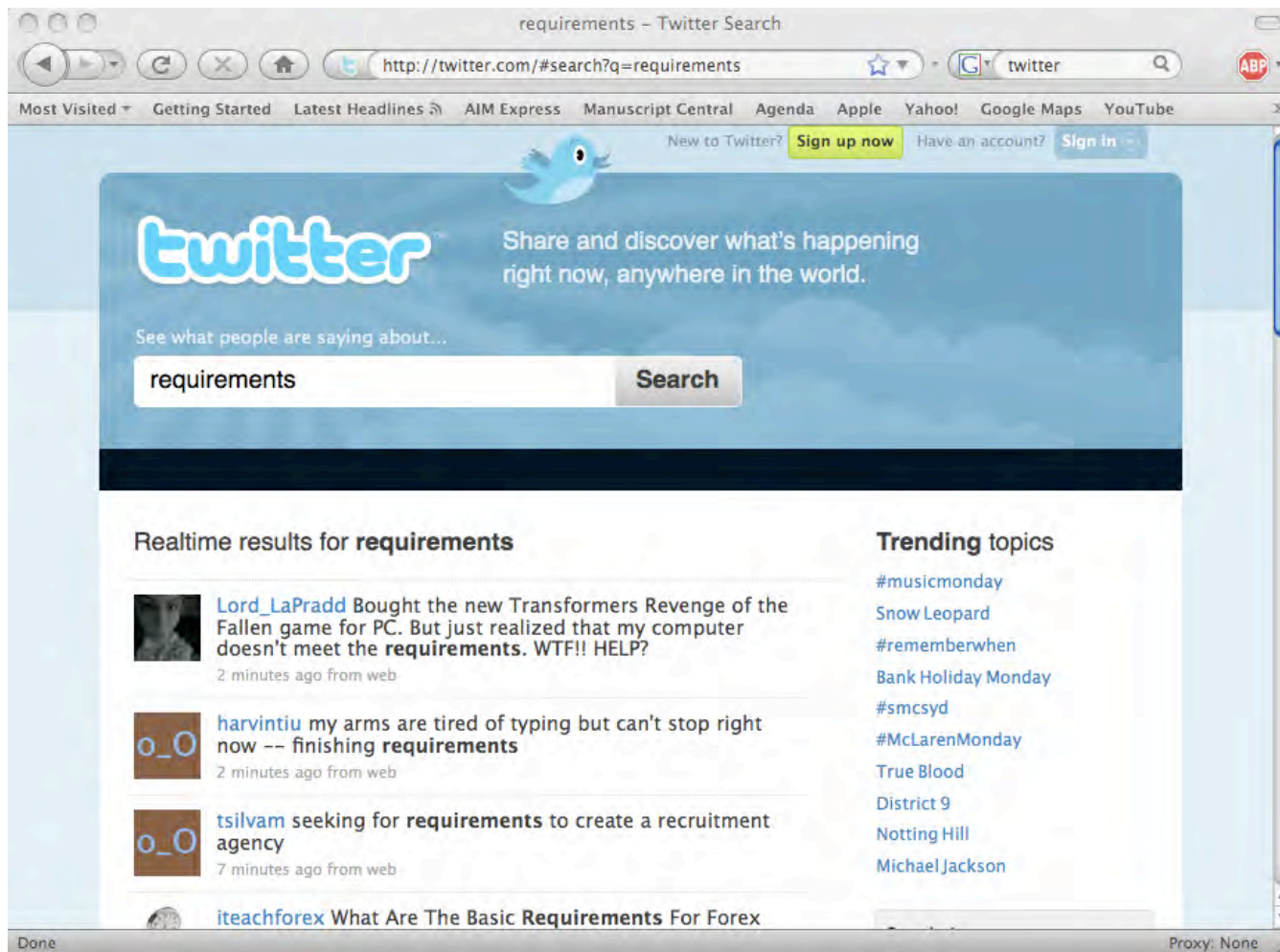
Done Proxy: None

And not just the young . . .

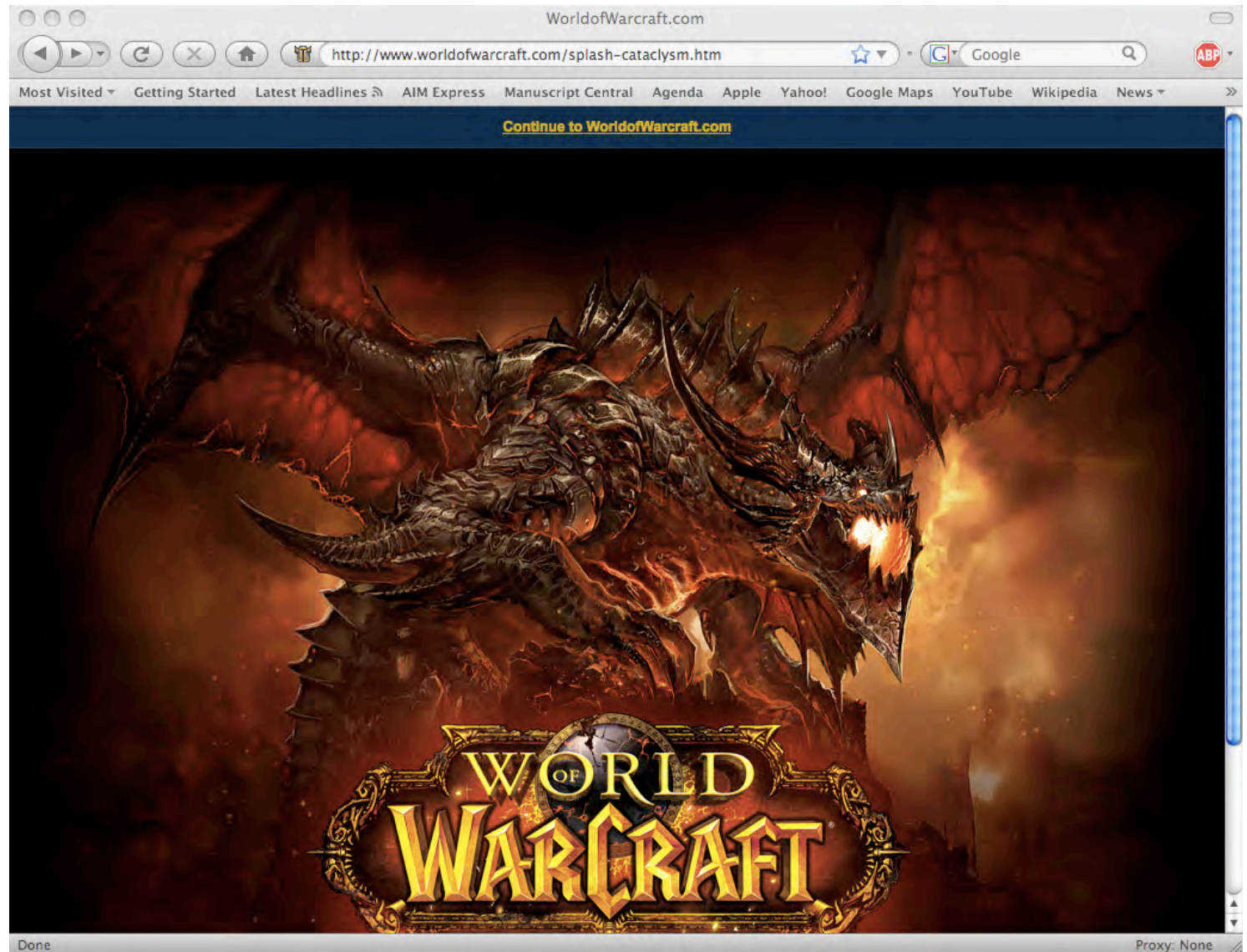


And not just men . . .





Tweeting



**Team-oriented collaborative
virtual mass murder**



Not just the web . . .

Ultra-Fast Trading

- Millions of shares in milliseconds
- Distribute orders to many exchanges
- Proprietary software
- Will generate \$8b in revenue this year

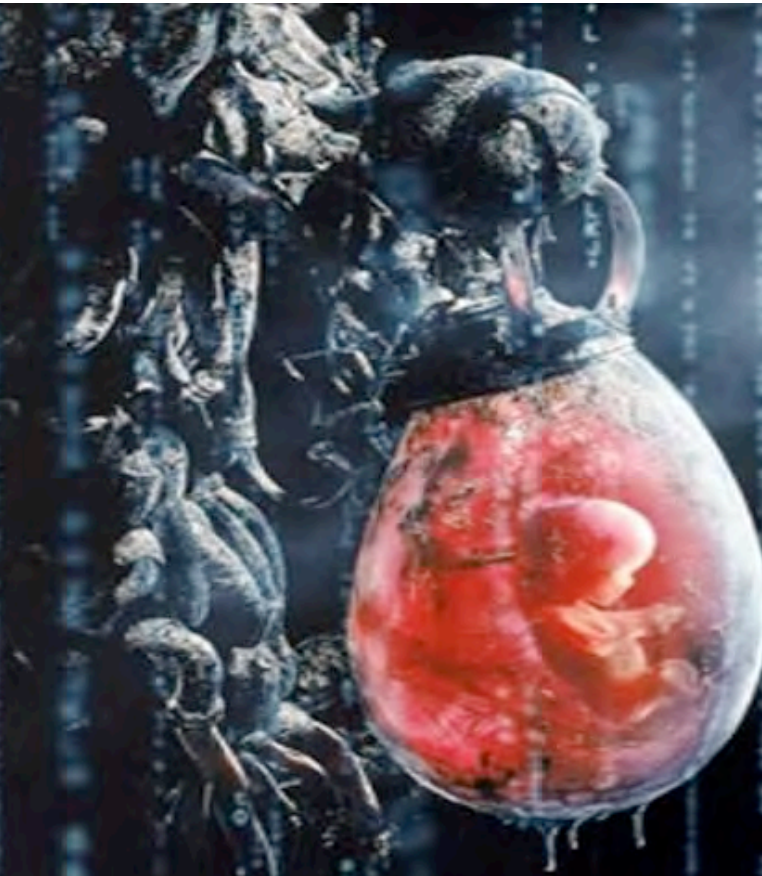


- Software engineers > \$10M
- Sergey Aleynikov arrested last week for stealing code
- Prosecutor claimed code could be used to “unfairly manipulate” markets

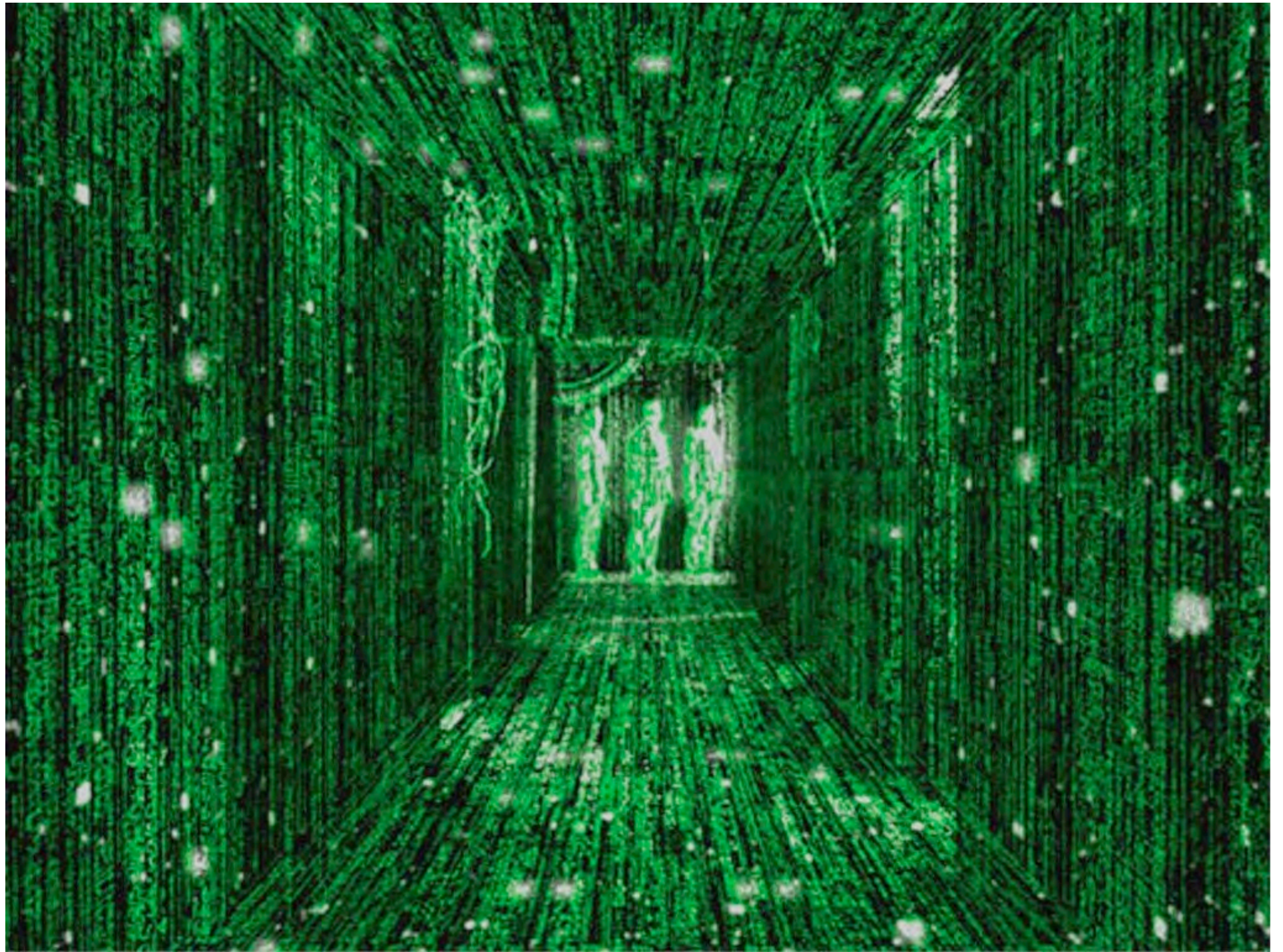
Where Are We Headed?

- More and more of life is
 - lived in and through computers
 - in contexts created, controlled, and manipulated by computers

MATRIX







Trends Shaping Technology Design

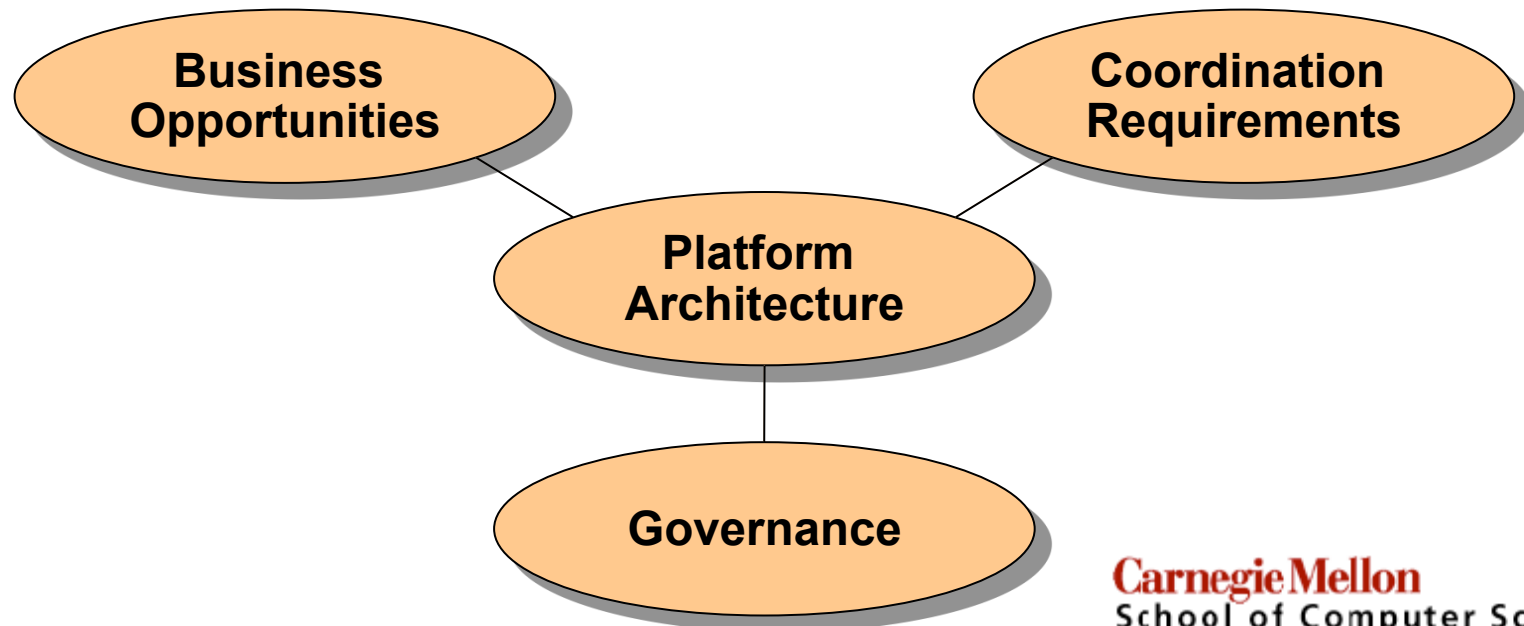
- Living in a computational landscape
- Side effects are often more important than intended effects
- Designed systems and social systems co-evolve
- How we organize to develop systems

Asking a Different Question

- Rather than ask
 - “How can I specify the system that my stakeholders need?”
- Maybe we should ask
 - “How can I set up the socio-technical system that will allow users, consultants, businesses, and everyone else to cooperatively build what all my stakeholders need?”
 - “Even though those needs are currently unknowable and evolving . . .”

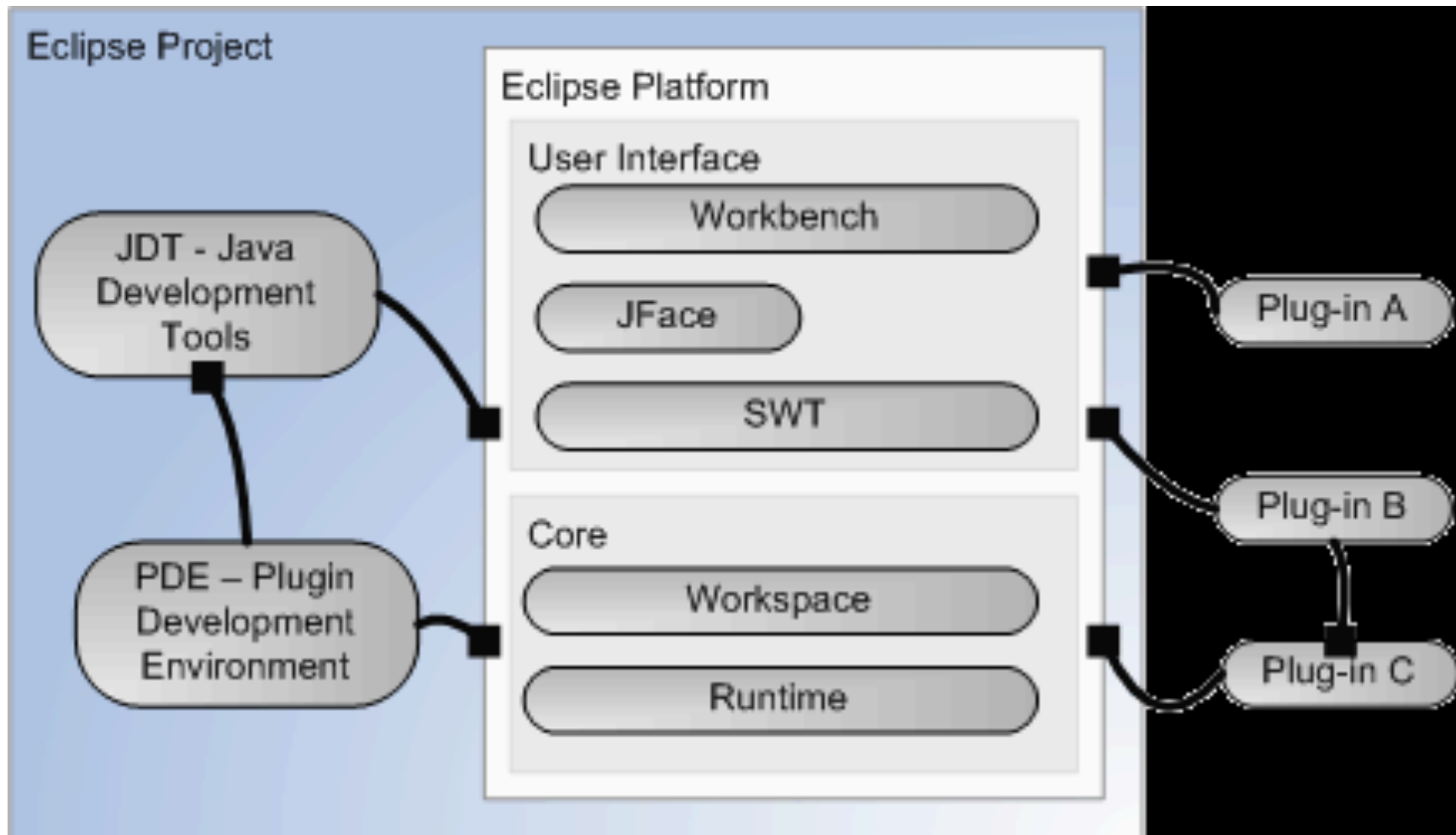
Research Directions

- How to design and deploy platforms for others to build on
 - Individual users (e.g., end-user programming)
 - Domain experts (e.g., statistics packages)
 - Commercial firms (e.g., open source ecologies)



Four Eclipse Slides

Eclipse Plug-in Architecture



Eclipse Business Opportunities

- Sell plugins: Eclipse Plugin Central
- Sell complementary hardware or software
- Sell customization, consulting, training services
- Use platform (RCP) for other products
- In all cases, strong network externalities

Eclipse Governance - 1

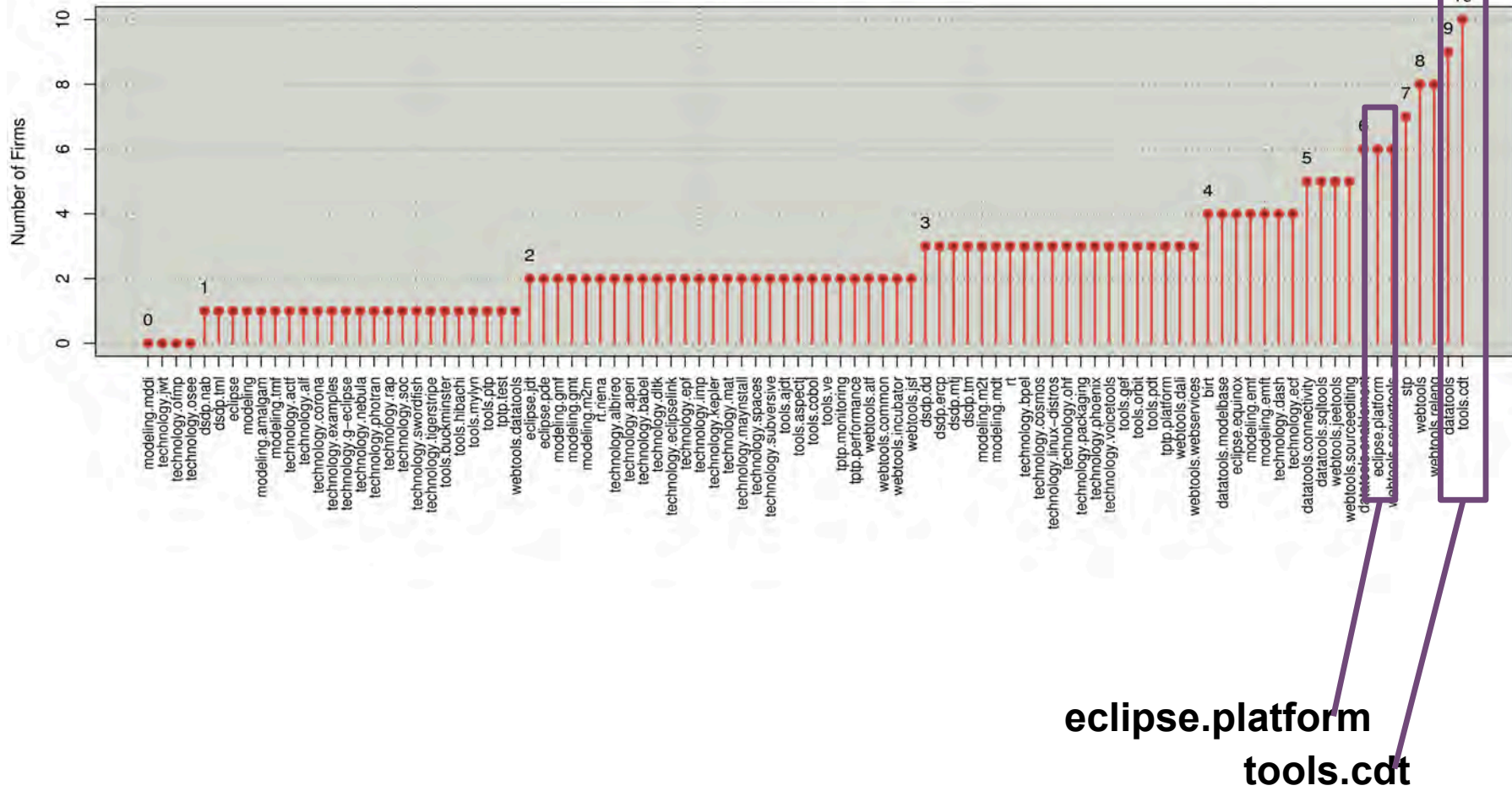
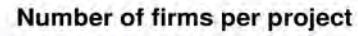
- Centralized functions
 - IP due diligence
 - Rules and process
 - Selecting, coaching, enforcing
 - Recruiting and marketing
- Decentralized functions
 - Deciding what (if anything) to build for the platform
 - Deciding if and how to contribute to Foundation
 - Committees
 - Marketing, etc.
 - Deciding on business model, how to pursue it
 - Services
 - Products

Eclipse Governance - 2

- Overall governance
 - Board of directors
- Foundation Councils
 - Requirements
 - Planning
 - Architecture

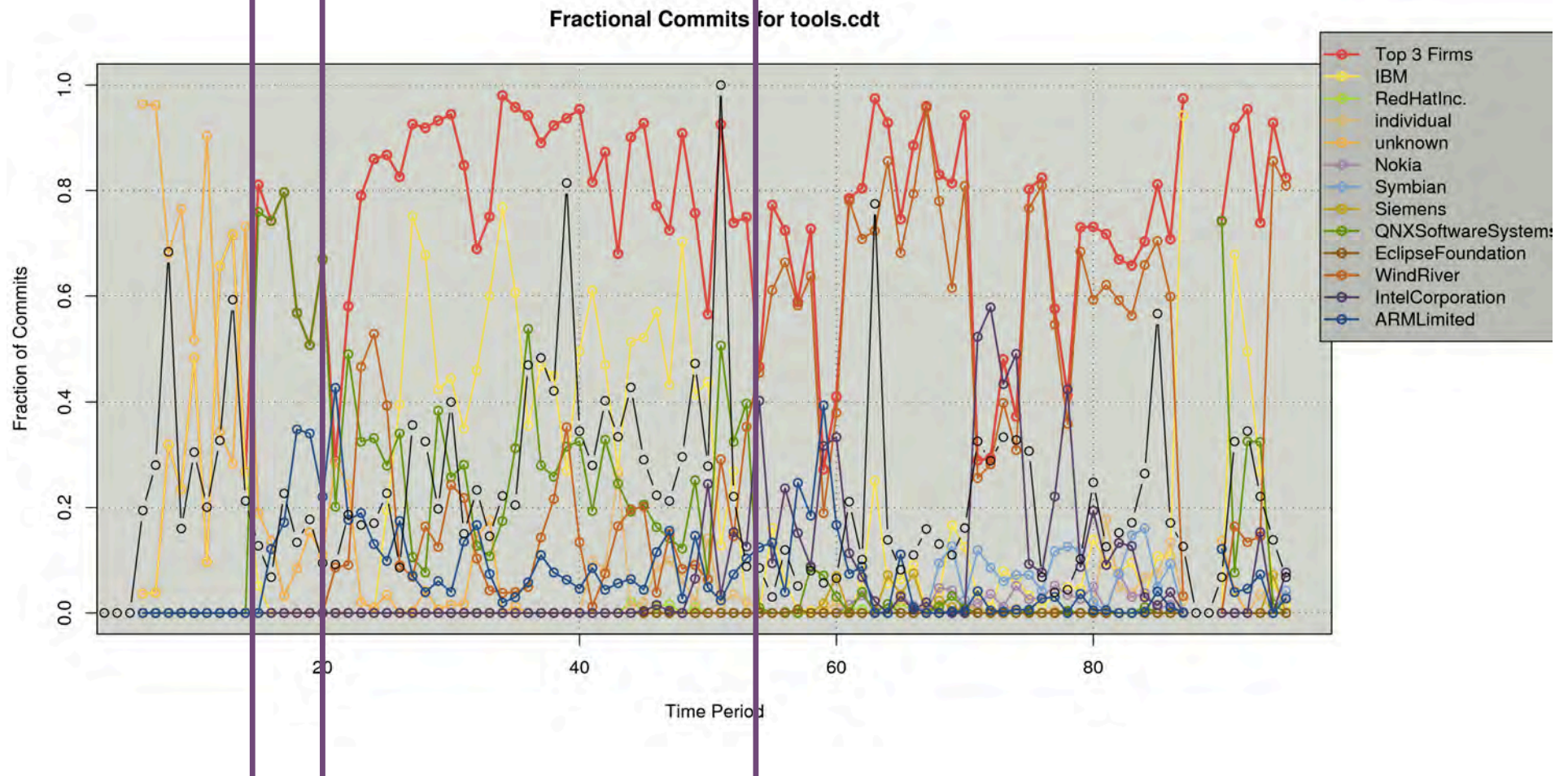
Coordination in Eclipse

- Overall, cooperative effort
- At level of subproject
 - One company does nearly all the work
 - Sometimes companies take turns on a particular subproject
 - IBM maintains and enhances the platform



Collaboration in CDT

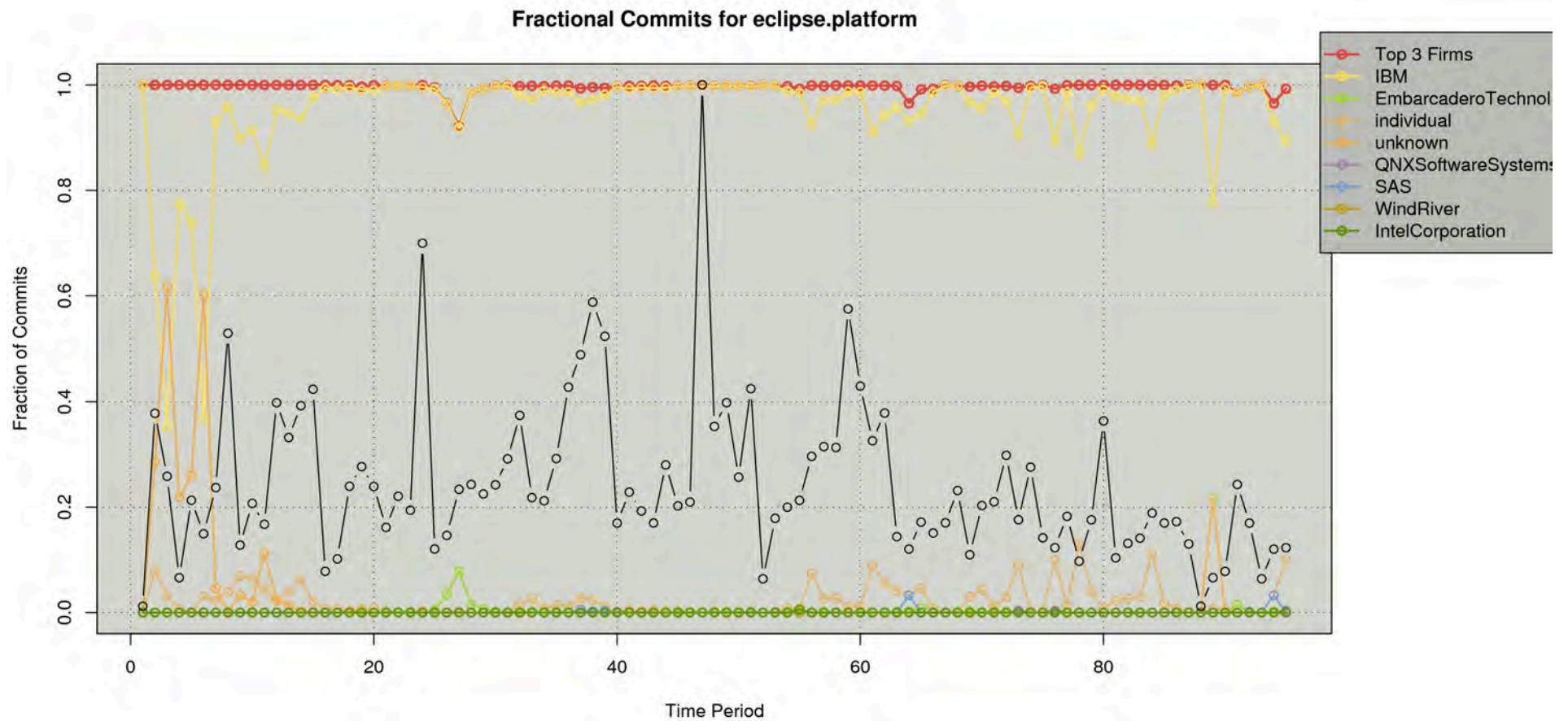
IBM Leaves/QNX Lead



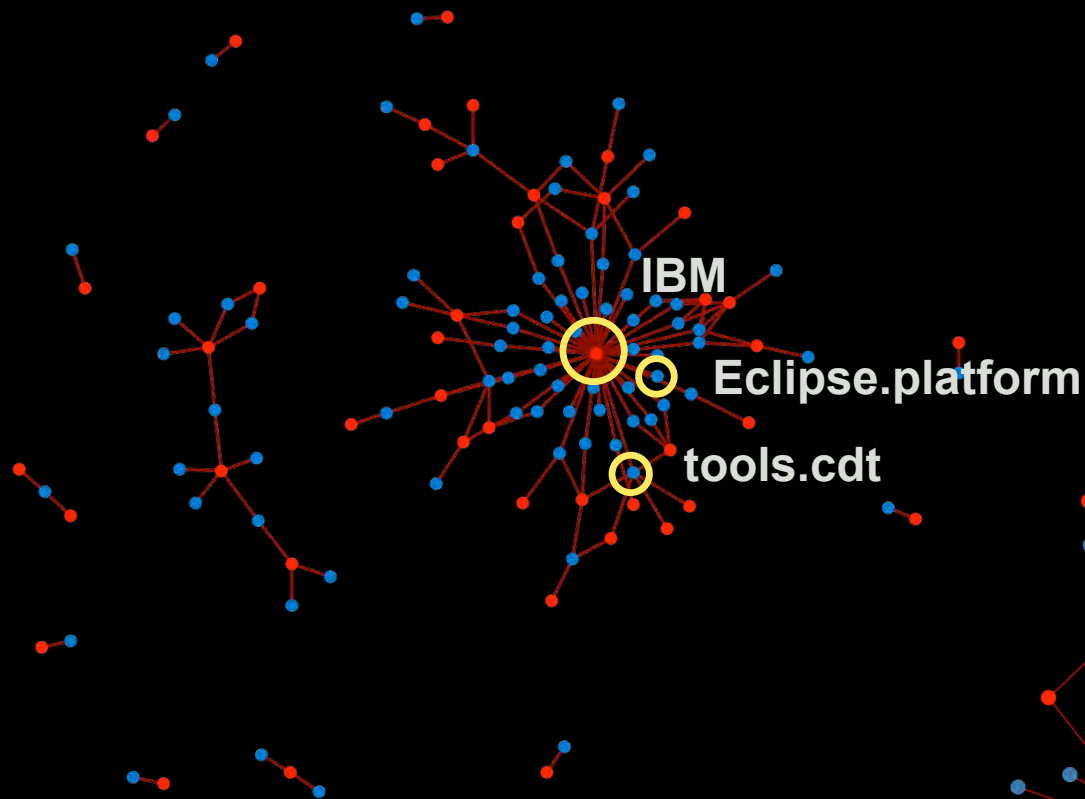
WindRiver Joins/IBM Lead WindRiver Leads

Carnegie Mellon
School of Computer Science

Who Builds the Platform?



Community Network Structure

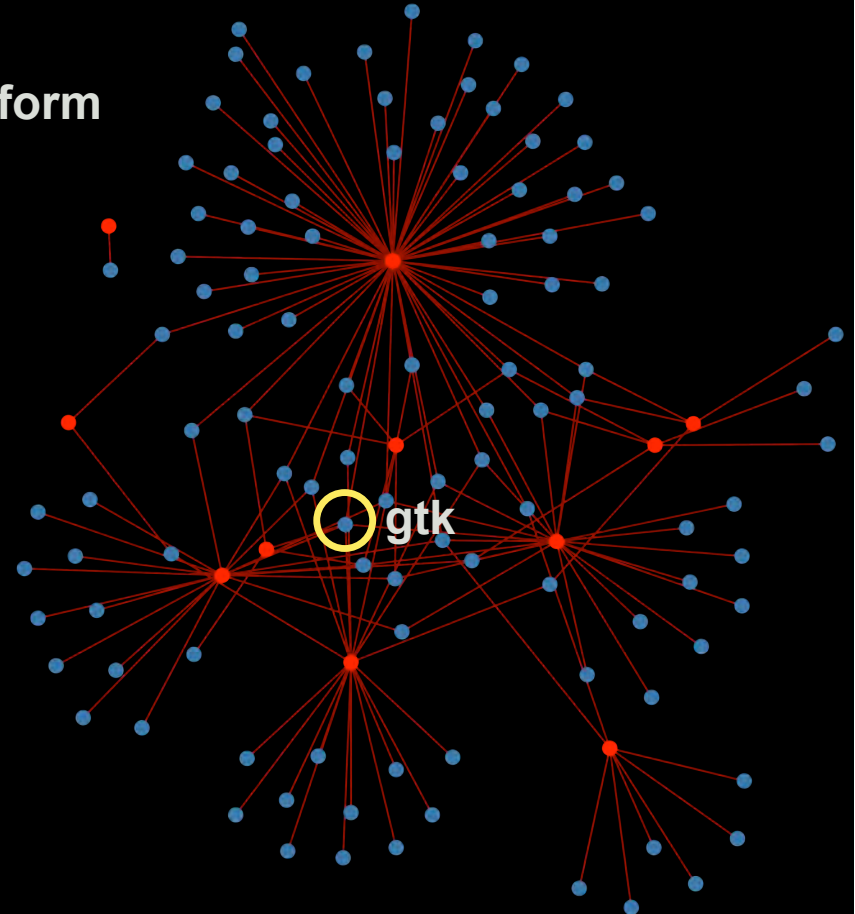


Eclipse

May 2008

GNOME

May 2005



Do commercial developers drive away volunteers (by firm)?

| <i>Variable</i> | <i>Estimate</i> | <i>Std Error</i> | <i>P-Value</i> |
|--------------------|-----------------|------------------|----------------|
| <i>Intercept</i> | 0.6032 | 0.1381 | <0.001 |
| <i>VolDevs</i> | 0.4212 | 0.0443 | <0.001 |
| <i>ComDevs(CF)</i> | 0.2050 | 0.0432 | <0.001 |
| <i>ComDevs(PF)</i> | -0.0433 | 0.0388 | 0.264 |
| <i>Commits</i> | 0.0711 | 0.0234 | 0.003 |

Developers at community focused firms have a significant attractive power while developers at product focused firms have no relation.

How to Train People for This?

- Computation, Organizations, & Society
 - PhD program in School of Computer Science at CMU
- Curriculum combines
 - Computer science
 - Machine learning/statistics
 - Network analysis/simulation
 - Policy
- Very successful to date

Summary of the Argument

- Systems that need “social smarts” are becoming increasingly prevalent
- Many key issues in determining the functionality of these systems are not amenable to traditional engineering approaches
- Therefore we need something *in addition* to traditional engineering approaches
- Alternatively, we could expand our notion of engineering to encompass new approaches

Questions?



Did you just say their field shouldn't exist?