The Dependability of Complex Socio-technical Systems

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Abstract. The story of software engineering has been one of learning to cope with ever greater scale and complexity. We're now building systems with hundreds of millions of users, who belong to millions of firms and dozens of countries; the firms can be competitors and the countries might even be at war.

Rather than having a central planner, we have to arrange things so that the desired behaviour emerges as a result of the self-interested action of many uncoordinated principals. Mechanism design and game theory are becoming as important to the system engineer as more conventional knowledge such as data structures and algorithms. This holds not just for systems no-one really controls, such as the Internet; it extends through systems controlled by small groups of firms, such as the future smart grid, to systems controlled by a single firm, such as Facebook. Once you have hundreds of millions of users, you have to set rules rather than micromanage outcomes.

Other social sciences have a role to play too, especially the behavioural sciences; HCI testing has to be supplemented by a more principled understanding of psychology. And as software comes to pervade just about every aspect of society, software engineers cannot avoid engaging with policy. This has significant implications for academics: for how we educate our students, and for choosing research topics that are most likely to have some impact.

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