Credits

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Recall from Mark Klein’s Talk…

“Theories and constructs from the field of economics can endow the notion of architecture with new meaning and consequently offer structuring principles for Ultra-Large-Scale Systems.”*

We put this idea to the test to allocate scarce bandwidth in an emulated tactical data network based on the US Navy’s LINK-11.

ULS Research Area
6.2 Computational Emergence
6.2.1 Algorithmic Mechanism Design
Computational

Mark Klein, Panel slides, SMART Ultra-Large-Scale Systems Forum
Did you know that...

- 98%+ of Google’s $6.7B revenue in 2006 has been attributed to an auction mechanism?
- the FCC has conducted auctions of licenses for electromagnetic spectrum since 1994?
- in 2007 three Nobel prizes in economics were awarded for work in mechanism design?
What is Computational Mechanism Design?

- A **mechanism** is an institution, such as a market or an auction, that defines the rules for how humans are allowed to interact, and governs the procedures for how collective decisions are made.

- A **computational mechanism** uses computational processes to act on behalf of humans, and/or uses computers to determine decision outcomes.

- **Computational mechanism design** is the art of designing computational mechanisms.

- Computational mechanism design straddles microeconomics, game theory, and computer science.
Why Study Tactical Data Networks?

A tactical data network will serve diverse needs of diverse users in a highly dynamic, performance-critical environment.

Many systems communicate only minimal information to conserve bandwidth and to minimize latency.

Mechanisms may provide a principled way to trade scarce bandwidth for value-driven improvements in data quality.

We will regard the system as a virtual economy, where bandwidth is scarce and information has value.
Our approach to studying mechanism design

Develop an environment to study mechanisms at scale

- tactical data network (LINK-11)

Study one mechanism in-depth in this environment

- Vickrey-Clarke-Groves auction

Evaluate engineering potential

- mechanism engineering as a peer of, for example, performance engineering?
demonstration...
Takeaway Point

“Since computation has moved over the past twenty years decisively closer to people, interfaces with social sciences such as Psychology and Sociology, besides Economics, have become increasingly important”

– Christos H. Papadimitriou, in “Algorithms, Games, and the Internet”