



FY2001 ONR CIP/SW URI



Software Quality and Infrastructure Protection for Diffuse Computing



Principal Investigator: Andre Scedrov

Institution: University of Pennsylvania

URL: <http://www.cis.upenn.edu/spyce>

STARTED IN MAY 2001



Software Quality and Infrastructure Protection for Diffuse Computing



URI, 2001

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Smart devices diffuse into the environment....



Room '40s

Desktop '80s

Wearable '90s

Pervasive '00s

... with control and assurance

URI Objective

Algorithms to model diffuse computing and achieve scaleable high assurance

DoD capabilities enhanced

Reduced cost, improved performance, and higher reliability for networked operations across untrusted networks

Scientific/technical approach

Computing and networking elements diffusing into the environment need:

- Local incentive-compatibility in global distributed computing
- Scaleable authorization mechanisms
- Assured communication
- Secure data storage and retrieval
- Experimental evidence

Accomplishments

- Incentive-compatible interdomain routing
- Tamper-proof algorithmic mechanisms
- Secrecy as non-deducibility
- Kerberos V protocol analysis
- Bottleneck analysis of Internet-scale network queuing and routing systems
- Multi-institution experimental platform

"Big Question"

- What is the right model for agent (in the general sense) behavior with respect to information, services, and security on the internet?

World contains:

- ☐ Rational agents who seek to maximize individual utility function
 - ☐ Byzantine agents. Traditional security model with malicious agents.
 - ☐ System components subject to failure
- Design systems to work with heterogeneous population of agents

SPYCE working groups include

- Interdomain routing and the Border Gateway Protocol (BGP)
 - Feigenbaum, Ramachandran : Yale
 - Mitchell, Teague : Stanford
 - Scedrov, Jaggard : Penn
- Network congestion control
 - Smith, Knutsson, Anagnostakis, Scedrov : Penn
 - Mitchell : Stanford
- Anonymity, privacy, and authorization
 - Syverson : NRL
 - Lincoln, Shmatikov : SRI
 - Dwork : Microsoft Research

Project Coordination:

Multi-Pronged Approach to Herding Research

- Physical meetings
 - Teleconferences
 - Video conferences
 - Email discussions
-
- Organization and coordination centered at UPenn

Project Meetings

- URI kickoff meeting July 7 '01 (DC)
- Video conference Oct 8 '01 (Penn-SRI)
- First board meeting Nov 5 '01 (Penn)
- Group meeting Nov 30-Dec 2 '01 (Calistoga)
- Weekly teleconferences in working groups
 - *Workshop on Economics and Information Security*
May '02 (Berkeley)
- Second board meeting June 21 '02 (Penn)

Sample presented today

- Market-based distributed computing
 - Chair: Joan Feigenbaum
- Secrecy and authentication
 - Chair: Patrick Lincoln
- Networking
 - Chair: John Mitchell

Market-based computing

- R. Sami, J. Feigenbaum, C. Papadimitriou, and S. Shenker
 - Lowest-cost routing mechanism
 - BGP-based distributed algorithm to compute prices
- J. Mitchell, V. Teague
 - Tamper-proof distributed mechanisms
 - Case study: multicast cost sharing

Secrecy and authentication

● J. Halpern and K. O'Neill

- Secrecy in multi-agent systems
- Knowledge-based approach: secrecy and non-interference seen as non-deducibility

● I. Cervesato, F. Butler, A. Jaggard, and A. Scedrov

- Scaling up formal methods to real-world authentication protocols
- Kerberos version 5

Networking

● B. Knutsson

- Content transcoding for heterogeneous clients
- Server-directed proxy transcoding that preserves semantics

● K. Anagnostakis, M. Greenwald, and R. Ryger

- Measurement methodology for internet congestion points
- Network simulation sensitive to topology
- Multi-institution experimental platform

Summary of Project: Multidisciplinary Research

- Software Quality and Infrastructure Protection for Diffuse Computing
- Algorithms to model diffuse computing and achieve scaleable high assurance
- Multi-institution experimental platform





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