Software Quality and Infrastructure Protection for Diffuse Computing

Principal Investigator: Andre Scedrov
Institution: University of Pennsylvania
URL: http://www.cis.upenn.edu/spyce

OPTION STARTED IN MAY 2004
The SPYCE Team

- Joan Feigenbaum (Yale)
- Joseph Y. Halpern (Cornell)
- Patrick D. Lincoln
- John C. Mitchell (Stanford)
- Andre Scedrov (U Penn)
- Jonathan M. Smith (U Penn) (until December 2003)
External Collaborators

- Cynthia Dwork (Microsoft)
- Tim Griffin (Intel)
- Vitaly Shmatikov (U Texas)
- Paul Syverson (NRL)
Postdocs

- Björn Knutsson, Penn (currently on leave)
- Ninghui Li, Stanford (until Summer 2003, now at Purdue Univ.)
- Michael Elkin, Yale (Fall 2003 - Summer 2004, now at Ben Gurion Univ., Israel)
- Gergei Bana, Penn (Fall 2004 - Summer 2005)

- 16 Ph.D. Students
8 Recent SPYCE Dissertations

• **Stanford**
  Ajith Ramanathan, Anupam Datta, Vanessa Teague

• **Penn**
  Kostas Anagnostakis, Gergei Bana
  MA Thesis: Jennifer Strong

• **Yale**
  Vijay Ramachandran, Jian Zhang

• **Cornell**
  Riccardo Pucella
Software Quality and Infrastructure Protection for Diffuse Computing
U Penn, Stanford, Cornell, Yale

URI, May 2001  Email: scedrov@math.upenn.edu  WWW: http://www.cis.upenn.edu/spyce/  May 23, 2005

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

Scientific/Technical Approaches
Computing and networking elements diffusing into the environment need:
- Local incentive-compatibility in global distributed computing
- Scalable authorization mechanisms
- Assured communication
- Experimental evidence

URI Objective
Algorithms to model, manage and maintain a computational infrastructure, distributed among many heterogeneous nodes that do not trust each other completely and may have incentives (needs, priorities).

Smart devices diffuse into the environment....

... with control and assurance

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Diffuse Computing

- Paradigm developing rapidly as a result of
  - commercial computing markets
  - now-recognized potential of peer-to-peer computing and grid computing
  - the need for distributed network-centric systems

- Raises challenges for
  - system design
  - software production
  - the development of mechanisms ensuring stable equilibria of diffuse systems
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Scientific Accomplishments
- Interdomain routing
  Path vector protocols [Penn-Yale-Intel]
  Local conditions for stable routes [Yale]
- Analysis of cryptographic protocols
  Formal methods for cryptography [Penn-Stanford]
  Kerberos 5 analysis [Penn-NRL]
- Logic for reasoning about policies [Cornell]
- SPAM reduction algorithms [Microsoft-Stanford]
- Privacy in databases [SRI-Microsoft]
- Anonymity and information hiding [Cornell-NRL]
- Content transcoding for heterogeneous clients [Penn]
- Flexible Lightweight Active Measuring Environment [Penn]

Educational Accomplishments
- Enhanced the ability to educate and train students in science and engineering and perform CIP/SW relevant research
  - 14 refereed journal publications
  - 65 refereed conference proceedings
  - 5 prototypes
  - 14 PhD students graduated, 16 PhD students supported
  - Members of NAS Computer Science and Telecommunications Board, Defense Science Board Task Force on Science and Technology, ACM Fellows, AAAI Fellows, ...

Project Contact Information
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          Prof. Joseph Halpern,
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SPYCE Objective:
Scalable Distributed Assurance

Develop fundamental understanding, models, algorithms, and network testbed, in order to reduce cost, improve performance, and provide higher reliability for networked operations across untrusted networks.

Incentives, Privacy, and Anonymity

Protocol Design and Analysis

Network Architecture

Trust Management
Today

- Network Security Analysis
  - Anupam Datta, Stanford
  - Gergei Bana, Penn

- Networking
  - Honghui Lu / Kostas Anagnostakis, Penn

- Privacy
  - Paul Syverson, NRL