Session 1: New Challenges and New Architectures

Session Chair: David Cousins
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Counter Terrorism Technology Challenges (1)

1. Pattern matching of streams at Tb/sec rates

2. Concept transformation and analysis technology
   - Engineering dynamic, overlapping, federated ontologies
     - Pruning, segmentation, decomposition, and re-aggregation
   - Convert concepts into pattern match templates

3. Manipulating Data as Networks and Graphs (huge ones at that)
   - Need techniques to discover and describe patterns of interest within extremely large graphs

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Counter Terrorism Technology Challenges (2)

4. Accurate machine translation of raw data such as images, video, handwriting, foreign language speech etc.

5. Context Aware Visualization
   - Enable people to monitor, understand, and interact with system activities at multi-terabyte rates
   - Visualize abstracted concepts, transforms, and feature spaces

6. System architectures
   - How to design, build, and control massive systems?
   - System metrics and performance characterization

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Invited Speaker: Dr. Ruth David

President and CEO,
ANSER Institute for
Homeland Security

Topic: Homeland Security:
Challenges for the Computing
Community

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The *Mercury* System: Embedding Computation into Disk Drives

Roger D. Chamberlain, Ron K. Cytron, Mark A. Franklin, and Ronald S. Indeck; Center for Security Technologies, WUSL

- *Problem:* Data Searches in a conventional systems result in inefficient use of fast components.
- *Solution:* embed a reconfigurable search engine directly in the disk drive. Enables unstructured text searching and sequence matching at full streaming disk rates
- *Future efforts:*
  Image search
  template matching

Table 1. Application speedups.

Application	Disk-limited speedup	Logic-limited speedup
Exact text search	1.1	14
Approx. text search	12	31
Biosequence search	50	125

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Hybrid Optical/Digital Processor for Radar Imaging

Mr. Keith Frampton, Essex Corporation;
Mr. Patrick Stover, Annapolis Micro Systems, Inc.

- *Presenting a case study:*
  - Integration of optical and COTS FPGA technologies.
  - Accelerated development through the use of COTS FPGA application builder tools.
  - Processes 1 GHz of instantaneous bandwidth in real time without wide band ADCs.

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HPCS Application Analysis & Assessment

Dr. Jeremy Kepner, MIT Lincoln Laboratory
Dr. David Koester, The MITRE Corporation

- ***Problem:*** How do we assess the end-user value of new "high productivity" computing systems for a given mission?
  - Must move beyond the "MachoFlop".
  - Reassess how one defines and measures:

    performance, programmability, portability, robustness and productivity.
- ***Solution:*** HPCS is developing an assessment framework where both *Execution Time* and *Development Time* are quantified in order to measure overall Productivity