Session 1: New Challenges and New Architectures

Session Chair: David Cousins
Division Scientist
High Performance Computing Dept
BBN Technologies
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
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
Invited Speaker: Dr. Ruth David
President and CEO,
ANSER Institute for Homeland Security

Topic: Homeland Security: Challenges for the Computing Community
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.

<table>
<thead>
<tr>
<th>Application</th>
<th>Disk-limited speedup</th>
<th>Logic-limited speedup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exact text search</td>
<td>1.1</td>
<td>14</td>
</tr>
<tr>
<td>Approx. text search</td>
<td>12</td>
<td>31</td>
</tr>
<tr>
<td>Biosequence search</td>
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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.
**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