ILLIAC IV
Pico Computing Cluster Architecture

- Start with Small Form Factor FPGA Board
  - ExpressCard/34
- Xilinx Virtex-5 FPGA
- Scalable – Can start with 7 FPGA’s
- Scale up to 100 FPGA’s
Pico Computing Products

- Small Form Factor
  - ExpressCard/34
  - E-16
  - Virtex-5 LX50
  - 32MB PS RAM
  - X1 PCIe Interface
HPC in a Laptop

- Random Number Generator Example
  - 9.1x Faster than CoreDuo
  - 20 Instances
  - 740 Million/Second
  - Integers
  - Approximately 50% of FPGA (LX50) Used
HPC in a Laptop

- Bluetooth Pin Cracking Example
  - 1 Instance
  - 10 Million/Second
  - Approximately 50% of FPGA (LX50) Used
Scalability

- Up to 7 E-16 Cards
- Fits a x8 or x16 PCIe Slot
- Full x1 PCIe Lane to each card
SC3 SuperCluster

- Up to 28 E-16 LX50 Cards
  (28 Virtex-5 LX50 FPGA’s)
- Intel Xenon Host CPU
- PCIe Backplane
- COTS Components
SC3 SuperCluster

- 28 E-16LX50 Cards
- Only Consumes Approximately 160 Watts
- Generates less heat than RAM
## SuperCluster Performance

<table>
<thead>
<tr>
<th>Key Recovery</th>
<th>Standard Core2Duo Processor</th>
<th>SC2 Cluster 15 E-12LX25</th>
<th>SC3 Cluster 28 E-16LX50</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lanman</strong> (all typable characters)</td>
<td>20 Days 5M/sec</td>
<td>24 Minutes 5.6B/sec</td>
<td>8 Minutes 17B/sec</td>
</tr>
<tr>
<td><strong>WPA</strong> (1 million word list)</td>
<td>4 Hours 90/sec</td>
<td>155 Seconds 6,450/sec</td>
<td>55 Seconds 18,060/sec</td>
</tr>
<tr>
<td><strong>WEP</strong> (40bit key)</td>
<td>42 Days 300K/sec</td>
<td>2 Hours 135M/sec</td>
<td>50 Minutes 364M/sec</td>
</tr>
<tr>
<td><strong>Blue Tooth Pin</strong> (10 digit pin)</td>
<td>2.4 Days 48K/Sec</td>
<td>66 Seconds 150M/sec</td>
<td>23 Seconds 420M/sec</td>
</tr>
</tbody>
</table>