Findings in High-Speed OrthoMosaic

David Piekny, Solutions Product Manager
PCI Geomatics
Committed To Image-Centric Excellence

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Think PCI Geomatics is just a desktop software company? Think bigger!

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Overview

- Quick Intro to PCI Geomatics
- Processing Trends
- GXL System Review
- Balancing GPU and CPU Resources
- System Considerations
- Results and Metrics
PCI Geomatics Profile

- **COTS** – Geomatica, GeoImaging Tools
  - North America – Direct
  - Internationally – 45 Resellers
  - GI Tools for ArcGIS – Image Processing

- **Solutions** – GXL
  - Aerial – MicroSoft UltraCam Channels
  - Satellite – Direct and Resellers

- **Custom Software Developer**
  - Industry & Customer specific
Processing Trends

- Industry Trends 2006-2011
  - Bigger Image Footprints
  - Bigger Project Blocks
  - Integrated Workflows

- Needs
  - Same or better turnaround
  - Same or better operational costs

- Solution
  - Automation and Innovation
  - Multi-Core CPU/GPU Parallel Processing
  - Local, Distributed and Cloud networks
The GeoImaging Accelerator (GXL) is a High Performance Computing solution for high-speed ortho-mosaic processing.

The GXL Offers:

- A Job Processing System
- Modular Components
- Advanced System Architecture
- Distributed Processing
GXL Workflow

Data → GeoImaging Accelerator → Products

Spotlight Interface/Database → Job Processing System (JPS) → GeoImaging Accelerator
Browser-Based Interfaces

Metadata
(Images/Sets)

Query Box, Results and Image Selection

Image Pane showing Footprints
Some Benefits of Recent Advances

- **High Throughput, High Speed**
  - Do more work, or conversely use less time

- **Flexible and Automated**
  - Fewer operations, greater output variety

- **Scalability and Extensibility**
  - Re-task HW to suit processing volumes
  - Re-task SW to suit output requirements
GXL Rack Architecture

Base System expandable with additional CPU or GPU processing nodes.
CPU/GPU Topology 1

- ‘Traditional’ GPU setup for general IT
- For GPU Intensive Tasks
- 4 GPUs for each CPU Server
- Not well suited to simple ortho
- Cannot ‘feed’ the GPUs
CPU/GPU Topology 2

- ‘Preferred’ GPU setup for GXL
- For both CPU and GPU Intensive Tasks
- 2 GPUs for each CPU Server
- Improved communication between devices
- Better performance:cost ratio
CPU/GPU Topology 3

- ‘Alternate’ GPU setup for general IT
- For both CPU and GPU Intensive Tasks
- 2 GPUs for each CPU Server
- More flexibility for CPU power, storage
- Larger price and footprint

CPU0

GPU0

GPU2

PCle 2.0 x16 HIC

CPU0

CPU2

CPU1

CPU

GPU1

GPU3

PCle 2.0 x16 HIC

CPU0

CPU2

CPU

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System Considerations

[Diagram showing a network of servers and workstations with a bottleneck highlighted between the Data Server and Processing Server 1.]

Controller Workstation  
Processing Server 1  
Processing Server 2  
Processing Server N  
Quality Control Workstations
Cloud Considerations

Bottleneck

Your Data

Cloud

Data Server

Controller Workstation
Processing Server 1
Processing Server 2
Processing Server N

Quality Control Workstations
Network Considerations

- Network bandwidth is the limiting factor
  - Anytime a SAN or NAS is used
  - Common to any HPC solution, not just the GXL
  - Can improve performance by reducing I/O operations

<table>
<thead>
<tr>
<th>Expected Throughput:</th>
<th>Required Network Speed:</th>
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<tbody>
<tr>
<td>~200 Images / day</td>
<td>50Mb/sec combined I/O</td>
</tr>
<tr>
<td>~1000 Images / day</td>
<td>100Mb/sec combined I/O</td>
</tr>
<tr>
<td>~2500 Images / day</td>
<td>200Mb/sec combined I/O</td>
</tr>
</tbody>
</table>
Speed Comparison: August 2010

- 25 UCX Images, ~400Mb Each, Level 3 RGB 8bit
- Dual Quad Core CPU with NVIDIA GTX 280 GPU

- **Test 1: Single-Threaded (Geomatica)**
  - Manual Ortho-Mosaic Workflow: 6 hours

- **Test 2: Multi-Threaded (OM/OV)**
  - Semi-Automated Ortho Mosaic Workflow: 2.5 hours

- **Test 3: GPU Optimized (GXL)**
  - Fully-Automated Ortho Mosaic Workflow: 20 minutes
  - Compare to today’s results: 7 minutes
Project Results

- Each vertical series is one project over time
- Topmost points represent 2nd generation HW
- Gen2: Speedup is 1.9x
- Mean speed is 1.6TB/day
- Median speed 1.5TB/day
What Next?

- **Hardware**
  - Solid-State Drives (SSD): Faster seek/read
  - New configurations, e.g. iSCSI, increasing parallel disks

- **IT Infrastructure**
  - Uni-Directional Data-Flow
  - Cloud data-management strategies

- **GXL Software**
  - Thread-safe operations for ‘per-core’ management
  - Reducing read/write operations
Thank You!

David Piekny

Product Manager – GXL
PCI Geomatics
Tel: +1 905 764 0614 x2273
M: +1 416 786 9290
Fax: +1 905 764 9604
piekny@pcigeomatics.com