



Findings in High-Speed OrthoMosaic

David Piekny, Solutions Product Manager

PCI Geomatics

Committed To Image-Centric Excellence

**Technical Session 6, Rm. 203D
Tuesday May 3rd, 9:30-11:00 AM
ASPRS 2011, Milwaukee, WI**

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



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, Geolmaging 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





GeoImaging Accelerator - GXL

The GeoImaging Accelerator (GXL) is a High Performance Computing solution for high-speed ortho-mosaic processing.

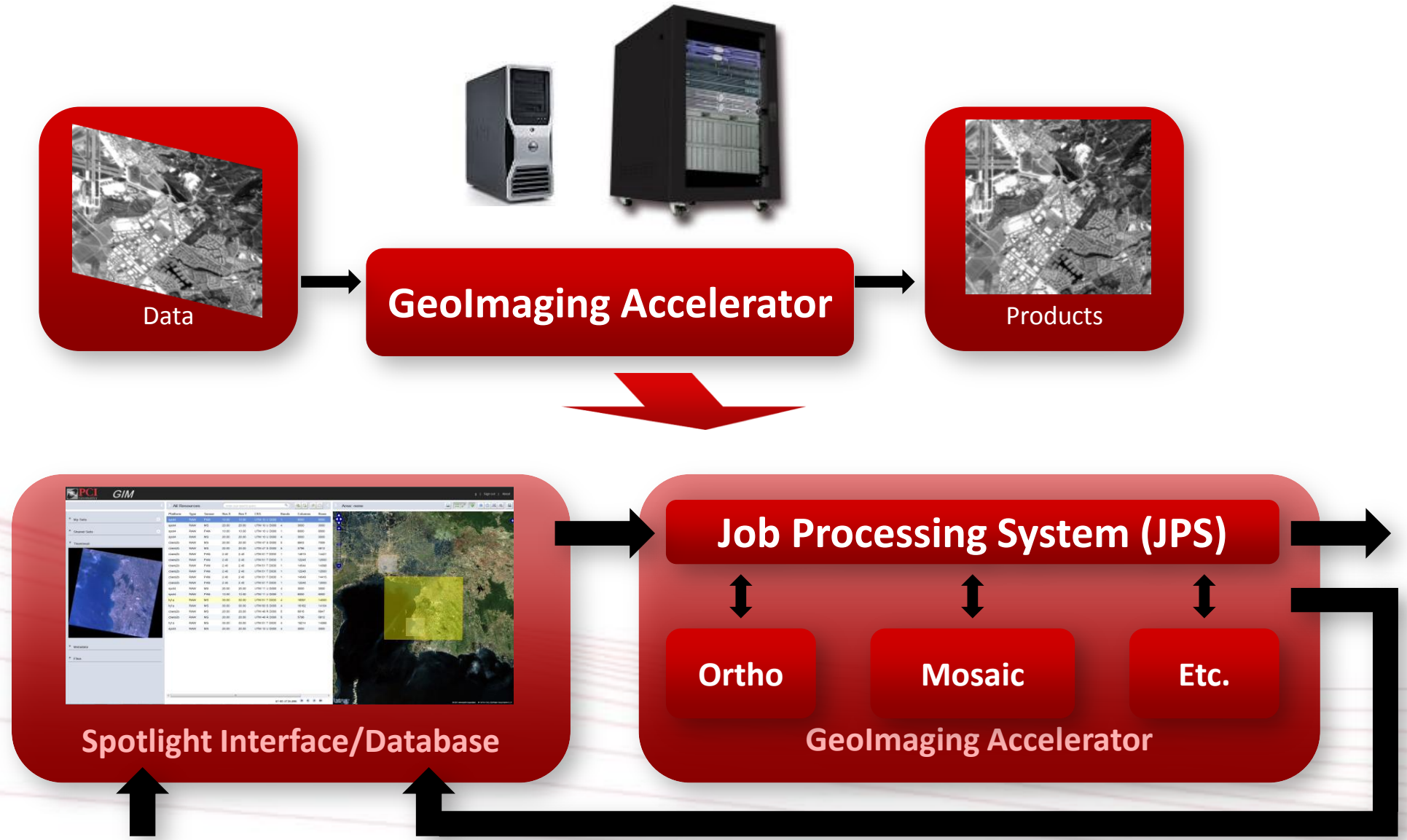
The GXL Offers:

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





GXL Workflow

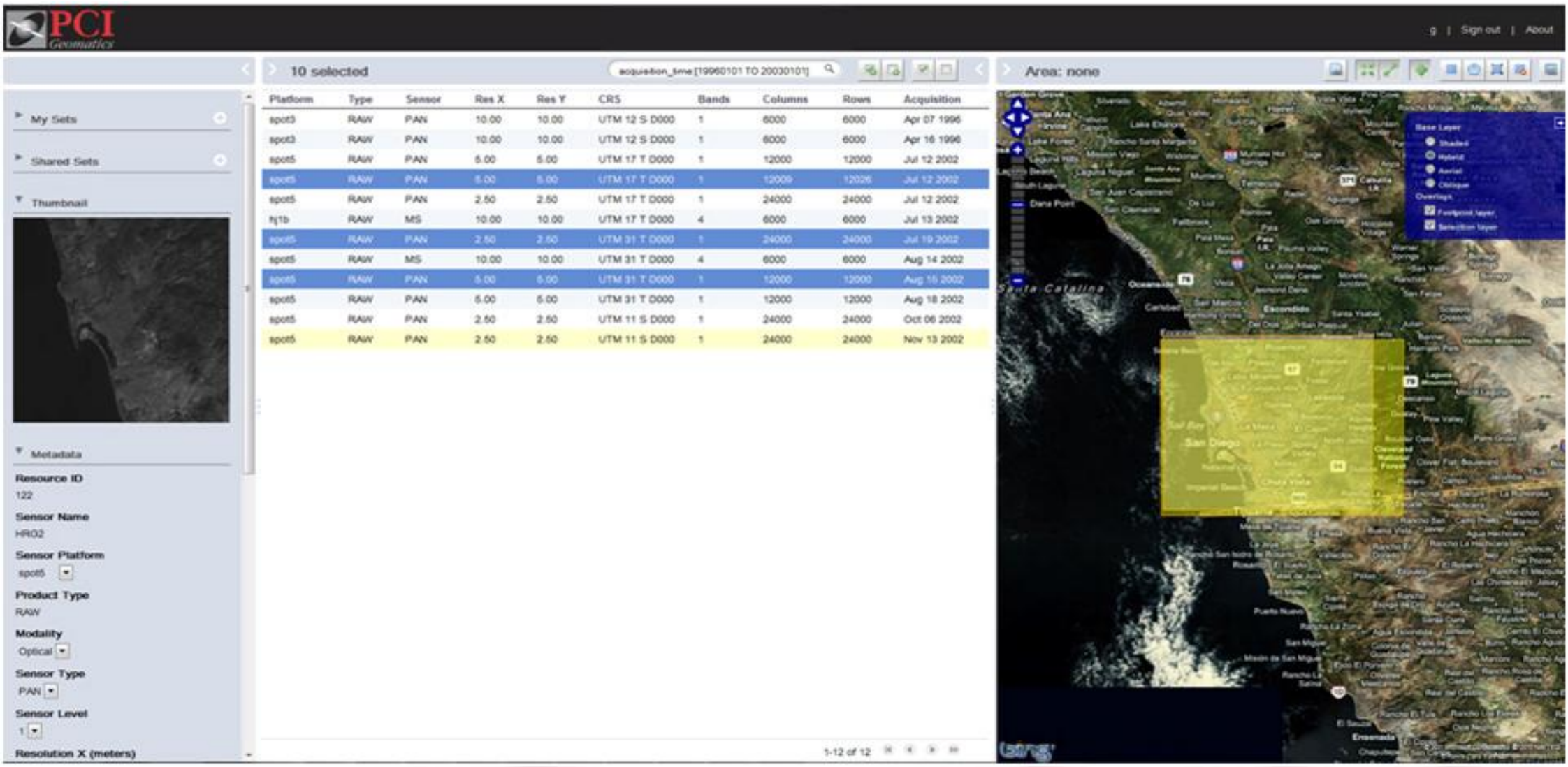




Metadata (Images/Sets)

Query Box, Results and Image Selection

Image Pane showing Footprints



The screenshot displays the PCI Geomatics web interface. On the left is a sidebar with 'My Sets', 'Shared Sets', and 'Thumbnail' sections. The main area features a search bar with the query 'acquisition_time[19960101 TO 20030101]' and a table of 10 selected results. The table columns are Platform, Type, Sensor, Res X, Res Y, CRS, Bands, Columns, Rows, and Acquisition. A metadata sidebar on the left shows details for a selected resource, including Resource ID (122), Sensor Name (HRO2), Sensor Platform (spot5), Product Type (RAW), Modality (Optical), Sensor Type (PAN), and Sensor Level (1). On the right, a map shows a yellow footprint overlay over a geographic area, with a legend on the far right.

Platform	Type	Sensor	Res X	Res Y	CRS	Bands	Columns	Rows	Acquisition
spot3	RAW	PAN	10.00	10.00	UTM 12 S D000	1	6000	6000	Apr 07 1996
spot3	RAW	PAN	10.00	10.00	UTM 12 S D000	1	6000	6000	Apr 16 1996
spot5	RAW	PAN	6.00	6.00	UTM 17 T D000	1	12000	12000	Jul 12 2002
spot5	RAW	PAN	5.00	5.00	UTM 17 T D000	1	12000	12000	Jul 12 2002
spot5	RAW	PAN	2.50	2.50	UTM 17 T D000	1	24000	24000	Jul 12 2002
HyTb	RAW	MS	10.00	10.00	UTM 17 T D000	4	6000	6000	Jul 13 2002
spot5	RAW	PAN	2.50	2.50	UTM 31 T D000	1	24000	24000	Jul 19 2002
spot5	RAW	MS	10.00	10.00	UTM 31 T D000	4	6000	6000	Aug 14 2002
spot5	RAW	PAN	5.00	5.00	UTM 31 T D000	1	12000	12000	Aug 16 2002
spot5	RAW	PAN	5.00	5.00	UTM 31 T D000	1	12000	12000	Aug 18 2002
spot5	RAW	PAN	2.50	2.50	UTM 11 S D000	1	24000	24000	Oct 06 2002
spot5	RAW	PAN	2.50	2.50	UTM 11 S D000	1	24000	24000	Nov 13 2002



Some Benefits of Recent Advances

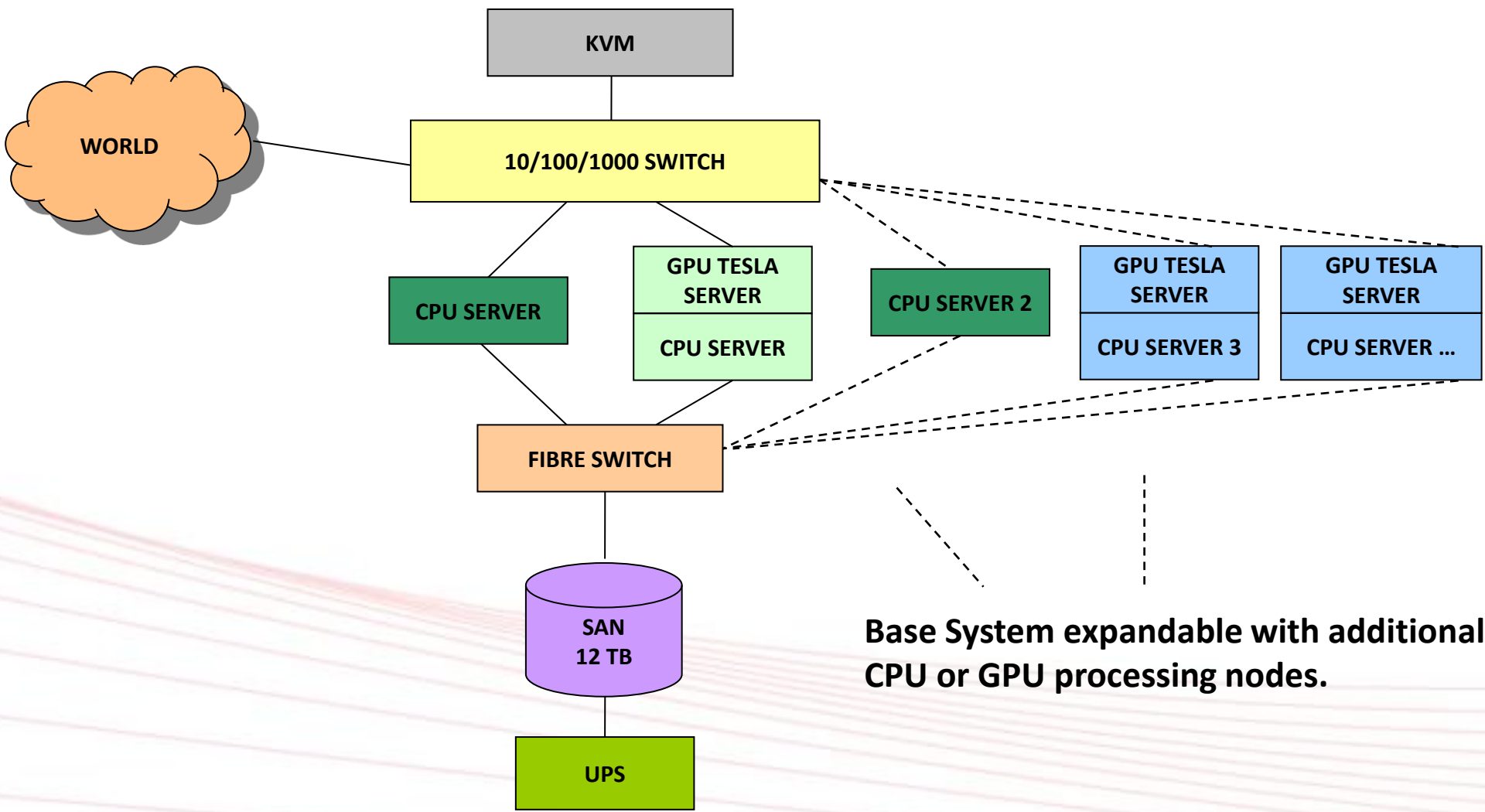
- **High Throughput, High Speed**
 - Do more work, or conversely use less time

- **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

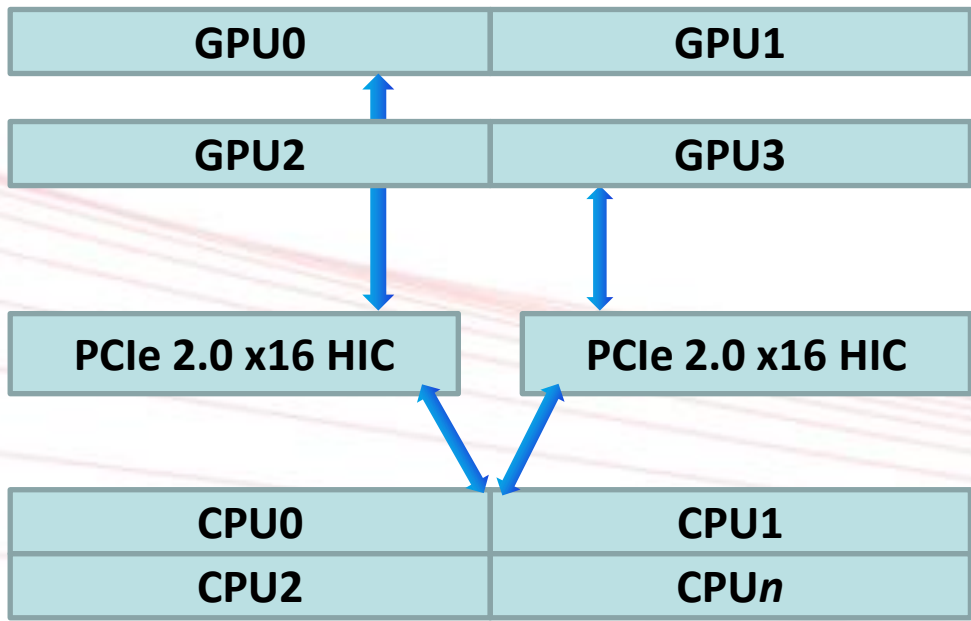
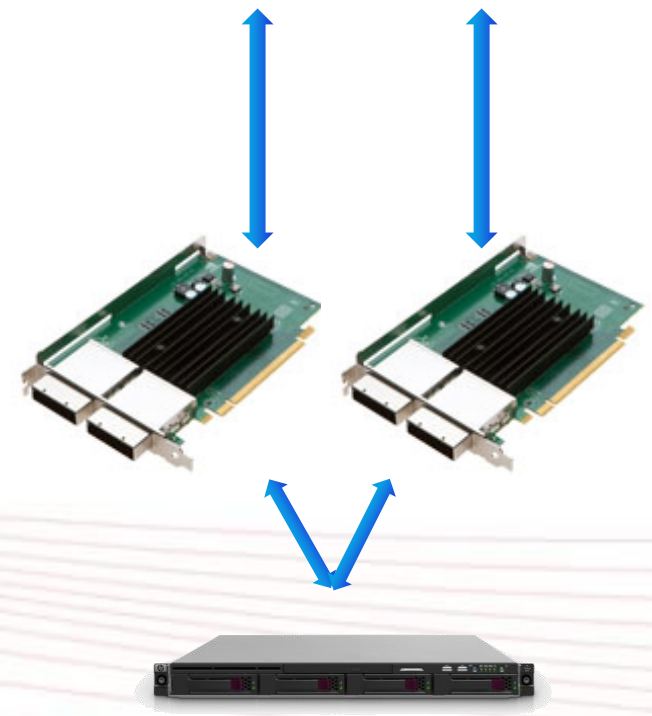


Base System expandable with additional CPU or GPU processing nodes.



CPU/GPU Topology 1

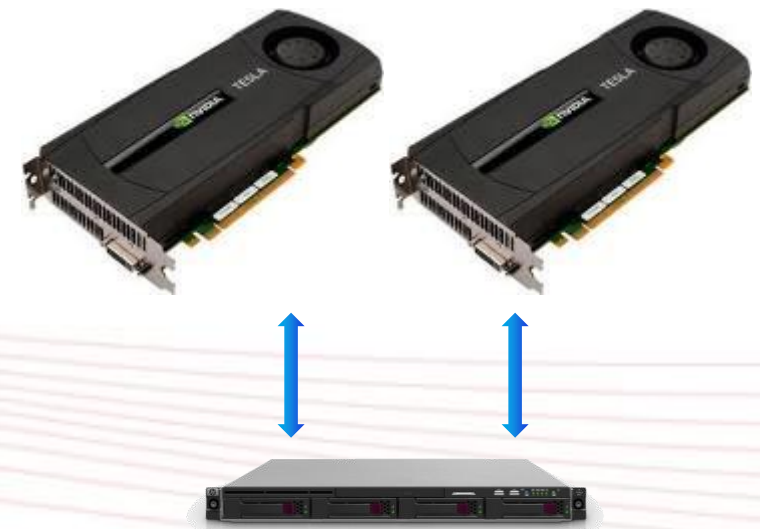
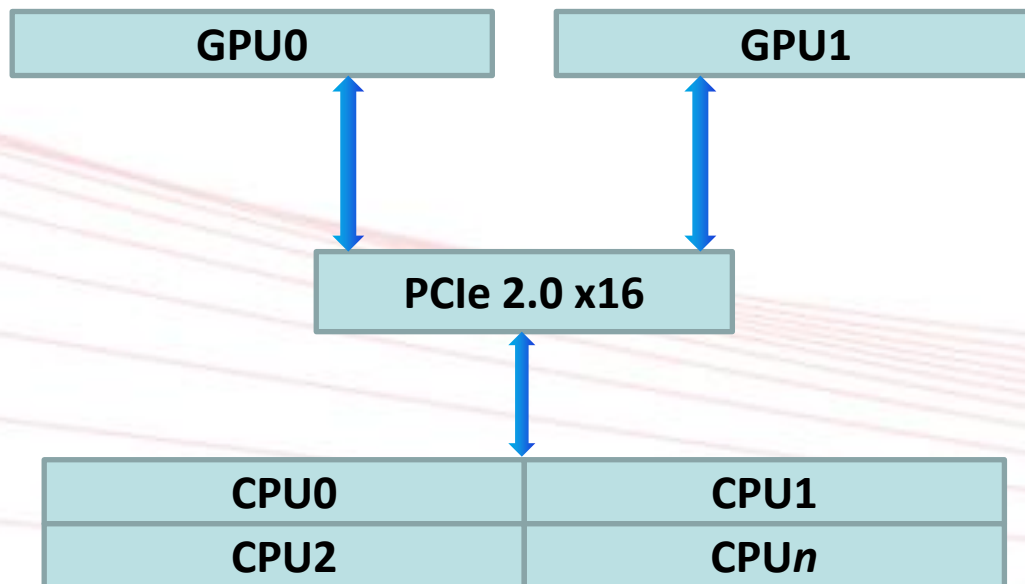
- ‘Traditional’ GPU setup for general IT
- For GPU Intensive Tasks
- 4 GPUs for each CPU Server
- Not well suited to simple ortho
- Cannot ‘feed’ the GPUs





CPU/GPU Topology 2

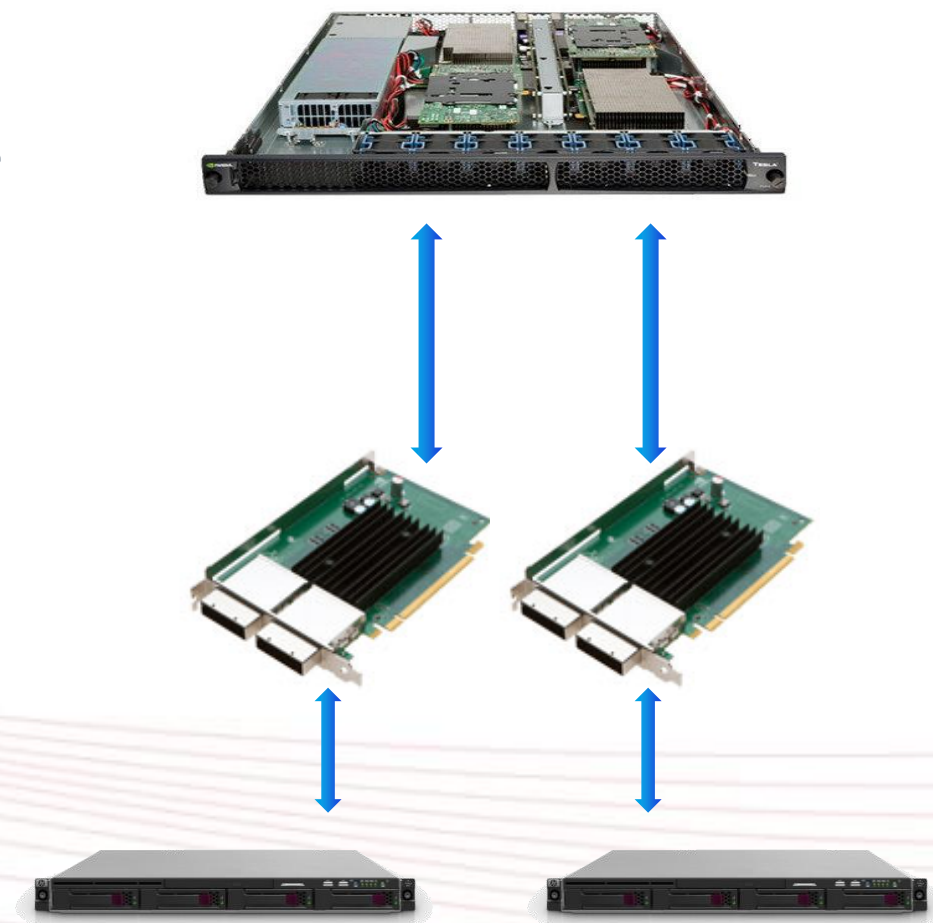
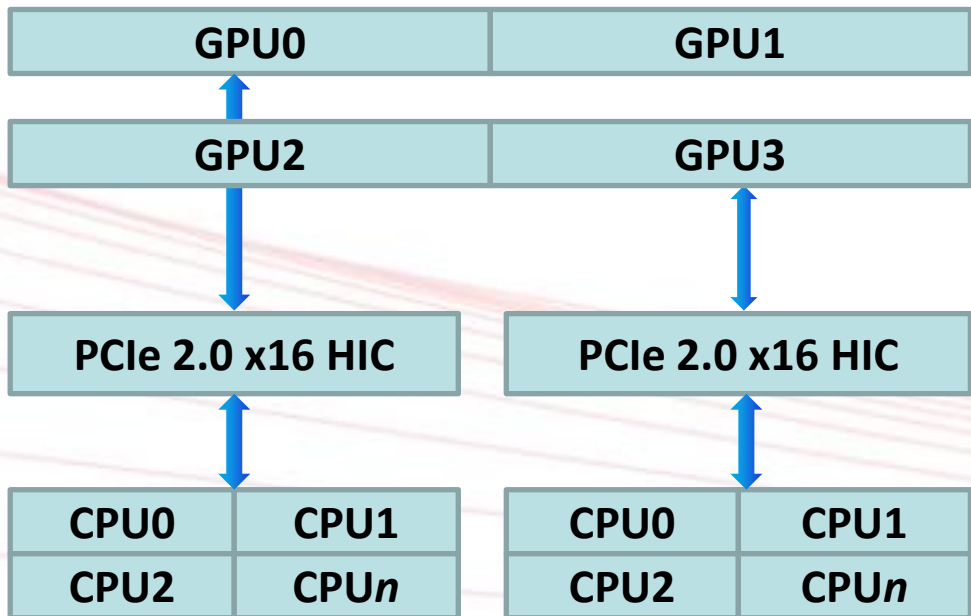
- 'Preferred' GPU setup for GXL
- For both CPU and GPU Intensive Tasks
- 2 GPUs for each CPU Server
- Improved communication between devices
- Better performance:cost ratio





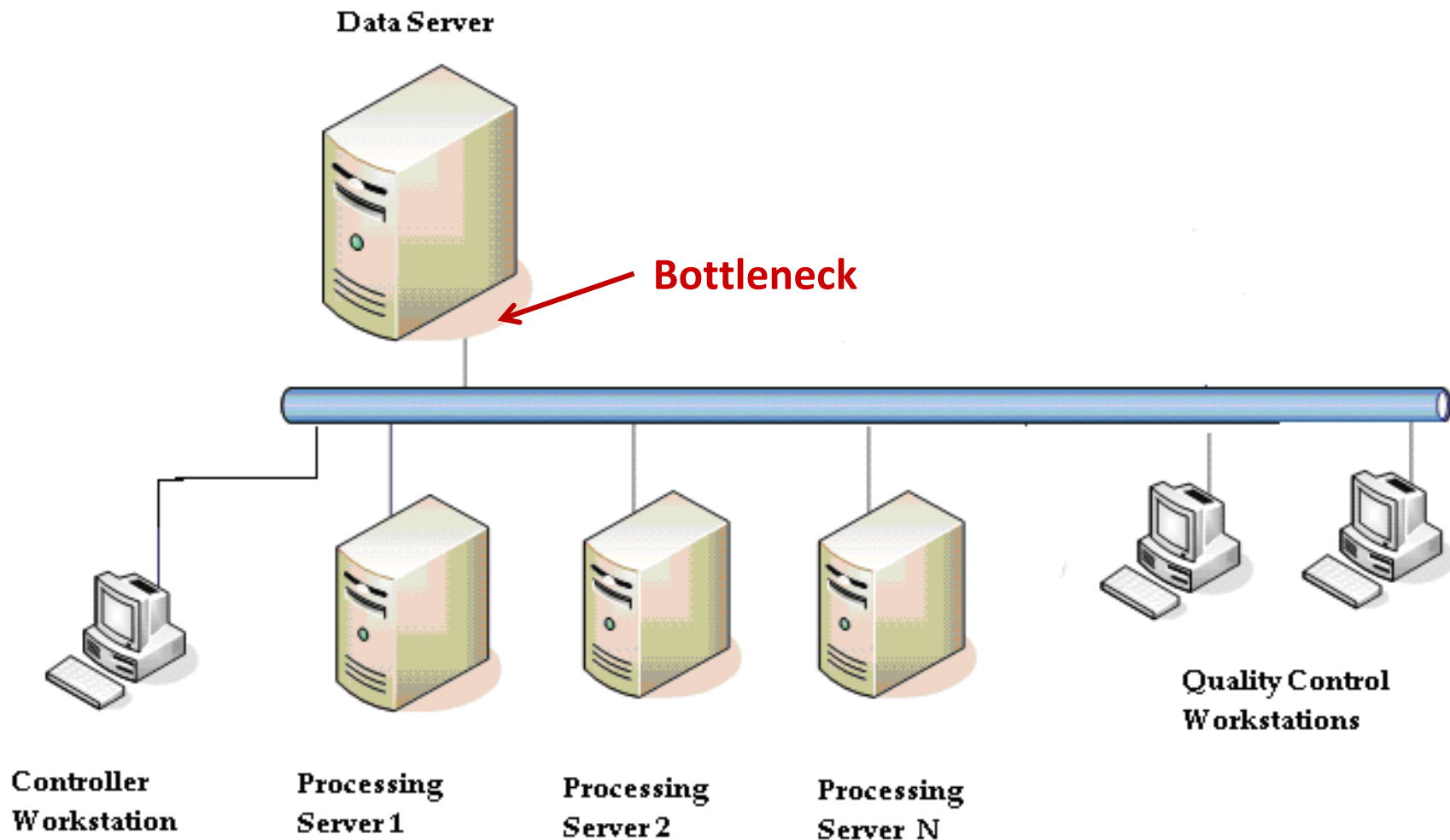
CPU/GPU Topology 3

- ‘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



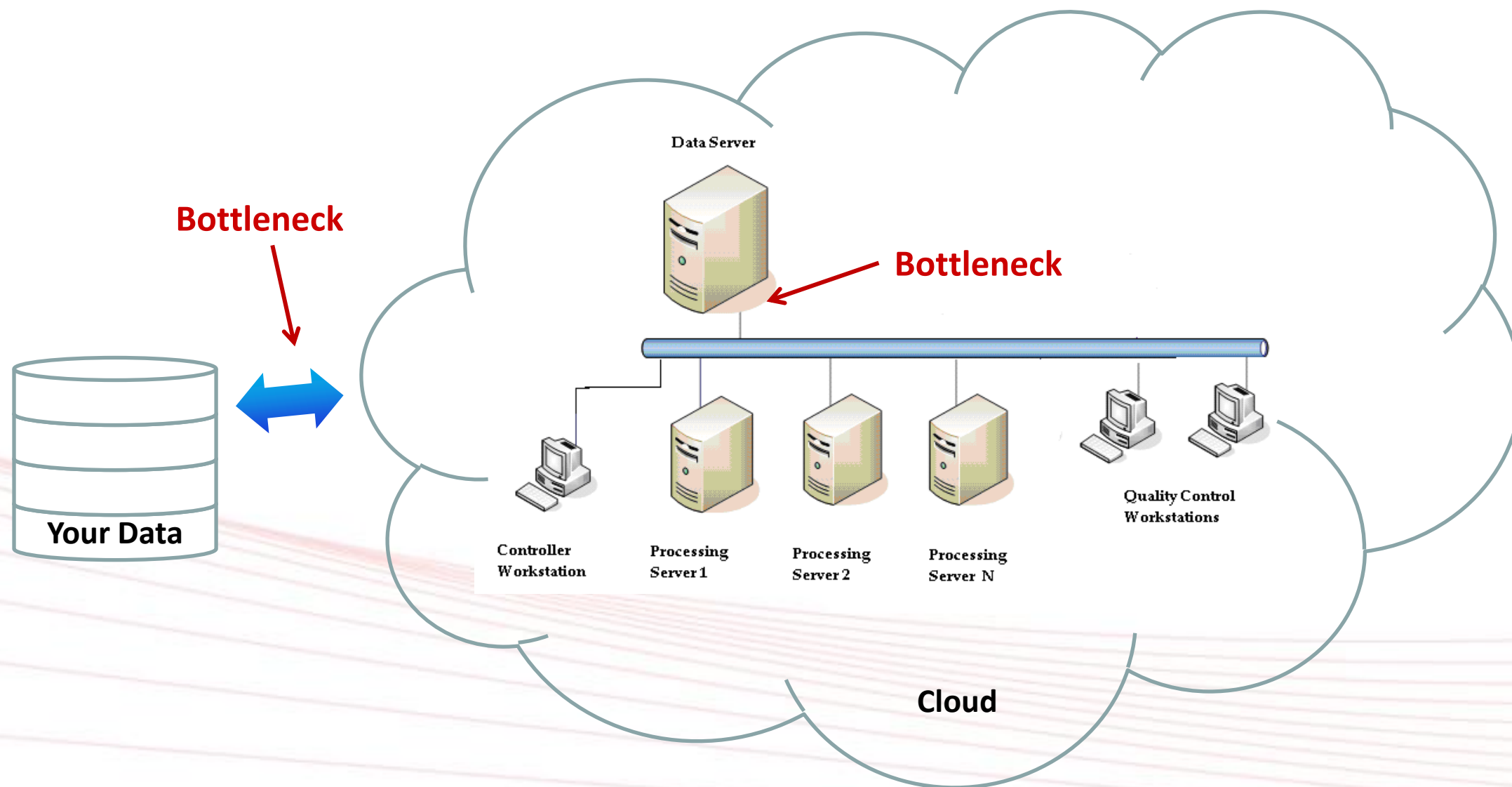


System Considerations





Cloud Considerations





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

Expected Throughput:	Required Network Speed:
~200 Images / day	50Mb/sec combined I/O
~1000 Images / day	100Mb/sec combined I/O
~2500 Images / day	200Mb/sec combined I/O



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**



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**



GXL

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