Michael Lewis
PhD Candidate
Disasterville

First person educational game designed for middle-scholars to understand what to do and not to do in the home when there is an earthquake. Funded by the Illinois Terrorism Task force.
Distributed Computing Research

<table>
<thead>
<tr>
<th>Distributed Classes</th>
<th>Systems/Frameworks</th>
<th>Key features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid</td>
<td>Condor, Globus</td>
<td>Ability to find resources. Virtualization technology.</td>
</tr>
<tr>
<td>Cloud</td>
<td>Open Stack, AWS, Azure,</td>
<td>Transparency of communication and I/O, Persistence of data.</td>
</tr>
<tr>
<td></td>
<td>Hadoop, Spark</td>
<td></td>
</tr>
<tr>
<td>HPC</td>
<td>MPI, UPC</td>
<td>Developer specification of communication and I/O.</td>
</tr>
</tbody>
</table>
Resource Description Framework (RDF)

RDF dataset is a collection of triples. Triples are Subject-Predicate-Object entities.

Node (Subject, Object)
Predicate Link
Literal
URI

:WhitneyYoung locatedIn Chicago visited Alumni hasDept Alumni UIC visited Jane speaks :English

:School type :City

:Math hasDept :Sanitation

"5'4"

:English

:Jane

:English

:UIC
Triple Patterns

Classification Patterns

- UIC type University
- Illinois type state
- Mike type person

Pattern 1
UIC current-student Mike

Pattern 2
UIC located in Illinois

Pattern 3
Mike Born in Chicago
Path approach to processing and retrieving linked data within a distributed environment.
Advisor: Preeti Malakar

Research Area: Optimizing Read Write times for Multidimensional Datasets
Architecture

- Master-Worker Architecture. Using MPI
- Cooley
  - 126 Compute Nodes
  - 2 Intel (2.4 Ghz processors) per node. 6 Cores per CPU
  - 24 GB Ram per node 12 GB per GPU.
- Mira – an IBM Blue Gene Supercomputer
  - 49, 152 compute nodes.
  - 16 Cores per node, at 1.6 GHz.
  - 16 GB of DDR3 memory.
- General Parallel File System (GPFS)
  - 24 PB of capacity.
  - 240 GB/s bandwidth.
  - Allows data to be accessed over a multiple number of computers at once.
Data Decomposition in S3D

S3D
- Combustion simulation code
- Uses 3D data volume for simulation

Data Decomposition: $N_x \times N_y \times N_z$ (E.g. $12 \times 12 \times 12$)

Virtual Process topology: $P_x \times P_y \times P_z$ (E.g. $3 \times 4 \times 4$)

Default I/O mechanism in S3D:
Each process performs I/O for its corresponding sub-blocks of data

Each block contains a segment of solution data (E.g. pressure, temperature). Blocks are stored contiguously in the filesystem.
I/O through few processes

Hierofixed Plane (Previous work): Selects $X=0$ processes for I/O
E.g.: 24 processes (leaders) from $x = 0$ plane for reading its entire row data.

Our approach: Extend Hiero to optimally select the leaders
Smallest Plane: Selects smallest plane (fewest processes)
E.g.: Selects 12 processes from the $z = 0$ plane for reading.

Why is this done?
- further reduce contention
Thank You!!