

Using Work Queue Inside and Outside the Classroom

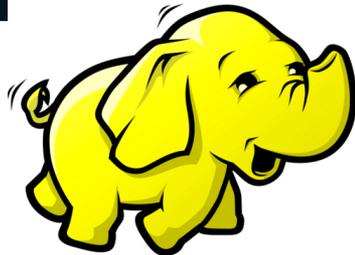
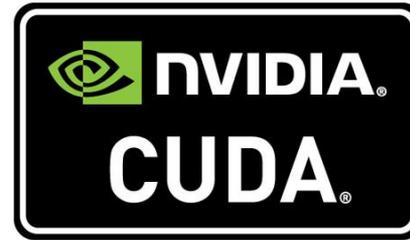
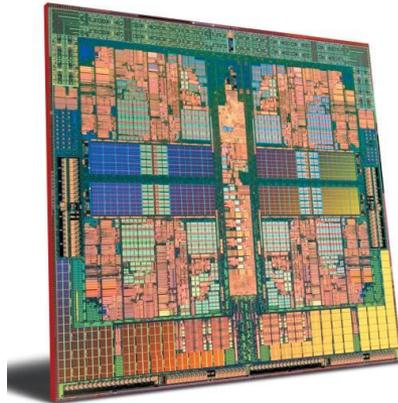
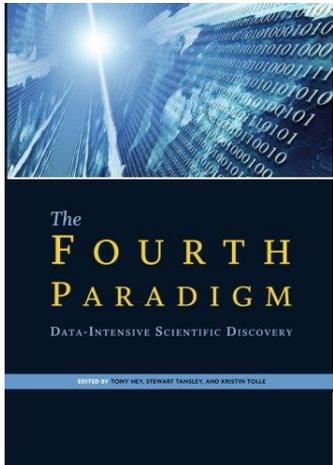
Peter Bui

University of Wisconsin - Eau Claire



Motivation

Problem: Introducing PDC



Parallel and **distributed computing** are becoming increasingly **important**.

Solution: Work Queue

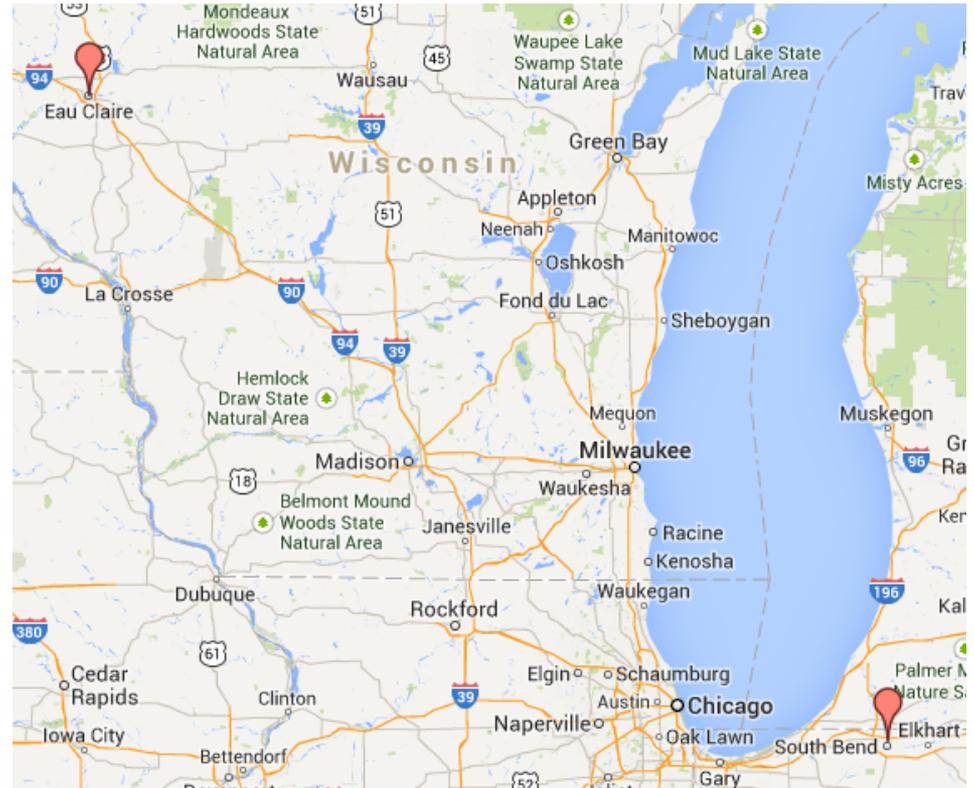
Use **Work Queue** to introduce undergraduates to **parallel** and **distributed computing** in the context of:

- **Class Assignments**
- **Independent Study**
- **Undergraduate Research**

Background

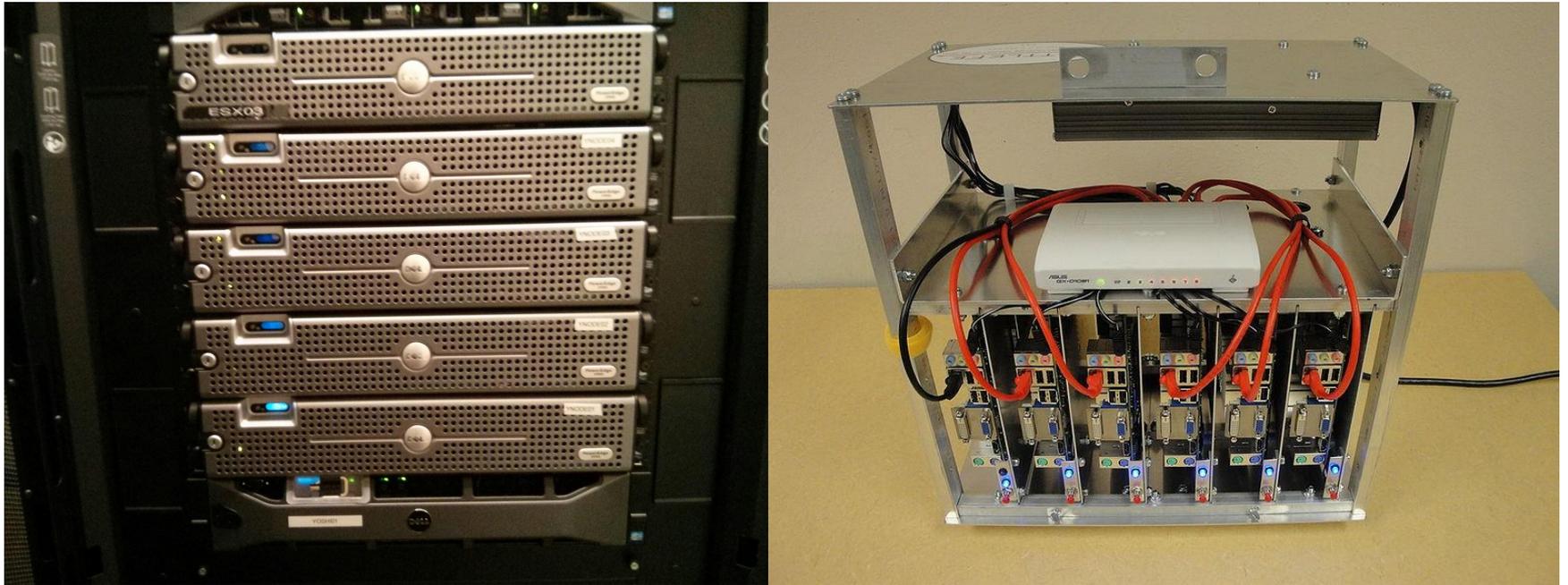
Teaching and Research @ UWEC

Liberal arts,
undergraduate
focused university.



Emphasize **teaching** and
faculty/student
collaborative **research**.

Distributed Computing @ UWEC



Teaching

Teaching Approach

- **Core**

- Computer Organization and Design

- **Service**

- Introduction to Programming in C++
- Computing for the Sciences and Mathematics

- **Elective**

- Cloud Computing
- Unix Systems Programming

Work Queue MapReduce

WorkQueue MapReduce

=====

Name: wqmr-buipj

Port: 9001

Work Directory: ./wqmr-buipj

Map: [=====] 100.00%
Reduce: [=====] 100.00%

Workers: I: 0 R: 12 B: 0 J: 12 Q: 0
Tasks: W: 0 R: 0 U: 0 D: 981 C: 981
Data: S: 237.21MB R: 706.65KB

Start Time: Fri Oct 11 12:40:57 2013

Work Time: Fri Oct 11 12:41:09 2013

Elapsed Time: 58

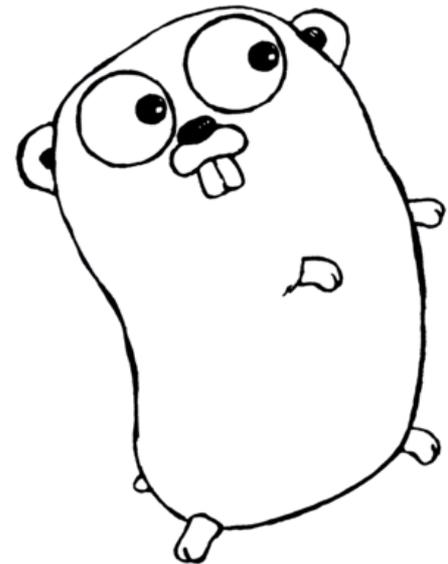
Elapsed Work Time: 45

Last Event: Task r0000 returned with exit status 0

Brute-force Password Cracking

Using **Go**, students implemented a brute-force password cracker:

- **Serial** version
- **Parallel** version using **CSP**
- **Distributed** version using **Work Queue**



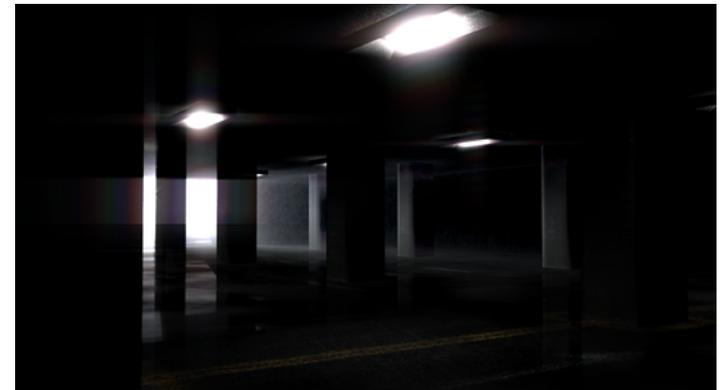
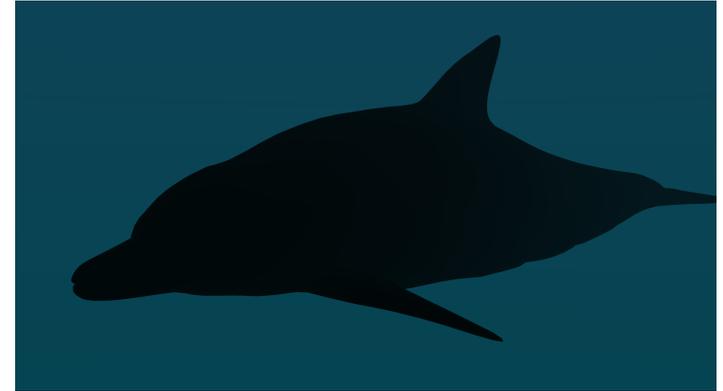
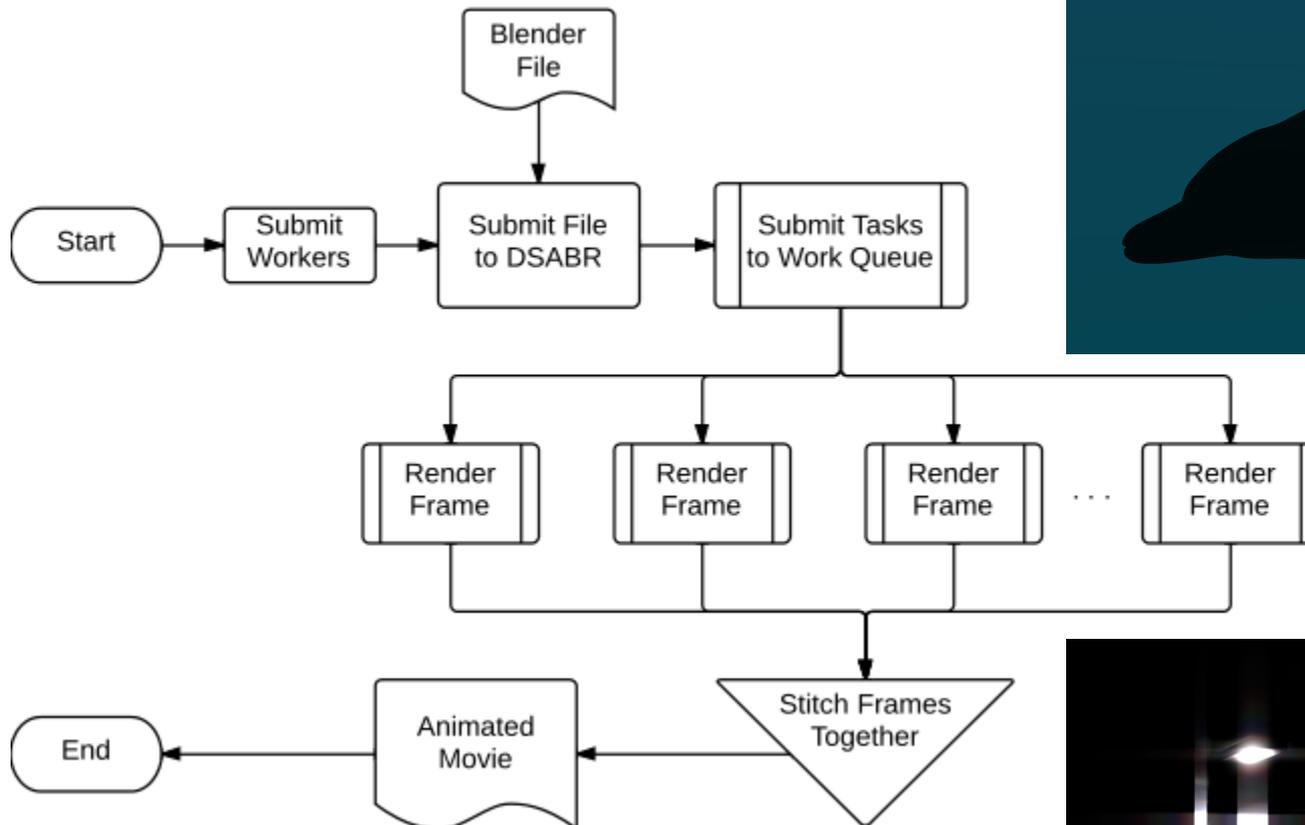
Research

Research Approach

- Focus on high-level **applications**
- Take advantage of **frameworks**
- Keep students **engaged** and **motivated**
- Reach out and take advantage of **resources**

***Work Queue** is a great framework for enabling novice users to explore **parallel** and **distributed computing**.*

Distributed Animation Rendering



Distributed Animation Rendering

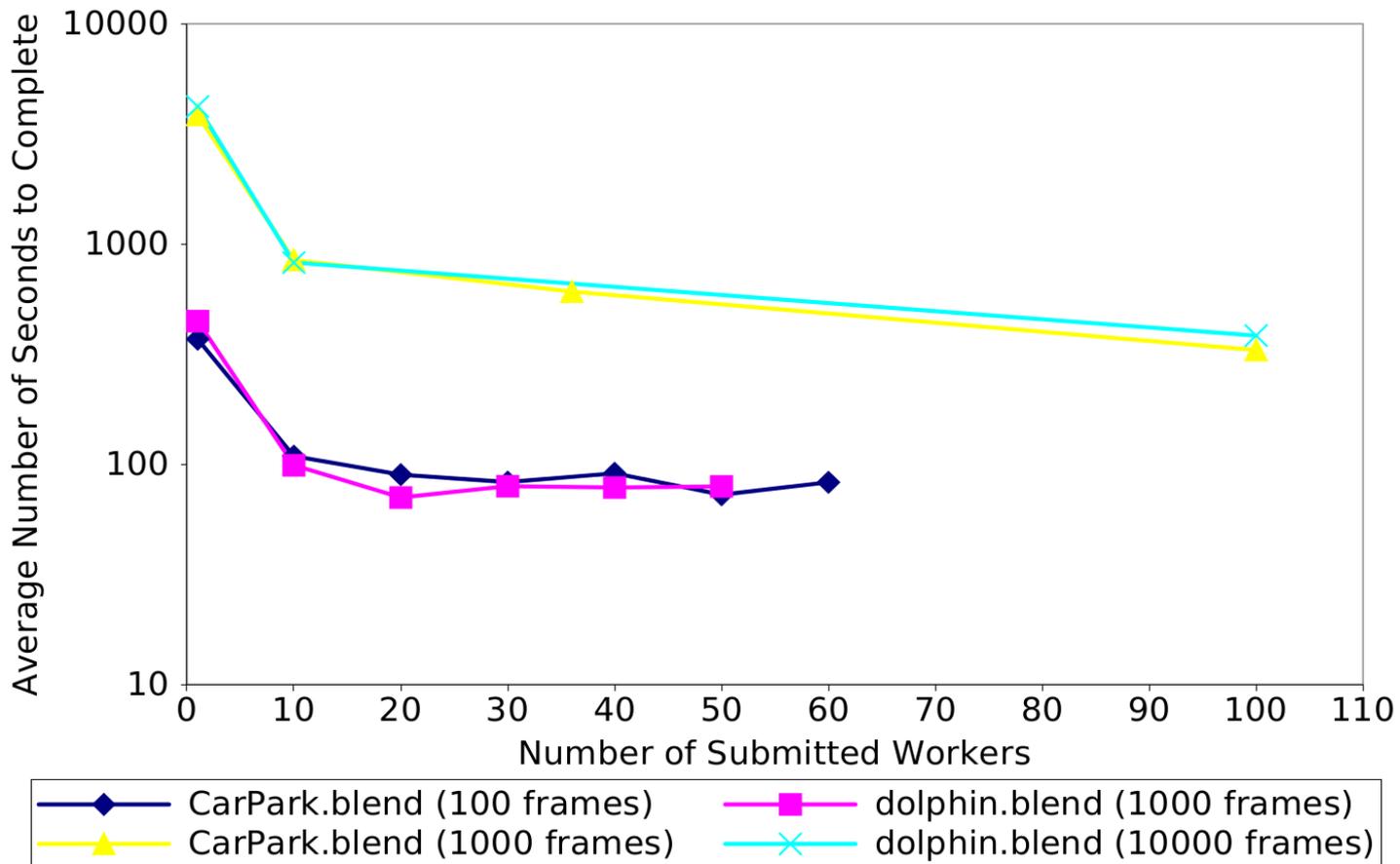


Photo Processing Pipeline

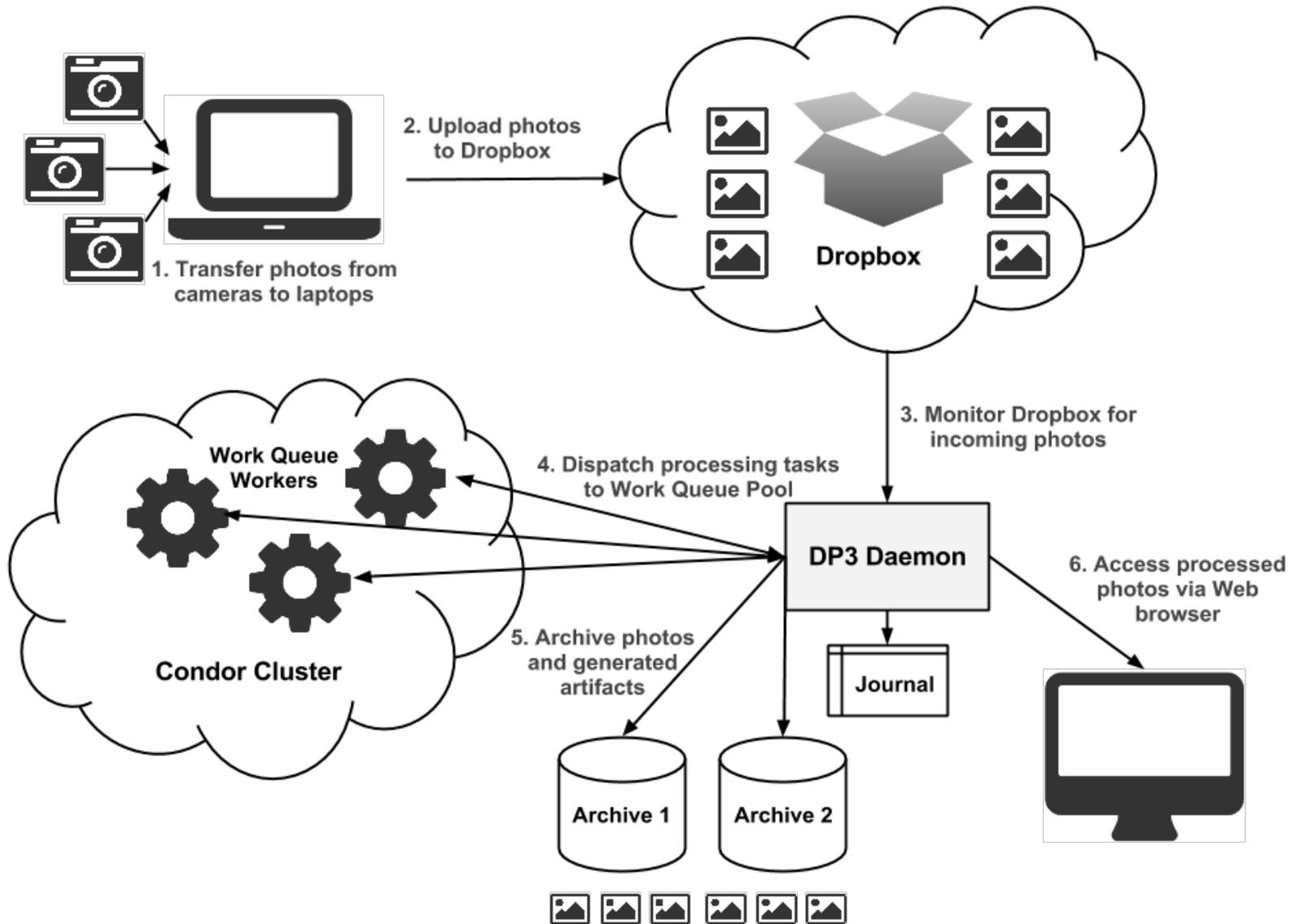
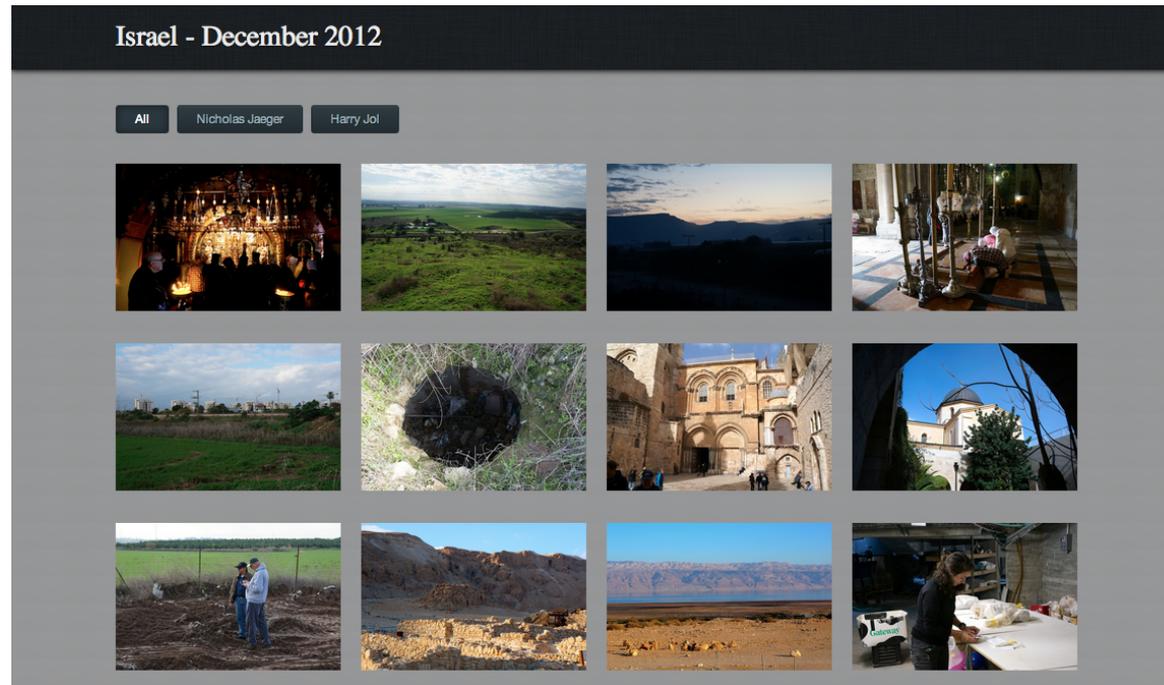


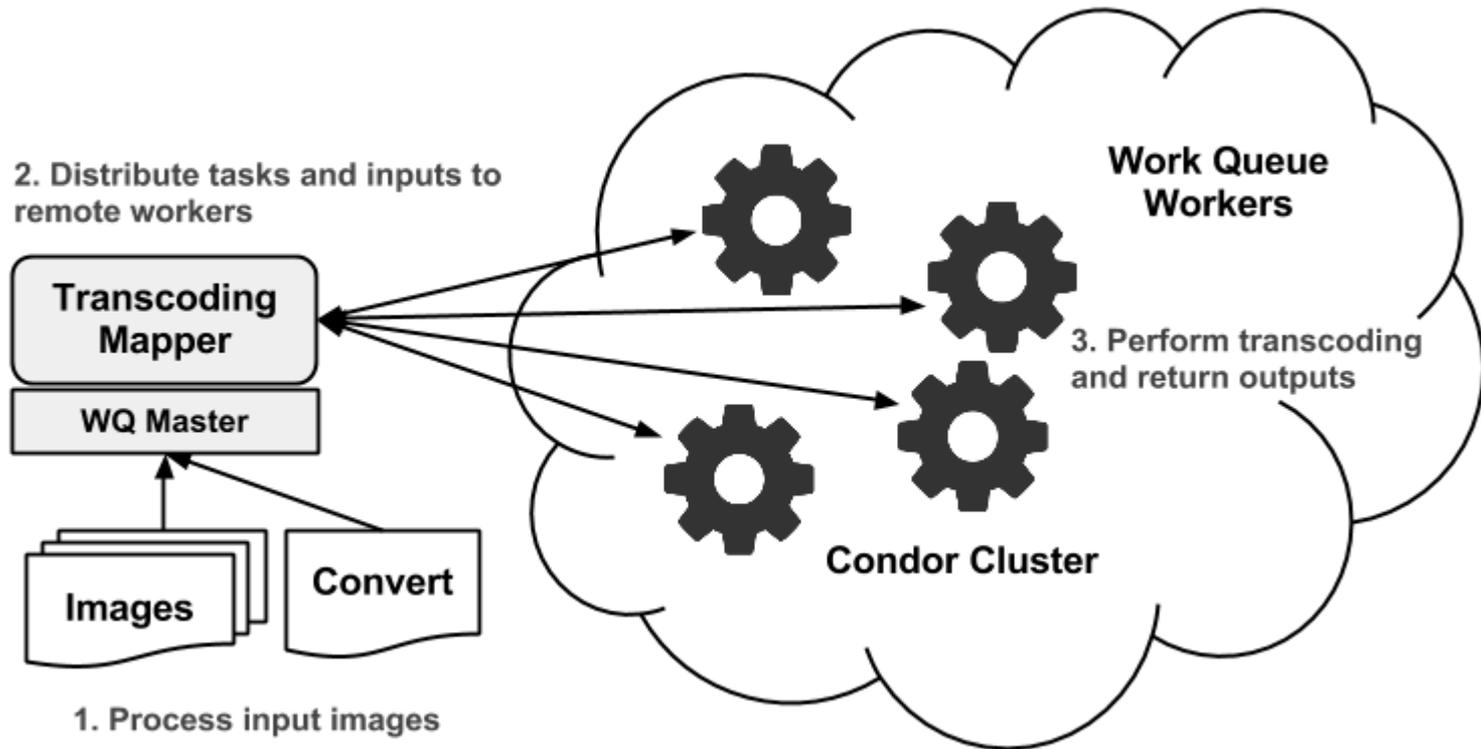
Photo Processing Pipeline



Num of Batches 448
Max Batch Size 1385
Min Batch Size 1
Avg Batch Size 16.4

Num of Tasks Submitted 7372
Num of Tasks Failed 104

Scalable Image Transcoding

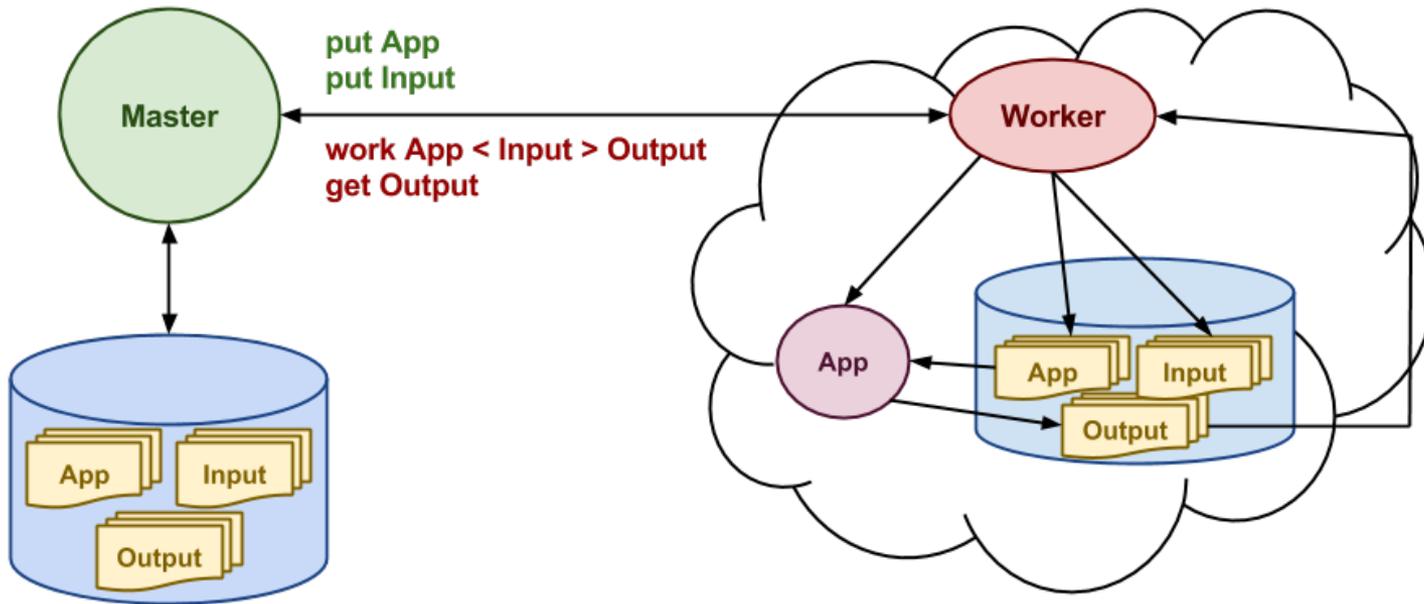


Scalable Image Transcoding

File Size	Set Size	# of Workers						
		1	2	4	8	16	24	30
15KB	10	1x	1.47x	1.56x	2.13x	1.85x	2.00x	2.40x
	100	1x	1.60x	2.80x	4.43x	5.96x	6.42x	6.44x
	1000	1x	1.65x	3.12x	5.02x	7.97x	9.27x	9.31x
1MB	10	1x	1.65x	2.40x	2.78x	3.05x	3.73x	3.87x
	100	1x	2.10x	3.87x	6.55x	9.56x	7.65x	8.27x
	1000	1x	2.17x	4.28x	7.75x	11.2x	10.5x	12.12x
10MB	10	1x	1.84x	2.46x	2.88x	4.48x	3.43x	3.27x
	100	1x	1.98x	3.90x	4.95x	7.34x	4.61x	4.76x
	1000	1x	1.74x	3.97x	5.63x	6.26x	4.75x	4.93x

Final Thoughts

Summary



- **Work Queue** is easy to use.
- **Work Queue** is flexible.
- **Work Queue** is portable.
- **Work Queue** is extensible.

Work Queue is a great way to introduce **PDC** to undergraduate students!

Future Work

Teaching

- Incorporate into **Computational Science** course
- Introduce in Computer Science **systems** course

Research

- **Web portal** for art students to utilize **DSABR**
- **Visualization** and **monitoring** of **Work Queue**

Acknowledgements

- **Students**

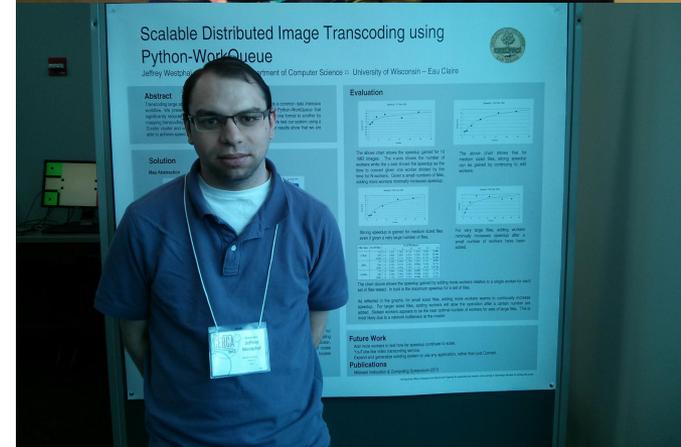
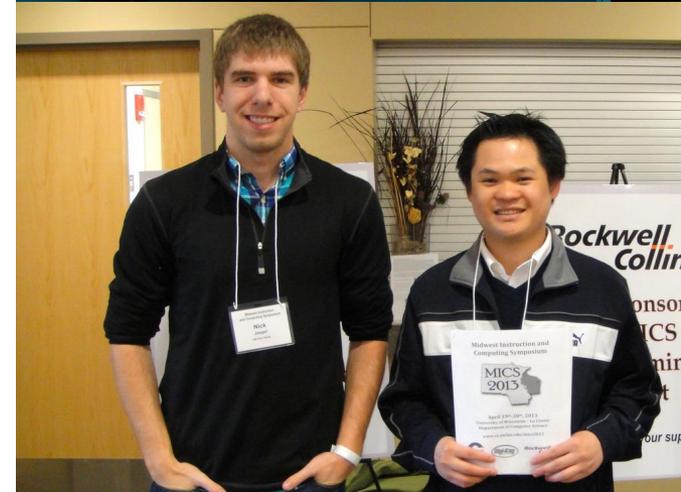
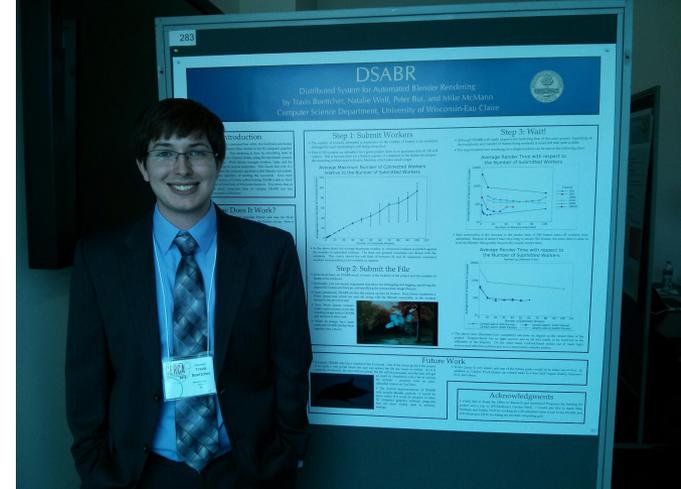
Travis Boettcher, Nick Jaeger, Jeffrey Westphal

- **ORSP**

Travel funding and student stipends

- **CHTC**

HTCondor flocking



Questions?

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