IPRO 313

Spring, 2008

Ultra-High-Speed Market Data Ticker System

Midterm Report

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Sponsor~~s~~ ~~Townsend Analytics~~Illinois Institute of Technology

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Illinois Institute of Technology
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1. Objectives

The objective of IPRO 313 is to create a high performance data ticker system ~~for our sponsor Townsend Analytics which needs to meet or exceed certain performance requirements~~. Ideally, ~~The~~ the data ticker plant has to have a sustained optimal throughput of three million price quotes per second – the current industry state of the art - ~~and minimize~~ with minimal latency ~~while maintain specific constraints~~. Toward this end, the team will create a proof-of-concept data ticker plant that processes real data. The initial system will be used as a baseline on which optimizations to specific components will be made. ~~The ticker plant aggregates streaming data for numerous global financial markets and disseminates the data to thousands of users in real time. The data is used in Townsend Analytics' RealTick® Execution Management System (EMS), its flagship institutional product for the financial services industry.~~

IPRO 313, Spring, 2008, builds on work done in the previous semester. Last Fall, IPRO 313 conducted background research on the market data systems and outlined a basic design and performance metrics for our system. ~~Our goal with IPRO 313 during the Spring 2008~~ This semester, we will ~~is to~~ resume system development, ~~implement~~ and work on performance ~~optimize a basic market data ticker system~~improvements, enhanced functionality, and more detailed benchmarks. ~~Using past semester result, research and development, the group will refine the design, prototype development and benchmark testing. The intent is to also provide detailed performance metrics of the system. This will enable future optimizations and algorithmic enhancements to the system in order to increase system throughput while minimizing latency and variance.~~

The team has set forth the following objectives:

- Explore competitors' solutions and available technology
  - Know what is currently on the market
  - Know what new technology is available for implementation
  - Understand what works and what does not
- Develop a functioning ticker plant system
  - Analyze ticker protocols used in previous semester
  - Redesign and refine the ticker plant architecture
  - Code a working system
- Improve system performance
  - Identify performance bottlenecks in the system
  - Design and implement performance optimizations
  - Record performance improvements
- Determine hardware requirements
  - Test off-the-shelf hardware for system
  - Design custom hardware configurations
  - Compare each solution
- Update the technical user manual
- Create a website contain every information regarding this project[~~Web site?~~]

No change has been made to the objectives

2. Result to date

Development team

- Successfully created a decoder for standardized packet (OPRA's)
- Successfully created UDP client/server to send/recieve OPRA data
- Ported last semesters code to be cross-platform
- Created programs that measure metrics(Such as messages/second)

Research/Optimization team

- Different hashing functions have been reasearched
- CRC32 was chosen for its flexibility and for the fact that Townsend Analytics also uses it.
- Basic metric was tested.

IPRO/Web Design team

- Each deliverables was delivered by deadline without fail.
- A website design and content management system has been chosen
- Web hosting space has been allocated.

The current IPRO 313 results are closely following the project plan the team set forth. By successfully implemented a packet decoder, the team is set in ensuring that the final product can process standardized messages. Statistical data has been collected from the real world data and a data feeder that is capable of sending out messages following the real world data flow is being created.

There had been a slight delay in achieving the objectives set forth in the project plan due to difficulties encountered in decoding OPRA message packet (see section 5). Because different team members depended on others' result, the whole team's plan was delayed. However, after the decoder was successfully created, the process was brought up to speed and the team caught up with the plan again. In fact, the decoder for FAST data has been completed two weeks ahead of estimated deadline.

Since the team caught up with the plan already, there is no deviation and no corrective plan at the moment.

~~**Market Value**~~

~~According to TowerGroup, a research firm, $480m is likely to be spent in America this year on developing technology for algorithmic trading. In 2005, providing fastest data to customers had such an impact that the financial industry increased spending on computers and software to $26.4 billion and in the past years, the compound annual growth rate for algorithm use from 2004 through 2007 was projected at 34%. Such is the focus on speed that even location counts. Servers positioned nearest to a trading venue can shave milliseconds of the timing of a trade and get a better price.~~

~~Ultimately, because the need for speed of information will only continue to grow, if TAL can develop a unique and reliable solution, it will provide a vital product for a demanding future market.~~

3. Revised task/Event schedule

The team is currently following the schedule originally proposed in the project plan with a few minor changes (noted under each team's section).

Development team

	Task	Start Date	Target end date	Lead
	1. Data Generator	**2/06/08**	**4/12/08**	**Kenny**
1.1	Obtain OPRA data.	2/06/08	2/08/08	
1.2	Implement code to stream OPRA data into RAM	2/06/08	4/15/05	
1.3	Implement code to take OPRA data from RAM and send to network sockets	2/06/08		
	2. Head End	**2/06/08**		**Jose**
2.1	Create a Decoder for OPRA FAST data	2/06/08	3/20/08	
2.2	Create a template for our data to send out	2/11/08	2/20/08	
2.3	Create UDP socket connection to receive data from CD			
2.4	Get timing metrics on UDP receiving speed and CODEC speed			
	3. Last Value Cache	**2/06/08**		**~~?~~Jong Su**
3.1	Provide ability to use different hash algorithms	3/03/08	3/10/08	
	4. Data Distributor	**2/06/08**		**Lance**
4.1	Separate subscription from LVC	2/12/08	3/12/08	
4.2	Interface subscription with Head End	2/18/08	2/25/08	
	5. Client Application	**2/06/08**		**Jong Su**
5.1	Improve JAVA client and monitor application	2/17/08	2/24/08	
5.2	implement hashing functions in c++ (superfast, CRC32, adler, tiger)	2/25/08	3/02/08	
5.3	plug hashing functions into LVC module			
			Baseline End Date	**5/2/08**

Section 5:

5.1 Convert Client into C++

5.2 Convert monitor application into C++

(from the Project Plan) were removed for the team has made the decision to stay with Java on these component.

Research/Optimization team

	Week	
1	2/17/08 - 2/24/08	- In depth view of ADLER32 and CRC32
2	2/24/08 - 3/02/08	- Get code to decode OPRA data - Test hash functions using the metrics chosen(time &reliability) - Select a hash function
3	3/02008 - 3/09/08	- Implementation of the chose hash function in to the LVC - Possibly, presentation on partitioning data sets
4	3/09/08 - 3/16/08	- presentation on Distributed and parallel processing - Hardware support
5	3/16/08 - 3/23/08	- Presentation on hardware support – necessary hardware structure? - Analysis of real workloads
6	3/23/08 - 3/30/08	- Presentation on analysis of workloads - Handling system failures
7	3/30/08 - 4/6/08	- presentation on handling system failures

There is no change.

IPRO/Web Design team

Week	Task	
02/17/08	Finalize project plan and Code of Ethics	- Starting web developement

	deliverables	
02/24/08	Midterm presentation creation	- Establish basic webspace
03/02/08	Collect materials for Midterm Report deliverable	- Research options and design
03/09/08	Finalize and reivise midterm report	- Layout
03/16/08	Web Development	- Basic text content ~~- Layout~~
03/23/08		~~- Basic text content~~
03/30/08		- Graphics
04/06/08		~~- Finalize and ready for updates from other team~~[wgy1]- Final adjustments and updates
04/13/08	Collect materials for IPRO Day and Final report	
04/20/08	IPRO day materials ready	Power point, poster, information booklet, CD
04/27/08	Presentation practice	

There is no change.

Detailed information available upon request

Updated budget

Experimental server	$1000.00
IPRO Day	$200.00
Miscellaneous	$200.00
TOTAL	**$1400.00**

There is no change.

4. Updated Task Assignments and Designation of Roles

The team's organization is the same and no change has been made in the organizational structure.

***Team Leader*:**
Oluwaseun Shonubi

***Minute Taker*:**
Jose Acuna-Rohter

In charge of recording decisions made during meetings including task assignments or changes under consideration.

***Agenda Maker*:**
Tarun Anupoju

Responsible for creating an agenda for each team meeting. This provides structure to the meetings and offers a productive environment.

***Time Keeper*:**
Tarun Anupoju

Responsible for making sure meetings go according to agendas.

***Master Schedule Maker*:**

Khanh Duong

Responsible for collecting schedules from all the team members and developing a master schedule, which tells the team when the members are available and how to contact them.

Name	Role	Major	Other
Khanh Duong	Master schedule maker	CPE	Web design experience
Jose Acuna-Rohter	Minute taker	CS	IPRO experience
Tarun Anupoju	Agenda maker, Time keeper	CPE	
Lance Cooper		CS	C++ Web design experience
Martin Kolodziej		EE	Web design experience
Konstantin Roytman		CS	
Oluwaseun Shonubi	Team leader	EE	
Jing Kai Tan		EE	
Jong Su Yoon		CS	Project experience
Wai Gen Yee	Professor	Prof.~~essor~~	
Ben Van Vliet	Advisor	Advisor	

Development (programming) Team
Developing the software and hardware for the system. Responsible for design and implementing the system.

Name	Role	Responsibilities
Konstantin Roytman	Sub-team leader	Overall, data generator
Jong Su Yoon		Client application
Lance Cooper		Data distributor
Jose Acuna-Rohter		Head end

Research/Optimization team
Look at the base system developed, research for solutions to improve and optimize the system for maximum reliability and performance.

Name	Role	Responsibilities
Tarun Anupoju	Sub-team leader	Overall
Jing Kai Tan		Assist and research

IPRO/ Web design team
Responsible for handling the creation of IPRO deliverables and the IPRO 313 Website

Name	Role	Responsibilities
Khanh Duong	Sub-team leader	Overall
Oluwaseun Shonubi		Deliverable research
Martin Kolodziej		Web development

[Web site? You might say something to the effect of – we expect it to be easy to use and have tons of useful information. We will check with our sponsors to see if the information is okay.]

5. Barriers and Obstacles

The IPRO 313 team had obstacles and barriers similar to all groups during their forming and storming phases of team building. Due to conflicting schedules, group meeting outside of class setting has been difficult. To solve this problem, one of the two class period of each week has been designated to members meeting and working together. Presentations of work and progress have been grouped together on the other class period.

Also, our IPRO is a continuation of last semester's project therefore there are problems of understanding what had been done and what needed to be done. The lack of documentation caused delays in the team's progress due to the extra time spent understanding past materials.

A technical difficulty was encountered in the development process. The team had trouble understanding the standard. This particular issue has been resolved but the team is expecting more to come in the future. This is a common occurrence in software development.

There is a possibility of barriers or obstacles that can appear during later work. Some of them could be lack of time, bugs in the system, programming complexity unrealistic, loss of interest of the members and others. However, we are ready to face them and solve these problems both independently and as a team.

6. Midterm Presentation Slides

See attachment.