

Integrated DNA Sequencing Service and Data Management System

Kuala Lumpur / Singapore, August 2005 – The genomics revolution has opened up exciting new avenues for discovery, but at the same time unleashed a tidal surge of data that continues to overwhelm life sciences researchers. There is a need for a robust, scalable solution that can address various scientific workflow processes, manage the massive data generated from the instruments and elegantly display the results. Such a unique and flexible platform that integrates and streamlines domain workflows in genomics research was recently implemented at Malaysian Palm Oil Board (MPOB).

The integrated DNA sequencing service and data management system (iDNAs) significantly in-

creases productivity and efficiency of the sequencing labs by integrating and automating sequencing workflows with advanced bioinformatics and data visualization tools. The end-to-end capability gives research laboratories the ability to implement streamlined solutions for the increasingly complex challenges associated with producing, storing and analyzing large volumes of DNA sequence data. It was conceptualized and designed to address bottlenecks in genomics research, especially to leverage information gained from expressed sequence tags, gene and SNPs discovery, as well as for vector sequencing for construct validation.

The iDNAs processes the chromatograms generated from DNA

sequencers; automatic quality checking, vector masking, vector trimming, sequence assembly, and passing the processed chromatogram into a designated secure database. Subsequently, the sequences are subjected to a pipeline of homology searches and annotated accordingly. The iDNAs also auto-generates files for sequence submission to databases like GenBank and dbEST.

Inside KOOP!

- iDNA system 1
- FPGA system 2
- Life Science Workflow Systems 3
- KOOPrime wins award 4
- World Wide Exchange 4

As a result of such end to end integration and automation, more data can be consistently produced and meaningful scientific results also can be easily and securely shared with their colleagues and collaborators worldwide.

KOOPrime has integrated three DNA sequencers at MPOB and demonstrated great improvement in performance. The capacity has surpassed 3,000 daily inputs and serves approximately 50 researchers. This is a critical threshold measurement of its ability to handle very large quantities of data in processing, managing and analyzing DNA. The system is highly-scalable to accommodate to the MPOB Genome Sequencing project in the near future. This potentially involves many more complex integration of analysis applications, including Gene Ontology and Visualization tools for enhanced interpretation of analyzed results.

In **Singapore**, the Institute of Molecular and Cell Biology (IMCB) recently completed a similar informatics system to enhance the services of its DNA Sequencing Laboratory. Like MPOB, the key objective of the development is to assist the DNA laboratory administrators to provide the sequencing service to the 500-strong researchers residing in IMCB. This is a challenge which involves seamless integration of instruments, databases, inventory system, web portal and various legacy systems. The result is a successful implementation that streamlines the following processes:

- Distributed data collection and management of DNA samples over the web.
- Automated monitoring of the sequencing status of machines on behalf of administrators.
- Secured publishing of sequence results on the web portal without administrator's intervention.
- Updating of sequencing process by a messaging system to inform users about the sequencing system status.
- Downloading of sequencing results by users through web-based ad-hoc queries.
- Managing and tracking of expensive resources that are utilized in the sequencing process.
- Generating of periodic reports for administrators to track the jobs done.
- Generating of audit logs to track the proper execution of the services.

IMCB is looking at extending such service-orientated systems to its other labs. The Zebrafish facility is in the process of implementing a management system with capacity of extending its services not just to researchers in IMCB, but to external non-

IMCB researchers as well.

Cost Effective FPGA-based High Performance Computing Solutions

Pakistan / Singapore, August 05

- Traditional high-performance bioinformatics computing infrastructure, such as clusters deployed at computer centers, interconnected through a high-speed broadband network, are extremely expensive to deploy. Such set up can run up to several hundred thousand dollars in capital cost. Recurring maintenance costs such as space and full-time administrative staff also add to the high total cost of ownership.

A Singapore based company, Progeniq has developed a solution that addresses this issue by providing a low-cost bioinformatics infrastructure in an easily-deployable box that comes with physical footprint no larger than a standard PC. Such achievements is made possible through a Field Programming Gated Array (FPGA) system.

Benchmark tests on the Smith Waterman algorithm have shown that a single FPGA processor per-



Progeniq's FPGA-based bioinformatics solution

forms 100 times faster than a 3GHz Intel Pentium 4 processor. Hence, a single FPGA chip is able to provide computational power equivalent to that of an entire cluster, at a fraction of the cost of a cluster.

Presently FPGA systems have successfully been deployed at both the Pakistan and Saudi Arabia institutes, for bioinformatics research and teaching purposes.

These systems will also be showcased at the 18th FAOBMB Symposium Satellite Workshop on Bioinformatics (Nov 2005), at the National Centre of Excellence in Molecular Biology, University of the Punjab Lahore, Pakistan and at the 1st Pan-Arabic Bioinformatics Symposium (Dec 2005), King Abdulaziz City for Science and Technology, Riyadh, Saudi Arabia

Beyond large computational power offered by the FPGAs, the package includes open-source bioinformatics application software, biological sequence databases, and an easy to use web-based interface to the end-user.

Such an approach offers universities an easier, lower cost, and beneficial route to deploy a complete infrastructure to support the teaching of life sciences courses, compared to using traditional expensive clusters, helping to jump start new infrastructure in many more universities.

Workflow Systems for Life Sciences

Thailand / Singapore, August 05
- In April 2005, the King Mongkut's University of Technology

Thonburi, Thailand attached Ms. Somkid Bumee and Ms. Amornpan Boontongchuy to KOOPrime as part of the exchange program with National University of Singapore. Since commencement of attachment, both researchers have been exploring High Performance

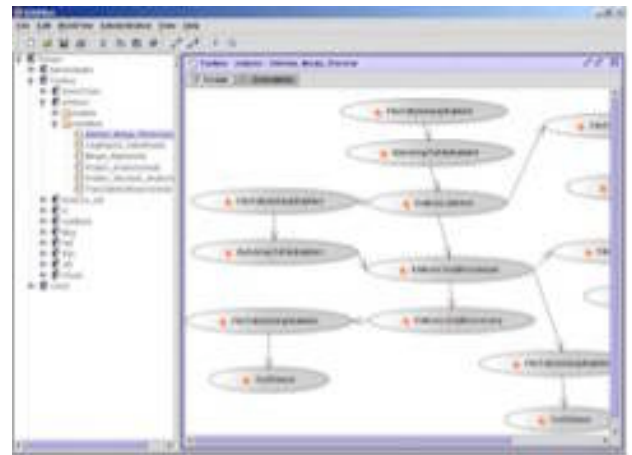
Computing issues that arise in various OMIC projects. The aim is to evaluate the requirements for workflow systems that can manage the increasingly complex and heterogeneous biological datasets, ultimately to automate and reduce the time and efforts in high throughput data analysis efforts.

The increase in laboratory throughput, proportionately increases the need for better streamlining of work procedures.



Although software designed to manage laboratory equipments have been in use for some time, the new challenge is to arrange these modular systems into an integrated framework, with the ability to establish the modus operandi for scientific experiments. Such is the strength of workflow management systems.

As part of their work in KOOPrime, both researchers have successfully implemented a parallel mpiBLAST system and a Field Programming Gated Array (FPGA) system, demonstrating how DNA and protein sequence analysis processes can be automated and run routinely (from



KOOPrime, a workflow automating tool to accelerate scientific research.

data collection to management to analysis) on various workflow systems including jBPM, Tarverna, Bonita and KOOPrime.

Development of workflow systems helps to establish orderliness in routine scientific processes, accelerating scientific research. This is an objective which the two ladies hope to achieve upon their return to Thailand.

KOOPRIME

KOOPrime is the leading life-science solutions company in asia. Providing solutions to the life science industry. KOOPrime's operations spans throughout Asia, with focus in Singapore, Japan, Malaysia, Thailand, China and India. KOOPrime has also established presence in Europe and USA.

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KOOPrime CEO wins NUS Centennial Entrepreneur Award

The National University of Singapore (NUS) Centennial Entrepreneurship Award (CEA) was launched on February 2005 by the NUS Students' BINGO (Business Incubation of Global Organizations) and the NUS Faculty of Engineering Technopreneurship Incubation Pro-



KOOPrime CEO, Lim Teck Sin (centre) receives best entrepreneur award for Science/SOC from Dr. Vivian Balakrishnan (right) and Provost (Prof.) Tan Chorh Chuan (left)

gram in conjunction with the NUS Centennial Celebration. The NUS CEA main purpose is to celebrate and award entrepreneurs of NUS alumnus over the past century, recognizing their achievements and contribution to the society and to encourage more students and alumnus to become entrepreneurs.

The inaugural award ceremony held on the 7th September 2005 at the NUS auditorium was graced by the Minister for Community Development, Youth and Sports and Second Minister for Trade and Industry of Singapore, Dr. Vivian Balakrishnan.

KOOPrime CEO, Mr. Lim Teck Sin emerged from the long list

of strong competition to win the Best Entrepreneur award for Science/SOC.

Mr. Lim founded KOOPrime in 2000 to pioneer Enterprise Application Integration services and products for the Life Science industry. Since its incorporation, the company has produced a spectrum of solutions for both the Medical and life Science Industry. Clients includes National Cancer Center (Singapore), Pfizer Phamacia, Lily Systems Biology, Ministry of Health (Singapore), National University Hospital, Novus Gene (Japan).

For more information on the CEA, please visit the BINGO website at: <http://cea.nusbingo.org/winners.htm>

Worldwide Exchange



Sweden

Mr. Björn Ljungholm joined KOOPrime

as an attachment student on September 2005. Having traveled to many parts of Asia, Mr. Ljungholm picked Singapore to do his overseas thesis project as he was attracted by Singapore's high standards and competency in the high-tech sector.

Mr. Ljungholm is a Masters student at Chamlers University of Technology, specializing in Computer Science and Engineering. The University is located in Gothenburg, Sweden's second largest city. Throughout his 5 months stay in KOOPrime, he will be participating in the next release of KOOPrime's

state-of-the-art workflow management system.



Norway

Ms. Harriett H. Lungberg worked as an intern

at KOOPrime Pte Ltd from 21 June 2005 until August 26, 2005. This is part of the exchange program between National University of Singapore and Norwegian School of Entrepreneurship at the University of Oslo.

During her stay in KOOPrime, Ms. Lungberg researched the biotechnology market in Scandinavia with the focus of discovering synergy between Asia and Europe. As noted by Ms. Lungberg, various bioinformatics systems that are developed in companies like KOOPrime can "makes the workflow for the scientist and the technician more easy and efficient". Given the experience gained, Ms. Lungberg aims to bridge and facilitate technological exchanges between both regions. Ms. Lungberg is now back at UiTø of Tromsø (the world northern most university) to further the development.

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