

Biomedical research gets its head into cloud computing

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As cloud computing becomes the next big consumer techo –trend, allowing people to access – but not have to physically store – everything from playlists to photos, it's also on the verge of revolutionizing the way research is done. Using the cloud model as inspiration, biomedical informatics scientists at The Ohio State University have created the Translational Research Informatics and Data management grid (TRIAD), a system which is helping researchers around the world access and analyze biomedical data at an unprecedented pace.

"With the current technology, a researcher might dedicate more than 100 hours to connect the dots between a set of tissue samples, the individual medical histories for the patients who provided those tissues, and then analyzing the group as a whole. With the TRIAD platform, researchers can now execute this type of search and analysis in minutes," says Philip R. O. Payne, chair of the department of biomedical informatics at The Ohio State University Medical Center.

The development of TRIAD started a year ago when a team led by Payne and Dr. Rebecca Jackson, principal investigator of Ohio State's Clinical and Translational Science Award, received funding from the National Institutes of Health to build a new system to meet the growing and unique needs of translational researchers. TRIAD has been so revolutionary for the biomedical informatics field, that the research team recently received an additional \$300,000 in funding to complete the grant's specific aims and help extend and support its implementation at other academic research institutions.

How it Works

[Cloud computing](#) is a term used to describe a system that allows easy access to a shared pool of resources (e.g., applications, servers, storage, networks) that can be quickly allocated and released with minimal effort by an administrator. The "cloud" acts like a virtual supercomputer that can pull together a cluster of other computers to work together to perform certain tasks. The system works well when the data that are being stored, accessed and shared are in common formats that are universally "recognized" by end user tools. But research data are often not captured or stored in formats that are compatible.

"When it comes to biomedical research, you have the digital equivalent of the Tower of Babel. One piece is written in French. And another is written in Russian. And maybe a third component is in Chinese," explains Payne. "TRIAD acts like the ultimate interpreter between all the different "languages" that biomedical data comes in so that researchers spend time figuring out how the information could improve the way we treat a disease rather than spend time finding and translating various data sets."

Built on the "framework" of the caGRID – a successful middleware platform that Ohio State created for the National Cancer Institute (NCI) in 2005, TRIAD pulls all of the data into a "cloud" where it can be translated into a "language" that the end user's data analysis tools can understand – regardless of the tool(s) the end user is running. Further, because TRIAD works with existing research databases such as REDcap and I2B2, its adoption doesn't replace what researchers are already familiar with, but exponentially expands what information and types of data repositories they are able to access.

This type of access helps overcome complexities that are unique to biomedical informatics, such as the way that tissue samples and medical

records are accessed and stored. Because of privacy issues, to match an individual tissue sample and a corresponding medical history becomes a search that must be approved by an internally. TRIAD enables researchers to anonymously match tissue samples with de-identified clinical data from medical records using what is known as "honest broker protocol," maintaining the patient's privacy rights while eliminating the time-intensive process of seeking additional approval for each individual study that does not require access to patient identifiers such as names, addresses, and medical record numbers.

Currently, nearly 20 sites, including several other CTSAs and NIH-funded programs, have adopted TRIAD. The critical pieces to the success of TRIAD are its open-source and collaborative design, development, technical documentation, best practices and software components. Members of the TRIAD community - including the CTSA Service Oriented Architecture Affinity Group - actively participate in the adoption, adaptation, and development of the TRIAD platform.

Accelerating research around the corner, around the world

TRIAD is not only simplifying research for multi-disciplinary teams working across campus from each other – but also for researchers who are working in different parts of the country, and on the other side of the globe. It has been particularly effective for scientists studying orphan diseases, allowing them to aggregate and analyze rare biomedical and clinical data in ways not possible before. Institutions are using TRIAD in a variety of groundbreaking projects:

- National Cancer Institute

- caBIG Getting Connected. A partnership between the Ohio State CCTS, Ohio State's Comprehensive Cancer Center and the NCI seeks to support integrative cohort discovery spanning multiple sources of clinical phenotype and bio-specimen data
- Chronic Lymphocytic Leukemia Research Consortium. A virtual database of medical information from 6,000 patients from around the world is helping scientists better understand and treat CLL.
- Hairy Cell Leukemia Research Foundation. Originally discovered by Ohio State researchers in 1958, Hairy Cell Leukemia (HCL) is diagnosed only about 2,000 times a year around the world. The HCL Research Foundation is using TRIAD to create a virtual data warehouse spanning institutions throughout the globe, helping get scientists closer to answers about the pathophysiology of HCL and possible treatments in large-scale patient cohorts.
- American College of Rheumatology: quality of life and arthritis. The ACR is also exploring the use of TRIAD as a virtual data warehouse for a registry to collect information on arthritis and quality of life.

Taking TRIAD to the Next Level

With the new funding, TRIAD creators will look to build out tools to help scientists further integrate and utilize this technology to create even larger "network of networks." Once the tools have been developed, the team will work to educate the research community about its availability and assist with adopting and evolving the platform.

Payne's team has also observed that one of the major barriers to adopting the TRIAD platform is that most institutions do not have the technical

resources for implementation and support. The researchers are currently exploring a partnership with a private vendor to create an offering that can provide round the clock support, something that could also bring new technology jobs to Ohio. With the group aiming to have a business plan in place before the end of the year, TRIAD will be poised to reach even more researchers.

Payne is eager to get TRIAD into more labs, noting that while cloud computing may be popular with consumers, getting researchers to understand the impact of a platform like TRIAD is difficult.

"Researchers are consumers, too. They are used to Google and Facebook and expect that it must be the same way when it comes to discovering and sharing [biomedical research](#) data," says Payne. "It's great to see that "a-ha" moment when a researcher realizes how much TRIAD simplifies and amplifies what they are already doing."

Provided by Ohio State University Medical Center

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