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Propelling Genomic Research and Public Health with Future-Proof Digital Infrastructure

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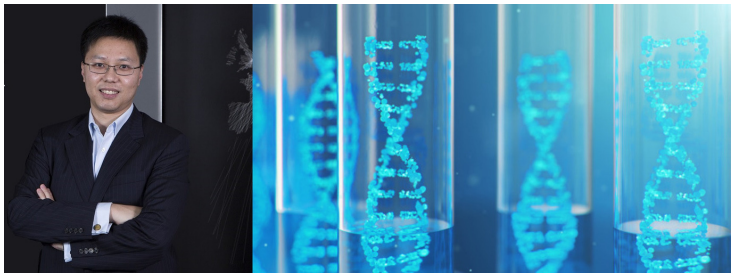
"The success of genomics innovation relies on robust and agile digital infrastructure to support the entire research program, from data processing and its ability to analyse and store data volume" explains Eric Hui is Director, IoT Ecosystems Development at Equinix Asia-Pacific



Digital transformation in healthcare has been at breakneck speed since the outbreak of the COVID-19 pandemic. It took just a year to develop the COVID-19 vaccine – a record-breaking speed given vaccine development usually takes up to10 years or more. This medical achievement would not have been possible without innovative technology and the advancement of genomic sequencing, allowing researchers to map the entire genetic makeup of an organism.

BCC Research has forecasted the Asia Pacific market for Bioinformatics in genomics to register a CAGR of 11% from 2020 to 2025, against the rising prevalence of infectious diseases such as Covid-19. With the expanding market value of genomics amid Asia Pacific's MedTech landscape, more R&D institutions are being established to explore novel solutions based on the study of genomes. This can largely be attributed to the increase of awareness and adaptation of genomic applications in Asia Pacific countries as well as improvements in health infrastructure, numerous urgently needed advances, increased patient disposable income and rising medical expenditures.

The advancement of genomics has helped develop treatments that improve healthcare, delivering better results for patients. Earlier in 2022, Singapore and India entered into an agreement to collaborate on genome and bioinformatics research, while the Genome Institute of Singapore has embarked on mapping Asian genomes to investigate how illnesses can affect different groups, providing valuable insight for researchers. The success of genomics innovation relies on robust and agile digital infrastructure to support the entire research program, from data processing and exchange to the ability to analyze and store increasing data volumes.

Putting things into perspective, a single human genome sequence alone takes up 200 gigabytes, equivalent to the space of 200 short streams videos. Future-proof digital infrastructure such as data centers play an important role in advancing genomic research possibilities, its applications, and future benefits to the public health agenda.

Facilitating collaboration with secure connections

Effective collaboration among countries was a key factor that catalyzed the development of COVID-19 vaccines. Considering the sensitivity of vaccine development, data security was important for researchers. This gave rise to the need for an interconnected infrastructure that is able to transmit data in a secure, fast, and reliable form, allowing researchers to bypass the public internet and reduce security threats and attack surfaces.

Bringing in a real world case study, a major genomics institute based in Asia has worked with Equinix to host genomics data. The infrastructure and interconnection bandwidth provided by Equinix provided them not only with direct connectivity to public clouds, required to run a variety of genome applications, but also to connect with other genome institutes worldwide. The data generated was essential to support genome analysis activities and the creation AI models to advance research. In this sense, connected and digital infrastructure not only advanced the speed of collaboration, but also advanced the research process itself to be able to deliver timely solutions. The outcome means that disease variations and solutions can be brought to market faster in the future as the research chain becomes more efficient, and barriers to sharing and collaborating become smaller. Furthermore, deploying an established digital infrastructure model that is secure, reliable and stable enables genomics institutions to focus on their data without concern for slow or stolen information.

The future of genome research and public health

Genomic technologies are transforming the future of healthcare at record speeds. Researchers are also tapping into artificial intelligence (AI) to predict outcomes and automate actions. AI can help identify DNA pieces quickly, a crucial factor in the fight against ongoing antibiotic resistance, cancer treatment and rare disease research. AI tools are also helping researchers automate routine tasks, such as trimming data, classifying relevant sequences and submitting medical certificates—saving valuable time for researchers.

Government bodies are also increasingly recognizing the importance of these advancements and turning to genomic research to provide personalized healthcare for patients. For instance, the Singapore National Precision Medicine (SG-NPM) program, established in 2017, aims to revolutionize healthcare by enabling a strategy that is tailored to country's population diversity through genomic sequencing. This effort is also coordinated under A*STAR's Artificial Intelligence Analytics & Informatics office which catalyzes the development and application of a broad range of science, AI capabilities and technologies. However, as healthcare becomes increasingly digitized, a key consideration is for government privacy frameworks to ensure that data remains secure. Policymakers can examine using blockchain to secure and trace instances of data sharing. When certain health data classification does not allow sharing, data federation techniques to query data can be considered.

Transforming the way we research health

Healthcare is being revolutionized. Whether we are increasing the speed of response, uncovering genetic mysteries, or collaborating with researchers worldwide, public health benefits from the leaps that researchers can make are aplenty. It is exciting to see what the future unfolds for healthcare in making new discoveries that would advance public health with the aid of technology.

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