



Unleashing the power of genomics

The UK National Health Services (NHS) team is working in collaboration with Cardiff University to capitalize on advances in high performance computing systems to transform public health and personalized medicine.



GIG
CYMRU
NHS
WALES

Healthcare



Business needs

Bioscience teams at NHS and at Cardiff University need high performance computing and storage systems to enable next-generation genome sequencing technologies.

Solutions at a glance

- Dell EMC PowerEdge R740 and C6525 servers
- NVIDIA® V100 GPUs
- PowerSwitch S3048-ON
- Mellanox® IB-SB7790
- [Red Hat® Ceph Storage](#)

Business results

- Accelerating genomic sequencing
- Fighting infectious diseases
- Improving public health
- Enabling personalized medicine

The HPC resources operated by MRC CLIMB are leveraged by

1,000
users



Over the past 12 months, Dr. Connor and his colleagues have sequenced

8,000 - 9,000
genomes



Unlocking genomic secrets to transform healthcare

Dr. Thomas R. Connor, the bioinformatics lead for the Public Health Wales Pathogen Genomics Unit, works with teams of scientists at the intersection of genomics, bioinformatics and high performance computing (HPC) in an effort to fight infectious diseases and enable personalized healthcare.

“A genome is essentially the blueprint that describes how that organism is built, including how it causes disease,” Dr. Connor says. “Using genomics data, one can predict the correct drug to use to treat an individual patient, identify vaccine targets or track the spread of an epidemic across the globe. This ability to read the genome of an infectious agent is transformative for healthcare.”

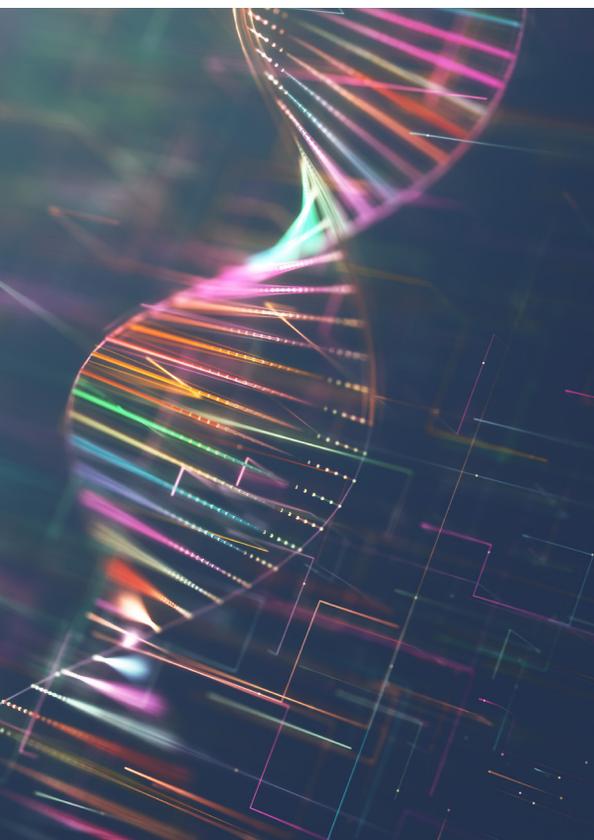
Dr. Connor offers an example of how healthcare providers can use genomic sequencing and bioinformatics — which turns genomic data into useful information — to target a precise therapy for a tuberculosis patient: “We can sequence the tuberculosis cells, and then use the sequencing data to identify the best drug that we can give to this patient,” he says. “The bioinformatics results tell us what drugs the patient is resistant to, and what drugs are going to work.”

The engine that makes bioinformatics possible: HPC

This highly advanced approach to fighting infectious diseases takes an enormous amount of computational power, lightning-fast data storage systems and the expertise to create high performance computing clusters that can be shared by many users. To meet this need, Dr. Connor and his colleagues have turned to Dell Technologies.

To date, Dr. Connor and his colleagues have developed three systems that incorporate products from Dell Technologies. In addition, they make use of Dell Technologies-based HPC clusters at Supercomputing Wales, which provide researchers across Wales with access to powerful computing facilities for science and innovation projects.

One of these systems that Dr. Connor helped develop is known as MRC CLIMB — for Medical Research Council (MRC) Cloud Infrastructure for Microbial Bioinformatics (CLIMB). The CLIMB project offers leading-edge cyber-infrastructure for microbial bioinformatics, including cloud-based compute, storage and analysis tools, for academic microbiologists across the UK.



Using AI to improve patient care

Researchers from Cardiff University have demonstrated how artificial intelligence can provide an equally accurate and reliable prognosis for patients with cardiovascular disease, compared to traditional methods.

In their study [published in PLOS One](#), the team trialed a technique known as genetic programming (GP) — a method inspired by evolution in nature whereby computer programs are encoded as a set of genes that are then iteratively modified or evolved.

The results showed that the machine-learning algorithms could perform comparably to traditional methods when predicting the risk associated with individual patients. For the full story, see the [Cardiff University news story](#).

CLIMB has become an essential national capability for microbiologists in the UK, Dr. Connor says. It serves more than 1,000 users and over 300 research groups from 89 research institutions, including universities, public health agencies and governmental organizations. In addition, CLIMB has provided training in bioinformatics to thousands of academics, students and clinical microbiologists across the UK and as far afield as Palestine, Gambia and Vietnam.

And the world is taking note of the impact of the CLIMB project, which has won international recognition, including an *HPCwire* Readers' Choice Awards in Best Use of HPC in Life Sciences and Best HPC Collaboration in Academia, Government or Industry.¹

Working with Dell Technologies

Dr. Connor began working with Dell Technologies when he joined Cardiff University as an independent researcher several years ago and needed to set up a small HPC system with startup funding.

"The HPC team at Dell gave me a lot of assistance in getting that first system set up," Dr. Connor says. "I learned quite a lot from them. They helped me develop an understanding of what I needed to do, how to architect the system and what was available in terms of hardware. I had a really great experience working with Dell."

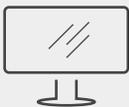
¹ HPCwire, "[HPCwire Readers' and Editors' Choice Awards](#)," November 14, 2017.

In the years since, Dr. Connor and his colleagues have developed a solid partnership with the HPC team at Dell Technologies. He notes that Dell Technologies supplied critical pieces of the hardware for the MRC CLIMB system and, more recently, a public health cloud based at Cardiff and Swansea universities.

"For seven or eight years, I've had a really great relationship with the HPC team at Dell," he says. "They answer our questions and help out whenever we need help. They have been really accommodating in terms of helping us to get the solution that we need to do the work that we do. That's a really positive thing that has come from my interactions with Dell."

Another positive outcome is the results of the research powered by the HPC clusters that drive the high-throughput sequencing and bioinformatics used to fight infectious diseases and enable personalized healthcare.

"In the last 12 month, we have sequenced around 8,000 to 9,000 patient samples across our genomics programs," Dr. Connor says, "and all of that has been processed through our hardware supplied by Dell."



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