

National Centre for Nuclear Research

Highlights

Challenge

High Performance Computing Key to Nuclear Testing & Development

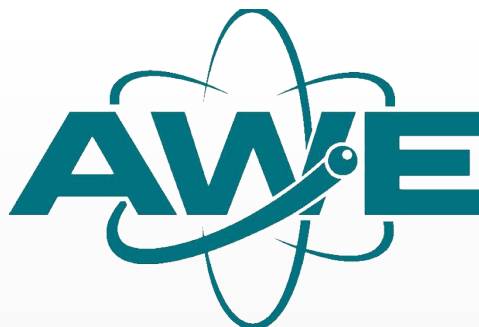
Solutions

- Arista 40GbE switches
- Arista EOS®

Results

AWE one of the first organisations in Europe to deploy 40GbE Arista switch technology in such scale.

Atomic Weapons Establishment makes significant investment in Arista's native 40 Gigabit Ethernet switches



Located on a 750-acre site in Aldermaston, Berkshire, the Atomic Weapons Establishment (AWE) plays a crucial role in defence with responsibility for the design, build, maintenance and decommissioning of the UK's Trident warheads.

AWE has been at the centre of the UK's nuclear defence for over 60 years. Since 2000, AWE has been managed and operated on behalf of the Ministry of Defence by a consortium of three firms – Serco Group plc, the Lockheed Martin Corporation and Jacobs Engineering Group. Around 4,500 staff and 2,000 contractors are employed at AWE under this GOCO1 arrangement, whereby the site and all facilities are owned by the government, but the day-to-day management of Britain's nuclear stockpile is contracted out.

¹ Government owned contractor operated

High Performance Computing Key to Nuclear Testing and Development

Following the UK's agreement in 1996 to sign the Comprehensive Nuclear Test-Ban Treaty, a multilateral treaty by which participating countries agreed to ban nuclear explosions irrespective of whether they are underground, underwater, in the air or space, all of AWE's work must be completed without recourse to actual test firing of weapons. This poses enormous technical and engineering challenges and means that high performance computing (HPC) systems today underpin much of its scientific research and development programmes as it relates to simulation and modeling, design and plasma physics, materials science, hydrodynamics and so on.

AWE has invested significantly in its HPC capability as a result and operates a number of supercomputing platforms. In November 2013, it purchased three SGI Ice X supercomputers utilizing the latest Ivy Bridge processors providing in excess of 80,000 cores which deliver a combined performance of 1.8 Petaflops – in other words almost two thousand trillion calculations per second.

The demands placed on networking are therefore significant. Neil McMahon, AWE's networking manager for HPC, explains, "The kind of technology and the lifecycle of equipment required in HPC environments is completely different to how standard corporate IT networks are managed where you want to minimise risk, introduce stability and modularity. In contrast, HPC is at the forefront of technology where the pace of change is faster with shorter refresh cycles and a willingness to install cutting edge equipment in a bid to increase the performance of calculations which can take weeks to complete and generate output files tens of terabytes in size."

Native 40GbE Switch Technology from Arista the Backbone to AWE's DPC Network

Historically, the management and delivery of AWE's HPC and corporate networks were combined but in October 2012, it was decided to separate the two, as each has different priorities. A new, dedicated HPC network has been built, managed by the HPC team using next generation native 40GbE switches to connect data centres and a test facility on the Aldermaston site, which spans a distance of about three miles.

To meet its unique needs, AWE worked with a consortium of suppliers comprising Datrix, its primary networking partner, and Vanix, an authorised Arista reseller, to install nine flagship high density, deep buffered wire speed Arista 7508E modular data center switches in the core of its HPC network. Furthermore, a large quantity of short and long-range 40GbE optics – some 400 in total – have been purchased. This makes AWE one of the first organisations in Europe to deploy 40GbE Arista switch technology in such scale.

AWE selected Arista as it wanted a network platform which – at a minimum – would provide the density of 40GbE to support its various programmes for between three and five years yet still fit into space constrained racks in its data centres. Speed, port density and form factor were not the only drivers.

McMahon says, "The flexibility of the switch operating system – Arista's EOS2 – is crucial as we can write our own scripts and applications which run on the switches themselves to address the obvious security and monitoring requirements we have. Given the type of work we do and the 40GbE density, there are no off-the-shelf tools available. The openness of EOS is important as it allows our own in-house programming staff to do this."

In addition, the Arista 7508E switches guarantee the creation of a 'lossless' Ethernet environment to underpin AWE's IBM-based cross campus multi-petabyte storage platform. This uses IBM's storage software to connect the various resilient storage silos to AWE platforms.

McMahon explains, "We had problems with our existing networking vendor as their switch buffers weren't big enough. Packets would drop; meaning the network then backs up and slows down. With some applications this doesn't particularly matter but with our distributed storage environment it most certainly does. Replacing them with Arista has totally solved the problem."

Arista Offers an Easy Pathway to 100GbE Performance

In terms of implementation, the rollout has been trouble free. The switches were configured and installed in pairs running MLAG3 and ECMP4 for resiliency. McMahon says, "Between buildings on the site, we're aggregating ten 40GbE connections to create bandwidth of 400 gig which we're using a significant portion of today."

Having a clear and seamless upgrade pathway therefore to 100 gigabit Ethernet capability when required was another attraction of selecting Arista switches given all that is required to do this is a change of line card rather than the actual chassis. This is important as AWE continues to develop its data centres in the future.

Whilst the project is still relatively new, AWE has seen clear benefits of selecting Arista and separating its HPC and corporate networks. Moving to 40GbE (from 10GbE) has removed bottlenecks, improved throughput and performance four fold, and is allowing the organisation to use its key platforms including the IBM storage to the maximum. Reliability has been enhanced, along with a clear growth path put in place. Ultimately, the new network means that AWE's team of scientists and engineers are more efficient and productive as they can move data and perform their research and development work that much faster.

McMahon concludes, "I've been building networks at AWE for 27 years. This project has been really exciting as it's the first time we've set up a whole new network from scratch and implemented the latest state of the art equipment. Based on the commitments made to the business 12 months ago, working with Arista has meant we've achieved what we set out to do. Our requirements have certainly been met."

Mark Foss, Arista's vice president, global operations and marketing, says, "It's a testament to our engineering excellence that Arista does truly deliver and works so well in supercomputing and big data environments where throughput, resiliency, scalability and manageability are so important.

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