GenUI improves Microsoft Quantum's computing research productivity with custom software

The high-stakes race to make quantum computing scalable is on, and Microsoft is leading the way[1]. Learn how GenUI decreased the research team's time-to-experiment by 80% and significantly improved data visualization.

Believed to be a lot faster and more capable than existing computer systems, quantum computing is set to herald the next wave of the digital revolution, disrupting the status quo and impacting our lives, communities and economies. A quantum computer could complete certain problems in minutes, hours or days compared to the years, decades, and millennia that it would take today's machines.

Microsoft believes it is less than five years away from empowering a quantum revolution with their unique topological approach, which involves the repeated configuration and execution of cold experiments in laboratory freezers, followed by review and interpretation of the data collected. If Microsoft could shorten the time required to execute those processes, they could maintain their lead.

Which is why, in 2017, Microsoft's program manager for quantum computing, Jeff Henshaw, reached out for help. He engaged GenUI to design and develop software products to support ongoing research vital to the development of the world's first scalable quantum computer.

At the time of the initial engagement, the Microsoft Quantum team was in its infancy. With aspirations to do great engineering work but a nascent team, Henshaw looked outside to find a software development firm with heavy engineering prowess and UX design expertise. He asked for referrals from colleagues within Microsoft as well as an agency he used in his Xbox days, and one firm surfaced to the top of the list: GenUI.

GenUI had just wrapped up a complex data visualization project for the Steve Ballmer Foundation to make understandable to the American people just where the US government spends its money. To do that, the firm had to find a way to make the platform access myriad government databases and aggregate data from multiple sources, which sounded very similar to Microsoft Quantum's situation: the need to build the next iteration of a web-based platform to unify and standardize laboratory data and processes, and allow for the sharing of important lab experiments being conducted around the globe.

 "From what I could tell," recounts Jeff, "GenUI was coming off of a high from the Ballmer work, and they were looking for their next intellectually challenging project to sink their teeth into. The timing was perfect." Jeff met for a few hours with GenUI CEO Jason Thane and his highly skilled, diverse team members ranging from graphic designers to cloud developers. "What really sold me on GenUI was their genuine excitement about what we were trying to achieve."

Within a matter of months, GenUI created and deployed a custom software application that replaced five other applications, decreased the time to create a new experimental run by 80%, and reduced the time it took to onboard a new researcher. GenUI developed an Azure

cloud-based web application based on the React JS web application framework – supported by Azure Cosmos DB, Azure Active Director – and operated on Azure Virtual Machines. The solution was also informed by the way the quantum researchers used Jupyter Notebooks, a popular technology tool within academia allowing teams to easily execute, edit and share Python code.

"GenUI is a superior all-around development shop, from concept to final deployment of a project. There are a lot of firms who are great at creative design, but can't do the engineering implementation. There are others who are great at prototyping – something we could put on stage beautifully at a tradeshow, for example – but they're not real and they cannot scale."

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As they wrapped up the initial project, the Microsoft Quantum team started to think about what else they could tap GenUI to take on. The second project presented a new challenge – how to plot and view experimental results as they stream in from across labs across the world. Microsoft's unique topological approach to scaling quantum computing relied on finding patterns to discover a particular particle that could unleash the final roadblock; discovering those patterns required fresh visualization perspectives.

The quantum scientists were looking at thousands of plots, but only one at a time – it was hard to make sense of the data because there wasn't a lot of context. GenUI's task was to mesh the data from multiple plots, moving to a multi-dimensional format to present parallel coordinate plots. To bring the idea to life, GenUI talked with scientists, observed them in action via recordings, and spent a week in a Microsoft Quantum research lab in Europe. The visualization tool that GenUI created is considered a huge boost to visualizing complex experimental data.

Ultimately, GenUI's success with the Microsoft Quantum research team relied heavily on knowledge sharing, collaboration, and their agile-style of practice, tackling short sprints, staying in constant communication with the client, and iterating as they learned every step of the way. GenUI CEO Jason Thane reflects that "Quantum computing is a domain that few people in the world understand. There was no precedent – this was an entirely novel approach to software development. I'm proud of our team and honored that Jeff and his Microsoft Quantum team entrusted this important work to GenUI."

About GenUI
GenUI is a software product engineering firm solving complex technical challenges for technology and software companies – or those who want to become them.

We provide an environment for our employees and our clients that is conducive to innovation.

Our knowledge center and community of excellence endows everyone on a project team with the best and most current thinking about software product engineering, and our Tech Radar provides focus and perspective on enabling tools and technologies.

[1] "How Microsoft is leading quantum computer race to unlock mysteries around us" – *The Economic Times*, November 3, 2018