

Quantum Marketplace Webinar: Quantum Computing Systems – 5/5/2022 (available 5/31/2022)

Murray Thom: Hey okay great. Hi everyone my name is Murray Thom, I'm the Vice President of Product Management at D-Wave Systems. I'm excited to be here today to talk to you about D-Wave systems and what we provide.

The first place I want to start is just beginning at the beginning here. What is a quantum computer? If we think about the computers in our everyday life like our laptops or our phones to reach in and you pull out the computing chip in there that's what's doing the information processing for you in a computer. And if you go into that, chip that CPU or GPU and change its fundamental building blocks so that they can now behave quantum mechanically. But more importantly, behave quantum mechanically in a way where that's going to accelerate your information processing. You've just made that a quantum computer. And in that way, that's different than any other computer that's on the planet.

Okay, so fair enough. If we give them a quantum mechanical property, how are we actually going to use that to accelerate information processing? So, there's two principal ways. One is that you can use those quantum states to store more information in your computer memory and to process over that. And that's fantastic. That's as called the gate model of quantum computing. It enables some very powerful algorithms. It also has some sensitivities if the quantum state collapses, I can actually destroy that information, which is part of the reason why we have error correction schemes for recovering it. There's another mode for using the quantum mechanics to help accelerate information processing, which is to use the quantum mechanics to move through solutions quickly. And this is usually referred to as the quantum annealing model. The great thing about this is that if a quantum state collapses, the movement between solutions will pause but as after the end of the pause, the quantum state will reemerge, and you'll continue moving through solutions. So, both of these are ways that we can leverage quantum mechanics to accelerate information processing. And D-Wave is the only company building both types of technology because we want to be able to provide the technology necessary for your full quantum use cases.

But having said that, this isn't about technology and the quantum computing industry is about helping businesses, governments, academics and users, to achieve their objectives more efficiently. So, let's focus our conversation here about practical quantum computing and the ways that we can make use of it.

There's a compulsory legal slide. So, at D-Wave Systems, we have the world's most powerful and connected quantum computers, the D-Wave Advantage Systems with over 5000 qubits and 15-way connectivity. It what's really different about these systems is that they're currently available in the cloud right now. And you can begin programming on them immediately and start working on getting demonstrations of application value, on the applications that we're working on. We have a cloud platform with an integrated developer environment. We've got Python, open source ocean tools that you can use for problem formulation as your program programming those systems, as well as the support site and user forums for you to collaborate with others.

Now, through that leap system, you can make use of hybrid solvers. And this is not about hybridizing and looking at the way that quantum computers use this is about achieving more results and applications scale quickly. And these cases when you're programming these systems, they actually deploy classical computers in the cloud that start working a process full application scale problem, breaking out pieces, submitting them to the quantum computer and then reincorporating them in the solution. So, it's a very powerful mechanism to allow you to get to up to a million variables for some binary quadratic model formulations or if you're working with problems with constraints up to 100,000 constraints, really enabling you to get like enterprise scale application problems and demonstrations of real value.

We get asked, you know, are people using these systems right now? Absolutely, they are. Here's a selection of a series of customers in different sectors, the types of applications that they're looking at, and the phases of that development that they're going through. So typically, beginning with application evaluation, looking for the places in their business where quantum computing technology could disrupt and provide big advantages for them. Developing to proof of concepts and application scale but then move to a pilot deployment and then to actual full production scale deployments. With some examples, for instance, being the development of new OLED materials, and also protein design for medical therapeutics.

Now when I'm out speaking at developer conferences, people who are looking to program on computers and application they sort of tell me if I knew more about what a quantum computer would could do, I'd be more interested in learning about the technology. Here's a set of examples with Menten that have done quantum design proteins that have been synthesized and taken to live virus testing and against COVID-19. Save On Foods which is using this for grocery optimization for their complicated business that includes ordering and home delivery and brick and mortar store operations. They've been able to take some important grocery optimization problems from 25 hours down to two minutes. DENSO has been looking at applications of optimizing the manufacturing floors, particularly the movement of autonomous vehicles, autonomously guided vehicles to the floor and even optimizing for safety they were able to demonstrate a 15% reduction in the time spent waiting for the movement of those vehicles. and OTI working on the oil quantum chemistry examples.

Now, I've got more here that we could possibly read or go through. This is just meant to be something as a reference to let you know what's possible here but there's a number of companies who are working in financial services and *[inaudible]* we've also got examples here in manufacturing, logistics and mobility group have actually done some really interesting work on optimizing waste collection vehicles in order to reduce co2 emissions. So really important applications for sustainability. And Savantech has done some work optimizing operations at the Port of LA in order to make their throughput more efficient, which is a really important part as we're looking at applications to do with supply chain logistics, changes and adapting to those and really allowing organizations to be more efficient and effective of what they're doing. as well as a variety of applications and Life Sciences, which is, of course something that's really important to us with a variety of companies working through this. So I'll just pass over this briefly. This was the phases that we typically see businesses working through as they're looking to apply quantum computing to their applications. And that encourage you to check it out and follow up with us and find out more.

Mark Wippich: We just finished the line-up and now we're going to go into the panel discussion. Are you a full stack quantum computing provider? And one question that as part of that: Can a third party software for quantum provider or providers work on your platform?... Murray do you care to comment on this?

Murray Thom: Yeah absolutely. The easy answer is absolutely, D-Wave is a full stack quantum computing provider. We're providing quantum computing systems, software and services that help people with mapping their applications and demonstrations of business value. Our technology is stacked things up up to our Ocean open source software which is Python-based and you can install with [inaudible] but it has a lot of C++ components for speed under the hood. And there are a number of ways that third parties can contribute. So we've had companies like [inaudible] in Japan and teams from Los Alamos National Laboratories that have actually contributed components to our Ocean library that have been incorporated. We've got folks like AWS Bracket who have actually developed tool kits to help people program in the quantum computing systems and they have created extensions to our Cloud client for people to be able to submit jobs to Amazon Bracket and our quantum computers there. And also in the case of those who are really familiar with the IBM Qiskit platform, we have extensions to the IBM Qiskit platform so they can formulate problems there and submit them to D-Wave quantum computers that way. So really it's quite robust and there are a lot of opportunities for people to be able to access the programming. I should also point out for researchers who have expertise that really applies to certain areas of the technology stack, because it's open source, you can actually go in and make improvements to some of the components of the technology stack. And what's great about that is that everyone who's building applications on top of that gets the compounding benefit from all the contributions from all those researchers at every point in the stack

Mark Wippich: Yeah great thank you.

Mark Wippich: Okay, so let's start this time with Murray. How does a customer today access your cloud platform and what does that look like?

Murray Thom: Absolutely. So right now, we have our leap cloud service that's available so if you just, you know, go to your favorite search, search engine search D Wade leap, or you'll find that a variety of links that will take you there with information about it. When you click on that you can sign up and get free immediate access to our quantum computers and by immediate, I mean that you can submit problems and demo is right there and leap.

Through the interface and through our integrated developer environment and get answers back immediately in seconds. You don't have to schedule the time later in the week or anything like that. And if you are willing to open source record if you're working on a project that you want to contribute to the open source community you can link that project and will continue to provide you with that access each month renewing access each month. And if you're looking for access into commercial terms you can actually contact absolutely contact us and we can work that out with you so that you can get tech continuing access to the quantum computers that way. It's also available in Amazon bracket so there are folks who can access it through that service for Amazon users. And, yeah, you can find support online and user portal and community as well for for when you're looking at that access and getting started with your programming and I should also mention that we have training courses available for those who want to learn about problem formulation techniques and and problems that are suitable for quantum computers.

Mark Wippich: Great, great.

Mark Wippich: How does your company define quantum advantage and where do you customers see this happening now or soon?

Murray Thom: Yeah, I think, my answer is probably going to divert from Ryan and Jerry so I would say that generally speaking, what we sort of see is that the interested in quantum advantages largely from academics and researchers, and most people who are looking at applications and practical business value we're looking at sort of like commercial advantage, so they're really looking for a situation where they can build a solution or an application that can incorporate quantum computing, and they can actually do better than the weather operating right now they're looking for improvements in efficiency you know they're reacting to the supply chain disruptions that they want to get more robust and they're looking for places where that's going to be.

We've already been able to do demonstrations in quantum material simulation where we're 3 million times faster, using our quantum healing systems, then the classical, the best possible alternative. That's plenty. But, you know, probably was most compelling for businesses is like that entire advantage materialize them to product generations, so we went from not being able to simulate the properties of those kinds of materials to being 3 million times faster at it that are going to leverage that growth. But I would say that like long after you have demonstrated a business advantage with quantum computing and quantum hybrid technology. There's a huge bar like technical bar that needs to be suppressed to prove that quantum mechanics was the only way that you could have gotten that advantage and quantum mechanics played a pivotal role in the solution finding in that particular node, we've, passed that bar with some of these simulations of papers that we've written on a material simulation but it's definitely not the places that we see businesses starting so they're terrible. It's much more about commercial advantage and I think that quantum advantage will emerge naturally over time.

Mark Wippich: Okay so, what are the economical potential applications of your technology to NISQ, and not everybody may know what NISQ is so I've defined that at the bottom as noise intermediate-scale quantum, right, based computation or simulation/annealing, any comment there?

Mark Wippich: So Murray, you guys have been at this a long time. What are you seeing?

Murray Thom: I think this is exactly the right question for us all to be focused on as a broad industry, not the technologist, but like the technologists, plus all the users and all the interested businesses. You know, if you look at the amount of money that's put into as a GPU development, I think Nvidia has spent something like \$2 billion on the latest GPU processor and that's the best GPU processor that's ever existed. But I've been playing video games using GPU processors from Nvidia for 20 years. So, you might ask the question like, Well, why didn't they just build this processor 20 years ago, and that's because it didn't cost them \$2 billion. It costs them every generation and all the money they spent on every successive processor they built so far, plus that \$2 billion to make that and the reason that they have the ability to build this processor is because they were able to produce value for their users at every iteration along the way. And that's what needs to be happening with quantum computing. That's exactly why we're so focused on practical quantum computing that brings people real business value on their applications right now. There is been a lot of work by the Boston Consulting Group looking at the total addressable market for quantum computing, you know, and it's going to be there's going to be applications in the area of optimization. There's going to be applications in the area of like quantum simulation, and in differential equations. what's now known

experimentally we've seen papers written with experimental investigations and mathematical investigations is that for the purposes of applications that involve optimization, some of the examples I talked about with sustainability for waste collection, and also for supply chain logistics with the optimization of the operations of the Port of Los Angeles is that quantum annealing is going to be the only quantum computing platform that's going to be able to effectively address those and that's primarily because of all the programming models that involve gate have such a huge overhead in that parameter tuning step, that actually negates the advantage you get from using the technology there. However, there are really important applications if you think about discovering new drugs, where you're going to need to be able to use gate model-based quantum computers so that you can do that fermionic molecular modeling that you need for that drug discovery. And then later in that process, you're going to be optimizing drug trials. So really, you're going to be using multiple technological modalities as you're bringing that application of that value to the market. But we should be focused on here is not technology lead inspiration for application but application lead inspiration for the technologies, which is that users should be coming to our cloud services, looking for those open source examples that show them how applications are approached. And then we should be bringing the technologies that bring the most potential to that whether that's annealing based gate model-based quantum computers, or even classical computing technologies and really combining these all together so that all of their strengths are brought to bear for the greatest advantage for our customers.

Mark Wippich: Yeah, I'm going to jump to the next question. I know we had a few that didn't answer here but, unless one or you feels very strongly about it, I want to get to the next point. Okay, so we'll do that. What is your pathway to fault tolerant quantum computing?

Murray Thom: Yeah, so we're taking a five phased approach to producing a fault tolerant quantum computer and we're really trying to accelerate directly to that end goal as quickly as possible, just precisely because if there needs to be in this case, we want that to be as short as possible. It's not super-duper clear yet where we can get the sort of economic value out of that for our customers. So, what we're primarily focusing on to begin with is that we have like a very advanced superconducting multilayer stacks, we want to validate our depot funding qubits in that multi-layer stack. The second phase is really about then validating the on-chip control of those systems, and then validate the error correction. So, we want to get through those three phases as quickly as possible because that will allow us to then demonstrate logical qubit manipulation so a logical qubit is one which is a combination of multiple devices, which allows you to create an error correction qubit. And it's, it's the one that my colleagues have been referring to, and that's part of the reason why so many of our implementations are looking at scaling to really large numbers of devices. Once we can get through that demonstration of the logical qubits manipulation, then we can start designing scalable task specific components for a processor. And D-Wave has a lot of experience with building processors that are going to be working in application workflows at full scale. So that kind of that approach there the multi qubit validation multivator stack, onto control the error correction, the logical qubit manipulation, and then the task specific components is our remain strategy and plan on our clarity roadmap, towards delivering these error correcting gate model.

Important Information About the Proposed Transaction between D-Wave Systems Inc. (“D-Wave”) and DPCM Capital, Inc. (“DPCM Capital”) and Where to Find It:

A full description of the terms of the transaction between D-Wave and DPCM Capital is provided in a registration statement on Form S-4, as amended, filed with the Securities and Exchange Commission (the “SEC”) by D-Wave Quantum Inc. that includes a preliminary prospectus with respect to the combined company’s securities, to be issued in connection with the transaction and a preliminary proxy statement with respect to the stockholder meeting of DPCM Capital to vote on the transaction. D-Wave Quantum Inc. and DPCM Capital urge investors, stockholders, and other interested persons to read the preliminary proxy statement/ prospectus, as well as other documents filed with the SEC, because these documents contain important information about D-Wave Quantum Inc., DPCM Capital, D-Wave, and the transaction. After the registration statement is declared effective, the definitive proxy statement/prospectus to be included in the registration statement will be mailed to stockholders of DPCM Capital as of a record date to be established for voting on the transaction. Stockholders also may obtain a copy of the registration statement on Form S-4, as amended—including the proxy statement/prospectus and other documents filed with the SEC without charge—by directing a request to: D-Wave Quantum Inc., 3033 Beta Avenue, Burnaby, BC V5G 4M9 Canada, or via email at shareholdercomm@dwavesys.com and DPCM Capital, 382 NE 191 Street, #24148, Miami, Florida 33179, or via email at mward@hstrategies.com. The preliminary and definitive proxy statement/prospectus to be included in the registration statement, once available, can also be obtained, without charge, at the SEC’s website (www.sec.gov).

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