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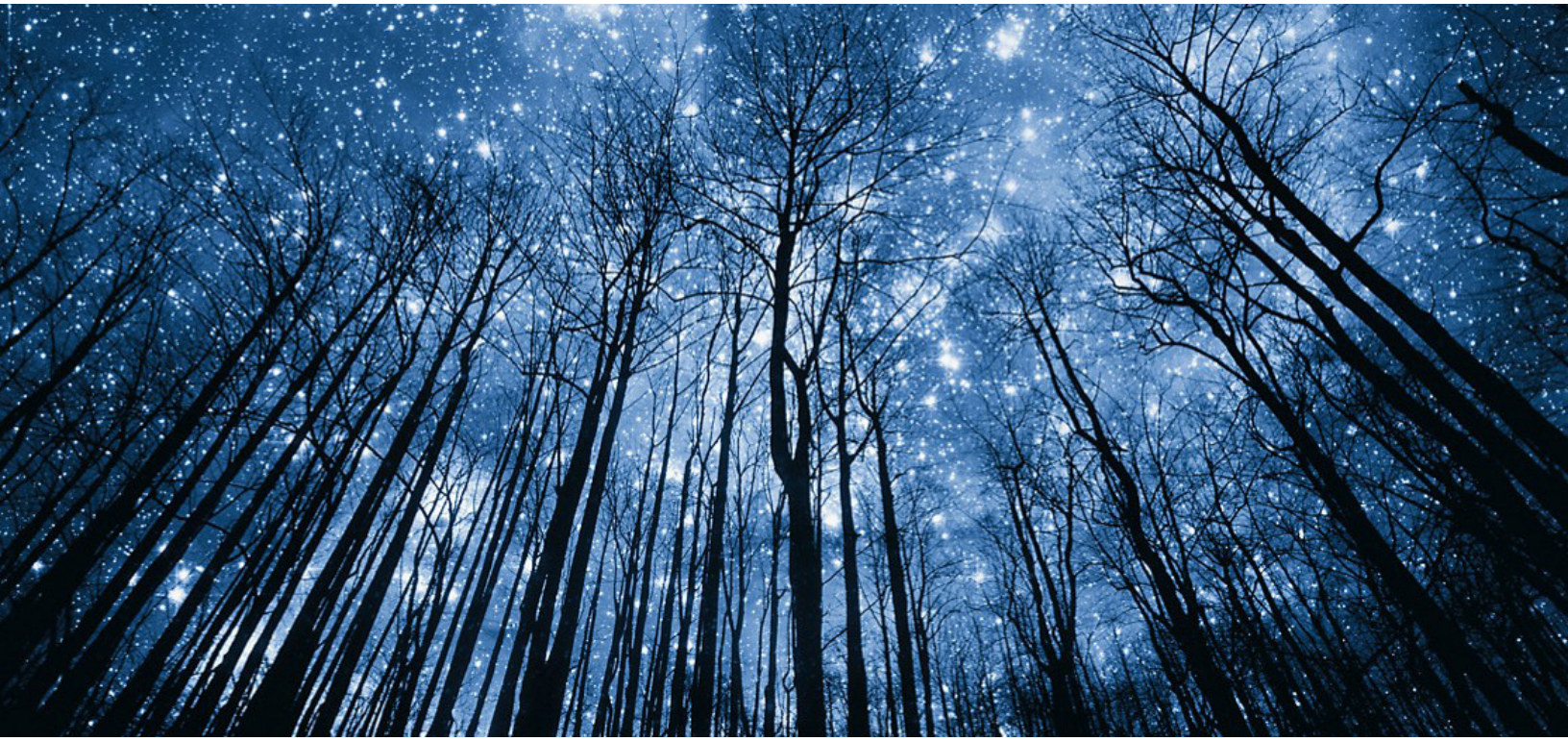
DARQ TECHNOLOGIES



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Executive Summary

This article deep dives into the technologies shown below to detail how each bring their own benefits and simplicity to our modern problems. Embracing all these technologies and employing them will benefit organizations in more ways than we can imagine.

Introduction to DARQ Technologies

The digital era is now moving towards a post-digital era. What comes after this and why is it important for leaders to look beyond their ongoing digital transformations. Technology leaders need more than digital transformation to stay ahead and succeed. That would come by embracing a set of technologies to drive innovation and growth.

Do you know what is the emerging technology powerhouse of the future? Have you ever heard of DARQ (Distributed Ledger, Artificial Intelligence, Extended Reality, and Quantum Computing) technologies or DARQ power? If you have, then you are on the right track with technology that will prepare you for the future. If you haven't, you must learn and be aware of these technologies as they are going to be the powerhouse of technology, power of computing or power of internet in few more years.

DARQ technologies is a bundled term or an abbreviation for Distributed Ledger, Artificial Intelligence, Extended Reality, and Quantum Computing.

Distributed Ledger Technology
DLT is a transactional technology. Its main benefit is that users or organizations can transfer money and other critical details in a manner not possible before. Prime examples are Cryptocurrency and the NFT world foreseen.

Artificial Intelligence (AI)
AI is something which is not quite as new as DLT, there are various existing privileges we use that employs AI for its operation. AI is predicted to spread even wider than its current existence and will be encountered more frequently in our day-to-day functioning. Examples include Netflix's prediction capability, Google's Search engine predictions, and so forth.

Extended Reality
Extended reality (XR) is an evolved term from the virtual and augmented realities we had previously. As its predecessor, it is used extensively in the entertainment industry and to help users interact with the world in a far simpler way. Examples are the recent Haptic gloves created for letting users feel things in the Metaverse, virtual reality enablement in movie houses, etc.

Quantum Computing
Quantum computing (QC) is touted by many because of its powerful and dynamic capabilities to solve many of the problem which had caveats in the recent past. It is sometimes referred to as micro computing.

DARQ is now at the place where the internet was in the 1990s. In those times few companies did not see the significance of internet whereas few other companies that understood the importance of internet - adopted it have now grown into multi-billion-dollar companies.

DARQ is an emerging technology and just like other new technologies that have been a catalyst for change, it is expected to be the catalyst in the next technology disruption or change to deliver new capabilities for businesses.

Each of the technologies within the DARQ technologies have individually proved to be a differentiator in different aspects and different industries. AI has made a significant mark in Financial and healthcare industries, while XR (Extended Reality) has paved its way in improving educational and customer experiences. Distributed ledgers are one of the best known in the context of cryptocurrencies. Quantum computing is going to be the ultimate problem solver in the aspects of computations.

Given that the technology is already blooming and expanding, imagine the kind of disruption the technologies could bring in if tied together. That disruption is not too far away. It is the DARQ technology.

Distributed ledger technology

Distributed Ledger Technology (DLT) is a digital system that record transactions and these transactions along with other details are recorded in multiple locations simultaneously.

Unlike the other databases, DLT is not centralized. It is a decentralized system which can be managed by multiple users from multiple different nodes. The data can be retrieved, checked for validation, or updated simultaneously over the computer network.

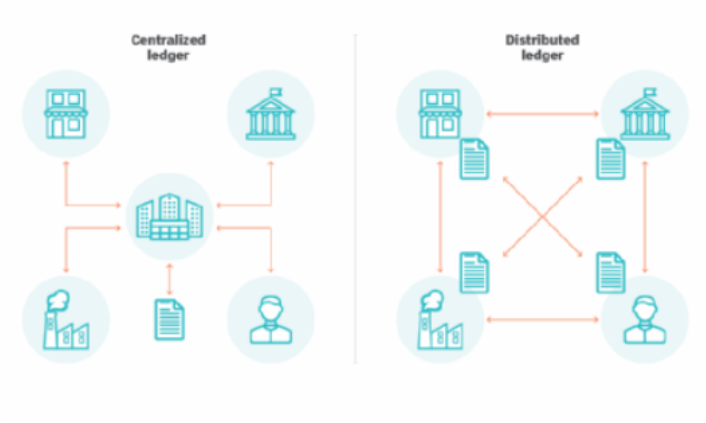

Figure (1): Centralized Ledger vs Distributed Ledger

(Source: https://www.techtarget.com/searchcio/definition/distributed-ledger)

DLT uses cryptographic technology to store data securely. Cryptographic signatures and keys are used to allow access to authorized users only.

The technology also creates a database that cannot be altered, which means that information, if stored, cannot be deleted and any updates are permanently recorded for generations. In this case, the advantage is that the user or organization can transfer money and other important information in a way that has never been done before.

DLT is being embraced across financial industries.

Fintech companies and most other financial entities have been adopting fintech methods to stay ahead in the business. Though Fintech companies often find it difficult to enter the financial services industry, that is no longer the case. Disruption comes from fast-moving companies, focusing on new technologies or processes in everything from mobile payments to insurance.

DLT has great capabilities in improving the financial industries, with applications in various fields such as money transfers, international-trade and securities, and so on. A common feature in all these areas is the need to link several characters between them that are not really a relationship of trust. Here, DLT has the potential to improve transaction and tracking efficiency and thus reduce certain costs and risks.

Types of DLT

Figure (2): Types of DLT

(Source: https://medium.com/@support_61820/different-types-of-dlts-and-how-they-work-cfd4eb218431)

Blockchain

Blockchain is the world's most popular DLT version. Work records are kept in the block in the form of a series of blocks, like a long list of records. Digital information stored in blocks includes time, date, and specifications. Additionally, Blockchain blocks contain sender information and a unique 'digital signature' to protect anonymity.

Blocks in Blockchain contain a unique ID called a 'hash' that is used to distinguish blocks in a ledger.

Hashgraph

The next addition to the DLT versions is Hashgraph, which allows for the maintenance of many works in a manual with a simultaneous stamp.

The record you read in Hashgraph is known as "Event" and includes the keeping of everything done in the same building. The Hashgraph DLT system ensures that no nodes in the network can alter transactions or information. Compared to Blockchain, you can clearly see additional resources for opt-in by installing a block.

Another interesting feature about Hashgraph as a variant of DLT refers to the system of small storage units, as you do not need to keep track of activities in the directory forever. In Hashgraph, all nodes in a network can reach an agreement on the action process and schedule the process accordingly.

Directed Acyclic Graph

The next addition to DLT types – DAG, or Directed Acyclic Graph – is basically an advanced DLT with a different structure. DAG can to support Nano transactions and better equity with network expansion. In addition, DAG differs from other types of DLT in terms of its compliance. Every node in the network must provide proof of transaction to the registrar and can initiate a transaction: locations must verify at least two functions to verify their functionality.

Thus, jobs with long branches of previously certified jobs will probably be considered legitimate. Companies that need to deal with a large number of jobs can use DAG.

Holochain

Holochain DLT is the latest addition among DLT types other than Blockchain. It is one of the most advanced DLT providers that gives developers new ways to create applications that are distributed worldwide. The main difference between Holochain and other types of DLT is clearly its agent-centric structure. Holochain DLT avoids compromising worldwide by providing all agents with their own breach system. Holochain is a promising alternative to business use cases that require high balance and integrity of the system.

Tempo (Radix)

The final addition to the new DLT variants refers to Tempo (Radix). Tempo is a relatively new addition that provides the benefit of the timestamp and other DLT functionality. A highlight of Tempo is that there is no need for any changes to use Tempo in public and private modules. Additionally, you will not need any remaining add-ons in hardware components to create your own country-class applications, coins, or tokens.

Artificial Intelligence

AI replicates human intelligence in machines to think like humans and replicate their actions with the help of the program. The word Artificial Intelligence can apply to any technology that exhibit traits of thinking by itself, such as learning and problem-solving.

An essential element of AI is its ability to be accountable and to perform actions that have the best chance of achieving a particular goal. A subset of AI is machine learning (ML), which refers to the concept that computer programs can automatically learn from and adapt to new data without human assistance. Deep learning (DL) in-depth learning methods enable this automatic reading by absorbing large amounts of random data such as text, images, or video.

Modern Method, one of the leading books in AI research, explores four potential goals or definitions of AI, which differentiate computer systems based on common sense and reasoning.

Personal route

Systems think like human beings

Systems work like human beings

Best way

Systems think logically

Systems work logically

Types of AI – Weak or Strong

Weak AI/Narrow AI is AI trained and engrossed to perform certain tasks. Most AI today is Weak AI. The word ‘Narrow’ might be a more precise descriptor for weak AI as it is anything but weak; it enables some very robust applications, such as Siri by Apple, Alexa by Amazon, and autonomous vehicles.

Strong AI/Artificial General Intelligence (AGI) is an AI where a machine would have intelligence on par to humans in theoretical form; it would have its own consciousness that is capable of solving problems, learn, and plan for the future. AGI – also called superintelligence – can surpass human intelligence and the ability of the human brain. While strong AI has no practical examples in use today, AI researchers are exploring its development.

Deep learning vs. machine learning

Deep learning (DL) and machine learning (ML) are often confused with each other. It’s important to note the difference between the two. Both are subnets of AI but actually, DL is a subset of ML.

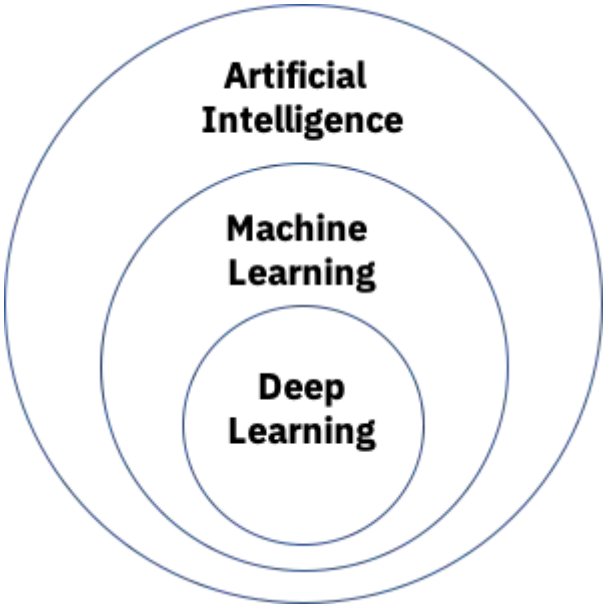

Figure (3): Artificial Intelligence subnets

DL is a sub-field of ML related to algorithms that simulate brain formation and function called artificial neural networks. DL connects to the neural network that consists of more than three layers which would be inclusive of the inputs and the output that can be considered a deep learning algorithm. This is generally represented in Figure 4.

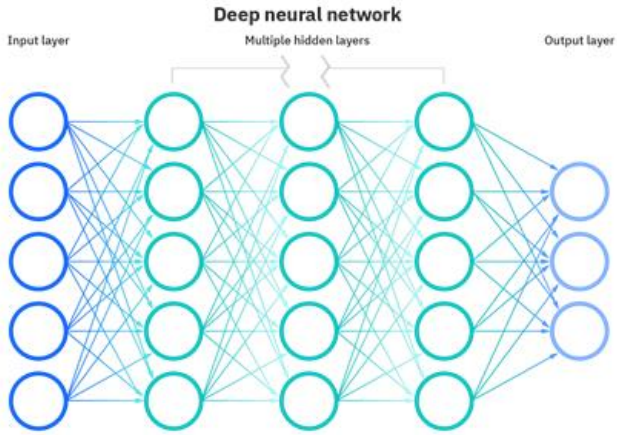

Figure (4): Deep neural network

DL and ML can be differentiated by how each algorithm learns. DL automates most of the feature extraction piece of the process, reducing human intervention and enabling use of larger data sets. ML is more dependent on human intervention to learn. Humans decide the order of features to understand the differences between data inputs, usually requiring more structured data to learn.

Artificial intelligence applications

There are many real-world applications of AI systems today. A few of the most common are:

Speech Recognition: Also known as automatic speech recognition (ASR), computer speech recognition, or speech-to-text, speech recognition uses natural language processing (NLP) to process human speech into a written format. Many mobile devices incorporate speech recognition into their systems to conduct voice search – e.g. Siri – or provide more accessibility around texting.

Customer Service: Online chatbots are replacing human agents along the customer journey. They answer FAQs on topics, like shipping, or provide personalized advice, cross-selling products or suggesting sizes for users, changing how we think about customer engagement across websites and social media platforms. Examples include messaging bots on e-commerce sites with virtual agents, messaging apps, such as Slack and Facebook Messenger, and tasks usually done by virtual assistants and voice assistants.

Computer Vision: Meaningful information is derived from digital images, videos, and other visual inputs after enabling AI technology into computers and systems. This ability to provide recommendations distinguishes it from image recognition tasks. Powered by convolutional neural networks, computer vision has applications within photo tagging in social media, radiology imaging in healthcare, and self-driving cars within the automotive industry.

Recommendation Engines: AI algorithms can help discover data trends using historical consumption behavioral data that can be used to develop more effective selling strategies. This helps customers by recommending relevant add-ons during the checkout process for online retailers.

Augmented Reality concept

Augmented Reality (AR) is a variation of Virtual Reality (VR). While VR immerses the user in the action environment, blocking out the real world around him, AR allows the user to see the real world, with real objects linked to the real world. Thus, AR complements reality, rather than completely alters it. AR can be considered a “middle ground” between VR and the real world. One concept that best describes AR is Reality-Virtuality Continuum (RVC). The virtuality continuum is a continuous scale ranging between the completely virtual, a virtuality, and the completely real, reality. In between are AR (near real location) and Augmented Virtuality (AV) [near real location).

More recently, with the ability to process video images in real-time, computer graphics systems and new display technology have combined to create a well-registered visual image display with a 3D landscape view around the user. Researchers working with AR programs have proposed them as solutions in many domains such as areas discussed above from entertainment to war training.

Many domains, such as medicine, have also been promoted to traditional VR programs. Given that imaging technology pervades the medical field, it is not surprising that this domain is considered one of the most important in AR systems. The simple AR method has been used in entertainment and business matters for a long time. A good example is a weather reporter

shown standing in front of a changing weather map. In the studio, the reporter actually stands in front of a blue or green screen. This real image is enlarged by computer-generated maps using a method called chroma-keying. Soldiers used posters on military bases to present information to the pilot on the front page or visor of their helicopter. This is a kind of AR.

Augmented Reality for mobile devices

Today, AR features are used in mobile applications. One of the most popular is the Layar Reality Browser, which shows your proximity by displaying real-time digital information over the real world as seen with your mobile phone camera. The real world is expanded as you see it with your cell phone, based on your location. Layar works by using a combination of a mobile phone camera, compass, and GPS data to identify the user's location and viewpoint, retrieve data based on that location integration, and cover that data with camera view.

Layar provides ways for anyone to create their own layers. Background is basically a PHP server that supports JavaScript Object Notation (JSON) through the MySQL website. Creating a new layer means that you are creating your own PHP server that can accept and process Layar applications that provide web-based services. Users can create a series of obj or mtl files will be converted to files using the Layar converter. The l3d file format is a special Layr-created format that contains a series of vertices and textures and can be provided by the Layar client application. After user has created their own server to access the layer from the client application, they must apply for the developer key and ask the Layar team to publish the layer, making it visible to all Layar users. From a developer's point of view, the options are limited: we cannot extend the functionality of the client application, nor create our client application. Thus, we are limited to the set of working client layar currently available. This is mainly because the system is not open source.

Wikitude World Browser is another AR browser for the Android platform based on Wikipedia content and Qype. The Wikitude API is only available as a library, but it is not an open source project. This library can be used to launch the Wikitude Intent. Speaking of Android development terms, it's like starting another app and managing a child app with a few tasks. This does not allow for much customization, which seems to be a problem if the user wants to configure, for example, the provision of a Wikitude-based system or adding SOAP call support to the server. This fact reveals that Wikitude is also limited and currently no open source client is fully customizable to create the Augmented Reality app.

Augmented Reality API

The big problem facing AR API development, in our view, is that right now any developer who wants to build an AR app needs to start from scratch. These are both time-consuming and ineffective because they face similar problems with many other engineers who have already solved them. They are often forced to turn to retrofit engineering to use certain features that are already used in other applications. Such an application may require knowledge in various fields such as Physics, Graphics, 3D modeling and Software Architecture. In addition, considering the most effective AR daily application can be on mobile devices, developers should be free to work on various mobile platforms such as Android OS, iOS (also known as iPhone OS), Windows Mobile or Symbian. Today, we need more resources to create an AR app, and more time and money is focused on duplicating other people’s work. This is where the AR framework and API can come in handy, I hope they are backed by a strong community of people who are interested

in the field, and who have a wide range of technological backgrounds. This will allow us to start creating better apps.

There are many other AR applications in different fields: Robotics and Telerobotic, Manufacturing, Care and Repair, Consumer Design, Education, etc. The problem is how to build systems that can work with material in the real world. The AR system generates a composite view of the user. It is a combination of a real user-friendly scene and a computer-generated visual interface that enhances the event with more information. The AR system improves the real-world environment so that the user maintains a sense of presence in the real world. Visual images are combined with the real view to create an extra display. There has to be a way to integrate real and virtual that is not in any other virtual reality function.

Improving the technology of combining real-time and virtual image streaming is the subject of active research. Material produced by a computer must be accurately registered with the real world at all levels. Errors in this registration will prevent the user from seeing real and virtual images as they are merged. Proper registration should also be maintained while the user navigates within the actual location. Disagreements or changes in transparent subscriptions will range from interruptions that make it difficult to work with additional views, to physical inconvenience to the user making the system completely unusable.

The VR system must be subscribed so that changes in the given field are consistent with the user's views. Any errors here are a conflict between the visual system and the kinesthetic or proprioceptive systems. The occurrence of visual photography gives the visual system a powerful influence on our perception.

Why do we need an AR API?

It is helpful to have an AR API that allows for easy development of AR applications. This API should be able to access certain important AR features, such as managing objects, analyzing images or rendering real and realistic images on the same display. Our main concern is to create a common tool for developing AR applications, which are accessible through the API, which contains the material manager, image analyst and material provider.

Because AR applications are highly specific to mobile devices, this tool should be designed to be accessible to mobile applications. Another obstacle is speed. AR is registered in real time, so our tool should manage, deliver material, and analyze images very quickly. The material manager must allow some basic operation over the material: to register and store the items, to perform calculations designed to retrieve objects between scales and to package them in a standard format. The image analyst must contain some important features such as depth detection and shape recognition.

These topics are in-depth research, but there are a few interesting ways in which such an analysis can be used. Provision is also an important feature that this tool should provide. Having them all (material manager, image analyst and provider), it can be very easy to use an app that registers something visual with a cell phone in a specified location so that we can later see it on the phone display. for example, the app analyzes camera input, requests return to visual object visible together.

Quantum Computing

Quantum Computing (QC) is another subset of DARQ technologies (it represents the last letter in the term, DARQ technologies). In general, QC is the technology of micro computing. Vast and powerful, QC is considered the key to solve a lot of problems earlier considered unsolvable. Its origin started almost 30 years ago and with all the advancements and focus on powerful computing and at the same time having a dynamic approach to it, we are now able to create computers that will address and solve some of today's most complex problems.

The science behind QC is that it lets us use the phenomena in quantum-mechanical such as entanglements. This helps organizations perform computations vaguely analogous to those carried out by standard computers or compute engines or even the phenomena of superposition.

One of the caveats that organizations face with implementing QC is its high capital investment and its expense in running the same, ultimately resulting in most organizations being unable to leverage this powerful machine of answers. But with the right funding and resources, organizations will be able to carry out tasks never possible before.

Quantum computers are devices that help us carry out the quantum computations that we are intending to perform. Figure (1) shows an image of a potential Quantum computer.

Figure (5) : A Quantum Computer

(Source : https://www.educative.io/courses/fundamentals-quantum-computing/qVYvrGLv54y)

Quantum computers' powers can be leveraged through three tenets:

1. Qubits
2. Superposition
3. Entanglement

Qubit

A Quantum Bit – commonly called a Qubit – is the basic unit of quantum information. The quantum versions of the classic binary bit are materialistically realized with the help of a two-state device. A Qubit is considered a two-state quantum mechanical system and is one of the simplest quantum systems that portray the peculiar activity of quantum mechanics. A helpful example is the spin of an electron; it can basically be taken in two levels, one level is spin up and the other is spin down.

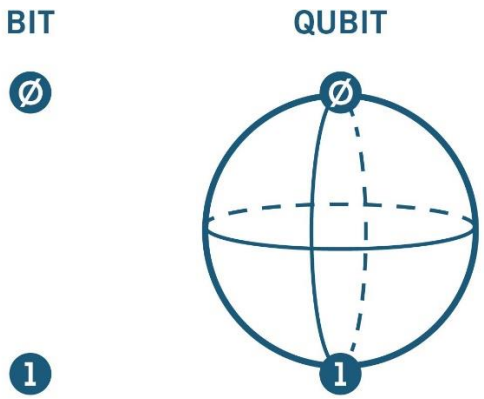

Figure (6) : Visual representation of two states of a bit

(Source : https://itif.org/publications/2018/09/20/itif-technology-explainer-what-quantum-computing)

Superposition

Superposition is the feature that makes a qubit stand apart from a classical bit and is considered by many as one of the fundamental principles in the field of quantum mechanics. In a classic phenomenon, a wave that make up a musical tone is collection of n number of waves all superposed on each other. Superposition when in quantum state can be seen similarly as a collection of linear combination of different and distinct quantum sizes. When the Superposition is in quantum state it forms a new valid quantum state.

Entanglement

Contrasting superposition, Entanglement is the same behavior in counter intuitive manner. It is basically when a pair or group of particles which when in quantum state of each particle would be hard to describe independently of the quantum state of the other particles. It is important to notice that at any point in time we cannot describe the quantum state of the system.

Figure 3 depicts Superposition and Entanglement.

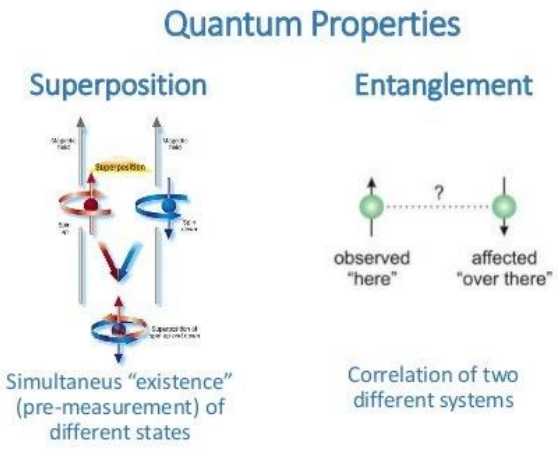

Figure (3): Visual representation of Superposition and Entanglement

(Source : https://www.c-sharpcorner.com/article/future-with-quantum-computers/)

Conclusion

This article discussed in general each of its individual parameters. However, we are just scratching the surface of the DARQ technologies iceberg; there remains a lot to study, research and develop. DARQ technologies is considered so powerful and influential that none of the organizations are risking underestimating it. Its potential is mentioned in various journals and whitepapers that it must change how organizations think, do business, or make strategic decisions.

Though at different points along adoption curve, the first wave of DARQ technologies adopters were able to drive differentiated outcomes and the differentiators are clearly seen with respect to their competitors in the market.

In various articles, DARQ is referred to as the internet of the early 1990s; ignoring its potential will lead to a huge gap which derail many organizations from achieve their goals or be too late to catch up. Being ready to embrace and harness the full power of DARQ in that post-digital future simply means beginning the journey with a simple step today.

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