DARQ TECHNOLOGIES

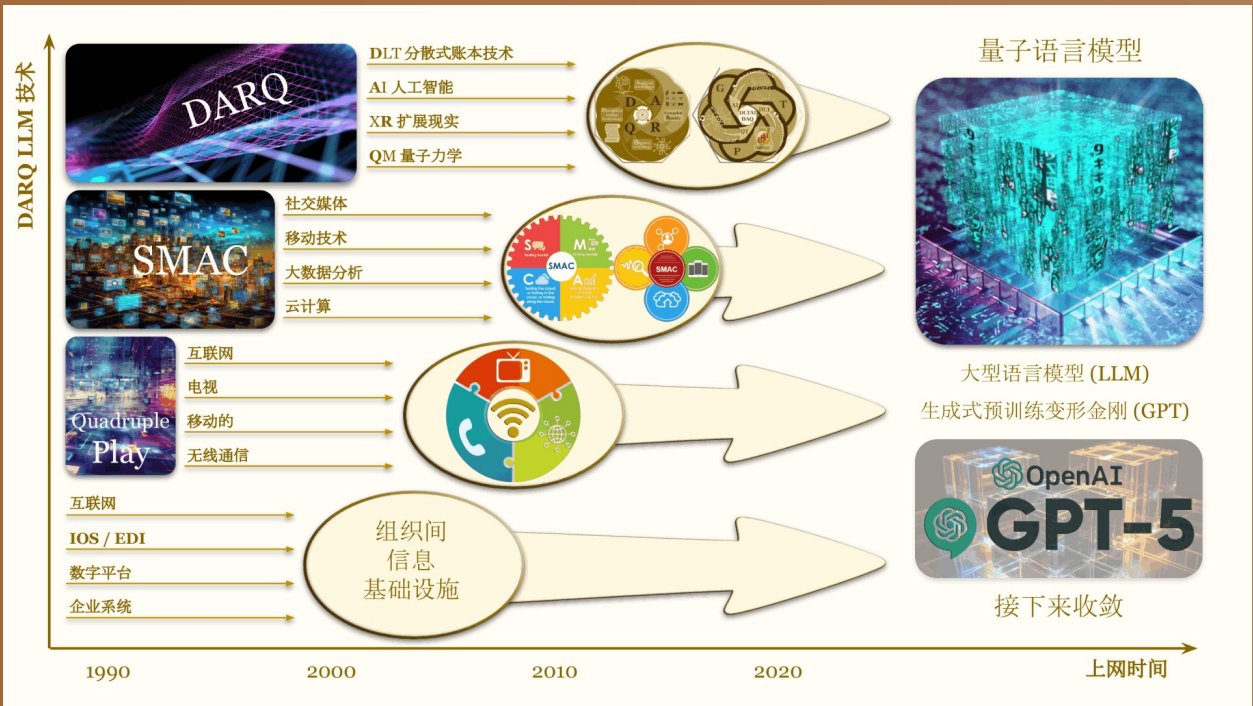
DARQ.

DARQ Technologies and their key capabilities.

DARQ Technologies is an acronym for Distributed Ledger Technologies (**D**LT), Artificial Intelligence Technologies (**A**I), Extended Reality Technologies (**XR**), and Quantum Technologies (**Q**T)[1]. These four emerging technologies individually stand at the forefront of technological advancements, and when combined, their collective potential is expected to bring about a substantial impact on multiple

industries including: financial[2], health care[3], manufacturing, travel & tourism, management systems[4], information technology, and renewable energy[5].

Core Technologies



Quantum Language Model integrates Quadruple Play, SMAC, and DARQ technologies leveraging their synergies towards the next convergence, drive innovation across industries, and reshape how we live, work, and interact in the digital age[6].

DARQ technologies represent a convergence of these four transformative technologies, offering synergies and new possibilities for innovation across various industries. Combining these technologies can unlock novel solutions, enhance security, improve efficiency, enable advanced problem-solving, and create immersive user experiences[2].

DLT Distributed Ledger Technologies

Distributed Ledger Technology (DLT) refers to a database architecture that is distributed across multiple sites, countries, or institutions.[7] It operates as a decentralized system, where data is stored across a network comprising computers, commonly referred to as nodes, rather than in a single central location, facilitating secure and transparent transactions without relying on intermediaries.[8] DLT foundation is in cryptographic algorithms, which ensure the integrity and security of the stored data.[7]

Distributed Ledger Technology (DLT) also serves as the foundation for creating digital assets, such as cryptocurrencies, digital or virtual tokens that utilize cryptographic techniques to ensure security and are built on DLT.[9] These decentralized currencies function autonomously, operating without the involvement of central banks.[8] Well-known examples include Cardano, Ethereum, Solana, Tron.

AI Artificial Intelligence Technologies

Artificial Intelligence (AI) refers to the development of computer systems that can perform tasks that typically require human intelligence, such as learning, problem-solving, and decision-making. AI is a broad field that encompasses many different techniques and approaches, including machine learning, natural language processing, computer vision, and robotics.

The large language model (LLM), a deep learning model that possesses an extensive set of parameters, started to emerge around 2018 and since then have been used in a variety of fields, including natural language processing, healthcare[10][11], chemistry[12], academic research[13], and software development [14]. These models are trained using unsupervised methods on vast amounts of textual data[15].

XR Extended Reality Technologies

Extended Reality (XR) is a term used to describe a range of technologies that offer immersive and interactive experiences beyond what is possible with traditional screens or interfaces. These technologies include Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), and other related technologies.

One prominent application of XR is the metaverse which refers to a collective virtual shared space where users can interact with each other and digital objects in real-time, creating a new form of interconnected reality. It can be thought of as a massive, persistent, and dynamic virtual universe that exists parallel to the physical world[16].

QT Quantum Technologies

Quantum Technology is a type of technology that is based on the principles of [[Quantum mechanics]], which describes the behavior of matter and energy at the atomic and subatomic level. It leverages the unique properties of quantum systems, such as superposition and entanglement, to perform complex calculations and operations that are beyond the capabilities of classical computers. Honeywell estimates that the value of quantum technology could reach a staggering $1 trillion within the next three decades. This highlights the immense potential for researchers and investors and scientific and economic significance of this cutting-edge field[17]. Scheidsteger et al. [18] provide a broad categorization for QT 2.0 dividing them into four fields. It is important to note that while these fields exhibit significant overlaps, they do not encompass all potential quantum technologies[19].

Quantum information science (Q INFO)

Quantum information science (Q INFO) serves as the foundational theory for QT 2.0. Its focus lies in key concepts such as the superposition of states and entanglement, which refers to the non-local correlation of quantum particles. A fundamental requirement for quantum information technology is the concept of a qubit, or quantum bit, which represents the quantum mechanical extension of a classical bit.

Quantum metrology, sensing, imaging, and control (Q METR)

Quantum metrology and sensing presents groundbreaking measurement techniques that surpass the precision of classical frameworks. Through the utilization of quantum entanglement's sensitivity to disturbances, a remarkable advancement in accuracy has been achieved by the latest generation of quantum logic clocks. Moreover, quantum tomography, a mathematical approach, enables the reconstruction of quantum states by employing a comprehensive set of measurements. This technique opens up new possibilities for accurately capturing and understanding quantum phenomena.

Quantum communication and cryptography (Q COMM)

Quantum cryptography and quantum key distribution are two emerging technologies that are expected to play a critical role in the coming future to mitigate vulnerabilities of traditional cryptographic methods in the face of quantum algorithms[20]

Quantum computation (Q COMP)

Quantum computation harnesses the power of superposition and entanglement in arrays of qubits to enable data processing and calculations that are beyond the capabilities of classical computers. By leveraging these quantum phenomena, quantum computing opens up

new possibilities for advanced computational tasks

DARQ Technologies Combined

2030 Market coverage forecast for the synthesis of individual DARQ technologies, taking into account the funds spent on their combinations.

DLT Technologies 10.96%
AI Technologies 25.57%
XR Technologies 10.96%
QT Technologies 4.65%

DLT + AI Technologies 10.96%
DLT + XR Technologies 6.64%
DLT + QT Technologies 2.99%
AI + XR Technologies 10.29%
AI + QT Technologies 5.64%
XR + QT Technologies 2.66%

DLT + AI + XR Technologies 3.66%
DLT + AI + QT Technologies 2.32%
DLT + XR + QT Technologies 1.33%
AI + XR + QT Technologies 2.32%

DLT + AI + XR + QT Technologies 1%

DLT AI Technologies

The convergence of Distributed Ledger Technology (DLT) and Artificial Intelligence (AI) is an area of active research and development. The combination of these two technologies has the potential to create new applications and services that are more secure, transparent, and efficient than traditional systems. DLT is impacted by AI focusing on AI-based consensus algorithms, smart contract security, decentralized coordination, DLT fairness, non-fungible tokens (NFT), decentralized finance, decentralized autonomous organizations (DAOs), and more[21].

The convergence of Distributed Ledger Technology (DLT) and Artificial

Intelligence (AI) presents a dynamic nexus where decentralized trust interfaces with intelligent automation. DLT's inherent transparency, immutability, and decentralized nature can feed AI algorithms with vast amounts of verifiable and consistent data. In turn, AI can optimize, analyze, and derive insights from these decentralized data streams, enhancing the efficiency and capabilities of DLT systems. For instance, AI-driven smart contracts on a blockchain could make decisions based on real-time data analytics, or predictive AI models could forecast market behaviors on decentralized finance platforms. Additionally, as DLT ensures data integrity across sectors, AI can act upon this data with reduced risks of biases or manipulations, fostering a future where decentralized systems benefit from informed, agile, and intelligent decision-making processes.

DLT XR Technologies

Companies and academic researchers have successfully integrated DLT and XR by leveraging the advantages offered by each technology. The combination of these technologies has opened up new opportunities and improved user experiences. VR and AR are added to Blockchain-based solutions as enabling technologies, enhancing the way users interact with digital content through natural interfaces like gaze and gestures. This integration allows for the creation of new and enriched experiences, such as virtual stores and immersive events. Additionally, the psychological effects of interacting with content in interactive, 3D environments are leveraged to enhance the effectiveness of experiences, particularly in education and training domains

DLT QT Technologies

The intersection of Distributed Ledger Technology (DLT) and Quantum Technology (QT) holds the potential to revolutionize data security and

transaction speeds in decentralized systems. As quantum computers pose threats to traditional cryptographic methods, integrating quantum-resistant algorithms into DLT ensures its resilience against potential quantum attacks. Additionally, leveraging quantum communication in distributed ledgers can enhance secure and virtually tamper-proof data transmissions, establishing a new paradigm of trust and efficiency in decentralized systems.

Called coarse-grained boson-sampling (CGBS) is a variant that can be used as a quantum Proof-of-Work (PoW) scheme for blockchain consensus. The users perform boson-sampling using input states that depend on the current block information and commit their samples to the network. Afterward, CGBS strategies are determined which can be used to verify the samples and reach consensus. Using this approach, quantum computers could be used to verify transactions on network such as Bitcoin or future, more efficient ones, more energy-efficiently reducing the electricity use by up to 90%.[22]

Add Your Heading Text Here

The quantum internet is an emerging concept that leverages quantum mechanics to transmit information through distributed network. Unlike the traditional internet that uses classical bits, the quantum internet uses quantum bits or qubits. Key aspects include:

1. **Quantum Key Distribution (QKD)**: Enables two parties to create a shared secret key with security rooted in quantum principles, making eavesdropping detectable.

2. **Entanglement**: Central to the quantum internet, entangled particles,

often photons, have states that depend on each other, irrespective of distance.

3. **Quantum Teleportation**: It's about transferring the state of a quantum system from one place to another using entangled particles and classical data. This isn't about teleporting objects, but rather quantum information.

4. **Quantum Repeaters**: These devices help maintain the integrity of quantum signals over long distances by reducing signal degradation.

5. **Enhanced Encryption**: The quantum internet can offer theoretically unbreakable encryption based on quantum mechanics.

6. **Complementing Classical Internet**: The quantum internet wouldn't replace our current internet but would work alongside it, addressing quantum-specific needs.

7. **Diverse Applications**: Beyond secure messaging, the quantum internet could interlink quantum computers, improving tasks like time-keeping and GPS.

Rudimentary work towards quantum internet has been successfully done by Dutch scientisist where they teleported quantum information on the network ("Dutch researchers teleport quantum information across rudimentary quantum network").

AI XR Technologies

The amalgamation of Artificial Intelligence (AI) and Extended Reality (XR) heralds a realm where intelligent computing dovetails with immersive environments, enhancing the depth and responsiveness of user experiences. Within XR's spectrum, AI introduces context-

awareness, real-time analytics, and adaptive interactivity. For instance, in a VR training simulation, AI can adapt scenarios in real-time based on a user's performance, or in an AR shopping experience, AI can provide personalized product recommendations overlaid on real-world items. As XR platforms become more complex, demanding intricate and dynamic interactions, AI plays an indispensable role in making these environments not only interactive but also intuitive, predictive, and tailored to individual user preferences and behaviors, laying the foundation for a deeply personalized and smart immersive digital future.

AI QT Technologies

The fusion of Artificial Intelligence (AI) and Quantum Technology (QT) signifies a frontier where machine learning meets the almost mystical capabilities of quantum mechanics. Quantum computers, with their potential to process vast amounts of information simultaneously through quantum superposition, can dramatically accelerate complex AI computations, leading to faster model training and data processing. Conversely, AI can be instrumental in optimizing quantum algorithms and deciphering quantum data outputs. Envision scenarios where AI models, which conventionally take weeks to train on classical computers, could be trained in mere minutes or where AI assists in stabilizing quantum systems. This synergy propels us closer to solving previously intractable problems, from real-time global climate simulations to discovering new drugs, symbolizing a leap in both computational prowess and intelligent analysis.

A Quantum Language Model (QLM) is a language model built using the principles of Quantum Probability Theory, which is a mathematical framework that describes the behavior of quantum systems. The QLM is a stochastic model that can take advantage of quantum correlations due to interference and entanglement. It is a new approach for building

language models that has been explored in recent years by the Natural Language Processing (NLP) community. The QLM is a proof-of-concept study that aims to show the potential of this approach rather than building a complete application for solving language modeling problems for any setting[23].

Quantum natural language processing (QNLP) is the application of quantum computing to natural language processing (NLP) that takes the phenomenon of superposition, entanglement, interference to run NLP models or language related tasks on the hardware. It computes word embeddings as parameterised quantum circuits that can solve NLP tasks faster than any classical computer[24].

Quantum Many-body Wave Function (QMWF) inspired language modeling approach to address the limitations of existing quantum-inspired language models (QLMs) in modeling the interaction among words with multiple meanings and integrating with neural networks[25].

XR QT Technologies

The intersection of Extended Reality (XR) and Quantum Technology (QT) paints a vision of immersive experiences enhanced by the extraordinary capabilities of quantum mechanics. Quantum computing, with its potential for parallel processing through quantum superposition, can significantly elevate the computational demands of XR environments, making them more intricate, responsive, and real-time. Envision VR simulations that model entire quantum systems or AR tools that visualize quantum phenomena, aiding in both education and research. Furthermore, quantum communication, with its ultra-secure encryption, could ensure unparalleled security for data transfers in XR applications. This blend hints at a future where our most advanced immersive digital interactions are powered and secured by the principles

of the quantum realm.

DLT AI XR Technologies

The confluence of Distributed Ledger Technology (DLT), Artificial Intelligence (AI), and Extended Reality (XR) signifies a transformative juncture in digital innovation, merging decentralized trust, computational intelligence, and immersive experiences. Within XR's expansive digital realms, DLT can anchor the authenticity and provenance of assets, ensuring transparent ownership and transactions. Simultaneously, AI can enhance user interaction, personalization, and context-awareness in these XR environments. Imagine a VR marketplace where AI recommends products based on user preferences, with each product's authenticity and ownership traceable and verifiable through DLT. Or an AR overlay that provides real-time data analytics using AI, with the underlying data anchored securely on a chain. This triad offers the promise of a deeply interconnected and intelligent metaverse, where experiences are as authentic as they are intelligent and immersive.

DLT AI QT Technologies ~ DAQ Supremacy

The integration of Distributed Ledger Technology (DLT), Artificial Intelligence (AI), and Quantum Technology (QT) presents a revolutionary crossroads in the digital landscape. DLT provides a foundation of decentralized trust and transparency, ensuring that data and transactions are immutable and verifiable. AI, on the other hand, brings the power of predictive analytics, machine learning, and intelligent automation, making sense of and acting upon the vast datasets within these ledgers. Meanwhile, QT, particularly quantum computing, offers the potential to process this information at previously unimaginable speeds and with unparalleled security. DAQ will offer technological supremacy whare DLT transactions are processed and verified almost

instantaneously using quantum algorithms, while AI models, powered by quantum computations, optimize and secure these systems. This confluence heralds a paradigm where data's integrity, its intelligent processing, and its ultra-fast computation converge, shaping an advanced and interconnected digital future.

DLT XR QT Technologies

Merging Distributed Ledger Technology (DLT), Extended Reality (XR), and Quantum Technology (QT) unfolds a vision of a future where decentralized digital realms are enhanced by quantum capabilities. DLT anchors the authenticity and provenance in XR spaces, ensuring tamper-proof recording of virtual assets and experiences. XR, encompassing VR, AR, and MR, presents users with immersive environments that can benefit from the super-speed computations of quantum machines. For instance, a quantum-driven VR simulation could model intricate quantum phenomena, while DLT ensures the authenticity of these digital interactions. Additionally, with quantum communication's promise of ultra-secure data transfer, XR experiences can achieve unparalleled levels of security and privacy. Together, these technologies sketch a landscape where immersive digital worlds are both deeply authentic and bolstered by the powers of quantum mechanics.

AI XR QT Technologies

The fusion of Artificial Intelligence (AI), Extended Reality (XR), and Quantum Technology (QT) charts a groundbreaking trajectory in the evolution of digital experiences. AI, with its capability for pattern recognition, personalization, and predictive analysis, enhances the depth and adaptability of XR environments, which span Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR). Quantum Technology, particularly quantum computing, introduces the potential to process vast

datasets and simulations for XR at unparalleled speeds, enabling hyper-realistic and complex virtual interactions. Imagine an AR interface that, powered by quantum computations, provides real-time complex data visualizations, while AI tailors the experience based on user behavior and preferences. This synthesis of technologies hints at a future where immersive experiences are not only deeply personalized and intelligent but also driven by the immense computational possibilities of the quantum realm.

DLT AI XR QT Techonologies

In the nexus of Distributed Ledger Technology (DLT), Artificial Intelligence (AI), Extended Reality (XR), and Quantum Technology (QT), we envision a digital frontier that's transformative in scale and capability. DLT provides a foundation of transparency and trust, ensuring verifiable interactions in virtual XR environments. AI enhances these XR experiences, tailoring them through learned user behaviors, real-time analytics, and context-aware interactions. XR, encompassing VR, AR, and MR, offers rich, immersive environments that can dynamically evolve and interact with users. Quantum Technology, especially quantum computing, supercharges this ecosystem by accelerating complex computations and potentially enhancing security protocols. Envision a quantum-processed, AI-driven virtual world, authenticated and secured by blockchain, where users interact with intricately detailed simulations, own assets with verifiable provenance, and experience a convergence of the digital and physical like never before. This amalgamation paints a future where trust, intelligence, immersion, and quantum speed coalesce into a holistic digital realm.

DARQ Technologies as IT evolution

Culminative Impact from Information Technologies (IT) during web 1.0, web 2.0, and web 3.0 eras in relation to the Converngence Time (CT) where DARQ Technologies are actual IT evolution.

DARQ technologies magnified Information Technologies (IT) evolution in relation to the Convergence Time (CT). These cutting-edge IT advancements have engendered an acceleration in the convergence of multifarious technological paradigms. The seamless integration of DARQ technologies with the IT ecosystem has instigated a paradigm shift in industries and societies, yielding transformative metamorphoses in the societal fabric. This complementary amalgamation has accelerated the development and implementation of innovative solutions, endowing society with augmented efficiency, balanced automation, and decision-making capabilities across diverse domains and has the potential to shape a better future by addressing global challenges, empowering individuals, and driving economic growth. As described by Klaus Schwab in his book “The Fourth Industrial Revolution” (4 IR), by adopting a

human-centered approach and fostering collaboration, we can harness technology to create positive change and improve the state of the world[26].

Information Technologies Convergence

Information Technologies Convergence Timeline

Year	Event	Timeline	Era	Acronym
1950	Turing Test	Mainframe	Web 1.0	
1964	System 360	Mainframe	Web 1.0	
1964	Server/Host	CS & PC	Web 1.0	
1969	ARPANET	Internet	Web 1.0	
1972	SAP	CS & PC	Web 1.0	
1977	PC	CS & PC	Web 1.0	
1990	System 390	Mainframe	Web 1.0	
1991	Public Internet	Internet	Web 1.0	
1994	Amazon	Internet	Web 1.0	
1997	Big Data	Big Data	Web 2.0	
1999	saleforce.com	Social	Web 2.0	SMAC
1999	IoT, M2M	IoT	Web 3.0	
2005	Web 2.0 start	Social, Media, Cloud	Web 2.0	SMAC
2006	AWS	Social, Media, Cloud	Web 2.0	SMAC
2007	IBM: Deep Blue	Artificial Intelligence	Web 3.0	DARQ

Information Technologies Convergence Timeline

Year	Event	Timeline	Era	Acronym
2008	iPhone	Social, Media, Cloud	Web 2.0	SMAC
2008	Bitcoin Whitepaper	DLT	Web 3.0	DARQ
2010	PC sales peak	CS & PC	Web 1.0	
2010	Self-driving cars	IoT	Web 3.0	
2010	Oculus Rift	External Reality	Web 3.0	DARQ
2011	D-Wave	Quantum Technology	Web 3.0	DARQ
2014	IDC: 4.4 ZB	Big Data	Web 2.0	
2017	4 IR	IoT	Web 3.0	
2019	Metaverse	External Reality	Web 3.0	DARQ
2020	Quantum Supremacy	Quantum Technology	Web 3.0	DARQ

Web 1.0

Web 1.0 refers to the early stage of the World Wide Web, characterized by static web pages and limited interactivity. It was the first iteration of the web that emerged in the early 1990s and lasted until around the early 2000s.

MAINFRAME

The Turing Test is a test proposed by the mathematician and computer scientist Alan Turing in 1950 as a way to measure a machine's ability to exhibit intelligent behavior that is indistinguishable from that of a human. It involves a human evaluator engaging in a conversation with both a machine and another human without knowing which is which. If

the evaluator cannot consistently determine which is the machine based on their responses, the machine is said to have passed the Turing Test.

A mainframe computer is a powerful and large computer used by large organizations for critical tasks. It has more processing power than other computers but is not as big as a supercomputer. Mainframes originated in the 1960s and are often used as servers. They played a crucial role in supporting the infrastructure and hosting the websites of that era[27].

System/360 (1964) and System/390 (1990) are computer systems developed by IBM. System/360 was a family of compatible computers that introduced advancements in compatibility, scalability, and software compatibility. It marked a significant milestone in computing history. System/390, an evolution of System/360, retained compatibility while introducing new features and enhancements. It focused on improving performance, reliability, and scalability for enterprise computing applications. Both systems played crucial roles in mainframe computing, influencing large-scale data processing and business computing.

CLIENT-SERVER & PC

The client-server model is a distributed application structure where tasks are divided between servers and clients, allowing communication over a network, with examples including email, network printing, and the World Wide Web[28]. It dates back at least to 1964, where it run a job and responded with the output for OS/360 as a remote job entry architecture.

In June 1972, SAP was founded as a private partnership. They developed a real-time system for payroll and accounting, storing data locally instead of on punch cards. This became their flagship product, later expanding to serve other clients.

A personal computer (PC) is a user-friendly, affordable microcomputer

designed for individual use, which has had a significant impact on people's lives globally during the Digital Revolution[29]. The Altair 8800, introduced in 1974 by MITS and powered by the Intel 8080 Microprocessor, is widely regarded as the first true personal computer and a catalyst for the microcomputer revolution[30]. A few years later, in 1977, three companies successfully deployed mass-marketed personal computers later known as the "1977 trinity": Commodore PET, Apple II, and TRS-80 which marked the arrival of mass-market, pre-assembled computers, expanding computer usage to a broader audience and shifting the focus towards software applications rather than processor hardware development.

The PC market experienced continuous growth and expansion until 2010, reaching its peak in shipments in 2012. However, on January 27, 2010, Apple introduced the iPad, a groundbreaking device that revolutionized web browsing, email communication, multimedia consumption, gaming, e-books, and more. This marked a significant shift in the way people engage with technology.

INTERNET

The Internet has its beginning as early as the mainframes. It was developed in 1960s by Advanced Research Projects Agency (ARPA) with the purpose to develop time-sharing of computers[31]. In 1969, Advanced Research Projects Agency Network (ARPANET) connected first computer nodes, starting what we know now as the Internet[32]. Gradually, the ARPANET transformed into a decentralized network, linking various remote centers and military bases across the United States[33]. Soon after, in 1972, came public data networks, communication networks accessible to the general public, enabling the transmission of data between different locations or users. It is operated by a telecommunications company and allows for the exchange of

information over long distances.

In the mid-1980s, the expansion of the internet presented significant economic opportunities for commercial involvement and service delivery to the public. MCI Mail and Compuserve connected to the internet in 1989, providing email and public access services to hundreds of thousands of users. Shortly after, on January 1, 1990, PSInet launched an additional internet backbone for commercial use, contributing to the development of the commercial internet in the years to come[34].

Amazon.com, Inc., founded on July 5, 1994, by Jeff Bezos, is a prominent American multinational technology company known for its involvement in e-commerce, cloud computing, online advertising, digital streaming, and artificial intelligence[35].

Web 2.0

Web 2.0, also referred to as the participative or social web, encompasses websites that prioritize user-generated content, user-friendly interfaces, participatory culture, and interoperability, allowing compatibility with other products, systems, and devices for end users[36]. Coined in 1999 and popularized at the first Web 2.0 Conference in 2004, the term "Web 2.0" represents a general shift towards interactive websites that surpassed the static nature of the original Web, rather than indicating a formal change in the World Wide Web itself.

Salesforce, Inc. is an American company founded in 1999 that provides cloud computing services. Salesforce played a significant role in the Web 2.0 era by leveraging cloud computing and providing innovative software-as-a-service (SaaS) solutions. As one of the pioneers in delivering business applications through the internet, Salesforce helped shape the concept of cloud-based platforms and collaborative

software tools. By offering a user-friendly and interactive interface, Salesforce empowered businesses to harness the potential of Web 2.0 technologies for customer relationship management (CRM) and sales automation.

BIG DATA

Big Data refers to large and complex datasets that cannot be easily handled by traditional data-processing software, often characterized by a high number of entries and attributes. It encompasses a vast amount of information that surpasses our comprehension when analyzed in smaller quantities[37].

In its 2013 predictions, IDC projected 4.4 zettabytes of data to be created or replicated that year, marking a 50% growth compared to 2012. IDC also noted that only a small fraction of the digital universe was being explored for analytic value[38].

SMAC: SOCIAL, MOBILE, ANALYTICS, CLOUD

In March 2006, Amazon Web Services (AWS) introduced Amazon S3 cloud storage, followed by the launch of EC2 in August 2006. At that time, Andy Jassy, the founder and vice president of AWS, emphasized how Amazon S3 alleviated concerns for developers regarding data storage, security, availability, server maintenance costs, and storage capacity.

The original iPhone, also known as iPhone 2G or iPhone 1, was the first smartphone developed and marketed by Apple Inc. Released in the United States on June 29, 2007, the iPhone revolutionized the mobile phone industry by introducing a touch interface, minimal hardware buttons, and continuous internet access. It became Apple's most successful product, paving the way for the App Store and transforming

the smartphone industry[39].

The public cloud started gaining significant traction and becoming mainstream around the early to mid-2010s with the increasing adoption and maturity of cloud computing technologies in recent years. As organizations recognized the benefits of scalability, cost-effectiveness, and flexibility offered by public cloud services, they started migrating their applications and data to public cloud platforms. The widespread availability of reliable and secure cloud infrastructure, along with advancements in cloud management and security tools, played a significant role in driving the mainstream adoption of public cloud services. Today, public cloud has become a popular choice for businesses of all sizes, enabling them to leverage the power of cloud computing for their operations and innovation.

Web 3.0

IOT AND SMART MACHINES

The Internet of Things (IoT) refers to physical objects equipped with sensors, processing capabilities, and software that can connect and exchange data with other devices and systems over the Internet or other communication networks. The concept of the Internet of Things (IoT) emerged in the early 1980s, with the first connected appliance being a vending machine at Carnegie Mellon University. Mark Weiser's 1991 paper and conferences like UbiComp contributed to the development of the IoT vision. In 1994, Reza Raji described it as automating various devices. Companies like Microsoft proposed solutions, and Bill Joy discussed device-to-device communication in 1999.

A self-driving car, also called an autonomous car or robo-car, is a vehicle that can operate without human input. Self-driving cars are sophisticated

smart machines that combine advanced technologies such as artificial intelligence, computer vision, and sensor systems to navigate and operate on roads autonomously. These vehicles can perceive their surroundings, interpret and analyze the data, make informed decisions, and safely navigate through various traffic situations without the need for human intervention. With the ability to learn and adapt from their experiences, self-driving cars represent a remarkable fusion of cutting-edge technology and automotive engineering, aiming to revolutionize transportation by improving safety, efficiency, and convenience on the roads.

DLT: DISTRIBUTED LEDGER TECHNOLOGY WEB 3.0

The Bitcoin whitepaper is a document titled “Bitcoin: A Peer-to-Peer Electronic Cash System” written by an individual or group using the pseudonym Satoshi Nakamoto. It was published in 2008 and serves as the foundational blueprint for the Bitcoin cryptocurrency. The whitepaper outlines the key concepts and mechanisms behind Bitcoin, including its decentralized nature, the use of blockchain technology for maintaining a public ledger, and the process of mining to secure the network and validate transactions. It introduces the concept of a digital currency that operates without the need for intermediaries such as banks and provides a solution for the double-spending problem. The Bitcoin whitepaper has had a significant impact on the development and adoption of cryptocurrencies worldwide.

AI: ARTIFICIAL INTELLIGENCE

Deep Blue, an IBM supercomputer, made history in the field of artificial intelligence. It was the first computer to defeat a reigning world chess champion, Garry Kasparov, in a match. The development began in 1985 at Carnegie Mellon University and later moved to IBM, undergoing name changes along the way. In 1996, Deep Blue lost to Kasparov but was

upgraded and won a rematch in 1997. Its victory is a notable milestone in AI history and has been featured in various media.

XR: EXTENDED REALITY

In the late 1980s, Jaron Lanier, a prominent figure in the field, popularized the term "virtual reality." During the 1990s, consumer headsets for virtual reality began to be commercially released, with predictions of affordable VR becoming available by 1994, as forecasted by Computer Gaming World in 1992.

Oculus Rift, developed by Oculus VR, revived the virtual reality industry by providing an affordable and high-quality VR experience. It was prototyped in 2011 and launched with the DK1 in 2013 after successful Kickstarted campaign. The Rift went through several models before the consumer release of the Rift CV1 in 2016. It was later replaced by the Oculus Rift S in 2019. The Oculus Rift software is compatible with its successor, the Oculus Quest.

The "metaverse" is a concept from science fiction that envisions a virtual world created through VR and AR technologies, serving as a universal and immersive iteration of the Internet. In everyday language, the metaverse refers to a network of 3D virtual worlds focused on social and economic connections. In 2019, Facebook introduced Facebook Horizon, a social virtual reality (VR) world,. and in August 2021, Facebook launched Horizon Workrooms, an open beta collaboration app designed for remote work. It provides virtual meeting rooms, whiteboards, and video call integration, accommodating up to 50 participants.

QT: QUANTUM TECHNOLOGY 2.0

D-Wave Quantum Systems Inc. is a Canadian company known for being the first to sell quantum computers that harness quantum effects. They

have developed quantum computers with increasing numbers of qubits, with their latest system featuring 5,000 qubits. While their current computers specialize in quantum annealing, they have also announced plans to work on universal gate-based quantum computers in the future. In May 2011, D-Wave Systems unveiled the D-Wave One, the world's first commercially available quantum computer. It operated on a 128-qubit chipset and utilized quantum annealing to solve optimization problems. Earlier prototypes, such as the 16-qubit Orion Quantum Computer, were demonstrated in 2007. D-Wave also showcased a 28-qubit quantum annealing processor fabricated at NASA's Jet Propulsion Laboratory Microdevices Lab.

Quantum supremacy is when a quantum computer can solve a problem that even the best classical computers cannot solve within a reasonable timeframe. It demonstrates the superior computational power of quantum computers compared to classical computers. In December 2020, researchers from the University of Science and Technology of China achieved quantum supremacy using their photonic quantum computer Jiuzhang. They implemented gaussian boson sampling with 76 photons, generating results that would take a classical supercomputer 2.5 billion years to compute in just 200 seconds[40].

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