GRC
GREEN REVOLUTION COOLING

The Immersion Cooling Authority

Blockchain: Beyond the Buzz

What IT Executives Need To Know
Before Planning a Blockchain
Computing Data Center.

10 YEARS

IN THE BEGINNING
WAS THE CODE

The blockchain technology underlying Bitcoin and other cryptocurrencies was invented by an unknown person (or persons) under the pseudonym of Satoshi Nakamoto, who first released the code in 2009. Offering an unprecedented level of trust, the technology quickly caught on with its association to Bitcoin and other ICOs (initial coin offerings) like Ethereum.

Almost ten years on, blockchain is often wrongly considered synonymous with cryptocurrency mining. But it has far broader applications, as enterprise-level businesses are now beginning to discover. "Smart" contracts. Financial and healthcare applications. Supply chain optimization. These are just a few of the many areas where blockchain technology can promote greater trust, lower transaction costs, speed processes and create value.

The global blockchain technology market size was valued at $604.5 million in 2016 and is expected to reach $7.59 billion by 2024[1]

$604.5 M 2016	$7.59 B 2024
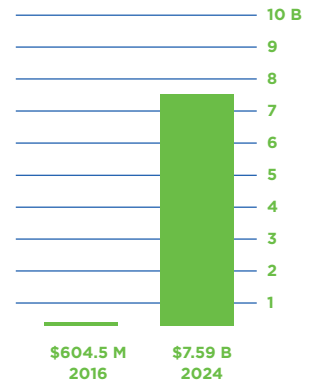
This white paper will give CIO, CTOs and other IT executives a real-world overview of blockchain basics, provide appropriate cautionary notes, plus offer solid guidance on blockchain data center provisioning.

What the Talk Is All About

Like all emerging technologies, blockchain's real benefits lie somewhere between the panacea some pundits insist it can be and the ambitions of today's enterprise executives.

On a functional level, because it is decentralized and provides innovative ways to quickly verify authenticity, blockchain can improve the efficiency, accuracy, security and trust of enterprise transactions, as well as lower transaction costs. What's more, by digitizing once manual operations, blockchain makes available a trove of data which can be easily analyzed to improve processes, plus develop new products and services.

For these reasons and more, many believe blockchain has the potential to revolutionize the way we store, validate and leverage information – and conduct business in general.

[1] Blockchain Technology Market Size Worth $7.59 Billion by 2024. Grand View Research. March 2018

Blockchain Technology
Can Help An Enterprise:

○ Increase Trust
○ Lower Transaction Costs
○ Speed Processes
○ Improve Accuracy
○ Create Value

Perhaps that is why PricewaterhouseCoopers (PwC) dubbed blockchain a 'tech breakthrough megatrend' for CIOs,[2] while Gartner named it as one of its top 10 strategic technologies for 2017.[3]

On balance, few would argue that, given blockchain's established benefits, companies with the right vision, business plan and infrastructure stand to benefit greatly from incorporating it into their operations.

Beyond the Blockchain Buzz: Cautionary Notes for IT Executives

Blockchain technology has much to offer the enterprise – along with business and society in general. Yet, as with any emerging technology, enterprise businesses should be aware of some of its limitations and challenges. To be sure, it presents unique requirements that impact data centers in terms of provisioning, power sources, chip design, cooling, security and scalability.

According to Gartner in 2018[4] only 1% of CIOs indicated any kind of blockchain adoption within their organizations, and only 8% were in short-term planning.

Moreover, the market is still evolving, many players are developing on many different platforms, and it's no simple matter for IT executives to choose the right path.

According to Gartner[5] only 1% of CIOs indicated any kind of blockchain adoption within their organizations, and only 8% were in short-term planning or active experimentation with blockchain.

A Bit on Blockchain Anatomy

A basic knowledge of how blockchain technology works makes it easier to understand its potential benefits.

Again, blockchain, or distributed ledger technology (DLT), refers only to the underlying technical architecture of Bitcoin and other cryptocurrency-based systems. Although it is also used for the exchange of digital coin, in its basic form a blockchain is simply an unalterable digital ledger of transactions distributed across a network of computers, or "nodes."

[2] https://www.pwc.com/gx/en/issues/technology/tech-breakthroughs-megatrend.html
[3] Gartner Identifies the Top 10 Strategic Technology Trends for 2018. October 4, 2017
[4] 2018 CIO Survey. Gartner
[5] 2018 CIO Survey. Gartner

The "Block" in Blockchain

New Block

Transaction Data
+ Unique Code
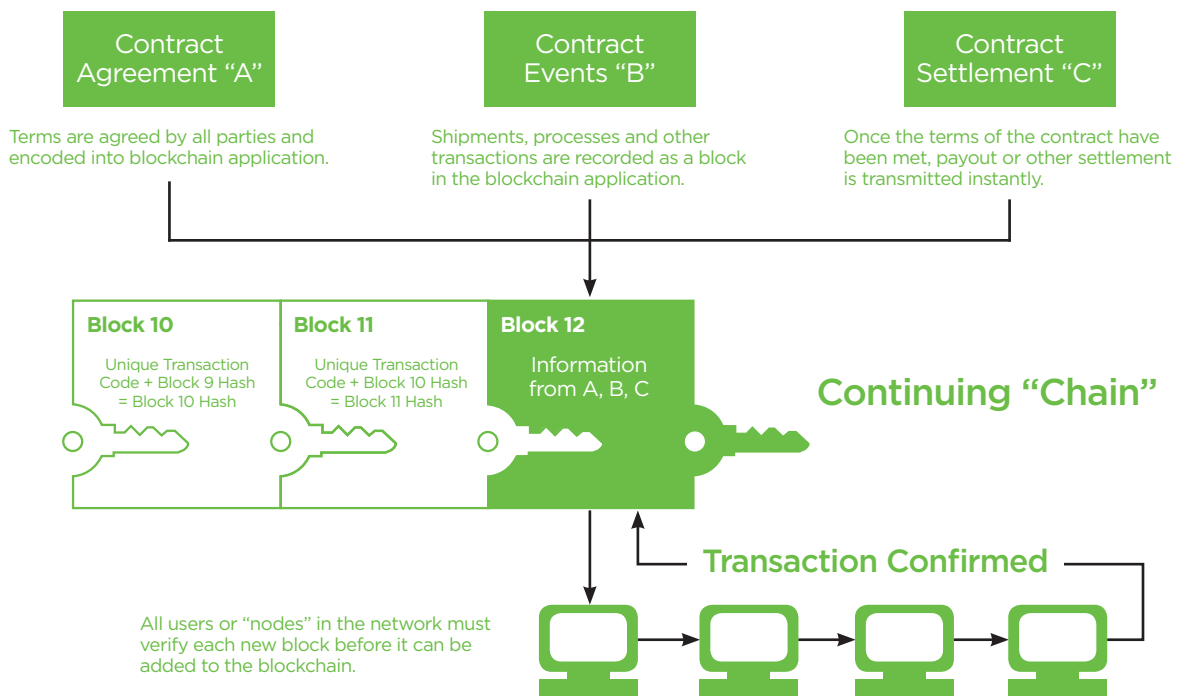+ Previous Block's
Hash Code

New Block's Hash Code

Each Block contains a cryptographic key called a *"Hash"*. When a new transaction is entered, a unique Transaction Code is generated. This code and Hash from the previous Block create a Hash for the next Block.
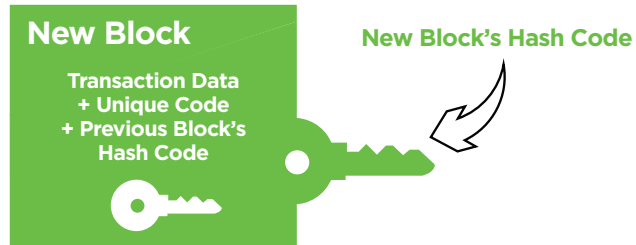
Transactions are compiled into a set called a block. In addition to these data, blocks contain what's known as a "hash" comprising the previous block's hash and a new unique code. This is essentially a cryptographic puzzle that is "solved" or validated by users in the system in a process known as "mining."

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The "Chain" in Blockchain

Contract Agreement "A"

Contract Events "B"

Contract Settlement "C"

Terms are agreed by all parties and encoded into blockchain application.

Shipments, processes and other transactions are recorded as a block in the blockchain application.

Once the terms of the contract have been met, payout or other settlement is transmitted instantly.

Block 10

Unique Transaction Code + Block 9 Hash = Block 10 Hash

Block 11

Unique Transaction Code + Block 10 Hash = Block 11 Hash

Block 12

Information from A, B, C

Continuing "Chain"

Transaction Confirmed

All users or "nodes" in the network must verify each new block before it can be added to the blockchain.

Because each transaction is verified by the entire community – not a single, centralized authority, blockchain technology promotes tremendous trust. It is also inherently accurate, secure and efficient.

As a result, enterprises across many segments are either exploring or currently using blockchain technology not just for payments or routine transactions, but for processing so-called "smart contracts," tracking shipments, maintaining the integrity and privacy of confidential records, and much more.

Blockchain Technology Holds
Great Potential for:

- ○ Smart Contracts
- ○ Financial Transactions
- ○ Healthcare
- ○ Supply Chain Logistics
- ○ Real Estate Transactions
- ○ Mortgage Lending
- ○ Food Safety

Public vs Private Blockchains Which Is Best for the Enterprise?

Like all emerging technologies, blockchain's real benefits lie somewhere between the panacea some pundits insist it can be and the ambitions of today's enterprise executives.

On a functional level, because it is decentralized and provides innovative ways to quickly verify authenticity, blockchain can improve the efficiency, accuracy, security and trust of enterprise transactions, as well as lower transaction costs. What's more, by digitizing once manual operations, blockchain makes available a trove of data which can be easily analyzed to improve processes, plus develop new products and services.

For these reasons and more, many believe blockchain has the potential to revolutionize the way we store, validate and leverage information – and conduct business in general.

Public Blockchains

A public blockchain network is completely open and allows most anyone to participate. Because public blockchains are larger, they require more computational power to maintain the distributed ledger, and therefore typically provide incentives to encourage more participants to join.

Because critical intellectual property – notably pricing and transactional data – is theoretically available to all participants, public blockchains are not always the best choice for the enterprise.

Private Blockchains

Private or consortium blockchain networks require an invitation and are generally set up as a permissioned network. Although they do not offer the high-trust decentralization of their public counterparts, they give the enterprise greater data control and security while still providing significant transactional cost-efficiencies.

With members including Cisco, Accenture, Bancor, Consensys, Intel, HP Enterprise and hundreds more, the Enterprise Ethereum Alliance (EEA) is perhaps the best example of a consortium blockchain network.

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Hurdles on the Way to Implementation

With all the buzz about blockchain, many IT executives are chomping at the bit to implement the technology if not facing increased pressure from boards and shareholders to do so. But CIOs, CTOs and data center managers would do well to look beyond the headlines and be aware of the following:

- Like any profound change to business processes – and depending on the breadth of the application, blockchain may not be easy to implement
- The regulatory environment is still somewhat ambiguous
- There are many different platforms available, each with its pluses and minuses
- Blockchain computing requires its own special data center provisioning

Data Center Considerations

Depending on the nature of the enterprise, IT executives may choose to deploy their blockchain computing solution on-premise, on the cloud, or as a hybrid, where applications move seamlessly between the two.

> Standard build and operating costs plus cooling capabilities can make blockchain operations very challenging to operate profitably.

Typically, these decisions are made based on budget, security, their organization's geographic footprint, and the mobility needs of their workforce.

Overall, standard build and operating costs plus cooling capabilities can make blockchain data centers very challenging to operate profitably. Along with some of the theoretical and organizational hurdles explained earlier, IT executives should also keep these considerations in mind:

Specialized Computing

Solving the cryptographic puzzle or "hash" at core of the blockchain requires powerful, purpose-built GPU-based or ASIC (Application-Specific Integrated Circuit) chips.

Scalability

With each transaction the distributed ledger at the core of the blockchain grows, requiring ever more computing power across the network. This requires that data centers in the be able to scale quickly.

Availability of Low-Cost Power

Given blockchain's baseline computing requirements, and the need to scale as the blockchain grows, data centers must have access to near-unlimited amounts of low-cost power. This availability is often limited to geographical areas with unfavorable climates.

Greater Hardware Density

As blockchain computing needs expand, hardware density can easily approach 50+ kW per rack.

Cooling Concerns

The specialized chipsets needed for blockchain computing run very hot. As rack densities approach 50 kW/rack, conventional cooling methods such as chillers, CRACs and CRAHs can become ineffective.
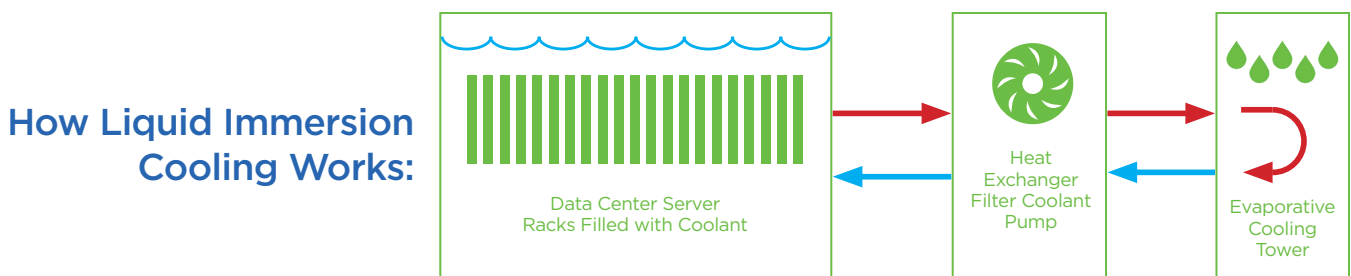
Space Issues

Spreading hardware across racks enables data centers to reach their target hardware density, but at the cost of valuable floor space.

Immersion Cooling Is a Game-Changer

Blockchain computing requirements are so unique that a traditional approach to data center design is simply not adequate. Required hardware densities will quickly exceed the existing power envelope as well as the center's cooling capabilities.

Yet a technology has emerged as a clear winner in this space – single-phase immersion cooling – which has been proven to eliminate all these barriers.

How Liquid Immersion Cooling Works:

Data Center Server
Racks Filled with Coolant

Heat
Exchanger
Filter Coolant
Pump

Evaporative
Cooling
Tower

Immersing servers in liquid enables cooling up to 100kW/rack, as liquid has 1,200X the heat retention capacity of air by volume.

Immersing servers in liquid has been shown to eliminate the issues associated with hardware density, cooling capacity, data center design and location options.

Advantages of Single-Phase Immersion Cooling:

- Break through barriers of deployment time, space and power
- Proven performance with large-scale commercial deployments across the globe
- Maximize power envelope
- Slash capital expenditures (capex) by 95%
- Cut energy costs in half
- Effectively cool 100 kW+ per rack
- Scale easily and cost-effectively

Founded in 2009, Green Revolution Cooling (GRC) pioneered single-phase immersion cooling with an initial grant from the National Science Foundation.

Perfected over the course of a decade, our innovative liquid-cooled server racks are now at work across the globe within some of the world's most IT-intensive organizations. We currently hold ten patents, and have eight more pending.

What Companies Can Do to Make Blockchain Work

Once an enterprise decides to take the plunge and implement a blockchain computing solution, the question becomes, "Now what?" Here are some suggestions for next steps:

Start With Single-Use Applications

These minimize risk because they involve little coordination with third parties.

Use Blockchain as a Database

Consider using blockchain as an internal database for applications like managing physical and digital assets, recording internal transactions, and verifying identities.

In the long term, blockchain "will lead to a reformation of whole industries. — Gartner[6]

[6] Top Trends in the Gartner Hype Cycle for Emerging Technologies, 2017. August 15, 2017.

Add Cryptocurrency As A Payment Mechanism

Adopting virtual currency forces the organization's IT, finance, accounting plus sales and marketing disciplines to work cross-functionally, which will help with broader blockchain implementation.

Join A Consortium

Becoming part of an existing blockchain consortium—like Chain, Hyperledger, R3, and the Enterprise Ethereum Alliance (EEA) can provide a short-cut to implementation. Beforehand, make sure the group aligns with your segment and business goals.

Provision Smart

Knowing blockchain computing's unique requirements, it's important to plan and build proper infrastructure from the start. Enlisting the help of data center provisioning experts like GRC can alleviate many of the challenges.

Unchained Opportunity

On balance – and beyond the buzz, blockchain technology truly can bring impressive levels of trust, cost-efficiencies and added value to enterprise operations. Hurdles do exist. But simple due diligence coupled with smart data center provisioning strategies like liquid immersion cooling will give IT executives a clear path to success.

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To Learn More About How GRC Can Help
Bring Blockchain Computing to Your Organization

Call **512.692.8003** • Email **info@grcooling.com** • Visit **grcooling.com**