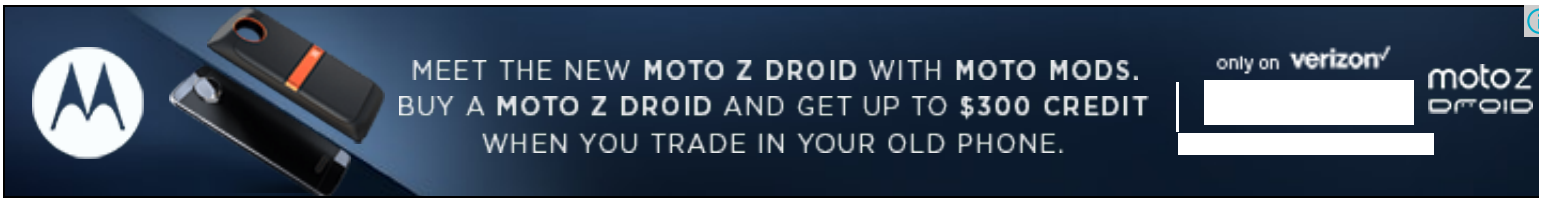


Blockchain is finding its way into new industries and business use cases every day, and soon the technology **will be everywhere (http://www.pcmag.com/article/345144/were-about-to-live-in-a-blockchain-based-world)**. Blockchain is complex enough to fill an entire alphabet of terms and definitions, but there's an even bigger ecosystem of start-ups,

academic institutions, open-source organizations and coalitions, and financial institutions aiming to shape how the technology evolves. That said, the players best-positioned to own our blockchain-based future are tech giants such as IBM and Microsoft.

IBM and Microsoft are defining a new Blockchain-as-a-Service (BaaS) market, making significant recent blockchain investments in enterprise services leveraging **cloud infrastructure (http://www.pcmag.com/article2/0,2817,2496292,00.asp)** to reduce the considerable back-end legwork for businesses setting up blockchains. Microsoft rolled out its **BaaS (https://azure.microsoft.com/en-us/solutions/blockchain/)** for **Microsoft Azure (http://www.pcmag.com/article2/0,2817,2496295,00.asp)** **$14,300.00 at Microsoft** last November, and IBM launched its **IBM Blockchain (https://www.ibm.com/blockchain/)** service in February. Just this week, IBM also announced a new **secure blockchain network (http://www-03.ibm.com/press/us/en/pressrelease/50169.wss)** for developers.

The companies are also pushing separate open-source initiatives, with IBM and The Linux Foundation beating Redmond to the punch with the **Hyperledger Project (https://www.hyperledger.org)** in December 2015, and then Microsoft firing back with **Project Bletchley (https://azure.microsoft.com/en-us/blog/bletchley-blockchain/)** this past June. PCMag recently talked to Marley Gray, blockchain chief and Director of BizDev and Strategy for Cloud & Enterprise at Microsoft, and Arvind Krishna, Senior Vice President and Director at IBM Research. Gray and Krishna discussed their companies' respective BaaS platforms, the interplay and dueling initiatives in the open-source blockchain space, and the ways in which each tech giant envisions the game-changing technology evolving from here.

[Editor's Note]: This is Part One of a two-part series on IBM, Microsoft, and the future of blockchain in enterprise tech. Below we'll explain what BaaS is and break down the companies' dueling cloud platforms. Part Two, coming soon, will delve into the open-source ecosystem around blockchain and take a broader look at the blockchain space to decide who's in the lead and where the technology might go next.

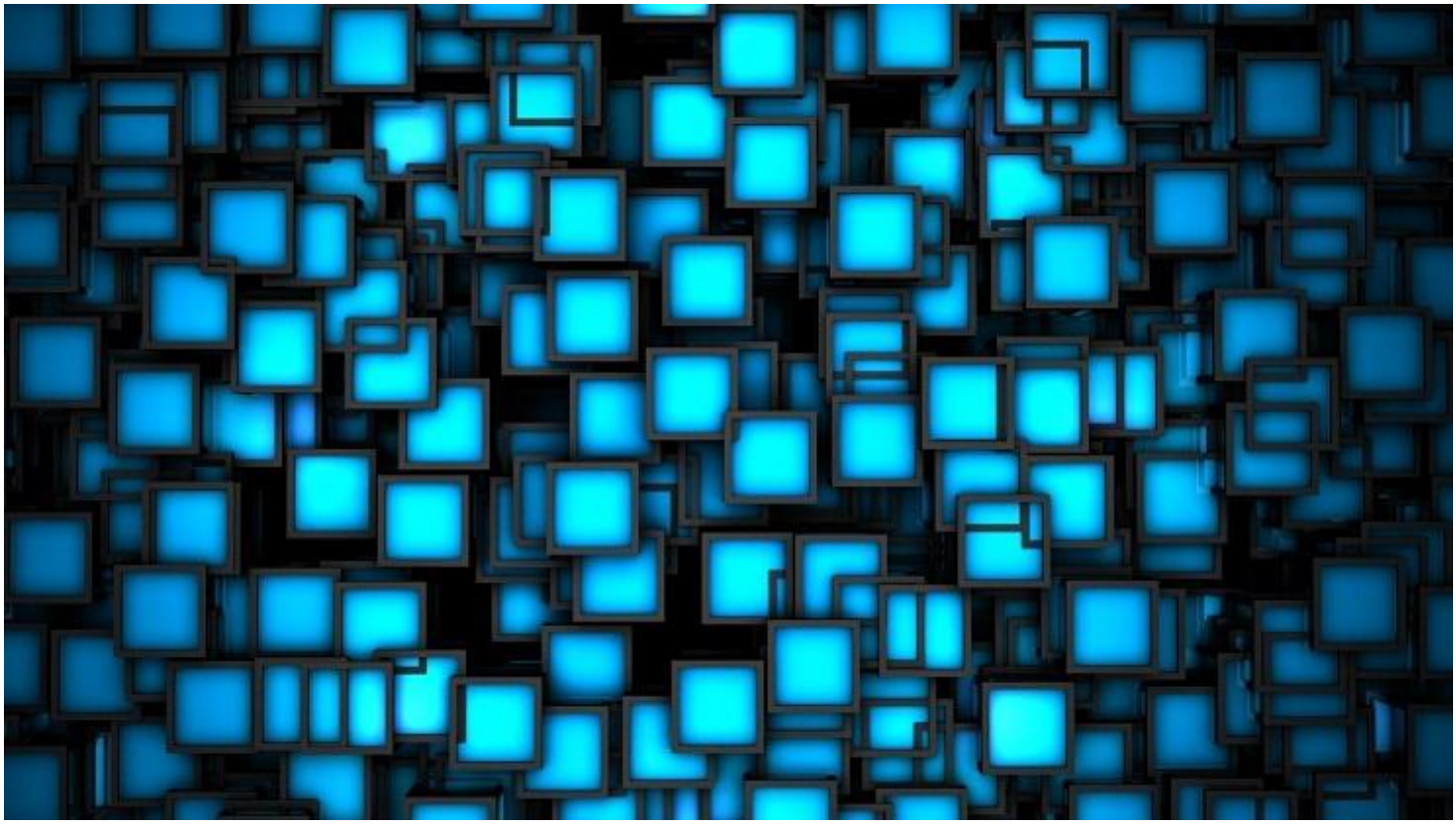
What's the Difference Between Blockchain and BaaS?

Blockchain is distributed **ledger (http://www.pcmag.com/article/342998/the-best-enterprise-class-general-ledger-accounting-software)** technology that can be used to record transaction data and act as an encrypted and immutable digital history of anything from cryptocurrencies such as Bitcoin and Ethereum (the "E" in our **Blockchain A-Z (http://www.pcmag.com/article/344969/blockchain-a-z-everything-you-need-to-know-about-the-game-c)**) to **smart contracts (http://www.pcmag.com/article/344333/will-smart-contracts-revolutionize-how-we-do-business)** and all manner of online assets, data, and transactions.

Blockchains can also be public or private. Bitcoin is the first and most known example of a public blockchain—one where "miners" all over the world build blocks of transactions and where a worldwide network of machines serves as the decentralized node infrastructure

that gives blockchain (and cryptocurrencies in particular) their anonymous appeal while maintaining immutable data security.

Businesses, on the other hand, are investing more in the development of private blockchains. These are blockchains that are using the same distributed ledger technology to record transaction data, but doing so within private clouds or virtual environments that are accessible only to businesses (or to networks of businesses like those working on the Hyperledger Project or the **R3 (http://r3cev.com/)** coalition).



Why do businesses want private blockchains? Think about blockchain as a kind of fabric underlying any business application or service, be it a system for processing banking and finance transactions to an enterprise's in-house **collaboration (http://www.pcmag.com/article2/0,2817,2489110,00.asp)** platform or database infrastructure. Integrated with blockchain, every business process and transaction is synced to a tamper-proof ledger that ensures transparency, accountability, and data integrity… forever.

Private blockchains are where BaaS comes in. Public blockchains enjoy the benefit of a vast peer-to-peer (P2P) network of nodes and machines to perpetuate and reinforce the decentralized infrastructure that makes blockchains such as Bitcoin so innovative. Private blockchains, on the other hand, require substantial manual development effort and back-end cloud-computing capacity on the business's part to build and maintain distributed infrastructure. Thus, companies such as IBM and Microsoft—both of which have established cloud infrastructure platforms sporting extensive developer tooling—can make it a lot easier

on businesses by hosting blockchains for them and doing all the heavy lifting. It's Platform-as-a-Service (PaaS) applied to the blockchain, with IBM and Microsoft tying in plenty of their cloud services as extra integrated goodies on top.

BaaS Tug-of-War

The tech giants know there's a huge market to be won for the future of blockchain-based businesses. IBM and Microsoft both want to help build a secure, trustworthy, and interoperable open blockchain, but they also both want enterprises to choose their cloud services on which to build. Even Amazon is angling to get in on the action, partnering with the **Digital Currency Group (http://dcg.co/)** earlier this year to create its own **BaaS sandbox (http://www.forbes.com/sites/laurashin/2016/05/02/amazon-steps-up-blockchain-commitment-web-services-partners-with-digital-currency-group/#784decca712e%20)** on **Amazon Web Services (http://www.pcmag.com/article2/0,2817,2496299,00.asp)** **$6,415.00 at Amazon** (AWS).

Microsoft's BaaS offering is geared at both enterprise businesses and developers. The idea from Microsoft's perspective is to provide everything a business needs to build a blockchain in the cloud: the back-end infrastructure on Microsoft Azure, the developer tooling through **Microsoft Visual Studio (https://www.visualstudio.com/en-us/visual-studio-homepage-vs.aspx)**, and the templates and resources to make it easy, interoperable, and secure.

"We entered the space looking at all the different technologies and our enterprise customers, the consortiums, and what the problems and questions were to identify things Microsoft could uniquely address," said Gray. "The common pain point we were hearing around blockchain was with **identity management (http://www.pcmag.com/article2/0,2817,2491437,00.asp)** and key management: how you get your hands around that. Privacy is the second one. The third is interoperability with existing systems and then with other blockchains. One blockchain isn't going to do everything; we're going to have many blockchains."

Microsoft BaaS includes a number of services and resources for businesses and developers. In the **Azure DevTest Labs (https://azure.microsoft.com/en-us/services/devtest-lab/)** environment, developers can build, test, and deploy blockchain-based applications on the Azure cloud. Devs can also access tools in the Visual Studio **integrated development environment (http://www.pcmag.com/encyclopedia/term/44707/ide)** (IDE) to build deeper analytics and monitoring into blockchain apps, and tools such as the **Cortana Intelligence Suite (http://www.pcmag.com/news/343333/microsoft-brings-ai-bots-to-business-chat)**, machine learning (ML), and Internet of Things (IoT) services.

Microsoft is also firmly in the Ethereum camp. Beyond its partnership with R3, the company also offers an **Ethereum-specific BaaS (https://azure.microsoft.com/en-us/blog/ethereum-blockchain-as-a-service-now-on-azure/)** environment geared toward building smart contract applications. According to Gray, all of these BaaS capabilities can also integrate with services such as Microsoft Azure Active Directory (AAD), **Microsoft Office**

365 (http://www.pcmag.com/article2/0,2817,2383731,00.asp) **$99.00 at Amazon** and **Microsoft Power BI (http://www.pcmag.com/article2/0,2817,2494375,00.asp)** **Free at Microsoft** in blockchain apps.

Gray said the company's main goal is providing guidance for people who need to build apps now. Microsoft's main advice is to focus on the smart contract and virtual machine (VM) level while BaaS takes care of the back-end infrastructure and database integration.

"Dig about two inches below the surface in any industry and you can find business processes that really haven't been revisited that could be dramatically flattened," said Gray. "Blockchain data services are a huge opportunity. We frankly don't know what we're going to glean out of this. We've never had this level of collaborative data across enterprises, where we can wrest a lot of historical data across domains and point machine learning at it. Visual Studio has the ability to plug into Azure so you can deploy smart contracts to these environments right from the tool and profile them, do static analysis, etc. Right now, there's no debugging you can do in smart contracts and it's debugging at all levels of the stack."

Microsoft BaaS is closely tied into what the company is doing with Project Bletchley, which acts as blockchain middleware filling in some of the missing pieces in BaaS, particularly around identity, interoperability, key management, privacy, and security. (We'll get deeper into Bletchley in Part Two of this two-part series.)

IBM thinks about blockchain development in a few different ways. In places like **IBM z Systems (http://www.ibm.com/blockchain/z.html)**, the company leverages blockchain-based app development as an added set of capabilities on top of the server technology tying in the parallel open-source work being done on Hyperledger. The key here, Krishna

explained, is integrating blockchain into existing systems without forcing organizations like banks or even governments to throw out their legacy technology, a process that could slow down wider blockchain adoption for years.

"Blockchain simplifies a lot of things, but at the end of the day, it has to integrate back into systems of record. Banks aren't going to take all their existing apps and throw them away. We are going to extend those traditional systems on the mainframe to be able to go directly in and out of the blockchain network," said Krishna. "Let's say I've got a smart contract on blockchain that calls out to the mainframe or any existing systems that banks, airlines, and large retailers all use to run many of their critical applications. All of the regulations, all of the closing of the books that happen on a large mainframe system, that's not going away tomorrow. Blockchain needs to work *with* those systems. Anything that connects to the real economy has to integrate with the real economy."

Krishna said IBM will begin deploying blockchain for internal applications this fall. On the other side, IBM breaks blockchain development down into a full set of cloud-based services for developers and enterprise businesses. Krishna said the goal with IBM Blockchain running on IBM's Bluemix cloud is to simplify blockchain setup and operation for developers and IT. The company's new secure blockchain service, running on IBM's LinuxONE server systems, adds more security on top with firmware protection and root access restrictions on blockchain apps and data. This "high-security business network" is another step toward easing blockchain use for system administrators in more highly regulated industries.

"Blockchain is a relatively new technology, so if I go to GitHub and take some version of some code and install it, blockchain requires many nodes to work," said Krishna. "Setup and operation becomes complicated for a developer, and a lot of the code bases today are not very mature. We wanted to make all that dead-simple. We're going to do all the work so you can log into the Bluemix DevOps environment and access your blockchain network with a single click."

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IBM also offers business consulting services on top of its BaaS platform, recently announcing the **IBM Bluemix Garage (http://www.ibm.com/blockchain/garage.html)** for blockchain at its chain of **agile development (http://www.pcmag.com/encyclopedia/term/37606/agile-development)** spaces

worldwide. IBM's blockchain ecosystem is also heavily tied to its open-source efforts with the Hyperledger Project. As with Microsoft, part of IBM's business value proposition is providing a developer network, reference architecture, application programming interfaces (APIs), and other open-source resources all aligned to Hyperledger.

Blockchain's BaaS and open-source arms are inextricably linked as IBM and Microsoft fight for not only blockchain market share but blockchain mindshare as well. As for which company will be leading the charge as the technology evolves, competition in the enterprise blockchain space will only get more heated from here. Krishna said IBM is up for the challenge.

"There's always competition. Something that's as interesting and as big as blockchain is going to have competition," said Krishna. "Do I belive [IBM] has superior capabilities and people who understand the technology better to help clients? Absolutely."

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Rob Marvin is the Assistant Editor of PCMag's Business section. He was previously an editor at SD Times covering software, managing social media, and writing narrative-driven features on any offbeat story or trend he could find. He graduated from Syracuse University's S.I. Newhouse School of Public Communications in 2013 with degrees in Magazine Journalism and Psychology. Rob is also an unabashed nerd who does occasional entertainment blogging on movies and TV, reads epic fantasy and historical fiction, and enjoys having his heart routinely broken by the... **MORE » (/AUTHOR-BIO/ROB-MARVIN)**

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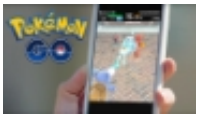

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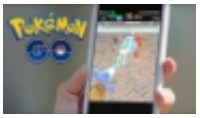

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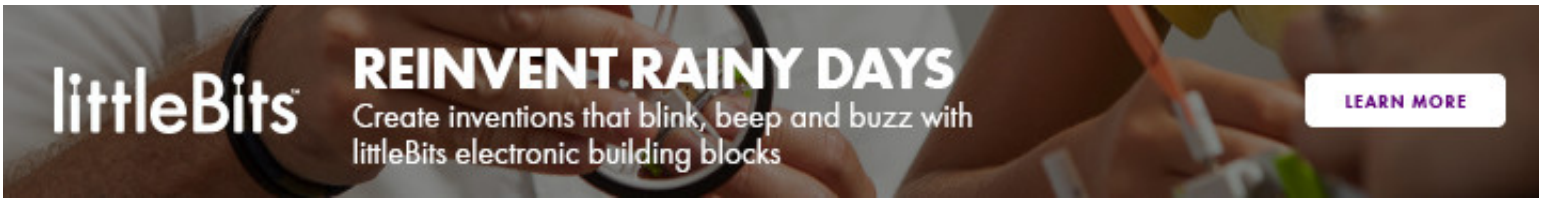

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