



SIGNALS FOR STRATEGISTS

Blockchain and the five vectors of progress

David Schatsky, Amanpreet Arora, and Aniket Dongre

For most companies, the value of blockchain is still more potential than actual. But barriers to adoption are falling, helping to resolve key issues and bring the technology into the mainstream.

BLOCKCHAIN TECHNOLOGY CONTINUES to inspire widespread enthusiasm. Business leaders across industries see its potential to streamline business processes, enable new business models, and potentially reshape industries. But for most enterprises, obstacles have kept the value of blockchain more prospective than actual, and commercial adoption thus far remains limited. As the technology continues to mature, progress along five vectors can help mitigate or topple existing barriers to adoption—and bring blockchain closer to the mainstream.

Signals

- IBM researchers tested an application running on the Hyperledger Fabric blockchain platform that achieved a throughput of 3,500 transactions per second with sub-second latency¹
- The Enterprise Ethereum blockchain consortium unveiled an open-source, cross-platform, standards-based framework²
- Over the past two years, major technology vendors—including five of the world’s biggest cloud companies—have introduced blockchain-as-a-service³
- State legislatures have taken action on dozens of blockchain-related bills so far this year, and at least eight US states have already passed laws pertaining to blockchain⁴
- The number of active blockchain consortia across industries has rapidly increased from 28 in 2017 to more than 60⁵

Multiple barriers to the adoption of blockchain technology

Analysts widely expect blockchain technology to one day have a significant impact on business. Effectively incorporated, the technology has the potential to improve efficiency and effectiveness, cut costs, and increase revenue by helping to create new products, services, and business models.⁶ This promise has led many companies to invest time and resources in blockchain pilot projects. In fact, analysts forecast enterprise spending on blockchain to double year over year, to US\$2.1 billion in 2018.⁷

However, unresolved issues are keeping many enterprises from adopting the technology. In a recent survey, only 9 percent of CIOs agreed that their organization has either implemented blockchain-related projects or plans to within a year.⁸

One major reason: As a means of processing transactions, blockchain-based systems are comparatively slow. Blockchain’s sluggish transaction speed is a major concern for enterprises that depend on high-performance legacy transaction processing systems.⁹ A lack of standards and interoperability between various blockchain platforms and solutions is another challenge.¹⁰ Unless blockchain technology can be readily connected to existing enterprise systems, it will be of little utility in large programs and initiatives. Legal and regulatory concerns around data privacy, intellectual property, enforceability of contracts, and choice of jurisdiction are inhibiting the technology’s adoption.¹¹ And businesses are constrained by blockchain’s technical complexity, which limits the feasibility of implementing distributed ledger systems.

Progress in five areas can help overcome barriers to adoption

There is good news for blockchain enthusiasts: Progress is being made in addressing these obstacles. Deloitte has identified five key vectors of progress that could drive wider adoption of blockchain. Three of these vectors—increase in transaction speeds, standards and interoperability, and ease of implementation—enhance technical feasibility. The other two—regulatory advancements and expansion of consortia—help broaden the technology’s applicability to a greater number of use cases and industries.

INCREASING THROUGHPUT AND PERFORMANCE

Blockchain can be slow. In contrast to some legacy transaction processing systems able to process tens of thousands of transactions per second, the bitcoin blockchain can handle only three to seven transactions per second; the corresponding figure for Ethereum blockchain is as low as 15 transactions per second.¹² Because of its relatively poor performance, many observers do not consider blockchain technology to be viable for large-scale applications.¹³

But developers are working on a promising way to close this performance gap: They are developing new consensus mechanisms. Consensus is how participants in a blockchain network come to agree that the transactions recorded in the digital ledger are valid. The consensus mechanism popularized by the bitcoin blockchain enables participants to trust the validity of the transactions even if they do not trust each other. This magic comes at a cost of sluggish performance and exorbitant use of computational resources entailed in the proof-of-work mechanism it uses.

Newer consensus mechanisms promise significantly higher performance. They achieve this with designs that reduce or eliminate time- and

energy-intensive mining and reduce the number of nodes that must validate a transaction for it to be considered final. Each of the emerging consensus mechanisms has advantages and disadvantages that make them better or worse for certain applications.¹⁴ Considering the diversity of applications for blockchain, this is actually a good thing: Applications can choose the tradeoffs in performance, functionality, and security that are appropriate for the application.

These mechanisms can bear exotic names such as Practical Byzantine Fault Tolerance, Federated Byzantine Agreement, and Delegated Proof of Stake and are being used by prominent blockchain platforms including Hyperledger, Stellar, and Ripple. The Ethereum platform is moving toward a hybrid consensus mechanism that combines proof-of-work mining with a proof-of-stake system intended to motivate trustworthy behavior in the network.¹⁵ In a proof-of-stake system, only participants that can show they own a certain number of cryptocurrency assets—and therefore have a stake in the reliable functioning of the system—are able to validate transactions. *Sharding*, a means of accelerating the consensus process by allowing nodes to work in parallel, is also coming to Ethereum;¹⁶ upstart Zilliqa has announced a live implementation of sharding that it claims can process some 2000 transactions per second.¹⁷

Applications can choose the tradeoffs in performance, functionality, and security that are appropriate for the application.

Blockchain designers continue to explore newer consensus mechanisms such as proof of burn, proof of capacity, and proof of elapsed time.¹⁸ The evolution of consensus mechanisms is improving blockchain speed significantly—good news for applications in domains such as trade finance, supply chain traceability, auto leasing, marine insurance, health care, and insurance.¹⁹

ENHANCING STANDARDS AND INTEROPERABILITY

A lack of standards grants blockchain coders and developers freedom—and can give IT departments headaches as they discover that platforms can't communicate without translation help. According to a Deloitte study, the cloud-based code repository GitHub features more than 6,500 active blockchain projects that use diverse platforms with multiple coding languages, protocols, consensus mechanisms, and privacy measures.²⁰

Standardization could help enterprises collaborate on application development, validate proofs of concept, and share blockchain solutions as well as make it easier to integrate with existing systems.²¹ Help is on the way as a growing number of industry participants work to enable cross-blockchain transactions, interconnectivity, and standardization.

For instance, last year the Enterprise Ethereum Alliance was founded to create a standard version of Ethereum blockchain software for business. As of July 2018, the alliance had nearly 600 members.²² Membership in the Hyperledger Foundation, an open-source collaborative effort created to advance cross-industry blockchain technologies, has reached 250 organizations.²³ One of the projects supported by the Foundation is the Interledger protocol, a means of routing payments across different ledgers that may be based on diverse technologies.²⁴

Help is on the way as a growing number of industry participants work to enable cross-blockchain transactions, interconnectivity, and standardization.

Another standardization effort gaining traction is the Decentralized Identity Foundation, a consortium formed to promote standards for blockchain-based identity systems.²⁵ Such systems may eventually enable new business models as

well as new ways of administering public services. Membership in that consortium has reached nearly 60 organizations so far.²⁶

In some cases, the industry is working toward interoperability simply by adopting existing standards in the context of new blockchain applications. For instance, IBM and Microsoft are implementing data standards developed by GS1, a leading global standards organization, in their respective enterprise blockchain applications for supply chain clients.²⁷

“The nice thing about standards,” quipped computer scientist Andrew Tanenbaum, “is that you have so many to choose from.”²⁸ Certainly, there are multiple blockchain standardization efforts under way. But there are also many facets to the technology, and innumerable industry-specific issues that will each require their own standards. The efforts we are seeing represent a vector of progress for blockchain technology.

REDUCING COMPLEXITY AND COST

The costs and complexities involved with building and deploying blockchain solutions are significant obstacles to the adoption of the technology.²⁹ To address these challenges, nearly a dozen big technology vendors—including Amazon, IBM, and Microsoft—now provide cloud-based blockchain technology as a service. New cloud offerings have been coming to market at an accelerating pace and have the potential to lower the barriers to developing and operating blockchain networks.³⁰ Cloud providers are releasing blockchain templates intended to automate the setup of basic blockchain infrastructure; vendors claim this can reduce application development from months to days.³¹ They are also partnering with developers of blockchain-building tools to ease development. For instance, Google and the startup Digital Asset announced a partnership to make Digital Asset's blockchain-building tools easily accessible in Google's cloud.³²

Besides the cloud, new software platforms are aiming to ease the development and deployment of blockchain applications. For example, the open-source Sawtooth platform has a modular design that separates the core system from application-specific functionality, hiding complexity from developers. It also allows developers to create apps in their preferred language, such as JavaScript and Python, without worrying about the underlying technology.³³

Cloud providers are releasing blockchain templates intended to automate the setup of basic blockchain infrastructure; vendors claim this can reduce application development from months to days.

There is a clear trend toward easier-to-use blockchain tools and platforms. This vector of progress is likely to foster greater adoption of blockchain technology over time.

REGULATORY SUPPORT

Regulatory issues are another major barrier to blockchain adoption. In a recent Deloitte survey of blockchain-savvy executives, nearly two in five cited regulatory issues as a barrier to greater investment in blockchain technology.³⁴ The reason for this is that the technology introduces concepts and methods, such as cryptographic signatures and smart contracts, that existing regulations don't address. In some cases, applications for the technology run counter to the practices those regulations envision. For instance, some organizations are exploring the use of blockchain for securely sharing patient medical records, with access to the records under patient control. But under Health Insurance Portability and Accountability Act rules,

many disclosures of personal health information require that the recipient enter into a business associate agreement, a process fundamentally at odds with a blockchain model.³⁵

Addressing these issues requires official action—and we are starting to see it. This year alone, some 17 US state legislatures have considered and passed dozens of bills pertaining to the adoption of blockchain technology. These bills cover areas such as the recognition of cryptographic signatures, the definition and use of smart contracts, and the use of blockchains for maintaining business records.³⁶ Meanwhile, the US Congress Joint Economic Report of 2018 endorsed blockchain and calls for a common and coordinated regulatory framework that creates clarity for developers.³⁷ And regulators such as the US Financial Stability Oversight Council, a government body that assesses financial system risks, and the US Federal Trade Commission have formed working groups to examine the ways in which the technology will affect their objectives.³⁸

There is a lot of work still to do before the major regulatory hurdles to blockchain adoption are cleared. But momentum is building. Continued progress here is a vector of progress that will help to increase adoption of blockchain technology.

Nearly two in five blockchain-savvy executives cited regulatory issues as a barrier to greater investment in blockchain technology.

MULTIPLYING CONSORTIA

As a technology that facilitates transactions across a network, the value of a blockchain network increases with the number of users. That's one reason why the growth of blockchain consortia is a bullish sign. Blockchain consortia are groups of

companies that collaborate to advance shared objectives for the technology; this can include defining use cases, setting standards, developing infrastructure and applications, and operating a blockchain network. Some consortia educate, conduct research, or provide advice to their members.³⁹ A recent study counted some 61 blockchain consortia across a dozen industries globally—significant growth versus the prior year.⁴⁰

Financial companies took the lead in launching blockchain consortia, and they've maintained enthusiasm. For instance, R3, which is building blockchain technology for the financial industry, leads a consortium whose membership has grown from 42 in 2015 to over 200 in 2018.⁴¹ In the risk management and insurance domain, 30 companies so far have joined the Riskblock consortium to collaborate on blockchain applications to lower transaction costs while increasing the speed and security of data transfers among participants in the network.⁴² (Deloitte is playing an active role in this consortium's establishment and management.)

Firms outside financial services are forming consortia of their own, such as the Blockchain in Transport Alliance that includes leading players from the logistics sector and the Medi-Ledger blockchain platform on which major players of the life-sciences sector are collaborating to keep counterfeit goods out of medical supply chains.⁴³ Even policymakers, regulators, and central banks are beginning to join or found and lead blockchain consortia.⁴⁴ In the aforementioned executive survey, 29 percent of respondents said their company was already participating in a blockchain consortium and another 45 percent said they were likely to join one.

Not all consortia are building applications, and not all are equally effective. But growing participation by enterprises, technology providers, regulators, and governments is a vector of progress in the development of blockchain that will help increase adoption of the technology.

Conclusion

Over time, the five vectors of progress outlined here may help enterprises lower the cost and risk of deploying blockchain while expanding the practical applications of the technology.

Companies should keep an eye on emerging consensus mechanisms and techniques that could increase their transaction speeds exponentially. Developers of blockchain platforms and solutions should intensify their efforts to increase interoperability between ledgers and their connectivity with existing systems in the application landscape. As the vendor landscape for blockchain-as-a-service evolves further, the complexity of applying blockchain-based solutions will likely ease. Companies already have a wide array of options to help implement blockchain. They can evaluate these alternatives and choose the option most closely aligned to their needs.

Companies should keep an eye on emerging consensus mechanisms and techniques that could increase their transaction speeds exponentially.

Though regulatory understanding of the technology is still nascent, firms can collaborate with lawmakers and policymakers to create a solid regulatory framework—and perhaps look at leveraging policymakers' experimental facilities. Finally, companies should look at creating an ecosystem of partners in order to derive maximum value from this collaborative technology.

It's understandable why, despite promising pilots and experiments, executives might wonder when—and even whether—blockchain will be ready for mass adoption. But progress along these vectors is bringing the technology closer to its breakout moment every day.

Endnotes

1. Marko Vukolić, "Behind the architecture of Hyperledger Fabric," IBM, February 2, 2018.
2. Stan Higgins, "Enterprise Ethereum Alliance unveils common blockchain standards," Coindesk, May 16, 2018.
3. Larry Dignan, "Top cloud providers 2018: How AWS, Microsoft, Google Cloud Platform, IBM Cloud, Oracle, Alibaba stack up," ZDNet, February 14, 2018.
4. National Conference of State Legislatures, "Blockchain legislation—2018 legislative session," July 10, 2018.
5. Fabio Chesini, Alex Pradhan, and Chrissy Healey, "Toolkit: Blockchain consortium initiatives," Gartner, March 20, 2018.
6. David Schatsky and Craig Muraskin, *Beyond bitcoin*, Deloitte University Press, December 7, 2015.
7. Lucas Mearian, "Spending on blockchain technology to double this year to \$2.1B," *Computerworld*, January 26, 2018.
8. David Furlonger and Rajesh Kandaswamy, "Blockchain status 2018: Market adoption reality," Gartner, March 27, 2018.
9. Rob Marvin, "Microsoft unveils Coco: An open-source blockchain framework," *PCMag*, August 10, 2017.
10. Salil Gunashekar et al., "The potential role of standards in supporting the growth of distributed ledger technologies/blockchain," Rand Corp., accessed September 11, 2018.
11. RANE, "Lack of understanding and legal frameworks are main impediments to blockchain adoption," January 25, 2018.
12. Daily Hodl, "Cryptocurrency transaction speeds: The complete review," April 27, 2018; Alyssa Hertig, "How will Ethereum scale?," Coindesk, accessed September 11, 2018. Note that we are referring to only transaction speeds—i.e., the amount of time a system takes to process a transaction—rather than block time, the average time taken by the power of the network to produce a new block or mine a block.
13. edChain, "Blockchain FAQ #3: What is sharding in the blockchain?," Medium, May 5, 2018.
14. For a helpful overview, see Zane Witherspoon, "A hitchhiker's guide to consensus algorithms," Hacker Noon, February 12, 2018.
15. Malek Mezni, "Casper v.0.1.0, the new Ethereum's proof-of-stake, released on Github," Blokt, May 10, 2018.
16. William Suberg, "Vitalik Buterin: Sharding scaling improvement 'is coming' to Ethereum network," Cointelegraph, May 1, 2018.
17. Paddy Baker, "Zilliqa closes in on Visa's 8000 transactions per second," Crypto Briefing, August 25, 2018.
18. Toshendra Kumar Sharma, "What are the alternative strategies for proof-of-work?," Blockchain Council, January 25, 2018.
19. Deloitte analysis; interview with Paul Sin, Deloitte Blockchain Labs Hong Kong.
20. Jesus Leal Trujillo, Steve Fromhart, and Val Srinivas, *Evolution of blockchain technology*, Deloitte Insights, November 6, 2017.
21. Gunashekar et al., "The potential role of standards in supporting the growth of distributed ledger technologies/blockchain."

22. Enterprise Ethereum Alliance, "Enterprise Ethereum Alliance expands presence in Asia; appoints blockchain expert Kazuaki Ishiguro to lead Japanese office," July 19, 2018.
23. Hyperledger, "Hyperledger passes 250 members with addition of 9 organizations," July 31, 2018.
24. Interledger, "Interledger," accessed September 11, 2018.
25. Decentralized Identity Foundation, "Decentralized Identity Foundation grows to 56 members in our first year," Medium, May 22, 2018.
26. Ibid.
27. GS1, "GS1 recommends use of existing data standards in enterprise blockchain implementations," 2017.
28. Andrew S. Tanenbaum, *Computer Networks*, 2nd edition (Upper Saddle River, NJ: Prentice-Hall, 1988), p. 254.
29. See, for instance, Deloitte's *2018 global blockchain survey*, in which "implementation" difficulty is the second-most chosen barrier; conversations with Deloitte clients.
30. Andy Patrizio, "Top 10 blockchain as a service providers," Datamation, March 27, 2018; Marley Gray, "Ethereum blockchain as a service now on Azure," Microsoft Azure, November 9, 2015; Alexander J. Martin, "Like a BaaS: IBM offers blockchain as a service," *Register*, March 20, 2017; Catherine Shu, "Amazon's new blockchain service competes with similar products from Oracle and IBM," TechCrunch, April 22, 2018.
31. Matthew Kerner, "Simplifying blockchain app development with Azure Blockchain Workbench," Microsoft Azure, May 7, 2018; AWS, "AWS blockchain templates," accessed September 11, 2018.
32. Jeff John Roberts, "Google expands blockchain push with digital asset tie-up," *Fortune*, July 23, 2018.
33. Sawtooth, "v1.0.5," accessed September 11, 2018.
34. Deloitte, *2018 global blockchain survey*.
35. Mike Miliard, "Blockchain and healthcare privacy laws just don't mix," Healthcare IT News, May 3, 2017.
36. National Conference of State Legislatures, "Blockchain legislation—2018 legislative session."
37. Joint Economic Committee, *The 2018 Joint Economic Report*, US House of Representatives, March 13, 2018; Max Ambrose, "U.S. Congress officially supports blockchain technology," Medium, March 19, 2018.
38. Stan Higgins, "US finance regulators form crypto working group, says Mnuchin," Coindesk, January 13, 2018; Annaliese Milano, "US trade regulator launches blockchain working group," Coindesk, March 19, 2018.
39. Peter Gratzke, David Schatsky, and Eric Piscini, *Banding together for blockchain*, Deloitte University Press, August 16, 2017.
40. Chesini et al., "Toolkit: Blockchain consortium initiatives."
41. R3, "The R3 story," accessed September 11, 2018.
42. Nathan Golia, "Insurance blockchain consortium RiskBlock adds 12 members, cybersecurity tools," Digital Insurance, August 21, 2018.
43. Global Trade, "Dutch logistics consortium to explore blockchain technology," December 30, 2016; Jeremy Nation, "Pfizer and Genentech turn to Ethereum blockchain," ETHNews, October 2, 2017.
44. Carlo R.W. De Meijer, "Blockchain Project Jasper: Reaching boundaries," Finextra, February 15, 2017.

About the authors

DAVID SCHATSKY is a managing director at Deloitte LLP. He tracks and analyzes emerging technology and business trends, including the growing impact of cognitive technologies, for the firm's leaders and its clients. Connect with him at twitter.com/dschatsky.

AMANPREET ARORA is an assistant manager at Deloitte Services India Pvt. Ltd. He tracks and analyzes emerging technology and business trends, with a primary focus on blockchain technologies, for Deloitte's leaders and its clients.

ANIKET DONGRE is a manager at Deloitte Support Services India Pvt. Ltd., focusing on the intersection of innovation, strategy, and technology. He frequently evaluates emerging technologies and business trends to support strategic initiatives for Deloitte's leaders and clients.

Acknowledgments

The authors would like to thank **Paul Sin** of Deloitte Advisory (Hong Kong) Limited, **Anthony Day** and **Antonio Senatore** of Deloitte (Ireland), and **Lisa Simpson** and **Dhananjay Goswami** of Deloitte Consulting LLP for their contributions to this article.

Deloitte.

Insights

Sign up for Deloitte Insights updates at www.deloitte.com/insights.



Follow @DeloitteInsight

Deloitte Insights contributors

Editorial: Matthew Budman, Rupesh Bhat, and Blythe Hurley

Creative: Molly Woodworth

Promotion: Nikita Garia

Cover artwork: Molly Woodworth

About Deloitte Insights

Deloitte Insights publishes original articles, reports and periodicals that provide insights for businesses, the public sector and NGOs. Our goal is to draw upon research and experience from throughout our professional services organization, and that of coauthors in academia and business, to advance the conversation on a broad spectrum of topics of interest to executives and government leaders.

Deloitte Insights is an imprint of Deloitte Development LLC.

About this publication

This publication contains general information only, and none of Deloitte Touche Tohmatsu Limited, its member firms, or its and their affiliates are, by means of this publication, rendering accounting, business, financial, investment, legal, tax, or other professional advice or services. This publication is not a substitute for such professional advice or services, nor should it be used as a basis for any decision or action that may affect your finances or your business. Before making any decision or taking any action that may affect your finances or your business, you should consult a qualified professional adviser.

None of Deloitte Touche Tohmatsu Limited, its member firms, or its and their respective affiliates shall be responsible for any loss whatsoever sustained by any person who relies on this publication.

About Deloitte

Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee ("DTTL"), its network of member firms, and their related entities. DTTL and each of its member firms are legally separate and independent entities. DTTL (also referred to as "Deloitte Global") does not provide services to clients. In the United States, Deloitte refers to one or more of the US member firms of DTTL, their related entities that operate using the "Deloitte" name in the United States and their respective affiliates. Certain services may not be available to attest clients under the rules and regulations of public accounting. Please see www.deloitte.com/about to learn more about our global network of member firms.