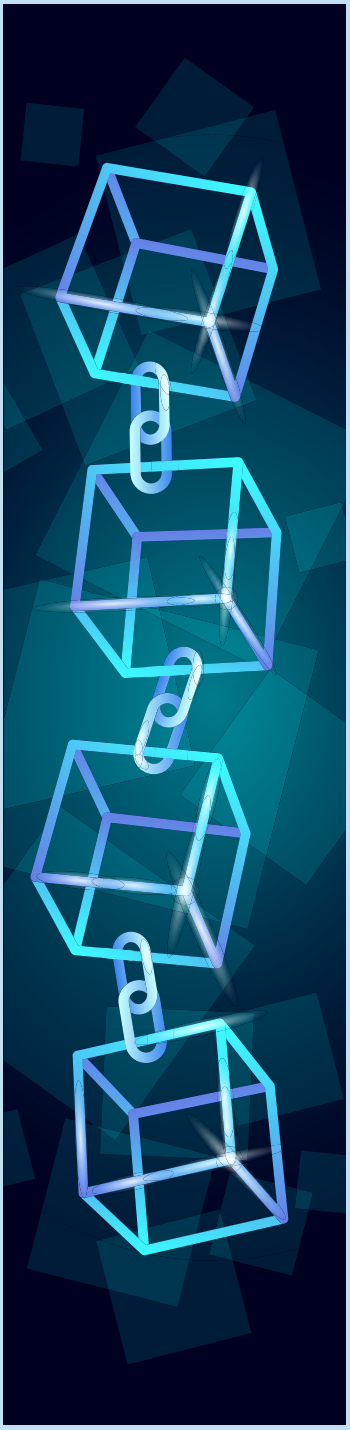
VIEW POINT



WHAT'S YOUR ENTERPRISE BLOCKCHAIN ARCHETYPE?

An Infosys analysis of the drivers of successful blockchain design

Infosys®
Navigate your next

Executive summary

Blockchain innovation is already surging ahead with several companies developing proofs-of-concept, use-cases, solutions, and service offerings. However, as a fairly new technology, there is a dearth of best practices on deploying blockchain to maximize its relevance and impact for organizations. This paper discusses a survey conducted by Infosys to uncover the common parameters of successful blockchain application design. The results, when plotted appropriately, provide clear insights into the four different archetypes of blockchain applications and how they map to varying organizational contexts and business goals. This paper is for technology decision-makers and influencers who need guidance on prioritizing or fine-tuning investments and efforts on blockchain initiatives within their organizations .

Introduction

Blockchain innovation is already surging Distributed ledger technology (DLT), the foundation of blockchain, is making waves across every industry. The surge of innovation in this field is evident in how standards bodies, open source communities, industry interest groups, technology shops, and universities are racing to discover new models, solutions and skills. There are a number of surveys and analyses being conducted to estimate the timeline by which various industries will go live with blockchain.

Today, most organizations are at different maturity stages of blockchain adoption. Many are evaluating multiple use cases and approaches towards creating blockchain applications. But, what does a typical blockchain solution architecture pattern look like? It is important to understand this as it plays a pivotal role in designing blockchain applications.

Key parameters of blockchain application design

To determine the common parameters of how blockchain is being used, Infosys undertook an analysis of solutions that have been proposed and/or implemented for blockchain use cases across industries. Some of the focus areas were:

- How business rules are implemented
- How existing assets are being reused
- Where data is stored
- What security mechanisms are used
- How futuristic technologies like IoT will be utilized

For this analysis, 'user interface' was not considered as an important parameter in order to maintain the focus solely on the use of blockchain technology. Table 1 provides a summary of the Infosys evaluation.

Table 1: Use case analysis

Use case description and purpose	Key solution parameters for blockchain				
	Business rules	Landscape interactions	Storage	Authentication	Sensor Inputs
Crypto-currency transactions: Leverage cryptocurrency as an alternative to flat currencies. End users use wallets for transactions.	Node-specific off-chain only	No interactions	On-chain only	On-chain only	No
Clinical trial supply chain: Improve quality and capture end-to-end provenance of clinical trial drugs within the organization's landscape. Distributed ledger handles provenance and integration with external sources like IoT for reusing existing assets	Smart contracts and shared off-chain	Reuse existing services	On-chain, shared document repository, node-specific DBs	On-chain and off-chain shared LDAP	Yes
Re-insurance process: Share data for efficient allocation of re-insurance risks within organization subsidiaries. Distributed ledger takes care of the lineage of transactions.	Smart contracts and shared off-chain	Reuse existing services	On-chain, shared data store, node-specific DBs	On-chain and off-chain shared LDAP	No
Loyalty management: Gain and redeem loyalty points among multiple merchants. Wallets and other features are implemented as node applications.	Smart contracts only	No interactions	On-chain and node-specific DBs	On-chain and off-chain node-specific	No
Provider data management: Improve the quality of provider data	Smart contracts and node-specific	Reuse existing services	On-chain and node-specific DBs	On-chain and off-chain shared LDAP	No
for consortia of health insurers networks. Distributed ledger takes care of the identity and information management of providers	off-chain				
Coffee bean provenance: Capture complete provenance of the coffee beans. Distributed ledger takes care of provenance and integration with IoT	Smart contracts and node-specific off-chain	Reuse existing services	On-chain and node-specific DBs	On-chain and off-chain node-specific	Yes
Multi-party insurance claims management: Improve claims resolution through efficient data sharing. Distributed ledger takes care of transaction management for insurance contracts	Smart contracts and shared off-chain	Reuse existing services	On-chain decentralized data sharing	On-chain and off-chain shared LDAP	No

Glossary	
Business rules > Smart contracts	Rules are implemented using smart contracts or chain code
Business rules > Node-specific off-chain rules	Services on nodes implement business rules and are different for different nodes without code or functionality sharing
Business rules > Shared off-chain rules	Multiple nodes use common services to validate certain business rules and reuse existing infrastructure
Storage > On-chain only	Data is stored on blockchain only
Storage > Node-specific	Each node has its own DB for functionality while the blockchain is used only for sharing data
Storage > Shared document repository	Shared document store is used by nodes and the link to the central repository is shared on the blockchain
Storage > Shared data source	Shared data store is used by nodes and the key to the data is shared on blockchain with services to access the shared data source
Storage > Decentralized data sharing	Small documents are shared on blockchain
Authentication > On-chain only	Only blockchain PKI is used for authentication
Authentication > Off-chain shared LDAP	Multiple nodes use the central LDAP of the organization for authentication
Authentication > Off chain node-specific	Each node has its own authentication mechanism that is not shared by other nodes

Results of the analysis

The questions posed by Infosys mapped clearly to typical solution architecture components like business rules, interfaces, storage, and security. In the context of blockchain, two key trends emerge, namely, decentralization and integration. For example, some degree of decentralization is observed in storage and business rules implementations. Similarly, various integration mechanisms are implemented to reuse existing assets or authentication mechanisms. These two trends – decentralization and integration – are further explained below:

- **Integration with business processes** – This refers to the extent of integration achieved with existing systems or processes. Integration can either be minimal or extensive. Minimal integration means that the implementation has zero or limited integration with existing systems. For example, a mobile app interacting with a blockchain node for loyalty points does not need to interact with any other system apart from the blockchain node. Extensive integration indicates that the implementation has a wide scope of integration with the existing landscape. For example, for provenance solutions, the IDs of packages come from existing applications residing in the IT landscape.
- **Decentralization of business processes** – This refers to the degree to which a business process has been decentralized. It can be either low or high. Low decentralization indicates the adoption of blockchain using partial decentralization of business processes. For example, in a specific organization, a solution for creating user identities is executed centrally. High decentralization indicates the adoption of blockchain using maximum decentralization of business processes

Mapping blockchain archetypes to organizational needs

Clearly, decentralization and integration are influential dimensions that impact the relevance and usefulness of blockchain. Fig 1 illustrates how blockchain solutions can be categorized using both dimensions.

Fig 1: Classification of blockchain archetypes

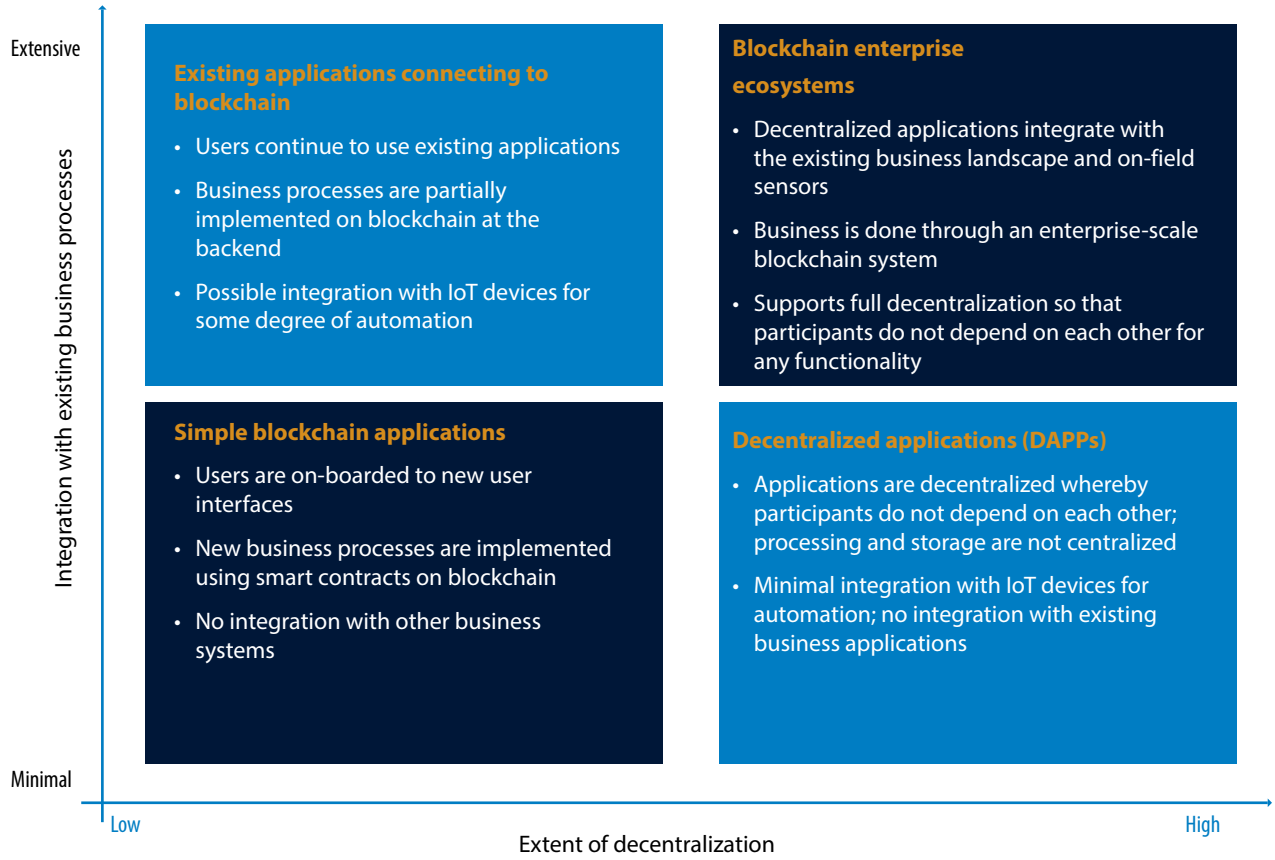


Fig 1: Classification of blockchain archetypes

Let us examine each category to understand its benefits, limitations and applications

A. Simple blockchain applications – Low decentralization, minimal integration

These are mobile and/or web apps that interact only with the blockchain network. The complete business problem is modeled on a blockchain ledger through smart contracts. Here, blockchain is used for a standalone process and nodes have local data storage. However, not all data is decentralized and some requirements like user authentication may be done using a centralized system. These types of apps are suitable when companies are evaluating blockchain as a technology, when solving business problems that do not depend on real-time inputs from external sources or when new business scenarios can be realized completely on a distributed ledger.

Benefits

- Easier to focus effort on implementing blockchain-related functionalities without being distracted by other technologies or integration with the current landscape
- Requires less effort and cost as compared to the other archetypes while enabling participant collaboration on the blockchain

Limitations

- Disconnects with existing business processes, which may lead to operational inefficiencies

Typical use cases

- Any proof-of-concept (PoC) use case like a loyalty points network where the aim is to demonstrate how blockchain works in a given context

B. Existing applications connecting to blockchain – Low decentralization, extensive integration

Here, existing business applications are enhanced to integrate with blockchain systems. End users may not even experience any change when using the legacy application as the integration happens at the back-end. This archetype is useful for enterprises that want to incorporate blockchain technologies into complex business processes using a phased approach without disturbing the existing business model. In cases where multiple departments within a single organization may use blockchain to decentralize processes, the organization can choose to reuse existing centralized IT assets like data access services, authentication mechanisms or ESBs.

Benefits

- Ease of convincing the business on how blockchain technology can drive value
- Promotes reuse of existing artefacts, knowledge and IT assets

Limitations

- Limited RoI since the complete benefit of decentralization is not achieved
- Some pain points will persist due to inherent issues in existing applications

Typical use cases

- Intra-organization use cases where there is value in reusing some existing assets or common services such as data harmonization, reinsurance placements and claims management within the organization
- Inter-organization consortium use cases where multiple departments participate to reuse their existing IT assets. For example, in a KYC use case, blockchain might have two nodes – one for compliance and one for the CRM department – within a single organization

C. Decentralized applications (DAPPs) – High decentralization, minimal integration

In this category, key business processes are decentralized and implemented on blockchain using smart contracts. These applications provide new interfaces for users. They also integrate with systems like IoT, smart sensors, etc., but will have either zero or limited integration with existing business processes

Benefits

- Extracts maximum value from blockchain through decentralization of trust
- Helps implement disruptive ideas while incentivizing meaningful collaboration

Limitations

- Slower time-to-market due to difficulties in collaborating and identifying business ideas
- Higher risk on investments for all participants
- Changes to the blockchain application requires an agreement between all participants, leading to slow deployment

Typical use cases

- Any blockchain use case where a new disruptive idea is being developed from scratch such as crypto currency, decentralized identity management or peer-to-peer insurance where smart contracts pool risk using the premiums paid by the insured, thereby eliminating the need for a dedicated insurer

D. Blockchain enterprise ecosystems – High decentralization, extensive integration

This category of blockchain applications are perfectly decentralized and integrate seamlessly with the existing landscape. It differs from DAPPs by enabling reuse of existing IT assets without compromising on the degree of decentralization. These applications might use decentralized storage mechanisms to share data.

Benefits

- Combines the best of both worlds through decentralization and reuse of existing assets
- Unlocks opportunities for the automation of cross-organizational business processes

Limitations

- Needs greater maturity of blockchain use cases
- Slower time-to-market owing to difficulties in collaborating and identifying business ideas
- Higher risk on investments for all participants
- Changes to blockchain application requires an agreement between all participants and may lead to slower deployment

Typical use cases

- Any blockchain use case where disruptive ideas should integrate with existing enterprise systems. Some examples include platforms for raising capital for startups that should integrate with established exchanges, platforms for supporting real-estate transactions through partial ownership that should integrate with existing rental systems, or real-time pharma supply chain networks that should integrate with existing IoT-enabled track and trace systems

Conclusion

There are different categories/archetypes by which blockchain applications can be implemented. Choosing the right category depends on various factors like the fitment of use case, feasibility, affordability, and maturity of the organization in developing blockchain applications. As the business context of an organization changes, so will the parameters that drive its choice of blockchain archetype. Therefore, choosing the right archetype is important for organizations to deploy the necessary blockchain capabilities and balance cost and implementation timelines so they can achieve their goals of blockchain-driven transformation.

About the Authors

Arshad Sarfarz Ariff, *Technology Architect*

Arshad Sarfarz is a Technology Architect with 15 years of experience. He currently works with the HI-Life - Architecture and Design Group at Infosys. He has handled projects in the sectors of healthcare, life sciences and insurance. His specializations include blockchain, enterprise application architecture design, .Net technologies, and single page applications (SPAs).

Ambadas Tulajadas Choudhari, *Senior Technology Architect*

Ambadas is a Senior Technology Architect with over 15 years of experience in the IT industry. His areas of expertise include legacy modernization, enterprise architecture, data architecture, and solution architecture. He has authored several white papers on reference architectures. Currently, he is working on blockchain and its applications in healthcare, insurance and life sciences.

For more information, contact askus@infosys.com

Infosys®
Navigate your next