

# The Conundrum of Resourcing DLT Nodes: Nine Considerations in Practise

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**Abstract.** Deciding on whether Distributed Ledger Technology (DLT) nodes should be insourced or outsourced is becoming urgent now that DLT projects transition from a pilot phase to a production environment. Currently it is unclear what considerations could be made leading to such a decision.

In this white paper we introduce nine considerations regarding resourcing of DLT nodes, based on interviews with experts. This non-exhaustive list of considerations can be used by any DLT project that is moving from a pilot phase to a production environment. We share and discuss several insights that the experts made in practise regarding resourcing of DLT nodes. Our aim is to contribute to the DLT community by sharing these considerations and experiences regarding resourcing of DLT nodes. These considerations and experiences are relevant because they may serve as a guidance for any company that is considering resourcing of DLT nodes.

## 1 Introduction

Distributed Ledger Technology (DLT) is becoming more mature, as the pilot phases make way for projects that are deploying their DLT solution into a production environment. At ING we observe an increasing need for guiding considerations on whether or not DLT nodes should be insourced, or outsourced. This need is expressed within ING, but also at other companies that start deploying DLT nodes to a production environment. Even more, some companies have addressed the need for these guiding considerations as urgent. However, as there are few resources available on resourcing DLT nodes, the decision on in- or outsourcing DLT nodes is becoming a conundrum.

The aim of this white paper is to share nine considerations regarding resourcing of DLT nodes. By interviewing DLT experts we provide a non-exhaustive list of considerations that these experts think are important. Furthermore, during the interviews the experts mentioned that currently a Babylonian confusion exists regarding the terminology of DLT resourcing. This is why we provide definitions for some of these concepts in DLT resourcing in Section 2. We then continue with a description of the nine considerations in Section 3. These considerations are 1. Risk, 2. Strategy, 3. Economies of scale, 4. Innovation, 5. Interdependence between DLT projects, 6. Time-to-market, 7. Vendor lock-in, 8. Employee lock-in, and 9. Cost. We choose these considerations because they are mentioned by all experts.

Then, in Section 4, we present a discussion on how these considerations are applied in practise, An major observation is that the experts consider these observations important, but there is no ‘one size fits all’. The set of considerations provide guidance for each unique use case. Finally, in Section 5 we provide our conclusions.

## 2 Definitions

The experts argue that in practise different interpretations are used for the concepts that are related to resourcing. This suggests that there is a need to establish definitions first before we consider resourcing of DLT nodes. In what follows we provide definitions for concepts related to resourcing with the aim to avoid Babylonian confusion. We address the following concepts as they were mentioned by the experts.

**Resourcing.** This concept is an umbrella term for both insourcing and outsourcing [11]. Both of these concepts are discussed in the text below. Resourcing is providing resources and capabilities (for example, financial resources, technology, or human skills) needed for a particular project. The rationale for resourcing is that a competitive advantage may be gained when products or services are produced more effectively and efficiently [9].

**Outsourcing.** Outsourcing is an agreement between two companies, in which one company contracts-out an activity to another company [9].

**Insourcing.** This is the use of internal resources and capabilities to achieve the same objectives of outsourcing [7].

**DLT node.** A DLT node is any node that is part of a DLT network. A DLT node includes the following components:

1. Computing resources. This is the bare metal or the virtual machine (VM) on which the ledger, wallet, or application reside. A DLT node always consists of computing resources and one or more of the following components,
2. A ledger. The ledger is database that contains a historical reference to all transactions that have been proposed and were committed, such that these transactions are all verifiable by all transactions of the DLT network.
3. A wallet. The wallet includes the keys that allow for managing an account on the ledger, including signing of transactions. Also, a wallet may contain a local copy of the participant’s own transactions.

With the keys access to the account is granted, and changes to the account can be made. For example, with the keys a confirmation can be provided to execute a transaction, or the keys can be used to initiate a transaction which may trigger a change to the data in the account.

A wallet may also contain transactions that are related to the keys in this wallet.

4. An application component. This contains the program code that is used to run the DLT protocol. It also provides the DLT API (application programming interface), and the functional API. Furthermore, it may provide sup-

port processes for the network, such as functional monitoring, and scheduling of batch processes.

Note that these components can be insourced and outsourced separately. This makes that resourcing of DLT nodes is a grey area, increasing the need for definitions of terminology.

**The cloud.** A computer cloud provides an on-demand availability of computer resources, which may include data storage of computing power. In practise, a cloud is a data centre available to a specific set of users. Clouds can be external or internal. An external cloud is a managed by an external provider to a company, to which that company may have access. An internal cloud is a data centre managed by a company, to which that same company has access. A company may choose to provide other parties access to their internal cloud. However, from the company’s perspective this is still an internal cloud, as it is managed by the company itself.

**Infrastructure as a Service.** IaaS is a concept in which infrastructure (e.g. processing power, data storage) is hosted at an external provider, and is accessible over the Internet [3].

**Software as a Service.** SaaS is a concept in which software is hosted at an external provider (which could be in a cloud) and delivered via the web.

Although there are other definitions of the concepts that we discussed above, our definitions are useful as they can help us think and communicate more clearly, which in turn help us to understand what considerations can be made for resourcing of DLT nodes.

### 3 Considerations

The literature suggests dozens of considerations for insourcing [5] [6] [10] and outsourcing [4] [12] [13]. In contrast to these dozens of considerations, we derive nine considerations from the interviews: 1. Risk, 2. Strategy, 3. Economies of scale, 4. Innovation, 5. Interdependence between DLT projects, 6. Time-to-market, 7. Vendor lock-in, 8. Employee lock-in, and 9. Cost. This may suggest that these considerations are top-of-mind during the interviews with the experts. We will discuss these considerations in the following sections.

Although *control* was mentioned by the majority of the experts, during the analyses of the interviews we found that control is an umbrella term for all other considerations. This is why we do not mention control as a separate consideration. Control is about how, and also the extent to which influence is carried out regarding managing a DLT node. For example, control is about managing the risks (see Section 3.1), control is about aligning to the strategy of a company (see Section 3.2), and as a final example, control is about obtaining economies of scale (see Section 3.3).

### 3.1 Risk

All experts mention that risk should be considered first when resourcing DLT nodes, by performing a risk assessment on the project that aims to resource DLT nodes. Complying to legislation and regulatory standards should be included in the risk assessment.

In particular, confidentiality and availability of data should be considered. Some of the experts argue that integrity of data is less of a concern as this is guaranteed by the distributed ledger protocol, under the assumption that the majority of the nodes in a DLT network is honest.

According to the majority of experts, risk is the first and main consideration when resourcing DLT nodes. For example, assume that the confidentiality level of transactions in a wallet, as discussed in Section 2, requires that the transactions can only be viewed by the company that owns the wallet. This would suggest that insourcing of the wallet is mandatory. Note that in this example we do not take into account cryptographic measures, such as zero-knowledge proofs, that can enhance the confidentiality when a wallet is outsourced. All experts perceived the term ‘risk’ differently, which can be explained by the different backgrounds of the experts, as well as that risk is a broad concept.

### 3.2 Strategy

A company may follow a strategy where it decides to focus only on its core activities, and outsource any other activity [14]. This is called a make-or-buy decision. One of the experts provided the following example. The offices of a company require electricity. The company chooses to buy the electricity from an energy supplier instead of generating the electricity itself, because generating electricity is not the core business of the company. Similarly, this example can be applied to resourcing of DLT nodes. As resourcing of DLT nodes is not a company’s core business, it would make sense to outsource the DLT nodes.

Note that a make-or-buy decision is a long-term approach, which is in contrast to a medium-term approach, which we discuss next.

### 3.3 Economies of scale

One expert suggests that DLT nodes should be insourced if a company has sufficient DLT projects, as this provides an economy of scale under the assumption that all DLT nodes are based on the same platform (e.g. Corda). Under these assumptions insourcing will likely be more cost effective compared to managing eight or more suppliers to whom the DLT nodes are outsourced. Note that it is hard to generalize and provide an exact number on what entails ‘sufficient’. The exact number depends on the quantification a company has to make for its own situation.

Note that this consideration is a medium-term approach, as a company may shift from outsourcing DLT nodes to insourcing DLT nodes when the company has sufficient DLT projects. This is in contrast to the consideration ‘strategy’,

as discussed above, where a long-term approach is chosen for insourcing or outsourcing DLT nodes.

### **3.4 Innovation**

Innovation may be an important factor for outsourcing DLT nodes. When a company tries to innovate typically it aims for proving technology in a limited amount of time. As speed becomes an important factor, and no real customer data is used yet, using the services of an external party takes precedence. The majority of the experts argues that outsourcing DLT nodes would be their first choice when participating in an innovation project.

However, as discussed in Section 1, at some point in time these innovative projects may shift toward a production environment. Here the other nine considerations start playing a role. This would suggest that even in a pilot phase the other nine considerations should be taken into account to ensure a smooth transfer from the pilot phase to the production phase.

### **3.5 Interdependence between DLT projects**

The experts observe in practise that DLT projects focus on transitioning from a pilot phase to a production phase. Over time, however, it may be that there is an interdependency between projects. For example, consider two DLT projects, where the first project is focusing on improving a supply chain with DLT, whereas the second project introduces a central bank digital currency (CBDC) based on DLT. Trades in the supply chain in the first project potentially can be made by using the digital currency of the second project. This suggests that an interdependency between the two projects exists. In this example a company should consider the combined resourcing of these projects. If, for example, the CBDC project requires to store its ledger content, as discussed in Section 2, in a European data centre, then the supply chain project should take this requirement into consideration, too.

### **3.6 Time-to-market**

For this white paper we define time-to-market as the length of time it takes from a product to be conceived until it is available for sale or usage. Creating, setting up, and connecting a DLT node in an environment with multiple companies and multiple legislation is a complex task. The choice for outsourcing a DLT node can significantly reduce the time in which a DLT node becomes available, see Section 3.1 and Section 3.8. As such, the time-to-market of a product is also reduced.

### **3.7 Vendor lock-in**

There are multiple types of vendors that may provide infrastructure (IaaS), software(SaaS), and even blockchain as a service. When choosing such a vendor

a vendor lock-in may occur. A vendor lock-in occurs when a company becomes sole dependent on a single vendor, making it hard to transfer to another vendor. The experts argued that this would not apply to a cloud provider, as discussed in Section 2, as currently it is fairly easy to transfer between cloud providers. Instead, the experts consider that a vendor lock-in may take place with the company that builds the application component (see Section 2) of a DLT node. In practise, the experts observe that the company building the application has a preference for a cloud provider. As such, it is the application builder that may decide which cloud provider is chosen for hosting the DLT node. Furthermore, the experts observed that in some use cases insourcing a DLT node is mandatory. This is because the confidentiality of the data is considered to be ‘high’ and the controls to maintain this confidentiality require that the DLT node can not be outsourced.

One expert considered the term ‘ledger lock-in’ where a company becomes dependent on a single technology. Therefore, vendors should be asked about the extent to which a company can migrate their hardware, data, or applications to another vendor, for example, by considering the possibilities of transferring to another vendor that offers the same service, or to a vendor that offers a different platform. As smart contracts are an essential component of DLT, a vendor should also provide information if smart contracts can be migrated from one platform to another platform. At this moment in time the experts argue that most smart contracts can not be migrated. This suggests that currently, once a platform is chosen, a vendor-lock-in may occur.

### 3.8 Employee lock-in

In contrast to vendor lock-in, as discussed in Section 3.7, a company may become sole dependent on a single employee when insourcing a DLT node. The majority of experts consider DLT to be a complex technology on which there is little expertise available as the DLT market of employees is very small. This makes it hard for companies to further develop or buy DLT expertise in-house. The skill set of how to create a DLT environment (e.g. managing and running the DLT nodes) is considered to be fairly common, as external parties offer such services. However, by contrast, the skill set of knowing and being able to apply this knowledge of what the possibilities (and restrictions) are of DLT, and how this to apply to an organisation specifically are considered to be rare.

A distinction was made between a pilot phase and a production phase. As the pilot phase involves experimenting, the employee lock-in is less of an issue because any experiments being conducted will likely have little impact on day-to-day business. However, when turning to a production phase, employee lock-in may become an issue for the reasons stated above.

### 3.9 Cost

The importance of cost differs according to the size, capacity and future vision of the institution planning to host DLT nodes. Some experts argued that insourcing

nodes may require a large financial budget and also may require DLT expertise in-house – both of which may not be present or relevant in a company. From the perspective of a large company, costs only become a relevant concern after a risk assessment allows for the possibility of both insourcing and outsourcing. Furthermore, some experts argue that a vendor specialises in providing hosting facilities as its core business. Consequently, outsourcing nodes to trusted vendors in the space may give access to a suite of additional services like monitoring, support, private networks, standardised implementation frameworks, which would not be available in-house.

## 4 Considerations in practise

Risks should be considered first by performing a risk assessment, according to the experts, before any of the other nine considerations. If the risk assessment suggests that outsourcing may be an option, then a company planning to outsource DLT nodes should determine if the party to which the components of DLT nodes, as discussed in Section 2, can be outsourced is able to comply to the required risk controls. In practise the experts observe that the party to which the DLT node is outsourced typically is a fintech or a startup. Although some of these parties are able to comply to risk controls, most experts argue that the majority of these parties may not be able to comply to risk controls related to, for example, cyber security, segregation of duties, and change management due to the current maturity of the fintech or startup.

The experts observe that many of their peers consider insourcing more secure than outsourcing. However, as one expert stated, in practise DLT nodes with the highest CIA (Confidentiality, Integrity, Availability) rating can be outsourced. This is because the party to which the DLT node is being outsourced, in fact, can comply to all risk requirements. From this we can conclude that outsourcing could be an alternative to insourcing, even when a project requires the most demanding risk controls. As it may be counter-intuitive to outsource a DLT node that requires the most demanding risk controls, one expert even argued that companies must be “psychologically ready” to make the decision.

Furthermore, technological properties such as the acclaimed immutability, and decentralisation are not unique to DLT solutions that are insourced. For example, Amazon offers QLDB (Quantum Ledger Database), a “database that provides a transparent, immutable, and cryptographically verifiable transaction log” [1]. This suggests that the choice for resourcing DLT does not depend on the properties of a technology, which is reflected in the answers of the experts in our interviews. The nine considerations appear to be business driven instead of technology driven.

All experts argue that the nine considerations should be applied per project. Applying these considerations cannot be generalised to all projects as there is no ‘one size fits all’.

The application component and the hardware, as discussed in Section 2 are considered to be less important by the experts. The discussion on resourcing is about the resourcing of the ledger and the wallet, as introduced in Section 2.

DLT nodes for some projects *must* be outsourced, but policies may require that the data of a ledger is stored within a jurisdictional boundary. For example, consider a project that involves parties on every continent. Here jurisdiction may require that data (of a ledger) is stored only on a particular continent (e.g. due to the USA Freedom Act [2]). A potential solution for this scenario could be that all data is stored in a third party data centre on that continent.

However, the experts also remark that if all components of all DLT nodes of all parties in a project are being outsourced to a single third party, the need for DLT should be reconsidered. Their arguments are in line with existing research [8]. Although an argument could be made for outsourcing a full DLT node when a company wants to participate in a particular network. Here, the considerations of outsourcing a node are again driven by business decisions.

## 5 Conclusion

As DLT projects transition from pilot to a production environment, the need for resourcing DLT nodes arises. At ING we observe that multiple companies (including ourselves) are looking for guidance on the considerations that can be made for resourcing DLT nodes. Based on interviews with experts, we provide nine considerations: 1. Risk, 2. Strategy, 3. Economies of scale, 4. Innovation, 5. Interdependence between DLT projects, 6. Time-to-market, 7. Vendor lock-in, 8. Employee lock-in, and 9. Cost. Although this is a non-exhaustive list, these considerations were mentioned in all interviews, which suggests an importance and focus on these considerations by these experts.

Overall, the experts consider risk to be the most important consideration. However, no ‘one size fits all’, as each project has its own risk requirements. This is reflected in, for example, the consideration cost, where some expert argue that costs are less important, whereas other experts consider this as important as the consideration risk.

Outsourcing of DLT nodes in practise, however, still may be a challenge. For example, the party to which the DLT nodes are being outsourced must be able to comply to risk requirements. Primarily fintech and startup companies are developing and providing services to host DLT nodes. These companies focus on time-to-market, and may focus less on complying to risk controls, as discussed in Section 4. This gap must be bridged, to ensure that a sound choice can be made on resourcing DLT nodes. The nine considerations in this white paper may help bridging that gap. Furthermore, the considerations and experiences in this white paper may serve as a guidance for any company that is considering resourcing of DLT nodes.

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