

# A High-Level Planning Methodology of Enterprise Application Architecture

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**Abstract.** Enterprise IT strategy is an important tool for the success of enterprise digitization and informatization. Enterprise application architecture is the core of enterprise IT strategy. Aiming at the shortcomings of traditional enterprise application architecture methodology, this paper proposes a high-level planning methodology, which starts from enterprise business architecture, integrates application status analysis and application solution survey results, and uses suitable application architecture principles to complete the high-level planning of enterprise application architecture. This methodology has been successfully used in many enterprise IT strategy projects, and this article illustrates it with examples.

**Keywords:** enterprise IT strategy; enterprise business architecture; enterprise application architecture.

## 1. Introduction

Enterprise IT strategy can be regarded as an advanced software engineering method for the overall IT top-level design of the enterprise. Its goal is to help enterprise management review the consistency of enterprise business strategy and IT strategy, so as to formulate and make decisions on the medium and long-term IT investment plan. With the rise of enterprise digital transformation, enterprise management is paying more and more attention to enterprise IT strategy. In this case, even senior managers with non-IT backgrounds will be very concerned about the blueprint of enterprise application architecture, which is the core content of enterprise IT strategy. Because the blueprint directly determines the scale and future success of enterprise IT investment. This is also the core issue of any enterprise IT strategy project.

In the current practice of enterprise IT strategy, one situation is that IT consulting firms build enterprise application architecture blueprints, but they are not responsible for enterprise application delivery, and their consulting costs are often high. In another case, IT technology companies design enterprise application architecture blueprints, but they are often used to technical language and cannot be understood by enterprise management.

At the same time, the digitization projects of a large number of enterprises are faced with the dilemma of being difficult to succeed. Tony Saldanha pointed out that 70% of digital transformation projects fail. [1]. In June, 2021, Tencent Research Institute released the digital transformation report of China state-owned enterprises [2]. Through the research questions of more than 60 enterprises, it was found that the main challenge of digital transformation in various industries was not the lack of leadership support and financial support, but the difficulty in integrating digital technology and business scenarios, resulting in many enterprises not knowing where to start to promote the digital transformation. It can be said that enterprise IT strategy has become an urgent need for many enterprises to carry out digitalization and informatization. Among them, an enterprise application architecture methodology suitable for enterprise understanding and implementation will play an important role in promoting the success of enterprise IT strategy.

To solve this problem, this paper proposes a high-level planning methodology for enterprise application architecture, which emphasizes the architecture at the overall perspective of the enterprise, starting from the enterprise business architecture, fully drawing on the industry IT practice and technology development. This methodology has been applied in the IT strategy projects of many enterprises and has achieved good results. This paper hopes that by summarizing and introducing this methodology, it can provide a useful reference for more enterprise digital practitioners.

## **2. Related Research and Practice**

The application architecture provides a blueprint for the individual applications to be deployed, their interactions, and their relationships to the core business processes of the organization [3]. There are two main categories of research and practice in application architecture over the past few decades.

### **2.1 Open Standards Based on Enterprise Architecture**

The open standards are based on Enterprise Architecture (EA). In 1987, John Zachman of IBM published information architecture framework, which started the framework standard of enterprise architecture. Zachman became the first reference model of enterprise architecture [4]. Over the past 30 years, enterprise architecture standards from different organizations and experts have been put forward. In addition to Zachman, the mainstream standards also include TOGAF, FEA, DoDAF, etc. Recognized and promoted by international mainstream IT manufacturers, TOGAF has become the most widely used mainstream open standard in the field of enterprise architecture.

TOGAF was developed by the Open Group in 1993 and officially released in 1995. Its full name is The Open Group Architecture Framework. TOGAF is a set of open standard framework and methodology for enterprise architecture planning, which is enterprise strategy oriented and business process driven. In 2018, TOGAF released the latest version 9.2, which can be downloaded from <https://www.opengroup.org/togaf>. The core of TOGAF is the Architecture Development Method (ADM). ADM provides a testable and repeatable architecture development process. For the application architecture, TOGAF gives the design steps, including identifying applications and their components from the business architecture, decomposing and merging applications, and determining the required applications.

However, since the implementation of EA requires a large investment of resources, in practice, only a few big companies with sufficient strength are capable of adopting EA. John McDowall believes that EA should be transformed from a static, document-centric consumer of resources into an active, operational management tool [5].

### **2.2 Practices of IT Consulting Firms**

Application architecture planning belongs to IT strategy consulting services of IT consulting firms. They are summarizing the business architecture and application architecture of various industries through the practice of many IT strategy projects, and focus on building a methodology around the connectivity of business and application architecture. The Component Business Model (CBM) developed by IBM is a typical representative of this type of methodology [6].

		Business competencies					
		Customers	Products/ services	Channels	Logistics	Business administration	
Accountability level	Direct	Market strategy	Merchandise planning Channel planning	Channel strategy Store design	Network design	Corporate strategy	
		Customer service strategy	Assortment planning Space planning Promotion planning	Real estate strategy Internet design	Warehouse design	Corporate planning Financial planning	
		Market strategy	Product development Sourcing	Catalog call center design	Demandflow planning	Corporate governance	
	Control	Campaign management	Product flow Planogramming Allocation	Channel management Labor management	Inbound routing	Business performance management Treasury and risk management	
		Service management	Inventory mgmt/OTB Demand forecasting Price management	Order management	Receipt scheduling	Legal and regulatory compliance	
			Contract management Vendor management	Real estate construction and facilities management	Delivery scheduling	Financial accounting and reporting	
				Loss prevention	Carrier management	IT systems and operations	
		Execute	Customer service	Item management	Order management	Warehouse management	Financial accounting and reporting
			Customer communications	Product management PO management	Inventory management	Transportation management	Indirect procurement
Marketing	Vendor management		Merchandise management	Fleet management	HR administration		
Advertising	Regulatory/audit		Price/sign management	Reverse logistics	IT systems and operations		
Public relations	Reversal/discount management						

Figure 1. IBM CBM example for retail industry.

Figure 1 is an example of IBM CBM for the retail industry. As shown in the figure, in the CBM business architecture, responsibility levels are set vertically, usually divided into three levels.

Direct: Responsible for strategy, overall management, and policy formulation.

Control: Responsible for monitoring, managing exceptions, and making decisions at the tactical level.

Execute: Responsible for daily work and implementation of specific matters.

Through the CBM, a componentized view can be established for an enterprise to help the enterprise analyze the status and gaps of its business architecture and organizational capabilities in various special fields. Through the analysis of the CBM business architecture, the enterprise management can determine which business components should be paid attention to so as to bring more value to the enterprise, including consolidating competitiveness, creating profit growth, and bringing about cost optimization. And these analysis results are the important basis for guiding enterprise application architecture planning. IBM will use this methodology to build application reference architectures for different industries. The specific content of these reference architectures can be read from <https://www.ibm.com/cloud/architecture>.

The application architecture practice of an IT consulting firm is its core knowledge asset, and each consulting firm has its own areas of expertise. Therefore, for the application architecture methodology required by the digital transformation of enterprises, the practice of IT consulting companies can be used for reference, but not every enterprise can afford it.

### 3. A High-Level Planning Methodology

In view of the above issues, this paper believes that the enterprise application architecture should be a high-level architecture, which can learn from the business domain driven approach of IT consulting firms and the architecture principles advocated by EA. Through the practices of many enterprise IT strategy projects, this paper summarizes and proposes a high-level planning methodology for enterprise application architecture, as shown in Figure 2.

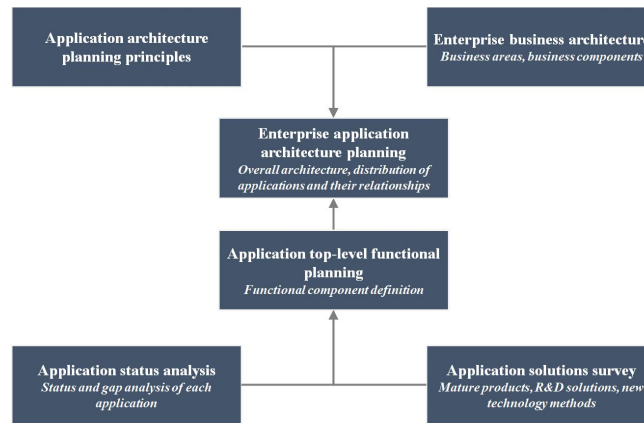


Figure 2. A High-Level Planning Methodology of Enterprise Application Architecture.

### 3.1 Application Architecture Planning Principles

This methodology recommends the following four architectural principles.

#### 3.1.1 Starting From the Enterprise Business Architecture:

The enterprise application architecture should be based on the planning results of the enterprise business architecture, and the core logic of the application architecture should conform to the core logic of the enterprise business architecture. For example, to define the scope and boundaries of an enterprise's core business application system, it needs to conform to the content of the core business in the enterprise business architecture.

#### 3.1.2 Planning From a Holistic Perspective:

It is necessary to analyze and plan the overall application architecture of the enterprise from the perspective of the enterprise as a whole, avoid simply stacking the applications of various business units and functional departments of the enterprise, and avoid problems such as scattered, overlapping, and unclear boundaries. For example, if two business units in an enterprise need to provide products and services to the same target customer group, then building a unified customer relationship management application for the two business units will help the enterprise establish a unified customer service management mechanism.

#### 3.1.3 Componentized Application Architecture and Component Reuse:

Enterprise application architecture planning should be built using application components. This not only helps to form a better mapping relationship with the enterprise business architecture, but also makes it easy for key stakeholders to understand. At the same time, this also helps to refine and form the architectural assets of enterprise application components, which is conducive to component reuse, and is conducive to system development and implementation efficiency improvement and cost control. For example, enterprises often have multiple different applications that require image management functions, so planning image management as a common application component is usually a profitable choice.

#### 3.1.4 Decoupling Between Applications:

Decoupling is a common principle in application architecture planning. In particular, it is necessary to avoid and reduce the process dependency and data dependency between applications. On the one hand, it helps to decompose a group of applications into different projects for efficient parallel execution in application development and implementation. On the other hand, during the operation of each application, it helps to carry out operation and maintenance independently according to the business attributes of different applications, reducing the complexity and risk of operation management.

### 3.2 Enterprise Business Architecture

Enterprise business architecture is the set of structures and stories that underpin “the business of the business”. The structures might include higher-level concerns such as business models, organizational structures, brand architectures, and financial structures [7]. In practice, enterprise business architecture plays an important role in closely linking enterprise strategy with enterprise application architecture. In this regard, we have proposed a high-level enterprise business architecture in another article [8]. We believe that enterprise business architecture should be built on the basis of understanding the enterprise and its industry, and a componentized approach is also required. The business architecture of the enterprise needs to be communicated and confirmed with the middle and senior management of the enterprise. Therefore, it needs to be constructed from a business perspective as much as possible. In particular, it needs to be constructed from the perspective of the corporate CEO.

The so-called CEO's perspective is to construct the grouping, hierarchy and relationship among business components from the CEO's point of view, so as to conform to the CEO's understanding logic and management ideas. For example, for a company engaged in capital market industry, the high-level business structure from the CEO's perspective may be as shown in the figure 3, with trade execution as the core, and expansion from the center to the outside according to the degree of attention, forming different areas of competence.

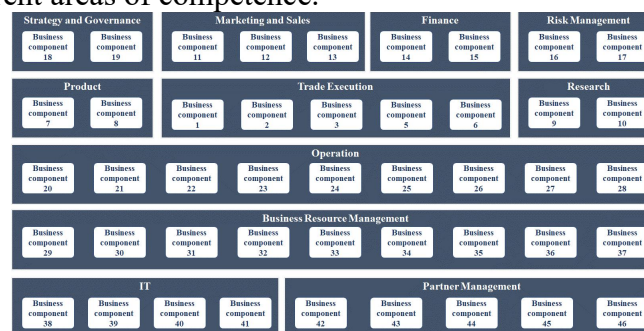


Figure 3. Example of business architecture from the perspective of the CEO of a capital markets company.

### 3.3 Application Status Analysis

The purpose of enterprise application status analysis is to analyze the coverage and support of current applications to key business processes in the enterprise business value chain, and to identify improvement points. The application status analysis should be oriented to the needs of IT strategy, comprehensive business perspective and technology perspective, starting from the requirements of business strategy and business capabilities, to find out the gaps and problems in the current application architecture. This work can be divided into three steps.

#### 3.3.1 Interviews and Data Collection:

This requires interviews with the company's management, middle managers and business teams, IT leaders and IT teams, to grasp the actual situation of enterprise applications in terms of technology, business and management, as well as everyone's views and expectations. At the same time, it is also necessary to collect various data closely related to the application, such as data reflecting the operation of the application.

#### 3.3.2 Build a Diagram of the Current State of the Application Architecture:

This is not an enterprise application architecture blueprint, but a diagram to summarize the current application status of the enterprise, and pay more attention to the boundaries of applications and the logical relationship between them. Further, it can be combined with the enterprise business architecture to analyze the coverage and support level of the enterprise's current application to various business fields of the enterprise.

### 3.3.3 Gap Analysis of Enterprise Application Capability:

Through the enterprise business architecture, the enterprise has clarified the requirements of the future business blueprint, and to formulate the enterprise application architecture, it is necessary to find out the gap between the current application capabilities of the enterprise and the capabilities required by the future business. If there is data on industry benchmarking companies, it will be more helpful for this gap analysis. Gap analysis and evaluation of each application can be divided into the following five levels.

No ability: It indicates that the enterprise does not have the application ability.

Insufficient ability: It shows that the enterprise's application ability is weak, which has become a problem that restricts the development of the enterprise.

Meet current needs: It indicates that the enterprise application capability can only meet the current needs of the enterprise, and does not consider the support needs for future development or changes.

Meet future needs: It shows that the enterprise has strong application ability and can meet the expected needs of the enterprise in the next few years.

Leading level in the same industry: It means that the application capability of the enterprise is already at the top level in the same industry.

The application capability assessment usually adopts the business dimension for analysis, and conducts the evaluation work against the application capabilities required by the business components of each business domain in the enterprise business architecture. Taking the wealth management business of a financial company as an example, the dimensions of its application capability gap analysis may include: customer group analysis, precision marketing, customer retention, business process experience, business compliance and risk management, etc.

## 3.4 Application Solutions Survey

Enterprise application architecture needs to be finally implemented. Therefore, it is necessary to investigate the solutions of each application in the enterprise application architecture, which can not only ensure the feasibility of the architecture, but also improve the architecture planning through the reference of industry solutions. The solution survey recommends the following principles.

### 3.4.1 Find Industry-Leading Case:

Select peer benchmarking companies that are in the same business field and are in a leading position. From the business development, investment focus and informatization construction cases of these benchmark enterprises in recent years, a useful reference for enterprise application architecture planning can be formed.

### 3.4.2 To Be Comparable:

Because enterprises of different scales and different business structures have large gaps in IT practice. Therefore, when selecting leading benchmarking enterprises in the same industry, attention should also be paid to collecting and planning benchmarking enterprises that are comparable in terms of development stage, business scale, and customer volume and are at a relatively advanced level. Often, the application solutions of this type of benchmarking enterprise are more useful for reference.

### 3.4.3 Information is Reliable:

Application solutions often involve the commercial secrets of some enterprises, and many information are not released. When selecting the best practice cases, the information published by various enterprises, media or related suppliers should be selected to ensure the reliability of the information and avoid misleading of misinformation. At the same time, attention should be paid to the timeliness of the cases.

#### 3.4.4 Look For Suppliers With Extensive Business Experience.:

Select an organization with rich business experience among application vendors. Generally, they can reflect the best practices of the industry based on years of experience.

### 3.5 Application Top-Level Functional Planning

Application top-level function planning is to define the top-level components of each application, which can be defined by corresponding methods through different application types. Generally speaking, an enterprise's applications are divided into the following five types, and the definition method of each type of application components is described below.

#### 3.5.1 General Purpose Applications:

The most common general-purpose applications in enterprises are financial management, capital management, human resource management and other applications. Taking financial management as an example, it basically includes general ledger management, budget management, expense reimbursement management, tax management, financial reporting, accounting files and other business functions. Enterprises in different stages of development often have different requirements for financial management applications. For most enterprises, general ledger management and financial reporting, as the basic functions of financial management, are also necessary in the initial stage of enterprise development. For other business functions, when the business scale and financial management complexity of the enterprise are low, they can also be implemented by manual management, and it is not necessary to realize digitization and informatization. Therefore, for a general-purpose application, the business functions of the mature application solution can be tailored in combination with the key requirements of the enterprise to determine the required components of the general-purpose application.

#### 3.5.2 Industry-Standard Business Applications:

For more mature industries, there are usually industry-standard applications to choose from. Like manufacturing enterprises, ERP(Enterprise Resource Planning) is generally used as the core business application of production, supply and marketing. ERP will include business functions such as production planning, material management, sales management, quality management, and equipment management. The application of industry standard business applications in application architecture planning does not mean that all of them need to be imported and used. This also requires top-down analysis to determine the needs and expectations of key stakeholders in the enterprise for such applications, while combining bottom-up analysis Analysis to find out whether the company has the conditions to import and implement industry standard business applications in actual operation. Therefore, many leading service providers of industry-standard business applications will have their implementation methodologies, and will combine the characteristics of the enterprise to determine the specific goals and functional architecture of the implementation of the applications, so as to ensure the successful delivery.

#### 3.5.3 Industry Innovation Business Applications:

In the scenario of emerging industries or traditional industry transformation, industry innovation business applications will become the focus of enterprise informatization and digitalization. For the planning of this type of application, top-down analysis and the experience of benchmarking companies are the most important planning basis. To define the application components of industry innovation business, we should grasp the business model and operation mode of industry innovation business. We can cut into industry innovation business from process operation, data flow, and user interaction, while making full use of the wisdom of key stakeholders and industry experts. Of course, if there is sufficient experience of benchmarking enterprises for reference, the abstraction and definition of application components can be completed more efficiently. Here, it should be noted that in terms of industry innovation business, the benchmarking companies do not necessarily

come from companies in the same industry, but can often choose other industry-leading companies with similar experience in target customer groups and business models.

#### 3.5.4 Data Applications:

Combined with application scenarios, data applications can be incorporated into the overall enterprise application architecture. There are usually three different architectural arrangements. First, as an independent enterprise-level data application, such as an enterprise big data platform or data warehouse, it is mainly aimed at middle and senior managers and business analysts of the enterprise, and involves scenarios including strategic analysis reports, business management reports, etc. Second, it exists as a data subsystem for business or management applications, such as financial reports for financial management applications, sales reports and production reports for ERP systems. The third is to embed it into business or management processes as specialized data tools, such as credit limit approval suggestions or automated credit granting for credit business applications.

#### 3.5.5 Legacy Applications:

In the Enterprise application architecture planning, appropriate arrangements should be made for enterprise legacy applications. There are three common situations, namely, upgrading or replacing legacy applications, retaining and integrating legacy applications, and abandoning legacy applications. For legacy applications that need to be upgraded, the components of legacy applications should be summarized, their functional boundaries should be defined, and unnecessary functions or functions that need to be carried by other applications should not be included in the upgrade scope of legacy applications. For legacy applications that need to be replaced, it is necessary to understand the value of the legacy application itself, and the application solution to replace it should avoid situations where the requirements cannot be fully satisfied after replacement. For the remaining legacy applications, integration arrangements need to be made at the same time, data integration is a necessary choice, and sometimes process integration needs to be considered. For legacy applications that carry unnecessary, to-be-eliminated, or low-value business or management functions, it is a more appropriate choice to abandon the application after obtaining the consensus of key stakeholders in the enterprise.

### 3.6 Enterprise Application Architecture Planning

After the above work is completed, the final enterprise application architecture planning can be started. This architecture planning is based on the analysis of key requirements, design application components that meet the requirements of each business field, and form corresponding applications through the combination of application components. Referring to the enterprise business architecture, the enterprise application architecture can further group applications on a layered basis, and group applications of the same business field and high correlation into a group. For example, in a financial company, applications related to retail financial services to individual investors can be grouped together. The purpose of grouping applications is to reflect business classification and aggregation, which is helpful for the implementation and delivery of future application projects.

In order to illustrate the enterprise application architecture planning, this paper uses a case of a typical Chinese securities company. According to the high-level planning methodology introduced in this article, the enterprise application architecture needs to be planned based on the enterprise business architecture. Therefore, the following uses the business architecture and application architecture of the case to explain.

Figure 6 is enterprise business architecture of this case. In terms of strategy and governance, senior managers will focus on enterprise strategy, M&A strategy, capital management, governance mechanisms, management analysis and change management. In terms of business units, the business of a typical securities company generally includes investment banking, retail brokerage, institutional brokerage, proprietary trading, asset management, and investment research. Each business unit will be composed of corresponding business components according to its business attributes.



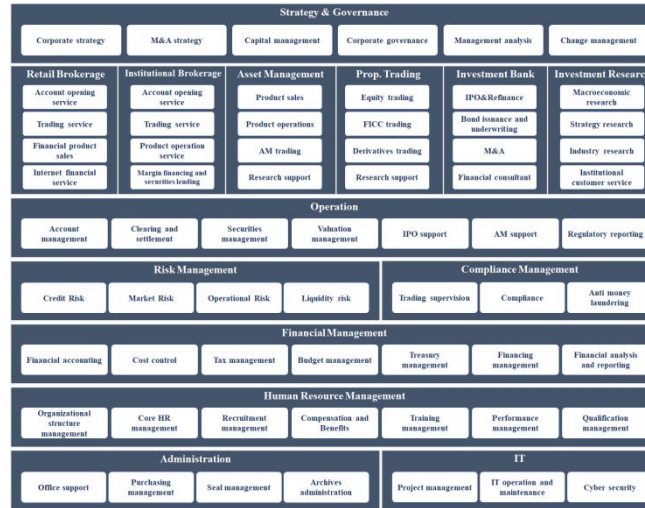


Figure 4. A case of enterprise business architecture of a typical Chinese securities company.

Usually, securities companies will build a centralized operation support department for each business segment and provide operation support services, including account management, clearing and settlement, securities management, valuation management, IPO support, AM support, and regulatory reporting. Risk management and compliance management have become key middle-office functions of securities companies. Risk management includes credit risk, market risk, operational risk and liquidity risk; compliance management covers trading supervision, compliance management, and anti-money laundering. Financial management, human resource management, administration and IT management are all important support functions and are usually incorporated as a supporting part of the business architecture.

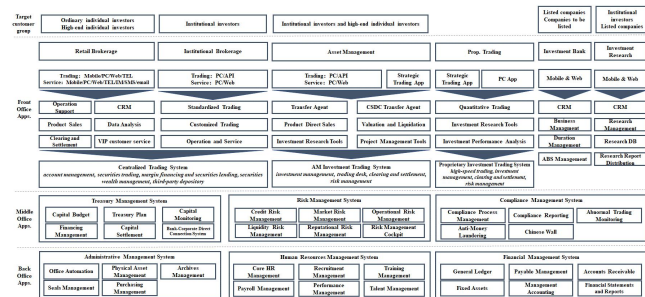


Figure 5. A case of enterprise application architecture of a typical Chinese securities company.

Referring to the enterprise business architecture, the enterprise application architecture can further group applications on a layered basis, and group applications of the same business field and high correlation into a group. Corresponding to the case in Figure 4, we also use the application architecture of a typical Chinese securities company, as shown in Figure 5. In this case, each business unit has its front office business applications. For example, in the proprietary trading business applications, we need to provide traders with a PC version of the trading client and strategy trading client, build a proprietary investment trading system on the server, and integrate special applications such as quantitative trading, investment research, and investment performance management. The middle office applications cover treasury management, risk management and compliance management, while the back office applications include financial management, human resource management and administrative management. So as to establish the enterprise application architecture corresponding to the enterprise business architecture as a whole.

#### 4. Conclusions and Future Work

The high-level planning methodology of enterprise application architecture proposed in this paper is suitable for use in enterprise digital strategy and IT strategy, and can help digital practitioners quickly establish a blueprint for future application architecture. This blueprint is referenced and aligned with the enterprise business architecture. This paper elaborates on this high-level planning methodology, which is, in fact, based on the methods and experiences of numerous IT strategy projects. Compared to the EA-based methodologies, this methodology is more concise and focuses on the structure at the strategic level. Compared with the methodologies of IT consulting firms, this methodology is more accessible and mastered by digital practitioners.

This methodology has been applied to many enterprise IT strategy projects with success. However, in practice, we also found that digital practitioners' grasp of enterprise business architecture and their understanding of industry IT practices determine the quality and effect of enterprise application architecture planning. Therefore, in the future work, we expect to form the enterprise application reference architectures of some industries through projects practice, so that it can connect the typical business architecture of the industry and the best IT practices of the industry, and can bring greater value to enterprise digitization.

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