Innovation Insight for Application Composition Technology

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Initiatives: Applications and Software Engineering Leaders; Software Engineering Technologies

Application composition is challenging as it requires a combination of different technologies. Software engineering leaders should use Gartner’s capability framework to evaluate technologies and products, and implement them via a modular approach that maximizes business value and minimizes risks.

Overview

Key Findings

- Software engineering leaders, under pressure to deliver greater business agility and innovation, face a dizzying array of composition technology options to serve many business domains and requirements.

- A growing number of vendors aggressively target software engineering leaders with a partial application composition technology set, putting them at risk of implementing fragmented, siloed, and often immature solutions.

- Software engineering leaders looking at composition technology are often torn between the (apparently safer) single-vendor approach and the technically optimized best-of-breed strategy.

Recommendations

Software engineering leaders responsible for delivering technology to enable application composition should:

- Apply application composition principles selectively — in scenarios where these principles can deliver tangible agility and innovation benefits — by deploying composition technology incrementally, and initially selecting low-risk, high-reward use cases.

- Adopt precursor products — using Gartner’s capability framework for application composition technologies as an evaluation grid for technology selection, and to assess the completeness of vendor offerings.

- Adopt a selective best-of-breed approach to application composition technology by fostering precursors based on a modular architecture and incrementally constructing your technology set. This will allow you to spread technology investments and skill-building efforts across multiple initiatives.
Introduction

User organizations are rapidly becoming more interested in developing applications through composition as they look at using a composable business architecture to achieve greater agility and resilience (see Quick Answer: What Is Composable Business Architecture?).

Although organizations will move to composition at their own pace, increasingly, software engineering leaders must provide an appropriate set of technologies to IT and business fusion teams.

However, with vendors across many markets targeting them with partial application composition technology sets, software engineering leaders may not have a clear perspective on which technologies they need (and which technologies they don't need).

Therefore, they risk being guided by vendors’ aggressive marketing rather than by their organizations’ business needs and goals.

Gartner’s capability framework for application composition technologies (see Figure 1) is designed to help software engineering leaders define a technology adoption plan that matches their organization’s short-term, medium-term and long-term composable business roadmap.
Description

Application composition technologies enable fusion teams to implement composable business applications, and encourage other forms of collaboration between the business and IT. Such a technology set should provide a proper combination of functionality (including design, development, assembly, deployment, execution and operation management) aimed at supporting collaborative application composition across team members with varying degrees of IT literacy. Software engineering leaders responsible for composition typically aggregate application composition technology sets by assembling componentry from one or multiple providers.

Fusion teams build, deploy, run and manage applications developed by composing together brand new, custom-developed or vendor-provided packaged business capabilities (PBCs) and heritage applications and services (see Innovation Insight for Packaged Business Capabilities and Their Role in the Future)
Composable Enterprise). These composable business applications are designed to meet the business needs embodied by their multiexperience interfaces and take advantage of an advanced set of technologies (see Figure 2 and Use Gartner’s Reference Model to Deliver Intelligent Composable Business Applications).

**Figure 2: Application Composition Technologies Enable Development, Deployment, Execution and Management of Composable Business Applications**

The capability framework in Figure 1 depicts a set of functionalities that supports different types of users:

- Software engineers
- Business technologists
- Technology users
- Composition technology curators

For more information, see Note 1.
These “personas” access composition technology through differentiated, yet collaborative developer experiences, tailored to their specific personas, roles and skills (for examples, see Note 2).

In their teams, personas collaboratively develop, extend and customize applications using the composition functionality within their technology set (see Note 3). All the required artifacts should be stored in, and retrieved from, a component catalog. This catalog represents the “marketplace” where the application composers can find both complete composite business applications and collections of discrete components that they can reuse to build new applications. The composition technology curators are responsible for maintaining and governing this catalog.

To support the interoperability, discovery, data access, deployment and execution of components, the composition technology set must also include the following technical enablers:

- API mediation
- Event brokering
- Data management
- Metadata management
- Artificial intelligence (AI)

For more information, see Note 4.

Finally, composition technology is supported by infrastructure functionalities for security, compliance, operations, governance and AI-powered smart assistance (see Note 5 and How to Build Agile Infrastructure Platforms That Enable Rapid Product Innovation).

**Benefits and Uses**

Composable business applications are not for everybody, because such an approach requires profound changes in the organization's development approaches and processes. Moreover, implementing a proper set of composition technologies is challenging and requires architecture and technology skills and resources that are expensive and not easy to find. Therefore, organizations must identify “how much composability” they need and can afford. Consequently, they must decide how many of the technologies described in the capability framework they will have to deliver, in which form, and to whom.

Composition technologies enable software engineering leaders to support interactive, collaborative application composition processes (see A New Mandate for the Applications Function: Enable, Rather Than Own, Solution Delivery):

- **Initial composition centralized development** — Central IT software engineers work with leaders within the business and those responsible for applications to procure or develop a PBC portfolio. This can
also include new, partially precomposed or fully precomposed applications. Central IT software engineers may or may not use composition technologies to build some of these PBCs, but they must import them into the component catalog to enable future composition and recomposition by line of business (LOB) fusion teams. The catalog may also contain application templates, legacy application API references, process models, user experience (UX) templates and other reusable artifacts.

- **Specialization (recomposition)** — Initially deployed or procured precomposed applications may be used as delivered by training and authorizing all relevant users. That’s the traditional practice, but the differentiating advantage of composable applications is that they are available for recomposition. LOB fusion teams use some of the application PBCs to form subset or superset compositions that correspond to the specific set of roles and responsibilities within the organization. This frees up the individuals in these roles from having to navigate irrelevant capabilities or switch applications to accomplish composite tasks. This approach may also reduce or eliminate the cost of shelfware.

- **Personalization** — Individual business technologists may use available composition technology to further customize and extend (that is, recompose) their role-specific compositions. At times, even technology users can automate simple personal or team processes via “citizen-integrator-oriented” automation tools.

A composition technology that is well-designed, implemented and managed, and delivered as an integrated technology set, will improve collaborative application development and execution by potentially providing the following benefits:

1. **Collaborative composition** — It provides a foundation for teams of business and IT people (whether these are fusion teams or otherwise) to collaboratively work together in initiatives around composable business applications.

2. **Business agility** — Different teams and personas can quickly develop new applications by reusing PBCs, full applications, process models, user experience (UX) elements and other components available. This will dramatically accelerate time to value for innovations and increase business agility.

3. **Managed tracking, governance and operations** — Enabling teams and individual users to compose and customize applications poses formidable governance and operational challenges. Therefore, the composition technology set must include functionality that enables curators to track teams’ activity; enforce governance, security and compliance policies; and put in place integrated administration, monitoring and management.

4. **Support for product-centric application delivery** — In product-centric delivery, individual business capabilities are released and maintained independent of the rest of the application. Well-designed PBCs maximize autonomy by encapsulating the full life cycle of the business entities they represent, and by minimizing external dependencies. Having autonomy of PBCs supports product-centric delivery by reducing component change and replacement friction.
In short, a well-designed and operated composition technology set enables extreme business agility and accelerated business innovation. This stems from the much tighter collaboration between the business and IT, which is the ultimate goal of a composable business strategy.

**Risks**

The notion of composable business applications is in its infancy. Therefore, the concept is not well-crystallized in the industry and most technology vendors and system integrators do not have a well-defined, tried-and-tested approach to composition technology. Therefore, at this stage, organizations wishing to establish an application composition technology set to power their composable business initiative face the following risks:

- **Overspending or underspending** — Inexperienced software engineering leaders run the risk of being guided more by their strategic technology and service partners than by their composable business strategy, which may lead them to either overspend or underspend. The outcome could be a composition technology set that is either excessively expensive and complex or too simplistic and unable to support their organization's ambitions. A realistic assessment of the level of composition they really need will help software engineering leaders mitigate this risk.

- **Overly complex implementation** — According to Gartner research, there are more than 30 vendors in the market (see Note 6) able to provide some subset of the Gartner composition technology capability framework. However, these vendor offerings are still typically incomplete, fragmented, immature, siloed in nature or unable to support collaborative composition. Therefore, implementing an appropriate composition technology set will usually require software engineering leaders to aggregate multiple technologies, often from different vendors, which may prove to be too complex of an effort for them.

- **Excessively long time to value** — Implementing a composition technology set is far from being a trivial exercise. It requires architecture, technology and governance skills that are hard to find, and therefore expensive. Currently, technology is only available in the form of “precursors,” partially implementing the needed functionality. Hence, software engineering leaders will have to climb several technology and methodological learning curves. This elongates time to value. The risk, therefore, is that they cannot provide timely support to impatient business leaders who want to experience the benefits of composable business.

If not properly addressed and mitigated, these risks will lead to a badly implemented technology set that will undermine the organization’s composable business strategy, thus holding back its ability to innovate and compete.

Gartner’s capability framework for application composition technologies is meant to help software engineers mitigate these risks. It will help them to identify the functionality they need (and the functionality they don’t need) to support their organization’s composable business strategy and plans.
An implementation plan, typically, is determined in order to initially deliver a minimal set of functionality (for example, including catalog, orchestration, PBC integration, multiexperience development for applications, API mediation, data and metadata management). Then, this initial set can be incrementally extended with additional functionality as needed to meet more ambitious requirements.

In this way, software engineering leaders can quickly deliver value from application composition technology and spread the efforts, technology and skills investments across multiple composable business application initiatives. This makes their technology investments easier to justify and less risky to implement.

**Adoption Rate**

Examples of basic composition technology sets were deployed when organizations that were engaged in digital transformation initiatives had to deliver new applications in a much more agile fashion. These sets were typically implemented by multiple technologies (for example, low-code application platforms [LCAPs], open-source development frameworks, integration platform as a service [iPaaS], API gateways and event brokers). They were primarily focused on enabling digital applications front-ending system-of-record applications via API-based integration. This was a task typically performed by IT or LOB system engineers.

However, other key trends contributed to a more widespread use of composition by business technologists and technology users — for example:

- Domain thinking and domain-driven design
- Fusion teams
- Broad availability of APIs and “headless” SaaS applications
- Popularity of low-code development tools
- Massive adoption of low-code integration platforms (including iPaaS)
- Growing use of machine learning and natural language processing to facilitate development and operations

Meanwhile, technology providers — to maximize upselling and cross-selling opportunities — have developed broad suites combining low-code development tools, integration, process orchestration, metadata management and other composition-oriented technologies.

Only a limited number of leading-edge organizations (for example, City of Antwerp, AutoZone, Nestlé, Air France, KLM and Nordstrom) are implementing composability (often limited in terms of scope). However, technology and market trends, as well as organizations’ trust toward greater strategic agility, have paved the way for a growing composition technology adoption. This is a trend that Gartner expects to continue over the next five years, across most vertical sectors and mainstream organizations.
Alternatives

Currently there are no commercial products implementing the full set of capabilities described in Figure 1. However there are several products that provide use-case-specific subsets of the framework and therefore can be seen as composition technology “precursors” (see Table 1).

Table 1: Examples of Composition Technology Precursors

<table>
<thead>
<tr>
<th>Product Category</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligent business process management suites</td>
<td>Supports the full cycle of business process and decision discovery, analysis, design, implementation, execution, monitoring and optimization.</td>
<td>Market Guide for Intelligent Business Process Management Suites</td>
</tr>
<tr>
<td>Enterprise low-code application platforms</td>
<td>Enable rapid application development, deployment, execution and management using declarative, high-level programming abstractions and one-step deployments.</td>
<td>Magic Quadrant for Enterprise Low-Code Application Platforms</td>
</tr>
<tr>
<td>Enterprise integration platform as a service</td>
<td>Deliver application, data and B2B integration capabilities, and API management, supported by low-code development tools.</td>
<td>Magic Quadrant for Enterprise Integration Platform as a Service</td>
</tr>
<tr>
<td>Full life cycle API management platforms</td>
<td>Support API planning, design, implementation, testing, publication, operation, consumption, versioning and retirement.</td>
<td>Magic Quadrant for Full Life Cycle API Management</td>
</tr>
<tr>
<td>Multiexperience development</td>
<td>Provide capabilities to enable distributed and scalable development of applications across digital touchpoints and</td>
<td>Magic Quadrant for Multiexperience</td>
</tr>
</tbody>
</table>

Source: Gartner

Many of these precursor products may evolve toward a composition technology “product suite” approach, whereas others may remain best-of-breed componentries. In many cases, however, adoption of these precursors is the easiest and lowest risk way for software engineering leaders to start their composable business application journey.

Recommendations
As a software engineering leader responsible for delivering technology to enable application composition, you should:

- Liaise with stakeholders throughout the organization (including application leaders, business leaders and fusion teams) and establish a relationship. This relationship should be communicative, and aimed toward providing them with the composition technologies that they need to support their ambitions, needs and plans.

- Use Gartner’s capability framework for application composition technologies as a reference to help determine what are the technologies that you need to deploy in order to match the functional needs and delivery timelines of all stakeholders.

- Favor technology providers that are able to support multiple levels of developer skills. Evaluate their fitness against your needs by assessing the extent to which they provide composition functionalities (described in Notes 3, 4 and 5). This will minimize the risk of overspending or underspending.

- Adopt a selective, best-of-breed approach to maximize your composition technology power, but foster components based on a modular, composable, API-enabled, event-enabled, and standard-oriented architecture. This will allow you to aggregate your composition technology incrementally in order to spread technology investments and skill-building efforts across multiple initiatives.

- If needed, adopt multiple technology sets, possibly from different vendors and based on different types of precursors, in order to address different use cases.

Evidence

1 Since the beginning of 2020, Gartner analysts have had almost 2,000 interactions with organizations that are in various stages on their journey toward a composable business architecture designed to achieve greater agility and resilience.

Acronym Key and Glossary Terms

<table>
<thead>
<tr>
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<tr>
<td>AI</td>
<td>artificial intelligence</td>
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<tr>
<td>iPaaS</td>
<td>integration platform as a service</td>
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<tr>
<td>LCAP</td>
<td>low-code application platform</td>
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<tr>
<td>LOB</td>
<td>line of business</td>
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<tr>
<td>NLP</td>
<td>natural language processing</td>
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<tr>
<td>PBC</td>
<td>packaged business capability</td>
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<tr>
<td>RPA</td>
<td>robotic process automation</td>
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<td>UI</td>
<td>user interface</td>
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</table>
Note 1: Application Composition Technology Users

Application composition technology support different classes of users (or personas):

- **Central IT software engineer** — A central IT software engineer supports and participates in the functional and nonfunctional analysis, implementation, development, enhancement, modification, integration, testing and delivery of enterprisewide PBCs, composable business applications and other reusable components.

- **Line of business software engineer** — A LOB software engineer supports and participates in the functional and nonfunctional analysis, implementation, development, enhancement, modification, integration, testing and delivery of PBCs, applications and other reusable components meant to support the LOB processes.

- **Business technologist** — An employee outside of IT who is not just a technology “end user,” but also a technology producer who actively assembles or customizes composable business applications.

- **Technology user** — An employee who only uses data and technology applications, but can, at times, implement basic customizations.

- **Composition technology curator** — A curator operates, manages, monitors, governs and supports the organization’s application composition technology set and assists and supports fusion teams. In particular, the curator maintains and governs the component catalog.

Note 2: Different Personas Access Different Composition Functionality

The types of functionality and components available to composition technology users will vary by role and skills. For example:

- Software engineers have full access to the composition technology set, albeit restricted in accordance with the organization’s security policies.

- Business technologists can only capitalize on the orchestration and choreography functionalities, and the multiexperience development capabilities that are relevant to their business team.

- Technology users can only customize their user experience via a minimal composition technology subset.

Note 3: Application Composition Technology — Composition Functionalities

An application composition technology set includes the following composition functionalities:
Component catalog — Provides users with a repository where they can collect, track and use APIs definitions, event schemas, process models, data schemas, PBC definitions, user interface (UI) structures and other metadata assets. The catalog also supports the definition and enforcement of security and usage restriction policies. Based on a common set of (typically vendor-defined), semantics, these assets represent the elementary components that users can compose to create applications. The other composition technologies use the catalog to discover, orchestrate, develop, track, support, govern and manage the life cycle of these components. This capability is currently partially implemented in a proprietary form by some composition technology precursors (for example, LCAPs, iPaaS and robotic process automation [RPA] tools). Fully implementing this capability often also requires combining multiple products (for example, metadata management tools, API marketplaces and data catalogs).

Process orchestration and choreography — Enables users to design, implement, deploy and run multistep processes composing user experiences and back-end components that expose APIs and event streams.

Packaged business capability development — Enables users to design, implement, deploy and run application, data and analytics PBCs via pro-code tools, low-code tools or digital twins technology. These PBCs are exposed for composition via APIs or event channels.

Packaged business capability integration — Enable users to design, implement, deploy and run PBCs obtained by wrapping heritage applications in APIs or event streams so that they look like PBCs (also known as pseudo-PBCs) to composition technology users.

Multiexperience development for applications — Enables users to design, implement, deploy and run omnichannel, digital user experiences composed by interfacing with back-end components via APIs and event streams.

Multiexperience development for analytics and data — Enables users to implement omnichannel, digital user experiences composed by interfacing with back-end data management and analytics components via APIs and event streams.

API mediation — Enables users to define, implement, monitor and track APIs and manage their life cycle. It also includes the ability to support key API transport protocols and formats, mapping among them, orchestrating services and transforming payloads.

Event brokering — Enables users to define, implement, monitor and track event streams and manage their life cycle. It also includes the ability to support key event transport protocols and formats, mapping among them, and transforming event data structures.
Note 5: Application Composition Technology — Infrastructure Functionalities

An application composition technology set includes the following infrastructure functionalities:

- **Data management** — Enables users to manage data in different formats (including relational, NoSQL, graph and spatial data), to store them on different media (for example, in-memory, SSD or cloud) and manage data quality. It also facilitates integration with the data fabric component of the Gartner reference model for composable business applications (see Emerging Technologies: Data Fabric Is the Future of Data Management).

- **Metadata management** — Enables users to store and track metadata that describes, inventories, understands and tracks the different facets of various types of assets to improve their usability throughout their life cycle. Metadata management technology is the key enabler for the component catalog.

- **Platform AI support** — Enables the use of machine learning (ML), natural language processing (NLP), chatbots and other AI techniques to assist development, deployment and operations across all or some of the capabilities listed in Note 3.

- **Security** — Functionality to prevent malicious, fraudulent or undesired access to the composition technology set, the composable business applications, components and data. This is done via authentication, authorization, encryption and other proper security techniques.

- **Compliance** — Ensures compliance to corporate and governmental standards (such as GDPR, HIPAA and FedRAMP) through policy administration conducted against components, data usage and user experiences managed by the catalog.

- **Governance** — Catalog-driven functionality to govern the applications and their component parts. It includes policy management and enforcement, life cycle management, execution tracking and operational analytics for composition technology activity.

- **Operations** — Functionality to deploy, provision, administer, monitor and manage the composition technology itself and the composable business applications running on that technology set. Operations functionality also enables and supports high availability and disaster recovery.

- **Smart Assistance** — Smart assistance uses ML, NLP, chatbot and other techniques to intelligently assist composition technology users in developing, deploying, running, operating, scaling, troubleshooting and managing composable business applications. This can be done to improve productivity, reduce skills demand or automate operations. This is an advanced capability that is currently only available in some composition technology precursors (for example, iPaaS and LCAPs).

These infrastructure functionalities primarily target the application composition curators, although all personas can capitalize on the subset appropriate for their roles and skills (for example, those needed for application deployment and monitoring). All personas are implicitly exposed to the smart assistance
capability, which supports users throughout an application's life cycle and operations (for example, by facilitating component discovery and matching, or by providing development and runtime recommendations and suggestions).

**Note 6: Example List of Technology Vendors for Application Composition Technology Precursors**

The following vendors provide application composition technology precursors. **This is not a comprehensive list.** The vendors listed here are those who responded to a Gartner survey conducted from December 2020 through January 2021.

- Adobe
- AgilePoint
- Amazon Web Services
- AppDirect
- Appian
- Axway
- Automation Anywhere
- Bearer
- Betty Blocks
- Boomi
- Google
- Graphite GTC
- IBM
- IFS
- Infor
- Informatica
- Mendix
- Microsoft
- Novulo
- OutSystems
Recommended by the Authors

Fusion Teams: A New Model for Digital Delivery
Use Gartner’s Reference Model to Deliver Intelligent Composable Business Applications
A New Mandate for the Applications Function: Enable, Rather Than Own, Solution Delivery
Market Guide for Intelligent Business Process Management Suites
Magic Quadrant for Enterprise Low-Code Application Platforms
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