Maturity Model For Event Driven Architecture

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EDA delivers some critical aspects of digital business: real-time intelligence and responsiveness, extensibility of applications, global scale, and “lossless” business activity analysis. Application leaders should use this research to assess their readiness and to plan their digital future.

Overview

Key Findings

- Real-time situation awareness is a requirement for a growing number of business initiatives, yet most deployed applications are poorly designed for event sensing and processing.
- Extensibility is an essential part of the application product delivery, but most applications use direct API connections that can entangle feature delivery. The minimal coupling of sources and consumers of events can be a better fit for continuous product-style application delivery.
- Many modern application designs, including IoT, digital twins, B2B ecosystems and platform business, are event driven. But a lack of event-driven architecture (EDA) competency delays organizations’ attempts to modernize.
- The limited availability of standards, productivity and governance tools, and tools that support testing and exception handling, increases the costs and complexity of initial event-driven design.
- When applicable, designing applications around business events can enable closer collaboration of business and IT professionals. This is because the language of event processing can follow business semantics closer than traditional APIs, typically designed by and for professional developers.

Recommendations

Application leaders responsible for modernization of application platforms and integration strategy should:

- Assess their current use of EDA and develop the inventory of available skills and deployed technologies capable of supporting event-driven design.

- Engage business analysts to understand the actual and potential roles that real-time business event awareness can play in advancing the organization's business outcomes.
- Identify the gap between the business recommendations for EDA and the IT organization's ability to meet them with its levels of technology, skills, budget and other constraints.
- Develop a strategic direction and implement a tactical roadmap to gradually and realistically advance IT capabilities to meet the business requirements for event-driven outcomes.

Strategic Planning Assumption

By 2022, support of event notifications in low-code application platforms and API management tools will make EDA common in new application design.

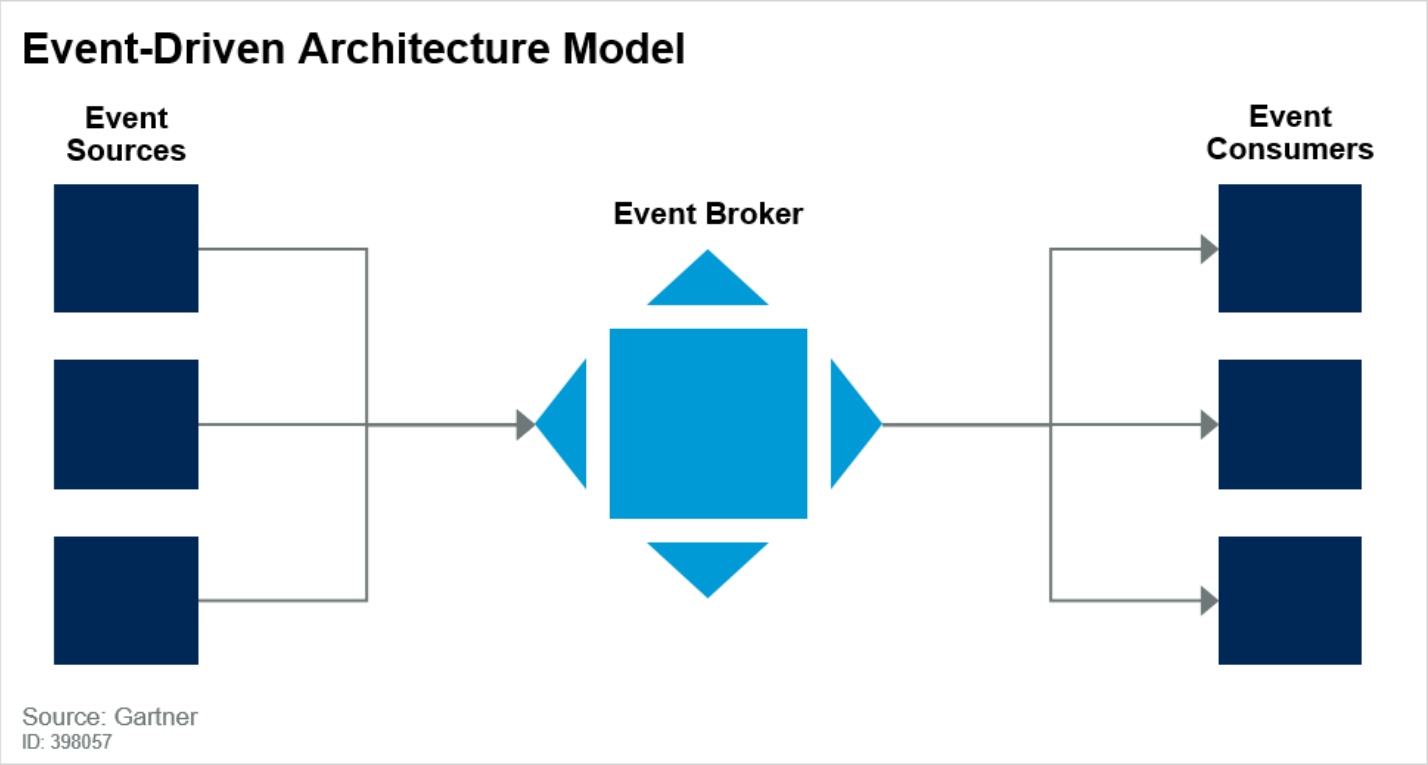
Analysis

This document was revised on 3 July 2019. The document you are viewing is the corrected version. For more information, see the Corrections page on gartner.com.

Traditional application design, centered on developer-centric APIs, has delivered significant improvements in application agility. But when facing the advanced characteristics of digital business, the API-centric request-driven model alone hits its limits. Applications become harder to scale and the web of connected APIs harder to manage, leading to ever-more tightly coupled systems. To move beyond the connected APIs and to enable more scalable, contextual and responsive digital business, application leaders add event-driven architecture (EDA) to the core of their platform and design capabilities.

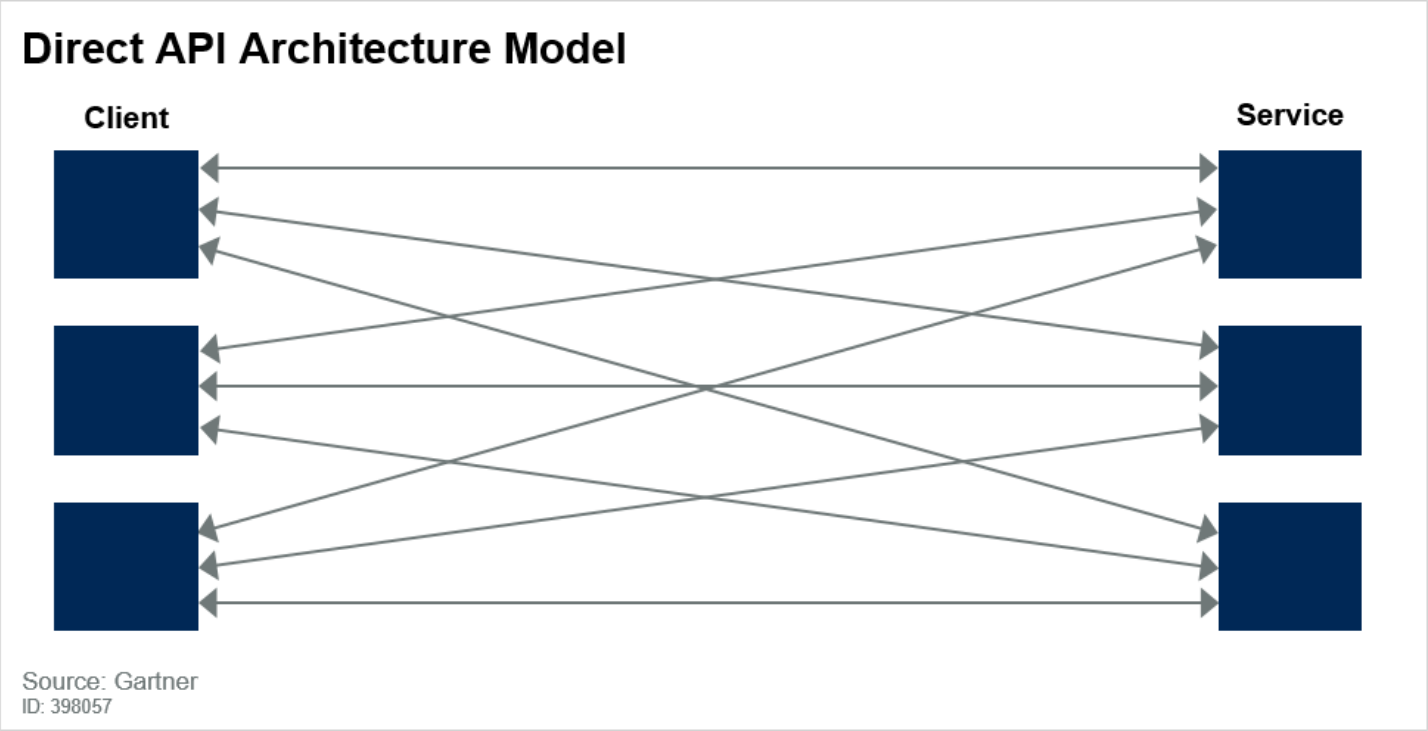
EDA is at the very heart of real-time-sensitive digital business. Organizations capture real-world business events in digital form as they happen, by "listening" to event sources like Internet of Things (IoT) devices, mobile applications, ecosystems, and social and business networks. For example, when a customer places an order, an event occurs. In an EDA-based system, a digital record such as a JSON message is generated by the source. It is then distributed across the network by an event broker, so that the event can be recognized and processed by all interested business processes (the event consumers) and their human users (see Figure 1).

Figure 1. Event-Driven Architecture Model



Multiple strategic business benefits can be achieved using EDA (see "Innovation Insight for Event Thinking"). But the lack of experience in most IT organizations for managing anything more than a basic one-to-one notification — for example, using message queuing or webhook technologies — compounded by the shortage of design and governance tools for EDA, creates major obstacles for adoption. Designers, lacking the skills in testing or managing exceptions in event-driven systems, often just "abandon ship" and settle for basic API and one-to-one notification relationships (see Figure 2).

Figure 2. Direct API Architecture Model



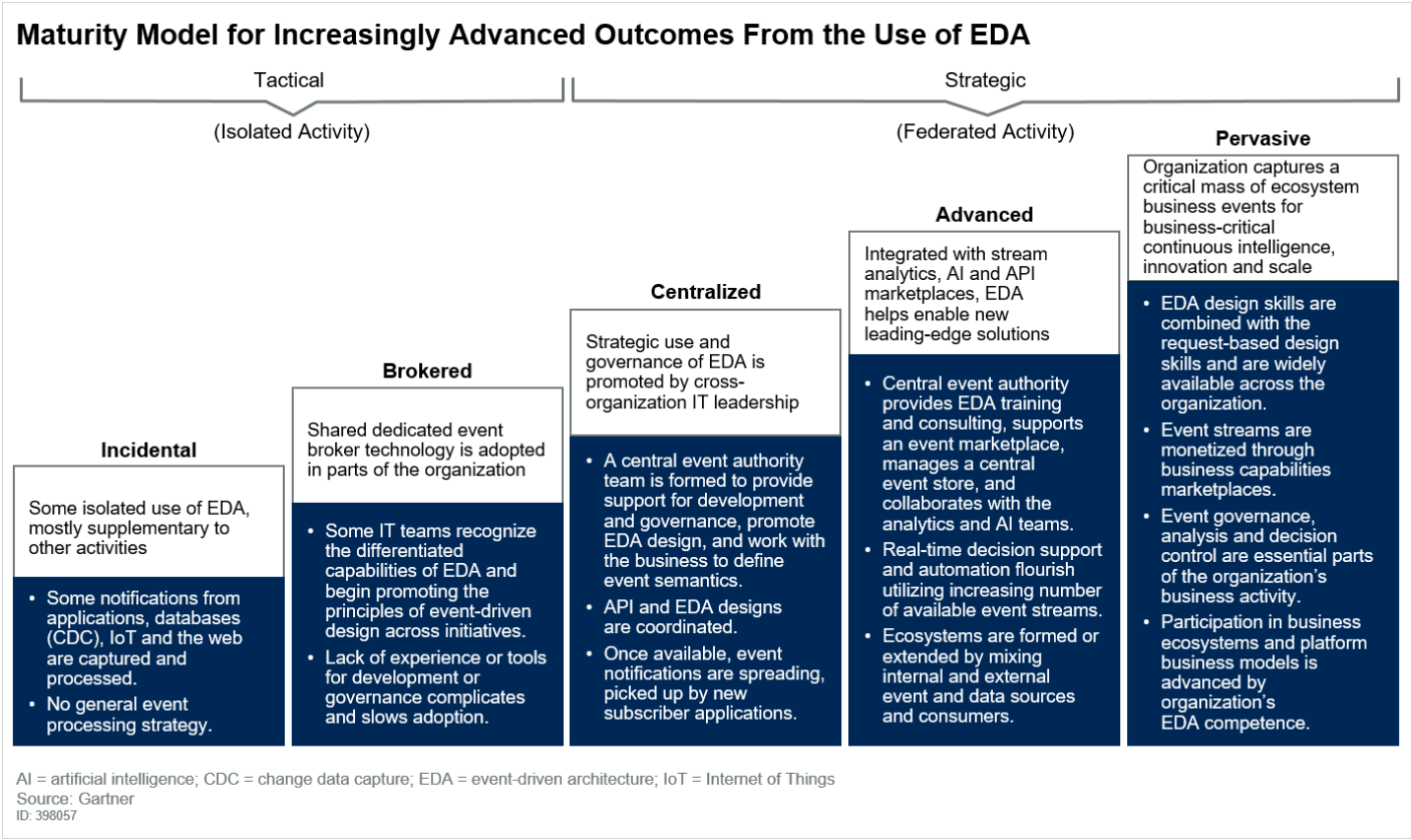
Even IT leaders often resist event-driven design as unfamiliar and challenging to the control patterns in the organization. This is caused by the intermediated nature of EDA, where control of transactions is delegated to the broker infrastructure (see "Innovation Insight For Event Brokers"). Leadership perception of increased risk, and a typical lack of technical skills, combine to slow down adoption of strategic event-driven systems, thus delaying some critical business innovation.

> **Advanced competence in event-driven design is built over time and requires investment in the technology, skills, policies and culture of the IT organization.**

As the mastery of EDA is essential to digital business, and achieving this mastery is a multistep process, application leaders — still lacking a plan of action for strategic use of EDA — must begin now.

This analysis offers guidance to the gradual mastery of an event-driven digital enterprise (see Figure 3). Of course, each organization will proceed through its own stages of EDA maturity differently, reflecting its business, technology and cultural realities.

Figure 3. Maturity Model for Increasingly Advanced Outcomes From



Organizations find themselves at different levels of preparedness and maturity with event-driven design. Nearly all are at the “incidental” or “brokered” stage: that is, on the receiving end of some event notification activity emanating from applications or databases (incidental); or using a pub/sub capability of message-oriented middleware (MOM) or an enterprise service bus (ESB) for some isolated event-centric application (brokered).

In recent years, due to the business demands for greater responsiveness and awareness of context in business decisions, organizations have taken a more strategic approach to supporting EDA. They have done so by selecting a broker technology as the shared resource, and by establishing some central governance over the event exchanges (centralized). This, and the need for greater real-time intelligence in business activity, has propelled technologies like Apache Kafka to fast adoption. At the same time, major vendors like Microsoft (Azure Event Grid and Event Hubs), Google (Cloud Pub/Sub), AWS (Amazon MQ), and Salesforce (Platform Events) have made strategic investments in event-driven technology. Multiple pure-play vendors, including Confluent, Solace, Streamlio, TIBCO Software and VANTIQ, are also actively innovating to support advanced and prevailing business use cases for EDA.

Having experienced the benefits of event processing and conquered the major challenges, some organizations are planning the ubiquitous cross-organization adoption and governance of EDA

("pervasive"). But the continuing shortage of productivity and governance tools, best practices and technology standards keeps this ultimate commitment experience of EDA off the real-world roadmaps of most organizations today.

A major transition on this roadmap happens from Stage 2 to Stage 3, where the investment in EDA shifts from tactical to strategic. This is the beginning of technological, organizational and cultural change in the organization, when events begin to take a role in the organization's business and technical innovation with an increasingly cross-organizational significance. Most applications become candidates for consuming or emitting business events and most business initiatives look for the event-informed, real-time context awareness for their business decisions.

Stage 1: Incidental EDA

Orientation (are we there yet?):

- Some incidental use of EDA, mostly supplementary to other activities.
- No general event processing strategy (all event notifications are processed in a manner that is specific for the use case at hand).
- EDA-capable middleware (MOM, ESB) is present, but used mostly for general data passing and integration.
- Webhook is the frequently used direct communication model between the event source and the event consumer. There is no recognized event broker or any other intermediary beyond HTTP.
- Notifications from packaged applications, SaaS, databases (change data capture [CDC]) or the web may be captured retrospectively, but most of the processing is isolated and generally tactical.
- A typical relationship between the producer and the consumer of the notification is one-to-one; for example, a dashboard API is called when a database change is detected.
- Stream analytics (if present in the organization) and event brokering are disconnected (see "Market Guide for Event Stream Processing")

Table 1: Incidental Occurrences of EDA

What outcomes can I achieve at this stage? ↓	How do I solidify this stage and prepare for the next step? ↓

What outcomes can I achieve at this stage?	How do I solidify this stage and prepare for the next step?
■ Respond in business real time to unscheduled changes in business activity or data, where applications are designed to send notifications. ■ Applications become more resilient to connectivity and other interruptions, due to the reliable nature of asynchronous communications via messaging middleware. ■ CDC is a noninvasive way to add some business situation awareness. But make sure to operate on CDC carefully — a change in the database may only be a part of the transaction, if the transaction updates multiple database tables. ■ The early experience with event processing begins to teach the application architects and business users of the potential advantages and special capabilities of event-driven design.	■ Look for new opportunities to utilize the event notifications that are already available by adding more event listeners to support new use cases (but also make sure the event distribution can scale to support increasing loads). ■ See if the same sources can be configured to emit other needed types of events to create opportunity for additional innovation. ■ Investigate the full spectrum of capabilities provided by the middleware used to deliver the event notifications. Even if used in a minimal mode, the middleware may be capable of more. ■ Look for opportunities of governance to improve transparency, accountability and error handling when event notifications are processed.

CDC = change data capture; EDA = event-driven architecture

Source: Gartner (June 2019)

Stage 2: Brokered EDA

Orientation (are we there yet?):

- Dedicated pub/sub-capable technology is adopted in parts of the organization for the role of an event broker for new event-driven initiatives.
- Some IT teams recognize the differentiated capabilities of EDA and begin promoting the principles of event-driven design across initiatives; others are unaware or choose to wait and see.
- Lack of experience or tools for development or governance complicates and slows adoption.
- Different teams select a separate broker without consideration of integration, only to face the need for federation and integration later on.
- Lack of experience or easily learned tools surface adoption challenges, including end-to-end testing and design for exceptions. In the absence of expert skills and advanced business-oriented tools, some projects disappoint, delaying further adoption.

- Only professional IT engineers create EDA designs and software, but the selection and definition of events may be coordinated with business.
- There is no central coordination of EDA design or governance.

Table 2: Brokered Use of EDA

What outcomes can I achieve at this stage? ↓	How do I solidify this stage and prepare for the next step? ↓
■ Many-to-many relationships between sources and consumers of event notifications support incremental delivery of innovation, parallel responses to changing conditions, and facilitate real-time application integration. ■ Even the spotty use of EDA begins to demonstrate the potential of the architecture and attracts attention. For example, even the teams that do not use brokered EDA themselves may subscribe to the now available event notifications. ■ EDA-based designs may be better at product-style delivery of application capabilities, since the consumers and sources of event notifications are relatively autonomous and can be added or changed without retesting and redelivering most of the rest of the application. ■ The IT team may improve business-IT collaboration for their project, but overall organization culture is unchanged. ■ The early lessons learned here will become very useful in the next stage of EDA adoption.	■ Document the best practices and templates for event exception and error handling, and version control. Share the findings. ■ Note organizational and cultural challenges to adoption of EDA. Document the experience of overcoming these challenges. ■ Seek application development tools that support event-driven design. ■ Form some governance discipline as the precursor to a future central governance team. ■ Highlight success stories to demonstrate the value of EDA, while also explaining the methods of the new styles of governance. ■ Begin to develop a general strategy for capturing and processing events, especially for business scenarios that tend to have significant multiapplication consequences and can benefit from centralized event brokering.

EDA = event-driven architecture

Source: Gartner (June 2019)

Stage 3: Centralized EDA

Orientation (are we there yet?):

- A central event authority team is formed to provide support for development and governance of EDA systems, to promote EDA design practices, and to work with the business to define event use cases. This team may be part of the larger strategic integration governance organization, like the integration strategy empowerment team (ISET).
- EDA is endorsed and promoted by leading architects and IT leadership as a general-purpose design model, with some applications taking full advantage of its differentiators, but others continuing to adopt a “wait and see” approach.
- API and EDA designs are coordinated.
- Despite the intended general use for the selected event broker technology, one vendor’s product is unlikely to fit all purposes, so different use cases may lend themselves to selection of multiple technologies across the organization. At a later maturity stage, a federated network of different event brokers may be formed.
- Stream analytics, though still typically separate, may be governed by the same team that now also governs EDA implementations.
- Once available and centrally managed, event notifications spread, picked up by new subscriber applications.

Table 3: Centralized Use of EDA

What outcomes can I achieve at this stage? ↓	How do I solidify this stage and prepare for the next step? ↓

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■ Active central event authority promotes consistency and safety in the use of event notifications, and facilitates best practices and dependable governance. ■ Combined operations of integration, API management and EDA governance improves outcomes and opportunities for all three. ■ Real-time situation awareness becomes more common and more easily achievable. ■ Integration of multiple event sources in a centralized brokerage offers the business greater insight on its heterogeneous operation, and supports new opportunities for extensibility, innovation and collaboration between teams. ■ Event-driven design allows IT analysts and business users to more easily share a common language, just as business events share semantics between business and technology designs. ■ EDA application design is useful for product-style delivery of application capabilities. ■ Cultural and organizational changes required to manage the real-time operations of EDA are easier to establish and advance with centralized leadership. ■ Centralized event brokering opens up an avenue for application leaders to connect to partners and begin to form multienterprise ecosystems for sharing business moment opportunities.	■ Seek application development tools that support event-driven design: specifically, advanced tools for advanced technical requirements; and low-code tools to improve productivity and to enable business users to design event-driven solutions. ■ Ensure that application designers across the organization are familiar with the available types of event notifications and have access to the tools required to take advantage of them, where there is a business opportunity for it. ■ Develop a strategy for selective use of API-driven and event-driven design. This may include segregated strategies for design of command, observation, and query processing. ■ Connect the event broker to other application platforms for greater leverage, including rule engines, business process managers, API gateways, integration platforms and analytics. ■ Discover the existing use of stream analytics and look for opportunities to enrich it with the addition of event brokering. ■ Develop or harvest, from the application team, and continuously document the best practices and templates for event exception and error handling, and version control. ■ Preserve some event streams in event stores for postprocessing, including diagnostics, machine learning and, in the more advanced cases, event sourcing. ■ Continuously strengthen the event governance and support organization, and ensure that it is coordinated with other governance teams, including integration, architecture, data science and security.

EDA = event-driven architecture

Source: Gartner (June 2019)

Stage 4: Advanced EDA

Orientation (are we there yet?):

- Integrated with stream analytics, AI and API marketplaces, EDA helps enable new leading-edge solutions. These include continuous intelligence, contextual decision making, global ecosystems operations, and monetizing of event-derived insights.
- The central event authority provides EDA training and consulting, supports an event marketplace, manages a central event store, and collaborates with the integration, analytics, AI and other teams, many of which are under shared governance leadership.
- Real-time decision support and automation flourish, utilizing an increasing number of available event streams and now integrated analysis and context.
- Ecosystems are formed or extended by mixing internal and external event sources and consumers.
- Event streams are captured in event ledgers and preserved in even stores for machine learning and other analytical uses.
- Some event notifications are forwarded to event/API marketplaces and monetized.

Table 4: Advanced Deployments of EDA

What outcomes can I achieve at this stage? ↓	How do I solidify this stage and prepare for the next step? ↓

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■ The extension of event brokers (and EDA use cases) with analytics, AI, application and data integration, API management, decision management, process control, IoT and other technology capabilities adds new levels of parallelism, intelligence and real time to the business opportunities of the organization. ■ Application activity data, normally isolated in the application's record but now persisted in event stores, provides advanced machine learning/analytics opportunities beyond what any one application can achieve. ■ The API economy now also includes the event economy. ■ The newly marketable commercial value of the organization's events, adding to the marketable APIs, increases the commercial value of IT overall. This makes discovery and publication of complex business events (and others) a business priority. ■ Stream analytics applications no longer mostly store their findings or signal alerts in dashboards, but distribute the complex events to multiple applications for appropriate action or further analysis in near real time. ■ Near-real-time context awareness — delivered by a combination of EDA, API, AI, CEP and IoT capabilities — supports empathetic user experiences and well-prepared decisions.	■ Continuously harmonize your event governance operations with the governance of data, intelligence, security, API marketplaces, decision management, and integration. ■ Join commercial API/event marketplaces. ■ Add AI capabilities to EDA operations and governance. ■ Post more of analytical findings as complex events to event brokers and encourage other applications to capitalize on this new information. ■ Seek to combine governance of all aspects of event processing, including the real-time EDA brokering, stream analytics, persistence, and the event stream postprocessing. ■ Seek opportunities to join with the EDA initiatives of partners and other external entities. ■ Explore platform business opportunities enabled by advanced event-driven infrastructure.

AI = artificial intelligence; CEP = complex-event processing; EDA = event-driven architecture; IoT = Internet of Things

Source: Gartner (June 2019)

Stage 5: Pervasive EDA

Orientation (are we there yet?):

- Organization captures a critical mass of ecosystem business events for business-critical continuous intelligence, innovation and scale.
- EDA design skills are combined with the request-based API design skills and are widely available across the organization. EDA is considered a safe and common model of application design, taking its place along with the file-based and request-based (API) designs.
- Most applications combine some API and some EDA interactions.
- Event streams are monetized, along with the APIs, through business capability marketplaces.
- Event-centric governance, analysis and decision control are some of the essential parts of the organization's business activity.
- Business users and IT architects share the same event design tools: business-IT collaboration flourishes.
- Consolidated event stores provide an integrated activity record of the organization — sourced from a large and growing collection of applications — for machine learning, analytics and AI modeling.

Table 5: Pervasive Use of EDA

What outcomes can I achieve at this stage? ↓	How do I solidify the opportunities of this stage? ↓

What outcomes can I achieve at this stage?	How do I solidify the opportunities of this stage?
■ With a significant number of business events digitized and captured in EDA designs, the organization becomes highly context sensitive and responsive. ■ The organization's operations, intelligence and decision management incorporate internal and external event sources for advanced understanding of its business context. ■ Real time becomes a common means of business experience. ■ Access to event streams enables more empathetic customer and employee services, increasing both employee productivity and customer satisfaction. ■ Extensibility of business capabilities is a common characteristic of the organization's application experience.	■ Prioritize security, accountability, resilience, scale, efficiency and other key integrity characteristics for your event-driven application environment. ■ Invest in management tools and organizational structures to ensure coordination of event-related processing with other information systems. ■ Continuously advance the cultural practices in the organization, in support of the real-time agility required to take full advantage of your EDA investments. ■ Prioritize broad distribution of low-code development tools to bring more business users into the realm of the design of event-driven systems and protection of event-related information. ■ Seek and implement the emerging standards for easier participation in ecosystems. ■ Look for opportunities to build platform business services, capitalizing on your now-advanced event processing skills and infrastructure. ■ To maximize trust, seek opportunities to incorporate blockchain as a potential technology basis for a strategic event ledger and store.

Source: Gartner (June 2019)

Additional research by Gary Olliffe and Anne Thomas.