Migrating D&A Architectures to the Cloud: Roadmap

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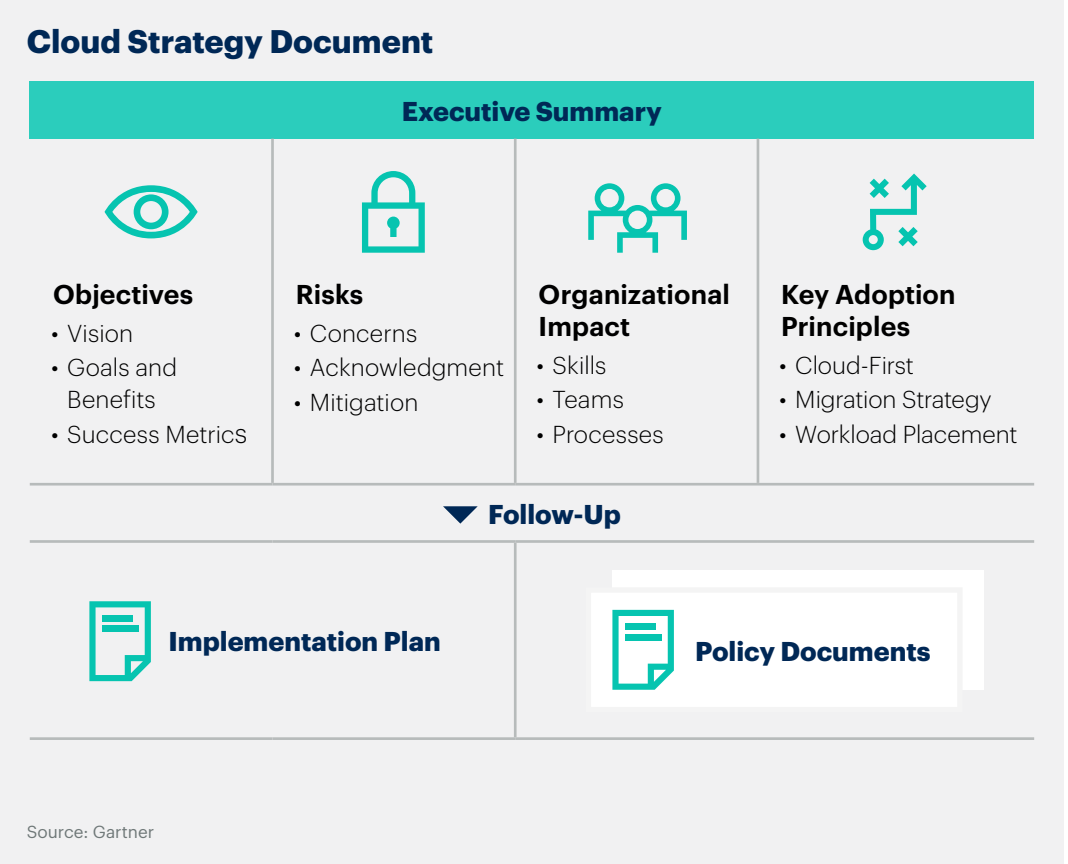
Gartner®

Question: How are enterprises migrating D&A architectures to the public cloud?

By 2025, cloud-native platforms will serve as the foundation for more than 95% of new digital initiatives — up from less than 40% in 2021. With data and analytics (D&A) being a core component of digital transformation, almost every organization is on a cloud migration journey.

Gartner believes that adopting cloud-native D&A architectures will provide the means to execute digital strategies — enabling business growth, customer retention and efficiency. Each organization goes through the process of building a comprehensive strategy, with the goal of automating tasks, storage and elasticity of compute infrastructure alongside improved collaboration.

But they struggle with the execution and implementation of the core capabilities required to support cloud-native D&A architectures. This roadmap captures the stages required for successful migration of D&A architectures to the public cloud.



Source: Gartner

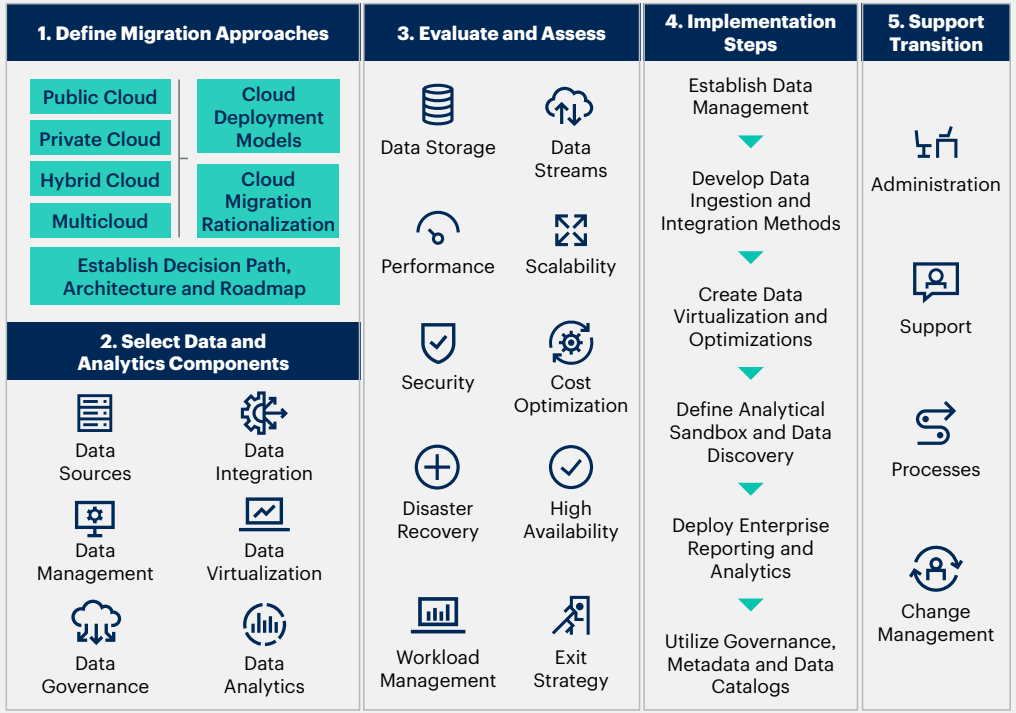
A strategic roadmap accounting for a new implementation and operating model is key to successful adoption of cloud D&A

IT leaders need to examine and target how they will manage digital workloads in the cloud that can help increase the adoption of self-service analytics, access to insights and agility to support reengineering decisions. Gartner predicts that by 2025, more than 90% of enterprises will have a multicloud infrastructure and platform, but less than 10% of enterprises have an effective strategy to embrace multicloud complexity.

A combination of modern D&A architecture, cloud technologies and operational best practices can empower organizations to build and run scalable analytics solution in new ways. This roadmap is designed to support modularity, autonomy and orchestration of distributed D&A workloads with hybrid, multicloud implementations by focusing on building the right strategy, architecture and, most important, operationalization as part of a composable business architecture.

A Guidance Framework for Data and Analytics Deployment

How do you create a strategy for deploying data and analytics components in the cloud, hybrid and multicloud platforms?



Source: Gartner

Some of the top questions with migrating D&A architectures to the cloud initiative are:

1. How do you address varied D&A cloud implementation architectures: hybrid cloud and multicloud?
2. How do you overcome operating model challenges during and after migration?
3. What teams and personas play critical roles as part of cloud D&A migration projects?

What are the key stages?

This roadmap shows the sequence of stages and steps for the smooth transitioning of D&A architectures to the public cloud. This will help achieve desired outcomes by addressing implementation, operating model and skills challenges alongside aligning business stakeholders expectations. It is distilled from interactions with clients who have successfully migrated and adopted cloud D&A implementations. A few key milestones and associated Gartner resources are highlighted below, but our full roadmap includes complete details of each of the milestones and resources for individual stages within the initiative.

Step 1: Strategy

Step 2: Architecture

Step 3: Operationalization

Step 1: Strategy

An effective cloud D&A migration strategy focuses on four areas: objectives, risks, organizational impact and key adoption principles with reengineering the decision. The migration strategy needs to be customizable, be optimized and provide complete analytic services for end-to-end migration. It should take into consideration the implementation approach, set of capabilities required to support existing and future use cases, and identify upskilling path based on gaps in technical expertise.

Actions to take

A

Identify cloud implementation approach: hybrid or multicloud?

B

Evaluate and select tools that integrate seamlessly.

C

Identify skill sets to support migration and operationalization.

+ more

Sample of associated Gartner resources

- **Research**
  - A Guidance Framework for Deploying Data and Analytics in the Cloud
  - Designing a Cloud Strategy Document
  - Quick Answer: How Do I Modernize the Organization's Data and Analytics Strategy?
  - Strategic Roadmap for Migration Data Management to the Cloud
- **Expert inquiry** to review the overall strategy for migrating D&A architecture to the public cloud
- **Phone consultation** to draft an enterprise adoption roadmap for D&A in the cloud
- **Conference:** Gartner Data & Analytics Summit

Step 1: Strategy (A)

Identifying cloud migration approach: Hybrid or multicloud?

Key findings

- Data gravity and entanglement play critical roles with cloud migration approaches.
- Successful D&A cloud migrations tend to be iterative, starting small to deliver a core set of cloud-based services, and expanding over time toward a broader set of use cases.
- Migrating the D&A application usually intersect with cloud platform architecture types: IaaS, PaaS, containers, low-code application platforms and SaaS.
- Although more data is generated in the cloud, organizations often fail to incorporate cloud analytics into their existing portfolios, and thus create analytics silos.

Recommendations

- Minimize basic lift-and-shift migrations that don't take full advantage of cloud attributes. Planned technical debt is always better than legacy or accidental.
- Assess the individual D&A components to determine the impact on deployment approach.
- Build a cost versus effort rationalization matrix to identify the approach with individual D&A components for replacing, rebuilding or rehosting individual capabilities.
- Make the promotion and sharing of analytics assets easier and quicker by enabling a cloud-driven collaborative analytics environment.

Sample of associated Gartner resources

- **Research**
  - What Are the Key Factors to Consider When Choosing a Cloud Data Management Architecture?
  - A Guidance Framework for Deploying Data and Analytics in the Cloud
  - Reengineering DBMSs to the Cloud Provides Big Benefits
  - Achieve Bimodal Equilibrium With Cloud Analytics

Step 1: Strategy (B)

Evaluate and select vendors that integrate seamlessly

Key findings

- Cloud IaaS and PaaS markets have mostly converged. Most enterprises adopt a range of differentiated software infrastructure services and management capabilities from these providers.
- The only metric that truly matters is price over performance when it comes to evaluating vendor IaaS and PaaS solutions with D&A.
- Good future-state architectures include a good mix of IaaS and PaaS components, and they are mostly hybrid or multicloud.

Recommendations

- Select a strategic primary cloud IaaS provider that will meet the requirements of most D&A workloads; ensure it fits well with the organization's skill set and has the diversity of use cases.
- Select "seamless integration" over "best-of-breed" when comparing PaaS solutions with third-party vendors.
- Leverage Cloud Decisions, Critical Capabilities and the Gartner Magic Quadrant™ methodology for selecting tools for the individual D&A capabilities.

Sample of associated Gartner resources

- **Research**
  - The Impacts of Emerging Cloud Data Ecosystems: An Architectural Perspective
  - How to Plan for Optimal Multicloud and Intercloud Data Management
  - Cloud Decisions
  - Critical Capabilities for Analytics and Business Intelligence Platforms
  - Critical Capabilities for Data Science and Machine Learning Platforms

Step 1: Strategy (C)

Identify skill sets to support migration and operationalization

Key findings

- Most organizations combine training, hiring, staff augmentation and outsourcing throughout their cloud journey, emphasizing different approaches at different points in their journey.
- Technical professionals welcome objective-driven cloud assignments, allowing them to apply their knowledge in practice and learn new things in the process.
- Migrating to the cloud usually results in expanding the team instead of shrinking it. Keep a lookout for emerging roles like cloud data engineers and cloud BI engineers.

Recommendations

- Take a top-down and bottom-up approach by investing in your own technical team for upskilling and bringing in consultants with expertise where there are gaps.
- Start with a small team, well-defined objectives, roles and responsibilities. Upskill as you iterate and evolve the D&A architecture and services.
- Upskilling is the way to go. Invest in your people through training, certifications and building a community of practices.

Sample of associated Gartner resources

- **Research**
  - Communities of Practice Unlock the Latent Expertise of Your Workforce
  - Jump-Start Your Cloud Skills With These Objective-Driven Assignments
  - Quick Answer: How Do I Overcome a Lack of Cloud Skills in My Organization?
  - Data and Analytics Essentials: Self-Service Analytics Operating Model
  - Achieve DSML Value by Aligning Diverse Roles in an MLOps Framework

Step 2: Architecture

Defining the expectations of cloud PaaS versus third-party independent software vendors to deliver foundational data management components, such as data integration, transformation, metadata and governance, is critical toward the successful migration and adoption of cloud. The architecture should enable self-service analytics across a broad range of personas: power users, expert data scientists, business stakeholders and end users. This requires a modular and scalable architecture to manage varied analytic workloads and a comprehensive data governance program to mitigate security risks.

Actions to take

A
Build a comprehensive data management architecture.

B
Redesign the end-to-end analytics, data science and AI pipeline.

C
Select the right mix of IaaS and PaaS solutions to manage D&A workloads.

D
Implement a robust governance framework to address privacy and security.

+ more

Sample of associated Gartner resources

- **Research**
  - Solution Path for Modernizing Analytic Architectures
  - Use Cloud to Compose Analytics, BI and Data Science Capabilities for Reusability and Resilience
  - Composable Analytics Shapes the Future of Analytics Applications
- **Expert inquiry** with GTP analysts to review current D&A pipelines as part of the migration
- **Phone consultation** to design the future-state architecture and execute the migration strategy
- **Conference:** Gartner Data & Analytics Summit

Step 2: Architecture (A)

Build a comprehensive data management architecture

Key findings

- Interestingly, organizations are not dealing with large volumes of data when it comes to migrating to the cloud. Instead, it is about compute and accessibility, which is driving adoption to the cloud.
- Persistent data stores are usually cloud PaaS, except when it comes to consumption for traditional analytics.
- Rearchitecting the data management architecture in the cloud is not significantly more expensive than a straight migration. In addition, it helps overcome technical debt while providing more flexibility for future use cases.

Recommendations

- Portability and interoperability with data stores is a myth, hence don't fret about vendor lock-in when it comes to adopting cloud PaaS database management system (DBMS) solutions.
- Make the cloud the first and default choice for all new DBMS instances to take advantage of dynamic elasticity and rapid provisioning.
- Adopt run-in containers-based architectures with hybrid and multicloud deployments using API-based database integration services.

Sample of associated Gartner resources

- **Research**
  - Solution Path for Building a Holistic Data Management and Analytics Architecture
  - Reengineering DBMSs to the Cloud Provides Big Benefits
  - Exploring Lakehouse Architecture and Use Cases

Step 2: Architecture (B)

Redesign the end-to-end analytics, data science and AI pipeline

Key findings

- Organizations will move more than two-thirds of advanced analytics for both development and production to the cloud by 2023.
- Enterprises investing in analytics and business intelligence (ABI) and data science and machine learning (DSML) in phases often bring complexity due to lack of advanced planning, cohesion and cross-manageability. This slows delivery of advanced analytics capabilities, which are an urgent need during cloud D&A migrations.
- The growing cloud ecosystem enables organizations to explore innovative cloud-based analytics capabilities. Cloud-based marketplaces are becoming an effective channel to distribute and share analytics applications, while building composable architectures to simplify decision making.

Recommendations

- Expand advanced analytics to production in the cloud through modular addition rather than a lift-and-shift approach by assembling the composable ABI and DSML building blocks in a cloud-enabled marketplace.
- Achieve faster, more cohesive delivery of advanced analytics capabilities by reducing the operational effort in the cloud to compose ABI and DSML capabilities together in a complementary fashion.
- Pilot composable analytics in the cloud, establishing an analytics marketplace to drive and support collaboration and sharing.

Sample of associated Gartner resources

- **Research**
  - Decision Point for Selecting Cloud Analytics Solution Architecture
  - Use Cloud to Compose Analytics, BI and Data Science Capabilities for Reusability and Resilience
  - Composable Analytics Shapes the Future of Analytics Applications
  - Toolkit: Gartner Analytics Atlas

Step 2: Architecture (C)

Select the right mix of IaaS and PaaS solutions to manage D&A workloads

Key findings

- Most customers will have a multicloud infrastructure as a service (IaaS) strategy. In addition to choosing a primary strategic provider that receives the bulk of their workloads, they are likely to choose at least one secondary strategic provider as well. They may also use additional providers for specific D&A and artificial intelligence (AI) use cases.
- The absolutely required capabilities that buyers looked for are security, compute and scaling. Compute is foundational for D&A workloads, and scalability is a key attribute of the cloud consumption model.
- Cloud data ecosystems may consist of both native and third-party components and address the challenges of multicloud, intercloud and hybrid deployments, resolving disparate and increasingly siloed data.

Recommendations

- Embrace and enable new cloud capabilities and styles of operation that position infrastructure and operations (I&O) as a catalyst for continuous improvement rather than a roadblock to the adoption of cloud D&A.
- Leverage the latest compute environments to design and deploy a network infrastructure that is automated, secure and resilient and supports a rapidly evolving, operate-from-anywhere D&A organization.
- Optimize cloud management and performance by creating a cloud center of excellence to formulate best practices across workload selection, governance, operations and organizational skills.

Sample of associated Gartner resources

- **Research**
  - How to Initiate the Selection of Strategic Cloud IaaS Providers
  - Critical Capabilities for Cloud Infrastructure and Platform Services
  - The Impacts of Emerging Cloud Data Ecosystems: An Architectural Perspective

Step 2: Architecture (D)

Implement a robust governance framework to address privacy and security

Key findings

- Data governance is usually an afterthought because it is too complicated with cloud implementations. Lack of governance is a big hindrance toward bringing agility and self-service with analytics in the cloud.
- There exists incorrect assumptions that data governance in cloud is difficult because of the lack of understanding on how to manage the metadata, create a catalog and capture lineage.
- Creating and sustaining value from D&A investment is the main driver for the adoption of cloud. But compliance with data locality regulations are major concerns with cloud governance programs.

Recommendations

- Disambiguate your end-to-end D&A pipeline to ensure that governance is accommodated at every stage of the data life cycle. Use a comprehensive framework to establish a clear data lineage built on rich active metadata.
- Improve user productivity and engagement by investing in capabilities supporting integration, interoperability and automation within and between applications, data catalog, quality and privacy irrespective of deployment model.
- One of the goals of comprehensive data governance should be to decrease the time it takes to operationalize analytical reports and AI.

Sample of associated Gartner resources

- **Research**
  - Building a Comprehensive Governance Framework for Data and Analytics
  - The State of Metadata Management: Data Management Solutions Must Become Augmented Metadata Platforms
  - Tool: The Gartner Data and Analytics Governance Technology Atlas

Step 3: Operationalization

Most D&A projects fail because operationalization is only addressed as an afterthought. The top barrier to scaling data and analytics and AI implementations is complexity around integrating the solution with existing enterprise applications and infrastructure. In addition, technical debt, implementation and infrastructure complexity associated with D&A cloud migration often stem from organizations following traditional software engineering approaches that lack collaboration and consist of monolithic platforms, rigid point-to-point interface dependencies and duplicated data efforts. Hence, it is important to create an integrated XOps practice that blends disparate functions, teams and processes to support D&A cloud migration and adoption with continuous delivery of self-serviced analytics.

Actions to take

A

Leverage XOps practices: DataOps, FinOps, ModelOps, MLOps, PlatformOps.

B

Focus on automation and augmentation as part of migration.

C

Define an operating model supporting change management and continuous delivery and support.

+ more

Sample of associated Gartner resources

- **Research**
  - Top Trends in Data and Analytics for 2021: XOps
  - Data and Analytics Essentials: Cloud
  - CDOs and CFOs Must Join Forces in the Cloud to Connect Business Value With Cost
- **Expert inquiry** to implement an operationalization framework to support the hybrid, multicloud D&A implementation
- **Phone consultation** to manage and scale D&A pipelines in the cloud postmigration
- **Conference:** Gartner Data & Analytics Summit

Step 3: Operationalization (A)

Leverage XOps practices: DataOps, FinOps, ModelOps, MLOps, PlatformOps

Key findings

- The goal of XOps (data, ML, model and platform ops for AI) is to achieve efficiencies and economies of scale using DevOps best practices and ensure reliability, reusability and repeatability while reducing duplication of technology and enabling automation.
- D&A leaders need teams with a combination of data management, software engineering and I&O skills to operationalize cloud D&A architectures.
- Cloud economics is a practice that goes beyond cloud cost management. It is focused on maximizing the value of cloud computing to the business, rather than minimizing cloud expenses.

Recommendations

- Leverage XOps practices and expertise to build a composable technical architecture, providing resilience, modularity and autonomy to business functions.
- Introduce financial operations (FinOps) as an interactive discipline by continually evaluating workloads for their price/performance and value over time, and eliminating or optimizing those workloads that do not provide sufficient value for cost.
- Nurture production mindsets with cloud D&A migration. This means utilizing standardized data and model pipeline infrastructure stacks to maximize reusability, reproducibility, reliability and rate of success.

Sample of associated Gartner resources

- **Research**
  - Data and Analytics Essentials: DataOps
  - How to Build a Data Engineering Practice That Delivers Great Consumer Experiences
  - Demystifying XOps: DataOps, MLOps, ModelOps, AIOps and Platform Ops for AI
  - Is FinOps the Answer to Cloud Cost Governance?

Step 3: Operationalization (B)

Focus on automation and augmentation as part of migration

Key findings

- Data fabric can free staff to provide more benefits from more data. It can do so by significantly accelerating the introduction and exploitation of second- and third-party data compared with traditional practices that require significant human integrator effort before any utilization.
- Metadata practices that focus exclusively on identifying, collecting and enabling search over static or passive metadata fall short in delivering business value.
- Augmented capabilities are bridging the gap between existing analytics platforms for analysts and business users, and data science and machine learning tools for citizen and expert data scientists.

Recommendations

- Explore the access and availability to system logs, user logs and data update/transaction logs to begin assessing use cases for data and their current locations.
- Deliver advanced metadata management capabilities by focusing on priority data domains that cross business areas to assist in a phased approach to metadata-enabled augmented data management.
- Use augmentation to expedite and enhance the value generated by existing analytics personas, allowing business users to interact with their data without requiring extensive IT support.

Sample of associated Gartner resources

- **Research**
  - Data and Analytics Essentials: Data Fabric
  - Market Guide for Augmented Analytics Tools
  - Adopt Cloud Analytics to Drive Innovation
  - Extending LDW Principles Toward Data Fabric
  - Worlds Collide as Augmented Analytics Draws Analytics, BI and Data Science Together

Step 3: Operationalization (C)

Define an operating model supporting change management and continuous delivery and support

Key findings

- Organizations are facing huge challenges: a lack of clarity and guidance in deploying end-to-end, automated, agile and repeatable data-driven systems. This is causing organizations to "duct tape" different products and frameworks together to build their solutions and delivery process.
- Enterprises that incorporate DevOps and DataOps practices have proven to increase productivity and minimize operational effort and are successful at deploying analytics data-driven solutions.
- Automating data management is more effective when applied to systematic processes, such as building models, code generation, script development, iterative deployment and metadata management by automating repetitive tasks.

Recommendations

- Operationalize data workloads with DevOps and DataOps practices by including them from the very beginning. Involve a cross-functional team, including developers, QA engineers and data scientists, for designing and building an operationalization-oriented process and culture.
- Operationalization of data workloads is extremely complex. Incorporate a configuration-driven process by leveraging containerization for various environments. This can help automate single-click deployments, minimizing discrepancies across component versions within the technology stack.

Sample of associated Gartner resources

- **Research**
  - Data Engineering Essentials, Patterns and Best Practices
  - How to Operationalize Data Workloads
  - Assessing the Capabilities of Data Warehouse Automation (DWA)

Who needs to be involved?

The most successful companies establish cross-functional teams for their cloud migration initiatives with D&A. We have outlined the recommended functions to involve and their roles to ensure the best success in hitting the milestones.

CDAO

The chief data and analytics officer (CDAO) is responsible for envisioning and executing the overall D&A strategy across all business functions and should play an active role in designing the D&A cloud migration strategy that can best enable the use of data analytics in the new environment.

Application leader and team

Play an important role in aligning operational and analytic dataset because of the interdependency, and hence play a critical role with the migration of enterprise applications and underlying D&A architectures to the cloud.

D&A leader and team

Lead the efforts to ensure reduced data duplication, fast and easy access to data, improved data quality, and minimize hurdles with cross-functional collaboration to effectively perform analytics "in-place."

Enterprise architecture leader and team

Help ensure standards with capabilities, tools and operating models across the cross-functional teams of application, D&A, infrastructure and security.

I&O leader and team

Must become the product development team and champion for IT infrastructure to achieve timelines with infrastructure migration, and optimize costs with D&A workloads in a distributed compute environment.

Security leader and team

Design security policies to standardize controls as well as enhance governance and security posture for cloud D&A architectures; implement capabilities to support continuous risk identification within cloud deployments.

Client success story:

Migrating D&A to the Cloud for Agility, Resiliency and Self-Service With Analytics

Most critical priority

The CIO's vision was to have a business-driven, cloud-first and innovation-focused approach with migrating to the cloud and, overall, to become more elastic, agile and asset-light as an organization.

How Gartner helped

Gartner research and experts were critical in providing strategic input to build next-generation cloud D&A architecture to support the client's current, and future, business requirements.

Mission accomplished

With the support of Gartner for IT Leaders, the client was able to:

- Emphasize the internal teams participating in piloting the cloud setup to apply company-appropriate standards and best practices and reduce dependency on service providers
- Ensure they invest in their people: training and certifications to ensure successful migration and adoption of cloud D&A architecture; upskilling is the way to go
- Bring together everyone — D&A, I&O, security and Apps teams — as part of the migration initiative because it is a collaborative effort and not siloed to the D&A organization

Actionable, objective insight

Explore these additional complimentary resources and tools for data and analytics leaders.

Research

Over 100 Predictions Data and Analytics Predictions Through 2025

Elevate data and analytics strategies to advance a new vision of business problem solving.

eBook

2022 Leadership Vision for Data and Analytics Leaders

Shift the conversation away from tools and technology and toward decision making as a business competency.

Webinar

The Role of Data and Analytics in Smarter Decision Making

Explore this Gartner survey of executive decision makers with broader research in behavioral psychology to examine how decisions are made within organizations.

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