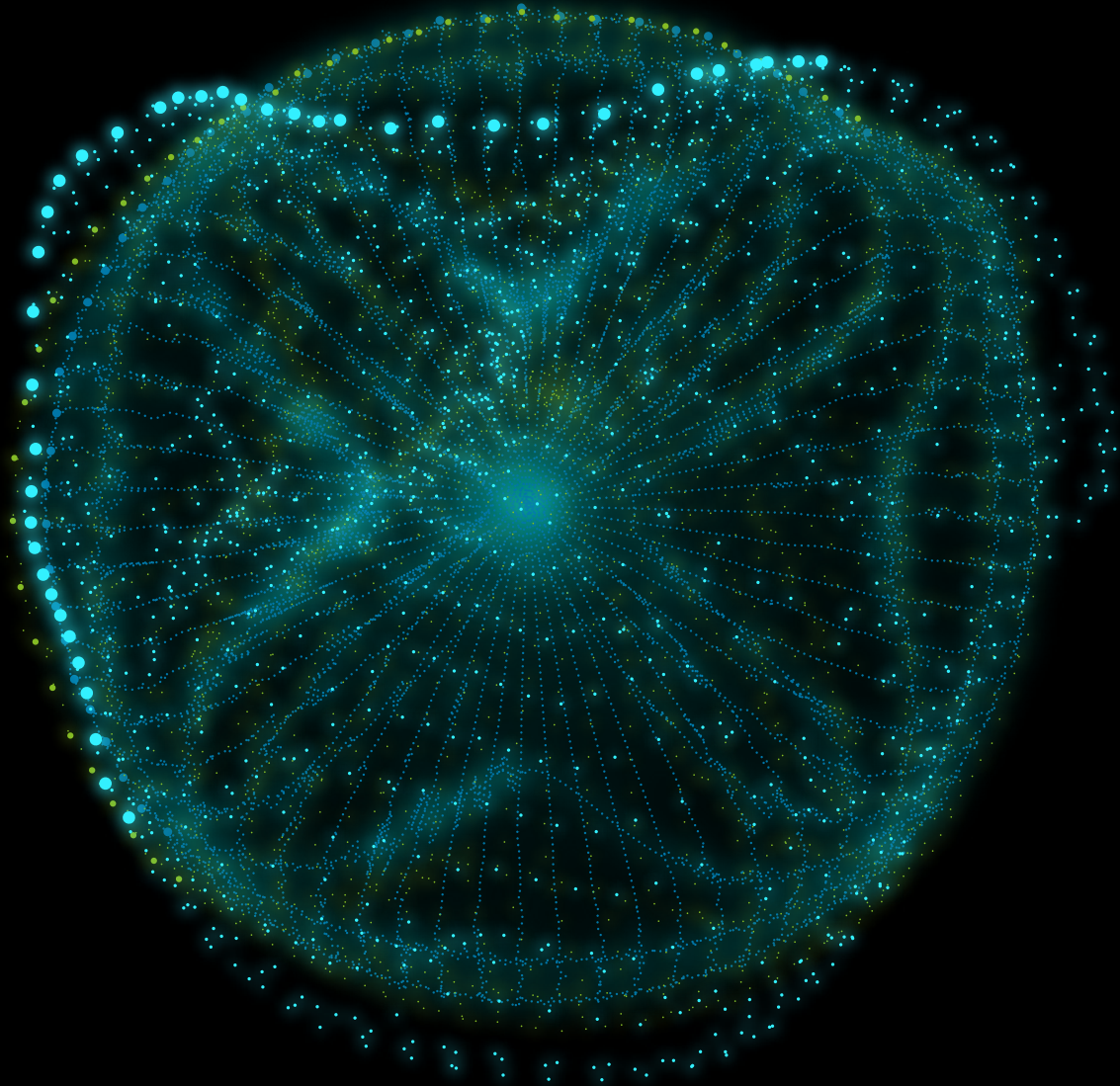




SAP on Google Cloud
Accelerate SAP business transformation

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Accelerating enterprise transformation in the public sector

Public sector organizations have invested in technology, strategic initiatives, and business and operational models to make digital transformation purposeful and effective. However, recent economic conditions—combined with software innovation, globalization, and evolving constituent needs—have accelerated the rate of change for every organization.

For many organizations, SAP S/4HANA® digital core Enterprise Resource Planning (ERP) is the primary system for integrating ERP functions from all lines of the business. As business complexity grows, organizations should consider migrating this critical business system to the cloud to become more agile, connected, and data-driven.

SAP's approach in the public sector, including RISE with SAP, is one that emphasizes the challenges unique to public sector organizations. From a value chain standpoint, SAP enables four strategic priorities in the public sector value chain: Reform to Policy; Policy to Operation; Operation to Outcome; and Outcome to Reform. SAP solutions, including ERP, the Business Technology Platform (BTP), Business Process Intelligence (BPI), and Business Networks, combined with Google Cloud as the underlying cloud platform, work together to achieve these transformation priorities.

Google Cloud provides an SAP-certified cloud platform that enables organizations to migrate and host their SAP applications in the cloud. By migrating

SAP applications and business data to Google Cloud, organizations can reduce hardware and maintenance costs and also reduce the complexities and risks of managing SAP applications on-premises. Once in the cloud, organizations can then look to advance their capabilities through the integration of artificial intelligence (AI) and machine learning (ML) to augment their intelligent enterprise. A recent IDC report¹ indicated using Google BigQuery™ data platform and business intelligence capabilities for their SAP data yielded significantly improved business results with faster time to insights, substantially lower data warehouse costs and more productive analytics teams.

Deloitte and its Alliance Partners stand ready to help organizations scale and analyze operations from enabling foundational cloud infrastructure and deploying cloud apps to transforming the enterprise with business process intelligence.

Understanding the value of SAP on Google Cloud

Google Cloud provides the solutions that SAP customers need, including scalable high availability, reliable disaster recovery, and data protections. These solutions allow customers to have their enterprise applications always available and secure.

By modernizing legacy applications and adopting cloud-based SAP applications on Google Cloud, an organization may recognize a number of benefits. As will be explored through the rest of this publication, shifting SAP workloads to Google Cloud may enable reduced IT infrastructure costs, secure and scalable infrastructure, and uncovering of cloud innovations that can be used to increase business insights with less risk.

Reduced IT infrastructure costs

Organizations with primarily on-premises infrastructure need to budget for the expense of the hardware and subsequent workforce to manage that footprint. Shifting to the public cloud enables a reduction in overall costs as cloud providers can better reduce overhead through scale, a savings that can be captured by an organization.

Google Cloud is well positioned to achieve savings for the organization

Through moving SAP workloads to Google Cloud, public sector organizations can reduce the size of their on-premises environments, subsequently reducing the associated operating and maintenance costs. In addition, implementation of SAP updates and iterative releases in the cloud is faster, easier, and more efficient than traditional on-premises architecture. New instances of SAP, including patches and upgrades, are simpler and less error-prone to test and deploy on Google Cloud, reducing the time and effort that developers spend on SAP releases each year. RISE with SAP also includes a breadth of solutions, such as BTP, BPI and Business Networks. SAP, Google Cloud, and Deloitte have worked together to innovate reference architectures that leverage the breadth of SAP solutions and the power of Google Cloud to bring maximum impact to client business outcomes.

Forrester recently conducted a total economic impact study with the purpose of providing readers with a way to evaluate the potential savings of running SAP on Google Cloud. The study interviewed six customers, surveyed 20 decision makers across industries that use SAP on Google Cloud, and surveyed 75 decision makers in several different industries that are using SAP on another cloud. These surveys and interviews found additional savings, efficiency, and productivity improvements that result from both moving SAP applications and SAP data to Google Cloud, including:



FIGURE 1: Savings, efficiency, and productivity improvements that result from both moving SAP applications and SAP data to Google Cloud¹

By avoiding on premise hardware, software, and other related operating costs, six customers using SAP on Google Cloud were able to save over \$7.1 million in legacy systems over a three-year period. This enabled customers to save \$1.3 million in IT team costs and reduce operating costs by 46%.

¹ The Total Economic Impact™ of SAP on Google Cloud, "The Total Economic Impact™ Of SAP On Google Cloud (inthecloud.withgoogle.com)," accessed February 23, 2022.

Google Cloud is designed to deliver high availability and performance

SAP application uptime is maximized by designing high availability (HA) architectures for organization's mission-critical systems. SAP step-by-step deployment guides and templates, managed by Google Cloud, help organizations get started with their cloud transition, to install the underlying compute, network, and storage infrastructure, and in some cases also install SAP database software such as SAP HANA® in multiple deployment options such as scale up, scale-out, high-availability cluster on SUSE Linux Enterprise Server (SLES) and Red Hat Enterprise Linux (RHEL). Google Cloud has a highly reliable and scalable infrastructure to help keep the SAP environment up and running and has highlighted the following benefits²:

MULTILAYER, HIGHLY AVAILABLE INFRASTRUCTURE

Google Cloud is highly available by design, with a redundant infrastructure of data centers around the world that contain zones designed to be independent from each other. For public sector clients this infrastructure includes authorized regions covered by FedRAMP at both Moderate and High designations in several areas around the world³.

RELIABLE DATA PROTECTION

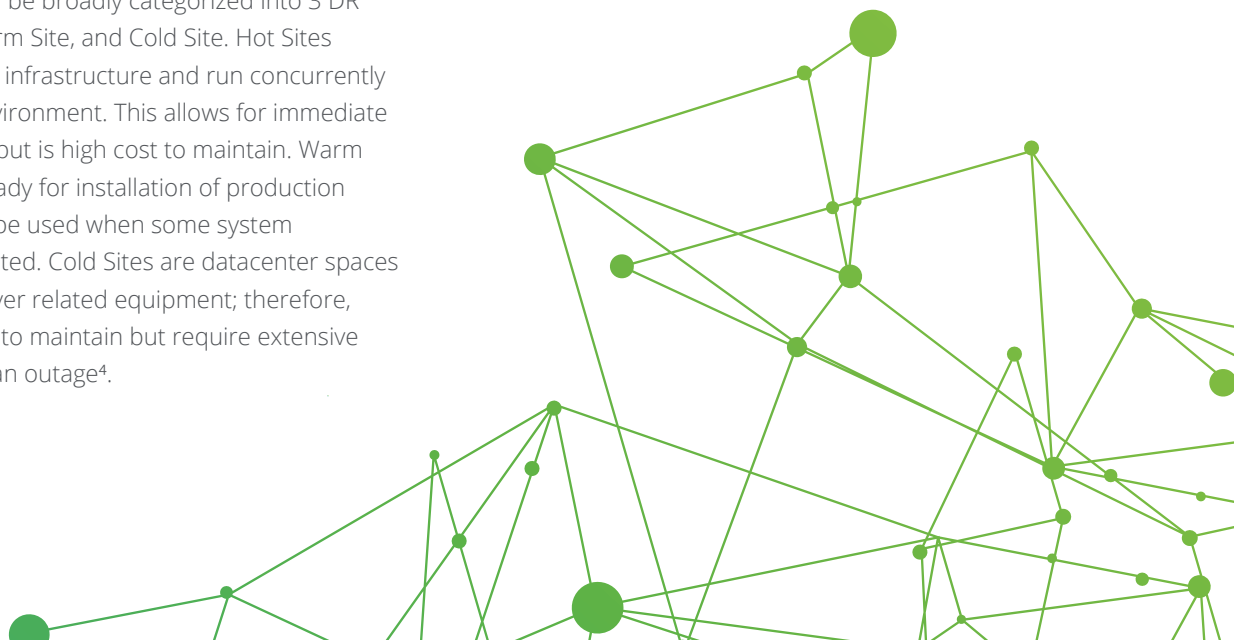
Google Cloud offers several native capabilities for automated, cost-effective SAP system backup. Backup options and interfaces that are offered by applications (e.g., SAP HANA Backint) or managed backup solutions from third parties are also available.

RELIABLE DISASTER RECOVERY (DR)

Data centers can be vulnerable from supply chain disruptions; using Google Cloud for DR ensures that critical SAP workloads and data sources are protected. DR plans should combine application and data recovery techniques but can vary based on public organization's mission critical priorities. Recovery Time Objective (RTO) and Recovery Point Objective (RPO) parameters should be defined, and these specifications can be broadly categorized into 3 DR strategies: Hot Site, Warm Site, and Cold Site. Hot Sites mirror the existing data infrastructure and run concurrently with the production environment. This allows for immediate response to an outage but is high cost to maintain. Warm sites contain servers ready for installation of production environments and can be used when some system downtime can be tolerated. Cold Sites are datacenter spaces that do not contain server related equipment; therefore, they are less expensive to maintain but require extensive support to respond to an outage⁴.

FLEXIBLE SCALABILITY

By moving SAP to Google Cloud, an organization benefits from more "operational agility", meaning that cloud capacity can scale as needed depending on the current bandwidth demands.



² Google Cloud Blog, "3 business continuity challenges SAP customers face, and how Google Cloud can help," accessed February 23, 2022.

³ Google Cloud "FedRAMP Marketplace - Compliance," accessed February 23, 2022.

⁴ Segue Technologies, "The Three Stages of Disaster Recovery Sites," accessed February 23, 2022.

SAP-Certified Google Cloud Instances powered by Intel

INTEL'S MEMORY-OPTIMIZED VMS

Intel's partnership with Google Cloud has led to the development and certification of multiple large memory-optimized VM instances, including M2-ultramem-412 and O2-ultra-mem-896-metal instances that range from 0.26 to 24 terabytes and are optimized for running SAP HANA on Google Cloud's platforms⁵.

OPTIMIZED PERFORMANCE/DOLLAR

Intel's optimized instances also provide increased operational efficiency, optimizing performance/dollar, with VM-based infrastructure and pay per use pricing⁷.

SIMPLIFIED WORKLOAD MANAGEMENT

Intel's M2-series VMs based on Intel® Xeon® Scalable processors allow for the flexibility to consolidate to a single high-capacity instance to simplify workload management⁶.

CONTINUOUS INNOVATION

Intel makes significant strides generation to generation within their product lines. For SAP HANA workloads, m2 and o2 instances have 47% faster runtimes* of complex queries⁸ while for SAP NetWeaver workloads there is a 36% increase in performance per dollar between the 2nd and 3rd Generation Intel® Xeon® Scalable processors⁹.



Reduced downtime

\$1.5M

in annual savings as a result of SLAs



Flexible sizing

Developers who spin up and down new SAP instances have reduced the development time for SAP applications and made it easier and less costly to plan, development, and test new applications.

FIGURE 2: Qualitative benefits that result from both moving SAP applications and SAP data to Google Cloud¹⁰

By migrating SAP to Google Cloud and reducing downtime, customers found \$1.5 million in annual savings. Customers were also able to reduce development time and cost planning by having the ability to spin up and down SAP instances on Google Cloud.

Secure & Scalable Infrastructure

It may appear that leveraging a private cloud will meet your unique agency needs and security requirements, however the government focused Cloud Service Providers (CSPs) such as Google Cloud that have incorporated government security controls provide substantial benefits at a higher security level. This enables agencies to achieve the best of both worlds providing for secure architecture that is scalable.

⁵ Intel Corp, Intel + SAP Cloud Transformation Playbook, accessed February 23, 2022.

⁶ Intel Corp, Intel + SAP Cloud Transformation Playbook, accessed February 23, 2022.

⁷ Intel Corp, Intel + SAP Cloud Transformation Playbook, accessed February 23, 2022.

* Compared to 2nd Gen Intel Xeon Scalable processors compared to E7-8800v4 CPU generation

⁸ SAP, "SAP Standard Application Benchmarks & Certified Hardware for SAP Solutions on Microsoft Windows," accessed March 4, 2022.

⁹ Google Cloud, "Certifications for SAP applications on GCP," accessed March 4, 2022.

¹⁰ In the Cloud with Google, "Forrester: The Total Economic Impact of SAP on Google Cloud," accessed February 23, 2022.

Google Cloud is designed to provide comprehensive cloud security

Google Cloud protects data, applications, infrastructure, and customers from fraudulent activity, spam, and abuse with the same infrastructure and security services Google uses. Google Cloud's networking, data storage, and compute services provide data encryption at rest, in transit, and in use. Google Cloud has many design considerations listed below that support compliance and data confidentiality. These considerations include:

FEDRAMP APPROVED SERVICES

Google Cloud is experienced in understanding the needs of government agencies including ensuring adequate data security and safeguards, high availability, and reduction in risk management costs¹¹. As a result, Google Cloud services are approved for both FedRAMP Moderate and FedRAMP High services. Google Cloud guides customers through FedRAMP implementation by providing the FedRAMP implementation guide and FedRAMP Quickstart. Beyond being FedRAMP approved, Google Cloud also meets several other compliance requirements such as CJIS, IRS 1075, IL2, and IL4. Google Cloud also supports FedRAMP compliance efforts by making all security, identity access, and user protection services available to all clients¹².

SEAMLESS MONITORING, LOGGING, AND DEBUGGING

Google Cloud has improved the security of its platform by offering seamless monitoring, logging, and debugging through its operations suite. In addition to having a one stop shop for operations, this suite of tools additionally allows for triggers if suspicious activities are detected, where log sinks are established to generate reports as necessary for external auditors¹³.

COMPREHENSIVE ENCRYPTION

Google Cloud utilizes Encryption at rest and in transit utilizing AES-256 or better. Additionally, Google Cloud has a variety of ways to manage keys, including Google Cloud's Key Management Solution (KMS) which eliminates the traditional complication of managing keys.

ARTIFICIAL INTELLIGENCE FOR SECURITY

Google Cloud is continuously applying advanced AI capabilities to security. Tools like Data Loss Prevention, which can actively redact sensitive data as it moves between systems, is one example of how Google Cloud can be designed to be even more privacy / security focused than traditional on-premises systems.

- Intel's latest processors leverage AI-based solutions that use hardware telemetry to detect advanced threats to enhance platform security¹⁴.

HIGHLY GRANULAR IDENTITY AND ACCESS MANAGEMENT (IAM)

From a security perspective, Google Cloud enables customers to design a least-privileged security approach, where projects are the core organizational component of the platform. Additionally, Google Cloud has created role-based access permissions and can integrate with SAP for single sign on, which helps further tailor user access on an application-by-application basis.

UNIQUE APPROACH COMPLIANT CLOUD

Google Cloud provides clients with a unique approach to a compliant cloud by leveraging products such as Assured Workloads. Assured Workloads allows clients to choose their security requirements and have Google Cloud configure cloud controls that meet compliance standards.

¹¹ FedRamp, "Understanding Baselines and Impact Levels in FedRAMP," accessed February 23, 2022.

¹² Google Cloud, "Google Cloud FedRAMP Implementation Guide," accessed February 23, 2022.

¹³ Google Cloud Community, "Export Google Cloud security data to your SIEM system," accessed February 23, 2022.

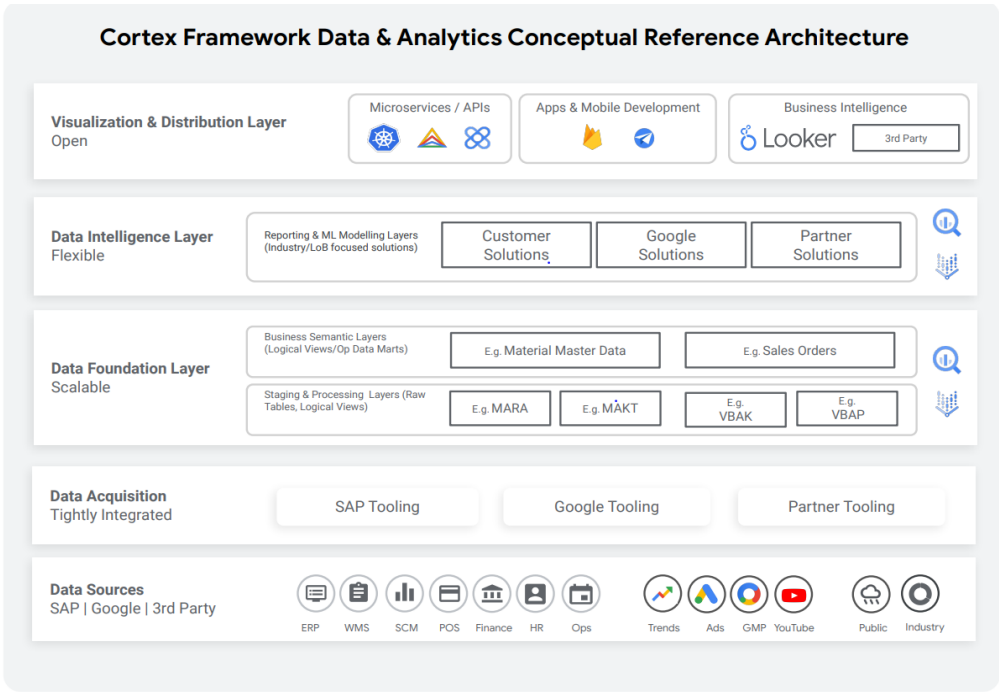
¹⁴ Intel Corp, "The Convergence of Cybersecurity and Artificial Intelligence", accessed February 24, 2022.

Increased business insights

When SAP workloads are in Google Cloud, public sector organizations can quickly and easily integrate SAP and Google technologies and products to streamline management, accelerate analytics, and automate processes. Google Cloud's API Management Platform, i.e., Apigee platform is FedRAMP-authorized. Apigee can ease the transformation from SAP ECC to SAP S/4HANA through its seamless management of APIs. API management tools can bring down the cost and time associated with developing APIs from months to weeks and allow for more seamless integration across any number of legacy systems. Additionally, much like other services on Google Cloud, Apigee can do on-demand scaling to meet the needs of spikes in usage. As an added benefit, Apigee is capable of cost recovery of this data through native monetization features of the associated data or insights generated through this SAP on Google Cloud ecosystem. An example of which could include an AI model developed by data collected by SAP and deployed onto CloudRun. This model would then be exposed as an API managed by Apigee allowing for the monetization of data without compromising sensitive information to 3rd parties.

Google Cloud can better manage SAP and related systems through their suite of services

Google Cloud simplifies and expedites the deployment of key SAP S/4HANA business processes through a business reference architecture called Google Cloud Cortex Framework. This framework assists SAP customers with ready-to-deploy templates and building blocks for SAP workloads. These pre-packaged services and deployment accelerators enable public organizations to kickstart insights and reduce time-to-value. See below, Google Cloud Cortex Framework reference architecture for context:



Google Cloud Cortex Framework is an enabler for SAP customers working to maximize the value of their data. It allows customers to kickstart insights and reduce time-to-value with reference architectures, packaged services, and deployment accelerators that guide organizations from planning to delivery, so organizations can get up and running quickly.

FIGURE 3:
Google Cloud's Cortex Framework
Data Foundation release¹⁵

Google Cloud Cortex Framework accelerator content can be utilized as a templated solution from Google Cloud and its alliances. Google Cloud Cortex Framework has the following pre-packaged features⁹:

Scenario-driven reference architectures ¹⁵	Deployment templates ¹⁵	Building blocks and blueprints ¹⁵	Integrated links to services from Google Cloud and its alliances ⁹
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The highly scalable data foundation release within Google Cloud Cortex Framework allows customers to accelerate their delivery through templates and automated deployment tools. In addition, one of the ready-to-deploy templates and building blocks Google Cloud Cortex Framework includes is Google BigQuery™ enterprise data warehouse. By leveraging Google BigQuery analytics capability, an organization can consolidate SAP and related systems and query petabytes of information at a fraction of the cost through native Google BigQuery connectors, or through Google Cloud's Apigee™ API platform tools. This service unlocks the ability to investigate the data and find patterns to drive organizational business decisions. Google Cortex Framework and Google BigQuery, support the concept of a "clean core": deployment of SAP with minimal customizations in the core ERP systems, and pushing innovation to parts of the architecture that are decoupled from but connected to the core. Further, SAP BTP solutions, such as SAP Analytics Cloud and SAP Data Warehouse Cloud, can be incorporated into the overall design to provide real-time access to SAP and non-SAP data. This federated data approach, leverages the best of both worlds, combining SAP and Google Cloud capabilities.

¹⁵ Storage Google APIS, "Accelerate SAP and Google Cloud innovation and value," accessed February 23, 2022.

Google Cloud in Action:

Accelerating Cloud innovation with Google Cloud Cortex Framework

Google Cloud Cortex Framework is an automation accelerator designed to assist SAP customers with ready-to-deploy templates and building blocks for SAP workloads. Cortex Framework includes reference architecture foundation for BigQuery along with endorsed packaged solutions.

Tools like BigQuery and AutoML provide accelerators for the development of insights, but those are just the beginning.

From innovations in analytics and AI/ML, application modernization, and high availability to SAP-certified compute and storage, Google Cloud is powering the smarter cloud.

Built on a foundation of proven technologies and solutions from Google Cloud, SAP and the trusted alliance ecosystem, organizations can deploy advanced cloud-native capabilities at a fraction of the time and cost of relying on specialized expertise.

The following graphic demonstrates how SAP can integrate with Google BigQuery and be utilized to build models leveraging SAP data.

Google BigQuery Integration

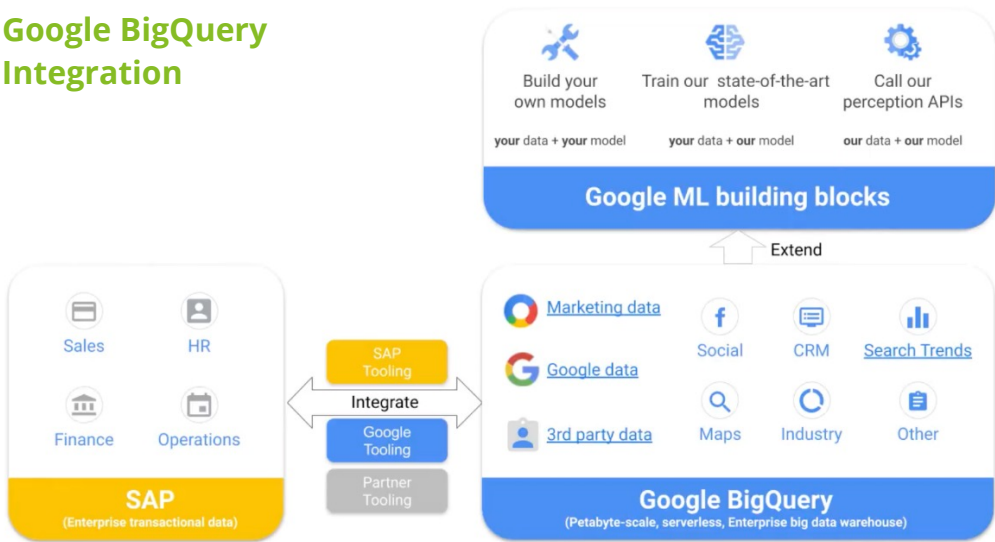


FIGURE 4:
Google BigQuery
integration with SAP¹⁶

Google BigQuery has been recognized throughout the industry for their impressive ability to lower costs and provide advanced insights. A recent IDC report sponsored by Google Cloud interviewed seven organizations that have experience with and knowledge about the benefits and costs of using BigQuery for SAP including a retail company and management consulting company. These organizations had an average of 36,200 employees and \$1.81 billion in annual revenue. The goal of the interviews was to determine how customers were able to realize additional benefits from utilizing Google BigQuery for their SAP data¹⁷. The benefits are highlighted in the table below:

Lower overall costs	Higher staff efficiency	Improved insights	Efficient investment
52% lower cost of operations for data warehousing utilizing Google BigQuery	51% more efficient data platform teams when utilizing a Google BigQuery environment	77% faster delivery of business reports compared to previous / other solution	323% 3-year ROI with an average payback period of 9 months

FIGURE 5: Benefits Associated with Leveraging BigQuery for SAP Data¹¹

Customers found a 52% reduction in operations and data warehousing over three years, a 51% increase in staff efficiency over 3 years by supporting Google BigQuery, a 77% increase in the time taken to deliver analytic reports, and a 323% increase in ROI over a three-year period with a payback period of 9 months.

¹⁶ Storage Google APIS, "SAP_and_Google_Data_Integ Image," accessed February 23, 2022.

¹⁷ Services Google, "The Value of BigQuery from Google Cloud for SAP Customers," accessed February 23, 2022.

Starting the transformation journey

The migration to cloud can be fraught with potential challenges. Selecting the right team and being methodical about this shift are both key to enabling success.

Organizations have a need to get the transition to cloud right the first time, recognizing that delays and unnecessary down time means putting the organizations' mission at stake. Recognizing that technology forms the backbone of public organizations' ability to achieve its stated mission, it is critical that these organizations select the right team for implementation and utilize a proven approach for migration.

Engaging the right team for success

Deloitte sees the mission of public sector clients through the lens of cloud, leveraging their extensive industry, strategy, human capital, security, and business domain capabilities to drive digital transformation. In 2022 Deloitte was recognized as a Leader in the Gartner Magic Quadrant for Public Cloud IT Transformation Services.¹⁸ Through the work with Ecosystem and Alliance members, Deloitte has successfully completed over **325 cloud migrations** enabled by proprietary Deloitte software which optimizes the migration process. In addition to collaborating with SAP and Google Cloud, Deloitte has also collaborated with Intel Corporation who provides much of the technological underpinning for an organization's migration to the cloud. The collaboration between Deloitte, SAP, Google Cloud, and Intel has resulted in the optimization of Intel instances for high performing SAP HANA and a seamless migration to the cloud for clients. It is through this breadth of relationship that we're able to provide a holistic, end-to-end solution for our clients. No matter the chosen direction of the IT journey, Deloitte brings the right advisors from their alliance and vendor relationships to collaborate with customers. Deloitte's approach can help customers derive maximum ROI on cloud and SAP related investments.

Figure 1: Magic Quadrant for Public Cloud IT Transformation Services



FIGURE 6:
Gartner Magic Quadrant for Public Cloud IT Transformation Services¹⁹

¹⁸ Deloitte US, "Gartner: Magic Quadrant for Public Cloud IT Transformation Services 2022," accessed February 23, 2022.

¹⁹ Deloitte US, "Gartner: Magic Quadrant for Public Cloud IT Transformation Services 2022," accessed February 23, 2022.

Deloitte's Alliance Members



Premier Alliance Partner

with over 139 partner awards over the past 6 years internationally.

Launch Partner

for SAP industry cloud launch in 2020

Strong Partner Award Performance:

4 awards in 2022 including:

- **SAP Pinnacle Award –**
Partner of the Year – Cloud Business Transformation – Sales Excellence
- **SAP Pinnacle Award –**
Partner of the Year – Sales Excellence – Large Enterprise
- **SAP Pinnacle Award –**
Partner of the Year – Industry Cloud
- **SAP Pinnacle Award –**
Partner of the Year – SAP Business Technology Platform



Premier Alliance Partner

demonstrating the highest levels of technical proficiency, expertise, and impact with customers.

Demonstrated Experience:

Deloitte holds 8 Google Cloud specializations, including SAP on Google Cloud.

Strong Partner Awards Performance:

Global Industry Solutions Partner of the Year award for 2021, Global Services Partner of the Year award for four consecutive years (2017, 2018, 2019, and 2020) and the inaugural Public Sector Partner of the Year award 2020.



Alliance Partner

demonstrating Deloitte's understanding of the importance of hardware in large-scale technology solution.

Demonstrated Experience:

Deloitte has dedicated specialists well-versed in the implications of hardware decisions on mission outcomes.

FIGURE 7: Deloitte's strong partnership with SAP, Google Cloud, and Intel Corporation

Deloitte's proven SAP to cloud migration approach

A successful migration program is contingent on an actionable roadmap that is accepted by the stakeholders and end-user communities. A detailed analysis of the technical components (infrastructure, security, hosting, etc.) is necessary to incorporate digital methods, and reduce technical complexity. Deloitte's cloud migration approach provides a repeatable process for the migration activities. The approach combines discovery, assessment, preparation, execution, and continuous operations with innovative operational and technical methodologies, such as DevSecOps and technical automation. The cloud migration approach is outlined in the graphic below.

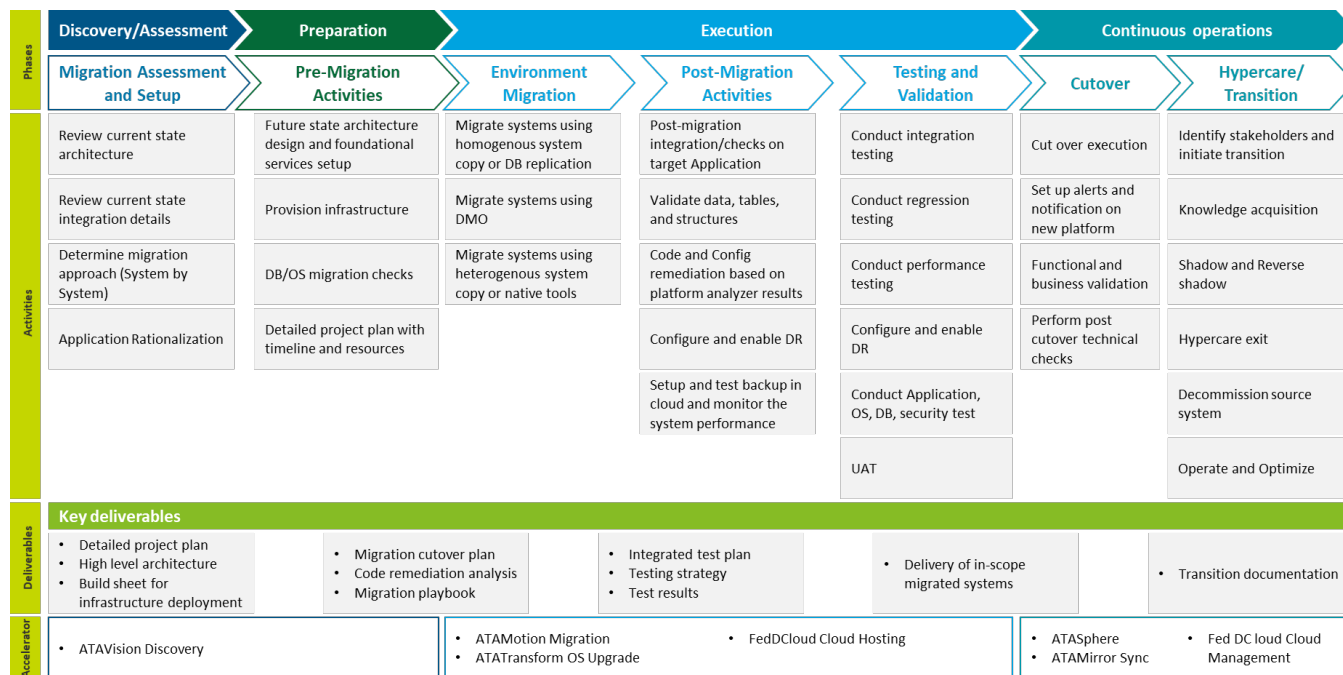
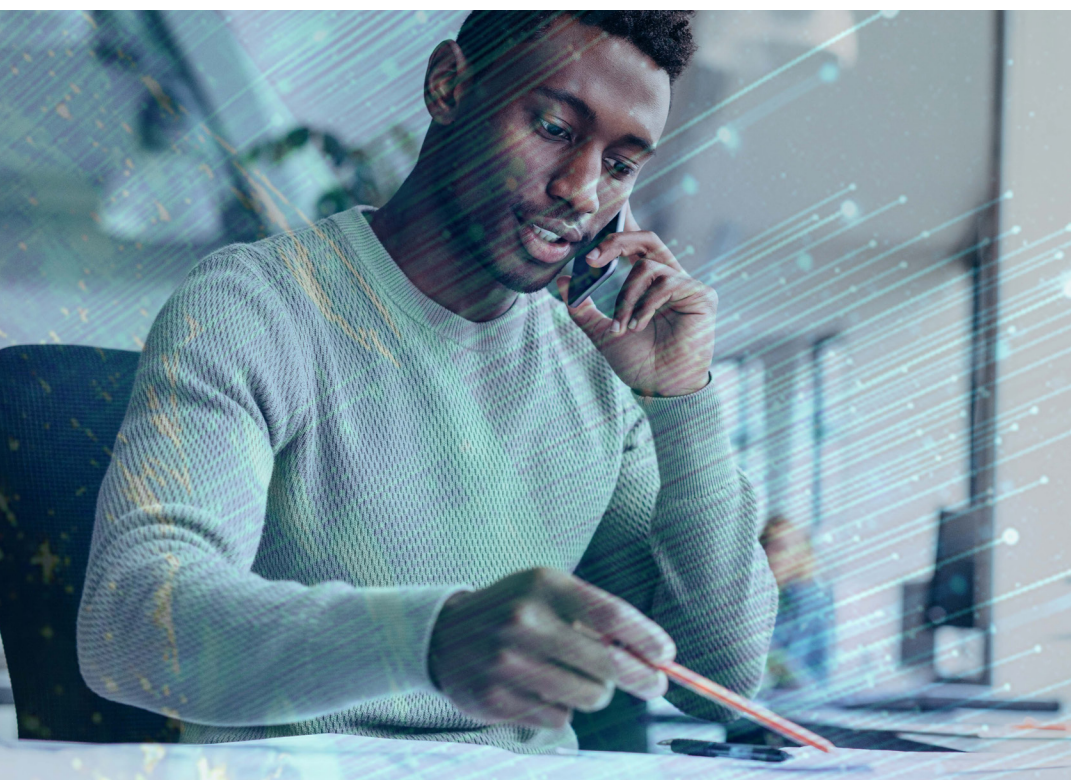


FIGURE 8: Deloitte's recommended SAP and related systems cloud migration approach



Together with Deloitte's strong Ecosystem and Alliance relationships and internal automation tools for cloud migration, we have the skills and experience necessary to assist a public sector organization in the migration of their SAP workloads to the cloud.



Meet the thought leaders

Key points of contact for any questions
regarding the content of this paper.



Marisa McWilliams

Managing Director & Public Sector SAP Leader
Deloitte Consulting LLP
mmontrasio@deloitte.com



Darren Pulsipher

Chief Solutions Architect Public Sector
Intel Corporation
darren.w.pulsipher@intel.com



Vijay Bandari

Cloud Solution Architect Data
Intel Corporation
vijay.bandari@intel.com



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