

Agentless Migration of VMware Workloads to Microsoft Azure: A Scalable and Conflict-Free Approach Using Azure Migrate

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ABSTRACT

The migration of VMware workloads to Microsoft Azure is critical for enterprises seeking cloud adoption, scalability and operational efficiency. Traditional agent-based migration tools often introduce performance overhead, resource contention and replication conflicts, particularly when deployed concurrently. Azure Migrate's agentless tool addresses these challenges, providing a seamless migration mechanism without in-guest agents while ensuring minimal downtime and data integrity. This paper analyzes the Azure Migrate agentless tool, examining its architecture, advantages and implementation in enterprise environments. The study investigates how this solution streamlines VMware-to-Azure transitions, enhances operational efficiency and preserves disaster recovery configurations where Azure Site Recovery is already in place. Through a case study, we demonstrate the efficacy of agentless migration, highlighting its capacity to right-size Azure resources, maintain workload integrity and optimize cost efficiency. The paper also outlines best practices for organizations using Azure Migrate's agentless approach, ensuring a scalable and secure migration process.

Keywords: Azure Migrate Agentless, VMware to Azure Migration, Cloud Migration Strategies, Hybrid Cloud Integration, Disaster Recovery and Azure Site Recovery, Agentless Hypervisor-Based Replication, Enterprise Cloud Transition and Virtual Machine Migration

1. Introduction

The adoption of cloud computing has become a fundamental aspect of contemporary information technology strategies, offering organizations enhanced scalability, flexibility and cost efficiency. Among the leading cloud platforms, Microsoft Azure provides a comprehensive suite of migration and management tools that enable enterprises to transition their on-premises workloads to the cloud with minimal disruptions. A critical component of this transition is the Azure Migrate service, which facilitates the workload assessment, migration planning and execution.

However, traditional agent-based migration tools often present significant challenges, including increased complexity,

performance degradation and potential conflicts, particularly in scenarios where Azure Site Recovery (ASR) already replicates workloads for disaster recovery (DRaaS). These issues create operational inefficiencies that complicate the migration of production workloads to Azure.

Several solutions are available for migrating on-premises VMware workloads to Azure while maintaining the ASR-based disaster recovery replication. One such solution is Zerto, which provides a hypervisor-based replication to facilitate seamless migration. However, Zerto requires a paid license, adding to migration costs, whereas Azure Migrate is a free native Azure service, making it a more cost-effective alternative for enterprises seeking budget-conscious migration strategies.

This study focuses on the Azure Migrate agentless tool as an optimal choice for VMware-to-Azure migration, particularly in environments where ASR is actively utilized for disaster recovery. By eliminating the need for in-guest agents, the agentless tool ensures a seamless and conflict-free migration process, thereby reducing the risk of replication conflicts and resource contention.

This study examined the architecture, key features and advantages of Azure Migrate's agentless tool, emphasizing its ability to deliver minimal downtime, scalability and integration with Azure services. Additionally, by synthesizing insights from recent research and real-world case studies, we demonstrate how an agentless approach enhances data consistency, network configuration and operational efficiency.

2. What is Azure Migrate and Why Azure Migrate

The adoption of cloud computing has significantly transformed enterprise IT strategies, necessitating efficient and structured approaches to migrating on-premise workloads to Microsoft Azure. Azure Migrate is a centralized migration, modernization and optimization service that facilitates the transition of infrastructure, databases, web applications and virtual desktops to Azure's cloud ecosystem. This tool serves as a comprehensive solution for organizations by discovering, assessing, planning and executing workload migrations and ensuring seamless integration with Azure's computational and storage resources.

The migration journey facilitated by Azure Migrate follows a structured multiphase approach, encompassing workload identification, business case generation, assessment, planning and execution. Each phase plays a crucial role in enabling a successful migration strategy, while optimizing costs and minimizing operational risks.

2.1. Phases of the azure migration journey

2.1.1. Workload identification and business case development:

The initial stage of migration planning involves identifying and analyzing workloads in an on-premise environment. This process, known as discovery, is essential to establish a clear understanding of the IT landscape and its readiness for cloud migration. Organizations can achieve this through the following:

- **Azure migrates appliance (Recommended Approach):** A lightweight virtual appliance deployed within the on-premises data center. This appliance collects configuration and performance metrics from existing servers and securely transmits the data to Azure Migrate for further analysis.
- **Manual inventory import:** In cases where deploying an appliance is not feasible organizations can import workload inventory data into Azure Migrate, allowing for a manual assessment of cloud readiness.
- Once workloads have been discovered and inventoried organizations can generate business cases for migration. Business case evaluation aids in determining whether transitioning to Azure is financially viable by estimating the costs and potential savings associated with cloud adoption. The evaluations included the following:
- **On-premises versus azure Total Cost of Ownership (TCO):** A comparative analysis of the long-term financial

implications of maintaining workloads on-premises versus Azure.

- **Year-over-year (YoY) cash flow analysis:** A projection of financial expenditures and savings over an extended period.
- **Resource utilization insights for azure targets:** Recommendations on optimizing azure resources to improve cost efficiency and performance.
- **Operational vs. capital expenditure considerations:** A transition from capital expenditure (CapEx) to an operating expenditure (OpEx) model, providing insights into long-term cost reductions.

2.1.2. Migration planning and assessment: After making the decision to migrate organizations must engage in detailed migration planning to ensure a smooth transition. Azure Migrate provides assessment tools to evaluate various factors, including

- **Azure readiness assessment:** Determines whether on-premises servers, SQL databases and web applications are compatible with azure-based resources.
- **Right-sizing recommendations:** Estimate the required VM sizes, SQL configurations and Azure VMware Solution (AVS) node allocations to ensure an efficient post-migration environment.
- **Azure cost estimation:** Projects the financial requirements for running migrated workloads in Azure, providing budget clarity for decision makers.
- **Dependency analysis:** Identifies network and application dependencies between on-premises servers, ensuring that interdependent workloads are migrated together to avoid service disruptions.

By leveraging dependency analysis organizations gain insight into the network interactions between workloads, allowing them to design optimized migration strategies that preserve business continuity and application functionality.

2.1.3. Migration execution and workload transition:

Upon completion of workload assessment and optimization organizations can commence the migration process, transferring on-premises resources to Azure, while minimizing downtime and operational risk. Azure Migrate facilitates migration of

- **Virtual Machines (VMs):** Migration of on-premises VMware, hyper-V and physical servers to Azure Virtual Machines.
- **Databases:** Transition of SQL Server databases and other database workloads to Azure SQL Managed Instance or Azure Database services.
- **Web applications:** Migration of on-premises and cloud-hosted applications to Azure app services for enhanced scalability.
- **Virtual desktops:** Deployment of Windows Virtual Desktop (WVD) and remote desktop services within Azure.

Organizations may use either Azure-native migration tools or third-party partner solutions integrated into Azure Migrate to facilitate migration execution.

2.2. Key advantages of azure migrate

2.2.1. Unified cloud migration platform: Azure Migrate provides a centralized interface that facilitates the end-to-

end cloud migration process, offering a single dashboard to manage the workload discovery, assessment and migration. By consolidating various migration functions within a unified portal organizations can efficiently track, control and execute their cloud migration strategies, thereby ensuring a well-organized transition to Azure.

2.2.2. Cost-effective and free-to-use solution: A significant advantage of Azure Migrate is its status as a free self-service tool that enables organizations to identify, assess and plan the migration of their IT infrastructure without incurring additional costs. This cost-effective approach allows enterprises to evaluate workloads for multiple infrastructure-as-a-service (IaaS) and platform-as-a-service (PaaS) Azure targets before making migration decisions. While first-party migration tools are included in Azure Migrate at no cost, some third-party partner tools integrated into the platform may incur additional charges.

2.2.3. Extensive toolset for assessment and migration: Azure Migrate comprises a range of built-in tools designed to support a comprehensive workload analysis and execution. The key components include the following.

2.2.4. Azure migrate: Discovery and Assessment - This enables organizations to perform an in-depth evaluation of their on-premises infrastructure, providing insights into compatibility, right-sizing, cost estimation and migration feasibility.

2.2.5. Azure migrate: Migration and Modernization – Facilitates the actual workload migration process, ensuring that virtual machines, databases and applications are transitioned efficiently and securely to Azure.

This integrated toolset ensures that enterprises have the necessary resources to assess, migrate and modernize their workloads within Azure's cloud ecosystem.

2.3. Key migration capabilities

2.3.1. Server, database and web application migration: Azure Migrate enables organizations to analyze and transition their on-premise infrastructure to azure-based solutions. The tool provides detailed assessments of physical and virtual servers, SQL databases and web applications, ensuring seamless migration to

- **Azure Virtual Machines (VMs):** For on-premises server workloads transitioning to Azure's computing infrastructure.
- **Azure SQL Managed Instance/Azure SQL Database:** Organizations migrating their SQL workloads to fully managed database services.
- **Azure App Service/Azure Kubernetes Service (AKS):** For enterprises seeking to transition web applications to Azure's serverless and containerized environments.

By leveraging Azure Migrate's assessment tools, businesses can identify optimal target environments and mitigate migration risks, while ensuring that their applications operate efficiently within Azure.

2.3.2. Large-scale data migration

For organizations requiring the migration of large volumes of data, Azure Data Box products offer a high-speed, cost-efficient solution for transferring terabytes to petabytes of data. This is particularly beneficial for enterprises dealing with big

data workloads, archival storage and backup migration, allowing for expeditious, secure and cost-effective data transfer without dependency on Internet bandwidth constraints.

3. Case Study

The migration of VMware workloads to Microsoft Azure necessitates a structured approach, particularly when disaster recovery mechanisms such as Azure Site Recovery (ASR) are already been implemented. In this scenario, an agent-based replication of Azure Site Recovery was configured for critical applications hosted on VMware virtual machines (VMs), replicating them to a disaster recovery site. However, as Azure Site Recovery permits replication to only one Recovery Services Vault, utilizing the ASR for migration is not a viable option. Similarly, adopting Azure Migrate's agent-based approach was also unfeasible, as it would create conflicts with existing ASR agents already deployed on virtual machines.

Given these constraints, Azure Migrate's agentless tool was selected for the assessment and migration of 1011 VMware VMs, which comprised both Windows and RHEL (Red Hat Enterprise Linux) servers. The migration process involves several critical steps.

- **Environment preparation:** The Azure Migrate appliance was deployed within the VMware vCenter and the Azure subscription and project were configured to facilitate migration. The VMware environment was prepared for discovery, ensuring that all the necessary prerequisites were met.
- **Continuous discovery:** Following the successful deployment of the Azure Migrate appliance, a continuous discovery process was initiated to collect the configuration details, performance metrics and dependency data from the VMware infrastructure.
- **Workload assessment:** Upon completion of discovery, a comprehensive assessment was conducted to:
 - Evaluate cloud readiness of the on-premises workloads.
 - Identify potential risks associated with the migration.
 - Estimate migration costs and operational complexity for each workload.

The assessment report categorized VMs based on migration readiness:

- **Cloud-ready VMs:** These VMs were fully compatible with Azure and could migrate without requiring modifications.
- **Conditionally ready VMs:** Some VMs required minor adjustments before they could be migrated. These configurations were analyzed and resolved to enable a smooth transition.
- **Unknown readiness VMs:** A subset of servers has an undefined readiness status, necessitating further investigation into configuration dependencies, software compatibility and resource constraints.

Additionally, the assessment report provided Azure VM size recommendations (SKU mappings) for each workload, enabling organizations to optimize resource allocation in Azure and enhance performance-to-cost ratios (**Figure 1**).

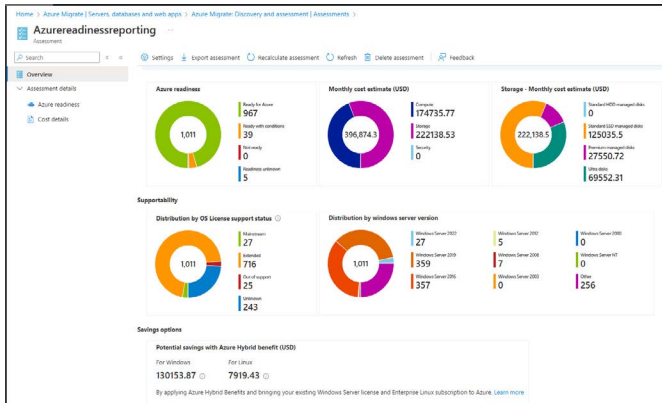


Figure 1: Azure readiness and cost estimation report for on-premises Vmware VM's.

Upon completion of the assessment report analysis, a cloud-ready virtual machine (VM) was selected for replication and migration using Azure Migrate. The migration process adhered to a structured workflow, ensuring a seamless transition aligned with the recommended configurations.

3.1. Configuring replication

The target environment in Azure was preconfigured, encompassing the resource group, subscription, virtual network and subnet. The VM was incorporated into Azure Migrate for replication, wherein the following target settings were specified:

- Azure Resource Group for VM deployment.
- Subscription details for cloud resource allocation.
- Virtual Network and Subnet configurations.
- New VM name and recommended VM size, as derived from the assessment report.
- OS Disk selection, ensuring compatibility with Azure storage.

3.2. Migration execution

Upon completion of the replication, the VM migration process was initiated. The selected VM is migrated through the following steps.

- Deactivating the source machine prior to finalizing the migration to prevent inconsistencies.
- Executing the migration process ensures the VM's transition from the on-premises VMware environment to Azure.
- The migration removed the VM from the Azure Migrate replication, ensuring its full operational status in the Azure cloud.

3.3. Post-migration configuration adjustments

Subsequent to migration, it was observed that despite the modification of the Azure VM resource name, the internal hostname (machine name within the OS) and the security identifier (SID) in Windows VMs remained unaltered. This phenomenon occurs because the rename operation in the Azure Portal solely modifies the resource name at the Azure level, without affecting the underlying system identity settings within the operating system.

To align the VM's identity with its new deployment environment, the following modifications were implemented:

The Windows VM is renamed within the OS settings to reflect the new Azure resource name.

Reconfiguring the Windows Security Identifier (SID) utilizing Sysprep ensures a unique system identity within the Azure cloud environment (**Figure 2**).

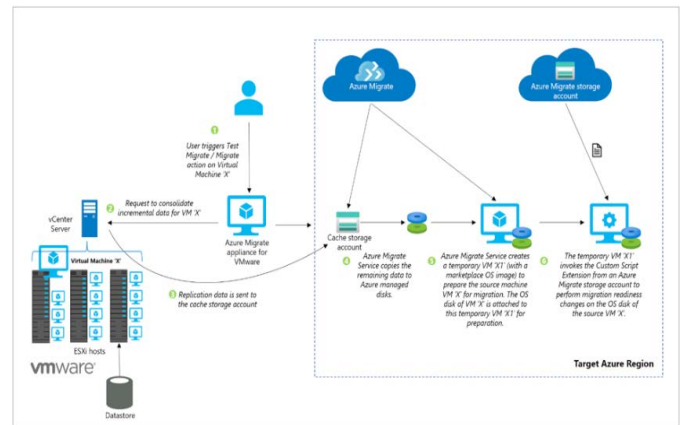


Figure 2: Azure migrate flow.

4. Analysis and Results

The migration process utilizing the Azure Migrate agentless tool demonstrated efficacy and the absence of conflicts, particularly in environments where ASR was actively employed for DR replication. The findings indicated the following.

- The agentless methodology eliminated conflicts with ASR agents, facilitating seamless workload migration.
- The assessment phase effectively identified cloud-ready workloads and provided critical insights into workload optimization.
- Resource right-sizing recommendations facilitated cost-efficient allocation of Azure resources.
- Post-migration adjustments, including hostname and SID updates, are essential to ensure proper system identity and security compliance.
- In conclusion, the migration process validates the effectiveness of Azure Migrate's agentless tool as a scalable and conflict-free solution for VMware-to-Azure transitions, ensuring minimal downtime, data consistency and seamless cloud integration (**Figure 3**).

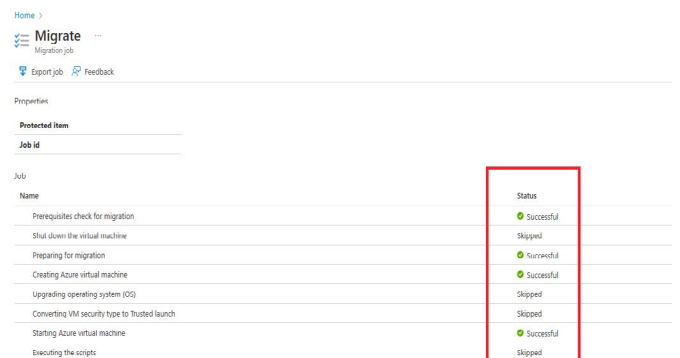


Figure 3: Migration of VM is successful using Azure migrate.

5. Conclusion

Effectively migrating VMware workloads to Microsoft Azure necessitates a methodical, expandable and non-conflicting strategy, particularly in settings where Azure Site Recovery (ASR) is already employed for disaster recovery replication. This research showed that Azure Migrate's agentless tool is an ideal solution for VMware-to-Azure transitions, effectively addressing issues related to agent-based replication conflicts, operational

inefficiencies and resource competition. The results of this study emphasize that Azure Migrate's agentless approach substantially improves the migration process by eliminating the requirement for in-guest agents, thereby ensuring a smooth and unobtrusive replication mechanism. The thorough assessment stage offers vital information on cloud readiness, potential risks, cost projections and resource optimization, allowing organizations to make evidence-based migration choices. Moreover, post-migration modifications such as hostname alignment and SID reconfiguration are crucial for maintaining system integrity, security compliance and application continuity in the Azure cloud environment. The effectiveness, scalability and automation provided by Azure Migrate's agentless tool confirm its value as a preferred migration strategy for businesses aiming to modernize their IT infrastructure with minimal downtime, data loss or operational disruption. As companies increasingly adopt cloud-first strategies, the demand for agentless, automated and cost-effective migration frameworks becomes more critical. Future studies could investigate additional automation enhancements, AI-driven migration optimizations and improvements in hybrid cloud interoperability to ensure that enterprises can achieve seamless digital transformation while preserving business continuity and resilience in an evolving cloud ecosystem.

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