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SOVEREIGN HEALTHCARE CLOUD

HC-HIPAA COMPLIANCE BRIEF

HIPAA Technical Safeguards in Multi-Tenant Infrastructure

How MicroVM isolation satisfies §164.312 requirements

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Executive Summary

HIPAA's technical safeguard requirements under §164.312 demand that covered entities implement controls preventing unauthorised access to electronic protected health information. In multi-tenant environments, this creates a specific challenge: demonstrating that isolation between tenants is not merely configured, but enforced in a manner that withstands failure or compromise.

The question auditors ask is not whether access is intended to be restricted, but whether it is possible to bypass those restrictions. MicroVM-based isolation directly addresses this requirement.

Hardware-Enforced Isolation

Each workload executes within its own hardware-enforced virtual machine. The guest kernel, memory space, and CPU context are isolated by KVM at the hypervisor layer. There is no shared kernel between tenants. This eliminates the class of cross-tenant attack vectors present in container-based systems, where kernel exploits can breach namespace boundaries.

This architecture maps to three core §164.312 requirements.

§164.312 Regulatory Mapping

§164.312(a)(1) - Access Control Unauthorised access across tenants is not merely disallowed by policy. It is prevented by hardware boundary. Administrative interfaces operate outside the guest execution context and do not provide ambient access to tenant workloads.

§164.312(b) - Audit Controls Because access paths are constrained by architecture rather than layered software controls, audit scope is reduced and evidence collection is simplified. Every administrative action occurs through a defined interface with no implicit privileges.

§164.312(c)(1) - Integrity Controls MicroVMs support ephemeral execution. Workloads can be created, destroyed, and replaced without residual state. This reduces the risk of data persistence beyond intended lifecycle.

The Container Contrast

Container-based systems rely on kernel namespaces and cgroups for isolation. These are logical constructs enforced by the same kernel that all tenants share. A kernel vulnerability becomes a multi-tenant vulnerability. Namespace escapes, while rare, are not architecturally impossible.

Container Model Risk: x Shared kernel creates single point of failure x Kernel exploit exposes all tenants simultaneously x Namespace isolation is policy-based, not hardware-enforced x Cross-tenant attack surface exists by architecture

MicroVMs eliminate this attack surface entirely.

Isolation Properties

Kernel: Isolated per tenant Memory: EPT-protected address space CPU: Ring -1 hypervisor boundary Lifecycle: Ephemeral, no residual state Admin Access: Outside guest context Audit Scope: Minimal, enumerable paths

Conclusion

In regulated healthcare environments, multi-tenancy is acceptable only when isolation is demonstrably equivalent to physical separation. MicroVM-based infrastructure meets this standard by shifting enforcement from software convention to hardware boundary.

Isolation is not configured. It is architectural.