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**Pengembangan Aplikasi Web Pengelolaan Laboratorium Virtual berbasis Hyper-V**
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# INTISARI

## Pengembangan Aplikasi Web Pengelolaan Laboratorium *Virtual* berbasis *Hyper-V*

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Laboratorium *virtual* berbasis *Hyper-V* di lingkungan kampus umumnya dikelola manual per host karena pengelolaan terpusat resmi (*System Center Virtual Machine Manager*) memerlukan lisensi mahal. Kondisi ini membuat *Provisioning* mesin *virtual* praktikum memakan waktu dan ruang penyimpanan besar, serta pengelolaan akses mahasiswa kaku jika hanya mengandalkan *Role-Based Access Control* (*RBAC*) statis. Penelitian ini mengembangkan *HyperView Dashboard*, aplikasi web pengelolaan laboratorium *virtual* berbasis *Hyper-V* yang mengintegrasikan arsitektur agent-manager terdistribusi (*FastAPI, agent .NET 8, Redis Pub/Sub*), teknik *differencing disk* dipadukan *Sysprep* dan *PowerShell Direct* untuk *Provisioning* instan, serta kontrol akses hibrida *RBAC* dan *Relationship-Based Access Control* (*ReBAC*) berbasis kelompok. Pengujian dilakukan pada satu host *Hyper-V* menggunakan 20 mesin *virtual* (10 *Ubuntu Server 24.04* dan 10 *Windows* 10). Hasil pengujian menunjukkan *differencing disk* mempercepat *Provisioning* 8,74 - 10,42 kali lipat dan menghemat ruang penyimpanan 61,36 - 87,85% dibanding instalasi manual, dengan keberhasilan konfigurasi identitas 100%. Pengujian fungsional menunjukkan *RBAC* lulus 30/30 skenario, *ReBAC* 6/6, revokasi token 3/3, dan *SSO Guacamole* 8/8. Arsitektur *agent-manager* konsisten pada operasi dasar (simpangan baku di bawah 0,31 detik) dan tahan uji beban hingga 1000 pengguna *virtual* tanpa kegagalan. *HyperView Dashboard* terbukti mempercepat penyediaan laboratorium *virtual* serta menerapkan kontrol akses granular tanpa biaya lisensi tambahan di luar infrastruktur *Hyper-V* yang telah dimiliki institusi.

Kata kunci: *Hyper-V*, laboratorium *virtual*, *differencing disk*, *RBAC*, ReBAC, *agent-manager*

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# *ABSTRACT*

## *Development of a Hyper-V-Based Virtual Laboratory Management Web Application*

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*Virtual laboratories based on Hyper-V in campus environments are commonly managed manually per host, since centralized orchestration (System Center Virtual Machine Manager) requires a costly license. This makes practicum Virtual Machine Provisioning time- and storage-intensive, while student access management becomes rigid under static Role-Based Access Control (RBAC). This research develops HyperView Dashboard, a Hyper-V-based web application integrating a distributed agent-manager architecture (FastAPI, .NET 8 agent, Redis Pub/Sub), a differencing-disk technique combined with Sysprep and PowerShell Direct for instant Provisioning, and a hybrid access-control model combining RBAC with group-based Relationship-Based Access Control (ReBAC). Testing was conducted on a single Hyper-V host using 20 Virtual Machines (10 Ubuntu Server 24.04 and 10 Windows 10). Results show the differencing-disk technique accelerates Provisioning by 8.74–10.42 times and reduces storage usage by 61.36–87.85% versus manual installation, with 100% identity-configuration success. Functional Testing shows RBAC passing 30 of 30 scenarios, ReBAC 6 of 6, token revocation 3 of 3, and Guacamole SSO 8 of 8. The agent-manager architecture proved consistent for basic operations (standard deviation below 0.31 seconds) and resilient under Load Testing up to 1,000 concurrent virtual users without failure. HyperView Dashboard thus accelerates virtual laboratory Provisioning and enforces granular access control without additional licensing cost beyond the institution's existing Hyper-V infrastructure.*

*Keywords: Hyper-V, virtual laboratory, differencing disk, RBAC, ReBAC, agent-manager*