



# INFORMATION TECHNOLOGY ENTERPRISE SOLUTIONS-3 HARDWARE (ITES-3H)

Thin Client Configuration W52P1J-16-D-0008

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# Solution Overview

This whitepaper outlines a converged HPE VDI solution designed around the HPE Hyper Converged 380 appliance (HC 380). With a foundation designed on the principles of “Intuitive, Affordable, Smart, and Integrated”, the HC 380 can serve as the ‘Swiss Army knife’ of the IT department, capable of satisfying requirements for multiple user segments and delivery models. The HC 380 enables IT to deliver the required resources to the correct users with the proper balance of security and availability, while maintaining a cost/user model that satisfies those focused on the bottom line. Built upon the HPE ProLiant DL380, the virtualized HC 380 and all its hardware and software components can be procured from a single provider – HPE.

By leveraging HPE servers, storage and networking with hypervisor and broker solutions from VMware, the HC 380 appliance offers a highly-available virtualized server and storage infrastructure that can be configured in minutes. By delivering a workload-optimized platform with pre-integrated software, customers can quickly procure, deploy and run virtual desktops and/or applications in a cost-effective and simple-to-manage fashion. This allows for single IT generalists (vs. various specialists) to not only tackle day-to-day management and deliver an end-user experience which satisfies expectations of both end users and IT staffs alike but secondarily frees up IT leaders to focus on innovation vs. simply ‘keeping the lights on’.

If you have questions please contact IBM, or our Thin Client partner CounterTrade:

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## Bill of Materials (less than 500 users)

QTY	Part Number	Description
1	BW908A	HPE 42U 600x1200mm Enterprise Shock Rack
4	P9D74A	HPE Hyper Converged 380 Cluster Appliance (Node)
4	719044-L21	HPE DL380 Gen9 Intel Xeon E5-2690v3 (2.6GHz/12-core/30MB/135W) FIO Processor Kit
4	719044-B21	HPE DL380 Gen9 Intel Xeon E5-2690v3 (2.6GHz/12-core/30MB/135W) Processor Kit

QTY	Part Number	Description
64	728629-B21	HPE 32GB (1x32GB) Dual Rank x4 DDR4-2133 CAS-15-15-15 Registered Memory Kit
4	724864-B21	HPE DL380 Gen9 2SFF Front/Rear SAS/SATA Kit
8	804587-B21	HPE 240GB 6G SATA Read Intensive-2 SFF 2.5-in SC 3yr Warranty Solid State Drive
16	804671-B21	HPE 800GB 6G SATA Write Intensive-2 SFF 2.5-in SC 3yr Warranty Solid State Drive
48	781518-B21	HPE 1.2TB 12G SAS 10K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive
4	719073-B21	HPE DL380 Gen9 Secondary 3 Slot GPU Ready Riser Kit
4	719076-B21	HPE DL380 Gen9 Primary 2 Slot GPU Ready Riser Kit
4	665243-B21	HPE Ethernet 10Gb 2-port 560FLR-SFP+ Adapter
4	749974-B21	HPE Smart Array P440ar/2GB FBWC 12Gb 2-ports Integrated FIO SAS Controller
4	726821-B21	HPE Smart Array P440/4GB FBWC 12Gb 1-port Integrated SAS Controller
4	726897-B21	HPE Smart Array P840/4GB FBWC 12Gb 2-ports Integrated SAS Controller
12	783009-B21	HPE DL380 Gen9 8SFF SAS Cable Kit
4	785989-B21	HP DL380 Gen9 2SFF x8 Front Cable Kit
4	786092-B21	HPE DL380 Gen9 8SFF H240 Cable Kit
8	753958-B21	NVIDIA GRID K2 RAF PCIe GPU Kit
4	733660-B21	HPE 2U Small Form Factor Easy Install Rail Kit
4	719082-B21	HPE DL380 Gen9 Graphics Enablement Kit
8	720620-B21	HPE 1400W Flex Slot Platinum Plus Hot Plug Power Supply Kit
4	JG505A	HPE 59xx CTO Switch Solution
2	JG510A	HPE 5900AF-48G-4XG-2QSFP+ Switch
2	JC772A	HPE 5900AF-48XG-4QSFP+ Switch
12	JD096C	HPE X240 10G SFP+ SFP+ 1.2m DAC Cable
8	JD097C	HPE X240 10G SFP+ SFP+ 3m DAC Cable
2	JG326A	HPE X240 40G QSFP+ QSFP+ 1m DAC Cable
9	C7535A	HPE Ethernet 7ft CAT5e RJ45 M/M Cable
8	JC680A	HPE A58x0AF 650W AC Power Supply

QTY	Part Number	Description
4	P9D85A	HPE ConvergedSystem 380-HC StoreVirtual Software LTU
1	HA124A1 XW4	HPE 3Y 4 hour 24x7 Proactive Care SVC
1	H1K92A3	HPE 3Y 4 hour 24x7 Proactive Care SVC
1	H1K92A3 YMW	HPE Hyper Converged 380 System Support
4	H1K92A3 YMX	HPE Hyper Converged 380 Node Support
4	H1K92A3 YMY	HPE Hyper Converged 380 SW LTU Support
1	HA114A1	HPE Installation and Startup Service
1	HA114A1 5WG	HPE 300 Series HC StoreVirtual Strtup Svc
43-84	M7K12AAE	VMware Horizon Enterprise 10 Pack 1yr Concurrent Users E-LTU

## Thin Client Options

We have included three thin client options to cover multiple use cases.

**Note:** Model numbers have been provided for the thin clients since part numbers will vary based on the OS selected and other configuration options.

### Basic User: HP t520 Flexible Thin Client

The basic option fits end users with limited application needs such as word processing and internet-based apps. Use cases include data entry, kiosks and general workstations.

- Dual-Core processor with integrated graphics card
- Single display (1920 x 1200), DVI or VGA
- 6 USB ports
- No serial, parallel or PS2 ports (no ability to repurpose older peripherals)
- No slot expansion options

### Midrange User: HP t620 Series Thin Client (Standard)

The midrange option supports end users requiring dual displays or additional computing and graphics capability. Use cases include knowledge workers in the legal, finance, engineering or marketing fields.

- Dual-Core processor with AMD Radeon HD 8280E graphics (1.65 GHz);
- Dual display (2560 x 1600), 2 DVI or 1 DVI + 1 VGA
- 8 USB ports
- 0 serial, 0 parallel and 2 PS2 ports (limited backward compatibility)
- No slot expansion options

## Advancer User: HP t730 Thin Client

The advanced option supports up to 4 displays and contains significant processing and graphics boosts. Use cases include displaying GIS maps or security stations requiring the display of multiple feeds.

- Quad-core processor with Radeon HD 9000 based graphics core
- Quad display (Up to 4096 x 2160 x 24 bpp @ 60 Hz), 4 DVI or 3 DVI + 1 VGA
- 9 USB ports
- 2 serial, 1 parallel and 2 PS2 ports (backward compatibility for older peripherals)
- 1 x half height PCI Express expansion slot x16 physical slot wired as a x8 (rear)

## More than 500 Users

The Bill of Materials above can be doubled, which is designed to provide future growth capacity up to 2,000 end users.

## Additional Optional Software

QTY	Part Number	Description
1	MCE1Y0100	PCoIP Management Console Enterprise Edition - Subscription license ( 1 year ) - 100 devices
1	N/A	Stratusphere FIT
1	MOVCADE-AA-CA	McAfee MOVE AntiVirus for Virtual Desktops - Perpetual License, 51-100 OS Instances, 1 Year

For organizations seeking to gather usage metrics directly from existing physical desktops (to assist with the pre-assessment data gathering process), the following item can be added:

PCoIP Management Console allows a small team to easily update thousands of devices. It also assists with asset management.

Stratusphere FIT collects and logs environmental metrics on:

- Users and user groups
- Applications and application versions
- Used versus installed applications
- Operating systems
- Resources including CPU, RAM, Disk and graphics (GPU)
- Storage IOPs
- Network bandwidth

McAfee MOVE antivirus reduces resource requirements by moving the compute usage to a centralized layer instead of polling each VM directly.

## Preventing “Boot Storms”

A VDI boot storm occurs when a large number of users boot up at the same time (such as at the start of a business day), creating a “storm” of requests that can overwhelm network resources and degrade performance. Even though a VDI solution may have been designed to adequately perform under ordinary network conditions, it may still be vulnerable to boot storms which can impact end user experience and threaten the success of the migration. While adding SSD memory to the storage solution may resolve this constraint, it can also drastically increase the overall project cost, resulting in an over-provisioned and under-utilized resources. The solution outlined in this whitepaper uses Adaptive Optimization to balance the need for performance boosts during temporary high activity, and the budgeting and financial realities facing agencies today.

### Overview of Adaptive Optimization

Adaptive Optimization is an innovative technology that greatly increases the efficient use of faster storage devices by intelligently moving data between storage devices with different performance characteristics within a single storage system. These differing storage devices, or tiers, have different speeds and costs. Adaptive Optimization detects the most frequently accessed data and in real time, migrates it to the highest performing tier, displacing less frequently accessed data to slower, less expensive disk storage. The net result of this selective provisioning is to offer performance approaching pure solid-state at a much lower cost. The feature adapts to changing workloads, re-provisioning storage to optimize the performance of a new workload. Each StoreVirtual storage system performs this re-provisioning independently based on its own workload.

Traditional tiered solutions have suffered from slow reaction times due to the scheduled transfers of data between tiers. While this has helped to mitigate performance degradation from excessive data movement, this type of tiering requires detailed planning and added management complexity and administrator overhead to the project. In contrast, the Adaptive Optimization feature reduces planning complexity by utilizing innovative algorithms to pinpoint hot data at a highly granular level and re-provision data in real time while maintaining a balance between background IO operations and application IO requirements. The result is an effective solution that increases performance substantially without administrator intervention.

### Advantages of Adaptive Optimization

The primary benefit of Adaptive Optimization is the ability to realize a higher level of performance by adding a small amount of Tier-0 storage compared to what could be achieved in a system consisting only of Tier-1 storage. This is accomplished at a much lower price point than a system consisting of only Tier-0 storage. By combining SSD and SAS drives the effective performance of the storage systems can approach that of an all SSD system in terms of both IOPS and latency. However, the system also benefits from the capacity provided by the SAS drives which drives down the cost considerably.

## Benefits of this Configuration

- **Simple, out-of-the-box deployment:** Ready to deploy virtual desktops in an hour
- **Predictable scale out:** Linear, non-disruptive VDI scaling supports desktop growth with efficient provisioning
- **Excellent user experience:** Eliminates storage bottlenecks resulting in faster application responsiveness regardless of size or type of deployment
- **Eliminate sizing risk:** Define VDI in terms of end-user requirements and minimize performance risk with VDI assurance.
- **Business continuity:** Get highly available desktops for mission-critical environments using built-in native replication and disaster recovery.
- **VMware, Citrix and Microsoft integration:** Support for VMware View Composer Array Integration (VCAI), Microsoft offloaded data transfers (ODX), and native plugins for Citrix XenDesktop Studio.
- **Lower costs:** Reduce on-going operating costs with simplified management, and shrink the IT footprint with the industry's highest virtual desktop density

# Potential VDI Project Pitfalls

Before embarking on a VDI project, reviewing the most common issues typically encountered helps to lower the risk of a failed project and minimize unexpected costs or resource demands.

## Not Involving Users

The success or failure of a VDI project hinges upon the user experience. Without their involvement, it can become very difficult to uncover the special requirements and demands that will ultimately affect user satisfaction. This means that users need to be involved throughout the entire project. User questionnaires are a simple way to increase involvement and lay the foundation for a responsive architecture.

## Picking the Wrong Team Members

While it may seem logical to build a VDI project team around virtualization architects, members with expertise managing desktop and application environment are more essential. Virtual desktops are far different than virtual servers, making virtualization expertise less applicable. The similarities between effective desktop and application management in both the physical and virtual environments, however, make these skills highly transferable. Additionally, storage, server and network specialists will also be needed to properly configure the environment.

## Not Defining Proper Use Cases

VDI use cases take into account the different roles within an organization, and how each of those roles may impact bandwidth, CPU, graphics processing and storage requirements. Overlooking the needs of a particular use case can lead to an architecture that is inadequate, negatively impacting all users.

## **Not Conducting a Pre-Assessment**

Desktop and application pre-assessments are critical for determining the technical requirements and utilization of the environment. Without this data, assumptions are made and the project's risk rises significantly. Adjusting computing resources or licensing requirements after the fact can be far more disruptive and expensive than polling accurate usage data and sizing the VDI properly to begin with. Including the Statusphere FIT pre-assessment software (listed in the *Additional Optional Software* section) provides for a more thorough and rigorous collection of data, which may lead to a more precise log of software utilization than by relying on surveys alone.

## **Not Optimizing the Desktop Image**

While the effects of optimizing a physical desktop may be minimally noticed by most users, the compounding effect of a non-optimized desktop image can dramatically impact the user experience in a virtual environment. Each unused service or application can place unnecessary strain on common resources, degrading performance or requiring larger sizing than is efficient. Determining which underutilized services or applications can be removed requires balancing the goal of efficient performance against the user demand for certain functionality. While a non-optimized image may result in poor performance, an over-optimized image may remove functionality that users require.

## **Underestimating Impacts to the Performance of Other Systems**

In a physical desktop environment, workload and performance impacts from the use of some applications may go unnoticed by users. In a common environment, however, where all user activity competes for limited resources in a common pool, performance issues can amplify rapidly. Relying on realistic proof-of-concept and pilot programs are the only way to reliably expose and mitigate these potential issues.

## **Not Developing an Application Deployment Strategy**

Application sprawl, the accumulation of “one off” applications and specialty products across an organization, can result in the organization-wide collection of hundreds of different applications. While the organization may have application deployment strategies for the common applications, these strategies may not include the myriad of applications utilized by a handful of users. Application deployment strategies must address commonly used applications, those specific to a user group, as well as those that are only used by a few individuals. One possible solution for some “one-off” applications that are not a good fit for VDI is to place them on a physical machine and access them via RDP. The deployment strategy should also consider the performance hit that may occur if application updates need to be pushed out to a large number of desktops in a short period.

## **Mismanaging (or Skipping) the Pilot Project**

Given the large number of variables involved in any VDI solution, the only way to get a true sense of how successful a VDI environment will be is to engage real users from various use cases in a pilot environment. The pilot must generate meaningful load data, and represent a good cross section of the rollout environment. Running a “simple” pilot that does not mimic likely real world demands (or, worse yet, failing to even run a pilot) means all sizing and utilization figures are based on assumptions which could easily be wrong. Trading actual metrics for theoretical ones greatly increases the risk level of the entire VDI project.

## **Lacking a Dedicated Project Manager**

Without a dedicated project manager, several factors can work against the project. Given the short time frame between the pilot and final rollout, the window for incorporating changes based on feedback from the pilot can be very compressed. A project manager can ensure that the data actually gets collected, and the changes are made on schedule. Additionally, the project manager can also help synchronize a team of diverse resources, and avoid the finger pointing that usually accompanies ad-hoc management by committee.

# Process Outline: How to Migrate to a Thin Client Environment

## Best times for a Migration

While a VDI migration can be scheduled at any point, there are certain conditions where “piggybacking” off of other already planned IT events can reduce the cost, resources and disruption associated with a transition. Examples these types of coinciding events include:

### PC Refreshment Cycles

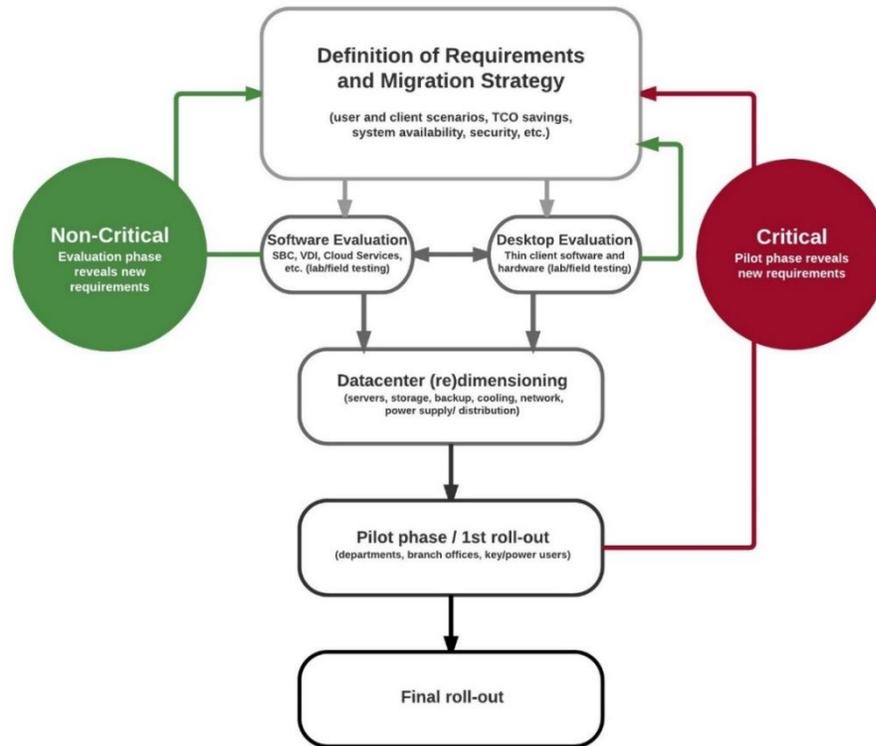
Instead of spending resources on a refreshment cycle of new PCs, the same resources can be shifted to a migration.

### Data Center Upgrades

When work is already scheduled to conduct upgrades to a data center, including a VDI migration offers less potential incremental disruption and resource demands since downtime and critical personnel may already be scheduled. Specific events to align with could include:

- Server Virtualization
- Equipment Upgrades
- Energy Optimization

Synchronizing a VDI migration with any combination of these other events leverages resources and helps optimize scheduling and minimize overall user impacts.



## Migration Plan

Organizing the migration tasks into a 5-step process allows for a more controlled, cohesive approach to the planning process.

### Analysis

During the Analysis phase, data is collected that will form the foundation of the next phase, Evaluation. This data can include:

- User Surveys
- Pre-Assessment Data (if using logging software)
- Concurrent Remote Users (and timing patterns)
- Data Center Upgrade Plans

#### Important Conditions to Identify:

- Applications that are used by relatively few users (but may be critical to those users)
- Groups or applications that have resource-heavy demands
- Users that do not fit easily into standard user groups

By the end of this phase you should be able to categorize users into logical user groups, build a list of common applications, catalog sporadically used applications, recognize high-demand users or applications and identify users that span multiple user groups.

## Evaluation

Once the data from the Analysis phase has been collected, it will be used to determine which architectural choices are appropriate for the environment. This evaluation should include identifying worker types, determining the scope of remote users and any other factors that may make a VDI implementation more difficult.

### Considerations:

- VDI Access Method: HTML5, Zero/Thin Client, VDI Client Application
- Client Choices: Thin Client (if GPU offloading is required) vs. Zero Client
- Boosting CPU and Graphics Processing
- Other Goals (Consolidation, Security/Backups, Energy efficiency etc.)

At the end of the Evaluation phase, your team should have made the architectural choices to allow for the next phase, Dimensioning.

## Dimensioning

When determining appropriate hardware dimensioning for a VDI environment, the first factor considered should be user performance. Ultimately, users will judge the success or failure of this project, and that judgement will be based on performance. Lags in response times, loss of functionality previously available in a physical desktop, and increased complexity can each doom an otherwise technically successful VDI project.

### Other Factors to Consider:

- Redundancy/Availability
- Retaining RDP Capability
- Tiered Storage Assignment
- Managing User Personas
- Space for Swap Files

## Testing/Piloting

Before conducting a full pilot, an optional simple proof-of-concept test can be set up to see if VDI is a good fit for the specific use cases in your organization. While it adds one more mini-step to the process, the ease of setting up a minimal testing environment means that the payoff from identifying potential road blocks early in the process usually outweighs the extra work. A productive pilot phase is critical for providing the real world feedback required to rollout a successful VDI environment. Incorporating lessons learned through the pilot before rolling out the production

version is essential. One of the consequences of not employing a dedicated project manager is that the collection of this pilot data may not be timely enough to impact the rollout, essentially wasting the benefits accrued during the pilot itself.

## Rollout

One benefit of the VDI setup process is that the configuration done in one stage can be easily transferred to the next. This means that work performed in the testing and pilot stage forms the foundation of the rollout stage. During this phase, as full scale is reached, many of the final issues revolve around more physical characteristics such as cabling, connecting monitors to clients etc.

# Successful Post-Launch Strategies

Once the VDI project is running in a full production environment, there are a few steps to ensure long-term success.

## On-Going Management

Although the life-cycle of a thin or zero client is significantly longer than a physical desktop, these devices will also require a refresh at some point. Scheduling the refresh cycle in advance can minimize future downtime and resource demand.

As user activity increases over time, several factors should be monitored to ensure performance standards are being met:

- GPU offloading (for power users with high graphics requirements)
- Data growth and storage demands
- Security upgrades and threat assessment

## Future Scaling

Properly forecasting when the VDI environment will require scaling is essential to budgeting the resources required for an upgrade. The Stratusphere FIT software listed in the *Additional Optional Software* section of the bill of materials includes this functionality. A popular alternative, with both free and paid versions, is Veeam's One for VMware.

<https://www.veeam.com/virtualization-management-one-solution.html>

This solution provides:

- 24x7 real-time monitoring and alerting
- 200+ pre-set alarms
- 100+ predefined reports
- Infrastructure Assessment tools for backup