Infrastructure Orchestration and the Next Generation Data Center

Enterprise data centers are filled with underutilized hardware platforms, statically configured to individual operating systems and applications — the direct result of legacy computing architectures not optimized for flexibility or responsiveness. Consequently, these environments are extremely complex and difficult to manage, resulting in high costs due to:

- Hardware and software over-provisioning for peak loads, high availability, and disaster recovery
- Resource utilization that averages just 15 to 20 percent
- Excessive expenses for space, power and cooling
- Personnel-intensive administration of redundant power, LAN, SAN, and management networks

Server virtualization provides a solution to these challenges for non-critical edge applications by consolidating smaller underutilized systems onto a single host server (see Figure 1). However, most business-critical and mission-critical applications are unlikely candidates for server virtualization because they require the high processing power and I/O performance that comes from dedicated physical servers.

Infrastructure orchestration, the next generation of data center management, delivers unprecedented agility and high availability to all applications, whether running on physical or virtual servers. This capability is realized today with Dell™ PAN System. Dell PAN System combines Dell PowerEdge™ servers with PAN Manager® software by Egenera® for Dell in a highly available and flexible computing platform that eliminates the need to maintain dedicated servers for scalability, high availability, or disaster recovery. PAN Manager aggregates processing, network, and storage resources into shared pools, enabling applications to be “right-sized” to data center resources in response to changing business demands.

With PAN Manager, enterprises can leverage x86 servers for critical applications, delivering automatic high availability and verifiable disaster recovery without the management complexity associated with static server configurations. In addition, PAN Manager is a zero-impact solution. It does not lower server performance the way other layered management products do. The end result is that enterprises are able to slash server count by up to 50% and reduce data center complexity by up to 80%.1

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1 For a complete list of Egenera customer case studies describing specific cost savings and other benefits, visit www.egenera.com/customers-case-studies.htm
PAN Architecture

PAN Manager aggregates multiple Dell servers into a Processing Area Network (PAN), which removes the physical bindings that processors and memory have with each server configuration and application. PAN abstracts server and network resources in the same way that a SAN abstracts storage resources (see Figure 2). PAN breaks the CPU and memory away from other non-core functions and removes all state and identity from the server. Therefore, any physical server can host any application (with any x86 operating system), at any time, automatically, because processing resources are shared.

When processing resources are pooled and shared, they can be flexibly allocated to any application as needed, whether for high availability, scalability, or disaster recovery. The result is a dramatic reduction in equipment levels, cost, and complexity, while delivering higher service levels in support of business operations.

The PAN architecture starts with a physical foundation consisting of three components:

1. **Stateless and anonymous processing servers**. PAN servers utilize only CPU and memory. System storage, Network Interface Cards (NICs) and Host Bus Adapters (HBAs) are centralized in the PAN Controller and abstracted through software to the servers, thereby eliminating any specific physical identity or state.

2. **Intelligent Fabric provides low-latency switching to support disk and network traffic**. The low latency fabric provides the physical switching layer for network and storage traffic through point-to-point connectivity among all control and processing servers in a PAN. Two redundant fabric switches support high data transfer rates between individual servers and between the servers and PAN Controllers.

3. **PAN Controller hosts the PAN Manager software, stores server definitions, and acts as physical I/O bridge**. The PAN Controller stores abstract server definitions and maps servers to physical CPU and memory. The PAN Controller also serves as a physical I/O bridge that dramatically consolidates the I/O infrastructure in the data center. All I/O between the Dell PAN System and the outside world occurs via ports on the PAN Controller which presents a host address (MAC, WWN) external to the PAN.
Introducing the Dell PAN System

Consolidated and Redundant I/O

The PAN architecture supports thousands of internal virtual switches, which enable massive I/O consolidation and reduced IT complexity. The dramatic reduction of physical complexity eliminates much of the labor associated with SAN/LAN provisioning because the SAN and LAN are only configured to the PAN Controllers once during installation. Applications and operating systems can be re-allocated to other physical hardware or locations without additional SAN or network configuration.

In addition, PAN provides integrated multipath support, which further reduces complexity and increases availability by consolidating and load-balancing I/O across redundant physical connections. In legacy architectures, multipath support is not integrated and requires the installation and maintenance of third-party software.

Built-In Reliability and Scalability

PAN is adaptable to a variety of high-performance hardware/software configurations and delivers built-in networking and I/O consolidation, full redundancy, and an infrastructure that protects hardware investments. Specific benefits include:

- **High-end serviceability**
  Since the servers are hot swappable, the PAN provides less than 30-second replacement time with application recovery time on the order of minutes. Administrators can increase or decrease processing capacity while power is on and the system is running. This facilitates the rapid and cost-effective replacement of failed components and permits processor/OS migrations without a forklift upgrade.

- **Improved I/O latency**
  System resources are connected using a built-in, low latency fabric. This internal network is significantly faster than a typical enterprise backbone, achieving high-throughput data transfer rates between applications running within the PAN. The result is a notable performance improvement versus using the standard data center network.

- **Full redundancy**
  All physical and virtual components in the PAN are fully redundant with no single point of failure. The PAN's active/active architecture provides high availability and increased throughput, resulting in exceptional speed and efficiency.

Dell PAN System Packaging

Dell PAN System combines Dell PowerEdge servers with PAN Manager software (see Figure 3). Table 1 shows a comparison of the specific components used for two configurations. Both configurations leverage the inherent capabilities and performance benefits of the PAN architecture using Dell PowerEdge servers and Dell PowerConnect™ switches. The Dell PAN System is designed to provide the following PAN architecture functionality:

**Servers:**

PowerEdge servers provide the system processing resources. These servers are stateless and anonymous, meaning that no system- or application-specific information is maintained locally. Instead, all firmware, system software, application software, and configuration information is stored on the SAN and mapped to an available server by the PAN Controllers.
PAN Controllers:
Two redundant PAN Controllers provide the I/O, health monitoring, and dynamic allocation of the system’s processing resources. The controllers perform all of the I/O on behalf of the entire system and for this purpose contain:
- Four 4-Gigabit-per-second Fibre Channel ports to a storage area network fabric that contains all disk partitions available to the PAN
- Eight 1-Gigabit-per-second Ethernet ports to the external network
- DVD drive
- Local hard disk

Fabric Switch:
Fully redundant Ethernet switches provide a converged low-latency fabric that transmits both disk and network traffic across the PAN. This fabric delivers a bidirectional 2 Gigabit-per-second (Gbps) fabric between servers and out to the PAN Controllers.

PAN Management Switch:
This switch supports out-of-band (OOB) management. In addition, a Dell Remote Assistance Card (DRAC) in each server and PAN Controller connects into the switch enabling remote management of individual PAN components.

Server Configuration
Dell PAN System servers are housed in a chassis, which provides a secure environment for the resident servers, as well as maximum visibility, accessibility, and airflow.

Figure 3: Dell PAN System combines Dell PowerEdge servers with PAN Manager software by Egenera for Dell
Introducing the Dell PAN System

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Table 1: Dell PAN System server configurations

PAN Manager Delivers Unified Infrastructure Orchestration

The PAN physical foundation is augmented by PAN Manager software, which abstracts the traditional hardware interfaces, enabling dynamic allocation of computing resources. When compared with legacy infrastructures, PAN Manager eliminates much of the complexity associated with server configuration management. PAN Manager provides the Dell PAN System with a number of inherent and integrated features that include:

- Centralized management of multi-server environments from a command line or GUI, accessed from any Web browser or telnet client (permitting remote, lights-out control).
- System event and monitoring capabilities that continuously monitor system health at both the hardware and application levels, and initiate failover when needed.
- A robust security model, including the ability to allocate resources to different organizational units that remain completely isolated from one another.

PAN Manager pools compute, network, and storage resources so they can be flexibly and dynamically allocated, enabling the Dell PAN System to deliver a truly unified computing platform that seamlessly provides:

- n+1 high availability and automatic failover to every application
- Verifiable n+1 disaster recovery to multiple datacenters
- Automated load balancing
- Rapid scale up, scale down, configuration and reconfiguration of servers
- Integrated management of both physical and virtual servers
- Consolidated servers and I/O connectivity
Introducing the Dell PAN System

These computing benefits are delivered by the following three PAN Manager components.

**PAN Builder™ software by Egenera for Dell**

PAN Builder provides PAN Manager’s foundation management services along with the user interface required to build, monitor, and control a PAN. PAN Builder offers the following services:

- **Server definition management:** Abstract server definitions allow IT administrators to dynamically move applications to any physical or virtual server within the PAN. The definitions are used to load the correct operating system and application images and retain bindings to the storage and networking resources.

- **On-demand server provisioning:** IT administrators can quickly configure servers from a management console rather than wiring each new server and manually installing software. This feature enables data center personnel to improve their responsiveness by rapidly provisioning servers and right-sizing applications to available resources.

- **Integrated server virtualization:** PAN Manager supports industry-standard server virtualization products, allowing you to manage both physical and virtual computing resources with one set of tools and processes. In addition, Egenera distributes Citrix® XenServer™ as a feature of PAN Builder.

- **Monitoring:** PAN Manager continuously checks the health and resource utilization of the system hardware and software and responds according to user-specified policies. This feature maintains application availability automatically, without requiring constant operator intervention.

- **Chargeback:** PAN Manager collects physical and virtual utilization data that can then be imported into billing and analysis applications. The data helps IT management better determine how costs are distributed, how to effectively map applications to available servers, and how to plan for future resource investment.

- **Administrative security:** Senior IT staff can specify ownership of and access rights to PAN resources among authorized IT administrators. PAN Manager defines three security roles: Administrator, Operator and Monitor. These roles can be assigned to all or a subset of the available PAN resources.

**PAN Server Portability™ software by Egenera for Dell**

PAN Server Portability allows for logical server images to shift between processing resources.

- **N+1 hardware high availability:** Failover resources can be shared across production environments, delivering automatic high availability to every application. If any processing server fails, all applications are automatically restarted on a designated stand-by resource within the time it takes to reboot the operating system.

- **Rapid scalability:** Applications can be right-sized to actual business needs and automatically scaled at times of peak demand. Scalability is achieved by moving applications to servers with more performance or dynamically adding additional servers in a horizontally clustered environment.

- **Dynamic repurposing:** Physical servers of various configurations can be easily repurposed to run different applications (with different operating systems) at different times. For example, disaster recovery resources can be repurposed for test/development/training and then assume the role of running production workloads when a site outage occurs.

**PAN Portability™ software by Egenera for Dell**

PAN Portability allows for entire PAN configurations to shift between arrays of processing resources. A PAN archive file, which describes an entire PAN configuration, is stored on the SAN and then automatically replicated between sites. PAN Portability delivers:

- **Verifiable Disaster Recovery:** Recovery procedures are verifiable, meaning that PAN Manager replicates the production environment exactly. The process works the same way every time and reduces recovery to 20-30 minutes (versus hours or days with traditional server architectures).
**Simplified Disaster Recovery management:** Disaster recovery management is simpler than with traditional approaches because change control processes are made only at the primary site. The PAN archive is automatically replicated along with any change in the underlying infrastructure configuration (e.g. firmware/driver updates, BIOS version levels, network configuration changes).

**N+1 Disaster Recovery:** One secondary disaster recovery site can support multiple primary production sites.

**Rapid repurposing of Disaster Recovery resources:** Because entire PAN environments can be repurposed very quickly and easily, disaster recovery resources can be used in the interim to support functions such as Development and QA, resulting in more efficient use of disaster recovery resources and lower TCO.

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**Enable Your Dell PAN System With Dell Support Services**

Dell ProSupport for IT is included with the Dell PAN System. With Dell ProSupport for IT, you are treated like the expert you are – allowing you to satisfy the needs of your internal customers while also freeing up your time to focus on strategic IT projects.

Dell ProSupport for IT provides:

- Ability to fast-track dispatch parts and labor, bypassing basic troubleshooting (certification required)
- 7x24 direct access to Dell Expert Centers
- Access to Dell IT professional training and certification
- Collaborative support for select third-party hardware and software vendors
- Single point-of-contact escalation management with customer-defined severity levels
- Global Command Centers to manage critical situations, monitor all mission-critical onsite dispatches, and provide proactive crisis management coordination and communication during events like natural disasters.

In addition to ProSupport for IT, Dell offers an acceleration service for the Dell PAN System called Dell PAN System Design and Implementation Accelerator. This is an estimated three week consulting engagement from Dell Global Infrastructure Consulting providing PAN implementation strategy, application/database deployment, configuration support, knowledge transfer and best practice assessment and recommendations. After deployment, your administration team will have acquired the tools and best practice guidance required to manage your Dell PAN System in a production environment.

We place an emphasis on:

- Competency ramp-up of your IT team through detailed examples, knowledge transfer and documentation of how PAN Manager software benefits the server, SAN, and network infrastructure team
- The determination of opportunities to improve the strategic and functional utilization of the Dell PAN System. Best practice includes the methodology to improve operational efficiencies and business processes for the PAN architecture
- The implementation of a strategy for server consolidation while utilizing PAN Manager for ease of administration
- The implementation of processes and technology to allow system administrators to rapidly deploy servers within minutes
- Working to help you scale your environment quickly and easily while maintaining the ability to return processing power when the need dissipates
- Helping your team to size and upgrade a server with minimal downtime
- Understanding Dell PAN Disaster Recovery principles, so the Dell PAN System can provide fully utilized, guaranteed failover as part of a business continuity plan
Why Wait? Take the Next Step

If you think your enterprise can benefit from infrastructure management and orchestration, then look to Dell and Egenera. With the Dell PAN System, you simply turn the system on and start working—achieving unprecedented levels of agility, scalability, and high availability for all your applications.

For more information on how infrastructure orchestration can take you to the next level, please visit www.egenera.com or email us at dell@egenera.com.