Inefficiencies of Existing Data Centers

Industries in several vertical market segments are experiencing spiraling growth in data services. This growth is driven primarily by the industries’ need for increased operational visibility and oversight, more efficient access to data, and mining that data for business intelligence. Examples of these industries include social networking, health care, transportation, and retail.

To address its data growth needs, enterprises are building large-scale data centers with farms of standard high-volume servers. The volume server segment in the United States is growing at a compound annual growth rate (CAGR) of 12% and has an installed base of over 15 million. This continued explosion of volume servers is driving up management costs and complexity, resulting in ever-increasing inefficiencies.

Another major issue resulting from the increased scale of these data centers is reliability. Disaster prevention and the cost of information technology (IT) outages are a large percentage of total cost of ownership (TCO) for organizations. The cost of failures is significant because of customer down-time, the operator time to fix/recover data, and the need for spare inventory.

Cloud computing is an increasingly popular trend with offerings from various vendors such as Amazon EC2 and Google App Engine. It is inevitable that enterprises will leverage cloud computing paradigms in some way to take advantage of its efficiencies of scale and pay-per-use model.

The enterprise would like a solution which truly provides them a vendor and compute platform agnostic model that finds ways to make existing IT equipment more efficient, allocate workloads intelligently and in a seamless way, driven by sound business logic and policies tied around them. Such a comprehensive solution does not exist today.
Advantages of Stateless Compute

Large-scale enterprise data centers today are a mix of heterogeneous hardware, operating systems, network and storage devices. Heterogeneity increases management complexity, making it a challenge to deliver IT services in a cost-efficient manner. Enterprises would like to take advantage of cloud computing to supplement their existing data centers to deliver efficiencies in their IT infrastructure and cost structure, specifically for disaster recovery, high availability, and load balancing. The major attribute of the cloud is that it is a true utility compute model, which offers an on-demand, scalable, measurable, and repeatable resource. This attribute solves two of the major challenges facing IT departments today – driving down the high costs of IT and providing innovative new solutions to improve the business.

To realize the technology and vendor agnostic compute model vision to its fullest potential, an enterprise should not have to worry about the type of platform (hardware or OS) it uses for development and deployment. It also should not have to worry about whether work objects (applications, OSs and hypervisors) are running on a hypervisor, bare metal system (physical server), or in the cloud. Ideally, applications should be written once, and be capable of flowing between bare metal systems, various hypervisors within the enterprise, and external cloud service providers (CSPs). The flow of applications between the various platforms should be tied to various business and technical policies relevant to the business rather than tied to platform limitations.

The enterprise data center needs to evolve to a “stateless compute model” to be able to garner the benefits of the utility compute vision. In this model, resource objects are applications, hypervisors, OSs, storage, networking and cloud resources (via CSPs). Work objects, such as web applications and email applications, are provisioned based on policies tied to the resource objects. A stateless compute model provides inherent superior reliability, availability, and overall improved TCO, in addition to providing avenues for gaining power and cooling efficiencies in the data center.

RackWare Management Module (RMM)

RackWare’s software is a holistic solution where an enterprise can evolve seamlessly towards a stateless compute model. This solution can then be used to provision work objects to bare metal systems, hypervisors and CSPs – creating a seamless, end-to-end, utility computing model. RackWare’s software, RackWare Management Module (RMM), implements a push-button installation process for existing and Green Field data centers, essentially creating a physical-virtual-cloud infrastructure. The RMM provides a powerful solution that encompasses multiple, heterogeneous platforms such as physical systems, hypervisors and cloud service providers, as shown in the following Figure 1.

![Figure 1 The RMM Solution Encompasses Multiple Heterogeneous Platforms](image)
The RMM can scale to manage thousands of servers in a relatively small data center to 100,000+ servers in an internet-scale data center.

The RMM has been architected from the ground up to include the appropriate hooks to enforce policies and service level agreements (SLAs) for various tiers of compute requirements. The metadata that is captured and maintained through this process is tremendously useful for performing audit trails of workloads and data. RackWare software also provides a rich database of the enterprise data center’s assets, statistics and monitoring. Analysis of this data may lead to improved resource management of all physical and virtual resources within the enterprise.

With maintenance records and access to a rich information pool, the RackWare software offers a robust set of application programming interfaces (APIs) that allow easy integration into existing management frameworks and other software solutions in an enterprise. Examples include billing, identity and credentials management, patch management software and existing configuration management databases (CMDBs). As an example, Figure 2 shows how RackWare’s management APIs can be integrated into a single pane of management of existing solutions such as IBM Tivoli, VMware Virtual Center, HP OpenView, proprietary in-house solutions, etc.

**Limitations of Virtualization Technologies**

While virtualization technologies based on hypervisors such as Xen, VMWare and Microsoft Hyper-V claim to provide a utility platform, they mainly allow multiple OS images to simultaneously run on a single machine. Their heritage does not stem from a cloud or utility paradigm. The hypervisor heritage is more of a consolidation or resource-sharing paradigm, with the goal of consolidating work objects into fewer hardware boxes.

Although hypervisor-based workload consolidation claims to lower cost of ownership, hypervisors don’t truly deliver on this claim due to hidden costs. These hidden costs include large unforeseen networking costs, administration complexities, and overhead of management of various hypervisor islands, unmet SLA guarantees and, the inevitable vendor lock-in. Hypervisor technology also adds a costly layer of
software that steals CPU, memory, and I/O resources, which impacts application performance.

Furthermore, a hypervisor tends to export the lowest common denominator in feature sets and extensions that CPUs may have to offer. For example, a hypervisor may not expose a CPU’s integrated cryptography offload capability to OSs and applications that may benefit from such acceleration. This suppression of features occurs because the OS or application running on the virtual machine may need to be migrated to a different system whose CPU may not have the same accelerated cryptography capability. This situation restricts the performance and/or mobility of the application.

**Migrate Enterprise Appliances**

Another advantage of RMM is that it enables provisioning of work objects to the cloud at various levels, from applications to the entire server stack running on bare metal systems or virtual machines. This latter advantage provides a huge opportunity for enterprise appliance providers that run on standard x86 platforms (e.g. filers and security appliances). A virtual instance of the appliance can be created and managed by the RMM, and then migrated wherever it is needed into the cloud.

For these enterprise appliances, it is important that the virtual appliances are provisioned on a bare metal system rather than a VM, as these virtual appliances expect to take advantage of the full complement of underlying compute cycles/resources. Indeed, customers are now demanding that this model is enabled by appliance providers when an enterprise may need to be physically relocated. Since servers may not have to be moved, as they may already reside in the cloud, it’s natural to wish to extend this model to enterprise appliances, eliminating the burden of rolling in a truck just to move the dedicated appliances to the new location.

**Conclusion**

The RMM provides a key building block for enterprise utility and cloud environments. The RackWare solution enables enterprises to embrace a stateless compute paradigm that takes advantage of physical, virtual, and cloud resources – thereby creating a truly “hybrid” compute environment that allows the user the choice of best-of-class resources for enterprise application workloads. The choice of these platforms can be made intelligently, using metrics that are relevant to the business – cost, performance, and scalability.

**RackWare Software Salient Features**

- Provides push button installation.
- Transforms a data center into a cloud-ready infrastructure.
- Runs on servers, switches and storage platforms.
- Enforces SLAs through a rich policy framework.
- Tracks and monitors workload life cycle history.
- Facilitates capacity planning, billing, and auditing.
- Easy integration into existing management frameset.

For more information regarding this white paper or RackWare, Inc, please email inquiries to: info@rackwareinc.com

© Copyright Rackware, Inc. 2009-2010. All Rights Reserved. No part of this document shall be reproduced, stored in a retrieval system, or transmitted by any means (electronic, mechanical, photocopying, recording, or otherwise) without written permission from RackWare, Inc. Revision 1.2, November 2010.

This document refers to various companies and products by their trade names. In most, if not all cases, their respective companies claim these designations as trademarks or registered trademarks. This information is provided for reference only. Although this information is believed to be accurate and reliable at the time of publication, RackWare assumes no responsibility for errors or omissions. This document is subject to change without notice. Rackware, Inc. shall not be liable to any loss or damages from the information herein or in connection with the furnishing, performance, or use of this material.