Vblock Infrastructure Packages —
Ready for Takeoff

Analyst: Jim Baker

Management Summary

As I cinch myself into my coach class airplane seat, I usually get pre-take off jitters. After all, I am voluntarily committing myself to a flying boxcar situated 35,000 feet in the air traveling at 500 plus miles per hour for several hours with no way to exit, all without a parachute or my personal knowledge about how to land the airplane! Calming me down, however, is the knowledge that the aircraft has been tested and shown to be airworthy and that the pilot and copilot are following a thoroughly vetted Pre-Flight Checklist to ensure that all systems are ready to go. Following the Pre-Flight Checklist is a mantra that takes place on every flight of every airplane – no matter how small. The act of checking off the readiness of all major systems ensures that the pilots do indeed consider every operational aspect of the flight well in advance of take off and do not depend upon human memory or someone else's thoroughness.

Data center managers and IT executives are tasked with providing highly-functional computing capabilities to their users consistently, with protection, and at a justifiable cost to the organization. Computing users themselves usually care far more about the application in front of them than its underlying architecture. They may have an interest in it, but count on the IT folks to make the best architectural decisions for the organization on behalf of its users. Therefore, when a different – possibly disruptive – technology is offered by leading vendors, it is incumbent on evaluators to analyze the new solution option(s) thoroughly. The operative question is "How." We present a technology assessment methodology (via a Pre-Flight Checklist) for a new approach to virtualization called *Vblock Infrastructure Packages.*

Since last November, Cisco, EMC and VMware have banded together to provide a new, simpler approach to IT involving virtualization of servers, storage, virtualization software, and communications known as *Vblock Infrastructure Packages* offered under the *Virtual Computing Environment (VCE) coalition.* Vblock is a unit of server virtualization granularity containing software for creating Virtual Machines (or VMs). Included is the hypervisor (or the software between the physical machine and operating system services), middleware, and security software to allow the VM entity to become disassociated from the hardware platforms on which it physically resides (processing, memory, storage, communications gear, power supplies, etc.) Vblock Infrastructure Packages constitute the configuration platforms on which the VMs will run. These Vblock Infrastructure Packages have been optimized for their special purpose by EMC, Cisco, VMware, RSA, Intel, and others to serve as an enabling technology for virtualization delivery.

Because virtualization and the VM approach is the basis for increasingly popular Private and Public Cloud implementations, it is appropriate for you to consider Vblock Infrastructure Packages' "flight readiness" for use by your enterprise. Borrowing from the airline industry, our analysis will use a checklist approach to examine what you, as a potential buyer, ought to know about Vblock Infrastructure Packages and their implementation. The point of view of this analysis is that of a skeptical (but fair) IT manager working through a Pre-Flight Checklist. The bottom line question to be answered by the checklist is: *Are Vblock Infrastructure Packages a viable alternative?* OK, please buckle up and read on to determine whether these packages are *flight ready.*

Technical Considerations

In November 2009, EMC, the storage giant, and Cisco, the networking giant, and VMware, the server virtualization leader, joined to form the *VCE coalition*[1]. Also participating financially in the VCE coalition is x86 provider Intel. Quoting from the joint Cisco, EMC, and VMware press release announcing the alliance, "The coalition has been created to accelerate customers' ability to increase business agility through greater IT infrastructure flexibility, and lower IT, energy, and real estate costs through pervasive data center virtualization and a transition to private cloud infrastructures."[2] It is time to assess how the program is progressing by looking at some key dimensions.

Virtual Data Centers in a Box

This paper examines Vblock Infrastructure Packages that enable IT to speed up deployments of a virtualized infrastructure using advanced technologies from Cisco, EMC, and VMware. The solutions are jointly created, validated, tested, and supported by the three firms, thus reducing the risk associated with deploying new solutions. The integrated units of infrastructure enable the rapid implementation of a virtualized infrastructure, so customers can realize a return on investment (ROI) more quickly. Vblock Infrastructure Packages are available with varying storage capacity, processing, network performance, and capabilities. These extensible packages support incremental capabilities such as enhanced security and business continuity to satisfy service-level agreements (SLAs). The following checklist is generalized enough to be used with most IT projects and, of course, could be used for any "due diligence" technology evaluation.

Vblock Infrastructure Packages come in three "Types" that vary by size (the number of virtual machines (VMs) that they support) as well as the options that the storage inherently provides like high availability, disaster recovery, security, etc. (See Exhibit 1, on the next page.)

- *Vblock 2* is for large installations and supports from 3000 to 6000 VMs. They contain 32 or 64 4-core dual-processor blades (based on the *Intel x5570* chip), with 96 GB of RAM.

- *Vblock 1* is for medium-sized installations and supports from 800 to 3000 VMs. They contain 12 or 24 4-core dual-processor blades (also based on the *Intel x5570* chip), with 48 GB of RAM.
- *Vblock 0 is* for entry-level installations supporting 300 to 800 VMs. They contain 4 or 16 4-core dual-processor blades (based on the *Intel x5550* chip), with 48 GB of RAM.

Each of the three infrastructure packages provides single call support and is a pre-configured, pre-integrated, pre-tested infrastructure block with the following contributions.

- Cisco (*UCS Unified Communications System* servers and right-sized switches),
- EMC (storage of various sizes, an Element Manager, plus RSA security), and
- VMware (*vSphere* platforms).

With Vblock Infrastructure Packages, IT managers receive end-to-end visibility into and accountability for virtualization, networking, computing, storage, security, and management while Vblock applications and users (by proxy) enjoy the benefits of a stable environment on which to run their apps. This pre-tested infrastructure provides an accelerated approach to deploying enterprise and test/dev applications.[3]

Overall Vblock Architecture

Architectural Viability of the technology as proven by alpha, beta, and scale testing

Vendor testing serves at least two purposes: (1) proving viability of the solution (i.e., *does it work?*) and (2) ensuring that it works properly across a range of configurations and workloads (i.e., *does it really work at scale?*) *Alpha testing* consists of bench testing by the developers followed by integration and functionality testing. Once the system behaves as designed, it is tested "at scale" to ensure that it will work across a wide variety of configurations and workloads. Only after this level of testing is completed do vendors allow real users to *beta test* it.

Beta test examples are relevant to commercial use and are important, as they show the real world applicability of the new technology. Cisco, EMC, and VMware have been selective in the choice of their beta test sites, as they chose sites with characteristics to which other large enterprises could immediately relate.

---

[1] It likely is not an accident that the letters VCE easily can represent the three primary members VMware, Cisco, and EMC.
[2] Joint Cisco, VMware, EMC Press release November 3, 2009. See http://www.marketwire.com/press-release/Cisco-NASDAQ-CSCO-1069957.html.

[3] You will see a white check in a black box (like the one to the right of this footnote number) to indicate that a checklist item has been checked.

Exhibit 1 — Vblock Specifications by Type

Vblock Type	Vblock 2			Vblock 1		
Hypervisor	vSphere 4 ESX			vSphere 4 ESX		
Boot Method	SAN			SAN		
vCenter	Yes			Yes		
Nexus 1000V	Yes			Yes		
UCS B-series	UCS B-200/250			UCS B-200/250		
Minimum	32*B200, Intel X5570, 96GB RAM			12*B200, Intel X5570, 48GB RAM		
Maximum	64*B200, Intel X5570, 96GB RAM			24*B200, Intel X5570, 48GB RAM		
CNA	Emulex, Qlogic, VIC			Emulex, Qlogic, VIC		
UCS-Manager	Yes (Preferred)			Yes (Preferred)		
Storage	Symmetrix V-Max			CLARiiON CX4-480		
Minimum	9*400GB EFD	124*450GB 15K	76*1TB SATA	6*400GB EFD	78*450GB 15K	21*1TB SATA
	Raw: 135.4TB	RAID:91TB	IOPS: 92,193	Raw: 58.5TB	RAID: 39.9TB	IOPS: 45,000
Maximum	25*400GB EFD	240*450GB 15K	110*1TB SATA	16*400GB EFD*	146*450GB 15K	27*1TB SATA
	Raw:228TB	RAID: 154.1TB	IOPS: 141,848	Raw: 99.9TB	RAID: 68TB	IOPS: 50,000
NAS Gateway	Optional: NS-G8 (recommended)			Optional: NS-G2 (recommended)		
SAN Switch	MDS 9506 (preferred)			MDS 9506 (preferred)		
UIM	Yes Preferred			Yes (Preferred)		

Vblock Type	Vblock 0 B-series	
Hypervisor	vSphere 4 ESXi	
Boot Method	Local[1]	
vCenter	Yes	
Nexus 1000V	Yes	
UCS B-series	UCS B-200/250	
Minimum	4*B200, Intel E5550, 48GB RAM	
Maximum	16*B200, Intel E5550, 48GB RAM	
CNA	Emulex, Qlogic, VIC	
Nominal VM Density	Minimum: 128	Maximum: 512
UCS-Manager	Yes (Preferred)	
Storage	Celerra NS-120	
Minimum	5*600GB 15K	5*1TB SATA
	Raw: 8.0TB	RAID: 5.3TB
Maximum	25*600GB 15K	15*1TB SATA
	Raw: 60TB	RAID: 36TB
SAN Switch	N/A	
Options	Yes: FC+EFD, VIC, X5650[5]	
UIM	Preferred	

Source: EMC

Architectural Scalability

It was a wise move to announce the larger implementations (Types 2 and 1) first. By offering a large-scale solution for enterprise level installations (Vblock 2 with up to 6000 or so VMs), the issue of scalability immediately was taken off the table. And, likewise, it was wise to announce simultaneously the mid-range quickly followed by the entry range to address the needs of the middle and bottom of the pyramid, where so many opportunities await, as here is a huge unspent demand fueled by the sheer quantity of the firms with between 300 and 3000 virtual machine instances. Our sole remaining question is: *What about greater than 6000 VMs?* Using conjecture, we anticipate a Type 3 category at some time in the not-too-distant future. How high is the top end? The VCE coalition is prohibited from revealing unannounced capabilities (as is any vendor) so we will have to wait and see, but it would not be surprising to see 12,000 VMs supported at a later date.

Architectural Growth and Extensibility

Architects and planners are always concerned with the growth and extensibility characteristics of a new architecture. Vblock Infrastructure Packages, with their announced support for Vblock 2, Vblock 1, and Vblock 0, clearly address this issue. From a software perspective, customers can install

Vblock 1 and easily move their VMs and applications to another Vblock 1 or Vblock 2. From a hardware perspective, the planner has to make an early decision about the size of the infrastructure but can easily expand the Vblock infrastructure to include other Vblock packages. This makes it easy for an IT manager to "build as you go" and not have to plan for the eventual full-scale deployment. Additionally, it isn't necessary to keep hardware lying around until it is ready to be deployed.

Architectural Provision for a Chargeback Infrastructure

One of the best reasons to consider the new Vblock Infrastructure Packages is the ability to charge back the consuming organization for services rendered – easily. In most cases, usage of the infrastructure is a good basis for cross-organizational charges. Users will like the fact that they are not being charged for infrastructure that they are not using. Moreover, they will like the fairness associated with charging *by the drink*.

Architectural Susceptibility to Viruses and Malware

Vblock Infrastructure Packages are no worse than any other state-of-the-art software when it comes to vulnerability to malware and viruses. In fact, because workloads can shift amongst physical building blocks, they likely are less susceptible to

intrusion and malware. EMC's RSA security and authentication components provide the needed protection.

Testing and Validation

Testing and Validation of the Reference Architecture

With the publication of the reference architecture and the announcement of pre-tested, pre-validated infrastructure packages from Cisco, EMC, VMware, including Intel engines, you can be assured reasonably that what you buy will work as advertised. Implementation details are spelled out carefully in this document. As such, they serve as actionable steps for hands-on implementers.

Testing and Validation Using Alpha and Beta Testing

Alpha tests are those conducted by the developers themselves. These tests are of functionality and scale and are quite rigorous but, by themselves, they are insufficient. Vendors always ask for customers and partners to test their products in Beta tests. Beta testing uses real life workloads and often reaches into situations that the internal developers and testers themselves did not consider. Beta tests also challenge the management software's administrative interfaces because the products are being used by those unfamiliar with its design but who are absolutely familiar with the environments in which the products will be placed into service. The VCE coalition has done its due diligence by engaging in a rigorous beta testing program for Vblock Infrastructure Packages.

Application Testing

Vblock Infrastructure Packages also undergo extensive testing with Tier 1 applications. We have been told that extensive testing with VMware View (for virtual desktop infrastructure (VDI) implementations) and SAP have led to some sizable deals and notable Proof of Concepts. You can read about the synergy between SAP and Vblock right from SAP's webpage[4]. Other Tier-1 applications that will be fully tested on the Vblock are well underway. We suggest that the user stay tuned as new application specific testing results are announced by the VCE coalition.

Performance

Server and Switch Performance

One of Cisco's key contributions to the VCE coalition is its line of *UCS* servers (or *Unified Communications Systems* servers). These

---

[4] http://www.sap.com/about/newsroom/press-releases/press.epx?pressid=13294

high-performance systems are blades built on Intel's four-core x86 *XEON 5500* architecture, and are endowed with a lot of memory, just what is needed for heavily virtualized environments.

Storage Performance

EMC offers three viable storage solutions of differing scale for Vblock 2, Vblock 1, and Vblock 0. Vblock 2 includes *VMAX* and *VPLEX* enterprise class storage. Storage for Vblock 1 is from the *CLARiiON CX-4* series or *Celerra Unified Storage NS-960*. Vblock 0 uses *Celerra's Unified Storage NS-120*. Each of these storage systems is a leader in its category with a real-world proven track record.

Performance of Virtualization Software

VMware provides the hypervisor and *vSphere* management across all three Types. As the acknowledged leader in virtualization software, these systems are in use in production around the world in demanding environments.

Completeness of Vision

For virtualization implementations, Vblock Infrastructure Packages are, by definition, "cloud ready." As virtualization reaches servers, storage, and endpoints, both IT architects and implementers will expect that virtualization infrastructure will be ready-to-go for both internal and external clouds. To understand the difference between the two, *internal clouds* are sometimes called *private clouds*, where the assets are owned and managed by the enterprise, usually behind their own firewall and housed in one of their datacenters. Alternatively, *external clouds* have an infrastructure that is owned and managed by a third-party service provider and, as such, usually is shared amongst many users. Multi-tenancy requires stringent protections to guarantee the safety of each user's data. Indeed, today there are systems integrators offering public cloud services based on Vblock Infrastructure Packages.

Operational Considerations

Confidence Building via the Acadia Joint Venture

As a means of building momentum for Vblock Infrastructure Packages virtualization and to provide implementers with help as they begin to roll out their own Vblock infrastructure, the founders of the VCE coalition set aside some of their best key engineering, testing, and marketing talent organized under the name *Acadia*. Acadia, also referred to as VCE, is a joint venture, founded by Cisco and EMC, and further capitalized by investments from VMware and Intel. The venture

---

was established to help partners and customers accelerate the transition to pervasive virtualization and the private cloud. Acadia's stated goal is to offer a simpler, more streamlined approach to IT transformation by leveraging best-of-breed technologies from the three parent companies that form the VCE coalition: Cisco's leading-edge networking and computing technologies; EMC's expertise in storage, security, and management; and VMware's industry leading virtualization technologies.

They have set up testing laboratories in Santa Clara, California, and Hopkinton, MA that test not only functionality but also scale, or how the systems work as they grow up and/or out. They use field-proven expertise to optimize these technologies for deployment and optimization, often using POC or Proof of Concept platforms to stage the rollout before putting the solution into widespread production. The press release announcing Acadia has many worthy goals but perhaps its unspoken goal is its most important one: building confidence in the approach.

Confidence Building by Priming the Professional Services Pump

The Acadia/VCE Joint Venture was put in place to provide professional services for using Vblocks. Their methodology is to provide implementation services using the B-O-T (Build-Operate-Turn over) Model. Acadia first *builds* the infrastructure using pre-configured, pre-tested, pre-integrated modules. They then *operate* the infrastructure for a period of time to ensure the solution works properly. During this implementation period, they look for stress points and seek to eliminate them. Following acceptance that the system is working as designed, they then *turn over* the infrastructure to those requesting it or to their designee. The designee part is important because it could just as easily have been turned over to a third party, like a VCE partner, as it would be to turn it over to an internal IT department.

Importantly, the VCE coalition has also partnered with many large Service Integrators to extend their reach as well. With the VCE coalition behind them, their credibility and technical acumen increases accordingly. Users gain because these Service Providers often add value in the form of domain-specific expertise and reputation. With both of these dynamics at work, the speed of acceptance for virtualization will only increase.

Confidence Building with an Industry Veteran at the Helm

The two owners of Acadia/VCE (Cisco and EMC) recently hired an industry veteran Michael Capellas as Acadia's CEO. Importantly, he came from an application level vendor and not just a hardware or software one (although he has experience in these kinds of firms as well). While at First Data, he had to live with the uncompromising demands of Service Level Agreements for the financial industry. This experience is invaluable when bringing a new technology to market, especially one so focused on service delivery.

One Call Support for Vblock

An improved set of standardized procedures and processes has been adopted, which are better than well-known industry Cooperating Support Agreements (or CSAs). Traditional CSAs allow first calls to be taken by any relevant vendor followed by escalation to the provider most likely to have the answer as to how to address the problem. Support for Vblock Infrastructure Packages is better because those taking first calls have been cross-trained to handle support from both Cisco and EMC as well as VMware. In this way, many first calls become last calls. However, if the complexity of the call is beyond the expertise of the team on the phone, escalation paths have already been designated, to minimize delays in answering the concerns of the administrators supporting Vblock Infrastructure Packages. EMC Technical Support for years has maintained an attitude of "Guilty until proven innocent." This attitude has won them many supporters over the years. VMware and Cisco likewise have strong commitments to their customers and have a "can solve" attitude.

Support with Worldwide Range

Because the members of the VCE coalition are leaders in their respective domains, they all have worldwide presence. Multi-national firms appreciate that they will not have to wait for support in far-off destinations. Support across the globe means not only repair and remediation but also sales and professional services support in local areas around the world. Were the VCE coalition to be made up of lesser vendors, it is possible that coverage would be less widespread and with less quality. Already in place are enough knowledgeable vendor support personnel to handle the expected success of the Vblock program. Customers with an international presence demand this level of coverage in order to support client locations, regardless of geographic locale.

Vblock Appropriateness Across Multiple Industries

New data is arriving daily as more users complete their test and development activities and bring their solutions on line. This experience base widens the range of industries and applications as users get more stick time and gather information about ease of migration, performance characteristics, and effectiveness of the solution. They also are measuring reliability, vendor support structures, and operational issue resolution times if they incur unexpected downside surprises.

VCE coalition supporting documentation highlights case studies, news releases, and video clips that graphically emphasize the widespread applicability of Vblock to almost every industry. There are strong use cases from IT Infrastructure as a Service (IaaS) at SAVVIS to high-performance computing at Purdue University. From your point of view, it is the summation of all of the many benefits that provides a compelling case for careful consideration of Vblock Infrastructure Packages by your team. (See Exhibit 2, below.)

Exhibit 2 — Use of Vblock Infrastructure across Industries

Industry Examples	Benefits
Global Retailing (Levi Strauss)	• Exceeded expectations on SAP performance • Reduced TCO on running legacy systems • Lower cost personnel to manage Vblock environment
Worldwide Banking	Data Center Consolidation: • Standardize platforms, including all subsidiaries • Ensure solid support model • High density, minimal footprint • Easy to move workloads as often as needed • Security including multi-tenancy
Government	• Predicable sizing; pre-validated and tested for min/max size • Provides units of infrastructure – incremental capacity growth • Re-provision on demand
Media/Entertainment	• Unified platform supporting multiple protocols • Centralized management portal • Multi-pathing; running on all channels at all times • Self tiering – when data is popular (videos), move to hot, and when the data is quiet, move to cold
Global IT Technology Provider (EMC themselves using their own technology internally)	• Rapid provisioning services to help migrate acquired companies to corporate applications • Additional Vblocks can be deployed quickly to meet future demand • Deploying validated Vblock architecture with embedded security avoids weeks of time spent on design, build and testing
Healthcare (Belfast Health and Social Care Trust and a Pediatric Hospital in Norfolk, Virginia)	• Reduce complexity of all Data Center elements • Improve consolidation • Enable automation for service driven IT • Improve flexibility
Managed IT Infrastructure Service (Affiliated Computer Services, Inc or ACS, a division of Xerox)	• Competitive advantage using trusted technology • Maximized margins through fast provisioning and integrated management • Ease of managing the Vblock environment reduces IT manpower requirements
Electronics Manufacturer	Cost savings: • Reduced maintenance costs from outdated legacy servers, disaster recovery and tape media systems. • Elimination of costs for outsourced disaster recovery service • Improved uptime, availability, & performance by ensuring appropriate bandwidth • End to end management capabilities (FCoE, service profiling, UIM tool)

Source: VCE coalition

Tentative Checks

The following areas receive *tentative check offs* because we are still awaiting definitive examples and further or more numerous proof points. Importantly, these are not serious deficiencies but rather areas to continue monitoring. As a buyer, you should watch for increasing evidence in the following areas.[5]

Ever More Live Customer Examples

✔

More real world production-based installations are coming on stream everyday, but it is always reassuring to see more and more, especially within your own industry. The VCE coalition will position customer examples and information on their new website[6]. The pace of these will be increasing and the variety of applications will become more widespread. This website serves as a consolidation point to look for implementation examples as well as all related technical and business level data (including the Reference Architectures). There is no need to search each partner's individual website for Vblock examples.

Vblock Trained and Certified Expertise

✔

Implementers will need Vblock-trained employees or a candidate pool from which to hire. In the short run, partnerships help fill this role but nothing takes the place of domain-knowledgeable staff. Under the principle of supply and demand, more experienced implementers and qualified candidates will be forthcoming and should help keep labor costs down.[7]

Tools and Analytics

✔

As a new technology, the decision processes surrounding Vblock Infrastructure Packages is (for now) immature. This means that for the time being you will be dependent on the tools and analytics provided by the primary vendors such as UIM V2.0 from EMC. UIM stands for *Unified Infrastructure Manager* and is *ITIL* certified for common IT department services. As time passes, smaller independent firms should emerge with analytical tools for performance, measurement, fault diagnosis, fault isolation, mapping,

configuration checking, and more. The summary paragraph of an early press release contains an important indicator: "VCE has already secured 45 partners and six system integrators that are currently selling Vblock Infrastructure Packages, and some 200 additional partners are in the certification phase." Look for further indicators like this that will indicate momentum and maturation of the infrastructure.[8]

Conclusion

As a relatively new approach in this space, Vblock Infrastructure Packages represent a disruptive technology to the status quo. Its implementations are new and growing. Vblock Infrastructure Packages are congruent with micro and macro trends in the IT industry, especially virtualization, multi-tenancy, security, clouds, and scalability. We are seeing them worldwide and not just in North America. We are seeing them in multiple different industries indicating their multidisciplinary appeal. The reasons for this success are many and varied but probably the biggest one is that integrating the solution across the entire software stack reduces risk for users. Integrated testing means not testing individual silos of technology. Troubleshooting, if any, is across the package and not for each element of the solution. The effect is transformative as IT staffs can now focus on the revenue-generating operations of the business rather than spending time and money learning and supporting individual technological projects in their firms.

Even our tentative checklist is not disqualifying. Far from it. Rather, each of them is being addressed with the passage of time and the inevitable maturation of the technology and its infrastructure. The good news is that there are no show-stoppers. The better news is that major companies are stepping up and filling in the holes. The best news is that maturation is inevitable and fast moving. If you are not considering Vblock Infrastructure Packages, you should be, because they represent the keys that unlock virtualization for the coming private and public clouds. Certainly, Vblock is worthy of serious consideration.

---

[5] You will see a white check in a gray box to indicate a *Tentative Check*, as are shown above.

[6] See www.VCEcoalition.com.

[7] Hint: Look toward virtualization and cloud technology experts that are springing up faster than a late afternoon Florida thundershower. Their experience is relevant and timely. Because they are likely coming from traditional mainframe and/or server environments, they will also have insights into migration issues as Vblocks come on-stream.

[8] From the VCE Coalition press release of May 5, 2010. "Cisco and EMC Appoint Michael D. Capellas to Lead VCE Coalition; Named CEO of Acadia Joint Venture". See http://newsroom.cisco.com/dlls/2010/corp_050510.html.

About The Clipper Group, Inc.

The Clipper Group, Inc., is an independent consulting firm specializing in acquisition decisions and strategic advice regarding complex, enterprise-class information technologies. Our team of industry professionals averages more than 25 years of real-world experience. A team of staff consultants augments our capabilities, with significant experience across a broad spectrum of applications and environments.

➤ *The Clipper Group can be reached at 781-235-0085 and found on the web at www.clipper.com.*

About the Author

Jim Baker is a Senior Contributing Analyst for The Clipper Group. Mr. Baker specializes in storage hardware and software, the relationship between technology and its application in business, and emerging technological trends affecting users and vendors in the Information Technology community. He recently joined The Clipper Group after three decades in hardware and software product marketing and product management at companies as large as EMC and Honeywell Information Systems and as small as IPL Systems and Datapoint Corporation. He most recently served as Research Manager for Storage Software at IDC in Framingham, MA. Mr. Baker earned a Bachelor of Science in Marketing degree from the University of Illinois at Urbana-Champaign and an MBA, also from UIUC.

➤ *Reach Jim Baker via e-mail at jim.baker@clipper.com or at 781-235-0085 Ext. 212. (Please dial "212" when you hear the automated attendant.)*

Regarding Trademarks and Service Marks

The Clipper Group Navigator, **The Clipper Group Explorer**, **The Clipper Group Observer**, **The Clipper Group** *Captain's Log*, **The Clipper Group Voyager**, *Clipper Notes*, and *"clipper.com"* are trademarks of The Clipper Group, Inc., and the clipper ship drawings, *"Navigating Information Technology Horizons"*, and *"teraproductivity"* are service marks of The Clipper Group, Inc. The Clipper Group, Inc., reserves all rights regarding its trademarks and service marks. All other trademarks, etc., belong to their respective owners.

Disclosures

Officers and/or employees of The Clipper Group may own as individuals, directly or indirectly, shares in one or more companies discussed in this bulletin. Company policy prohibits any officer or employee from holding more than one percent of the outstanding shares of any company covered by The Clipper Group. The Clipper Group, Inc., has no such equity holdings.

After publication of a bulletin on *clipper.com*, The Clipper Group offers all vendors and users the opportunity to license its publications for a fee, since linking to Clipper's web pages, posting of Clipper documents on other's websites, and printing of hard-copy reprints is not allowed without payment of related fee(s). Less than half of our publications are licensed in this way. In addition, analysts regularly receive briefings from many vendors. Occasionally, Clipper analysts' travel and/or lodging expenses and/or conference fees have been subsidized by a vendor, in order to participate in briefings. The Clipper Group does not charge any professional fees to participate in these information-gathering events. In addition, some vendors sometime provide binders, USB drives containing presentations, and other conference-related paraphernalia to Clipper's analysts.

Regarding the Information in this Issue

The Clipper Group believes the information included in this report to be accurate. Data has been received from a variety of sources, which we believe to be reliable, including manufacturers, distributors, or users of the products discussed herein. The Clipper Group, Inc., cannot be held responsible for any consequential damages resulting from the application of information or opinions contained in this report.