COMPAQ'S CLUSTER MANAGEMENT INITIATIVE

Harvard Research Group has determined through extensive primary and secondary research that today's business managers want Enterprise Management Systems that can help them gain control over the business process and reduce complexity. IT managers are increasingly looking for ways to effectively and efficiently implement new technologies while at the same time achieve a seamless and cost effective way to manage their systems and software. They want to "virtualize" their system environment and manage it as if it were a single logical system. At the same time, the rapid growth in the number of business-critical applications running on Intel-based systems coupled with the need for high availability and continuous data access is driving the demand for clustered servers. While clusters help solve problems with availability and scalability, they also bring increased complexity, immature management tools, and added cost. This situation is most evident in the Intel server market where the use of Microsoft Cluster Server (MSCS) is accelerating faster than the capability of the tools that manage it.

Harvard Research Group has spoken with more than 700 users of highly available systems. Our findings and research show that users of high availability systems typically have mixed operating system and hardware environments, and believe that current cluster system management tools are too complex and costly. They view the current set of cluster administration tools as point products that are difficult to integrate, proprietary in nature, and require too much time and money to properly implement. Many of them have expressed the desire to reduce the complexity of cluster configuration, administration, and problem determination / resolution. At the same time, they have expressed a desire to minimize the number of interfaces and tools they need to manage their system and clustered environments.

Harvard Research Group believes that all clustered solutions, still lack adequate and extensible cluster monitor / management tools. While there are management tools that partially address this issue for a particular operating environment (HP/UX, Solaris, NT), they tend to be limited in their functionality and unable to address the larger issue of managing multiple and dispersed cluster environments. This is contributing to the high cost of ownership of server hardware and causing potential profits to be consumed by increased administrative staff and lower user productivity. Studies have shown that deploying manageable systems in concert with well managed IT processes can create actual value for a company. It stands to reason, then, that tightly integrating cluster management tools with the non-clustered systems management interface should create more value.

It appears that Compaq, in concert with its acquisitions of Tandem Computer and Digital Equipment Corporation, is building itself into an enterprise systems provider with some key strides in changing the direction of enterprise systems management. In doing so, Compaq has defined some interesting goals and is delivering on these goals.

Compaq's E2000 Platform Architecture and Cluster Management Vision

Compaq's E2000 Platform Architecture is based around industry standard servers, networking, and storage systems that are connected via high speed SAN interconnect to create a scalable and available clustered server environment. Some of the significant components of the E2000 Platform Architecture include:

- 2-, 4-, & 8-processor Compaq ProLiant Servers
- Intel 32-bit Pentium Pro, Pentium II, Xeon, and 64-bit Merced servers
- Enterprise Management Utilities for large scale application processing
- Fibre Channel-based storage products and backup libraries
- Gigabit Ethernet, ATM and other high speed networking technologies
- High availability, scalable System Area Network SAN interconnects

The E2000 Platform Architecture would integrate these components with industry-standard operating systems such as Microsoft Windows NT, Novell NetWare, and SCO UnixWare and with key enterprise applications from Microsoft, Oracle, SAP and other ISV's. Many of the key Compaq components of the E2000 Platform Architecture are already being delivered to customers (such as high-availability SMP servers and ServerNet SAN interconnect), while others like integrated and easy-to-use management and administrations tools are just beginning to take shape as part of Compaq's Cluster Management Vision. By tightly integrating leading, standards based, enterprise management tools with their E2000 Platform Architecture and Cluster Management products, Compaq will be able to provide users an easy-to-use, end-to-end solution that supports easy administration and troubleshooting of all the components of an enterprise's IT structure.

Compaq's Cluster Management Vision

Compaq has outlined a cluster management vision and road map that will allow them to deliver intuitive, easy-to-use cluster management tools that simplify the tasks of planning, deploying and operating clusters. The Tables below highlight Compaq's cluster management concepts, goals and how they will bring high-end cluster system management features to the volume cluster market and help develop industry standards.

Ease of Use

- Common data repository for all enterprise devices
- Problem definitions and remedies for rapid resolution
- Extensive help text for ease of understanding
- Web based management tools for flexibility and efficiency
- Intuitive and consistent User Interface for immediate understanding

Richness of Function

- Common Data Repository
- Real Time Cluster Monitor
- Cluster Administration and Configuration Management
- Extensible Architecture
- Multi Node Cluster Support
- Common Cluster Monitor and Administration Utilities

- Application Capacity Modeling
- Dynamic Load Balancing
- Self Defining Clusters
- Application Policy Management

Extensibility

- NT – MSCS Proliant Cluster as a base
- Industry Standard Server and Operating System Support
- Digital and Tandem Legacy System Support

The management and administration redundancies caused by having to support six different operating system environments and two processor architectures has compelled Compaq to develop a strategy and plan for implementing a consistent cluster management environment. Compaq intends to leverage Tandem and Digital technologies to deliver enterprise cluster management functionality to the NT volume cluster market and provide industry standards for cluster management. While initially they are implementing their cluster management tools for NT and Microsoft Cluster Server (MSCS), they fully recognize the need to include all their supported operating environments. Over time Compaq is expected to enhance its cluster management tools to include it's Operating System partners Novell NetWare, SCO UnixWare, as well as Compaq legacy systems Tru64Unix, Open VMS, and Non-Stop (NS) systems.

The first tangible evidence of this strategy is two new NT MSCS management offerings. These are Cluster Monitor and Intelligent Cluster Administrator. They leverage the power of anytime and anywhere Web technology and operate within Compaq's Web based Enterprise Management (WBEM) framework.

Compaq Insight Manager XE - Cluster Monitor

The Cluster Monitor is a management subsystem that allows administrators to view all of their clusters from a single browser. As a subsystem of Insight Manager XE, it is fully integrated into Compaq's Insight Manager suite of offerings, thus providing a one-stop administrative facility helping to minimize the number of applications and interfaces required to manage the systems environment. It supports the ability to configure monitoring points and specific operational performance thresholds, which will alert the administrator when critical cluster operational thresholds have been met or exceeded. Administrators can select cluster configurations based on their level of responsibility, location, or cluster type, as well as perform administrative tasks either locally or remotely from the cluster. Cluster events can be prioritized allowing the administrator to select an event and drill down to get a view of the specific cluster node where the problem exists. Some of the more significant features and benefits of Compaq's Cluster Monitor include:

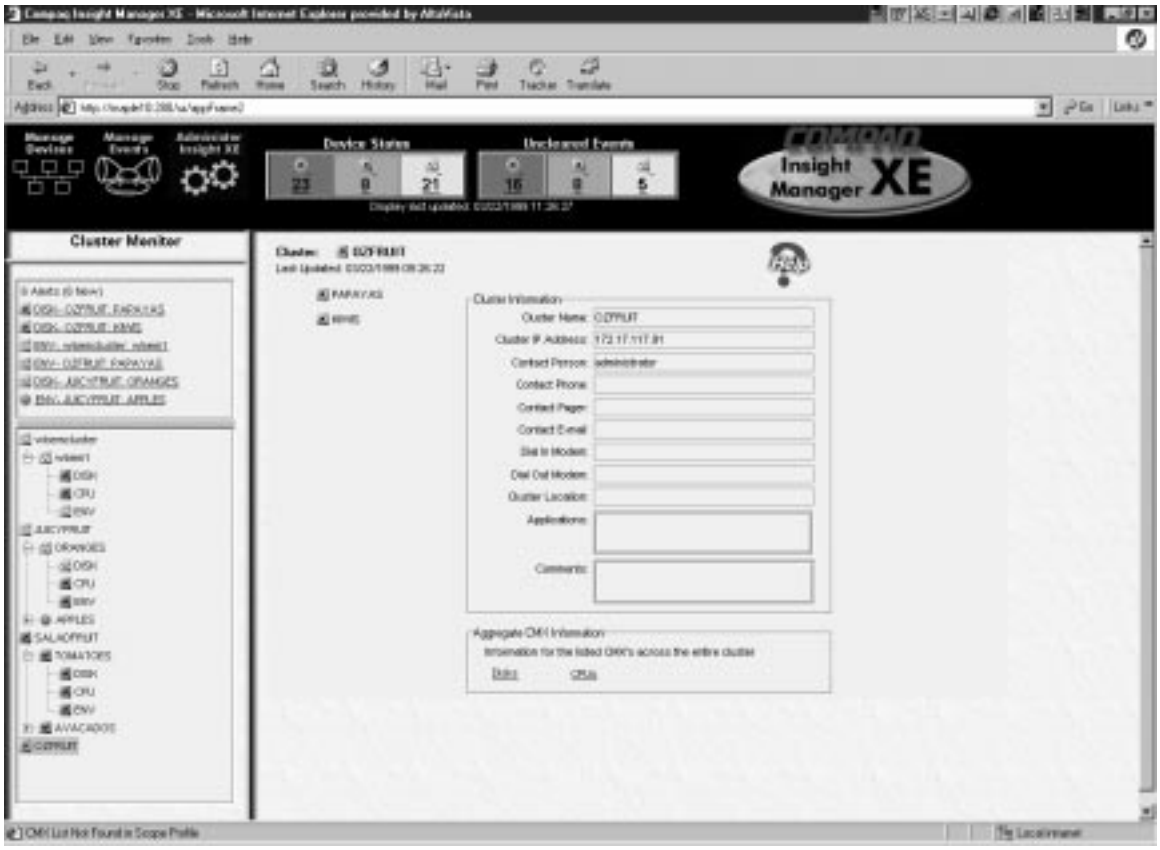
- Web based interface for ease of utilization with anytime anywhere access
- Customizable to meet administrator workload or job responsibility
- Selectable monitor points for cluster monitor customization
- Security levels for administration control and access
- Problem Window and Topology Tree event selection for micro or macro management
- Event Problem Description and Potential Remedy displayed for efficiency

- Drill down to problem device for further analysis and repair
- Extensible for third party management system provider interfaces

The Cluster Monitor, to be delivered as a subsystem of Compaq's Insight Manager XE, will be included with all Compaq servers. A major benefit to system administrators is its single point of control for desktops, servers and clusters. The browser-based interface provides administrative flexibility via anytime anywhere access making cluster management less complex and time consuming. It is both simple and easy to view, with extensive problem definition/remedy information displayed whenever an event or device is selected. The intuitive color-coded identification of cluster "hot spots" supports rapid problem determination and resolution that can make the administrator more efficient, decrease cluster downtime, and minimize "hung" systems.

Compaq Insight Manager XE – Cluster Monitor employs Compaq management agents for basic information on system health and the health of the MSCS cluster. Compaq has structured the Cluster Monitor to utilize the Insight Manager XE Event and Data Repository for data storage. As a result, the cluster monitor will automatically perform an aggregation and presentation of that data to the administrator, who can then review it and take whatever actions are appropriate.

The administrator can easily access the Cluster Monitor through a query from the Insight Manager XE introduction screen. The administrator can define multiple queries to view different cluster environments for flexibility and ease of use providing another level of efficiency. These queries can be structured to meet a variety of administrative needs, such as, all clusters, clusters performing a specific set of applications, clusters on the tenth floor, or clusters in the state of New Hampshire. The first thing the administrator sees after navigating through the introduction screen is a display that presents critical cluster events and a tree structure reflecting those clusters as defined by a specific query. Anytime an event occurs that is considered destabilizing, an alert notice will be broadcast to the cluster monitor screen. Alert notices that require immediate attention by the administrator are likewise added to the Cluster Problem Window and highlighted in the Topology Tree with a color-coded severity notation.



(Figure 1 – Cluster Monitor Introduction Screen)

The main Cluster Monitor screen is shown in Figure 1. In the upper left-hand corner is the Cluster Problem window that displays a prioritized listing of all cluster events by severity level. This allows the administrator to work efficiently by addressing cluster problems in order of severity, attacking the most critical cluster problems first. The administrator has a scroll bar so they can choose which events to work but it is displayed in most critical order based on clusters defined in the query. Compaq has color-coded the events in order to make it easy to recognize those most critical to smooth cluster operations. Clusters are displayed in a tree topology in the lower left section the Cluster Monitor screen. The topology tree and the clusters displayed are depicted in an iconic form, which includes the name of the cluster, the cluster condition, and the Cluster Manager Extensions selected for the specific cluster node or cluster itself. In order to help the administrator visualize what event(s) or device(s) are making the cluster unstable, Compaq has provided a set of selectable monitor programs for systems devices, and cluster manager health. The programs, Cluster Manager Extensions, can be applied to an individual cluster or to an individual node in a cluster. This is a powerful, yet simple approach that delivers a comprehensive view of the cluster that assists the administrator in making the proper problem determination and resolution decisions.

In Figure one, the administrator can select an event such as a Disk Full Condition. The Cluster Monitor screen Data Viewer Area, the main body of the Cluster monitor screen will change based on what event or topology device the administrator selects. When a cluster is initially selected, key cluster management information will appear such as cluster ownership, cluster resources, hardware configuration, software configuration, emergency contacts, and installed application software. The administrator then has the ability to selectively "drill down" to any cluster node that he/she wishes to examine more closely and display a comprehensive set of node metrics. A simple "go back" mechanism allows the administrator to quickly link back to the entry screen. Fast response to cluster problems is supported by giving the administrator the ability to select cluster administration either via the Topology Tree or through the Cluster Problem Window.

When things go wrong:

When an event or group of events causes a cluster to become unstable or fail, the Cluster Monitor will display the event(s) with a detailed description and a recommended solution. Depending upon the seriousness of the event, the problem can be approached from either a micro- or a macro-management fashion.

Event Micro Management

The Cluster Monitor Problem Window represents a micro-management approach to cluster administration in that the administrator selects from the problem list by event severity. The process is quite simple and begins with the administrator selecting the problem event from the Problem Window. The Cluster Monitor then displays the selected cluster data in the main data area in the same fashion as the tree methodology. Events remain in the Cluster problem window for as long as it takes to resolve them, and are only removed after the error condition has been satisfied. The Tree Structure is updated simultaneously to the problem window thus providing the administrator with a quick way to determine the status of the cluster. The micro approach provides a quick and easy way to identify and resolve cluster problems within multiple cluster sites.

Device Macro Management

The macro-management approach starts at the Cluster Topology Tree. It allows the administrator to select from a cluster or device(s) within a cluster that may be failing or causing instability. The administrator can then take the necessary action(s), to resolve the device or cluster error condition. Compaq has supplied a simple method of implementing the macro approach, whereby all the administrator needs to do is click on the color-coded icon for the cluster or the device, and the system will automatically bring the required level of cluster or device information to the data viewing area. The Data Viewer displays the problem definition, remedy action(s) and static cluster or device information. Once in the Data Viewer, it is quite simple to perform a "drill down" to the specific device causing the problem.

In HRG's view, the Compaq Cluster Monitor represents a significant step in Compaq's Cluster Management vision for the management of large and small enterprises. The tight integration with Insight Manager XE affords system administrators a low cost (free) tool

that supports the access, single point control and management of systems on both a local and enterprise wide basis.

Compaq's Intelligent Cluster Administrator

Along with the Cluster Monitor, Compaq also announced a browser based Intelligent Cluster Administration tool for NT MSCS clusters. It represents a significant improvement over the console-based functions offered by most other vendors and extends the administrators flexibility by allowing them to execute cluster administration functions anywhere and anytime via the Web. The Intelligent Cluster Administrator also provides a set of unique tools for cluster configuration management and deployment that allow administrators to copy, modify and dynamically install a cluster configuration onto any cluster, anywhere in the enterprise. The Intelligent Cluster Administrator is available as a stand-alone offering but is designed to integrate with Insight Manager XE - Cluster Monitor as a Cluster Management Extension in the future. This gives administrators more flexibility in managing their clusters and choosing which offering meets their most current needs.

Compaq Intelligent Cluster Administrator is an innovative cluster utility that makes cluster administration easier and less time consuming. Its Web enabled anywhere anytime cluster administration allows for a single point of control for NT MSCS clusters. Some of the most significant features and benefits include:

- Web based for ease of utilization with anytime anywhere access
- Enhanced cluster management facilities for planning, modification, and deployment for enhanced cluster configuration management and control
- Extensible for added cluster types and configurations to meet Compaq's Cluster Management Vision and strategy for consolidated systems and cluster management
- Designed to integrate with Compaq's Insight Manager XE-Cluster Monitor
- Complete operational controls for MSCS clusters from a browser allowing the administrator to perform the full set of administrative functions provided, through MSCS cluster administration, increasing administrator flexibility and efficiency
- Provides a single point of control for distributed enterprise cluster configuration management and rapid response to meet operational processing events displayed through the Insight Manager XE - Cluster Monitor.

Figure 2 – Intelligent Cluster Administrator History Screen

The Intelligent Cluster Administrator is an easy-to-use cluster administration tool that provides the administrator a single point of control for all MSCS clusters in the enterprise. It significantly reduces the time consuming and complex task of administrating clusters by allowing users to monitor and manage a Compaq Proliant Cluster from either an Internet Explorer or Netscape Communicator browser. Its strength lies in its ability to check for cluster destabilizing conditions and then allowing the administrator to dynamically reallocate the resources of the cluster to alleviate a destabilizing situation. It also offers the added flexibility of performing these actions remotely without causing a cluster failover.

The Intelligent Cluster Administrator performs all of the administration tasks found in the console based "Cluadmin" product shipped with Microsoft Cluster Server. By selecting a configuration entry from the tree structure, the administrator can:

- add/change/delete a group or resource
- start/stop a service, a node, a cluster
- transfer a service from one node to another
- evict node from a cluster

The remote web based access frees administrators from being tied to a particular console or area, helps reduce administration time and reduces the number of active console program resources. From the main Intelligent Cluster Administrator screen, any administrator can efficiently create new cluster configurations, model them against existing configurations, and deploy the configurations to the same cluster or to another

physical cluster in the enterprise. Other functions supported by the Intelligent Cluster Administrator include:

- Add/change/delete configuration log entries
- Compare any two configurations in the log
- Compare any cluster configuration in the log with current configurations
- Designate one entry in the log as the “ideal” cluster state
- Export the current configurations, or any configuration in the log
- Verify any configuration in the log against the current cluster
- Import any saved configuration to the log or to the cluster

The import/export utilities are particularly helpful in maintaining and deploying uniform clusters. All the administrator needs to do is point to any configured cluster, extract the current configuration, modify it if necessary, and then archive it for disaster recovery situations or deploy it to the same or another cluster. Furthermore, the Intelligent Cluster Administrator can do all this dynamically without needing to reboot the cluster. The Intelligent Cluster Administrator with it's anytime anywhere browser based implementation is an innovative tool that frees the administrator from the inflexibility of a dedicated management console. This innovative facility clearly establishes Compaq as a leader in NT MSCS cluster development / deployment, and helps to reduce cost of ownership by providing cluster management flexibility and control. Compaq has advanced the state of the art in cluster administration of enterprise business critical solutions and made it possible to easily manage and deploy MSCS clusters. The Intelligent Cluster Administrator is a significant step towards providing a common, intuitive, easy to understand, and consistent system management interface.

Comparable Alternatives

Both IBM and HP are on a similar cluster management path and they are beginning to develop and deploy integrated cluster policy and management solutions. However, their current products are point solutions that are not as tightly integrated with the system management interface, as the Compaq products.

Hewlett-Packard’s ClusterView product is a hardware centric cluster monitor that supports a single point for monitoring UNIX and NT clusters. ClusterView supports a visual mapped-based interface, and event notification. It enables the automatic detection, monitoring, and control of remote clusters and certain cluster components. ClusterView requires HP's OpenView and Network Node Manager when used in conjunction with HP MC/ServiceGuard and Microsoft Cluster Server. This is a heavy investment in overhead if you are not committed to HP's Open View framework manager. While it has the advantage of supporting both HP-UX MC/Service Guard and NT MSCS clusters, it still requires MSCS “Cluadmin” to add, change, and delete cluster configurations. ClusterView’s reliance on optional software products such as the OpenView / Network Node manager adds cost, additional complexity, and more processing overhead.

IBM’s Cluster System Management (ICSM) product is designed to manage NetFinity MSCS clusters. It supports plug-in modules for IBM NetFinity Manager, Intel LANdesk

and Microsoft System Management Server (SMS). It is a hardware centric tool that provides GUI based cluster administration, dynamic wizards, configurable alerts, and a single console view of a cluster.

Product Summary

Compaq's Insight Manager XE - Cluster Monitor and Intelligent Cluster Administrator are cost effective and innovative tools for consolidating both systems and cluster management. There are alternative tools that provide similar or complementary functionality to Microsoft MSCS "Cluadmin", such as NET IQ's Application Manager, IBM's ICSM and NuView's ClusterX, but they are focused on MSCS management and can cost significantly more to implement. Compaq's cluster management products are less costly and they are not just focused on NT and MSCS. Compaq has a cluster management strategy and vision for all the cluster environments its supports including NetWare, SCO UnixWare, Tru64Unix, Open VMS, and Non-Stop (NS) systems.

Furthermore, based upon our research and interviews we view the alternative products as more standalone and not as tightly integrated with a system management interface, as the Compaq products are with Insight Manager XE. As a result, system administrators are required to deal with learning and maintaining multiple management interface systems. With Compaq's Cluster Monitor and Intelligent Cluster Administrator products, administrators can view the entire enterprise through a single consistent interface that makes administration and control much simpler, less time consuming, and more efficient. And Compaq's use of the Web based anytime anywhere access to cluster management, monitoring and administration provides a significant advantage over the static console based approach offered by other vendors.

The Intelligent Cluster Administrator provides significant administrative services that are unique in the industry and that, when coupled with the Insight Manager XE-Cluster Monitor meet and exceed what is currently available from other vendors. The Cluster Monitor and Intelligent Cluster Administrator enhance MSCS "Cluadmin" by extending cluster management and administration across the entire Enterprise with features such as anywhere anytime access and the ability to flag a system device that is causing a destabilizing event.

In HRG's opinion, Compaq offers customers both a comprehensive architectural plan and significant new products that are an important first step in bringing enterprise cluster management capabilities to the volume NT cluster market. The technology, products and strategy that Compaq has put forth make them the clear leader in standards-based cluster administration and management. Based on what Compaq is delivering now and in the future, HRG feels Compaq has a leg up on the competition and customers should not hesitate to consider Compaq when implementing enterprise-wide cluster facilities.

Summary of HRG Opinions

The combination of the Compaq E2000 Platform Architecture, cluster management vision and initial release of these cluster management products place Compaq in the best position to deliver intuitive, easy-to-use, cluster management tools that simplify the task

of planning, deploying and operating clusters. Compaq's strong commitment to industry standards will help customers establish a more flexible and cost-effective computing environment that integrates with all Compaq supported environments and allows them to take advantage of emerging capabilities. By combining their Cluster Management Vision with the E2000 Platform Architecture, Compaq has provided customers unparalleled choice, flexibility, scalability, availability, and cost effectiveness.

Compaq clearly gets it when it comes to the issues and benefits of good Enterprise Systems management techniques and they have effectively transferred that knowledge into the Intelligent Cluster Administrator and Cluster Monitor products. They have leveraged the technologies, knowledge and experience of their Digital and Tandem divisions to extend the functionality of their system management products to include MSCS clusters today, with a well defined plan to include all supported cluster environments in the future. Additionally, the integration with the Insight Manager XE suite of applications provides a consistent set of interfaces and standards that Compaq customers can utilize to reduce learning, reduce their cost of ownership and make their most crucial operations activity even easier. Compaq's new cluster administration and monitoring tools are a significant step towards reducing system management costs, improving administrator efficiency, and minimizing system downtime.

Harvard Research Group is an information technology market research and consulting company. The company offers highly focused market research and consulting services to vendors and users of computer hardware, software, and services. For more information contact Harvard Research Group as follows:

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