Intel® Cloud Builders Guide
Intel® Xeon® Processor-based Servers
Neusoft Aclome* Cloud

Intel® Cloud Builders Guide to Cloud Design and Deployment on Intel® Platforms

Neusoft Aclome* Cloud

Intel® Xeon® Processor 5500 Series

Intel® Xeon® Processor 5600 Series

Neusoft 东软

AUDIENCE AND PURPOSE

For cloud service providers, hosters and enterprise IT organizations who intend to build their own cloud infrastructure, it is always useful to start with the knowledge and experience gained from previous work. This reference architecture provides a detailed step by step guide to build up a cloud using Neusoft Aclome*, and also highlights the importance and benefits gained from Neusoft Aclome. Using the contents of this guide, including detailed scripts, screen shots and best practices, should significantly shorten the learning process for building and operating a new cloud computing infrastructure with Neusoft Aclome.

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Executive Summary

Cloud enables agility and efficiency as they provide customers with the benefits of an automated and optimized virtualized service. A cloud may represent a group of computing resources that are dedicated to only one customer (private cloud), or shared with other customers (public cloud). Cloud makes IT more agile and efficient, and it is becoming one of the major trends that affect the server market and customer data centers. This technology has exhibited a series of positive benefits, including improving infrastructure hardware utilization during testing and development, prolonging life cycles, and achieving power efficiency, high availability and disaster recovery. Neusoft Aclome is an open cloud platform for enterprise business solutions and IDC SaaS (software-as-a-service)solutions, it provides an efficient way to build up your own cloud, which makes it easier for customers to build up a cloud in their data centers. Neusoft Aclome uses Intel® VT to dynamically manage hardware resources. It also generates certain solution templates and corresponding instance to implement usage models like load balancing, disaster recovery and resource allocation. Neusoft Aclome benefits customers with more valuable usage models and benefits:

- Intelligence
- Management efficiency
- Energy efficiency
- Utility efficiency

Introduction

Neusoft is the leading IT Solutions and Services provider in China with its operations spread across the globe. Neusoft provides customers from various industries with secure, reliable, high quality, and scalable solutions to help them implement best practices of informationenabled management for improved business operations. Neusoft has developed and delivered a wide range of IT solutions for various industries, including telecom, utilities, financial services, social security, manufacturing, trade logistics, healthcare, education, transportation and other segments. Based on the rich IT solution experiences and increasing customer cloud solution demands, with Intel support, Neusoft developed Neusoft Aclome as a complete cloud computing solution to be the enterprise IT infrastructure, enabling customers to enjoy the cloud benefits without too much building and validation effort. Neusoft Aclome is an open cloudbased solution management platform for traditional enterprise data center and Internet Data Center (IDC). Neusoft Aclome has the following main features:

Solution Management:

Neusoft Aclome is based on virtualization technology and transforms current enterprise IT infrastructure into a cloud platform. It is managed through WEB 2.0 self-service portal as graphical user interface, and can create solution instance based on on-demand request with dynamic resource allocation and management, like computing, network and storage.

Intelligent IT management policy and intelligent IT infrastructure:

Based on intelligent customizable system events management mechanism, Neusoft Aclome supports intelligent policies for various scenarios, like loadbalancing and disaster recovery. This enables Neusoft Aclome to automatically handle various system events under different scenarios, and also makes it possible to intelligently allocate computing resources to fulfill customers' dynamic business requirements.

Unified resource management:

Neusoft Aclome implemented a real-time management for all physical and virtual servers, database servers, application servers, network and storage. All resource statuses are displayed through a graphical user interface, which simplifies the customer's effort to perform various real-time operations, such as monitoring, risk analysis and historic data query.

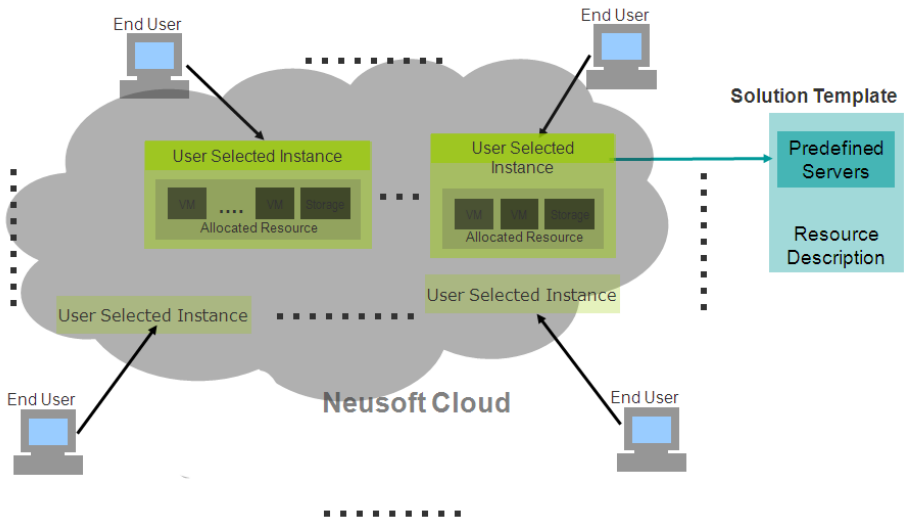


Figure 1: Neusoft Reference Architecture

Lower TCO:
Neusoft Aclome is based on Intel® VT. Intel Architecture has been widely used in various data centers, due to its high reliability and high performance and lower data center operation costs.

Neusoft Aclome dynamically manages the IT infrastructure, shipped with robust manageability, supports customers to effectively lower the total cost of ownership (TCO) and reduce operation risks.

Remote Access:
While evolving a traditional data center into a cloud data center, computing resources and storage resources are both isolated from business solutions. Neusoft Aclome provides various reliable technical methods for solutions to access their data

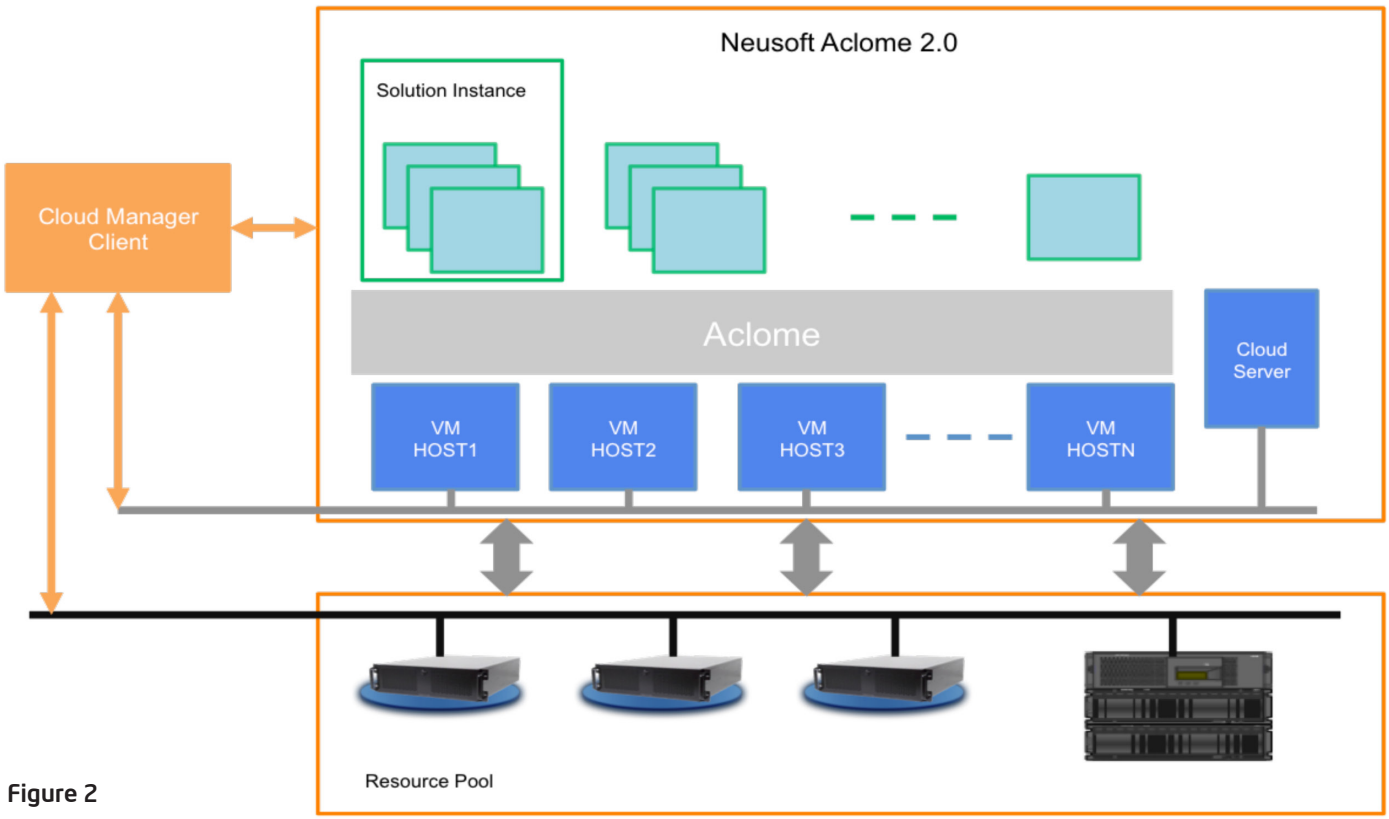


Figure 2

Module	Function
User Management	manage cloud data center user profile, login and authentication.
Billing	gather statistics of resource utilization(computing, storage, network), serve as billing basis
Resource Management	mange physical resources of computing, storage and network, together with corresponding virtual resources and solution templates.
Power Management	manage power consumption based on power policy
Monitor	real-time monitor resource status
Policy Management	support automatically intelligent management

Figure 3: Neusoft Aclome management modules list

remotely through, VPN (Virtual Private Network), SSH (Secure Shell) and VNC (Virtual Network Computing).

Intelligent energy management for green data center:

The goal of Policy Power Management usage models is to optimize productivity per watt in order to reduce total cost of ownership (TCO). Requirements include the capability to monitor and cap power in real-time at server, rack, zone and data center levels. This means the ability to manage aggregated power consumption within a rack, zone or data center based on available power and cooling resources. Load migration policies based on power consumption and cooling resources bring further benefits. With the help of Intel® Node Manager technology and intelligent policy management, Neusoft Aclome perfectly aligns business solutions with IT resources in an efficient way. Neusoft Aclome not only implements resource on-demand allocation, but also implements power on-demand allocation. Neusoft Aclome can allocate power via real-time monitor and also can intelligently allocate power through dynamic power adjustment.

Neusoft Aclome Overview

As an open cloud platform for enterprise business solutions and IDC SaaS solutions, Neusoft Aclome provides convenient and efficient resource management, policy management and solution management, providing customers with agile resources management (computing resources, storage resources and network resources), fast cloud building process, while lowering enterprise IT infrastructure TCO. In Neusoft Aclome based cloud solution, various hardware resources are integrated as a resource pool, which includes computing resources, storage resources and network resources. Neusoft Aclome uses Intel® VT to dynamically manage hardware resources. Based on business requirements, Neusoft Aclome generates certain solution templates and corresponding instance, then uses these templates and instances to implement load balancing, disaster recovery and resource allocation according to real-time status and requirements. So far, Neusoft Aclome supports most major VMM (Virtual Machine Manager) software on Intel® Architecture, including VMWare Xen*, XenServer*, KVM, etc. For guest OS on VMM, it supports Windows* and Linux*.

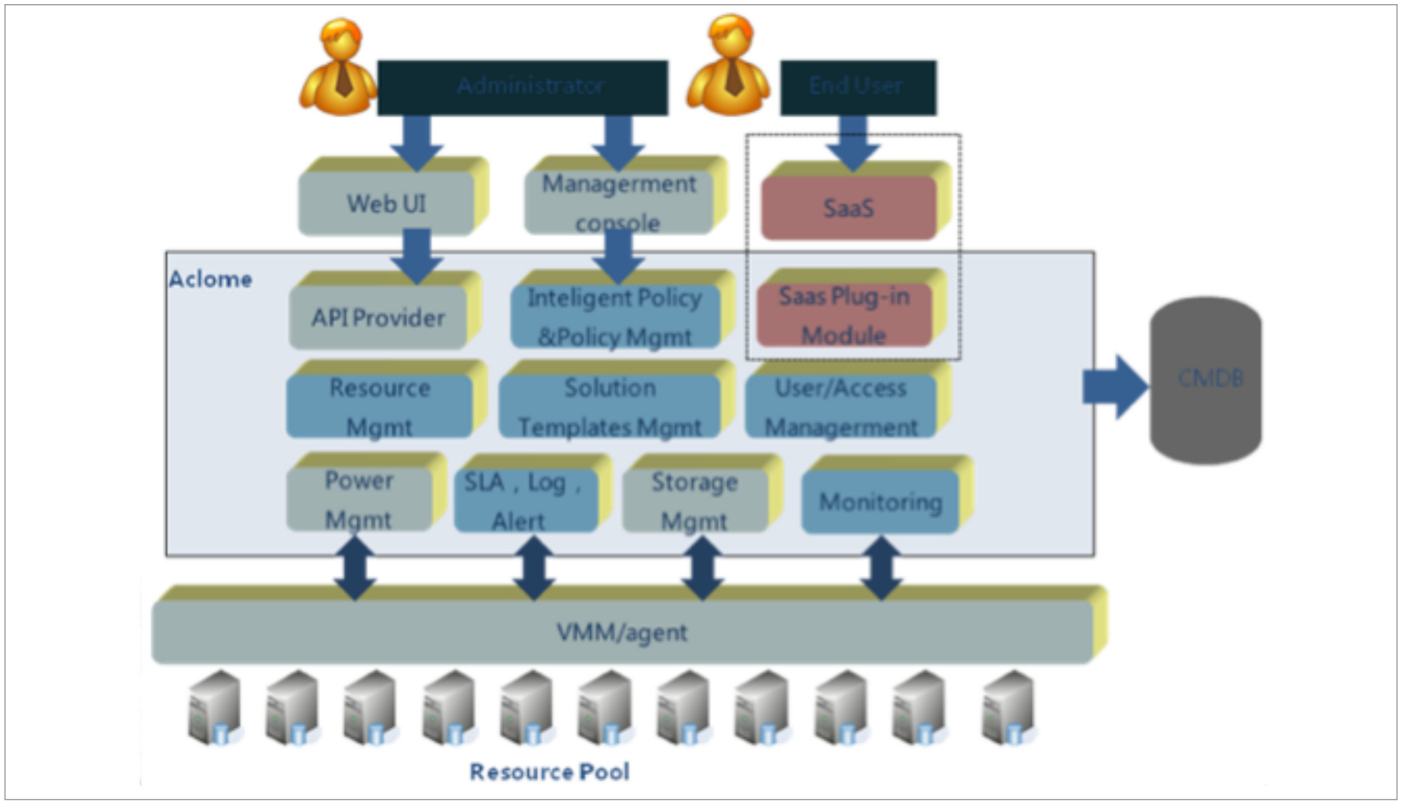


Figure 4: Neusoft Aclome software architecture overview

Neusoft Aclome is based on Intel® Xeon® processors and Intel® VT (Intel VT). During our benchmarking on Intel® Xeon® X5680, Intel VT provided great support on Neusoft Aclome, efficiently reduced the VMM I/O traffic, sped up data transfer and greatly boosted solution performance. Neusoft Aclome also adopts Intel® Intelligent Power Technology to regulate power consumption and adjust server performance according to application demand, maximizing both energy cost savings and performance.

Neusoft Aclome uses storage virtual mirror and instance to provide necessary block devices for file system and solution business. At the same time, the storage needs to have good scalability to fulfill middle and large scale cloud. Neusoft Aclome storage device also requires NFS (Network File System) or iSCSI (internet SCSI) service for virtual mirror storage.

Neusoft Aclome mainly uses the cooperation of virtual switch and physical switch to finish the cloud network management, such as VLAN (Virtual Local Area Network) allocation and QoS (Quality of Service) management.

Category	**VMM**	**OS** (can be monitored)	**Database** (can be monitored)	**Application Server** (can be monitored)
Software System	VMware Xen XenServer KVM	FreeBSD HPUX LINUX MacOSX Solaris Win32	Tomcat ColdFusion Geronimo GlassFish IIS iPlanet JBoss Jetty OC4J Perlbal Resin Weblogic Weblogic Admin WebSphere	DB2 Oralce Sybase PostgreSQL MySQL Microsoft SQL Server

Figure 5: Neusoft Aclome Software Configuration

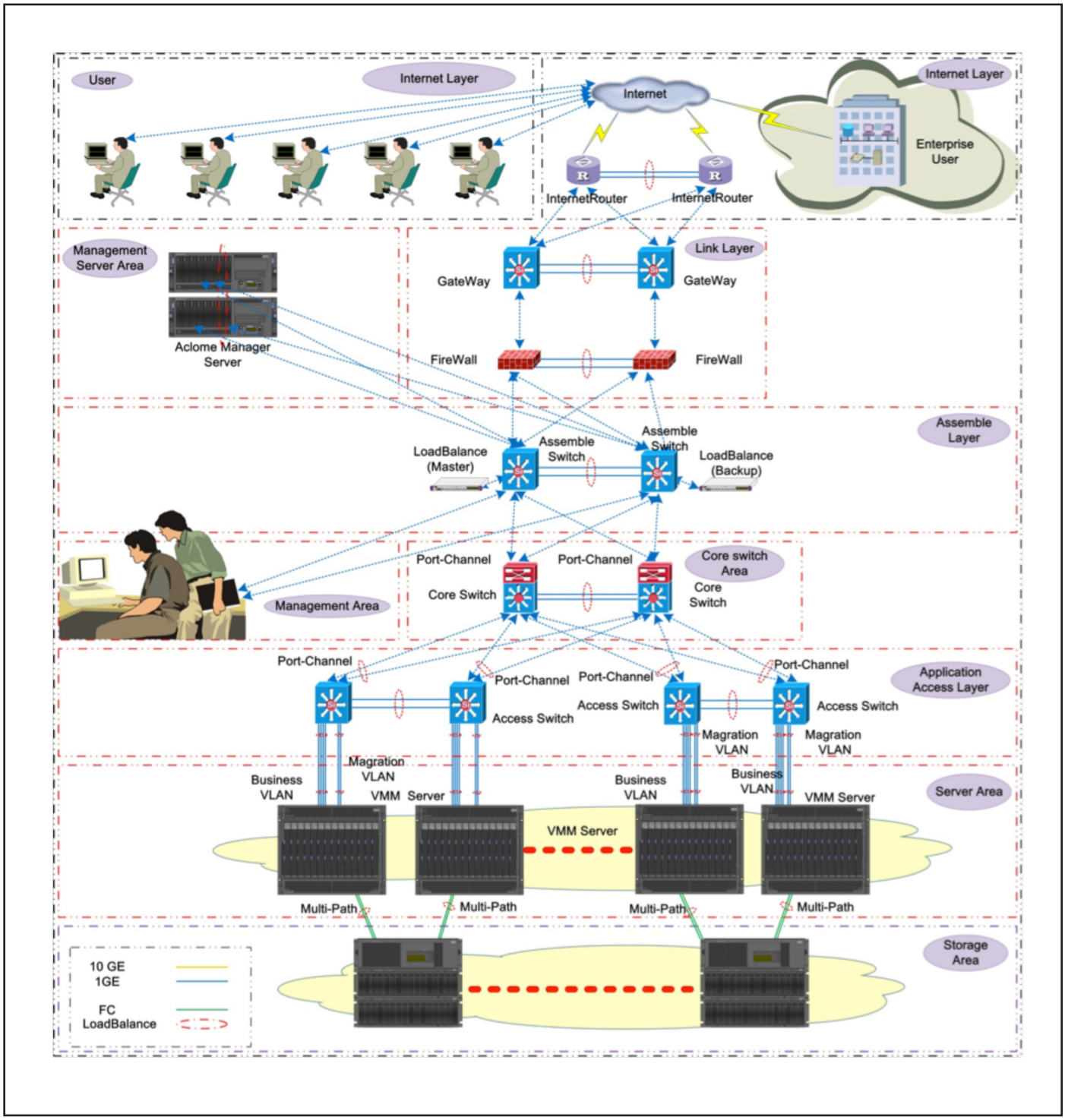


Figure 6: Neusoft Aclome validation environment

Test Bed Blueprint

In this reference architecture, we demonstrate the building up of a private cloud for a small cloud data center with Neusoft Aclome. A cloud data center usually includes management server, NFS storage, virtual machines as computing resource, and network devices. Here is the hardware configuration. We use this configuration to validate Neusoft Aclome valuable usage models.

Technical Review

Use Case Details

This section discusses the process for

Device Type	Configuration	Number
Servers	Intel® Xeon® x5680*2, 16GB Memory 6 * GE NICs, 500G *2 SATA	4
Neusoft Aclome Server	Intel® Xeon® x5680 *2, 8GB Memory, 2 * GE NICs, 500G *2 SATA	1
NFS Storage	2TB	1
Network Device	Catalyst 3560G	1
DHCP Server	default configuration	1

Figure 7

Neusoft Aclome network is comprised of three parts:

- Management Network is for private cloud administrator to manage physical devices and virtual resources. IP address will be 192.168.180.0/255 segment
- Migration Network is used to complete the virtual resource dynamic migration between various physical devices, and to avoid business interruption. IP address will be the same as Management Network.
- Service Network is used to support business solutions by connecting to external services. To make it more reliable and secure, this network may be divided into several independent VLAN for business isolation. This network mainly configured in virtual machines or physical machines which provides services. IP address may be 192.168.185.0/255, and can set up different VLAN according to real needs.

a number of use cases ranging from basic system functionality to advanced cases, including performance and power management. The following use cases were applied:

- Initialize resource management
- Create and apply solution template
- Configure intelligent policy
- Apply policy for solution
- Resource monitor
- Energy management

Actors

- For the following use cases, Aclome is the Neusoft Aclome cloud administrator with access to resources such as physical servers, network, storage, load balancers, virtual machine templates, and etc.

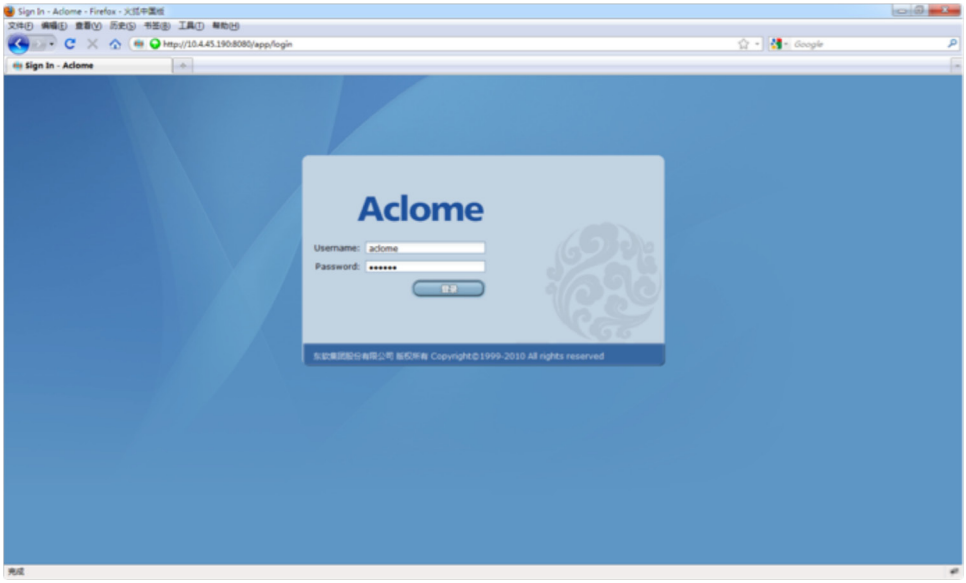
Preconditions

- This section describes the preconditions to finish actions in the following sections.
- Installed VMM (KVM/VMWare/Xen/Xenserver) in the physical servers
- Set up IT infrastructure according to previous topology diagram
- Installed Neusoft Aclome correctly
- The Acorn solution is ready for validation (Acorn is one example solution)

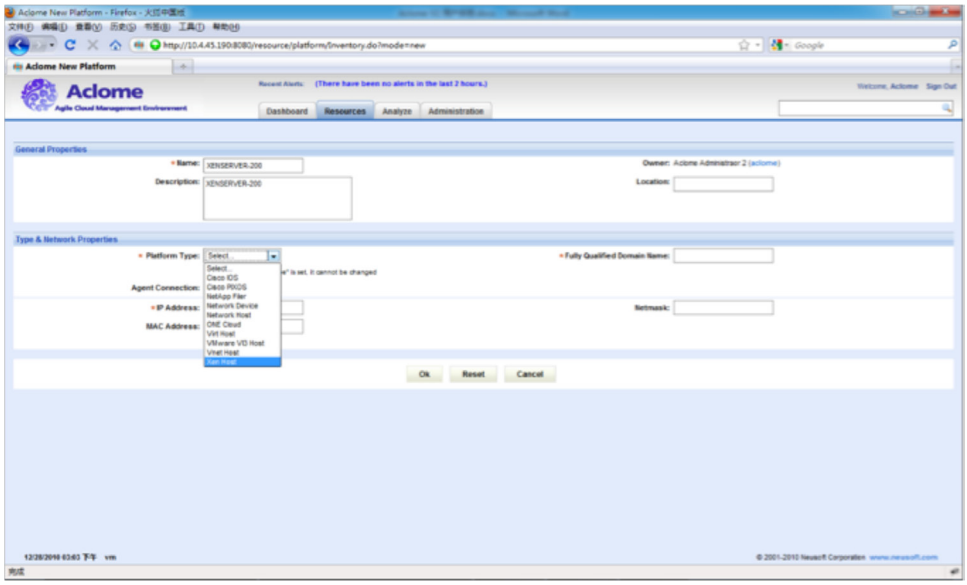
Execution and Results

Initialize Resource Management

1. Open Web browser and input the URL of Aclome Server
2. Input user name "Aclome" and passwd, log into Neusoft Aclome

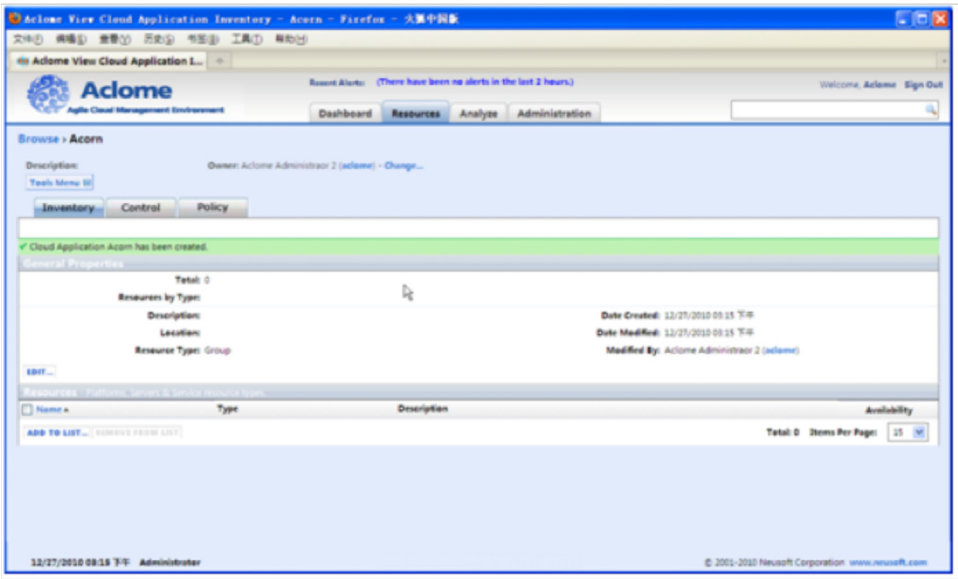


3. Initialize resource management
   - Click "Resources" tab, open the resource management page
   - Click "Tools Menu" button, select "New Platform" from the menu
   - Fill platform attributes (input "Virtual Host" as "Platform Type") then press "OK"
   - The new VMM server is installed into Aclome and ready to provide corresponding services

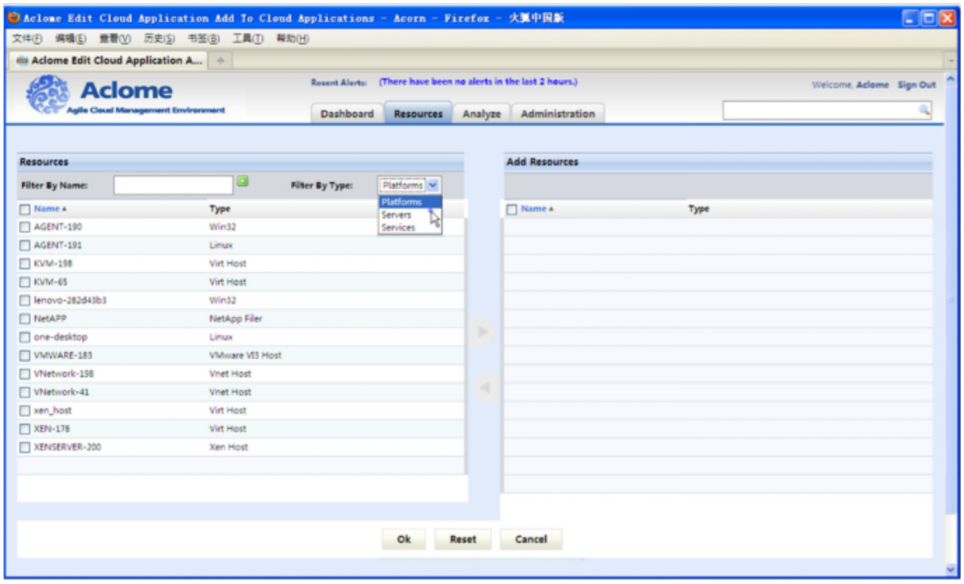


Create and Apply Solution Template

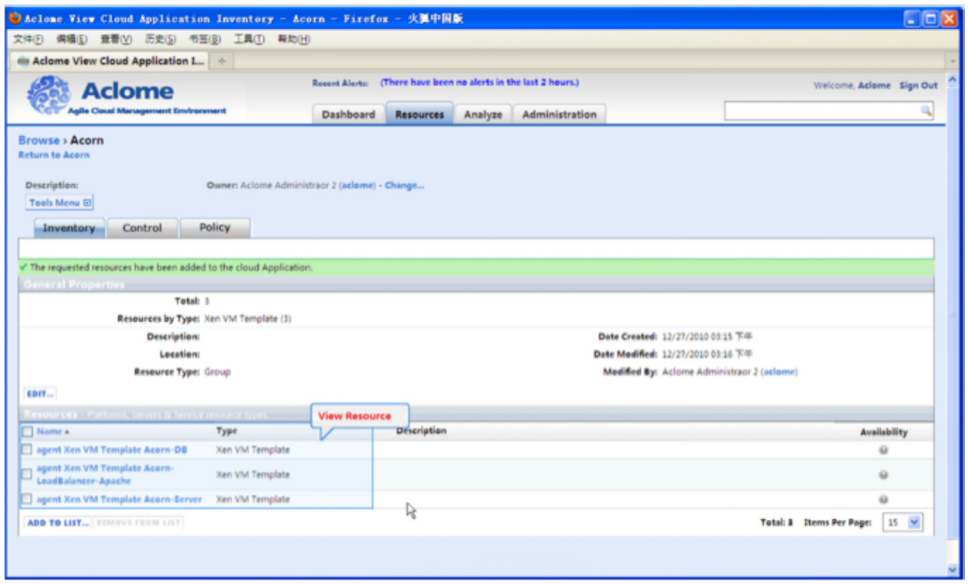
1. Create solution template
   - Click "Resources" tab > "Cloud Applications" > "Tools Menu" > "New Cloud Application" > open the cloud application attribute page
   - Fill cloud application name and description, click "OK"



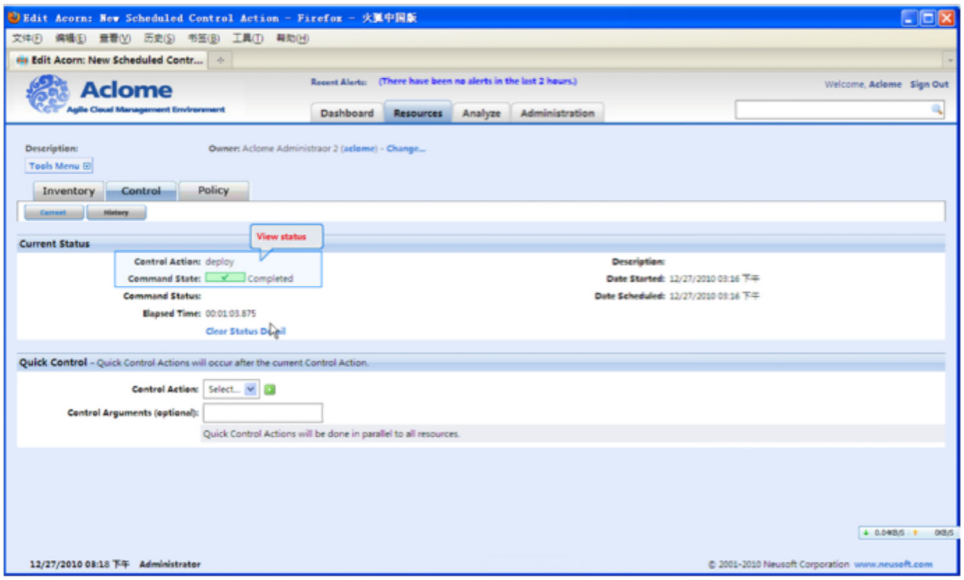
   - Click "Add To List" to add resources to cloud application
   - Select three virtual machine templates ("Acorn-LoadBalancer-Apache," "Acorn-Server" and "Acorn-DB" for Acorn), add them into "Add Resources" list, then press "OK" button



- Verify virtual machine template appears in "Resource" list



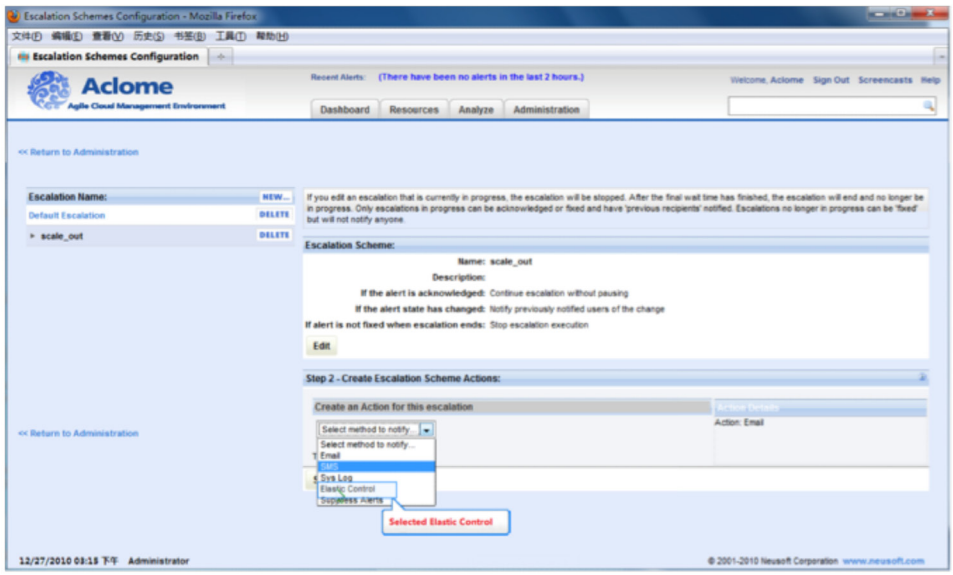
2. Apply solution template
   - Click "Control" tab of Acorn application, select "Deploy" from the "Control Action" menu, click "Execution" button
   - Verify "Command State" changed to "Completed", which indicates the application success



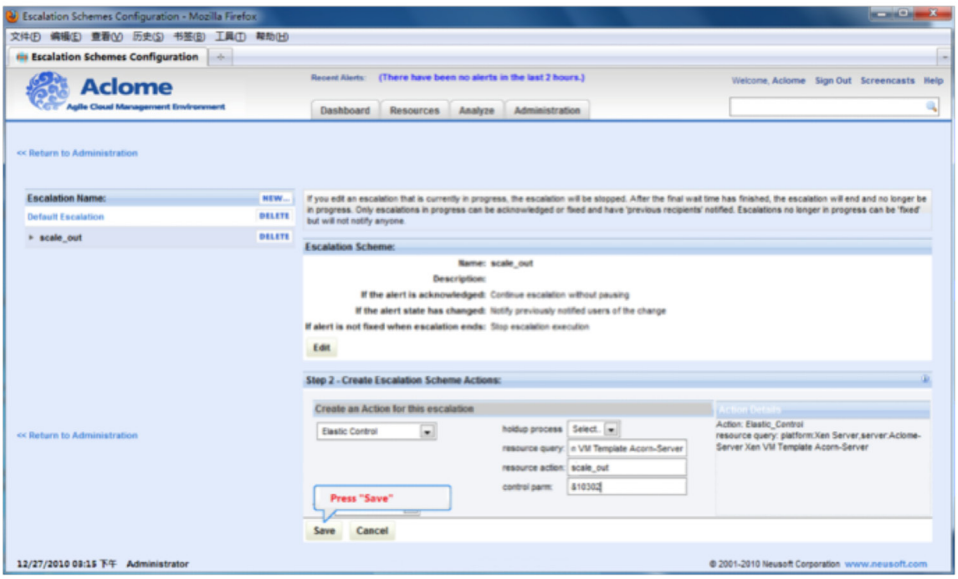
Configure Intelligent Policy

1. Define elastic computing "Scale Out" policy

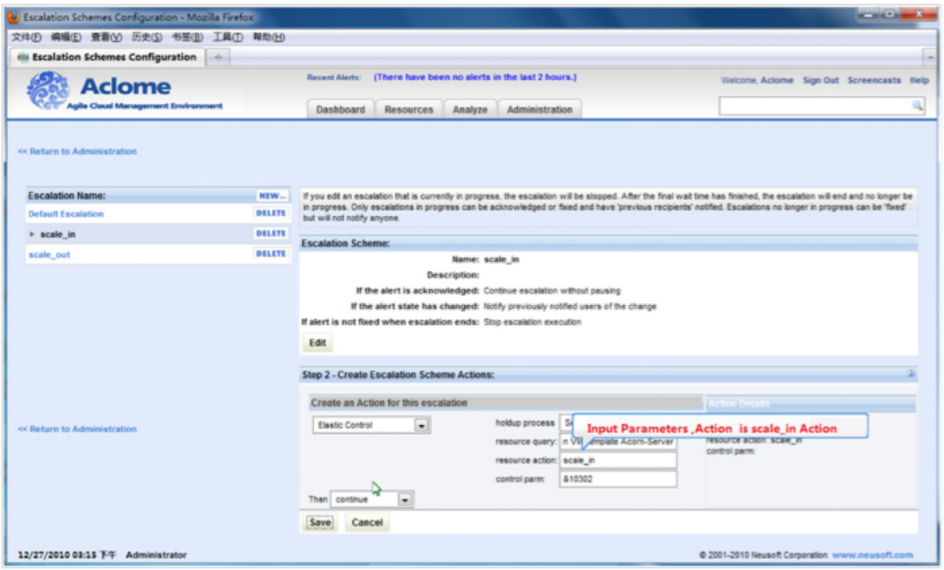
   - Click "Administrator" tab, click "Escalation schemes Configuration"
   - Fill policy name, then press "Next Step" button
   - Select "Elastic Control" from "Create an Action For this Escalation" menu



   - Fill policy query rule, "Scale Out" as Action method, click "Save" to save our changes

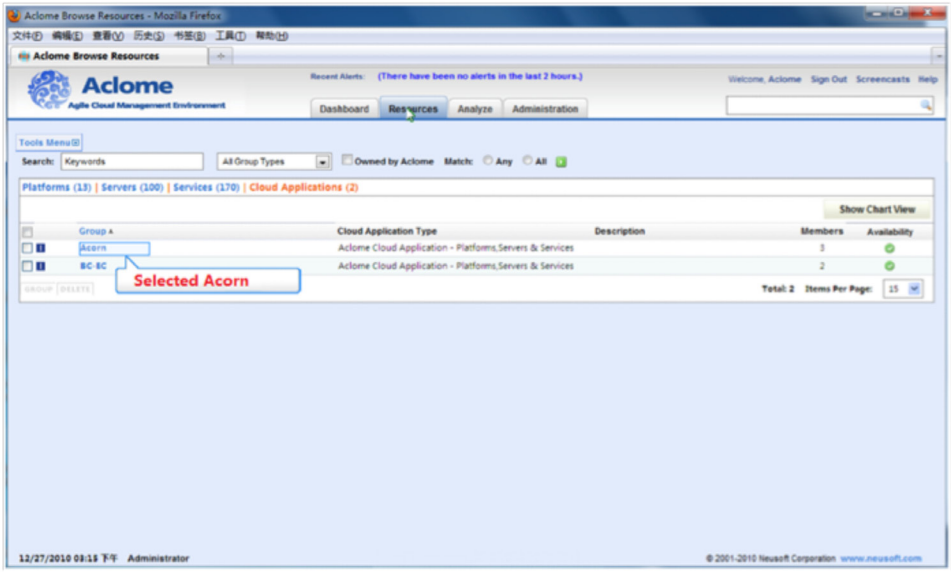


2. Define elastic computing "Scale In" policy
   - Following the same steps to define elastic computing "Scale In" policy, only choose "Scale In" in Action

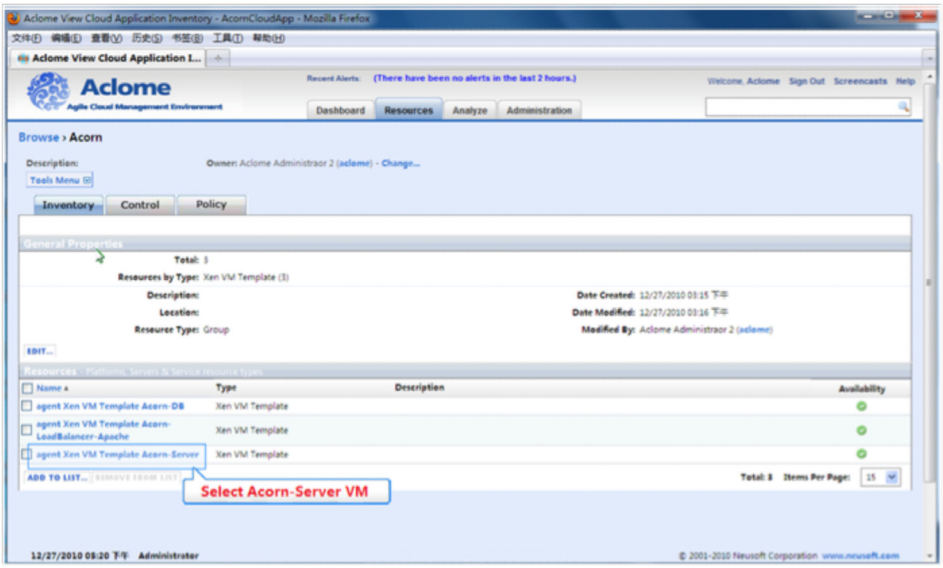


Apply Policy for Solution

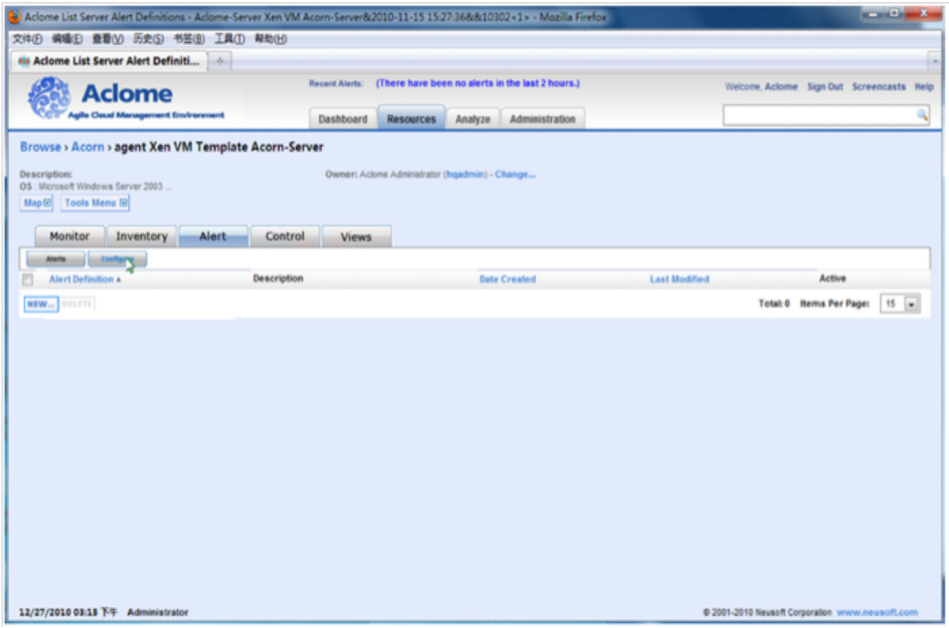
1. Select Acorn solution
   - Click "Resources" tab, open the resource management page



2. Select virtual machine
   - Select Acorn solution's virtual machine "Acorn-Server"

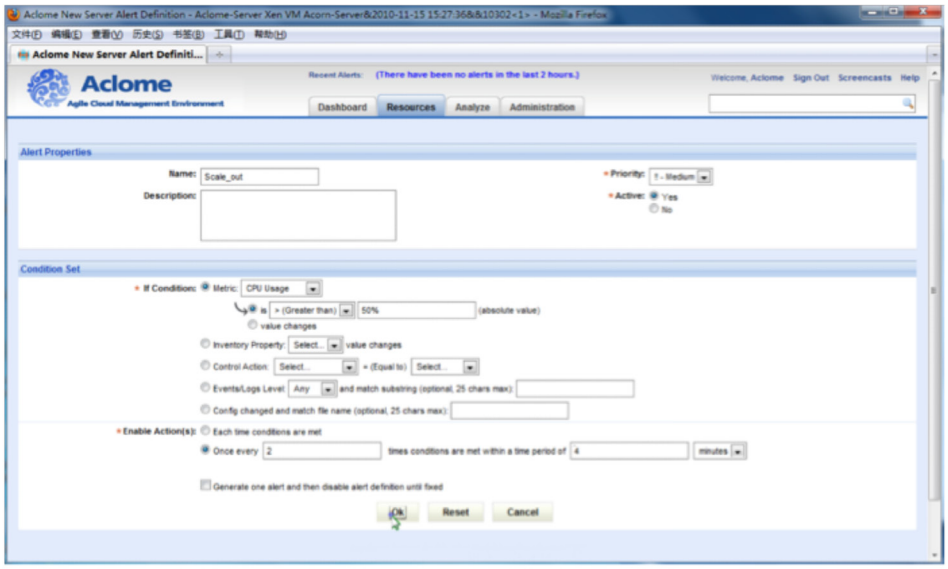


3. Create Alert
   - Click "Alert" tab, then press "Create" button

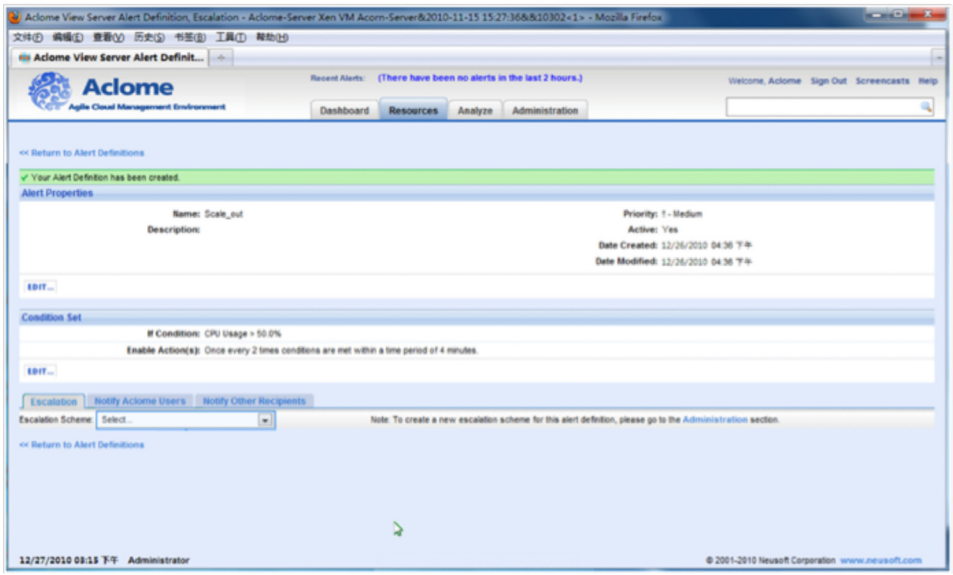


4. Define "Scale out" Alert condition

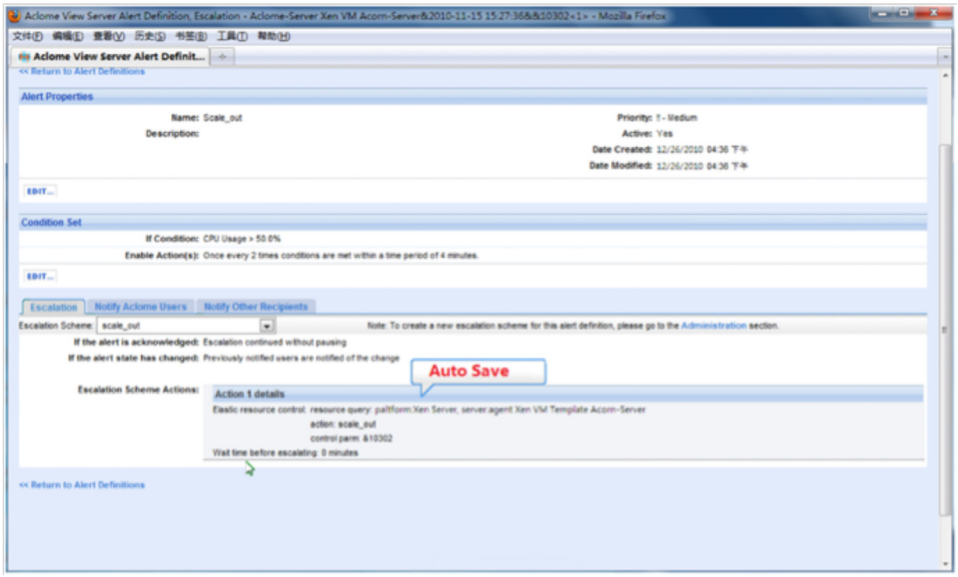
   - Select alert monitor indicator "CPU Usage" from "Metric" menu, fill in trigger value as "Greater than", "50%", which means this alert will be triggered when CPU usage is greater than 50%
   - Fill in monitor cycle as "Once every 2 times within a time period of 4 minutes"
   - Press "OK" button to save change
   - Select elastic computing policy in the "Alert Definition" page



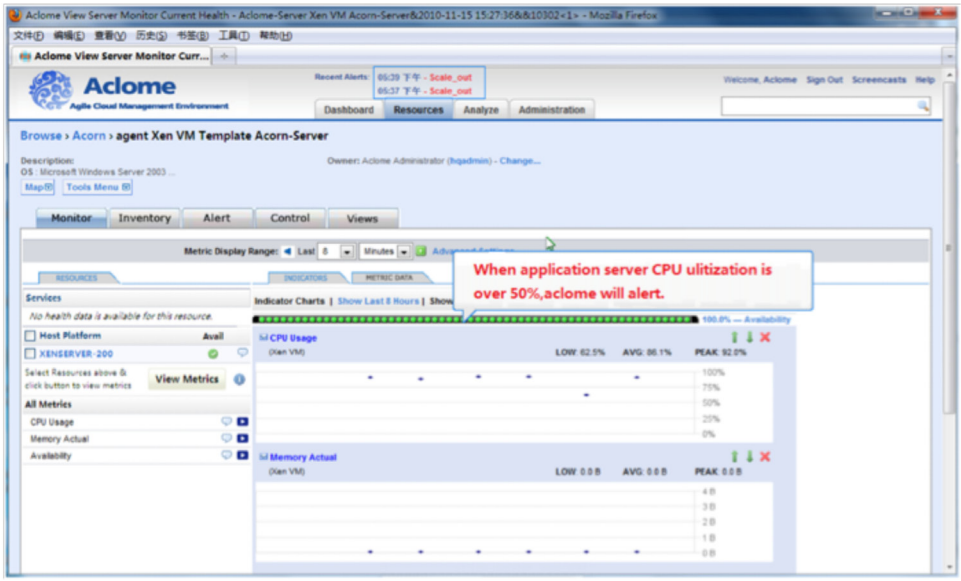
   - Verify the policy is automatically saved



5. Define "Scale in" Alert condition
   - Repeat above step 4 to define "Scale in" alert, only difference from step 4 is to fill trigger value as "Little than", "10%"

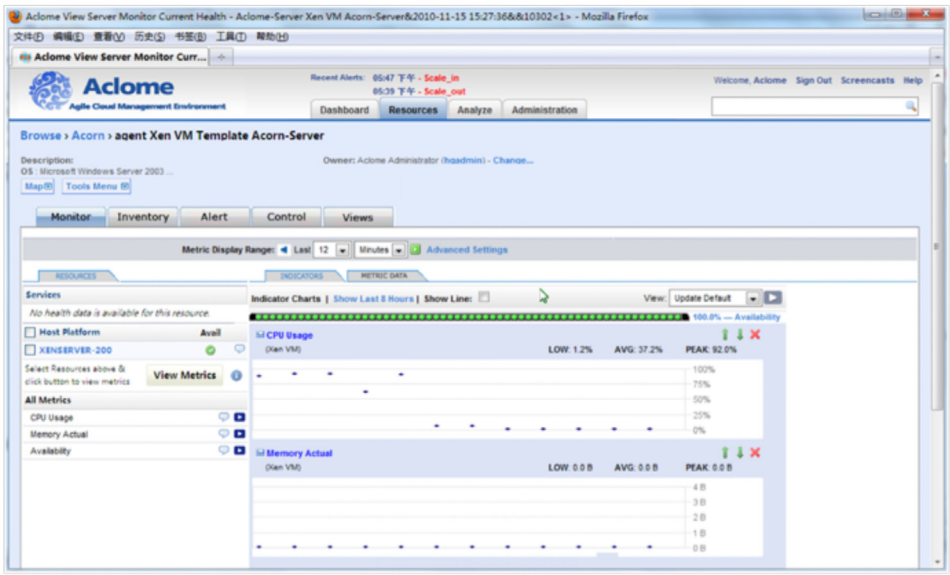


6. Verify policy
   - Using the performance benchmarking tool to add on Acorn solution requests, Neusoft Aclome then monitors the higher CPU usage



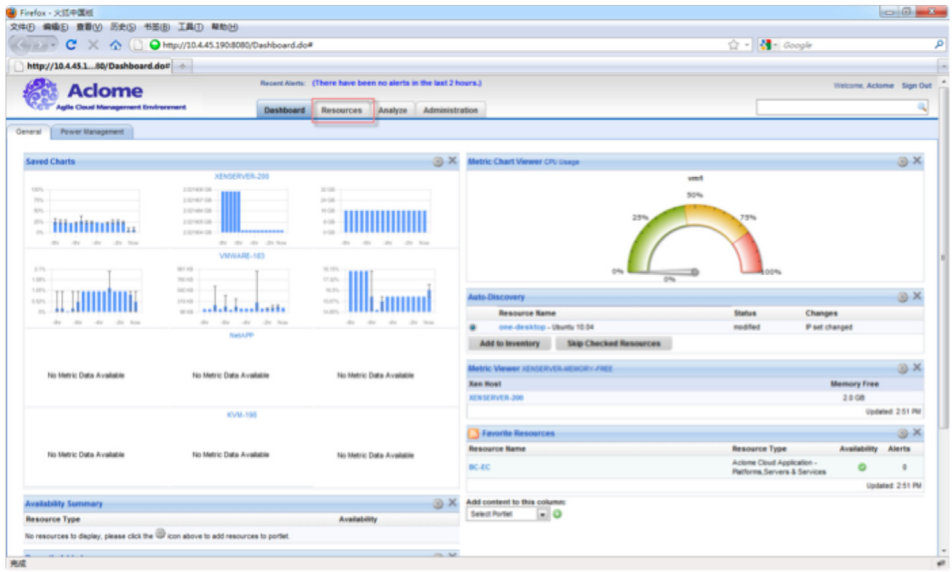
   - Then Neusoft Aclome will automatically create new virtual machines to lower the performance pressure based on the "Scale Out" policy
   - Verify the policy success execution indicator: "Scale Out" in the top of Neusoft Aclome

- Using the benchmark tool to lower Acorn utilization, the CPU usage is lower and lower. "Scale In" policy is triggered and verified via the policy success execution indicator: "Scale In" in the top of Neusoft Aclome.



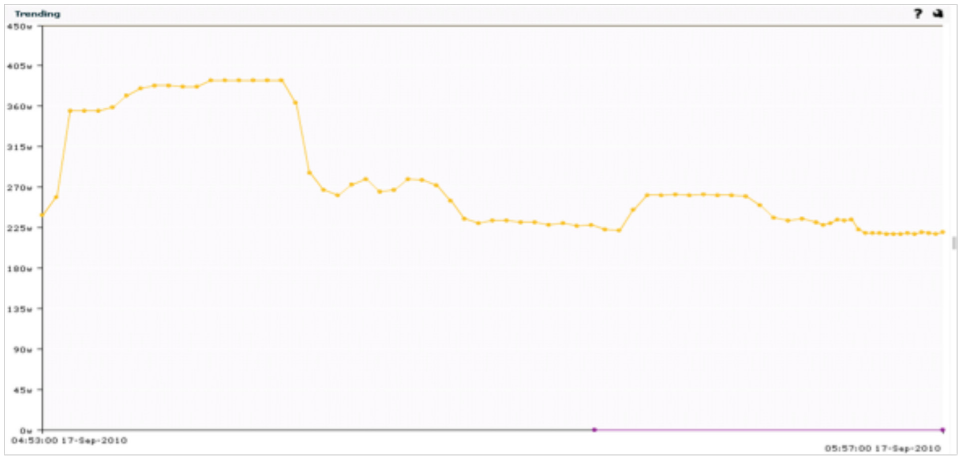
Resource Monitor

1. Log in Neusoft Aclome, enter "Dashboard" page; all major performance indicators are visualized as list, diagram and flash
2. Click "  " button, modify "CPU Usage" display settings

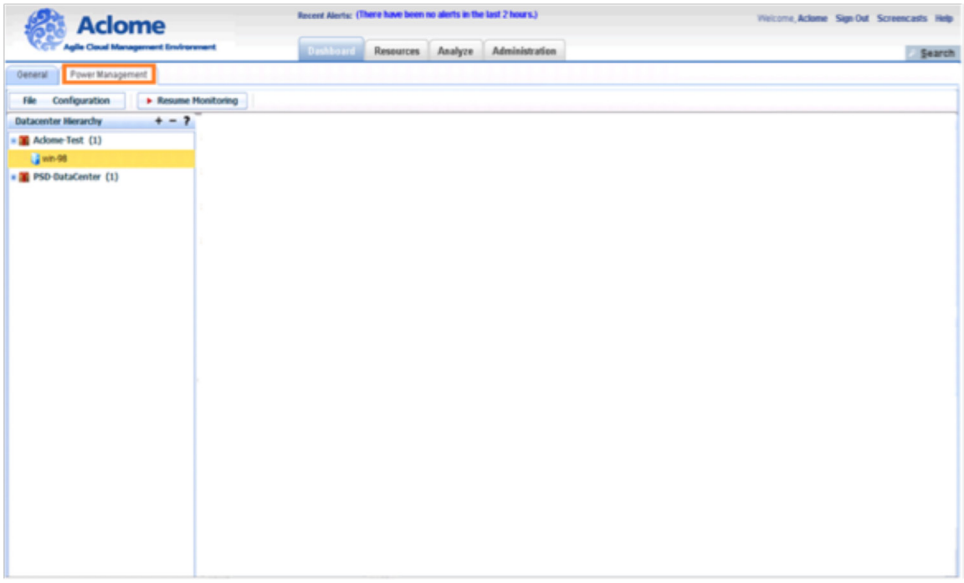


Energy Management

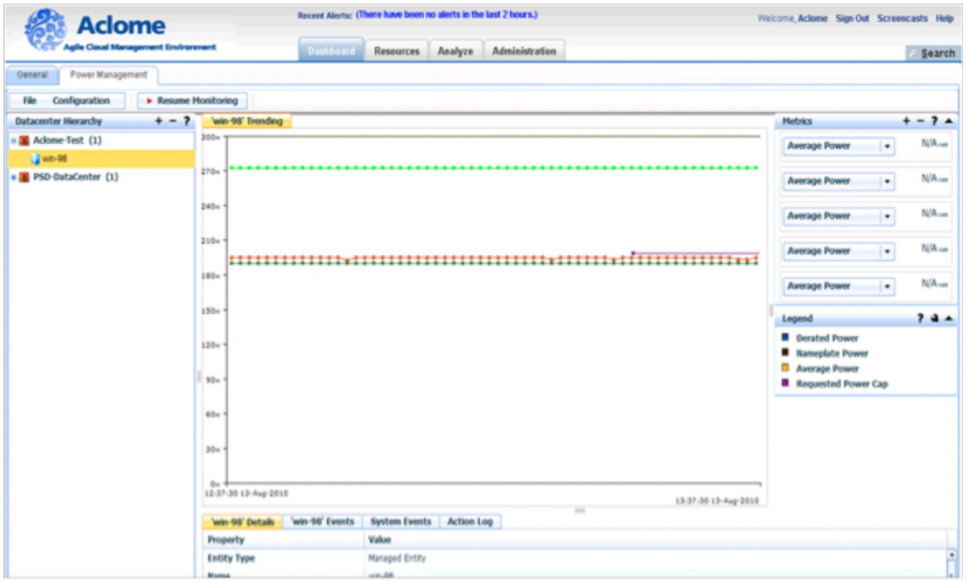
1. Neusoft Aclome energy management policy is not applied at first to gain the baseline. During this verification, user numbers are changed every 5 minutes, and collected energy consumption information. Three changes were applied and below is the power consumption result:



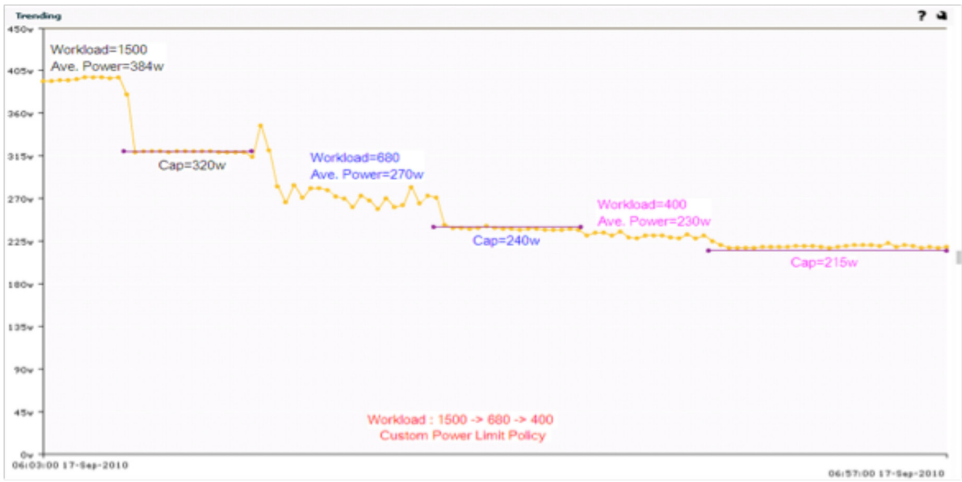
2. Now Neusoft Aclome is used to monitor resource pool energy consumption and apply energy limitation with policy on the workload.
   - Click "Power Management" button in "Dashboard" page, entering energy management page



   - Click corresponding server button to apply detailed energy management policy: when user requests are 0-400, set the resource pool total power consumption limitation as 215W; while user requests are 401-680, set the resource pool total power consumption limitation as 240W; while user requests are 681-1500, set the resource pool total power consumption limitation as 320W.



3. Neusoft Aclome energy management policy was applied. During this verification, user numbers were changed every five minutes, and collected energy consumption information. Three changes were applied and below is the power consumption result:



- The difference is clear: Neusoft Aclome energy management module effectively reduced the power consumption based on the policy

Workload	CPU%	No Policy Power (W)	Custom Limit Power (W)	Run Time Power (W)
1500	96%	384	320	320
680	43%	270	240	239
400	25%	230	215	218

Things to Consider

Scalability

Current topology in this document is to build up a cloud infrastructure for small enterprise. When you target for middle and large scale cloud, corresponding devices should also scale out. The scalability of the solution is heavily impacted by:

- Network devices capability and architecture. For middle and large scale cloud, we suggest to use 10GE network, running management network in an independent non-VLAN environment.
- Storage architecture. We suggest using scalable storage infrastructure and effectively integrating storage resources.
- Server hardware capability. We suggest using the latest Intel® Xeon® processor-based servers to gain better performance and scalability.

IO performance

Currently, Neusoft Aclome has made use of Intel® VT to achieve better performance and reliability. But there is still room for Neusoft Aclome to keep improving the storage and network IO performance with the latest Intel Xeon processor-based servers and the latest Intel VT, to reduce VMM interruptions in IO operation and release more CPU computing capability from IO package encoding and decoding.

Conclusion

In this guide, the components, implementation process and key usage models for cloud is described and validated, a prototype built jointly by Intel and Neusoft with the goal of demonstrating possible architecture and deployment of a cloud based on Neusoft Aclome.

This document demonstrates that Neusoft Aclome provides an efficient way to build up your own cloud, and greatly reduced the development cycle for customers to build up cloud in their data centers. Neusoft Aclome has the standard functionality expected from normal cloud system, together with more valuable usage models and benefits, such as intelligence, management efficiency, energy efficiency and utility efficiency. Neusoft Aclome unified the physical resource management and virtual resource management, linked them together to achieve the best performance and energy consumption in an efficient way.

Glossary

Intel® Virtualization Technology (Intel® VT): Provides comprehensive hardware assists, which boost virtualization software performance and improve application response times. Intel® VT reduces demands placed on virtualization software so that more applications and heavier workloads per server can be consolidated to get better value from server and software investments.

Intel® Intelligent Power Technology: Conserves power while delivering advanced power-management capabilities at the rack, group, and data center level. Providing the highest system-level performance per watt[1], Intel Intelligent Power Technology helps business gain capacity to grow, increase IT performance, and save energy costs.

Intel® Intelligent Power Node Manager: Intel Intelligent Power Node Manager resides on Intel® Xeon® 5500 series server (and later) platforms. It provides power and thermal monitoring and policy based power management for an individual server. Capabilities are exposed through standard IPMI interface from supported Baseboard Management Controllers (BMC). This requires an instrumented power supply such as PMBus™.

Intel® Data Center Manager (Intel® DCM): Intel Data Center Manager scales Intel Intelligent Power Node Manager functions to racks and groups of servers and enables IT users to benefit from increased rack density, reduced capital and operational expenses.

Appendix
Server Power Management

Intel® Power Management Technologies

Micro-processors are possibly the most energy intensive components in servers and have traditionally been the focus of power management strategies. Emerging technologies such as solid state drives have the potential to significantly reduce power consumption and in future, management of memory power consumption may be incorporated.

Intel Node Manager and Intel Data Center Manager are designed to address typical data center power requirements such as described above.

Intel Node Manager is implemented on Intel server chipsets starting with Intel Xeon processor 5500 series platforms.[1] Intel Node Manager provides power and thermal monitoring and policy based power management for an individual server and is exposed through a standards based IPMI interface [2] on supported Baseboard Management Controllers (BMCs). Intel® Node Manager requires an instrumented power supply conforming to the PMBus* standard. [3]

Intel® DCM SDK provides power and thermal monitoring and management for servers, racks and groups of servers in data centers. Management Console Vendors (ISV's) and System Integrators (SI's) can integrate Intel DCM into their console or command-line applications to provide high value power management features. Intel DCM capabilities can be found on OEM platforms that support

Intel® Node Manager. These technologies enable new power management paradigms while minimizing workload performance impact.

Intel Intelligent Power Node Manager

Intel Xeon processors regulate power consumption through voltage and clock frequency scaling. Reducing the clock frequency reduces power consumption, as does lowering voltage. The scale of reduction is accomplished through a series of discrete steps, each with a specific voltage and frequency. The Intel Xeon processor 5500 series can support 13 power steps. These steps are defined under the ACPI (Advanced Configuration and Power Interface) [4] standard and are colloquially called P-states. P0 is nominally the normal operating state with no power constraints. P1, P2 and so on aggressively increase the power capped states.

Voltage and frequency scaling also impacts overall system performance, and therefore will constrain applications. The control range is limited to a few tens of watts per individual micro-processor. This may seem insignificant at the individual micro-processor level, however, when applied to thousands or tens of thousands of micro-processors typical found in a large data center, potential power savings amount to hundreds of kilowatt hours per month.

Intel® Node Manager is a chipset extension to the BMC for supporting in-band/out-of-band power monitoring and management at the node (server) level. Some of the key features include:

- Real-time power monitoring.
- Platform (server) power capping.
- Power threshold alerting.

Figure 9: Intel® Node Manager Power management Closed Control Loop shows the Intel NM server power management closed control loop.

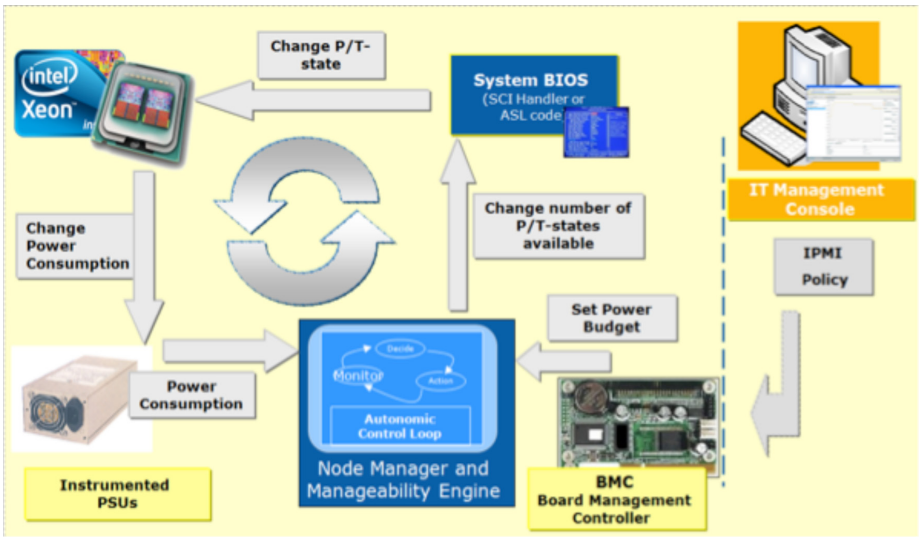


Figure 9: Intel® Node Manager Power management Closed Control Loop

End Notes

1. Intel® Microarchitecture Codename Nehalem, http://www.intel.com/technology/architecture-silicon/next-gen/index.htm?iid=tech_micro+nehalem
2. Intelligent Platform Management Interface, http://www.intel.com/design/servers/ipmi/ipmi.htm
3. PMBus*, http://pmbus.org/specs.html
4. Advanced Configuration & Power Interface, http://www.acpi.info/

For More Information

Intel® Cloud Builders: http://intel.com/cloudbuilders

Intel® Xeon® processors: http://intel.com/xeon

Intel® Virtualization Technology: http://www.intel.com/technology/virtualization/

Neusoft: http://www.neusoft.com/

Intel® Intelligent Power Node Manager: http://www.intel.com/technology/intelligentpower/index.htm

Intel® Data Center Manager: http://software.intel.com/sites/datacentermanager/index.php

Disclaimers

Δ Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See www.intel.com/products/processor_number for details.

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