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Feature

Power Source Management for Network Equipment

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1. Introduction

With the recent rise in various services using networks, the types of network equipment and the methods of composing a network system never cease to increase. For personal use, networking users are on the rise.

For such a wide range of network systems, uninterruptible power supplies (hereinafter referred to as " UPS "), Network Power Manager, and other power controllers are required to be flexibly adapted. (For the purpose of this paper, UPSs and power controllers are called " power supply units. ")

This paper describes the basic technology and control techniques for typical network devices and specifies the functions required in power supply units used in those devices.

2. Characteristics of network devices

Network devices include computers, printers, hard disks, hubs, routers, firewalls, and LAN switches, along with other equipment for various uses. This chapter characterizes devices closely linked with power supply management.

2.1 Computers

2.1.1 Shutdown management

Many of the computer operating systems (hereinafter referred as " OS ") retain information to be written to the hard disk temporarily to increase the input/output efficiency of the hard disk. Therefore, when the computer is stopped, the information in the memory must be written to the hard disk. One must also stop the application software that uses the hard disk. This series of tasks required to stop the computer is called shutdown management.

When a sudden power failure occurs, the information in the memory is lost, resulting in the hard disk getting logically destroyed. The use of a UPS and UPS control software allows shutdown management to be conducted in the case of a power failure, thus enabling the computer to stop safely.

2.1.2 Advanced Configuration and Power Interface (ACPI)

The use of an ACPI-compatible computer and OS makes power controls listed below a reality.

① Shutdown by the power switch on the computer

② Automatic power-off after the completion of shutdown

③ Low-power-consumption action in suspense mode.

These functions avoid system destruction induced by user mishandling, thus making the system as user-friendly as a home electronics product. Even when a UPS is used,

one does not have to turn off the UPS output after the computer stops.

In a scheduled run with a UPS, the ACPI may keep the computer unstarted even when the UPS output is turned on. This may be avoided by a particular configuration of the computer, although the configuration may not be the same in all computers. Care must therefore be taken.

2.1.3 Wake On LAN (WOL)

The use of WOL-compatible LAN board and computer enables the computer to start via a network. With commercially available system management software and the power management function of the ACPI, one can stop the computer from a remote site.

However, if one is attempting to conduct a scheduled run with system management software, one needs a control computer that runs round the clock. In such a case, using a power supply unit will, as always, be effective in terms of reliability, along with other terms.

2.2 Network relay equipment

2.2.1 Computer-base architecture

Of all network devices, firewalls, proxy servers, routers, and other equipment designed for the advanced relaying of parts of a network may have been implemented with UNIX or other computer. One therefore requires a UPS to protect the equipment, although it does not look like a computer.

2.2.2 Power supply by LAN

LAN cables used in many network systems are twisted pair cables. Of the four pairs of stranded wires in the twisted pair cable, two pairs are used to supply power to the terminals and other equipment. Fig. 1 shows how equipment is typically used.

When equipment is installed on a wall or ceiling, it requires no power wiring. There is no need for backup by UPS for each item of equipment; the only thing needed is backup by the LAN switch on the premises of the power supplier. This will therefore considerably facilitate system introduction and modification.

Different manufacturers design their devices differently, and standards are being set by the Institute of Electrical and Electronic Engineers (IEEE).

2.3 High-reliability server system

2.3.1 Duplexing of the computer internal unit

The system has a duplexed version of CPU, I/O board and other components to increase reliability. Power is provided by a hot-swap AC/DC unit to enable power to be received by multiple systems. Fig. 2 shows a typical configuration of a system with a duplexed power supply. There can also be a system that detects failures in power reception and units.

In such a system, the use of a low-priced UPS achieves sufficient reliability. However, UPS management software to be mounted on the computer is required to comprehensively manage the status of multiple UPSs.

2.3.2 Cluster system

Multiple computers are interlinked to increase reliability and distribute the load. Another computer or a particular application can handle those computers as a single computer.

Fig. 3 shows a typical configuration of the smallest cluster system. The UPS used in this example is required to achieve the following functions:

① When the system starts, the hard disk should start before all other computers.

② When the system stops, the hard disk should stop before all other computers.

③ Whichever computer may be stopped, all other computers should be able to be shut down normally.

Cluster systems vary greatly in composition methods and network equipment used depending on the scale of the system and tasks that use the system. Therefore, in introducing any power supply unit, one must give sufficient consideration.

2.3.3 Storage Area Network (SAN)

One mid-to-large system now spotlighted is the SAN. Fig. 4 shows a typical configuration of a system based on SAN. A server proper on the one hand and a hard disk or other storage device on the other are connected by an Internet-based network called the Fibre Channel. Its transmission distance of 10km maximum facilitates the installation of server and hard disk on different floors.

The basic requirement is a 24-hour consecutive run. Therefore, in introducing a UPS, one must place reliability, which is the essence of the UPS, first. It is considered rare to control a UPS.

3. Methods of management network equipment

3.1 Control by means of system control software

A mid-to-large system contains a great number of units to be managed, including servers, routers, and client computers. Using a Hewlett Packard ″ Open View ″ or other system management software allows equipment to be managed efficiently in such an environment.

Fig. 5 shows a typical application of system management software. From a computer for system management, one can centrally management various network devices installed at remote sites.

Network equipment is often managed by a communications protocol called the Simple Network Management Protocol (SNMP).

The SNMP uses management information defined for each type of network equipment, which is called the Management Information Base (MIB). Besides defined management information, one can add equipment management information designed by the particular manufacturer. Many manufacturers therefore provide MIB and extended software conforming to the type of equipment used, thus enhancing their management functions and operability.

3.2 Control by means of a web browser

If there are not so many units to be managed and one has only to manage those units from a remote site, it is effective to manage them with a web browser. The system will have screens and functions independent for each unit but will require no special computer for managememt and entail few constraints on the communications protocol due to a relay unit and other equipment. This system is therefore used in many network units.

3.3 Control by means of control software designed for power supply units

To manage power supply units integrally in an environment using no system management software requires management software designed by the particular manufacturer.

The system will basically be specified specially by the manufacturer of the power supply unit used. Since the system is designed specifically for power supply units and no constraints are imposed on the use of a web browser, the functions of the equipment can be made the most of.

4. Sanyo Denki's products for power management

Just like many other companies, Sanyo Denki has been enhancing the functions of power supply units and developing products to meet the network equipment and environments described above. Of these, the UPS management system " SAN GUARD IV " and " Network Power Manager " enable the management of various network devices. These systems are outlined below.

4.1 " SAN GUARD " series UPS control software

" SAN GUARD I " to " III " are products designed to manage the power supply of computers. The computer, which is a load, exercises control.

" SAN GUARD IV " consists of a UPS with load management capability to enable self-reliant controls. Therefore, if a router or other network equipment alone is used, fine operation management is possible. The capability of giving instructions directly from the network without going through the load computer facilitates the startup and stop of the network devices. Management by means of a web browser or SNMP is also possible. The system also greatly reinforces UPS operation history and other monitoring functions.

4.2 " Network Power Manager "

This power supply controller focuses on uses on a network, such as remote management and SNMP capability with a web browser. Fig. 6 is an outside view. Since it is also designed for UPS-purpose SNMP MIB definitions, it can be managed similarly to a UPS from system management software as well. When combined with a UPS, the system can monitor the UPS. Using a " SAN GUARD IV " ensures flexible conformance to various network configurations.

5. Future trends

Power supply units connected to a network are " network devices " in themselves. In view of that, this chapter describes the management of power supplies for future network equipment.

5.1 Capacity reduction and control of many loads

Personal computers (" PCs ") these days are declining in power consumption. Since the beginning of this year, the increase in the production and the reduction in the pricing of large LCD panels have been considerable. In desktop PCs, the use of LCDs is projected to grow quickly, thus accelerating the reduction of PC power consumption.

In server-base systems, on the other hand, Internet-related systems, along with Linux and other UNIX-base servers will spread. Above all, rack-mounted small servers without a display are expected to grow. Also increasing greatly is the number of firms introducing LAN switches to reduce traffic on the network.

Due to the decline in the power consumption of PCs and the changes in equipment configurations, the number of network devices controlled by a single power supply unit is expected to rise more than ever.

5.2 Alleviating the workload of system administrators

5.2.1 High-workload network management

Here, to illustrate the workload of network administrators, the results of a questionnaire survey conducted by Nikkei Market Access (http://ma.nikkeibp.co.jp) of system administrators are shown in Fig. 7. Notable is the very high workload of tasks other than ″ daily management. ″

Power supply units must be capable of adapting themselves as easily as possible to troubleshooting, system reconfiguration, and other non-daily management tasks. For many network system administrators, power supply units are something of a different nature from computers, routers and other majority network devices. To make such devices feel any less different, it is important to make the devices easy to handle.

It is also quite necessary to make positive use of power supply units to provide functions that alleviate the workload of system administrators.

5.2.2 Power control of network equipment

Of all management tasks, one task with which one can use a power supply unit effectively and positively is the startup and stop of the equipment to upgrade the software of the computer or to combat a failure.

If a router or LAN switch hangs up or malfunctions, one may reboot the system via the network. ″ Network Power Manager ″ or other power supply unit capable of remote control can be used to securely reboot network equipment that cannot be reset by software.

Also sufficiently probable is a situation where the network itself is out of service. To cope with such a situation, one needs to duplex the network of the power supply unit itself and provide access through a telephone line or cellular phone, along with other operations.

If the power supply unit itself can accurately detect failures in the network equipment, the equipment can be automatically rebooted. Since this obviates the need of stepping up the network or that of a system administrator as the intermediary, it will cut initial costs and shorten the MTTR.

5.3 Conformity to the standards

5.3.1 Support for the new standards

The standardization of many specifications according to the purpose is under way, such as the next version of the SNMP, Web-based Enterprise Management (WBEM) and other network management systems, Java for Industrial Monitoring Framework (JIM) of the web-base monitoring type in industrial applications, and LONWORKS (which is a decentralized managememt network). The same is true of standard interface systems on an application level, such as Windows Management Instrumentation (WMI).

Providing various functions according to these standards is the basic requirement of network equipment. Power supply units must adapt themselves to the specifications that are best suited for the environment where they are to be operated.

5.3.2 Ensuring security

For all network devices, power supply units equipped with control are required to

achieve extremely high security. This is a particularly important element in the Internet environment. The equipment itself must be secure against outside access and be able to have access to other equipment by means of standard security specifications.

Complete security can be ensured by a management-only network or a special means of communications instead of using a user network.

5.3.3 Adding and renewing functions

Network equipment is representative equipment that undergoes quick advances. If one waits for the finalization of standards or wishes to support all functions using new standards, one may miss the good timing for release. A just-released product may be called inadequately functional.

If it becomes possible to add or renew functions easily after the release of a product, one can provide functions in descending order of the magnitude of ″ applicable ″ specifications and market demand. The product can also be made less hardware-dependent to enlarge the scope of functional modification and increase flexibility dramatically. Some of the consumer units are also beginning to allow functional add-ons by software reconfiguration. These trends are expected to intensify further.

6. Conclusion

Regarding the power supply management of network equipment, this paper has outlined the network equipment and their characteristics and described the functional requirements for power supply units.

In developing power supply units compatible with network systems, it is more necessary than ever to have a good understanding not only of the capacity and quality of the power supply capacity but also of the characteristics of the network equipment (which is the load) and the purpose of the network system.

The most important thing is to proceed with the development process while identifying the functions that are really necessary for the users.

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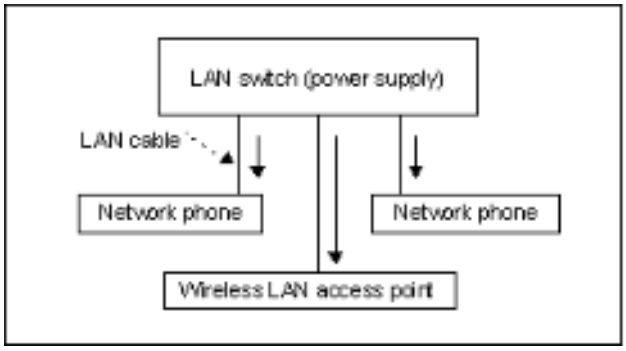

Fig. 1 Typical power supply by LAN cable

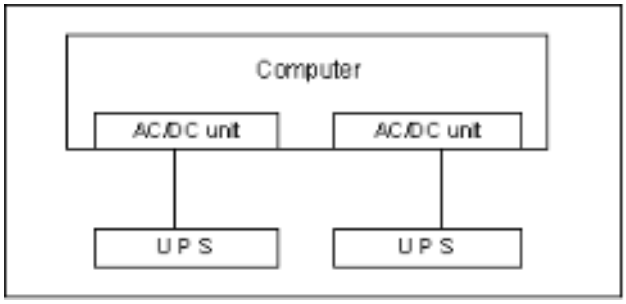

Fig. 2 A typical configuration with a duplexed power supply

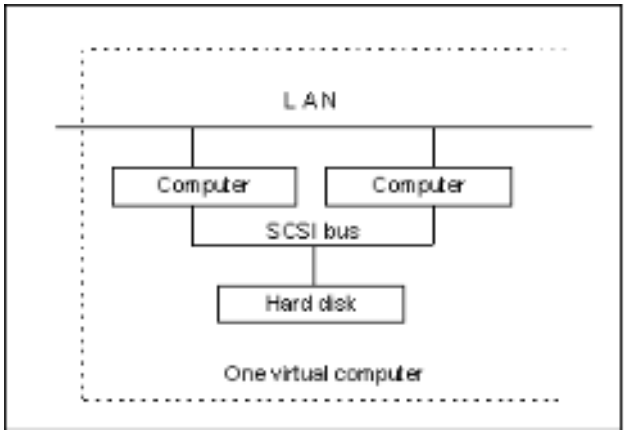

Fig. 3 A typical configuration of a cluster system

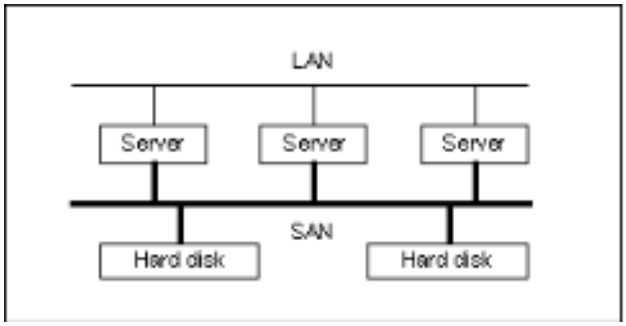

Fig. 4 A typical application of the SAN

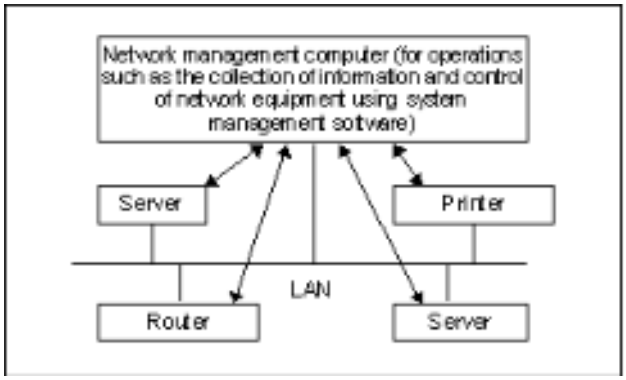

Fig. 5 A typical application of system control software

Fig. 6 Network Power Manager

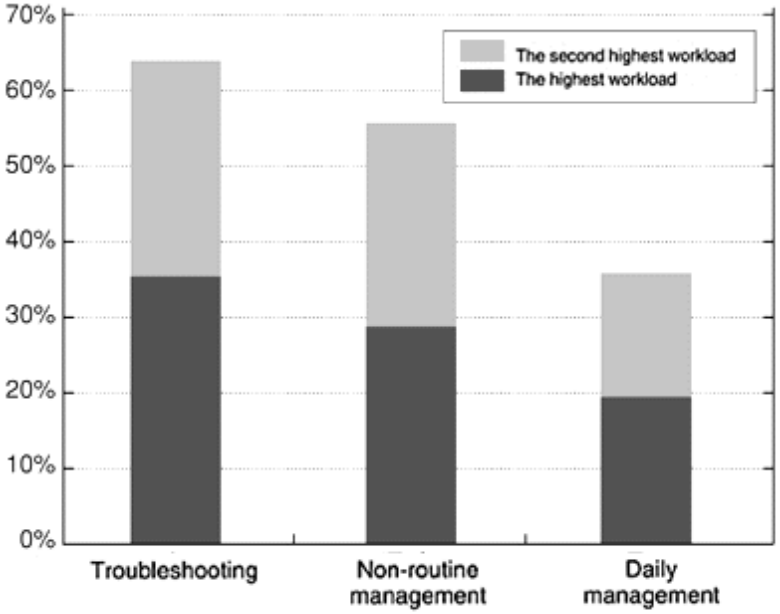

Fig. 7 High-workload tasks of network management
(as of late December, 1999)