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**Data Centre Operations Manual
National Stock Exchange of India Ltd.**

**Financial Institutions Reform and
Expansion (FIRE) Project**

August 1996

**Financial Institutions Reform and Expansion (FIRE) Project
US Agency for International Development (USAID/India)
Contract #386-0531-C-00-5010-00
Project #386-0531-3-30069**

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Price Waterhouse LLP



October 8, 1996

Dr. R. H. Patil
Managing Director
National Stock Exchange of India Ltd.
Mahindra Towers, 'A' Wing
1st Floor, RBC, Worli
Bombay - 400 018.

Dear Dr. Patil,

Sub: NSE Data Center Operations Manual

As a part of our contract with USAID, we have completed our activity under Task Order No. 3. The purpose of this activity was to provide you with a manual on the operations of the data center at the NSE.

Background

The Data Centre of NSE has grown very rapidly to support the pace of growth and the requirements of the organisation. The equipment has been upgraded and enhanced and the current configuration is detailed in the Manual. The hardware and support systems in the Data Centre and the respective maintenance contractors have been documented.

Change and problem management is critical to achieving a stable, reliable and well-controlled operation. These procedures have been documented in the Manual and it is the responsibility of Management to see that these are followed.

Scope of Manual

The Data Center Operations Manual documents the activities of the Data Center and details its administration, operations, the systems and the environment. The areas covered are :

1. Technology Organization
2. Hardware & Support Systems
3. Data Center Operations and Controls
4. Change & Problem Management Process
5. Backup Management

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Local Area Network (LAN) and Telecom have been specifically excluded from the scope.

Approach to Work

The assignment was coordinated by Price Waterhouse/India, Sr. Manager Mr. Bimal Bhavanani. He was assisted by Price Waterhouse/FIRE Project Technical Writer, Ms. Ferzana Khanna and Manager, Mr. R. Raghu in the systems area.

Overall guidance for the work was provided by Mr. Walter D. Pugh, a Partner (Retd.) of the Price Waterhouse LLP(U.S.A.) with more than 35 years experience in all aspects of systems security and responsible for major banking and security client relationships in New York city, involving the Depository Trust Company.

To prepare this manual we have interviewed all senior members of your Systems Department as well as three Officers and the Manager of TCS, and reviewed the environment and equipment in the Data Center located at NSE's Worli headquarters. We also reviewed appropriate documentation to enable us to compile this manual.

Recommendations

During our preparation of this manual we noted a number of areas where controls should be strengthened to help mitigate the risks where we feel the organization is exposed, with specific reference to the Data Center. We believe these areas of residual risk are significant and need to be addressed on a timely basis.

Next Steps

The efficient functioning of the Data Center requires the participation from the top management as well and ongoing commitment of time and resources from your staff .

Due to the dynamic nature of operations at NSE, it is necessary to appoint a Technical Writer to keep the information current. This manual must be regularly updated to reflect the changes which have occurred since the last release.

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Managing Director
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Finally, we would like to express our appreciation to you and your other colleagues at NSE for the time, courtesy and cooperation extended to us during the study.

Please do not hesitate to contact **PW/FIRE Project, Mr. Bimal Bhavanani or me**, at 494 8718/6630, 497 3216/3238, if you require any clarifications on this report.

Sincerely yours,

A handwritten signature in black ink, appearing to read 'W. Dennis Grubb'.

W. DENNIS GRUBB
PRINCIPAL CONSULTANT CAPITAL MARKETS

Enclosures

cc:	Mr. Ravi Narain	{	
	Dy. Managing Director	{	
cc:	Mr. Satish Naralkar	{	National Stock Exchange of India Ltd.
	Vice President	{	Bombay.
cc:	Mr. G. M. Shenoy	{	
cc:	Mr. L. K. Singhvi	{	Securities and Exchange Board of India
	Sr. Executive Director	{	Bombay.
	(FIRE Project Co-ordinator)	{	

A small handwritten mark or signature at the bottom right corner of the page.

Recommendations

1. Maintain a log of hardware problems.

The Annual Maintenance Contract for hardware has been undertaken by Tata Consultancy Services for the Stratus machines, HCL-HP Ltd. for the HP 9000 machines and Digital Equipment India Ltd. for the DEC-Alpha machines. The System Administrator liaises with the appropriate parties to ensure that they meet the standards specified in their contract. Currently no log is maintained by NSE of any hardware problems encountered and the time taken by the vendor to rectify the problem.

It is recommended that a log for hardware problems reported be maintained machine-wise and analysed to help rectify future problems.

Cross Ref. Section 1.4.4

2. Maintain a log for hardware and software changes.

It is recommended that a separate log book be maintained for changes made to hardware, operating software and application software. The date and the reason for making the change should be recorded, so that a history is maintained that can help solve future problems.

Cross Ref. Section 4.4

3. Prepare an annual status chart for hardware equipment and support system maintenance and integrate with the present daily schedule.

A daily status chart for the hardware equipment and support systems is completed in by the Operation Assistants. The items monitored in this chart are the UPS battery charging, Halon 1301 and 1211 cylinder pressure, UPS status, UPS output voltage, output current, status of all air-conditioning units, voltage and current status on each of the power distribution panels, status of emergency lamps, Diesel Generator fuel and water level and the performance chart of the air-conditioning units for the last 72 hours. If the functioning of any equipment is found to deviate from the required specification, corrective action is taken immediately.

It is recommended that an annual status chart be prepared for the equipment in the Data Centre which should be checked and signed periodically by the Vice-President/Asst. Vice-President. This chart should list activities which are to be carried out to clean and maintain the equipment periodically (monthly or six-

monthly) for optimal performance. This process should be integrated with the daily status chart to remind the Operation Assistants that a specific task has to be carried out on a particular day.

Some of the activities which could be listed on the annual status chart are listed below:

- The UPS Invertor should be run on battery for 10 minutes once every fortnight.
- The Diesel Generator system should be run with the loaded UPSs and the two A/C systems for at least half an hour once a fortnight.
- The pre-filter of the air-conditioning units should be cleaned with soap water once a month and fan belt inspected for physical damage.
- Each detector of the fire alarm system should be checked monthly.
- The ground pit resistance should be measured individually once a year. All systems should be powered down for this check.

Cross Ref. Section 2.2 and Appendix A-9

4. Maintain a manual log of which of the three users has logged into the root command and what functions have been performed.

For each machine, three NSE staff know the root password: Asst. Vice-President (Systems), the Systems Administrator and his assistant. The root password is placed in a sealed envelope and kept with the Department Head and is to be opened in case all these three people are not available during an emergency. The Operations Assistant can then make use of this password to access the root functions and then records this in a log. The password must be changed the following day.

Although there is proper documentation for the use of the emergency password by the Operation Assistants, currently no manual log is maintained of which of the other users has logged into the root command and what functions have been performed. It is recommended that this be done for individual accountability.

Cross Ref. Section 3.1.2

5. Maintain a log of who assigned the password for each user.

Logical access to each system is controlled by user ids and passwords. Each user id is given specific rights and privileges.

It is recommended that a log of who assigned the password for each user be maintained. The user's name, designation and department should be logged in a

register for future reference.

Cross Ref. Section 3.1.2

6. Develop an internal help desk using the IVR system.

The Systems Department runs a Help Desk for brokers to report problems encountered with the system. When the broker calls in, the request is recorded on the Interactive Voice Response (IVR) system and then entered into a database. A number is assigned and the problem is routed to the appropriate department for resolution.

A formal approach to problem tracking should be developed for internal staff and followed to avoid many of the pitfalls associated with informal approaches. This internal help desk, similar to that used by brokers, should be developed using the IVR system. The problems should be documented separately for each application software and a complete history of problems should be maintained. This way, repeat problems can easily be solved.

Also, all NSE terminals should have access to the problem reporting mechanism on-line.

Cross Ref. Section 4.1

7. Maintain a log of actions taken to resolve help desk problems.

Data Centre management need help desk reports to assess the causes of operational inefficiency and poor user service and to allocate appropriate resources to prevent such failures in the future.

Administrative procedures should be developed to minimise excessive time associated with obtaining background information, allocating problems for resolution, tracking possible causes, updating historical files, getting approvals, etc. A history of system problems, how they were resolved and the time taken to resolve them should be maintained. A review of recovery actions taken helps determine if the action was just a temporary fix to the problem or if it will prevent the problem from recurring.

Cross Ref. Section 4.3

8. Develop procedures to ensure that Problem Management is formal and structured.

Data centre staff are responsible for problem tracking and summarising key data for management review and discussion at regularly scheduled management meetings. Items informally tracked include the following:

- On-line response time
- Batch job turnaround time
- Equipment reliability
- Systems software changes applied
- Jobs that terminated abnormally
- Number of jobs rerun, and causes of rerun
- Accuracy of reports
- Data centre responsiveness to users seeking assistance

It is recommended that problem management be formal and structured. As systems become larger and more complex, the potential for an increase in the number of problems rises. Problems can include the following:

- Deviations from standards and expectations
- Incidents and malfunctions
- Unusual occurrences
- Unscheduled system re-initialisation
- Degradations and intermittent conditions
- Abnormal situations and incomplete functions
- Incorrect results

Cross Ref. Section 4.1

9. Ensure hardware vendors are held accountable for their recommendation of upgrades to hardware.

When a hardware upgrade or a new hardware purchase is being considered, the vendor should be informed of the functional change required and should recommend the hardware changes required and be responsible for its performance. After the purchase and installation of the hardware, if the hardware does not meet the agreed specification, NSE should have the right to reject it. This clause should be made a part of the purchase agreement.

Cross Ref. Section 4.4.1

10. Ensure problem ownership and management reports are initiated in the problem management process.

Problem management relates to the procedures and controls used to identify, report and correct processing problems, both hardware and software, to minimise any disruptions to normal operational processing.

Under current procedures, the problem is recognised, determined and resolved, but there is no ownership of the problem and management reports of the action taken.

- **Problem ownership.** The problem assignee(s) should be responsible for maintaining problem logs and ensuring that a resolution is obtained;
- **Management reports.** Management reporting should be used to ensure control over the flow of problems through the problem management process. Responsibility for the review, assignment and monitoring of the processing of reported problems should be assigned at a management level.

Cross Ref. Section 4.5

11. Consider additional procedures in Backup Management to mitigate risks.

Whilst backup of data is done regularly, there are various procedures which require further consideration.

For the Stratus machine, periodic dumping of data (say every half hour) to the development machine "Kautilya" may be evaluated.

If the tape drive is upgraded, care must be taken to preserve one old drive so that data which has been backed up using the old drive can be read by installing the old drive if necessary.

Off-site copies of systems, programs, user and operations documentation must be updated to reflect system revisions.

Regular inspection of off-site storage locations should be undertaken and security measures examined.

Media security controls should ensure that data outside the system (e.g. tape or printed output) is protected to an appropriate degree. Procedures and security measures for media transported for destruction and to backup locations are particularly important.

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Instructions on how to restore from backup copies of program and data files should be available in the Data Centre Operations Room so that they are available to the Operation Assistants if required.

Periodic testing of the alternate facility's/backup machine's operations should be undertaken using backup copies of program and data files.

Cross Ref. Section 5

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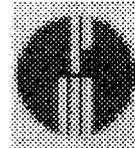
Data Centre Operations Manual

National Stock Exchange of India Limited



Manual prepared by:

Price Waterhouse LLP/USAID FIRE Project



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Version: 1.1/Aug 1996

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- A Forms used by NSE**
- B Names and Addresses of Maintenance Contractors for Hardware and Support Systems**
- C Emergency Procedures**

1. Technology Organisation

This Data Centre Operations Manual documents the activities of the Data Centre and details its administration, operations, the systems and the environment. It also covers the personnel responsible for the various activities and their roles and responsibilities. LAN and Telecom are excluded from the scope of this document.

Background

The National Stock Exchange of India (NSE) began operation as an automated stock exchange in April 1994. Today operating from Bombay, it provides on-line securities and debt instrument trading facility to its members and, through the NSE members, to investors in India's capital markets.

NSE's objectives include:

- To establish a nation-wide trading facility for equities, debt instruments and hybrids
- To ensure equal access to investors across the country
- To provide a fair, efficient and transparent securities market
- To enable shorter settlement cycles and book entry settlement systems and
- To meet the current international standards prevalent in the securities industry

The growth of NSE has been very rapid. In March 95, NSE had 350 members in 8 cities and the number of installed VSATs was 224. In just one year, in March 96, the number of members grew to 900 in 33 cities and the number of VSATs rose to 882. The Systems Department has proficiently supported this rapid growth.

Objectives of the Data Centre

NSE relies very heavily on Information Technology for its business operations.

The Data Centre Objectives include:

- To ensure system availability for on-line real time processing
- To provide a controlled environment with consistent service quality levels
- To ensure adequate and current backup and contingency plans
- To ensure timely and precise processing and distribution of output

Operations procedures endeavour to provide consistency of operation, continuity of operation, reduced reliance on individual personnel and optimum utilisation of resources. Procedures to ensure recovery from operational failures and the maintenance of full documentation should be up-to-date.

1.1 Organisation Chart

An Organisation Chart of the Information Technology Department and the reporting lines is shown on the next page. This Manual covers the various functions and duties to be performed by staff of the Systems Department in order to meet the business objectives.

The Vice-President - Systems & Telecom is the Operations Head, and his functional job description is detailed in Section 1.4.1.

The Asst. Vice-President - Systems reports directly to the Vice-President - Systems & Telecom, and his functional job description is detailed in Section 1.4.2. It is his responsibility to see to the day-to-day operations of the Data Centre and to evaluate and implement the recommendations suggested.

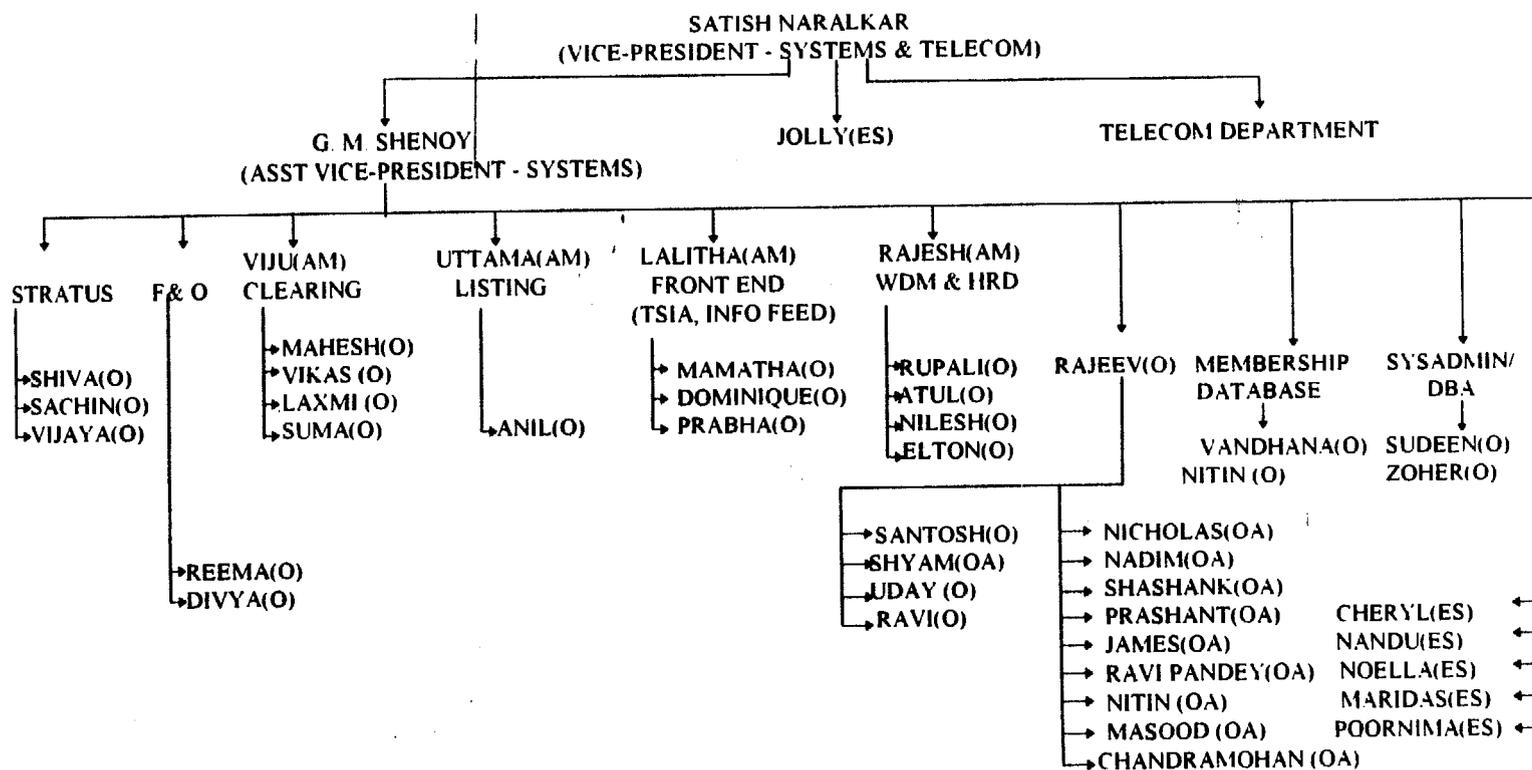
At the next level are the Asst. Managers who are Data Base Administrators (DBA). The DBA should be aware of his interactions with the various business areas which are detailed in Section 1.4.5, and accordingly advise the Officers who report to him. He should also be familiar with the Change and Problem Management process and ensure that NSE standards and procedures are adhered to by his team.

There are two System Administrators: one for the Stratus system and the other for the HP 9000 and DEC-Alpha systems. The functional job description of the System Administrator is detailed in Section 1.4.4. He should also be proficient with the Change and Problem Management Process (Section 4) and ensure that each step of a procedure is carried out for every change implemented in his section.

The Data Centre Officer supervises the Operation Assistants and co-ordinates the activities which they perform. His functional job description is detailed in Section 1.4.3. He and the Operation Assistants should be aware of all the Data Centre's hardware and support systems which are detailed in Section 2. They should also be aware of the Data Centre Operations and Controls which are detailed in Section 3. Access Controls, Emergency fixes, Start up and shut down procedures for hardware and support systems are documented in this section. The Data Centre Officer is responsible for the backup management which is documented in Section 5.

This Manual can also be used as part of the induction program for new joiners to the Systems Department to give them an overview of the Organisation and the Department (Section 1). They should read and understand the entire Manual so that they are familiar with how the Department as a whole operates and functions and can therefore direct their queries to the appropriate person.

ORGANISATION CHART OF THE SYSTEMS DEPARTMENT



AM - Assistant Manager
 O - Officer
 ES - Executive Secretary
 OA - Operations Assistant

Listed below are the names, residential addresses and contact numbers of NSE personnel to be contacted in case of an emergency.

In case of any major problem with the Data Centre or emergency, contact:

Satish V. Naralkar
Vice-President - Systems and Telecom
C-202, Juhu Abhishek Apts
Juhu Versova Link Road
Andheri West
Bombay 400 053
PAX Off. Ext. 106
Direct Off. No. 495 4454
Residence No. 623 6785
Pager 982 101 4388

For most problems with the overnight run for the Stratus, HP 9000 or DEC-Alpha, contact:

Rajeev Shinde
Officer
10 Asara, Kherwadi
Bandra East
Bombay 400 051
PAX Off. Ext. 151
Residence No. 642 2203

For problems with the Stratus system, if Rajeev is unavailable contact:

Santosh Hariharan
Officer
No.-3 Usha Swapna
7 Bungalows
Andheri West
Bombay 400 061
PAX Off. Ext. 203
Residence No. 634 0571

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For problems with the DEC-Alpha or HP 9000 systems, if Rajeev is unavailable contact:

Sudeen Kinnarkar
Officer
c/o C. K. Joshi
Phadkewadi
Opp. Sikkanagar
V. P. Road, Girgaum
Bombay 400 0904
PAX Off. Ext. 142
Residence No. 389 1197
Pager 217 774

For problems with the overnight run for the HP 9000 or DEC-Alpha, in case Sudeen cannot be contacted, then contact:

G. M. Shenoy
Asst. Vice-President
11/2nd Floor, Mogra
Ankur Co-op Hsg. Society
BEST Nagar Road
Goregaon West
Bombay 400104
PAX Off. Ext. 149
Direct Off. No. 494 9225
Residence No. 872 8468

For problems with the database contact:

Laxmi B. Khatri
138/240 Lalwani Building, 1st Floor
Saraswati Chowk
Mulund Colony
Mulund West
Bombay 400 082
PAX Off. Ext. 118
Residence No. 565 5077

1.2 Data Centre Locations and Layouts

The Data Centre is located in Bombay, on the 1st floor of Mahindra Towers 'A' Wing which is part of the Ridge Business Complex in Worli.

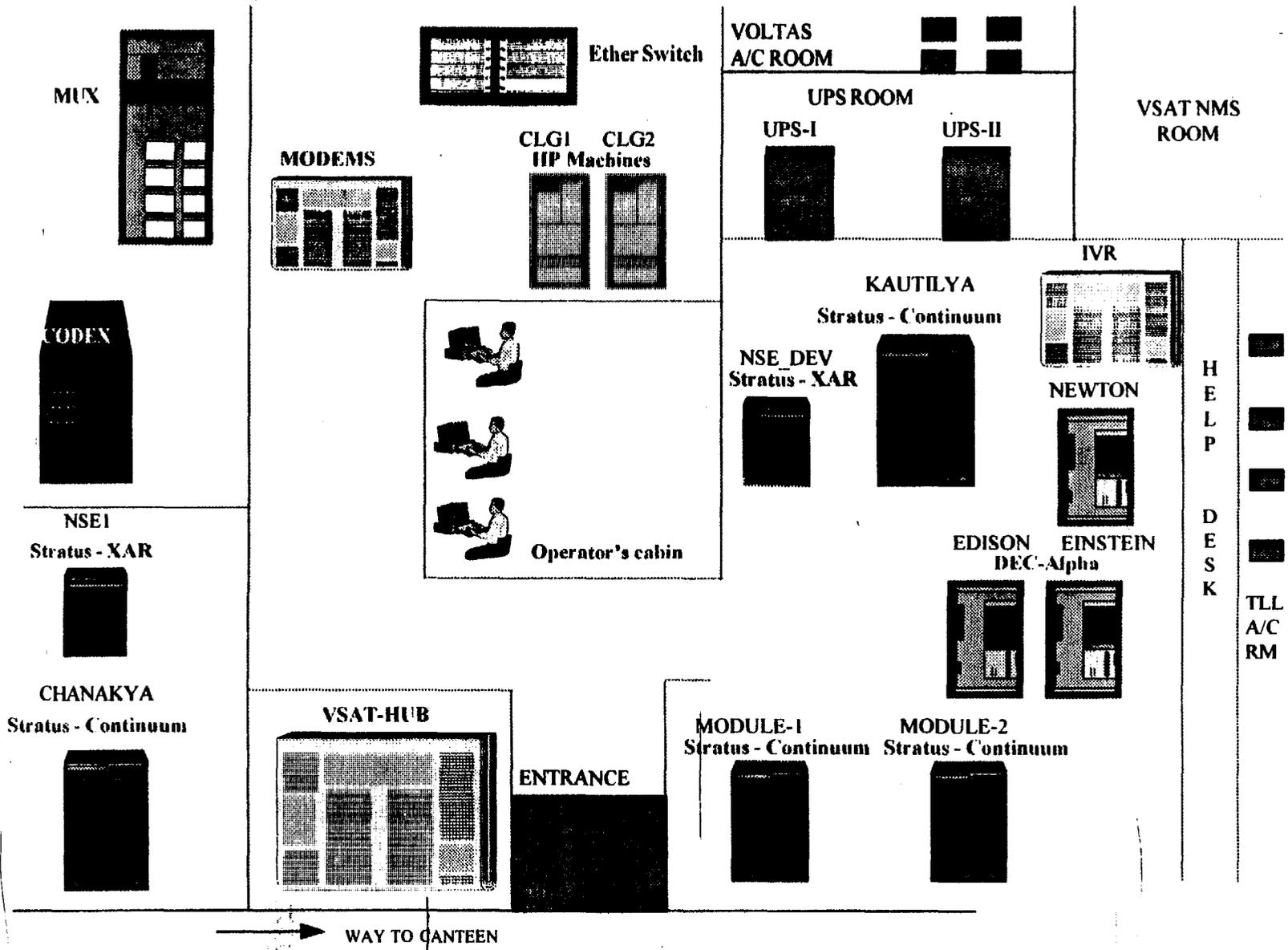
The Data Centre comprises of six rooms. The computer systems are installed in two rooms and the support equipment is installed in two rooms. The fifth room houses the HCLComnet Network Management (NMS) Centre. This HCLComnet NMS centre is located next to the UPS and the extended computer room. The Market Watch group is set up in the Market Watch Room, the sixth room, which is located across the passage. The line printers that are used for bulk printing are located in the main hall.

The Data Centre Operations Room has a false floor at a height of 15" from the floor. The air-conditioning is provided by two separate A/C systems. These systems provide cooling to the two computer rooms and the UPS room.

The main electrical distribution unit is located at the rear of the A1 wing of the floor. The backup power to the site is provided by a Diesel generator located on the ground floor just outside the Mahindra Towers A/C plant room, in a sound proof cabin.

The HCLComnet antenna and its Radio Frequency Transmitter (RFT) equipment is located on the terrace of the building.

The Data Centre layout is shown on the next page.



1.3 Functional Summary

Table showing the various functions of the Data Centre, with the present incumbent and the backup for the incumbent.

Functions	Present Incumbent	Backup
Operations Head	Satish Naralkar	G M Shenoy
Systems Manager	G M Shenoy	Manoj Nair
Data Centre Officer	Rajeev Shinde	Santosh Hariharan
Systems Administrator (Stratus)	Santosh Hariharan	Divya Ballani
Systems Administrator (HP 9000 & DEC-Alpha)	Manoj Nair	Sudeen Kinnarkar Ravi Poojari
Shift Scheduler	Prashant Hajare	Rajeev Shinde
Librarian	Nicholas Tuscano	Prashant Hajare

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1.4 Functional Job Descriptions

1.4.1 Operations Head

- Provide direction and training to all the Systems and Telecom Department personnel.
- Prepare development and action plan for hardware/system software upgrades.
- Provide budget and supervise expenses.
- Evaluate manpower resources.
- Co-ordinate priorities of Business Plans.
- Direct all the Data Centre operations and Systems & Telecom projects.
- Co-ordinate with vendors for installation and maintenance of hardware.
- Co-ordinate risk assessment and contingency plans for all applications supported.
- Ensure quality and control aspects are taken care of, in all processes and operations.
- Co-ordinate the service level requirements for hardware and software.
- Conduct periodical project reviews with key personnel in the Department.

1.4.2 Systems Manager

- Formulate and implement the Systems strategies for the Organisation.
- Keep all systems running smoothly and maintain the required standards.
- Assume responsibility for the program/system changes and new system design as per the requirements of the users or the changes of the organisation.
- Review the documentation of program change.
- Ensure that programming meets with NSE standards.
- Evaluate the feasibility and necessity of proposals for new systems or modifications to existing systems.
- Supervise project management for software projects to ensure the quality and on-time delivery of system deliverables.
- Liaise with software houses supporting NSE's development effort.
- Ensure testing is adequately done in a controlled environment.
- Review summary reports on software failures and formulate a plan of action for resolution on a monthly basis submitted by members of the software project team.
- Review the monthly activity plan with each AM individually to review the status of various tasks and projects undertaken by the team.
- Plan the resources for the Department with respect to manpower, equipment and services.

1.4.3 Data Centre Officer

The Data Centre Officer supervises the Operation Assistants and co-ordinates the activities which they perform. Currently there are 10 Operation Assistants who work in 8 hour shifts, as the Data Centre operates around the clock. The Operation Assistants are responsible for the day-to-day activities of the Data Centre and the health of the systems.

- Ensure that the machines are released to the users in time daily.
- See that jobs executed by the Operations Assistants are as per the schedule.
- Review the hardware and software reports and effect escalation procedures.
- See that reports are generated and distributed as per the user requirements.
- Make available all systems to the hardware vendors on time as per preventive maintenance schedules.
- Review the shift report and see that it is complete in all respects before putting it up to the Vice-President/Asst. Vice-President for review.
- Ensure that all backups are taken regularly. The backup schedule and backup register for all the machines is checked daily. A sample of these is in Appendix A-5 and A-6.
- Overall supervise the jobs carried out by the Data Centre operation assistants and advise them from time to time.
- Oversee the handing over of the shift to the next shift Operating Assistants properly and documenting all important activities. The shift report which details the jobs completed and suspended for each machine as well as the status of the machines and the support equipment is signed by the Operations Assistant who hands over the shift as well as the Operations Assistant who takes over the shift. A sample of the shift report is in Appendix A-1.
- Ensure dual control requirement in the computer room for all sensitive equipment.
- Prepare and review the daily VSAT load report and broadcast load report which are prepared by the Operation Assistants daily and sent to the Vice-President - Systems and Telecom.
- Co-ordinate between the various people within NSE and the hardware maintenance contractors and prepare the hardware maintenance contracts for each of the systems.

1.4.4 System Administrator

The System Administrator is responsible for managing the resources of the system. He knows specifics about system configuration, hardware and operating software. He should be able to communicate efficiently with management, programmers, operators, analysts, users and the maintenance contractors.

The System Administrator is also the central point of contact for questions and problems related to their systems. He then communicates these to the appropriate parties for clarification, if necessary, and rectification.

System operations like starting up the machine, opening the database, backup and restore operations, and shutting down the machine is controlled by the Systems Department under direction from the System Administrator.

The functions of the System Administrators are to:

- Setup and maintain users
 - ⇒ Formulate and implement security policies. They assign access levels and privileges to users of the system.
 - ⇒ Execute privileged commands on the system. Privileged commands can globally affect other user processes, as well as the operation of the system. Also, some non-privileged commands have more capability when a privileged user executes them. Therefore users of the system are given permission and rights on a "need to use" basis only. These users include users from the Systems Department and other departments within NSE, traders and custodians. Currently several NSE staff are defined as privileged users of the Stratus system at the system level, but certain commands such as "shutdown" are restricted to a few users. The Systems Administrator's Group, which includes Asst. Vice-President - Systems, System Administrator (HP and DEC Systems) and two others, are privileged users of the HP 9000 and DEC-Alpha systems.
 - ⇒ Create the initial user for each department. At the application level, user setup is performed by the individual user departments.
 - ⇒ Add users for the development team. DBAs who require access to the production machine and custodians based on forms approved by the Heads of the Departments. The System Administrators can also reset the user's password if a user forgets his password or the system locks out a user because of incorrect passwords keyed in.

-
- ⇒ Ensure that the custodians who have dial-up connectivity to the HP 9000 system can connect to the system. While setting up the user, the System Administrator must ensure that only data relevant to that custodian is accessible and available to them. The System Administrator's responsibilities include reinstating terminals, and reactivating users whose lines are disabled after 5 incorrect login attempts after getting the authorisation from the appropriate authority.

 - **Manage Disk Space**
 - ⇒ Ensure the weekly backup of the Oracle database for HP 9000 and DEC-Alpha is taken and the previous week's transaction log file is then deleted to free disk space, after taking a full database backup successfully. On the Stratus machine, the settlement data is generated every day after the trading hours and the transaction log files are archived and stored off-line.

 - ⇒ Decide which files should be deleted, compressed and backed up before being purged. Print files, temporary files and unwanted logs created by users are deleted. Archive logs pending deletion, source codes and list files to be kept for a period of time are compressed. Logs created by the clearing system are backed up before being deleted.

 - ⇒ Decide the usage of each disk for the clearing application to ensure optimum performance by disk space management. When there is some change in the physical structure of the database, for example at the time of database creation, depending on the usage, the System Administrator will spread the actively used databases across controllers.

 - **Evaluate Performance**
 - ⇒ Evaluate day to day systems resource management. Every afternoon, a batch is run periodically on the Stratus system to check disk and CPU utilisation on the Stratus system. Currently this is only viewed on the monitor and not printed out because it would degrade the performance of the system if it was done every 5 seconds.

 - ⇒ Conduct performance tests on the HP 9000 machine using GLANCE to determine system utilisation. On the DEC-Alpha machine TOP, VMUBC, IOSTAT and VMSTAT are run to determine system utilisation. Based on these results, a decision is taken to tune the parameters.

 - ⇒ Evaluate the performance of the machine by checking the daily log book for the HP machine which is filled in by the Operation Assistants. This specifies the disk space, loading details and status of backups/Exports. A sample of the HP Daily Log Book is in Appendix A-4.

- ⇒ Schedule jobs for users to maintain a high level of system performance by scheduling certain processes which are CPU intensive separately, for example downloading data to brokers. The System Administrators also ensure exclusive usage to a certain group of users during batch operations for time-critical tasks.
- Procure and install hardware
 - ⇒ Plan the configuration prior to procurement of new hardware which is based on capacity. If the system utilisation crosses 50%, enhancements are suggested.
 - ⇒ Work with the Network Manager to add routes and keep a track of the network topology.
 - ⇒ Evaluate the specification of any purchase requests such as a new version of operating software, printers and disk. These are initiated and approved by the Heads of the User Department and sent to the System Administrators, who evaluate the specifications depending on their requirements, place the order and arrange for the installation.
 - ⇒ Plan for hardware capacity. A report is sent daily to the Asst. Vice-President and Vice-President on trading volumes and system delays if any. Periodically the System Administrators review performance details of all three machines and submit a report for enhancing the capacity of the machine or procuring new machines.
 - ⇒ Procure Digital Audio Tapes (DAT) and spools. Every 3 months, quotes are taken from three vendors for these consumables. Once a decision is made, approval is obtained from the Vice-President/Asst. Vice-President and an order is placed.
 - ⇒ Ensure proper installation and testing of new hardware and system software. When new hardware is installed, the vendor carries out the tests on the hardware. The application tests are then carried out in co-ordination with the users. After the System Administrator is satisfied, the installation and acceptance certificate is signed by the Vice-President/ Asst. Vice-President.
 - ⇒ Release the new version of software. If a new version of Oracle or Unix is to be installed, it is first installed on the development machine. Users evaluate and test it over a period of time. During this period of time, support staff from Oracle are present at the NSE site to help resolve problems. Once users are satisfied, the old version is backed up first and the new version is copied from the development to the production machine over a long weekend.

- **Ensure system availability**
 - ⇒ Work with the DBA to import the database if the database crashes. This can be done either by using the weekly database backup and transaction logs or by using the previous day's export.
 - ⇒ Liaise with the appropriate maintenance contractor to restore the system as soon as possible in case the system crashes due to hardware or software problems.
 - ⇒ Liaise with the appropriate parties to ensure that they meet the standards specified in their contract. The Annual Maintenance Contract has been undertaken by Tata Consultancy Services for the Stratus machines, HCL-HP Ltd. for the HP 9000 machines and Digital Equipment India Ltd. for the DEC-Alpha machines.
 - ⇒ Investigate the cause of down time. A daily log-sheet is filled in by the Operating Assistants for the HP and DEC-Alpha machines. This details the jobs completed, the jobs and processes suspended or pending and the machine status. If any down time is recorded, the System Administrator immediately works to resolve the problem. A sample of the HP and Alpha Daily Log Sheet is in Appendix A-3.
 - ⇒ Prepare a list of the hardware to be included in the contract. The system has been insured by Oriental Insurance on an annual basis.
 - ⇒ Liaise with the Telecom Department to see that the problem is rectified if the telephone lines are down.
- **Formulate and Implement Backup and Restore policies**
 - ⇒ Supervise the day-end processing. The 2 night shift operation assistants are responsible for the successful completion of the backups. If a major problem occurs, the System Administrators are contacted by phone, or the Asst. Vice-President is contacted. Currently Asst. Vice-President - Systems and System Administrator (HP and DEC Systems) can log onto the HP 9000 and DEC-Alpha systems from their home PCs and instruct the Operation Assistants how to proceed with the overnight run.
 - ⇒ Ensure that the backup strategy laid down for the machine is carried out. The backup logs are checked every morning to examine if something was omitted in the overnight run. Sometimes there is a problem accessing a directory, in which case the System Administrator changes the script or changes the access rights.
 - ⇒ Resolve any problems which occur in the day end run. After completing the backup at the end of the day, the Operators send the System Administrators and Asst. Vice-President an e-mail on details of the backup and any exception messages they received during the backup as a result of problems. The System

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Administrator then takes the appropriate steps to resolve the problem.

⇒ Decide which DATs are to be recycled. They co-ordinate with the users to decide whether data is required or whether it can be scratched. The backup for the Stratus machine is done on DATs or spools and on the HP 9000 on DATs. The DEC-Alpha system uses Digital's proprietary DATs in addition to normal DATs.

- Formulate and Test Disaster Plans

⇒ Currently the data on the Stratus production machine is replicated on the development machine. In case of machine failure, production data can be accessed on the development machine. Once the disaster site at Pune is operational, the production machine will have a live backup on that machine. The HP 9000 & DEC-Alpha have two machines of similar capacity - one for production and the other as a hot standby.

1.4.5 Data Base Administrator

The Database Administrators (DBAs) are responsible for ensuring the smooth operation of the database system and for monitoring its use. Since the database is large, the administrative duties are divided among multiple administrators. Currently, the NSE has several DBAs, each of whom are responsible for maintaining the databases for one or two user departments. For example one DBA is responsible for the listing database, another for the membership database and another for the local and national clearing database.

By its nature, the role of the DBA is separated from the functions of the rest of the organisation. The following are specific areas in which the DBA interacts with other business areas:

- Users
 - ⇒ in determining, agreeing and maintaining data ownership, particularly in shared data situations,
 - ⇒ in resolving database access and integrity, and
 - ⇒ in providing documentation like user creation forms;
- Management:
 - ⇒ in reporting database performance daily to the Asst. Vice-President,
 - ⇒ in maintaining confidence in the database, and
 - ⇒ in correlating company objectives and database technology;
- The application areas:
 - ⇒ in providing the database information necessary for application development,
 - ⇒ in ensuring the distribution of information pertaining to changes in the database by maintaining a log book,
 - ⇒ in implementing physical data storage relationship which optimise program development and execution,
 - ⇒ in ongoing monitoring of program maintenance to ensure the continued integrity and responsiveness of the database;
- Designer/developer
 - ⇒ in ensuring that the design and development takes care of performance issues, and
 - ⇒ in ensuring that all the available facilities are used optimally;
- Operations/system programming:
 - ⇒ in ensuring the optimal physical storage of the database,
 - ⇒ in developing save/restart/recovery capabilities,
 - ⇒ in ensuring the provision of adequate monitoring of database usage, and
 - ⇒ in developing procedures governing computer operators and other operating personnel;
- Data security officer:
 - ⇒ in providing facilities for implementation of data security policy, and
 - ⇒ in providing assistance in implementation of database security;

- **Suppliers**
 - ⇒ in maintaining a current understanding of the potential benefits of the database software,
 - ⇒ in ensuring regular updates of the latest versions of software,
 - ⇒ in ensuring a trouble-free installation of the database and its enhancements, and
 - ⇒ in ensuring prompt supplier support should failures occur; and
- **Education**
 - ⇒ in providing training or providing materials to support training in areas such as database concepts, implementation and maintenance of the database and operation of database features.

The DBA is concerned specifically with technical issues, especially concerning the implementation and maintenance of physical data models on a DBMS. In the NSE the DBA function is grouped with that of application development. In this position, the DBA concentrates on assisting the education of the teams in database concepts and in the organisation's database standards. The DBA provides day-to-day technical support for the application teams and effects the physical implantation of databases for them.

The DBAs are responsible for:

- **Maintaining Users and controlling user privileges and roles**
 - ⇒ Users are placed in different privilege categories depending on their job function. For example in the Membership Department, there are three roles, based on the categories of users: Manager, Officer and Secretary. The Head of the User Department sends a form to the Systems Department informing them to add, delete or change the rights of a particular user. Depending on the application accessed, the role is also specified. The DBA then assigns the rights and informs the user, who checks that all the necessary functions can be accessed. A sample of the User Maintenance form is in Appendix A-2.
- **Direct Data Fixes**
 - ⇒ Direct data fixes are generally not allowed. In extreme emergency, after obtaining approval from the Head of the User Department, the DBA updates data outside the system. On a daily basis, direct data fixes made during the day are reviewed by the Asst. Vice-President or Vice-President to monitor direct manipulation of data.
- **Performance tuning**
 - ⇒ DBA's analyse and monitor programs on a continuous basis to identify bottlenecks or problems and rectify them in order to improve performance. If necessary, performance tuning is done by suitably altering the parameter values after getting

the necessary approval.

⇒ The DBA manages the physical storage space in the database by managing table spaces and data files. The DBAs prepare the schedule for the periodic recreation and dropping of indexes, and arrange the shifting of data off-line. Currently the database is growing very rapidly, and DBAs are heavily involved in shifting data from the on-line system to the history system. This process will soon be automated.

- Database Backup and Recovery

⇒ The DBAs ensure that the backup is taken as per the backup strategy laid down by the management. Procedures for the restoration of the database should be documented, tested and known to the relevant persons.

⇒ On a daily basis, the DBAs assist the Operators to download data from the Stratus to the HP 9000 machine. Each evening after trading hours, data is downloaded from the Stratus machine to the HP 9000 machine. This takes approximately one hour. One DBA stands by during this process to rectify any problems or errors.

⇒ The Operators run scripts to backup the database. Any problems with this export are referred to the DBA.

1.4.6 Shift Scheduler

- Prepare the shift schedule for the Operating Assistants for the month.
- Act as a co-ordinator for the Operation Assistants who work on 8-hour shifts.

1.4.7 Librarian

The librarian handles the organisation, control and security of materials related to data processing such as data tapes and other related documents. The proper control of these materials is required to ensure that these are available to the Data Centre whenever required and it is not available to unauthorised persons.

The Librarian keeps a track of backup tapes and knows on which tape data is stored. For example, if the trades for Nov 94 are required two years later, the librarian should know in which tape or DAT drive the data is stored and how the data can be read.

For each machine, backups are organised according to the type of backup and then date of backup so that they can be located easily.

The label on the magnetic media carries the date of the backup and details of the contents of the backup. The labeling convention observed for tapes is N followed by T for spools or D for DATs followed by a four digit serial number. A log book is maintained chronologically in which the date of backup and description of the data stored is noted.

The main functions of the Librarian are:

Tape Management

- Maintain and control the tape library (on-site/off-site) inventory.
- Follow the retention period for all backups and maintain regular recycling schedule.
- Ensure proper labeling and easy access to tapes.
- Ensure database/data files backup are taken regularly and follow ups for pending backups.
- Ensure library materials like tapes, documents, manuals are released under authorised request.
- Review backup and retention schedules periodically.

Manuals Management

- Keep custody of all manuals and books used in the Data Centre and release them under authorised request.

2. Hardware and Support Systems

The main objective of the Data Centre is to ensure optimum system up-time and minimise disruption due to failures. This Chapter describes the hardware and support systems of NSE's Data Centre and the activities required to maintain the system in an "operational" state. It also covers the management of hardware and environmental equipment and describes the appropriate maintenance which is required to be undertaken.

The list of maintenance contractors for all the equipment and their contact numbers are listed in Appendix B. This list should be updated regularly in order to remain current.

Procedures should be defined and observed to ensure consistency of operations and hence system availability and integrity.

2.1 Hardware

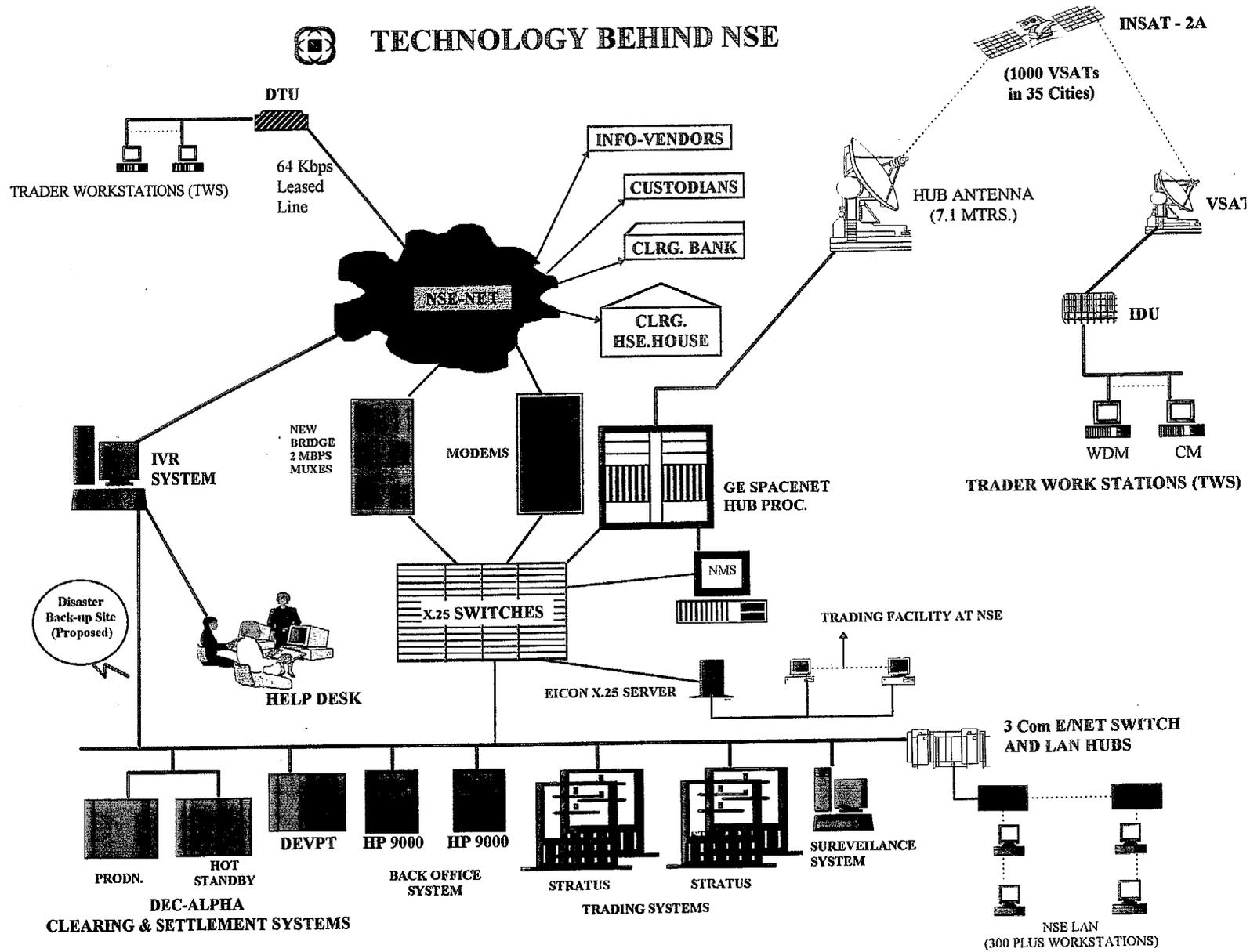
The Stratus machine runs the trading system, National Exchange Automated Trading (NEAT) system. A satellite-based very small aperture terminal (VSAT) communications network is used for communicating with brokers. The Clearing and Settlement (C&S) system runs on the HP 9000/DEC-Alpha systems. The daily position reports are prepared by Stratus and conveyed to the members. The topology diagram is shown on the following page.

The hardware configuration of the development and production machines, the operating system and application environment is described for each machine below.

Scheduled preventive maintenance is regularly carried out for all the machines, as per the maintenance contract signed with the respective contractors.



TECHNOLOGY BEHIND NSE



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2.1.1 Stratus

The NSE has 4 Continuum machines and 2 XAR machines. Continuum processes data on the Capital Market and XAR processes data on the Money Market.

Two Continuum machines of similar configuration are the production machine, Chanakya and development machine, Kautilya.

The configuration of each of these machines is as follows:

Stratus 1225 Continuum (duplexed CPU)
512 MB memory
Duplexed SCSI & ENET bio card
Duplexed PKIO card
16 GB duplexed hard disk
IO adapters 6 Sync, 1 Async
2 Ethernet cards (LAN)
Duplexed console card and 2 VT103 terminals
1 DAT drive
1 X PE/GCR tape drive

The other two Continuum machines are Module 1 for production data and Module 2 for development data. The configuration of these machines is given below.

Stratus 1225 Continuum (duplexed CPU)
512 MB memory
Duplexed SCSI & ENET bio card,
Duplexed PKIO card,
10 GB duplexed hard disk
IO adapters 10 sync, 1 async
1 Ethernet card (LAN)
Duplexed console card and 2 VT103 terminals
1 DAT drive

There are also 2 Stratus XAR machines, NSE1 for production and NSE_DEV for development.

The configuration for the production machine NSE1 is detailed below.

Stratus R330 (3 duplexed CPUs)
320 MB memory and 3 x 1.46 GB disk
IO adapters 6 sync, 2 async, 2 SCSI
1 Tape drive
1 DAT

1 Ethernet
1 Console
1 PE/ GCR tape drive
1 DAT drive

The configuration for the development machine NSE_DEV is detailed below.

Stratus R320 (simplex CPUs)
128 MB memory and 3 x 1.46 GB disk
IO adapters 6 sync, 2 async, 2 SCSI
1 Tape
1 DAT
1 Ethernet
1 Console
1 PE/ GCR tape drive
1 DAT drive

On the Stratus machine, there are two levels of operations: the first is system operations like starting up the machine and backup/restore which is controlled by the Systems Department. The second level of operations is Market operations like monitoring and controlling market timings and application startup which is controlled by the Market Operations Group in the Market Watch Room. This involves running the script to start up the database and to load the relevant data into memory.

The hardware maintenance contract is currently awarded annually to Tata Consultancy Services (TCS). They supply a daily health report on the trading machines to Asst. Vice-President - Systems. TCS have a two shift on-site support from 8 a.m. to 8 p.m. The expiry date of the contract is 31 March each year.

The TCS contact person for on-site support is Mr. N. J. Fernandis.

For on-call support contact:

Tata Consultancy Services,
Air India Building,
Nariman Point,
Bombay 400 021.
Tel: 202 6542, 202 4827

The Operating system is Virtual Operating System (VOS) and the current release number is 13.1.0b.

The National Exchange Automated Trading System (NEAT) software runs on the Stratus computer system. This is a fully automated, on-line trading system for an order driven market which enables many members across the country to trade simultaneously.

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Currently, it provides trading facilities for the wholesale debt paper as well as capital market securities. This application software is supported by TCS. NEAT makes use of a proprietary database structure and does not share its databases or processing modules with other NSE systems.

At the end of the day, data is downloaded to the Clearing machines (HP 9000 and DEC-Alpha) for processing.

The steps to power on and off the machines are detailed in Chapter 3.3.1.1 of this Manual.

2.1.2 HP 9000

There are two HP-9000 machines of similar configurations. The primary machine is NSECLG1 which stores production data. The secondary machine is NSECLG2 which stores the development database and the history database. The history database has data on trades, obligations and deliveries since the start of NSE's operations. Data on orders is only available for the current month. At the beginning of the next month this data is archived and stored off-line.

The configuration of both the production and development/history machines is:

Series & Model:	K-series Model 400
No. of CPUs:	2
Memory:	256 MB
Hard-disk Space:	40 GB
UNIX Version :	10.01
ORACLE RDBMS :	7.1.6

The Annual Maintenance Contract has been undertaken by :

HCL-HP Ltd.
Udyog Bhavan
W. H. Marg
Ballard Estate
Bombay 400 001
Tel: 262 0169, 262 0170, 262 0171
Contact: Mr. Vinayak

The expiry date of the contract is 30 May each year.

The HP 9000 and DEC-Alpha systems run the Clearing and Settlement systems and the Back Office systems.

The Clearing & Settlement (C&S) system was developed by TCS in consultation with NSE's Operations staff. It runs on the HP 9000 and DEC-Alpha machines with an Oracle-7 database. C&S consolidates data downloaded by the NEAT system and generates and transmits appropriate notices and reports to the trading members to notify them of their trading obligations. It also generates selected summary and exception level reports for NSE's Capital Markets (CM) and Debt Market (WDM) management.

The Back Office Systems include the CM and WDM management information systems (MIS), including market analysis and surveillance, membership information, securities listing data, membership investigations, grievance redressal, billing and accounts.

The steps to power on and off the machines are detailed in Chapter 3.3.1.2 of this Manual.

2.1.3 DEC-Alpha

NSE has three DEC-Alpha machines:

Two Alpha 8200 -	Edison	Production and
	Einstein	Hot standby
One Alpha 2000 -	Newton	Development

The configuration of the production and hot-standby machines are:

Series:	Alpha
Model:	8200
No. of CPUs:	2
Memory:	512 MB
Hard-disk space:	40 GB
UNIX version:	DEC-OSF 3.2C
ORACLE RDBMS:	7.2.2.

The configuration of the development machine is

Series:	Alpha
Model:	2000
No. of CPUs:	2
Memory:	192 MB
Hard-disk space:	24 GB
UNIX version:	DEC-OSF 3.2C
ORACLE RDBMS:	7.2.2.

The hardware maintenance contract for the machine has been undertaken by:

Digital Equipment India Ltd.
Digital Centre, CTS No. 124
Tunghwa Village
Saki Vihar Road
Andheri East
Bombay 400 072
Tel.: 852 1041, 852 6563, 852 6564
Contact: Mr. Sachin

As the equipment is less than one year old, it is still under warranty. The expiry date of the warranty is 31 Jan 97.

The HP 9000 and DEC-Alpha systems run the Clearing and Settlement systems and the Back Office systems. These are detailed in the previous sub-section 2.1.2.

The steps to power on and off the machines are detailed in Chapter 3.3.1.3 of this Manual.

2.2 Support Systems

The support systems include the air-conditioning units UPS, fire fighting equipment and other miscellaneous equipment which are vital for maintaining the environment within the Data Centre. In case of an emergency or a power failure, this equipment takes over until the situation is brought back to normal. It is therefore necessary to regularly maintain and test the functioning of the equipment.

A daily status chart for the equipment is filled in by the Operation Assistants. The items monitored in this chart are the UPS battery parameters, Halon 1301 and 1211 cylinder pressure, UPS status, UPS output voltage, output current, status of all air-conditioning units, voltage and current status on each of the power distribution panels, status of the emergency lamps, Diesel Generator fuel and its water level and the performance chart of the air-conditioning units for the last 72 hours. A sample of the daily status chart is shown in Appendix A-9. If any equipment is found to deviate from the required specification, corrective action is required to be taken immediately.

This sub-section contains a description of the support system equipment, maintenance of equipment and procedures to be followed in case the equipment malfunctions.

2.2.1 Air-conditioning

The Data Centre Operations Room is cooled by two air-conditioning systems. The room temperature must be $20^{\circ}\text{C} \pm 2$. The humidity must be $50\% \text{ RH} \pm 5\%$

The two systems comprise of

- 1) Voltas - 4 x 7.5 tonnes package units
- 2) Tata Liebert - 4 x 7.5 tonnes package units

The Voltas units provide cooling for the Stratus production machines, Motorola X.25 switches, Indchem multiplexor plus DTUs, modems, HP 9000 systems, console terminals and PCs.

The Tata Liebert units provide cooling for the Stratus development machines, DEC-Alpha systems, IVR system, UPS system and annexed help desk room.

In both these systems, only three units are powered on and are normally running and one of them is kept on standby. The one to be shut is cycled on a weekly basis, and a chart of this is stuck on the electrical panel of the respective air conditioning unit. Both systems have their condensers located on the parapet just outside the canteen. Both system units have air cooled condenser units.

As the temperature in the A/C rooms is high, no waste paper or packaging must be stored in and around the A/C room as it is a fire hazard.

The maintenance contract for the Voltas Air-conditioner is maintained with Voltas Ltd. on an annual basis.

Voltas Ltd.
Air-conditioning and Refrigeration Division
Voltasagar
P O Box 7803
Dr. Ambedkar Road
Bombay 400 033

Voltas has sub-contracted Central Services for mechanical faults and Sai Services for electrical faults. These companies may be called directly for faster service. The persons to contact and their phone numbers are listed in Appendix B.

The expiry date of the contract is 31 March each year.

The Tata Liebert A/C is under warranty support with Tata Liebert Ltd.

Tata Liebert Ltd.
Plot # C-20, Road # 19
Wagle Industrial Estate
Thane West
Bombay 400 604

The expiry date of the warranty is 1 October 96.

The persons to contact and their phone numbers are listed in Appendix B.

The steps to power on and off the Air conditioning Units are detailed in Chapter 3.3.2.1 of this Manual.

2.2.2 Uninterrupted Power Supply

There are two Uninterrupted Power Supply (UPS) systems - UPS-I and UPS-II. Each of these is an 80 KVA unit with a 30 minute battery backup. In case of an interruption in the power supply, the UPS takes over. In the meantime, the backup diesel generator (D.G.) automatically switches on to take over.

The UPSs have been configured to run in the parallel redundant mode. This means that while both the UPSs are functioning normally, the load is shared between them. In case one UPS fails, the full load is transferred to the running, healthy UPS. In the normal mode, the inverter of the UPS takes on the load. If both the UPS invertors fail, the load is transferred to the bypass line through the static switch.

If the mains to any UPS fails, the inverter of that UPS switches over to battery backup. Each UPS battery bank will provide power to the UPS for a minimum of 30 minutes. When the UPSs are running in the parallel redundant mode, both battery banks will support the UPS load for an hour. The amount of battery charge remaining can be gauged by pressing the sw4 on the UPS display panel and reading the display.

Fortnightly, each UPS Inverter is run on battery backup for 10 minutes. The battery voltage and the discharge current initially and after 10 minutes are recorded.

The UDP is the UPS Distribution Panel. This panel is located in the UPS room. Its main function is to receive the two feeders and distribute power to UPS-I and UPS-II and their associated isolation transformers. A diagram of the UDP is shown on the following page.

The UPS is under warranty support with Tata Liebert Ltd.

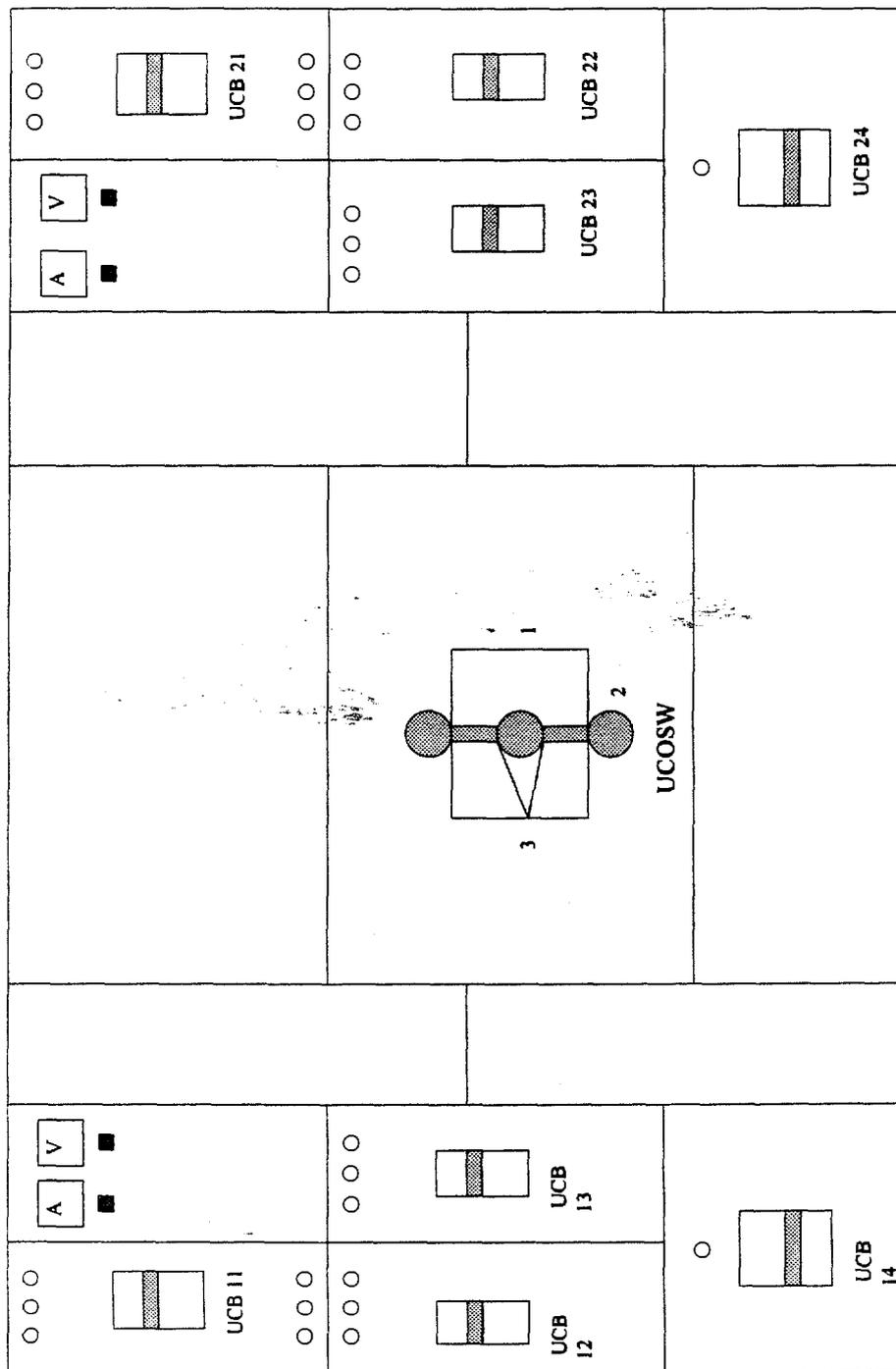
Tata Liebert Ltd.
NELCO Complex
Mahakali Caves Road
Andheri East
Bombay 400 093

The expiry date of the warranty is 15 January 97.

The persons to contact and their phone numbers are listed in Appendix B.

The steps to power on and off the UPS Units are detailed in Chapter 3.3.2.2 of this Manual.

UPS DISTRIBUTION PANEL



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2.2.3 Computer Room Distribution Panel

There are 2 Computer Room Distribution Panels (CRDPs) for the Data Centre Operations Room which provide power to the equipment in the Computer Room.

CRDP-1 provides power to the Stratus production machines, HP 9000 systems, VSAT Hub and VSAT tracking system, Motorola X.25 switches, Newbridge Mux, modems, console terminals and PCs, Pentium server located in the computer room, the PCs and printer in the Market Watch Room, LAN communicating equipment.

CRDP-2 provides power to the Stratus development machines, DEC-Alpha systems, IVR server, DEC console terminals, PCs located on the nearest cluster facing the Computer Room wall and emergency lamps located in the ceiling of the Data Centre Operations Room.

Each CRDP consists of a main circuit breaker which receives power from the UDP via the Emergency Breaker Panel (EBP). There is also a main spare circuit breaker. There are meters to provide voltage and frequency readings of the incoming UPS supply and a current meter which displays the current drawn by the load connected to the panel.

The steps to power on and off the CRDP are detailed in Chapter 3.3.2.3 of this Manual.

2.2.4 Change Over Panel

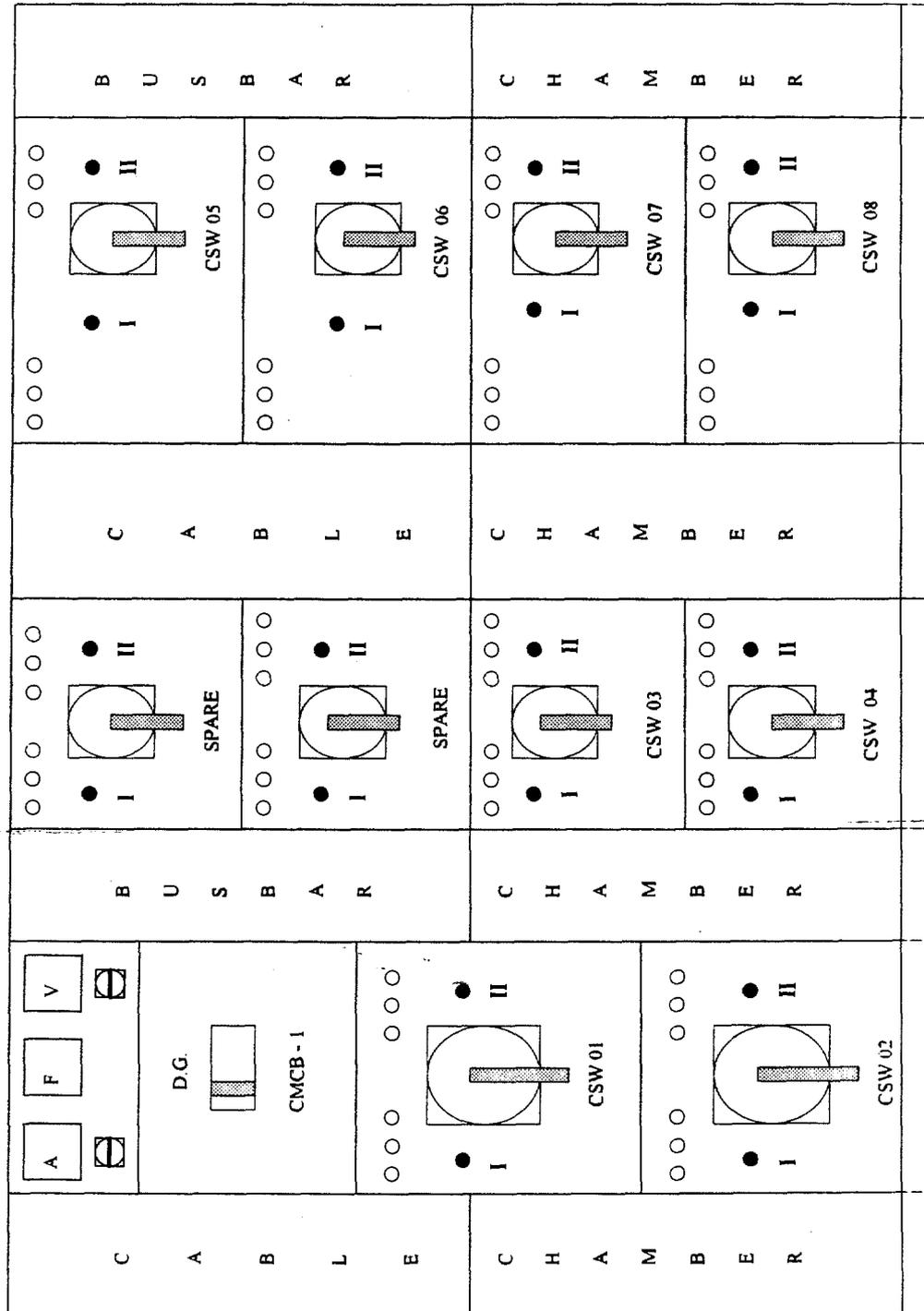
The function of the Change Over Panel (COP) is to provide power from either BEST mains or the Diesel Generator (DG) supply to the panel feeders. This panel is located in the centre of the Electrical room no 1 which is at the back of the first floor.

If the power fails and the Diesel Generator power is to be supplied to the other panels, then the main Circuit Breaker (CMCB-1) must be set to ON. To select the source of power, the change over switches must be turned to select either Mains or the Diesel Generator. The D.G. set must be turned on before this step is carried out.

A diagram of the Change Over Panel is shown on the following page.

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CHANGE OVER PANEL
(COP)



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2.2.5 Diesel Generator

The Diesel Generator room is located on the left hand side of the Mahindra Towers air-conditioning plant door. This sound proof room houses the D.G. set, the D.G. distribution panel, the main oil tank, the backup oil tank and the D.G. control panel.

When the BEST power fails, the DG will start up automatically. To switch the source of power from the Mains to the D.G., the main circuit breaker of the Change Over Panel must be switched to ON. This is described in detail in Section 2.2.4. But if a manual start is desired the DG may be switched on manually. The power from the D.G. is transmitted over three feeders which terminate on the Change Over Panel located in the electrical room.

In case an input mains fails, all efforts must be made to switch that feeder to the DG power. The battery power should be saved for an emergency situation, where even the D.G. fails to start.

As a precautionary measure, the D.G. must be allowed to cool for an hour after an 8 - 10 hour run.

Water to the radiator is to be added only after the D.G. is switched off for at least twenty minutes which allows the water in the radiator to cool. Otherwise the boiling water will spurt out when the radiator cap is loosened.

After a mains failure, the UPS power must be returned to the mains, otherwise the UPSs will still be on the battery backup if the D.G. is shut down. This change over is done by switching the Low Tension Distribution Box 1 (LTDB1) and LTDB2 feeders back to source II on the Change Over Panel.

Once a fortnight, the D.G. system is run with the loaded UPSs and the two air-conditioning systems for at least half an hour.

2.2.6 Alarm Systems - Fire and Smoke

The Data Centre Operations Room has been protected by an automatic fire detection and Halon 1301 extinguishing system. This room is divided into three areas horizontally:

1. Area above the false ceiling
2. Area below the false ceiling
3. Area below the false flooring

Each area is covered in two zones duly cross zoned in the panel. At least one detector in two different zones must actuate before the extinguishing media is released. Also, a combination of ionisation and photo electric detectors are used and both must actuate before the extinguishing medium is released to minimise the possibility of discharge due to a false alarm.

On actuation of these detectors, Halon gas will be discharged in the affected area after a delay of 40 seconds. This delay has been provided to enable the evacuation of all occupants of the area. The Halon 1301 gas is stored in 4 cylinders which are located in the UPS room.

There are also 2.5 kg hand held Halon 1211 extinguishers located in every room, usually near the entrance to the room. These should be used if fire or smoke is noticed in the computer, UPS or A/C rooms.

There is a Halon release switch and a Halon inhibitor switch located behind the console table area and near the Control Panel at the entrance of the Data Centre Operations Room. The Halon release switch is used to manually release the Halon 1301 gas in the room without a delay if a fire is seen before the detectors sound the alarm. The switch is activated by breaking the glass using the hammer.

The Halon inhibitor switch is used to immediately disable the release of the Halon 1301 gas in the data centre operations room, in case of a false alarm. The switch is activated by breaking the glass using the hammer. This switch overrides the 40 second Halon discharge delay started by the control system. One must be very sure before taking this step as it inhibits the release of the Halon 1301 gas.

The fire fighting equipment is serviced by Steelage Industries Ltd.

Steelage Industries Ltd.
Minimax Systems Division
208 Atlas Mills Compound
Reay Road, Bombay 400 010

The expiry date of the warranty is 31 March each year. The persons to contact and their phone numbers are listed in Appendix B.

Preventive maintenance is carried out regularly on a monthly basis and every detector is checked.

2.2.7 Fire Control

A fire alarm and protection system has been installed in the Data Centre. If the alarm sounds, the reason for the alarm must be investigated immediately. If there is a possibility of fire, all personnel who are not required at the site should be evacuated from the building. Someone should then go to that zone armed with a Halon 1211 hand held extinguisher to inspect the area, gauge the intensity of the fire and take the necessary action. Also someone should quickly inform the security officer or the floor warden if the fire is not traceable and the alarm persists. The alarm is only to be reset when everyone is sure that there is no fire.

In order to protect any area against the risk of an outbreak of fire, it is necessary to detect it at a very early stage in order to extinguish it. In order to detect the fire at an early stage, automatic sensors are provided and linked to the Control Panel.

The Control Panel of the alarm system is located in the corridor outside the Data Centre Operations Room to the right of the door. This is the Central Monitoring Station where all signals are received and transmitted. It is imperative that the person responsible for taking action should know exactly where and what the problem is as soon as he receives a signal from the panel.

The Data Centre Operations Room is divided into 10 zones:

Room	Area	Halon 1301 protection	Zone nos. for ionisation detectors	Zone nos. for photo detectors
Computer Room 1*	Below false ceiling & above false floor	Yes	1	2
Computer Room 1*	Above false ceiling & below ceiling	Yes	3	4
Computer Room 1*	Below false floor & above floor	Yes	5	6
Voltas A/C room & UPS room 3*	Full room	No	7	-
Computer Room 2*	Below false ceiling & above false floor	Yes	8	9
Computer Room 2*	Above false ceiling & below ceiling	Yes	8	9
Computer Room 2*	Below false floor & above floor	Yes	8	9
TLL A/C room 3*	Full room	No	10	-

1* Computer Room 1 includes the Stratus production machine, HP 9000 machines, Motorola switches Indchem multiplexor + DTUs, modems and operator's cabin.

- 2* Computer Room 2 includes the Stratus development machine, DEC Alpha machines, IVR system and UPS room.
- 3* The two A/C rooms are not covered by the automatic Halon 1301 extinguishing system, but have photo detectors to sense any abnormal conditions. They are equipped with hand-held extinguishers.

Given below are explanations of how to interpret the various lights and switches on the panel.

When the system is switched on and the system is working normally, the green LED indicating SYSTEM ON will light up on the panel. All other LEDs will be off.

In case of alarm in any particular zone, the signal is received by the Control Panel, and two red LEDs of the particular zone will light up along with the common "FIRE" flashing lamp and an intermittent buzzer in the panel is activated.

After the alarm has been registered, the audible buzzer can be silenced by pressing the ACCEPT push button. However, the 2 red LEDs will remain on and the common FIRE lamp will continue flashing.

After identifying the zone on the Panel, the security marshal can take necessary action.

After an outbreak of fire, it is important that the area be inspected thoroughly for hot areas and only after being convinced of the same and receiving authorisation from the Vice-President - Systems & Telecom, should the area be ventilated by opening the doors and windows. The empty cylinder and actuator should then be refilled or replaced.

If the equipment is damaged, the Oriental Insurance Company should be informed. If the fire is extensive, alternate sites should be made available to continue operations.

Periodically, when requested by NSE, Minimax demonstrate to the Data Centre Operations staff how to use the fire fighting equipment.

Remember although the equipment in the Data Centre is costly, human lives are far more important and absolutely no risk is to be taken in this respect.

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2.2.8 General Equipment

Emergency Breaker Panel (EBP)

This panel allows the power supply to the equipment in the Data Centre Operations Room to be suspended in case of an emergency, like fire. One must be reasonably sure before breaking the toughened glass of this panel using the hammer kept on the left hand side of the fire panel.

Control Panel

The Control Panel also serves as a line monitoring system. The detector switch line of each zone is monitored against Open or Short circuit. In either case, the respective LED of the corresponding zone lights up on the panel, thereby pin-pointing the nature and location of the fault immediately. The audible alarm will be activated, but with a continuous sound which can be silenced by pressing the ACCEPT push button. However the LED will remain on until the fault is rectified.

General Note

No edibles, no smoking and no delivery of packages into the data centre operations room are allowed. The packing of any equipment which is unpacked in the data centre operations room must be removed immediately.

2.2.9 X.25 Switches

The Motorola Switch routes X.25 calls between various ports of the same node or a neighbouring node through inter-nodal links. This is achieved by the Route Selection Table (RST) of the Switch.

The Switch is the common device for all the three communications media in the NSE network, i.e. VSATs, leased lines (MUX and RAD modems) and dial-up lines.

The Switch has different data interfaces to the outside world, they are V.35 ports for high speeds, V.24 (RS-232) ports for low speeds and Async ports for the Control Terminal Ports. A port can be configured depending on the application. For example, a high speed port for VSAT can be configured from the V.35 port available on the CPU card, and a low speed port for a dial up application can be configured from a V.24 port on either a CPU card or a Universal I/O card (UIO).

The various cards available on the Modules of the Switch are as follows:

1. **CPU Card** is the heart of the switch. It has the processor to handle various tasks such as allocating buffers and priorities to various intensive tasks like Broadcast Multiplication to various user ports on that card. It also contains Flash memory which loads the Operating Software into RAM. This card has 2 V.35 ports and 4 V.24 ports, the former for inter-nodal links and/or user ports, and the latter for RS-232 applications.
2. **UIO Card** is the Universal Input output card which supports 6 V.24 ports.
3. **Convertor Card** provides V.35 at the output and accepts V.24 as input. There are six ports out of which 3 are inputs (V.24) and 3 are outputs (V.35).
4. **Network Storage Option Card (NSO)** is needed to download new releases onto the RAM and/or the Flash memory. The updated version of the Operating System for Motorola Switches are loaded through the NSO card having a 1.44 kb floppy diskette drive to load the O/S onto the RAM of the first CPU. The server module of the switch having the NSO card will load the O/S onto the loader modules of the other switch and thus load the new O/S into the Flash Memory of all the Switches.

In NSE there are 13 switches, numbered 01 - 14 and excluding switch 04. Three of these are used for VSAT link ups, two are used for dial up purposes primarily for WDM operations for participants, one switch is used for development purposes and the rest are utilised for the terrestrial network (Multiplexer network). The details of each switch and its connectivity is filed and kept in the computer room.

The Broadcast feature permits messages to be broadcast to all network end points or to selected end points. The Broadcast source can be any device connected on any node in the network

The Network Management Software (NMS) aids in configuring, monitoring and troubleshooting switch-related problems. It is possible to access any node from the NMS and view the configurations for any node. The statistics of switches with respect to data traffic analysis and utilisation is taken daily after 3.30 p.m. Problems detected by the switches are referred to the Telecom group.

To disseminate the stock quote feed to news agencies like Reuters, Knight Ridder, etc., there is a server which collects data from the on-line market, changes the format into text based data and then dumps this data on the Broadcast Module of Sw 9.

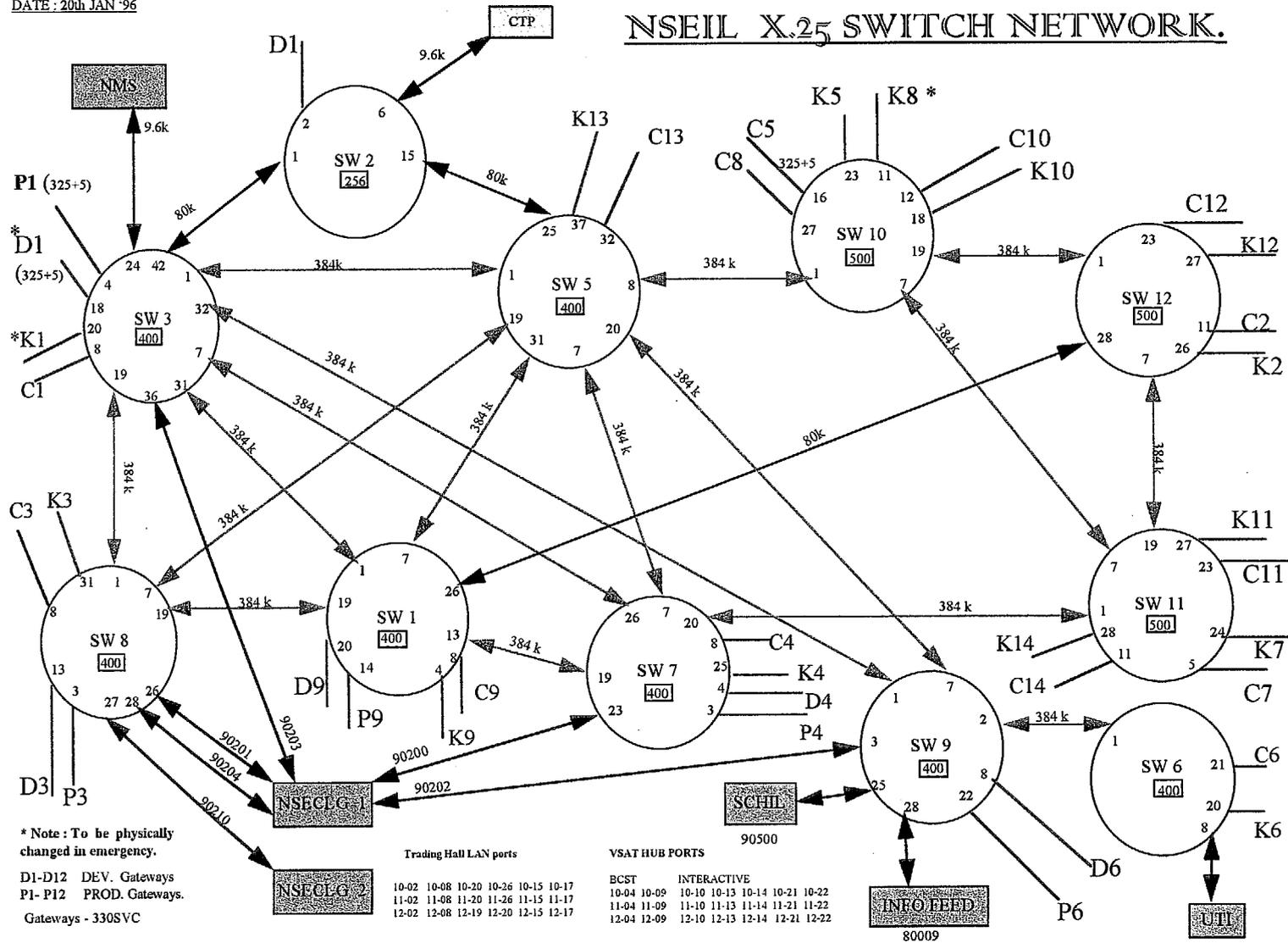
Currently the backup is performed by the Telecom group and TCS. The Operations Department is in the process of taking this process over.

Every fortnight the configuration of all the Motorola switches are backed up onto floppies. The last twelve versions of the configurations are retained. Three sets of such backup are taken: one set will be on the hard disk of the NMS PC and the other two will be on the backup floppies. Of these backup floppies, one set is kept outside the computer room and is brought out only when the backup is to be done.

A diagram of the X.25 Switch Network is shown on the following page.

DATE : 20th JAN '96

NSEIL X.25 SWITCH NETWORK.



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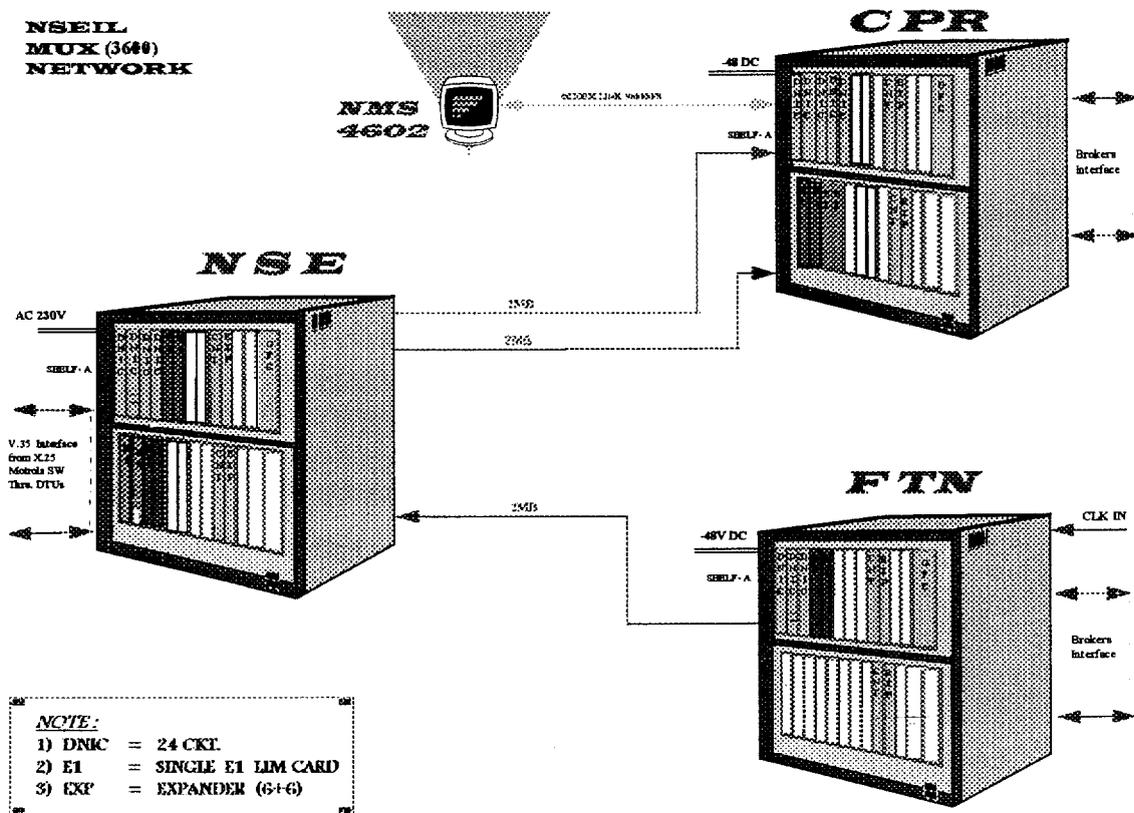
2.2.10 Multiplexer Network

The NSEIL MUX (3600) is an integrated voice and data multiplexer which can operate in either the E1 (2.048 Mbps CAS) or T1 (1.544 Mbps) primary rate environments. Each node can be individually managed from a VT-100 compatible terminal located at the installation site or from a 4600 series MainStreet manager system which provides local or remote management capability from a large number of networked 3600 nodes.

The 3600 provides a data bandwidth throughput of 64 Mbps and a fully non-blocking, cross-connect facility for all circuits routed through the 3600.

Applications:

- primary rate multiplexing
- drop, insert and bypass multiplexing
- digital cross-connecting
- conversion between 2.048 Mbps E1 and 1.544 Mbps T1 formats
- communication segregation and distribution
- low and high speed data transmission
- voice and data compression



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3. Data Centre Operations and Controls

3.1 Access Controls

Access to the computer system can be controlled and allowed only to authorised users by implementing physical and logical access controls.

3.1.1 Physical

Entry to the Data Centre Operations Room is restricted to NSE's Operations and Telecom staff, TCS's hardware group and HCLComnet's group only. Only those staff whose names appear on the approved list are allowed to enter the Data Centre using a swipe card, and their staff badge must be displayed at all times. The cleaning staff are also permitted in the room during the cleaning hours, which are before and after the working hours.

All visitors other than the authorised staff must get the necessary approval before being allowed into this room. Certain parties such as maintenance engineers are given a swipe card and are allowed without approval. Any outsiders must be accompanied by a NSE staff member throughout the duration of their stay in the Data Centre Operations Room.

3.1.2 Logical

Logical access to each system is controlled by user ids and passwords. Each user id is given specific rights and privileges.

When a user initially requests access to the system, identification data is established for that user to be utilised throughout that session. In on-line mode, the user may be identified by user ID, terminal ID and application and/or transaction. In batch mode, the user may be identified by job name and application and/or transaction. All accesses to any data files through the database are tracked through the user identification data.

Segregation of duties is important to ensure that only operators have access only to the commands and facilities necessary for their work and that operators do not have access to user application functions and data. Controls include physical and logical access restrictions.

Operators do not have access to production data except as required to run production work. They also do not have access to program source code. End-users and programmers do not have access to operator commands.

For each machine, three NSE staff know the root password: Asst. Vice-President (Systems), the Systems Administrator and his assistant. The root password is placed in a sealed envelope and kept with the Department Head and is to be opened in case all these

three people are not available during an emergency. The Operations Assistant can then make use of this password to access the root functions and record these in a log. The password must be changed the following day. The "sulog" provided by the system logs the activities performed using the root password and are reviewed daily.

In the NSE, three terminals are linked directly to the Stratus machine: 1 is in the Data Centre and is manned by Operation Assistants, and two are in the Market Watch room. The terminals in the Market Watch room are used to set market parameters (i.e. market start and close times etc.) and to switch on and shut down the trading application system. The Market Watch users do not have all privileges. For example, only the system administrator can shut down the system.

It is important that the organisation must not be unduly reliant on the integrity of individual personnel and that user access is appropriate for each job. Segregation of duties must be maintained during rotation of duties and shifts, holiday and vacation arrangements and following termination of employment.

At the trader level, the keyboard lock is activated after 5 minutes. The broker then has to key in his password in order to continue using the system. A trader is allowed to attempt to login 6 times with an incorrect password before his account is disabled. When a trader has to be reinstated, the Systems Department must receive a fax signed by the authorised signatories. The Systems Department then assigns a new password and informs the trader.

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3.2 Emergency Fixes

It is recognised that important changes will occasionally need to be made to the system at short notice. Such changes may be implemented before being approved but are thoroughly documented and retrospectively approved by the Vice-President - Systems & Telecom.

When a problem is reported, if the problem is very critical it must be rectified immediately, bypassing normal problem management procedures.

In an emergency, the system is got back into action either by fixing the problem or by a temporary patch or by bypassing the problem. However, it is important to log and review ALL activities and later fix the problem permanently.

From time to time, a production program may abort during processing and urgent action may be needed to investigate and fix the problem. The actions necessary may include making program changes on an emergency basis and moving or copying the changed program to the production library; or executing the changed program from the test or a "special production" library. The program change is made by computer operations staff under the guidance of the responsible programmer and after receipt of management approval to bypass normal change procedures. In any case, the normal process that requires that the user and Asst. Vice-President review the changes and of test results is not followed.

It is important that emergency program changes and emergency program moves to production are documented when they occur. The Officer responsible for program change ensures (on the next business day, if possible) that the program source code in the production program library matches the program "load" module (machine executable code) in the production load library. Additional program testing may be necessary "after the fact" as it is unlikely that the changes were thoroughly tested in the emergency situation. Also, program, operations and user documentation are updated to reflect the change.

3.3 Start up and shut down procedures

This section covers step by step instructions on how to power on and off the equipment in the Data Centre, including the commands to be keyed in to start up the operating system and database.

3.3.1 Hardware

Operations staff can boot the system by switching on the switch. Then the designated persons can start up the application.

Only the system administrator with superuser capabilities or a designated user with superuser capabilities can shut down the system. Typically the system is shut down before updating the system parameters, reconfiguring or activating a new kernel, checking the file system or backing up the system. The system is turned off completely when the System Administrator has to perform a task such as installing a new disk or interface card.

3.3.1.1 Stratus

XAR

Start Up

1. Check room temperature ($20^{\circ} \pm 1^{\circ}$ C or below in STRATUS room - thermometer is available on wall).
2. Confirm that appropriate breakers on the CRDP are on.
3. Check that all peripherals are powered on.
4. AUTOBOOT from STRATUS Monitor panel on the machine.
5. Press CYCLE button and select AUTOBOOT option.
6. Press ENTER button within 3 seconds.
7. Wait for *logon* screen at CONSOLE.
8. Start the Application(s). This is done by the Market Operations Group.

Shut Down

1. login username -privileged.
2. Check whether any application batch processes are running by typing:
 lui batch
3. Close all applications.

4. type shutdown command and confirm the request.

Continuum

Start Up

1. Power on Circuit Breakers (CB) on the Computer Room Distribution Panel (CRDP) which correspond to the system input power.
2. Power on CBs on CRDP panel which correspond to console input power.
3. From system console type ctrl + break
4. Type boot_auto and press ENTER.
5. The machine will boot.

Shut Down

1. Login as privileged user.
2. See that all the users have logged off.
3. Type shutdown and pull form. In form specify the reason for shutdown and press ENTER.
4. The machine will shutdown.
5. Power off input power CBs from the CRDP.

Emergency Shut Down

1. Type ctrl+break from system console.
2. Type power_off . Press ENTER.
3. The machine will shutdown.

3.3.1.2 HP 9000

Start Up

1. Switch ON all peripherals, the External Disks and monitors first.
2. Ensure that the Motorola switch is switched ON.
3. Switch ON the Primary (NSECLG1) system.
4. Wait for the login prompt of the Primary (NSECLG1) machine.
5. Login as orastart, to start ORACLE.
6. Perform Steps 3, 4 and 5 for the Secondary (NSECLG2) machine.

Shut Down

1. Send message to all users to log off. Ensure that all users have logged off.
2. Login as orashut in NSECLG2, to shutdown ORACLE.
3. Shutdown the secondary (NSECLG2) system first by login as shutdown.
4. Wait for the secondary (NSECLG2) system to be fully shutdown.
5. Perform steps 2 and 3 for the primary (NSECLG1) system.
6. Switch OFF the Router, External Disks and monitors.

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3.3.1.3 DEC-Alpha

Alpha 2000 (Newton)

Start Up

1. Switch ON all peripherals, the Juke box and monitors first.
2. Ensure Motorola switch is switched ON.
3. Switch ON the Newton system.
4. Wait for the login prompt of the machine.
5. Login as orastart, to start ORACLE.

Shut Down

1. Send a message to all users to log off. Ensure that all users have logged off.
2. Login as orashut in Newton to shutdown ORACLE.
3. Login as root. Type sync, sync
4. Type shutdown -h
5. Wait for the system to fully shutdown. Power off the Newton machine.

While starting up the Alpha 8200 systems, Einstein should be started up followed by Edison and while shutting down, Edison should be shut down first followed by Einstein.

Alpha 8200 (Edison)

Start Up

1. Power on both the Storage works-300 cabinets.
2. Power on the Edison CPU cabinet.
3. Login as Orastart to start Oracle.

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Shut Down

1. Send a message to all users to logoff. Ensure that all users have logged off.
2. Login as orashut to shut down Oracle.
3. Login as shutdown to shutdown Edison machine.
4. Power off Edison machine.

Alpha 8200 (Einstein)

Start Up

1. Power on the Einstein CPU cabinet.
2. Login as Orastart to start Oracle.

Shut Down

1. Send a message to all users to logoff. Ensure that all users have logged off.
2. Login as orashut to shutdown Oracle.
3. Login as shutdown to shutdown Einstein machine.
4. Power off Einstein machine.

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3.3.2 Support Systems

3.3.2.1 Air-conditioning

Voltas A/C

Of the four Air-conditioning package units, one unit is kept off on a weekly rotation basis. A weekly power-on chart showing this schedule is stuck on the panel in the Voltas A/C room.

Start Up

1. Move the Incomer on the main panel to the "ON" position. The three indicators R, Y and B should light up.
2. On the panel, turn on switch F1/F2/F3/F4 for the units that are selected as per the weekly power on chart.
3. Put on the Airstat. This is done by pressing the marked green push button switch on the panel. The Airstat's green indicator will glow.
4. Ensure that the damper handle at the top of each of the functioning A/Cs must be in the vertical position (horizontal position implies closed) prior to starting the A/Cs. The damper handle of the A/C which is not to be powered up must be in the horizontal closed position.
5. Press FAN switches (2 green buttons) for each A/C on the front panel.
6. The ON/OFF power switch for each A/C is in a rectangular slot on the front of each A/C. This is to be put on only after about 15 minutes of putting on the Airstat.
7. For the A/C to be working the fan switch at the side should be in *cool* position. Move it from OFF to FAN and then to COOL. This switch is located at the left hand side of the A/C package unit.
8. The thermostat switch at the side is not to be used. The thermostat located on the front of each A/C is to be used.

Shut Down

1. For the shut down, press the Red STOP button of Airstat on the panel. The green indicators will go off and the red indicators will come on.

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2. Put off individual condenser fans from the panel by pressing the appropriate red push button switch. The green indicators will go off and a red indicator will come on.
3. Finally the main circuit breaker i.e. the incomer is to be moved to the Off position (Vertical position).

Tata Liebert A/C

Of the four Air-conditioning package units, one unit is kept off on a weekly rotation basis. A weekly power-on chart showing this schedule is stuck on the panel in the Tata Liebert A/C room.

Start Up

1. Switch on main incomer TLL Panel Circuit Breaker (TMCCB1) on the Air-conditioning Distribution Panel (ACDP) to energise it. Ensure the 3 indicators on the panel are on. Ensure that the voltage between the three phases is $415 \pm 10\%$. Use the rotary switch to observe these readings. Confirm the set values are 21 °C and 50 RH.
2. Switch on the corresponding switch on the ACDP panel for the 3 A/C units to be started.
3. Press start switch on the A/C front panel. The A/C unit will start.
4. Read the set and actual values of temperature and humidity by pressing the set switch on the A/C front panel.

Shut Down

1. Depress the stop switch for the appropriate unit on the A/C front panel. The A/C units will stop after 1 minute.
2. Switch off corresponding switch on the ACDP panel.

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3.3.2.2 Uninterrupted Power Supply

UPS-I

Start Up

1. Switch on main incomer -1 on the UPS Distribution Panel (UDP) (left-hand side top).
2. **Caution:** If bypass-2 input Circuit Breaker (CB) is already on, then skip this step otherwise switch on bypass -1 input UP on the UDP panel.
3. Change over selector switch to bypass-1 position (centre of UDP panel).
4. Switch on UPS-I input CB on UDP panel (left side middle).
5. Switch on the UPS -I o/p CB on UDP panel (left side bottom).
6. Open UPS-I door by unlocking with the key which is placed near the box.
7. Switch on "UPS input" switch of UPS-I located on the right side bottom. A beep will sound. It can be silenced by pressing the "alarm reset" button (orange colour) on the front panel.
8. Switch on UPS bypass input switch (second from right, bottom).
9. Switch on UPS output switch (left side, bottom).
10. Check whether the "inverter on" led is lit on the front panel. If not then press "inverter on" button on the front panel.
11. If the inverter is still not on, then press the "reset" push button on the UPS logic board and again press the "inverter on" button on the front panel.
12. Check whether the "inverter unsynchronised" message is displayed on the message window. If so, then switch off the bypass I/P switch of UPS (second from right). Now load will be ready to be connected to UPS. Switch on bypass input switch.
13. Switch on battery CB which is located in bypass transformer-1 cubical. First push it downwards until it latches there, then push it up to turn it on.

Note: Switch on either bypass-1 or bypass-2 CP on UDP panel. This way one of the two bypass transformers are selected.

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Shut Down

1. Press "Emergency Off" button of the front panel after lifting the protecting flap
2. Switch off UPS-I input CB on UDP panel (left side middle).

Note: If a total power shut down is required, switch off both "Main Incomer-1" and "Main Incomer-2" on the UDP Panel.

UPS-II**Start Up**

1. Switch on main incomer-2 on the UDP (right side top).
2. **Caution:** If bypass-1 input CB is already on then skip this step. Otherwise switch on bypass-2 input CB on UDP panel (right side middle).
3. Move the changeover switch to bypass-2 position (centre of UDP panel).
4. Switch on UPS-II input CP on UDP (right side middle).
5. Switch on the UPS-II o/p CB on UDP panel (right bottom).
6. Open UPS-II door by unlocking with the key.
7. Switch on UPS input switch of UPS (right side, bottom). A beep will be heard. It can be silenced by pressing the "alarm reset" button (orange colour) on the front panel
8. Switch on UPS bypass input switch (second from right).
9. Switch on UPS output switch (leftmost side).
10. Check whether the "inverter on" led is lit on the front panel.
11. If not, then press "inverter on" button on front panel.
12. If the inverter is still not on, then press "reset" switch on the UPS logic board and again press the "inverter on" button on front panel.
13. Check whether the "inverter unsynchronised" message is displayed on the message window. If so, then switch off bypass switch of UPS-II (second from right). Now load will be ready to be connected to UPS-II. Switch on the bypass input switch.
14. Switch on battery CB which is located in the bypass transformer-2 cubical. First push it downwards until it latches there, then push it up to turn it on.

Note: Switch on either bypass-1 or bypass-2 CB on the UDP. This way one of the bypass transformers will be selected.

Shut Down

1. Press "Emergency Off" button of the front panel after lifting the protecting flap
2. Switch off UPS-II input CB on UDP panel (right side middle).

Note: If a total power shut down is required, switch off both "Main Incomer-1" and "Main Incomer-2" on the UDP Panel.

3.3.2.3 Power Distribution Panel

Computer Room Distribution Panel (CRDP)

Power On

1. Check UPS - Monitor display and ensure "normal operation" message.
2. Switch on Incomer supply, Incomer-1 switch and list of CBs on CRDP.
3. Switch on all peripherals (Console, Terminals, Printers, Motorola Switches, Multiplexers, Modems etc.)

Power Off

1. Switch off peripherals and machines connected to the Power distribution panel.
2. Switch off - Power distribution Incomer supply - 2 switches INCOMER-1 and INCOMER-2.

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3.3.2.4 The Mains

The power to the computer room is fed from two sources - the BEST and the on-site Diesel Generator. Each of these has three feeders which terminate the Change Over Panel (COP) located in the Electrical Room. The COP feeds the Low Tension Distribution Box No. 1 and 2. (LTDB-1 and LTDB-2 panels). Both these panels are located in the electrical room. The working range for the mains supply is $415 \pm 10\%$ across phases and frequency $50 \pm 1\text{Hz}$.

LTDB-1 provides power to UPS-1, the four Voltas A/C units, the RFT equipment and the UPS on the fourth floor which is used for brokers workstations. LTDB-2 provides power for UPS-2, four Tata Liebert A/C units, maintenance power points in the computer room and the fire alarm and protection panel.

The COP enables the equipment to receive power from either the BEST mains or the D.G. set via the change over switches.

In case of a fire or disaster, the Mains to the Computer room have to be switched off. This must be done with caution and only after receiving clearance from the appropriate authority.

Start Up

1. Switch on the Mains switch.
2. Switch on LTDB-1 and LTDB-2.

Shut Down

1. Switch off LTDB-1 and LTDB-2.
2. Switch off the Mains switch.

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3.3.2.5 Diesel Generator

When the BEST power fails, the DG will start up automatically. The power from the D.G. is transmitted over three feeders which terminate on the Change Over Panel located in the electrical room. To switch the source of power from the Mains to the D.G., the main circuit breaker of the Change Over Panel must be switched to ON. This is described in detail in Section 2.2.4.

But if a manual start is desired the D.G. may be switched on manually. This is done every morning to check that the D.G. is functioning normally.

Start Up

1. For a manual start, turn the switch on the extreme right to "Manual".
2. Press "Engine Start" button.
3. Press "Mains Contractor On" button.

Shut Down

1. Press "Mains Contractor Off" button.
2. Press "Engine Stop" button.
3. Turn the switch on the extreme right to "Auto".

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3.3.2.6 Total shutdown of all equipment

The equipment in the Data Centre room is powered on 24 hours a day. Certain equipment may be shut down for maintenance or upgradation and this is preferably scheduled after office hours or on weekends. In an emergency, if all equipment has to be powered off, authorisation must first be obtained from the Vice-President - Systems and Telecom. The order in which the equipment is to be shut down and started up is given below.

Start Up

1. Power on the Uninterrupted Power Supply (UPS) system.
2. Power on the Voltas and TLL A/C units. Wait until the temperature and humidity is normalised before proceeding to the next step.
3. The Circuit Breakers (CBs) on CRDP-1 and CRDP-2 should also be switched on for the respective equipment.
4. Power on the MCCB1 on both the CRDP panels. Switch on all the equipment in both the computer rooms, VSAT NMS room, the Market Watch room and UPS dedicated equipment in the main hall.
5. Power on each of the hardware units following the start up procedures for that unit.

Shut Down

1. Ensure that clearance is obtained from the Vice-President - Systems & Telecom to power off all equipment which would include EPBX and VSAT.
2. Power off each of the hardware units following the shut down procedures for that unit.
3. Once all the equipment in both the computer rooms, VSAT NMS room, the Market Watch room and UPS dedicated equipment in the main hall are switched off, then power off the MCCB1 on both the CRDP panels.
4. All the CBs on CRDP-1 and CRDP-2 should also be switched off to ensure a controlled loading of the UPS when the UPS power is normalised.
5. Power off the Voltas and TLL A/C units.
6. Power off the UPS system.

3.3.2.7 Multiplexer

Start Up

1. To switch On the power after an emergency shut down, NSE's Telecom Department must first be informed.
2. Put On the MULTIPLEXER Shelf 's individually, first put ON SHELF-1 and after about 5 seconds SHELF -2.
3. After the power ON signal is displayed, the status of all the cards must be checked to ensure that it is displaying a message that they are OK through the PROCOMM/NETMGR software using the Config-Show All menu.
4. The DATE & TIME must be checked through PROCOMM/NETMGR software using the House option

Shut Down

1. In case of an emergency power shut down, permission must first be obtained from NSE's Telecom Department for any shut down which affects the Telecommunication setup.
2. Shut OFF the MULTIPLEXER shelves individually, (Press the power ON/OFF switch on the front of the power unit of each individual Multiplexer). First put OFF the switch for SHELF-2 and subsequently for SHELF-1

4. Change and Problem Management Process

Change and problem management is critical to achieving a stable, reliable and well-controlled operation. It involves problem tracking, escalation procedures, management review of problems and changes required, program change management and systems software change control.

4.1 Problem Tracking

Data centre staff are responsible for tracking and summarising key data for management review and discussion at regularly scheduled management meetings. Items informally tracked include the following:

- On-line response time
- Batch job turnaround time
- Equipment reliability
- Systems software changes applied
- Jobs that terminated abnormally
- Number of jobs rerun, and causes of rerun
- Accuracy of reports
- Data centre responsiveness to users seeking assistance

Problems may result from the network, hardware, software, the facility (e.g. the cooling system), applications/data, procedures, and personnel. Most problems are generated by changes to the computer system. User requirements change and often require new equipment or applications. Changes also occur to resolve problems (e.g. an operating system is changed to improve response time, or an application is modified to correct a parameter error). Problems and changes are a way of life in the Systems Department and must be handled in a well-organised manner.

The Systems Department runs a Help Desk for brokers to report problems encountered with the system. When the broker calls in, the request is recorded on the Interactive Voice Response (IVR) system and then entered into a database. A number is assigned and the problem is routed to the appropriate department for resolution.

However, when NSE staff encounter problems on the system, they report them directly to the System Administrators or DBAs. If the problem is critical, it is reported to the Asst. Vice-President.

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4.2 Problem Escalation Procedures

All problems are reported at an appropriate management level depending on the severity of the problem and whether it is time-critical. Although there is no demarcation, problems are categorised into four levels depending on the complexity of the problem and then routed to the appropriately skilled staff member(s). First-level problems are treated as the least severe and fourth-level problems are treated as the most severe:

- First-level problems are usually recognised by the end-user and are typically associated with procedures, applications and terminal operations. They can be quickly handled by the help desk.
- Second-level problems are related to system software components and can be handled by a master terminal operator or system console operator.
- Third-level problems cross multiple technical specialisations or are intermittent and hence, not easily isolated. They are usually handled by systems programmers and host or network technicians, on receipt of the Field Trouble Report (FTR) or Change Management Request (CMR) form.
- Fourth-level problems, due to their critical nature or the length of time they have remained unresolved, require management involvement and reallocation of personnel.

The time which can elapse between a problem being logged and it being reported to management is determined by the nature and severity of the problem. If the problem is not resolved within an acceptable time period, the problem is then reported to a higher level of management action for action and rectification.

Pre-defined restart and recovery procedures may be used to solve certain problems. For example, re-initialising the system, restarting a program and reconfiguring equipment are possible procedures that may be planned and pre-approved for certain situations. In most situations, however, pre-defined procedures have to be supplemented by the active intervention of technical support and application development/maintenance staff.

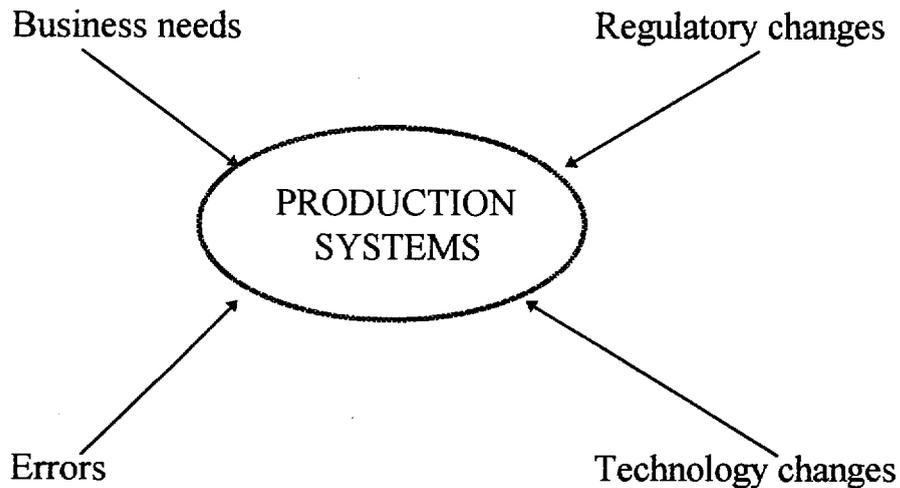
4.3 Management Review

Data Centre management use help desk reports to assess the causes of operational inefficiency and poor user service and to allocate appropriate resources to prevent such failure in the future. The following three factors are typically used to measure system incidents:

- Status of reported problem, which might include the number of unresolved problems, reported problems, resolved problems etc.
- Rerun time, which measures total rerun time and reason for rerun.
- System failure and unscheduled downtime, which also provides reasons for the breakdown.

4.4 Change Management

CHANGES ARE CONSTANTLY REQUIRED



Change management is used to manage and control the process of change in an organisation. The primary objective of change management is to maintain the pace of change as dictated by business needs within acceptable risk parameters.

Change management encompasses a wide range of efforts, from the introduction of a new product or system which has broad external and/or internal impacts, to a simple modification of an internal program. Each change affecting data centre activities, regardless of scope, must be integrated into the production environment in a systematic and controlled manner.

Change management covers the procedures and controls necessary to ensure that all changes to hardware and software are formally requested, approved and adequately tested to minimise the risk of errors and irregularities in the production processing environment.

Changes to a business application system may affect program, system software, hardware or any other aspect of the information processing environment. Software and hardware change management standards and procedures are necessary to ensure that changes to any component are applied in a controlled and consistent manner. Procedures are also necessary to ensure that production problems arising are properly identified and resolved.

The principal objective of change management, are, therefore, to ensure:

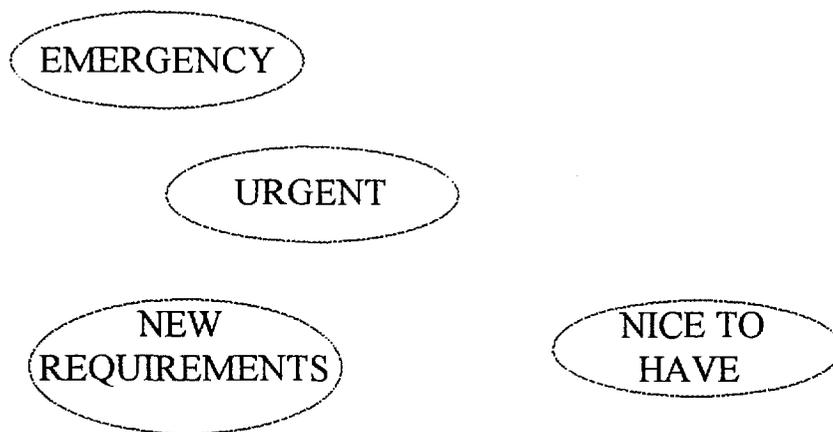
- That changes to systems are applied in a controlled manner so that the stability and security of systems are not compromised;
- That changes to systems are only implemented on the basis of formal requests authorised by management; and
- Continued compatibility of all software and hardware components

Management considers the following issues to minimise risk:

Initiation of change. The Field Trouble Report (FTR) and Change Management Request (CMR) form provide a basis for change management and the method by which all information regarding a particular change can be held. A sample of the forms is in Appendix A-7 and A-8. The FTR form is used to document errors which need to be corrected and the CMR is used to document enhancements needed. Both forms have a section to be filled in by the initiator and another to be filled in by the Project Leader.

Risk assessment. The severity of changes to the computer system is assessed so that adequate notice can be given to all users and appropriate recovery procedures put in place, should a failure occur;

Classify Changes



Priority. All changes are assigned a priority which is agreed by the system owner. The criticality of the problem depends on its impact on business operations. Faults in the system are assigned a higher priority after which change requests are actioned. For example, an error in client reports would be actioned immediately whereas an enhancement to a system function would be actioned later.

Twice a week, the users from various departments meet with the developers to discuss the status of outstanding requests and reset priorities. The Vice-President of Clearing Operations then agrees on the prioritisation and authorises the changes. Depending on the resources available and the time required to complete each change, they then agree on which changes will be actioned;

Testing of changes. All changes are appropriately tested before they are applied to the production environment to reduce the risk of subsequent failure. The changes are first moved from the development to the acceptance test environment, where extensive testing is carried out by the users who have requested the change. Only after this testing is the change moved to the production environment;

Documentation of changes. Change control documentation is maintained so that approval of changes can be ensured. Each FTR and CMR form is approved by the Vice-President and one person assigns a serial Change Request (CR) number. The project leader then details the changes made on this form. These are then filed.

Change approval and rejection. Changes to systems are authorised by the system owners following consultation with the system users;

Implementing the change. Changes are only implemented by appropriate personnel who record the success or failure of the change. The user initiates the change, the Asst. Vice-President approves it and the developer implements the change;

Emergency changes. Important changes are occasionally required to be made to the system at short notice. Such changes are implemented before being approved but are thoroughly documented and retrospectively approved by the Asst. Vice-President; and

4.4.1 Hardware

The reason for making a hardware change has to be justified by the Systems Department and then approved by the appropriate authority. All changes to hardware are tested and subject to formal testing and acceptance. Training is provided to operators prior to the implementation of hardware or systems software changes which result in operating procedures being modified. Documentation of the hardware configuration, including computer room floor plans and telecommunication topology maps are maintained.

The changes are scheduled on a Saturday evening or the evening before a holiday so that system availability is ensured. After the changes are made, the users give their feedback to the Systems Department whether the current configuration now meets their requirements.

4.4.2 Software

4.4.2.1 Systems Software Change Control

Changes to systems software are closely monitored, controlled and completed on schedule to ensure the stability of the Information Systems environment. This process includes the following:

- Authorisation for each requested change
- Change to be performed by authorised personnel

Management supervises the systems software change process to ensure that controls are strictly followed and that changes are efficiently completed. The following are two particularly important areas:

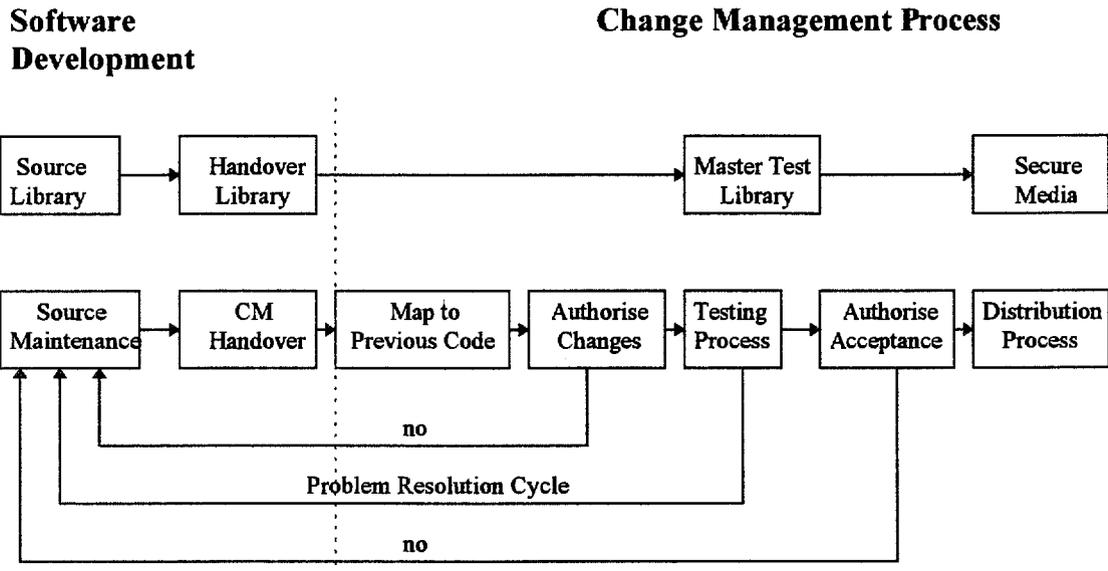
- Authorisation and review of changes - All affected parts of the organisation are informed in advance of a pending change. Standardised test methods have been developed for all systems software changes and "fixes" across different processing environments.
- Restricted access to facilities used for making changes - Particularly with the increase in on-line programming and maintenance, access to systems software has become much easier. Systems logs, documented audit trails and access control software are maintained to control access to main memory, systems programming data, specifications and documentation.

Upgrades to the operating software are usually done as patches. This is scheduled on a Saturday evening or on an evening preceding a holiday to ensure system availability. The upgrade should be authorised by the appropriate authority. A complete backup of the system is taken before the modifications are made. The reason for the change is then noted in a log book.

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4.4.2.2 Application Software Change Control

The following diagram illustrates the change management process structure for software change which has been established to ensure segregation of duties. In addition, independent assessment and authorisation of changes occur at specified points.



At the library level, the programs to be changed are copied from the Source Library to the Handover Library by the programmer. After the changes are complete, the project supervisor moves the programs to the Master Test Library where it is tested by NSE Systems staff and the users. The System Administrator then takes a backup on the appropriate magnetic media.

Changes to NEAT software are made by TCS programmers on the development machine. The TCS team leader then hands over the amended programs to NSE Systems staff who map it to previous code. The changes are authorised and extensively tested by NSE staff from the appropriate user department who requested the change. Acceptance of the changes are authorised by the appropriate authority before being moved to production by NSE Systems staff and then distributed to traders. A new release of NEAT is released to traders every 4 to 6 months. A broadcast message is sent to all traders at the time of the release. When they next login, the new version of the software is automatically downloaded to their PCs by the Stratus system.

Any problem arising during the change management cycle result in the proposed software change being passed back to development for correction and re-introduction into the process. At each authorisation point, the software is transferred into a separate library to ensure its integrity. The final acceptance test is conducted by a separate team from the users and system developers.

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4.5 Problem Management

Problem management relates to the procedures and controls used to identify, report and correct processing problems, both hardware and software to minimise any disruptions to normal operational processing.

Problem management controls and procedures provide a formal method of managing problems and ensure that they are resolved in a timely and appropriate manner. Without such control there is a risk that systems errors will not be resolved in a timely manner and that incorrect solutions will be applied. Management must be able to clearly demonstrate that they have considered the following issues to minimise risk:

- **Problem recognition.** Problems should be recognised by their effect and once recognised, the actual cause and effect must be determined.

When problems are encountered, appropriate personnel must be informed. The persons to be contacted will vary depending on the severity and nature of the problem and its likely duration;

- **Problem determination.** In many circumstances problems can be bypassed and recovery procedures initiated without a solution to the problem being found. These recovery actions must be documented and their adequacy reviewed. If a complete solution is found, then this must be logged;
- **Problem resolution.** When problem are resolved, the solution is logged and the problem closed. The manager then reviews the adequacy of the solution. Any requirements to apply changes to the data processing environment should be processed through the change control system;

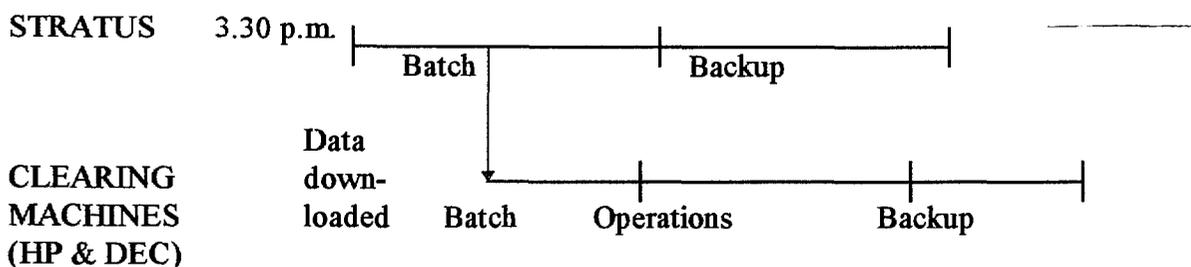
5. Backup Management

Backups are taken to protect against an accidental or intentional deletion of files and directories, a disk failure or a disaster. It is essential that backup copies of all production and system data and programs must be secure and current.

NSE's backup controls include:

- Master/transaction/log files are copied at prescribed frequencies (backup cycle)
- Update of duplicate main file simultaneously with actual main file
- Key resources (e.g. master and transaction/log files and source documents) are regularly backed up and stored for a sufficient period of time in a suitable location to assist in recovery
- Prescribed retention of input documents to match backed up files
- Complete backups of all data and programs taken at prescribed intervals (i.e. weekly)
- Backup data is removed from the operating site as soon as practicable after creation and kept securely until replacement and
- Backup tapes are periodically tested (i.e. reloaded to disk) to ensure continued integrity of both media and backup process.

Each trading day, the market closes at 3.30 p.m., unless there is an auction in which case the market closes at 4.30 p.m. After this it takes approximately one hour to run a batch and each broker is sent a consolidated report of the trades completed during that day. During the batch run, after the settlement data has been generated, flat files are generated which are then downloaded to the Clearing machines. The Stratus backup is then started. Using the downloaded data the HP 9000 and DEC-Alpha processing is done and the backup is taken.



The 2 night shift operation assistants are responsible for the successful completion of the backups. If a major problem occurs, the System Administrators are contacted by phone, or the Asst. Vice-President is contacted. Currently Asst. Vice-President - Systems and System Administrator (HP and DEC Systems) can log onto the HP 9000 and DEC-Alpha systems from their home PCs and instruct the Operation Assistants how to proceed with the overnight run.

The System Administrators check backup logs every morning to check for any exceptions which are reported during the overnight run. The Operators report to two Systems

Administrators - one on the HP 9000 & DEC-Alpha machines, and the second on the Stratus machines. After completing the backup at the end of the day, the Operators send the System Administrators and Asst. Vice-President an e-mail on details of the backup, any exception messages they received during the backup. The System Administrator then takes the appropriate steps to resolve the problem.

The backup strategy for each machine is detailed below:

Stratus Continuum 1225 (Chanakya) - Production Machine

At the end of the day, the Pre-batch backup and Post-batch backup is taken on Digital Audio Tapes (DATs) for the day's transactions and a backup for the week (Monday to Saturday) upto that day is also taken on DATs. The DAT for the monthly backup is then loaded and the pre and post batch files are backed up in pass1 and pass2 i.e. two copies after the DAT is brought to End of Volume stage.

The backup DATs are kept on first floor and fourth floor of Mahindra Towers. The backups for the day, the current week and pass1 (monthly backup) are kept on the first floor, while those for the previous days, weeks and pass2 (monthly backup) is kept on the fourth floor.

The daily backups are recycled after a week. i.e. The Monday DAT is overwritten next Monday. For weekly backup, the DATs are recycled after five weeks. The monthly backup is kept permanently.

At the end of the month, a complete dumpdisk backup is taken of the O/S disk. All hardware, system and application error logs are backed every month end and are kept permanently.

The backups being kept at present on the fourth floor of Mahindra Towers as well as those of dumpdisks will be moved to Kamla Mills as soon as the air-conditioning facilities are ready there.

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Stratus Continuum 1225 (Kautilya) - Development Machine

The daily consolidated user directories are backed up on Digital Audio Tapes (DATs) drives. Two copies are taken and one is kept on the fourth floor and the other on the first floor of Mahindra Towers.

The daily backup DATs are recycled after a fortnight i.e. The Monday DAT is overwritten after fourteen days. Every Saturday, weekly backup is taken as complete backall of the machine and it is recycled after four weeks.

Monthly backall is taken and is recycled after four months. All hardware, system and application error logs are backed every month end and are kept permanently. The backup DATs are kept on the first floor and fourth floor of NSE. At the end of the month an OS disk backup called "dumpdisk" is taken which is recycled after two months.

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Stratus XAR - 330 - Production Machine

At the end of the day, the Pre-batch backup and Post-batch backup is taken on Spool Tapes for the day's transactions and a backup for the week (Monday to Saturday) upto that day is also taken on DATs. The DAT for the monthly backup is then loaded and the pre and post batch files are backed up in pass1 and pass2 i.e. two copies after the DAT is brought to End of Volume stage.

The backup DATs are kept on first floor and fourth floor of Mahindra Towers. The backups for the day, the current week and pass1 (monthly backup) are kept on the first floor, while those for the previous days, weeks and pass2 (monthly backup) is kept on the fourth floor.

The daily backups are recycled after a week. i.e. The Monday DAT is overwritten next Monday. For weekly backup, the DATs are recycled after five weeks. The monthly backup is kept permanently.

At the end of the month, a complete dumpdisk backup is taken which includes backup of all programs, the operating system and user directories which are not taken in the regular backups. All hardware, system and application error logs are backed every month end and are kept permanently.

There is a proposal to move the backups being kept at present on the fourth floor of Mahindra Towers as well as those of dumpdisks to Kamla Mills as soon as the air-conditioning facilities are ready there.

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Stratus XAR - 330 - Development Machine

The daily consolidated user directories are backed up on Digital Audio Tapes (DATs) drives. Two copies are taken and one is kept on the fourth floor and the other on the first floor of Mahindra Towers.

The daily backup DATs are recycled after a fortnight i.e. The Monday DAT is overwritten after fourteen days. Every Saturday, weekly backup is taken as complete backall of the machine and it is recycled after four weeks.

Monthly backall is taken and is recycled after four months. All hardware, system and application error logs are backed every month end and are kept permanently. The backup DATs are kept on the first floor and fourth floor of NSE. At the end of the month an OS disk backup called "dumpdisk" is taken which is recycled after two months.

HP and DEC Alpha

All the databases are exported daily and backed up and kept for six months. Permanent backup is taken every Thursday. Two copies are made: one is kept at Kamla Mills and the other is kept at Mahindra Towers.

Every week on Saturday, the Oracle backup of production databases is taken for all the machines individually. This backup is recycled on the third Saturday. Archived Redo logs are backed up daily for all machines. This is also overwritten on the same day in the third week. User directory backup is taken daily and recycled on the same day in the third week.

Before a version release, the complete RDMS is backed up and kept. Whenever any change is effected in the operating system, pre change and post change backups are taken.

The application data downloaded from Stratus daily is kept on the HP machine and backed up every month and then purged, during month end or when it reaches 2 GB level. The data on orders is also backed up every month and purged from the machine.

The backup media used is Digital Audio Tapes (DATs) which are kept locked in fire-proof cupboards. The backup DATs are released to staff only after authorisation by senior management.

APPENDICES

an

APPENDIX - A

FORMS USED BY NSE

- A-1 Shift Report
- A-2 User Maintenance Form
- A-3 HP and Alpha Daily Log Sheet
- A-4 HP Daily Log Book
- A-5 Backup Schedule
- A-6 Backup Register
- A-7 Field Trouble Report
- A-8 Change Management Request
- A-9 Operation Assistant's Daily Status Chart
- A-10 System Administrator's Daily Check List

**SHIFT REPORT**

DATE:

SHIFT No:

OPERATOR NAME(s):

INITIAL(s):

I. Jobs Done

Machine	Job description	Remarks
STRATUS NSE1		
STRATUS NSE_DEV		
CONTINUUM CHANAKYA		
CONTINUUM KAUTILYA		
Other Jobs		

(Detailed job schedule and activity logs need to be attached)

II. Jobs / Process Suspended / Pending

Machine Name	Reason



III. Machine Status

Machine	Status	Down Time	Remarks
STRATUS NSE1			
STRATUS NSE_DEV			
CONTIN - CHANAKYA			
CONTIN - KAUTILYA			
MOTOROLA SWITCHES			
MULTIPLEXERS +DTUs			
RACK MODEMS			

IV. UPS Status

LOAD ON:

1	2
---	---

UPS- on 4th Floor

V. A/C Unit(s) Running (Voltas) :

1	2	3	4
---	---	---	---

A/C Unit(s) Running (Tata Libert) :

1	2	3	4
---	---	---	---

VI. Temperature, Humidity, Voltage / Frequency Readings:

Time	Temp °C	Humidity %	I/P Bypass Voltage	Frequency Hz	Ammeter Reading	Remarks

VII. Remarks:

VIII. SHIFT handed over by:

NAME(s):

SIGN :

SHIFT Taken-Over by:

NAME(s):

SIGN :



1. List of VOS processes immediately comes up after BOOT-UP Date :
(Production Machine (CONTINUUM))

Sl. No	Process Name	Status
1	Overseer(BatchOverseer)	
2	overseer inter Switch SVC calls (Sw03_01, Sw03_02, Sw03_05, Sw03_06, Sw03_07, Sw03_08, Sw03_09, Sw03_10, Sw03_11, Sw03_12, Sw03_91, Sw03_94, Sw 10_03)	
3	Overseer(Spooler)	
4	Overseer(TheOverseer)	
5	Overseer(TPOverseer)	
6	Overseer(x25_exchange)	
7	Overseer(x25_gateway1....14)	

2. Activity Log

Time	Activity	Status
08:30	Reset INFO feed Server PC & Server PC for MD & DMD	
08:45	Reset Modem(s) of Knight-Rider & DART	
08:50	Call the above modems and ensure Modem tone	
08:55	Check CD led on Reuters, modem	
09:15	Power-on 4th floor UPS	
09:30	Power-on 4th floor Server PCs	
10:30	Check Reuters modem TD led blinking	
14:30	Money market Same Day settlement data transfer to HP-9000 Directory: #m1_d01>users>prabhab>mm_ftp_time.out	TIME
15:45	Capital Market settlement data transfer to HP-9000 Directory: #m1_d01>users>cmops>cm_ftp_time.out	TIME
17:30	Money market Other day settlement data transfer to HP-9000 Directory: #m1_d01>users>prabhab>mm_ftp_time.out	TIME
20:00	Power-off 4th Floor server PCS and Trading member's PCS	
20:05	Power-off-4th Floor UPS	

3. CONTINUUM DISK SPACE DETAILS (Note Left percent and alert if its less than 10%)

Time	m1_d01	m1_d02	m1_d03	m1_d05	m1_d06	Remarks

GENERAL REMARKS IF ANY :

INITIAL :

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Number of Money Market users per Relays:

Time	Relay 1	Relay 2	Relay 3	Relay 4	Relay 5	Relay 6	Relay 7	Relay 8

Number of Capital Market users per Relays:

Time	Relay 1	Relay 2	Relay 3	Relay 4	Relay 5	Relay 6	Relay 7	Relay 8	Relay 9	Relay 10

Number of SVCs per Gateways

port 8 sw 1	port 8 sw 3	port 32 sw 5	port 20 sw 6	port 8 sw 7	port 8 sw 8	port 12 sw 10	port 16 sw 10	port 27 sw 10	port 11 sw 11	port 23 sw 11	port 5 sw 11	port 11 sw 12	port 23 sw 12

Maximum number of simultaneous calls per Switch

Time	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-10	SW-11	SW-12
				XXX								
				XXX								
				XXX								
				XXX								

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CAPITAL MARKET CLEARING & SETTLEMENT SYSTEM USER MAINTENANCE

USER NAME (MAX 30 CHARS)	
USER INITIALS (3 CHARACTERS)	
USER CODE (MIN 5 CHARS)	
LEVEL	
REMARK	
AUTHORISED BY	
SIGNATURE	
DATE	



**HP & ALPHA DAILY LOG-SHEET**

DATE:

I. Jobs Done

Machine	Job description	Remarks	Initial
HP - 9000 NSECLG1			
HP - 9000 NSECLG2			
DIGITAL ALPHA			
DIGITAL ALPHA			
Other Jobs			

(Detailed job schedule and activity logs need to be attached)

II. Jobs / Process Suspended / Pending

Machine Name	Reason

III. Machine Status

Machine	Status	Down Time	Remarks
HP - 9000 NSECLG1			
HP - 9000 NSECLG2			
DIGITAL- ALPHA			
DIGITAL- ALPHA			



HP DAILY LOG-BOOK

Date : _____

2) Disk-space (at 9:00 a.m.)

Reported By : _____

No	File system	Space left (MB)	No	File system	Space left (MB)	No	File system	Space left (MB)	No	File system	Space left (MB)
1			5			9			13		
2			6			10			14		
3			7			11			15		
4			8			12			16		

3) Loading details

Reported By : _____

No	Table	Start-T	End-T	No	Table	Start-T	End-T
1.	Securities			8.	Trades		
2.	Sec. Details			9	Orders		
3.	Trading mem			10.	FCM Index		
4.	Trd.memdet.			11.	Index Wegt		
5.	Trd.mem Brch details			12.	Mkt Movemt		
6.	Custodials Parti			13.	Alerts		
7.	Users			14.	Freezes		

1) Backups/Exports

No	Backup Name	Start Time	End Time	Status*	DAT Nos.	Started By
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

* Status = S for successful completion / F for failed completion

Comments * :

* Put exceptions like machine hanging, system shut-down over here

BACKUP SCHEDULE FOR 27/03/1996 - (Wednesday)

I. STRATUS

* *Development module NSE_DEV*

- Daily Consolidated bak on ND0409-Pass1 , ND0376-Pass2 from 26/03/96 (EOV)

* *Development module KAUTILYA*

- Daily Consolidate backup on ND0497-Pass1 , ND0302-Pass2 from 26/03/96 (EOV)

* *Production module NSE-1*

1. Money Market - (MM) :

Pre batch backup	DC	NT0068	Fresh
Post batch backup	DC	NT0069	Fresh

WC	ND0575	EOV
WC	ND0575	EOV

Pre batch backup	MP1	ND0580	EOV
Post batch backup	MP1	ND0580	EOV

MP2	ND0581	EOV
MP2	ND0581	EOV

2 Capital Market - (CM) : CHANAKYA

Pre_batch_backup	DC	NT0056 NT0241 NT0256 NT0018	Fresh
Post_batch_backup	DC	NT0057 NT0248 NT0249 NT0261 NT0023	Fresh

WC	ND0026	EOV
WC	ND0026	EOV

Pre batch backup	MP1	ND0576	EOV
Post batch backup	MP1	ND0576	EOV

MP2	ND0586	EOV
MP2	ND0586	EOV

Note : DC = Daily Cycle Bkp ; WC = Weekly Cycle Bkp;
MP1 = Monthly Permanent Bkp Pass 1; MP2 = Monthly Permanent Bkp Pass 2;

II. HP 9000

* *NSECLG1 System*

- clg1backup on Dats marked as CLG1-WED-1 & CLG1-WED-2
- archbak on Dats marked as WED 1 -Pass-1 & WED 1 -Pass-2

* *NSECLG2 System*

-clg2backup on Dats marked as CLG2-WED-1 & CLG2-WED-2
-exp_bak on Dats marked as ND0339 & ND0340

* *NEWTON System*

-newtonbackup on Dats marked as NEW-WED-1 & NEW-WED-2

Tape No:	Backup Date	Start Time	End Time	Backup Type D/W/M	Module Disk	Contents	Taken By	Storage Location	Ckecked By	Remark
				D		M.M. Pre Batch Backup				
				D		M.M. Post Batch Backup				
				W		M.M. Pre & Post Batch Backup				
				MP1		M.M. Pre & Post Batch Backup				
				MP2		M.M. Pre & Post Batch Backup				
				D		C.M. Pre Batch Backup				
				D		C.M. Post Batch Backup				
				W		C.M. Pre & Post Batch Backup				
				MP1		C.M. Pre & Post Batch Backup				
				MP2		C.M. Pre & Post Batch Backup				

Handwritten mark

FIELD TROUBLE REPORT

FTR No:	Software:	Date:
Version:		Severity:
Status:		Tested By:
Area:		Priority :
Module:		

Description:

Remarks:

CHANGE MANAGEMENT REQUEST

No:

-----To be filled by initiator -----

Client : NATIONAL STOCK EXCHANGE OF INDIA LTD.

Project : Capital Market Clearing System ver 1.0

Date of initiation : 29-03-96 Date required : 01.04.96

Initiated by : Capital Market- Post Trade

Document Name : **Bank Interface**

Version No. : 1.00

Initiation reference : CMR No: 70
(Reference to any related correspondence)

Priority (I / U / A / D): Immediate
(Immediate/Urgent/As Soon As Possible/Desirable)

Type of Change : Change
(Correction/Enhancement/Change)

Page No. : **Note: Enclosed**

Authorized By : _____

-----To be filled by PL -----

CR No: Date received:

10/2/96

Daily check list for the month of July 1996.

Mont	h JULY 1996			To be taken at 0830 hrs																																		
S no		Date		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31				
1	R320 Prod	System Check	in cabinet																																			
		Fans	System																																			
		Fans	Expansion																																			
		Fan	Tape drive																																			
		Sys fault led on	System																																			
		Sys err log clear																																				
2	R320 Devp	Fans	System																																			
		Fans	Expansion																																			
		Fans	Tape drive																																			
		Sys fault led	System																																			
		Sys err log clear																																				
3	Chanakya	Fans normal speed	System																																			
		Fans normal speed	Expansion 1																																			
		Fans normal speed	Expansion 2																																			
		B/P P.S																																				
		Sys fault led	System																																			
		Sys error log clear																																				
4	Kautilya	Fans normal speed	System																																			
		Fans normal speed	Expansion 1																																			
		Fans normal speed	Expansion 2																																			
		B/P P.S																																				
		Sys fault led	System																																			
		Sys error log clear																																				
5	Aryabhat	Fans normal speed	System																																			
		Fans normal speed	Expansion 1																																			
		B/P P.S																																				
		Sys fault led	System																																			
		Sys error log clear																																				
6		Fans normal speed	System																																			
		Fans normal speed	Expansion 1																																			
		B/P P.S																																				
		Sys fault led	System																																			
		Sys error log clear																																				
7	Power drawn																																					
		At CRDP1	150 amps max																																			
		At CRDP2	150 amps max																																			
		All parameters mentioned on these four pages are checked by																																				
		Checked by																																				
		TIME	0800 hrs																																			
		NSEIL senior personnel																																				

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Daily check list for the month of July 1996

Month : June 1996				Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			
S.no	System	Parameter	Expected																																		
1	UPS1	Output voltage	230volts																																		
		Output current																																			
		Batt charge current	1amp max																																		
		Fans (6 inside)	working																																		
		Leds 1,2,3,4 & 6 on																																			
2	UPS2	Output voltage	230volts																																		
		Output current																																			
		Batt charge current	1 amp max																																		
		Fans (6 inside)	working																																		
		Leds 1,2,3,4 & 6 on																																			
3	A/C	TLL unit no 1	Operational																																		
		TLL unit no 2	Operational																																		
		TLL unit no 3	Operational																																		
		TLL unit no 4	Operational																																		
		Voltas unit no 1	Operational																																		
		Voltas unit no 2	Operational																																		
		Voltas unit no 3	Operational																																		
		Voltas unit no 4	Operational																																		
4	Fire sys	Any alarm on panel	all off																																		
5	Gas	Cylinder (s)																																			
		pressure	500psi																																		
		in 1301	Cylinder 2	green zone																																	
			Cylinder 3	30-40 bars																																	
			Cylinder 4	green zone																																	
6	Gas	Console room	green zone																																		
		pressure	HP system area	green zone																																	
		in	Switch room	green zone																																	
		1211	Stratus room	green zone																																	
		hand	VSAT room	green zone																																	
		held	UPS room	green zone																																	
		In all	Voltas A/C room	green zone																																	
		there	Modem rack area	green zone																																	
		are	Extn room cyl no 1	green zone																																	
		fourteen	Extn room cyl no 2	green zone																																	
		small	Extn room cyl no 3	green zone																																	
		cylinders.	Extn room cyl no 4	green zone																																	
	Extn room cyl no 5	green zone																																			
	Extn room cyl no 6	green zone																																			
7	Emrgncy	Lamp in console rm	working																																		
		Lamp in UPS rm	working																																		
8	D.G	No load run. 10min	10 mins run																																		

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Daily check list for the month of June 1996.

Mon th JUNE 1996			Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
S.no	Unit	Modulus I.D	Status																															
	Power supply	SW1	ok																															
		IF2	ok																															
	Three green leds	SW2	ok																															
	will be on, in	SW3	ok																															
	each of these	IF4	ok																															
	modulus,	IF5	ok																															
		SW5	ok																															
		IF6	ok																															
		IF7	ok																															
		SW7	ok																															
		IF9	ok																															
		SW8	ok																															
		IF11	ok																															
		SW10	ok																															
		SW11	ok																															
		SW12	ok																															
		IF16	ok																															
		SW9	ok																															
		SW6	ok																															
		IF19	ok																															
		SW13	ok																															
		IF18	ok																															
		SW14	ok																															
		IF22	ok																															

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Daily check list for the month of June 1996.

Mon. th JULY 1996		
INTERNODAL	Switch port	
	SW3.42-SW2.1	up
	SW3.1-SW5.1	up
	SW3.32-SW7.26	up
	SW3.7-SW9.1	up
	SW3.31-SW1.1	up
	SW3.19-SW8.1	up
	SW5.8-SW10.1	up
	SW5.20-SW6.7	up
	SW5.7-SW7.7	up
	SW5.31-SW1.7	up
	SW5.19-SW8.7	up
	SW5.25-SW2.15	up
	SW1.13-SW7.20	up
	SW1.19-SW8.19	up
	SW19.19-SW12.1	up
	SW10.7-SW11.7	up
	SW11.19-SW12.7	up
	SW11.2-SW7.1	up
	SW9.2-SW6.1	up
	SW1.26-SW12.20	up
	SW10.8-SW14.1	up
	SW10.13-SW13.7	up
	SW13.1-SW14.13	up
	SW3.13-SW13.13	up

Capital Market - Trading System
Check List for Daily Operations - before opening of the Market

Activity	Expected Result	Actual Result	Comments	Remarks
Market date in mkt & net region	Sys-Date			
Market Timings in mkt & net region	10:00 to 15:30			
Check all the processed are up				
Check size of corresponding out file of the processes run	Size of the file = 0			
Disk Space in D05	more than 45% free			
Disk Space in D06	more than 70% free			
Que build up	less than 30			
No of "WARNING" messages in application logs	0			
No of "FATAL" messages in application logs	0			
check for "file is in use" message in syserr.log	Not found			
Send a broadcast wishing the traders "GOOD MORNING" from control work station to all and test whether the same is received at a trade work station (in NSE)	Message received within a minute			
Check CPU utilisation	less than 5%			

Date : ___/___/___

Time :

O (STRATUS) Name : _____ Sign : _____

M (V)

AVP (GM)

VP (SN)

Money Market - Trading System
Check List for Daily Operations - before opening of the Market

Activity	Expected Result	Actual Result	Comments	Remarks
Market date	Sys-Date			
Market Timings	SD:10:00 to15:00 OD:10:00 to17:00			
Check all the processes are up				
Check size of corresponding out file	Size of the file 0			
Disk Space in D03	more than 30% free			
Que build up	less than 30			
No of "WARNING" messages in application logs	0			
No of "FATAL" messages in application logs	0			
check for "file is in use" message in syserr.log	Not found			
Send a broadcast "." from control work station to all and test whether the same is received at a trade work station (in NSE)	Message received within a minute			
Check CPU utilisation	less than 5%			

Date : ___/___/___

Time :

O (STRATUS) Name : _____ Sign : _____

M (V)

AVP(GMS)

VP (SN)

APPENDIX - B

**NAMES AND ADDRESSES OF
MAINTENANCE CONTRACTORS
FOR
HARDWARE & SUPPORT SYSTEMS**

- B-1 Normal Fault Reporting Numbers
 - B-2 Fault Escalation Numbers
 - B-3 Multiplexer-related Numbers
-

Normal Fault Reporting Numbers

Equipment	Maintenance Contractor	Contact Person	Tel/ Pager/ Fax	Contract Expiry Dt
Stratus	TCS	On-site service N. J. Fernandis Nitin Purohit Deepak Shah On-call service	Direct Tel: 496 0559 PAX Off Ext: 347, 348 & 349 202 6542, 202 4827	31 Mar
HP 9000	HCL-HP Ltd.	Vinayak	262 0169, 262 0170 262 0171	30 May
DEC-Alpha	Digital Eqt. India Ltd.	Sachin	852 1041, 852 6563 852 6564	31 Jan
Voltas Air-conditioner	Central Service (mechanical)	Kumar	415 0399	31 Mar
	Sai Service (electrical)	Mahesh/Prakash	413 0199	
Tata-Liebert Air-conditioner	TLL	Ajit Domnic Jiten Damle K Sridhar(Mktg) Venkat S(Mktg) Thana Office	Pager: 9624-207282 Pager: 9624-207283 Pager: 9624-207283 Pager: 9624-207281 Pager: 9624-208799 532 8405, 530 2388 532 8406	1 Oct
UPS	TLL	D. N. Patil Laxman Aglawe Thane Factory	837 7449 Pager: 9624-208793 821 9754 Fax: 838 7335 Pager: 9624-207 277 532 8405, 532 8406 532 8358, 532 8397 532 8375, 532 8398	15 Jan
Fire Equipment	Minimax	Zakir/Sarkar	374 8109, 373 8961-62 Fax: 373 3905	31 Mar

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Fault Escalation Numbers

Equipment	Maintenance Contractor	Contact Person at a Senior Level	Telephone No.
Stratus	TCS	Mr. B. Gopal	202 4827
HP 9000	HCL-HP Ltd.	Anil Gidh Sr. Regional CE Manager Mr. Sangameshwar Regional CE Manager	262 0169, 262 0170 262 0171
DEC-Alpha	Digital Eqt. India Ltd.	Milind Karnad Sales Manager - Financial Services Group Prakash Khavaskhan Operations Manager	O: 852 1041, 852 6563 852 6564 R: 605 1992 R: 567 5297
Voltas Air-conditioner	Voltas	Mehta/ Ivan D'Souza	372 4052, 372 5194 372 0667 Fax: 374 2421
Tata-Liebert Air-conditioner	TLL	Vilas Chitnis	832 7511, 839 1458 830 0532, 837 7449
UPS	TLL	Anand Ekbote Vice-President, Marketing	839 1460
Fire Equipment	Minimax	Mahesh/Bupesh	374 8109, 373 8961-62 Fax: 373 3905

Multiplexer-related Numbers

AREA	CONTACT PERSON	TELEPHONE NO.
NMS (MUX)	AJIT SHINDE (ENG.) RANE (JTO) PATIL (TECH.)	2846996
COOPERAGE PCM	YADAV BANDIKATTI (JTO) Kansotia(DE)	2852100 2852255 2042958(DE)
FOUNTAIN PCM	YADAV(JTO) RANE(TECH.) KAROGAL NANDKUMAR- (SDE)	2615135/36 2623190/94 2676241 2623684 (SDE)-2615136 (JTO)-2676241
WORLI PCM	PATHAK GANESHAN	4936029/1000 4922011/ 3574
KANDIVILI PCM		8061338
GHATKOPAR PCM		5139629 5148225 5129938
SOUTH COLABA	RLU MODEM ROOM 2152750 2181500/7211 Gupta (JTO)	PCM 2186000/6400 2187211 2186400
Phoniex Mill Comp.	Tripati(AE) Yadav(JTO)	4939378 4934758
Prabhadevi	Deshpande(AE) Chandika (Ext.DE)	4221213 /4142
GM TX.	*VISHNATHAN	4306702 4226373
D.E. DATA	BUDDHAN	2852900
DE(Coop. / Fntr.)	KANSOTIA	2042958
DGM	CHEDDA	2852500
BARVE		4309416
CHAVAN		2833784
NIVENDKAR		2851800/2832000
RADHA KRISHNAN/SUJA		2832690
KNIGHT RIDER	KHALID, RAJESH	2875396 2880445
DART	TUSHAR	2046165
MONEY TV		
REUTERS	SAMIR CHAVAN	2852851
LIC		2021383
NABARA		4949167 4920758

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APPENDIX - C

EMERGENCY PROCEDURES

- C-1 Fire Fighting
- C-2 Power Failure
- C-3 UPS Failure
- C-4 Air-conditioner Failure
- C-5 Recovery Procedures

Fire Fighting

1. If the fire alarm sounds, excepting for the designated staff all other people on the premises must be evacuated.
2. The Operation Assistants must view the control panel of the alarm system to find out which zone is affected. The details of the 10 zones and the areas they cover are detailed in Section 2.2.7.
3. Except for the two air-conditioning rooms, the other zones are protected by an automatic Halon extinguishing system. On actuation of these detectors, Halon gas will be discharged in the affected area after a delay of 40 seconds.
4. There are also hand held Halon extinguishers located in every room which can be used.
5. The Halon release switch which is located near the Control Panel can be used to manually release Halon in the room without a delay. The switch is activated by breaking the glass using the hammer.
6. In case of a false alarm the Halon inhibitor switch may be used to disable the release of Halon in all zones. This switch overrides the 40 second Halon discharge delay so it must be used with caution.
7. To suspend power supply to the equipment in the Data Centre Operations Room, break the glass of the Emergency Breaker Panel which is located to the left of the fire panel.

For further details, please refer to Sections 2.2.6, 2.2.7 and 2.2.8.

Power Failure

1. If there is a power failure, the UPS automatically takes over using its battery. Each UPS battery bank will provide power to the UPS for a minimum of 30 minutes, therefore both battery banks will support the UPS load for one hour.
2. When the power goes off, the Diesel Generator is also automatically switched on. To switch the source of power from the Mains to the D.G., the Main Circuit Breaker (CMCB-1) on the Change Over Panel must be manually switched to ON.

This should be done as soon as possible after the power interruption. The battery power should be saved for an emergency situation when even the D.G. fails to start.

3. The D.G. must be allowed to cool for an hour after an 8-10 hour run.
4. When normal power supply is resumed, the Main Circuit Breaker (CMCB-1) on the Change Over Panel should be manually switched off and the D.G. should also be manually powered off.

For further details and diagrams, please refer to Sections 2.2.4 and 2.2.5.

UPS Failure

There are two Uninterrupted Power Supply (UPS) systems - UPS-I and UPS-II. Each of these is an 80 KVA unit with a 30 minute battery backup. In case of an interruption in the power supply, the UPS takes over. In the meantime, the backup diesel generator (D.G.) automatically switches on to take over.

1. In case one UPS fails, all efforts must be made to get the TLL engineers to the site as soon as possible.
2. In case the power fails while one UPS is down, the full load is transferred to the running, healthy UPS. The source of power should then be switched from the Mains to the D.G., by manually switching the Main Circuit Breaker (CMCB-1) on the Change Over Panel ON.
3. In case both UPS units fail and the power also fails, the source of power should be switched from the Mains to D.G. (as mentioned above in point 2) as soon as possible.

For further details and diagrams, please refer to Section 2.2.2.

Air-conditioner Failure

The TLL and Voltas A/Cs consist of 4 units; 3 of which are normally running and one of them is kept as a standby. The one to be shut is cycled on a weekly basis.

1. If one A/C unit fails to function (the condenser fans or the compressor does not start), it should be shut down and its damper should be closed. The damper of the spare unit should be opened and the unit powered on. The appropriate maintenance contractor should be called in to rectify the fault.
2. If two units fail, it is still sufficient to cool the respective rooms, but the temperature in these rooms must be closely monitored.

For further details and diagrams, please refer to Section 2.2.1.

Recovery Procedures

Hardware Recovery

1. Analyse the problem. Shut down the machine and reboot to clear the hanging processes and corruption, if any. Reboot to clear the corruption.
2. If the problem persists, escalate it to the vendor. The list of contact numbers for the vendors are listed in Appendix B. This list should be available with the Operation Assistants.
3. If the problem is severe and will take a long time to restore, start up the disaster machine and shift the processes over to this machine.
4. After the problem is rectified, move the processes back to the original machine.
5. Document the problem and the solution for future use.

Operating System Recovery

1. Analyse the problem. Shut down the machine and reboot to clear the hanging processes and corruption, if any. Reboot to clear the corruption.
2. If this does not solve the problem, load the disk containing the core "kernel" of the operating system and boot the machine. This will ensure immediate availability of the machine and data but this will be with limited features. You can then call the vendor and rectify the problem.
3. If the problem persists, escalate it to the vendor. The list of contact numbers for the vendors are listed in Appendix B. This list should be available with the Operation Assistants.
4. If the problem is severe and will take a long time to restore start up the disaster machine and shift the processes over to this machine.
5. After the problem is rectified, move the processes back to the original machine.
6. Document the problem and the solution for future use.
7. Change in parameters can be made and these should be documented. Before making any change to the o/s, a backup must be made.

Database Recovery

1. If recovery is attempted at the data level (i.e. logical structures), it can be specifically retrieved from the previous day's export.
2. If the physical structure like control files is lost or corrupted, they should be restored from the previous week's backup.

Application Recovery

1. If the failure is due to the object code, recompile it from the source code.
2. If both the source code and object code are lost, load the current application version which is always maintained on the development system,
3. If recovery is still not possible, restore the application from the previous day's backup.

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