

## 2 National Stock Exchange: The Change Exchange

### NSE - THE CHANGE AGENT

The Indian securities markets architecture has undergone massive transformation in the last few years. NSE not surprisingly played the catalytic role in bringing about these transformations, substantially fulfilling the mandate for which it was setup. The securities market infrastructure now compares favorably with similar facilities available in many of the developed markets and has been one of the major contributory factors for recent resurgence in the securities markets.

#### *Paradigm Shift*

Prior to the emergence of NSE, the market was fragmented with limited liquidity, trading systems were dated and largely opaque, clearing and settlement cycles were long and uncertain, counter party trading member risk was high and investor protection measures were limited. The processes and procedures set up by NSE marked a paradigm shift in the securities industry. NSE was the first exchange to introduce a nation-wide VSAT driven screen based trading system. NSE's operations, which commenced in Mumbai in mid 1994, rapidly spread all over India, with 5000 trading terminals currently offering investors trading facilities in about 305 towns and cities. The transition, from the time an order from a remote town took three to five days for confirmation to the present time when the orders and prices are visible on the screen and instantly available to investors across the country, represents a dramatic improvement in investor access to the market. This has served to unify the earlier fragmented market into a single national order book, bringing with it unprecedented increases in liquidity and transparency.

#### *Risk Management and the Clearing Corporation*

NSE introduced for the first time risk containment measures that were common internationally but so far absent from our market place. Mark to market margins, exposure limits etc. brought enormous safety to a fast growing and changing electronic market. Today these measures have become de facto standards in the Indian market.

In recognition of the fact that the trading members in India were in general under capitalised, NSE encouraged setting up of corporate trading members with higher capitalisation. The fact that an anonymous electronic order book would no longer allow members to assess credit risk of the counterparty necessitated some innovation in this area. To effectively address this issue, NSE introduced the concept of a clearing corporation, and set up the first such corporation, viz. National Securities Clearing Corporation Ltd. (NSCCL), which commenced operations in April 1996. The NSCCL assumes the counter party risk of each member and guarantees financial settlement. Counter party risk is guaranteed through tight risk management systems and an innovative method of on-line position monitoring and automatic disablement of trading members. A large Settlement Guarantee Fund provides the cushion for any residual risk through a fine-tuned risk management system. As a consequence, despite the fact that daily traded volumes are now as much as 20 to 50 times the pre-NSE levels, credit risk no longer poses any problems for the market place. The market has now full confidence that settlements will take place on time and will be completed irrespective of isolated trading member defaults. The concept of guaranteed



settlements has completely changed the way market safety is perceived.

### ***Dematerialised Settlement***

Another area of concern was the serious problem for trading members and investors posed by the emergence of fake, forged and stolen shares on a large scale in the system. The only effective solution to the problem was scripless trading. NSE took the lead along-with IDBI and UTI in setting up the country's first depository, NSDL in 1996.

Dematerialised custody and settlement have since experienced exponential growth. The value of securities dematerialised has crossed Rs. three trillion and the number of beneficial accounts registered with NSDL has crossed the 1.7 million by the end of December 1999. The ever growing popularity of demat settlement has resulted in elimination of the paper in the settlement process. Demat delivery accounts for 90% of trades settled by delivery.

The introduction of settlements in demat form has begun to completely change the face of the capital markets. As SEBI made demat settlements mandatory in an ever increasing number of securities in a phased manner it became possible to introduce rolling settlements. The gradual reduction in physical paper not only reduced risk in the system but also diminished operating costs. It has also facilitated introduction of newer products such as lending borrowing of securities.

### ***Securities Lending Borrowing***

NSCCL introduced an Automated Lending Borrowing Mechanism (ALBM) to facilitate borrowing and lending of securities by members at market determined rates. This system of market driven automated lending borrowing mechanism,

using the NSE trading system and network, is unique and has at one stroke provided a nation-wide access to facilities for lending borrowing shares in India for the first time. This facility also derives importance from the perceived need to regulate naked short sales. As lending and borrowing of securities takes off, it should be feasible to put in place necessary restrictions on naked short sales in the Indian markets as well.

### ***Surveillance and Stock Watch***

The securities markets in India are characterised by (i) a healthy mix of institutional and retail investors, (ii) multiple exchanges and common listings, (iii) a mix of cash and forward markets, (iv) common members across exchanges and (v) non-uniform trading and settlement cycles. This has resulted in significant arbitrage business by common members and clients across exchanges. As a consequence, during times of high market volatility the process of surveillance becomes a particularly complex task. The problem is further compounded by the fact that each exchange is able to monitor open positions of their trading members on a real time basis but is unable to assess positions taken by seemingly unrelated clients across other exchanges, except through client inspections which are necessarily time consuming. There is need to introduce information sharing mechanism which may enable each exchange to monitor group open positions of a client on the basis of exposure to the system as a whole.

NSE, which has put in place an effective margining and risk containment system, is alive to the need to constantly review and strengthen such systems in the light of changing circumstances and emerging windows of risk.

An Inter Exchange Group constituted by SEBI had recommended that all the stock exchanges should



have an effective surveillance mechanism. The objective of this system, termed as the Stock Watch System, is to provide suitable timely alerts for the detection of improper trading activity to protect investor confidence and the integrity of the securities market and its participants. NSE was the first exchange to implement the Stock Watch System in May 1998. The system generates real-time alerts, graphs and reports to detect abnormality in trading. These parameterised alerts, graphs and reports are flexible and user configurable and has helped NSE to effectively monitor the trading in the Exchange.

### ***Investor Awareness & Protection***

NSE has strongly emphasised investor education and protection. In an effort to spread the habit of investing in equities, NSE has been actively sponsoring and organising investor awareness programmes in different parts of the country. As a measure of investor protection, the Exchange and trading members contribute to an Investor Protection Fund (IPF) which currently has a corpus of Rs. 40 crore. The amounts payable in respect of valid claims of an investor has been raised by the NSE to Rs.5 lakh. This has in turn motivated other exchanges to follow suit thereby increasing the overall protection to investors in the market.

### ***Debt Markets***

Unlike developed markets where activity in the debt market exceeds by several times that in the equities market, the Indian debt market has shown limited activity. The activity in this segment has however begun to pick up with daily volumes often crossing Rs.1000 crores. NSE endeavours to (a) increase the number of participants, (b) build market depth, (c) introduce new instruments, (d) standardise products and practices (e) improve settlement efficiencies

and (f) build market benchmarks and reference rates.

NSE has taken several steps to build a retail market for debt securities as well as used its experience and expertise gained through the NSCCL in introducing settlement efficiencies. NSE has developed market benchmarks in the form of MIBID/MIBOR for overnight and term rates, which are now used by the industry to build products off them. NSE continues to make significant efforts in education and training of participants in the latest developments.

### ***Index Products***

Scientifically built and maintained indices that have strong tradable characteristics lie at the heart of a vibrant derivatives market. Towards this end NSE has built an array of such indices which have found acceptance in the market. NSE has entered into a partnership with CRISIL and Standard & Poor's, USA to provide special impetus to the building of indices in India through a specialised vehicle, India Index Services & Products Limited (IISL).

### ***Information Technology Initiatives***

In line with global trends, NSE is structured and operates much like an information technology company. It boasts of the largest VSAT network in this part of the world with huge and complex web of hardware and software. In recognition, NSE has won several IT user national awards and continues to be in the forefront of developments in IT. It successfully completed Y2K compliance on all its systems and has in place a detailed disaster recovery system including a remote disaster recovery site that mirrors all operating systems. NSE has set up its own Internet website, which is visited daily by over 5 lakh persons.

### ***Building and Certification of Participant Skills***

It is an accepted international practice for market intermediaries to be certified. NSE took the initiative to introduce such a facility for testing and certification viz., NSE's Certification in Financial Markets (NCFM), which is only of its kind today in the country. The system is a web based automated examination/testing system that provides for self-administration for the purpose of certification. This certification system is presently available from 7 cities viz., Mumbai, Delhi, Kolkotta, Chennai, Hyderabad, Pune and Ahmedabad.

### ***Exchange Governance***

Amongst the many new concepts introduced by NSE in the securities market, the most crucial one relates to the governance of the Exchange. Historically the trading members who provided broking services also owned, controlled and managed the stock exchanges. This model was designed to serve exchanges which were essentially regional in character. This model, apart from facing a severe handicap of a perceived conflict of interests is considered unsuitable for electronic exchanges which have trading members spread all over the country. NSE represent a paradigm shift in that, for the first time in the country, the ownership and management of the exchange have been separated from trading rights. NSE is owned by a set of premier financial institutions and banks in the country and is managed by professionals who do not directly or indirectly trade on the exchange.

It is important to note that the NSE model does not preclude but accommodates member involvement, support and contribution in a variety of ways. In fact a large part of the success of NSE has been due to the active and strong support of its members. This has taken place through several key committees as also through formal and informal

member interactions. NSE continues to emphasise relationship-building with all its participants, including trading members, investor community and the issuers, whose securities are traded on the Exchange.

### ***NSE Research Initiative***

In order to improve market efficiency further and to set international benchmarks in securities industry, NSE has launched the NSE Research Initiative with a view to producing significant knowledge and insight in to the working of securities market in India. The objective of this Initiative is to foster research which can support and facilitate: (a) stock exchanges to design market micro-structure, (b) participants to frame their strategies in the market place, (c) regulators to frame regulations, (d) policy makers to formulate policies and (e) to expand the horizon of knowledge about the securities market. NSE supports research initiatives on issues that have a bearing on securities market in India.

### ***NSE's Vision***

NSE's vision of the industry continues to drive its search for newer products and processes. It recognises that technology, which forms its core, is all the time evolving. NSE is making preparations to participate in the technological changes that are revolutionising the markets elsewhere. NSE will be offering internet based trading systems not only across the country but hopefully off shore as well. The latter will help to integrate non-resident investors into the domestic on line real time systems.

It is crucial for a developing market such as ours to have in place hedging products against the volatility faced in the market. Recognising that products such as futures and options are new to our market, NSE

has spent more than two years building skills and disseminating knowledge in this vital segment. As soon as regulatory approvals are in place, NSE will be in the forefront of the developments in derivatives segment of the markets as well.

The mandate placed before NSE has been to offer services in the securities industry comparable to best global standards as also to strengthen the market through competitive pressure. While considerable progress has been made, the task is by no means complete. NSE recognises that the securities industry in the coming years will continue to evolve rapidly. Product innovation and improved service standards will increasingly determine leadership in the market place. NSE is well poised to stay in the forefront of the change.

## **NSE – THE INSTITUTION**

### ***Objectives***

NSE has been promoted by leading financial institutions at the behest of Government of India and has been incorporated as a tax-paying company, unlike other stock exchanges in the country, with the objectives of

- v establishing a nation wide trading facility for equities, debt instruments and hybrids,
- v ensuring equal access to investors all over the country through an appropriate communication network,
- v providing a fair, efficient and transparent securities market to investors using electronic trading systems,
- v enabling shorter settlement cycles and book entry settlement system and
- v meeting the current international standards of securities markets

in November, 1999 when the Indian market was plagued by

- Ø uncertainty of the execution prices,
- Ø gala i.e. short-charging the customer,
- Ø front-running, i.e. trading ahead of a client based on knowledge of the client order,
- Ø systemic failure of entire markets and market closures,
- Ø uncertain delivery and settlement periods,
- Ø no risk management in market, and
- Ø club mentality of the brokers.

### ***Management***

In pursuit of these objectives, NSE started with the concept of an independent governing body with a view bring in discipline, cure typical stock market ills such as price rigging, and avoid conflicts of interest which was hindering the development of the securities market in India. The ownership and management of NSE was therefore completely divorced from the right to trade on the Exchange. This has enabled smooth conduct of business of the Exchange in a fair and non-partisan manner.

The affairs of NSE are administered by a Board of Directors and an Executive Committee (EC). The Board comprises of senior executives from the promoter institutions and banks, eminent professionals in the fields of Law, Accountancy, etc., three nominees of SEBI including a Senior Executive Director of SEBI and two full time Executives. While the Board deals with the broad policy issues, the EC formed under the Articles of Association and Rules manages the day to day affairs of the Exchange. The EC has four broker members who are nominated by the Board of NSE based on their experience in securities industry and



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they represent different regions. The EC has constituted several other Committees like Index Committee, Committee on Settlement Issues (COSI), etc. for looking into various issues related to these areas and these Committees consist mostly of trading members. As a matter of practice, NSE strives to take the views of the trading members through formal and informal consultations before taking any policy decision.

### *Milestones*

On its recognition as stock exchange in April 1993, NSE commenced operations with the Wholesale Debt Market segment in June 1994. NSE started equity trading in November 1994 and in a short span of one year surpassed the trading volume of the then largest stock exchange in the country. Thus, in October 1995, within the first year of its operations in equity trading, NSE became the largest exchange in terms of volume transacted. Some of the important milestones in the life of NSE are:

- Ø Launched Jr. Nifty (Mid-cap 50 Index) – December 1996
  - Ø Regional Clearing facilities go live - February 1997
  - Ø Recognition renewed for a further period of five years - April, 1998
  - Ø Launched certification programme - July 1998
  - Ø NSCCL commences stock lending/borrowing, ALBM – February 10, 1999
  - Ø Debt Market operations averages Rs. 1305 crore a day - December, 1999
  - Ø Capital Market operations averages Rs. 4481 crore a day - December, 1999
  - Ø Market Capitalisation of CM segment – Rs. 8,52,985 crore at the end of December 1999
  - Ø Market Capitalisation of WDM segment – Rs. 4,80,023 crore at the end of December 1999
  - Ø Approximately 1000 trading members
  - Ø 1211 equity stocks and 1355 debt securities available for trading.
  - Ø Over 5000 trading terminals using 2485 VSATs spread in 305 locations.
- NSE has many records to its credit. It introduced for the first time fully automated screen based trading thereby eliminating the need for physical trading floors. The screen based trading system introduced by NSE was the first to go live in the world through satellite communication. NSE is the only stock exchange in the world which became the largest in the country within the very first year of its operation. NSE's Information Technology set up is the largest by any company in the country, having state of the art client server application.



***NSE trading system***

The trading system of the NSE, known as NEAT (**N**ational **E**xchange for **A**utomated **T**rading), is a fully automated screen based trading system that enables members from across the country to trade simultaneously with enormous ease and efficiency. In one stroke it dispensed with the need for people to congregate on the floor of an exchange to trade and took the exchange floor to the investors' doorstep. The NSE trading software was originally developed by TCAM Systems Inc., New York for the Vancouver Stock Exchange. Subsequently, the system was enhanced and modified for use in several other exchanges around the world. This software was further modified and thoroughly customised to suit the requirements of the Indian markets.

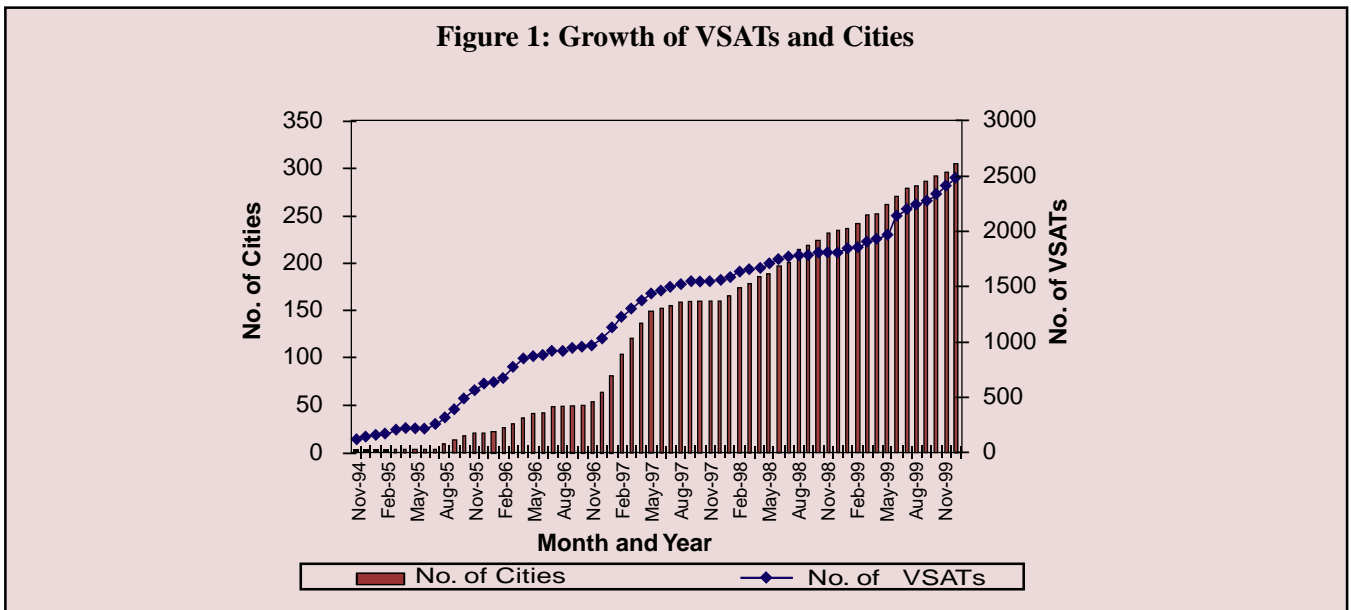
The Exchange provides a facility for screen based trading with automated order matching. The trading system is an anonymous order driven system. This helps orders whether large or small to be placed without the members being disadvantaged by disclosure of their identity. The trading system operates on a strict price time priority. All orders received on the system are sorted with the best priced order getting the first priority for matching i.e. the best buy order matches with the best sell order. Within similar priced orders, they are sorted on time i.e. the one that came in early gets priority over the later one. Orders are matched automatically by the computer keeping the system transparent, objective and fair. Where an order does not find a match, it remains in the system and is displayed to the whole market, till a fresh order comes in or the earlier order is cancelled or modified.

The trading system provides tremendous flexibility to the users in terms of the kinds of orders that can be placed on the system. Several time related (Good-Till-Cancelled, Good-Till-Day, Immediate-

Or-Cancel), price related (buy/sell limit orders, stop loss orders) or volume related (All-Or-None, Minimum Fill, etc.) conditions can easily be built into an order. The trading system also provides complete market information on-line through various inquiry facilities. The market screens, at any point of time, provide complete information on the total order depth in a security, the five best buys and sells available in the market, the quantity traded during the day in that security, the high, the low, the last traded price etc. This information is updated on-line, on real time basis, enabling a member to make better decisions. It is thus possible for investors to know the actual position of the market before placing orders. Investors can also know the fate of the orders almost as soon as they are placed with the Trading Members. Thus the salient features of NSE's NEAT system are:

- Ø computerised, automated trading system
- Ø strict price-time priority of order execution
- Ø no jobber intervention and hence lesser chances of price manipulation
- Ø automatic dissemination of trade prices and printing of contract notes

The members are connected to NSE from their work stations to the central computer located at NSE via satellite using VSATs. The Annexure-I lists towns and cities and the state-wise distribution of 2485 VSATs. The Figure 1 depicts the growth of VSATs and the number of cities of their location since inception. Table No. 1 presents expansion of NSE network in different cities and number of VSATs. The members can place orders from their office thus being easily accessible to the investors. The members can extend their client connectivity through Computer to Computer Link (CTCL) facility outside their premises. The registered dealers of the members have remote trading



terminals in their offices and trade electronically on ‘NSE-NET’ trading system through CTCL server installed at the member’s office. This facility gives the trading members total control over their entire network and thereby closely monitor the orders entered by their registered dealers/branches.

### Membership on NSE

There are no entry and exit barriers for membership. Members can exit just by surrendering membership without any overt or hidden cost. Any body can become member by meeting the eligibility criteria. In reflection of the need to upgrade professional standards of market intermediaries, the admission standards laid down by the Exchange stresses on factors such as capital adequacy, corporate structure, track record, education, experience etc. The capital adequacy requirement stipulated by NSE is substantially higher than the minimum statutory requirement and also in comparison to those stipulated by other exchanges. This reflects a conscious effort by the Exchange to improve the membership standards so as to further strengthen confidence in the Exchange operations. Admission is a two stage process with applicants requiring to go through a written examination followed by an interview. Candidates are interviewed by a committee consisting of experienced people from the industry to assess the applicant’s capability to operate as an NSE member.

**Table No. 1: Distribution of VSATs across cities at the end of December 1999**

No. of VSATs	No. of Cities	VSATs
1	125	125
2	73	146
3	33	99
4	18	72
5	16	80
6-10	18	138
11-25	12	190
26-50	4	155
51-100	3	238
>100	3	1242
<b>TOTAL</b>	<b>305</b>	<b>2485</b>



The Exchange admits members separately to the Wholesale Debt Market segment and the Capital Market segment. Only corporate members are admitted on the debt market segment whereas individuals and firms are also eligible on the capital market segment. As of now, a prospective trading member has to seek admission to both WDM and CM segment of the Exchange.

Traditionally brokerage firms in India were individually owned or partnership concerns with unlimited liabilities. This restricted the amount of capital that such firms could raise. The growing

volume of transactions made it imperative for such firms to be well capitalised and professional. NSE encouraged corporate membership. At the end of December 1999, 768 members out of total of 891 were corporate members. They handle about 90% of trades. The number of members on NSE’s capital and wholesale debt market segments and their constitution are presented in Table No. 2 and Figure 2.

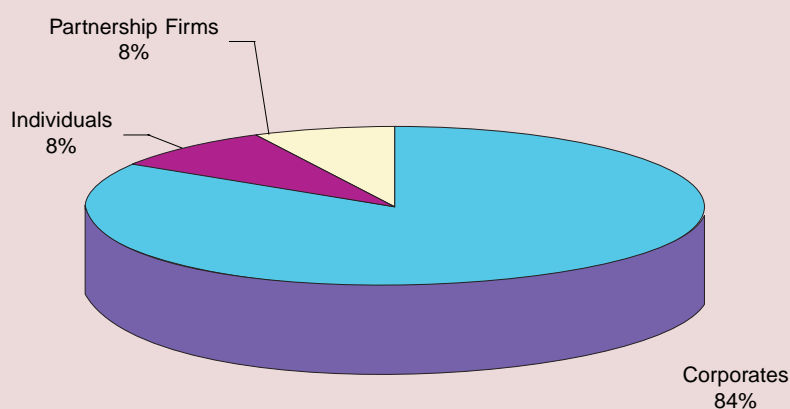
### WDM Segment

Only trading mechanism available in the debt market was the telephone market before June 1994

**Table No. 2: Membership on NSE as on 31st December 1999**

Constitution of Members	CM Segment	WDM & CM Segment	TOTAL
Corporates	673 (Exclusively CM Segment)	95 (89 - CM & WDM Segment 6 - Exclusively WDM Segment)	768
Individuals	61	NIL	61
Partnership Firms	62	NIL	62
<b>Total</b>	<b>796</b>	<b>95</b>	<b>891</b>
Members having Joint Venture Agreements with Foreign Institutions or Indian Subsidiaries of Foreign Institutional Broking Firms	7 (Exclusively CM)	2 (Exclusively WDM ) 18 (WDM & CM both)	27

**Figure 2: Composition of Trading Members**





when NSE launched Wholesale Debt Market (WDM) segment. This provides the only formal platform for trading of a wide range of debt securities. The trading system, known as NEAT (National Exchange for Automated Trading) is a fully automated screen based trading system that enables members across the country to trade simultaneously with enormous ease and efficiency. The trading system is an order driven system which matches best buy and sell orders on a price-time priority. The identity of the buyer and seller are completely protected on the system.

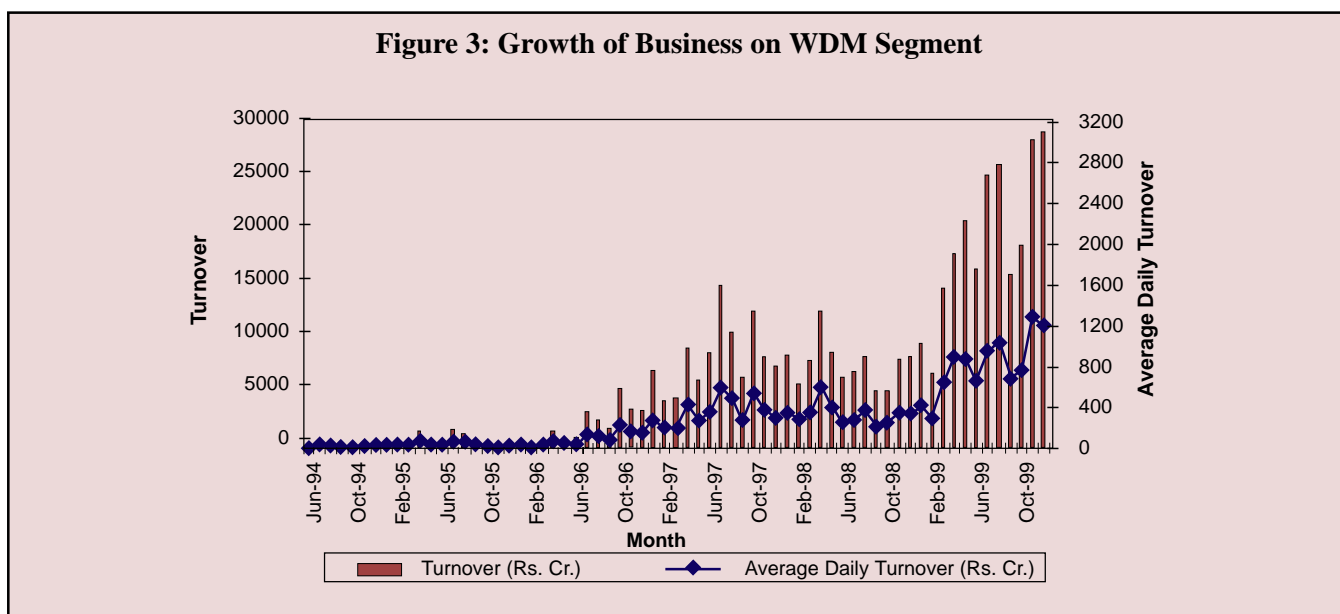
The turnover on the WDM segment has been increasing by leaps and bounds. The number of trades per day increased from 5 in 1994-95 to 51 in 1998-99 and to 140 in April-December 1999. Similarly average daily turnover increased from Rs.30 crore to Rs. 904 crore during the same period. The turnover increased from Rs. 6,781 crore in 1994-95 to Rs. 1,05,469 crore in 1998-99. April-December 1999 witnessed a turnover of Rs. 205287 crore. The business growth on the WDM is presented in Annexure No III of Chapter-7. Further details of WDM are available in the said chapter.

The growth of business in the WDM is presented in Figure 3.

### Capital Market Segment

Equities, convertible debentures, warrants etc are traded in the Capital Market segment. This segment commenced trading on November 3, 1994. NSE consciously opted in favour of an order driven system as opposed to a quote driven system. This has helped reduce jobbing spreads thus reducing transaction cost. This has a major implication for investors. Till the advent of NSE an investor wanting to transact in a security which is not traded on the nearest exchange would have to route orders through a series of correspondent brokers to the appropriate exchange. This resulted in a great deal of uncertainty and high transaction costs. NSE has made it possible for an investor to access the same market and order book irrespective of location at the same price and at the same cost.

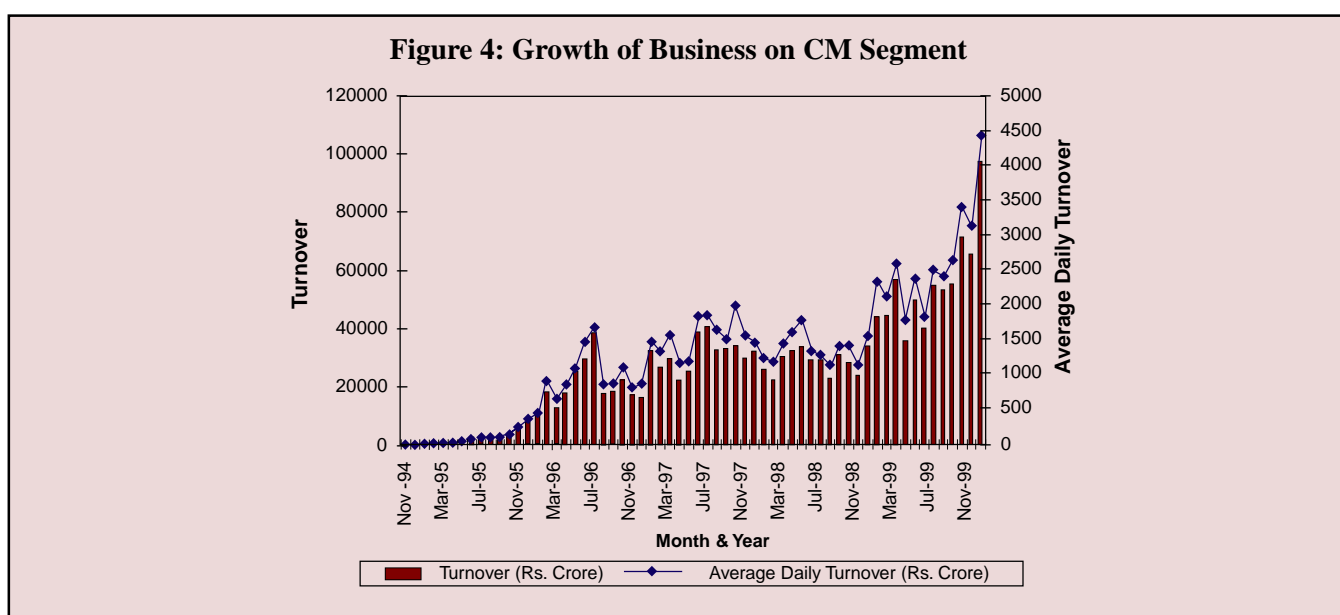
Trading on NSE commenced in over 200 securities and subsequently securities have been added gradually. During 1998-99, the number of



companies listed on the capital market segment of the exchange rose from 612 to 645 with the number of companies available for trading moving to 1254. As the end of December 1999, 1211 securities were available for trading on this segment. The liquidity in the market has been increasing steadily. Capital market segment of the NSE witnessed a jump in turnover from Rs. 3,70,193 crore in the year 1997-98 to Rs. 4,14,474 crore during the 1998-99 with the average daily turnover increasing from Rs.1,517 crore in 1997-98 to Rs. 1,651 crore in 1998-99 representing a percentage growth of 8.8%. The average number of trades per day increased from 2,33,114 in April 1998 to 3,07,982 in March 1999. It is of interest to note that, on an average, 85% of the stocks are traded on every day. Over 90% stocks are traded every month. The market capitalisation of securities traded on NSE was over 90% of total market capitalisation, while only about one-eighth of the total number of companies traded on stock exchanges are traded on NSE. The business growth capital market segment is presented in Annexure 1 of Chapter 4 and Figure 4.

### NSE-THE MARKET LEADER

The Annual report of the SEBI for 1998-99 clearly brings out the dominant position that NSE occupies in the Indian securities markets. Of the total turnover of Rs.10,23,382 crore by the 23 stock exchanges in 1998-99, the turnover on NSE was highest at Rs. 4,14,383 crore accounting for about 41% of the total, ahead of next largest stock exchange by Rs. 1,02,384 crore. NSE's trading turnover originating from 14 cities was significantly higher than the turnover on the respective stock exchanges located in these cities. For example NSE's turnover originating from Chennai was Rs. 17317crore while the local stock exchange recorded a turnover of Rs.370 crore. Similarly NSE recorded a turnover of Rs. 4344 crore in Jaipur as against Rs. 65 crore recorded on the local exchange and Rs.78702 crore in Delhi compared to a turnover of Rs. 51759 on the local exchange. The details of turnover on NSE originating from these cities compared to the respective local stock exchanges are given Table No. 3.



Stock Exchange Centre	On Regional Stock Exchange*	On NSE
Mumbai	311999	165097
Kolkotta	171780	42812
Delhi	51759	78701
Ahmedabad	29734	10549
Uttar Pradesh	18627	4133
Pune	7453	4941
Bangalore	6779	8327
Ludhiana	5978	1205
Vadodara	1749	3458
Hyderabad	1276	12648
Cochin	773	2680
Coimbatore	395	3793
Chennai	370	17317
Bhubaneshwar	77	409
Jaipur	65	4344
Gauhati	30	787
Mangalore	11	493
Madhya Pradesh	1	3287
Magadh	0	624
SKSE	0	2124

\* Source : SEBI Annual Report, 1998-99

### **Liquidity on the NSE**

Liquidity refers to the ease with which shares can be purchased or sold without facing a high impact cost. The lesser the impact cost, the higher is the liquidity. A common perception is that market makers supply liquidity in quote driven markets. The market maker is a person who stands ready to buy and sell shares. The market maker buys low and sells high and earns his profit from this spread. However the intervention of a third entity such as a market maker makes the system vulnerable to manipulation at a considerable loss to the investors. In an order driven system investors' sell orders are directly matched with other investors' buy orders.

Thus there is no intervention by a market maker or jobber. The liquidity is provided to the order book market by the huge number of limit orders submitted by investors from different parts of the country. The integrity of the order book market is ensured by the fact that trade matching takes place directly without the intervention of any other intermediary.

### **Open Electronic Consolidated Limit Order Book**

The concept of a computer performing the services of order matching took root in the early 1980s and proved to be very successful. The investors enter their buy/sell orders and the computer performs the order matching by using a pre-determined algorithm. Since the computers perform the function of order matching, the chances of possible price manipulations are considerably reduced. NSE's trading system is organised as an "open electronic consolidated limit order book" (OECLOB). Electronic refers to the fact that the computer does all the order matching without the intervention of any intermediary. The term consolidated refers to the fact that NSE is a national market and that orders from all over India are consolidated in a single order book. Thus an order entered by an investor from a terminal outside Mumbai is exposed to the entire market and is in no way disadvantaged vis-à-vis orders from Mumbai. Limit orders are orders to buy or sell shares at a stated quantity and stated price. If the price-quantity conditions do not match, the limit order will not be executed. The term "limit order book" refers to the fact that only limit orders are stored in the book and all market orders are crossed against the limit orders sitting in the book. Since the order book is visible to all market participants, it is termed as an "open book".

**Price Discovery on NSE**

One of the ways of judging the efficiency of a market is through the “price discovery process”. An efficient price discovery enables better resources allocation decision and greater efficiency. Prior to the establishment of NSE, the financial industry in other locations in the country was unable to have equal access to markets and participate in the price discovery process. A chain of additional intermediaries used to carry the orders to the trading floor in Mumbai and this resulted in increased transaction costs. This situation has been transformed by two developments, viz.:

- Ø **Nation-wide connectivity** - The NSE has established a satellite communication which gives trading members of NSE from other parts of the country, equal access to the market thus increasing the price discovery.
- Ø **Open electronic limit order book** - NSE has shifted from the ‘open outcry system’ to an electronic CLOB system.

The entry of NSE has led to a large increase in the supply of brokerage services and thus to a reduction in the brokerage fees, an important constituent of transaction costs. With the introduction of an electronic trading system, the several layers of intermediaries are eliminated and transaction costs have dropped substantially for investors located outside Mumbai. This in turn has generated an enormous increase in market participation from investors. The increased participation has improved liquidity of the Indian capital markets as a whole and led to a better price discovery. Electronic trading also enables users to execute larger orders than would have been possible in a floor trading system. Electronic connectivity has enabled brokers to open branches in other cities and the securities

industry has become more retail in nature much like the banking industry.

**NSE-THE TECHNOLOGY DRIVEN STOCK EXCHANGE**

NSE was set up with a mandate from the Government of India to provide automated trading of securities throughout India. By virtue of its mandate, NSE was required to be of national character enabling its members from anywhere in the country. The mandate of automated trading and nation-wide access implied a reliance on technology for delivery of its services.

**Automated Trading System**

NSE’s approach towards the organisation of trading is based on two ideas: the use of automated order-matching, and the use of satellite communication technology to allow full access to the nation wide market from locations all over the country.

At NSE, trading is purely based on a limit order book with automated order matching. Investors and traders from all over the country place limit orders or market orders, and the computer pairs off orders which are mutually compatible. There are no market-makers and there is no physical trading floor.

Satellite communication technology is the key factor that has enabled and energised the participation from more than 305 cities spread all over India. NSE happens to be the first stock exchange in the world to have used satellite communication system for trading on a wider area network basis. Incidentally, the captive satellite communication system of the NSE has been amongst the first in the world to go live with extended C Band technology. Through 2485 satellite dishes, there are about 5000 computer



terminals connected into NSE. The time-lag between placing an order and getting an order confirmation, from anywhere in the country, is less than two seconds. The full and equal access to the exchange trading system from these geographically dispersed locations has harnessed an order flow, which was previously latent. Traditionally, Mumbai has been considered the dominant centre of finance in India. Today, thanks to NSE's satellite technology, trading volumes have increased with 60% of the volumes originating from rest of India and only about 40% from Mumbai.

This approach to trading has also served to make the market more accessible to retail investors, as opposed to the traditional focus in the equity market upon large institutional users.

#### ***VSATS: Backbone of the NSE-Network***

One of the most important objective of NSE is to ensure an equal access to its members operating from any corner of the country. Moreover, NSE wants its members to trade from their own offices located in more than 305 cities across the country and thereby facilitating them to keep the cost of operational infrastructure and travel to the minimum and most importantly be closer to their own business clients. Setting up of a "Wide Area Network" at national level has been an obvious choice to meet the above objectives.

VSAT network has been appropriate choice especially considering the prevailing Indian scenario where the reliability and availability of the terrestrial links is inadequate. But setting up a private VSAT network then was not an easy task. This was primarily because of restriction of using only extended C-band technology for private VSAT networks in the country while at that time no-where else in the world such technology was being used. However, considering the distinct advantages of

VSAT technology like reliability, high availability, quick expandability, operational flexibility etc., NSE decided to opt for VSAT network. Thus NSE's VSAT network is the first high speed private network in India and the first extended C-band VSAT network in the world.

In the network configured for NSE, the hub is located at its headquarters in Worli, Mumbai. The hub is connected to the host computer located in the same premises. All the subscribing members of NSE are equipped with at least one VSAT each. These VSATs are interfaced with their PCs. The VSATs enable real-time communication between these PCs and the host computer at Worli, and by means of a sophisticated trading software, members trade in securities across the network. NSE network is X.25-based network with a customised X.25 broadcast software.

The State of the art VSAT technology from GE-Gilat consortium used at NSE, employs proprietary modified slotted Aloha space access method for its inbounds (from VSAT to Hub). By utilising unique time/frequency matrix method for inbound data transfer, optimum utilisation of the precious space segment resource is achieved with minimum Response Time. Also the outbound (from Hub to VSAT) dynamically adjusts the data packets for efficient data transfer on the outbounds. Further the entire VSAT network is tuned for supporting time tested X.25 protocol. Central NMS using sophisticated tools continuously monitors the entire network. A redundant Hub architecture ensures high uptime.

#### ***Advance Features of VSAT Network of NSE:***

- A network availability in excess of 99.9%.
- A uniform response time of less than 1.5 seconds for members situated across the country, made possible by a unique time and



frequency satellite access scheme that facilitates efficient use of satellite bandwidth.

- Remote communications equipment-VSATs- to be used at the member locations, were made affordable to the members by shifting all the design complexities to the hub location and keeping the VSATs simple and economical.
- Extremely high security provision by built-in measures against jamming, interference and illegal access.
- Expandability of the exchange, allowed for by design of the central hub in a modular fashion.
- Network partitioning, allowing money market and capital market operations to function independently by the use of advanced network management features.
- Ability to handle high peak-loads through the use of data flow control techniques.

Business applications supported by NSE's VSAT network are:

- Equity Market
- Wholesale Debt Market
- Clearing and Settlement System
- National Security Depository System
- Reports/Circulars/Messages downloads etc.
- Extranet

### ∅ **NSE-THE 'TOP IT USER'**

NSE uses the latest Telecom or Software product to provide a state-of-art trading facility. A state of the art technology has been deployed by NSE in other areas such as 'In-memory Database' for trading application, Client/Server architecture, clustering, Distributed Databases/processing,

Satellite based WAN, Intelligent Hubs/E-net switches for LAN, Voice/Data Muxes, Routers, Remote Access Servers, BBS, IVR, X.25/Frame Relay/TCP/IP protocols Switches, Windows 95/NT/UNIX, Oracle7/SQL server, Forms 4.5/Gupta SQL/Centura, Developer 2000, Oracle Case tools, TIBCO, Informix, Web technology etc., all available under one roof of NSE. Nearly 250 I.T. professionals are full time busy doing software development/maintenance or operational work of which about 140 staff are NSE's own.

Today, NSE's Information Technology setup is the largest by any company in the country. NSE has received two 'TOP I.T. USER' national awards in 1996 and again one more in 1997 from Computer Society of India (CSI). NSE has received 'Cyber Corporate of the Year 1998' award by Microland & Computer Associate for its internet website. In 1999, the 'CHIP Magazine Award' by CHIP magazine was conferred on NSE.

### *Overview of NSE's I.T. set-up*

NSE trading system software named as NEAT (National Exchange for Automated Trading) is a state-of-art client server application. At the server end, all trading information is stored in an in-memory database to achieve minimum response time and maximum system availability for users. The trading server software runs on a fault tolerant STRATUS main frame computer while, the client software runs under Windows on PCs.

NEAT is a fully automated screen-based trading system which adopts the principle of an order driven market and allows trading members to trade from their offices through a communication network. The telecommunications network is the backbone of the automated trading system. Each trading member trades on NSE with other members through a computer located at the trading member's office,



anywhere in India. The computers of few trading members are linked to the central computer at NSE through dedicated high speed (64 Kbps) lines. These leased lines are multiplexed using dedicated 2 Mbps, optical fibre links.

The Exchange uses powerful RISC-based Digital and HP UNIX servers, for the back office processing. These systems are clustered and connected on HOT-STANDBY mode for high availability. The latest software platforms like ORACLE 7/SQL SERVER, RDBMS, GUPTA-SQL/ORACLE FORMS 4.5 Front-Ends, are used for the exchange applications. The 20 large computer systems in NSEIL include non stop fault tolerant computers and high end UNIX servers, connected through UTP LAN having over 1000 PC nodes and a large number of NT servers, all operational to support NSE applications. This coupled with the nation wide VSAT network makes NSE the country's largest Information Technology user. An overview of the entire I.T. Setup is diagrammatically shown in Figure 5.

National clearing and settlement system has been implemented to support nationwide clearing operations from four regions. NSE has developed in-house an Online Position Monitoring System as a part of its Surveillance system. The system provides an online real time information on trade by trade member's position. The system generates alerts at multiple levels: First warning is displayed on the member's trading workstation on reaching a level of 70% of his exposure position limit. A further warning is displayed on reaching 85% level, beyond which if the member continues to build the position, his trading workstation is automatically disconnected by the system on reaching 100% position limit. NSE is the only exchange in the world having such system.

## Ø **NSE-A SERVICE ORGANISATION**

The trading members of the exchange perceive the Exchange as a professionally managed organisation. They are particularly happy with the user-friendly features of the trading software. They greatly appreciate the business discipline followed by the Exchange, especially in the clearing and settlement areas.

Hands-on training programmes are organised for users on a continuing basis. It is interesting to note that although most of the trading members had never used computers, after NSE's strategic training they have started using the system quite confidently. The 'Computer Based Training' (CBT) multimedia package has been made available to all members which helps them to learn the system at their own office and at their own pace and convenience. The exchange has also put in place a 'Certification system' for training and certifying the various participant entities of its markets.

The Exchange runs a help desk for 12 hours on each working day. This has been successful in addressing member problems quickly. Problems have ranged from how to start the computer to complex requirements of regulations. Most problems are addressed immediately and very few problems are carried over beyond a day. The Exchange has installed an Interactive Voice Response (IVR) system to automate the Help Desk operation. Additionally, it provides facilities like fax on-demand, voice mail, audio text information etc. For critical problems, on-site service is also offered by NSE.

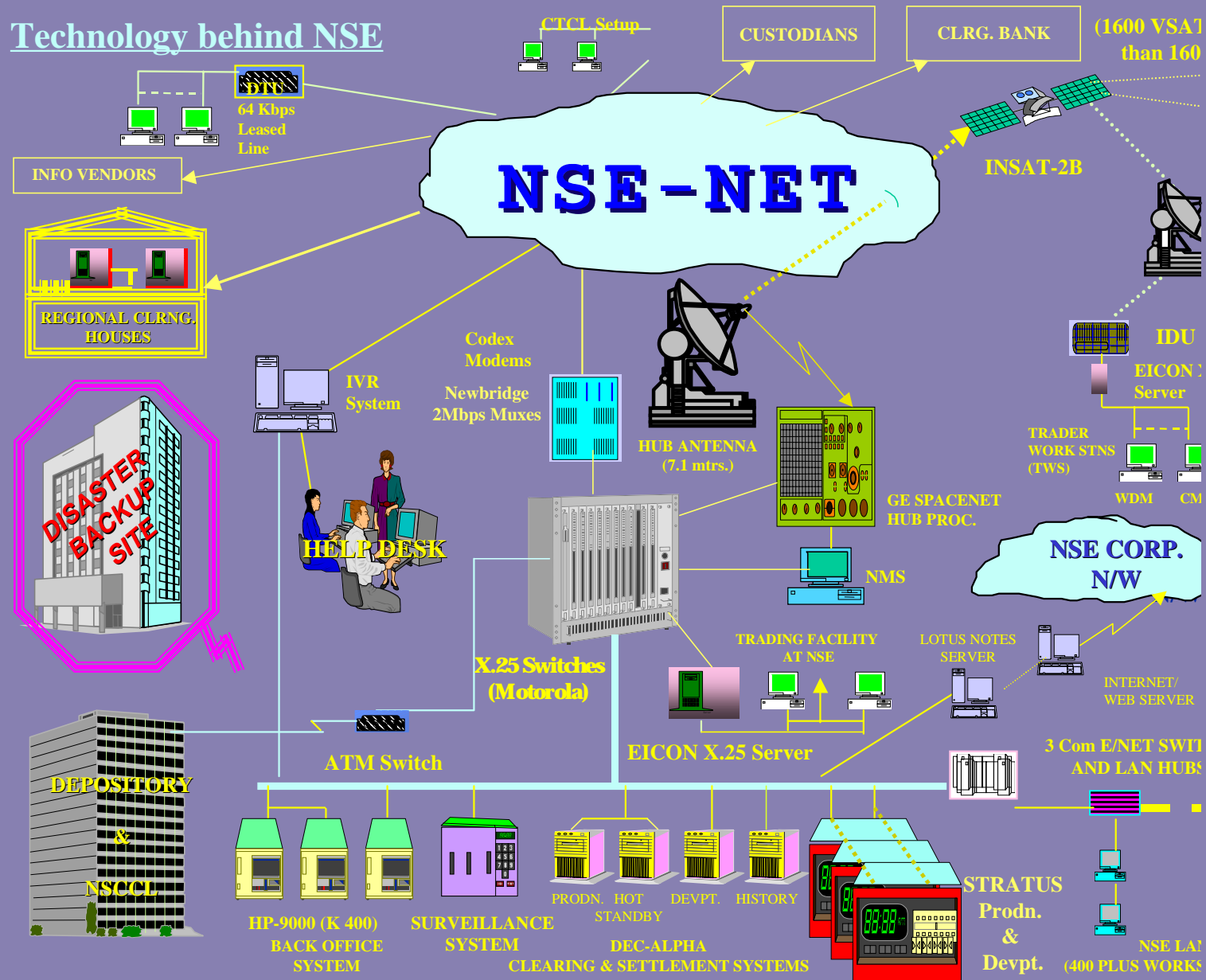
The Exchange has been electronically delivering to all members daily reports regarding trades, obligations etc. This allows them to have a direct interface to their computerised back office systems. The Exchange has a computerised 'Bulletin Board





Figure : 5

# Technology behind NSE





## National Stock Exchange: The Change Exchange

Services' (BBS) for distributing information electronically to its members and news vendors. In addition, the exchange now has an 'Extranet' facility whereby members can download various information like bills, margin payments, circulars etc. at their convenience.

Each employee has a dedicated PC with a LAN connection. Cat 5 structured cabling and intelligent hubs, Ethernet Switches from M/s. 3 COM are used for the LAN set-ups in all NSE offices. Most of the staff has an access to Internet. The Exchange has set up an enterprise network to provide efficient communications facilities for its offices in the country. The corporate network of NSE provides various value added services like e-mail, file transfer, document flow, voice mail, web browser, access through dedicated Lotus Notes Servers and web server for Internet services. Two major operational centres of the Exchange in Mumbai are linked up by a dedicated 2 mbps line.

NSE has always endeavored to provide quality service to its members. NSE periodically conducts meetings of users to address their grievance and also to share the future plans of the Exchange.

NSE has initiated an 'Investors Awareness' program wherein the Exchange representatives visit small towns in the country to educate the investors on their investment options and rights and also share their grievances/demands. Informative booklets on the subject have also been made available by the Exchange. The Exchange shares lot of information on security market through its web site on Internet.

## **DEVELOPMENTS DURING 1998-99**

### ***Web Site***

The Exchange has its own web site, (<http://www.nse.co.in>) on Internet hosted from USA. The

web site provides IN-LINE near REAL-TIME price information on stocks traded at NSE. The detailed features of the web-site may be seen in the Box No.1. The web site attracts 5 lakh hits daily.

### ***Y2K Compliance***

Year 2000 problem posed significant challenge for the securities market and related activities. Failure to address this issue in timely manner would cause operational problems to all institutions operating in the securities market, even to the extent of disruption of financial markets. Being India's premier stock exchange, NSE took a lead role to tackle the Y2K problem.

The exchange recognized the potential Year 2000 threat that its operations faced and, therefore, took steps to see that all the programs and IT/ Communications equipment were Y2K ready. The size and scale of the effort involved intensive planning and monitoring, since the problem permeated almost every aspect of IT, from large mainframe computers to the smaller computers that serve office computing, as well as electronically controlled devices where a date dependant device was used.

Monitoring the Year 2000 Progress was a high priority and was done by the specially formed "Year 2000 Core Committee" comprising of IT project leaders responsible for the technology applications and representatives from each business functions (i.e. functional leaders). The core committee in turn reported to the "Year 2000 Apex Committee" comprising of the IT chief and the business heads. A periodic report of the Year 2000 progress was being sent to NSE Board.

The entire project was spread over the following *five* phases :



**Box No. 1: WWW.nse.co.in**

The National Stock Exchange has been a frontrunner in dissemination of real time information. As a part of this endeavour, NSE officially launched its web site [www.nse.co.in](http://www.nse.co.in) on May 21, 1998. In consonance with its open and transparent policy of operations, the major focus of NSE's web site has been in disseminating maximum information.

The NSE web site has many features such as providing real-time prices, charts of intra-day prices of a stock of the viewer's choice, a portfolio manager which can be easily customised by the viewer and real time information on the S&P CNX Nifty and CNX Nifty Junior indices through a ticker.

For the uninitiated, the web site is a storehouse of information on the operations of the primary and the secondary equity markets. The site also has information on the clearing and settlement procedures on the exchange. A comprehensive glossary of terms is provided to help the user understand the various terms of market usage.

Besides the above the site provides information on price, trade details relating to stocks, and historical stock price information on 1200 odd stocks traded on the NSE. In addition, NSE press releases, details of the Exchange's trading members, investor forum are also available on the net. Most of this information is available for download.

Some of the salient features of the NSE web site include:

1. **STOCK TICKER:** It features the last traded price of S&P Nifty & CNX Nifty Junior stocks alongwith the online index. The user has the option to change the speed and direction of the ticker.
2. **PORTFOLIO MANAGER:** The Live Portfolio Manager lets the user track the movement in the prices of 25 stocks of his choice. The data available in the portfolio includes the last traded price, percentage / value change in the rates. He also gets an email notification when the price reaches a certain pre-determined level set by the user.
3. **ONLINE GRAPHS:** This module is your source for ascertaining the online, intra day movement on NSE of all the stock traded on NSE and also the S&P CNX Nifty. You can view the movement of the index on a real time basis. The chart also plots the corresponding previous day's movement for easy comparability. You can access the menu below the online Nifty chart to check the movement of a particular stock during the day, on the basis of last traded prices.
4. **NIFTY STOCK WATCH:** This gives you detailed information of all S&P CNX Nifty stocks on real time basis. Details like last traded price, open, high, low, close prices, quantity details etc. can be seen here.
5. **NIFTY JUNIOR STOCKWATCH:** This give you detailed information of all CNX Nifty Junior stocks similar to S&P CNX Nifty Stocks. Details like last traded price, open, high, low, close prices, quantity details etc. can be seen here.
6. **STOCK CHARTS (HISTORICAL):** These charts show the movement of an individual stock over a user-specified period of time in terms of closing prices.
7. **NSE INDICES (HISTORICAL):** This section gives you the option to choose to view the movement of NSE indices in terms of open, high, low & close prices with respect to a user-specified period of time in a graphical form or a table. You can download the data in the tabular format on to your hard disk.
8. **CO-MOVEMENT OF STOCK PRICES:** This section gives you the comparison of the last traded prices of two selected stocks over a user-specified period of time in a graphical form.
9. **DOWNLOAD BHAVCOPY:** The Bhavcopy or 'Market Statistics' of CM and WDM are available for download on a daily basis (after trading hrs).
10. **CIRCULARS:** The circulars issued by the Exchange are hosted in this section.
11. **PUBLICATIONS:** This section contains the newsletters, brochures and other public information booklets for the benefit of site visitors.



**I. Awareness**

1. Define Year 2000 Problem and identify its potential impact on the organisation.
2. Create awareness among NSEites about the Y2K problem through presentations / Intranet.
3. Appraise the Senior management and obtain their support.
4. Formation of the Year 2000 Core Committee.
5. Formation of the Year 2000 Apex Committee.
6. Appoint Year 2000 Program manager and Coordinator.

**II. Assessment**

1. Focus on core business areas and processes and develop a Year 2000 assessment document
2. Assess the severity of an impact of Year 2000-induced failures
3. Conduct enterprise-wide inventory of information systems for each business area
4. Prioritize systems and components to be converted or replaced
5. Develop Year 2000 program plan
6. Identify and acquire Year 2000 tools

**III. Renovation / Remediation**

1. Convert selected applications, databases, archives, and related system components
2. Replace selected applications and related system components wherever required.
3. Retire selected applications and related system components wherever required.

**IV. Test / Certification**

1. Develop and document test and compliance plans and schedules

2. Perform unit, integration, and system testing
3. Initiate acceptance testing
4. Final Certification

**V. Implementation**

1. Develop implementation schedule
2. Implement contingency plans
3. Implement converted and replaced systems

The Exchange achieved 100% completion in the crucial phases of component inventory, initial assessment, code conversion & User acceptance testing. Each and every systems and sub-systems at NSE was subjected to the final phase of Independent Verification & Validation (IV&V) by external consultants. NSE successfully completed mock trading sessions to ascertain the Year 2000 readiness of its systems & also the systems deployed at the external business associates. These mock-trading sessions involved the participation of external business associates such as trading members, Clearing banks, Custodians, Depository, Information Vendors etc. All important Y2K dates were simulated during these mock sessions.

The taste of pudding lies in eating. A very smooth roll over to the year 2000 compliments the care and efforts NSE took to make its systems Y2K compliant.

**Data Warehouse**

Building a 'Data Warehouse' may be the 'IN' thing today, but getting down to building up one that can actually make a difference to the organisation is a different story altogether. It is not easy, but the benefits of a well-designed warehouse start paying off even before the warehouse is complete. The real challenge lies in the management of every large database in a manner that is unified, centrally accessible, analysis-friendly and facilitates



decision-supporting systems. In this context the concept of data warehouse has found much acceptability and importance world wide, and is no more a buzzword, at least, amongst the mature IT users.

Globally Data warehousing technology is widely being used especially in Supermarkets, Credit-card companies, Airlines, etc. The concept is also rapidly gaining round in India too. As far as stock exchanges are concerned, NSE is the second Stock Exchange in the world, after NASDAQ, to embark the enterprise-wise data warehouse. The first phase of data warehousing project is to provide benefits in the area of risk analysis information storage & retrieval; and analytical processing has gone live.

**Data warehousing and NSE**

Citicorp Information Technology Industries Limited (CITIL) and Wipro Infosystems have played a key role in building up NSE’s Datawarehouse of 500 GB database size. The base product supplied by CITIL has successfully been deployed at CITIBANK offices in over 20 countries. The underlined platforms used are :-

- Hardware : Digital ALPHA 8200
- Operating System : Digital UNIX
- RDBMS : Oracle 8
- Tools : Oracle Express, Sales Analyser, Business Objects.

Phase II plans to incorporate the other department’s requirements. The focus will be on data dissemination to provide better services, data mining and use of artificial intelligence for advanced detection system.

As per a recent American survey, 80% of an analyst’s time is spent in locating information.

Another 15% is spent in ordering it into some meaningful manner and only 5% of the time in actually making a decision. NSE expects the analysis period to be significantly shorter, thereby enabling the warehouse to reap huge dividends.

**Business Continuity Plan(BCP)**

The biggest single risk to business continuity is the lack of awareness that a risk actually exists. Most businesses believe that it will never happen to them!! But those who care for customers can ill afford to ignore possibility of business interruption. They endeavour to develop a BCP, i.e. identify critical business processes and resources required to maintain an acceptable level of business, protecting those resources and preparing procedures to ensure the survival of the organisation in times of business disruption. In the absence of a BCP, there could be business interruption, financial loss, legal liability and going out of business.

**Live incidents of disasters**

Of the 300 companies that were affected by the 1993 bombing of the World Trade Center in New York, 260 had no recovery plan in place. Within a year 150 of those companies had closed their doors. This staggering statistics illustrates the serious risk assumed by not having an adequate plan for recovery from a protracted work stoppage. Of course, it doesn’t take a disaster of that magnitude to wipe out a company. Local power outages, communications failures, and fires are much more common and can be equally debilitating to business functions.

Nearer home, disasters such as the fire that engulfed the Express Towers at Nariman Point has caused incalculable loss to the affected companies. The collapse of the Poonam Chambers in Worli is a



glaring examples of businesses in India not having a business recovery site in case of a disaster. In this case, the affected companies had to physically relocate in a city that has high real estate values. Such disasters are generally public relations nightmares. If a business is not able to turn around quickly after such an occurrence it will sound the death knell for these companies.

### ***Impact of Disaster***

NSE, as mentioned earlier, has a huge IT infrastructure to support its fully automated screen based trading operations which includes multiple fault tolerant mainframe computers, dozens of large/medium range UNIX/NT servers, hundreds of PCs, large number of communication equipment and its own satellite based VSAT-network. NSE's network of more than 2500 VSATs in over 300 cities currently being the largest VSAT network in Asia, should such disaster strike at a site running a mission critical business application like trading operations, the impact on its business could be enormous. It would take a minimum of 4 months to re-establish the same. Presently, one-sided turnover on NSE reached a staggering level of Rs. 7000 crore per day through participation of nearly 5000 trading terminals spread across over 300 cities in the country. Assuming average brokerage charges of 0.5%, the total loss amongst only trading members would amount to around Rs. 15 crore daily. In addition, it would adversely affect the earnings of the Exchange and other business partners like Clearing Corporations, Depositories, Custodians, etc. Most importantly it would result in unmeasurable intangible losses: loss of image and perhaps loss of the business. One can calculate the revenue loss caused due to such a disaster for the entire trading community.

### ***BCP project implementation***

The BCP project at NSE was triggered-off immediately after the main site of operations was fully functional and stabilized to handle the minimum required business base. BCP implementation for NSE was no easy task because of its large and highly complex IT infrastructure and fulfillment of the requirement of on-line, real time mission critical application handling most sensitive and very high value business transactions. Main complexities arose owing to the fact that NSE had to set-up a complete satellite Earth Station at a technically suitable back-up site. The criterion applied to select a suitable disaster back-up site for BCP were:

- (a) Different city
- (b) SACFA (Standing Advisory Committee for Radio-Frequency Allocation) approved
- (c) Can be easily linked to main site via a high speed data link (optical fibre) for online-real time connectivity
- (d) Easily and quickly reachable from Mumbai (well connected by road/rail/air)
- (e) Protected from natural calamities.

Most critical and time-consuming factor was SACFA approval for finalising the back-up site. It took almost a year to satisfy all the conditions and Pune was the final choice for NSE BCP site.

### ***BCP Life cycle***

There are major stages in the life cycle of a BCP:

1. Business Impact Analysis
2. Strategy selection
3. Plan preparation, testing and maintenance.



NSE adopted a very systematic approach and completed all the stages of BCP life cycle successfully to draw a detailed BCP. Price WaterHouse helped NSE in this process under the FIRE (US-Aid) project.

### ***BCP at NSE***

Early 1998, the disaster back-up site for BCP at Pune was completely ready with its entire infrastructure including the satellite earth station and the high speed optical fibre link between its main site at Mumbai and the BCP site at Pune. NSE's BCP site is a mirror replica of the complete production environment at Mumbai. The transaction data is backed up on near real time basis from the main site to the disaster back-up site through the 2 mbps high-speed link to keep both the sites all the time synchronized with each other.

NSE has been a pioneer in the areas it chose to operate in and with the comprehensive BCP in place it has further provided boost to its image as a technology leader. Numerous tests were conducted while setting up the BCP site at Pune. This was followed by mock runs simulating live environment, to build the confidence in the BCP operations. In 3<sup>rd</sup> quarter of 1998 the 1<sup>st</sup> live trading operation for NSE's Wholesale Debt Market (WDM) was conducted successfully from Pune. Soon after that, a live trading for Capital Market (CM) segment was also conducted without any hitch.

A dedicated core team comprising of business and IT staff is responsible for the entire BCP operations. The function of this group is not just to ensure successful BCP drills but also to update the checklist for BCP operations on a continuous basis. This team maintains exhaustive documentation on the BCP procedures, which also includes details of

classification of events falling under disaster category and corresponding action plan. In case of a disaster actually striking the main site, a nominated commander of the BCP team would assume charge and control the operations from a pre-allotted command room. Although the BCP operations are headed by a Senior IT person the activities encompass the entire organisation and are supported and co-ordinated by all the business functions.

The BCP site is manned with minimum required staff to run the daily operations and provide continuity during switch over. As a part of maintenance plan, at least one live operation in a month from BCP site at Pune is conducted.

NSE always endeavours to adopt the best business practices available and deploy state-of-the-art technology to maintain its leading edge. NSE is the first Stock Exchange in the country to have its full-fledged disaster back-up site for BCP. With BCP in place, even if the entire primary site at Worli, Mumbai collapses today (because of any disaster), NSE will be back in business in no time. NSE has been a pioneer in the areas it chose to operate in and now with comprehensive BCP in place, it has further provided boost to its image as a technology leader.

### ***Intranet, Extranet & Internet***

Companies that are serious about competing in the global market of the next century understand that Web technology viz. Intranets, Extranets and the Internet will play an increasingly important role in the shape of their business strategies. Technological decisions today are not just about using technology but how to effectively deploy them. The people and the organisations who make these decisions are no longer simply technology leaders. They are business leaders and visionaries.



## **National Stock Exchange: The Change Exchange**

NSE has been the first Stock Exchange in this country to set up a web page on the internet. Since then it has gone much beyond, having completely revamped its web site and setting up an effective internal Intranet and deploying an Extranet for its members. While the NSE Internet site has a rich content of static pages the greatest draw to this site is the on-line ticker of the NIFTY and Midcap stocks. The average number of hits per day to this site is over 5,00,000 hits. The site also boasts of a unique and free portfolio management feature, which today has over 9200 user accounts. The other things that the site offers is access to circulars downloaded by the Exchange, new happenings and continuous update on the Y2K readiness of the Exchange. The site has won two awards this year for its uniqueness, popularity and creativity. One of these is the “Cyber Corporate of the Year” award and the other is “CHIP Magazine” award.

The Exchange has hosted an Intranet within its premises for providing an effective communication within the Exchange. The Intranet among other things provides the forum for disseminating information to its employees. Currently technical articles, personnel policies, internal circulars and the mirrored replica of its Internet site is hosted on the Intranet site. The site is being used by the regional offices also in addition to employees of the Head office at Mumbai.

While Intranet is for internal dissemination of information and an Internet for dissemination of the information to the outside world, the Extranet serves as the communication from the Exchange to its partners Viz., the members of the Exchange. This site is used by the Exchange members to pick up useful information like daily margins, trades done reports, monthly bills, DNR files, custodial confirmations and software versions. Currently due

to network considerations the site provides a medium for exchange of information from the Exchange to the members only and that too after trading hours. It is proposed, in the nearer future, to provide a continuous two way communication medium through this Extranet facility as soon NSE’s nation-wide leased line network is in place.

### **NSE.IT**

NSE has set up an Information Technology (IT) company. In addition to being the premier stock exchange of the country and a leading edge technology user, NSE houses state of the art IT infrastructure and skills. With the setting up of this IT company NSE proposes to sharpen its technology edge. This new IT company would be synergistic with NSE’s overall goal of harnessing the latest technology for the securities industry and business. NSE recognises that technology will continue to redefine the shape of the securities industry, and this specialised IT company will enable NSE to gain considerable advantage within the industry as it strives to offer improved and innovative services to investors and major market participants.

The Exchange currently owns and operates the largest VSAT network in the country, making it one of the world’s largest communication network being used for financial services. In addition to the deployment of the latest technologies, the Exchange has designed and developed technologically complex IT solutions. It has been one of the first few organisations in the country to initiate major projects such as Data-Warehousing, Interactive Web site, Business Continuity Plan etc. Under the Business Continuity Plan the Exchange has set up a full-fledged disaster backup site at Pune. In addition to the nation-wide VSAT network, it has





a voice and data network across the country being used for office workflow and regional business activities. Numerous delegations from stock exchanges around the world have visited the NSE with a view to study and experience the exchange technology first-hand.

The IT department of the Exchange which started in a small way, has by now grown in size and skill-strength to take up large complex projects in various facets of information technology. It has also provided consultancy to other financial organisations in the area of Information Technology. The IT endeavours of the Exchange have been highly appreciated in the form of numerous prestigious national level awards.

The separate company status is expected to provide a platform for taking up more challenging assignments both within India and outside and attaining global exposure. The move will infuse better management and harnessing of technology skills. The existing IT staff (numbering 150) comprising a third of the total staff strength of NSE, is being transferred to the new company. Its immediate focus would be the management of the Exchange IT requirements. The company will also be identifying strategic partners for its business endeavours. The company is also expected to make significant resource investments in the areas of consultancy and niche product development. The NSEIL customer fraternity is expected to benefit by this move, as the new company will target cost effective solutions and services for the securities industry.

There has been a long-felt need for products in the area of treasury management, Asset Liability Management (ALM) and banking and the market participants have been expressing a desire for top-of-the-line solutions in these areas. It is felt that NSE's expertise in the debt market will help

develop solutions in these areas, which will be an added focus of the new IT company. The rapidly modernising financial sector and the capital market will provide plethora of opportunities to NSE's IT company.

The company is expected to commence its business operations by the beginning of the next millennium and the total staff strength of the new company is expected to be around 200 on the date of commencement.

### *CTCL Solution*

With a view to provide cost-effective IT solutions and services for the securities industry, NSE.IT has released CTCL product for the use of NSE trading members. The product has entire order management and routing features that is currently available in NSE's NEAT front-end. The product also includes risk-management, client accounting, advance administrative function and web and other external interfaces to establish links to banks, depository participants etc. The product is offered in two versions viz. Workgroup version and Enterprise version. The workgroup version would be suitable for small/medium size broking firms supporting up to 100 users; while the Enterprise version would be suitable to large broking firms and regional stock exchanges planning to connect to NSE, supporting up to 500 users.

The system architecture of the product follows consistent, three-tier client server architecture with client application located at registered dealer sites or client application functions that run internally at the brokerage firms office. The business transaction supports LAN, WAN and Internet technology while maintaining security, transaction integrity and management functions.

The product enables a brokerage firm or a stock exchange to have a complete control on the trading



operations and provide an efficient service to all its clients. The product consists of four modules for different system user categories and purpose.

**Trader work station (TWS) Module:** This module displays on-line market information and facilitates order entry for execution at NSE. Users can define market watch screens to view market in real-time mode using user-friendly features of the product. On-line query of positions, order status and other modifications are also possible.

**Risk Management and on-line Surveillance Module:** Through this module the brokerage firm manages the risk and surveillance of the dealers trading activities. This module provides a comprehensive set of services such as On-line trading limit check, circuit filter warning, client, trade and order supervision, client wise Instrument supervision, Instrumentwise client supervision, Alerts and Event audit trail.

**External Interface Module:** This module provides interfaces to establish links to news feed vendors, back office accounting system, banks, Depository Participants system etc, using private network or Internet.

**Administration Module:** Various advanced level features are available under this module.

The product runs on a server at the members premises which is linked to NSE through a VSAT or Leased Line link. All the authorised dealers of the member are in turn connected to the above server using client software or Internet browsers. The limitation of up to 5 NEAT terminals per VSAT is eliminated. Members can have up to 500 terminals with CTCL facility.

### ***Countrywide Backup Network for Trading***

The trading operations of the NSE members heavily rely on the Satellite based Telecommunications

Network. In order to protect the members' business interests NSE has made large investments in setting up fault tolerant and fully reliable systems. Also large investments have been made to set up disaster recovery site at Pune to take care of any unforeseen disruptions in operations at the Mumbai office. However there is no redundancy / back up available against failure of the Satellite. In such events in the past the exchange had to be closed for a couple of days in order to facilitate the shifting of VSATs to a healthy Satellite. This had badly affected the business of all trading members.

In order to take care of such eventualities in future, NSE has decided to setup a terrestrial Leased Line network as a back up to the existing VSAT network. As per the proposed scheme each of the trading members will have at least one Leased Line connectivity to his / her corporate office. He can have dedicated trading terminals operating on this Leased Line parallel to the existing VSAT set up. This means that the trading member can carry out his normal trading operations simultaneously on the Leased Line and the VSAT connectivity. This arrangement will offer following advantages :

1. Trading operations will continue uninterrupted even during the rare periods of Satellite failures
2. This can act as immediate backup when individual VSAT fails at member's premises
3. The members will be able to add more trading terminals in his / her office and use the same for wide range of applications / facilities like trading CM/ WDM/ OTCEI/ IPO/ Futures & Options, Depository participant on NSDL, Extranet, Online analysis / financial news (New application) etc.
4. Better response time.



5. Sufficient dedicated bandwidth taking care of various data traffic requirements
6. Latest technology
7. The members will be able to avail the Extranet services even during trading hours. Few of these services include Daily consolidated margin payable report for a member, Facility for sending file for trade modification, Clearing data download, Lost and Stolen shares (DNR) details, New Trading software version releases for NT, Daily Bhav Copy, Weekly updates of NT LDB, Consolidated online backup for all ID's of a member, Monthly and other bills, Top 10 Gainers/losers file, Press Releases and Circulars.

#### *IT Plans of NSE*

NSE continues to stress on innovation and investment in technology areas to remain ahead in the competition. The Exchange has therefore actively worked towards setting up its terminals abroad and also in offering consultancy services to exchanges abroad.

The software for the Futures & Options segment, both on the trading and settlement end is ready for operations subsequent to the successful testing done internally. The live operations will be commenced as soon as necessary clearances are received. The risk analysis and management software, namely VaR (Value at Risk) has been developed in consultation with IGIDR. As a precursor to the Futures and Options trading, SEBI had mandated certification of dealers and users on this segment by the exchange. For this the exchange has developed a web based certification system which

can be accessed from its offices across the country. More than 1500 people have passed the test.

NSE has already taken steps towards revamping its Trading and Clearing & Settlement systems. The Exchange is currently studying the limitations of the existing systems and preparing new business requirements. The new generation Trading and Clearing systems would use the State-of-the-art technology and would have all the latest features that Stock Exchanges in the world support, thereby enabling the Exchange enter into global competition. The applications and the systems architecture will be designed to provide scalability, flexibility and reliability to the systems so as to support large volumes (upto 2 million trades/day) of business on the Exchange. The new generation system is targeted to be the place within next two years.

The Exchange proposes to operate its VSAT Network on two different satellites simultaneously with the VSATs equally distributed on both the satellites. With this, at any given time of failure of a satellite, only 50 % of the VSATs are affected which will substantially lower the time required for recovery from such failures.

The Exchange is planning to set up one way VSAT network for disseminating the trading broadcast data. With this technology, the overall performance of the VSAT network will improve and also result in savings on satellite space requirement for the Exchange. Further, other value-added services like publishing live market information, telecast of relevant lectures for the benefit of trading community will also be introduced by the Exchange soon.

## ANNEXURE - I

### List of Towns and Cities with VSATs as on 31st December 1999

STATE/UT	TOWNS AND CITIES	NO. OF CITIES	TOTAL NO. OF VSATs
Andhra Pradesh	Bhimavaram, Cuddapah, Eluru, Gujuwaka, Guntur, *Hyderabad, Kakinada, Karimnagar, Khammam, Kothagudem, Kurnool, Mirialguda, Nalgonda, Nellore, Ongole, Palakol, Proddatur, Rajamundry, Secunderabad, Suryapet, Tanuku, Tenali, Tirupathi, Vijayawada, Vizag, Vizianagaram, Warangal, Dharamavaram, Srikakulam, Anantpur, Chirala, Nandyal, Mahboobnagar, Kandukur, Nizamabad, Anakapalle, Tadepalligudem, Mandapeth, Kukatpally, Mancheril, Adilabad.	41	143
Assam	*Guwahati, Jorhat, Silchar,	3	8
Bihar	Bhagalpur, Dhanbad, Jamshedpur, *Patna, Ranchi, Muzaffarpur	6	21
Delhi	*Delhi	1	351
Goa	Panaji	1	5
Gujarat	*Ahmedabad, Anand, *Baroda, Bhavnagar, Bhuj, Botad, Borsad, Dahod, Gandhinagar, Jamnagar, Junagadh, Kalol, Mandvi, Mehsana, Morbi, Nadiad, Navsari, Patan, Palanpur, Petlad, *Rajkot, Savarkundla, Surat, Surendranagar, Unjha, Veraval, Visnagar, Kadi, Porabnder, Dhrangadhra, Khambat, Amreli	32	197
Haryana	Ambala Cantt, Bhiwani, Faridabad, Gurgaon, Hissar, Jagadhri, Jind, Karnal, Kurukshetra, Nabha, Panipat, Rewari, Rohtak, Sirsa, Yamuna Nagar, Sonapat, Kaithal, Panchkula, Fatehabad	19	56
Himachal Pradesh	Shimla, Parwanoo	2	3
Jammu & Kashmir	Jammu, Srinagar	2	5
Karnataka	*Bangalore, Belgaum, Chickmagalur, Davangere, Hubli, Madikeri, *Mangalore, Mysore, Shimoga, Udupi, Manipal	11	77
Kerala	Alappuzha, Aluva, Angamaly, Calicut, *Kochi, Ernakulam, Iringalakuda, Kanjirapally, Kannur, Kodungallore, Kollam, Kothamangalam, Kottayam, Kattapana, Kunnamkulam, Muvattupuzha, Pala, Palakad, Pathanamthitta, Thalassery, Thiruvalla, Thodupuzha, Trichur, Thiruvananthapuram, Kasaragode, Mavelikara, Mattancherry, Muddakayam, Parur, Tripunithura, Kanhangad, Changancherry, Kozhencherry, Ranni, Vadakara, Guruvayur, Malappuram, Kalamassery, Chalakudy, Kalpetta, Kottarakkara, Koothattukulam	42	101
Madhya Pradesh	Bhilai, Bhopal, Bilaspur, Gwalior, *Indore, Jabalpur, Katni, Korba, Nagda, Neemuch, Raipur, Ratlam, Sagar, Ujjain, Jhabua, Bhatapara, Khandwa, Pithampur	18	74
Maharashtra	Ahmednagar, Akola, Amravati, Dhule, Jalgaon, Kolhapur, *Mumbai, Nagpur, Nashik, *Pune, Sangli, Satara, Kopergaon, Ichalkaranji, Chandrapur	15	789
Orissa	*Bhubaneswar, Rourkela, Cuttack, Berhampur, Sambalpur	5	12
Punjab	Amritsar, Bathinda, Chandigarh, Hoshiyarpur, Jalandhar, Khanna, *Ludhiana, Mandi Gobinagarh, Mansa, Moga, Mohali, Pathankot, Patiala, Barnal, Ferozepur, Rajpura, Abohar, Kotakpura, Betala, Muksar, Sangrur	21	81
Rajasthan	Ajmer, Alwar, Bharatpur, Bhilwara, Bikaner, Chittorgarh, Hindaun, *Jaipur, Jodhpur, Kota, Sikar, Udaipur, Chirawa, Sri Ganganagar, Dungarpur, Banaswara, Pali	17	71
Tamil Nadu	*Chennai, Chidambaram, *Coimbatore, Cuddalore, Erode, Karaikal, Karaikudi, Karur, Kovilpatti, Kumbakonam, Madurai, Nagercoil, Namakkal, Neyveli, Rajapalayam, Salem, Sivakasi, Thanjavur, Tirunelveli, Tirupur, Trichy, Tuticorin, Theni, Hosur, Virudhunagar, Vellore, Pudukottai,	27	160
Uttar Pradesh	Agra, Aligarh, Allahabad, Banda, Bareilly, Dehradun, Farukhabad, Firozabad, Gorakhpur, Ghaziabad, Haldwani, Haridwar, Hathras, Jaunpur, Jhansi, Jagdisdhpur, *Kanpur, Khatauli, Lucknow, Mathura, Meerut, Moradabad, Muradnagar, Muzzafarnagar, Najibabad, Modinagar, Rishikesh, Roorkee, Saharanpur, Varanasi, Bulandshar, Shahjahanpur, Unnao, Kashipur, Kasganj	35	140
West Bengal	Asansol, *Kolkata, Siliguri, Jalpaiguri, Howrah, Durgapur	6	188
Pondicherry	Pondicherry	1	3
	<b>Total</b>	<b>305</b>	<b>2485</b>

\*Indicates cities which have a Regional Stock Exchange