

Network Infrastructure Facilities: A Case Study of NIT Libraries in India

Y. Srinivasa Rao* and B.K. Choudhury#

*National Institute of Technology,
Rourkela, Orissa, India

#Department of LISc, Sambalpur University,
Sambalpur, Orissa, India

Abstract

Libraries of higher education system use Network Infrastructure (NI) facilities to store disseminate and retrieve information and extract the maximum outcome. In this study, the paper mainly focuses the NI facilities consist of connectivity, cables, bandwidth and spread etc available at National Institute of Technology (NIT) libraries in India. The survey finds that, majority of library's local network is a part of campus network. In use of network cables, both optical fiber and CAT5/enhanced cables hold an equal share of percentage. All libraries have internet connections, in which majority of them (60%) use leased connections. Fifty percent of institutions have the network bandwidth of 6.0 Mbps and above. Invariably, all institutions have campus-wide network connections to various units including departments, in which 75% of them have connections to student's halls/hostels and very few them (25%) have connections to faculty's and officer's residences. This study also indicates South zone (78%) libraries have more NI facilities than the other zones.

Keywords: Network Infrastructure (NI); Academic Library; National Institute of Technology (NIT); Campus-wide Local Area Network; Network Bandwidth

1. Introduction

Library and network are two structural concepts build for storing, disseminating and retrieving information worldwide. The concept of library in the academic environment is not only for obtaining, storing, lending and sharing local and remote resources but also for building a common space for teaching, learning, research and training. The concept of network is to "connect as much as entities and to share as much as data." Connecting entities means linking systems, individuals and organisations, and

sharing data (information) means equal distribution of information among peers through network.

In an academic setting, the use of both libraries and networks combine to become the main source of information today. The amount of information used in the library is largely network-based. The carriage of information and the methods of storage, transmission and retrieval of information are much different compared with traditional methods¹. Library, as an individual organisation, uses different kinds of networks for different purposes in order to provide a variety of services to variety of users. The word 'networking' has meant two quite different things in library usage. One is for resource sharing. Second one is for information services through telecommunications networks². "Local area network to link the workstations within a building to support access to transaction processing systems, such as a library management system; International and national wide area networks for access to e-mail, document deliver, news bulletins and databases; national data and voice networks to access videotext services; national and international voice networks for telephone calls; and broadcast services to receive teletext"³. A library with equipped network capabilities can produce qualitative results, and improves visibility and usability. A possible network significantly improved teaching, learning, research, recruitment, administrative tasks, library use, help resources, the campus social/cultural environment, professional development, and collaboration⁴. Hence, building NI is an essential component for library functions and services.

Network is a common pool. One can easily exchange, transfer and provide information through a network. The trend of network is evolving much more global. The availability of NI today is affordable than it was at its outset. Therefore, the majority of academic libraries build NI(both wire and wireless) in order to extract maximum outcome. It is an essential element for building library system on which the library resources and services can be actively circulated and distributed. Libraries are trusted for producing and providing authoritative, reliable information to users in wide variety of disciplines through a network. It provides access not only to library databases, a variety of online full-text and abstract databases, locally-produced reference databases, document delivery services but also provides e-publishing, e-learning, alert, blog and wiki services. By using NI facilities, the user (faculty, students, researchers and staff) able to get benefitted by sharing resources, expertise, experiences etc. The NI becomes more widespread, communications and computational capacity diffuses through more of our research, learning and consumer behaviours⁵. An equipped and effective NI facilities in the library is not only attracting wider audience to access, search and retrieve resources but also reducing their cost, time and replication works. It increases the institutional productivity and improves the visibility.

In Indian academic library environment, especially in the higher education institutions concern there has been increasing demand for building NI to automate their library

system, functions and services. This study is limited to the National Institute of Technology (NITs) libraries in India concerning about NI facilities. These NITs erstwhile *Regional Engineering Colleges* (RECs) are prime institutions, established across the country in state-wide to produce qualitative trained manpower to meet the need and expectations of the country and promote high quality teaching, learning and research in the field of engineering, science and technology. Presently, there are twenty (20) NITs in India. These institutions are “national importance institutions” established on the lines of the prestigious Indian Institutes of Technology (IITs). The NIT Act – 2007 has come into force with effect from August 15, 2007. They offer degree courses at various bachelors, masters and doctorate levels. All institutions have their own autonomy to draft curriculum and functioning policies. These are fully funded by the Central Government. Greater infrastructure facilities have been given to these institutions for development in teaching, learning, research and dissemination of information. These institutions are not only for inducting qualitative teaching, learning and research but also for pouring funds to create central facilities to support them and also to help neighbour technical institutions.

In general, there are many issues involved in building the NI facilities, but this study only confined to NIT libraries across the country concerning the NI facilities consisting of connectivity, cables, spread and bandwidth etc. The main objectives of the study are as follows:

- To examine the level of network connections and medium used among NIT libraries in India.
- To study the spread of network among NITs
- To find out the network bandwidth among NITs
- To evaluate zone-wise performance with respect to network infrastructure facilities

2. Methodology

A methodology used for collecting data was questionnaire. The choice of selecting questionnaire method was survey-based. A questionnaire was designed in structural form consist of different sections representing specific facets. A representative sampling was 20 (Table 1). The target users were administrators of the libraries (librarians). Data were collected from the librarians of various NITs using the structural questionnaire method. A reminder was sent to those librarians who failed to respond in time. Finally, all responses were received. As part of research, the data (Annexure) that are considered important for this study were quantified using numerical scales (i.e. 0-1, 1-2, 1-3) for the purpose of analysis.

Table 1 Number of Institutions in Zone Wise

Sl. No.	Zones	Name of the Institutions
1	North	MNNIT Allahabad
2		NIT Hamirpur
3		NIT Jalandhar
4		NIT Kurukshetra
5		NIT Srinagar
6	East	NIT Durgapur
7		NIT Jamshedpur
8		NIT Patna
9		NIT Rourkela
10	North East	NIT Agartala
11		NIT Silchar
12	South	NIT Calicut
13		NIT Surathkal
14		NIT Tiruchirapalli
15		NIT Warangal
16	West	MNIT Jaipur
17		VNIT Nagpur
18		SVNIT Surat
19	Central	MANIT Bhopal
20		NIT Raipur

3. Scope and Limitations

The present study is confined to twenty NIT libraries in India, concerning the availability of NI facilities only. In this study, data received from the respondents are authenticated and assumed factual. User interview/opinions and their degree of satisfaction through user survey would have added more value to the present study.

4. Findings

The data that considered for this study were described and analysed based on the objectives. The NI encompasses mainly connectivity, cables, bandwidth and spread etc. Additionally, the institutions were ranked in zone wise. These zones are North, East, North East (NE), South, West and Central.

4.1 Local Area Network (LAN) Connectivity

A network (physical/wireless) is connecting to a group of computers and communication devices that allows many users to share resources within a small geographic area (building or group of buildings). In this study, the LAN connection may be an independent connection of the building or a part of campus network connection with respect to library local area network connection. Figure 1 shows one-fourth of libraries reported that, they have independent network connectivity,

while three-fourth of libraries (75%) has dependent connectivity (as a part of campus network).

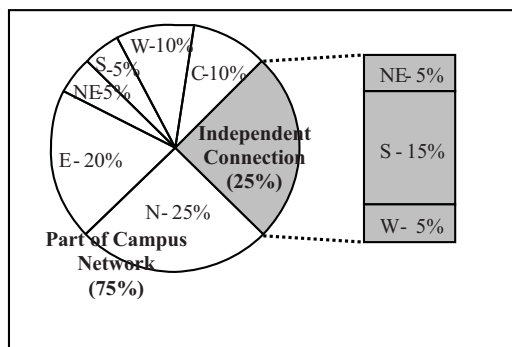


Figure 1 Local Area Network (LAN) Connections

4.2 Network Medium

Cable is the medium to transfer information from one point to another. In a LAN, various kinds of cables (coaxial, optical fiber, twisted pair) are in use based on the network's topology, protocol, and size. This study covers hardware of network cabling which consists of CAT5, Enhanced and Optical Fiber cables. Category 5 (CAT5) is a form of Ethernet cable commonly used today that supports high-speed networking. Enhanced cables are the version of Cat 5. Fiber optic cables are high speed data communication cables designed to carry information using pulses of light. Table 2 shows that, 50% of respondents indicated that, they are using optical fiber cables. 40% libraries are using CAT5 and 10% enhanced cables.

Table 2 Network Media

Cables	North	East	NE	South	West	Central	Frequency (N=20)	Percentage
CAT5	0	1	1	3	2	1	8	40
Enhanced	1	1	0	0	0	0	2	10
Optical Fiber	4	2	1	1	1	1	10	50

4.3 Types of Internet Connections in the Library

As a tool, internet has become commonplace for users to browse, search and retrieve information easily and quickly. The internet connection (wire/wireless) in the library is an important utility to access library resources and services appropriately and timely. Various types of Internet connections are available to improve faster and better internet accessibility. In this study the internet connections such as leased, V-sat/WiFi and others (dial- up/radio link/cable) are examined to know the potential of

internet connectivity of the NIT libraries in India. Figure 2 identifies that, 60% of the libraries reported that, they are using leased lines connections, while 8 (40%) libraries are using V-Sat connections. No library is using dial-up, radio-link and cable connectivity.

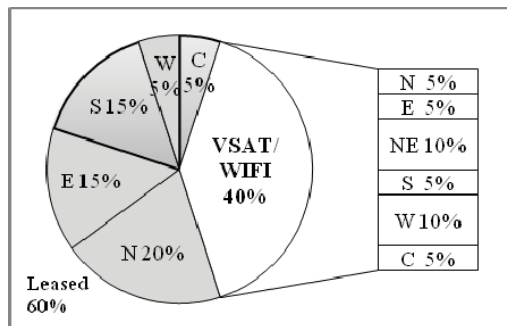


Figure 2 Types of Internet Connections

4.4 Spread of campus LAN

Extension of campus local area network is essential for searching, accessing, communicating and retrieving information worldwide. The campus LAN irrespective of locations (departments, laboratories, library and even students' hostels and the residential areas) is not only for browsing and accessing local resources but also accessing and retrieving remote information. In this study covers extension of campus LAN of NIT libraries in India. Table 3 reports that, all departments and libraries are having LAN connectivity. Most of the NITs (95%) are having connectivity to laboratories, centres and units. 15 (75%) NITs have connectivity to student's halls/hostels. Interestingly 12 (60%) NITs have provided the facility of connectivity to student individual rooms. Further, 5 (25%) NITs provide connectivity to faculty and officers residences.

Table 3 Spread of Campus LAN

Spread of Campus LAN	North	East	NE	South	West	Central	Frequency (N=20)	Percentage
All Departments	5	4	2	4	3	2	20	100
Central Library	5	4	2	4	3	2	20	100
All Labs/Centres/Units	5	4	1	4	3	2	19	95
All Students Halls/Hostels	4	3	1	4	2	1	15	75
Students Individual Rooms	3	2	1	4	2	0	12	60
Faculty and Officers Residences	2	1	0	1	1	0	5	25

4.5 Bandwidth

Bandwidth refers to the transmission capacity of a network. It means that the maximum amount of data that can be transmitted via network in a given period of time. The internet connection relies on bandwidth and how fast it can be delivered data. Higher bandwidth may cost more but it increases the speed in accessibility. Table 4 identifies that, four (20%) NIT libraries are having bandwidth between >1.0 to <=2.0 Mbps, 6 (30%) are in the range of >2.0 Mbps to <=4.0 Mbps. Majority of NIT libraries (50%) are having 6.0 Mbps of bandwidth and above.

Table 4 Bandwidth of Network

<i>Bandwidth</i>	<i>North</i>	<i>East</i>	<i>NE</i>	<i>South</i>	<i>West</i>	<i>Central</i>	<i>Frequency (N=20)</i>	<i>Percentage</i>
<=1.0 Mbps	0	0	0	0	0	0	0	0
>1.0 to <=2.0 Mbps	1	1	0	0	1	1	4	20
>2.0 Mbps to <=4.0 Mbps	2	2	1	0	1	0	6	30
>4.0 Mbps to <=6.0 Mbps	0	0	0	0	0	0	0	0
>6.0 Mbps and above	2	1	1	4	1	1	10	50

Strength of NI facilities among NIT libraries in India has been presented zone wise in Table 5.

Table 5 Potential of NI Facilities among the NIT Libraries – Zone Wise

<i>Sl. No.</i>	<i>Zone</i>	<i>Name of the Library</i>	<i>Score Achieved</i>	<i>Total Score Achieved in Zone Wise</i>	<i>Total Ideal Score (20) in Zone Wise</i>	<i>Percentage</i>
1	North	MNNIT Allahabad	17	71	100	71
2		NIT Hamirpur	17			
3		NIT Jalandhar	14			
4		NIT Kurukshetra	11			
5		NIT Srinagar	12			
6	East	NIT Durgapur	12	53	80	66
7		NIT Jamshedpur	13			
8		NIT Patna	12			
9		NIT Rourkela	16			
10	North	NIT Agartala	12	26	40	65
11	East	NIT Silchar	14			
12	South	NIT Calicut	15	62	80	78
13		NIT Surathkal	15			
14		NIT Tiruchirapalli	16			
15		NIT Warangal	16			

16	West	MNIT Jaipur	12	39	60	65
17		VNIT Nagpur	12			
18		SVNIT Surat	15			
19	Central	MANIT Bhopal	9	24	40	60
20		NIT Raipur	15			

Figure 3 shows that the South zone (78%) has more potential in facilitating network infrastructure and followed by the North zone. All other zones have relatively similar NI facilities available at their libraries.

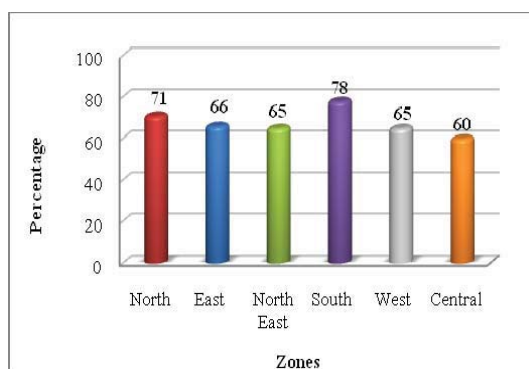


Figure 3 Network Infrastructure Facilities - Zone wise

5. Major Findings:

- 1) All libraries respondents indicate that they are connected with Local Area Network (LAN), but one-fourth of libraries have independent network connectivity. While, three-fourth of libraries (75%) have dependent connectivity (as a part of campus network).
- 2) Fifty percent of libraries report that they are using optical fiber cables, whereas another 50% libraries are using CAT5 and enhanced cables.
- 3) All libraries are having internet connection and majority of them (60%) having leased connections followed by V-Sat connections. No library use dial-up, radio-link and cable connectivity.
- 4) All institutions extend campus-LAN connections to departments and libraries. Whereas, about 95 percent of institutions extend connections to laboratories, and other units. 75% of respondents report that, they have LAN connections to student's halls/hostels. Hardly, few institutions (25%) provide campus wide LAN connection to faculty and officers residences.

- 5) Regarding to bandwidth (transmission capacity of a network), four (20%) libraries are having between >1.0 to <=2.0 Mbps lines, while 6 (30%) are in the range of >2.0 Mbps to <=4.0 Mbps. Majority of libraries (50%) are having 6.0 Mbps and above bandwidth of network connection.
- 6) Concerning the NI facilities at various zones, the South zone (78%) libraries wealthier than the other zones followed by North zone with 71%.

6. Conclusion

The trend of network is evolving much more global. Both libraries and networks are common place for academic institutions to store, disseminate and share information, experience and expertise. This study is limited to NITs across the country with respect to NI. In this survey, we observed that, all departments, library, laboratories, and other units connected with campus-wide LAN. Majority of institutions connected to student's halls/hostels, in which few of them (25%) have connections to faculty's and officer's residences. With respect to NIT libraries the NI needs to be upgraded. Few libraries are at primitive stage. Majority of libraries prefer to use a dedicated network (local area network) with high-end speed internet connectivity for connecting local users to meet their information needs. In a zone wise performance pertaining to NI facilities among NIT libraries, The South zone (78%) libraries are far better than the other zone libraries. However, it can be concluded that the current stage of libraries of NITs across the country with respect to NI facilities are quite admirable, though some them finding difficulty in their perception, structure and implementation. Moreover, using emerging network technological tools and techniques could have offer better opportunities for academic community in accessing resources and ensuring qualitative services simultaneously. Future studies may be conducted in other universities on NI development in Indian context. The study can also be extended to other technical universities on financial implications for building up NI facilities.

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Annexure: NI Facilities of the NIT Libraries – Zone wise

S/N o.	Library	LAN Connection		LAN Connected with Inter net	Cables			Type Network Connection in the Library		Spread of Campus LAN						Bandwidth						
		Independent	Part of campus network		Yes	CAT 5	Ethernet	Optical fiber	Leased	V-sat/WiFi	Other (Dialup/Radio Link/Cable)	All Deparments	Central Library	All Labs/Centres/Units	All students/halls/hostels	Students individual rooms	Faculty and offices/residence	<= 1 Mbps	>1.0 to <=2.0 Mbps	>2.0 to <=4.0 Mbps	>4.0 to <=6.0 Mbps	>6.0 Mbps
1	North				(1)	(2)	(3)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(2)	(3)	(4)	(5)
2	MNNIT Allahabad	x	√	√	x	x	√	x	x	√	√	√	√	√	√	√	√	x	x	x	x	√
3	NIT Hamirpur	x	√	√	x	x	√	√	x	√	√	√	√	√	√	√	√	x	x	x	x	√
4	NIT Jalandhar	x	√	√	x	x	√	√	x	√	√	√	√	√	√	√	√	x	x	√	x	x
5	NIT Kurukshetra	x	√	√	x	√	x	√	x	√	√	√	√	√	√	√	√	x	√	x	x	x
6	NIT Srinagar	x	√	√	x	x	√	x	√	√	√	√	√	√	√	√	√	x	√	x	x	x
7	NIT Durgapur	x	√	√	x	x	√	√	x	√	√	√	√	√	√	√	√	x	√	x	x	x
8	NIT Jamshedpur	x	√	√	x	x	√	√	x	√	√	√	√	√	√	√	√	x	√	x	x	x
9	NIT Patna	x	√	√	x	x	√	√	x	√	√	√	√	√	√	√	√	x	√	x	x	x
10	North East				(1)	(2)	(3)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(2)	(3)	(4)	(5)
11	NIT Rourkela	x	√	√	x	√	x	√	x	√	√	√	√	√	√	√	√	x	x	x	x	√
12	NIT Agartala	x	√	√	x	x	√	x	√	√	√	√	√	√	√	√	√	x	√	x	x	√
13	South				(1)	(2)	(3)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(2)	(3)	(4)	(5)
14	NIT Silchar	x	√	√	x	x	√	x	√	√	√	√	√	√	√	√	√	x	√	x	x	√
15	NIT Calicut	√	x	√	x	x	√	x	√	√	√	√	√	√	√	√	√	x	√	x	x	√
16	NIT Surathkal	√	x	√	x	x	√	x	√	√	√	√	√	√	√	√	√	x	√	x	x	√
17	NIT Tiruchirappalli	x	√	√	x	x	√	√	x	√	√	√	√	√	√	√	√	x	√	x	x	√
18	NIT Warangal	√	x	√	x	x	√	x	√	√	√	√	√	√	√	√	√	x	√	x	x	√
19	West				(1)	(2)	(3)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(2)	(3)	(4)	(5)
20	MNIT Jaipur	x	√	√	x	x	√	x	√	√	√	√	√	√	√	√	√	x	√	x	x	√
21	MNIT Nagpur	√	x	√	x	x	√	x	√	√	√	√	√	√	√	√	√	x	√	x	x	√
22	SVNIT Surat	x	√	√	x	x	√	x	√	√	√	√	√	√	√	√	√	x	√	x	x	√
23	Central				(1)	(2)	(3)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(2)	(3)	(4)	(5)
24	MANIT Bhopal	x	√	√	x	x	√	x	√	√	√	√	√	√	√	√	√	x	√	x	x	√
25	NIT Raipur	x	√	√	x	x	√	x	√	√	√	√	√	√	√	√	√	x	√	x	x	√