

# Information Technology Services issues and challenges with a case study in Small Medium Enterprises

**Abstract** – Information Technology is one among the high priority resource in the current competitive business scenario. Digital Infrastructure consists of Hardware, Software, Network, Protocols, Policies and Practices that together organize and deliver the increasing power to business and society. The Information Technology services such as Messaging services, Web services, Email services, Data services, Log Monitoring services and others are important for any business. The malfunction or failure of any IT resources during critical situations is not accepted by the stake holders of any business. The Service Level Agreement provides the relationship between the IT service provider and the business customers; it is an evidence of written document which properly addresses the issues. The issues and challenges of Information Technology infrastructure management in Small and Medium Business Enterprises are discussed in this paper.

**Keywords:-** Digital Infrastructure, Issues and Challenges of IT in SME, Open Source Infrastructure.

## I. Introduction

Information Technology services enhance the business activities and provide business information on our doorstep. Information Technology infrastructure and services are integral part of any business and is unavoidable in today's competitive business scenario. IT Infrastructure includes traditional data and information but they also include significant explosion of data. The Proliferation of social media, cloud computing and mobile technology has enhanced the quality and quantity of data generated every day. Internet of Everything (IOE) which includes not only an interconnection of things but also an exploding digital network of people and data. During the last decade, the Business infrastructure has become digital with increased interconnections among products, processes and services. Across many firms spanning different industries and sectors, digital technologies (viewed as a combination of information, computing, communication and connectivity technologies) are fundamentally transforming business strategies, business processes, firm capabilities, products and services. Also these digital technologies are fundamentally reshaping traditional business strategy as modular, distributed, cross functional and global business processes that enable work to be carried out across boundaries of time, distance and function [Subhash Bhatnagar, 2000, P. Mohanan, 2000, Khaiser Nikam, 2004].

Globally more than 95% of business in most countries are small (<100 Employees) and 25-35% of world manufactured exports is in SMEs. The new arrivals of electronic gadgets such as Iphone, Ipad, TabletPC, PalmPC, Wearable devices and other digital devices are used by the end users and providing IT services to these devices are highly challenging. The IT services such as Message services, Web services, Mail services, Data services, Log Monitoring services and others are important for any business. The malfunction or failure of

any IT resources during critical situations is not accepted by the stake holders of any business. The figure 1 shows the worldwide future growth of IT infrastructure space in Personal, Home, Small and Medium and other Business Enterprises.

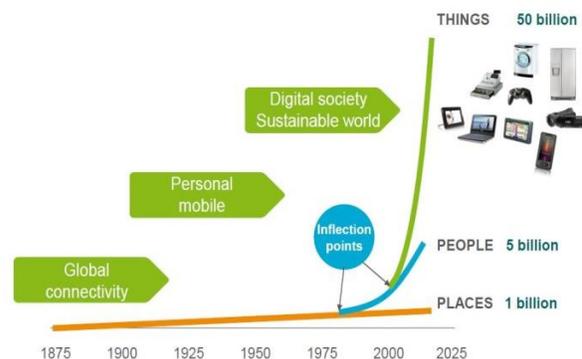


Fig. 1. Future growth of IT Infrastructure

Technology Acceptance Model (TAM) was adapted from the theory of reasoned action, user acceptance is often the pivotal factor that determines the success or failure of an Information Systems and TAM is most widely accepted model used to understand end-user acceptance of Information Technology. Innovation Diffusion Theory (IDT) provides a framework with which we can make predictions for the time period that is necessary for a technology to be accepted [Anandhi Bharadwaj, 2013, Ruth N. Bolton, 2013]. In this paper IT infrastructure issues and challenges faced by Indian SMEs are discussed. The research outcome of this paper is useful to Small and Medium Business Enterprises for better IT management. The rest of the paper is organized as follows, section II list out the general IT infrastructure that physically spreads over the entire campus, branch offices, regional and head offices. The managerial issues and challenges over this IT infrastructure in small and medium business enterprises are discussed in section III

and section IV discusses a case study with sample results and graphs for a real IT infrastructure management with conclusive remarks.

## II. General IT infrastructure in Small and Medium Enterprises

The IT infrastructure requirements are varying from industry to industry, the Table 1 lists the common IT infrastructure used by the most of the small and medium enterprises.

Table 1 – Common IT infrastructure in SMEs

Type of Infrastructure	Purpose
Mail Server	Internal and external mail communications
Web Server	Corporate web content services
Domain Server	Domain Name registrations
Application Server	Business applications varies from industry to industry
Antivirus Server	Protection from Virus, Malware and Spam
Authentication server	Provides user and device authentication to access the IT resources
Storage Server	Provides data backup to avoid the data loss, storage space ranged from Terabytes to Petabytes
Intranet Server	To all internal communications such as company news, circulars, birthday greetings of Employee and others
Portable Clients	Laptop, Ipad, Iphone, Palm PCs, Tablet PCs, Wearable Devices used for portable IT usage
Backbone Cables	Backbone network is OFC Leased Line ranged from gbps to mbps, RF, WiMax or other medium of communications
Router	Provides Routing from internal to external network
Firewall	Provides content filtering and allow or deny the digital content based on the stated policies

Intrusion Detection System	Provides malfunction detection, analysis of attacks
Wireless Access Points	Controller based Access Points spread across the campus and have the features of Bandwidth Management, Seamless Roaming, User authentication, Rogue AP Management and Device Authentication and others
CCTV Cameras	Photo and Video capturing for recording and for monitoring.
Scanners	Digitization of documents.
LCD Projectors	Projection facility for group or mass presentation to share the knowledge.
UPS	Provides the regulated power supply without any surge and interruption

It is not must that all these infrastructures are used by the *Small and Medium Enterprises* (SME). Sometimes no or part or whole of this IT infrastructure is used in the SMEs because it depends on the IT awareness, Budget, Readiness to accept the new technologies and others.

## III. Issues and Challenges of IT Infrastructure

### A. Infrastructure Issues and challenges

The requirement analysis, identifying suitable technology, financial or budget issues, implementation and operational issues are the challenging tasks for creating new IT infrastructure in SMEs. The existing IT infrastructures are purchased from different vendors and on different time frames. The *use, reuse or scrap* the existing infrastructure is a challenging task to the IT heads. The next challenge is to understand the new products or technology and is really fit into the existing IT infrastructure or going to use independently within the organization. Since the existing IT infrastructures are purchased from different suppliers, its annual maintenance by the same supplier or by the different service providers or by the SME itself, but the *Quality of Services* (QOS) of these three are varying with one another. Also adopting to the new operating systems, extending IT services to new devices, new plug-and-play hardware and software are unavoidable and managing these are a complex and difficult task to the IT team. The quality of services such as timely response, faster

overcoming of critical failures, tolerable waiting time and completion of services in stipulated time, backup or standby IT support services are very important for critical IT infrastructure.

The *Service Level Agreement* (SLA) is a glue that holds together the relationship between the IT service provider and the business customer. i.e. SLA is an evidence of written document which properly addresses most of the issues. The violations of SLA are a penalty or extension of old services or discounts to new services. IT Organizations provide a wide variety of *cloud services* such as *Infrastructure as a Service* (IaaS), *Platform as a Service* (Paas), *Software as a Service* (SaaS) and all these services are clearly recorded in SLA. It helps to demonstrate value by clearly identifying the service responsibilities of the service provider and performance expectations of the business customer. i.e. it is a contract between the IT service provider and the business customer receiving the services. *Service Level Goals* (SLG) represent the performance expectation metrics of the customer for specifying service being delivered. *Service Improvement Goals* (SIG) establish the service performance criteria which are measured against actual service performance. These measurements determine if the service provider is meeting the basic service commitments. *Service Performance Penalty and Reporting* penalizes the service provider if service goals are not meet. Service reports and graphs must be produced by service provider for the customer which communicates the comparison of actual service performance to service goals [Bob Anderson, 2008, Xiaoyue Han, 2012].

*Wireless Network issues and challenges:* Any open and unsecured node especially wireless is an extremely serious security hazard for any network, whether it is corporate, personal, home or small office user. Security needs

- One time initial security policy / planning and execution/implementation
- Constant monitoring of existing security, new threats and risks
- Periodic review/revise of implemented security policy/plan addressing the feedback and new challenges.
- Implementation of revised policy/plan.

People preferred to use the wireless network because of the portability, mobility and wireless devices. The basic symptoms of wireless network being hacked if the download or browsing speed is slow, the connection breaks frequently, the usage bill escalates in case you use

chargeable download and there are unused log activities. The wireless networks have issues such as disconnecting clients, rogue clients, unsupportive networks, protocol issues, IP issues and others [Ramesh M Goyal, 2008, Sheebha K, 2013]. Based on the policy violations the appropriate steps should be taken within the SMEs.

#### *B.HR Issues*

Nearly every employee in an enterprise operating the digital devices (PCs, Laptops, I-Phones, I-Pads etc.,) for performing his/her daily activity. *Human Resource issues and challenges* such as Recruitment, Retention, Training and Compliance, Productivity, Health and Safety and Discipline are critical issues in IT management. Knowledge over the existing products or technology, use or misuse of technology, mishandling of infrastructure, leave taking on critical situations, deadline violations, unusual calls for failures and stress over the job are the other HR issues to consider for better management of IT infrastructure.

#### *C. Privacy Issues*

*Open Source and proprietary Software issues:* Generally user of proprietary software may assume to be its owner since he/she has paid for it. A user may often (unknowingly or deliberately) replicate or install the proprietary software purchased for single use onto multiple system, thus accounting him/her for committing software piracy [Chaang-Iuan Ho, 2012]. There are many acts that may lead to software piracy. Some of them are

- Sharing the software licensed for single use for installation on multiple systems
- Reselling the purchased software to others (without proper reseller license)
- Cracking the trail or demo edition of software to avoid the license purchase.

#### *D. Security Issues and Challenges*

Security is the physical manifestation of our mental state of vigilance against risks and threats. A weak encryption means it can be easily broken within manageable time i.e. few seconds or minutes. The biggest protection to any asset whether IT or non-IT including wireless equipment or network is user awareness and user education. According to recent studies security is the biggest challenge faced by small and medium sized business because of the shortage of over a million cyber security professionals. The *hacker* is an any unauthorized user or intruder or perpetrator or criminal or terrorist breaking information any network, get access

not only to your internet bandwidth, but he can send emails, download classified and/or confidential data/information, upload obscene material, hack information networks, indicate attacks on other computers in the network or connected to internet, send malicious code to others, install Trojan or Botnet on the victim's computer to get long-term control of it through internet etc.,. Cyber crimes in business are increasing in double fold in every quarter. *Hacking, Denial of Services, Viruses, Credit Card Frauds, Phishing, Spoofing, Corporate Espionage, Threads from internal employee, Cyber attacks* and others are unpredictable challenges to manage the IT infrastructure in a secured way. Each attack is different in terms of the target method used, duration, depth, scale, players involved, decision and attack signature. It is thus very difficult to develop a pattern or a predictable signature or modus operandi of an individual terrorist attack. They follow no rules, they have no fear of law, no ethics or morality, they are zero loss, they are either not afraid of death or ready to die anyway [Sheebha K, 2013]. Port scan activity, traffic anomaly detection, Botnet C&C traffic, unauthorized vulnerability scan, alert logs, Online reputation management are the recent defense mechanisms to overcome these security problems and issues. The SMEs must have a reliable *cross device security platform* in place to protect the PCs, Tablets, Smart-phones and other applicable devices from malware and malicious attacks and also keep security software up-to-date so that SMEs may reasonably be protected.

#### E. Policy issues:

Security in the internet is an issue that has gripped policy planner and computer professionals. *Digital Rights Management* technologies may seem to be good news for content owners; they record companies' movie studios, news organizations, or online publications. However the inevitable consequence of the implementation of DRM technologies is inconvenience and needless restrictions for users of digital media and the net. Most DRM experts agree that the best rights systems combine software and hardware access mechanisms. By trying access rights directly, to computer CPUs, hard drives, or other storage media. Publisher can control not only who is reading the information but also on what device. This level of protection is important for highly sensitive documents such as legal documents, or proprietary market research where illegal copying and sharing could result in substantial damages [Vishu Kankhere, 2009, Liran Einav, 2014, Loanna Bizirgianni, 2013, Beba Rakic, 2014]. Extensible Access control markup language (XACML) will define the representative for rules that specify who, what, when and how of information access.

IT policy, password policy, anti-virus/spam/spyware policies, Firewall policies, encrypted tunneling, SSL/SHTTP, VPNs, Continuous Monitoring and others are the areas where more attention is required. Physical access logs, Application/Network Access logs, Tail gating, Usual/unusual access pattern, IP reputation checks, IP Geo Analytics, Device Profiling Analytics are the recent methods used to address and overcome most of these security issues raised in SMEs.

#### F. Open Source Infrastructure

In the current globalised business scenario many new low cost IT technologies such as *Cloud and Open Source Infrastructure* are easily available. Table 2 listed some of the *Free and Open Source software (FOSS)* used in SMEs. Render services for the software either free of charge or at premium cost and being open source professional can look inside the code and customize the software [P. Monica, 2014, S.P. Mohan, 2014]. *Dedication and will to help selflessly* are the prime reasons why these FOSS applications are alive.

Table 2 - List of Open Source Software

Open Source Type	Software Name
Operating System	Unix, Linux, Variants, Android, Free BSD, Ubuntu, Debian
Programming Languages	Python, Perl, Java, Ruby
IDEs	Netbeans, Eclipse
Enterprise Resource Planning	Openbrave, Compiere, ERP 5, Fedena
DBMS	MySQL, Postgre SQL, Ingres, SQLite
Data mining Tool	R, Weka, RapidMine, Orange
ETL Tool (Extract, Transform, Local)	Talend, Clover ETL, Pentaho
Scripting Language	PHP, Javascript, Groovy, Jython
Application Servers	Glassfish, JBoss, Resin
Web Servers	Apache, Lighttpf, jigsaw
Web Browsers	Chrome, Mozilla, Safari
Web Publishing	Worepress, Source Forge.net
Search Engine	Isearch, Namazu, Sciencenet, SWISH-E
Web Management	Wordpress, Joomla
e-Learning System	Moodle, Atutor, eFront
Office suite	Open Office, Libre Office, Lotus Symphony
Text Editor	Vim, Emacs
Animation	Beamer, Ktoom, K-3D
Video Editing	openshot video editor, klenlive, blander VSE
Audio Editing	Audacity, Wavosaur
Image Editing	GIMP, PaintNET, Krita
Payment System	Paypal, flattr
Cloud Management	Open Stack, Eucllyptus, Open Nebula, Xen Cloud platform
MS Sharepoint	Alfresco, Drupal
AutoCAD	Archimedes, FreeCAD

#### IV. Case Study

The Sri Meenaksi Textiles (SMT), Madurai is a 600 crore textile company has been taken as a case study and the issues and challenges of IT infrastructure management in SMT are discussed. Table 3 lists the infrastructure facilities available in SMT for their effective day to day operations.

Table 3 - IT infrastructure facilities in SMT

IT Facility	Brand Names
Servers	IBM, DELL, HP
Client	DELL, HCL
Network – OFC ILL (1:1)	BSNL, Reliance
Router	Cisco
Firewall	Fortinet
WiFi Devices	Aruba Controller, Aruba Access Points
Software	SAP, Microsoft
Backup Storage	Seagate
Video Conferencing System	LifeSize
LED Television	Samsung
Projectors	BenQ, Sony
Closed-Circuit TeleVision	EverFocus
Camera – Still & Video	Sony
Scanner	HP

The following are the list of *IT services* extended to all stakeholders of SMT,

- Mail Services
- Internet and Web Services
- Network services
- Storage Services
- Software Application Services
- Authorization Service – who can access what
- Content Filtering services

IT Team of SMT comprises of six members working on shift basis to ensure the 24 x 7 availability of IT resources. SMT have intranet online complaint system for faster and smoother IT operations to fulfill all the stakeholders' expectations. The IT team of SMT continuously monitoring the usage pattern on daily, weekly, monthly and yearly basis which are helpful to observe the abnormalities of usage in the SMT, Figure 3-6 shows the graphs for the same. From these graph the *Step* shows the increasing usage patterns, *Peak* shows the highest usage pattern, *Step and Peak* indicates the optimum usage of IT Resources. The *Ramp* shows the decreasing usage pattern which indicates that the less utilization of IT Resources. Customized reports such as Traffic Analysis, Log History, List of Attacks and

advanced security management functions such as quarantined file archiving, vulnerability assessments, archiving of email and Web access are all useful for better and effective IT management in SMT. In the Fig. 6, there is no signals in the graph indicates that, no usage of IT resources for long time or the closedown period of SMT or the failure of IT Resources or the services are newly started. Fig. 7 shows the weekly traffic summary of the SMT with volume of download and in Fig. 8 the graph shows the availability of backbone network, i.e. SMT is maintaining an average of 99.63% uptime for past 4 years, since SMT is having two service providers for backbone network, and they can easily manage the downtime of 0.37 %.

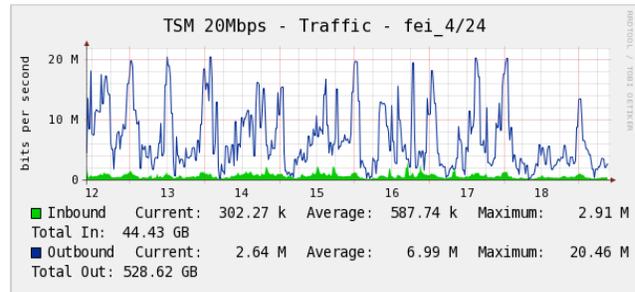


Fig 3. Daily usage pattern of bandwidth utilization

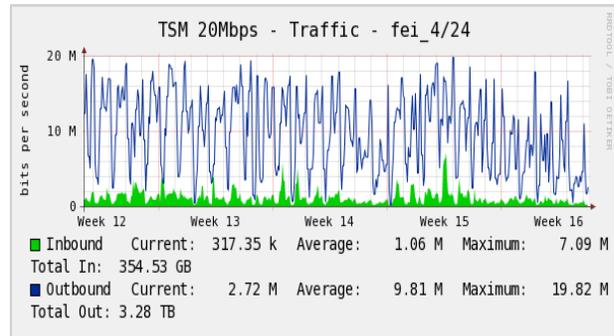


Fig 5. Weekly usage pattern of bandwidth utilization

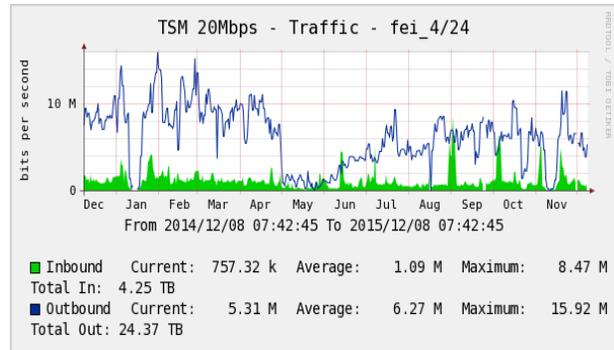


Fig 6. Monthly usage pattern of bandwidth utilization

Figure 7. Weekly Traffic Summary

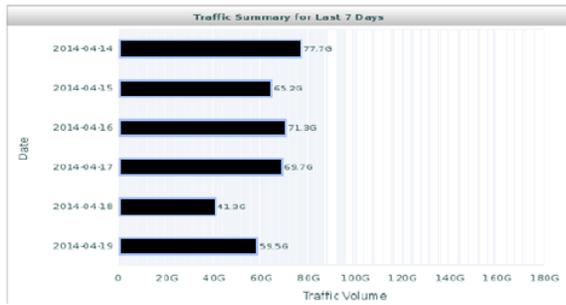
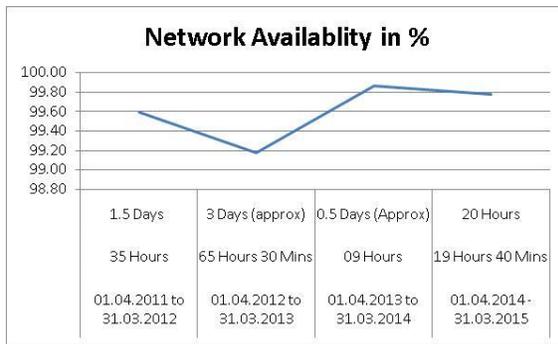


Figure 8. Network Availability



## V. Conclusion

In this paper the IT infrastructure management issues and challenges in SMEs are discussed. Issues and challenges are everywhere in normal life and no exceptions for IT infrastructure management. How fast we are addressing the issues and overcome the challenges is low risk for the SMEs. A textile mill is taken as a case study for better understanding of issues and challenges in real situation which is discussed in this paper. All round performance, updating of knowledge in all the IT domains and monitoring of all IT failures with alert facility provides an effective and better management of IT infrastructure in SMEs.

## References

1. Subhash Bhatnagar, "Getting Value from IT Investment: Experiences from Two organizations, IT in context: Studies from the perspective of developing countries", Ashgate Publishing, England, pp 83-95, 2000
2. Anandhi Bharadwaj, Omar A. El Sawy, Paul A. Pavlou, N. Venkataraman, "Digital Business Strategy : Toward a next generation of insights", MIS Quarterly Vol. 37, No. 2, pp 471-482, June 2013
3. P. Mohanan, "Understanding Corporate use of the internet in India, Delivering Service Quality: Managerial Challenges for the 21<sup>st</sup> Century", Macmillian India, 2000
4. Ramesh M Goyal, Ankur Goyal, "Securing WiFi Network", Center for Research and Prevention of Computer Crimes, Oct. 2008, ISBN 81-900385-6-7

5. Bob Anderson, "Structuring Meaningful SLAs for IT support", Computer Aid Inc, pp 35-37, CSI Communications, Dec.2008
6. Sheebha K, "A Journey through cryptography", CSI Communications, Vol. 37, pp 37-38, May 2013
7. P. Monica, "Open Source Technologies – A Boon for people in all fields", CSI Communications, pp 7, Vol.No.37, Issue No. 11, Feb 2014.
8. S.P. Mohan, "ICT News", CSI Communications, pp 34, Vol.No.37, Issue No. 11, Feb 2014.
9. Vishu Kankhere, "Information System – The new horizon for terrorism", CSI Communi. pp 11-13.Feb. 2009.
10. Jens Kr. Steen Jacobsen, Ana Maria Munar "Motivations for sharing tourism experiences through social media", Tourism Management, Volume 43, August 2014.
11. Ruth N. Bolton, A. Parasuraman et. al. "Understanding Generation Y and their use of social media: a review and research agenda", Journal of Service Management, Vol. 24 No. 3, 2013, pp. 245-267.
12. Beba Rakic, Mira Rakic, "Integrated Marketing Communications Paradigm In Digital Environment : The Five Pillars Of Integration", Scientific review paper, Vol. II, No I, (2014) 187-204.
13. Chaang-Iuan Ho, Meng-Hui Lin, Hui-Mei Chen . " Web users' behavioural patterns of tourism information search: From online to offline", Journal of Tourism Management 33 (2012) 1468-1482.
14. Khaiser Nikam, A.C. Ganesh, et. al. "The changing face of India: knowledge management for digital preservation", Library Review, Volume 53, Number 6 (2004) pp. 309-312.
15. Loanna Bizirgianni, Panagiota Dionysopoulou, "The influence of tourist trends of Youth Tourism through Social Media (SM) & Information and Communication Technologies (ICTs)", Procedia - Social and Behavioral Sciences 73 (2013) 652 – 660.
16. Xiaoyue Han, Lianhua Tian, Minjoo Yoon, Minsoo Lee, "A Big Data Model supporting Information Recommendation in Social Networks ", Second International Conference on Cloud and Green Computing (2012) IEEE, DOI 10.1109/CGC.2012.125.
17. Liran Einav, "The data revolution and economic analysis" Stanford University and NBER, Jonathan Levin, Stanford University and NBER 2014, National Bureau of Economic Research.