Computational Facilities and Web-Resources: Case Study of Large Private University with Fast-Growing Clients

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Abstract: Speed, space and judicious sharing web-related resources are the key indicators of successful management of the computing-facilities and other web-resources of any progressive organisation. Such a case becomes much more demanding for any professional academic institution, where the majority stake-holders, that is the young student-users of web-resources, are heavily dependent on web-based learning and personal communications. Other stake holders, like administrative staff, teaching and research community of universities have web-dependence, mostly for known resources. Fast growing dependence of different categories of stake-holders of such large institutes warrants a case-study research, so as to study the present pattern of uses of web-resources, including the timing and pockets of users, and then to have a sustainable strategic planning for a better resource-management of web-resources for future.

The present paper is a case study of a leading private university of Odisha (in India) with over 65,000 users of 'university web-network' and over 7500 fixed-systems, which analyses users' time-series data of last quarter and suggests a futuristic model for optimal and effective use of 'Institute Web-Resources and computing facilities'.

It studies both fixed-line load and load-management of wireless (Wi Fi) connections, across the 25 campuses of the Institute, scattered and geographically located within 15 sq. km.

Keywords: Web-Resource management, Web-resources, LAN, software-management.

INTRODUCTION

This paper is a case study of a leading private university of Eastern-India, with actual data obtained with due permission of the ICT-head and the management. It presents actual demand on ICT by stake holders. Speed, space and judicious sharing web-related resources are the key indicators of successful management of 'computing-facility' and the web-resources of any progressive organisation. Case becomes much more demanding for the professional academic institutions, where the majority stake-holders, that is the young student-users of web-resources, are heavily dependent web-based learning and personal communications. Other stake holders, like administrative staff, teaching and research community of Universities of course have web-dependence, mostly for known resources. Fast growing dependence of different categories of stake-holders of such large institutes makes the situation really very challenging.

Subject expert and researchers, like Subudhi (2013) and Hadjerrouit (2010), have mostly highlighted the urgent need of effective uses of web-resources of an institute as the key enabler of success. But hardly any literature gives in-depth, detail picture of uses and veracity and complexity of the very web-resources of any standard/ big educational institute, particularly in India. This present case study is expected to contribute, providing an authentic factual report of web-resource management of a big university.

KXT University is a reputed private university in Eastern-India, having over 70,000 users of ICT, directly or indirectly. KXT University ICT is the heart of Infrastructure facility for the fast growing institution, which strives to provide its users with the best of the services when it comes to their accessibility, automation, security & communication needs. Information Communication Technology (ICT) is a critical department to share knowledge at a fingertip and has become part of the present day society to catch up with the emerging trends and hold a lot of promise for posterity. It is accomplished by analysing each user's specific (and changing) requirements and then coming up with a customised solution.

Organizational Goal and Objectives

Changing the way of teaching, learning and networking by providing ICT infra platform to share large amount of information available on the World Wide Web, is the main objective, achieved by:

- adopting high standards of ethics in institutes business actions and practices
- providing our students, faculties & administrative staff with high quality services, solution tailor-made to their needs and expectations

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- guaranteeing highly competitive services to its all users
- engaging a highly skilled personnel supported by an effective organisational structure with effective tools
- implementing an 'equal opportunities' and 'environmentally friendly' policy
- prevention of pollution by responsible management of materials, reduction of emissions and waste and efficient use of energy and natural resources

Consultancy Services Provided by ICT

ICT cell has extensive experience in the delivery of consulting services targeted at developing, promoting, stimulating and supporting University users in setting up and running their IT environment and information systems. As an indication, consulting services involve many diverse domains.

Information Communication and Technology Services Details and Delivery: (ITIL)

ICT cell is a major provider of information, communication and promotional services, offering a complete package, from business to technical solutions and support to University:

- Provide 24*7 accesses to the institute community to the raceway of knowledge through high speed bandwidth. Meet the ICT needs of institute community by providing appropriate technical guidelines.
- Provisioning all the services as per ITIL standards.
- And many other related requirements.

ICT Cell of KXT University has robust facility and secure managed datacenter with Firewall, Unified Threat Management (UTM), Load Balancer, virtualized Blade Server supporting private cloud, hosted public cloud for mailing and office under SAAS mode, Servers (Tower & Rack), SAN Storage (SAS & SSD), NAS Storage (SATA), Tape Storage and Multi point Video Conferencing.

It is to facilitate Cloud-based Service, Virtualization Technologies (VMware, Hyper-V both windows and RHEL, Oracle Virtual VM box & KVM), End-to-end fully redundant data centre facility, on-demand Resource and Managed back-up services.

Network Accessibility is supported by its L2 and L3 network service with 10G Fiber, 1G Fiber and 1G Copper (Cat 6) links. It has a wifi 802.11 a/c ready network and Motorola canopy for 20 G and 10G Links. 2.88Gbps Internet bandwidth (dedicated and shared access) with 3 different ISP. It has a Link Load balanced ISP with Secured VPN access. It has Dark Fiber connectivity for 10G and 1G Intranet for running application Lync Online. It maintained a Active Directory (Load Balanced for all 20k user) for the students, faculty and staff members of the University.

It also provides Individual Ids under university domain, MS System Centre Configuration Manager, MS End-point Antivirus (Server Client base), MS Office 365 for Students, Open Source Software Services (Ubuntu, SCilab, Open-Office, Apache, etc.), QOS Bandwidth Management, Internet Download and Upload Management, Language Lab. with floating license, KIIT Live Web-streaming and CDN.

The road map of the IT Infrastructure of KXT University for the past 5 year's academic sessions are tabulated and given under Table **1**.

Networking

University has 10-1Gbps OFC / Ethernet connection from ICT Cell to all campuses except Campus I (RF link). It is a secured network and each user has authentication for accessing our network. Our campus network uses currently 250 VLANs can be extended to 1500 VLANS with current configurations. The networking switches which are used at different campuses are given in Table **2**.

Wifi Network

The Aruba Controller and access points which supports IEEE 802.11ac (1G) and IEEE 802.11n (2*300Mbps) are used in all the Hostels of the University to provide uuninterrupted internet access to the students for their academic and research works. Wifi and WLANs are provided, by using Motorola Access points to the academic and administrative buildings for faculty and staff members for their research and administrative works. The details of Access Points are as given in Table **3**.

Since the academic session 2015-16, the WLAN was converted to Wi-Fi. Aruba access points AP205 as a multifunctional and affordable facility (802.11ac

Table 1: Network Switches and Firewall

	Model	Qty	Session
Core Switch LIII			
Dlink7210	7210	1	2008-2013
Cisco	6509	1	2005-till date
CISCO	C6509	1	2013-2014
CISCO	C4500-10G(40 Ports)	1	2014-2016
Layer III switch			
CISCO	C3750X/C3750	4	2010-2011
	C3750X	2	2014-2015
CISCO	WS-C4500X-40X-ES	1	2010-2011
CISCO	WS-C4500X-40X-ES	1	2014-2015
Firewall/ UTM			
Juniper firewall	SRX 5600 +IPS	1	2010-2011
Juniper UTM	SRX650	1	2010-2011
Cyberoam	2500iNG	4	2013-2014
LINK LOAD BALANCER			
RADWARE	Link-Proof 2016 ODS2	1	2010-2011
Wifi Controller			
Aruba	7240 controller	1	2012-2013
Aruba	7240 controller	1	2013-2014
CPPM	Clear Pass Policy Manager	2	2015-2016
Cisco	Nexus 7009	2	2017-2018
Cisco	Nexus 3172PQ	2	2017-2018
Cisco	Firepower4120	2	2017-2018
Cisco	Nexus 3172T	2	2017-2018

Table 2:

Make/Model	Qty	Session
Aruba S2500	40	2015-2016
Cisco C2960	50	2014-2015
Aruba S2500	35	2014-2015
Aruba S2500	28	2013-2014
Cisco C2960s	34	2012-2013
Cisco 2960	160	2008-2016
Juniper EX2200	34	2009-2016
Aruba HP 2930F 24G POE+	116	2016-2017

Table 3: Access Point Details

Session	Make	Model	Specification	Qty
2010-2011	Motorola	5131	maximum 54Mbps data transfer rate, 802.11a/g radio, external antenna	200
2011-2012	Aruba	AP 93	One 2×2 MIMO dual-band 2.4-GHz or 5-GHz radio with internal antenna, with 802.11a/b/g/n	150
2012-2013	Aruba	AP 105	two dual-band 2.4-GHz and 5-GHz radios with 2x2 MIMO and four integrated omnidirectional down-tilt antennas with 802.11n	450
2013-2014	Aruba	AP 105	two dual-band 2.4-GHz and 5-GHz radios with 2x2 MIMO and four integrated omnidirectional down-tilt antennas with 802.11n	500
2015-2016	Aruba	AP 205	Dual-radio, 867MBps to 5 Ghz with 802.11ac leveraging two spatial MIMO streams	768
2017-2018	Aruba	AP 305	Dual-radio, 1300MBps to 5 Ghz with 802.11ac leveraging three spatial MIMO streams	384
2017-2018	Aruba	AP 315	Dual-radio, 1733 MBps to 5 Ghz with 802.11ac leveraging four spatial MIMO streams	128

Table 4: Laptop Requirements Statistics

Session	Make	Make and Model	Specification	Qty
2010-2011	Lenovo	Think pad L412	Intel Core i3, 4GB DDR3 RAM, 320GB HDD, 14” Display	3477
2011-2012	HP	Pro-book 6460b	Intel Core i5 Processor i5-2540U, , (2x2) 4 GB DDR3 1600MHz RAM, 500GB HDD, Monitor 14” HD Display	4322
2012-2013	HP	Pro-book 4440s	Intel Core i5 Processor i5-3360m, , (2X4) 8 GB DDR3 1600MHz RAM, 500GB HSDD, Monitor 14” HD Display	4600
2013-2014	Acer	Aspire V7-Ultrabook (Touch Screen)	Intel core i5 processor i5-3337u, (4X2) 8 GB DDR3 RAM, intel HD 4000 graphics, 500GB HDD+20GB SSD, 14” HD with touch screen	5000
2014-2015	HP	Pro-book 440 G2 (Touch Screen)	Intel Core i5 Processor i5-4210U, AMD 4600 Graphics,2X4 GB DDR3 1600MHz RAM, 500GB HSDD, Monitor 14” HD Display with touch screen.	4100
2015-2016	DELL	Latitude 3450 (Touch Screen)	Intel Core i5 Processor i5-5200U, 2X8 GB DDR3 1600MHz RAM, 1 TB HSDD, Monitor 14” HD Display with touch screen.	6000
2016-2017	Lenovo	Think-pad Yoga460	Intel Core i5 Processor i5-6200U, 8 GB DDR3 1600MHz RAM, 16GB SSD ,1 TB HDD, Monitor 14” FHD IPS Display with touch screen. 360 degree rotation hinge	6000
2017-2018	HP	Pavilion X 360	Intel Core i5 Processor i5-7200U, 8 GB DDR4 1600MHz RAM, 128GB SSD,1 TB HDD, Monitor 14” FHD IPS Display with touch screen. 360 degree rotation hinge	6000

wireless APs maximize mobile device performance in medium-density environments).

Laptops and Desktops

Each year KXT University is procuring the new laptops for their students and staff members, with latest configuration which enables the students and staff members as learning and teaching aid. Not only the number but also the specification of laptop procured was increased exponentially year by year. The session wise list of the laptop with specification is given under Table **4**, as above:

In the above table it is cited that KXT is the first university to procure the ultra-book with touch screen in 2013. After that KXT used to procure the touch screen in 2014, 2015 and 2016. As far as the processor is concerned, the laptop is of i5 processor since 2012 and the generation of processor increase year by year. The RAM increased from 4 to 12 GB, hard disk space increased from 320GB to 1TB. KXT University used to

Table 5: Desktop Requirements

Session	Make	Model	Specification	Qty
2010-2011	Acer	Veriton (M200-H57MT)	Intel Core i3 processor i32.93Ghz, intel H57 express chipset, intel HD graphics,2x2 GB DDR-3 RAM@1333MHz, 320GB SATA HDD, 17" TFT Monitor	1000
2012-2013	Lenovo	M72e (TINY)	Intel Core i3 Processor i3-2120T, Intel H61 express chipset, Intel HD Graphics, 2X4 GB DDR3 1600MHzRAM, 500GD SATA HDD, Monitor 18.5 inch	1800
2012-2013	Lenovo	M72e (Tower)	Intel Core i3 Processor i3-2120T, Intel H61 express chipset, Intel HD Graphics, 2X4 GB DDR3 1600MHzRAM, 500GD SATA HDD, Monitor 18.5 inch	200
2014-2015	Lenovo	M73(Tiny)	Intel Core i3 Processor i3-4570T, Intel H81 Express chipset, Intel HD 4600 Graphics,2X4 GB DDR3 1600MHzRAM, 1TB SATA HDD, Monitor 19.5 inch	250
2014-2015	Lenovo	P300 (Workstation)	Intel Core i5 Processor i5-4460, Intel C226 chipset, AMD Firepro W2100 with 2GB Ram Graphics,2X4 GB DDR3 1600MHzRAM, 1TB SATA HDD, Monitor 19.5 inch	250
2016-2017	HP	Pro-Desk400G2	Intel Core i5 Processor i5-6500T Quad-core, Intel H110 chipset, 2X4 GB DDR4 2133MHzRAM, 1TB SATA HDD, Monitor 21.5 inch	1250

have better laptop year by year. Around 17,100 laptops are used all over the University by the Students, Staff Members of the University.

Desktops are procured as and when required, with changing specifications of the desktops are given under Table **5**.

The numbers of desktop labs located at different campuses of the University is given in Table **6**:

Using the data, as made available by University ICT cell, following graph (in Figure **1**) shows gradual growth in demand and uses of computing facilities of the University. Figure **2** shows bandwidth and number of users of computing facilities of University.

Internet Connectivity

- 10Mbps internet connectivity from BSNL since 2010
- 20Mbps internet connectivity from Bharti on 2011-2013
- 1Gbps Internet connectivity from NKN (under NMEICT)
- 80 Mbps (upgraded from 20Mbps above) on 2013-14
- 100Mbps internet connectivity from NKN
- 1Gbps internet connectivity from Bharti
- 150Mbps internet connectivity from Vodafone
- Above is upgrade to 170Mbps(year 2017)
- 5Mbps internet connectivity from Reliance communication ltd.
- 6Mbps internet connectivity from Ortel Communication ltd.
- 600 Mbps (Upgraded from 80Mbps) internet connectivity from Bharti Airtel Ltd. In 2014-2016
- 1000 Mbps internet connectivity from Bharti Airtel Ltd. in 2015-2016

KXT University used to increase the bandwidth year by year. Currently KXT is having a dedicated internet connectivity of 2881 Mbps.

- Bandwidth Per user 512-1048 Kbps shared
- All users are assigned unlimited access to internet & intranet
- All wi-fi & wire LAN users have 1 GB access

Video Conferencing

The video conferencing device is used for video conferencing with other campuses and campus interviews. For the session 2014-2015 KXT procure and installed 10 number of Video conferencing device of Cisco SX20 in different school of University.

Table 6: LAB-Wise Desktop Distribution

Name of the School	Location	QTY
School of Technology	CSP LAB-1	81
	CSP LAB-2	62
	SIMULATION LAB-1	100
	LANGUAGE LAB	58
School of Management	LAB-1	66
School of Electronics	DSP Lab	60
	VLSI / EMBEDDED LAB	68
	NI Lab	42
	Simulation Lab	100
	MICROPROCESSOR LAB	20
	Communication Lab	10
	Digital Lab	12
	Analog Lab	12
	WCN Lab	40
	Design &Thinking Lab	10
School of Computer Science	DL-1	96
	DL-2	72
	DL-3	72
	DL-4	108
	DL-5	48
	DL-6	96
	DL-7	84
	DL-8	96
	DL-9	84
	Research Lab	82
Campus-14	Lab (Two numbers)	90
School of Mechanical Engineering	CADD Center	42
	CIM Lab	10
	Siemens Lab	50
	CAD LAB	48
	NEW CAD LAB-1	48
	NEW CAD LAB-1	20
School of Computer Application (SCA)	Lab-1	77
	Lab-2	77
	Graphics Lab	30
	Project Lab	21
School of Law	Lab-1	50
	Lab-2	60
Kalinga Polytechnic	Lab-1, Computer Lab	90
	Lab-2, CADD Lab	30

(Table 6). Continued.

Name of the School	Location	QTY
KIIT International Lab	LANGUAGE LAB	32
	Jr. Computer Lab	28
	Sr. Computer Lab	31
School of Rural Management	LAB	58
Campus-6 Lab	LAB	487
KSBT Lab(In process)	LAB	63
Architecture Lab(in process)	LAB	66
Campus-3 KISS	LAB	120

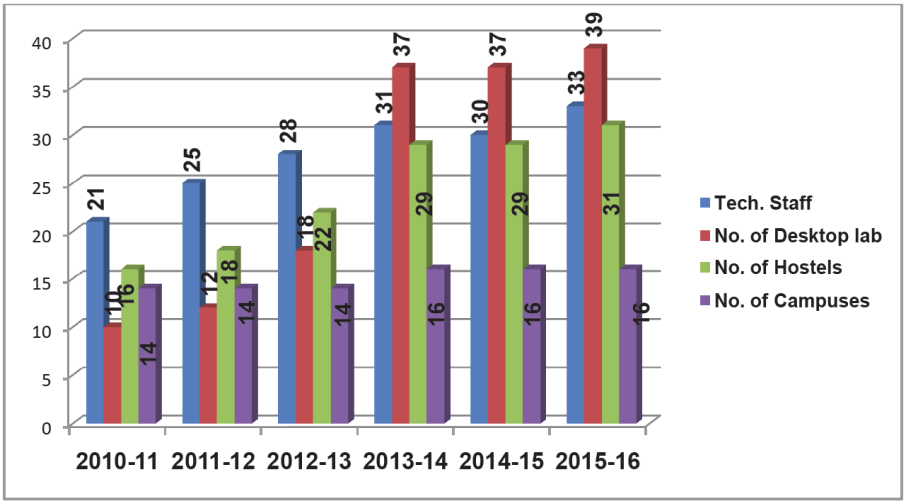

Figure 1: Man Power Vs Computing facilities.

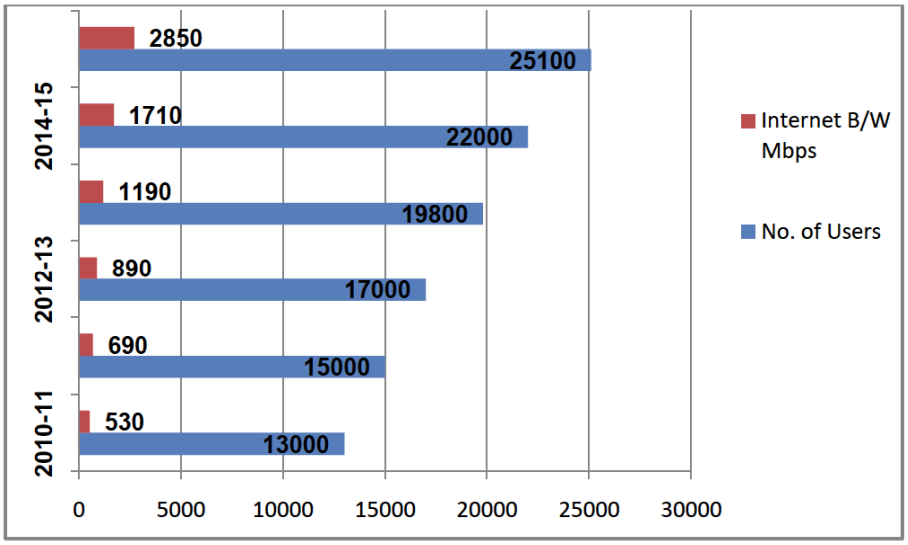

Figure 2: Bandwidth and number of Users.

Biometric Devices for Staff Student Attendance

Almost all academic, hostel areas are having Biometric devices to capture attendance of individuals to maintain proper academic transparency and associated with a parent and mentor messaging systems to update the status of the student on daily basis.

SAP Implementation

KXT University has used all the modules of SLCM implemented at Data Centre premise with Private Cloud accessible to all its stake holders.

Webservers now hosted are as follows:

http://kiit.ac.in/

http://ksac.in/

http://kiitalumni.in/

http://kims.ac.in/

www.kiit.tv

www.kiitworld.net

SLCM under kiituniversity.net domain

and 50 more (other) domains

Mail servers: The capacity of the users is as follows:

Domain Name	Capacity (Total no of Users)	Space on cloud per user
Mail.kiit.ac.in	31839	30 GB including google office
Mail.ksom.ac.in	8000	30 GB including google office
Mail.ksrm.ac.in	2000	30 GB including google office
Mail.kiitbiotech.ac.in	3000	30 GB including google office
Mail.kls.ac.in	2000	30 GB including google office
Mail.kims.ac.in	5000	30 GB including google office
Mail.kiss.ac.in	2000	30 GB including google office
Kiitmail.in (portal.microsoftonline.com)	27000	25GB including office 365

Surveillance Facilities of KXT University:

KXT UNIVERSITY is covered with surveillance camera and security monitored round the clock by security team. All cameras are IR inbuilt which can support to zero lumens. The hostels, academic buildings, classrooms and labs of the university are covered by our surveillance covered. The quantities, added session wise, are as follows:

Session	Type of Camera	Make	Model	Qty
2010-2011	IP Camera			264
2011-2012	PTZ camera	Samsung	SNP3301HP	50
2012-2013	Analog Camera	LG	L6213R	532
2013-2014	Analog Camera	LG	LCV5300R	1041
2014-2015	Analog Camera	LG	LCV5300R	358
2015-2016	Analog Camera	LG	LCV5300R	690
2015-2016	IP Camera	HV	2MP	185

Currently, the demand of integration, analytics and converting of all analog system with IP based surveillance is under progress,

Live Web and Mobile Streaming

KXT University streaming its programs, events, annual convocation and many other events for web as well as for mobile user. The achievements are also available at www.kiit.tv. KXT is using this platform for streaming all important events and programs since the year 2012.

Challenges

Growing demand is always an expected challenge, which has to be met within a limited budget but at an acceptably limited/ stipulated time frame. Challenges can broadly be listed as:

a. Ever growing demand of new services

b. Mobile computing

c. More numbers of applications lunching in existing platform

d. Budget verses Performance

e. Man Power retaining

Solution and Recommendations

ICT Cell creates a Dynamic Roadmap for next two years for applications and five years for core Network and Server augmentation/ revamping technology changes. This strategy is adopted since 2012 to 2015 and now it is revamped/ revisited gain, this academic year 2017-18. Following are the notable solution-recommendations:

a. Instead of Buying bandwidth, cashing solutions (http) in 2015 and planning to have https cashing in 2018 be adopted.

b. Platform was mobile ready since 2014 but currently, it is developing apps for LMS, Mentor Mentee and Online Exam solutions with collaboration of third party solution providers. Integration of Biometric attendance system is a major achievement in academics, publication and evaluation of results online makes the system transparent and trust worthy.

c. Easy access with interesting GUI for stakeholders is the key with which the current applications are developed.

d. Use of open source and proprietary software in proper balance is the solution that suits budget and also creates balance with Performance and need of course curriculum. Virtual Platform helps managing licence costs.

e. ICT cell provides special training to upgrade existing technical staff and retain them mostly. But in some niche area out sourcing and tie-ups with third party service providers is preferred and adopted to keep uptime 99.99% high. Continuous up gradation and training requirement are key focus points.

CONCLUSION

In case of any educational Institution, IT plays important backbone of development and delivery in the back ground of all services silently. But the spiralling current demand warrants special attention by the top level management. Administrative support for planning independently, for all policy frame work, creating effective support system, is expected. This paper is intended to provide insight for all similar Institutions, aspiring to self-manage and fulfil their goals and objectives, through proper management of web-resources and ICT services.

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