BANGLADESH: SECONDARY EDUCATION SECTOR INVESTMENT PROGRAM (SESIP)

L3047-BAN

TERMS OF REFERENCE

for

Technical Support for ICT Learning Centers (ILC) Network Operations (SD-10)

A.   Program Background

1.   The Secondary Education Sector Investment Program (SESIP) was approved by Asian Development Bank's Board on 27 September 2013. Periodic Financing Request 1 (Tranche 1) for $90 million (2013–2017) was approved by the ADB President on 21 October 2013. The loan became effective on 06 December 2013. The government's Development Program Proposal (DPP) was approved by the Executive Committee of the National Economic Council on 29 October 2013.

2.   SESIP supports secondary education in Bangladesh over 10 years, using a multi tranche financing facility (2013–2022). SESIP will support the implementation of key reforms envisaged in the National Education Policy (NEP), 2010 in a phased manner. The MOE has approved a 10-year Secondary Education Sector Road Map for implementation of the NEP. SESIP will also adopt a sector-wide approach that supports a government-led common secondary education program framework with enhanced harmonization of ADB and other development partner's assistance. The Ministry of Education (MOE) is the executing agency and the Directorate of Secondary and Higher Education (DSHE) is the implementing agency.

3.   Under Output Area 1.4. "Enhanced Use of ICT for Pedagogy" the ICT infrastructure will be created in 640 schools to provide a technical platform (equipment, operating systems and utilities) for an integrated system of software applications to support e-learning, such as: creation of multimedia materials; use of repository of e-learning materials; office productivity – document editor, spreadsheets, slide presentation; website authoring tools; email; Internet browsing.

4.   Other relevant e-learning activities have been completed or are being implemented by SESIP's GD-4 contract (ILC infrastructure), Second Teaching Quality Improvement in Secondary Education (TQI II), Secondary Education Quality and Access Enhancement Project (SEQAEP), British Council, English in Action, Primary Education Development Program (PEDP) II and III, Access to Information (A2I) and BRAC Education Program to mention a few. Consultation with TQI II is especially important as they are planning to develop e-learning materials for Grade 6 on 16 subjects and also for Grades 9 and 10.

5.   NCTB is the main co-implementing partner to work closely together with in the area of effective usage of ICL facilities and determining user requirements (ANNEX1 and ANNEX2) and technical support for operations of ILC. Also the DSHE Training Wing and local entities like TTCs are important partners when it comes to training and continuous professional development of teacher trainers, teachers and administrators in the field. DSHE Secondary Wing and M&E Wing will be implementing partners for monitoring.

B.   Purpose and Objective of the Assignment

6.   The purpose of this Service Package SD-10 is the selection/development and installation of appropriate software applications (see ANNEX1: User Requirements for more details), security settings, proper configuring of laptops (Windows 10) and server systems. It means setting up the enable/disable system options, user profiles and accounts, allocation of work storage for teachers and students, utilities for organizing, monitoring, and reporting the usage of the system, and maintenance of Repository of E-Learning Materials (RELM). These are the tasks of creating the software architecture for entire network of ILCs and the Central Node at DSHE. The work requested in this Terms of Reference is the creation of proper software system architecture and a plan for continuous technical support for ILC operations (effective use of software and data/information/e-learning resources, and provision of operational instructions for students and teachers).

7.   The overall objective of the work is to have fully functional and sustainable ICT Learning Centers in 640 schools as a seed network for the introduction of ICT in the pedagogical process and development of ICT skills by students and teachers in entire secondary level education in Bangladesh in the future.

8.   The expected outcome of the work is that all secondary schools will join gradually the network based on the experiences of the seed ILC network. If direct Internet connection is not available, the schools will be able to use the repository of e-learning materials in off-line mode of operations. It means access to resources on the LAN server.

C. Implementation Arrangements.

9.   A firm/organization will be engaged through National Competitive Bidding (NCB) by Directorate of Secondary and Higher Education (DSHE) on open tender using Quality and Cost-based Selection – Full Technical Proposal (QCBS-FTP 90:10) to undertake the software architecture development. The firm will support SESIP with assistance and coordination from the SESIP Sector Program Support Unit (SPSU) and consultant staff. Main counterparts are NCTB, Team Leader and Deputy Team Leader of SESIP and the international and national e-learning specialists. Other consultants will support as needed.

10.   The ILC software architecture and technical support for ILC network operations will be developed based on the logical model described in Annex 1 and in accordance with industrial standards and relevant ISO requirements for software maintenance and security. The arrangement of technical support will take into consideration diverse conditions of operations in different locations, such as unreliable power supply and intermittent connectivity, insufficient computing knowledge and skills of users to solve complex technical problems, needs for diverse channels of communication – telephone, e-mail, local ICT specialists, SKYPE chat, Users' Forum website and Help Desk, and Frequently Asked Questions (FAQ) facility implemented in Bengali.

11.   The duration of the consultancy will be for a total of 15 months [Subject to the extension of existing loan closing date (31 December 2017)], with roughly four-month allocation (**First Phase**) for selecting and/or developing application software, including the search engine for the Repository of E-Learning Materials. The selection of application software will be in addition to a standard application package of Windows 10 or Network Operating System. The result of this phase will be setting up of the Windows 10 (appropriate

options and permissions for laptops) and setting up the server-based software and NOS parameters. The next three-month allocation (**Second Phase**) will be for testing the configured ILC software system in 2-3 schools and generating the master copies of software architecture for the server and laptops, and developing the concept of technical support and compiling operational instructions for system administrators and users of applications. In the following three months (**Third Phase**) the application architecture will be installed in the entire network including 640 schools and the central DSHE Node, and operational instructions delivered. In the next period (**Fourth Phase**, 5 months) the firm/organization will provide the technical support for the ILC network operations including the maintenance of application software and user support facilities as mentioned above. At the end of the Forth Phase the firm/organization will deliver a plan/business model for continuous technical support and training needs for ILC network expanding in the following years.

The location of the assignment will be Dhaka for the First and Second Phase. The consultant firm will provide their own facilities for carrying out the work. Some temporary working space will be arranged also for counterparts from NCTB or SESIP when/if working with the Consultant. Individuals of the firm team members will visit NCTB as needed, and adequate work space will be provided in NCTB, if needed. In the following phases the main location of the assignment will be Dhaka with field visits related to installation and testing of the software architecture and in some cases as a direct technical support in the field.

12.   In terms of scope of work, it should encompass all technical and organizational issues concerning the entire functionality (application software) required to meet user needs in regard to objectives of ICT in pedagogy and acquiring basic computing skills. It means the use of e-learning materials by teachers and students and performing common tasks such as using email, browsing the Internet, communicating via SKYPE, using the office productivity tools, and eventually learning the processing of media objects (video, audio, animation) and creating a school website.

13.   **The scope of work includes (but is not limited to if additional activities/expertise is needed to achieve the assignment objective) the following elements:**

Repository of e-Learning Materials (RELM) and applications installed on laptops;

•   Adapt, or develop the application for maintenance and usage (search engine) of repository of e-learning materials on the LAN server – based on the software and e-learning materials (6 subjects) delivered by NCTB (SD-13);

•   Create a master copy (installation module) of repository application (software) and the repository content (collection of e-learning materials and other related documents such as curriculum guides) to be installed and periodically updated on each ILC server;

•   Create a master copy (disk image) of Windows 10 and individual user software applications (laptop) to be replicated on each laptop;

•   Provide operational instructions for teachers and students for using the e-learning materials repository in collaboration with NCTB (SD-13).

Configuration of server-based applications and user accounts maintenance software:

- Design and implement the user accounts maintenance module:
  Creation, Update, and Removal of user accounts including allocation of work storage for each user and individual permissions to use server-based applications;

- Configure the security options including the control of access to websites from laptops and other devices allowed to connect to the server (authentication facility);

- Configure server-based applications developed by SD-13 and facilities such as Web authoring tools, Proxy Server, Email Services, Print Services, File Services, Backup Facility;

- Develop the concept of providing the technical operational support for all ILCs and the Central Node and provide effective technical support following the installation of application software and distribution of operational instructions.

D. Scope of the Service

14. **The activities to be covered under the scope of the review are:**

   a. **During First and Second Phase**, the consultant's team members will work with experts appointed by SESIP, comprising experts covering e-learning methodology, member of the consultant's team of SD-13, local telecommunication and computer networking experts, and telecom regulatory agencies. This group of experts will help to determine feasible, reliable, and acceptable solutions regarding the technical feasibility of large network of networks for schools (telecom costs) and regulatory issues applicable to the access to Internet resources by students. The consultant's Team Leader will be responsible for coordination with other SESIP and TQI programs, software suppliers (e.g. Microsoft) and other agencies in regard to availability of required application software, information resources (e.g. e-learning materials), and operational support.

   b. During the **Third Phase** the application software (replica of Master Architecture) will be installed in all 640 schools and the facilities for technical operational support activated and provided continuously over the period of 5 months **(Fourth Phase)**. Lessons learned will allow for development a plan/business model for permanent support facilities for the ILC network;

   c. The roles and responsibilities for DSHE Secondary, Training and M&E Wings during implementation of all phases will be determined during implementation, and mainly be related to quality and dissemination of operational instructions and technical support;

   d. The contracted firm/organization will develop or acquire all requested application software and information resources needed to achieve expected result – fully functioning network of ILCs supported by effective technical assistance. Issues related to Copyright have to be clarified at all stages of the work;

   e. The firm/organization must deliver in a proper form all master copies of properly configured software architecture of server and laptop to be reliably installed in existing and future hardware installations. The copyright will be with MOE.

15. **The sources of information are:**

   a. SESIP's document "ICT LEARNING CENTERS Program Implementation Plan";
   b. Documentation regarding the production of e-learning materials (SD-13);

c. Other relevant sources of information concerning ICT and computer networking available with MoE and DSHE may be used.

16**.** **An Inception Report** will be presented by the firm/organization before the end of the second month, comprising any changes proposed to the TOR, a detailed time plan and milestones for deliverables. A mid-term report will be presented by the end of the eighth month with presentation of the status and results of the development of the ILC network software architecture and operational support.

17. **The following specific activities will be undertaken:**

a. **First Phase**, including: review of pertinent documentation and development and presentation (diagram format with written explanations) of a conceptual model of software architecture (components and relations between them) for the ICL network - at server and laptop levels;

b. Selection and testing of commercial, free and developed in-house software applications to be integrated in the ILC network software architecture.;

c. Assembly of complete software architecture and determination/documentation of configuration parameters and execution options at the operating system level and application usage (update, upgrade, permissions to use specific facilities, etc.).

d. Regularly discuss progress and feasibility of proposed software architecture and operational support for ILC in order to make effective use of ILC facilities, mostly informally, with NCTB, DSHE, SPSU, and SESIP Team Leader and E-Learning/ICT consultants;

e. **Second Phase**, including: generation of master copy (after extensive testing) of software architecture for ILC server and laptops, including setup of all options for execution, upgrade, and update. Compilation and printing of operational instructions for all components of software architecture. Report on assessment of required technical support for ILC operations.

f. **Third Phase**: including: arrangement of software architecture installation and testing, populating the user accounts and other databases, setting up user email accounts, and other system administrative setups. Reporting on installation results and readiness for full operations of ILC.

g. **Fourth Phase:** including: regular (monthly) reports on technical support activities and performance of ILC from the point of view of use in pedagogy (teaching and learning).

h. Deliver a plan/business model for continuous technical support and training needs for ILC network expanding in the following years (2018-2023).

i. Preparation of Draft Final Report with findings, recommendations and justifications for any proposed changes. All materials should be annexed, where possible on DVDs and/or with links to web pages, and;

j. Presentation of the Final Report, incorporating any comments on the draft report.

E.   Consultant Requirements:

Positions (all national)	**Estimated Person-Months Over period of 15 months** (Subject to extension of existing loan closing date (31 December 2017)
Team Leader/Software Architect	8
Network Manager	10
User Support Specialist/WLAN	8
Web-based Applications Developer x 2	16
User Support Facilitator (Help Desk, Users' Forum)	8
Total	**50 months**

18.   **The eligibility of the firm is described below. The firm/organization must have:**

1.   5 years-experience on a) WLAN design and implementation, b) Networking and Application software integration;

2.   A track record and in-house expertise on designing and providing technical support to users of WLAN networks and laptop software usage (MS Windows environment including 1-year experience in using Windows 10);

3.   Experience on designing web based fast-track technical support platform with ticketing system for ensuring quick solutions of technical problems to the computer classrooms, and other user support facilities;

4.   In-house expertise in developing and implementing software systems for educational environment including schools at the secondary level in Bangladesh;

5.   The selected firm must have experience on designing business models to propose permanent solutions for technical operational support for the network of ILCs.

6.   High level expertise in configuring WLAN server and laptops (Windows 10) used in WLAN architecture.

19. **Qualifications and Experience of individual experts and related tasks are as follows:**

i. **Team Leader/Project Manager: national: Eight (8) months**

Qualification and Experience:

Master's Degree, preferably in Education including E-Learning/ICT, from a recognized University, having 10 years of experience in Project Management with emphasis on the application of ICT in education sector, of which five years in development partner funded projects/programs.

Tasks:

The main task of the consultancy assignment is to provide high quality environment (integrated software system and technical support for users) for E-Learning at the secondary level of education. Therefore, the TL will lead, guide and support the team with necessary oversight for all related activities including undertaking exchange of views and sharing information with other experts of the program and representatives of the Client. The tasks, among others, will include effective planning, management, top level software architecture conceptualization, coordination and reporting of all work.

The detailed tasks shall be:

- establish the team, coordinate, and monitor communication with specialists and counterparts from DSHE and NCTB as well as other players for obtaining all required technical information and collection of e-learning materials;
- prepare plan and timetable for the work related to all phases of the project;
- guide, monitor and supervise the team in detailed planning and implementing the project activities;
- guide the team and contribute to the development of the concept of ILC operations including the selection of application software, development of the repository of e-learning materials (6 subjects (SD-13) and additional materials, and arrangement of technical support for users of ILCs;
- ensure high quality of all outputs;
- provide oversight and monitor the progress of ILC software system integration;
- participate in meetings, and;
- prepare inception and progress reports.

ii. **Network Manager: Ten (10) months**

Qualification and Experience:

Master Degree, preferably in ICT – Computer Networking or equivalent practical expertise in network management and software installation. At least 3 years of

experience in network management and user support and deep understanding of wireless connectivity.

Tasks:

The main task of the consultancy assignment is to provide high quality environment (integrated software system and technical support for users) for E-Learning at the secondary level of education. The core of the system is a Web-connected network of networks (school WLANs connected via Internet and supported by the Central Node at DSHE). This architecture requires well defined and robust procedures for maintaining the network, proper setup of user profiles and system and application configurations (permissions, options, etc.), and providing effective user technical support.

The detailed tasks shall be:

- support the Team Leader in planning the installation of application software and technical support for users;
- design, implement, monitor and review school procedures for managing and recording software installations and configuration changes;
- implement the ILC's security and back-up systems and plan disaster recovery;
- contingencies to enable an efficient return of service after any unforeseen system outages;
- set up and maintain the schools Anti-Virus system;
- set up manage Internet access filtering, email filtering and related monitoring systems;
- set up and maintain user registry;
- communicate with network engineers responsible for hardware and NOS infrastructure installation and maintenance;
- keep a log of all technical faults in the network;
- work to improve the helpdesk and technical support for users;
- ensure all school ICL systems are fully operational;
- take responsibility for Data Protection issues;
- development a plan/business model for permanent support facilities for the ILC network;
- provide feedback on training needs.

iii. **User Support Specialist/WLAN: Eight (8) months**

Qualification and Experience:

Bachelor's degree in computer science or information systems from a recognized University, having minimum 3 years of experience working as a computer support specialist, preferably in educational environment. Skills: excellent knowledge of computer networks, maintenance; excellent knowledge of Microsoft windows; aware of web authoring tools; ability to work in a team; excellent communication and interpersonal skills.

Tasks:

The main task of the consultancy assignment is to provide high quality environment (integrated software system and technical support for users) for E-Learning at the

secondary level of education, based on ILC network. Therefore, the User Support Specialist, in close cooperation with Network Manager, will design, develop, and deploy the technical support system for diverse categories of users, and contribute to development of a plan/business model for permanent support facilities for the ILC network.

The detailed tasks shall be:

- devise a system (conceptual model) for providing help and advice to people and schools using the ICT Learning Centre, including assisting with usage of E-Learning Materials Repository, application software, Internet browsing, school website development, e-mail, and operating systems;
- contribute to development a plan/business model for permanent support facilities;
- oversee the daily performance of ILCs and user support;
- answer users' questions about computer software or hardware operations to resolve problems to make sure the system runs correctly and to detect errors;
- refer major hardware or software problems to Team Leader and DSHE authorities.

iv.   **Web-based Applications Developer x 2:   Sixteen (16) months**

Qualification and Experience:

Master's Degree in computer science or information systems including E-Learning, from a recognized University, having 4 years of experience preferably in Web technologies/programming languages, web interface design, connecting web front ends to back-end, databases management systems, and object-oriented software design practices is essential.

Tasks:

The main task of the consultancy assignment is to provide high quality environment (integrated software system and technical support for users) for E-Learning at the secondary level of education. Therefore, in collaboration with other software developers, business analysts and software architects to plan, design, develop, test, and maintain web based applications required by ICT Learning Centres, in particular the Repository of E-Learning Materials. Support the design and creation of school websites.

The detailed tasks shall be:

- develop/adapt software for the management of the Repository of E-Learning Materials (add, delete, edit, search);
- lead in the development of model school website (user requirements, features, security, etc.);
- produce guidelines and standards for development of school website;
- recommend and adapt/develop software solutions for user support facilities (e.g. Helpdesk, FAQ, Technical support Ticketing system, Users' Forum);
- integrate applications by designing overall software architecture for ILC (server and laptop) and setting up defaults and options for serve and laptop software;
- provide advice to Team Members in regard to selection of Web technologies and application integration.

v. User Support Manager/Facilitator Eight (8) months

Qualification and Experience:

Bachelor's Degree, in computer science or information systems from a recognized university, having minimum 4 years of experience preferably working as a computer and networking support specialist, preferably in educational environment. Professional skills include: strong communication and customer service skills, including the ability to communicate effectively with a nontechnical person about technical issues and patience to deal with frustrated customers; ability to follow detailed instructions and organizational skills; problem solving skills and willingness to learn all the time; ability to work independently and as part of a team.

Tasks:

The main task of the consultancy assignment is to provide high quality environment (integrated software system and technical support for users) for E-Learning at the secondary level of education. Therefore, with network manager ensures the stable operation of the ILC network, managing user requests for technical assistance and assuring that local technicians will provide needed services. Based on the initial experiences and lessons learned the User Support Manager/Facilitator will develop in collaboration with the entire team a plan for long-term sustainable technical support for growing ILC network and provide recommendation for future training of users and school WLAN administrators.

The detailed tasks shall be:

- devise a system (conceptual model) for providing help and advice to people and schools using the ICT Learning Centre, including assisting with usage of E-Learning Materials Repository, application software, Internet browsing, school website development, e-mail, and operating systems;
- manage security solutions, ensure the rigorous application of security/information policies, principles, and practices;
- organize and manage the help desk and provide a single point of contact for users in need of technical support;
- explore possible modalities of user technical assistance (Users' Forum, FAQ);
- contribute to development a plan/business model for permanent support facilities;
- advise management and users;
- develop and provide recommendations for user support policy.

ANNEX1: User Requirements and Functionality Summary

The purpose of the user requirements and functional specification is to determine teaching/learning activities of users of ICT Learning Centres and the application software that will be necessary to support the activities and provide safe and reliable system for users.

The analysis of user requirements is based on available information in DSHE, NCTB, TQI and NAEM documents, materials from dNet, KOICA, visit to schools and selected documents from international sources. The guiding principle for requirements analysis and functional specification is the identification of practical and effective solutions suitable for ILCs operating in different environments.

The scope of this document is limited to short descriptions of users' (students and teachers) activities directly related to teaching and learning and suggestion of which application software is needed without specifying detailed functionality and technical data of applications.

User Categories

In addition to distinguishing two main categories of ILC users – students and teachers, we identify user categories taking into consideration different levels of computing skills, differences in learning capability of students, teaching practices and experience, appreciation of new technologies, and willingness to engage in some extra work. This may help determine options for functionality of the system and diversification of application software.

The following **categories of ILC users** are identified in this document:

- **A. Teachers**
    - A1. Basic level computing skills
    - A2. Intermediate level of computing skills and interest in ICT for Pedagogy
    - A3. Experience in using computer and software suitable for educational environment

- **B. Students**
    - B1. No computing skills and no usage of computer
    - B2. Basic level computing skills
    - B3. Intermediate level of computing skills and ability of independent use of computer
    - B4. Higher grades students who at school and through self-learning acquired computer skills allowing for independent work in such areas as multimedia processing, web page creation and website maintenance, and laptop operating system (Windows 10) utilities.

- **C. Local ICT Specialists** (Local Technical Support Staff or trained Teachers who will be also the first level LAN administrators)
    - C1. Self-trained teachers interested in ICT
    - C2. Teachers or local ICT specialists who studied ICT or are certified ICT engineers

Diverse levels of computing skills and communication capabilities of users impose a challenge for selection of proper application software and setting up an effective technical support system.

We expect that the functionality of installed ILC software architecture will provide a working environment suitable for each category of users and collecting valuable data about users' and ILC performance as a whole to support decision- making in regard to improvement/enhancement of ICT use in pedagogy and sustainability of the ILC network.

User Login and User Profile

User registration will require:
- Registration form in Bangla
- Input of essential data about the user (e.g. full name, user category as specified above, grade for students, level of computing skills, level of proficiency in English, …)
- Automatic generation of User Name and Password to be used to login on laptop.

Note1: *A need for more detailed profile data and interface with EMIS in this regard must be discussed before the technical design of the software system for ILC.*

The user profile data will be linked (if useful) with the record of user activities in the system such as use of e-learning materials, email, Internet browsing, use of storage space, and if useful the use of available applications (office productivity, multimedia processing).

ILC-WLAN System Architecture[1] and User Requirements

An architecture description is a presentation that comprises specifications of system components, the externally visible properties of those components, the relationships (e.g. the behavior) between them, and provides a plan for procurement of products and services, that will work together to implement the system.

A wireless local area network (**WLAN**) is a wireless computer network that links two or more devices using a wireless distribution method within a limited area such as a home, school, or office building. This gives users the ability to move around within a local coverage area and still be connected to the network, and can provide a connection to the wider Internet. Most modern WLANs are based on IEEE 802.11 standards (Wi-Fi).

The ILC system is a **network of standardized ILC WLANs (School Nodes) and Master Node (DSHE)** connected via Internet. **Some ILC WLANs may work offline**, if connection to Internet is not available. Diagrams below show a conceptual model of the ILC system.

The Master Node functions are: maintain the Master Repository of E-learning Materials, maintain master copies of server and laptop applications software, monitoring and managing of the entire network of ILC-WLANs, and keeping master copies and licenses of all utility and application software used in the network

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[1] A system architecture is a conceptual model that defines the structure, behavior, and views of a system.

Network of Distributed Repositories of E-Learning Materials

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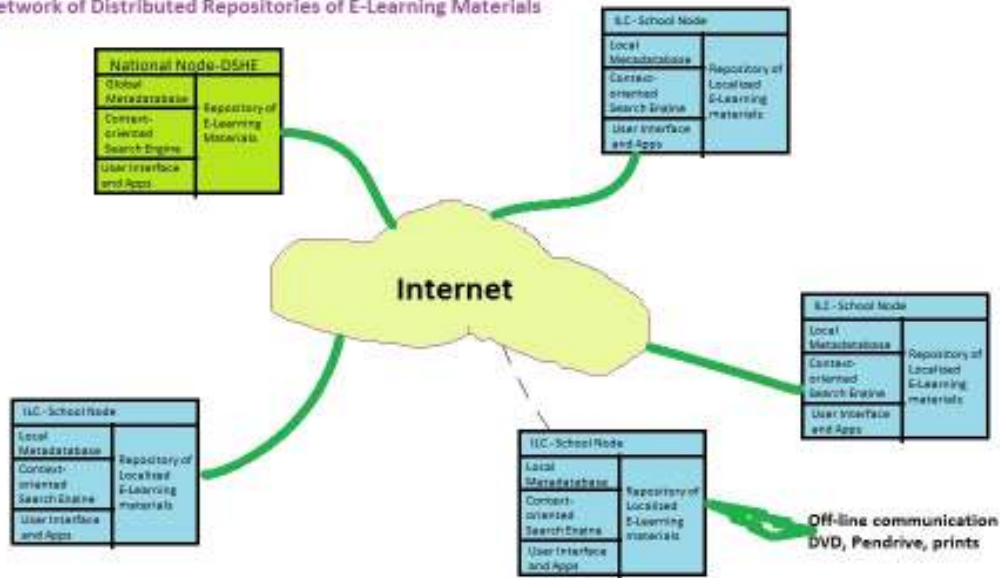
The ILC-School Node functions are: maintenance of Local Repository of e-learning materials (copy of Master Repository plus locally developed and approved by DSHE materials), maintenance of LAN including: user registration, access to Internet (filters), server-based applications (client-server mode), monitoring of consistency of laptop software, ILC-WLAN administration and performance data collection.
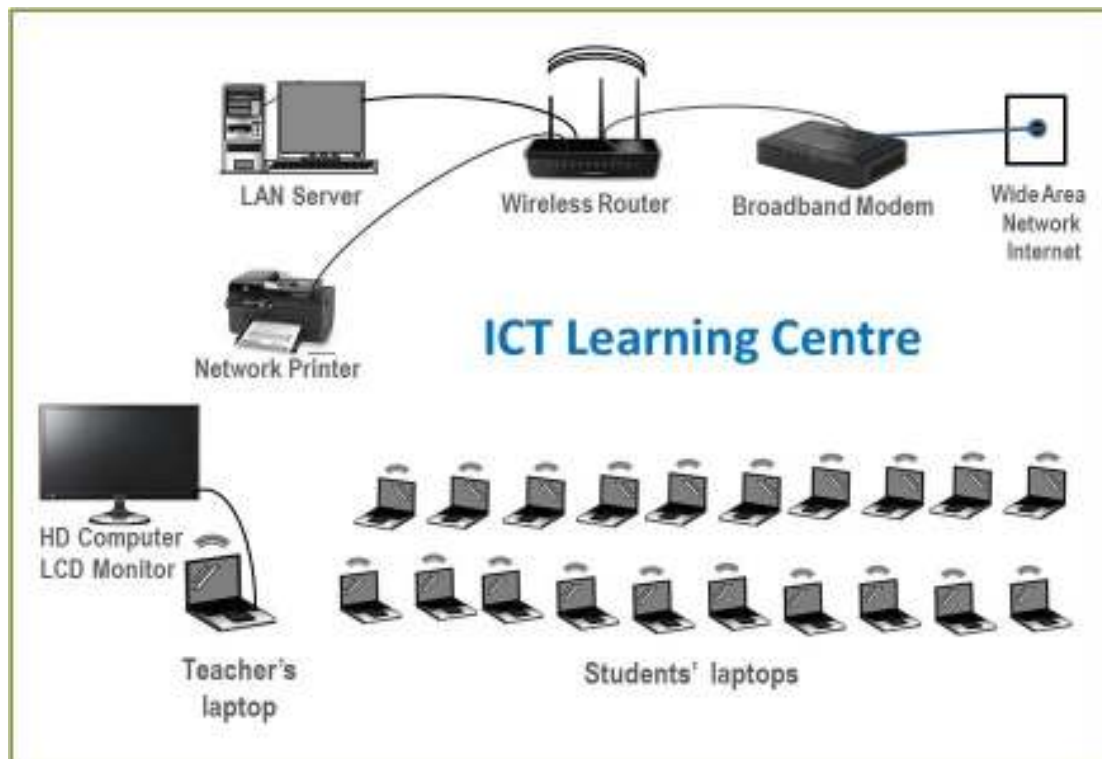
Logical model of ILC hardware architecture

School Node (ILC-WLAN)

WLAN Server Hardware:

The hardware of WLAN server should have the capacity to provide:

- high bandwidth connection to the Internet allowing for simultaneous wireless connection of 21 laptop users (multimedia capacity) to the Internet websites; (and if found possible for external devices such as laptops, smart phones, tablets, and other mobile devices);
- storage and computing capacity to: maintain all networking functions including performance data collection, management of the repository of e-learning materials and other server-based applications such as email, shared storage space, database management, etc.

Note2: *Concrete hardware configuration should be decided by specialists who will find the best solution for setting up the WLAN at Bangladeshi schools today and in the future.*


WLAN Server Software:

The server network operating system (NOS) is installed on a dedicated server computer from which it can monitor all the activities of the systems connected to the server and provide opportunities to share applications and files/data. Network administrator utility is the main component of the network operating system that allows for configuring NOS to wireless or wired networks. Another important component of the NOS is the file server. File server is the device that provides facilities for data storage of clients associated with WLAN. Network operating system can also play a vital role between the file server and the network i.e. monitors the sharing information.

The software of WLAN server (Client/Server Networking) should have the capacity to provide:
- interfaces with existing systems such as Ethernet networks, communication protocols, network utilities, email, user profiles maintenance, and databases.;
- website development tools and hosting facilities (Web server);
- information security requirements, the level of protection that user data and programs need from particular threats;
- collection of network performance data and application software usage;
- installation of user application software in Client/Server implementation (Browser-based interface);
- backup facility; Multiuser File Sharing, data base management;

Diagrams below show an example of Server and Client Software in a network and a logical model of software architecture from user's point of view.
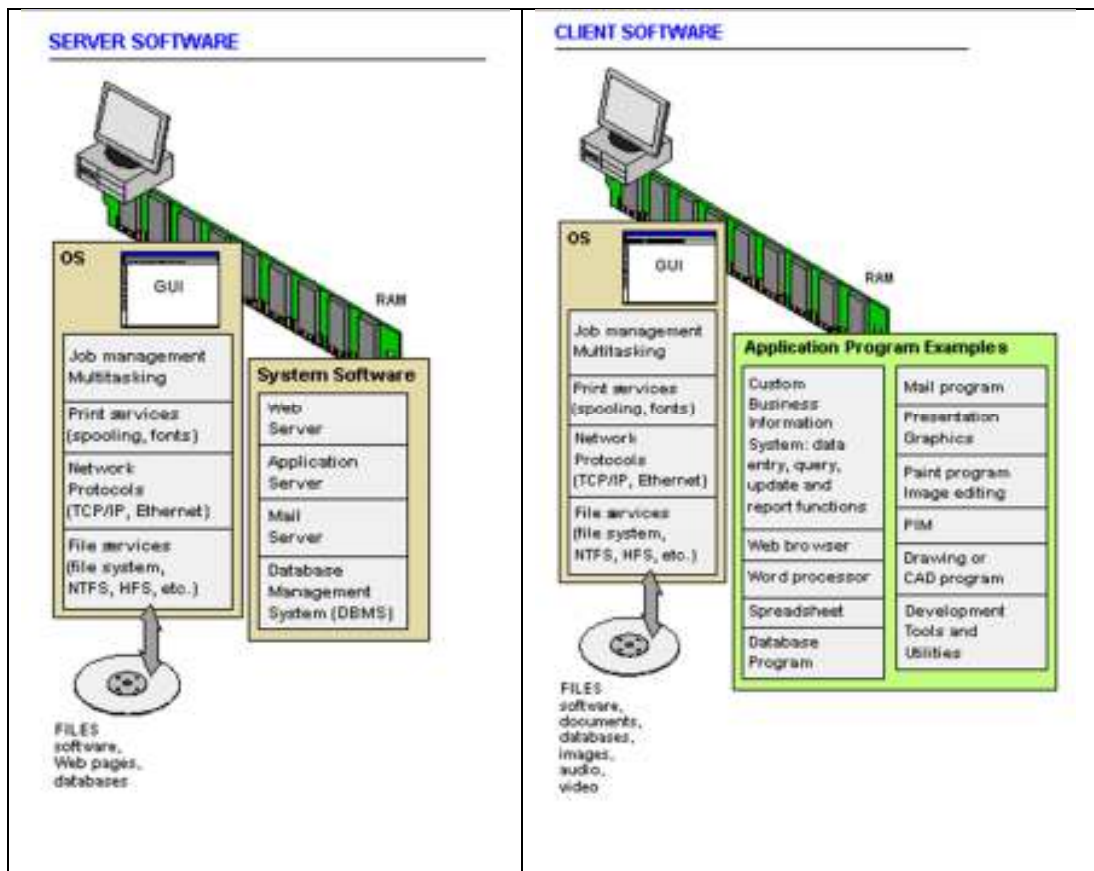
Laptop Application Software

All new laptops in the ILC classroom will have **Windows 10 (English version)** and exactly the same application software installed. It means the same software architecture/work environment (the same Windows 10 options and permissions, and application setup). A diagram below shows a logical structure of the user layer of application software on the top of Windows 10, utilities software, and network infrastructure (hardware and software).

The user of the laptop (student, teacher) will not be able to change the options of the work environment. Any change in user environment must be consulted and approved by the ILC Network Manager and eventually performed by the LAN Administrator or Technical Support Specialist.
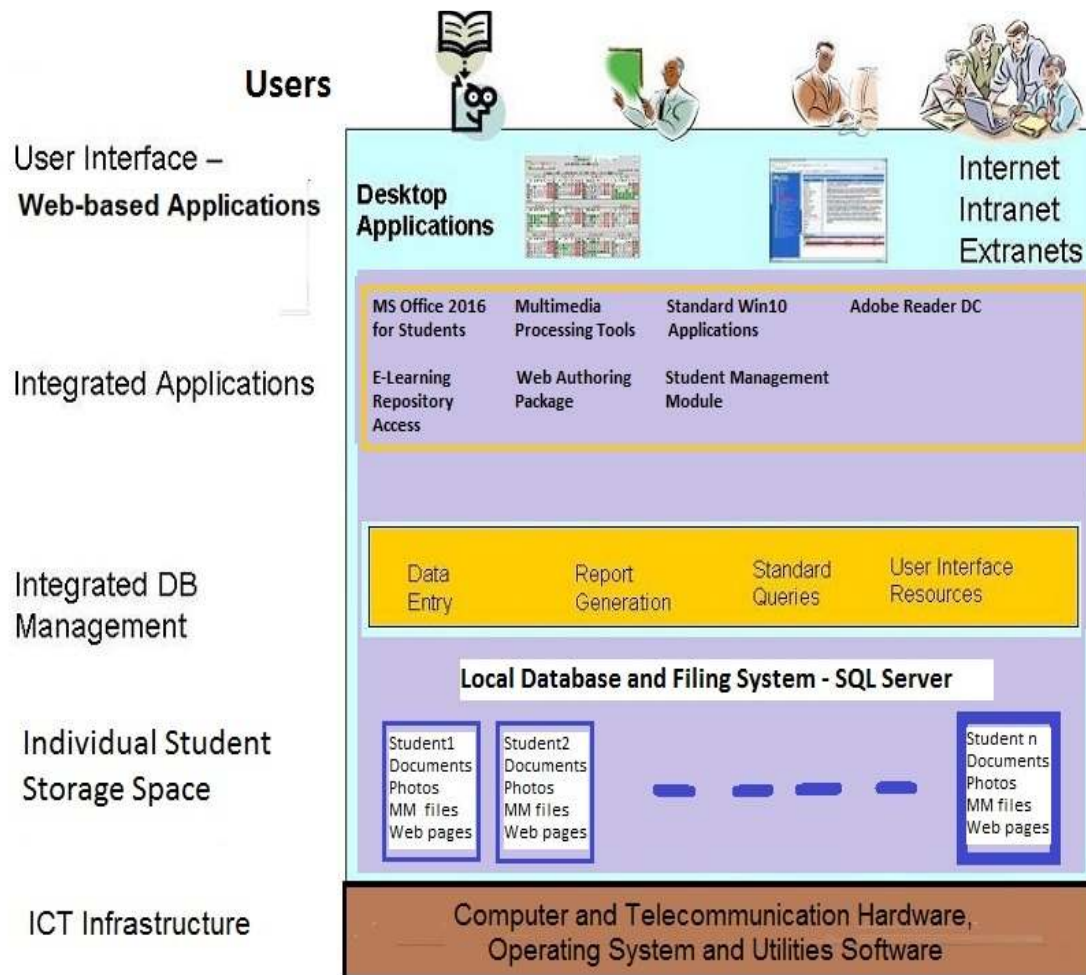
Note3: *Technical details and feasibility of proposed hardware and software solutions need discussions with ICT specialists at DSHE (people who run DSHE LAN and EMIS).*

User Registration and Use of Application Software

Each user of ILC must be registered (have an account at the proxy server). All devices (laptops, printers, monitor, external disk drives will be also registered at the server for authentication procedure. It means no other devices will be able to connect to the WLAN. Laptops will be able to connect with Wide Area Network (Internet) only through the server. ILC server will provide the functionality in regard to user registration and services and applications made available to users:

A user of the ILC computer classroom will work in an environment presented in the diagram below:
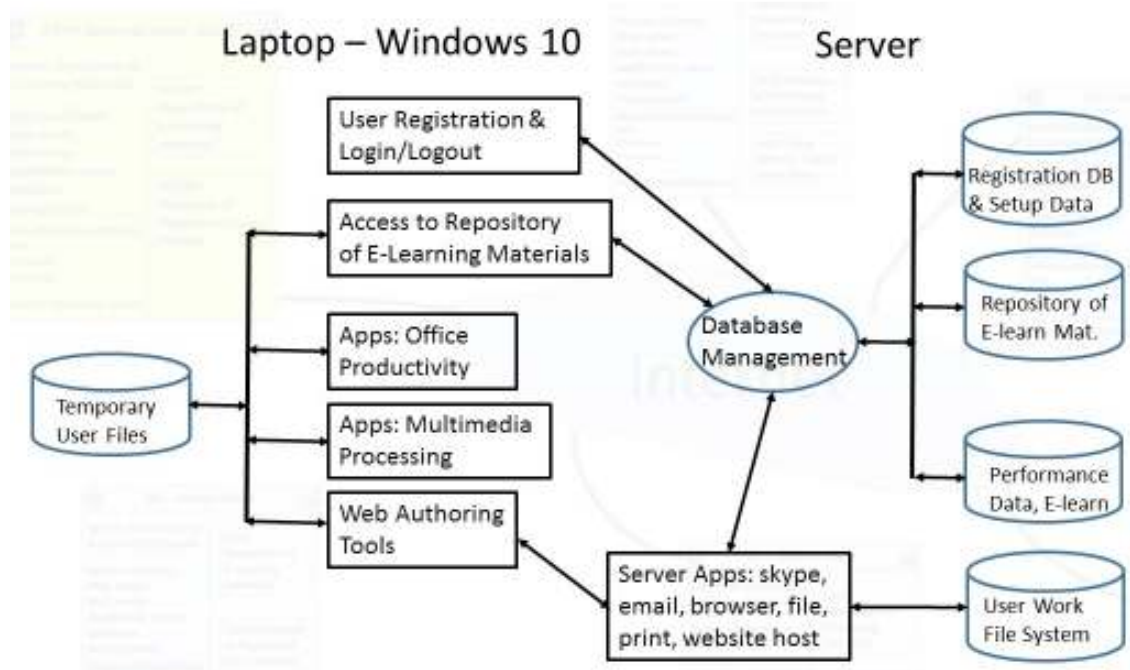
Special attention must be paid to setting up the options and permissions (update, defaults for applications, security) for Windows 10 which were designed for the usage of laptop connected almost all the time to the Internet. All updates, upgrades, and connections of applications with the Internet (e.g. Apps Store) must be done from the proxy server. It means disabling all direct connection to the Internet.

Basic set of laptop applications to be discussed (install Bangla keyboard and fonts):

- Notepad (Win10)
- WordPad (Win10)
- Windows Media Player (Win10)
- Microsoft Edge (Win10)
- Calculator (Win10)
- Calendar (Win10)

- Camera (Win 10)
- Photos (Win10)
- Voice Recorder (Win10)
- Windows DVD Player (Win10)
- SKYPE (Win10)
- Selected Windows Accessories (Win10)

Free External software:

- Acrobat Reader DC (install)
- WAMP Server (if website development needed)
- Image Editor (e.g. IrfanView)
- Image Converter

- Video Editor (e.g. Movie Maker)
- Video Converter
- Audio Editor
- Audio Converter

In-house developed applications:

- Repository of E-learning Materials Client

ANNEX 2: E-learning materials

E-Learning material is a single computer multimedia file or a named collection of multimedia files to be used in a pedagogical process. Selection and production of e-learning materials for inclusion in the ILC's repository will be based on curricula and textbooks. A **subject module** (or for short a module) is a collection of e-learning materials pertinent to e-learning of specific subject.

The purpose of **logical attributes** of e-learning materials such as title, abstract, tags and keywords, sub-subject, target audience (grade), presentation time, etc is to make search for desired materials more efficient and accurate than browsing through the alphabetical or hierarchical index.

The purpose of **technical attributes** e-learning material such as file name and format (e.g. vertebrateClassification.pdf, forest.jpeg, vegetableMarket.mp4) and creation of computer directories structure in order to organize storage of e-learning materials is required for computer operations as well as for providing a direct access to files constituting the content of Repository of E-learning Materials (RELM for short).

Attributes of e-learning materials are stored and managed using the database management system (DBMS).

The RELM installed on the server will include software allowing for collecting data concerning the usage and performance of the repository in the pedagogical process and involvement of ILC users registered in the ILC E-learning system (see section on user registration and profile in ANNEX1).

File formats of e-learning materials

Interactive simulations / animations

Simulations are an active representation of some system, process or phenomenon. For example, a simulation might model a beam of light entering a prism and being divided into the colors of the spectrum. The term *interactive* is used to indicate that the teacher or student can adjust certain elements of the simulation to change certain aspects of the of the simulated system. For example, a simulation of an electric circuit may enable the user to adjust the resistance of components in the circuit, add a switch or bulb, and so on. In such cases the behavior of the simulation must model the details of the system being studied. Simulations are most useful when accompanied by some simple interactive tests that students must answer to demonstrate that they have grasped the target knowledge and/or skills embodied in the simulation.

Animations are to graphics as videos are to photographs, and can show a dynamic representation in the way a photographic image or video cannot. For example, a diagrammatic animated cross section of a combustion engine can show the operation of the 4-stroke cycle. This is not possible to achieve through a video of a real engine. Animations must be used only when necessary to illustrate aspects of the topic. Animations for decorative purposes will not necessary support the understanding of the topic in question. Animations should normally be embedded in other objects, such as a presentation, and must be in a standard format, such as GIF and (or) Flash.

Audio

Audio is particularly useful for subjects in which the spoken word has a significant role. Audio is a requirement mainly for the English subject. The TQI-II project uses audio materials developed by English in Action (EiA). EiA has free audio resources for many topics available for use. However, detailed study of the curriculum may reveal topics in other subjects for

which audio has a useful role to play. In such cases it should be considered to use audio as one of the resources. Audio format should preferably be MP3 and must be playable in Windows, Mac and Android systems.

Video

Video clips should be used only when it is the best way to show something, usually a real world situation which cannot be represented in sufficient detail by a more abstract and cost-effective representation. The ability to pause and rewind can also very useful to teachers and learners. Video sequences should be no longer than is required to present the salient details of the topic. Video should be compressed as much as possible with sufficient quality being maintained and should be in a format which can also be viewed on mobile devices, such as .mpeg4 (.mp4).

Image (photo)

Like video, photographs will usually depict real life things and must be used when necessary to the topic presentation. Photographs used for decorative purposes will not have any added value in the e-learning materials. Photographs should be resized (when embedded in documents/presentation resized to 800x600 pixels or smaller) and compressed as much as possible without sacrificing necessary image quality. They should be in a standard format, preferably .jpeg.

Diagram / graph

Graphics are effective as illustrative tools for offering alternative representations of complex phenomena. A graphical image can show an abstraction presenting the details in an uncomplicated way. Diagrams and graphs should normally be embedded in other objects, such as presentations. No specific additional software for viewing diagrams should be required.

Text

Text will usually be part of another resource (a simulation, for example, may feature text, while a diagram may have text labels and notes). Since text is fundamental to many resources its design for usability must be considered when creating e-learning materials. The following guidelines apply to the design of text:

- maintain a high color contrast between text and background (black and white if reasonable);
- keep text as brief as possible, using bullet point format when applicable;
- use consistent and neat bulleting and indentation styles;
- use fonts that are readable when presented on a screen if the text is to be used in a presentation and ensure that is can be seen from all parts of a typical sized classroom (e.g. Calibri, Arial, Vrinda (Bengali));
- avoid overuse of multiple fonts and styles.