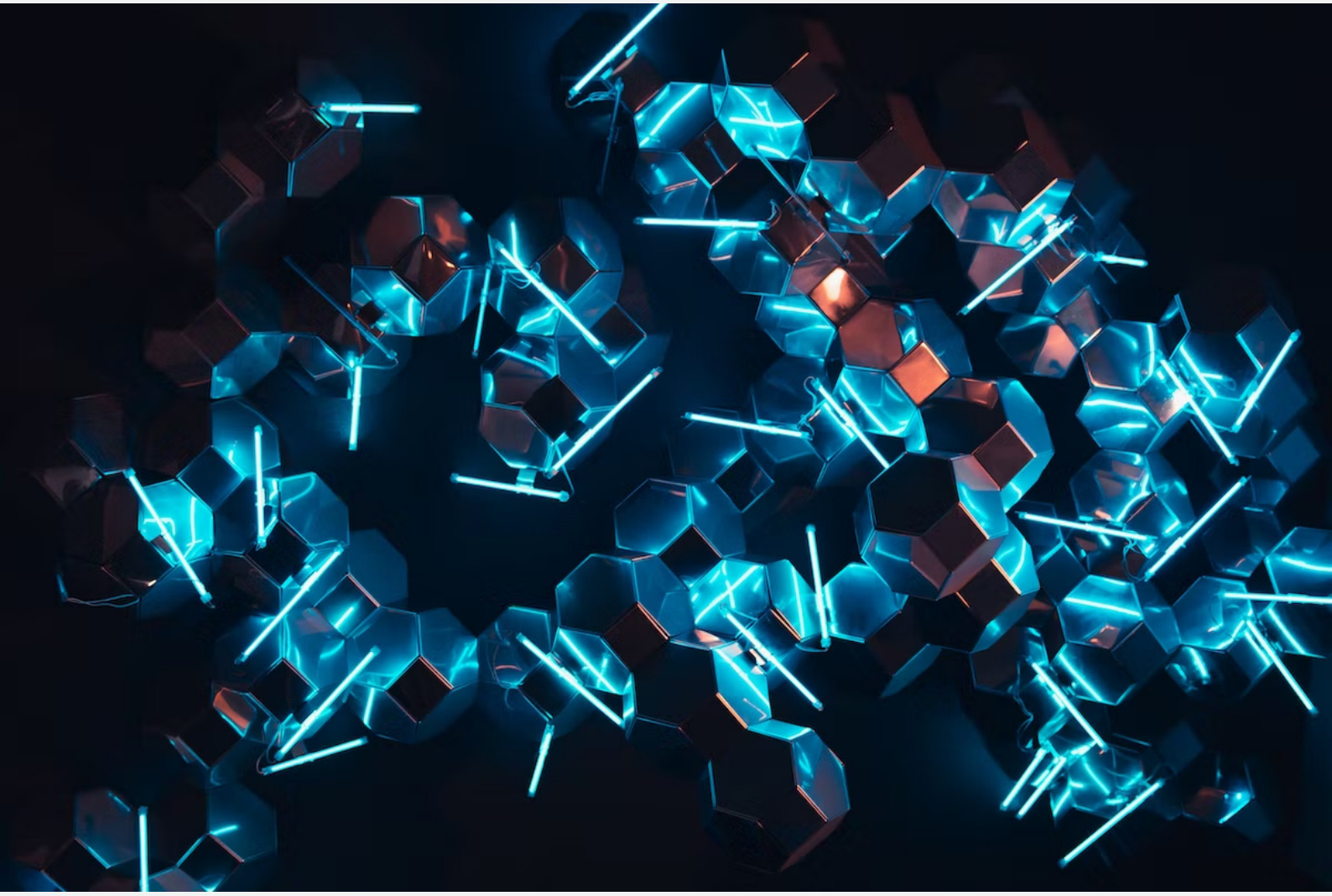
CelluTech

E-Government ERP

(Enterprise Resource Planning)



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Executive Summary

Managers handle multiple projects all the time. They juggle with people, tasks, and goals to ensure that every project is successful. But managing projects, by nature, is not an easy task. Since there are a lot of moving parts, it can easily become chaotic and disorganized.

When you don't use a project management system, chances are that you're wasting a lot of time on the little things and doing more work than necessary. It's difficult to keep track of who's working on what. Collaboration among teams is inefficient and spread across email threads and chat software. As a result, deadlines are missed and clients become unsatisfied.

It's important to use an efficient project management system to help you stay organized at work while planning and executing projects.

Project management software is used to plan, organize, and allocate resources for managing projects. It helps teams collaborate and keep track of the project's progress while clearly defining tasks and responsibilities. It lets project managers control costs and time and allows smooth collaboration between stakeholders.

To deliver projects on time, teams must keep everything organized particularly when there are multiple ongoing projects. Cloud project management software provides an overview of all the projects, helps prioritize tasks, and keeps everyone on the same page.

Project management software includes a wide variety of tools that serve different people for different purposes.

2. Essential functions and features of Project Management System

2.1 Functions of PMS

- **Project Planning –** Be able to easily plan projects while taking previous track record into account.
- **Tracking project evolution-** when it comes to completion, time and costs – Warn the right people when things are veering off track.
- **Scheduling and Time Management –** Be able to easily register time on work items and take people's work schedule into account.
- **Resource allocation –** Making sure that people are working on the right things at the right time.
- **Project budgets, incl. costs of people –** Keeping real-time check of not only time but also allotted budget.
- **Communication and Collaboration –** Easily post comments and concerns, communicate with external stakeholders, all while keeping a full historic record of all actions.
- **Documentation & Files –** Easily document requirements, specs, directly or via files.
- **Easy to use –** The software should be an enabler and not get in the way of actual work.
- **No need for a specific method –** Support the company's preferred method of breaking down any project, making schedules, allocating people and managing project budgetst

2.2 The key features of PMS:

No	Feature	Description
1	Company Setup	1. Set up company information 2. Set up project templates they wish to use a) Software Project b) Construction Project c) Sales and Marketing Project
2	Member Management	1. Invite Members with links – email, text etc. 2. Assign roles to members e.g. Admin, supervisor, collaborator etc. 3. Revoke member 4. Reset password 5. Edit or update member information 6. companies can upload the progress of the projects 7. Companies will receive and reply on the cooments
3	Project Setup	1. Setup multiple project per company 2. Define project requirements and activities 3. Setup Steps after each activity e.g. pending, complete, in progress, testing etc. -track project percentage per company 4. Setup the project Map or API for the MAP
4	Task Management	1. Set up tasks with team 2. Set up sub-tasks 3. Assign task and sub tasks to members 4. Set up dependencies 5. Back track and Forward track tasks 6. Tracking the finance of the project 7. commenting on the tasks and projects before the approval 8. Receiving picture and videos that's been sent by the companies.
5	Collaboration Management	1. Split task into groups and their dependencies 2. Managing different tasks at the same 3. Multiple layer of approval for projects and tasks 4. Fetching the data easily whenever it be needed
6	Communication Management	1. Chat among group members 2. Call 3. Share images, videos etc.
7	Dashboard	1. View Task summary – pending, complete etc. 2. Percentage of the project 3. Financial status 4. Live users

2.3 Cellutech-Solution Modules

PMS consists of Business and technical modules.

No	Feature	Description
1	**Administration module**	• User friendly interface for defining the parameters of the work • Functionality for defining the data that needs to be recorded in the report database, with flexible options • Functionality for defining • Functionality for setting up the transaction protocols • Functionality to define incoming and outgoing conversions • User rights, user groups and user roles management
2	**ESB module**	• Self-restore service application (with all functionality of services) • Functionality for organizing multiple queues • Conversion of the incoming and outgoing messages • Fast routing engine • Fast parsing and assembling engine (the switch can work as a translator from one message format to another) • Full audit trial • Capability to build a specific databases based on the client requirements for reporting purposes
3	**Monitoring**	• Flexible setup to show real time summary information • Functionality to provide the information graphically • Data comparison functionality • Flexible refresh modes • List of last activities and alarms
4	**Reports**	• Functionality to capture the parameters, create and show the following reports: - Activity report - Transactions list - Project report - Financial report - Reconciliation and settlement reports - Activity report by the contractor - Activity report by the MNU team - Activity report by the Project manager •Functionality to review the reports in real time •Summary reports •Report generator functionalit
5	**Authorization and Authentication module**	•Functionality to setup the authentication rules •Functionality to setup the authorization rules
6	**Store and forward module**	•Functionality to store the balances in case the main host is down and the switch is working in 'store and forward' mode •Functionality to store pictures, signatures and finger print information for additional verification in case there is no CMS or no such information in the main host •Functionality to store information for prepaid models

2.3.2 PMS – Basic Technical Modules

Below are the Technical modules offered under UT Route:

HTTP server port (ut-port-httpserver) and HTTP client port (ut-port-http) - allows HTTP and HTTPS communication

- TLS, including client and server certificate handling
- JSON RPC 2.0 over HTTP
- SOAP
- XML over HTTP
- Websockets (planned)
- SSE

TCP client/server port (ut-port-tcp + ut-bitsyntax + ut-codec) - allows low level TCP communications.

- TLS, including client and server certificate handling
- SMPP
- ISO8583
- APTRA Advance NDC
- PayShield 9000
- XML over TCP
- JSON RPC 2.0 over TCP
- Many binary protocols can be handled by configurable definition of their fields

SQL (ut-port-sql) - allows communications with SQL servers.

- MSSQL
- MySQL (planned)
- PostgreSQL (planned)
- Oracle (planned)

Bus (ut-bus) - the base module for the ESB (enterprise service bus) and SOA(service oriented architecture) functionalities, used by almost all other modules.

- Local and remote procedure calls (req/rep)
- Messaging and notifications by publish and subscribe (pub/sub)
- Error handling
- Restart single port connection
- Loop prevention
- Expiration time

Logging (ut-log + ut-port-console) - allows logging

- Configurable logging levels per port, allowing to be changed during runtime
- log to Sentry (planned)
- log to Graylog2 (planned)
- log to Logstash (planned)
- log to LevelDB
- Remote debug console + REPL
- Log in JSON format, log to browser
- Access/query all kinds of log data through web browser
- Per port monitoring / logging
- Per transaction monitoring / logging
- Edit source code in browser (planned)

Data scaling (ut-port-couchbase) - allows handling large data by using non-relational (NoSQL) database architecture (planned)

File (ut-port-file) - allows input and output of data to file. Supported formats are:

- CSV
- TSV
- XML
- JSON
- Binary formats, supported through ut-codec and ut-bitsyntax

FTP (ut-port-ftp) - allows upload/download of files from FTP server. Supported protocols are:

- FTP
- FTPS
- SFTP

Monitoring (ut-port-performance) - allows monitoring of application performance and reporting the data to various third party monitoring systems:

- Zabbix (planned)
- Grafana (planned)
- Nagios (planned)

Scheduling (ut-port-schedule) - allows data processing to be scheduled for execution at specific time

Business logic (ut-port-script) - allows flows and business logic to be loaded as modules

1 load business logic from implementation specific or generic modules
○ controls access to business logic based on the request origin (planned)

Serial port (ut-port-serial) - allows communication via the following serial port types:

1 USB
○ COM

Emails (ut-port-smtp) - allows Email sending by using the following protocols:

1 SMTP

Load balancing (ut-run) - allows distributing the processing load to separate processes running on one or several machines

1 single process running
○ multiple processes running (planned)
○ multiples machines running (planned)
○ version upgrade (planned)
○ keep old versions in separate folders (planned)
○ installation validation (planned)
○ source code protection (planned)
○ run on windows/linux, possibly/partly on browser (planned)
○ run on x86 32/64, possibly/partly on ARM (planned)
○ restart/update single port process with/without breaking connection (planned)
○ run without any (core) database
○ run simultaneously multiple implementations from same folder (planned)

Templating (ut-template) - allows defining templates using the following formats:

1 SQL
○ XML
○ HTML
○ JSON
○ Plain text

Multilanguage (planned)

○ allows customer to define translations to static texts in multiple languages (planned)
○ allows customer to define translations to dynamic texts in multiple languages (planned)
○ allows customer to define formatting rules for dates, money, numbers, etc. (planned)

Nomenclatures / dictionaries

○ Taken from CBS
○ Taken from UT database
○ Taken from third party

Cache DB (planned) - allows storing and controlled invalidation of frequently accessed objects like user sessions, nomenclatures, etc. in a cache for quicker retrieval

1 Session persistence across restarts

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Test - allows execution of automatic tests or helps for manual tests of the following kind:

1 Unit testing (planned)
○ Performance testing (planned)
○ Integration testing (planned)
○ API testing (planned)
○ UAT testing (planned)

Export - allows generation of the following file formats:

1 PDF (planned)
○ Excel (planned)
○ Word (planned)
○ PNG/JPG (planned)
○ CSV/TSV (planned)

Record handler - responsible for the automated record handling and data transformations.

1 Data encapsulation
○ Data transformation
○ Data distribution
○ Data validation

3 Implementation + Support Services

3.1 Project Management Pillars

To ensure the highest quality in service delivery to our clients, Software Group has built its Project Management Capabilities on the following 4 pillars:

3.1.1 Project Management Methodology

• Cellutech has a tried and trusted implementation process that it applies to all projects.
• This methodology is continuously reviewed to ensure that it remains updated with feedback from live projects

3.1.2 Project Management Team

• Cellutech has a team of 22 highly skilled Project Managers and Business Analysts, with an average of 12 years relevant professional experience and quality qualifications;
• All our PMs have extensive experience and background in microfinance / ing / IT development and in managing complex technology projects or organizational change
• All PM's report to a central PMO office that supports them during the project lifecycle and helps with all methodology tools and documentation.

3.1.3 Project Management Tools

• Cellutech has 2 specific platforms that are used for managing and supporting projects, which are accessible to clients as well o Our Issue Tracking System allows full and detailed management of issues, questions or defects throughout their life cycle, from logging to resolution

o Our Project Management System allows tracking all project information, status and history, project plans and resources

• Both of these tools are constantly developed and improved to accommodate all Cellutech's and client's project management needs

• We log and track in our PMS all the activities that are part of the execution and management of the project such as:

- Analysis and design of objectives and events
- Planning the work according to the objectives
- Assessing and controlling risk (or Risk-Management)
- Estimating resources
- Allocation of resources
- Organizing the work
- Acquiring human and material resources
- Assigning tasks
- Directing activities
- Controlling project execution
- Tracking and reporting progress
- Analyzing the results based on the
- facts achieved

- Defining the products of the project
- Forecasting future trends in the project
- Quality Management
- Issues management
- Issue solving
- Risk management
- Defect prevention
- Identifying, managing & controlling changes
- Project closure (and project debrief)
- Communicating to stakeholders
- Building the knowledge database

3.1.4 Project Management Experience and Track Record

• Cellutech has built a solid and verifiable track record of successfully implemented projects both for our own solutions as well as project management of third party solutions including T24.

• As a team, we have successfully implemented more than 200 projects to date and can confidently claim to have zero project failures amongst this track record.

3.2 Project Management Methodology

To ensure the highest quality in service delivery to our clients, Cellutech has built its Project Management Capabilities to include the following processes and procedure to ensure that best practices are following through the project lifecycle. Software Groups Methodology is a set of phases and steps based on the best practices.

It is aligned with in project's procedures and well defined methods applied. Cellutech's approach in the applied methodology takes into consideration the entire cycle of the project, aiming to provide excellent service and smooth processes for delivering the projects. Finally, it is well tested and approved based on Cellutech's over 200 successfully delivered projects.

Project Deliverables	Cellutech	institution
Project Management		
Project plan	Create	Approve
Project management reports	Create	Review
INITIATION - officially starting up the project. clarification of the project purpose and justification and establishment of clear and shared project objectives		
Kick-off meeting	Create	Participate
Project charter	Create	Approve
ANALYSIS - identifying, capturing, analyzing and documenting the client's business requirements (functional, interface, conversational)		
Business requirements specification	Review	Create
Initial build setup	Create	Review
Induction training	Create	Participate
Business process matrix	Create	Approve
Delta business requirement document	Create	Approve

Cont...

Project Deliverable	Cellutech	Institution
DESIGN - providing detailed solution for the client's future operating model, both from a process and a system perspective. providing detailed baselines and deliverables.		
Field data mapping	Review	Create
Functional specification document	Create	Approve
Technical specification document	Create	Approve
BUILD - solution development and training preparation		
Build Architecture	Create	Support
Build Configuration	Create	Support
Build Customization	Create	Support
Build Interface	Create	Support
Build Data Migration	Create	Support
TEST - preparation and execution of test scenarios and conduct train the trainer session		
Test plan	Create	Support
Integration and system test	Create	Support
Training Materials	Create	Review
Train the Trainer	Create	Participate
UAT environment setup	Create	Support
UAT	Support	Create
DEPLOY - solution implementation and end user training		
Deployment plan	Support	Create
Deployment in production	Support	Create
CLOSURE - formal closure of the project and post implementation support		
Handover to Support	Create	Support
Project sign off	Create	Approve

3.3 Change management

The purpose of this change management is to manage change requests so that approved changes will be controlled, ensuring the project remains on schedule, within budget and provides the agreed deliverables.

The Change Management is the mechanism used to initiate, record, assess, approve and resolve project changes based on issue, risk or new requirement. Project changes are needed when it is deemed necessary to change the scope, time or cost of one or more previously approved project deliverables. Most changes will affect the budget and/or schedule of the project.

3.3.1 Change Process

Process	Responsible	Description of Activity
1. Identify Change	Cellutech Project Manager	Based on the project (work plan) progress and budget, the Cellutech Project Manager will determine if a change request is needed based on the issue, risk or a new requirement in order to maintain the success of the project. The Project Manager identifies, document in Change Control Log, and is responsible for scope change follow through.
2. Approve Change	CCB	The Change Control Board (CCB) must approve the change before it can be submitted for impact analysis.
3. Submit Change Request	Client Project Manager	The [Client] Project Manager must submit in written a Change Request form to the Cellutech Project Manager.
4. Initial impact assessment	Cellutech Project Team	The Cellutech Project Team do initial impact assessment and effort brake down on: Scope, Development, and Test. The Project Manager must update in written the Change Request form and send it to Change Control Board (CCB) for approval.
5. Accept and approve Change Request	CCB	The Change Control Board (CCB) must approve the updated Changer Request form before creation of Change Proposal.
6. Create Change Proposal	Cellutech Project Team	Based on the approved Change Request the Cellutech Project Team creates a Project Proposal document and do analysis, design and full impact assessment.
7. Accept and approve Change Proposal	Client Project Manager	If the impact assessment is increased significant the CCB must accept and approved it, otherwise the [Client abbreviation] Project Manager must accept and approve the Change Proposal document.
8. Implement the change	Cellutech Project Team	The change goes through the same development-testacceptance-live phases as a normal project deliverable.
9. Close the change	Cellutech Project Team	The change is closed once the request has been resolved/implemented.

3.4 Maintenance & Support

3.4.1 Support Process and Methodology

Software Group provides support for all its software products as a part of Service Level Agreements (SLA) signed with its clients. The main types of support services provided within the SLA include:

- Investigation, replication and documentation of issues
- Fixing of defects
- Advice on software maintenance
- Advice on hardware and software compatibility
- Training which includes transfer of skills to use and administer the software installed.

Modes of communication

Methods and means of providing these support services are always adjusted to both the client's capacity (infrastructure or staff) and to the urgency of the issue (the more urgent, the more immediate the contact with the client). The available modes of communication include:

- **Telephone / Video Conference or Support Call –** used for both first contact and subsequent training or presentation of solution
- **Email –** preferred means, used for more lengthy documentation of an issue when it is not clearly replicable from the beginning and/or when several people from the client's organization need to provide feedback
- **Remote (Desktop) Access / VPN Server to access client installation –** used for direct investigation of issues or questions raised, when the client's staff doesn't have the capacity to describe issues or when issues are not replicable on Cellutech's installations
- **Screen Sharing / Remote Control–** used for demonstrations both by the client and/or by Cellutech's Support Team to deliver solutions to issues identified; This mode is the preferred option to support any written instructions or descriptions
- **File exchange and mirror installations –** used for replication of the client's live environment on Cellutech servers and provision of data for investigation and replication of issues raised; this is the preferred method for issues that require a lot of testing which can't be done by the client and/or when the connection to client's installations is very bad;
- **Instant Messaging –** used only for quick discussion and confirmation of issues or questions; has to be followed up by documentation through email and/or by posting the issue on Cellutech's own tracking system
- **Site Visits –** when the issues raised are pervasive (for example, data inconsistencies that need investigation of accounting documents as well) or when solutions need to be applied on several sites or communicated to larger groups of people

We usually suggest the most suitable means of communication at different stages in the support process depending on the type of issue or solution, but the client always has the choice of channels to be used for communicating and delivering support based on their technical and human resources and capacities; we are very flexible and well equipped to adapt our delivery to the client's preferences.

While we have our own helpdesk and issue management platform, we don't mind using a different Help Desk interface if it is preferred by the client.

Cellutech's Issue Tracking System

Cellutech uses a dedicated Issue Tracking System in its support and helpdesk activities. Red mine is a web based system that supports multiple users, projects, components, versions and provides email notifications and detailed reporting on any issue or question posted.

It provides a solid base for issue tracking and resolution and helps manage the entire client support process – from logging a support request, to its documentation and assignment and through to resolution and conclusion.

Cellutech's Issue Tracking System allows both the client and the Support Team to:

• Create new issues and add as much description as needed (including attach any type of supporting files)
• Edit an existing issue in order to add information and /or update the status, as well as view a full issue history of these changes at any time
• Route issues to the appropriate users, who will receive email notifications; if the issue is assigned by mistake, users can reassign to the more appropriate person
• Display of a "dashboard" of issues that allows any user to immediately identify the highest priority issues or those that have been escalated to them
• Automatic escalation of issues if not resolved in specified timeframe
• Closing of issues with determination of resolution type
• If an issue is found to be unresolved or if it repeats some time later, it can be reopened and reassigned to the appropriate support person to work on again
• View issue status and track its progress through the different stages of the process
• Measure issue metrics – hours spent, time since raising, deadlines (if any), priorities etc.

Additional features and functionalities of our Issue Tracking System that we feel are significant for the quality of our support services:

• **24/7 Web access** from anywhere in the world through a standard web browser

• **Complete history and log -** all comments, changes or additions to a tracked ticket are logged and saved with date and user reference, thus providing a complete view of a ticket's history and detailed tasks performed from logging to resolution

• **E-mail notifications –** our system automatically notifies the reporter and owner of a ticket about any status changes, updates or file attachments; the assignee for any new ticket created is notified by email; every ticket accepts a custom list of emails if specific people within the organization have to be notified of progress on an issue, task or question

• **Categorize and filter bugs** by type, priority, version, category, phase and product release, by client or reporter or owner etc.

• **Security –** the system is secured with SSL encryption.

• **Time Estimation –** functionality for tracking estimated time and the actual time to resolution

• **Role-based permissions –** functionality for managing user roles and access for each project

• **Data import/export –** functionality for importing from CSV or Excel or download data for local backup

• **Reporting –** detailed reporting on all activities on the system - for gathering statistical information and essential analysis for both Cellutech's and the client's management.

3.5 Education and Training

Cellutech strongly emphasizes the importance of training as a primary aspect of effective support for the use of our own products and of our partner's products. This translates into training provisions as a constant feature of both our License and Implementation Contracts and our Service Level Agreements.

In general terms, the "training package" we offer all our client consists of the following types of trainings:

• **Initial trainings –** All clients are given training on Cellutech products as part of the deployment process. In these training sessions we prefer the "train the trainers" approach, by which we would help build "super user" capacity that can be easily transferred to the other users and client staff, but we also provide very detailed end-user trainings if so requested by the client.

• **On-going trainings –** As part of the support process, we offer constant training which aims at a complete transfer of skills to use and administer the software installed. Tracking of the kinds of questions received by the various support teams allows us to develop and offer timely and appropriate training sessions, consolidating and stabilizing the knowledge pool at the client's level.

• **Targeted trainings –** Additional training can be arranged, to be delivered both remotely and on site. These are usually delivered when new modules are added to the software, when the client identifies the need for a "refresher training" for its current staff or of initial training for new staff.

• **Pooled trainings / courses –** We have also organized and delivered common sessions with staff from several financial institutions, which encourage knowledge pooling and sharing, as well as building a "support network". We can and do organize specific training sessions in partnership with industry stakeholders.

• **Self-learning tools (electronic updated manual, eLearning)-** We can organize a portal where the staff can be

3.5.1 Training Facilities

All Cellutech offices are equipped with space to hold trainings sessions. We can deliver these trainings at and from our main office locations in Kenya, Addis Ababa and Jigjiga.

Training facilities availability is not an issue. Given that most of our trainings are delivered on site at the client's location, if a training session needs to be organized in another location and/or with specific requirements (projectors and screens, laptops for participants etc.), then we usually arrange for third-party conferencing and training facilities.

3.5.2 Training Personnel

We at Cellutech have dedicated trainers, but training is only a component of our employees' main job description. We strive to have a holistic approach – practitioners make the best trainers and people with the most diverse experience will be the most appropriate to train others.

Therefore, an approach we have developed and wish to maintain is that training is part of all business analysts/ PM's jobs, as well as that of more technical staff if they have shown particular skills and interest in training.

We consider that successful training is not about dedicated staff delivering ready-made courses or content, but about people who know their jobs very well and can train others on them. The value-added of this approach consist in very detailed tailoring of the trainings we deliver to meet the exact needs of people in a specific situation and in our experienced trainers' capacity to meet all questions and ad-hoc information requests from trainees.

Trainers within the company have on average 7.5 year of experience in challenging projects which called on their ability to adapt to local contexts and analyze requirements from a range of sources. All of our trainers have direct experience of working with or for financial institutions and as such have a solid understanding of the sector

3.5.3 Training Localization

We deliver an overwhelming majority of our trainings at client's sites, without any limitation to the availability of delivering courses locally.

Our local knowledge makes the trainings we provide highly effective and where possible they are delivered in the local language.

3.5.4 Training Tools

We have developed templates, tools and a solid intra-company knowledge base to support:

• **Course scheduling and detailed planning –** templates with attendance management depending on the course contents, to help our client put the right people on the training and track delivered contents and attendance
• **Pre-course and post-course testing questionnaires –** templates with options for all types of questions (single choice, multiple choice, open questions), a simple web-based platform for participants to enter their answers and an interface to quickly analyses
• **User Manuals and Product Guides –** these are modular templates and tools that enable our staff to build manuals as needed, reflecting installed functionality as well as considering specific customer's policies and procedures.
- The user training manuals will be availed in English and Somali

Below is full information on Software Groups Support process and methodology:

3.6 Documentation

Cellutech will avail both Technical and User manuals of the system to be given to your organization. With the Technology transfer we will ensure that the super users of the system which include the administrators of the system are capable of modifying the processes and hence the manuals of the system in order to suit the organization operations. The manuals will contain both data and process flows for better uptake.

5. Appendix 2

Cellutech Standard IT Architecture

5.1 UT Suite – Integration & Architectural Overview

In addition to the functional presentation of UT Suit family of products this document is aimed to provide more details about the IT Architecture. Any product in UT can be integrated to interact and exchange data with the rest utilizing the UT Route. High level diagram below explains the relations between the products and the main feature of each and every one of them.

5.2 Application Layer

All Cellutech applications are designed and developed with scalability in mind. Cellutech apps provide business critical real-time functionality, so it is highly recommended that they are deployed in a highly-available redundant fashion. Since all the real-time session state data is stored in a shared database, they all support the scale-out approach for achieving high availability and load balancing between a number of running instances of the same application using an application-layer load balancer appliances.

Application layer co-residency is defined by running two or more different Cellutech applications within the same Operating system server instance.

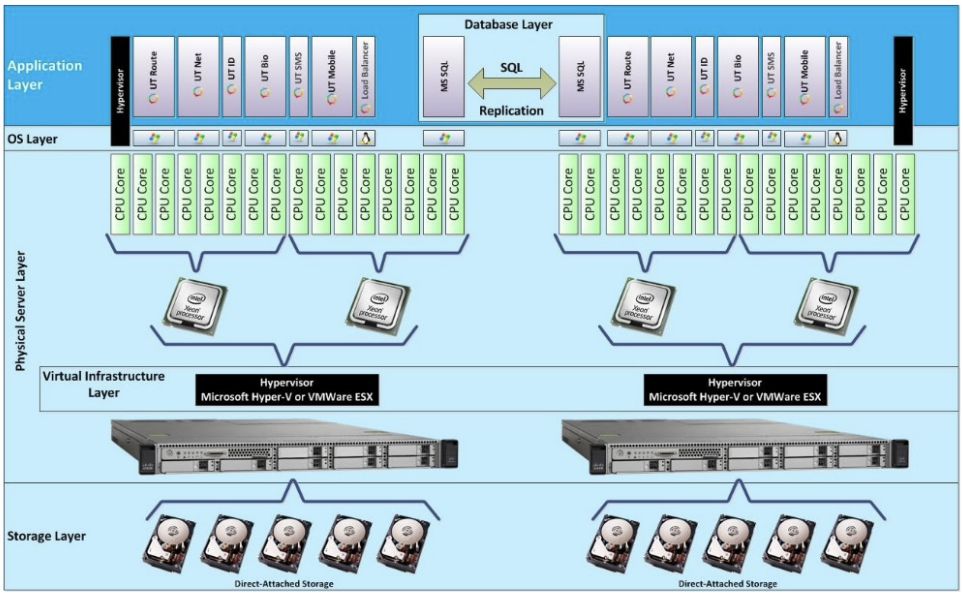


Diagram 1.
Application Layer

For the application layer as the products are running as self-restore services, the requirement is the application server to be with Windows OS or Linux. Supported Windows Servers are Windows 2003 or higher. Supported Linux distributions are RHEL, Debian, Ubuntu.

5.3 Database Layer

Using a single centralized database system for all Cellutech applications is highly recommended. Utilizing an existing database server or cluster is also supported while all sizing requirements and guidelines still apply.

Cellutech applications support MS SQL, Oracle and industry standard database engines. Since these are business critical applications, it is highly recommended that all installations use a highly-available redundant database subsystem.

Cellutech apps support and rely on the vendors proprietary high-availability and scalability technologies such as MS SQL failover clustering and Oracle Real Application Cluster.

All database solution-specific requirements and guidelines should be followed to provide healthy and solid DB backend for the applications.

All database products should be properly licensed according to the selected vendor's licensing policy and based on the solution sizing.

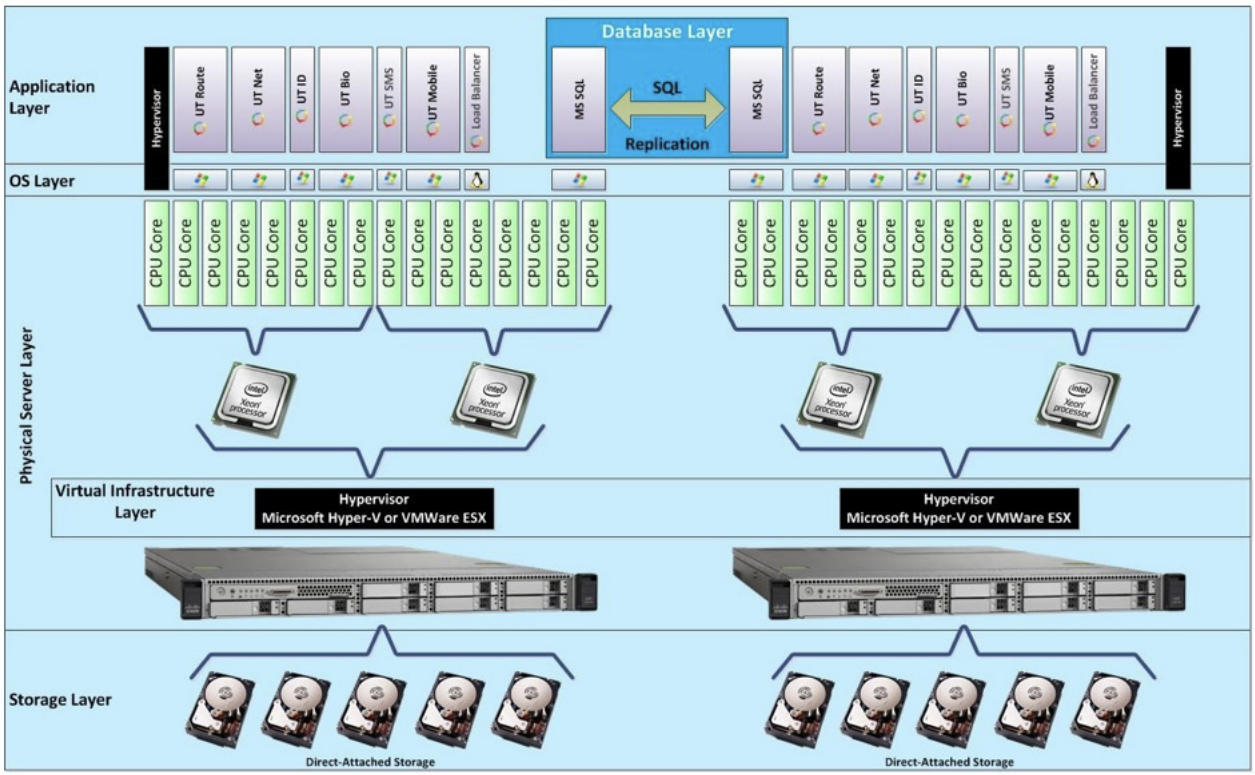


Diagram 2. *Database Layer*

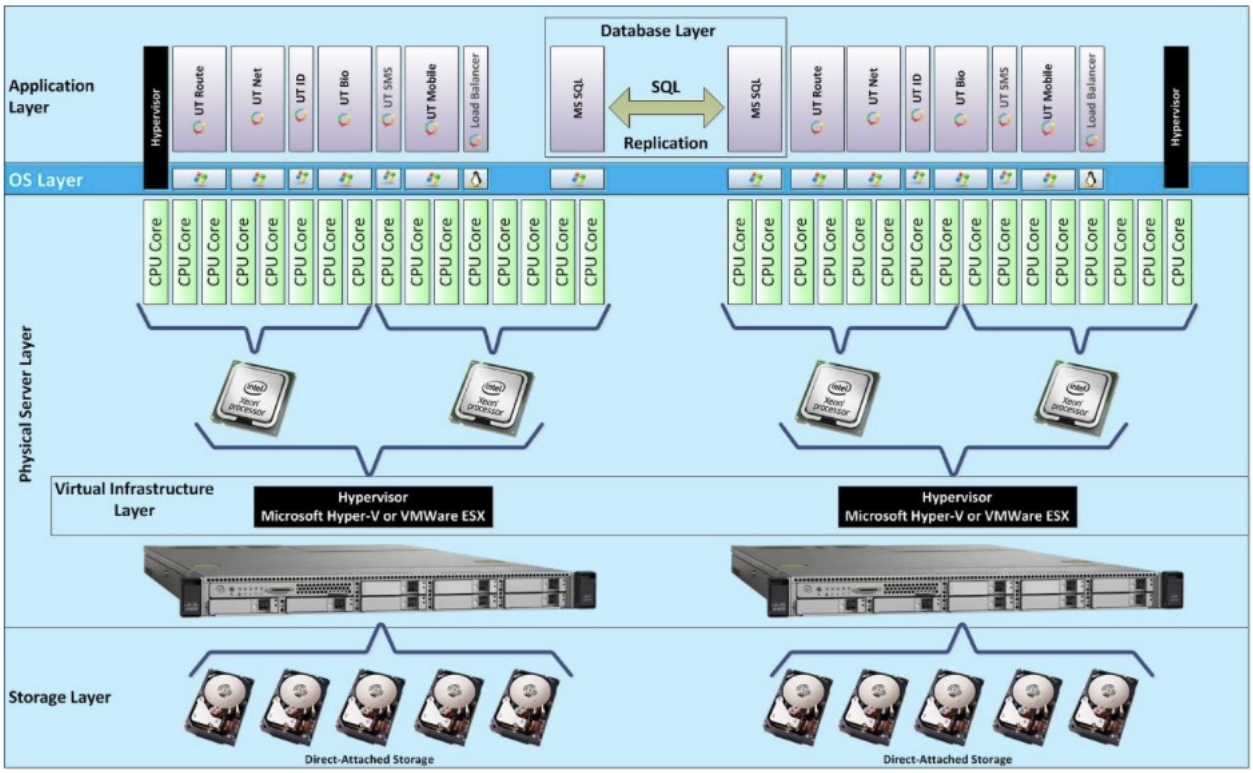
5.4 Operating System Layer

Proposed Cellutech applications can run on Microsoft Windows Server OS or Linux. Latest Windows Server operating systems include hypervisor feature/role in the standard license.

Each Microsoft Windows Server Standard License allows for 2 virtual OS instances running. To ensure high availability and optimize project cost running all PMS applications on virtual servers is highly recommended.

A dual redundant deployment of PMS apps is highly recommended.

All operating systems should be properly licensed according to the selected vendor's licensing policy and based on the solution sizing.



5.5 Virtual Infrastructure Layer

Due to the fact that all Cellutech apps achieve high-availability and scalability on the upper application layer by running multiple instances of the same software with a load balancer, they do not require costly and complex virtual infrastructure.

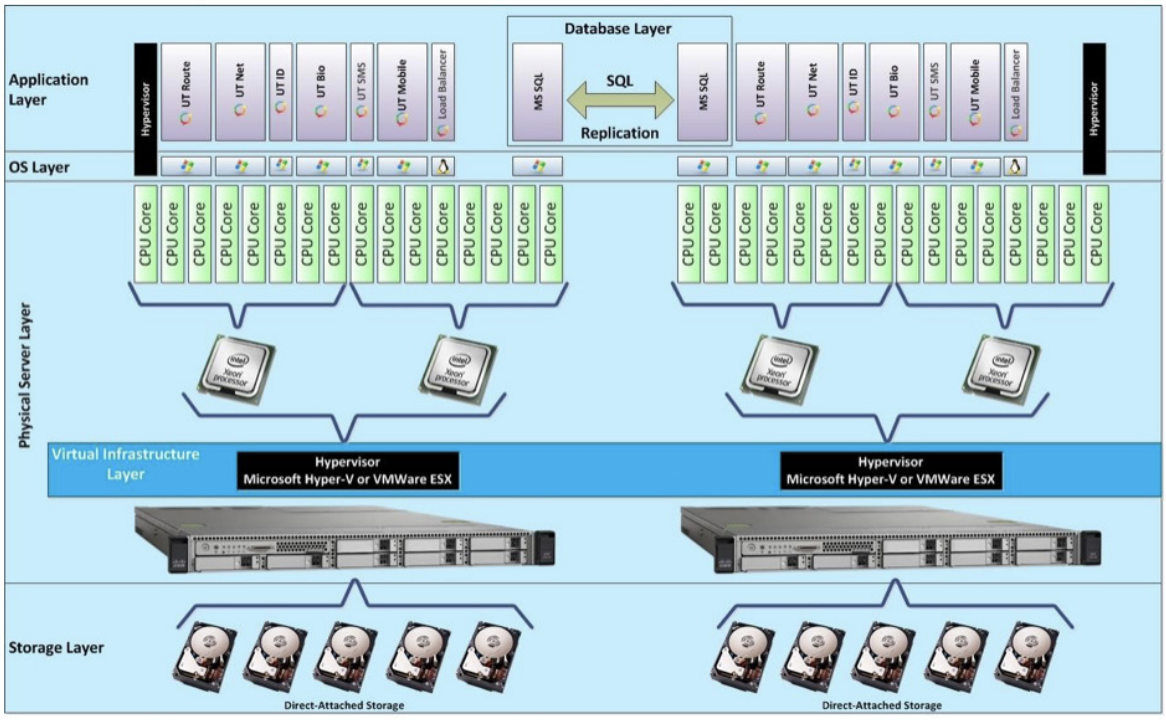
There is no requirement for virtual-machine level redundancy (such as VMWare high-availability and fault tolerance or Microsoft NLB or Failover clusters), so there's no strict requirement for running costly and complex virtual clusters with shared storage.

It is enough that different instances of each installed application are running on separate host servers. This can be achieved using servers with sufficient local storage (RAID) and free version of VMWare ESX or Microsoft Hyper-V included in Windows server license.

VM-level co-residency is defined as VMs sharing the same physical server and the same virtualization hypervisor. Cellutech apps support full VM-level co-residency while all other requirements and sizing rules still apply and shall be strictly followed.

Hypervisors for running virtualized Cellutech apps supported are as follows:

- Microsoft Hyper-V on windows server 2008 or above
- VMWare vSphere 4.0 or above



5.6 Physical Server Layer

Hardware Servers should provide sufficient resources (CPU cores/frequency and RAM) without any oversubscription for all concurrent applications running based on the input sizing parameters.

Solution high-availability is achieved by running identical software components on separate physical servers, so in case of physical server failure, service availability is maintained.

Typical solution deployment consists of two properly sized servers that provide sufficient performance and redundancy, but the solution supports the scale-out approach to provide unlimited scalability in case of increased workload. Hypervisor components introduce some form of overhead which should be accounted for as well.

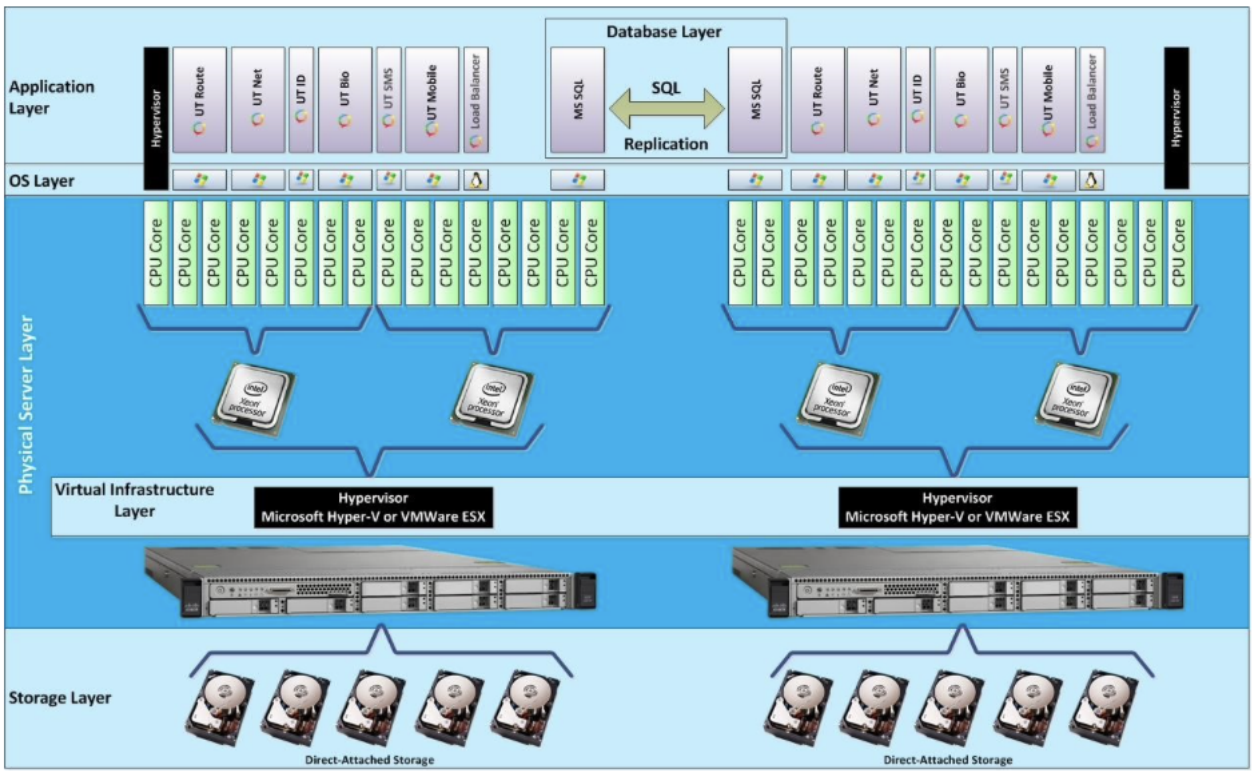


Diagram 5. *Physical Server Layer*

5.7 Storage Layer

Cellutech apps support DAS, NAS or SAN storage subsystem. All forms of storage oversubscription are not supported, thus total sum of vDisk capacity should be less than total sum of physical storage capacity. Thin provisioning on vDisk or physical disks is not supported. The storage solution must supply enough performance to handle the total load of all the applications:

- End-to-end data store latency should not exceed 20 milliseconds at any time.
- Must provide enough IOPS to handle sum of the applications/VMs.

Since applications do not rely on any form of shared storage resources, based on the applications sizing it is acceptable for small deployments to use servers with local direct attached storage. For medium and large deployments in most of the cases centralized SAN storage appliances prove to be more scalable and optimal solution. Based on this assumption the recommended reference configurations are using both technologies.

5.8 Networking Layer
5.8.1 Architechture - Design, Isolation, Security

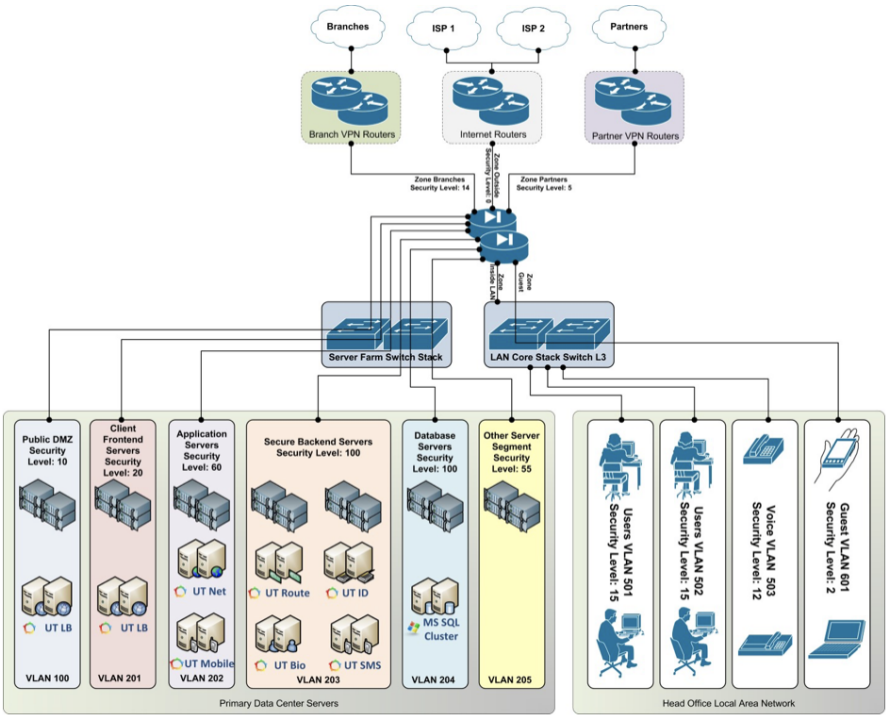


Diagram 1. *Networking Layer – Reference Architecture Design*

Network isolation rules and guidelines should be followed when placing individual application VMs on the network based on their function and communications requirements.

Network segregation and VM isolation should be achieved by using 802.1Q VLANs utilizing both hardware network infrastructure, as well as the virtual switch provided by the selected hypervisor vendor.

The entire network topology should be segregated on security zones with custom policies such as:

- Outside-Internet
- Branches
- Head Office LAN
- Partners
- Public DMZ
- Data Center

Network firewalling between each security zone is required to provide network access filtering. Only application traffic should be explicitly allowed and everything else denied.

To provide additional level of security as well as to meet certain standards and regulations (such as PCI-DSS) it is recommended to use intrusion detection and prevention appliances and application firewalls.

Network traffic to and from remote locations should be protected by using secure and reliable technologies such as IPSec or SSL VPN.

Where applicable, traffic to and from external partners should also be protected with encrypted VPN.

Employee remote access for business operations and administration should be strictly protected with encryption and authentication.

5.8.2 Performance

The aggregate networking load of the co-resident virtual machines or applications must be met with the physical networking infrastructure, including NICs on the hosts, network infrastructure equipment, and links. Refer to Table 1 for application-specific network sizing.

All server NICs should be at least 1Gbps. Deployments leveraging unified fabric infrastructure (network + storage on the same infrastructure) must account for network traffic from both VM LAN access and VM storage access.

Bandwidth stated in the table represents aggregate network bandwidth for a given application and load. Based on the client-specific deployment, network infrastructure specifics, as well as the particular business use of the application, the aggregate bandwidth stated will be distributed across different links - high speed local area network, branch WAN, Internet WAN, mobile 3G connections and many others.

All link-specific parameters such as throughput, latency, packet-loss, competing traffic, combined with the expected Cellutech application bandwidth should be thoroughly evaluated and accounted for.

Conclusion:

The proposed PMS solution can help any institution to streamline its project management processes and achieve its business objectives. Our team is committed to providing high-quality implementation, training, and ongoing support services to ensure a successful and long-term partnership.

Thank You!

CelluTech

E-Government ERP

(Enterprise Resource Planning)

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