Software Development Guidelines

for Encentral Solutions’ Software Development Team

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1. Introduction

Encentral Solutions is a software company that continues to engage in a number of software development projects and initiatives. As a company, our major objective is centred around solving information technology problems by providing reliable and sustainable solutions that our clients can depend on. We pay a lot of attention to the nature of projects or problems we choose to solve. Our goal is to ensure that we solve problems with a significant impact on end users and society at large.

Any serious software company should have a set of defined processes on how to go about developing their software applications. Sometimes, these processes may not be documented but passed on from developer to developer. In cases where processes are not well documented or not documented at all, the company risks inconsistency in their software development processes. Inconsistency in processes can lead to unpredictable results.

A software company without a well-documented set of processes/guidelines will make it difficult for new team members to integrate quickly. This difficulty is more pronounced when the development team operates remotely. Developers may not know what to expect at different stages of development thereby resulting in them making mistakes that may negatively affect the project that they are working on.

The purpose of this document is to outline the guidelines, processes, principles and methodologies that software developers in Encentral Solutions should follow in carrying out their day-to-day software development responsibilities.

It is important to note that this document is a living document and will continue to be reviewed from time to time. The purpose of the continuous review is to enable clarity, detailed explanations and document revised/improved processes and guidelines.

2. Goals & Objectives

The goal of this Software Development Guide is to create a single frame of reference that new and existing members of the development team are to follow at different stages of their software development journey at Encentral Solutions.

This document is meant to help standardise our software development processes. Thereby ensuring that team members work in a consistent and predictable way. The processes defined in this guideline are geared toward ensuring that Encentral Solutions continues to develop quality, reliable and sustainable software solutions that have a significant impact on end-users and society at large.

Other objectives of this Software Development Guide include:

- Ensure consistency in our software development processes.
- Enable team members to know what to expect from others.

- Educate and guide new team members by bringing them up to speed and enabling them to hit the ground running in the quickest way possible.

3. Stakeholders

The main stakeholders who should be involved in this guideline are as follows;

- Engineering Team
- Engineering Management and Quality Assurance Team
- Project Management Team
- Management Team

4. Working on a Project

The management decides on the projects to be implemented and the priorities of such projects. Since this guide is about software development, the recommendations here apply only to software projects.

Depending on the circumstance, the engineering team lead or the management can decide the composition of the project team. All software projects/implemenation are based on a set of requirements. At the moment, these requirements come from the management team. This can change in the future. If the project is a new project, there will be a brief requirements document produced by the management team. In cases where there is a need to update an existing system, the requirements may come in the form of a briefing session or some short notes (sometimes both) describing what needs to be implemented.

For new projects, the design team will develop the user interface of the system after studying and understanding the system requirements. At this stage, all members of the design and engineering team are required to study the requirements of the system and participate in various requirements briefing sessions until the requirements are fully understood. It is recommended that those requirements sessions be recorded in Loom or other suitable platforms for later access by the team.

The backend team assigned to a project should begin the **design of the Entity Relationship Diagram** (Database Schema) after understanding the requirements. Frontend team members are welcome to join the ERD sessions. The ERD will be reviewed and approved by the management team before the backend team can proceed with the implementation of the system.

As for the frontend team, they are the last team to start their implementation because the design team would need to complete the **user interface design** for the system before frontend implementation can start. The design team must get management approval before **handing off designs** to the front-end engineering team. For an existing project where the new requirements necessitate an update to the user interface, the design team will implement the user interface changes after a full understanding of the new/additional requirements. It is advisable for the design or development team to request documentation that can help communicate complex requirements such as process flow diagrams, system context diagrams or other types of representation of the requirements to be implemented.

4.1. Project Configuration

For every project, there should be a corresponding project folder on Google drive. The project folder should be accessible to all project team members (Designers, Frontend Engineers, Backend Engineers, Project Manager, Engineering Team Lead, Management and any other project stakeholder).

Each project folder should contain the following subfolders at the minimum:

- Requirements: For project requirements files
- Design: For UI and ERD files
- Documentation: For documentation files
- Knowledge Base: For knowledge base files
- Other Documents: For any other document that do not fit into the above-mentioned folders

Projects that require the writing of code would require the management/engineering team lead to **create software repositories to manage the code base** of the project. At the moment, Encentral Solutions makes use of GitHub for code version control.

New Project

Immediately after a project is announced by the management, the project manager and the engineering team should work together to **create a project work plan**. The work plan will require input from all team members including the management. The work plan for a new project should contain information such expected project start date, expected project completion date, timeline and resources responsible for

- Requirements documentation (with User Experience documentation)
- Design documentation (ERD and Initial SQL Script)
- Quality Assurance Documentation
- UI Design
- Backend Development
- Frontend Development (if applicable)
- Mobile App Development
- User Guide Documentation (Document, Google Site, Videos)

Changes to Existing Project

There are a number of situations where changes are required to be made to an implemented project. Some of those situations are

- Quality Assurance (Test)
- Management Feedback
- Client Feedback
- Post-deployment fixes and enhancements
- Post-deployment implementation of new features (System upgrade)

When an update to an existing system has been agreed upon, the project manager and engineering team line are expected to develop a work plan specifically for the updates require. Some updates may require updating existing requirements while others require some sort of briefing through video sessions, meetings and other forms of communication/documentation.

4.2. Team Configuration

The management in collaboration with the engineering team lead will be responsible for assembling the project team. The work plan for the project should contain all team members and their assigned tasks.

4.3. Task Configuration

The tasks that team members working on the project are responsible for should be defined in the project work plan. There should be a **work plan for every project implementation** (new/existing no matter how small the requirements are.

Being a remote-friendly organization where the activities of team members are not being monitored, the work plan should be the tool that will be used to ensure that team members are contributing their quota to the success of a project and are doing so as at when due.

The project manager and engineering team lead should be held accountable for non-adherence to the rule that says that there should be a work plan for every implementation. No matter how small.

5. Development Environment and Activities

This section of the guideline is about processes and procedures that relate to software development activities and the development tools used in the process.

5.1. The Development Server Setup

For all software applications that require a backend and a web/mobile frontend, an application server is required to be set up and configured with the appropriate subdomain and development stack installation.

The engineering team lead is responsible for the set-up and configuration of the new servers. The engineering team lead may choose to delegate the server set-up to any other team member. The process of setting up the server involves set up of :

- **Creating a server instance on AWS** and configuring the appropriate security groups and other relevant configuration
- **Backend API server and development environment**
- Web Server to serve as a proxy server to the backend API server and also a repository for frontend application files
- **Frontend development environment**
- **Configuration of Continous Integration and Continous Development** (CICD) agent for auto deployment (of backend and frontend apps)
- Other required tools and configuration need to get the application server up and running.

5.2. The Database Setup

Most of our applications make use of the Postgres SQL database management system. Therefore we have a dedicated development (dev) database server that all applications that make use of Postgres SQL connect to.

For every application that requires a Postgres SQL database, the engineering team lead is expected to create a database on the database server and share the credentials with the backend development team responsible for connecting to the database in their application.

For security reasons, database credentials should be unique to each application.

Database Credentials for developers

The engineering team lead is responsible for **managing the database server access.** While application database credentials are typically unique to each database, developers can have database accounts that are connected to one or more databases. This is useful if a developer is working on more than one application at the same time. Such developer accounts should not be able to access all databases on the database server, only the relevant databases to that developer (based on the applications they are working on).

5.3. Continuous Integration/Continous Development (CICD) Configuration

For ease of testing and deployment, **we use GoCD as our CICD tool**. CICD is a process that automates the building of source codes from the code repository and deploying them on specific servers in order to make the services available to other applications or users.

For example, when a backend developer is done with the code for a module, the code a pushed to a working branch in the Git repository. The developer is then responsible for creating a pull request to merge their code to the main branch and adding reviewers to the pull request. The purpose of the pull request is to allow an experienced developer to check and review the code that is to be merged to the main branch in the code repository.

After the code is reviewed, the reviewer can choose whether to accept the commit/request or not. If accepted, the code will be merged into the main branch. Based on the configuration of the CICD, it can be configured to monitor the main branch and then carry a set of automated tasks to pull the latest code, run unit and integration tests, build the code and copy the deployment files to the appropriate location on the server. The process usually invoices stopping and starting the application server as part of the automated tasks.

5.4. Code Repository

Encentral Solutions uses **git for her source (code) control**. Every developer should have git installed and configured on the development system. As for our remote git repository, we use GitHub. With GitHub, we don't need to set up our own git server.

For every project that involves writing or making use of existing codes, a git repository must be set up to help manage the code. Git makes it easy for many people to work on a piece of code at the same time without having to manually copy and move codes around in storage devices. The engineering team lead is responsible for **setting code repositories and grating required access to team members** that will be working on the code.

As part of the code repository set-up, the engineering team leader is expected to configure **pull request review rules and other relevant rules** necessary for protecting the code and enforcing some standard practices.

5.5. Commits and Pull Requests

Creating commits and pull requests is a regular and continuous event for every developer. Therefore, it is very important to follow a set of guidelines to enable consistency and ease of collaboration among team members.

Commits/Push to Server

Code commits are done on a code branch that a developer is working on. The following guidelines should be followed when working with branches.

- Branches should be created for specific features in an application. This will make it easy to merge the branch to the main branch and also allow the developer to proceed with other features even while the previous branch is yet to be merged.
- Avoid combing more than one feature in a branch
- Name a branch in such a way that the reviewer can tell that a feature is contained in the branch
- Don’t commit/push to the main branch directly. Such commits should be done through a pull request.

The purpose of a commit is to save a piece of code to a repository (especially a local repository). A code that has been committed to a local repository is of no use to other developers other than the developer that did the commit. As long as the committed code has not been pushed to the git server (in our case GitHub), the code is as good as not existing because anything can happen to a developer’s system which can make the code inaccessible. As a result of a bad hard disk, loss of the entire system or other unforeseen circumstances, a developer may completely lose the code committed to their local repository.

Every commit should be given an appropriate description. This is to enable developers to understand the purpose of the commit at a future time. When a code is left for a long time, one tends to forget some details of what was done at the time the project was active. Good commit descriptions make it easy to find our way back to understanding what was done.

As a rule of thumb, every developer is expected to constantly push their locally committed code to the server. This can be done several times a day. As the bearest minimum, **there has to be one push to the server within a day**.

Pull Requests

For codes to be merged to the main branch, it has to come through a pull request. The purpose of the pull request is to ensure that the developer is not adding codes that will cause instability in the code execution. Therefore, all pull requests are to be reviewed and approved by designated team members.

When creating pull requests, the description of the pull request should be such that other team members can understand the purpose of the pull request without having to ask the author of such requests.

We should make it a duty to review pull requests on time so as not to delay other development activities that other team members are depending on in order to proceed with their tasks.

5.6. Testing

Unit and Integration testing are important as they improve the quality of our code that minimized bugs when updating existing code. At the moment, Encentral Solutions is yet to take a holistic approach to testing. The level of testing at the moment is based on the willingness of the developer to do what is required. This is an area that greatly needs an overhaul.

Unit testing

Unit testing is a type of software testing where individual software components are tested. Unit Testing of the software product is carried out during the development of an application. An individual component may be either an individual function or a procedure. Unit Testing is typically performed by the developer. It is a testing method in which every independent module is tested to determine if there is any issue by the developer himself.

Integration Testing

Integration testing is the process of testing the interface between two software units or modules. Its focus is on determining the correctness of the interface. Integration testing aims to expose faults in the interaction between integrated units. Once all the modules have been unit-tested, integration testing is performed.

Difference between Unit and Integration Testing:

Unit Testing	**Integration Testing**
In unit testing, each module of the software is tested separately.	In integration testing, all modules of the software are tested combined.
In unit testing tester knows the internal design of the software.	Integration testing doesn't know the internal design of the software.
Unit testing is performed first of all testing processes.	Integration testing is performed after unit testing and before system testing.
Unit testing is white box testing.	Integration testing is black box testing.
Unit testing is performed by the developer.	Integration testing is performed by the tester.
Detection of defects in unit testing is easy.	Detection of defects in integration testing is difficult.
It tests parts of the project without waiting for others to be completed.	It tests only after the completion of all parts.

Unit testing is less costly.	Integration testing is more costly.
Unit testing is responsible to observe only the functionality of the individual units.	Error detection takes place when modules are integrated to create an overall system
Module specification is done initially.	The interface specification is done initially.
The proper working of your code with the external dependencies is not ensured by unit testing.	The proper working of your code with the external dependencies is ensured by integration testing.
Maintenance is cost-effective.	Maintenance is expensive.
Fast execution as compared to integration testing.	Its speed is slow because of the integration of modules.
Unit testing results in in-depth exposure to the code.	Integration testing results in the integration structure's detailed visibility.

System Testing

System Testing is carried out on the whole system in the context of either system requirement specifications or functional requirement specifications or in the context of both. System testing tests the design and behaviour of the system and also the expectations of the customer. It is performed to test the system beyond the bounds mentioned in the software requirements specification (SRS). System Testing is basically performed by a testing team that is independent of the development team that helps to test the quality of the system impartial. It has both functional and non-functional testing.

5.7. Deployment

When it comes to deployment in our development environment, the CICD process has taken care of that. However, in production environments, the deployment is done manually mainly due to the sensitivity of the applications we develop. In the near future, we will set up CICD tools in production environments in order to automate the deployment process.

At the moment team members are expected to build the distribution file for deployment and upload the same to a Google Drive folder "App Deployment" for onward deployment to production servers.

6. Coding Standards

Code standards are rules, techniques, and guidelines to create cleaner, better readable, and more efficient code with minimal bugs and errors. In addition, they offer a uniform way for developers to build highly functional code.

Remember that coding standards are not personal opinions; they are concrete rules determining your code's programming style, procedures, and methods. Therefore, they need to be explicitly defined and made available to developers.

Coding standards make sure all developers follow specified guidelines. As a result, every developer – even newcomers – can easily understand, debug and maintain the code. Ideally, the team's source code should look like it was written by a single developer in a single session.

Why are coding standards necessary?

- They reduce security concerns and performance issues that might have resulted from poor coding practices;
- They help guarantee code quality, making our code easier to read, analyze, and work through. The code also becomes easier to maintain and extend, even by new developers;
- They lead to lower code complexity and more elegant design solutions;
- Any developer can examine any part of the code, understand it, and change it independently of when and who wrote it.

Advantages of using coding standards

- Enhancement of the efficiency of the software development process: developers spend a large part of their time fixing code quality issues that could have been avoided. Implementing coding standards will help your team detect the problems early on or prevent them entirely.
- Reduction in the code complexity and the number of bugs: if your codebase is unnecessarily complex, the chances of being vulnerable to errors and bugs are higher. Coding standards help you develop less complex software and, therefore, reduce errors.
- Improvement of the bug-fixing process: with coding standards, it becomes easier for developers to locate and correct bugs in the source code because it is written in a consistent manner.
- Improvement of the code maintenance process: if developers are following coding standards, the code is consistent and can be easily maintained. Anyone can understand it and modify it easily at any time.
- Reduction of development cost and time by enabling reusability: A clear code allows the developers to reuse the code whenever required. Reusability can radically reduce the cost and time of the development process.
- Better team integration: onboarding new developers become painless because the code is uniform and effortless to understand. New team members can quickly comprehend the codebase, and they know how to contribute to it in the same consistent way.

6.1. Adopted Coding Standards

Java Coding Standards (Backend Development) - View

Angular Coding Standards (Frontend Development) - View

Flutter Coding Standards (Mobile) - Not yet available

7. Documentation

One of the core values of Encentral Solutions is to build with sustainability and continuity in mind. To do this, systems will have to be passed on from team to team, individual to individual, manager to manager etc. Without effective documentation, it is going to be difficult for one team member to pass on their knowledge of a project assigned to them to another team member.

7.1. New Project Documentation

For every new project, the engineering team lead should ensure that **proper documentation is put in place** during the implementation of the project and not in the end. The reason for this is that we tend to lose the full context of what we implemented because it has been a while since the implementation. Therefore, it is important to update the project/application documentation as soon as certain implementations are carried out. Implementations that are likely to create a knowledge gap among other team members.

Before the deadline of any project, full documentation should have been produced and reviewed by the engineering team lead and in some cases, management.

7.2. Existing Project Documentation

Whenever a team member is assigned to an existing project or an ongoing project, the team member is expected to **document all new implementations that are likely to create a knowledge gap** among other team members.