Green Information System

Unit 3

Introduction

This chapter describes a generic Green information system (GIS). A GIS is a system that is dedicated to management of carbon data. Therefore, a GIS forms the basis for measuring, monitoring, and reporting on the carbon data of the organization. As such, this system is integral to environmental strategies of an organization.

This chapter focuses on the design and development aspect of such a GIS. GIS can be of different sophistication and can operate at varying levels. Most GIS have web services-based implementations and are deployed as SaaS.

Philipson has done a substantial work in studying, collating, analyzing, and listing close to 60 vendors offering over 100 GIS products.

These CEMS products have been grouped on CEMSUS ranging from spreadsheets and free online calculators through to large vendors and consulting organizations providing comprehensive green ERP solutions

Describing a GIS

- A GIS (or a CEMS or EIS) is a software system that provides support to the business to implement its environment responsible business strategies (ERBS). Thus, this system has to cover the length, breadth, and depth of various structural and dynamic aspects of the business.
- Some aspects of this system are similar to any other software system—it has underlying carbon emissions data that is gleaned from the devices that emit that carbon, it has processes and applications that help analyze that data, identify the trends, and, eventually, it has interfaces that present, report, and interact (and collaborate) with other external sources of carbon services and data.

- A generic GIS should be architected and designed in a way that enables it to be configured and used in all industry sectors. Furthermore, a good GIS must be able to cater for product service and infrastructure industries
- The development of a GIS h as to also cater to the interfaces with existing software packages (such as the existing ERP packages, including those that provide customer relationship, CRM, and supply chain management [SCM]). The development of a GIS has to provide a strategic purpose— especially as it is designed from ground up.

- The technologies to be used will include an underlying content management system, an object-oriented approach to design, an object-relational database, support for mobile devices and interfaces, and implementation in an object-oriented language (say, Java).
- The deployment of almost all new GIS is expected to be SaaS-based. Therefore, the system should be aware of SaaS and Cloud computing. GIS system is the software with the functions for measuring, monitoring, and performance checking o f t he various emissions generated by devices employed in the business activities.
- Organizational emissions values are computed by the system. These values are then compared to the standards set by the regulatory bodies.

Phases in a GIS Development and Deployment

Figure depicts the major phases of any typical software development lifecycle. In terms of GIS, they apply as follows:

- Develop:- GIS needs to be developed by following agile practices and considering the important phases of a SDLC starting from requirements, analysis, design, and code to testing. Development has to consider issues of deployment, integration, and operations. Analysis and design of the system is undertaken using the unifi ed modeling language (UML) diagrams that helps in modeling the problem space and develop a solution in design space (model of solution space). CAMS provides this overall methodological approach.

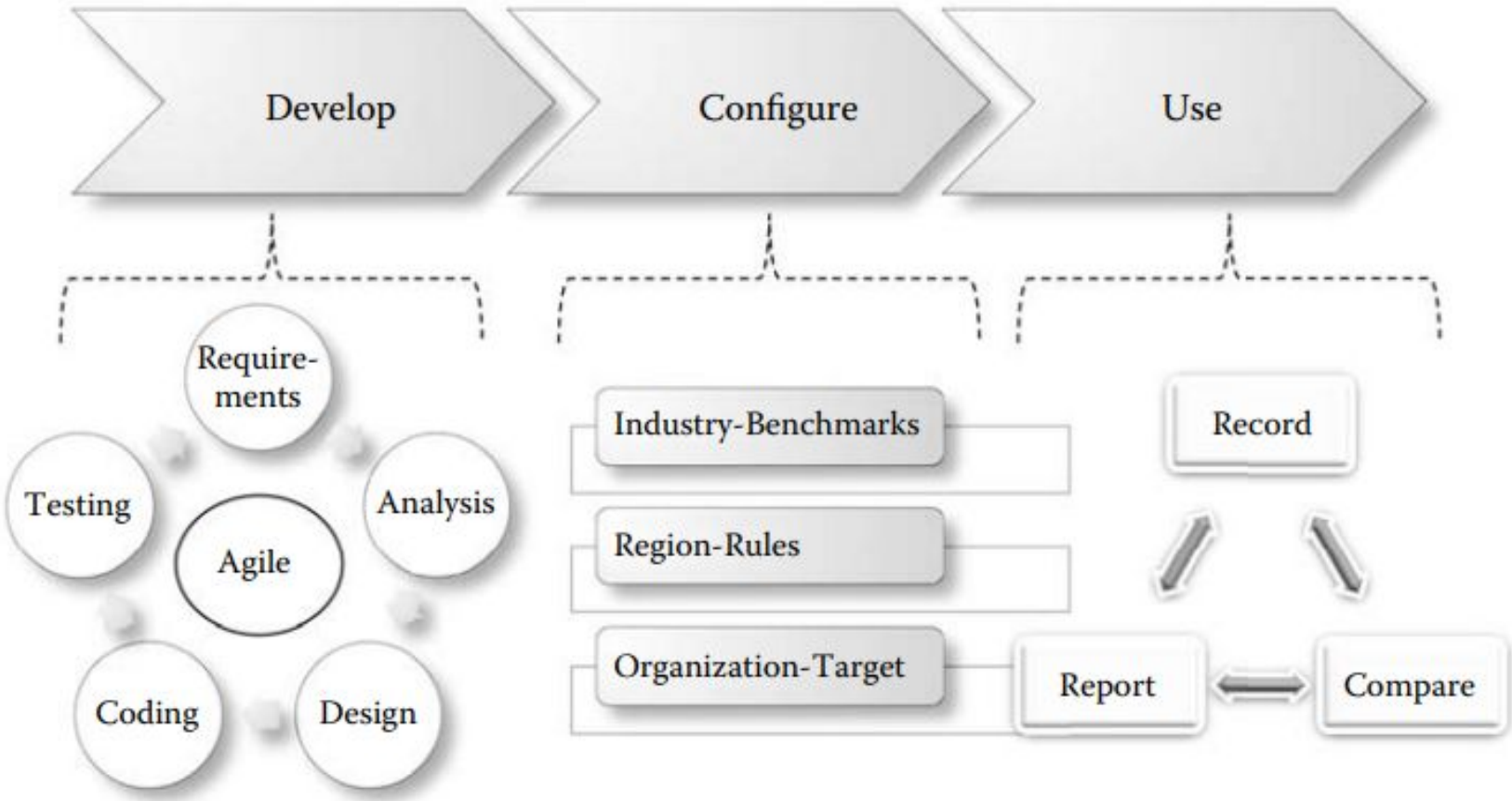


Figure **Major phases in GIS: development, configuration, and use.**

- Configure:- Configuring GIS according to benchmarks and rules of organization. This would be an activity specific to each organization within each industry sector.
- Use:- Use of GIS will lead to ongoing recording of carbon data creation of reports as well as comparisons

Features of GIS

GIS are required to have all relevant features for supporting the organization in its green initiative. These include support for the routine, operations, and also strategic trends.

GIS also includes enhancement of the business systems with green capabilities. This would enable the organization to make use of its existing data and processes and extend them for carbon control

GIS implementation needs to consider the integration issues—particularly as organizations have many existing ERP applications that will continue to be used irrespective of the environmental initiatives. Integration projects within ERBS will immensely benefit by the earlier discussion on technologies and EI

The features of a GIS that play a significant role in enhancing this ability of business to coordinate its environmentally responsible approaches can be listed as follow:

- Collecting environment-related data in real time:-The GIS has to be geared to collect data such as number of devices in use and on standby. Mobility further enhances this data capture ability and makes it real time. GIS has to also relate this data to other business applications.
- Providing querying tools, key performance indicators (KPIs), and business analytics to field workers and decision makers in the area of EI. Availability of querying mechanisms can provide information that enables closing down of unused servers, desktops, and other equipment

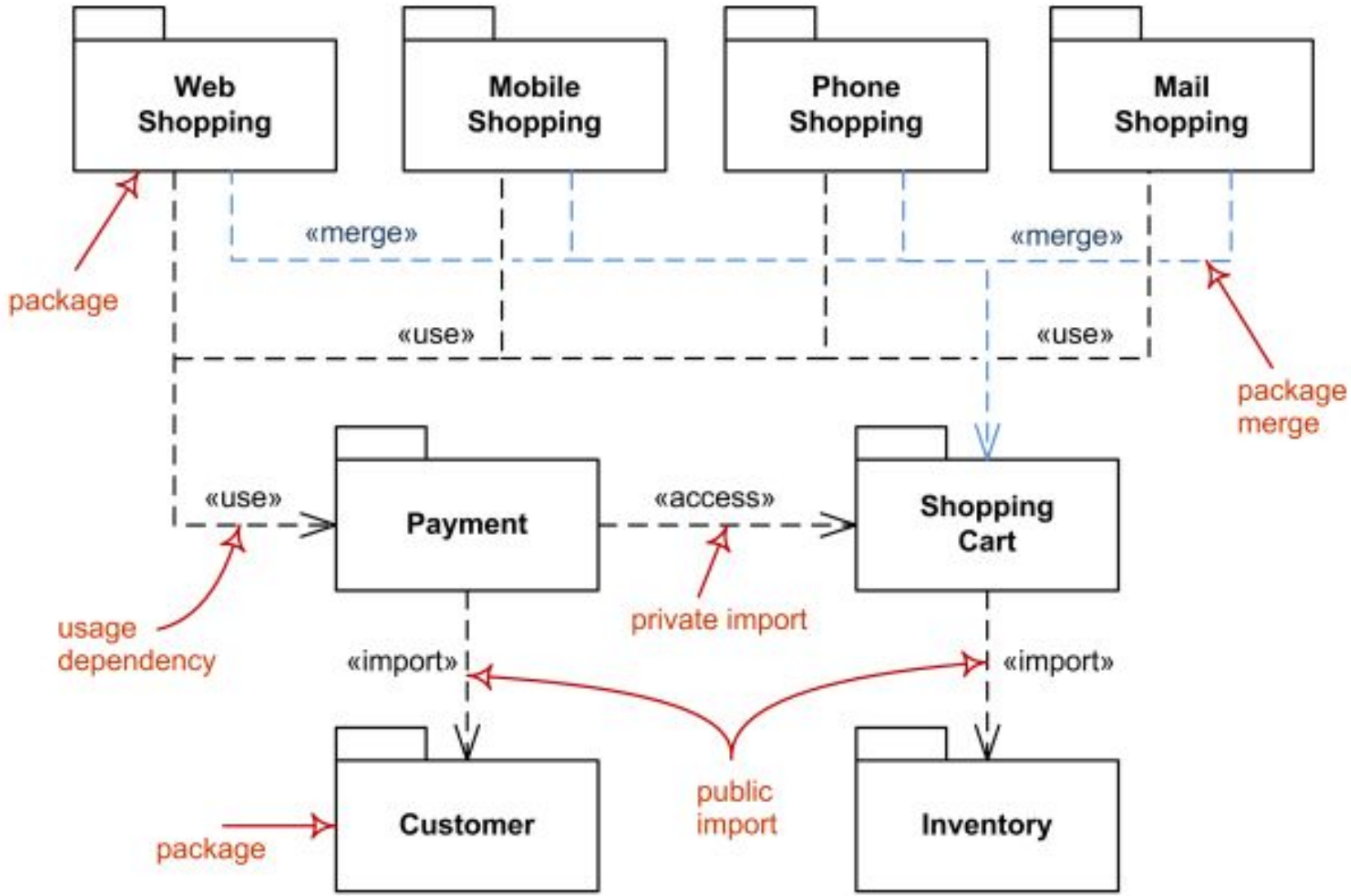
- Enhancing the decision-making capabilities of senior management by collating and computing up-to-date information from varied external sources (e.g., government regulatory bodies and weather information) and feeding t hat into GIS. As a result, knowledge management in the green domain of the organization is enhanced. This service-oriented approach in GIS and the resultant real-time analytics goes a long way in enhancing the organization’s green credentials.
- GIS substantiates the green effort of the organization through the metrics, thereby providing positive feedback and impact on the employees’ job satisfaction
- GIS can continuously identify and upgrade business processes and business practices in manufacturing, sales, and field support operations in order to make them environmentally responsible. GIS can help in optimizing the business processes

- GIS also provides feedback to customers and other external users of the business on its environmental performance—potentially resulting in increased customer service and satisfaction—especially for the environmentally sensitive and responsible customers
- GIS provides t he business with the ability to sustain itself for a long time. An environmentally responsible business and a sustainable business are complimentary. GIS can bring together technologies and processes for environmental sustainability.
- GIS enables collaboration amongst businesses for the purpose of achieving environmental responsibilities.

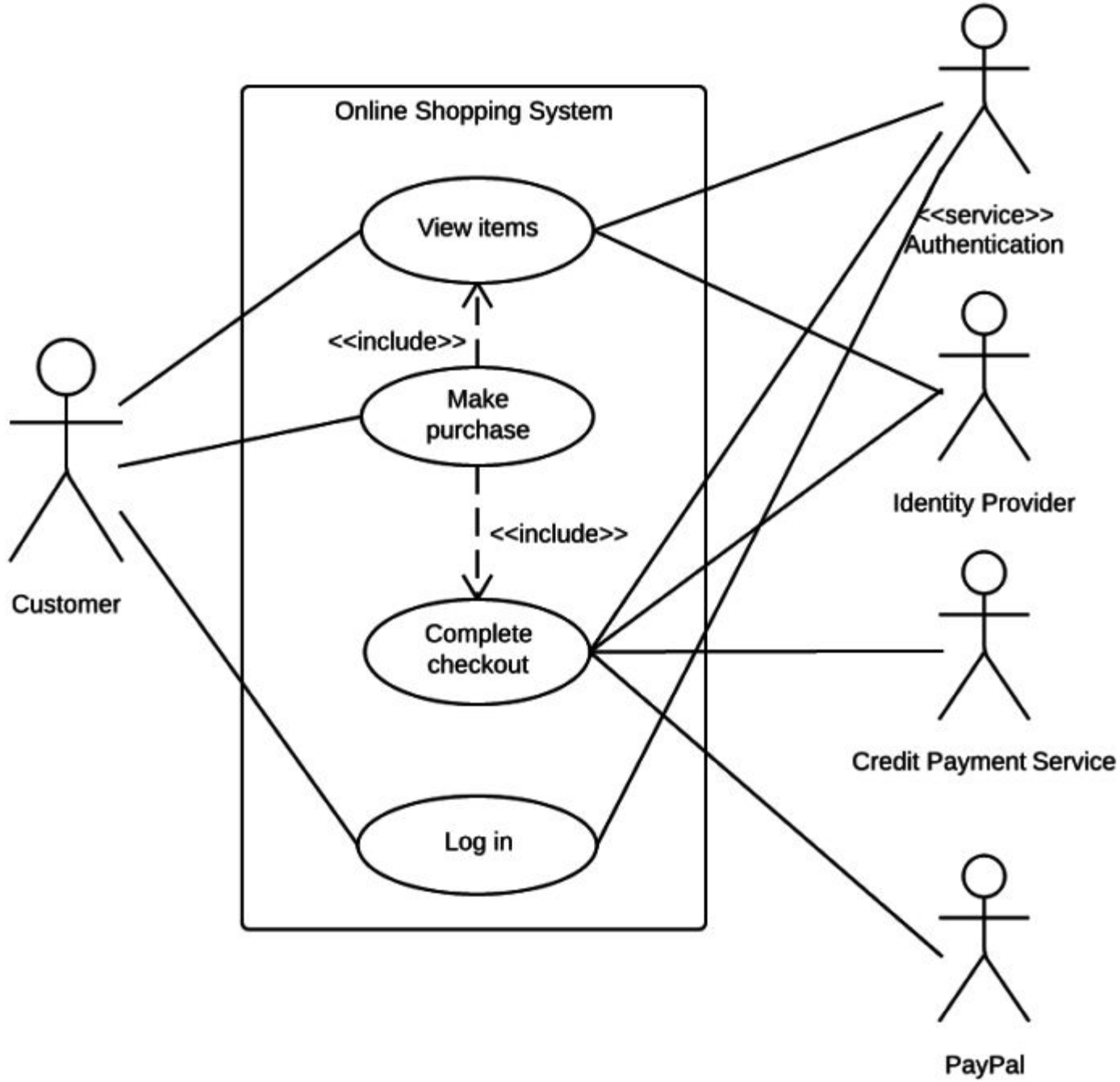
Modeling and Architecting GIS—Requirements, Design, Implementation, and Testing

The UML has been used in presenting the models of the GIS. The modeling constructs of the UML that are used in this chapter are as follows:

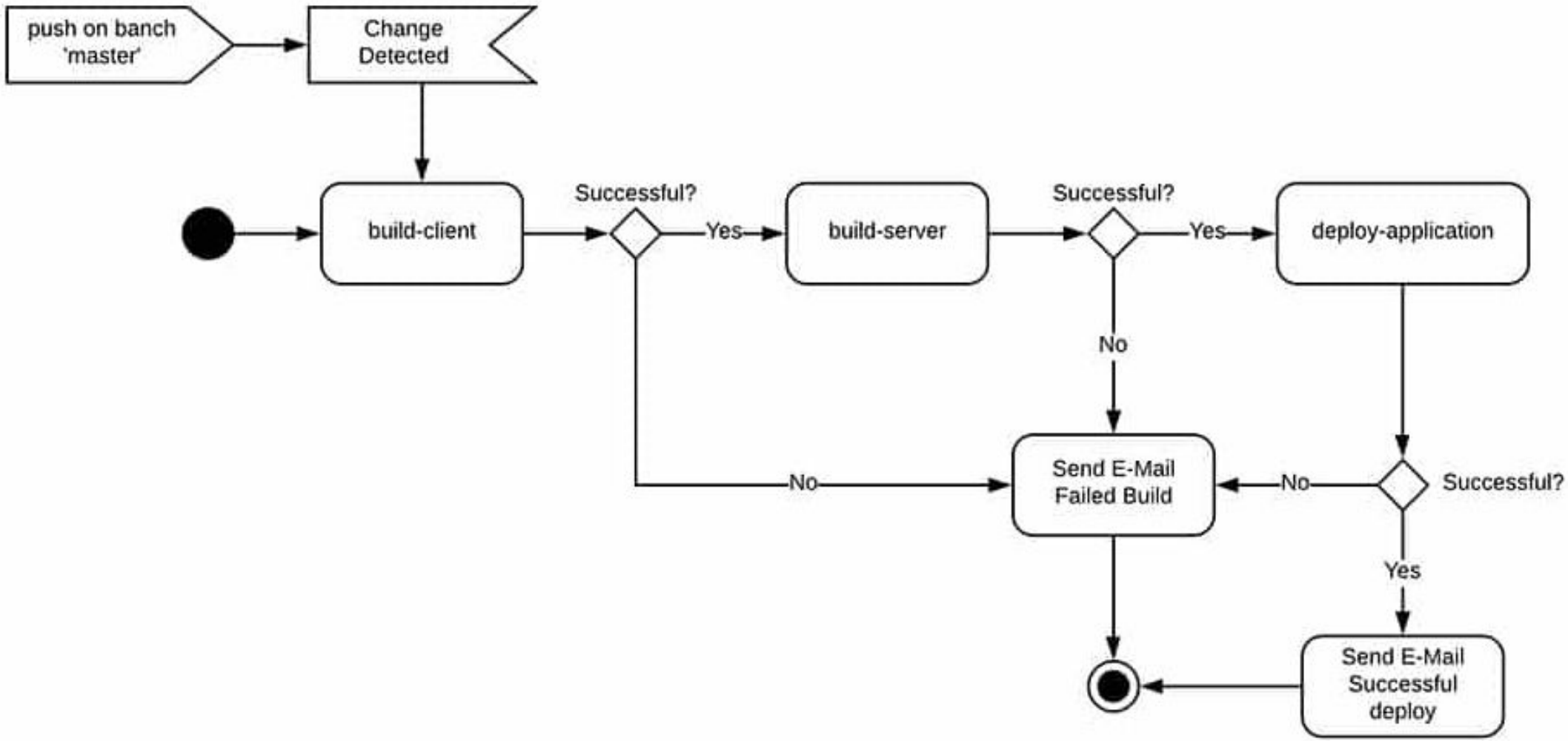
- Package diagrams—Used to create and model subsystems/Green information portals. Packages can also be used to create increments and sprints in an agile development approach.


Web Shopping
Mobile Shopping
Phone Shopping
Mail Shopping
«merge»
«merge»
package
«use»
«use»
package merge
«use»
Payment
«access»
Shopping Cart
usage dependency
private import
«import»
«import»
Customer
public import
Inventory
package

- Use cases—Used to show functionalities and business processes from a user's point of view. This is the expected behavior of the system documented as interactions.
- Use case diagrams—Provides a model describing all the related business processes/functionalities of a particular package. These diagrams also provide the scope of the

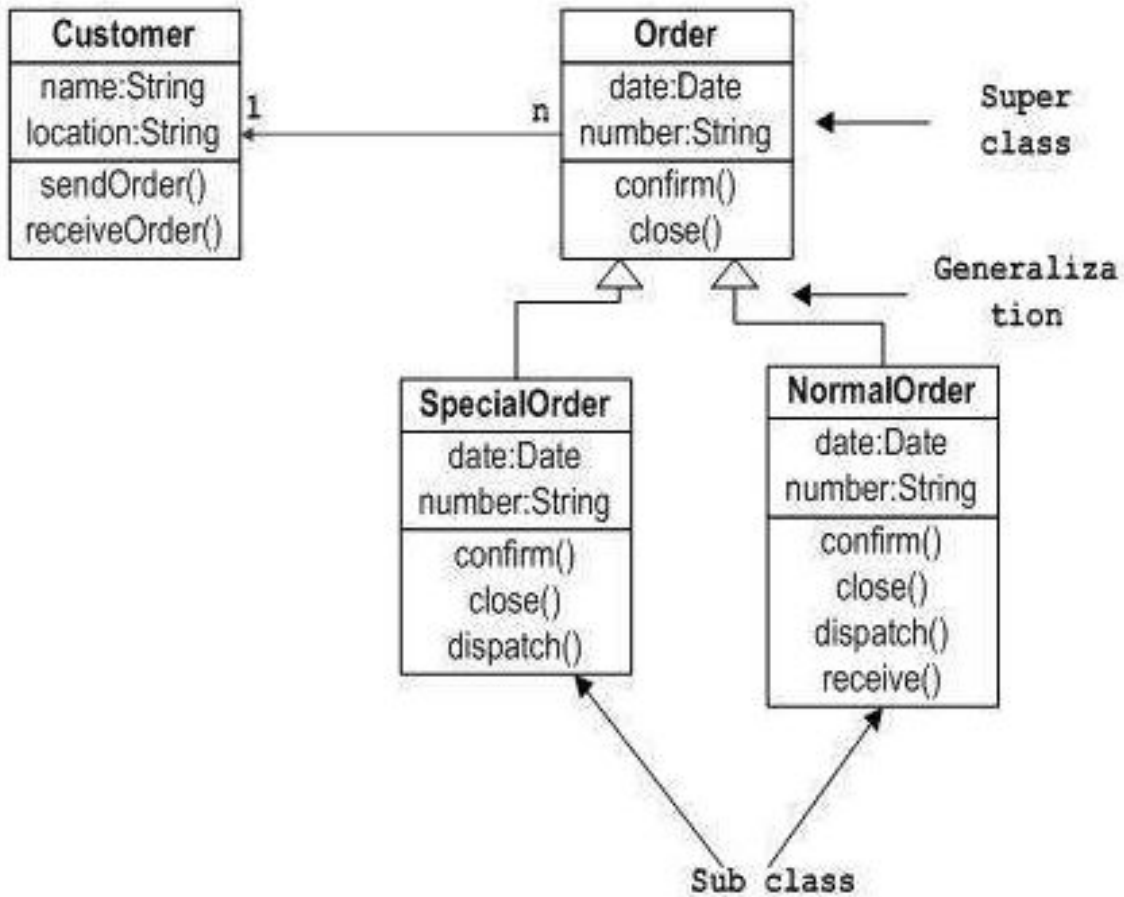

Online Shopping System
View items
<<include>>
Make purchase
<<include>>
Complete checkout
Log in
Customer
<<service>>
Authentication
Identity Provider
Credit Payment Service
PayPal

- Activity graphs—Provides a detailed view of every step of a business process. They provide the flow within a use case or a package of GIS.

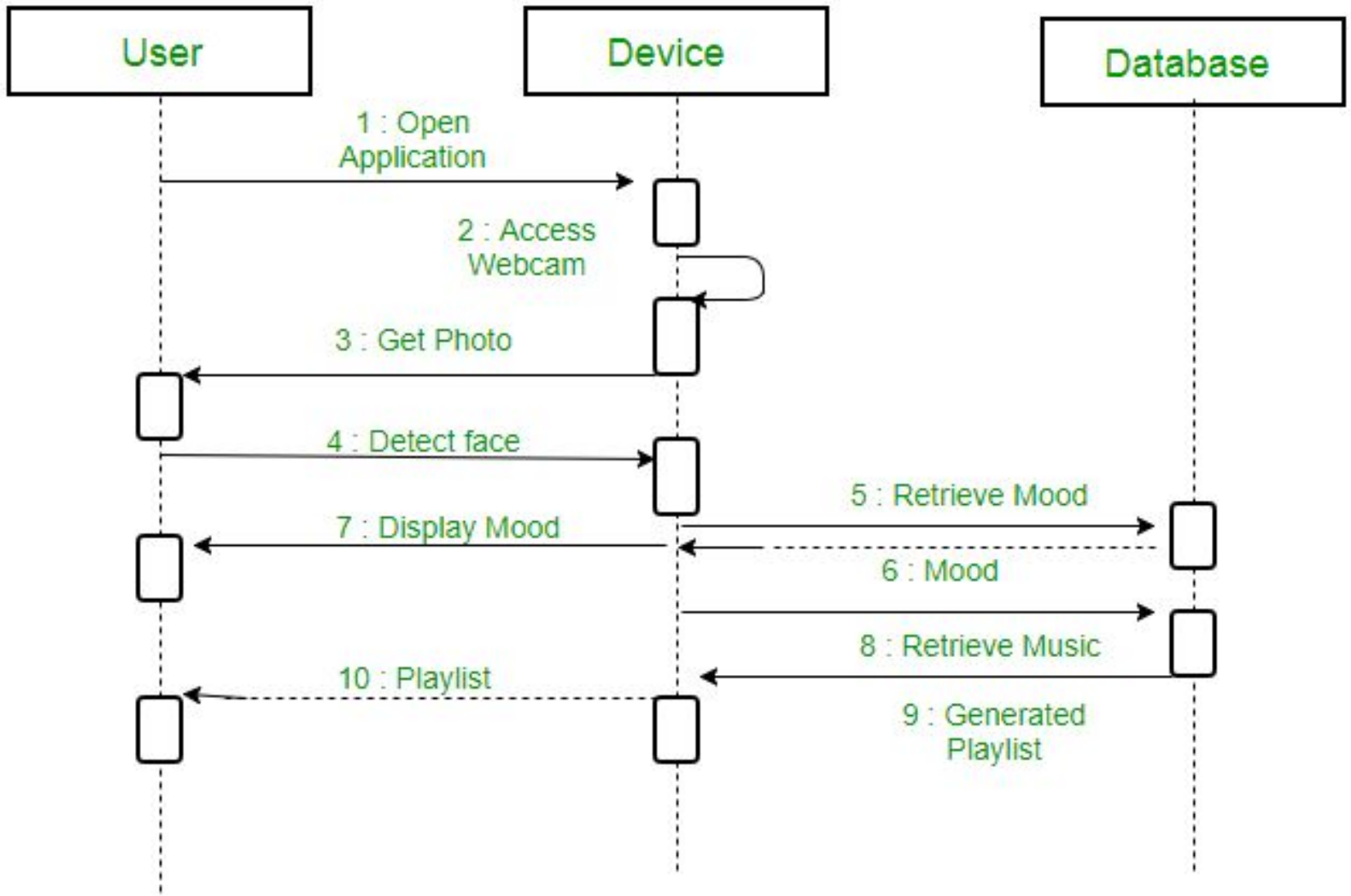

push on banch 'master'
Change Detected
build-client
Successful?
Yes
build-server
Successful?
Yes
deploy-application
No
No
Send E-Mail Failed Build
No
Successful?
Yes
Send E-Mail Successful deploy

- Class diagrams—Provides a static model of GIS based on its key business entities. This diagrams can also be used to model underlying carbon data warehouse

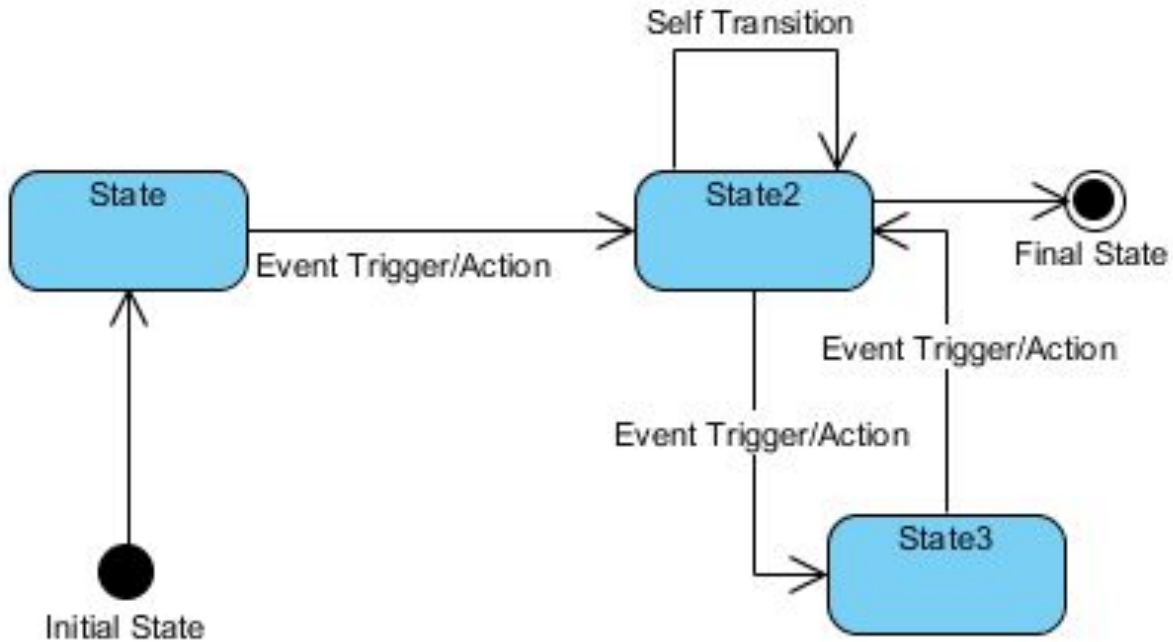
Sample Class Diagram



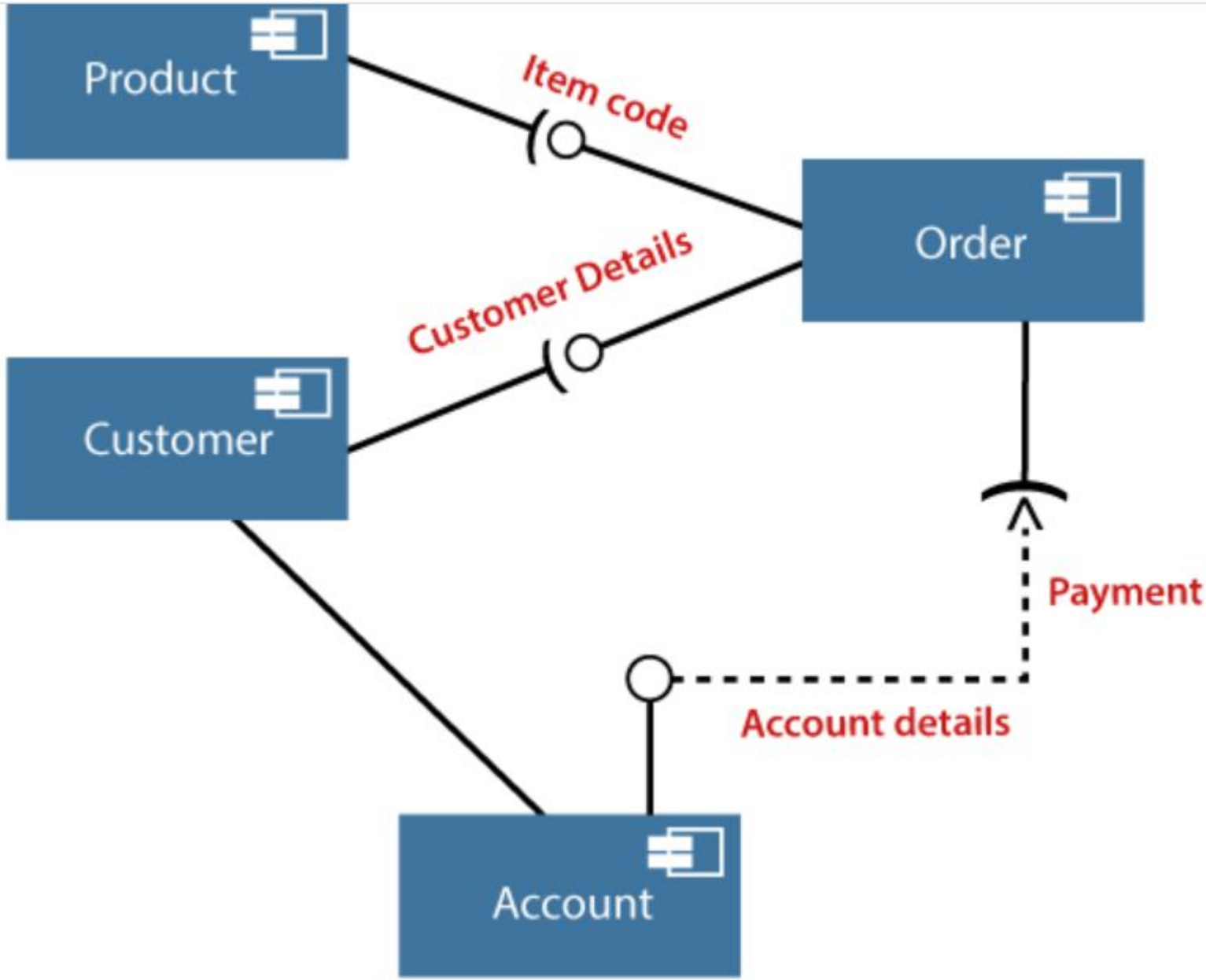
- Sequence diagrams—Provides a model for the interactions between objects and also rules for these interactions that are architectural decisions


User
Device
Database
1 : Open Application
2 : Access Webcam
3 : Get Photo
4 : Detect face
5 : Retrieve Mood
7 : Display Mood
6 : Mood
8 : Retrieve Music
10 : Playlist
9 : Generated Playlist

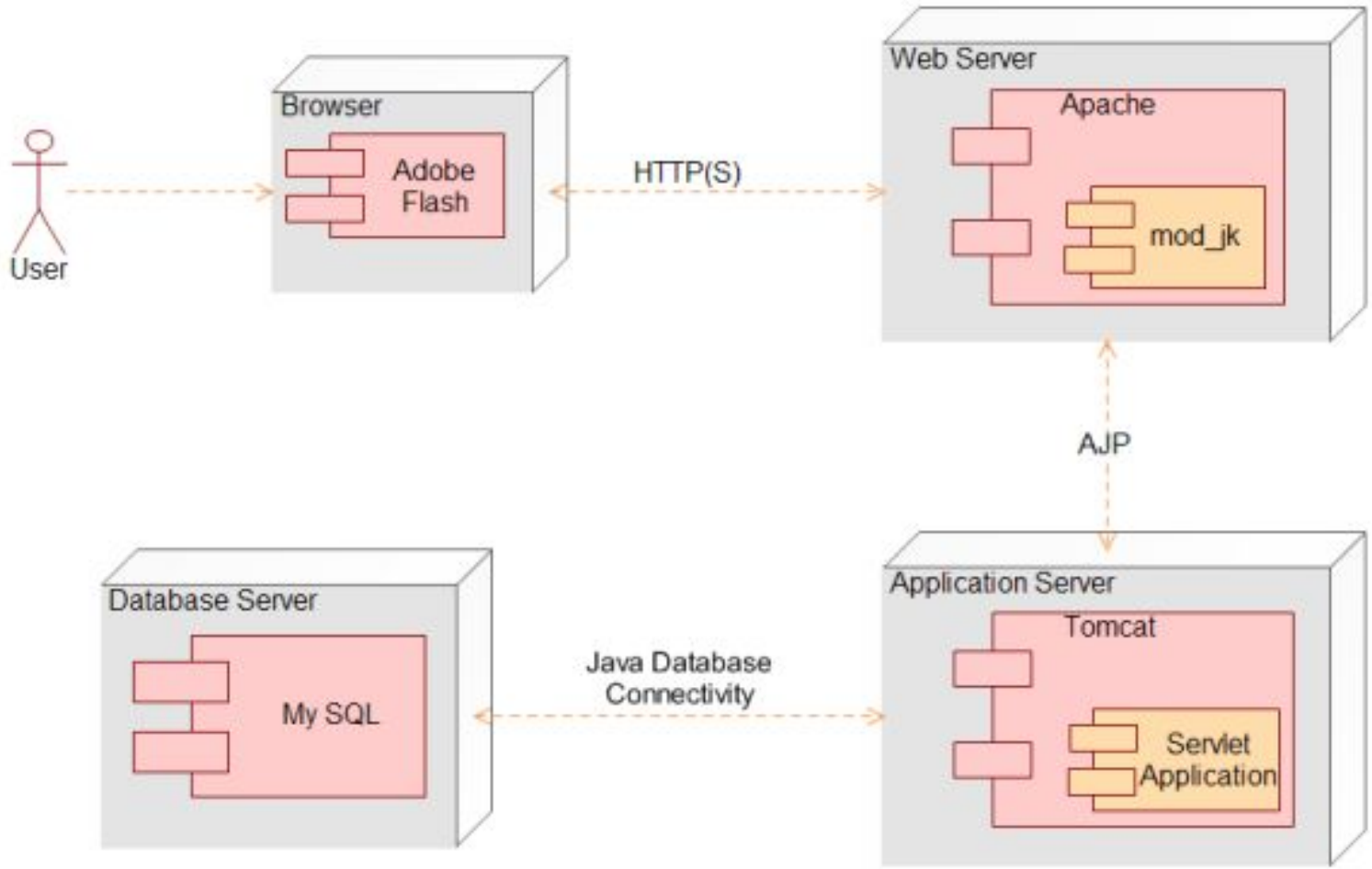
- State Machine diagrams—Provides a view in which a particular entity passes through different states as a business process is executed.


Self Transition
State
State2
Final State
Event Trigger/Action
Event Trigger/Action
Event Trigger/Action
State3
Initial State

- Component diagrams—Used to show the interaction of every component with each other


Product
Item code
Order
Customer Details
Customer
Payment
Account details
Account

- Deployment diagrams—Used to show the way application will be deployed including hardware and related infrastructure


User
Browser
Adobe Flash
HTTP(S)
Web Server
Apache
mod_jk
AJP
Application Server
Tomcat
Servlet Application
Java Database Connectivity
Database Server
My SQL

GIS Requirements

- The Green ICT is developed to measure only energy consumption and environmental parameters such as carbon emissions, chemical wastes, and other office and industrial wastes. The Department of Environment, a government agency, is responsible for monitoring the carbon footprint of all the companies. This document will concentrate on process of gathering requirements, the resources needed to build the standards module of the project, and monitoring the progress of the project through a Gantt chart
- Green ICT system analysis and design is performed using the UML. UML diagrams such as use case, class, sequence, activity, state machine, package component, and deployment diagram are used in modeling the problem space and in designing of the system.

- As mentioned earlier, these diagrams help in modeling the operations and interactions at the business level and also in system design thorough classes, packages, components, and deployment diagrams. A typical GIS would involve two subsystems:
  - Green organizational portal (GOP)
  - Regulatory standards portal (RSP)
- Regulatory portal provides the standard emission value determined by the regulatory body for each emission type based on the industry and company.

- Organizational portal focuses on the capture of emission data and its comparison with the emission standards.
- These standards, set by regulators are made available through t he RSP. Interaction between different users and operations performed by individual users are modeled as part of designing the system.
- Access to the system needs to be provided though an authentication mechanism to ensure the confidentiality and integrity of data.

Green Organizational Portal

- The GOP is made up of organizational data on its “green” performance. These data are updated by the organizational representatives on an ongoing basis.
- These data record the organization’s pollutant performance such as (a) heat generated by the desktop machines, data centers and network equipment within the organization, (b) carbon emissions in the petrol/diesel consumed by the organization, and (c) hazardous materials produced by the organization’s activities such as lead in batteries and mobile phones.
- The organizational portal should be fully customizable.

- This means, it should be usable in many different industries. Therefore, it should have the ability to create and record various categories of pollutant data.
- The organizational portal should have the ability to record the energy ratings of all the devices used within the organization (such as computers, vehicles, air-conditioners, and fridges).
- However, this GIS will not store the details of the organization's inventory, but only its carbon emissions. Therefore, the GIS's organizational portal will have to have an interface with the existing inventory management system, supply chain system and the customer relationship management system.

- The system is not meant to immediately measure t he scope 3 emissions. However, it should have the provision to do so later, when scope 3 emissions become mandatory and need to be included in the system.

Regulatory Standards Portal

- RSP is a large portal that will be maintained by the government agency responsible for emission control within a country or region.
- The RSP will have to have detailed and continuously updated information on the pollutant categories that are producing the carbon emissions.
- There are a large number of pollutant categories, which are also growing as new pollutants of the environment get recognized and added to the list.

RSP is made up of thousands of units of data, examples of which are as follows:

- Various types of pollutants that may not be directly related to IT such as petrol fumes from vehicles
- Pollutants t hat a re related to I T equipment and consumables—such a s monitors, printer ink, and lead batteries.
- The approved standard for each of the pollutants—for example, 0.03 mg carbon per liter of petrol, and 0.05 mg of carbon per cartridge of printer ink.

- The variations to the pollutants depending on the type of industry. Currently, RSP supports hundreds of industries such as airline, hotel, car rental, packaging, computer manufacturers, restaurants, farms, and so on.
- The standards also vary depending on the size and location of the organization. For example, in developed regions, organizations with less than 20 employees are categorized a s small, 20–100 as medium, and more than 100 employees as large organizations. Ā e same pollutants are allowed in different levels for different size of organizations.

Stakeholders/Actors

- There are number of actors (also called stakeholders) in the GIS system. These actors are typically the people who are directly responsible for measurements, monitoring, and mitigation of emissions.
- In addition, these people/roles also include employees directly responsible for production or services within an organization. Thus, for example, in an airline or a hotel industry, for example, there will be an “Environmental Manager” who will be responsible for the implementation of the strategies for reducing greenhouse gases. In addition, the check-in manager (airline) or the duty manager (hotel) will have some responsibilities toward carbon management as well, which need to be supported by the GIS.

- There will b e numerous additional roles in this system, such as the workers responsible for entering the environmental data, the government representatives responsible for entering the standards or acceptable benchmarks, and also the senior management of the organization, who will be interested in having a bird’s eye view of the “green” performance of t heir organization.
- Furthermore, it is expected that the “general public” will also be interested in finding out the performance of the organization in relation to its green-ness.

- In addition to the abovementioned end-users, there a re also administrators of the system, both within the organization and external to the organization, who will be maintaining the data, information, and the applications.
- Finally, these users can be individual users and there can be organizational users (who have individual nominees) who can use this system.
- There will be several types of users of the system. Each of those users will have specific access to system functions so that they can view specific information such as average carbon emissions registered for a specific company, what pollutants an organization produces, and so on.

- Some users will be in-charge of entering the environmental data for a specific organization (data entry officer).
- Senior managers of the organizations will be able to have a glance on the green performance of their organizations.
- Government representatives will have access to other parts of the system in order to set up the benchmarks for all the organizations. It is also expected that the general public will have access to the system to find out information regarding the green performance of any organization registered in the system.

- User administrators are expected in the system and they will be in-charge of setting up access and creating user-id for each of those different users of the system.
- These users at both a personal and organizational level need to interact with GIS in various ways. Thus, some users w ill be keen to login on the organizational web site in order to access GICT, whereas others will be coming in through a handheld device. There is a need for the system to handle interactions from users who are “in the field” and not in front of a desktop.

- Furthermore, each interaction, which can include a query, an update, a retrieval of data, a check for control total on the green performance, and so on, needs to be stored securely. The privacy of the individuals making those enquiries and updates need to be secured—especially as this system has the potential to be politically sensitive.