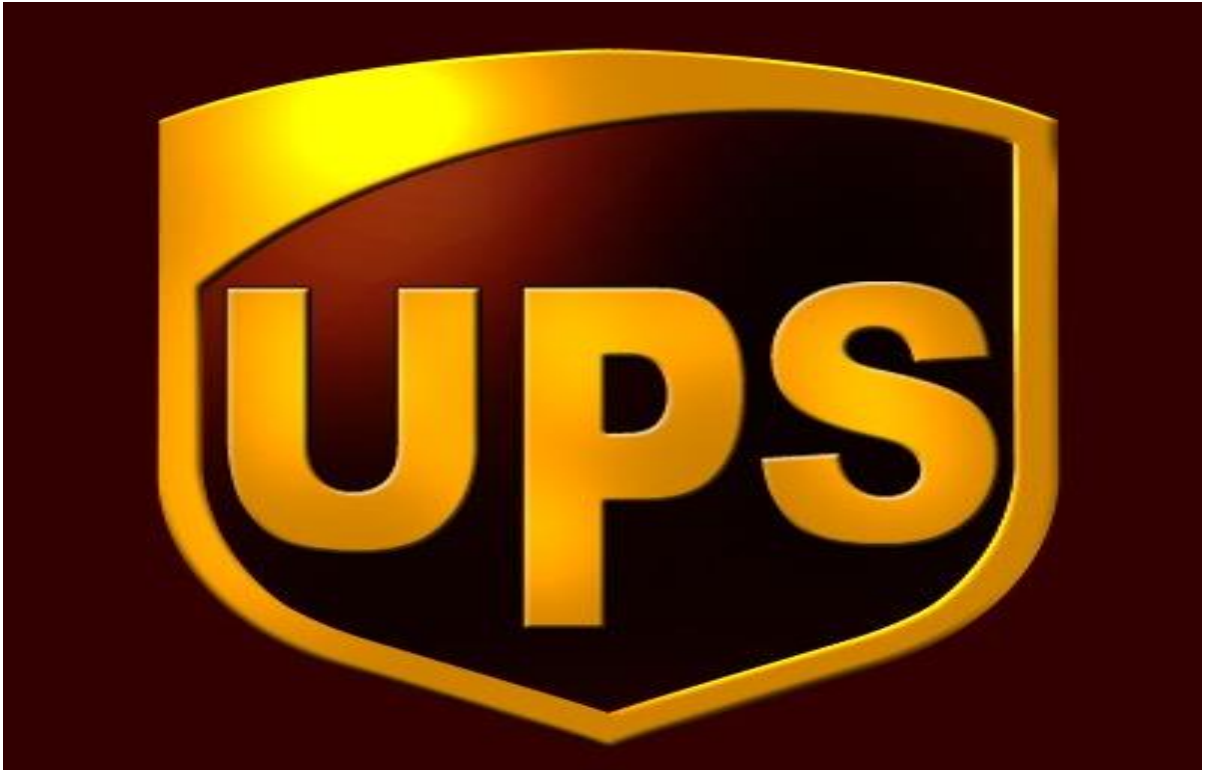# Designing Business Process and Patterns for System Integration at United Parcel Service Corp

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1. Abstract

This paper focuses on system integration and identifies business process patterns at United Parcel Service, Inc. (UPS), a truck delivery system. In the mid-980s, UPS faced strong competition for market share from Federal Express (Fed Ex), an air freight company so UPS installed ERP modules from Oracle (for HR functions and financials) which integrates systems in this organization. In this paper we have identified several patterns in the overall package delivery and shipping process. System integration is done at logical as well as physical level which helps in better package shipping and tracking at real-time. Customer, Address Validation API, Accounting API, Finance team, Tracking API, Operation team, Logistic team, Inventory management team, Locater API, and Rating API are the main actors and agents which interact in a culture of embracing technology as a strategic competitive advantage for better customer service.

2. Introduction

Rapid increase in population worldwide created a need for the expanding markets, and this expansion in the consumer base in various highly differentiated products have led to the ever increasing competition in the global market for nearly all products. In such a competitive scenario, businesses need to evolve rapidly and dynamically according to the needs of the market. This competitions and the need for the change has made businesses implement and follow various advanced practices that can promote such improvements in business.

Integration of IS is very critical for an organization's existence and growth. Any organization has many functional departments which handle their respective operations and activities. System integration moves a company from silo system to an enterprise information

system, which in turn helps in elimination of manual data re-entry, reduction of spreadsheets to generate management reports. Along with benefits of new ERP implementation for SI it has some drawbacks (e.g. high cost of implementation, required process change, training the employees to use this new system etc.). System Integration allows a heterogeneous IS to communicate with one another. Earlier information generated from one system was re-entered manually by users into other systems. But it involves errors and inaccuracies, and real-time information sharing between stakeholders is impossible. Thus ERP systems are required that allows organization to integrate the heterogeneous systems with an integrated database management system.

Business processes that are modelled to implement the change in the business can be better explained using the patterns involved in the business process. Patterns are the unit steps in the working of the business process. These patterns help describe various processes and implement them easily and without any problems. Business patterns combine to form the complete business process and they can be of different types. There are 15 different types of business patterns, which includes -
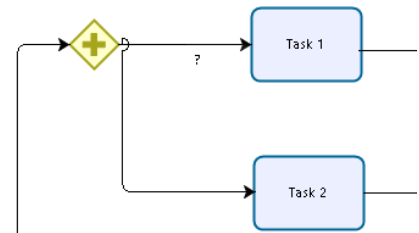
1. Sequence Pattern

    It is the most common and obvious business pattern involved in any business process and all of the business process use at least one sequence pattern. In designing any business process, business analysts initially model the things as they work today ("As-Is" processes). Instances in sequence pattern moves through the activities one by one.
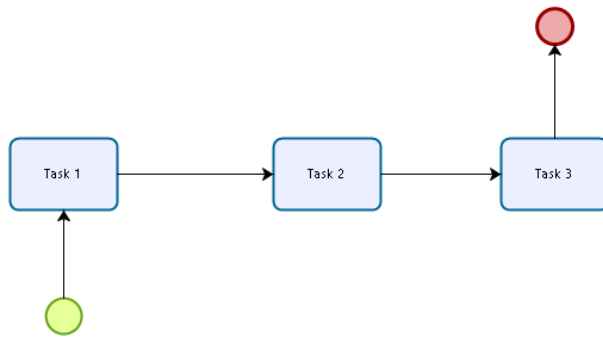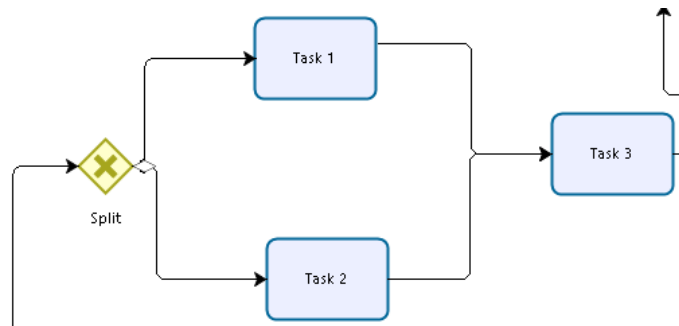
2. **Exclusive Choice Pattern**

   This is another common form of pattern observed in business processes. It involves the selection between two exclusive choices and then the process proceeds.


3. **Simple Merge Pattern**

   In such patterns, business process distributes in multiple steps which then finally combines to complete the pattern.


4. **Parallel Split and Synchronization Pattern**

   A sequence pattern when improved using a parallel split and synchronization, it takes less time by speeding up the process. This pattern represents concurrent activities in business flows, which are splitted in parallel manner then junction/join activity merges the transitions coming into it.
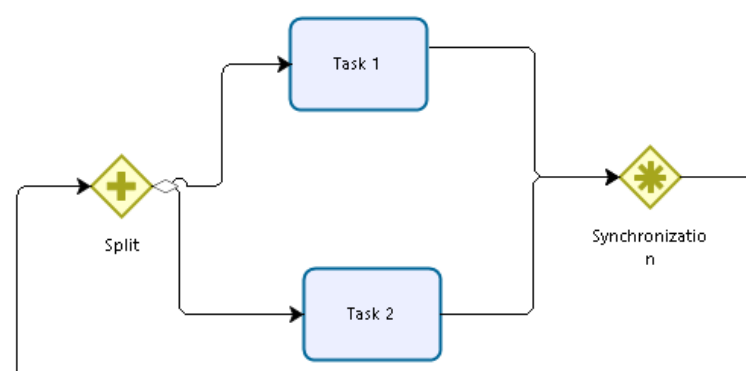
5. Multiple Choice and Synchronizing Merge Pattern

    This pattern is same as previous pattern but conditional transitions play an interesting and important role here. The instance will flow through one (which satisfies the condition)of the parallel activity paths. The default behaviour is to have the instance not continue beyond the synchronize activity until all the valid transitions leaving the split activity reach it.
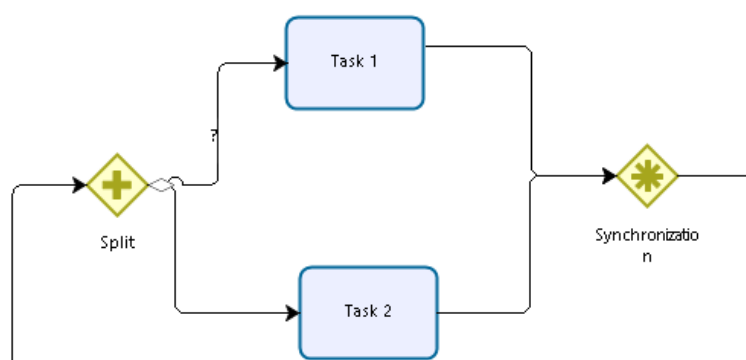
6. Discriminator and N-out-of-M Join Pattern
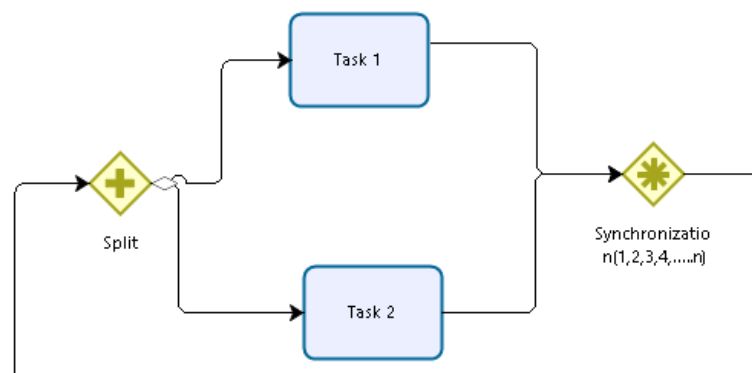
7. Multiple Merge Pattern

First multiple tasks split out of the process and then they recombine or merge and synchronise.
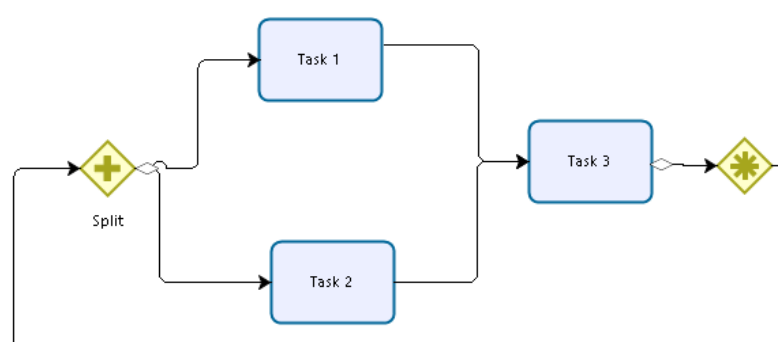
8. Collaboration Pattern-

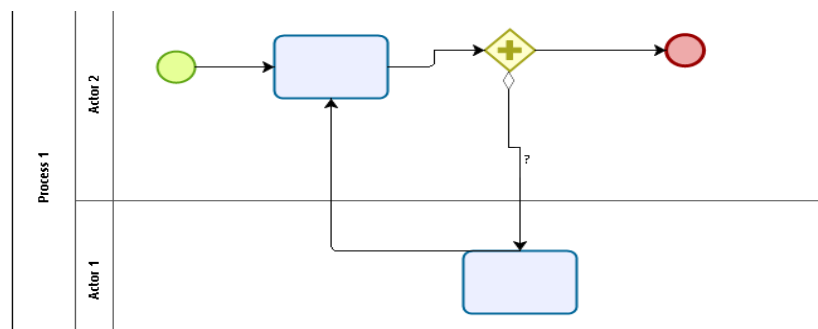This pattern is quite common in Business Process Modelling. Here the instance continues in a loop until and unless the actor decides that the negotiations are over .

9. Implicit Termination Pattern

10. Multiple Instances without Synchronization Pattern

11. Multiple Instances with Design and / or Runtime Knowledge Pattern

12. Deferred Choice Pattern

13. Milestone Pattern

14. Cancel Activity

15. Cancel Case

Case Study : Change Management at UPS Corp

In mid 1980s. United Parcel Service, Inc (UPS from hereafter) struggled for its market share due to competition from a newcomer, Federal Express (Fed Ex) in shipping industry. Success of Fed Ex was largely attributed to its culture of accepting and implementing improved technology which enhanced its efficiency and customer service, whereas UPS employed less technical changes. Basically at starting point, UPS was a truck delivery company and Fed Ex was an air freight company but with time, they started grabbing market shares in the other's core business.

In the old legacy system at UPS, there were inconveniences of shipping errors, expensive and time consuming shipping, manual data entry, overwhelming no. of costly and time consuming phone inquiries each day, picking errors etc. Fed Ex used new technologies as a strategic competitive advantage which captured most of the market. In order to recapture the market share lost by the UPS Corp, it understood the need to incorporate the use of internet in its business process to reduce losses, optimize the cost, improve customer service and make the overall process time efficient. It decided to invest heavily in the technology to drive growth.

UPS studied their process through a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis and concluded that they had extensive infrastructure and expertise in transportation but need to integrated information and real time connectivity in their business process. In order to

integrate technology (from a business perspective), UPS chose to centralize data in one of two large data centres (i.e. the hubs of their IT platform). UPS installed a couple of ERP modules from Oracle for HR functions and for financials. Its logistics network is extensive and rigorous because of well-defined technological standards it followed. A corporate culture of open communication and a commitment to training contributed to the successful integration of technology.

The IT platform of UPS uses new software Package Flow12, enabling it to identify the package in order of delivery. It also uses Trade Direct12, which provides a web based system to track packages. The UPS integrated system provides real-time communication links between packages. A client's customer service puts the power directly in the customer's hand.

This paper tries to study the business processes and changes implemented. Here we model various business patterns involved in the processes to make the whole practice efficient. The paper first identifies different actors and then models the patterns involved in the process. It then tries to improve the efficiency of the business process by integrating the system using web portal.

Various actors involved in the process include the business clients (the customers of the UPS Corp), Accounting team, management team, finance team, logistics team, inventory management team and Web Portal. Here the customer places the order for delivery of package, the cost of which is found by the accounting team, and the payments are checked by the finance team. The delivery of package is the responsibility of the logistics team and the warehousing is the responsibility of the Inventory management team. Web Portal is the essential part of UPS Corp as it enables it to integrate the whole system. It uses various APIs for different purposes. For ex it uses tracking API to track the order delivery, locator API enables the UPS Corp to sort the packages in order of delivery location, Rating API sorts them on the basis of their priority, address

validator API verifies the details of the customer, its address etc. in real time and helps to identify wrong information and in turn reduces the cost of processes.

IS architectures

In order to implement system integration at UPS corp., various Information system architecture can be used by it based on the needs of the process. These architectures were developed over time. These IS architectures are classified as -

1. **Centralized architectures:** It uses centralized mainframe computer to host all application systems and data resources. It restricts user to manipulate the data for specific needs and hence provides good control over information systems, easy system maintenance, and technical support. These were mostly used at the beginning of development of IS architecture. Exa: First generation computer.

2. **Decentralized architectures:** Under this framework, each user has a personal computer. They can control the IS and data resources on their computer. It provides flexibility in H/W size and speed. But due to very little data and application integration, there may exist effort duplication, data redundancy, and inconsistent information. Exa: Next generation computer.

3. **Distributed architectures:** Combining the features of centralized and decentralized, it allows sharing of applications and data resources between the central server computers and the end users. Here personal computers are connected to a server computer via a network. Server stores data and application shared across the organization, and PCs store data that are not shared. It provides minimal effort duplication and data consistency. Since it is very complex, it requires trained IT support staff.

IS functionalization:

In an organization, IS supports manufacturing, marketing, accounting, finance, and HR. Each of these areas has different information and report requirements and multiple level of management.

Type of system	People supported
Executive Support Systems (ESS)	Top Managers
Decision Support Systems (DSS)	Knowledge Workers Professionals
Management Information System (MIS)	Mid-level Managers
Transaction Support System (TSS)	Line Managers and Operators
Office Automation System (OAS)	Clerical Staff
Operating & Database System (ODS)	IT staff

Various systems support different processes at UPS corp., OAS supports the activities of employees, TSS records detailed information, DSS processes data from TPS to assistant managers (Generally help in conducting what-if analysis, in identifying trends, and making data-driven decisions.) and ESS provides report of the organizational performance to top-level management in real-time.

In order to make the process of UPS Corp. effective and efficient, system integration is essential. It will help the UPS Corp to enhance its ability to respond quickly towards market condition and changing customer needs. Inventory management is the crucial part of UPS corp.'s processes, its profitability can be badly affected due to poor inventory handling. Integrated systems allow the linking of demand side and supply-side function of a company so that one can get quick responses to change in demand of customers.

System integration is a difficult task but has been implemented successfully by Amazon, Dell etc. UPS Corp. can use many Application Programming Interfaces to integrate its

transportation for small size packages and shipments. This integration for UPS Corp will increase its internal effectiveness and overall customer satisfaction for shipping, ordering and customer services.

Some of the Application Programming Interfaces (API) that can be used in integration of UPS are listed below: -

- **Address Validation API** - Verifies the validity and existence of given postal address whether in real time. This can improve the customer database of the company. The Address Validation API will give automated integration between one's website or enterprise system and UPS. This will help the company in reduction of operating costs and improvement in customer service.

- **Locator API-** It can be used in finding delivery location with less difficulties.

- **Paperless Document API-** provides customers the option to schedule the collection at their ease.

- **Quantum View API –** It is a web service that give inbound and outbound shipment manifests and status updates for the shipment. By help of this one can check UPS shipment sent by sellers to delivery locations and information regarding package sent using UPS Accounts.

- **Rating API –** This will provide the option to the clients to compare delivery and services.

- **Shipping API –** The Shipping API can permit one to coordinate UPS shipping usefulness straightforwardly into venture framework. Clients will appreciate the profundity of UPS administrations and abilities, while your business turns out to be more profitable with enhanced procedures. Shipping API bring down overall costs by making more prominent efficiencies and better controls over delivery exercises.

Logical versus physical system integration -

Logical / human level system integration takes into consideration access to share data both between organization's individuals and additionally organization's stakeholder.

Physical integration / technical integration is the integration of data of heterogeneous systems across a company to give continuous connectivity of information and decision making tools.

Management required to modify processes and structure of organisation and responsibility and roles of employees to achieve logical system integration. BPR's work is not merely integrating heterogeneous technology but also to change mind-set of the members of the organisation, to motivate them to do work in a new way.

Steps in Integration System

- Resource categorization - This implies the inventory of different software and hardware resources involved in the process. It focusses on vendors, operating systems platform and IS architecture.

- Compliance and standards - It involves verifying whether the technologies used comply with latest standards or not.

- Legacy systems support - Develop a policy in support of older legacy applications.

- Middleware tools - During transition from one technology to new, most of the organisations keep their old system in work. In such cases of system integration, when the existing applications are kept in use by the organization, middleware tools were used.

- Authentication and authorization policies - One of the most important goal of system integration is that the employees and clients can access the required data anytime, from

anywhere. This requires to develop a single sign-on policy for application and data access which will help them to access the data.

- Centralized IT services and help desk support - Instituting IT support for an integrated systems environment is necessary to avoid support and maintenance problems with the integrated system. Centralization does not mean that they are all physically in one location. The IT staff can be all over the organization, but they need to be able to support all applications and platforms with a centralized IT help desk support.

- Back-up, recovery, and security policies - Planning data and disaster recovery for organization's data in an integrated system IT is crucial for building the trust and confidence for the new system. A good back-up and recovery system is essential if there is a system failure or a major disaster.

- Hardware and software standardization policies -Incorporating new hardware or software in use by the company, should consider the existing application, IT strategy and IS architecture and should be properly aligned with the IT strategy of the company. This can be done be creating proper standards and policies for introducing such changes.

ERP and system integration

ERP system is integrated, multi-module application software package that helps organization to integrate business processes, optimize the allocation of available resources, plan for the future and to standardize its business processes. It facilitates collection and integration of information related to different areas for e.g. finance, accounting, HR, inventory, procurement, customer service etc. In case of UPS, they installed ERP modules from Oracle specially for HR functions and financials.

## ERP's role in logical integration

It requires organizations to focus on business process rather than on functions. For example UPS receives an order for shipping. Then its main goal is to provide better services related to package shipping and tracking through UPS website. The UPS IT offers new softwares. Package Flow 12 identifies the sequence of packages that should be loaded on the delivery truck so that the first deliveries are in the rear of the truck, then comes second delivery and so on.Trade Direct 12 allows retailors, dotcom sites, and other enterprises to track the status of packages. These packages include both small and large freight through a single web-based system of ERP. There are many departments and actors involved in overall shipment process for e.g. Finance Team, Technical Team, Management Team, Customer, and Logistics Team. Each department is regularly updated on the status of the tracking and shipping. When customer places a request on the web portal for the transportation he/she can check the proceedings any time, till the packages reach to the destination.

ERP's role in physical integration

An organization may have to get rid of their system's H/W and S/W or to upgrade or install middleware. Middleware is used for integrating legacy system to current generation ERP systems. Technical team develops middle-wares and trains the users on how to use new system. Layered systems architectures is used to integrate the systems. Integration is done at the data level, at client level and at the application level. ERP system provides better business processes focusing on organizational goals instead of individual departmental goals. ERP system helps organizations to form quick alliances and partnerships with other organizations. ERP system process the deliveries without bottlenecks in package shipping, customer service, and account administration.

Business process of UPS Corp can be presented using various patterns involved in the process. UPS Corp can use Address Validation Form on its web portal to simply check the address entered i.e. its validity and existence. Once verified it proceeds with the process. In this case, system is not completely integrated. Such a process can be presented as given in fig 1. So, here first the customer places the order for the delivery of its package on the web portal, which is verified by the address validator API. Once verified, the order is placed and the payment is made to the finance team. The Accounting team will find out the charge to be paid by the customer to the UPS Corp based on the package i.e. its weight, volume, priority, delivery destination etc. Once the amount is charged by the finance team, the Logistics team will enable the delivery of the package from its initial location to the final destination. This is the simple way of completing the business process of UPS Corp. It has not used the complete system integration of the UPS Corp and hence is not efficient one.

Fig 1. Patterns involved in process with address validator API
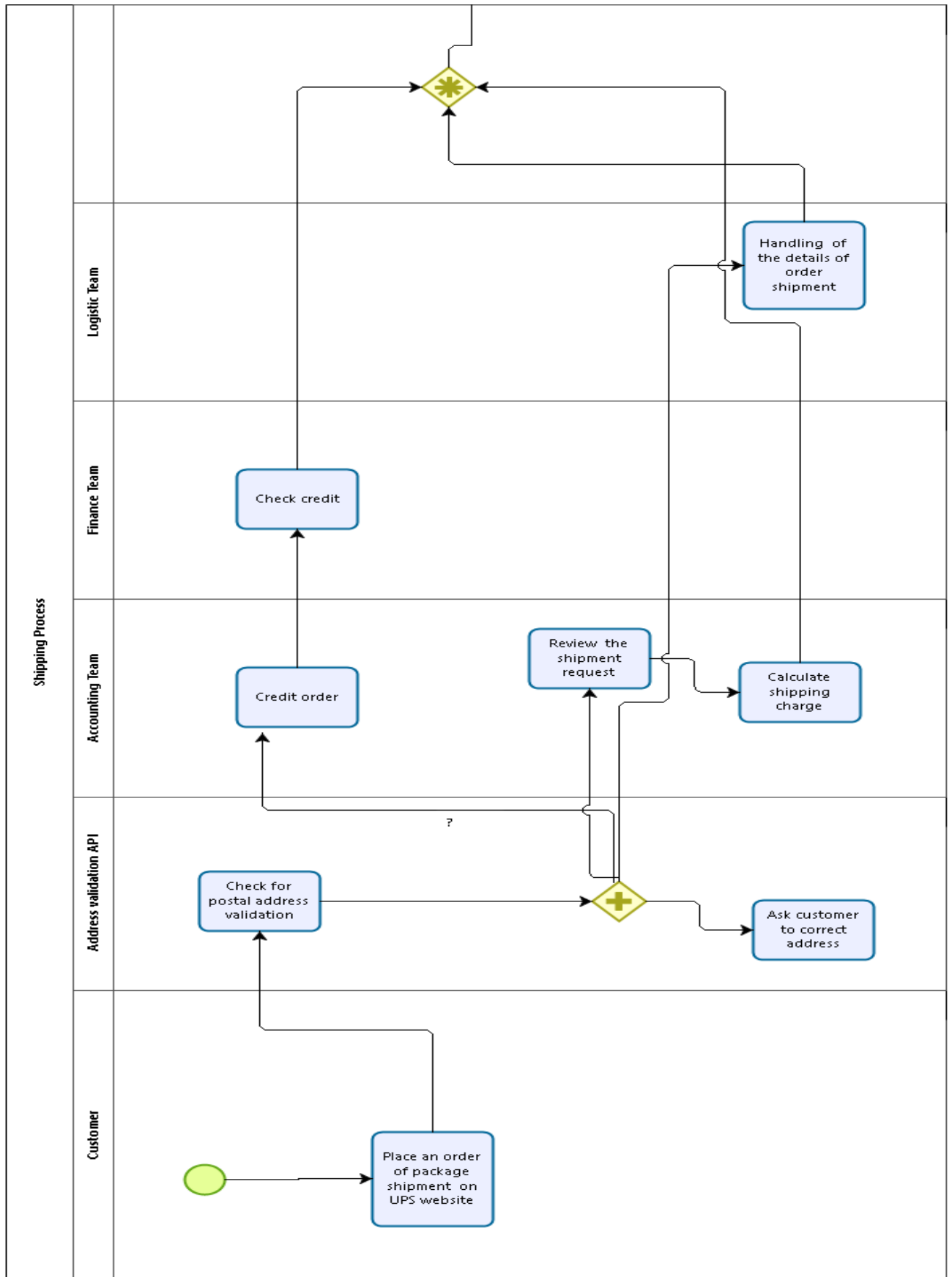
UPS Corp, can improve the process by utilising the complete system integration at all levels of the process. This is done using the web portal that it has and various API present at the main server computer of UPS Corp.

The fig 2. presents the various business patterns involved in the process of placing an order at UPS Corp. It involves the working of various actors which are the customer, finance team, address validation API, accounting API, and Tracking API. The customer will first visit the web portal in order to place the order for delivery of the shipment. Address validation API, Accounting API and Tracking API are part of the web portal / website. These are the programs which help improve the efficiency of the process. These are located on the server and are used by the host, hence it is a kind of distributed IS architecture.

First, the customer accesses the portal and inputs the shipment and the payment details on the web portal. Then, the address validation API verifies the entered address for a match in its existing database and updates the database if it's not there in database. Address validation API checks the address input by the user in real time and notifies the customer if the address is invalid or is non-existent. The customer is asked to fill the address and other details again, which appears to be wrong. When the address and other details are validated by the address validator API, it proceeds forward this process.

Accounting API calculated the charges to be imposed on the customer for the shipment based on the size, volume, distance to be covered and other factors on the shipment. Once it obtains the charge to be made, it forwards it to the accounting team.
Parallel to this the payment details of the customer is asked by the web portal. The payment details entered by the customer is sent to the finance team, which has an exclusive choice to either confirm that the details are valid or reject the payment details. In case, details appeared to be wrong, then

the accounting team requests for the correct details again from the customer after which it repeats the same process again till the correct data is obtained.

When the correct payment details is obtained, and the accounting team provides the shipping cost or the charges to be paid by the customer, and the address validator API, the accounting API and the finance team synchronizes i.e. the correct payment details with the amount of payment to be done is processed together to complete the payment process to the UPS corp for the shipping delivery order made by the customer.

Here, the three steps involved in the order process, i.e., input validation, payment validation and the payment amount calculation occurs simultaneously, which reduces the overall time of the process and hence make the UPS Corp team more responsive and efficient, This reduction in overall time of the process reduces the cost of the process. It is an example of Parallel Split and Synchronisation Pattern. Here, we also saw that the Address Validator API and the Finance team got the option to do one of the two things, i.e., accept the data entered and proceed or reject the data entered and request for the entry again by the customer. This forms an arbitrary cycle pattern at the payment and address validation steps,

Once, the whole ordering process is completed, it is important to update the order details on the web portal for tracking its status later, by both the clients and different departments of the UPS Corp, The Tracking API is the one which enables all to track the status of the package. In order to do so, the finance team sends payment done notification to the tracking API, when the payment is done and order is placed,
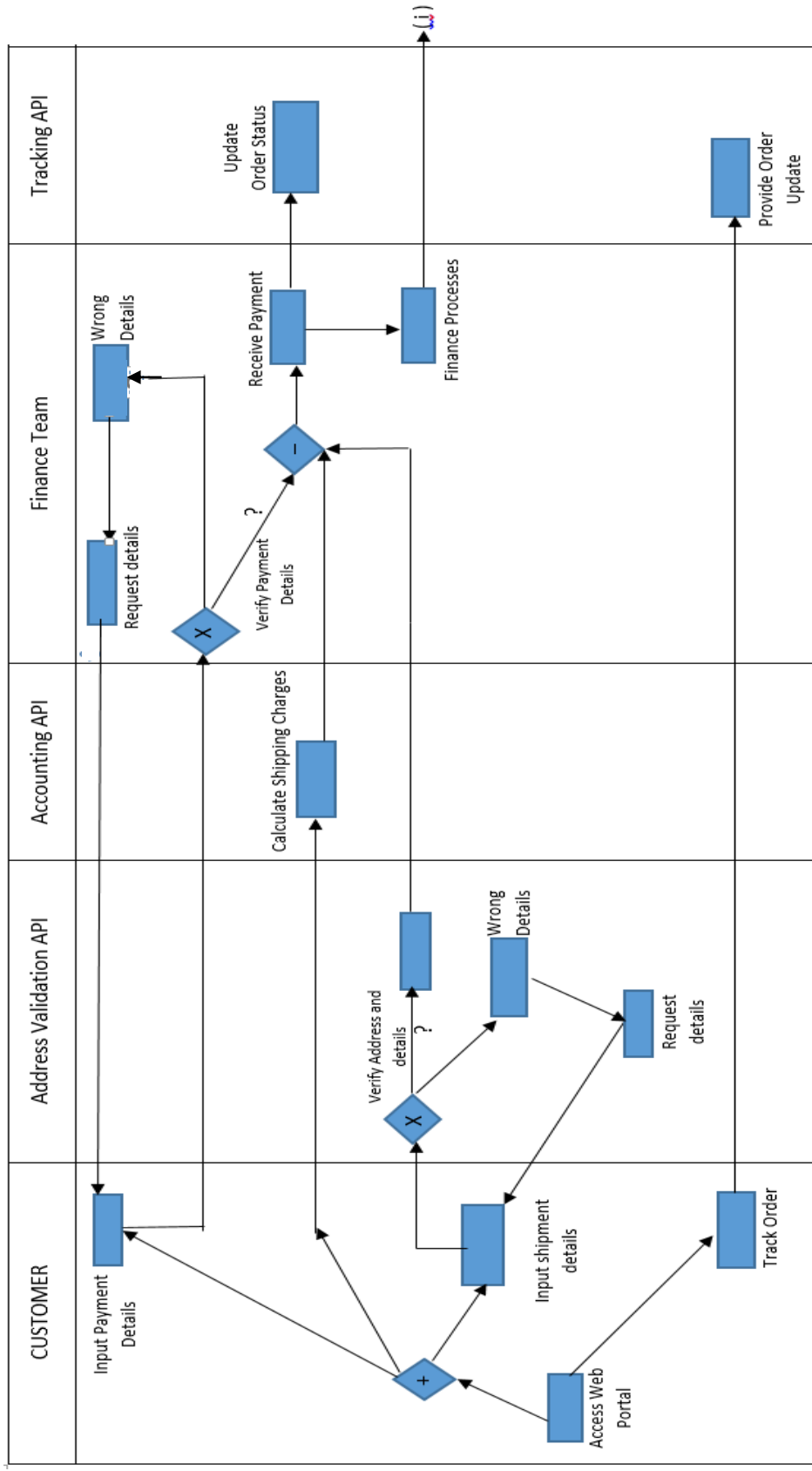
Fig 2. Patterns involved in placing the order

After the order is placed properly, finance team receives the payment from the customer and it then updates the tracking API with the order status as confirmed, Updating the tracking API is necessary at every step as it will help the client to track their order status and package delivery. It also sends the payment received from the customer, to the operations team for the working of the process.

Once the Operations team receives payment from the finance team, it distributes it to the other sections of the UPS Corp. At the same time, the Tracking API sends the order details to the operations team. Since it received both the order details and the payment / finance, it forwards the shipment details to the logistics team. Once the order confirmation status is obtained by the customer, the Logistics team obtains the package from the customer and it provides / transfers the package to the Inventory management team.

Also, when the logistics team obtains the package from the customer, it sends the order details to the tracking API to update the order status on the web portal, which can be accessed by both the clients and the different departments of the UPS Corp. It helps the client to easily track their package and helps the UPS Cop in tracking their work.

Logistics team delivers the package to the inventory, where the Inventory management team keeps checking the date of delivery so that the date is not missed. It has an exclusive choice, under which it first check whether the delivery date of the package is reached or not (or it can be delivered on time or not). If the delivery date is reached, the package gets delivered for shipment to the Logistic team otherwise, the package is not moved out of the inventory and then after some time the delivery date is again checked so that it doesn't gets missed..

Inventory management team receives the package from the logistics team, it sends the information to both the locator API and the rating API about the package details. The locator API sorts the product or the package according to the delivery location and the ranking API ranks the packages based on their priority (highest priority packages are charged heavily and will be delivered first.)

Both be locator API and the rating API, synchronizes and provides the order of delivery to the inventory management team in a sorted way, such that the package that is at the top of the list is the one which needs to be delivered first and one at the end of the list is to be delivered at the end. Inventory management team receives the sorted list of the packages and also checks for the delivery date of the package and then it sends it to the Logistic team to deliver the package to its destination and alongside update the order status to the tracking API for the clients.

Fig 3. Patterns involved in delivery of Package
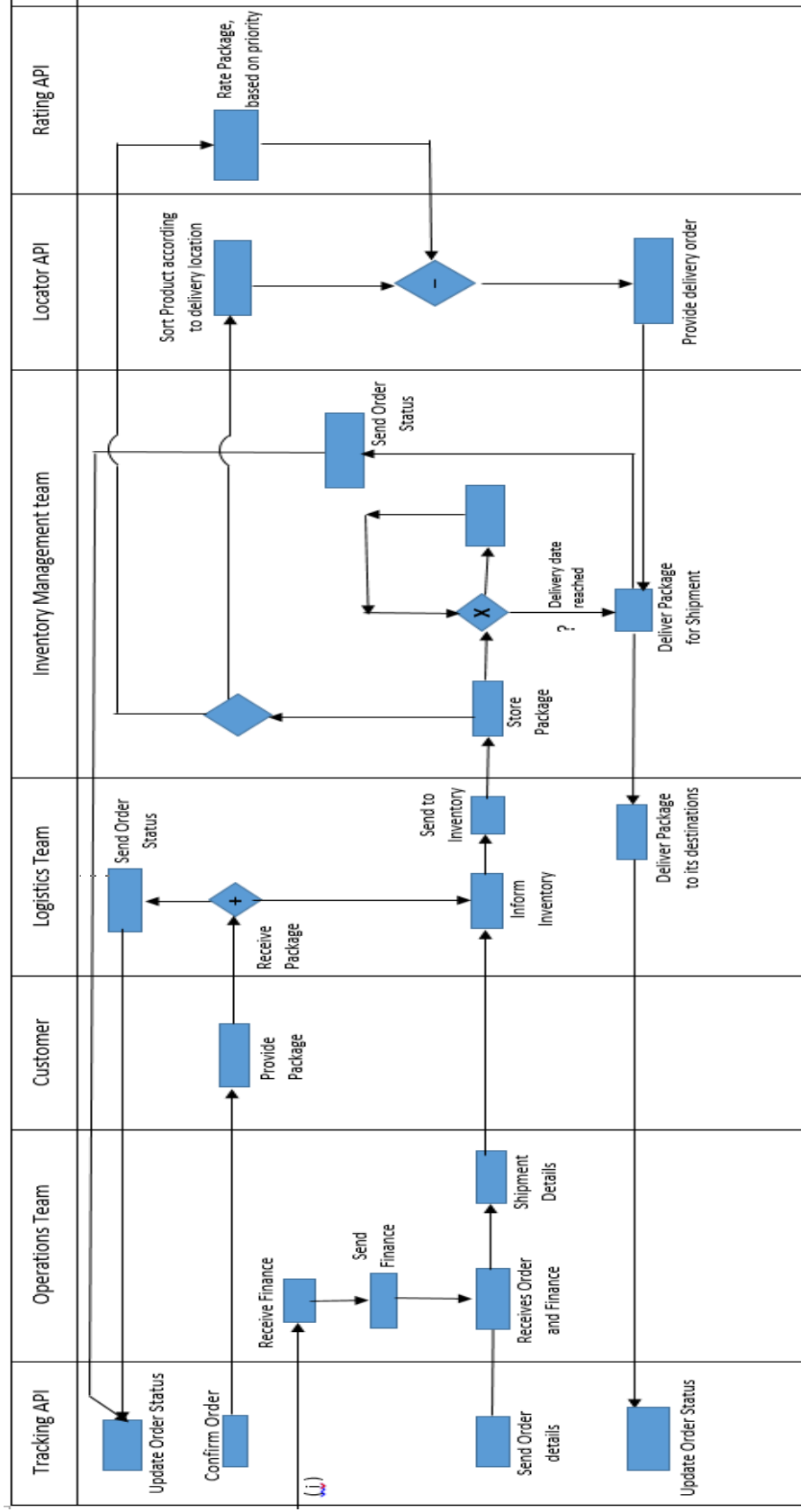
Conclusion

UPS Corp, a shipping company, faced competition from expanding shipping industry as it was not able to successfully implement technological changes in its business process like the other companies. In order to improve the efficiency of its business process, UPS Corp decided to integrate the whole system using web portal. It used a distributed IS architecture to create the integration, and used a range of APIs like address validator API, rating API, locator API, shipping API, tracking API etc. which helped improve the output of the company. Since, the continuous improvement in technology outdates the older technology at rapid pace, UPS Corp also provided training for its staff to stay updated with the latest technology. This paper presented various complex business patterns involved in the system integration at UPS Corp. The system integration benefitted the UPS Corp in many ways.

Benefits of system integration at UPS Corp.-

Systems integration helped UPS Corp. to improve its business process by reducing the overall time of the process, reducing errors, data redundancies, etc. This resulted in expanding income and development, increases competitive environment for the company and information visibility. It also helped the UPS Corp to improve the customer service provided by the company as it helped to provide quick responses to the queries of customer and address them effectively. Use of various APIs helped UPS Corp to reduce the cost of delivery by optimising the way they deliver. For ex. Locator API and Rating API, sorted the order of delivery so that the order is completed at minimum cost.

One of the biggest downsides of Systems integration at UPS Corp, or any other company, is the underlying expense of planning and actualizing the framework, and not having a full knowledge of the long term advantages that might be available. Likewise, control and interdepartmental clashes may require some business reformation to comply with the new framework, in the trusts that things will work and stream better.

Although, System integration at UPS Corp had its own problems, but the benefits outweigh the problems and, system integration proved to be a successful step for UPS Corp. In order to keep the pace of progress high, the UPS Corp needed to incorporate the further technological changes in its business process with time.

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