

# Modeling Enterprise Systems

Mario G. Cimino - University of Pisa

## OVERALL LANDSCAPE

- A blueprint of **enterprise information systems** is made by three levels (figure in next slide): IT infrastructure, applications, and business processes.
- Usually, the IT infrastructure is globally distributed on **many countries** and founded on a **wide area network**.
- A huge number of **composite applications** coordinate and serve a large number of business processes: the production planning, the customer relationship management, the supply chain management, and so on.
- To introduce new software applications in this complex environment, the supported **business process** should be clearly defined, as a coordinated set of activities (workflow). Each activity can involve multiple actors and tasks.
- A **task** can be defined in terms of a detailed steps of a use case. A **use case** represents a user goal that supports one or more tasks of the business process.
- The new **software application** supporting the business process should be **highly integrated** with the existing applications: (i) it takes inputs and supplying information from one or more back-end applications connected to a data lake, (ii) it takes additional user inputs from configuration panels of the information system, (iii) it provides images and xml/json outputs to the front-end of the information system.

# Enterprise Architecture Blueprint

## Context

## Business Strategy and Digital Transformation Overview



80%

YTD: 75%

Happy Customers

45K

YTD: 67K

Average Order Size

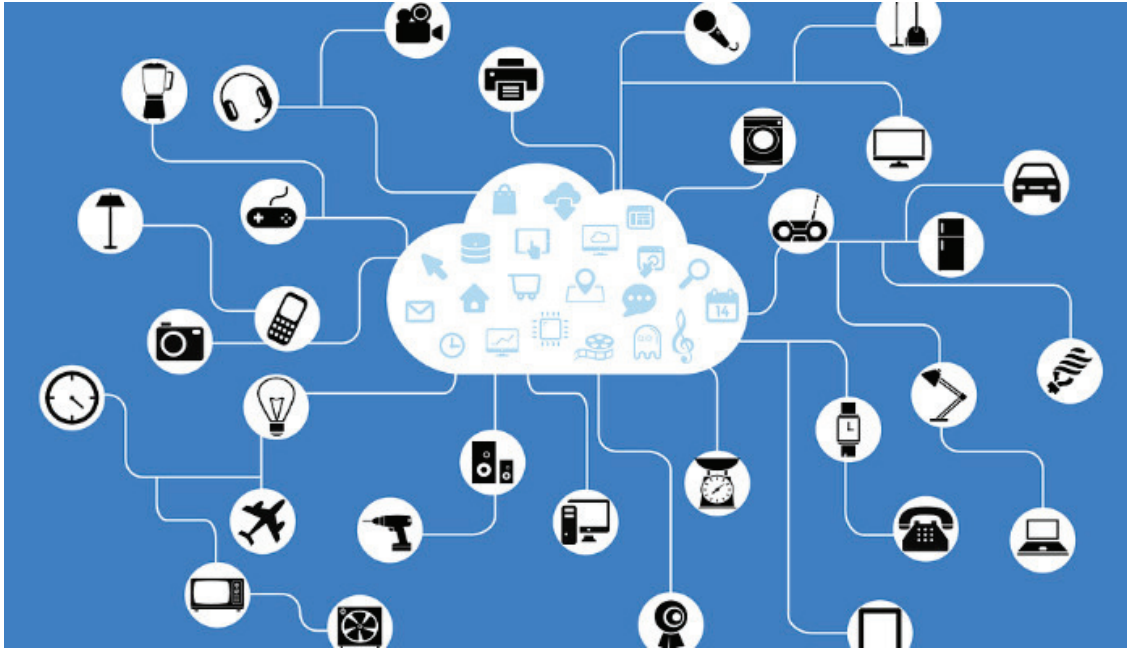
Processes

Applications

IT infrastructure



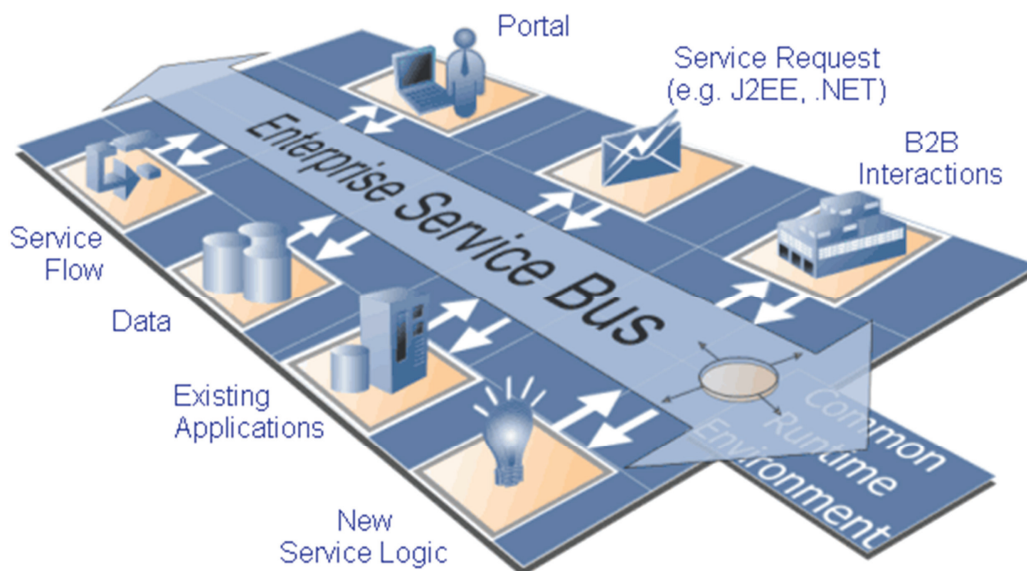
- ✓ The world is becoming a huge, system interconnected by the Internet



- ✓ Each element (object, service, human,...) plays different roles

*Cimino – Introduction to workflow modeling – 3*

- ✓ Enterprises look like enormous processors. Example: enterprise service bus



- ✓ We need **new languages** to model the flow of work (workflow) in this service-oriented environment.
- ✓ Object-Oriented programming is not sufficient to model the orchestration or collaboration business logic

*Cimino – Introduction to workflow modeling – 4*

# “DevOps”

- A methodology combining **software DEVELOPMENT** and **IT OPERATIONS**
- It is supported by a **Toolchain**: a set of tools for the development and delivery process:
  - *Coding*: code development and review, source code management tools, code merging.
  - *Building*: integration tools, build status.
  - *Testing*: testing tools providing timely feedback on business risks.
  - *Packaging*: artifact repository, application pre-deployment staging.
  - *Releasing*: change management, release approvals, release automation.
  - *Configuring* – infrastructure configuration and management.
  - *Monitoring* – applications performance monitoring, end-user experience.



## Basic ontology for process orientation approach

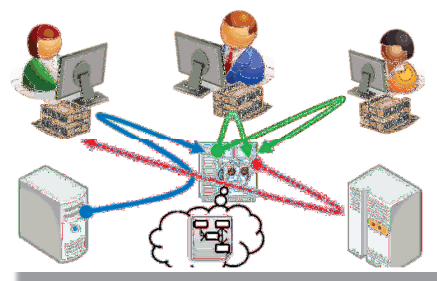
- Companies compete on the basis of business processes: simple/complex, flexible, robust, clear or ambiguous, partially automated, manual, ad-hoc,...
- **Business Process**: a collection of interrelated **activities**, initiated in response to a triggering **event**, achieving a specific discrete **result** for the **customer** and other stakeholders of the process.
- An **activity** is work that might be named as a single unit but can involve multiple actors, each separately making a contribution.
- A **task** is an actionable item that needs to be performed to complete an activity. An activity may consist of more tasks. A task consists of **steps**.
- A **result** is an individually identifiable and countable entity
- A **customer** is the recipient of beneficiary of the result (person, organization, broad marketplace, ...)
- An **event** is an action, a date or time reached, a condition (rule).



Cimino – Introduction to workflow modeling – 5

## Basic ontology for process orientation approach

- Business Process (BP) Analysis includes a broad meaning encompassing modeling, simulation, diagnosis, verification, performance of BP.
- A **workflow** is a (partial) automation of a business process. In a workflow (“flow of work”) resources, information, activities, follow a coordinated control flow established by a **BP modeling language**.
- **Business Process Modeling** is the creative act of producing a workflow from a business process.
- A BP modeling language is very different from a programming language:



Automation paradigm	Description language	Execution language	Core runtime	Complexity
Service oriented computing	UML/BPMN	XML	Workflow Management System	+++
Object oriented programming	Java/C#/C++	Byte code	Virtual Machine	++
Procedural programming	C	Assembler	CPU	+

Cimino – Introduction to workflow modeling – 6

# Business Process Model and Notation (BPMN 2.0)

- **BPMN is...**

- ✓ *human-readable*: a standard visual notation for modeling business processes;
- ✓ *accessible*: easy to understand for various roles: who analyzes and defines processes, who leads the technological implementation, who is responsible for management and control;
- ✓ *machine-readable*: a notation serializable to XML for process execution (e.g. WS-BPEL 2, SOA environments).

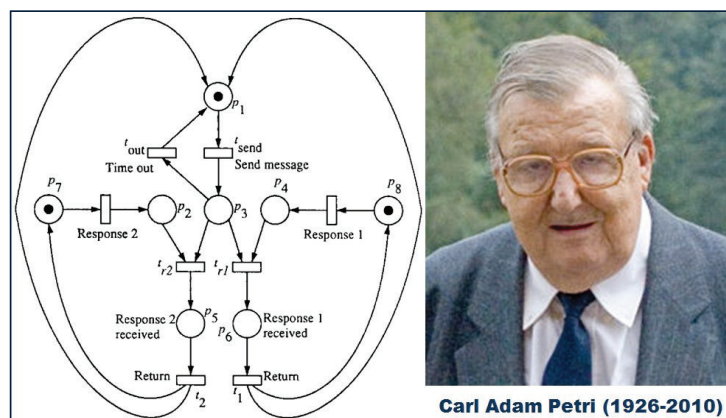
- **BPMN is not...**

- ✓ a language for representing data flows and object flows, although this can be done at a certain abstraction level;
- ✓ a notation to represent structures, functional decompositions, data models, organization strategies, business rules.

*Cimino – Introduction to workflow modeling – 7*

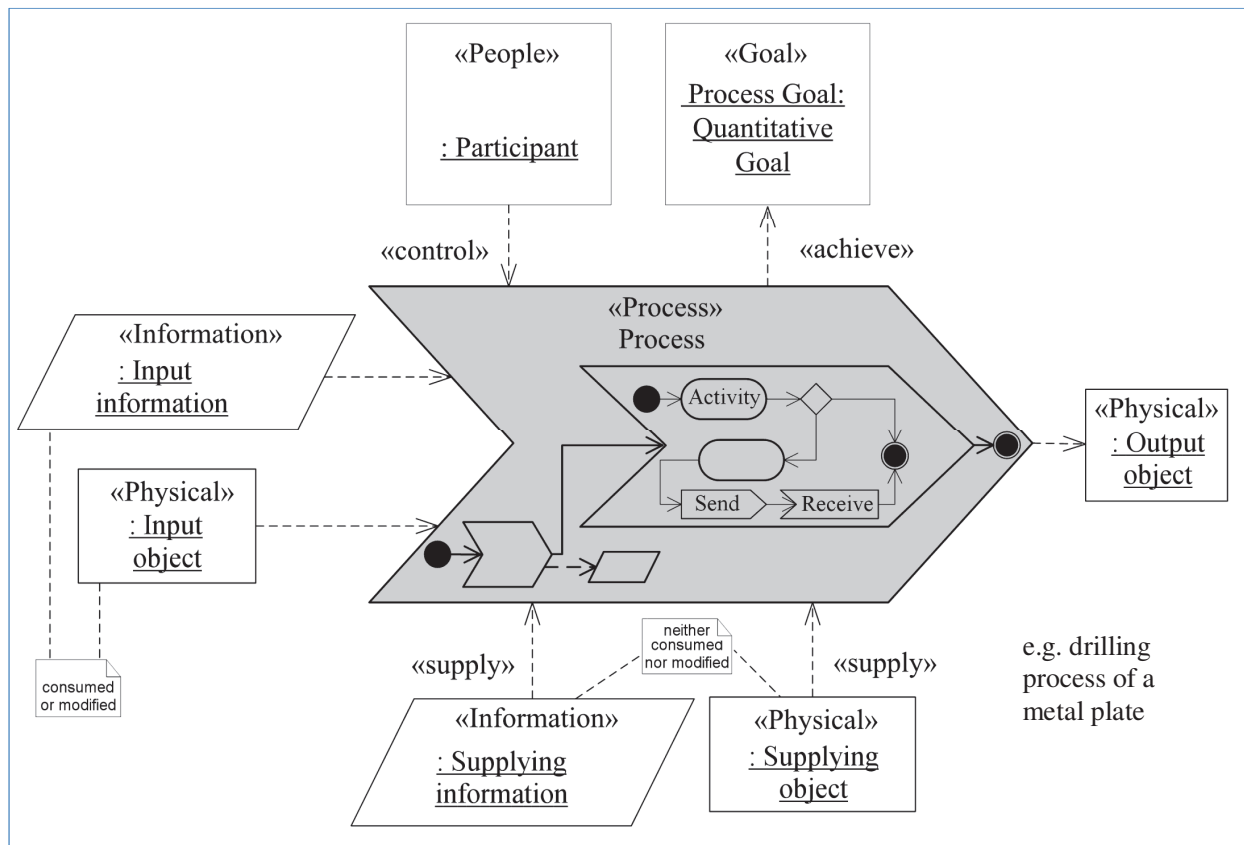
- **“Relatives” of BPMN (languages for workflow-based analysis)**

- ✓ *Petri Nets* (1962): formal language to model distributed systems, usable by computer scientist and designers of specialized software. It consists of a visual representation and a corresponding mathematical notation (graphs), allowing advanced analyses such as validation, verification (e.g.. *soundness* to identify deadlock and livelock)



- ✓ *UML Activity Diagram* (OMG, 1997): language for visual modeling for the object-oriented paradigm, usable by software engineers. The extended UML of Eriksson e Penker (2000) is suitable for business process modeling, and usable also by business level (non-technical) roles.

*Cimino – Introduction to workflow modeling – 8*



Cimino – Introduction to workflow modeling – 9

## Workflow Modeling

10 of 73

### How to name a process

(Readings: pp. 40-46, Sharp, *Workflow modeling*, 2009)

A01) The process name must be in the form *verb-noun*

e.g. *Assign Inspector*.

A02) It might be in the form *verb-qualifier-noun* or *verb-noun-noun*

e.g. *Assign Backup Inspector*, *Assign inspector to route*

A03) Processes are almost always defined in the **singular**

e.g. ~~*Handle Orders*~~ → *Fill Order*, i.e. an (a specific) order.

A04) The verb-noun name must indicate the **result** of the process.

A05) **Guideline: if you flip the terms around into 'noun is verbed' form, the phrase should indicate the result of the process**

e.g. *Assign Inspector* → *Inspector is Assigned*

---

**A process delivers a specific, essential result**

The process result in 'noun is verbed' form must meet 3 criteria:

A08) **The result is discrete and identifiable:** you can differentiate individual instances of the result, and it makes sense to talk about 'one of them'

e.g. *Inspector is Assigned* → it makes sense in a business context to talk about *when was Joe assigned to the midtown route*

A09) **The result is countable:** you can count how many of that result you have produced in an hour, a day, a week, etc.

e.g. *How many inspector assignments were completed this week*

A10) **The result is essential:** it is fundamentally necessary to the operation of the enterprise, not just a consequence of the current implementation

e.g. *Fax Inspector Assignment* → the essence of the process has not been reached by the technology of notification → *Notify Inspector of Assignment* is ok ('what, not who or how')

A11) A process should be defined in terms of the essence of what it does, i.e., the result it delivers (what), not the technologies used to support it (how) or the organizations and roles that carry it out (who)

A12) Distinguish between result and objective:

- a *result* is the *output* of a single execution of a process  
e.g. *'employee is hired from the process Hire Employee'*

- an *objective* is some desired state or performance target, generally over many instances

e.g. *'Hired employees will go on to have an average tenure of greater than five years'*

e.g. *'Fewer than 10% of newly hired employees will leave the company within the first year'*

A13) An *action* verb indicates a single activity that happens at a particular point in time, for which it is easy to visualize a result.

e.g. *count, evaluate, print, attach, return, prioritize, sort, provide Allocate Service Representative, Calculate Stock Index, Retrieve Sample, Issue Refund, Translate Document*

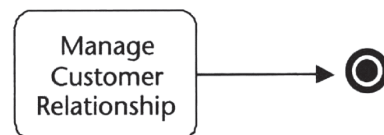


A14) Avoid mushy verbs: a *mushy* verb tends to indicate an activity or multiple activities that happen *over time*. While they might indicate some overall objective, they do not help us visualize a single, specific result.

A15) *Mushy verbs* are also called ‘360 verbs’, as they sound good but often say little about what was actually accomplished.

A16) A list of mushy verbs you should avoid using, except when naming process areas or other broad groups of activities:

- |                      |                   |
|----------------------|-------------------|
| - <i>Maintain;</i>   | - <i>Manage;</i>  |
| - <i>Administer;</i> | - <i>Handle;</i>  |
| - <i>Process;</i>    | - <i>Do;</i>      |
| - <i>Improve;</i>    | - <i>Support;</i> |
| - <i>Facilitate;</i> | - <i>Drive;</i>   |
| - <i>Track;</i>      | - <i>Review;</i>  |
| - <i>Analyze;</i>    | - <i>Monitor;</i> |
| - <i>Coordinate.</i> |                   |



**Process:**  
Manage  
Customer Relationship  
(*mushy verb – noun*)

**Result:**  
Customer Relationship  
is Managed  
(*noun is verbed*)

- *not* discrete
- *not* countable
- *not* an essential result (an objective)

Process naming—no mushy verbs.

A17) When describing a process it is necessary to be able to identify the *triggering* or *initiating* event.

Event categories:

A18) *Action event*: it happens when a person or an organization decides to do something, for any reason. You cannot predict exactly when

e.g. *a customer deciding to place an order, a manager deciding the company needs a new employee, a regulator deciding to issue a new guideline*

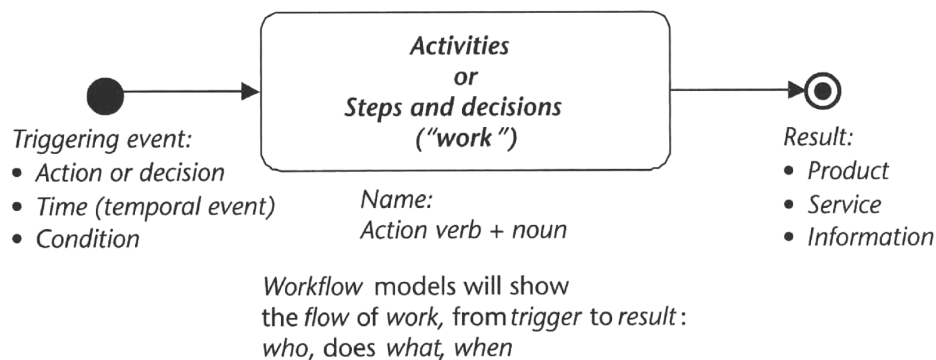
A19) *Temporal event*: it happens when some predetermined date or time is reached at which some activity must begin. You always know exactly when it will next happens.

e.g. *time to run the payroll, time to close the books, time to take inventory*

A20) *Condition or rule event*: it happens when a monitoring activity detects some exception condition. You cannot predict it in advance

e.g. *a smoke alarm being set off, a stock price hitting a predetermined limit.*

The figure represents the *trigger-activities-result* conceptual framework.



It is in contrast with input-process-output (which sounds mechanical)

## Summary

A22) the process comprises an identified body of work that can be characterized as a set of related activities or a defined sequence of steps and decisions.

A23) the process name is (essentially) in action verb-noun format, although it might have a qualifier or another noun.

A24) The name is in the singular.

A25) The name, if put in "noun is verbed" format, will indicate the intended result (output) of the process.

A26) The result must be discrete and countable. If a mushy verb is used, these criteria will not be met.

A27) The result is what the customer of the process wants.

A28) The process is initiated by a triggering event that could be action, time, or condition.

A29) Rule-of-thumb: **NO RESULT → NO PROCESS**

**How to discover business processes**

(Readings: pp. 129-132, Sharp, *Workflow modeling*, 2009)

A36) Identify the **nouns** that sit over the process .

A38) Do not think too hard, you are doing discovery and not analysis

A39) Take each selected noun and ask the group to identify activities by thinking of which verbs go with it. Incrementally new discovered activities are added to the collection

A40) Clean up the activity names so they use an action verb and one or more nouns:

e.g. Designing -> design advertise;

Writing -> write editorial item;

Billing -> issue invoice

A41) Generalize any that refer to specific actors or technologies unless those references are key to understand the activity

A42) Eliminate duplicates, use the noun-is-verbed form to check the names, remind people the difference between result and objective

**Workflow Modeling****Link the Activities and Determine Business Processes**

A43) The purpose is to uncover a set of related business processes by linking the activities into “result-trigger” chains, analyzing the linkages and determining business process boundaries

A44) Rules: a cluster of activities with 1:1 links generally is a well-formed business process, whereas 1:M and M:1 connections are not coordinated within the same process

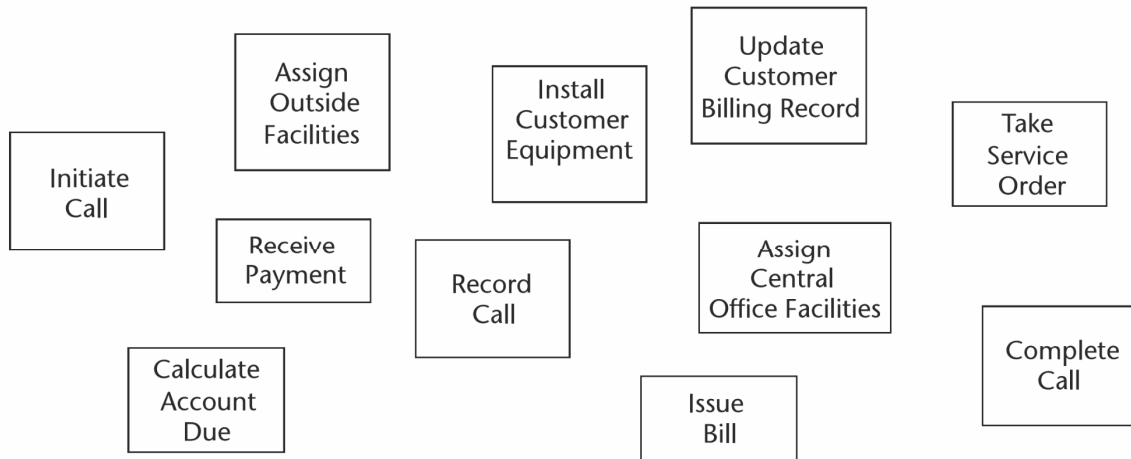
A45) The group places, on long sheets of plotter pages, the activities in sequence. Simply ask to identify cases when an activity is generally preceded or followed by another activity

A46) This sequencing makes missed activities more evident.

A47) Activities can be made of a long chain, but also of some parallel streams. Sometimes M:M linkages are also possible. Focus on ‘happy path’ (do not worry about looping or instances 1:0).

A48) Identify the business process boundaries and name the business processes.

Example: a Brainstorm Diagram to discover real processes in a Telephone Company

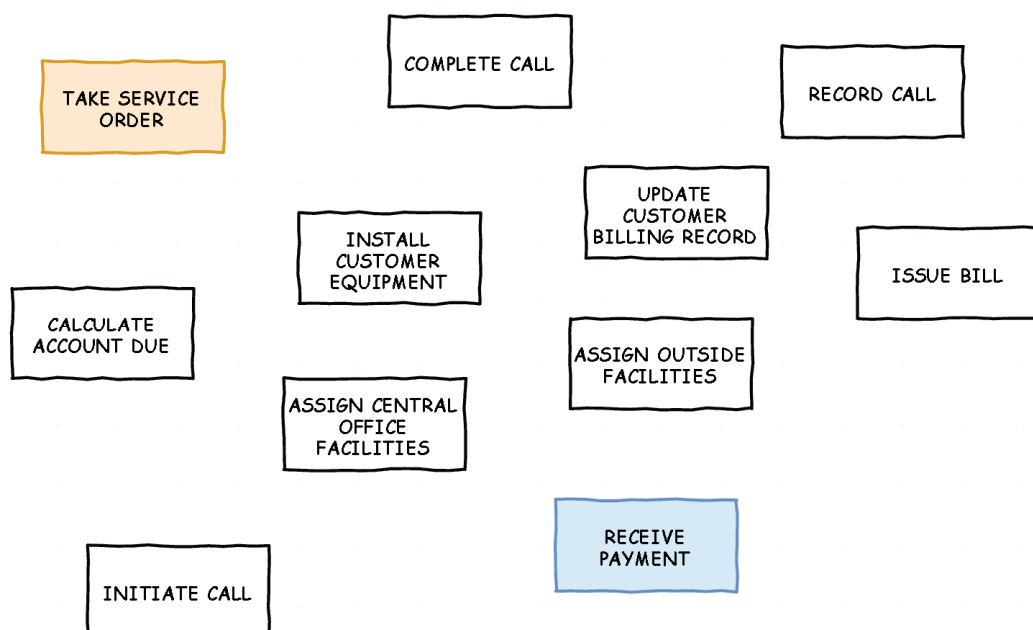


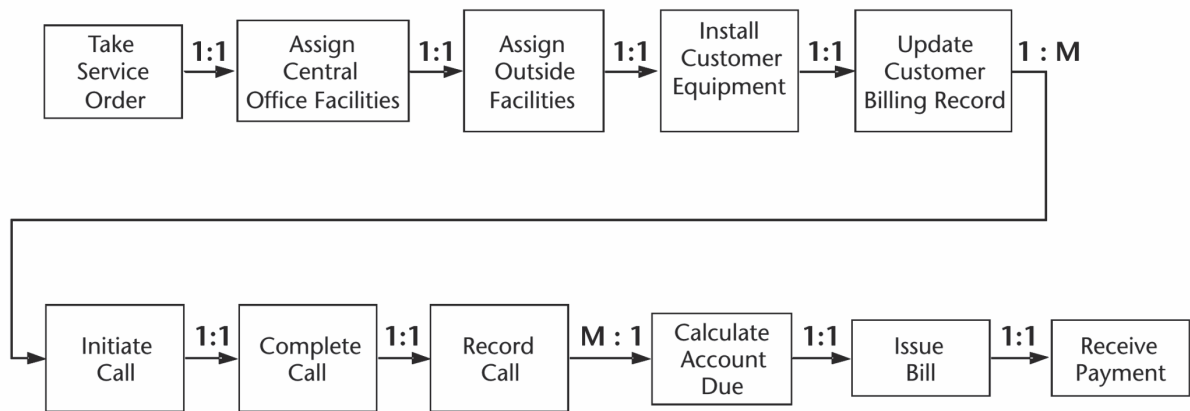
Partial results from activity identification.

<https://www.draw.io/>

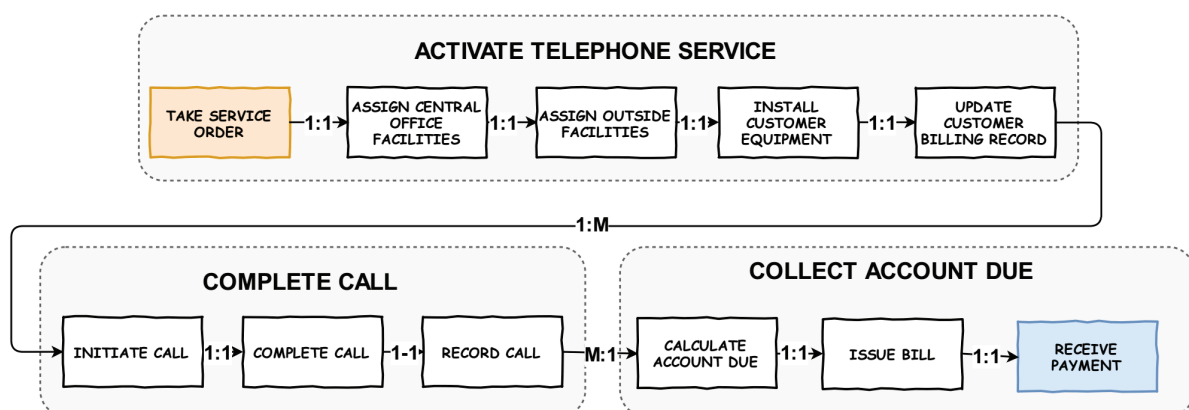
File > Save as > download > html

File > Open from > device > html





Sequence activities and analyze linkages.



Identify business processes