Software Development

ART or ENGINEERING?

Agenda

- ES@Pesc
- Software Development
- Software Engineering
  - Process
  - Project
- AgileKip: SE in Practice

SE@PESC

Profa. Claudia Werner - Software Reuse, Games in SE and SE Education

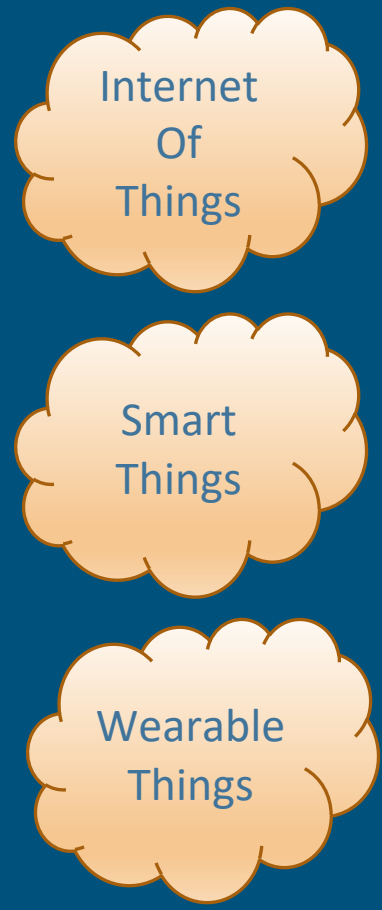
Prof. Claudio Miceli - Internet of Things (IoT), Smart Grid and Security

Prof. Guilherme Horta Travassos - Empirical Software Engineering and Evidence-based Software Engineering

Prof. Toacy C. de Oliveira - Software Process Representation and Analysis, Process Mining and BPM

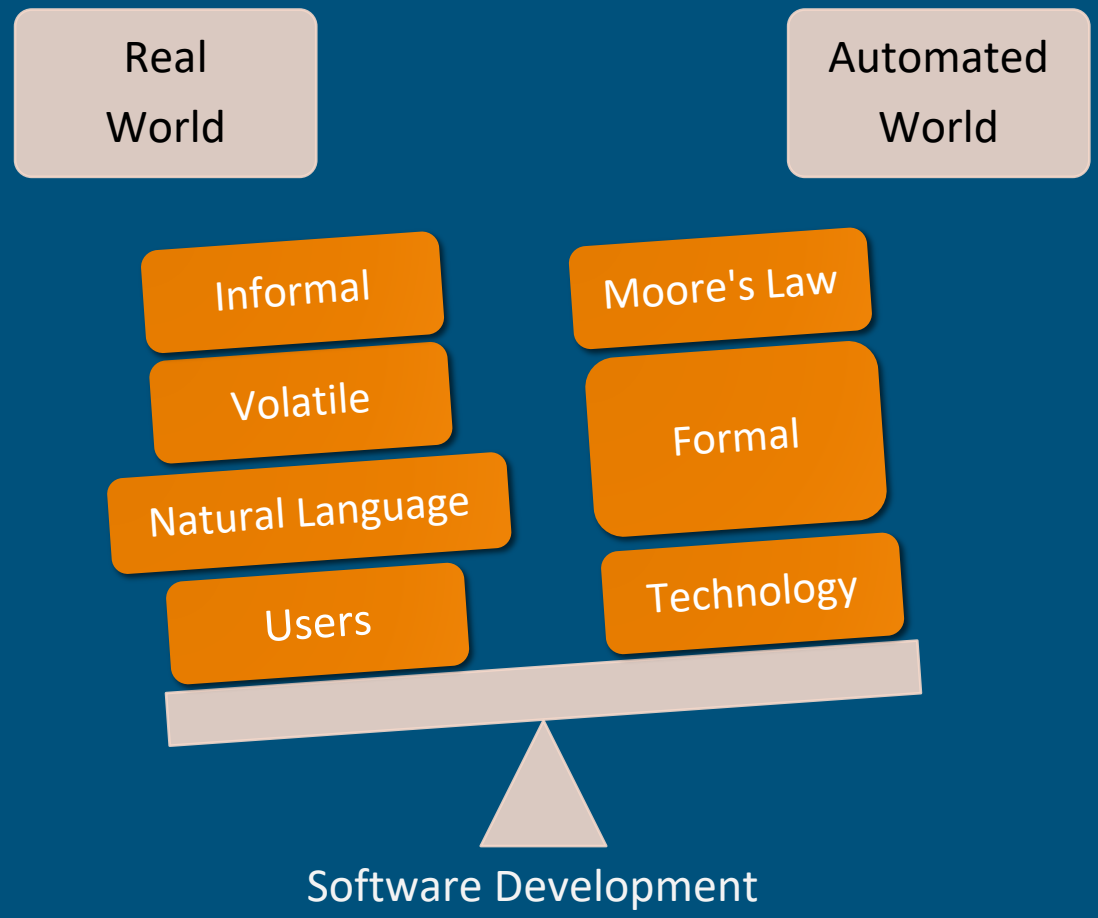
Increasing Demand

- Software Systems are reshaping society…..
- People…
  - Are highly connected
  - Take care of their own stuff
    - Buy tickets, do banking, get paid, find places, book hotels
  - Demand more and more information (awareness, transparency)
- Organizations (Companies, Governments, NGOs,..)…
  - Are also highly connected
  - Need to do more with less (be efficient)
  - Need to be transparent and responsible
- Both people and organizations generate tons of information!
- Things need software ☺



Software Development: Context

In practice, Software Development practitioners battle between the "Real World" and the "Automated World" to create bespoke (semi-)automated systems that usually mimic real world procedures.



Who is winning?

CHAOS RESOLUTION BY AGILE VERSUS WATERFALL

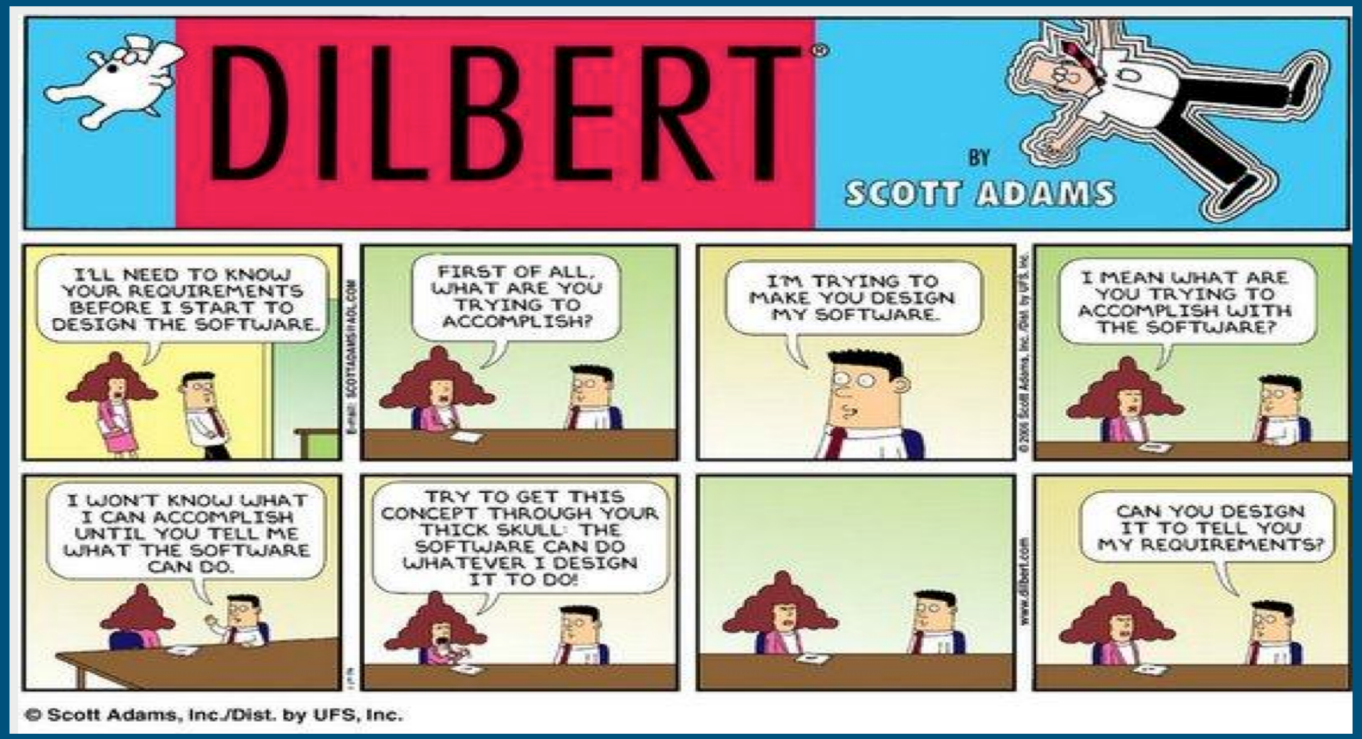
SIZE	METHOD	SUCCESSFUL	CHALLENGED	FAILED
All Size Projects	Agile	39%	52%	9%
	Waterfall	11%	60%	29%
Large Size Projects	Agile	18%	59%	23%
	Waterfall	3%	55%	42%
Medium Size Projects	Agile	27%	62%	11%
	Waterfall	7%	68%	25%
Small Size Projects	Agile	58%	38%	4%
	Waterfall	44%	45%	11%

The resolution of all software projects from FY2011–2015 within the new CHAOS database, segmented by the agile process and waterfall method. The total number of software projects is over 10,000

Why developing software is so complex ?

USER VS TECHNOLOGY VS "US"

User!



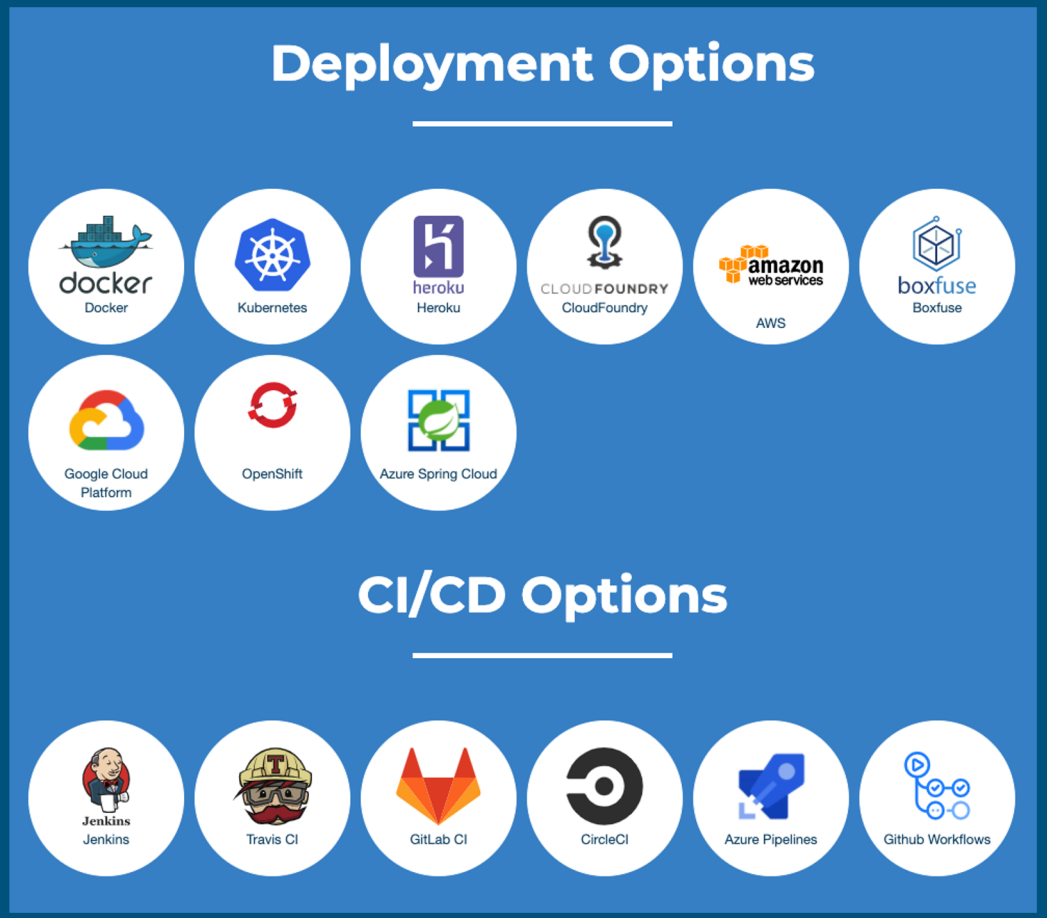
It might be not so obvious to understand their needs… ...and their domains (banking, insurance, HR, education, logistics, healthcare, etc..).

Technology!

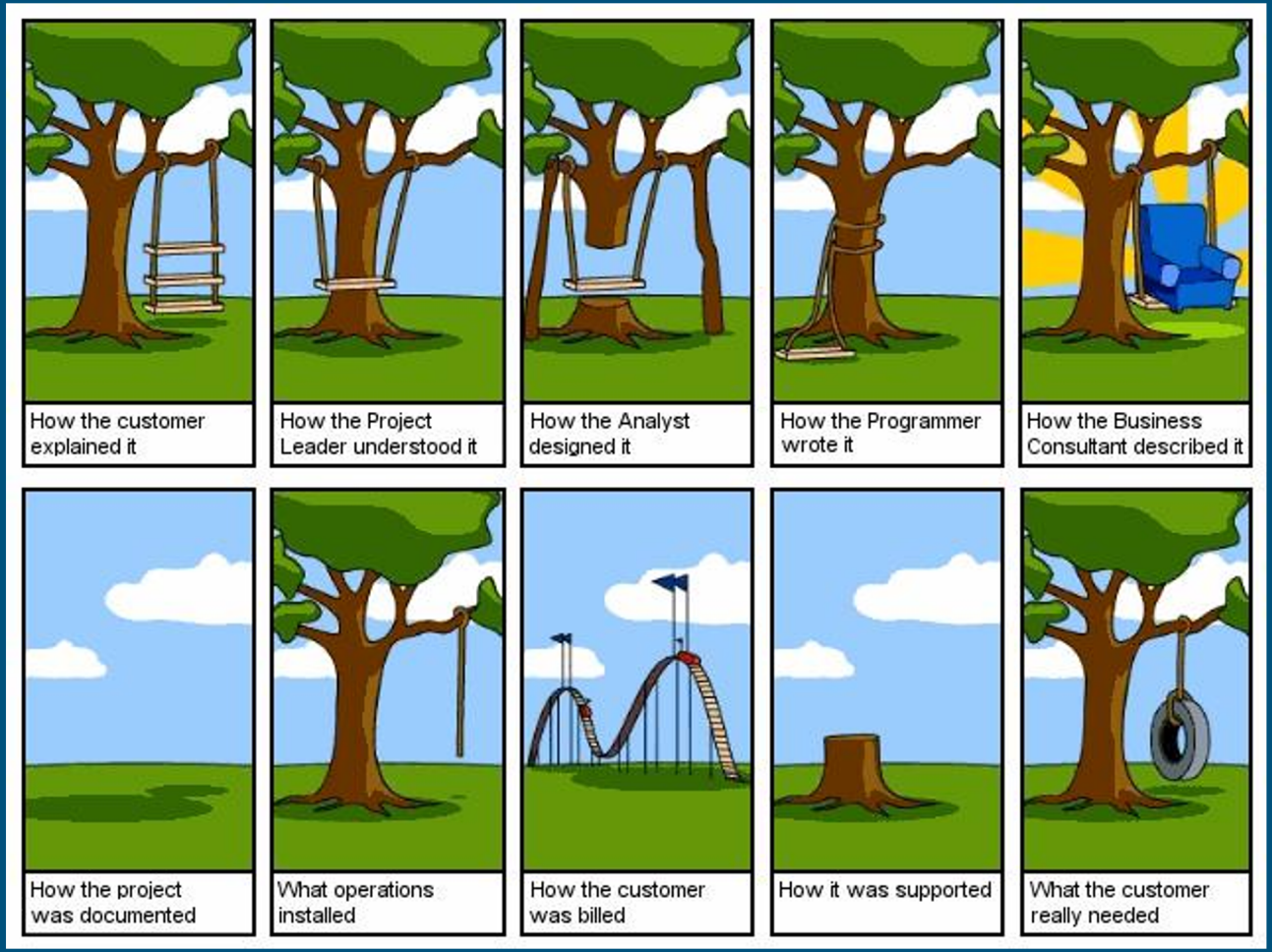

Client Side Options
HTML5
CSS3
Bootstrap
TypeScript
Angular
React
Vue
Redux
Websockets
Yarn
Webpack
Sass
Browsersync
Jest
Protractor

+Technology ……!


Server Side Options
Spring Boot
Spring Security
Netflix OSS
Consul
Gradle
Maven
Hibernate
Liquibase
MySQL
MariaDB
PostgreSQL
Oracle
MS SQL
MongoDB
Cassandra
Couchbase
Neo4j
EhCache
Caffeine
Hazelcast
Infinispan
Memcached
Redis
Elasticsearch
Kafka
Swagger
Elastic Stack
Prometheus
Thymeleaf
Gatling
Cucumber
ArchUnit
Testcontainers

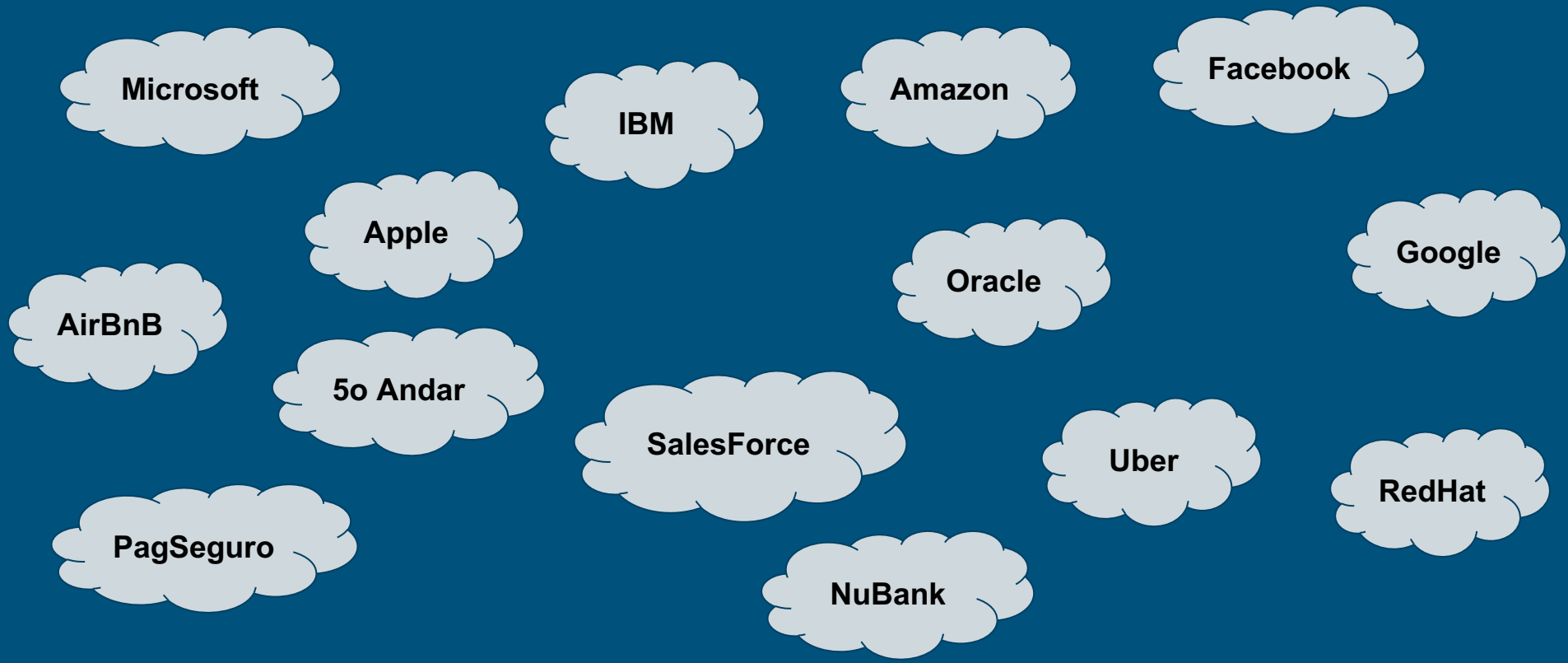

Deployment Options
Docker
Kubernetes
Heroku
CloudFoundry
AWS
Boxfuse
Google Cloud Platform
OpenShift
Azure Spring Cloud
CI/CD Options
Jenkins
Travis CI
GitLab CI
CircleCI
Azure Pipelines
Github Workflows

Us!!



Project Leader
Analyst
Programmer
Business Consultant
Operations

It's not all lost!!!



The Solution!!

Software Engineering – According to IEEE's definition, software engineering can be defined as the application of a **systematic**, **disciplined**, **quantifiable** approach to the development, operation, and maintenance of software, and the study of these approaches; that is, the application of engineering to software.

- systematic: *def*. done or acting according to a fixed plan.
- disciplined : *def*. showing a controlled form of behavior or way of working.
- quantifiable : *def*. express or measure the quantity.

The Solution in practice 😊

1. Apply Divide and Conquer
2. Apply Abstraction
3. Gather a bunch of **well educated** and **experienced** people with **different skills and backgrounds**...and don't forget the users!!!
4. Understand, Implement, Test, Document, Deploy an increment (set of divided bits)
5. Goto 1 until run out of budget or the boss says it is done!

Do all this with a plan in mind!!!

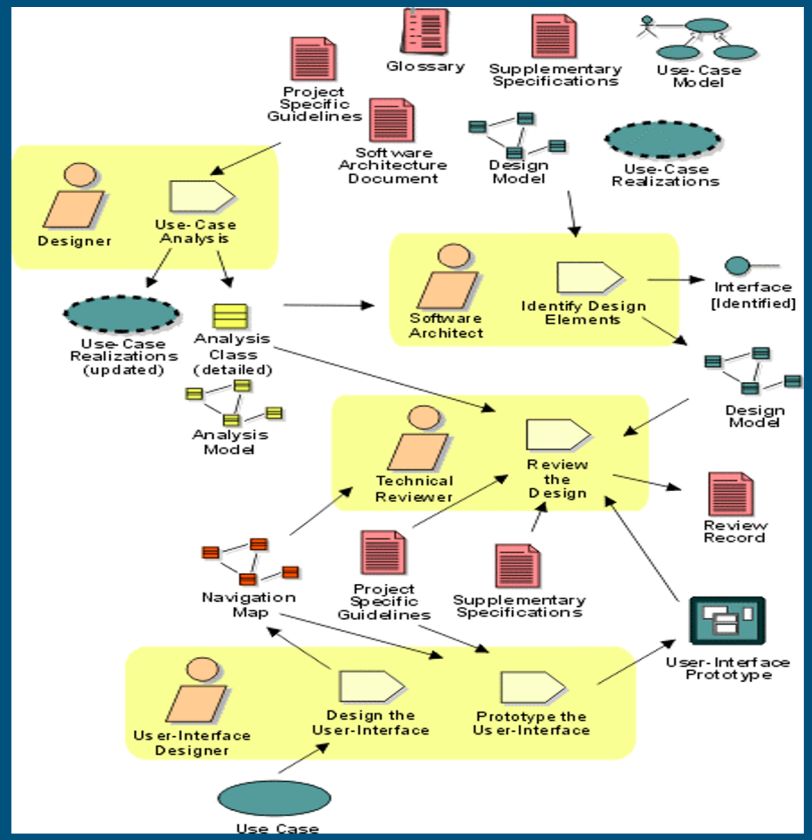
Software Development Processes

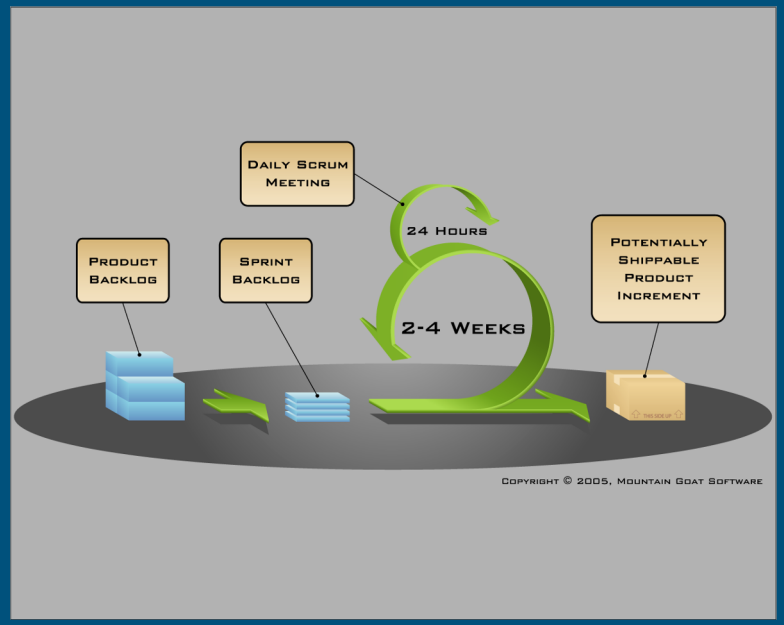
A software process is a set of interrelated **activities** and **tasks** that transform **input work products** into **output work products**. At minimum, the **description** of a software process includes required inputs, transforming work activities, and outputs generated.

-Swebok, 2014

Software Development Processes (SDPc) attempt to represent common and successful practices that together facilitate how software systems are built or maintained. Processes typically come from independent ”entities" such as ISO, CMM, MPS.Br and SCRUM Manifesto or from companies such as the Rational (Rational Unified Process).

Example – A Process





Software Development Projects

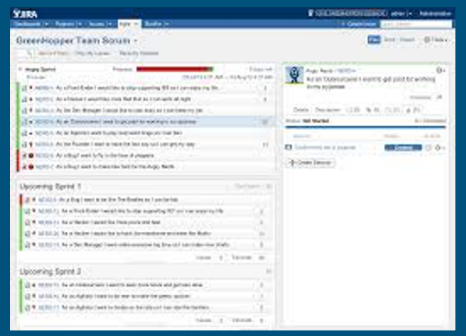
Software Development **Projects (SDPj)** using Software Engineering principles and concepts:

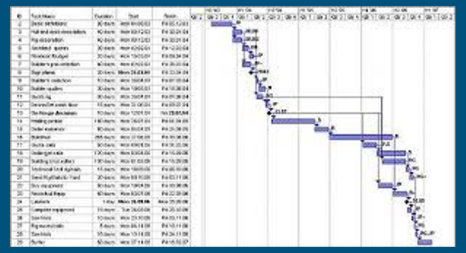
- Leverage on **plans** (to be systematic)
- Measure (time, budget, satisfaction, errors, etc.) what is happening
- Control (execution, implementation,…) what is happening

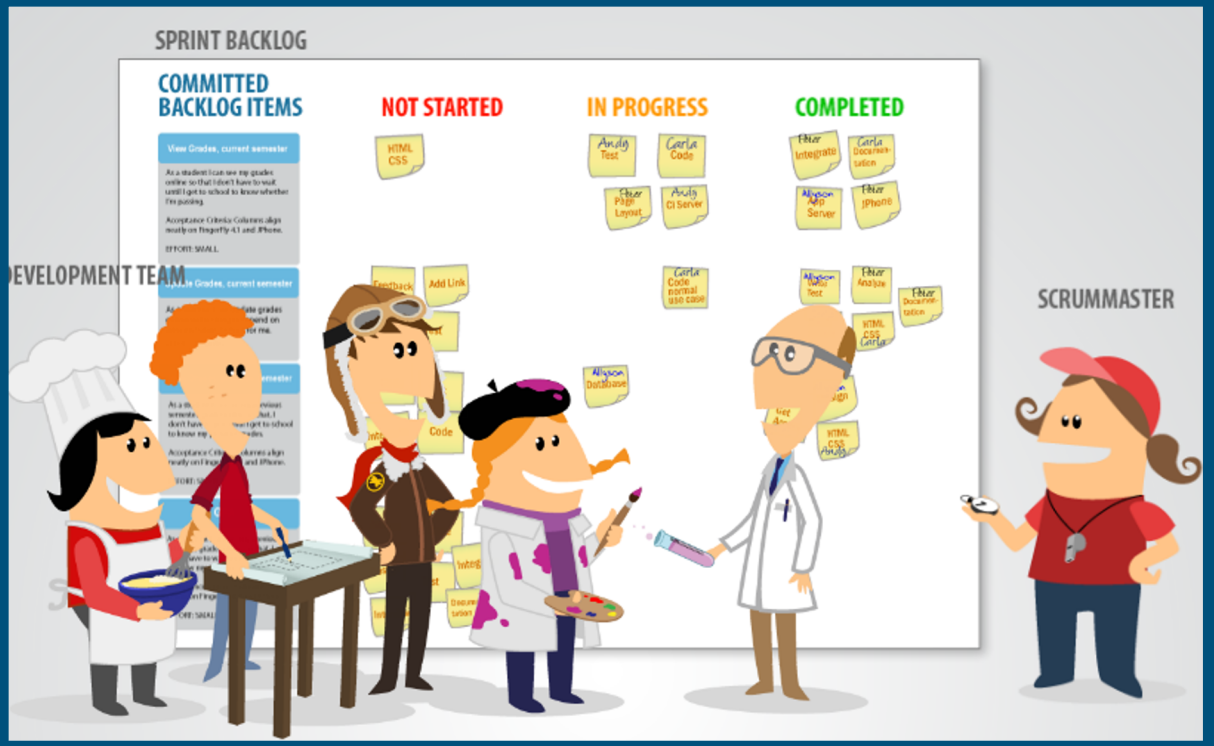
…and...

- Gather volatile and unstable information from users and the like (manuals, procedures, laws, etc.)
- Convert informal information to formal representations (NL => UML, BPMN, Java,)
- Add technology to the mix (web, mobile, tv, cloud, etc.)

Example – A Plan in SDPjs







Art or Engineering?

Software Development is still a mix of Art and Engineering, and it will stay like this as long as people play the central role.

But who cares!!! Software is needed everywhere and this discussion is pointless.

AgileKip -

A "small" example of engineering in practice

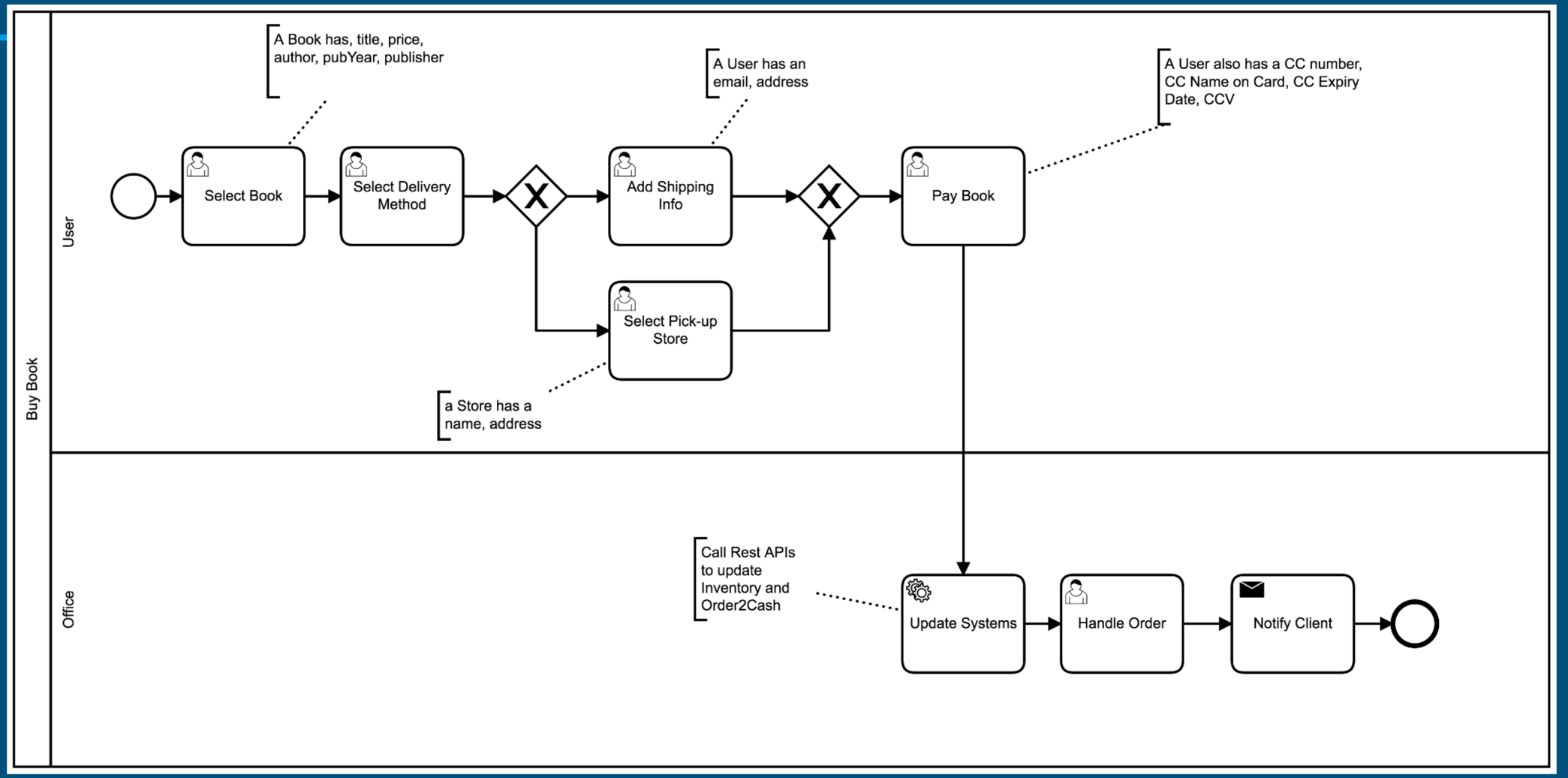
AgileKip – A R&D Agenda intended to investigate, develop and communicate state-of-the-art research and also create an ecosystem based on open-source tools to help practitioners navigating the Agile and Knowledge-Intensive Process Lifecycle (agilekip.com)

- Project 1 – AgileQube – Agility Assessment
- Project 2 - PACA – Process Aware Conversational Agent
- Project 3 - Intelligent Process Automation Platform

Process Automation

- The adoption of software systems to support the execution of normative and explicit workflows.
- Promote a standardized way to handle "things".
- Examples
  - Procurement
  - Order2Cash
  - Employee Onboarding
  - Planning a Trip
- It is bootstrapped by a process model, typically BPMN.

Process Model - BuyBook



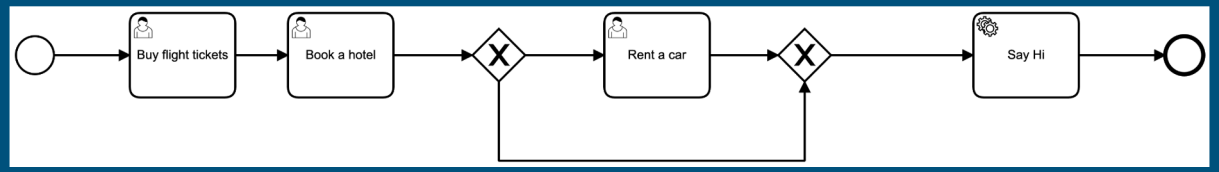
Problem

- How to simplify developing Process Aware Information Systems?
  - avoiding vendor lock in;
  - based on state-of-the-art and proven technologies;
  - using an approach where most of the system is automatically generated;
  - using a reference architecture that is highly configurable;
  - that can be available on premise or as a service;
  - allowing bespoke extensions (see What's next).

Solution Rationale

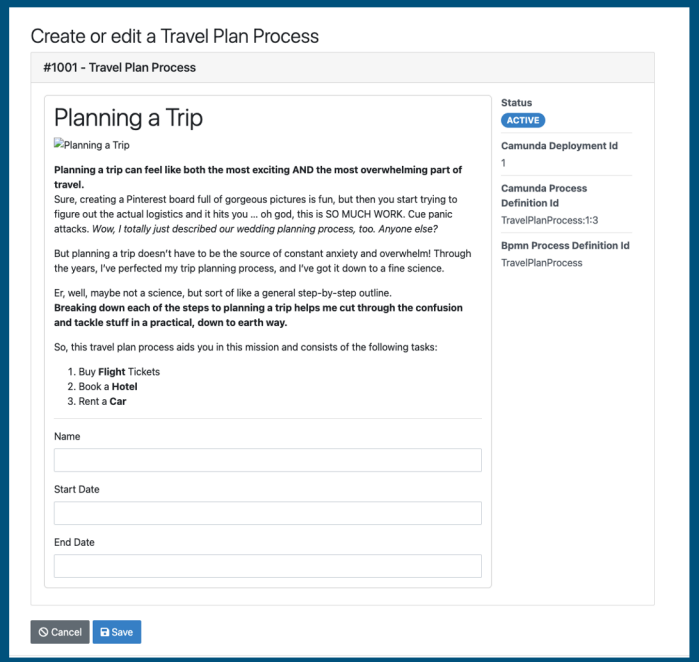
Generate

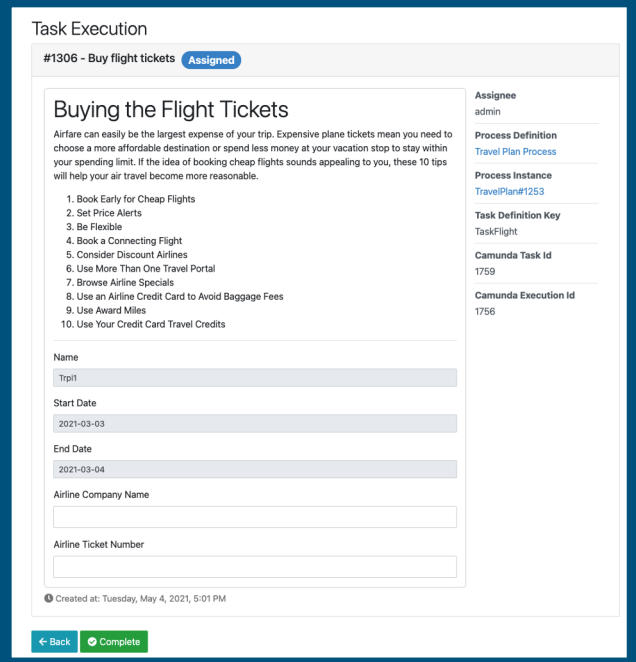
From



+ Entities + code

To





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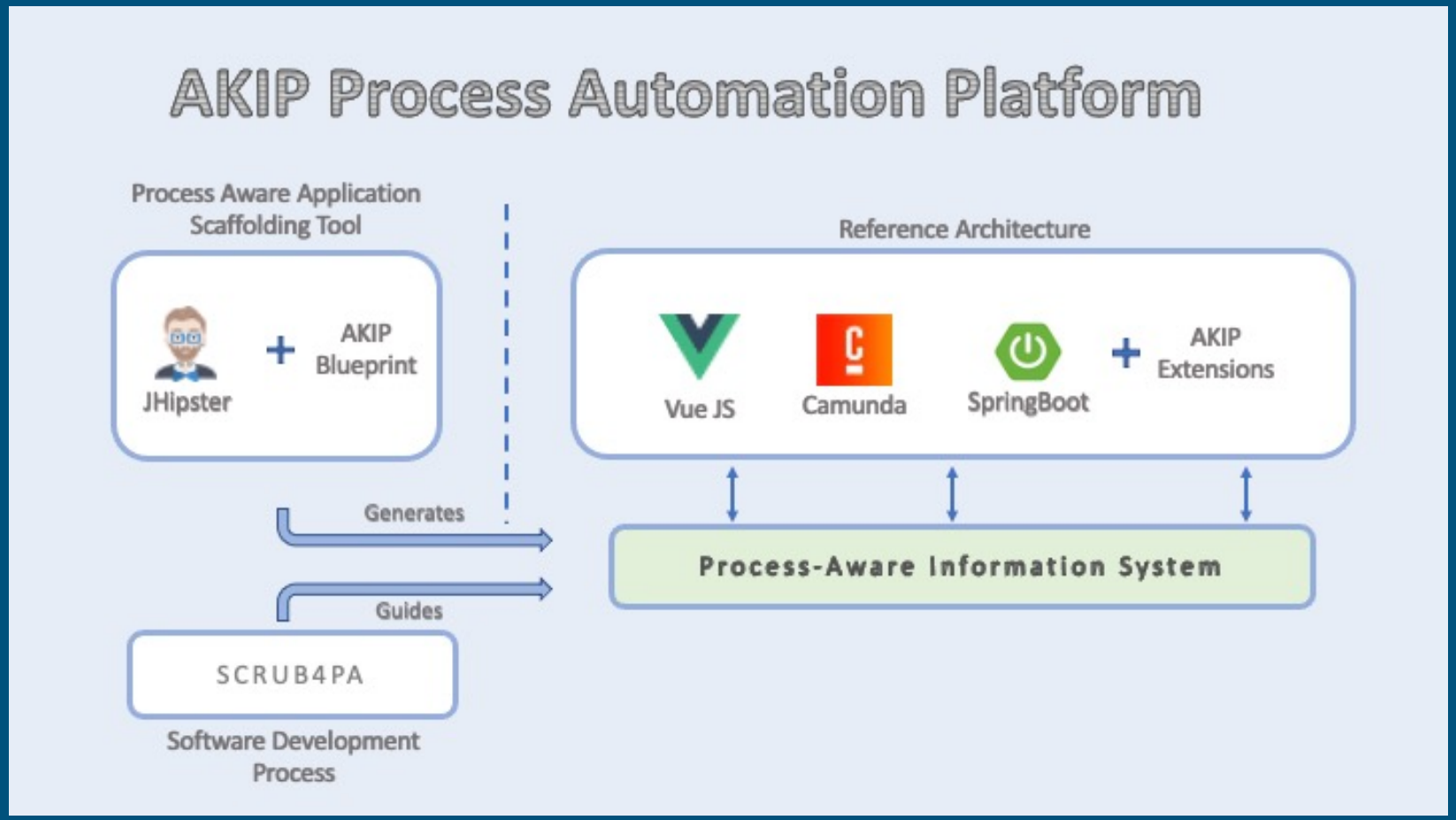
Support for:

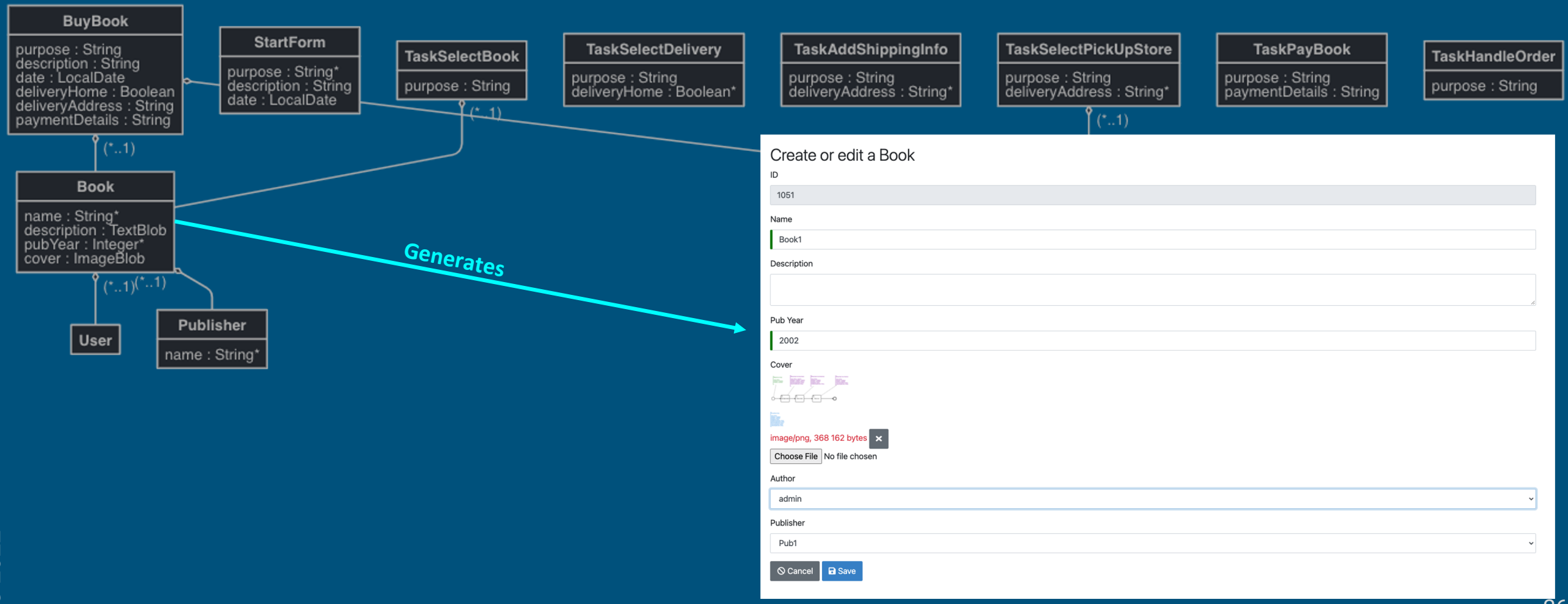
- CRUDs
- User Management
- Rest EndPoints
- Internationalization
- Database Management
- Microservices support
- & more...

The Platform

Site



Specifying Entities



Specifying Forms

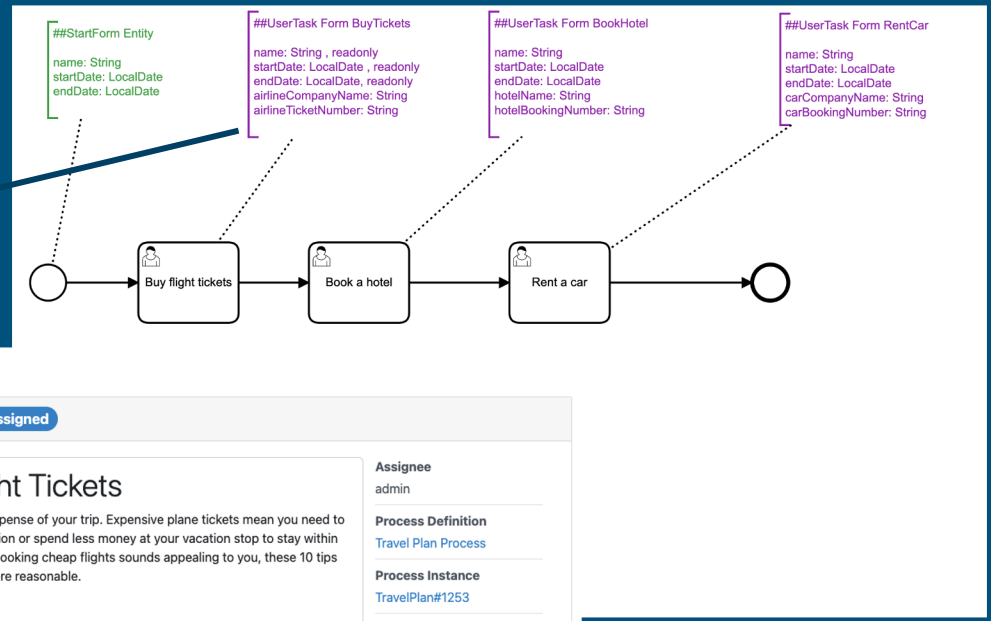
##TaskForm

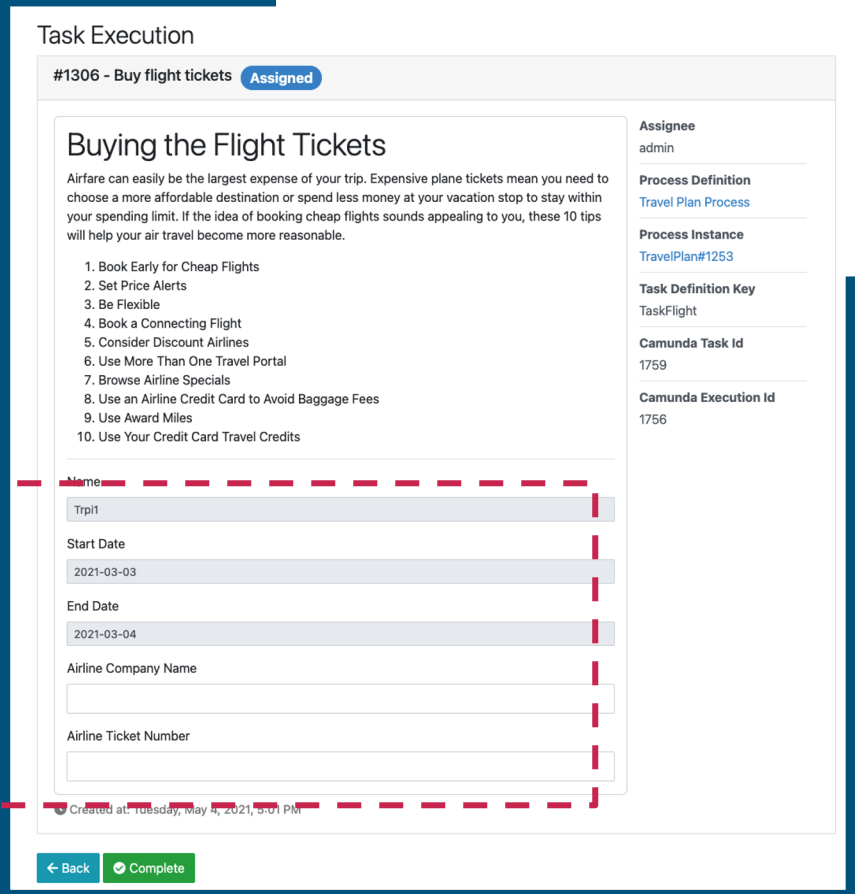
name: String , readonly
startDate: LocalDate , readonly
endDate: LocalDate, readonly
airlineCompanyName: String
airlineTicketNumber: String

Generates

#TravelPlan Entity

***name*: String**
***startDate*: LocalDate**
***endDate*: LocalDate**
***hotelName*: String**
***hotelBookingNumber*: String**
***airlineCompanyName*: String**
***airlineTicketNumber*: String**
***carCompanyName*: String**
***carBookingNumber*: String**





TLDR

Demo

Take aways

- Creating Modern Software Systems is hard.
  - It involves several participants, with different skill sets.
  - It involves ever changing technology.
  - It involves discovering domains that engineers are not used to.

- Software Engineering is about organizing how software is built and maintained.
  - It defines practices on how information should flow between participants (engineers, customers, stakeholders, etc.).
  - It defines responsibilities that should be followed (manager, scrum master, tester, etc.).
  - It defines a workflow (or a ritual) to organize collaborative work.

Take aways

Software Engineering is not a silver bullet but working in an organized way typically outweighs working in an ad-hoc manner.

Thanks

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