Human Computer Interaction course

Part 2

ENSEEIHT

January 2023

Course content

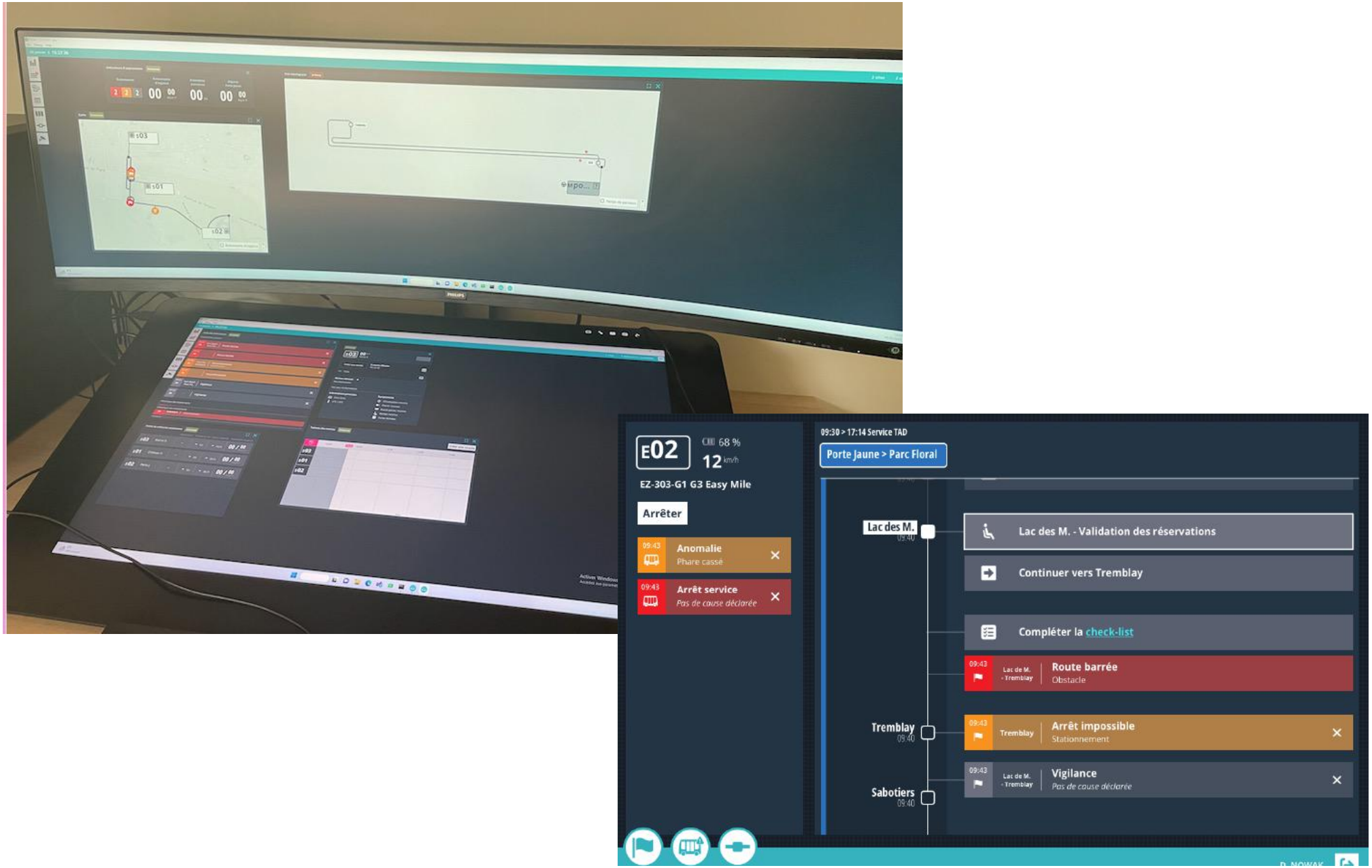
- **Course 1**
  - HCI, HSI, distributed systems, interactive software engineering
  - First contact with Ingescape
  - Presentation of the exam
- **Course 2**
  - **Exam groups**
  - **HCI & UX methodologies**
  - **Visual programming with Ingescape**
- **Course 3**
  - Software design patterns for HCI development
  - Generating code and crossing models for interactive applications
  - Verification & Validation applied to interactive systems
- **Course 4**
  - Methodologies for multidisciplinary and iterative System Engineering, notions of HSI
  - Human Factor assessments, why and how
  - Co-simulation and data record/replay with Ingescape
- **Course 5**
  - Practical exchanges on your exam projects using system architecture models

What are objectives of HCI projects ?

- **Objective**
  - Create systems that answer **final users needs** in an **efficient way** inside **real operational environment**

- **Associated challenges**
  - Solutions design
  - Ability to achieve
  - Research on efficiency and users satisfaction

PCVA Poste de Commandes de Véhicule Autonomes



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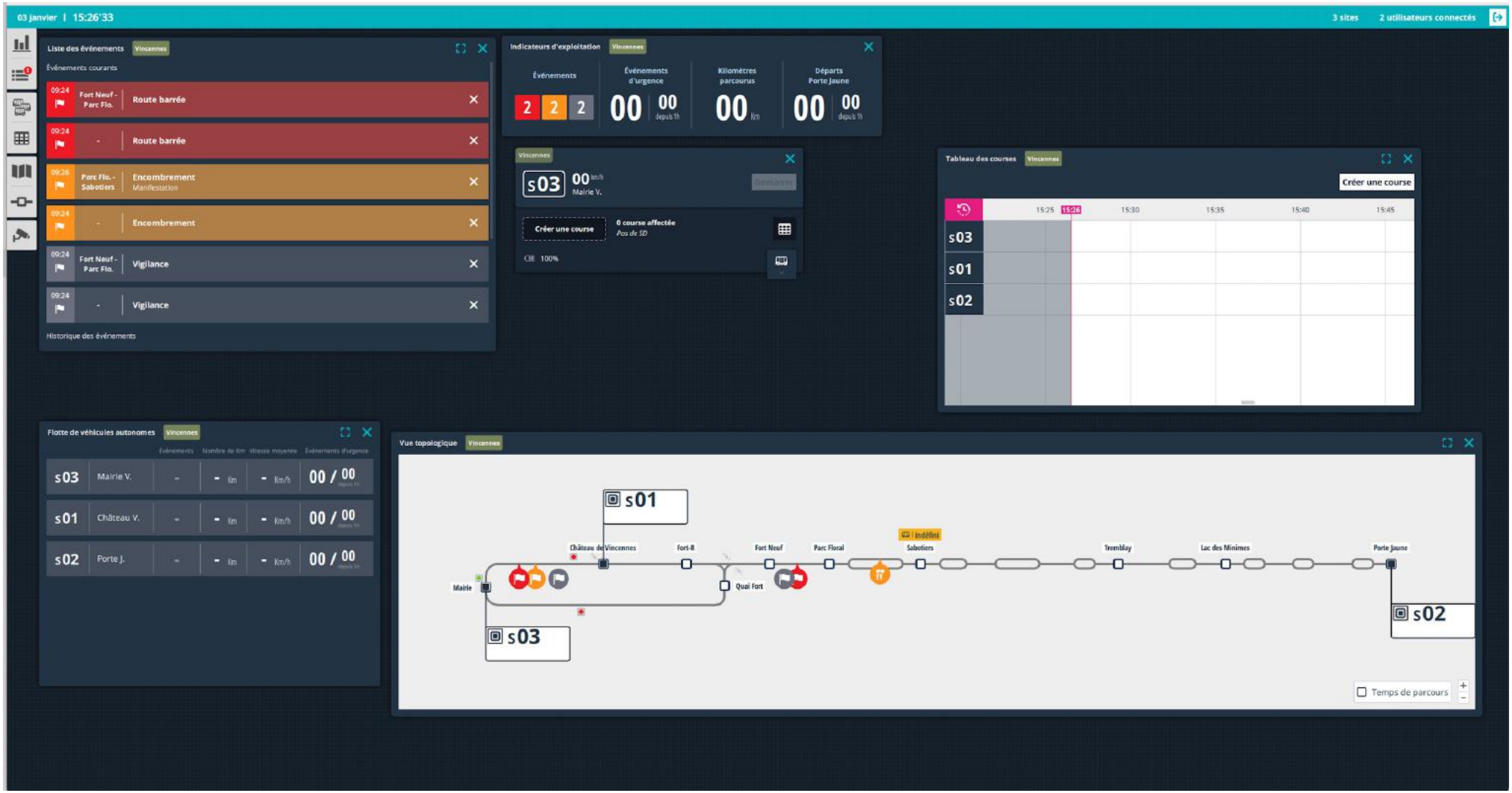


HCI is based on Multidisciplinary

- **Ergonomics, Human Factors and cognitive sciences**
  - To address all issues relative to human being, so that solutions fit the people who use them (comfort, efficiency, safety).
  - To introduce methods on user analysis and effective evaluation processes

- **User-centered design (UCD), UX, UI and interactions design, graphic design… that bring all aspects of HMI creation**
  - For specifying the task flow, interface content, intuitive navigation path, information architecture, UI overall appearance, layout…
  - … by putting users at the center of the design and development

- **Interactive software Engineers & Developers**
  - To ensure the system design, the software implementation and the complete integration in collaboration with the teams of customers.

What is User eXperience design ?

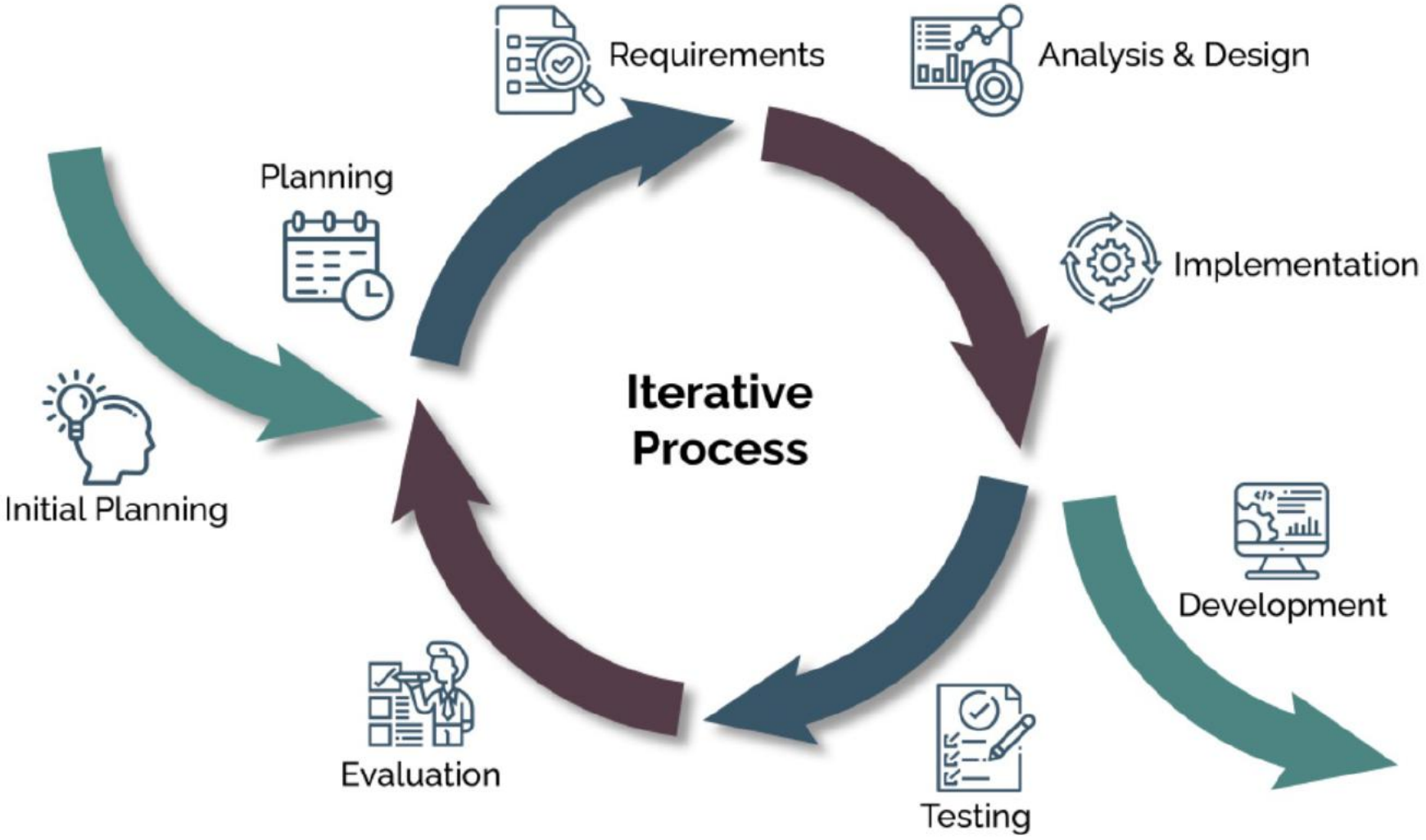
The inclusion of observation and analysis of the **user activity** throughout a product design process, whether digital or not.

- User experience (UX) design aims at products that provide meaningful and relevant experiences to users.
- The user experience is the set of user perceptions during their interaction with a product, device, service, company...

HCI design process includes different phases .....

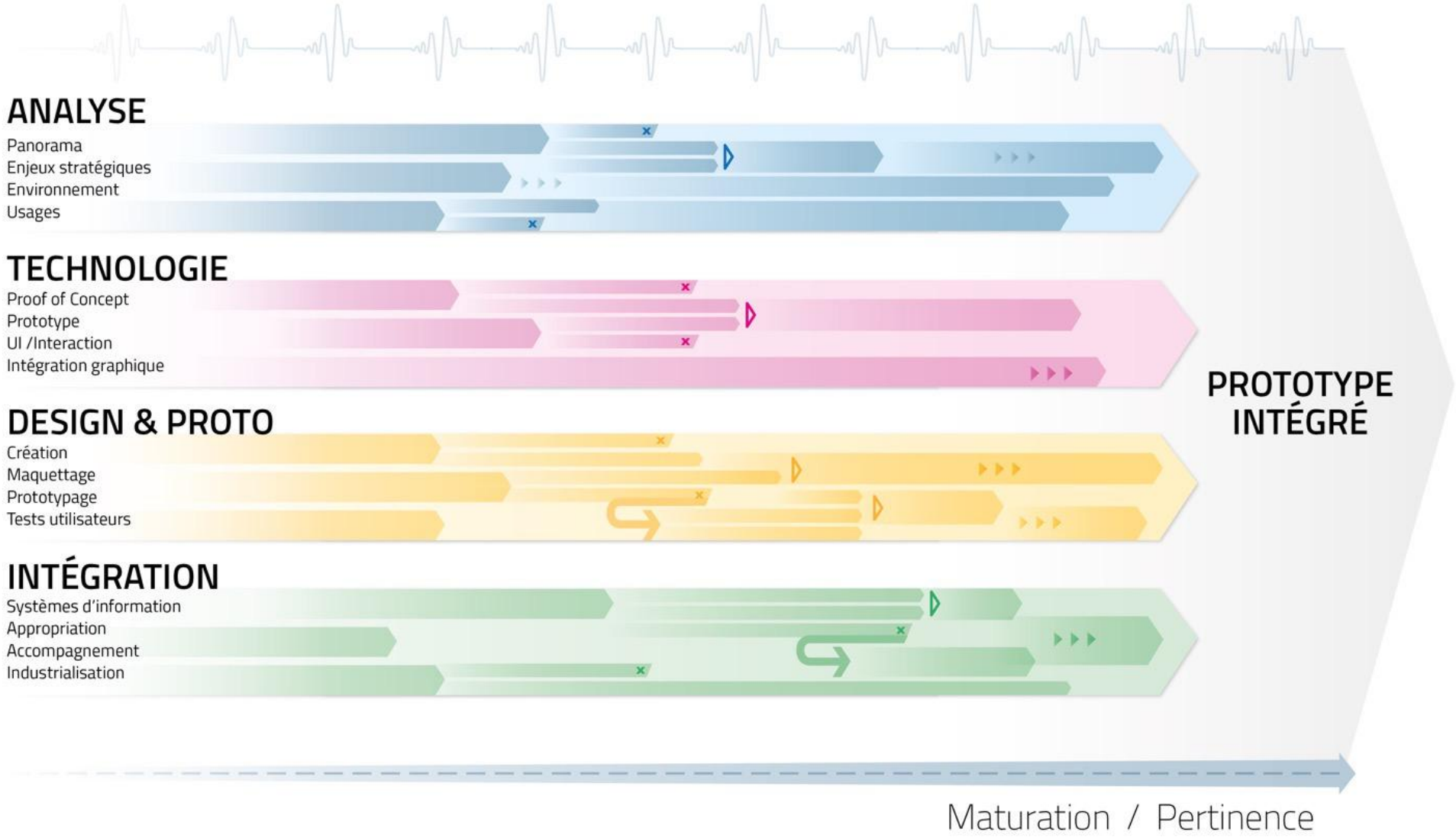
- **Initial analysis**
  - Project issues and objectives
  - User research
  - Technologies and system
- **High-level concepts definition**
  - What problem needs to be addressed and how ?
- **Solutions detailed design**
  - Functional specifications (requirements)
  - User Interface and Interactions
  - Graphic Design
  - Logical and technical Architecture
- **Prototypes implementation & evaluations**

… but is highly iterative



https://radiant.digital/what-is-iterative-design/

Solution is built progressivaly



Utilisateurs & co.

Utilisateur final

- a des besoins
- s'exprime en (mauvaises) solutions
- peut être très divers/diffus
- détient les clés du **succès global**

Représentant des utilisateurs

- UN utilisateur dont les propos n'engagent que lui

Expert métier

- a la pression de son chef qui s'imagine qu'il détient les solutions
- connaît effectivement bien le domaine et donc les besoins
- s'exprime en solutions … avec aplomb et arguments construits
- n'est pas créatif

Client

- paye et valide
- a besoin de contrôle
- veut un ROI rapide et important
- a une vision idéalisée des solutions qu'il attend
- détient les clés de la **convergence** du projet dans les **délais**

Marketing

- croit connaître le besoin
- croit détenir des solutions
- connaît bien la stratégie
- détient les clés du **succès commercial**

Expert données/contenus

- se demande ce qu'il fait là (ou ce que nous faisons là)
- détient les clés de la **pertinence** et de la **cohérence**

Expert technique

- a peur du chaos
- a peur de se trouver en situation de pression
- détient les clés de **l'intégration opérationnelle**

Voilà pourquoi il faut créer une **dynamique d'adhésion et de contribution collective !!**

Initial Analysis: What are the objectives ?

- **Centralize knowledge about**
  - Project
    - Issues and objectives
    - Resources constraints : budget and planning
  - Users
    - User Characteristics and profiles (specific skills, knowledge, experiences)
    - Needs
    - Existing (or projected) activity analysis and context of use
    - Tasks and operating scenarios
  - Technologies and systems
    - Technical Environment and Constraints
    - Existing systems analysis
    - Input/Output Data

➔ **It's important to keep a broad view during this first phase !**

Initial Analysis: How to proceed ?

- **Users Interviews & Observations**
- **Documentation research**
- **State of the art of alternative solutions**
- **Existing tools analysis**
- **Workshops with**
  - Customers
  - Technical teams
  - The other stakeholders...

PCVA – Project Objectives

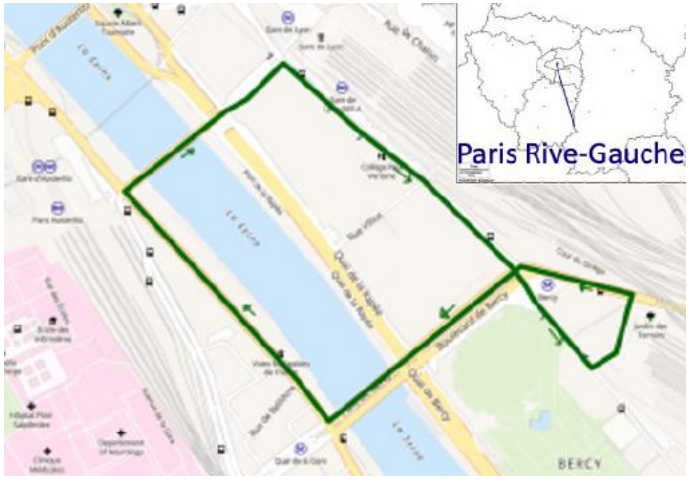
- **Innovation project**
- **Experimentation and exploration**
- **Users roles and activities not established**
  - Need to have highly iterative process during the development
  - Changing functional scope
- **Diversity of input data that can evolved**

PCVA - Experimentations

- **Vincennes**
  - 2 shuttle constructors
  - Fixed Time Table

- **Saint Rémy**
  - On-demand transportation

- **3 Gares**
  - Connected Infra-structure



PCVA – Operating Scenarios

- **Launch of shuttles and daily opening of the line**
- **Nominal management of the line**
  - Regulation of the shuttles to regulate passages and respect the timetable
  - Traffic lights and intersections crossing
  - Reservations management
- **Incidents**
  - Incident on the line: presence of obstacles
  - Security incident: passengers discomfort
  - Failure or anomaly of a vehicle or infrastructure
- **Vehicle fleet maintenance**

PCVA - Utilisateurs

SUPERVISEUR

Accès à l'ensemble des modules

- Surveillance
- Régulation; gestion des SD
- Commande de véhicules et manœuvres
- Gestion de la flotte des véhicules
- Gestion des incidents

SAFETY-DRIVER

- Centré sur son service et son véhicule
- Commandes de véhicules et mnœuvres
- Gestion des incidents

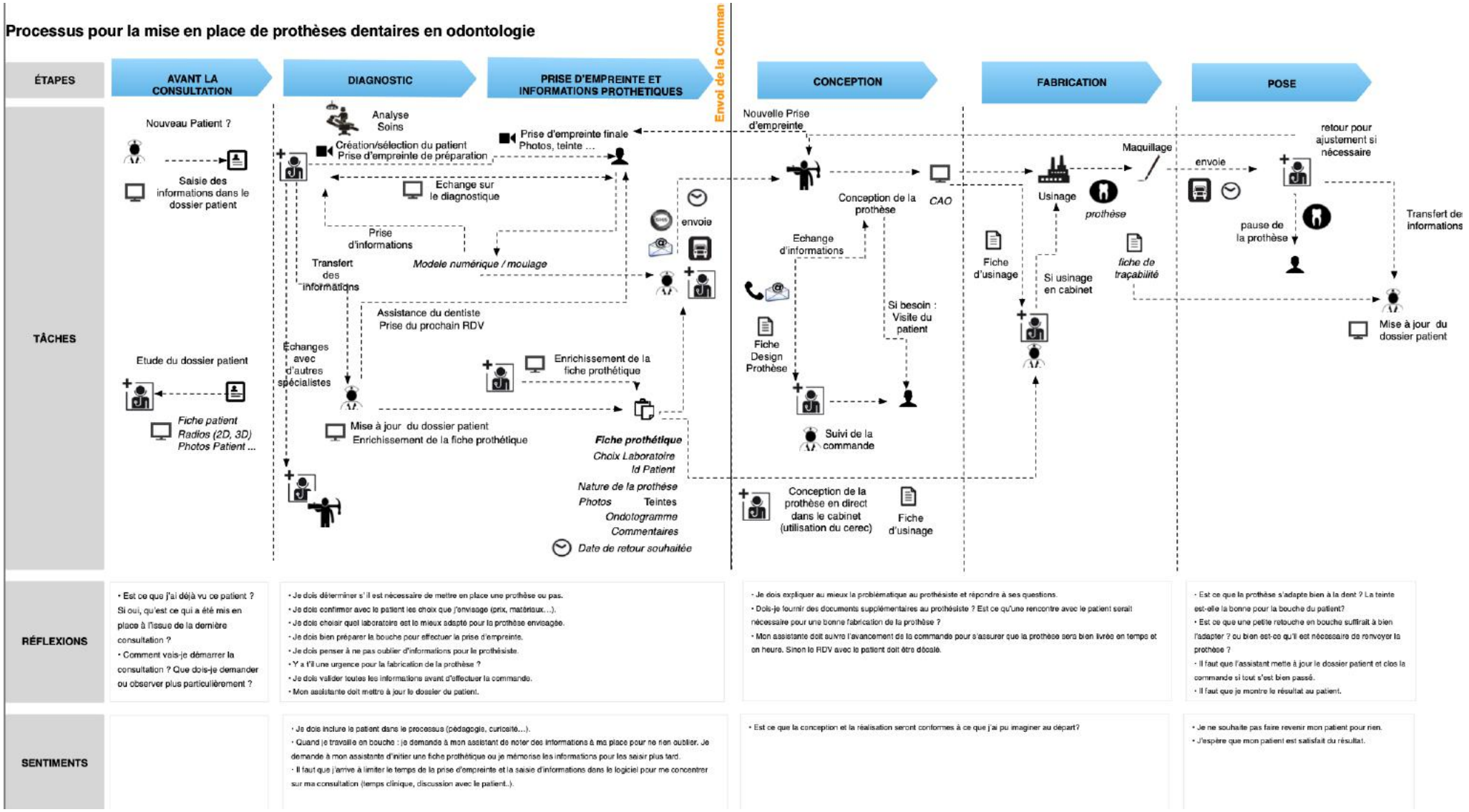
AGENT DE TERRAIN

- Commandes de véhicules et manœuvres
- Gestion de la flotte de véhicules
- Gestion des incidents

PCVA – Data providers

- Shuttle
- Connected lights
- Videos
- On-demand Transportation Application (reservations)
- Users on the field
- Connected infrastructure (videos, algorithms results, presence and motion sensors)

Other exemple : Experience Map



High-level concepts definition

- **What problem needs to be addressed and how ?**
- **Allowed to have**
  - Clear idea of the project objectives
  - Coherent area of work
  - Consolidated general concepts
- **Concepts could be defined by**
  - Data definition and model
  - First functional analysis and breakdown
  - Architecture principles
  - Technological bases description : hardware, display format, interactions means...
  - Interface global layout and workflows
  - Etc.

PCVA – Information & Functions Analysis

Equipements

- Affichage des informations détaillées
- Etat de fonctionnement
- Commandes : bouger caméra ? piloter un feu ?

Incidents / Todo List

- Edition : création, localisation, caractérisation
- Suivi : statut et progression, procédures, instructions pour le SD/l'agent terrain
- Commandes véhicule (selon le type)

Véhicules

- Affichage des informations d'exploitation
- Etat, Pannes et Anomalies
- Commandes :
  - -> portes, Stop&go, phares, vidéo
  - -> messages IV
- Courses : Safety Driver, dessertes et horaires
  - -> Créer une course HLP sans voyageur
  - -> Editer la course en cours
  - -> Désaffecter le véhicule de son service
- Actions de maintenance : créer, supprimer, début/fin, caractérisation, état du véhicule associé (disponibilité)

Régulation

- Au niveau d'une course :
  - -> Création : trajet, horaires (effectuée depuis mission prédéfinie, de type HLP, ou création automatique selon réservations)
  - -> Modification : horaires de départ, retenues en station, passage en omnibus.
  - -> Suppression (gestion SD et véhicule ?)
- Affectation de véhicules et de SD à une courses (et aux suivantes)
- Gestion de l'état de la ligne (en cas d'incidents, travaux)
  - -> station indisponible
  - -> interruption de ligne : mise en place d'un service provisoire, durée asossiée, et option de remise à l'heure
- Actions de régulation globales ligne :
  - -> Pilotage de dérives
  - -> Vision et pilotage des fréquences de dessertes
- Chargement d'un nouveau tableau de marche
- Annotation permettant d'éditer les points remarquables sur la ligne

PCVA – User Interfaces Modules

PCVA | PROFILS ET MODULES

SUPERVISEUR

Accès à l'ensemble des modules

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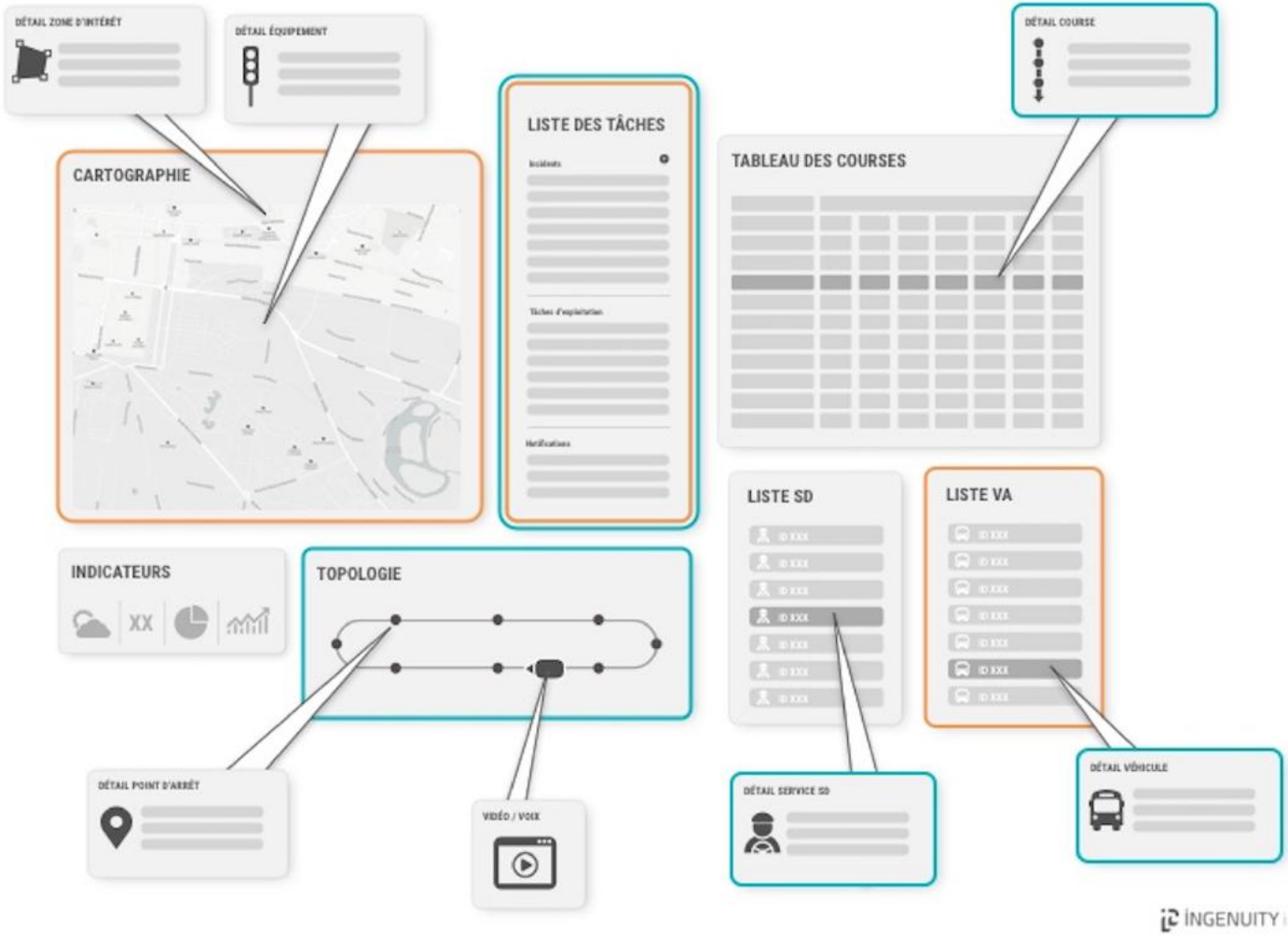
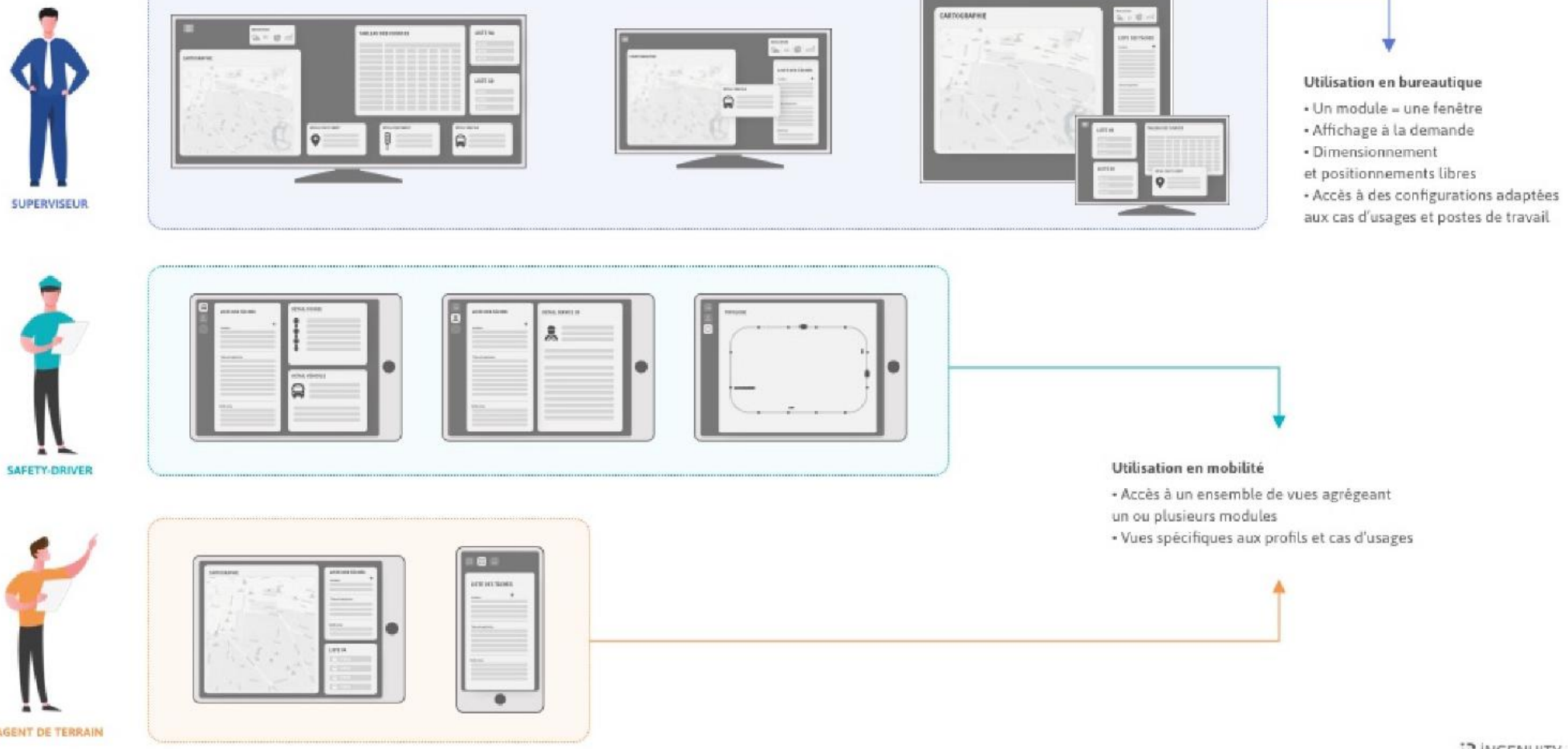
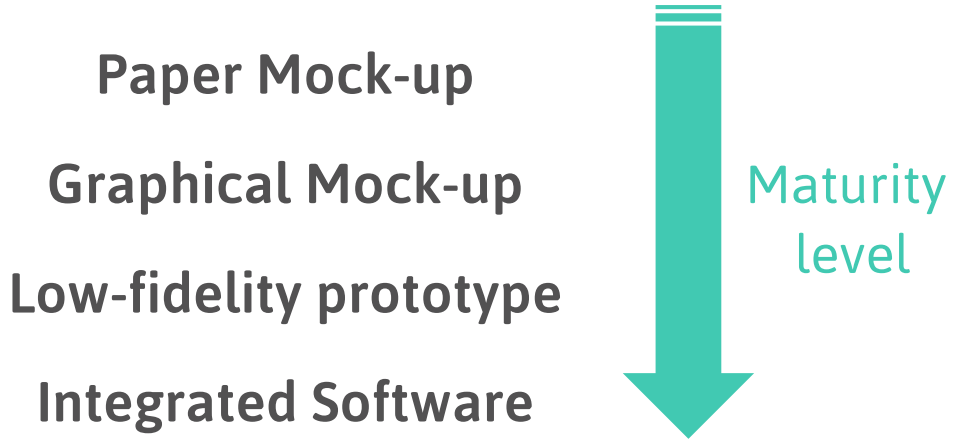


PCVA – HMI global Concept

PCVA | **VUES GLOBALES IHM**



Detailed design: Prototyping



- **Prototypes allow to evaluate solutions at each step of the process.**
- **At each iteration**
  - Solutions refinement
  - Functional scope increase
  - Prototypes more and more faithful and integrated

Detailed Design: Participative workshops

Detailed Design

- **What are "participatory design sessions with the customer" for?**

Not really for solution creation …

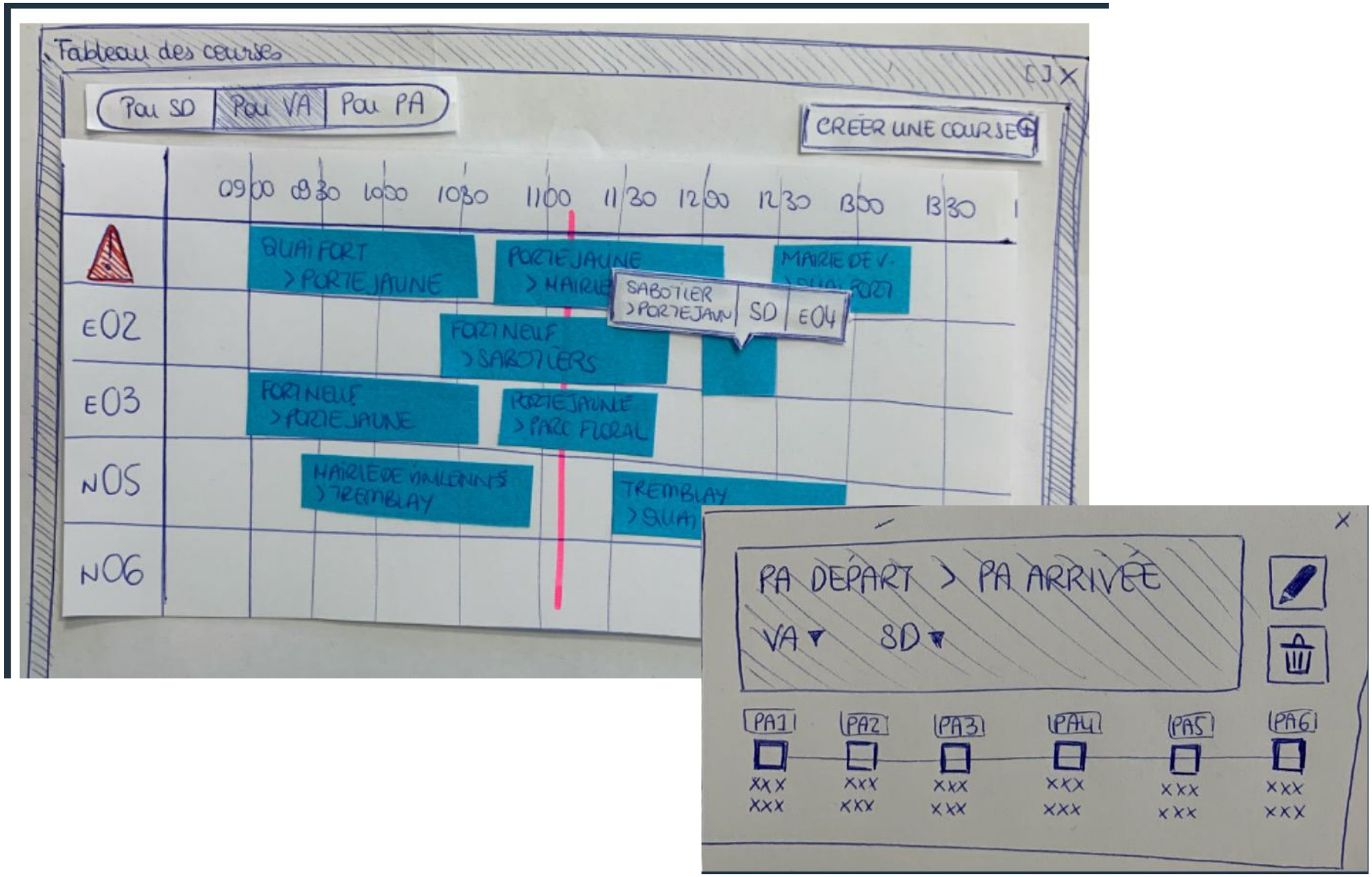
But allow rather to

- **Consolidated** elements that need to be discussed (use cases, information hierarchy, integration, issues, etc.)
- **Evaluated** design faced to reality : operational and technical context
- **Validated project progression and choices**

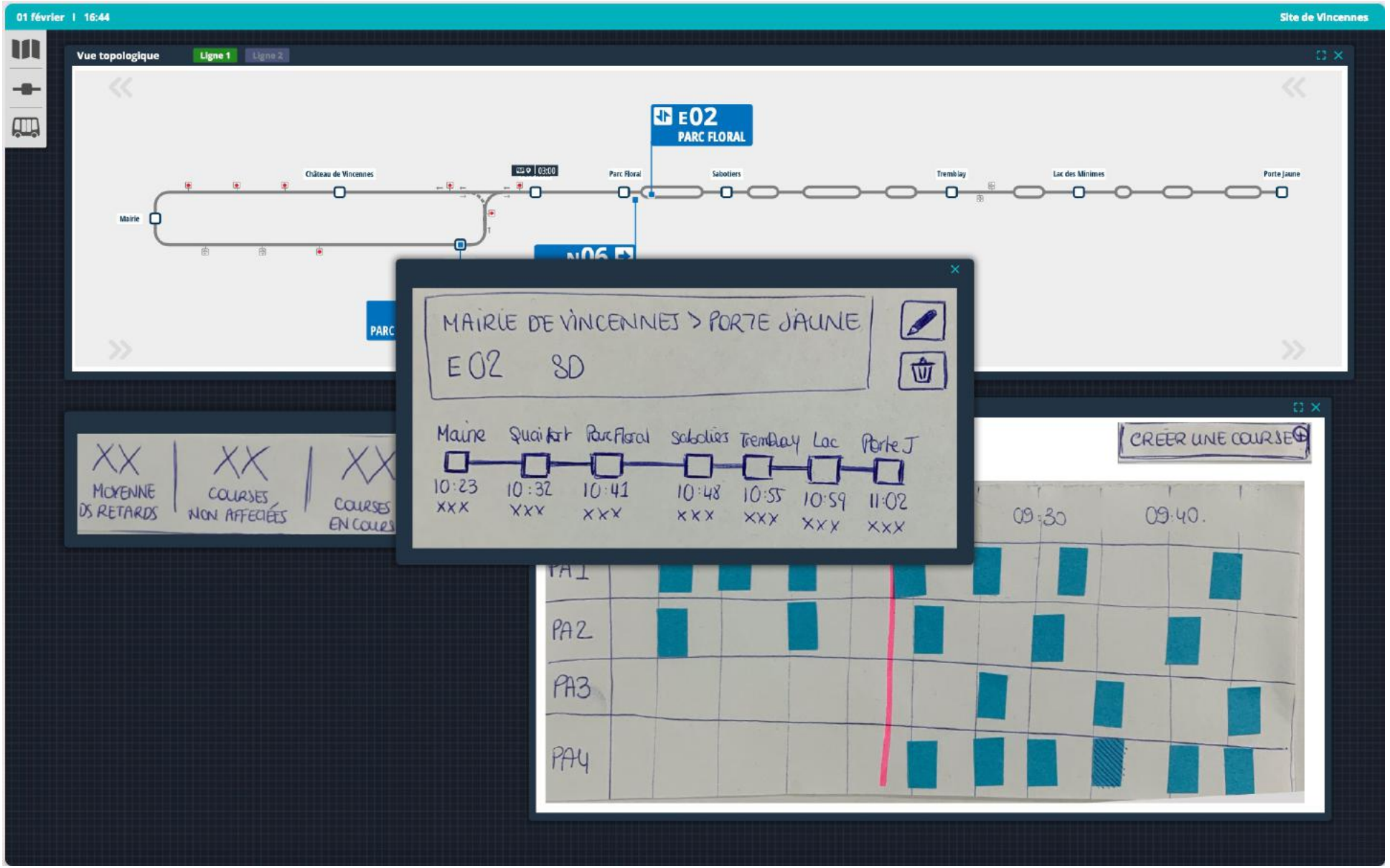
➔ **And especially to create membership and work around a common vision**

- **Need to be completed with :**
  - Regular and targeted workshops with all of stakeholders
  - …… and consolidation and analysis work

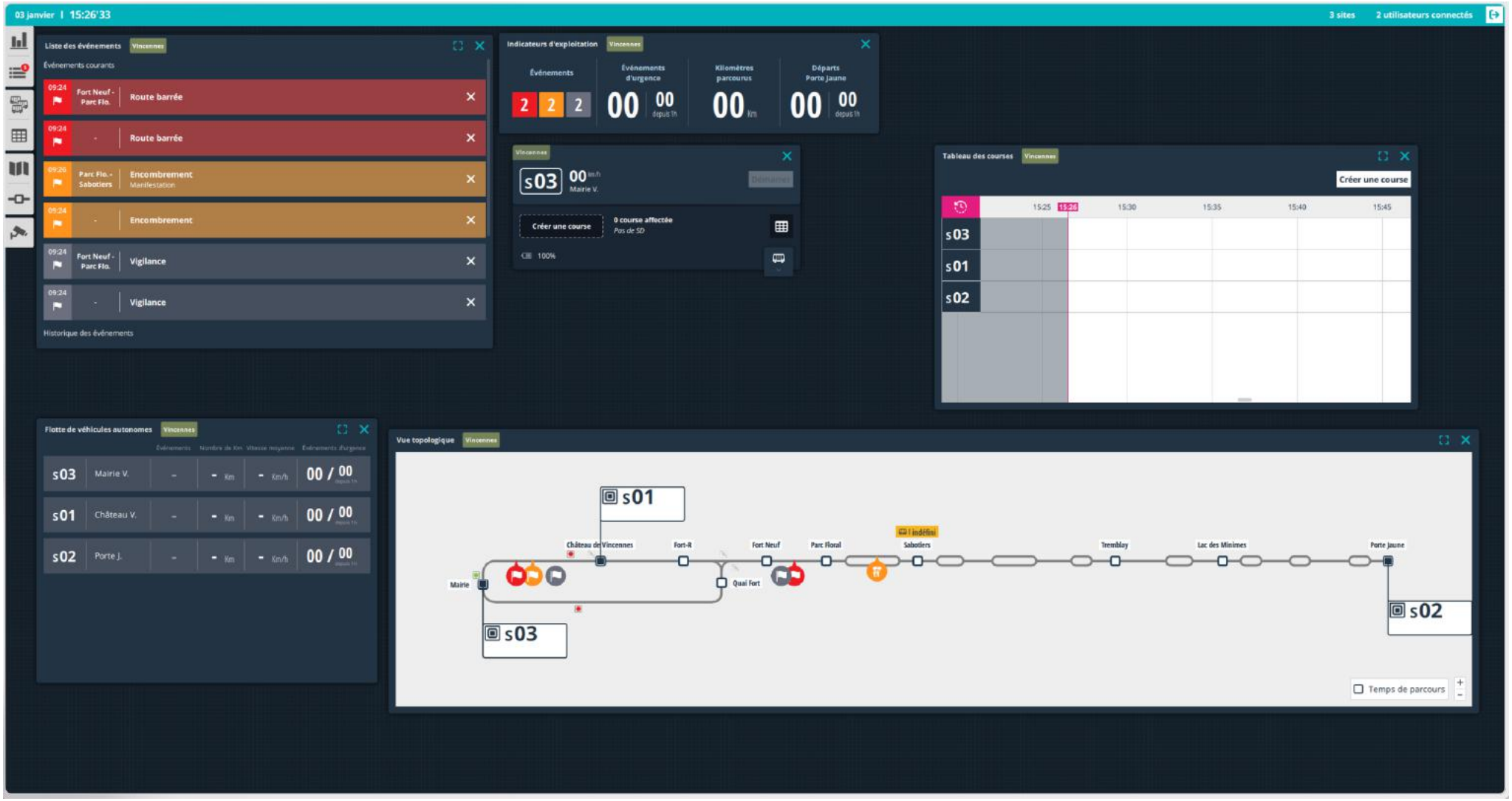
PCVA – HMI Design



PCVA - HMI Design

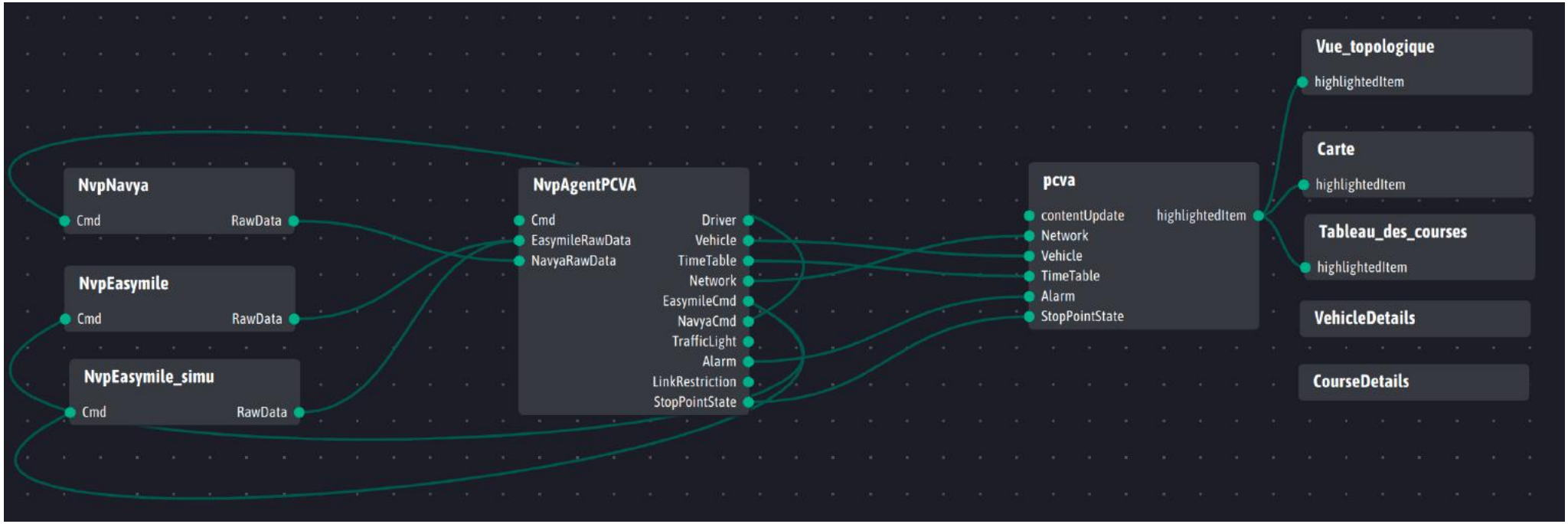


PCVA - HMI Design



PCVA – Solution Architecture

- **Agents breakdown and definition**
  - Data Inputs / Outputs
  - Services
- **Exchange Protocol and Data Format**



Software prototypes implementation

- **Technologies and architecture should be chosen in order to allow**
  - User Evaluations
  - Creativity and flexibility during the software development
  - Facilities to developers on the creation of rich and heterogeneous interactive environments

- **Iterations remain very important during implementation**
  - Begin with limited functional scope with only major functions

- **Complexity and integration levels should be adapted to the maturity level of the function**
  - Technology is a powerful medium… but should not overshadow the UX process.

Evaluations Methodologies

- **Observations**
- **Interviews and surveys**
- **Use of operating scenarios**
- **Use of standards**
  - Heuristic evaluation, Ergonomics Criteria
- **Quantitative experimentations**

Visual programming … with Ingescape Circle !

- **Allow to create programs by manipulating elements *graphically* rather than by specifying them *textually*.**

- **Allow low-cost prototypes achievement**
  - Prototypes could be implemented by all members of the team and notably designers.
  - Give the possibility to conduct assessments very early in the creative process.

- **Demo = Circle introduces visual programming tools.**

Some relevant rules to conclude ….

- **Always keep in sight the project objectives**
- **Adapt the project, methods, solutions in the face of unforeseen events and opportunities**
- **Iterate as soon as possible and continuously**
  - Share information and solutions : it's a team work !
- **Best solution is often the simplest**

  « Si c'est compliqué, tu t'es planté ! »

Course 5 : January 16

- **Practical exchanges on your exam projects using**
  - System architecture models
    - You could notably use IGS Circle to create a platform including your agent definition .
  - Paper Mock-up
  - Specifications Presentation
  - …. Support of your choice !

- **5 to 10 minutes for each working group… but it is possible to create links between groups !**