# APPLYING TRANSFORMATION TEMPLATES TO DIVERSIFY USER INTERFACES GENERATED BY MODEL-DRIVEN ENGINEERING

NATHALIE AQUINO[1], LUCA CERNUZZI[1], OSCAR PASTOR[2]

[1]Departamento de Electrónica e Informática, Universidad Católica "Nuestra Señora de la Asunción", Paraguay
nathalie.aquino@uc.edu.py, lcernuzz@uc.edu.py

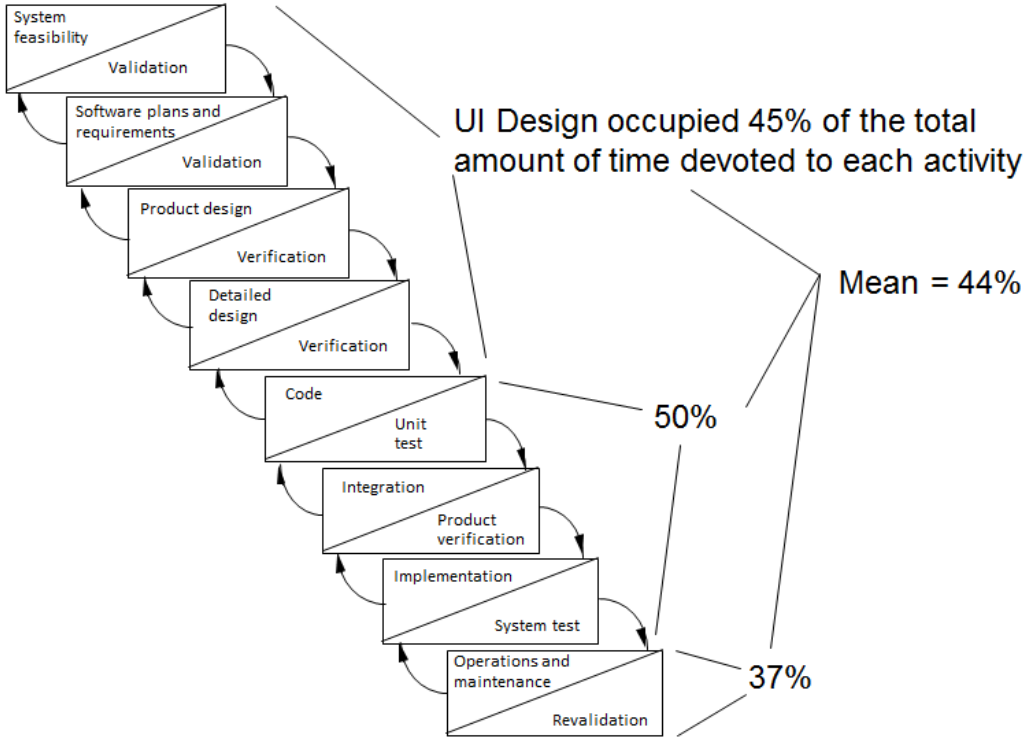
[2]Centro de Investigación en Métodos de Producción de Software, Universitat Politècnica de València, España
opastor@pros.upv.es

This work was funded by CONACYT through the PROCIENCIA program, with resources from "Fondo para la Excelencia de la Educación e Investigación - FEEI", FONACIDE.
This work was developed under project "Mejorando el proceso de desarrollo de software: propuesta basada en MDD"(14-INV-056).

CIbSE2018
Bogotá (Colombia) 23 - 27 de Abril

# MOTIVATION
# DIFFICULTIES RELATED TO USER INTERFACE DEVELOPMENT

- The development of graphical user interfaces is challenging in terms of skills, time, resources




Distribution of user interface development effort in a waterfall development life cycle [Meixner et al. 2014]

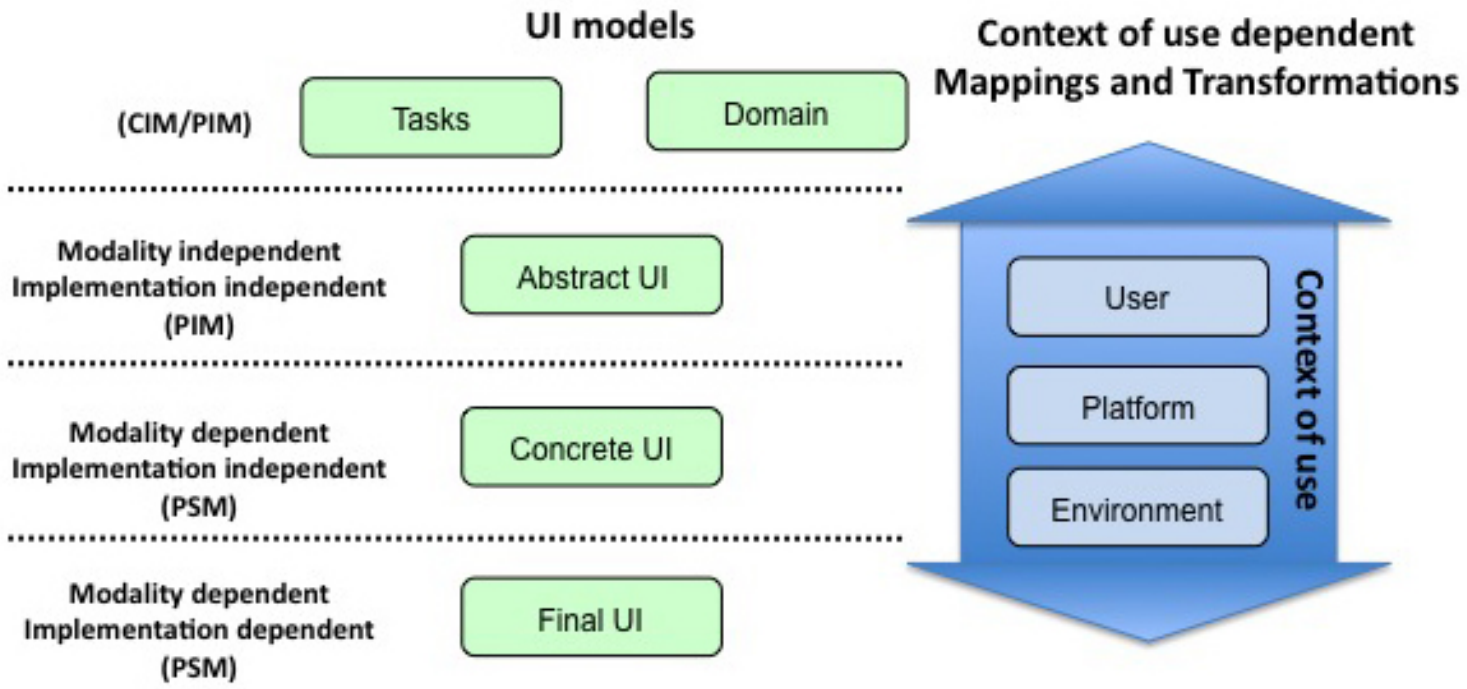
# MOTIVATION
# MULTIPLE SOURCES OF HETEROGENEITY

Computing platforms, interaction modalities, input/output capabilities

Programming/markup languages and widget toolkits

Users

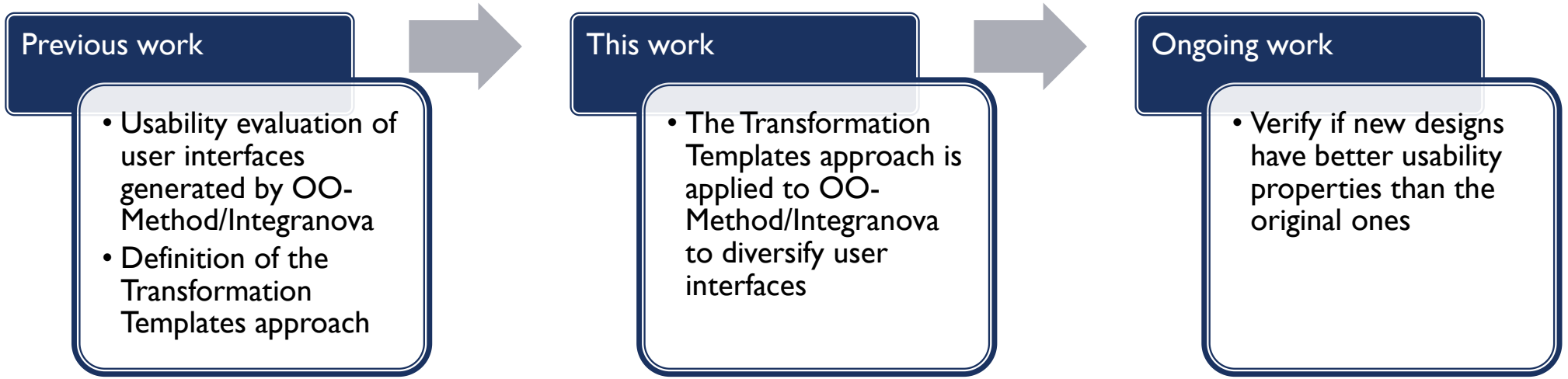
# MOTIVATION
# MODEL-DRIVEN ENGINEERING OF USER INTERFACES




Cameleon Reference Framework [Calvary et al. 2001]

- Open issues
  - The possibility to generate different, customised user interfaces is not provided
  - Usability problems

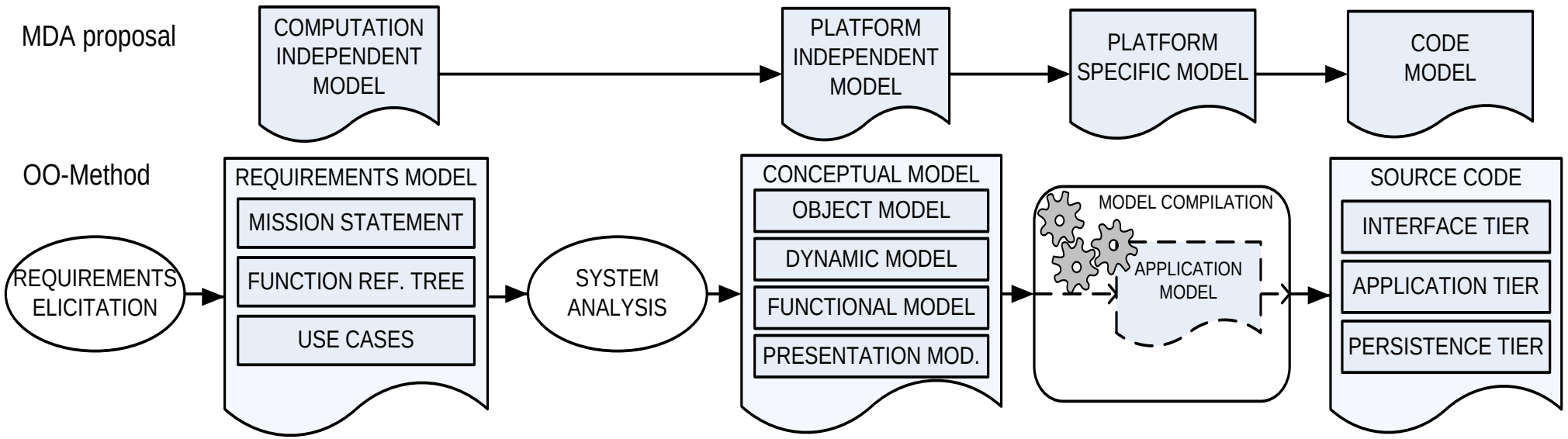
# CONTEXT AND SCOPE



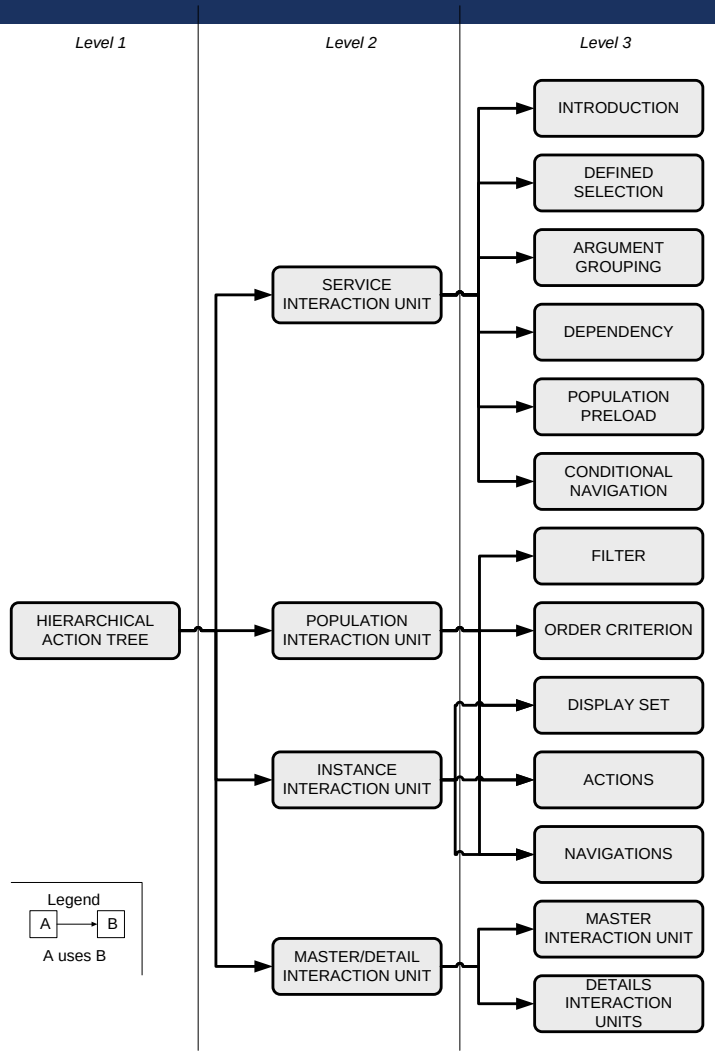
# AGENDA

- Previous work
  - OO-Method/Integranova and its Presentation Model
  - Usability evaluation of user interfaces generated by OO-Method/Integranova
  - Transformation Templates
- This work: Applying the Transformation Templates approach to OO-Method/Integranova
  - Parameter Types for OO-Method/Integranova
  - Alternative designs for Population and Service Interaction Units
- Discussion and future work

# OO-METHOD / INTEGRANOVA



# PRESENTATION MODEL

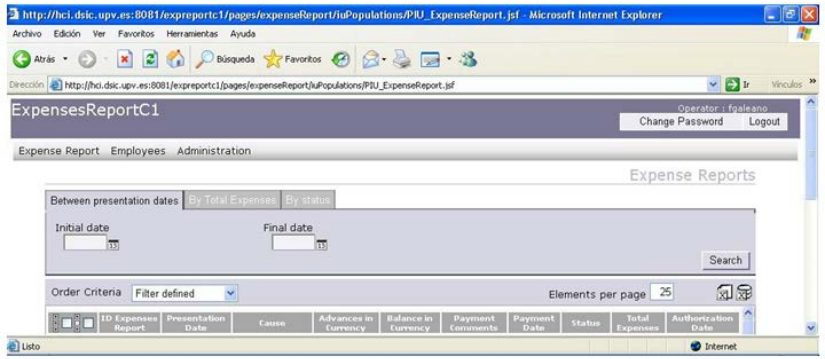


# USABILITY EVALUATION OF USER INTERFACES GENERATED BY OO-METHOD/INTEGRANOVA

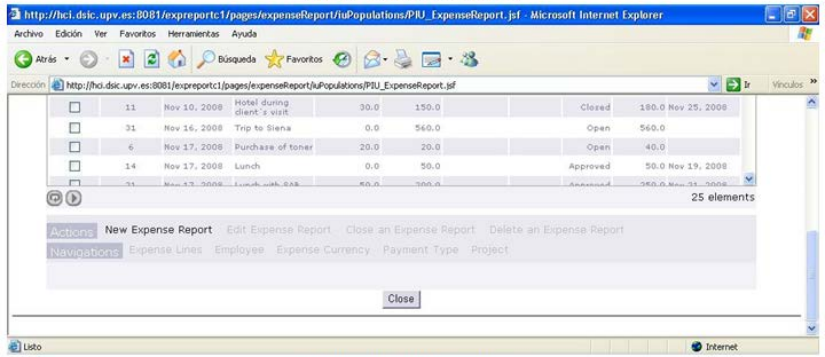
- An exploratory usability evaluation was carried out in an experimental controlled context
- Usability was examined in terms of satisfaction, effectiveness and efficiency
- Interfaces generated from Population and Service Interaction Units (PIUs and SIUs)
- Expenses Report application
- Different platforms
  - Web: JavaServer Faces running on Java
  - Desktop: C# running on .NET
- Devices with different screen sizes
  - Small (7")
  - Standard (19")
  - Large (32")
- 31 participants

# USABILITY EVALUATION OF USER INTERFACES GENERATED BY OO-METHOD/INTEGRANOVA

- PIU – Web – Small screen

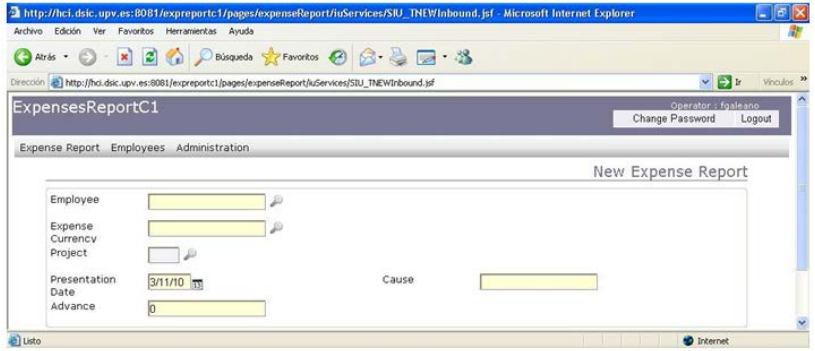



Upper part of the screen

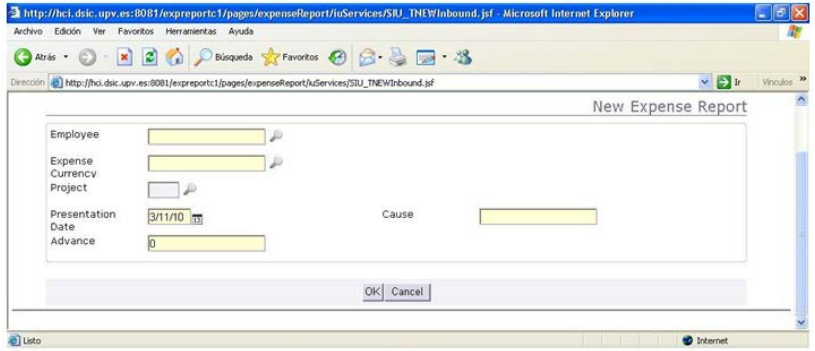



Lower part of the screen

- SIU – Web – Small screen




Upper part of the screen




Lower part of the screen

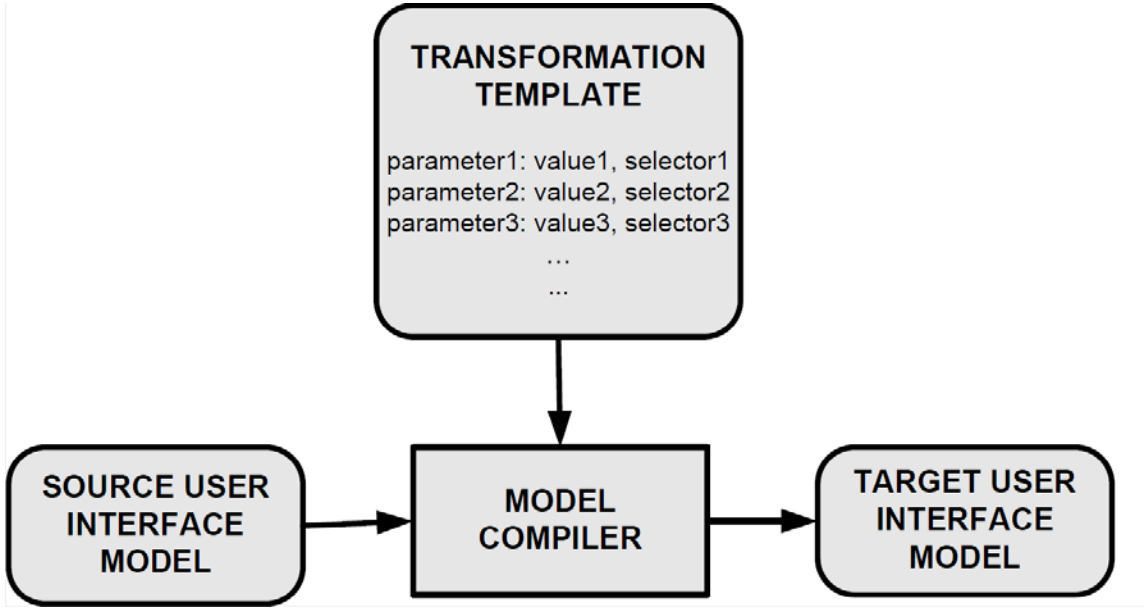
# USABILITY EVALUATION OF USER INTERFACES GENERATED BY OO-METHOD/INTEGRANOVA

- Efficiency results were most affected by the use of different platforms and devices
- The web platform obtained worse results than the desktop platform
- The small screen obtained worse results than standard or large screens

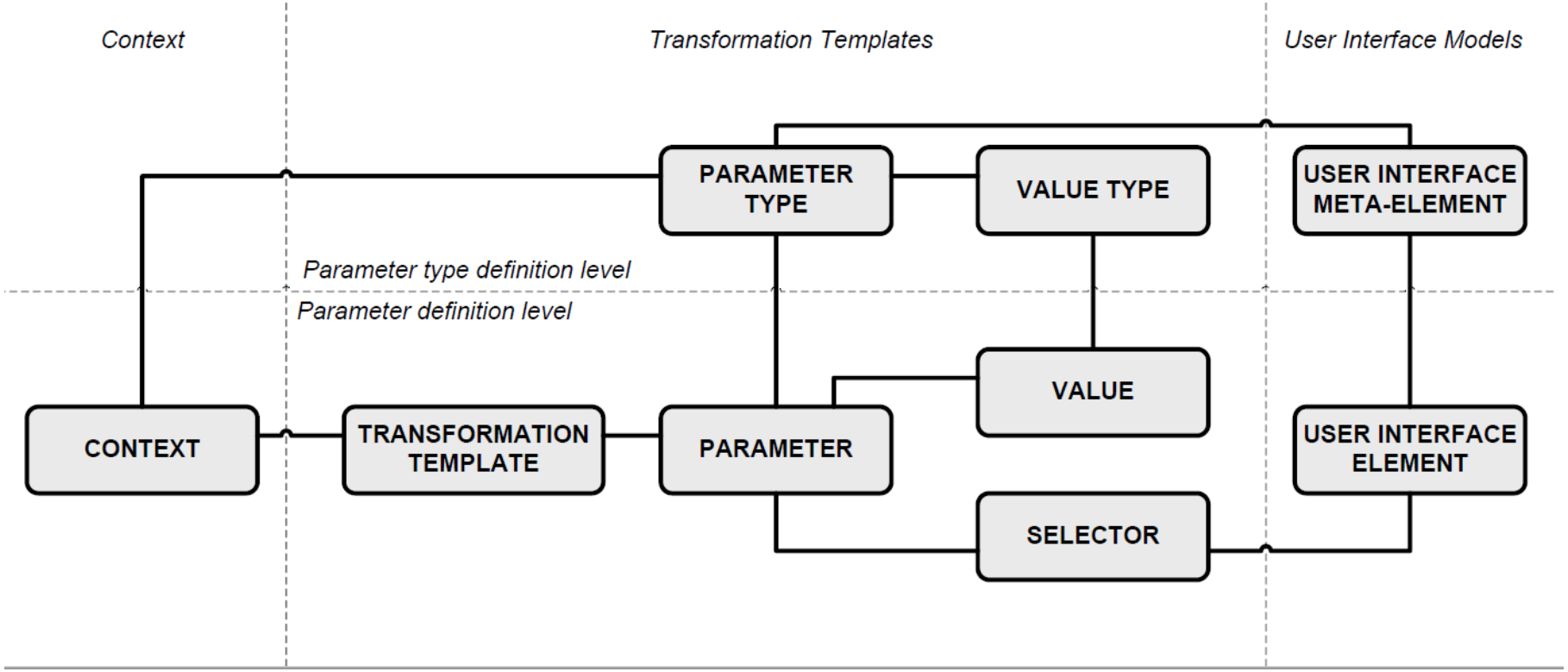
- The OO-Method/Integranova approach should incorporate enhancements in order to generate multi-device/platform user interfaces with improved usability

# TRANSFORMATION TEMPLATES

- Transformation Templates
  - Specify the structure, layout, and style of a user interface
  - Are composed of parameters with associated values that parameterize user interface model transformations
  - Are inputs for transformation tools



# TRANSFORMATION TEMPLATES



# NEW PARAMETER TYPES FOR OO-METHOD/INTEGRANOVA

Parameter Type: Filter Widget

| Name | Description | Affects To | Possible Values | Contexts of Use |
|---|---|---|---|---|
| Filter Widget | Allows to select the widget to be used to present filters of a PIU | Filter | Tabs<br>Combo<br>Accordion | Desktop<br>Web |

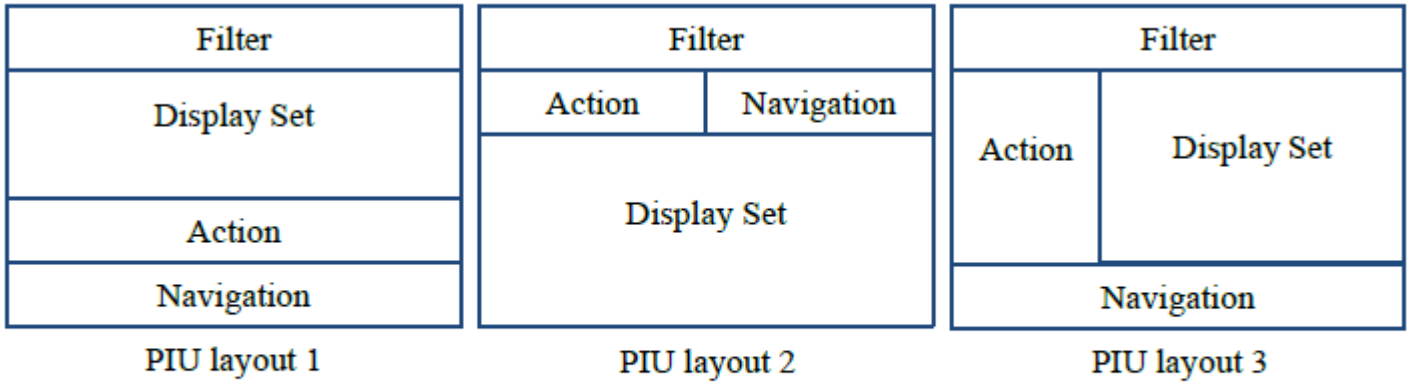
Parameter Type: Filter Widget - importance level, development cost and usability guidelines for the web platform

| Value | Importance Level | Development Cost | Usability Guidelines |
|---|---|---|---|
| Tabs | high | low | The number of filters is not too big, less than 8 |
| Combo | low | low | The number of filters is high |
| Accordion | high | low | The number of panels should be small, less than 8 |

# NEW PARAMETER TYPES FOR OO-METHOD/INTEGRANOVA

Parameter Type: PIU Layout

| Name | Description | Affects To | Possible Values |
|---|---|---|---|
| PIU Layout | Provides options for positioning elementary patterns of a PIU | PIU | PIU layout 1<br>PIU layout 2<br>PIU layout 3 |




Graphical representation of the possible values of PIU Layout

# NEW PARAMETER TYPES FOR OO-METHOD/INTEGRANOVA

Parameter Type: Display Set Layout

| Name | Description | Affects To | Possible Values |
|---|---|---|---|
| Display Set Layout | Allows to specify if a display set is going to be displayed with a table or with a set of independent fields | Display Set | Table<br>Reduced table<br>Independent fields |

| Last name | Name | From |
|---|---|---|
| Damon | Matt | EEUU |
| Pitt | Brad | EEUU |
| Vaughn | Vince | Australia |
| Depp | Johnny | UK |
| Aniston | Jennifer | EEUU |
| Jolie | Angelina | UK |

**Subscriber code: 12149**
Undertaken diameter: 0
Distributor diameter: 0
Invoiced: Yes
Creating date: 28/05/2005
**Subscriber code: 12149**
Undertaken diameter: 0
Distributor diameter: 0
Invoiced: No
Creating date: 1/1/2000

# NEW PARAMETER TYPES FOR OO-METHOD/INTEGRANOVA

Parameter Type: SIU Layout

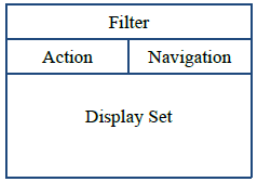
| Name | Description | Affects To | Possible Values |
|---|---|---|---|
| SIU Layout | Allows to specify if a SIU is going to be displayed in 1 or 2 columns, or following the standard algorithm | SIU | Standard algorithm<br>1 column<br>2 columns |

# NEW PARAMETER TYPES FOR OO-METHOD/INTEGRANOVA

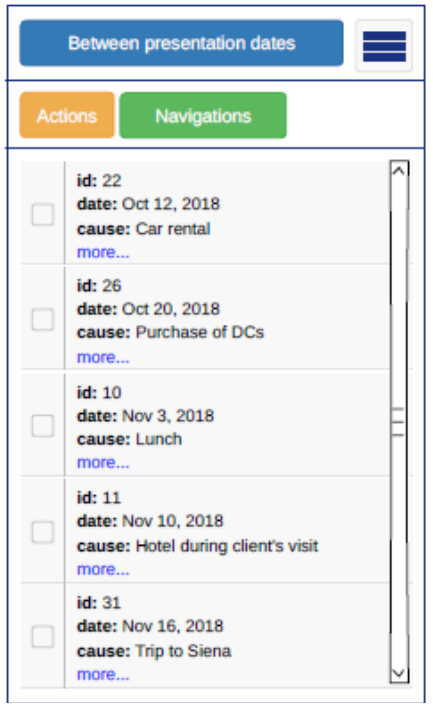
Parameter Type: Label Alignment

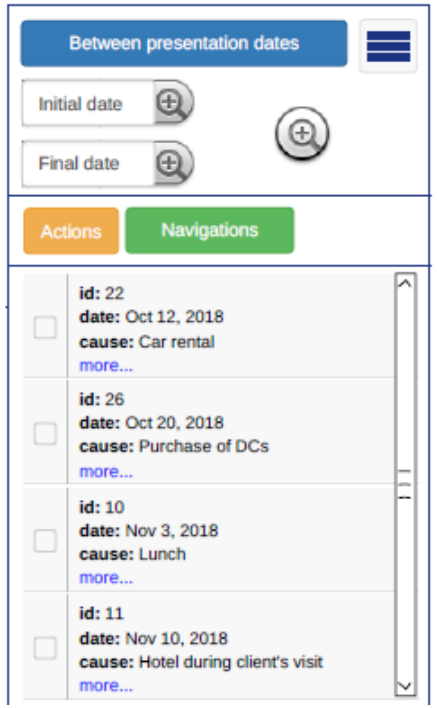
| Name | Description | Affects To | Possible Values |
|---|---|---|---|
| Label Alignment | Allows the alignment of a label with regard to an input field to be specified | Filter<br>SIU | Left<br>Up<br>Inside |

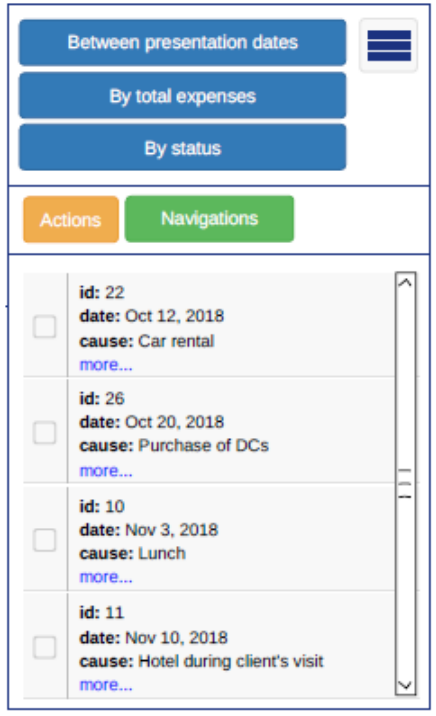
# NEW ALTERNATIVE DESIGN FOR PIU - #1

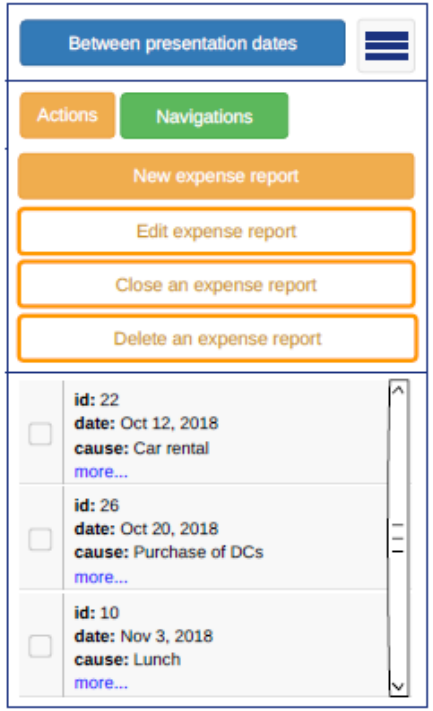



- PIU layout = PIU layout 2
- Filter widget = accordion
- Display set layout = independent fields
- Label alignment = inside

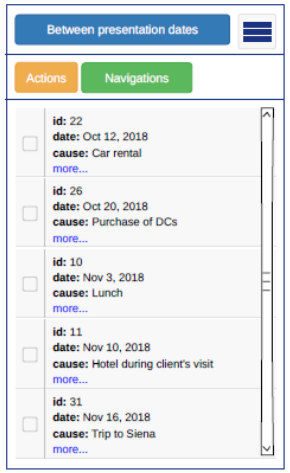


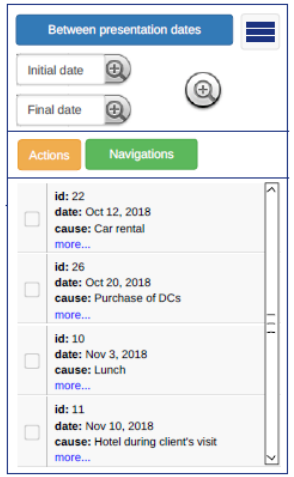



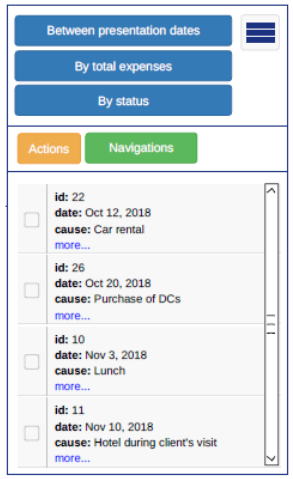



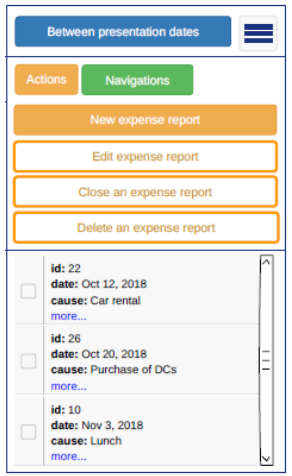



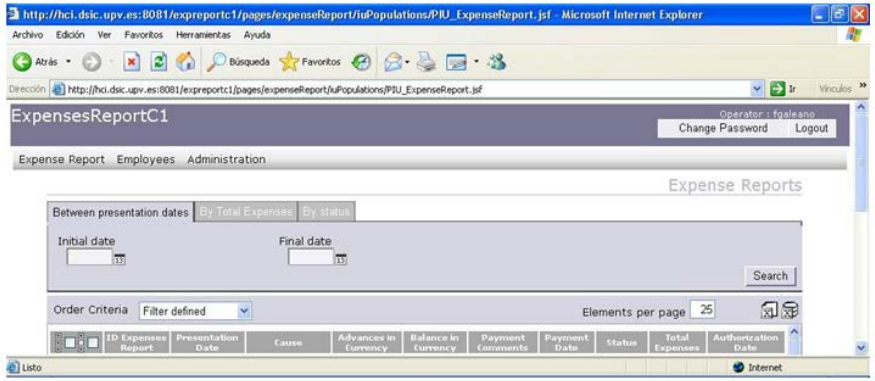
# NEW ALTERNATIVE DESIGN FOR PIU - #1



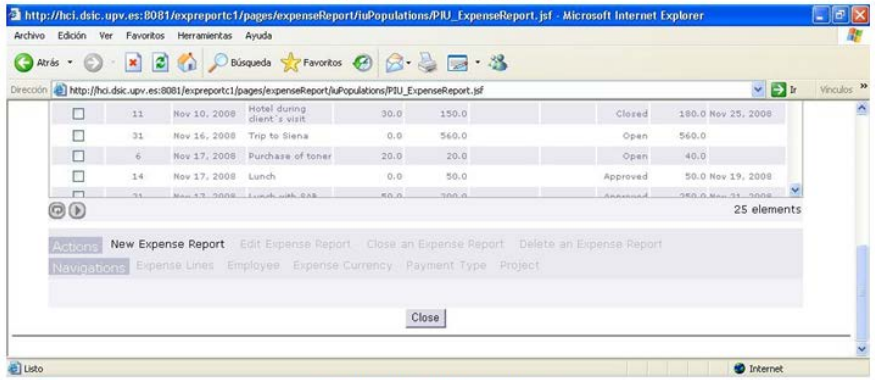



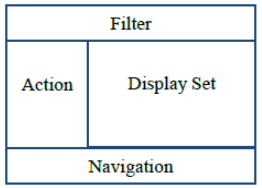

Upper part of the screen

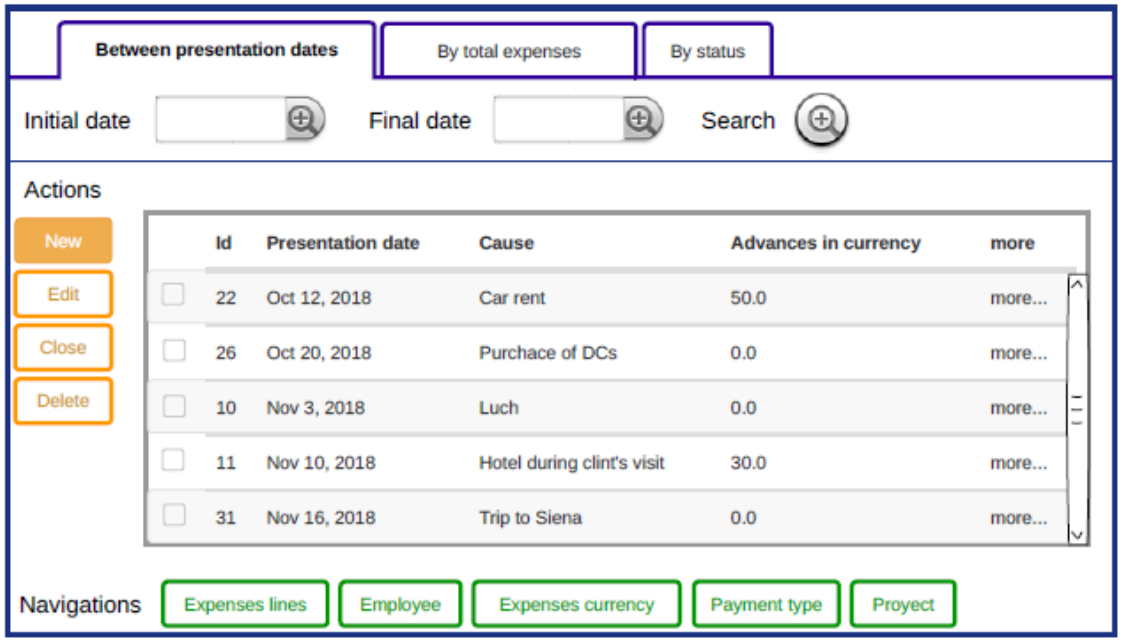



Lower part of the screen

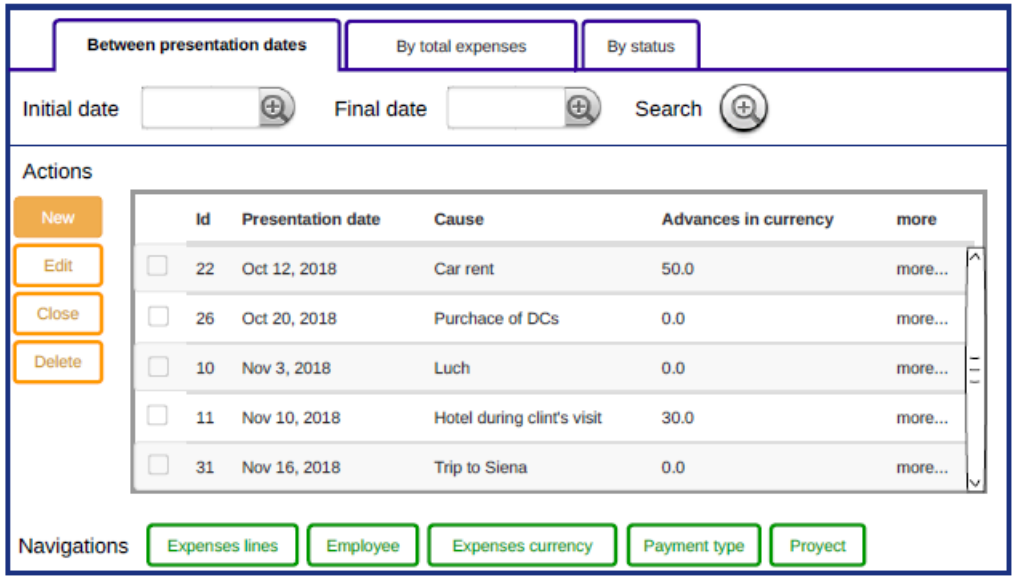
# NEW ALTERNATIVE DESIGN FOR PIU - #2

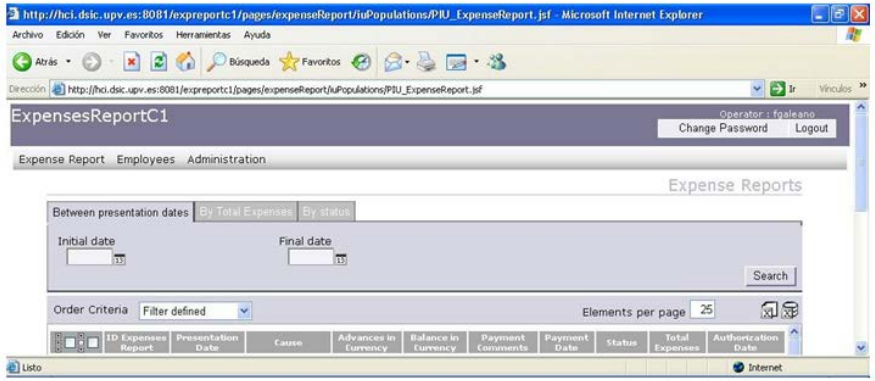
- PIU layout = PIU layout 3
- Filter widget = tab
- Display set layout = reduced table
- Label alignment = left



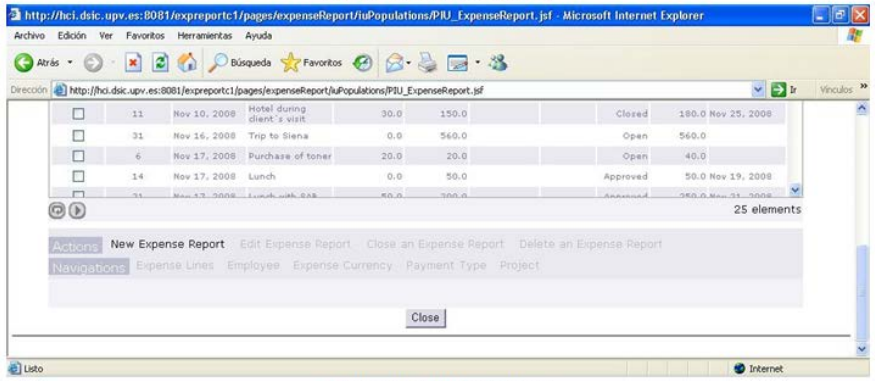



# NEW ALTERNATIVE DESIGN FOR PIU - #2



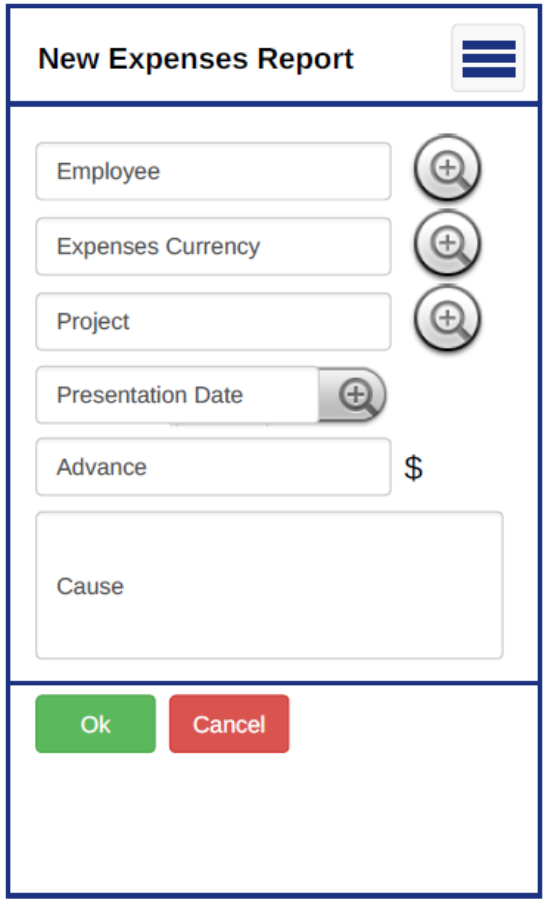

Upper part of the screen



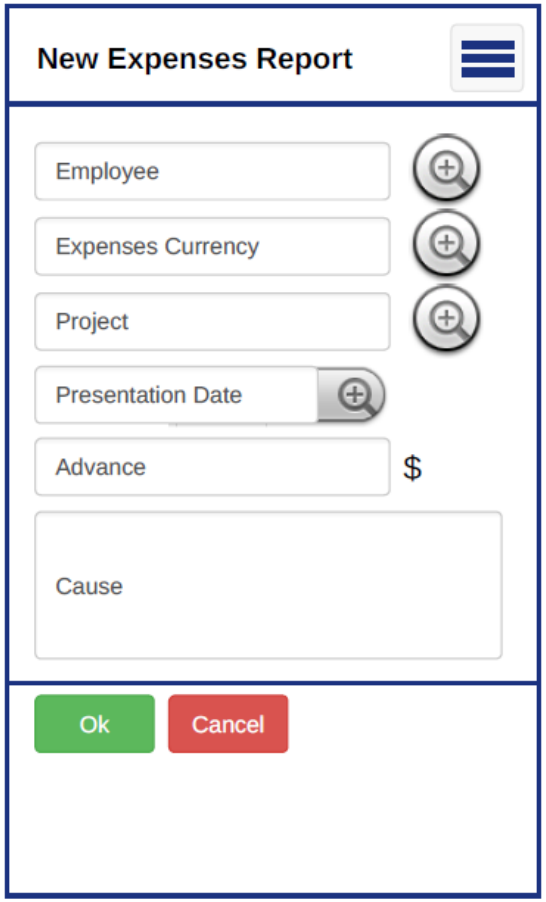

Lower part of the screen

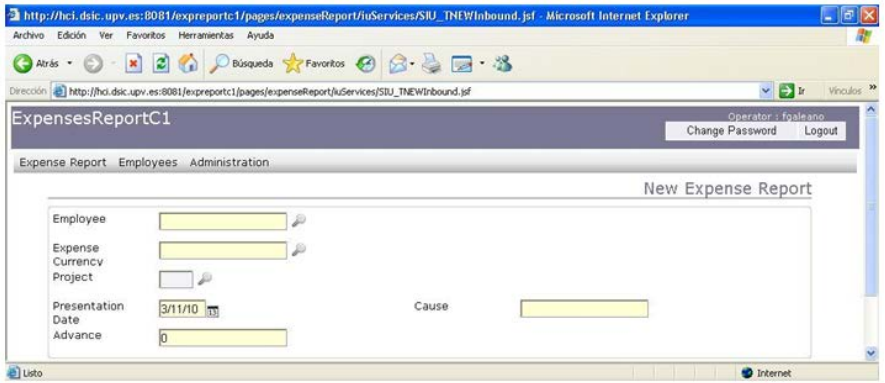
# NEW ALTERNATIVE DESIGN FOR SIU - #1

- SIU layout = 1 column
- Label alignment = inside

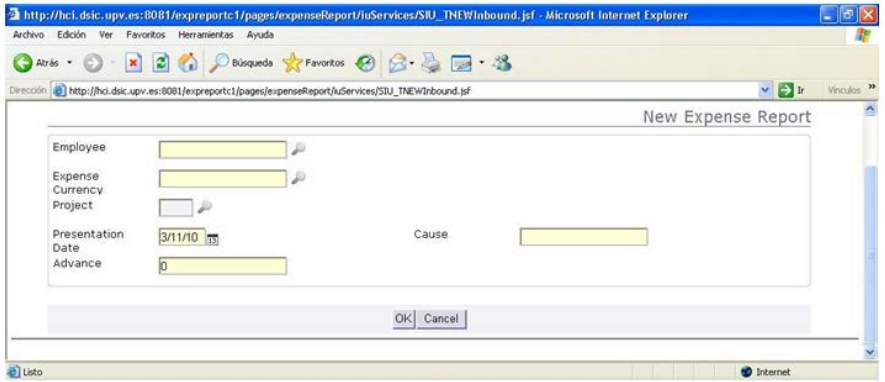


# NEW ALTERNATIVE DESIGN FOR SIU - #1



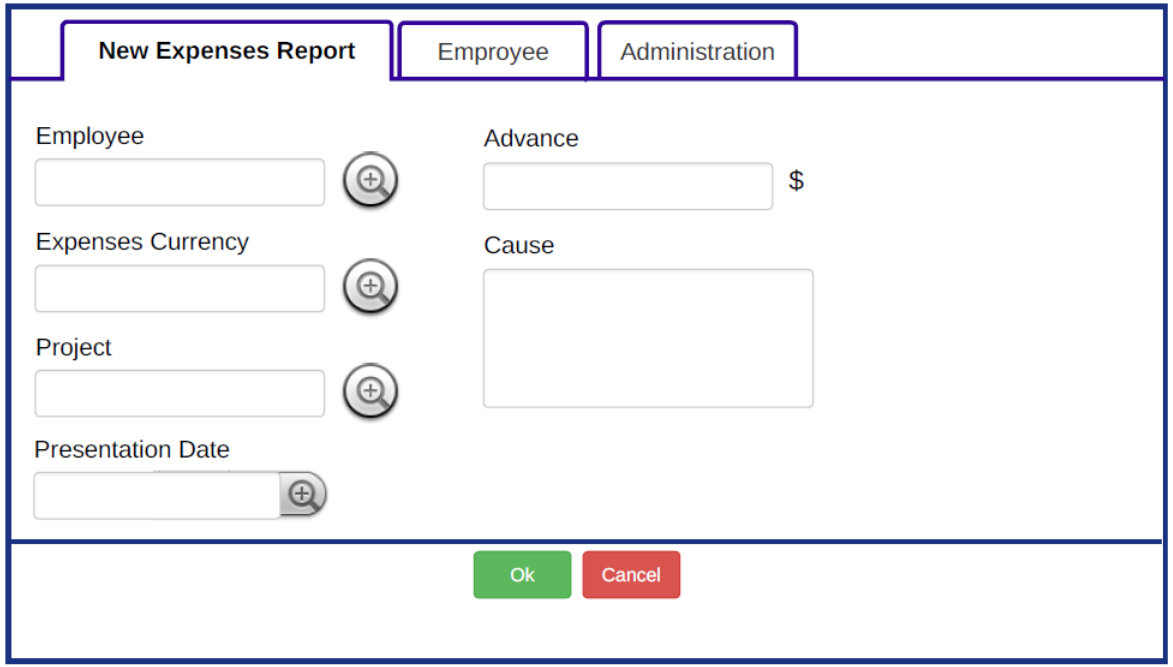

Upper part of the screen



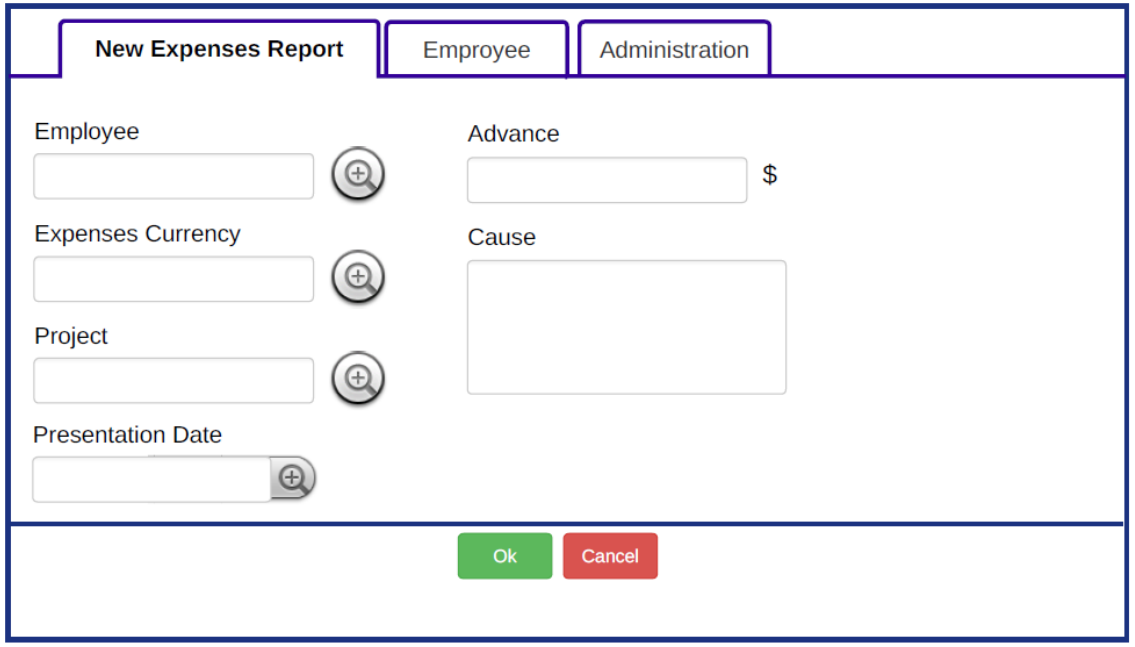

Lower part of the screen

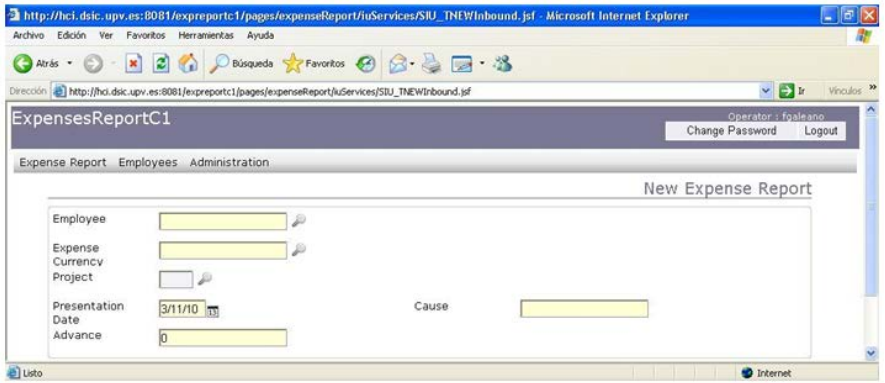
# NEW ALTERNATIVE DESIGN FOR SIU - #2

- SIU layout = 2 columns
- Label alignment = up

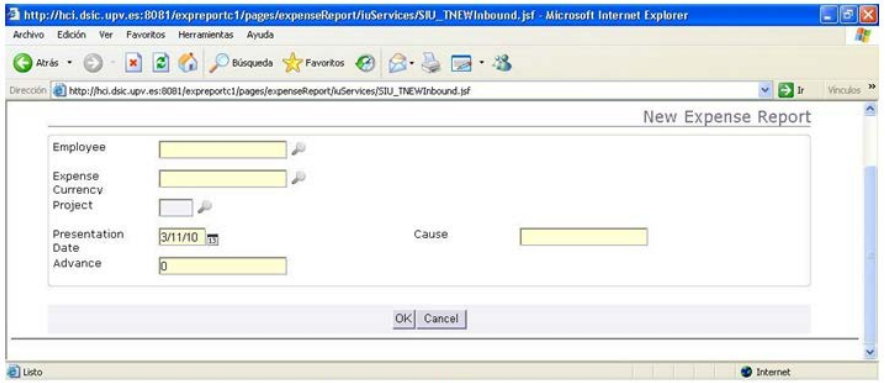


# NEW ALTERNATIVE DESIGN FOR SIU - #1




Upper part of the screen




Lower part of the screen

# DISCUSSION

- Benefits of Transformation Templates for OO-Method/Integranova
  - The transformation logic becomes explicit and customisable
  - It becomes possible to target specific contexts of use
  - It becomes possible to generate different types of user interfaces
  - Some new designs could have better usability properties than original designs
    - Usability guidelines are provided for each possible value of a parameter type and each context of use

# NEXT STEP

- Perform an empirical evaluation in order to verify if new designs improve usability with regard to original designs

# THANK YOU VERY MUCH FOR YOUR ATTENTION

NATHALIE AQUINO

nathalie.aquino@uc.edu.py

LUCA CERNUZZI

lcernuzz@uc.edu.py

OSCAR PASTOR

opastor@pros.upv.es