SOAPL 2008
Limerick, 8th September

Business Process Lines to develop Service-Oriented Architectures through the Software Product Lines paradigm

Nicola Boffoli, Danilo Caivano, Daniela Castelluccia,
Fabrizio Maria Maggi, Giuseppe Visaggio
SERLAB - Department of Informatics
University of Bari - Italy
{boffoli, caivano, castelluccia, maggi, visaggio}@di.uniba.it

Outline

SPL + SOA

- Why?
- What?
- How?

Our proposal

- Business Process Line
- Decision Models
- Case Study

SPL + SOA: *Why?*

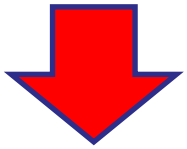
Two common perspectives

- Software reuse
  - implementing new software systems reusing existing software resources rather than developing the same software capabilities again
- Software flexibility
  - allowing to adapt the systems to the different customers of a whole market segment
    - ***SPL*** focuses on the commonality and variability to build a set of software products
    - ***SOA*** *allows to compose, orchestrate and maintain solutions based on services, implementing business processes*

SPL + SOA: *What?*

Our Proposal

- transferring peculiarities/advantages from SPL to SOA



- build a SOA systems line suitable to customers or market segments needs in a specific application domain

SPL + SOA: *How?*

We start from a deep analysis of the business processes identifying in them commonality and variability typical of the SPL paradigm

Business Process Line

+

Decision Models

Business Process Line (BPL)

A BPL realizes processes able to adapt themselves to different customer needs

- Each process of a BPL can be then transformed into the corresponding SOA system
  - ***If*** the business processes are adaptable to the customer needs
  - ***then*** the generated SOA system, it will result in its turn suitable to the specific customer requirements

From SPL to BPL: Analogies and Tailoring …

SPL

- Collection, organization and systematic refinement of the assets (invariant or variant)
- Automatic building of the products
  - Product Configuration: through asset integration procedures
  - Product Specialization: through the specification of the assets parametric part

… From SPL to BPL: Analogies and Tailoring

BPL

- Asset concept is referred to activities and work definitions
- Product Configuration Ł Process Configuration
  - *the assets (activities and work definitions) can be added to a basic business process in order to configure the target business process*
- Product Specialization Ł Process Specialization
  - *each asset of the target business process can be specialized through attributes indicating specific architectural characteristics to implement them*

BPL Decision Models

Hypothesis: two kind of relations

1. between the business capabilities (characterizing the customer needs) and the suitable processes elements (that have to be integrated in the target business process)
2. between the customer requirements and the specific peculiarities of the processes elements previously integrated in the target process.

Decision Table Formalism

A decision table (DT) is divided in four quadrants: conditions (Cond), conditional states (S), actions (Act) and rules (x)

The table is defined so that each combination of conditions and conditional states corresponds to a set of actions to carry out.

$Cond_1$	S_{11}				S_{12}			
$Cond_2$	S_{21}		S_{22}		S_{21}		S_{22}	
.....	...							
$Cond_N$	S_{N1}	S_{N2}	S_{N1}	S_{N2}	S_{N1}	S_{N2}	S_{N1}	S_{N2}
Act_1	-	-	-	-	X	X	X	X
Act_2	-	-	-	-	-	-	-	X
.....	...							
Act_M	-	X	-	X	-	X	-	

- *Compact overview*
- *Modular knowledge organization*
- *Evaluation of consistency, completeness and redundancy*

Configuring DT …

For each BPL a configuring DT is built in order to select the variant assets characteristic of the requested business capabilities

- They have to be composed with the invariant assets (integrated into a basic process) in order to generate the target business process

… Configuring DT

- the CONDITION quadrant contains a set of business capabilities, BC_i i=1,...n
- the CONDITIONAL STATE quadrant contains the possible values of each business capability $[BC_i]=\{bc_{i1}, bc_{i2}, \ldots, bc_{iq}\}$
- the ACTION quadrant contains all the possible variant assets $\{va_1, va_2, \ldots, va_r\}$ that can be added to the process commonality
- the RULE quadrant re
corresponding varian

BC_1	bc_{11}				bc_{12}			
BC_2	bc_{21}		bc_{22}		bc_{21}		bc_{22}	
…	.....							
BC_n	bc_{n1}	bc_{n2}	bc_{n1}	bc_{n2}	bc_{n1}	bc_{n2}	bc_{n1}	bc_{n2}
va_1	-	-	x	-	-	-	-	-
va_2	x	-	-	-	-	-	-	-
va_3	-	-	-	-	x	-	-	-
va_4	-	-	-	-	-	-	x	-
va_5	-	-	-	-	-	x	-	-
.....	.....							
va_r	-	-	-	-	-	-	-	x

DIB

Specializing DT

For each asset, variant or invariant, a specializing DT is built as follows

- the CONDITION quadrant contains a set of customer requirements, CR_j j=1,..,m, to specialize the parametric part of the asset
- the CONDITIONAL STATE quadrant contains the possible values of each requirement: $[CR_j]=\{cr_{j1}, cr_{j2}, \ldots, cr_{jt}\}$
- the ACTION quadrant contains the parameters $\{p_1, p_2, \ldots, p_s\}$ and their values allowing to specialize the parametric part of the asset
- the RULE quadrant set to the correspo

CR_1	fr_{11}				fr_{12}				fr_{13}			
CR_2	fr_{21}		fr_{22}		fr_{21}		fr_{22}		fr_{21}		fr_{22}	
...	.....											
CR_n	fr_{n1}	fr_{n2}	fr_{n1}	fr_{n2}	fr_{n1}	fr_{n2}	fr_{n1}	fr_{n2}	fr_{n1}	fr_{n2}	fr_{n1}	fr_{n2}
p_1 = "Y"	-	-	-	x	x	-	-	-	-	-	x	x
p_1 = "N"	x	x	x	-	-	x	x	-	x	x	-	-
.....	.....											
p_s = "x"	x	-	-	x	-	-	-	-	x	-	-	x
p_s = "y"	-	x	x	-	x	-	x	-	-	-	-	-
p_s = "z"	-	-	-	-	-	x	-	x	-	x	x	-

DIB

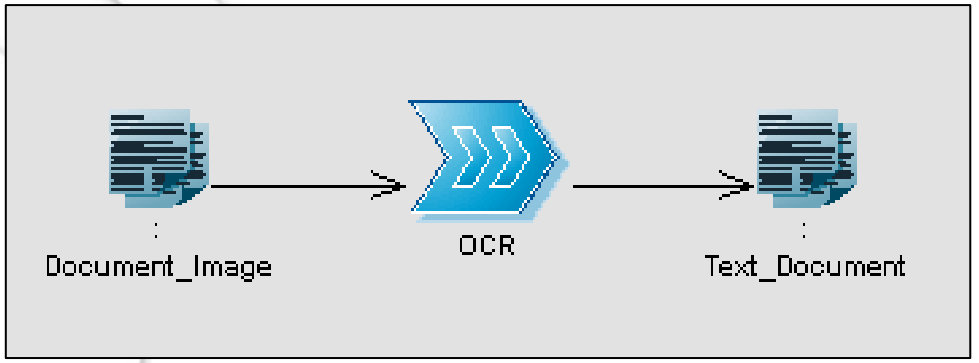
Case Study …

Our proposal has been investigated in an industrial case during the research project "DAMA" (Data Archiving Management and Acquisition)

- A specific part, Document Recognizing, is here summarized

Invariant Part

- the process contains an OCR (Optical Character Recognition) activity requiring a scanned Document Image as input and produces a recognized Text Document as output



… Case Study …

Configuring DT

- the table provides the following business capabilities: Signature Extraction, Layout Analysis and Image Extraction

Signed Documents	Digital				Autographic				Without Sign			
Document Type	Structured		Unstructured		Structured		Unstructured		Structured		Unstructured	
Documents with Images	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
Layout Analysis	X	X	-	-	X	X	-	-	X	X	-	-
Image Extraction	X	-	X	-	X	-	X	-	X	-	X	-
Autographic Sign Extraction	-	-	-	-	X	X	X	X	-	-	-	-
Digital Sign Extraction	X	X	X	X	-	-	-	-	-	-	-	-

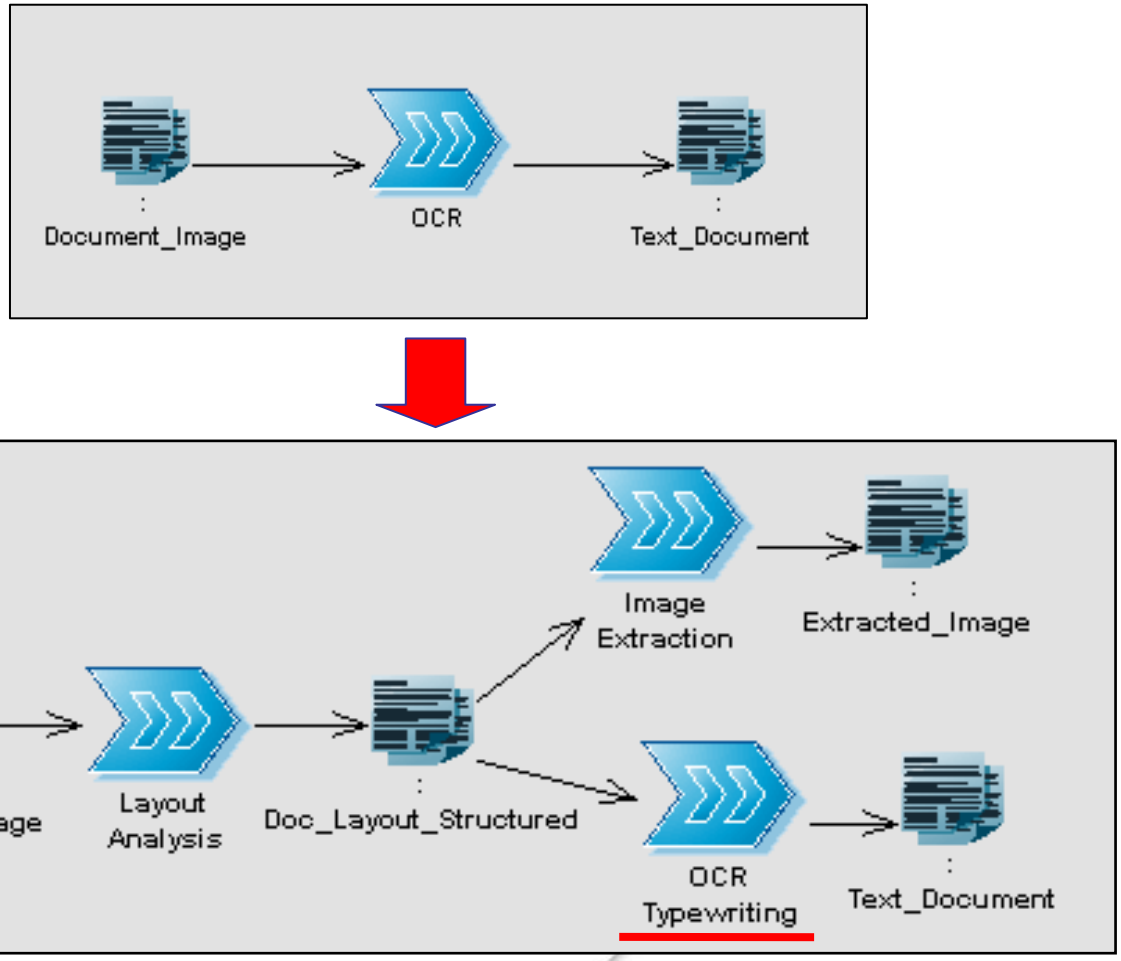
… Case Study …

Scenario

- "*The enterprise needs besides to elaborate and archive typewriting and structured documents, containing images and without signature*"

Signed Documents	Digital				Autographic				Without Sign			
Document Type	Structured		Unstructured		Structured		Unstructured		Structured		Unstructured	
Documents with Images	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
Layout Analysis	X	X	-	-	X	X	-	-	X	X	-	-
Image Extraction	X	-	X	-	X	-	X	-	X	-	X	-
Autographic Sign Extraction	-	-	-	-	X	X	X	X	-	-	-	-
Digital Sign Extraction	X	X	X	X	-	-	-	-	-	-	-	-

… Case Study


Document_Image
OCR
Text_Document
Image Extraction
Extracted_Image
Document_Image
Layout Analysis
Doc_Layout_Structured
OCR Typewriting
Text_Document

Conclusion …

This work proposes to apply the good practices of SPL to SOA, the authors introduce

- the concept of BPL in order to identify commonality and variability of SOA systems at the process level
- two kind decision models supporting BPL activities
  - Configuring Decision Model
  - Specializing Decision Model

The case study DAMA is ongoing and encourages further investigations in other applicative domains in order to confirm and generalize the preliminary results

… Conclusion

In order to support the application of the proposal here presented, the authors are developing two tools:

- the former aims to automate the decision tables management (design and consulting)
- the latter is able to transform business process models in executable workflows for SOA systems