

Electronic Contracts Specification: C-O Diagrams

M. Emilia Cambronero Piqueras Escuela Superior de Ingeniería Informática de Albacete University of Castilla-La Mancha

E-Mail: MEmilia.Cambronero@uclm.es





- C-O Diagrams History and Motivation.
- E-Contracts Formal Specification.
- Case Study: Coffee Machine.
- Current Work.



On the one hand, in the SOA environment several contracts specification languages can be found: ebXML, WSLA, WS-Agreement, etc.

		(Contracts Languages/Approaches		
Aspects		Web Services (WS-*)	Semantic Web (*-S)	Electronic Business (eb-*)	
Interface		WSDL	OWL-S	ebBSI	
Functionality		WS-BPEL, WSOL	OWL-S (IOPE), WSMO	ebBPSS	
Protocol		WS-BPEL, WS-CDL	WSMO	ebBPSS	
Security		WS-Security		ebCPA(SecurityPolicy)	
Quality	policy	WS-Policy			
	trust	WS-Trust		ebCPP(XMLDSIG)	
	availability	WSOL			
	performance	WSLA, WSOL	WSMO/WSML	ebCPA	

[J. Okika and A. P. Ravn, 2008]:

3

These standardized specification languages suffer from one or more of the following problems:

- 1. They are restricted to bilateral contracts.
- 2. Lack formal semantics (so it is difficult to reason about them).
- 3. Their treatment of functional behavior is rather limited.
- 4. The lack of suitable languages for contracts in the context of SOA is a clear conclusion of the survey, where a taxonomy is presented.

Some researchers have investigated variants of **deontic logic** to specify different aspects of software systems.



C-O Diagrams Motivation. Deontic Logic

"Deontic [G. H. Von Wright, 1951.]

Deontic Operators:

Obligation.
Permission.
Prohibition.

As well as their interrelation and properties.



On the other hand, to further close the gap between contracts and its representation, we consider that three criteria must be met:

a) the representation must be usable and understandable for non-expert users,

b) the logic behind this representation must provide reasoning techniques and

c) the internal machine-codification must be easy manipulated by programmer and allow runtime monitoring.



We envision two possible ways to accomplish this:

 the development of suitable techniques to get a proper translation from contracts written in natural language into formal languages, or

ii) the development of a graphical representation (and tools) to manipulate contracts at a high level, with formal semantics supporting automatic translation into the formal language. We take the second approach.



Why a graphical over a textual representation?

The main problem with textual contract specification is that **the relationship among the different clauses** is not clear, therefore any analysis kind is complex.

Graphical contract representation allows understand the contract and the relationship among its clauses, overall in the case of complex contracts with many dependent clauses.



Correct Web Services Methodology (Cambronero, PhD, 2007)



WST Tool: available for Windows/Linux systems under virtual machine Java, at **http://www.dsi.uclm.es/retics/WST/**.



Contract-Oriented diagrams (C-O) are inspired by KAOS technology.

The KAOS goal model allows analysts and specifiers to gather the requirements of software systems in a hierarchical order.

- Goals lead to requirements.
- Goals can be used to assign responsibilities to agents.



Each goal is either a root or is justified by at least another goal that explain WHY it is needed.

Each goal except a leave is refined as a collection of subgoals describing HOW it can be reached



11

Extended KAOS goal model

Specification of requirements in the analysis elicitation phase.

These requirements will be checked in the verification phase by using the UPPAAL model checker.

Therefore, we introduced new notions, such as different types of goals and the inheritance capability types from goals to their subgoals.



Temporal behavior patterns



The goal model for the Internet Purchase Process.





Electronic Contracts Specification

Contract-Oriented Diagrams

Graphical representation for contract clauses inspired by KAOS Boxes:



- **g**: condition.
- tr: time restriction.
 - **P:** propositional content (O/P/F over actions).
- R: reparation.
- agent.
- name: clause name.



Contract-Oriented Contracts

We also use the AND/OR refinements of KAOS technology:



But, we enrich them with two new kind of refinements: SEQ and REP.





- C-O Diagrams History and Motivation.
- E-Contracts Formal Specification.
- Case Study: Coffee Machine.
- Current Work.



e-Contracts Formal Specification. C-O Diagrams



C-O Diagrams syntax:

name



e-Contracts Formal Specification. C-O Diagrams







- C-O Diagrams History and Motivation.
- E-Contracts Formal Specification.
- Case Study: Coffee Machine.
- Current Work.



e-Contracts Formal Specification. Case Study

Coffee Machine.





Electronic Contracts Specification



- C-O Diagrams History and Motivation.
- E-Contracts Formal Specification.
- Case Study: Coffee Machine.
- Current Work.



Current Work

Currently, we are working on the definition of queries sets, which allow users involved in a contract specify properties to check in the contract.

These queries are written in natural language, then we are also working on the translation from these queries specifications to the TCTL UPPAAL logic.

A tool for implemented this translation is been performing.





Electronic Contracts Specification: C-O Diagrams

M. Emilia Cambronero Piqueras Escuela Superior de Ingeniería Informática de Albacete University of Castilla-La Mancha

E-Mail: MEmilia.Cambronero@uclm.es

