USING CSP IN DESCRIPTION OF WORKFLOW PROCESSES

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ABSTRACT

In this paper is described an idea how to take use of communicating sequential processes (CSP) formal specification in description of workflow processes. Concretely how to use CSP for description of workflow processes which are represents through the behaviour diagrams. The method will be presented on one practical example of workflow process.

1. INTRODUCTION

Communicating Sequential Processes (CSP) is a formal language for describing patterns of interaction in concurrent systems. This algebra is subscribed by various software tools which allow make an analyses and verification of the systems. The CSP model is based on the idea of several regular sequential processes that are running parallel to each other [1]. During its duration the processes may pursue the various events and actions.

A workflow is a reliably repeatable pattern of activity enabled by a systematic organization of resources, defined roles and information flows, into a work process that can be documented and learned. Workflows are always designed to achieve processing intents of some sort, such as physical transformation, service provision, or information processing.

Workflow processes are usually described by Workflow Process Definition Language (WPDL). This language uses special keywords for specification of the objects, attributes, relations, and own grammatical constructions for its terms and values specification. The grammar of WPDL is context-free and keywords are used for indication of the beginning of entities, attributes and its values and relations between entities. The keywords are written in capitals and appear from Workflow Management Coalition (WfMC) terminology.

The main theme of this paper is how to use the CSP in description of workflow processes which are represented by behaviour diagrams.

2. USING CSP FOR WORKFLOW PROCESS DESCRIPTION

At first it is necessary to describe specification of communication sequential processes (CSP) and behaviour diagrams which are used for description of workflow processes in this article.

2.1. CSP CHARACTERISATION

CSP allows the description of systems in terms of component processes that operate independently, and interact with each other solely through message-passing communication. The relationships between different processes, and the way each process communicates with its environment, are described using various process algebraic operators. So this algebraic approach allow to quite complex process descriptions can be constructed from a few primitive elements.

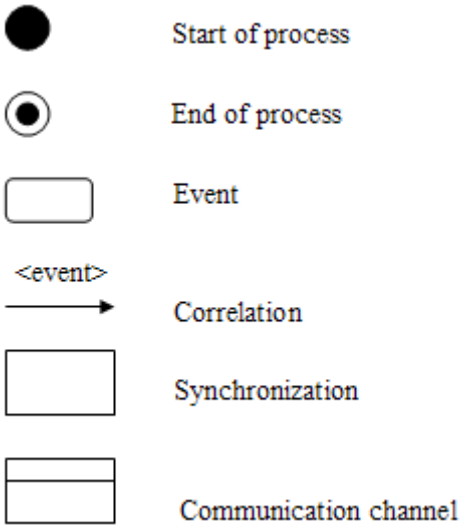
CSP provides two classes of primitives in its process algebra – events and primitive processes. Events represent communications or interactions. They are assumed to be indivisible and instantaneous. They may be atomic names, compound names, or input/output events. The set of events, which are used by processes is named process alphabet or process interface. To the process alphabet it is possible to put only the events, which present aspects of the process behaviour, which is interesting for us. Primitive processes represent fundamental behaviours. The most simply behaviour of the process is designate as STOP. If the behaviour of the system is in this process so does nothing and means the deadlock state. The second process is SKIP. For more details see [2]. This process also does nothing but is terminated and means the correct ended process behaviour.

CSP has a wide range of algebraic operators. Some of them are presented bellow [2].

- Prefix operators - combines an event and a process to produce a new process. $a \rightarrow P$: It represents the process which is willing to communicate with its environment, and, after a, behaves like the process P.
- External Choice - operator which allows the future evolution of a process to be defined as a choice between two component processes, and allows the environment to resolve the choice by communicating an initial event for one of the processes. $(a \rightarrow P) \Box (b \rightarrow Q)$: It represents the process which is willing to communicate the initial events a and b, and subsequently behaves as either P or Q depending on which initial event the environment chooses to communicate. If both a and b were communicated simultaneously the choice would be resolved internally.
- Internal Choice – operator which allows the future evolution of a process to be defined as a choice between two component processes, but does not allow the environment any control over which of the component processes will be selected. $(a \rightarrow P) or (b \rightarrow Q)$: It can refuse to accept a or b, and is only obliged to communicate if the environment offers both a and b.
- Interleaving - operator represents completely independent concurrent activity. $P|||Q$: It represents the process, which behaves as both P and Q simultaneously and the events from both processes are arbitrarily interleaved in time.
- Interface parallel - operator represents concurrent activity that requires synchronization between the component processes – any event in the interface set can only occur when all component processes are able to engage in that event. $(a \rightarrow P) ||\{\alpha\}|| (a \rightarrow Q)$: It represents parallel composition in which processes P and Q share event a.
- Hiding - operator provides a way to abstract processes, by making some events unobservable. $(a \rightarrow P) \setminus \{a\}$: It represents that the event a doesn't appear in P.

2.2. BEHAVIOUR DIAGRAMS

According to the source [3] we can also use behaviours diagrams for the description of system behaviour, which is based on UML specification. The diagrams describe a particular status of system and events, which invoke transition from one status to the second one. In the behaviour diagrams there is presented train of events instead status of the system. The graphical symbols are presented below.



Picture 1: Symbols of behaviour diagrams

- Start of process – symbol represents the beginning of process behaviour
- End of process – symbol represents the end of actual process behaviour and also specified the next system behaviour
- Event – object specified event which was effected by the process
- Correlation – symbol which presented relation between events and processes
- Synchronization – object which presented mutual process interaction, include the list of events
- Communication channel – object which presented mutual process interaction. The list of events also specifies type of communication channel

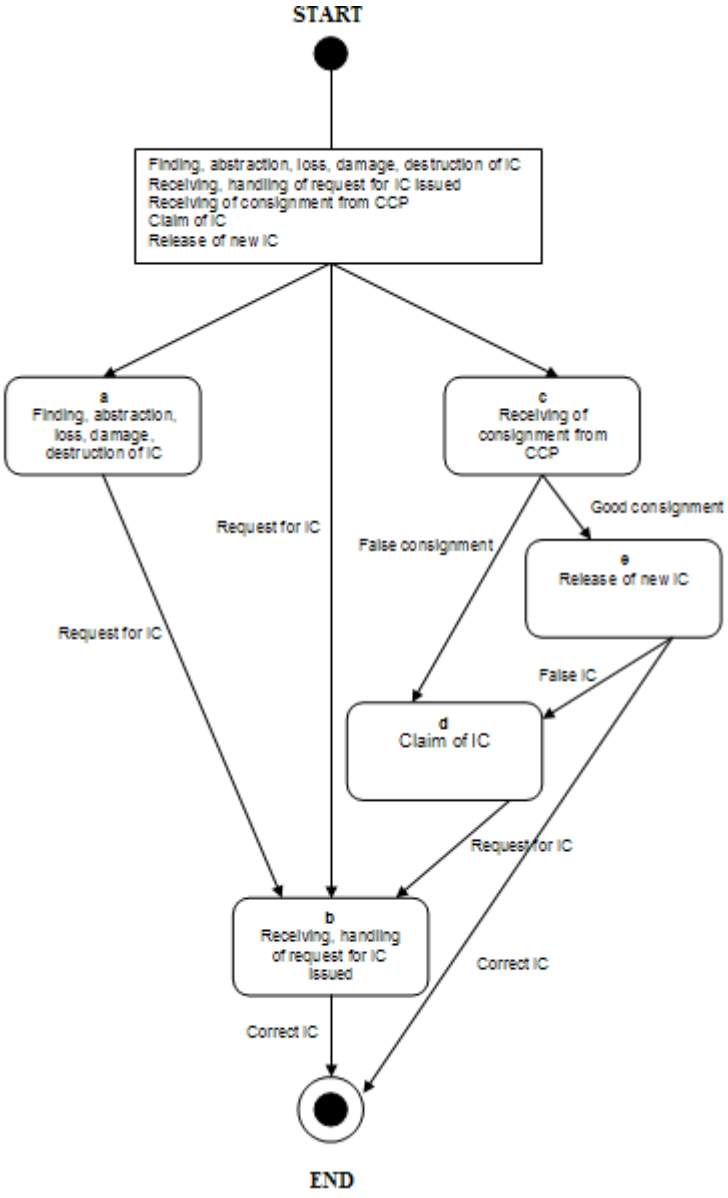
2.3. EXAMPLE OF USING CSP FOR WORKFLOW PROCESS DESCRIPTION

Now will be described the workflow process of the evidence and issuing of identity cards. This workflow process describes the partial activities accordance with the stuffs of identity cards and inhabitant evidence sectors issue the identity cards. In this section there are registered and issued the identity cards and certificate of identity cards. Process at the highest decomposition level, which is presented bellow, contains 5 basic activities – 5 events in CSP [4]:

- Finding, abstraction, loss, damage, destruction of the identity card
- Receiving and handling of the request for a identity card issued
- Receiving of the consignment from the Central Certificate Production (CCP)

- Release of the new identity card
- Claim of the identity card

So the set of events which are used by the process is named process alphabet or process interface and includes the following events: finding, abstraction, loss, damage, destruction of IC, receiving, handling of request for IC issued, receiving of consignment from CCP, claim of IC, release of new IC.



Picture 2: Behaviour diagram of workflow process

Partial events are represented by symbols a - e. And now we can try to describe the process of the evidence and issuing of identity cards via CSP algebraic operators.

START = (a → b → END)

$(b \rightarrow END)$

$(c \rightarrow d \rightarrow b \rightarrow END)$ $(c \rightarrow d \rightarrow e \rightarrow b \rightarrow END)$ $(c \rightarrow e \rightarrow END)$

3. CONCLUSION

In this paper is illustrated how to use communicating sequential processes (CSP) in description of workflow process, concretely for description of workflow process of evidence and issuing of identity cards. First there is the workflow process presented by behaviour diagram and then it is described by CSP algebraic operators. The description of workflow processes by CSP is appears more effective and sententious then description by WPDL.

ACKNOWLEDGEMENT

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