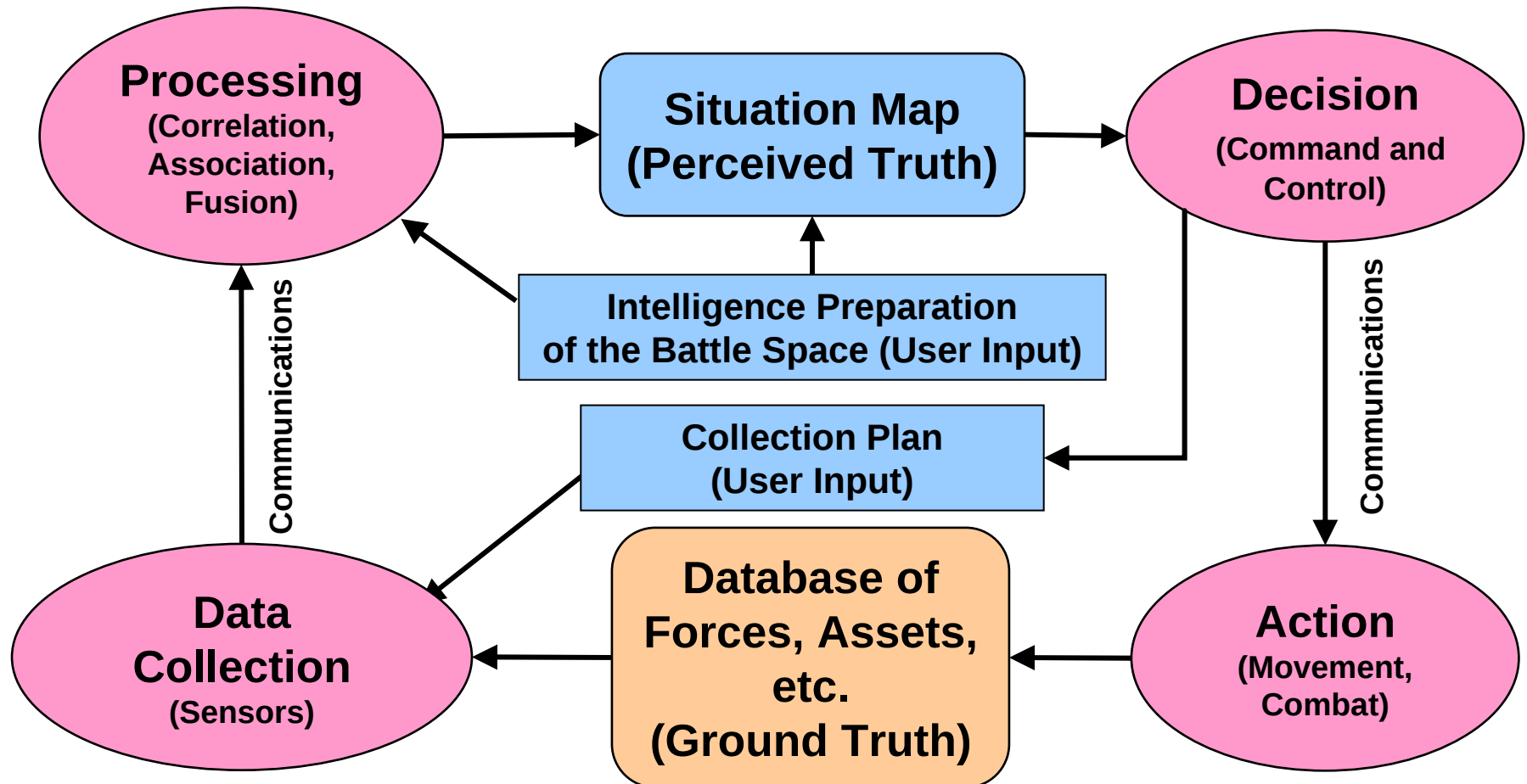

A Generative Decision Support Architecture (GDSA)

Doug Lange
Mike Cowen
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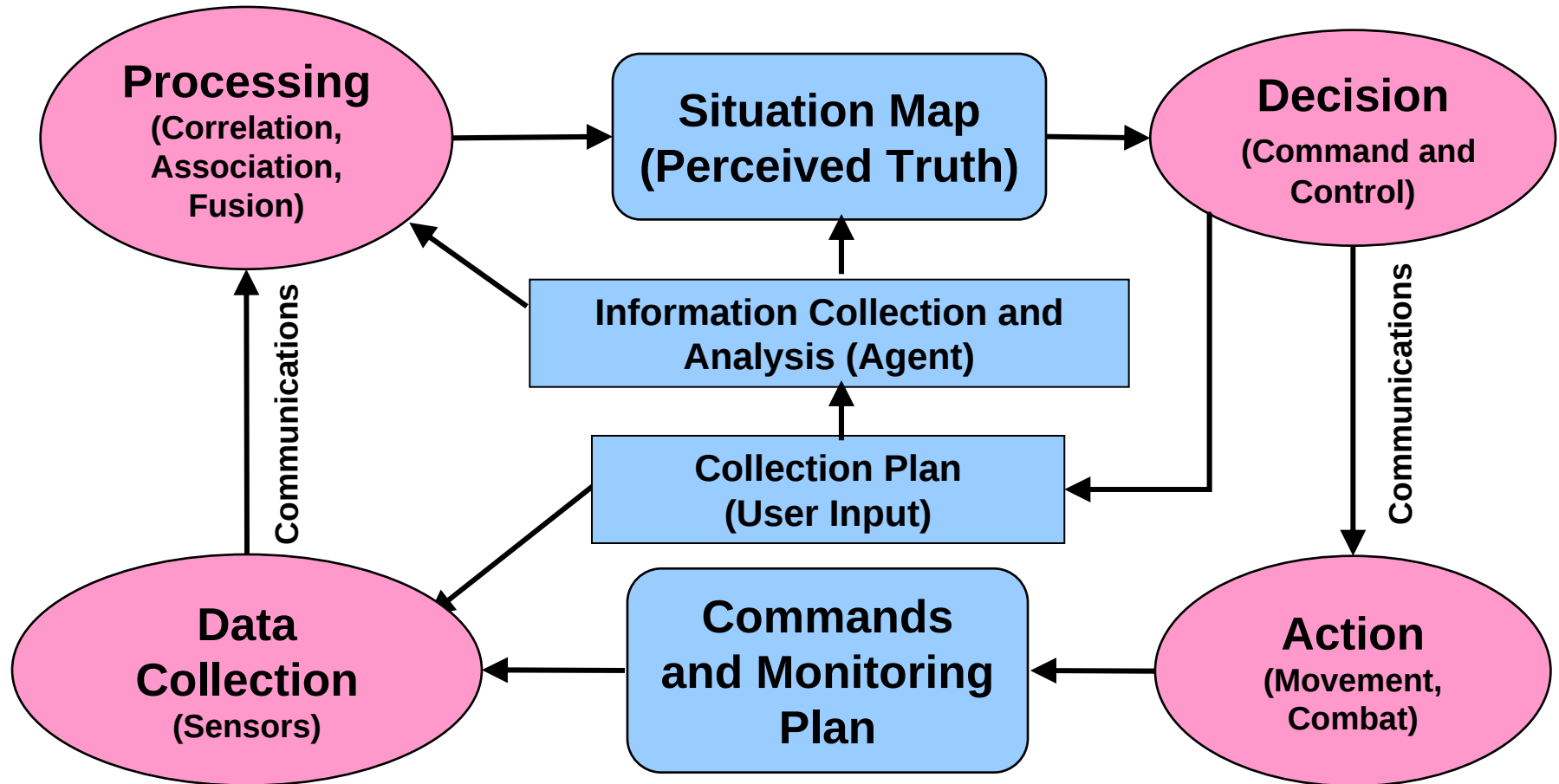
15 January 2002

Report Documentation Page				Form Approved OMB No. 0704-0188	
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1. REPORT DATE 15 JAN 2002		2. REPORT TYPE		3. DATES COVERED 00-00-2002 to 00-00-2002	
4. TITLE AND SUBTITLE A Generative Decision Support Architecture (GDSA)				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Office of Naval Research,Cognitive and Neural Sciences,Code 342,Arlington,VA,22203				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES ONR TC3 Workshop, Cognitive Elements of Effective Collaboration, 15-17 Jan 2002, San Diego, CA					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 17	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

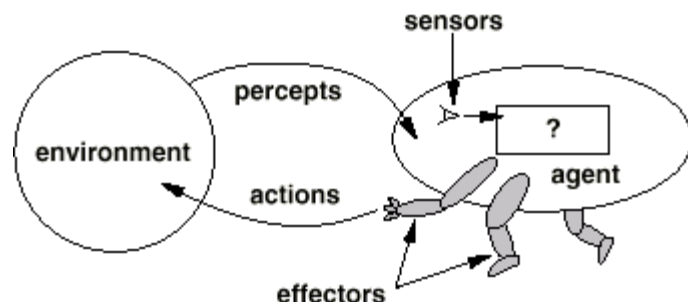
C⁴ISR Model



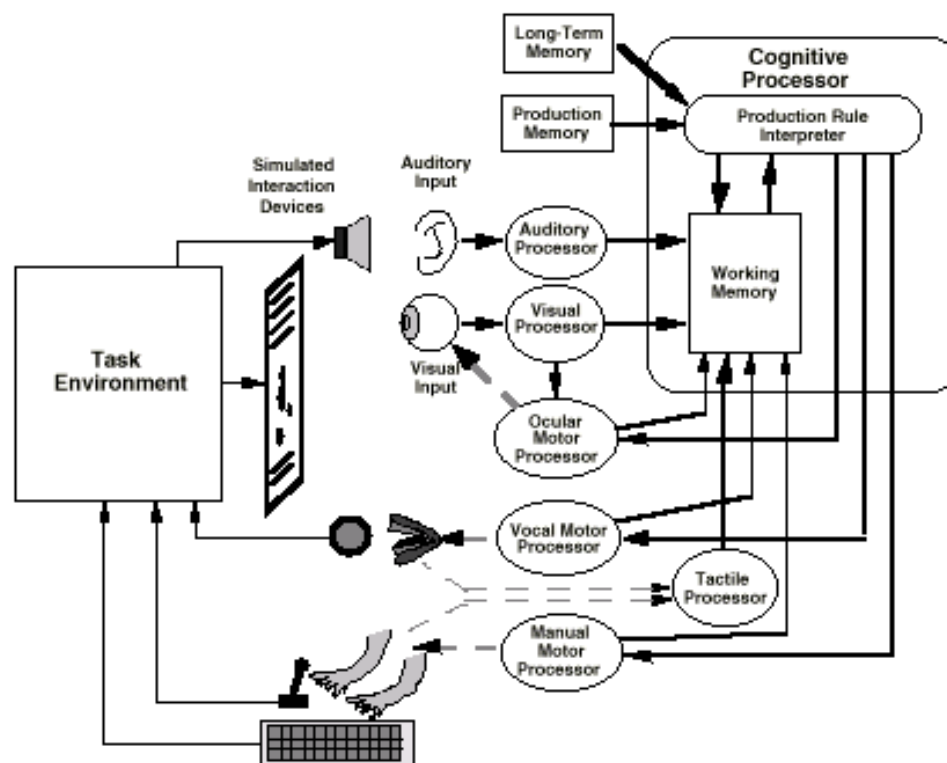
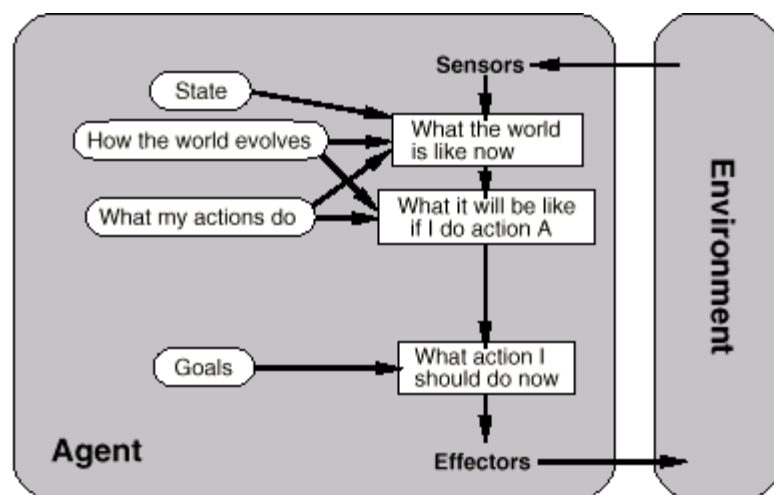
Decision Support Model



Agents



Russell and Norvig, Artificial Intelligence: A Modern Approach



Objective

- Develop an agent generation architecture for decision support applications.
 - Improve the tie between cognitive task analysis and software development.
 - Lessen the time necessary for developing decision support software.
 - Improve the quality of decision support software
 - Provide the flexibility necessary to support NCW
- Provide a method to evaluate an agents contribution to decision support.



Problem/Deficiency Being Addressed

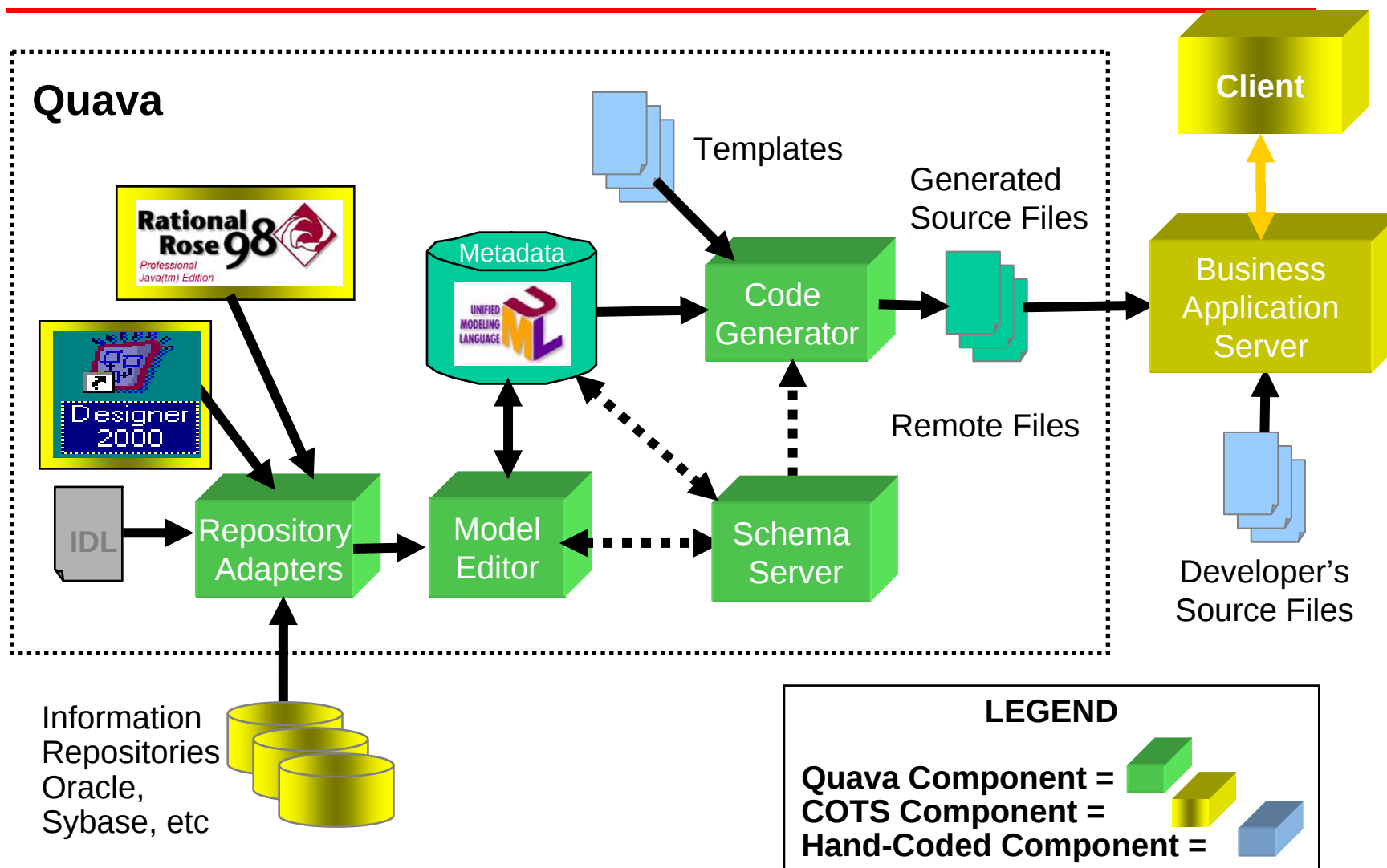


- Decision support requirements change rapidly in the operational war-fighting environment.
- Our current process for developing decision support software cannot meet the needs of the move towards NCW. Even current demands are stressing our capabilities.

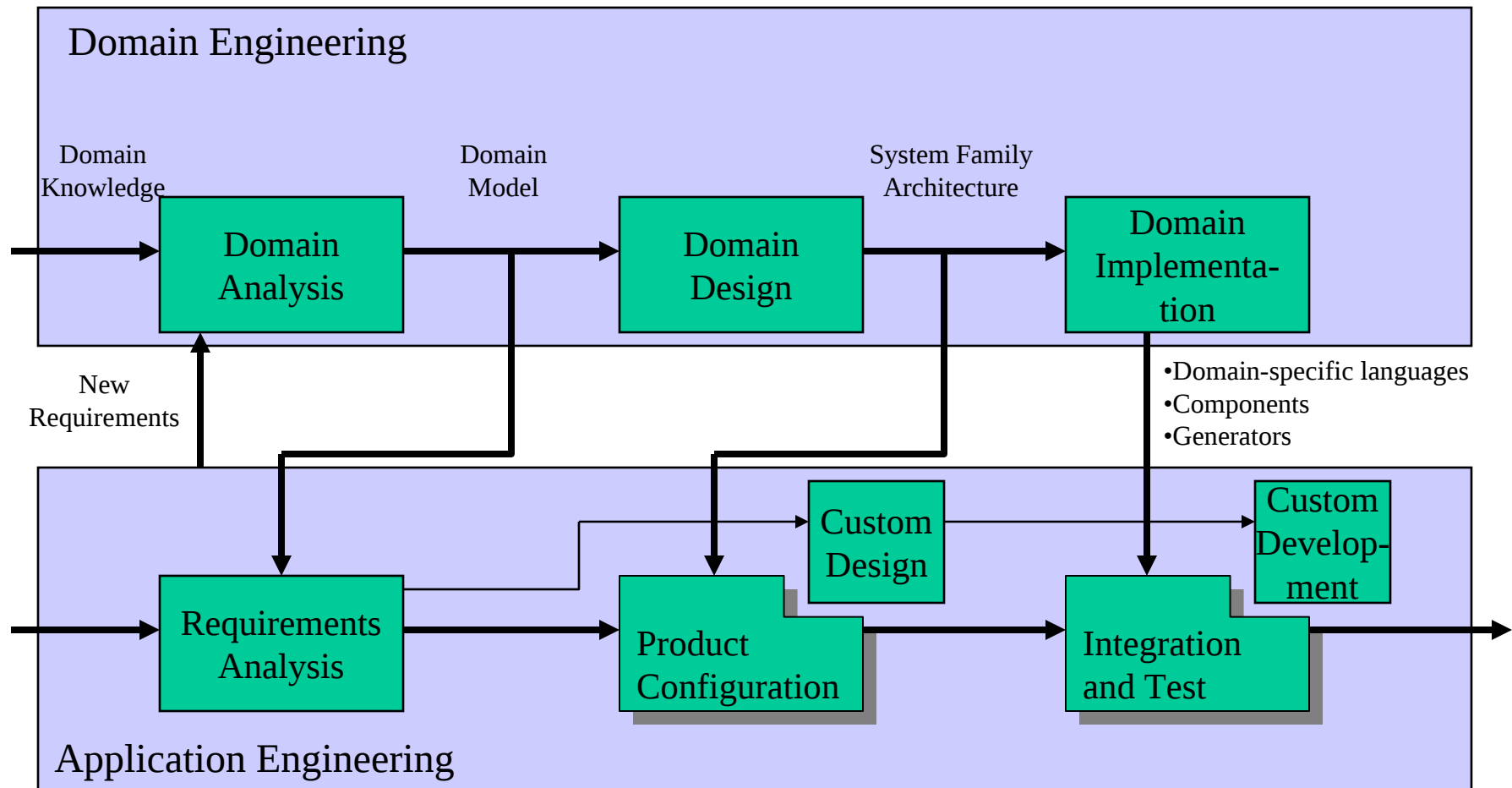
Technical Approach

- Identification of cognitive task domain.
- Evaluate models of cognitive decision-making.
- Define a cognitive model that describes the environment.
- Translate the cognitive task model into a formal software model within a generative software architecture.
- Create a domain specific language (DSL).
- Domain design.
- Domain implementation.

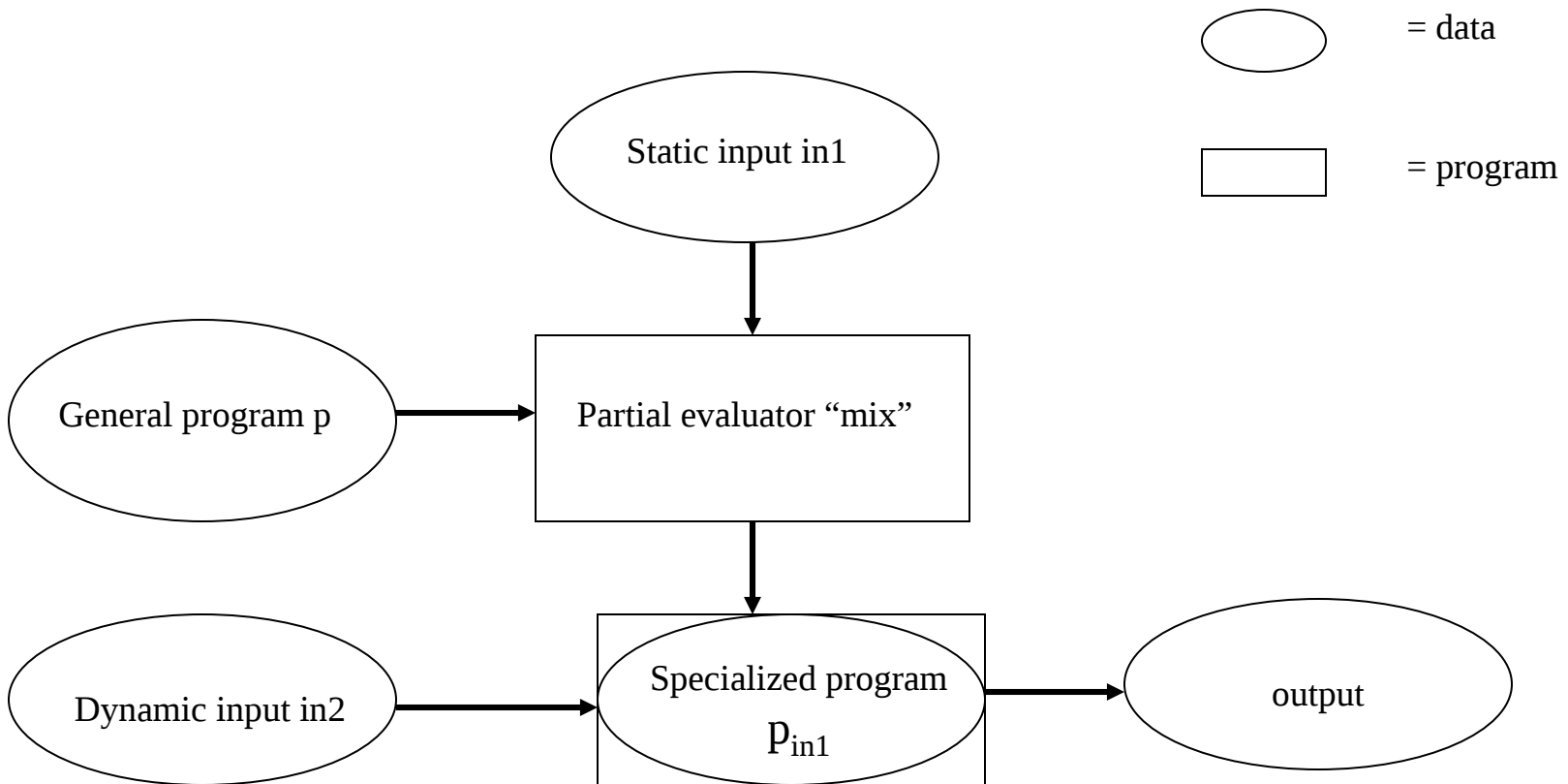
Template Based Techniques



Generative Software Development

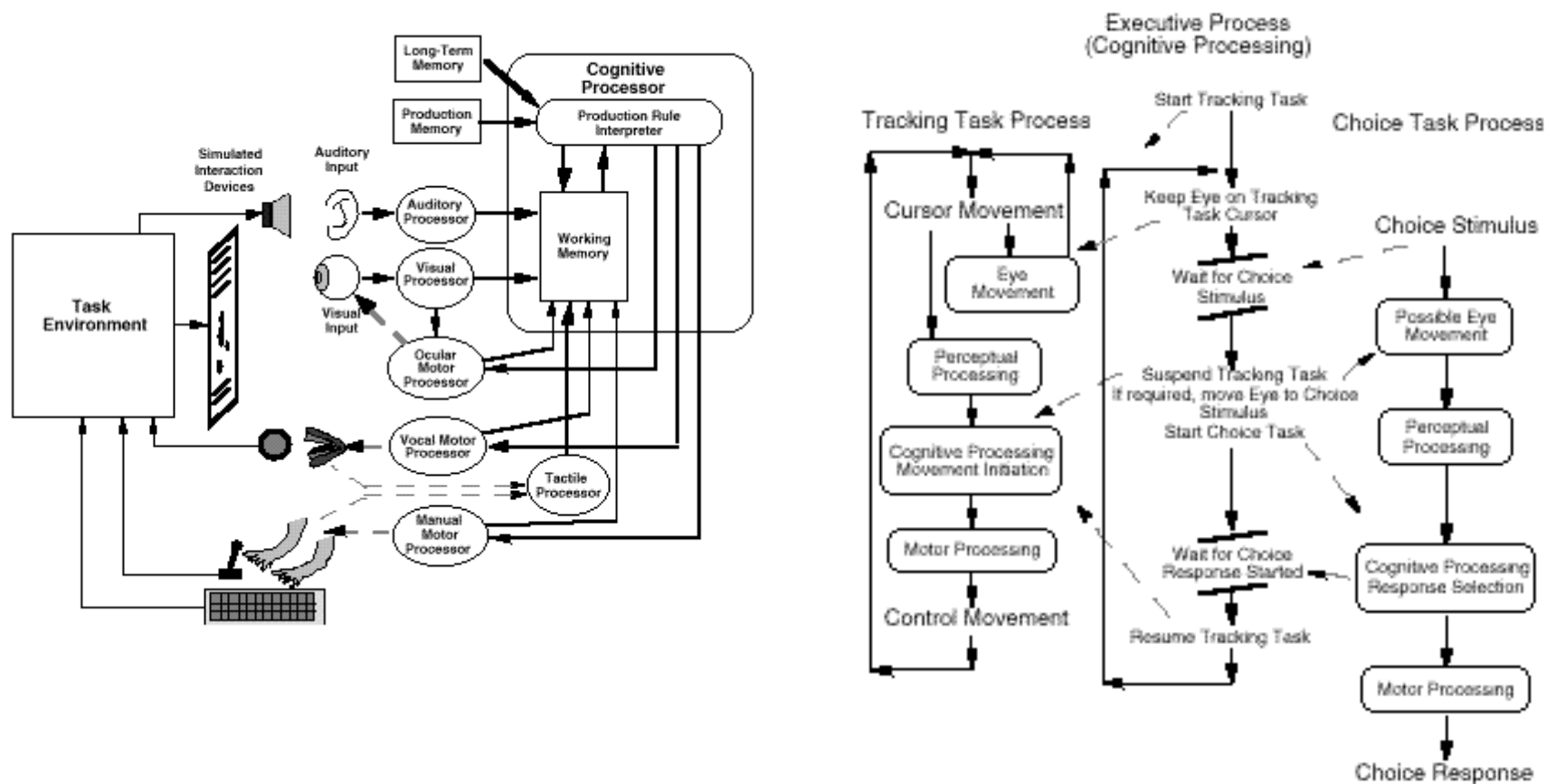


Partial Evaluation



$$[p] [in1, in2] = [p_{in1}] in2$$

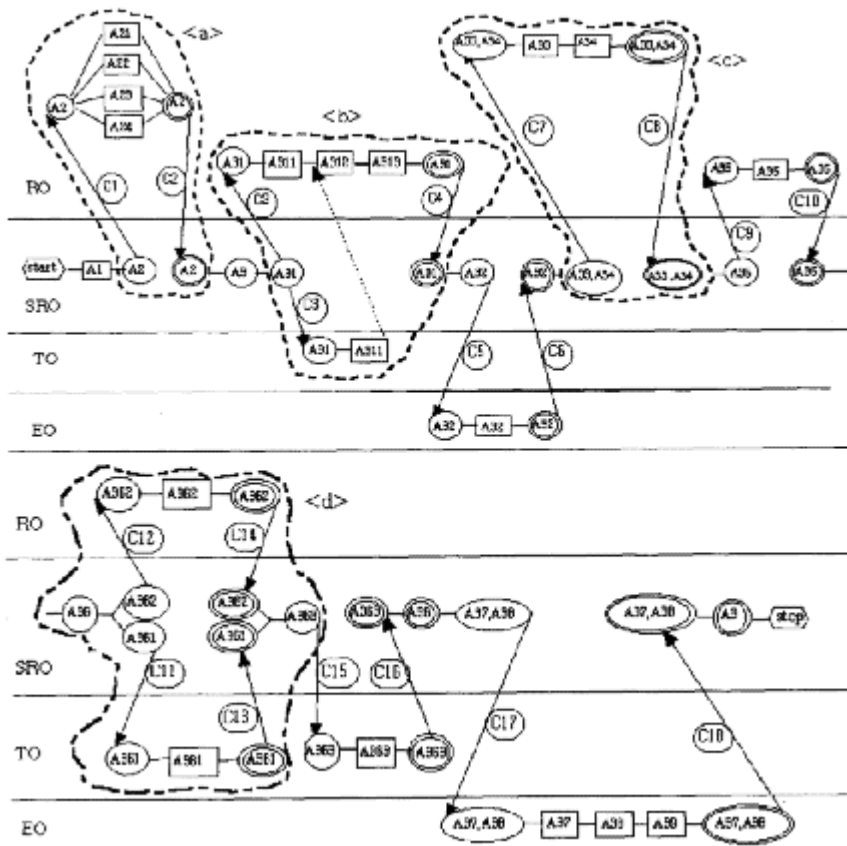
EPIC Model





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GOMS Models



Method for goal: edit the document

- Step 1. Get next unit task information from marked-up manuscript.
- Step 2. Decide: If no more unit tasks, then return with goal accomplished.
- Step 3. Accomplish goal: move to the unit task location.
- Step 4. Accomplish goal: perform the unit task.
- Step 5. Goto 1.

Selection rule set for goal: perform the unit task

- If the task is moving text, then
accomplish goal: move text.
- If the task is deletion, then
accomplish goal: delete text.
- If the task is copying, then
accomplish goal: copy text.
- ... etc. ...
- Return with goal accomplished.

Method for goal: move to the unit task location

- Step 1. Get location of unit task from manuscript.
- Step 2. Decide: If unit task location on screen, return with goal accomplished.
- Step 3. Use scroll bar to advance text.
- Step 4. Goto 2.

Method for goal: move text

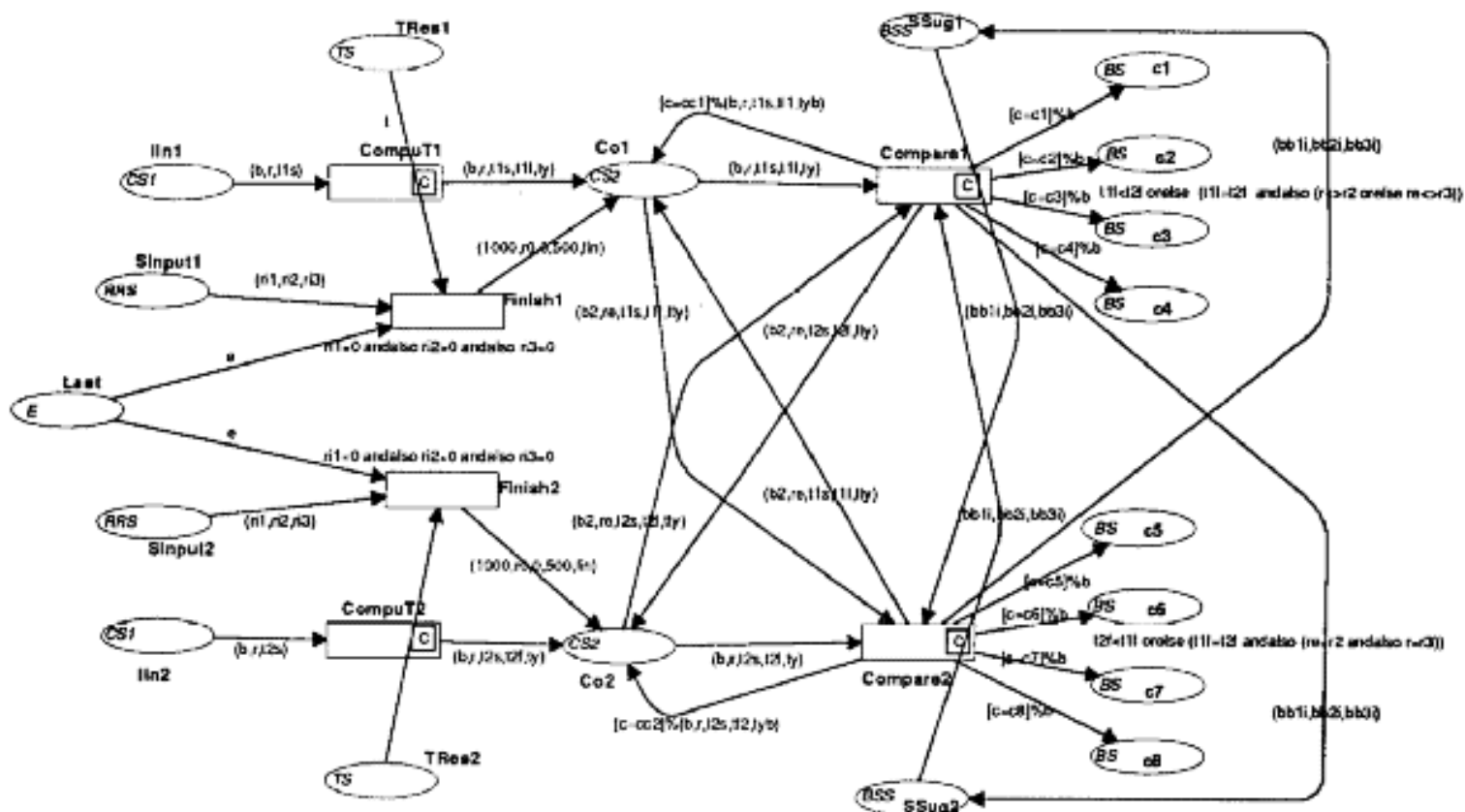
- Step 1. Cut text
- Step 2. Paste text
- Step 3. Verify correct text moved.
- Step 4. Return with goal accomplished.



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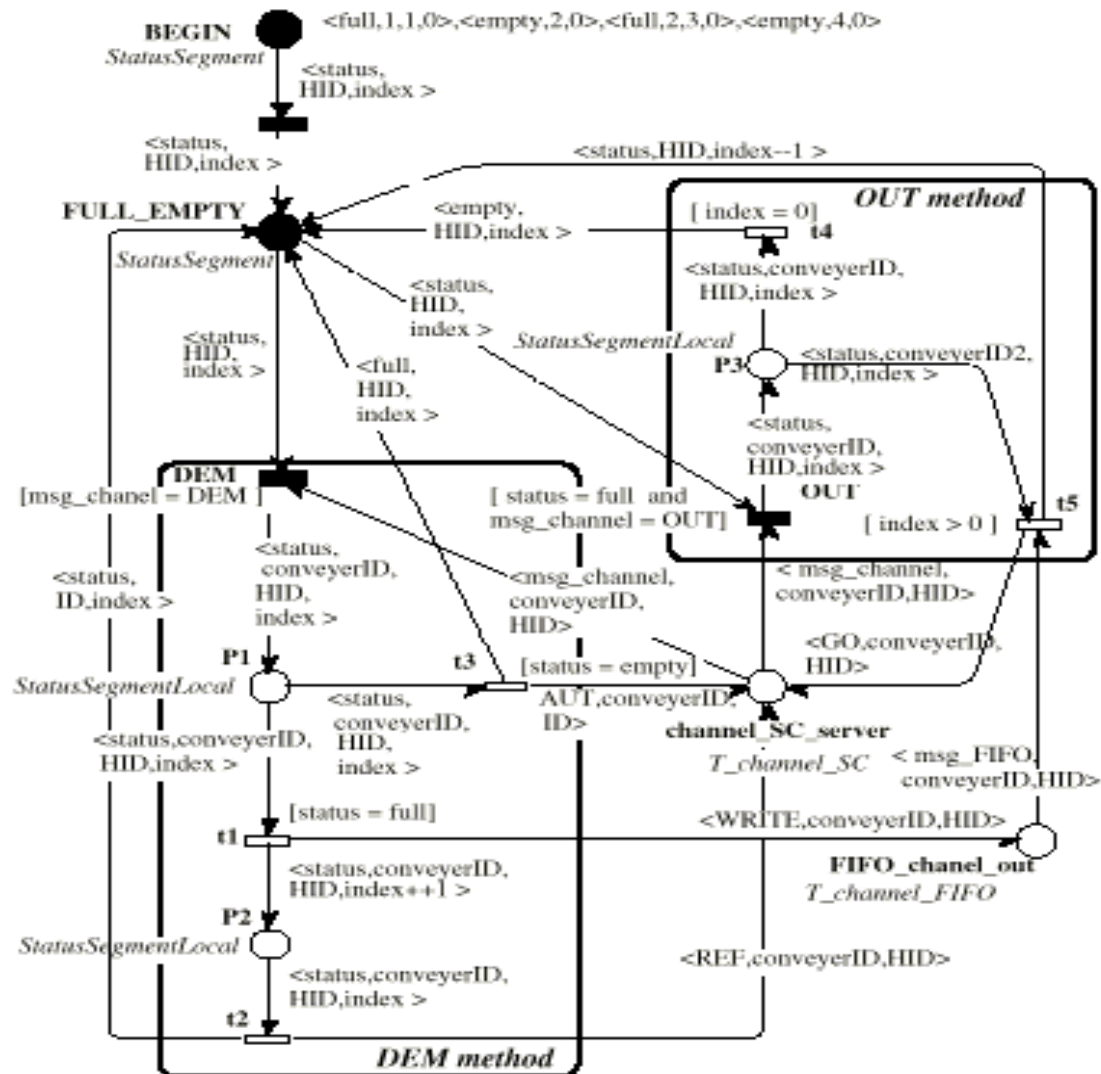


Colored Petri Nets

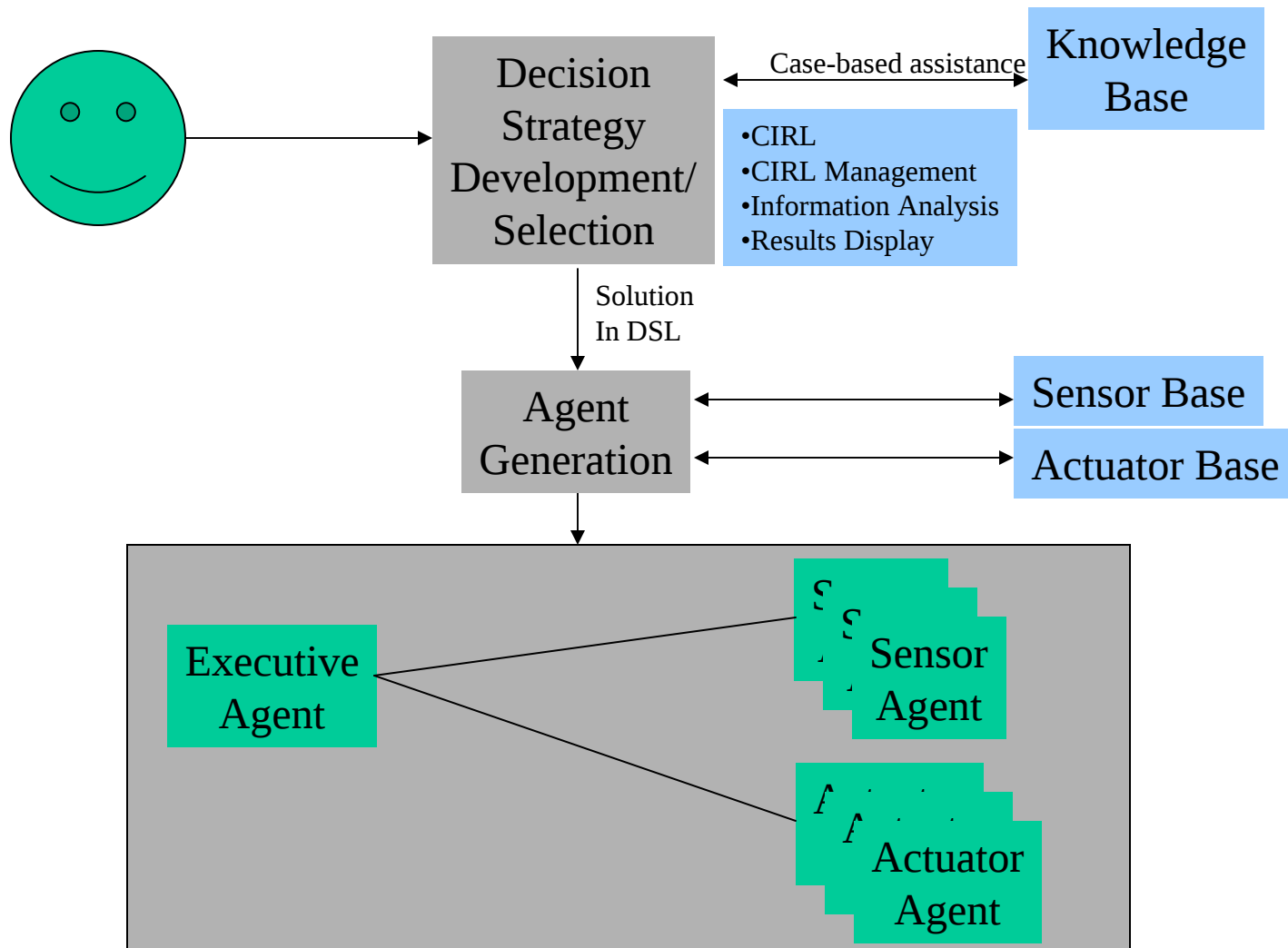


Lu, A Colored Petri Net Model of Tactical Decision Making

Petri Nets for Code Generation



GDSA



Domain Specific Language



- Based on Deterministic Timed Hierarchical Colored Petri Nets. Adds semantic content to the places, transitions, and edges relative to decision support agents.
 - Interactions with infrastructure
 - Use of sensors and actuators
 - Information item and list management strategies
 - Analysis steps
 - Result display
- Initial level is based on the level of reusable sensor and actuator modules and the level of abstraction of associated information objects.

Research Areas

- Cognitive model adaptation for decision strategy description for agent use and generation
 - Critical Information Requirements List
 - CIRL management criteria
 - Information analysis method
 - Result display
- Domain specific language for decision strategies
- Agent generation engine
- Sensor and Actuator reuse bases and semantic descriptions for selection
- User interface language for decision strategies
- Case-based reasoning support for decision strategy selection