



Designing an Agent to Support the Retrieval of Medical Evidence to Support Emergency Physician Decision Making at the Point of Care

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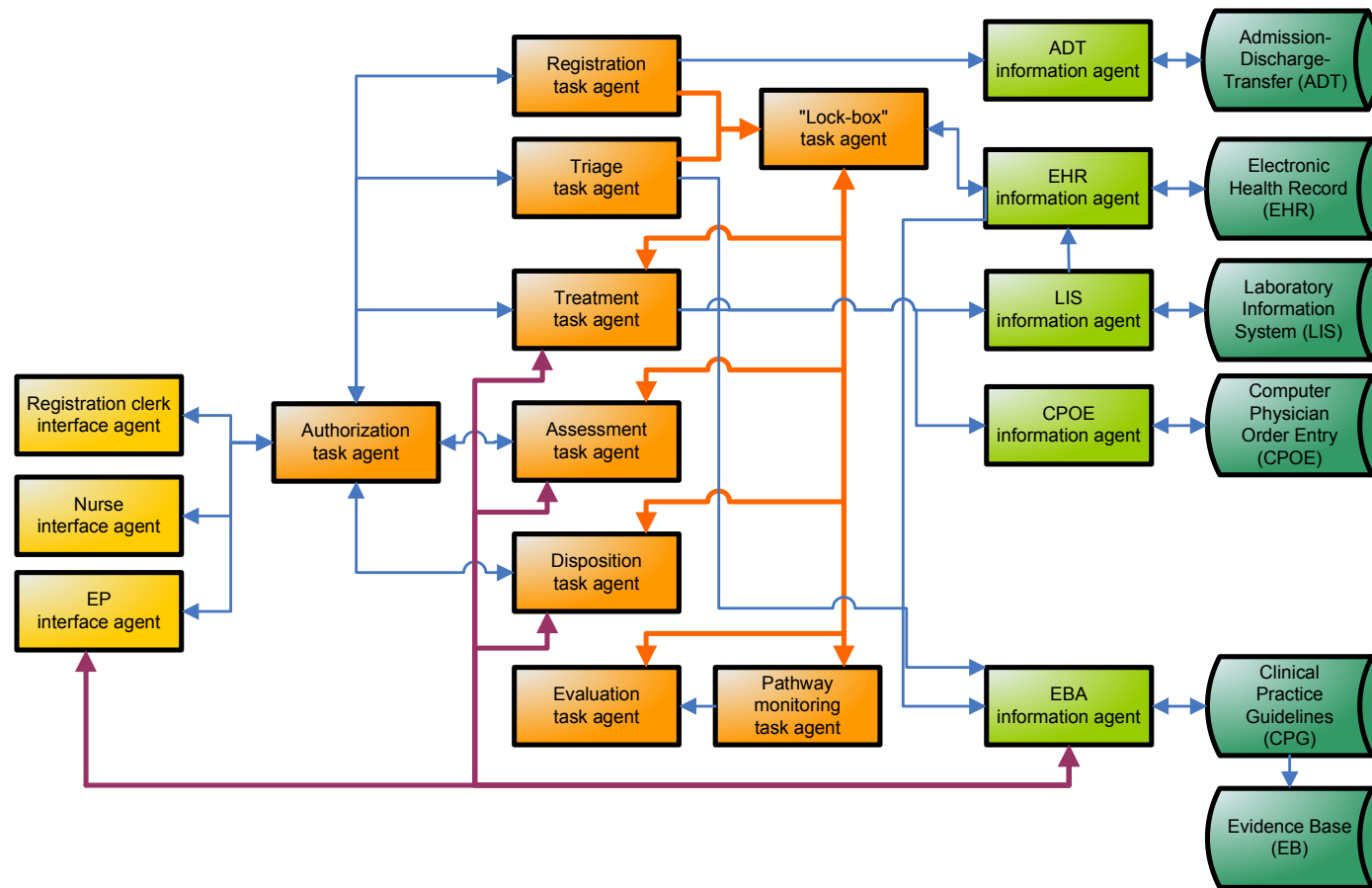
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MET (Mobile Emergency Triage)

- Multi-purpose Clinical Decision Support System
- Current implementation is pediatric asthma
 - Provides Early Assessment for Asthma Severity
 - Supports Patient Management and Clinical Workflow
 - Multi-agent architecture to support complex care pathway
 - Clinical personnel, patient management tasks, hospital information systems
 - Point of care support

MET Multi-Agent Design





Issues and Challenges in Supporting Evidence-based Medicine

□ Issue

- How to provide the most relevant evidence in a concise manner at the point of care

□ Challenges

- Natural language processing/semantic understanding difficult for **highly specialized medical corpuses**
- Difficult to locate “most relevant” documents due to **low precision** of text-based search methodologies
- Ranked **presentation style** favored by many search engines not suitable for point of care support



Requirement and Solution

□ Requirement:

- Access to evidence must be **integrated with existing clinical workflow**
- Evidence must be **contextually relevant** for the current patient-physician encounter
- Evidence should be available at the **point of care**

□ Solution:

- Employ a **logical concept-based query**, where concepts relate to specific disease and patient state
- Combine concept-based query for document retrieval with **cluster-based approach** for document presentation



Use Case for Designing Evidence-based Agent (EBA)

1(a) Physician evaluates child's state (including asthma exacerbation severity)

1(b) MET displays in a structured manner all available patient data (history and recorded assessments) together with verified prediction

2(a) Physician prescribes treatment

2(b) MET captures treatment (using structured format)

3(a) Physician requests evidence for prescribed treatment and child's state

3(b) MET looks for evidence by creating a query, consulting clinical practice guidelines, mining the Cochrane Library and clustering results. MET presents clusters to the physician

4(a) Physician reads and reviews provided evidence

4(b) --

5(a) Physician decides whether to check another treatment or to continue with the currently prescribed one

5(b) MET allows the physician to go back to step 2 or to continue with the prescribed treatment

6(a) --

6(b) MET stores the prescribed treatment

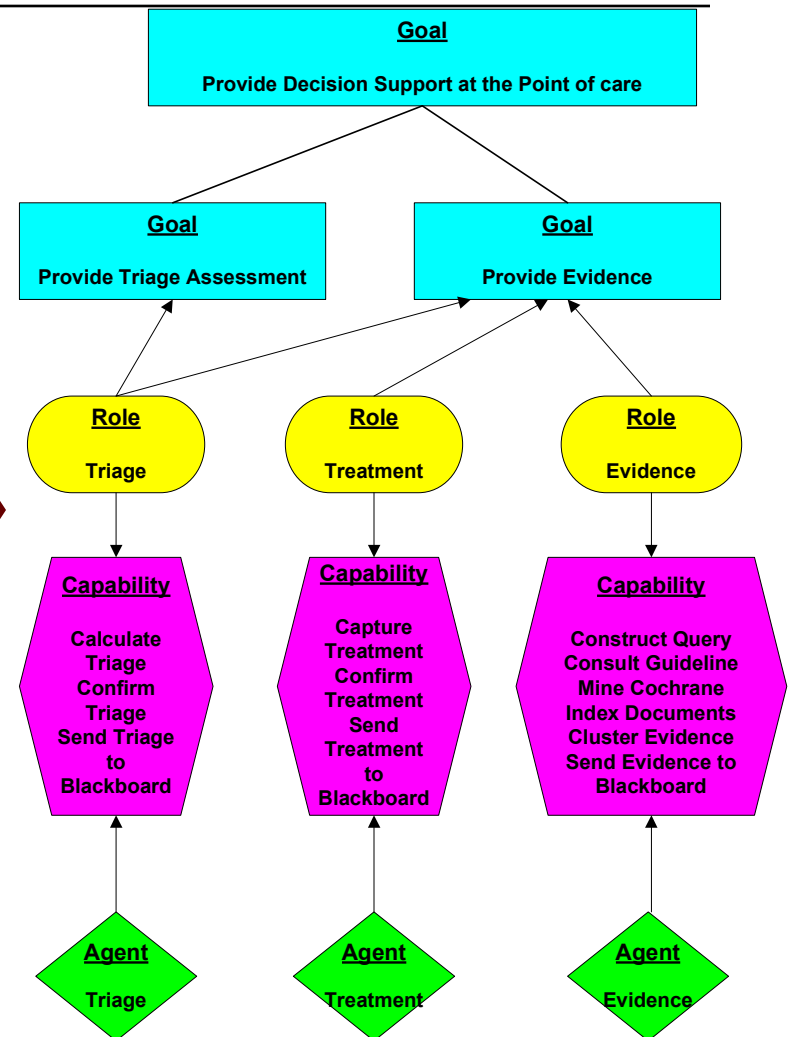
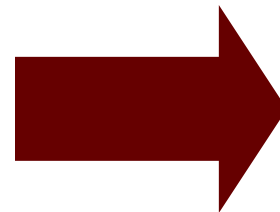
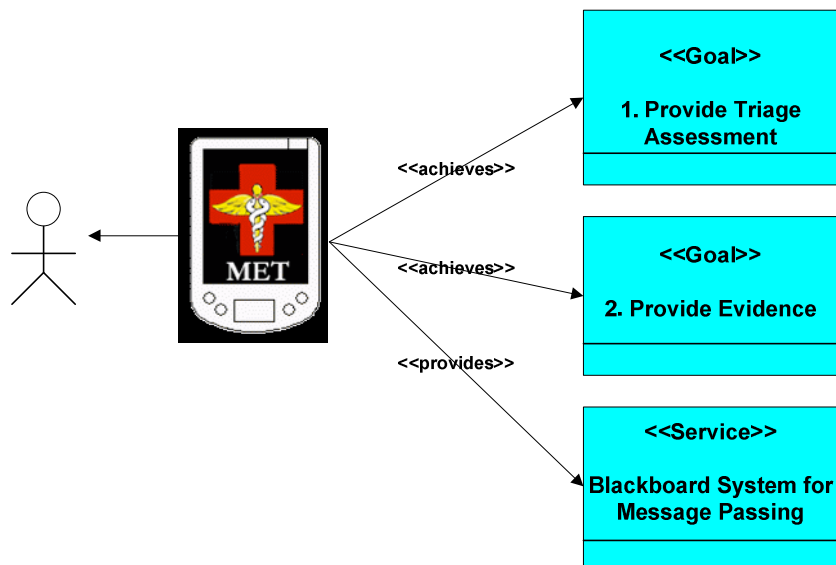


O-MaSE

- ❑ Methodology for modeling agents in a multi-agent system (MAS)
- ❑ Allows for integration of sub-teams of cooperating agents
- ❑ MAS defined in terms of Organizational, Goal, Role, and Agent Models
- ❑ MET architecture is simplified – One organization and each agent has fixed capabilities

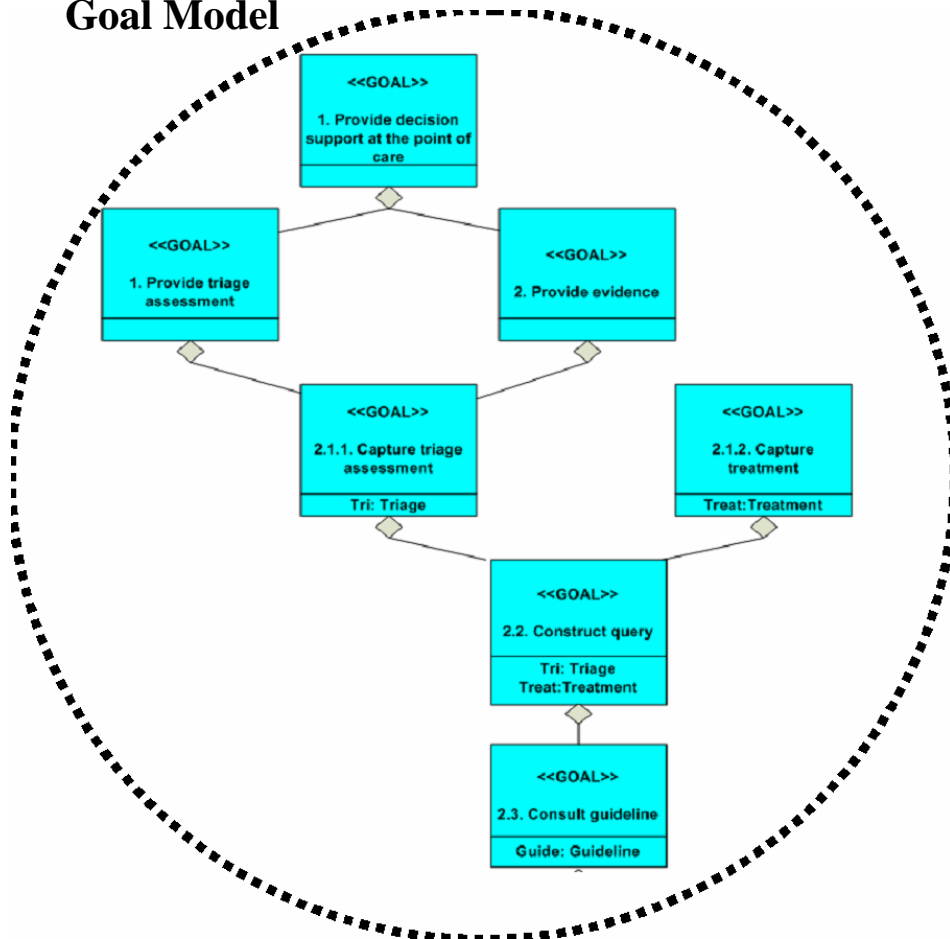
MET EBA and O-MaSE

Organisational Model → Organisational State Model



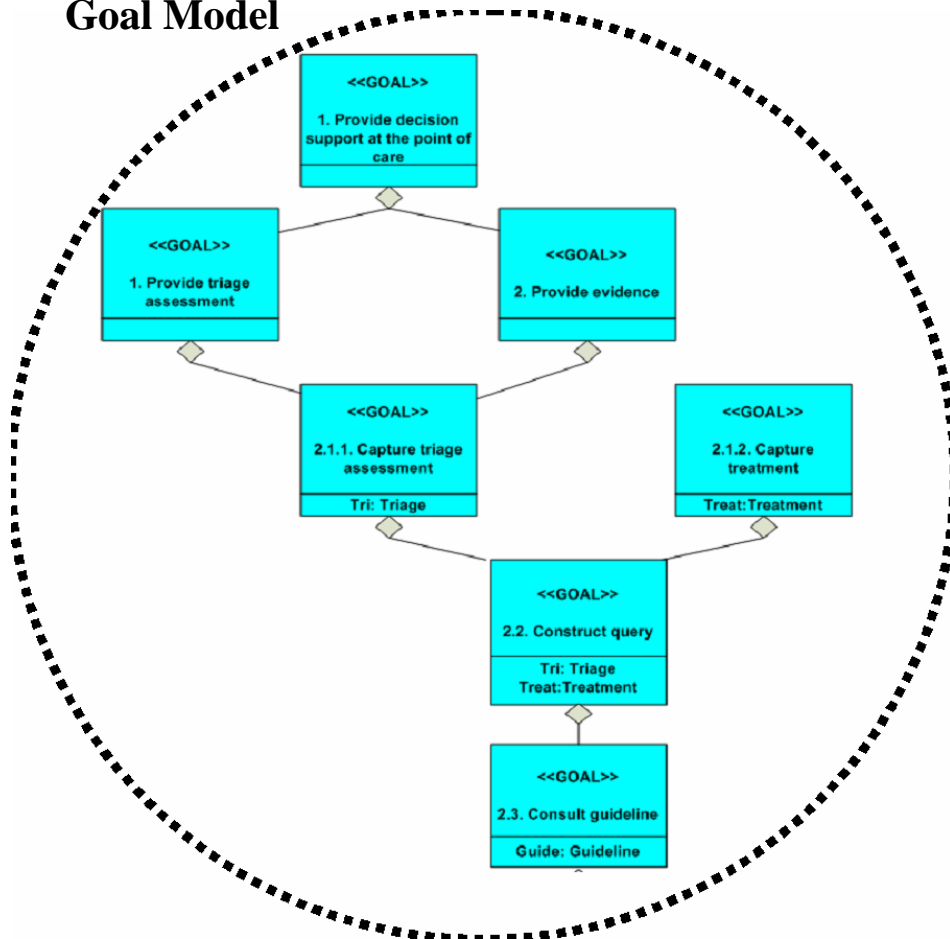
MET EBA and O-MaSE

Goal Model



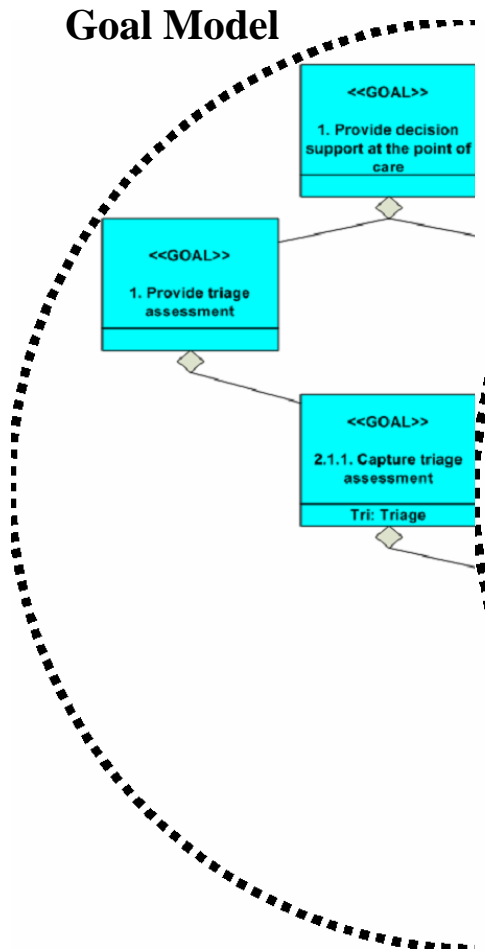
MET EBA and O-MaSE

Goal Model

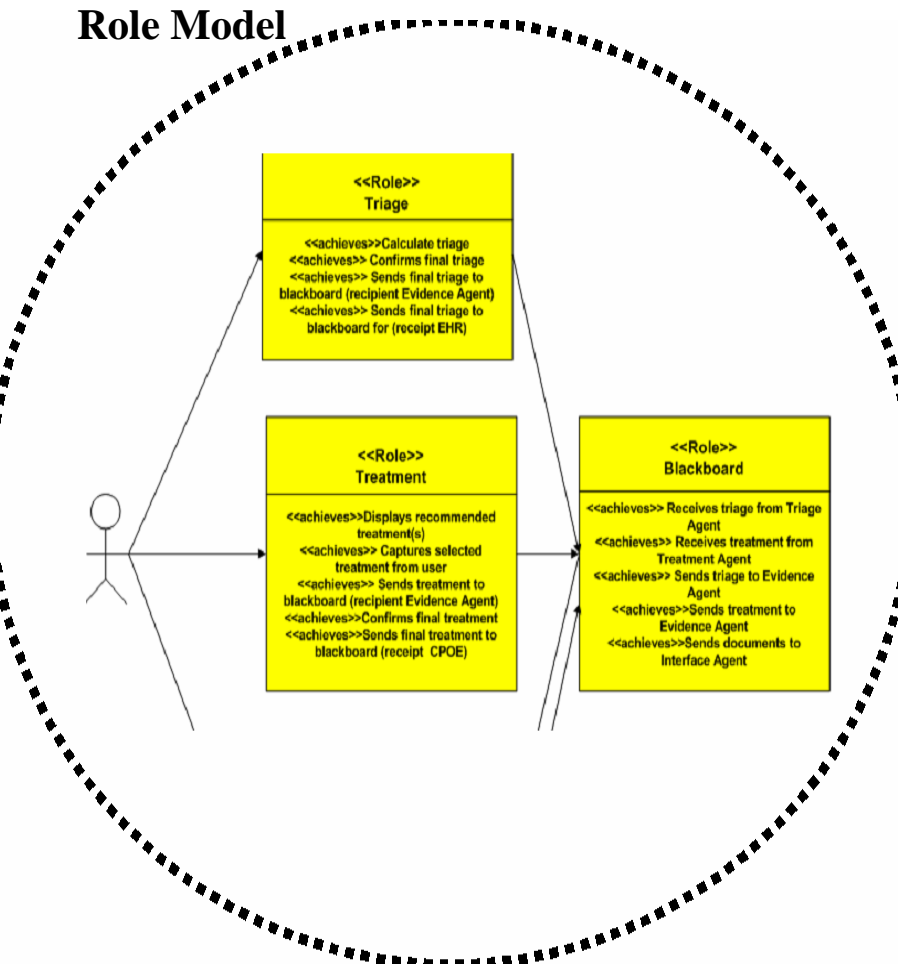


MET EBA and O-MaSE

Goal Model

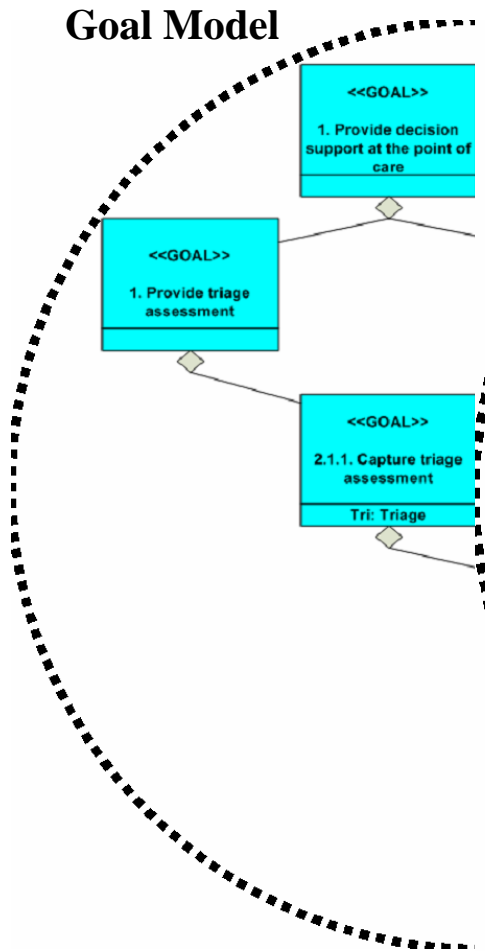


Role Model

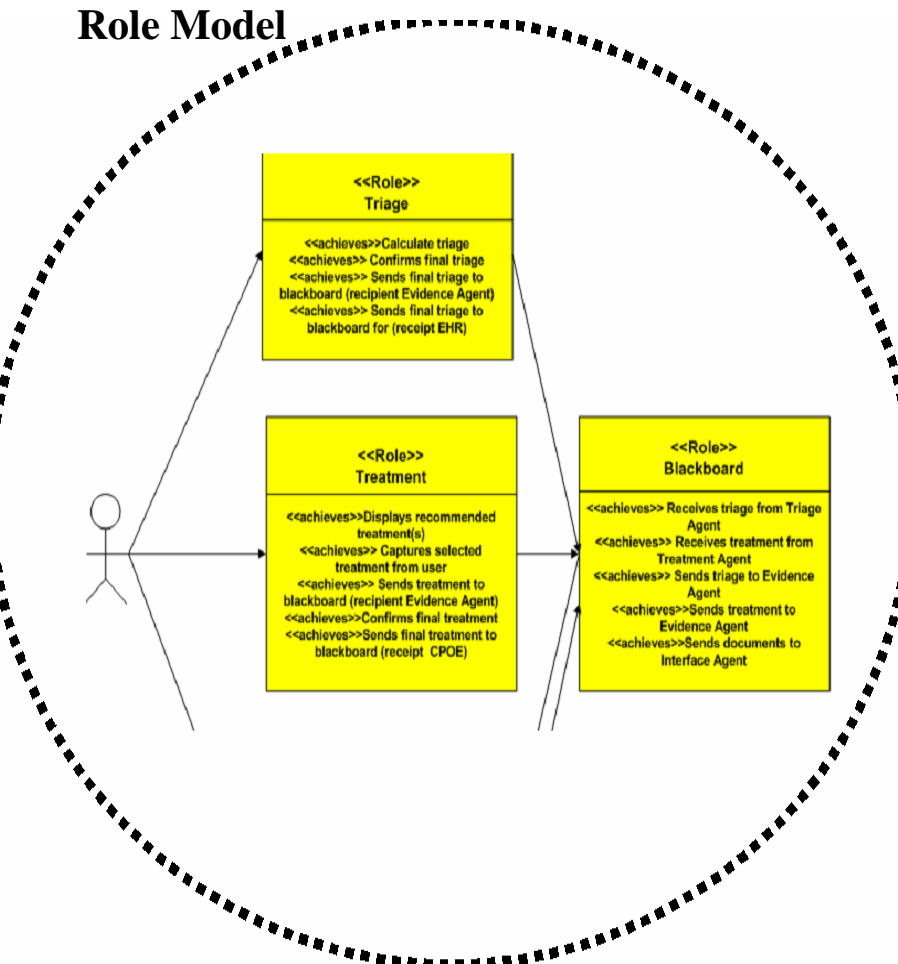


MET EBA and O-MaSE

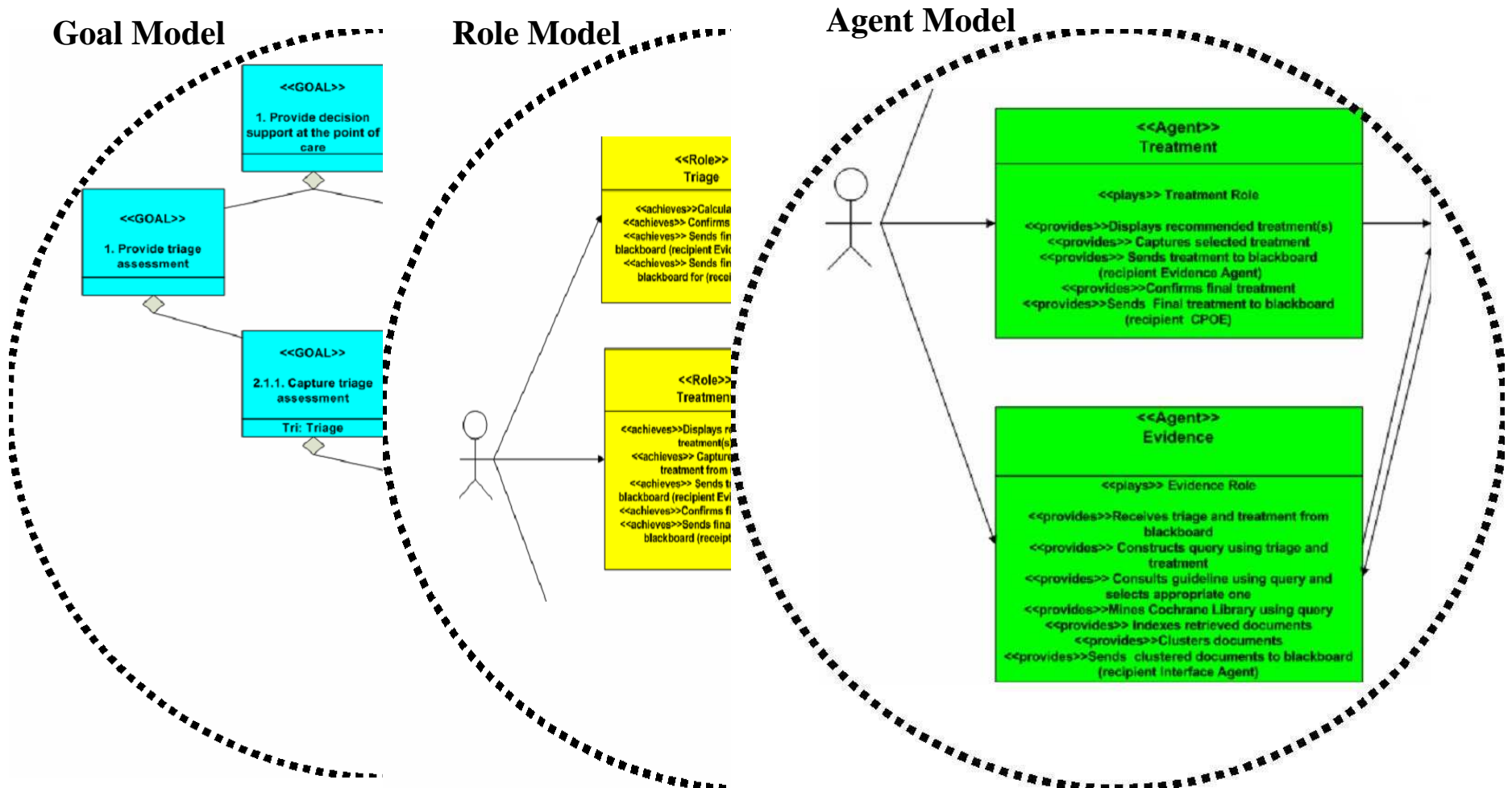
Goal Model



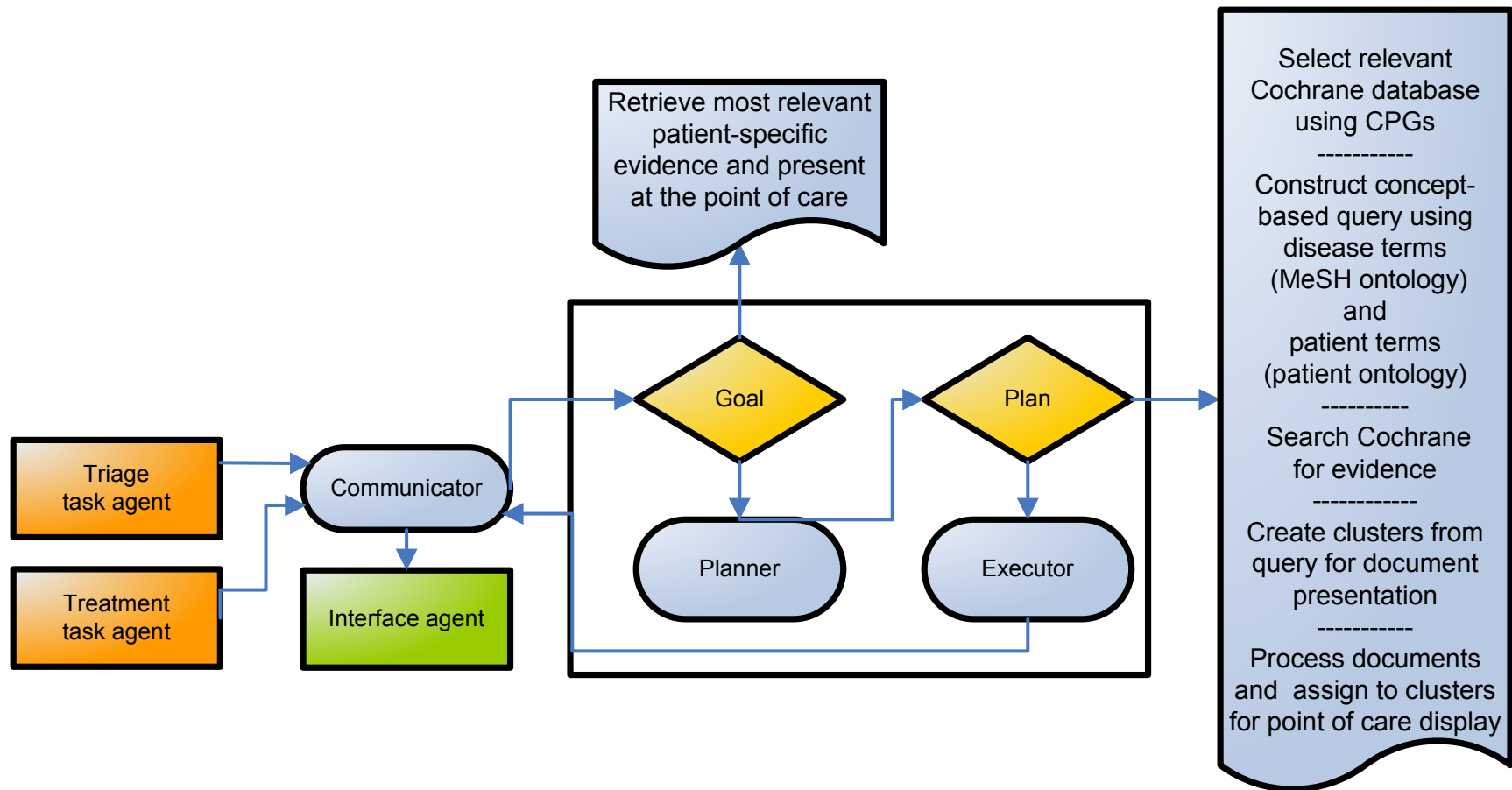
Role Model



MET EBA and O-MaSE



Design of the EBA





Planning an Evidence-Based Search

□ **Formulate Concept-Based Search**

- Instantiate disease and patient concepts with instances from MeSH ontology and underlying patient ontology respectively
- Combine disease and patient concepts into text-based search using Boolean operators and specify Cochrane index to be searched

*“asthma [MeSH]” AND “child [MeSH]” AND
“moderate [full text]” AND “β-agonists [full text]”*

□ **Create Clusters for Retrieved Documents**

- Formulate labeled clusters by automatically extracting instances of the patient ontology used in the concept-based query

“treatment” , “severity and treatment”

□ **Assign Retrieved Documents to Correct Clusters**

- Formulate queries by extracting attribute names and values from instances of patient ontology used in the concept-based search

“treatment, β-agonists”, “severity, moderate, treatment, β-agonists”

- Pass queries to local text search engine and assign documents to relevant clusters based on discovery of queries in documents



Conclusions and Future Work

- Concept-based framework for retrieving evidence
 - Integrated with asthma management workflow
 - Contextualizes evidence for current patient presentation
 - Clustering enhances precision and provides better presentation of information at the point of care

- Implementation and integration of the prototype EBA underway using JADE environment

- Integrating of EBA with Computerized Clinical Practice Guidelines

- Please visit us at: <http://www.mobiledss.uottawa.ca>