A Concept-Based Framework for Retrieving Evidence to Support Physician Decision Making at the Point of Care

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Premise and Issue

- Premise
  - Physicians should manage patients in the most effective way using the latest available clinical evidence regarding treatments and diagnosis
- Issue
  - How to provide the most relevant evidence in a concise manner at the point of care to support physician decision making

Sucessful Provision of Evidence

- Access to and provision of medical evidence must be **integrated with existing clinical workflow**
- Retrieved evidence must be **contextually relevant** for the current patient-physician interaction
- Evidence should be available where it is most often required - at the **point of care**

Challenges in Retrieving Evidence

- 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

Task and Proposed Solution

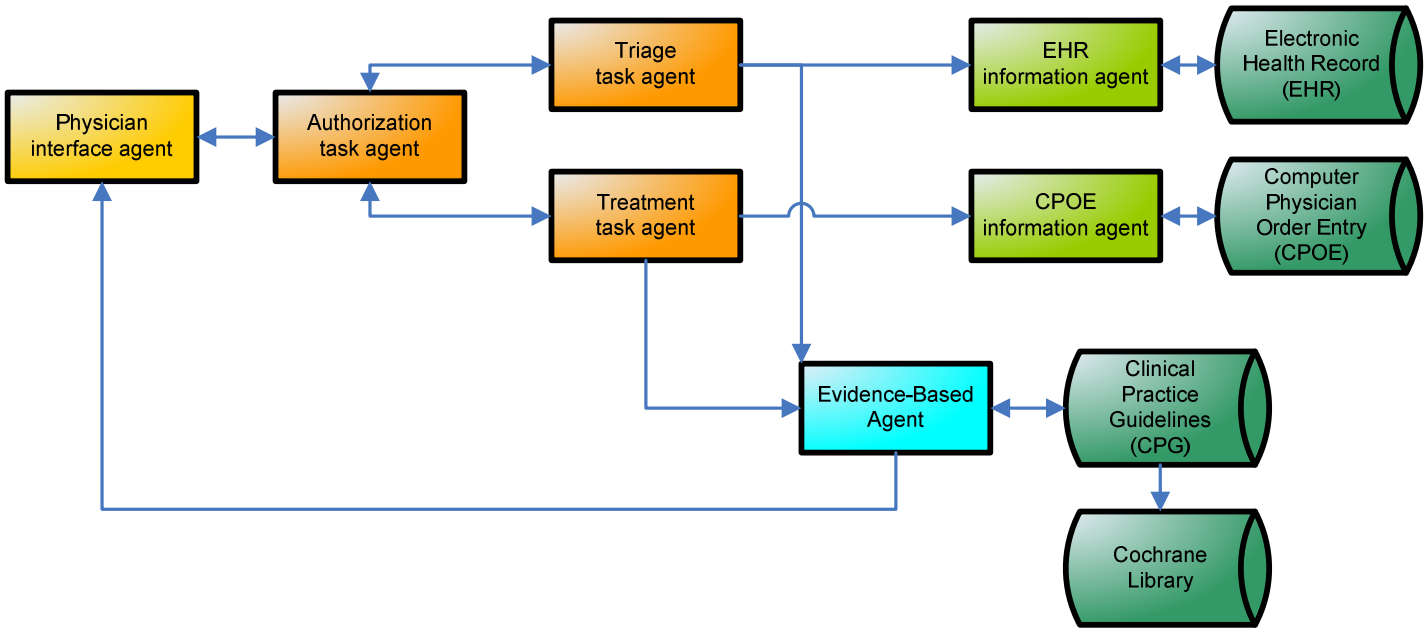
- **Task:**
  - Retrieve most relevant documents from the Cochrane Library and provide visualization that allows fast discrimination of relevant results

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

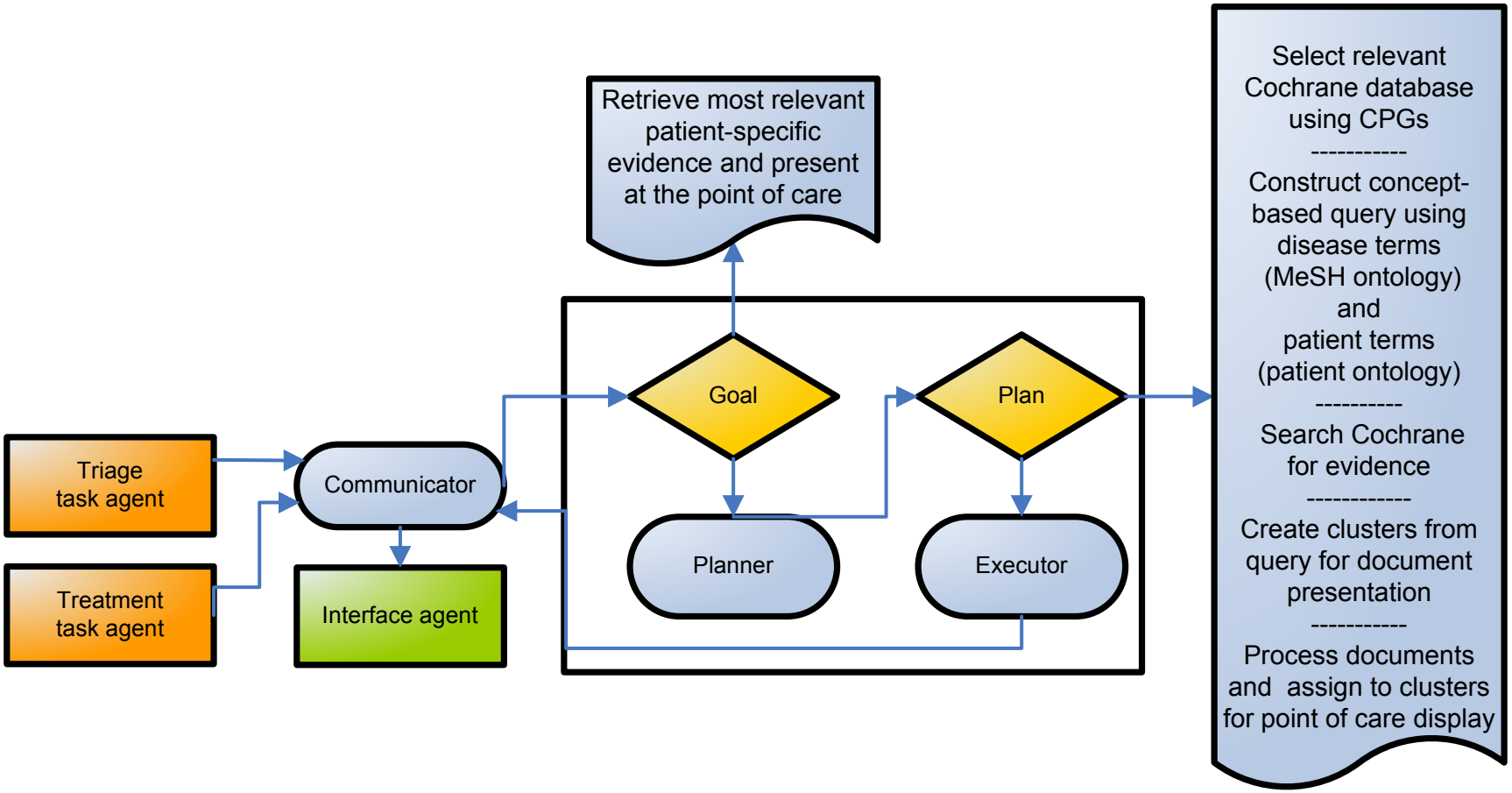
MET (Mobile Emergency Triage)

- Generic Clinical Decision Support System
- Current implementation is pediatric asthma
  - Provides Triage Recommendation 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

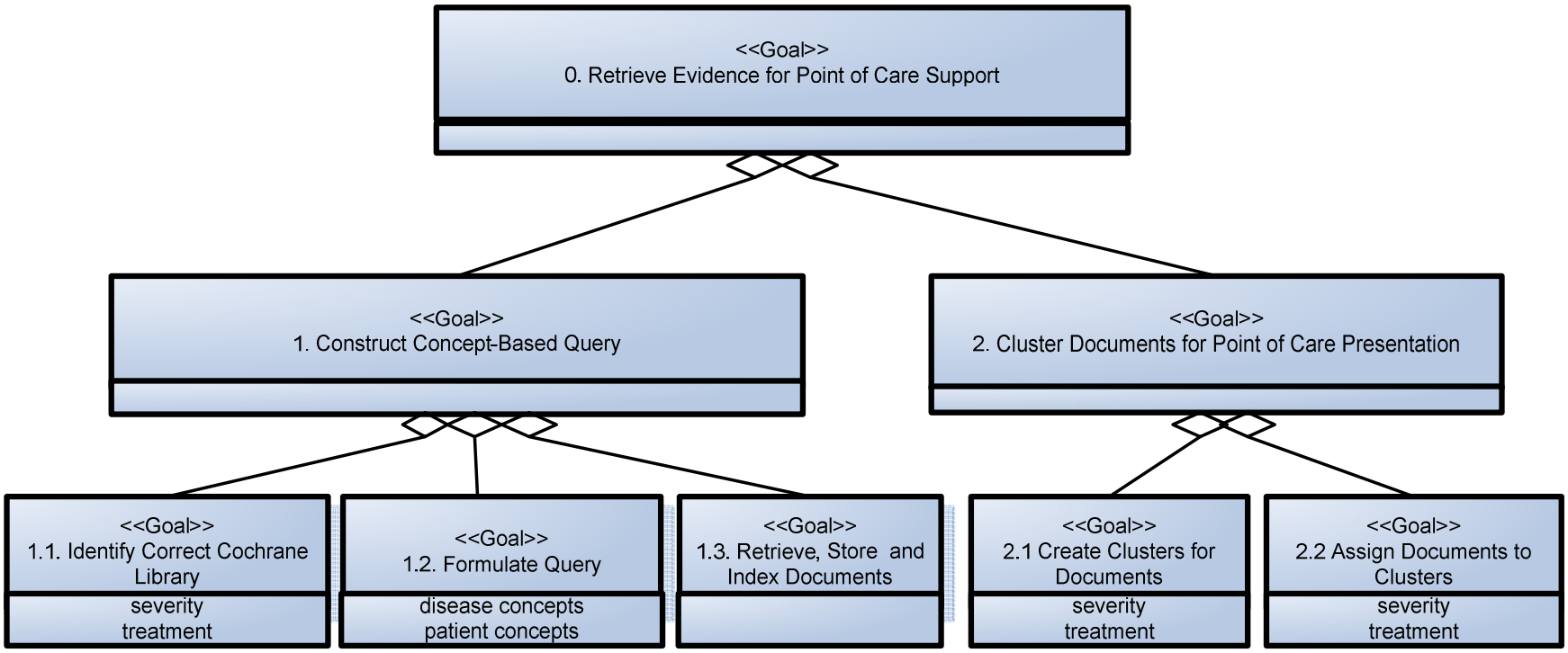
Agents Required for Retrieval of Evidence



Design of the Evidence-Based Agent



EBA Planning Component



Planning an Evidence-Based Search I: Constructing a Concept-Based Query

- **Identify Appropriate Cochrane Database**
  - Compare values of patient attributes to asthma CPG lookup table
- **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]"

- **Retrieve documents and export to local database**
  - Index documents using standard text-based indexing engine

Planning an Evidence-Based Search II: Cluster Results for Presentation

- **Create Clusters for Retrieved Documents**
  - Formulate labeled clusters by automatically extracting instances of the patient ontology used in the concept-based query

    "severity", "treatment" "severity and treatment"

- **Assign Retrieved Documents to Correct Clusters**
  - Formulate queries by extracting attribute names and values from instances of the patient ontology used in the concept-based search

    "severity, moderate", "treatment, β-agonists",
    "severity, moderate, treatment, β-agonists"

  - Pass query strings to local text search engine and assign documents to relevant clusters based on discovery of queries in the 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 visualization of information at the point of care
- Implementation and integration of the protoype agent underway using JADE environment
- Investigate Latent Semantic Indexing for enhanced retrieval of textual information
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