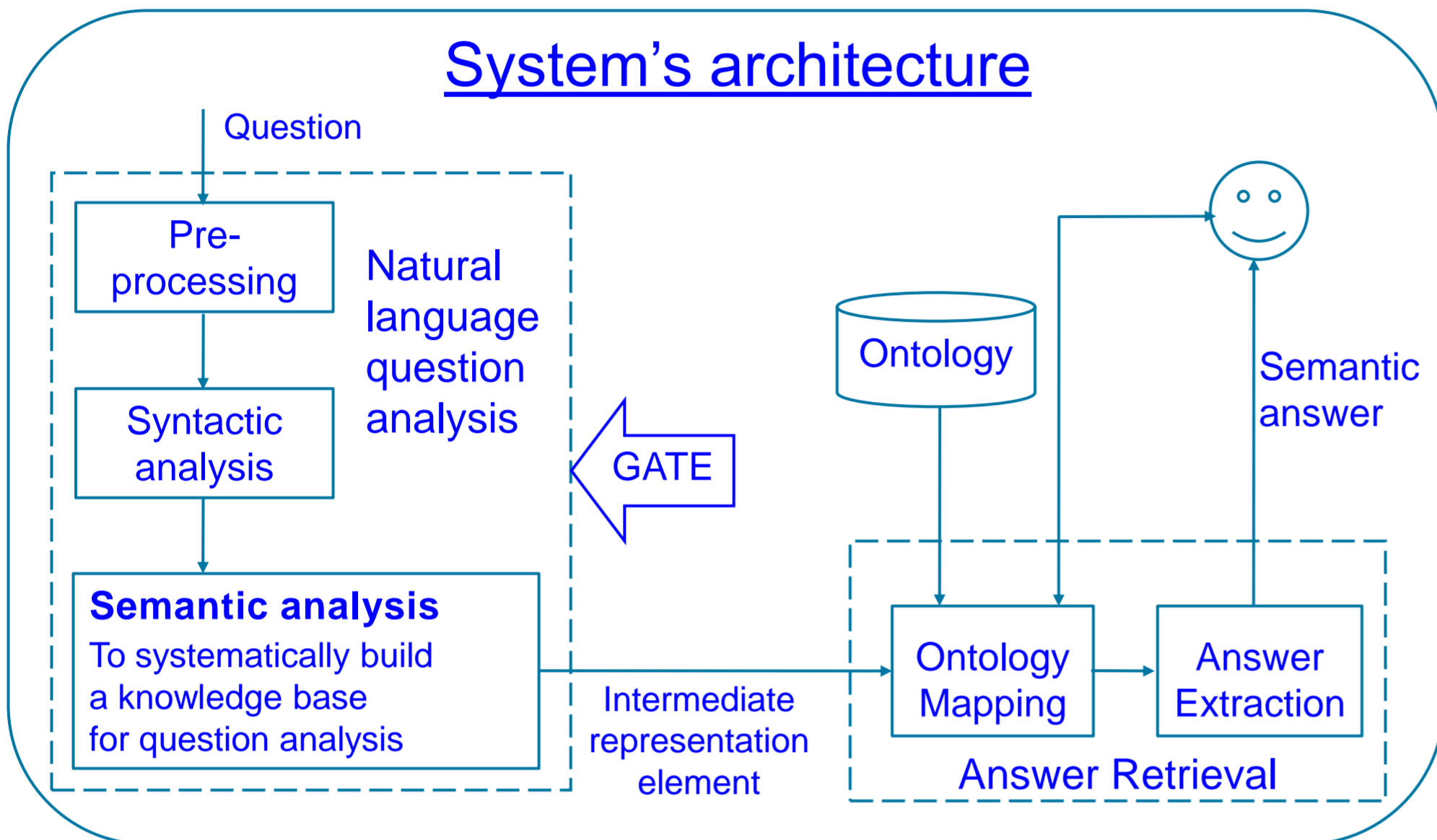




# KbQAS: A Knowledge-based Question Answering System

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## System's architecture



## Contributions:

- The first Ontology-based question answering system for Vietnamese.
- A new knowledge acquisition approach to systematically build knowledge bases of grammar rules for processing natural language questions over semantic annotations.

## Question analysis component:

- Preprocessing: redefine question-words
- Syntactic analysis: identify noun-phrases, question-phrases and relation phrases
- Semantic analysis: produce the intermediate representation of input question

Questions	Questions
Liệt kê tất cả các sinh viên học lớp khoa học máy tính mà có quê quán ở Hà Nội ? ("List all students studying in K50 computer science course, who have hometown in Hanoi?")	which projects are about ontologies and the semantic web ?
<input type="button" value="Display Annotations"/> <input type="button" value="Clear"/>	<input type="button" value="Display Annotations"/> <input type="button" value="Clear"/>
<b>Output</b> Question-structure: And The number of tuples: 2 --- Sub-structure: Normal Question-class: List Term 1: sinh viên Relation: học Term 2: lớp khoa học máy tính Term 3: ---	<b>Output</b> Question-structure: And The number of tuples: 2 --- Sub-structure: UnknRel Question-class: QU-whichClass Term 1: projects Relation: ontologies Term 2: ontologies Term 3: ---
Sub-structure: Normal Question-class: List Term 1: sinh viên Relation: cô quê quán Term 2: Hà Nội Term 3: ---	Sub-structure: UnknRel Question-class: QU-whichClass Term 1: projects Relation: semantic web Term 2: semantic web Term 3: ---

Screenshot of the KbQAS web interface. The browser address bar shows 'cntt.dyndns.info:8856/KbQAS/'. The page title is 'KbQAS Knowledge-based Vietnamese Question Answering System'. There are navigation links for 'Introduction', 'Examples', 'NL Question Analysis', 'Publications', and 'Contact'. A text input field contains the question: 'liệt kê các sinh viên học lớp k50 khoa học máy tính mà có quê quán ở Hà Nội'. An 'Ask Question' button is next to it. Below the input, it says 'The answer:' followed by the answer: 'nguyễn quốc đại nguyễn bá đạt nguyễn quốc đạt'.

Screenshot of the KbQAS web interface showing the RDR RuleBase and Grammar, Condition and Conclusion sections. The 'RDR RuleBase' section shows a tree structure of nodes: Except node (1), Except node (2), False node (3), Except node (5), False node (4), Except node (7), False node (21), Except node (50), False node (22), Except node (23), False node (36), and False node (37). The 'Grammar, Condition and Conclusion' section shows the following text: 'Exception of Rule 1', 'Rule 4( time stamp= 7)', 'Rule: R4', '({RDR1\_})', '):left --> :left.RDR4\_ = {category1 = "Normal"}', and 'Constraints: RDR1\_QU.hasanno == QUWhichClass'.

Screenshot of the KbQAS web interface. The browser address bar shows 'cntt.dyndns.info:8856/KbEnQA/'. The page title is 'KbQAS Knowledge-based English Natural Language Question Analysis'. There are navigation links for 'Description', 'Examples', 'Vietnamese Question Analysis', and 'KbQAS Demo'. A text input field contains the question: 'is there any research area about semantic web in AKT ?'. An 'Analyze Question' button is next to it. Below the input, it says 'The intermediate representation element:' followed by the following text: 'Question-structure: AffirmNeg\_3Term', 'The number of tuples: 1', '---', 'Sub-structure: AffirmNeg\_3Term', 'Question-class: QU-there', 'Term 1: research area', 'Relation:', 'Term 2: semantic web', 'Term 3: AKT'.

## Ontology Mapping and Answer Extraction

- Map terms and relations to concepts, instances and relations in the ontology
- Return the answer depending on the question-structure and question category

Screenshot of the KbQAS web interface showing a question in Vietnamese and a dialog box for resolving ambiguity. The browser address bar shows 'cntt.dyndns.info:8856/KbQAS/'. The page title is 'KbQAS Knowledge-based Vietnamese Question Answering System'. There are navigation links for 'Introduction', 'Examples', 'NL Question Analysis', 'Publications', and 'Contact'. A text input field contains the question: 'số lượng sinh viên học lớp khoa học máy tính là bao nhiêu ?'. An 'Ask Question' button is next to it. Below the input, it shows 'Concept: sinh\_vien::Relation: học:: Instance: lớp\_khoa\_hoc\_máy\_tinh'. A dialog box is open with the text: 'Resolve the ambiguity on: lớp\_khoa\_hoc\_máy\_tinh by selecting from options: k50\_khoa\_hoc\_máy\_tinh (Instances of concept: lớp)'. An 'OK' button is at the bottom of the dialog box.