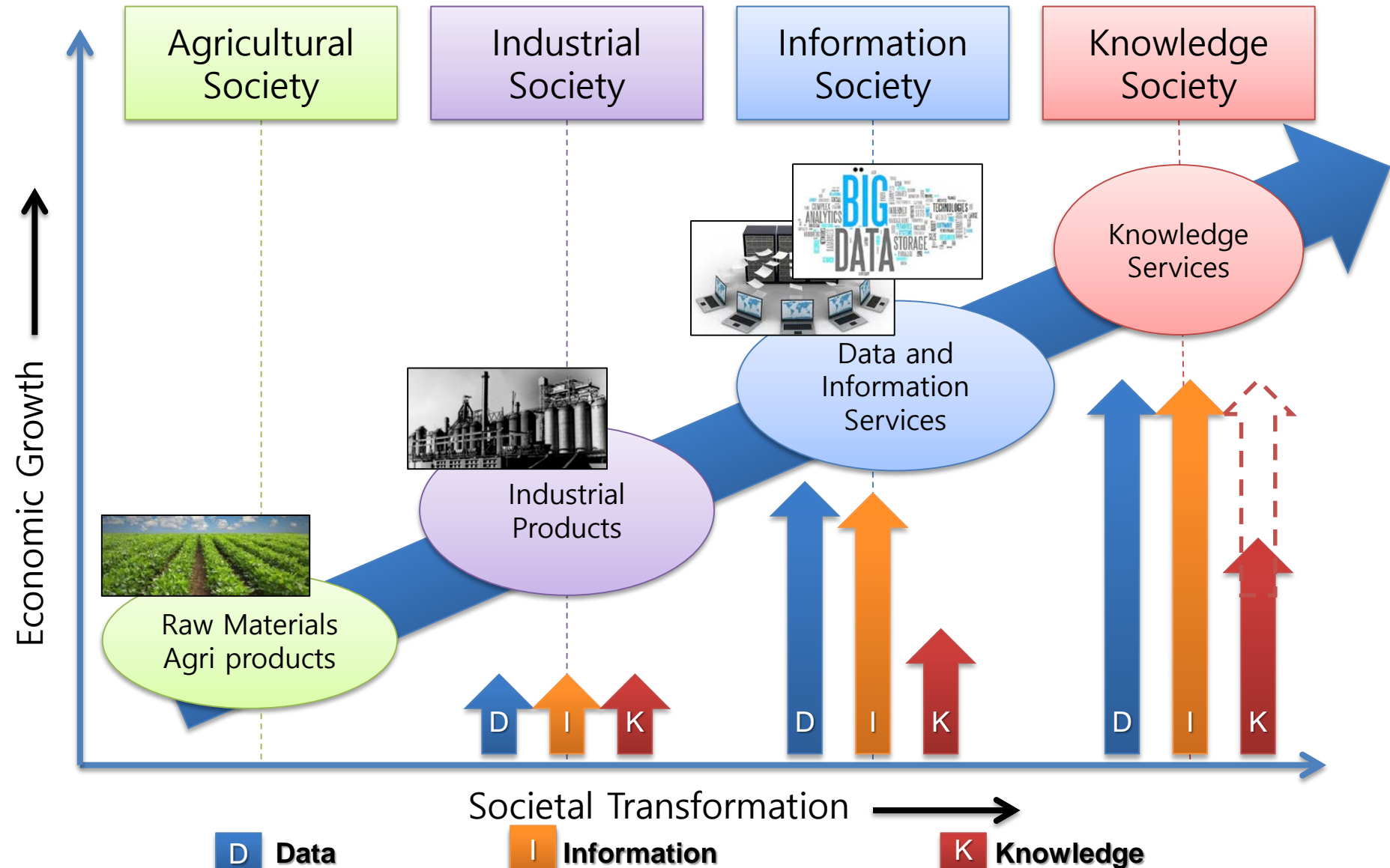


Knowledge Service Platform with Live Knowledge Based System

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University of Tasmania



The Dawn of Knowledge Era



Current Knowledge Service

Examples of current knowledge service



- Most knowledge services use **inactive knowledge**, which is the **knowledge of the people, by the people, for the people**.
- What is **Inactive Knowledge**?
 - ❖ Inactive knowledge (a.k.a explicit knowledge) is the contents have been articulated, codified, and stored in the certain media, such as Article, Figure, Audio, Video.

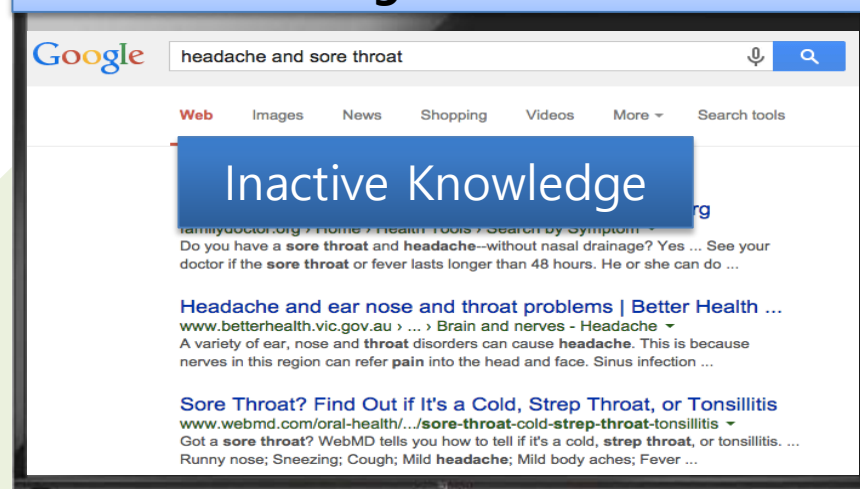
Example of current knowledge service

I have a headache
and a sore throat.
What should I do?

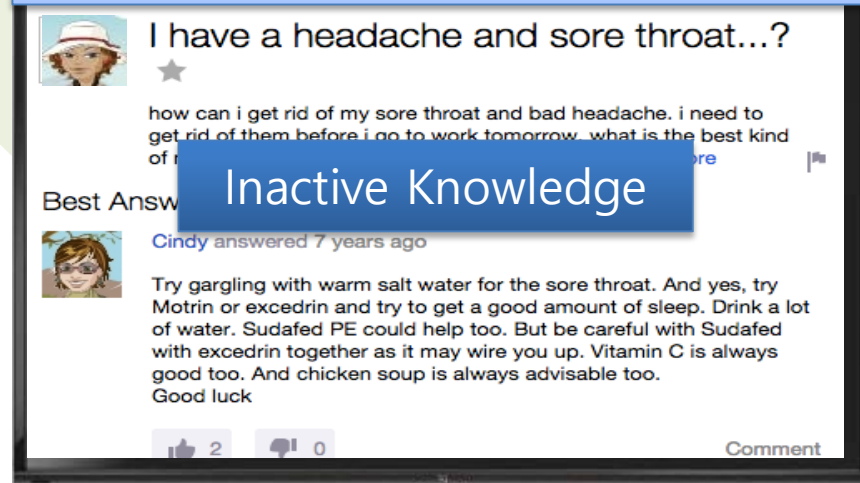
Live Knowledge
in Human

Make a decision

Google Search



Q & A Service



Example of knowledge service

Where is 'Opera House'?
How can I get there?



Required Knowledge:

- Search the location on the map
- Search the path

Data: Number, Name

Information: Latitude, Longitude, Road

Example of knowledge service

Where is 'Opera House'?
How can I get there?



Map Search



Required Knowledge:

- Understand the map
- Search the path

Data: Number, Name

Information: Latitude, Longitude, Road Name

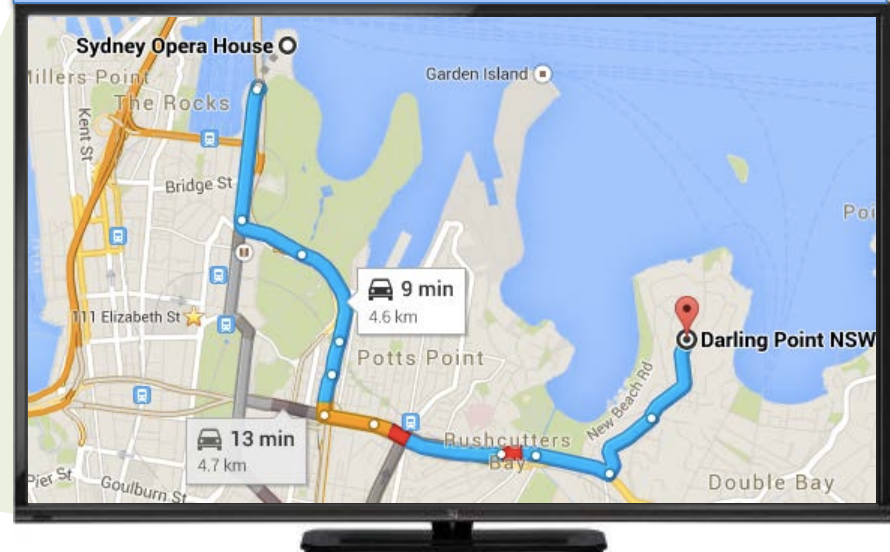
Knowledge: Draw Map, Search Location

Example of knowledge service

Where is 'Opera House'?
How can I get there?



Path Search



Required Knowledge:

- Understand the map
- Understand the path

Data: Number, Name

Information: Latitude, Longitude, Road Name

Knowledge: Draw Map, Search Location, Path Search

Example of knowledge service

Where is "Opera House"?
How can I get there?

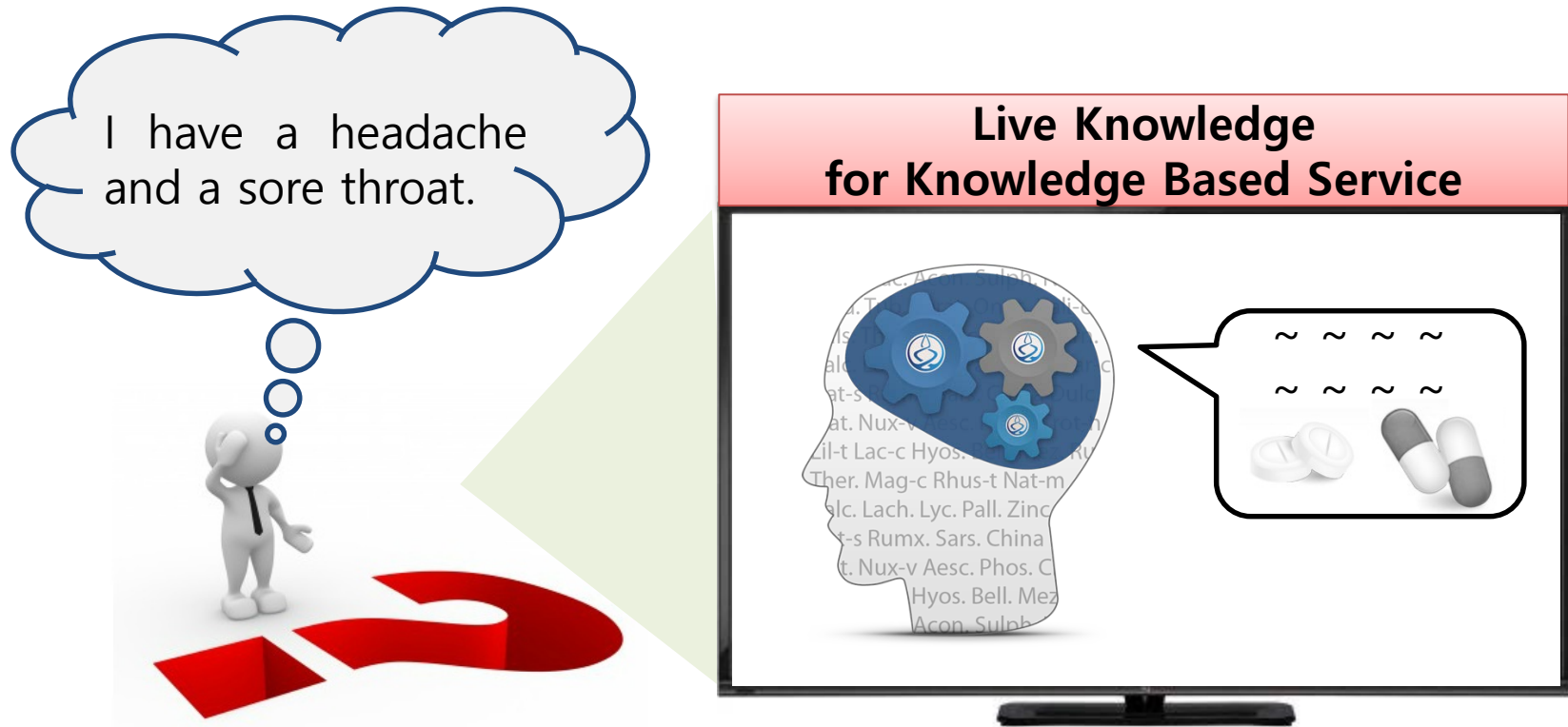


Data: Number, Name

Information: Latitude, Longitude, Road Name

Knowledge: Draw Map, Search Location, Path Search, **Guide appropriate direction and lane (Live Knowledge)**

"Live" Knowledge Based System

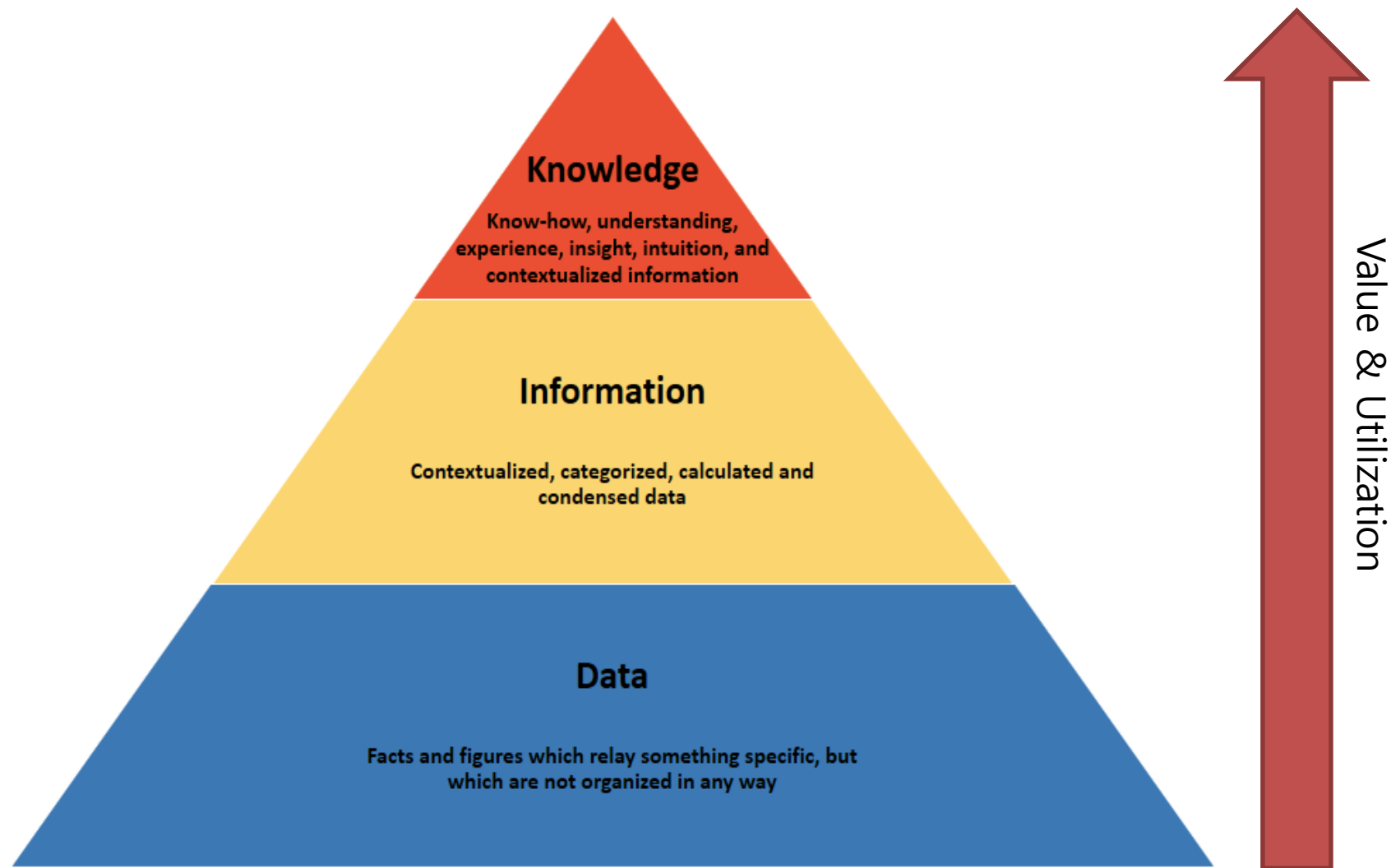


Live Knowledge:

- Knowledge of **computer**
- Knowledge by **computer**
- Knowledge for people

“Live” Knowledge Based System

- “Live” Knowledge System cover the following three layers



“Live” Knowledge Based System

TYPE 1: Knowledge based service in Data Analytics

- Analyses the (big) data in real time and provide the analytics result
- Data analytics techniques (e.g. data integration, data processing)

1
Knowledge
2
Know-how, understanding, experience, insight, intuition, and contextualized information

TYPE 2: Knowledge Based Service in Information

- Stores real-time information knowledge from human expert
- Provides knowledge search service
- Technique: information mining, classification, etc.

Facts and figures which relay something specific, but which are not organized in any way

TYPE 3: Knowledge based Service in experiential knowledge

- Acquires knowledge from data or human experts in real time
- Provides computer-based knowledge service
- Technique: expert system

Utilization

What is the “Knowledge”?

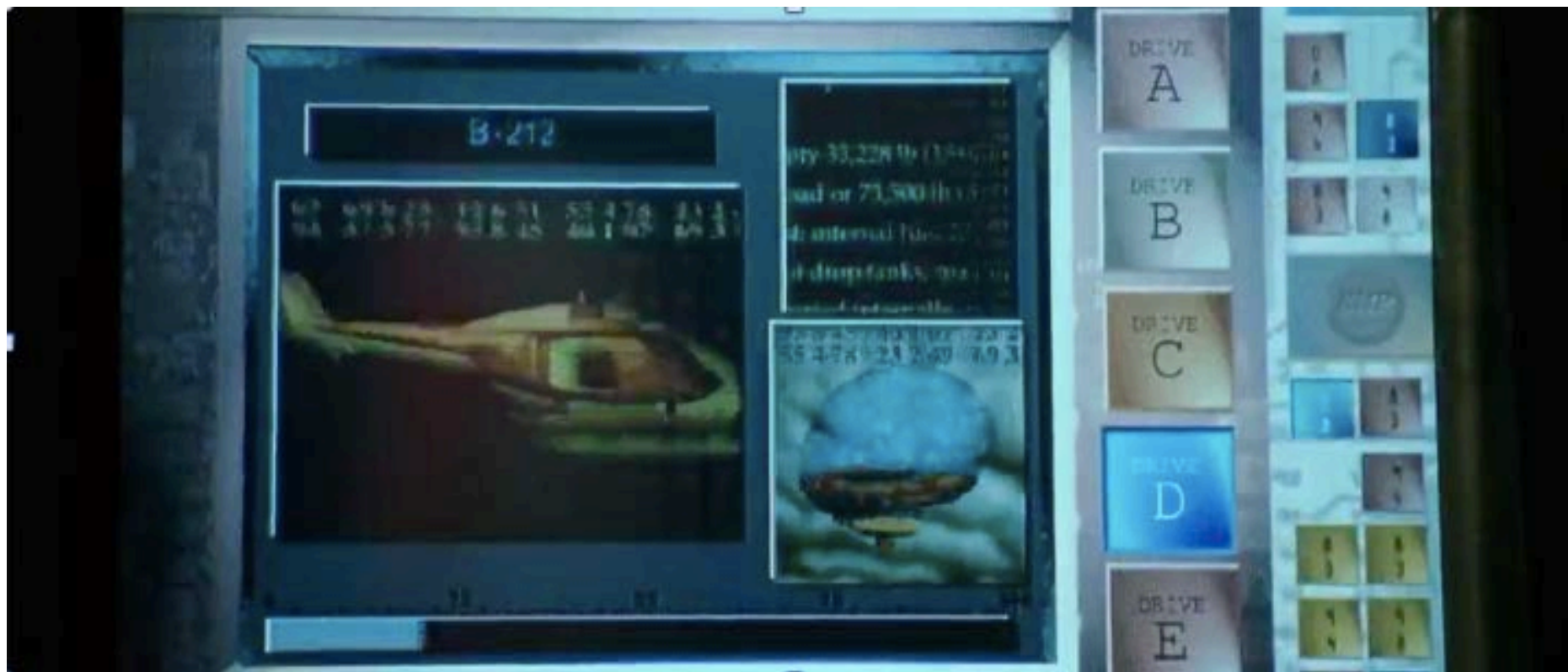


Experiential Knowledge

- Personal, subjective & affective
- Gained through direct encounter, which are the seeds of experiential knowledge, tacit
- Loaded with personal (often experiential) meanings



What is the “Knowledge”?



Experiential Knowledge

- Personal, subjective & affective
- Gained through direct encounter, which are the seeds of experiential knowledge, tacit
- Loaded with personal (often experiential) meanings



“Live” Knowledge based System

- Traditional “Live” Knowledge based system are made by machine learning or expert system but **those approaches are not successful**
- “Live” Knowledge based system processed with **experiential knowledge** (Difficult to acquire and maintain).

- “Live” Knowledge based system process:

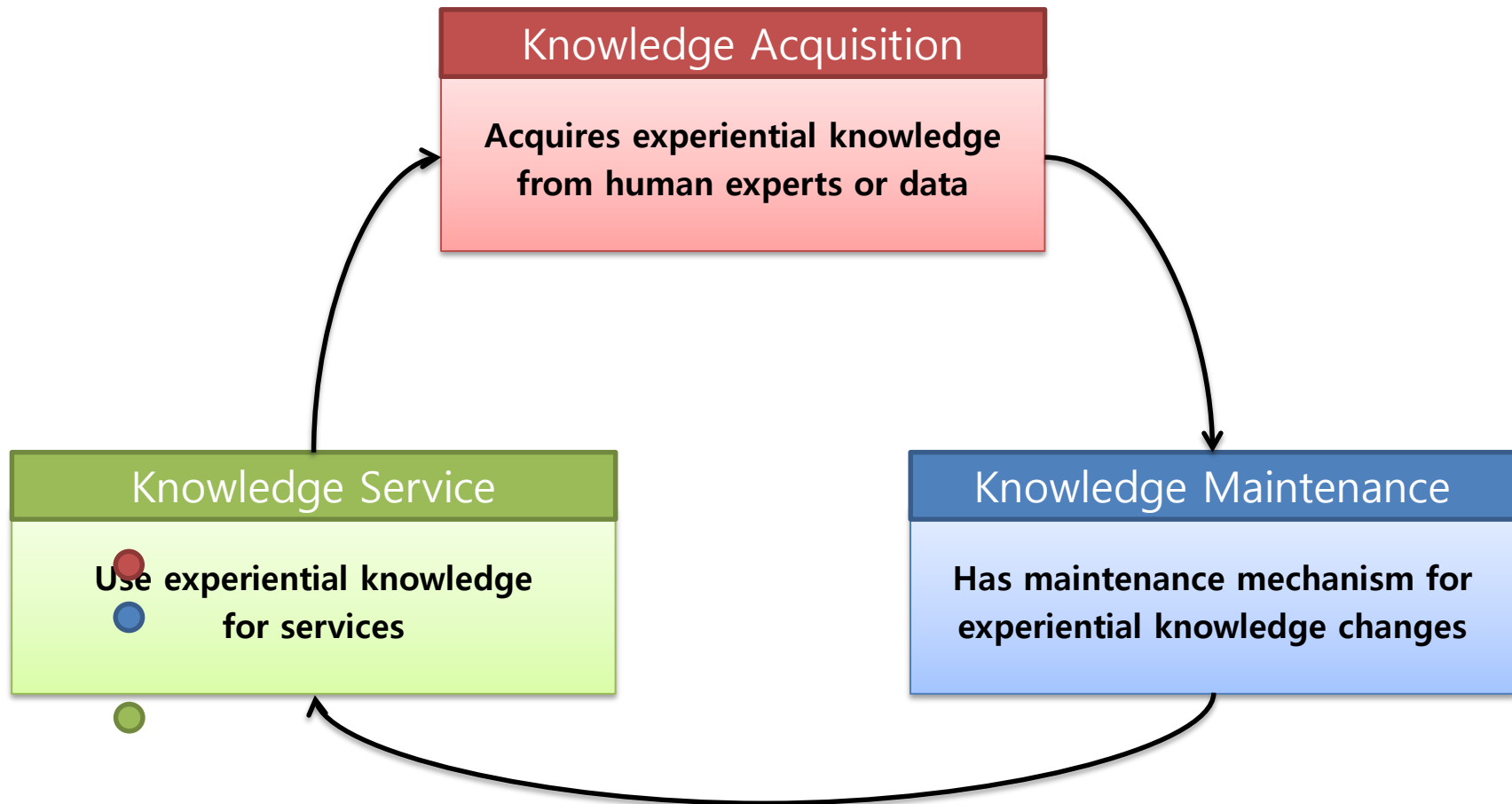
Experiential Knowledge

- Personal, subjective & affective
- Gained through direct encounter, which are the seeds of experiential knowledge, tacit
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“Live” Knowledge Based System

- Traditional “Live” Knowledge Based Systems were proposed with **machine learning** and **expert system** in the following manner:

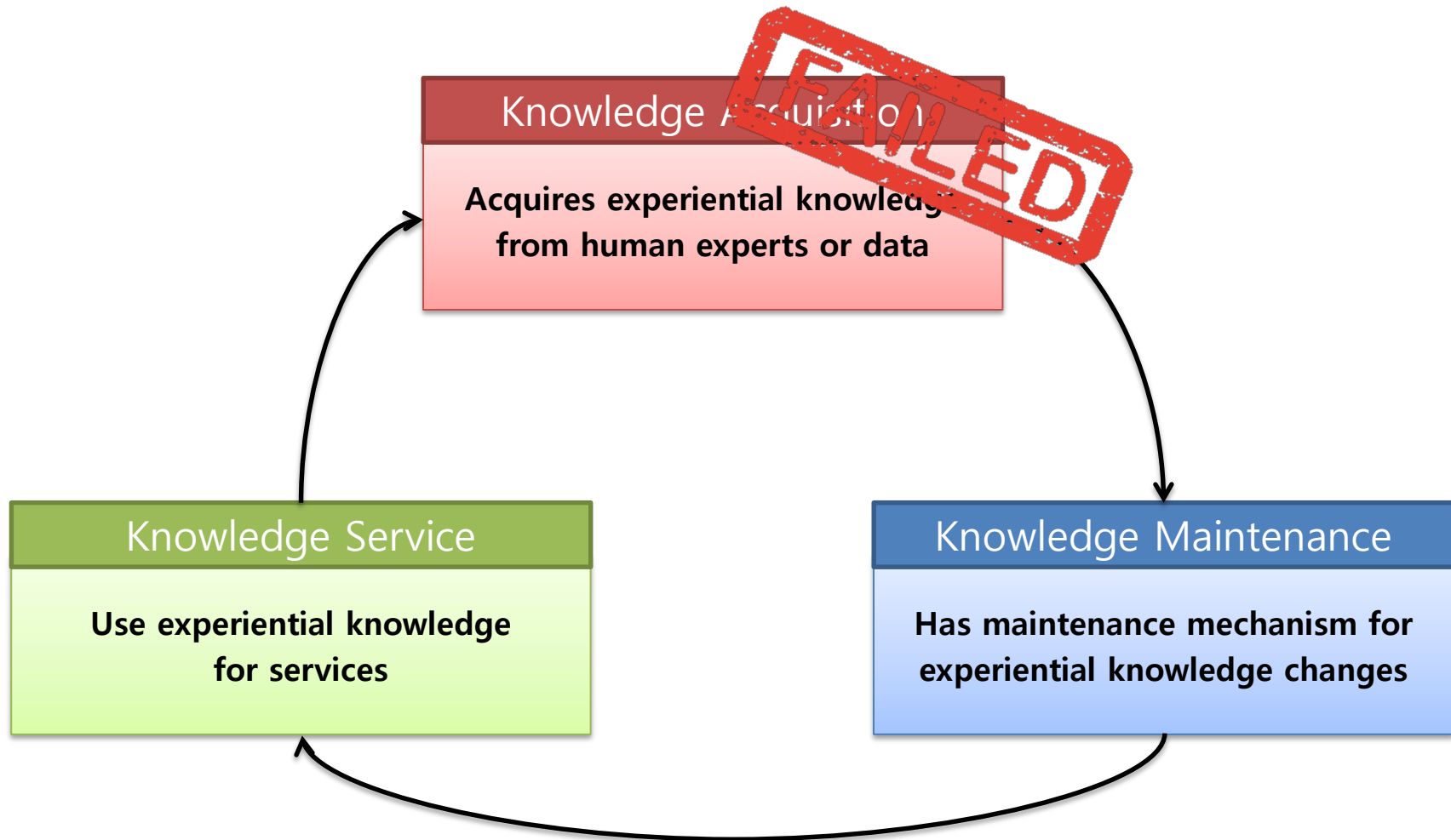


LKBS: Knowledge Acquisition

- Acquires experiential knowledge from human experts or data
- Two conventional LKBS approaches
 1. Machine Learning
 2. Expert System (human expert – knowledge engineer)

| | Knowledge Acquisition Process | Limitation |
|--|--|---|
| Machine Learning | <ol style="list-style-type: none">1. Collect and select the cases2. Labelled dataset3. Extract the pattern (knowledge) | Difficult to acquire the clear and appropriate knowledge |
| Expert System (Engineer and Expert) | <ol style="list-style-type: none">1. Human expert provides knowledge2. Knowledge Engineer put the knowledge into knowledgebase | Difficult to acquire the knowledge if the size is too large for human engineer and expert |

LKBS: Knowledge Acquisition

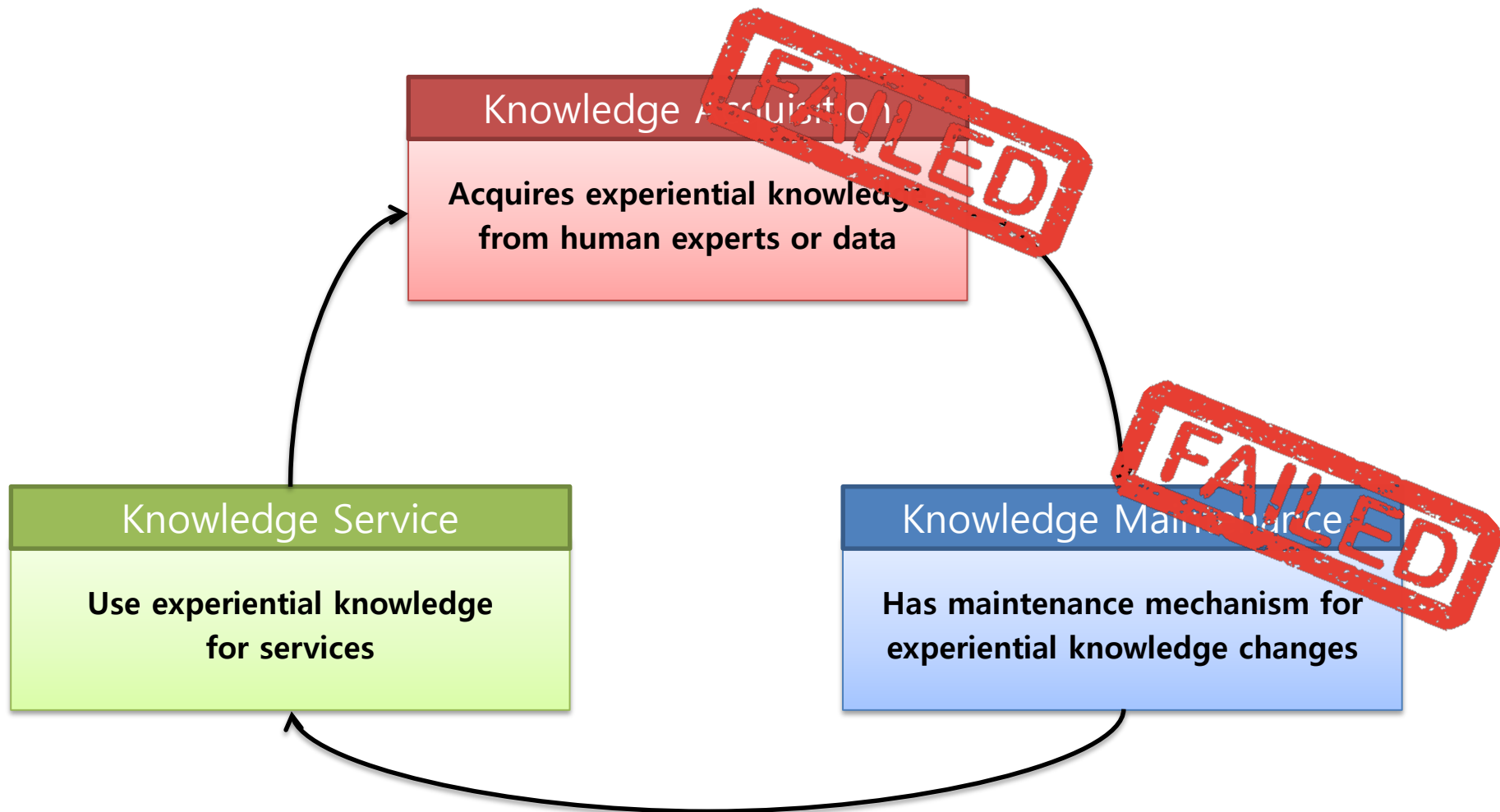


LKBS: Knowledge Maintenance

- Has maintenance mechanism for experiential knowledge changes
- Machine learning and expert system approaches **have limitations** in maintaining the knowledge base

| | Knowledge Maintenance Process | Limitation |
|--|--|--|
| Machine Learning | If the knowledge base are required to maintain, the machine learning model should be initialized and rebuilt | It is required to reengineering whole structure of machine learning model every sing time to maintain the knowledge |
| Expert System (Engineer and Expert) | Human expert asks knowledge engineer to update the knowledge base | The human expert should receive help from knowledge engineers to manage the knowledge base. |

LKBS: Knowledge Maintenance

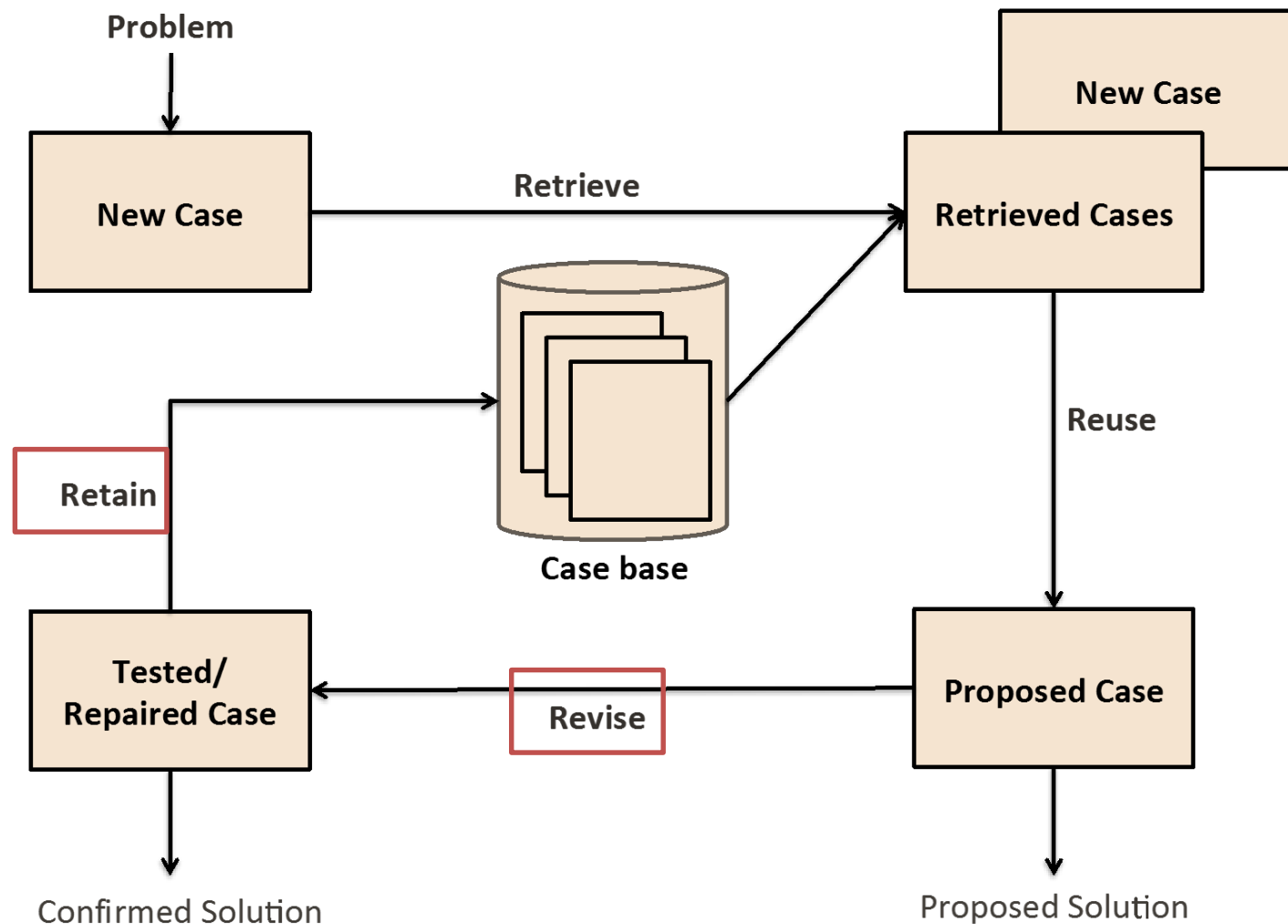


Solution for Main-tenable LKBS

- Expert Systems and machine learning systems have limitation in their knowledge maintenance mechanism. There are two approaches (case-based reasoning and ripple down rules) that **supports the knowledge maintenance mechanism**
- **Case Based Reasoning**
 - ❖ the process of solving new problems based on the solutions of similar past problems
- **Ripple Down Rules**
 - ❖ An incremental knowledge acquisition technique which enables human experts to maintain the knowledge base by themselves without any knowledge engineering technologies.

Main-tenable LKBS: Case Base Reasoning

- Case Based Reasoning



Main-tenable LKBS: Ripple Down Rules

- RDR uses standard rules as knowledge representation scheme.

IF antecedent THEN actions

- **The experts do not create rules without evidence**
 - ❖ Rather they look at each case and its inference result, and create rules to correct wrong inference result.
- **New rule become an exception of the wrongly fired rule (rules).**
 - ❖ **To keep this semantic, RDR adds new rule with the last fired rule information or each rule has its exception rule information.**
- RDR make each rule to fire only one time and the rules are evaluated in strict order from the oldest to the newest.

Main-tenable LKBS: Ripple Down Rules

- Knowledge Acquisition and Maintenance with Ripple Down Rules
 - ❖ A rule is added when the current knowledge base suggest **wrong conclusion** or **null conclusion**.
 - ❖ Each rule can have **exception rule** and **alternative rule**
→ result in a fixed KB structure
- New rule should be acquired:

| Situation | New rule location |
|--|---|
| If the current knowledge base provides no classification | Add new rule at the bottom of the root rule's decision list |
| If the current knowledge base provides wrong classification | Add new rule as the childe of the current fired rule(rules) |
| If the current knowledge base provides correct conclusion, but the expert wish to create alternative conclusion (for multiple classification). | Add new rule at the bottom of the decision list/s that the current fired rule/s |

Advantage of RDR-based LKBS

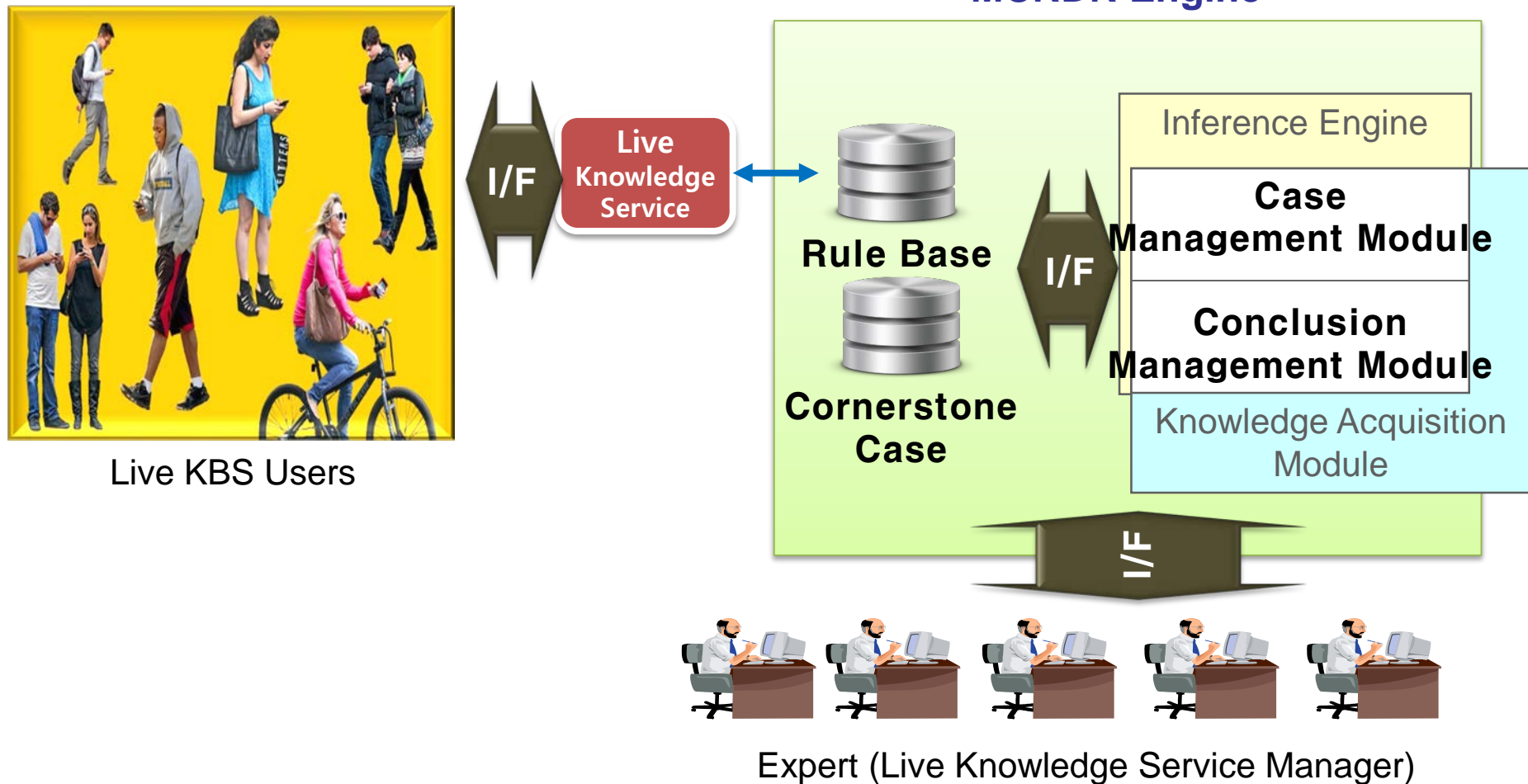
New concept of
cognitive science
based knowledge
acquisition system

- Incremental knowledge acquisition
- Case based reasoning: knowledge from experience
- Solution of knowledge acquisition bottleneck problem: remove the role of knowledge engineer

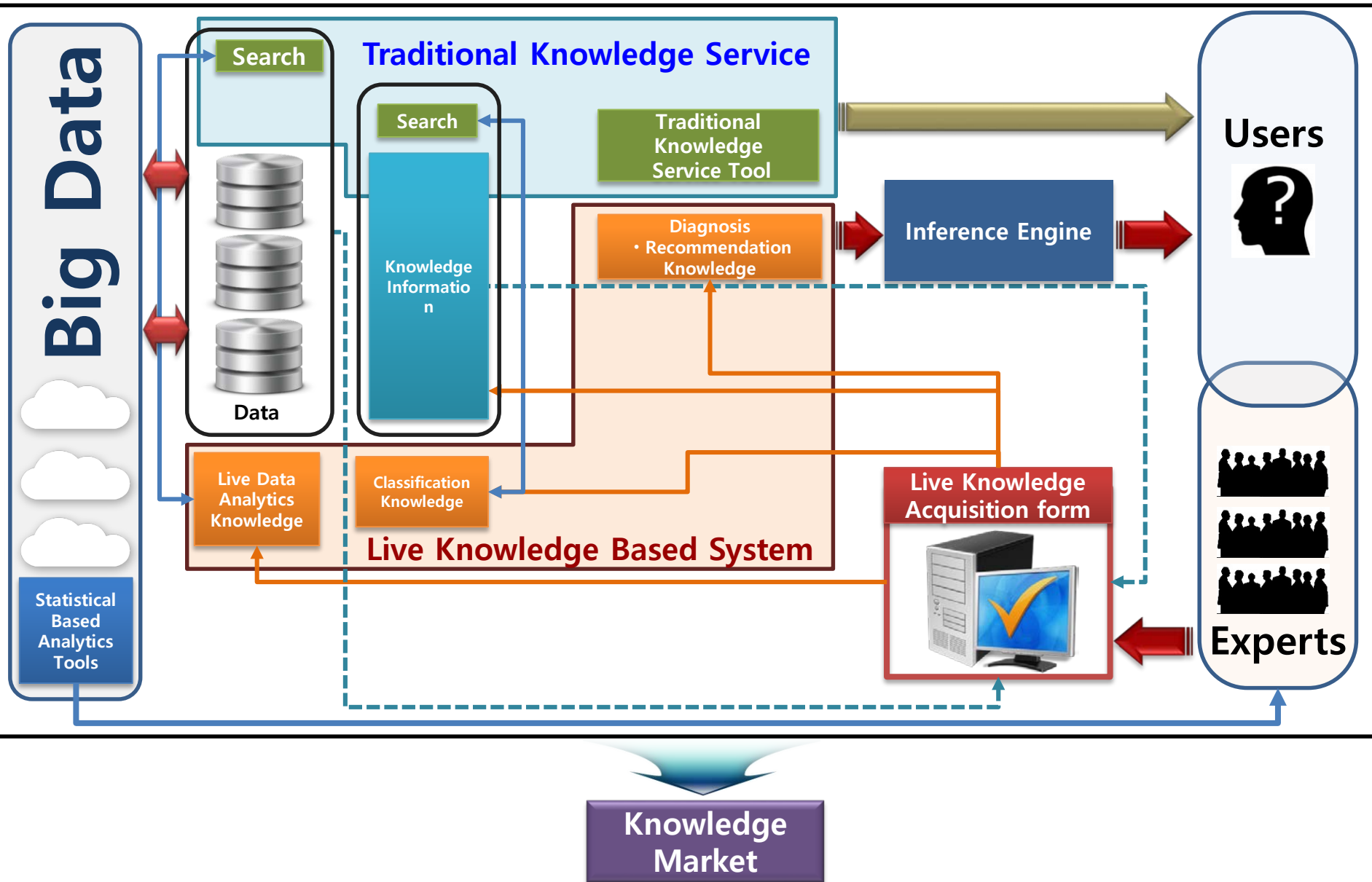
RDR-based
commercial
knowledge based
system

- Commercial application- Pathology
 - About 30% of Australian pathology laboratories as well as laboratories in the US and Europe use a commercial version of RDR.
- Other applications
 - RDR-based solution for converting product descriptions to standard ontologies for Tesco
 - Safety management, document classification.....

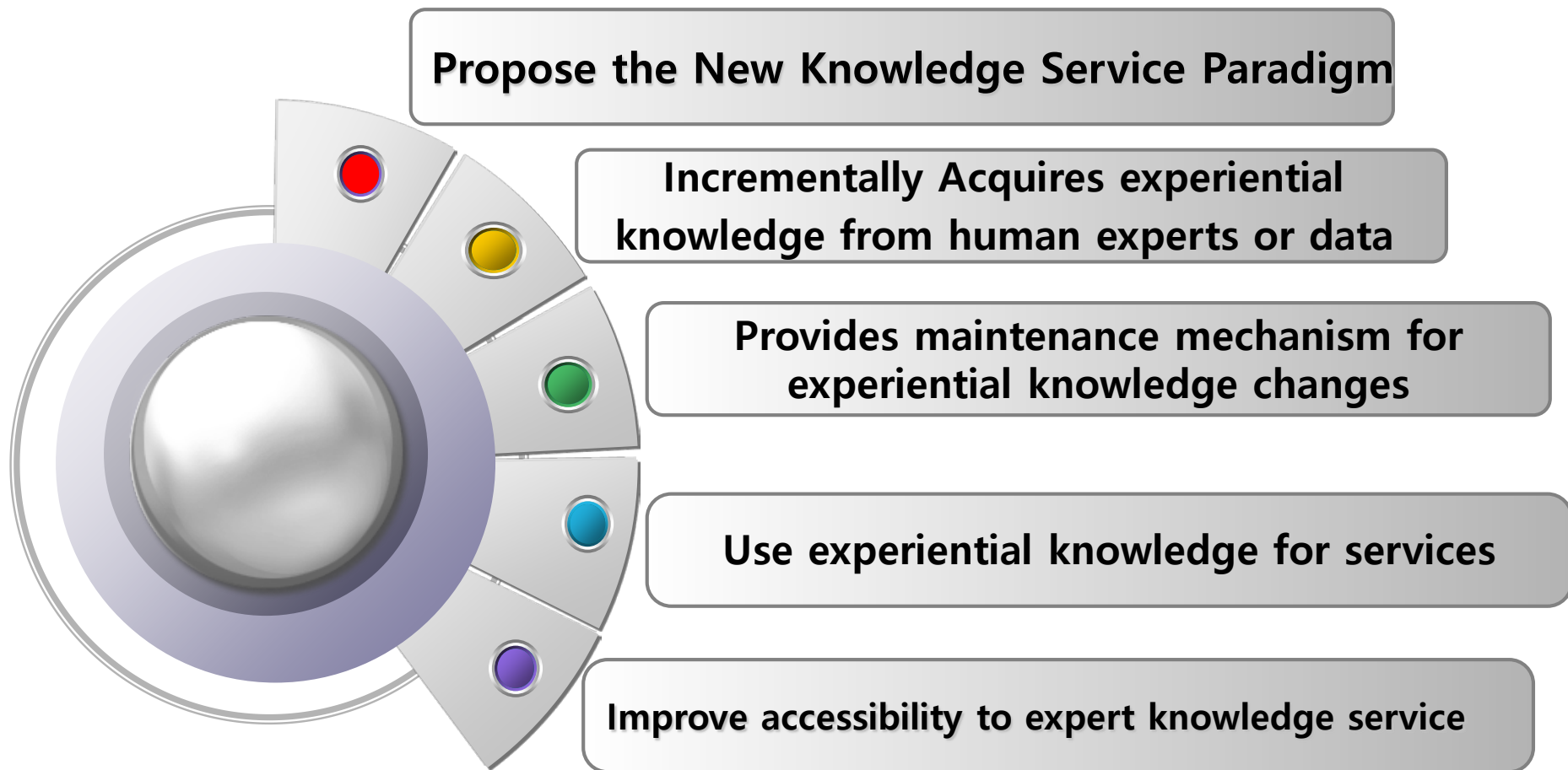
What can RDR do in LKBS?



Live Knowledge Based Platform (RDR-based)



Conclusion



Thank you!

