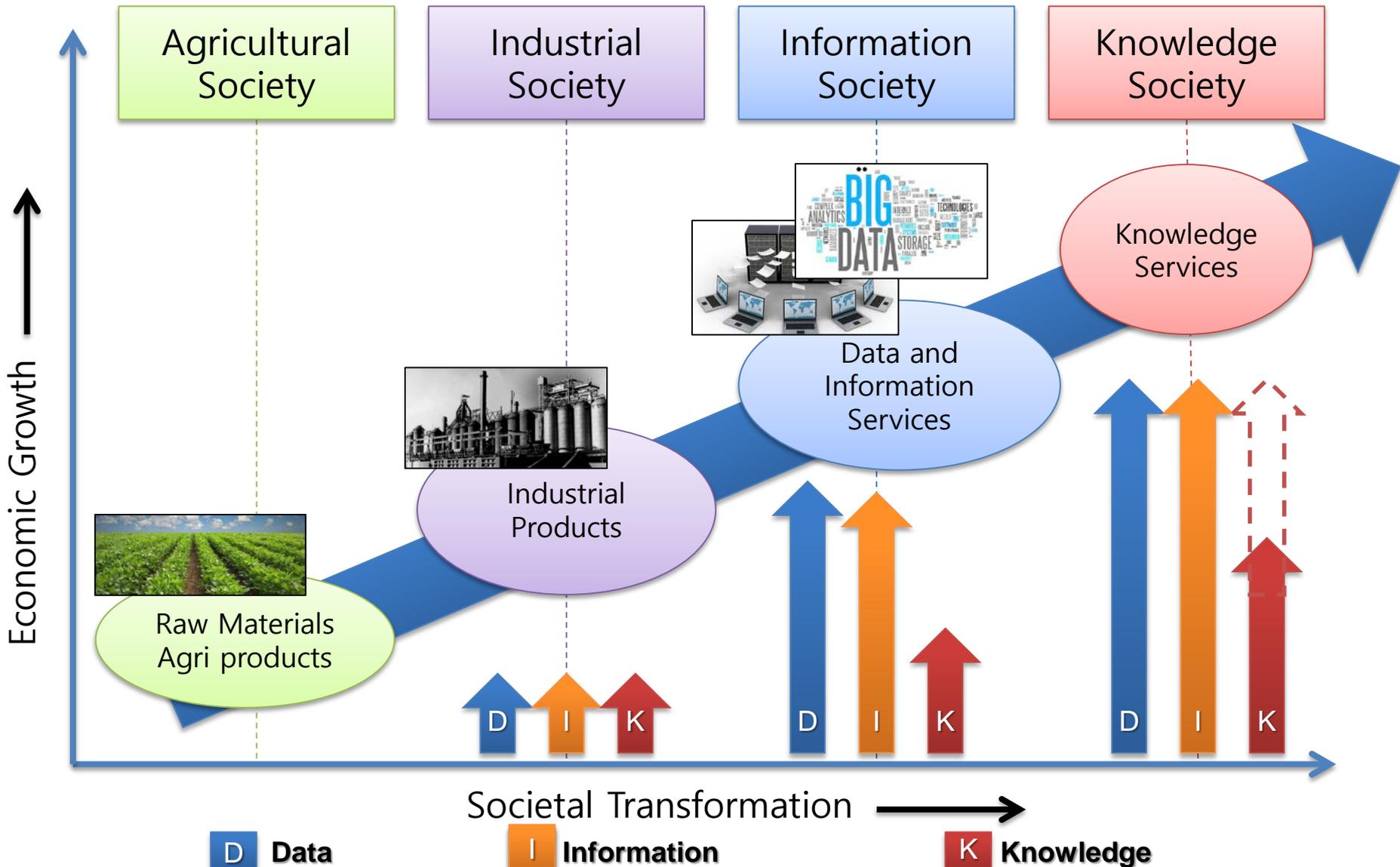


Knowledge Service Platform with Live Knowledge Based System

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The Dawn of Knowledge Era



Current Knowledge Service

Examples of current knowledge service



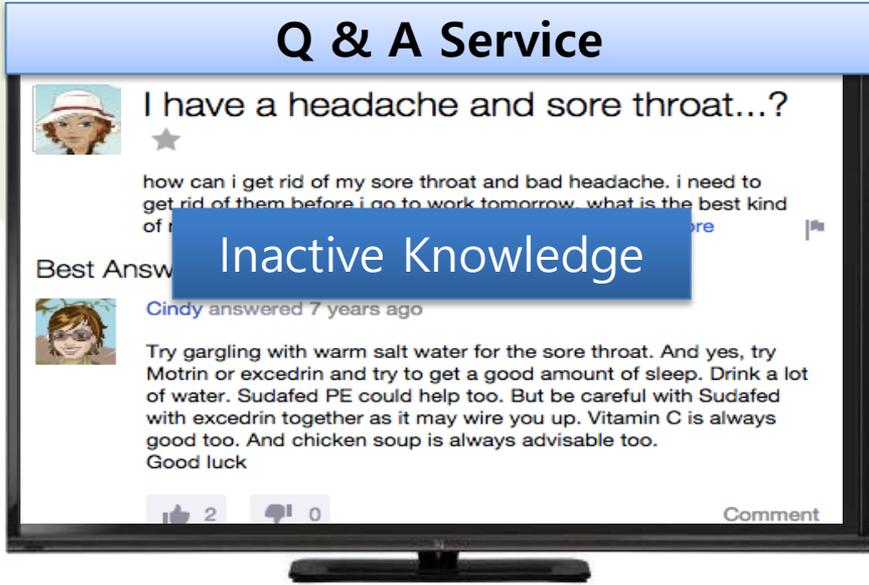
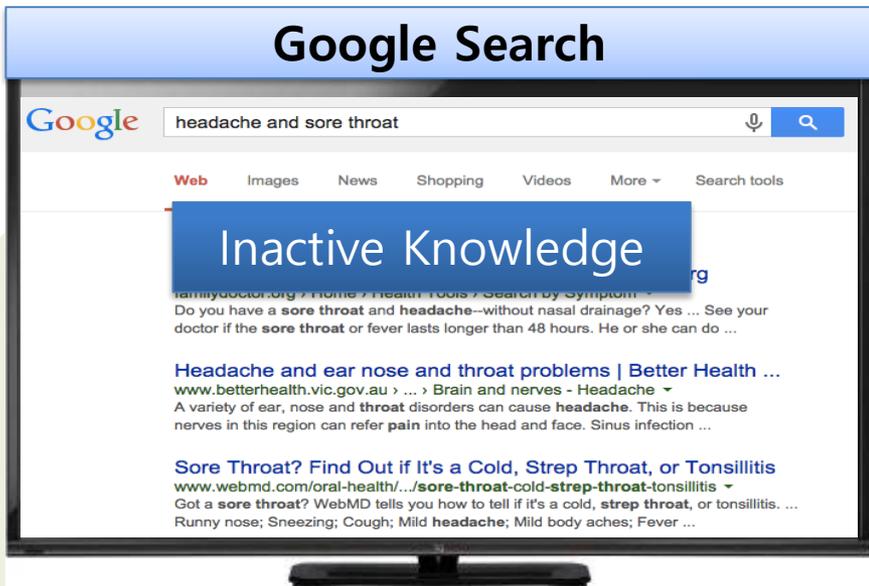
- Most knowledge services use **inactive knowledge**, which is the **knowledge of the people, by the people, for the people**.
- What is **Inactive Knowledge**?
 - ❖ Inactive knowledge (a.k.a explicit knowledge) is the contents have been articulated, codified, and stored in the certain media, such as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

Example of current knowledge service

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



Make a decision



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?

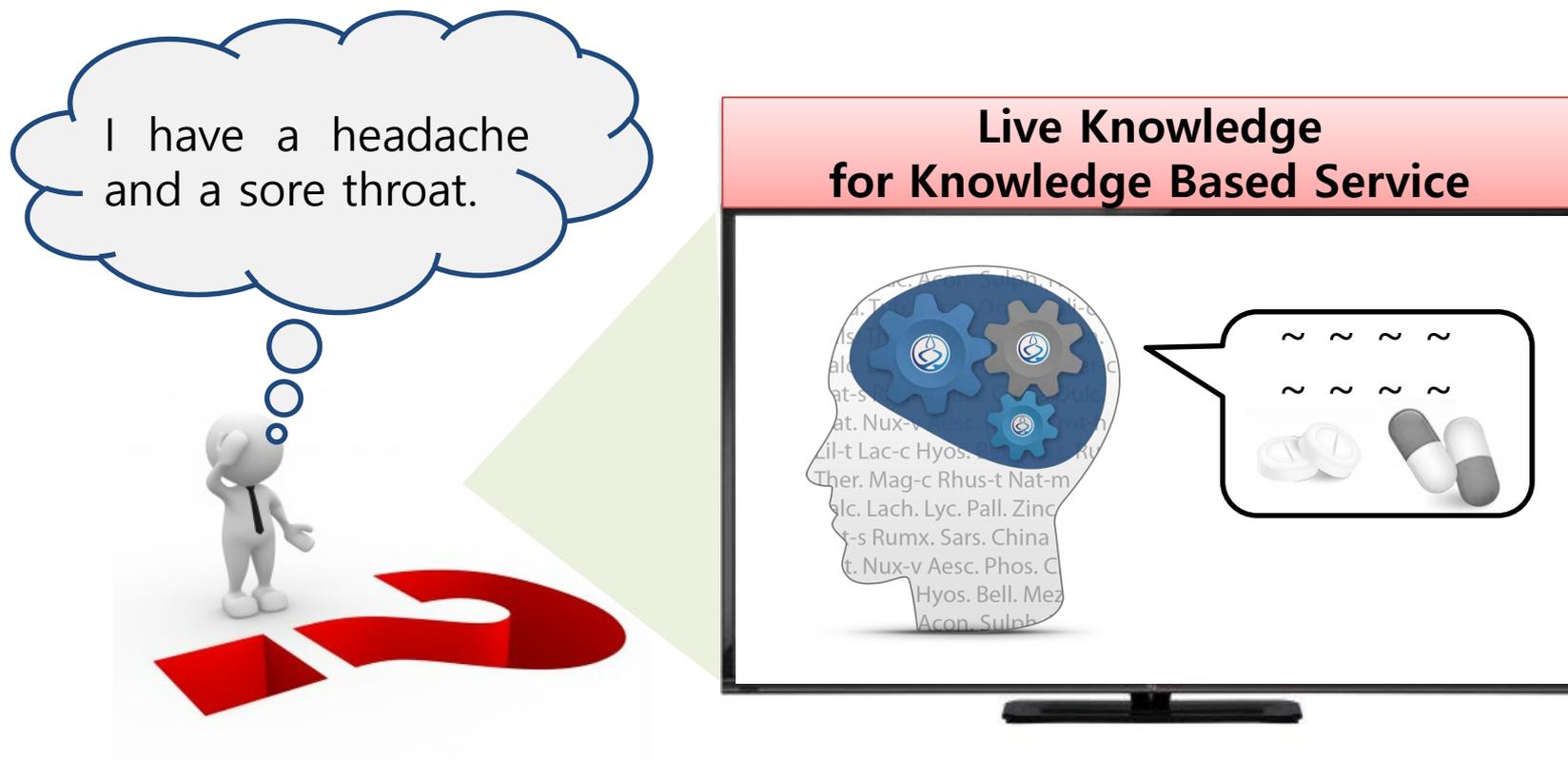


Data: Number, Name

Information: Latitude, Longitude, Road Name

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

"Live" Knowledge Based System

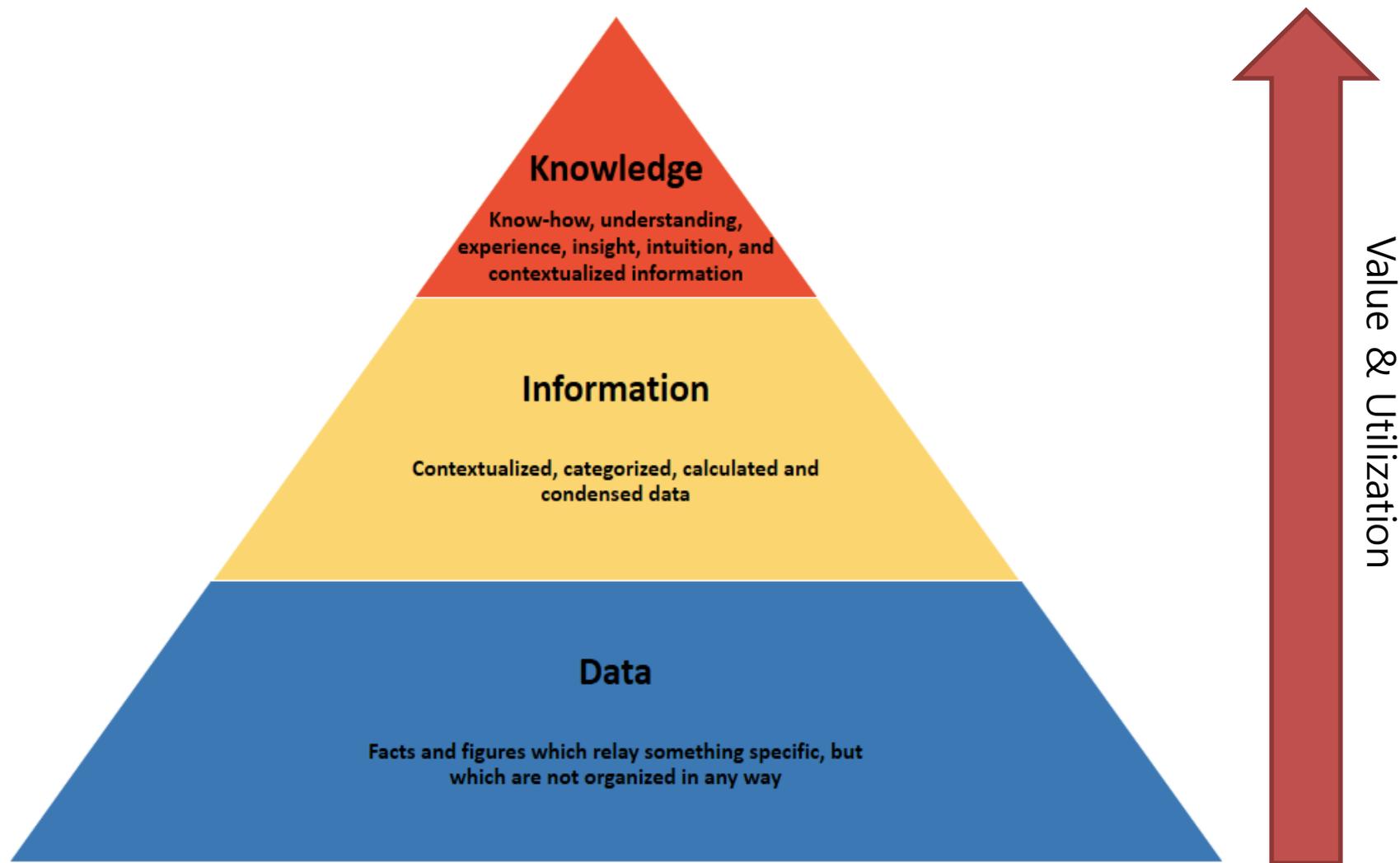


Live Knowledge:

- 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

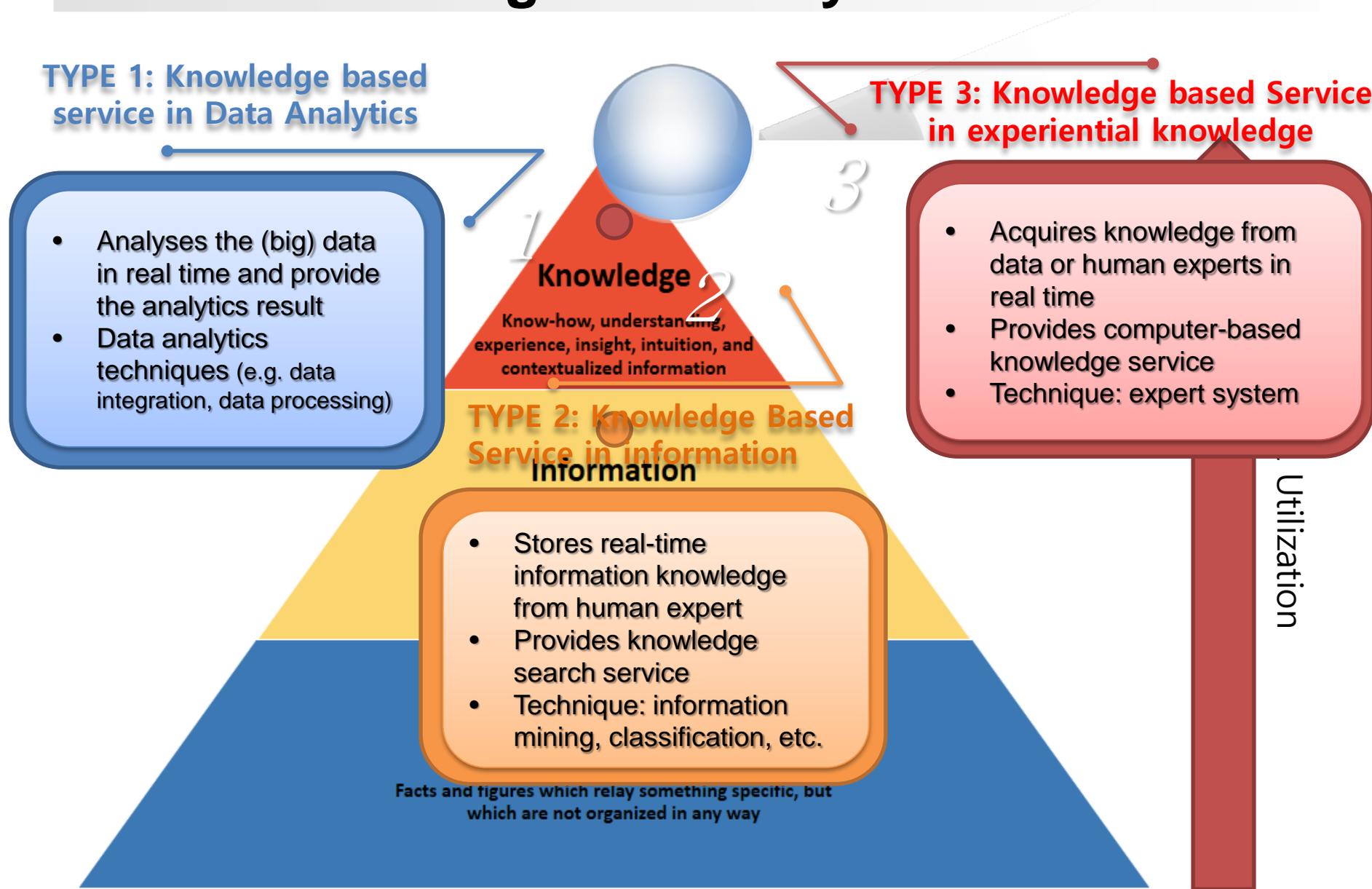
- Stores real-time information knowledge from human expert
- Provides knowledge search service
- Technique: information mining, classification, etc.

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”?

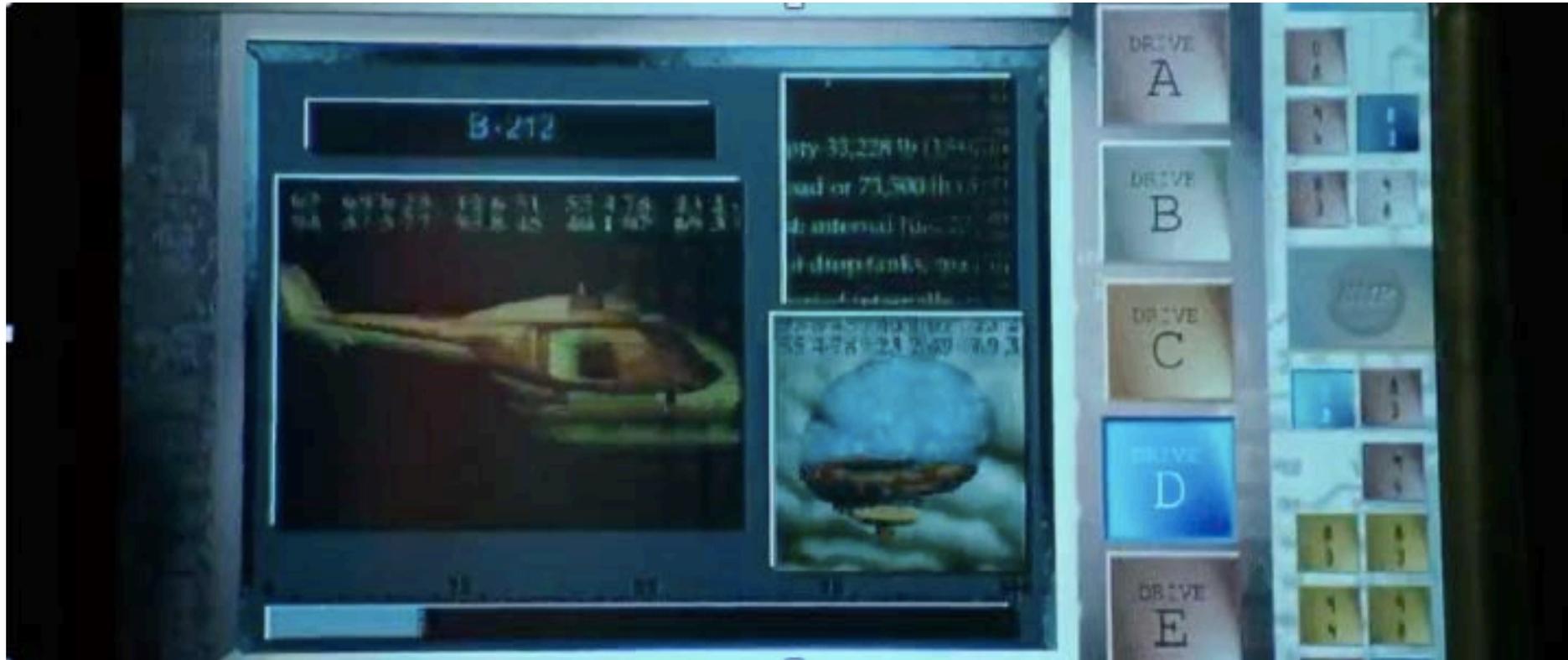


Experiential Knowledge

- 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

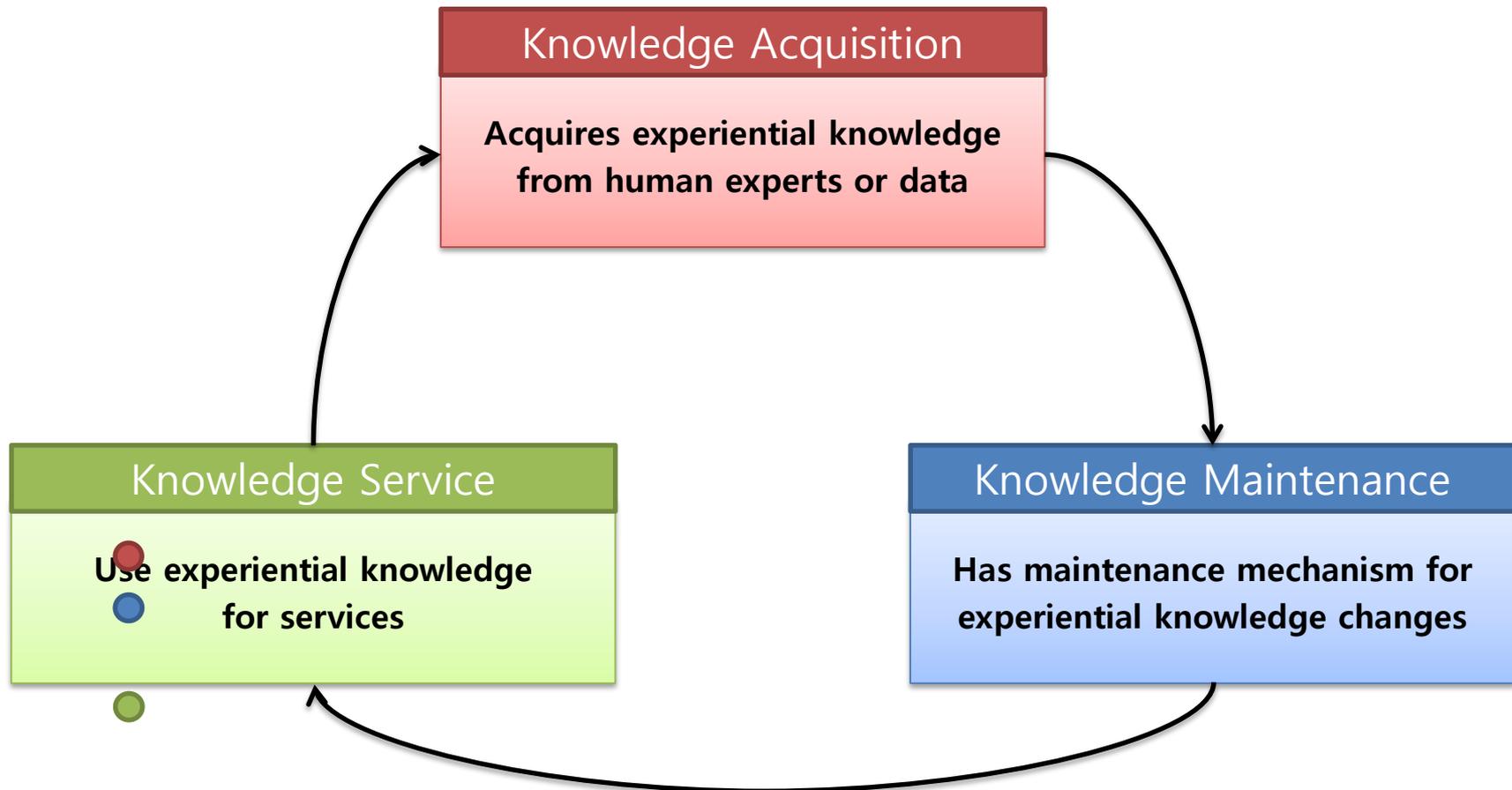
- Personal, subjective & affective
- Gained through direct encounter, which are the seeds of experiential knowledge, tacit
- Loaded with personal (often experiential) meanings



data in real time
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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:

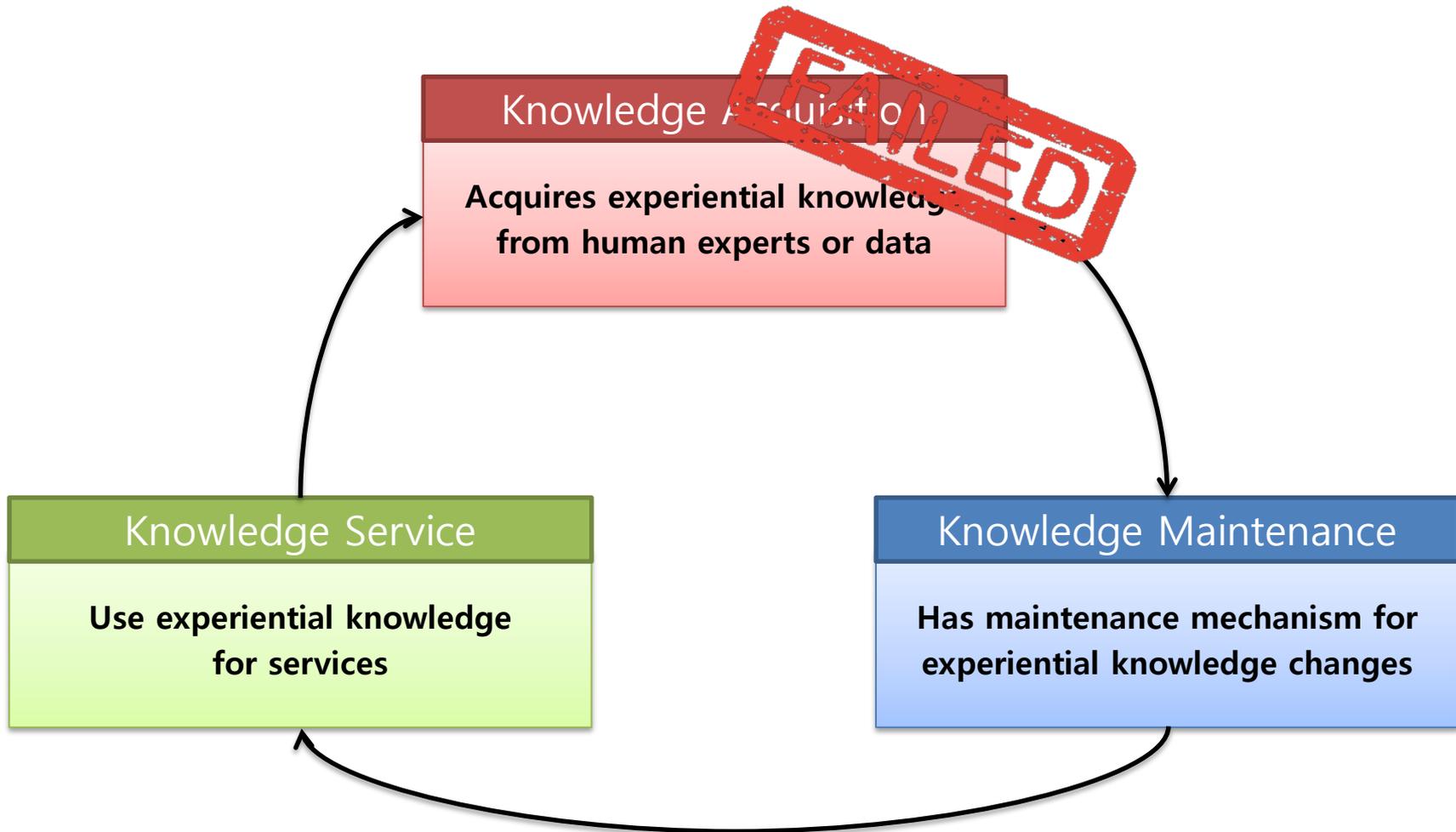


LKBS: Knowledge Acquisition

- 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 cases 2. Labelled dataset 3. 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 knowledge 2. 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

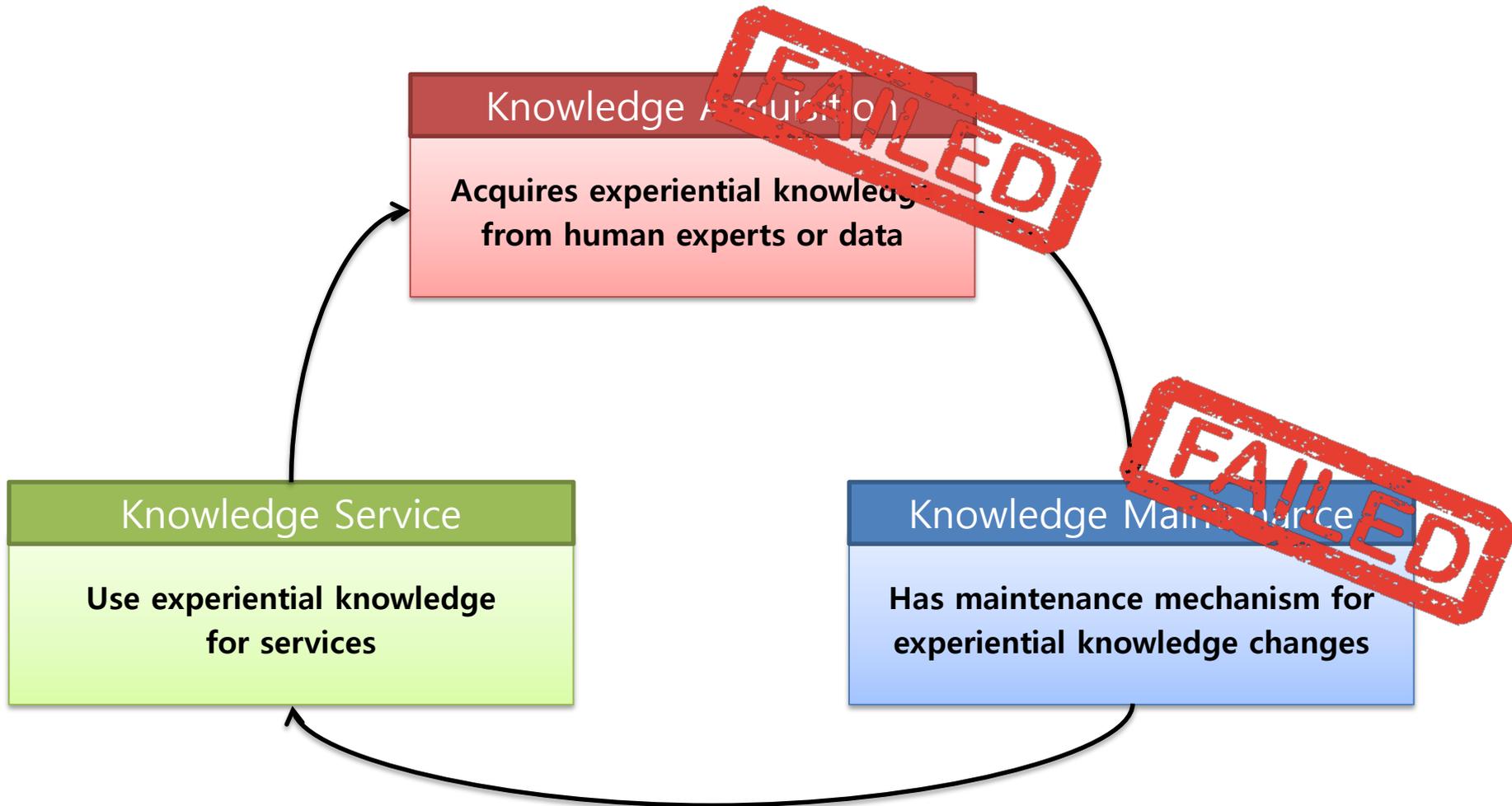


LKBS: Knowledge Maintenance

- 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

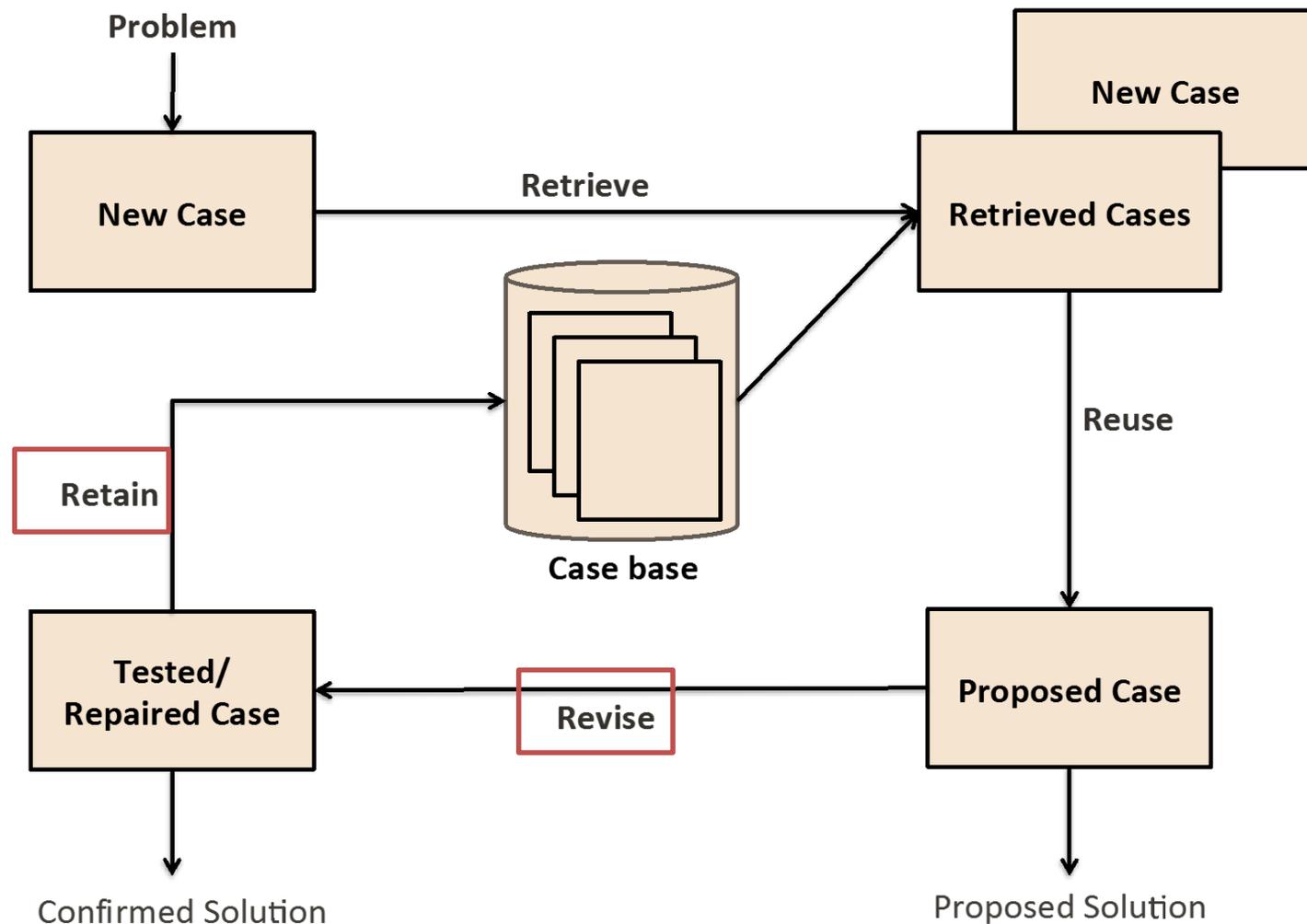


Solution for Main-tenable LKBS

- 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

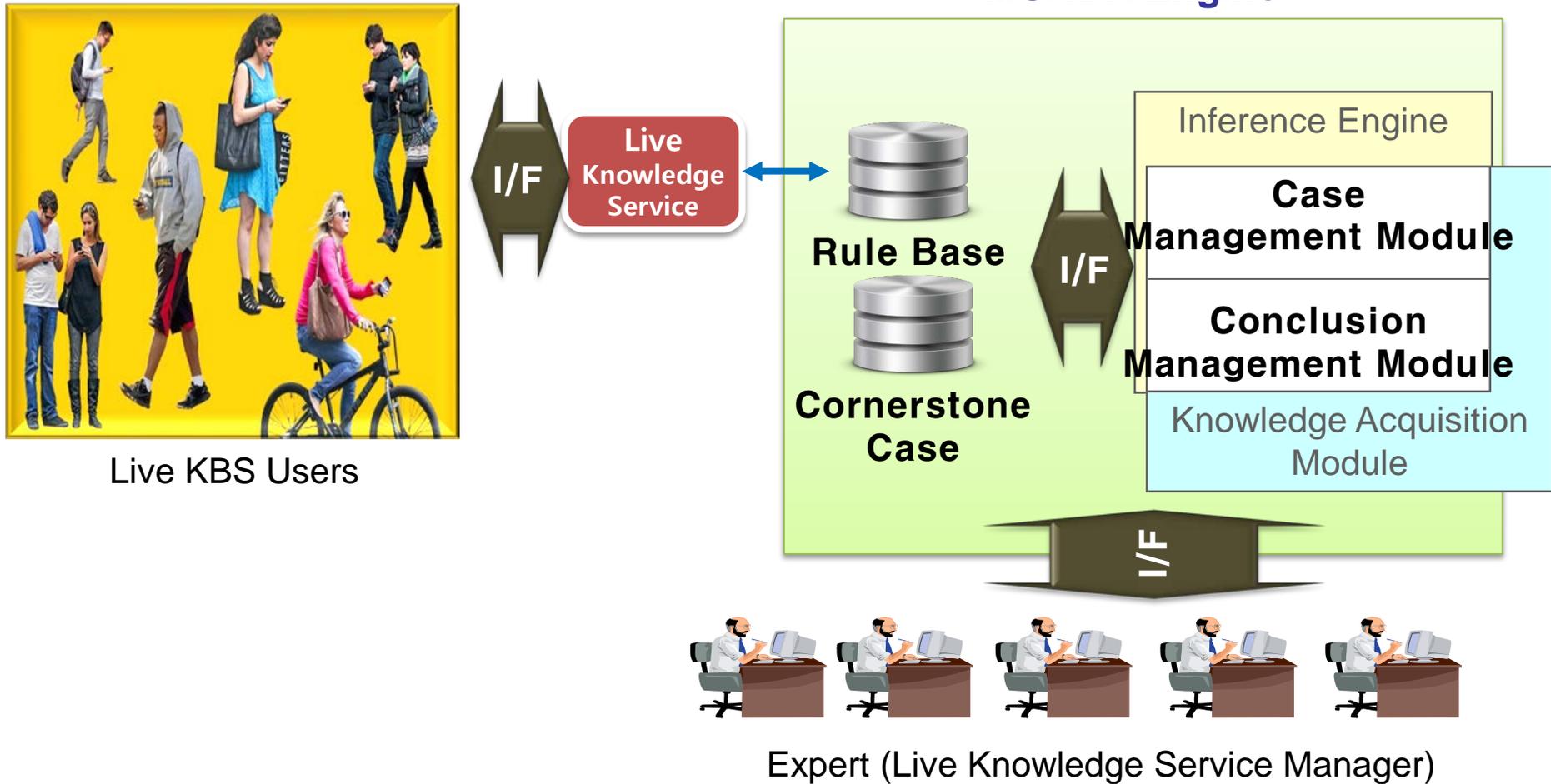
New concept of cognitive science based knowledge acquisition system

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

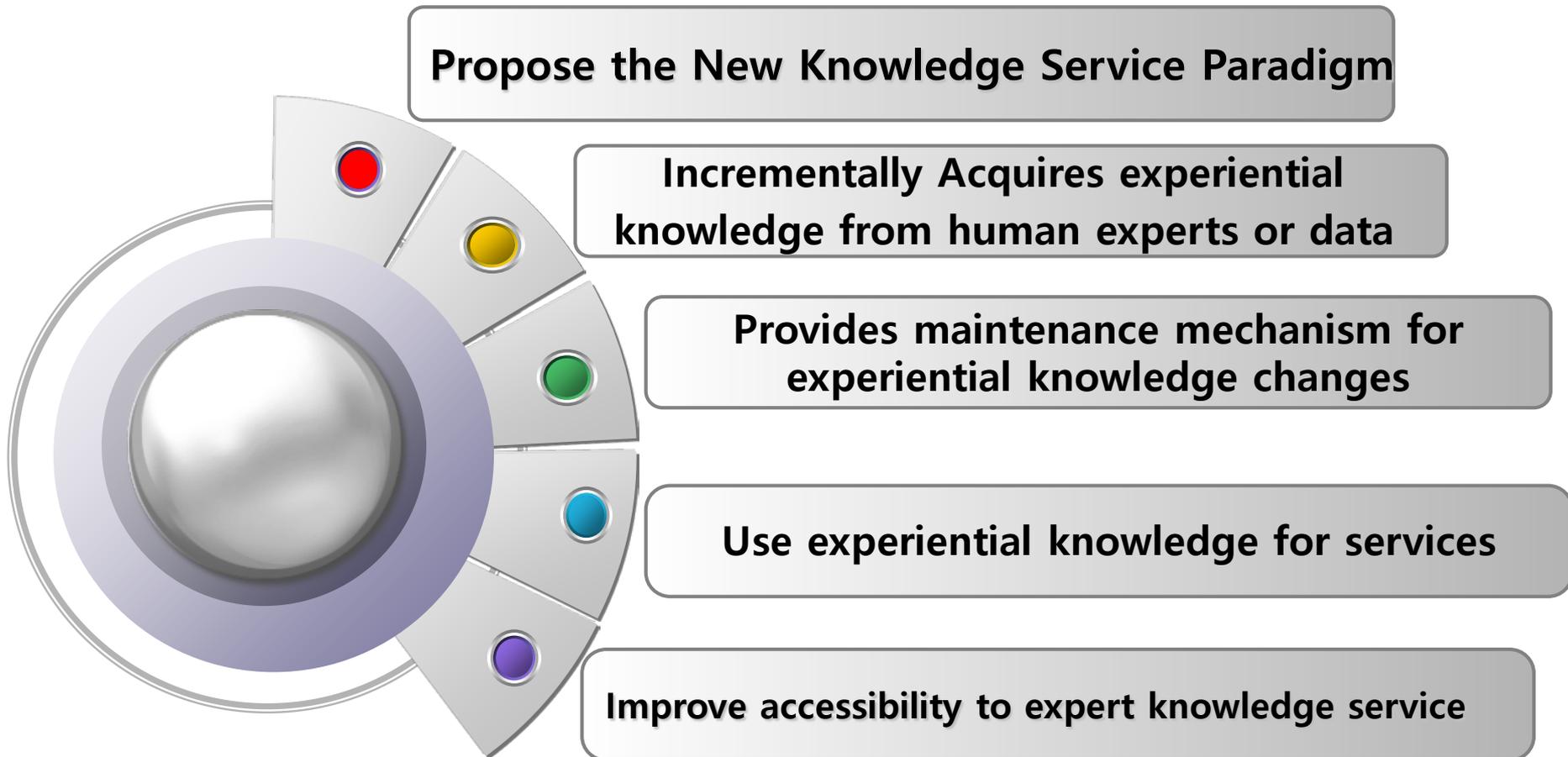
RDR-based commercial knowledge based system

- 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?



Conclusion



Thank you!

