

Construction of a Knowledge Map-based System for Personalized Second Language Learning

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Introduction & Problem Statement

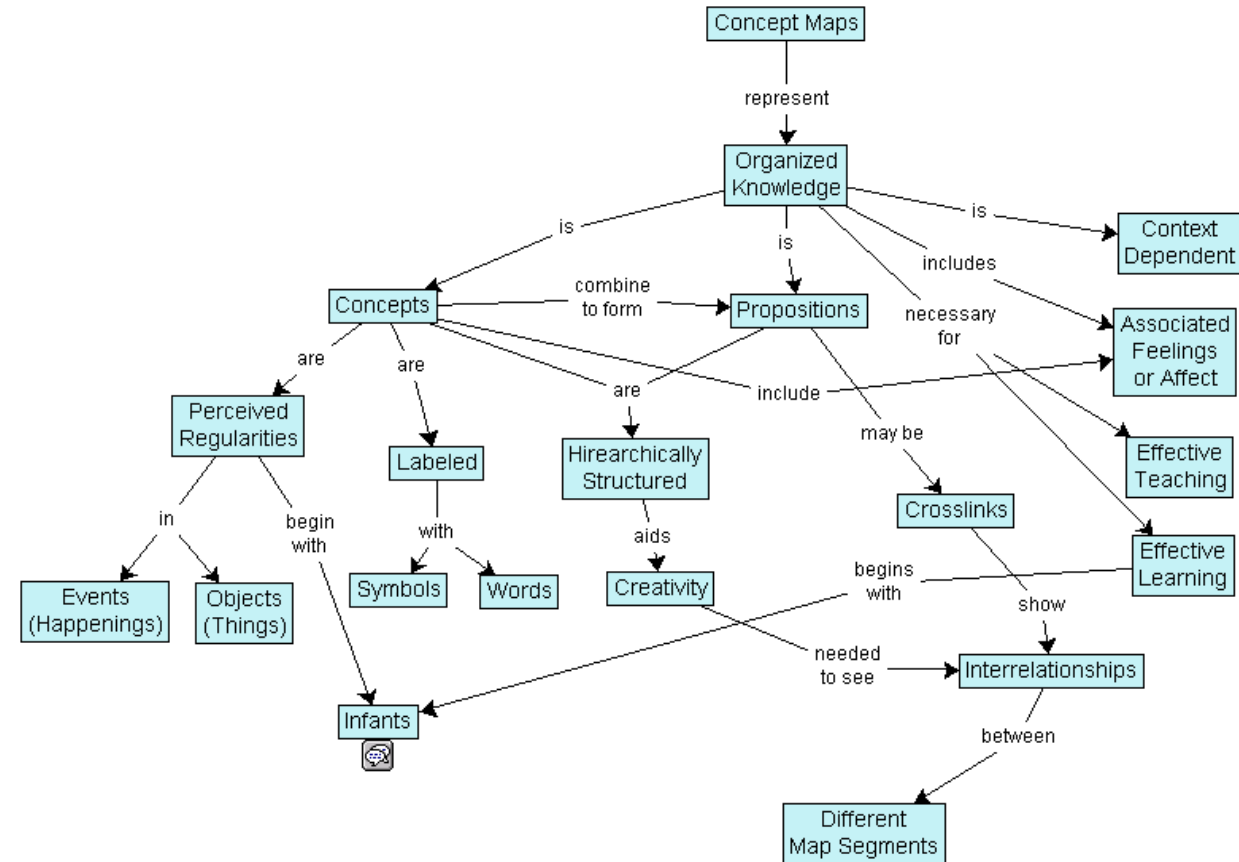
- Numerous Intelligent Computer-Assisted Language Learning (ICALL) and Intelligent Tutoring Systems (ITS) have been developed
- 1) Slavuj [1] says that ITS are “overrestricting the learning domain” and “focus on a single linguistic skill”
- 2) Slavuj: “an inability of an ITS to cater for learners with different levels of language proficiency”
- 3) Each system maintains its own domain and user modeling that is not exportable to another system
- RQ: how to model a L2 learner’s knowledge in a sufficiently fine-grained & flexible manner so it supports multiple skills and multiple CALL systems?

Graph Usage?

- Graphs are already in use in various knowledge modeling areas:
 - Pedagogy (concept-maps)
 - Web (Knowledge Graphs, semantic web, linked data)
 - Lexicography (lexical networks, linked data)
- Support heterogeneous data
- Easy extension

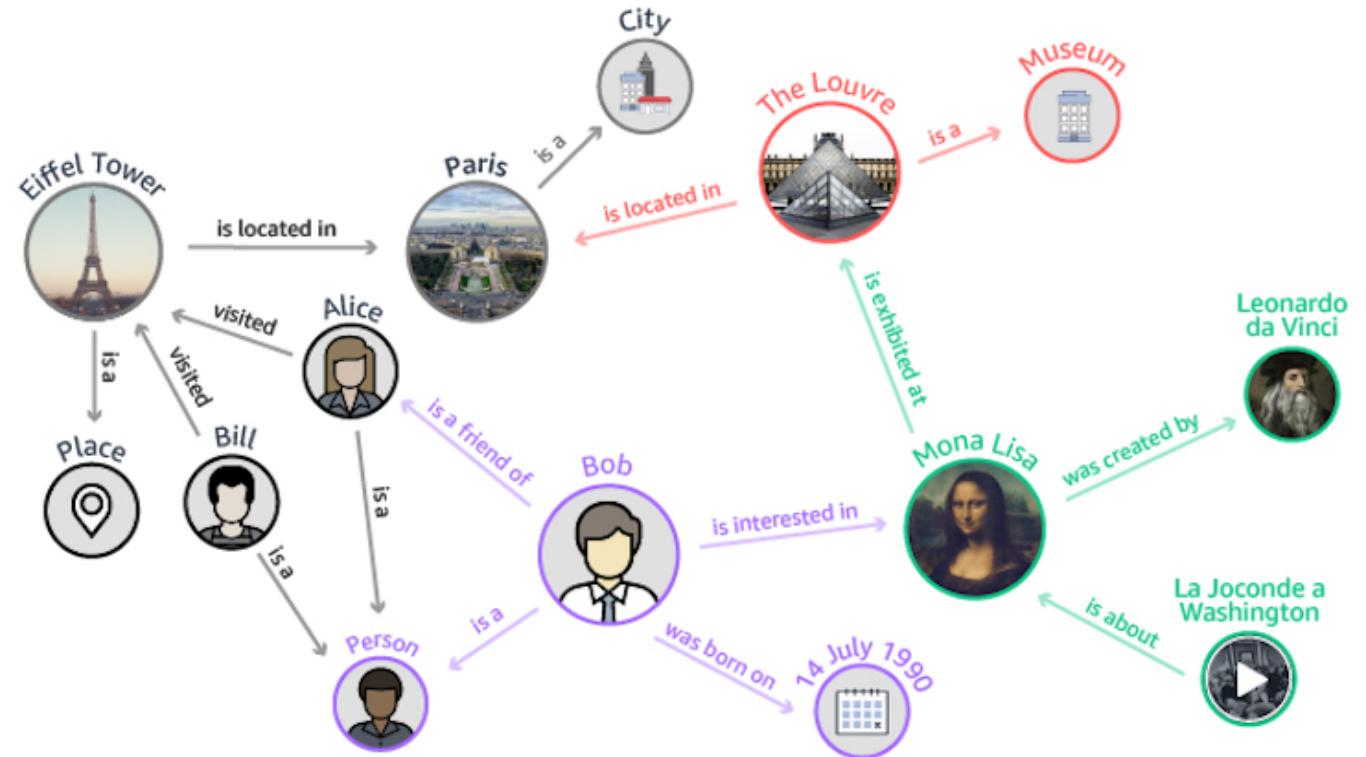
Concept Maps

- Pedagogical tool
- Created for hierarchical concept representation
- Have been used in L2 learning studies
- May or not make use of computers



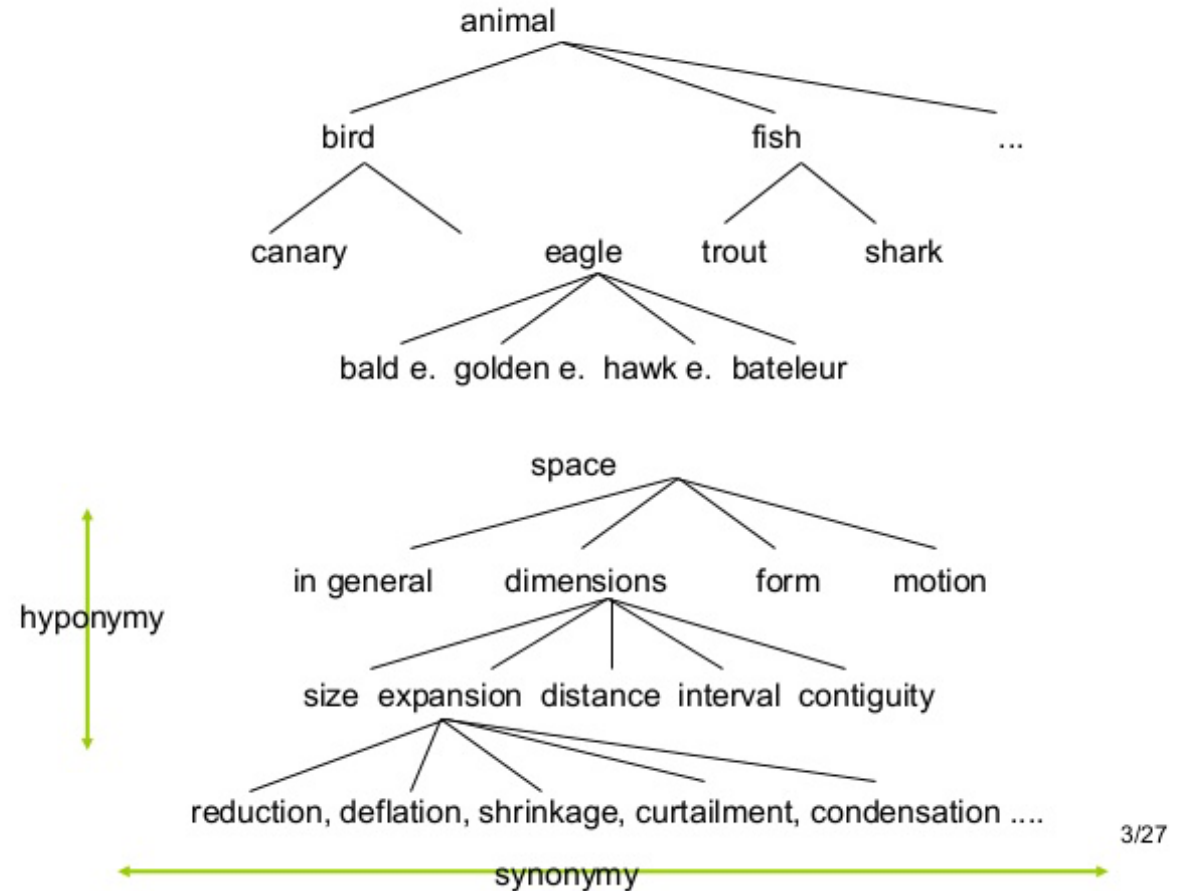
Knowledge Graph

- Term coined by Google
- No agreed definition
- Aggregation of facts
- Magnitude of m/billions nodes & edges
- Created automatically



Lexical Networks

- Princeton Wordnet
- Derivatives in multiples languages
- Structured around synonymy: "synset"

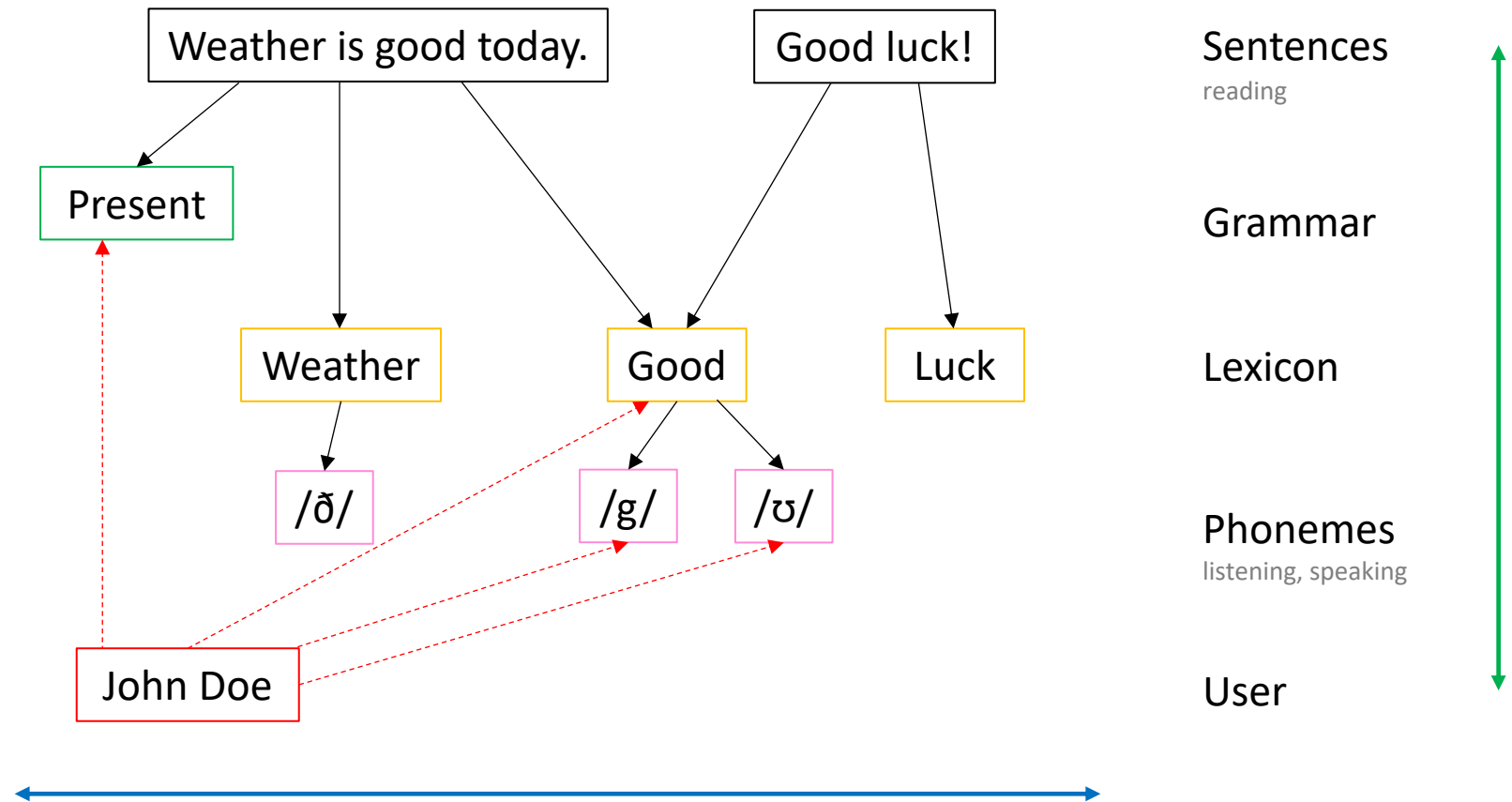


Issue With Direct Use of Existing Graphs

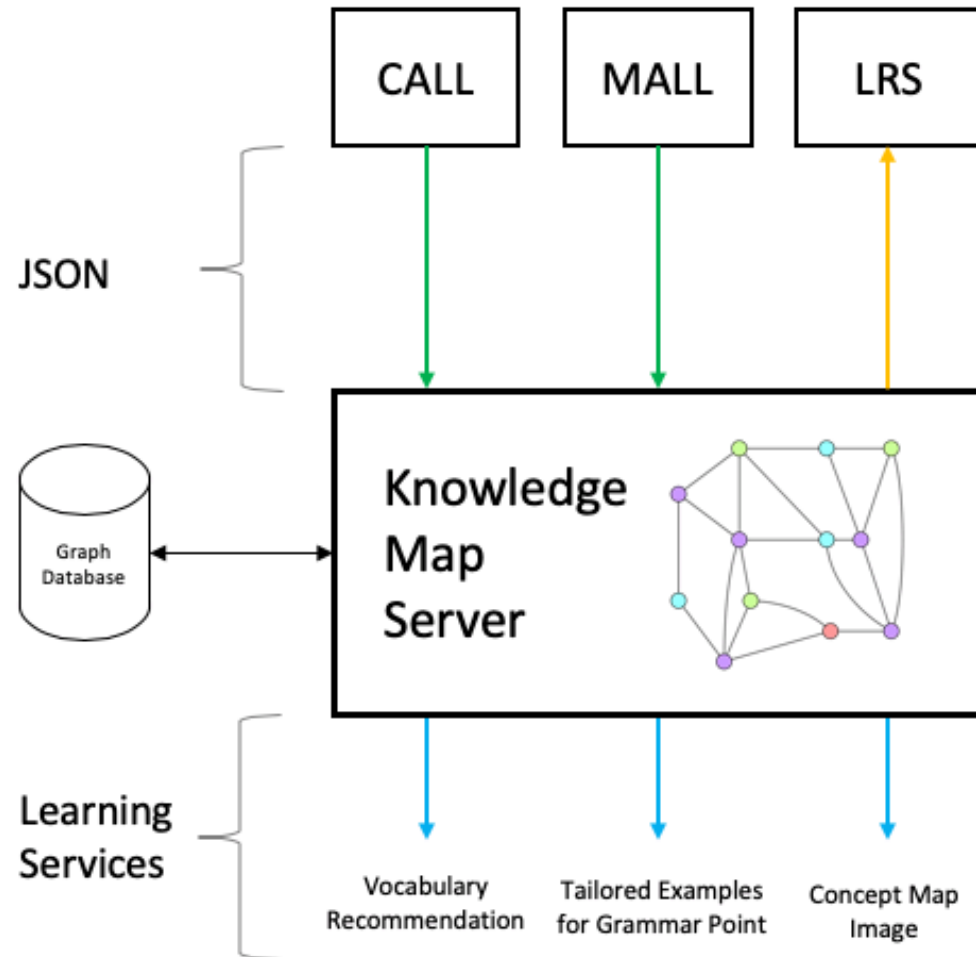
- All:
 - Built for a given purpose, not for L2 teaching/learning
- Lexical networks
 - When translated, often made automatically => errors
 - Centered on synonymy/hyperonymy

Knowledge Map Design

- Different layers corresponding to linguistics level
- Layers allows modeling **multiple skills** (intro. pt 1)
- Graph width: different **level proficiency** (pt 2)



Architecture



Use Case Example #1

- One system: a dictionary application
- Issues:
 - Unknown words
 - Unknown grammar
- Applications:
 - Example sentences selection
 - No more than 1 unknown word
 - Example sentences ranking
 - Based on the learner knowledge

The screenshot shows a mobile application interface with a red header bar containing a back arrow, the word "Examples", and a search icon. Below the header is a green bar labeled "Certified Examples". The main content area displays three example sentences, each with a flag icon, the Japanese text with furigana, the English translation, and the German translation. Blue arrows point from the text in the list to the corresponding text in the detailed view below. The first example sentence is "今日は 天気 なら いいのに。" (kyou wa tenki nara ii noni.) with English "I wish it were fine today." and German "Ich wünsche, es wäre heute schönes Wetter." The second example sentence is "彼は 天気の よい 日 を 利用 して 壁 を 塗った。" (karewa tenki no yoi hi o riyou shite kabe o nutta.) with English "He took advantage of the fine weather to paint the wall." and German "Er nutzte das gute Wetter aus, um die Wand zu streichen." The third example sentence is "今日は とても よい 天気 だ。" (kyou wa totemo yoi tenki da.) with English "It is very fine today." The interface also includes a status bar at the top showing "docomo", signal strength, time "17:55", and battery level "79 %".

docomo 17:55 79 %

< Back Examples

Certified Examples

きょう てんき
今日は 天気 なら いいのに。
kyou wa tenki nara ii noni.

🇬🇧 I wish it were fine today.

🇩🇪 Ich wünsche, es wäre heute schönes Wetter.

かれ てんき ひ りょう かべ
彼は 天気の よい 日 を 利用 して 壁 を
karewa tenki no yoi hi o riyou shite kabe o

ぬ
塗った。
nutta.

🇬🇧 He took advantage of the fine weather to paint the wall.

🇩🇪 Er nutzte das gute Wetter aus, um die Wand zu streichen.

More Examples

きょう てんき
今日は とても よい 天気 だ。
kyou wa totemo yoi tenki da.

🇬🇧 It is very fine today.



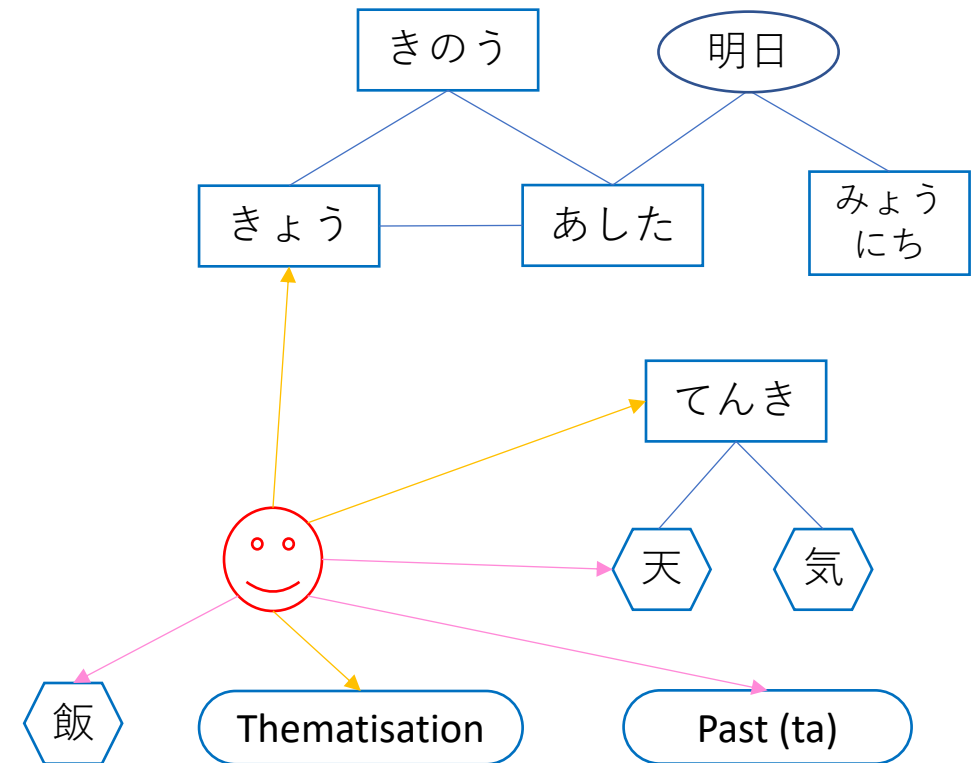
Knowledge Map Update

- Pre-existing content made from existing learning materials
- Data input update user profile
- Graph update if needed

KMS input:

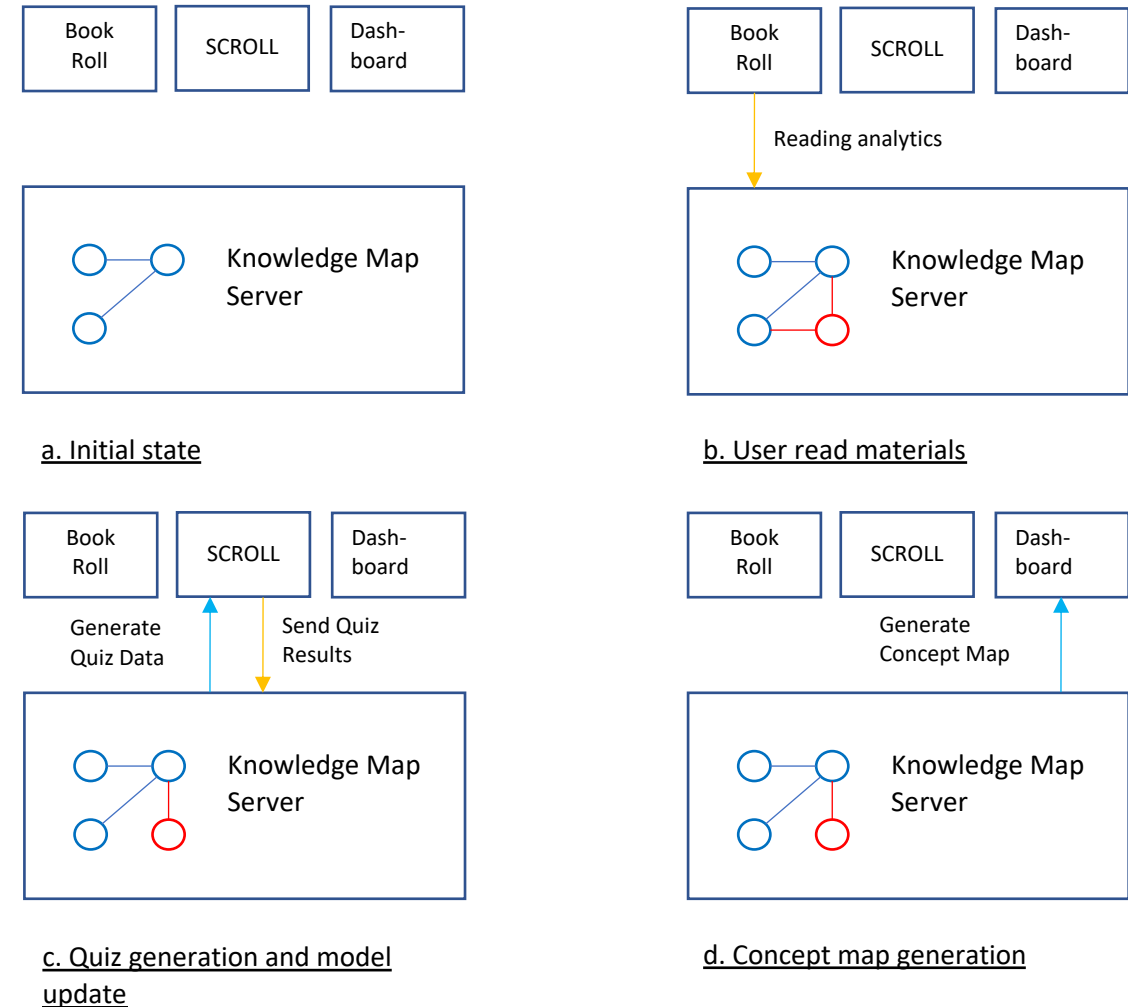
{
Action: listened,
Content:
今日はいい天気ですね。
}

{
Action: read,
Content:
天津飯食べた。
}



Use Case Example #2

- Three existing systems:
 1. BookRoll
 2. SCROLL
 3. Dashboard
- Data acquisition from 1 & 2
 - Reading analytics
 - Quiz results
- Pedagogical service to 2 & 3
 - Quiz generation
 - Knowledge map generation



References

- [1] Slavuj, V., Kovačić, B., & Jugo, I. (2015, May). Intelligent tutoring systems for language learning. In 2015 38th *International Convention on Information and Communication Technology, Electronics and Microelectronics* (MIPRO) (pp. 814-819). IEEE.
- Full list (21) in the paper

ご清聴ありがとうございました

- Thanks for your attention
- Questions and Answers