



**From Knowledge Organization (KO)
to Knowledge Representation (KR)**
Fausto Giunchiglia, Biswanath Dutta, **Vincenzo Maltese**
maltese@disi.unitn.it

**Knowledge Organization:
make information available**

LIS developed its own very successful solutions for the classification and search of documents.

In KO, search is focused on document properties (e.g. title, author, subject).

KO tends to fail in situations when users express their needs in terms of entity properties (e.g., of the author)

Limitations in KO:
Lack of expressiveness

Search by document properties

Give me documents with *subject*
“Michelangelo” and “marble sculpture”

Search by entity properties

Give me documents *about* marble sculptures
made by a person born in Italy

Subject: *Buonarroti, Michelangelo*

Subject: *sculpture – Renaissance*

In indexes the **syntax** of the subjects is given by a subject indexing language grammar.

What about the semantics?

- Is *Michelangelo* the Italian artist? When and where he was born? What are his most famous works?
- Is *sculpture* the form of art?
- Is *Renaissance* the historical period? When and where exactly?

Limitations in KO:
Lack of formalization

From documents to entities

Image of David
by Michelangelo
removed for
copyright
reasons

Name: David

Class: statue

Author: Michelangelo

Date of creation: 1504

Matter: marble

Height: 4.10 m

Name: Michelangelo

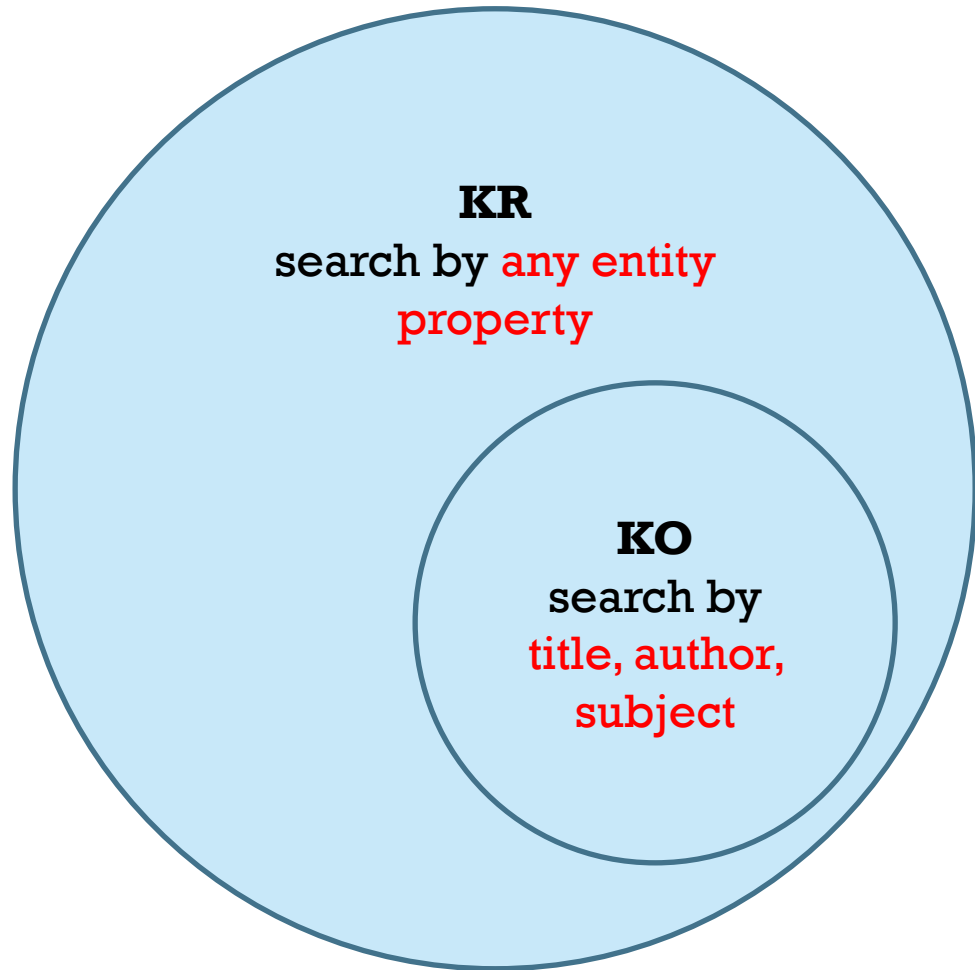
Surname: Buonarroti

Class: artist

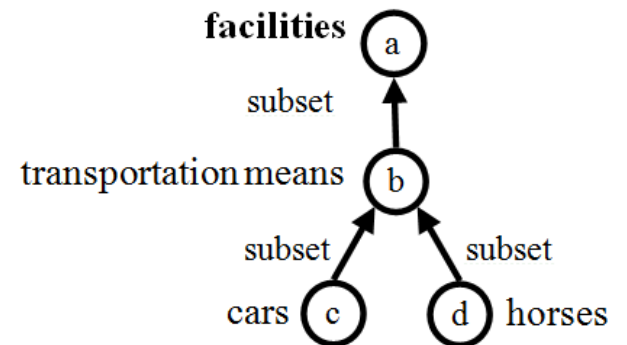
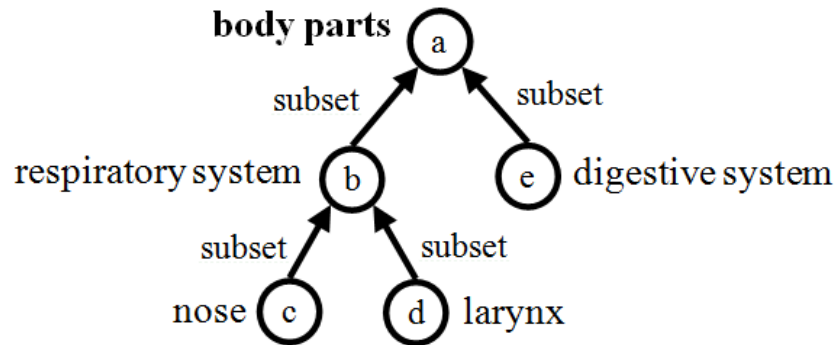
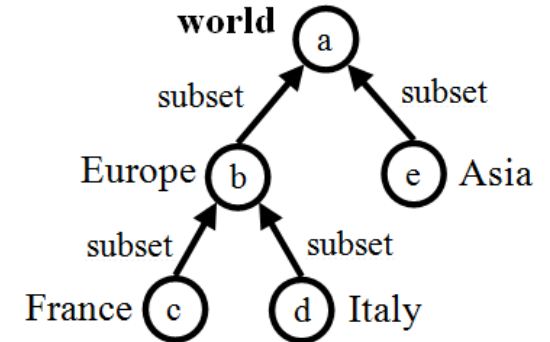
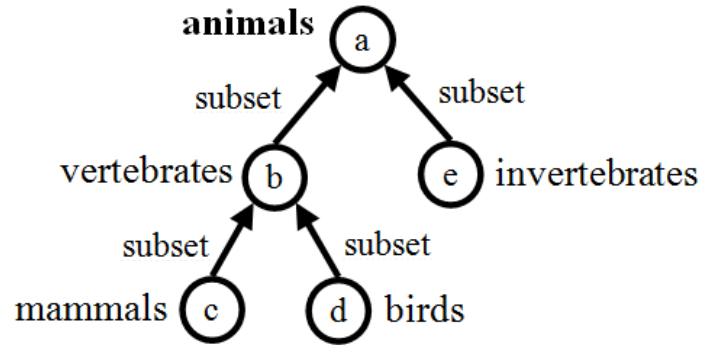
Date of birth: 6th March 1475

Date of death: 18th February 1564

From KO to KR

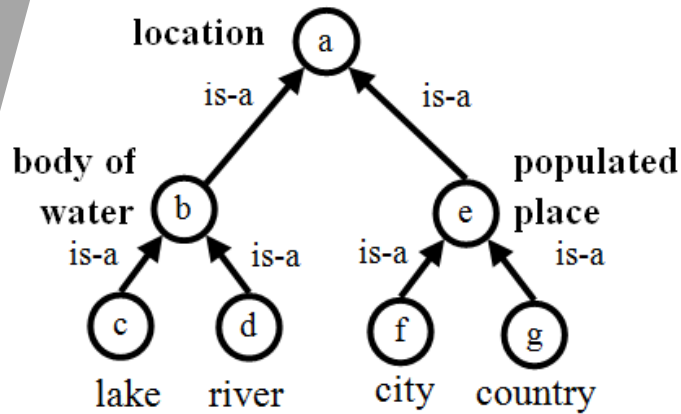


Classification Ontologies

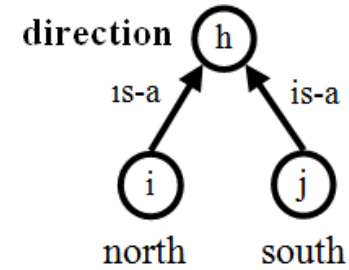


Descriptive Ontologies: intensional knowledge

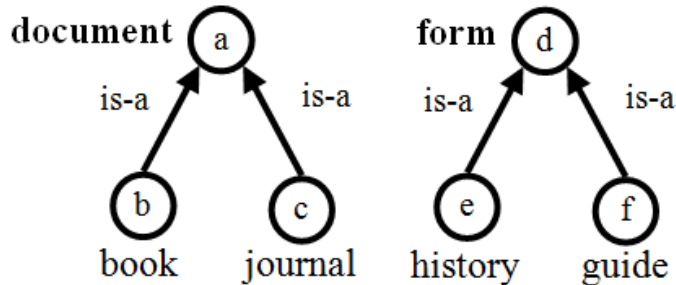
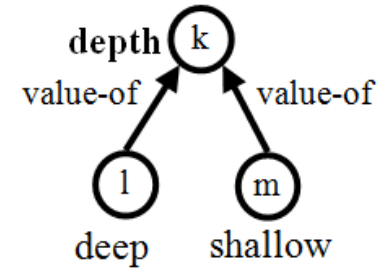
ENTITY



RELATION



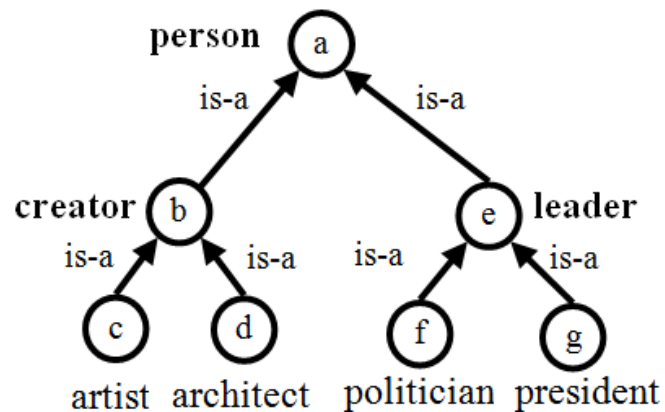
ATTRIBUTE



author **g**

title **h**

subject **i**



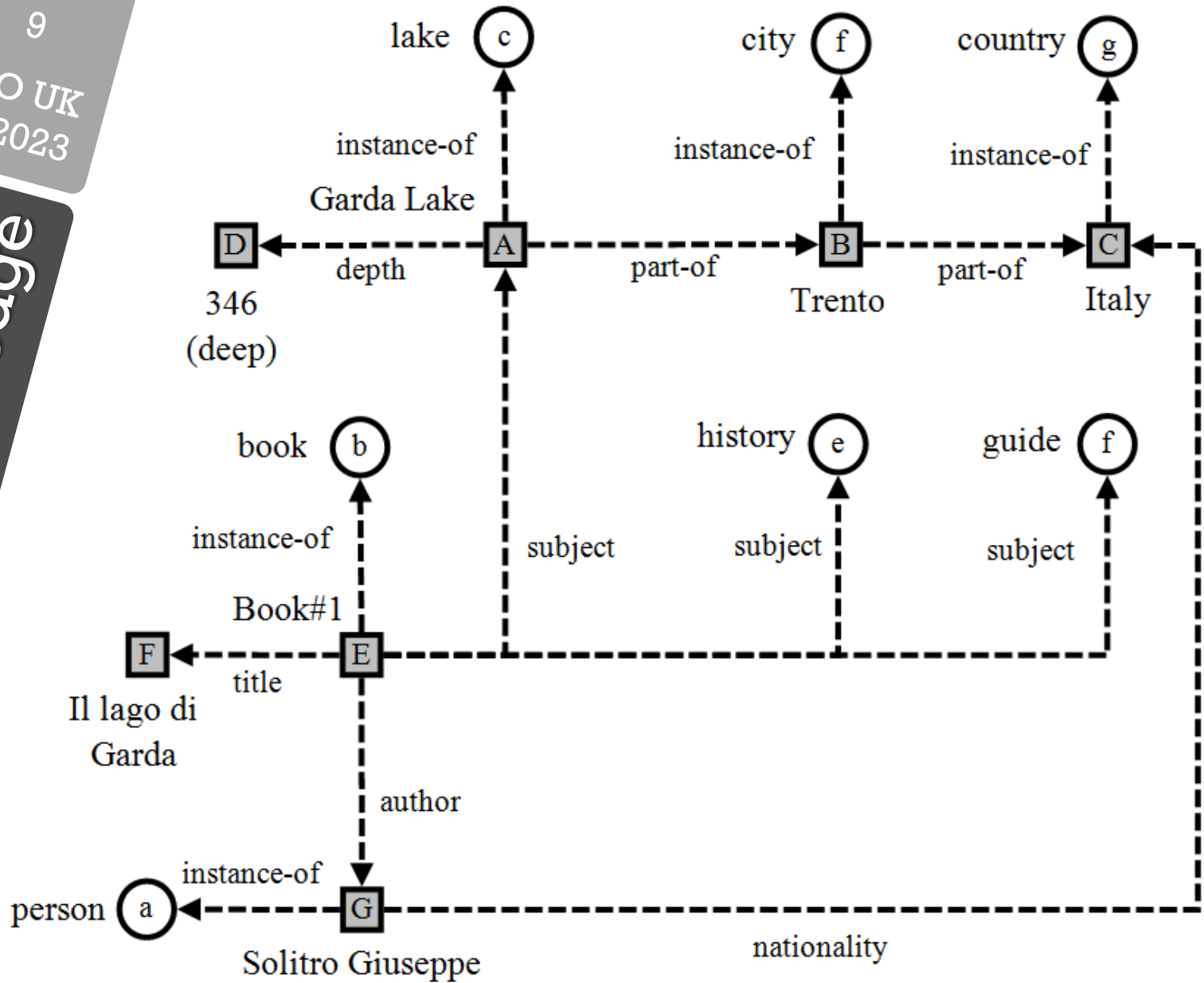
nationality **h**

gender **j**

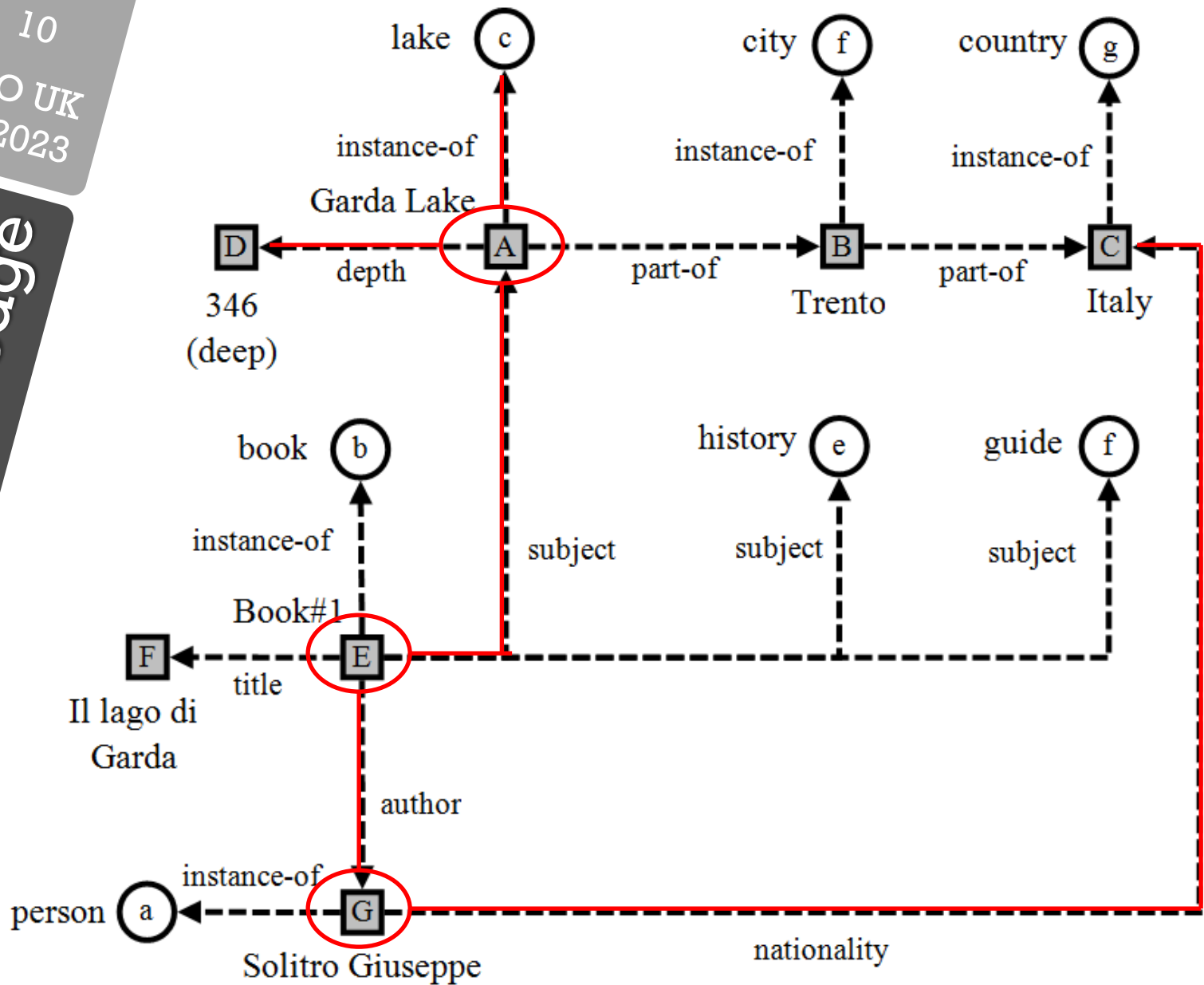
birthplace **i**

birthday **k**

Descriptive Ontologies: extensional knowledge



Descriptive Ontologies: extensional knowledge



**Give me documents about any lake
with depth greater than 100 written by Italians**

How to build high quality and scalable descriptive ontologies?

DERA is faceted as it is inspired to the principles and canons of the faceted approach by Ranganathan

DERA is a KR approach as it models entities of a domain (**D**) by their entity classes (**E**), relations (**R**) and attributes (**A**)

Step 1: Identification of the atomic concepts

(E) watercourse, stream: a natural body of running water flowing on or under the earth

Step 2: Analysis

a body of water

a flowing body of water

no fixed boundary

confined within a bed and stream banks

larger than a brook

Step 3: Synthesis.

- (E) Body of water
 - (is-a) Flowing body of water
 - (is-a) Stream
 - (is-a) Brook
 - (is-a) River
 - (is-a) Still body of water
 - (is-a) Pond
 - (is-a) Lake

Step 4: Standardization.

- (E) stream, watercourse: a natural body of running water flowing on or under the earth

Step 5: Ordering

Terms and concepts in the facets are ordered

Step 6: Formalization

Descriptive ontologies are translated into **Description Logic** formal ontologies, e.g.,:

River \sqsubseteq Stream

River (Volga)

Length (Volga, 3692)

Properties of DERA

- DERA facets have *explicit semantics* and are modeled as descriptive ontologies
- DERA facets inherits all the nice properties of the faceted approach, such as robustness and scalability
- DERA allows for a very expressive document search *by any entity property*
- DERA allows for automated reasoning via the formalization into Description Logics ontologies

The usefulness of moving from KO to KR

- **KO** is methodologically very strong, but **subjects are limited in formality and expressiveness** as, by employing *classification ontologies*, it only supports queries by document properties.
- **KR**, by employing *descriptive ontologies*, supports queries by any entity property, but it is methodologically weaker than KO.

We propose the DERA faceted KR approach

- DERA, being faceted, allows the development of high quality and scalable descriptive ontologies
- DERA, being a KR approach, allows modeling relevant entities of the domain and their E/R/A properties and enables automated reasoning.
- It supports a **highly expressive search** of documents exploiting entity properties.

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**From KO to KR
Thank you!**