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Transformative characteristics and research agenda for the SDI-SKI step change:

A Cadastral Case Study

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An Australian Government Initiative

Australian Government
Department of Industry, Innovation and Science

Business Cooperative Research Centres Programme

CRC AUSTRALIA

Presentation Outline

Limitations of SDIs

Transformative Characteristics

Explain methodologies – case study

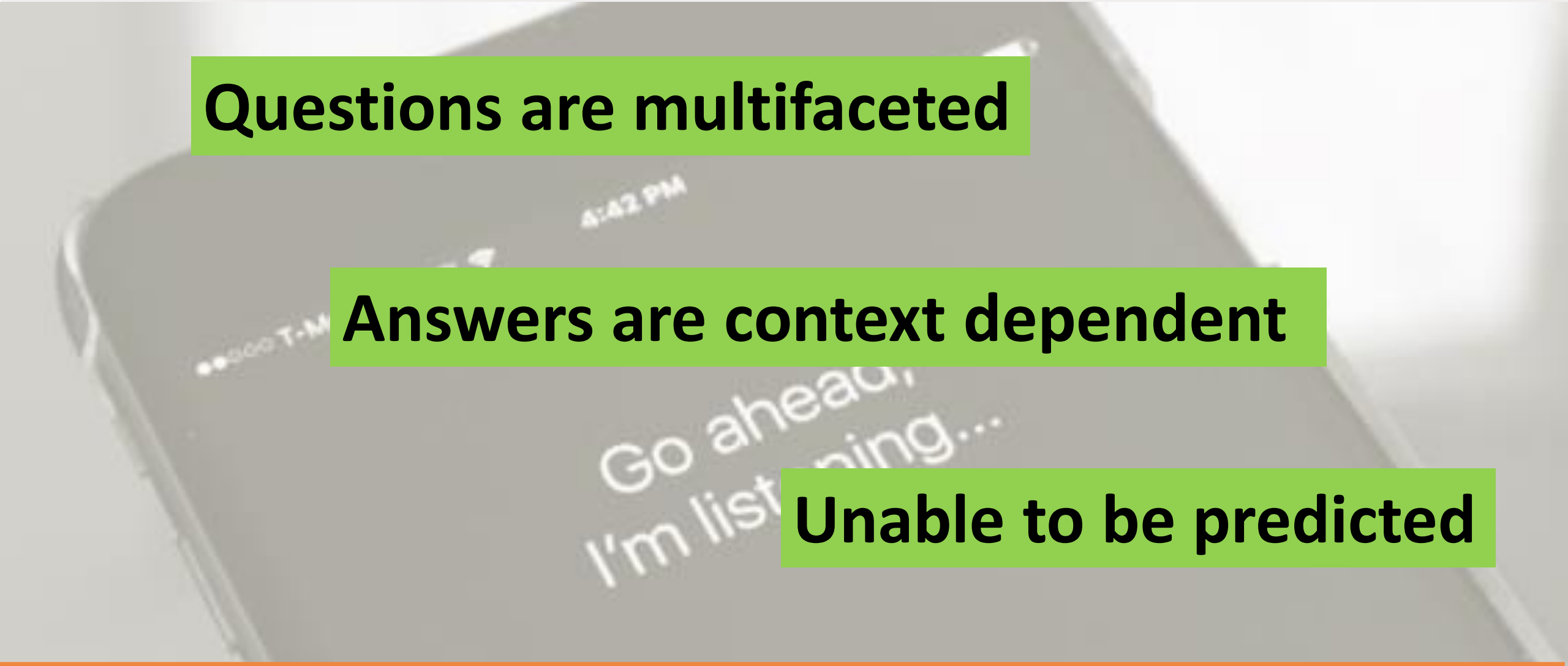
SKI Architecture and Framework

The On-demand Generation

SIRI has limitations

Problem lies with how we organise our data

On-Demand Limitations – The Query

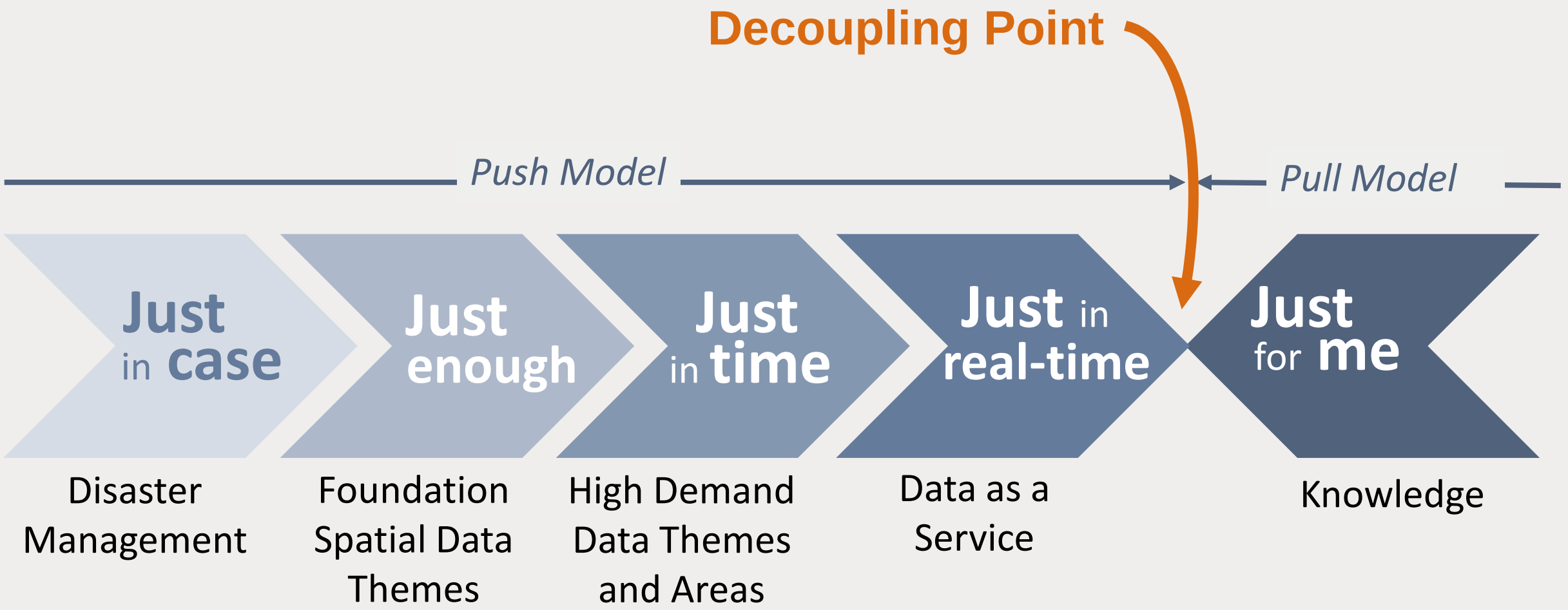


Questions are multifaceted

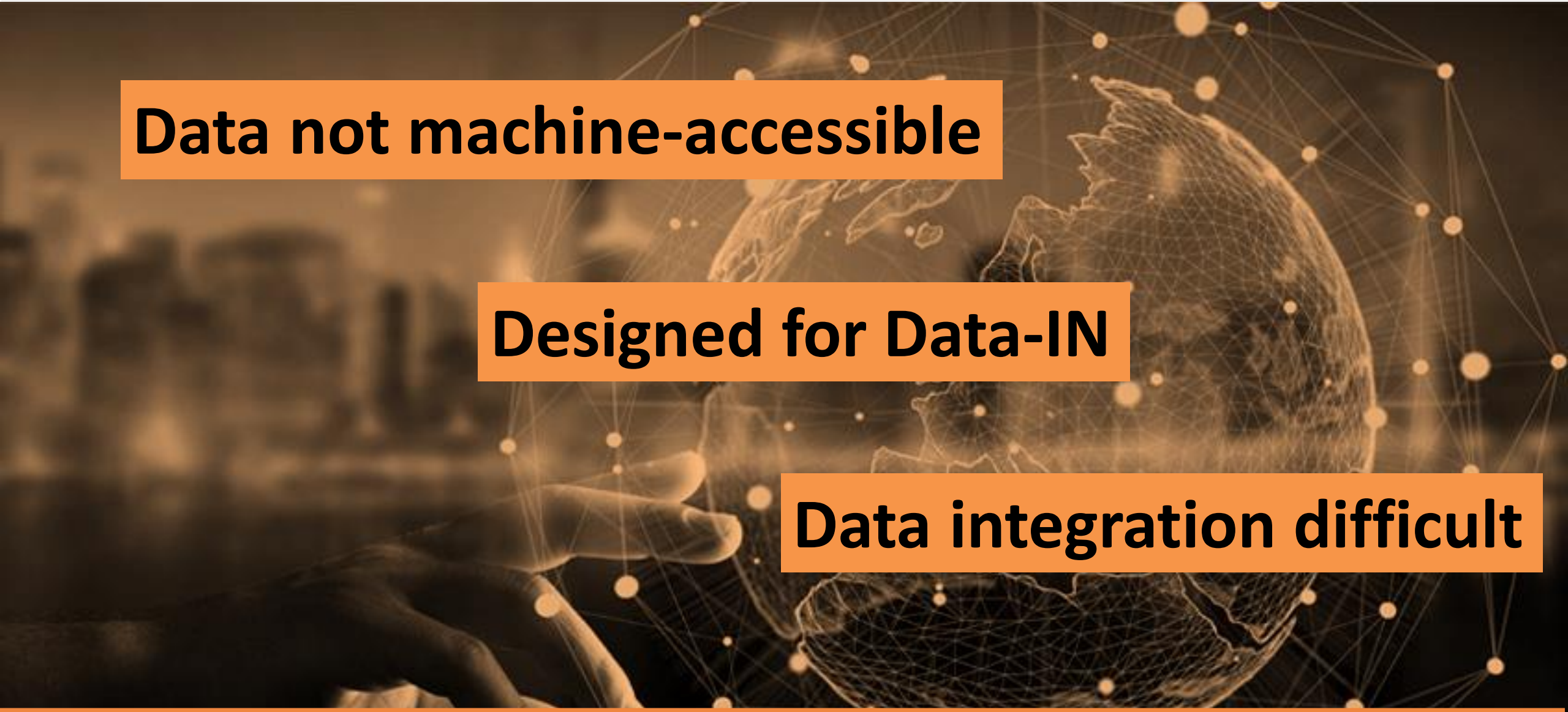
Answers are context dependent

Unable to be predicted

Limitations - Forecasting Demand



On-Demand Limitations – The SDI

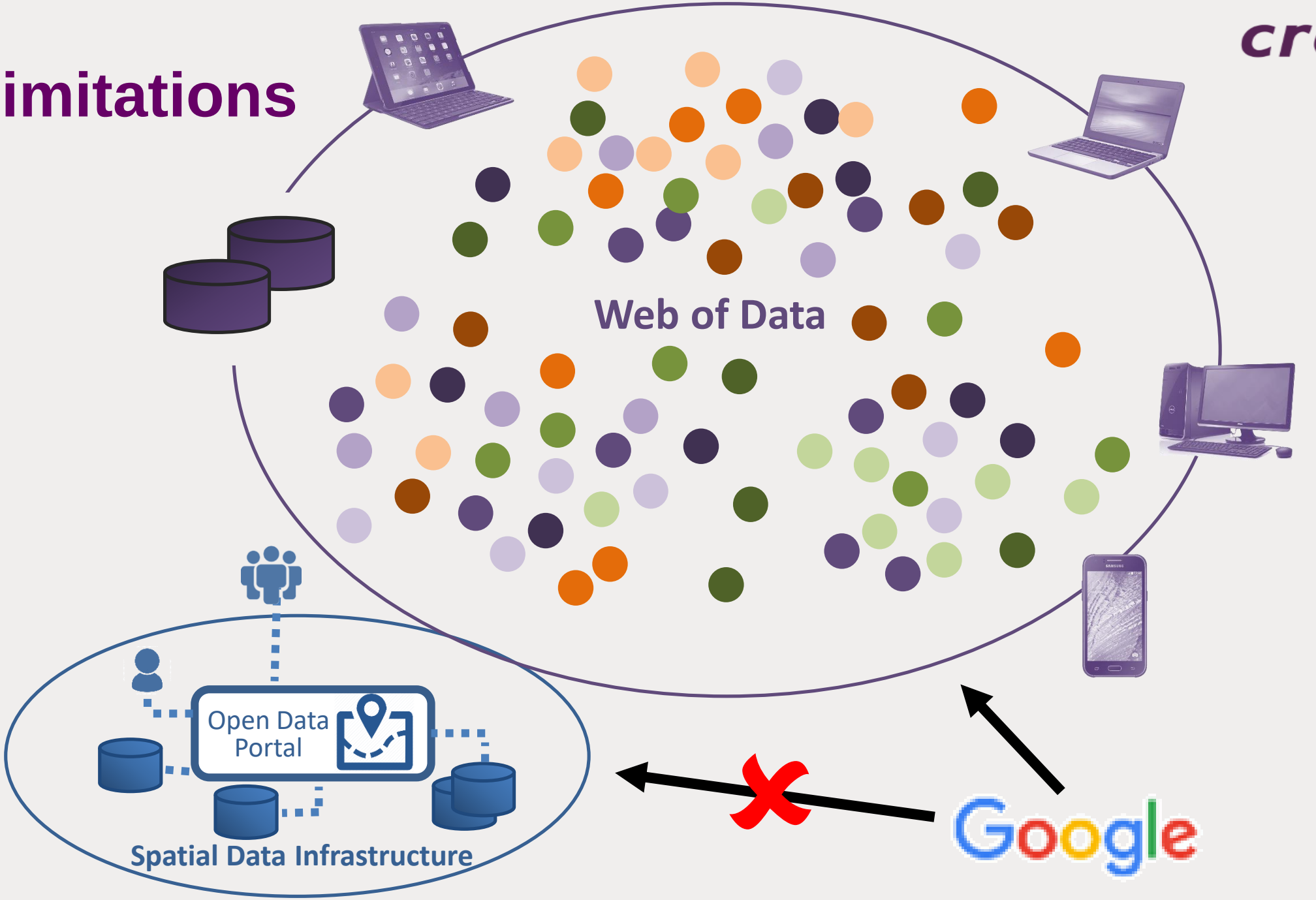


Data not machine-accessible

Designed for Data-IN

Data integration difficult

Limitations



On-Demand Limitations – The Data

Duplicate information

Aggregated data = LCD

Provenance unknown

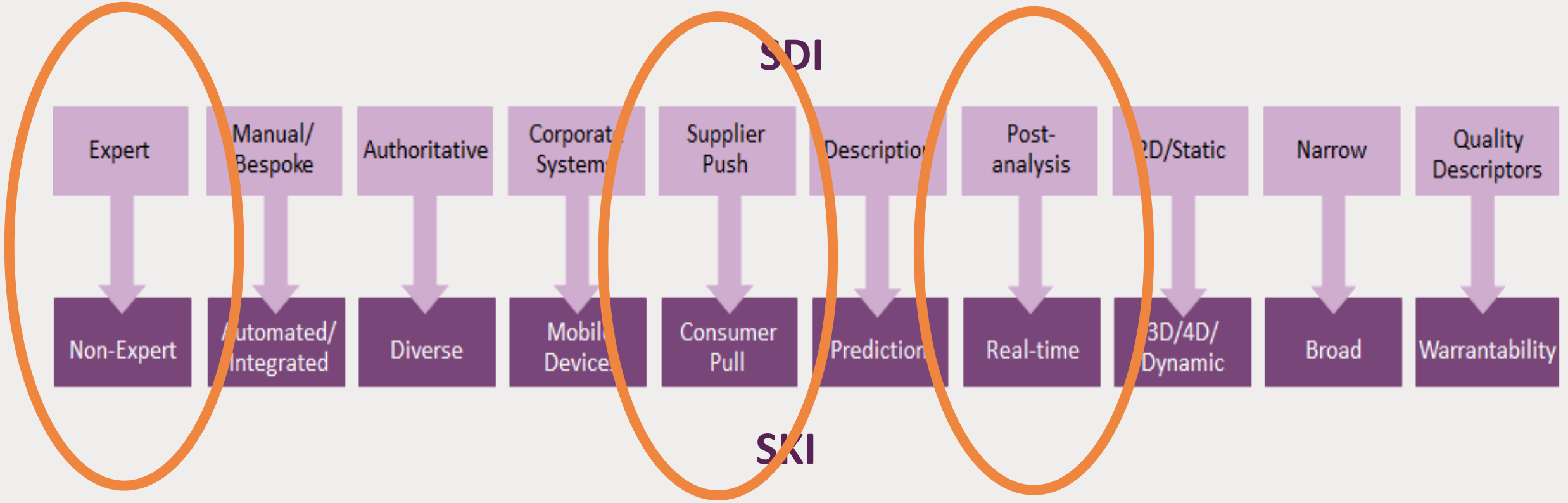
On-Demand Revolution

The Smart Phone Revolution in connectivity has created an On-demand Economy

"Access is now more important than ownership"

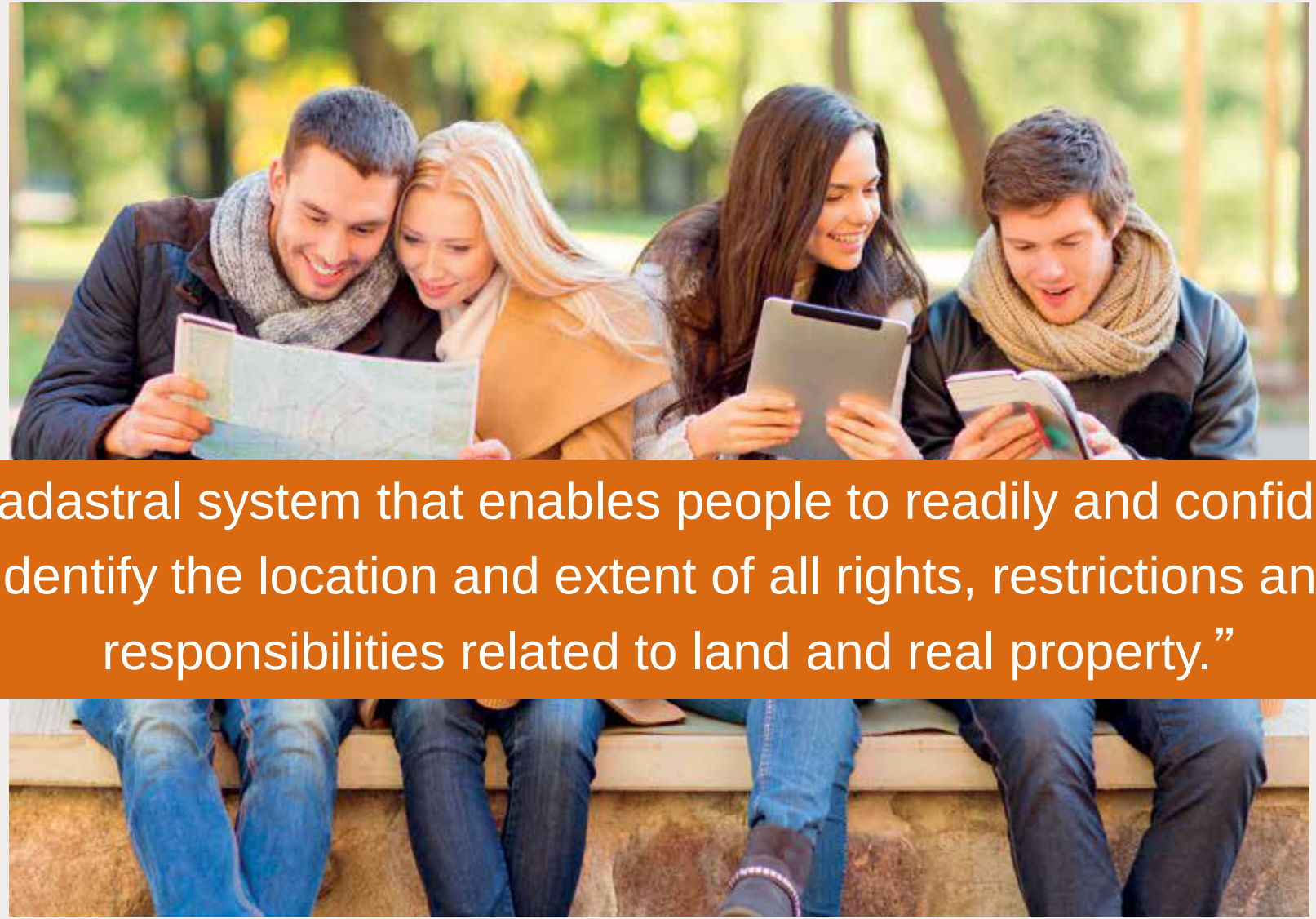
- Futurist Kevin Kelly

Transformative Characteristics



… When combined: Knowledge on Demand

Cadastre 2034 - Vision



"A cadastral system that enables people to readily and confidently identify the location and extent of all rights, restrictions and responsibilities related to land and real property."

Cadastre 2034

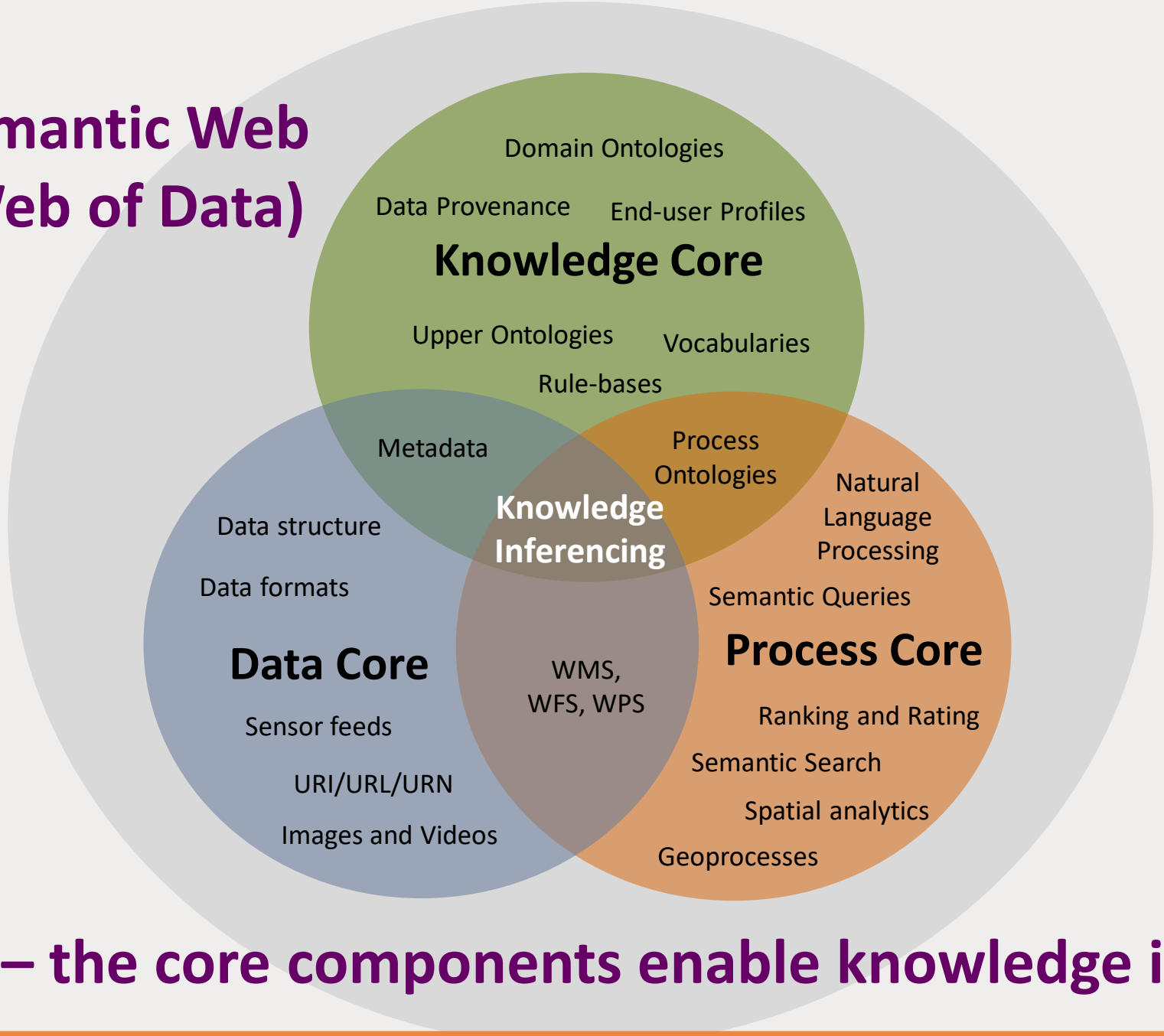
About Knowledge On-demand

Semantic Web – Making Data Smart

Third stage in the Evolution of the Web

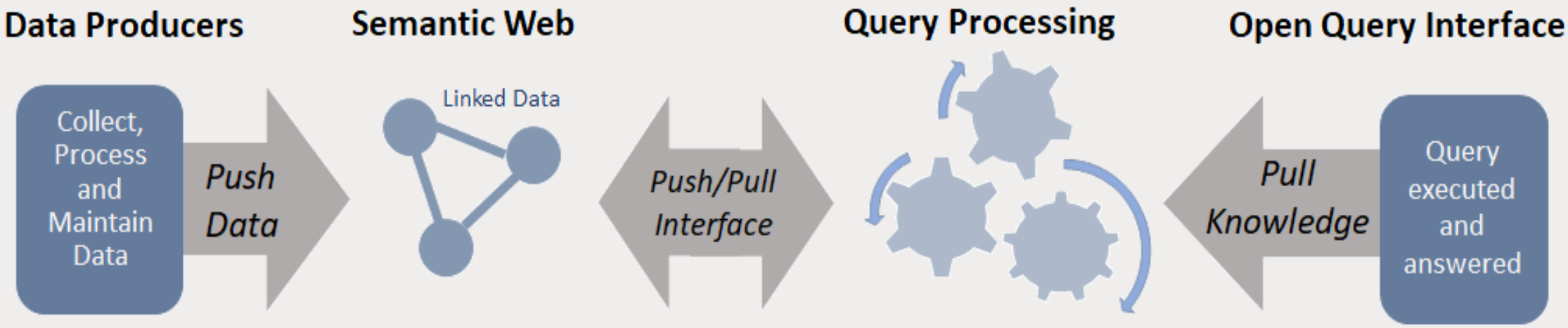
- **Web 1.0** — One-way interaction
- **Web 2.0** — Two-way participation
- **Web 3.0** — Linked Data (Semantic Web)

Semantic Web (Web of Data)

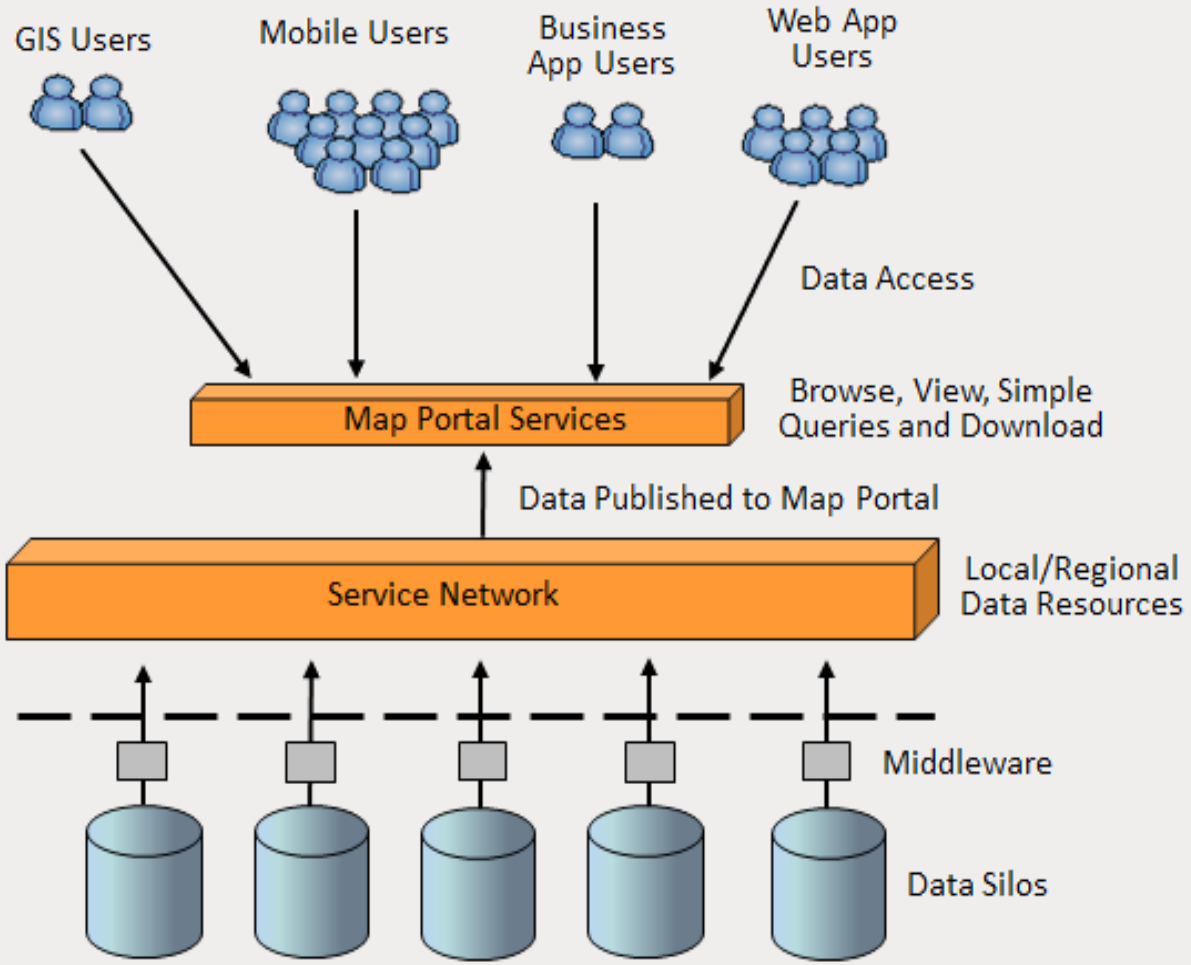


Combined – the core components enable knowledge inferencing

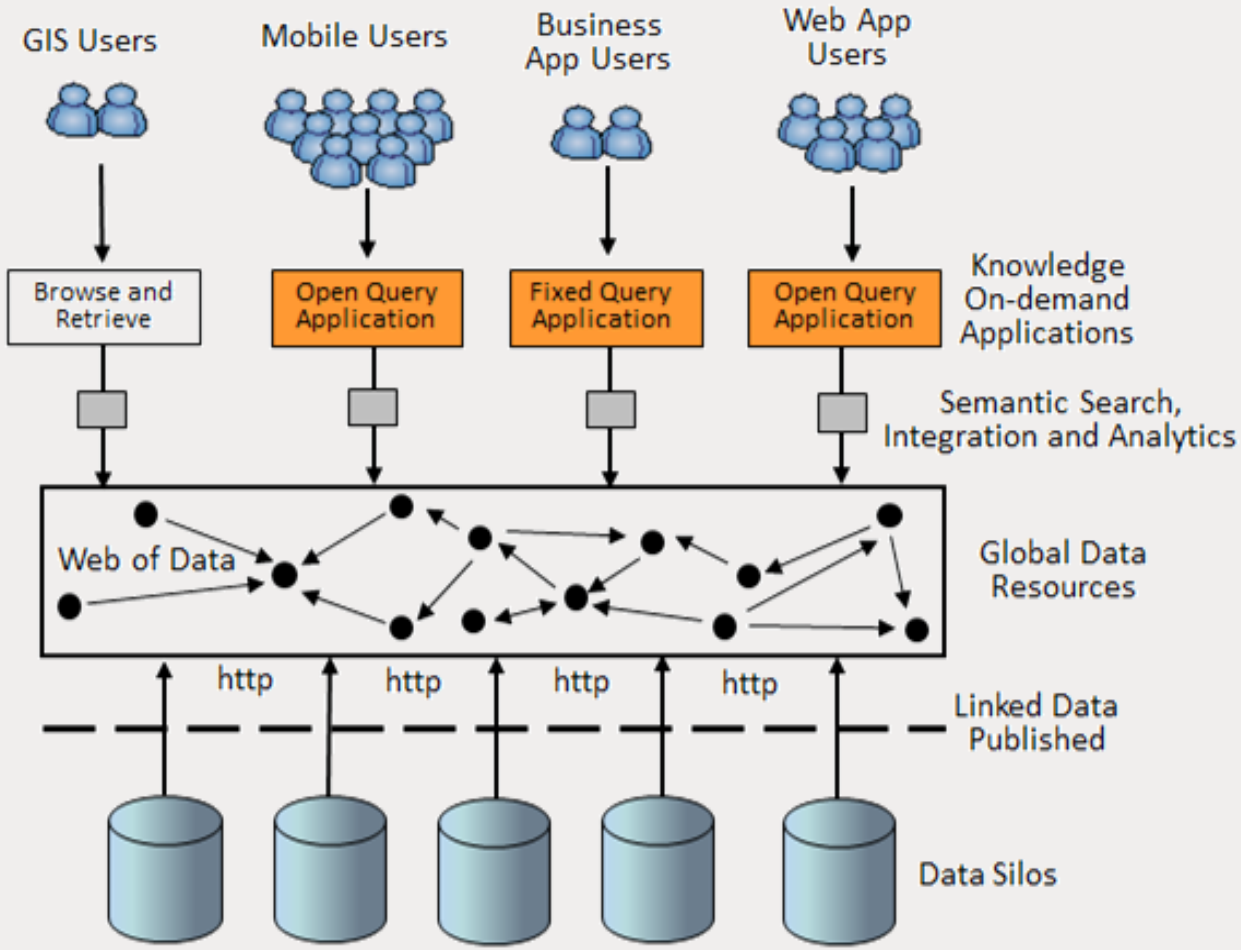
Query Processing



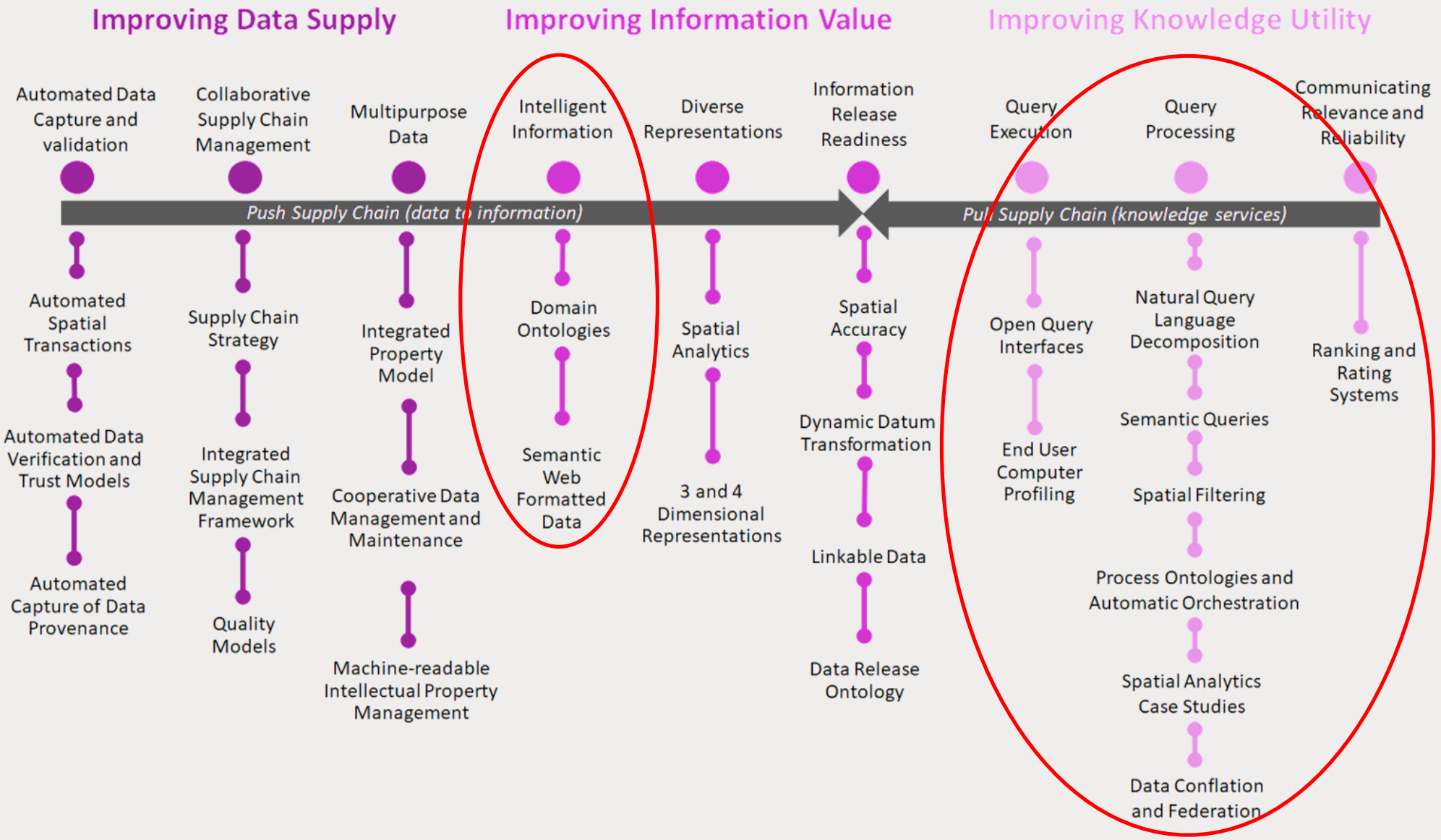
SDI – Data Access Focussed



SKI – Knowledge Discovery Focussed

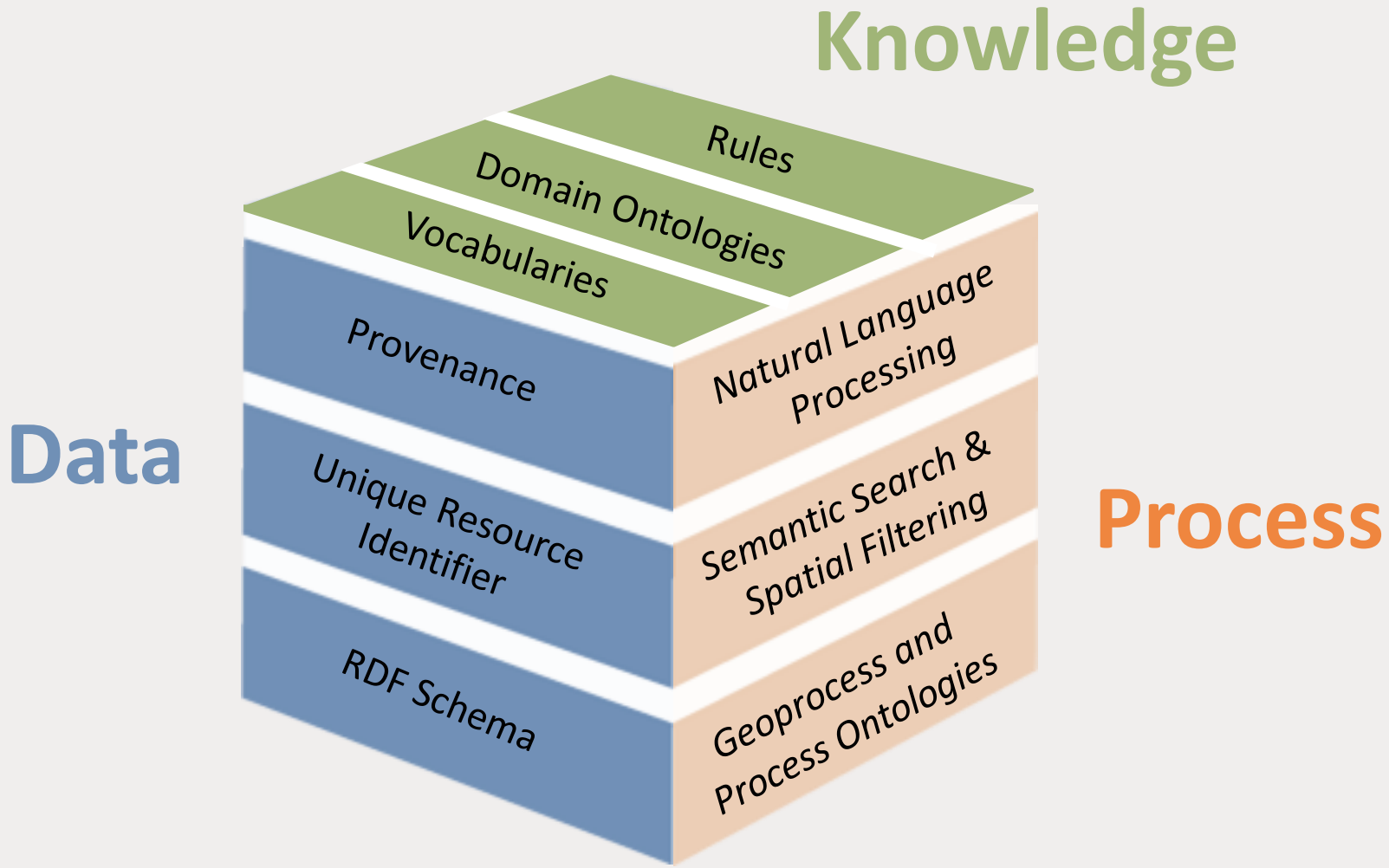


Research Agenda



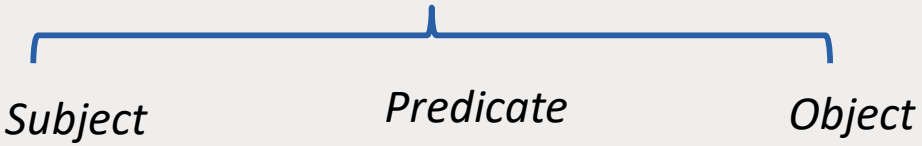
Query Processing

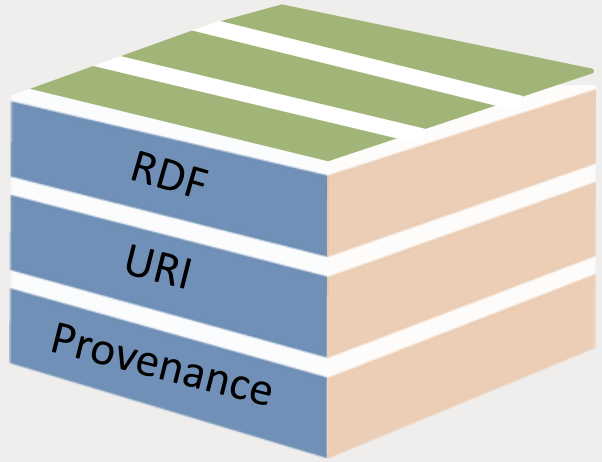
The Building blocks

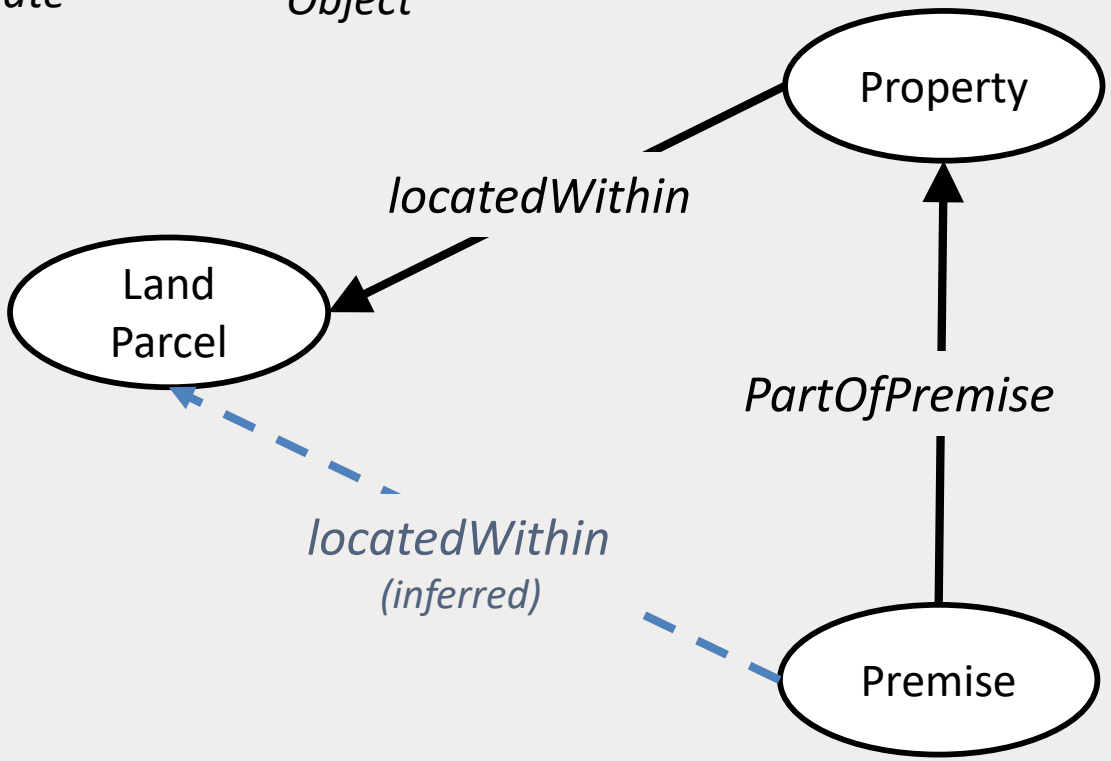


Data: Building Blocks

Resource Description Framework



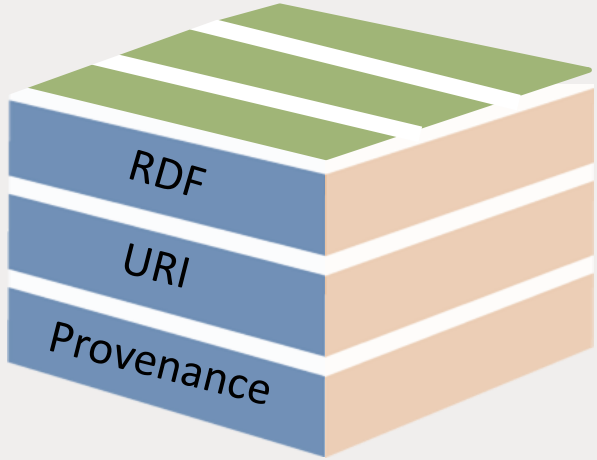


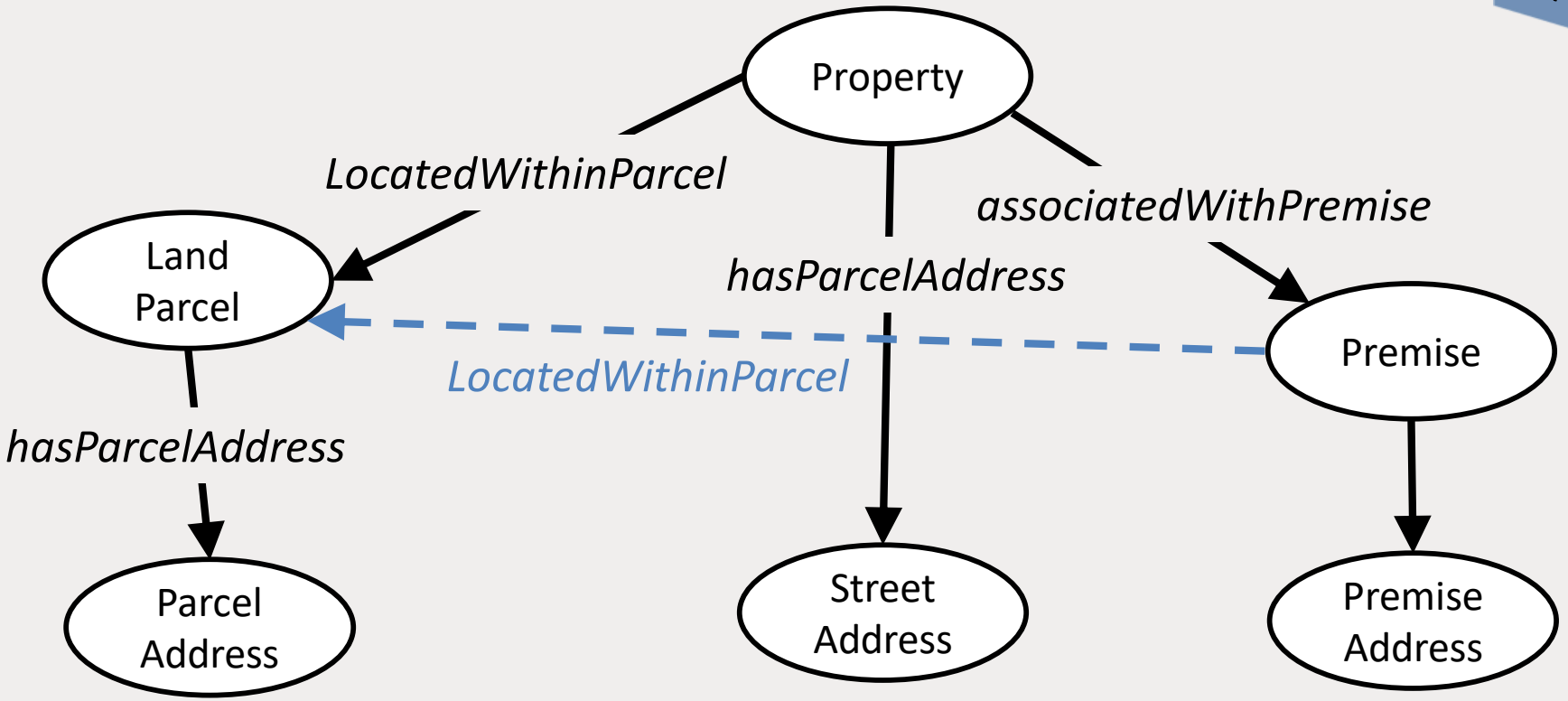


RDF is a standard model for data interchange on the Web.

Data: Building Blocks

Resource Description Framework

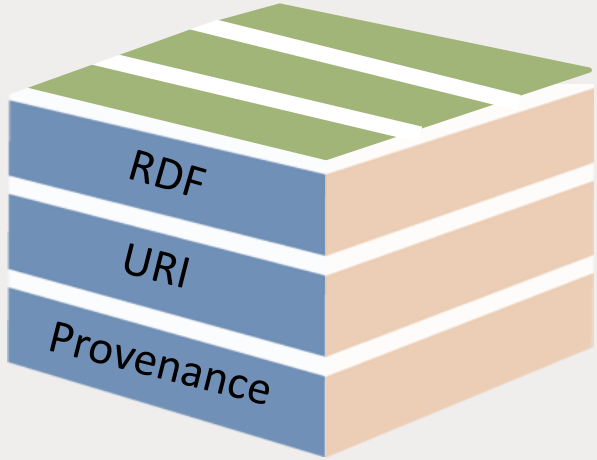




RDF Schema are used to build ontologies

Data: Building Blocks

Resource Description Framework



URI

Property

URI

Land Parcel

LocatedWithinParcel

associatedWithPremise

hasParcelAddress

LocatedWithinParcel

Premise

URI

hasParcelAddress

URI

Parcel Address

URI

Street Address

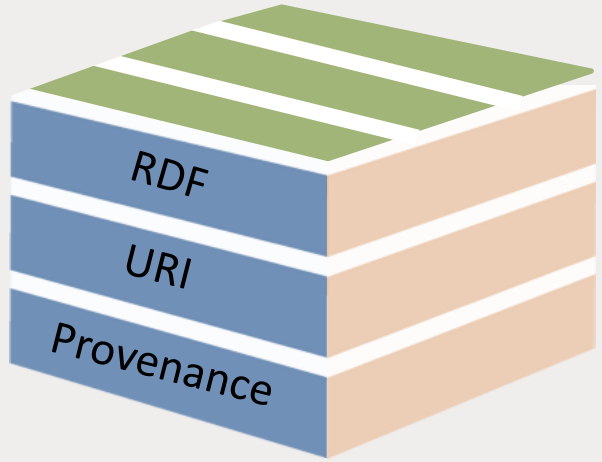
URI

Premise Address

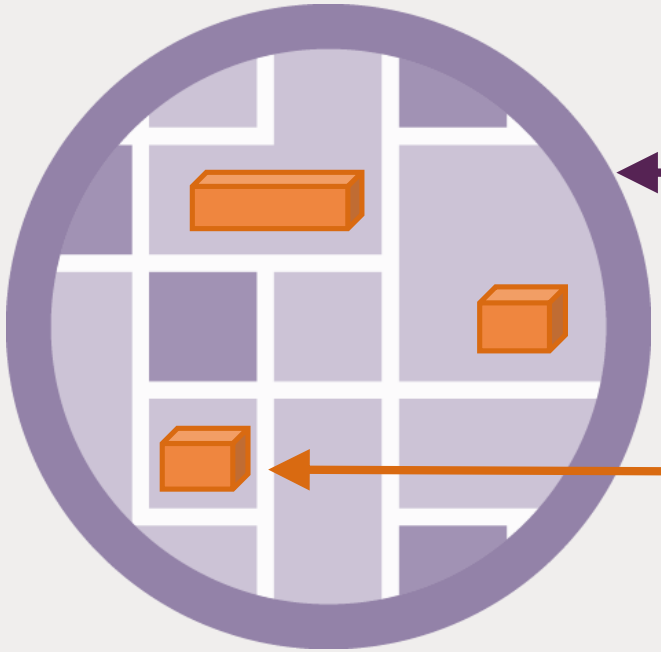
RDF Schema are used to build ontologies

Data: Building Blocks

Unique Resource Identifier



Shopping Centres



http://data.gov.au/doc/shoppingcentre

http://data.gov.au/doc/shoppingcentre/63540

URI unambiguously identifies a data resource so it can be found

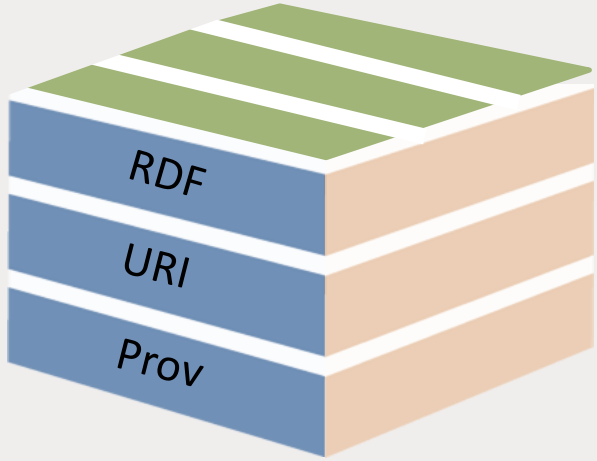
Data: Building Blocks

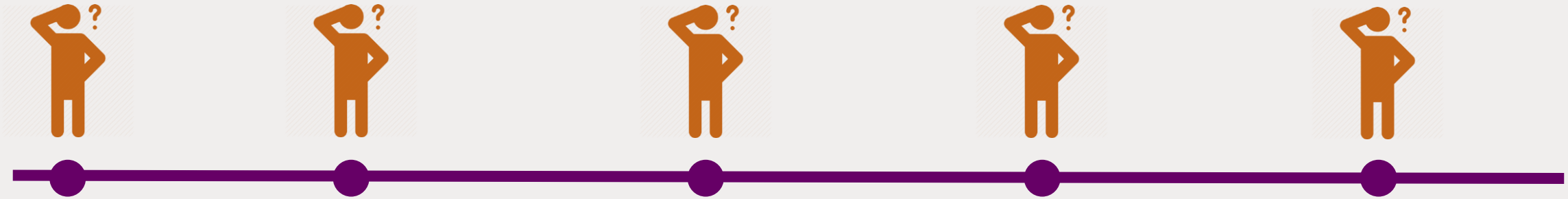
Provenance

Information quality changes as data is transferred along the supply chain

QUALITY DIMENSIONS

Completeness (C)
Logical Consistency (LC)
Positional Accuracy (PA)
Temporal Accuracy (TA)
Attribute Accuracy (AA)
Data Useability (U)



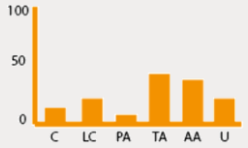


Electronic Survey Plan

Land Authority Cadastre (Data fudged)

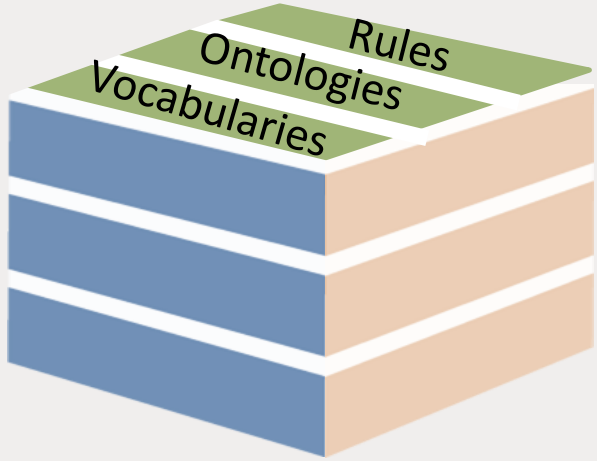
Utilities Cadastre (Inconsistent)

Nationally Aggregated Cadastre (LCD)



Generalised Cadastre (Land use map)

Knowledge: Building Blocks



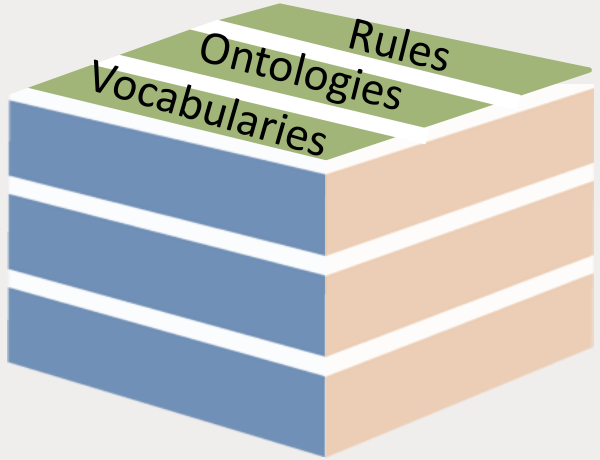
Vocabularies

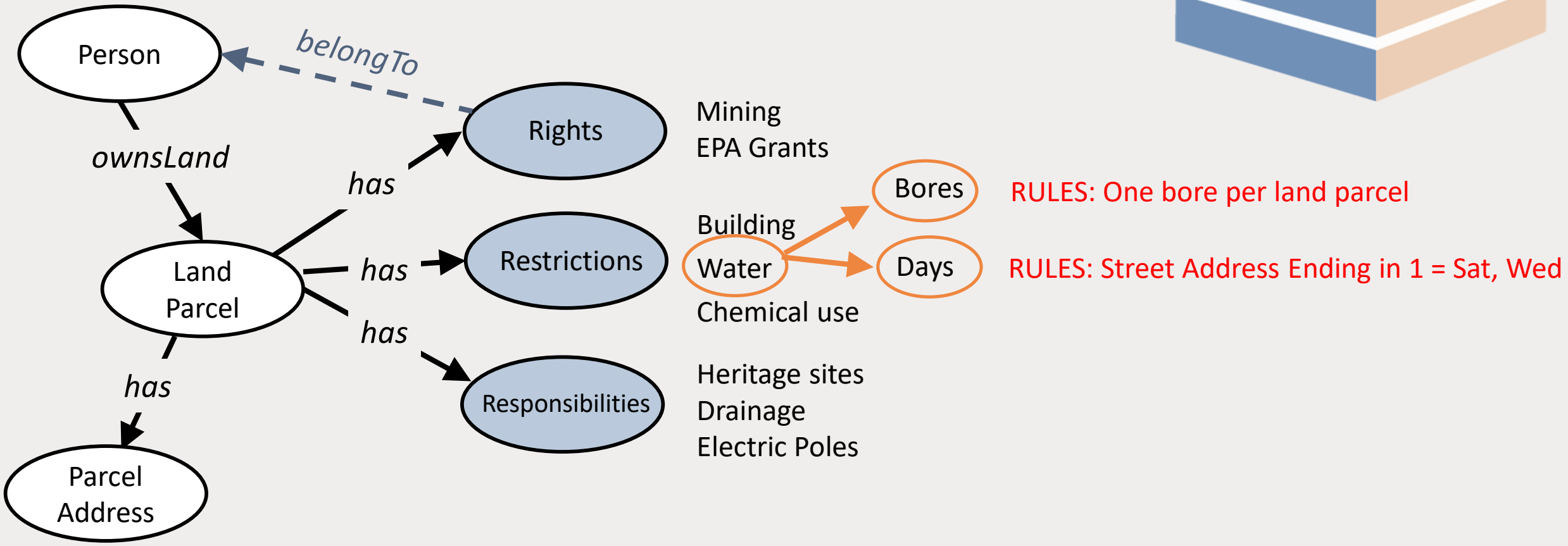
https://documentation.ands.org.au/display/DOC/Research+Vocabularies

Controlled vocabularies – agreed terms used to support data integration

Knowledge: Building Blocks

Ontologies and Rules – Rights, Restrictions and Responsibilities

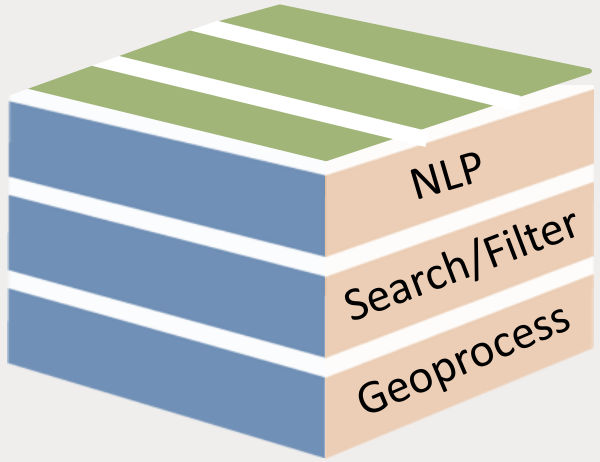




Ontologies– set of concepts in a subject area

Process: Building Blocks

Natural Language Processing



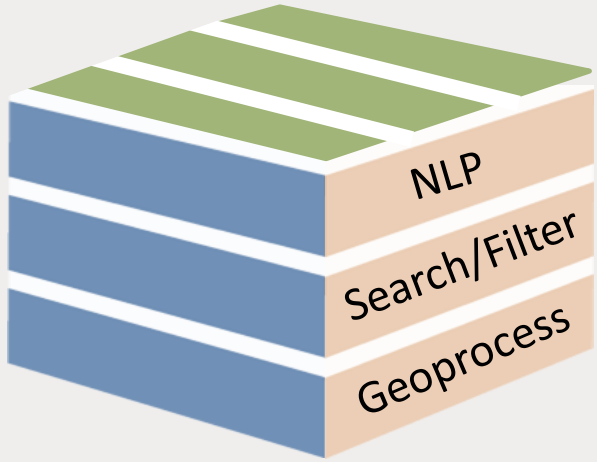
What responsibilities are associated with this land?

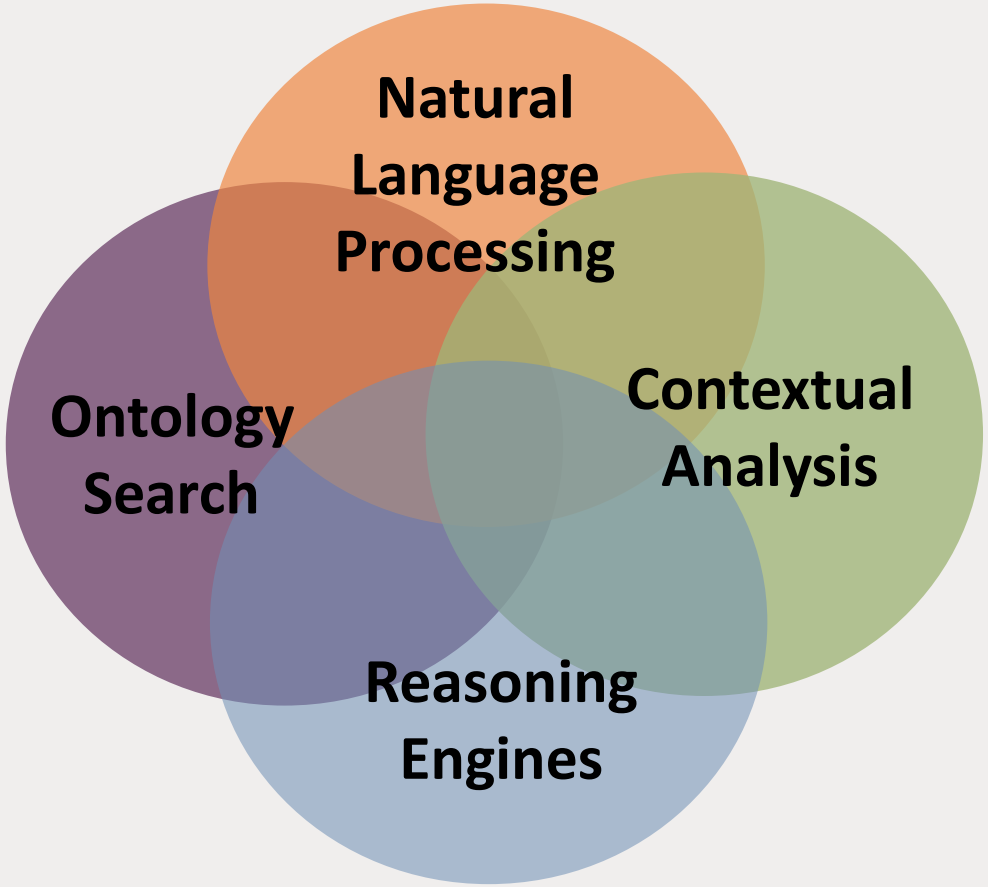
- Refer to RRR Ontology
- Parcel, Property, Premise, Address
- Planar topology 'Within'
- Current GPS location
- Polygon feature

NLP – Breaks down the query into manageable units

Knowledge: Building Blocks

Semantic Search and Spatial Filtering





Semantic Search – understand searchers intent using contextual meanings

Spatial Filtering – narrowing the search by location

Process: Building Blocks

Process Ontologies

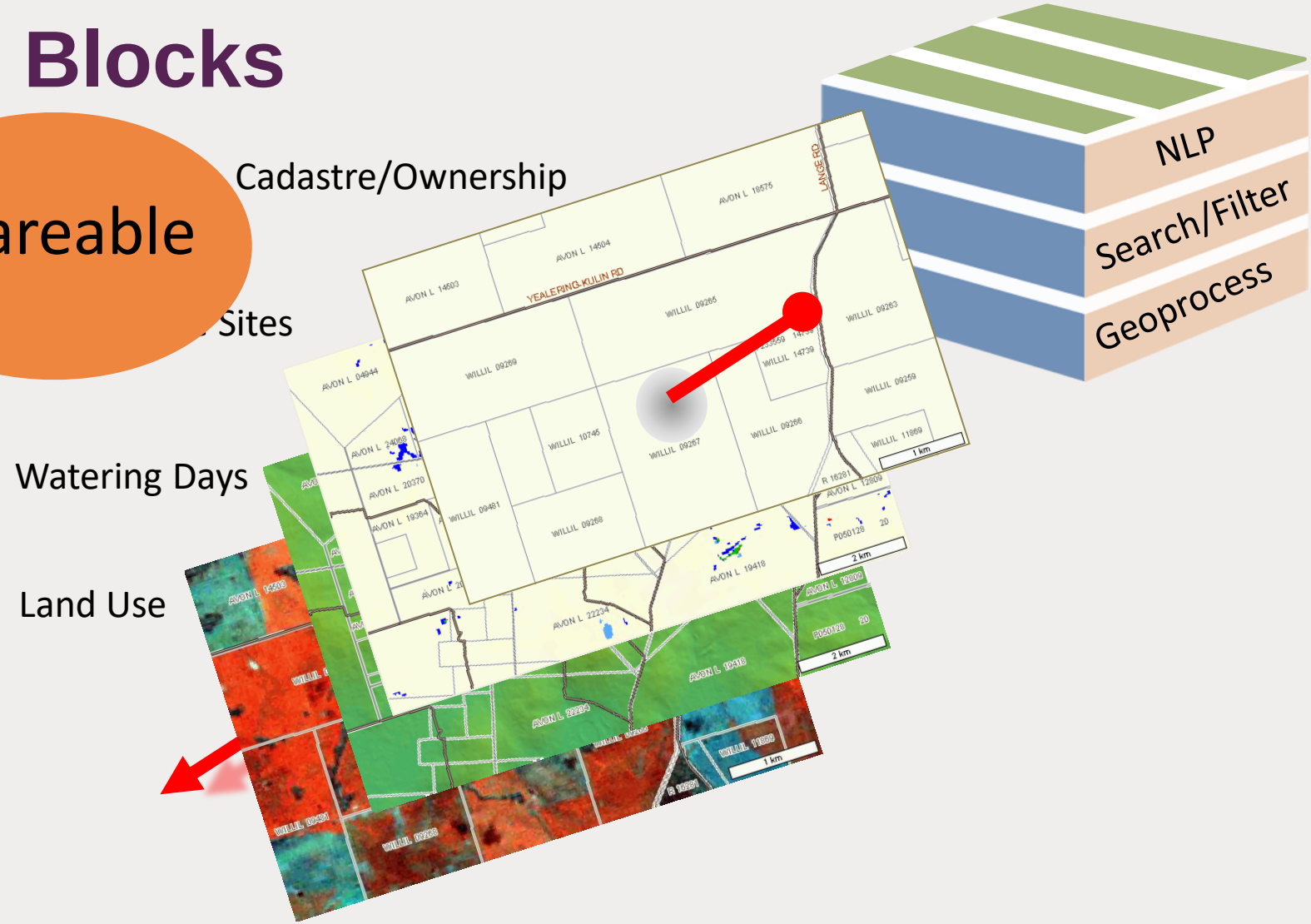
Shareable

Identify data resources

Geo-reference

Identify Property Point in Polygon

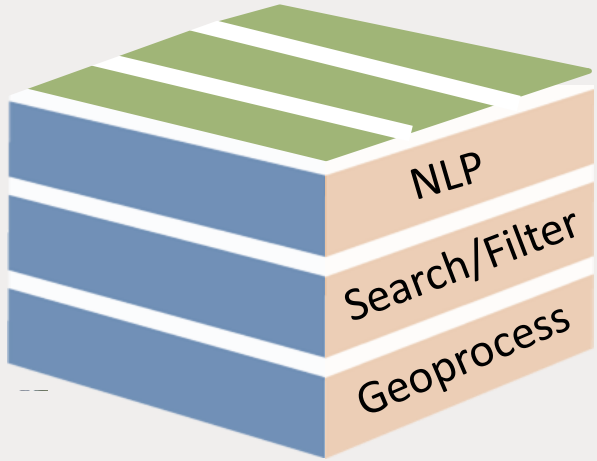
Spatial Intersect

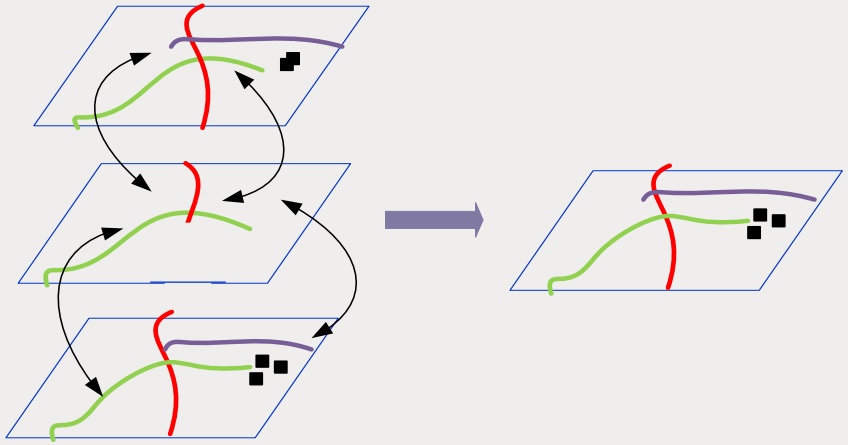


Process Ontology – knowledge required to automatically compile, coordinate and run a series of geoprocess

Process: Building Blocks

Geoprocesses





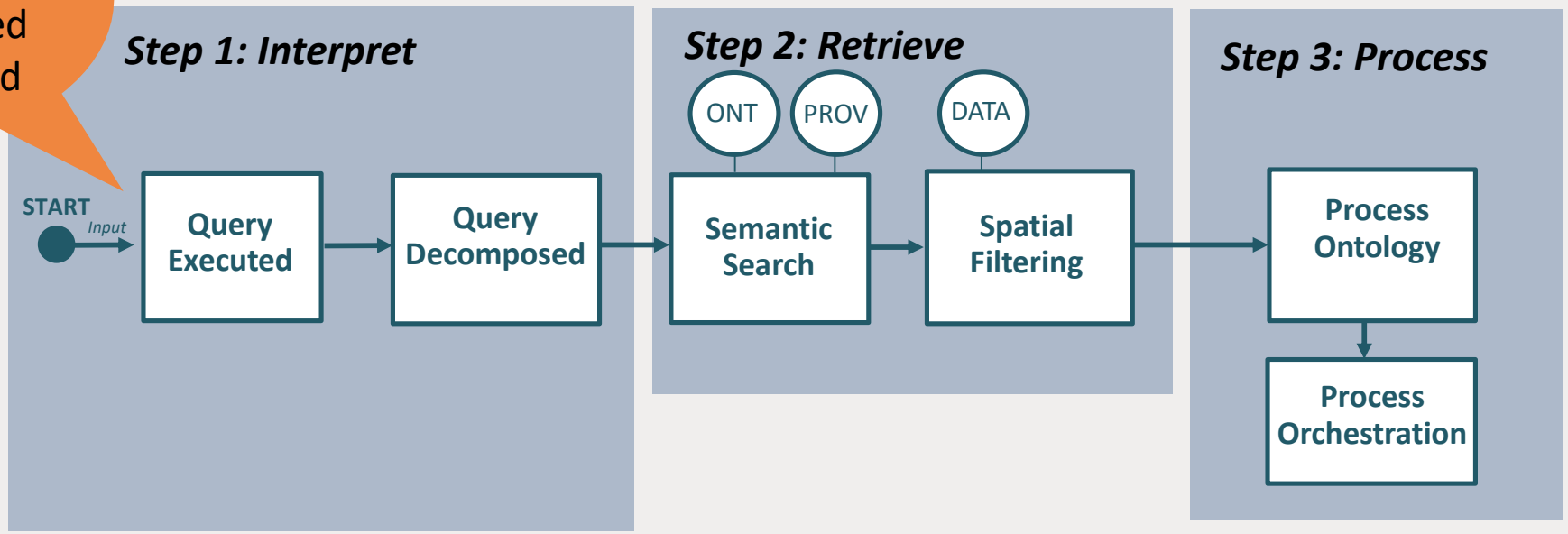
CONFLATION

FEDERATION

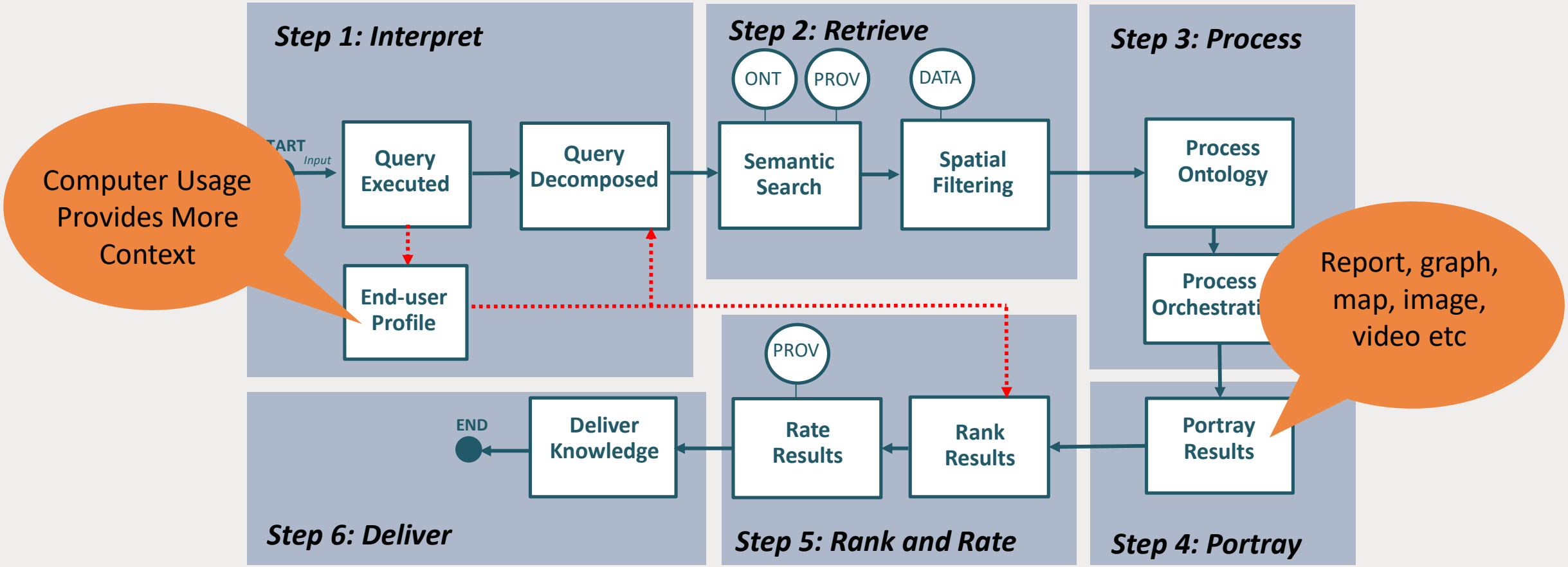
Conflate – single best dataset from multiple sources
Federate – joining adjacent datasets

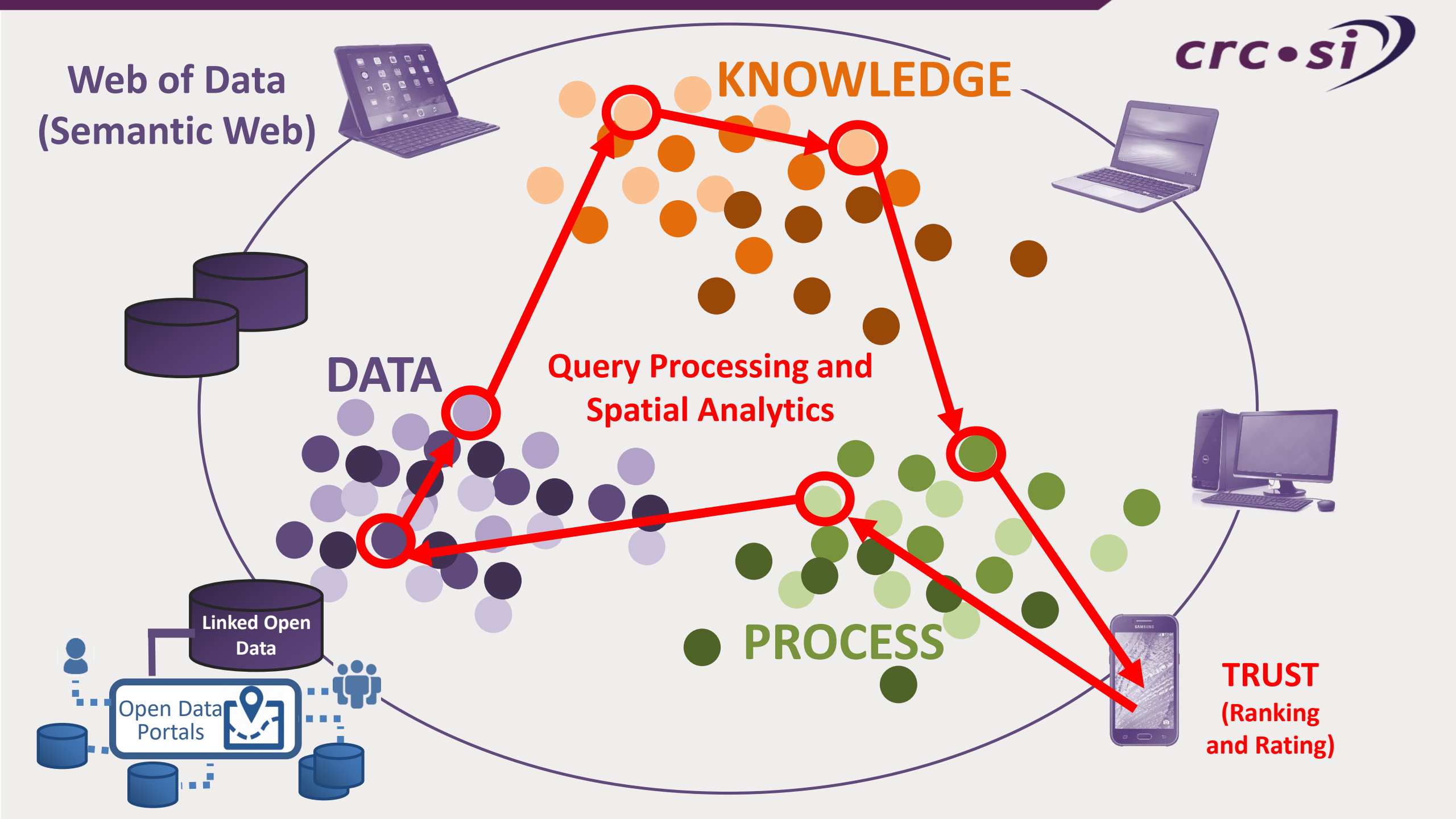
Steps 1-6 Query Processing

What responsibilities are associated with this land



Steps 1-6 Query Processing




Web of Data
(Semantic Web)
KNOWLEDGE
DATA
Query Processing and
Spatial Analytics
PROCESS
Linked Open
Data
Open Data
Portals
TRUST
(Ranking
and Rating)

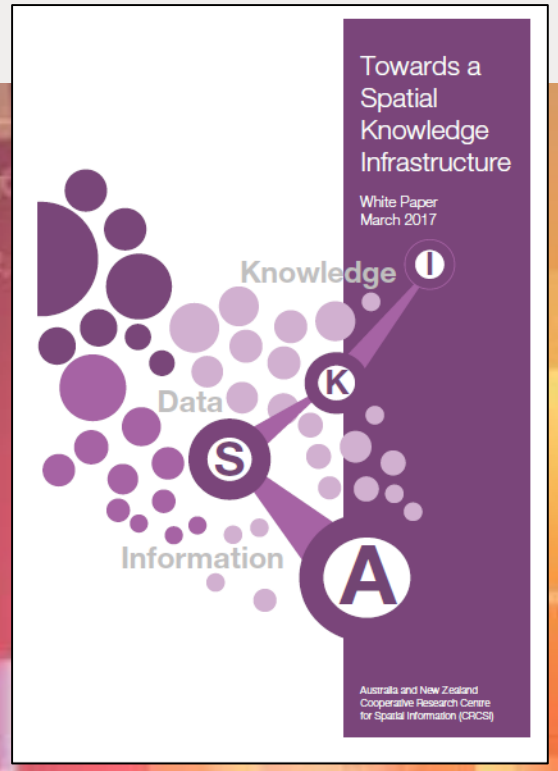
The SKI is not a centralised service or distinct entity.

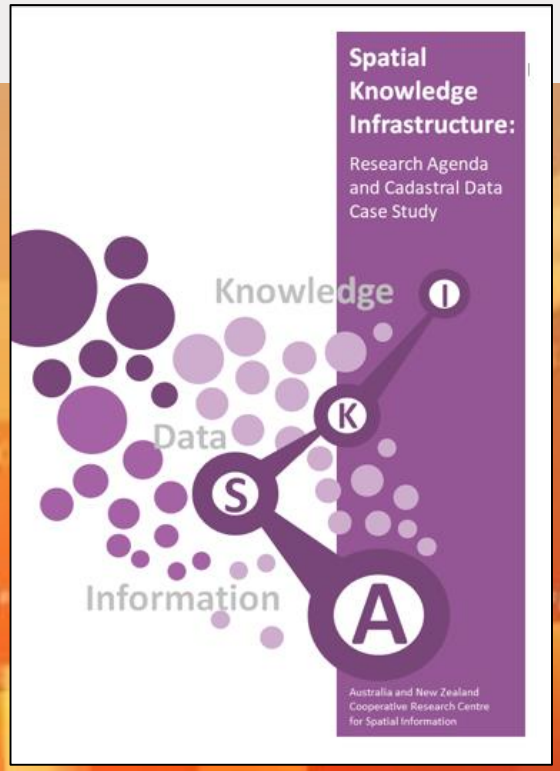
The SKI embodies the behaviour of resources available in the Web of Data.

Spatial Knowledge Infrastructure

For more information

Download the White Papers at http://www.crcsi.com.au/





Knowledge On-demand: Using Semantic Web Technologies to Deliver the Next Generation Spatial 'Knowledge' Infrastructure

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Abstract

This paper conceptualises a future Spatial Knowledge Infrastructure (SKI). The framework and architecture presented provide a foundation for *knowledge on-demand*. This is a paradigm shift from current data-driven decision-making processes that rely on supplier-driven data and spatial analytics, to one where end-users are able to pull knowledge at will from the Web of data in their own time and context.

The customary data-driven approach relies on data suppliers knowing how their information is to be used and what questions need to be answered. Creating data that is fit for a multitude of purposes is problematic and impractical. Decision-making may cross several knowledge domains and end-user needs are often arbitrary and multifaceted. Information requirements are therefore open-ended, and hard to predict and plan for.

Rather than tackle *demand forecasting* from a data producer's perspective, the proposed SKI confronts the problem from the user's viewpoint. It moves the traditional SDI norm on from data creation and access as the core underpinning principles for information sharing, to open query interfaces and spatial analytics for knowledge discovery.

The SKI specifically targets 'quest for knowledge', where end-users are seeking real-time answers to make informed decisions and solve problems. The motivation is to satisfy society's growing expectation for knowledge on-demand. Targeting system design from a knowledge-*out* rather than a *data-in* perspective makes good sense. However, getting knowledge-out requires a rethink in the way data is structured, particularly the linkages between data elements that enable knowledge inferencing.

This paper explores the core elements of the Semantic Web in combination with natural language processing and orchestrated spatial analytics to attain an SKI that is in step with modern community expectations and the emerging *On-demand Revolution*.

1. Introduction

It's time for the spatial sector to extend its focus beyond simply *delivering access to data* in spatial data infrastructures (SDI), and take a more proactive step in *delivering knowledge value*. The SDI is arguably one of the most significant advancements in the spatial sector and a game changer for governments in providing for the coordination and sharing of spatial data, however today's decision-makers require far more from these SDIs than simply access to data. Anecdotally, they want to be able to query data at will and receive answers in a format that they can use immediately (or consume directly into systems) without having to first download, manipulate and process data in order to get the knowledge they seek. This is a new value proposal for the decision-making consumer and will require a shift in thinking from the current SDI 'data access' focal point.

Thank you