Geo-Crawler

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Under Guidance of

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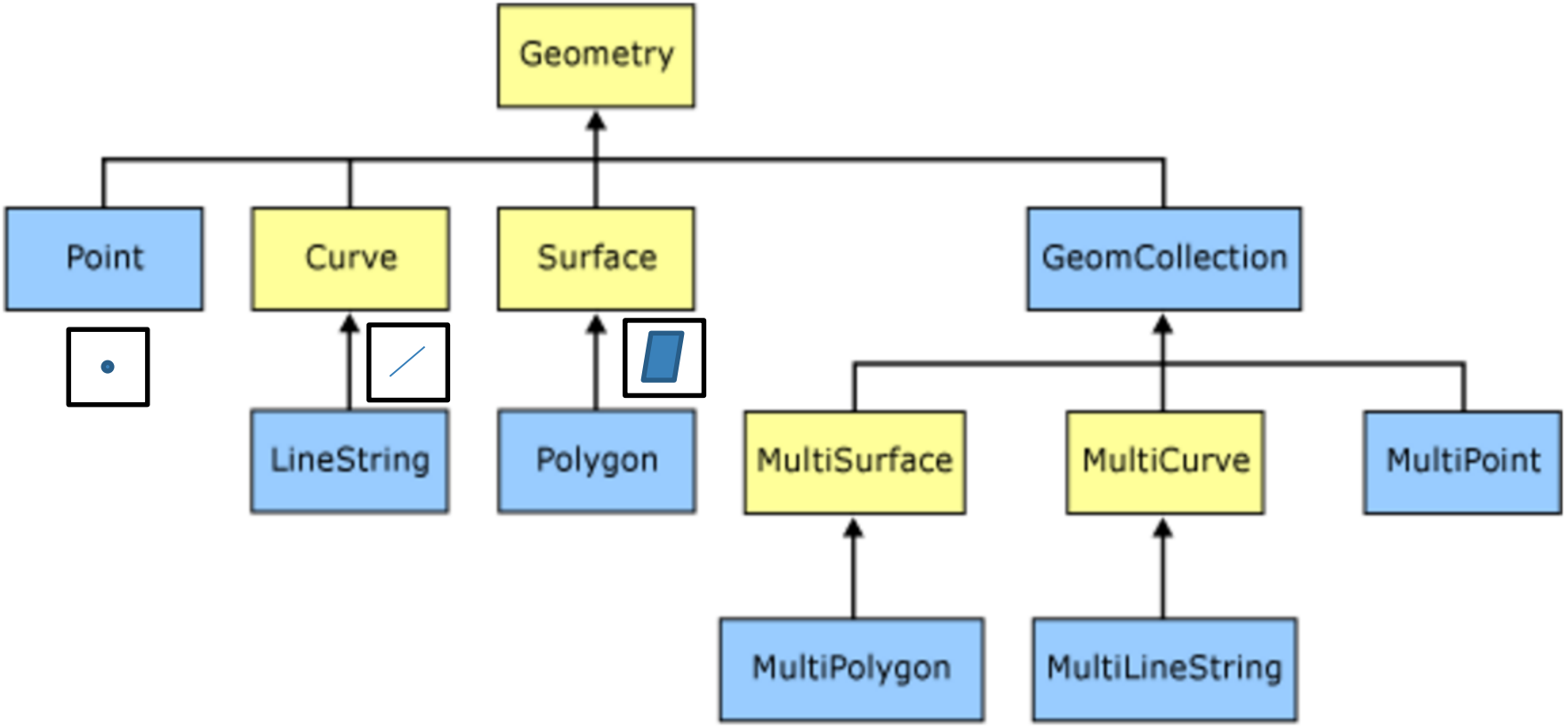
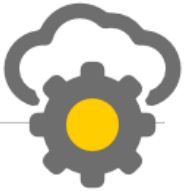
Spatial data
is data containing Information about the locations and shapes of geographic features and the relationships between them, usually stored as coordinates and topology.

Source: http://support.esri.com/



Spatial Object Types

Source: msdn.microsoft.com



OGC Web Services

WMS

- Deliver map images
- Metadata about available layers
- GetCapabilities, GetMap, DescribeLayer

WFS

- Direct access to features
- GML/SOAP interface
- Query/get feature
- Add feature
- Delete feature
- Update feature

WCS

- Multi-dimensional coverage of data
- Provides sptio-temporal information
- Provides rich semantics than WMS and WFS

3 *terabytes*

on daily basis

Source : [NASA:2007]

How to search spatial data ?

Catalog Approach

- Registry not up to date
- Incorrect classification of services
- Not all service providers registers, all kind of services

Utilize popular search engines

- Google, Yahoo, Bing etc.
- Uses page rank, instead of quality of service (QoS)

What is a *Crawler* ?

" A program that systematically browses the
World Wide Web
in order to create an index of data. "

- E.g. bingbot, polybot, googlebot

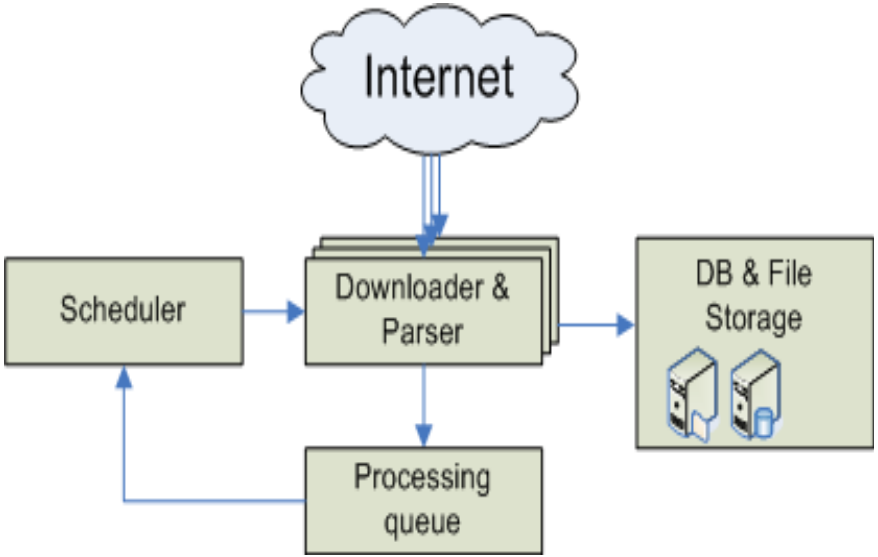
Challenges

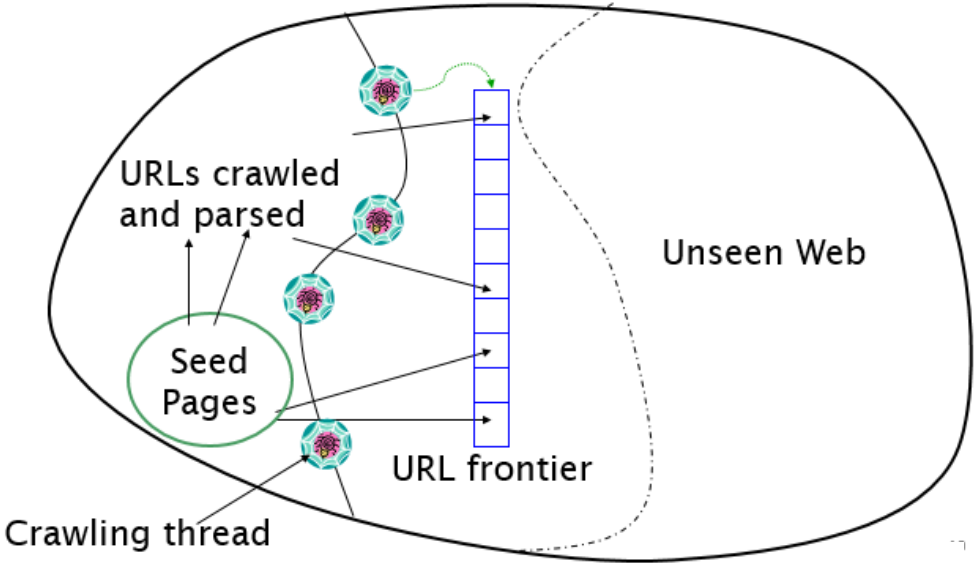
- Scale of the web
- Refresh rate
- heterogeneity

Types of Crawler

- Universal crawler
- Focused crawler
- Topical crawler

How it works ?





Source: nazou.fiit.stuba.sk/home/?page=webcrawler

Spatial Web Crawler: Objectives

- **Building a spatial web crawler** using *WFS* based on *OGC* standard.
- Building a ***domain ontology*** with spatial *feature type*.
- **Semantic matching** using *ontology* and indexing of geo-servers with offered *feature type* reference.
- Performing experiment with test seed *URLs* and **analysing the performance** of the crawler in terms of accurate semantic annotations.

Crawler Architecture

Extraction module

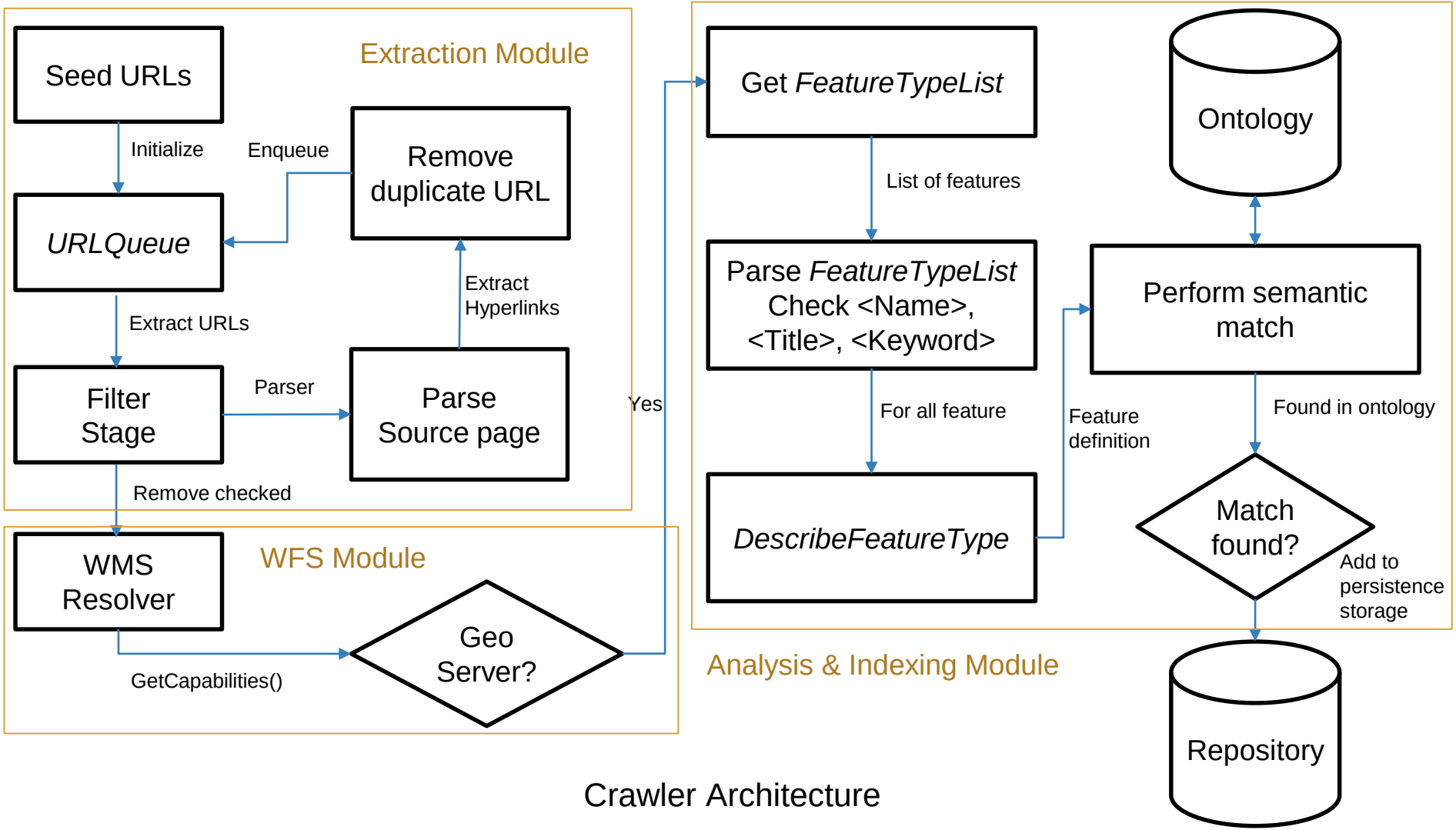
- Read URL from *URLQue*
- Extract hyperlinks
- Remove duplicates
- Push to *URLQueue*

WFS module

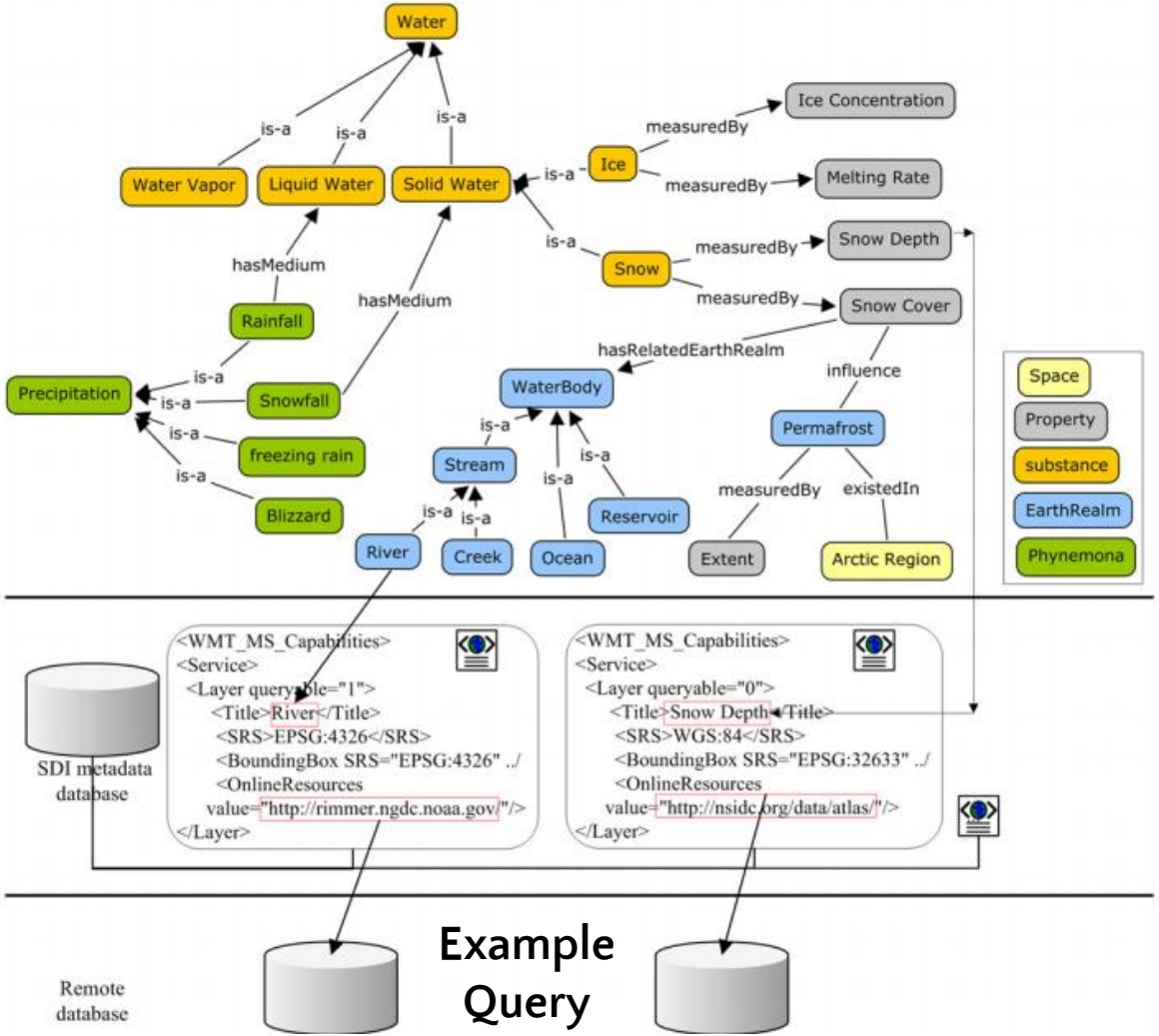
- Generate GetCapabilities request by appending to URL
- Check whether server is a *WFS* server via XML response

Analysis & Indexing module

- Extract *features*
- Perform a semantic match
- Compare extracted features with *ontology*
- Add geo-server to repository



Crawler Architecture



source: Li, W., *et al*. Computers & Geosciences,2011.

Advantages of Spatial web crawler

- Allows searching of pages that are currently not searchable from the general search engines
- Provides a more up-to-date search
- Provides improved accuracy and extra features not possible with general search engines

Performance Evaluation

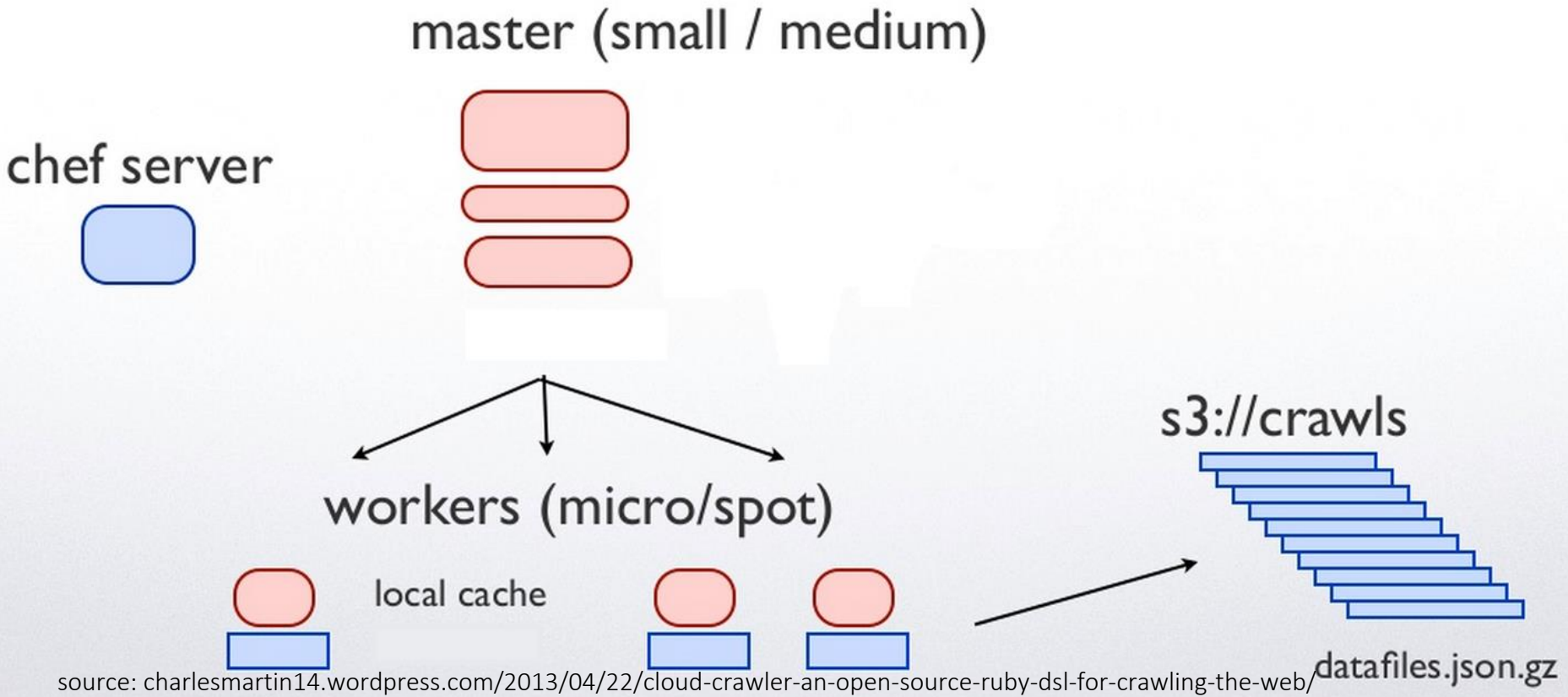
- $$precision = \frac{(Number\_of\_relevant\_geoservers\_found)}{(Total\_Number\_of\_geoservers\_found)} * 100\%$$
- $$recall = \frac{Number\_of\_relevant\_geoservers\_found\_in\_search}{Total\_Number\_of\_existing\_relevant\_geoservers} * 100\%$$
- $$F1 = 2 * \frac{(precision * recall)}{(precision + recall)}$$

Final score is calculated by taking average over all *feature types*.

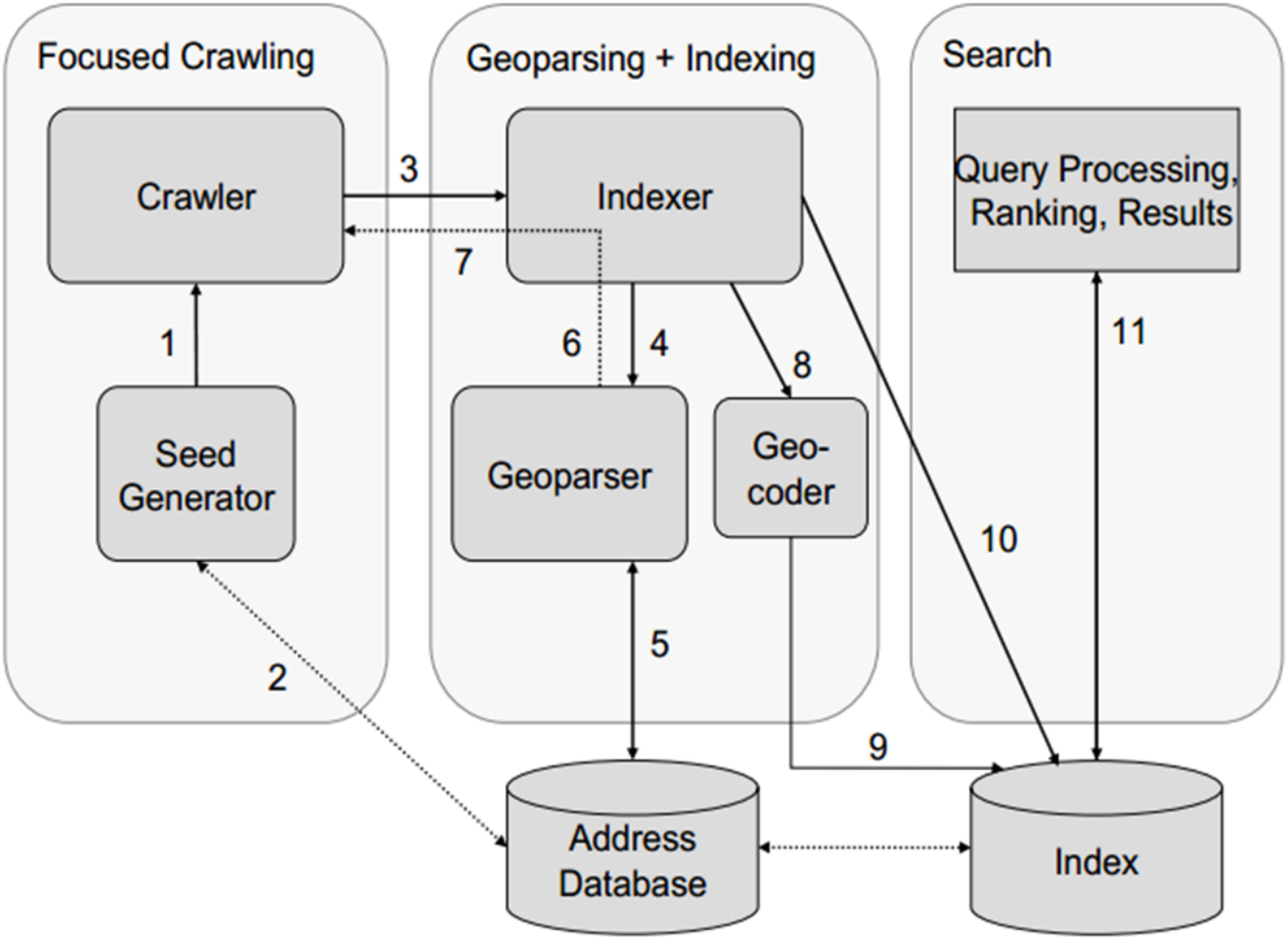
Future work & Extensions

- Priority based crawling
- Parallelization
- Cloud based crawler implementation
- Spatial search engine & ranking

cloud-crawler: architecture



source: charlesmartin14.wordpress.com/2013/04/22/cloud-crawler-an-open-source-ruby-dsl-for-crawling-the-web/



Architecture of a spatial search engine [Source: Ahlers *et al.* Springer London, 2009.]

References

I. Patil, Sonal, Shrutilipi Bhattacharjee, and Soumya K. Ghosh. "**A spatial web crawler for discovering geo-servers and semantic referencing with spatial features.**" Distributed Computing and Internet Technology. Springer International Publishing, 2014. 68-78.

II. Li, Wenwen, Chaowei Yang, and Chongjun Yang. "**An active crawler for discovering geospatial web services and their distribution pattern–a case study of OGC web map service.**" International Journal of Geographical Information Science 24.8 (2010): 1127-1147.

III. Jiang, Jun, Chong-jun Yang, and Ying-chao Ren. "**A spatial information crawler for opengis wfs.**" Sixth International Conference on Advanced Optical Materials and Devices. International Society for Optics and Photonics, 2008.

IV. Marc Najork. "**Web crawler architecture.**" Microsoft Research.

V. Ahlers, Dirk, and Susanne Boll. "**Location-based Web search**." The Geospatial Web. Springer London, 2009. 55-66.

VI. Li, W., et al. "**Semantic-based web service discovery and chaining for building an Arctic spatial data infrastructure.**" Computers & Geosciences 37.11 (2011): 1752-1762.

Thanks!

Any questions ?