The technology of the IANCIS platform

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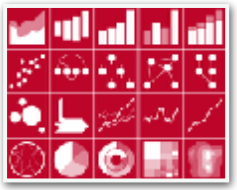
Data Analysis Framework

ACQUISITION

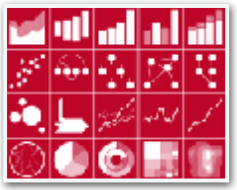
ELABORATION

VISUALIZATION



Data Analysis Framework

ACQUISITION → ELABORATION → VISUALIZATION



Acquisition

- *Broad* crawling
- *Focused* crawling

Data Analysis Framework

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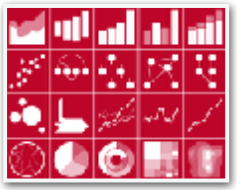

Acquisition

- *Broad* crawling
- *Focused* crawling

Elaboration

- *Data grabbing* from web pages
- *Text extraction* from web resources
- *Analysis* of extracted texts

Platform Workflow

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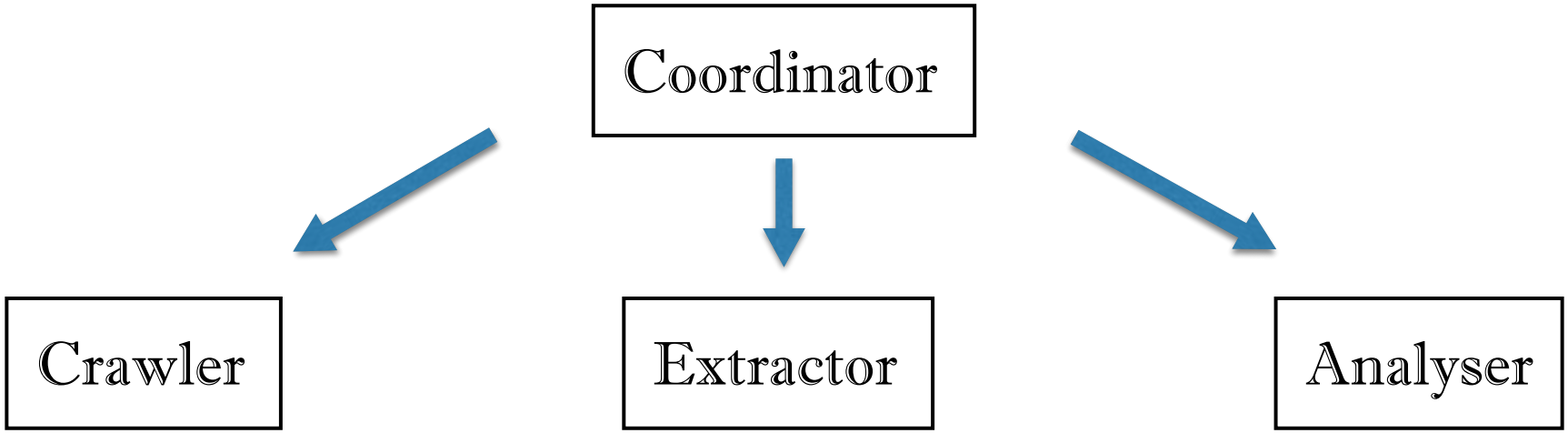

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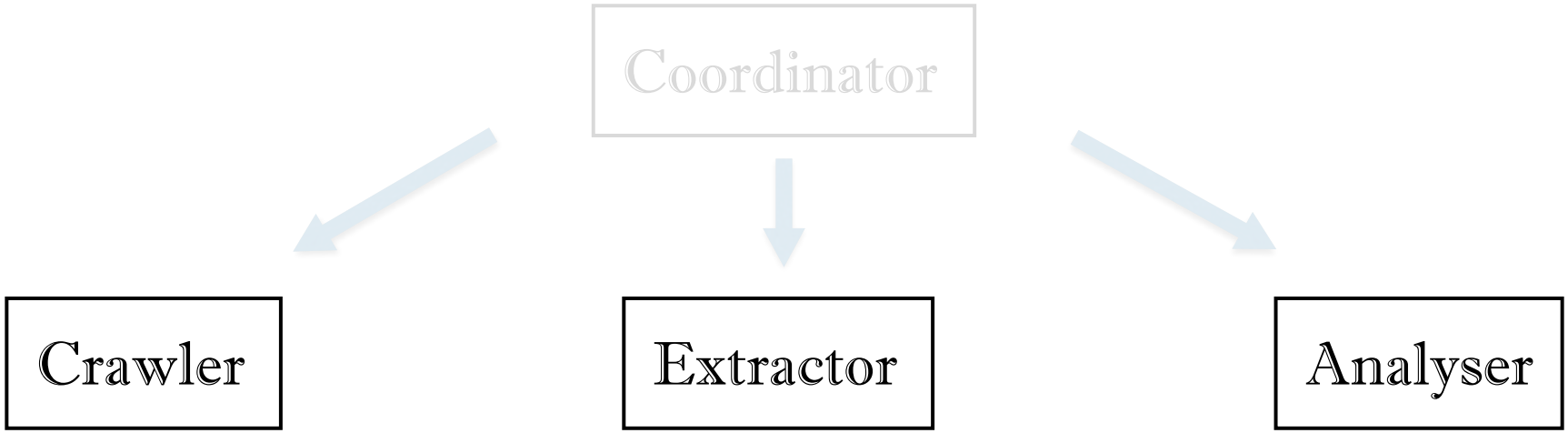

Platform Workflow

Coordinator

Crawler

Extractor

Analyser

BUbiNG

WARC

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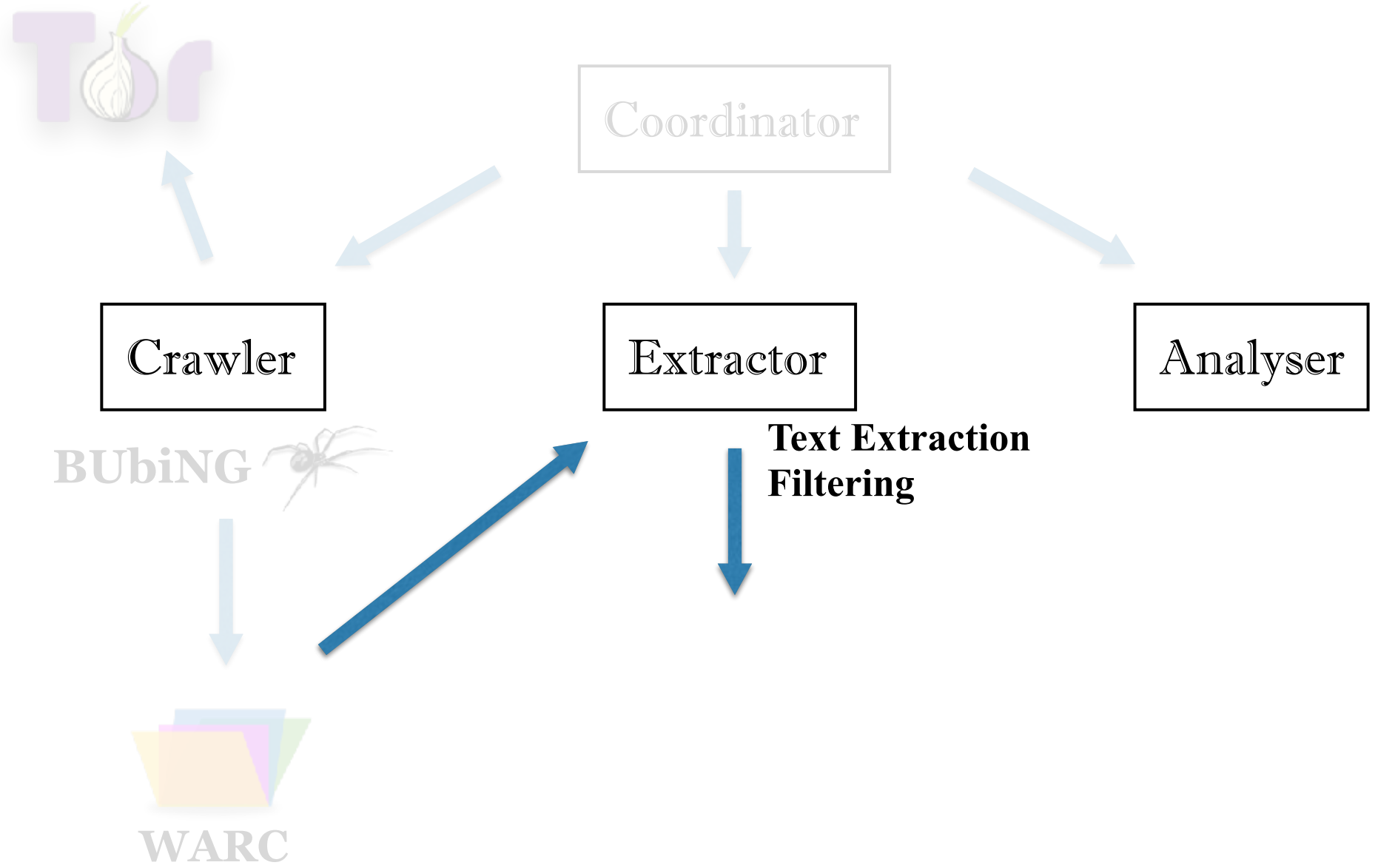

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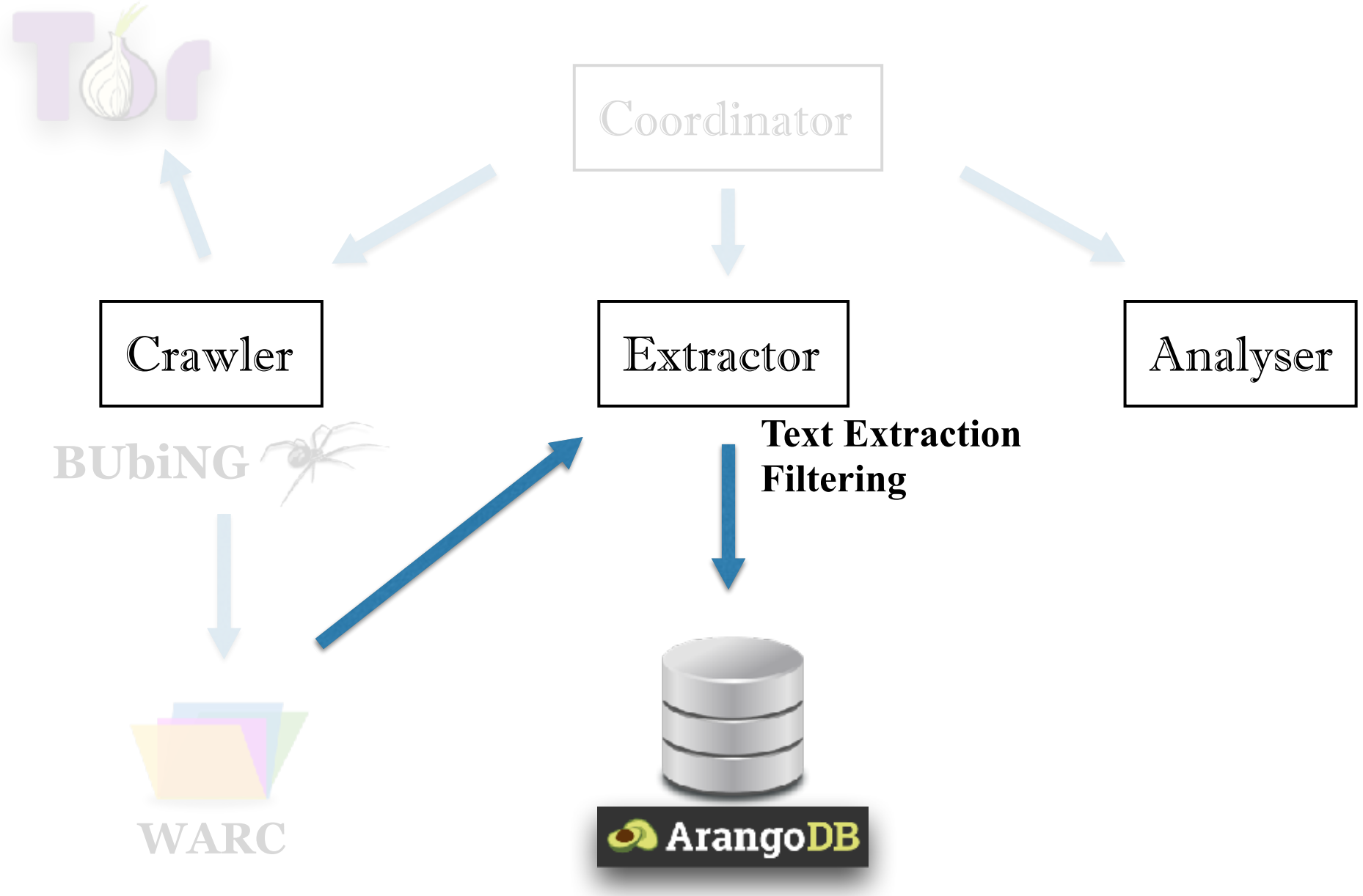

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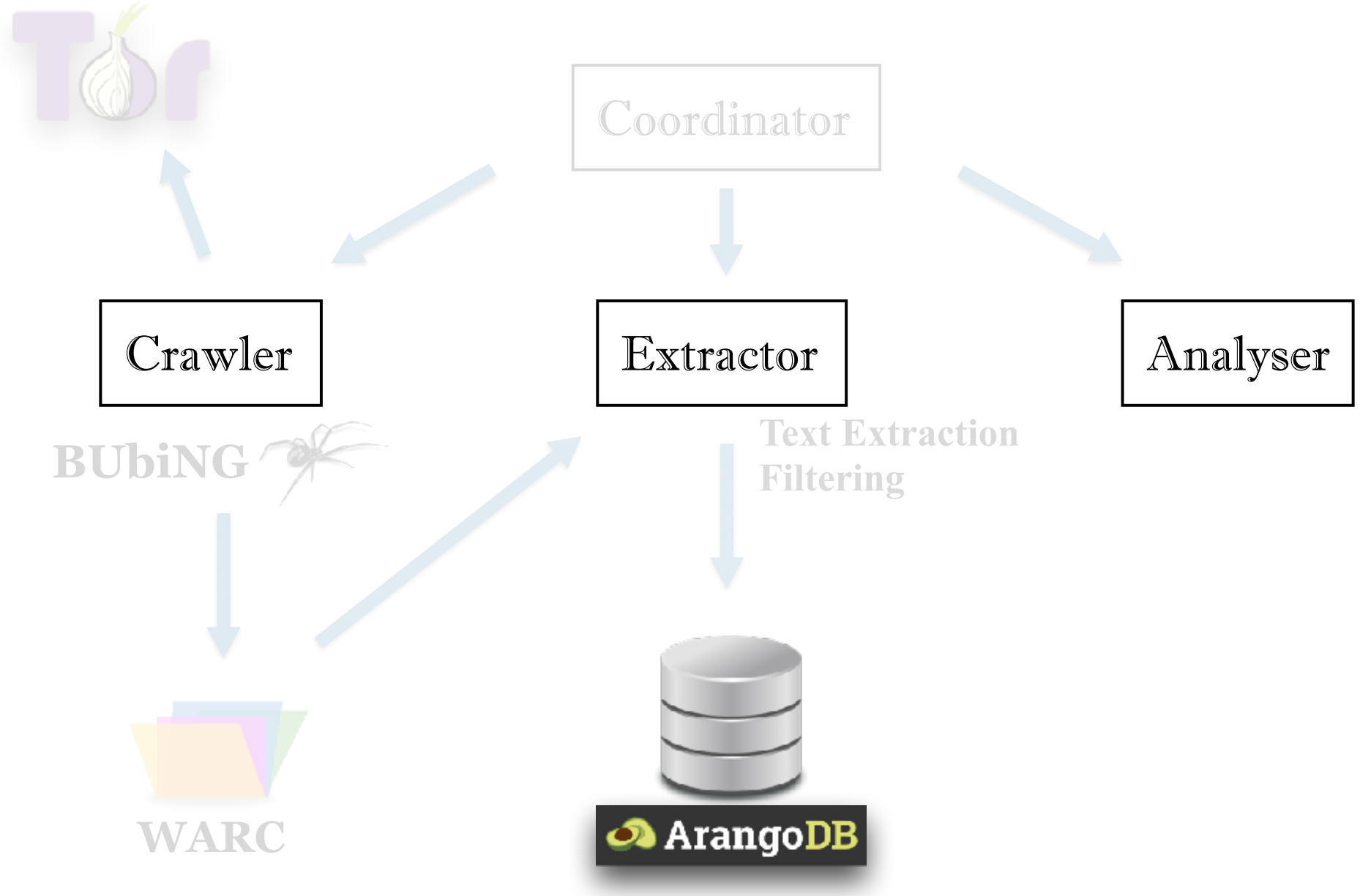

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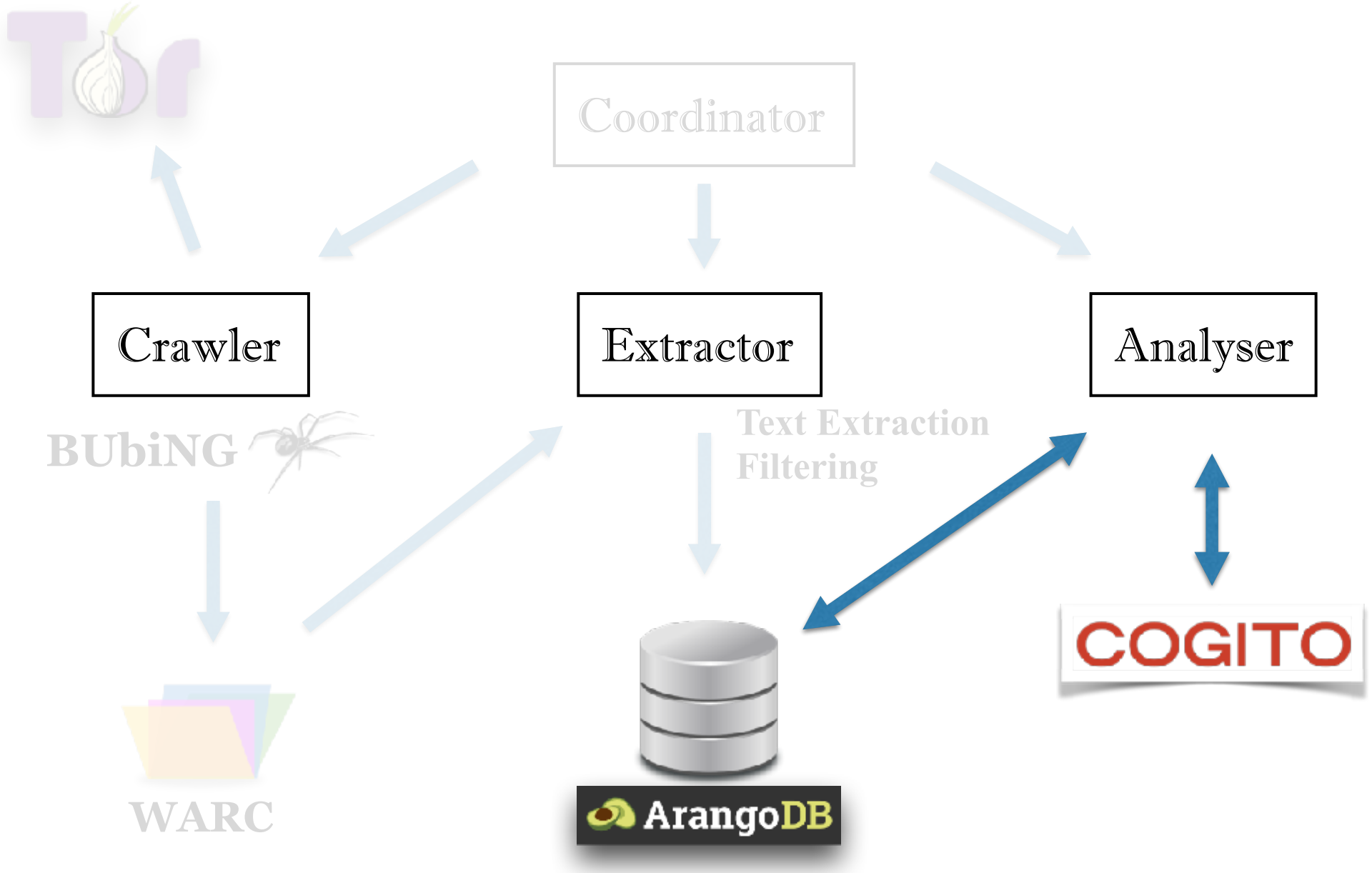

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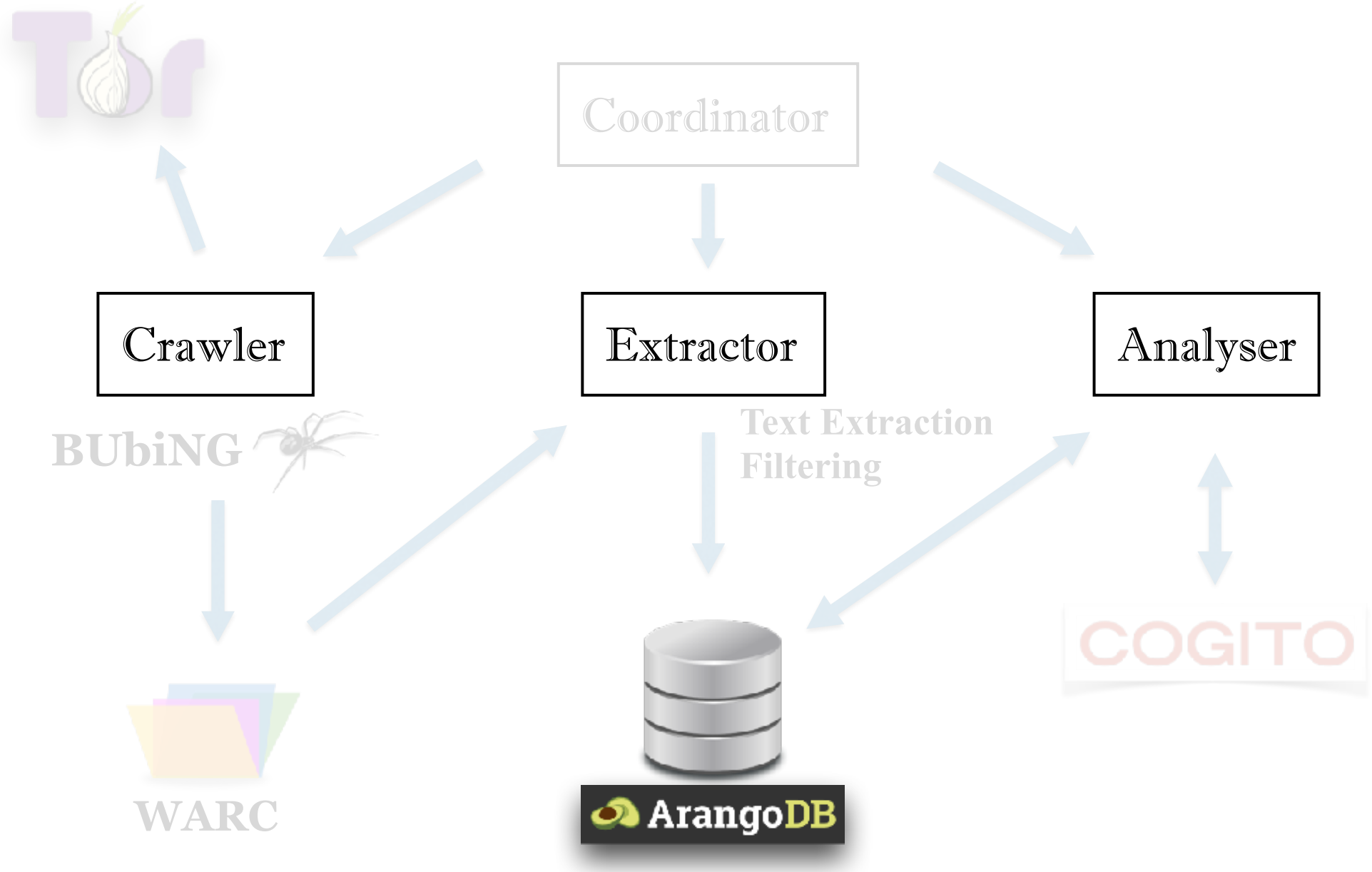

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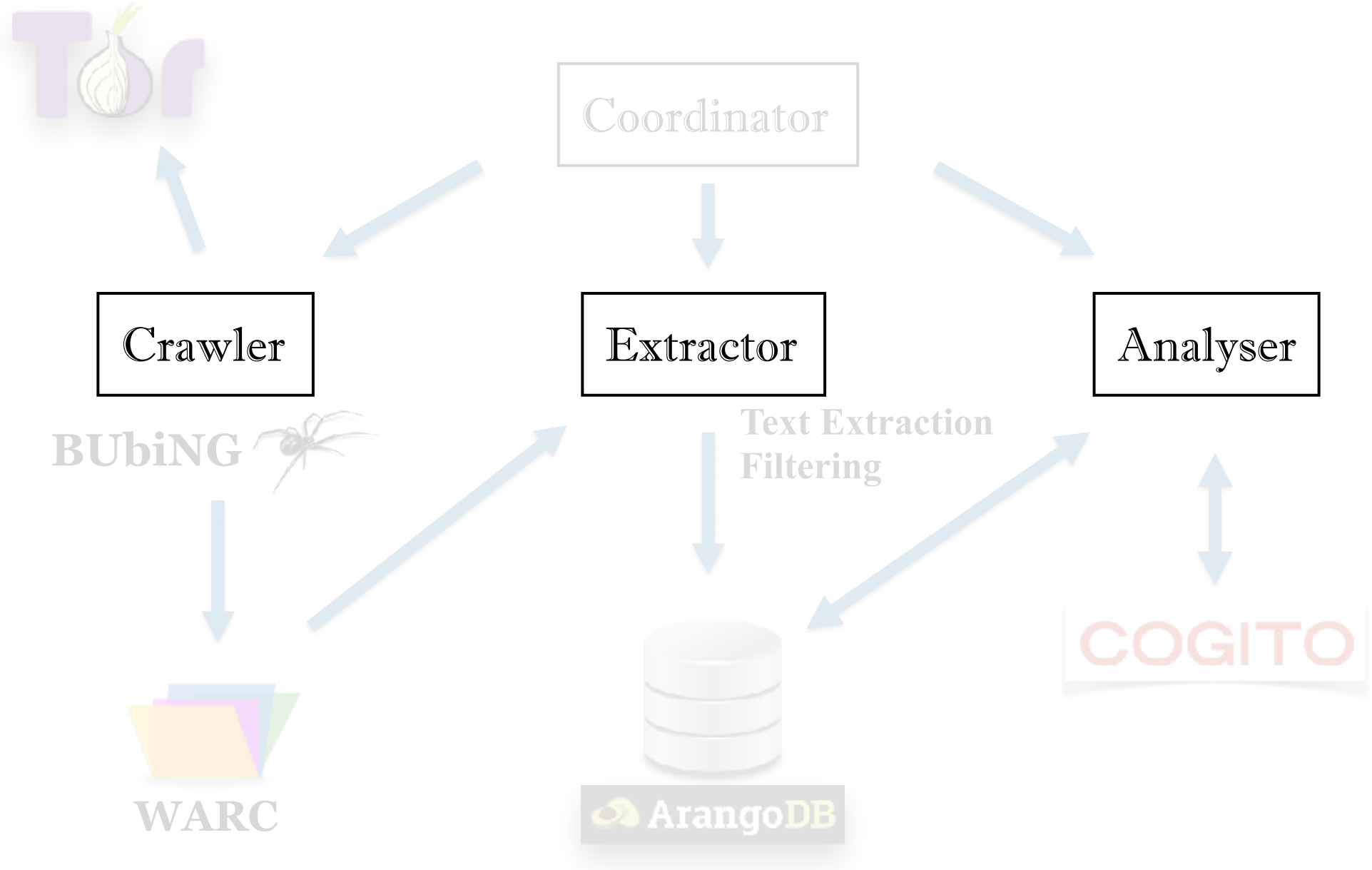

Crawling

New crawler from scratch

Explored alternatives:

BUbiNG

For our evaluation we considered: **performance, configurability, extensibility and supportability**

We tested the performance of our **crawler prototype** and evaluated the time required to implement the missing features

We identified BUbiNG as the base for our crawler component. A customized version of BUbiNG is currently part of the crawling unit of our framework

Data Storage

It supports several data models: ***documents, graphs, and key-values***

It supports ***ACID transactions*** if required

It provides a ***SQL-like query language*** or JavaScript extensions

DOCUMENTS

The storage unit is a document, in a relational database the storage unit is a record

Documents in a collection may have a ***different structure***

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For each web resource we store the following informations

TEXT
LANGUAGE
CRAWLING_DATE
EXTRACTION_DATE

WARC_HEADER
HTTP_HEADER
TIKA_METADATA
URL

ANALYSIS_DATE
COGITO

Technologies

ACQUISITION

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ELABORATION **Text Extraction**

TIKA: open-source software suite for the identification and extraction of text from more than 1500 different file types

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COGITO: semantical analysis engine by Expert System, which classifies a text according to a suitable taxonomy, providing both quantitative and qualitative information (*what topic* is the text about and *to what extent* the text discusses such topic)

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DATA STORAGE

ArangoDB

ArangoDB: is a multi-model, open-source, NoSQL database with flexible data models for documents, graphs, and key-values

Focused Crawling

OBJECTIVE:

Crawling of a known subset of websites (e.g. blogs, forums, marketplaces, etc.), and possibly only of a specific portion of such websites

CUSTOM SPIDERS

SCRAPY: an open source and collaborative application framework for crawling web sites, which can be used for a wide range of useful applications

Each web site has its own page layout, which can be used:

- to drive spiders
- to automatically grab data

Focused Crawling

SPIDERS

Each spider crawls a targeted website

TOR WEBSITES

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Relevant data are grabbed from each page

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Data are stored and organized in a database

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DATA STORAGE

SEMI-STRUCTURED data *(web pages)* are transformed into **STRUCTURED** data *(DB tables)*

Exploring and Analyzing the Tor Hidden Services Graph

Analyzing the Tor Graph

OBJECTIVE:

Gather ***information concerning the topology*** of the Tor Web and identify potential relationships among ***topological properties and hidden services' contents***

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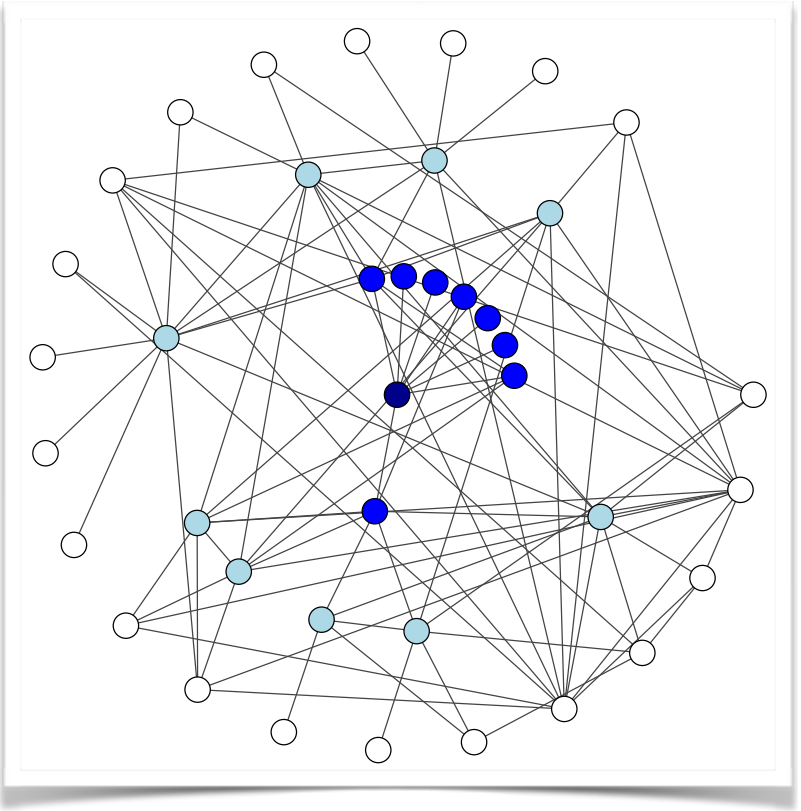
We construct 3 graphs:

- Page Graph (PG)
- Host Graph (HG)
- Service Graph (SG)

Graph	# Nodes	# Arcs
Page Graph	918885	17963147
Host Graph	5420	64379
Service Graph	5144	59492



Analyzing the Tor Graph

TOPOLOGY

We identify ***the most important nodes*** in the network, namely those with highest degrees and Betweenness Centrality*

Top nodes represents interesting ***targets for investigation***

Table IV: Degree and Betweenness Centrality (Top 10)

Rank	Node Index				
	In-degree (PG)	Out-degree (PG)	Degree (PG*)	BC (PG)	BC (PG*)
1	255	6855	255	142	154
2	3399	496	496	452	461
3	13499	8107	3399	653	4217
4	341315	42224	13499	422	15324
5	344053	218797	341315	12630	28608
6	341666	103530	343628	3467	37137
7	790729	131172	344053	1558	39458
8	343628	130099	341666	348	40354
9	342870	128671	790729	1913	42400
10	411	128096	6855	1198	46429

*BC measures the extent to which a vertex lies on paths between other vertices

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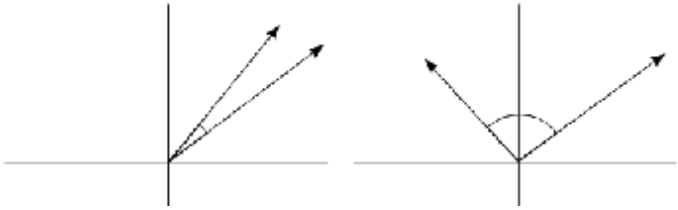
HIDDEN SERVICES' CONTENTS

We use ***Cogito's output to represent the content*** of each visited page (a vector for each page)

We use the ***cosine similarity*** to measure the similarity between any two pages



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Analyzing the Tor Graph

FINDING COMMUNITIES:

We can identify ***components with increasing semantic similarity by cutting off graph nodes with increasing BC score*** (or increasing degree)

It emerges that the ***BC is a better performing metrics than the degree*** to the end of identifying semantic uniform sub-components

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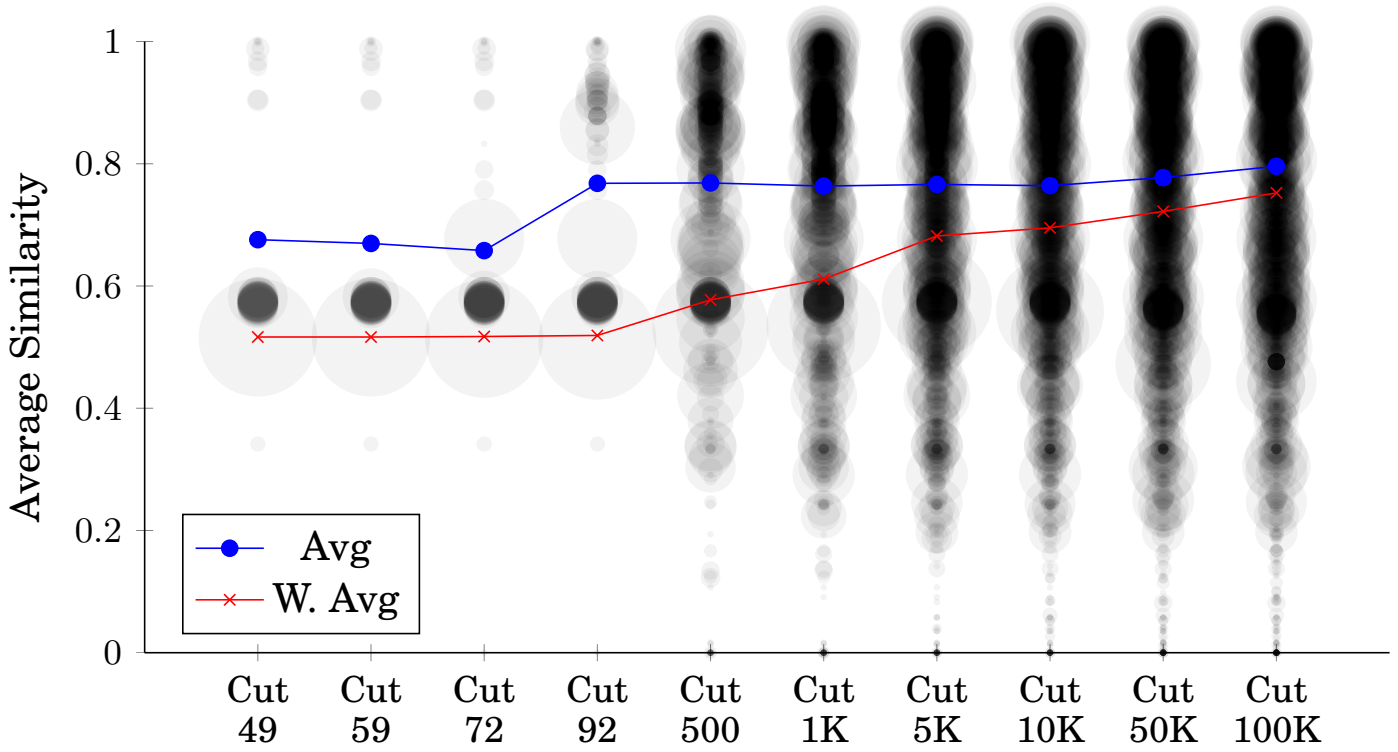

Thank you for your time