

(The art of not shooting yourself in the foot using Elasticsearch)

# Using Elasticsearch as the Primary Data Store

CNCML Vienna

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@cloudnativecv

#CNCML19

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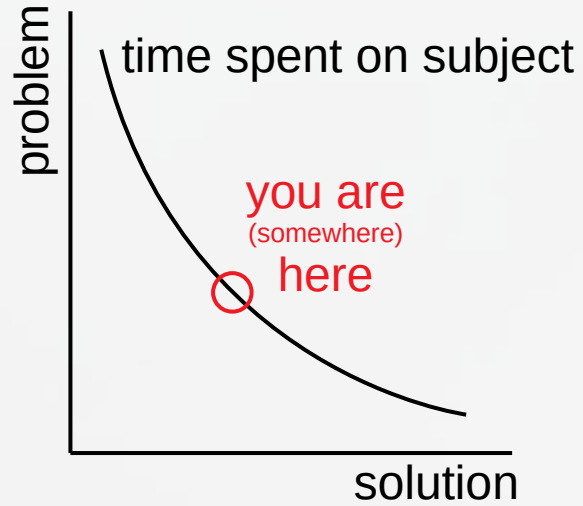
# Poll time!

- Recently purchased an item online?
- Elasticsearch users?
- Elasticsearch users with 10+ node clusters?
- Updating Elasticsearch indices real-time?

# Who am I?

- Volkan Yazici ([volkan.com](https://volkan.com) – @yazicivo – github/vy)
- Java plumber in the domain of search (bol.com, since 2014)
- interested in networking & concurrency
  - OpenJDK Project Loom (aka. fibers/coroutines for JVM)
  - Reactive Streams (Reactor, RxJava)
- F/OSS contributor
  - log4j2-logstash-layout
  - HRRS (HTTP Request Replay Suite)
  - quasar-maven-plugin
- BS in math, MS and PhD in CS

# Disclaimer





# **bol.com**

9+ million active<sup>1</sup> clients<sup>2</sup>

17+ million articles<sup>2</sup>

200k+ sellers<sup>2</sup>

1500+ employees<sup>2</sup>

62+ million visits/month<sup>2</sup>

<sup>1</sup> Customers who ordered an item in the last 365 days.

<sup>2</sup> As of October 2018.

# E-commerce search

- Search
  - Matching
  - Ranking
  - Faceting
- Guidance
  - Suggestions
  - Auto-corrections
  - Recommendations

The screenshot shows the Bol.com website interface for a search of 'wijn glazen'. The top navigation bar includes the Bol.com logo, a search bar with 'wijn glazen' entered, and links for 'Inloggen' and a shopping cart. Below the navigation, there are category filters and promotional banners. The main content area is divided into a left sidebar with filters and a main product listing area.

**Filters:**

- Categorieën:** Koken & Tafelen (1104), Glazen (Wijn glazen), Speelgoed (77), Wonen (63), Elektronica (13), Kamperen & Outdoor (10), Meer.
- Merk:** Riedel (67), Schott Zwiesel (77), Royal Leerdam (34), Meer.
- Kleur:** Transparant (877), Zwart (46), Multi (41), Meer.
- Aantal glazen:** 6 (432), 1 (217), 2 (172), Meer.
- Opties:** Vaatwasserbestendig (853), Y (484), Met voet (49), Meer.

**Product Listing:**

- Leonardo Puccini Witte Wijn glas - 6 Stuks**  
Vaatwasserbestendig | 6 stuks | 560 ml | Glas  
★★★★★ (39)  
Het ontwerp van deze Puccini wijn glazen voldoet niet alleen aan de huidige tijdgeest, maar de brede kelk zorgt er ook voor dat de... Meer  
24,-  
Op voorraad  
Voor 23:59 besteld, morgen in huis  
+ Select bezorgopties  
Verkoop door bol.com  
+ In winkelwagen
- Leonardo Puccini Rode Wijn glas - 0,75 l - 6 stuks**  
Vaatwasserbestendig | 6 stuks | 750 ml | Glas  
★★★★★ (26)  
Het ontwerp van deze Puccini wijn glazen voldoet niet alleen aan de huidige tijdgeest, maar de brede kelk zorgt er ook voor dat de... Meer  
30,96  
Op voorraad  
Voor 17:00 uur besteld, morgen in huis  
Verkoop door Brandsupply24  
+ In winkelwagen

# Who is using search?

- Customers
- Sellers
  - via web
  - via API
- Bots
  - search engines (Google, Bing, etc.)
  - competitors
- Internal services

# Search input

- **Product attributes** (title, EAN, ISBN, color, etc.)
- **Seller offers** (price, availability, deliverability)
- **Derived content** (for ranking)
  - Sale popularity
  - Price quality
  - Customer feedback (reviews, etc.)
- **Configuration** (faceting, value translations, etc.)



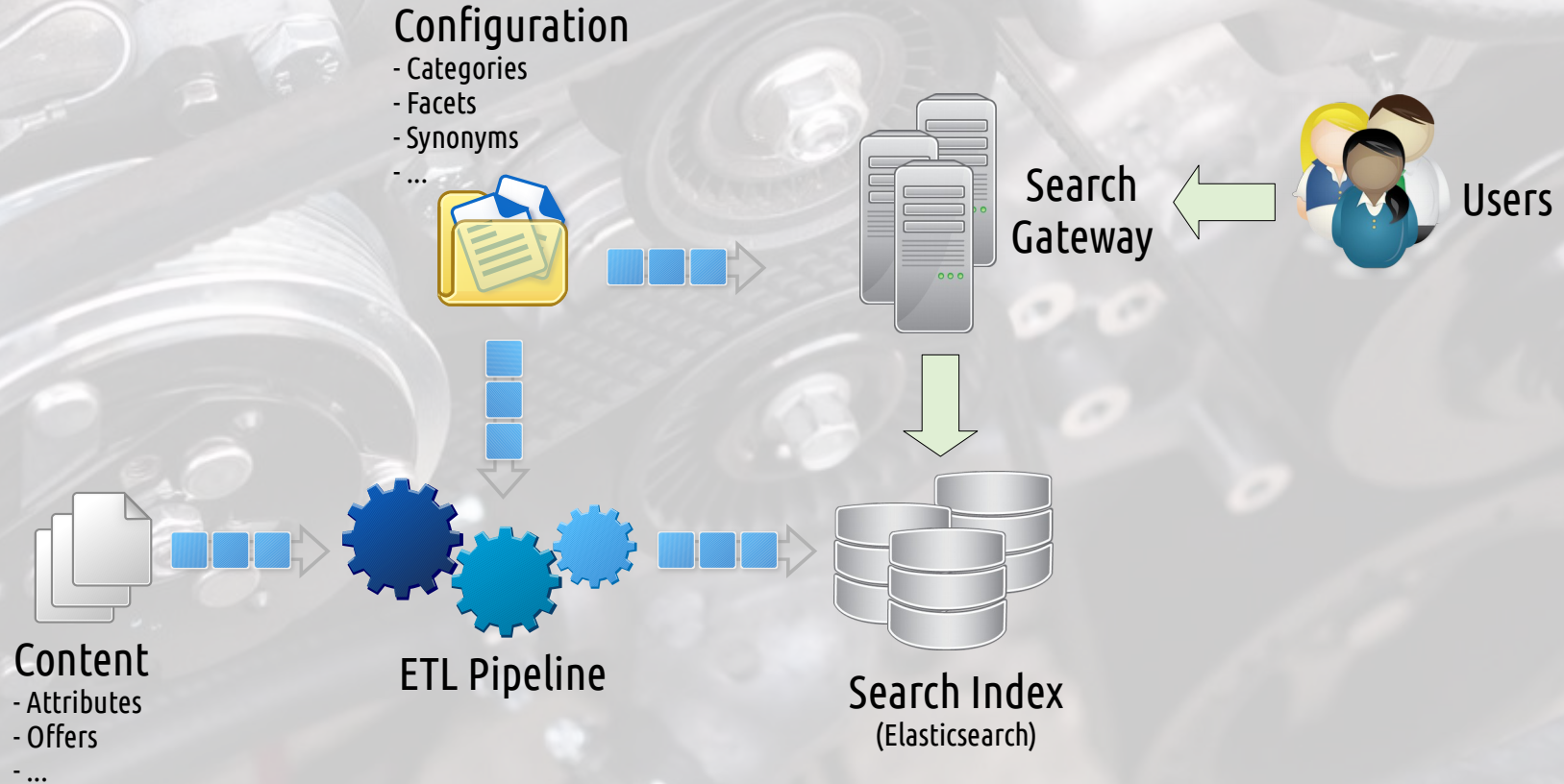
volume  
&  
volatility



# Search output

- **Hits** (products and offers)
- **Facets**
- **Auto-corrections**
- **Redirects** (huge SEO impact)

# Architecture overview



# Data arrival latency

Source	Past	Present	Future
Attributes	1/24h	streaming	streaming
Offers	streaming	streaming	streaming
Facets	1/24h	1/24h	streaming
Indexing	1/24h	1/5h	streaming

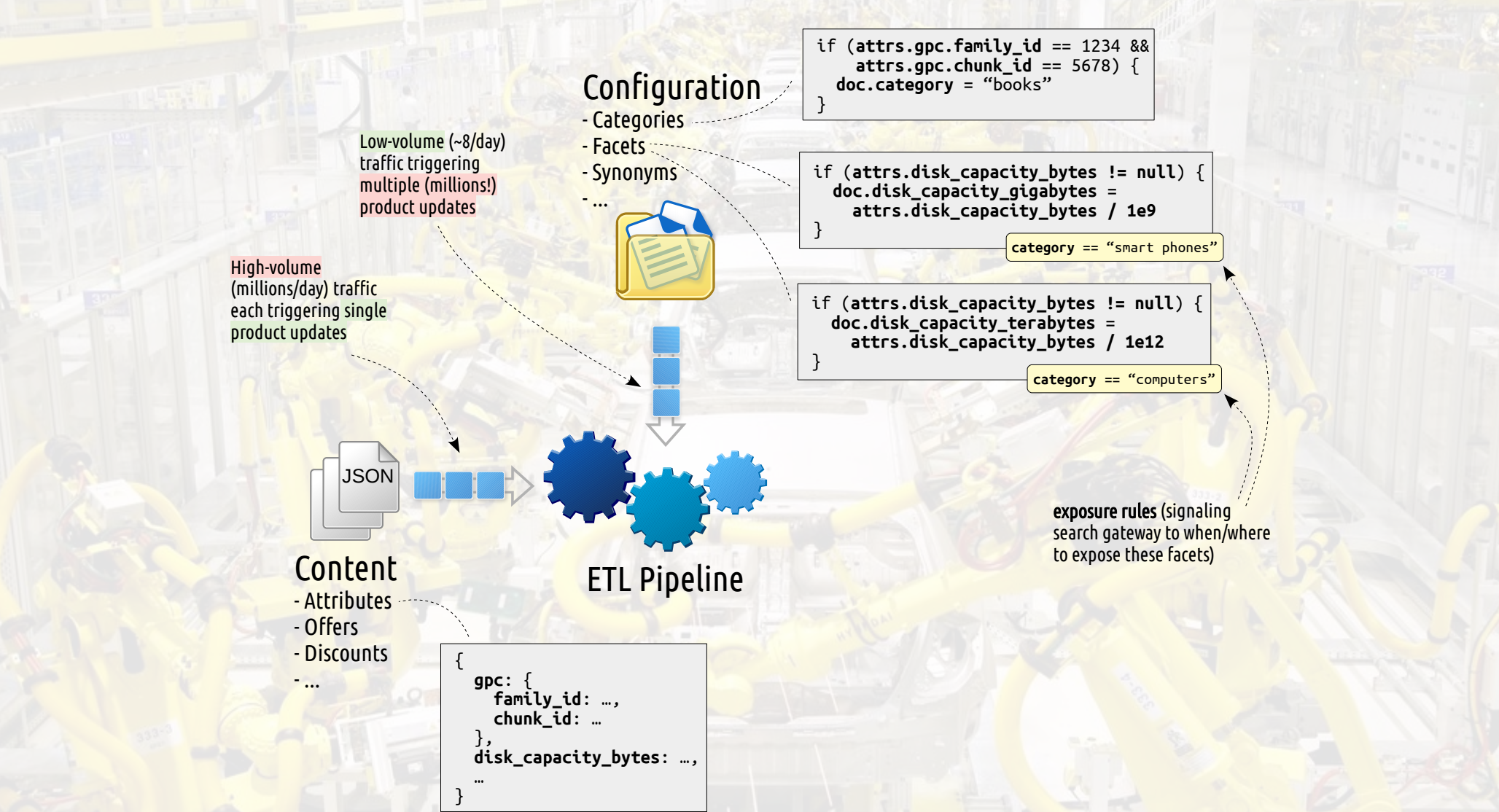
# Performance

- Search
- ETL
- Caching  
(see [Varnishing Search Performance](#))



A high-angle, perspective view of a car assembly line. The line is filled with silver car chassis moving away from the camera. On both sides of the line, numerous yellow robotic arms are positioned, ready to work on the vehicles. The factory floor is clean and industrial, with various equipment and safety railings visible. The lighting is bright and even.

ETL  
(Extract, Transform, Load)



## Configuration

- Categories
- Facets
- Synonyms
- ...

```
if (attrs.gpc.family_id == 1234 &&
    attrs.gpc.chunk_id == 5678) {
  doc.category = "books"
}
```

```
if (attrs.disk_capacity_bytes != null) {
  doc.disk_capacity_gigabytes =
    attrs.disk_capacity_bytes / 1e9
}
category == "smart phones"
```

```
if (attrs.disk_capacity_bytes != null) {
  doc.disk_capacity_terabytes =
    attrs.disk_capacity_bytes / 1e12
}
category == "computers"
```

Low-volume (~8/day)  
traffic triggering  
multiple (millions!)  
product updates

High-volume  
(millions/day) traffic  
each triggering single  
product updates



## Content

- Attributes
- Offers
- Discounts
- ...

```
{
  gpc: {
    family_id: ...,
    chunk_id: ...
  },
  disk_capacity_bytes: ...,
  ...
}
```

## ETL Pipeline

exposure rules (signaling  
search gateway to when/where  
to expose these facets)

# Why ETL at all?

Strategy	Advantages	Disadvantages
Without ETL	Changes take immediate effect	Latency and throughput hurts Aggregations become impractical
With ETL	Optimal query-time performance	Need to bake affected products

# Content stream

- Sources
  - Content
  - Offer
  - Ranking
  - ...

- Volatility


- ETL'ing is expensive  
(due to tens of thousands of configurations)

```
if (attrs.gpc.family_id == 1234 &&  
    attrs.gpc.chunk_id == 5678) {  
    doc.category = "books"  
}
```



# Configuration stream

- Business screens
  - Configuration snapshots
  - Query on any field
- Volatility
- Retrospective changes



```
if (attrs.gpc.family_id == 1234 &&  
    attrs.gpc.chunk_id == 5678) {  
    doc.category = "books"  
}
```

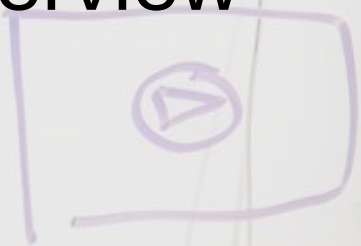
H1-HG  
Design

1. ~~~~~
2. ~~~~~
3. ~~~~~

Equal | Down

H1-Headline

# ETL Operational Overview

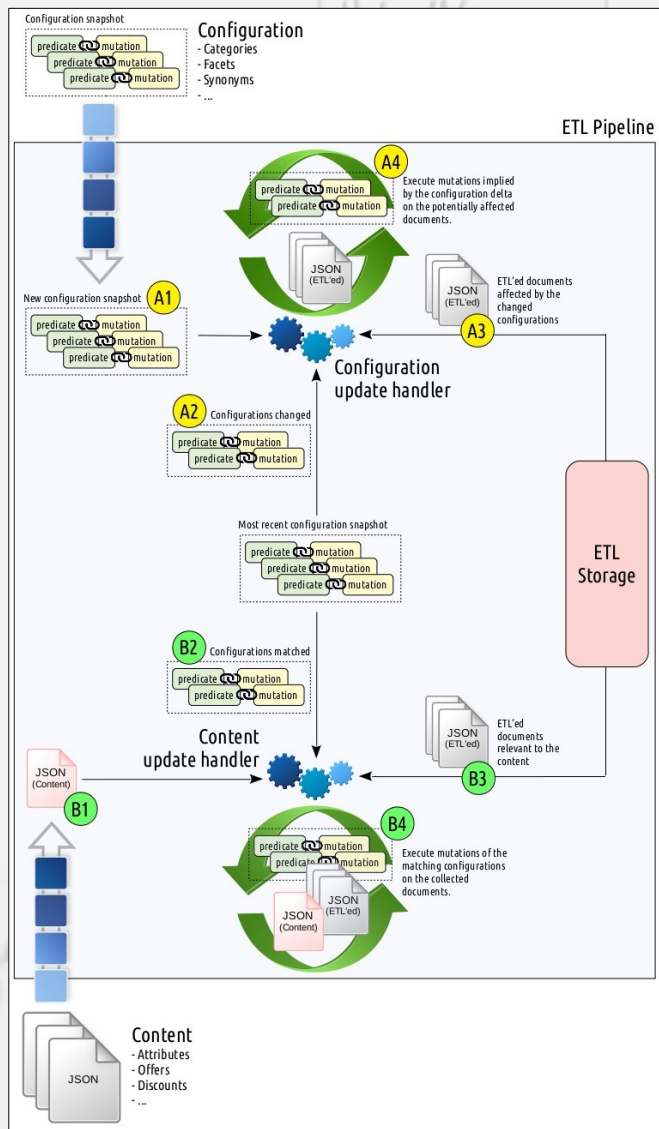


Video  
Module

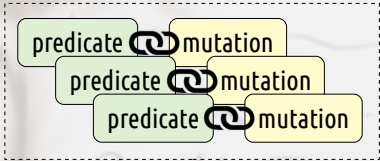
Menu



|||

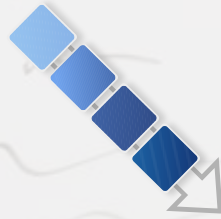


## Configuration snapshot



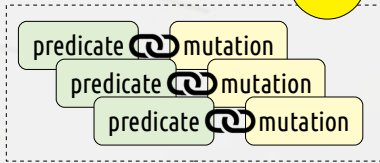
## Configuration

- Categories
- Facets
- Synonyms
- ...



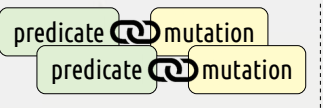
New configuration snapshot

A1

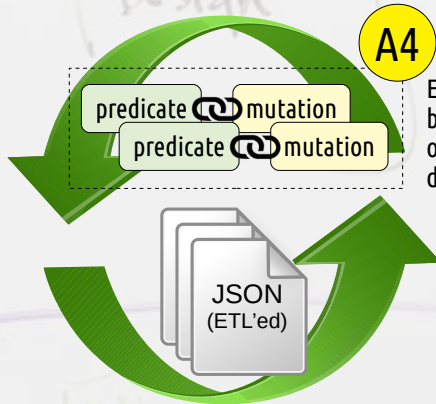
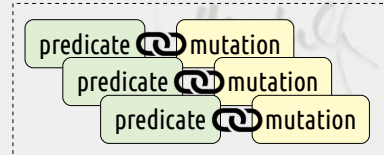


```
if (attrs.gpc.family_id == 1234 &&  
    attrs.gpc.chunk_id == 5678) {  
    doc.category = "books"  
}
```

A2 Configurations changed



Most recent configuration snapshot



Execute mutations implied by the configuration delta on the potentially affected documents.

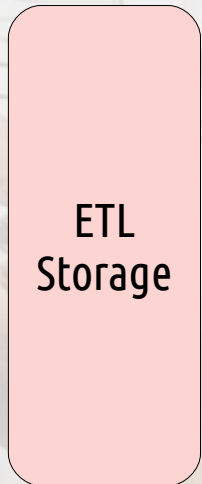


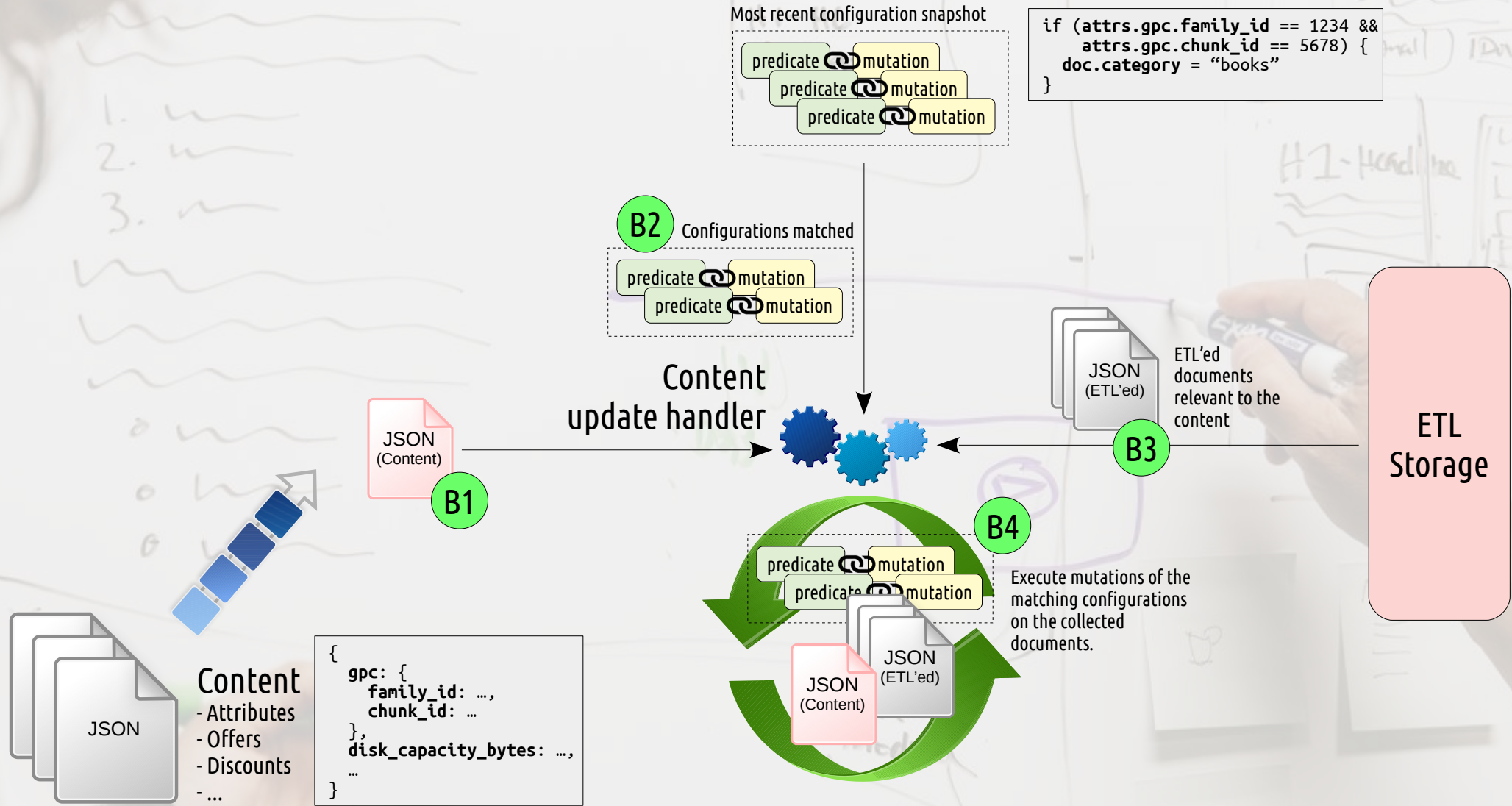
ETL'ed documents affected by the changed configurations

A3



Configuration update handler





# Old ETL

- One giant PL/SQL troop marching 1/24h
- “Baseline” taking ~12h
- Failures hurt a lot
- Difficult to
  - innovate
  - debug
  - observe
- At the edge of software limits
  - e.g. max column count
  - multiple threads in PL/SQL
  - optimizer hints getting broken as
    - upgrades take place
    - data size change

# Battle of ETL Storage Solutions

Storage Solution	Distributed?	Sharded?	Required Indices	Integrity Measure
PostgreSQL	No	No	One <sup>1</sup>	Transactions
PostgreSQL (partitioned)	No	Yes <sup>2</sup>	One <sup>1</sup>	Transactions
MongoDB	Yes	Yes <sup>3</sup>	Some <sup>4</sup>	Transactions/CAS <sup>5</sup>
Elasticsearch	Yes	Yes	None	CAS <sup>6</sup>

- 1) PostgreSQL jsonb index covers all fields.
- 2) PostgreSQL partitioning is not sharding in distributed sense, but still serves a similar purpose.
- 3) MongoDB sharding requires manual configuration.
- 4) MongoDB requires an explicit index for each whitelisted field allowed in ETL configuration predicates.
- 5) MongoDB updateMany() or findAndModify() can be leveraged for the desired integrity.
- 6) Elasticsearch \_version field can be leveraged to implement a CAS (compare-and-swap) loop.

A silhouette of a person standing on a rocky mountain peak with their arms outstretched, looking towards a bright sun over a mountain range. The scene is bathed in a warm, golden light, suggesting sunrise or sunset. The text "New ETL" is overlaid on the image.

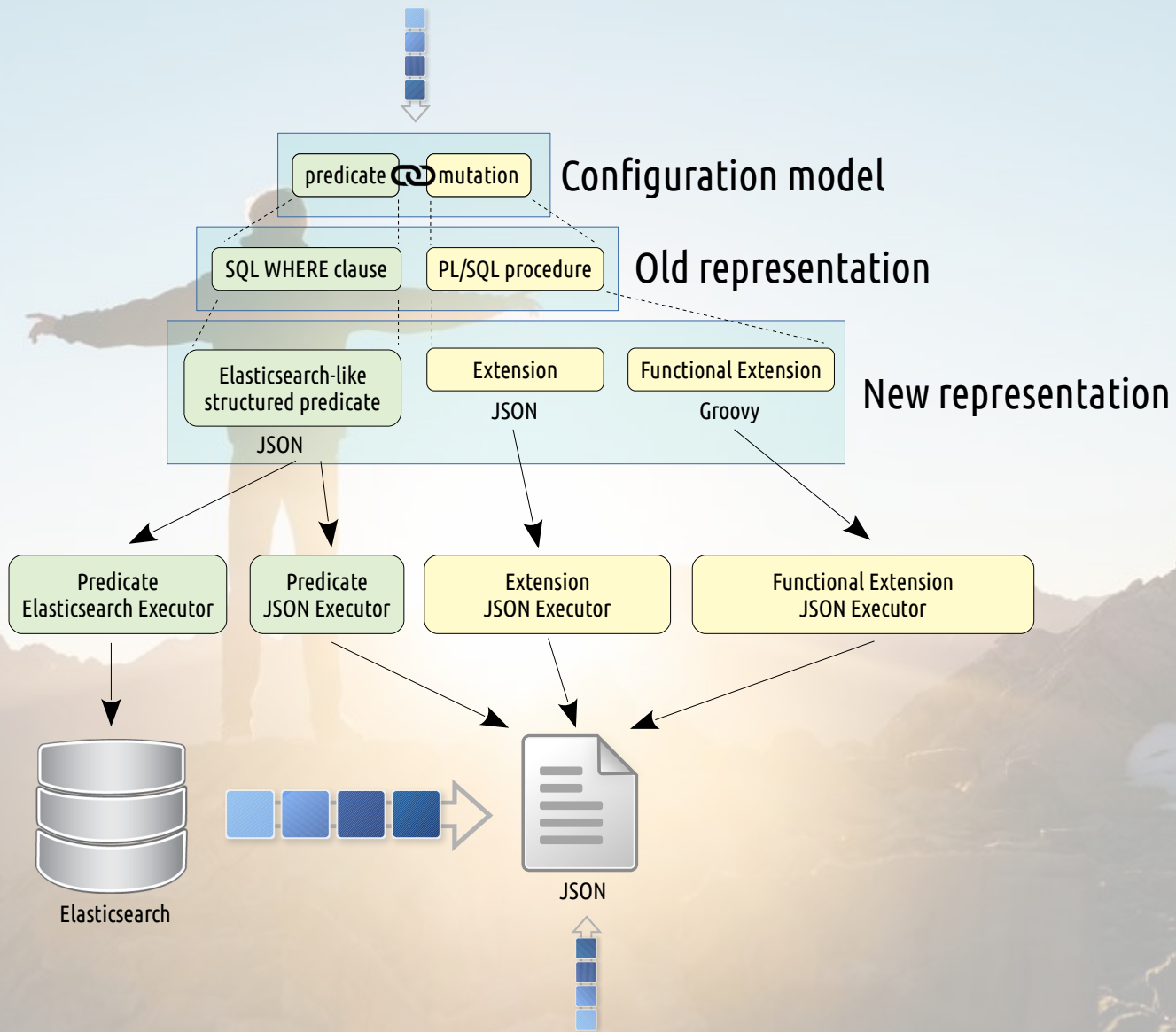
New ETL



# Storage solution winner: **Elasticsearch**



- Versatile query support
- Implicit indexing
- Scales good for reads, ok'ish for writes
- Easy to maintain
- Extensive experience



# TL;DR

Google-like search != e-commerce search  
(though both employ full-text search)

ETL = the art of cooking content (for search)

ETL rules necessitate search as well  
(due to excessive faceting)

Elasticsearch is a good candidate for storage in ETL

# Thank you!

(Questions?)

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