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@linse



Your Search Service as a Composable Function

Etsy

- online marketplace
- 1.5 million active sellers
- handmade + vintage items

Etsy Search for items or shops **Search** Sell on Etsy Register Sign in Cart

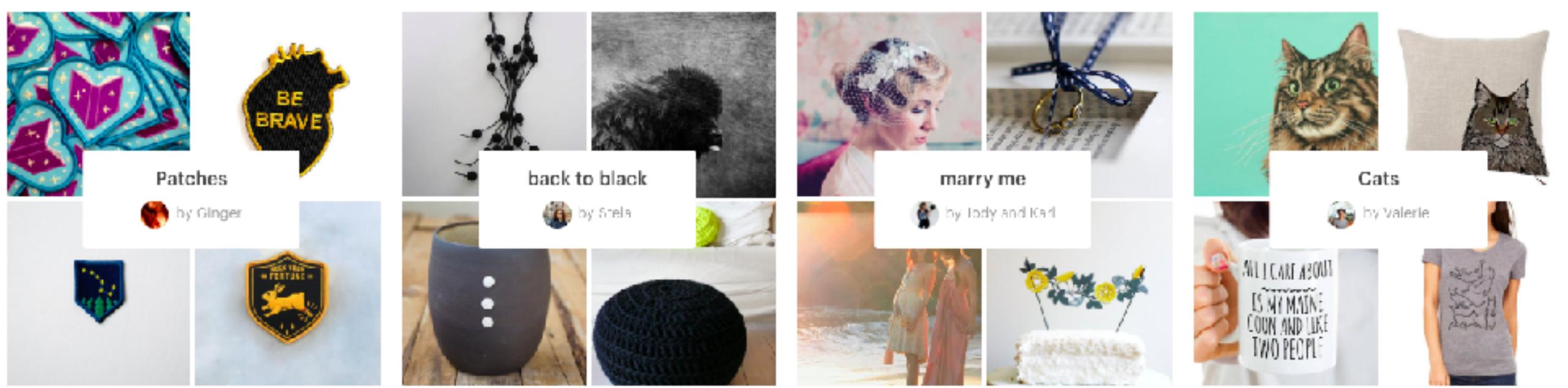
Jewelry & Accessories Clothing & Shoes Home & Living Wedding & Party Toys & Entertainment Art & Collectibles Craft Supplies & Tools Vintage

GARDENING
Hand-crafted by green thumbs.
[Shop now >](#)

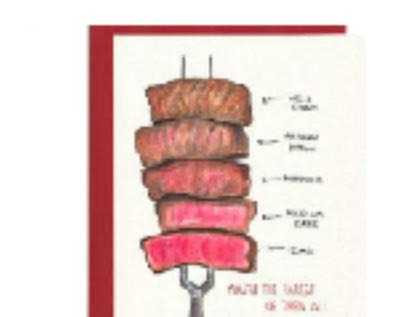
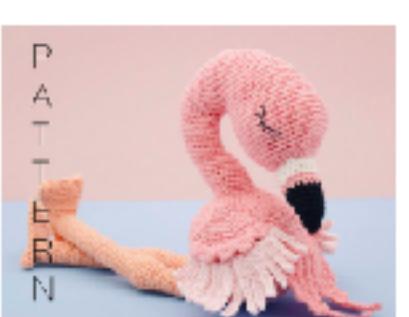
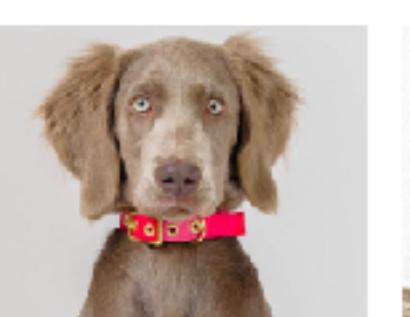


Unique everything
We have millions of one-of-a-kind items, so you can find whatever you need (or really, really want).
✓ Unique everything
We have millions of one-of-a-kind items, so you can find whatever you need (or really, really want).
✓ Independent sellers
Buy directly from someone who put their heart and soul into making something special.
✓ Secure shopping
We use best-in-class technology to protect your transactions.

Discover lists by creative people
A new way to explore



Popular right now

 <p>About to Leave - Graphic Novel franreed ★★★★★ (2,293) €20.16 Bestseller</p>	 <p>Rarest of Them All Father's Day Amigurumi crochet doll part... golamago ★★★★★ (765) €4.38 Bestseller</p>	 <p>Amigurumi crocheted dog pattern BubblesAndBingo ★★★★★ (1,173) €3.80 Bestseller</p>	 <p>Pink Guatemalan Ikat + Brass Dog Collar AnimalsInCharge ★★★★★ (745) €26.23 Bestseller</p>	 <p>Nursery Wall Art, Girl X O Print LILAxLOLA ★★★★★ (3,901) €5.77 Bestseller</p>	 <p>Mid Century Modern Plant Stand HookAndStemCo ★★★★★ (923) €31.10 €34.58 (10% off)</p>
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Etsy

- online marketplace
- 1.5 million active sellers
- handmade + vintage items
- unique search problem!

Etsy sun microsystems

Search

Jewelry & Accessories Clothing & Shoes Home & Living Wedding & Party Toys & Entertainment Art & Collectibles Craft Supplies & Tools Vintage

All categories > "sun microsystems" (4 Results)

Sort by: Relevancy ▾

			
Custom LSC keycap for Cherry MX s... DecendKeyboards ★★★★★ (123) €4.39	Vintage 90s JAVA Shirt Size M Free S... maxvintageshop ★★★★★ (190) €28.07 Free shipping	Rare!!! True Vintage 90s Nike Sweats... Negocios1990 ★★★★★ (89) €21.04	Vintage JAVA Sun Microsystems Pro... hainessstreet ★★★★★ (1) €24.56

All categories

Clothing Electronics & Accessories Accessories

Shipping

Free shipping
 Ready to ship in 1 business day
 Ready to ship within 3 business days

Special offers

On sale

Shop location

Anywhere
 Germany
 Custom

Enter location

Item type

All items
 Handmade
 Vintage

Price (€)

Any price
 Under €20
 €20 to €50
 €50 to €100
 Over €100
 Custom

Low to High

Ordering options

Accepts Etsy gift cards
 Customizable
 Can be gift-wrapped

Ship to

Germany

Get fresh Etsy trends and unique gift ideas delivered right to your inbox.

Enter your email

Subscribe

Shop

Gift cards
Etsy blog
What's hot

Sell

Sell on Etsy
Teams
Events

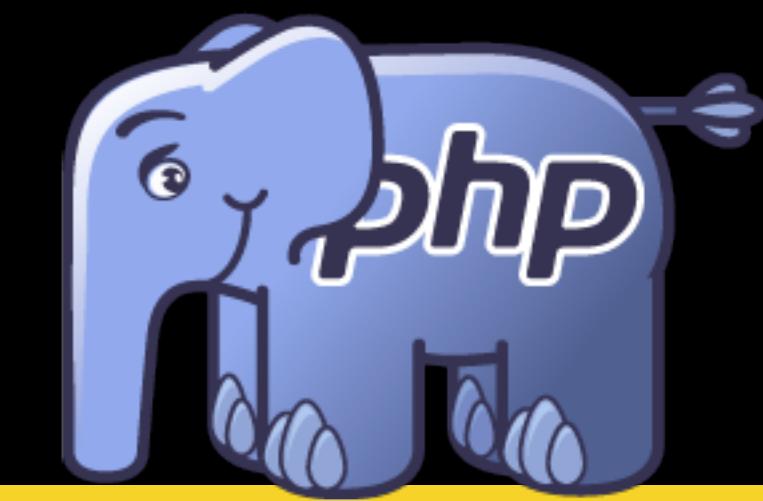
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Infrastructure Challenge



Etsyweb

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Jewelry & Accessories Clothing & Shoes Home & Living Wedding & Party Toys & Entertainment Art & Collectibles Craft Supplies & Tools Vintage

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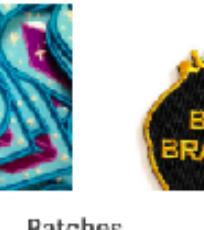
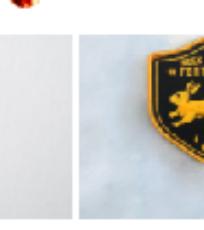
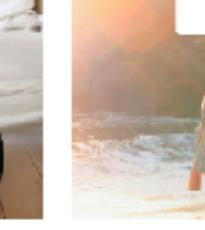


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Discover lists by creative people
A new way to explore

 Patches by Ginger	 BE BRAVE	 back to black by Stella	 marry me by Tandy and Karl	 Cats by Valerie
 by	 by	 by	 by	 by

Popular right now



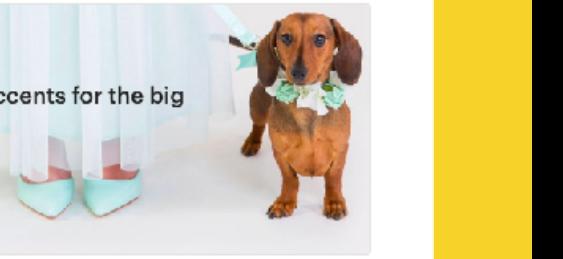
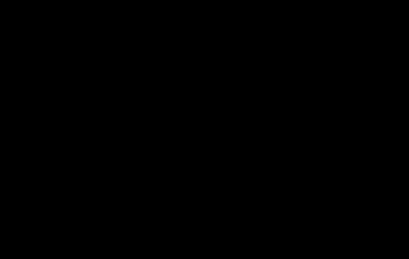
Etsyweb

Etsy

Sell on Etsy Register Sign in Cart

Jewelry & Accessories Clothing & Shoes Home & Living Wedding & Party Toys & Entertainment Art & Collectibles Craft Supplies & Tools Vintage

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Patches by Ginger BE BRAVE back to black marry me Cats ABSOLUTELY FINE Father's Day Amigurumi crochet doll pattern Pink Guatemalan Ikat + Brass AnimalInCharge Mid-Century Modern Plant Stand

Popular right now

About to Leave - Graphic Novel framed
★★★★★ (2,293) €20.18 Bestseller

Forest of Them All Father's Day gifttagoo
★★★★★ (755) €4.58

BulkyAndBungee
★★★★★ (1,715) €3.80 Bestseller

Amigurumi crochet doll pattern
★★★★★ (745) €26.23

AnimalInCharge
★★★★★ (3,901) €5.77

Nursery Wall Art, Girl X O Print
★★★★★ (923) €31.10 €24.59 (15% off)

Shop by category





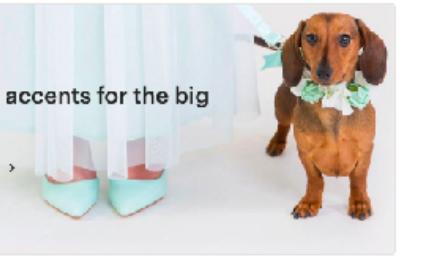
Etsyweb

Etsy

Sell on Etsy Register Sign in Cart

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Patches BE BRAVE back to black marry me Cats

Popular right now

About to Leave - Graphic Novel €20.18 Bestseller

Bacon of Them All Father's Day gift €4.58 Bestseller

Amigurumi crochet doll pattern €3.80 Bestseller

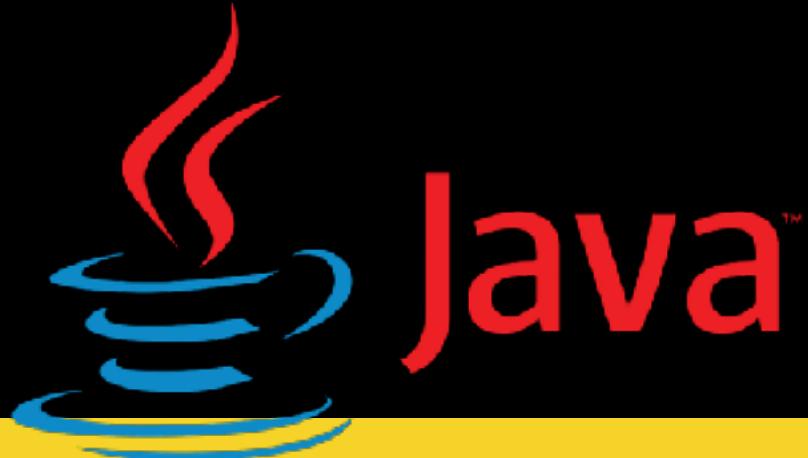
Pink Guatemalan Ikat + Brass Bubbles and Bangs €26.23 Bestseller

AnimalsInCharge ULAxLCA €5.77 Bestseller

Nursery Wall Art, Girl X O Print Mid-Century Modern Plant Stand HookAndSpanCo €31.10 €24.59 (10% off)

Shop by category





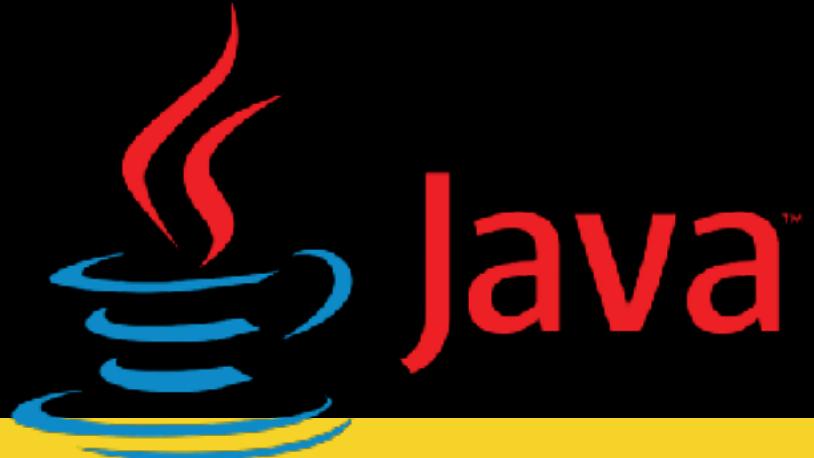
Search Backend





Etsyweb

The screenshot shows the top navigation bar with categories like Jewelry & Accessories, Clothing & Shoes, Home & Living, Wedding & Party, Toys & Entertainment, Art & Collectibles, Craft Supplies & Tools, and Vintage. Below the navigation is a yellow sidebar with a 'GARDENING' section and a 'Hand-crafted by green thumbs.' button. The main content area features a large image of a potted plant and a small dog wearing a bow tie. A callout box says 'Unique accents for the big "I do".'. Below the main image are three bullet points: 'Unique everything', 'Independent sellers', and 'Secure shopping'. A section titled 'Discover lists by creative people' shows various user profiles. At the bottom, there's a 'Popular right now' section with items like a framed graphic novel and a pink flamingo figurine.



Search Backend





Search Backends



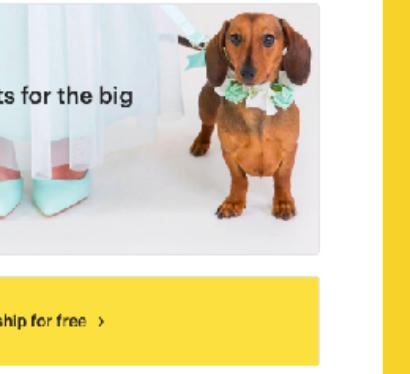
Etsyweb

Etsy

Sell on Etsy

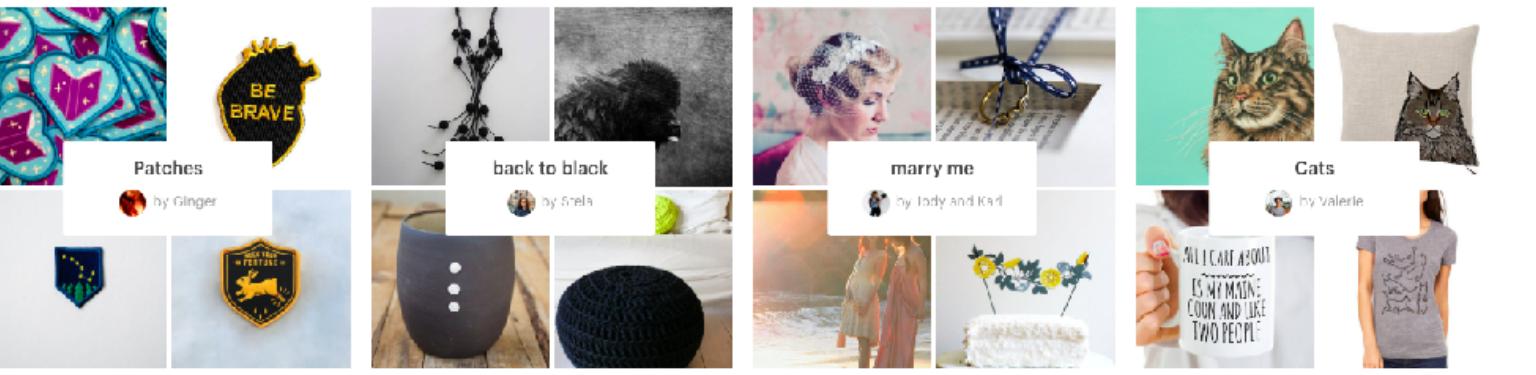
Jewelry & Accessories Clothing & Shoes Home & Living Wedding & Party Toys & Entertainment Art & Collectibles Craft Supplies & Tools Vintage

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Discover lists by creative people
A new way to explore



Popular right now



[About to Leave - Graphic Novel](#) [Father of Them All Father's Day](#) [Amigurumi crochet doll pattern](#) [Pink Guatemalan Ikat + Brass](#) [Nursery Wall Art, Girl X O Print](#) [Mid-Century Modern Plant Stand](#)

About to Leave - Graphic Novel...
framed
★★★★★ (2,293)
€20.18
Bestseller

Father of Them All Father's Day
gigimago
★★★★★ (155)
€4.58

Amigurumi crochet doll pattern
BubblesAndBingo
★★★★★ (1,715)
€3.80

Pink Guatemalan Ikat + Brass
AnimalsInCharge
★★★★★ (1,745)
€26.23

Nursery Wall Art, Girl X O Print
ULAsLOA
★★★★★ (3,901)
€5.77

Mid-Century Modern Plant Stand
HookAndStairCo
★★★★★ (923)
€31.10 €24.59 (15% off)

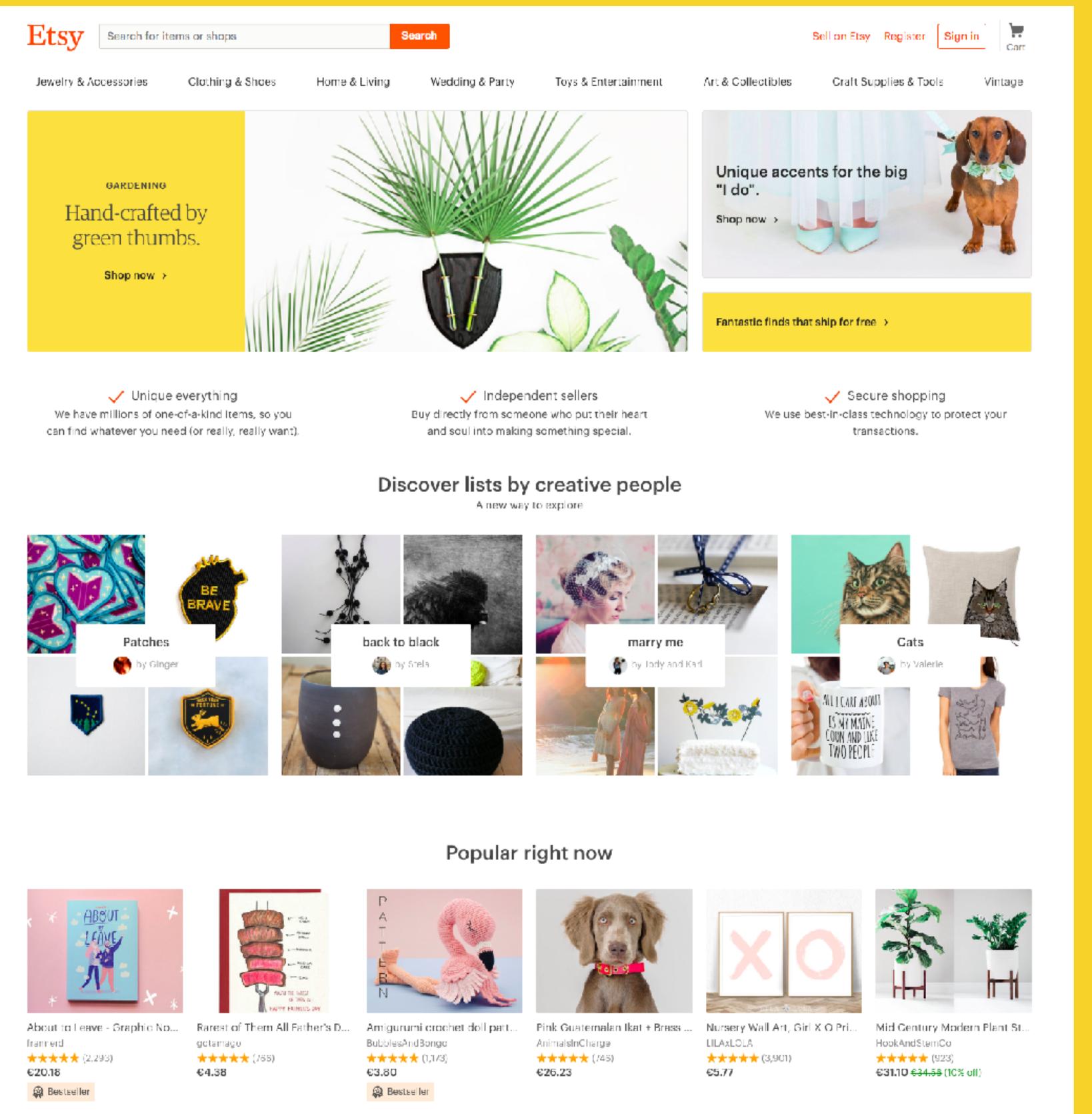
Shop by category



Machine Learning Models



Etsyweb



The screenshot shows the homepage of the Etsy website. At the top, there's a navigation bar with links for Jewelry & Accessories, Clothing & Shoes, Home & Living, Wedding & Party, Toys & Entertainment, Art & Collectibles, Craft Supplies & Tools, and Vintage. Below the navigation is a large yellow banner with the text "GARDENING" and "Hand-crafted by green thumbs." followed by a "Shop now >" link. To the right of this is a product thumbnail for a potted plant. Further right is another thumbnail for a dachshund wearing a bow tie. Below these are three bullet points: "Unique everything" (with a note about millions of one-of-a-kind items), "Independent sellers" (buying from individuals), and "Secure shopping" (using best-in-class technology). Below these points is a section titled "Discover lists by creative people" with various thumbnail images of user-generated content like patches, cards, and t-shirts. At the bottom, there's a "Popular right now" section with thumbnails for items like a book titled "About to Leave - Graphic Novel", a flamingo figurine, a dog, and some wall art.



Search Backends

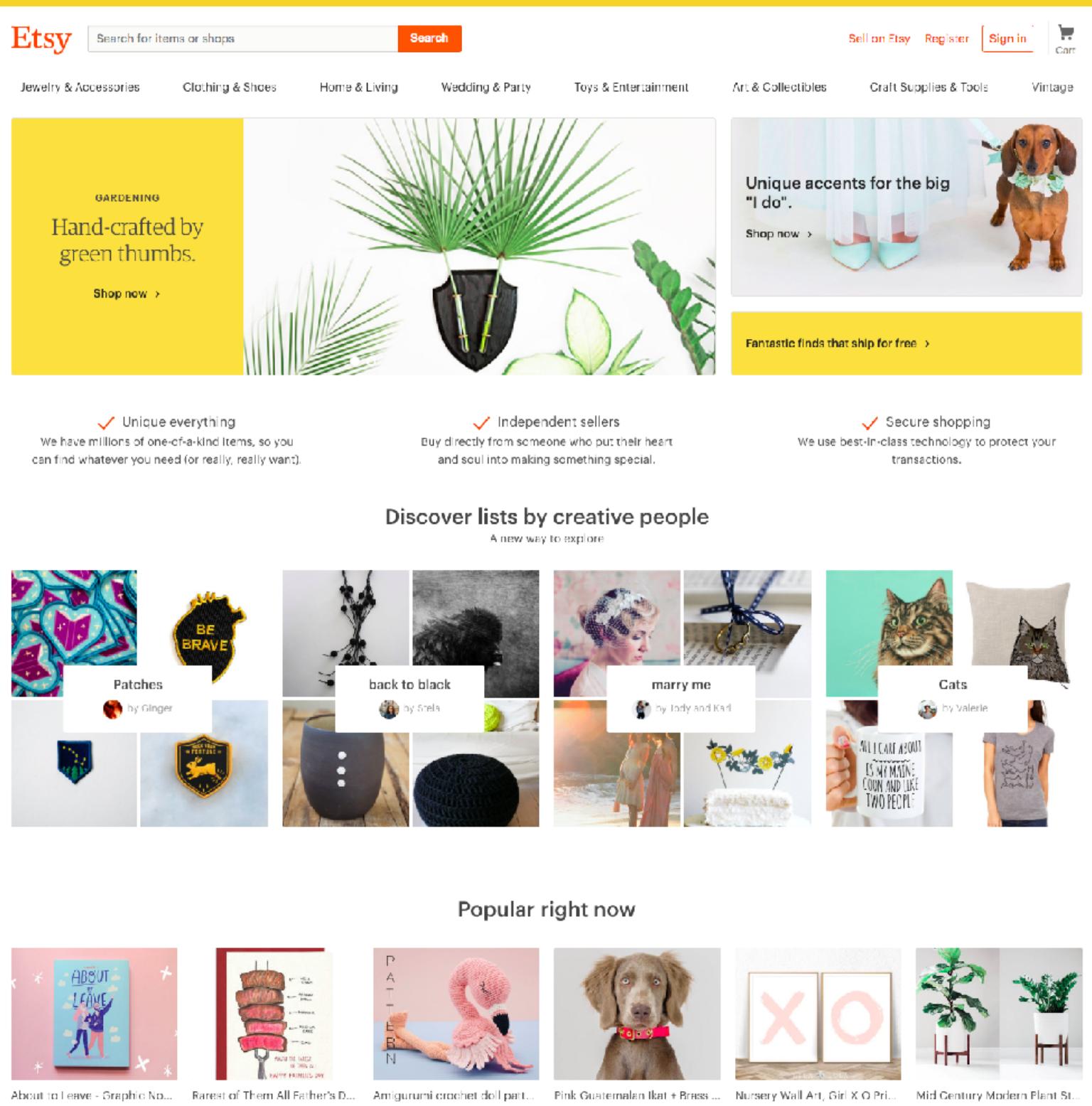


The image contains three search backend logos. At the top left is the Java logo, which consists of a red coffee cup icon with a blue steam trail above the word "Java". To the right of it is the "Search Backends" heading. Below the Java logo is the Arizona Iced Tea logo, which features the word "Arizona" in a stylized teal font with a yellow outline, set against a yellow background with a pink and teal geometric sunburst graphic. At the bottom right is the Solr logo, which features the word "Solr" in a large, dark gray sans-serif font next to a red sunburst icon.

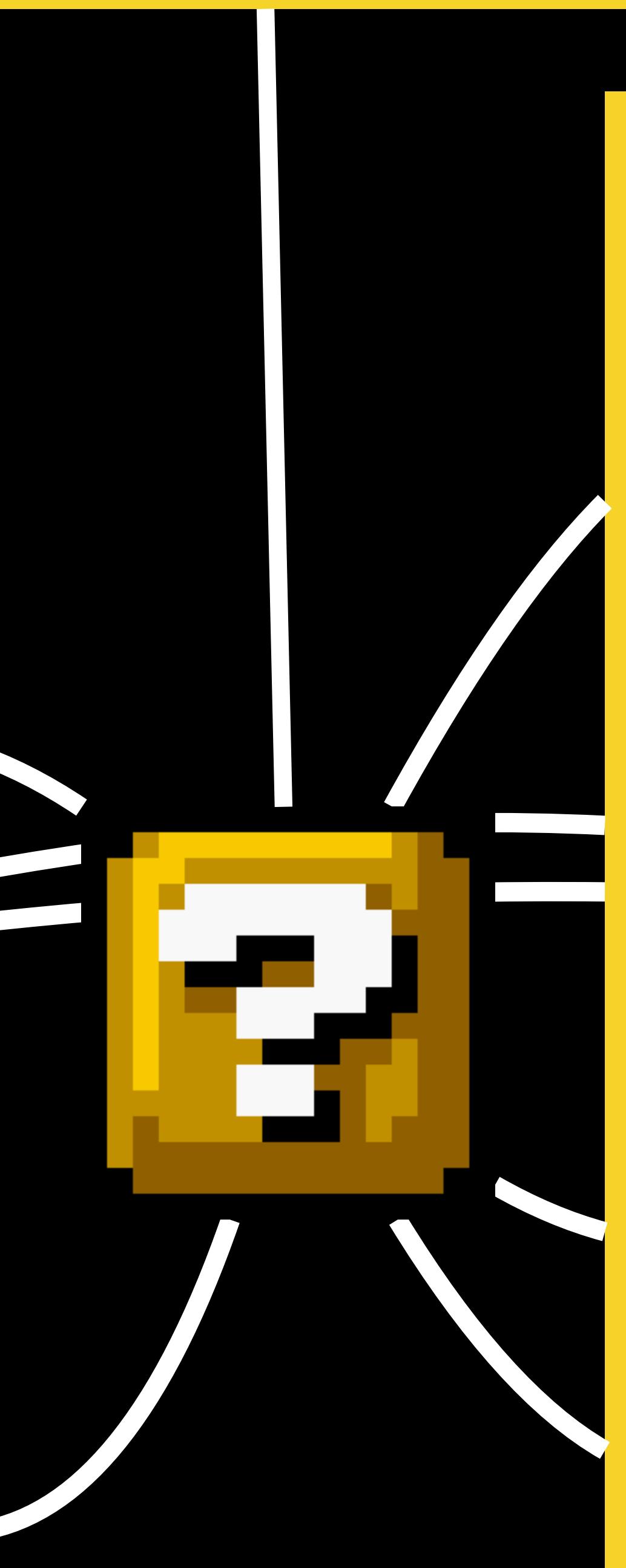
Machine Learning Models



Etsyweb



The screenshot shows the main navigation bar with links for Jewelry & Accessories, Clothing & Shoes, Home & Living, Wedding & Party, Toys & Entertainment, Art & Collectibles, Craft Supplies & Tools, and Vintage. Below the navigation, there's a featured section for "GARDENING" with a call to action "Shop now >". There are also sections for "Unique everything", "Independent sellers", and "Secure shopping". The "Discover lists by creative people" section displays various user-generated lists such as "Patches", "BE BRAVE", "back to black", "marry me", "Cats", and "ALL I CARE ABOUT IS REMAINING COOL AND LIKE TWO PEOPLE". The "Popular right now" section shows items like "About to Leave - Graphic Novel Framed", "Rarest of Them All Father's Day", "Amigurumi crochet doll pattern", "Pink Guatemalan Ikat + Brass ...", "Nursery Wall Art, Girl X O Pri...", and "Mid-Century Modern Plant St...". Each item has a small image, a title, a rating, and a price.



Search Backends



The slide features three search backend logos. At the top is the Java logo, which includes a red coffee cup with steam and the word "Java" in red. Below it is the Arizona logo, which consists of the word "Arizona" in green and orange with a stylized sunburst graphic made of green and pink triangles. At the bottom is the Solr logo, which features the word "Solr" in a large, dark font with a red sunburst icon to the right. The background of the slide is yellow.

Machine Learning Models



Etsyweb

Etsy

Search for items or shops

Search

Jewelry & Accessories Clothing & Shoes Home & Living Wedding & Party Toys & Entertainment Art & Collectibles Craft Supplies & Tools Vintage

GARDENING Hand-crafted by green thumbs. Shop now >

Unique everything We have millions of one-of-a-kind items, so you can find whatever you need (or really, really want). ✓ Unique everything

Independent sellers Buy directly from someone who put their heart and soul into making something special. ✓ Independent sellers

Secure shopping We use best-in-class technology to protect your transactions. ✓ Secure shopping

Discover lists by creative people A new way to explore

Patches BE BRAVE back to black marry me Cats

All I care about is remaining cool and like two people

Popular right now

About to leave - Graphic Novel Framed 5.0 (2,222) €20.18 Bestseller

Rarest of Them All Father's Day 5.0 (788) €4.38 Bestseller

Amigurumi crochet doll pattern 5.0 (1,753) €3.80 Bestseller

Pink Guatemalan Ikat + Brass ... 5.0 (745) €26.23

Nursery Wall Art, Girl X O Pri... 5.0 (3,901) €5.77

Mid-Century Modern Plant St... 5.0 (923) €31.10 €24.58 (10% off)



Search Backends



Acquiring a New Approach

Etsy buys Blackbird Technologies to bring AI to its search

Ingrid Lunden @IngridLunden Sep 20, 2016

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Startups
Apps
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Videos
—
Crunchbase
More

Search  Transportation
Hardware
Funding & Exits
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It's not just gigantic search engines that are looking to [acquire tech and talent](#) around emerging areas like speech recognition. Even design and craft marketplaces can use a little machine learning and artificial intelligence to make their wheels turn a little better.

Today, the popular handmade-goods site [Etsy](#) announced it has acquired a startup called [Blackbird Technologies](#), which developed algorithms for natural language processing, image recognition and analytics — similar to those used by Amazon and Google for product and other searches — and then “democratized” them to be used by any company of any size. At Etsy, the tech will be used to improve its own search features.

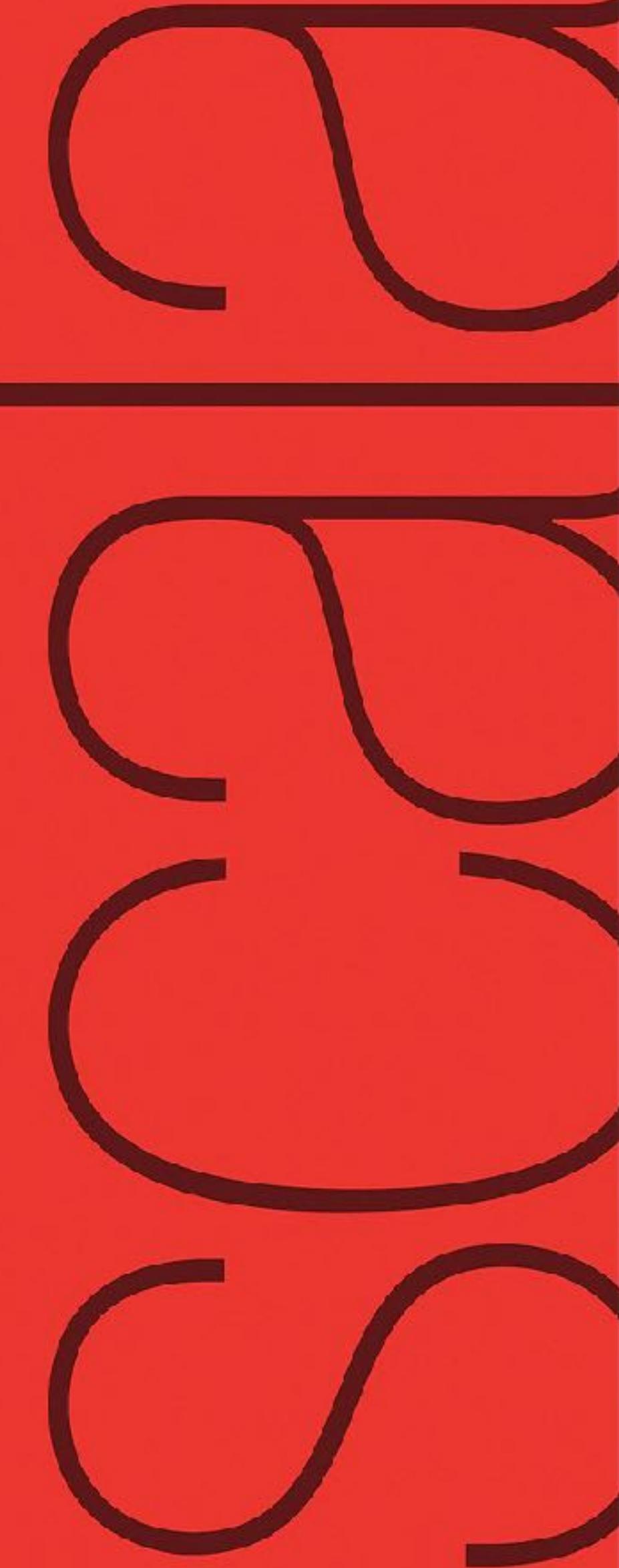
Financial terms of the deal have not been disclosed, but we’re asking and will update if we learn more. The company’s employees — it appears [there were around 10](#) — will all be joining Etsy. “The team possesses a deep expertise in Artificial Intelligence, search, and distributed systems and has direct experience working in these areas for some of the largest technology companies in the world,” [Etsy](#) said in a statement.

Little is known about Blackbird — no listings on Crunchbase or AngelList, a fairly unspecific website for Blackbird itself — and even Etsy’s announcement of the deal is light on company details. According to LinkedIn, though, the two co-founders are [Nikhil Raghavan](#) (CEO) and [Manju Rajashekhar](#) (CTO), who collectively had worked on similar technologies across places like Google, Twitter, Microsoft, Oracle and Yahoo.

Because Etsy is going to be using Blackbird’s tech for its own platform, it seems that Blackbird’s [current business plans](#), which deployed its tech by way of an API, will shut down. Customers had [included](#) Nasty Gal, ThreadUP, and Tophatter.



Functional Programming in



Paul Chiusano
Rúnar Bjarnason



Your Server as a Function

Marius Eriksen

Twitter Inc.

marius@twitter.com

Abstract

Building server software in a large-scale setting, where systems exhibit a high degree of concurrency and environmental variability, is a challenging task to even the most experienced programmer. Efficiency, safety, and robustness are paramount—goals which have traditionally conflicted with modularity, reusability, and flexibility.

We describe three abstractions which combine to present a powerful programming model for building safe, modular, and efficient server software: Composable *futures* are used to relate concurrent, asynchronous actions; *services* and *filters* are specialized functions used for the modular composition of our complex server software.

Finally, we discuss our experiences using these abstractions and techniques throughout Twitter’s serving infrastructure.

Categories and Subject Descriptors D.1.1 [Programming techniques]: Applicative (Functional) Programming; D.1.3 [Program-

Services Systems boundaries are represented by asynchronous functions called *services*. They provide a symmetric and uniform API: the same abstraction represents both clients and servers.

Filters Application-agnostic concerns (e.g. timeouts, retries, authentication) are encapsulated by *filters* which compose to build services from multiple independent modules.

Server operations (e.g. acting on an incoming RPC or a timeout) are defined in a declarative fashion, relating the results of the (possibly many) subsequent sub-operations through the use of future combinators. Operations are phrased as *value transformations*, encouraging the use of immutable data structures and, we believe, enhancing correctness through simplicity of reasoning.

Operations describe *what* is computed; execution is handled separately. This frees the programmer from attending to the minutiae of how the computation is performed.



Reqle=>

Your Server as a Functions

Set of Composable

Marius Eriksen

Twitter ID:
marius@twitter.com

Future[Rep]

Abstract

Building server software in a large-scale setting, where systems exhibit a high degree of concurrency and environmental variability, is a challenging task to even the most experienced programmer. Efficiency, safety, and robustness are paramount—goals which have traditionally conflicted with modularity, reusability, and flexibility.

We describe three abstractions which combine to present a powerful programming model for building safe, modular, and efficient server software: Composable *futures* are used to relate concurrent, asynchronous actions; *services* and *filters* are specialized functions used for the modular composition of our complex server software.

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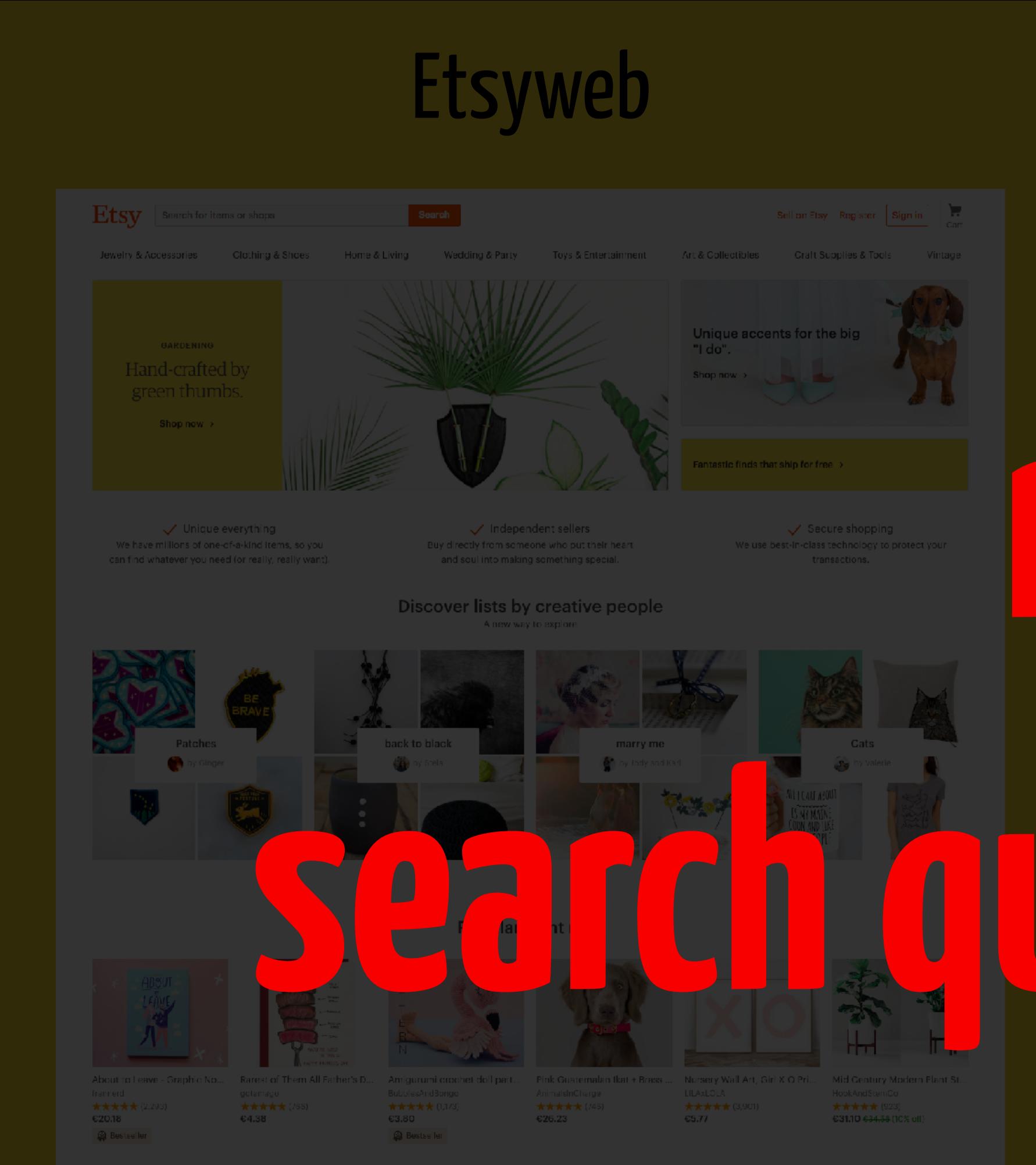
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Machine Learning Models

Goal:
rewrite
search query + response



Search Backends



Machine Learning Models

Format: proxy, “no state”
async + protocol agnostic



Search Backends





Future + slow call

```
scala> |
```



Service + slow service

```
scala> []
```

$$g(f(x)) = g \circ f(x)$$

function
composition

Service with filter

```
import com.twitter.finagle.Service
import com.twitter.finagle.http

val service: Service[http.Request, http.Response] = ...
val timeoutFilter = new TimeoutFilter[http.Request, http.Response](...)

val serviceWithTimeout: Service[http.Request, http.Response] =
  timeoutFilter.andThen(service)
```

~
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-- VISUAL --

A Finagle Service

```
trait Service[Req, Rep]  
extends (Req => Future[Rep])
```

```
import com.twitter.util.Future
import org.jboss.netty.handler.codec.http._
import com.twitter.logging.Logger
import com.twitter.finagle.http.{Method, Request, Response, Version}
import play.api.libs.json.{JsNull, JsString}
import com.twitter.finagle.stats.DeltaStat
```

Example: Service[ArizonaReq, ArizonaRsp]

```
import scalaz.{\/, \/-}
import java.util.zip.CRC32

object ArizonaService {
    // Usually we read this map from production.php. This is for testing convenience only.
    val shard2hostForTestingOnly = Map(1 -> "az-shard-1-vip.ny2.etsy.com:80", 2 -> "az-shard-2-vip.ny2.etsy.com:80")
}
```

```
case class ArizonaService(name: String, shard2host: Map[Int, String], sro: Option[StatsReceiver], timeout: Int = 100)
extends Service[ArizonaRequest, ArizonaResponse] {
```

```
private val log      = Logger(getClass)
private val sr       = sro.getOrElse(DefaultStatsReceiver)
private val retryFilter = RetryTimeoutsFilter[Request, Response](sr, log, 1)
```

```
if (shard2host.isEmpty) {
    throw new Exception("shard2host map was empty.");
}
```

```
private[this] val shard2client = shard2host.map { case (s, h) => (s, shardedClient(s, h)) }.toMap
```

```
private[this] val threadLocalShardHasher = new ThreadLocal[CRC32] {
    protected override def initialValue(): CRC32 =
        new CRC32
}
```

```
def shardedClient(shard: Int, host: String): Service[Request, Response] = {
```

apply: ArizonaReq => Future[ArizonaRsp]

```
def apply(req: ArizonaRequest): Future[ArizonaResponse] =  
  req match {  
    case MultiGet(_, keys) if keys.size > MultiGet.maximumRequestSize =>  
      Future.exception(  
        new RuntimeException(s"MultiGet supports up to ${MultiGet.maximumRequestSize} keys per request; got ${keys.size}")  
      )  
    }  
    case _ => {  
      val datasetName = req.dataset_name  
      val shardHasher = threadLocalShardHasher.get()  
      shardHasher.reset()  
      shardHasher.upload(datasetName, ByteString("shardCharsets.UTF_8"))  
      val shardNum = (shardHasher.getValue() % shard2client.keys.size).toInt + 1  
      val client = shard2client.getOrDefault(shardNum, throw new Exception(s"Client for shard $shardNum missing."))  
  
      val r = Request(Version.Http11, Method.Get, makeUrl(req))  
      r.headerMap.set(HttpHeaders.Names.CONNECTION, HttpHeaders.Values.KEEP_ALIVE)  
      r.headerMap.set(  
        HttpHeaders.Names.HOST,  
        shard2host.getOrElse(shardNum, throw new Exception(s"Host for shard $shardNum missing.")))  
    };  
    client(r).map { resp =>  
      makeResponse(req, resp)  
    }  
  }
```

fail if multiget #keys exceeded

find client for shard

set request headers

Service: Req => Future[Rep]

```
def Future[A].flatMap[B](f: A =>  
  Future[B]): Future[B]
```

Future: can flatMap over it!

```
val f = for {  
    user   <- authenticate(request)  
    banned <- isBanned(user)  
} yield (user, banned)
```

reader monad



Readers

**/ListingSearchThriftController.scala:

```
def handle(Search) { args: Search.Args =>
  val req = constructReq(args)
  val rsp = for {
    config  <- cdb.read[Config](req)
    index   <- req.read("index") \> "url path is missing index component"
    ctx     <- config.read[SearchCSRCtx](index -> req)
  } yield {
    searchWithBackoff(args)(ctx.listingsCtx)
  }
  rsp.fold(e => Future.exception(new RuntimeException(e)), resFuture => resFuture)
}
```

A Merlin Mixer Service

Req => ReaderToFuture[Ctx, Rep]

Type: Reader to Future

ReaderMonad + FutureMonad

```
type ReaderToFuture[Req, Rep] = ReaderT[Future, Req, Rep]

object ReaderToFuture extends KleisliInstances {
  def apply[Req, Rep](f: Req => Future[Rep]): ReaderToFuture[Req, Rep] = Kleisli.kleisli(f)
}

implicit object FutureMonad extends Monad[Future] {
  def point[A](a: => A): Future[A] = Future.value(a)

  def bind[A, B](fa: Future[A])(f: A => Future[B]): Future[B] = fa.flatMap(f)
}
~
```



It's a proxy!

`ThriftReq =>`

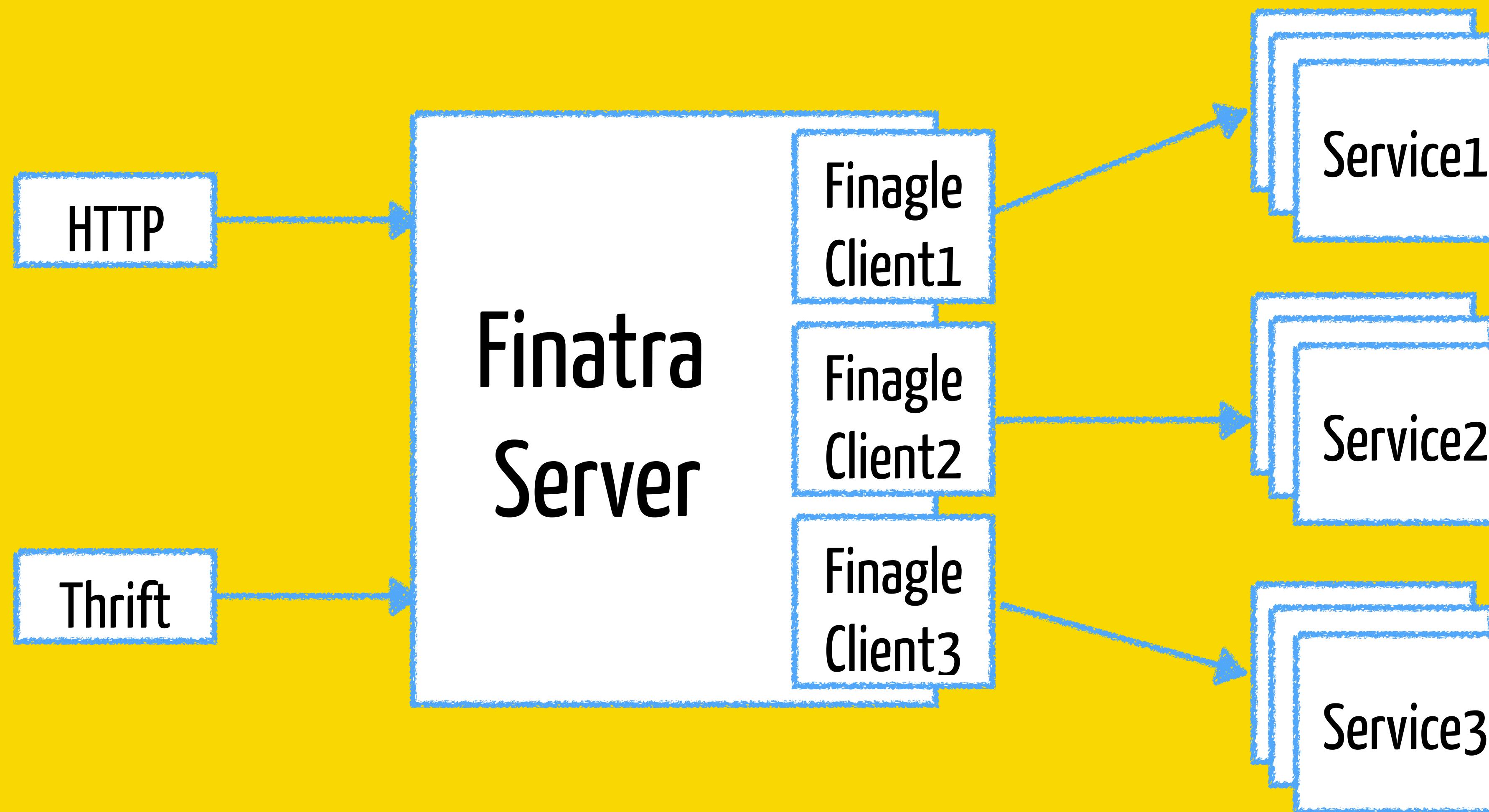
`ReaderToFuture[Ctx, ThriftRep]`



Example

Query Pipeline

MMX: Built with Finatra & Finagle



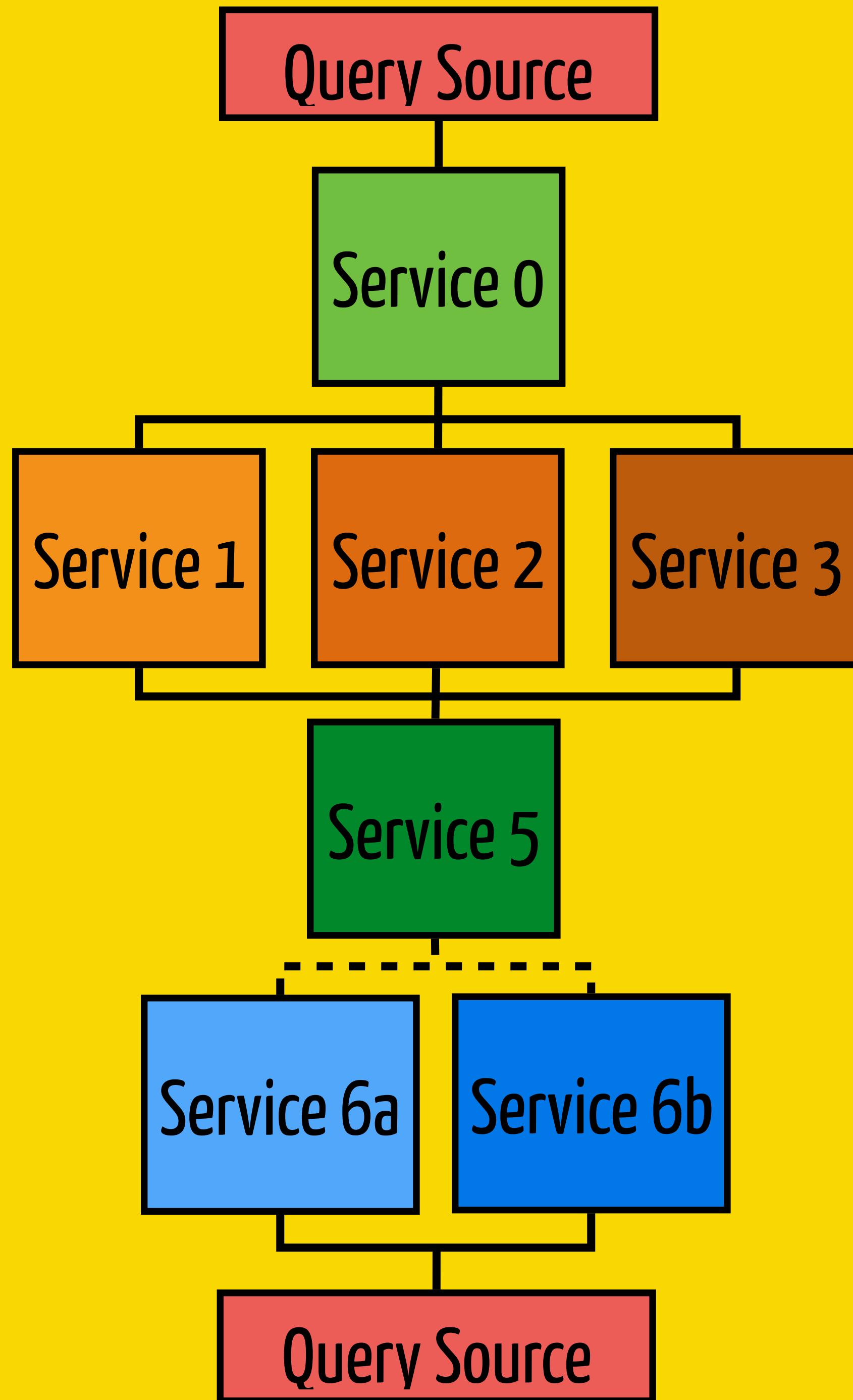
What is a Service?



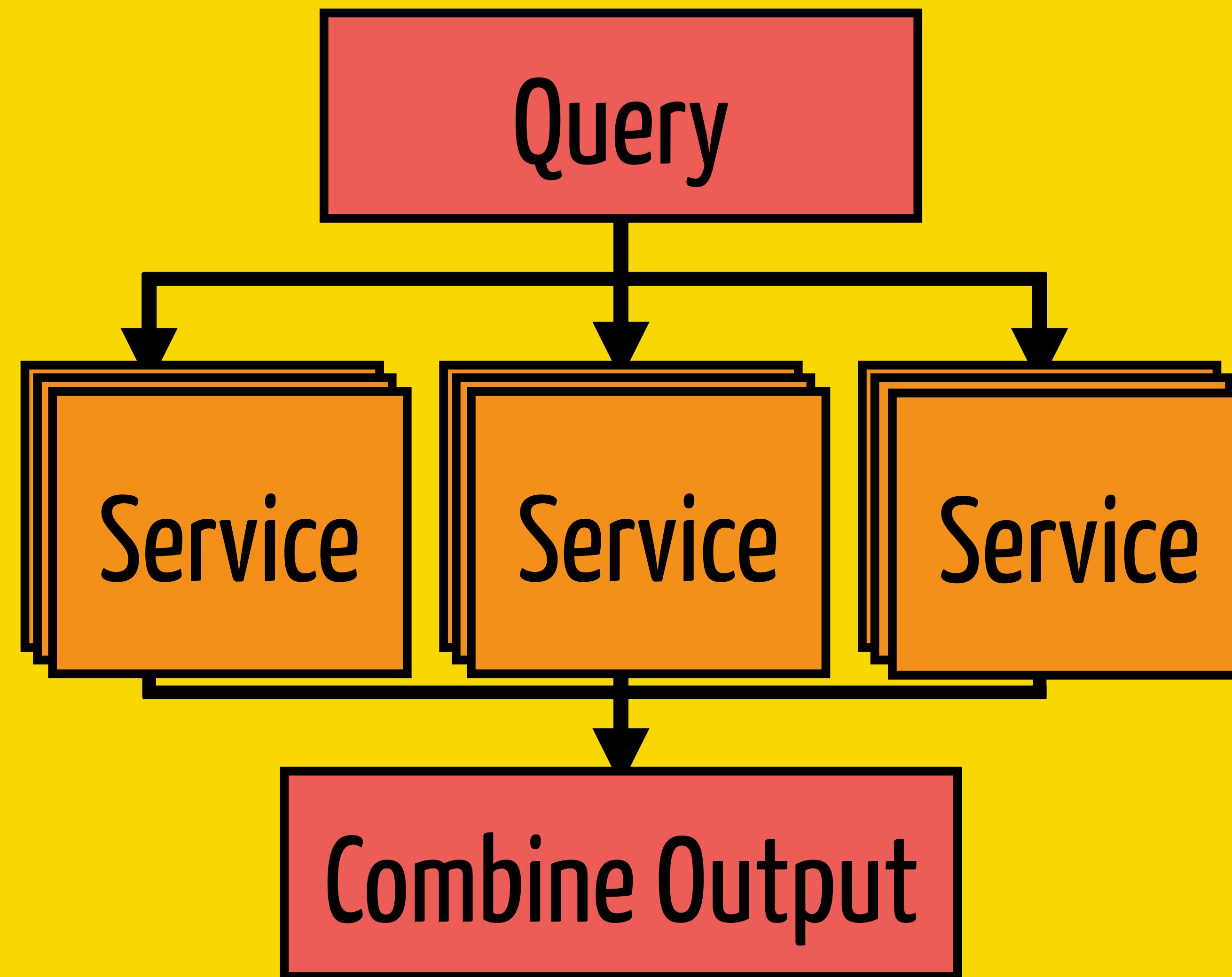
A Query Pipeline: Sequential + Concurrent Calls

call all!

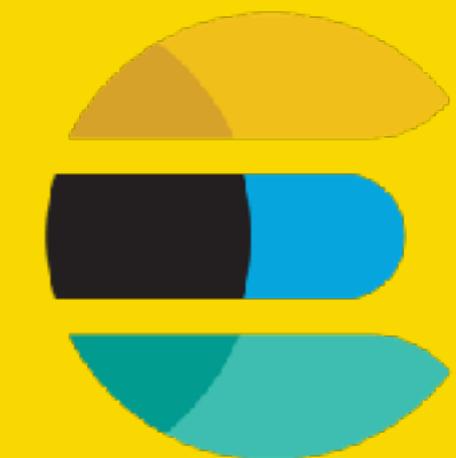
call one!



Horizontally Scalable



Service building blocks



- **Search Indexes**
 - Solr
 - ElasticSearch
- **Feature & Candidate stores**
 - Arizona → Key-Value Store
 - BigTable / DynamoDb
 - Mysql
- **Cached model output**
 - Memcache / Redis





VOWPAL WABBIT

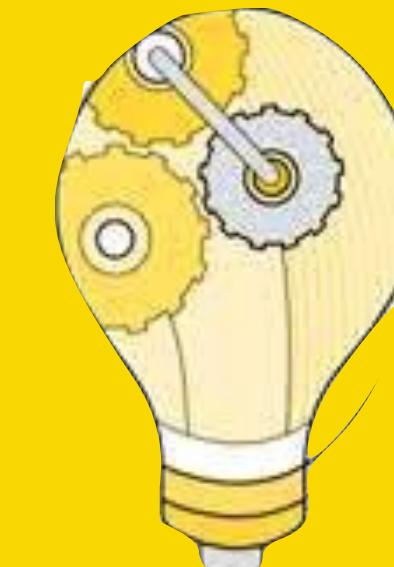
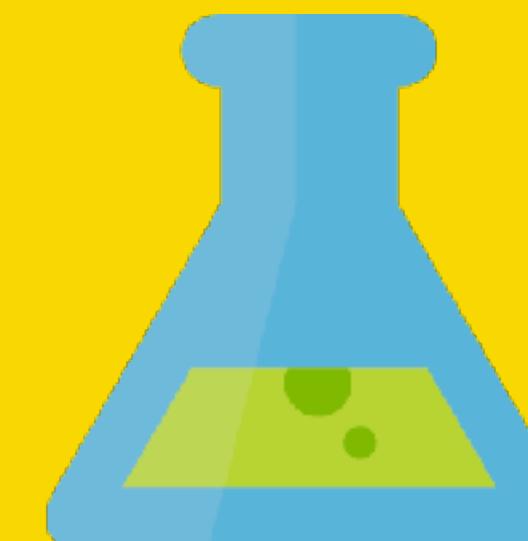
The Incredible
PYTORCH



TensorFlow

Service building blocks

- **Models** → Hosted on a separate service.
 - Engine agnostic: **Vowpal Wabbit** or **tensorflow** or **pytorch**?
 - Json Input → Output over HTTP
 - Send batch calls with features → get back scores.
 - **Finagle** : send parallel batches!
- **External APIs**
 - Any cloud provider ML APIs.



Models as a service!

- **Inference in real time**
 - No precomputed values → **No fixed domain**
 - Separate update schedules for model & feature stores
- **Each model scales independently.**
 - Allows sub-models to be more expensive.

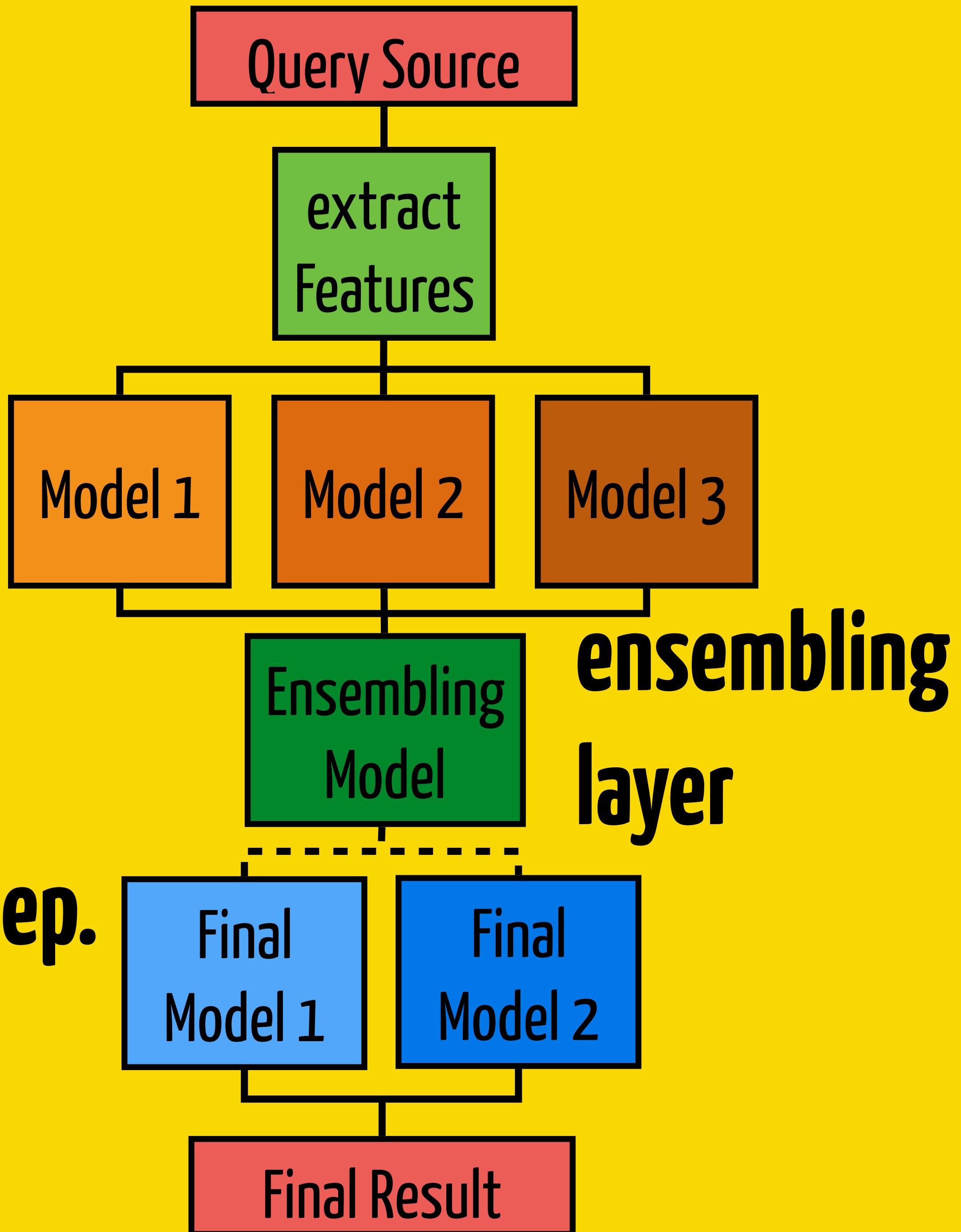
ENSEMBLE OVER MODELS IN REAL TIME!

- Each model gets updated independently.
- The combining function can be a model itself.
- Can define failure scenarios for partial failure.

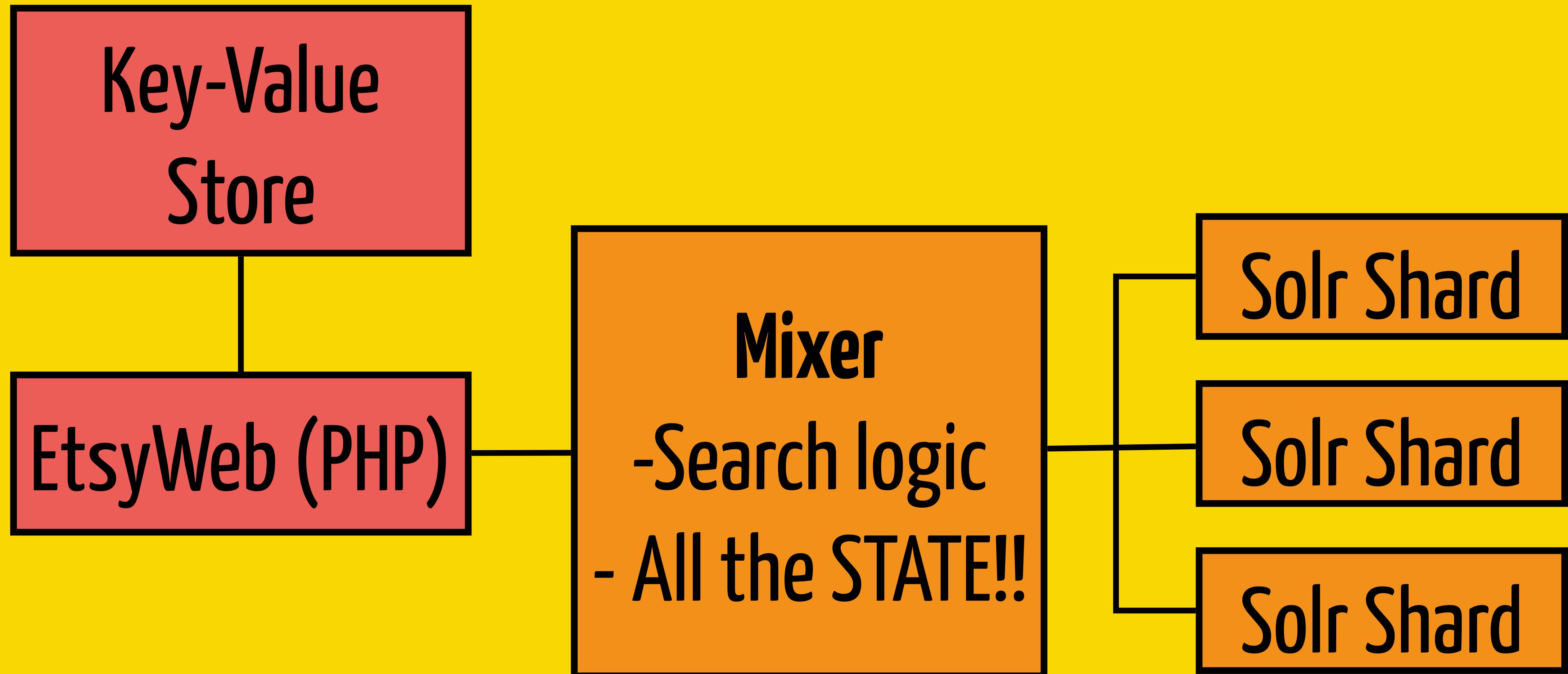
Example of Model Ensembling at Runtime.

**call all
in parallel!**

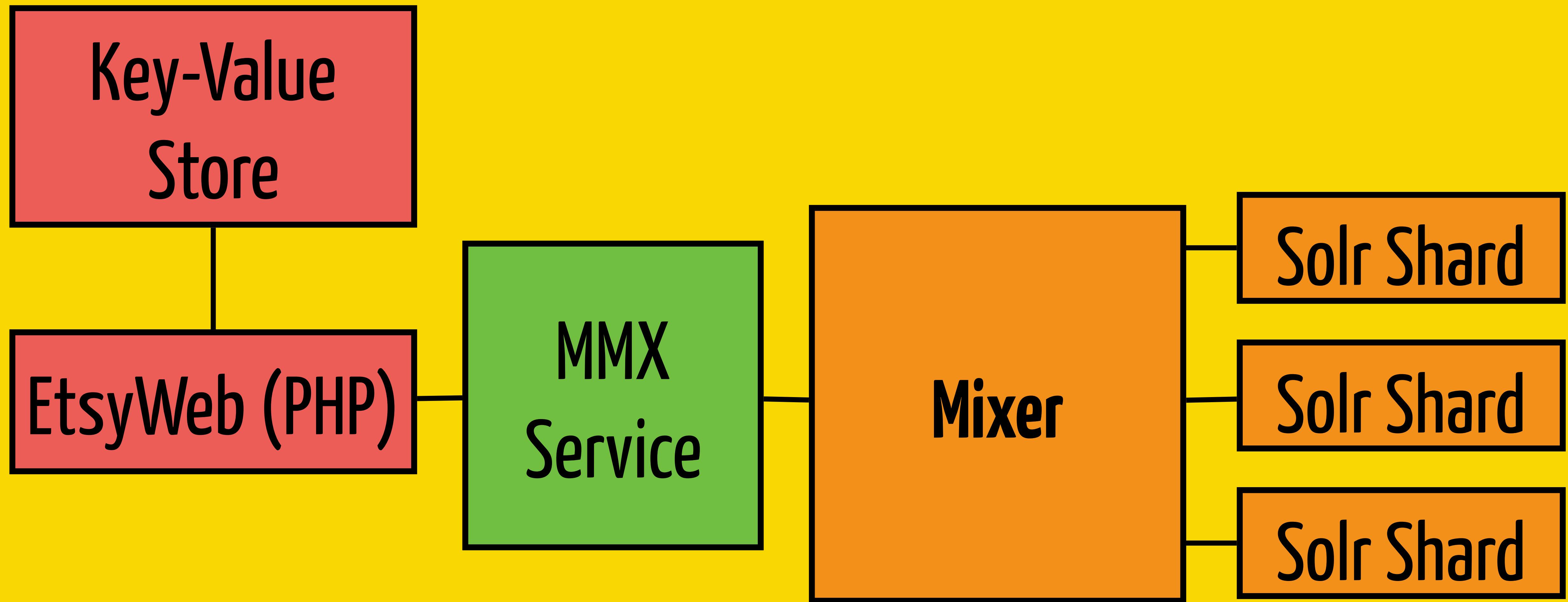
**call one, dep.
on score!**



Search Stack before MMX



Search Stack with MMX



Before

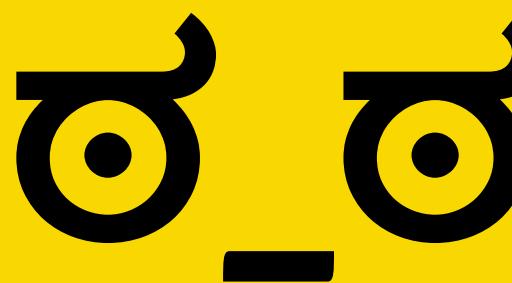
- Java / PHP
- Models tightly coupled to search code
- Query being mutated and then “executed”
- Cost of change is high

After

- Scala / Finagle / Finatra.
- Models as a service, scale independently.
- **Real time inference pipelines.**
- Build a query plan with ReaderToFuture.
- Async communication with sub-services.

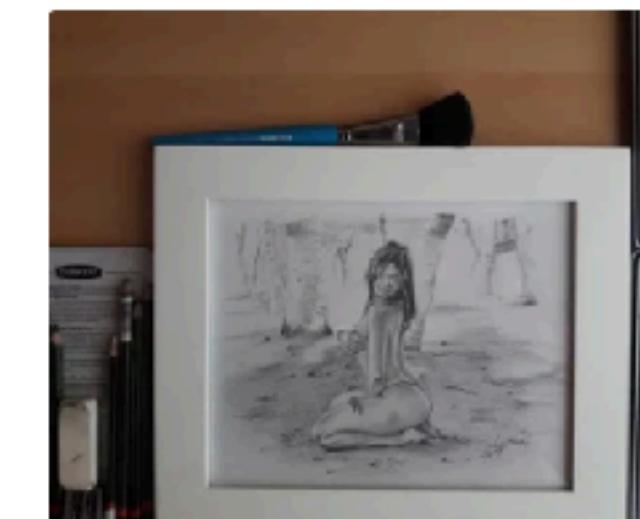
State woven into one service => Service DAG from config.

no pencils for “pencils”



All categories > “pencils” (244,159 Results)

Sort by: Relevancy ▾

			
Julius Caesar Pencil Holder (with Cust... ElevatedInnovations ★★★★★ (2) \$15.00	Teacher SVG, DXF File, Beaching Not T... TheSmudgeFactoryLLC ★★★★★ (3,850) \$3.99	Original Colored Pencil Drawing, Red ... ArtCornerShop ★★★★★ (239) \$100.00	Rise Up Pencil Set ThePoshShopCo ★★★★★ (176) \$10.00
			
Small African Print Pouch, Ankara Smal... LollyKiks ★★★★★ (48) \$20.78	A5 storage tin with hinged lid Simple,... WhirlingWorld ★★★★★ (84) \$5.54	Miss Doughmestic Thank You with Pen... BobbisCookiesCutters ★★★★★ (9,539) \$6.00	Elephant wall art print / Pencil / digital ... BringGoodMood (9) \$3.90
			
Framed Art: original 8x10 inch pencil d... ARTuro1984 \$59.99 Free shipping	Thanos Portrait - Colored Pencil Drawi... JimmiePetrascuART \$19.99	vtg 50s flannel pencil skirt high waist ... mad4modvintage ★★★★★ (375)	Color Pencil Rose StitchMadnessMarket \$8.00 Free shipping

MMX + Query Ranking Model

Etsy pencils Search

Jewelry & Accessories Clothing & Shoes Home & Living Wedding & Party Toys & Entertainment Art & Collectibles Craft Supplies & Tools Vintage

personalized pencils pencils with quotes funny pencils grammar pencils cute pencils engraved pencils mechanical pencils pens pencil case

All categories > "pencils" (244,159 Results)

Sort by: Relevancy ▾

All categories

- [Art & Collectibles](#)
- [Craft Supplies & Tools](#)
- [Bags & Purses](#)
- [Paper & Party Supplies](#)

[+ Show more](#)

Shipping

- Free shipping
- Ready to ship in 1 business day
- Ready to ship within 3 business days

Special offers

- On sale

Color

- Black
- White
- Blue
- Pink
- Green

[+ Show more](#)

Shop location

- Anywhere
- United States
- Custom

▶

Item type

- All items
- Handmade
- Vintage

Price (\$)

- Any price
- Under \$25
- \$25 to \$50
- \$50 to \$100
- Over \$100



More colors

1, 2, 3, 4, 5, 6 or 12 Personalized Pencil...

InklingsPaperie

★★★★★ (277) \$1.80

Bestseller



White and Gold Foil Heart Mini Pencils ...

TwistedCrafters

★★★★★ (9,204) \$8.00



72 Gold Mini short half Hexagon Golf #...

ExpressPencilsLLC

★★★★★ (447) \$9.95



Koh I Noor Mondeluz aquarell colored ...

FoxberryStore

★★★★★ (94) \$4.99



MATHS PENCIL SET Geek Stationery Gi...

NewtonAndTheApple

★★★★★ (4,391) \$10.39

Eligible orders ship free



Custom Pencils By The Dozen, Foiled E...

MadeMarketCo

★★★★★ (196) \$19.00



The Adventure Begins Mini Pencils // B...

NattyMichellePaperie

★★★★★ (2,048) \$8.00

Bestseller



Earthy Goodies slate chalk pencils (thi...

EarthyGoodies

★★★★★ (585) \$9.99



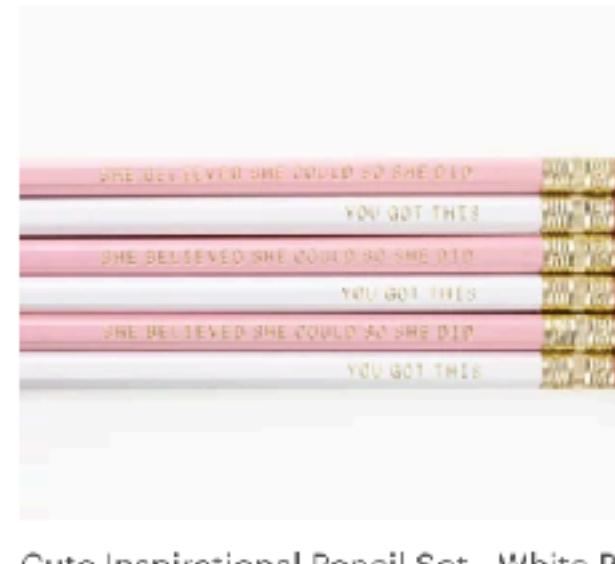
CHARLIE IS AWESOME

More colors



WHAT WOULD BLAIR WALDORF DO?

More colors



Cute Inspirational Pencil Set - White Pi...

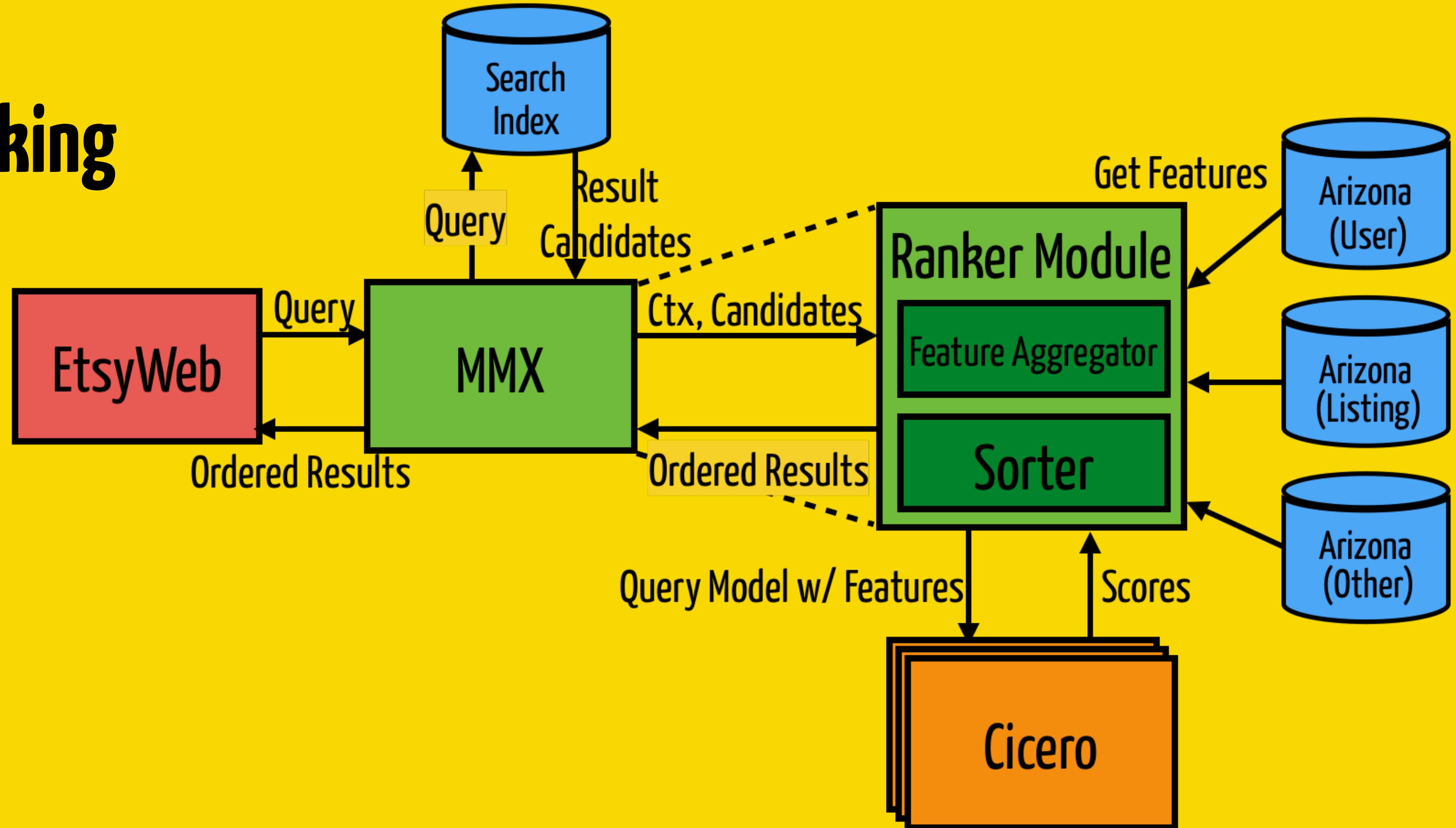
More colors



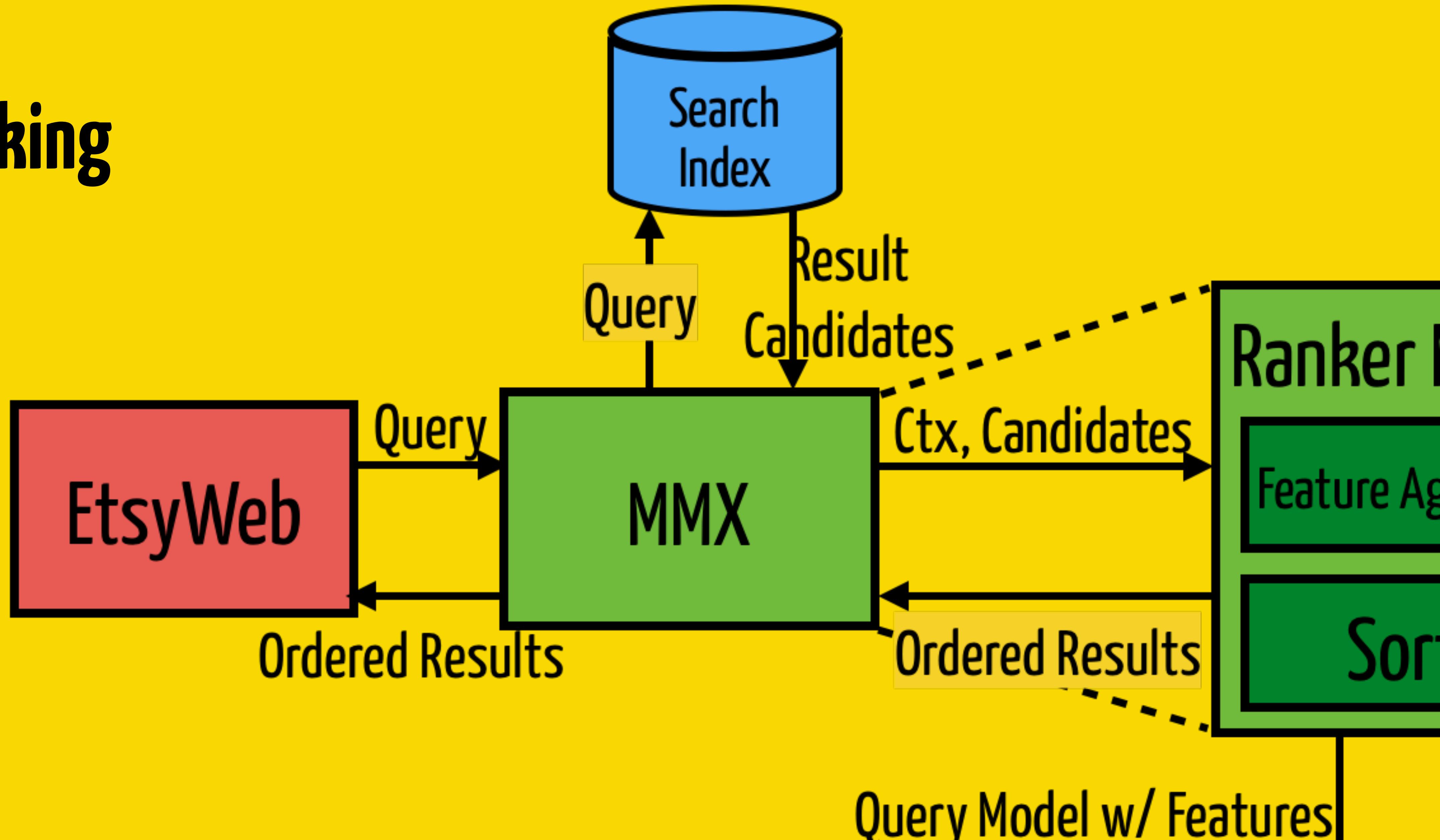
Inspirational pencils for teachers

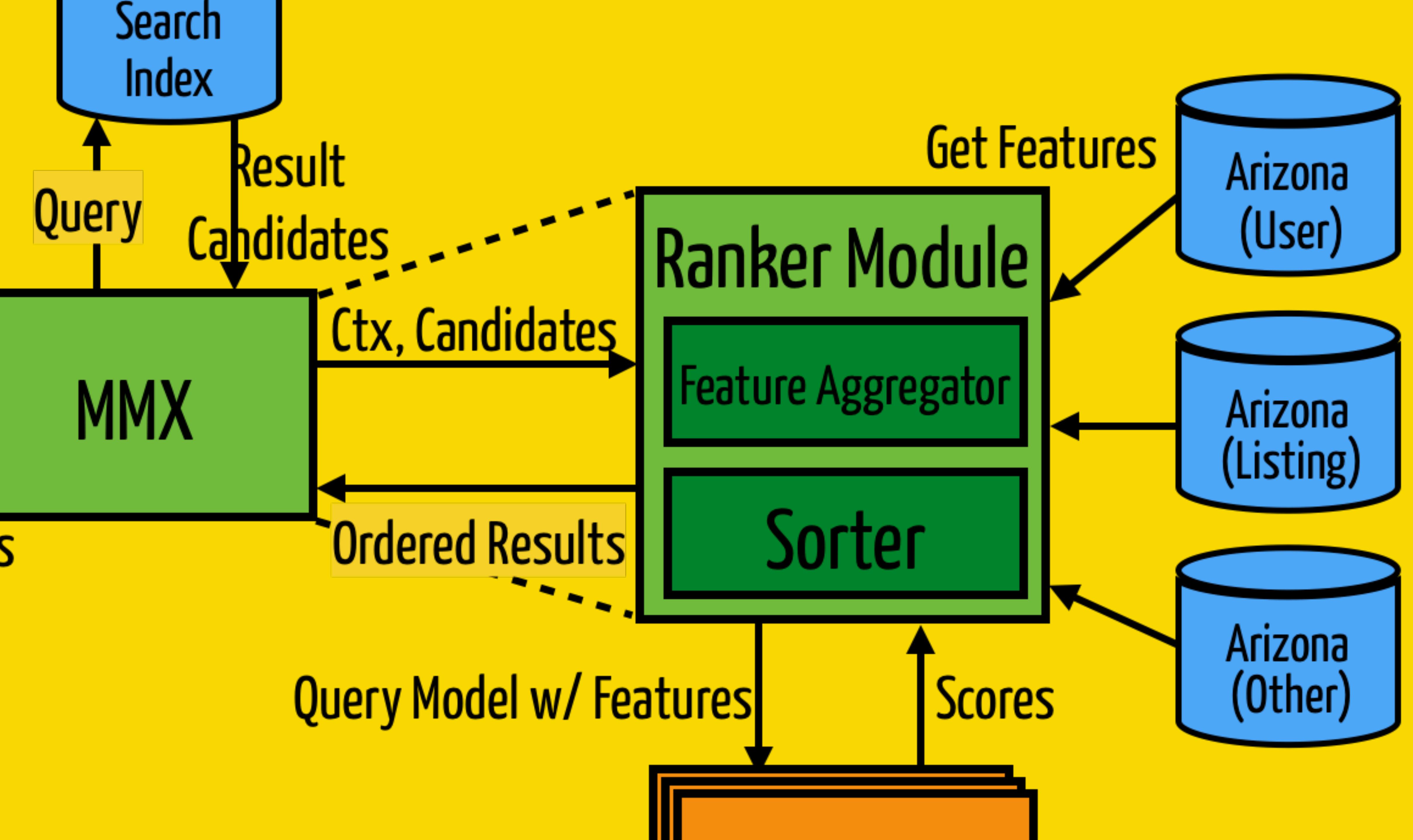
More colors

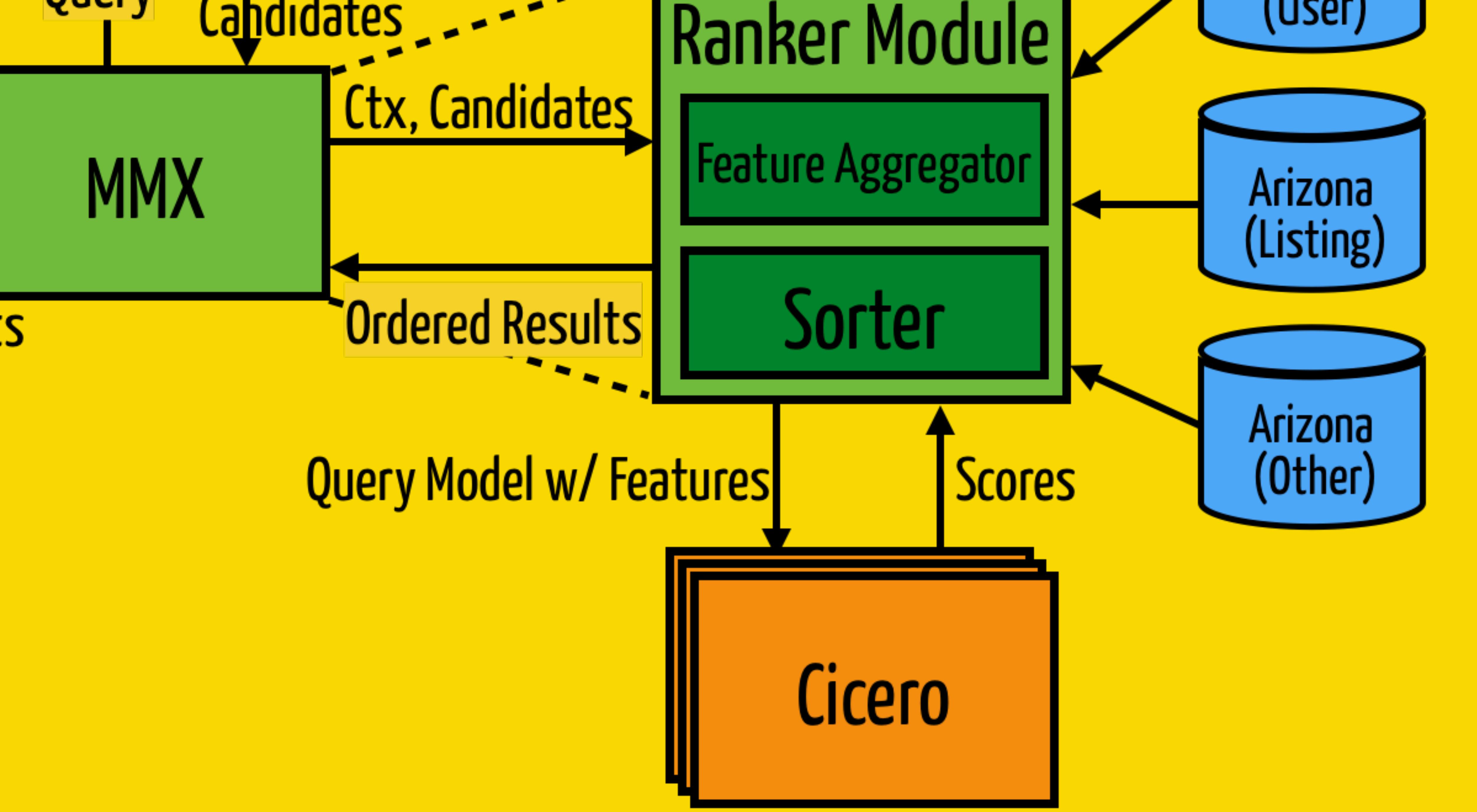
New Ranking Pipeline

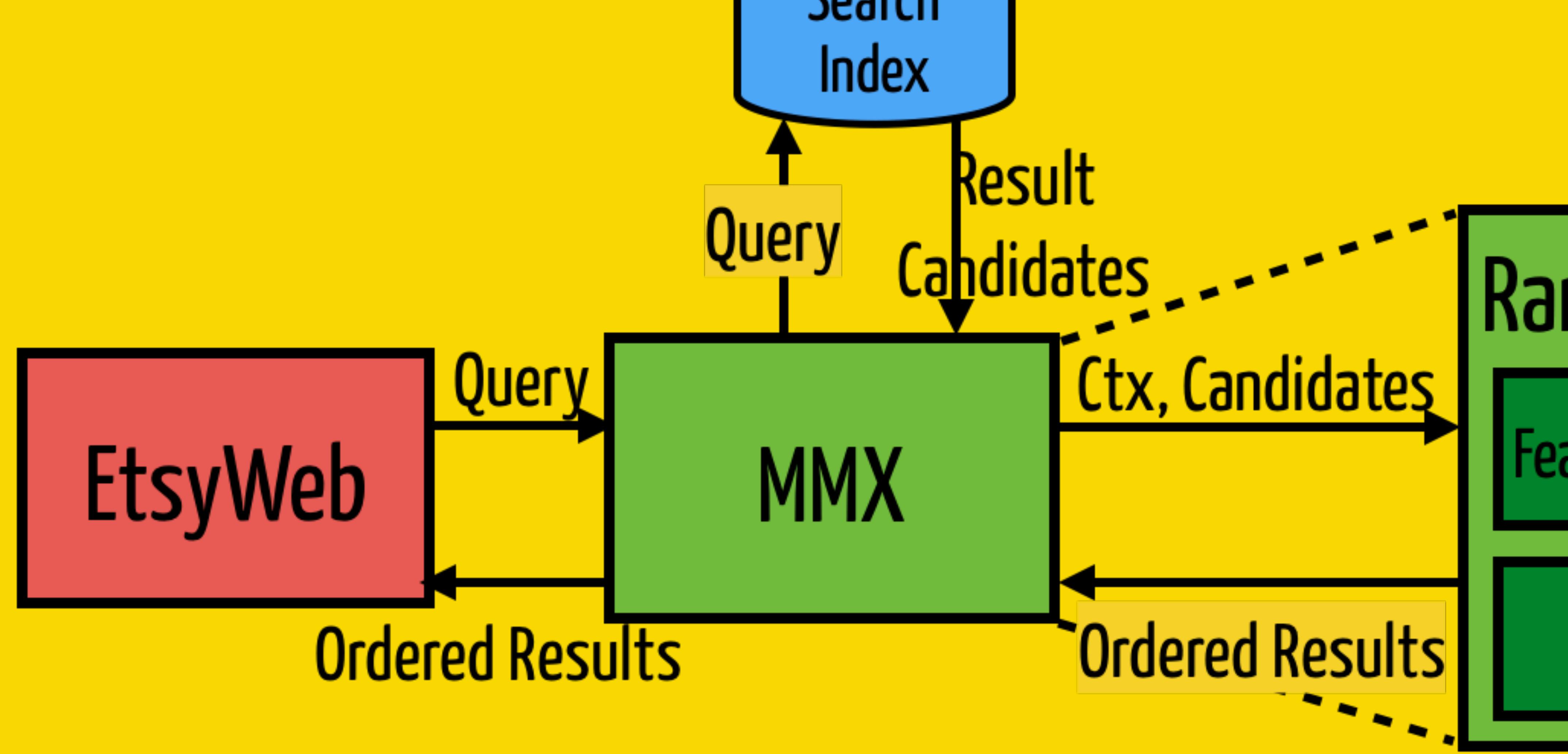


New Ranking Pipeline



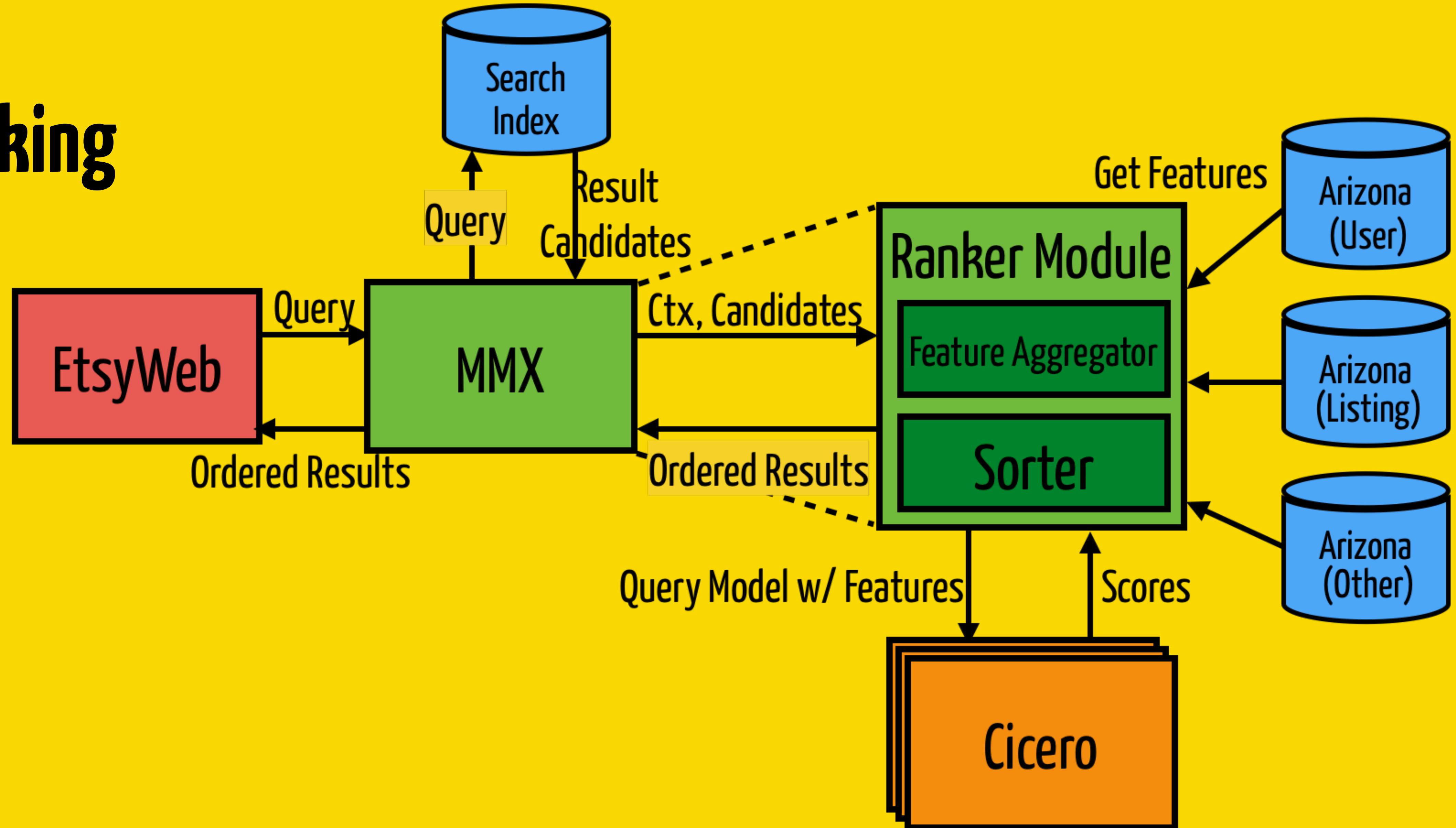






Query Model w/ Features

New Ranking Pipeline





No Results ➡
Query Backoff

Query Backoff

TV 1340ms + 211ms + 4676ms = 6227ms

Etsy

Home Favorites Your shop You Cart

Jewelry & Accessories Clothing & Shoes Home & Living Wedding & Party Toys & Entertainment Art & Collectibles Craft Supplies & Tools Vintage

Showing results for sneakers for puppies.

kayne west sneakers for puppies had no results.
Search instead: [kayne west sneakers](#) [west sneakers](#) [sneakers](#)

All categories > "sneakers for puppies" (81 Results)

Sort by: Relevancy ▾

Special offers
 On sale

All categories
Shoes
Art & Collectibles
Pet Supplies
Toys & Games
[+ Show more](#)

Shipping
 Free shipping
 Ready to ship in 1 business day
 Ready to ship within 3 business days

Shop location
 Anywhere
 United States
 Custom

Item type
 All items
 Handmade
 Vintage

Price (\$)
 Any price
 Under \$25
 \$25 to \$50
 \$50 to \$100
 Over \$100
 Custom

Fabric, Dawgs and Sneakers on Brown, Funny ...
BluePacificFabrics
\$10.00
★★★★★ (2,446)

Custom Personalize Design Your Waterproof P...
DGCustomGraphics
\$39.00
★★★★★ (114)

It's A Ruff Life Nike Roshe Run Black Custom P...
NYCustoms
\$135.00 ~~\$150.00~~ (10% off)
★★★★★ (1,211)

Sneakers the Corgi Pillow (Mermaid)
thousandskies
\$35.00
★★★★★ (1,033)

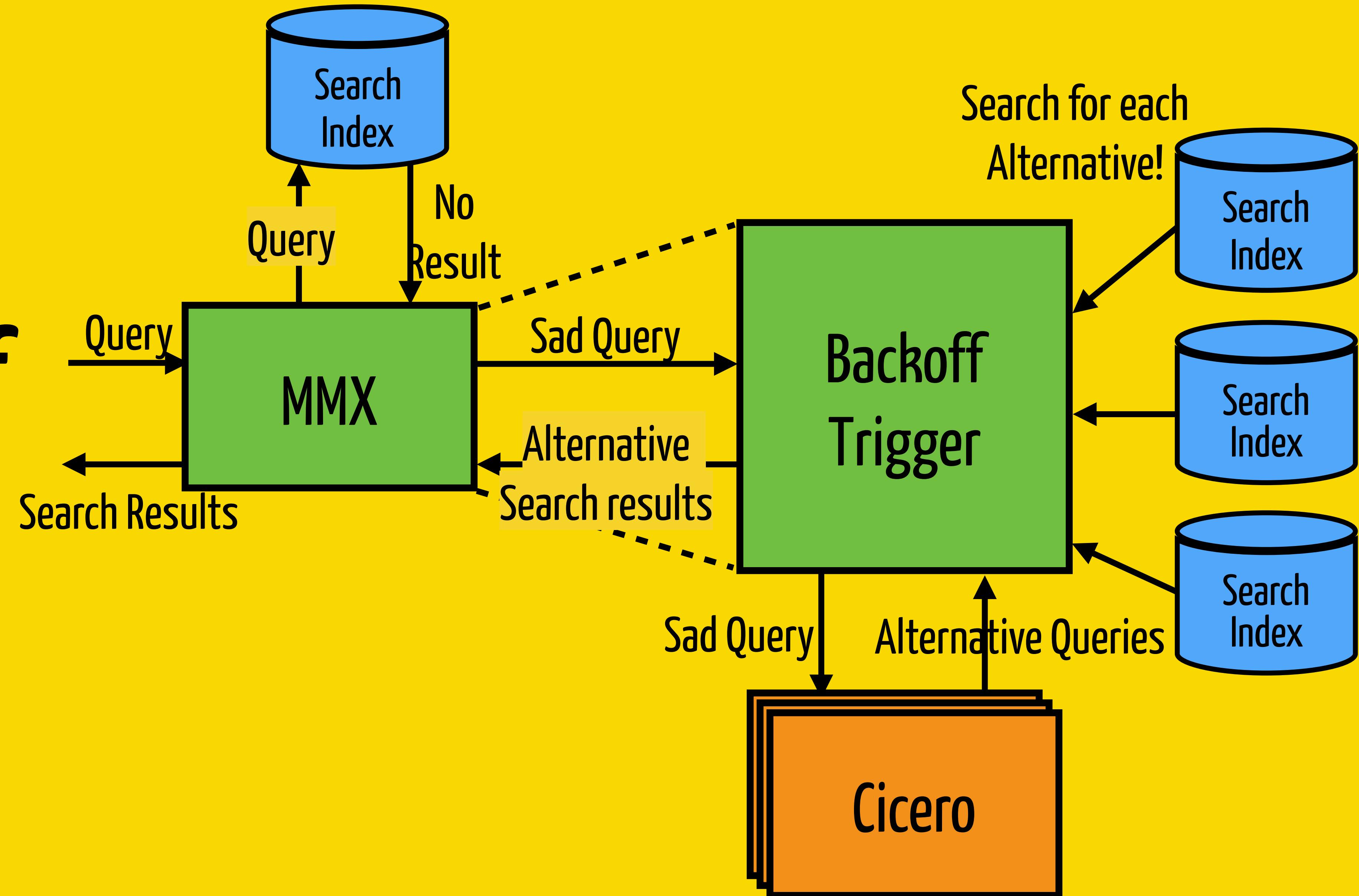
Naughty Dachshund - Women's Sneakers with ...
CustomKIKScom
\$69.95

Sneakers the Corgi Pizza Pillow (Teal collar)
thousandskies
\$30.00

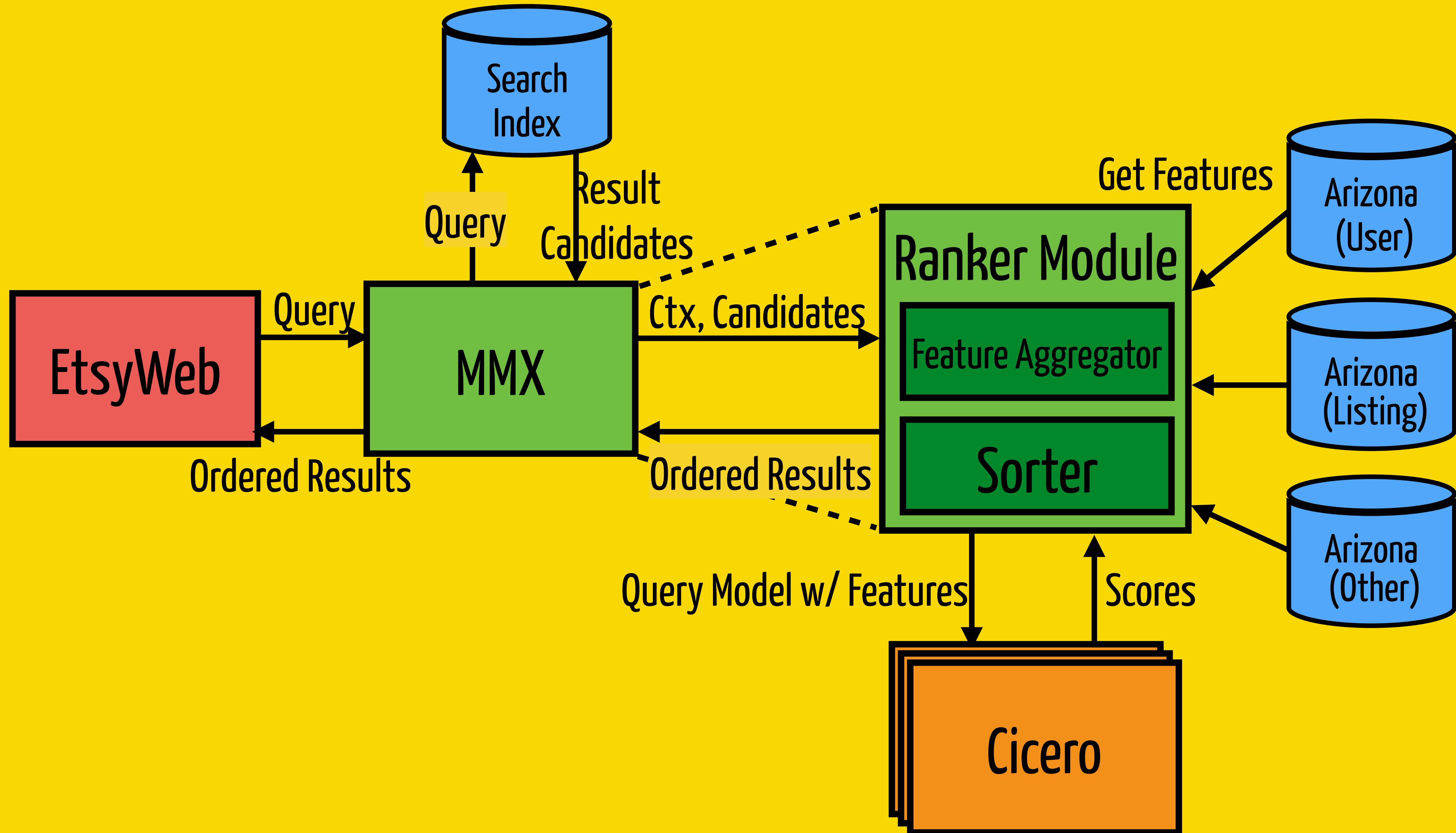
vintage womens Hush Puppies golf shoes - ta...
humblepeacock
\$75.00

Girls High Top Puppy Shoes Custom High Top...
PricklyPaw
\$78.50

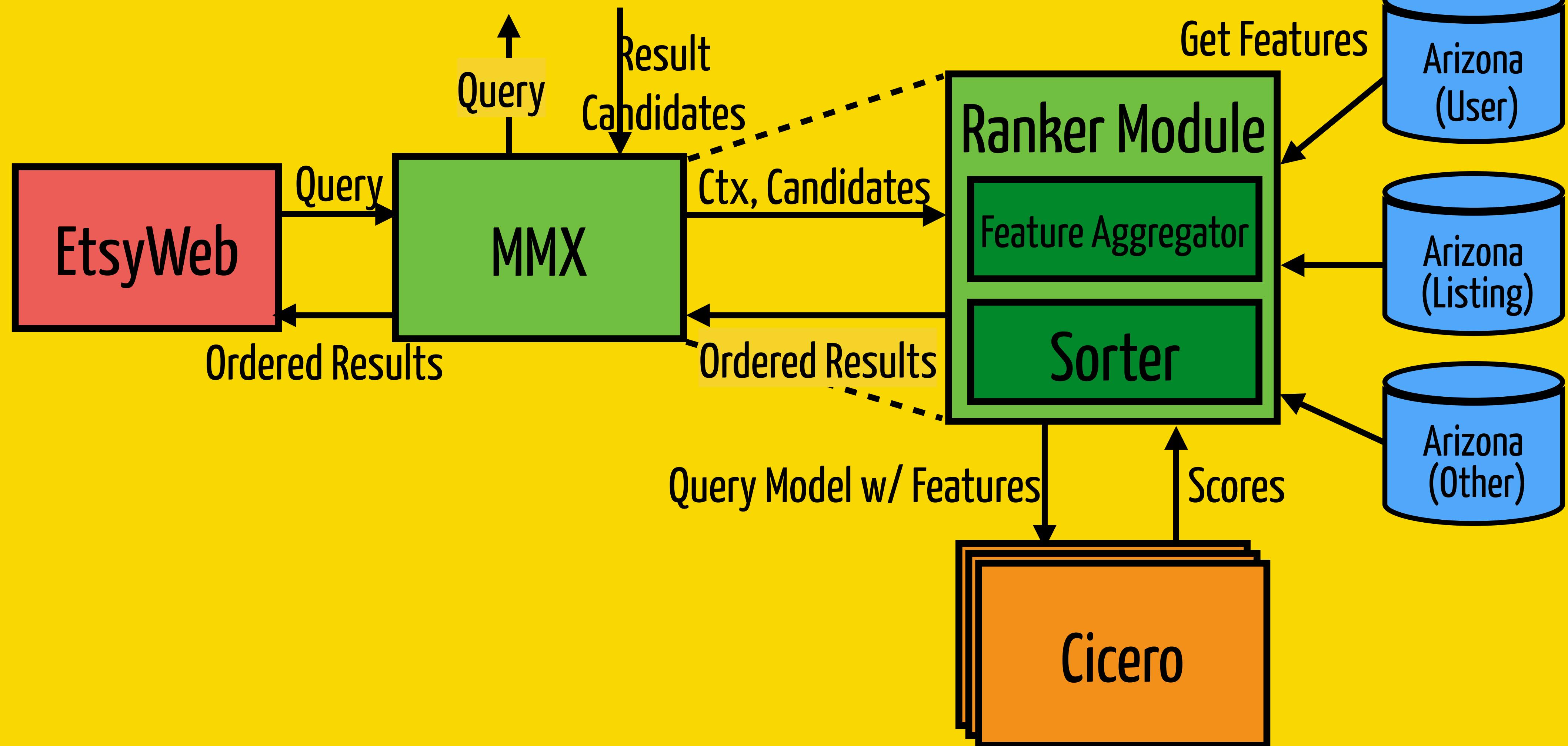
Query Backoff Pipeline



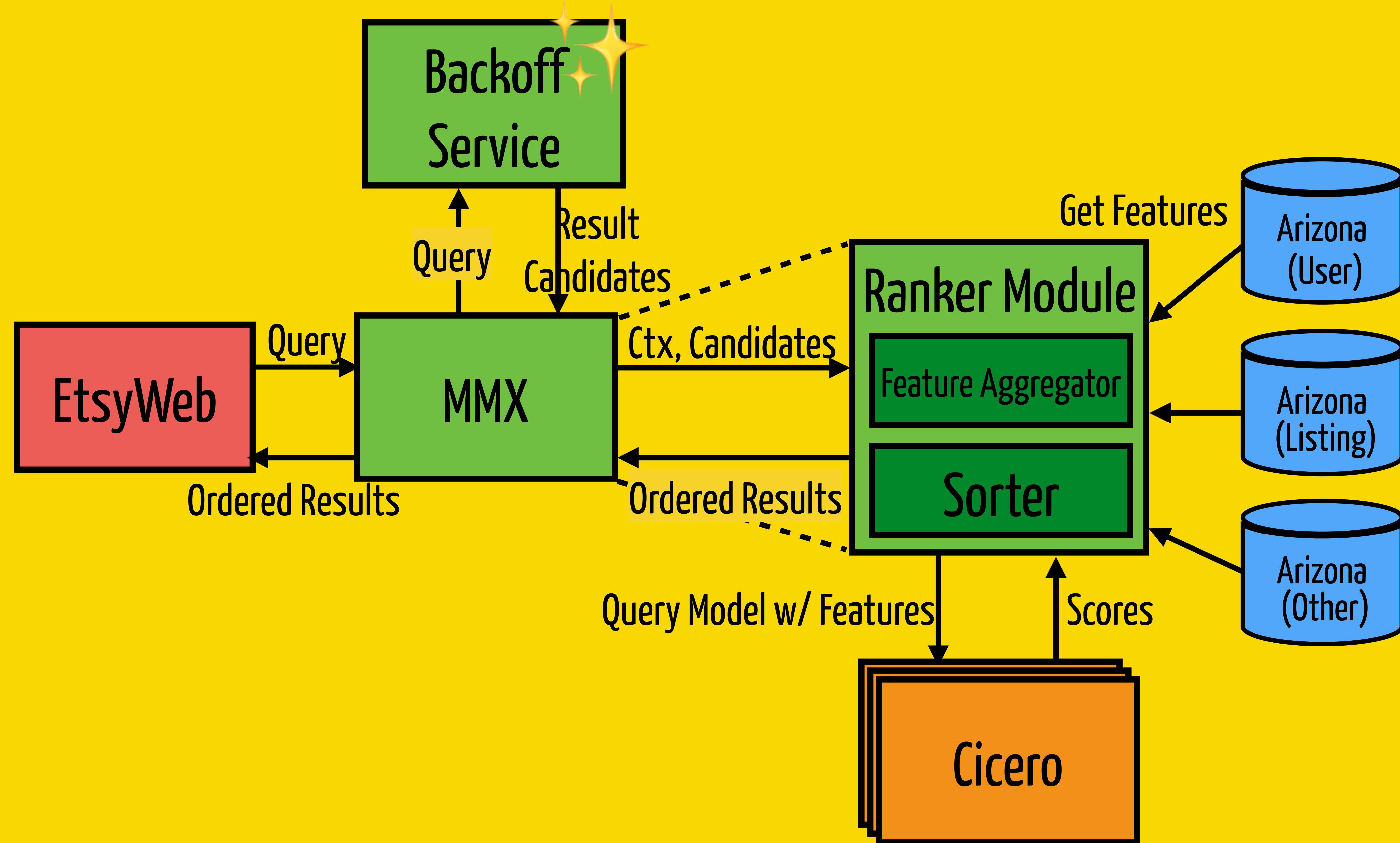
Current Ranking Pipeline



Ranking + Backoff



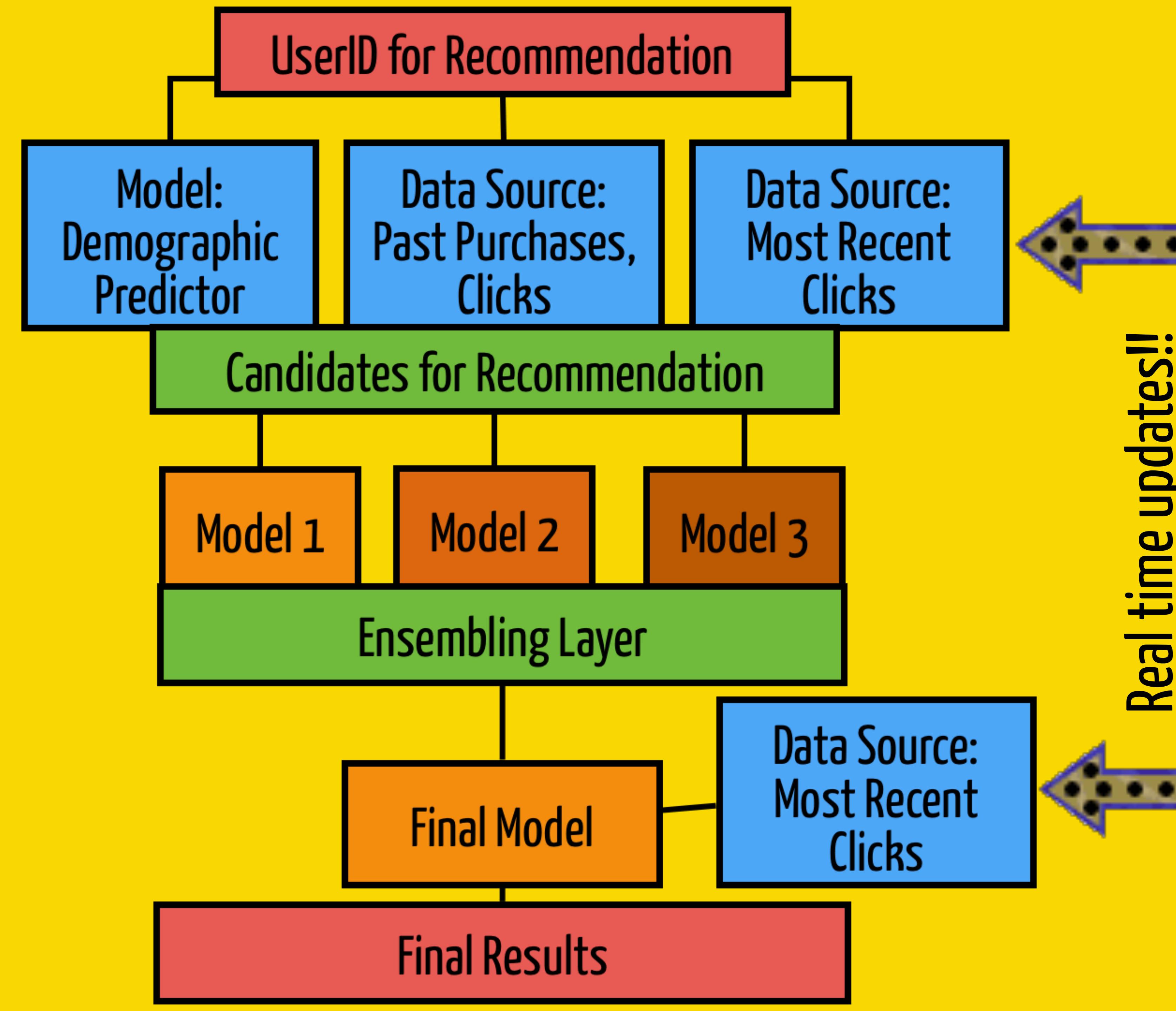
Ranking + Backoff



Recommendation Pipeline

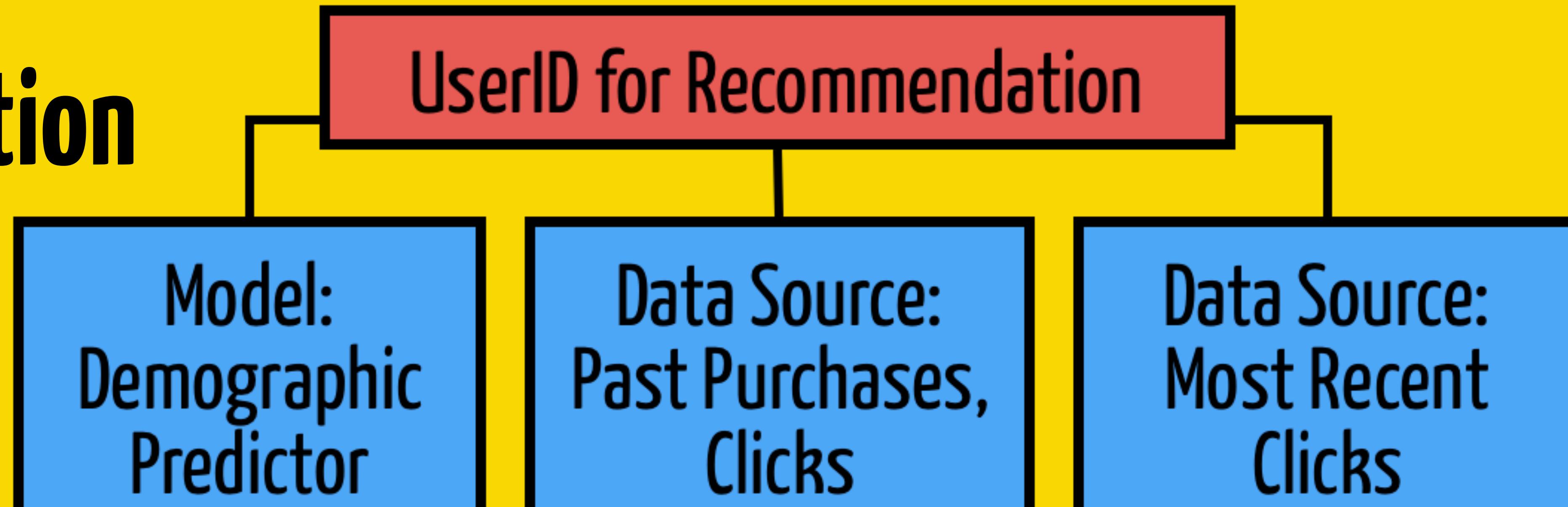


Recommendation Pipeline



Recommendation

Pipeline

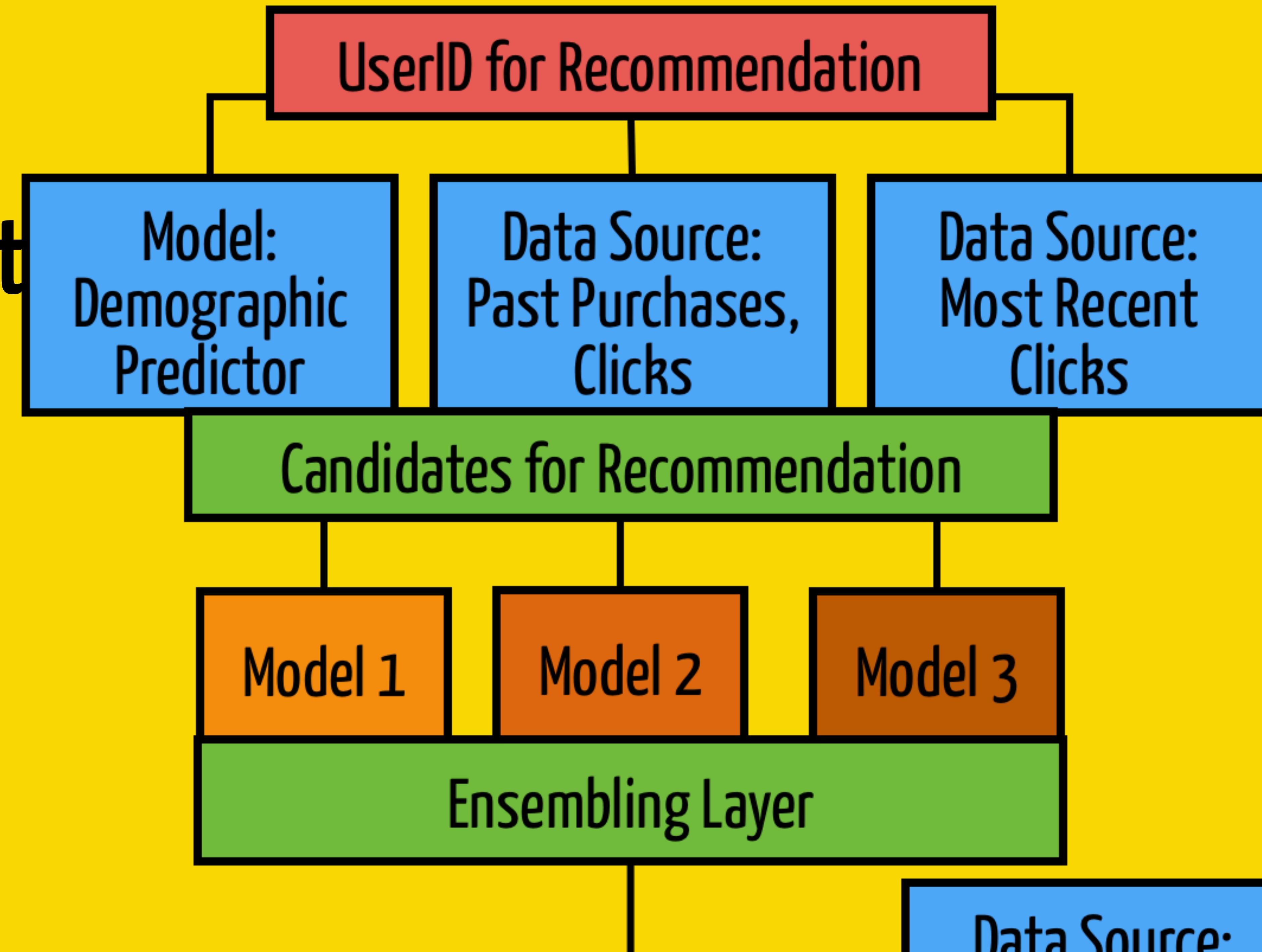


Model 1

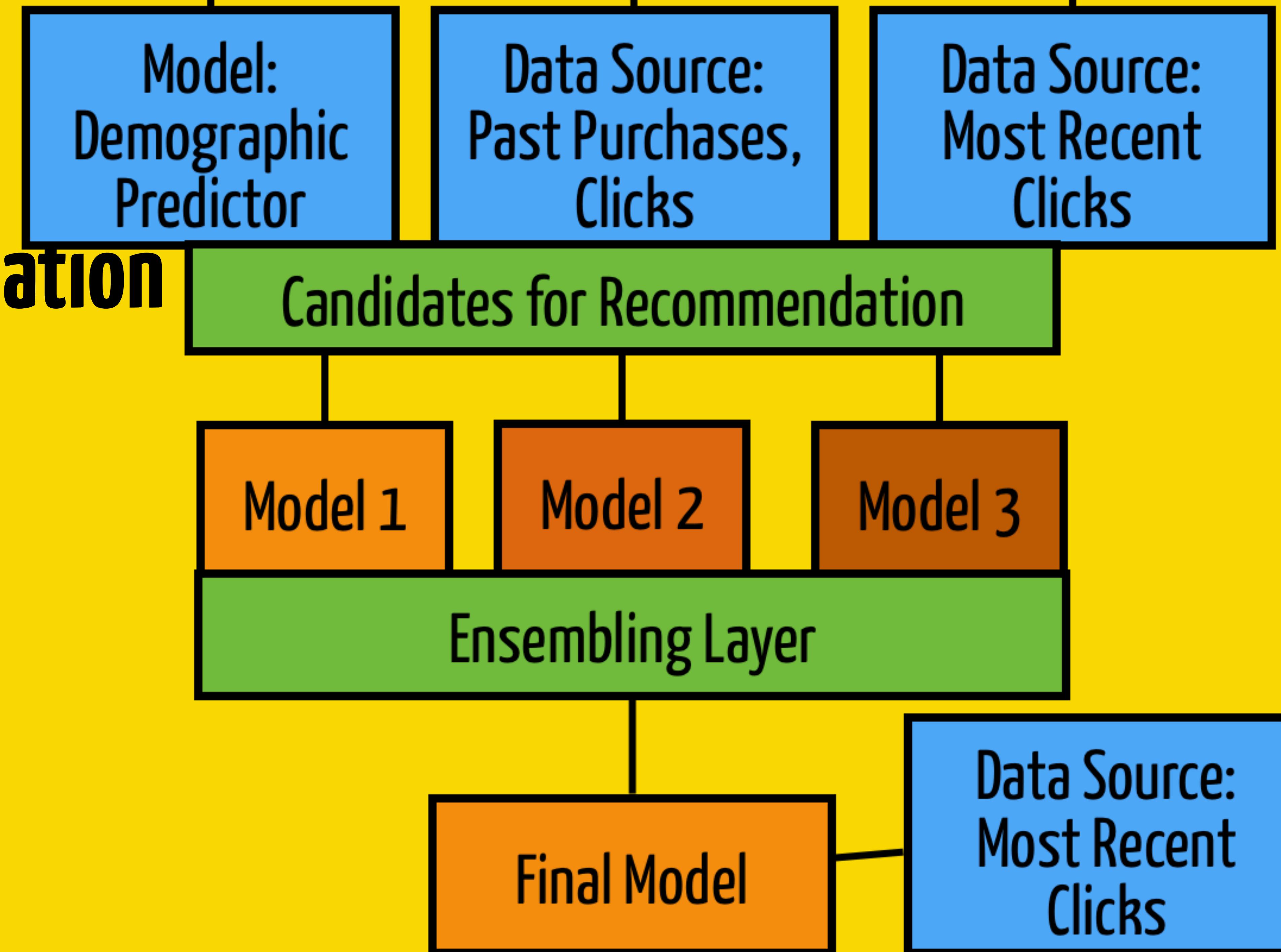
Model 2

Model 3

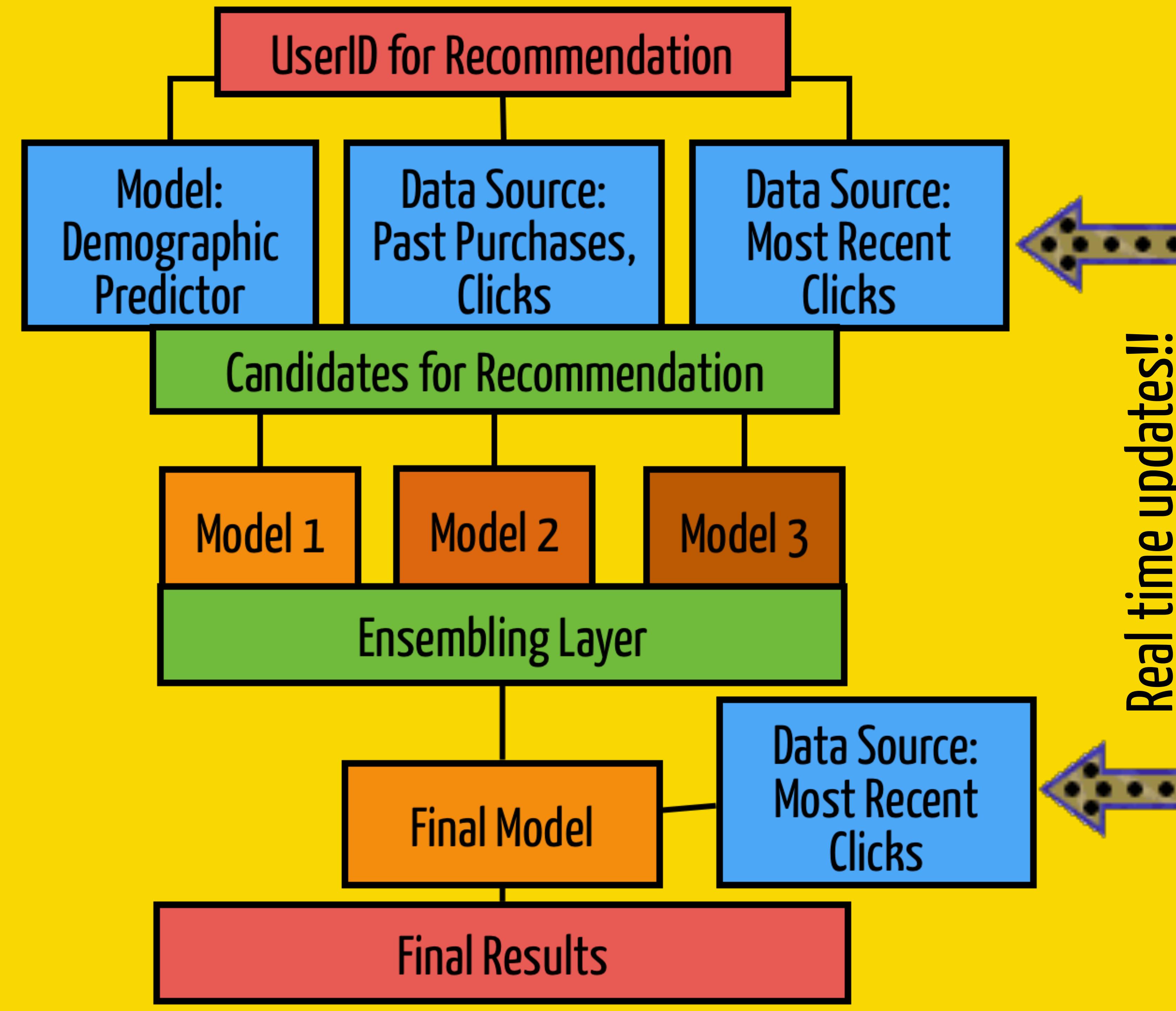
Recommendation Pipeline



Recommendation Pipeline



Recommendation Pipeline



A/B Testing

- Configurable pipelines ⇒ Create **versions of a pipeline**.
 - different model versions.
 - different arguments to services.
 - Example: Increasing reranking coverage was only a config knob switch.
 - different data sources → **Features, Candidates** etc
 - Pick and choose datasets, versions

A/B Testing: Configuring Variants

```
"variant_200" : ${configs.control} {  
    ranker_options: { "rank_limit": 200}  
},  
"variant_400" : ${configs.control} {  
    ranker_options: { "rank_limit": 400}  
},  
"variant_tuned_boosts" : ${configs.control} {  
    ranker_options: {  
        "rank_limit" : 400  
        "variant_mean" : 0.71,  
        "variant_std" : 0.53,  
        "control_mean" : 0.20,  
        "control_std" : 0.95,  
        "relevance" : false,  
        "missing_val" : 0.23  
    }  
}
```

Takeaways

- Each service is a **reusable unit** in the query DAG.
=> **algebra over services.**
- Models as a Service => **Real time inference.**
- Building new ML query pipelines is **fun!!**
+ we can debug and **experiment.**
- Towards **query understanding!**



Thank you! Danke!

Questions?

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