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FROM THEORY TO PRACTICE

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# STREAM REASONING

RW 2020, 16th Reasoning Web Summer School - 25.06.2020

## STREAM REASONING RESEARCH QUESTION

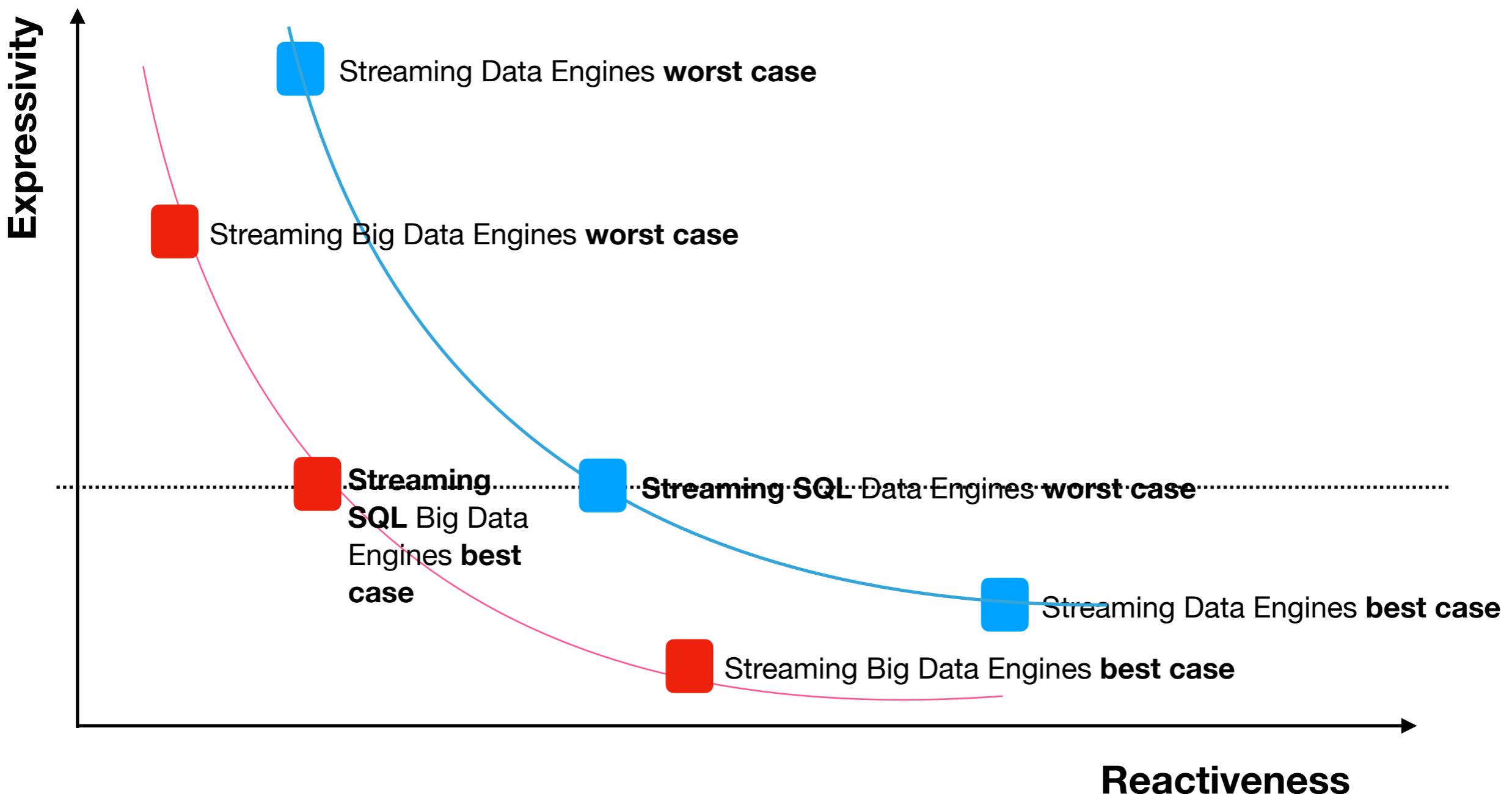
Is it possible to **make sense** in **real time** of **multiple, heterogeneous, gigantic** and **inevitably noisy** and **incomplete data streams** in order to support the **decision** processes of **extremely large numbers of concurrent users**?

E. Della Valle, S. Ceri, F. van Harmelen & H. Stuckenschmidt, 2010

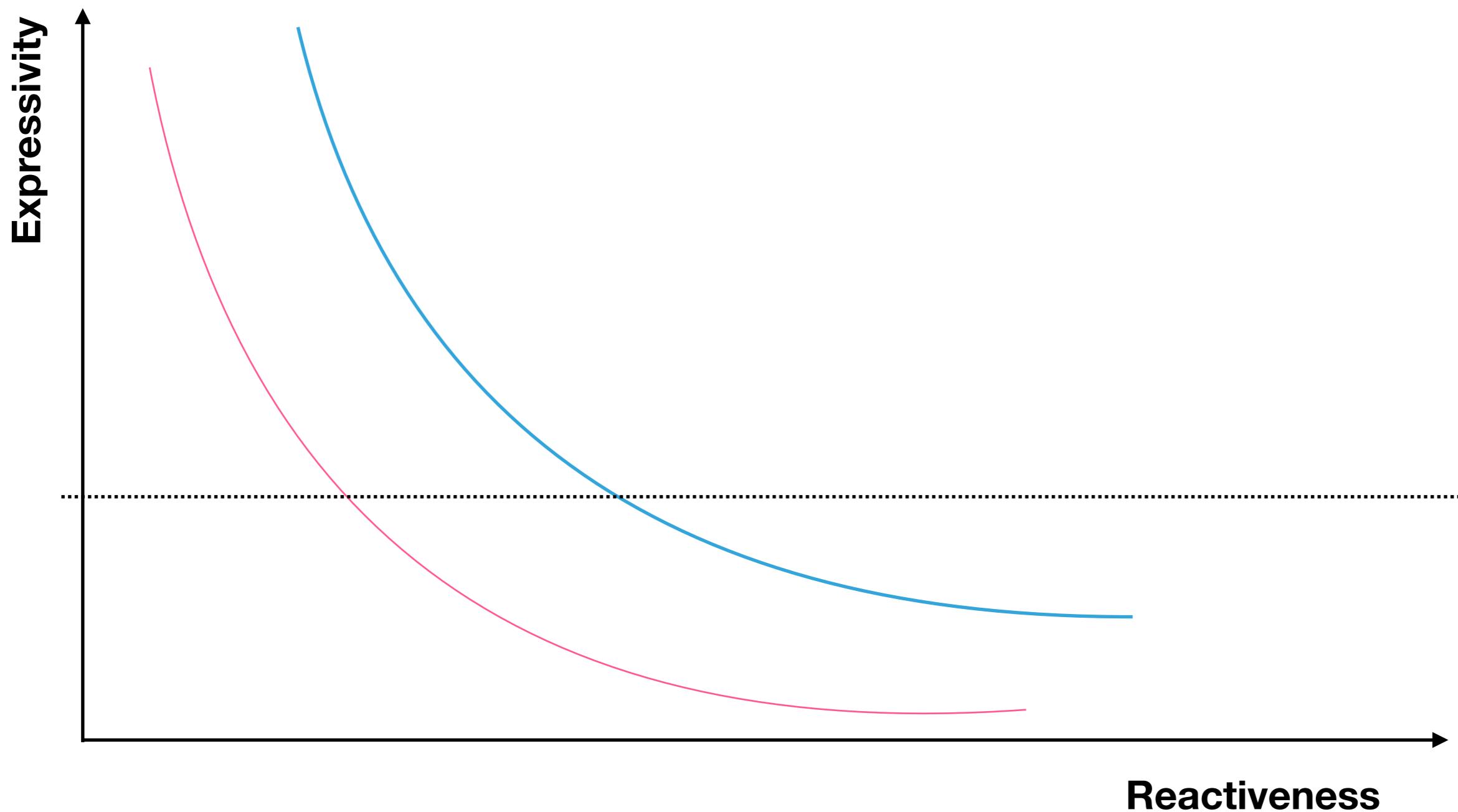
# VARIETY & VERACITY MAKES PROBLEMS HARDER



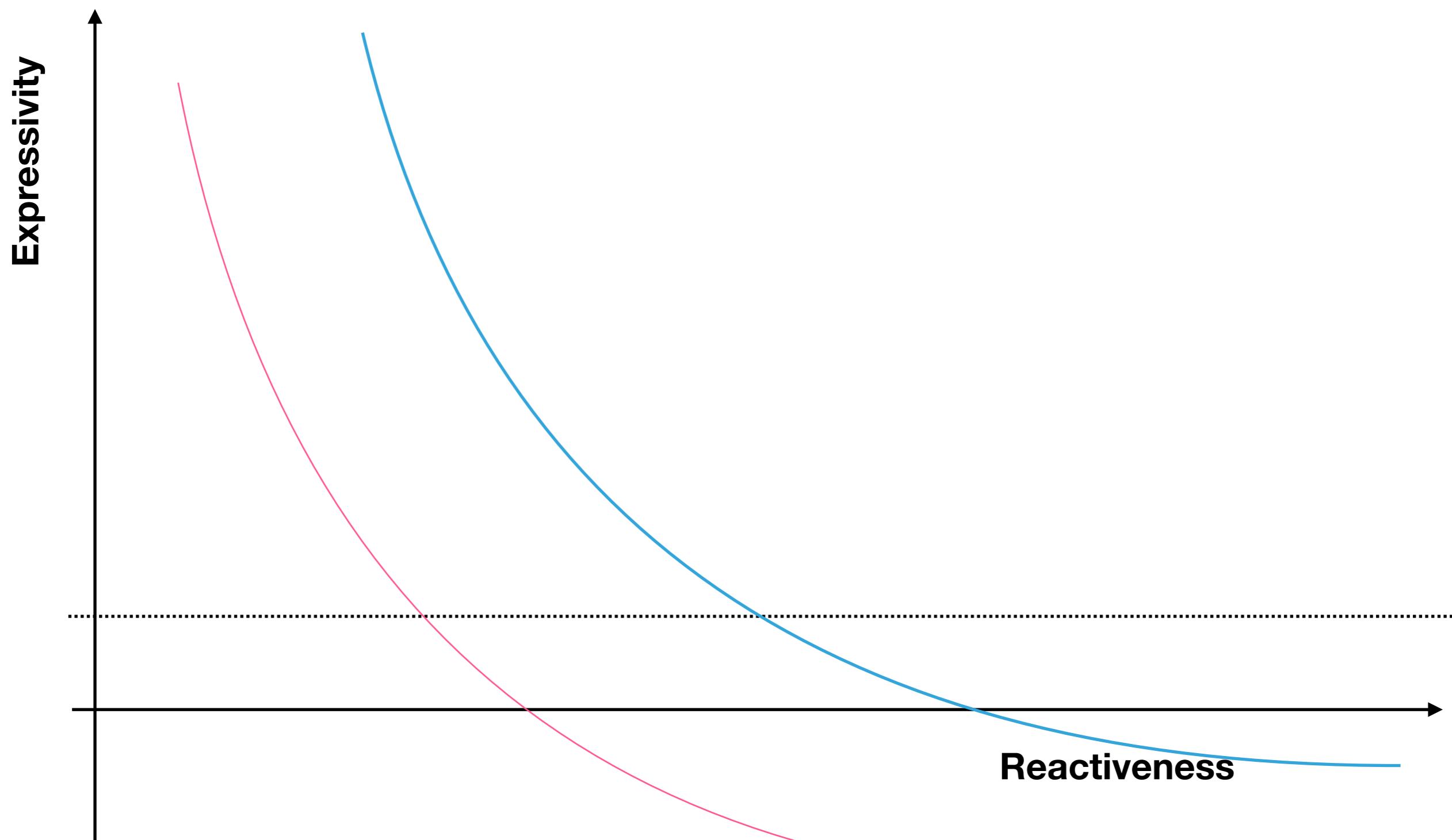
# SOLUTION LANDSCAPE (QUALITATIVE)



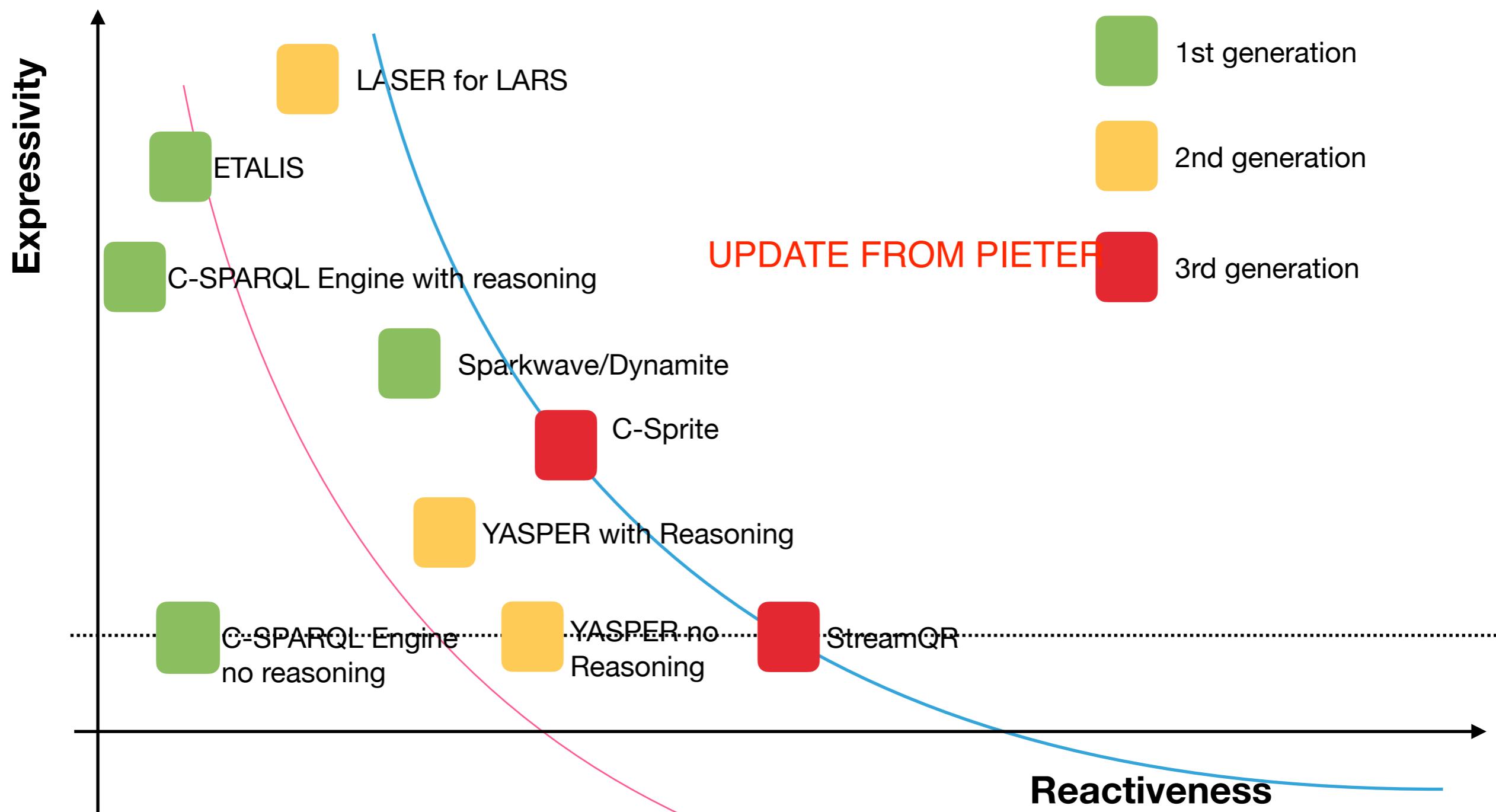
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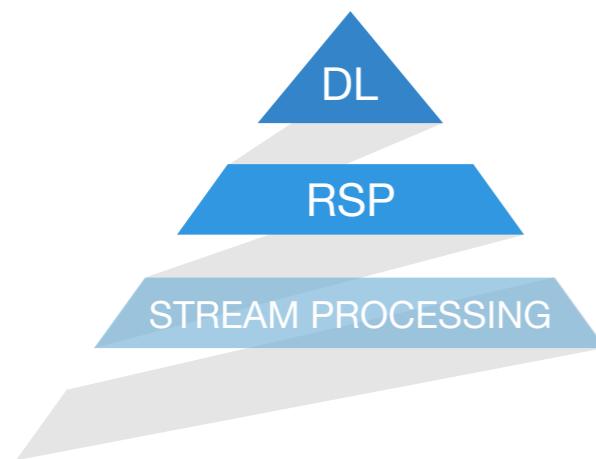
# STREAM REASONING VS. REQUIREMENTS

Requirement	Stream Reasoning
massive datasets	★
data streams	★★
heterogeneous dataset	★★
incomplete data	★
noisy data	★
reactive answers	★★
fine-grained information access	★★
complex domain models	★★

★ not specifically treated so far   ★★ treated but not resolved   ★★★ universally addressed by all studies

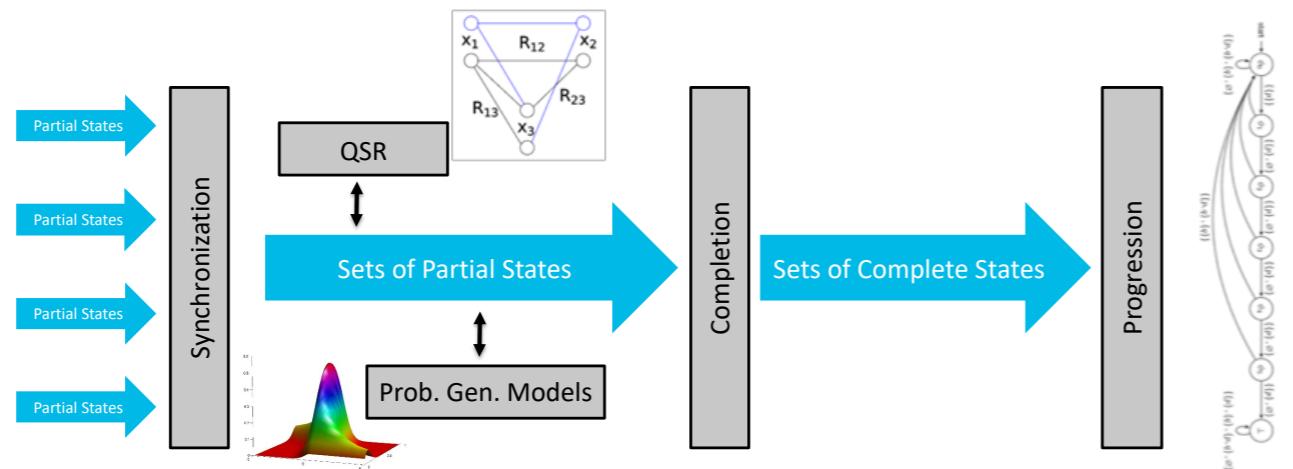
# CATEGORIES

- ▶ Window- and Event-based: **reactiveness matters!**



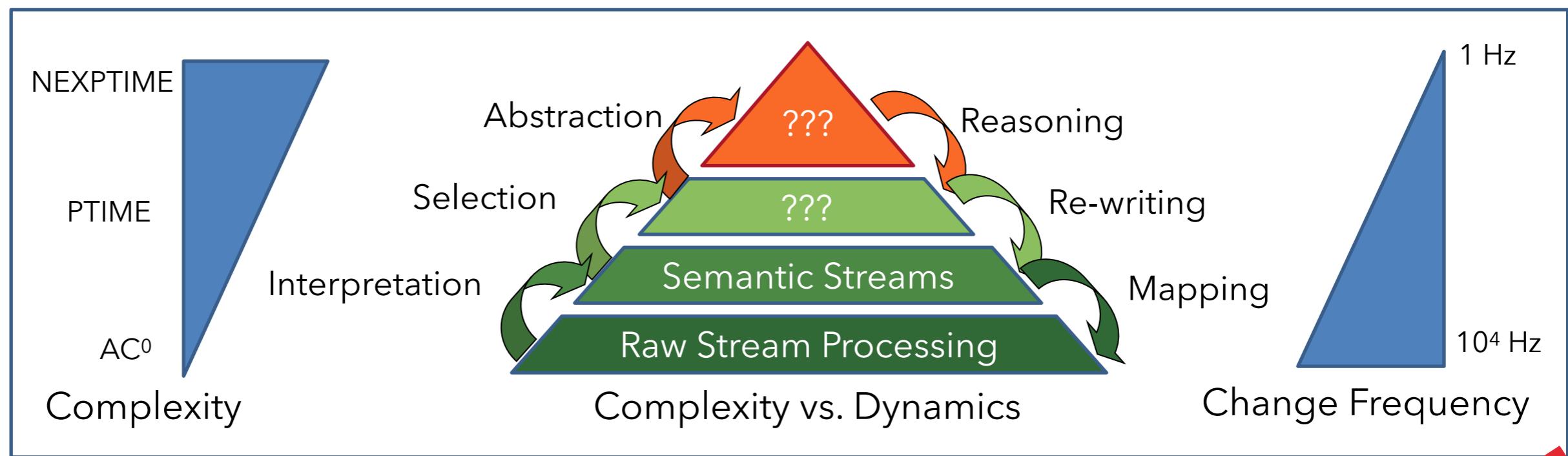
**HELP TO UNIFY THEM!**

- ▶ Logic-based: **expressivity matters!**



# IS THERE A SWEET-SPOT?

- ▶ the **data access** layers are **clear** (enough)



- ▶ ... but,
- ▶ how many layers are worth to add ontop of data access?
- ▶ what kind of reasoning should we put at the top?

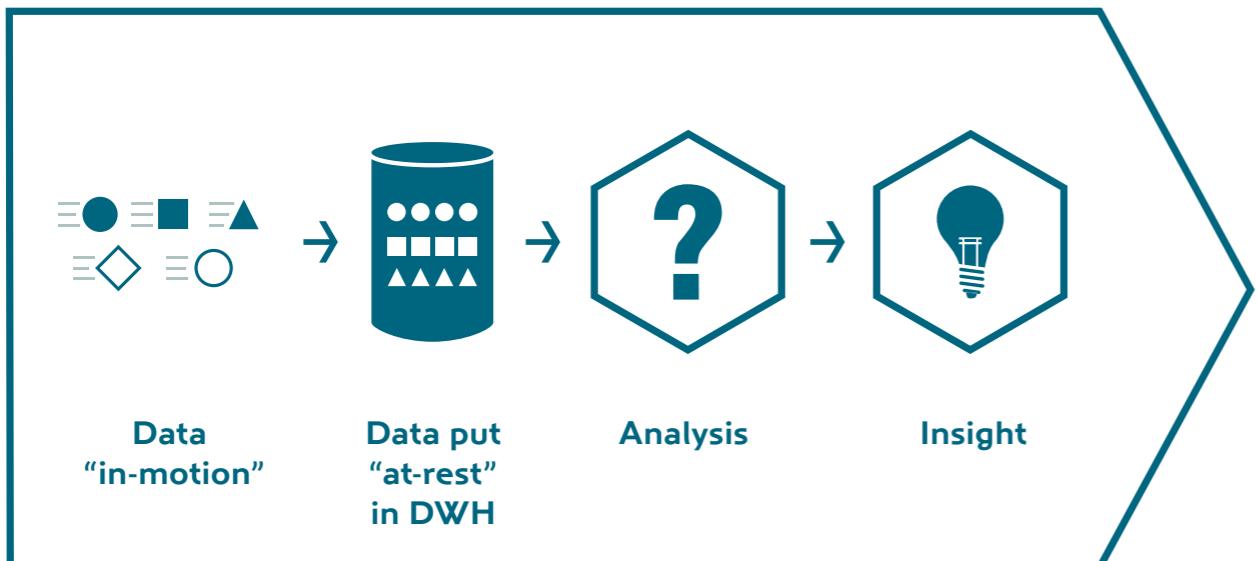
# TOWARDS STREAM REASONING FOR ANALYTICS

- ▶ Focus on languages and abstractions able to easily **capture user needs**
  - ▶ **Analytic queries**
    - ▶ Which electricity-producing turbine has sensor readings similar (i.e., **Pearson correlated** by at least 0.75) to any turbine that subsequently had a critical failure in the past year?
  - ▶ **Advance analytics** (Machine Learning) **tasks**
    - ▶ **Where am I likely going** to run into a traffic jam during my commute **tonight** and **how long will it take**, given current weather and traffic conditions?
  - ▶ ... *many more ...*

# TOWARDS STREAM REASONING FOR ANALYTICS

- ▶ Used semantics to model **more than the data access**

Traditional

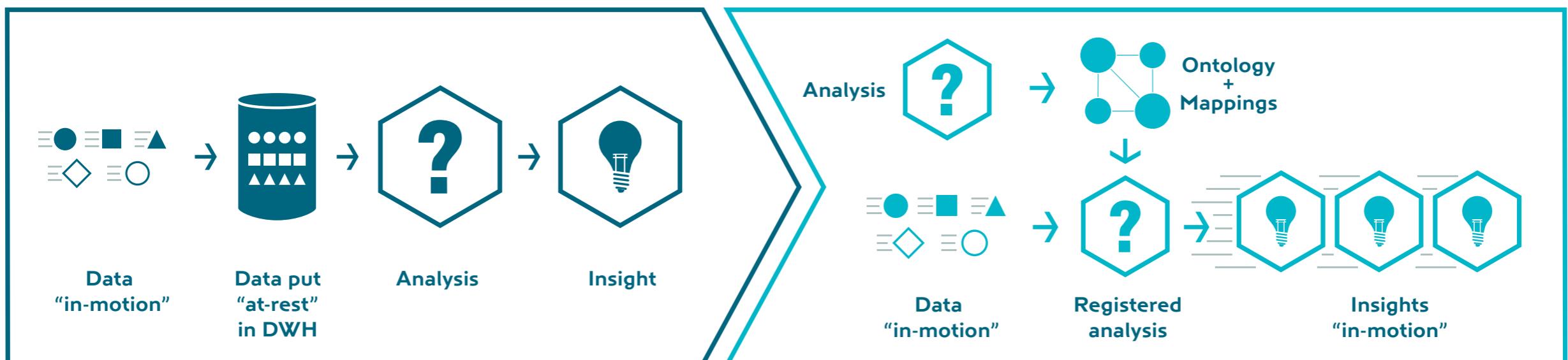


# TOWARDS STREAM REASONING FOR ANALYTICS

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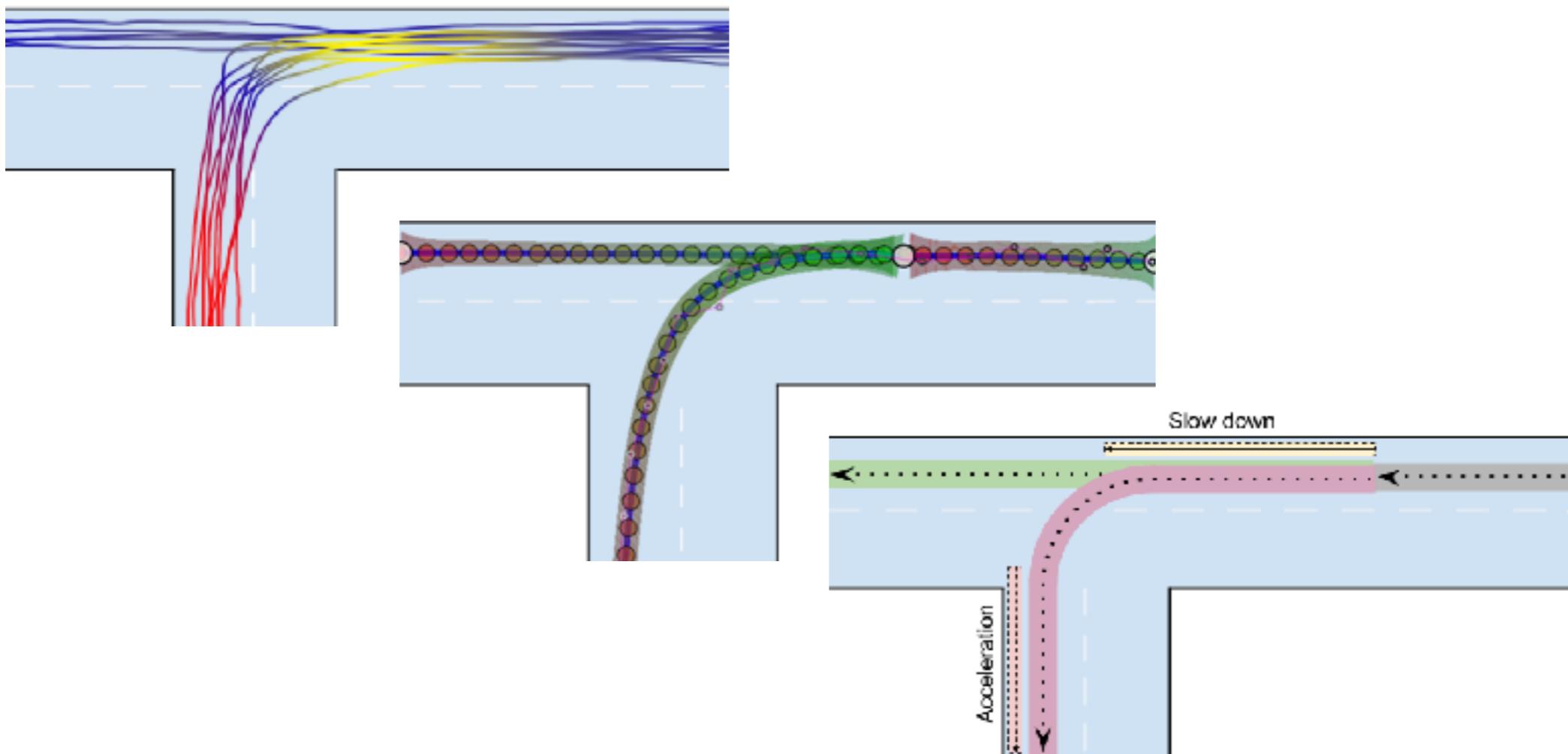
Stream Reasoning



# INDUCTIVE STREAM REASONING

- ▶ e.g., through Unsupervised Trajectory Learning

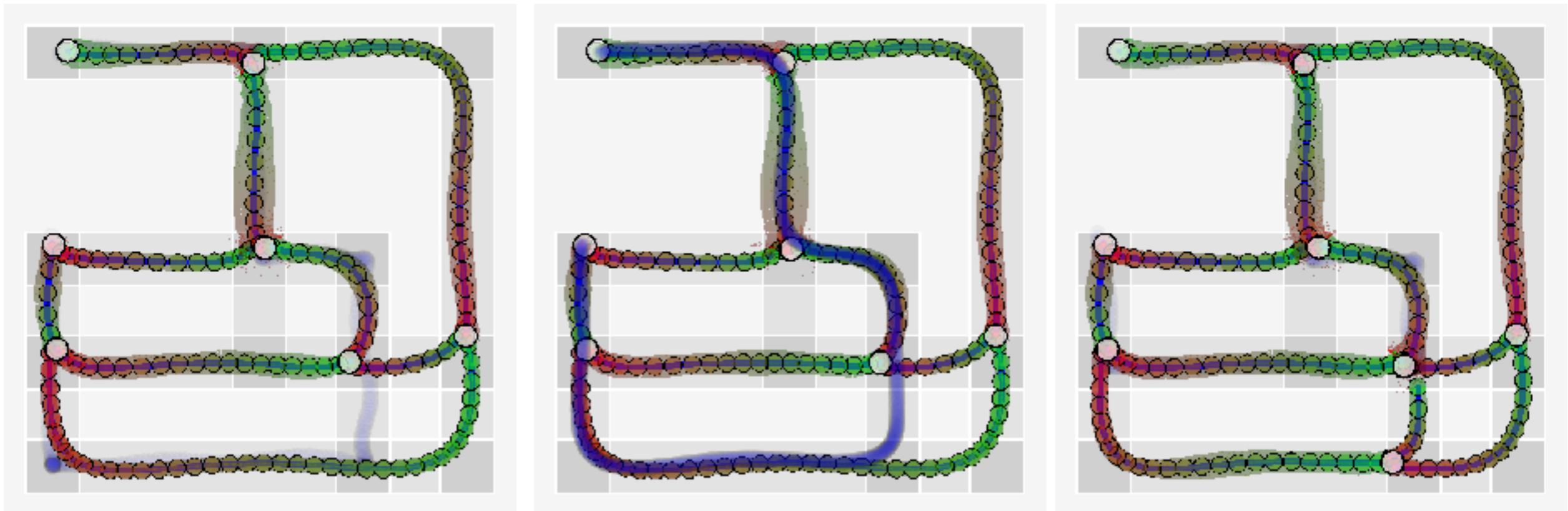
[Tiger and Heintz IV 2018, Tiger and Heintz FUSION 2015, Tiger and Heintz STAIRS 2014]



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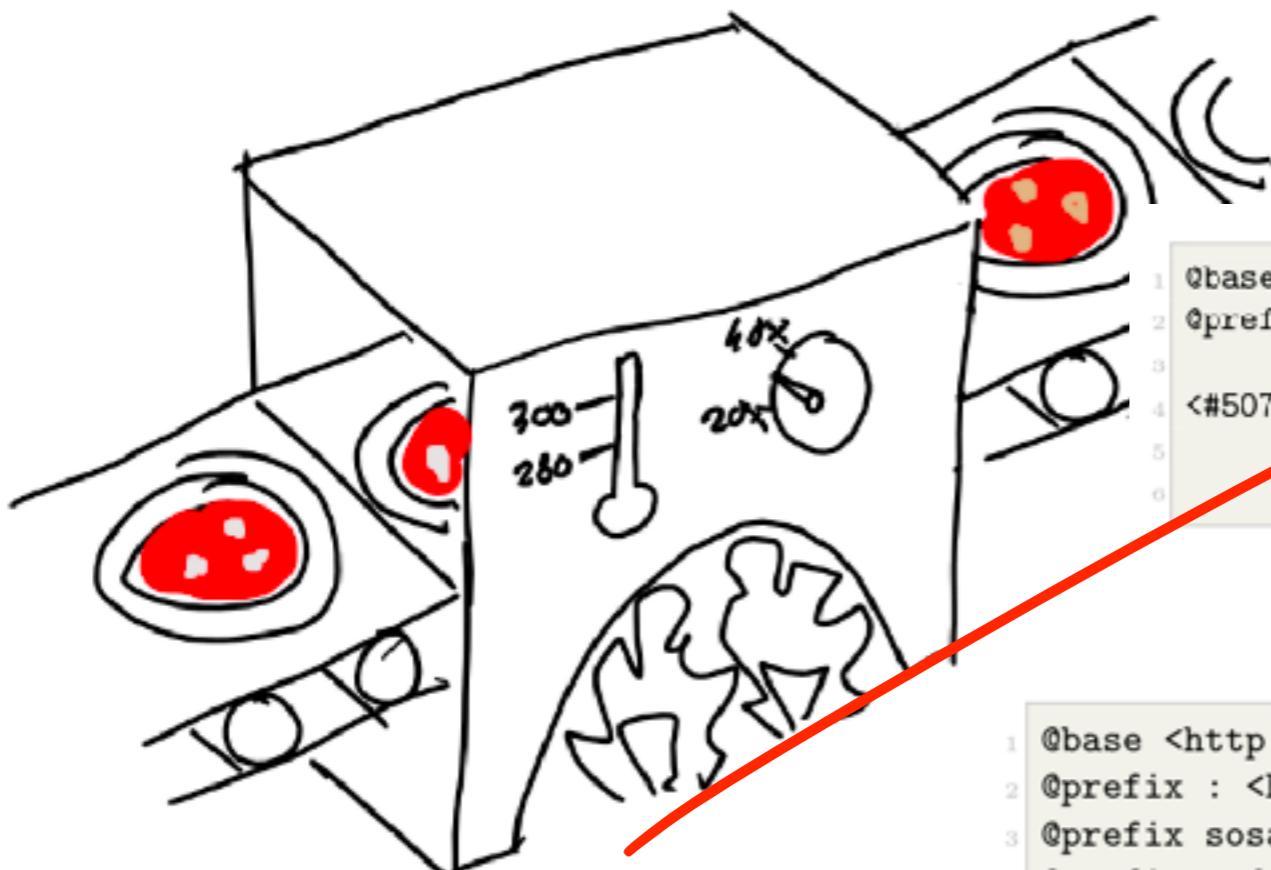
[Tiger and Heintz IV 2018, Tiger and Heintz FUSION 2015, Tiger and Heintz STAIRS 2014]



## NOW WHAT?



# LET'S CHALLENGE YOU TO HELP COOKING GOOD PIZZAS!



```
1 @base <http://linkeddata.stream/streams/pizza-S1/1588684149> .  
2 @prefix : <http://www.co-ode.org/ontologies/pizza/pizza.owl#> .  
3  
4 <#507f704d-dfb8-4fa3-97ca-64a93e56abb0> a :Pizza ;  
5   :hasTopping :MozzarellaTopping ,  
6   :TomatoTopping .
```

Named Pizza	Temp Avg	Temp Std
Margherita	280	10
American	275	5

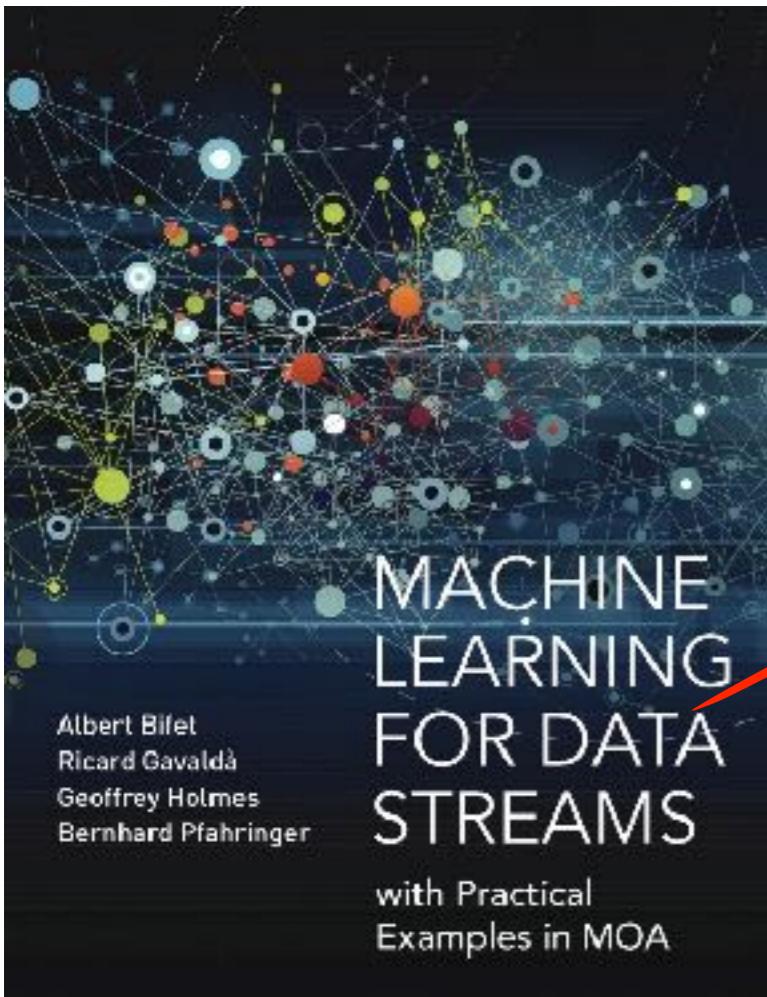
```
1 @base <http://linkeddata.stream/streams/pizza-S2/1588684151> .  
2 @prefix : <http://linkeddata.stream/streams/pizza-S1/1588684149#> .  
3 @prefix sosa: <http://www.w3.org/ns/sosa/> .  
4 @prefix qudt: <http://qudt.org/1.1/schema/qudt#> .  
5 @prefix qudt-unit: <http://qudt.org/1.1/vocab/unit#> .  
6  
7 <#575d1e00-1b70-4a3b-9ed4-961990aaead8> a sosa:Observation ;  
8   sosa:hasFeatureOfInterest :507f704d-dfb8-4fa3-97ca-64a93e56abb0 ;  
9   sosa:hasResult [  
10    a qudt:QuantityValue ;  
11    qudt:unit qudt-unit:DegreeCelsius ;  
12    qudt:numericValue 280.4 ] .
```

# LET'S CHALLENGE YOU TO HELP COOKING GOOD PIZZAS!

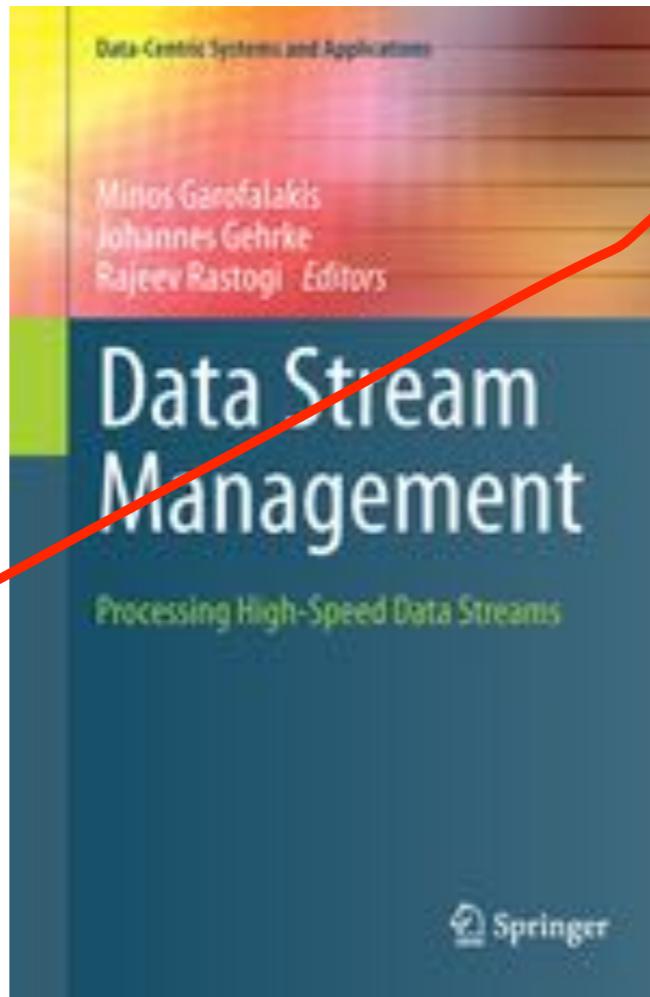
- ▶ Rules
  - ▶ branch our GIT repository
    - ▶ <https://github.com/riccardotomasini/colorwave/tree/RW-2020>
  - ▶ ask for support on our slack channel
  - ▶ publish your solution under Apache 2.0 solution (preferable on [github.com](#))
  - ▶ send an email by 24.7.2020 telling where your repo is
  - ▶ More details on <http://streamreasoning.org/events/rw2020>

## THE PRIZES FOR THE CHALLENGE

1st prize



2nd prize



3rd prize



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