EBERHARD KARLS
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Transformation Lifecycle Management with Nautilus

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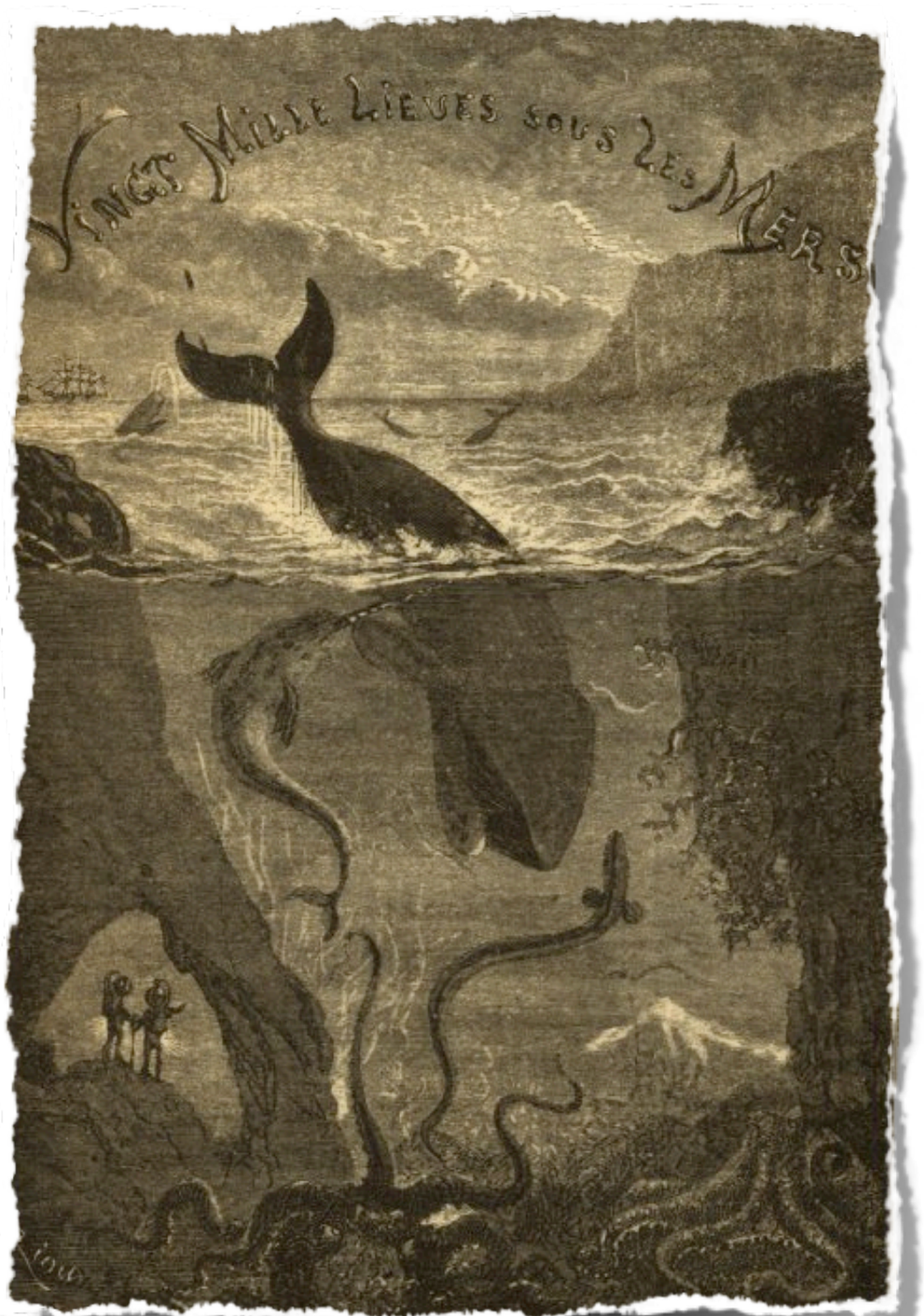
University of Tübingen
Germany

Workshop on Quality in Databases 2011
collocated with VLDB

What is Nautilus?



"The **deepest parts of the ocean** are totally unknown to us[...] **What goes on** in those distant depths? What creatures **inhabit**, or could inhabit, those regions twelve or fifteen miles beneath the surface of the water? It's almost beyond **conjecture**" Jules Verne, 20.000 Leagues under the Sea, Chapter 2.

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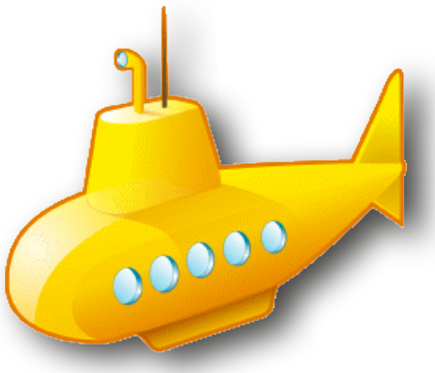

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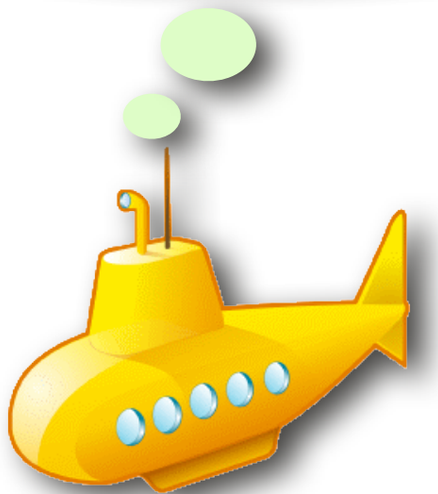


What is Nautilus?

What happens within transformation?

What data?

How is data combined?

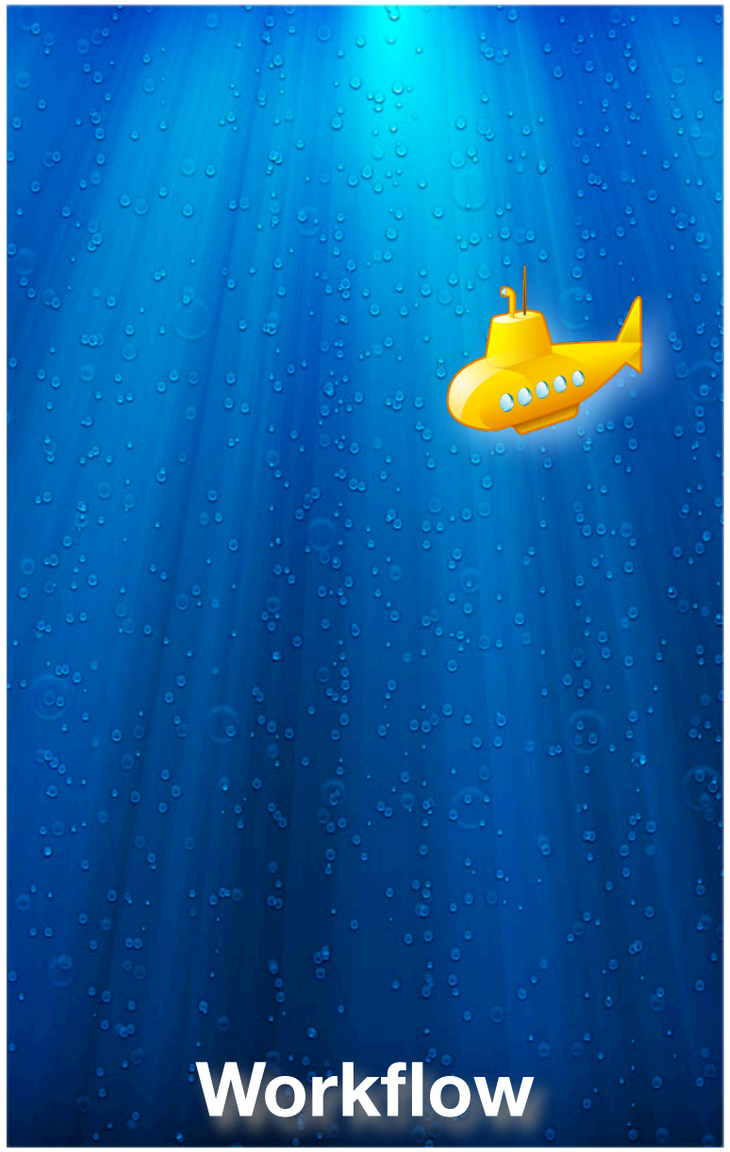
Developing data transformations - state of the art

- Manual trial-and-error process
- No systematic tool exists that supports the complete Analyze-Fix-Test (AFT) cycle.
- New requirements lead to further cycles.

Why Transformation Lifecycle Management?

- Tool-supported help for developing and evolving transformations.
- Management, sharing, or documentation of a transformation throughout its entire lifecycle.
- Faster development or reaction to requirement changes.
- Easier transformation development for non experts.

Agenda



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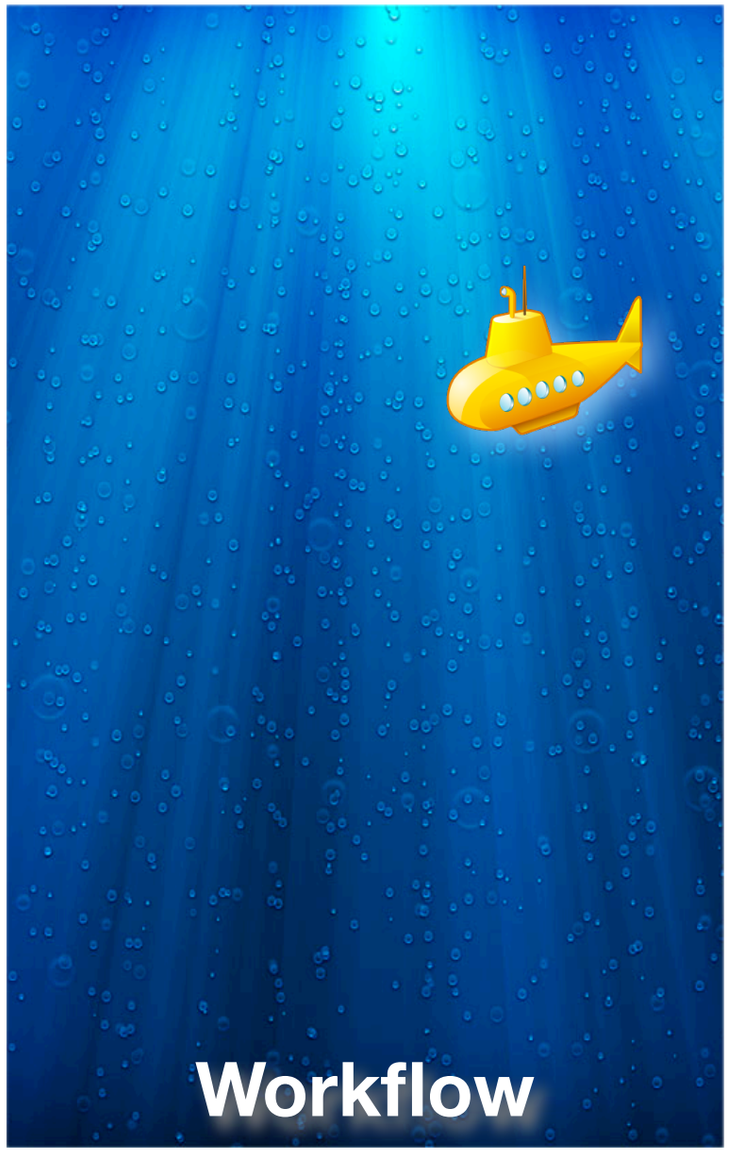
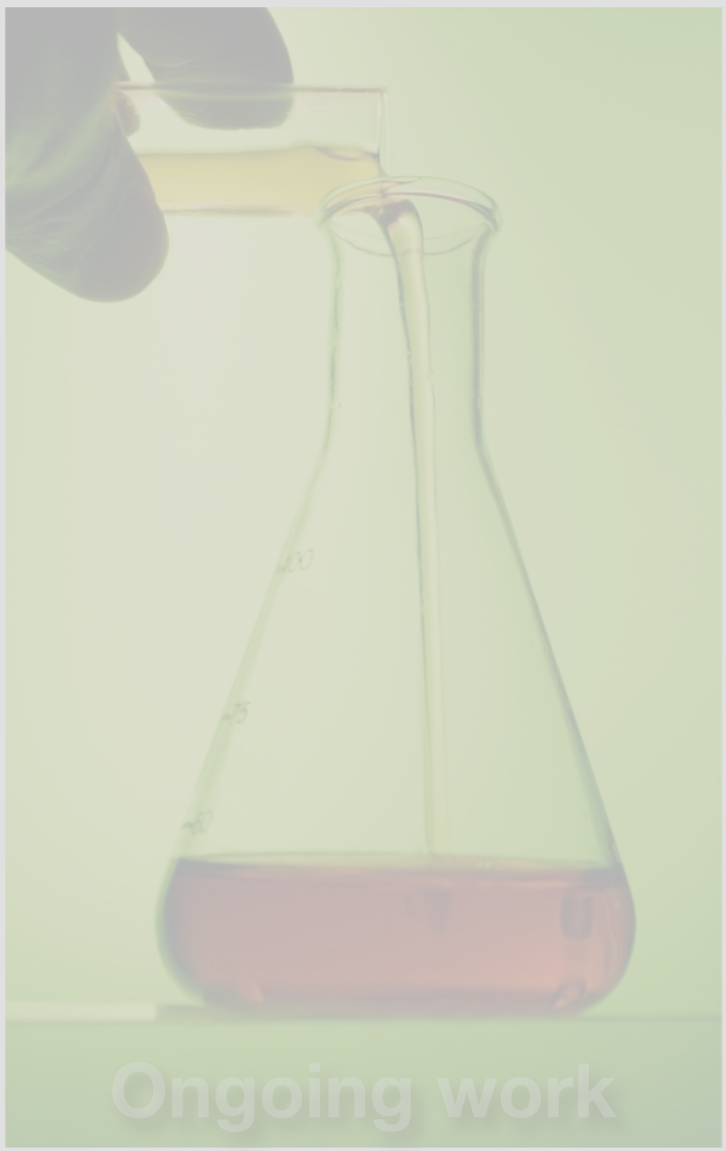
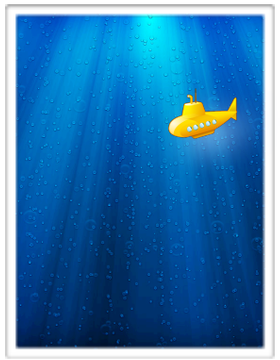
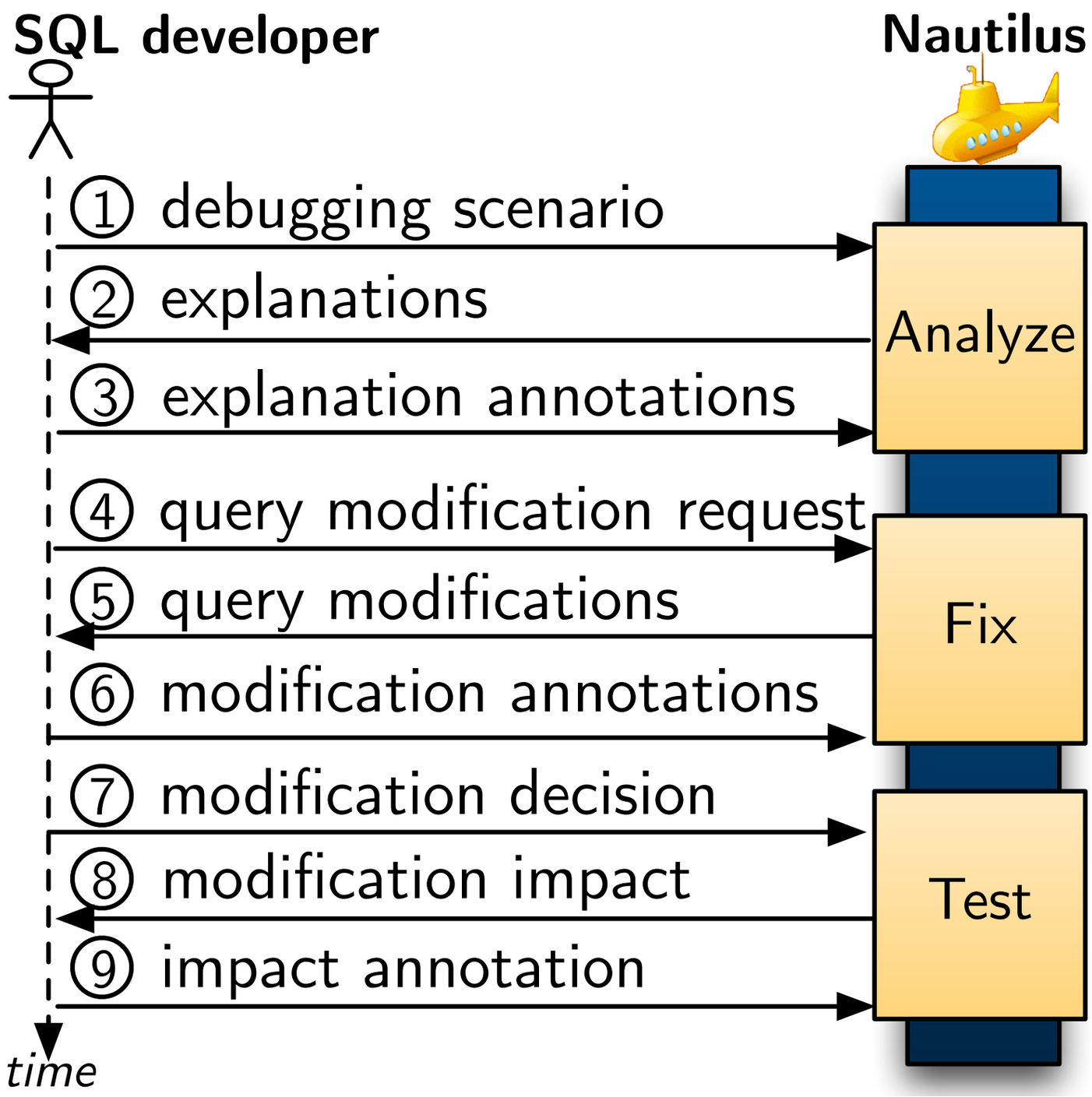




The Complete Workflow





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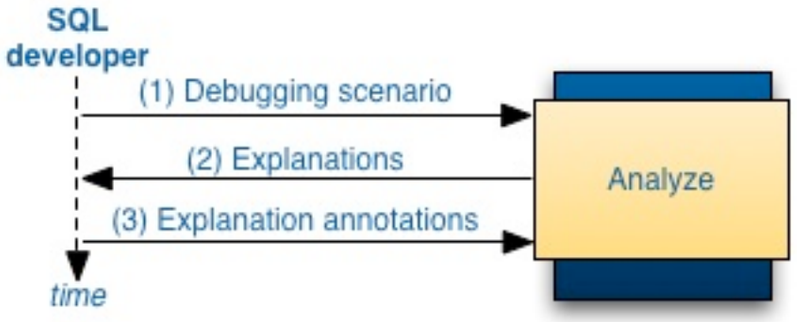
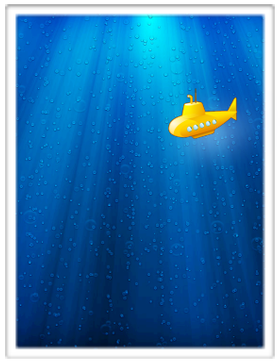




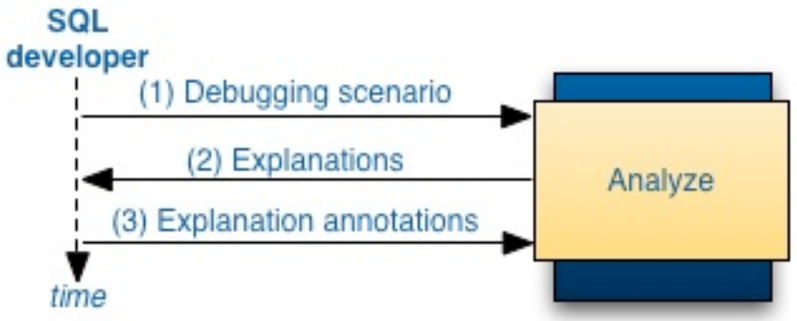
Analyze

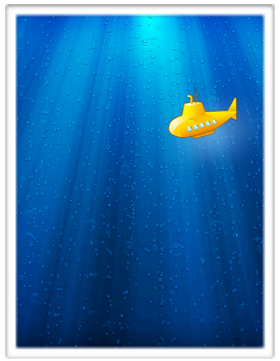
Fix

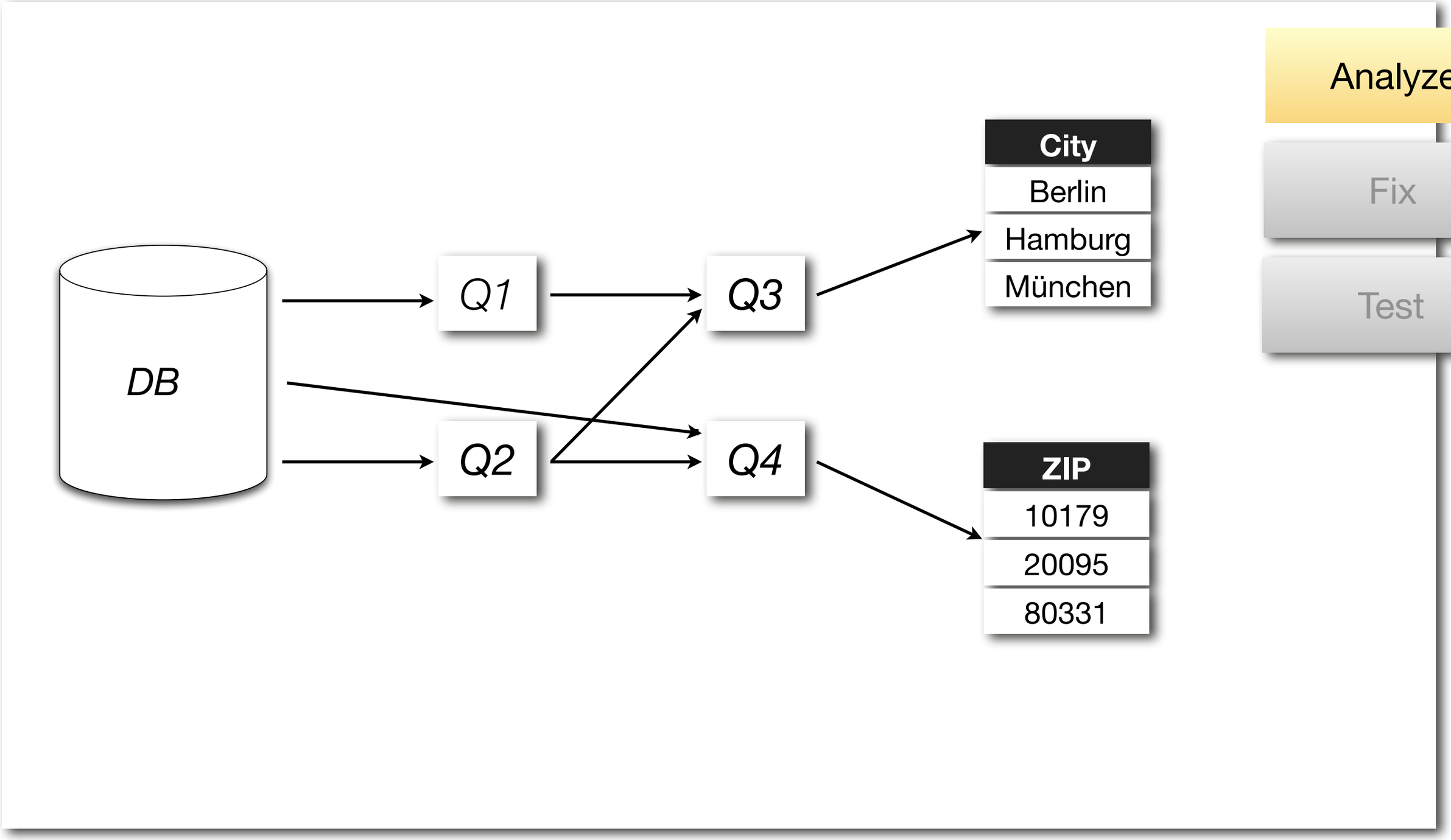
Test

....

Sample Workflow







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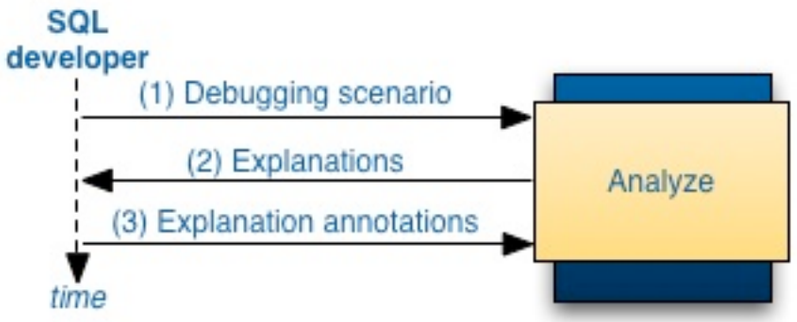

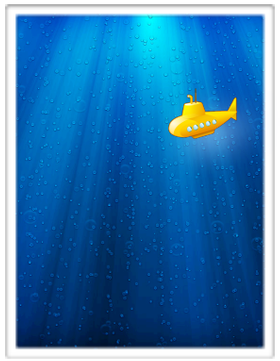

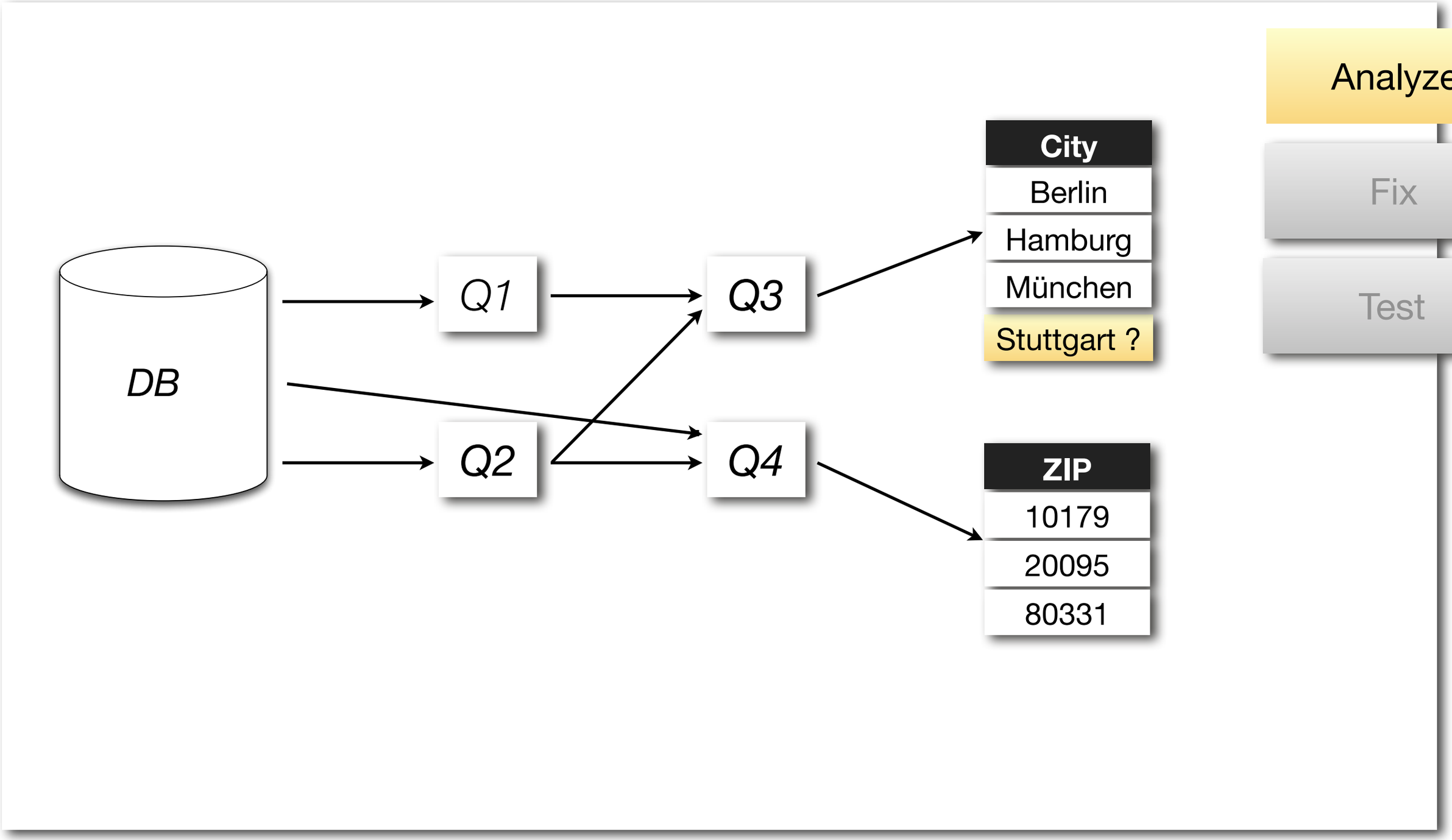

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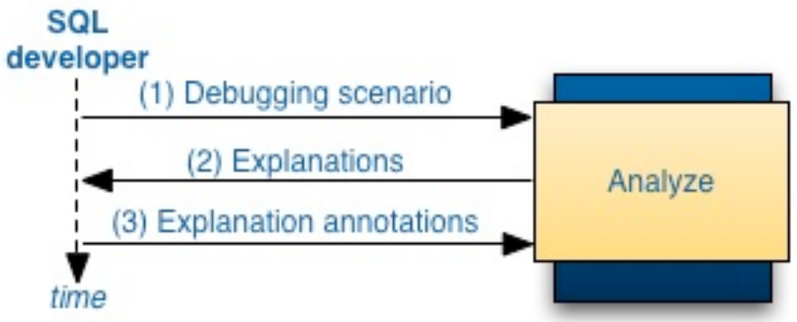

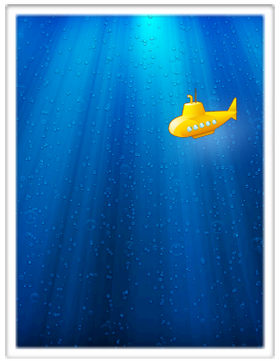

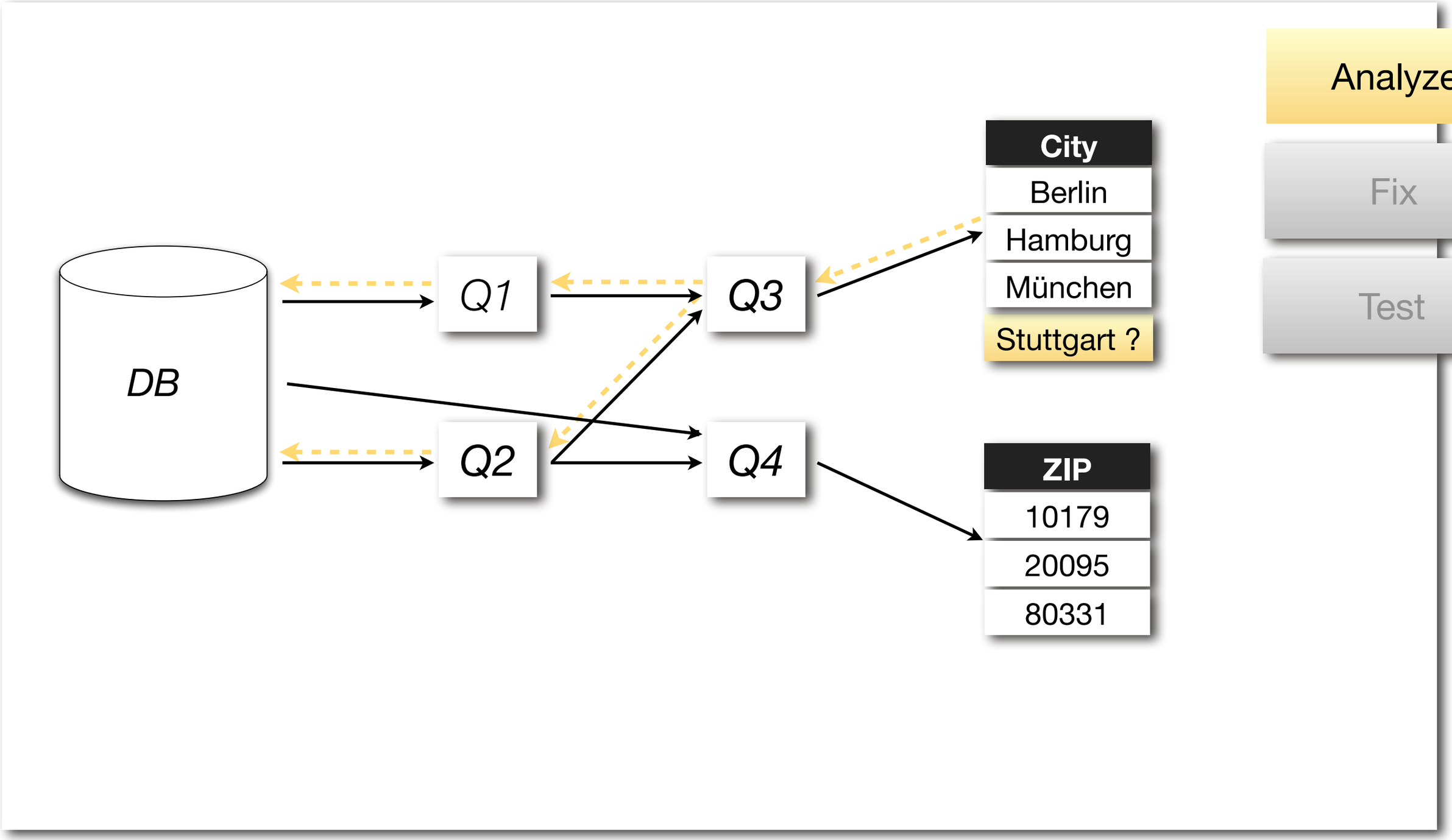

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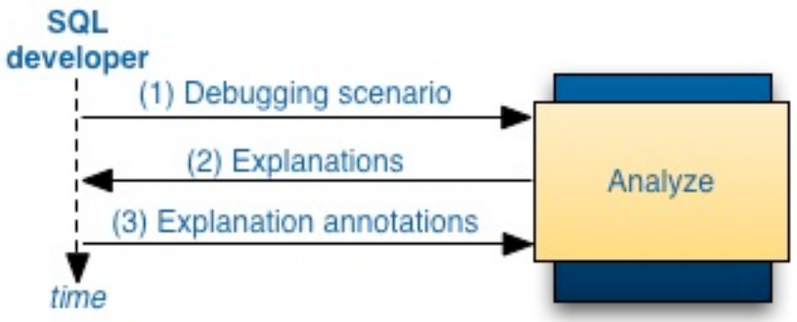
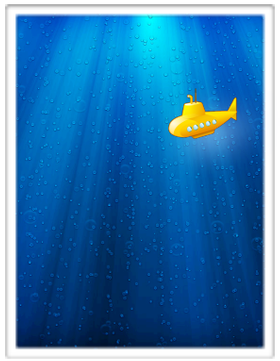
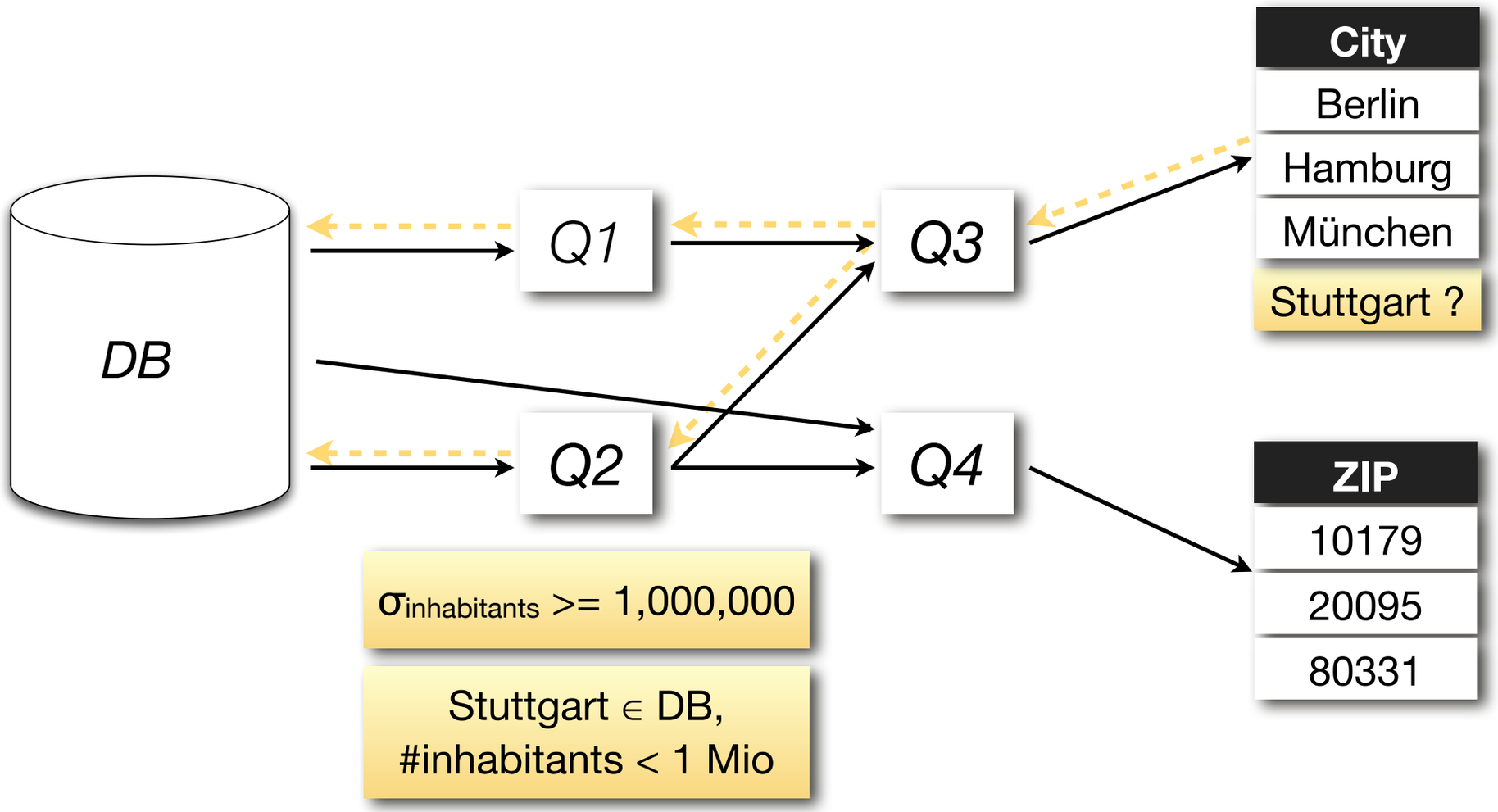




Analyze

Fix

Test



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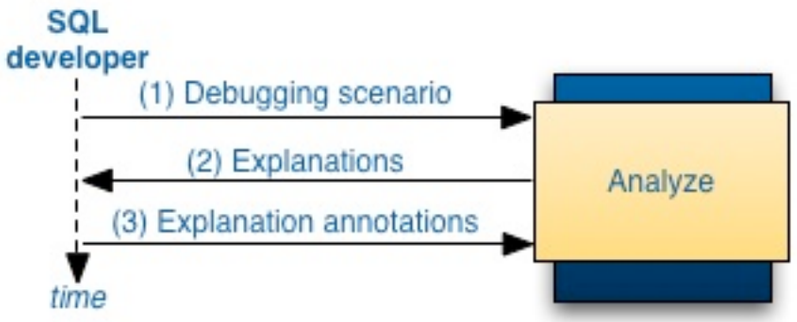

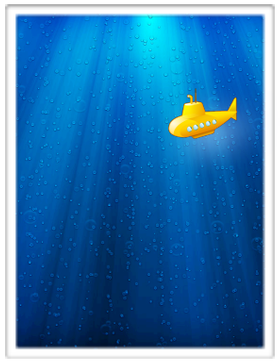

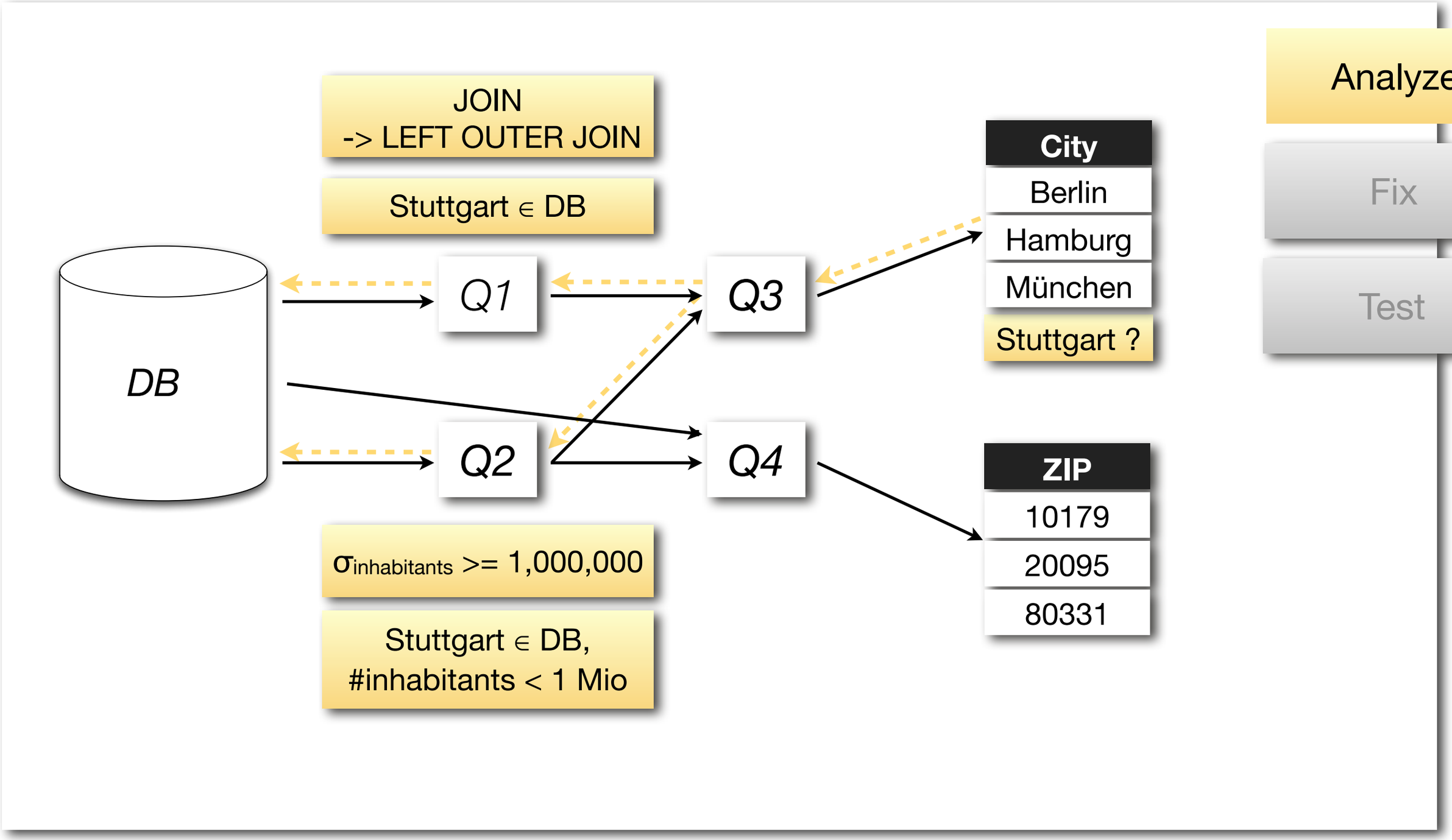

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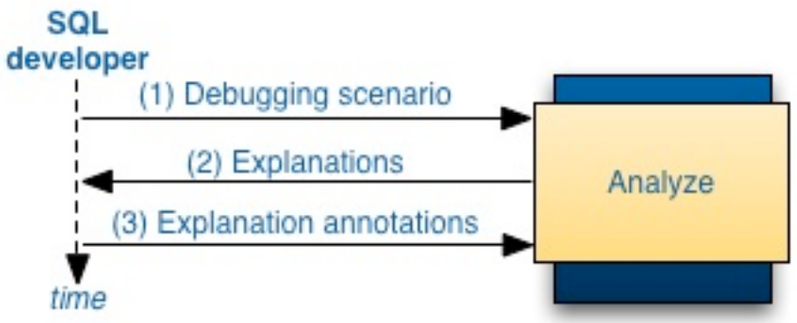

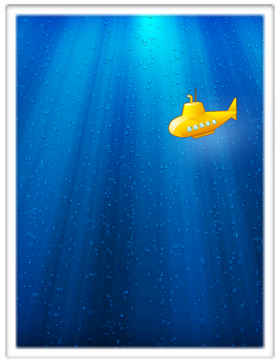

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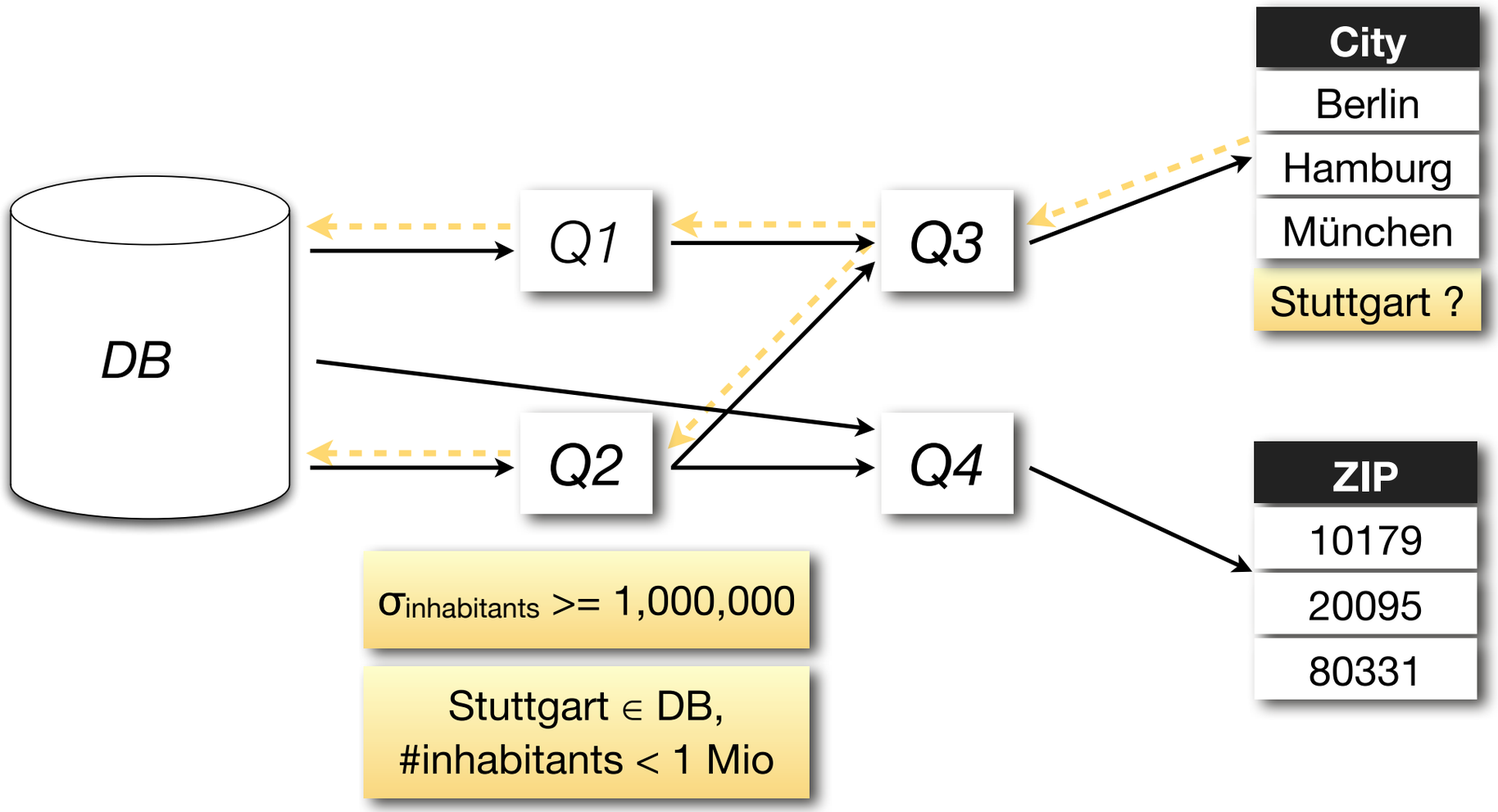

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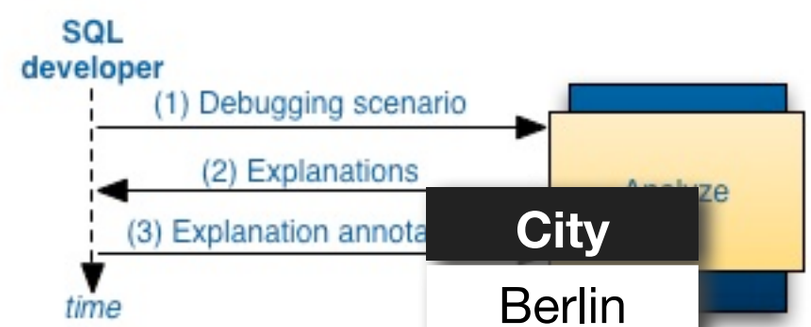
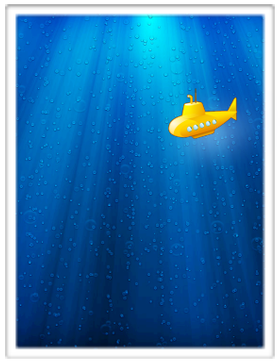
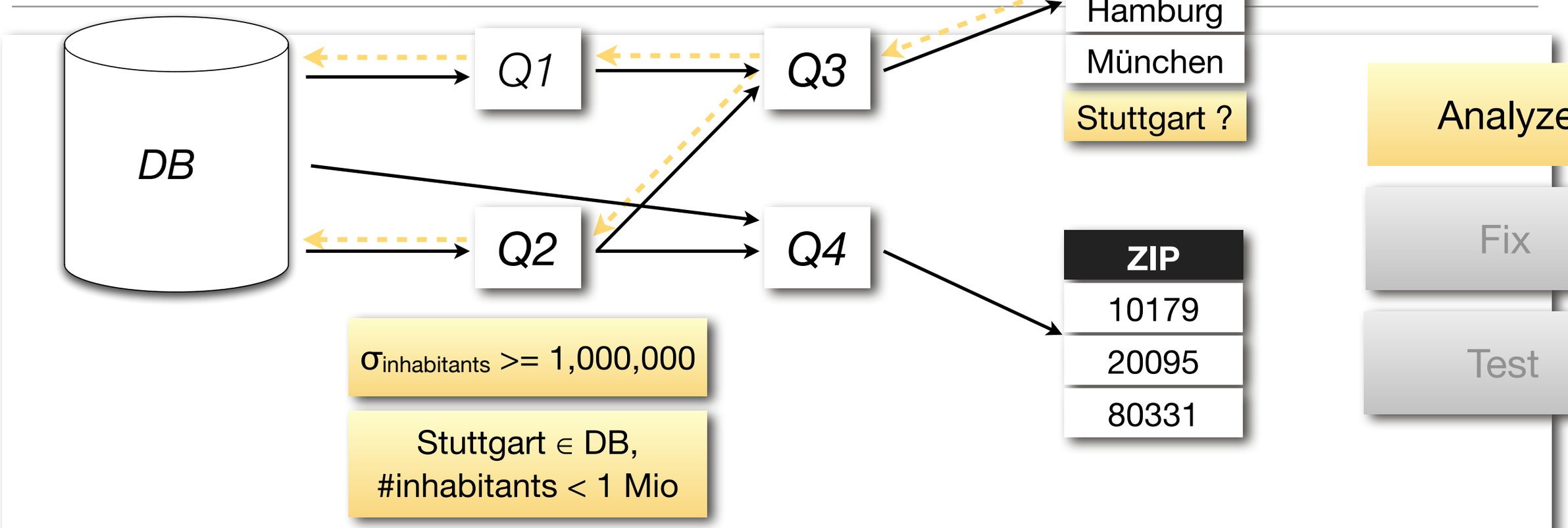






(1) Debugging Scenario

- Queries to be analyzed and source data
- Description of the result
- constraints

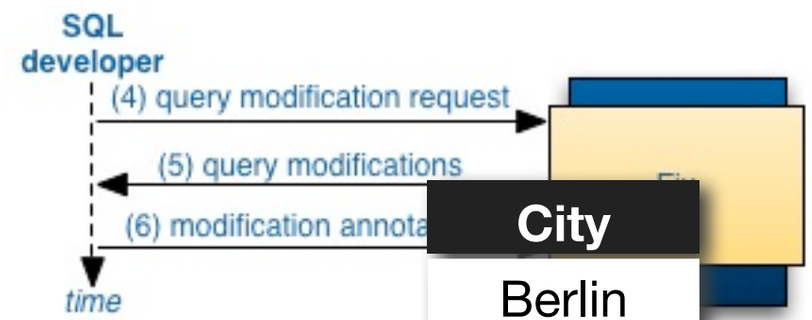
(2) Explanations

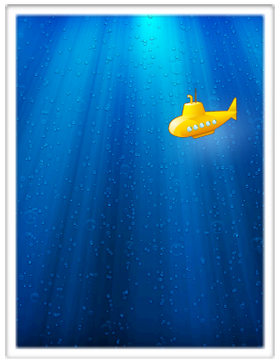
- Explain existing data
- Explain missing data

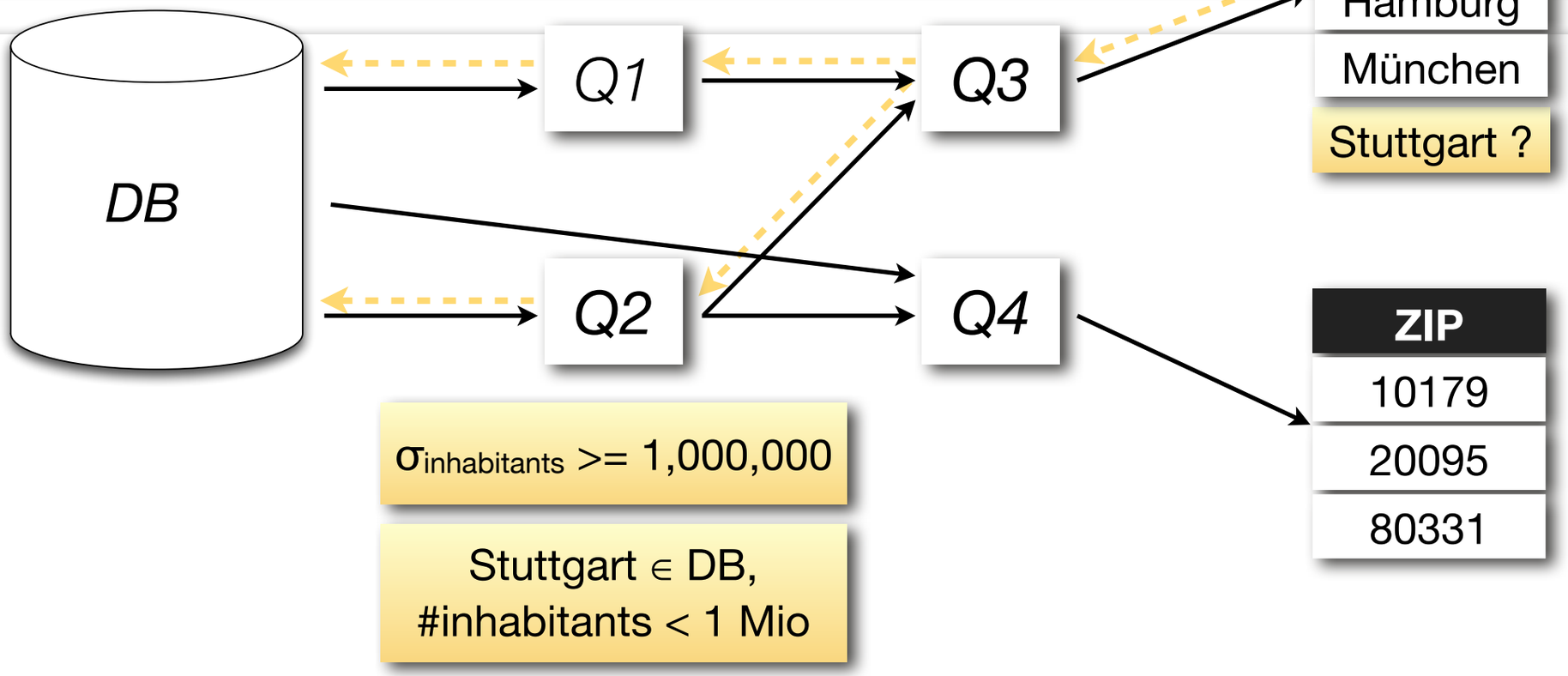
(3) Explanation Annotation

- Guidance and input for fixing phase
- suggestion from the user

Sample Workflow







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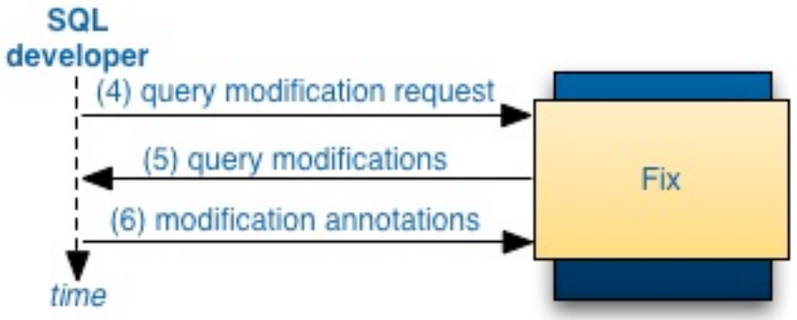

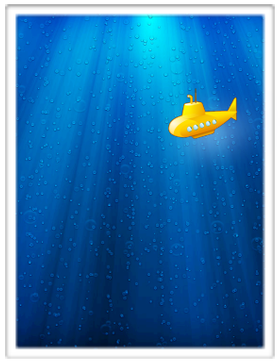

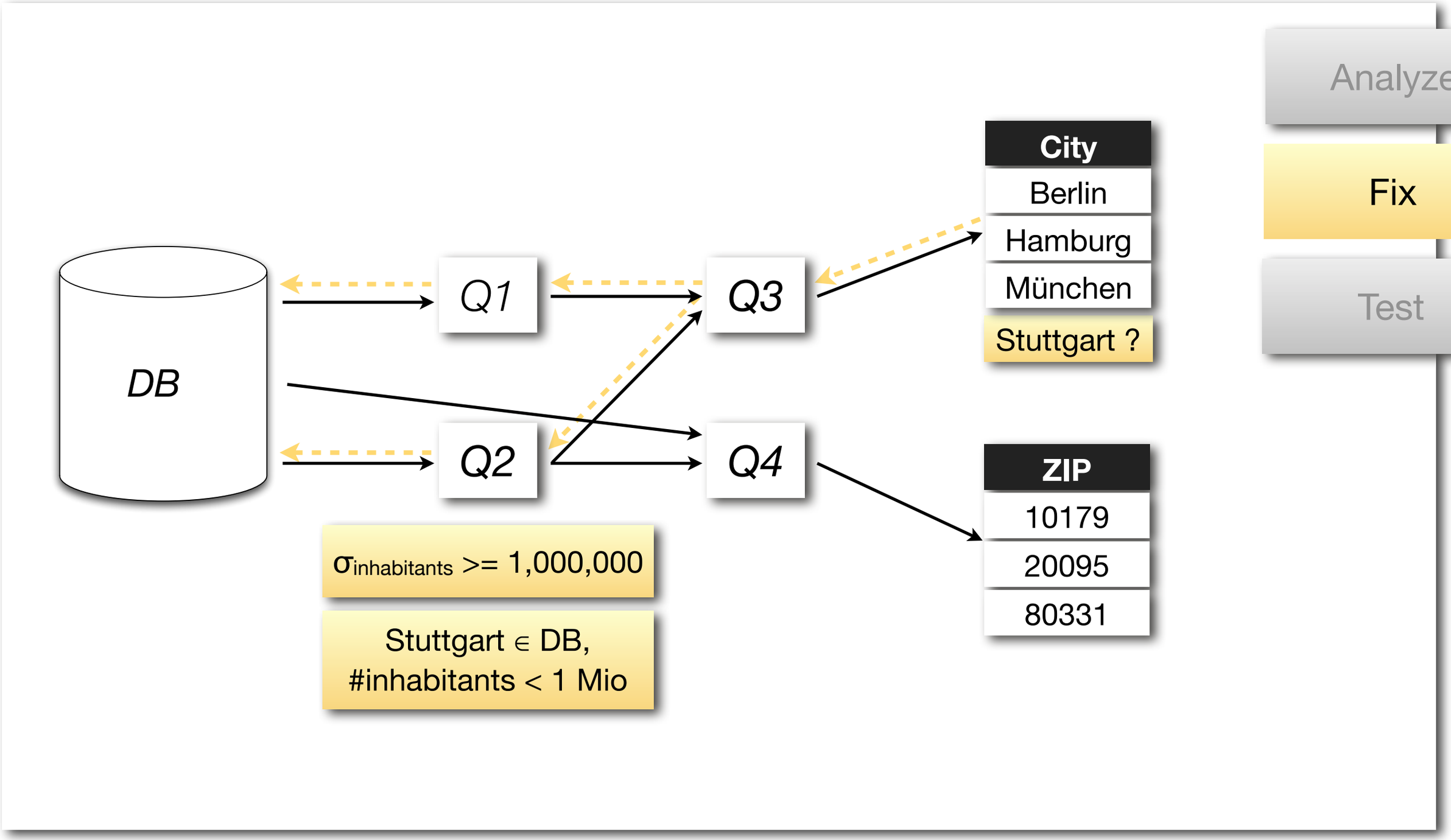

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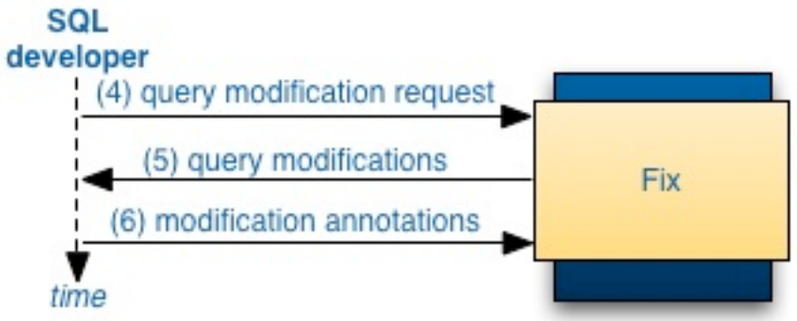

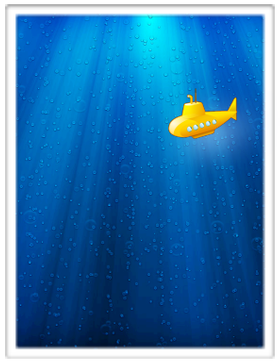

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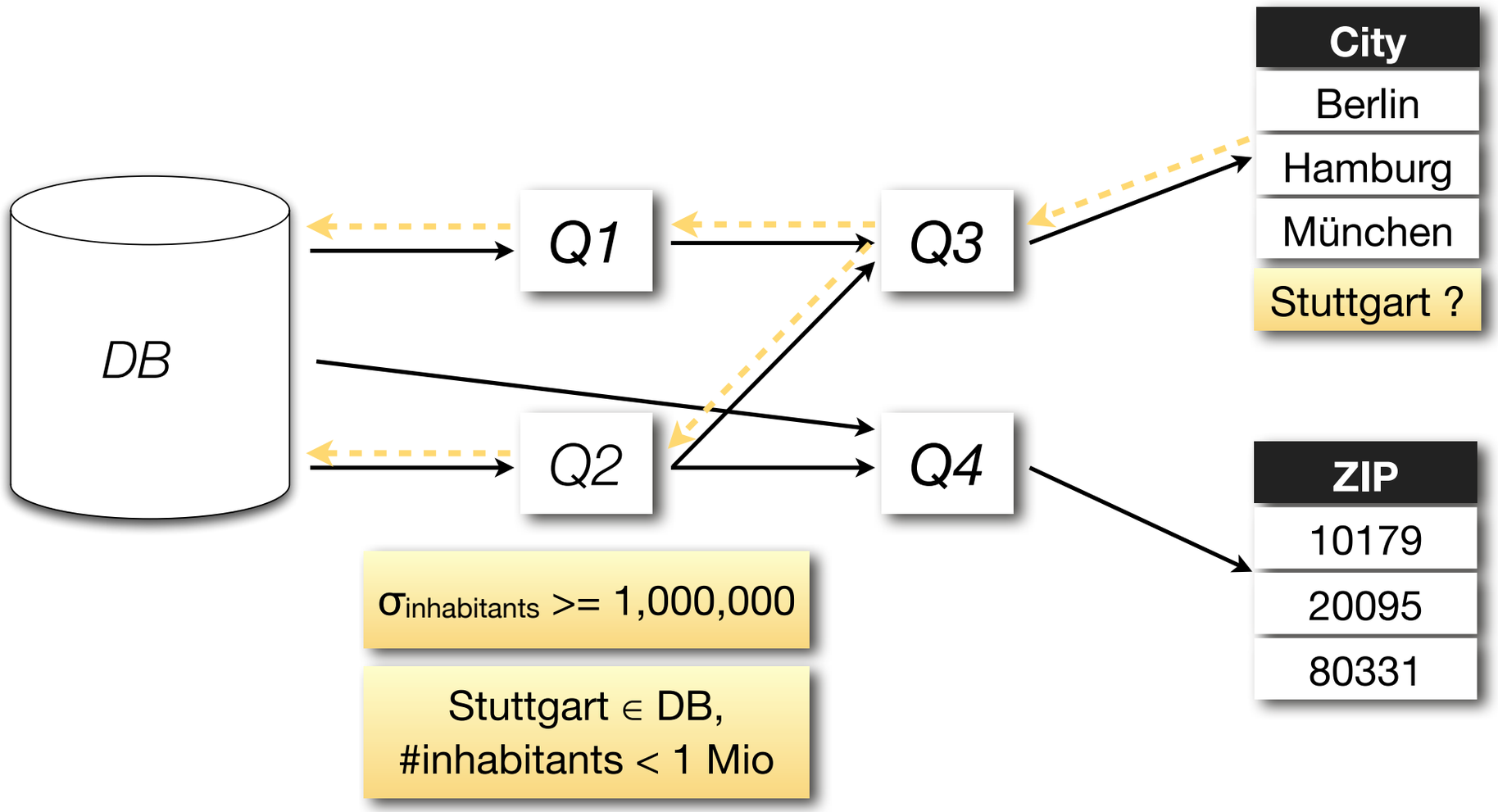

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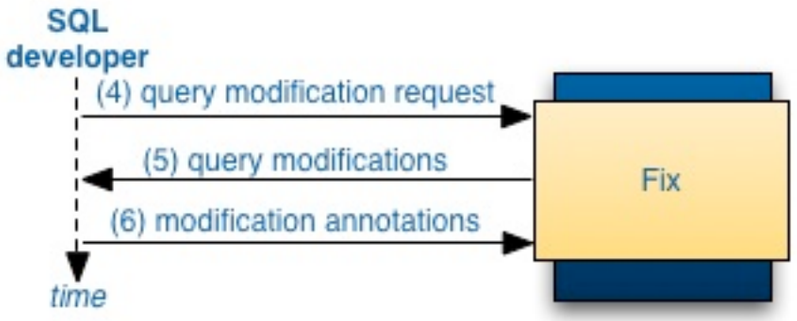

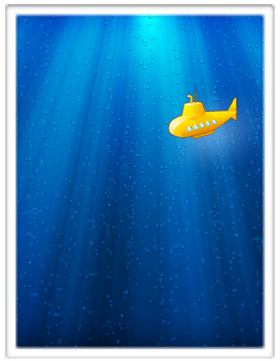

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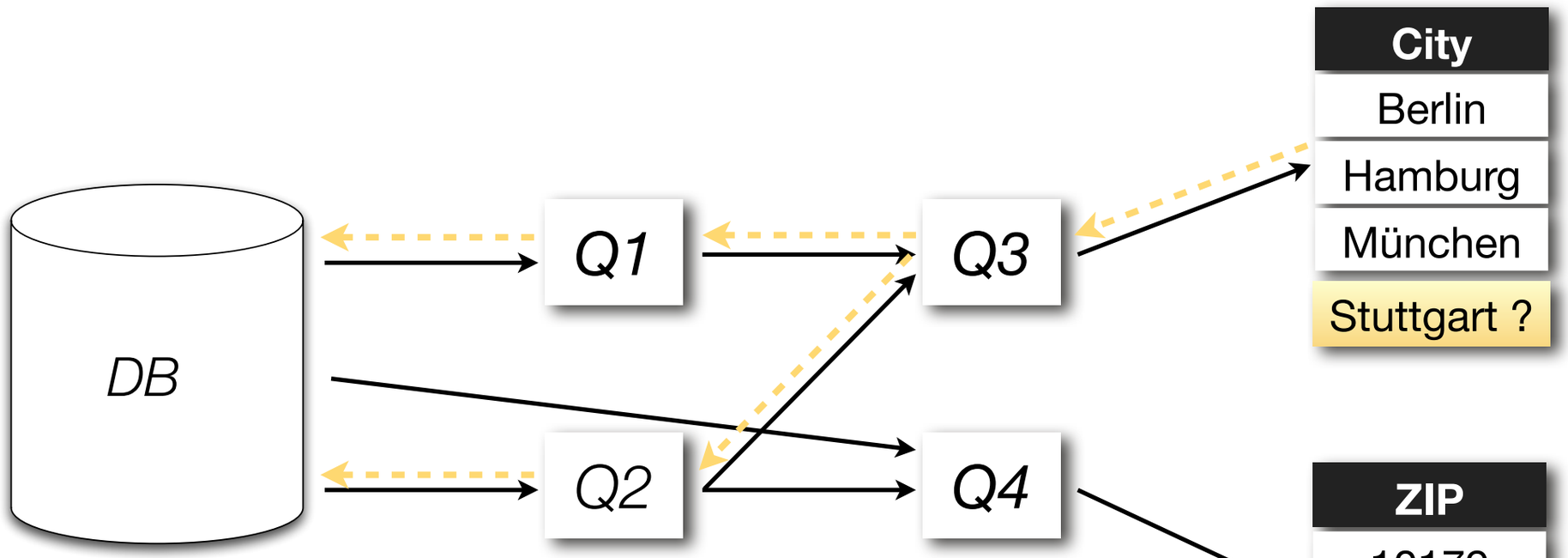

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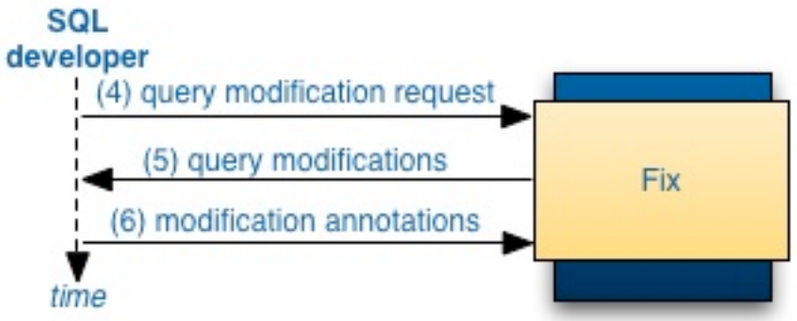
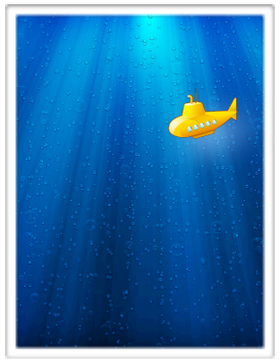
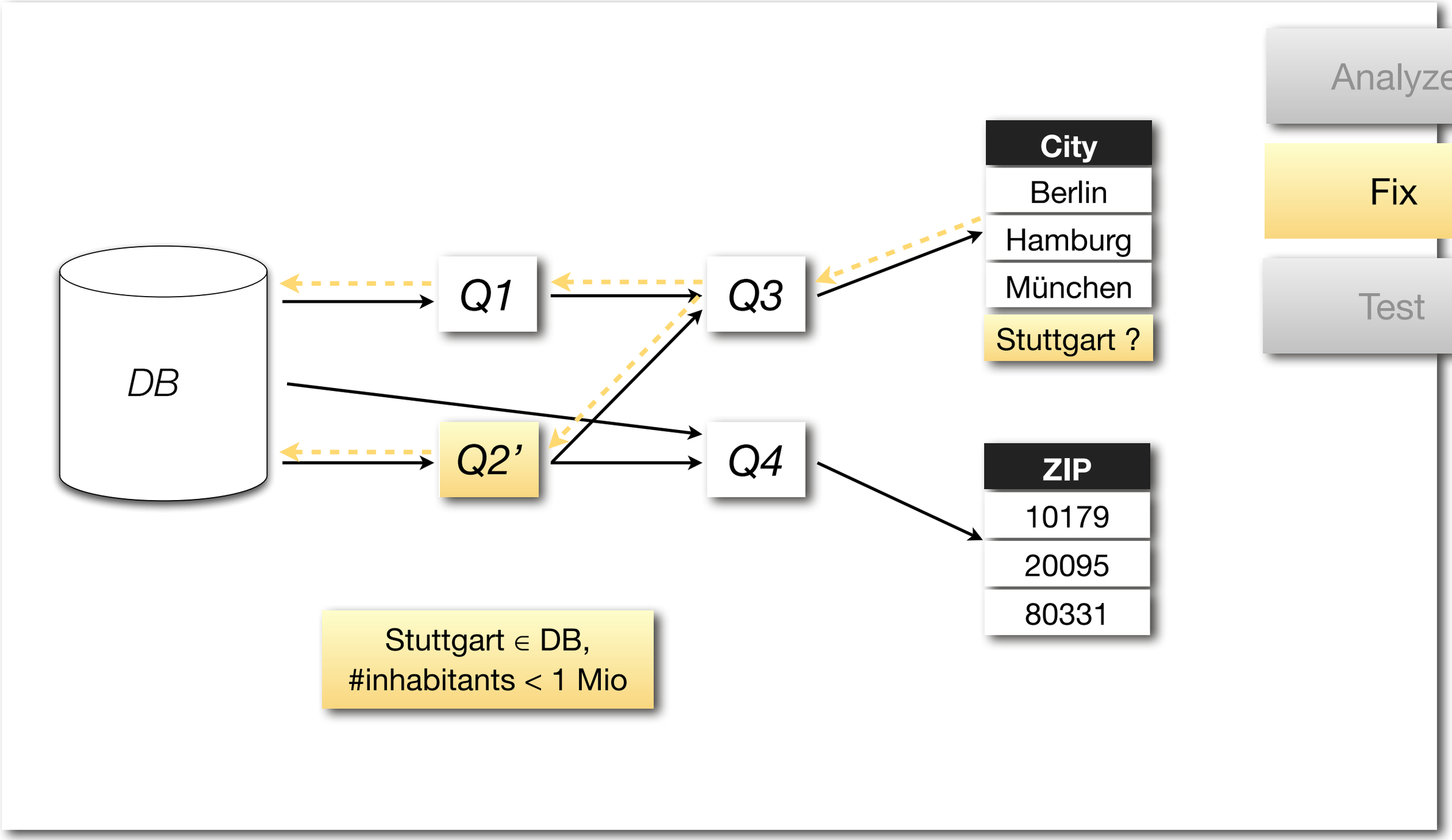
Sample Workflow







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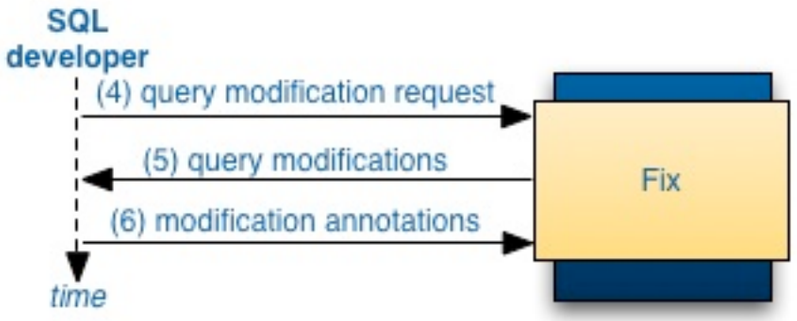

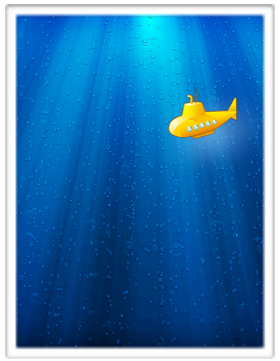

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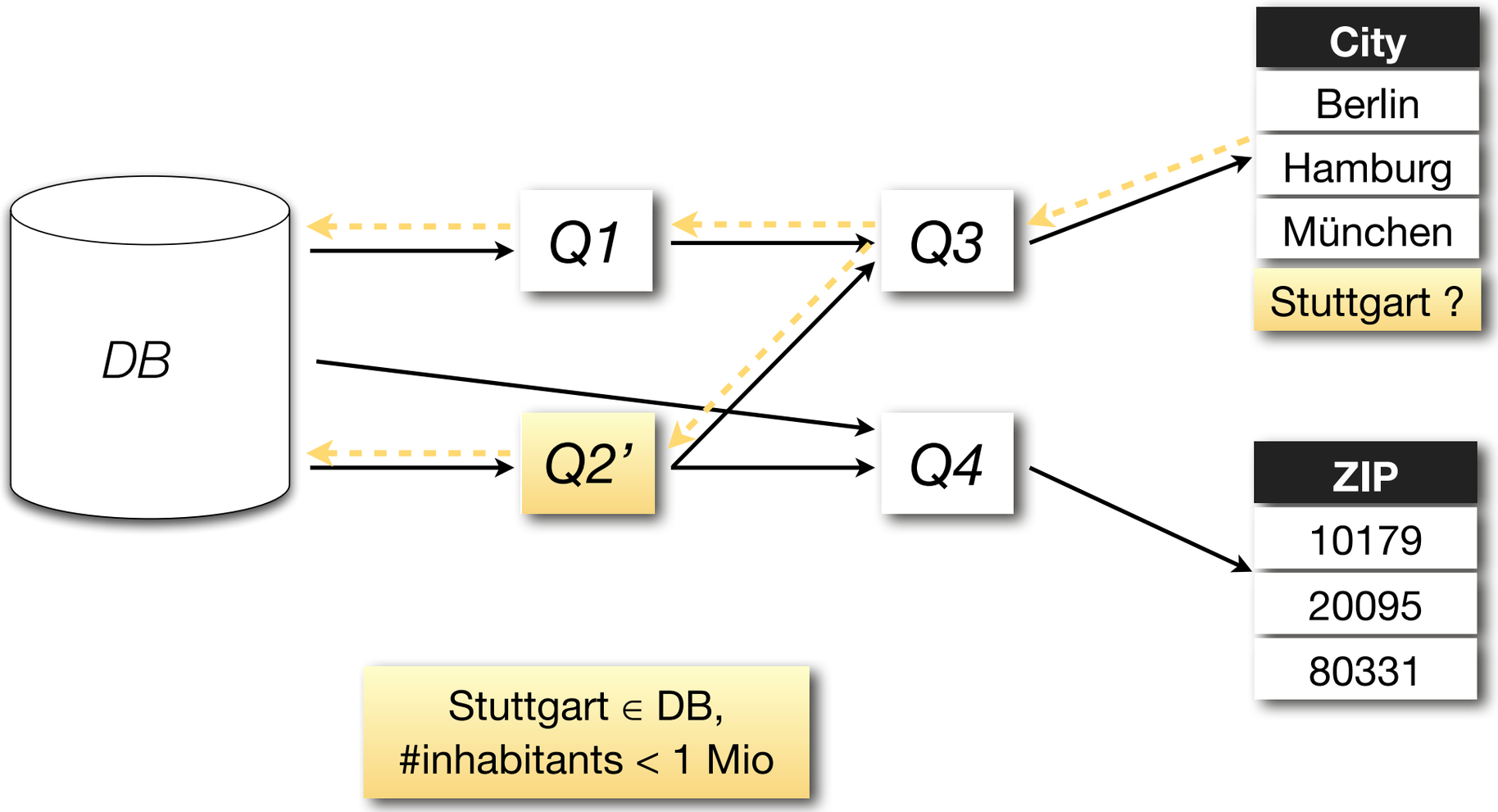

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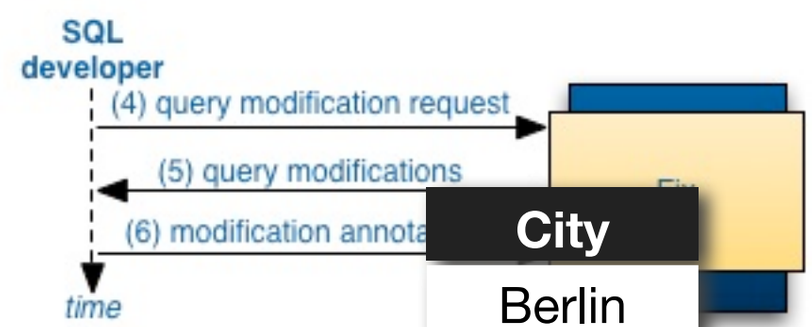
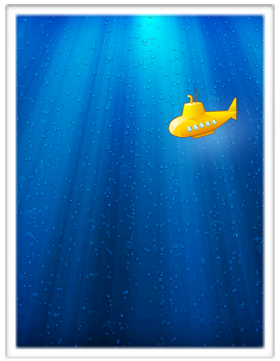
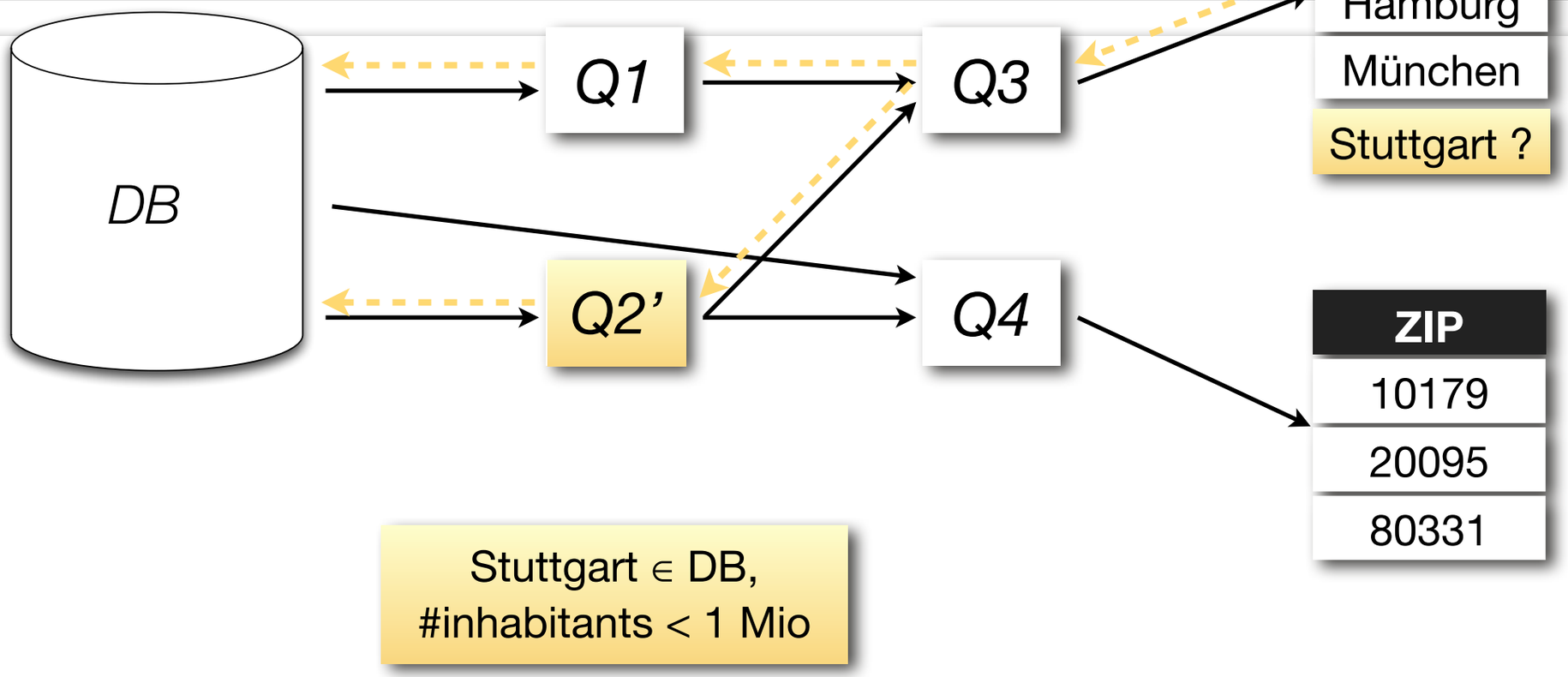






Analyze

Fix

Test

query modification request

- request to generate modifications

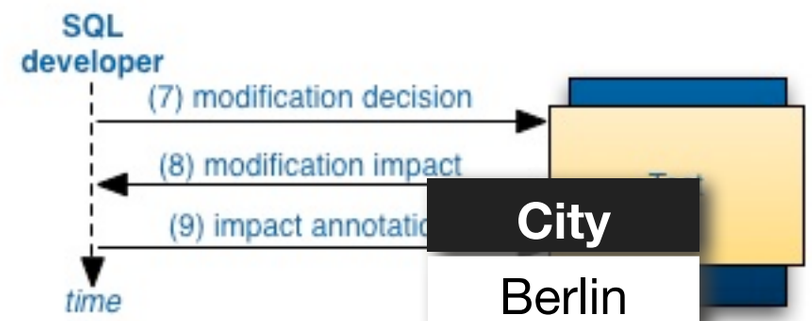
query modifications

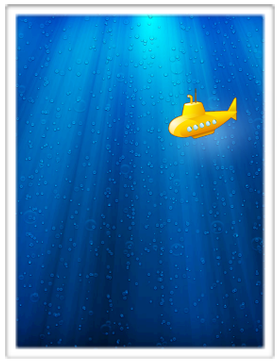
- computing modifications
- w. r. t. previous annotations and constraints
- rewritten SQL with highlighted changes

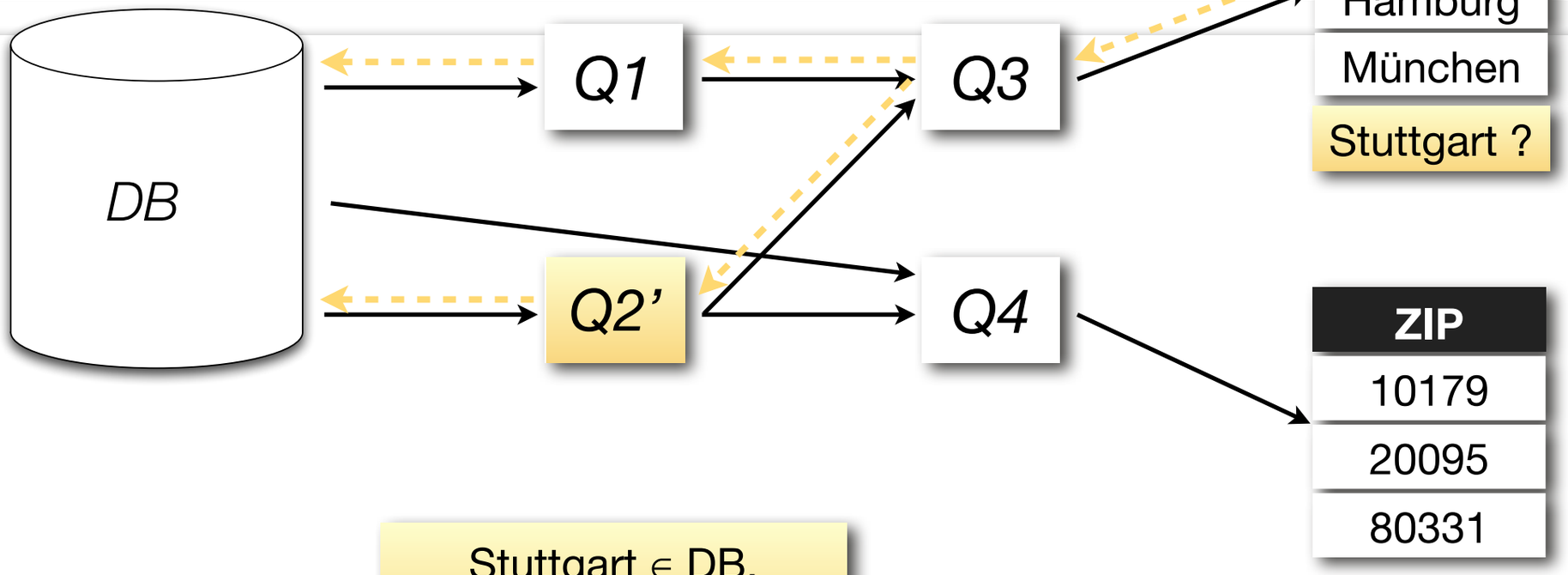
query modification annotation

- analogous to explanation annotation

Sample Workflow







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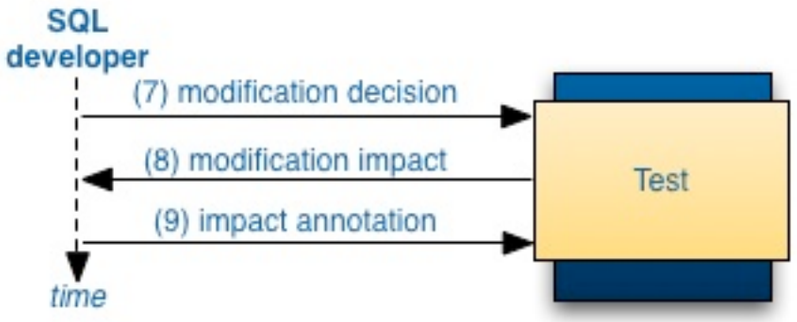
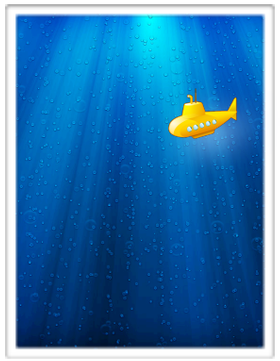
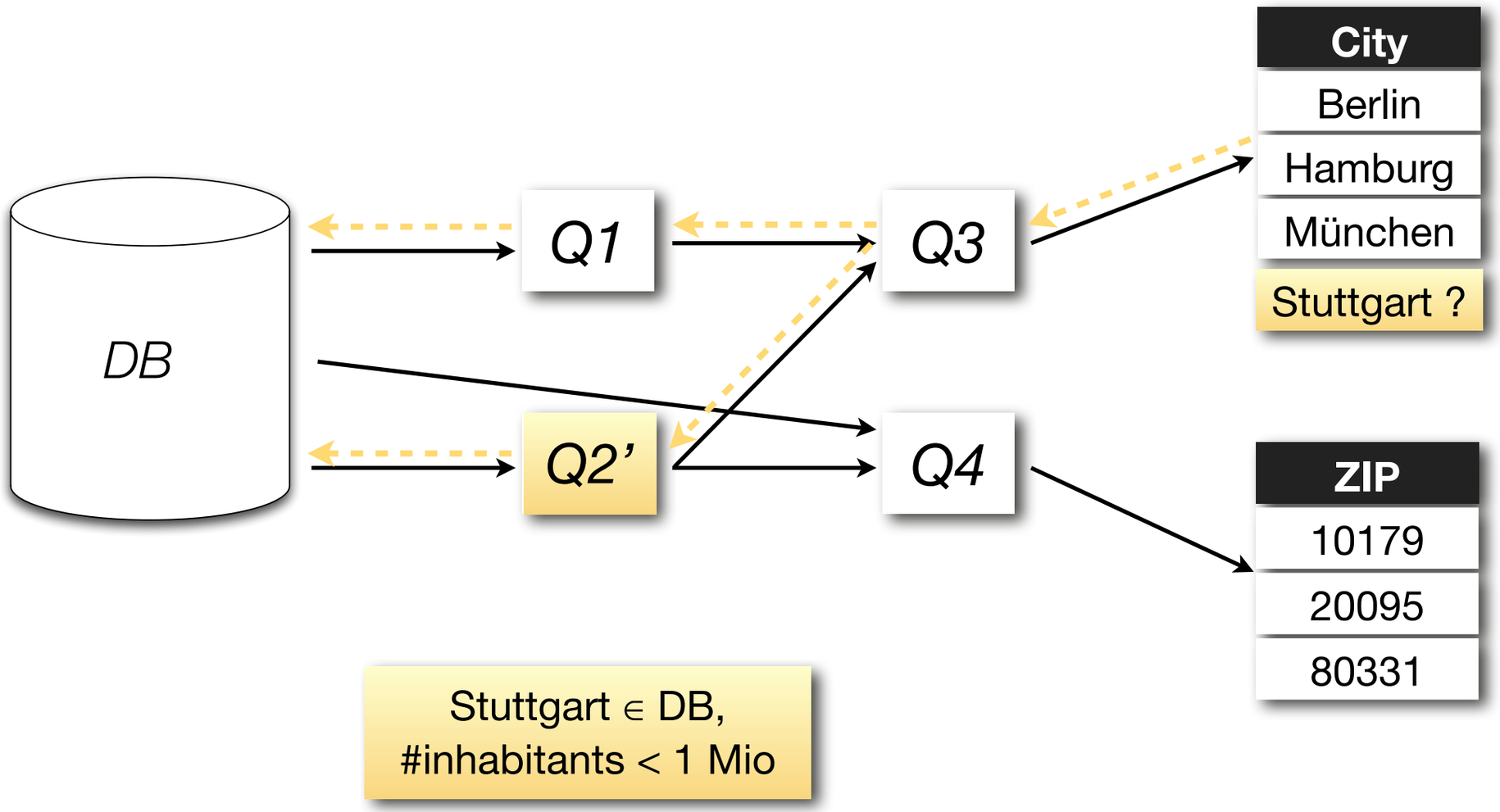




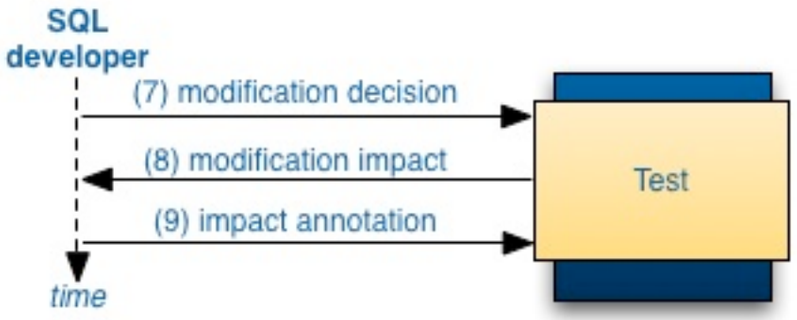
Analyze

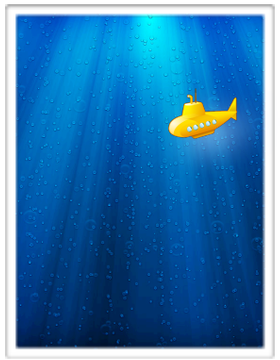
Fix

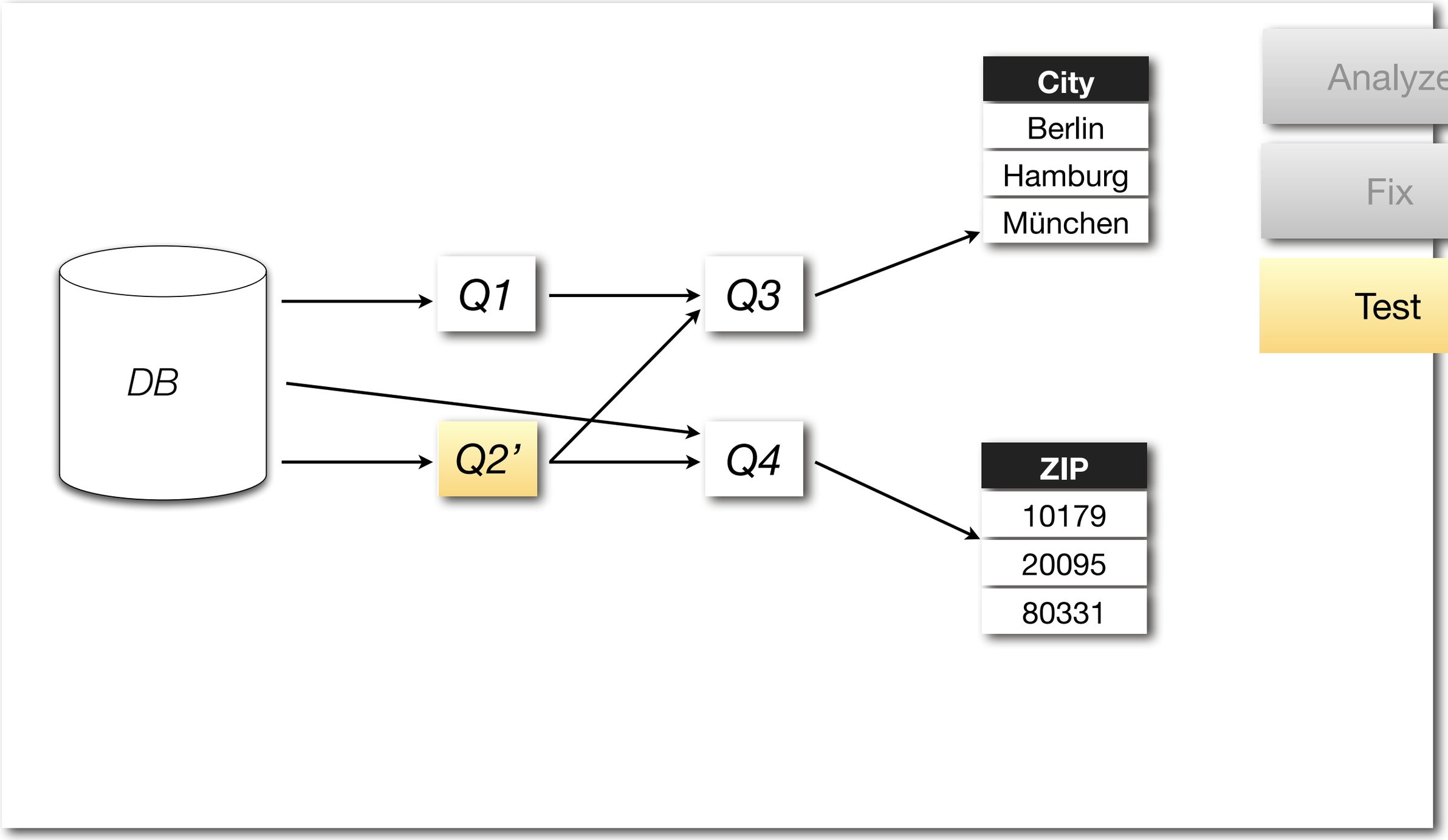
Test



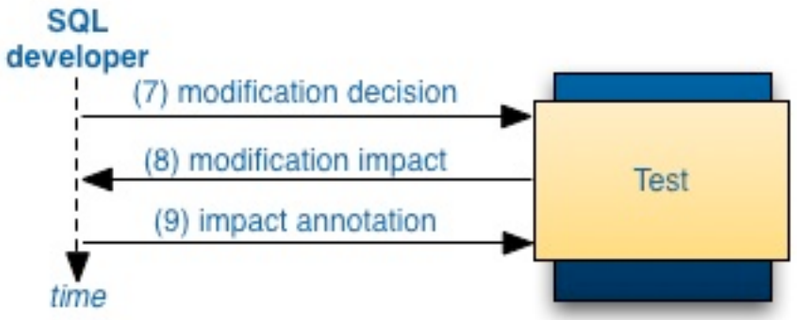
Sample Workflow

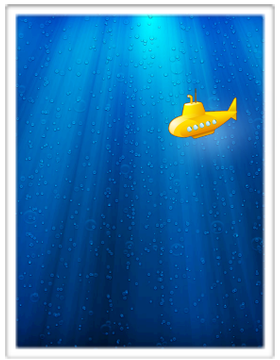


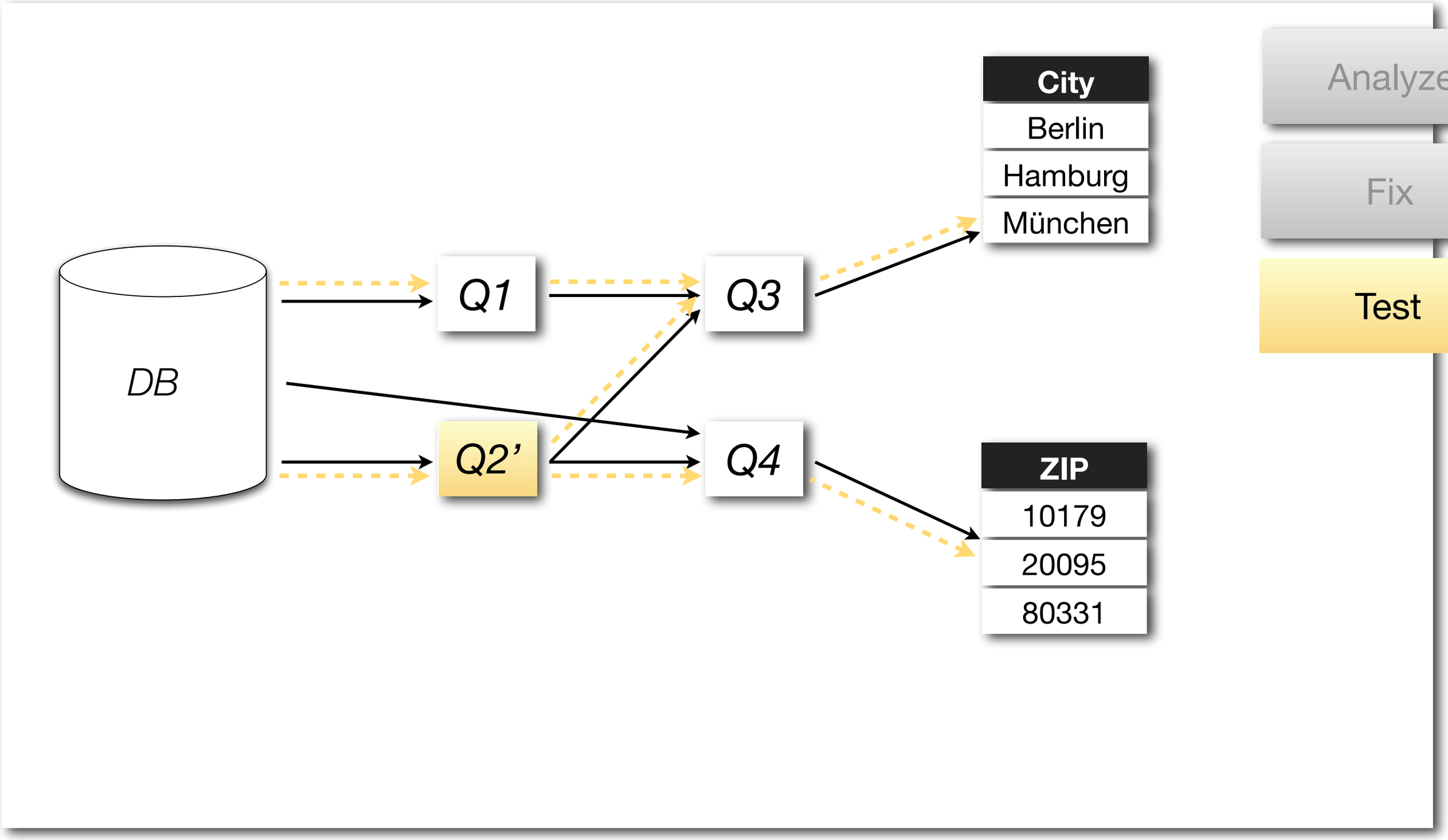




Sample Workflow







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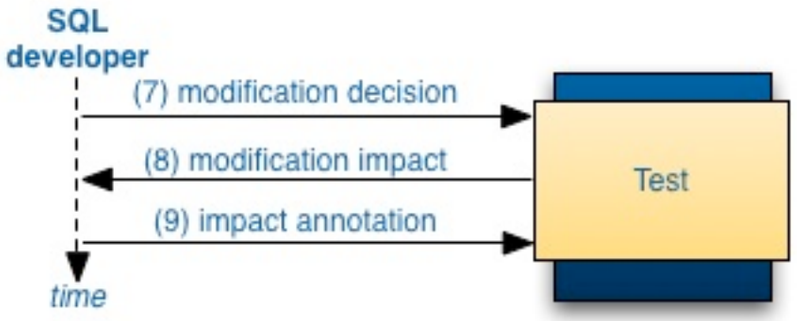
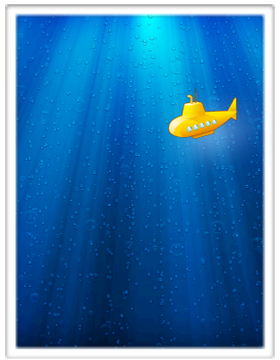
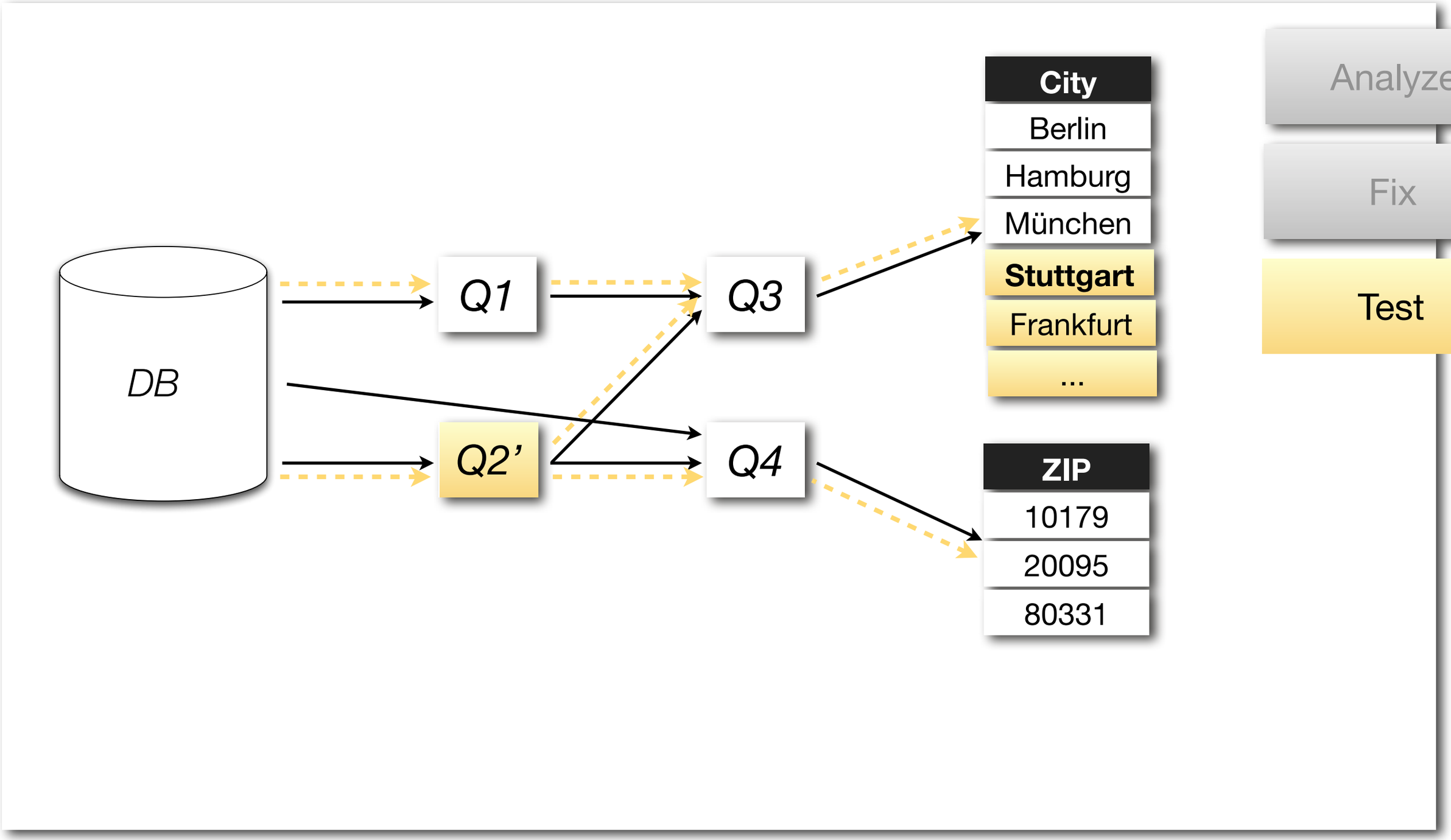
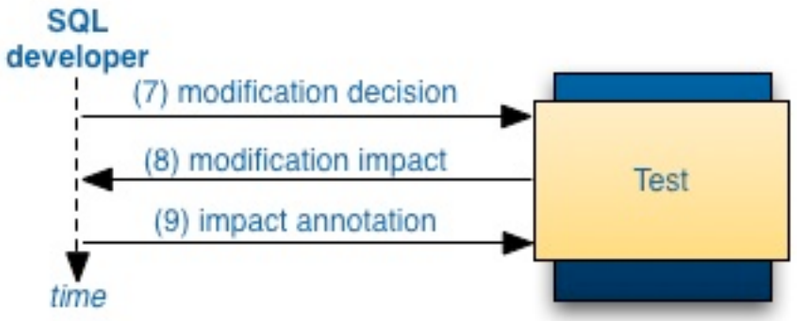
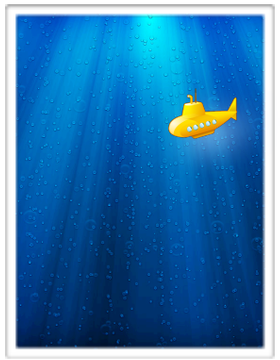


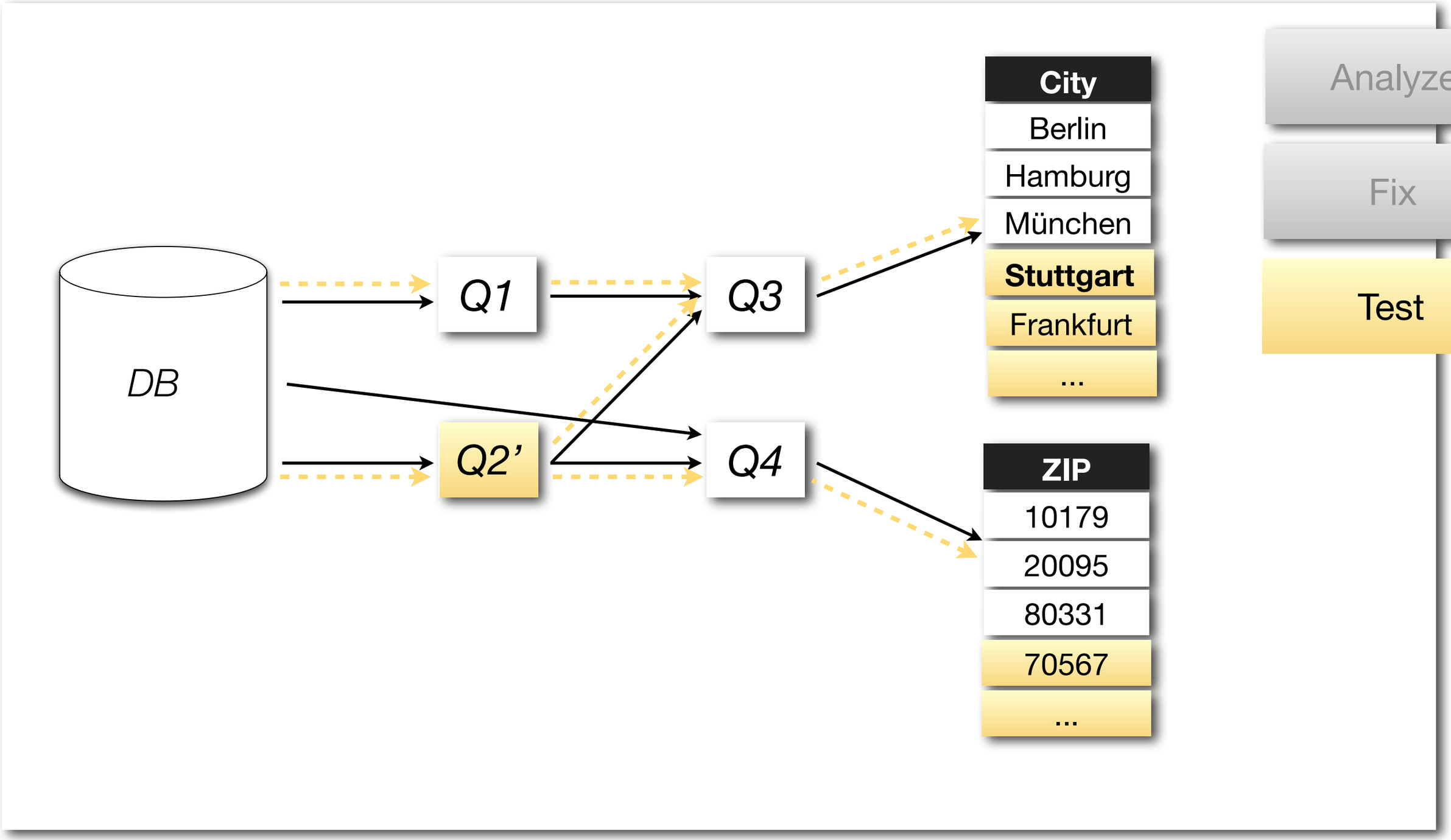




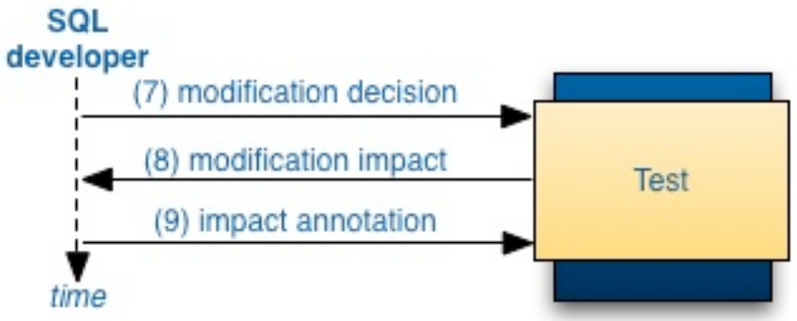
Sample Workflow

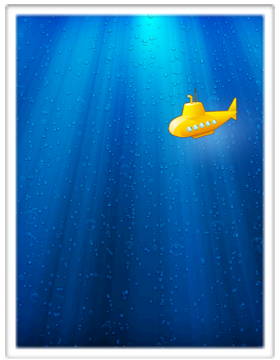


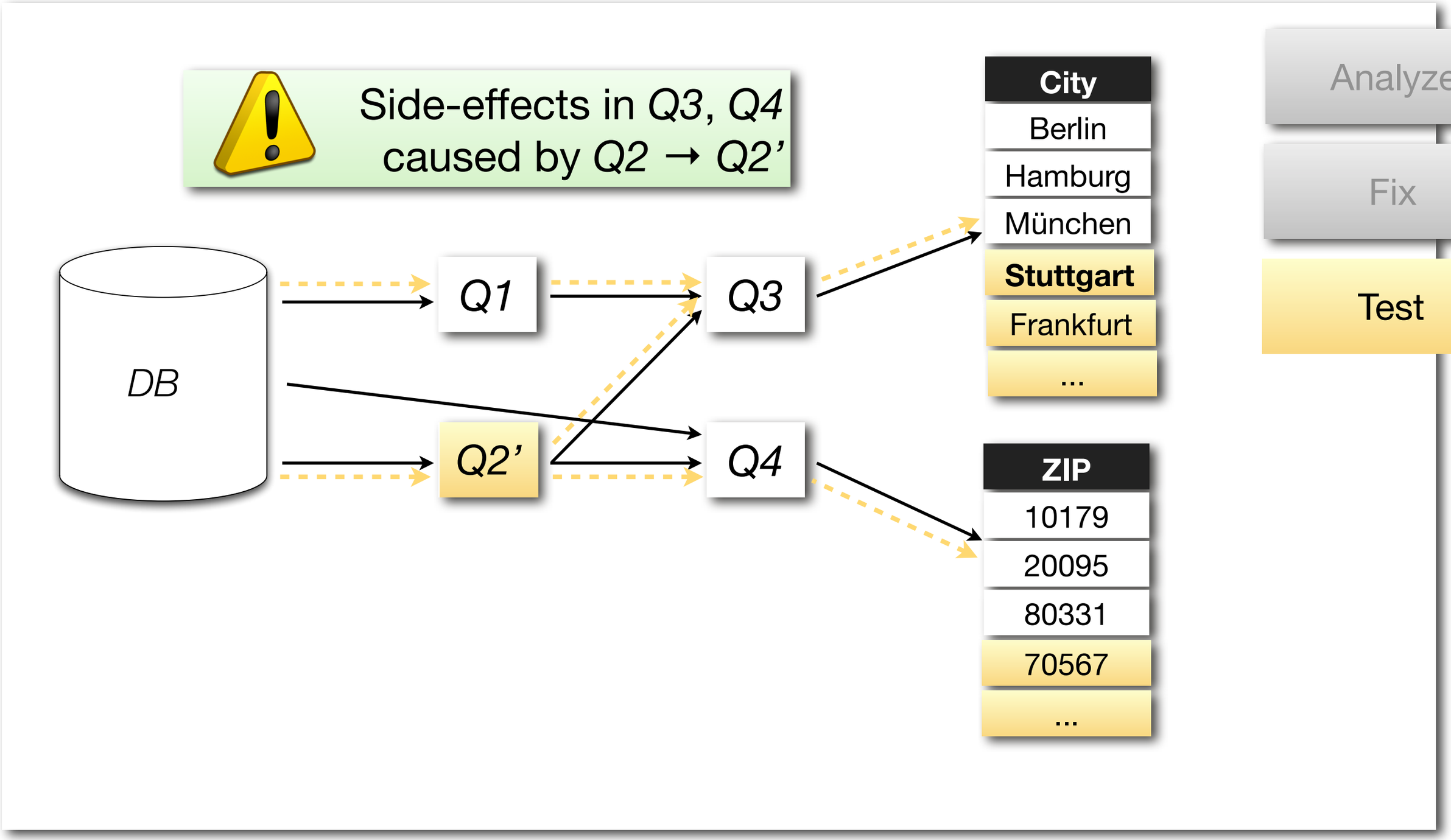




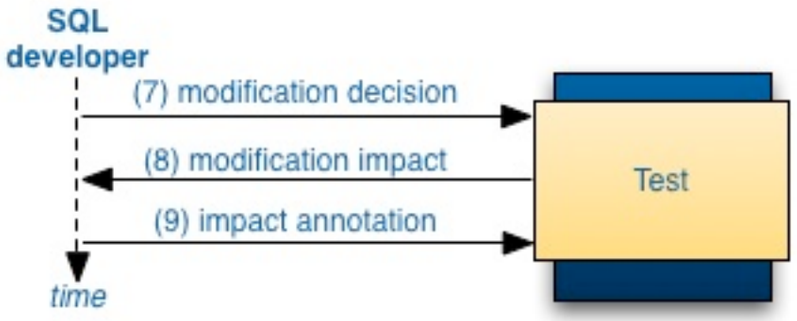
Sample Workflow

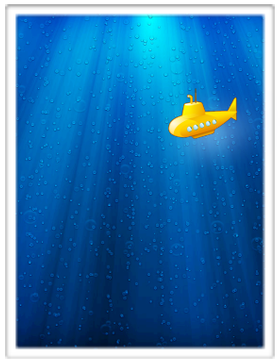




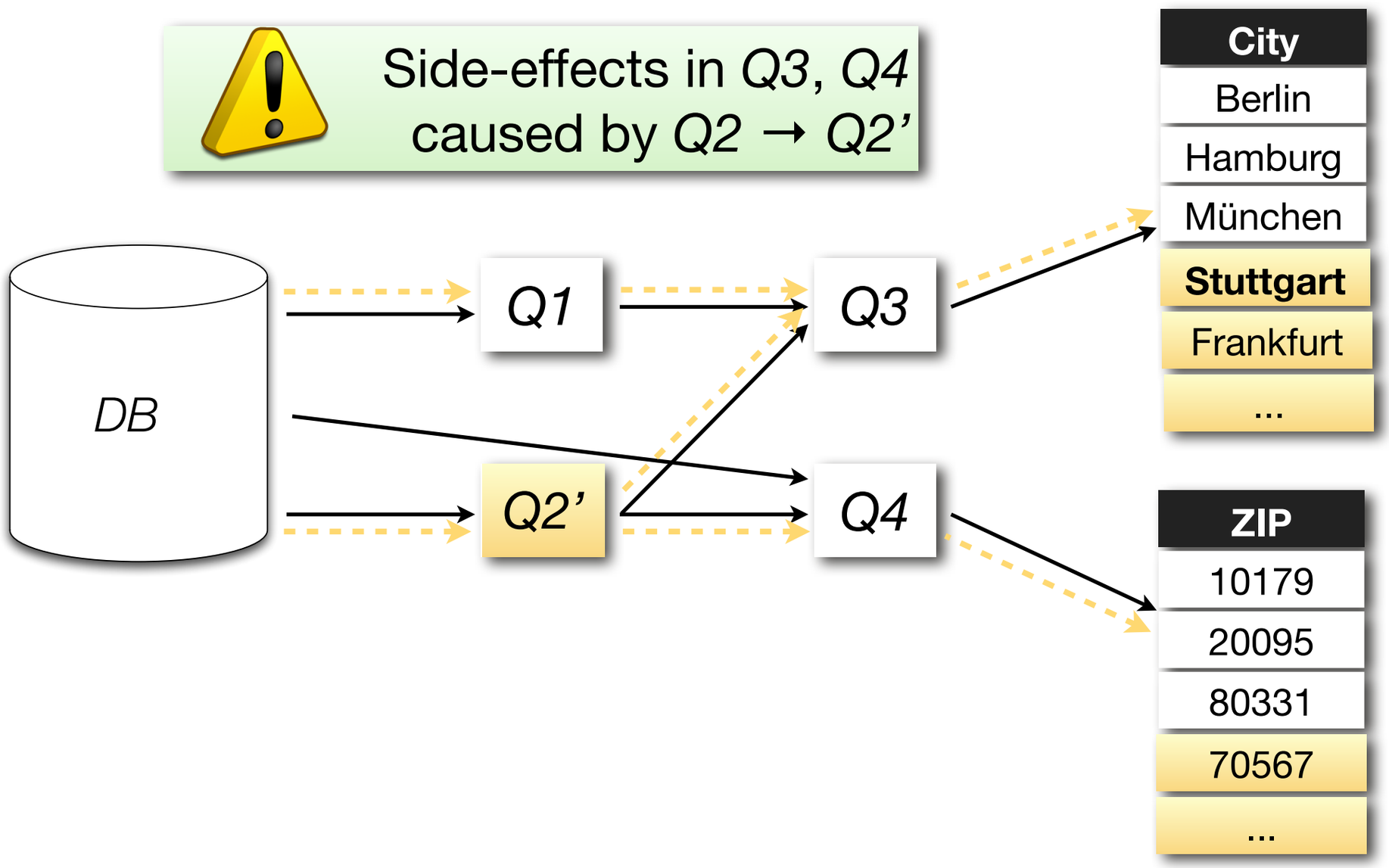


Sample Workflow





Side-effects in *Q3*, *Q4* caused by *Q2* → *Q2'*



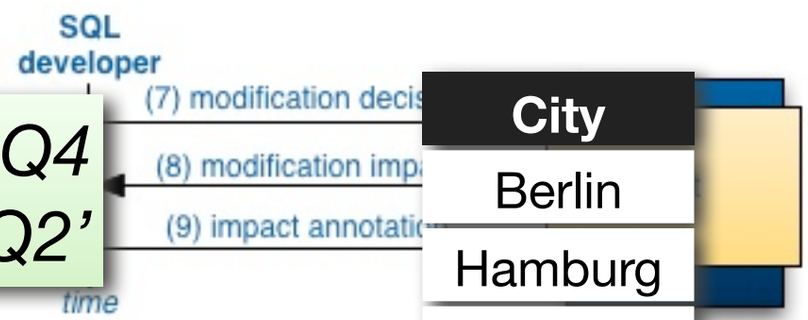
Analyze

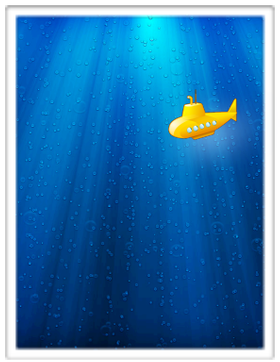
Fix

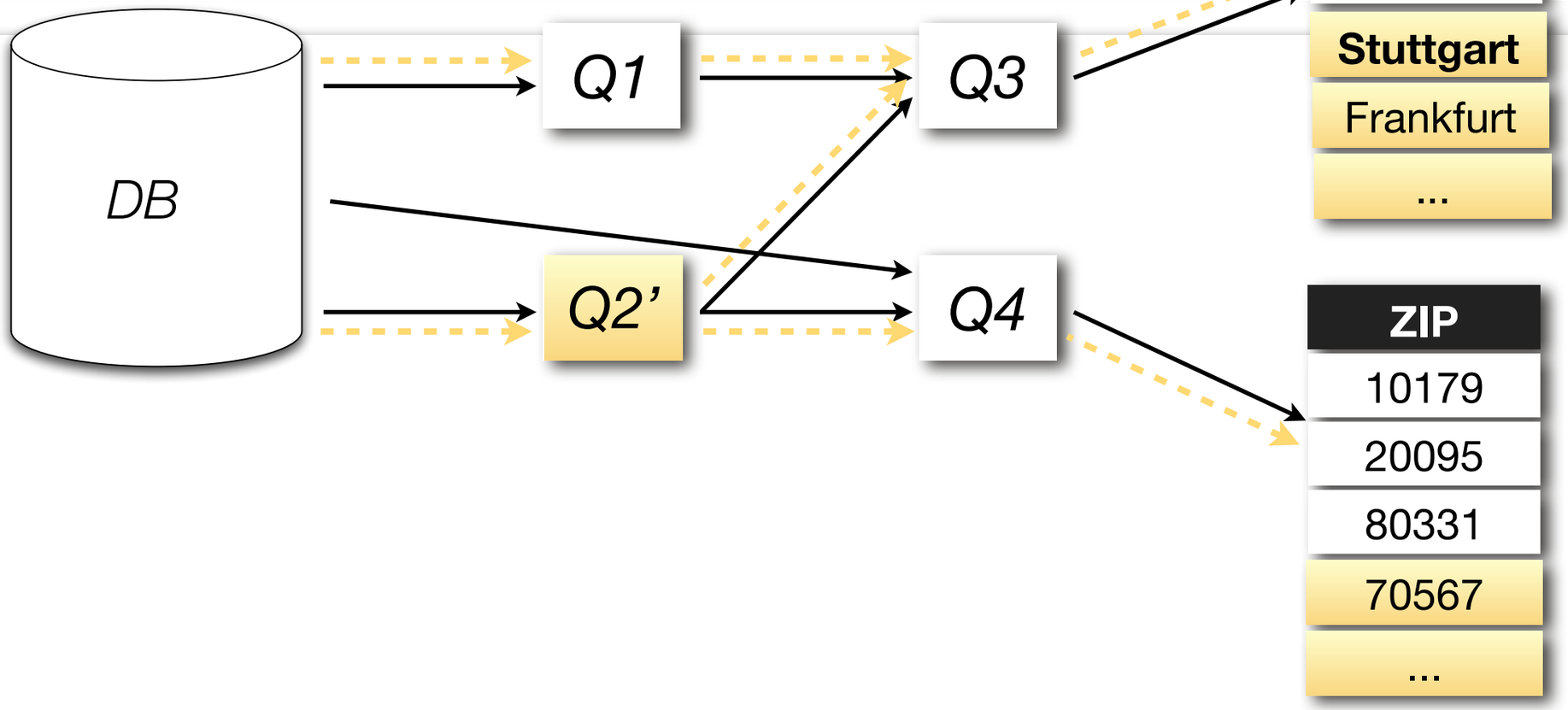
Test

Sampl

Side-effects in *Q3*, *Q4* caused by *Q2* → *Q2'*







Analyze

Fix

Test

modification decision

- submit modification(s) to the query based on the annotations

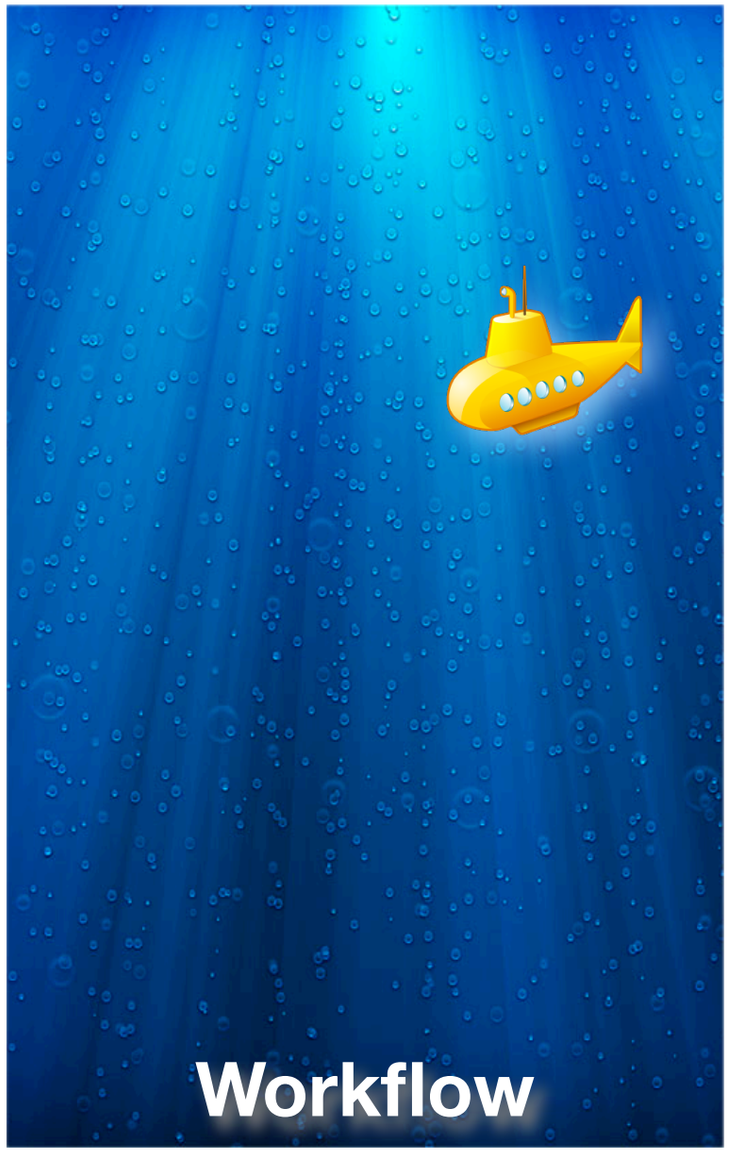
modification impact

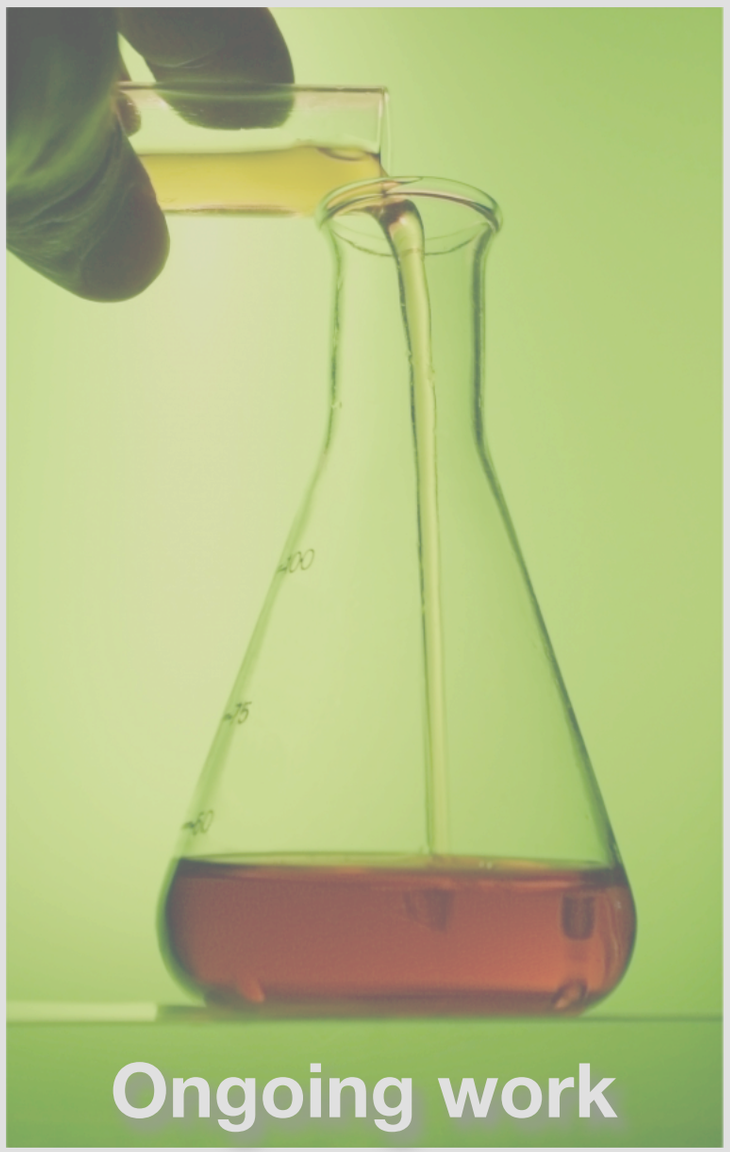
- test the query
- calculating the impact (verifying constraints and report statistics)

impact annotation

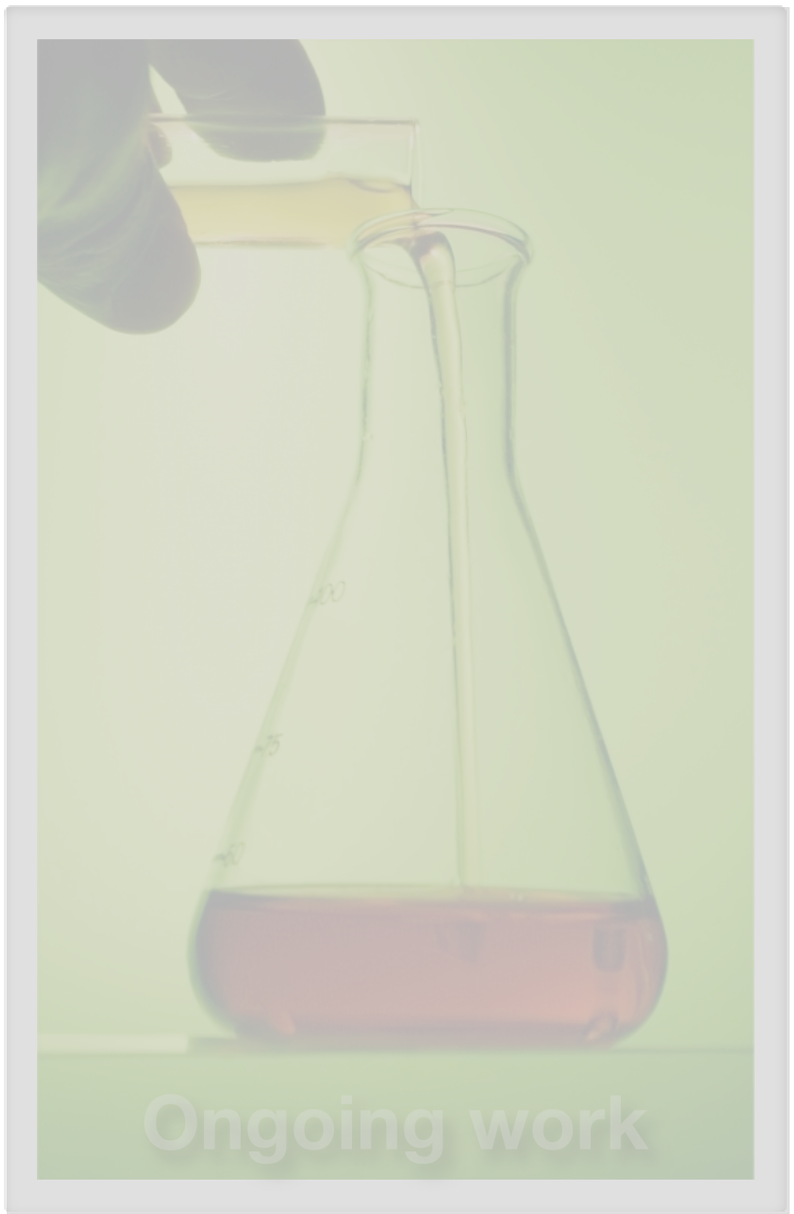
- acceptable changes
- effect on further AFT-cycles and debugging scenario

Agenda

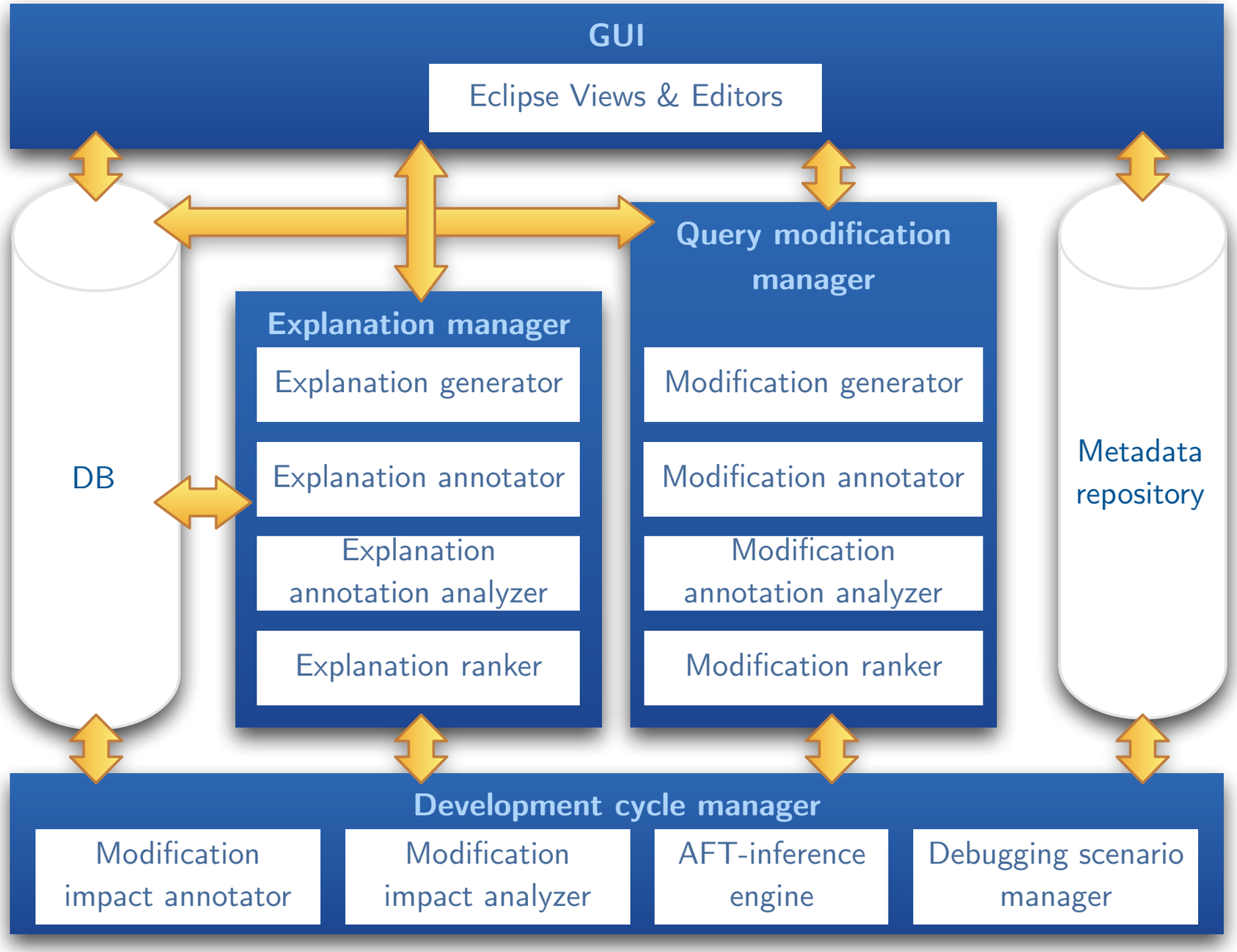




Agenda



Nautilus Architecture



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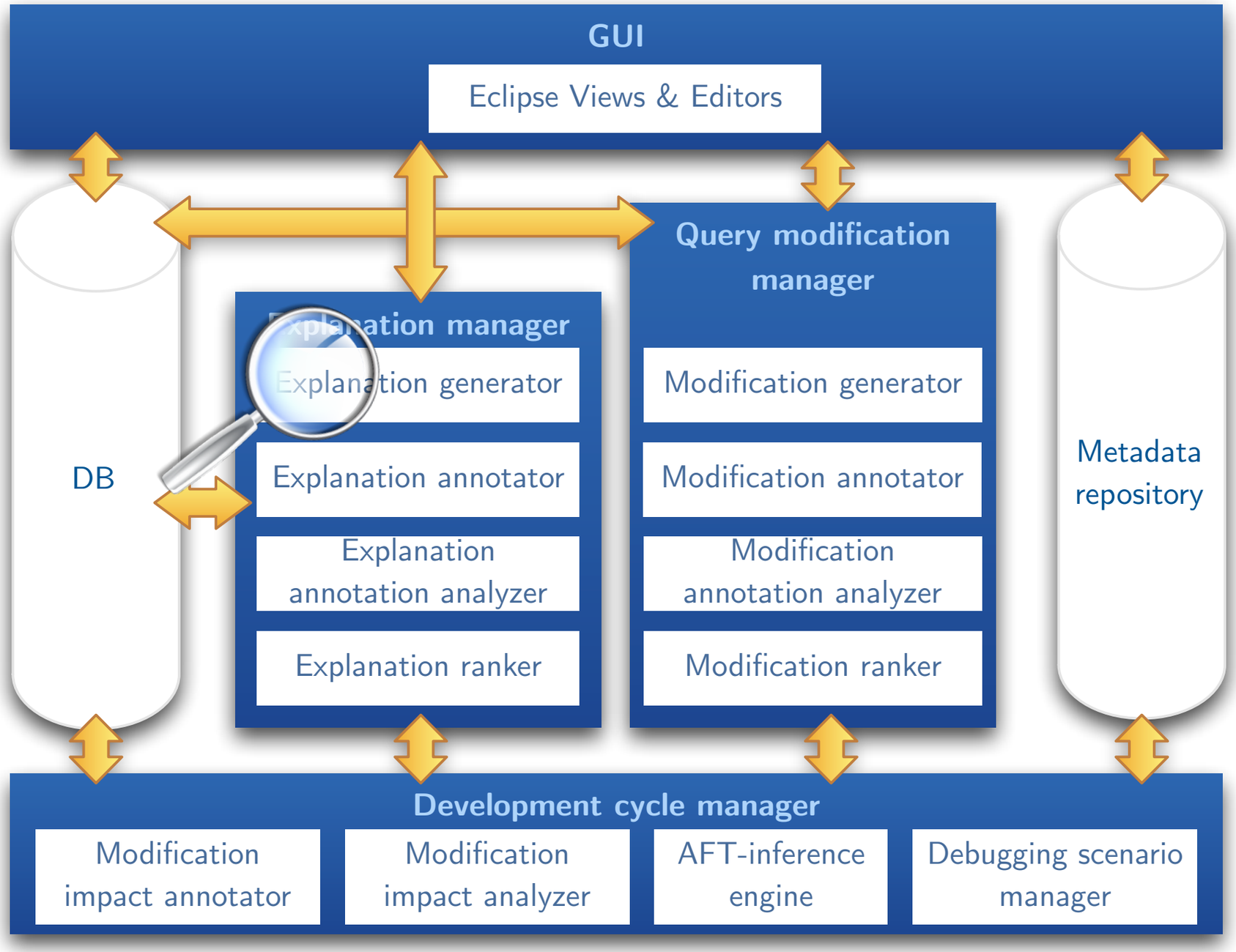

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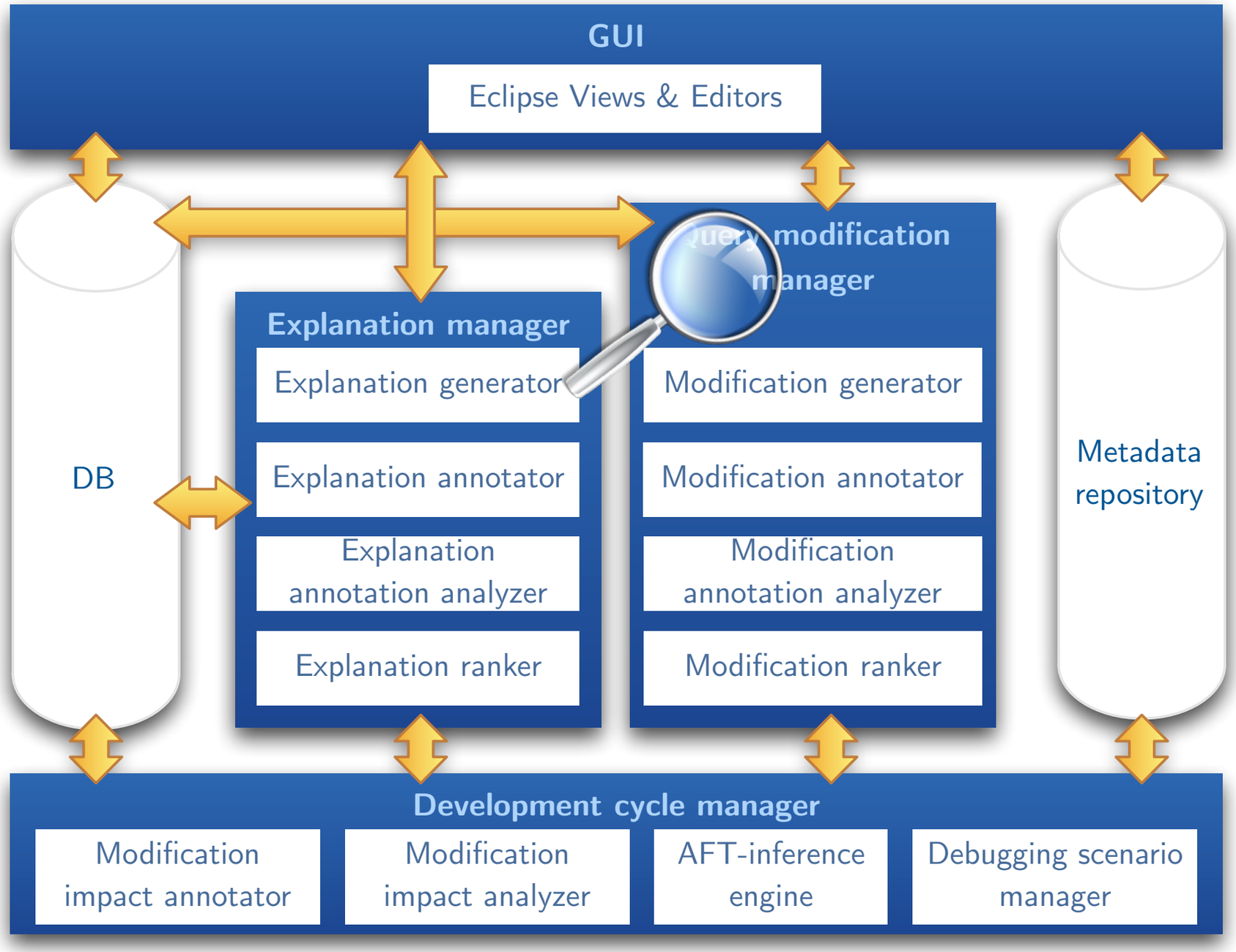

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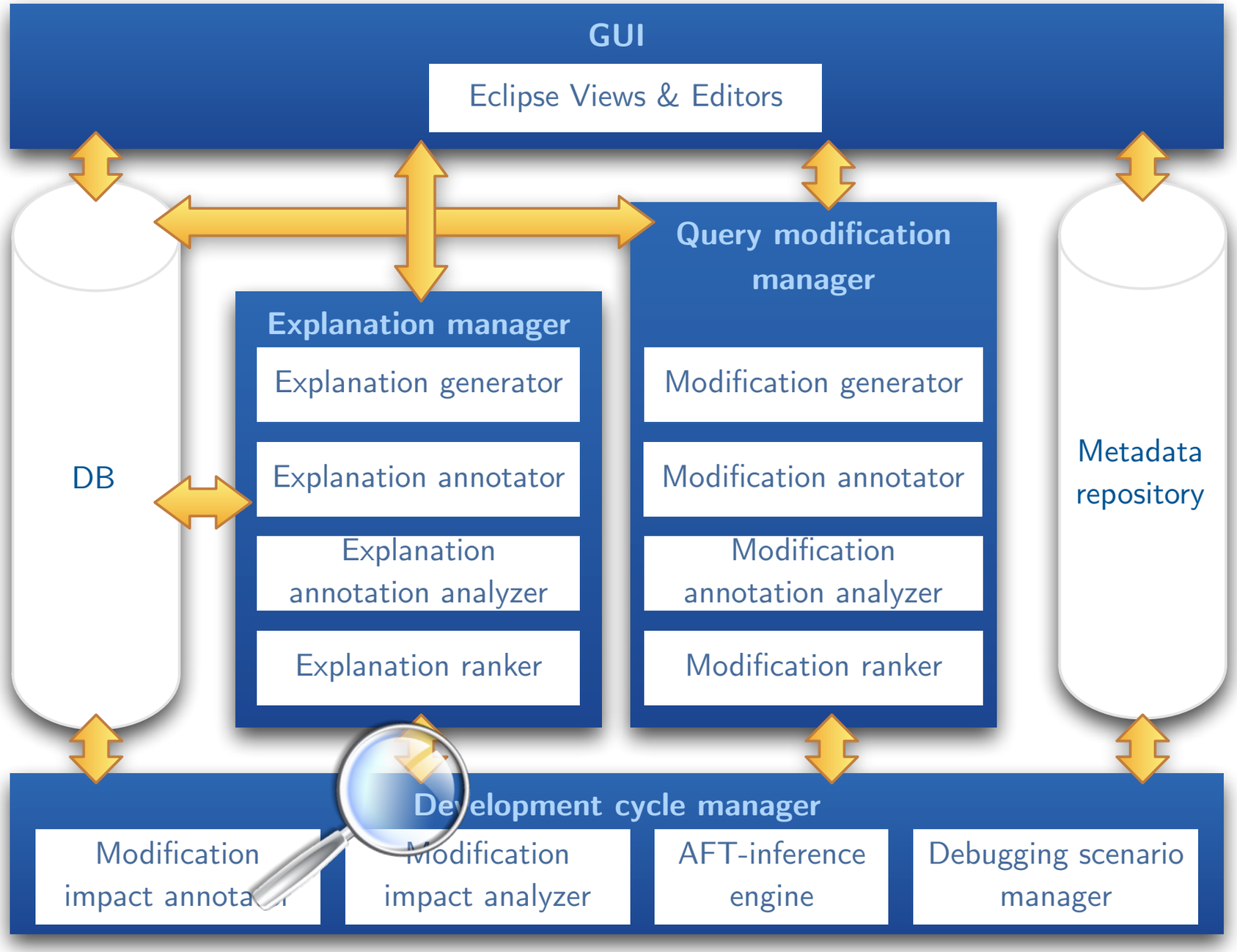


Agenda

Agenda

Conseil - Hybrid explanations

Goal: Ideally pointing out both, the problem of missing source data and the problem of problematic query operators of a non-monotonous query.

Idea:

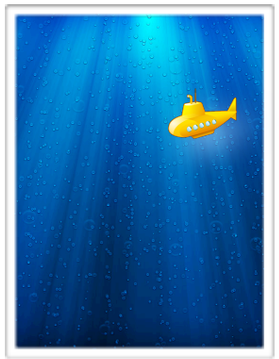
- Conseil follows a positive example to generate explanations.
- A positive example is an existing tuple with a high similarity to the missing answer.
- Annotate the canonical logical tree of the positive example and the missing tuple with passing properties.

Conseil - Idea (continuation)

Idea (continuing):

- Transform the tree to a passing tree, by changing blocking nodes to passing nodes.
- The choice of pointing out the problematic operator or the problematic data tuple(s) is based on a cost model.
- While generating explanations dependencies to previous taken decisions can lead to non optimal global costs (Branch&Bound).

Summary & Outlook



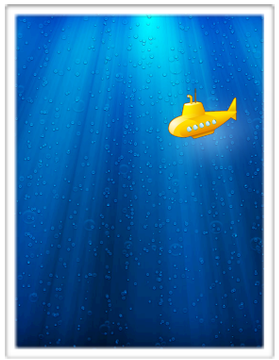
Transformation Lifecycle Management with **Nautilus**

- Semi-automatic tool to support the three phases (AFT) of the currently manual development process
- For various components of the architecture, solutions how to implement the desired functionality were presented.
- A possible benchmark is proposed to evaluate different steps of the AFT cycle.

Outlook

- Evaluate algorithms relevant to different steps with the benchmark.
- Boost the debugging scenario expressiveness and the explanation scope.
- Involve developers through user studies to measure usability.
- Build a real system and evaluate it.

Summary & Outlook



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Nautilus

Thank you for your attention.

http://nautilus-system.org