EMF-IncQuery gets Sirius: faster and better diagrams

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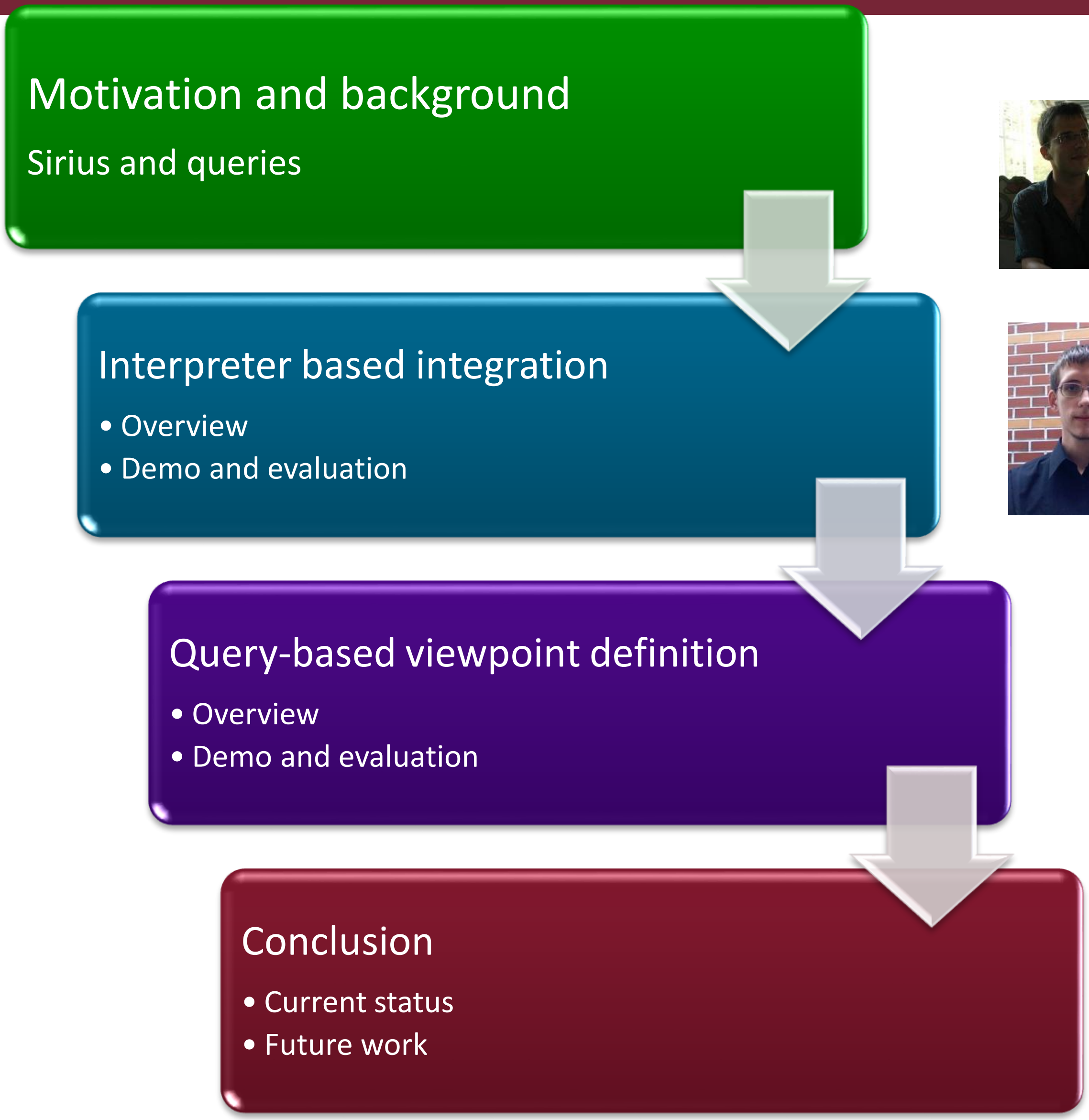
Outline of the talk



Motivation and background

Sirius and queries

Interpreter based integration

- Overview
- Demo and evaluation

Query-based viewpoint definition

- Overview
- Demo and evaluation

Conclusion

- Current status
- Future work

- Main Contributors
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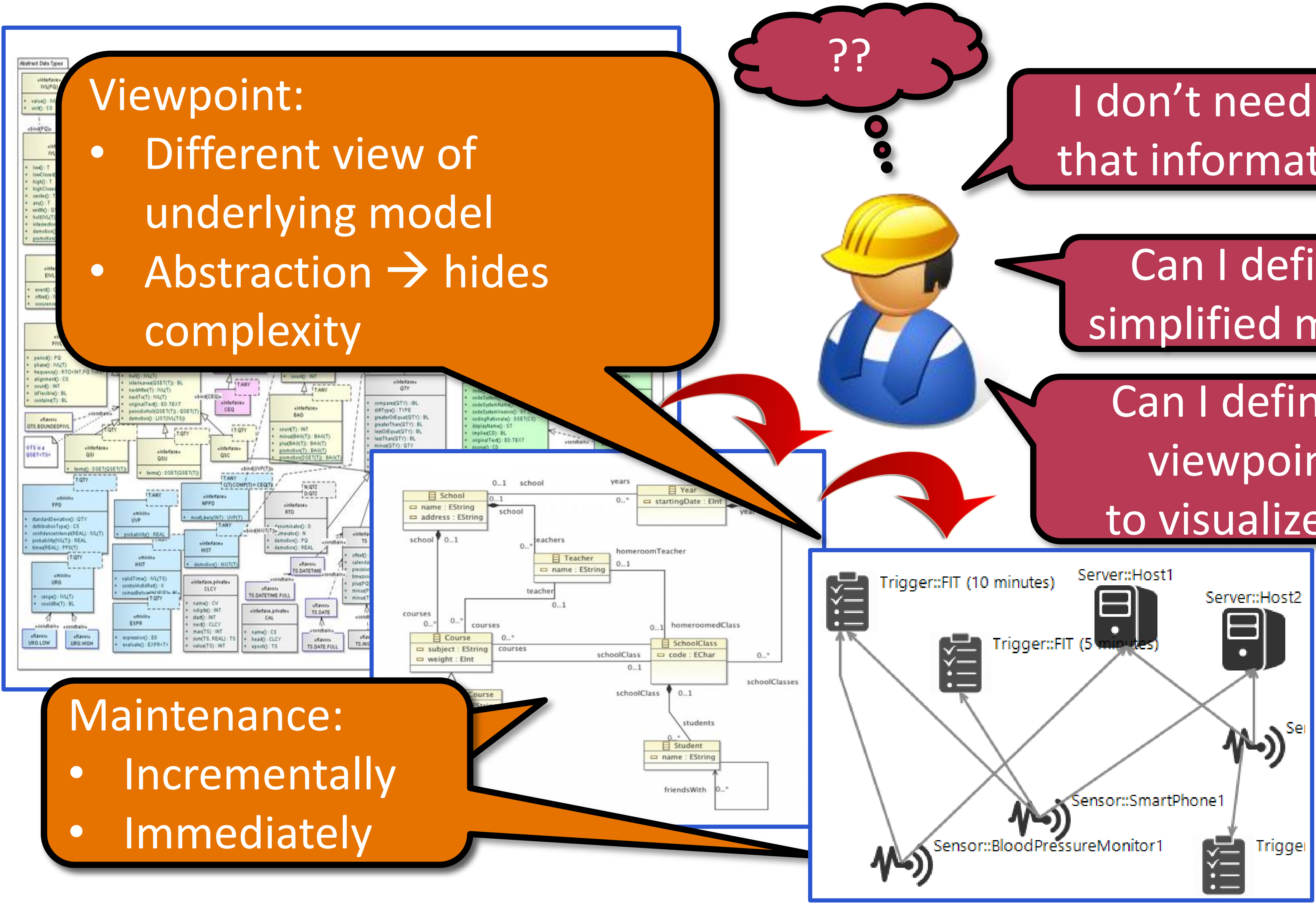
  - István Ráth
  - Ákos Horváth

Introduction



Viewpoint:
- Different view of underlying model
- Abstraction → hides complexity

Maintenance:
- Incrementally
- Immediately

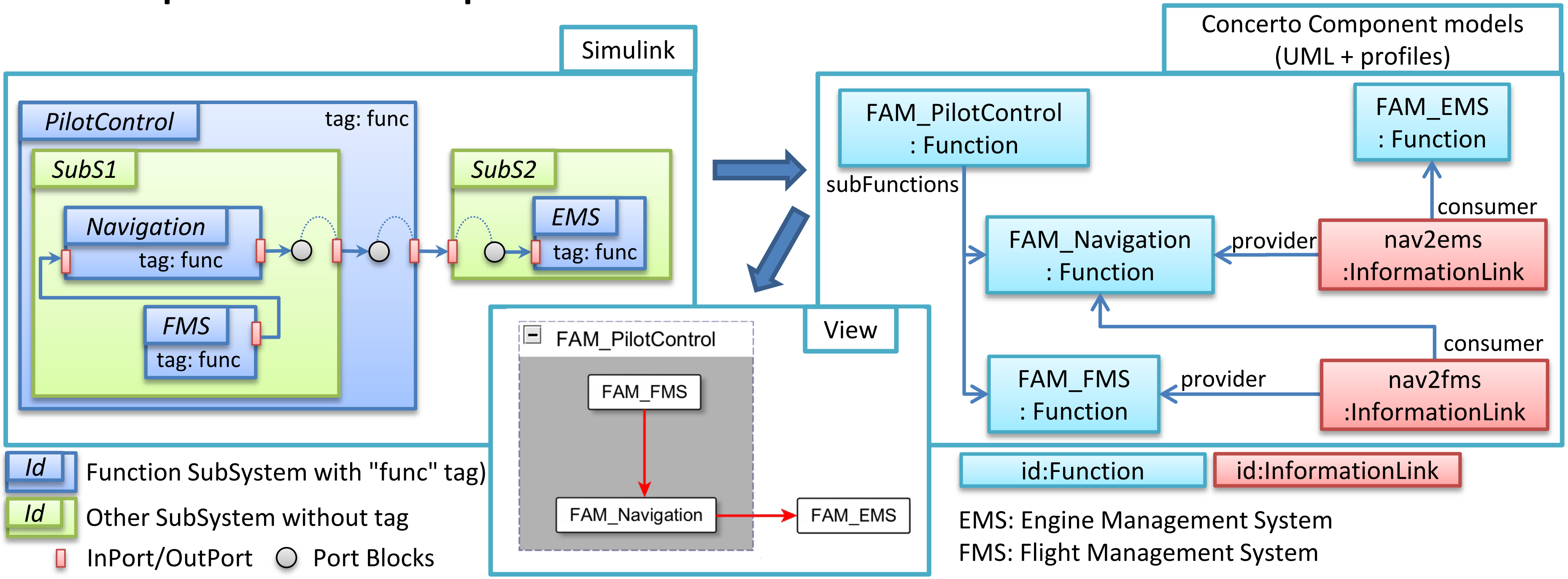
I don't need all that information

Can I define a simplified model?

Can I define a viewpoint to visualize it?

Motivating scenario: CONCERTO

- EU-ECSEL project (started in 2013)
  - General MDD toolchain for safety-critical systems
    - Analysis and code generation for component based systems
    - UML based modeling
    - Non-modifiable PSM
- Simplified Example



EMS: Engine Management System
FMS: Flight Management System

More details on *Matlab Simulink and Eclipse* integration: https://github.com/FTSRG/massif

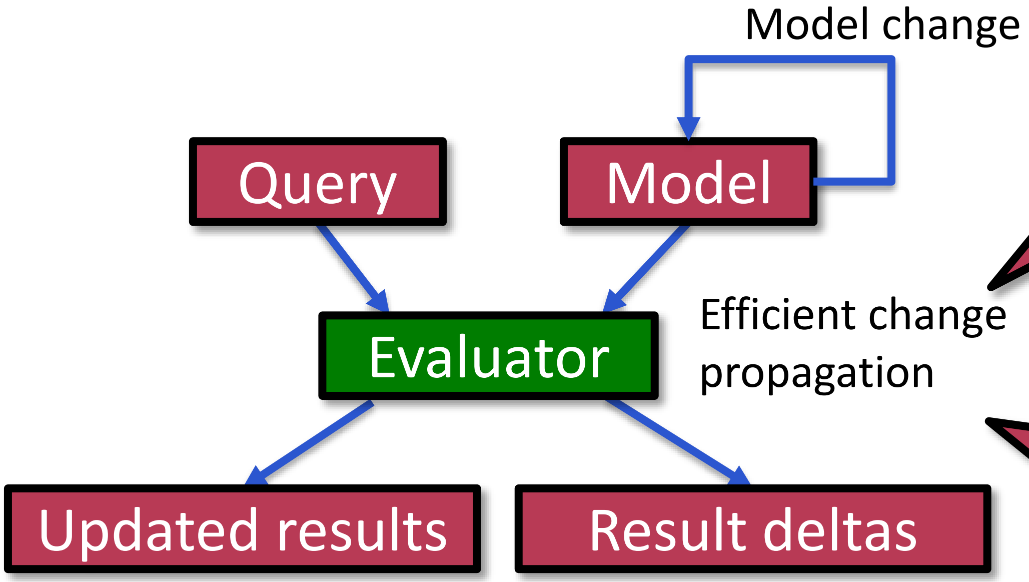
Background: Sirius

- Sirius
  - Custom concrete syntax for visualization
    - Tree, table, graph, etc.
  - Provides viewpoint definition over EMF models
  - Abstraction can be defined using interpreted expressions
    - MTL – Acceleo Model-to-Text language
    - OCL- Object Constraint language
    - *AQL (recommended as of 3.1) – Acceleo Query Language*
  - Supports several viewpoints over the same abstract syntax

More details on *Sirius*: https://eclipse.org/sirius/

Background: EMF-IncQuery

- EMF-IncQuery
  - Incremental model query engine
  - Own query language = IQPL
    - declarative
    - graph pattern based



Always up-to-date results without model re-traversal

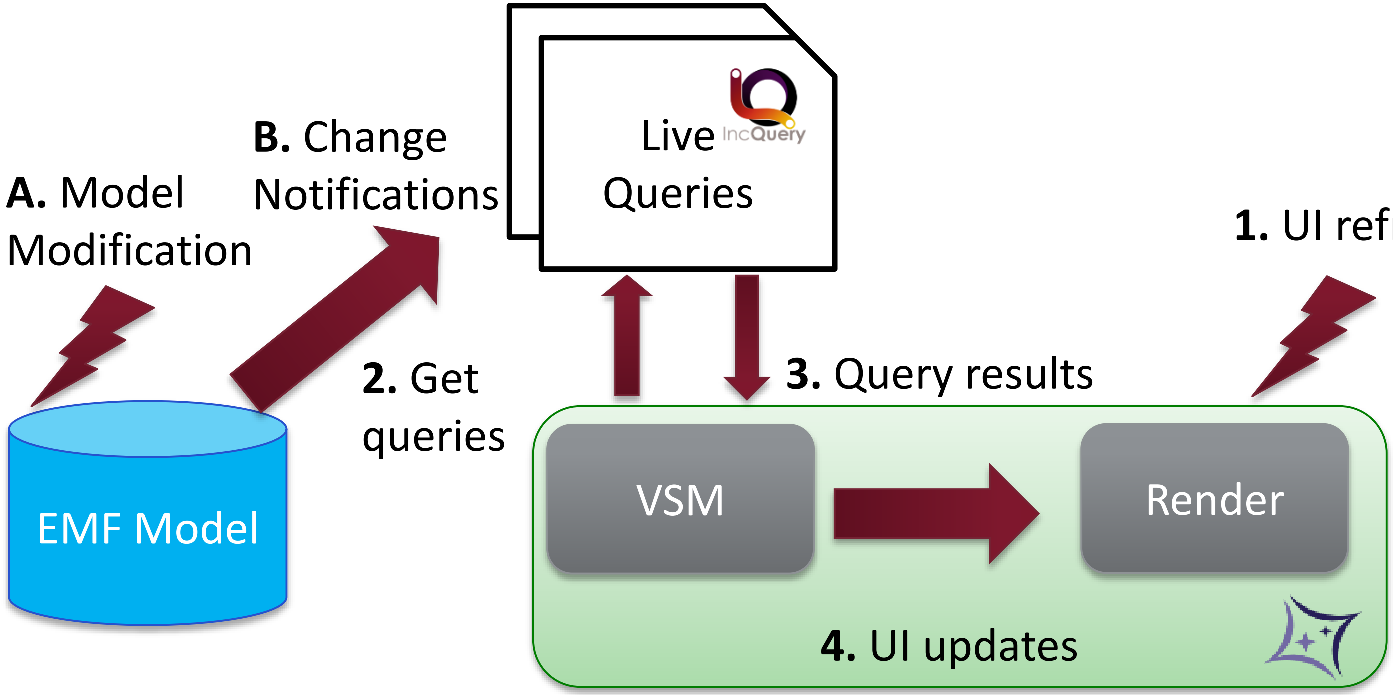
Track changes of your model in terms of queries

More details on *EMF-IncQuery* integration: http://www.eclipse.org/incquery/

IncQuery as a query language in Sirius

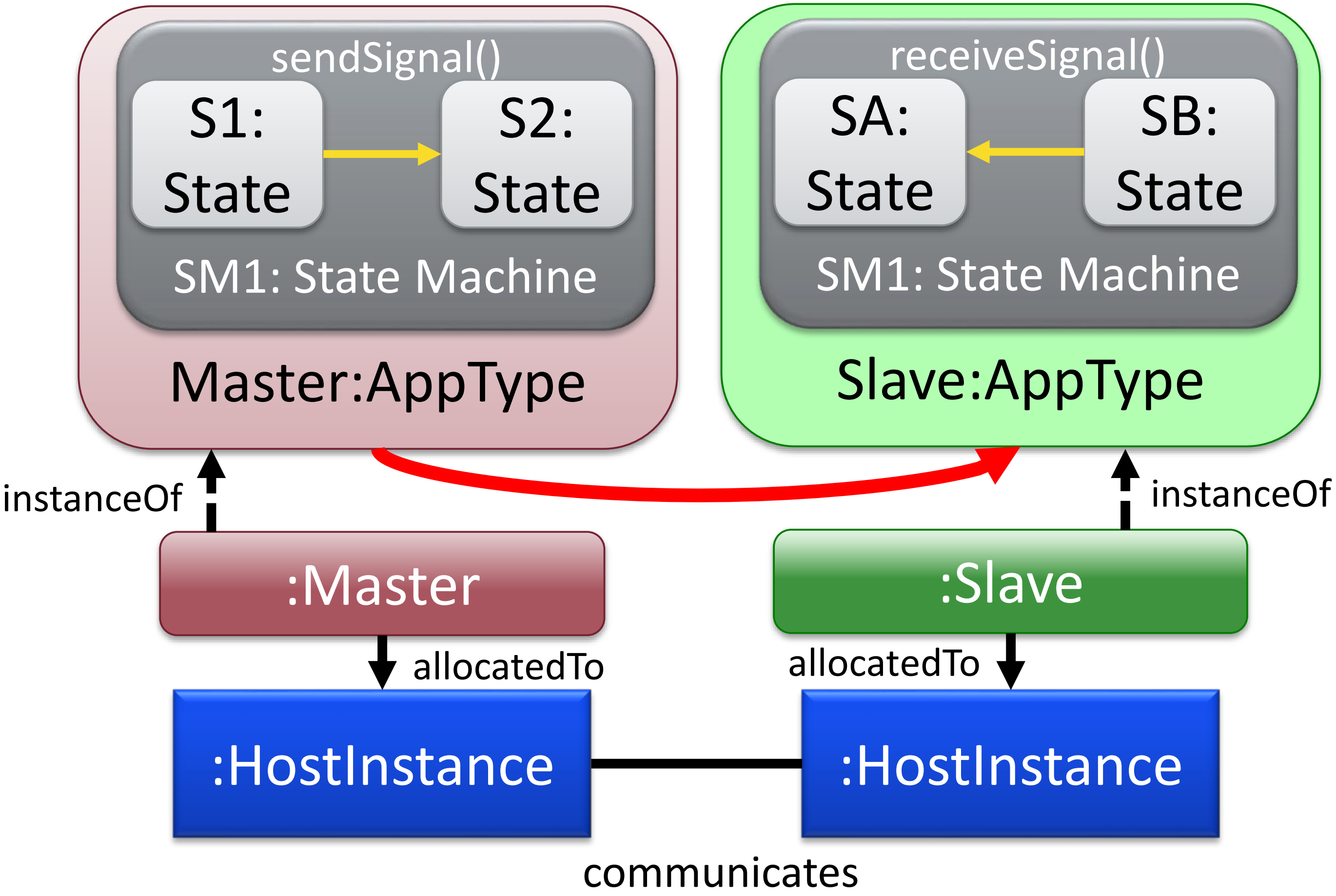
Overview: IQPL as query language for Sirius

- Sirius provides API to provide custom expression interpreter
  - `org.eclipse.sirius.common.expressionInterpreter`
  - `org.eclipse.sirius.common.proposalProvider`



DEMO Using IncQuery in Sirius

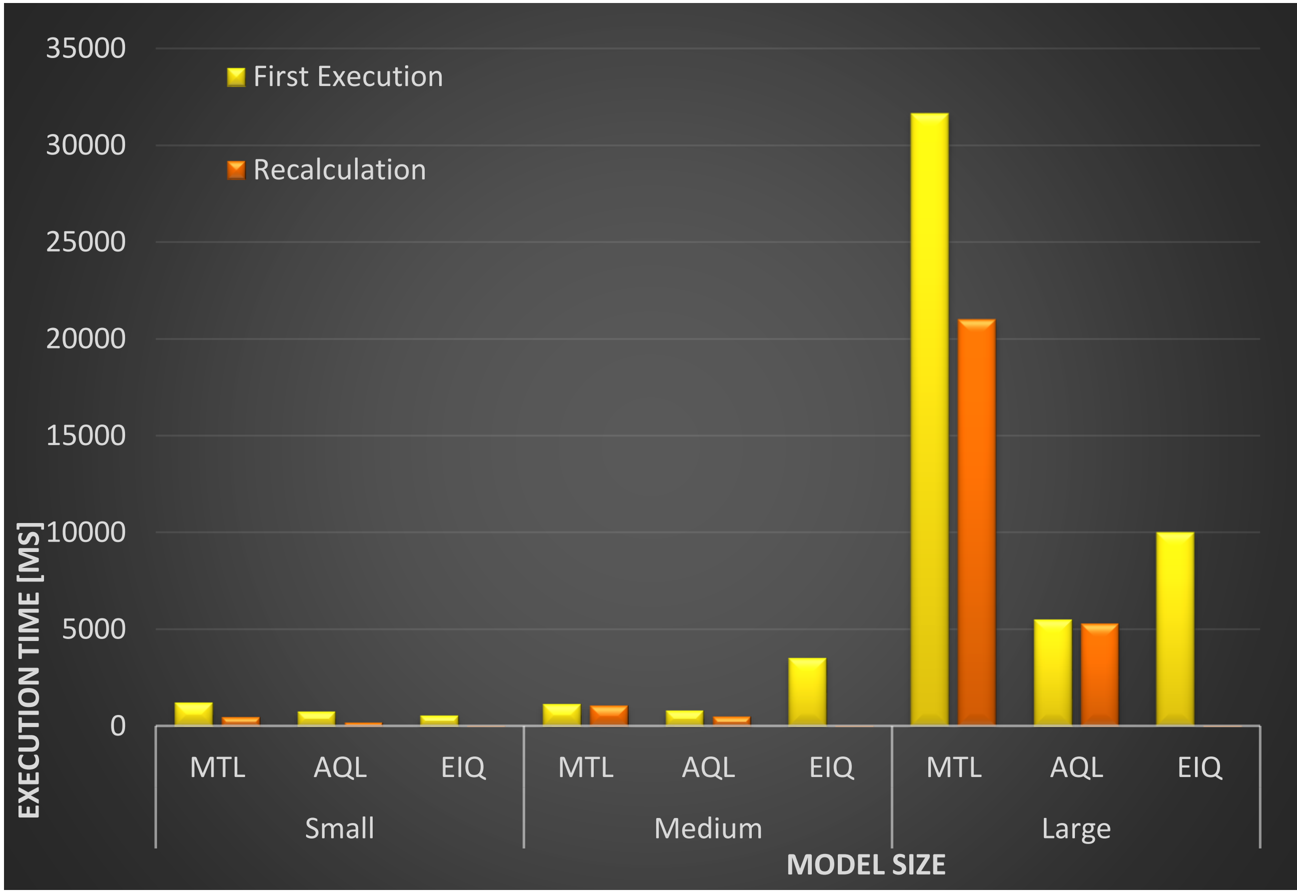
- Same model query written in
  - MTL
  - AQL
  - IncQuery



Evaluation: Interpreted expression

- Profiler was used to isolate query execution time
- AQL
  - provides good performance
  - Low memory profile
- IncQuery
  - Recalculations < 50 ms
  - Requires up to 2x memory
    - Large ~1.2 Gb

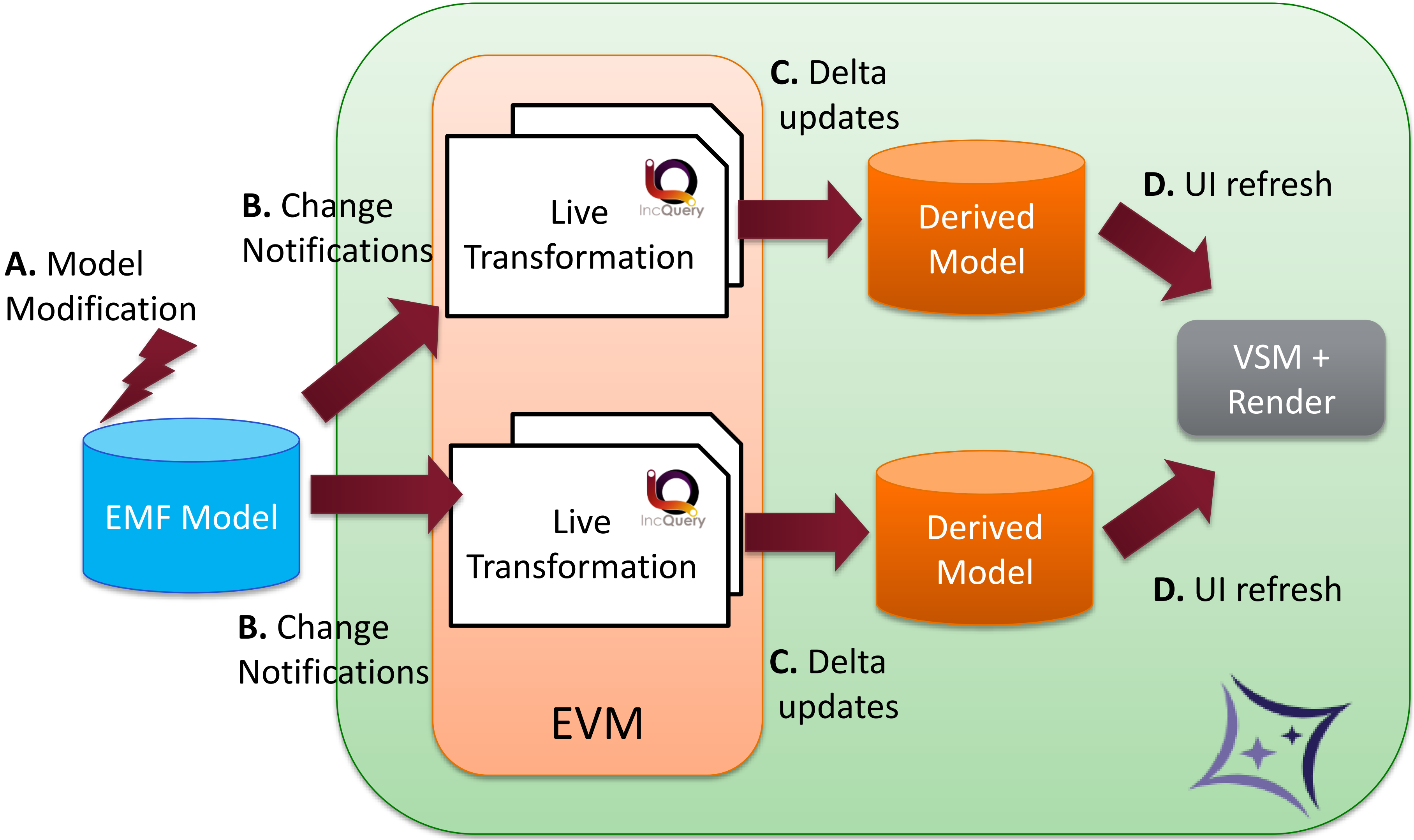
Models	EObjects	EReferences	EAttributes	Diagram nodes	Diagram edges
Small	3550	34222	9471	12	17
Medium	6994	124708	22129	17	13
Large	63580	1233581	457230	167	6154



Query-based resource

Viewpoints as separate EMF resources

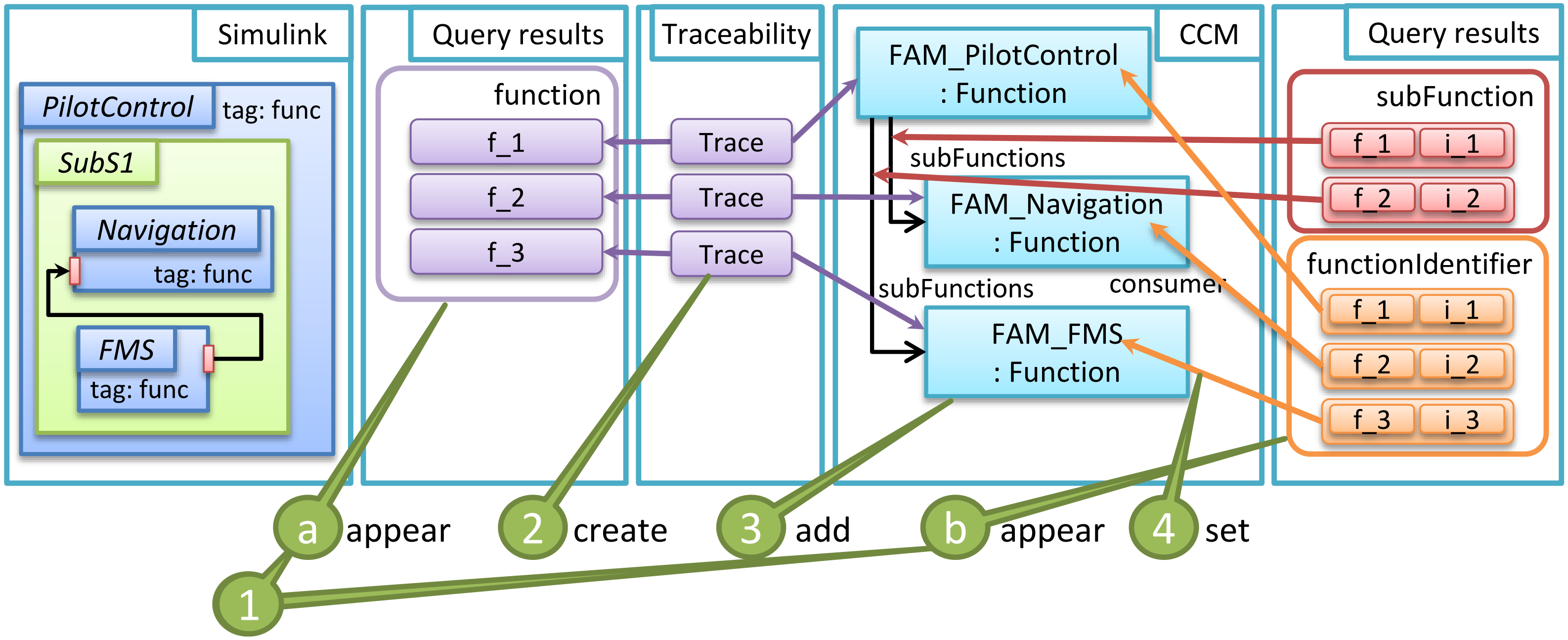
View models and Sirius



More details on *EVM*: http://wiki.eclipse.org/EMFIncQuery/DeveloperDocumentation/EventDrivenVM

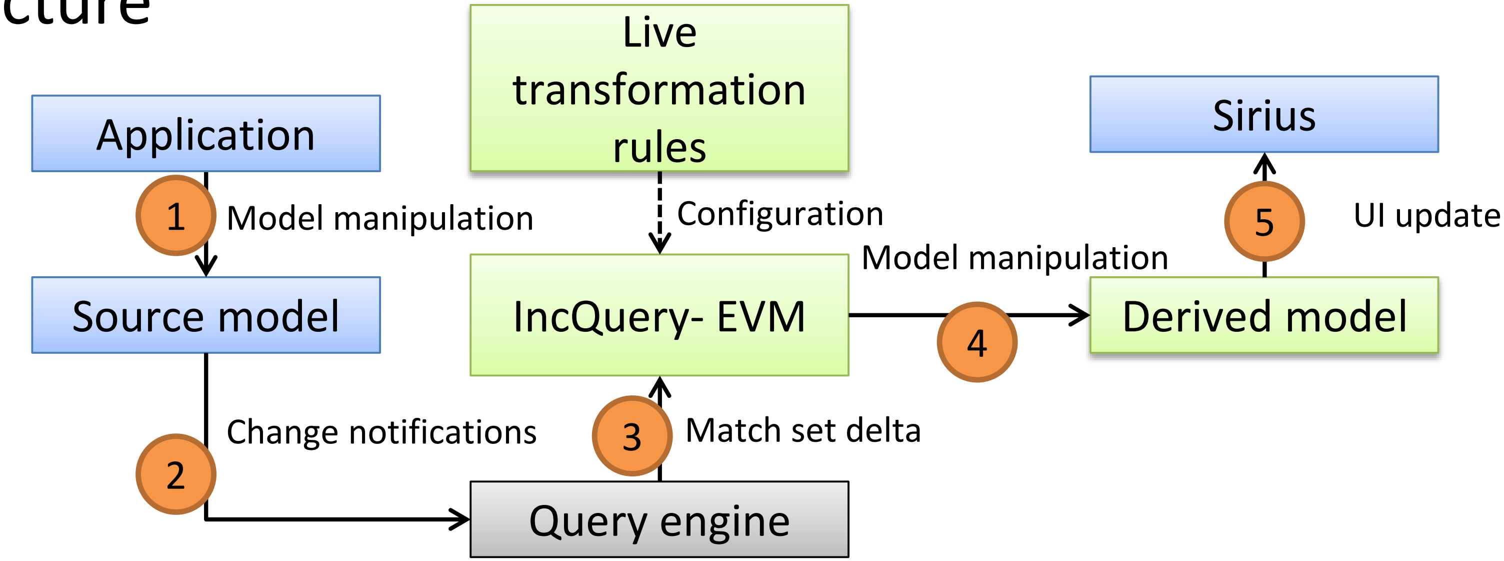
Execution of motivating example

- More matches can appear at the same time
  - Ordered execution schema (priority for rules)
- Internal traceability for created objects
  - Explicit definition
- Configuration model hides underlying EVM rule definitions
  - Predefined set of manipulation rules available
- In summary: *One way incremental synchronization* → *arbitrary transformation*



Updating derived models

- Initial setup of derivation rules
  - *EClassifiers, EStructuralFeatures*
- Query result deltas
  - *Delta = (Found, Lost, Updated)*
- *Based on EMF-IncQuery Event-Driven Virtual machine*
- Integration architecture



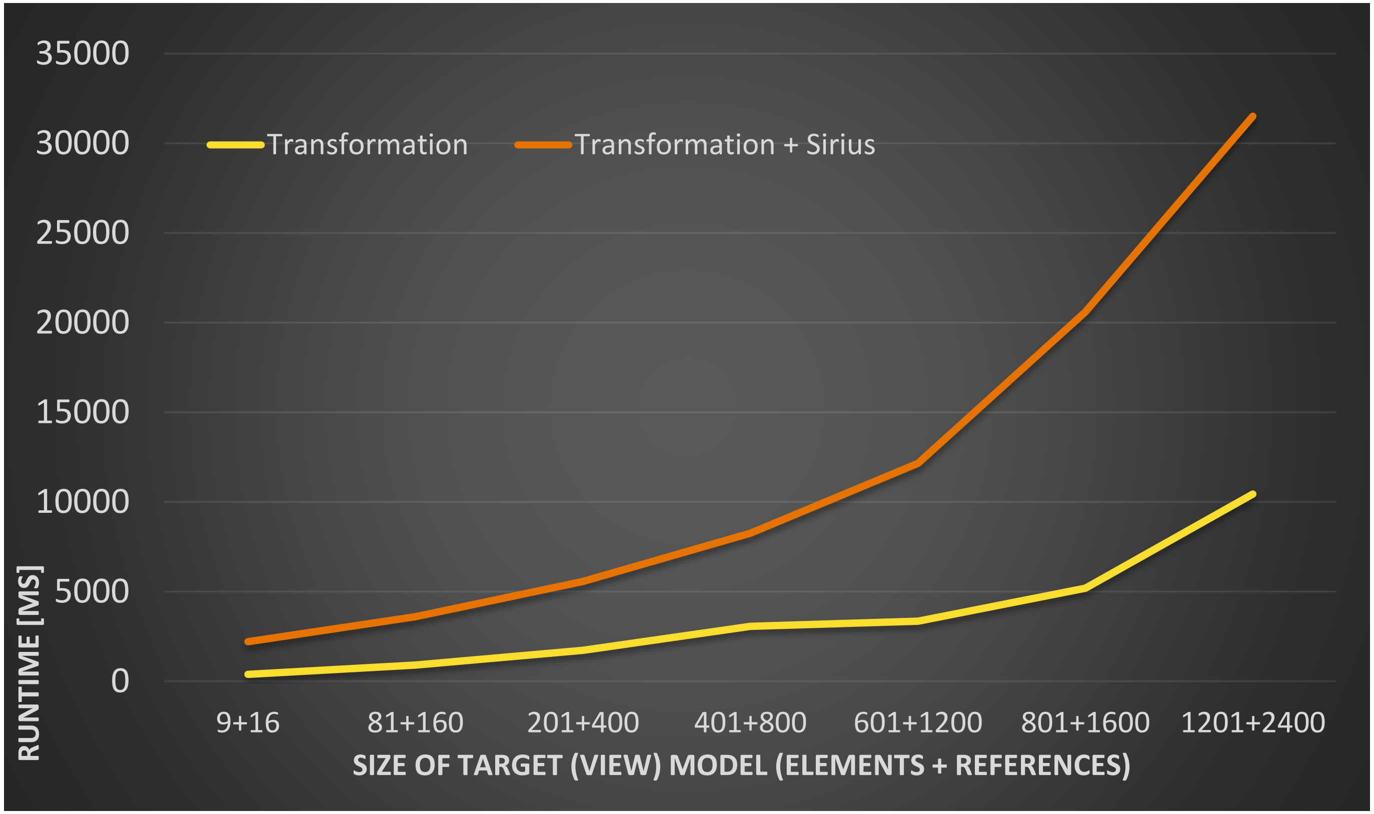
DEMO Using IncQuery in Sirius

- Standard Sirius domain
  - Family representation
  - Incremental synchronization
    - On-the-fly
- Concerto EMF-UML2
  - Viewpoint for simplified representation

Evaluation - Concerto

- First time execution
  - 10+ derivation rules
  - Transformation ~33% of overall runtime
  - Memory consumption ~3.5x of original model

Models	EObjects	EReferences	Diagram nodes	Diagram edges
9+16	38	89	9	16
81+160	371	890	81	160
201+400	926	2225	201	400
401+800	1851	4450	401	800
601+1200	2776	6675	601	1200
801+1600	3701	8900	801	1600
1201+2400	5551	13350	1201	2400



Evaluation - Concerto

- Incremental recalculation
  - Transformation re-execution < 50 ms
  - Refreshing < 1 s
  - Refreshing is also faster

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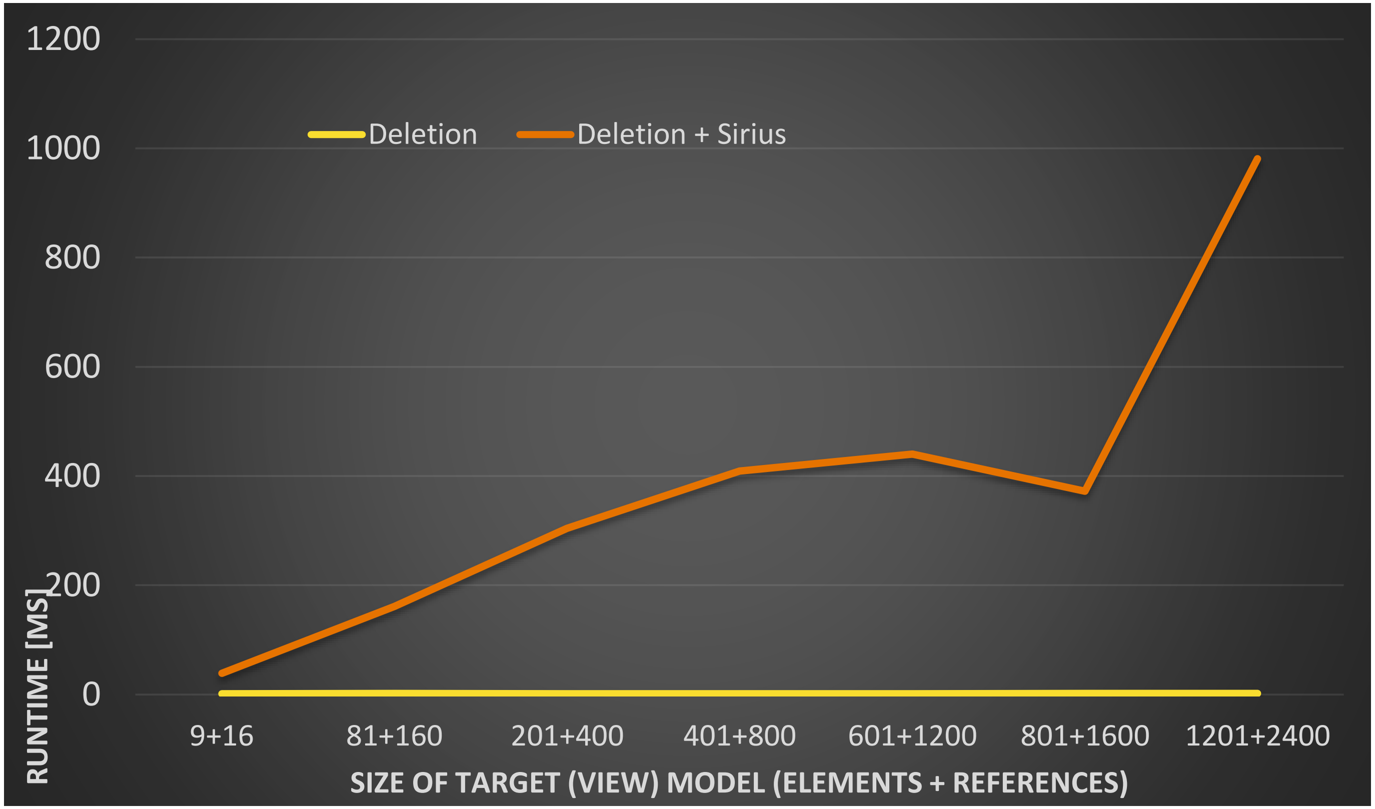

Conclusions

What we have done and where to move forward

Conclusions

- *Proof-of-concept version is available*
  - IncQuery does well as expected in incremental recalculations
  - Incremental refreshing is not available
    - *Would be nice to have explicit API ☺*
  - Usage requires deep knowledge of both Sirius and IncQuery
  - Common base with new EMF-IncQuery Viewers

- *Experience*
  - *Concerto EU-ECSEL project*
    - Works with Papyrus and EMF-UML2!
  - Aimed application scenario
    - Viewpoint definition directly for EMF models (one-to-one mapping)
    - Online synchronization

Final points

- The examples and more details are available form
  - https://github.com/FTSRG/iq-sirius-integration
  - Contributors:
    - Main: BME-FTSRG, IncQuery Labs Ltd.
    - Supporting projects: Concerto (EU-Artemis)
    - (Hopefully) future partner: **Obeo** ☺
- **Your contributions (feedback, forum posts, ideas, patches) are very welcome!**
  - *To what direction should we enhance this approach?*

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