

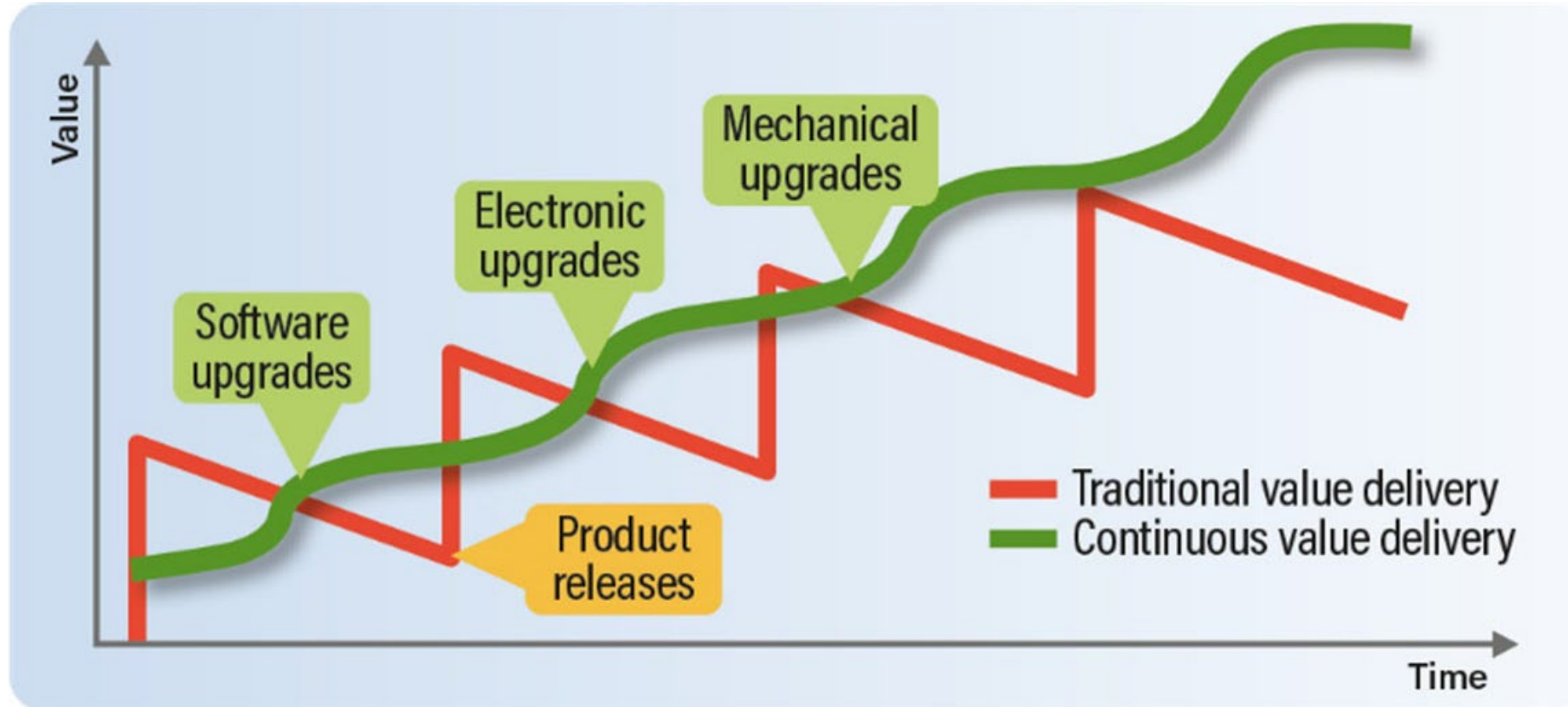
CoDig – Vinnova Competence Center on Continuous Digitalization

Presentation for MODPROD 2024-02-06

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Vision



CoDig activities

Center Management

Networking

Mobility

Education

Sustainability

WP1: Continuous and automated quality assurance

WP2: Continuous safety and security

WP3: Data-driven digital transformation

WP4: AI-supported digitalization

Research @ LiU

- P1-1 (PhD student): Continuous static quality assurance for ML programs
- P1-2 (PhD student): Continuous testing of machine learning components
- P1-3 (PhD student): Efficient Anti-Pattern Detection for Machine Learning Programs
- P1-5 (Postdoc): Sustainable automated quality assurance pipelines
- P1-7 (Regular): Aspects of automated testing

- Coordination of all sustainability activities

Partners



Don't miss the project leader's talk tomorrow

Wednesday February 7

08.00-08.30

outside room A2

Registration and coffee

08.30-10.20

room A2

Plenary Session 4. Chair: Gert Johansson

- **Keynote:** Victor Björkgren, Saab Dynamics. *"Success story: Generative Machine Learning in Product Development at Saab"*
- **Keynote:** Prof. Jan Bosch, Chalmers University. *"AI Engineering: A Research Agenda"*



Model-based Techniques and Tools for the Design and Assurance of Cyber-Physical Systems

Dániel Varró

Presentation for MODPROD 2024-02-06

Foundations for Design Tools for CPS: The VIATRA Project and the IncQuery Product Family

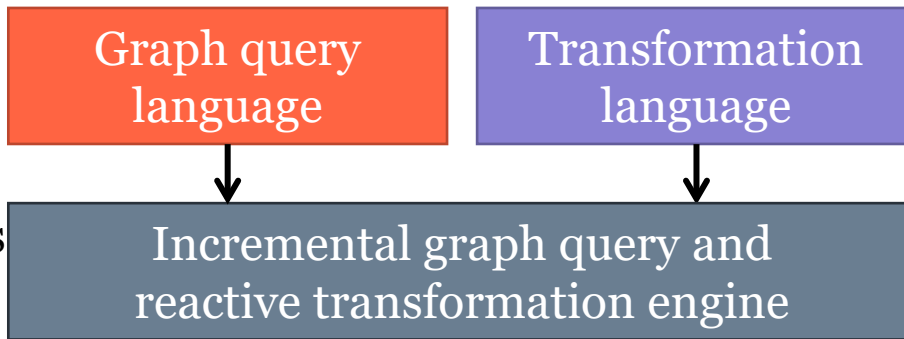
Application domains



Systems Engineering Tools



VIATRA:
open-source foundations for design tools (tech enabler)



IncQuery:
scalable incremental queries for validation



- Open source Eclipse projects since 2005
 - Founder and strategic leader until 2016
 - PhD supervisor of key contributors
- Successful transition
 - From an early research prototype to a product family
 - From academia to a successful company
- Most Influential Paper awards
 - MODELS'14
 - MODELS'20
 - VL/HCC'16 (benchmark)



<http://eclipse.org/viatra>



Jet Propulsion Laboratory
California Institute of Technology

<https://incquery.io/>

Refinery: Automated Graph Generation for Tool Qualification

Consistent, Realistic, Diverse, Scalable, Domain-Specific

Refinery <> CODE GRAPH TABLE GENERATE

```

class State extends RegularState, CompositeElement.

class Statechart extends CompositeElement.

%% Constraints

%% Entry

pred entryInRegion(Region r, Entry e) ↔
  vertices(r, e).

error noEntryInRegion(Region r) ↔
  !entryInRegion(r, _).

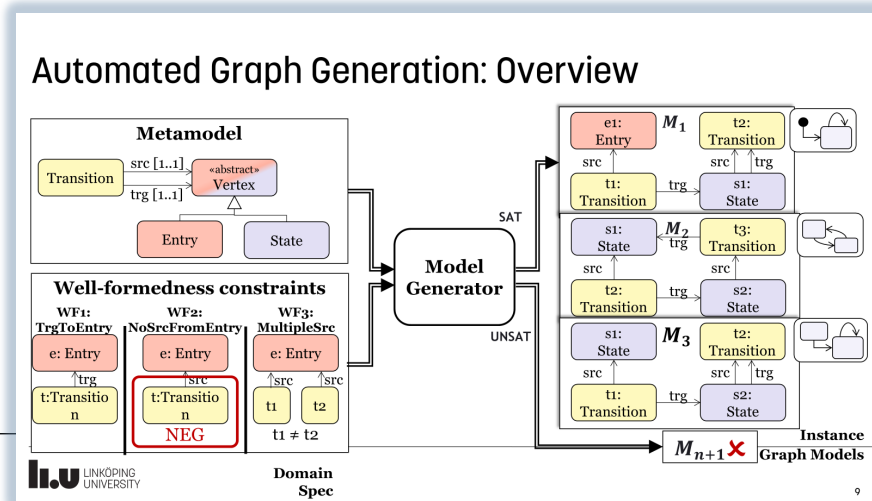
error multipleEntryInRegion(Region r) ↔
  entryInRegion(r, e1),
  entryInRegion(r, e2),
  e1 ≠ e2.
  
```

INITIAL MODEL GENERATED AT 22:19:27 (1)

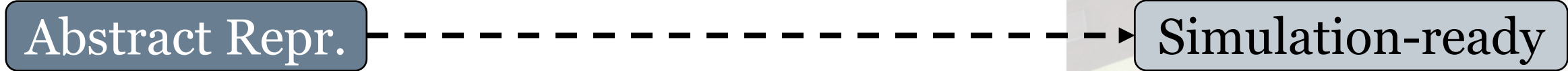


<https://refinery.services/>

- Graph solver as a service
- Consistent graph generation with refinement
- Partial models



Automated Synthesis of System-Level Test Scenarios



Functional Scene

uses

Qualitative abstractions

Logical Scene

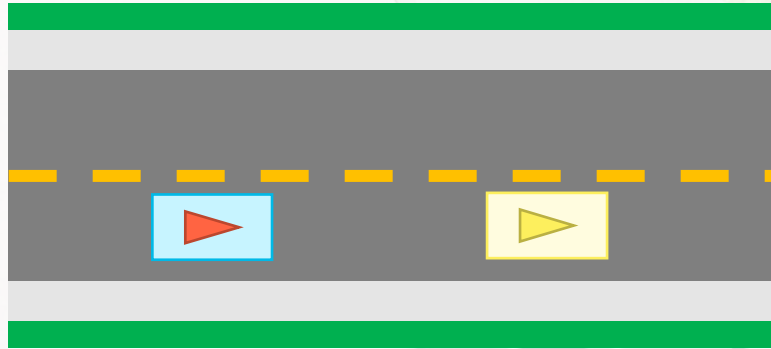
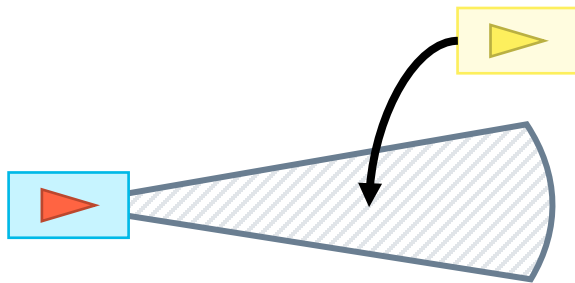
uses

Intervals and regions

Concrete Scene

uses

Exact numeric values



Application Context: Cars, Trams, Vessels, UAVs
See talk on Wednesday

Research in AI4SE / SE4AI

<p>How to generate consistent, diverse and realistic graphs? O. Semerath, K. Marussy, A. Babikian, B. Chen (SoSyM, TSE)</p>	<p>How to train and deploy ML-based predictors used in aeroderivative gas turbines? S. Pilarski, N.Katiyar (SoSyM21)</p>	<p>How to identify vulnerabilities from textual issue reports of GitHub repos of IoT projects?</p>	
<p>How to generate traffic scenes and scenarios for AV testing? A. Babikian (SoSyM)</p>	<p>How to derive domain/goal models with LLMs? Y. Yang, K.Chen, B. Chen, J. Hernandez Lopez (MODELS 23, MoDRE23)</p>	<p>How to combine simulation and RL to reduce food waste in smart food retail? S. Pilarski, A. Sidhu (ANNSIM)</p>	AI4SE

<p>How to calculate optimal policy for multi-armed bandits (possibly with delayed feedback)? S. Pilarski (TAI22, TAI21)</p>	<p>How to ensure fully consistent output for ML techniques (scene graphs, taxonomies)? B. Chen (ASE22)</p>	<p>How to certify ML classifiers for GNNs in case of graph-level perturbations? B. Chen (McGill)</p>	SE4AI
<p>How to ensure that ML components fail independently in ML ensembles?</p>	<p>How to detect inter-dataset code duplication and data leakage for LLMs? J.A. Hernandez Lopez (LiU)</p>	<p>How to statically detect bugs and anti-patterns in ML notebooks? Y. Wang (LiU)</p>	