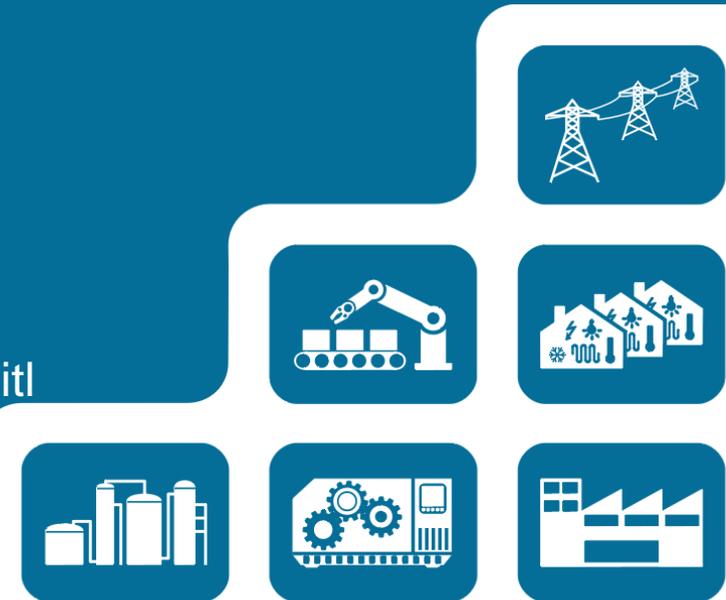




Thesis Topics (and PR) at the LIT CPS Lab



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Christian Doppler Lab VaSiCS
LIT | Cyber-Physical Systems Lab
Johannes Kepler University Linz

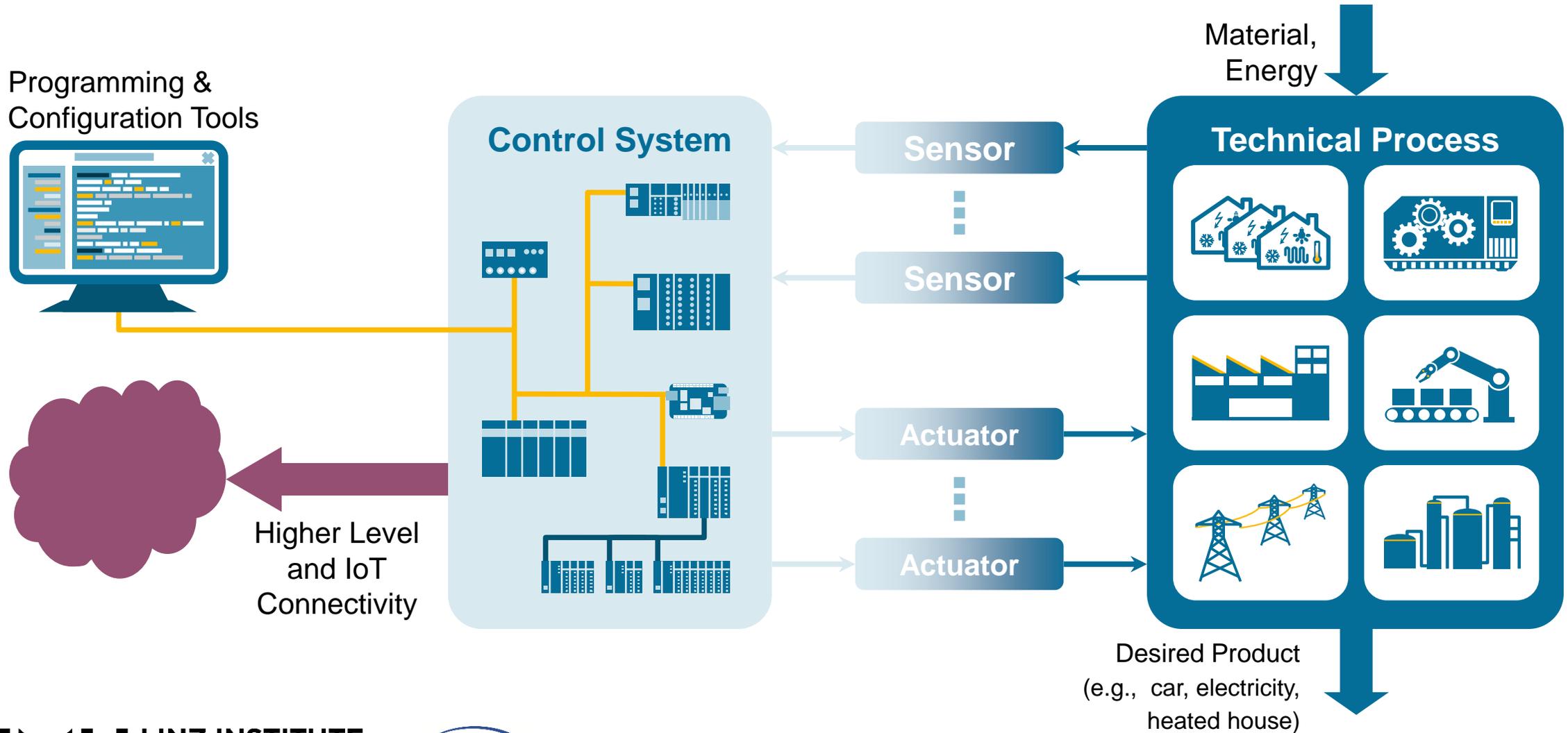


LIT Cyber-Physical Systems Lab

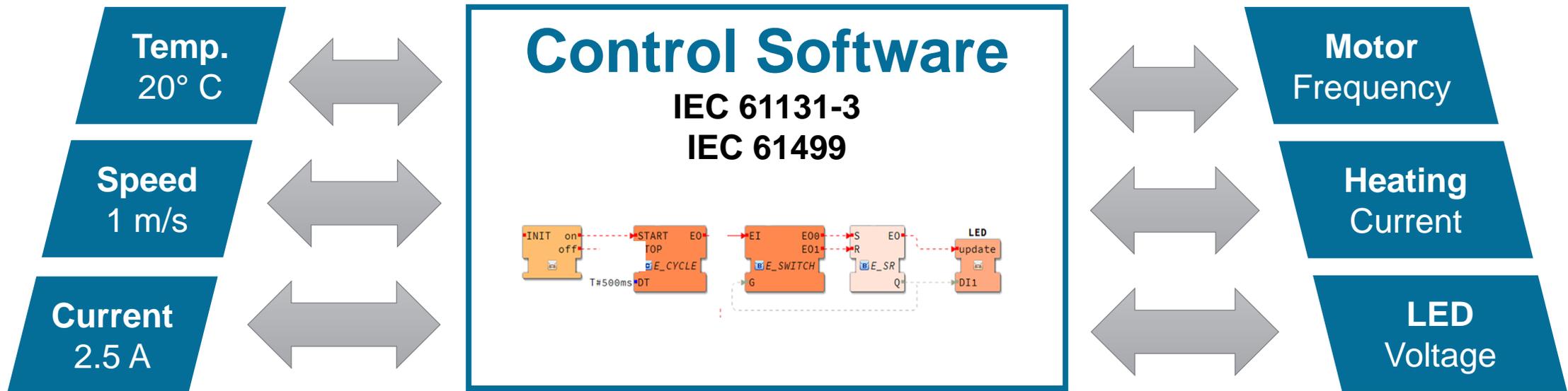
<https://www.jku.at/lit/cps-lab>



Cyber-Physical Production Systems



Cyber-Physical Production Systems

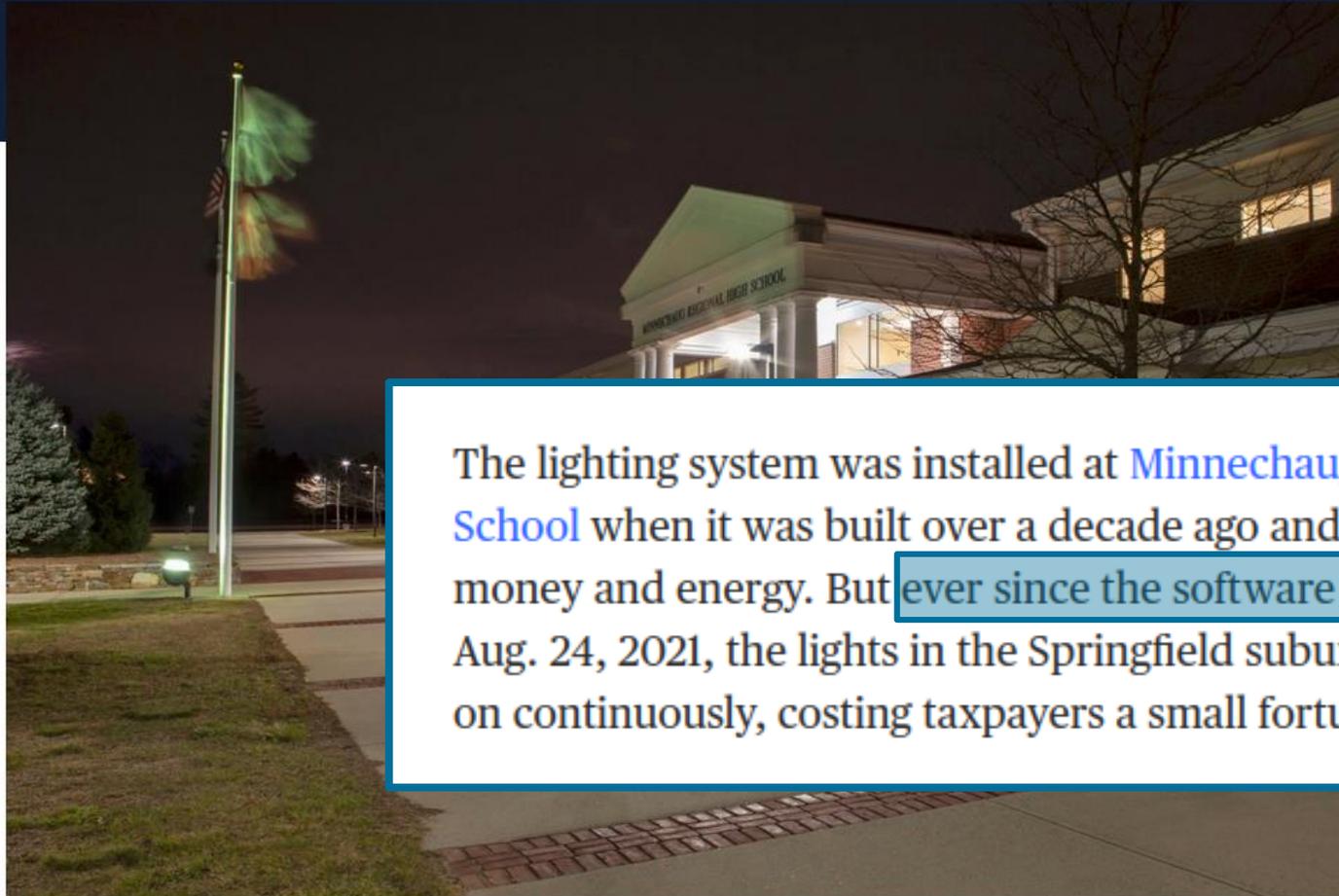


EXCLUSIVE

U.S. NEWS

The lights have been on at a Massachusetts school for over a year because no one can turn them off

Blame it on the pandemic and "supply chain problems," says the school district's assistant superintendent of finance.



The lighting system was installed at [Minnechaug Regional High School](#) when it was built over a decade ago and was intended to save money and energy. But **ever since the software that runs it failed** on Aug. 24, 2021, the lights in the Springfield suburbs school have been on continuously, costing taxpayers a small fortune.

Selected Current Projects & Possible Topics

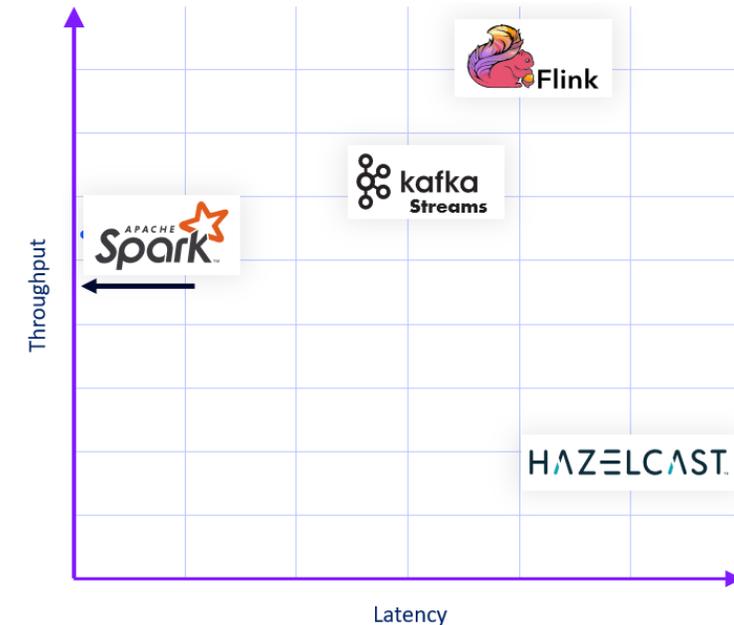


Please note: for all these projects, practica and theses are possible (Bachelor, Masters, PhD)



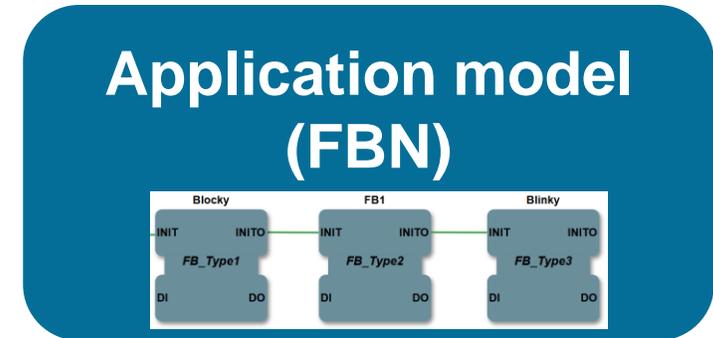
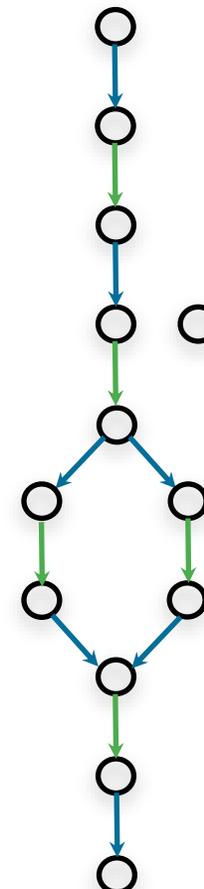
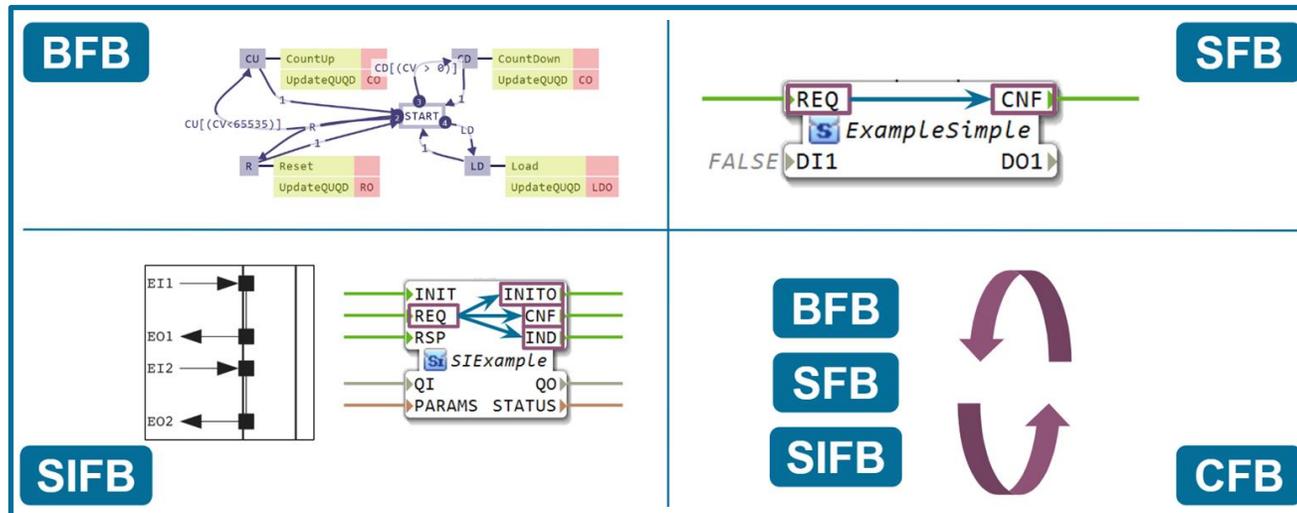
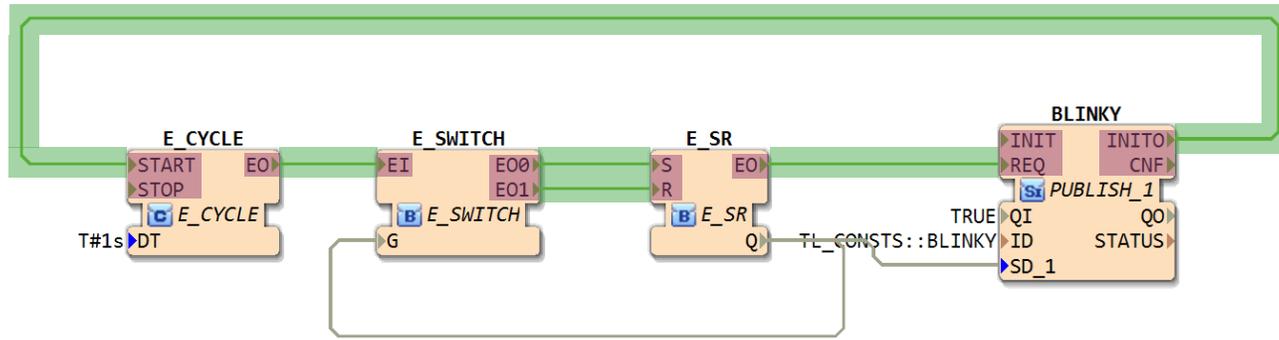
JKU/Dynatrace Co-Innovation Lab

- Distributed Software Systems and Software Architectures, especially Distributed Stream Processing Systems
- Scalable Data Processing and Querying
- Cloud Computing
- Software Performance, especially in Large, Distributed Data Systems and Parallel Computing
- Overall goal: infrastructures, algorithms, and tools supporting processing (ingest, storage, data analysis, and anomaly detection) huge amounts of data, in real-time





Implement 4diac2efg

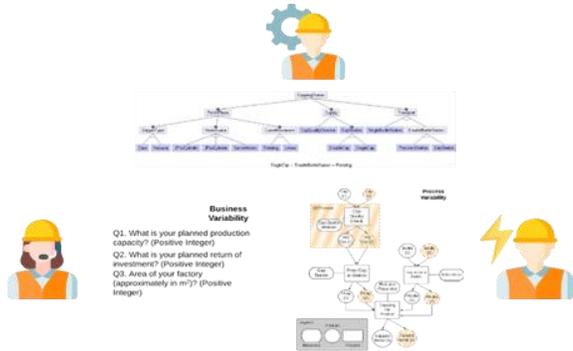


[1,2]



[1] D. Životin and A. Zoitl, "Towards event flow graphs for analyzing event propagation in iec 61499," in 2025 IEEE 30th International Conference on Emerging Technologies and Factory Automation (ETFA), 2025, pp.1–8.
 [2] D. Životin and A. Zoitl, Extending the EFGs to Model Synchronization and Environment Boundaries in IEC 61499

Variability Management in Cyber-Physical Systems



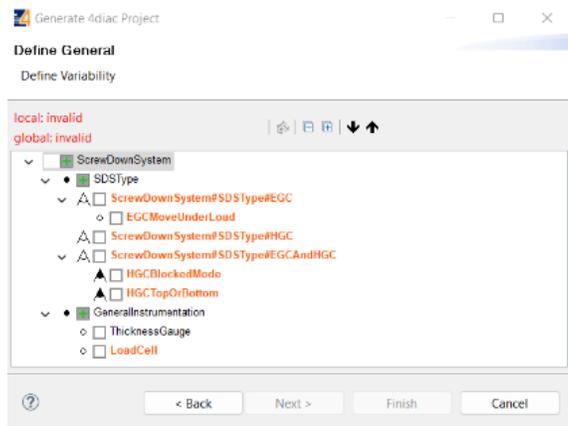
Expressing variability from different aspects (e.g., business, signal, process) using multiple variability models

```

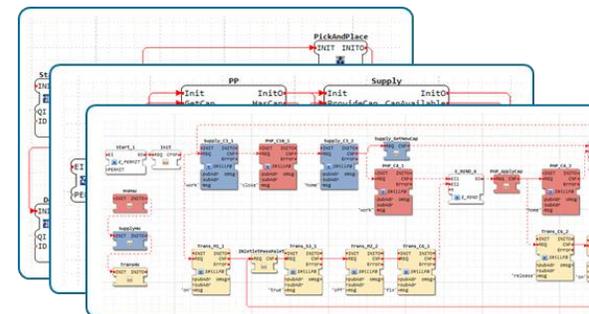
delta DApplyCapPresNotReached;
uses Application;

{
  <Modify> Subapplication PnP_ApplyCap {
    <Add> EventOutput Error type=Event;
    <Add> FB PnP_PressureSens_3 type=SkillIFB;
    <Add> EventConnection PnP_C5_1.CNF
      PnP_PressureSens_3.REQ;
    <Add> EventConnection PnP_PressureSens_3.CNF
      PnP_PressureSens_2.REQ;
    <Remove> EventConnection PnP_C5_1.CNF
      PnP_PressureSens_2.REQ;
  }
}
    
```

Express control software variability using **delta models**



Product configuration interface based on variability models



Control software generator based on selected configuration options



Artifact-Independent Variability Mining

Goal:

- Extract variability information from product variants and build variability models in a flexible way

Approach:

- Extensible framework
- A separate extractor for each artifact type
- Filter out irrelevant variabilities

Possible Topics:
Choose one artifact type
and implement a
variability extractor for it

Product Variants



Extracted Variabilities

```
private String findWord()
//For searching & finding the word
//this is a method for searching the drop list from the text area
public void Find()
{
    //this is an event listener which returns a string (String)
    findWord = NotepadFM.this.getTextArea().getText().trim().toLowerCase();
    //if the findWord on the drop list is empty (null), then return a message dialog
    if (findWord == null || findWord.isEmpty()) {
        JOptionPane.showMessageDialog(this, "Please enter a word to search for.", "Error", JOptionPane.ERROR_MESSAGE);
        return;
    }
    //this is a message dialog which is warning the user
    //to enter the drop list or return to enter the word
    Object[] options = {"Search", "Cancel", "OK"};
    int result = JOptionPane.showConfirmDialog(this, "Search for: " + findWord, "Search for word", JOptionPane.OK_CANCEL_OPTION);
    if (result == JOptionPane.CANCEL_OPTION) {
        return;
    }
    //for selecting the word which the user search for it
    n_getTextArea().setText(findWord);
    n_getTextArea().setSelectionStart(0);
    n_getTextArea().setSelectionEnd(findWord.length());
    n_getTextArea().requestFocus();
}

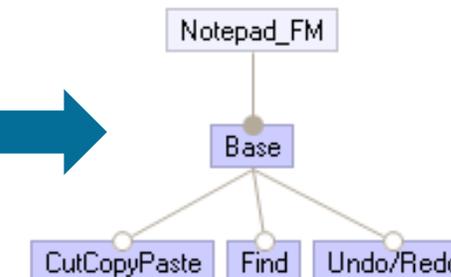
//to cut the selected text
public void cut()
{
    n_getTextArea().cut();
}

//to copy the selected text
public void copy()
{
    n_getTextArea().copy();
}

//to paste the selected text
public void paste()
{
    n_getTextArea().paste();
}

//For using undo & redo
UndoManager undo = new UndoManager();
UndoAction undoAction = new UndoAction(this);
RedoAction redoAction = new RedoAction(this);
private JButton undoButton, redoButton;
```

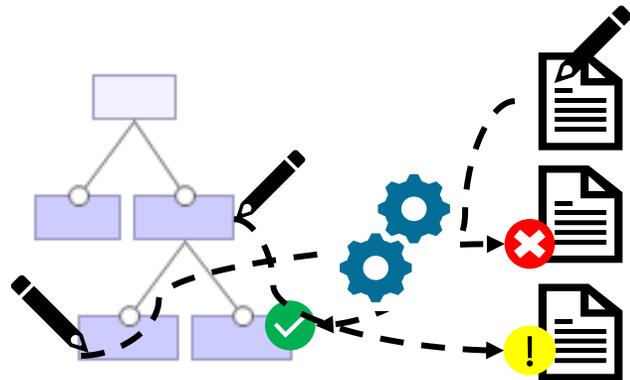
Variability Model





Further Topics

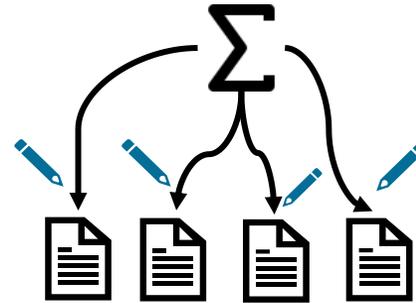
Consistency Checker



Ensure consistency between:

- Variability Models
- Delta Models
- Cross-Discipline Constraints

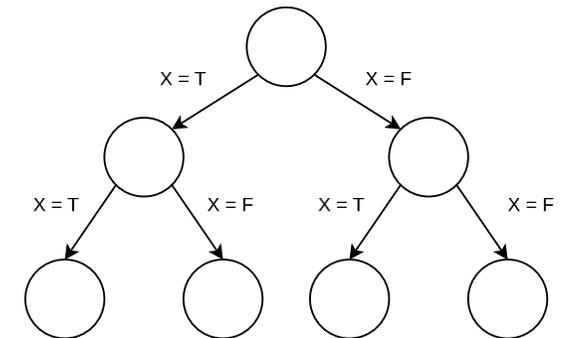
Formal Mapping



Define formal mappings between:

- Delta Models
- Variation Points (e.g., Features)

SMT / Model Checking



Ensure that models solvable :

- CNF concatenation
- Optimizing the formular

Improving the Eclipse Platform



```

31 @Override
32 public boolean keyPressed(final KeyEvent event) {
33     final boolean modifierPressed = (event.stateMask & SWT.MODIFIER_MASK) != 0;
34     currentKeyCode = event.keyCode;
35     switch (event.keyCode) {
36     case SWT.ARROW_DOWN:
37         if (modifierPressed) {
38             getView().scrollByOffset(0, SCROLL_SPEED_Y);
39             return true;
40         }
41         break;
42     case SWT.ARROW_UP:
43         if (modifierPressed) {
44             getView().scrollByOffset(0, -SCROLL_SPEED_Y);
45             return true;
46         }
47         break;
48     case SWT.ARROW_RIGHT:
49         if (modifierPressed) {
50             getView().scrollByOffset(SCROLL_SPEED_X, 0);
51             return true;
52         }
53         break;
54     case SWT.ARROW_LEFT:
55         if (modifierPressed) {
56             getView().scrollByOffset(-SCROLL_SPEED_X, 0);
57             return true;
58         }
59         break;
60     case SWT.PAGE_DOWN:
61         if ((event.stateMask & SWT.SHIFT) != 0) {
62             getView().scrollByOffset(getViewer().getFigureCanvasSize().x, 0);
63         } else {
64             getView().scrollByOffset(0, getViewer().getFigureCanvasSize().y);
65         }
66         return true;
67     case SWT.PAGE_UP:
68         if ((event.stateMask & SWT.SHIFT) != 0) {
69             getView().scrollByOffset(-getViewer().getFigureCanvasSize().x, 0);
70         } else {
71             getView().scrollByOffset(0, -getViewer().getFigureCanvasSize().y);
72         }
73     }
74 }

```

Problems x | Target Platform | Console | Properties | Git Staging | SonarLint Rule D | Progress | History | Javadoc | Package Explorer | Plug-in Image Br

17 errors, 2,485 warnings, 948 others

Description	Resource	Path
Couldn't resolve reference to EClassifier 'STVarGlobalDeclarationBlock'.	GlobalConstants.xtext	/org.eclipse.fo
Couldn't resolve reference to EClassifier 'STVarGlobalDeclarationBlock'.	GlobalConstants.xtext	/org.eclipse.fo

Writable | Smart Insert | 50: 63: 1868

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Open Thesis Topics:

Topic	Type of thesis	Supervisor	Link to Details
Developing an Extractor for Mining Variability from Product Variants	Bachelor- or Masterthesis	Alexander Stummer	Details
Guidelines for IEC 61499 Development in Eclipse 4diac IDE	Masterthesis	Dunja Zivotin	Details
C++ Function Block Verifier	Masterthesis	Michael Oberlehner und Dunja Zivotin	Details
Visualisation of OPC UA Information Model	Masterthesis	Mainak Majumder	Details
Implementing a function block network editor in eclipse theia	Bachelorthesis	Malte Grave	Details





Thank you!



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