

# Connect data across apps for traceability using only add-ons

---

INCOSE IW 2024

Axel Reichwein, January 28, 2024

# From 2005 to 2012: Focus on using data standards

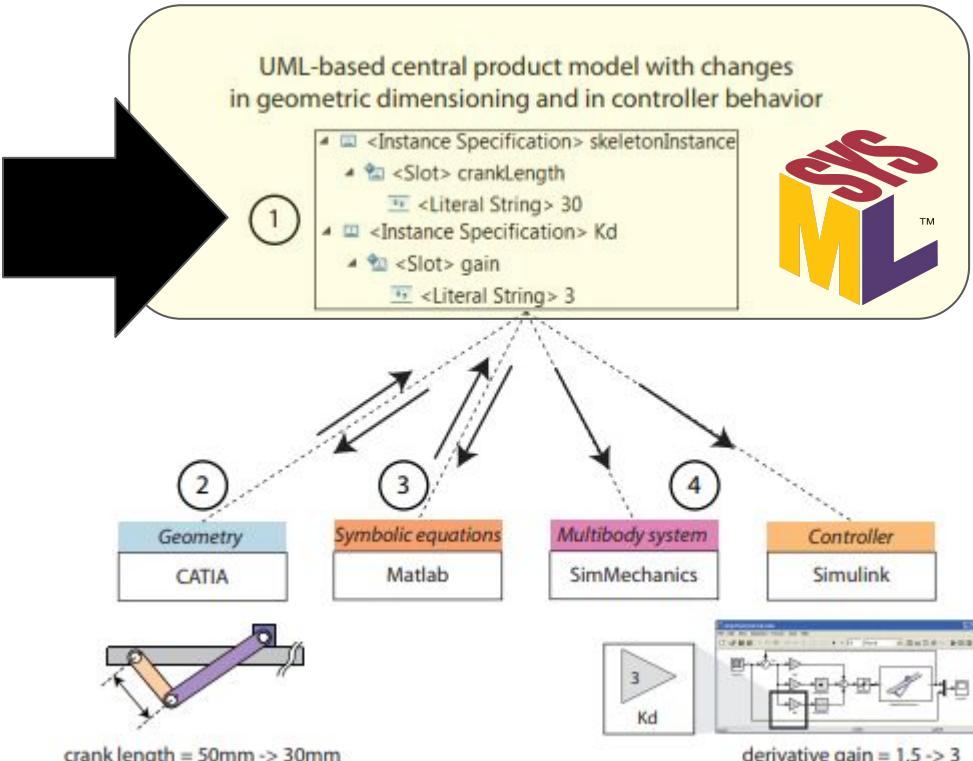
PhD and postdoc focused on tradeoff studies



Reconfiguring architecture model to then automatically sync detailed discipline-specific models

Applying rule-based design in engineering

## Centralized Link Creation Strategy



# From 2012 to 2022: Focus on using API standards

Using Web APIs

Using widely adopted open standards like HTTP, URLs, and RDF

Data integration inspired by the World Wide Web

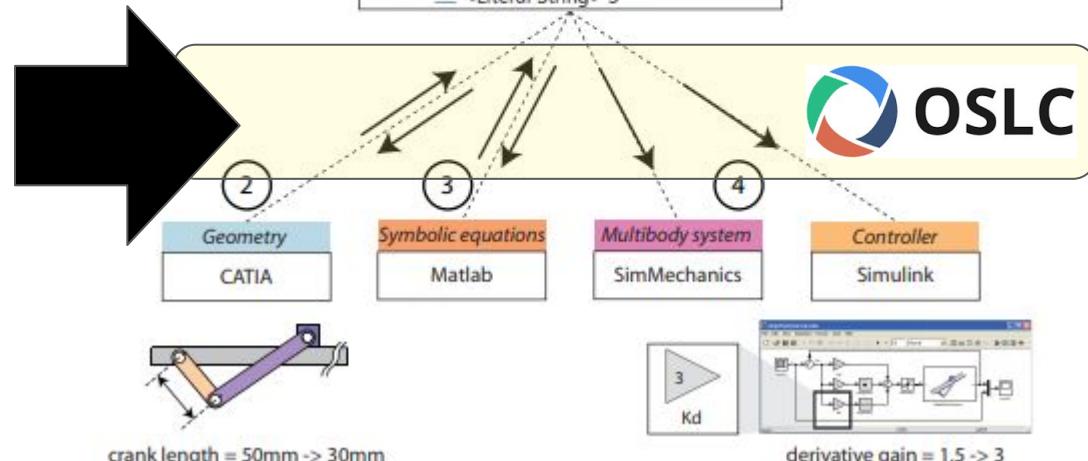
**Distributed Link Creation Strategy**

Koneksys

UML-based central product model with changes in geometric dimensioning and in controller behavior

1

- <Instance Specification> skeletonInstance
  - <Slot> crankLength
    - <Literal String> 30
  - <Instance Specification> Kd
    - <Slot> gain
      - <Literal String> 3



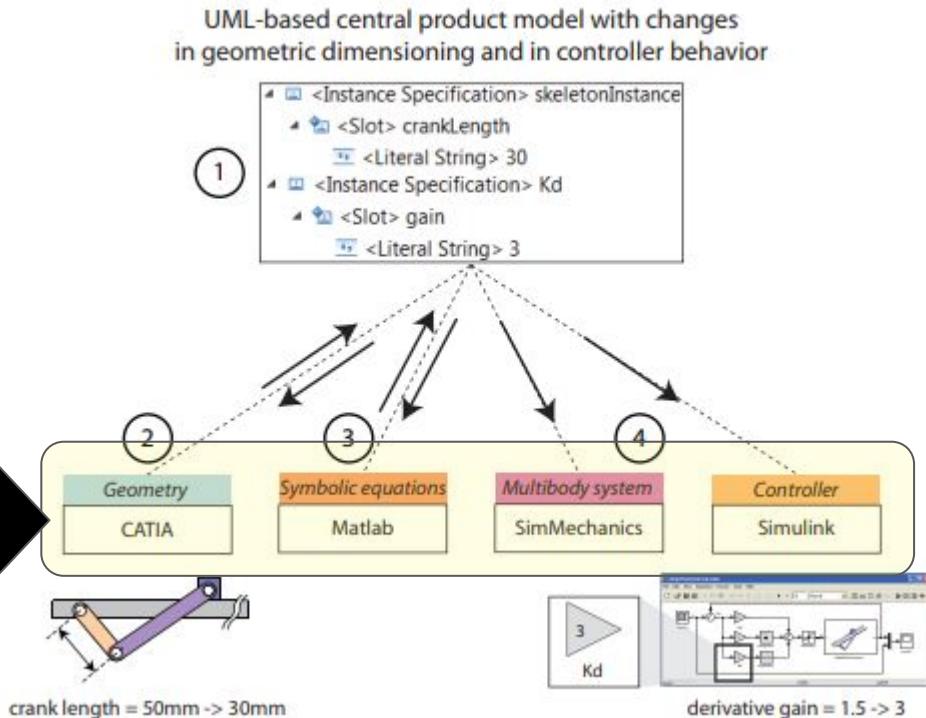
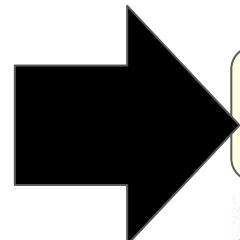
# From 2023: Focus on in-app link creation

Inspired by OSLC

Taking advantage of the common interface of Web applications (HTML and REST API)

Creating lightweight Web browser extensions for traceability

**TraceLynx**



# Koneksys

## Main Milestones



2012	US company created to offer <b>consulting services to integrate engineering data</b> First consulting projects related to OSLC Participated in several <b>R&amp;D projects</b> for large aerospace companies as OSLC experts
2017	Integrated <b>3rd party apps with IBM ELM using OSLC</b> Developed first open-source OSLC API SDK in Python named <b>PyOSLC</b> Created our own OSLC API software factory named <b>Koatl</b>
2024	Developed first cross-application link editor application as <b>Web browser extension</b> Development of <b>TraceLynx</b> : new in-app <b>link management software</b>

# Koneksys Consulting Clients

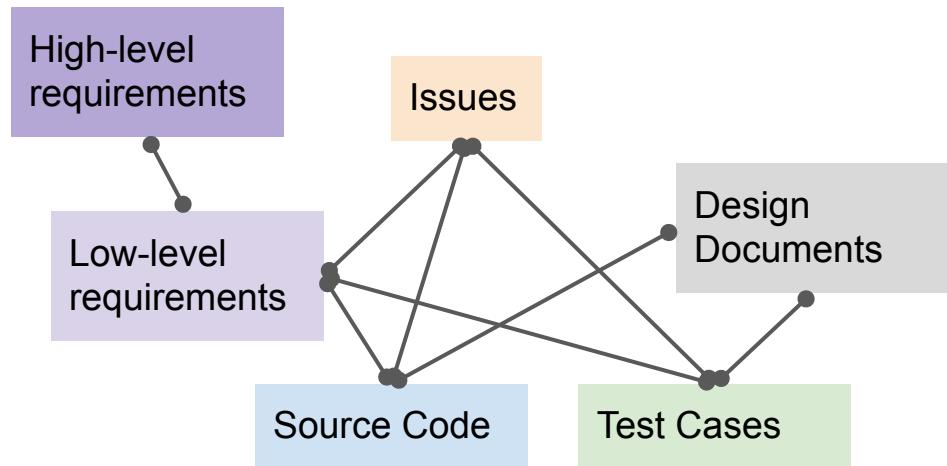
- Engineering organizations
- Software vendors
- Research organizations
- Universities
- Standards organizations



# Use Case to Connect Data: Traceability

---

# Traceability Required for Safety



# Problem

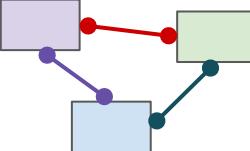
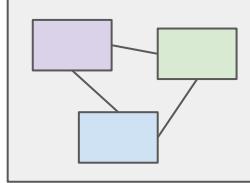
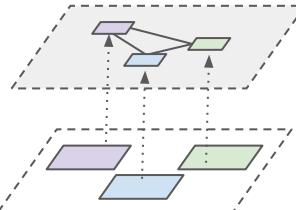
**Engineers** cannot easily create traceability links (too much manual copy/paste of data and identifiers across engineering software applications)

**Lack of traceability** leads to more design errors, less safety, more costs to fix issues, more production delays, and in the worst case loss of life

# Approaches to Connect Data

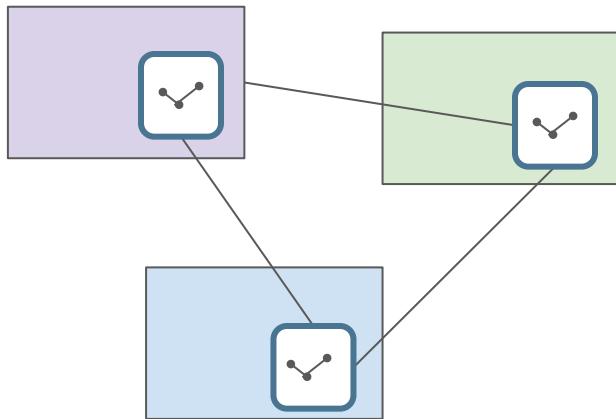
---

# Existing Traceability Approaches

Point-to-point		<ul style="list-style-type: none"><li>• Cannot scale</li><li>• Each point-to-point integration is unique (different UX)</li><li>• no holistic overview of trace links</li></ul>
All-in-one		<ul style="list-style-type: none"><li>• No one size fits all (e.g. UX of ALM, PLM, MBSE, and simulation apps are very different, and have never successfully been integrated into a single app)</li><li>• Vendor lock-in often prevents extensibility</li></ul>
3rd party		<ul style="list-style-type: none"><li>• Loss of context: only a subset of app data is copied into 3rd party app</li><li>• Bad UX: Engineers need to switch to 3rd party app to create trace links</li></ul>

# Solution: In-App Traceability Solution

## In-App

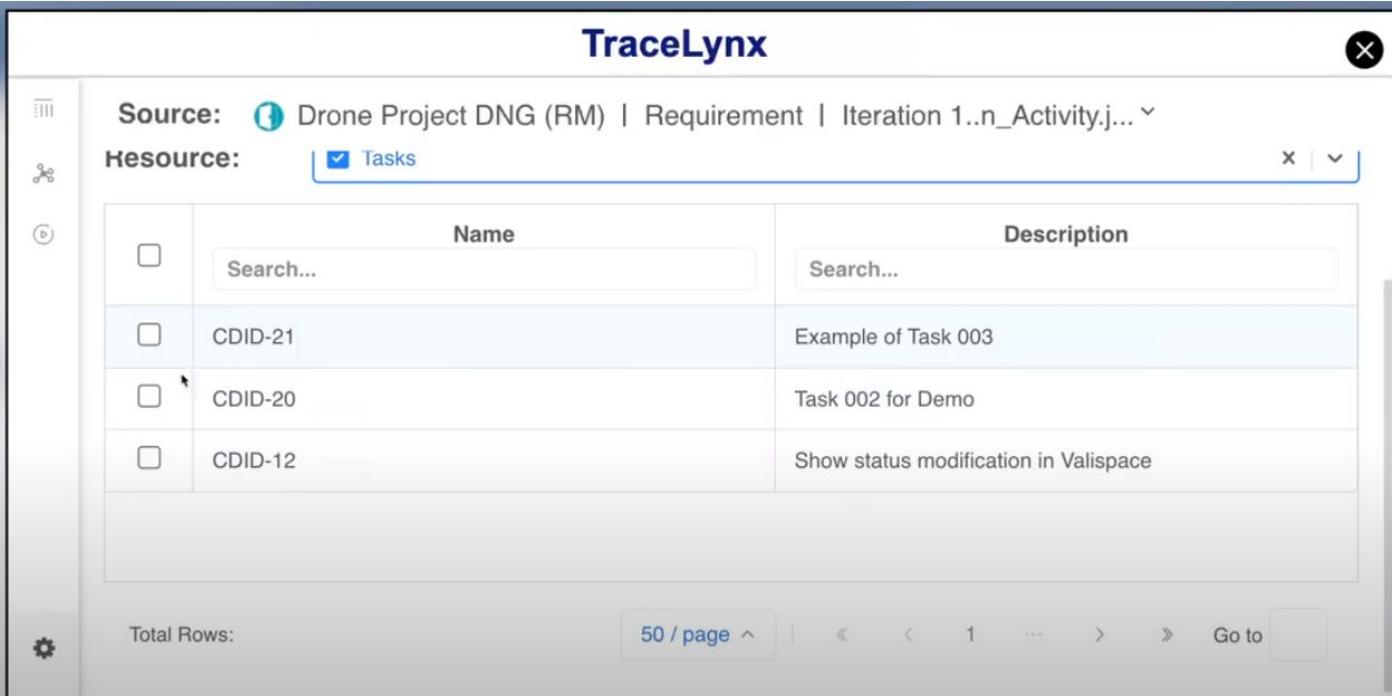


- Links can be created **without a third-party application**. Engineers can keep using their daily applications but with additional traceability superpowers.
- **Common UX** to manage cross-functional aspects, incl. holistic overview of trace links
- **No vendor lock-in**: standards used to create the adapters and trace links will be accessible via an API to allow other vendors and organizations to develop their own link management applications
- **Mix-n-Match** applications that need to be connected for traceability and **plug-n-play integration** of best-of-breed applications is possible

# Quick Demo

---

# Linking Requirement to Task

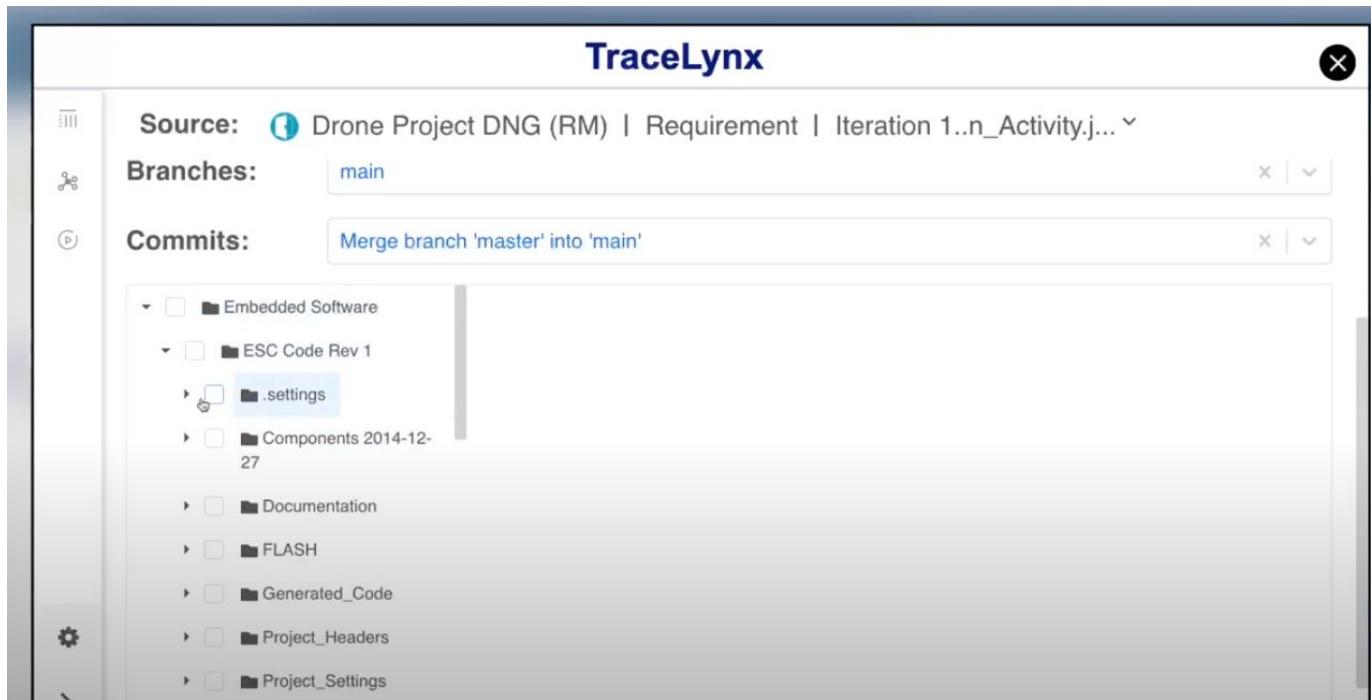


The screenshot shows the TraceLynx software interface. The title bar says "TraceLynx". The "Source" field is set to "Drone Project DNG (RM) | Requirement | Iteration 1..n\_Activity.j...". The "Resource" field is set to "Tasks". The main area is a table with columns "Name" and "Description". The table contains the following data:

	Name	Description
<input type="checkbox"/>	Search...	Search...
<input type="checkbox"/>	CDID-21	Example of Task 003
<input type="checkbox"/>	CDID-20	Task 002 for Demo
<input type="checkbox"/>	CDID-12	Show status modification in Valispace

At the bottom, there is a "Total Rows:" label, a "50 / page" dropdown, and a navigation bar with arrows and a "Go to" input field.

# Linking Requirement to Block of Code

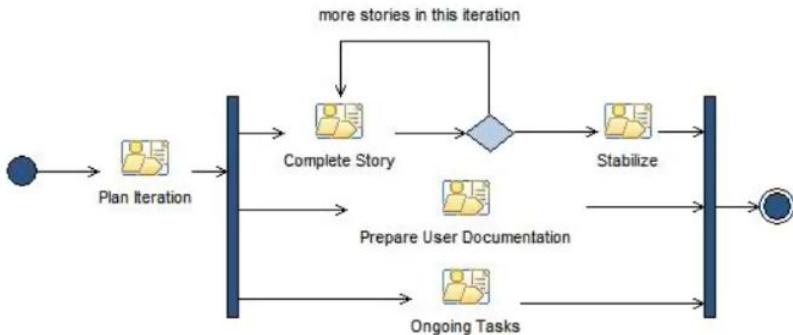


# How It Works

---

← | ... > images > | 67629 Iteration 1..n\_Activity.jpeg ?

 Download for viewing  Download and lock for editing  Upload a new version



Lightweight  
context-specific UI  
extension provided  
by Web browser  
extension

67629: Iteration  
1..n\_Activity.jpeg

 No Tags Defined

Description: CLM for IT agility@scale(tm) solution

Project: Drone Project DNG (RM)

Team Ownership: Drone Project DNG (RM)

Created On: Sep 28, 2023, 2:28:12 PM

Created By: **koneksys**

Modified On: Sep 28, 2023

Modified By: koneksys

Is Suspect:

Type:  Supporting Resource

Format:  File

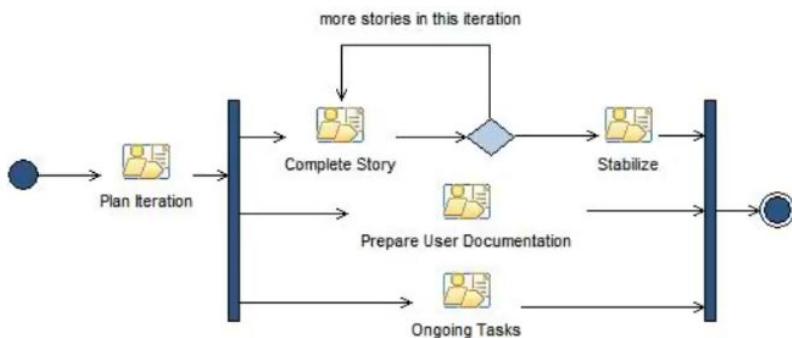
## Comments

## Links

### Where I Used

← | ... > images > | 67629 Iteration 1..n\_Activity.jpeg

Download for viewing Download and lock for editing Upload a new version



On mouse hover, UI extension becomes more visible

67629: Iteration 1..n\_Activity.jpeg

No Tags Defined

Description: CLM for IT agility@scale(tm) solution

Project: Drone Project DNG (RM)

Team Ownership: Drone Project DNG (RM)

Created On: Sep 28, 2023, 2:28:12 PM

Created By: koneksys

Modified On: Sep 28, 2023, 2:28:12 PM

Modified By: koneksys

Is Suspect:

Type: Supporting Resource

Format: File

Comments

Links

Where Used

⚠ Your ALM license will expire in 17 days.

## Battery presence sensor

Details



Required Editable [All](#)



### Default

Parent

EPS Hardware requirements



Tracker

Hardware Safety Requirements



Business

Must have



Status

DRAFT



Upstream Reference

Charger



Type

Functional

Risk



Complexity



Reached Coverage

Release



Submitted by

bond



Submitted at

Sep 28 2023 14:22

Lightweight  
context-specific UI  
extension provided  
by Web browser  
extension

⚠ Your ALM license will expire in 17 days

## Battery presence sensor

Details



+

⋮

Required Editable All

### Default

Parent

EPS Hardware requirements



Tracker

Hardware Safety Requirements



Status

DRAFT



Risk



Complexity



Reache



Release



Submitted by  
bond

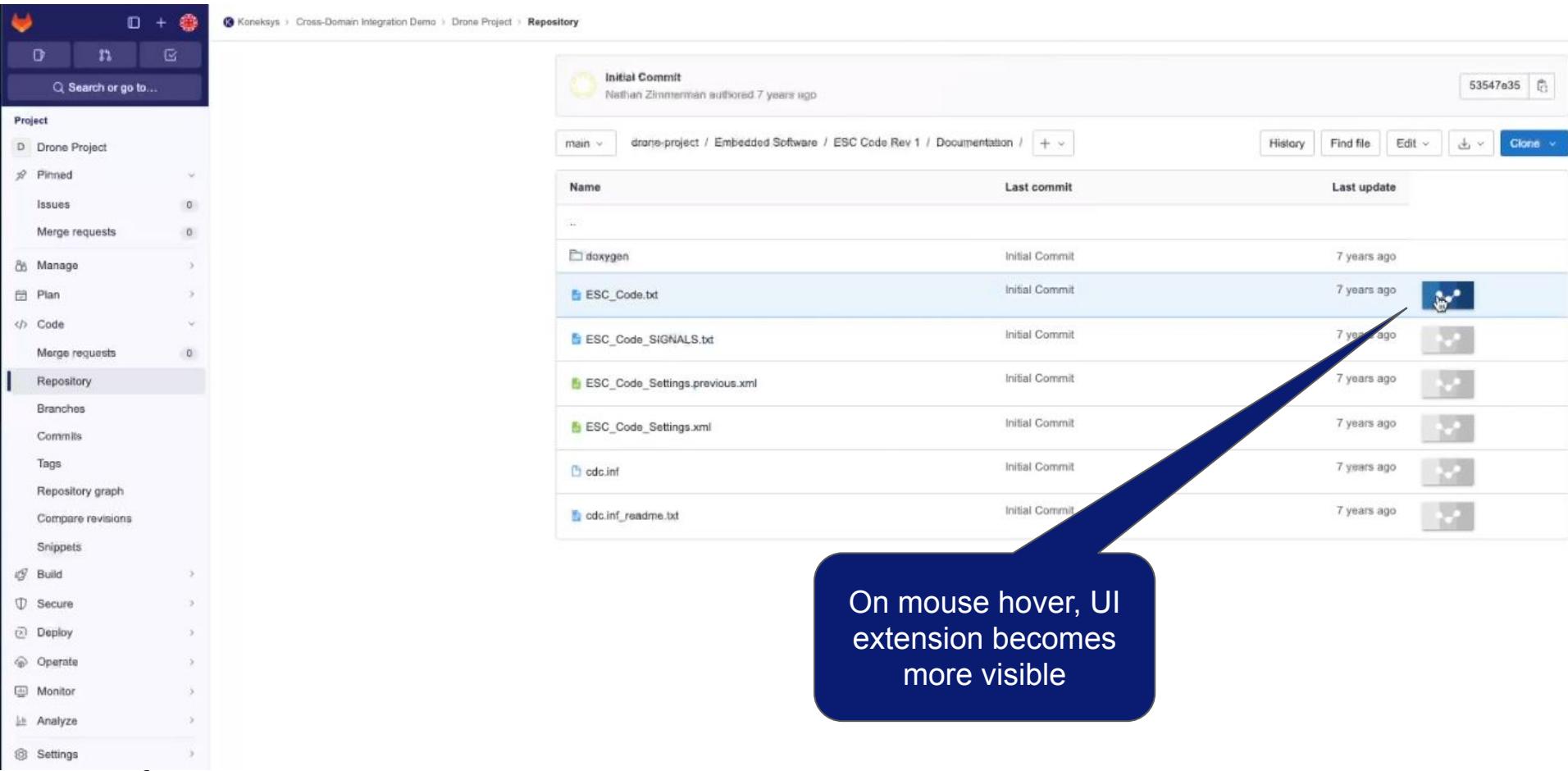


Submitted at  
Sep 28 2023 14:22

On mouse hover, UI extension becomes more visible

A screenshot of the Jira Software interface. The top navigation bar includes 'Jira Software', 'Your work', 'Projects', 'Filters', 'Dashboards', 'Teams', 'Apps', 'Create', and a search bar. The left sidebar shows 'Cross-Domain Integra...' as a 'Software project' with sections for 'PLANNING' (Timeline, Backlog, Board), 'DEVELOPMENT' (Code, Project pages, Add shortcut, Project settings), and 'Activity' (Comments tab selected, showing a comment input field and a pro tip). The main content area shows a task titled 'Example of Task 003' with sub-tasks and activity. A large blue arrow points from the 'Comments' tab in the sidebar to a blue callout box in the center. The callout box contains the text: 'On mouse hover, UI extension becomes more visible'. To the right of the callout, the task details are visible, including 'To Do' and 'Actions' tabs, assignee (Unassigned), labels (None), sprint (None), and story point estimate (None). A 'Quick start development' section is also present. The bottom of the page shows creation and update dates (December 1, 2022) and a 'Configure' button.

On mouse hover, UI extension becomes more visible



The screenshot shows a software interface with a dark-themed sidebar on the left and a light-themed main content area. The sidebar contains various project management and development tools. The main content area is a 'Repository' view showing a list of files in a 'main' branch. A large blue arrow points from a callout box to the file list, highlighting the UI extension for the 'ESC\_Code.txt' file. The callout box contains the text: 'On mouse hover, UI extension becomes more visible'.

Initial Commit  
Nathan Zimmerman authored 7 years ago

main ▾ drone-project / Embedded Software / ESC Code Rev 1 / Documentation / + ▾

History Find file Edit ▾ Clone ▾

Name	Last commit	Last update
doxygen	Initial Commit	7 years ago
ESC_Code.txt	Initial Commit	7 years ago
ESC_Code_SIGNALS.txt	Initial Commit	7 years ago
ESC_Code_Settings.previous.xml	Initial Commit	7 years ago
ESC_Code_Settings.xml	Initial Commit	7 years ago
cdc.inf	Initial Commit	7 years ago
cdc.inf_readme.txt	Initial Commit	7 years ago

On mouse hover, UI extension becomes more visible

# TraceLynx



Source: Drone Project DNG (RM) | Requirement | Iteration 1..n\_Activity.j...

Search...

<input type="checkbox"/> > Link Type	Resource Type	Target	Status	Actions
<input type="checkbox"/> > issueCompliedByFile	Search...	Search...	Search...	<input type="button" value="Search"/>
		ESC_Code.txt [51-54]		⋮

Context-specific  
dialog for a specific  
artifact → display of  
artifact title

Total Rows: 1

10 / page



# TraceLynx



Source: Drone Project DNG (RM) | Requirement | Iteration 1..n\_Activity.j...

Search...

<input type="checkbox"/> > Link Type	Resource Type	Target	Status	Actions
<input type="checkbox"/> > issueCompliedByFile	Search...	Search...	Search...	<input type="button" value="Search"/>
		ESC_Code.txt [51-54]		

Context-specific  
dialog for a  
specific artifact →  
display of existing  
links for that  
artifact

Total Rows: 1

10 / page



1



# TraceLynx



Source: Drone Project DNG (RM) | Requirement | Iteration 1..n\_Activity.j...

Search...

Link Type	Resource Type	Target	Status	Actions
<input type="checkbox"/> > issueCompliedByFile	Search...	Search...	Search...	Search ▾
		ESC_Condition [51-54]		⋮

Total Rows: 1 10 / page ▾ < < 1 > > >>

Context-specific dialog for a specific artifact → display of create link button whereby artifact would be link source

# TraceLynx



Source: Drone Project DNG (RM) | Requirement | Iteration 1..n\_Activity.j...

Link:

tr

trackedBy

constrains

constrainedBy

Creation of link →  
selection of link  
type

Cancel

OK

# TraceLynx



Source:  Drone Project DNG (RM) | Requirement | Iteration 1..n\_Activity.j...



Link:

trackedBy



Target:

 Jira



cross

Cross-Domain Integration

Cross-Domain Integration Demo

Creation of link →  
selection of link  
target application  
and project



Cancel

OK

# TraceLynx



Source: Drone Project DNG (RM) | Requirement | Iteration 1..n\_Activity.j...

Link: trackedBy x | v

Target: Jira x | v Cross-Domain Integration Demo x | v

Resource: Choose resource type v

- Tasks
- Epics
- User Stories
- Bugs
- Improvements
- New Features

Creation of link →  
selection of link  
target artifact type

Cancel

OK

# TraceLynx



Source: Drone Project DNG (RM) | Requirement | Iteration 1..n\_Activity.j...

	Name	Description
<input checked="" type="checkbox"/>	CDID-21	Example of Task 003
<input type="checkbox"/>	CDID-20	Task 002 for Demo
<input type="checkbox"/>	CDID-12	Show status modification in Valinspace

Total Rows:

1 ... > >> Go to

Creation of link →  
selection of link  
target

Cancel

OK

# TraceLynx



Source: Drone Project DNG (RM) | Requirement | Iteration 1..n\_Activity.j...



Search...

Search

Create Link



> Link Type

Resource Type

Target

Status

Actions

Search...

Search...

Search...

Search

> issueCompliedByFile

ESC\_Code.txt [51-54]



trackedBy

CDID-21....



Creation of link →  
created link  
appears in list of  
links

Link successfully created

Total Rows: 2

10 / page



1



# TraceLynx



Source: Drone Project DNG (RM) | Requirement | Iteration 1..n\_Activity.j...



Search...

Search

Create Link



> Link Type

Resource Type

Target

Status

Actions

Search...

Search...

Search...

Search

> issueCompliedByFile

ESC\_Code.txt [51-54]



trackedBy

CDID-21....



Link status  
changes if a linked  
artifact has been  
modified

Total Rows: 2

10 / page

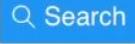


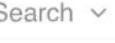
1



# TraceLynx

Source:  Drone Project DNG (DNG) ▾ requirement ▾ iteration ▾ Activity...

 Search...  Search  Create Link  

 ▾ Link Type	Resource Type	Target	Status	Actions
<input type="checkbox"/> ▾ issueCompliedByFile	 Search...  Search...  Search...  Search ▾	ESC_Code.txt [51-54]	 ▾	
		CDID-21....	 ▾	

 **CDID-21**

**Overview**

Description	Example of Task 003
Status	Valid

**Details**

 Project	Cross-Domain Integration Demo
Label	

UI preview on  
mouse hover over  
link target

« < 1 > »

# TraceLynx

Source:  Drone Project DNG (DNG) | Requirements | Iterations | Activity...

Link Type	Resource Type	Target	Status	Actions
<input type="checkbox"/> > Link Type	Search...	Search...	Search...	<input type="button" value="Search"/>
<input type="checkbox"/> > issueCompliedByFile		ESC_Code.txt [51-54]	<input checked="" type="checkbox"/>	<input type="button" value=""/>
		CDID-21....	<input checked="" type="checkbox"/>	<input type="button" value=""/>

Click to open link in web application.

 **CDID-21**

Overview

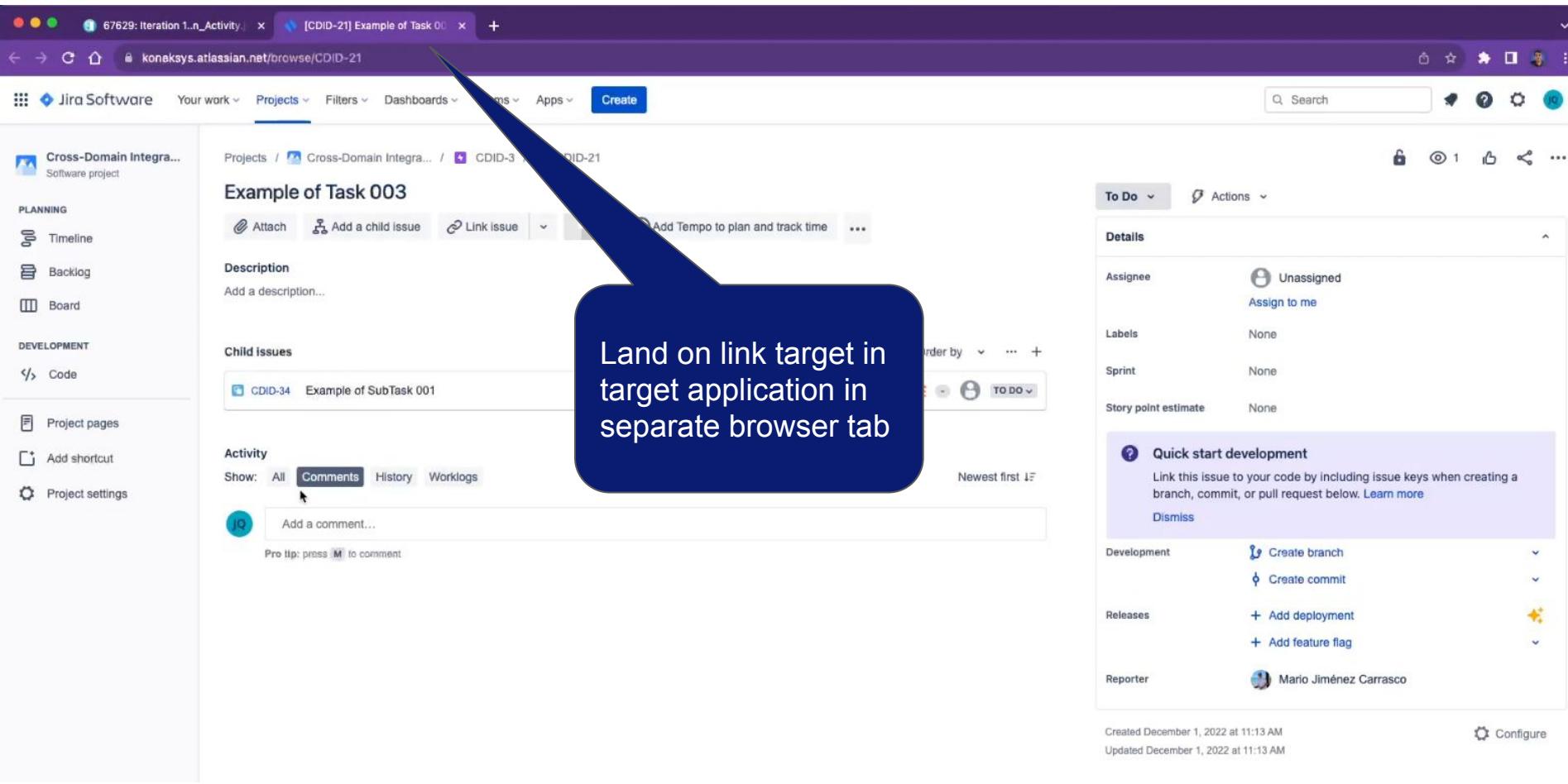
Description Example of Task 003

Status Valid

Details

Project Cross-Domain Integration Demo

Click on link target title in UI preview to navigate to link target



The screenshot shows a Jira Software interface for an issue titled 'Example of Task 003'. The page includes a sidebar with project navigation, a main content area with tabs for 'Description', 'Child issues', and 'Activity', and a right sidebar with 'Details' and 'Quick start development' sections. A large blue callout box with the text 'Land on link target in target application in separate browser tab' is overlaid on the 'Activity' section.

67629: Iteration 1\_n\_Activity.x [CDID-21] Example of Task 003 + koneksys.atlassian.net/browse/CDID-21

Jira Software Your work Projects Filters Dashboards Apps Create

Search

Cross-Domain Integra... Software project

PLANNING

- Timeline
- Backlog
- Board

DEVELOPMENT

- Code

Project pages

Add shortcut

Project settings

Example of Task 003

Attach Add a child issue Link issue Add Tempo to plan and track time ...

Description

Add a description...

Child issues

CDID-34 Example of SubTask 001

Activity

Show: All Comments History Worklogs

Add a comment... Pro tip: press M to comment

TO DO

Newest first

Details

Assignee Unassigned Assign to me

Labels None

Sprint None

Story point estimate None

Quick start development

Link this issue to your code by including issue keys when creating a branch, commit, or pull request below. Learn more

Dismiss

Development

- Create branch
- Create commit

Releases

- Add deployment
- Add feature flag

Reporter

Mario Jiménez Carrasco

Created December 1, 2022 at 11:13 AM Updated December 1, 2022 at 11:13 AM

Configure

Land on link target in target application in separate browser tab

67629: Iteration 1..n\_Activity.x 67629: Iteration 1..n\_Activity.x [CDID-21] Example of Task 00 [CDID-21] Example of Task 00 + [koneksys.atlassian.net/browse/CDID-21](https://koneksys.atlassian.net/browse/CDID-21) 

## TraceLynx

Source: Projects | Task | CDID-21

Search...  Create Link  

<input type="checkbox"/> > Link Type	Resource Type	Target	Status	Actions
<input type="checkbox"/> > tracksRequirement	Search... <input type="button" value="Search..."/>	Search... <input type="button" value="Search..."/>	Iteration 1..n_Activity.jpeg... 	

Total Rows: 1 | 10 / page 

TraceLynx dialog of link target has reverse link to previous link source

Click on target of  
reverse link to  
navigate back to the  
original link source

67629: Iteration 1..n\_Activity.x | [CDID-21] Example of Task 00 | 67629: Iteration 1..n\_Activity.x | +

Not Secure

Requirements Management (/rm)

## Drone Project DNG (RM)

Project Dashboard Artifacts Reviews Reports

Search Artifacts

... > images > | 67629 Iteration 1..n\_Activity.jpeg

Download for viewing Download and lock for editing Upload a new version

more stories in this iteration

Complete Story

Prepare User Documentation

Ongoing Tasks

Stabilize

Plan Iteration

3rd browser tab shows same artifact as in the first browser tab (original link source)

Overview

67629: Iteration 1..n\_Activity.jpeg

No Tags Defined

Description: CLM for IT agility@scale(tm) solution

Project: Drone Project DNG (RM)

Team Ownership: Drone Project DNG (RM)

Created On: Sep 28, 2023, 2:28:12 PM

Created By: koneksys

Modified On: Sep 28, 2023, 2:28:12 PM

Modified By: koneksys

Is Suspect:

Type: Supporting Resource

Format: File

Comments

Links

Where Used

IBM.

jazz

# A Few Link Management Apps

---

# TraceLynx

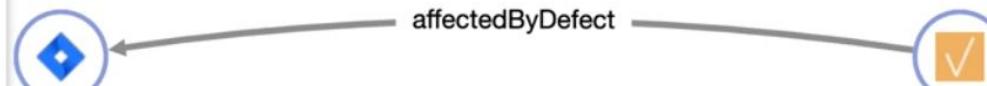


Link Editor

Graph View

Pipelines

Graph view of  
created links



The propellant volume mass should be less than 65.00 liters



 Users Integrations Projects Link Rules Events Pipelines[Add New](#) 

ID	Script	Event	Action
18	update_valispace_status.py	Jira event	 

Total Rows: 1

10 / page     Configuration of event-based pipelines

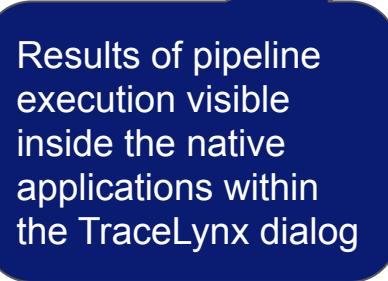
 

Started	Duration (s)	Event	Organization	Status	Action
10/10/2023, 12:1...	5.31	Jira event	Koneksys		 
10/10/2023, 12:1...	1.118	Jira event	Koneksys		 
10/10/2023, 12:1...	4.421	Jira event	Koneksys		 

Total Rows: 3

5 / page 

1



Results of pipeline execution visible inside the native applications within the TraceLynx dialog



- Users
- Integrations
- Projects
- Link Types
- Link Constraint
- Events
- Pipelines
- Migration

**Source**

- Valispace
- Training Workspace
- Valicopter\_5000
- Requirements

**Direction**

Choose direction

**Target**

- Jira
- ADAM
- Create New Project
- Tasks

**Cancel** **Submit**

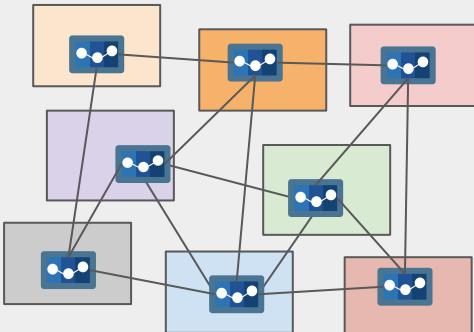
Shallow syncing  
configuration

# Architecture

---

# Architecture

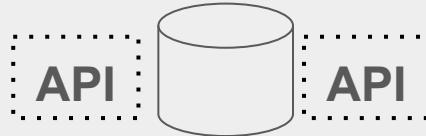
## TraceLynx Adapters



Reference implementation will be released as open-source

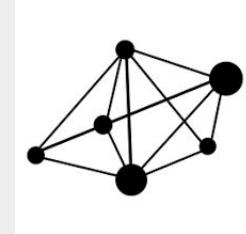
## TraceLynx Link Repository

Persistence of links as well as their metadata, events, and pipelines



Open API allowing others to create apps to manage links

## Link Management Apps



Apps can be created by other vendors or organizations

# Adapters

## Current Adapters:

- CodeBeamer
- GitLab
- Glide SysLM
- IBM DOORS NG
- JIRA
- Valispace
- Bitbucket
- Github
- ServiceNow

## Recycling old OSLC adapters into TraceLynx adapters :

- Modelon Impact
- TestRail

## Potential future adapters on our roadmap

- Excel 365
- SAP ERP
- PTC Windchill

# Inspired by OSLC

---

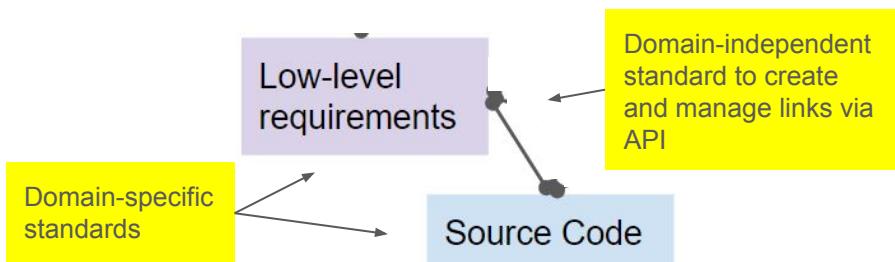
# Commonalities And Differences with OSLC

## In Common with OSLC

- Usage of Web standards to identify linked artifacts (e.g. HTTP URLs)
- Link description is agnostic to the description of the linked artifacts
- **Standardized API to create and manage links**

## Differences with OSLC

- No usage of RDF as API request payload format



# Next Steps

Capturing versions of links and versions of linked artifacts

Conducting discovery calls with potential customers

- Which use cases?
- Which pain points?
- Which adapters?
- Which link management applications?

Discovering early adopters

Please contact me if you want to share your perspective!

Thanks and get in touch!  
[axel.reichwein@tracelynx.com](mailto:axel.reichwein@tracelynx.com)