

# Automating Builds

## in Git on IBM i

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🌟 Special thank you to Liam Allan for slide content!

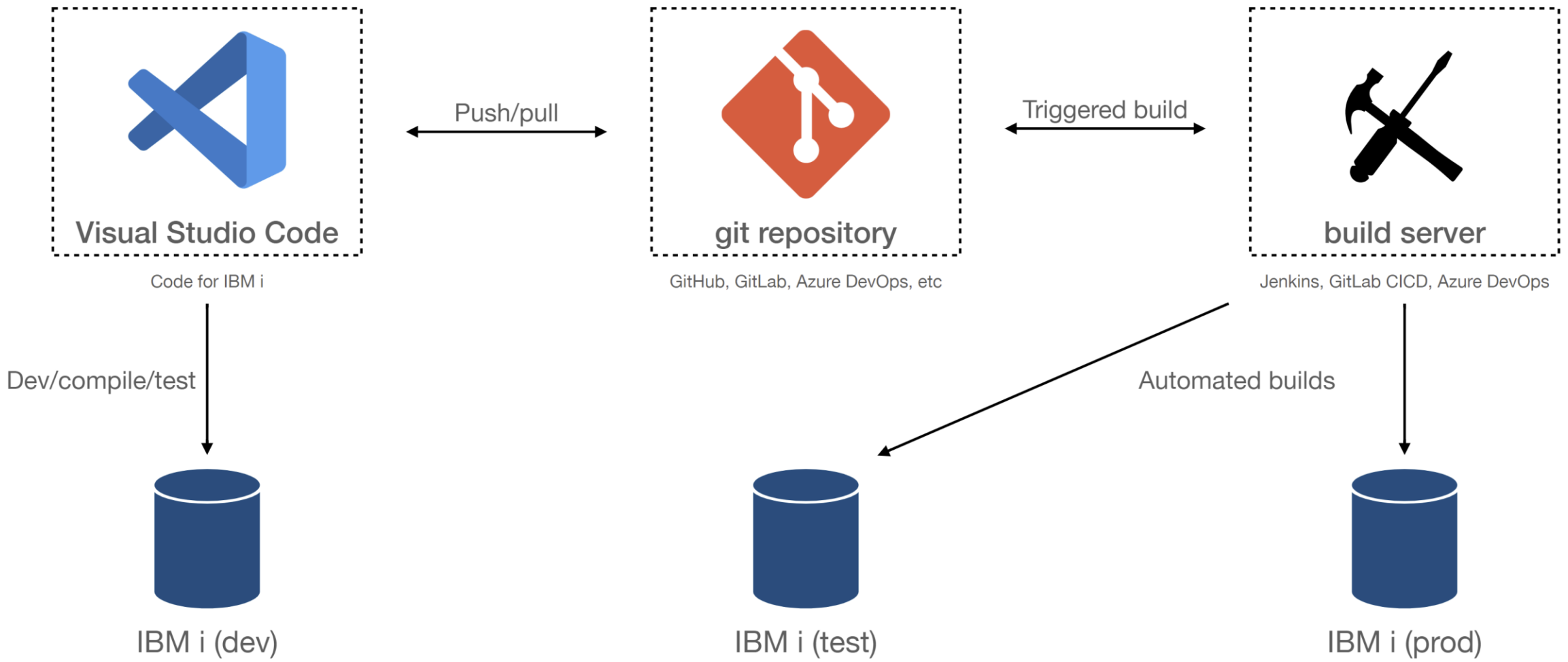


# Agenda

- The Modern Development Lifecycle with Git
- Unlock Automated Builds with ibmi-ci
- ILE Dependency Analysis with Source Orbit
- Use Cases
- Demo

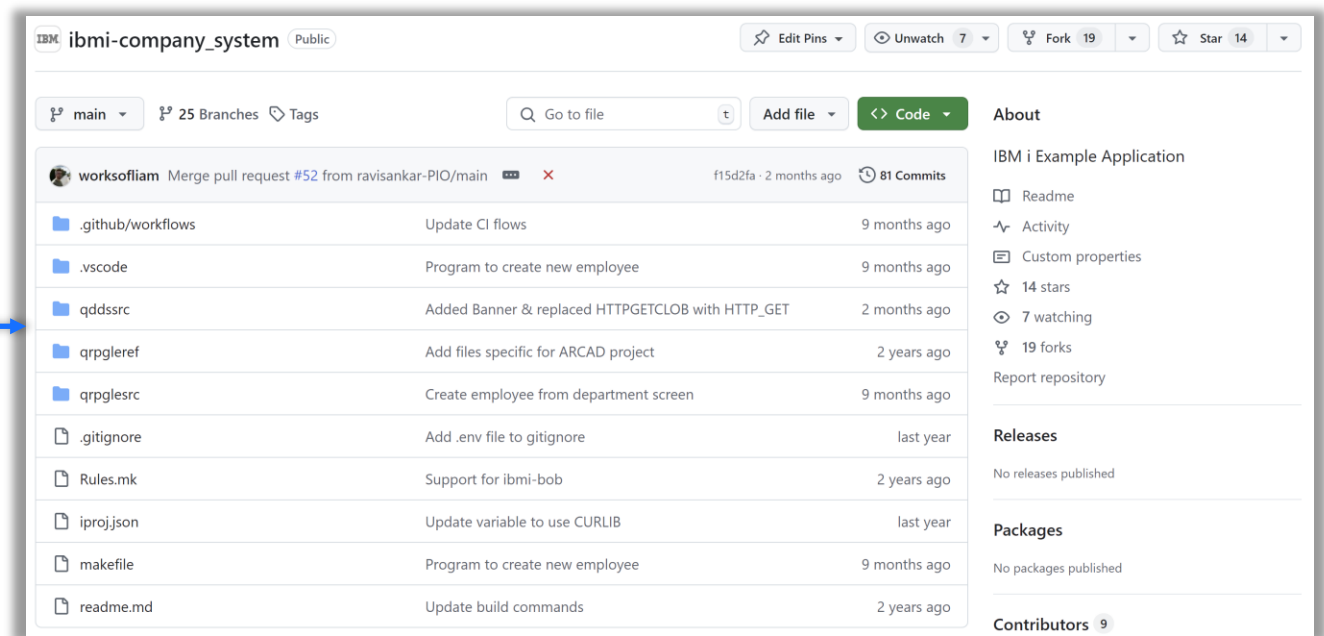
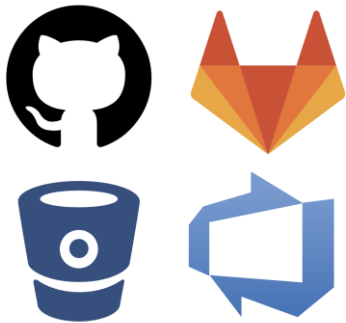
# **The Modern Development Lifecycle with Git**

# What Does Modern Development Look Like?



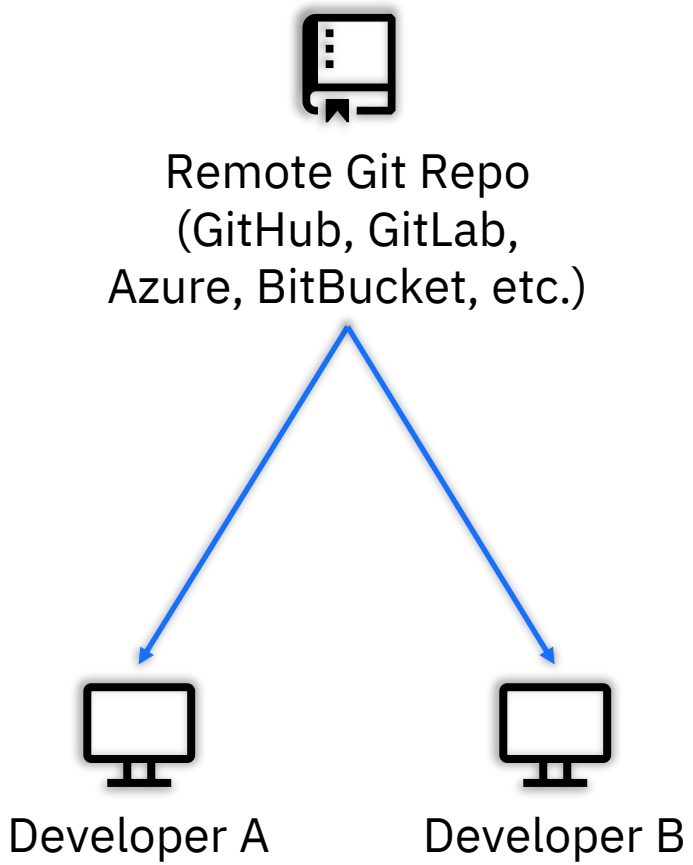
# Development with Git

- Source is managed by Git
  - Complete change history
  - Branching and merging capabilities
  - Traceability
- Variety of options for Git hosting services
  - GitHub, GitLab, Azure DevOps, etc

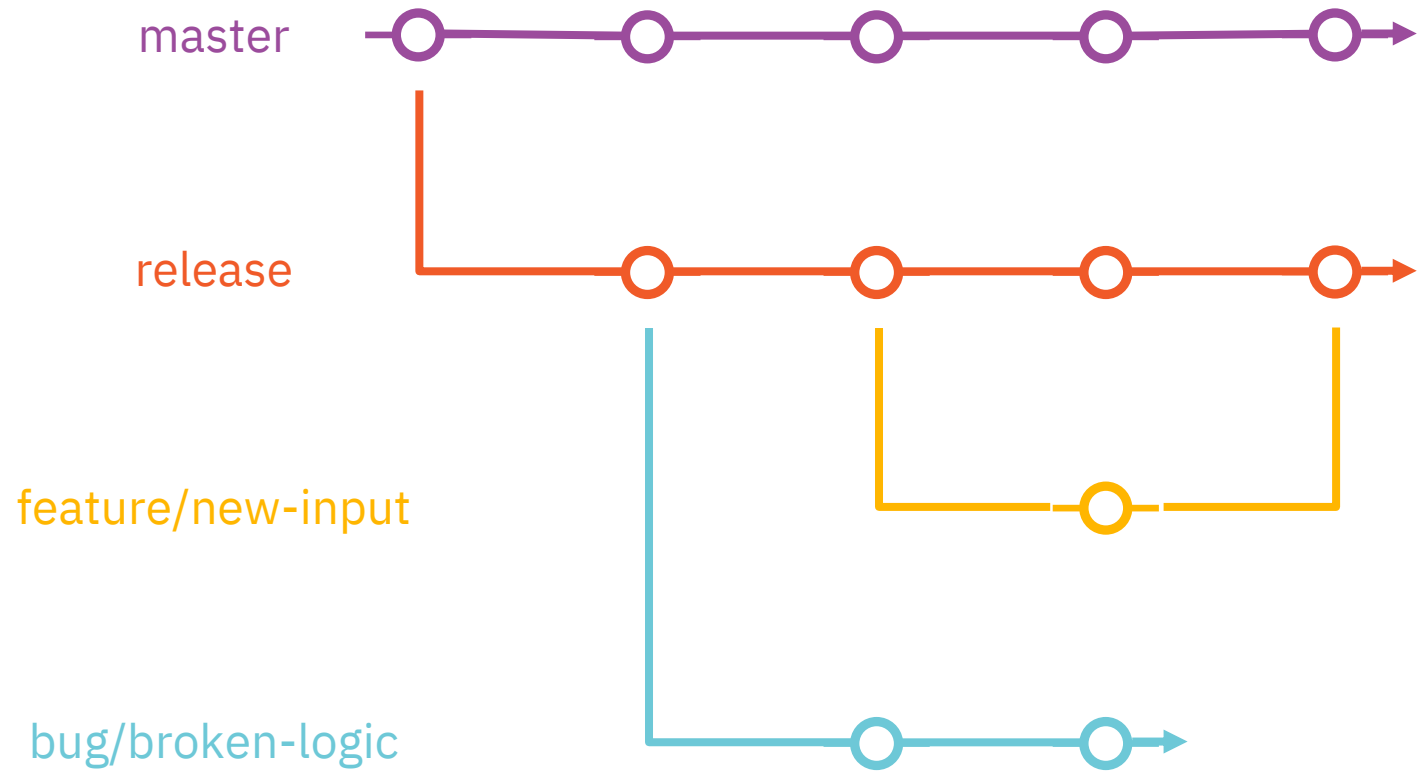


# Why use Git?

## Distributed Development



## Version Control and Git Workflow

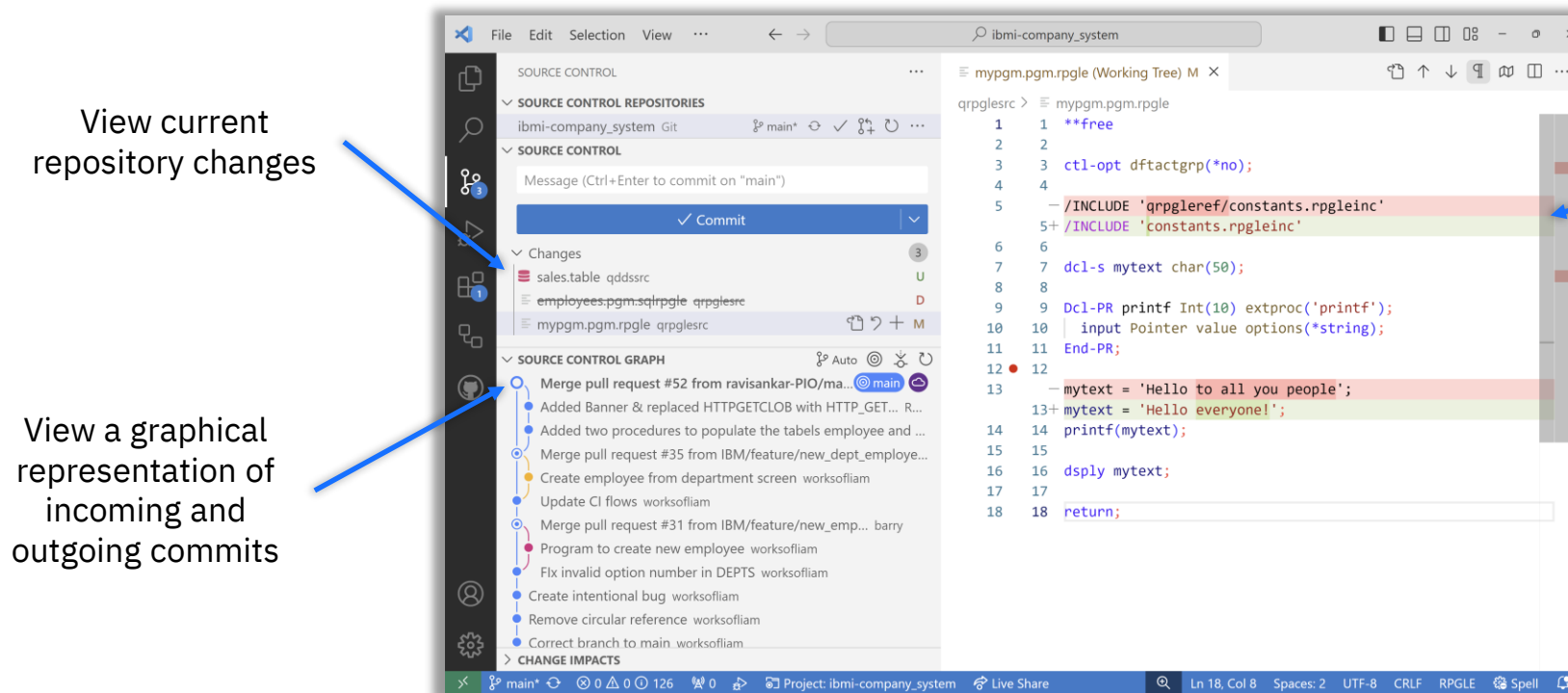


# Local Development Experience

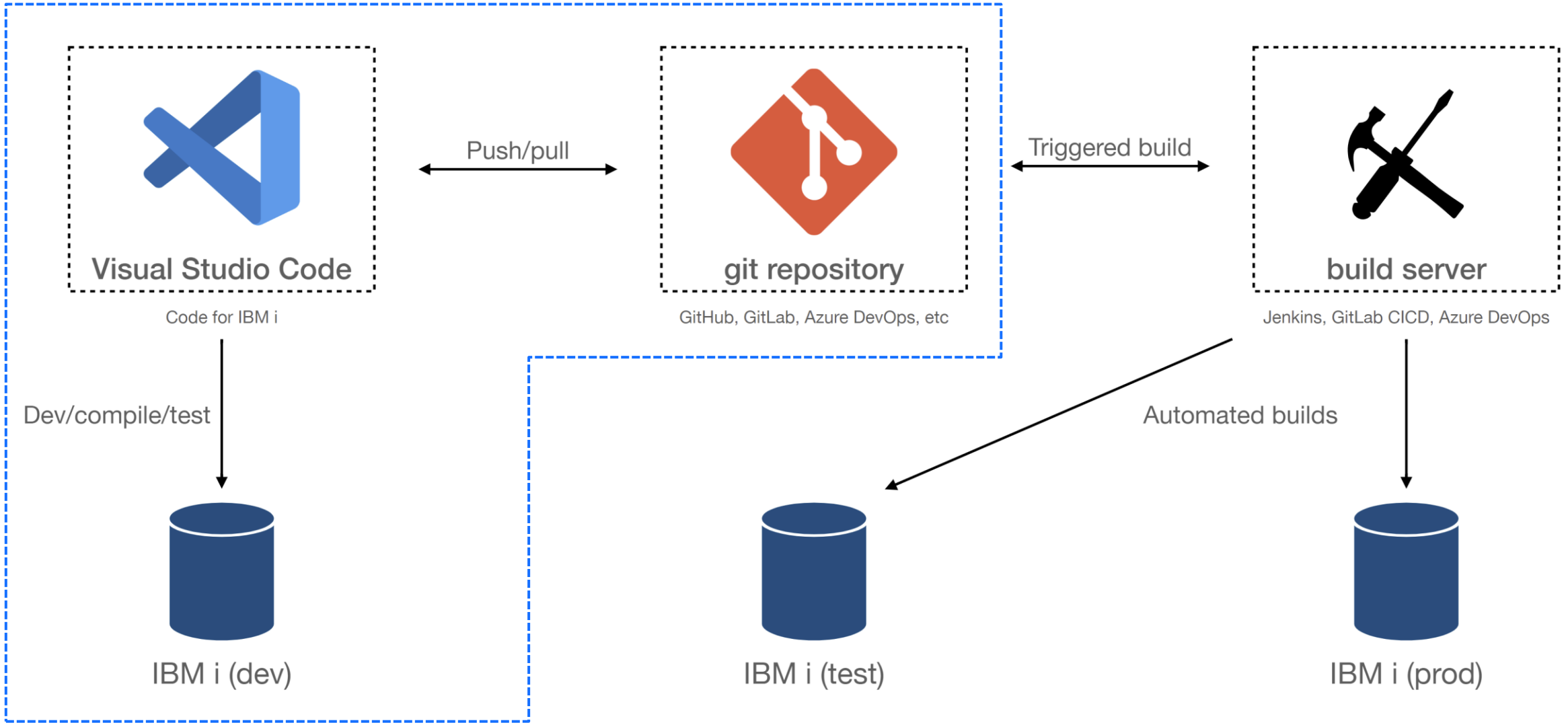
- IBM i
  - IBM i integration via open-source extensions
  - Support for RPGLE, COBOL, CL, SQL, and more!
- Git
  - First class Git support
  - Hundreds of Git tools



Code for IBM i

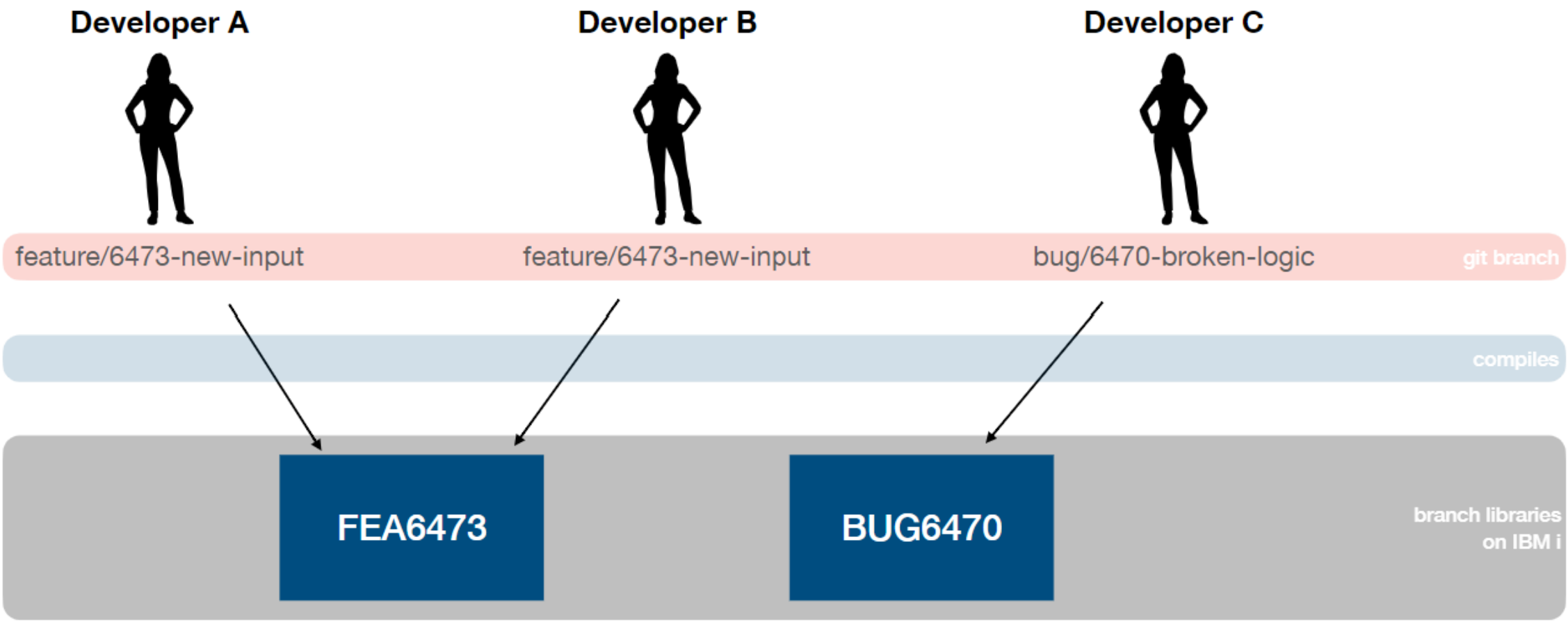


# How to work efficiently with these 3 components?



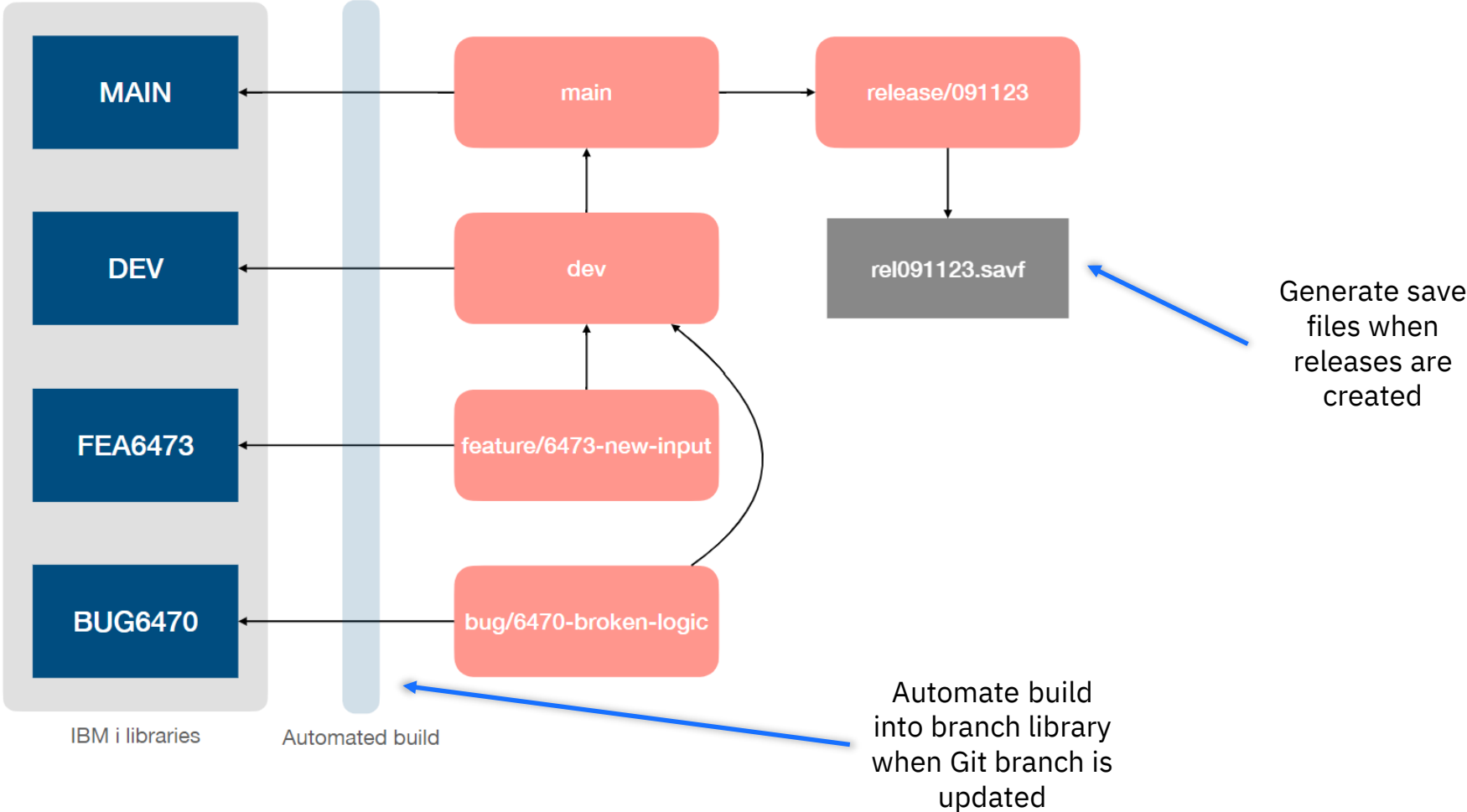


# Map Git branches to libraries on IBM i



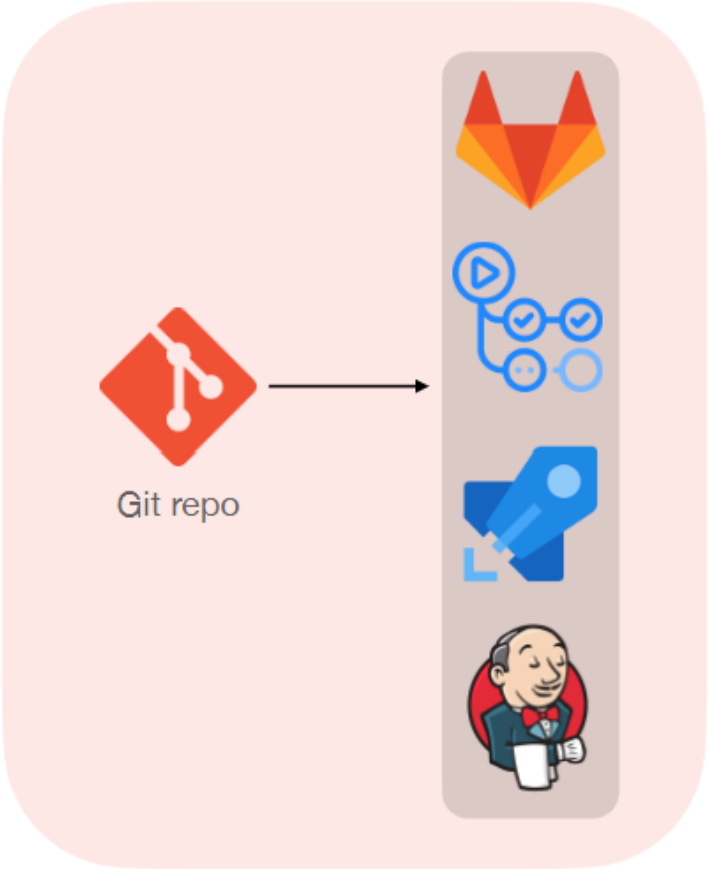
# Build Server

*Let's go one step further and automate this process*



# How to create workflows?

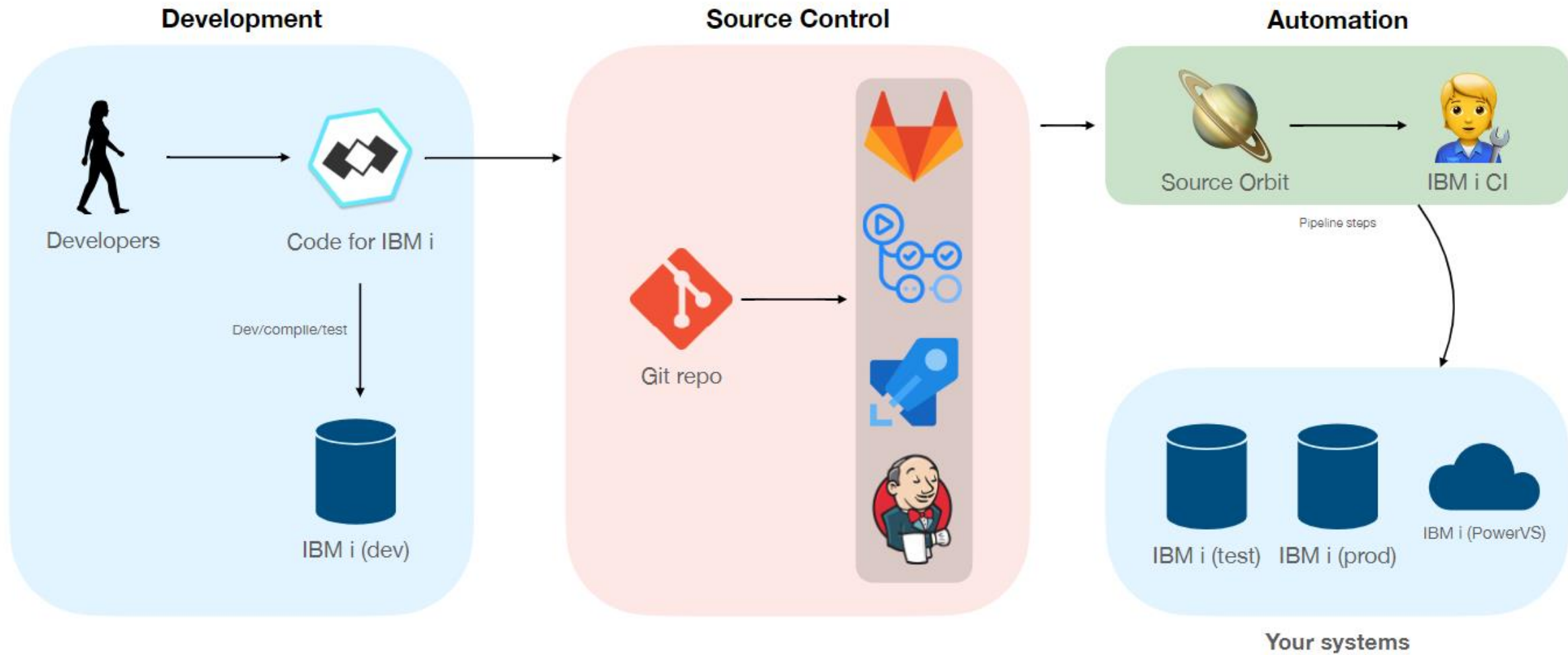
## Source Control & Automation



GitLab	<code>.gitlab-ci.yml</code>
Azure DevOps	<code>azure-pipeline.yml</code>
GitHub	<code>anything.yml</code>
Jenkins	<code>Jenkinsfile</code>

yml can also be yaml

# How to achieve automation with IBM i?



# Unlock Automated Builds with ibmi-ci

# Overview

- A CLI tool to simplify working with IBM i from pipelines (ex. GitHub Actions, GitLab CICD, etc.)
- Outline a series of steps to perform with the first default step being to connect to an IBM i
- Installation: `npm i @ibm/ibmi-ci`
- Establishing IBM i connection
  - Required
    - IBMI\_HOST
    - IBMI\_SSH\_POST
    - IBMI\_USER
  - At least one required
    - IBMI\_PASSWORD
    - IBMI\_PRIVATE\_KEY

The screenshot shows the GitHub repository page for `@ibm/ibmi-ci`. The repository is a TypeScript (TS) project, version 0.2.5, published a year ago. It has 1 dependency and 0 dependents. The page includes tabs for Readme, Code (Beta), 1 Dependency, 0 Dependents, 4 Versions, and Settings. The main content area is titled `ibmi-ci` and describes it as a command line tool to make it easier to work with IBM i from pipelines. It includes sections for Installation, How to use, and a list of collaborators. The installation instructions show how to install the package using npm. The 'How to use' section provides an example of running the `ici` command with various options. The right sidebar shows the weekly download count (56), version (0.2.5), license (Apache 2), unpacked size (1.75 MB), total files (21), and the last publish date (a year ago).

**@ibm/ibmi-ci** TS  
0.2.5 • Public • Published a year ago

Readme Code (Beta) 1 Dependency 0 Dependents 4 Versions Settings

## ibmi-ci

ibmi-ci is a command line tool to make it easier to work with IBM i from pipelines, like GitHub Actions, GitLab CICD, etc.

### Installation

Read about [installing packages from GitHub](#).

### How to use

After installation, run `ici` to see the help text and available parameters.

ibmi-ci is made up of steps and steps are built up from parameters, with the default step of connecting to the remote system, which always takes a place.

The steps `ici` will take is based on the parameters used on the CLI. For example:

```
ici \  
  --rcwd "./builds/myproject" \  
  --push "." \  
  --cmd "/QOpenSys/pkg/bin/gmake BIN_LIB=MYLIB"
```

Install

```
> npm i @ibm/ibmi-ci
```

Weekly Downloads

56

Version	License
0.2.5	Apache 2

Unpacked Size	Total Files
1.75 MB	21

Last publish  
a year ago

Collaborators

[Try on RunKit](#)

# CLI Usage

<code>--lcwd &lt;localDirectory&gt;</code>	Sets the current working directory on the local system
<code>--rcwd &lt;remoteDirectory&gt;</code>	Sets the current working directory on the remote system. It will be created if it does not exist.
<code>--push &lt;remoteRelativeDirectory&gt;</code>	Pushes the current working directory to a chosen directory on the IBM i
<code>--pull &lt;remoteRelativeDirectory&gt;</code>	Pulls a directory from IBM i to the local current working directory
<code>--get &lt;remoteRelativeDirectory&gt; &lt;localRelativePath&gt;</code>	Gets a specific file from IBM i
<code>--cmd &lt;shellCommand&gt;</code>	Execute a command on the remote system
<code>--cl &lt;clCommand&gt;</code>	Execute a CL command on the remote system

# Simplistic Example

Upload the local  
working directory to  
the remote working  
directory (.)

Build project with  
gmake

```
ici \  
  --rcwd "./builds/myproject" \  
  --push "." \  
  --ignore --cl "CRTLIB LIB(MYLIB)" \  
  --cmd "/QOpenSys/pkg/bin/gmake BIN_LIB=MYLIB"
```

Set the remote  
working directory to  
./builds/myproject

Create build library if  
it does not exist

★ IBM i connection is specified as environment variables

Suppress errors and  
continue execution



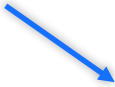
# GitHub Action Example

```
jobs:
  ibmi-build:
    environment: COMMON1
    runs-on: ubuntu-latest
    steps:
      # Checkout repository and setup node steps omitted

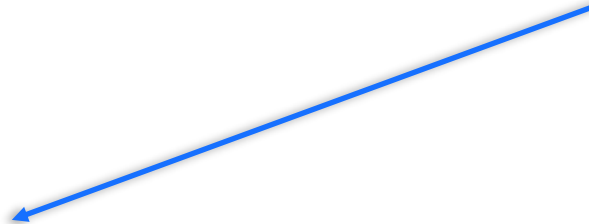
      - name: Install Dependencies
        run: npm i -g @ibm/sourceorbit

      - name: Deploy to IBM i
        run: |
          ici \
            --cmd "mkdir -p './builds/ics_${GITHUB_HEAD_REF}'" \
            --rcwd "./builds/ics_${GITHUB_HEAD_REF}" \
            --push "." \
            --cmd "/QOpenSys/pkg/bin/gmake BIN_LIB=CMPSYS"
        env:
          IBMI_HOST: ${ secrets.IBMI_HOST }
          IBMI_USER: ${ secrets.IBMI_USER }
          IBMI_PASSWORD: ${ secrets.IBMI_PASSWORD }
          IBMI_SSH_PORT: ${ secrets.IBMI_SSH_PORT }
```

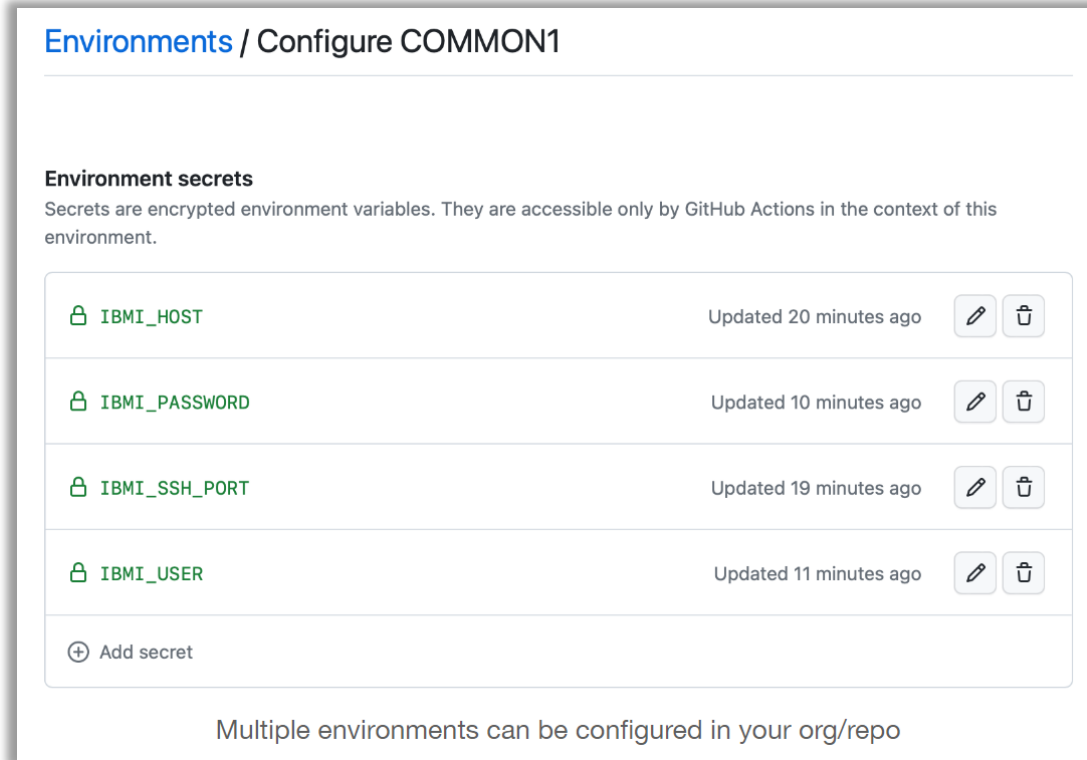
IBM i connection is  
specified as  
environment  
variables



GITHUB\_HEAD\_REF  
is the head ref or  
source branch of the  
pull request




# Why use environments?



```
jobs:  
  ibmi-build:  
    strategy:  
      matrix:  
        environment: [COMMON1, OSSBUILD]  
environment: ${{ matrix.environment }}  
runs-on: ubuntu-latest
```

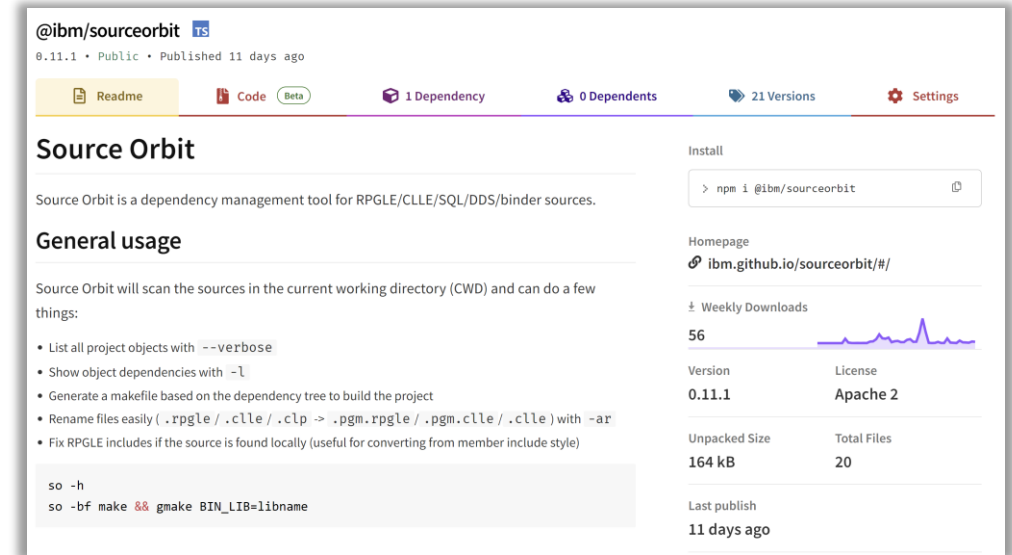
Use a matrix to run a workflow on multiple IBM i machines



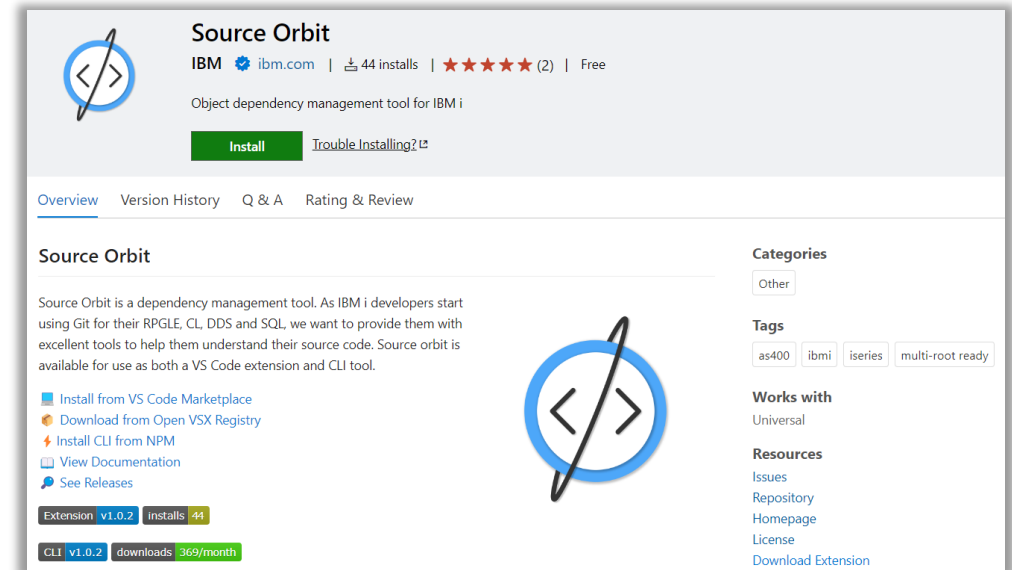
# ILE Dependency Analysis with Source Orbit

# Overview

- A dependency management tool (CLI and VS Code extension!)
  - Build dependency tree for RPGLE, DDS, SQL, CL, etc.
  - Generates impact analysis information
  - Generate scripts to automate builds
  - Clean up your project
- CLI Installation
  - `npm i @ibm/sourceorbit`
- Extension Installation
  - <https://marketplace.visualstudio.com/items?itemName=IBM.vscode-sourceorbit>



The screenshot shows the npm package page for @ibm/sourceorbit. The package is version 0.11.1, published 11 days ago, and is public. It has 1 dependency, 0 dependents, and 21 versions. The package is a dependency management tool for RPGLE/CLLE/SQL/DDS/binder sources. The general usage section describes how Source Orbit scans the current working directory and can perform various tasks like listing project objects, showing object dependencies, generating makefiles, renaming files, and fixing RPGLE includes. The install section shows the command `npm i @ibm/sourceorbit`. The homepage is [ibm.github.io/sourceorbit/#/](https://ibm.github.io/sourceorbit/#/). The weekly downloads are 56. The version is 0.11.1, licensed under Apache 2. The unpacked size is 164 kB, and there are 20 total files. The last publish was 11 days ago.



The screenshot shows the Visual Studio Marketplace page for the Source Orbit extension. The extension is by IBM, with 44 installs and a 2-star rating. It is free and available for installation. The overview section describes Source Orbit as a dependency management tool for IBM i developers. The categories section shows 'Other'. The tags section shows 'as400', 'ibmi', 'iseries', and 'multi-root ready'. The works with section shows 'Universal'. The resources section includes links to Issues, Repository, Homepage, License, and Download Extension. The extension version is v1.0.2, with 44 installs and 369 downloads per month.

# CLI Usage

- so -ar
  - Scan all source code and fix extensions
    - Rename programs to have *.pgm*.
    - Rename include files to use *.rpgleinc*
    - Rename SQL source to use extension based on *CREATE* statement
- so -fi
  - Fix include/directory directives to use UNIX style paths if found in local source
- so -bf <type>
  - make: Generate single makefile with targets and rules
  - bob: Generate Rules.mk files for Bob
  - imd: Generate impact analysis for branches
  - json: Generate dependency info as JSON
- so -bl <name>
  - Generate a deterministic library name given a branch name

# Repository Cleanup

Filter 23 PAYROLLORG/\*.\* (\*SRCPF)

qddssrc

mstdsp.dspf Master DSPF

qprotosrc include files

errortable.rpgle error table include

qrpglesrc ILE RPG source for programs and includes

payroll.rpgle Payroll main program

qsqlsrc SQL TABLES

empmst.table Employee Master table

prjmst.table Project Master

rsnmst.table Reason Master

Original source in QSYS

PAYROLL-DEMO

QDDSSRC

mstdsp.dspf

QPROTOSRC

errortable.rpgleinc

QRPGLSRC

payroll.pgm.rpgle

QSQLSRC

empmst.table

prjmst.table

rsnmst.table

Cleaned up file extensions

Clipboard → PAYROLL.RPGLE ×

PAYROLLORG > QRPGLSRC > PAYROLL.RPGLE

```
31 2  ctl-opt Dftactgrp(*no);
32 29 Dcl-F MSTDSP      WORKSTN;
33 30 Dcl-F EMPMST      Usage(*Update:*Delete:*Output) Keyed;
34 31 Dcl-F PRJMST      Usage(*Update:*Delete:*Output) Keyed;
35 32 Dcl-F RSNMST      Usage(*Update:*Delete:*Output) Keyed;
36 33
37 34 Dcl-S EMESS        Char(50);
38 35
39 - /copy 'QPROTOSRC/errortable.rpgleinc'
36+ /include QPROTOSRC,ERRORTABLE
40 37
41 38 //
42 39 // *****
43 40 //  MAINLINE CALCULATIONS
44 41 // *****
45 42 //  This mainline routine controls the display file processing and
46 43 //  editing.  Using the function keys described on each display
47 44 //  format, you can transfer from one maintenance application to
48 45 //  another.  The action code you select on the selection formats
49 46 //  determines if the program will add a new record to the file or
50 47 //  update an existing record in the file.
51 48 // *****
52 49 //  Housekeeping, clear display fields and reset indicators.
53 50 //
54 51 CALLP MAIN();
```

Cleaned up source code

Source Locally

# Impact Analysis...What Objects Am I Affecting?

so-impact summary

Impact Analysis

Touched objects:

NEMP.FILE : qddssrc/nemp.dspf

NEMP.FILE

▼Click to expand

NEMP.FILE ( qddssrc/nemp.dspf )

NEWEMP.PGM ( qrpglesrc/newemp.pgm.sqlrpgle )

DEPTS.PGM ( qrpglesrc/depts.pgm.sqlrpgle )

Messages

No messages to show.

Impacted objects based on source changes

Dependencies of impacted objects

Full project dependency tree

Project Listing

▼Click to expand

-	Object	Type	Path	Warnings	Parents	Children
📁	DEPARTMENT	FILE	qddssrc/department.table	▶ ⓘ	▶ 2	0
📁	DEPTS	FILE	qddssrc/depts.dspf	✓	▶ 1	0
📁	EMPLOYEE	FILE	qddssrc/employee.table	▶ ⓘ	▶ 2	0
📁	EMPS	FILE	qddssrc/emps.dspf	✓	▶ 1	0
📁	NEMP	FILE	qddssrc/nemp.dspf	✓	▼ 1 NEWEMP.PGM	0
🔗	POPDEPT	PGM	qddssrc/popdept.sql	▼ ⚠ Extension should be based on type. Suggested name is 'popdept.sqlprc'	0	▶ 1
📁	POPEMP	FILE	qddssrc/popemp.sql	✓	0	0
🔗	DEPTS	PGM	qrpglesrc/depts.pgm.sqlrpgle	▶ ⓘ	0	▶ 4
🔗	EMPLOYEES	PGM	qrpglesrc/employees.pgm.sqlrpgle	▶ ⓘ	▶ 1	▶ 2
🔗	MYPGM	PGM	qrpglesrc/mypgm.pgm.rpgle	▶ ⓘ	0	0
🔗	NEWEMP	PGM	qrpglesrc/newemp.pgm.sqlrpgle	▶ ⓘ	▶ 1	▶ 2

- Parents are objects that depend on this object.
- Children are objects that this object depends on.

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# GitHub Action Example

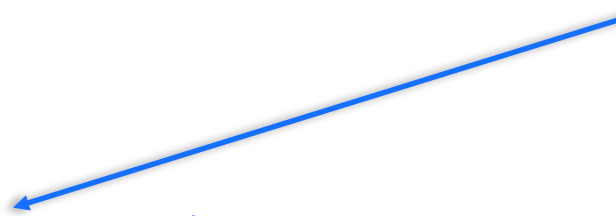
```
jobs:  
  so-impact:  
    runs-on: ubuntu-latest  
    steps:  
      # Checkout repository and setup node steps omitted
```

```
- name: Install Dependencies  
  run: npm i -g @ibm/ibmi-ci
```

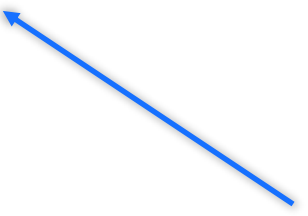
```
- name: Generate impact information  
  run: so -bf imd -l `git diff --name-only origin/main origin/${GITHUB_HEAD_REF}`
```

```
- name: Adding markdown  
  run: cat impact.md >> $GITHUB_STEP_SUMMARY
```

Generate impact analysis  
for changed files  
(compare main branch  
with pull request branch)



Redirect output to  
GITHUB\_STEP\_SUMMARY  
to create a custom  
Markdown job summary





# What is built into the Source Orbit VS Code extension?

View impacted objects for the current active editor

▼ SOURCE IMPACTS

EMPLOYEE.FILE qddssrc\employee.table

▼ EMPLOYEES.PGM qrpglesrc\employees.pgm.sqlrpgle

DEPTS.PGM qrpglesrc\depts.pgm.sqlrpgle

▼ NEWEMP.PGM qrpglesrc\newemp.pgm.sqlrpgle

DEPTS.PGM qrpglesrc\depts.pgm.sqlrpgle

View impacted objects for any changed files detected by Git

▼ CHANGE IMPACTS

DEPARTMENT.FILE qddssrc\department.table

POPDEPT.PGM qddssrc\popdept.sql

DEPTS.PGM qrpglesrc\depts.pgm.sqlrpgle

▼ NEMP.FILE qddssrc\nemp.dspf

▼ NEWEMP.PGM qrpglesrc\newemp.pgm.sqlrpgle

DEPTS.PGM qrpglesrc\depts.pgm.sqlrpgle

▼ EMPLOYEES.PGM qrpglesrc\employees.pgm.sqlrpgle

DEPTS.PGM qrpglesrc\depts.pgm.sqlrpgle

MYPGM.PGM qrpglesrc\mypgm.pgm.rpgle

▼ PROJECT EXPLORER

ibmi-company\_system Company System project

> Source /home/SANJULA/builds/ibmi-company\_system (compare)

> Variables

> Library List

> Object Libraries

> Include Paths

▼ Source Orbit

> DEPARTMENT.FILE (table)

> DEPTS.FILE (dspf)

> EMPLOYEE.FILE (table)

> EMPS.FILE (dspf)

▼ NEMP.FILE (dspf)

No dependencies

▼ POPDEPT.PGM (sql)

DEPARTMENT.FILE (table)

▼ POPEMP.FILE (sql)

No dependencies

▼ DEPTS.PGM (sqlrpgle)

EMPLOYEES.PGM (sqlrpgle)

NEWEMP.PGM (sqlrpgle)

DEPARTMENT.FILE (table)

DEPTS.FILE (dspf)

View project's dependency tree with integration in IBM i Project Explorer

Actions to “Autofix” and “Generate Build Files”

# Source migration made easy

CVTSRCPF  
from BOB

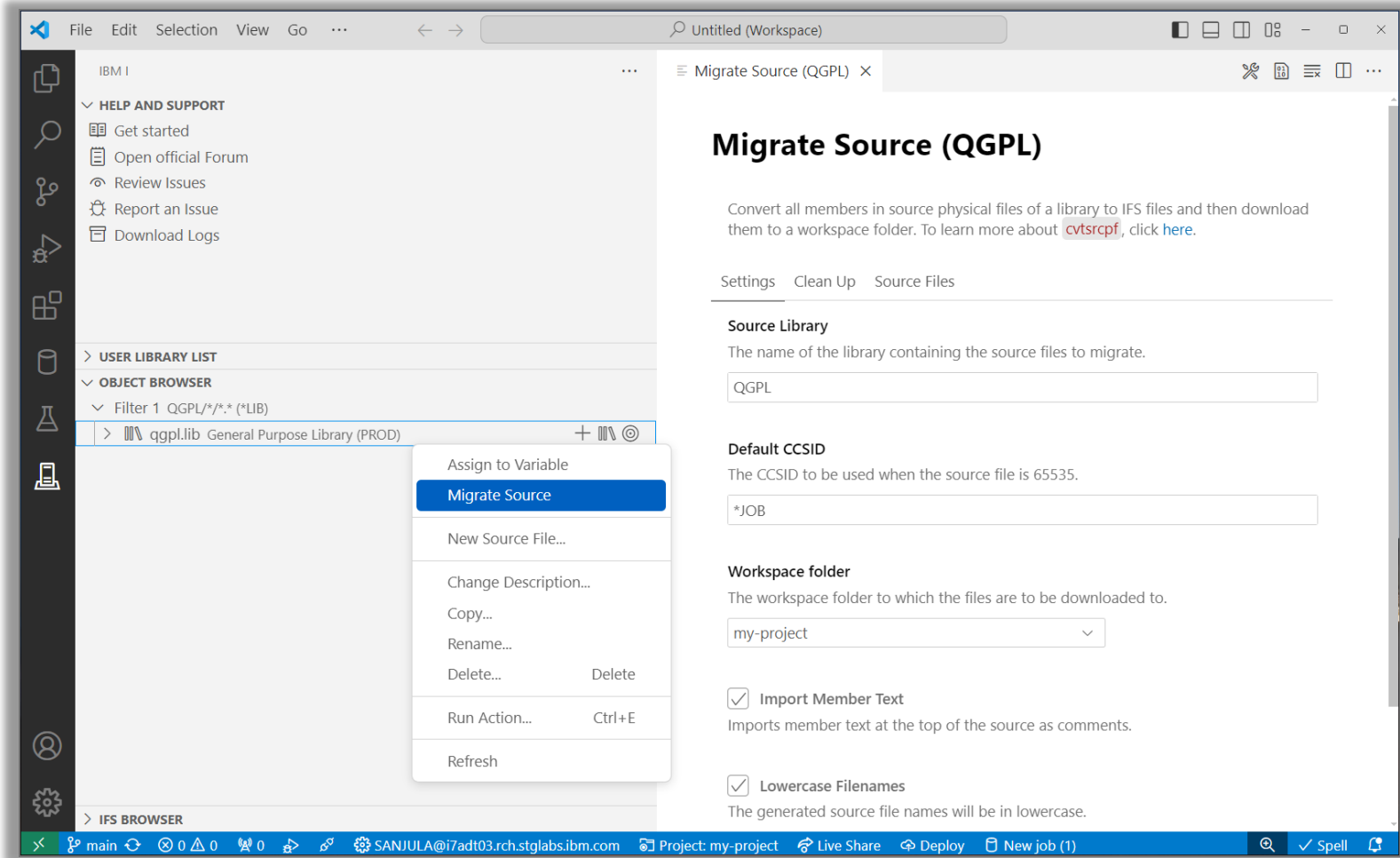


QSYS members in  
source physical files  
↓  
Properly encoded,  
terminated, and named  
source files in an IFS  
directory

↓  
Download to local  
project

↓  
Rename extensions  
↓  
Convert includes/copy  
directives to Unix style  
paths

Source Orbit



# Use Cases

# Impact Analysis



# Automated Builds



# Demo

# Any Questions?

# Important Links

## **ibmi-ci**


- NPM <https://www.npmjs.com/package/@ibm/ibmi-ci>
- GitHub Repository <https://github.com/IBM/ibmi-ci>

## **Source Orbit**

- NPM <https://www.npmjs.com/package/@ibm/sourceorbit>
- Extension <https://marketplace.visualstudio.com/items?itemName=IBM.vscode-sourceorbit>
- Documentation <https://ibm.github.io/sourceorbit/#/>
- GitHub Repository <https://github.com/IBM/sourceorbit>



# For More Information

Links You Need	Twitter	#Hashtags
<p>IBM i Home Page: <a href="https://www.ibm.com/it-infrastructure/power/os/ibm-i">https://www.ibm.com/it-infrastructure/power/os/ibm-i</a> (find link to Forrester Study and updated IBM i Strategy Whitepaper)</p> <p>IBM Strategy Whitepaper: <a href="https://www.ibm.com/it-infrastructure/us-en/resources/power/i-strategy-roadmap/">https://www.ibm.com/it-infrastructure/us-en/resources/power/i-strategy-roadmap/</a></p> <p>IBM Client Success: <a href="https://www.ibm.com/it-infrastructure/us-en/resources/power/ibm-i-customer-stories/">https://www.ibm.com/it-infrastructure/us-en/resources/power/ibm-i-customer-stories/</a></p> <p>Support Life Cycle: <a href="https://www.ibm.com/support/lifecycle/">https://www.ibm.com/support/lifecycle/</a></p> <p>License Topics: <a href="https://www-01.ibm.com/support/docview.wss?uid=nas8N1022087">https://www-01.ibm.com/support/docview.wss?uid=nas8N1022087</a></p> <p>Fortra IBM i Marketplace Survey <a href="https://www.fortra.com/resources/guides/ibm-i-marketplace-survey-results">https://www.fortra.com/resources/guides/ibm-i-marketplace-survey-results</a></p>	<div></div> <div><a href="#">@IBMSystems</a> <a href="#">@COMMONug</a> <a href="#">@IBMChampions</a> <a href="#">@IBMSystemsISVs</a> <a href="#">@IBMiMag</a> <a href="#">@ITJungleNews</a> <a href="#">@SAPonIBMi</a> <a href="#">@SiDforIBMi</a></div>	<div><a href="#">#PowerSystems</a> <a href="#">#IBMi</a> <a href="#">#IBMAIX</a> <a href="#">#POWER9</a> <a href="#">#LinuxonPower</a> <a href="#">#OpenPOWER</a> <a href="#">#HANAonPower</a> <a href="#">#ITinfrastructure</a> <a href="#">#OpenSource</a> <a href="#">#HybridCloud</a> <a href="#">#BigData</a></div>

