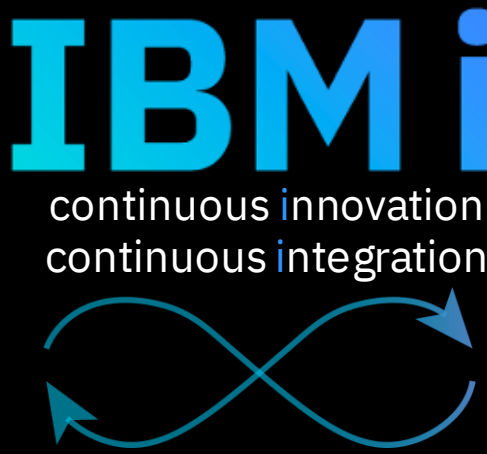
# Automating Builds
## in Git on IBM i

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✨ Special thank you to Liam Allan for slide diagrams!

# Agenda

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

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# The Modern Development Lifecycle with Git

# What Does Modern Development Look Like?

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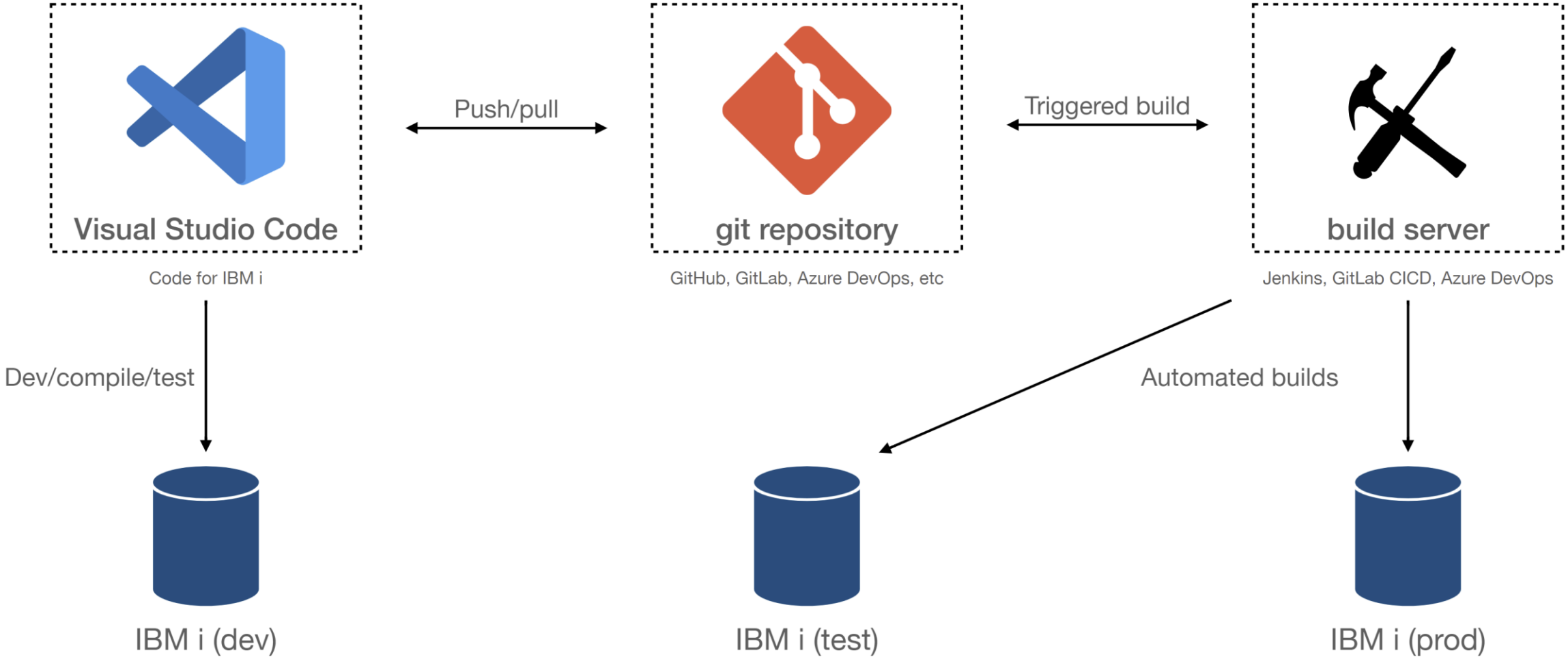

# Development with Git

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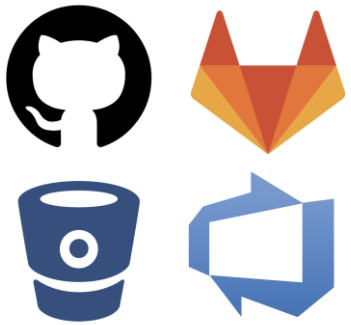
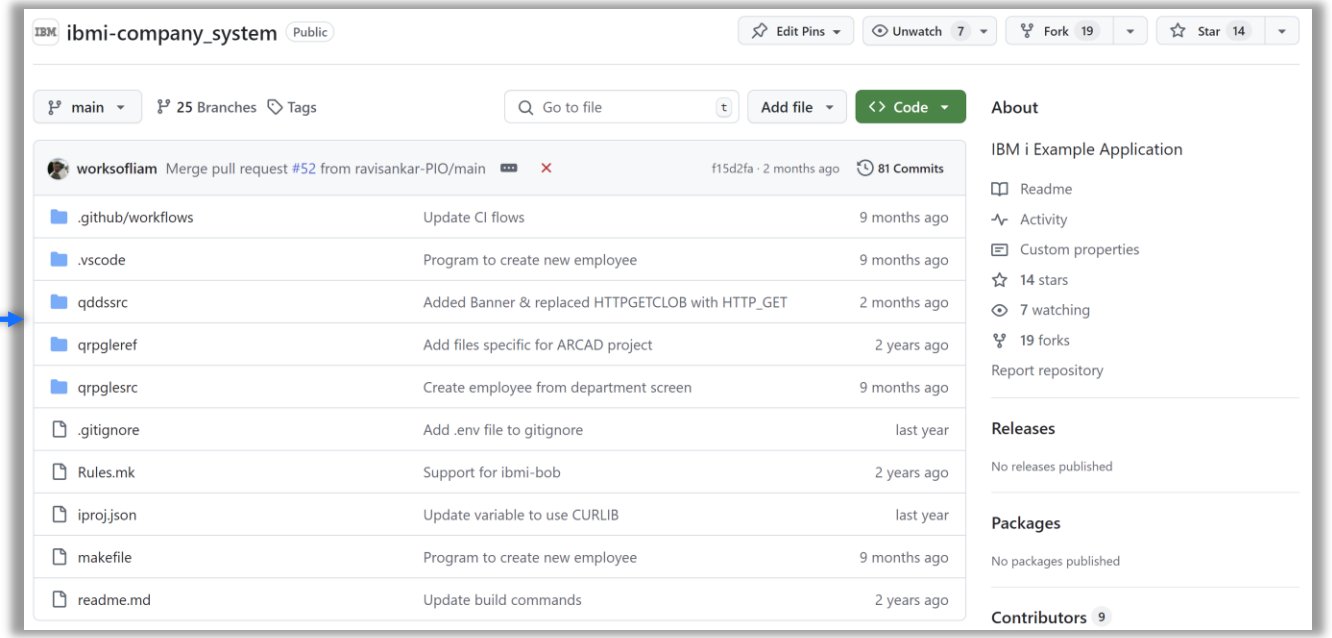
- Source is managed by Git
  - Complete change history
  - Branching and merging capabilities
  - Traceability


GitHub, GitLab, Azure DevOps, etc

- Variety of options for Git hosting services
  - GitHub, GitLab, Azure DevOps, etc





# Why use Git?

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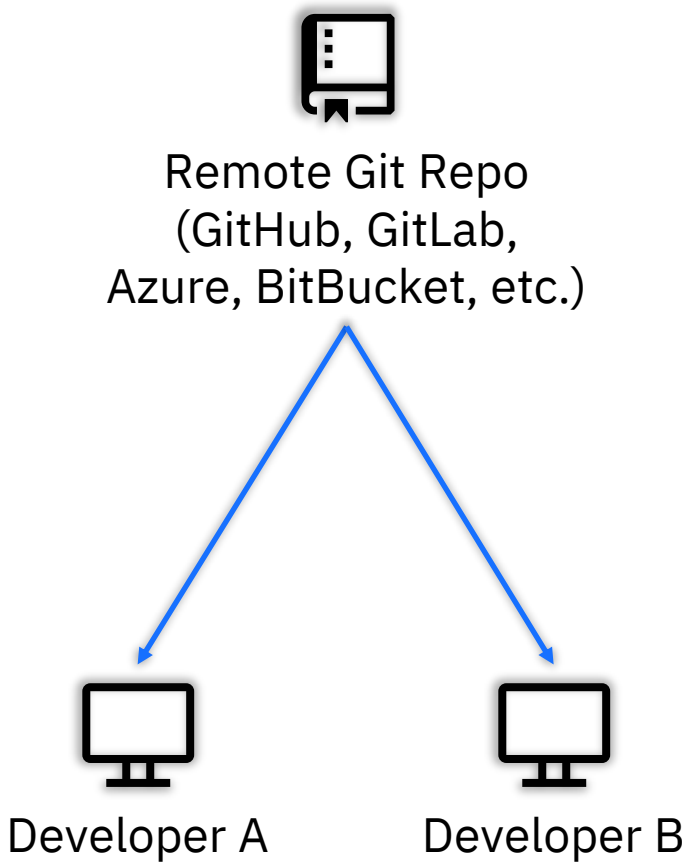
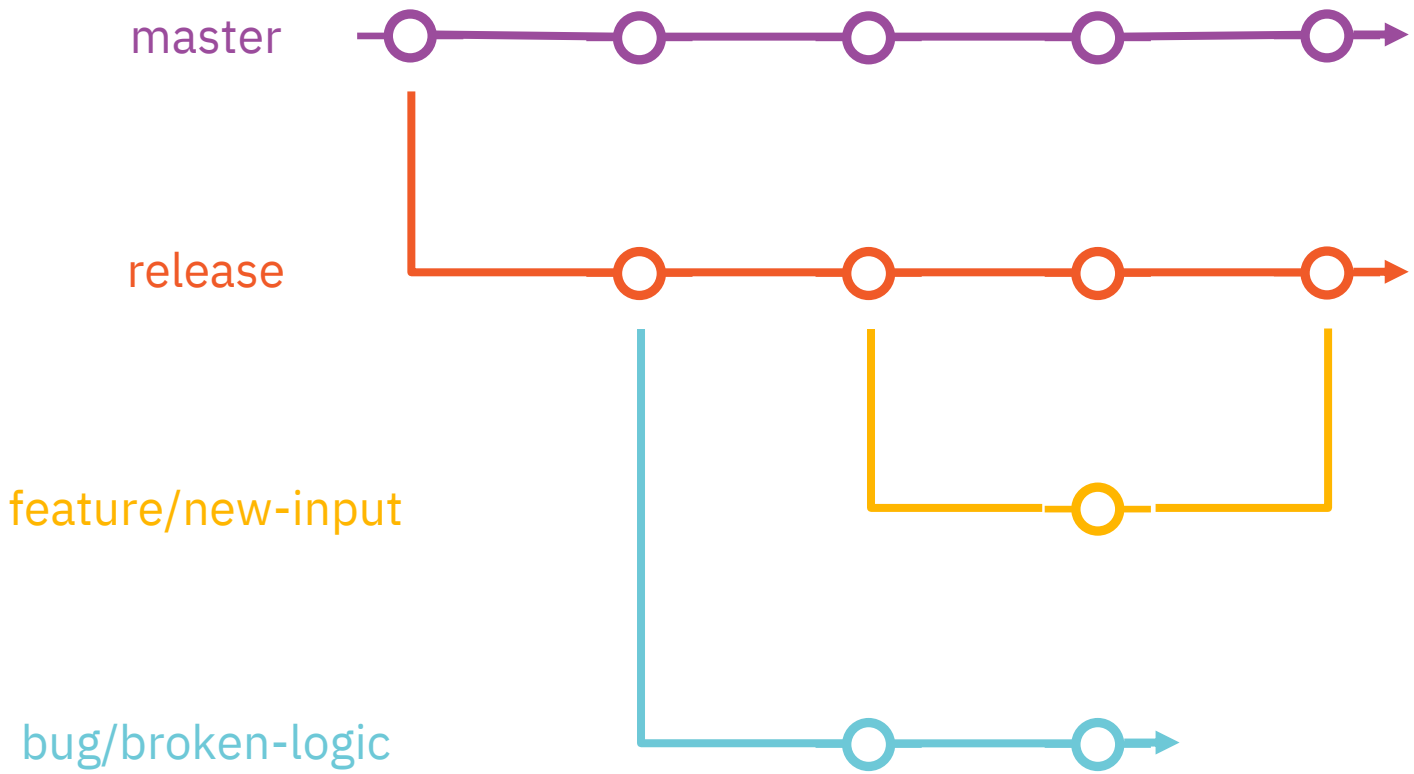
*Distributed Development*




*Version Control and Git Workflow*



# Local Development Experience

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- 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

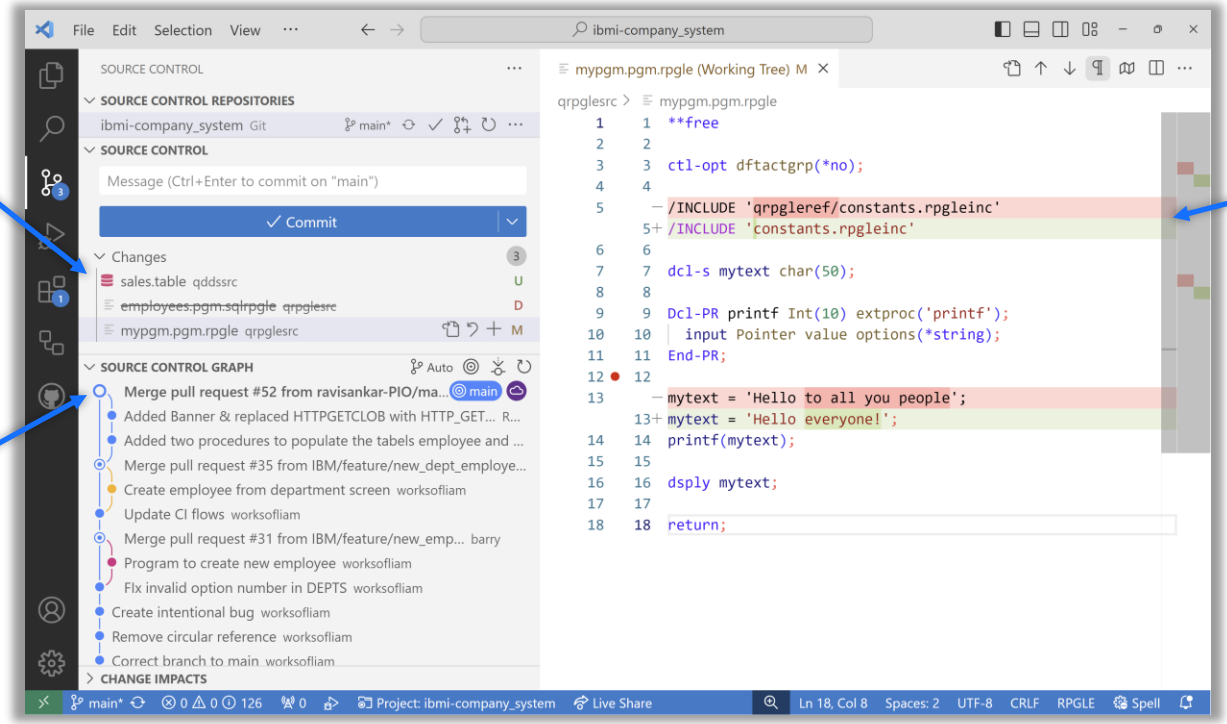
Visual Studio Code

Code for IBM i

View current repository changes

View a graphical representation of incoming and outgoing commits

View changes line by line



# How to work efficiently with these 3 components?

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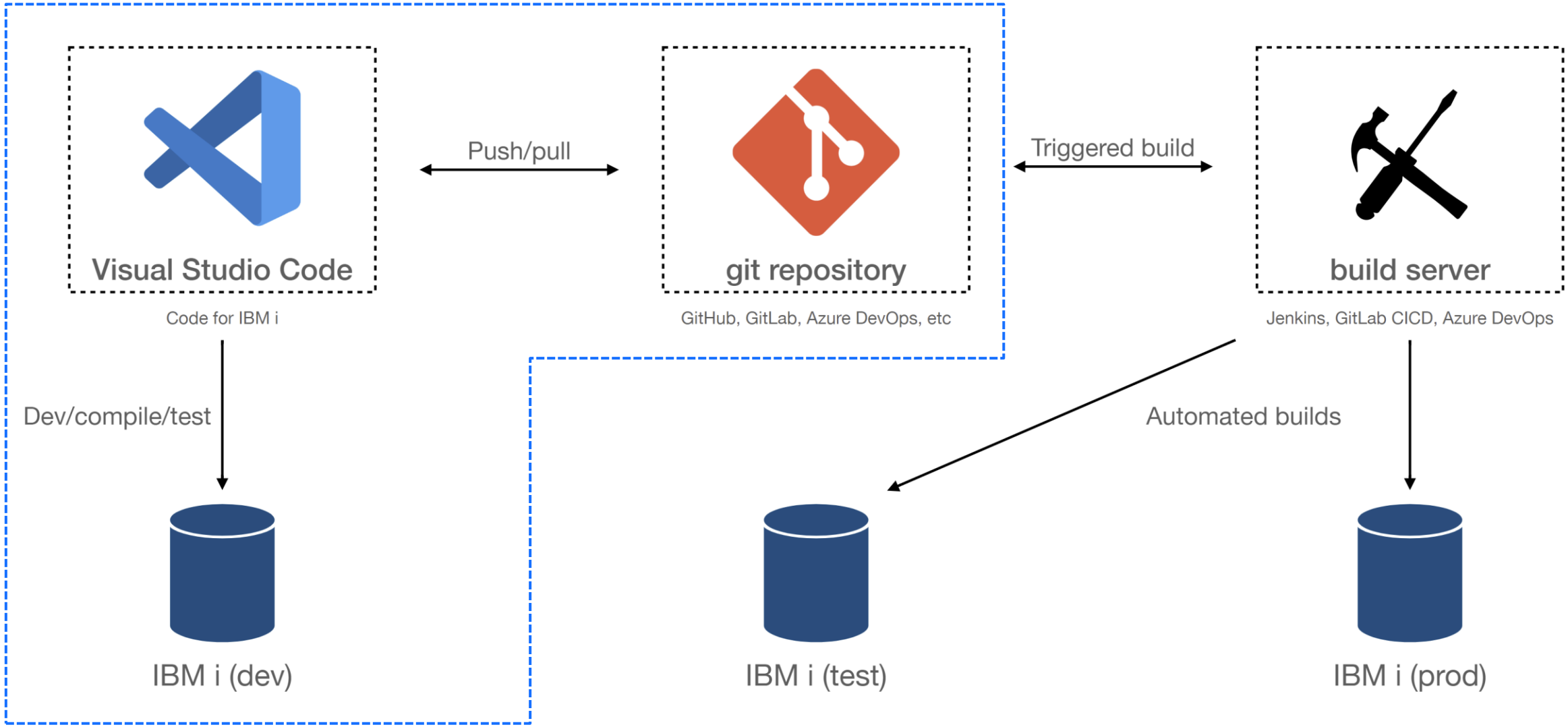

# Map Git branches to libraries on IBM i

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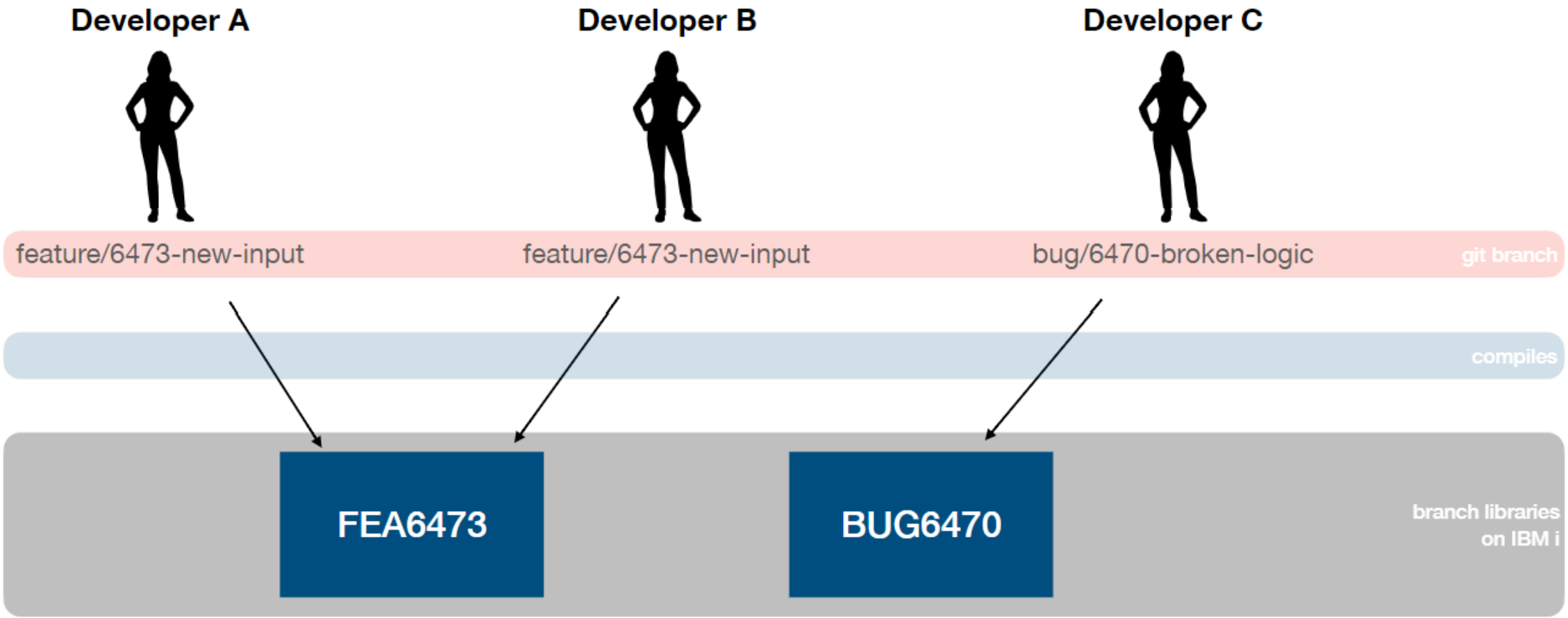

# Build Server

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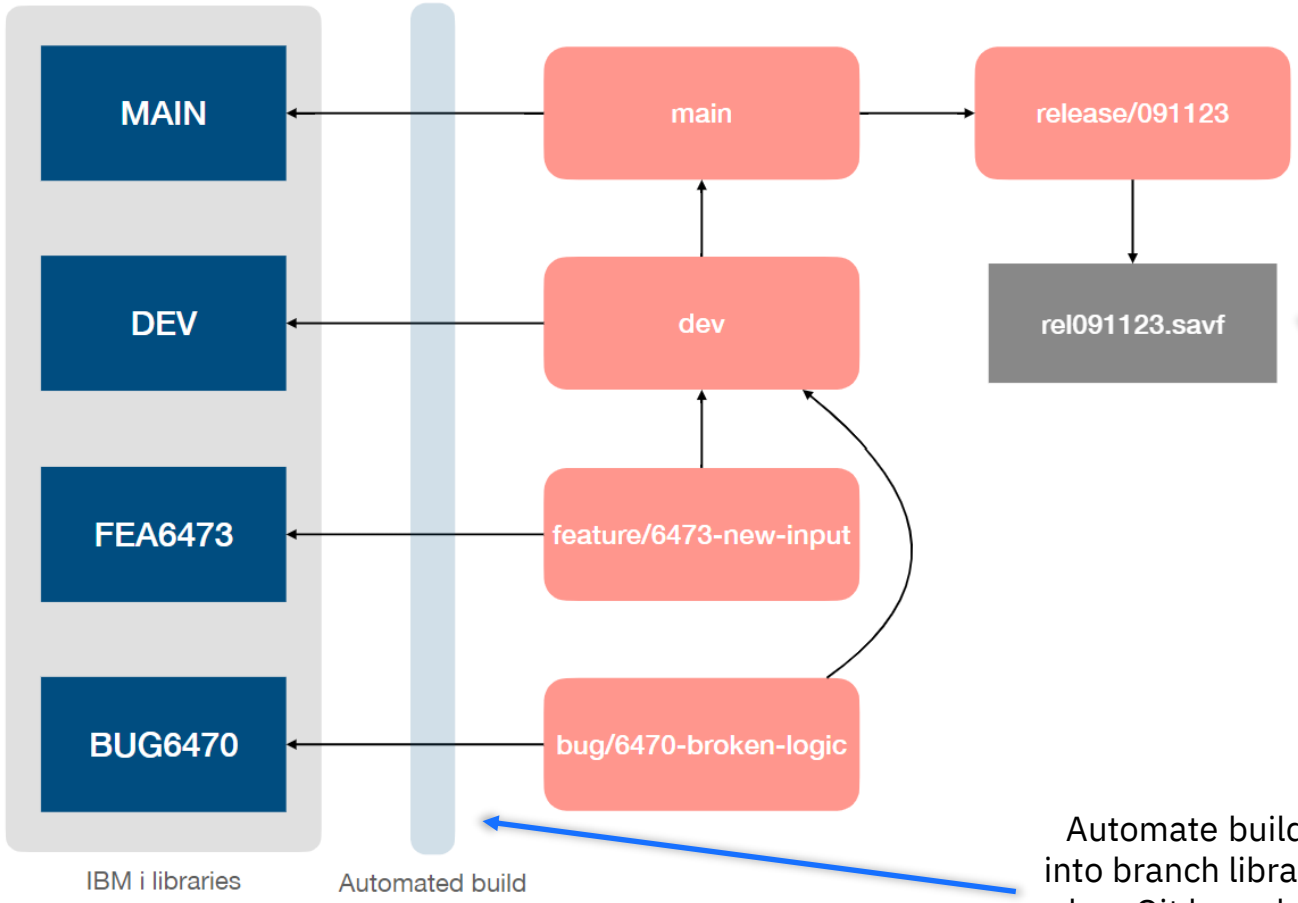
*Let's go one step further and automate this process*





Jenkins, GitLab CICD, Azure DevOps

Generate save files when releases are created

Automate build into branch library when Git branch is updated

# How to create workflows?

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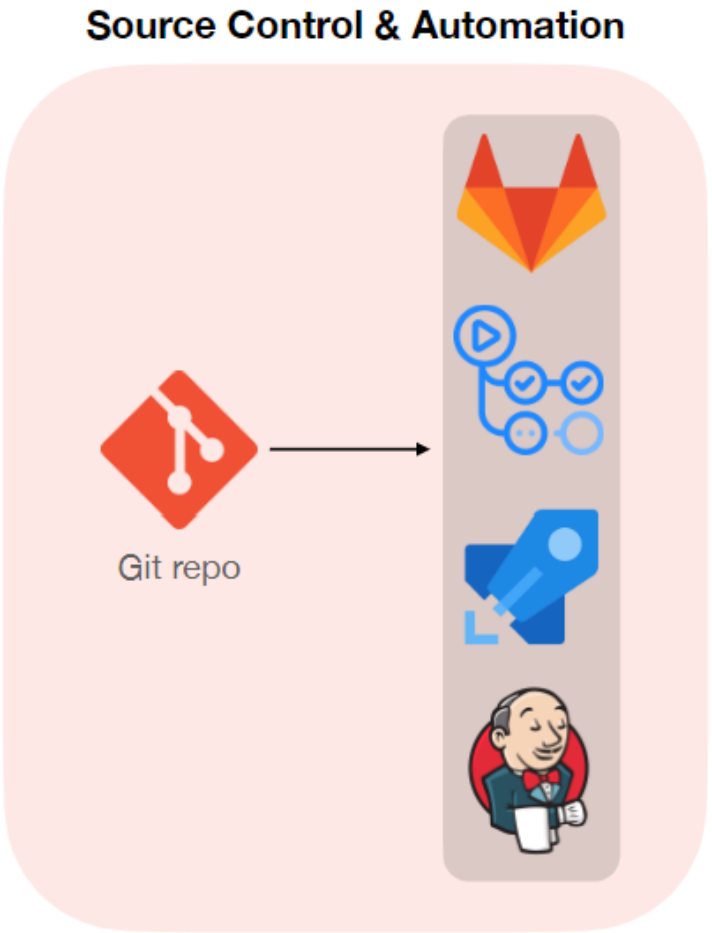


| | |
|---|---|
| GitLab | `.gitlab-ci.yml` |
| Azure DevOps | `azure-pipeline.yml` |
| GitHub | `anything.yml` |
| Jenkins | `Jenkinsfile` |

yml can also be yaml

# How to achieve automation with IBM i?

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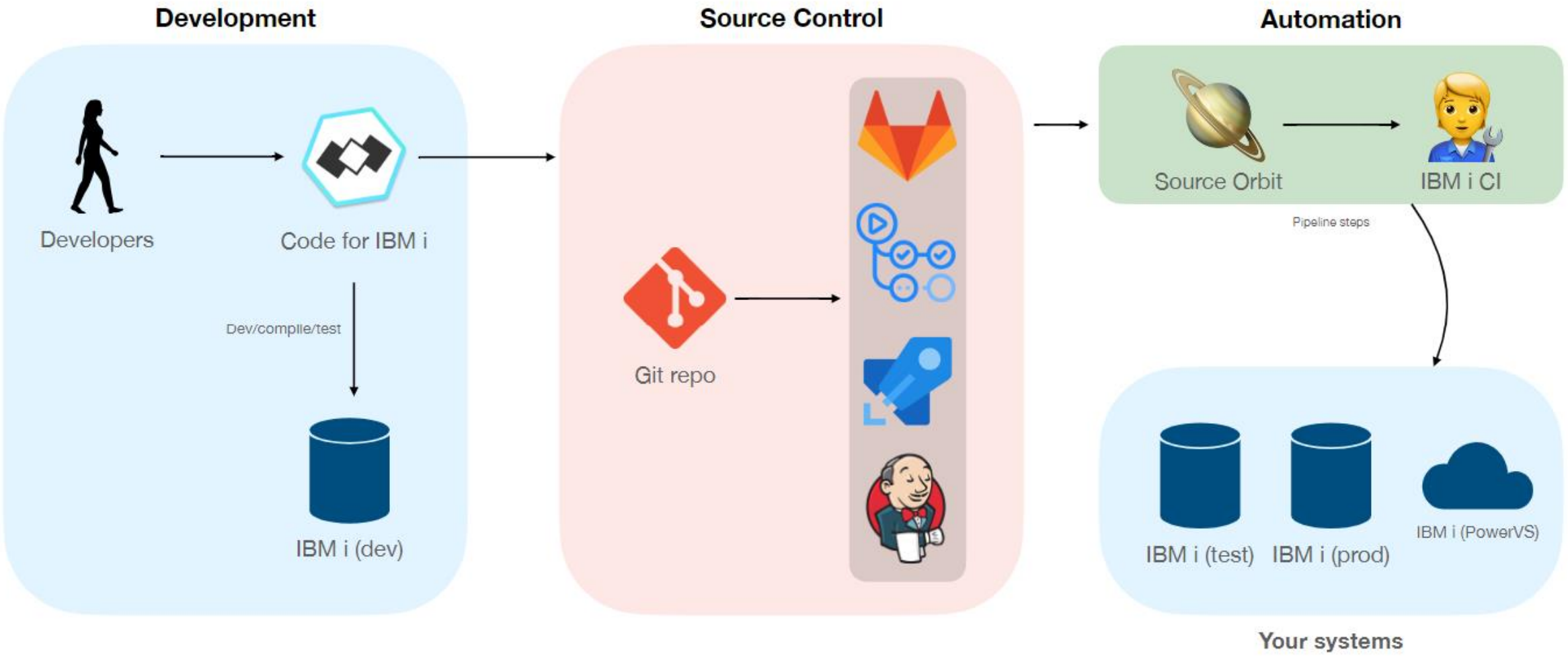

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# Unlock Automated Builds with ibmi-ci

# Overview

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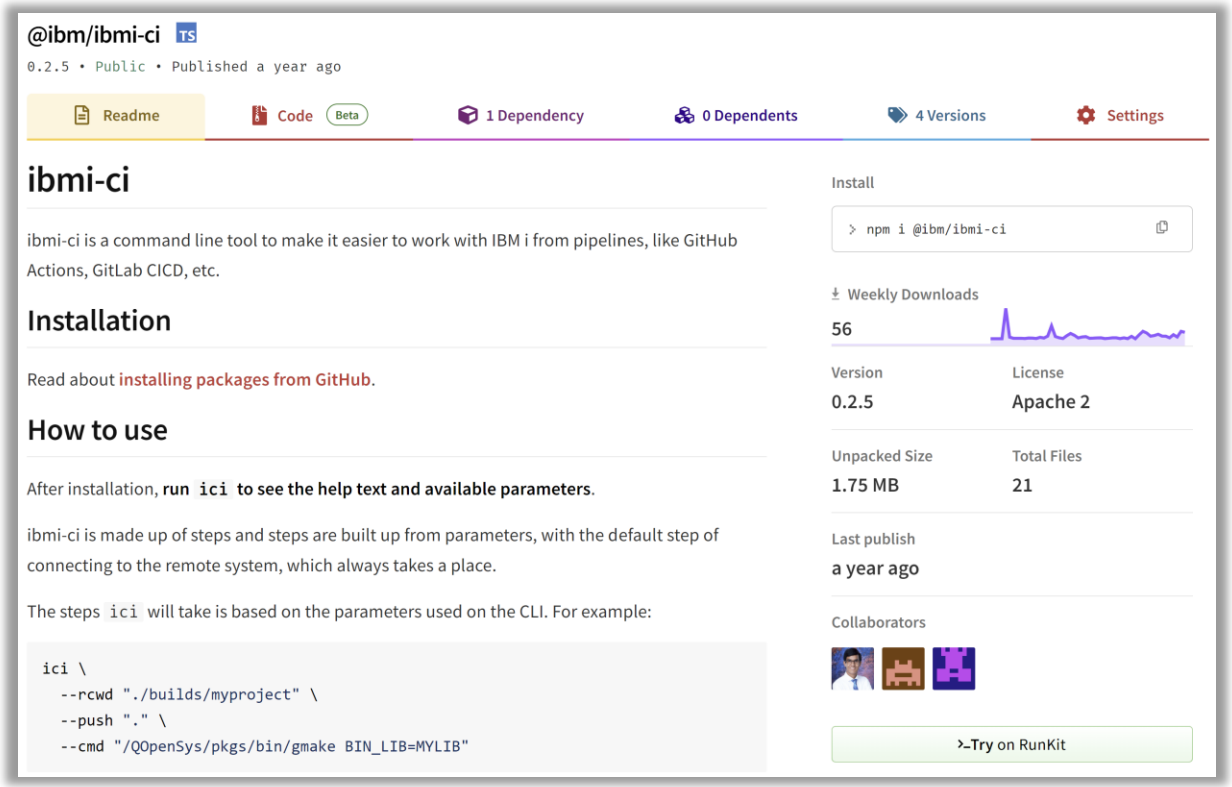
- A CLI tool to simplify working with IBM i from pipelines (ex. GitHub Actions, GitLab CICD, etc.)

- 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



# CLI Usage

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

# Simplistic Example

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

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

Build project with gmake

Suppress errors and continue execution

Set the remote working directory to ./builds/myproject

Create build library if it does not exist

⭐IBM i connection is specified as environment variables

# GitHub Action Example

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```yaml
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/pkgs/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 }}
```

GITHUB_HEAD_REF is the head ref or source branch of the pull request

IBM i connection is specified as environment variables

# Why use environments?

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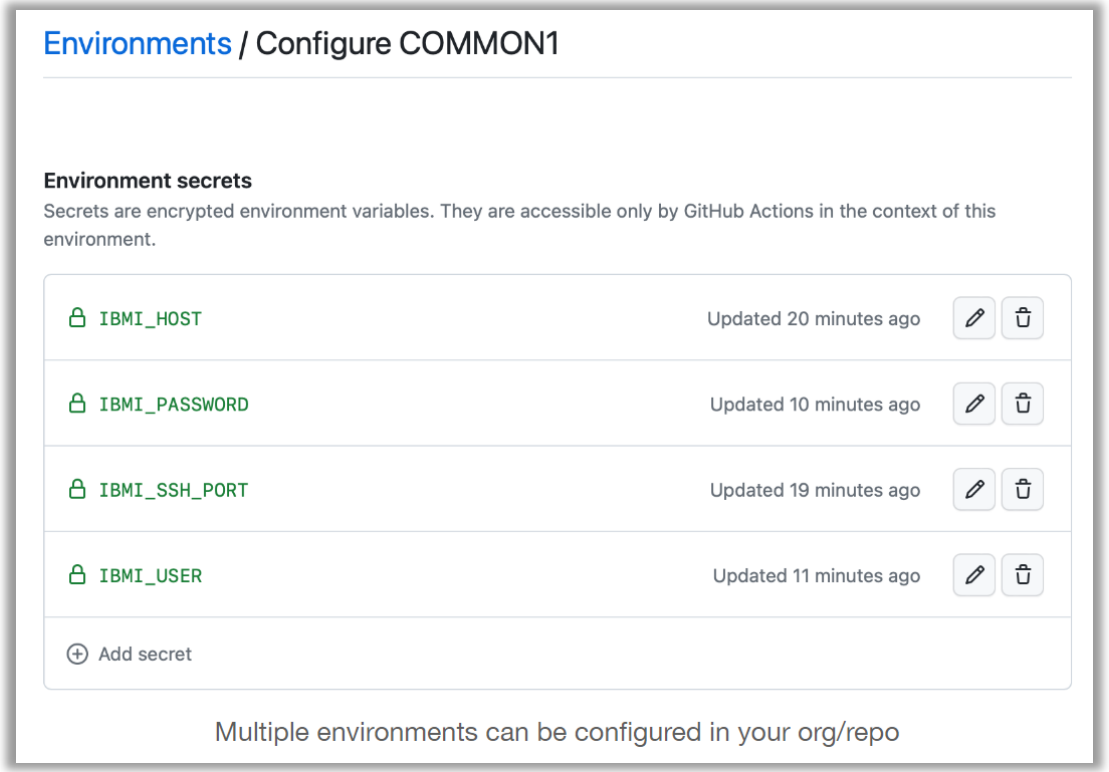


Use a matrix to run a workflow on multiple IBM i machines

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

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# ILE Dependency Analysis with Source Orbit

# Overview

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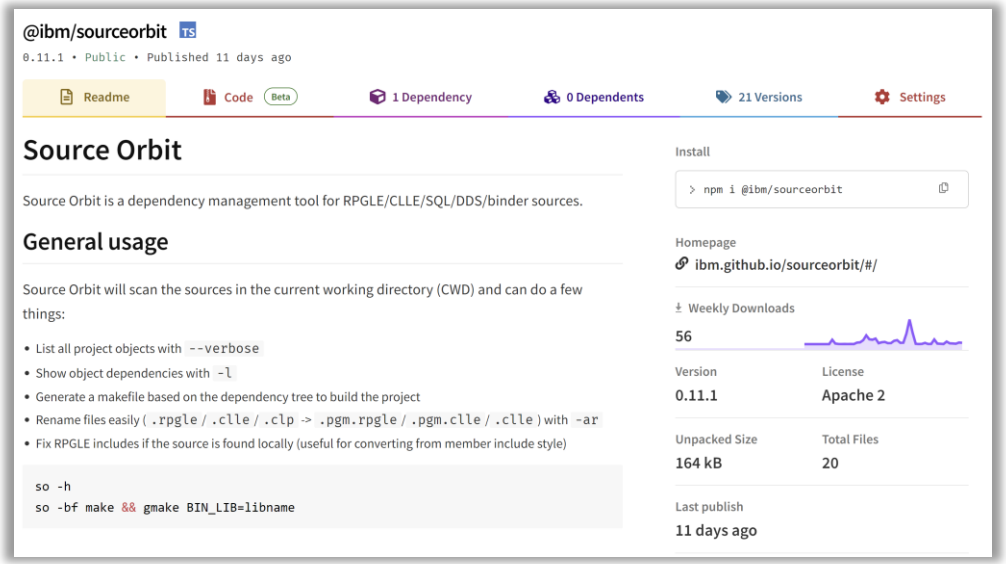
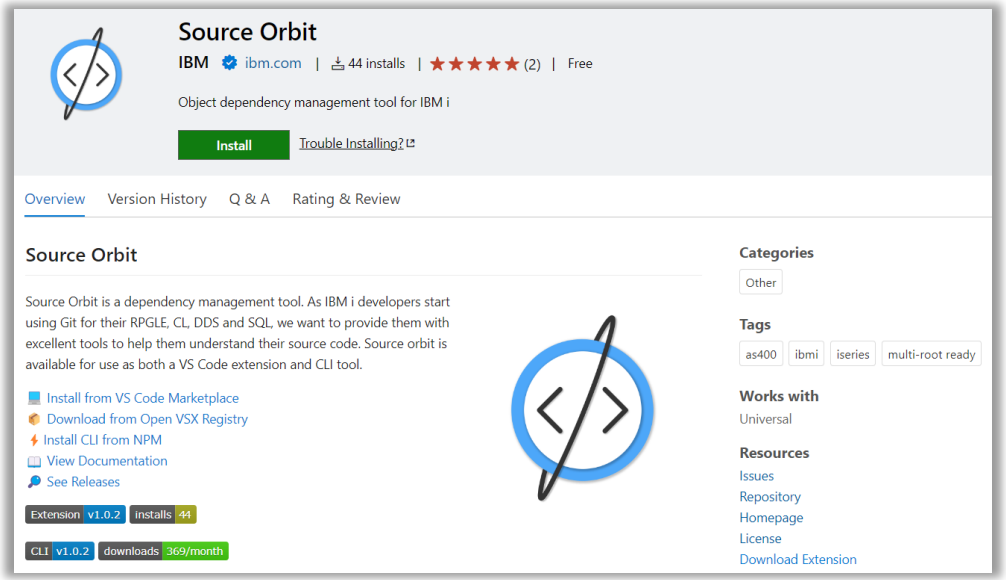
- A dependency management tool (CLI and VS Code extension!)
  - Build dependency tree for RPGLE, DDS, SQL, CL, etc.
  - Generates impact analysis information
  - Generate scripts to automate builds
  - Clean up your project
- CLI Installation
  - npm i @ibm/sourceorbit
- Extension Installation
  - https://marketplace.visualstudio.com/items?itemName=IBM.vscode-so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



# CLI Usage

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- 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>
  - Generate build and dependency files
    - 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

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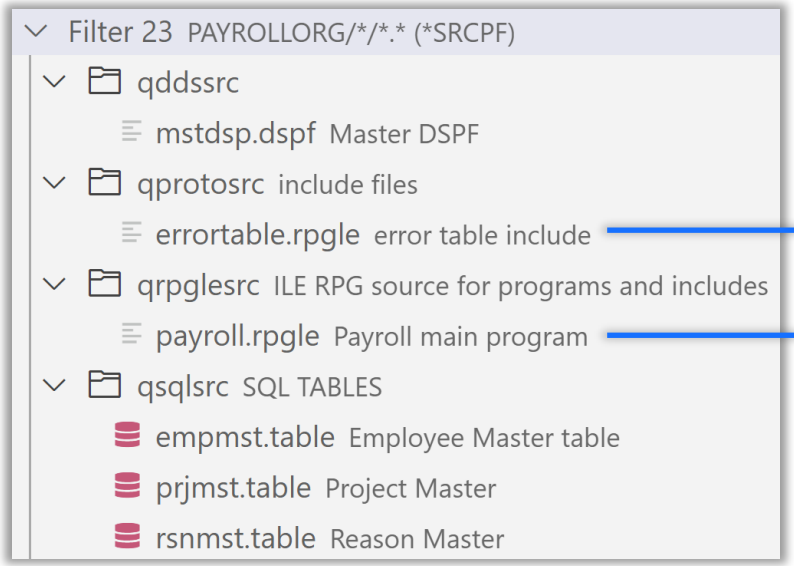
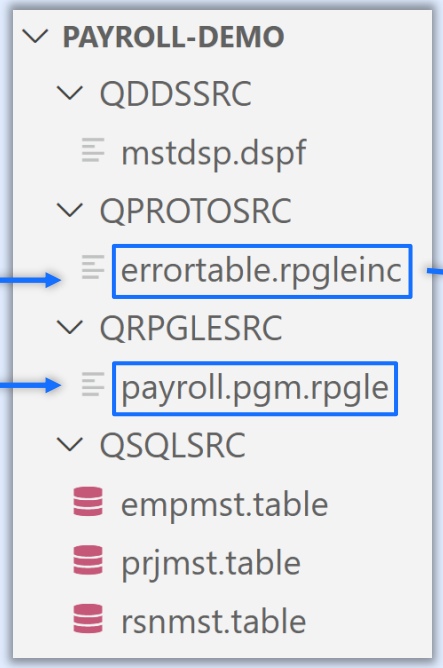
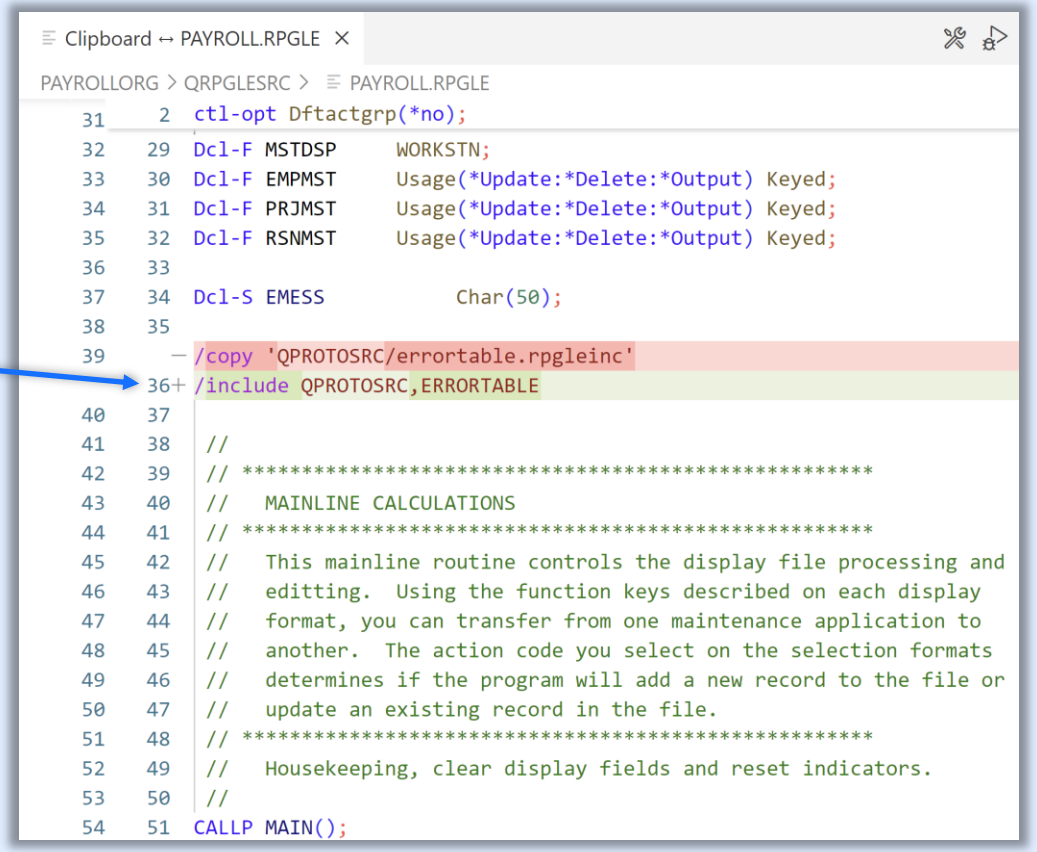
Source Locally




Original source in QSYS




Cleaned up file extensions




Cleaned up source code

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

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Impacted objects based on source changes

Full project dependency tree

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.

Dependencies of impacted objects

## 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.

# GitHub Action Example

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```yaml
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?

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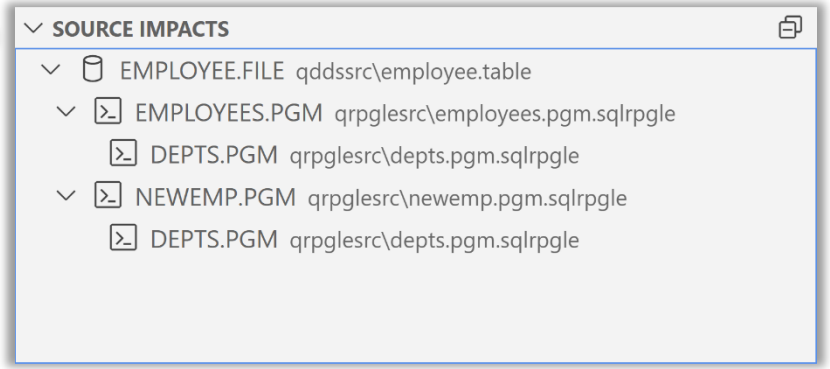
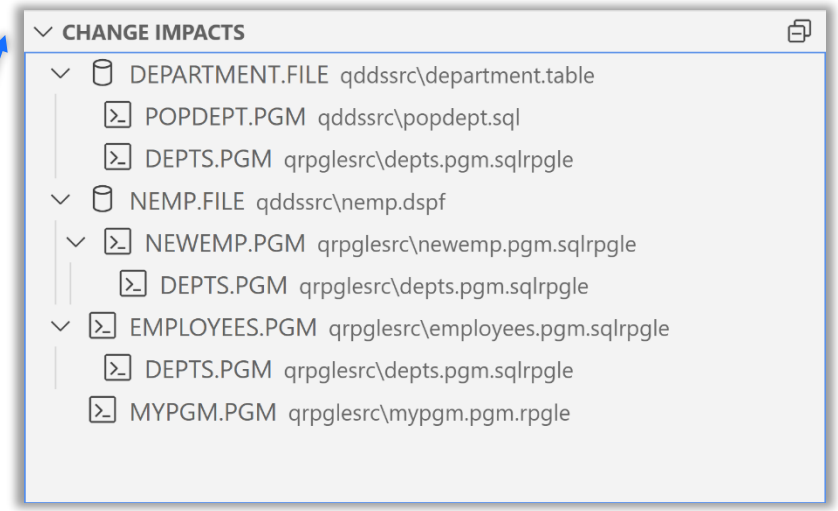
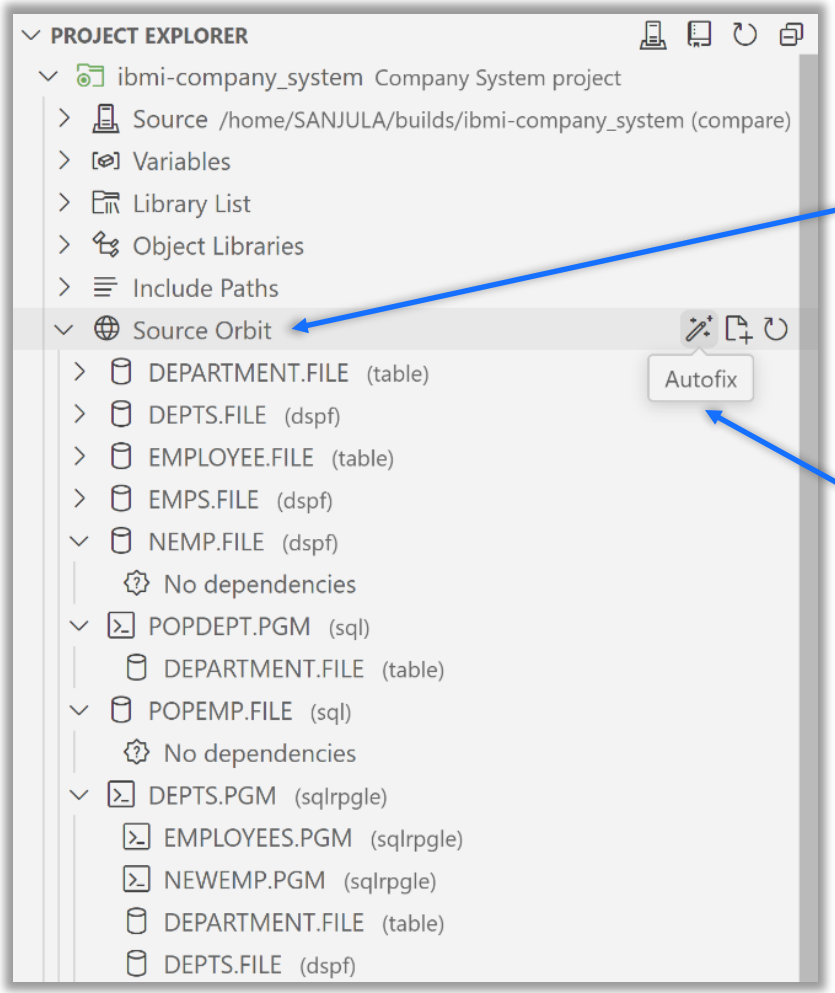
View impacted objects for the current active editor




View impacted objects for any changed files detected by Git




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




Actions to "Autofix" and "Generate Build Files"

# Source migration made easy

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CVTSRCPF from BOB

QSYS members in source physical files

↓

Properly encoded, terminated, and named source files in an IFS directory

↓

Download to local project

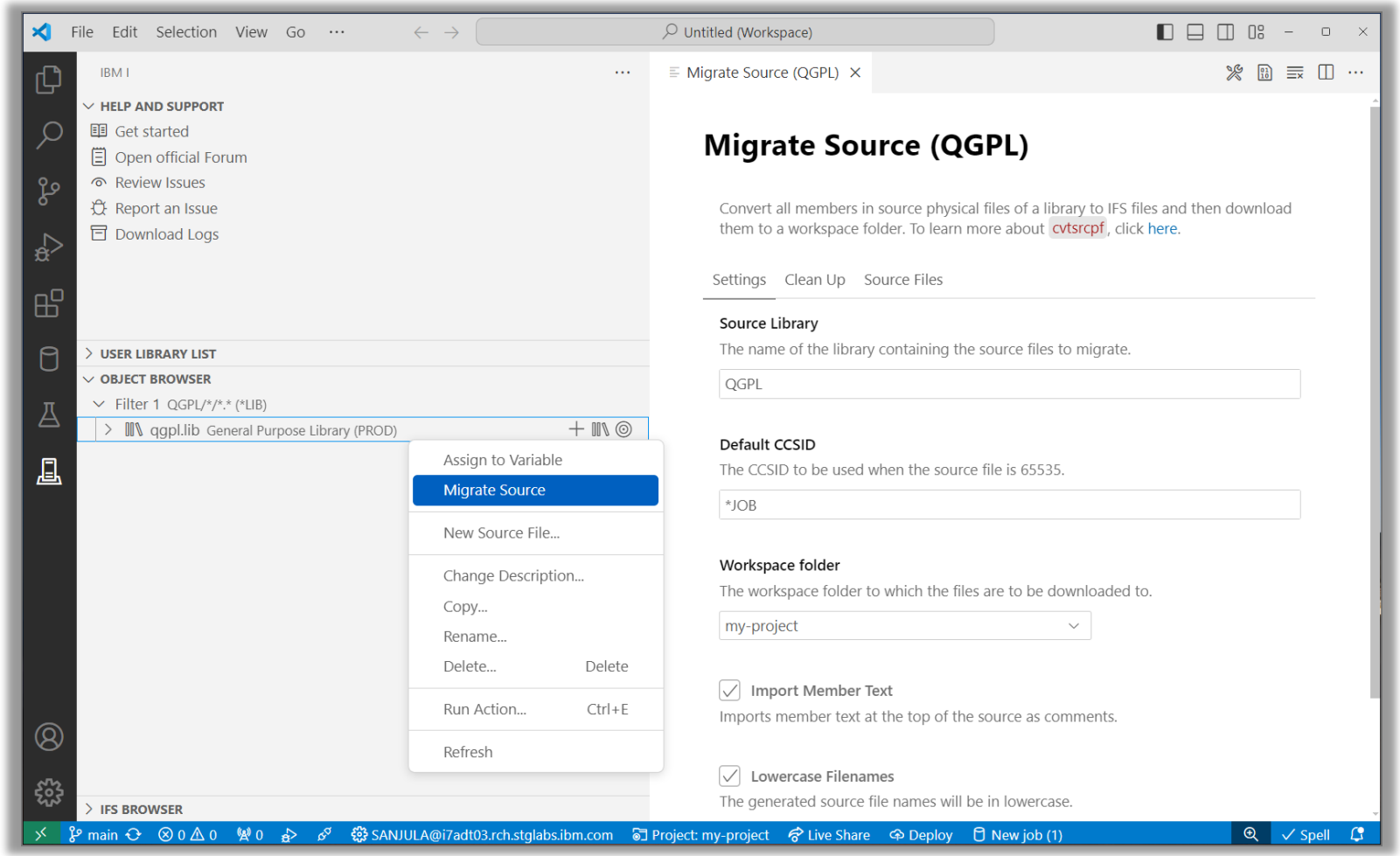
↓

Source Orbit

Rename extensions

↓

Convert includes/copy directives to Unix style paths



# Source Code Rules – Supported Extensions

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| Extension | Extension meaning | Notes |
|---|---|---|
| `sqlrpgle` | RPGLE (SQL) | Can use `.pgm` notation |
| `rpgle` | RPGLE | Can use `.pgm` notation |
| `clle` | CLLE | Can use `.pgm` notation |
| `cl` | CLLE | Can use `.pgm` notation |
| `clp` | CL (OPM) | Should be renamed to `clle` |
| `pf` | Physical File | Table |
| `lf` | Logical File | View/Index |
| `dspf` | Display File | |
| `prtf` | Printer File | |
| `msgf` | Message filee | |
| `sql` | Any SQL object | Type determined by create statement |
| `table` | SQL table | Expects `CREATE TABLE` |
| `view` | SQL view | Expects `CREATE VIEW` |
| `index` | SQL index | Expects `CREATE INDEX` |
| `alias` | SQL alias | Expects `CREATE ALIAS` |
| `sqlalias` | SQL alias | Expects `CREATE ALIAS` |
| `sqlprc` | SQL procedure | Expects `CREATE PROCEDURE` |
| `sqludf` | SQL function | Expects `CREATE FUNCTION` |
| `sqludt` | SQL table function | Expects `CREATE FUNCTION` |
| `sqltrg` | SQL trigger | Expects `CREATE TRIGGER` |
| `sqlseq` | SQL sequence | Expects `CREATE SEQUENCE` |
| `bnd` | Binder source | |
| `binder` | Binder source | Should be renamed `bnd` |
| `cmd` | Command | |

# Source Code Rules – Object Names

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- Base name of source file becomes object name
- If source includes *.pgm*, then it will become a program
- If source does not include .pgm, then it will become a module, cmd, dtaara, etc.
- Assumes binder source (*.bnd*/*.binder*) is a service program

| Source name | Resulting object |
|---|---|
| LCUS.LF | LCUS.FILE |
| CUS.PF | PCUS.FILE |
| dothing.cmd | DOTHING.CMD |
| pos123.dspf | POS123.FILE |
| faq500.rpgle | FAQ500.MODULE |
| faq401.pgm.sqlrpgle | FAQ401.PGM |
| faq500.bnd | FAQ500.SRVPGM |

# Source Code Rules – Long File Names

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Source Orbit will generate a deterministic object name based on the file name

| Source name | Resulting object | Note |
|---|---|---|
| `abcd.rpgle` | `ABCD.MODULE` | No change |
| `ab_cd.pgm.rpgle` | `AB_CD.PGM` | No change |
| `thisIsASuperLongName.pgm.clle` | `TIASLN.PGM` | First character plus following capitals |
| `FetchUserData.cmd` | `FUD.CMD` | All capitals from file name |
| `ua_fetchUserData.sqlrpgle` | `UAFUD.MODULE` | Prefix, followed by first post-prefix character plus following capitals |
| `ART200D-Work_with_Article.DSPF` | `ART200D.FILE` | Support for ibmi-bob file name |

# Source Code Rules – Unresolved Objects

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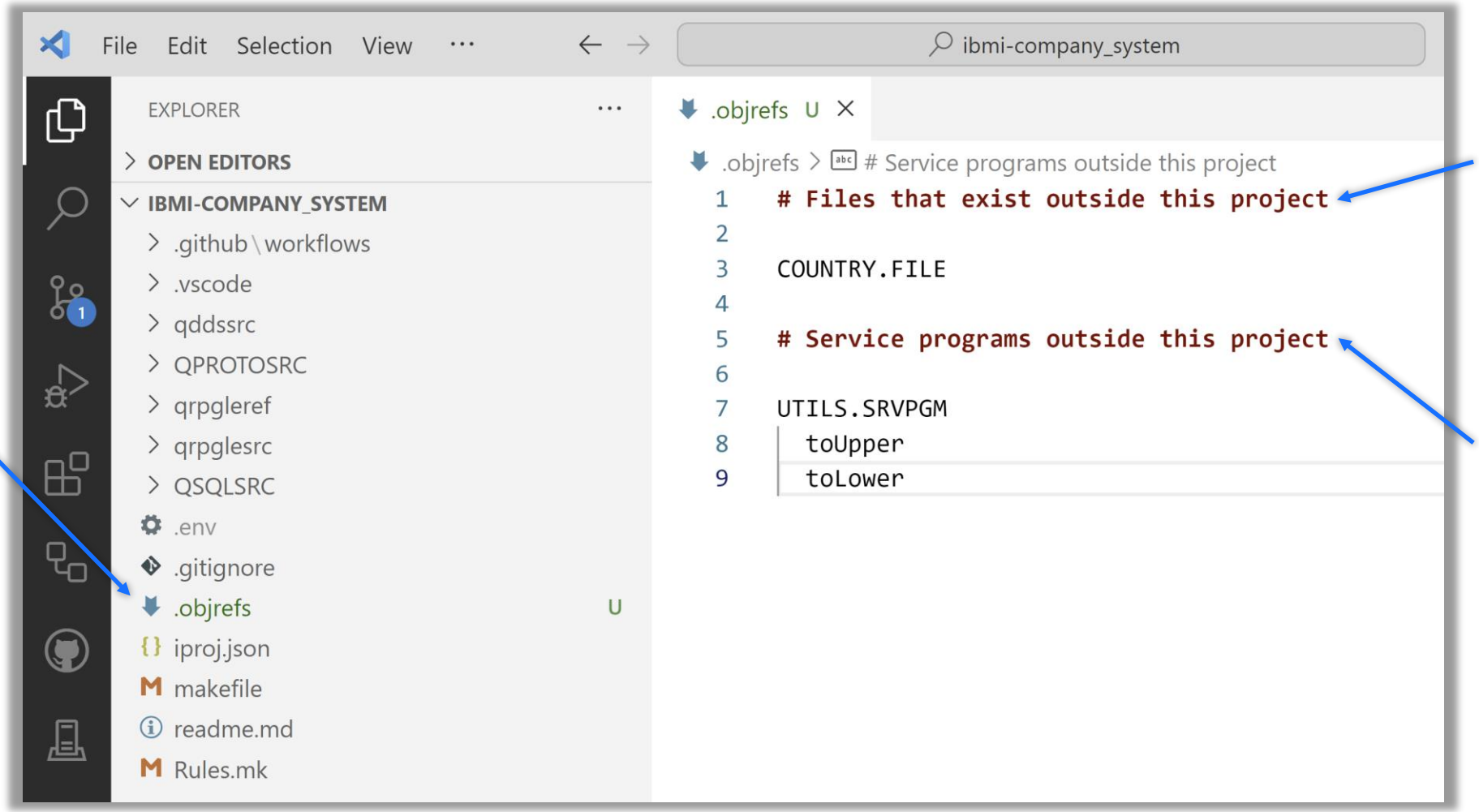
Source Orbit will complain about unresolved objects

```
no object found for reference 'COUNTRY'
```




List objects/source that are in another repository or already exist in a library

Create file in project root

For service programs, list exports by indenting after reference

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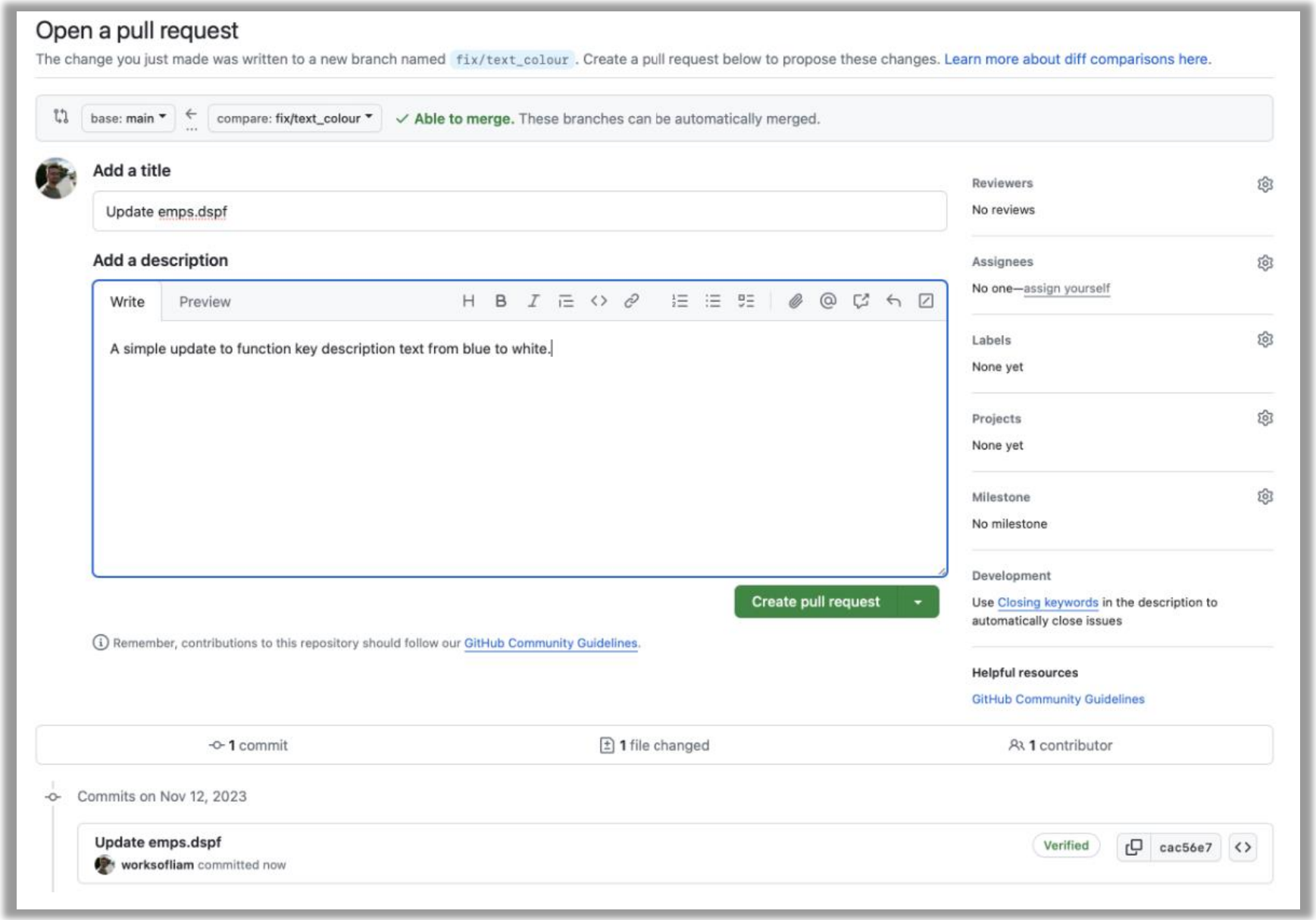
# Practical Use Cases

# Create New Pull Request...



# Trigger a Workflow...

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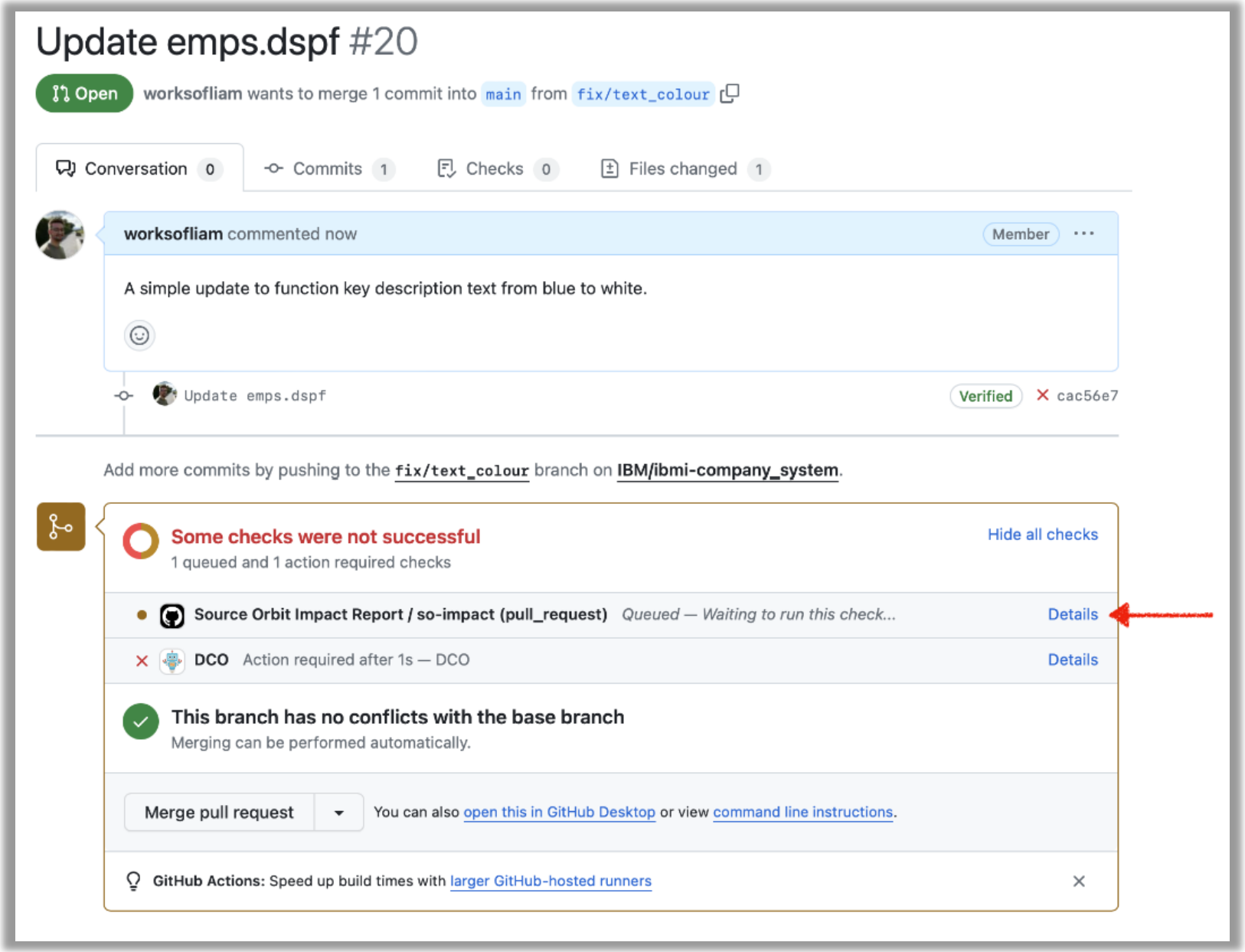

# Post a Comment...

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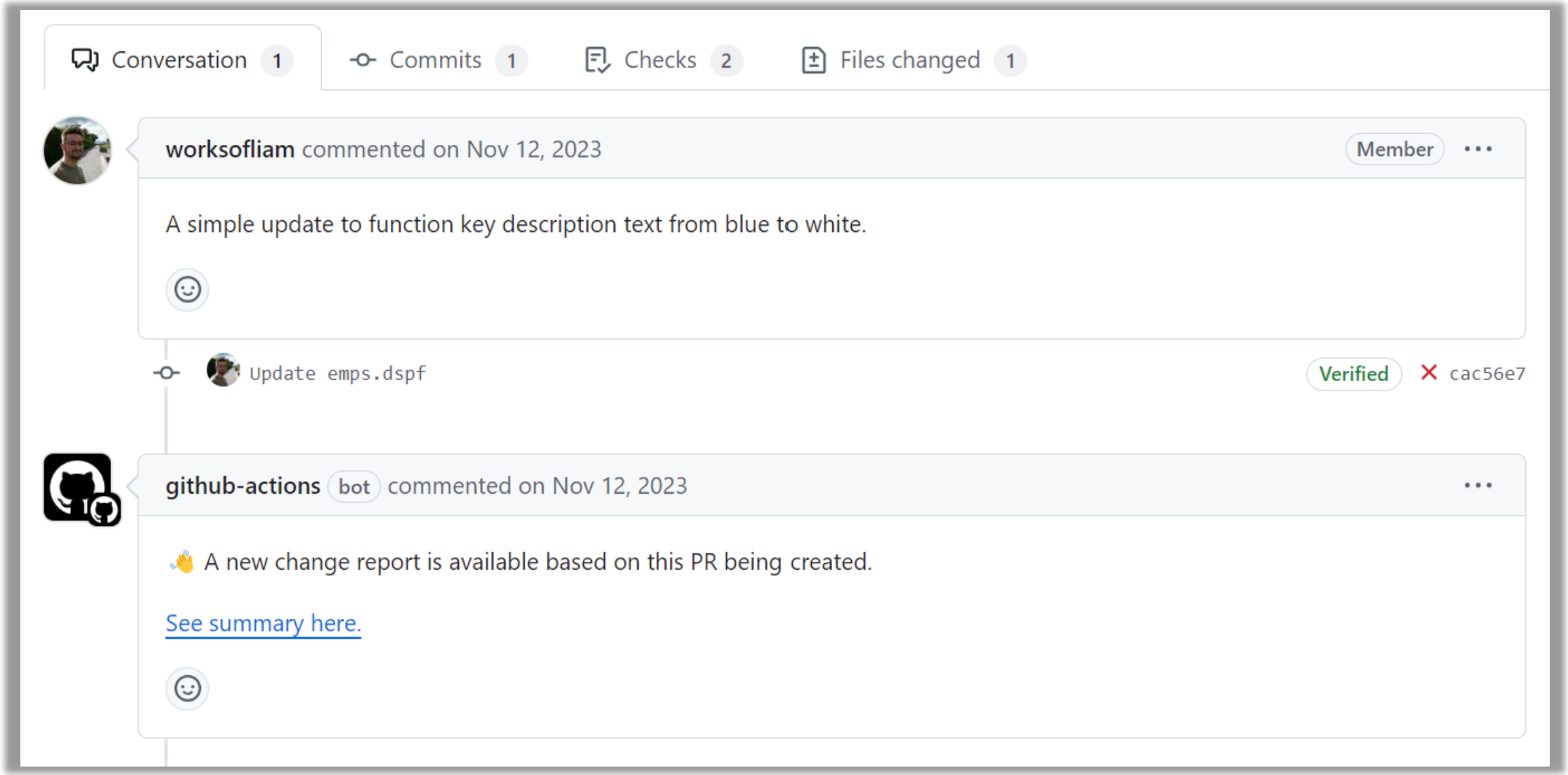

# View Impact Analysis....

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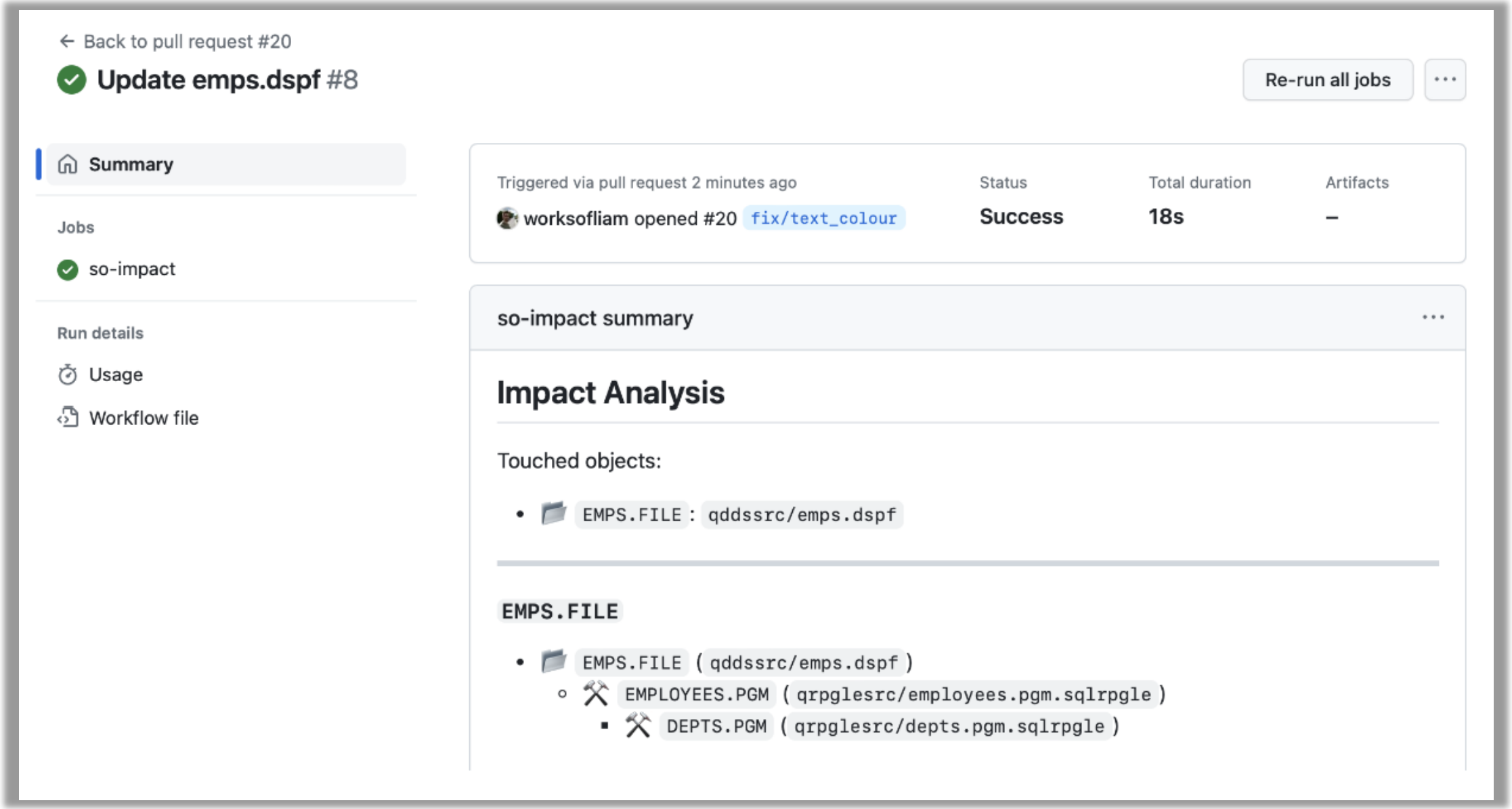

# View Build Status...

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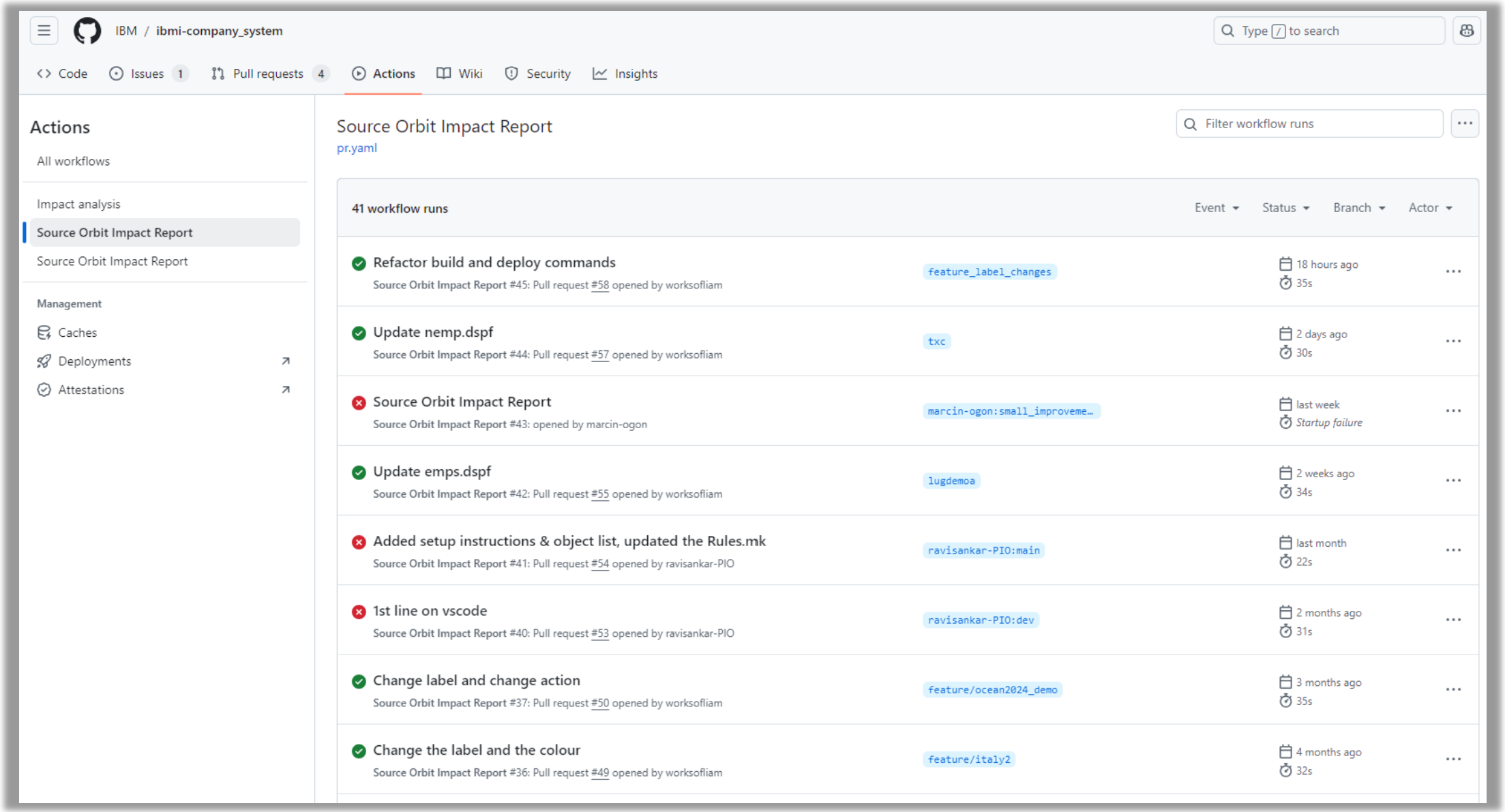

# Demo

# Any Questions?

# Important Links

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## 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

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

# Automating Builds in Git on IBM i - Sanjula Ganepola

Please take the last minute of this session to complete the evaluation. A direct link to the evaluation can be found using the QR code below.

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