

Automating Builds

in Git on IBM i

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🌟 Special thank you to Liam Allan for slide content!

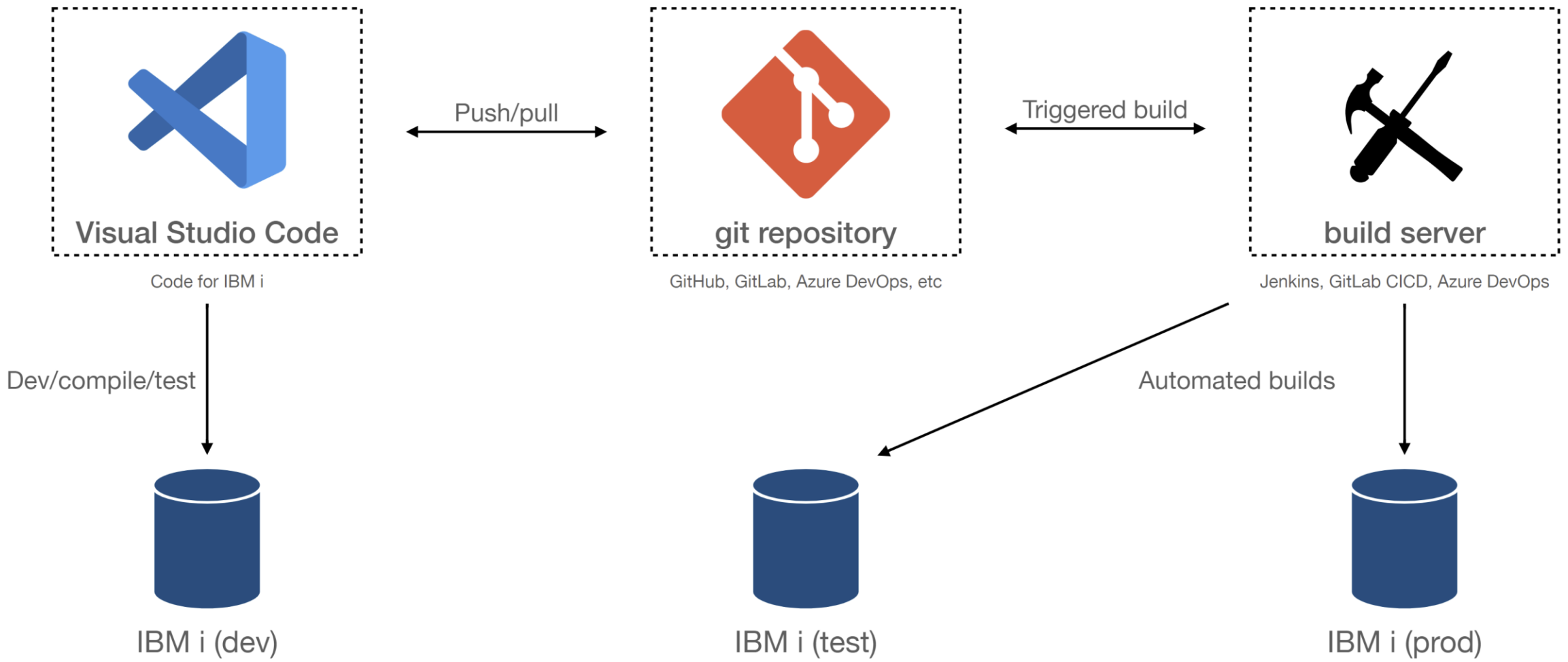


Agenda

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

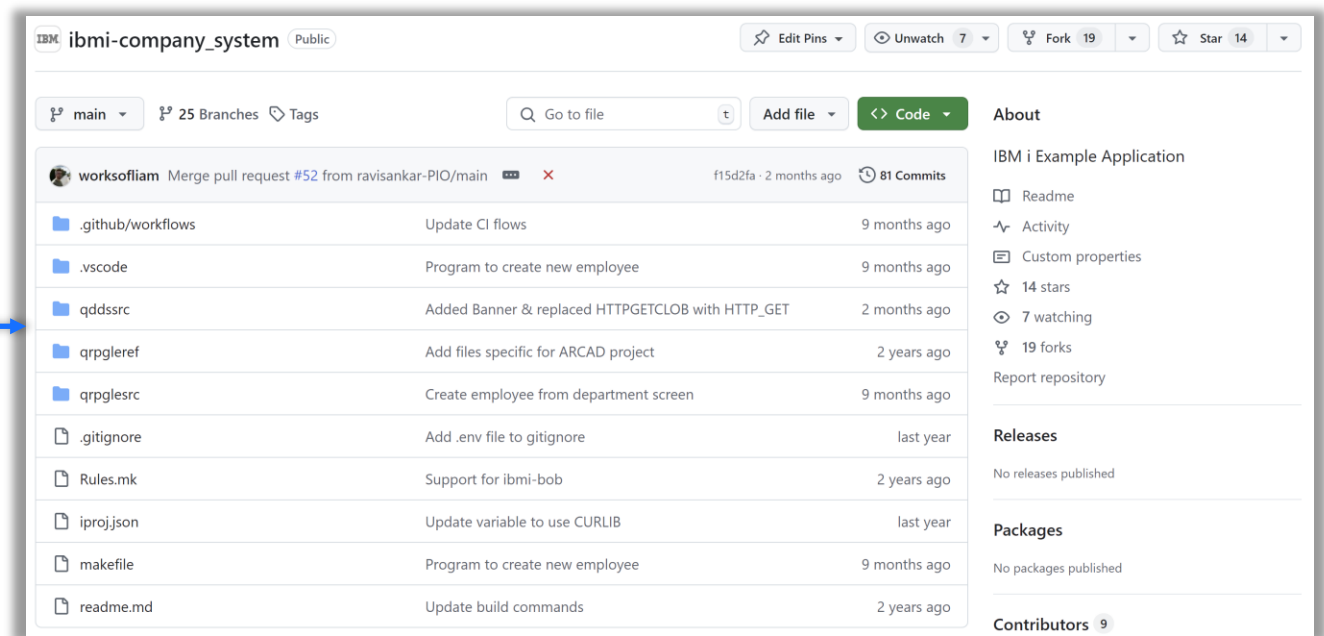
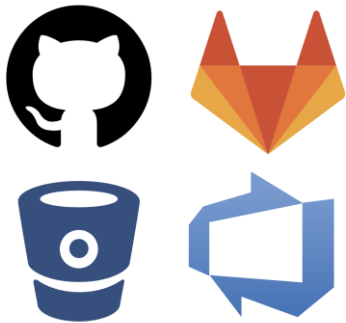
The Modern Development Lifecycle with Git

What Does Modern Development Look Like?



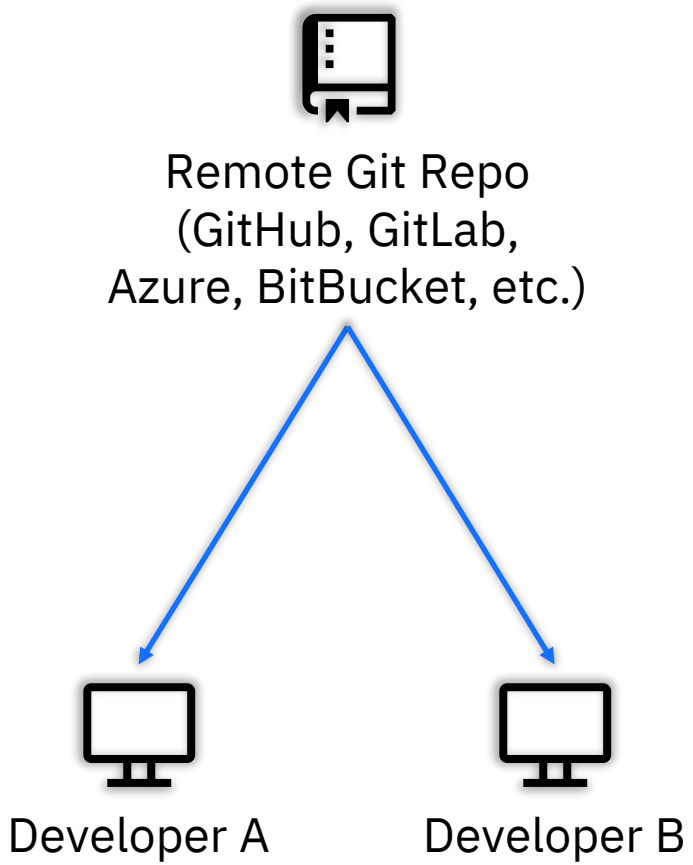
Development with Git

- 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

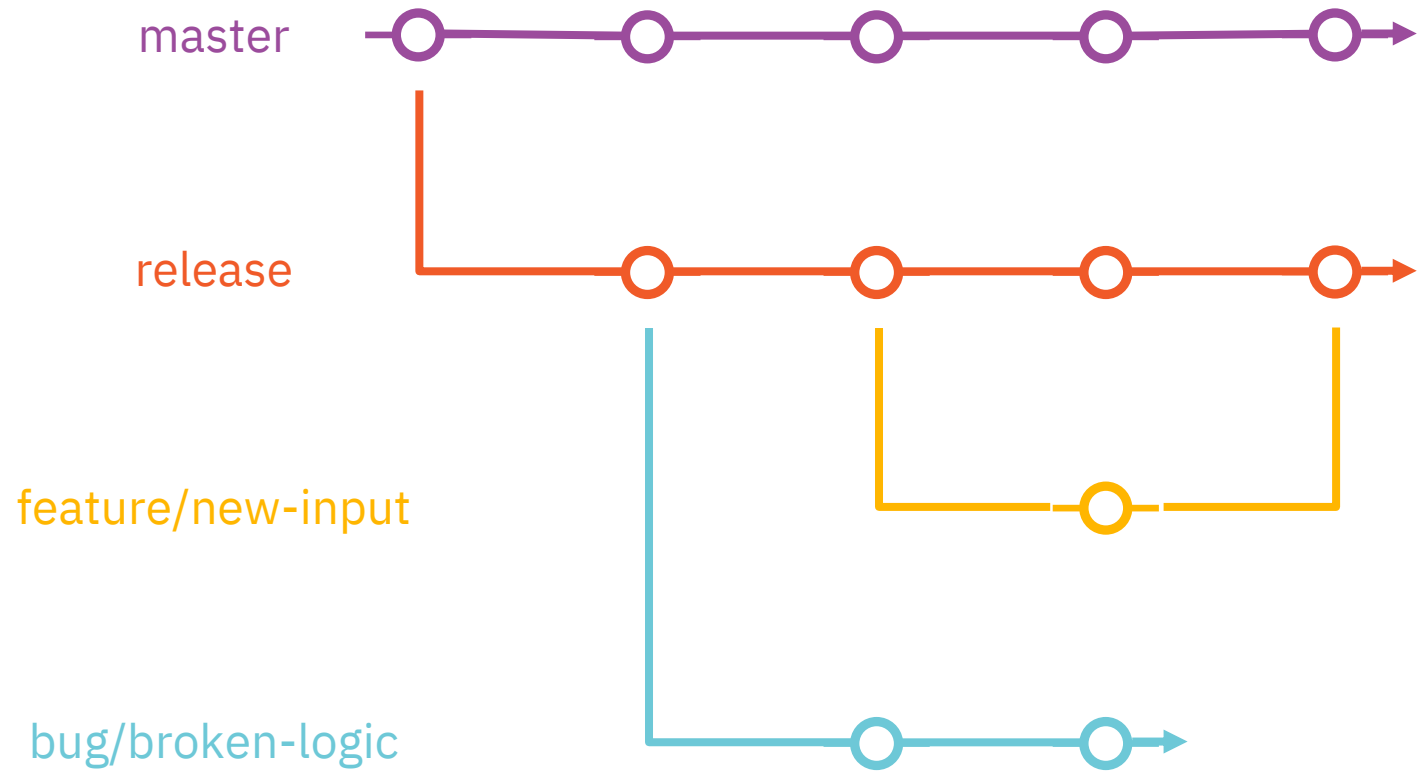


Why use Git?

Distributed Development



Version Control and Git Workflow

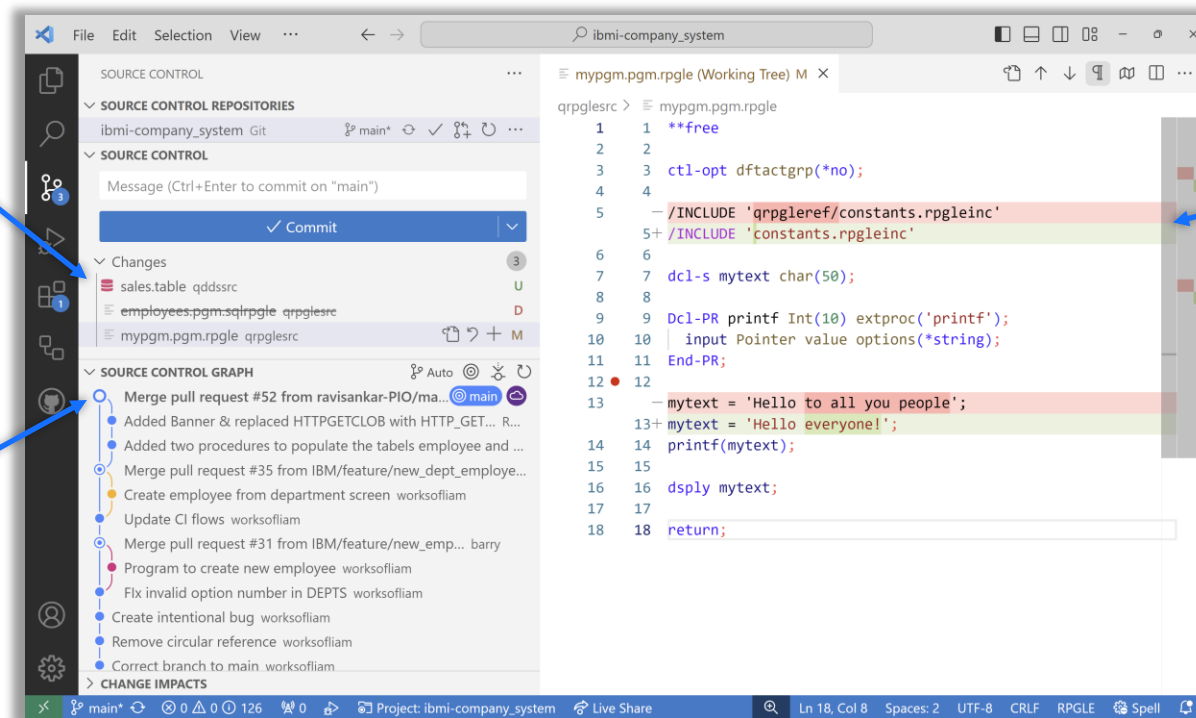


Local Development Experience

- 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

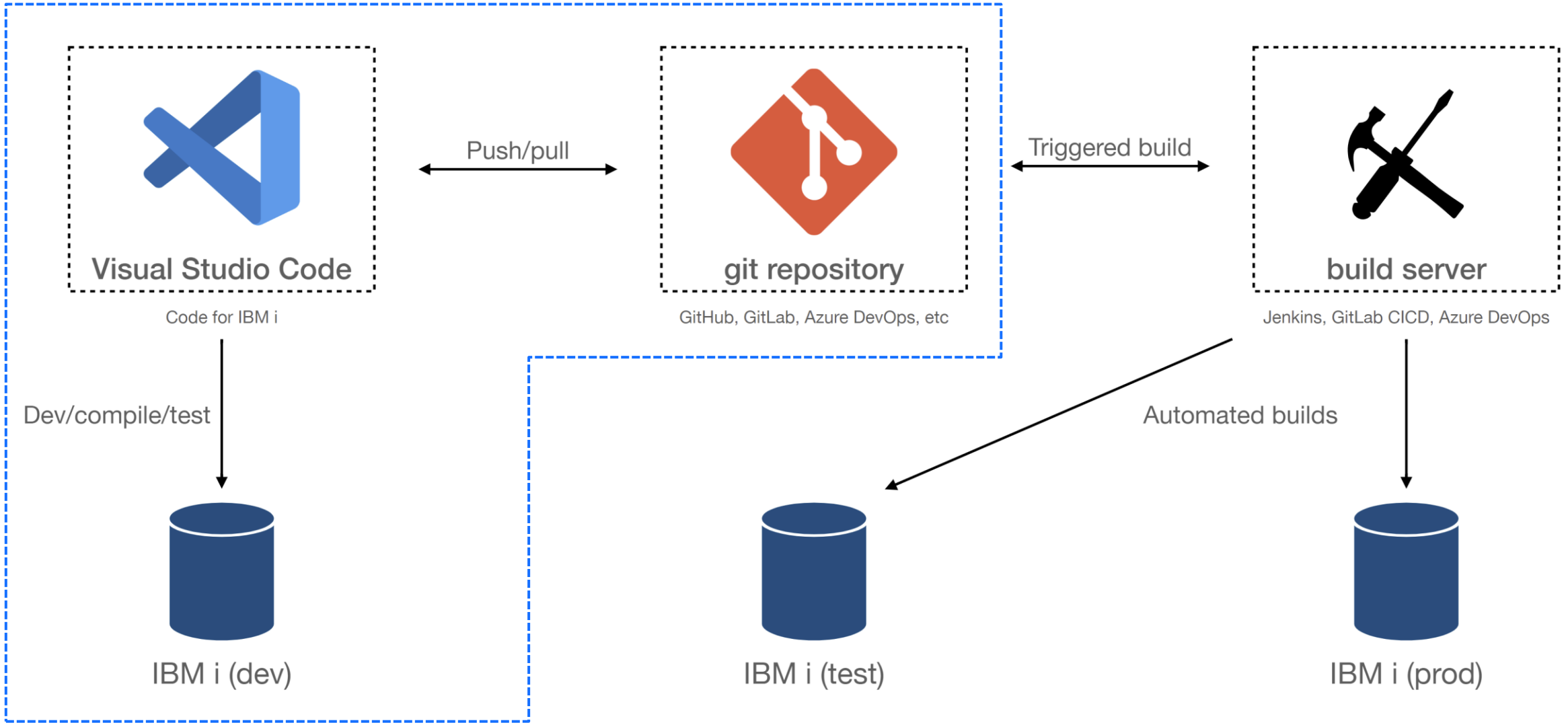


View current
repository changes

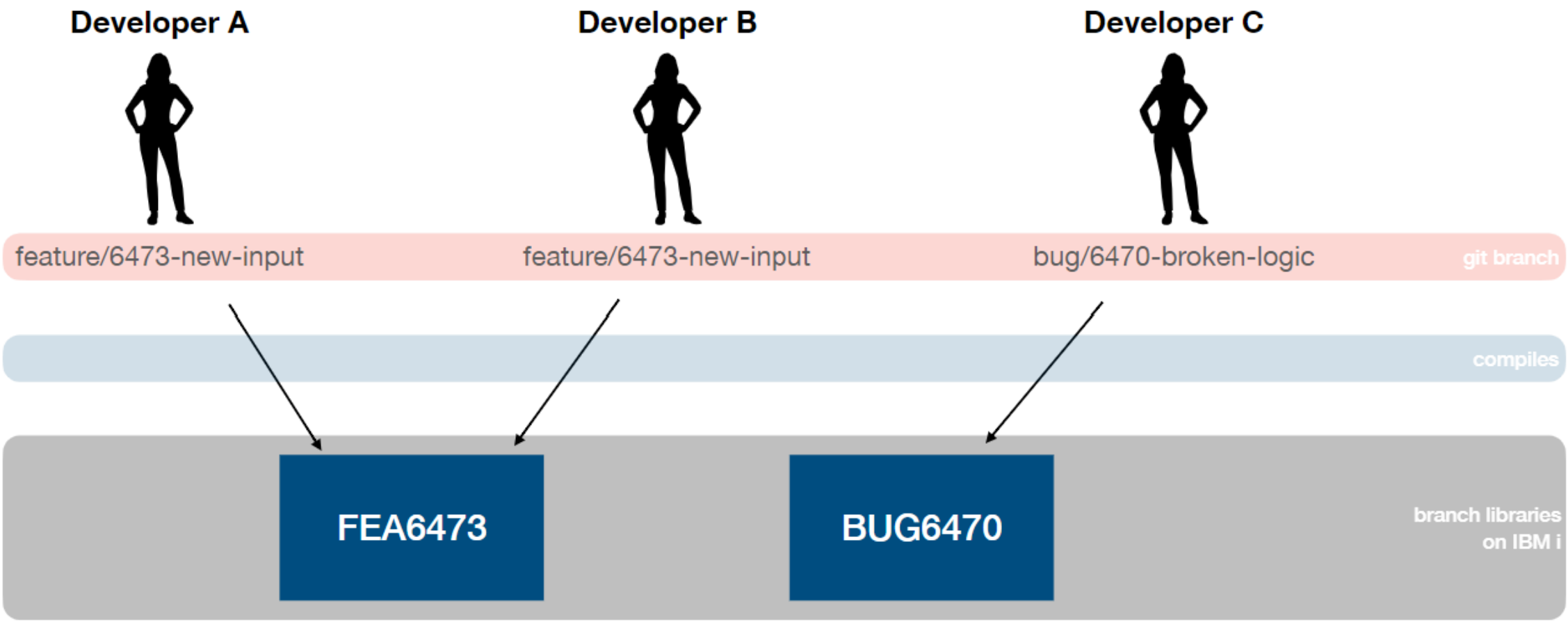
View changes
line by line

View a graphical
representation of
incoming and
outgoing commits

How to work efficiently with these 3 components?

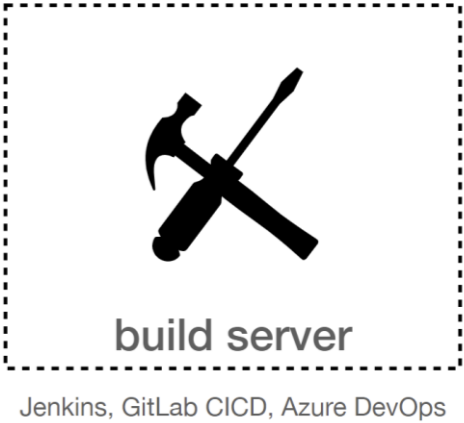
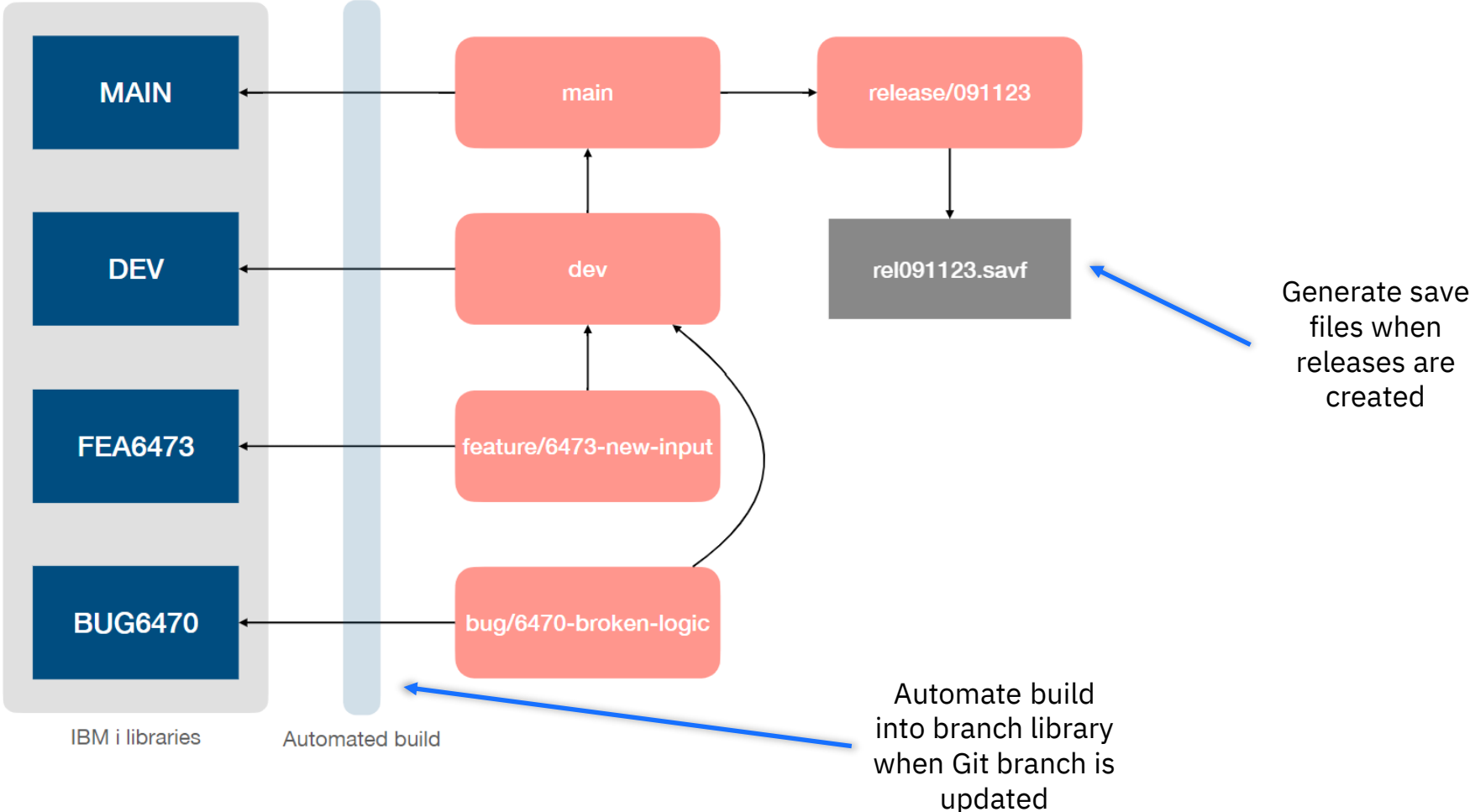


Map Git branches to libraries on IBM i



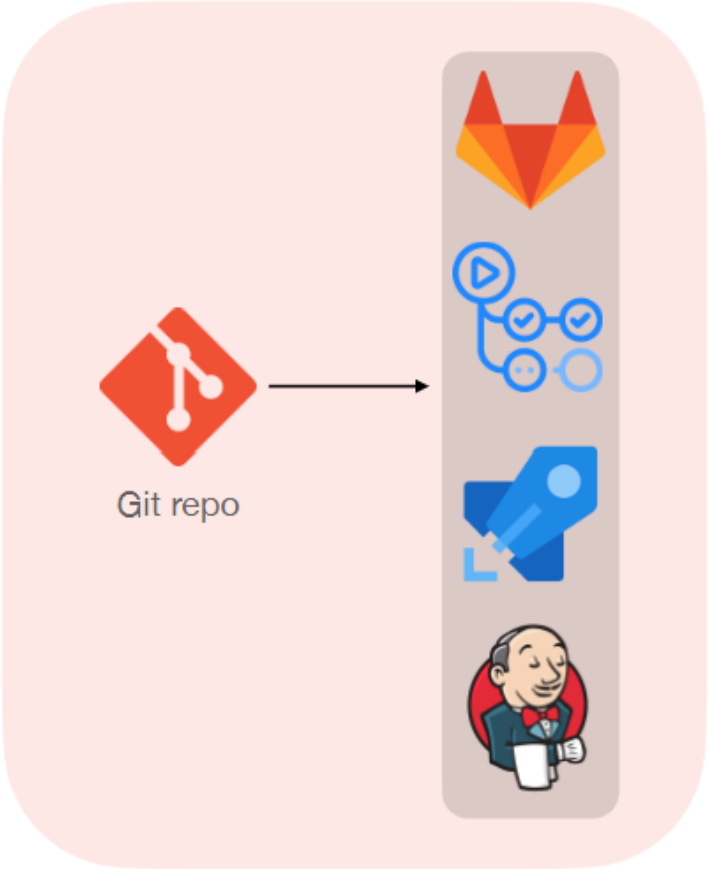
Build Server

Let's go one step further and automate this process



How to create workflows?

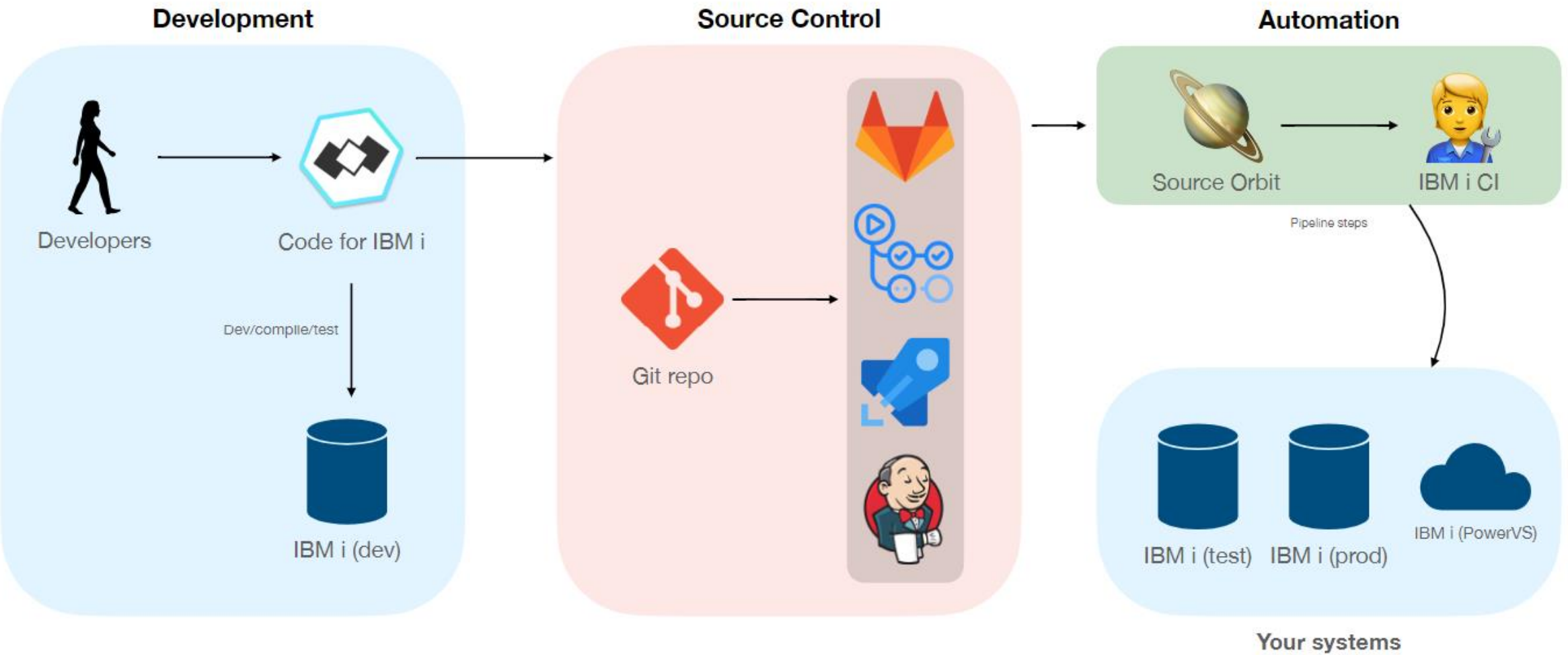
Source Control & Automation



| | |
|--------------|---------------------------------|
| 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

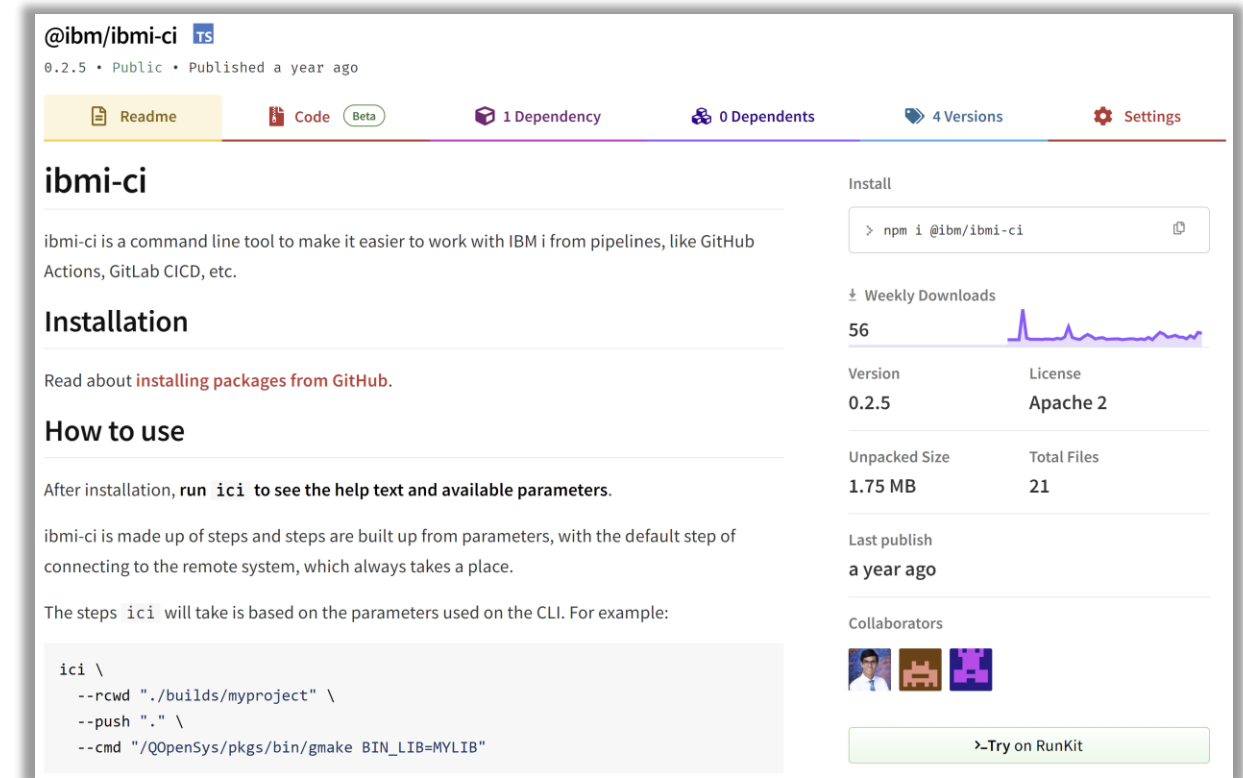
How to achieve automation with IBM i?



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 npm package page for `@ibm/ibmi-ci`. The package is version 0.2.5, published a year ago, and is public. It has 1 dependency and 0 dependents. The package is available in 4 versions and has settings. The package is described as a command line tool to make it easier to work with IBM i from pipelines, like GitHub Actions, GitLab CICD, etc. The installation command is `npm i @ibm/ibmi-ci`. The package has 56 weekly downloads. The version is 0.2.5 and the license is Apache 2. The unpacked size is 1.75 MB and the total files are 21. The last publish was a year ago. The package has collaborators. The package is available on RunKit.

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

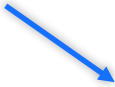
GitHub Action Example

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

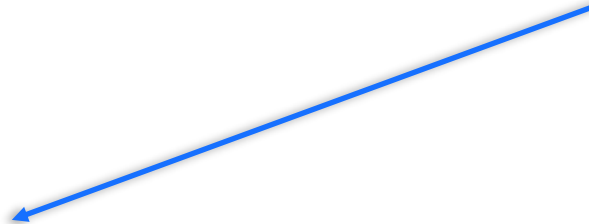
      - name: Install Dependencies
        run: npm i -g @ibm/sourceorbit

      - 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 }
```

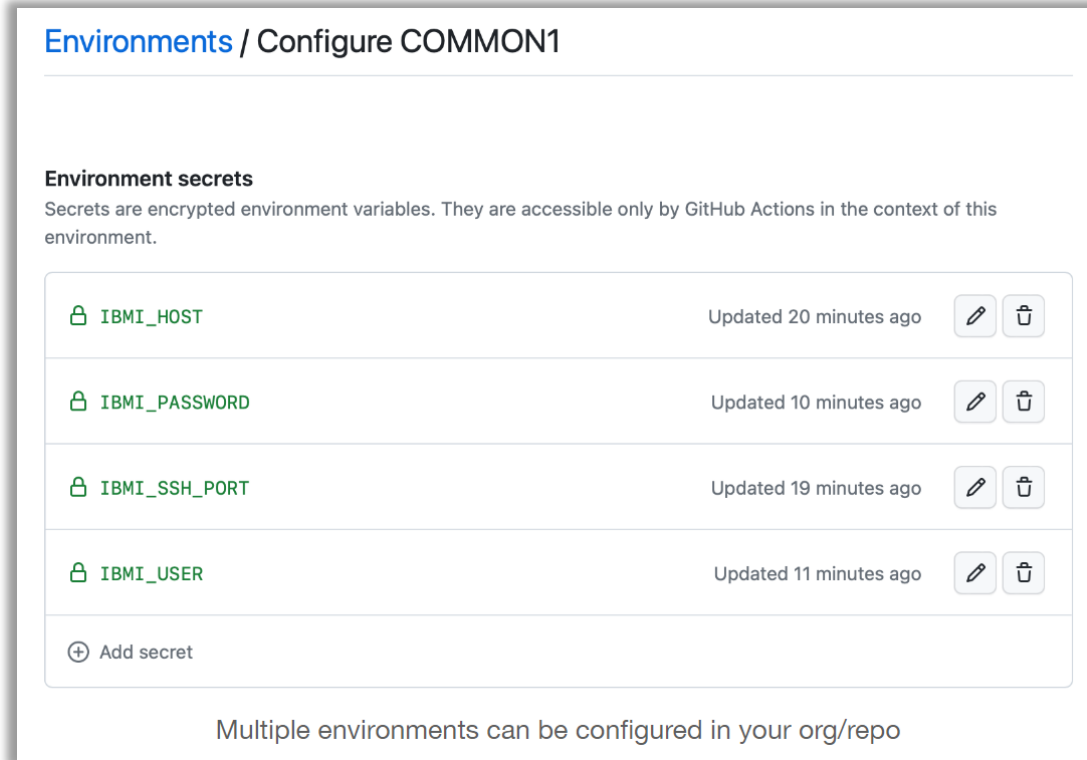
IBM i connection is
specified as
environment
variables



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 page includes a 'Readme' tab, a 'Code' tab (marked as Beta), and a 'Settings' tab. The 'Source Orbit' section describes it as a dependency management tool for RPGLE/CLLE/SQL/DDS/binder sources. The 'General usage' section lists several features: listing project objects with `--verbose`, showing object dependencies with `-l`, generating a makefile based on the dependency tree, renaming files easily, and fixing RPGLE includes. The 'Install' section shows the command `npm i @ibm/sourceorbit`. The 'Homepage' is `ibm.github.io/sourceorbit/#/`. The 'Weekly Downloads' are 56. The 'Version' is 0.11.1 and the 'License' is Apache 2. The 'Unpacked Size' is 164 kB and the 'Total Files' are 20. 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 5-star rating (2 reviews). It is free and available for installation. The page includes an 'Install' button and a 'Trouble Installing?' link. The 'Overview' tab is selected, showing a description of the extension as a dependency management tool for IBM i. The 'Categories' section shows 'Other'. The 'Tags' section includes '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' section shows version v1.0.2 with 44 installs. The 'CLI' section shows version v1.0.2 with 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

QRPGLESRC

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.

GitHub Action Example

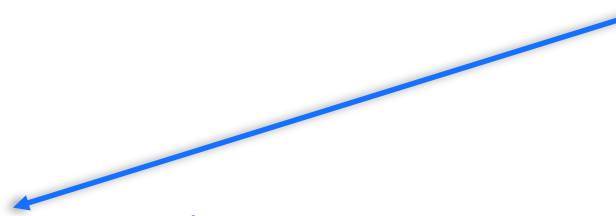
```
jobs:
  so-impact:
    runs-on: ubuntu-latest
    steps:
      # Checkout repository and setup node steps omitted

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

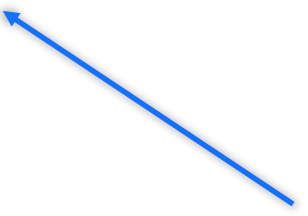
      - name: Generate impact information
        run: so -bf imd -l `git diff --name-only origin/main origin/${GITHUB_HEAD_REF}`

      - 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

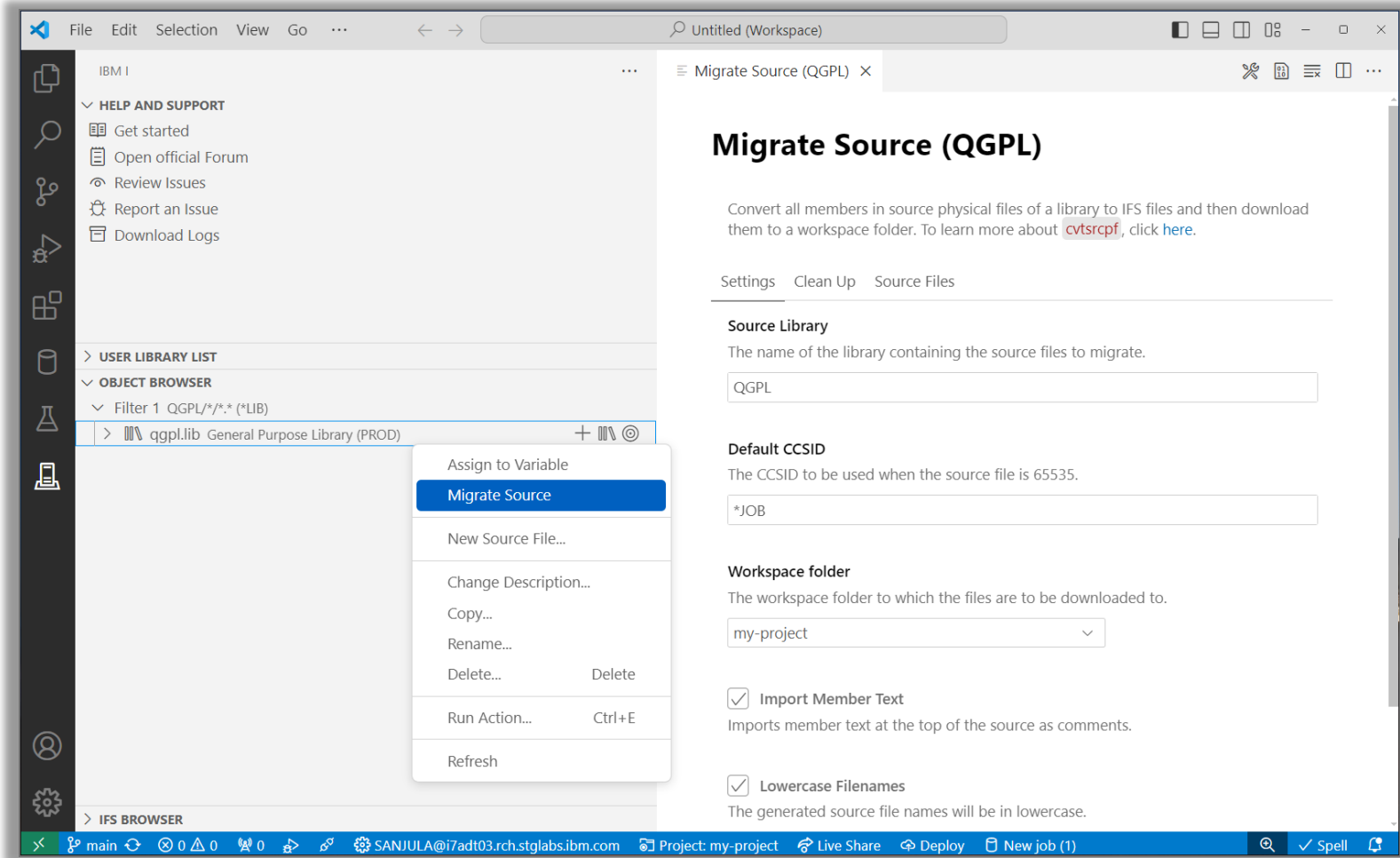


QSYS members in
source physical files
↓
Properly encoded,
terminated, and named
source files in an IFS
directory

↓
Download to local
project

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

Source Orbit



Practical Use Cases

Create New Pull Request...

Open a pull request

The change you just made was written to a new branch named `fix/text_colour`. Create a pull request below to propose these changes. [Learn more about diff comparisons here.](#)

base: main

compare: fix/text_colour

✓ Able to merge. These branches can be automatically merged.

Add a title

Update emps.dspf

Write

Preview

H B I

≡ < >

🔗

≡ ≡ ≡

🔗 @ ↻ ↶

A simple update to function key description text from blue to white.

Create pull request

Remember, contributions to this repository should follow our [GitHub Community Guidelines](#).

Reviewers

No reviews

Assignees

No one—[assign yourself](#)

Labels

None yet

Projects

None yet

Milestone

No milestone

Development

Use [Closing keywords](#) in the description to automatically close issues

Helpful resources

[GitHub Community Guidelines](#)

1 commit

1 file changed

1 contributor

Commits on Nov 12, 2023

Update emps.dspf

worksofliam committed now

Verified

cac56e7

<>

Trigger a Workflow...

Update emps.dspf #20

Open

 worksofliam wants to merge 1 commit into `main` from `fix/text_colour`

Conversation 0

Commits 1

Checks 0

Files changed 1

worksofliam commented now

Member ...

A simple update to function key description text from blue to white.

 Update emps.dspf

Verified cac56e7

Add more commits by pushing to the `fix/text_colour` branch on [IBM/ibmi-company_system](#).

Some checks were not successful [Hide all checks](#)

1 queued and 1 action required checks

Source Orbit Impact Report / so-impact (pull_request) *Queued — Waiting to run this check...* [Details](#)

DCO Action required after 1s — DCO [Details](#)

This branch has no conflicts with the base branch
Merging can be performed automatically.


Merge pull request


You can also [open this in GitHub Desktop](#) or view [command line instructions](#).


GitHub Actions: Speed up build times with [larger GitHub-hosted runners](#)


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Post a Comment...

 Conversation 1

 Commits 1

 Checks 2


 Files changed 1






worksofliam commented on Nov 12, 2023


Member ...

A simple update to function key description text from blue to white.




 Update emps.dspf

Verified  cac56e7




github-actions bot commented on Nov 12, 2023

...

 A new change report is available based on this PR being created.

[See summary here.](#)



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View Impact Analysis....

[← Back to pull request #20](#)

✓ **Update emps.dspf #8**

Re-run all jobs



Summary

Jobs

✓ so-impact

Run details

Usage

Workflow file

Triggered via pull request 2 minutes ago

Status

Total duration

Artifacts

worksofliam opened #20 [fix/text_colour](#)

Success

18s

—

so-impact summary



Impact Analysis


Touched objects:

- EMPS.FILE** : `qddssrc/emp.dspf`


EMPS.FILE

- EMPS.FILE** (`qddssrc/emp.dspf`)
 - EMPLOYEES.PGM** (`qrpglesrc/employees.pgm.sqlrpgle`)
 - DEPTS.PGM** (`qrpglesrc/depts.pgm.sqlrpgle`)

☰

 IBM / ibmi-company_system

🔍 Type / to search



<> Code

🔴 Issues 1

🔗 Pull requests 4

▶ Actions

📖 Wiki

🛡 Security

📊 Insights

Actions

All workflows

Impact analysis

Source Orbit Impact Report

Source Orbit Impact Report

Management

🗄 Caches

🚀 Deployments ↗

🛡 Attestations ↗

Source Orbit Impact Report

[pr.yaml](#)

🔍 Filter workflow runs

⋮

41 workflow runs

Event ▾ Status ▾ Branch ▾ Actor ▾

✔ Refactor build and deploy commands

Source Orbit Impact Report #45: Pull request #58 opened by worksofliam

feature_label_changes

📅 18 hours ago
🕒 35s

⋮

✔ Update nemp.dspf

Source Orbit Impact Report #44: Pull request #57 opened by worksofliam

txc

📅 2 days ago
🕒 30s

⋮

✖ Source Orbit Impact Report

Source Orbit Impact Report #43: opened by marcin-ogon

marcin-ogon:small_improveme...

📅 last week
🕒 Startup failure

⋮

✔ Update emps.dspf

Source Orbit Impact Report #42: Pull request #55 opened by worksofliam

lugdemoa

📅 2 weeks ago
🕒 34s

⋮

✖ Added setup instructions & object list, updated the Rules.mk

Source Orbit Impact Report #41: Pull request #54 opened by ravisankar-PIO

ravisankar-PIO:main

📅 last month
🕒 22s

⋮

✖ 1st line on vscode

Source Orbit Impact Report #40: Pull request #53 opened by ravisankar-PIO

ravisankar-PIO:dev

📅 2 months ago
🕒 31s

⋮

✔ Change label and change action

Source Orbit Impact Report #37: Pull request #50 opened by worksofliam

feature/ocean2024_demo

📅 3 months ago
🕒 35s

⋮

✔ Change the label and the colour

Source Orbit Impact Report #36: Pull request #49 opened by worksofliam

feature/italy2

📅 4 months ago
🕒 32s

⋮

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

