

Automating Builds

in Git on IBM i

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🌟 Special thank you to Liam Allan for slide content!

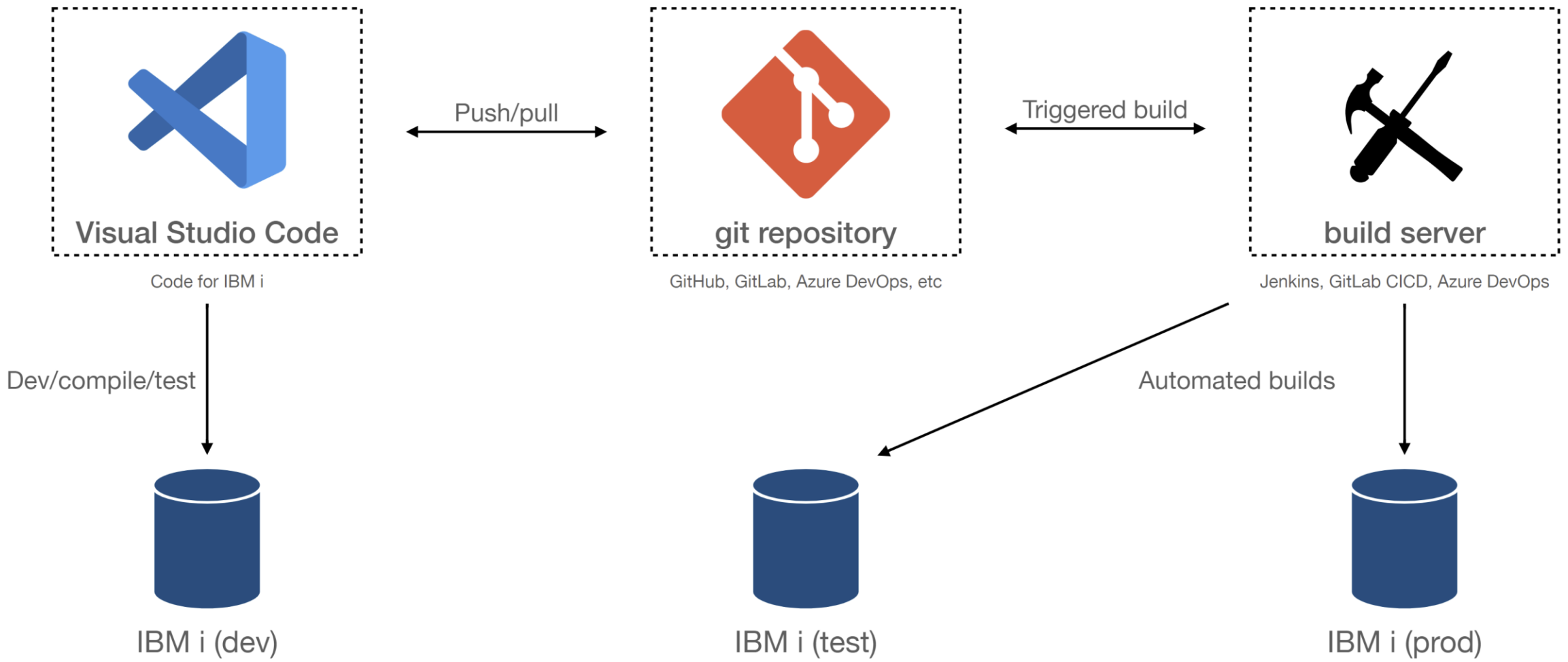


Agenda

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

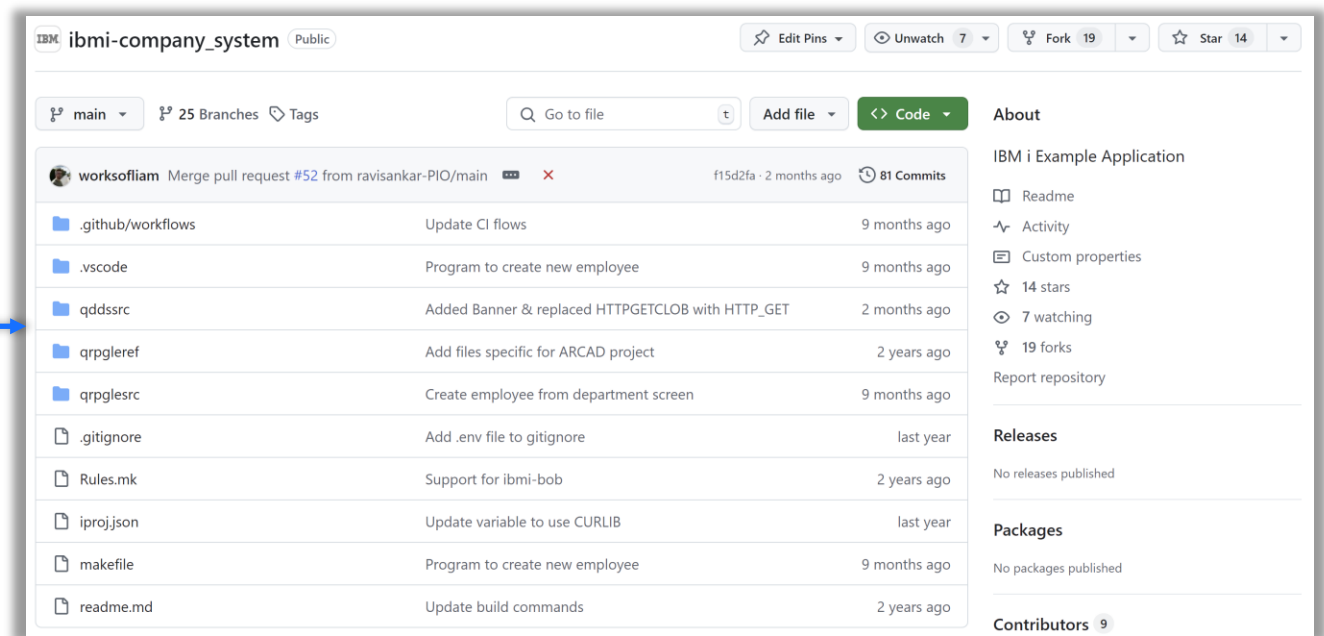
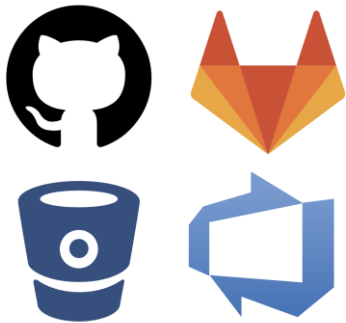
The Modern Development Lifecycle with Git

What Does Modern Development Look Like?



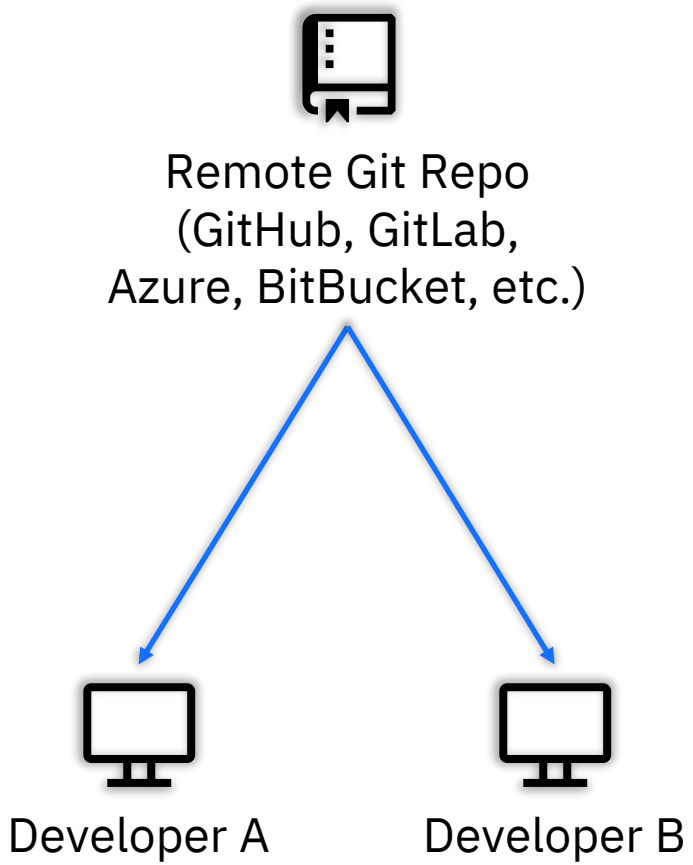
Development with Git

- 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

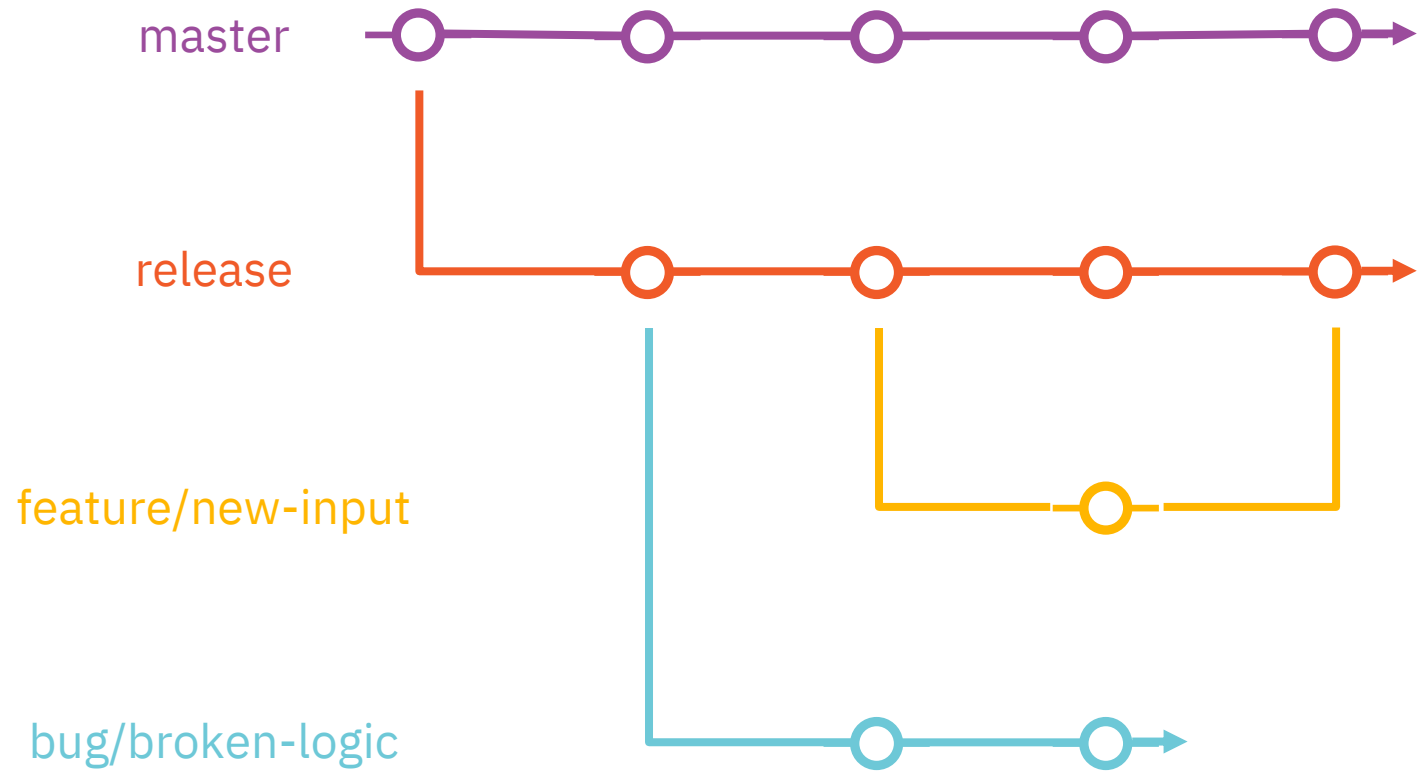


Why use Git?

Distributed Development



Version Control and Git Workflow

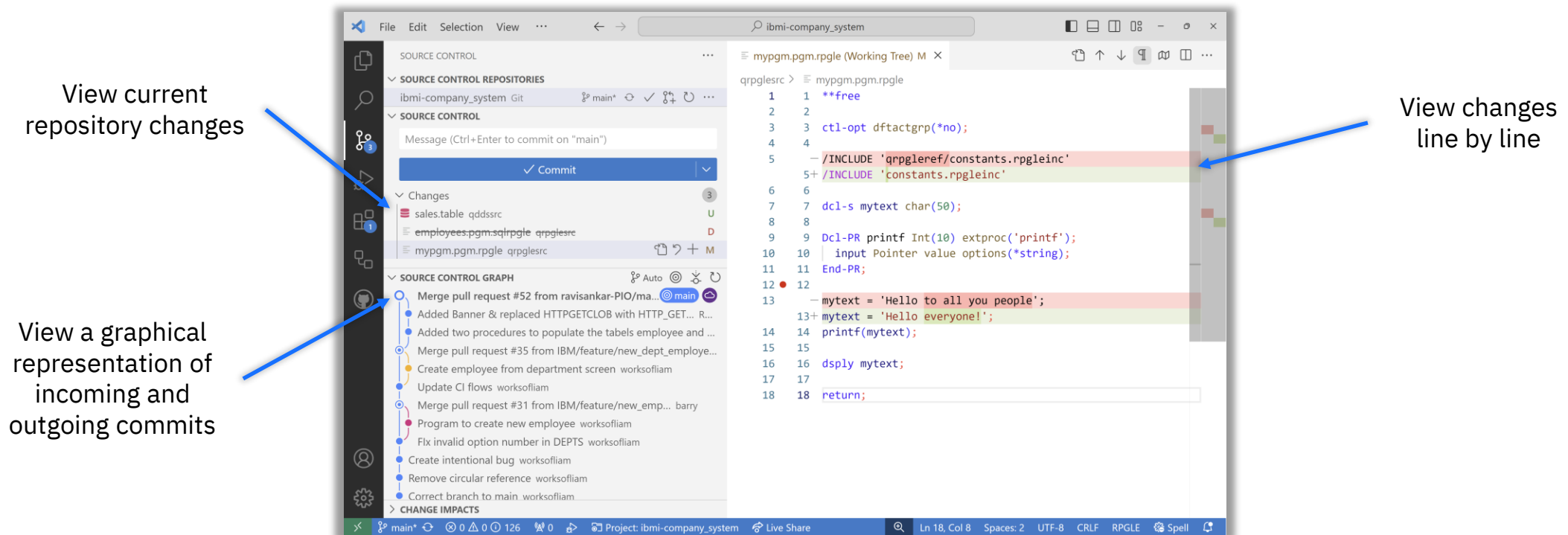


Local Development Experience

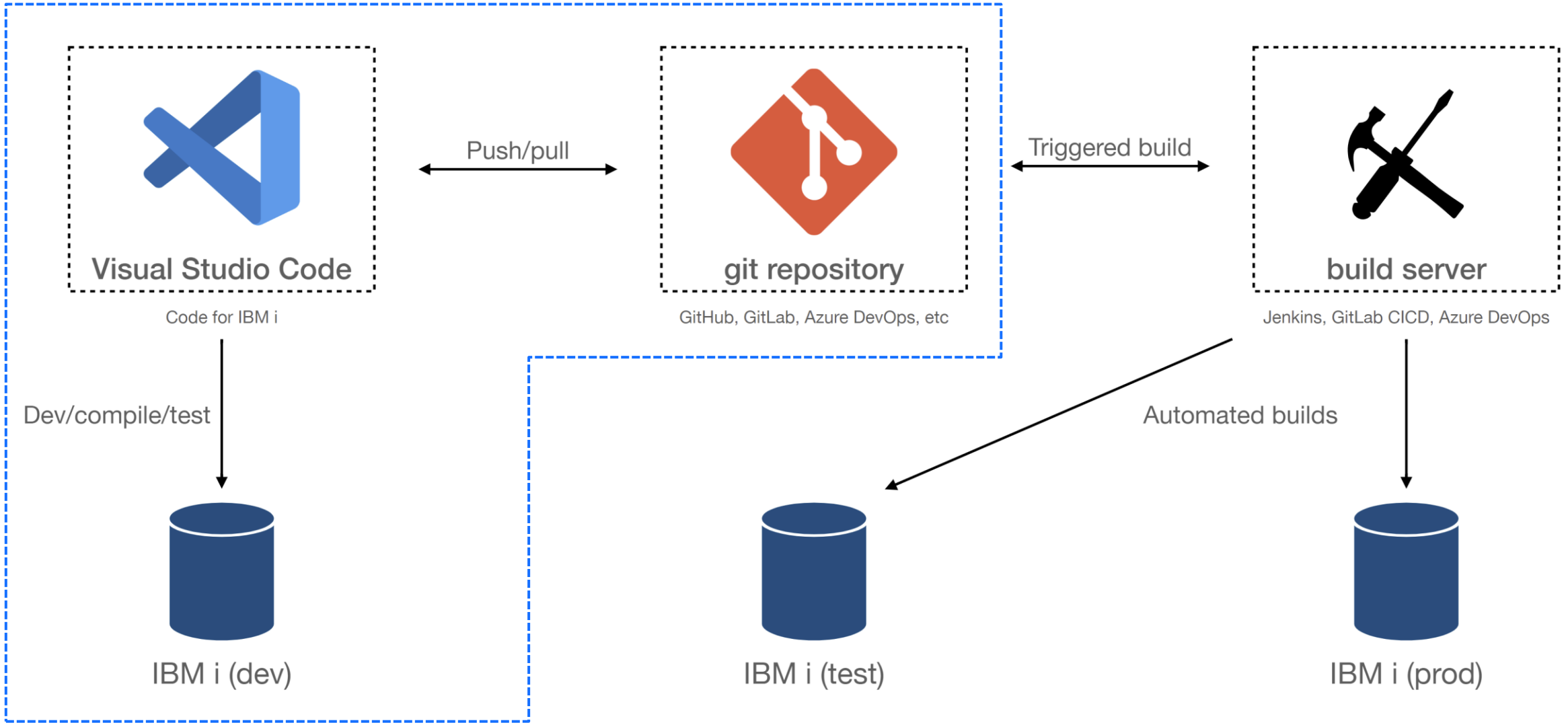
- IBM i
 - IBM i integration via open-source extensions
 - Support for RPGLE, COBOL, CL, SQL, and more!
- Git
 - First class Git support
 - Hundreds of Git tools



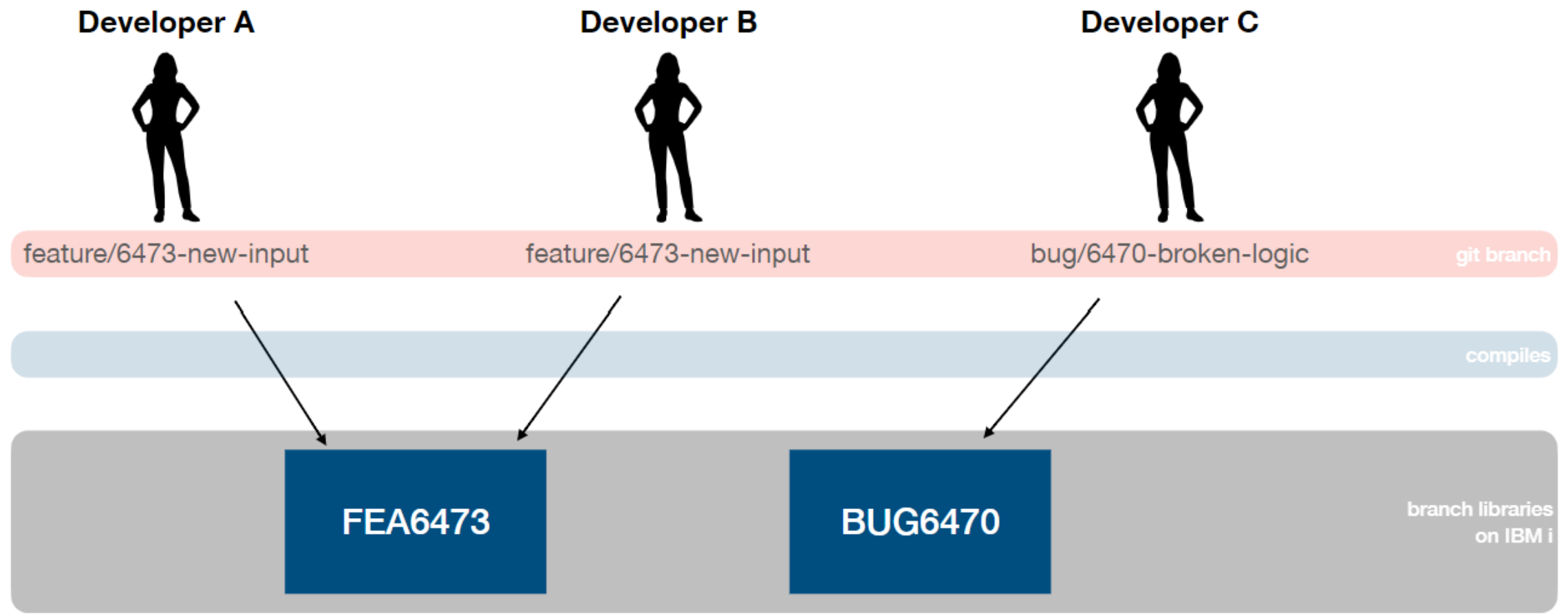
Code for IBM i



How to work efficiently with these 3 components?

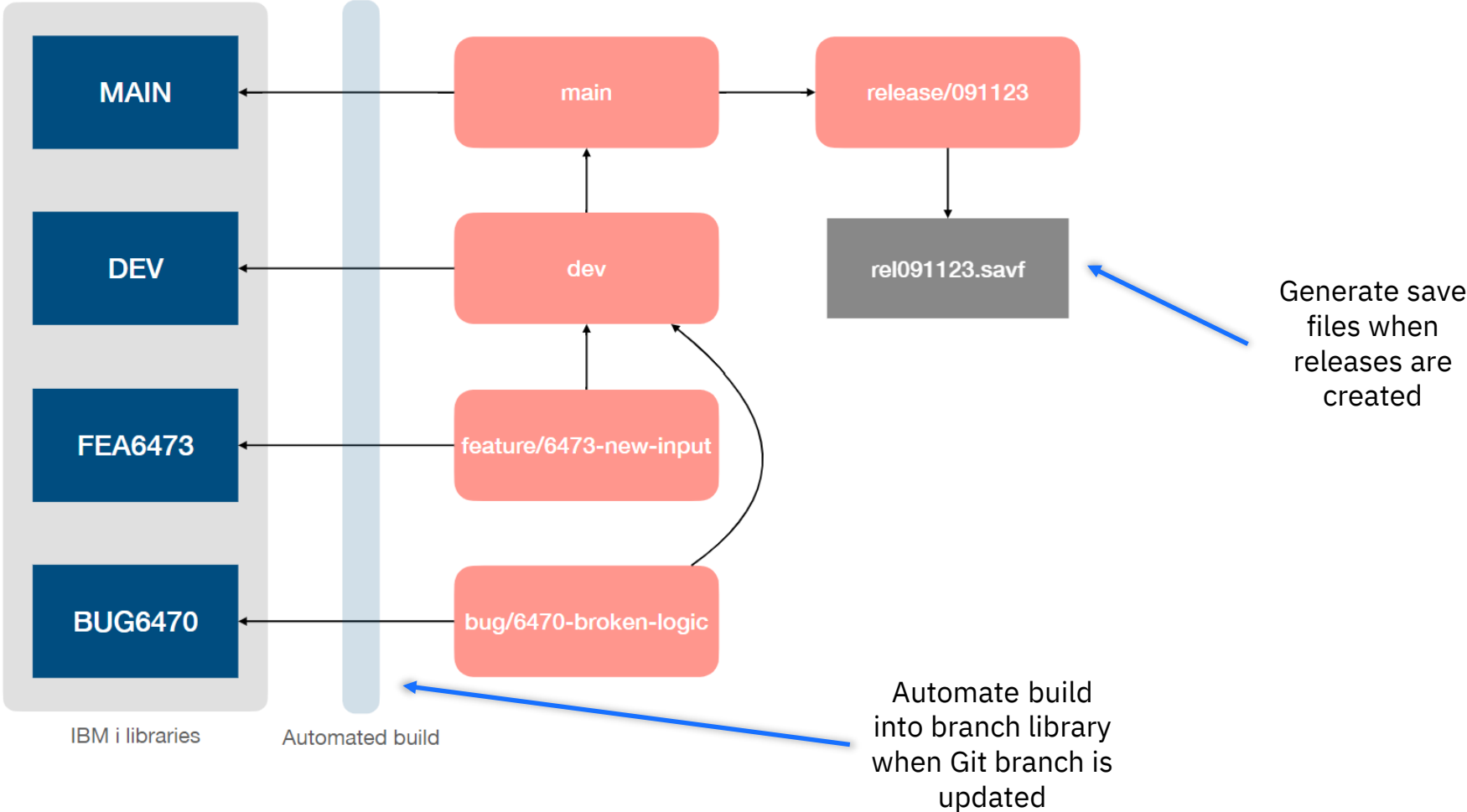


Map Git branches to libraries on IBM i



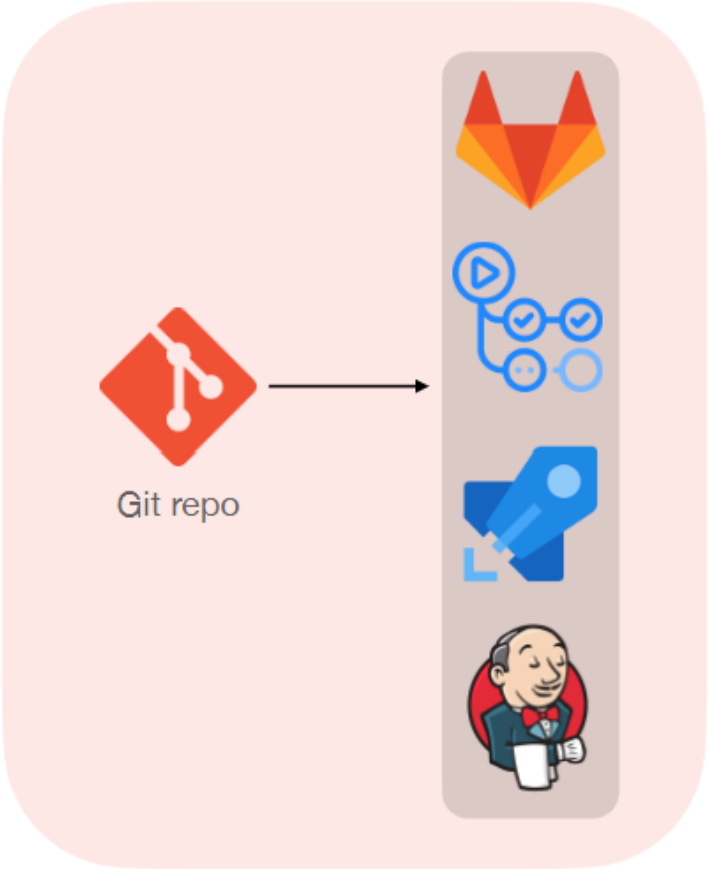
Build Server

Let's go one step further and automate this process



How to create workflows?

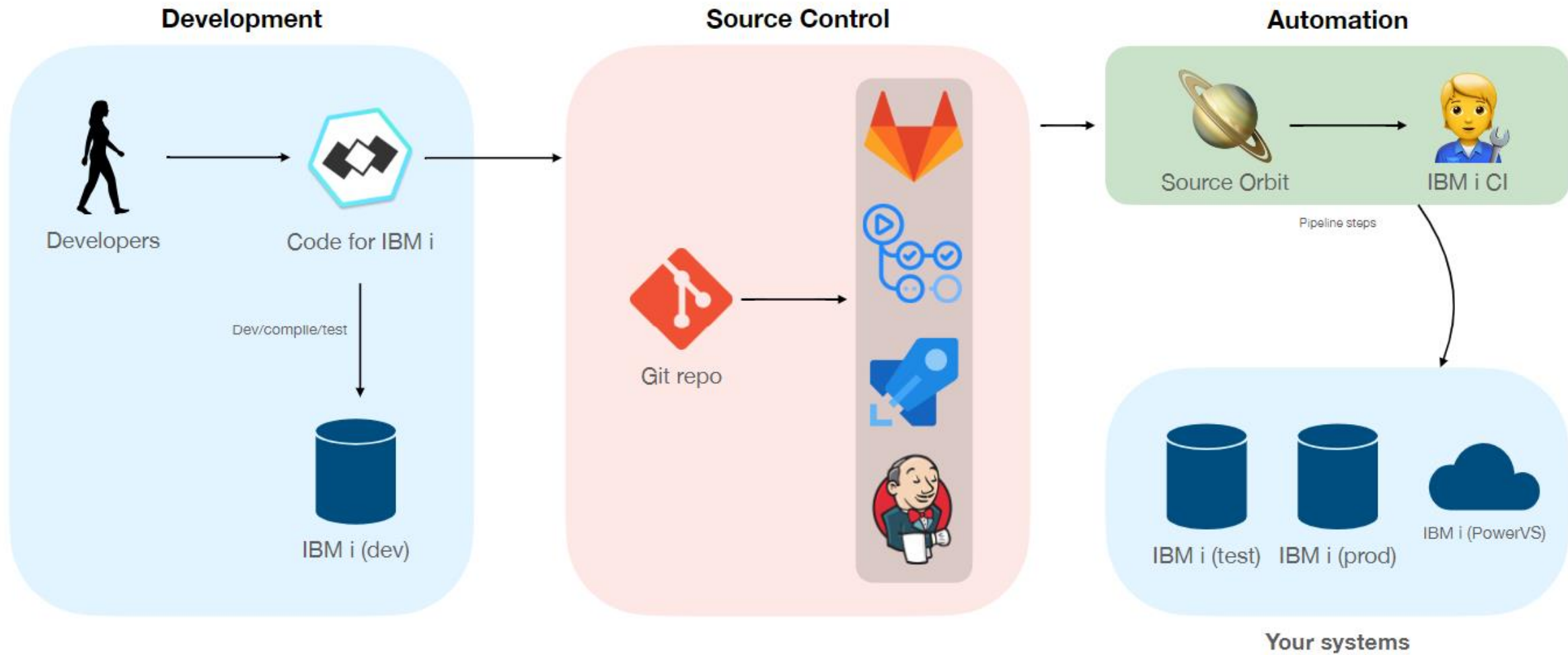
Source Control & Automation



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 code example. The right sidebar shows the install command `> npm i @ibm/ibmi-ci`, a weekly downloads graph with 56 downloads, version 0.2.5, Apache 2 license, 1.75 MB unpacked size, 21 total files, and a last publish date of a year ago. It also lists collaborators and a button to try 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

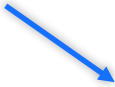
GitHub Action Example

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

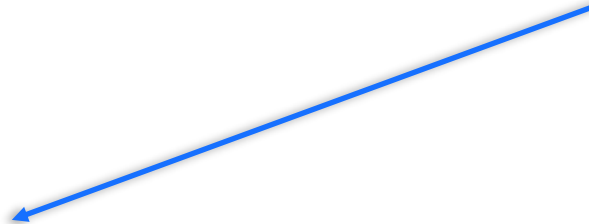
      - name: Install Dependencies
        run: npm i -g @ibm/sourceorbit

      - 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 }
```

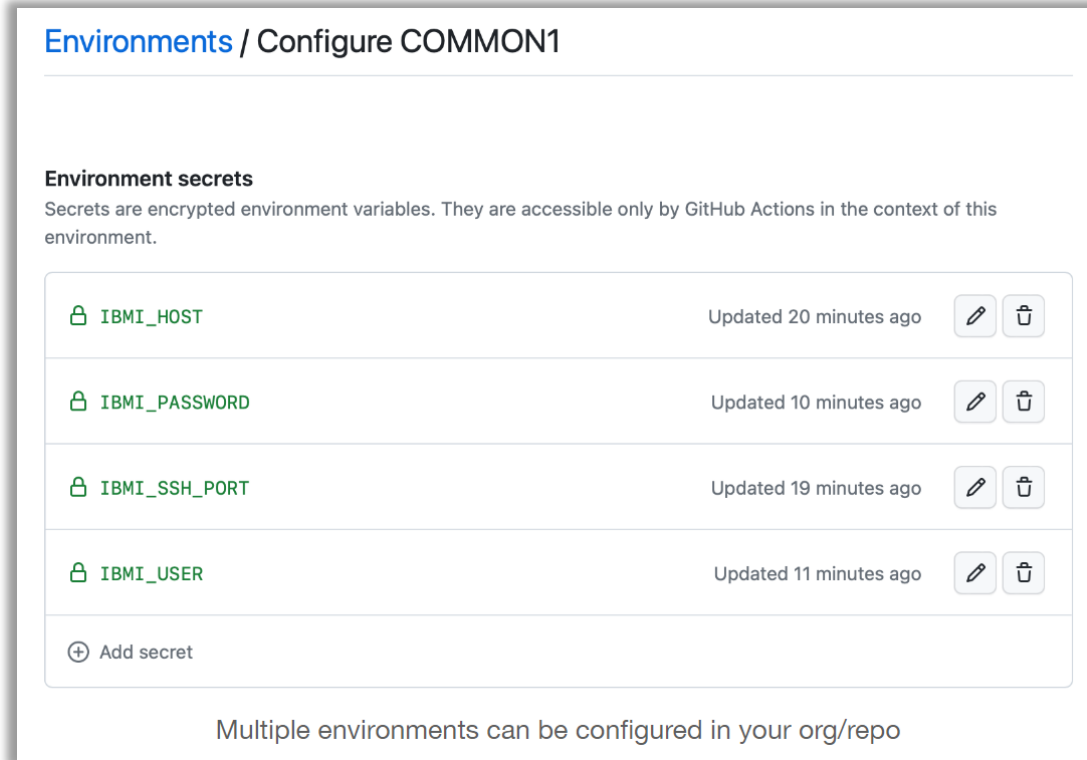
IBM i connection is
specified as
environment
variables



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 package is 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 there are 20 total files. The last publish was 11 days ago.

The screenshot shows the Source Orbit extension page on the Visual Studio Marketplace. The extension is by IBM, with 44 installs and a 5-star rating (2 reviews). It is free. The page includes an 'Install' button and a 'Trouble Installing?' link. The overview section describes Source Orbit as a dependency management tool for IBM i developers. It lists installation options: from VS Code Marketplace, from Open VSX Registry, from NPM, or by installing the CLI. It also provides links to view documentation and see releases. The extension version is v1.0.2, and it has 44 installs. The CLI version is v1.0.2, with 369 downloads per month. The categories are 'Other', and the tags are 'as400', 'ibmi', 'iseries', and 'multi-root ready'. The extension works with Universal. Resources include Issues, Repository, Homepage, License, and Download Extension.

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

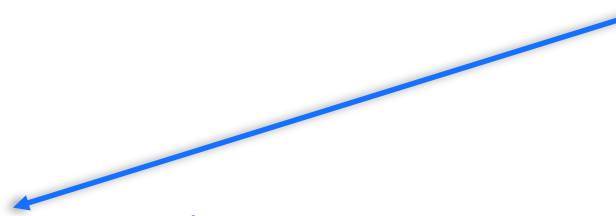
```
jobs:
  so-impact:
    runs-on: ubuntu-latest
    steps:
      # Checkout repository and setup node steps omitted

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

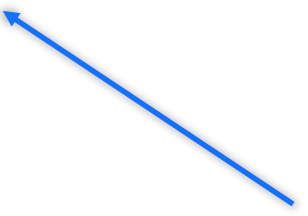
      - name: Generate impact information
        run: so -bf imd -l `git diff --name-only origin/main origin/${GITHUB_HEAD_REF}`

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

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

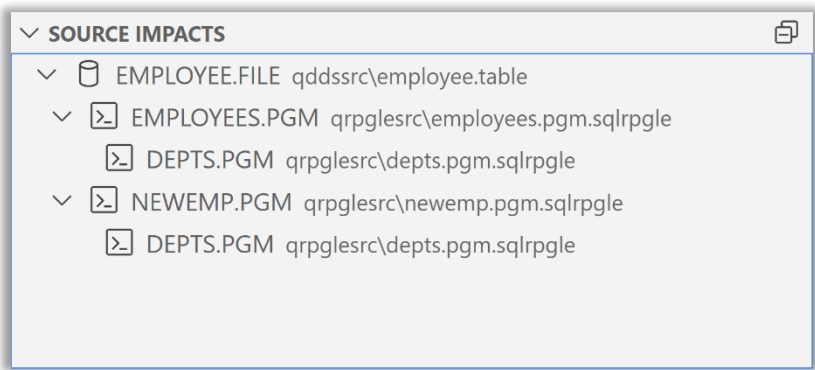


Redirect output to
GITHUB_STEP_SUMMARY
to create a custom
Markdown job summary



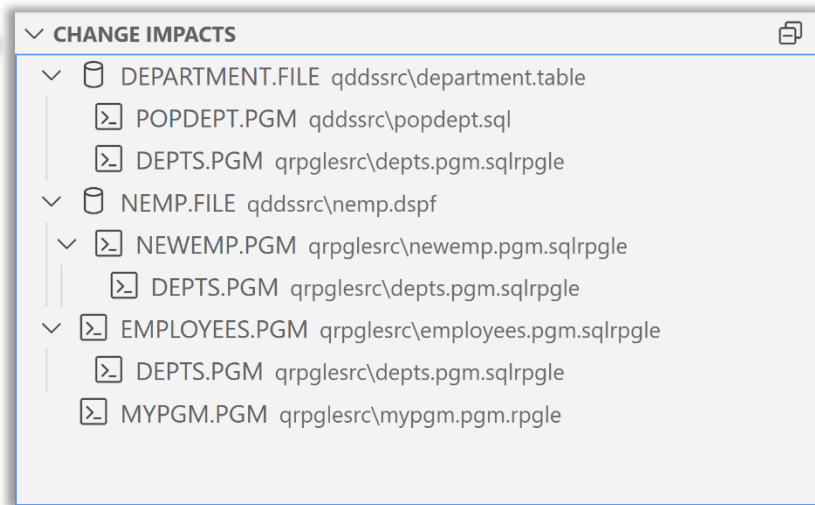
What is built into the Source Orbit VS Code extension?

View impacted objects for the current active editor

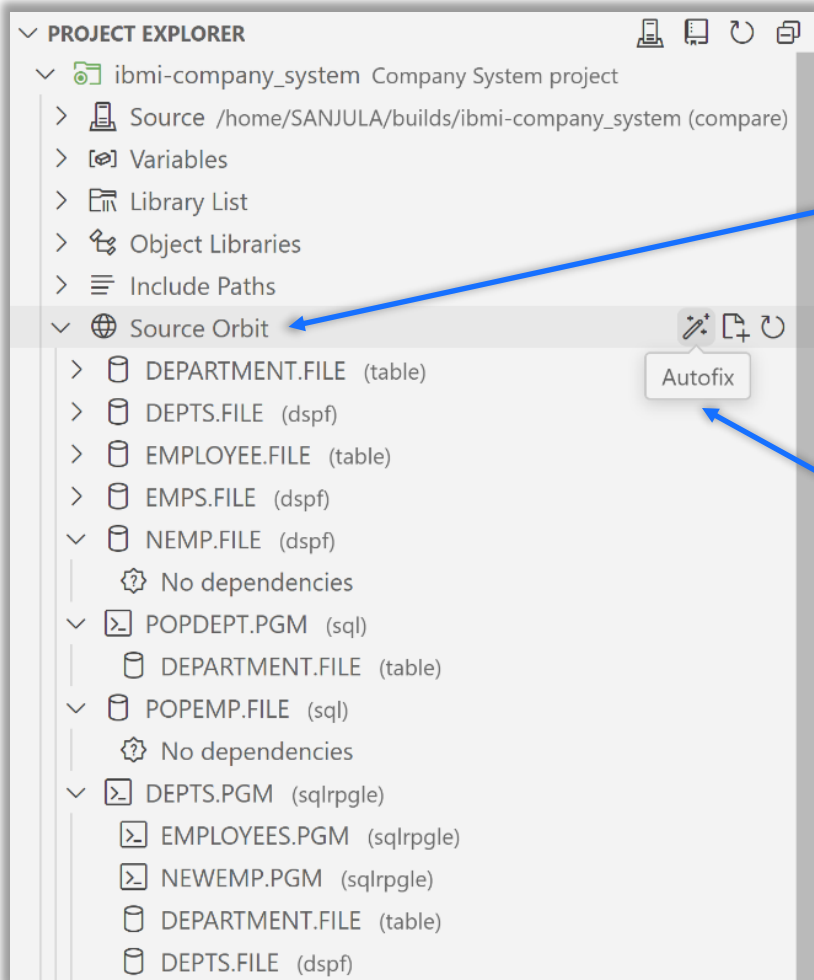


- ▼ SOURCE IMPACTS
 - EMPLOYEE.FILE qddssrc\employee.table
 - ▼ EMPLOYEES.PGM qrpglesrc\employees.pgm.sqlrpgle
 - DEPTS.PGM qrpglesrc\depts.pgm.sqlrpgle
 - ▼ NEWEMP.PGM qrpglesrc\newemp.pgm.sqlrpgle
 - DEPTS.PGM qrpglesrc\depts.pgm.sqlrpgle

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

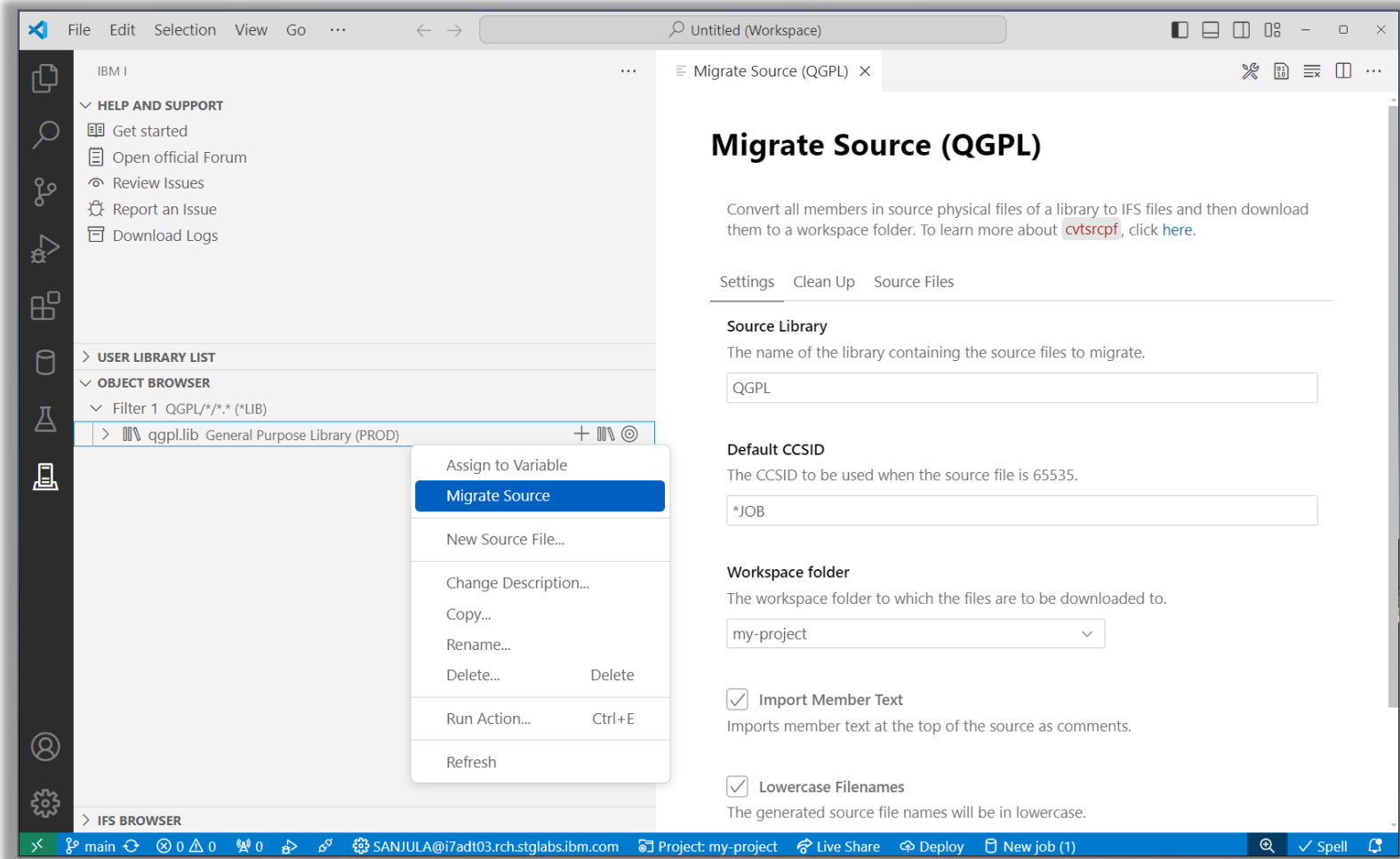


QSYS members in
source physical files
↓
Properly encoded,
terminated, and named
source files in an IFS
directory

↓
Download to local
project

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

Source Orbit



Practical 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: 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>	<div></div> <div>@IBMSystems @COMMONug @IBMChampions @IBMSystemsISVs @IBMiMag @ITJungleNews @SAPonIBMi @SiDforIBMi</div>	<div>#PowerSystems #IBMi #IBMAIX #POWER9 #LinuxonPower #OpenPOWER #HANAonPower #ITinfrastructure #OpenSource #HybridCloud #BigData</div>

