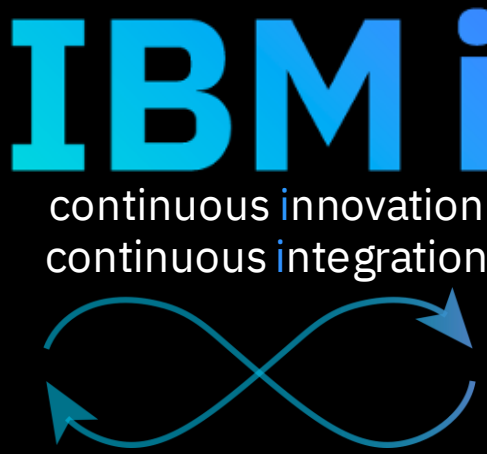
Modern, Buildable Projects
with IBM i Project Explorer and Bob



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Agenda

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- Challenges with Building on IBM i
- How does local development overcome this?
- How does Bob and IBM i Projects tie into local development?
- Ins and Outs of IBM i Project Explorer

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Challenges with Building on IBM i

Building on IBM i is limiting...

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1. SRC-PF
   - 10 char names
   - Fixed record length
   - Not accessible to open ecosystem, including Git and Make
   - Source of the same type stored in QxxxSRC to avoid name conflicts (member type does not disambiguate)

2. Libraries
   - Only 2 level hierarchy to organize, with only short 10 char names

3. Source control
   - None (sequence number dates)
   - Home grown
   - Proprietary IBM i systems
     - Cost
     - Smaller market = less investment

4. Build system
   - Individual CRTXXXMOD + CRTPGM
   - CL Scripts
   - A couple of vendors have dependency-based build

Let’s look ahead to the future

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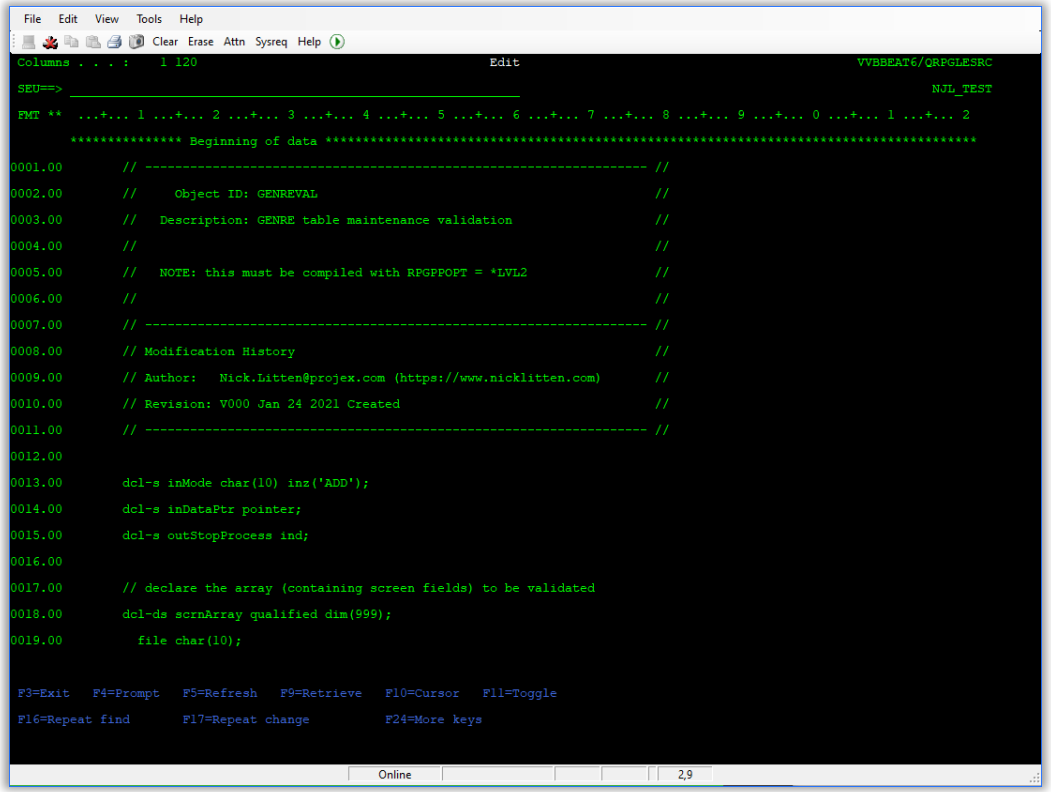
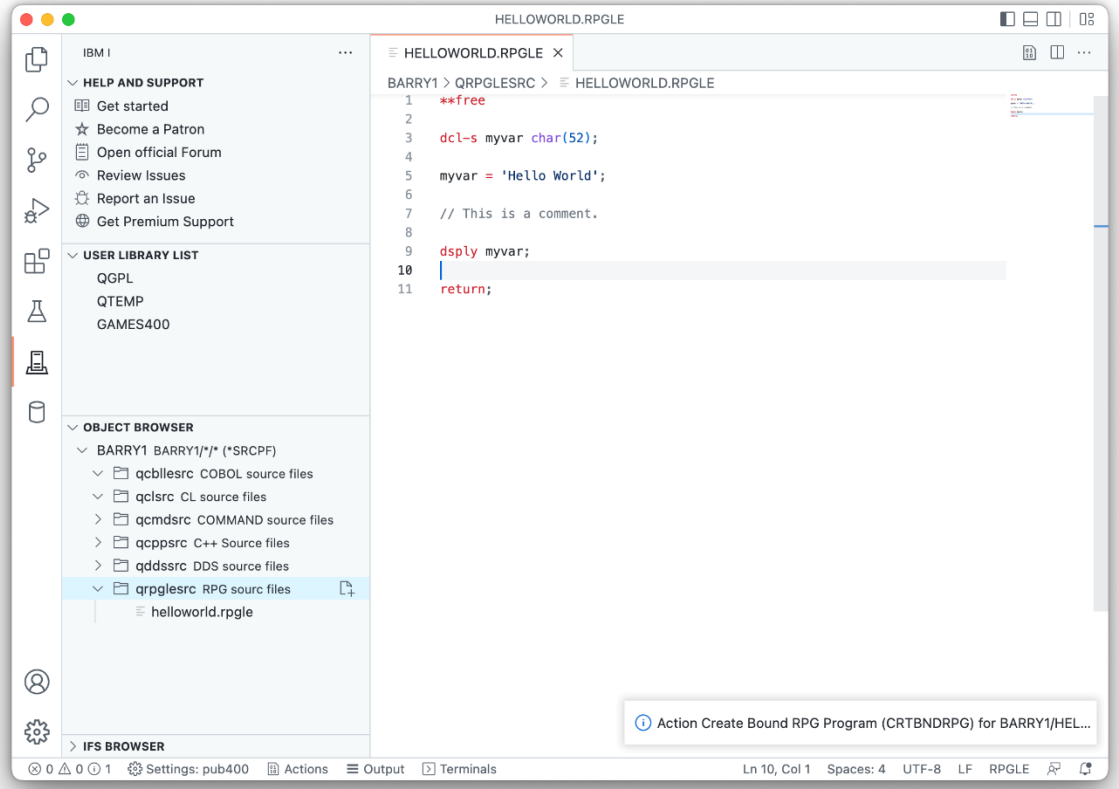
New Developers Incoming!

Need for Modernization is Urgent

New development tools/ecosystems (ie. Code for IBM i/Merlin)

Modern development practices (ie. Git)





How does local development overcome this?

Let's use a different (but similar) file system

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MYPROJECT
- QRPGLESRC
  - CUSTOMER.RPGLE
  - INVENTORY.RPGLE
  - STARTJOB.RPGLE
- QSQLSRC
  - CUSTOMERS.SQL
  - INVENTORY.SQL
- QCLLESRC
  - START.CLLE
- QCMDSRC
  - STARTJOB.CMD

QSYS.LIB Library

No more character name restrictions

Now usable with Git and Make

/my-project
- /.git
- qrpglesrc
  - customer.rpgle
  - inventory.rpgle
  - startjob.rpgle
- qsqlsrc
  - customer.table
  - inventory.table
- qcllesrc
  - start.clle
- qcmdsrc
  - startjob.cmd

IFS/Local File System

Let’s go one step further!

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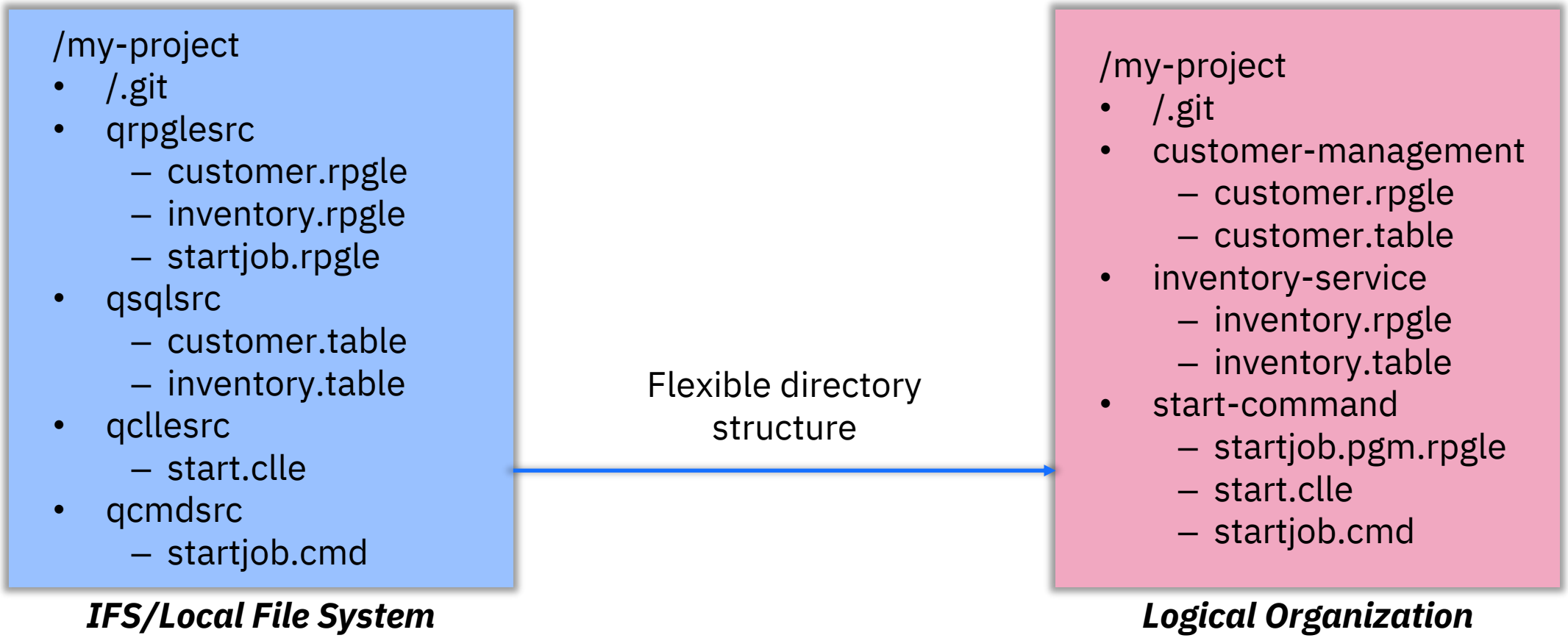

Unlocking source control with Git

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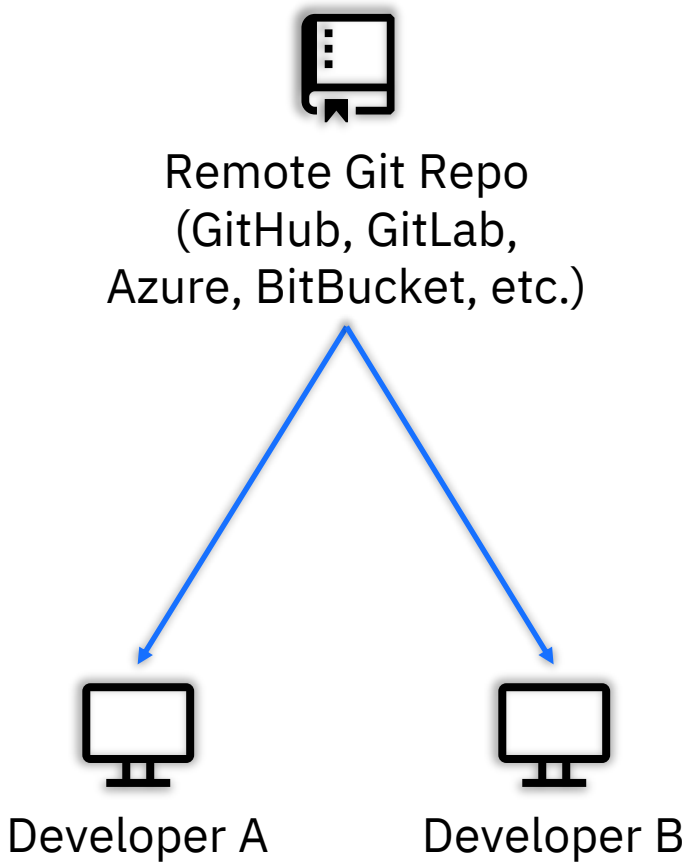
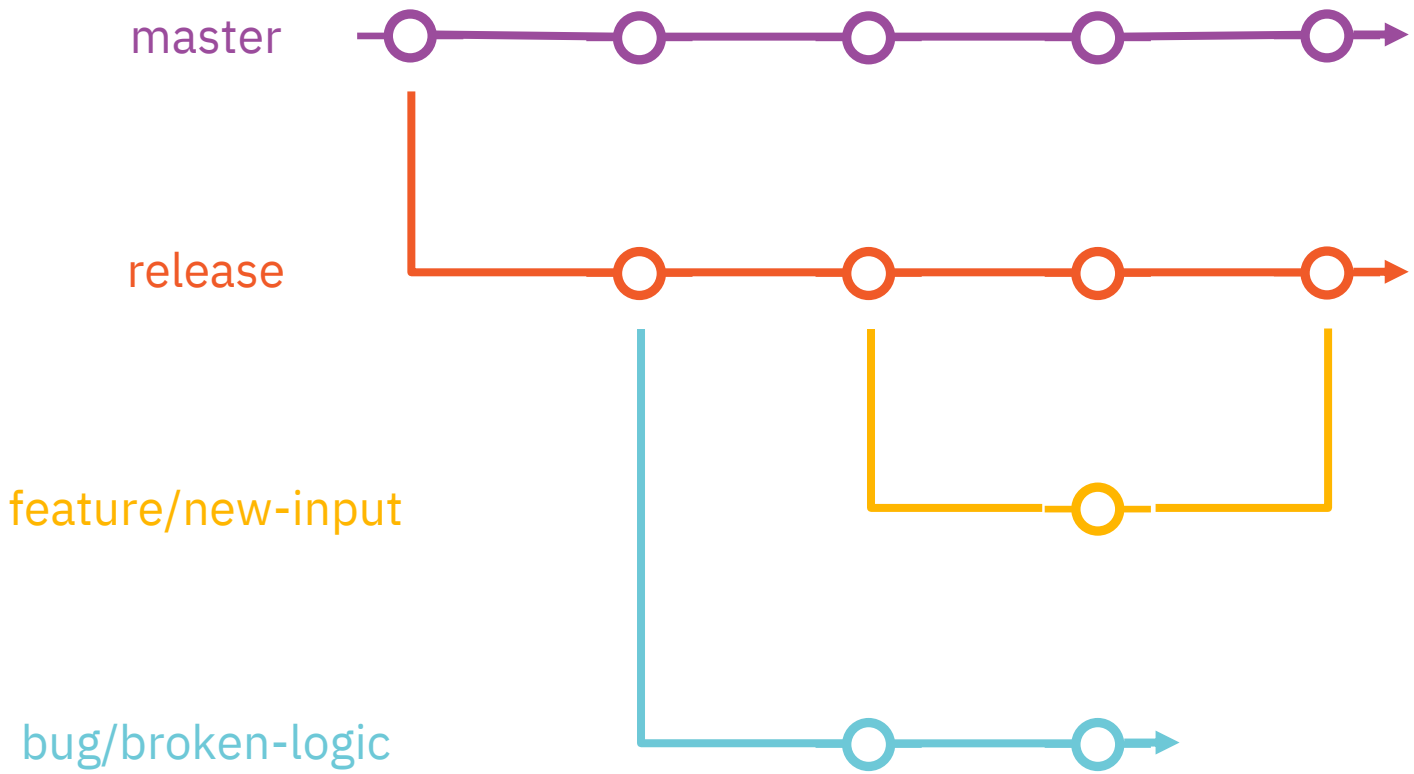
Distributed Development



Version Control and Git Workflow



Did we solve our problems?

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1. ~~SRC-PF~~
   - ~~10 char names~~
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   - ~~Not accessible to open ecosystem, including Git and Make~~
   - ~~Source of the same type stored in QxxxSRC to avoid name conflicts (member type does not disambiguate)~~

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4. Build system
   - Individual CRTXXXMOD + CRTPGM
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How does Bob and IBM i Projects tie into local development?

What is Bob?

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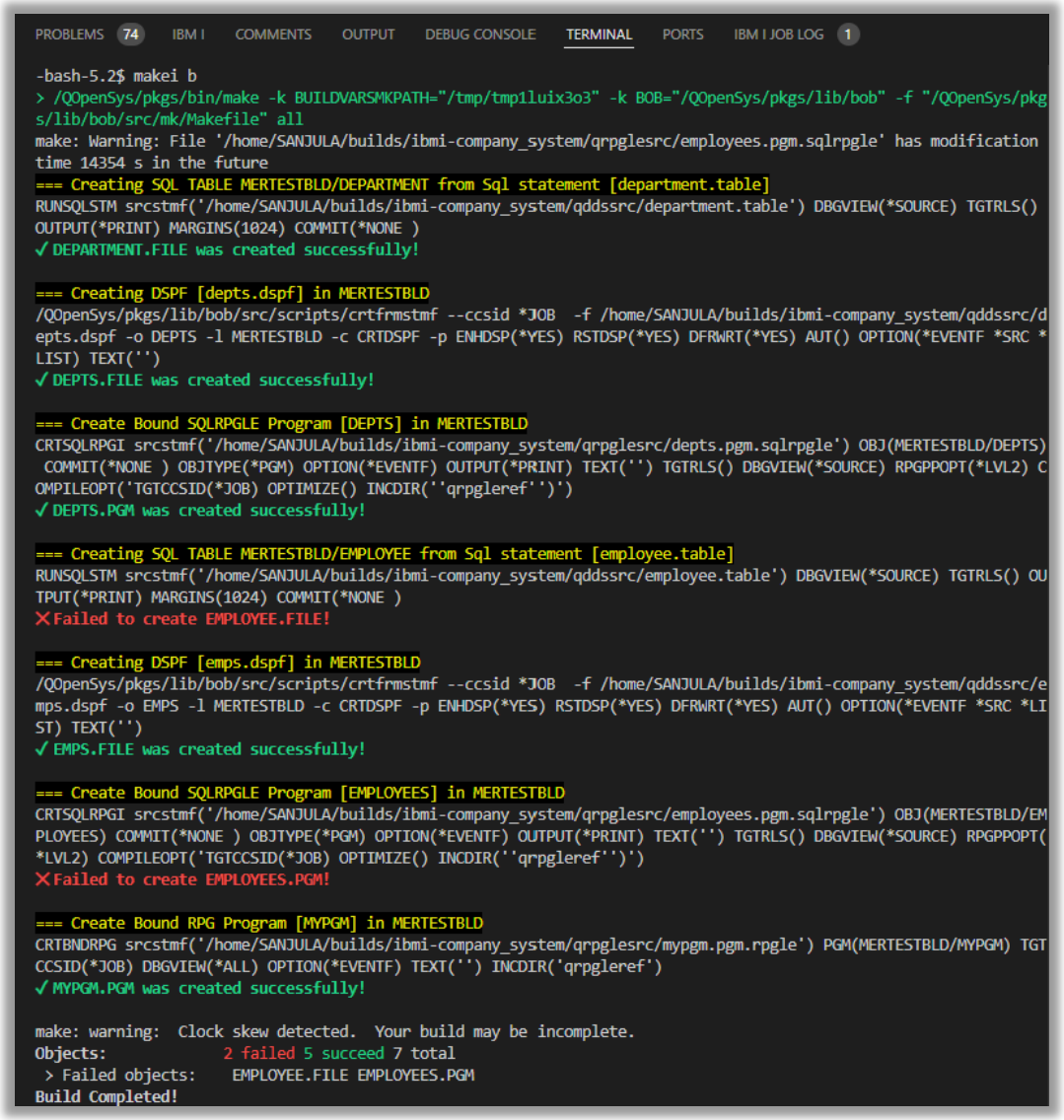
Free and open-source build system to build QSYS objects on IBM i

- 🚀 Speed: Compile objects that need recompiling (new or changed source code)
- 🛠️ Reliability: If an item changes, then it and everything it depending on it will be rebuilt
- 💎 Industry standard: Object dependencies are specified using standard makefile syntax
- 🔧 Flexibility: Override compile parameters, write custom recipes (If you can code it, you can build it!)
- 🌟 Ease of use: Build with a single command or a single button in an IDE (IBM i Project Explorer in VS Code)



Projects that self-describe how to build themselves!?

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- my-project
  - .evfevent
    - file.evfevent
    - source.evfevent
  - .logs
    - joblog.json
    - file.splf
    - source.splf
  - includes
    - constants.rpgleinc
  - QRPGLESRC
    - .ibmi.json
    - Rules.mk
    - source.rpgle
  - QDDSSRC
    - Rules.mk
    - file.pf
  - .env
  - .gitignore
  - .ibmi.json
  - iproj.json
  - Rules.mk

Project Information

Configure library list

Configure build/compile environment

iproj.json

```
{
    "version": "0.0.1",
    "description": "SAMPLE PROJECT",
    "repository": "https://github.com/edmundreinhardt/bob-recursive-example.git",
    "license": "Apache 2.0",
    "objlib": "&CURLIB",
    "curlib": "&CURLIB",
    "includePath": [
        "includes",
        "QPROTOSRC"
    ],
    "preUsrlibl": [
        "&lib1"
    ],
    "postUsrlibl": [
        "&lib2"
    ],
    "setIBMiEnvCmd": [],
    "compileCommand": "makei c -f {filename}",
    "buildCommand": "makei build"
}
```

Standardized metadata format with variables (&...)

Set build/compile command

iproj.json in project root

Flexible subdirectories and build customization

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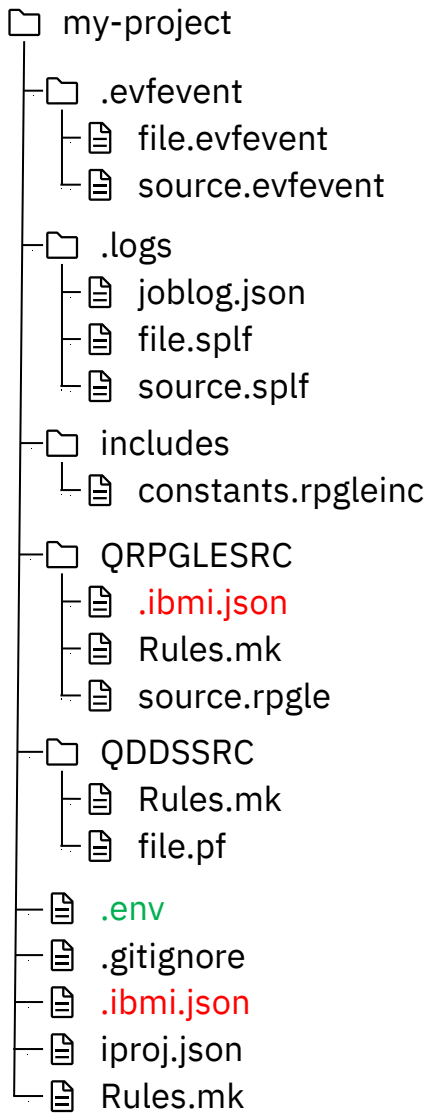
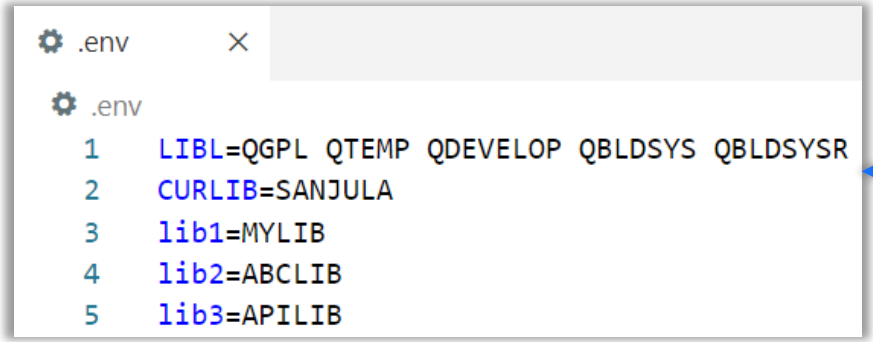


EBCDIC encoding for compiler

Target object library for directory

.ibmi.json in project root or subdirectories



Custom variable values so that each developer can customize build

.env in project root

Control what objects to build and how to build them

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- my-project
  - .evfevent
    - file.evfevent
    - source.evfevent
  - .logs
    - joblog.json
    - file.splf
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    - constants.rpgleinc
  - QRPGLESRC
    - .ibmi.json
    - Rules.mk
    - source.rpgle
  - QDDSSRC
    - Rules.mk
    - file.pf
  - .env
  - .gitignore
  - .ibmi.json
  - iproj.json
  - Rules.mk

Rules.mk

```
1   SUBDIRS = qrpglesrc qddssrc
```

Rules.mk in project root

Declare subdirectories to be built

Rules.mk

```
1   FVAT.SRVPGM: fvat.bnd VAT300.MODULE
2   FVAT.SRVPGM: TEXT = Functions VAT
3   FVAT.SRVPGM: private TEXT = Functions VAT
4
5   VAT300.MODULE: vat300.rpgle QPROTOSRC/vat.rpgleinc VATDEF.FILE
6   VAT300.MODULE: private TEXT := bound into FVAT.SRVPGM
7   VAT300.MODULE: private DBGVIEW ::= *SOURCE
8
9   VATDEF.FILE: vatdef.pf SAMREF.FILE
```

Rules.mk in subdirectories

Makefile with list of objects to be built and from which source files

Build and Compile Process

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Initialization and Migration

Command	Description
makei init	Create iproj.json
makei cvtsrcpf	Convert QSYS members to Unicode IFS stream files

Building

Command	Description
makei build	Build the entire project
makei b –t <object>	Build target object
makei b –d <directory>	Build all objects in the specified directory (based on Rules.mk)

Compiling

Command	Description
makei compile -f <stream file>	Compile target object of specified stream file
makei compile –files file1: file2: …	Compile target objects of all specified stream files

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Ins and Outs of IBM i Project Explorer

Overview

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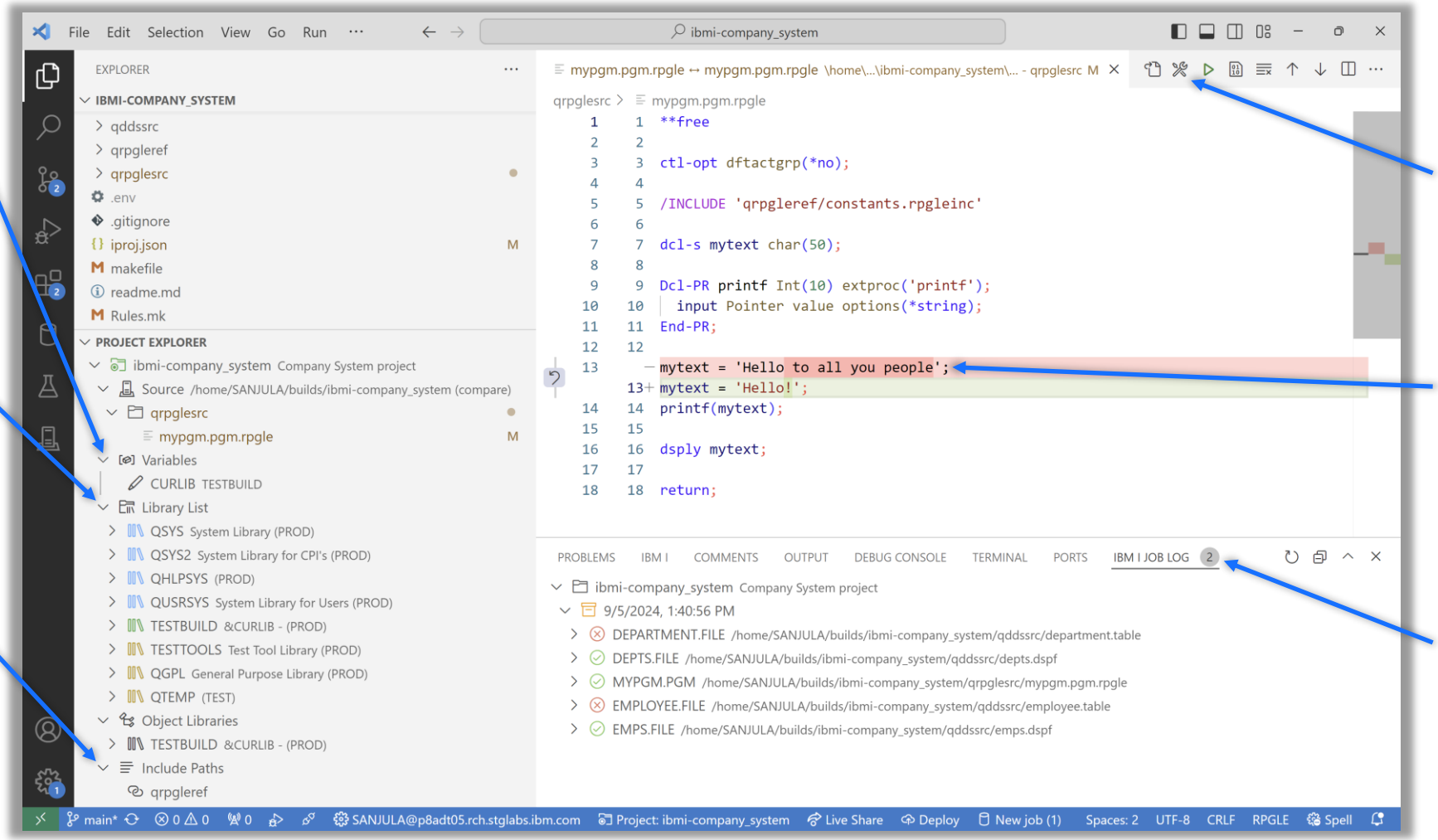
The ultimate tool for local development on IBM i!

Set variables

Manage library list

Modify include paths



Build and Compile

Local source vs. IFS source

View job logs

Installation

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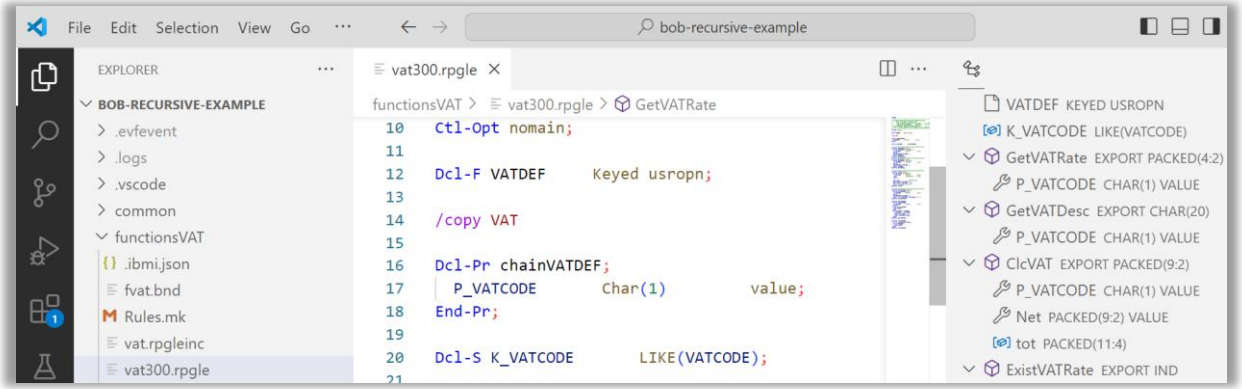
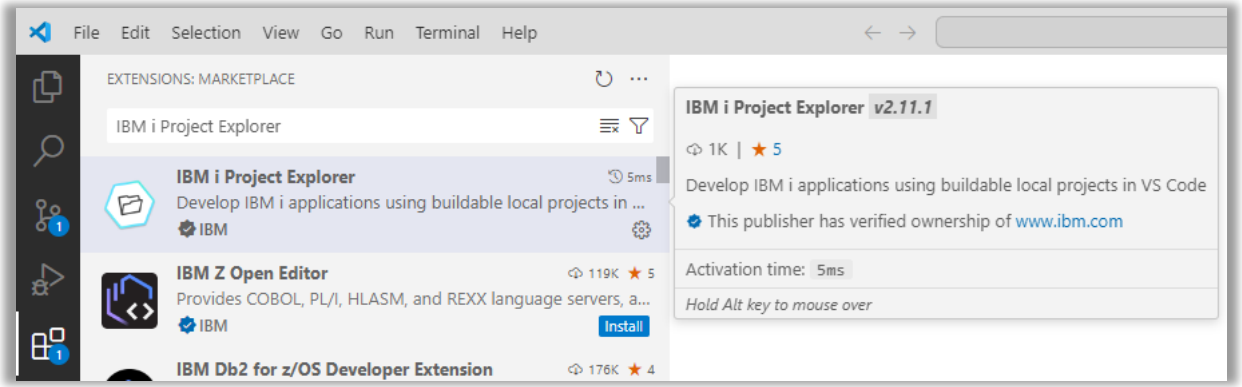
1 *Download*
Visual Studio Code



2 *Download VS Code extensions*
IBM i Project Explorer,
Source Orbit and *Code for IBM i*



3 *Run*
yum install bob
on IBM i

Create a New Project

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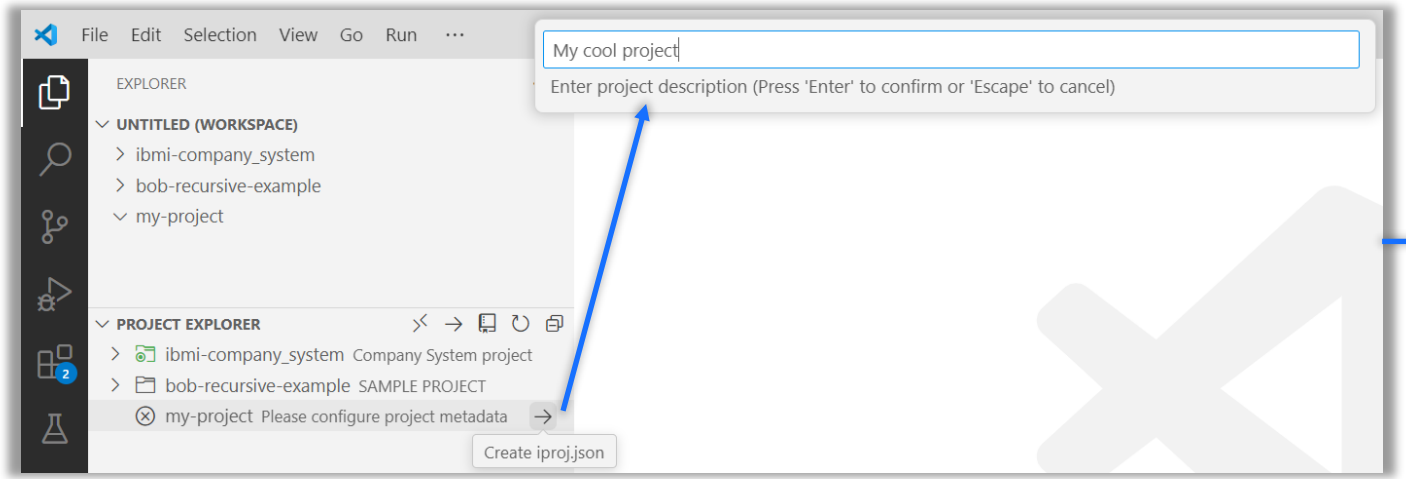
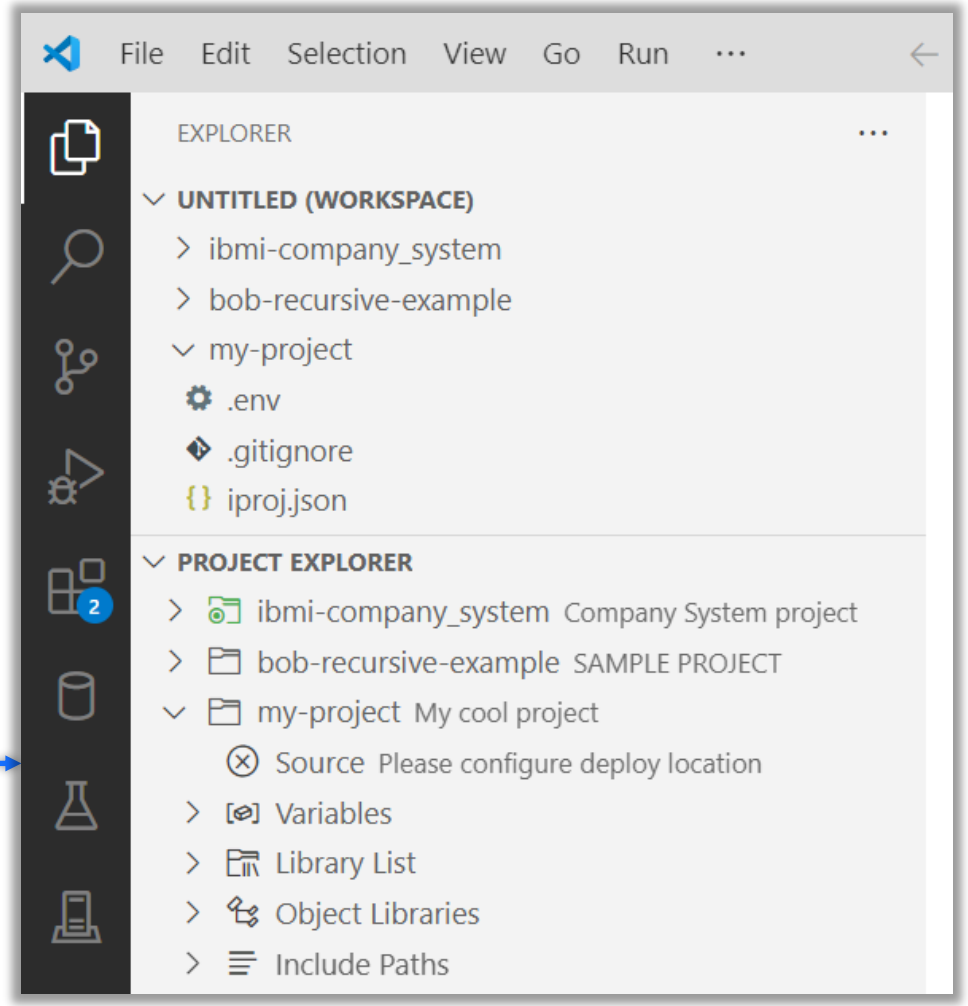
- Create and open a folder for your project
- Create an iproj.json
- Set the project description





Connect to an IBM i

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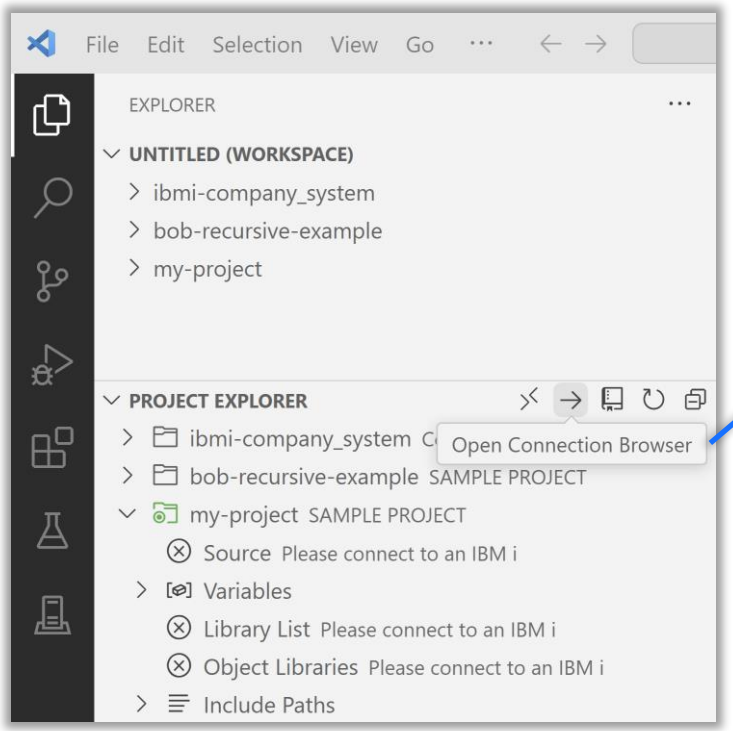
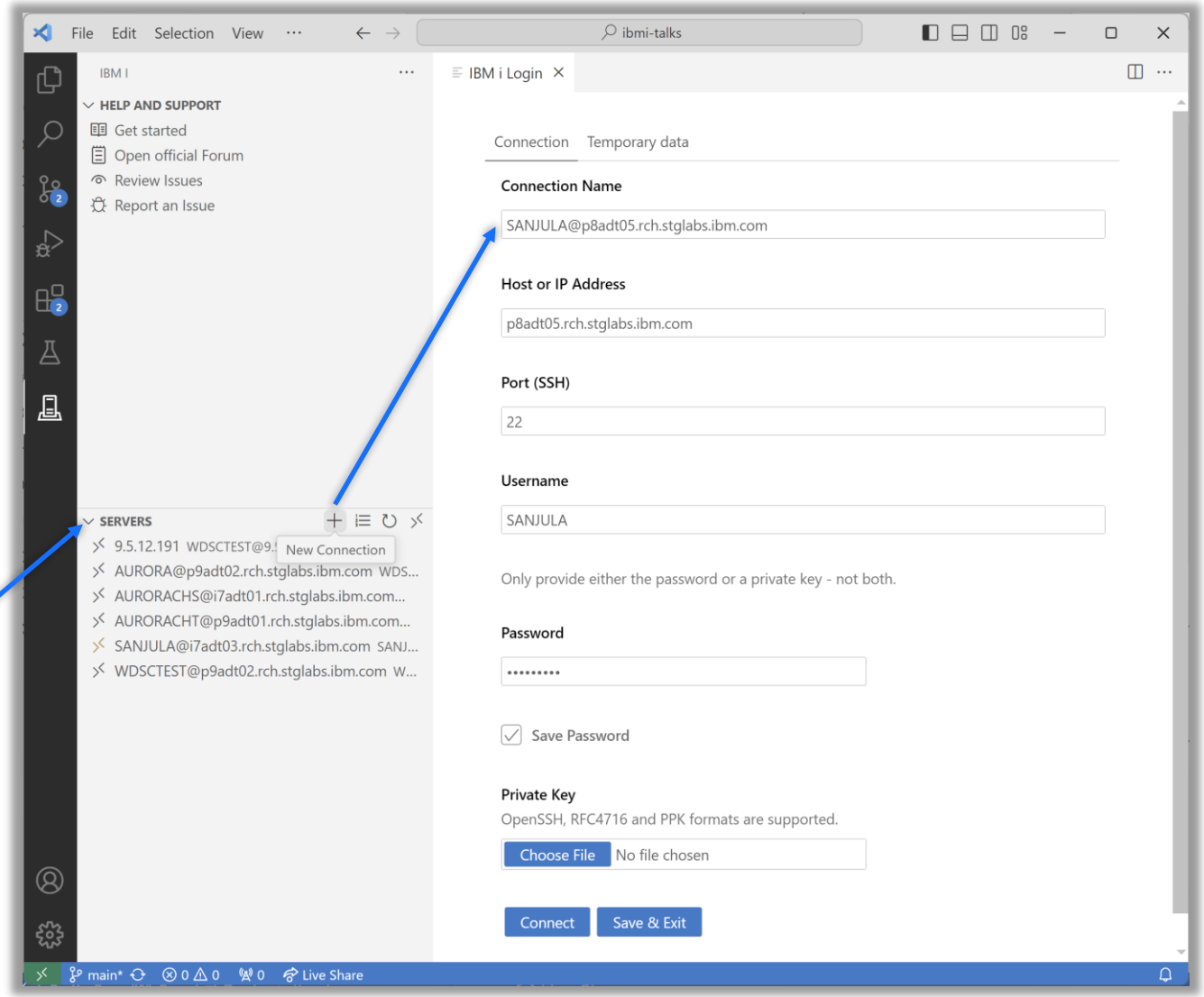
- Open the *Connection Browser* from Project Explorer
- Create new IBM i connection from the *Server* view





Migrate Source from QSYS

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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

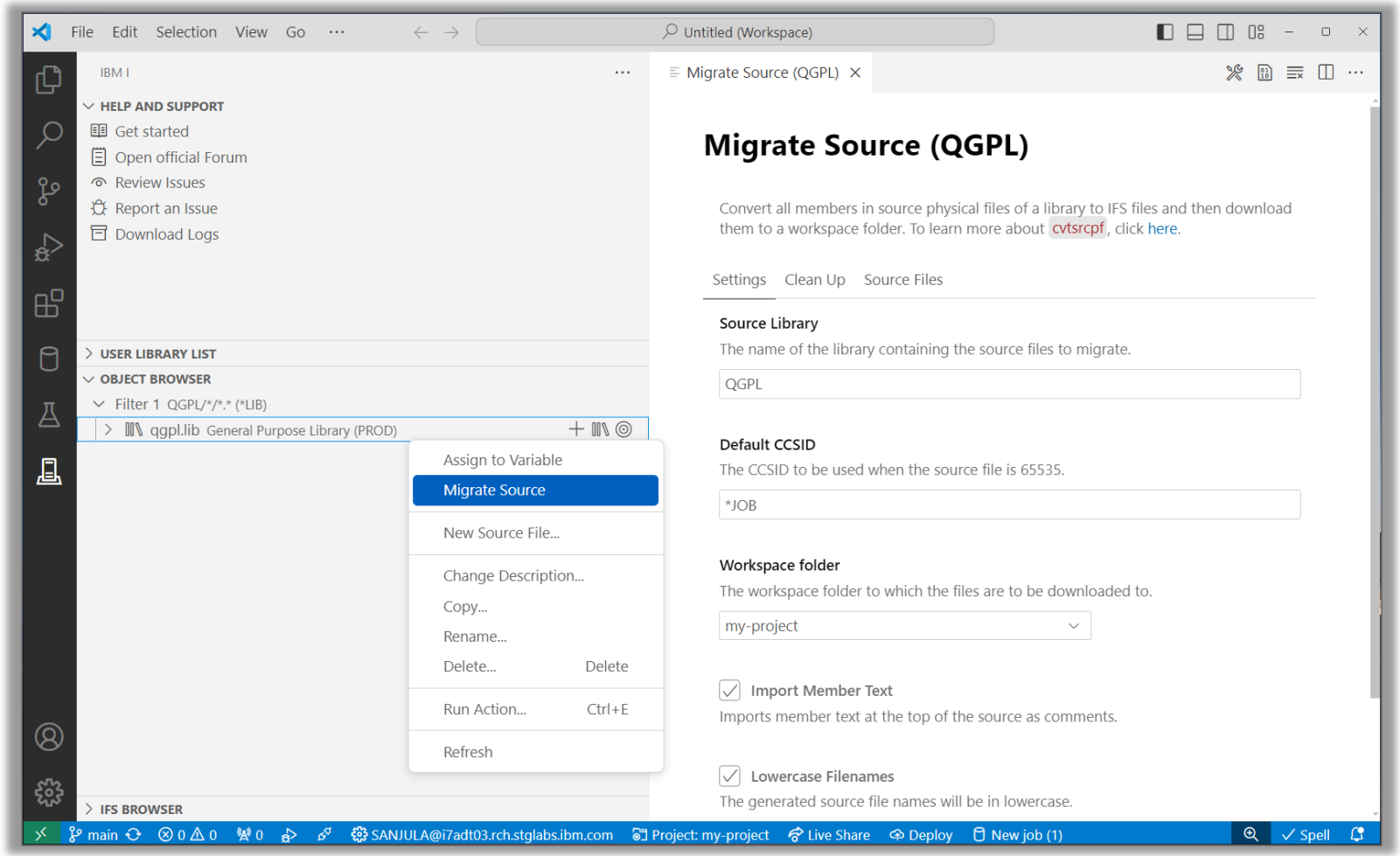
↓

Source Orbit

Rename extensions

↓

Convert includes/copy directives to Unix style paths



Deployment

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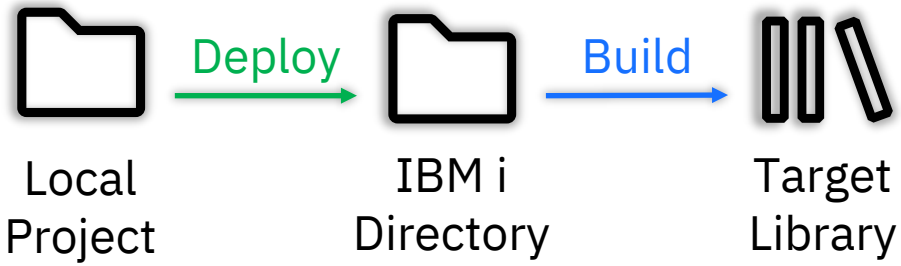
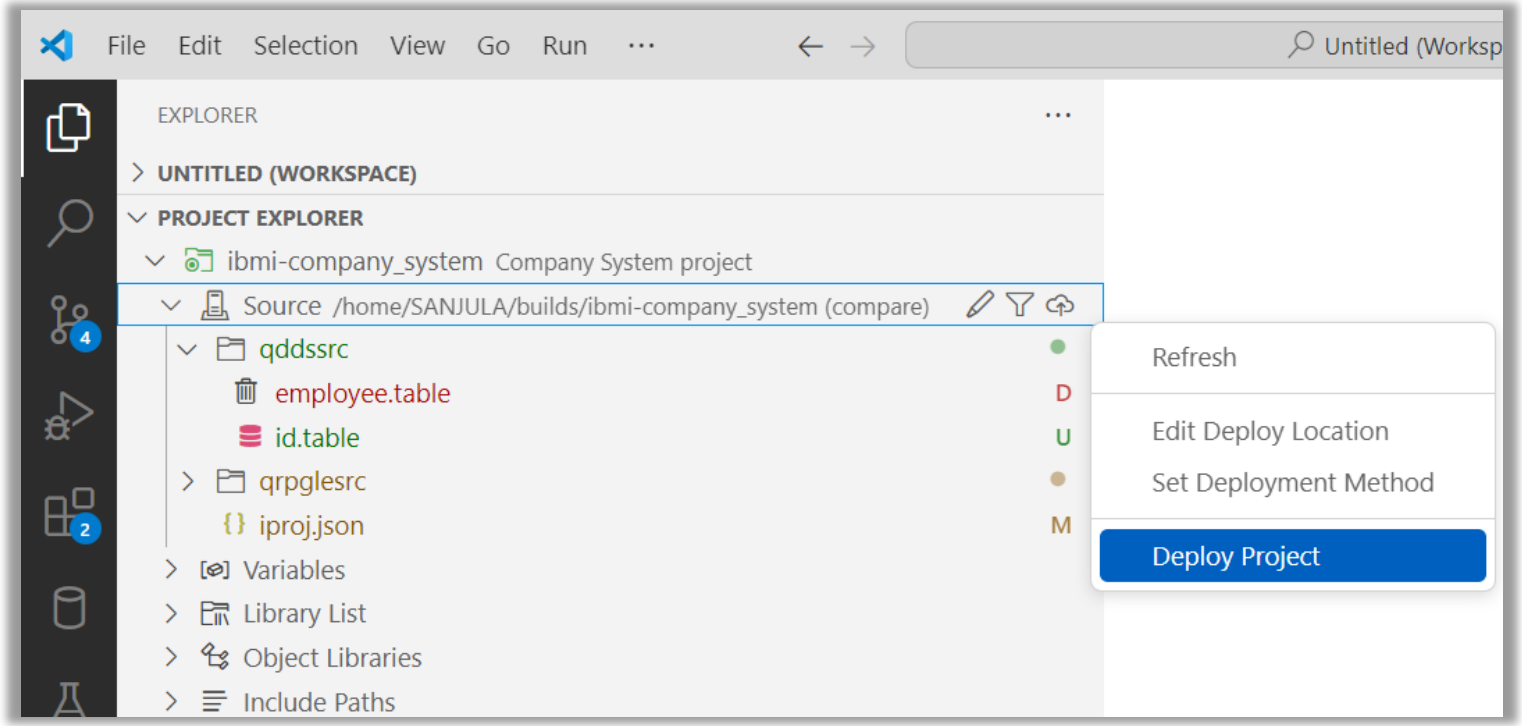
- Set deploy location
  - Where source gets uploaded to
  - Typically set one
  - Each developer gets a unique location
  - Each repository gets a unique location
- Set deployment method
  - Compare (typically the safest)
  - Changes (typically the fastest)
  - Working Changes
  - Staged Changes
  - All
- Deploy project
  - Moves files to deploy location based on deployment method





Visualize Local vs. Remote Source Files

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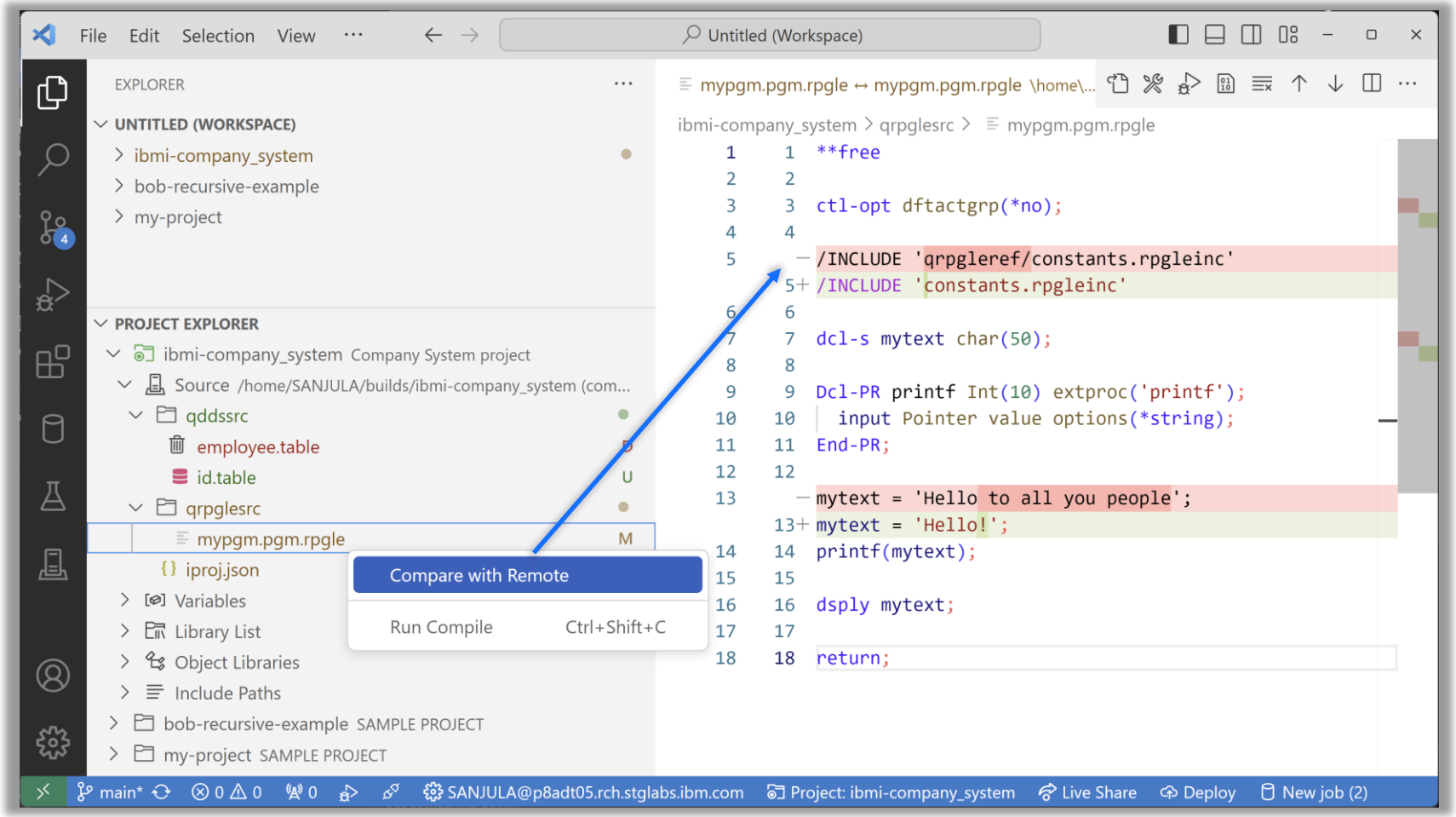
- Visualize, compare, and deploy your local source files to the deploy location in the IFS
- Track file changes (added, modified, deleted, etc.)
- Compare local file content with remote IFS



Work with Variables

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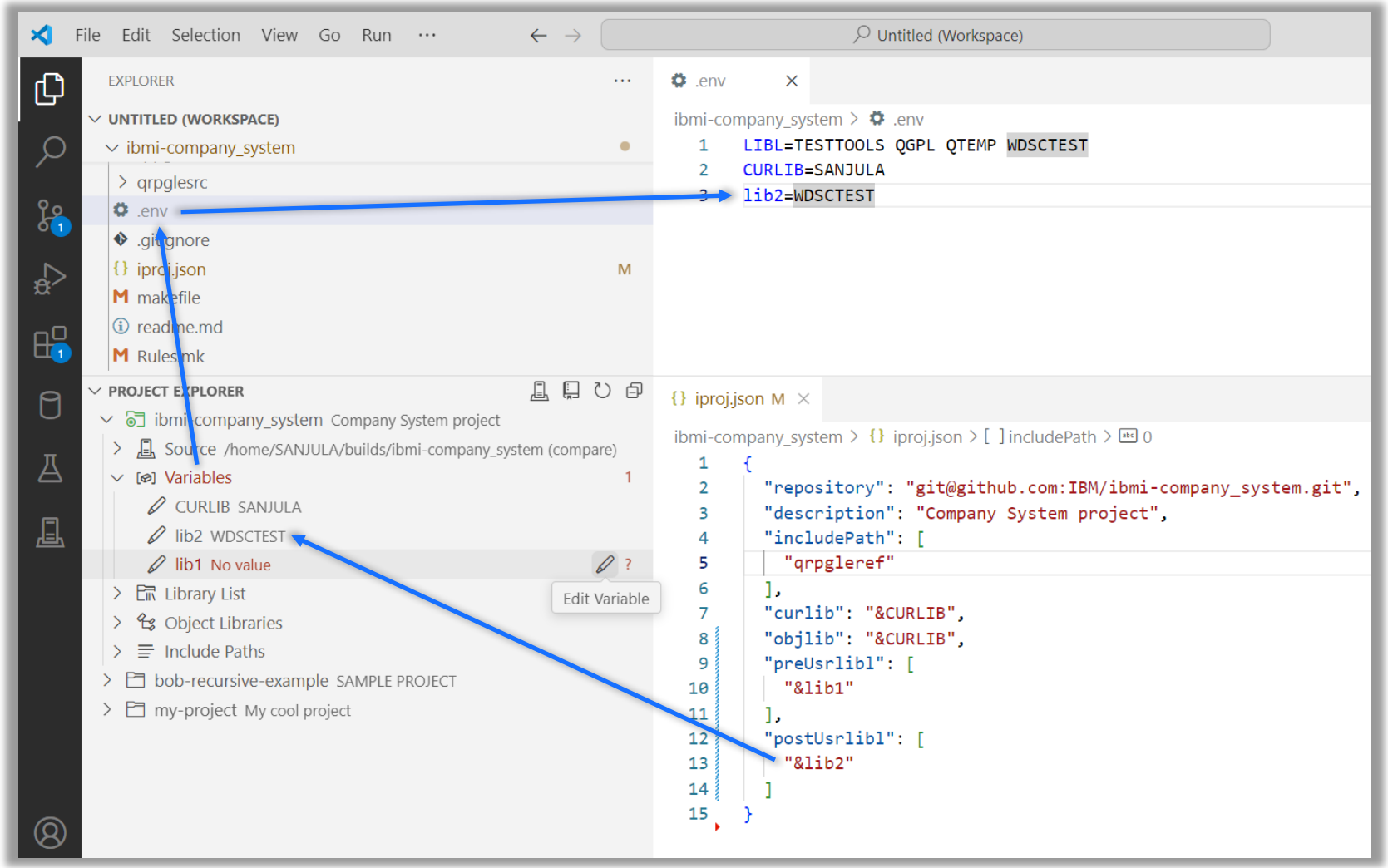
- Reusable project definition that can be used by multiple developers or in automated builds
- View and set variables (for libraries, include paths, or build/compile commands)
- Browse for libraries and assign values to variables
- Configure hardcoded values as variables

Do not push .env file to Git!



Manage the Library List

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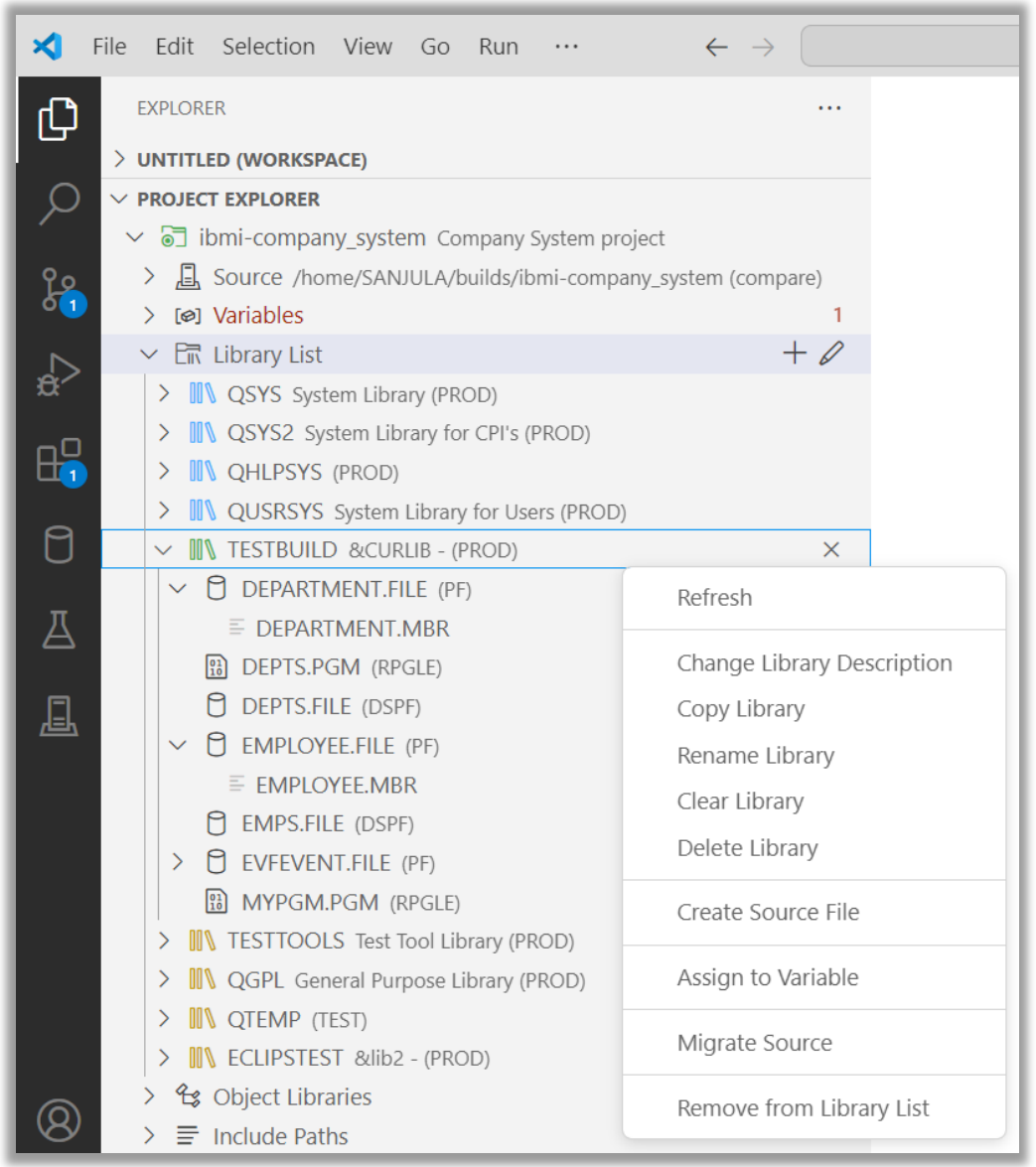
- Project's library list is a composition of your user profile's library list (from JOBD) + set of project specific libraries
- Add to beginning/end of library list (preUsrlibl and postUsrlibl) and set current library (curlib in iproj.json)
- Reorder library list
- Browse objects and members
- Manage libraries, objects, and members



Browse Object Libraries

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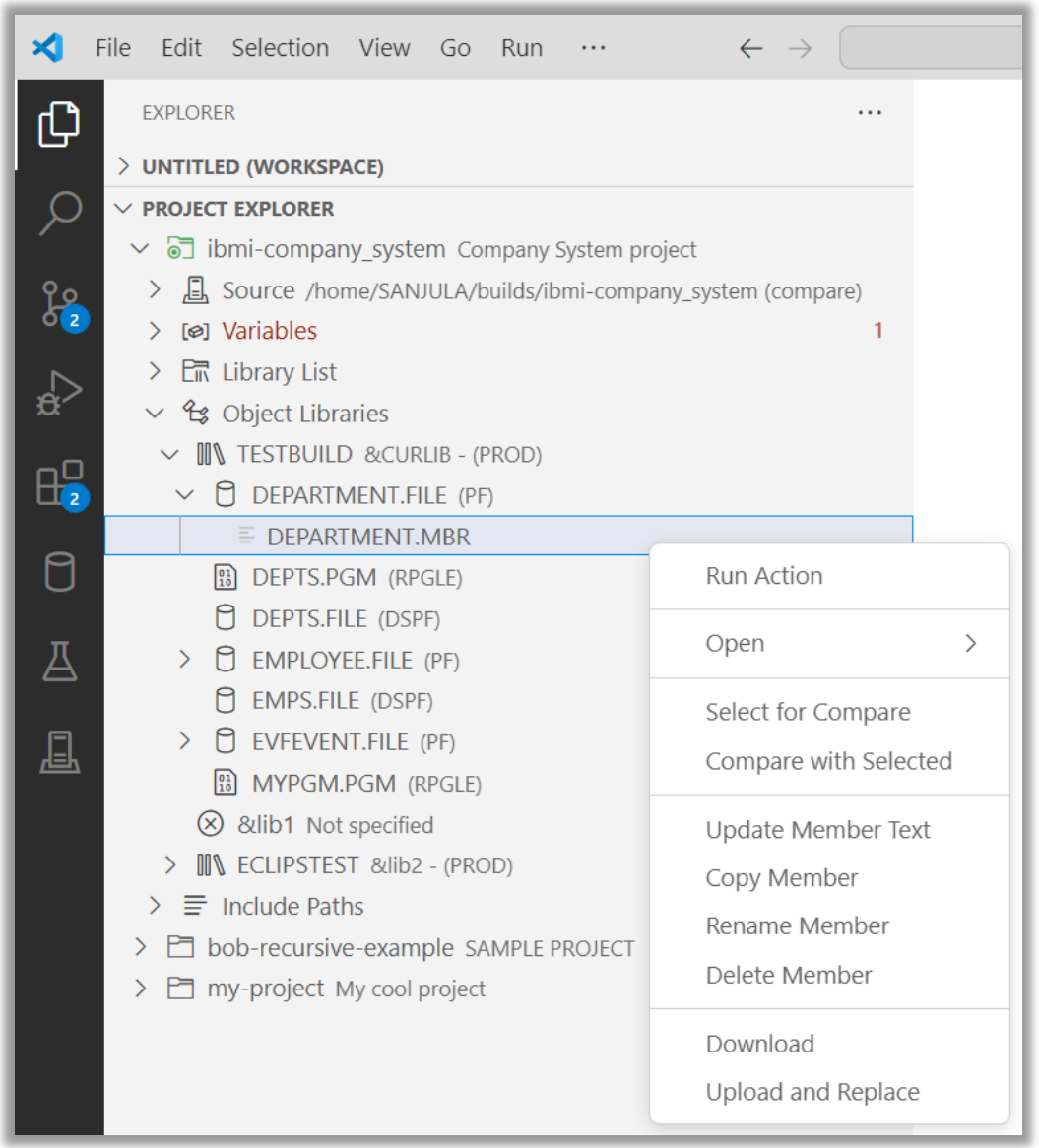
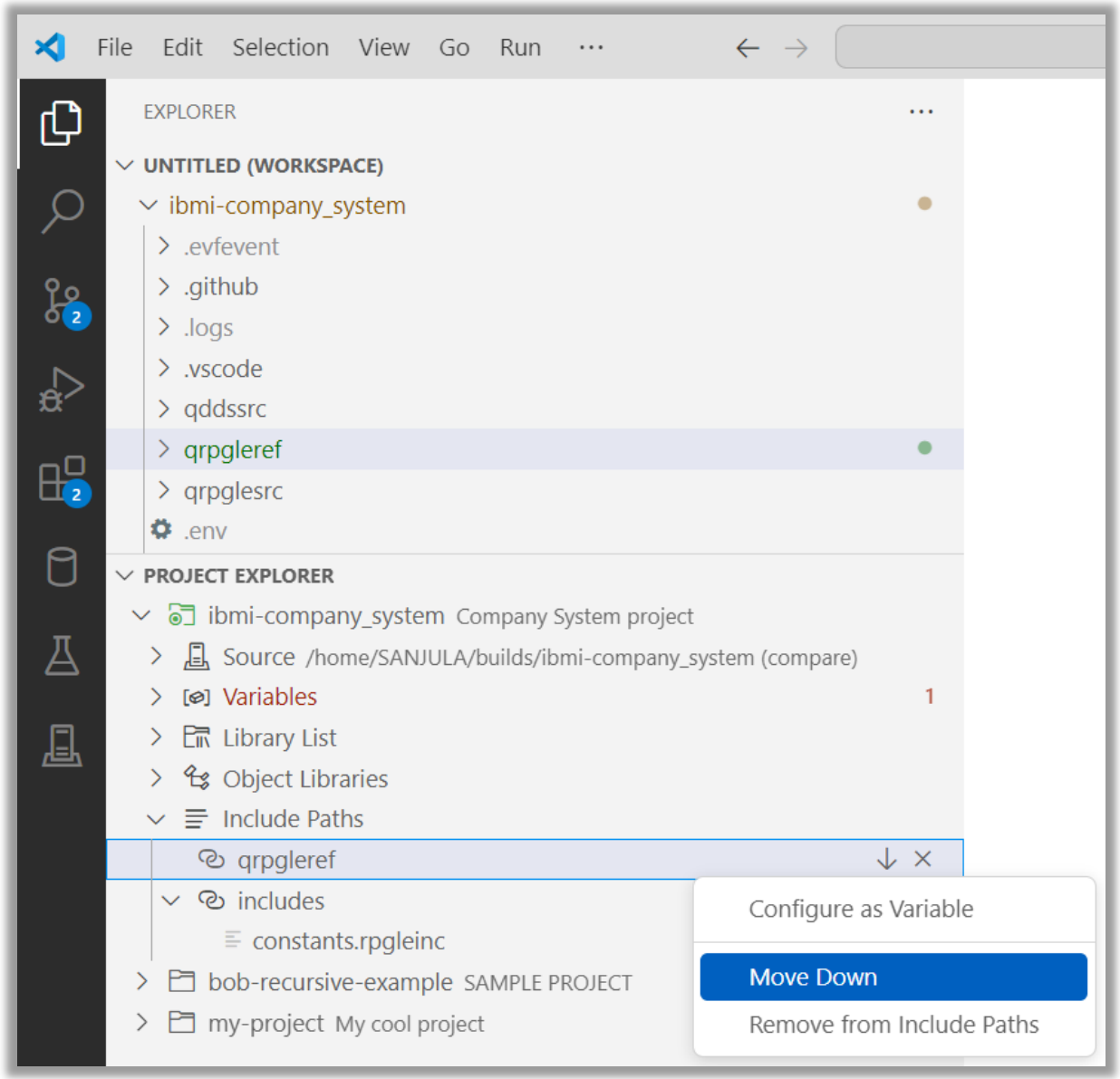
- The place for developers to easily see, debug, and manipulate the results of your build
- Another place to manage libraries in iproj.json (curlib, objlib, preUsrlibl, postUsrLibl)
- Manage libraries, objects, and members



Manage Include Paths

- Self-contained projects should know where to find includes within the project
- Add, remove, and reorder include paths
- Visualize if includes resolve locally or to remote IFS



Build and Compile

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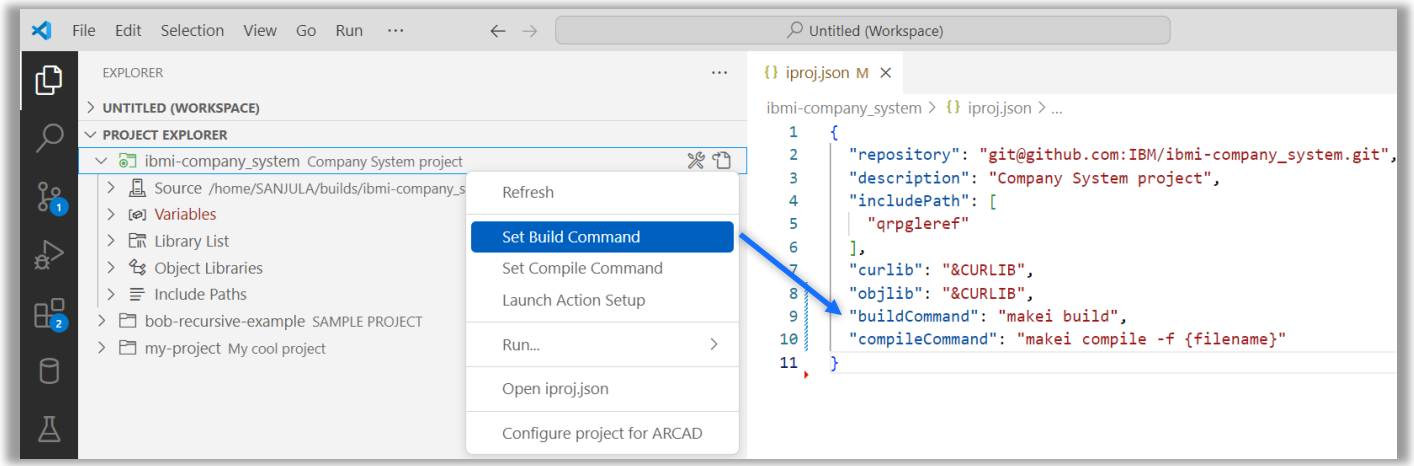
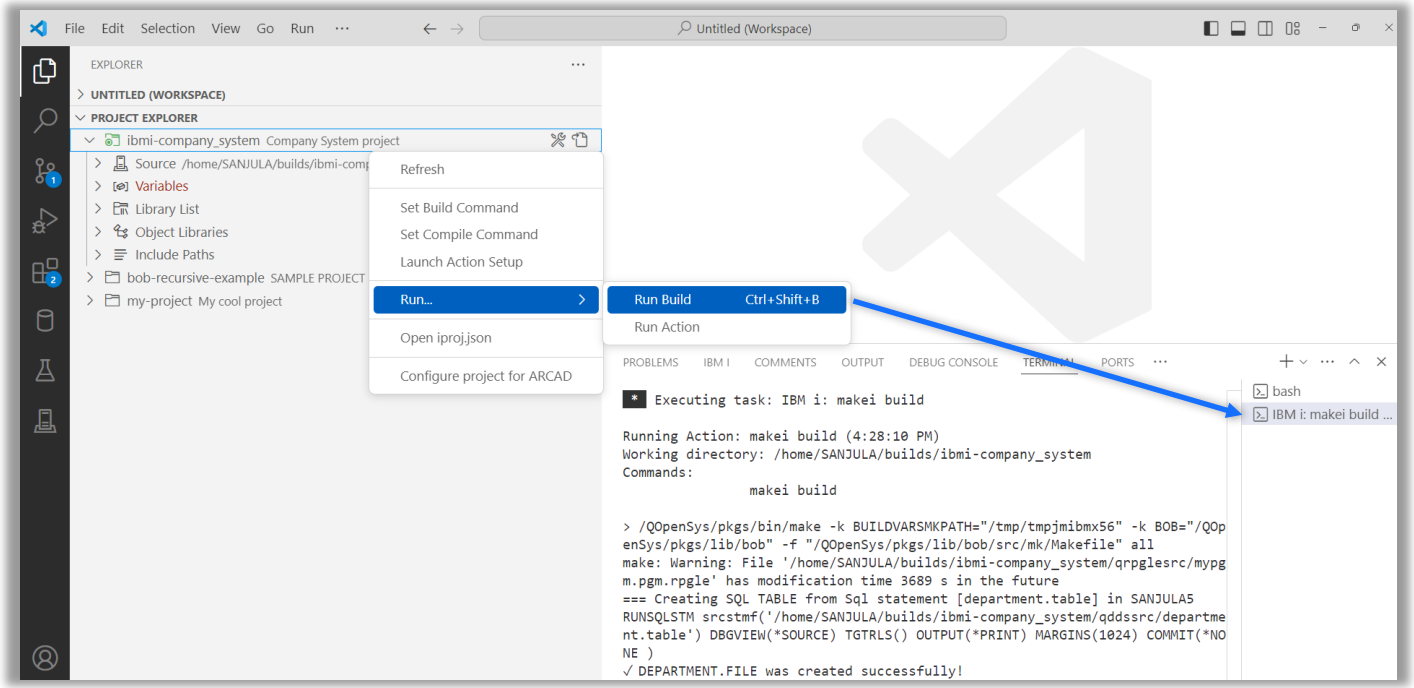
1. Deploy
↓
2. Run build or compile command (any build framework)
↓
3. Download logs and evfevent files





- Building
  - Set build command
  - Run Build (*Ctrl+Shift+b* or *Cmd+Shift+b*)
- Compiling
  - Set compile command
  - Run compile (*Ctrl+Shift+c* or *Cmd+Shift+c*)
    - On active editor
    - On file or directory in File Explorer
    - On file or directory in Source

Run Actions

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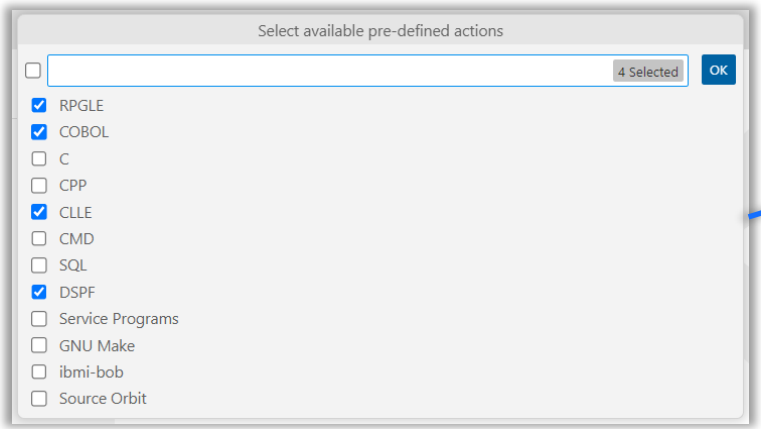
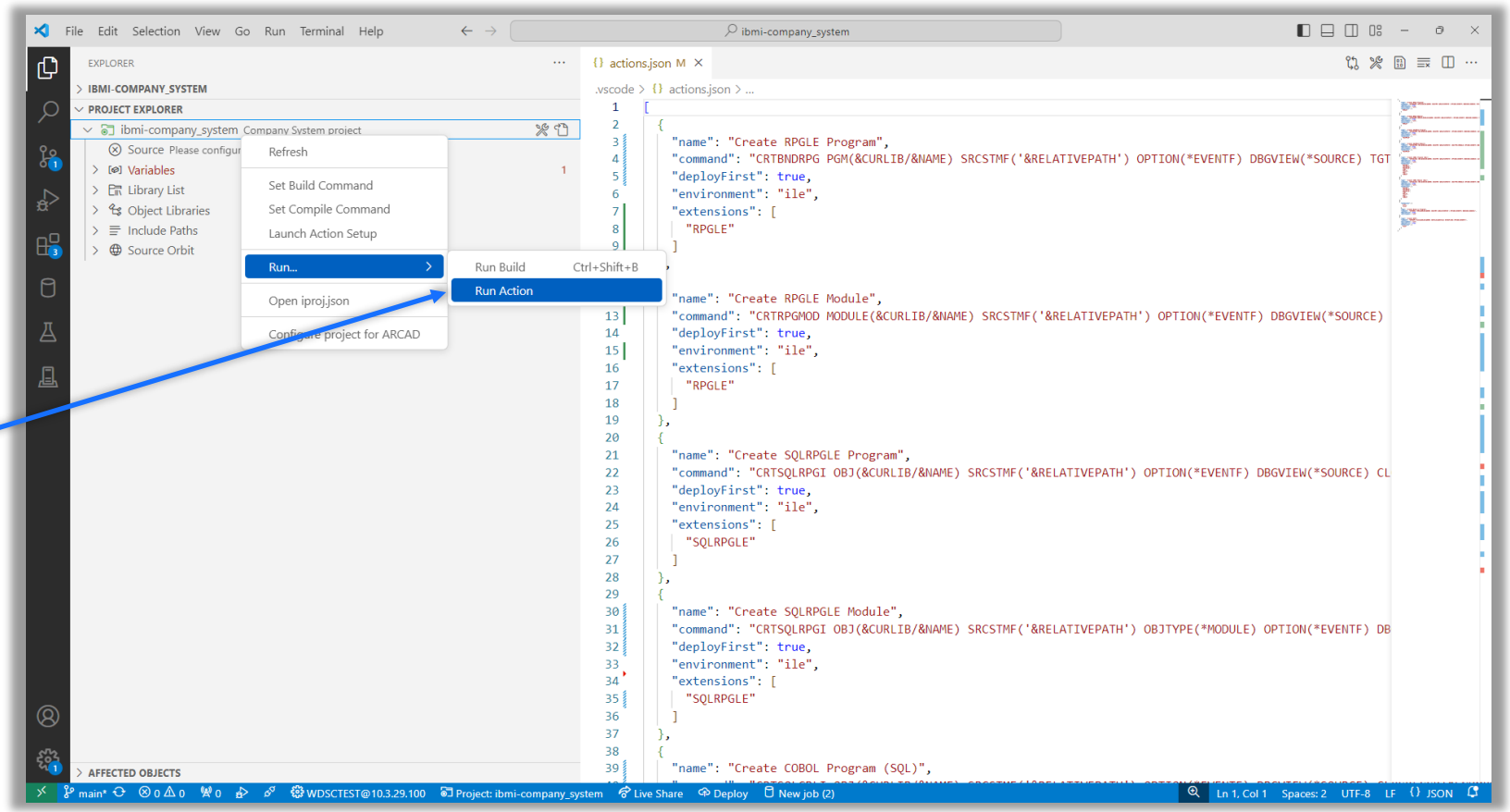
IBM i Project Explorer also supports running Code for IBM i's custom workspace actions





View Diagnostics

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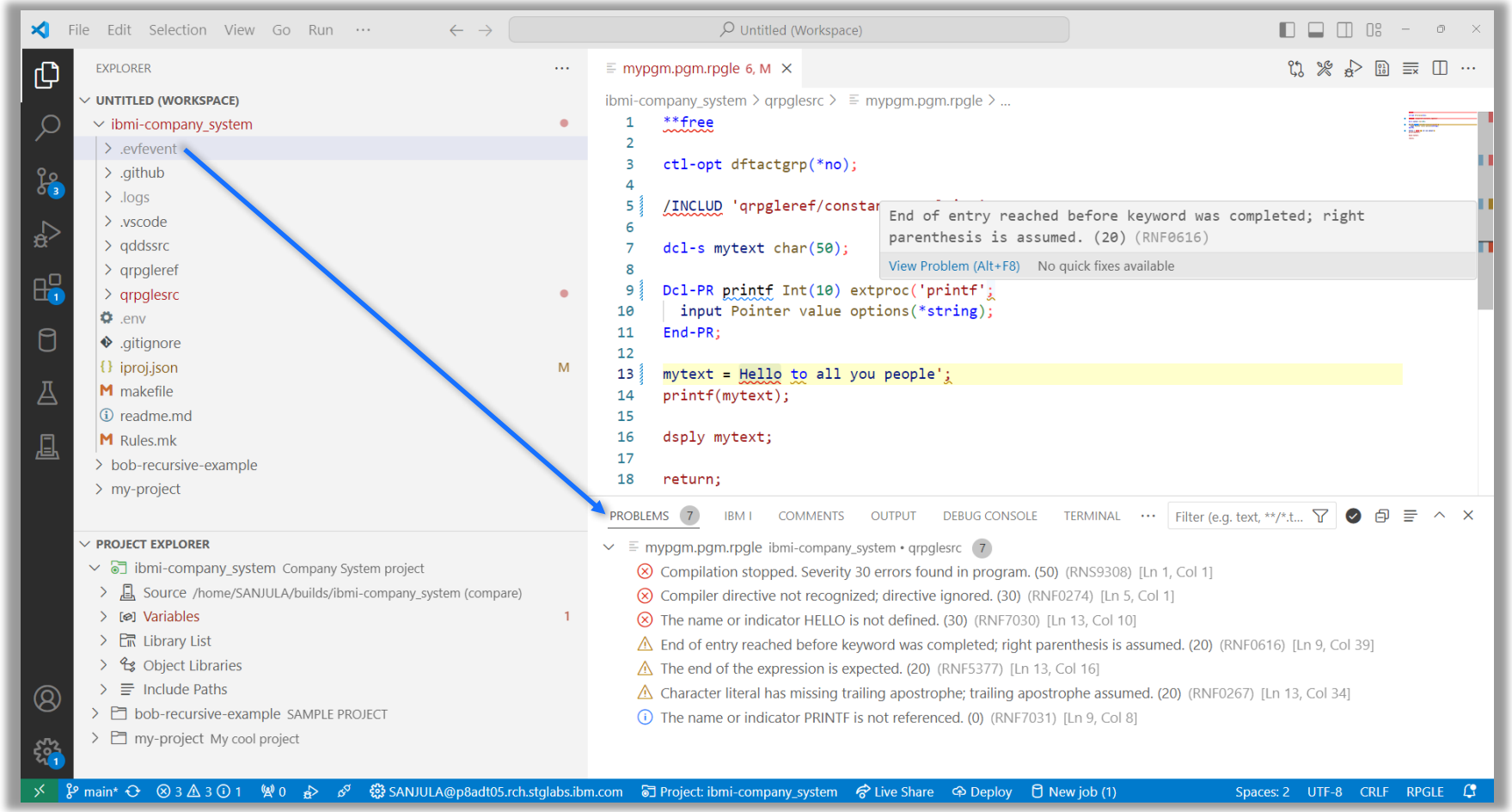
- Visualize build or compile diagnostics in the Problems view
- Evfevent file diagnostics are dumped in a .evfevent directory after a build or compile
- Diagnostics are also rendered inline in the source file



View Job Logs

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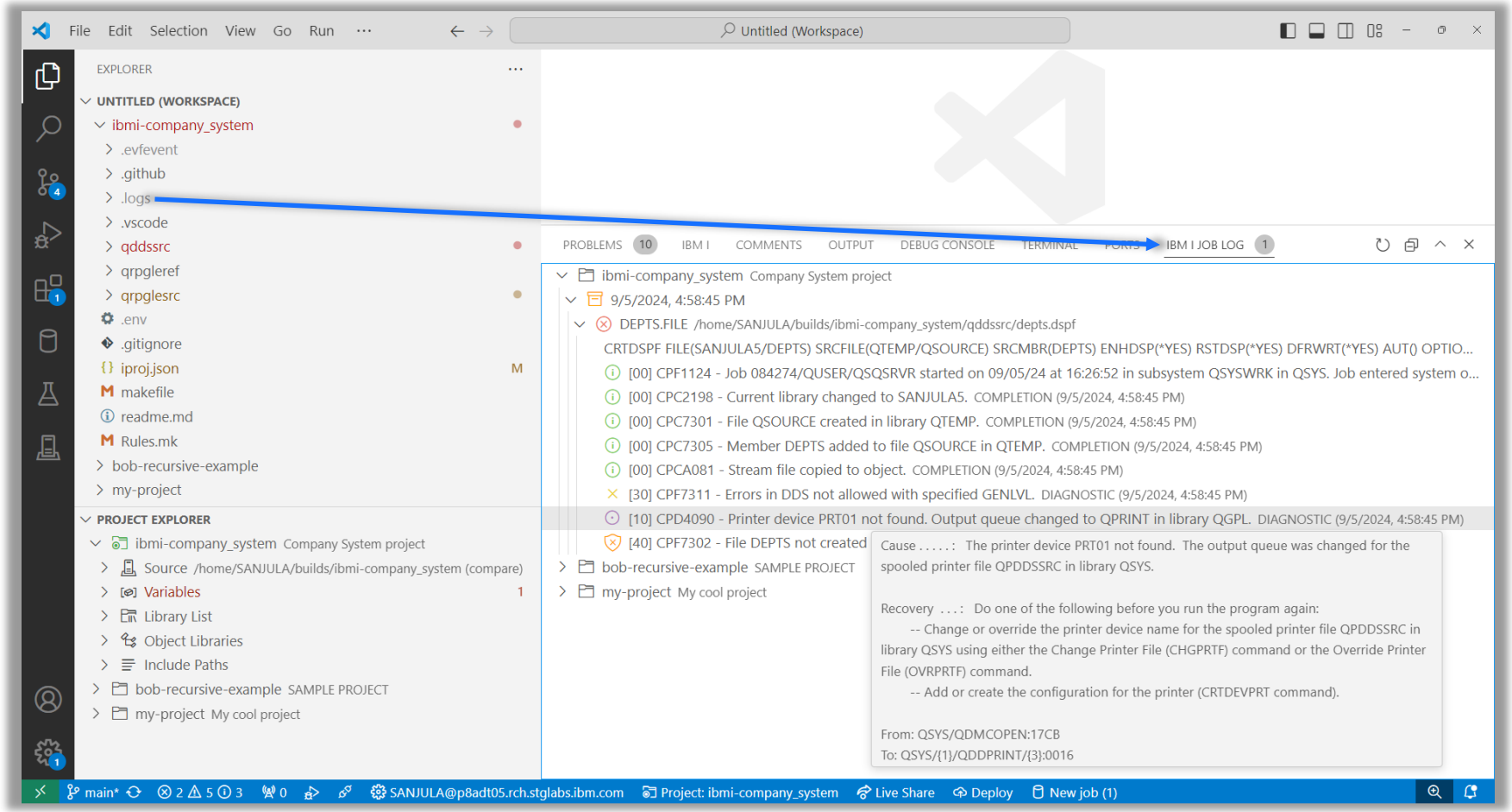
- Visualize and manage anything that could be seen in an IBM i job log including second level help
- Job log and spool files are dumped in .logs directory after a build or compile
- Track up to 10 of the previous logs in memory
- Organized by the ILE objects being built
- Filter by failed objects or severity



Integration

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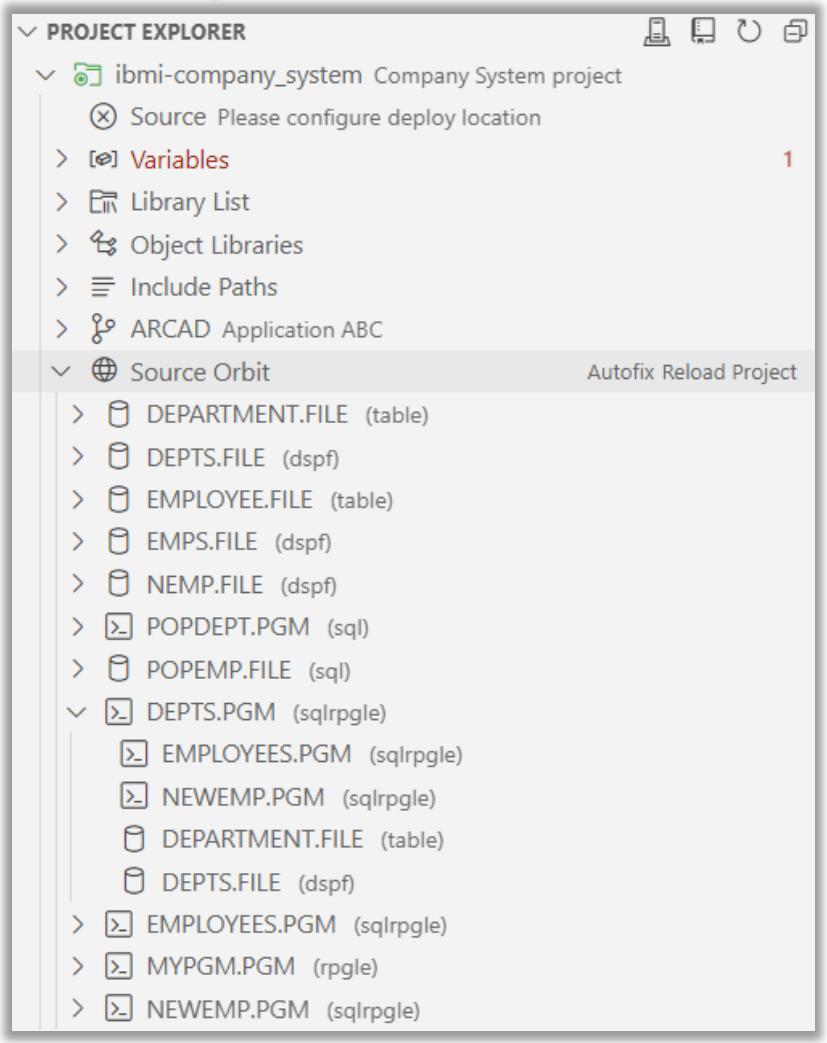
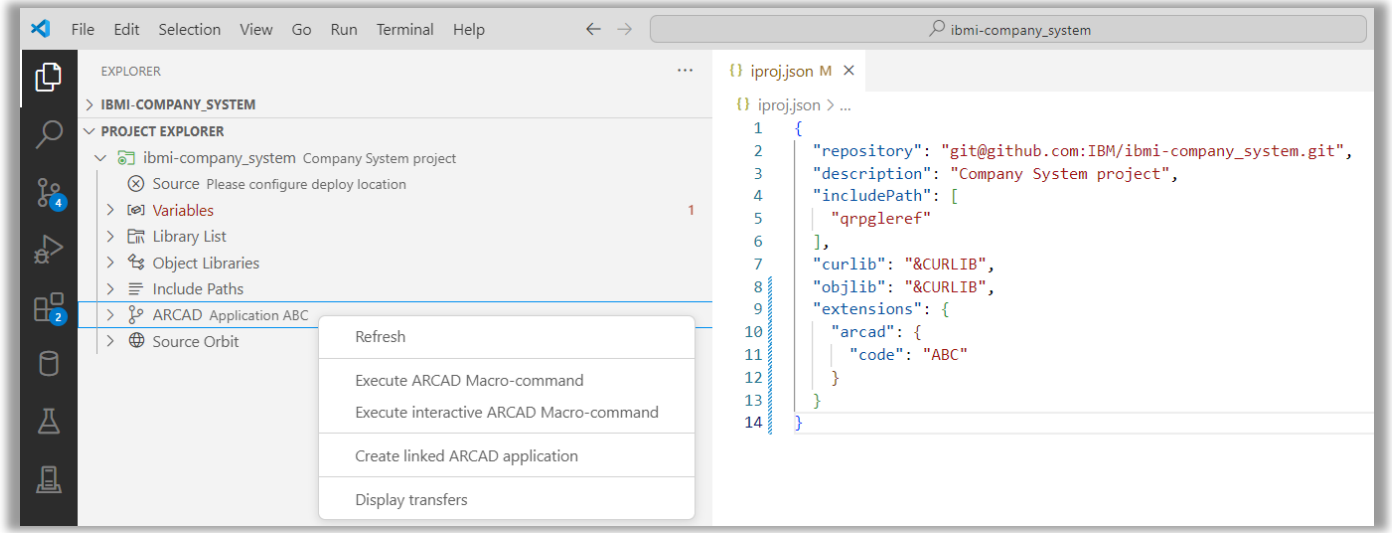
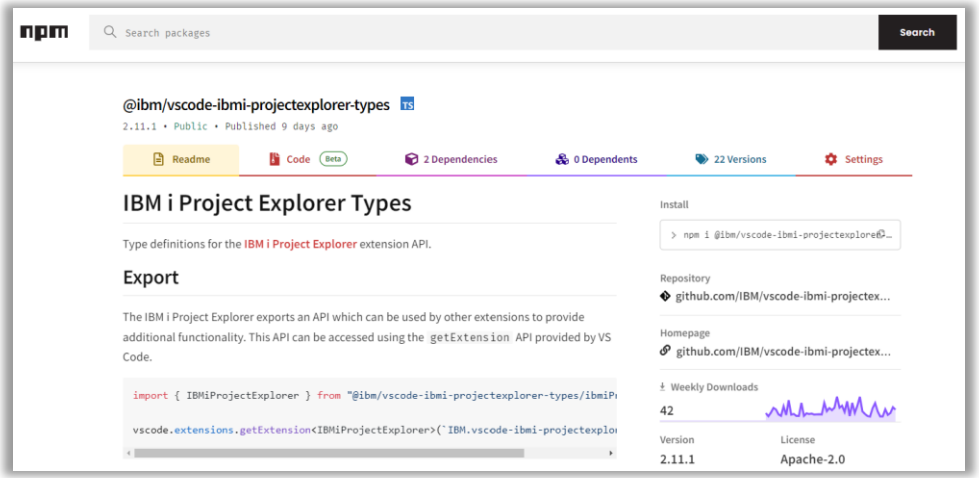
Source Orbit



ARCAD-Elias



What can you integrate with IBM i Project Explorer's API?



Any Questions?

Important Links

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IBM i Project Explorer

- VS Code Marketplace https://marketplace.visualstudio.com/items?itemName=IBM.vscode-ibmi-projectexplorer
- Documentation https://ibm.github.io/vscode-ibmi-projectexplorer/#/
- GitHub Repository https://github.com/IBM/vscode-ibmi-projectexplorer
- API https://www.npmjs.com/package/@ibm/vscode-ibmi-projectexplorer-types

Bob

- Documentation https://ibm.github.io/ibmi-bob/#/
- GitHub Repository https://github.com/IBM/ibmi-bob

Code for IBM i

- VS Code Marketplace https://marketplace.visualstudio.com/items?itemName=HalcyonTechLtd.code-for-ibmi
- Documentation https://codefori.github.io/docs/#/
- GitHub Repository https://github.com/codefori/vscode-ibmi
- API https://www.npmjs.com/package/@halcyontech/vscode-ibmi-types

For More Information

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