



# Leveraging GitHub as a *MATLAB* User

Gareth Thomas

# Focal Points

- Embracing GitHub is a journey
- GitHub Actions and File Exchange is a powerful combination
- Automating Testing really helps

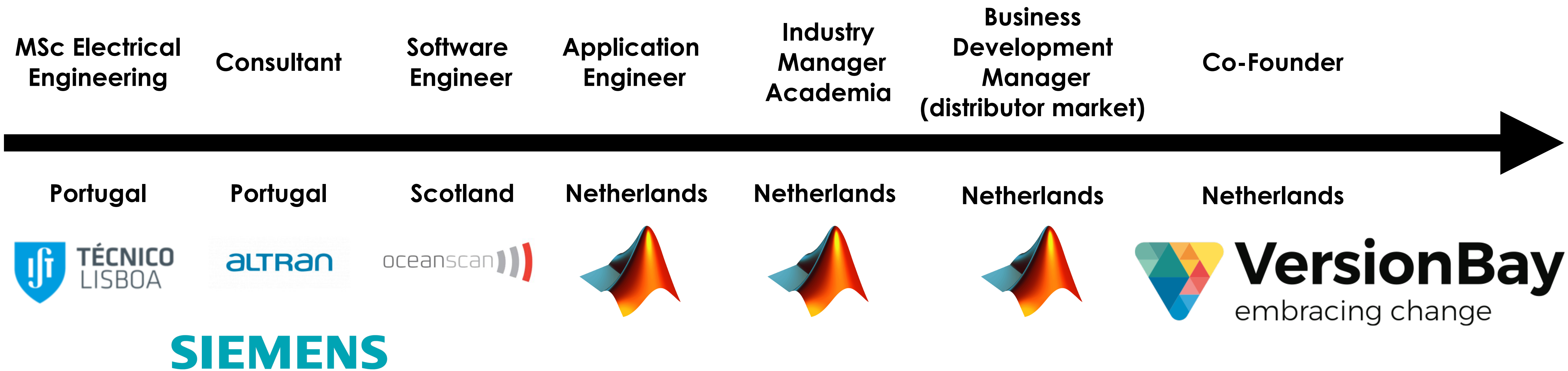


# Motivation

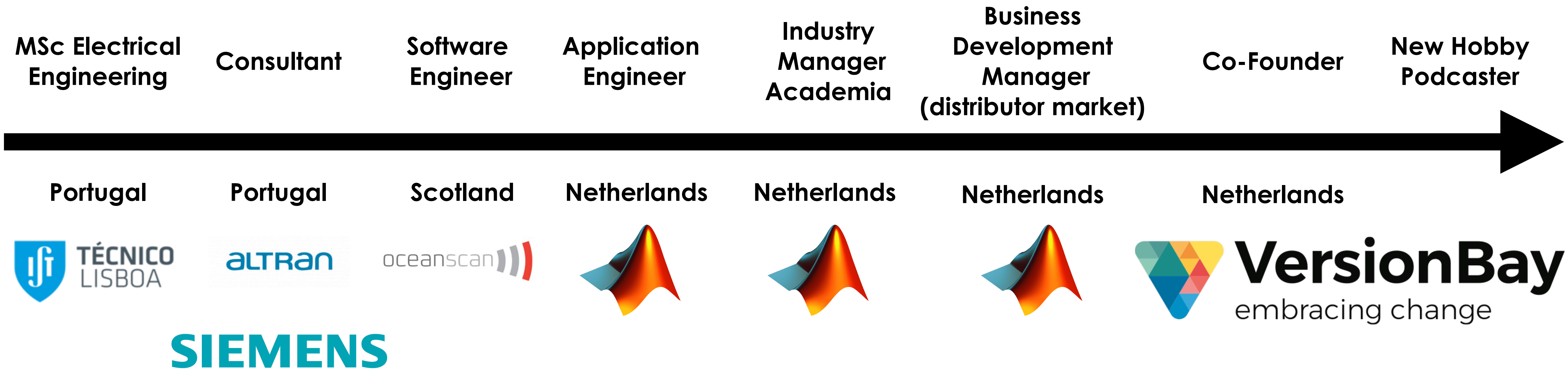
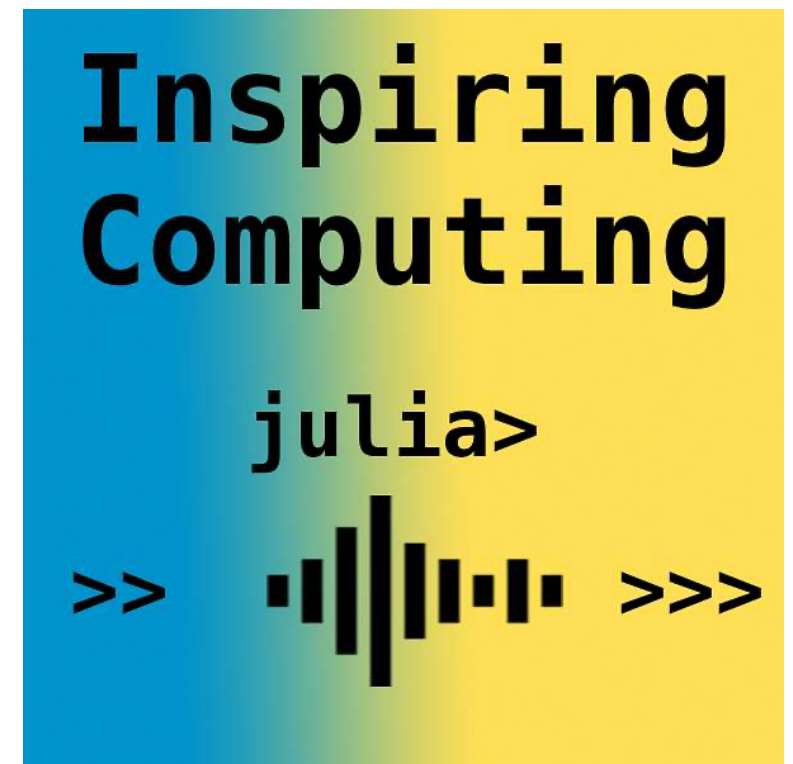
- Embracing GitHub is a journey
  - Solid foundations are needed to progress (git, testing, CI/CD, ...)
- GitHub Actions and File Exchange is a powerful combination
  - Good way to learn something new and get recognition
- Automating Testing really helps
  - Professional software developers expect this



# My Path...



# My Path...





# **My last appearance @ TCC 2018**



# Leveraging GitHub as a MATLAB User

**GitHub** ([/ˈɡɪθʌb/](https://github.com/)) is a developer platform that allows developers to create, store, manage and share their code. It uses **Git** software, providing the **distributed version control** of Git plus **access control**, **bug tracking**, **software feature requests**, **task management**, **continuous integration**, and **wikis** for every project.<sup>[6]</sup> Headquartered in **California**, it has been a subsidiary of **Microsoft** since 2018.<sup>[7]</sup>

This presentation is for  
MATLAB, but the  
**underlying principles**  
apply to **any technical**  
**computing environment**



# Isn't GitHub like File Exchange?

**GitHub** ([/ˈɡɪθhʌb/](https://github.com/)) is a developer platform that allows developers to create, store, manage and share their code. It uses **Git** software, providing the **distributed version control** of Git plus **access control**, **bug tracking**, **software feature requests**, **task management**, **continuous integration**, and **wikis** for every project.<sup>[6]</sup> Headquartered in **California**, it has been a subsidiary of **Microsoft** since 2018.<sup>[7]</sup>

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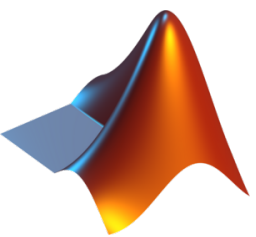
Files Authors My File Exchange ▾ Publish About

## About File Exchange

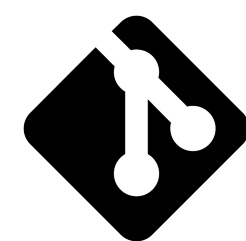
File Exchange lets you find and share custom applications, classes, code examples, drivers, functions, Simulink models, scripts, and videos. With File Exchange, you can:

- [Submit files](#)
- [Linking to GitHub Repositories](#)
- [Share website containing your MATLAB code](#)
- [License information](#)
- [Provide instructions for others to cite your work](#)
- [Find files using content types](#), the search box, and [search directives](#)
- Annotate submissions by adding [tags](#) for future lookups, [review](#) and [discuss](#) based on your use
- [Gain community recognition](#) by submitting files that members use, tag, and rate
- [Earn badges](#)
- [Build your reputation](#)
- [Questions and Feedback](#)

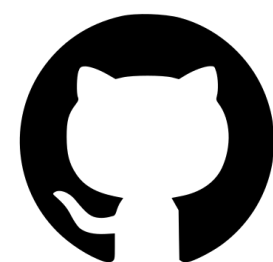




1984

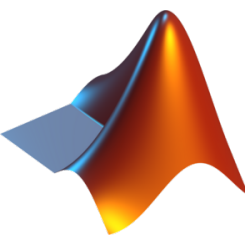


2005



2008

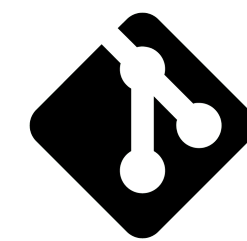




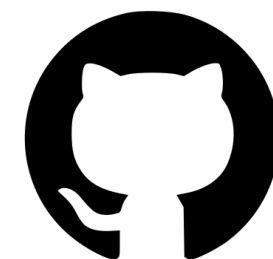
1984

1997  
File  
Exchange

2001  
MATLAB  
Central



2005



2008

2024

## 20th Anniversary – Most Active FEX Entries

Posted by [Jiro Doke](#), December 29, 2021

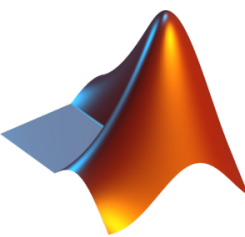
👁 11 views (last 30 days) | 👍 0 Likes | 💬 0 comment

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- [Systemic Risk](#) by [Tommaso Belluzzo](#)
- [fitVirusCOVID19](#) by [milan batista](#)
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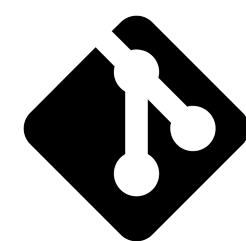




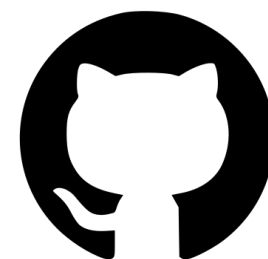
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"File Exchange Now  
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### File Exchange Now Hosts GitHub!

Posted by [Ned Gulley](#), April 18, 2014

4 views (last 30 days) | 1 Likes | 10 comments

Let's say you've created an awesome MATLAB file, and you want the world to know about it. So you go to the File Exchange page and click on the big blue button that says "Submit a File". In the past, you'd see a page that asks you to submit a ZIP-file to be uploaded. But something has changed. Now you have options. What are they?

#### Step 1

Upload from your computer

Upload multiple files as a single ZIP file. Do not include binary executables such as exe or dll files.

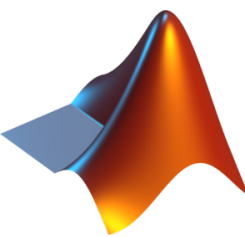
Choose File No file chosen

Link to GitHub

Enter Repository Name (e.g. gh/github)

I certify that I am the owner

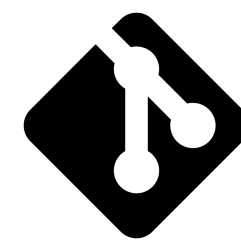




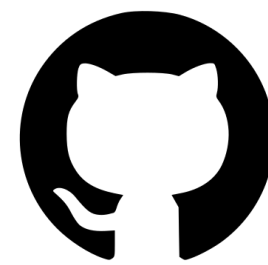
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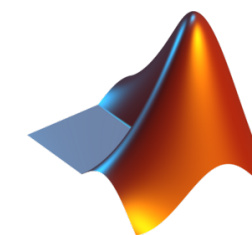
2005



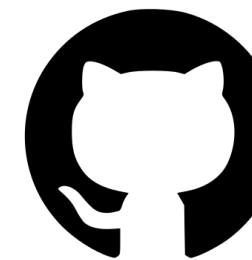
2008

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“File Exchange Now  
Hosts GitHub!”



2024



Revenue	▲ \$1 billion (2022) <sup>[2]</sup>
Employees	5,595 <sup>[3]</sup>
Parent	Microsoft (2018–present)

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**Step 1**

The screenshot shows two main options: "Upload from your computer" with a "Choose File" button (labeled "No file chosen") and "Link to GitHub" with a text input field for "Enter Repository Name (e.g. gh/github)". A red arrow points to the "Link to GitHub" option.

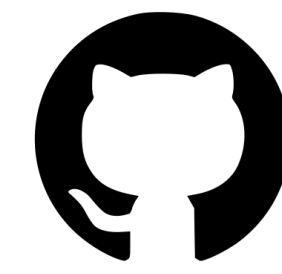


Both Companies have around 6000 employees

9 year head start

Let's see

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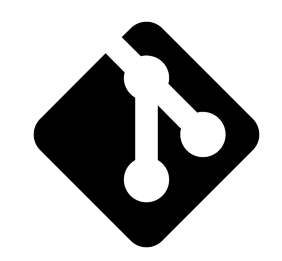
Lot's to learn and understand!

2024

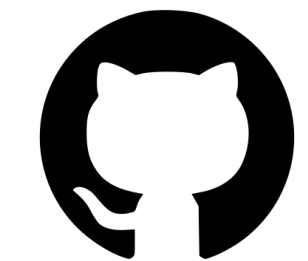
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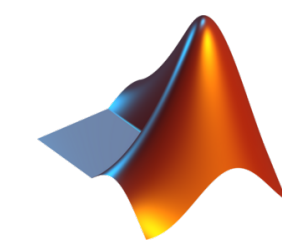
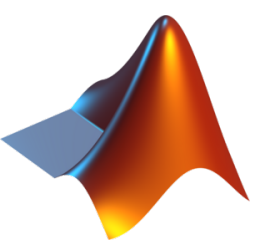
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1997 File Exchange  
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Upload multiple files as a single ZIP file. Do not include binary executables such as exe or dll files.  
 No file chosen

OR

Link to GitHub  
Enter Repository Name (e.g. gh/github)

I certify that I am the owner



# Why GitHub?



Sharing

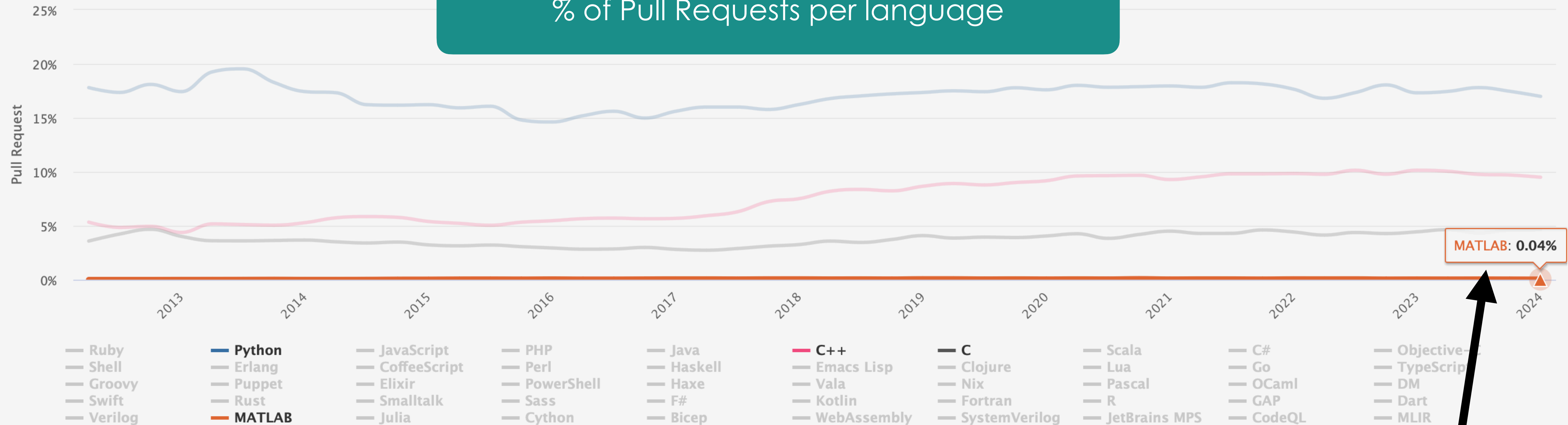
Collaboration

Task Automation

Idea -> Production

Trusted

### % of Pull Requests per language



MATLAB: 0.04%

PULL REQUESTS

STARS

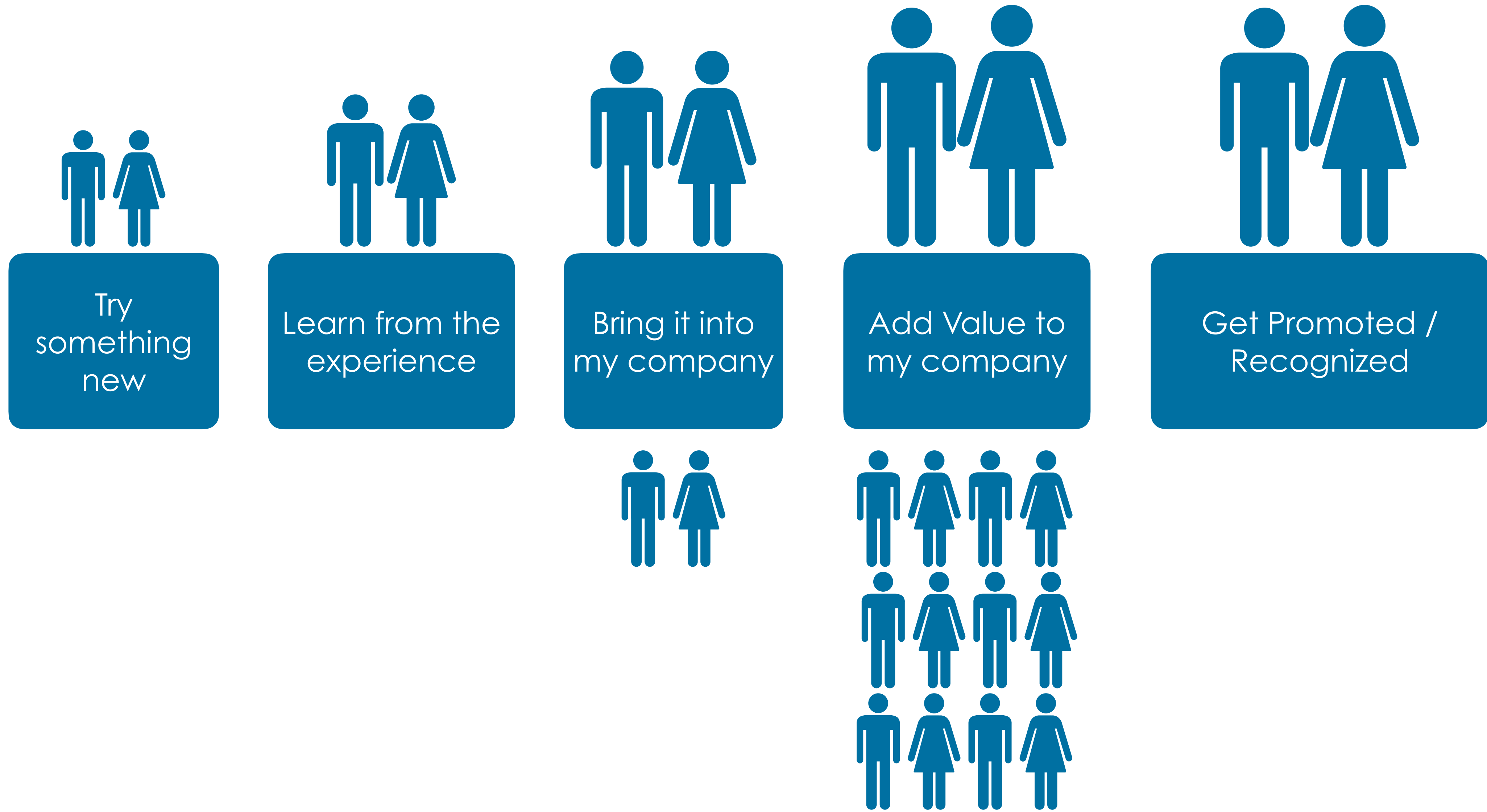
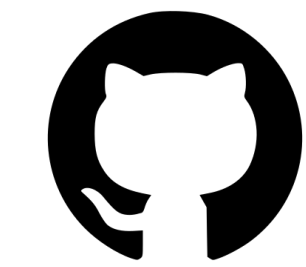
PUSHES

ISSUES

This number should be bigger!



# MATLAB User Journey





# MATLAB User Journey



MATLAB only for me

MATLAB to collaborate with others

MATLAB to empower others



# How to use GitHub?



I want to open MATLAB and  
have the **joke of the day!**

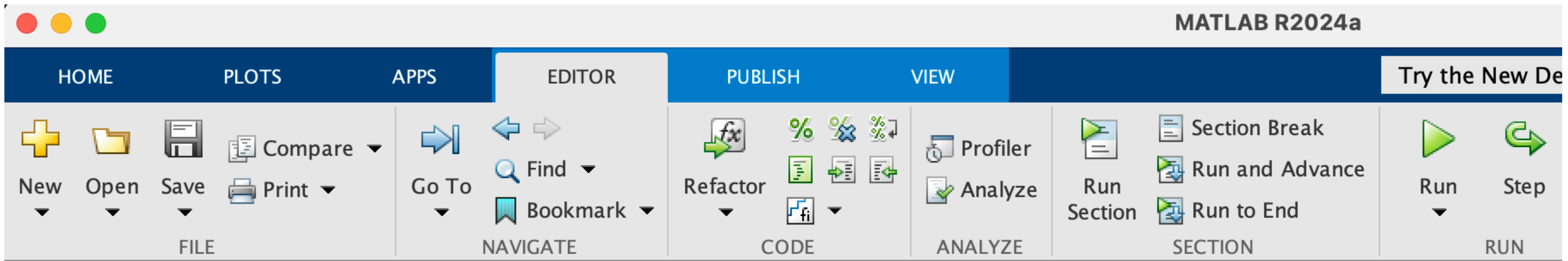
I would like to **share this with others**  
and have them **add jokes**  
in **different languages**

It would be awesome to have this appear in  
**Add-On Manager**



Let me show you  
what I have





Users > gareth > Documents > MATLAB > jokes >

Command Window

```
>> joke()
There are 10 types of people in the world: those who understand binary, and those who don't.
>> joke(jokeNumber=28)
Given a circular pizza with radius z and thickness a, return the pizza's volume. pi*z*z*a
>> joke(language="portuguese")
Existem somente 10 tipos de pessoas no mundo inteiro:Aquelas que entendem binário e aquelas que não entendem.
>> joke(language="portuguese", jokeNumber=2)
Qual é a comida que liga e desliga? É o Strog-on-off.
fx >>
```





**Jokes in MATLAB** Version 0.3.2 by Gareth

Get **MATLAB** to tell you a **joke**.

[[View **Jokes in MATLAB** on File Exchange](https://www.mathworks.com/matlabcentral/images/matlab-file-exchange.svg)](https://nl.mathworks.com/matlabcentral/fileexchange/172039-matlab-jokes) [!]

[Open in

- fx [joke](#)
- fx [get\\_joke](#)
- fx [test\\_joke](#)

★★★★★

22 Downloads ⓘ

Updated 2 Sep 2024



“Now I want to add **4 Czech Jokes**  
and **release a new version**  
Jokes in MATLAB Toolbox

...

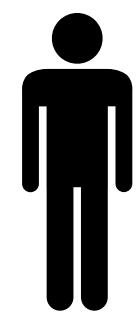
**as quickly as possible”**



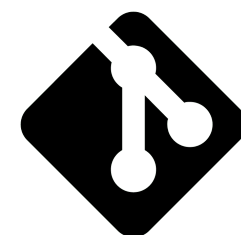
Let's go over what happened  
and how this is setup



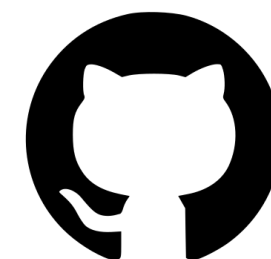
# Workflow to add 4 Czech Jokes and release



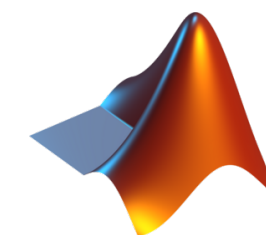
Me



Git



GitHub



MATLAB

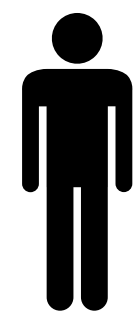
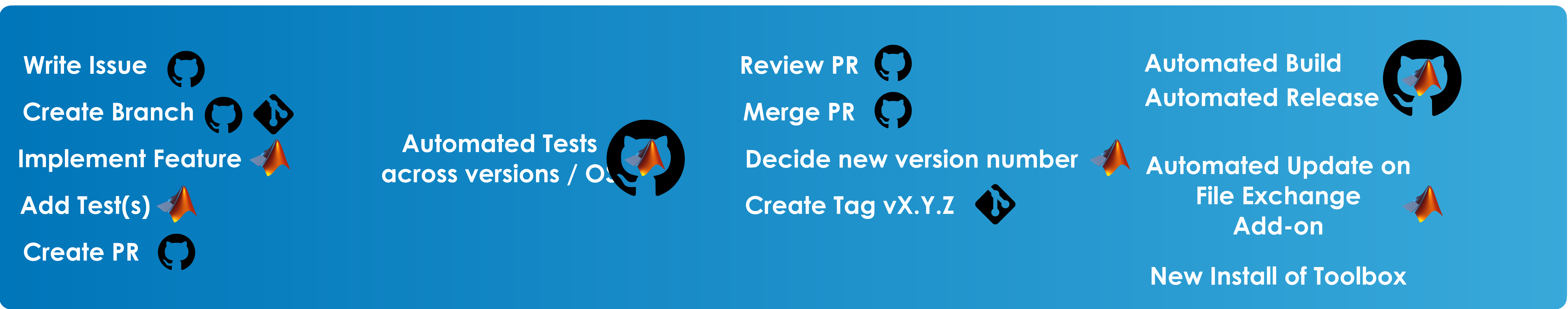


Automated  
with GitHub & MATLAB

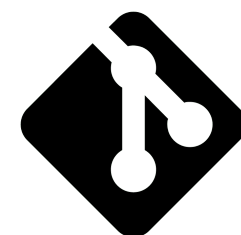




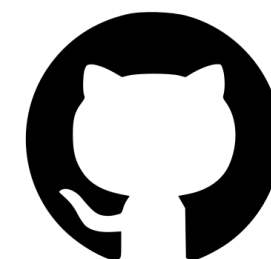
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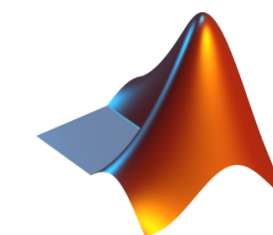
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Git



GitHub



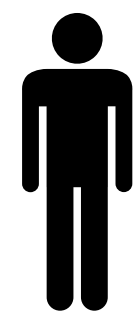
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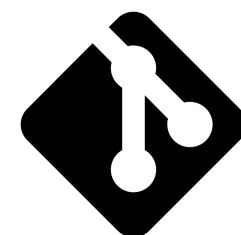
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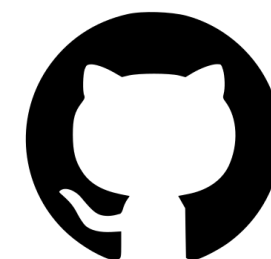
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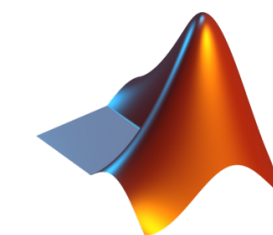
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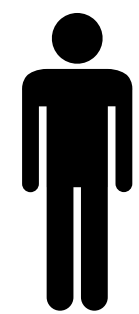
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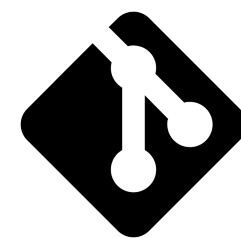
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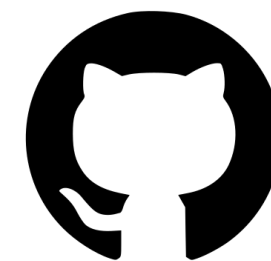
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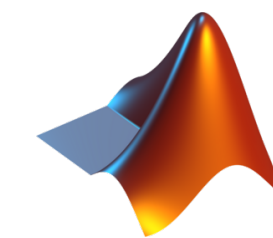
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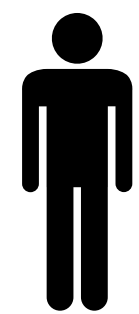
MATLAB



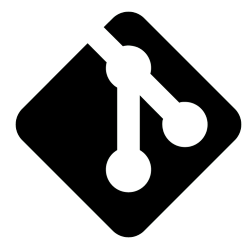
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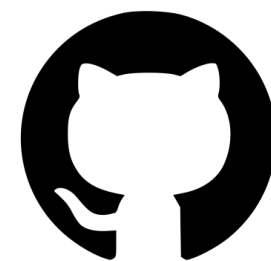
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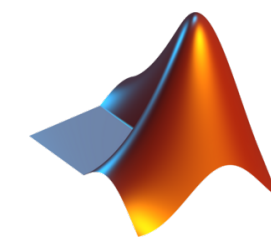
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MATLAB

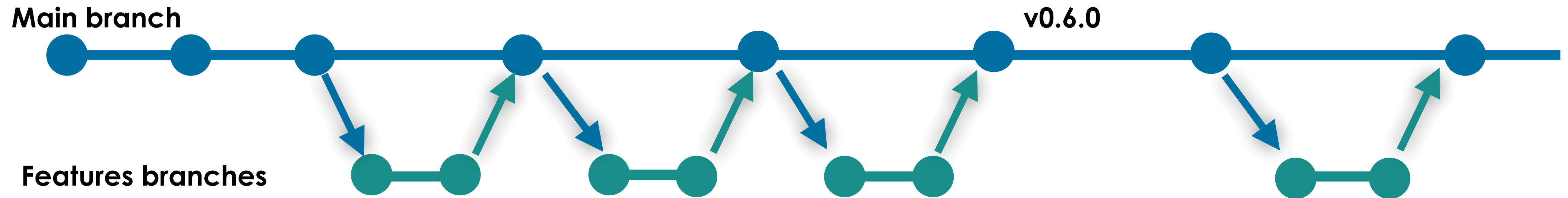


Automated  
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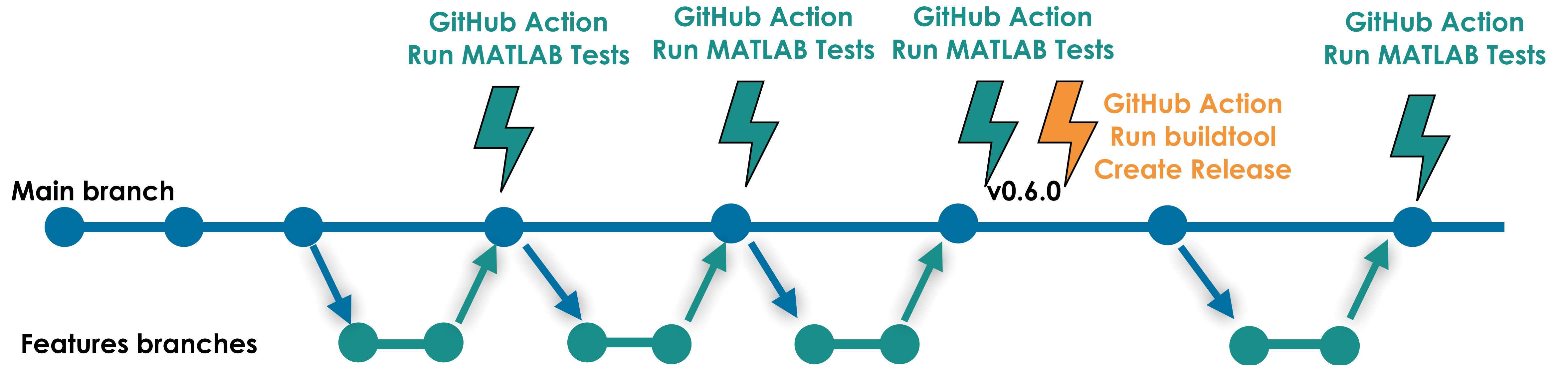
# Git workflow

Very simple and general workflow

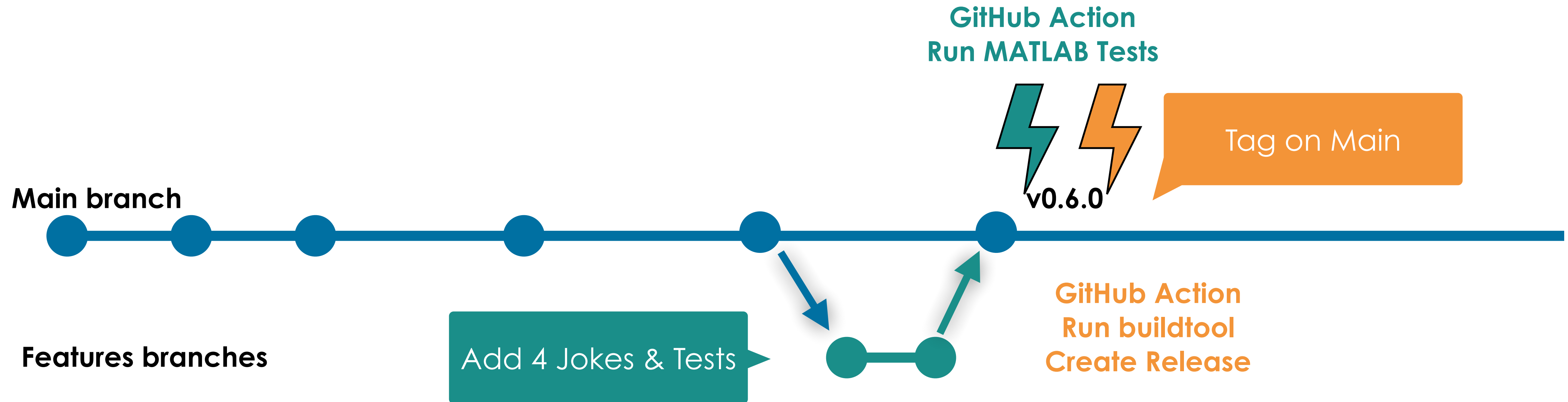


# Git workflow

I have 2 GitHub Workflows



# Git workflow



# Folder Structure

Following MathWorks Guidelines

Name ▲	
> .github	
apps	<b>App and App Project</b>
> jokeApp_resources	
displayJoke.html	
jokeApp.mlapp	
jokeApp.prj	
images	
toolbox	
> doc	<b>Documentation</b>
> examples	
> internal	<b>Internal dependencies</b>
> tests	<b>Tests</b>
info.xml	
joke.m	
.gitattributes	
.gitignore	
buildfile.m	<b>buildtool</b>
license.txt	
README.md	
toolboxPackaging.prj	<b>Toolbox Packaging Project</b>





# MATLAB Project

GitHub Actions are enabled by MATLAB Project

The screenshot displays the MATLAB Project interface for a project named "Project - Jokes in MATLAB". The interface is divided into several sections:

- PROJECT SHORTCUTS:** Includes buttons for "New", "Open", and "Share" under the "FILE" tab, and "Dependency Analyzer", "Class Diagram", and "MATLAB Test Manager" under the "TOOLS" tab.
- ENVIRONMENT:** Contains "References", "Details", "Project Path", and "Startup Shutdown".
- SOURCE CONTROL:** Features "Git Details", "Refresh", "Commit", "Fetch", "Push", "Pull", "Remote", "Branches", and "Submodules".

The main workspace shows a file tree for "Project (34)" with the following items:

Name	Status	Git	Classification
.github	✓	·	
apps	✓	·	
jokeApp_resources	✓	·	
displayJoke.html	✓	●	Artifact Design
jokeApp.mlapp	✓	●	Design
jokeApp.prj	✓	●	
images	✓	·	
toolbox	✓	·	
doc	✓	·	
examples	✓	·	
internal	✓	·	
tests	✓	·	
info.xml	✓	●	Derived Design
joke.m	✓	●	Design
.gitattributes	✓	●	
.gitignore	✓	●	
buildfile.m	✓	●	
license.txt	✓	●	
README.md	✓	●	
toolboxPackaging.prj	✓	●	

The "Git" section at the bottom left indicates the current branch is "main", with a "Branch status: Normal" and "Coincident with /origin/main".



# .gitignore

---

```
# Autosave files
*.asv
*.m~
*.autosave
*.slx.r*
*.mdl.r*

# Derived content-obscured files
*.p

# Compiled MEX files
*.mex*

# Packaged app and toolbox files
*.mlappinstall
*.mltbx

# Deployable archives
*.ctf

# Generated helpsearch folders
helpsearch*/

# Code generation folders
slprj/
sccprj/
codegen/

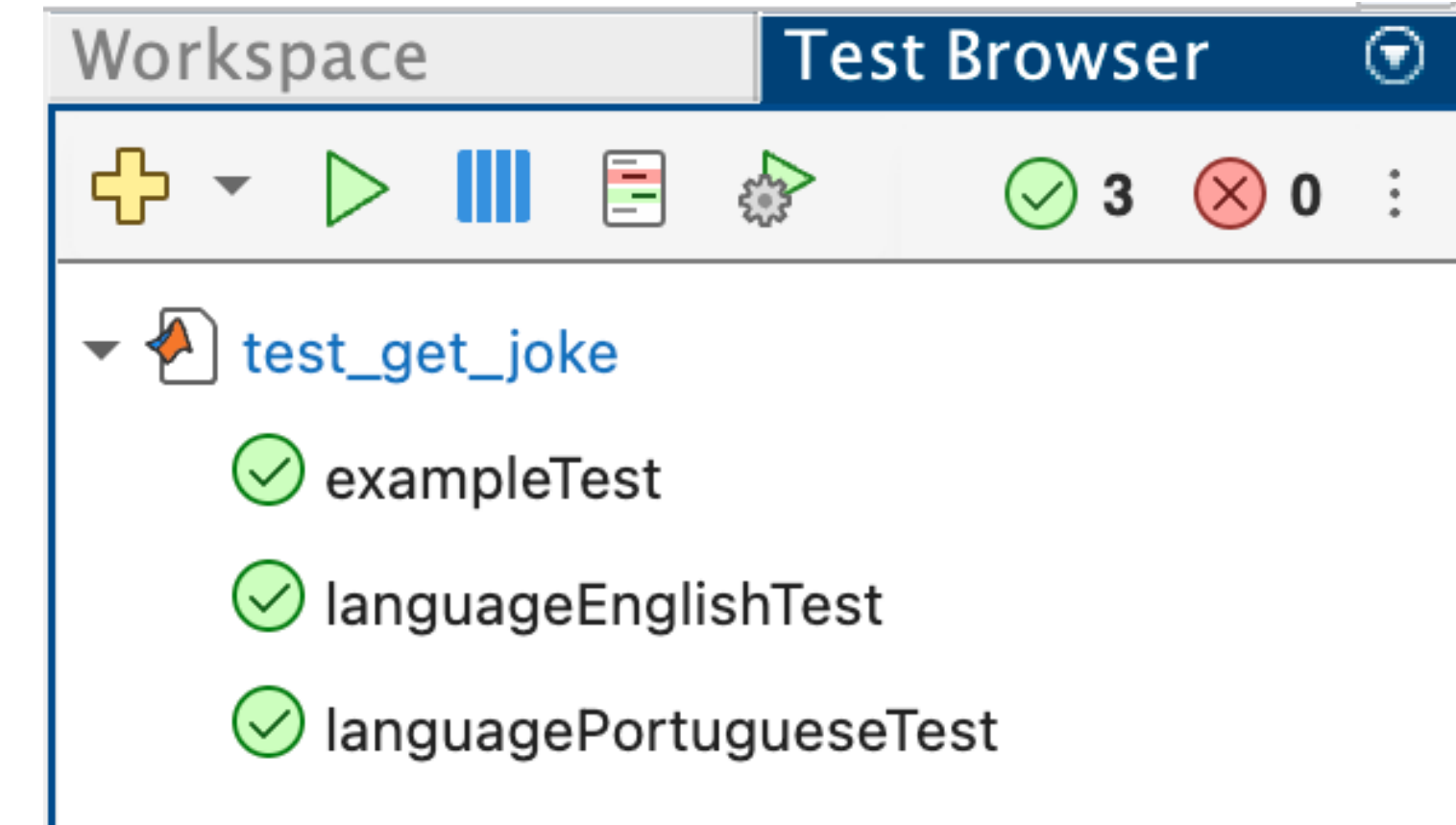
# Cache files
*.slxc

# Cloud based storage dotfile
.MATLABDriveTag
```

Generated with MATLAB Project



# MATLAB Unit Test



The screenshot shows the MATLAB Test Browser interface. The 'Workspace' tab is active, and the 'Test Browser' window displays the results for a test suite named 'test\_get\_joke'. The test suite contains three individual tests: 'exampleTest', 'languageEnglishTest', and 'languagePortugueseTest'. All three tests are marked with green checkmarks, indicating they passed successfully. The overall status shows 3 passed tests and 0 failed tests.

```
1  classdef test_get_joke < matlab.unittest.TestCase
2
3  methods (Test)
4      % Test methods
5      function exampleTest(testCase) ...
21     function languageEnglishTest(testCase)
22         j = get_joke("jokeNumber",2,"language","english");
23         testCase.verifyEqual(j,"How many programmers does it take to change a light bulb?");
24     end
25     function languagePortugueseTest(testCase)
26         j = get_joke("jokeNumber",2,"language","portuguese");
27         testCase.verifyEqual(j,"Qual é a comida que liga e desliga? É o Strog-on-off.");
28     end
29
30 end
31
32 end
```

Most domain experts forget about this





# License.txt

Why does MathWorks require the BSD license for File Exchange?

The BSD license is **simple, well-known, open source**, and **permissive**. It is one of the most widely used licenses approved by the [Open Source Initiative](#). It is short enough to fit on an index card.

BSD License is a must for File Exchange



# App Project

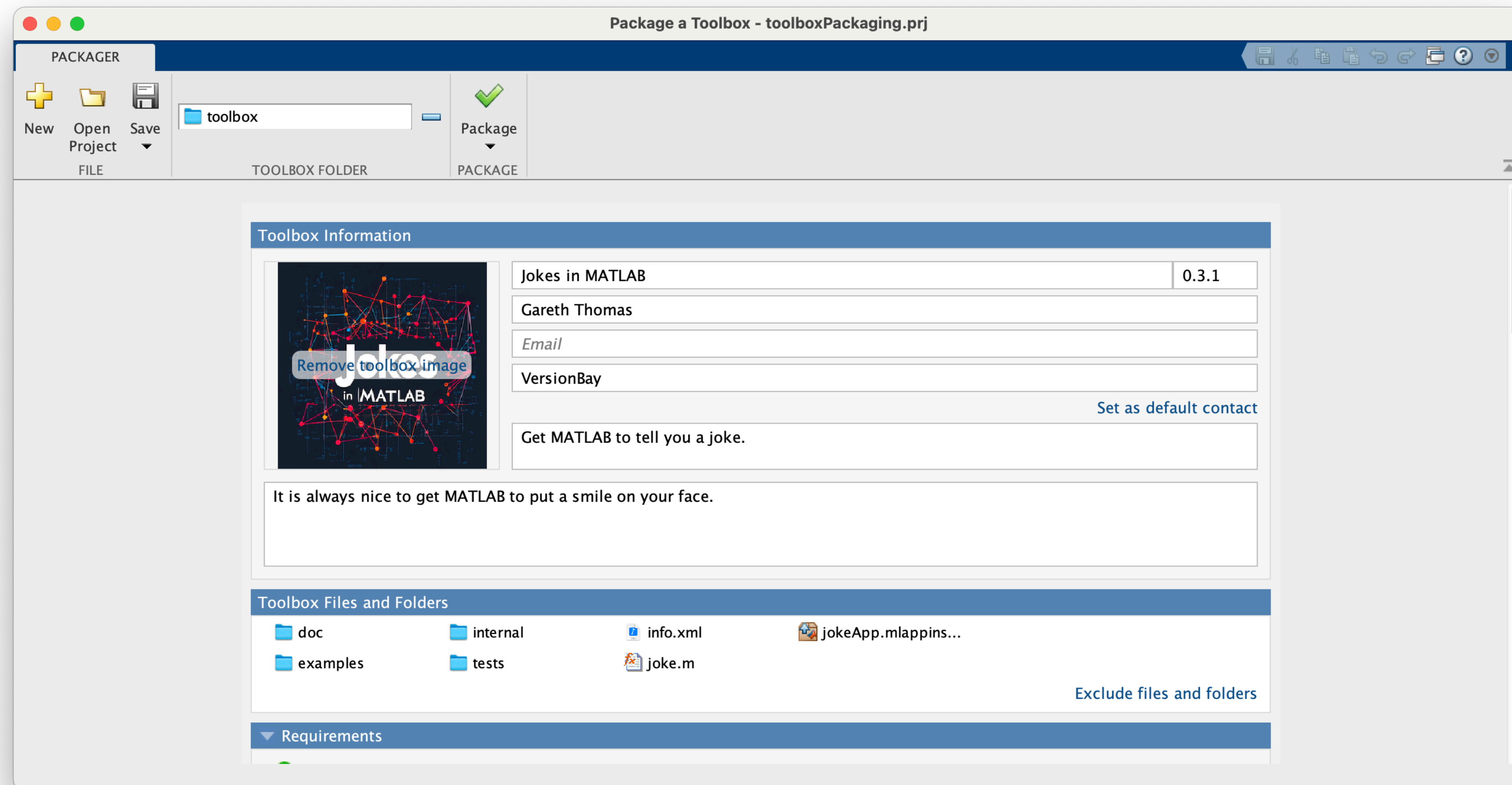
Apps can have their own version

The screenshot shows the 'Package App' wizard in MATLAB. The window title is 'Package App' and the path is '/Users/gareth/Documents/MATLAB/clonedJokes/MATLABJokes/apps/jokeApp.prj'. The wizard is divided into three main sections: 'Pick main file', 'Describe your app', and 'Package into installation file'.  
1. 'Pick main file': Shows 'jokeApp.mlapp' as the main file with a 'Remove main file' button. Below it, 'Files included through analysis' (displayJoke.html) and 'Shared resources and helper files' (displayJoke.html) are listed.  
2. 'Describe your app': Includes a 'jokeApp' icon and version '0.2' field, a 'Gareth Thomas' name field, an 'Email' field, and a 'VersionBay' field with a 'Set as default contact' link. A 'Remove screenshot' button is over the 'Jokes in MATLAB' image. The description text reads: 'MATLAB App that tells a joke.' and 'Simple MATLAB App that gets installed with MATLAB Jokes Toolbox.'  
3. 'Package into installation file': Shows an 'Output folder' field with the path '/Users/gareth/Documents/MATLAB' and a 'Browse' button. A 'Package' button is at the bottom of this section.  
4. 'Products': A list containing 'MATLAB' with a close button and an add button (+).



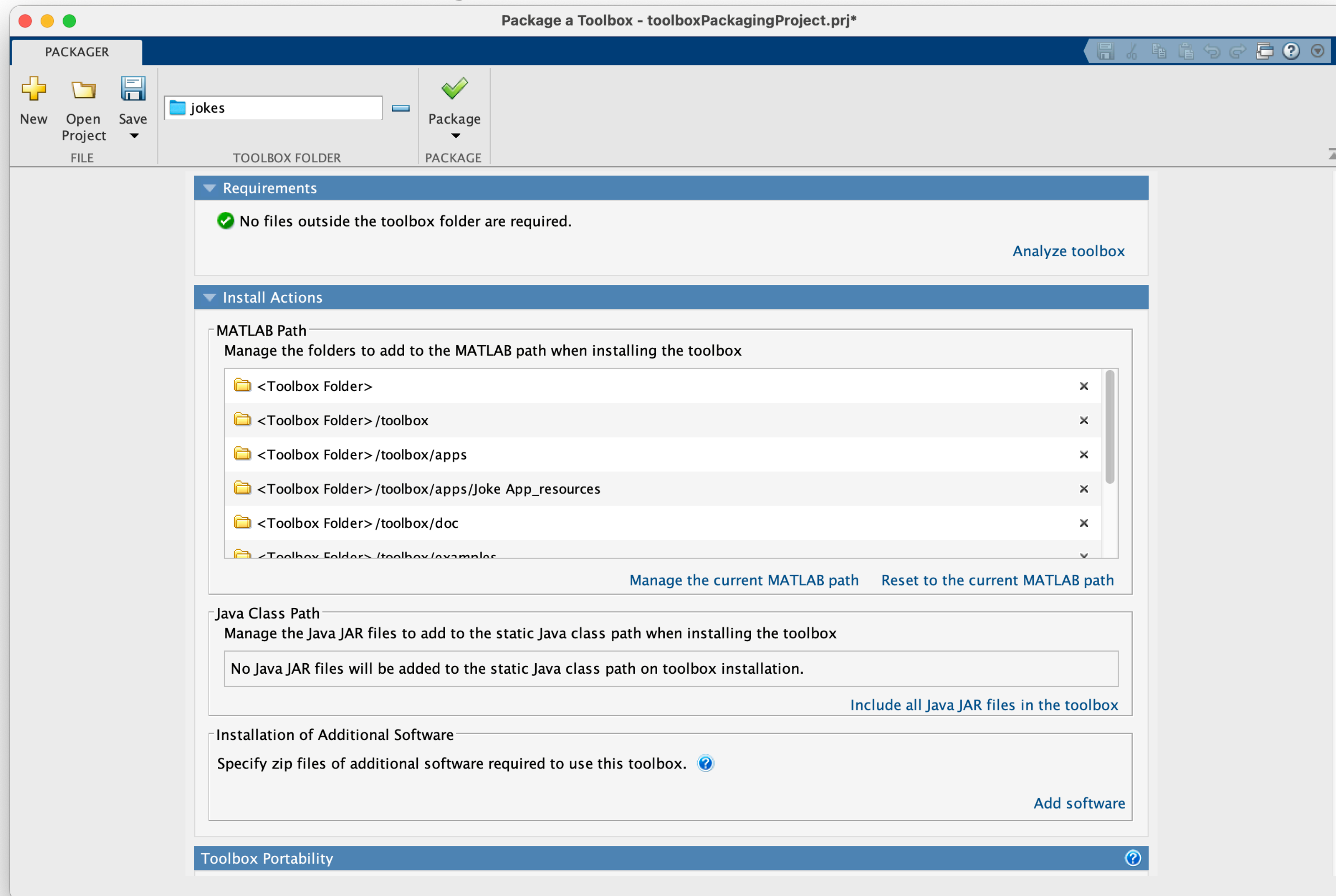
# Toolbox Project

Toolbox Version is important



# Toolbox Project

Lots of options...





# Toolbox Project

Metadata for File Exchange

Package a Toolbox - toolboxPackagingProject.prj\*

PACKAGER

New Open Project Save FILE

TOOLBOX FOLDER: jokes

PACKAGE

### Toolbox Portability

Platform Compatibility

- Windows
- Linux
- macOS
- MATLAB Online

Release Compatibility

- All MATLAB Releases
- MATLAB Releases from R2021a to latest
- Current MATLAB Release only (R2024a)

Products

- MATLAB

### Examples, Apps, and Documentation

Examples

Include your MATLAB code as HTML examples. [Add examples](#)

- Republish all example files when packaging the toolbox

examples

- jokeexample

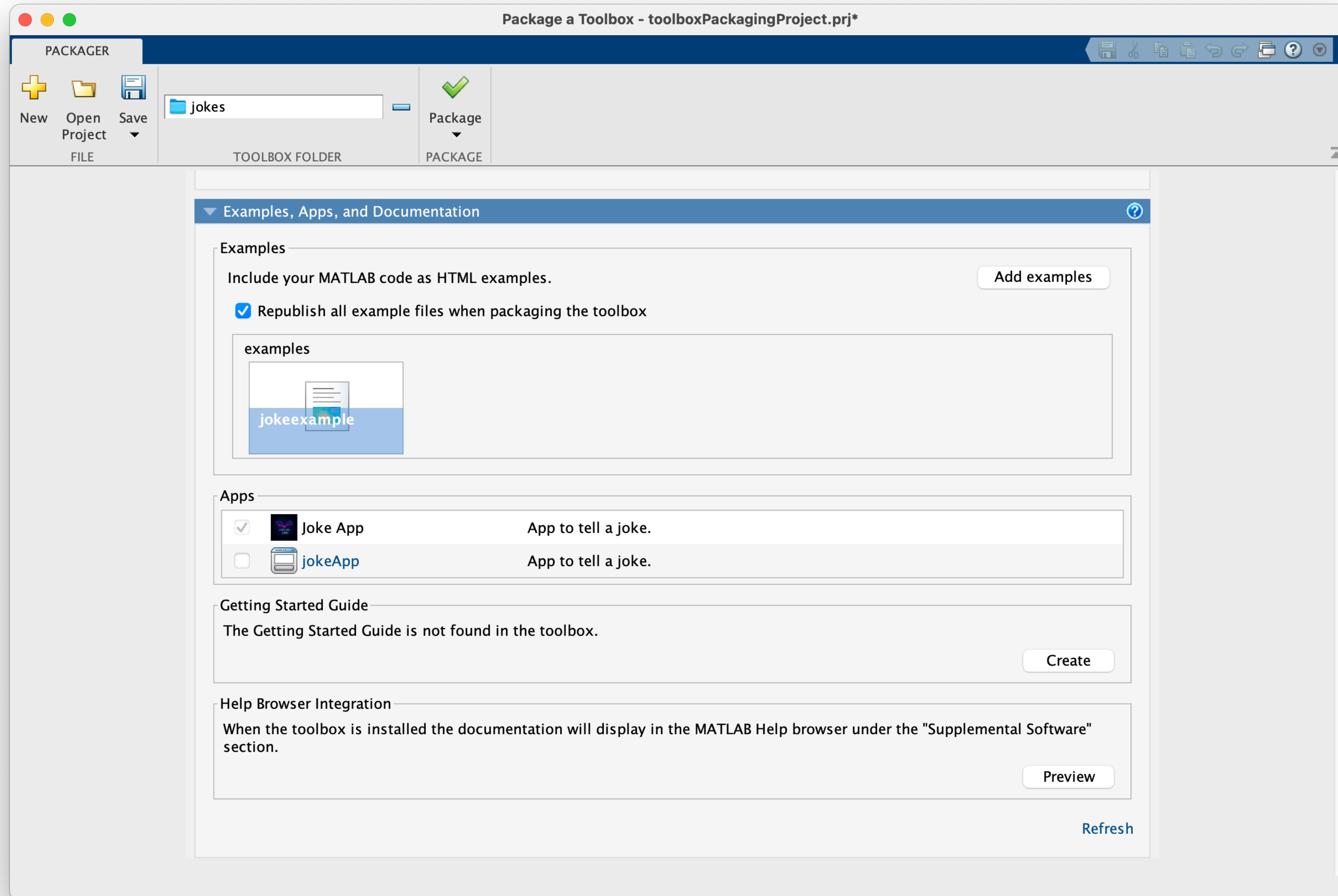
Apps

- loke App: App to tell a ioke.



# Toolbox Project

Notice Examples and Documentation options



# MATLAB Function Arguments

```
function joke(NameValueArgs)

arguments
    NameValueArgs.jokeNumber {mustBeNonnegative}
    NameValueArgs.language string = "english"
end

if isfield(NameValueArgs,"jokeNumber")
    joke_str = get_joke(jokeNumber=NameValueArgs.jokeNumber, language=NameValueArgs.language);
else
    joke_str = get_joke(language=NameValueArgs.language);
end

disp(joke_str);

end
```

Don't forget about function Argument Validators



# MATLAB Build Tool

```
function plan = buildfile
import matlab.buildtool.tasks.CodeIssuesTask
import matlab.buildtool.tasks.TestTask

% Create a plan from task functions
plan = buildplan(localfunctions);

% Add a task to identify code issues
plan("check") = CodeIssuesTask(WarningThreshold=1, ...
    Results="code-issues/results.sarif");

% Add a task to run tests
plan("test") = TestTask;

% Make the "archive" task the default task in the plan
plan.DefaultTasks = "release";

plan("release").Dependencies = ["test", "build"];

end
```

Define workflow in buildtool

```
function buildTask(context)
currentPath = context.Plan.RootFolder;
matlab.apputil.package(fullfile(currentPath, "apps", "jokeApp.prj"));
while (~exist(fullfile(currentPath, "apps", "jokeApp.mlappinstall"), "file"))
    pause(0.1)
end
movefile(fullfile(currentPath, "apps", "jokeApp.mlappinstall"), fullfile(currentPath, "toolbox"))
end
```

Creates New App

```
function releaseTask(~)

projectFile = "toolboxPackaging.prj";
opts = matlab.addons.toolbox.ToolboxOptions(projectFile);
opts.OutputFile = opts.OutputFile.replace(" in MATLAB", "");
opts.ToolboxVersion = "0.3.3";
matlab.addons.toolbox.packageToolbox(opts);

end
```

Creates New Toolbox Release



# GitHub Marketplace











The screenshot shows the top of the GitHub Marketplace page. On the left, there is a hamburger menu icon, the GitHub logo, and the word "Marketplace". On the right, there is a search bar with the placeholder text "Type to search" and several utility icons: a plus sign, a refresh icon, a settings icon, a mail icon, and a user profile icon. Below the navigation bar is a large banner with a purple and blue background. The banner contains the text "Enhance your workflow with extensions" and "Tools from the community and partners to simplify tasks and automate processes". Below this text is a search input field containing the word "MATLAB". To the right of the text is a colorful illustration of a robot head and various geometric shapes.

- Featured
- Copilot
- Models
- Apps
- Actions
- + Create a new extension

## Search results for "MATLAB"

6 results

Filter: All | By: All creators | Sort: Popularity

- |   |  |
|---|--|
|  <b>Setup MATLAB</b>  <span>Action</span><br>Set up a specific version of MATLAB                      |  <b>MATLAB Start</b> <span>Action</span><br>Run MATLAB scripts, functions, and statements   |
|  <b>Run MATLAB Tests</b>  <span>Action</span><br>Run MATLAB and Simulink tests and generate artifacts |  <b>Run MATLAB Command</b>  <span>Action</span><br>Run MATLAB scripts, functions, and statements |
|  <b>Run MATLAB Build</b>  <span>Action</span><br>Run a build with the MATLAB build tool               |  <b>MOxUnit Action</b> <span>Action</span><br>Run unittests for Matlab/Octave using MOxUnit   |

Explore all the different things you can "bolt" on to GitHub



# MATLAB Actions

Made by MathWorks (for anyone to use)



## Setup MATLAB

Set up a specific version of MATLAB

Action



## MATLAB Start

Run MATLAB scripts, functions, and statements

Action



## Run MATLAB Tests

Run MATLAB and Simulink tests and generate artifacts

Action



## Run MATLAB Command

Run MATLAB scripts, functions, and statements

Action



## Run MATLAB Build

Run a build with the MATLAB build tool

Action



## MOxUnit Action

Run unittests for Matlab/Octave using MOxUnit

Action



# GitHub Action for Testing

```
name: Run Tests
```

```
on:
```

```
  push:
```

```
    branches:
```

```
      - main
```

```
  pull_request:
```

```
    branches:
```

```
      - main
```

What triggers the workflow

```
jobs:
```

```
  test:
```

```
    name: Run MATLAB Tests
```

```
    strategy:
```

```
      matrix:
```

```
        release: [R2021a, R2021b, R2022a, R2022b, R2023a, R2023b, R2024a]
```

```
        os: [ubuntu-latest, windows-latest, macos-latest]
```

```
    runs-on: ${{ matrix.os }}
```

Setup multiple releases  
and OS

```
  steps:
```

```
    - name: Check out repository
```

```
      uses: actions/checkout@v4
```

```
    - name: Set up MATLAB
```

```
      uses: matlab-actions/setup-matlab@v2
```

```
      with:
```

```
        release: ${{ matrix.release }}
```

Gets MATLAB running on  
GitHub (no license needed)

```
    - name: Run tests
```

```
      uses: matlab-actions/run-tests@v2
```

Uses MATLAB Project and finds all files tagged with Test Label

# GitHub Action for Building

```
name: Build and Release
```

```
on:
```

```
  push:
```

```
    tags:
```

```
      - "v*.*.*" # This triggers the workflow when a new version tag is pushed
```

Triggered on Tag v\*.\*.\*

```
jobs:
```

```
  build:
```

```
    name: Run MATLAB Build
```

```
    runs-on: ubuntu-latest
```

```
    steps:
```

```
      - name: Check out repository
```

```
        uses: actions/checkout@v4
```

```
      - name: Set up MATLAB
```

```
        uses: matlab-actions/setup-matlab@v2
```

```
      - name: Run build
```

```
        uses: matlab-actions/run-build@v2
```

```
      - name: Upload MLTBX
```

```
        uses: actions/upload-artifact@v4
```

```
        with:
```

```
          name: jokes-toolbox
```

```
          path: Jokes.mltbx ...
```

Runs **buildtool** that is defined in **buildfile.m**  
in MATLAB Project

Upload to Artifacts for Release job



# GitHub Action for Release

...

## release:

**name:** Create GitHub Release

**needs:** build

**runs-on:** ubuntu-latest

**permissions:** write-all

## steps:

- **name:** Checkout repository

**uses:** actions/checkout@v4

- **name:** Download MLTBX

**uses:** actions/download-artifact@v4

**with:**

**name:** jokes-toolbox

- **name:** Create GitHub Release with Auto-generated Release Notes

**run:** gh release create `${{ github.ref }}` 'Jokes.mltbx' --generate-notes

**env:**

**GITHUB\_TOKEN:** `${{ secrets.GITHUB_TOKEN }}`

Download **Jokes.mltbx** artifact from **build job**

Creates release with automated release notes

# GitHub Release

Changelogs are an important part of this.

Releases Tags

Draft a new release

Find a release

36 minutes ago

github-actions

v0.3.3

4a09fe2

Compare

v0.3.3 Latest



Full Changelog: [v0.3.2...v0.3.3](#)

## Assets 3

<a href="#">Jokes.mltbx</a>	347 KB	36 minutes ago
<a href="#">Source code (zip)</a>		38 minutes ago
<a href="#">Source code (tar.gz)</a>		38 minutes ago



# File Exchange & Add-on Manager



## Jokes in MATLAB

Version 0.3.2 (1.44 MB) by Gareth

Get MATLAB to tell you a joke.

<https://github.com/versionbaygt/MATLABJokes>

⊗ Unfollow

Overview Functions Examples Version History Reviews (0) Discuss

File Exchange Open in MATLAB Online

## Jokes in MATLAB Toolbox

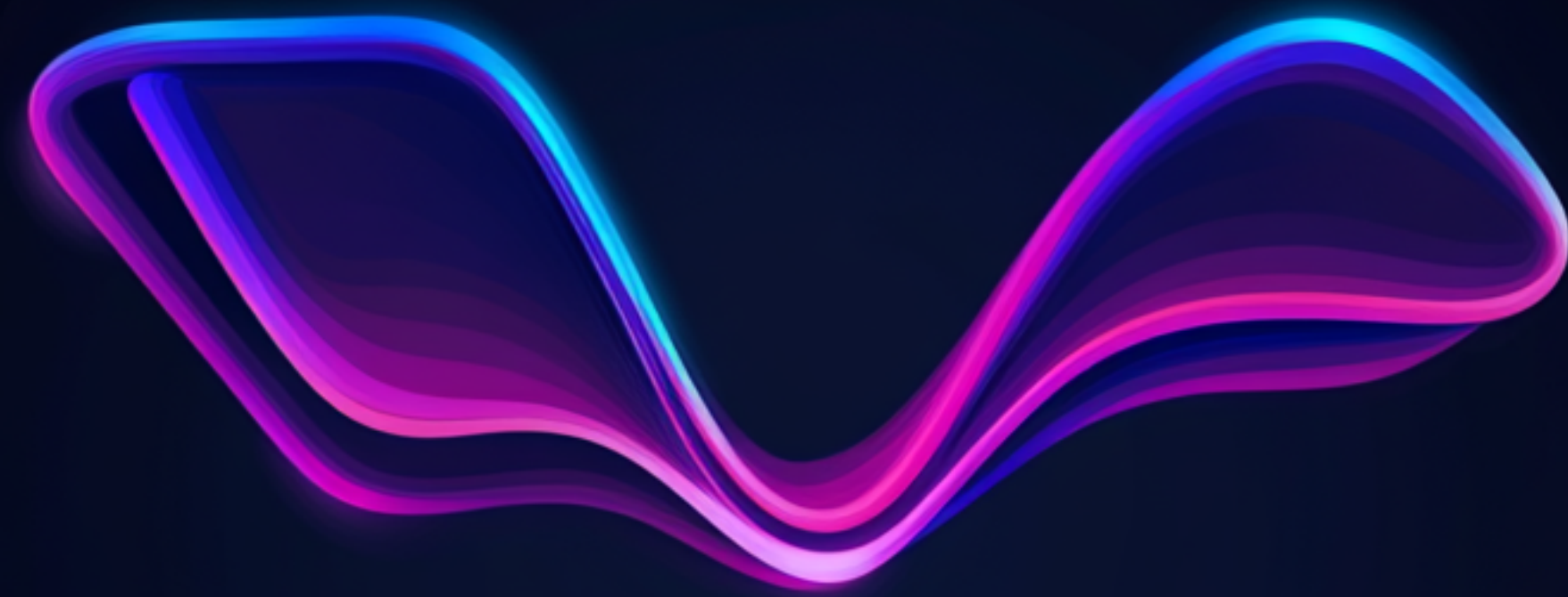
Often at conferences or meetups there is a moment when the hosts need to distract the audience meant to just show a funny joke from within MATLAB.

## Joke Guidelines

Jokes are meant to be shown at a MATLAB Meetup and put a smile on the audience face. T

The screenshot shows the MATLAB Add-On Explorer window. At the top, there's a search bar with 'jokes in matlab' entered. Below the search bar, it says '40,386 RESULTS'. The first result is 'MATLAB by MathWorks', described as 'The Language of Technical Computing'. The second result is 'Jokes in MATLAB Version 0.3.2 by Gareth', which is marked as 'Installed'. The interface includes navigation icons, a filter button, and a 'Did you mean' suggestion for 'jones in matlab'. The 'Jokes in MATLAB' entry shows its version, size, and a list of associated functions: `joke`, `get_joke`, and `test_joke`.





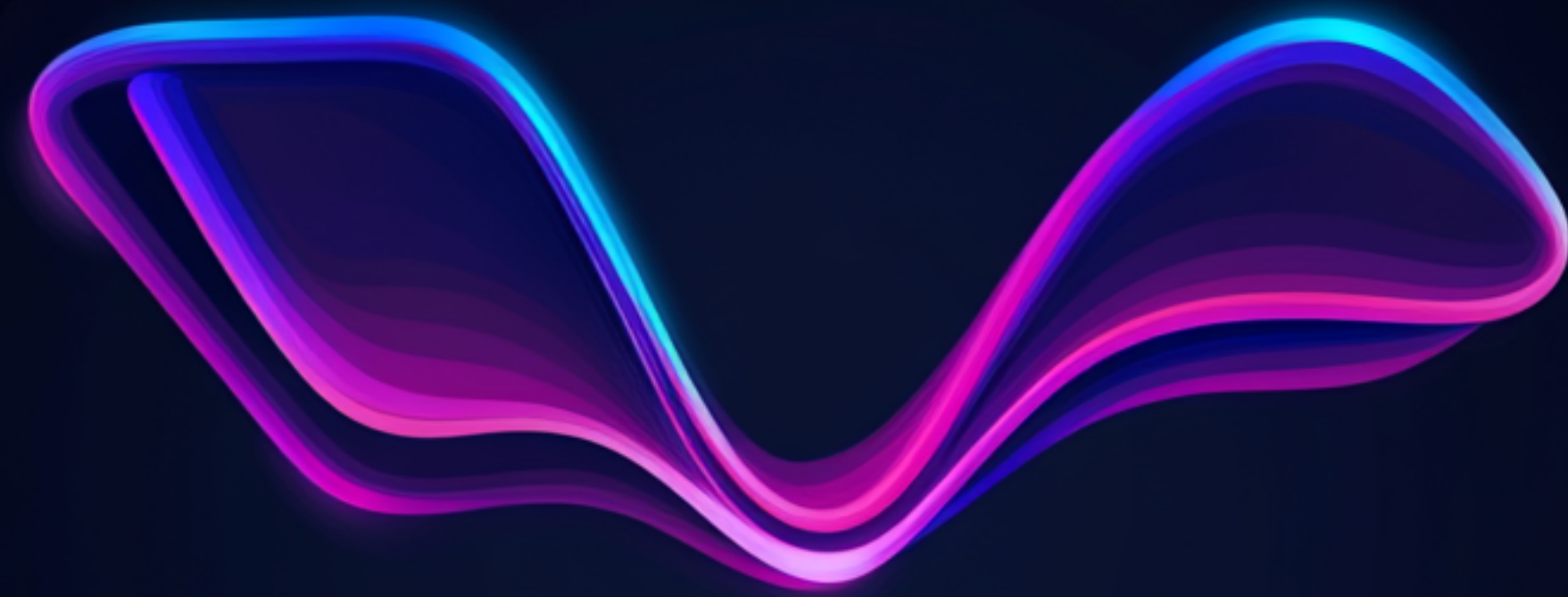
# MATLAB

## Jokes

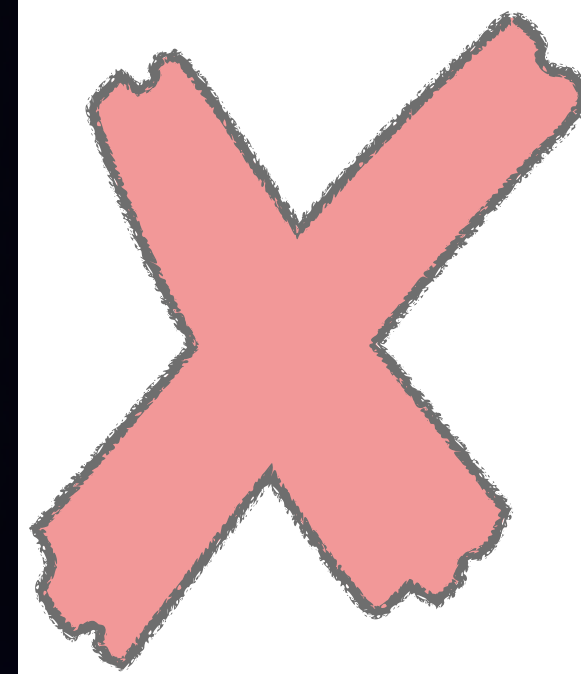
# MATLAB

## Jokes





# MATLAB Jokes



MATLAB  
Jokes

I wanted to let you know that I changed the title of your submission to better adhere to our upcoming naming conventions rules.

The new title is "Jokes in MATLAB"

MathWorks





# Jokes

in | MATLAB

Feel free to  
add jokes





**VersionBay**  
embracing change

# Products & Services

Measure Toolbox(es) Usage per User  
(Toolbox Usage Analyzer)

Standardize CI/CD  
Pipelines  
(Package Tester)

Regression Test Generator  
(Package Tester)

AltCode Navigator (Beta)

**Services drive  
Product Development**

Optimize License Usage

Migrate to new Versions of MATLAB

Migrate to Python/Julia

Automatic Code Generation

DevOps

Training (onsite)



**VersionBay**  
embracing change

**Measure Toolbox  
Usage per User**

**Being on a Podcast**

**Use CI/CD and MATLAB  
in your company**





# Focal Points

- Embracing GitHub is a journey
- GitHub Actions and File Exchange is a powerful combination
- Automating Testing really helps





**VersionBay**  
embracing change