Collaborating & Automation

Exploring GitLab

Outline

- Sharing & Collaborating via remotes
- The GitLab flow (Merge Requests)
- Project Management in GitLab
- Forks (Intro)
- Automating wit GitLab CI/CD
- GitLab Pages (Intro)
- Auto DevOps

Remotes

> Local references to external repositories

- You'll reference one or more *remotes* from your local repository
- Not a live link / No auto-synchronization

```
# add a remote called "origin"
git remote add origin git@gitlab.com:rm-training/a.git

# inspect
git remote -vv

# upload a branch
git push origin my-branch
```

GitLab

> A platform for the entire software development lifecycle

- Very full-featured
- Open-source, enterprise and on-site available
- Release updates monthly
- Devops focused solutions

Alternatives include: GitHub, Bitbucket, Gerrit, etc...

High level features

- Project Management
- Code Management
  - Code review
  - Common workflow
- Web IDE
- Tight CI/CD Integration
  - Reporting & Monitoring
  - DevOps

Demo: I'll share my repository

> Let's explore GitLab while I push up my personal repository

To create a new repository...

1. Create an empty repository on the host
2. Add a *remote reference* called `origin`
3. *Pushed* my `master` branch up

```
git remote add <remote name> <url of repo>
git push <remote name> <branch name>
```

I can optionally *track* remote branches

```
git push origin master -u
```

Project management in GitLab

- Members
- Projects
- Groups

GitLab Projects

- Projects are repository
- Can have own **Issues**, **Boards** and **Milestones**
- Releases map to Git `tag` s
- Merge Requests
- CI/CD settings

Repository Rule-Setting

- Set access permissions
- Protect special branches
- Require reviews
- Limit who can push to where
- *Auto-sync* across other repositories

SSH vs HTTPS

You'll likely want to set up your SSH keys if you haven't already

Lab: Share your repository

> Make sure you have an account!

1. Create a new repository on the host, called "About Me"
    - Do not *initialize* with a readme
2. Reference the remote in your local repository
    ```
    git remote add origin <url>
    ```
3. Push your master branch up, with tracking enabled
    ```
    git push origin master -u
    ```
4. Visit the project on GitLab! Refresh to see the updates.
5. Locally, list your remotes and all branches
    ```
    git branch -a
    ```
    ```
    git remote -vv
    ```

`push` to share

> Push uploads only the necessary commits reachable in the branch you push

- Typically one branch at a time (but you can push many)
- Keep branch names the same
- It does not matter where you are when you push

```
git push origin bug-1
git push upstream master

# send all
git push origin --all
```

`fetch` to refresh local data

> Fetch updates your repository with the latest data from the remote

- **It does not merge anything**
  - You'll need to merge manually
- Safe to do from anywhere

```
git fetch origin

# then update your local master
git checkout master
git merge origin/master
```

`pull` to update a branch

> Pull will get the latest data and update the branch you are on

- It does a `fetch` and then `merge` to your current branch
- It does matter where you are - **it affects the branch you are on!**

```
# update master
git checkout master
git pull origin master

# update a branch you are working on
git checkout 1-my-profile
git pull origin master

# update a branch with changes from your team mate
git checkout 2-our-index
git pull origin 2-our-index
```

Remote Branches

> Remote branches can be *referenced* locally but they are not really branches for you to work on...

- The *refs* look like `remote-name/branch-name`
- Need to be pruned manually
- Not a branch - more like a "tag"

```
git branch --all
git branch --remote

git fetch origin --prune
git push origin --delete 1-feature-work
```

Want to work on a remote branch?

Just check it out, git will auto-create a local copy and set up tracking, too.

```
$> git branch -a
  master
  remotes/origin/master
  remotes/origin/5-feature-work

$> git checkout 5-feature-work
Branch 'pipeline' set up to track remote branch...
Switched to a new branch 'pipeline'
```

Tracking Branches

> Indicates that a branch is *related* to another branch on the remote

- Does not auto-sync
- Gives you extra info & shortcuts
- Can configure through `branch` or `push`

```
git pull # error! needs tracking

git branch --track 1-bug origin/1-bug
git pull # success!

# view tracking details of your branches
git branch -vv
```

Sharing tags

> Tags must be explicitly pushed or configured to do so

```
# push one by one
git push origin v1

# push all reachable tags
git push origin --tags

# configure git to always include tags
git config push.followTags true
```

Merge Requests

> Merge (or Pull) Requests encapsulate a set of changes (in a branch) you want to introduce to the project

- "Please merge my branch"
- Enables discussion, code review & automation around that branch
- *Issues* can be related to *merge requests*, too
- You can mark it `WIP`
- aka *Pull Requests* on other platforms

Quiz

1. How do you share your branch?
2. How do you get your `master` up to date?
3. How do you get your `1-super-feature` branch up to date with the latest from `master`?
4. What is the difference between `fetch` and `pull`
5. Does it matter what branch you're on?
    - when you `fetch`
    - when you `pull`
    - when you `push`

Lab: Push & Pull (the GitLab Flow)

> On your personal project, make a change and get it merged with a Merge Request, then update your local `master`

Sharing work

- Make a change in your local repo on a new branch, pushing it up to the remote.

Integrate your work

- Open a pull/merge request into `master`, review and merge it on GitLab

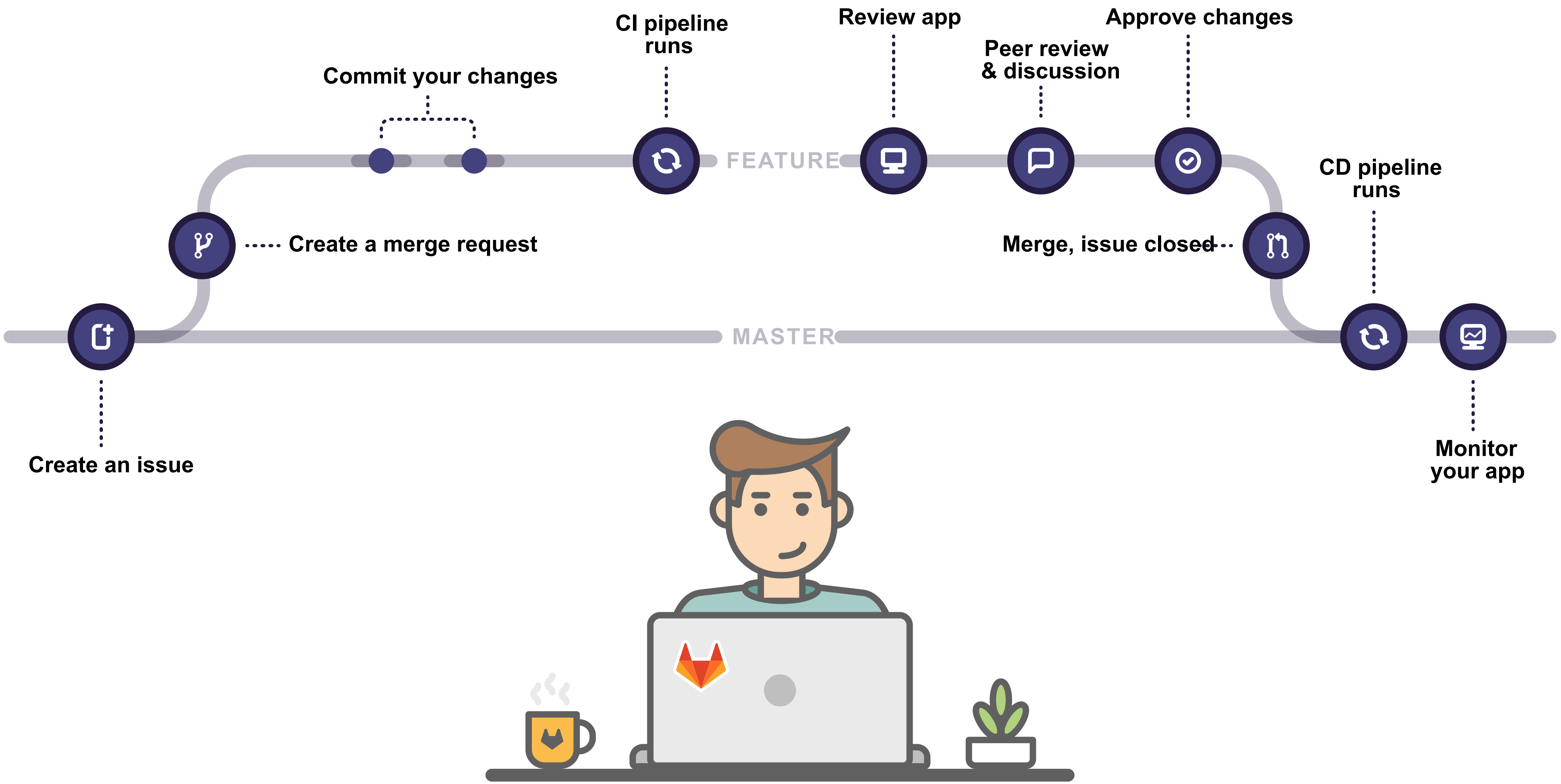
Get your local up to date

- Use `pull` to update your local `master`

Bonus

- Delete your branch & prune the remote

This is the GitLab Flow



Remote vs Local

Two copies of the repository are now at play

Our **local** keeps track of the remote's branches

The **remote** has no idea we exist...

Collaborating in a repository

Demo - Set up to work as a team

Just watch while I...

- Make a *public* **sub group** for our project(s)
- Add a new "About Us" Project w/ some branching rules
- Add some tasks to our board, maybe milestones
  - #1 "Add a Readme"
  - #2 "Add Ryan's Profile"
  - #3 "Add an index"
  - #4 "Add your name to the index"
  - #5 "Build HTML & Deploy"
- And finally complete task #1

When I'm done, you should:

Request Access to the Sub Group!

Groups

- Assemble related projects in a "folder" like structure
- Give access to several projects at once
- Can be nested to match org structure
- Own Epics (along with boards & milestones)

We'll use a group to define a "team" with their own project(s) that they can access

Namespaces in GitLab

Projects will exist in group or user namespaces

```
http://gitlab.example.com/username
http://gitlab.example.com/groupname
http://gitlab.example.com/groupname/subgroup_name
```

Issue Management

- Epics
- Milestones (ie: sprints)
- Issues
- Labels
- Boards

Some features are only available at both a project and group level.

Cloning

- Copy repository to another location
- Sets up `master` branch and `origin` remote
- You can choose a folder if you prefer

```
git clone git@gitlab.com/user/repo_name
cd repo_name
```

Lab: Add & Resolve an Issue

- Make a new issue in the **About Us** Project
  - `Add my <name> Profile`
  - Assign it to yourself
- Go local and complete the issue
  - `clone` the repository
  - Create a branch from `master`
    - Name it after the issue #
  - Do your work and `push` it up
- Create a **Merge Request**
  - Request to merge your branch into `master`
- Go *review* your teammates' Merge Requests

Don't merge anything

Lab: Update your branch

> Pretend I reviewed your code and requested a small change, ex: add your favorite animal *or* clean up some formatting.

- Make the update locally
- Push it up to the same branch
- Refresh your merge request

Keeping branches up to date

- Get the latest master
  - Merge the remote `master` into your topic branch
- Get updates from the topic branch itself
  - Merge the remote topic branch into your local topic branch

Demo: I'll add an `index.md` file if I haven't already

Lab: Update & Collaborate

The task: Add your name to the `index.md` file

- Make sure your local `master` is up to date

```
git checkout master
git pull
```

- Then do the work
  - Branch off master
- Finally, share your work
  - Push it up and open a merge/pull request

Don't merge it

Conflicts with Remotes

> When you get a conflict in a merge/pull request, you'll need to make the fix locally

On your local "topic" branch (that is conflicted):

- `merge` in the latest copy of `master`
    - this should cause the conflict
- resolve the conflict
- push up the update

Lab: Dealing with conflicts

The task: Fix the conflict and update your merge/pull request

- Make sure `master` is up to date
- Update your branch to cause the conflict
  - Merge `master` into your branch
  - or simply `pull origin master` into your branch
- Resolve the conflict
  - Fix, stage, commit
- Share
  - Push it up!
  - View your updated merge/pull request

Forks

- Break one project down into many sub-projects
- Copy another team's project so you can use it or contribute to it
- Typical of open source contributors
- GitLab/GitHub thing, not a git thing

Typical fork flow

- Personal fork will act as a go-between to the "main" project

```
Main Repo  ->  Fork to my account -> Clone to local
(upstream)     (my origin)
```

- `push` to your personal `origin`
- Merge Request into the main repo
- `pull` from the main repo, the `upstream`

module

GitLab Pages

GitLab Pages

Host a static site on GitLab:

`<username or groupname>.gitlab.io/<project name>`

- Lots of templates out there
- Anything in a `./public` folder will be exposed
  - If you build this folder you'll need to export as an `artifact`
- Requires GitLab CI & a `job` labeled `pages`

Getting started with Pages

Create a `.gitlab-ci.yml` file

```yaml
image: alpine:latest

pages:
  stage: deploy
  script:
    - echo 'Nothing to do...'
  artifacts:
    paths:
      - public
  only:
    - master
```

CI/CD in GitLab

Modern Software Lifecycle

> We want to plan, implement and release to market as quickly as possible, then collect feedback, rinse and repeat.

And to do it with:

- Speed
- Agility
- Stability
- Flexibility

How do we get there?

At the DevOps level

- Tightly integrate dev & operations teams
- Automate *All The Things*
- Keep configuration close to code
- Treat infrastructure like code

And at the feature/code level

- Make small units of changes
- Which are easier to review, test and release
- Merge quickly to avoid conflicts
- Reduce risk and increase speed to market

Continuously

> The faster we can release, the more feedback we get and the better we can response.

- Integrate
- Build, Test, Analyze
- Deploy

There are a lot of things we may want to do:

- Write code
- Run tests
- Check code quality
- Check for security issues
- Containerize
- Build
- Deploy
- Monitor

And we want to do it *frequently* and *quickly*

GitLab wants to be the central platform for your entire software development pipeline from code to deploy & monitoring

Unify your development and operations teams on one platform.

Reduce and remove "brittle" connections between many disparate platforms/services.

> "spend more time writing code, less time maintaining the tool chain"

One end-to-end tool

We'll need a few additional tools to pull this off in GitLab

- YAML (for configs)
    - And knowledge of their pipelines
- Basic knowledge of containers (ie: docker)
- Going cloud native (containerize) will make this easier

Containerization

- *Virtualized* instances of your application bundled with all dependencies and services
- Cloud-native (but doesn't have to be)
- Docker & Kubernetes

YAML

> YAML Ain't Markup Language

- Flexible and data-oriented
- Indentation matters!
- YAML primer here and here

YAML Example

```yaml
# comment line
# use 2 spaces to indent
a_nested_map:
  key: value
  another_key: value

# inline sequence
[milk, eggs, juice]

a_sequence_or_array:
  - Item 1
  - Item 2
  -
    - Another
    - sequence indice

data: |
  Block of content
  One new lines
```

GitLab Pipelines

Just requires a `.gitlab-ci.yml` file to be present.

Broken down into *stages* & *jobs*

- Stages
  - Logical grouping of work
  - ie: build, test, deploy
- Jobs
  - Each stage can contain one or more
  - Can pass files between stages

Demo: CI/CD with Pipelines

I'll set up a basic pipeline while we learn some of the configurations

I can force a failure: `test -f README.md && return 1 || return 0`

Stages

- `stages` map defines order of stages
    - defaults to `build`, `test` and `deploy`
- The default `stage` for any *job* is `test`
- You can skip with `.`
- `.pre` and `.post` are always first/last

```yaml
stages:
  - build
  - test
  - deploy

magical_flower:
  stage: build
  script: "echo 1"
```

Jobs

- Run in parallel
- When all jobs are complete, next stage begins
- A job will fail if any non-0 value is returned
    - But jobs can be allowed to fail
- Must contain `script` clause
- No limit to the # of jobs
- Read up on configuration parameters

Example jobs

```
job1:
  stage: test
  script: "./build.sh"
  allow_falure: true

test:
  script:
    - echo "OK, Going to test"
    - npm install
    - npm test
```

Pipeline Images

Can define a container image for the entire pipeline, or per job.

```yaml
image: alpine

test:
  image: node:latest
  script:
    - echo "OK, Going to test"
    - npm install
    - npm test
```

Need custom dockerfiles each build? Use the docker-in-docker image

Control *when* a job or stage runs

`when` controls when the job runs, such as `manual`, `delayed`, etc…

```yaml
cleanup_job:
  stage: cleanup
  script:
    - ./cleanup.sh
  when: on_failure

deploy:
  stage: deploy
  environment: production
  when: manual
  script:
    - apt-get update -qy
    - apt-get install -y ruby-dev
    - gem install dpl
    - dpl --provider=heroku --api-key=$HEROKU_API_KEY --app=gitlab-demo-ci
```

Caching between stages

```yaml
cache:
  key: ${CI_COMMIT_REF_SLUG}
  paths:
  - node_modules/

before_script:
  - yarn install
```

Artifacts

- You can pass data between Stages (not jobs)
- Can be set to expire
- Can be downloaded or pushed into reporting tools
- Read more in the docs

```yaml
build:
  stage: build
  script: make build
  artifacts:
    - build
    - .config
```

Read more in the docs

Only / Except

- Can run jobs or stages *only* on specific branches
  - `only` defines when the job will run
  - `except` defines when it will *not* run
- They are inclusive (you can use both together)
- Default `only` is `['branches', tags']`

```
review:
  only:
    - master
```

Warning: may be deprecated in favor of `rules`

Pipelines for Merge Requests

> Protected against "race condition" conflicts

- Set `only: merge_requests` and it will detach the merge request and test it (not testing the result)
- In combo with `Attempt to test the merge result` it will test the merge between the MR and master

```
                         ⤺ or after the merge
x--x---------------m---->
    \
     x--- x---x---x ⤺ test before we merge?
```

Merge Trains

> Ability to queue a chain of merge requests, each built against the previous merge

- Requires "pipelines for merge results" enabled
- Queues merges but *immediately* begins their pipelines on the result
  - This can be wasteful if you skip the queue
- Each merge will be done against the previous branch in the chain
- Max of 20 will be run in parallel

Read more

Environment Vars in the Pipeline

These can be defined per project in the UI

As well as within the pipelines for all stages, or individual stages and jobs.

```
variables:
  TEST: "HELLO WORLD"
```

Deploying

- You can deploy anywhere!
    - S3
    - EC2 on AWS
    - Heroku
    - Google Cloud
    - Azure
    - bare metal...
- Tight integration with Kubernetes
- Use DPL as your deployment cli tool

```
staging:
  stage: deploy
  script:
  - gem install dpl
  - dpl --provider=heroku --app=my-app-staging --api-key=$HEROKU_STAGING_API_KEY
```

Deploy to AWS

- Use the AWS image to get cli commands
- Add your AWS key/secret to your env vars
- Specify the image for your deployment

```
deploy:
  stage: deploy
  image: registry.gitlab.com/gitlab-org/cloud-deploy:latest # see the note below
  script:
    - aws s3 ...
    - aws create-deployment ...
```

Read the docs

Deploy to Google App Engine

- Create a service account role in google App engine
- Create a JSON key
- Add PROJECT_ID & SERVICE_ACCOUNT env vars

```
image: google/cloud-sdk:alpine

deploy_production:
  stage: deploy
  environment: Production
  only:
  - master
  script:
  - echo $SERVICE_ACCOUNT > /tmp/$CI_PIPELINE_ID.json
  - gcloud auth activate-service-account --key-file /tmp/$CI_PIPELINE_ID.json
  - gcloud --quiet --project $PROJECT_ID app deploy app.yaml dispatch.yaml
```

(Read the docs)[https://medium.com/google-cloud/automatically-deploy-to-google-app-engine-with-gitlab-ci-d1c7237cbe11]

Demo: Team Pipeline

> Let's get a pipeline going for our team project

- I want to build html from our markdown
- I want to deploy it to "GitLab Pages"

These have working builds & pipelines I could steal from:

https://gitlab.com/rm-training/fork-me-for-the-team

https://gitlab.com/rm-training/demo-about-me

Lab: Basic Pipeline Playground

> Create a basic pipeline

- Start a new Project
- Create the `.gitlab-ci.yml` file
- Set up 3 `stages` with at least 5 `jobs`
- Pass an `index.html` through each stage
- Have it "deploy to pages"
  - By putting html files in `./public`

Bonus:

- Make the deploy step `manual`
- Add a merge request that fails the pipeline

GitLab Runners

- Executes pipeline *Jobs*
- Open Source
- Scalable

Runner Types

- Shared (on GitLab.com)
    - but may be slow, unavailable and uses "minutes"
    - may want a more secure environment
- Local
- Self-hosted

Runners

- You can install them locally or on another instance
- Runner tags can define runners that only handle specific jobs

module

Auto DevOps

> Zero-config CI/CD

Demo: Auto DevOps

> I'll set up a new project from the Node/Express template and turn on Auto DevOps

- View the pipeline(s) created
- Make a merge request to edit the title of the site

I have a project that is ready to look at as an "end state" of the demo: Demo Auto DevOps with Node

Auto DevOps

- Pretty awesome... when your app fits into the requirements
    - Deploys automatically into Kubernetes clusters (GKE, Amazon)
- Can be customized & extended
- Uses Herokuish and buildpacks to detect and auto-build, test, etc...
- "Best Practices" built-in

- Auto Build
- Auto Test
- Auto Code Quality
- Auto SAST (Static Applicaiton Security Testing)
- Auto Dependency Scan
- Auto License Compliance Scan
- Auto Container Scanning
- Auto "Review Apps"
- Auto DAST (Dynamic...)
- Auto Browser Performance Testing
- Auto Deploy
- Auto Cleanup

Read up

Extending Auto DevOps

Easy to customize and extend pipelines

Copy the Auto DevOps template as needed.

```
include:
  - template: Auto-DevOps.gitlab-ci.yml

build_merge:
  stage: build
  extends: build
  only:
    - merge_requests
```

You can also disable jobs via ENV vars, ex `CODE_QUALITY_DISABLED`

Define your own Dockerfile

Auto DevOps can be limiting, if you have your own Dockerfile, GitLab will use that.

But you may need the *Container Registry* enabled.

Example Dockerfile

```
FROM node:8.11-alpine

WORKDIR /usr/src/app

ARG NODE_ENV
ENV NODE_ENV $NODE_ENV

COPY package.json /usr/src/app/
RUN npm install

COPY . /usr/src/app

ENV PORT 5000
EXPOSE $PORT
CMD [ "npm", "start" ]
```

Deploying to Kubernetes Clusters

Kubernetes

- Can use Docker, or other container systems
- Automates provisioning, load balancing, etc
- Manages a collection of *nodes*
- Cluster
  - Node(s) (Worker Machine)
    - Pod(s)