EPICS IOC Development Guide

ALS-U Controls Technical Document

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Contents

1 Revision History

Rev.	CM number	Description of Change
A		Add the basic workflow

2 Abbreviations and Acronyms

ALS	Advanced Light Source
ALS-U	Advanced Light Source Upgrade
LBNL	Lawrence Berkeley National Laboratory
N/A	Non Applicable
EPICS	The Experimental Physics and Industrial Control System
IOC	Input-output controller

3 Introduction

3.1 Scope

- The purpose of this document is to describe the engineering procedure and troubleshooting about how the EPICS IOC should be developed and be maintained in cooperation with the ALS-U EPICS Environment.
- This document attempts to be a simple guideline, not to be a mandatory procedure.

3.2 Target Audience

This document is targeted to ALS/ALS-U Controls System engineers and technical stakeholders. It is assumed that the target audience has a technical background in the EPICS

development, a Unix/Linux environment, and a revision control system, specifically, `git`.

4 Build EPICS Application and an IOC

4.1 IOC Name Naming Convention

The first step is to define `IOCNAME`, its directory name, and repository name according to the IOC Name naming conventions [1]. The important name is Device Name, which can be used in multiple names, such as the repository name, and its EPICS application name. Each engineer has a different preference. Thus, please consult other engineers if one wants to follow a common standard name. Table 4.1 shows the IOC Name Naming example. Here we have two TC-32 devies in difference locations (B46 and B6).

Description	Name	EPICS Variable
Location	TEST, ALSU	
Device Name	TCTEMP	
Common IOC Stats Name	`test-tctemp`	`$IOCNAME`
Full IOC Name (Dir Name)	`ioctest-tctemp`	`$IOC`
Git Repository Name	`tctemp`	
Application Name	`tctemp`	

Table 1 TC-32 IOC Name Naming Example

4.2 Make Base Application : manual procedure

- One must check the `EPICS_BASE` variable and all other EPICS-related environment variables. For example,

```
export EPICS_BASE=/somewhere/epics_base
export EPICS_HOST_ARCH=darwin-aarch64
export PATH=${EPICS_BASE}/bin/${EPICS_HOST_ARCH}:${PATH}
export LD_LIBRARY_PATH=${EPICS_BASE}/lib/${EPICS_HOST_ARCH}:${LD_LIBRARY_PATH}
```

- Create a directory, e.g., `tctemp`, and change the current path to `tctemp`.
- Run `makeBaseApp.pl` to create the EPICS application.
- Run `makeBaseApp.pl` to add the IOC `test` into the created EPICS application.

```
$
$ echo ${EPICS_BASE}
/Users/JeongLee/epics/macOS/11.2.1/e881cb1/base

$ which makeBaseApp.pl
/Users/JeongLee/epics/macOS/11.2.1/e881cb1/base/bin/darwin-aarch64/makeBaseApp.pl

$ mkdir tctemp
$ cd tctemp

$ makeBaseApp.pl -t ioc tctemp
$ tree -L 1
.
+---[JeongLee  900]  Makefile
+---[JeongLee  320]  configure
+---[JeongLee  160]  tctempApp

$ makeBaseApp.pl -i -t ioc -p tctemp test-tctemp
$ tree -L 2
.
+--- [JeongLee  900]  Makefile
+--- [JeongLee  320]  configure
|     +-- [JeongLee  838]  CONFIG
|     +-- [JeongLee 1.6K]  CONFIG_SITE
|     +-- [JeongLee  157]  Makefile
|     +-- [JeongLee 1.6K]  RELEASE
|     +-- [JeongLee  120]  RULES
|     +-- [JeongLee   39]  RULES.ioc
|     +-- [JeongLee   41]  RULES_DIRS
|     +-- [JeongLee   40]  RULES_TOP
+-- [JeongLee  128]  iocBoot
|     +-- [JeongLee  121]  Makefile
|     +-- [JeongLee  128]  ioctest-tctemp
+-- [JeongLee  160]  tctempApp
      +-- [JeongLee   96]  Db
      +-- [JeongLee  304]  Makefile
      +-- [JeongLee  128]  src
```

4.3 Make Base Applicatoin : Use a script

- Clone https://git.als.lbl.gov/alsu/tools
- Run `generate_ioc_structure.bash` outside the cloned `tools` folder.

```
$ git clone https://git.als.lbl.gov/alsu/tools.git
$ bash tools/generate_ioc_structure.bash -n tctemp -l test
Using target architecture darwin-aarch64 (only one available)
--------
  Please create tctemp as Project Name in the ALS git server.
  tctemp also is used for Project slug in the gitlab server.

  After this, one may need to execute the following command:
  git remote add origin ssh:...../tctemp.git
--------
```

```
$ tree --charset uft-8 -L 2 tctemp/
tctemp/
|-- [JeongLee  900]  Makefile
|-- [JeongLee   30]  README.md
|-- [JeongLee  320]  configure
|   |-- [JeongLee  838]  CONFIG
|   |-- [JeongLee 1.6K]  CONFIG_SITE
|   |-- [JeongLee  157]  Makefile
|   |-- [JeongLee 1.6K]  RELEASE
|   |-- [JeongLee  120]  RULES
|   |-- [JeongLee   39]  RULES.ioc
|   |-- [JeongLee   41]  RULES_DIRS
|   `-- [JeongLee   40]  RULES_TOP
|-- [JeongLee  128]  iocBoot
|   |-- [JeongLee  121]  Makefile
|   `-- [JeongLee  128]  ioctest-tctemp
`-- [JeongLee  160]  tctempApp
    |-- [JeongLee   96]  Db
    |-- [JeongLee  304]  Makefile
    `-- [JeongLee  128]  src
$
```

4.4 Customization

- Edit `configure/CONFIG_SITE` if necessary
- Edit `configure/RELEASE` if necessary
- Add the proper database files into `xxxApp/Db`, and edit `Makefile` in `xxxApp/Db`
- Add the additional source files, sequencer files into `xxxApp/src` if necessary
- Edit `Makefile` into `xxxApp/src`

5 Add another IOC to the existing EPICS Application

There are two TC-32 units, one will be located in the B46, and the other will be located in the ALS SR ring for the radiation hardness test. Therefore, we need one more IOC startup script for an other EPICS IOC based on the same EPICS application, e.g., `tctemp`.

```
$ cd tctemp
$ $ makeBaseApp.pl -i -t ioc -p tctemp alsu-tctemp
Using target architecture darwin-aarch64 (only one available)
JeongLee@JeongLee-M70: tctemp$ tree --charset uft-8 -L 2 .
.
|-- [JeongLee  900]  Makefile
|-- [JeongLee   30]  README.md
|-- [JeongLee  320]  configure
|   |-- [JeongLee  838]  CONFIG
|   |-- [JeongLee 1.6K]  CONFIG_SITE
```

```
|   |-- [JeongLee  157]  Makefile
|   |-- [JeongLee 1.6K]  RELEASE
|   |-- [JeongLee  120]  RULES
|   |-- [JeongLee   39]  RULES.ioc
|   |-- [JeongLee   41]  RULES_DIRS
|   `-- [JeongLee   40]  RULES_TOP
|-- [JeongLee  160]  iocBoot
|   |-- [JeongLee  121]  Makefile
|   |-- [JeongLee  128]  iocalsu-tctemp
|   `-- [JeongLee  128]  ioctest-tctemp
`-- [JeongLee  160]  tctempApp
    |-- [JeongLee   96]  Db
    |-- [JeongLee  304]  Makefile
    `-- [JeongLee  128]  src
```

6 To a remote repository

There are many ways in which we can create a repository, but here we limit our scenario to create a repository through the web interface.

- Login the gitlab server
- Move the proper IOCs directory
- Create blank project
- Initialize the git repository according to its configuration

6.1 Create a remote repository

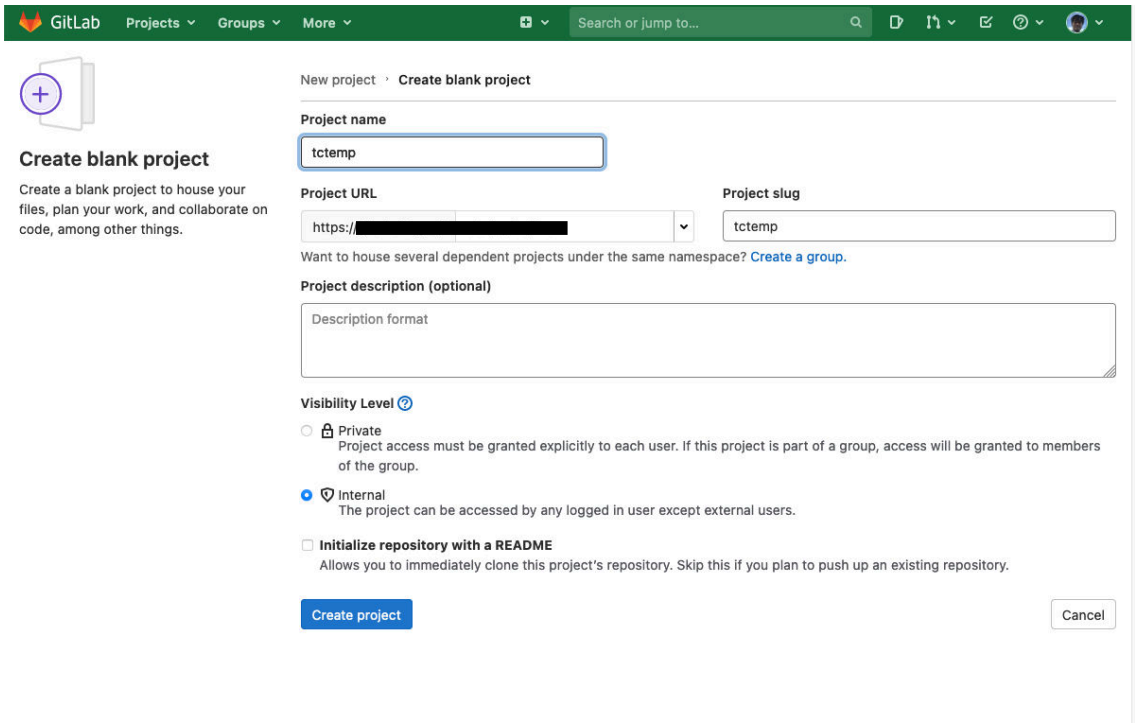

Figure 1 Create a Project which is the remote repository.

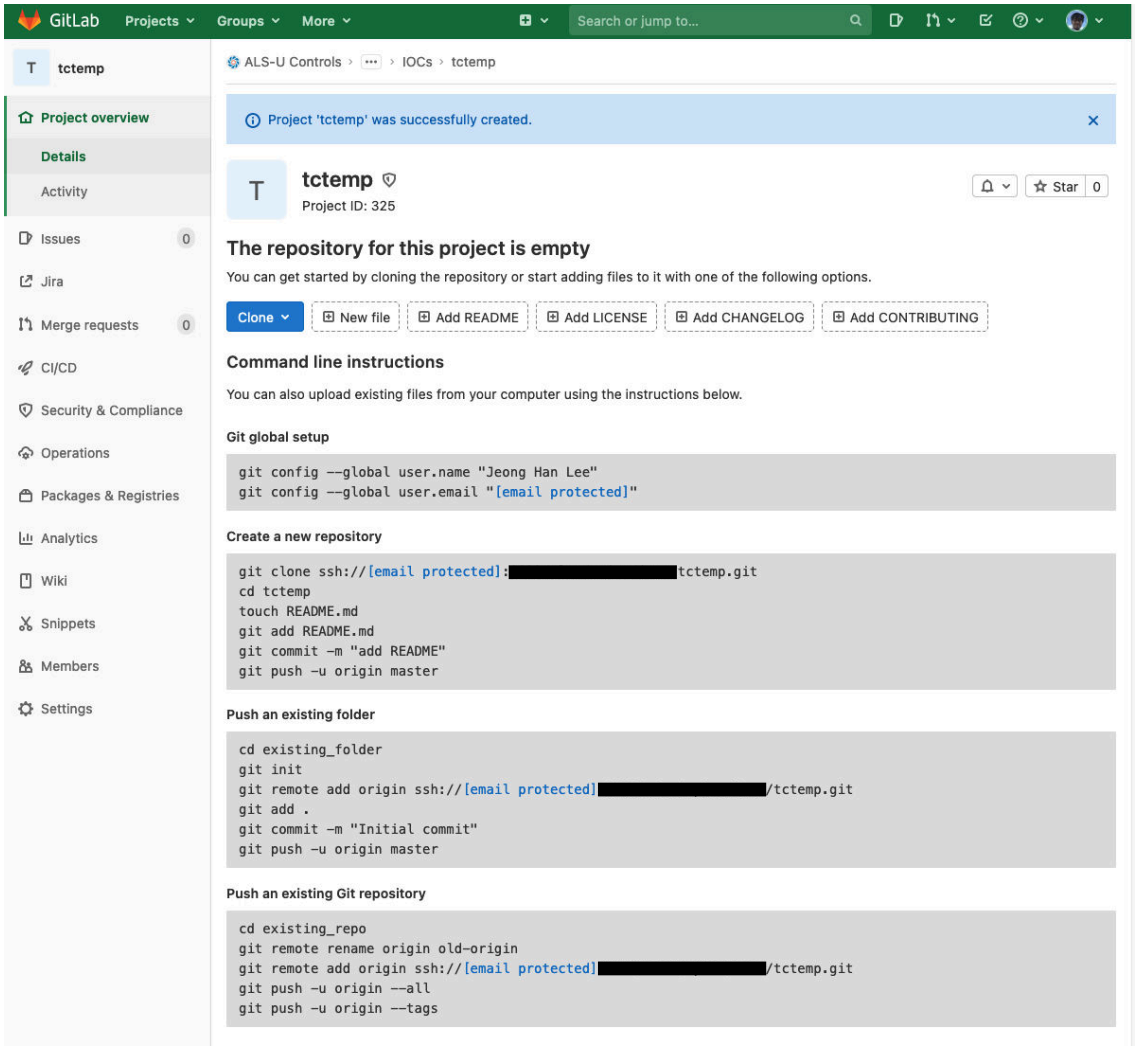

Figure 2 Project `git` configuration.

6.2 Push local source files to the remote repository

```
$ cd tctemp
$ git init
Initialized empty Git repository in /Users/JeongLee/gitsrc/tctemp/.git/
$ git add .
$ git status
On branch master

No commits yet
```

```
Changes to be committed:
  (use "git rm --cached <file>..." to unstage)
   new file:   Makefile
   new file:   README.md
   new file:   configure/CONFIG
   new file:   configure/CONFIG_SITE
   new file:   configure/Makefile
   new file:   configure/RELEASE
   new file:   configure/RULES
   new file:   configure/RULES.ioc
   new file:   configure/RULES_DIRS
   new file:   configure/RULES_TOP
   new file:   iocBoot/Makefile
   new file:   iocBoot/iocalsu-tctemp/Makefile
   new file:   iocBoot/iocalsu-tctemp/st.cmd
   new file:   iocBoot/ioctest-tctemp/Makefile
   new file:   iocBoot/ioctest-tctemp/st.cmd
   new file:   tctempApp/Db/Makefile
   new file:   tctempApp/Makefile
   new file:   tctempApp/src/Makefile
   new file:   tctempApp/src/tctempMain.cpp
$ git remote add origin ssh://git@xxxxxxxxxxxxxxxxxxxxxxxxxxxx/tctemp.git
$ git commit -m "Initial Commit"
$ git push --set-upstream origin master
```

Bibliography

[1] Jeong Han Lee and Tyna Ford. *AL-1451-7452 : IOC Name Naming Convention at ALS*, June, 2021. ALS-U Document AL-1451-7452.