core Flight Executive (cFE)

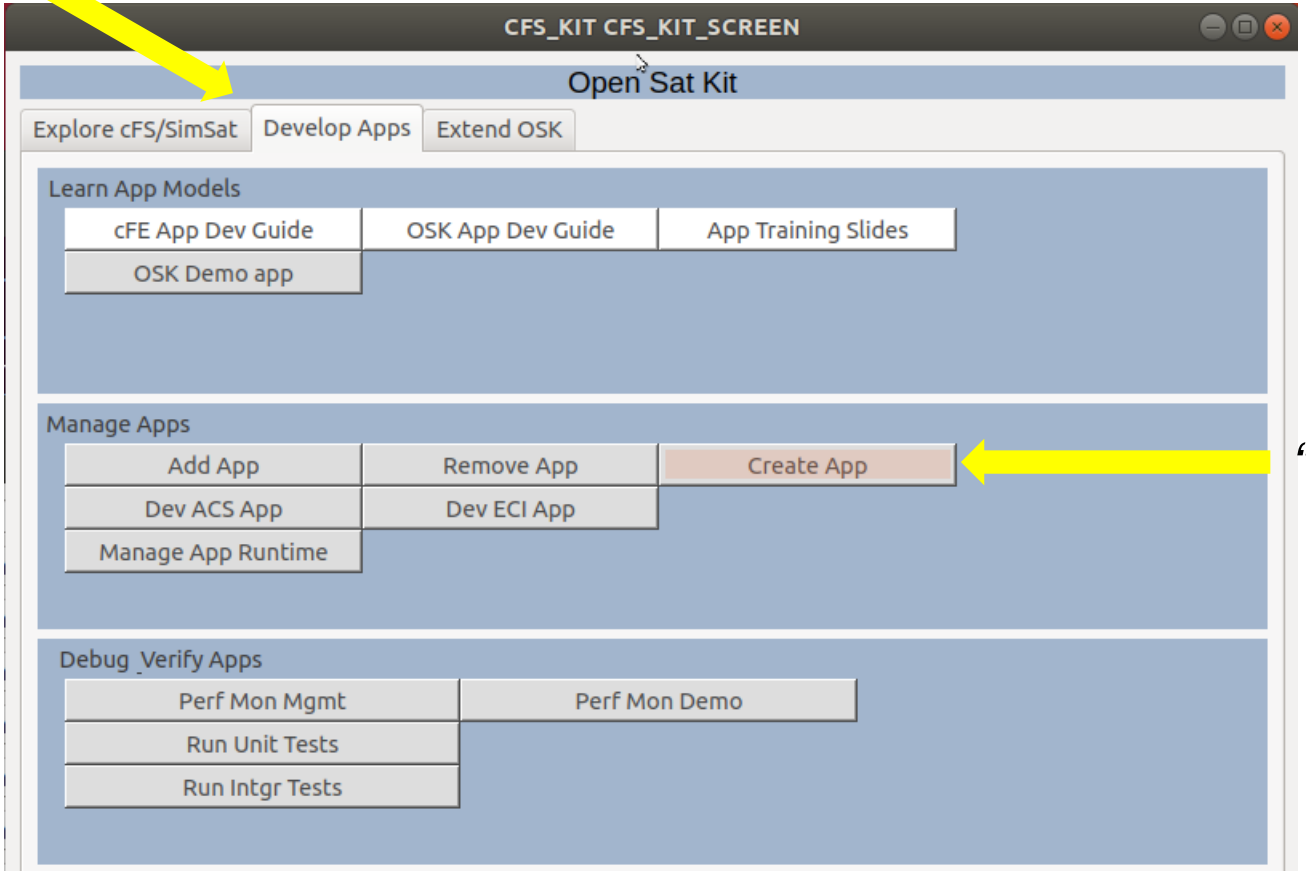
Training Exercises

Introduction

- **These slides contain exercises for the cFS core Flight Executive application development training module**
  1. Create a “Hello World” app
  2. Add a command
  3. Add a table
- **See “OSK Training – Intro.pptx” for an OpenSatKit introduction for running exercises**
- **Some of the cFS file standards/conventions are not followed to reduce the number of files that need editing to complete an exercise**
- **“~/” is used to indicate the OSK base directory**
  - “~/cfs” is equivalent to “/home/user/OpenSatKit-master/cfs” if OpenSatKit was installed in the home directory for an account named “user”

Create "Hello World" App (1 of 5)

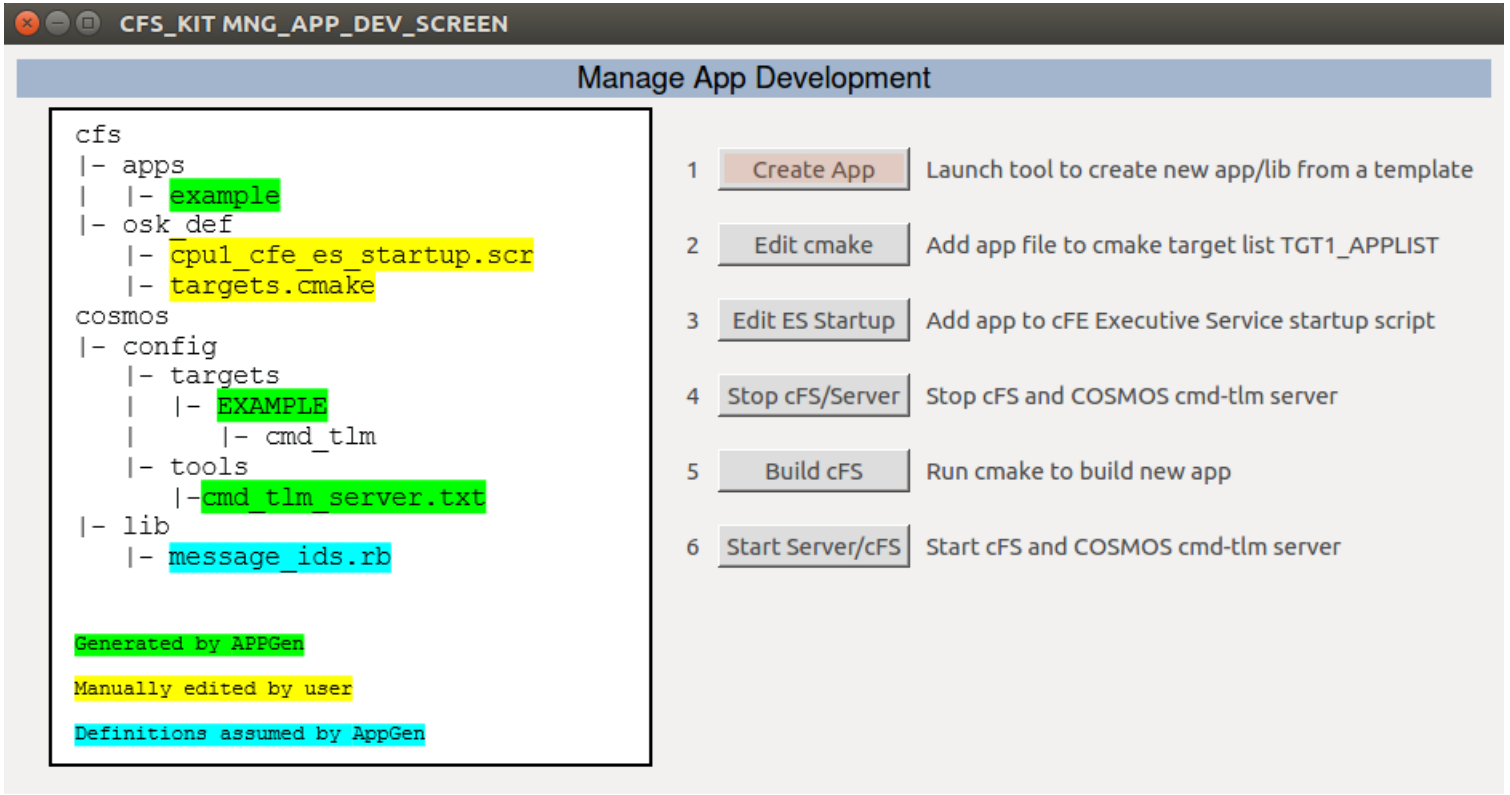
Select Develop *App* *Tab*



Launch *"Create App"* screen

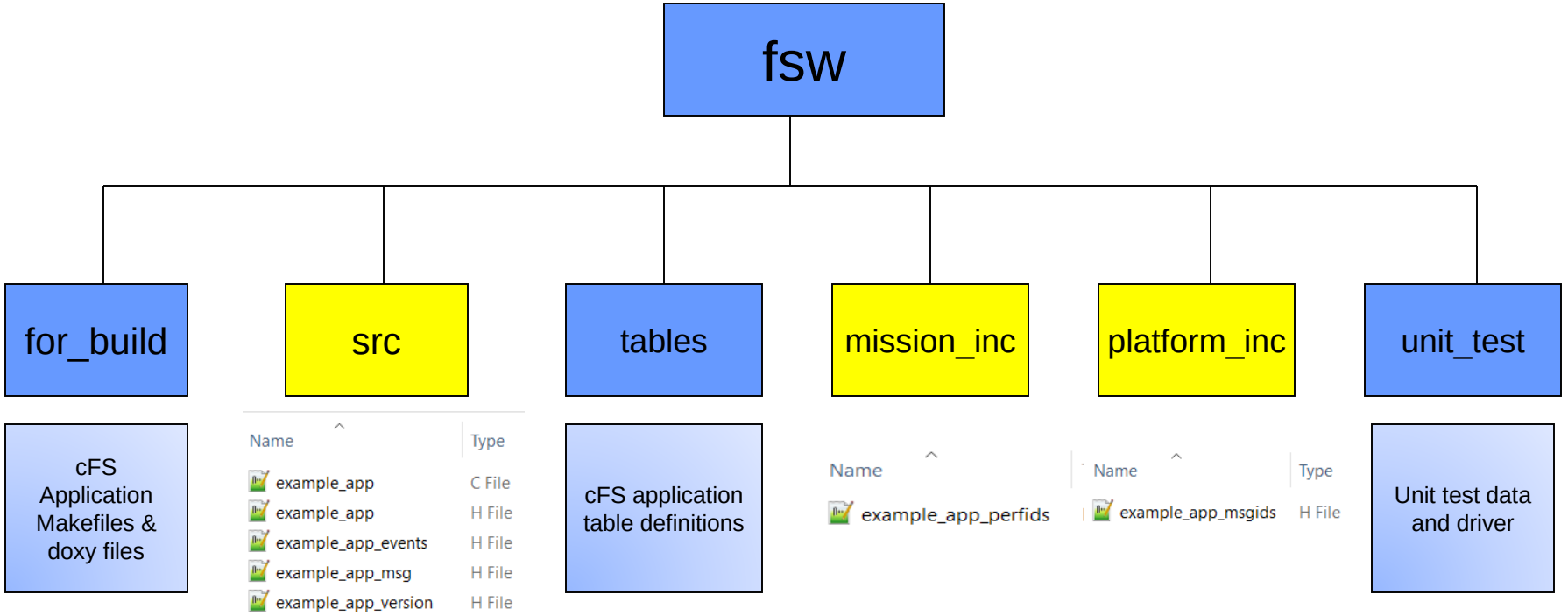
Create "Hello World" App (2 of 5)

- Follow the steps on the screen to create, build, and install the app
- In step 1 select the *"cFE App Training"* template
- When prompted, use "example" as the name of your app. The directories in the left figure assume *"example"* is used as the app name as do all of the exercises in this package.



Create "Hello World" App (3 of 5)

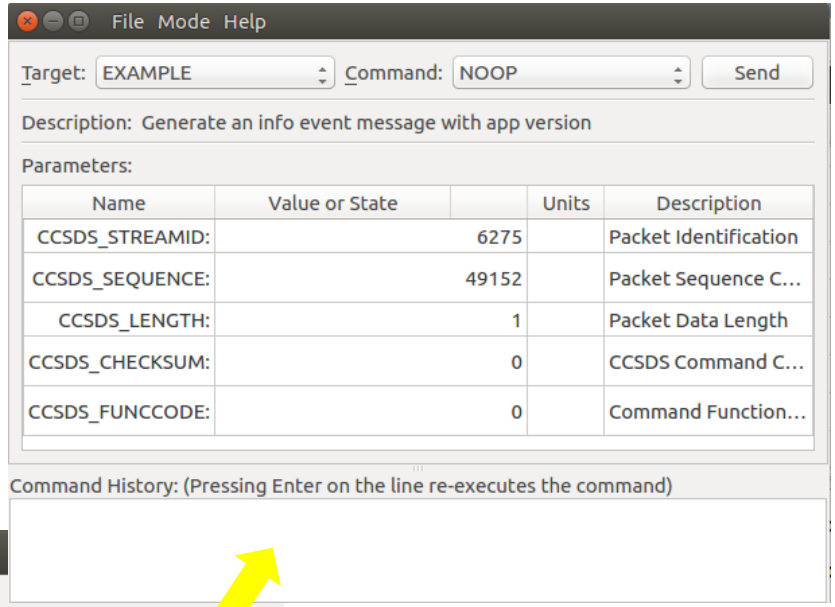
The tool generated code in ~/cfs/apps/example/fsw and populated the yellow highlight boxes

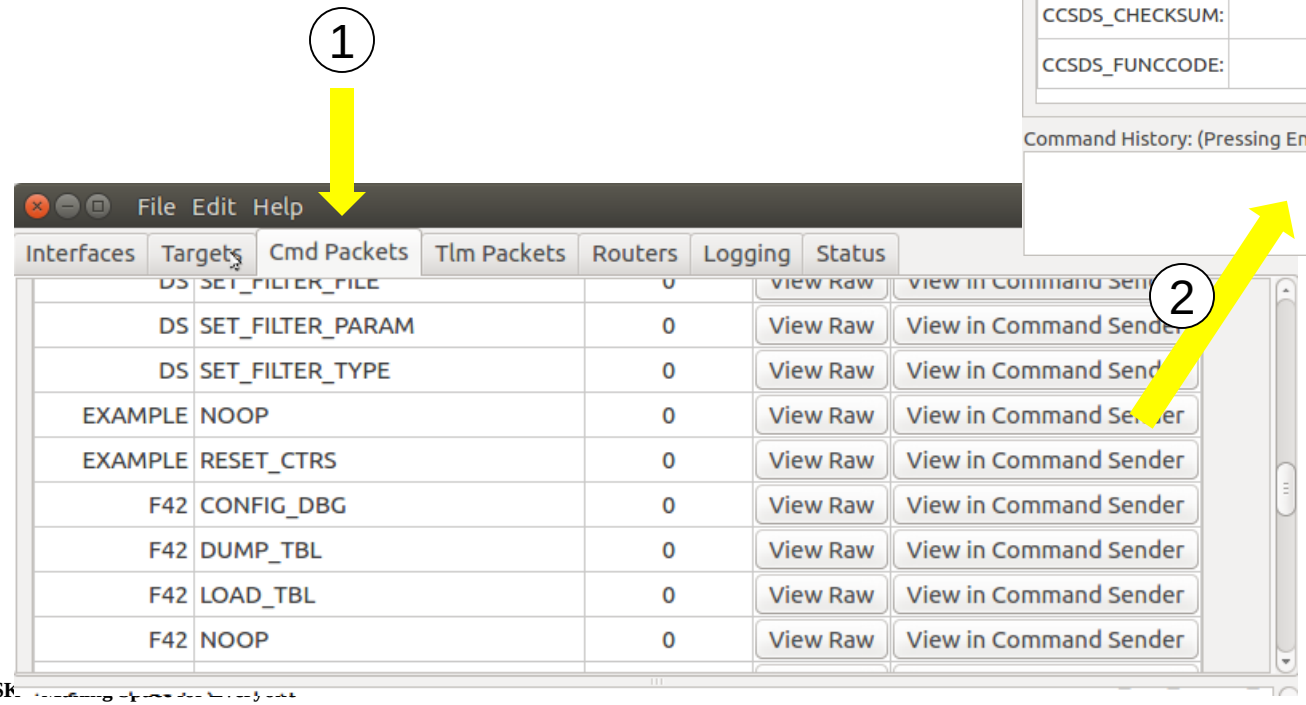


Open ~/cfs/apps/example/fsw/example_app.c in a text editor to review the code

Create "Hello World" App (4 of 5)

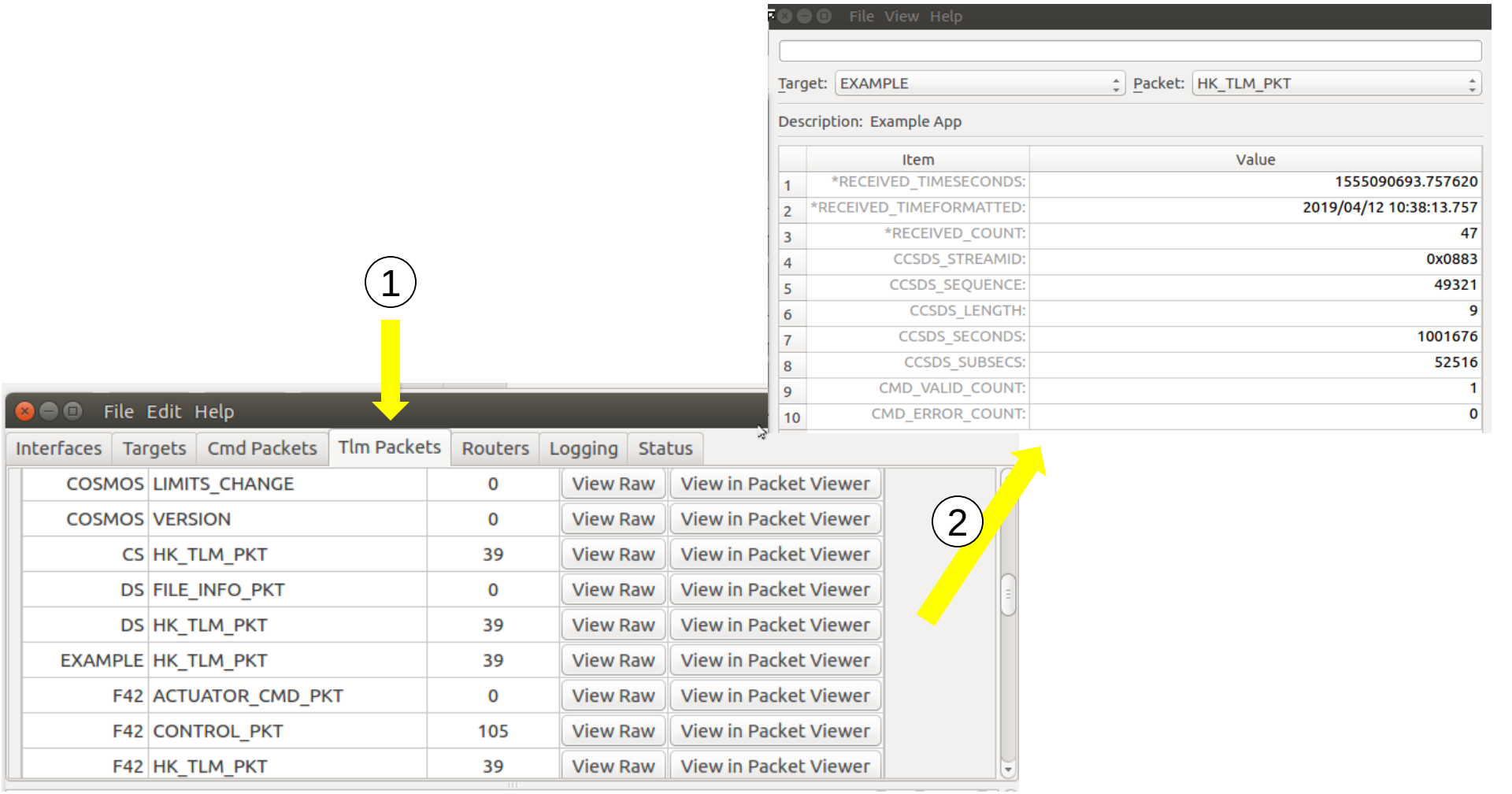
- **Using COSMOS "Command and Telemetry Server" open Command Sender with example's command target**





Create "Hello World" App (4 of 6)

- **Using COSMOS "Command and Telemetry Server" open Telemetry Server with example's housekeeping tlm target**



Exercise #1 - Add a Command (1 of 3)

In this exercise you will add a command that sends an event message that reports the value of the 16-bit integer command parameter

1. **example_app.h**
   a. Define event message ID and a new command code by uncommenting the following definitions (remove "//Ex#1")

```
EXAMPLE_NEW_CMD_INF_EID
EXAMPLE_NEW_CMD_CC
```

   b. Locate `EXAMPLE_NoArgsCmd_t` and create a new command message structure next to it that defines one16-bit unsigned command parameter. Easiest to copy, paste, and modify the `EXAMPLE_NoArgsCmd_t` function to

```
typedef struct {
  uint8  CmdHeader[CFE_SB_CMD_HDR_SIZE];
  uint16 Param;
}
EXAMPLE_NewCmd_t
```

2. **example_app.c:** Add a function to process the new cmd and logic to call the function
   a. In `EXAMPLE_AppPipe()` uncomment (remove "//Ex#1") the following case

```
case EXAMPLE_NEW_CMD_CC:
```

Exercise #1 - Add a Command (2 of 3)

2. example_app.c: Continued…

b. Locate `EXAMPLE_NoopCmd()` and create the following function next to it. Easiest to copy, paste, and modify the noop function

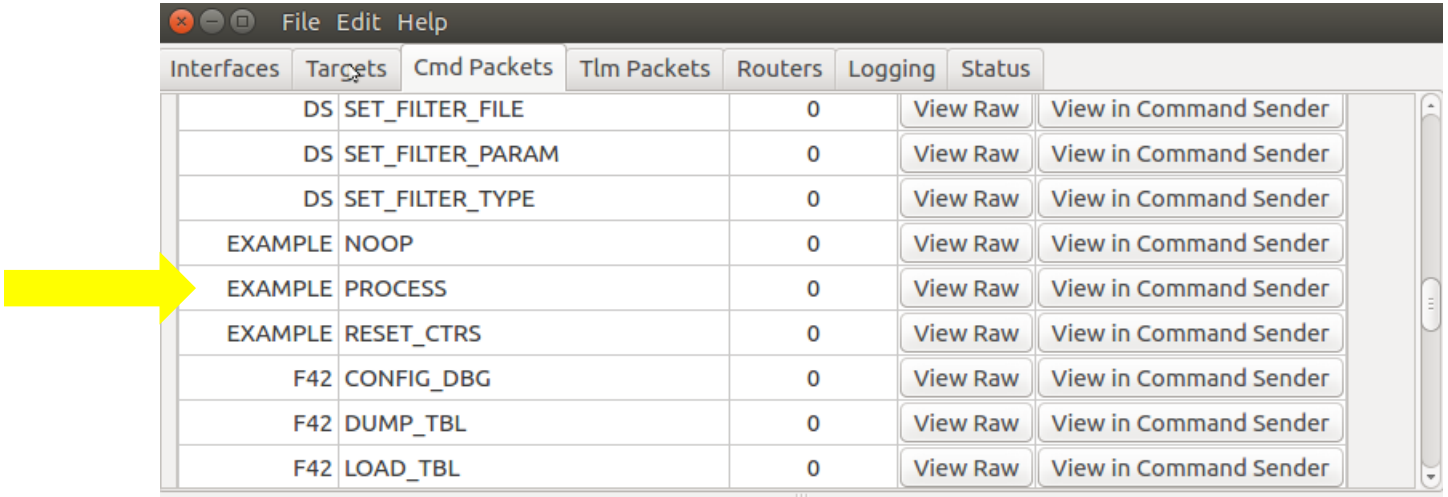
```
void EXAMPLE_NewCmd(CFE_SB_MsgPtr_t msg) {

   uint16 ExpectedLength = sizeof(EXAMPLE_NewCmd_t);
   EXAMPLE_NewCmd_t* Cmd = (EXAMPLE_NewCmd_t*)msg;

   if (EXAMPLE_VerifyCmdLength(msg,ExpectedLength)){

      EXAMPLE_AppData.CmdCounter++;

      CFE_EVS_SendEvent(EXAMPLE_NEW_CMD_INF_EID,CFE_EVS_INFORMATION,
      "EXAMPLE: New command parameter %d",Cmd->Param);
   }
}
```

3. Note that when example app was initially created the COSMOS command definition for "NEW_CMD" was created in ~/cosmos/config/targets/EXAMPLE/cmd_tlm/example_cmd.txt

- Each FSW command must have a corresponding COSMOS command definition
- See TBD for a description of OSK's Embedded Ruby (ERB) extensions to COSMOS

Exercise #1 - Add a Command (3 of 3)

- **Repeat steps 4-6 on the *Manage App Development* page build/install updated app in the FSW and to install the new PROCESS command**
  4. Stop cFS/Server
  5. Build cFS
  6. Start Server/cFS
- **The new PROCESS command will be displayed**



Add a Table (1 of 2)

In this exercise we will add a table

1. **Copy example_tbl.h from**
   ~/cosmos/cfs_kit/tutorials/cfe/training **to**
   ~/cfs/apps/example/fsw/src

2. **Create a new tables directory: ~/cfs/apps/example/fsw/tables**
3. **Copy example_tbl.c from**
   ~/cosmos/cfs_kit/tutorials/cfe/training **to**
   ~/cfs/apps/example/fsw/tables

4. **Open ~/cosmos/cfs_kit/tutorials/cfe/training/example_tbl_code_snippets.txt and follow the instructions in the file to update example_app.c and cmakelist.txt**
5. **Repeat steps 4-6 on the *Manage App Development* page build/install the updated example app in the FSW**
   4. Stop cFS/Server
   5. Build cFS
   6. Start Server/cFS

Add a Table (2 of 2)

Verify the tables is functioning properly

1. Issue an EXAMPLE NEW_CMD command and verify table data displayed in an event message
2. From OSK's main screen open the "Manage Table" screen
3. Select Dump Table
    1. EXAMPLE.MyFirstTbl
    2. Active buffer
4. After display table in Table Manager tool change the values of the table
5. Save file as osk_tmp_bin.dat
6. Load Table