Drinking from the firehose: the ADEiger driver

Bruno Martins

U.S. DEPARTMENT OF ENERGY

BROOKHAVEN NATIONAL LABORATORY

Dectris Eiger Specs

- Eiger 1M: 1030x1065 @ 3 kHz
- Eiger 4M: 2070x2167 @ 750 Hz
- Eiger 9M: 3110x3269 @ 238 Hz
- Eiger 16M: 4150x4371 @ 133 Hz

- All of them saturate a 10Gbps link:
  - That's a lot of data!

Data Sources

There are three ways of getting data out of the detector:

- FileWriter API
- Stream API
- Monitor API

FileWriter API

- Generates HDF5 files
- Available via HTTP
- HDF5 files have **mandatory** (and huge) headers: pixel mask, flatfield, etc are always included.
- Lossless: files are stored on detector's disk
- Not “real time”: each HDF5 container typically has more than one frame: driver has to wait N frames before pulling a file

Stream API

- ZeroMQ stream of frames: PUSH socket
- Fast, “real time”
- Optional headers
- No frame bundling
- Potential frame loss if the client isn't fast enough pulling data

Monitor API

- TIFF frames, available through HTTP
- Slow (< 10Hz)
- Useful for checking the state of the experiment without tapping into the main data stream

And nothing else

- Detector server is a black box – no access other than REST/Stream APIs

The ADEiger driver

- Supports all three APIs:
  - (filewriter || stream) && monitor
- Supports using none of the APIs:
  - Use the driver only to control the detector, don't touch the data
- Pipelined, multithreaded architecture

http://github.com/brunoseivam/ADEiger

Eiger 16M

Eiger 16M

Eiger Detector Control – XF:17IDC-ES:FMX{Det:Eig16M}cam1:

Info

Asyn port	EIG
EPICS name	XF:17IDC-ES:FMX{
Manufacturer	Dectris
Model	Eiger 16M
Firmware Version	1.6.4
Serial Number	E-32-0101
Size	4150 4371
Connected	

Connect | Disconnect

Plugins

File | ROI | Statistics | Other

Detector Status

Status Update	5 second
Temperature	24.5 C
Humidity	1.7 %
Links	
State	idle
DCU Buffer Free	100.0 %

Error parameters

[]

Shutter

Shutter Mode	None
Status	Closed
EPICS Status	Closed

Open | Close

Delay Open	0.000
Delay Close	0.000

EPICS Shutter Setup

Acquisition Parameters

Threshold	4500.000 eV	4500.000 eV
Photon Energy	9000.000 eV	9000.000 eV
Exposure Time	0.04999	0.04999
Acquire Period	0.05000	0.05000
# Images	7	7
# Triggers	1	1
Flatfield Correct	Enabled	Enabled
Trigger Mode	Internal Seri	Internal Series

Acquire

Start | Stop | Trigger

Data Source	None	None
Acquire Status	Done	
Armed		
Image Counter	0	0
Image Rate		0.00 Hz
Array Callbacks	Enable	Enable
Trigger Exposure	0.000000 s	0.000000 s
Manual Trigger	☑	

Driver Status

Waiting for acquire command

Monitor

Enable	☐	
Polling Period	0.1 s	0.1 s

Stream

Enable	☐	
Dropped Frames		0

FileWriter

Enable	☑	
Compression	Enabled	Enabled
# Images / File	200	200
Name Pattern	XtalSamp_3_10	XtalSamp_3_10_F
Sequence ID		48
Auto Remove	Yes	Yes
Save Files Locally	Yes	Yes
Path	/GPFS/[redacted]	
Det. Free Space	177542640 kB	

Remove Files on Detector

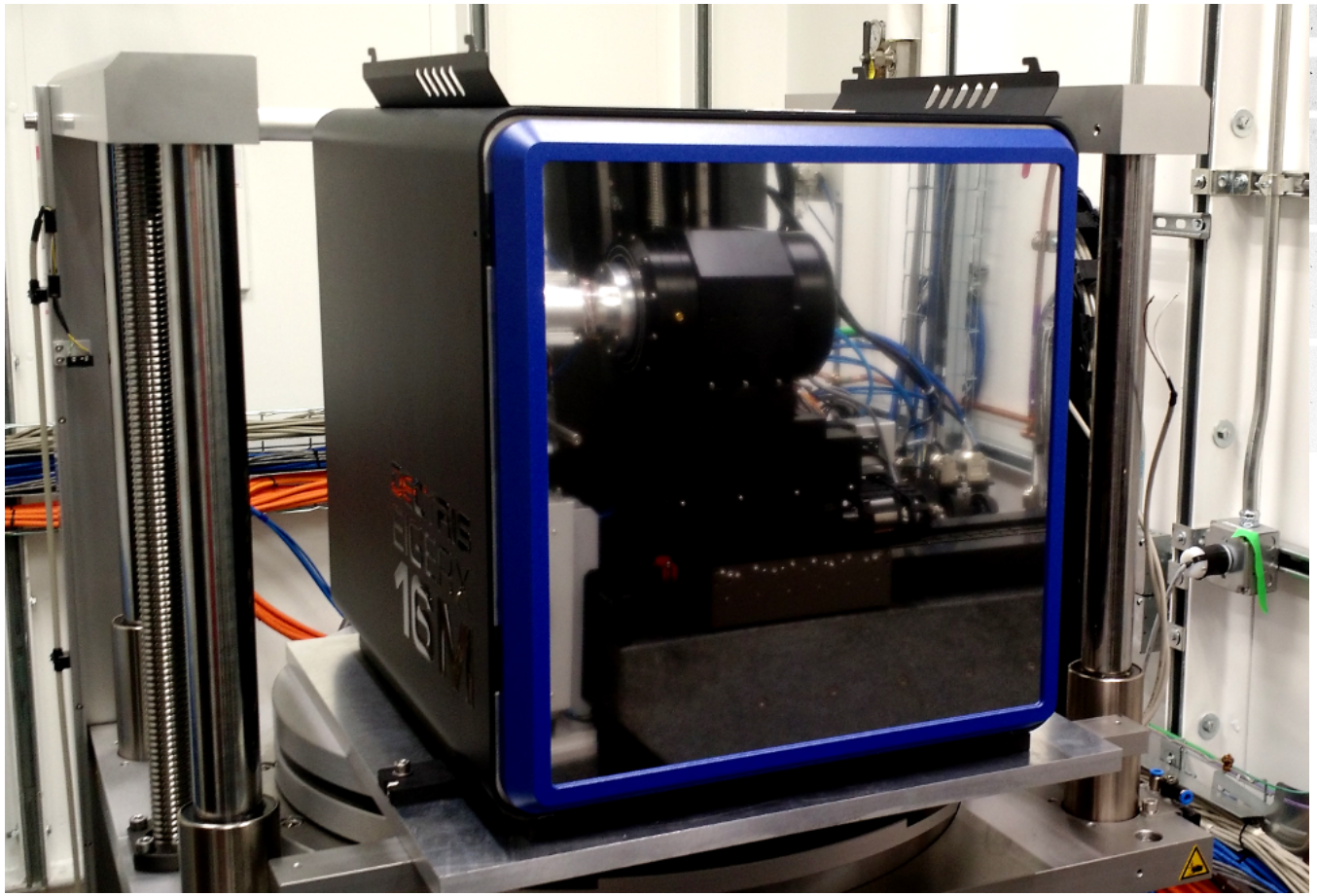
Metadata

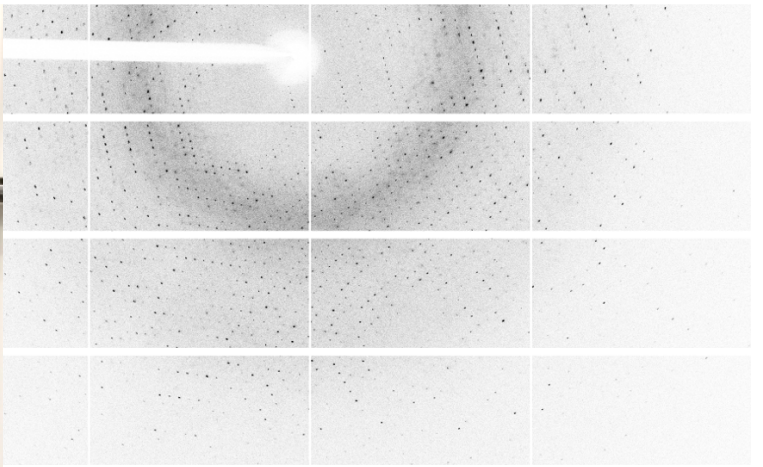
Beam Center X	2012.000 pixels	2012.000 pixels
Beam Center Y	2420.000 pixels	2420.000 pixels
Wavelength	1.3772 Angstro	1.3772 Angstro
Detector Distance	0.209 m	0.209 m

MX Metadata

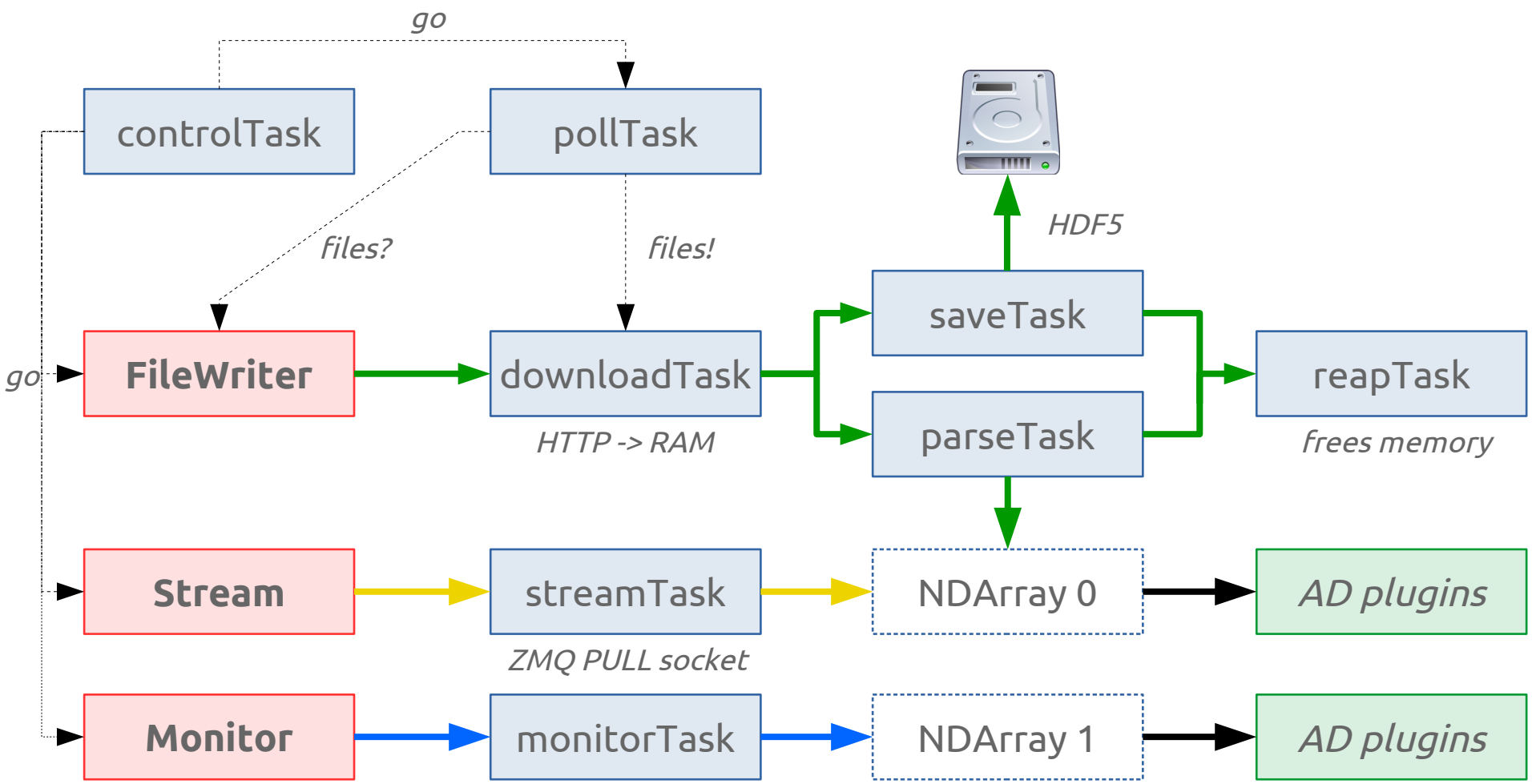
	Angle Start		Angle Increment	
Chi	0.000 deg	0.000 deg	0.000 deg	0.000 deg
Kappa	0.000 deg	0.000 deg	0.000 deg	0.000 deg
Omega	-19.550 deg	-19.550 deg	0.050 deg	0.050 deg
Phi	0.000 deg	0.000 deg	0.000 deg	0.000 deg
Two Theta	0.000 deg	0.000 deg	0.000 deg	0.000 deg

FMX's Eiger 16M





Data and control planes

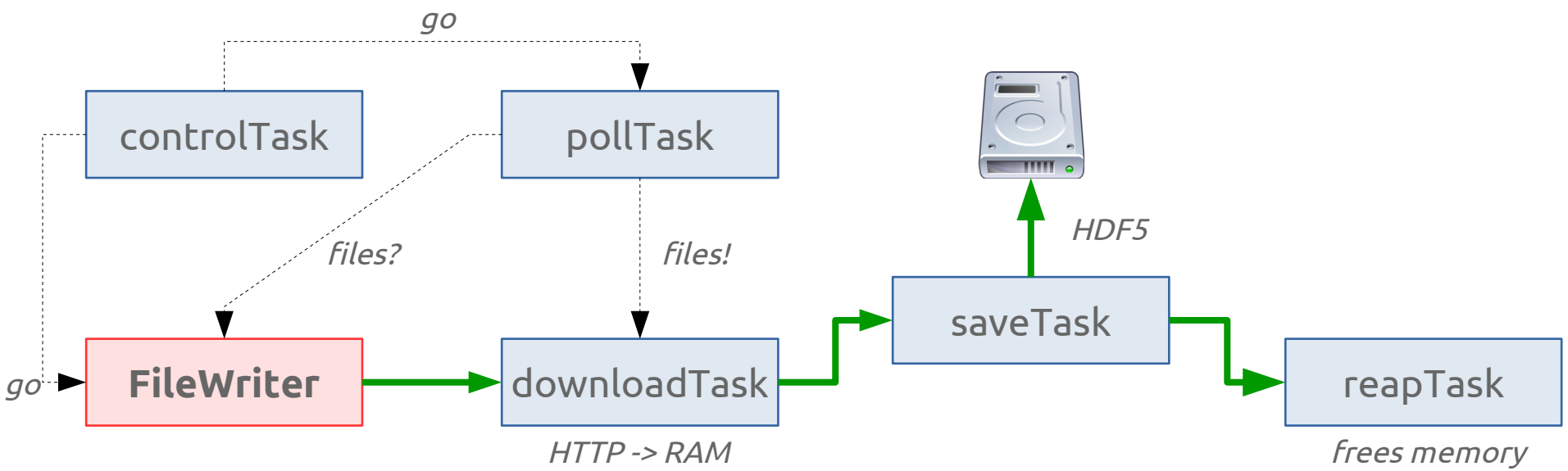


Eiger API

ADEiger

areaDetector

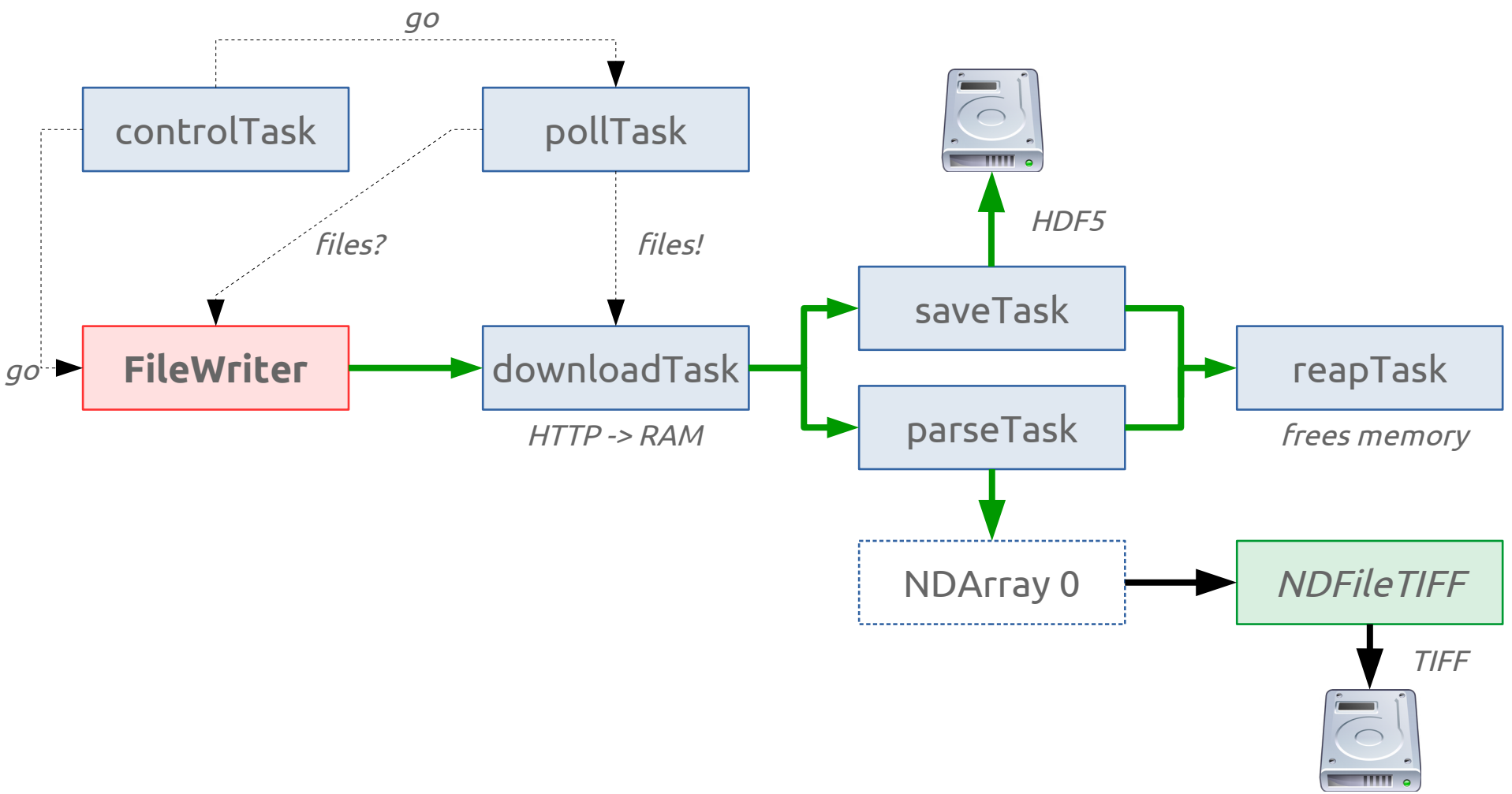
Use case: just saving to disk



U.S. DEPARTMENT OF ENERGY

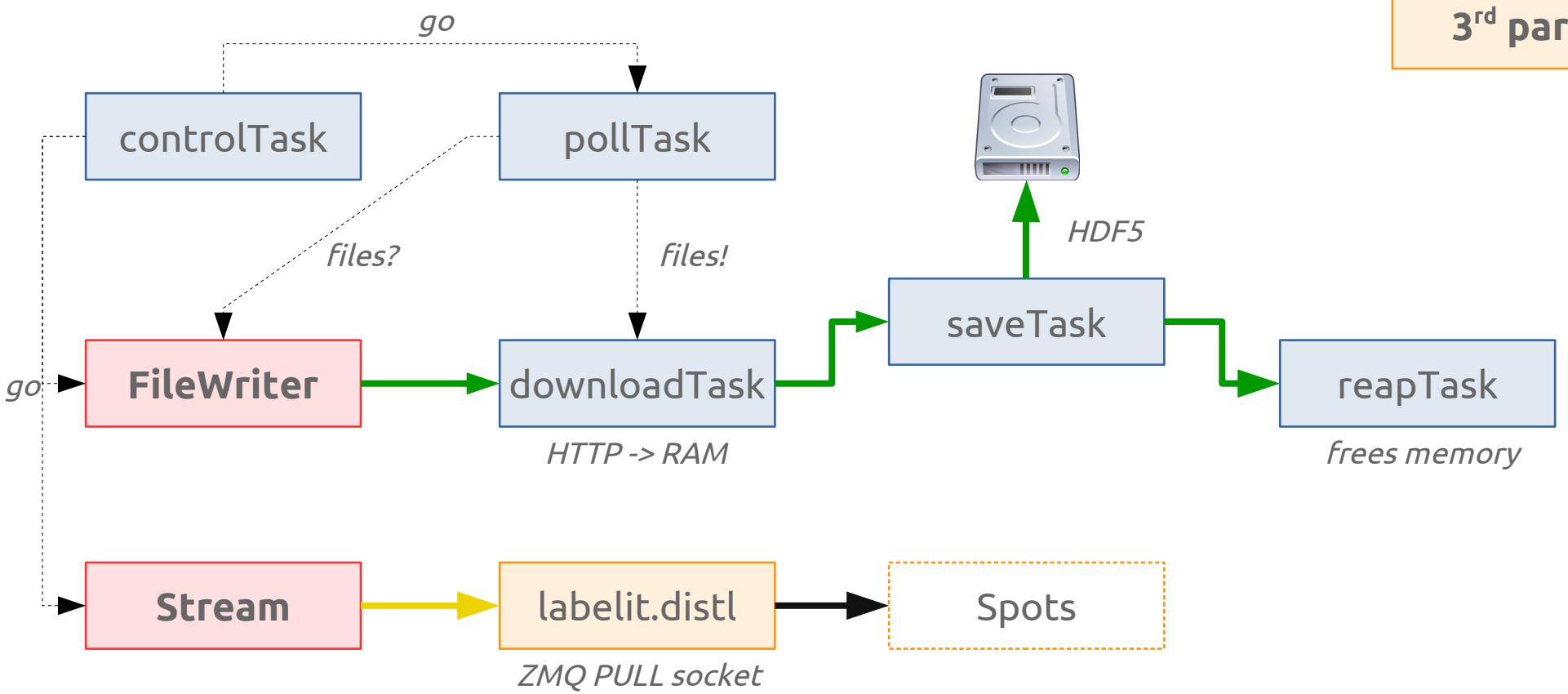
BROOKHAVEN NATIONAL LABORATORY

Use case: converting data



U.S. DEPARTMENT OF ENERGY
BROOKHAVEN NATIONAL LABORATORY

Use case: real time processing by 3rd party



FileWriter and Stream don't work in parallel for high frame rates

U.S. DEPARTMENT OF ENERGY
BROOKHAVEN NATIONAL LABORATORY

Questions?

Thank you!

U.S. DEPARTMENT OF
ENERGY

BROOKHAVEN
NATIONAL LABORATORY