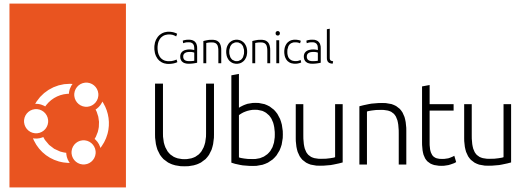
Packaging & Deployment at KIT

24.04.2026

E. Blomley – Spring EPICS collaboration meeting 2026

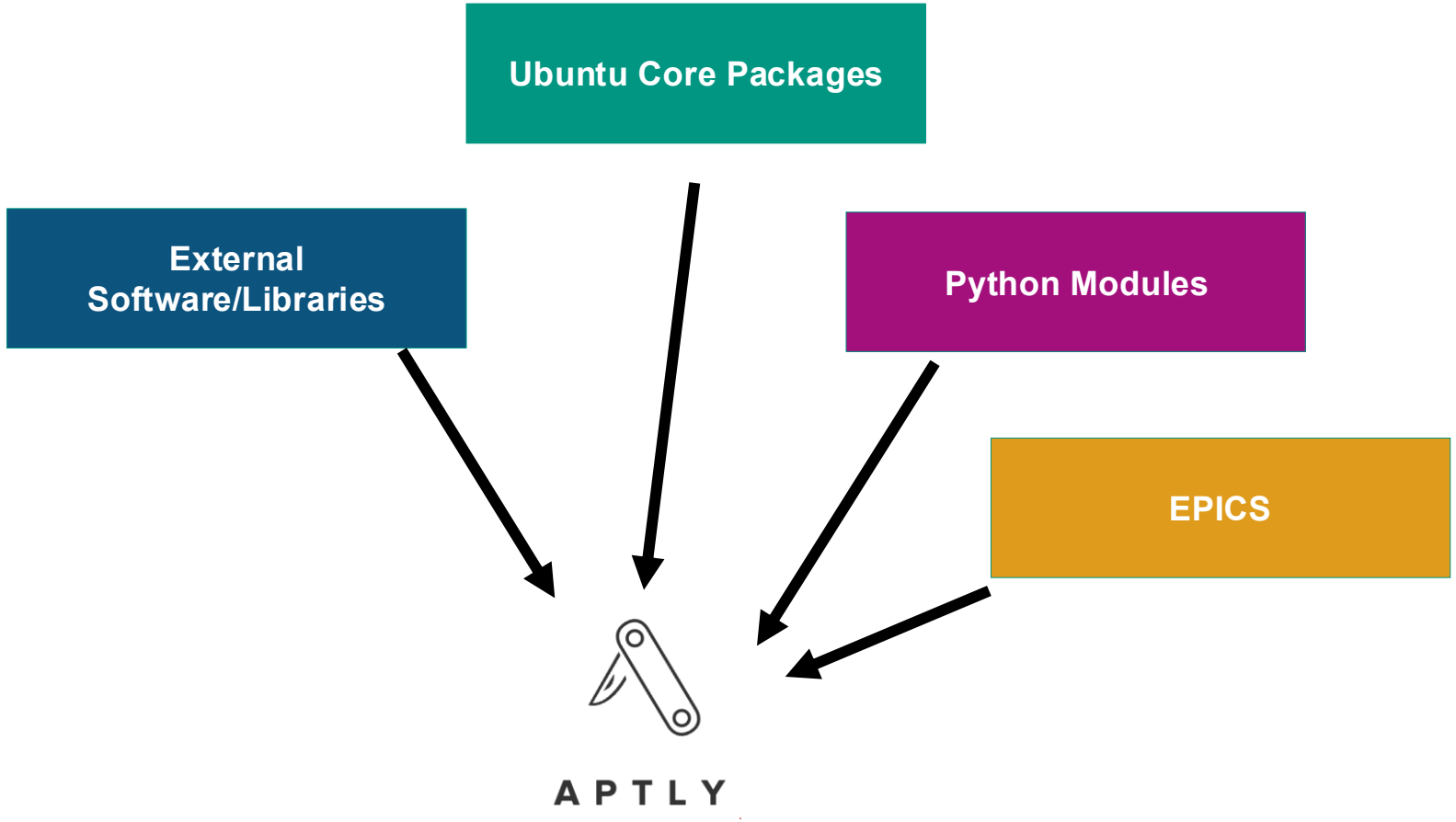
Software Stack

- EPICS: 2012
- Ubuntu: ~ 2014
- Salt: ~ 2016
- GitLab CI: ~ 2020



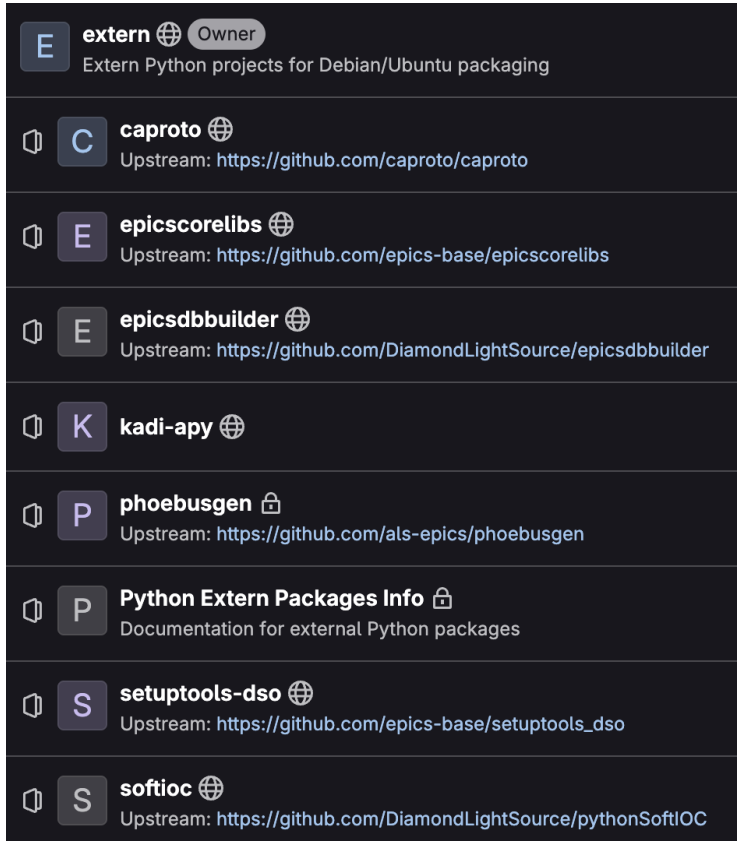
Packaging – Ubuntu LTS & Debian Packages

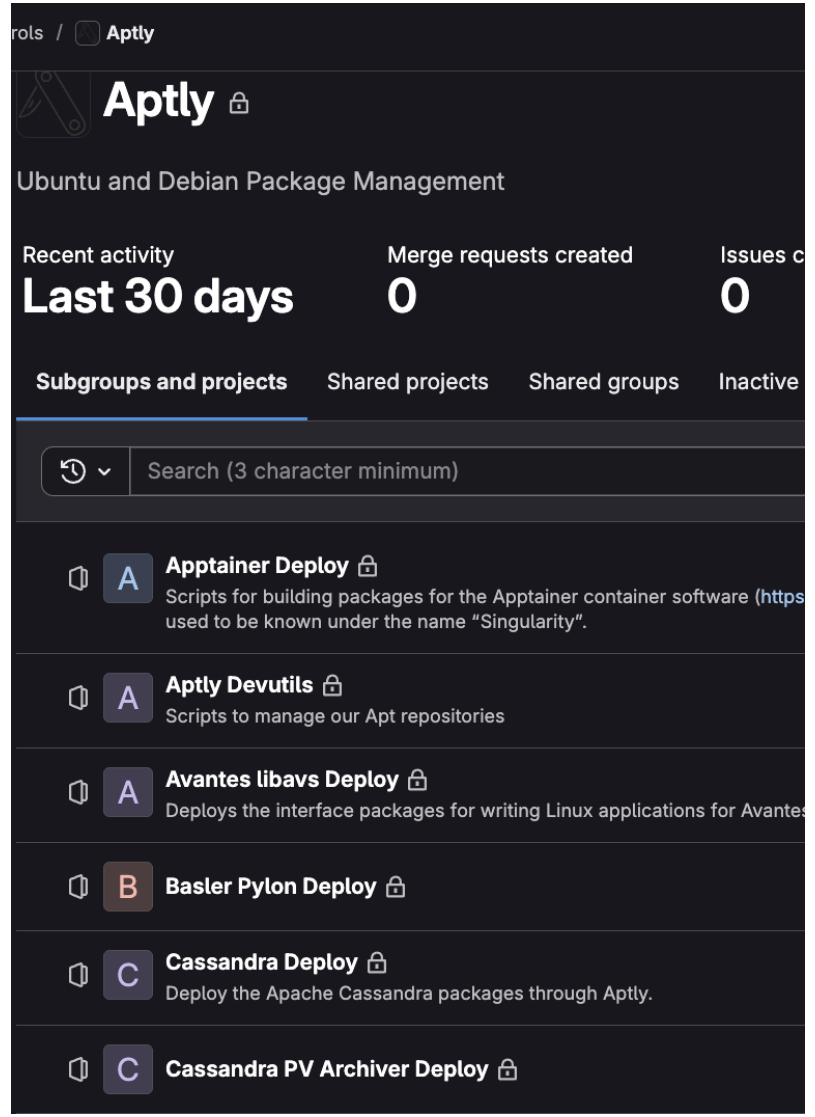
- Basic rule (since 2016?):
  .deb .deb .deb .deb
- Use it as “whitelist” filter



External Libraries & Python

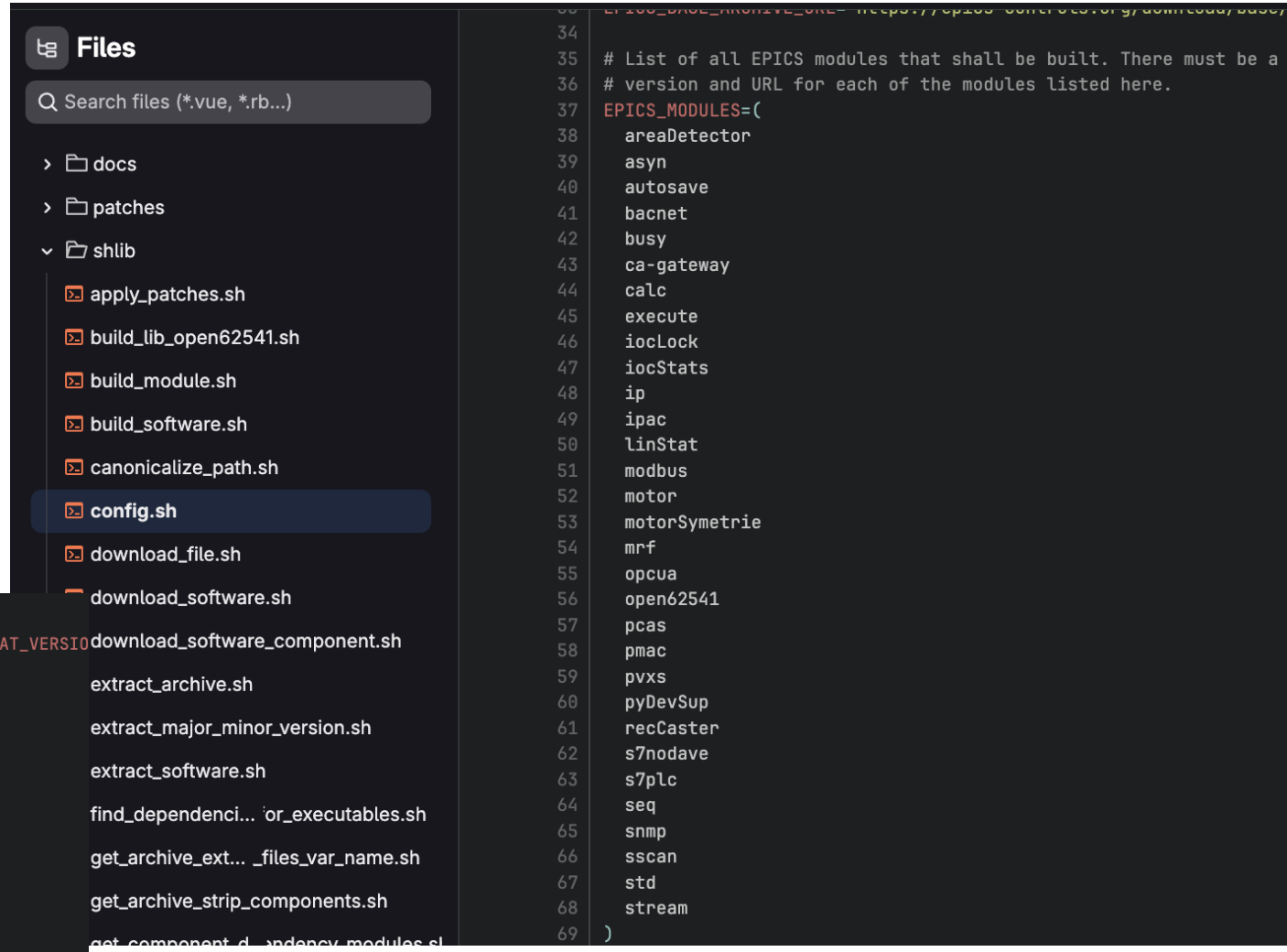
- Allow all Ubuntu Python packages
- Bundle fixed set of core EPICS related libraries
- Mirror or host external .deb
- Build .deb via CI





EPICS Packaging

- Package EPICS to Debian
- BUT: do not follow Debian rules
  - /opt/epics/base-<version>
  - /opt/epics/modules/<xyz>
  - /opt/epics/extensions/<abc>




```
EPICS_LINSTAT_VERSION="1.1.0"
EPICS_LINSTAT_ARCHIVE_URL="https://github.com/mdavidsaver/linStat/archive/refs/tags/$EPICS_LINSTAT_VERSIO

EPICS_MODBUS_VERSION="3.4"
EPICS_MODBUS_ARCHIVE_URL="https://github.com/epics-modules/modbus/archive/R3-4.tar.gz"
EPICS_MODBUS_DEPEND_MODULES=( asyn )

EPICS_MOTOR_VERSION="7.3.1"
EPICS_MOTOR_ARCHIVE_URL="https://github.com/epics-modules/motor/archive/R7-3-1.tar.gz"
EPICS_MOTOR_DEPEND_MODULES=( asyn busy ipac seq )
EPICS_MOTOR_SUB_MODULES=(
  motorMotorSim
  motorNewport
  motorOms
  motorOmsAsyn
  motorPIGCS2
  motorPhytron
  motorSmarAct
  motorThorLabs
)
```

https://gitlab.kit.edu/kit/ibpt/controls/epics/distribution/epics-build-tool

Build CI

Sources (mostly GitHub)

Build (& Bug) Patches

"Vanila" EPICS

Internal Modules

IBPT (*) Patches

IBPT EPICS

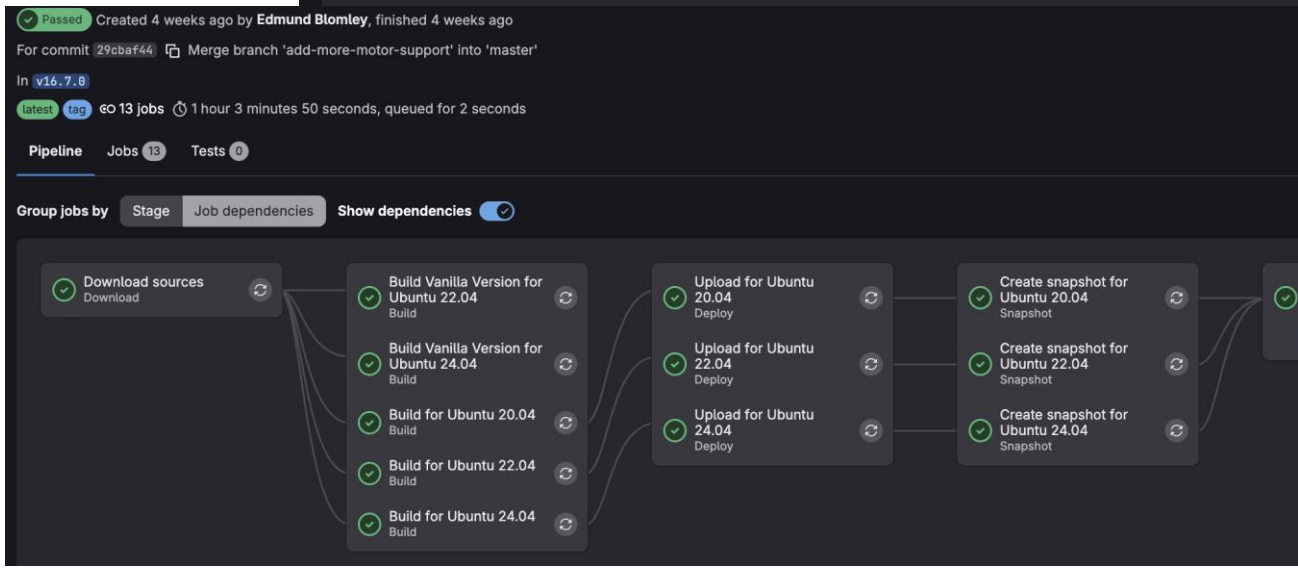
Patch & Vanilla split since 2025

Publish to public webserver missing

```
                prompt("Record Name")
                special(SPC_NOMOD)
-               size(61)
+               size(256)
        }
        field(DESC,DBF_STRING) {
                prompt("Descriptor")
diff -Naur base-7.0.5.orig/modules/lib
--- base-7.0.5.orig/modules/libcom/src
+++ base-7.0.5/modules/libcom/src/misc
@@ -70,7 +70,7 @@
 #endif

/** \brief Size of a record name incl
-#define PVNAME_STRINGSZ 61
+#define PVNAME_STRINGSZ 256
```

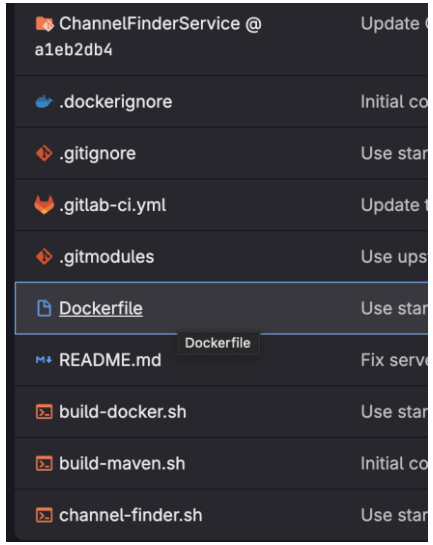
- ibpt-epics-module-ca-gateway_16.7.0-1ubuntu1.24.04.1_amd64.deb
- ibpt-epics-module-calc_16.7.0-1ubuntu1.24.04.1_amd64.deb
- ibpt-epics-module-execute_16.7.0-1ubuntu1.24.04.1_amd64.deb
- ibpt-epics-module-ioclock_16.7.0-1ubuntu1.24.04.1_amd64.deb
- ibpt-epics-module-iocstats_16.7.0-1ubuntu1.24.04.1_amd64.deb
- ibpt-epics-module-ip_16.7.0-1ubuntu1.24.04.1_amd64.deb
- ibpt-epics-module-ipac_16.7.0-1ubuntu1.24.04.1_amd64.deb
- ibpt-epics-module-linstat_16.7.0-1ubuntu1.24.04.1_amd64.deb

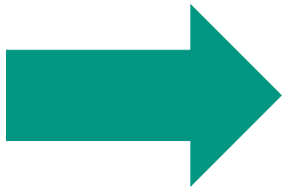


*Institute for Beam Physics & Technology (IBPT) as part of Karlsruhe Institute of Technology (KIT)

From Zero to EPICS....

- IF you run Ubuntu LTS (no other requirements):
  - < 15 minutes from 0 EPICS to working OPC-UA PLC communication
  - Tested in a photovoltaics lab
- BUT: only solves the EPICS problem
- Services are NOT .deb packages





Deployed as Docker services via Salt

IOC Management

- GitLab Project Template
  - .gitignore
  - .gitattributes
  - .gitlab-ci.yml
  - README.md template
- makeBaseApp.pl
  - + run executable
- Manually set up modules

- CI only for README.md publication
  - After meeting:
  - Add db->markdown list
  - Add db->markdown visual
  - Add tree-sitter based lintings
  - Add build + run stage with shell output parsing

~200 – 300 IOC GitLab projects

run 103 B

```
1  #!/bin/sh
2  cd "`dirname "$0"`"
3  ioc="`head -n 1 st.cmd | grep -E "^#\!" | cut -b 3-`"
4  exec "$ioc" st.cmd
5
```

.gitlab	update templates
OsciRsMeasurementApp	Added option to faste
configure	initial commit
iocBoot	Added possibility to r
.gitattributes	update default LFS ob
.gitignore	re-add autosave
.gitlab-ci.yml	Add default readme
Makefile	initial commit
README.md	Slightly updated read

README.md

R&S Oscilloscope Measurements

Overview

?!?

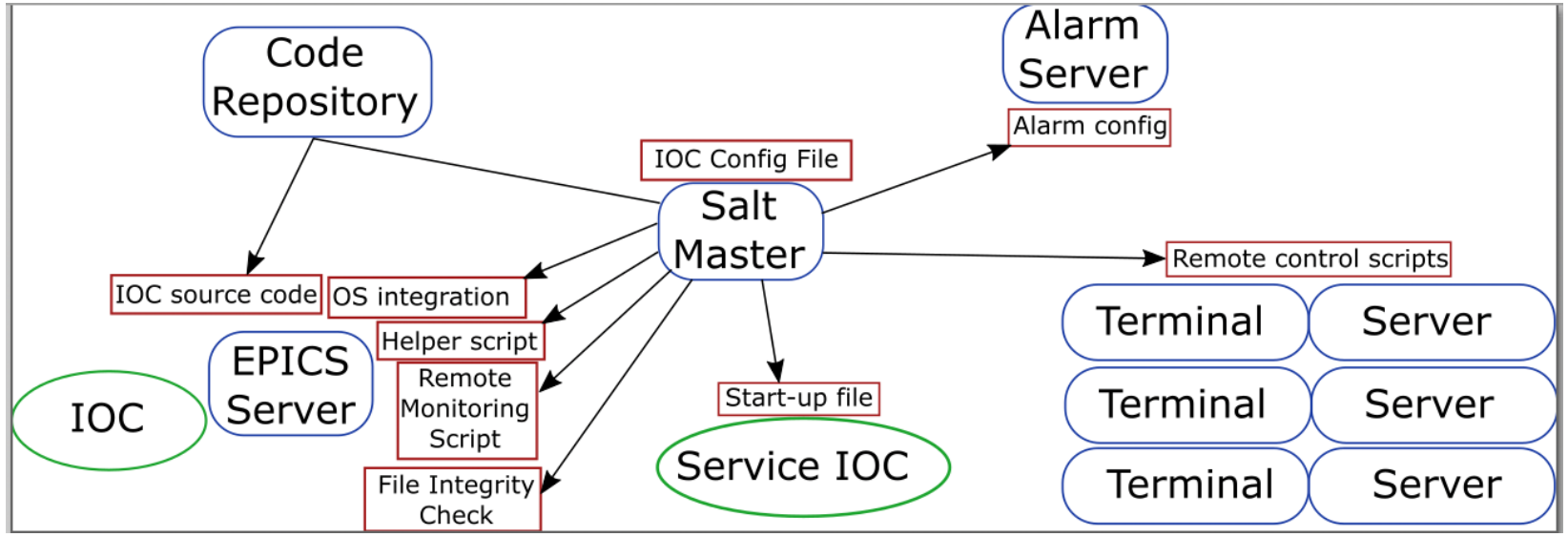
- Base & module version upgrades painful….
  - **Require module?**
  - **IOC structure which is just .db .st ?**

IOC Deployment

```
[…]
beam-info:
      service-name: Beam Info
      description: Current,energy,lifetime,dump status
      dir-name: beam-info
      host: acc-pc-epics01.anka-acc.kit.edu
[…]
camera-url:
      autostart: False
      service-name: URL Cameras
      description: Controls URL cameras via AreaDetector
      dir-name: camera-areadetector
      host: acc-pc-cam01.anka-acc.kit.edu
[…]
```

- Salt: Single Source of Truth
  - All configured IOC instances
  - Which Gitlab project to which host
  - Additional configuration options
  - Host has ibpt-epics-base & ibpt-epics-modules-all installed

- Automated via Salt
  - Target host:
  a. Clone IOC
  b. Build
  c. Systemd config
  d. Local launch script
  e. Monitoring scripts
  - Global:
  a. Alarm server
  b. Remote control scripts

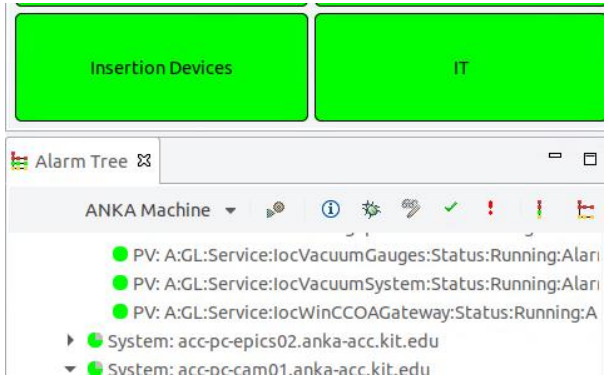


IOC Management

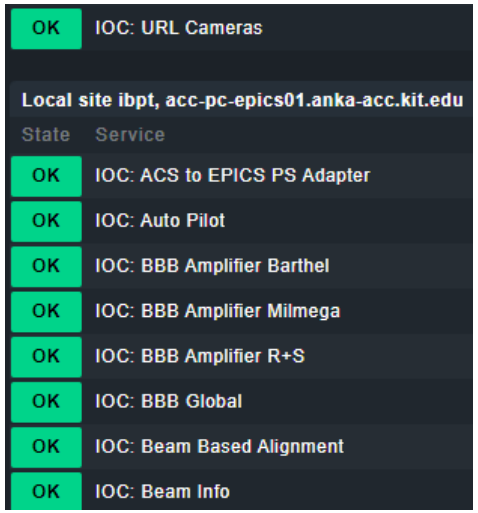
- IOCs run in screen sessions wrapped in systemd processes

```
ankaop@acc-pc-oc04:~$ ioc-manage
ioc-acs-ps-adapter
ioc-agilent-func-gen
ioc-agilent-ion-pump
ioc-agilent-ion-pump2
ioc-amplifier-barthel
ioc-amplifier-rs
ioc-auto-pilot
ioc-aux-diag
ioc-basler-camera
ioc-bba
ioc-bbb-amplifier
ioc-bbb-global
ioc-beam-info
```

Terminal – independent of host



Salt injects xml config for alarm server

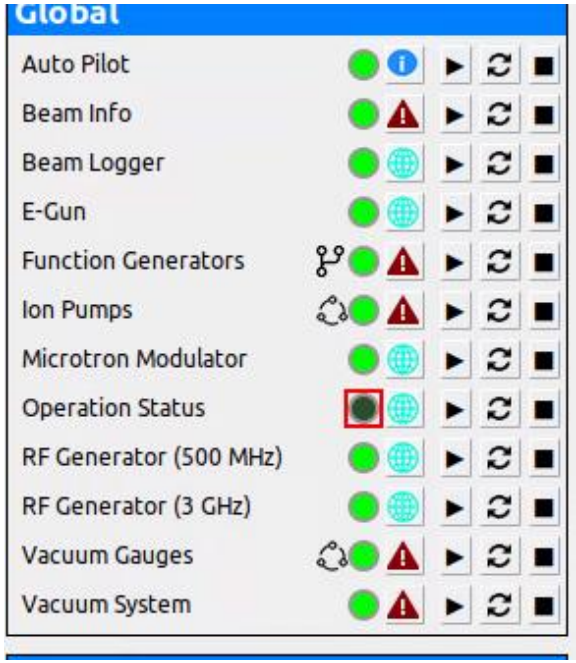


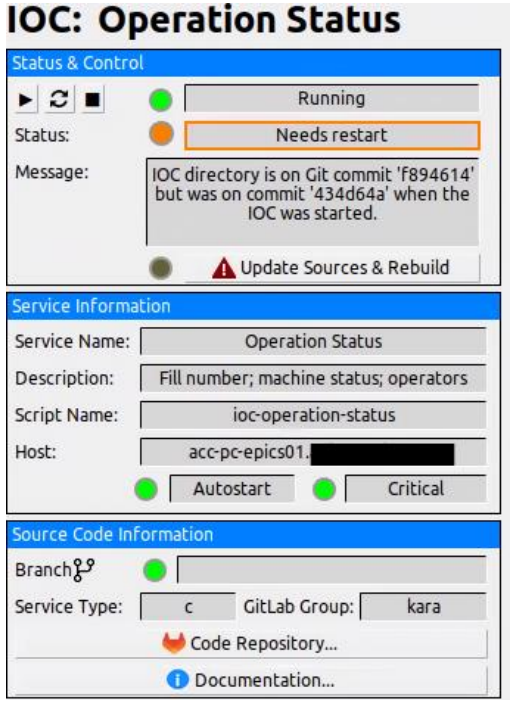
Salt creates local script for IT monitoring integration (CheckMK)

- System logging: Elastic -> Kibana stack
- KARA runs 150-160 IOC instances

IOC to Manage IOCs

- IOC status and basic IOC control via EPICS with panel integration
- Inject st.cmd file via Salt to Service IOC





Linstat for every IOC service

Execute device support for EPICS

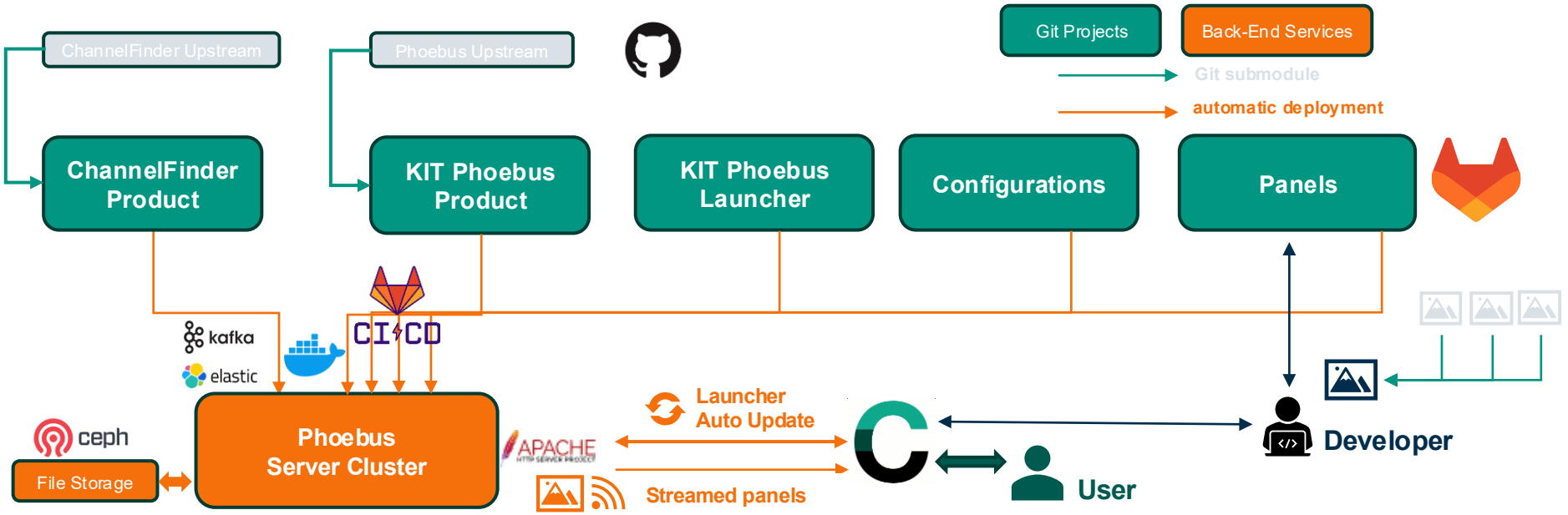
The execute device support is a general-purpose software device support that can be used to run any program from an EPICS IOC. Typically, this will be scripts (e.g. Bash, Python), but it is perfectly possible to run binary programs as well.

The possibility to use arbitrary scripts facilitates a wide range of possible applications, like sending notifications, writing log files, calling web services, querying databases, and many more.

The execute device support always runs program asynchronously, so a program will never block operation of the IOC. Data can be passed from the IOC using arguments (command-line parameters), environment variables, and a stream of characters (supplied to the program on the standard input). Both the program's exit code and its output can be passed back to the EPICS IOC.

https://github.com/KIT-IBPT/epics-execute

Honorable Mention: Phoebus



Honorable Mention: Embedded Systems, Backups and monitoring

- Central IT provides VEEAM for backups and CHECK_MK for IT monitoring
- We only backup data drives
- No EPICS server, terminals, salt master, …
  - Use distributed CephFS file cluster for autosave

- Embedded systems hardly managed/automated
  - ~80-90 embedded systems vs 150-200 IOCs
  - Basic idea: VM to manage embedded systems via SSH (backup and configuration)

Operations Schedule creates Opportunities

KARA

2 months shutdown

ELUTE

1+ year shutdown

New laser plasma accelerator

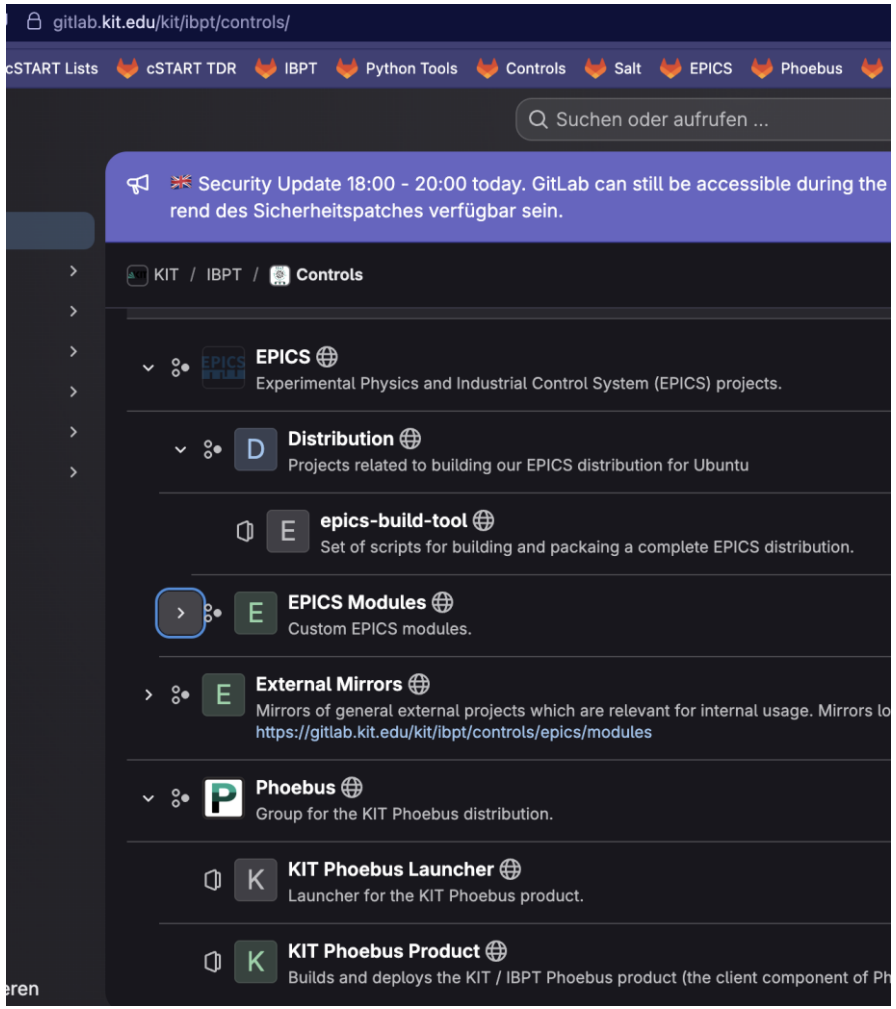
Commissioning

Opportunity to rethink packaging, deployment & managing

Also: interest in self-contained EPICS setup for labs

Resources

https://gitlab.kit.edu/kit/ibpt/controls/



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