Working Together to Build a Modular CI Ecosystem

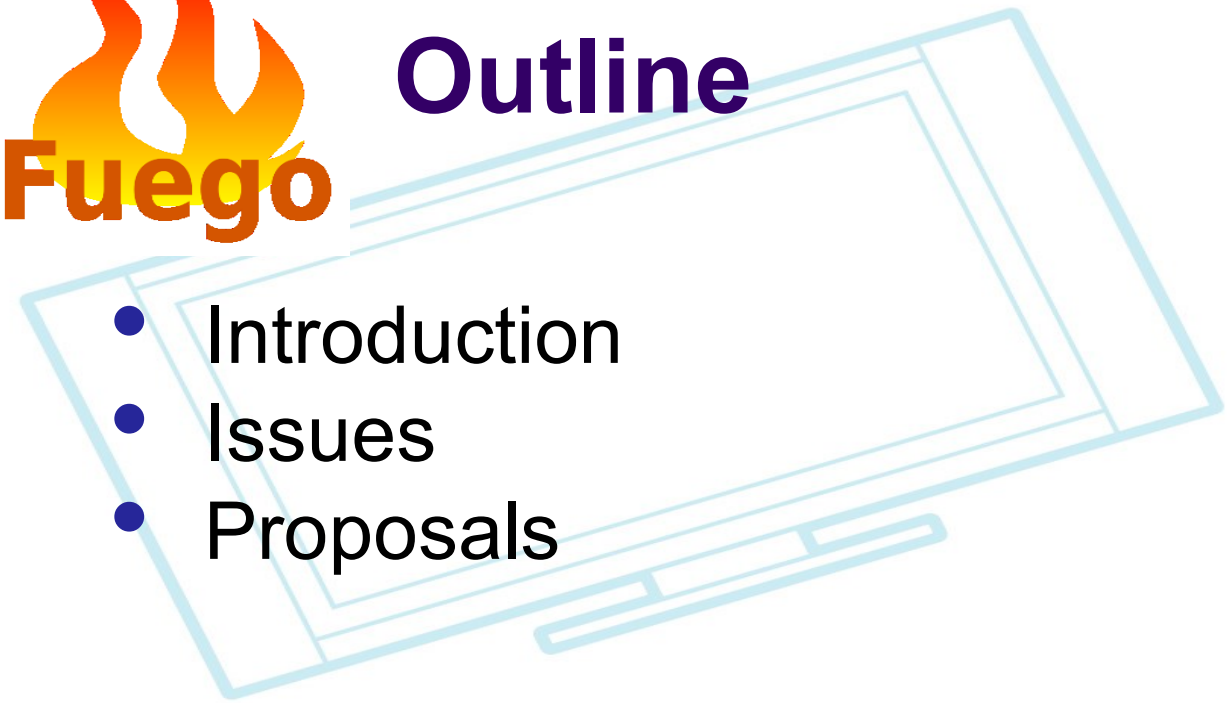
Tim Bird

Fuego Test System Maintainer

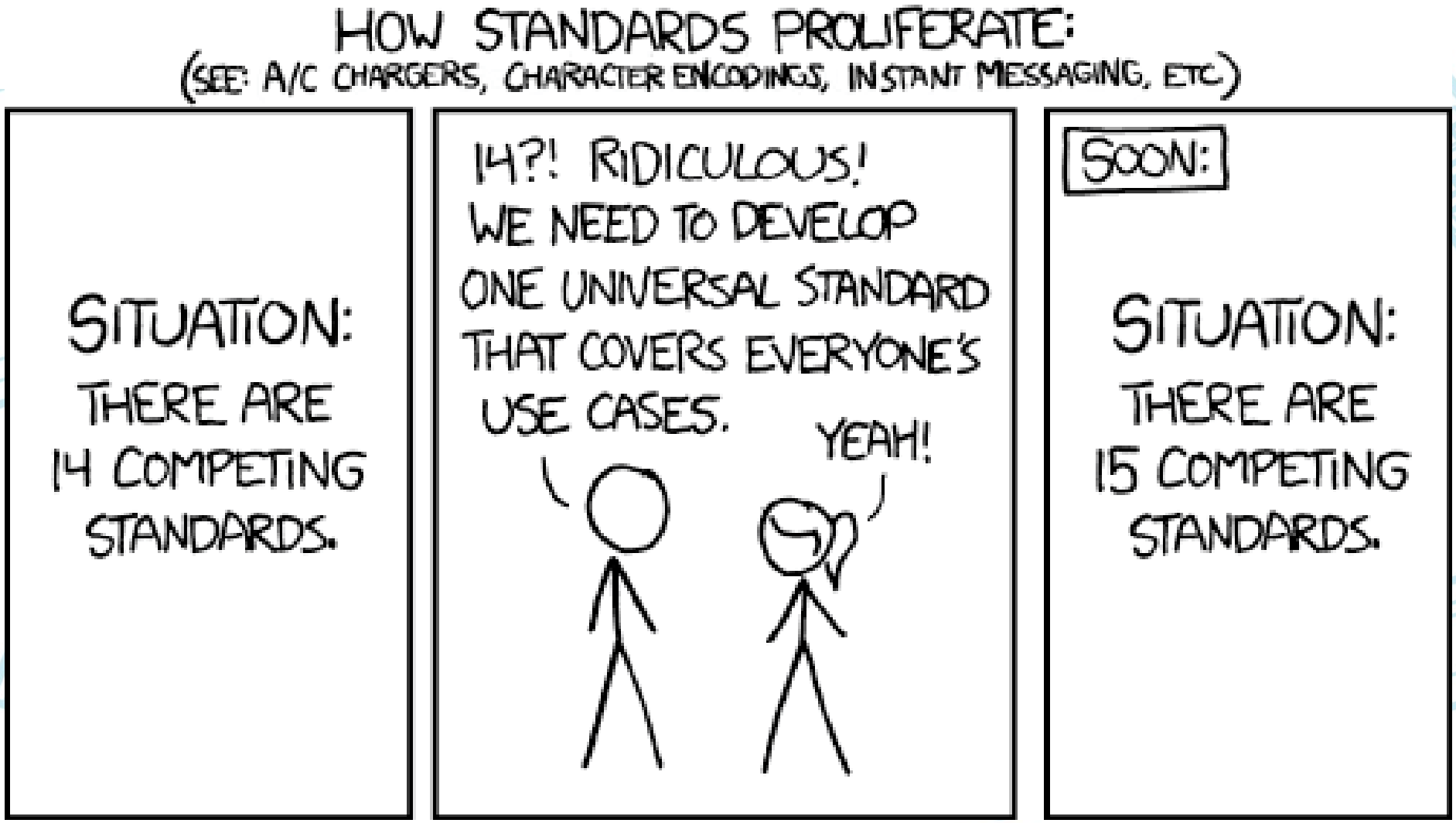
Sr. Staff Software Engineer, Sony Electronics

Outline

- Introduction
- Issues
- Proposals



Standards...

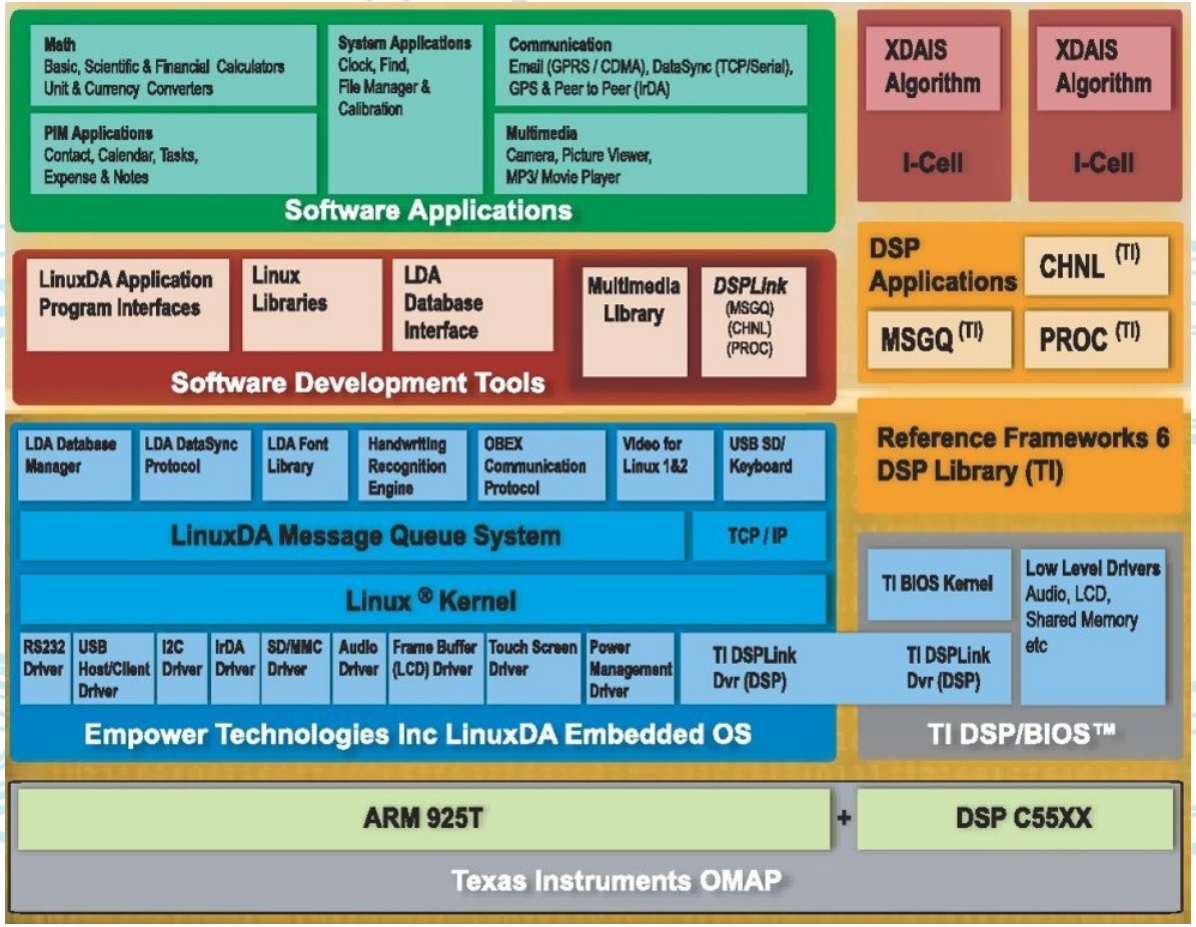


Source: https://xkcd.com/927/ License: see https://xkcd.com/license.html

Reason for Open Source CI standards

- Many test framework systems are monolithic
  - Or at least tied closely to specific sub-components
    - e.g. Jenkins, ttc, LAVA, Beaker, buildbot, labgrid, etc.
- Want to mix and match components
- Want an ecosystem of modular CI components
- Allow for collaboration and specialization
- Reduce work!

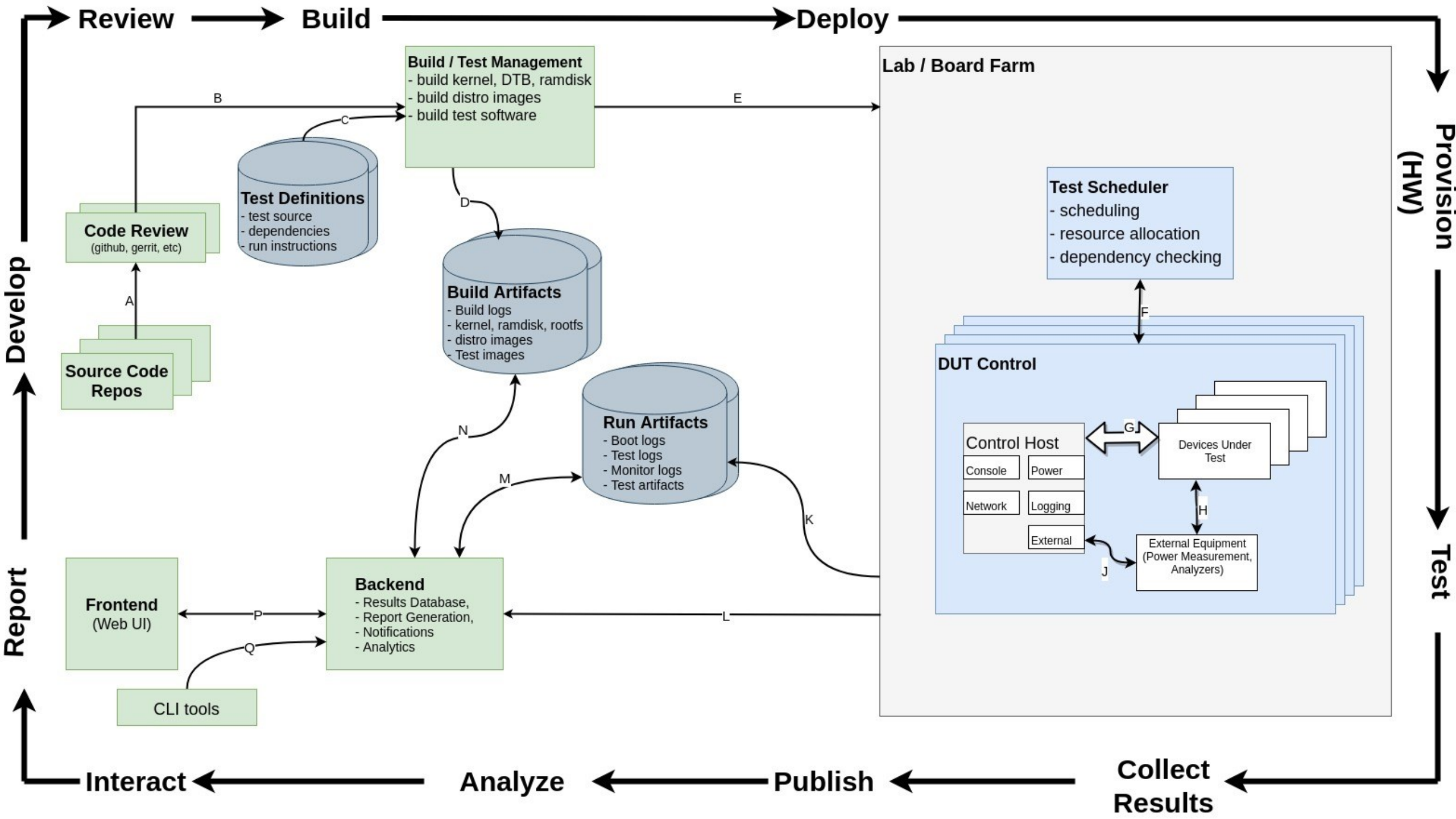
A software stack



Need similar APIs

Need similar APIs

Need similar APIs


Review
Build
Deploy
Provision (HW)
Test
Collect Results
Publish
Analyze
Interact
Report
Develop
Build / Test Management
- build kernel, DTB, ramdisk
- build distro images
- build test software
Test Definitions
- test source
- dependencies
- run instructions
Code Review
(github, gerrit, etc)
Source Code Repos
Build Artifacts
- Build logs
- kernel, ramdisk, rootfs
- distro images
- Test images
Run Artifacts
- Boot logs
- Test logs
- Monitor logs
- Test artifacts
Lab / Board Farm
Test Scheduler
- scheduling
- resource allocation
- dependency checking
DUT Control
Control Host
Console
Power
Network
Logging
External
Devices Under Test
External Equipment (Power Measurement, Analyzers)
Backend
- Results Database,
- Report Generation,
- Notifications
- Analytics
Frontend
(Web UI)
CLI tools
A
B
C
D
E
F
G
H
J
K
L
M
N
P
Q

Key issues

- Module boundaries
- Nature of the APIs
- Language
- How to share and re-use code?
  - Install-time issues (how to access, where to install)
  - Sharing configuration data
  - Discoverability
- How to share data?
  - Common place to share objects?
  - Common formats?

Major modules and repositories

Modules

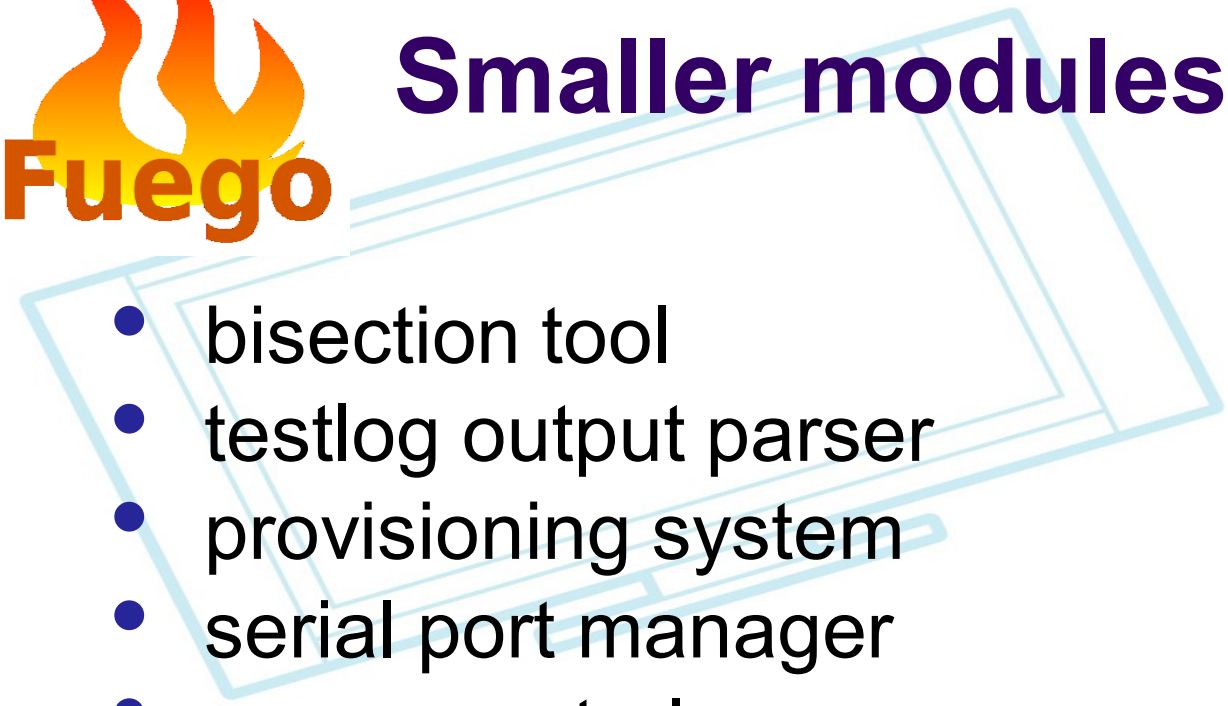
- Test manager
  - Job definition front-end
  - Job manager front-end
- Test scheduler
- Board manager
- Lab equipment manager
- Notification generator
- Report generator
- Results visualization front-end

Servers/Repositories

- Test definition repository
- Build artifact server
  - SUT image repository
  - Test binary package repository
- Job request server
- Results artifact server
- Results database

Smaller modules or pieces

- bisection tool
- testlog output parser
- provisioning system
- serial port manager
- power control manager
- expect tool



High level

- Need way to incorporate other system's pieces (modules) into our frameworks
  - Need to define modules
- Definition:
  - Responsibilities
  - Interface (module APIs)

Accessing modules from other frameworks

- How?
  - Do we have to install multiple frameworks?
    - If I want to use CKI triggers, LAVA provisioning, Labgrid lab management, Fuego tests, and LKFT reporting, how would this work?
  - Do we need to split out modules as separate components?
    - Does this make things harder for our own users?
  - Can we import modules from other frameworks' git repositories, for our framework's users?

API options

- <language X> library (LIB)
  - C, python, go, Haskell, java, ruby, etc.
- Linux command line (CLI)
- Linux IPC (IPC)
- Network API (NET)

CLI-style proposal

- git-style interfaces: <toolname> <verb> <args>
  - Using standardized operation verbs and args
- Result data output in JSON
  - With exceptions (not json) for single-value or bulk data
- For async operations:
  - Use start/stop/collect verbs
  - With data going to a file
- Question:
  - Input as environment variables, command line args, or JSON?

CLI-style rationale

- Can easily wrapper LIB, IPC or NET interfaces with CLI
- Operations are not time-critical
  - Overhead of CLI invocation is small compared to duration of operations
- Many systems already have an existing CLI
  - But args are not standardized
    - To support common verbs and args, can extend existing tool or create thin wrapper

CLI proposal details:

- Filesystem discoverability:
  - /usr/lib/testing prefix
  - Propose a "<module>.d" interface, with a <name>-<module> program name
    - Could end in nothing, or standard executable extension (.sh, .py)
    - Examples:
      - ttc-power-control, pdud-power-control
      - grabserial-access-serial
      - lava-provision, r4d-provision
      - kcidb-results, kernelci-results, squad-results

How to get from here to there

- Take existing systems, without breaking them
- Good presentation at LinuxCon Japan (keynote)
  - Monolithic monster
  - Can’t break system while refactoring it
    - Need to break system apart slowly
    - Take a little piece at a time
- Ability to use a feature from a test framework without importing the whole system

Chicken and egg problem

- No incentive for framework author to change until benefits are available
  - e.g. not worth creating a board management API if no systems use it
  - and not worth changing test system to use a generic board management API until multiple systems provide it
- Someone has to go first
  - Actually, multiple people have to do one side of a layer for there to be benefits
    - Is this true – are the other benefits from modularity?
- Danger of locking in a bad interface

Pieces that could be isolated

- Results parser
- Smart diff (for easier expected value)
  - seddiff
- Expect (tcl-less)
  - for program control, firmware control
  - Small footprint, simplified
- bisect tool
- aggressive rmdir (see Dmitry email)

Place to share objects

- Project neutral site for collecting/disseminating objects
- or...
- Agreement to consolidate tests in one repository
- Possible uses:
  - Peer-to-peer test sharing
    - Eliminate gatekeeping for collaboration in testing community
  - Allow customization and enhancement of ad-hoc tests
    - For diagnosing problems
  - Apply tests to board that have hardware needed for test
    - Give access to developer who does not have hardware

Conclusions

- Fragmentation makes it difficult to collaborate
- Need to identify modules, and boundaries between modules
- Start working on creating modules
  - Create internal APIs, data structures and protocols
  - Without changing functionality
- Need to decide common IPC
- Proposal:
  - Data format=json
  - Schema= <*to be determined per object*>
  - IPC=Linux command line
- Propose to use KernelCI for shared repositories

Thanks

Tim Bird

Fuego Test System Maintainer

Sr. Staff Software Engineer, Sony Electronics