Tormach Overview
December 2020

- We help people make stuff
- CNC Machines
- Madison WI HQ, employees around the world
- 100% employee-owned

TORMACH®

TORMACH®

New additions

PathPilot CNC control

- Developed in collaboration with the open-source LinuxCNC community

MachineKit/LinuxCNC

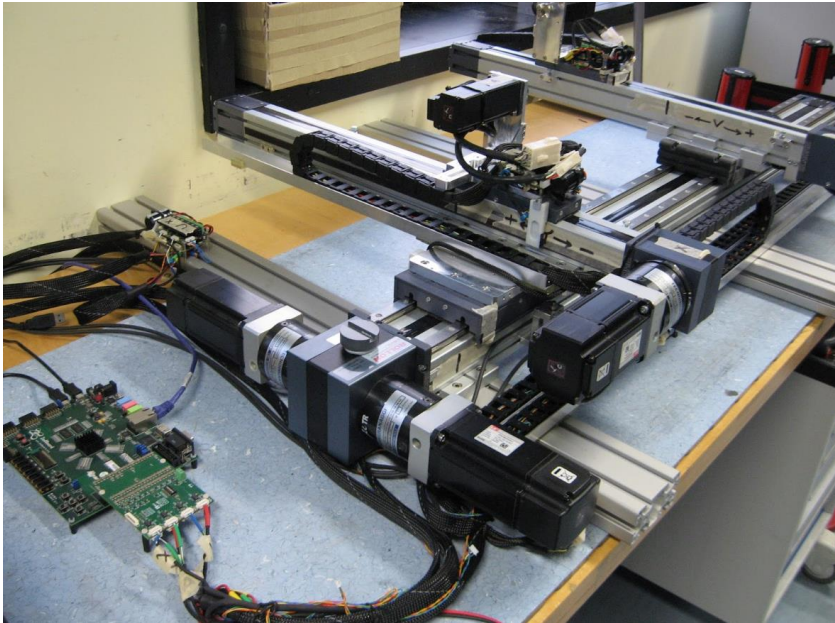Motion control software, primarily aimed at CNC machines

- History:
  - 1990s – NIST, public domain
  - 2000s - Community development takes over
  - 2010s – MachineKit fork established to focus on general purpose machine control (not just g-code machines)

TORMACH®

MachineKit/LinuxCNC

- Linux with real-time OS on consumer-grade PCs
- Decent availability of external interface cards
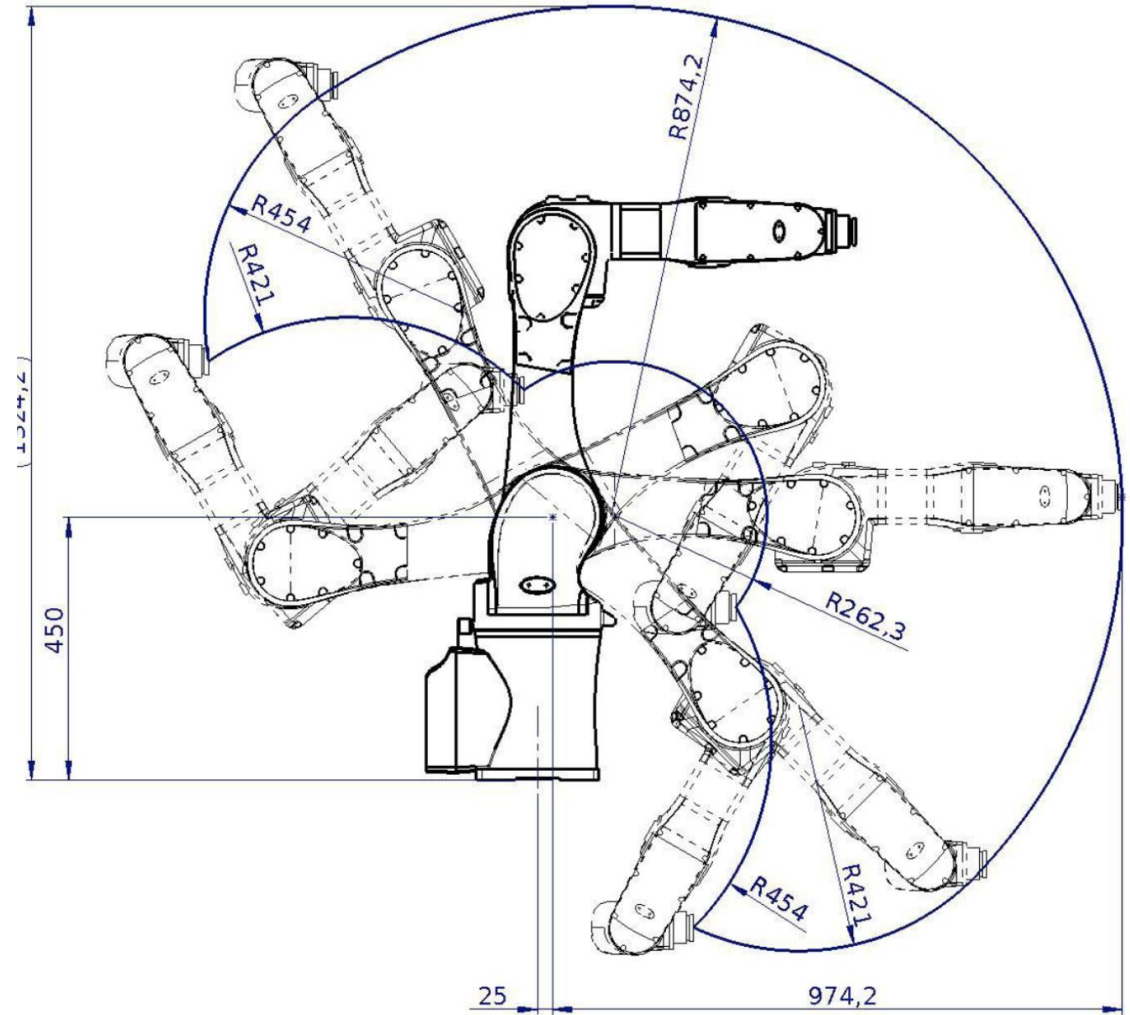- Popular choice for CNC retrofits

TORMACH®

Robots!

- Why?
  - ROS – replicate success we had with LinuxCNC/MachineKit
  - Help people make stuff

At-a-glance

- 6kg payload
- Industrial hardware – links are castings, harmonic gearboxes, servo motors/drives
- 16 digital IO
- 970mm reach
- Controlled by PathPilot/ROS

What makes it different?

- Price ($16,950)
- ROS integration – 1kHz control loop, all machine parameters exposed to ROS via HAL
- Robot programming language is Python
- Works natively with Tormach CNC machines
- Technical support and contract software development

TORMACH®

Screenshare

Future work

- Stepper-based model aimed at middle/high school educators
- Web-based simulator
- ?

Questions?

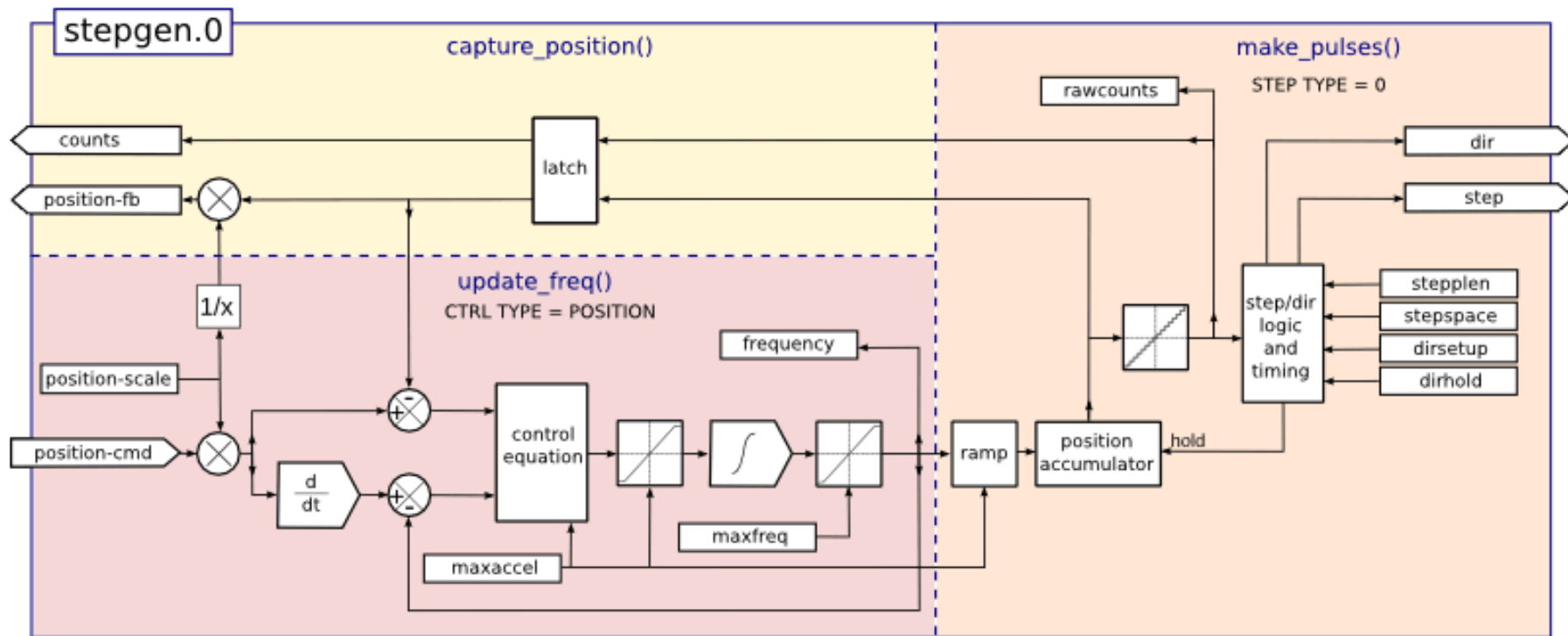- Contact drogge@tormach.com

HAL

- Hardware Abstraction Layer - allow a number of *building blocks* to be loaded and interconnected to assemble a complex system
- Requirement: RTAPI (RT threading environment)
  - `PREEMPT_RT`
  - Well-proven for motion control applications
- Fundamental building blocks
  - Components
  - Pins
  - Signals
  - Parameters
  - Functions
- Tool chain (HAL Scope)

HAL

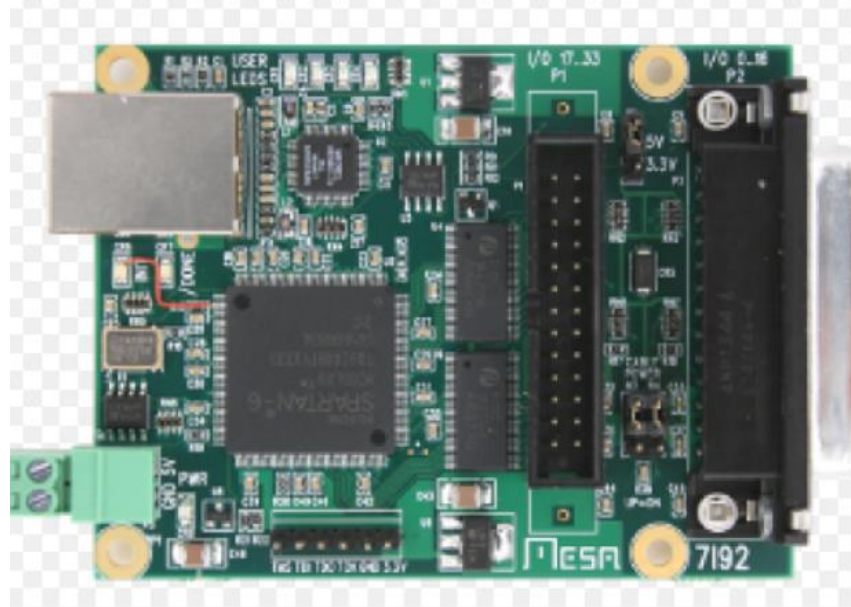- Component example: stepgen

HAL

- Some common components:
  - Debounce
  - Pwmgen
  - Encoder
  - Pid
  - Bldc drivers
  - Siggen
  - LUT
  - Tristate
  - Watchdog
  - Limits, filters, mux, or, xor, oneshot, etc.

HAL

- Wide range of off-the-shelf hardware to get signals in and out
  - Mesa Electronics (PCI, Ethernet, PP)
  - Pluto Systems
  - BeagleBone + any number of capes
  - Many more

Questions?