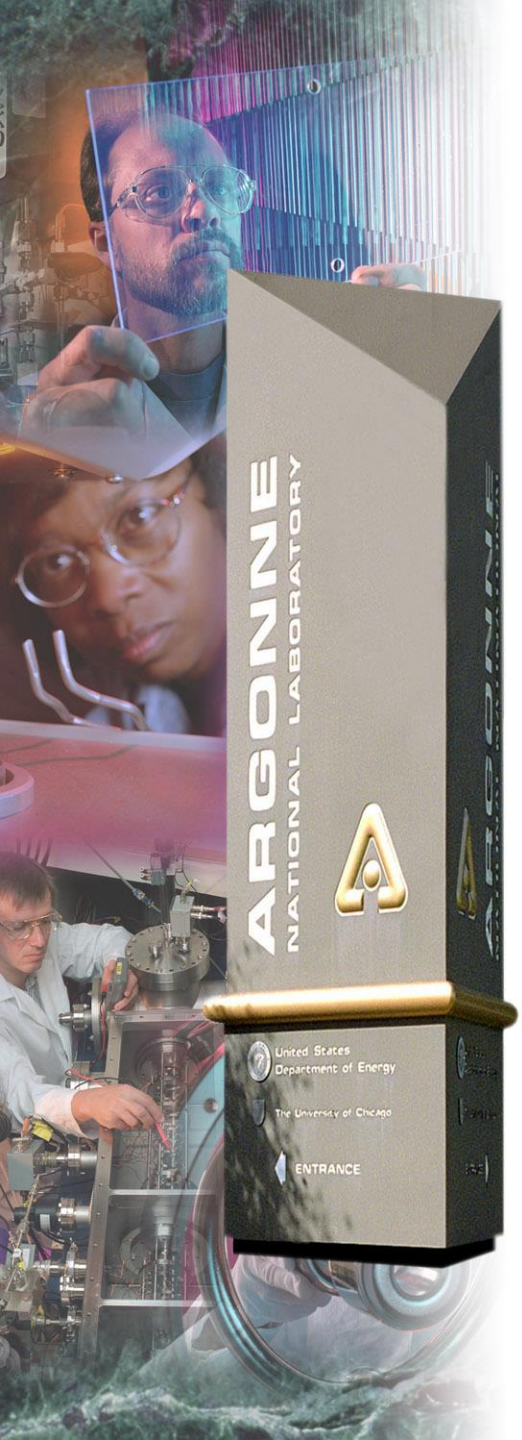

softGlue

Run-time programmable digital electronics

Tim Mooney

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Argonne National Laboratory

Office of Science
U.S. Department of Energy

A U.S. Department of Energy
Office of Science Laboratory
Operated by The University of Chicago

Overview

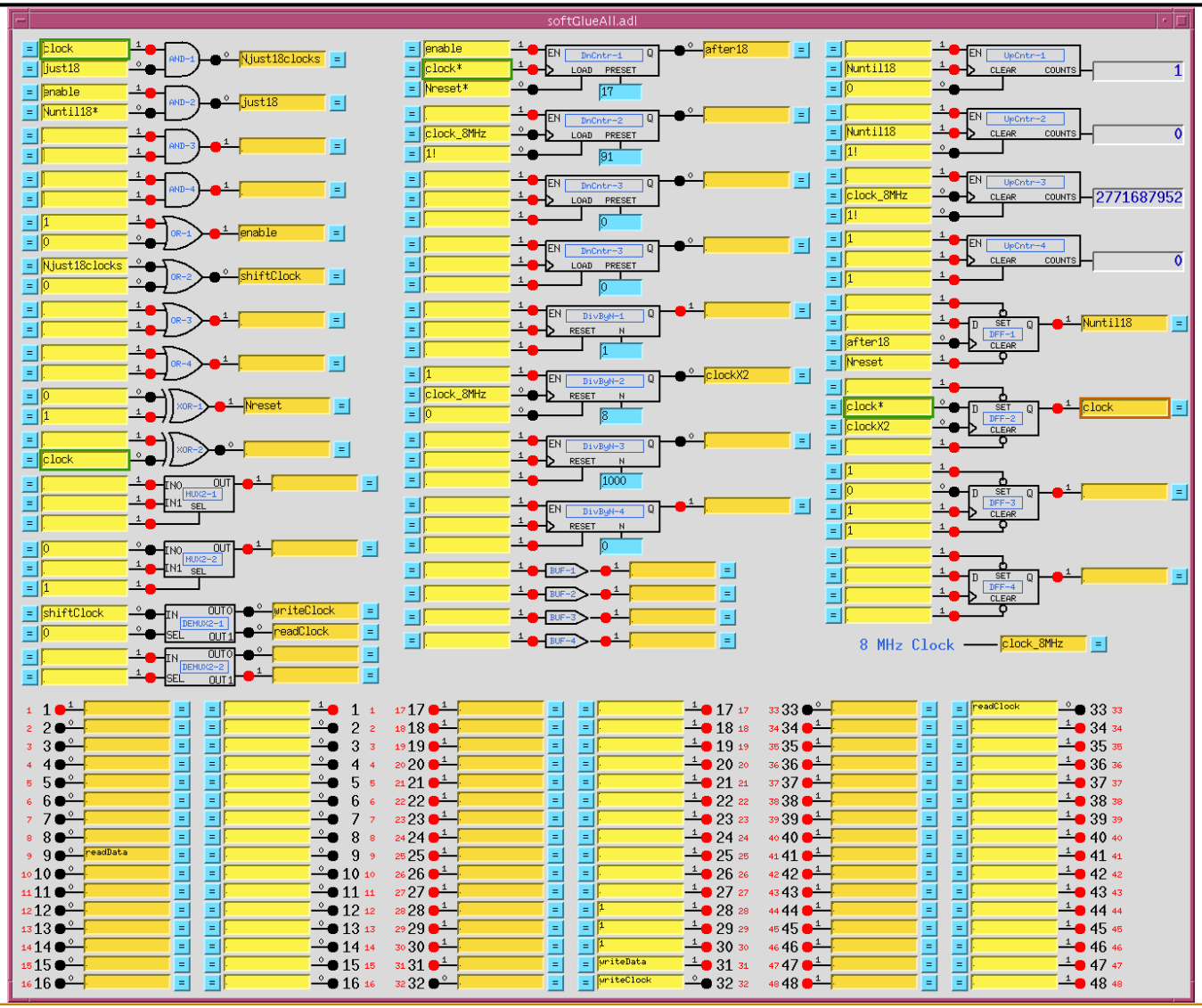
- **SoftGlue enables beamline users and staff to construct simple digital electronic circuits, and connect those circuits to field wiring, by writing to EPICS process variables (PVs).**

- **SoftGlue also provides safe (throttled) user control over how hardware interrupts are generated by field I/O signals, and dispatched to cause EPICS processing.**

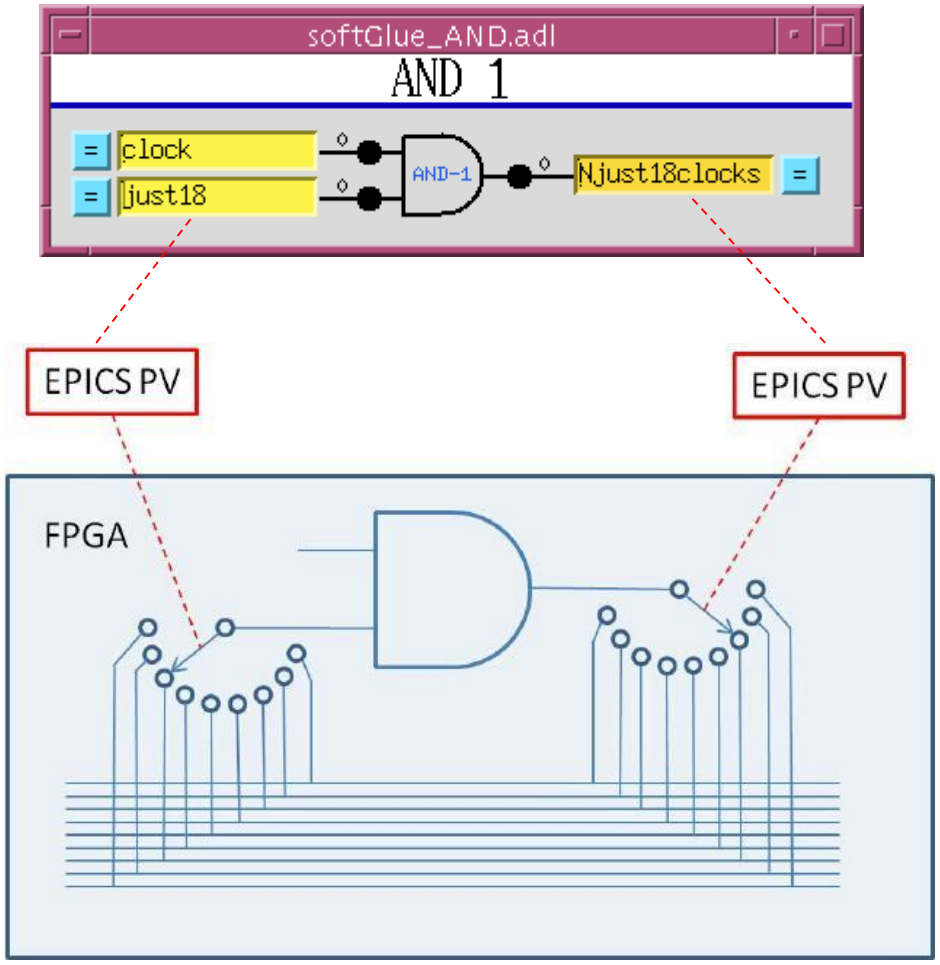
- **SoftGlue circuits can be autosaved and restored, saved as text files, emailed to another user, and managed by *configMenu*.**

- **SoftGlue does this by loading an IndustryPack FPGA-based digital I/O module with a predefined collection of circuit elements (logic gates, counters, flip-flops, etc.), whose inputs and outputs are connected to switches controlled by EPICS PVs.**

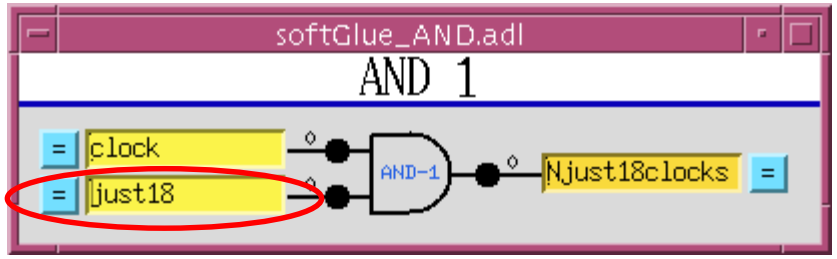
MEDM display



How it works, conceptually



Circuit-element inputs



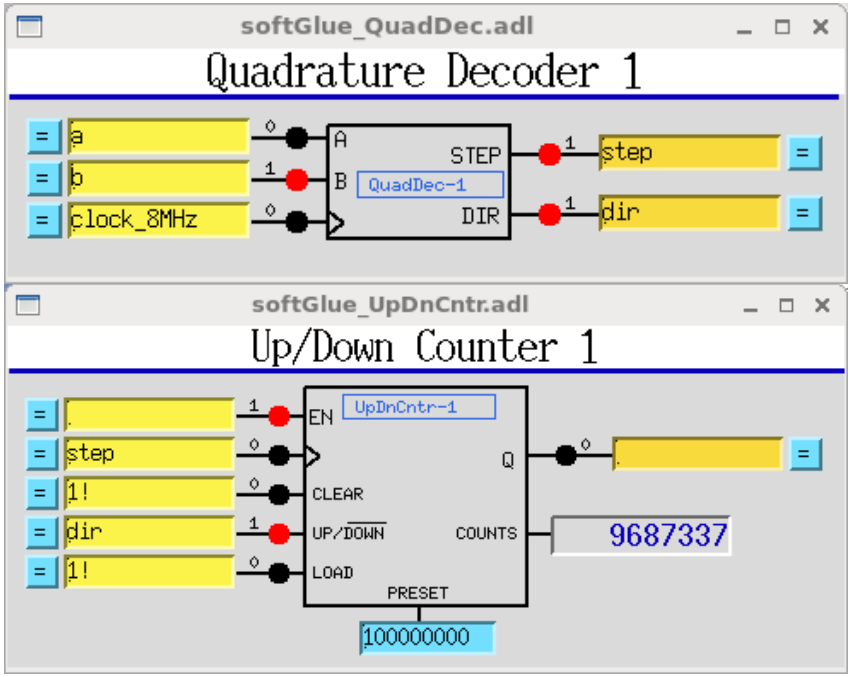
option	example	result	comment
empty		1	
number	1 0 1! 0! 0.499	1 0 Positive-going pulse Negative-going pulse 0	 ~6 µs ~6 µs
name	mySignal	Connected to all other inputs and output named “mySignal”	

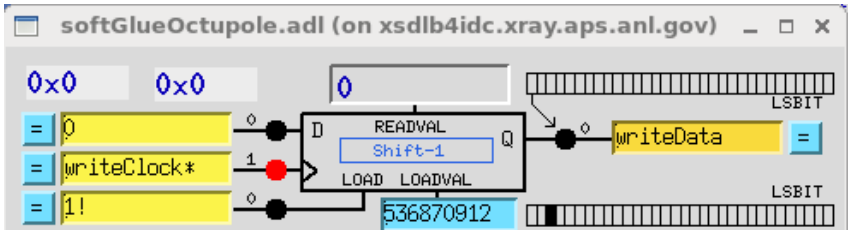
Additional circuit elements

- **Quadrature decoder**
  read encoder

- **Up/Dn Counter**
  count output signals from quadrature decoder

- **Shift register**
  bit stream I/O





- **Other circuit elements are possible. See Kurt Goetze.**

Example applications

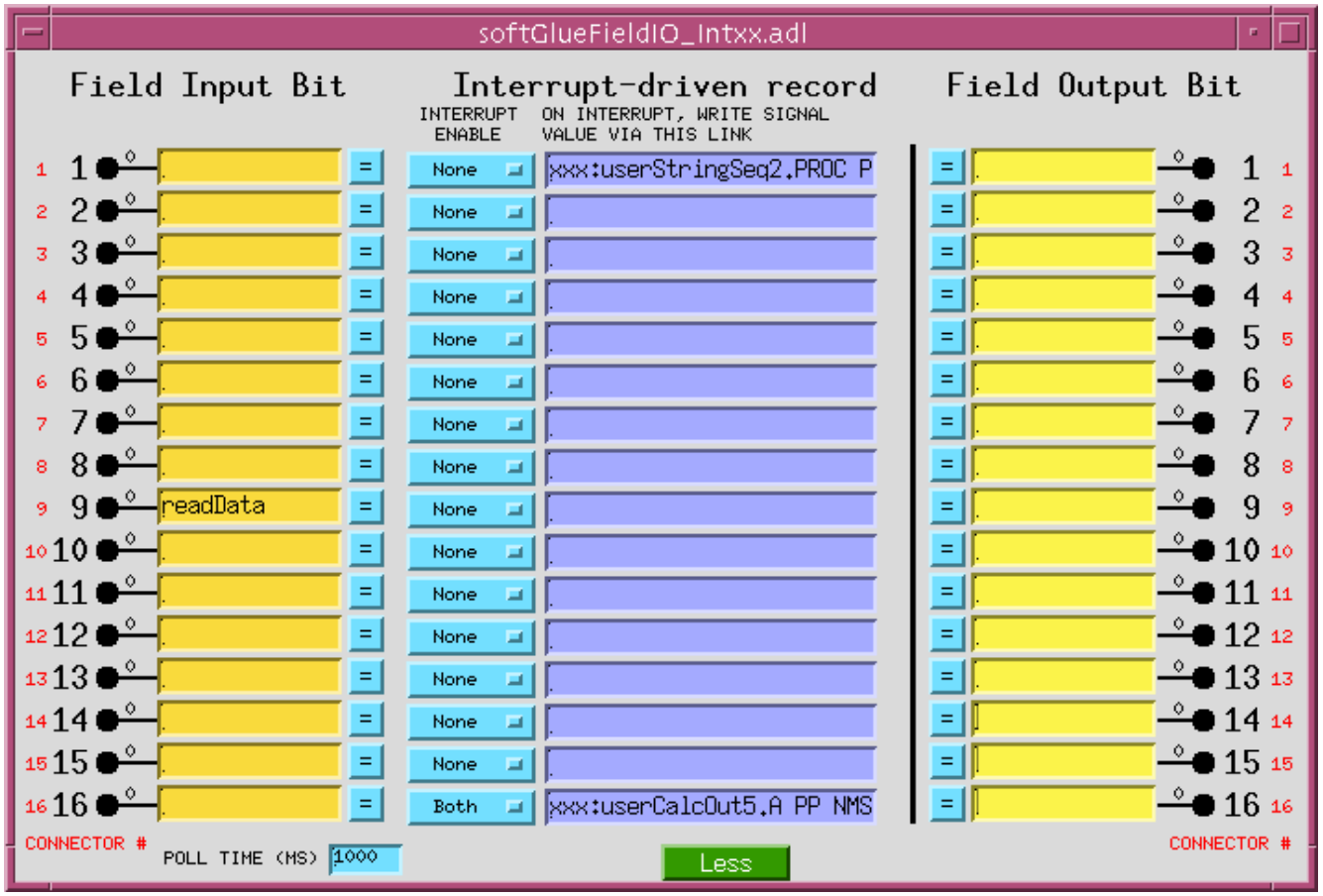
- With no user programming, softGlue is a digital I/O module.
- Trigger a detector after every N steps of a motor.
- Trigger a detector after every N[i] steps of an encoder.
- Gate a detector off during a motor's accel/decel time.
- Trigger a detector 23.7 ms after a shutter.
- Conditionally execute an EPICS record on the rising edge of an external signal.
- Implement an extraordinarily smart oscilloscope trigger.
- Cause an EPICS database to wait for 0.7 ms.
- Count encoder pulses.
- Convert encoder pulses to up/down pulses, for use with a multichannel scaler.
- Send/receive a bit stream from external hardware.
- Latch the value of an external signal.

Documented example circuits

- **https://subversion.xray.aps.anl.gov/admin_bcdaext/softGlue_examples**
  - Programmable pulse train
  - Gated scaler
  - Pulse burst
  - Delay generator
  - Motor accel/decel pulse gate
  - Debouncer
  - TTL Pulse Stretcher and Delay

Field I/O

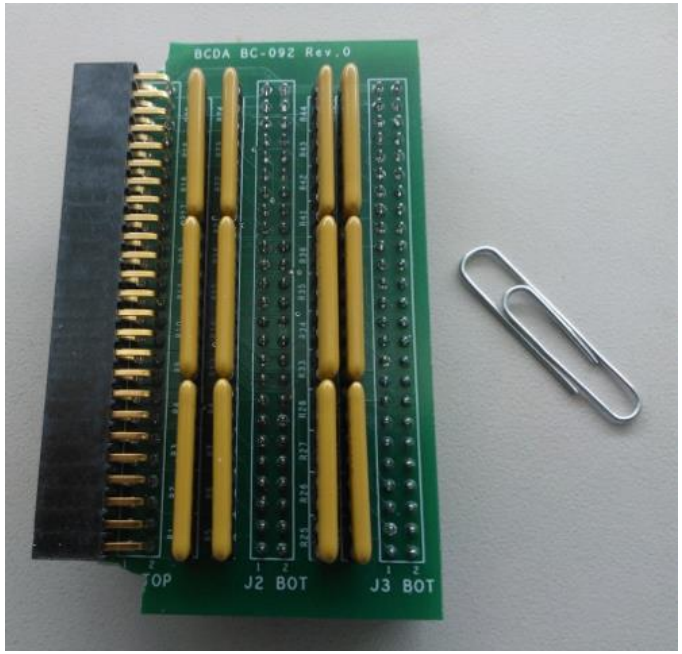
- Connected just as are circuit elements
- Interrupt can drive EPICS record on falling edge, rising edge, etc.



Field I/O cable termination

- **A: 100-Ohm series termination to ribbon cables**
- **B: 50-Ohm line driver for RG58/RG174 coaxial cables**

A



B