EPICS-Tcl
Status Report

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Outline

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EPICS-Tcl SIG

- **Group Charter**

  "To collaborate in the development of Tcl libraries and applications for use in the EPICS environment."

- **Email Exploder:**

  epics-tcl@csg.lbl.gov

  To join, email to **listserv@lbl.gov** with text:

  subscribe epics-tcl <your-email-address>

  Send the message "help" to learn more about this mail server.

- **FTP:**

  ftp://csg.lbl.gov/pub/Epics-tcl

- **WWW:**

  Not implemented yet, but will be available soon at:

  www://csg.lbl.gov/csg.html

  Other EPICS web servers will point here as well.

- **EPICS Distribution**

  To be part of "contributed" code.

  Libraries (Command extensions, C-APIs, tcl proc's)

  Applications (eg. arr archiver, GUI builders, database tools)

Other Tcl Resources

- **Reference Book**

  "Tcl and the Tk Toolkit", John Ousterhout, Addison Wesley, 1994.

- **News Group**

  Comp.lang.tcl

- **FTP Sites**

  ftp://harbor.ecn.purdue.edu:/pub/tcl/

  ftp://ftp.cs.berkeley.edu:/pub/tcl

- **WWW Sites**

  http://www.sco.com/IXI/of_interest/tcl/Tcl.html

  http://web.cs.ualberta.ca/~wade/Auto/Tcl.html

  http://http2.brunel.ac.uk:8080/TCL2/TCL2.html

Overview of Tcl & Tk Toolkit

Tcl Architecture

- Scripting language
- Extendible
- Embeddable
- Rapid Development
- Good Glue

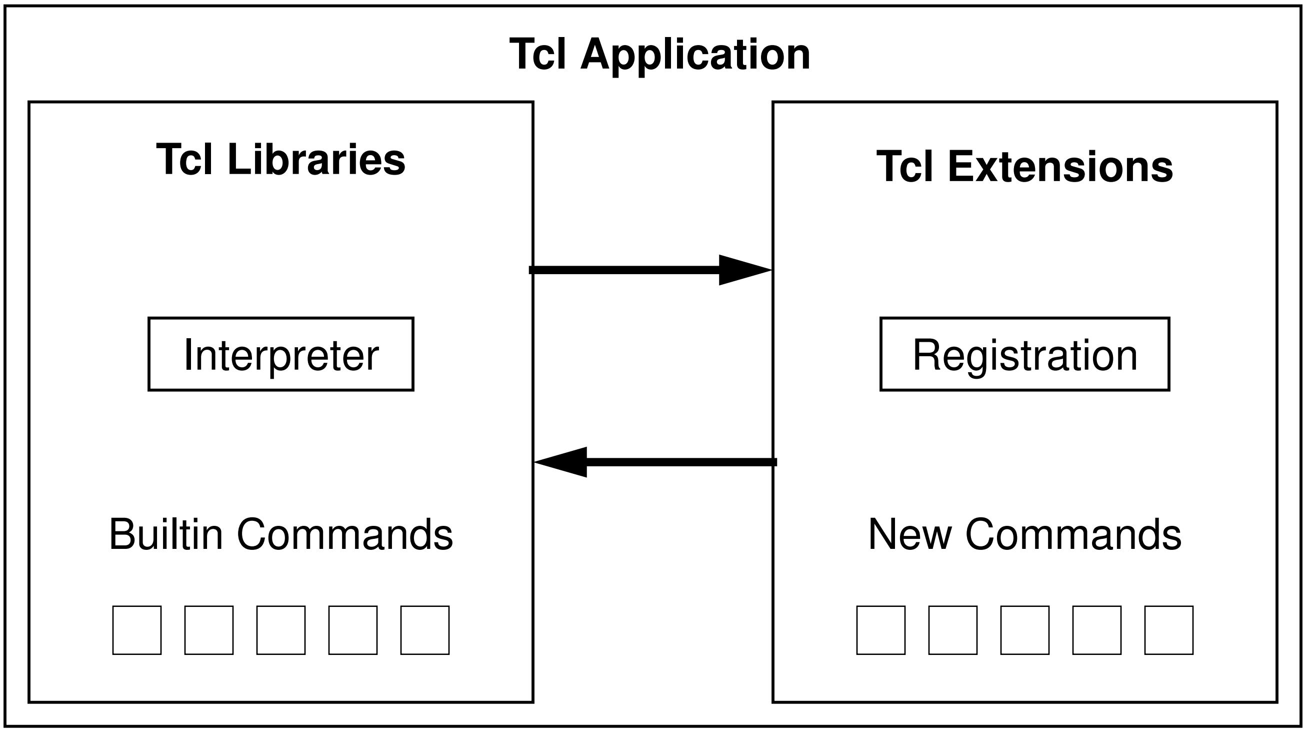
Tk Toolkit Architecture

- Tcl GUI toolkit
- Policy vs Mechanism
- Widgets
- Event Binding

Pros & Cons

- Pros
- Cons

Tcl Architecture



- **Scripting language**

  For controlling and extending applications

- **Extendible**

  New commands in C; with Command Registration

- **Embeddable**

  C language API to Tcl interpreter

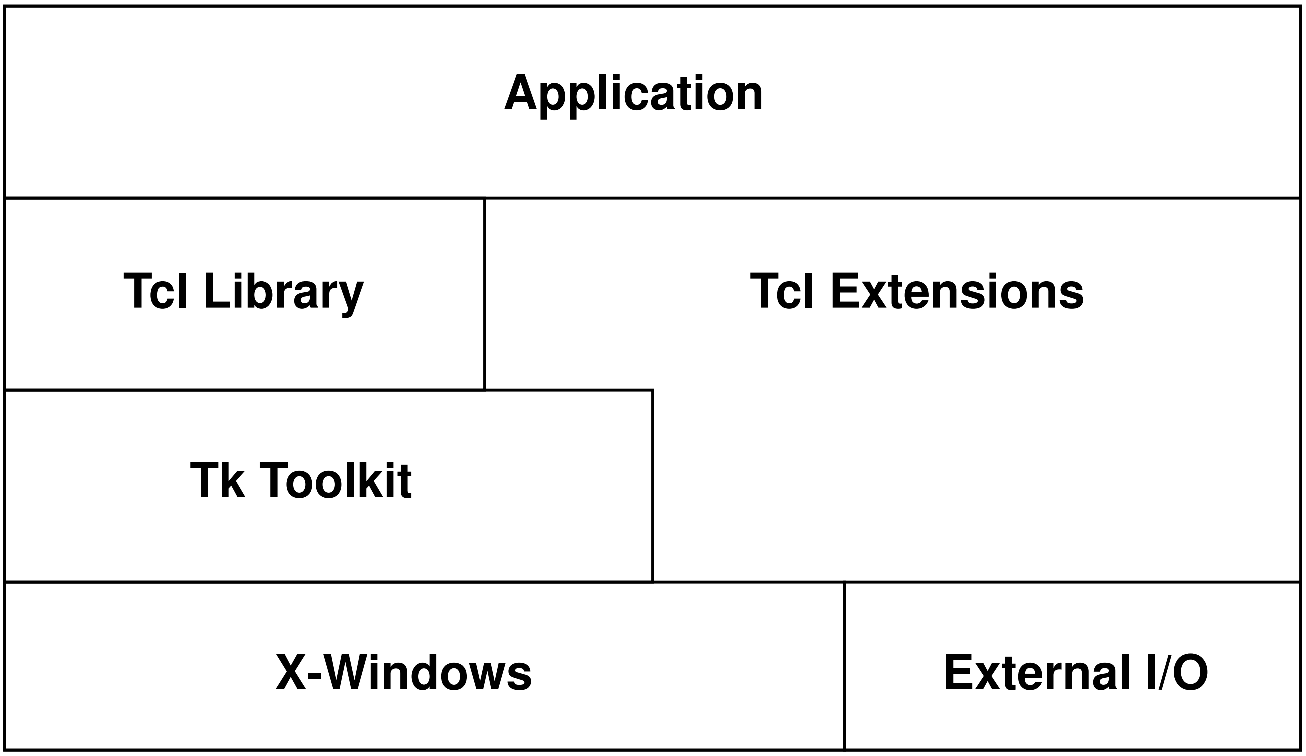
- **Rapid Development**

  tclsh & wish interactive shells

- **Good Glue**

  Strings as first-class objects

Tk Toolkit Architecture



- **Tcl GUI toolkit**

  "Tk is a toolkit that allows you to create GUIs for the X11 window system by writing Tcl scripts."

- **Policy vs Mechanism**

  Tcl Scripts = Policy

  Tk Widgets = Mechanism

- **Widgets**

  Implement the Motif™ look-and-feel.

- **Event Binding**

  Tcl subscripts can be bound to asynchronous events.

Tcl Pros & Cons

Pros:

-- Best for loosely-coupled, interactive systems.

-- Embed Tcl scripts in other GUIs (eg. DM/MEDM).

-- Control mixed systems with Tk GUI.

-- Good tool for interactive GUIS.

-- Very nice development environment.

Cons:

-- Worst for tightly-coupled, feedback systems.

-- Tcl interpreter slow for math intensive scripts.

-- Slow for iterative feedback loops.

-- Bad real-time performance at interpreter level.

External I/O

I/O Streams

- gets and puts on any file descriptor.

Data Transmission

- Via interpreter

  Tcl_Eval()

- Indirect

  Tcl_GetVar(), Tcl_SetVar()

- Direct

  Tcl_LinkVar(), BLT_GraphElement()

Event Handlers

- X events

  Tk_CreateEventHandler()

- File I/O events

  Tk_CreateFileHandler()

- Timer events

  Tk_CreateTimerHandler()

- Variable change events

  Tcl_TraceVar()

EPICS-Tcl Status, Extensions

ANL

- **pv - Second generation channel access interface**

  -- Supports connection management, tcl lists, and synch/async.

  -- Author: Bob Daly (rtd@aps.anl.gov)
  Available: November 1994.

pv link <tcl_list> <pv_list>	#Connection management
pv get <tcl_list>	#Asynchronous Get
pv getw <tcl_list>	#Synchronous Get
pv put <tcl_list>	#Asynchronous Put
pv putw <tcl_list>	#Synchronous Put
pv mon <tcl_list>	#Monitor list
pv info <parameter>	#Service information

EPICS-Tcl Status, Extensions (Cont.)

CEBAF

- **epics - First generation channel access interface**
  - -- Cached pv channels, event loop within Tcl interpreter.
  - -- Author: Johannes van Zeijts (johannes@cebaf9.cebaf.gov)
    Available: Now.

epics update	#ca_pend_event()
epics get <pv_name>	#synchronous get
epics getcallback <pv_name>	#asynchronous get
epics put <pv_name> <value>	#synchronous put
epics addlist <pv_list>	#monitor list

EPICS-Tcl Status, Extensions (Cont.)

CEBAF

- **Dimad - Interface to 'dimad' optics modelling library.**

  -- Spawns dimad as separate process and communicate via bidirectional pipe.

  -- Author: Johannes van Zeijts (johannes@cebaf9.cebaf.gov)
  Available: Now.

  Code details not available at this time.

- **Matrix - interface to Matrix handling library**

  Author: Johannes van Zeijts (johannes@cebaf9.cebaf.gov)
  Available: Now.

  Details not avalable, sample code follows:

```
Matrix2Octave p$n
OctaveDiff p$i p$j p${i}TOp$j
OctaveMatrix $list
OctaveSVD list U W V
OctaveSVDsub U W V error delta
```

EPICS-Tcl Status, Extensions (Cont.)

LANL

- **arr - Archive file interface**

  Author: Carl Timmer (timmer@atdiv.lanl.gov)
  Available: Oct 94.

  No code details available.

LBL

- **sca - synchronous channel access interface**

  Author: Carl Cork (CWCork@LBL.GOV)
  Available: Now.

scaget <pv_name>	#synchronous get
scaput <pv_name> <value>	#synchronous put

- **bl - misc. extensions to support CA interface to graphs.**

  Author: Rolf Behrsing (rolf@csg.lbl.gov)
  Available: Now.

bl_pv_init <params>	#initialize data channels
bl_timer_cmd <interval>	#initiate timer callbacks #update graph elements
bl_toggle_axis	#toggle auto scaling
bl_get	#return x&y pair
bl_getA	#return x&y array , #plus graph update.

EPICS-Tcl Status, Applications

ANL

- **MEDM wrapper to Tcl interpreter**

  -- Author: Claude Saunders (saunders@aps.anl.gov)

  widget1 - invoke argument-free tcl procedure

  widget2 - Dialog box for interactive argument specification

  widget3 - Submenu

  High level menu is put on an MEDM script button called OPERATIONS.

- **APS RF cavity conditioner**

  -- Author: Bob Daly (rtd@aps.anl.gov)

  Replace MEDM & Mathematica application which required dummy IOC database variables for interactive control.

EPICS-Tcl Status, Applications (Cont.)

CEBAF

- **Linac Energy Management**

  -- Author: Johannes van Zeijts (johannes@cebaf9.cebaf.gov)

  Set RF gradient profile in the Linac by scaling the requested energy versus the total available accelerating gradient. Displays live updating bars of the set and measured RF gradient profile, the Energy profile and the Quadrupole excitation profile.

- **Orbit/Energy Lock/Correction**

  -- Author: Johannes van Zeijts (johannes@cebaf9.cebaf.gov)

  Lock the orbit and energy at a slow rate (~every 2 seconds). Interactive control of BPMs, corrector magnets, and RF cavities.

- **Online Modelling and Simulation**

  -- Author: Johannes van Zeijts (johannes@cebaf9.cebaf.gov)

  Encapsulate ‘Dimad’ optics code as a subprocess of the ‘wish’ shell. Use bidirectional pipes for communication. Use transfer matrices to update matrices for other applications.

EPICS-Tcl Status, Applications (Cont.)

CEBAF

- **Autophasing**

  -- Author: Johannes van Zeijts (johannes@cebaf9.cebaf.gov)

  New interface to existing ‘three point’ phasing procedure.

- **Data Graphing and Analysis**

  -- Author: Johannes van Zeijts (johannes@cebaf9.cebaf.gov)

  Display time trace of any control system signal. Supports zooming and strip charting. Also supports links to ‘Numerical Recipes’ extensions for calculation of spectra for selected range of data and for correlations for two data ranges.

- **BPM Spike Charts**

  -- Author: Johannes van Zeijts (johannes@cebaf9.cebaf.gov)

  Set RF gradient profile in the Linac by scaling the requested energy versus the total available accelerating gradient. Displays live updating bars of the set and measured RF gradient profile, the Energy profile and the Quadrupole excitation profile.

EPICS-Tcl Status, Applications (Cont.)

LANL

- **arr - Archive Retrieval Tool**

  -- Author: Carl Timmer (timmer@luke.ATdiv.Lanl.GOV)

  Supports a number of capabilities:

  1. selection of binary and ascii archive files with wildcard file listing
  2. help window for each top level arr window
  3. one-step selection of process variables with wildcard viewing
  4. data retrieving options
  5. one-button loading of data
  6. textual viewing of timestamps, data, and status codes
  7. plotting of numerical data with any number of graphs
  8. fully configurable graph parameters
  9. color postscript output to files and/or printers of graphs and text

- **Loss Monitor for LANSCE Controls System**

  -- Author: Gary P. Carr (carr@aotv2.atdiv.lanl.gov)

  Convert existing non-Tcl program into color coded bar graph of activation protection system for beamline status.

  Plans to use BLT barchart widget, and CEBAF tcl_ca channel access extensions.

EPICS-Tcl Status, Applications (Cont.)

LBL

- **blplot - Beamline scan control**

  -- Author: Rolf Behrsing (rolf@csg.lbl.gov) &
  Alan Robb (ARobb@lbl.gov)

  Scan control and plot routine for ALS beamline 7.0.1. Uses simple channel access to acquire array data for plotting.

  Supports:

  1. dynamic selection of pv channels for plotting
  2. user definable menu configuration
  3. one button toggle for fixed and automatic scaling
  4. postscript output of graph
  5. rubber band zooming
  6. datapoint data retrieval
  7. cursor position (scaled) relative to selected datapoint

  Planned:

  1. zoom window print feature
  2. two plot overlay
  3. file system save and restore of graph array

Future Plans

Proposed Development Mechanism

- REQ/RFP: Solicitations on the net
- SPEC: Review on the net
- CODE: Volunteers, Review via email

Proposed Extensions

- Choose baseline extensions: BLT, incrTcl, Tcl-DP
- pv_tcl - standard interface to EPICS process variables
- dev_tcl - standard interface to EPICS devices

Proposed Applications

- Choose baseline applications: XF?
- E-Designer - EPICS GUI screen builder (based on XF?)
- DB-Builder - Database builder utility (interface to RDB?)