



Testing the limits – tcl/tk in power plant simulation

Talk and online simulator presentation

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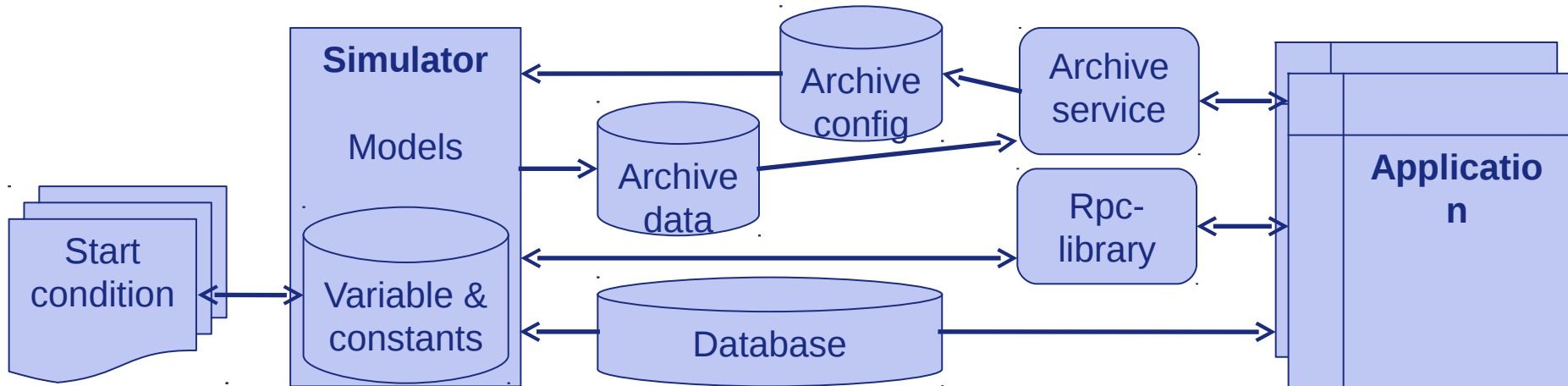
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Common simulator hard- and software

- Hardware development
 - Mainframe computers >100.000 \$
 - p.e. http://www.ensemble-support.com/htmls/32_87.htm
 - Specialised multi-processor workstation with disk arrays
 - p.e. Sun Fire Serie ~40.000 \$
 - Fast PC's <10.000 \$
 - Dell, HP
 - Laptop ~1.000 \$
 - Used in presentation
- Software
 - Core model (Fortran)
 - Process and control models (Flex, Fortran, C, C++)
 - Non-modelling (C, C++)
 - GUI (Motif, Tk, C++, Qt, Java)



Simulator structure



Overall simulation data:

- 1.500.000 variables and constants
- 70.000 malfunction, remote function, panel override, generic malfunctions
- 7.000 process and control drawings
- 18.000 panel io's
- 3.000 archive variables
- 4900 process computer variables
- Cycle time 250 ms, some control modules up to 100 ms
- Fast mode factor up to 5

Used development platform

- Mingw/msys to build kkgkit with:
 - kbs0.4.8, tcl/tk8.6.5, sqlite3.11.0, tablelist5.15, rbc0.1, tkpath0.3.3, pdf4tcl0.8.2
- Modifications
 - Rbc: more default ticks, bindings
 - Tkpath: version from android.org
<https://sourceforge.net/projects/kbskit/files/kbs/0.4.8/tkpath033.tgz>
 - Pdf4tcl: version from android.org (oo instead of snit)
<https://sourceforge.net/projects/kbskit/files/kbs/0.4.8/pdf4tcl082.tgz>
 - Tk: progressbar with text (TIP #442)
- Icons
 - <http://www.famfamfam.com/lab/icons/silk/> from Mark James
 - <http://p.yusukekamiyamane.com/> from Yusuke Kamiyamane
- Internal binary extension build with VisualStudio
 - C and tcl interface to rpc calls
 - Windows service to access archive functionality

Common script functions

- Shortcuts: @→image ?→msgcat::mc !→logging
- `zz::class: cget ,configure, options, component, private variables`
<http://wiki.tcl.tk/38916>
- `ztk::grid: scrollbars, tooltip, row/columnconfigure as -c* and -r* options`
`::ztk::grid 1 1 -cweight 1 -rweight 1 -sticky news\
 -sb ase -tip "text" -tipimage [@ icons/question.png\
 -statevar kkg,start ::canvas .c ...`
- `ztk::msgcat: extract messages ([? {...} ?arg1? ..])`, easy editing
- `ztk::tip: tooltips with images`
- `ztk::shell: configurable dialog widget`
- `ztk::fileopen, ztk::filesave, ztk::filedir: handling of file extensions and initialdir setting`
- `ztk::state: normal/disabled state handling`
- Create menu and menubar entries from data dictionary

Archive functionality

- Use of sqlite as database
- Simulator archive library
 - Archive in wal-mode with up to 3000 variables in 50 ms loop (only changes)
 - One table for variable information
 - One table for each used variable:

```
create table if not exists data%d(  
  data_x integer primary key asc,  
  data_y real)
```
 - Read only access of configuration database
 - Apply configuration changes only in freeze mode
 - Drop table when <50000 row, otherwise rename and schedule for drop
- Windows archive service
 - Configuration database in wal-mode written by windows service
 - Read only access of archive database to get variable values
- ~ 400 MB/hour for transients/tests
- Databases > 2GB with delay on curve display









Applications (old)

The collage displays several software applications:

- Configuration Management System:** A central window with a blue header, containing a search bar and a list of items.
- Database Manager Version 3.3.2:** A window titled "Verwaltung des Datenbanksystems" with a table of data.
- Spreadsheet:** A window with a grid of data, likely for reporting or analysis.
- System Information:** A window showing system details like "Systembeschreibung" and "Systemeigenschaften".
- Event Log:** A window displaying a list of system events.
- Configuration Tables:** Several windows showing tables of configuration parameters and their values.
- Control Panels:** Various windows with buttons and checkboxes for system control.

Applications (new)

-  Instructor station
 - 70000 interventions in tablelist
-  Curve display
 - 50 online variables used in tests
-  Control and process drawing display
 - ebpd01 with 25000 elements & 1000 variables
-  Softpanel
 - LA panel with 12000 elements, 2500 DO, 400 AO
-  Core data display
 - 1200 AO
-  Numeric display
- Test tools

Demonstration

- Load 20 → Run → Intervention (70000)
- → Curve display (main values)
- → Drawing display (EB)
- → Panel (Resa)
- → Core (neutron flux, power distribution)
- Tests
 - Trip main cooling water pump: ssasba vc10d001
 - Trip main cooling pump: ssasba yd20d001
 - Loss of grid connection, self sustained isolated operation: ac03a
 - TUSA: Button LA05
 - RESA: Button LA05
 - Loss of on-site power, start diesel generator: bt02a

Conclusions

- Hidden goodies of tk: vector, graph, tkpath
- Pdf output is easy and great for printing
- Use C-extensions for fast and tcl for compact code
- Rapid development (<2 man year of these project, 30.000 loc in tcl)
- Wish list
 - Include vector, graph and tkpath in tk
 - Easier modification of tk widgets (cget,configure,functions,megawidget?)
 - X11→svg,sdl,...?
 - -svg option instead of –image (4k displays)
 - Localization (error code → message)

Questions?