



Tracing and Monitoring Framework

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François Chouinard
Ericsson Canada



Summary

- Background
- Project Scope
- Framework Overview
- Framework Structure
- Exemplary Tool Integration (LTTng)
- Screenshots
- Demo



Background

- **Open-Source IDE initiative**
 - Full-fledged, C/C++ development environment
 - State-of-the-art tool suite
 - Open-source
 - Eclipse integration

- **Tracing and Monitoring component**
 - Facilitate the integration of tracing tools
 - Provide out-of-the-box “common” functionalities
 - Hosted by Eclipse Technology / Linux Tools



Project Scope

- **Extendable support for:**
 - Tools discovery
 - Tools control
 - Trace/data retrieval and storage
 - Trace/data visualization
 - Analysis/correlation/comparison/... modules integration

- **Additional features:**
 - Local and remote tools
 - Live and concurrent trace streams
 - Asynchronous events
 - Traces/logs that exceed available memory
 - External, host-based, libraries and analysis tools
 - Custom trace/log parsers



Tool Discovery

- Purpose
 - Identify the available trace providers and their capabilities
 - This information is used to generically control the tools

- Features
 - Discovery of available log providers
 - Discovery of log provider capabilities
 - Integration scheme for existing monitoring tools
 - Support for local and remote tools



Tool Control

- Purpose
 - Control the tool operation
 - Manage the resources allocated to tracing

- Features
 - Basic tool control (conf/start/stop/pause/resume/...)
 - Generic trace triggering, filtering
 - Tracing rate regulation (throttling)
 - ❖ To avoid congestion on the target, host, transport link, ...
 - Budget policy (per trace, trace type, ...)
 - ❖ To constrain target resource usage (CPU, memory, bandwidth)
 - Control settings persistence



Data Retrieval and Storage

- Purpose
 - Collect and store tracing/monitoring data
 - Generic trace/log data interface (for the analysis tools)

- Features
 - Collect monitoring data from the tool
 - ❖ File transfer
 - ❖ Continuous stream
 - ❖ Multiple, heterogeneous streams
 - Provide a generic log file interface
 - ❖ Support for log-specific parsers
 - ❖ Support for sequential, random access, checkpoints, DB, ...
 - ❖ Support for large files (bigger than available memory)



Data Visualization

- Purpose
 - Provide a set of standard data visualization tools
 - Toolbox of widgets (trace agnostic)

- Features
 - Provide generic monitoring views
 - ❖ Event logs (raw, tabular)
 - ❖ Time Line, Sequence Diagram, Logic Analyser, Gantt Chart
 - ❖ CPU/Memory/Heap/Network usage
 - ❖ Search filters, pattern matching, saved search queries, ...
 - Provide generic graphical widgets
 - ❖ Charts, Histograms, ...
 - Extendable for application-specific contents

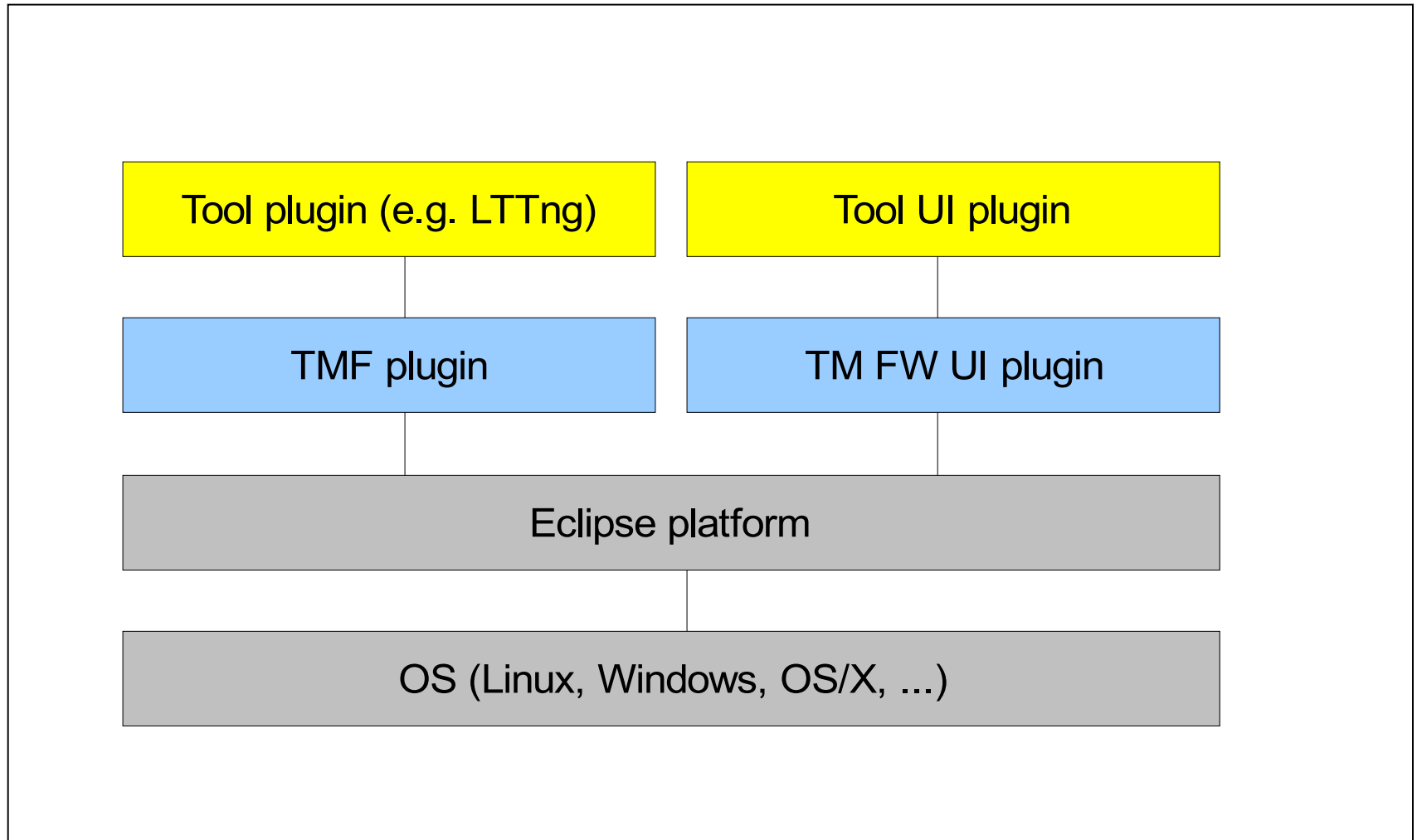


Analysis Tools Integration

- Purpose
 - Provide basic analysis functions
 - Support host-based, external analysis tools and libraries

- Features
 - Log comparison (regression testing, health monitoring, performance analysis,...)
 - Causal dependency analysis
 - ❖ Event Dependency Tree
 - ❖ Critical Path
 - ❖ Correlation of event data
 - ❖ Reconstruction of event sequences from related traces
 - ❖ Execution replay
 - External tools integration
 - ❖ Scheme to access the tracing data generically
 - ❖ Scheme to send the analysis results to UI views/widgets

Framework Structure



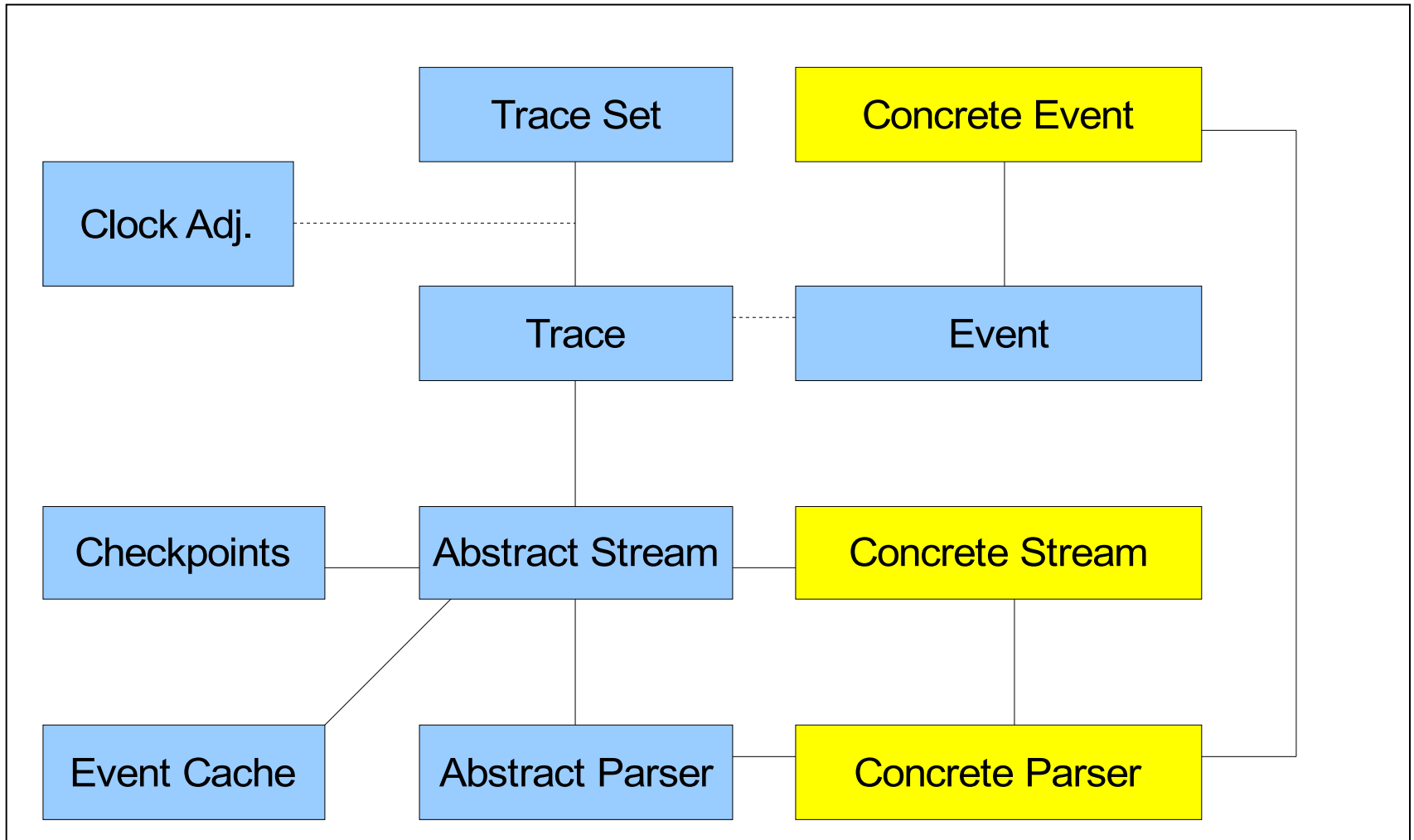


Framework Structure

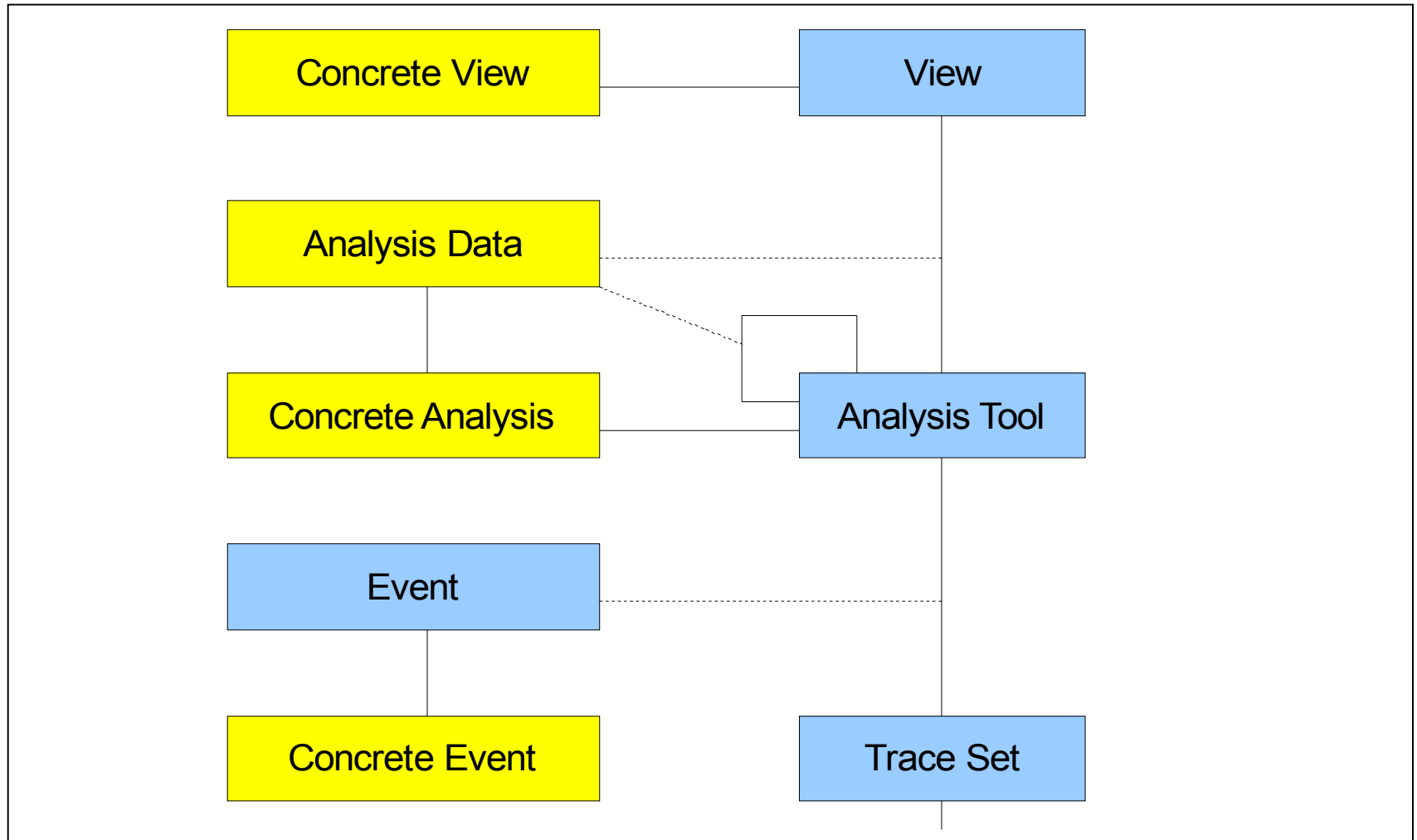
- Key Concept: The Event
 - Basic Event
 - ❖ Timestamp
 - ❖ Source
 - ❖ Type (→ format)
 - ❖ Content (→ fields)
 - Extended for application-specific events
 - Possibility to handle derived/synthetic events

- Benefit:
 - Allows the handling of events using the framework generic components and APIs

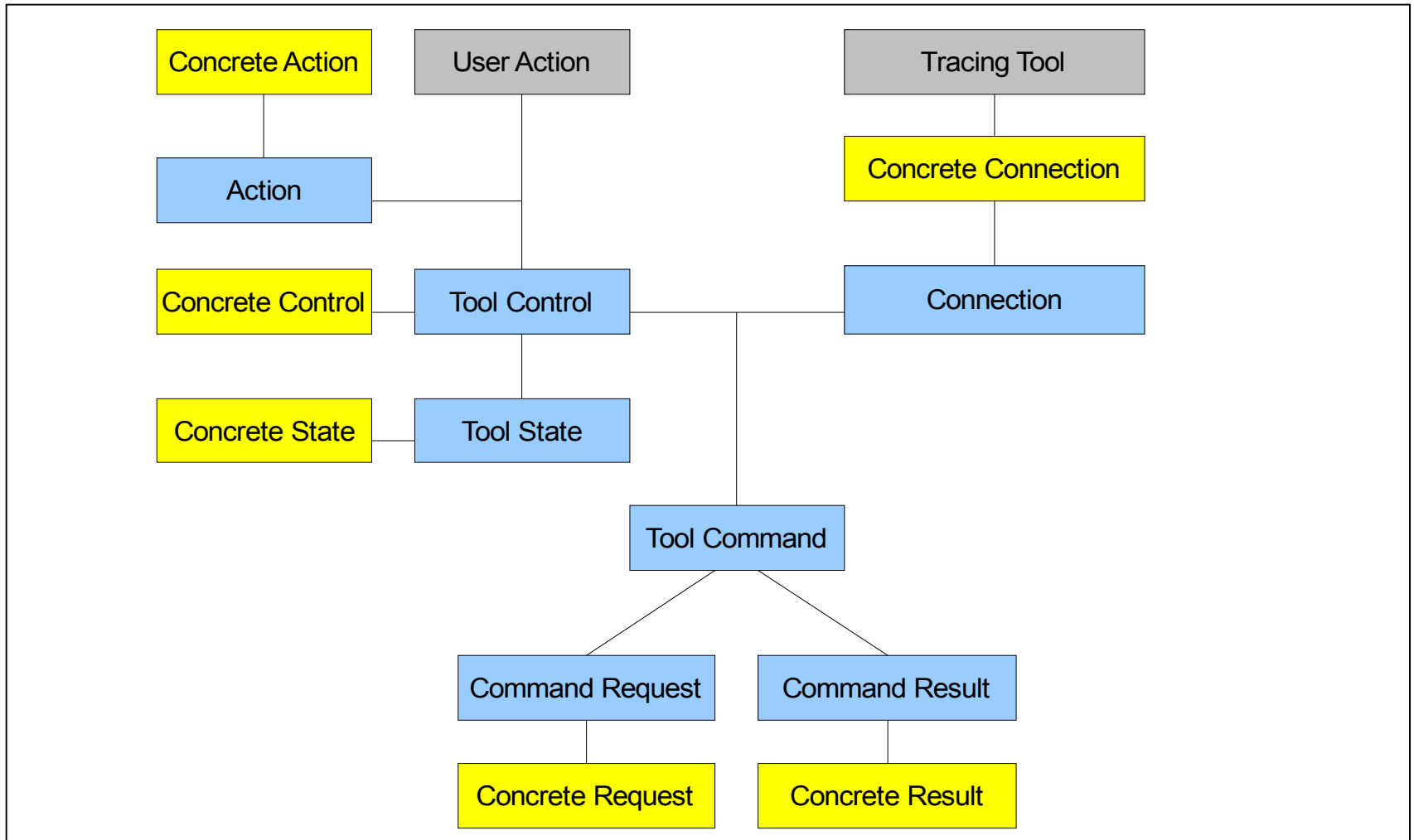
Framework Structure



Framework Structure



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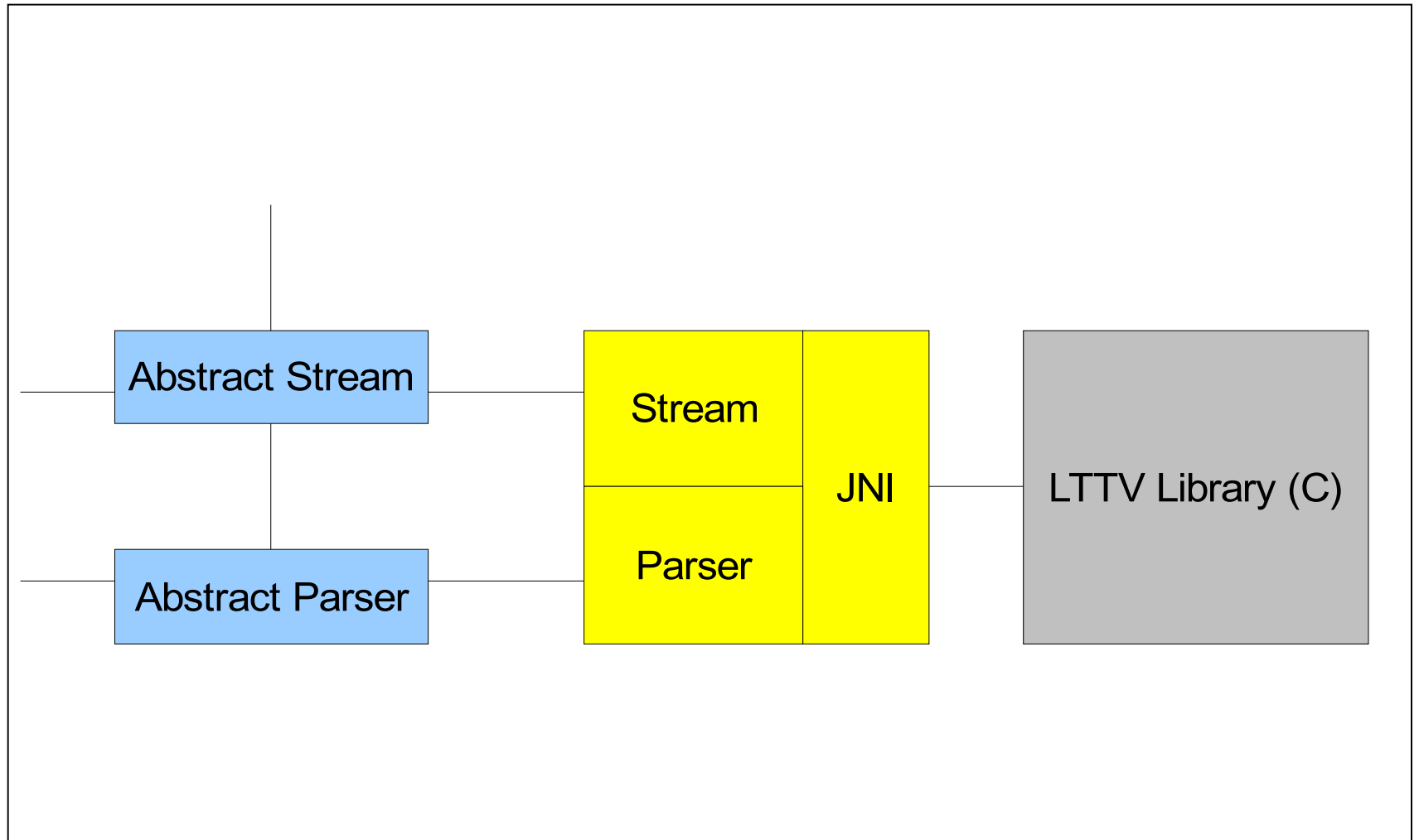




LTTng Integration

- LTTng Perspective
 - Project View
 - Control View
 - Time Frame View
 - Statistics View
 - Events Table View
 - Control Flow View
 - Resources View
 - Histogram View
- LTTng Control (remote and local)
 - Probe configuration
 - Start, stop, pause, resume
 - Trace retrieval
- Framework Models
 - Event Model
 - Event Log (Trace) Model
 - Request Model
 - View Model
 - Control Model
- Framework Components
 - Generic Events Table View
 - Widgets Toolbox
 - Support for very large trace files
 - Support for non-java parsers
 - Support for analysis components

External Library Integration



Screenshots: LTTV



Linux Trace Toolkit Viewer

File View Tools Plugins Help

Traceset

- events
 - mode_types
 - IRQ
 - submodes
 - events
 - mode_types
 - SOFTIRQ

Statistic for 'events':

```

irq_entry : 2021
timer_update_time : 1546
softirq_raise : 1925
sched_try_wakeup : 433
irq_exit : 276
send_signal : 278
    
```

Resource

- Trace 0
 - CPU0
 - IRQ 14 [irq 14]
 - IRQ 239 [irq 239]
 - SOFTIRQ 1
 - SOFTIRQ 4

Process

Process	Brand	PID	TGID	PPID	CPU	Birth sec	Birth nsec	TRACE
/usr/lib/policykit/polkit-read-auth-helper		8998	0	0	0	0	0	0
/usr/lib/ConsoleKit/run-session.d/pam-foreground-compat.ck		9014	0	0	0	0	0	0
/usr/lib/ConsoleKit/run-session.d/pam-foreground-compat.ck		9016	9016	9015	0	701	983583955	0
/usr/lib/policykit/polkit-read-auth-helper		9017	9017	9016	0	701	986381700	0
/usr/lib/ConsoleKit/run-session.d/pam-foreground-compat.ck		9018	9018	9016	0	702	75149132	0

Trace

Trace	Tracefile	CPUID	Event	Time (s)	Time (ns)	PID	Event Description
/home/francois/LTTng/trace1	mm	0	page_alloc	701	945582706	9014	mm.page_alloc: 701.945582706 (/home/francois/LTTng/trace1/mm_0), 9014, 0, /usr/bin/cut, , 0, 0x0, MOD
/home/francois/LTTng/trace1	mm	0	page_alloc	701	945586772	9014	mm.page_alloc: 701.945586772 (/home/francois/LTTng/trace1/mm_0), 9014, 0, /usr/bin/cut, , 0, 0x0, MOD
/home/francois/LTTng/trace1	mm	0	page_alloc	701	946188403	9014	mm.page_alloc: 701.946188403 (/home/francois/LTTng/trace1/mm_0), 9014, 0, /usr/bin/cut, , 0, 0x0, MOD
/home/francois/LTTng/trace1	mm	0	page_alloc	701	946318257	9014	mm.page_alloc: 701.946318257 (/home/francois/LTTng/trace1/mm_0), 9014, 0, /usr/bin/cut, , 0, 0x0, MOD
/home/francois/LTTng/trace1	mm	0	page_alloc	701	946321786	9014	mm.page_alloc: 701.946321786 (/home/francois/LTTng/trace1/mm_0), 9014, 0, /usr/bin/cut, , 0, 0x0, MOD
/home/francois/LTTng/trace1	mm	0	page_free	701	946712081	9014	mm.page_free: 701.946712081 (/home/francois/LTTng/trace1/mm_0), 9014, 0, /usr/bin/cut, , 0, 0x0, MOD

Time Frame start: 701 s 631306766 ns end: 702 s 631306766 ns Time Interval: 1 s 0 ns Current Time: 701 s 945032256 ns

Screenshots: LTTng Perspective



The screenshot displays the LTTng Eclipse Platform interface. The main window is titled "LTTng - Eclipse Platform" and features a menu bar (File, Edit, Navigate, Search, Project, Run, Window, Help) and a toolbar. The interface is divided into several panes:

- Project Explorer:** Shows a tree view of the project structure, including "MyLTTngProject" with sub-items like "Traces", "test", "trace1", "trace6", "Tracesets", and "MyOtherLTTngProject".
- Control Flow View:** The central pane displays a timeline of events. The x-axis represents time, with markers at 0:000:000:500, 0:000:001:000, 0:000:001:500, and 0:000:002:000. The y-axis lists processes from Source-0 to Source-10. A tooltip is visible over the "Source-6" process, showing details such as "Process Name: Source-6", "Class Name", "State: Type-3", "Test Tip2: Test Value tip2", "Test Tip1: Test Value tip1", "Start Time: 00:00:000.001.261", and "Duration: 00:00:000.000.091".
- Events View:** A table below the timeline lists individual events with columns for Timestamp, Source, Type, Reference, and Content. The content column shows kernel events like "kernel/0/printk", "kernel/0/vprintk", "kernel/0/irq_entry", "kernel/0/timer_update_time", "kernel/0/softirq_raise", "kernel/0/sched_try_wakeup", and "kernel/0/sched_try_wakeup".
- Time Frame View:** A pane at the bottom allows for filtering events by time. It includes fields for Start Time (952 sec 12140052 ns), End Time (960 sec 12140052 ns), Interval (8 sec 0 ns), and Current Time (952 sec 12140052 ns).

Demo!





References

- **Linux Tools Project**
<http://www.eclipse.org/linuxtools>
- **LTTng Integration**
<http://www.eclipse.org/linuxtools/projectPages/ltnng>
- **Linux Tracing Toolkit (LTTng)**
<http://ltnng.org>



Contacts

- ❖ François Chouinard (TM Framework, LTTng)
francois.chouinard@ericsson.com

- ❖ Dominique Toupin (Open-Source IDE)
dominique.toupin@ericsson.com

Questions?



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