



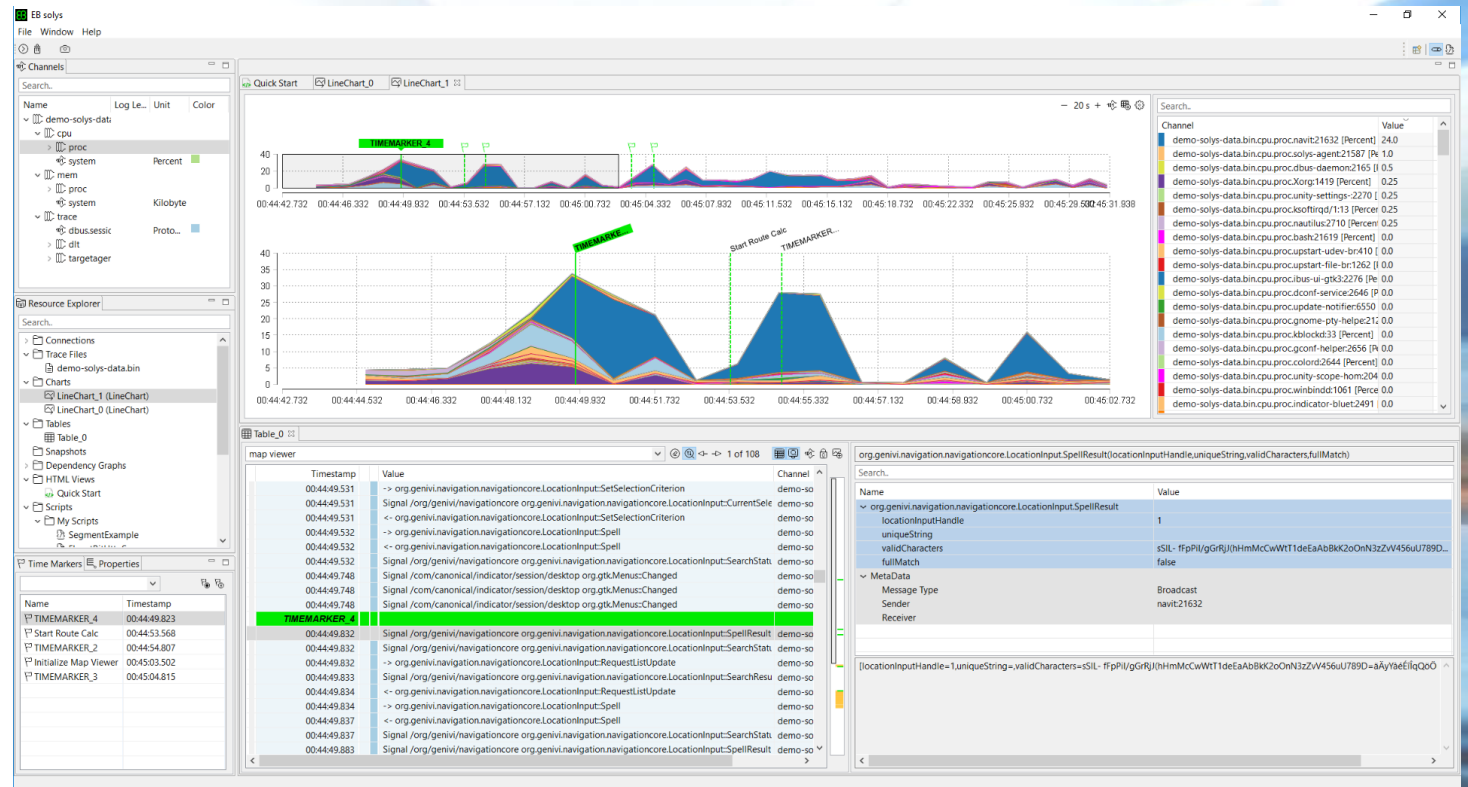
EB solys

Runtime analysis with DLT and beyond

Torsten Mosis, Software Architect, systemticks GmbH | 15th May 2019



Introduction



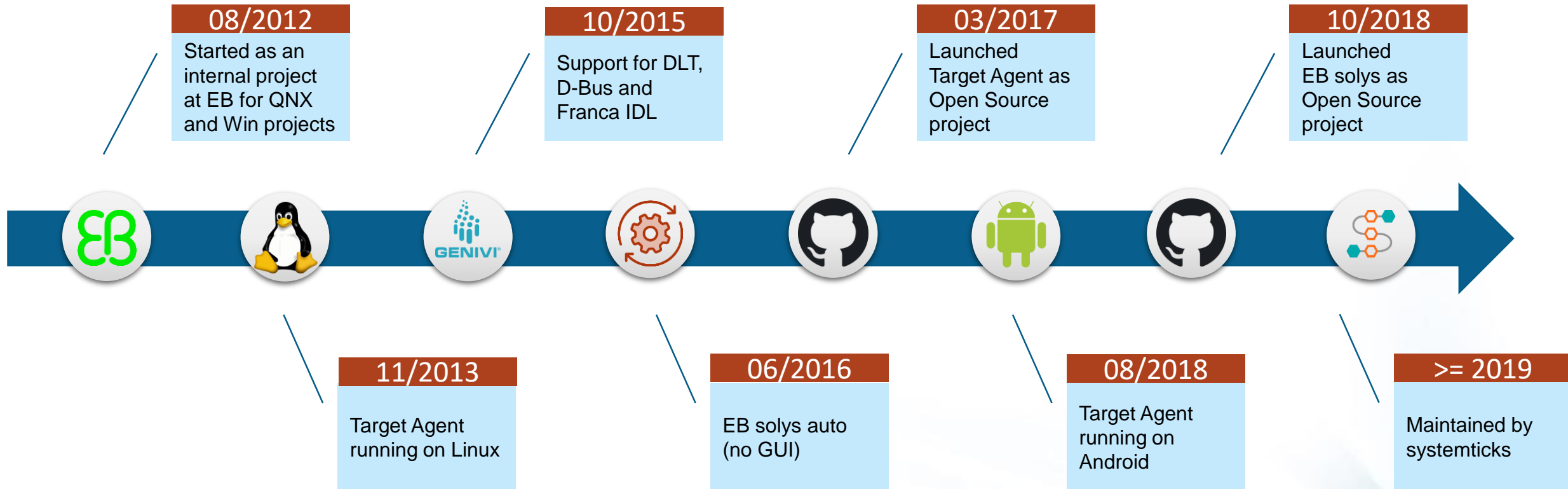
EB solys



- is a powerful **tool** or rather a **construction kit** for **runtime analysis** of **complex** software systems
- collects **multiple streams** of **events**, **logs**, and **tracing** information from **different sources**, **combines** them on a single timeline for **analysis** and **visualizes** the results
- has its roots in **automotive IVI**, but can be applied for **other domains**, such as IoT or consumer electronics
- has built-in support for a couple of **GENIVI** features, such as **Automotive DLT**, **D-Bus** and **Franca IDL**
- is based **on Eclipse RCP** and is running under **Windows**, **Linux** and **MacOS**
- is designed to be easy **extensible** and **customizable**
- is an **open source** project since October 2018, under EPL 2.0 and is **maintained** by **systemticks**



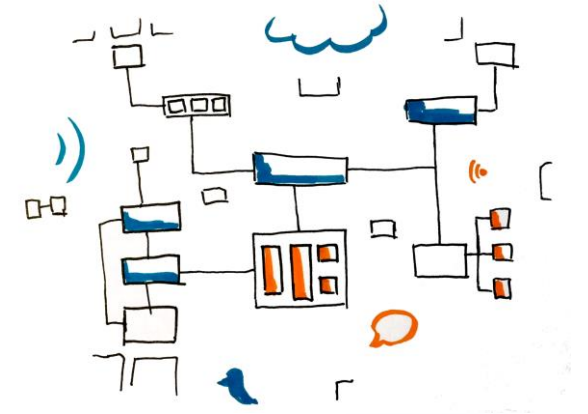
Brief History



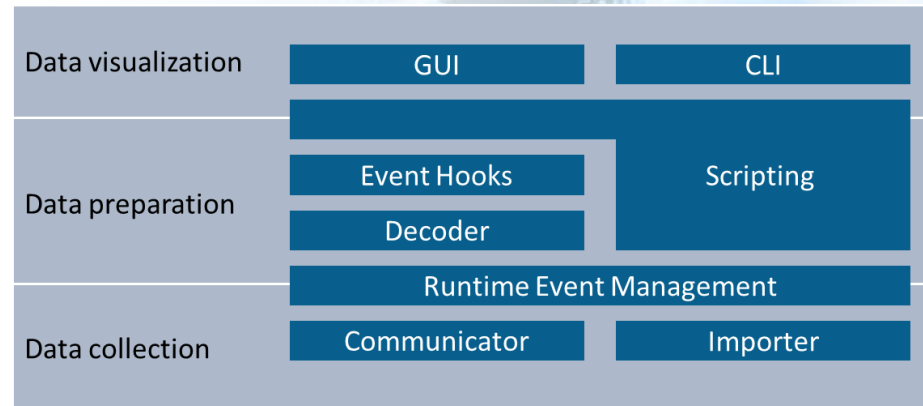
Objective

- Gain a **greater insight** into the **operational activity** of **complex software systems**
- Enable the development team creating a **joint system understanding**
- **Localize** and **isolate** errors **faster** and with significant **less workforce** than usual

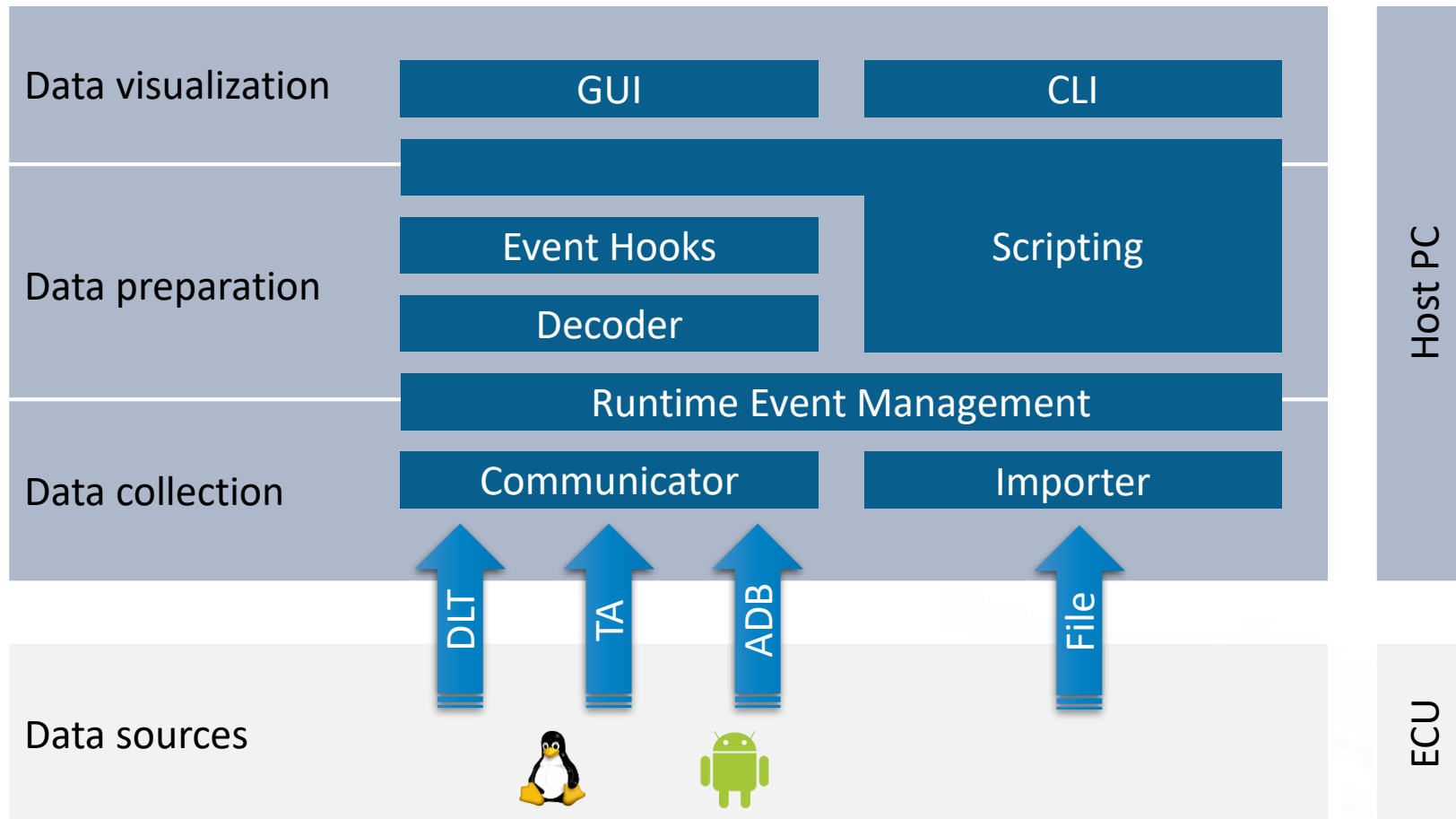
Provide a **toolchain** with the focus on gathering **valuable runtime data** from **different sources** and setting them **in relation to each other**



Architecture



Architecture

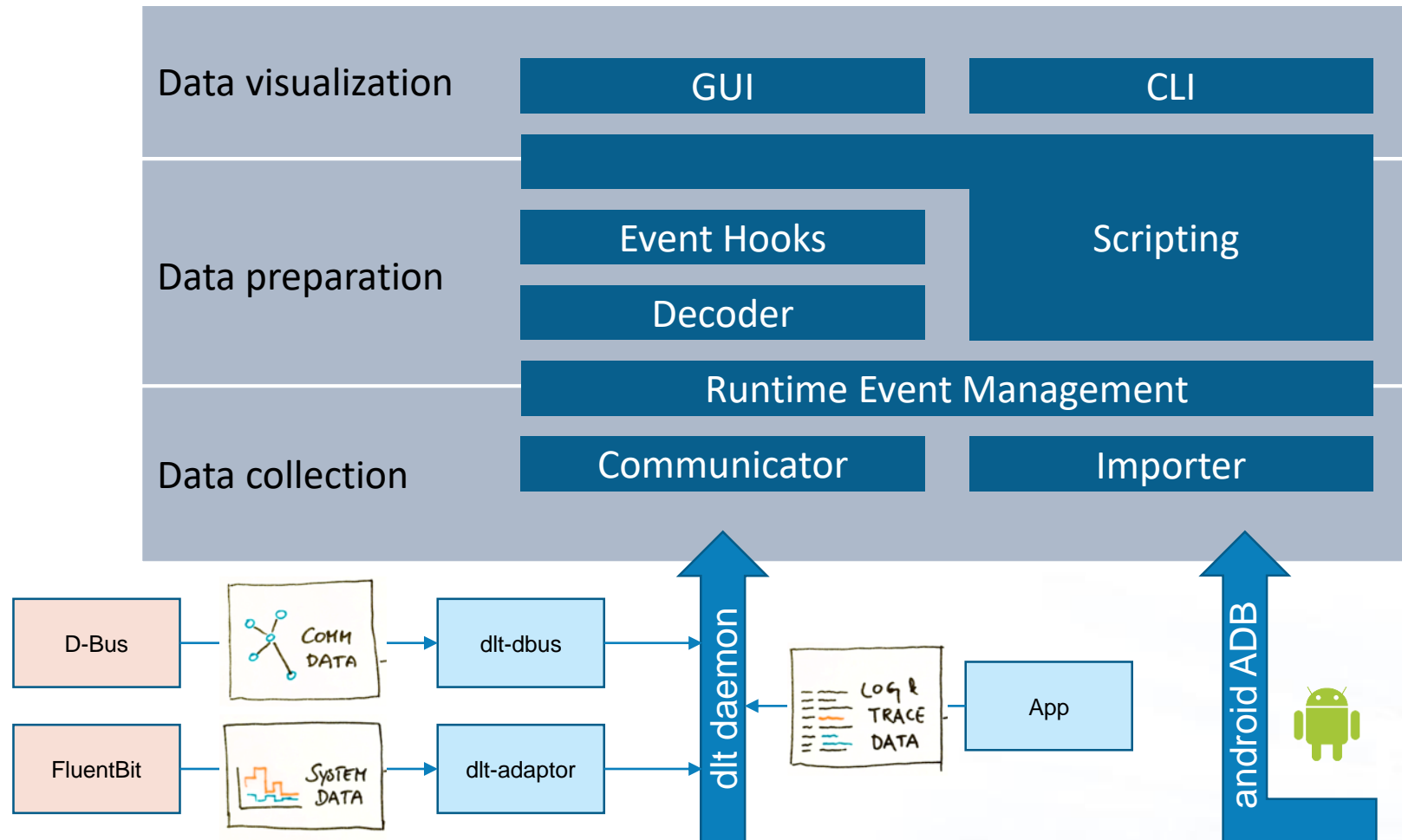


Example Setup with DLT

EB solys provides built-in features and APIs for the purposes of:

- demultiplexing
- visualizing
- filtering & searching
- aggregating
- decoding
- correlating
- transforming
- automating

across different data sources in a single place.



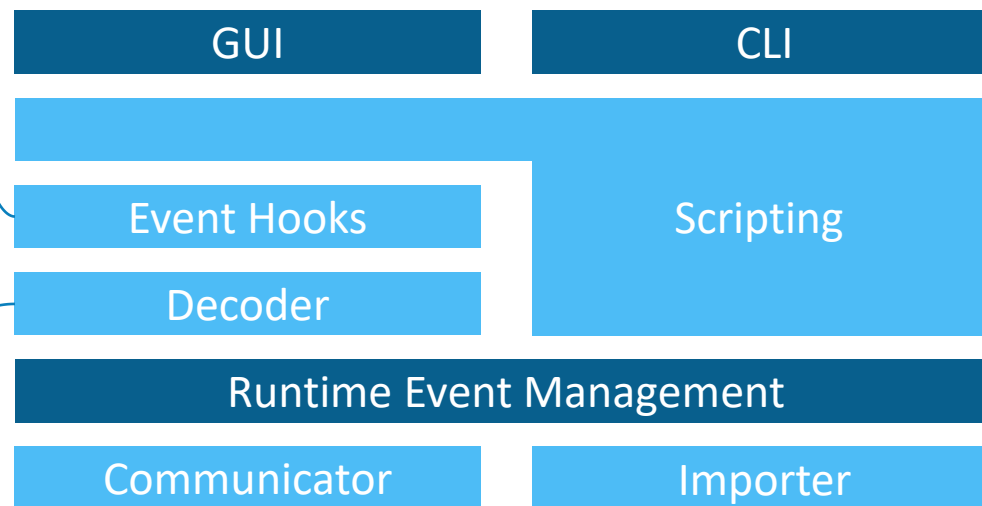
Customization and Extension Points

With **Event Hooks** one can intercept single runtime events and transform or restructure its data contents.

Hook in your own **Decoder**, that transforms arbitrary non-primitive data (e.g. binary payload) into structured readable text.

Built-In Support:

- D-Bus
- Franca IDL (incl. Contracts)
- Protobuf
- Json
- FIBEX (under development)



Use the Built-in **Script** Engine to add new functionality by accessing the EB solys raw data and UI resources through a powerful API.

Scripts are developed and executed directly within EB solys, which allows very short turnaround cycles.

Scripts are developed with Xtend

Provide your own **Communicator** to be able to connect to any trace provider.

Built-In Support:

- DLT daemon (TCP/IP)
- DLT via UART (under development)
- EB solys target agent (Linux and Android)

Provide your own **Importer** for any kind of log file

Built-In Support:

- Automotive DLT 4.0
- Target Agent Logs
- Android Logcat
- PDML



Features



Feature Overview

- **Graphical correlation** and analysis of target runtime data
- Hot spot analysis & **root cause isolation**
- Static and dynamic **communication analysis**
- GENIVI-ready with support for **Linux, DLT, D-Bus** and **Franca IDL**
- **Extension points** for custom importer and decoders **to process any trace format**
- **Built-In Script Engine** to add new functionality by accessing the EB solys raw data and resources
- **Multi-OS** (Linux, Android, QNX) target-agent with **extensible plug-in architecture**
- Out-of-the-box plug-ins available for analyzing system resources, inter-process communication and application traces
- **Integration** into **continuous** build and test toolchain with EB solys Auto mode

Data correlation from different sources



Resource consumption (CPU load) at that Timemarker

Select Timemarker

Places all around the Timemarker

Sent D-Bus message with content at that Timemarker

Channel

Channel	Value
demo-solys-data.bin.cpu.proc.navit:21632 [Percent]	24.0
demo-solys-data.bin.cpu.proc.solys-agent:21587 [Pe	1.0
demo-solys-data.bin.cpu.proc.dbus-daemon:2165 [I	0.5
demo-solys-data.bin.cpu.proc.Xorg:1419 [Percent]	0.25
demo-solys-data.bin.cpu.proc.unity-settings-2270 [0.25
demo-solys-data.bin.cpu.proc.ksftirqd/1:13 [Perce	0.25
demo-solys-data.bin.cpu.proc.nautilus:2710 [Perce	0.25
demo-solys-data.bin.cpu.proc.bash:21619 [Percent]	0.0
demo-solys-data.bin.cpu.proc.upstart-udev-br:410 [0.0
demo-solys-data.bin.cpu.proc.upstart-file-br:1262 [I	0.0
demo-solys-data.bin.cpu.proc.iibus-ui-gtk3:2276 [Pe	0.0
demo-solys-data.bin.cpu.proc.dconf-service:2646 [P	0.0
demo-solys-data.bin.cpu.proc.update-notifier:6550	0.0
demo-solys-data.bin.cpu.proc.gnome-pty-helper:212	0.0
demo-solys-data.bin.cpu.proc.kblockd:33 [Percent]	0.0
demo-solys-data.bin.cpu.proc.gconf-helper:2656 [P	0.0
demo-solys-data.bin.cpu.proc.colord:2644 [Percent]	0.0
demo-solys-data.bin.cpu.proc.unity-scope-hom:204	0.0
demo-solys-data.bin.cpu.proc.winbind:1061 [Perce	0.0
demo-solys-data.bin.cpu.proc.indicator-bluet:2491	0.0

Table_0

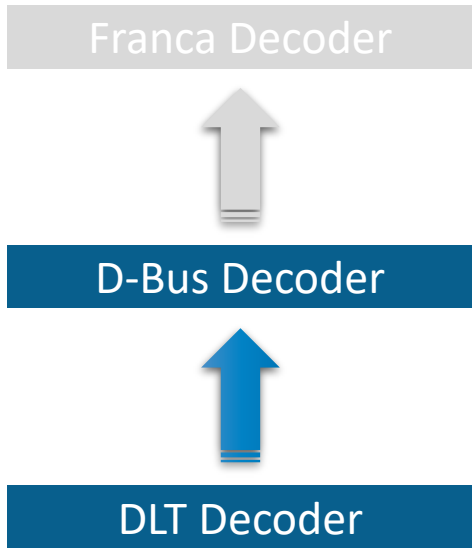
Timestamp	Value	Channel
00:44:49.531	-> org.genivi.navigation.navigationcore.LocationInput:SetSelectionCriterion	demo-so
00:44:49.531	Signal /org/genivi/navigationcore org.genivi.navigation.navigationcore.LocationInput:CurrentSele	demo-so
00:44:49.531	-< org.genivi.navigation.navigationcore.LocationInput:SetSelectionCriterion	demo-so
00:44:49.532	-> org.genivi.navigation.navigationcore.LocationInput:Spell	demo-so
00:44:49.532	-< org.genivi.navigation.navigationcore.LocationInput:Spell	demo-so
00:44:49.532	Signal /org/genivi/navigationcore org.genivi.navigation.navigationcore.LocationInput:SearchStat	demo-so
00:44:49.748	Signal /com/canonical/indicator/session/desktop org.gtk.Menus:Changed	demo-so
00:44:49.748	Signal /com/canonical/indicator/session/desktop org.gtk.Menus:Changed	demo-so
00:44:49.748	Signal /com/canonical/indicator/session/desktop org.gtk.Menus:Changed	demo-so
00:44:49.832	Signal /org/genivi/navigationcore org.genivi.navigation.navigationcore.LocationInput:SpellResult	demo-so
00:44:49.832	Signal /org/genivi/navigationcore org.genivi.navigation.navigationcore.LocationInput:SearchStat	demo-so
00:44:49.832	-> org.genivi.navigation.navigationcore.LocationInput:RequestListUpdate	demo-so
00:44:49.833	Signal /org/genivi/navigationcore org.genivi.navigation.navigationcore.LocationInput:SearchResu	demo-so
00:44:49.834	-< org.genivi.navigation.navigationcore.LocationInput:RequestListUpdate	demo-so
00:44:49.834	-> org.genivi.navigation.navigationcore.LocationInput:Spell	demo-so
00:44:49.834	Signal /org/genivi/navigationcore org.genivi.navigation.navigationcore.LocationInput:SearchStat	demo-so
00:44:49.837	Signal /org/genivi/navigationcore org.genivi.navigation.navigationcore.LocationInput:SearchStat	demo-so
00:44:49.883	Signal /org/genivi/navigationcore org.genivi.navigation.navigationcore.LocationInput:SpellResult	demo-so

org.genivi.navigation.navigationcore.LocationInput.SpellResult(locationInputHandle,uniqueString,validCharacters,fullMatch)

Name	Value
locationInputHandle	1
uniqueString	
validCharacters	s\$IL- fFpPll/gRrJj(hHmMcCwWtT1deEaAbBkK2oOnN3zZwW456uU789D...
fullMatch	false
MetaData	
Message Type	
Sender	Broadcast
Receiver	navit:21632



Stacked Decoding

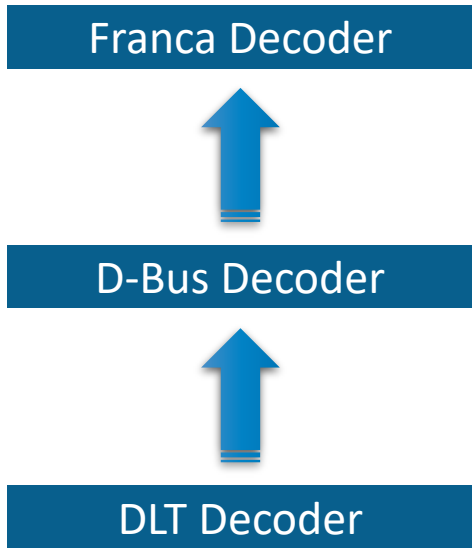


Timestamp	Value	Channel
00:44:54...	Signal /org/genivi/navigationcore org.genivi.navigation.navigationcore.Rou	demo-solys-d
00:44:54...	-> org.genivi.navigation.navigationcore.Routing::GetRouteOverview	demo-solys-d
00:44:54...	<- org.genivi.navigation.navigationcore.Routing::GetRouteOverview	demo-solys-d
00:44:54...	-> org.genivi.navigation.navigationcore.Routing::GetRouteSegments	demo-solys-d
00:44:54...	<- org.genivi.navigation.navigationcore.Routing::GetRouteSegments	demo-solys-d
00:44:54...	-> org.genivi.navigation.navigationcore.Routing::CreateRoute	demo-solys-d
00:44:54...	<- org.genivi.navigation.navigationcore.Routing::CreateRoute	demo-solys-d
00:44:54...	-> org.genivi.navigation.navigationcore.Routing::SetWaypoints	demo-solys-d
00:44:54...	<- org.genivi.navigation.navigationcore.Routing::SetWaypoints	demo-solys-d
00:44:54...	-> org.genivi.navigation.navigationcore.Routing::CalculateRoute	demo-solys-d
00:44:54...	Signal /org/genivi/navigationcore org.genivi.navigation.navigationcore.Rou	demo-solys-d
00:44:54...	<- org.genivi.navigation.navigationcore.Routing::CalculateRoute	demo-solys-d
00:44:54...	Signal /org/genivi/navigationcore org.genivi.navigation.navigationcore.Rou	demo-solys-d
00:44:54...	Signal /org/genivi/navigationcore org.genivi.navigation.navigationcore.Rou	demo-solys-d
00:44:54...	-> org.genivi.navigation.navigationcore.Routing::GetRouteOverview	demo-solys-d
00:44:54...	<- org.genivi.navigation.navigationcore.Routing::GetRouteOverview	demo-solys-d

Name	Value
org.genivi.navigation.navigationcore.Routing.GetRouteC	
DBUS_MSG_PARAM_TYPE_ARRAY	
DBUS_MSG_PARAM_TYPE_DICT_ENTRY	
DBUS_MSG_PARAM_TYPE_INT32	398
DBUS_MSG_PARAM_TYPE_VARIANT	
DBUS_MSG_PARAM_TYPE_UINT32	4460
DBUS_MSG_PARAM_TYPE_DICT_ENTRY	
DBUS_MSG_PARAM_TYPE_INT32	399
DBUS_MSG_PARAM_TYPE_VARIANT	
DBUS_MSG_PARAM_TYPE_UINT32	123398
MetaData	
Message Type	Response
Reply Message Serial	13
Sender	navit:21632
Receiver	test-route-calc:21658



Stacked Decoding



Timestamp	Value	Channel
00:44:54...	Signal /org/genivi/navigationcore org.genivi.navigation.navigationcore.Rou	demo-solys-c
00:44:54...	-> org.genivi.navigation.navigationcore.Routing::GetRouteOverview	demo-solys-c
00:44:54...	<- org.genivi.navigation.navigationcore.Routing::GetRouteOverview	demo-solys-c
00:44:54...	-> org.genivi.navigation.navigationcore.Routing::GetRouteSegments	demo-solys-c
00:44:54...	<- org.genivi.navigation.navigationcore.Routing::GetRouteSegments	demo-solys-c
00:44:54...	-> org.genivi.navigation.navigationcore.Routing::CreateRoute	demo-solys-c
00:44:54...	<- org.genivi.navigation.navigationcore.Routing::CreateRoute	demo-solys-c
00:44:54...	-> org.genivi.navigation.navigationcore.Routing::SetWaypoints	demo-solys-c
00:44:54...	<- org.genivi.navigation.navigationcore.Routing::SetWaypoints	demo-solys-c
00:44:54...	-> org.genivi.navigation.navigationcore.Routing::CalculateRoute	demo-solys-c
00:44:54...	Signal /org/genivi/navigationcore org.genivi.navigation.navigationcore.Rou	demo-solys-c
00:44:54...	<- org.genivi.navigation.navigationcore.Routing::CalculateRoute	demo-solys-c
00:44:54...	Signal /org/genivi/navigationcore org.genivi.navigation.navigationcore.Rou	demo-solys-c
00:44:54...	Signal /org/genivi/navigationcore org.genivi.navigation.navigationcore.Rou	demo-solys-c
00:44:54...	-> org.genivi.navigation.navigationcore.Routing::GetRouteOverview	demo-solys-c
00:44:54...	<- org.genivi.navigation.navigationcore.Routing::GetRouteOverview	demo-solys-c

Name	Value
org.genivi.navigation.navigationcore.Routing.GetRouteC	
routeOverview	
RouteOverview	TOTAL_TIME
RouteOverviewItem	
uValue	4460
RouteOverview	TOTAL_DISTANCE
RouteOverviewItem	
uValue	123398
MetaData	

Sequence Logic Visualization



EB solys

File Window Help

Channels

Search...

Name	Log Le...	Unit	Color
demo-solys-dat:			
cpu			
proc		Percent	
system			
mem		Kilobyte	
proc			
system			
trace			
dbus.sessic		Proto...	
dlt			
targetager			

Resource Explorer

Search...

- Connections
- Trace Files
 - demo-solys-data.bin
- Charts
 - LineChart_1 (LineChart)
 - LineChart_0 (LineChart)
- Tables
 - Table_0
- Snapshots
- Dependency Graphs
- HTML Views
- DBus-Sequence-Chart
- Quick Start
- Scripts
 - My Scripts

Time Markers Properties

Name	Timestamp
TIMEMARKER_4	00:44:49.823
Start Route Calc	00:44:53.568
TIMEMARKER_2	00:44:54.807
Initialize Map Viewer	00:45:03.502
TIMEMARKER_3	00:45:04.815

DBus-Sequence-Chart

Sequence Chart

navit: 21632

org.genivi.navigation.navigationcore.Routing

Broadcast

test-route-calc: 21658

21658

CreateRoute(sessionHandle=1)

CreateRoute(result=OK routeHandle=1)

SetWaypoints(sessionHandle=1 routeHandle=1 startFromCurrentPosition=false waypointsList=[...])

Start Route Calc

SetWaypoints(result=OK)

CalculateRoute(sessionHandle=1 routeHandle=1)

RouteCalculationProgressUpdate(routeHandle=1 status=208 percentage=5)

CalculateRoute(result=OK)

RouteCalculationProgressUpdate(routeHandle=1 status=208 percentage=50)

RouteCalculationProgressUpdate(routeHandle=1 status=208 percentage=100)

RouteCalculationSuccessful(routeHandle=1 unfulfilledPreferences=null)

GetRouteOverview(routeHandle=1 valuesToReturn=[...])

GetRouteOverview(routeOverview=[...])

map viewer

Timestamp

Value

00:44:53.563 <- org.freedesktop.DBus.Introspectable:Inspect

00:44:53.563 -> org.genivi.navigation.navigationcore.Session:Create

00:44:53.564 <- org.genivi.navigation.navigationcore.Session:Create

00:44:53.564 -> org.freedesktop.DBus.GetNameOwner

00:44:53.564 -> org.freedesktop.DBus.Introspectable:Inspect

00:44:53.565 <- org.freedesktop.DBus.Introspectable:Inspect

00:44:53.566 -> org.genivi.navigation.navigationcore.Routing:Create

00:44:53.566 <- org.genivi.navigation.navigationcore.Routing:Create

00:44:53.567 -> org.genivi.navigation.navigationcore.Routing:SetWa

Start Route Calc

00:44:53.568 <- org.genivi.navigation.navigationcore.Routing:SetWa

00:44:53.568 -> org.genivi.navigation.navigationcore.Routing:Calcul

00:44:53.624 Signal /org/genivi/navigationcore org.genivi.navigation

00:44:53.624 <- org.genivi.navigation.navigationcore.Routing:Calcul

00:44:54.131 Signal /org/genivi/navigationcore org.genivi.navigation

00:44:54.152 Signal /org/genivi/navigationcore org.genivi.navigation

00:44:54.152 Signal /org/genivi/navigationcore org.genivi.navigation

00:44:54.153 -> org.genivi.navigation.navigationcore.Routing:GetRo

00:44:54.153 <- org.genivi.navigation.navigationcore.Routing:GetRo

00:44:54.153 -> org.genivi.navigation.navigationcore.Routing:GetRo

00:44:54.189 <- org.genivi.navigation.navigationcore.Routing:GetRo

00:44:54.192 -> org.genivi.navigation.navigationcore.Routing:Create

00:44:54.193 <- org.genivi.navigation.navigationcore.Routing:Create

00:44:54.193 -> org.genivi.navigation.navigationcore.Routing:SetWa

00:44:54.193 <- org.genivi.navigation.navigationcore.Routing:SetWa

00:44:54.193 -> org.genivi.navigation.navigationcore.Routing:Calcul

00:44:54.224 Signal /org/genivi/navigationcore org.genivi.navigation

00:44:54.224 <- org.genivi.navigation.navigationcore.Routing:Calcul

00:44:54.473 Signal /org/genivi/navigationcore org.genivi.navigation

00:44:54.483 Signal /org/genivi/navigationcore org.genivi.navigation

00:44:54.483 Signal /org/genivi/navigationcore org.genivi.navigation

00:44:54.483 -> org.genivi.navigation.navigationcore.Routing:GetRo

00:44:54.484 <- org.genivi.navigation.navigationcore.Routing:GetRo

00:44:54.484 -> org.genivi.navigation.navigationcore.Routing:GetRo

00:44:54.511 <- org.genivi.navigation.navigationcore.Routing:GetRo

00:44:54.514 -> org.genivi.navigation.navigationcore.Routing:Create

00:44:54.514 <- org.genivi.navigation.navigationcore.Routing:Create

00:44:54.514 -> org.genivi.navigation.navigationcore.Routing:SetWa

00:44:54.514 <- org.genivi.navigation.navigationcore.Routing:SetWa

00:44:54.516 -> org.genivi.navigation.navigationcore.Routing:Calcul

00:44:54.555 Signal /org/genivi/navigationcore org.genivi.navigation

00:44:54.555 <- org.genivi.navigation.navigationcore.Routing:Calcul

org.genivi.navigation.navigationcore.Routing.CreateRoute(sessionHandle)

Search...

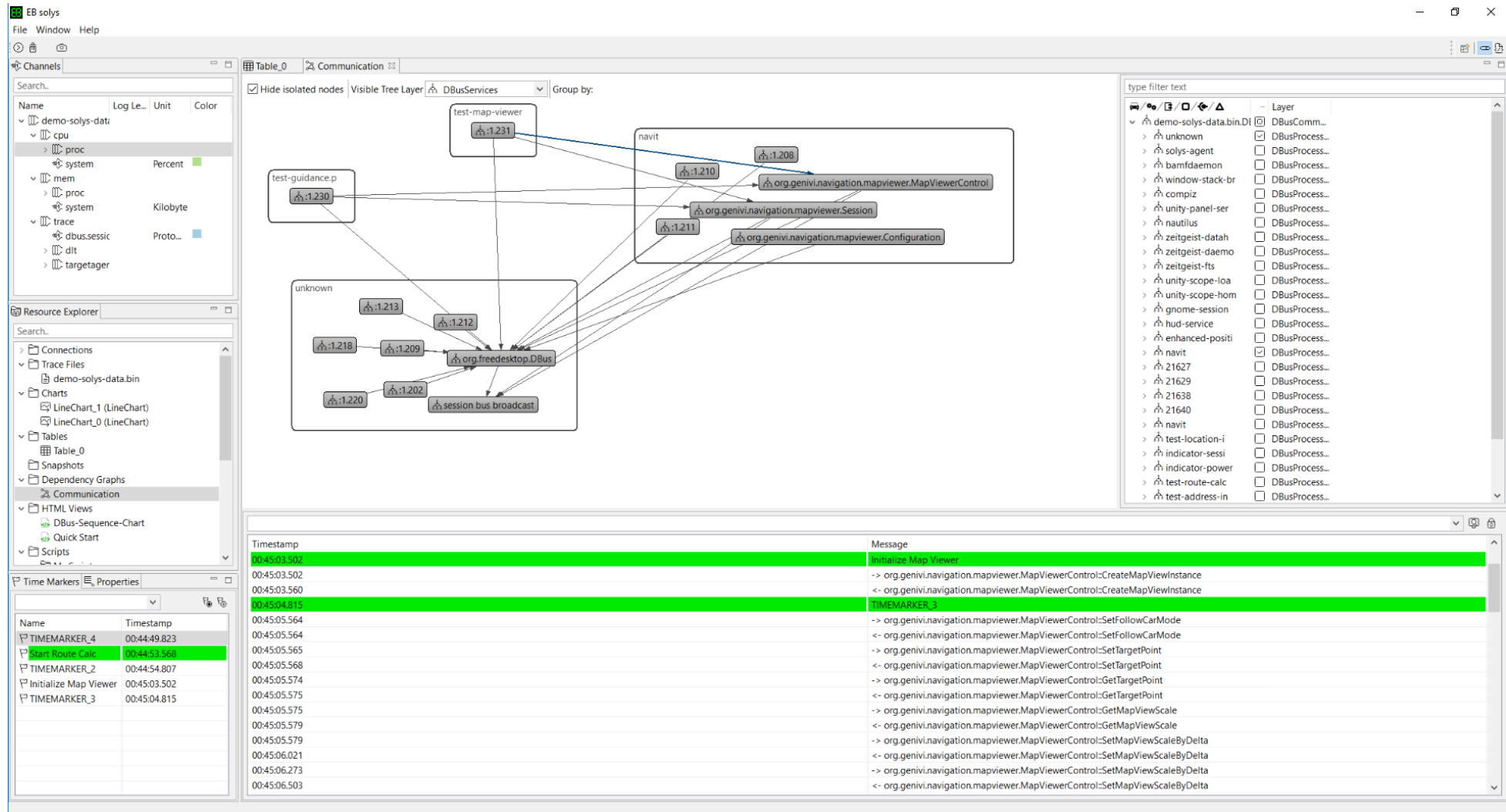
Name	Value
org.genivi.navigation.navigationcore.Routin	
MetaData	

[sessionHandle=1]

Delta Time: 00:00:00.587



Structural Inspection



The screenshot displays the EB solys interface for structural inspection. The main window shows a communication graph with nodes and their interactions. The nodes include:

- test-map-viewer (address :1.231)
- navit (address :1.210)
- org.genivi.navigation.mapviewer.MapViewerControl (address :1.208)
- org.genivi.navigation.mapviewer.Session (address :1.211)
- org.genivi.navigation.mapviewer.Configuration (address :1.211)
- test-guidance.p (address :1.230)
- unknown (address :1.213, :1.212, :1.218, :1.209)
- org.freedesktop.DBus (address :1.220)
- session bus broadcast (address :1.220)

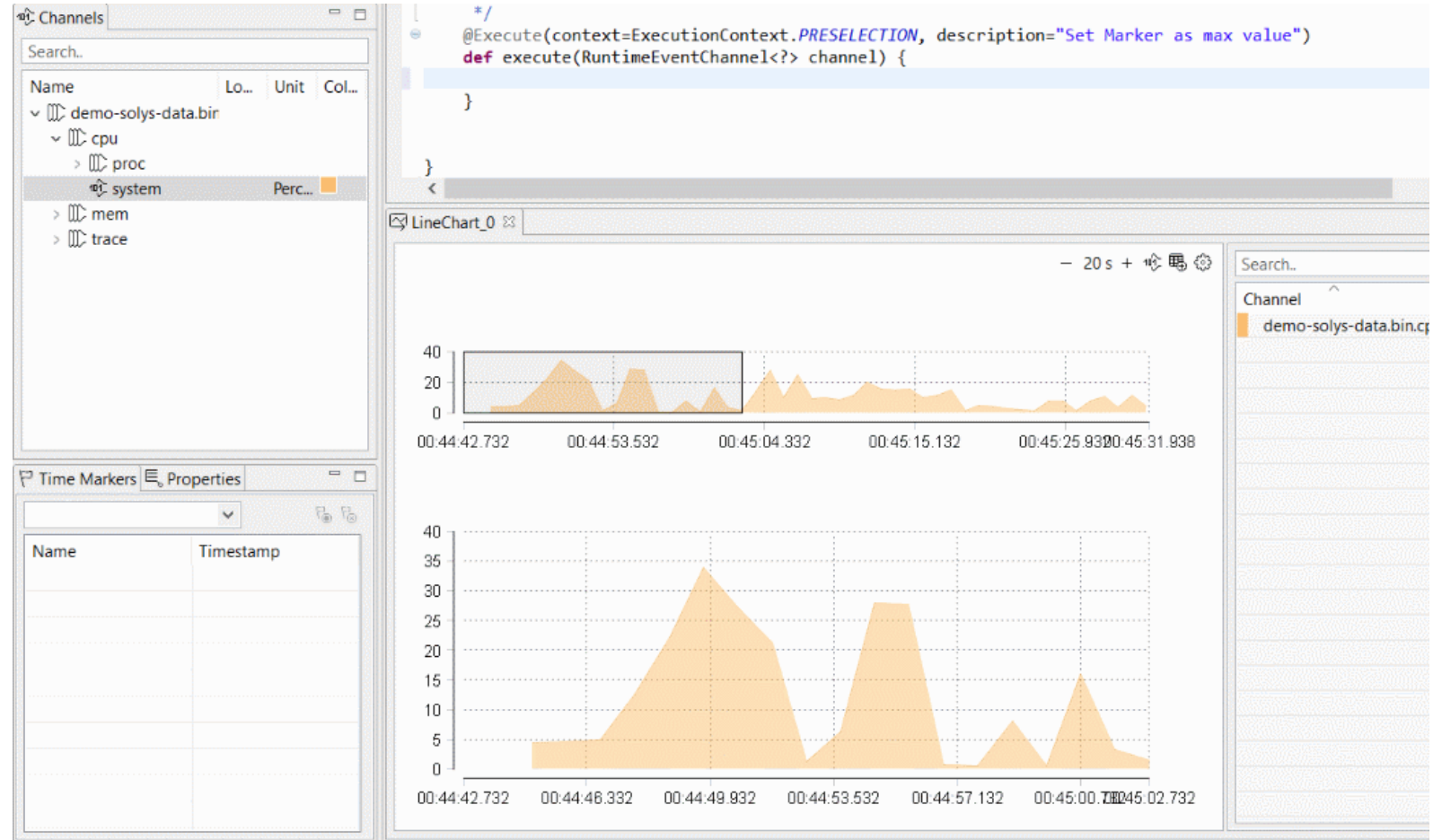
The message log at the bottom shows the following sequence of messages:

Timestamp	Message
00:45:03.502	Initialize Map Viewer
00:45:03.502	-> org.genivi.navigation.mapviewer.MapViewerControl:CreateMapViewInstance
00:45:03.560	<- org.genivi.navigation.mapviewer.MapViewerControl:CreateMapViewInstance
00:45:04.815	TIMEMARKER_3
00:45:05.564	-> org.genivi.navigation.mapviewer.MapViewerControl:SetFollowCarMode
00:45:05.564	<- org.genivi.navigation.mapviewer.MapViewerControl:SetFollowCarMode
00:45:05.565	-> org.genivi.navigation.mapviewer.MapViewerControl:SetTargetPoint
00:45:05.568	<- org.genivi.navigation.mapviewer.MapViewerControl:SetTargetPoint
00:45:05.574	-> org.genivi.navigation.mapviewer.MapViewerControl:GetTargetPoint
00:45:05.575	<- org.genivi.navigation.mapviewer.MapViewerControl:GetTargetPoint
00:45:05.575	-> org.genivi.navigation.mapviewer.MapViewerControl:GetMapViewScale
00:45:05.579	<- org.genivi.navigation.mapviewer.MapViewerControl:GetMapViewScale
00:45:05.579	-> org.genivi.navigation.mapviewer.MapViewerControl:SetMapViewScaleByDelta
00:45:06.021	<- org.genivi.navigation.mapviewer.MapViewerControl:SetMapViewScaleByDelta
00:45:06.273	-> org.genivi.navigation.mapviewer.MapViewerControl:SetMapViewScaleByDelta
00:45:06.503	<- org.genivi.navigation.mapviewer.MapViewerControl:SetMapViewScaleByDelta



Data Analysis using scripting capabilities

- Feature Set can be enriched on-the-fly with (Xtend) scripts
- API to access all collected runtime data and most of the GUI elements
- Full-featured built-in editor with syntax highlighting, code completion, content assist, javadoc, etc.
- Scripts can also be executed in „live mode“ (callback scripts)
- Fully Java compatible
- Invocations from Xtend code into Javascript code possible. And vice-versa



The screenshot displays the GENIVI IDE interface. On the left, the 'Channels' panel shows a tree view with 'demo-solys-data.bin' expanded to 'cpu' > 'proc' > 'system'. Below it, the 'Time Markers' panel is empty. The main editor shows Xtend code:

```

@Execute(context=ExecutionContext.PRESELECTION, description="Set Marker as max value")
def execute(RuntimeEventChannel<?> channel) {
}

```

Two line charts are visible. The top chart, titled 'LineChart_0', shows a signal over time from 00:44:42.732 to 00:45:31.938. The bottom chart shows a similar signal from 00:44:42.732 to 00:45:02.732. Both charts have a y-axis from 0 to 40. A search bar on the right shows 'demo-solys-data.bin.cp'.

Download & Installation



Installation & Development

- EB solys <https://github.com/Elektrobit/eb-solys>
- Data Sources
 - DLT <https://github.com/GENIVI/dlt-daemon>
 - Target Agent Linux <https://github.com/Elektrobit/eb-solys-target-agent>
 - Target Agent Android <https://github.com/Elektrobit/eb-solys-android-agent>
- Development Prerequisites
 - Java 8 Runtime Environment
 - Maven 3.3.1 or higher
 - Eclipse Installer
 - openjfx (for Linux only)

See also

- **EB solys Introduction**

- Product Homepage

<https://www.elektrobit.com/services/software-engineering/software-integration-and-engineering-services/eb-solys/>

- Technical article (german)

<https://www.iot-design.de/allgemein/lokalisierung-von-fehlern-in-entwicklungsprojekten/>

- **EB solys & Franca Contracts**

- Contract-based software development with Franca

<https://blogs.itemis.com/en/contract-based-software-development-with-franca>

- EB solys and Franca Contracts – An overview

<https://blogs.itemis.com/en/eb-solys-and-franca-contracts-an-overview>

- Retrace and validate the usage of interfaces

<https://blogs.itemis.com/en/eb-solys-and-franca-contracts-retrace-and-validate-the-usage-of-interfaces>

- **EB solys, DLT & Fluent Bit**

- Automotive logging on Linux with Fluent Bit, DLT and EB solys

https://systemticks.de/2019/02/27/automotive_logging_1.html

- Visualize Fluent Bit metrics with EB solys

https://systemticks.de/2019/03/15/fluentbit_and_solys.html

Thank you! Any Questions?

Visit GENIVI:

<http://www.genivi.org>

<http://projects.genivi.org>

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help@genivi.org

