Package 'starvz'

September 8, 2024

Title R-Based Visualization Techniques for Task-Based Applications

Version 0.8.2

Description Performance analysis workflow that combines the power of the R language (and the tidyverse realm) and many auxiliary tools to provide a consistent, flexible, extensible, fast, and versatile framework for the performance analysis of task-based applications that run on top of the StarPU runtime (with its MPI (Message Passing Interface) layer for multi-node support). Its goal is to provide a fruitful prototypical environment to conduct performance analysis hypothesis-checking for task-based applications that run on heterogeneous (multi-GPU, multi-core) multi-node HPC (High-performance computing) platforms.

URL https://github.com/schnorr/starvz

BugReports https://github.com/schnorr/starvz/issues

Depends R (>= 3.6.0)

Imports methods, grDevices, stats, utils, magrittr, dplyr, ggplot2, tibble, rlang, tidyr, patchwork, purrr, readr (>= 1.4.0), stringr, yaml, lpSolve, gtools, data.tree, RColorBrewer, zoo, Rcpp

License GPL-3

Encoding UTF-8

SystemRequirements C++, arrow package with gzip codec, StarPU

LazyData true

LinkingTo Rcpp (>= 1.0.6), BH

RoxygenNote 7.2.3

Collate 'RcppExports.R' 'starvz_data.R' 'phase1.R' 'phase1_outlier.R' 'phase1_parse_csv.R' 'phase2.R' 'phase2_aggregation.R' 'phase2_applications.R' 'phase2_atree.R' 'phase2_config.R' 'phase2_events.R' 'phase2_gaps.R' 'phase2_imbalance.R' 'phase2_kchart.R' 'phase2_lackready.R' 'phase2_memory.R' 'phase2_metrics.R' 'phase2_mpi.R' 'phase2_node_summary.R'

'phase2_pmtool.R' 'phase2_progress.R' 'phase2_states_chart.R'
'phase2_themes.R' 'phase2_time_integration.R' 'phase2_util.R'
'phase2_var_chart.R' 'phase2_var_panels.R' 'read_functions.R'
'write_functions.R'

Suggests arrow (>= 3.0.0), testthat, flexmix, car, viridis, ggrepel, mclust

NeedsCompilation yes

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Repository CRAN

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cholesky_colors *Colors for lu*

Description

This will be deprecated

Usage

```
cholesky_colors()
```

data_name_coordinates *Handles Name coordinates*

Description

Give handles name by their coordinates

Usage

```
data_name_coordinates(df)
```

Arguments

df	data_handle table of Starvz data

Value

data_handle table with new column Value with the name

Examples

```
data_name_coordinates(starvz_sample_lu$Data_handle)
```

data_name_handle *Handles Name address*

Description

Give handles name by their address

Usage

```
data_name_handle(df)
```

Arguments

df	data_handle table of Starvz data

Value

data_handle table with new column Value with the name

Examples

```
data_name_handle(starvz_sample_lu$Data_handle)
```

data_name_tag *Handles Name Tag*

Description

Give handles name by their tag

Usage

```
data_name_tag(df)
```

Arguments

df	data_handle table of Starvz data

Value

data_handle table with new column Value with the name

Examples

```
data_name_tag(starvz_sample_lu$Data_handle)
```

handles_presence_states *Computes presence of handles over resources*

Description

Use for precomputation of other memory-related functions

Usage

```
handles_presence_states(data)
```

Arguments

data	starvz_data with trace data

Value

Time-Step aggregated handle presences

Examples

```
handles_presence_states(starvz_sample_lu)
```

lu_colors *Colors for lu*

Description

This will be deprecated

Usage

```
lu_colors()
```

multiple_snaps *Create multiple snapshot of memory*

Description

Create multiple visualizations of memory Useful for continuing views

Usage

```
multiple_snaps(
  data = NULL,
  start = 0,
  end = 1000,
  step = 100,
  path = ".",
  scale = 8,
  width = 4,
  height = 3
)
```

Arguments

data	starvz_data with trace data
start	start time
end	end time
step	between snaps
path	path to save files
scale	for ggsave
width	for ggsave
height	for ggsave

Value

A ggplot object

Examples

```
## Not run:
multiple_snaps(data = starvz_sample_lu, 100, 200, 10, ".")

## End(Not run)
```

panel_abe_solution *Create a plot with the solution computed by ABE*

Description

Plot per-node and per-tasktype repartion among resource types

Usage

```
panel_abe_solution(data, base_size = data$config$base_size)
```

Arguments

data	starvz_data with trace data
base_size	base_size base font size

Value

A ggplot object

Examples

```
panel_abe_solution(data = starvz_sample_lu)
```

panel_activenodes *Create the active nodes in memory plot*

Description

Use starvz_data to create a line plot of the number of active nodes per type along the application execution time

Usage

```
panel_activenodes(
  data = NULL,
  step = data$config$activenodes$aggregation$step,
  aggregation = data$config$activenodes$aggregation$active,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  legend = data$config$activenodes$legend
)
```

Arguments

data	starvz_data with trace data
step	size in milliseconds for the time aggregation step
aggregation	enable/disable time aggregation for the plot
x_start	X-axis start value
x_end	X-axis end value
legend	enable/disable plot legends

Value

A ggplot object

Examples

```
## Not run:
panel_activenodes(data = starvz_sample_lu, step = 100)

## End(Not run)
```

---

panel_atree *Create the elimination tree plot with some options in the config file*

Description

Use starvz_data to create a representation of the elimination tree structure considering initialization, communication, and computational tasks. These representations can be controlled in the configuration file.

Usage

```
panel_atree(
  data = NULL,
  step = data$config$atree$step,
  legend = data$config$atree$legend,
  zoom = FALSE,
  computation = data$config$atree$computation$active,
  pruned = data$config$atree$computation$pruned$active,
  initialization = data$config$atree$initialization$active,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  communication = data$config$atree$communication$active,
  anomalies = data$config$atree$anomalies$active,
  performance_metric = "time",
  level = 0,
  end_arrow = "ParentEnd"
)
```

Arguments

data	starvz_data with trace data
step	size in milliseconds for the time aggregation step
legend	enable/disable panel legend
zoom	enable/disable vertical zoom in the tree structure
computation	enable/disable computations representations in the tree
pruned	enable/disable pruned computations representations in the tree
initialization	enable/disable initialization tasks representation
x_start	X-axis start value
x_end	X-axis end value
communication	enable/disable communication tasks representation
anomalies	enable/disable anomalies tasks representation
performance_metric	which metric to represent ["time", "gflops"]
level	draw a dashed line to divide the tree at the level h
end_arrow	behavior of the end arrow [ParentEnd, ComputationEnd]

Value

A ggplot object

Examples

```
## Not run:
panel_atree(starvz_sample_lu, step = 10)
panel_atree(starvz_sample_lu,
  step = 20,
  communication = FALSE, initialization = FALSE
)

## End(Not run)
```

---

panel_atree_structure *Create the elimination tree structure plot along time*

Description

Use Atree and Application data to create the elimination tree structure plot in a ggplot object and return it

Usage

```
panel_atree_structure(data = NULL, end_arrow = "ParentEnd")
```

Arguments

data	starvz_data with trace data
end_arrow	behavior of the end arrow [ParentEnd, ComputationEnd]

Value

A ggplot object

Examples

```
## Not run:
panel_atree_structure(starvz_sample_lu)

## End(Not run)
```

---

panel_compare_tree *Combine two atree plots to compare two different executions*

Description

Use starvz_data Application and Atree to create a plot that shows the total resource utilization, painted by tree node using geom_ribbon. The colors are reused between nodes, not tied to a specific tree node.

Usage

```
panel_compare_tree(
  data1 = NULL,
  data2 = NULL,
  step = data1$config$utiltreenode$step,
  x_start = data1$config$limits$start,
  x_end = data1$config$limits$end,
  performance_metric = "Time",
  add_diff_line = FALSE,
  add_end_line = FALSE
)
```

Arguments

data1	starvz_data with trace data
data2	starvz_data with trace data
step	size in milliseconds for the time aggregation step
x_start	X-axis start value
x_end	X-axis end value
performance_metric	which metric to represent ["time", "gflops"]
add_diff_line	add the computed gflops difference line
add_end_line	add smaller end time vertical line

Value

A ggplot object

Examples

```
## Not run:
panel_compare_tree(data1, data2, step = 100)

## End(Not run)
```

`panel_dist2d` *Show the 2D MPI distribution*

Description

Visualizate the data distribution across nodes of 2D structured data

Usage

```
panel_dist2d(
  data,
  legend = data$config$dist2d$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand
)
```

Arguments

`data`	starvz_data with trace data
`legend`	enable/disable legends
`base_size`	base_size base font size
`expand_x`	expand size for scale_x_continuous padding

Value

A ggplot object

Examples

```
panel_dist2d(data = starvz_sample_lu)
```

panel_gflops *Create a line chart panel with GFlops*

Description

Use the Variable traces to create a line chart panel with GFlops per resource, aggregated by a configurable time step

Usage

```
panel_gflops(
  data,
  legend = data$config$gflops$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  y_start = 0,
  y_end = data$config$gflops$limit,
  step = data$config$gflops$step
)
```

Arguments

data	starvz_data with trace data
legend	enable/disable legends
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding
x_start	X-axis start value
x_end	X-axis end value
y_start	Y-axis start value
y_end	Y-axis end value
step	time step for aggregation

Value

A ggplot object

Examples

```
panel_gflops(data = starvz_sample_lu)
```

`panel_gflops_computed_difference` *Plot the total computed GFlops difference over time given two traces*

Description

Use starvz_data Application and the GFlop columns to create a plot that shows the total computed GFlop difference over time using geom_line. The blue color represent the faster execution and the red the slower one.

Usage

```
panel_gflops_computed_difference(
  data1 = NULL,
  data2 = NULL,
  legend = FALSE,
  x_start = NULL,
  x_end = NULL,
  add_end_line = TRUE
)
```

Arguments

`data1`	starvz_data with trace data
`data2`	starvz_data with trace data
`legend`	enable/disable plot legends
`x_start`	X-axis start value
`x_end`	X-axis end value
`add_end_line`	add smaller end time vertical line

Value

A ggplot object

Examples

```
## Not run:
panel_gflops_computed_difference(data1, data2)

## End(Not run)
```

panel_gpubandwidth *Create a line chart panel with GPU bandwidth*

Description

Use the Variable traces to create a line chart panel with GPU bandwidth per resource, aggregated by a configurable time step

Usage

```
panel_gpubandwidth(
  data,
  legend = data$config$gpubandwidth$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  y_start = 0,
  y_end = data$config$gpubandwidth$limit,
  step = data$config$gpubandwidth$step,
  total = data$config$gpubandwidth$total
)
```

Arguments

data	starvz_data with trace data
legend	enable/disable legends
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding
x_start	X-axis start value
x_end	X-axis end value
y_start	Y-axis start value
y_end	Y-axis end value
step	time step for aggregation
total	show total bandwidth of the execution per resource

Value

A ggplot object

Examples

```
panel_gpubandwidth(data = starvz_sample_lu)
```

panel_handles *Create a space time visualization of data handles*

Description

Visualizate data handles movement To accelerate the process:

```
data$handle_states <- handles_presence_states(data)
data$handle_gantt_data <- pre_handle_gantt(data)
To Select time:
handles_gantt(data, JobId=c(jobid))
snap_data <- pre_snap(data, data$handle_states)
memory_snap(snap_data, 1000, tasks_size=200, step=1)
```

Usage

```
panel_handles(
  data,
  JobId = NA,
  lines = NA,
  lHandle = NA,
  name_func = NULL,
  legend = data$config$handles$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end
)
```

Arguments

data	starvz_data with trace data
JobId	Select handles of jobid
lines	vertical lines
lHandle	select handles
name_func	function to give names to handles
legend	enable/disable legends
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding
x_start	X-axis start value
x_end	X-axis end value

Value

A ggplot object

Examples

```
panel_handles(data = starvz_sample_lu)
```

`panel_hete_imbalance` *Create a line chart with heterogeneous resources and tasks imbalance metrics*

Description

This function creates a line chart with imbalance metrics. The function applies the metrics on fixed time-steps defined by the user. The metrics consider that the resources are heterogeneous, and each task has a different performance per resource.

Usage

```
panel_hete_imbalance(
  data,
  legend = data$config$hete_imbalance$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  y_start = 0,
  y_end = data$config$hete_imbalance$limit,
  step = data$config$hete_imbalance$step
)
```

Arguments

`data`	starvz_data with trace data
`legend`	enable/disable legends
`base_size`	base_size base font size
`expand_x`	expand size for scale_x_continuous padding
`x_start`	X-axis start value
`x_end`	X-axis end value
`y_start`	Y-axis start value
`y_end`	Y-axis end value
`step`	time step for aggregation

Value

A ggplot object

Examples

```
panel_hete_imbalance(data = starvz_sample_lu)
```

`panel_imbalance` *Create a line chart with homogeneous imbalance metrics.*

Description

This function creates a line chart with imbalance metrics. The function applies the metrics on fixed time-steps defined by the user. The metrics consider that the resources are homogeneous.

Usage

```
panel_imbalance(
  data,
  legend = data$config$imbalance$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  y_start = 0,
  y_end = data$config$imbalance$limit,
  step = data$config$imbalance$step
)
```

Arguments

`data`	starvz_data with trace data
`legend`	enable/disable legends
`base_size`	base_size base font size
`expand_x`	expand size for scale_x_continuous padding
`x_start`	X-axis start value
`x_end`	X-axis end value
`y_start`	Y-axis start value
`y_end`	Y-axis end value
`step`	time step for aggregation

Value

A ggplot object

Examples

```
panel_imbalance(data = starvz_sample_lu)
```

panel_kiteration *Create a special chart for applications with iterations*

Description

Plot iterations Y over Time X

Usage

```
panel_kiteration(
  data = NULL,
  middle_lines = data$config$kiteration$middlelines,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  legend = data$config$kiteration$legend,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  per_node = data$config$kiteration$pernode,
  sub_ite = data$config$kiteration$subite
)
```

Arguments

data	starvz_data with trace data
middle_lines	plot a middle line
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding
legend	enable/disable legends
x_start	X-axis start value
x_end	X-axis end value
per_node	Create node facets
sub_ite	Use Subiteration as Y

Value

A ggplot object

Examples

```
panel_kiteration(data = starvz_sample_lu)
```

panel_lackready *Shows if the runtimes is lacking ready tasks*

Description

Plot a bar over time that shows when the runtime is lacking ready tasks

Usage

```
panel_lackready(
  data = NULL,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end
)
```

Arguments

data	starvz_data with trace data
x_start	X-axis start value
x_end	X-axis end value

Value

A ggplot object

Examples

```
panel_lackready(data = starvz_sample_lu)
```

panel_memory_heatmap *Heatmap of memory presence*

Description

Visualizate the presence of memory handles across memory managers

Usage

```
panel_memory_heatmap(
  data,
  legend = data$config$memory_heatmap$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand
)
```

Arguments

data	starvz_data with trace data
legend	enable/disable legends
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding

Value

A ggplot object

Examples

```
panel_memory_heatmap(data = starvz_sample_lu)
```

---

panel_memory_snap *Create a snapshot of memory*

Description

Visualizate memory in a specific time

Usage

```
panel_memory_snap(
  data,
  selected_time,
  step,
  legend = data$config$memory_snap$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  tasks_size = 30
)
```

Arguments

data	starvz_data with trace data
selected_time	time
step	for discreate events
legend	enable/disable legends
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding
x_start	X-axis start value
x_end	X-axis end value
tasks_size	size of tasks in the visualization

Value

A ggplot object

Examples

```
panel_memory_snap(data = starvz_sample_lu, 100, 10)
```

---

panel_memory_state *Create a memory state space time*

Description

Show memory events

Usage

```
panel_memory_state(
  data = NULL,
  combined = data$config$memory$combined,
  legend = data$config$memory$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  show_state_total = data$config$memory$state$total,
  show_transfer_total = data$config$memory$transfer$total
)
```

Arguments

data	starvz_data with trace data
combined	shows links
legend	enable/disable legends
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding
x_start	X-axis start value
x_end	X-axis end value
show_state_total	Show the percentage of selected state
show_transfer_total	Show total transfer amount

Value

A ggplot object

Examples

```
panel_memory_state(data = starvz_sample_lu)
```

`panel_model_gflops` *Create the diagnostig plot for the regression model*

Description

Use the starvz Application data to observe how the regression model used in the task anomaly classification fits the data.

Usage

```
panel_model_gflops(data,
         freeScales = TRUE, model_type = "LOG_LOG")
```

Arguments

`data`	starvz_data with trace data
`freeScales`	free X,Y scales for each task and resource type combination
`model_type`	Choose the regression model type to use

Value

A ggplot object

Examples

```
## Not run:
panel_model_gflops(data = starvz_sample_sample)

## End(Not run)
```

`panel_mpibandwidth` *Create a line chart panel with MPI bandwidth*

Description

Use the Variable traces to create a line chart panel with MPI bandwidth per node, aggregated by a configurable time step

Usage

```
panel_mpibandwidth(
  data,
  legend = data$config$mpibandwidth$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  y_start = 0,
  y_end = data$config$mpibandwidth$limit,
  step = data$config$mpibandwidth$step
)
```

Arguments

data	starvz_data with trace data
legend	enable/disable legends
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding
x_start	X-axis start value
x_end	X-axis end value
y_start	Y-axis start value
y_end	Y-axis end value
step	time step for aggregation

Value

A ggplot object

Examples

```
panel_mpibandwidth(data = starvz_sample_lu)
```

---

panel_mpiconcurrent *Create a line chart panel with MPI concurrent*

Description

Use the Variable traces to create a line chart panel with MPI concurrent per node, aggregated by a configurable time step

Usage

```
panel_mpiconcurrent(
  data,
  legend = data$config$mpiconcurrent$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  y_start = 0,
  y_end = data$config$mpiconcurrent$limit,
  step = data$config$mpiconcurrent$step
)
```

Arguments

data	starvz_data with trace data
legend	enable/disable legends
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding
x_start	X-axis start value
x_end	X-axis end value
y_start	Y-axis start value
y_end	Y-axis end value
step	time step for aggregation

Value

A ggplot object

Examples

```
panel_mpiconcurrent(data = starvz_sample_lu)
```

---

panel_mpiconcurrentout

Create a line chart panel with MPI concurrent out

Description

Use the Variable traces to create a line chart panel with MPI concurrent out per node, aggregated by a configurable time step

Usage

```
panel_mpiconcurrentout(
  data,
  legend = data$config$mpiconcurrentout$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  y_start = 0,
  y_end = data$config$mpiconcurrentout$limit,
  step = data$config$mpiconcurrentout$step
)
```

Arguments

data	starvz_data with trace data
legend	enable/disable legends
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding
x_start	X-axis start value
x_end	X-axis end value
y_start	Y-axis start value
y_end	Y-axis end value
step	time step for aggregation

Value

A ggplot object

Examples

```
panel_mpiconcurrentout(data = starvz_sample_lu)
```

---

panel_mpistate *Create a space-time view of MPI controlers*

Description

Create a space-time view of MPI controlers

Usage

```
panel_mpistate(
  data = NULL,
  legend = data$config$mpistate$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  y_start = 0,
  y_end = data$config$mpistate$limit
)
```

Arguments

data	starvz_data with trace data
legend	enable/disable legends
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding
x_start	X-axis start value
x_end	X-axis end value
y_start	Y-axis start value
y_end	Y-axis end value

Value

A ggplot object

Examples

```
panel_mpistate(data = starvz_sample_lu)
```

---

panel_nodememuse *Create the node memory usage plot*

Description

Use starvz_data to create a line plot of the memory usage in MB of active nodes along the application execution time

Usage

```
panel_nodememuse(
  data = NULL,
  step = data$config$activenodes$aggregation$step,
  aggregation = data$config$activenodes$aggregation$active,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  legend = data$config$activenodes$nodememuse$legend
)
```

Arguments

data	starvz_data with trace data
step	size in milliseconds for the time aggregation step
aggregation	enable/disable time aggregation for the plot
x_start	X-axis start value
x_end	X-axis end value
legend	enable/disable plot legends

Examples

```
## Not run:
panel_nodememuse(starvz_sample_lu, step = 100)

## End(Not run)
```

---

panel_node_events *Shows nodes events*

Description

Plot a Gantt chart for all nodes where program events are states An example of event is the fxt_flush

Usage

```
panel_node_events(
  data = NULL,
  legend = data$config$node_events$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end
)
```

Arguments

data	starvz_data with trace data
legend	enable/disable legends
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding
x_start	X-axis start value
x_end	X-axis end value

Value

A ggplot object

Examples

```
panel_node_events(data = starvz_sample_lu)
```

---

panel_node_summary *Create a bar plot with node information*

Description

Bar plot with makespan and abe per node

Usage

```
panel_node_summary(
  data,
  legend = data$config$summary_nodes$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end
)
```

Arguments

data	starvz_data with trace data
legend	enable/disable legends
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding
x_start	X-axis start value
x_end	X-axis end value

Value

A ggplot object

Examples

```
panel_node_summary(data = starvz_sample_lu)
```

`panel_pmtool_kiteration` *Create a special chart for applications with iterations with PMtool data*

Description

Plot iteraionts Y over Time X of PMtool data

Usage

```
panel_pmtool_kiteration(
  data = NULL,
  legend = data$config$pmtool$kiteration$legend,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end
)
```

Arguments

`data`	starvz_data with trace data
`legend`	enable/disable legends
`x_start`	X-axis start value
`x_end`	X-axis end value

Value

A ggplot object

Examples

```
panel_pmtool_kiteration(data = starvz_sample_lu)
```

panel_pmtool_st *Create a space time visualization of pmtool application as a Gantt chart*

Description

Use the PMTOOL Application trace data to plot the task computations by ResourceId over the execution time.

Usage

```
panel_pmtool_st(
  data = NULL,
  legend = data$config$pmtool$state$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end
)
```

Arguments

data	starvz_data with trace data
legend	enable/disable legends
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding
x_start	X-axis start value
x_end	X-axis end value

Value

A ggplot object

Examples

```
panel_pmtool_st(data = starvz_sample_lu)
```

`panel_power_imbalance` *Create a line chart with heterogeneous imbalance metrics.*

Description

This function creates a line chart with imbalance metrics. The function applies the metrics on fixed time-steps defined by the user. The metrics consider that the resources are heterogeneous and defined by a constant power factor. For the effects of this function, one task is select for computing the relative power between resources.

Usage

```
panel_power_imbalance(
  data,
  legend = data$config$power_imbalance$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  y_start = 0,
  y_end = data$config$power_imbalance$limit,
  step = data$config$power_imbalance$step,
  task = data$config$power_imbalance$task
)
```

Arguments

`data`	starvz_data with trace data
`legend`	enable/disable legends
`base_size`	base_size base font size
`expand_x`	expand size for scale_x_continuous padding
`x_start`	X-axis start value
`x_end`	X-axis end value
`y_start`	Y-axis start value
`y_end`	Y-axis end value
`step`	time step for aggregation
`task`	Task used to computer relative resource power.

Value

A ggplot object

Examples

```
panel_power_imbalance(data = starvz_sample_lu)
```

panel_progress *Create the progress panel*

Description

The progress panel show a progress metric per node, clustering nodes with a similar metric

Usage

```
panel_progress(df_app, nsteps, cluster_option,
                        func_progress_node = NULL,
                        func_progress_global = NULL,
                        cluster_func = "Mode Density",
                        show_abe = TRUE,
                        plot_node_lines = FALSE,
                        plot_cluster_info = FALSE,
                        abe_label_pos_y = 0.05,
                        abe_label_pos_x = 1.02)
```

Arguments

df_app	starvz_data Application data
nsteps	integer Number of times steps
cluster_option	numeric In case of "Mode Density", the bandwidth
func_progress_node	function progress funcion per node that return [0-1]
func_progress_global	function progress function globaly that return [0-1]
cluster_func	string "Mode Density" or "GMM"
show_abe	boolean Add abe to plots
plot_node_lines	boolean Add to return list the progress metric non-clustered
plot_cluster_info	boolean Add to return list the plot of cluster information
abe_label_pos_y	numeric ajust ABE label in y
abe_label_pos_x	numeric ajust ABE label in x

Value

List, steps - numeric list of steps, step - numeric the number of steps, original_metrics - ggplot, if plot_node_lines is true, plot_den - ggplot, if plot_cluster_info is true, joined_data - tibble, cluster data computed, cluster_metrics - ggplot the progress cluster visualization

Examples

```
panel_progress(starvz_sample_lu$Application, 20, 0.01, show_abe = FALSE)
```

`panel_ready` *Create a line chart panel with ready tasks submission*

Description

Use the Variable traces to create a line chart panel with ready tasks submission per node, aggregated by a configurable time step

Usage

```
panel_ready(
  data,
  legend = data$config$ready$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  y_start = 0,
  y_end = data$config$ready$limit,
  step = data$config$ready$step,
  lack_ready = data$config$ready$lack_ready$active
)
```

Arguments

`data`	starvz_data with trace data
`legend`	enable/disable legends
`base_size`	base_size base font size
`expand_x`	expand size for scale_x_continuous padding
`x_start`	X-axis start value
`x_end`	X-axis end value
`y_start`	Y-axis start value
`y_end`	Y-axis end value
`step`	time step for aggregation
`lack_ready`	show lack ready area in this panel

Value

A ggplot object

Examples

```
panel_ready(data = starvz_sample_lu)
```

panel_resource_usage_task *Plot resource utilization using tasks as color*

Description

Use data Application to create a panel of the total resource utilization that helps to observe the time related resource utilization by task

Usage

```
panel_resource_usage_task(
  data = NULL,
  step = NULL,
  legend = FALSE,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end
)
```

Arguments

data	starvz_data with trace data
step	size in milliseconds for the time aggregation step
legend	enable/disable plot legends
x_start	X-axis start value
x_end	X-axis end value

Value

A ggplot object

Examples

```
panel_resource_usage_task(data = starvz_sample_lu)
```

panel_st *Create a space time visualization of the application as a Gantt chart*

Description

Use the Application trace data to plot the task computations by ResourceId over the execution time. It will select the aggregation mode if requested.

Usage

```
panel_st(
  data,
  agg = data$config$st$aggregation$active,
  agg_met = data$config$st$aggregation$method
)
```

Arguments

data	starvz_data with trace data
agg	boolean Active or not aggregation
agg_met	Aggregation method, possible: static, dynamic, nodes

Value

A ggplot object

Examples

```
panel_st(data = starvz_sample_lu)
```

panel_st_agg_dynamic *Create a space-time visualization with dynamic aggregation.*

Description

Use any state trace data to plot the task computations by ResourceId over the execution time with Gantt Chart. This function dynamically aggregate states with a dynamic/automatic time-step.

Usage

```
panel_st_agg_dynamic(
  data = NULL,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  expand_x = data$config$expand,
  expand_y = data$config$st$expand
)
```

Arguments

data	starvz_data with trace data
x_start	X-axis start value
x_end	X-axis end value
expand_x	expand size for scale_x_continuous padding
expand_y	expand size for scale_y_continuous padding

Value

A ggplot object

Examples

```
panel_st_agg_dynamic(data = starvz_sample_lu)
```

---

panel_st_agg_node *Create a space-time visualization with node aggregation.*

Description

Use any state trace data to plot the task computations by Node over the execution time with Gantt Chart. This function aggregate states within the same resource type.

Usage

```
panel_st_agg_node(
  data,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  step = data$config$st$aggregation$step,
  legend = data$config$st$legend,
  selected_nodes = data$config$selected_nodes
)
```

Arguments

data	starvz_data with trace data
x_start	X-axis start value
x_end	X-axis end value
step	time-step
legend	option to activate legend
selected_nodes	select only some nodes in some plots

Value

A ggplot object

Examples

```
panel_st_agg_node(data = starvz_sample_lu)
```

`panel_st_agg_static` *Create a space-time visualization with static aggregation.*

Description

Use any state trace data to plot the task computations by ResourceId over the execution time with Gantt Chart. This function aggregate states with a static/user-defined time-step.

Usage

```
panel_st_agg_static(
  data = NULL,
  runtime = FALSE,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  expand_x = data$config$expand,
  expand_y = data$config$st$expand,
  outliers = data$config$st$outliers,
  step = data$config$st$aggregation$step
)
```

Arguments

`data`	starvz_data with trace data
`runtime`	if this is runtime data
`x_start`	X-axis start value
`x_end`	X-axis end value
`expand_x`	expand size for scale_x_continuous padding
`expand_y`	expand size for scale_y_continuous padding
`outliers`	print outliers on top
`step`	time-step

Value

A ggplot object

Examples

```
panel_st_agg_static(data = starvz_sample_lu)
```

panel_st_raw *Create a space time visualization as a Gantt chart*

Description

Use the Application trace data to plot the task computations by ResourceId over the execution time.

Usage

```
panel_st_raw(
  data = NULL,
  ST.Outliers = data$config$st$outliers,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  expand_y = data$config$st$expand,
  selected_nodes = data$config$selected_nodes,
  labels = data$config$st$labels,
  alpha = data$config$st$alpha,
  idleness = data$config$st$idleness,
  taskdeps = data$config$st$tasks$active,
  tasklist = data$config$st$tasks$list,
  levels = data$config$st$tasks$levels,
  makespan = data$config$st$makespan,
  abe = data$config$st$abe$active,
  pmtoolbounds = data$config$pmtool$bounds$active,
  cpb = data$config$st$cpb,
  cpb_mpi = data$config$st$cpb_mpi$active,
  legend = data$config$st$legend,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  drop_small = data$config$st$drop_small,
  runtime = FALSE
)
```

Arguments

data	starvz_data with trace data
ST.Outliers	enable/disable the anomalous task highlighting
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding
expand_y	expand size for scale_y_continuous padding
selected_nodes	select only some nodes in some plots
labels	labels: [ALL, 1CPU_per_NODE, 1GPU_per_NODE, FIRST_LAST]
alpha	alpha value for non-anomalous tasks
idleness	enable/disable idleness percentages in the plot

taskdeps	enable/disable task deps path highlighting
tasklist	list of JobIds to highlight the dependencies
levels	number of dependencies to be shown
makespan	enable/disable application makespan at the end of the plot
abe	enable/disable ABE metric
pmtoolbounds	enable/disable pmtool theoretical bounds
cpb	enable/disable critical path bound makespan metric
cpb_mpi	enable/disable critical path bound makespan considering MPI
legend	enable/disable legends
x_start	X-axis start value
x_end	X-axis end value
drop_small	Drop states smaller then this value
runtime	TODO I think we should create a separated function for it

Value

A ggplot object

Examples

```
panel_st_raw(data = starvz_sample_lu)
```

---

panel_st_runtime *Create a space time visualization of the runtime as a Gantt chart*

Description

Use the runtime trace data to plot the task computations by ResourceId over the execution time. It will select the aggregation mode if requested, only static aggregation is available for runtime.

Usage

```
panel_st_runtime(data,
             agg = data$config$starpu$aggregation$active)
```

Arguments

data	starvz_data with trace data
agg	Active or not static aggregation

Value

A ggplot object

Examples

```
panel_st_runtime(data = starvz_sample_lu)
```

`panel_submitted` *Create a line chart panel with submitted tasks submission*

Description

Use the Variable traces to create a line chart panel with submitted tasks submission per node, aggregated by a configurable time step

Usage

```
panel_submitted(
  data,
  legend = data$config$submitted$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  y_start = 0,
  y_end = data$config$submitted$limit,
  step = data$config$submitted$step
)
```

Arguments

`data`	starvz_data with trace data
`legend`	enable/disable legends
`base_size`	base_size base font size
`expand_x`	expand size for scale_x_continuous padding
`x_start`	X-axis start value
`x_end`	X-axis end value
`y_start`	Y-axis start value
`y_end`	Y-axis end value
`step`	time step for aggregation

Value

A ggplot object

Examples

```
panel_submitted(data = starvz_sample_lu)
```

panel_title *Create the title of StarVZ plot*

Description

Use the directory of traces name to create a plot title

Usage

```
panel_title(data, title = data$config$title$text)
```

Arguments

data	starvz_data with trace data
title	title text, if NULL it will fallback to data$Origin then to "Null Title"

Value

A ggplot object

Examples

```
panel_title(data = starvz_sample_lu)
```

panel_usedmemory *Create a line chart panel with used memory*

Description

Use the Variable traces to create a line chart panel with used memory per resource, aggregated by a configurable time step

Usage

```
panel_usedmemory(
  data,
  legend = data$config$usedmemory$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  y_start = 0,
  y_end = data$config$usedmemory$limit,
  step = data$config$usedmemory$step
)
```

Arguments

data	starvz_data with trace data
legend	enable/disable legends
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding
x_start	X-axis start value
x_end	X-axis end value
y_start	Y-axis start value
y_end	Y-axis end value
step	time step for aggregation

Value

A ggplot object

Examples

```
panel_usedmemory(data = starvz_sample_lu)
```

---

panel_utilheatmap *Create a heatmap of resource utilization*

Description

Similar to the other resource oriented plots but shows the utilization per time step

Usage

```
panel_utilheatmap(
  data,
  legend = data$config$utilheatmap$legend,
  base_size = data$config$base_size,
  expand_x = data$config$expand,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  y_start = 0,
  y_end = NA,
  step = data$config$utilheatmap$step
)
```

Arguments

data	starvz_data with trace data
legend	enable/disable legends
base_size	base_size base font size
expand_x	expand size for scale_x_continuous padding
x_start	X-axis start value
x_end	X-axis end value
y_start	Y-axis start value
y_end	Y-axis end value
step	time step for aggregation

Value

A ggplot object

Examples

```
panel_utilheatmap(data = starvz_sample_lu)
```

---

panel_utiltreedepth *Create the resource utilization by tree depth plot*

Description

Use starvz_data Application and Atree to create a plot that shows the total resource utilization, painted by tree depth level using geom_ribbon

Usage

```
panel_utiltreedepth(
  data,
  step = data$config$utiltreenode$step,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end,
  legend = data$config$utiltreedepth$legend
)
```

Arguments

data	starvz_data with trace data
step	size in milliseconds for the time aggregation step
x_start	X-axis start value
x_end	X-axis end value
legend	enable/disable plot legends

Value

A ggplot object

Examples

```
## Not run:
panel_utiltreedepth(starvz_sample_lu, step = 100, legend = TRUE)

## End(Not run)
```

`panel_utiltreenode` *Create the resource utilization by tree node plot*

Description

Use starvz_data Application and Atree to create a plot that shows the total resource utilization, painted by tree node using geom_ribbon. The colors are reused between nodes, not tied to a specific tree node.

Usage

```
panel_utiltreenode(
  data = NULL,
  step = data$config$utiltreenode$step,
  x_start = data$config$limits$start,
  x_end = data$config$limits$end
)
```

Arguments

`data`	starvz_data with trace data
`step`	size in milliseconds for the time aggregation step
`x_start`	X-axis start value
`x_end`	X-axis end value

Value

A ggplot object

Examples

```
## Not run:
panel_utiltreenode(data = starvz_sample_lu, step = 100)

## End(Not run)
```

plot.starvz_data *Plot starvz_data*

Description

Plot starvz_data

Usage

```
## S3 method for class 'starvz_data'
plot(x, ...)
```

Arguments

x	A starvz_data
...	optional

Value

Nothing

Examples

```
plot(starvz_sample_lu)
```

pre_handle_gantt *Pre-Computation for memory handles panel*

Description

Use for precomputation of memory handles panel

Usage

```
pre_handle_gantt(data, name_func = NULL)
```

Arguments

data	starvz_data with trace data
name_func	function to give names to handles

Value

Pre-Computated data for panel_handles

Examples

```
pre_handle_gantt(data = starvz_sample_lu)
```

`print.starvz_data` *Print starvz_data*

Description

Print starvz_data

Usage

```
## S3 method for class 'starvz_data'
print(x, ...)
```

Arguments

`x`	A starvz_data
`...`	optional

Value

Nothing

Examples

```
print(starvz_sample_lu)
```

`qrmumps_colors` *Colors for qr mumps*

Description

This will be deprecated

Usage

```
qrmumps_colors()
```

resource_utilization_tree_node *Create the node memory usage plot*

Description

Use starvz_data to create a line plot of the memory usage in MB of active nodes along the application execution time

Usage

```
resource_utilization_tree_node(
  Application = NULL,
  Atree = NULL,
  step = 100,
  group_pruned = FALSE,
  performance_metric = "Time"
)
```

Arguments

Application	starvz application data
Atree	starvz elimination tree data
step	size in milliseconds for the time aggregation step
group_pruned	aggregate computations of the same parent pruned nodes
performance_metric	Performance metric to save in Value1 [Time, GFlops]

starvz_assemble *Assemble multiple StarVZ panel lists*

Description

Take a panel list, or a list of list of panels and assemble it

Usage

```
starvz_assemble(
  ...,
  config = NULL,
  remove_Y_info = TRUE,
  remove_legends = TRUE
)
```

Arguments

...	Panel list or list of panel lists
config	StarVZ configurations for determaning panels heights
remove_Y_info	remove Y labels for a second and subsequent list of panels
remove_legends	remove legends for a second and subsequent list of panels

Value

The ggplot plot

Examples

```
starvz_assemble(starvz_plot_list(starvz_sample_lu),
  config = starvz_sample_lu$config
)
```

---

starvz_check_data *Check if all required data is available*

Description

The following conditions are check in order and return FALSE if any fail - If data is not NULL - If data is a StarVZ Class - If data has all tables (given by the names of the list tables) - If each respective table has all columns (given the associated vector) - Execute extra_func on data (that should return true or false)

Usage

```
starvz_check_data(data = NULL,
             tables = list(), extra_func = NULL)
```

Arguments

data	starvz_data with trace data
tables	A named list (names are tables of data) of vectors (elements are columns), if tables is null continue
extra_func	Extra function to be applied on data to do a last check

Value

Logical, TRUE if data pass all tests

Examples

```
starvz_check_data(starvz_sample_lu,
  tables = list("Comm_state" = c("Node"))
)
```

`starvz_phase1` *Execute StarVZ Phase one.*

Description

This function calls all CSV-converter inner-functions to pre-process they into StarVZ files. Although this can be directly used in a folder where all CSV compressed (gzip) files reside, we suggest to use the shell tool `starvz` or `phase1-workflow.sh` in the `tools/` directory.

Usage

```
starvz_phase1(
  directory = ".",
  app_states_fun = lu_colors,
  state_filter = 0,
  whichApplication = "",
  input.parquet = "1",
  config_file = NULL
)
```

Arguments

`directory`	Directory of CSV files
`app_states_fun`	Function to determine application
`state_filter`	Type of filder
`whichApplication`	Name of Application
`input.parquet`	Use or not of parquet files
`config_file`	StarVZ config structure, this function uses only the app_tasks

Value

ggplot object with all starvz plots

Examples

```
example_folder <- system.file("extdata", "lu_trace", package = "starvz")
starvz_phase1(directory = example_folder)
```

starvz_plot *Make a StarVZ plot*

Description

Create a StarVZ plot considering the data supplied

Usage

```
starvz_plot(
  data = NULL,
  name = NULL,
  save = FALSE,
  guided = data$config$guided$active,
  dpi = 120
)
```

Arguments

data	starvz_data class with $config
name	Path for saved image
save	call ggplot to save the image
guided	compute ideal figure height
dpi	dpi for ggsave

Value

ggplot object with all starvz plots

Examples

```
starvz_plot(starvz_sample_lu)
```

starvz_plot_list *Generate the StarVZ Plots*

Description

Use data to create the list of StarVZ plots

Usage

```
starvz_plot_list(data = NULL)
```

Arguments

data	starvz_data with trace data

Value

A list of ggplot plots

Examples

```
starvz_plot_list(starvz_sample_lu)
```

---

starvz_read *Read starvz trace files*

Description

Read the directory of trace files (feather or parquet)
and the configuration file, and return a starvz_data class used in starvz functions

Usage

```
starvz_read(directory = ".",
               config_file = NULL, selective = TRUE)
```

Arguments

directory	Directory path of trace files
config_file	Path for configuration yaml file
selective	if True, only read data needed for creating panels activated in config

Value

The starvz_data with all tables

Examples

```
starvz_read("folder_to_parquet_files/")
starvz_read(
  directory = "folder_to_parquet_files/",
  config_file = "path_to_config.yaml"
)
starvz_read() # Read current directory
```

starvz_read_config *Read config files*

Description

Read starvz configuration yaml files. This function is design to replace an already existing configuration on starvz data.

Usage

```
starvz_read_config(file = NULL, warn = TRUE)
```

Arguments

file	The path to a file
warn	Give a warn in case the config file is not found

Value

A list containing starvz configuration

Examples

```
example_file <- system.file("extdata", "config.yaml", package = "starvz")
config <- starvz_read_config(example_file)
```

starvz_sample_lu *Small StarVZ data of LU Factorization*

Description

A small StarVZ data object obtained from Chameleon+StarPU LU Factorization Generated by:

```
library(starvz)
pre_phase1 <- starvz_phase1(system.file("extdata", "lu_trace",
                                        package = "starvz"),
                            lu_colors,
                            state_filter=2,
                            whichApplication="lu")
starvz_sample_lu <- starvz_read(system.file("extdata",
                                            "lu_trace",
                                            package = "starvz"),
                                system.file("extdata",
                                            "config.yaml",
                                            package = "starvz"),
                                selective=FALSE)
usethis::use_data(starvz_sample_lu)
```

Usage

```
starvz_sample_lu
```

Format

An object of class `starvz_data` of length 24.

Source

starvz_phase1 and starvz_read

---

starvz_set_log *Active internal debug logs*

Description

Active internal debug logs

Usage

```
starvz_set_log(state)
```

Arguments

`state`	Active or not logs

Value

Nothing

Examples

```
starvz_set_log(FALSE)
```

starvz_transform_olddata *Try to convert old StarVZ data to the new type*

Description

Old StarVZ data are usually just a tibble

Usage

```
starvz_transform_olddata(data)
```

Arguments

data	starvz_data old data

Value

starvz_data the data converted

Examples

```
starvz_transform_olddata(starvz_sample_lu)
```

summary.starvz_data *Summary starvz_data*

Description

Summary starvz_data

Usage

```
## S3 method for class 'starvz_data'
summary(object, ...)
```

Arguments

object	A starvz_data
...	optional

Value

Nothing

Examples

```
summary(starvz_sample_lu)
```

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