vmalert

`vmalert` executes a list of the given alerting or recording rules against configured `-datasource.url`. For sending alerting notifications `vmalert` relies on Alertmanager configured via `-notifier.url` flag. Recording rules results are persisted via remote write protocol and require `-remoteWrite.url` to be configured. `vmalert` is heavily inspired by Prometheus implementation and aims to be compatible with its syntax.

A single-node or cluster version of VictoriaMetrics are capable of proxying requests to `vmalert` via `-vmalert.proxyURL` command-line flag. Use this feature for the following cases:

- for proxying requests from Grafana Alerting UI;
- for accessing `vmalert`'s UI through VictoriaMetrics Web interface.

VictoriaMetrics Cloud provides out-of-the-box alerting functionality based on `vmalert`. This service simplifies the setup and management of alerting and recording rules as well as the integration with Alertmanager. For more details, please refer to the VictoriaMetrics Cloud documentation.

Features

- Integration with VictoriaMetrics and MetricsQL;
- Integration with VictoriaLogs and LogsQL. See this doc;
- Prometheus alerting rules definition format support;
- Integration with Alertmanager starting from Alertmanager v0.16.0-alpha;
- Keeps the alerts state on restarts;
- Graphite datasource can be used for alerting and recording rules. See these docs;
- Recording and Alerting rules backfilling (aka `replay`). See these docs;
- Lightweight and without extra dependencies.
- Supports reusable templates for annotations;
- Load of recording and alerting rules from local filesystem, URL, GCS and S3;
- Detect alerting rules which don't match any series.

Limitations

- `vmalert` execute queries against remote datasource which has reliability risks because of the network. It is recommended to configure alerts thresholds and rules expressions with the understanding that network requests may fail;
- `vmalert` executes rules within a group sequentially, but persistence of execution results to remote storage is asynchronous. Hence, user shouldn't rely on chaining of recording rules when result of previous recording rule is reused in the next one. See how to chain groups here.

QuickStart

To start using `vmalert` you will need the following things:

- list of rules - PromQL/MetricsQL expressions to execute;
- datasource address - reachable endpoint with Prometheus HTTP API support for running queries against;

- notifier address [optional] - reachable Alert Manager instance for processing, aggregating alerts, and sending notifications. Please note, notifier address also supports Consul and DNS Service Discovery via config file .
- remote write address [optional] - remote write compatible storage to persist rules and alerts state info. To persist results to multiple destinations use vmagent configured with multiple remote writes as a proxy;
- remote read address [optional] - MetricsQL compatible datasource to restore alerts state from.

You can use the existing docker-compose environment as example. It already contains vmalert configured with list of alerting rules and integrated with Alert Manager and VictoriaMetrics.

Alternatively, build `vmalert` from sources:

```
git clone https://github.com/VictoriaMetrics/VictoriaMetrics
cd VictoriaMetrics
make vmalert
```

Then run `vmalert` :

```
./bin/vmalert -rule=alert.rules \           # Path to the file with rules configuration. Supports wildcard
    -datasource.url=http://localhost:8428 \  # Prometheus HTTP API compatible datasource
    -notifier.url=http://localhost:9093 \    # AlertManager URL (required if alerting rules are used)
    -notifier.url=http://127.0.0.1:9093 \    # AlertManager replica URL
    -remoteWrite.url=http://localhost:8428 \ # Remote write compatible storage to persist rules and alerts state info (required if recording rul
    -remoteRead.url=http://localhost:8428 \  # MetricsQL compatible datasource to restore alerts state from
    -external.label=cluster=east-1 \         # External label to be applied for each rule
    -external.label=replica=a                # Multiple external labels may be set
```

> **Note**
> *To validate the syntax of configured rules simply run vmalert with `-rule` and `-dryRun` cmd-line flags.*

Note there's a separate `-remoteWrite.url` command-line flag to allow writing results of alerting/recording rules into a different storage than the initial data that's queried. This allows using `vmalert` to aggregate data from a short-term, high-frequency, high-cardinality storage into a long-term storage with decreased cardinality and a bigger interval between samples. See also stream aggregation .

See the full list of configuration flags in configuration section.

If you run multiple `vmalert` services for the same datastore or AlertManager - do not forget to specify different `-external.label` command-line flags in order to define which `vmalert` generated rules or alerts. If rule result metrics have label that conflict with `-external.label` , `vmalert` will automatically rename it with prefix `exported_` .

Configuration for recording and alerting rules is very similar to Prometheus rules and configured using YAML. Configuration examples may be found in testdata folder. Every `rule` belongs to a `group` and every configuration file may contain arbitrary number of groups:

```
groups:
  [ - <rule_group> ]
```

> **Note**
> Explore how to integrate `vmalert` with VictoriaMetrics Anomaly Detection in the following guide .

> **Note**
> For users of VictoriaMetrics Cloud , many of the configuration steps (including highly available setup of `vmalert` for cluster deployments) are handled automatically. Please, refer to the VictoriaMetrics Cloud documentation for more details.

Groups

Each group has the following attributes:

```
# The name of the group. Must be unique within a file.
name: <string>

# How often rules in the group are evaluated.
[ interval: <duration> | default = -evaluationInterval flag ]

# Optional
# Group will be evaluated at the exact offset in the range of [0...interval].
# E.g. for Group with `interval: 1h` and `eval_offset: 5m` the evaluation will
# start at 5th minute of the hour. See https://github.com/VictoriaMetrics/VictoriaMetrics/issues/3409
# `interval` must be specified if `eval_offset` is used, and `eval_offset` cannot exceed `interval`.
# `eval_offset` cannot be used with `eval_delay`, as group will be executed at the exact offset and `eval_delay` is ignored.
[ eval_offset: <duration> ]

# Optional
# Adjust the `time` parameter of group evaluation requests to compensate intentional query delay from the datasource.
# By default, the value is inherited from the `-rule.evalDelay` cmd-line flag - see its description for details.
# If group has `latency_offset` set in `params`, then it is recommended to set `eval_delay` equal to `latency_offset`.
# See https://github.com/VictoriaMetrics/VictoriaMetrics/issues/5155 and https://docs.victoriametrics.com/victoriametrics/keyconcepts/#query-lat
[ eval_delay: <duration> ]

# Limit limits the number of alerts or recording results the rule within this group can produce.
# On exceeding the limit, rule will be marked with an error and all its results will be discarded.
# 0 is no limit.
[ limit: <integer> | default 0]

# How many rules execute at once within a group. Increasing concurrency may speed
# up group's evaluation duration (exposed via `vmalert_iteration_duration_seconds` metric).
[ concurrency: <integer> | default = 1 ]

# Optional type for expressions inside rules to override the `-rule.defaultRuleType(default is "prometheus")` cmd-line flag.
# Supported values: "graphite", "prometheus" and "vlogs"(check https://docs.victoriametrics.com/victorialogs/vmalert/ for details).
[ type: <string> ]

# Optional
# The evaluation timestamp will be aligned with group's interval,
# instead of using the actual timestamp that evaluation happens at.
#
# It is enabled by default to get more predictable results
# and to visually align with graphs plotted via Grafana or vmui.
# When comparing with raw queries, remember to use `step` equal to evaluation interval.
#
# See https://github.com/VictoriaMetrics/VictoriaMetrics/issues/5049
# Available starting from v1.95
[ eval_alignment: <bool> | default true]

# Optional list of HTTP URL parameters
# applied for all rules requests within a group
# For example:
#  params:
#    nocache: ["1"]               # disable caching for vmselect
#    denyPartialResponse: ["true"] # fail if one or more vmstorage nodes returned an error
#    extra_label: ["env=dev"]      # apply additional label filter "env=dev" for all requests
# see more details at https://docs.victoriametrics.com/victoriametrics/single-server-victoriametrics/#prometheus-querying-api-enhancements
params:
  [ <string>: [<string>, ...]]

# Optional list of HTTP headers in form `header-name: value`
# applied for all rules requests within a group
# For example:
#  headers:
#    - "CustomHeader: foo"
#    - "CustomHeader2: bar"
# Headers set via this param have priority over headers set via `-datasource.headers` flag.
headers:
  [ <string>, ...]

# Optional list of HTTP headers in form `header-name: value`
# applied for all alert notifications sent to notifiers
# generated by rules of this group.
```

```
# It has higher priority over headers defined in notifier config.
# For example:
#  notifier_headers:
#    - "TenantID: foo"
notifier_headers:
  [ <string>, ...]

# Optional list of labels added to every rule within a group.
# It has priority over the external labels.
# Labels are commonly used for adding environment
# or tenant-specific tag.
labels:
  [ <labelname>: <labelvalue> ... ]

rules:
  [ - <rule> ... ]

# Enable debug mode for all rules in the group.
# This can be overridden by the `debug` field in rule.
[ debug: <bool> | default = false ]
```

Rules

Every rule contains `expr` field for PromQL or MetricsQL expression. `vmalert` will execute the configured expression and then act according to the Rule type.

There are two types of Rules:

- alerting - Alerting rules allow defining alert conditions via `expr` field and to send notifications to Alertmanager if execution result is not empty.
- recording - Recording rules allow defining `expr` which result will be then backfilled to configured `-remoteWrite.url`. Recording rules are used to precompute frequently needed or computationally expensive expressions and save their result as a new set of time series.

`vmalert` forbids defining duplicates - rules with the same combination of name, expression, and labels within one group.

Alerting rules

The syntax for alerting rule is the following:

```
# The name of the alert. Must be a valid metric name.
alert: <string>

# The expression to evaluate. The expression language depends on the type value.
# By default, PromQL/MetricsQL expression is used. If group.type="graphite", then the expression
# must contain valid Graphite expression.
expr: <string>

# Alerts are considered firing once they have been returned for this long.
# Alerts which have not yet been fired for long enough are considered pending.
# If param is omitted or set to 0 then alerts will be immediately considered
# as firing once they return.
[ for: <duration> | default = 0s ]

# Alert will continue firing for this long even when the alerting expression no longer has results.
# This allows you to delay alert resolution.
[ keep_firing_for: <duration> | default = 0s ]

# Whether to print debug information into logs.
# Information includes alerts state changes and requests sent to the datasource.
# Please note, that if rule's query params contain sensitive
# information - it will be printed to logs.
# Logs are printed with INFO level, so make sure that -loggerLevel=INFO to see the output.
[ debug: <bool> | default = false ]

# Defines the number of rule's updates entries stored in memory
# and available for view on rule's Details page.
# Overrides `rule.updateEntriesLimit` value for this specific rule.
# Available starting from https://docs.victoriametrics.com/victoriametrics/changelog/#v1860
```

```
  [ update_entries_limit: <integer> | default 0 ]

  # Labels to add or overwrite for each alert.
  # In case of conflicts, original labels are kept with prefix `exported_`.
  labels:
    [ <labelname>: <tmpl_string> ]

  # Annotations to add to each alert.
  annotations:
    [ <labelname>: <tmpl_string> ]
```

Templating

It is allowed to use Go templating in annotations to format data, iterate over or execute expressions. The following variables are available in templating:

Variable	Description	Example
$value or .Value	The current alert's value. Avoid using value in labels, it may cause unexpected issues.	Number of connections is {{ $value }}
$activeAt or .ActiveAt	The moment of time when alert became active (`pending` or `firing`).	http://vm-grafana.com/ ?viewPanel=&from={{($activeAt.Add (parseDurationTime "1h")).UnixMilli}}&to={{($activeAt.Add (parseDurationTime "-1h")).UnixMilli}}
$labels or .Labels	The list of labels of the current alert. Use as ".Labels. <label_name>".	Too high number of connections for {{ .Labels.instance }}
$type or .Type	The rule type: "graphite", "prometheus" or "vlogs"	Link: 'explore?left={"datasource":"{{ if eq .Type "vlogs" }}VictoriaLogs{{ else }}VictoriaMetrics{{ end }}"}'
$alertID or .AlertID	The current alert's ID generated by vmalert.	Link: vmalert/alert?group_id={{.GroupID}}&alert_id={{.AlertID}}
$groupID or .GroupID	The current alert's group ID generated by vmalert.	Link: vmalert/alert?group_id={{.GroupID}}&alert_id={{.AlertID}}
$expr or .Expr	Alert's expression. Can be used for generating links to Grafana or other systems.	/api/v1/query?query={{ $expr|queryEscape }}
$for or .For	Alert's configured for param.	Number of connections is too high for more than {{ .For }}
$externalLabels or .ExternalLabels	List of labels configured via `-external.label` command-line flag.	Issues with {{ $labels.instance }} (datacenter-{{ $externalLabels.dc }})
$externalURL or .ExternalURL	URL configured via `-external.url` command-line flag. Used for cases when vmalert is hidden behind proxy.	Visit {{ $externalURL }} for more details

Additionally, `vmalert` provides some extra templating functions listed here and reusable templates .

Template functions

`vmalert` provides the following template functions, which can be used during templating :

- `args arg0 ... argN` - converts the input args into a map with `arg0` , ..., `argN` keys.
- `externalURL` - returns the value of `-external.url` command-line flag.
- `first` - returns the first result from the input query results returned by `query` function.
- `htmlEscape` - escapes special chars in input string, so it can be safely embedded as a plaintext into HTML.
- `humanize` - converts the input number into human-readable format by adding metric prefixes . For example, `100000` is converted into `100K` .
- `humanize1024` - converts the input number into human-readable format with 1024 base. For example, `1024` is converted into 1ki`.
- `humanizeDuration` - converts the input number in seconds into human-readable duration.

- `humanizePercentage` - converts the input number to percentage. For example, `0.123` is converted into `12.3%`.
- `humanizeTimestamp` - converts the input unix timestamp into human-readable time.
- `jsonEscape` - JSON-encodes the input string.
- `label name` - returns the value of the label with the given `name` from the input query result.
- `match regex` - matches the input string against the provided `regex`.
- `parseDuration` - parses the input string into duration in seconds. For example, `1h` is parsed into `3600`.
- `parseDurationTime` - parses the input string into time.Duration.
- `pathEscape` - escapes the input string, so it can be safely put inside path part of URL.
- `pathPrefix` - returns the path part of the `-external.url` command-line flag.
- `query` - executes the MetricsQL query against `-datasource.url` and returns the query result. For example, `{{ query "sort_desc(process_resident_memory_bytes)" | first | value }}` executes the `sort_desc(process_resident_memory_bytes)` query at `-datasource.url` and returns the first result.
- `queryEscape` - escapes the input string, so it can be safely put inside query arg part of URL.
- `quotesEscape` - escapes the input string, so it can be safely embedded into JSON string.
- `reReplaceAll regex repl` - replaces all the occurrences of the `regex` in input string with the `repl`.
- `safeHtml` - marks the input string as safe to use in HTML context without the need to html-escape it.
- `sortByLabel name` - sorts the input query results by the label with the given `name`.
- `stripDomain` - leaves the first part of the domain. For example, `foo.bar.baz` is converted to `foo`. The port part is left in the output string. E.g. `foo.bar:1234` is converted into `foo:1234`.
- `stripPort` - strips `port` part from `host:port` input string.
- `strvalue` - returns the metric name from the input query result.
- `title` - converts the first letters of every input word to uppercase.
- `toLower` - converts all the chars in the input string to lowercase.
- `toTime` - converts the input unix timestamp to time.Time.
- `toUpper` - converts all the chars in the input string to uppercase.
- `value` - returns the numeric value from the input query result.

Reusable templates

Like in Alertmanager you can define reusable templates to share same templates across annotations. Just define the templates in a file and set the path via `-rule.templates` flag.

For example, template `grafana.filter` can be defined as following:

```
{{ define "grafana.filter" -}}
  {{- $labels := .arg0 -}}
  {{- range $name, $label := . -}}
    {{- if (ne $name "arg0") -}}
      {{- ( or (index $labels $label) "All" ) | printf "&var-%s=%s" $label -}}
    {{- end -}}
  {{- end -}}
{{- end -}}
```

And then used in annotations:

```
groups:
  - name: AlertGroupName
    rules:
      - alert: AlertName
        expr: any_metric > 100
        for: 30s
        labels:
          alertname: 'Any metric is too high'
          severity: 'warning'
        annotations:
          dashboard: '{{ $externalURL }}/d/dashboard?orgId=1{{ template "grafana.filter" (args .CommonLabels "account_id" "any_label") }}'
```

The `-rule.templates` flag supports wildcards so multiple files with templates can be loaded. The content of `-rule.templates` can be also hot reloaded.

Recording rules

The syntax for recording rules is following:

```
# The name of the time series to output to. Must be a valid metric name.
record: <string>

# The expression to evaluate. The expression language depends on the type value.
# By default, MetricsQL expression is used. If group.type="graphite", then the expression
# must contain valid Graphite expression.
expr: <string>

# Labels to add or overwrite before storing the result.
# In case of conflicts, original labels are kept with prefix `exported_`.
labels:
  [ <labelname>: <labelvalue> ]

# Whether to print debug information into logs.
# Information includes requests sent to the datasource.
# information - it will be printed to logs.
# Logs are printed with INFO level, so make sure that -loggerLevel=INFO to see the output.
[ debug: <bool> | default = false ]

# Defines the number of rule's updates entries stored in memory
# and available for view on rule's Details page.
# Overrides `rule.updateEntriesLimit` value for this specific rule.
[ update_entries_limit: <integer> | default 0 ]
```

For recording rules to work `-remoteWrite.url` must be specified.

Alerts state on restarts

`vmalert` holds alerts state in the memory. Restart of the `vmalert` process will reset the state of all active alerts in the memory. To prevent `vmalert` from losing the state on restarts configure it to persist the state to the remote database via the following flags:

- `-remoteWrite.url` - URL to VictoriaMetrics (Single) or vminsert (Cluster). `vmalert` will persist alerts state to the configured address in the form of time series `ALERTS` and `ALERTS_FOR_STATE` via remote-write protocol. These time series can be queried from VictoriaMetrics just as any other time series. The state will be persisted to the configured address on each evaluation.
- `-remoteRead.url` - URL to VictoriaMetrics (Single) or vmselect (Cluster). `vmalert` will try to restore alerts state from the configured address by querying time series with name `ALERTS_FOR_STATE`. The restore happens only once when `vmalert` process starts, and only for the configured rules. Config hot reload doesn't trigger state restore.

Both flags are required for proper state restoration. Restore process may fail if time series are missing in configured `-remoteRead.url`, weren't updated in the last `1h` (controlled by `-remoteRead.lookback`) or received state doesn't match current `vmalert` rules configuration. `vmalert` marks successfully restored rules with `restored` label in web UI.

Link to alert source

Alerting notifications sent by vmalert always contain a `source` link. By default, the link format is the following `http://<vmalert-addr>/vmalert/alert?group_id=<group_id>&alert_id=<alert_id>`. On click, it opens vmalert web UI to show the alert status and its fields.

It is possible to override the link format. For example, to make the link to vmui specify the following cmd-line flags:

```
./bin/vmalert \
    -external.url=http://<vmui-addr> \  # the hostname and port for datasource vmui
    -external.alert.source='vmui/#/?g0.expr={{.Expr|queryEscape}}' # the path built using alert expr
```

Now, all `source` links will lead to `http://<vmui-addr>/vmui/#/?g0.expr=$expr`, where $expr is an alerting rule expression.

The `-external.alert.source` cmd-line flag supports templating and allows using labels and extra data related to the alert. For example, see the following link to Grafana:

```
./bin/vmalert \
    -external.url=http://<grafana-addr> \  # the hostname and port for Grafana
    -external.alert.source='explore?left={"datasource":"{{ if eq .Type \"vlogs\" }}VictoriaLogs{{ else }}VictoriaMetrics{{ end }}","queries":[{"
```

In this example, `-external.alert.source` will lead to Grafana's Explore page with `expr` field equal to alert expression, and time range will be selected starting from `"from":"{{ .ActiveAt.UnixMilli }}"` when alert became active. The `datasource` name is set to `VictoriaLogs` if rule's type ? (`prometheus`, `vlogs` or `graphite`) is `vlogs`. Otherwise, it is set to `VictoriaMetrics`. See how we set alert source in docker.

In addition to `source` link, some extra links could be added to alert's annotations field. See how we use them to link alerting rule and the corresponding panel on Grafana dashboard.

Multitenancy

There are the following approaches exist for alerting and recording rules across multiple tenants:

- To run a separate `vmalert` instance per each tenant. The corresponding tenant must be specified in `-datasource.url` command-line flag according to these docs. For example, `/path/to/vmalert -datasource.url=http://vmselect:8481/select/123/prometheus` would run alerts against `AccountID=123`. For recording rules the `-remoteWrite.url` command-line flag must contain the url for the specific tenant as well. For example, `-remoteWrite.url=http://vminsert:8480/insert/123/prometheus` would write recording rules to `AccountID=123`.
- To use the multitenant endpoint ? of vminsert as the `-remoteWrite.url` and vmselect as the `-datasource.url`, add `extra_label` with tenant ID as an HTTP URL parameter for each group. For example, run vmalert using `-datasource.url=http://vmselect:8481/select/multitenant/prometheus` `-remoteWrite.url=http://vminsert:8480/insert/multitenant/prometheus`, along with the rule group:

```
groups:
- name: rules_for_tenant_456:789
  params:
     extra_label: [vm_account_id=456,vm_project_id=789]
  rules:
    # Rules for accountID=456, projectID=789
```

The multitenant endpoint in vmselect is less efficient than specifying tenants in URL.

For security considerations, it is recommended restricting access to multitenant endpoints only to trusted sources, since untrusted source may break per-tenant data by writing unwanted samples or get access to data of arbitrary tenants.

- To specify `tenant` parameter per each alerting and recording group if enterprise version of vmalert is used with `-clusterMode` command-line flag. For example:

```
groups:
- name: rules_for_tenant_123
  tenant: "123"
  rules:
    # Rules for accountID=123

- name: rules_for_tenant_456:789
  tenant: "456:789"
  rules:
    # Rules for accountID=456, projectID=789
```

The results of alerting and recording rules contain `vm_account_id` and `vm_project_id` labels if `-clusterMode` is enabled. These labels can be used during templating , and help to identify to which account or project the triggered alert or produced recording belongs.

If `-clusterMode` is enabled, then `-datasource.url` , `-remoteRead.url` and `-remoteWrite.url` must contain only the hostname without tenant id. For example: `-datasource.url=http://vmselect:8481` . `vmalert` automatically adds the specified tenant to urls per each recording rule in this case.

If `-clusterMode` is enabled and the `tenant` in a particular group is missing, then the tenant value is obtained from `-defaultTenant.prometheus` or `-defaultTenant.graphite` depending on the `type` of the group.

The enterprise version of vmalert is available in `vmutils-*-enterprise.tar.gz` files at release page and in `*-enterprise` tags at Docker Hub and Quay .

Reading rules from object storage

Enterprise version of `vmalert` may read alerting and recording rules from object storage:

- `./bin/vmalert -rule=s3://bucket/dir/alert.rules` would read rules from the given path at S3 bucket
- `./bin/vmalert -rule=gs://bucket/dir/alert.rules` would read rules from the given path at GCS bucket

S3 and GCS paths support only matching by prefix, e.g. `s3://bucket/dir/rule_` matches all files with prefix `rule_` in the folder `dir` .

The following command-line flags can be used for fine-tuning access to S3 and GCS:

- `-s3.credsFilePath` - path to file with GCS or S3 credentials. Credentials are loaded from default locations if not set.
- `-s3.configFilePath` - path to file with S3 configs. Configs are loaded from default location if not set.
- `-s3.configProfile` - profile name for S3 configs. If no set, the value of the environment variable will be loaded (`AWS_PROFILE` or `AWS_DEFAULT_PROFILE`).
- `-s3.customEndpoint` - custom S3 endpoint for use with S3-compatible storages (e.g. MinIO). S3 is used if not set.
- `-s3.forcePathStyle` - prefixing endpoint with bucket name when set false, true by default.

Topology examples

The following sections are showing how `vmalert` may be used and configured for different scenarios.

Please note, not all flags in examples are required:

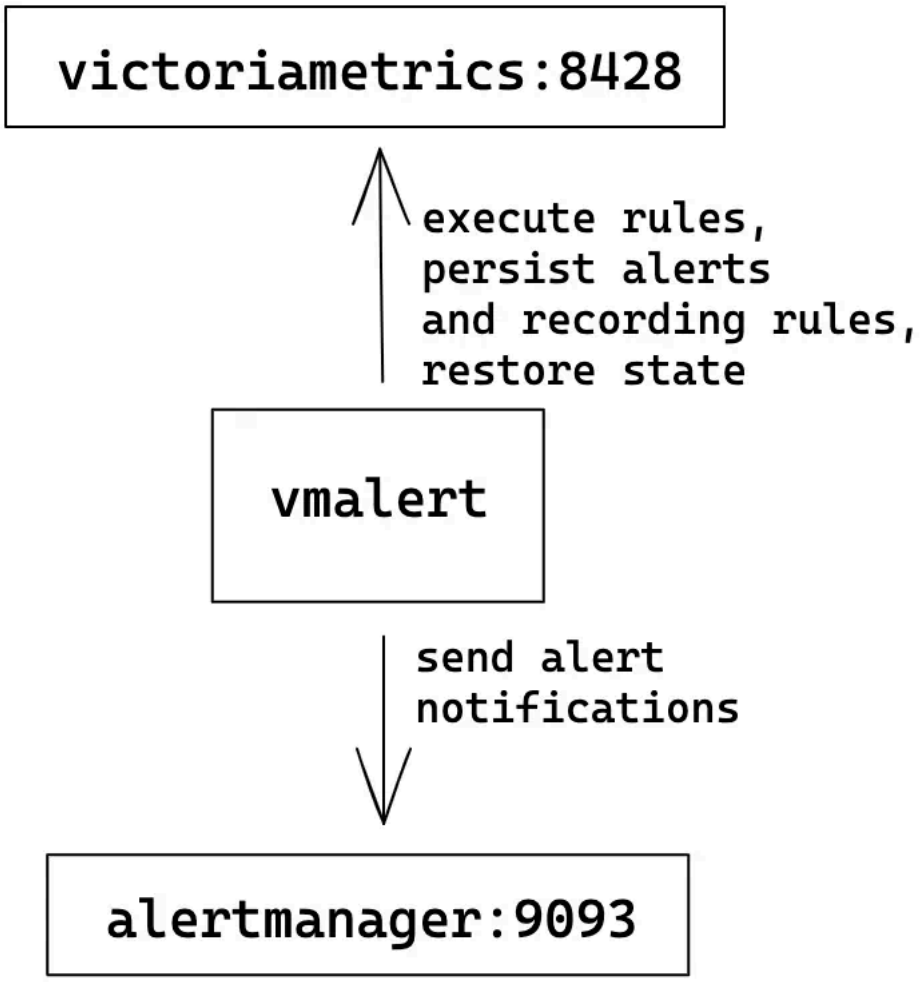
- `-remoteWrite.url` and `-remoteRead.url` are optional and are needed only if you have recording rules or want to store alerts state on `vmalert` restarts;
- `-notifier.url` is optional and is needed only if you have alerting rules.

Single-node VictoriaMetrics

The simplest configuration where one single-node VM server is used for rules execution, storing recording rules results and alerts state.

`vmalert` configuration flags:

```
./bin/vmalert -rule=rules.yml  \                    # Path to the file with rules configuration. Supports wildcard
    -datasource.url=http://victoriametrics:8428 \   # VM-single addr for executing rules expressions
    -remoteWrite.url=http://victoriametrics:8428 \  # VM-single addr to persist alerts state and recording rules results
    -remoteRead.url=http://victoriametrics:8428 \   # VM-single addr for restoring alerts state after restart
    -notifier.url=http://alertmanager:9093          # AlertManager addr to send alerts when they trigger
```

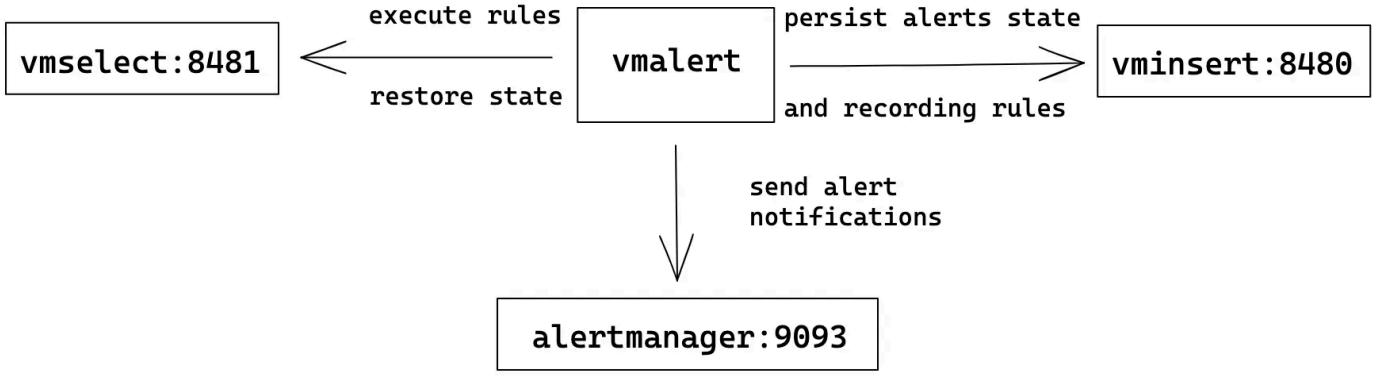


Cluster VictoriaMetrics

In cluster mode VictoriaMetrics has separate components for writing and reading path: `vminsert` and `vmselect` components respectively. `vmselect` is used for executing rules expressions and `vminsert` is used to persist recording rules results and alerts state. Cluster mode could have multiple `vminsert` and `vmselect` components.

`vmalert` configuration flags:

```
./bin/vmalert -rule=rules.yml  \                          # Path to the file with rules configuration. Supports wildcard
    -datasource.url=http://vmselect:8481/select/0/prometheus    # vmselect addr for executing rules expressions
    -remoteWrite.url=http://vminsert:8480/insert/0/prometheus   # vminsert addr to persist alerts state and recording rules results
    -remoteRead.url=http://vmselect:8481/select/0/prometheus    # vmselect addr for restoring alerts state after restart
    -notifier.url=http://alertmanager:9093                    # AlertManager addr to send alerts when they trigger
```



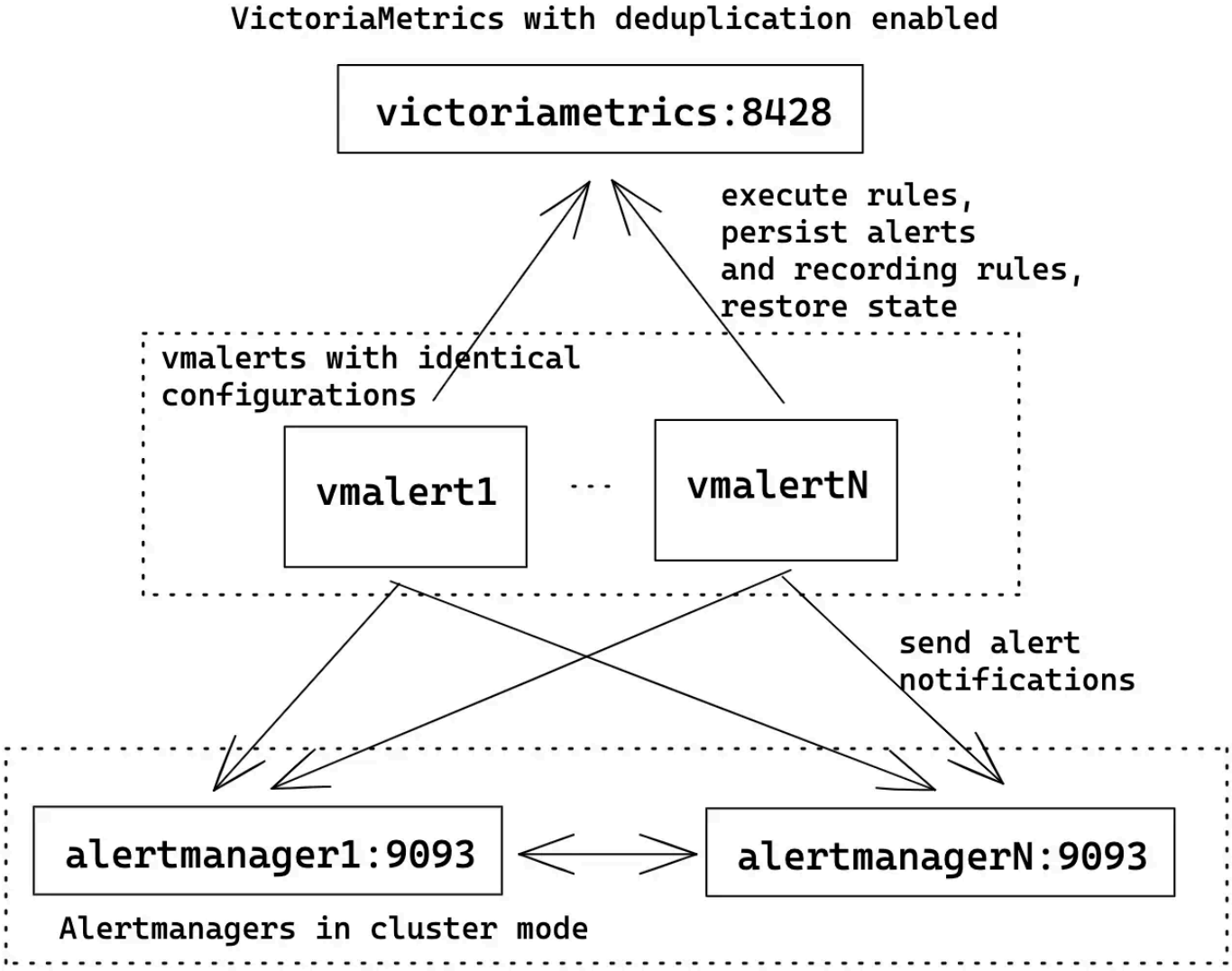
In case when you want to spread the load on these components - add balancers before them and configure `vmalert` with balancer addresses. Please, see more about VM's cluster architecture here .

HA vmalert

For High Availability(HA) user can run multiple identically configured `vmalert` instances. It means all of them will execute the same rules, write state and results to the same destinations, and send alert notifications to multiple configured Alertmanagers.

`vmalert` configuration flags:

```
./bin/vmalert -rule=rules.yml \                  # Path to the file with rules configuration. Supports wildcard
    -datasource.url=http://victoriametrics:8428 \   # VM-single addr for executing rules expressions
    -remoteWrite.url=http://victoriametrics:8428 \  # VM-single addr to persist alerts state and recording rules results
    -remoteRead.url=http://victoriametrics:8428 \   # VM-single addr for restoring alerts state after restart
    -notifier.url=http://alertmanager1:9093 \       # Multiple AlertManager addresses to send alerts when they trigger
    -notifier.url=http://alertmanagerN:9093         # The same alert will be sent to all configured notifiers
```



To avoid recording rules results and alerts state duplication in VictoriaMetrics server don't forget to configure deduplication . Multiple equally configured vmalerts should evaluate rules at the same timestamps, so it is recommended to set `-dedup.minScrapeInterval` as equal to vmalert's `-evaluationInterval` .

If you have multiple different `interval` params for distinct rule groups, then set `-dedup.minScrapeInterval` to the biggest `interval` value, or value which will be a multiple for all `interval` values. For example, if you have two groups with `interval: 10s` and `interval: 15s` , then set `-dedup.minScrapeInterval=30s` . This would consistently keep only a single data point on 30s time interval for all rules. However, try to avoid having inconsistent `interval` values.

It is not recommended having `-dedup.minScrapeInterval` smaller than `-evaluationInterval` , as it may produce results with inconsistent intervals between data points.

Alertmanager will automatically deduplicate alerts with identical labels, so ensure that all `vmalert` s are having identical config.

Don't forget to configure cluster mode for Alertmanagers for better reliability. List all Alertmanager URLs in vmalert `-notifier.url` to ensure high availability .

This example uses single-node VM server for the sake of simplicity. Check how to replace it with cluster VictoriaMetrics if needed.

Downsampling and aggregation via vmalert

Please note, stream aggregation might be more efficient for cases when downsampling or aggregation need to be applied ***before data gets into the TSDB.***

`vmalert` can't modify existing data. But it can run arbitrary PromQL/MetricsQL queries via recording rules and backfill results to the configured `-remoteWrite.url` . This ability allows to aggregate data. For example, the following rule will calculate the average value for metric `http_requests` on the `5m` interval:

```
  - record: http_requests:avg5m
    expr: avg_over_time(http_requests[5m])
```

Every time this rule will be evaluated, `vmalert` will backfill its results as a new time series `http_requests:avg5m` to the configured `-remoteWrite.url`.

`vmalert` executes rules with specified interval (configured via flag `-evaluationInterval` or as group's `interval` param). The interval helps to control "resolution" of the produced series. This ability allows to downsample data. For example, the following config will execute the rule only once every `5m`:

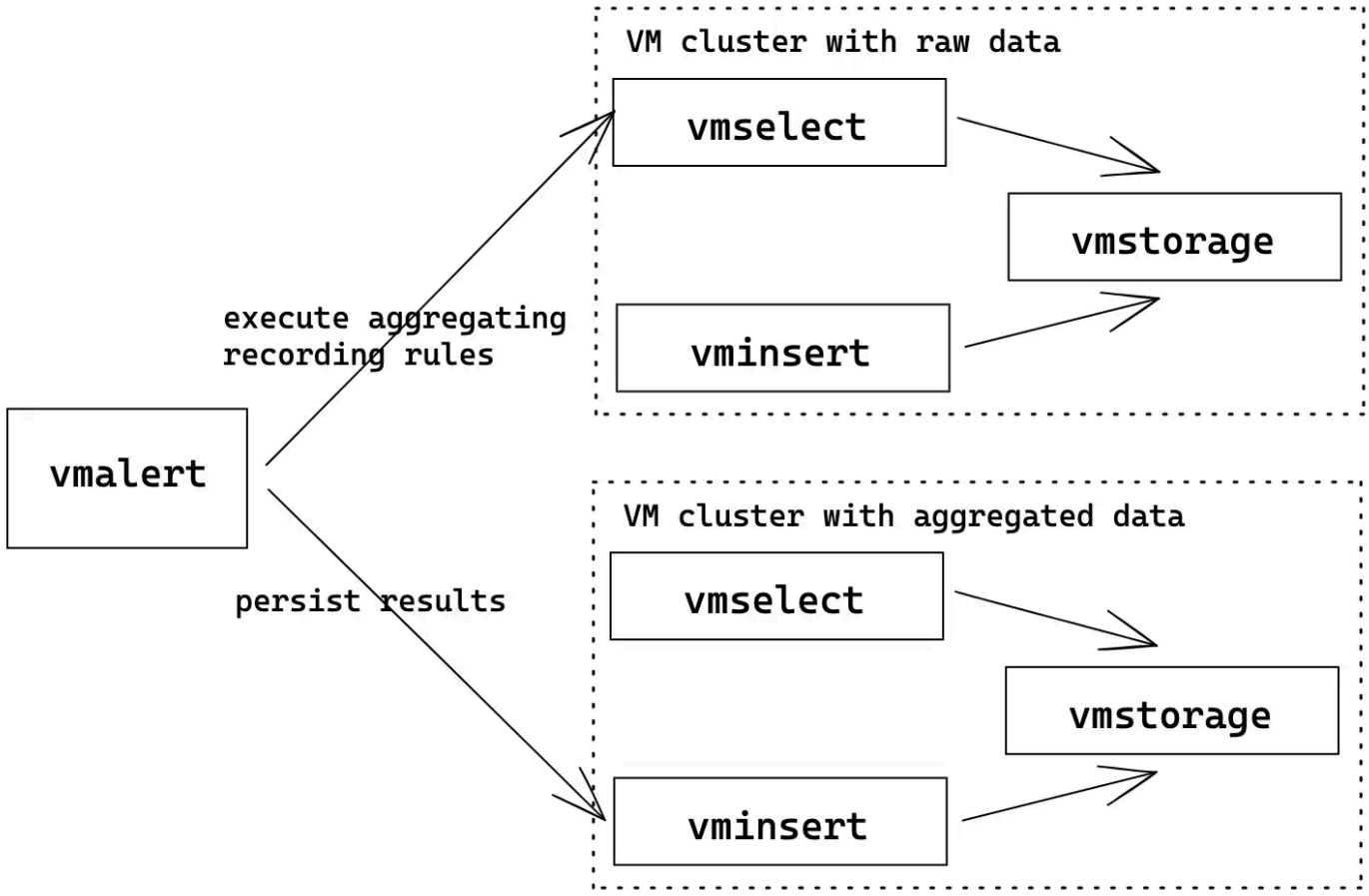
```
groups:
  - name: my_group
    interval: 5m
    rules:
    - record: http_requests:avg5m
      expr: avg_over_time(http_requests[5m])
```

Ability of `vmalert` to be configured with different `-datasource.url` and `-remoteWrite.url` command-line flags allows reading data from one data source and backfilling results to another. This helps to build a system for aggregating and downsampling the data.

The following example shows how to build a topology where `vmalert` will process data from one cluster and write results into another. Such clusters may be called as "hot" (low retention, high-speed disks, used for operative monitoring) and "cold" (long term retention, slower/cheaper disks, low resolution data). With help of `vmalert`, user can setup recording rules to process raw data from "hot" cluster (by applying additional transformations or reducing resolution) and push results to "cold" cluster.

`vmalert` configuration flags:

```
./bin/vmalert -rule=downsampling-rules.yml \                                  # Path to the file with rules configuration. Supports wildca
    -datasource.url=http://raw-cluster-vmselect:8481/select/0/prometheus      # vmselect addr for executing recording rules expressions
    -remoteWrite.url=http://aggregated-cluster-vminsert:8480/insert/0/prometheus    # vminsert addr to persist recording rules results
```



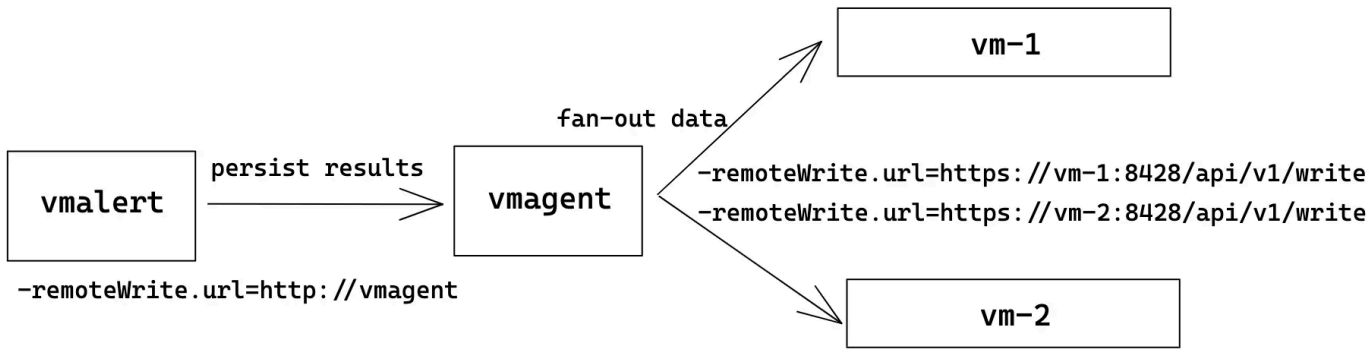
Please note, replay feature may be used for transforming historical data.

Flags `-remoteRead.url` and `-notifier.url` are omitted since we assume only recording rules are used.

See also stream aggregation and downsampling .

Multiple remote writes

For persisting recording or alerting rule results `vmalert` requires `-remoteWrite.url` to be set. But this flag supports only one destination. To persist rule results to multiple destinations we recommend using vmagent as fan-out proxy:



In this topology, `vmalert` is configured to persist rule results to `vmagent` . And `vmagent` is configured to fan-out received data to two or more destinations. Using `vmagent` as a proxy provides additional benefits such as data persisting when storage is unreachable , or time series modification via relabeling .

Web

`vmalert` runs a web-server (`-httpListenAddr`) for serving metrics and alerts endpoints:

- `http://<vmalert-addr>` - UI;
- `http://<vmalert-addr>/api/v1/rules` - list of all loaded groups and rules. Supports additional filtering ;
- `http://<vmalert-addr>/api/v1/alerts` - list of all active alerts;

- `http://<vmalert-addr>/vmalert/api/v1/alert?group_id=<group_id>&alert_id=<alert_id>` - get alert status in JSON format. Used as alert source in AlertManager.
- `http://<vmalert-addr>/vmalert/alert?group_id=<group_id>&alert_id=<alert_id>` - get alert status in web UI.
- `http://<vmalert-addr>/vmalert/rule?group_id=<group_id>&rule_id=<rule_id>` - get rule status in web UI.
- `http://<vmalert-addr>/vmalert/api/v1/rule?group_id=<group_id>&alert_id=<alert_id>` - get rule status in JSON format.
- `http://<vmalert-addr>/metrics` - application metrics.
- `http://<vmalert-addr>/-/reload` - hot configuration reload.

`vmalert` web UI can be accessed from single-node version of VictoriaMetrics and from cluster version of VictoriaMetrics . This may be used for better integration with Grafana unified alerting system. See the following docs for details:

- How to query vmalert from single-node VictoriaMetrics
- How to query vmalert from VictoriaMetrics cluster

Graphite

vmalert sends requests to `<-datasource.url>/render?format=json` during evaluation of alerting and recording rules if the corresponding group or rule contains `type: "graphite"` config option. It is expected that the `<-datasource.url>/render` implements Graphite Render API for `format=json` . When using vmalert with both `graphite` and `prometheus` rules configured against cluster version of VM do not forget to set `-datasource.appendTypePrefix` flag to `true` , so vmalert can adjust URL prefix automatically based on the query type.

VictoriaLogs

vmalert supports VictoriaLogs as a datasource for writing alerting and recording rules using LogsQL . See this doc for details.

Rules backfilling

vmalert supports alerting and recording rules backfilling (aka `replay`). In replay mode vmalert can read the same rules configuration as normal, evaluate them on the given time range and backfill results via remote write to the configured storage. vmalert supports any PromQL/MetricsQL compatible data source for backfilling.

Please note, that response caching may lead to unexpected results during and after backfilling process. In order to avoid this you need to reset cache contents or disable caching when using backfilling as described in backfilling docs .

See a blogpost about Rules backfilling via vmalert .

How it works

In `replay` mode vmalert works as a cli-tool and exits immediately after work is done. To run vmalert in `replay` mode:

```
./bin/vmalert -rule=path/to/your.rules \        # path to files with rules you usually use with vmalert
    -datasource.url=http://localhost:8428 \     # Prometheus HTTP API compatible datasource
    -remoteWrite.url=http://localhost:8428 \    # remote write compatible storage to persist results
    -replay.timeFrom=2021-05-11T07:21:43Z \     # to start replay from
    -replay.timeTo=2021-05-29T18:40:43Z         # to finish replay by, is optional
```

The output of the command will look like the following:

```
Replay mode:
from:   2021-05-11 07:21:43 +0000 UTC   # set by -replay.timeFrom
to:     2021-05-29 18:40:43 +0000 UTC   # set by -replay.timeTo
```

```
max data points per request: 1000       # set by -replay.maxDatapointsPerQuery

Group "ReplayGroup"
interval:       1m0s
requests to make:       27
max range per request:  16h40m0s
> Rule "type:vm_cache_entries:rate5m" (ID: 1792509946081842725)
27 / 27 [----------------------------------------------------------------------------------------------------] 100.00% 78 p/s
> Rule "go_cgo_calls_count:rate5m" (ID: 17958425467471411582)
27 / 27 [----------------------------------------------------------------------------------------------------] 100.00% ? p/s

Group "vmsingleReplay"
interval:       30s
requests to make:       54
max range per request:  8h20m0s
> Rule "RequestErrorsToAPI" (ID: 17645863024999990222)
54 / 54 [----------------------------------------------------------------------------------------------------] 100.00% ? p/s
> Rule "TooManyLogs" (ID: 9042195394653477652)
54 / 54 [----------------------------------------------------------------------------------------------------] 100.00% ? p/s
2021-06-07T09:59:12.098Z        info    app/vmalert/replay.go:68        replay finished! Imported 511734 samples
```

In `replay` mode all groups are executed sequentially one-by-one. Rules within the group are executed sequentially as well (`concurrency` setting is ignored). vmalert sends rule's expression to /query_range endpoint of the configured `-datasource.url` . Returned data is then processed according to the rule type and backfilled to `-remoteWrite.url` via remote Write protocol . vmalert respects `evaluationInterval` value set by flag or per-group during the replay. vmalert automatically disables caching on VictoriaMetrics side by sending `nocache=1` param. It allows to prevent cache pollution and unwanted time range boundaries adjustment during backfilling.

Recording rules

The result of recording rules `replay` should match with results of normal rules evaluation.

Alerting rules

The result of alerting rules `replay` is time series reflecting alert's state . To see if `replayed` alert has fired in the past use the following PromQL/MetricsQL expression:

```
ALERTS{alertname="your_alertname", alertstate="firing"}
```

Execute the query against storage which was used for `-remoteWrite.url` during the `replay` .

Additional configuration

There are following non-required `replay` flags:

- `-replay.maxDatapointsPerQuery` - the max number of data points expected to receive in one request. In two words, it affects the max time range for every `/query_range` request. The higher the value, the fewer requests will be issued during `replay` .
- `-replay.ruleRetryAttempts` - when datasource fails to respond vmalert will make this number of retries per rule before giving up.
- `-replay.rulesDelay` - delay between sequential rules execution. Important in cases if there are chaining (rules which depend on each other) rules. It is expected, that remote storage will be able to persist previously accepted data during the delay, so data will be available for the subsequent queries. Keep it equal or bigger than `-remoteWrite.flushInterval` .
- `-replay.disableProgressBar` - whether to disable progress bar which shows progress work. Progress bar may generate a lot of log records, which is not formatted as standard VictoriaMetrics logger. It could break logs parsing by external system and generate additional load on it.

See full description for these flags in `./vmalert -help` .

Limitations

- Graphite engine isn't supported yet;

- `query` template function is disabled for performance reasons (might be changed in future);
- `limit` group's param has no effect during replay (might be changed in future);
- `keep_firing_for` alerting rule param has no effect during replay (might be changed in future).

Unit Testing for Rules

You can use `vmalert-tool` to test your alerting and recording rules like promtool does . See more details here .

Monitoring

`vmalert` exports various metrics in Prometheus exposition format at `http://vmalert-host:8880/metrics` page. See the list of recommended alerting rules to track the vmalert health. We recommend setting up regular scraping of this page either through vmagent or by Prometheus-compatible scraper, so that the exported metrics may be analyzed later.

If you use Google Cloud Managed Prometheus for scraping metrics from VictoriaMetrics components, then pass `-metrics.exposeMetadata` command-line to them, so they add `TYPE` and `HELP` comments per each exposed metric at `/metrics` page. See these docs for details.

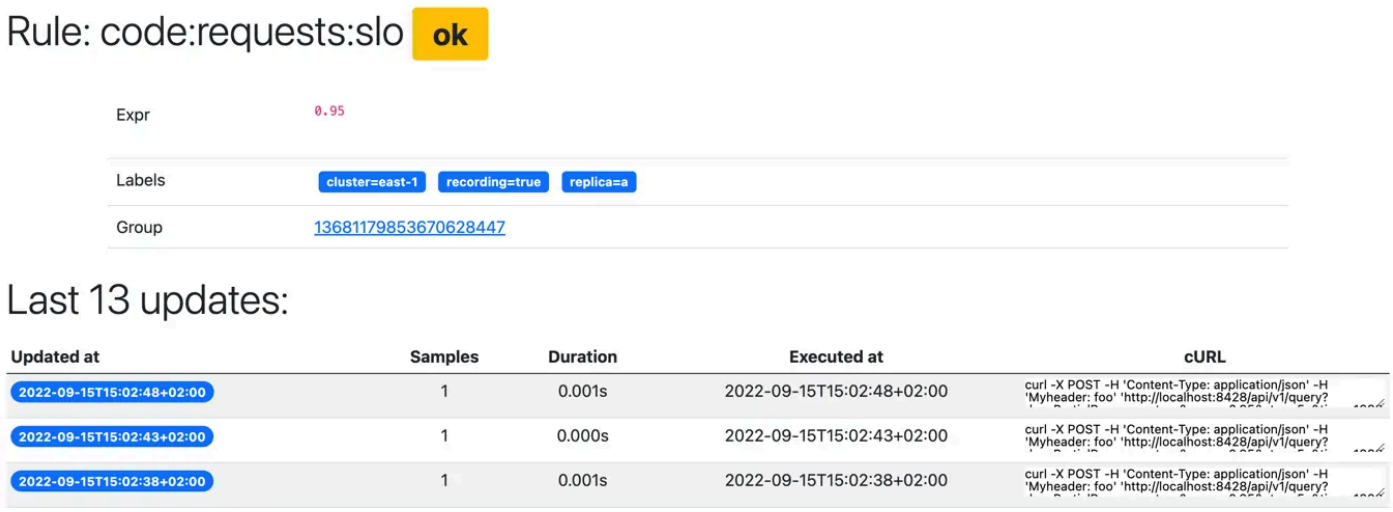
Use the official Grafana dashboard for `vmalert` overview. Graphs on this dashboard contain useful hints - hover the `i` icon in the top left corner of each graph in order to read it. If you have suggestions for improvements or have found a bug - please open an issue on GitHub or add a review to the dashboard.

Troubleshooting

Rule state

vmalert stores last `-rule.updateEntriesLimit` (or `update_entries_limit` per-rule config) evaluation updates for each rule. The updates are available in vmalert web UI :

1. Go to the `Groups` tab
2. Find the corresponding Group and rule within it
3. Click on `Details` link next to rule's name and check the `Last N updates` section:



Rows in the section represent ordered rule evaluations and their results.

Every state has the following attributes:

1. `Updated at` - the real time when this rule was executed by vmalert.
2. `Executed at` - `time` param that was sent within the evaluation request to datasource.

3. `Samples` - the amount of data samples returned during at this evaluation. Recording rule that has 0 samples produces no results. Alerting rule that has 0 samples means `expr` condition is false and rule is in inactive state.
4. `Series fetched` - the amount of series scanned during query evaluation. See never-firing alerts.
5. `Duration` - the time it took to evaluate the rule. If `Duration` is close or bigger to evaluation interval, then this rule can skip evaluations. See how to deal with slow queries.
6. `cURL` - contains an example of HTTP request sent by vmalert to the `-datasource.url` during evaluation, including all extra headers and query params. The command can be used for debugging purposes to see what vmalert receives in response from datasource. *Sensitive info is stripped from the `curl` examples - see security section for more details.*

If a specific state shows that there were **no samples returned** and executed **cURL command returns some data**, then it is likely there was no data in datasource on the moment when rule was evaluated. See about data delay.

vmalert exposes `vmalert_recording_rules_last_evaluation_samples` for recording rules to represent the amount of samples returned during evaluations. The following alerting rule can be used to detect those recording rules that produce no data:

```
- alert: RecordingRulesNoData
  expr: vmalert_recording_rules_last_evaluation_samples < 1
  annotations:
    summary: "Recording rule {{ $labels.recording }} ({{ $labels.group }}) produces no data"
```

See more about alerting rules in Monitoring.

Alert state

Sometimes, it is not clear why some specific alert fired or didn't fire. It is very important to remember, that alerts with `for: 0` fire immediately when their expression becomes true. And alerts with `for > 0` will fire only after **multiple consecutive evaluations**, where each evaluation of the expression must be positive.

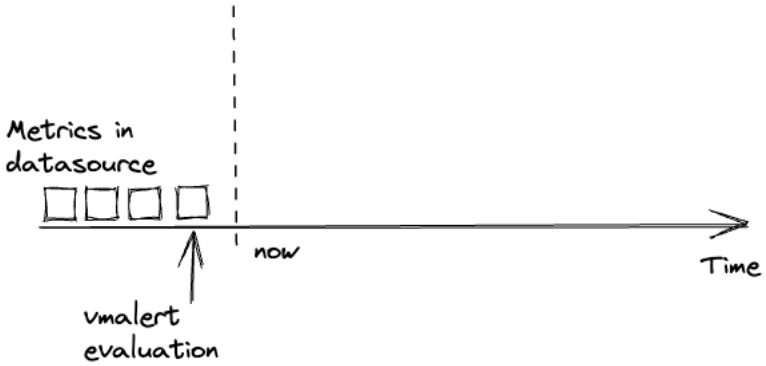
If at least one evaluation returns no data, then alert's state resets to the initial state.

> **Note**
> Please note, the alert state is tracked individually for each returned time series during evaluation. If 1st evaluation returned series A and B, and 2nd evaluation returned only B - then alert will remain active only for B.

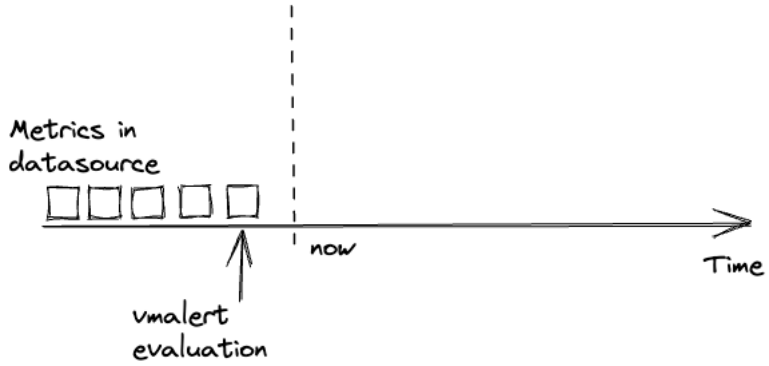
If `-remoteWrite.url` command-line flag is configured, vmalert will persist alert's state in form of time series `ALERTS` and `ALERTS_FOR_STATE` to the specified destination. Such time series can be then queried via vmui or Grafana to track how alerts state changed in time.

Data delay

Data delay is one of the most common issues with rules execution. vmalert executes configured rules within certain intervals at specifics timestamps. It expects that the data is already present in configured `-datasource.url` at the moment of time when rule is executed:



Usually, troubles begin when data in `-datasource.url` is delayed or absent. In such cases, evaluations may get empty response from the datasource and produce empty recording rules or reset alerts state:



Try the following recommendations to reduce the chance of hitting the data delay issue:

- Always configure group's `-evaluationInterval` to be bigger or at least equal to time series resolution ;
- Ensure that `[duration]` value is at least twice bigger than time series resolution . For example, if expression is `rate(my_metric[2m]) > 0` then ensure that `my_metric` resolution is at least `1m` or better `30s` .
- Extend `[duration]` in expr to help tolerate the delay. For example, `max_over_time(errors_total[10m]) > 0` will be active even if there is no data in datasource for last `9m` .
- If time series resolution in datasource is inconsistent or `>=5min` - try changing vmalerts `-datasource.queryStep` command-line flag to specify how far search query can look back for the recent datapoint. The recommendation is to have the step at least two times bigger than the resolution.

> **Note**
> Please note, data delay is inevitable in distributed systems. And it is better to account for it instead of ignoring.

By default, recently written samples to VictoriaMetrics aren't visible for queries for up to 30s (see `-search.latencyOffset` command-line flag at vmselect or VictoriaMetrics single-node). Such delay is needed to eliminate risk of incomplete data on the moment of querying, due to chance that metrics collectors won't be able to deliver that data in time. To compensate the latency in timestamps for produced evaluation results, `-rule.evalDelay` is also set to `30s` by default. If you expect data to be delayed for longer intervals (it gets buffered, queued, or just network is slow sometimes), or you changed default value of `-search.latencyOffset` - consider increasing the `-rule.evalDelay` value accordingly.

Debug mode

vmalert allows configuring more detailed logging for specific alerting or recording rule starting from ⓘ . Or for all rules within the group ⓘ . Just set `debug: true` in configuration and vmalert will start printing additional log messages:

```
2022-09-15T13:35:41.155Z  DEBUG alerting rule "TestGroup":"Conns" (2601299393013563564) at 2022-09-15T15:35:41+02:00: query returned 0 samples (
2022-09-15T13:35:56.149Z  DEBUG datasource request: executing POST request with params "denyPartialResponse=true&query=sum%28vm_tcplistener_conns
2022-09-15T13:35:56.178Z  DEBUG alerting rule "TestGroup":"Conns" (2601299393013563564) at 2022-09-15T15:35:56+02:00: query returned 1 samples (
2022-09-15T13:35:56.178Z  DEBUG datasource request: executing POST request with params "denyPartialResponse=true&query=sum%28vm_tcplistener_conns
2022-09-15T13:35:56.179Z  DEBUG alerting rule "TestGroup":"Conns" (2601299393013563564) at 2022-09-15T15:35:56+02:00: alert 10705778000901301787
...
2022-09-15T13:36:56.153Z  DEBUG alerting rule "TestGroup":"Conns" (2601299393013563564) at 2022-09-15T15:36:56+02:00: alert 10705778000901301787
```

Sensitive info is stripped from the `curl` examples - see security section for more details.

Never-firing alerts

vmalert can detect ⓘ if alert's expression doesn't match any time series in runtime starting from v1.91 . This problem usually happens when alerting expression selects time series which aren't present in the datasource (i.e. wrong `job` label) or there is a typo in the series selector (i.e. `env=prod`). Such alerting rules will be marked with special icon in vmalerts UI and exposed via `vmalert_alerting_rules_last_evaluation_series_fetched` metric. The metric value will show how many time series were matched before the filtering by rule's expression. If metric value is `-1` , then this feature is not supported by the datasource (old versions of VictoriaMetrics). The following expression can be used to detect rules matching no series:

```
max(vmalert_alerting_rules_last_evaluation_series_fetched) by(group, alertname) == 0
```

See more details here and read Never-firing alerts blogpost.

Series with the same labelset

vmalert can produce the following error message:

```
result contains metrics with the same labelset during evaluation
```

The error means there is a collision between time series during evaluation.

For example, a rule with `expr: {__name__=~"vmalert_alerts_.*"} > 0` returns two distinct time series in response:

```
{__name__="vmalert_alerts_pending",job="vmalert",alertname="HostContextSwitching"} 12
{__name__="vmalert_alerts_firing",job="vmalert",alertname="HostContextSwitching"} 0
```

As label `__name__` will be dropped during evaluation, leads to duplicated time series. To fix this, one could use function like label_replace to preserve the distinct labelset.

mTLS protection

By default `vmalert` accepts http requests at `8880` port (this port can be changed via `-httpListenAddr` command-line flags), since it is expected it runs in an isolated trusted network. Enterprise version of vmagent supports the ability to accept mTLS requests at this port, by specifying `-tls` and `-mtls` command-line flags. For example, the following command runs `vmalert`, which accepts only mTLS requests at port `8880`:

```
./vmalert -tls -mtls -remoteWrite.url=...
```

By default system-wide TLS Root CA is used for verifying client certificates if `-mtls` command-line flag is specified. It is possible to specify custom TLS Root CA via `-mtlsCAFile` command-line flag.

Security

See general recommendations regarding security here.

vmalert web UI exposes configuration details such as list of Groups, active alerts, alerts state, notifiers. Notifier addresses (sanitized) are attached as labels to metrics `vmalert_alerts_sent_.*` on `http://<vmalert>/metrics` page. Consider limiting user's access to the web UI or `/metrics` page if this information is sensitive.

Alerts state page or debug mode could emit additional information about configured datasource URL, GET params and headers. Sensitive information such as passwords or auth tokens is stripped by default. To disable stripping of such info pass `-datasource.showURL` cmd-line flag to vmalert.

See also mTLS protection docs.

Profiling

`vmalert` provides handlers for collecting the following Go profiles:

- Memory profile. It can be collected with the following command (replace `0.0.0.0` with hostname if needed):

```
curl http://0.0.0.0:8880/debug/pprof/heap > mem.pprof
```

- CPU profile. It can be collected with the following command (replace `0.0.0.0` with hostname if needed):

```
curl http://0.0.0.0:8880/debug/pprof/profile > cpu.pprof
```

The command for collecting CPU profile waits for 30 seconds before returning.

The collected profiles may be analyzed with go tool pprof . It is safe sharing the collected profiles from security point of view, since they do not contain sensitive information.

Configuration

Flags

Pass `-help` to `vmalert` in order to see the full list of supported command-line flags with their descriptions.

The shortlist of configuration flags is the following:

```
-blockcache.missesBeforeCaching int
   The number of cache misses before putting the block into cache. Higher values may reduce indexdb/dataBlocks cache size at the cost of highe
-clusterMode
   If clusterMode is enabled, then vmalert automatically adds the tenant specified in config groups to -datasource.url, -remoteWrite.url and -
-configCheckInterval duration
   Interval for checking for changes in '-rule' or '-notifier.config' files. By default, the checking is disabled. Send SIGHUP signal in order
-datasource.appendTypePrefix
   Whether to add type prefix to -datasource.url based on the query type. Set to true if sending different query types to the vmselect URL.
-datasource.basicAuth.password string
   Optional basic auth password for -datasource.url
-datasource.basicAuth.passwordFile string
   Optional path to basic auth password to use for -datasource.url
-datasource.basicAuth.username string
   Optional basic auth username for -datasource.url
-datasource.bearerToken string
   Optional bearer auth token to use for -datasource.url.
-datasource.bearerTokenFile string
   Optional path to bearer token file to use for -datasource.url.
-datasource.disableKeepAlive
   Whether to disable long-lived connections to the datasource. If true, disables HTTP keep-alive and will only use the connection to the serv
-datasource.disableStepParam
   Whether to disable adding 'step' param in instant queries to the configured -datasource.url and -remoteRead.url. Only valid for prometheus
-datasource.headers string
   Optional HTTP extraHeaders to send with each request to the corresponding -datasource.url. For example, -datasource.headers='My-Auth:foobar
-datasource.idleConnTimeout duration
   Defines a duration for idle (keep-alive connections) to exist. Consider setting this value less than "-http.idleConnTimeout". It must preve
-datasource.maxIdleConnections int
   Defines the number of idle (keep-alive connections) to each configured datasource. Consider setting this value equal to the value: groups_t
-datasource.oauth2.clientID string
   Optional OAuth2 clientID to use for -datasource.url
-datasource.oauth2.clientSecret string
   Optional OAuth2 clientSecret to use for -datasource.url
-datasource.oauth2.clientSecretFile string
   Optional OAuth2 clientSecretFile to use for -datasource.url
-datasource.oauth2.endpointParams string
   Optional OAuth2 endpoint parameters to use for -datasource.url . The endpoint parameters must be set in JSON format: {"param1":"value1",...
-datasource.oauth2.scopes string
   Optional OAuth2 scopes to use for -datasource.url. Scopes must be delimited by ';'
-datasource.oauth2.tokenUrl string
   Optional OAuth2 tokenURL to use for -datasource.url
-datasource.queryStep duration
   How far a value can fallback to when evaluating queries to the configured -datasource.url and -remoteRead.url. Only valid for prometheus da
-datasource.roundDigits int
```

```
   Adds "round_digits" GET param to datasource requests which limits the number of digits after the decimal point in response values. Only val
-datasource.showURL
   Whether to avoid stripping sensitive information such as auth headers or passwords from URLs in log messages or UI and exported metrics. It
-datasource.tlsCAFile string
   Optional path to TLS CA file to use for verifying connections to -datasource.url. By default, system CA is used
-datasource.tlsCertFile string
   Optional path to client-side TLS certificate file to use when connecting to -datasource.url
-datasource.tlsInsecureSkipVerify
   Whether to skip tls verification when connecting to -datasource.url
-datasource.tlsKeyFile string
   Optional path to client-side TLS certificate key to use when connecting to -datasource.url
-datasource.tlsServerName string
   Optional TLS server name to use for connections to -datasource.url. By default, the server name from -datasource.url is used
-datasource.url string
   Datasource compatible with Prometheus HTTP API. It can be single node VictoriaMetrics or vmselect endpoint. Required parameter. Supports ad
-defaultTenant.graphite string
   Default tenant for Graphite alerting groups. See https://docs.victoriametrics.com/victoriametrics/vmalert/#multitenancy .This flag is avail
-defaultTenant.prometheus string
   Default tenant for Prometheus alerting groups. See https://docs.victoriametrics.com/victoriametrics/vmalert/#multitenancy . This flag is av
-disableAlertgroupLabel
   Whether to disable adding group's Name as label to generated alerts and time series.
-dryRun
   Whether to check only config files without running vmalert. The rules file are validated. The -rule flag must be specified.
-enableTCP6
   Whether to enable IPv6 for listening and dialing. By default, only IPv4 TCP and UDP are used
-envflag.enable
   Whether to enable reading flags from environment variables in addition to the command line. Command line flag values have priority over val
-envflag.prefix string
   Prefix for environment variables if -envflag.enable is set
-eula
   Deprecated, please use -license or -licenseFile flags instead. By specifying this flag, you confirm that you have an enterprise license and
-evaluationInterval duration
   How often to evaluate the rules (default 1m0s)
-external.alert.source string
   External Alert Source allows to override the Source link for alerts sent to AlertManager for cases where you want to build a custom link to
-external.label exported_
   Optional label in the form 'Name=value' to add to all generated recording rules and alerts. In case of conflicts, original labels are kept
   Supports an `array` of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-external.url string
   External URL is used as alert's source for sent alerts to the notifier. By default, hostname is used as address.
-filestream.disableFadvise
   Whether to disable fadvise() syscall when reading large data files. The fadvise() syscall prevents from eviction of recently accessed data
-flagsAuthKey value
   Auth key for /flags endpoint. It must be passed via authKey query arg. It overrides -httpAuth.*
   Flag value can be read from the given file when using -flagsAuthKey=file:///abs/path/to/file or -flagsAuthKey=file://./relative/path/to/fil
-fs.disableMmap
   Whether to use pread() instead of mmap() for reading data files. By default, mmap() is used for 64-bit arches and pread() is used for 32-bi
-http.connTimeout duration
   Incoming connections to -httpListenAddr are closed after the configured timeout. This may help evenly spreading load among a cluster of ser
-http.disableCORS
   Disable CORS for all origins (*)
-http.disableResponseCompression
   Disable compression of HTTP responses to save CPU resources. By default, compression is enabled to save network bandwidth
-http.header.csp string
   Value for 'Content-Security-Policy' header, recommended: "default-src 'self'"
-http.header.frameOptions string
   Value for 'X-Frame-Options' header
-http.header.hsts string
   Value for 'Strict-Transport-Security' header, recommended: 'max-age=31536000; includeSubDomains'
-http.idleConnTimeout duration
   Timeout for incoming idle http connections (default 1m0s)
-http.maxGracefulShutdownDuration duration
   The maximum duration for a graceful shutdown of the HTTP server. A highly loaded server may require increased value for a graceful shutdown
-http.pathPrefix string
   An optional prefix to add to all the paths handled by http server. For example, if '-http.pathPrefix=/foo/bar' is set, then all the http re
-http.shutdownDelay duration
   Optional delay before http server shutdown. During this delay, the server returns non-OK responses from /health page, so load balancers can
-httpAuth.password value
   Password for HTTP server's Basic Auth. The authentication is disabled if -httpAuth.username is empty
   Flag value can be read from the given file when using -httpAuth.password=file:///abs/path/to/file or -httpAuth.password=file://./relative/p
-httpAuth.username string
   Username for HTTP server's Basic Auth. The authentication is disabled if empty. See also -httpAuth.password
-httpListenAddr array
   Address to listen for incoming http requests. See also -tls and -httpListenAddr.useProxyProtocol
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-httpListenAddr.useProxyProtocol array
```

```
   Whether to use proxy protocol for connections accepted at the corresponding -httpListenAddr . See https://www.haproxy.org/download/1.8/doc/p
   Supports array of values separated by comma or specified via multiple flags.
   Empty values are set to false.
-internStringCacheExpireDuration duration
   The expiry duration for caches for interned strings. See https://en.wikipedia.org/wiki/String_interning . See also -internStringMaxLen and
-internStringDisableCache
   Whether to disable caches for interned strings. This may reduce memory usage at the cost of higher CPU usage. See https://en.wikipedia.org/
-internStringMaxLen int
   The maximum length for strings to intern. A lower limit may save memory at the cost of higher CPU usage. See https://en.wikipedia.org/wiki/S
-license string
   License key for VictoriaMetrics Enterprise. See https://victoriametrics.com/products/enterprise/ . Trial Enterprise license can be obtained
-license.forceOffline
   Whether to enable offline verification for VictoriaMetrics Enterprise license key, which has been passed either via -license or via -licens
-licenseFile string
   Path to file with license key for VictoriaMetrics Enterprise. See https://victoriametrics.com/products/enterprise/ . Trial Enterprise licens
-licenseFile.reloadInterval duration
   Interval for reloading the license file specified via -licenseFile. See https://victoriametrics.com/products/enterprise/ . This flag is ava
-loggerDisableTimestamps
   Whether to disable writing timestamps in logs
-loggerErrorsPerSecondLimit int
   Per-second limit on the number of ERROR messages. If more than the given number of errors are emitted per second, the remaining errors are s
-loggerFormat string
   Format for logs. Possible values: default, json (default "default")
-loggerJSONFields string
   Allows renaming fields in JSON formatted logs. Example: "ts:timestamp,msg:message" renames "ts" to "timestamp" and "msg" to "message". Suppo
-loggerLevel string
   Minimum level of errors to log. Possible values: INFO, WARN, ERROR, FATAL, PANIC (default "INFO")
-loggerMaxArgLen int
   The maximum length of a single logged argument. Longer arguments are replaced with 'arg_start..arg_end', where 'arg_start' and 'arg_end' is
-loggerOutput string
   Output for the logs. Supported values: stderr, stdout (default "stderr")
-loggerTimezone string
   Timezone to use for timestamps in logs. Timezone must be a valid IANA Time Zone. For example: America/New_York, Europe/Berlin, Etc/GMT+3 or
-loggerWarnsPerSecondLimit int
   Per-second limit on the number of WARN messages. If more than the given number of warns are emitted per second, then the remaining warns are
-memory.allowedBytes size
   Allowed size of system memory VictoriaMetrics caches may occupy. This option overrides -memory.allowedPercent if set to a non-zero value. T
   Supports the following optional suffixes for size values: KB, MB, GB, TB, KiB, MiB, GiB, TiB (default 0)
-memory.allowedPercent float
   Allowed percent of system memory VictoriaMetrics caches may occupy. See also -memory.allowedBytes. Too low a value may increase cache miss
-metrics.exposeMetadata
   Whether to expose TYPE and HELP metadata at the /metrics page, which is exposed at -httpListenAddr . The metadata may be needed when the /m
-metricsAuthKey value
   Auth key for /metrics endpoint. It must be passed via authKey query arg. It overrides -httpAuth.*
   Flag value can be read from the given file when using -metricsAuthKey=file:///abs/path/to/file or -metricsAuthKey=file://./relative/path/to
-mtls array
   Whether to require valid client certificate for https requests to the corresponding -httpListenAddr . This flag works only if -tls flag is
   Supports array of values separated by comma or specified via multiple flags.
   Empty values are set to false.
-mtlsCAFile array
   Optional path to TLS Root CA for verifying client certificates at the corresponding -httpListenAddr when -mtls is enabled. By default the h
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.basicAuth.password array
   Optional basic auth password for -notifier.url
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.basicAuth.passwordFile array
   Optional path to basic auth password file for -notifier.url
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.basicAuth.username array
   Optional basic auth username for -notifier.url
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.bearerToken array
   Optional bearer token for -notifier.url
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.bearerTokenFile array
   Optional path to bearer token file for -notifier.url
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.blackhole
   Whether to blackhole alerting notifications. Enable this flag if you want vmalert to evaluate alerting rules without sending any notificati
-notifier.config string
   Path to configuration file for notifiers
-notifier.headers array
```

```
   Optional HTTP headers to send with each request to the corresponding -notifier.url. For example, -remoteWrite.headers='My-Auth:foobar' would
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.oauth2.clientID array
   Optional OAuth2 clientID to use for -notifier.url. If multiple args are set, then they are applied independently for the corresponding -not
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.oauth2.clientSecret array
   Optional OAuth2 clientSecret to use for -notifier.url. If multiple args are set, then they are applied independently for the corresponding
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.oauth2.clientSecretFile array
   Optional OAuth2 clientSecretFile to use for -notifier.url. If multiple args are set, then they are applied independently for the correspond
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.oauth2.endpointParams array
   Optional OAuth2 endpoint parameters to use for the corresponding -notifier.url . The endpoint parameters must be set in JSON format: {"para
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.oauth2.scopes array
   Optional OAuth2 scopes to use for -notifier.url. Scopes must be delimited by ';'. If multiple args are set, then they are applied independe
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.oauth2.tokenUrl array
   Optional OAuth2 tokenURL to use for -notifier.url. If multiple args are set, then they are applied independently for the corresponding -not
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.sendTimeout array
   Timeout when sending alerts to the corresponding -notifier.url (default 10s)
   Supports array of values separated by comma or specified via multiple flags.
   Empty values are set to default value.
-notifier.showURL
   Whether to avoid stripping sensitive information such as passwords from URL in log messages or UI for -notifier.url. It is hidden by defaul
-notifier.suppressDuplicateTargetErrors
   Whether to suppress 'duplicate target' errors during discovery
-notifier.tlsCAFile array
   Optional path to TLS CA file to use for verifying connections to -notifier.url. By default, system CA is used
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.tlsCertFile array
   Optional path to client-side TLS certificate file to use when connecting to -notifier.url
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.tlsInsecureSkipVerify array
   Whether to skip tls verification when connecting to -notifier.url
   Supports array of values separated by comma or specified via multiple flags.
   Empty values are set to false.
-notifier.tlsKeyFile array
   Optional path to client-side TLS certificate key to use when connecting to -notifier.url
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.tlsServerName array
   Optional TLS server name to use for connections to -notifier.url. By default, the server name from -notifier.url is used
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-notifier.url array
   Prometheus Alertmanager URL, e.g. http://127.0.0.1:9093. List all Alertmanager URLs if it runs in the cluster mode to ensure high availabil
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-pprofAuthKey value
   Auth key for /debug/pprof/* endpoints. It must be passed via authKey query arg. It overrides -httpAuth.*
   Flag value can be read from the given file when using -pprofAuthKey=file:///abs/path/to/file or -pprofAuthKey=file://./relative/path/to/fil
-promscrape.consul.waitTime duration
   Wait time used by Consul service discovery. Default value is used if not set
-promscrape.consulSDCheckInterval duration
   Interval for checking for changes in Consul. This works only if consul_sd_configs is configured in '-promscrape.config' file. See https://d
-promscrape.discovery.concurrency int
   The maximum number of concurrent requests to Prometheus autodiscovery API (Consul, Kubernetes, etc.) (default 100)
-promscrape.discovery.concurrentWaitTime duration
   The maximum duration for waiting to perform API requests if more than -promscrape.discovery.concurrency requests are simultaneously perform
-promscrape.dnsSDCheckInterval duration
   Interval for checking for changes in dns. This works only if dns_sd_configs is configured in '-promscrape.config' file. See https://docs.vi
-pushmetrics.disableCompression
   Whether to disable request body compression when pushing metrics to every -pushmetrics.url
-pushmetrics.extraLabel array
   Optional labels to add to metrics pushed to every -pushmetrics.url . For example, -pushmetrics.extraLabel='instance="foo"' adds instance="f
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
```

```
-pushmetrics.header array
   Optional HTTP request header to send to every -pushmetrics.url . For example, -pushmetrics.header='Authorization: Basic foobar' adds 'Autho
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-pushmetrics.interval duration
   Interval for pushing metrics to every -pushmetrics.url (default 10s)
-pushmetrics.url array
   Optional URL to push metrics exposed at /metrics page. See https://docs.victoriametrics.com/victoriametrics/single-server-victoriametrics/#
   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-reloadAuthKey value
   Auth key for /-/reload http endpoint. It must be passed via authKey query arg. It overrides -httpAuth.*
   Flag value can be read from the given file when using -reloadAuthKey=file:///abs/path/to/file or -reloadAuthKey=file://./relative/path/to/f
-remoteRead.basicAuth.password string
   Optional basic auth password for -remoteRead.url
-remoteRead.basicAuth.passwordFile string
   Optional path to basic auth password to use for -remoteRead.url
-remoteRead.basicAuth.username string
   Optional basic auth username for -remoteRead.url
-remoteRead.bearerToken string
   Optional bearer auth token to use for -remoteRead.url.
-remoteRead.bearerTokenFile string
   Optional path to bearer token file to use for -remoteRead.url.
-remoteRead.disablePathAppend
   Whether to disable automatic appending of '/api/v1/query' or '/select/logsql/stats_query' path to the configured -datasource.url and -remot
-remoteRead.headers string
   Optional HTTP headers to send with each request to the corresponding -remoteRead.url. For example, -remoteRead.headers='My-Auth:foobar' wou
-remoteRead.idleConnTimeout duration
   Defines a duration for idle (keep-alive connections) to exist. Consider settings this value less to the value of "-http.idleConnTimeout". I
-remoteRead.lookback duration
   Lookback defines how far to look into past for alerts timeseries. For example, if lookback=1h then range from now() to now()-1h will be sca
-remoteRead.oauth2.clientID string
   Optional OAuth2 clientID to use for -remoteRead.url.
-remoteRead.oauth2.clientSecret string
   Optional OAuth2 clientSecret to use for -remoteRead.url.
-remoteRead.oauth2.clientSecretFile string
   Optional OAuth2 clientSecretFile to use for -remoteRead.url.
-remoteRead.oauth2.endpointParams string
   Optional OAuth2 endpoint parameters to use for -remoteRead.url . The endpoint parameters must be set in JSON format: {"param1":"value1",...
-remoteRead.oauth2.scopes string
   Optional OAuth2 scopes to use for -remoteRead.url. Scopes must be delimited by ';'.
-remoteRead.oauth2.tokenUrl string
   Optional OAuth2 tokenURL to use for -remoteRead.url.
-remoteRead.showURL
   Whether to show -remoteRead.url in the exported metrics. It is hidden by default, since it can contain sensitive info such as auth key
-remoteRead.tlsCAFile string
   Optional path to TLS CA file to use for verifying connections to -remoteRead.url. By default, system CA is used
-remoteRead.tlsCertFile string
   Optional path to client-side TLS certificate file to use when connecting to -remoteRead.url
-remoteRead.tlsInsecureSkipVerify
   Whether to skip tls verification when connecting to -remoteRead.url
-remoteRead.tlsKeyFile string
   Optional path to client-side TLS certificate key to use when connecting to -remoteRead.url
-remoteRead.tlsServerName string
   Optional TLS server name to use for connections to -remoteRead.url. By default, the server name from -remoteRead.url is used
-remoteRead.url vmalert
   Optional URL to datasource compatible with MetricsQL. It can be single node VictoriaMetrics or vmselect.Remote read is used to restore aler
-remoteWrite.basicAuth.password string
   Optional basic auth password for -remoteWrite.url
-remoteWrite.basicAuth.passwordFile string
   Optional path to basic auth password to use for -remoteWrite.url
-remoteWrite.basicAuth.username string
   Optional basic auth username for -remoteWrite.url
-remoteWrite.bearerToken string
   Optional bearer auth token to use for -remoteWrite.url.
-remoteWrite.bearerTokenFile string
   Optional path to bearer token file to use for -remoteWrite.url.
-remoteWrite.concurrency int
   Defines number of writers for concurrent writing into remote write endpoint. Default value depends on the number of available CPU cores. (d
-remoteWrite.disablePathAppend
   Whether to disable automatic appending of '/api/v1/write' path to the configured -remoteWrite.url.
-remoteWrite.flushInterval duration
   Defines interval of flushes to remote write endpoint (default 2s)
-remoteWrite.headers string
   Optional HTTP headers to send with each request to the corresponding -remoteWrite.url. For example, -remoteWrite.headers='My-Auth:foobar' w
-remoteWrite.idleConnTimeout duration
   Defines a duration for idle (keep-alive connections) to exist. Consider settings this value less to the value of "-http.idleConnTimeout". I
-remoteWrite.maxBatchSize int
```

```
   Defines max number of timeseries to be flushed at once (default 10000)
-remoteWrite.maxQueueSize int
   Defines the max number of pending datapoints to remote write endpoint (default 100000)
-remoteWrite.oauth2.clientID string
   Optional OAuth2 clientID to use for -remoteWrite.url
-remoteWrite.oauth2.clientSecret string
   Optional OAuth2 clientSecret to use for -remoteWrite.url
-remoteWrite.oauth2.clientSecretFile string
   Optional OAuth2 clientSecretFile to use for -remoteWrite.url
-remoteWrite.oauth2.endpointParams string
   Optional OAuth2 endpoint parameters to use for -remoteWrite.url . The endpoint parameters must be set in JSON format: {"param1":"value1",..
-remoteWrite.oauth2.scopes string
   Optional OAuth2 scopes to use for -notifier.url. Scopes must be delimited by ';'.
-remoteWrite.oauth2.tokenUrl string
   Optional OAuth2 tokenURL to use for -notifier.url.
-remoteWrite.retryMaxTime duration
   The max time spent on retry attempts for the failed remote-write request. Change this value if it is expected for remoteWrite.url to be unr
-remoteWrite.retryMinInterval duration
   The minimum delay between retry attempts. Every next retry attempt will double the delay to prevent hammering of remote database. See also
-remoteWrite.sendTimeout duration
   Timeout for sending data to the configured -remoteWrite.url. (default 30s)
-remoteWrite.showURL
   Whether to show -remoteWrite.url in the exported metrics. It is hidden by default, since it can contain sensitive info such as auth key
-remoteWrite.tlsCAFile string
   Optional path to TLS CA file to use for verifying connections to -remoteWrite.url. By default, system CA is used
-remoteWrite.tlsCertFile string
   Optional path to client-side TLS certificate file to use when connecting to -remoteWrite.url
-remoteWrite.tlsInsecureSkipVerify
   Whether to skip tls verification when connecting to -remoteWrite.url
-remoteWrite.tlsKeyFile string
   Optional path to client-side TLS certificate key to use when connecting to -remoteWrite.url
-remoteWrite.tlsServerName string
   Optional TLS server name to use for connections to -remoteWrite.url. By default, the server name from -remoteWrite.url is used
-remoteWrite.url string
   Optional URL to VictoriaMetrics or vminsert where to persist alerts state and recording rules results in form of timeseries. Supports addre
-replay.disableProgressBar
   Whether to disable rendering progress bars during the replay. Progress bar rendering might be verbose or break the logs parsing, so it is r
-replay.maxDatapointsPerQuery int
   Max number of data points expected in one request. It affects the max time range for every '/query_range' request during the replay. The hi
-replay.ruleRetryAttempts int
   Defines how many retries to make before giving up on rule if request for it returns an error. (default 5)
-replay.rulesDelay duration
   Delay between rules evaluation within the group. Could be important if there are chained rules inside the group and processing need to wait
-replay.timeFrom string
   The time filter in RFC3339 format to start the replay from. E.g. '2020-01-01T20:07:00Z'
-replay.timeTo string
   The time filter in RFC3339 format to finish the replay by. E.g. '2020-01-01T20:07:00Z'. By default, is set to the current time.
-rule array
   Path to the files or http url with alerting and/or recording rules in YAML format.
   Supports hierarchical patterns and regexpes.
   Examples:
    -rule="/path/to/file". Path to a single file with alerting rules.
    -rule="http://<some-server-addr>/path/to/rules". HTTP URL to a page with alerting rules.
    -rule="dir/*.yaml" -rule="/*.yaml" -rule="gcs://vmalert-rules/tenant_%{TENANT_ID}/prod".
    -rule="dir/**/*.yaml". Includes all the .yaml files in "dir" subfolders recursively.
   Rule files support YAML multi-document. Files may contain %{ENV_VAR} placeholders, which are substituted by the corresponding env vars.

   Enterprise version of vmalert supports S3 and GCS paths to rules.
   For example: gs://bucket/path/to/rules, s3://bucket/path/to/rules
   S3 and GCS paths support only matching by prefix, e.g. s3://bucket/dir/rule_ matches
   all files with prefix rule_ in folder dir.
   See https://docs.victoriametrics.com/victoriametrics/vmalert/#reading-rules-from-object-storage

   Supports an array of values separated by comma or specified via multiple flags.
   Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-rule.defaultRuleType string
   Default type for rule expressions, can be overridden via "type" parameter on the group level, see https://docs.victoriametrics.com/victoria
-rule.evalDelay duration
   Adjustment of the 'time' parameter for rule evaluation requests to compensate intentional data delay from the datasource. Normally, should
-rule.maxResolveDuration duration
   Limits the maxiMum duration for automatic alert expiration, which by default is 4 times evaluationInterval of the parent group
-rule.resendDelay duration
   MiniMum amount of time to wait before resending an alert to notifier.
-rule.stripFilePath
   Whether to strip file path in responses from the api/v1/rules API for files configured via -rule cmd-line flag. For example, the file path
-rule.templates array
   Path or glob pattern to location with go template definitions for rules annotations templating. Flag can be specified multiple times.
   Examples:
```

```
     -rule.templates="/path/to/file". Path to a single file with go templates
     -rule.templates="dir/*.tpl" -rule.templates="/*.tpl". Relative path to all .tpl files in "dir" folder,
    absolute path to all .tpl files in root.
     -rule.templates="dir/**/*.tpl". Includes all the .tpl files in "dir" subfolders recursively.

    Supports an array of values separated by comma or specified via multiple flags.
    Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-rule.updateEntriesLimit int
    Defines the max number of rule's state updates stored in-memory. Rule's updates are available on rule's Details page and are used for debug
-rule.validateExpressions
    Whether to validate rules expressions for different types. (default true)
-rule.validateTemplates
    Whether to validate annotation and label templates (default true)
-s3.configFilePath string
    Path to file with S3 configs. Configs are loaded from default location if not set.
    See https://docs.aws.amazon.com/general/latest/gr/aws-security-credentials.html . This flag is available only in Enterprise binaries. See h
-s3.configProfile string
    Profile name for S3 configs. If no set, the value of the environment variable will be loaded (AWS_PROFILE or AWS_DEFAULT_PROFILE), or if bo
-s3.credsFilePath string
    Path to file with GCS or S3 credentials. Credentials are loaded from default locations if not set.
    See https://cloud.google.com/iam/docs/creating-managing-service-account-keys and https://docs.aws.amazon.com/general/latest/gr/aws-security
-s3.customEndpoint string
    Custom S3 endpoint for use with S3-compatible storages (e.g. MinIO). S3 is used if not set. This flag is available only in Enterprise binar
-s3.forcePathStyle
    Prefixing endpoint with bucket name when set false, true by default. This flag is available only in Enterprise binaries. See https://docs.v
-tls array
    Whether to enable TLS for incoming HTTP requests at the given -httpListenAddr (aka https). -tlsCertFile and -tlsKeyFile must be set if -tls
    Supports array of values separated by comma or specified via multiple flags.
    Empty values are set to false.
-tlsAutocertCacheDir string
    Directory to store TLS certificates issued via Let's Encrypt. Certificates are lost on restarts if this flag isn't set. This flag is availal
-tlsAutocertEmail string
    Contact email for the issued Let's Encrypt TLS certificates. See also -tlsAutocertHosts and -tlsAutocertCacheDir .This flag is available on
-tlsAutocertHosts array
    Optional hostnames for automatic issuing of Let's Encrypt TLS certificates. These hostnames must be reachable at -httpListenAddr . The -htt
    Supports an array of values separated by comma or specified via multiple flags.
    Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-tlsCertFile array
    Path to file with TLS certificate for the corresponding -httpListenAddr if -tls is set. Prefer ECDSA certs instead of RSA certs as RSA cert
    Supports an array of values separated by comma or specified via multiple flags.
    Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-tlsCipherSuites array
    Optional list of TLS cipher suites for incoming requests over HTTPS if -tls is set. See the list of supported cipher suites at https://pkg.
    Supports an array of values separated by comma or specified via multiple flags.
    Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-tlsKeyFile array
    Path to file with TLS key for the corresponding -httpListenAddr if -tls is set. The provided key file is automatically re-read every second
    Supports an array of values separated by comma or specified via multiple flags.
    Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-tlsMinVersion array
    Optional minimum TLS version to use for the corresponding -httpListenAddr if -tls is set. Supported values: TLS10, TLS11, TLS12, TLS13
    Supports an array of values separated by comma or specified via multiple flags.
    Value can contain comma inside single-quoted or double-quoted string, {}, [] and () braces.
-version
    Show VictoriaMetrics version
```

Hot config reload

`vmalert` supports "hot" config reload via the following methods:

- send SIGHUP signal to `vmalert` process;
- send GET request to `/-/reload` endpoint (this endpoint can be protected with `-reloadAuthKey` command-line flag);
- configure `-configCheckInterval` flag for periodic reload on config change.

URL params

To set additional URL params for `datasource.url`, `remoteWrite.url` or `remoteRead.url` just add them in address: `-datasource.url=http://localhost:8428?nocache=1`.

To set additional URL params for specific group of rules modify the `params` group:

```
groups:
  - name: TestGroup
    params:
      denyPartialResponse: ["true"]
      extra_label: ["env=dev"]
```

Please note, `params` are used only for executing rules expressions (requests to `datasource.url`). If there would be a conflict between URL params set in `datasource.url` flag and params in group definition the latter will have higher priority.

Chaining groups

For chaining groups, they must be executed in a specific order, and the next group should be executed after the results from previous group are available in the datasource. In `vmalert`, user can specify `eval_offset` to achieve that ⓘ.

For example:

```
groups:
  - name: BaseGroup
    interval: 1m
    eval_offset: 10s
    rules:
      - record: http_server_request_duration_seconds:sum_rate:5m:http_get
        expr: |
          sum without(instance, pod) (
            rate(
              http_server_request_duration_seconds{
                http_request_method="GET"
              }[5m]
            )
          )
      - record: http_server_request_duration_seconds:sum_rate:5m:http_post
        expr: |
          sum without(instance, pod) (
            rate(
              http_server_request_duration_seconds{
                http_request_method="POST"
              }[5m]
            )
          )
  - name: TopGroup
    interval: 1m
    eval_offset: 40s
    rules:
      - record: http_server_request_duration_seconds:sum_rate:5m:merged
        expr: |
          http_server_request_duration_seconds:sum_rate:5m:http_get
          or
          http_server_request_duration_seconds:sum_rate:5m:http_post
```

This configuration ensures that rules in `BaseGroup` are executed at(assuming vmalert starts at `12:00:00`):

```
[12:00:10, 12:01:10, 12:02:10, 12:03:10...]
```

while rules in group `TopGroup` are executed at:

```
[12:00:40, 12:01:40, 12:02:40, 12:03:40...]
```

As a result, `TopGroup` always gets the latest results of `BaseGroup`.

By default, the `eval_offset` values should be at least 30 seconds apart to accommodate the `-search.latencyOffset(default 30s)` command-line flag at vmselect or VictoriaMetrics single-node. The minimum `eval_offset` gap can be adjusted accordingly with `-search.latencyOffset`.

Notifier configuration file

Notifier also supports configuration via file specified with flag `notifier.config`:

```
./bin/vmalert -rule=app/vmalert/config/testdata/rules.good.rules \
  -datasource.url=http://localhost:8428 \
  -notifier.config=app/vmalert/notifier/testdata/consul.good.yaml
```

The configuration file allows to configure static notifiers, discover notifiers via Consul and DNS: For example:

```
static_configs:
  - targets:
      # support using full url
      - 'http://alertmanager:9093/test/api/v2/alerts'
      - 'https://alertmanager:9093/api/v2/alerts'
      # the following target with only host:port will be used as <scheme>://localhost:9093/<path_prefix>/api/v2/alerts
      - localhost:9093

consul_sd_configs:
  - server: localhost:8500
    services:
      - alertmanager

dns_sd_configs:
  - names:
      - my.domain.com
    type: 'A'
    port: 9093
```

The list of configured or discovered Notifiers can be explored via UI. If Alertmanager runs in cluster mode then all its URLs needs to be available during discovery to ensure high availability.

The configuration file specification is the following:

```
# Per-target Notifier timeout when pushing alerts.
[ timeout: <duration> | default = 10s ]

# Prefix for the HTTP path alerts are pushed to.
[ path_prefix: <path> | default = / ]

# Configures the protocol scheme used for requests.
[ scheme: <scheme> | default = http ]

# Sets the `Authorization` header on every request with the
# configured username and password.
# password and password_file are mutually exclusive.
basic_auth:
  [ username: <string> ]
  [ password: <string> ]
  [ password_file: <string> ]

# Optional `Authorization` header configuration.
authorization:
  # Sets the authentication type.
```

```
      [ type: <string> | default: Bearer ]
      # Sets the credentials. It is mutually exclusive with
      # `credentials_file`.
      [ credentials: <secret> ]
      # Sets the credentials to the credentials read from the configured file.
      # It is mutually exclusive with `credentials`.
      [ credentials_file: <filename> ]

    # Configures the scrape request's TLS settings.
    # see https://prometheus.io/docs/prometheus/latest/configuration/configuration/#tls_config
    tls_config:
      [ <tls_config> ]

    # Configures Bearer authentication token via string
    bearer_token: <string>
    # or by passing path to the file with token.
    bearer_token_file: <string>

    # Configures OAuth 2.0 authentication
    # see https://prometheus.io/docs/prometheus/latest/configuration/configuration/#oauth2
    oauth2:
      [ <oauth2_config> ]

    # Optional list of HTTP headers in form `header-name: value`
    # applied for all requests to notifiers
    # For example:
    #  headers:
    #    - "CustomHeader: foo"
    #    - "CustomHeader2: bar"
    headers:
      [ <string>, ...]

    # List of labeled statically configured Notifiers.
    #
    # Each list of targets may be additionally instructed with
    # authorization params. Target's authorization params will
    # inherit params from global authorization params if there
    # are no conflicts.
    static_configs:
      [ - targets: ]
          [ - '<host>' ]
          [ oauth2 ]
          [ basic_auth ]
          [ authorization ]
          [ tls_config ]
          [ bearer_token ]
          [ bearer_token_file ]
          [ headers ]

    # List of Consul service discovery configurations.
    # See https://prometheus.io/docs/prometheus/latest/configuration/configuration/#consul_sd_config
    consul_sd_configs:
      [ - <consul_sd_config> ... ]

    # List of DNS service discovery configurations.
    # See https://prometheus.io/docs/prometheus/latest/configuration/configuration/#dns_sd_config
    dns_sd_configs:
      [ - <dns_sd_config> ... ]

    # List of relabel configurations for entities discovered via service discovery.
    # Supports the same relabeling features as the rest of VictoriaMetrics components.
    # See https://docs.victoriametrics.com/victoriametrics/vmagent/#relabeling
    relabel_configs:
      [ - <relabel_config> ... ]

    # List of relabel configurations for alert labels sent via Notifier.
    # Supports the same relabeling features as the rest of VictoriaMetrics components.
    # See https://docs.victoriametrics.com/victoriametrics/vmagent/#relabeling
    alert_relabel_configs:
      [ - <relabel_config> ... ]
```

The configuration file can be hot-reloaded .

Contributing

`vmalert` is mostly designed and built by VictoriaMetrics community. Feel free to share your experience and ideas for improving this software. Please keep simplicity as the main priority.

How to build from sources

It is recommended using binary releases

- `vmalert` is located in `vmutils-*` archives there.

Docker image

You can build `vmalert` docker image from source and push it to your own docker repository. Run the following commands from the root folder of the repository :

```
make package-vmalert
docker tag victoria-metrics/vmalert:version my-repo:my-version-name
docker push my-repo:my-version-name
```

To run the built image in `victoria-metrics-k8s-stack` or `VMAlert` CR object apply the following config change:

```
kind: VMAlert
spec:
  image:
    repository: my-repo
    tag: my-version-name
```

Development build

1. Install Go .
2. Run `make vmalert` from the root folder of the repository . It builds `vmalert` binary and puts it into the `bin` folder.

Production build

1. Install docker .
2. Run `make vmalert-prod` from the root folder of the repository . It builds `vmalert-prod` binary and puts it into the `bin` folder.

ARM build

ARM build may run on Raspberry Pi or on energy-efficient ARM servers .

Development ARM build

1. Install Go .
2. Run `make vmalert-linux-arm` or `make vmalert-linux-arm64` from the root folder of the repository . It builds `vmalert-linux-arm` or `vmalert-linux-arm64` binary respectively and puts it into the `bin` folder.

Production ARM build

1. Install docker .

2. Run `make vmalert-linux-arm-prod` or `make vmalert-linux-arm64-prod` from the root folder of the repository. It builds `vmalert-linux-arm-prod` or `vmalert-linux-arm64-prod` binary respectively and puts it into the `bin` folder.

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