



我想要理解35%怎麼計算出來的用法，為了規劃vmstorage容量大小，你能教我嗎，或是你能給更簡單的範例：

#### Capacity planning #

VictoriaMetrics uses lower amounts of CPU, RAM and storage space on production workloads compared to competing solutions (Prometheus, Thanos, Cortex, TimescaleDB, InfluxDB, QuestDB, M3DB) according to our case studies.

Each node type - vminsert, vmselect and vmstorage - can run on the most suitable hardware. Cluster capacity scales linearly with the available resources. The needed amounts of CPU and RAM per each node type highly depends on the workload - the number of active time series, series churn rate, query types, query qps, etc. It is recommended setting up a test VictoriaMetrics cluster for your production workload and iteratively scaling per-node resources and the number of nodes per node type until the cluster becomes stable. It is recommended setting up monitoring for the cluster. It helps to determine bottlenecks in cluster setup. It is also recommended following the troubleshooting docs.

The needed storage space for the given retention (the retention is set via `-retentionPeriod` command-line flag at vmstorage) can be extrapolated from disk space usage in a test run. For example, if the storage space usage is 10GB after a day-long test run on a production workload, then it will need at least  $10\text{GB} \times 100 = 1\text{TB}$  of disk space for `-retentionPeriod=100d` (100-days retention period). Storage space usage can be monitored with the official Grafana dashboard for VictoriaMetrics cluster.

It is recommended leaving the following amounts of



spare resources:

50% of free RAM across all the node types for reducing the probability of OOM (out of memory) crashes and slowdowns during temporary spikes in workload.

50% of spare CPU across all the node types for reducing the probability of slowdowns during temporary spikes in workload.

At least 20% of free storage space at the directory pointed by `-storageDataPath` command-line flag at `vmstorage` nodes. See also -

`storage.minFreeDiskSpaceBytes` command-line flag description for `vmstorage`.

Increase free storage space and -

`storage.minFreeDiskSpaceBytes` to match at least the amount of data you plan to ingest in a calendar month:

on each `vmstorage` pod, the monthly final

deduplication process will temporarily need as much space as is used for the previous month's data, before

it can free up space. For example, if you have a 3

month retention period and you want to keep at least 10 % space free at all times, you could pick 35 % of

your total space as value. When some of your

`vmstorage` pods are in read-only mode, the remaining pods will have a higher share of the total data

ingestion, and will therefore need more free space the next month.

Some capacity planning tips for VictoriaMetrics cluster:

The replication increases the amounts of needed resources for the cluster by up to  $N$  times where  $N$  is replication factor. This is because `vminsert` stores  $N$  copies of every ingested sample on distinct `vmstorage` nodes. These copies are de-duplicated by `vmselect` during querying. The most cost-efficient and performant solution for data durability is to rely on replicated durable persistent disks such as Google Compute persistent disks instead of using the replication at VictoriaMetrics level.



It is recommended to run a cluster with big number of small vmstorage nodes instead of a cluster with small number of big vmstorage nodes. This increases chances that the cluster remains available and stable when some of vmstorage nodes are temporarily unavailable during maintenance events such as upgrades, configuration changes or migrations. For example, when a cluster contains 10 vmstorage nodes and a single node becomes temporarily unavailable, then the workload on the remaining 9 nodes increases by  $1/9=11\%$ . When a cluster contains 3 vmstorage nodes and a single node becomes temporarily unavailable, then the workload on the remaining 2 nodes increases by  $1/2=50\%$ . The remaining vmstorage nodes may have no enough free capacity for handling the increased workload. In this case the cluster may become overloaded, which may result to decreased availability and stability.

Cluster capacity for active time series can be increased by increasing RAM and CPU resources per each vmstorage node or by adding new vmstorage nodes. Query latency can be reduced by increasing CPU resources per each vmselect node, since each incoming query is processed by a single vmselect node. Performance for heavy queries scales with the number of available CPU cores at vmselect node, since vmselect processes time series referred by the query on all the available CPU cores.

If the cluster needs to process incoming queries at a high rate, then its capacity can be increased by adding more vmselect nodes, so incoming queries could be spread among bigger number of vmselect nodes.

By default vminsert compresses the data it sends to vmstorage in order to reduce network bandwidth usage. The compression takes additional CPU resources at vminsert. If vminsert nodes have limited CPU, then the compression can be disabled by passing -  
`rpc.disableCompression` command-line flag at vminsert nodes.

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vmselect during queries in order to reduce network bandwidth usage. The compression takes additional CPU resources at vmstorage. If vmstorage nodes have limited CPU, then the compression can be disabled by passing `-rpc.disableCompression` command-line flag at vmstorage nodes.  
See also resource usage limits docs.



這段文件中提到的「**可以選擇設定為總空間的 35%**」，是為了確保你在使用 `vmstorage` 時有足夠的「**臨時可用空間**」來處理 **每月一次的資料清除與壓縮 (deduplication)** 過程。

## ✅ 怎麼推導出「35%」這個數字？

舉例來說，如果你：

- 資料保留 (retention) 設定為 3 個月 (=90 天)
- 希望 **至少保留 10% 空間是永遠空的** (避免磁碟用滿)
- 每個月的資料大小差不多，例如：
  - 每月約用掉 30% 空間 (因為 3 個月總共是 100%)

那麼你要預留的空間至少是：

10% (永遠保留) + 30% (本月將被清掉的資料，但清除前會先暫存在一個地方)  
= 40%

但因為壓縮、碎片化、read-only pod、資料傾斜等實際情況，官方建議 **35%** 是一個相對保守且合理的預留值。



## 用更簡單的方式來理解

假設你有一台 `vmstorage` 節點，設定如下：

- 你打算保留資料 3 個月
- 每個月會寫入約 100GB 的資料
- 所以三個月大約會佔用 **300GB**

這時你該怎麼設定整體的磁碟大小呢？

### 正確做法：

你至少需要：

- **300GB (資料)**
- **+ 100GB (當月清理過程需要的暫存空間)**
- **+ 一點額外緩衝 (比如 10%)**

所以你應該準備大約：

**300 + 100 + 40 = 440GB**，也就是 **預留空間 140GB / 440GB  $\approx$  32%**

這個比例就非常接近官方建議的 **35%**。

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## 為什麼預留空間很重要？

因為當 `vmstorage` 清除資料時，它會：

1. 將要刪除的資料標記為「舊」
2. 產生新的壓縮檔案（同一時間還沒刪除舊的）
3. 再刪除原始的資料



這就意味著：在清除過程中，你會暫時使用兩倍的空間

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## ✓ 小結：怎麼簡單估出你需要的空間？

你可以這樣算：

$$\text{總磁碟大小} = \text{保留期的資料大小} \times 1.35$$

例如：

若每月資料為 200GB，保留 3 個月：

$$\Rightarrow 200\text{GB} \times 3 = 600\text{GB} \text{ (資料)}$$

$$\Rightarrow 600\text{GB} \times 1.35 \approx 810\text{GB} \text{ (磁碟總空間)}$$

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需要我幫你寫成一個小工具（Python script 或 Excel 計算表）來自動算嗎？或你想根據你現在的使用量來估算磁碟空間？