



RAPPORT R5.02

Université de la réunion / IUT

Département Réseaux, Télécommunication en Cybersécurité – 3ème années

**R5.02
SUPERVISION DES RÉSEAUX**

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TP1

Variables du dashboard :

Variable \$host :

La variable **\$host** permet de sélectionner dynamiquement la machine (hôte Docker) sur laquelle les métriques sont collectées.

- Elle filtre les métriques par instance, ce qui permet d'observer l'utilisation CPU, RAM, réseau et disque **spécifiquement pour un host choisi**.
- Grâce à ce mécanisme, il est possible de comparer plusieurs hôtes ou de cibler uniquement l'infrastructure TAAF.

The screenshot shows the configuration for a template variable named 'host'. On the left, under 'General' settings, the 'Name' is set to 'host' and the 'Label' is set to 'instance'. On the right, the 'Query options' panel is shown for a Prometheus data source. It has 'Label values' set to 'instance' and 'Metric' set to 'container_last_seen'. Below this, there's a 'Regex' section with a placeholder '.*'.

Variable \$conteneur :

La variable **\$conteneur** sert à filtrer les métriques en fonction d'un conteneur particulier.

- Elle est utilisée dans les requêtes PromQL avec le label `name=~"$conteneur"`.
- Elle permet de sélectionner rapidement un conteneur parmi la liste (postgres-af, prometheus-taaf, grafana-taaf, etc.) et d'afficher uniquement ses ressources ou son trafic.
- Cela rend le dashboard **flexible et interactif**, car on peut naviguer d'un conteneur à l'autre sans changer les requêtes.

The screenshot shows the configuration for a template variable named 'conteneur'. On the left, under 'General', the 'Name' is set to 'conteneur' and the 'Label' is also 'conteneur'. Under 'Sort', it is set to 'Disabled'. Under 'Refresh', it is set to 'On dashboard load'. In the 'Selection options' section, three checkboxes are checked: 'Multi-value' (enables multiple values to be selected at the same time), 'Allow custom values' (enables users to add custom values to the list), and 'Include All option' (enables an option to include all values). On the right, the 'Query options' panel shows a query setup for 'prometheus'. The 'Data source' is 'prometheus', 'Query type' is 'Label values', 'Label' is 'name', and 'Metric' is 'container_last_seen'. A 'Label filters' section includes 'instance' and 'host'. A 'Regex' section is present but empty.

Réponses attendues :

Question 1 – Variables de base

Combien d'hosts différents sont disponibles dans \$host ?

The screenshot shows the 'Preview of values' for the variable '\$host'. It displays two items: 'All' and 'cadvisor:8080'.

Il y'a en tout 1 hosts dans la variable \$host.

Question 2 – Métriques simples

Combien de conteneurs sont actuellement en cours d'exécution au total ?

PromQL :

```
count(container_last_seen{name!=""})*
```

Dashboard final :



Réponse : 14 Conteneur actif

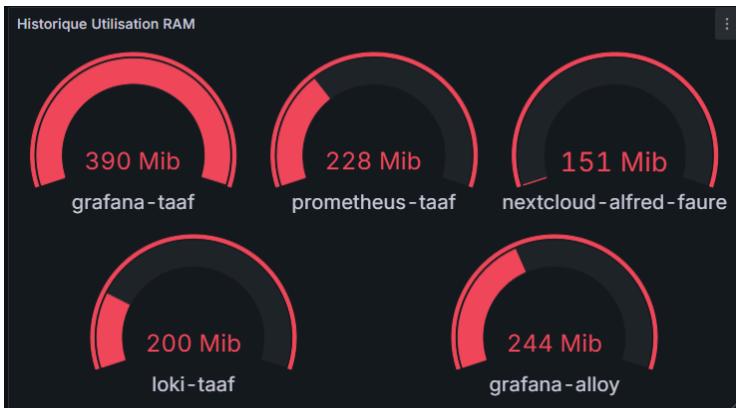
Question 3 – Filtrage par conteneur

Top 5 conteneurs mémoire.

PromQL :

```
topk(5, container_memory_usage_bytes{name!="", instance=~"$host", name=~"$conteneur"})
```

Dashboard final :

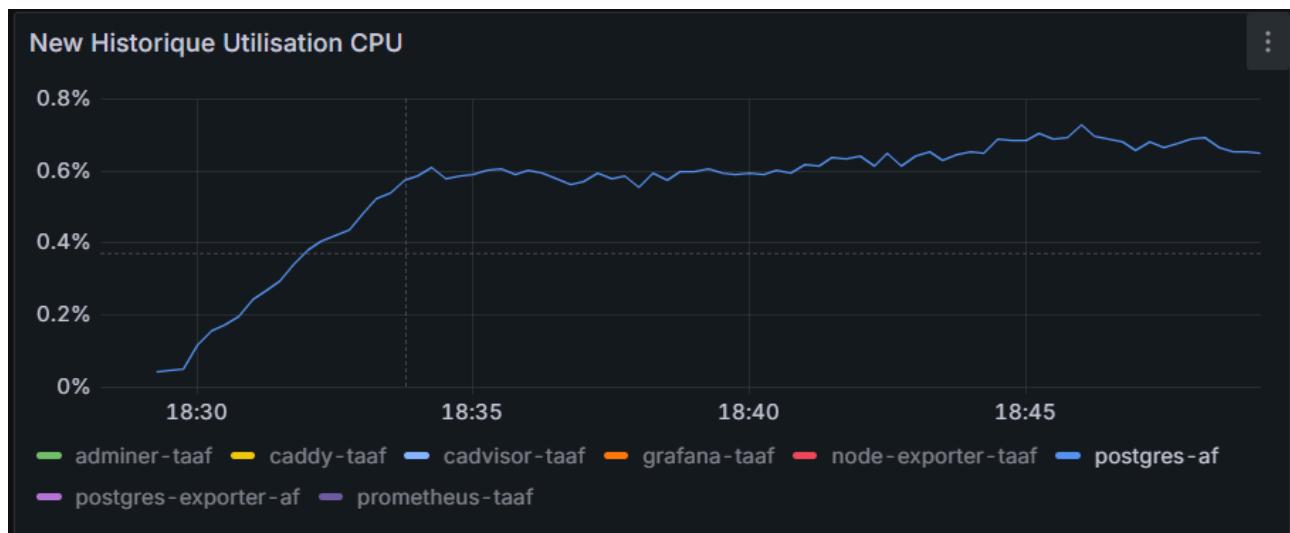


Question 4 – Pourcentage CPU du conteneur postgres-af

PromQL :

```
avg(rate(container_cpu_usage_seconds_total{name="postgres-af"}[5m])) * 100
```

Dashboard final :

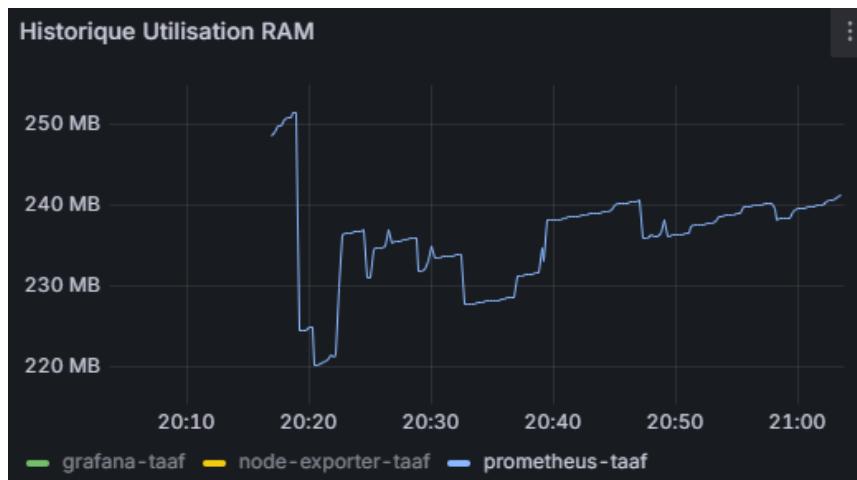


Consommation en moyenne : **0,68 %** de CPU

Question 5 – Analyse temporelle

Pic mémoire du conteneur `prometheus-taaf` sur la dernière heure.

Dashboard final :



Réponse : Au cours de la dernière heure, le conteneur *prometheus* a atteint un pic de consommation mémoire de **251 MB** vers **20:18**, probablement lors d'une opération de collecte ou d'évaluation de requêtes lourdes.

Question 6 – Métriques réseau

Conteneur avec le plus de trafic sortant (TX bytes).

PromQL :

```
topk(1, sum(rate(container_network_transmit_bytes_total{name!="",  
instance=~"$host", name=~"$conteneur"}[1h])) by (name))
```

Dashboard final :



Réponse : Durant la dernière heure, le conteneur postgres-af a généré le plus de trafic réseau sortant avec environ **22 MiB**, lié à l'envoi continu de métriques système vers Prometheus.

Question 7 – Corrélation métrique

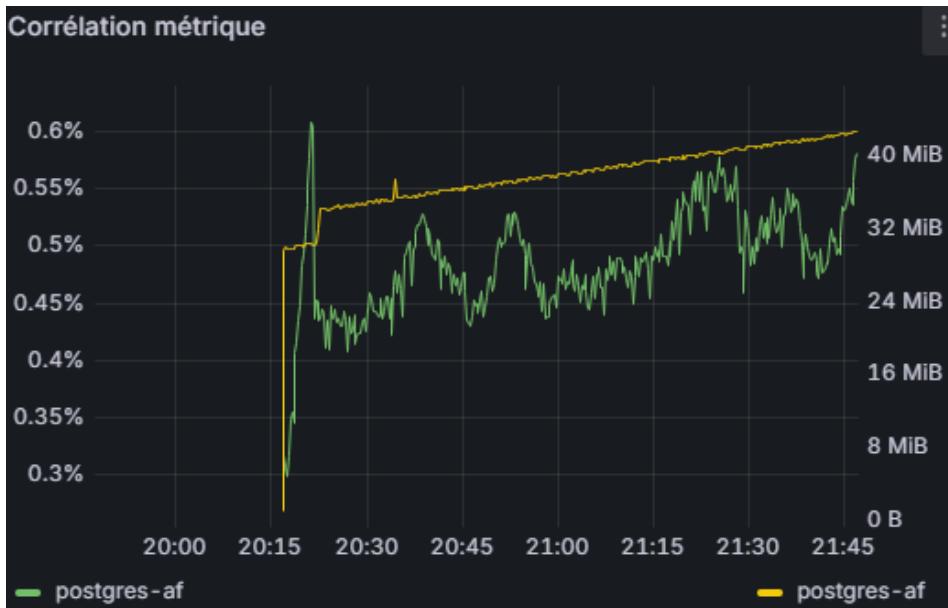
CPU vs Mémoire sur 2h.

- CPU :

```
rate(container_cpu_usage_seconds_total{name="postgres-af",  
instance=~"$host"}[5m]) * 100
```

- RAM :

```
container_memory_usage_bytes{name="postgres-af", instance=~"$host"}
```



En vert : CPU

En jaune : RAM

Réponse : On observe une corrélation positive entre l'utilisation CPU et la mémoire du conteneur postgres-af.

Les pics CPU correspondent à des phases de traitement ou d'accès intensif aux données, suivies d'une augmentation progressive de la mémoire utilisée.

Ce comportement est cohérent avec le fonctionnement de PostgreSQL, où la charge CPU ponctuelle alimente une montée en mémoire due au caching et à la gestion des buffers internes.

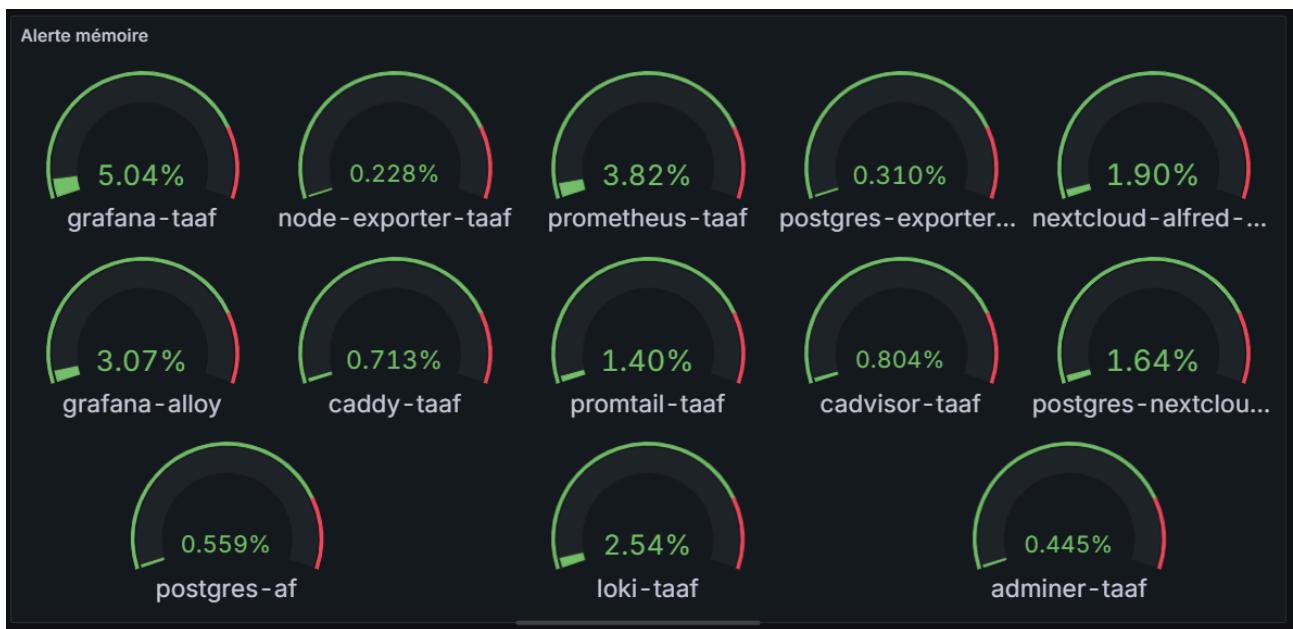
Question 8 – Alertes mémoire

Conteneurs avec >80% mémoire.

On prend

PromQL (si les limites mémoire existent via `container_spec_memory_limit_bytes`) :

```
(container_memory_usage_bytes{name!="", job="cadvisor"}
 / (7.762 * 1024 * 1024 * 1024)
) * 100 > 0
```



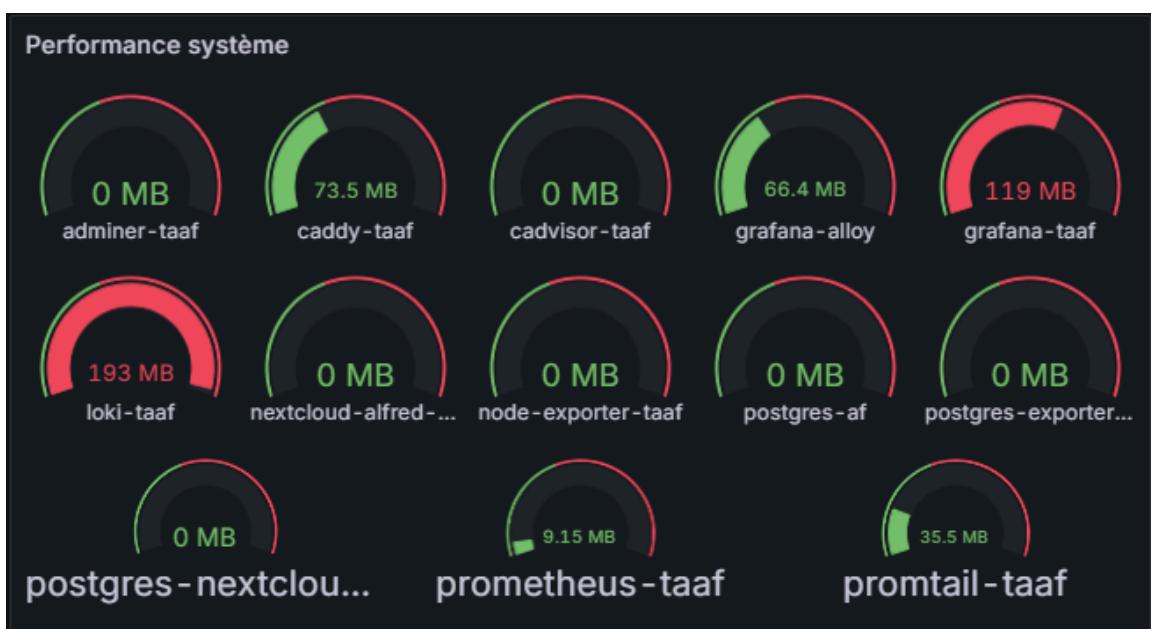
Réponse : Après avoir défini des limites mémoire sur les conteneurs Docker, Prometheus rapporte désormais des valeurs correctes. On voit les conteneurs *qui peuvent* dépasser 80 % de leur limite , ce qui déclenche l'alerte mémoire. Les autres conteneurs restent en dessous du seuil.

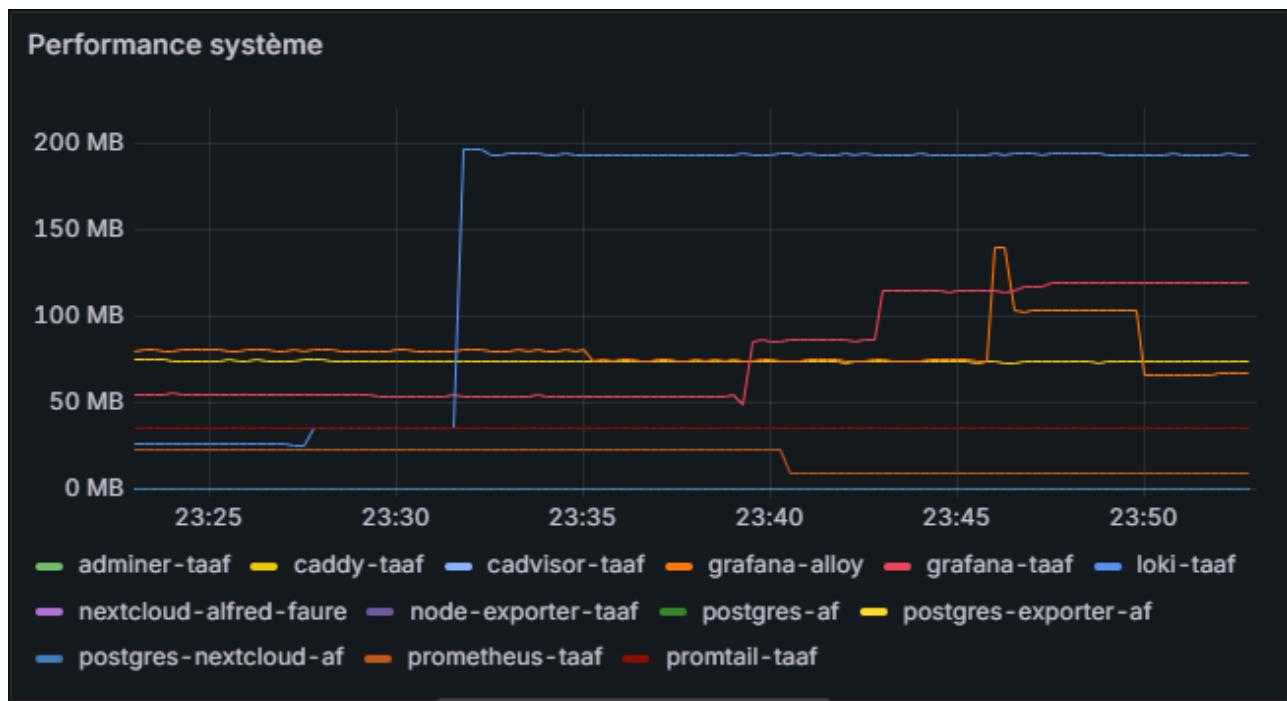
Question 9 – Impact I/O disque

Quel conteneur fait le plus d'I/O disque ?

PromQL :

```
sum(rate(container_fs_reads_bytes_total{name!="", instance=~"$host", name=~"$conteneur"}[1h])) by (name)
```





Réponse : Durant la dernière heure, le conteneur *loki-taaf* a généré le plus d'I/O disque (~193 MB), principalement pour écrire et indexer les logs entrants. Cela peut affecter la performance globale du host si le disque n'est pas suffisamment rapide, tandis que les autres conteneurs ont une activité disque moindre.

Impact opérationnel

- Le conteneur *loki-taaf* peut saturer le disque si le flux de logs est élevé.
- Risque : ralentissement du host pour les autres conteneurs, délais d'accès aux fichiers, latence pour Prometheus et Grafana.
- Solution : stockage rapide (SSD), quotas I/O, ou isolation sur un disque dédié.

Question 10 – Optimisation infrastructure

Propositions possibles :

1- Optimisation Postgres

- Action :** Mettre en place une alerte si le CPU du conteneur Postgres dépasse 70 % sur 10 min.
- Justification technique :** Permet d'identifier les pics de charge dus aux requêtes lourdes ou aux index manquants. Optimiser les requêtes ou les indices réduit le risque de saturation CPU.

- **Impact opérationnel :** Maintien des performances de la base de données, garantie de disponibilité des services bancaires simulés, réduction des ralentissements pour les utilisateurs.

2- Limitation mémoire pour Grafana et Prometheus

- **Action :** Définir des limites mémoire sur les conteneurs et créer une alerte si utilisation > 80 %.
- **Justification technique :** Ces conteneurs consomment beaucoup de RAM pour les dashboards et la collecte de métriques. Limiter la mémoire évite le swapping et les crashes.
- **Impact opérationnel :** Assure la continuité du monitoring et la fiabilité des métriques affichées dans Grafana.

3- Surveillance du trafic réseau

- **Action :** Créer une alerte si un conteneur dépasse un débit sortant moyen de 50 MB/s.
- **Justification technique :** Permet de détecter les conteneurs générant un trafic réseau excessif pouvant saturer le lien ou impacter la communication entre conteneurs.
- **Impact opérationnel :** Prévention des congestions réseau, maintien de la collecte de métriques et de la communication inter-conteneurs, garantissant la stabilité de l'infrastructure :

Dashboard final :





ANNEXE JSON :

```
{
  "id": 16,
  "type": "timeseries",
  "title": " Performance système",
  "gridPos": {
    "x": 0,
    "y": 0,
    "h": 9,
    "w": 13
  },
  "fieldConfig": {
    "defaults": {
      "custom": {
        "drawStyle": "line",
        "lineInterpolation": "linear",
        "barAlignment": 0,
        "barWidthFactor": 0.6,
        "lineWidth": 1,
        "fillOpacity": 0,
        "gradientMode": "none",
        "spanNulls": false,
        "insertNulls": false,
        "showPoints": "auto",
        "pointSize": 5,
        "strokeDash": []
      }
    }
  }
}
```

```
"stacking": {  
    "mode": "none",  
    "group": "A"  
},  
"axisPlacement": "auto",  
"axisLabel": "",  
"axisColorMode": "text",  
"axisBorderShow": false,  
"scaleDistribution": {  
    "type": "linear"  
},  
"axisCenteredZero": false,  
"hideFrom": {  
    "tooltip": false,  
    "viz": false,  
    "legend": false  
},  
"thresholdsStyle": {  
    "mode": "off"  
}  
},  
"color": {  
    "mode": "palette-classic"  
},  
"mappings": [],  
"thresholds": {  
    "mode": "absolute",  
    "steps": [  
        {  
            "color": "green",  
            "value": null  
        },  
        {  
            "color": "red",  
            "value": 80  
        }  
    ]  
},
```

```
        "unit": "decabytes"
    },
    "overrides": []
},
"pluginVersion": "12.1.1",
"targets": [
{
    "editorMode": "code",
    "expr": "sum(rate(container_fs_reads_bytes_total{name!=""\",
instance=~\"$host\", name=~\"$conteneur\"){1h})) by (name)\r\n",
    "legendFormat": "{{name}}",
    "range": true,
    "refId": "A"
}
],
"datasource": {
    "type": "prometheus",
    "uid": "dezjs3gl35r7kc"
},
"options": {
    "tooltip": {
        "mode": "single",
        "sort": "none",
        "hideZeros": false
    },
    "legend": {
        "showLegend": true,
        "displayMode": "list",
        "placement": "bottom",
        "calcs": []
    }
}
}
```

```
{  
  "id": 15,  
  "type": "gauge",  
  "title": "Alerte mémoire",  
  "gridPos": {  
    "x": 13,  
    "y": 0,  
    "h": 9,  
    "w": 11  
  },  
  "fieldConfig": {  
    "defaults": {  
      "mappings": [],  
      "thresholds": {  
        "mode": "absolute",  
        "steps": [  
          {  
            "color": "green",  
            "value": null  
          },  
          {  
            "color": "red",  
            "value": 80  
          }  
        ]  
      },  
      "color": {  
        "mode": "thresholds"  
      },  
      "unit": "decabytes"  
    },  
    "overrides": []  
  },  
  "pluginVersion": "12.1.1",  
  "targets": [  
  ]
```

```
        "editorMode": "code",
        "expr": "(container_memory_usage_bytes{name!="\",
instance=~\"$host\"} / 1024 / 1024) > 160\r\n",
        "legendFormat": "{{name}}",
        "range": true,
        "refId": "A"
    },
],
"datasource": {
    "type": "prometheus",
    "uid": "dezjs3gl35r7kc"
},
"options": {
    "reduceOptions": {
        "values": false,
        "calcs": [
            "lastNotNull"
        ],
        "fields": ""
    },
    "orientation": "auto",
    "showThresholdLabels": false,
    "showThresholdMarkers": true,
    "sizing": "auto",
    "minVizWidth": 75,
    "minVizHeight": 75
}
}
```

```
{
    "id": 8,
    "type": "timeseries",
    "title": "Corrélation métrique",
    "gridPos": {
        "x": 0,
        "y": 9,
        "h": 8,
```

```
"w": 13
},
"fieldConfig": {
  "defaults": {
    "custom": {
      "drawStyle": "line",
      "lineInterpolation": "linear",
      "barAlignment": 0,
      "barWidthFactor": 0.6,
      "lineWidth": 1,
      "fillOpacity": 0,
      "gradientMode": "none",
      "spanNulls": false,
      "insertNulls": false,
      "showPoints": "auto",
      "pointSize": 5,
      "stacking": {
        "mode": "none",
        "group": "A"
      },
      "axisPlacement": "auto",
      "axisLabel": "",
      "axisColorMode": "text",
      "axisBorderShow": false,
      "scaleDistribution": {
        "type": "linear"
      },
      "axisCenteredZero": false,
      "hideFrom": {
        "tooltip": false,
        "viz": false,
        "legend": false
      },
      "thresholdsStyle": {
        "mode": "off"
      }
    },
    "color": {
```

```
        "mode": "palette-classic"
    },
    "mappings": [],
    "thresholds": {
        "mode": "absolute",
        "steps": [
            {
                "color": "green",
                "value": null
            },
            {
                "color": "red",
                "value": 80
            }
        ]
    },
    "unit": "percent"
},
"overrides": [
{
    "matcher": {
        "id": "byFrameRefID",
        "options": "B"
    },
    "properties": [
        {
            "id": "custom.axisPlacement",
            "value": "right"
        },
        {
            "id": "unit",
            "value": "bytes"
        }
    ]
}
],
"pluginVersion": "12.1.1",
```

```
"targets": [
  {
    "editorMode": "code",
    "expr": "sum(rate(container_cpu_usage_seconds_total{name=\"postgres-af\", instance=~\"$host\"})[5m])) by (name) * 100",
    "legendFormat": "__auto",
    "range": true,
    "refId": "A"
  },
  {
    "datasource": {
      "type": "prometheus",
      "uid": "dezjs3gl35r7kc"
    },
    "editorMode": "code",
    "expr": "sum(container_memory_usage_bytes{name=\"postgres-af\", instance=~\"$host\"}) by (name)",
    "hide": false,
    "instant": false,
    "legendFormat": "__auto",
    "range": true,
    "refId": "B"
  }
],
"datasource": {
  "type": "prometheus",
  "uid": "dezjs3gl35r7kc"
},
"options": {
  "tooltip": {
    "mode": "single",
    "sort": "none",
    "hideZeros": false
  },
  "legend": {
    "showLegend": true,
    "displayMode": "list",
  }
}
```

```
        "placement": "bottom",
        "calcs": []
    }
}
```

```
{
  "id": 6,
  "type": "timeseries",
  "title": "Métriques réseau",
  "gridPos": {
    "x": 13,
    "y": 9,
    "h": 8,
    "w": 11
  },
  "fieldConfig": {
    "defaults": {
      "custom": {
        "drawStyle": "line",
        "lineInterpolation": "linear",
        "barAlignment": 0,
        "barWidthFactor": 0.6,
        "lineWidth": 1,
        "fillOpacity": 0,
        "gradientMode": "none",
        "spanNulls": false,
        "insertNulls": false,
        "showPoints": "auto",
        "pointSize": 5,
        "stacking": {
          "mode": "none",
          "group": "A"
        },
        "axisPlacement": "auto",
        "axisLabel": "",
        "axisColorMode": "text",
        "axisColor": "#3399CC"
      }
    }
  }
}
```

```
        "axisBorderShow": false,
        "scaleDistribution": {
            "type": "linear"
        },
        "axisCenteredZero": false,
        "hideFrom": {
            "tooltip": false,
            "viz": false,
            "legend": false
        },
        "thresholdsStyle": {
            "mode": "off"
        },
        "color": {
            "mode": "palette-classic"
        },
        "mappings": [ ],
        "thresholds": {
            "mode": "absolute",
            "steps": [
                {
                    "color": "green",
                    "value": null
                },
                {
                    "color": "red",
                    "value": 80
                }
            ]
        },
        "unit": "kbytes"
    },
    "overrides": []
},
"pluginVersion": "12.1.1",
"targets": [
{

```

```
        "editorMode": "code",
        "expr": "topk(1,
sum(rate(container_network_transmit_bytes_total{name!="\"\", instance=~\"$host\", name=~\"$conteneur\"})[1h])) by (name))",
        "legendFormat": "{{{name}}}",
        "range": true,
        "refId": "A"
    },
],
"datasource": {
    "type": "prometheus",
    "uid": "dezjs3gl35r7kc"
},
"options": {
    "tooltip": {
        "mode": "single",
        "sort": "none",
        "hideZeros": false
    },
    "legend": {
        "showLegend": true,
        "displayMode": "list",
        "placement": "bottom",
        "calcs": []
    }
}
}
```

```
{
    "id": 1,
    "type": "stat",
    "title": "Conteneurs Actifs",
    "gridPos": {
        "x": 0,
        "y": 32,
        "h": 8,
        "w": 12
    }
}
```

```
},
"fieldConfig": {
  "defaults": {
    "mappings": [],
    "thresholds": {
      "mode": "absolute",
      "steps": [
        {
          "color": "green",
          "value": null
        },
        {
          "color": "red",
          "value": 80
        }
      ]
    },
    "color": {
      "mode": "thresholds"
    }
  },
  "overrides": []
},
"pluginVersion": "12.1.1",
"targets": [
  {
    "datasource": {
      "type": "prometheus",
      "uid": "dezjs3gl35r7kc"
    },
    "editorMode": "code",
    "exemplar": false,
    "expr": "count(container_last_seen{name!=\"\", instance=~\"$host\"})",
    "format": "time_series",
    "instant": true,
    "legendFormat": "__auto",
    "range": false,
    "refId": "A"
```

```
        },
    ],
  "datasource": {
    "type": "prometheus",
    "uid": "dezjs3gl35r7kc"
  },
  "options": {
    "reduceOptions": {
      "values": false,
      "calcs": [
        "lastNotNull"
      ],
      "fields": ""
    },
    "orientation": "auto",
    "textMode": "auto",
    "wideLayout": true,
    "colorMode": "value",
    "graphMode": "area",
    "justifyMode": "auto",
    "showPercentChange": false,
    "percentChangeColorMode": "standard"
  }
}
```

```
{
  "id": 3,
  "type": "gauge",
  "title": "Utilisation RAM",
  "gridPos": {
    "x": 0,
    "y": 26,
    "h": 6,
    "w": 12
  },
  "fieldConfig": {
    "defaults": {
```

```
"mappings": [ ],
"thresholds": {
  "mode": "absolute",
  "steps": [
    {
      "color": "green",
      "value": null
    },
    {
      "color": "red",
      "value": 80
    }
  ]
},
"color": {
  "mode": "thresholds"
},
"unit": "bytes"
},
"overrides": []
},
"pluginVersion": "12.1.1",
"targets": [
{
  "editorMode": "code",
  "expr": "sum(container_memory_usage_bytes{name=~\"$conteneur\",
instance=~\"$host\"})",
  "legendFormat": "__auto",
  "range": true,
  "refId": "A"
}
],
"datasource": {
  "type": "prometheus",
  "uid": "dezjs3gl35r7kc"
},
"options": {
  "reduceOptions": {
```

```
        "values": false,
        "calcs": [
            "lastNotNull"
        ],
        "fields": ""
    },
    "orientation": "auto",
    "showThresholdLabels": false,
    "showThresholdMarkers": true,
    "sizing": "auto",
    "minVizWidth": 75,
    "minVizHeight": 75
}
}
```

```
{
    "id": 5,
    "type": "timeseries",
    "title": "New Historique Utilisation CPU",
    "gridPos": {
        "x": 0,
        "y": 17,
        "h": 9,
        "w": 13
    },
    "fieldConfig": {
        "defaults": {
            "custom": {
                "drawStyle": "line",
                "lineInterpolation": "linear",
                "barAlignment": 0,
                "barWidthFactor": 0.6,
                "lineWidth": 1,
                "fillOpacity": 0,
                "gradientMode": "none",
                "spanNulls": false,
                "insertNulls": false,
                "strokeDash": []
            }
        }
    }
}
```

```
"showPoints": "auto",
"pointSize": 5,
"stacking": {
    "mode": "none",
    "group": "A"
},
"axisPlacement": "auto",
"axisLabel": "",
"axisColorMode": "text",
"axisBorderShow": false,
"scaleDistribution": {
    "type": "linear"
},
"axisCenteredZero": false,
"hideFrom": {
    "tooltip": false,
    "viz": false,
    "legend": false
},
"thresholdsStyle": {
    "mode": "off"
},
"color": {
    "mode": "palette-classic"
},
"mappings": [],
"thresholds": {
    "mode": "absolute",
    "steps": [
        {
            "color": "green",
            "value": null
        },
        {
            "color": "red",
            "value": 80
        }
    ]
}
```

```
        ],
      },
      "unit": "percent"
    },
    "overrides": []
  },
  "pluginVersion": "12.1.1",
  "targets": [
    {
      "editorMode": "code",
      "expr": "sum(rate(container_cpu_usage_seconds_total{name!=\"\", instance=~\"$host\", name=~\"$conteneur\"}[5m])) by (name) * 100",
      "legendFormat": "{{name}}",
      "range": true,
      "refId": "A"
    }
  ],
  "datasource": {
    "type": "prometheus",
    "uid": "dezjs3gl35r7kc"
  },
  "options": {
    "tooltip": {
      "mode": "single",
      "sort": "none",
      "hideZeros": false
    },
    "legend": {
      "showLegend": true,
      "displayMode": "list",
      "placement": "bottom",
      "calcs": []
    }
  }
}
```



```
"hideFrom": {  
    "tooltip": false,  
    "viz": false,  
    "legend": false  
},  
"thresholdsStyle": {  
    "mode": "off"  
},  
"color": {  
    "mode": "palette-classic"  
},  
"mappings": [],  
"thresholds": {  
    "mode": "absolute",  
    "steps": [  
        {  
            "color": "green",  
            "value": null  
        },  
        {  
            "color": "red",  
            "value": 80  
        }  
    ]  
},  
"unit": "decbytes"  
,  
"overrides": [  
    {  
        "__systemRef": "hideSeriesFrom",  
        "matcher": {  
            "id": "byNames",  
            "options": {  
                "mode": "exclude",  
                "names": [  
                    "prometheus-taaf"  
                ],  
                "order": 1  
            },  
            "type": "byName"  
        },  
        "series": {  
            "name": "prometheus-taaf",  
            "type": "series"  
        }  
    }  
],  
"series": [  
    {  
        "name": "prometheus-taaf",  
        "type": "series"  
    }  
]
```

```
        "prefix": "All except:",
        "readOnly": true
    },
},
"properties": [
{
    "id": "custom.hideFrom",
    "value": {
        "legend": false,
        "tooltip": false,
        "viz": true
    }
}
]
},
"pluginVersion": "12.1.1",
"targets": [
{
    "editorMode": "code",
    "expr": "topk(5, container_memory_usage_bytes{name!="\\"\\",
instance=~\"$host\", name=~\"$conteneur\"})\r\n",
    "legendFormat": "{{name}}",
    "range": true,
    "refId": "A"
}
],
"datasource": {
    "type": "prometheus",
    "uid": "dezjs3gl35r7kc"
},
"options": {
    "tooltip": {
        "mode": "single",
        "sort": "none",
        "hideZeros": false
    },
}
```

```
"legend": {  
    "showLegend": true,  
    "displayMode": "list",  
    "placement": "bottom",  
    "calcs": []  
}  
}  
}
```

```
{  
    "id": 2,  
    "type": "gauge",  
    "title": "Utilisation CPU",  
    "gridPos": {  
        "x": 12,  
        "y": 26,  
        "h": 6,  
        "w": 12  
    },  
    "fieldConfig": {  
        "defaults": {  
            "mappings": [],  
            "thresholds": {  
                "mode": "absolute",  
                "steps": [  
                    {  
                        "color": "green",  
                        "value": null  
                    },  
                    {  
                        "color": "orange",  
                        "value": 70  
                    },  
                    {  
                        "color": "red",  
                        "value": 90  
                    }  
                ]  
            }  
        }  
    }  
}
```

```
        ],
      },
      "color": {
        "mode": "thresholds"
      },
      "unit": "percent"
    },
    "overrides": []
  },
  "pluginVersion": "12.1.1",
  "targets": [
    {
      "editorMode": "code",
      "expr": "sum(rate(container_cpu_usage_seconds_total{name=~\"$conteneur\",
instance=~\"$host\"})[5m]) * 100",
      "legendFormat": "__auto",
      "range": true,
      "refId": "A"
    }
  ],
  "datasource": {
    "type": "prometheus",
    "uid": "dezjs3gl35r7kc"
  },
  "options": {
    "reduceOptions": {
      "values": false,
      "calcs": [
        "lastNotNull"
      ],
      "fields": ""
    },
    "orientation": "auto",
    "showThresholdLabels": false,
    "showThresholdMarkers": true,
    "sizing": "auto",
    "minVizWidth": 75,
```

```
    "minVizHeight": 75
  }
}
```