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## Operations

### System metrics

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Find useful metrics provided by Kubernetes and other system resources to monitor the status and performance of the cluster and nodes.

## Related documentation:

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# Kubernetes and Node metrics

In addition to the service-defined metrics described in the service-level guides (see links here), standard Kubernetes and other system metrics are obviously important for monitoring the status and performance of your cluster(s), nodes, and services.

- Kubernetes metrics
- Node metrics

## Kubernetes metrics

For full information about all the cluster metrics Kubernetes provides, see the Kubernetes documentation. Genesys recommends that you pay attention to the following cluster-related metrics in particular.

Metric	Prometheus formula	Indicator of
Pod Restarts	increase(kube_pod_container_status_restarts_total{namespace="\$namespace", pod=~"\$service.*"}[1m])	
The cgroup's total memory	sum(container_memory_usage_bytes{namespace="\$namespace", pod=~"\$service.*", container!=""} by (pod))	Memory
The cgroup's CPU usage	sum (rate(container_cpu_usage_seconds_total{namespace="\$namespace", pod=~"\$service.*", container!="POD"}[1m])) by (pod) * 100	CPU utilization
Bytes transmitted over the network by the container	rate(container_network_transmit_bytes_total{namespace="\$namespace", pod=~"\$service.*", container!=""}[1m])	
Bytes received over the network by the container	rate(container_network_receive_bytes_total{namespace="\$namespace", pod=~"\$service.*", container!=""}[1m])	

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## Node metrics

Genesys recommends that you pay attention to the following node-related metrics in particular.

Metric	Prometheus formula	Indicator of
Process HEAP All	<code>{SERVICE_NAME}_process_heap_bytes{pod=~"\$pod",service="\$service"}</code>	
Process CPU All	<code>sum(rate({SERVICE_NAME}_process_cpu_seconds_total{pod=~"\$pod",service="\$service"} * 100) by (pod))</code>	CPU utilization
Process Memory All: resident memory	<code>{SERVICE_NAME}_process_resident_memory_bytes{pod=~"\$pod",service="\$service"}</code>	
Process Memory All: virtual memory	<code>{SERVICE_NAME}_process_virtual_memory_bytes{pod=~"\$pod",service="\$service"}</code>	