CS542600 Distributed System
Lab: Kubernetes

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- The screenshot of `kubectl get nodes`

```
student@ds-student13:~/NTHU-Scheduler-Plugin$ kubectl get nodes
 NAME                STATUS   ROLES           AGE    VERSION
 kind-control-plane  Ready    control-plane   15h    v1.29.2
 kind-worker         Ready    <none>          15h    v1.29.2
 kind-worker2        Ready    <none>          15h    v1.29.2
```

- The screenshot of passing all the unit tests

```
root@580af0e8cf11:/go/src/app# go test -v ./...
?       my-scheduler-plugins/cmd/scheduler      [no test files]
=== RUN   TestCustomScheduler_PreFilter
=== RUN   TestCustomScheduler_PreFilter/pod_is_accepted
finish adding2024/06/14 06:25:17 Pod  is in Prefilter phase.
=== RUN   TestCustomScheduler_PreFilter/pod_is_just_accepted
finish adding2024/06/14 06:25:17 Pod  is in Prefilter phase.
=== RUN   TestCustomScheduler_PreFilter/pod_is_rejected
finish adding2024/06/14 06:25:17 Pod  is in Prefilter phase.
--- PASS: TestCustomScheduler_PreFilter (0.00s)
    --- PASS: TestCustomScheduler_PreFilter/pod_is_accepted (0.00s)
    --- PASS: TestCustomScheduler_PreFilter/pod_is_just_accepted (0.00s)
    --- PASS: TestCustomScheduler_PreFilter/pod_is_rejected (0.00s)
=== RUN   TestCustomScheduler_Score
=== RUN   TestCustomScheduler_Score/least_mode
2024/06/14 06:25:17 Custom scheduler runs with the mode: Least.
2024/06/14 06:25:17 Pod  is in Score phase. Calculate the score of Node m1.
2024/06/14 06:25:17 Pod  is in Score phase. Calculate the score of Node m2.
=== RUN   TestCustomScheduler_Score/most_mode
2024/06/14 06:25:17 Custom scheduler runs with the mode: Least.
2024/06/14 06:25:17 Pod  is in Score phase. Calculate the score of Node m1.
2024/06/14 06:25:17 Pod  is in Score phase. Calculate the score of Node m2.
--- PASS: TestCustomScheduler_Score (0.00s)
    --- PASS: TestCustomScheduler_Score/least_mode (0.00s)
    --- PASS: TestCustomScheduler_Score/most_mode (0.00s)
=== RUN   TestCustomScheduler_NormalizeScore
=== RUN   TestCustomScheduler_NormalizeScore/scores_in_range
=== RUN   TestCustomScheduler_NormalizeScore/scores_out_of_range
=== RUN   TestCustomScheduler_NormalizeScore/negative_score
--- PASS: TestCustomScheduler_NormalizeScore (0.00s)
    --- PASS: TestCustomScheduler_NormalizeScore/scores_in_range (0.00s)
    --- PASS: TestCustomScheduler_NormalizeScore/scores_out_of_range (0.00s)
    --- PASS: TestCustomScheduler_NormalizeScore/negative_score (0.00s)
PASS
ok      my-scheduler-plugins/pkg/plugins        0.032s
```

- Explain the 3 scenarios you design to validate your implementation by describing the expected results and showing the screenshots of the results. (You have to explain them during the demo.)

The correctness of **prefilter()**

PreFilter.yaml

```
! PreFilter.yaml                          15  ---                              30  ---
  1   apiVersion: v1                      16  apiVersion: v1                   31  apiVersion: v1
  2   kind: Pod                           17  kind: Pod                        32  kind: Pod
  3   metadata:                           18  metadata:                        33  metadata:
  4     name: pod1                        19    name: pod2                     34    name: pod3
  5     labels:                           20    labels:                        35    labels:
  6       podGroup: "g1"                  21      podGroup: "g1"               36      podGroup: "g1"
  7       minAvailable: "1"               22      minAvailable: "3"            37      minAvailable: "2"
  8   spec:                               23  spec:                            38  spec:
  9     schedulerName: my-scheduler       24    schedulerName: my-scheduler   39    schedulerName: my-scheduler
 10     containers:                       25    containers:                    40    containers:
 11     - name: nginx                     26    - name: nginx                  41    - name: nginx
 12       image: nginx:1.14.2             27      image: nginx:1.14.2          42      image: nginx:1.14.2
 13       ports:                          28      ports:                       43      ports:
 14       - containerPort: 80             29      - containerPort: 80          44      - containerPort: 80
```

```
student@ds-student13:~/NTHU-Scheduler-Plugin$ kubectl create -f PreFilter.yaml
 pod/pod1 created
 pod/pod2 created
 pod/pod3 created
```

```
I0616 13:46:02.197035        1 log.go:194] Pod pod1 is in Prefilter phase.
I0616 13:46:02.197757        1 log.go:194] Pod pod1 is in Score phase. Calculate the score of Node kind-worker.
I0616 13:46:02.197783        1 log.go:194] Pod pod1 is in Score phase. Calculate the score of Node kind-worker2.
I0616 13:46:02.202056        1 schedule_one.go:252] "Successfully bound pod to node" pod="default/pod1" node="kind-worker" evaluatedNodes=3 feasibleNodes=2
I0616 13:46:02.247633        1 log.go:194] Pod pod2 is in Prefilter phase.
I0616 13:46:02.248172        1 schedule_one.go:867] "Unable to schedule pod; no fit; waiting" pod="default/pod2" err="0/3 nodes are available: not enough pods in the group
. preemption: 0/3 nodes are available: 3 No preemption victims found for incoming pod.."
I0616 13:46:02.297601        1 log.go:194] Pod pod3 is in Prefilter phase.
I0616 13:46:02.298380        1 log.go:194] Pod pod3 is in Score phase. Calculate the score of Node kind-worker.
I0616 13:46:02.298429        1 log.go:194] Pod pod3 is in Score phase. Calculate the score of Node kind-worker2.
I0616 13:46:02.302726        1 schedule_one.go:252] "Successfully bound pod to node" pod="default/pod3" node="kind-worker" evaluatedNodes=3 feasibleNodes=2
```

```
student@ds-student13:~/NTHU-Scheduler-Plugin$ kubectl get pods -o wide
NAME                            READY   STATUS    RESTARTS   AGE   IP           NODE          NOMINATED NODE   READINESS GATES
my-scheduler-69cfc986c7-nq5fn   1/1     Running   0          74m   10.244.2.4   kind-worker   <none>           <none>
pod1                            1/1     Running   0          69s   10.244.2.8   kind-worker   <none>           <none>
pod2                            0/1     Pending   0          69s   <none>       <none>        <none>           <none>
pod3                            1/1     Running   0          69s   10.244.2.9   kind-worker   <none>           <none>
```

A few minutes later, pod2 is in prefilter phase again and scheduled successfully.

```
I0616 13:51:14.662611        1 log.go:194] Pod pod2 is in Prefilter phase.
I0616 13:51:14.663470        1 log.go:194] Pod pod2 is in Score phase. Calculate the score of Node kind-worker2.
I0616 13:51:14.663518        1 log.go:194] Pod pod2 is in Score phase. Calculate the score of Node kind-worker.
I0616 13:51:14.670315        1 schedule_one.go:252] "Successfully bound pod to node" pod="default/pod2" node="kind-worker" evaluatedNodes=3 feasibleNodes=2
```

```
student@ds-student13:~/NTHU-Scheduler-Plugin$ kubectl get pods -o wide
NAME                            READY   STATUS    RESTARTS   AGE     IP            NODE          NOMINATED NODE   READINESS GATES
my-scheduler-69cfc986c7-nq5fn   1/1     Running   0          82m     10.244.2.4    kind-worker   <none>           <none>
pod1                            1/1     Running   0          9m27s   10.244.2.8    kind-worker   <none>           <none>
pod2                            1/1     Running   0          9m27s   10.244.2.10   kind-worker   <none>           <none>
pod3                            1/1     Running   0          9m27s   10.244.2.9    kind-worker   <none>           <none>
```

kind-worker has less allocatable memory than kind-worker2.

```
Addresses:                                    Addresses:
  InternalIP:  172.19.0.3                       InternalIP:  172.19.0.2
  Hostname:    kind-worker                       Hostname:    kind-worker2
Capacity:                                     Capacity:
  cpu:                6                           cpu:                6
  ephemeral-storage:  50620216Ki                 ephemeral-storage:  50620216Ki
  hugepages-2Mi:      0                           hugepages-2Mi:      0
  memory:             6063024Ki                   memory:             6063024Ki
  pods:               110                         pods:               110
Allocatable:                                  Allocatable:
  cpu:                6                           cpu:                6
  ephemeral-storage:  50620216Ki                 ephemeral-storage:  50620216Ki
  hugepages-2Mi:      0                           hugepages-2Mi:      0
  memory:             1344432Ki                   memory:             1868720Ki
  pods:               110                         pods:               110
```

The correctness of "**Least mode**": The pod should be bound to **kind-worker**.

values.yaml

```
11    pluginConfig:
12    - name: CustomScheduler
13      args:
14        mode: Least
```

LeastMode.yaml (Same as pod-example.yaml, only change the name.)

```
! LeastMode.yaml
1   apiVersion: v1
2   kind: Pod
3   metadata:
4     name: least-mode
5     labels:
6       podGroup: "A"
7       minAvailable: "1"
8   spec:
9     schedulerName: my-scheduler
10    containers:
11    - name: nginx
12      image: nginx:1.14.2
13      ports:
14      - containerPort: 80
15      resources:
16        requests:
17          memory: "100Mi"
18        limits:
19          memory: "100Mi"
```

```
student@ds-student13:~/NTHU-Scheduler-Plugin$ kubectl create -f LeastMode.yaml
pod/least-mode created
```

```
I0616 12:12:04.334314       1 log.go:194] Pod least-mode is in Prefilter phase.
I0616 12:12:04.335326       1 log.go:194] Pod least-mode is in Score phase. Calculate the score of Node kind-worker.
I0616 12:12:04.335348       1 log.go:194] Pod least-mode is in Score phase. Calculate the score of Node kind-worker2.
I0616 12:12:04.342756       1 schedule_one.go:252] "Successfully bound pod to node" pod="default/least-mode" node="kind-worker" evaluatedNodes=3 feasibleNodes=2
```

```
student@ds-student13:~/NTHU-Scheduler-Plugin$ kubectl get pods -o wide
NAME                            READY   STATUS    RESTARTS   AGE     IP           NODE           NOMINATED NODE   READINESS GATES
least-mode                      1/1     Running   0          4m51s   10.244.2.2   kind-worker    <none>           <none>
my-scheduler-69cfc986c7-gc62b   1/1     Running   0          2d5h    10.244.1.2   kind-worker2   <none>           <none>
```

[The correctness of "**Most mode**"](): The pod should be bound to **kind-worker2**.

values.yaml (Change from Least mode to Most mode.)

```
11    pluginConfig:
12    - name: CustomScheduler
13      args:
14        mode: Most
```

Remove the scheduler and deploy it again.

```
student@ds-student13:~/NTHU-Scheduler-Plugin$ make remove
helm uninstall scheduler-plugins
release "scheduler-plugins" uninstalled
student@ds-student13:~/NTHU-Scheduler-Plugin$ make deploy
helm install scheduler-plugins charts/
NAME: scheduler-plugins
LAST DEPLOYED: Sun Jun 16 12:25:42 2024
NAMESPACE: default
STATUS: deployed
REVISION: 1
TEST SUITE: None
```

MostMode.yaml (Same as pod-example.yaml, only change the name.)

```
! MostMode.yaml
1    apiVersion: v1
2    kind: Pod
3    metadata:
4      name: most-mode
5      labels:
6        podGroup: "A"
7        minAvailable: "1"
8    spec:
9      schedulerName: my-scheduler
10     containers:
11     - name: nginx
12       image: nginx:1.14.2
13       ports:
14       - containerPort: 80
15       resources:
16         requests:
17           memory: "100Mi"
18         limits:
19           memory: "100Mi"
```

```
student@ds-student13:~/NTHU-Scheduler-Plugin$ kubectl create -f MostMode.yaml
pod/most-mode created
```

```
I0616 12:28:21.760463       1 log.go:194] Pod most-mode is in Prefilter phase.
I0616 12:28:21.761675       1 log.go:194] Pod most-mode is in Score phase. Calculate the score of Node kind-worker.
I0616 12:28:21.761742       1 log.go:194] Pod most-mode is in Score phase. Calculate the score of Node kind-worker2.
I0616 12:28:21.769142       1 schedule_one.go:252] "Successfully bound pod to node" pod="default/most-mode" node="kind-worker2" evaluatedNodes=3 feasibleNodes=2
```

```
student@ds-student13:~/NTHU-Scheduler-Plugin$ kubectl get pods -o wide
NAME                             READY   STATUS    RESTARTS   AGE     IP           NODE           NOMINATED NODE   READINESS GATES
most-mode                        1/1     Running   0          15s     10.244.1.4   kind-worker2   <none>           <none>
my-scheduler-69cfc986c7-kszdw    1/1     Running   0          2m54s   10.244.1.3   kind-worker2   <none>           <none>
```