



KubeCon



CloudNativeCon

Europe 2020

Help! Please Rescue Not-Ready Nodes Immediately

Virtual

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About us



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Agenda



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- What's the Problem
- What is NPD?
- Node Self Healing
- Lessons We've Learnt
- Some Discussions
- Summary



Node Is Not Ready

```
1 [zhangxiaoyu-zidif@tencent ~]# kubectl get nodes
2 NAME           STATUS        AGE   VERSION
3 test-001       Ready,Schedul
4 test-002       Ready
5 test-003       NotReady
6 test-004       Ready
7 test-005       Ready
```

What Should We Do?

1. Find out what happened immediately ...
 - a. Check Node.Status.Conditions field.
 - b. Review Prometheus;
 - c. ELK Suit to analysis all kinds of logs;
2. Fix it ASAP!



Node Problem Detector



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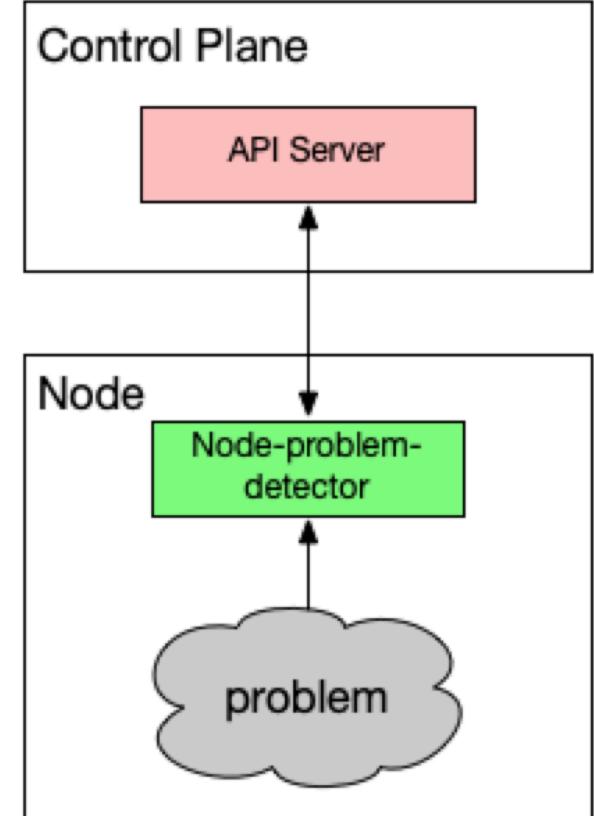
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Node Problem Detector: A Daemon Set detects node problems and reports them to API-Server.

User could run daemons or shell script to check specified problems periodically.

With Two Types:

- **NodeCondition**: A field in [NodeStatus](#) describes the condition of a node. Permanent problem making the node unavailable such as, KernelDeadlock, DockerHung, BadDisk etc;
- **Event**: A report of an event somewhere in the cluster. Temporary problem but informative, such as OOM Kill, etc.



Node Self Healing

What NPD Does Now?

Only detect problems and report them, that's not far enough.

What We Really Need?

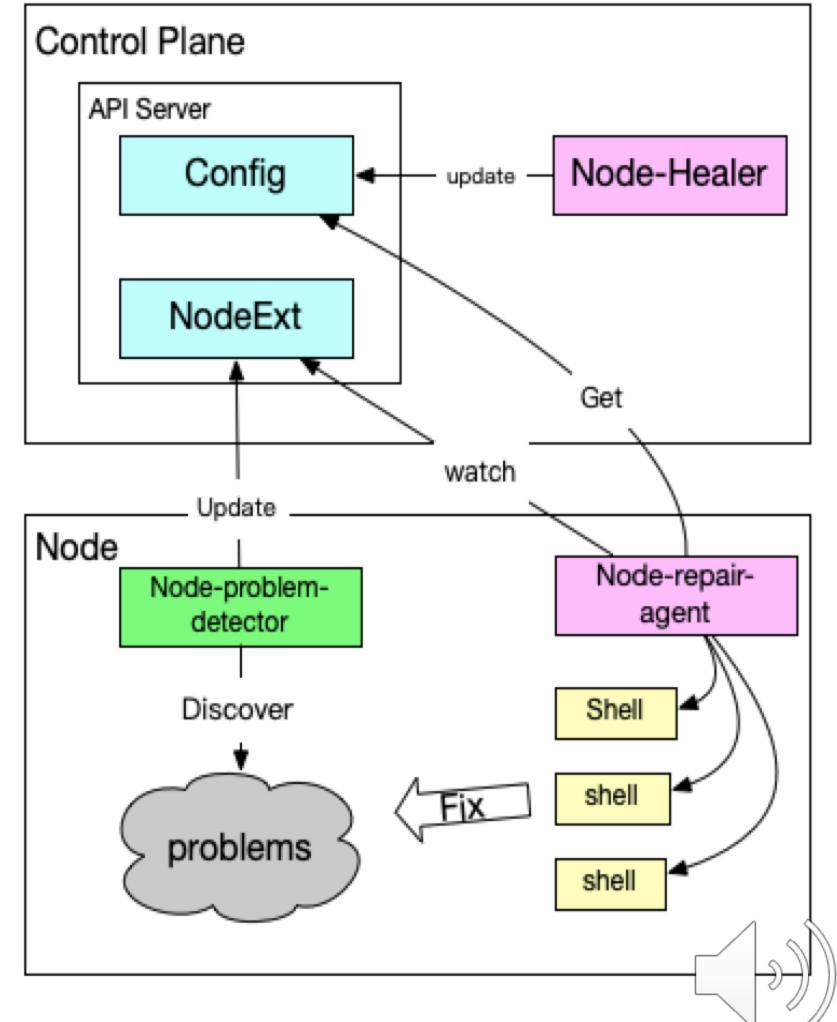
Observe events and/or node conditions and take actions to bring the Kubernetes cluster back to a healthy state.

The Missing Parts

Fix them automatically using prepared repairing strategies.

So we should:

- Make node problem visible
- Update CRD, not the native resource
- Watch CRD, and fix problems immediately
- If problem can not be fixed, drain the pod and taint this Node



Problem Category

Hardware

- MCE (Machine Check Exceptions), such as Memory Errors, Processor Over-Heating, etc;
- Disk Problems, such as Bad Sectors, SSD Controller Damaged, etc;
- NICs Issues;
- Cloud Disk IO Hang;

System Software

- Kernel Bug
- Systemd hang
- Crond Exceptions
- Logrotate Not Working: disk full

Runtime

- Kubelet Bug, such PLEG;
- Container runtime, such docker, containerd, etc;
- CNI, CSI;

....



How We Detected

```
1 apiVersion: v1
2 kind: ConfigMap
3 metadata:
4   name: node-problem-detector-config
5   namespace: kube-system
6 data:
7   docker-monitor.json: |
8     {
9       "plugin": "journald",
10      "pluginConfig": {
11        "source": "dockerd"
12      },
13      "logPath": "/var/log/journal",
14      "lookback": "5m",
15      "bufferSize": 10,
16      "source": "docker-monitor",
17      "conditions": [],
18      "rules": [
19        {
20          "type": "temporary",
21          "reason": "CorruptDockerImage",
22          "pattern": "Error trying v2 registry: failed to register"
23        }
24      ]
25 }
```

```
26 kernel-monitor.json: |
27   {
28     "plugin": "kmsg",
29     "logPath": "/dev/kmsg",
30     "lookback": "5m",
31     "bufferSize": 10,
32     "source": "kernel-monitor",
33     "conditions": [
34       {
35         "type": "KernelDeadlock",
36         "reason": "KernelHasNoDeadlock",
37         "message": "kernel has no deadlock"
38       },
39       {
40         "type": " ReadonlyFilesystem",
41         "reason": "FilesystemIsReadOnly",
42         "message": "Filesystem is read-only"
43       }
44     ],
45     "rules": [
46       {
47         "type": "temporary",
48         "reason": "OOMKilling",
49         "pattern": "Kill process \d+ (.+) scor"
50       }
51     ]
52 }
```



Sample Plugins

Check fd Plugin

- Modify node condition when system fd amount exceeds 80%
- Use goroutine to concurrently calculate fd amount;

```
"rules": [  
  {  
    "type": "permanent",  
    "condition": "FDPressure",  
    "reason": "NodeHasFDPressure",  
    "message": "too many fds have been used",  
    "path": "/home/kubernetes/bin/check-fd",  
    "args": [  
      "-p=/host/proc"  
    ],  
    "timeout": "10s"  
  }  
]
```

```
FDPressure      False  Tue, 21 Jul 2020 20:56:15 +0800  Tue, 21 Jul 2020 20:16:10 +0800  NodeHasNoFDPressure  
node has no fd pressure
```

Inode monitoring

- Modify node condition when the system disk inode amount exceeds 80%

```
InodesPressure  False  Tue, 21 Jul 2020 20:50:00 +0800  Tue, 21 Jul 2020 11:13:49 +0800  NodeHasNoInodesPressure  
node has no inodes pressure
```



Lessons We've Learnt



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- Remedy scripts are mostly written in shell
- Too many corner cases to be considered
- Hard to maintain
- Hard to extend
- Hard to keep idempotent
- Mostly unable to perform atomic operations
- Complex Interdependence



Some Discussions



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How to Deploy

- rpm/deb packages + systemd
- DaemonSet

How to Upgrade

- CI/CD Working Flow

How to Config

- Remedy plugins & Strategy
- Static (built-in) vs dynamic (configmap)

Resource Limitations

- NPD Resource Overheads



Community Recommendations



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planetlabs/draino

- <https://github.com/planetlabs/draino>
- Automatically cordon and drain Kubernetes nodes based on node conditions.
- Cordoned immediately and drained after a configurable drain-buffer time

```
> kubectl describe node {node-name}
.....
Unschedulable:    true
Conditions:
  Type        Status  LastHeartbeatTime          LastTransitionTime        Reason                               Message
  ----        -----  ---------------------          ---------------------        ----                               -----
  OutOfDisk   False   Fri, 20 Mar 2020 15:52:41 +0100  Fri, 20 Mar 2020 14:01:59 +0100  KubeletHasSufficientDisk  kubelet has sufficient disk space available
  MemoryPressure  False   Fri, 20 Mar 2020 15:52:41 +0100  Fri, 20 Mar 2020 14:01:59 +0100  KubeletHasSufficientMemory  kubelet has sufficient memory available
  DiskPressure   False   Fri, 20 Mar 2020 15:52:41 +0100  Fri, 20 Mar 2020 14:01:59 +0100  KubeletHasNoDiskPressure  kubelet has no disk pressure
  PIDPressure    False   Fri, 20 Mar 2020 15:52:41 +0100  Fri, 20 Mar 2020 14:01:59 +0100  KubeletHasSufficientPID   kubelet has sufficient PID available
  Ready          True    Fri, 20 Mar 2020 15:52:41 +0100  Fri, 20 Mar 2020 14:02:09 +0100  KubeletReady                kubelet is posting ready status. AppArmor enabled
  ec2-host-retirement  True    Fri, 20 Mar 2020 15:23:26 +0100  Fri, 20 Mar 2020 15:23:26 +0100  NodeProblemDetector        Condition added with tooling
  DrainScheduled  True    Fri, 20 Mar 2020 15:50:50 +0100  Fri, 20 Mar 2020 15:23:26 +0100  Draino                     Drain activity scheduled 2020-03-20T15:50:34+01:00
```



Summary



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- Repairing policies are NOT universally valid in any infrastructure;
- No silver bullet;
- “**KISS**” (**K**eep your **I**nfrastructure **S**imple and **S**tandard);





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