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CloudNativeCon
North America 2022
BUILDING FOR THE ROAD AHEAD
DETROIT 2022
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Windows HostProcess Containers For Configuration And Beyond

James Sturtevant &
Mark Rossetti

Windows Debug


```
⎈ test-aks-13796-cluster in ~
❯
```

Windows HostProcess Containers

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James Sturtevant
Software Engineer
Microsoft
@aspenwilder

Mark Rossetti
Software Engineer
Microsoft
[not on twitter]

Agenda

- Overview of HostProcess Containers
- Deployments in Action
- Demos
  - Restricting Node Access
  - Building HostProcess Containers
  - Collecting Events
  - Network Troubleshooting
- Additional Resources
- Q & A

What are HostProcess Containers?

HostProcess Containers

- Workloads are packaged / distributed / deployed as containers
- Container workload is run as a process directly on the host
  - Full access* to host's file-system, network stack, process space, etc
- Native support in Kubernetes / full support for:
  - Volume mounts
  - Resource limits
  - Metrics
  - Logging
  - ServiceAccount based cluster access
  - much more!

Motivation

- Provisioning / managing Windows nodes ~~is~~ was difficult.
- No standardization on how to run essential components like CNI solutions / kubeproxy / etc!

Before HostProcess Containers

- Difficult to deploy / manage
  - ✗ Custom PowerShell
  - ✗ Service helpers like nssm.exe
  - ✗ No (good) upgrade story
  - ✗ Required access to the nodes
- Difficult to monitor
  - ✗ No visibility
  - ✗ Required access to the nodes
  - ✗ No easy way to get logs

With HostProcess Containers

- Deploy as DaemonSet
  - ✓ Familiar install story
  - ✓ Runs as a container
  - ✓ Familiar upgrade story
  - ✓ Node access not required
- Monitor just like any other K8s workload
  - ✓ Visibility
  - ✓ Easily get logs

Support

- Beta in K8s v1.23, Stable in v1.26
- Currently containerd only!

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HostProcess Containers in Action

CNIs


```
securityContext:
       windowsOptions:
         hostProcess: true
         runAsUserName: "NT AUTHORITY\\system"
     hostNetwork: true
initContainers:
       - name: install-cni
         image: sigwindowstools/calico-install:v3.20.0-hostprocess
         args: ["calico/install.ps1"]
containers:
     - name: calico-node-startup
       image: sigwindowstools/calico-node:v3.20.0-hostprocess
       args: ["calico/node-service.ps1"]
       workingDir: "calico/"
     - name: calico-node-felix
       image: sigwindowstools/calico-node:v3.20.0-hostprocess
       args: ["calico/felix-service.ps1"]
       imagePullPolicy: Always
       workingDir: "calico/"
volumeMounts:
       - name: calico-config-windows
         mountPath: /etc/kube-calico-windows/
volumes:
     - name: calico-config-windows
       configMap:
         name: calico-config-windows
     # Used to install CNI.
     - name: cni-bin-dir
       hostPath:
         path: /opt/cni/bin
     - name: cni-net-dir
       hostPath:
         path: /etc/cni/net.d
```

```
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       windowsOptions:
         hostProcess: true
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```

```
initContainers:
        - name: install-cni
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          args: ["calico/install.ps1"]
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```
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    - name: calico-node-startup
      image: sigwindowstools/calico-node:v3.20.0-hostprocess
      args: ["calico/node-service.ps1"]
      workingDir: "calico/"
    - name: calico-node-felix
      image: sigwindowstools/calico-node:v3.20.0-hostprocess
      args: ["calico/felix-service.ps1"]
      imagePullPolicy: Always
      workingDir: "calico/"
```

```
volumeMounts:
       - name: calico-config-windows
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     - name: cni-bin-dir
       hostPath:
         path: /opt/cni/bin
     - name: cni-net-dir
       hostPath:
         path: /etc/cni/net.d
```

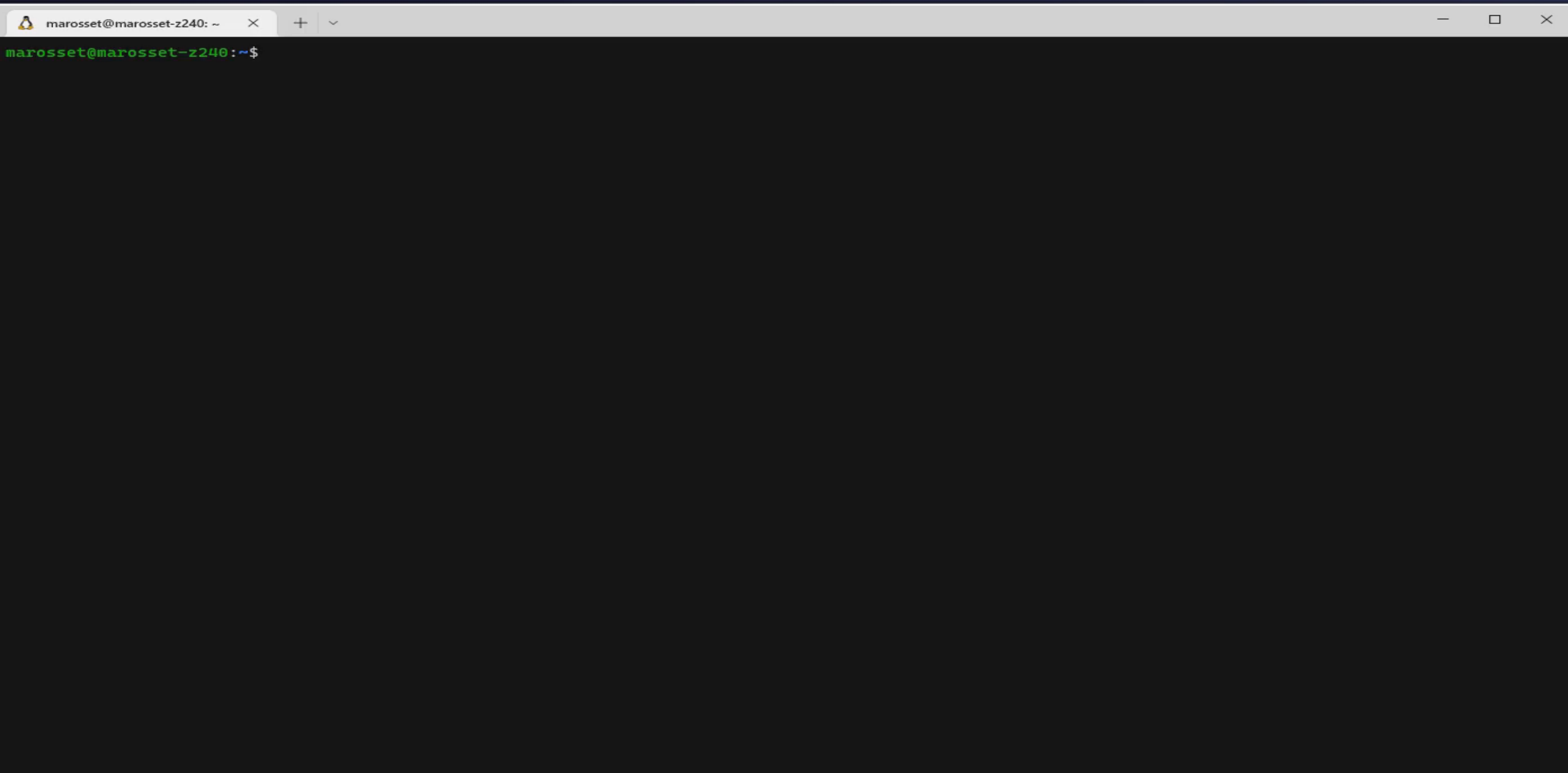
Kube-proxy


```
securityContext:
  windowsOptions:
    hostProcess: true
    runAsUserName: "NT AUTHORITY\\system"
hostNetwork: true
containers:
     - image: sigwindowstools/kube-proxy:v1.24.3-
calico-hostprocess
       args: ["kube-proxy/start.ps1"]
       workingDir: "kube-proxy/"
       name: kube-proxy
       env:
       - name: NODE_NAME
         valueFrom:
           fieldRef:
             apiVersion: v1
             fieldPath: spec.nodeName
       - name: POD_IP
         valueFrom:
           fieldRef:
             fieldPath: status.podIP
tolerations:
    - key: CriticalAddonsOnly
      operator: Exists
    - operator: Exists
updateStrategy:
  type: RollingUpdate
```

```
containers:
     - image: sigwindowstools/kube-proxy:v1.24.3-
calico-hostprocess
       args: ["kube-proxy/start.ps1"]
       workingDir: "kube-proxy/"
       name: kube-proxy
       env:
       - name: NODE_NAME
         valueFrom:
           fieldRef:
             apiVersion: v1
             fieldPath: spec.nodeName
       - name: POD_IP
         valueFrom:
           fieldRef:
             fieldPath: status.podIP
```

```
tolerations:
    - key: CriticalAddonsOnly
      operator: Exists
    - operator: Exists
updateStrategy:
  type: RollingUpdate
```

Security Options



HPC Base Image

- Can only be used with HostProcess containers
- Very small! ~25Kb
- Same image work on all Windows Server OS versions!!!
- Must use BuildKit to build images
- http://bit.ly/hpc-base-image (link to GH repo)

HPC Base Image - Demo

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```
marosset@marosset-z240:~/scratch/hpc$
```

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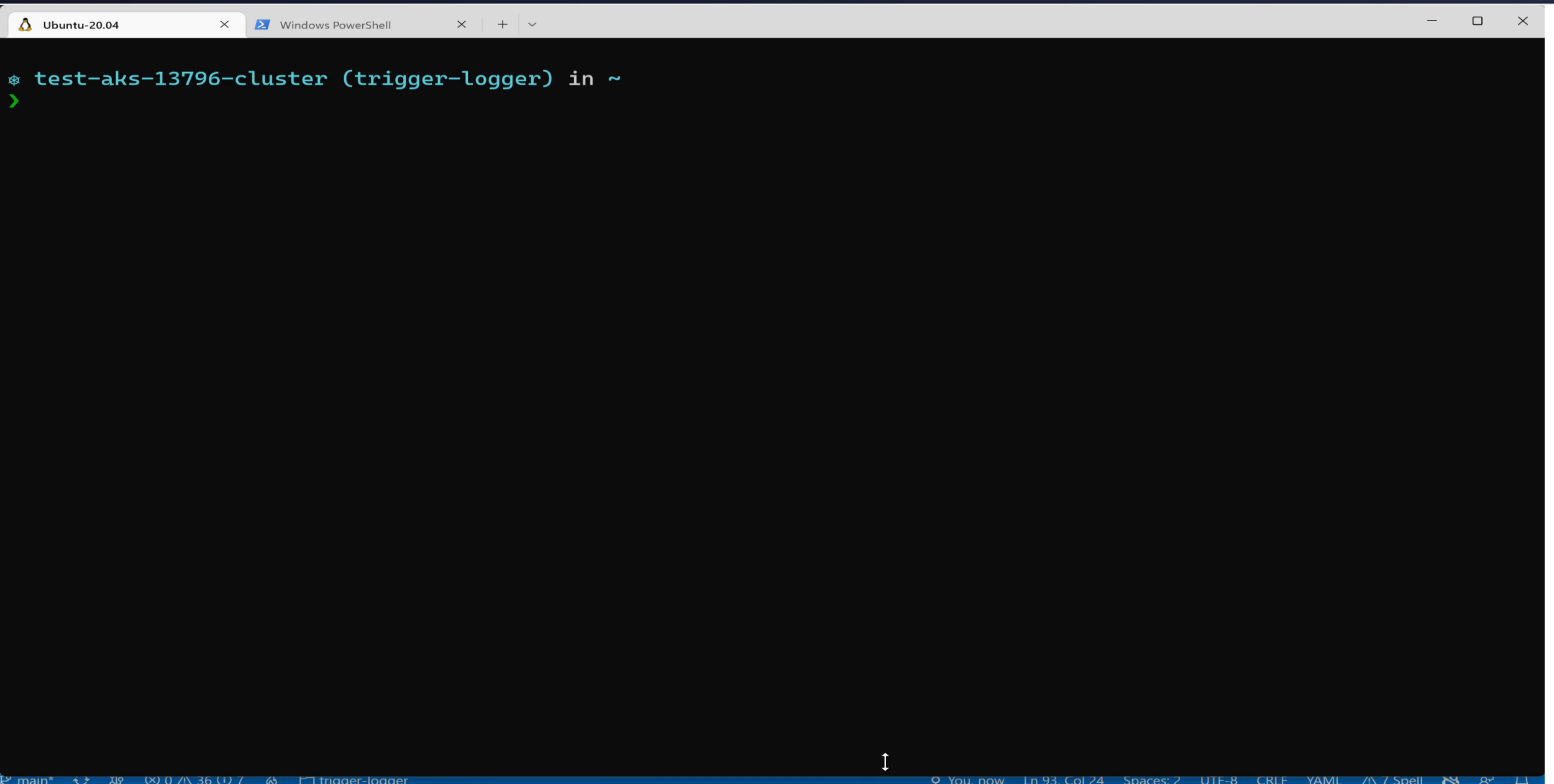
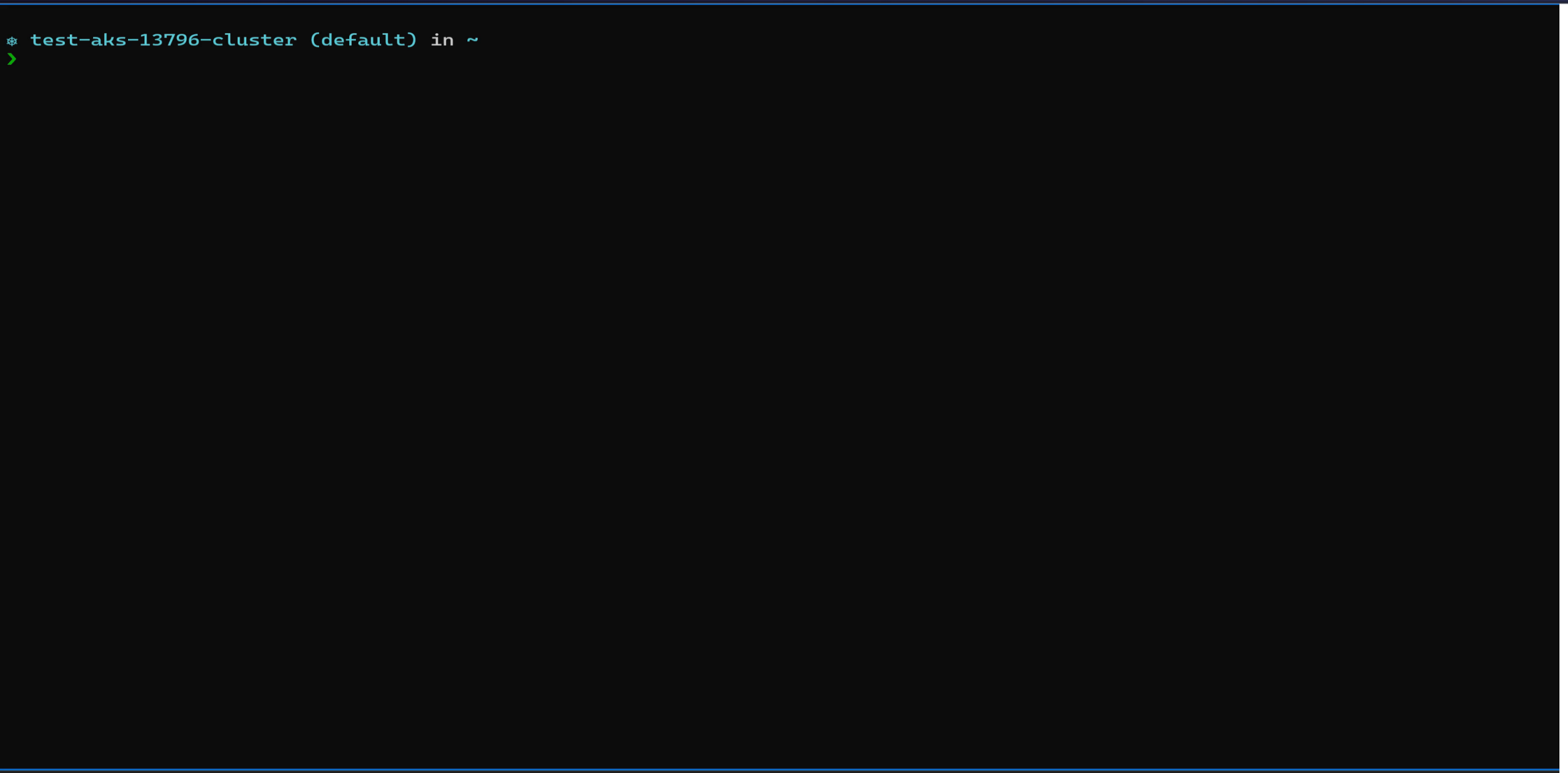
Collecting Events from the Node

Logging - Demo



Networking - Demo



Additional Resources

Projects to check out

- WCNspect
- Window-Debug image
- Trigger Logger
- EventFlow Logger
- CSI-proxy
- Kube-proxy
- Calico CNI
- Windows Exporter (Prometheus)
- KuReD
- Democratic-CSI
- More!

(Download slides for links)

Great way to contribute to new projects!

More SIG-Windows Talks

- **Windows Operational Readiness**
  Thursday - Oct 27th 3:25 PM EDT – Ambassador Ballroom (Room 360)
  https://sched.co/182FM

- **What's New With SIG-Windows**
  Thursday - Oct 27th 5:25 EDT – 142 ABC
  https://sched.co/182Oq

- **Lessons From Scheduling 20 Million Windows Containers a Month**
  Friday - Oct 28th 11:55 EDT – 250 ABC
  https://sched.co/182Ea

Resources

James Sturtevant
@jsturtevant [K8s Slack]
@jsturtevant [GitHub]
@aspenwilder [twitter]

Mark Rossetti
@Mark Rossetti [K8s Slack]
@marosset [GitHub]

KEP : https://bit.ly/k8s-hpc-kep

Docs: https://kubernetes.io/docs/tasks/configure-pod-container/create-hostprocess-pod/

Base Image: https://github.com/microsoft/windows-host-process-containers-base-image

Examples: https://github.com/kubernetes-sigs/sig-windows-tools/tree/master/hostprocess

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SIG-Windows

- #sig-windows [K8s Slack]
- https://github.com/kubernetes/community/tree/master/sig-windows
- Community meetings every Tuesday @ 12:30 pm EST

Q & A

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