containerd-shim

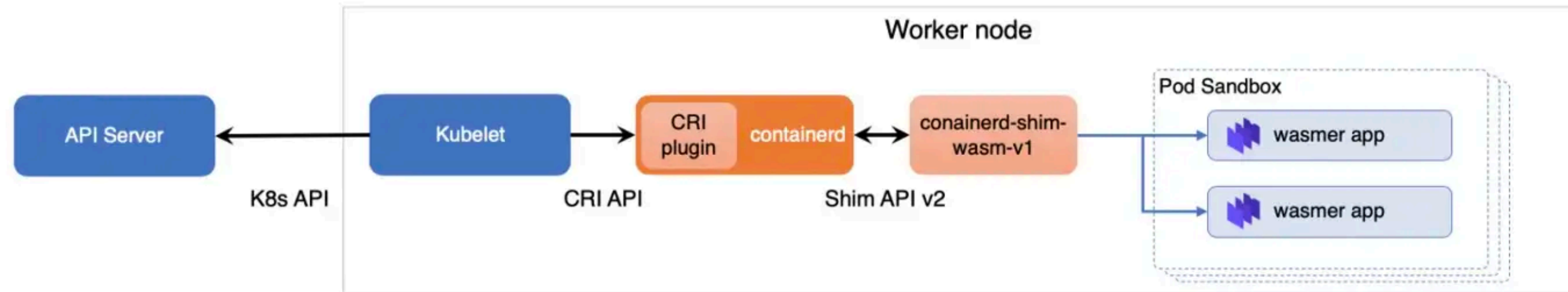- https://github.com/denverdino/containerd-wasm

- One difficulty with this shim implementation is that the **shim API** assumes **a container runtime**, but this doens't align as well with running WebAssmebly modules

- 实现思路：创建容器，容器内的线程使用wasmer

```go
func (p *process) Start(context.Context) (err error) {
    var cmd *exec.Cmd

    if len(p.args) > 0 && p.args[0] == "/pause" {
        // Hack for /pause
        logrus.Info("exec pause")
        cmd = exec.Command( name: "./pause")
    } else {
        var args []string
        args = append(args, elems...: "run", "--dir=.")

        // for _, rm := range p.remaps {
        //   args = append(args, "--mapdir="+rm)
        // }

        for _, env := range p.env {
            // Ignore the PATH env
            if !strings.HasPrefix(env, prefix: "PATH=") {
                args = append(args, "--env="+env)
            }
        }
        args = append(args, p.args...)
        logrus.Infof("exec wasmer %s", strings.Join(args, sep: " "))
        cmd = exec.Command( name: "wasmer", args...)
    }
```

runwasi

- https://github.com/containerd/runwasi

  - This is a project to **facilitate running wasm workloads managed by containerd** either directly (ie. through ctr) or as directed by Kubelet via the CRI plugin.

```
root@VM-0-17-ubuntu:~/test-perf# \time -v bash test-containerd-wasm-shim.sh
Command exited with non-zero status 1
        Command being timed: "bash test-containerd-wasm-shim.sh"
        User time (seconds): 2.61
        System time (seconds): 1.81
        Percent of CPU this job got: 80%
        Elapsed (wall clock) time (h:mm:ss or m:ss): 0:05.48
        Average shared text size (kbytes): 0
        Average unshared data size (kbytes): 0
        Average stack size (kbytes): 0
        Average total size (kbytes): 0
        Maximum resident set size (kbytes): 26400
        Average resident set size (kbytes): 0
        Major (requiring I/O) page faults: 0
        Minor (reclaiming a frame) page faults: 494424
        Voluntary context switches: 46846
        Involuntary context switches: 21223
        Swaps: 0
        File system inputs: 0
        File system outputs: 0
        Socket messages sent: 0
        Socket messages received: 0
        Signals delivered: 0
        Page size (bytes): 4096
        Exit status: 1
```

```
root@VM-0-17-ubuntu:~/test-perf# \time -v bash test-runc.sh
Command exited with non-zero status 1
        Command being timed: "bash test-runc.sh"
        User time (seconds): 2.80
        System time (seconds): 1.71
        Percent of CPU this job got: 81%
        Elapsed (wall clock) time (h:mm:ss or m:ss): 0:05.58
        Average shared text size (kbytes): 0
        Average unshared data size (kbytes): 0
        Average stack size (kbytes): 0
        Average total size (kbytes): 0
        Maximum resident set size (kbytes): 26280
        Average resident set size (kbytes): 0
        Major (requiring I/O) page faults: 0
        Minor (reclaiming a frame) page faults: 496872
        Voluntary context switches: 48407
        Involuntary context switches: 21586
        Swaps: 0
        File system inputs: 8
        File system outputs: 0
        Socket messages sent: 0
        Socket messages received: 0
        Signals delivered: 0
        Page size (bytes): 4096
        Exit status: 1
```

- ctr run --rm --runtime=io.containerd.**wasmtime**.v1 docker.io/wasmedge/example-wasi:latest wasm-example

- ctr run --rm --runc-binary runc --runtime io.containerd.runc.v2 docker.io/leviyanx/runc-wasm-example:v1.3 runc-wasm-example