

I found a system performance tools for the Linux operating system called sysstat to monitor VM. There is a way to get the output from this command to draw images and also get json output. I ran orchestrator.js with num(actions) = 1000,1200,2000,2050,2100,2200,2300. For num(counts) >= 2600, the system kept on throwing different errors each time.

For num(actions) in [1000 ... 2300], I only modified the following properties.

```
required: true
- name: WHISK_ACTIONS_INVOKES_CONCURRENT
  description: Default number of concurrent actions per user
  value: "100000"
  required: true
- name: WHISK_ACTIONS_INVOKES_CONCURRENT_IN_SYSTEM
  description: Number of concurrent actions allowed across the entire system
  value: "100000"
  required: true
- name: WHISK_ACTIONS_INVOKES_PER_MINUTE
  description: Default number of action invocations per minute per user
  value: "100000"
```

Below is the graph for CPU utilisation across all 8 cores. Observation made was that full CPU utilisation never happened. It was always under 100%.

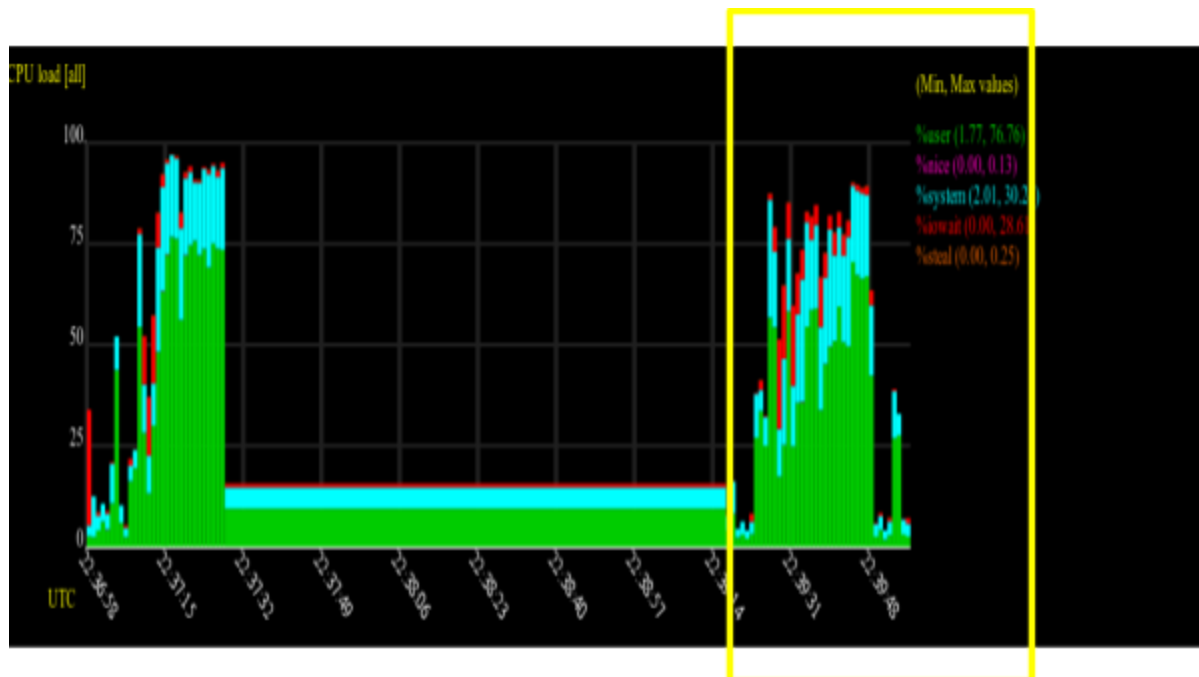


Figure: NUM(ACTIONS)=1000

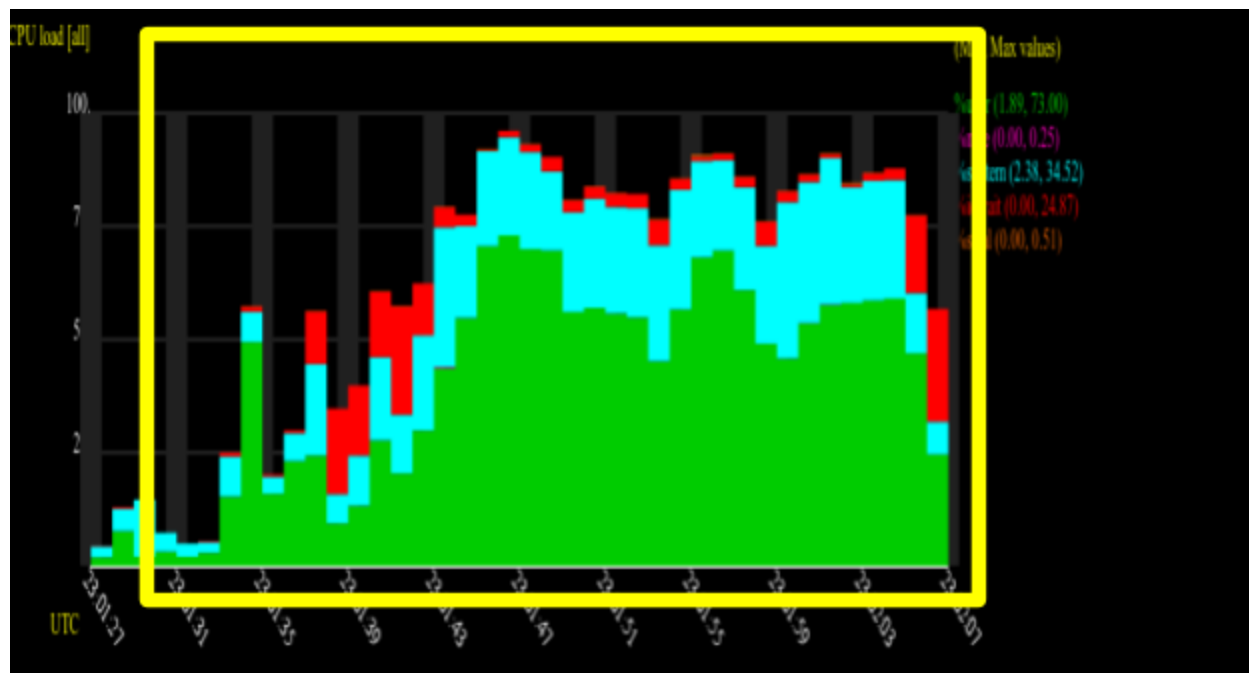


Figure: NUM(ACTIONS)=2050

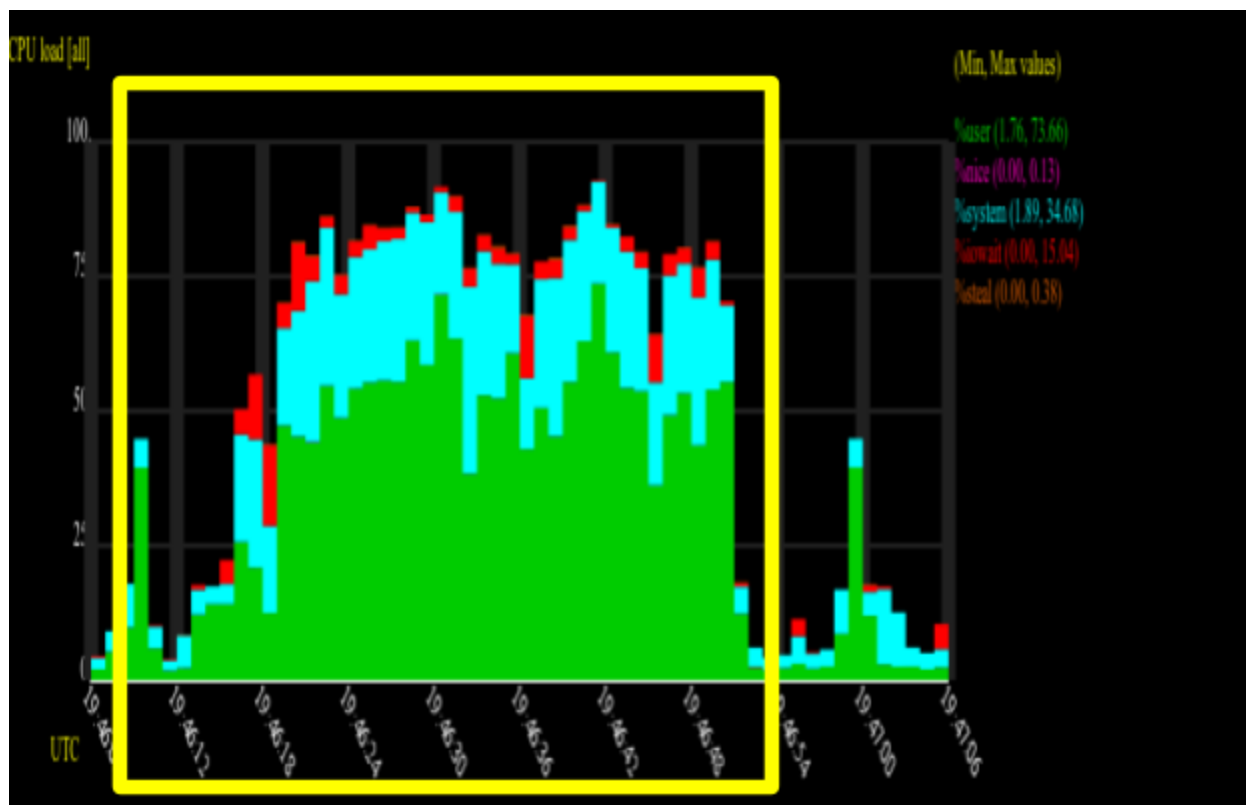


Figure: NUM(ACTIONS)=2200

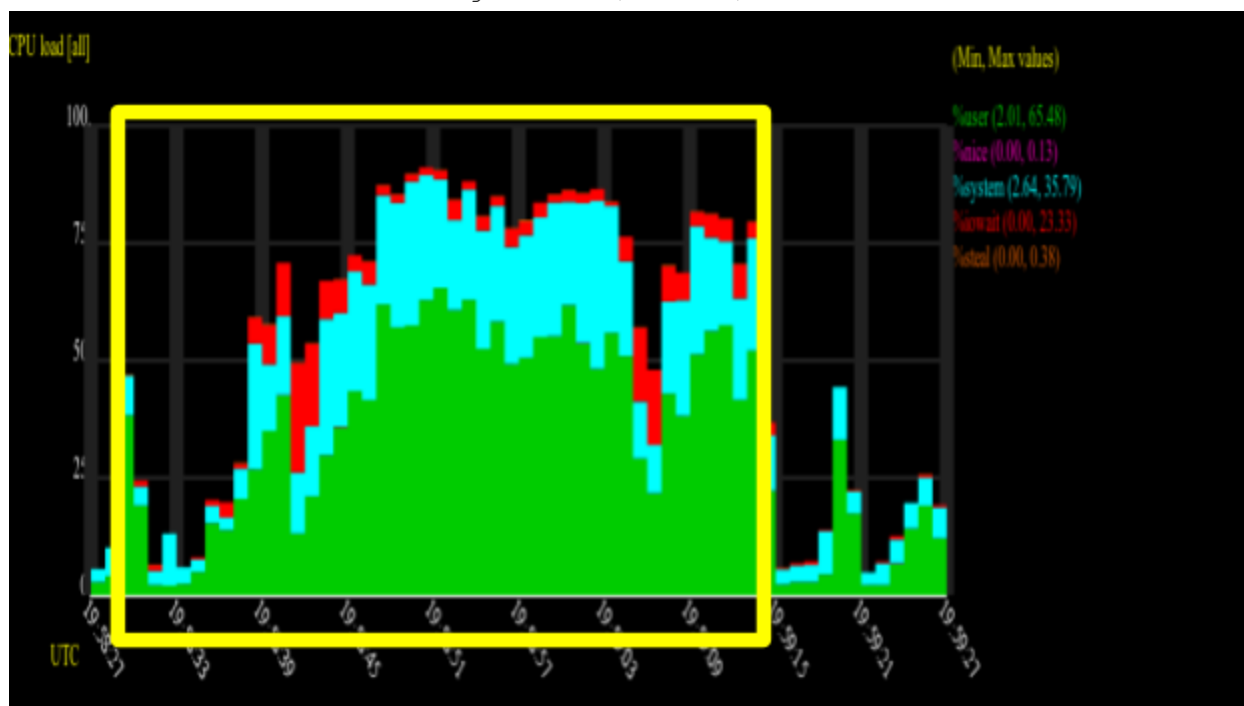


Figure: NUM(ACTIONS)=2300

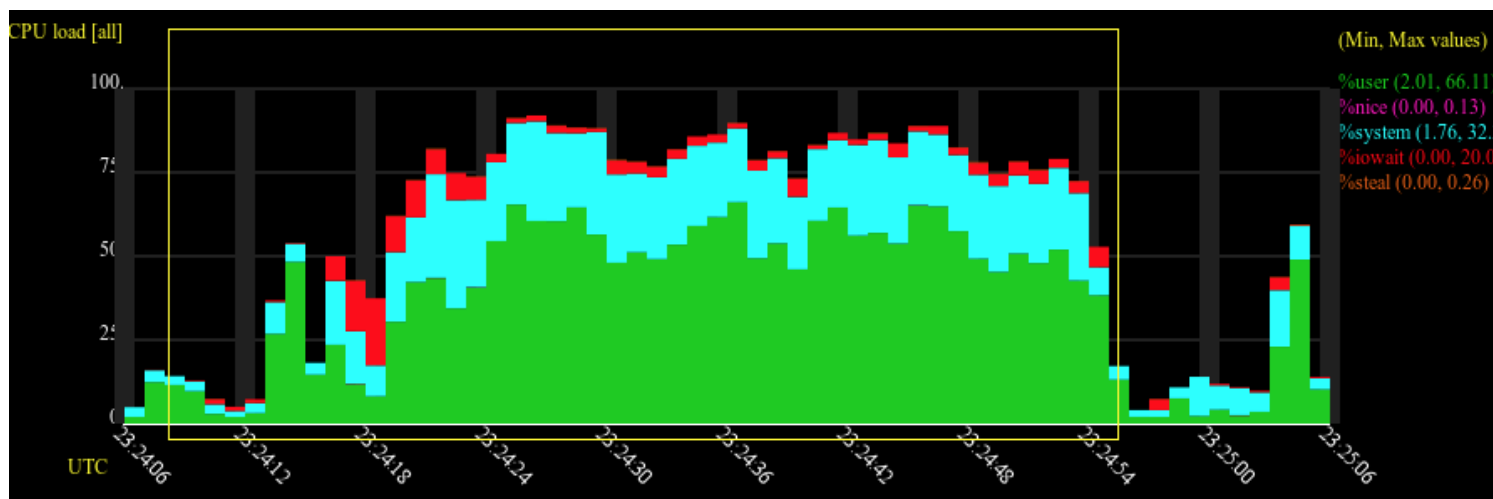


Figure: NUM(ACTIONS)=2400

To figure out if the numbers of containers launched were same as the number of actions invoked, I created a small script to find the pattern “**XXX_THE_END_OF_A_WHISK_ACTIVATION_XXX**” in the wskinvoker pods. There seems to be 2 kinds of wskinvoker pods. One is the **wskinvoker-00-20-prewarm-nodejs6** which runs Language-Specific docker containers for actions. The other kind has function containers which executes the submitted functions. Both of these types of containers have

same pattern in their logs, i.e they both contain

“XXX_THE_END_OF_A_WHISK_ACTIVATION_XXX”. Ideally the count of lines in **wskinvoker-00-XX-whisksystem-testpoints** should correspond to total number of actions. But it was not true. I still haven’t figured out how to find total number of containers launched.

Actions	Wskinvoker pods launched	NUM(Actions) inside each pods
2200	wskinvoker-00-20-prewarm-nodejs6 wskinvoker-00-21-prewarm-nodejs6 wskinvoker-00-28-prewarm-nodejs6 wskinvoker-00-29-prewarm-nodejs6 wskinvoker-00-30-whisksystem-testpoints wskinvoker-00-31-whisksystem-testpoints wskinvoker-00-32-whisksystem-testpoints wskinvoker-00-33-whisksystem-testpoints wskinvoker-00-34-whisksystem-testpoints wskinvoker-00-35-whisksystem-testpoints Total: 2450	319 346 0 0 304 306 293 295 286 301 Count (wskinvoker-00-30-whisksystem-testpoints)=1785
2300	wskinvoker-00-28-prewarm-nodejs6 wskinvoker-00-29-prewarm-nodejs6 wskinvoker-00-36-prewarm-nodejs6 wskinvoker-00-37-whisksystem-testpoints wskinvoker-00-38-whisksystem-testpoints wskinvoker-00-39-whisksystem-testpoints wskinvoker-00-40-prewarm-nodejs6 wskinvoker-00-41-whisksystem-testpoints wskinvoker-00-42-whisksystem-testpoints wskinvoker-00-43-whisksystem-testpoints Total : 2230	315 309 0 278 262 264 0 266 272 264 Count (wskinvoker-00-30-whisksystem-testpoints)=1606
400	wskinvoker-00-44-prewarm-nodejs6 wskinvoker-00-45-prewarm-nodejs6 wskinvoker-00-52-prewarm-nodejs6 wskinvoker-00-53-whisksystem-testpoints wskinvoker-00-54-whisksystem-testpoints wskinvoker-00-55-whisksystem-testpoints wskinvoker-00-56-whisksystem-testpoints wskinvoker-00-57-whisksystem-testpoints wskinvoker-00-58-whisksystem-testpoints wskinvoker-00-59-prewarm-nodejs6 0 Total: 409	64 63 0 46 47 46 48 46 49 Count (wskinvoker-00-30-whisksystem-testpoints)= 282
2400	wskinvoker-00-31-prewarm-nodejs6 wskinvoker-00-32-prewarm-nodejs6 wskinvoker-00-36-prewarm-nodejs6 wskinvoker-00-37-prewarm-nodejs6 wskinvoker-00-38-whisksystem-testpoints wskinvoker-00-39-whisksystem-testpoints wskinvoker-00-40-whisksystem-testpoints wskinvoker-00-41-whisksystem-testpoints wskinvoker-00-42-whisksystem-testpoints wskinvoker-00-43-whisksystem-testpoints 	255 252 0 0 231 230 247 244 231 238

	Total: 1928 Count(wskinvoker-00-30-whisksystem-testpoints)=1421 [1 invoker, 1 controller, CONTROLLER_MEMORY_LIMIT 512Mi/controller]
2600	Failed

Table-2

Since for 2400 actions, the system was giving errors, I played around with some properties in template.yml. Table-3 explains the configurations I changed. Some actions did complete before the system threw error. However these numbers differed each time. Even after changing all these the system gave error for 2400 actions. So I gave up. I ran again the test for 2400 actions after a day and the system executed 2400 actions. But similar behaviour for 2600 actions. I could not figure out why this inconsistent behaviour is shown by the system. I have listed the errors I encountered in Table-5. With no progress to find out how to scale the system to large number of workers, I asked this question on openwhisk-openshift github issues section.

Property Name	Description	
INVOKER_INSTANCES Run Language-Specific Docker Containers for Actions	The desired number of invokers.	Default 1 Changed to 2 When 1 count(wskinvoker-00-XX-pre warm-nodejs6)=4 When 2 count(wskinvoker-00-XX-pre warm-nodejs6)=6
CONTROLLER_INSTANCES Implement Scala-based REST API. Controller contains two sub-services: i. activator and ii.load balancer Activator: processing events produced by triggers, calling the action bound by a rule to a particular trigger. (POST to load balancer) core/controller/src/main/ scala/whisk/core/controlle r/Triggers.scala Load balancer: selecting a proper invoker to run the action, publishing messages to message service.		Default 1 Changed to 2

whisk.core.loadBalancer		
INVOKER_MAX_CONTAINERS	Maximum function containers per Invoker	Default 8. Changed to 16
CONTROLLER_MEMORY_LIMIT	The maximum container memory for each Controller	Default 512Mi/controller. Changed to 1Gi

Table-3

NUM(Actions)	NUM(Actions) completed	Configurations in template.yaml
2400 failed	Failed after 2158	[1 invoker, 1 controller, CONTROLLER_MEMORY_LIMIT 512Mi/controller, 8 INVOKER_MAX_CONTAINERS]
2400 failed	2128	[2 invoker, 2 controller, CONTROLLER_MEMORY_LIMIT 512Mi/controller, 8 INVOKER_MAX_CONTAINERS]
2400 failed	1910	[2 invoker, 2 controller, CONTROLLER_MEMORY_LIMIT 1Gi/controller, 16 INVOKER_MAX_CONTAINERS]
2400 passed		1 invoker, 1 controller, CONTROLLER_MEMORY_LIMIT 512Mi/controller, 8 INVOKER_MAX_CONTAINERS]

Table-4

Error code	Description	NUM(Actions)
502 Bad Gateway Error	often a network error between servers on the internet	2400, 2600
500 Internal Server Error		
504 Gateway Time-out	The server didn't respond in time.	

Table-5