Multilayer traces analysis with Kernel Tracing

Cédric Biancheri Michel Dagenais

> *10 December, 2015 École Polytechnique de Montréal*



Content

- General objectives
- Previous approach

 -Virtual Machine Cpu Analysis
 -Virtual Machine View
- Fused Virtual Machine Analysis
- Fused Virtual Machine View

2

Objectives

- Represent multilayer traces (Virtual machines, Containers, JVM...)
- Bring out indirect interactions between machines
- Track a virtual CPU and processes
- Find possible sources of preemption

Virtual Machine Analysis

Based on Kernel tracing

Required events:

- sched_switch
- sched_process_fork
- sched_process_exit
- kvm_entry
- kvm_exit

Δ

State History Tree:

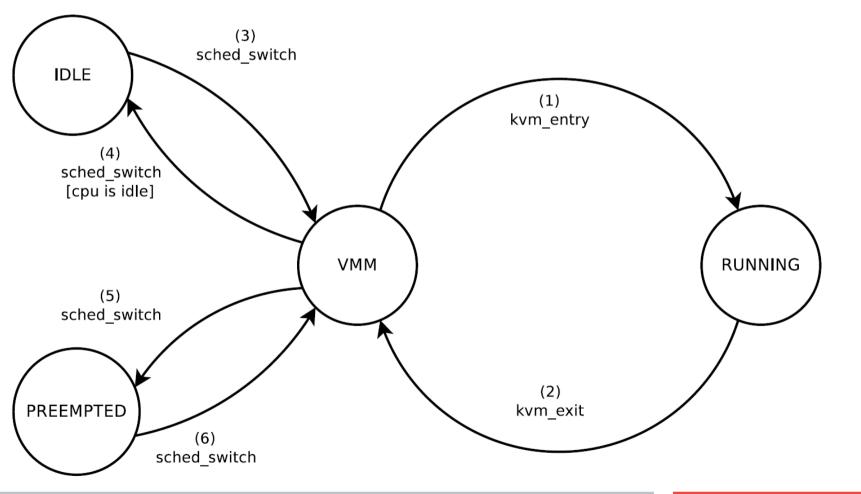
--Virtual Machines |--Ubuntu | |--CPUs | |--CPU 0 | | |--Current Status

M. Gebai: "Fine grained preemption analysis across virtual machines"



Virtual Machine Analysis

Virtual Cpu states transitions:



5

Virtual Machine Cpu View

Resources View:



Virtual Machine Cpu View

Resources View:



Virtual Machine View:

Resource	1	~	16:32:02	16:32:0)4	16:32:06	16:32:08	16	5:32:10	16:	32:12	16:32:	14
⊿ vm				·				· · ·					
▲ Guest: server1_													
VCPU 0													
·													

Virtual Machine Cpu View

Resources View:



Virtual Machine View:

Resource		~	16:32:02	16:32:04	16:32:06	16:32:08	16:32:10	16:32:12	16:32:14	4
					10.52.000		10.52.10	10.52.12	10.52.1	
⊿ vm										
▲ Guest: server1_		_								
VCPU 0		_								
.										
Resource	^		16:32:07.920	16:32:07.940	16:32:07.960	16:32:07.980	16:32:08.000	16:32:08.020	16:32:08.040	16:32:08.060
⊿ vm										
✓ Guest: server1_										
VCPU 0		i i								
Resource	^		16:32:0	7.997720	16:32:07.997740	16:32:	07.997760	16:32:07.997780	16:32:07	7.997800
⊿ vm			· · ·		· · · · · · · · · · · · · · · · · · ·			· · · ·		
Guest: server1_										
VCPU 0										

8

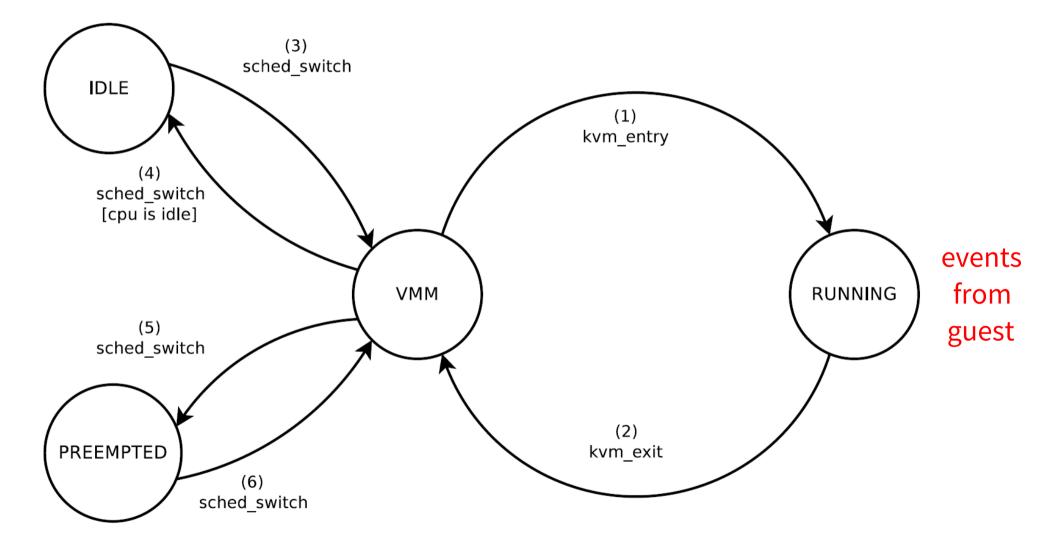
- Similar to the Kernel Analysis
- Centered on the host
- Requires traces from the host and guests

Objective:

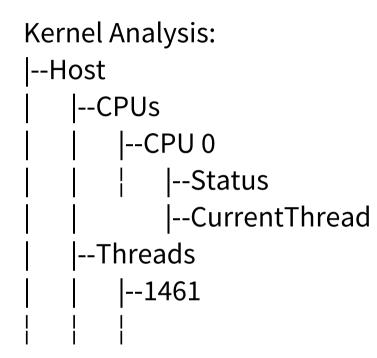
Analyse the events of guests as if they were from the host

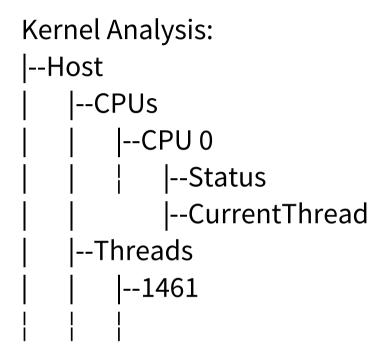
And remember where they are really from











Fused Virtual Machine Analysis: --Host --CPUs --CPU 0 --Condition --Status --CurrentThread --MachineName --vCPU --Threads --Host |-1523 |--VM1 |--2401

Fused Virtual Machine View

Demo:

- Host with 8 pCPUs
- One task switching between pCPUs 0 & 1
- Guest with 2 vCPUs on pCPUs 0 & 1
- One task on each vCPU

Conclusion

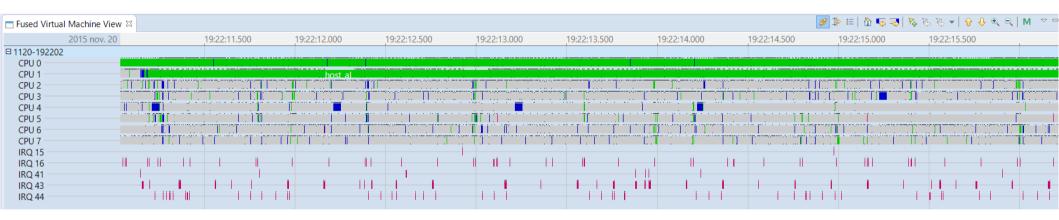
- Multilevel traces aggregated in one level
- Highlight a virtual machine
- Track a vCPU on the host
- Observe directly the cause of a preemption

email: cdc.biancheri@gmail.com Github: https://github.com/cbiancheri/



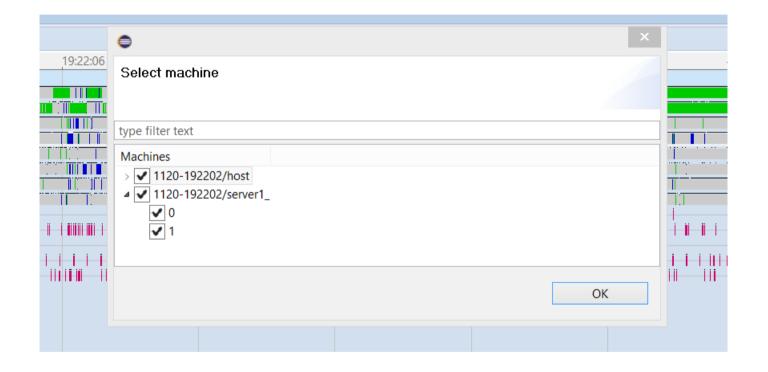


Fused Virtual Machine View	22							🍠 🎘 🏭 🏠 🤜 🗟	3 隆 🤴 🦉 🔻 🕻
2015 nov. 20	ті	19:22:04	19:22:06	19:22:08	19:22:10	19:22:12	19:22:14	19:22:16	19:22:18
□ 1120-192202									
CPU 0									vm
CPU 1						h			vII
CPU 2									
CPU 3									
CPU 4						I I I I			
CPU 5									
CPU 6									
CPU 7					<u> </u>				
IRQ 15									
IRQ 16	╎╷╻╷╶	<u>│ </u>		▋╢┠╶╢╶┼╴┠╴╫╴┠╴┠╶┼╶┼	1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 +	╎┼╫┼┼╂╂┼╟╂┼	<u>┤ ┦ ╢ ╎ ┦ ╢ ╢ ╎ ╎</u>	▋┼╫╫┼┼╂╫┼╂╢	
IRQ 41				l i			İ		
IRQ 43				▏▋ヺヺヺヺ゚゚゚ヺ゚゚゚゚゚゚゚゚゚゚゚゚゚゚゚゚゚゚゚゚゚゚゚゚゚゚゚゚゚					+ + + + + + + + + + + + + + + + + + + +
IRQ 44								<u>) </u>	



-														
Fused Virtual Machine Vi	iew 🛛										🍠 静 🏭 🏠	ਙ ⇒	🛱 🖗 🖗 🔺 🗌	∱ ᡛ € €
2015 nov. 2	20	19:22:12.840	19:22:12.850	19:22:12.860	19:22:12.870	19:22:12.880	19:22:12.890	19:22:12.90	0 19:2	22:12.910	19:22:12.920		19:22:12.930	19:22:12.9
□ 1120-192202														
CPU 0	-vi i				i i i i i i i i i i i i i i i i i i i	j i i								vm_fo
CPU 1	vm_f hos	t_altern_cpu	vm_for		ern_cpu vr	n_for	host_altern_cpu	vm_for		host_a	ltern_cpu	vm_fo		host_altern_cr
CPU 2			l. 				- <u> </u>		Trace	CPU 1				
CPU 3			1 . 1				1.		State		E_HIGHLIGHT	•••		
CPU 5	i			Ĩ							-			
CPU 6	— 1 İ	i	j	i İİ	i i		j j	i	> Machine	1120-1922	02/server1_	1 i		Í
CPU 7	— I 1 1 I	İ İ	i :	i 🗰 j	1	Í	i í	i í	> VCPU	0		i i		
IRQ 15									> Hover Tim	ne 19:22:12.90	04040818			
IRQ 16									> TID	1419				
IRQ 41 IRQ 43									> Process	vm_forks				
IRQ 44									Date	2015-11-2	0			
inde i i									Start Time	19:22:12.90				
									Stop Time	19:22:12.90				
									Duration	0.0034945	90s			





	● ×	
22:06	Select machine	
	type filter text	
	Machines	
	> 1120-192202/host	<u> </u>
Ì.	▲ 1120-192202/server1_	Î.T
		i ii
		i i
-ii		÷.
	OK	



E Fused Virtual Machine Vie	≥w ⊠							🍠 静 🏭 🏠 🤜 🦻	6 B F
2015 nov. 20	٥	19:22:04	19:22:06	19:22:08	19:22:10	19:22:12	19:22:14 m	19:22:16 19:22:	:18
□ 1120-192202									
CPU 0									vm_I
CPU 1						h la la la la la la la la la la la la la			
CPU 2									
CPU 3									
CPU 4								· · · · · · · · · · · · · · · · · · ·	
CPU 5									
CPU 6									
CPU 7									
IRQ 15									
IRQ 16						· · · · · · · · · · · ·	<u> </u>	I I II I I I I II I I I I I I I I	(
IRQ 41									
IRQ 43				<u>/ </u>					
IRQ 44			/ !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!			18 118-111 111 1118			

