

Forcefully Unmap Complete Kernel With Interrupt Trampolines benchmarks

	CLIMB						BEARCloud							
	Intel(R) Xeon(R) CPU E5-4620 v2 @ 2.60GHz (Ivybridge)			Intel(R) Xeon(R) CPU E5-2640 v4 @ 2.40GHz (Broadwell)										
	spades -t 8 -m 62			bwa mem -t 8			spades -t 8 -m 62			bwa mem -t 8				
	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3		
<b>VM</b>													no other VMs running on the hypervisor	
HV unpatched	33m24.604s	33m40.366s	33m42.394s	2m49.387s	2m52.585s	2m52.281s	23m45.672s	24m5.478s	24m5.281s	2m32.596s	2m38.435s	2m27.841s		
HV patched	32m38.347s	33m23.009s	33m23.688s	2m47.751s	2m51.380s	2m50.854s	24m0.255s	24m6.685s	24m8.823s	2m32.932s	2m38.861s	2m31.807s		
HV and VM patched	34m2.901s	33m58.638s	33m47.558s	2m52.331s	2m50.538s	2m51.579s	24m12.928s	24m9.103s	24m16.020s	2m30.825s	2m27.318s	2m26.955s		
<b>baremetal</b>													BEARCloud: "isolcpus" removed for the duration of the benchmark	
unpatched	30m36.366s	30m30.106s	30m16.049s	2m11.929s	2m11.405s	2m13.246s	23m42.121s	23m38.104s	23m24.928s	1m57.326s	1m59.097s	1m57.755s	I don't have any good explanation for BWA MEM benchmarks results except <quote> heng li is a god-like	
patched	32m29.813s	32m29.819s	32m15.912s	2m15.754s	2m15.041s	2m13.656s	25m41.185s	25m45.519s	25m46.879s	1m59.513s	2m0.780s	1m59.207s	genius at coding </quote>	
kernel tunables		# cat /sys/kernel/debug/x86/pti_enabled1# cat /sys/kernel/debug/x86/ibpb_enabled1# cat /sys/kernel/debug/x86/ibrs_enabled1											On patched vms only pti_enabled is set, regardless of underlying hypervisor patch status	
CPU flags		PCID flag present in all cases												
unpatched kernel ver		3.10.0-693.5.2												
patched kernel ver		3.10.0-693.11.6												
unpatched qemu-kvm		2.9.0-16.el7_4.11.1												
patched qemu-kvm		2.9.0-16.el7_4.13.1												
microcode version		revision 0x42a, date = 2017-12-01									revision 0xb000025, date = 2017-11-18			
VM spec		64 CPUs (with HT) 512GB RAM						8 CPUs 64GB RAM			20 CPUs 128GB RAM			
HV spec														

- <https://access.redhat.com/security/vulnerabilities/speculativeexecution>
- <https://access.redhat.com/articles/3311301>
- <https://newsroom.intel.com/news-releases/intel-issues-updates-protect-systems-security-exploit>
- <https://downloadcenter.intel.com/download/27431/Linux-Processor-Microcode-Data-File>

calculated values and graphs in extra sheets

Environment	HV patched	VM patched	label	Cloud	Test	Rep	Mins	Secs	Total time (s)	Performance difference (%)	Relative perf (%)	Mean relative perf (%)	Comparator standard					
													Patch state	Environment	Cloud	Test	Mean time (seconds)	
VM	no	no	Unpatched VM	CLIMB	SPAdes	1	33	33	24.604	2004.604	-9.6906	90.3094	89.6974	Patch state	Environment	Cloud	Test	Mean time (seconds)
VM	no	no	Unpatched VM	CLIMB	SPAdes	2	33	33	40.366	2020.366	-10.5531	89.4469	unpatched	baremetal	CLIMB	SPAdes	1,827.5070	
VM	no	no	Unpatched VM	CLIMB	SPAdes	3	33	33	42.394	2022.394	-10.6641	89.3359	unpatched	baremetal	CLIMB	bwa mem	132.1933	
VM	no	no	Unpatched VM	CLIMB	bwa mem	1	2	2	49.387	169.387	-28.1358	71.8642	70.3281	unpatched	baremetal	BEARCloud	SPAdes	1,415.0510
VM	no	no	Unpatched VM	CLIMB	bwa mem	2	2	2	52.585	172.585	-30.5550	69.4450	unpatched	baremetal	BEARCloud	bwa mem	118.0593	
VM	no	no	Unpatched VM	CLIMB	bwa mem	3	2	2	52.281	172.281	-30.3250	69.6750						
VM	no	no	Unpatched VM	BEARCloud	SPAdes	1	23	23	45.672	1425.672	-0.7506	99.2494	98.3210					
VM	no	no	Unpatched VM	BEARCloud	SPAdes	2	24	24	5.478	1445.478	-2.1502	97.8498						
VM	no	no	Unpatched VM	BEARCloud	SPAdes	3	24	24	5.281	1445.281	-2.1363	97.8637						
VM	no	no	Unpatched VM	BEARCloud	bwa mem	1	2	2	32.596	152.596	-29.2537	70.7463	70.4403					
VM	no	no	Unpatched VM	BEARCloud	bwa mem	2	2	2	38.435	158.435	-34.1995	65.8005						
VM	no	no	Unpatched VM	BEARCloud	bwa mem	3	2	2	27.841	147.841	-25.2260	74.7740						
VM	yes	no	Unpatched VM / f CLIMB	CLIMB	SPAdes	1	32	32	38.347	1958.347	-7.1595	92.8405	91.1989					
VM	yes	no	Unpatched VM / f CLIMB	CLIMB	SPAdes	2	33	33	23.009	2003.009	-9.6034	90.3966						
VM	yes	no	Unpatched VM / f CLIMB	CLIMB	SPAdes	3	33	33	23.688	2003.688	-9.6405	90.3595						
VM	yes	no	Unpatched VM / f CLIMB	CLIMB	bwa mem	1	2	2	47.751	167.751	-26.8982	73.1018	71.4043					
VM	yes	no	Unpatched VM / f CLIMB	CLIMB	bwa mem	2	2	2	51.38	171.38	-29.6435	70.3565						
VM	yes	no	Unpatched VM / f CLIMB	CLIMB	bwa mem	3	2	2	50.854	170.854	-29.2455	70.7545						
VM	yes	no	Unpatched VM / f BEARCloud	BEARCloud	SPAdes	1	24	24	0.255	1440.255	-1.7811	98.2189	97.8656					
VM	yes	no	Unpatched VM / f BEARCloud	BEARCloud	SPAdes	2	24	24	6.685	1446.685	-2.2355	97.7645						
VM	yes	no	Unpatched VM / f BEARCloud	BEARCloud	SPAdes	3	24	24	8.823	1448.823	-2.3866	97.6134						
VM	yes	no	Unpatched VM / f BEARCloud	BEARCloud	bwa mem	1	2	2	32.932	152.932	-29.5383	70.4617	69.1054					
VM	yes	no	Unpatched VM / f BEARCloud	BEARCloud	bwa mem	2	2	2	38.861	158.861	-34.5603	65.4397						
VM	yes	no	Unpatched VM / f BEARCloud	BEARCloud	bwa mem	3	2	2	31.807	151.807	-28.5853	71.4147						
VM	yes	yes	Patched VM / Pat CLIMB	CLIMB	SPAdes	1	34	34	2.901	2042.901	-11.7862	88.2138	88.5714					
VM	yes	yes	Patched VM / Pat CLIMB	CLIMB	SPAdes	2	33	33	58.638	2038.638	-11.5530	88.4470						
VM	yes	yes	Patched VM / Pat CLIMB	CLIMB	SPAdes	3	33	33	47.558	2027.558	-10.9467	89.0533						
VM	yes	yes	Patched VM / Pat CLIMB	CLIMB	bwa mem	1	2	2	52.331	172.331	-30.3629	69.6371	70.2789					
VM	yes	yes	Patched VM / Pat CLIMB	CLIMB	bwa mem	2	2	2	50.538	170.538	-29.0065	70.9935						
VM	yes	yes	Patched VM / Pat CLIMB	CLIMB	bwa mem	3	2	2	51.579	171.579	-29.7940	70.2060						
VM	yes	yes	Patched VM / Pat BEARCloud	BEARCloud	SPAdes	1	24	24	12.928	1452.928	-2.6767	97.3233	97.3405					
VM	yes	yes	Patched VM / Pat BEARCloud	BEARCloud	SPAdes	2	24	24	9.103	1449.103	-2.4064	97.5936						
VM	yes	yes	Patched VM / Pat BEARCloud	BEARCloud	SPAdes	3	24	24	16.02	1456.02	-2.8952	97.1048						
VM	yes	yes	Patched VM / Pat BEARCloud	BEARCloud	bwa mem	1	2	2	30.825	150.825	-27.7536	72.2464	74.3293					
VM	yes	yes	Patched VM / Pat BEARCloud	BEARCloud	bwa mem	2	2	2	27.318	147.318	-24.7830	75.2170						
VM	yes	yes	Patched VM / Pat BEARCloud	BEARCloud	bwa mem	3	2	2	26.955	146.955	-24.4755	75.5245						
Baremetal	no		Unpatched barem	CLIMB	SPAdes	1	30	30	36.366	1836.366	-0.4848	99.5152	100.0000					
Baremetal	no		Unpatched barem	CLIMB	SPAdes	2	30	30	30.106	1830.106	-0.1422	99.8578						
Baremetal	no		Unpatched barem	CLIMB	SPAdes	3	30	30	16.049	1816.049	0.6270	100.6270						
Baremetal	no		Unpatched barem	CLIMB	bwa mem	1	2	2	11.929	131.929	0.2000	100.2000	100.0000					
Baremetal	no		Unpatched barem	CLIMB	bwa mem	2	2	2	11.405	131.405	0.5963	100.5963						
Baremetal	no		Unpatched barem	CLIMB	bwa mem	3	2	2	13.246	133.246	-0.7963	99.2037						
Baremetal	no		Unpatched barem	BEARCloud	SPAdes	1	23	23	42.121	1422.121	-0.4996	99.5004	100.0000					
Baremetal	no		Unpatched barem	BEARCloud	SPAdes	2	23	23	38.104	1418.104	-0.2158	99.7842						
Baremetal	no		Unpatched barem	BEARCloud	SPAdes	3	23	23	24.928	1404.928	0.7154	100.7154						
Baremetal	no		Unpatched barem	BEARCloud	bwa mem	1	1	1	57.326	117.326	0.6212	100.6212	100.0000					
Baremetal	no		Unpatched barem	BEARCloud	bwa mem	2	1	1	59.097	119.097	-0.8789	99.1211						
Baremetal	no		Unpatched barem	BEARCloud	bwa mem	3	1	1	57.755	117.755	0.2578	100.2578						
Baremetal	yes		Patched baremet:	CLIMB	SPAdes	1	32	32	29.813	1949.813	-6.6925	93.3075	93.5609					
Baremetal	yes		Patched baremet:	CLIMB	SPAdes	2	32	32	29.819	1949.819	-6.6928	93.3072						
Baremetal	yes		Patched baremet:	CLIMB	SPAdes	3	32	32	15.912	1935.912	-5.9319	94.0681						
Baremetal	yes		Patched baremet:	CLIMB	bwa mem	1	2	2	15.754	135.754	-2.6935	97.3065	98.0153					
Baremetal	yes		Patched baremet:	CLIMB	bwa mem	2	2	2	15.041	135.041	-2.1542	97.8458						
Baremetal	yes		Patched baremet:	CLIMB	bwa mem	3	2	2	13.656	133.656	-1.1065	98.8935						
Baremetal	yes		Patched baremet:	BEARCloud	SPAdes	1	25	25	41.185	1541.185	-8.9137	91.0863	90.8500					
Baremetal	yes		Patched baremet:	BEARCloud	SPAdes	2	25	25	45.519	1545.519	-9.2200	90.7800						
Baremetal	yes		Patched baremet:	BEARCloud	SPAdes	3	25	25	46.879	1546.879	-9.3161	90.6839						
Baremetal	yes		Patched baremet:	BEARCloud	bwa mem	1	1	1	59.513	119.513	-1.2313	98.7687	98.4974					
Baremetal	yes		Patched baremet:	BEARCloud	bwa mem	2	2	2	0.78	120.78	-2.3045	97.6955						
Baremetal	yes		Patched baremet:	BEARCloud	bwa mem	3	1	1	59.207	119.207	-0.9721	99.0279						

Spectre/Meltdown Mitigation Impact Benchmarks

