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Abstract:

Since Experimental Physics and Industrial Control System (EPICS) is becoming more widely used in accelerator control systems and the EPICS Input/Output Controller (IOC) has ported to different operating systems, the performance of EPICS IOCcore on different hardware and software platforms is crucial. This paper will provide real-time performance measurements of EPICS IOCcore on a Coldfire module uC5282 and on two different OS platforms: RTEMS 4.9.2 and uClinux 2.6.21. The most recent EPICS base and extensions are used to build the test application.

Introduction

As more and more Coldfire uC5282 modules are being used at the Advanced Photon Source (APS) and other sites, it is of interest to know the EPICS IOCcore real-time performance on this platform. Similar performance measurements were done on the MVME2100 [1]. Based on the measurement software [2], a few changes have been made to measure on the Coldfire uC5282 module. These real-time parameters are measured on both RTEMS 4.9.2 and uClinux 2.6.21 platforms: interrupt latency, context switch latency, and total response latency. Two more parameters are measured on the uClinux 2.6.21: interrupt top half to bottom half, and interrupt bottom half to user space interrupt service routine (ISR).

Conclusion

The results show that RTEMS has better real-time performance than uClinux. Compared with the real-time performance results on MVME2100 [2], it seems that the MVME2100 has better performance than the Coldfire uC5282 module, though the RTEMS and Linux versions are different. Measurement on the uClinux with a preemptive kernel should be conducted in the future for further comparison.

References

- [1]S. Xu and M. Kraimer, “Real-Time Performance Measurements of EPICS iocCore,” ICALEPCS’2005, Geneva, Switzerland, October 2005, PO2.075-5 (2005); <http://www.JACoW.org>.
- [2]<http://www.aps.anl.gov/epics/modules/soft/realTimePerform/index.html>.
- [3]<http://www.arcturusnetworks.com/products/uc5282>

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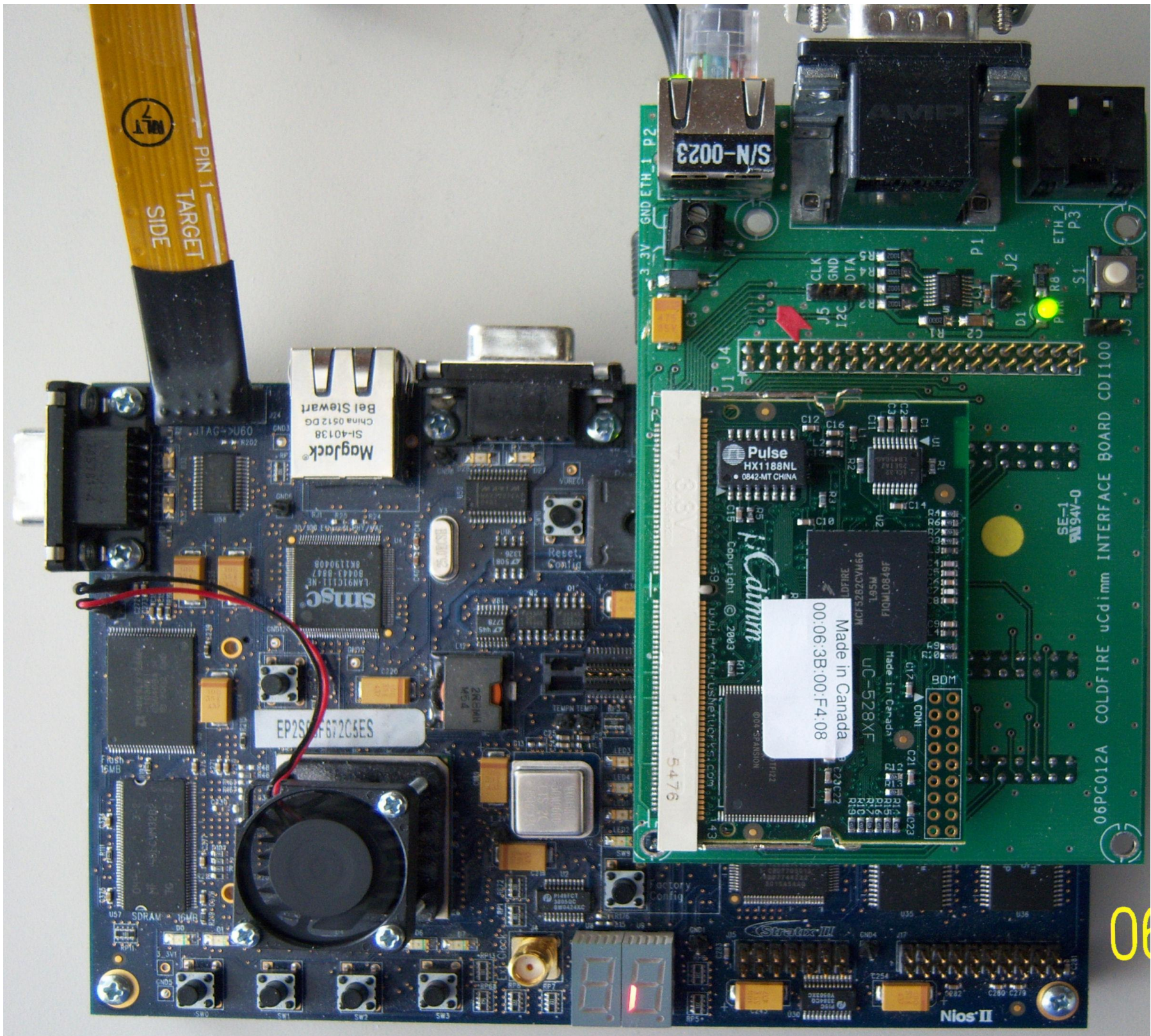


Figure 1: The hardware platform.

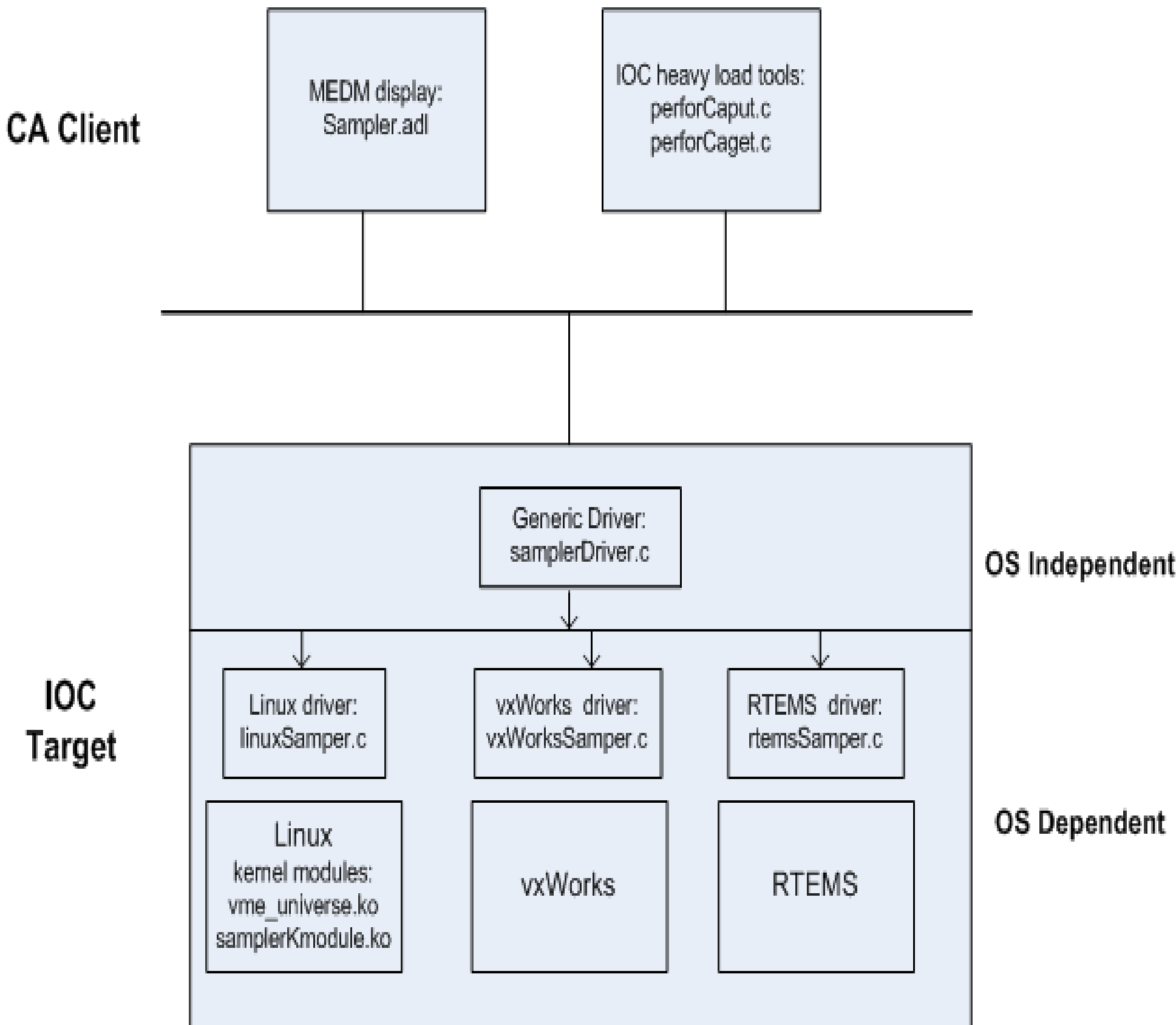


Figure 2: The measurement software structure.

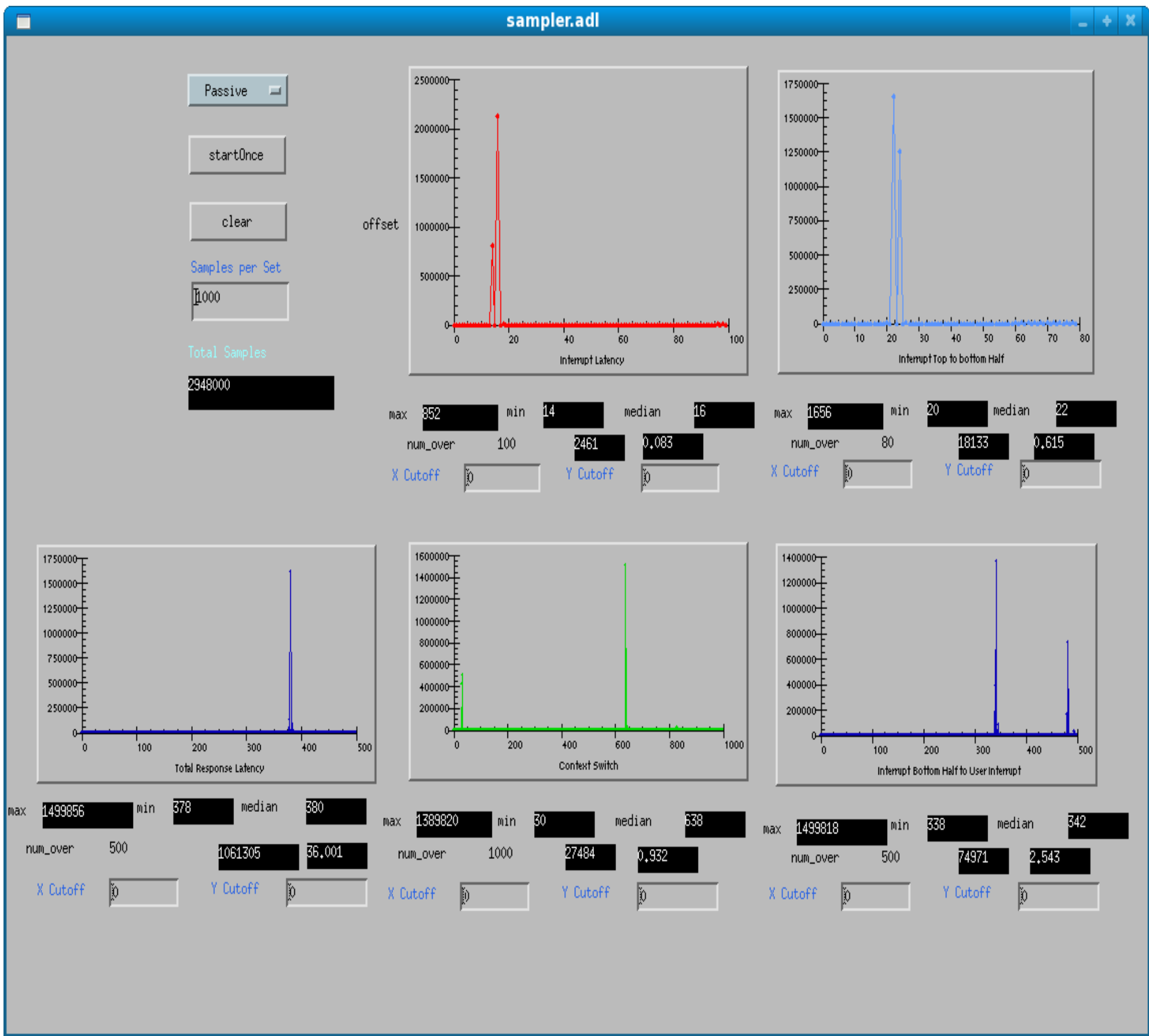


Figure 3: The User Interface

Table 1: Interrupt Latency

	OS	Minimum	Median	Maximum	>100 μ s(%)
Private Network	uClinux non-preemptive	12	14	1822	0.05
	uClinux non-preemptive with user level ISR	14	16	852	0.083
	RTEMS net task has higher priority	18	19	142	0.006
	RTEMS net task has lower priority	18	19	131	0.008
Public Network	uClinux non-preemptive	14	14	1926	0.056
	uClinux non-preemptive with user level ISR	14	16	1604	0.101
	RTEMS net task has higher priority	18	19	165	0.006
	RTEMS net task has lower priority	18	19	132	0.006

Table 2: Interrupt Top Half to Bottom Half Latency

	OS	Minimum	Median	Maximum	>100 μ s(%)
Private Network	uClinux non-preemptive	20	22	1934	0.144
	uClinux non-preemptive with user level ISR	20	22	1656	0.615
Public Network	uClinux non-preemptive	20	22	1932	0.125
	uClinux non-preemptive with user level ISR	20	22	1828	0.605

Table 3: Interrupt Bottom Half to User Level Interrupt Latency

	OS	Minimum	Median	Maximum	>500 μ s(%)
Private Network	uClinux non-preemptive with user level ISR	338	342	1499818	2.543
Public Network	uClinux non-preemptive with user level ISR	338	342	1264560	2.703

Table 4: Context Switch Latency

	OS	Minimum	Median	Maximum	>100 μ s(%)
Private Network	uClinux non-preemptive	28	30	121464	0.482
	uClinux non-preemptive with user level ISR	30	638	1389820	0.932*
	RTEMS net task has higher priority	44	46	1934	0.077
	RTEMS net task has lower priority	44	46	158	0.032
Public Network	uClinux non-preemptive	28	30	113374	0.481
	uClinux non-preemptive with user level ISR	30	638	1440814	0.914*
	RTEMS net task has higher priority	44	46	2013	0.152
	RTEMS net task has lower priority	44	46	161	0.056

* over 1000 μ s(%)

Table 5: Total Response Latency

	OS	Minimum	Median	Maximum	>100 μ s(%)
Private Network	uClinux non-preemptive	80	84	121518	0.81
	uClinux non-preemptive with user level ISR	378	380	1499856	36.001**
	RTEMS net task has higher priority	63	65	1954	0.19
	RTEMS net task has lower priority	63	65	177	0.229
Public Network	uClinux non-preemptive	80	84	113580	0.799
	uClinux non-preemptive with user level ISR	378	380	1264638	37.531**
	RTEMS net task has higher priority	63	65	2033	0.264
	RTEMS net task has lower priority	63	65	181	0.171

** over 500 μ s(%)

All the units are in units of μ s

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