PERFORMANCE TESTING OF EPICS USER INTERFACES -- AN ATTEMPT TO COMPARE THE PERFORMANCE OF MEDM, EDM, CSS-BOY, AND EPICS*

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Abstract

The upgrading of the display manager or graphical user interface at EPICS sites reliant on older display technologies, typically MEDM or EDM, requires attention to both functionality and performance. For many sites, performance is not an issue; all display managers will update a small number of process variables at rates exceeding the human ability to discern changes. For certain applications typically found at larger sites, however, the ability to respond to update rates at sub-Hertz frequencies for thousands of process variables is a requirement. This paper describes a series of tests performed on both older display managers—MEDM and EDM—as well as the newer CSS-Boy, epicsQT, and CaQtDM. Modestly performing modern hardware is used.

STANDARDIZED PERFORMANCE REGRESSION TESTS

The carrying out of any general -purpose standardised software performance tests requires a standard set of hardware, a standard set of operating systems, a standard set of operating environments, and some common functionality in the products to compare against each other. This was in mind when the tests presented below were devised. The aim was to ensure that, as much as possible, the tests were carried out in a reproducible way, that the hardware used would be typical, and that the tests were fair and representative of real-world operations. In order to achieve a performance comparison across software that was written and designed over several decades, it was necessary to restrict the tests to the "lowest common denominator," i.e., the simplest of all possible user interface requirements. (Unsurprisingly this is possibly at odds with certain real-world operations, and the results presented may need to be considered against other factors such as extended functionality when making an actual selection.) Additionally, the modern software trends of functionality over performance may lead to selection of lower-performing software as it has a better fit to the functionality required for a given situation. This set of tests is intended to assist selection and help answer the question "Is it fast enough?" rather than the question "Which is fastest?".

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THE HARDWARE

Modestly performing, name branded, and commodity desktop hardware was purchased. As hardware changes occur very rapidly, it is anticipated that the absolute numbers that the tests indicate will vary somewhat with hardware. The hardware chosen was:

- HP Compaq 8300 Elite Convertible Minitower with Intel® 3.4GHz i7-3770 Quad Core 8 MB cache, Chipset: Intel® Q77 Express Chipset, Memory: 8GB (2x4GB) DDR3-1600 (32GB Max)
- Hard Drive: 1TB SATA Hard Drive (7,200rpm)
- Graphics: NVIDIA Quadro 600 Graphics with 1GB

It was configured with a 22-inch Dell monitor; see [1] for full details.

The choice was made for no greater reason other than at the time of writing this was the standard desktop deployed at the Advanced Photon Source, and therefore likely to be close in specification to any modern PC desktop hardware. It was purchased specially and reserved for these tests.

THE OPERATING SYSTEMS

Two operating systems were used: Windows 7 Enterprise SP1 and Linux Redhat Enterprise 6.4; both were 64-bit versions in a dual boot scenario.

Use of a Mac was also attempted [2], but results were incomplete and difficult to compare and have thus been omitted.

THE USER INTERFACES

The test user interfaces were the community-available MEDM, EDM, CSS-Boy, EPICSQt, and CAQtDM, and the Australian Synchrotron internal accelerator GUI system developed using Borland Delphi prior to EPICSQt (AS-Delphi).

THE EPICS DATABASE

A very simple EPICS database was configured. It has five hundred PVs running on a Soft IOC. Each PV counts from 0-99 at ten times per second. To eliminate network variations, the IOC runs on the machine being tested.

THE USER INTERFACE MEASUREMENT TECHNIQUE

The user interface was monitored manually at thirty frames per second using a video camera, and updating screens were successively generated using the five

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hundred PV database. These were placed on the screen until such time as limits conditions were met. The two measured limit conditions were:

1. The user interface skipped updates. This is the lossless threshold.
2. The user interface failed altogether. This is the absolute threshold. Typically this is where (or just before) the user interface either locked up or failed to update any PVs.

Video recording and inspection of the recorded video led to the verification of the USER interface limits. The average CPU utilization was measured on Linux. The results are generally, although not always, rounded to the nearest 500.

RESULTS

The results of the test are summarized in Tables 1, 2, 3, and 4.

Table 1: Linux Update Rates, Text Widget

UI	Version	CPU	Max Update Linux	Lossless Update Linux
CSS-BOY	3.1.4	14.88	22000	15000
EPICSQt	2.4.18	13.12	11100	10000
EDM	1.12.40	10.95	35100	20000
MEDM	3.1.7	12.83	65000	45000
CAQtDM	2.8.0	13.71	13500	5000
AS-Delphi	Int	16.54	9900	5000

Table 2: Windows Update Rate, Text Widget

UI	Version	CPU	Max Update W7	Lossless Update W7
CSS-BOY	3.1.4	14.88	23000	16500
EPICSQt	2.4.18	13.12	10000	8000
EDM	1.12.40	10.95	NA	NA
MEDM	3.1.7	12.83	22250	16000
CAQtDM	2.8.0	13.71	13000	5500
AS-Delphi	Int	16.54	NA	NA

A series of lowest common denominator graphical tests were performed using a simple bar graph, which all displays supported. Note, due to technical difficulties, there are incomplete measures of the AS-internal or the CAQtDM widgets.

Table 3: Linux Update Rates, Graphical Widget

UI	Version	Max Update Linux	Lossless Update Linux
CSS-BOY	3.1.4	9840	8000
EPICSQt	2.4.18	14400	4000
EDM	1.12.40	142880	32000
MEDM	3.1.7	136800	48000
CAQtDM	2.8.0	16600	12000
AS-Delphi	Int	--	--

Table 4: Windows Update Rates, Graphical Widget

UI	Version	Max Update W7	Lossless Update W7
CSS-BOY	3.1.4	28800	16000
EPICSQt	2.4.18	40000	40000
EDM	1.12.40	NA	NA
MEDM	3.1.7	36000	7360
CAQtDM	2.8.0	--	--
AS-Delphi	Int	--	--

A NOTE ON THE UNITS USED IN THE TABLES OF RESULTS

To calculate the update rate in Hertz, the total number of characters on the screen at the limit condition was multiplied by the display update frequency.

CONCLUSION, COMMENTARY, AND INTERPRETATION OF RESULTS

The comparison of older user interfaces—MEDM and EDM—may show significant performance in their favor for text widgets. It is useful to note that these were developed at a time when hardware was less developed, and they have had many years of optimization. The younger interfaces have different design criteria, faster hardware, and less time spent on optimization for performance. It is anticipated that significant performance improvements are both possible and likely; newer versions of these products may provide results that are markedly different from these tests. Also, in determining the update rates, the numbers presented here are somewhat arbitrary and should be interpreted carefully.

It may also be noted that, in general, the performance of CSS-BOY exceeds that of the Qt products. This is a surprising result as Eclipse and Java, on which CSS-BOY is built, have been generally considered slower than the C

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or C++ platforms that Qt is based upon. It may indicate that the greatest future performance improvements may come from the Qt platforms as these products mature.

It is planned that these tests will be performed regularly as later versions of the new user interface software become available. It is anticipated that performance results will vary greatly as the products mature.

REFERENCES

[1] Standard PC Hardware, full details may be found at http://www8.hp.com/us/en/products/desktops/product-detail.html?oid=5232845#!tab=features

[2] IMAC hardware full details may be found at http://www.forevermac.com/2007/08/apple-imac-core-2-duo-2-4ghz-24-inch-aluminium/

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