

MITSUBISHI ELECTRIC RESEARCH LABORATORIES
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Saffron Update

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11/26/2012

Nitro Research - Background

- Embedded systems often have no or poor support for floating point operations
- Previous Nitro prototype was based on floating point arithmetic
- Focused our research on integer-based algorithms and data structures for Nitro



Nitro Research - Results

- Completed the integer-based research with very successful results
- The integer-based implementation is **faster** than the floating point implementation even on strong floating point systems such as the Intel Core i7
- We can eliminate the need for maintaining both a floating point and integer-based code base
 - The integer-based code will serve all needs
- This minimizes complexity, enhances further development, and simplifies testing and quality assurance



Nitro Research - Results

PPEM	Saffron	Freetype	Nitro: Float	Nitro: C Fixed	Nitro: ASM Fixed	Nitro: C Fixed x64
20	166000	231000	606000	603000	669000 (4.03x)	843000 (5.08x)
28	126000	179000	490000	498000	544000 (4.32x)	684000 (5.43x)
40	87000	143000	387000	394000	430000 (4.94x)	514000 (5.91x)
60	52000	108000	282000	289000	309000 (5.94x)	359000 (6.90x)
80	34000	86000	215000	224000	235000 (6.91x)	266000 (7.82x)
100	24000	68000	175000	180000	188000 (7.83x)	208000 (8.66x)
200	7800	37000	71000	75000	75000 (9.62x)	79000 (10.13x)

Glyphs per second on an Intel Core i7 Q840 CPU, Font: Verdana, Quality Setting: Highest, Symmetric CSM, ASM is x86 assembly language for a very small number of functions (7 functions, only 80 lines of code, function line lengths: 4, 6, 2, 6, 6, 28, 28), C Fixed x64 is pure C code with compiler settings permitting single instruction 32 bit x 32 bit = 64 bit multiplies to be generated



Nitro Research - Results

PPEM	Saffron	Freetype	Nitro: ASM Fixed	Nitro: C Fixed x64
20	166000	231000	706000 (4.25x)	889000 (5.36x)
28	126000	179000	572000 (4.54x)	706000 (5.60x)
40	87000	143000	455000 (5.23x)	544000 (6.25x)
60	52000	108000	331000 (6.37x)	383000 (7.37x)
80	34000	86000	256000 (7.53x)	287000 (8.44x)
100	24000	68000	204000 (8.50x)	222000 (9.17x)
200	7800	37000	82000 (10.51x)	85000 (10.90x)

Glyphs per second on an Intel Core i7 Q840 CPU, Font: Verdana, Quality Setting: Normal, Symmetric CSM, ASM is x86 assembly language for a very small number of functions (7 functions, only 80 lines of code, function line lengths: 4, 6, 2, 6, 6, 28, 28), C Fixed x64 is pure C code with compiler settings permitting single instruction 32 bit x 32 bit = 64 bit multiplies to be generated