**VFORTH Description**

VFORTH is a 32 bit Forth derivative. Its initial platform is a simple 32 bit virtual machine.

Like OCF (and like Chuck Moore’s 1970 FORTH version !), all words are executed. No exceptions. Some words, when executed, do compilation though.

Words have two forms, which are distinguished between using a bar prefix.

DUP Executes a DUP

DUP| Executes the code that compiles a DUP. Call to DUP or inline code.

RFORTH code is driven by either Color (like Color FORTH) or Syntax as follows. Color FORTHs colour scheme is kept, but this is not Color Forth. Code is compiled to ‘object code’.

Note that when producing the standard words (e.g. DUP) you cannot always use code that just compiles the primitive. The reason is because some words – R> >R and ; access or update the return stack and as such when called as a “word-ised” version will have the return call from that initial call in the way.

**Executable Words**

Directly executed words are in underline and/or Yellow.

In the example above DUP or DUP will execute DUP. A numeric constant will be pushed on the stack.

**Compiled Words**

Words that are compiled into the dictionary are in normal font and/or Green.

In the example above DUP or DUP will execute DUP| rather than DUP. This will normally either compile a call to DUP, or generate the inline code for DUP, but it also allows for words that are executed at Compile time. If (say) |IF exists but IF does not, then IF cannot be run directly, only in compile mode. If DUP exists but DUP| does not it compiles a call to DUP. If that does not exist it throws an error.

A numeric constant will cause code that generates that literal to be pushed on the stack. The dictionary is checked first. This will be presented to the system as |42 – compiles the code to push 42 on the stack – using the same syntax.

**Dictionary Entries**

Dictionary Entries are in bold and/or red. So **DROP** or DROP both define a word DROP. This does not put anything in code merely puts a reference in the dictionary (or overrides a currently existing one). So code like 8\* 2\* 4\* 2\* 2\* ; works. It will actually – record a reference to 8\*, compile the code for 2\* whatever that is, record a reference to 4\* and compile the code for 2\* twice, followed by the code for return. Compilation will be done by |2\* and |; respectively.

**Comments**

Comments are in italics and/or white. So *this Is a comment* and so is this. Comments by convention are *italicised like this* in editors (e.g. Kompozer or Blue Griffon) if the display system supports it. Obviously it has to support either bold/italic/underline or colour.

**CSS Styling**

<style type="text/css">  
em {

color: white;

}  
body {

font-size:x-large;  
font-family:consolas,tahoma,sans-serif;  
color: green;  
background-color:black;  
}  
strong {  
color: red;  
}  
u {  
text-decoration:none;  
color:yellow;  
}  
</style>

Code can be written in HTML editors that support italic bold underlined rendering as WYSIWYG (it will still work with <em>code</em> tags but it won’t be very readable. I have had success with both Kompozer and Blue Griffon.

The CSS on the right, when inserted at the top of a HTML file, makes it into a “Color FORTH” editor in ASCII.

A script will be created which takes the HTML and converts it to the internal format.

**Design**

Initially there will be a machine with about 40 primitives , non packed, on a 32 bit machine architecture with 4 byte words, lower end format (e.g. LSB first), byte addressed (e.g. a 386 structure).

Bootstrapping will be done via a very limited simple in built compiler which compiles the base primitive definitions, call and return and a skip call if zero primitive #0if

**FORTH primitives (bootstrap)**

@ ! c@ c! +! + - \* / and or xor

not 0= 0> 0< 0- 1+ 1- 2\* 2/ dup drop

swap rot over ; r> >r #0if $hwio

*Note that 2\* and 2/ are logical shift lefts and rights, not arithmetic or division. So 2\* and 2/ shift zero bits on the appropriate end.*

*#0if is ‘execute the next word only if the top of stack is non zero’ e.g. skip call if zero. It only makes sense in execute mode (it adds 4 to to the top of the return stack), it is not inline compiled.*

**Bootstrapping language**

This is a vastly simplified FORTH.

:[x] indicates put definition x here. In bootstrapping, definitions cannot fall through

<word> call to x

<digits> x is a decimal constant, push it on the stack.

$<digits> x is a hexadecimal constant, push it on the stack.

$wordsize pushes word size on stack

+++<n> allocates empty space of <n> words

$loop loop back to the start of the word by branch (equivalent to call <self> ;)

The design of code should provide position independent code. The first two words, which are manually generated, are the variables $HEAD (of dictionary) and $TOP (of memory), these are hand coded and the values filled in by the Bootstrapping language compiler.

**Virtual Machine**

2 stacks in same memory space as code.

00000000-7FFFFFFF Push literal on stack

80000000-8FFFFFFF Relative call forward (from following instruction)

90000000-9FFFFFFF Relative call backward (from following instruction)

A0000000-AFFFFFFF Relative branch forward (from following instruction)

B0000000-BFFFFFFF Relative branch backward (from following instruction)

F0000000-F00000FF Primitive 0-255

**BackEnd (platform specific)**

generateLiteral(n) generate code for a literal

generateCall(n) generate code for a call

generatePrimitive(n) generate code for a specific primitive

generateLoop() generate branch to definition start (the use of “recursion” for loops.

**Hardware**

00000-3FFFF 256k bytes of RAM memory, 64k 32 bit words.

40000-7FFFF 256k bytes of RAM memory, 64k 32 bit words (non volatile)

Keyboard 0 $iohw <n> returns key pressed if any, 0 if no key press.

Video display <a> 1 $iohw sets write address in video RAM (32 x 16)

<d> 2 $iohw writes data to vRAM bits 0-7 char 8-10 colour BBCRGB