

# Forth auf dem Propeller Chip

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# Outline

# P8X32A Controller

- ▶ introduced in 2006, design: Chip Gracey
- ▶ 32 bit microcontroller
- ▶ 32kHz .. 80 MHz (via pll from 5.000 MHz crystal),
- ▶ 8 cores! (aka cogs)
- ▶ up to 20Mips/core
- ▶ No interrupts!
- ▶ 512 words/2kB memory per core
- ▶ round robin access to 8k words (32kB) instructions / 8k words (32kB) ram by an internal bus controller (aka hub)

## P8X32A Controller (2)

- ▶ almost no dedicated periphery on chip!
- ▶ 2 32bit counters per core to generate signals (PWM, ...)
- ▶ plus 2 special video registers per core to generate VGA/NTSC/PAL

All periphery interfaces like i2c, spi, pwm are simulated by software making use of the timers.

builtin rom provides

- ▶ bootloader
- ▶ spin interpreter
- ▶ bitmap font
- ▶ log, antilog, sine tables

# Languages

- ▶ from Parallax
  - ▶ pasm assembly language
  - ▶ spin interpreter and language

exchange of modules at [obex.parallax.com](http://obex.parallax.com)

- ▶ other

The index at

<http://humanoidlabs.blogspot.tw/2012/03/ultimate-list-of-big-brain-languages.html> list > 250 entries for languages. Take your pick! Among them:

- ▶ Forth
  - ▶ mv4th
  - ▶ jdforth (Carl Jacobs)
  - ▶ propellerforth (Cliffe Biffle)
  - ▶ propforth (ex spinforth) (Sal Sancì)
  - ▶ tachyon (Peter Jakacki)
  - ▶ m|ental (Ingo ?, hive project)
  - ▶ pfth (Dave Hein)

## Example 1 (spin)

```
'' 2012-11-26 ew
CON
  _clkmode    = xtall + pll16x  ' Feedback and PLL multiplier
  _xinfreq    = 5_000_000      ' External oscillator = 5 MHz
  LED0        = 0              ' Pin0 -- LED
  PUSHBUTTON  = 18            ' Pushbutton Input Pin
PUB run
  ' Main method
  dira[LED0] := 1             ' LED0 pinoutput
  repeat
    ' Endless loop
    outa[LED0]~~             ' set LED0
    waitcnt(   clkfreq / 4 + cnt)
    outa[LED0]~              ' clear LED0
    waitcnt( 3 * clkfreq / 4 + cnt )
```

## Example 1 (spin) cont.

```
$ ./bstc.linux -e 01_led1.spin
...
Loading Object 01_led1
Program size is 56 longs
Compiled 13 Lines of Code in 0.004 Seconds
$ ./bstl.linux -p 3 01_led1.eeprom
Brads SpinTool Loader v0.05 - Copyright 2008,2009 All rights reserved
Compiled for i386 Linux at 09:34:58 on 2009/07/03
Found a USB Serial Device
Propeller Version 1 Found!
$
```

# Tools

- ▶ board (propeller proto board)
- ▶ programmer adapter (propeller plug)
- ▶ power supply (6..9 V)
- ▶ assembler
- ▶ spin compiler
- ▶ loader



# The sorry state of bst

- ▶ IDE including assembler, loader
- ▶ written in FreePascal by Brad ???
- ▶ not Free Software
- ▶ dead
- ▶ unavailable for other archs (e.g. arm)
- ▶ see: propeller forum “is bst dead?”

## Example 2 (spin)

```
'' example with submodule, started on 2 cogs
CON
  _clkmode    = xtal1 + pll16x ' Feedback and PLL multiplier
  _xinfreq    = 5_000_000      ' External oscillator = 5 MHz
  LED0        = 0              ' Pin0 -- LED
  LED1        = 1              ' Pin1 -- LED
VAR long stack[30]
PUB Main
  cognew(Blink(LED0,clkfreq/4, 40), @stack[0])
  cognew(Blink(LED1,clkfreq, 10), @stack[10])
PUB Blink ( pin, rate, reps )
  dira[pin]~~
  outa[pin]~
  repeat reps * 2
    waitcnt (rate/2 + cnt)
    !outa[pin]
```

## install propforth (need prop-plugin)

```
$ cd V5.0/CurrentRelease/PropForth
$ ../../../../bstc.linux -e PropForthDevKernel.spin
...
Loading Object PropForthDevKernel
Program size is 32700 longs
Compiled 1048 Lines of Code in 0.161 Seconds
$ ../../../../bstl.linux -p 3 PropForthDevKernel.eeprom
...
$
```

## connect to propforth (needs prop-plug)

```
$ cat /etc/minicom/minirc.prop
# Machine-generated file - use "minicom -s" to change parameters
pu port                /dev/ttyUSB0
pu baudrate            57600
pu bits                8
pu parity              N
pu stopbits            1
pu rtscts              No
$ minicom -wo -D /dev/ttyUSB0 prop
Prop0 Cog6 ok
```

## Example (propforth)

```
Prop0 Cog6 ok
```

```
cog?
```

```
Cog:0 #io chan:1 PropForth v5.0 2012JAN09 14:30 0
```

```
Cog:1 #io chan:1 PropForth v5.0 2012JAN09 14:30 0
```

```
Cog:2 #io chan:1 PropForth v5.0 2012JAN09 14:30 0
```

```
Cog:3 #io chan:1 PropForth v5.0 2012JAN09 14:30 0
```

```
Cog:4 #io chan:1 PropForth v5.0 2012JAN09 14:30 0
```

```
Cog:5 #io chan:1 PropForth v5.0 2012JAN09 14:30 0
```

```
Cog:6 #io chan:1 PropForth v5.0 2012JAN09 14:30 0 6(0)->7
```

```
Cog:7 #io chan:1 SERIAL 7(0)->6
```

```
Prop0 Cog6 ok
```

```
0 cogstop
```

```
Prop0 Cog6 ok
```

## Example (propforth) 2

colon does funny things on org-export, so remove its function with leading pipe. To be fixed.

```
|Prop0 Cog6 ok
|: init 0 pinout ;
|Prop0 Cog6 ok
|: run init begin
|    0 pinhi d200 delms
|    0 pinlo d800 delms
|  0 until ;
|Prop0 Cog6 ok
|Prop0 Cog6 ok
```

## install tachyon

```
$ unzip Tachyon.zip
$ cd Tachyon/binaries
$ ../../bst1.linux -p3 Tachyon\ V2\ 230400baud-5MHZ.binary
$ minicom -wo -b 230400 -D /dev/ttyUSB0 prop
|: .base base C@ DUP DECIMAL . base C! ; ok
|: hi ." howdy, mate!" CR ; ok
|BINARY .base 2 ok
|$FA . 11111010 ok
|HEX ok
|4 0 DO hi LOOP howdy, mate!
|howdy, mate!
|howdy, mate!
|howdy, mate!
| ok
```

# tachyon

- ▶ is fast on the terminal (230400 baud)
- ▶ is case sensitive
- ▶ compiles the input into a temporary word immediately after entering space/return
- ▶ can run a loop entered on the prompt
- ▶ / is unsigned, bug or feature?

```
$ ascii-xfr -s -c 1 -l 30 EXTEND.fth > /dev/ttyUSB0
```



## Example (tachyon)

- ▶ pressure and humidity sensors added on i2c bus (pins 4,5)

```
$ ascii-xfr -s -c 1 -l 30 t_sensoren > /dev/ttyUSB0
$ minicom -wo -b 230400 -D /dev/ttyUSB0 prop
|...
|  ok
|run
|A0
|A2
|EE
| 294 %rF    9155 1/10 hPa    218 1/10 C
| 294 %rF    9154 1/10 hPa    218 1/10 C
| 294 %rF    9154 1/10 hPa    218 1/10 C  ok
```

## Further Reading

- ▶ Parallax Propeller P8X32A
  - ▶ [http://en.wikipedia.org/wiki/Propeller\\_chip](http://en.wikipedia.org/wiki/Propeller_chip)
  - ▶ [Propeller-P8X32A-Datasheet-v1.4.0<sub>1</sub>.pdf](#)
- ▶ PE-Kit Handbook
  - ▶ [PELabsFunBook-v1.1.pdf](#)
- ▶ BST
  - ▶ <http://www.fnarfbargle.com/bst.html>
- ▶ PropForth
  - ▶ <http://code.google.com/p/propforth/wiki/GettingStarted>
  - ▶ [V5.0/doc/PropForth.htm](#)
- ▶ Tachyon
  - ▶ <http://docs.google.com/document/pub?id=1bEH0DfGmu99M1SqCbr>
  - ▶ <http://forums.parallax.com/showthread.php?141061-TACHYON-A-Fast-and-small-Forth-byte-code-VM-%28source-code-available%29-Web-pages&highlight=tachyon>
- ▶ Hive
  - ▶ Retro-Home-Computer project featuring 3 propeller chips
  - ▶ <http://hive-project.de>