

Programming The Pebble

Time To Code



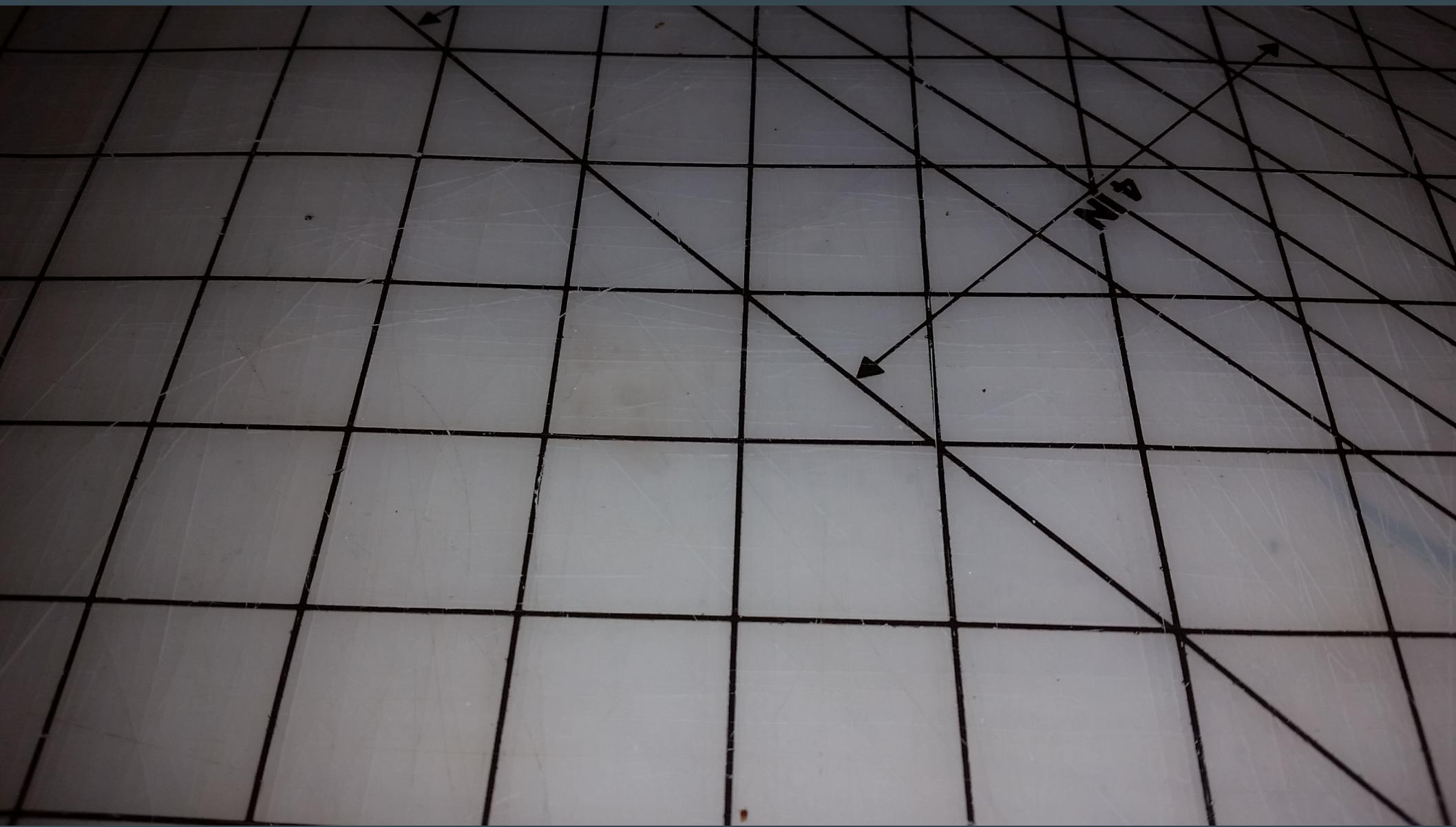
Kent Archie

I am a software developer at DRW Trading.

Over the years I have programmed on everything from Fortran using punched cards on a Univac 1100 to web applications using node.js and Mongodb.

I have taught at several local colleges including a brief stint at IIT.

I am lately having fun playing with my Pebble watch and Ringo toy robot.











Pebble History

The first Pebble was the product of a hugely successful Kickstarter, raising over \$10,000,000



The Pebble Time and Pebble Steel were pre-sold on Kickstarter.



Most recently, they produced the Pebble Round



Pebble Time Features

screen type, size, resolution

1.25 inches, 144x168 pixels, 182 ppi, 64 color e-paper, backlight

Interaction type

4 buttons, TimeLine interface

Phone OS's supported

Android, IOS

Watch processor, memory, radios, sensors

100Mhz Cortex M4, 16Mb memory, Bluetooth 4 6 axis accelerometer
ambient light sensor, compass, gyrometer,
magnetometer, pedometer, microphone

Battery Life

150 mAh, up to 7 days, I see 5-6 days

Watch peripherals

Watch strap connects to watch, more battery, sensors, open specs

TimeLine Interface

Events on the watch are time ordered

Calendar events, alarms, notifications etc are sorted by the time they have or will occur

Using the buttons on the watch, you can see upcoming calendar events and what happened earlier

Development Environments

Development tools run natively on Linux and Mac

Run on Windows using VM running Linux

Command Line Development Tools

Web based IDE

Command Line Development Tools

Installing the Pebble tools installs the toolchain to build ARM applications

After build, it copies the executable and other files to the phone using the local network.

The phone app transfers the watch executable to the watch using Bluetooth

The Pebble phone app implements the configuration code, if any

Development Tools And OS

Options on the build tools compile for different version of the watch

The OS is custom to Pebble but is based on FreeRTOS

Recent updates have been pushing features back to earlier watches, trying to unify the code environment

config.js (~/projects/pebble/pebble-IceWatch/config/js) - GVIM

IceWatch.c (~/projects/pebble/pebble-IceWatch/src) - GVIM1

index.html j/config.js c/config.css

```

$(().ready(init);

function clearLog()
{
  $('#logger').html('');
} // clearLog

function logger(str)
{
  var oldStr = $('#logger')
  $('#logger').html(oldStr)
} // logger

(function(){
  clearLog();
  $("#b-cancel").click(cancel);
  $("#b-submit").click(send);
  loadOptions();
})();

function init()
{
  logger('init start');
  $("#b-cancel").click(cancel);
  $("#b-submit").click(send);

  //Set form values to what we want
  loadOptions();
} // init

```

IceWatch.c ./SetupDisplay.c ./Actions.c ./ConfigHandlers.c ./Utilities.c ./Constants.h ./Global.h ./Actions.h ./SetupDisplay.h ./Cor

Terminal

```

self.spawn_qemu()
File "/home/kent/pebble/pebble-sdk-4.0-linux64/pebble-tool/pebble_tool/sdk/emulator.py", line 223, in _spawn_qemu
    self.wait_for_qemu()
File "/home/kent/pebble/pebble-sdk-4.0-linux64/pebble-tool/pebble_tool/sdk/emulator.py", line 240, in _wait_for_qemu
    while True:
KeyboardInterrupt
kent@gadgetdev ~/projects/pebble/pebble-IceWatch $
kent@gadgetdev ~/projects/pebble/pebble-IceWatch $
kent@gadgetdev ~/projects/pebble/pebble-IceWatch $
kent@gadgetdev ~/projects/pebble/pebble-IceWatch $
kent@gadgetdev ~/projects/pebble/pebble-IceWatch $ pebble -v install --emulator basalt --logs
usage: pebble [-h] [--version]
              {build,clean,new-project,install,logs,screenshot,insert-pin,delete-pin,emu-accel,emu-app-config,emu-battery,emu-bt-connection,emu-compass,emu-control,emu-tap,emu-time-format,ping,login,logout,repl,transcribe,data-logging,sdk,analyze-size,convert-project,kill,wipe}
pebble: error: unrecognized arguments: -v
kent@gadgetdev ~/projects/pebble/pebble-IceWatch $ pebble install --emulator basalt --logs
Installing app...
App install succeeded.
[17:34:29] javascript> phoneSide: init called!

```

QEMU - + ×

15,24 Top

Menu Terminal config.js (~...) IceWatch.c... [Command...][kentarchie...][PebbleDe...][pebble] QEMU

Code Locations

Developer written code ends up in 3 places

The ARM executable ends up on the watch
This is built from C code and the Pebble library

Code that provides an interface between the
Pebble phone app and the watch

This is dev written Javascript code and the
Pebble javascript library on the phone app

The configuration page, if any, is on a developer
provided web site

This is normal web page code

Debugging/Testing

The watch code and the Pebble phone app Javascript code write to the same logging stream

```
APP_LOG(DebugLevel, "ICEWatch: key=%d: bool  
value=%s",key,value ? "true" : "false");  
console.log("phoneSide: init called!");
```

The configuration page code doesn't go into the logging stream. This can be tested using a normal web browser

The Pebble build tool can compile apps to be run in a Pebble watch emulator running on the development machine

Coding Techniques

The Pebble is primarily a second display for your phone

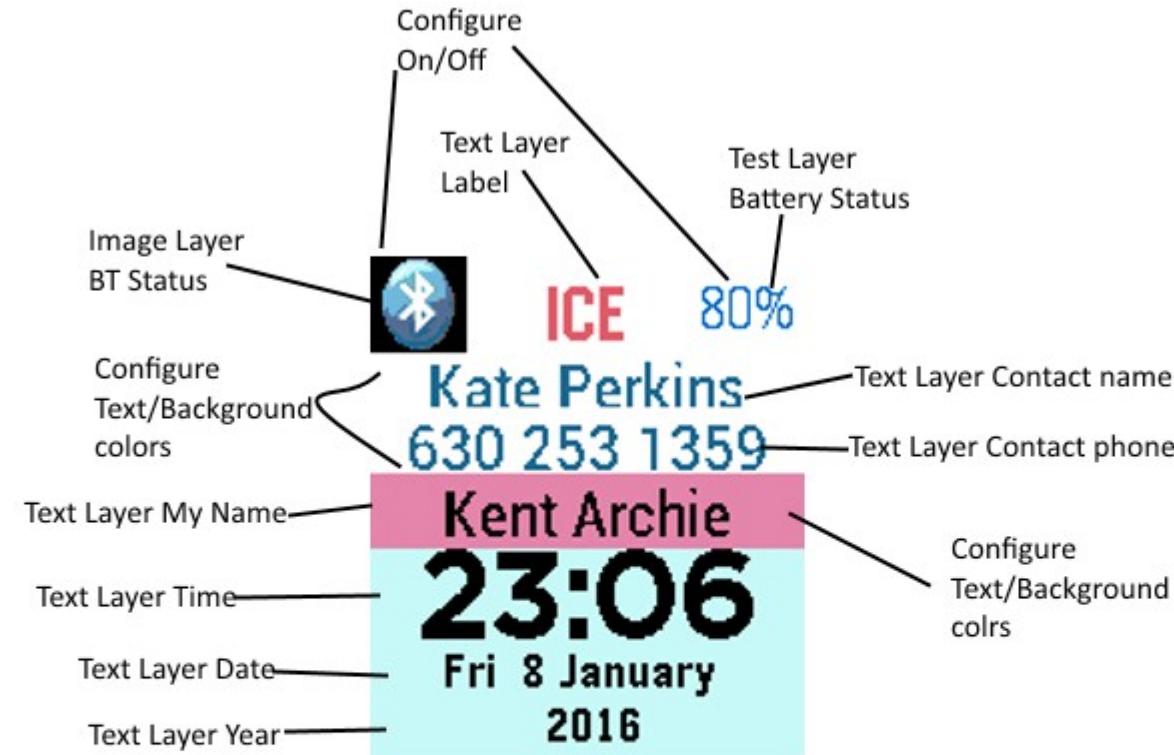
Little ability to create content

No camera, no keyboard, some voice control

So, the interface is not very interactive

You create text or image items and position them on the watch display

Configurable Elements



Configure
Contact Name
Contact phone
My Name
12/24 hour

Data Communication

The main data structure is the Dictionary.

Abstractly this is a map of an integer key to an arbitrary C data type

Internally, it is a collection of Tuple which has two components

The key is an integer and the value is the C data

Communication between the watch and the phone is 2-way and each message is acknowledged

Callbacks are registered on the watch to be woken when a message is received

Messages consist of Dictionary objects

The pebble phone app Javascript can send data using this technique

Data Storage

Data can be stored in persistent storage on the watch

I use this to save configuration values and set them when the watchface is restarted

Values can be saved in the web browser in the phone app using the localStorage API

Web Based IDE (CloudPebble)

CloudPebble - IceWatchJS - Mozilla Firefox

File Edit View History Bookmarks Tools Help

TalkOutline - Google Docs | CloudPebble - IceWatchJS | cloudpbebble edit github u... | Cloudpebble - can't set gi... | Taking screenshots of So... | kentarchie/pebble-IceWa... | +

https://cloudpbebble.net/ide/project/213801#

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DOCUMENTATION PROJECTS SETTINGS SIGN OUT

CLOUDPEBBLE

SIMULATOR

TIMELINE (PREVIEW)

COMPILATION

GITHUB

SOURCE FILES [ADD NEW](#)

ConfigHandlers.h
ConfigHandlers.c
Actions.h
Actions.c
IceWatch.c
SetupDisplay.h
SetupDisplay.c
Utilities.c
Utilities.h

```
151     .unload = mainWindowUnload
152 };
153
154 // Show the Window on the watch, with animated=true
155 window_stack_push(mainWindow, true);
156
157 // Register service handlers
158 tick_timer_service_subscribe(MINUTE_UNIT, tickHandler);
159 battery_state_service_subscribe(handleBattery);
160 bluetooth_connection_service_subscribe(blueoothHandler);
161
162 app_message_register_inbox_received(inbox_received_handler);
163 app_message_open(app_message_inbox_size_maximum(), app_message_outbox_size_maximum());
164 } // init
165
166 static void_deinit()
167 {
168     // Destroy Window
169     window_destroy(mainWindow);
170 } //deinit
171
172 int main(void)
173 {
174     init();
175     app_event_loop();
176    _deinit();
177 } // main
```

AI

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English Katharine @ pebble

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Web Based IDE (CloudPebble)

CloudPebble - IceWatchJS - Mozilla Firefox

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CLOUDPEBBLE

ConfigHandlers.c Actions.h Actions.c IceWatch.c SetupDisplay.h SetupDisplay.c Utilities.c Utilities.h Constants.h Global.h

RESOURCES [ADD NEW](#)

bluetooth32-color.png ↗ ston32-color.png ↗

LAST BUILD

STARTED: 25 January, '16 – 21:09
BUILD TIME: 4 seconds
STATUS: FAILED

[RUN BUILD](#) [GET PBW](#) [BUILD LOG](#)

#	DATE	STATUS
3289471	25 January, '16 – 21:09	FAILED

[BUILD LOG](#)

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Web Based IDE (CloudPebble)

CloudPebble - IceWatchJS - Mozilla Firefox

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https://cloudpbebble.net/ide/project/213801#

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CLOUDPEBBLE

ConfigHandlers.c Actions.h Actions.c IceWatch.c SetupDisplay.h SetupDisplay.c Utilities.c Utilities.h Constants.h Global.h

RESOURCES ADD NEW

bluetooth32-color.png

ston32-color.png

```
[ 4/19] layouts.jsonl appinfo.jsonl -> build/basalt/layouts.jsonl
[ 5/19] reso: resources/images/stop32-color.png -> build/basalt/resources/images/stop32-color.png.RESOURCE_ID_bluetoothOff.reso
[ 6/19] reso: resources/images/bluetooth32-color.png -> build/basalt/resources/images/bluetooth32-color.png.RESOURCE_ID_bluetoothOn.reso
[ 7/19] resource namespace: build/basalt/resources/images/stop32-color.png.RESOURCE_ID_bluetoothOff.reso build/basalt/resources/images/bluetooth32-color.png.RESOURCE_ID_bluetoothOn.reso
[ 8/19] c: src/ConfigHandlers.c -> build/src/ConfigHandlers.c.6.o
[ 9/19] c: src/IceWatch.c -> build/src/IceWatch.c.6.o
[10/19] c: src/Utilities.c -> build/src/Utilities.c.6.o
[11/19] c: build/basalt/appinfo.auto.c -> build/basalt/appinfo.auto.c.6.o
[12/19] c: src/Actions.c -> build/src/Actions.c.6.o
[13/19] c: src/SetupDisplay.c -> build/src/SetupDisplay.c.6.o
./src/ConfigHandlers.c:6:20: fatal error: Layers.h: No such file or directory
compilation terminated.
./src/IceWatch.c:11:20: fatal error: Layers.h: No such file or directory
compilation terminated.
./src/SetupDisplay.c:5:20: fatal error: Layers.h: No such file or directory
compilation terminated.
./src/Actions.c:5:20: fatal error: Layers.h: No such file or directory
compilation terminated.
Waf: Leaving directory `/tmp/tmpj05C8m/build'
Build failed
-> task in 'basalt/pebble-app.elf' failed (exit status 1):
    {task 139785863705104: c ConfigHandlers.c -> ConfigHandlers.c.6.o}
['arm-none-eabi-gcc', '-std=c99', '-mcpu=cortex-m3', '-mthumb', '-ffunction-sections', '-fdata-sections', '-g', '-Os', '-D_TIME_H_', '-Wall', '-Wextra', '-Wstrict-aliasing=2']
-> task in 'basalt/pebble-app.elf' failed (exit status 1):
    {task 139785863705232: c IceWatch.c -> IceWatch.c.6.o}
['arm-none-eabi-gcc', '-std=c99', '-mcpu=cortex-m3', '-mthumb', '-ffunction-sections', '-fdata-sections', '-g', '-Os', '-D_TIME_H_', '-Wall', '-Wextra', '-Wstrict-aliasing=2']
-> task in 'basalt/pebble-app.elf' failed (exit status 1):
    {task 139785863705360: c SetupDisplay.c -> SetupDisplay.c.6.o}
['arm-none-eabi-gcc', '-std=c99', '-mcpu=cortex-m3', '-mthumb', '-ffunction-sections', '-fdata-sections', '-g', '-Os', '-D_TIME_H_', '-Wall', '-Wextra', '-Wstrict-aliasing=2']
-> task in 'basalt/pebble-app.elf' failed (exit status 1):
    {task 139785863704848: c Actions.c -> Actions.c.6.o}
['arm-none-eabi-gcc', '-std=c99', '-mcpu=cortex-m3', '-mthumb', '-ffunction-sections', '-fdata-sections', '-g', '-Os', '-D_TIME_H_', '-Wall', '-Wextra', '-Wstrict-aliasing=2']
```

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Developing in Javascript

Pebble Watch apps can be built entirely in Javascript

They run entirely on the phone, using the watch as a display

Lots of Bluetooth traffic and code running on the phone can be a battery drain on Both devices

Also probably slower than C applications

Should I get one?

Probably not.

For me, the main criteria where
Works with any Android and IOS phones

Water proof

Long battery life

Relatively cheap

Most other watches have more features, more
interactivity and so might be better choices

Resources

The presentation slides and project code can all be found at

<https://github.com/kentarchie/>

Contact me at
kentarchie@gmail.com