MicroFlo

flow-based &
visual programming
for microcontrollers

http://microflo.org

Jon Nordby, MeshCon 2015

Programming Today

File Edit Sketch Tools Help

Blink

```
// the setup function runs once when you press reset
void setup() {
  // initialize digital pin 13 as an output.
  pinMode(13, OUTPUT);
}

// the loop function runs over and over again foreve
void loop() {
  digitalWrite(13, HIGH);   // turn the LED on (HIGH
  delay(1000);              // wait for a second
  digitalWrite(13, LOW);    // turn the LED off by ma
  delay(1000);              // wait for a second
}
```

1

"Code"

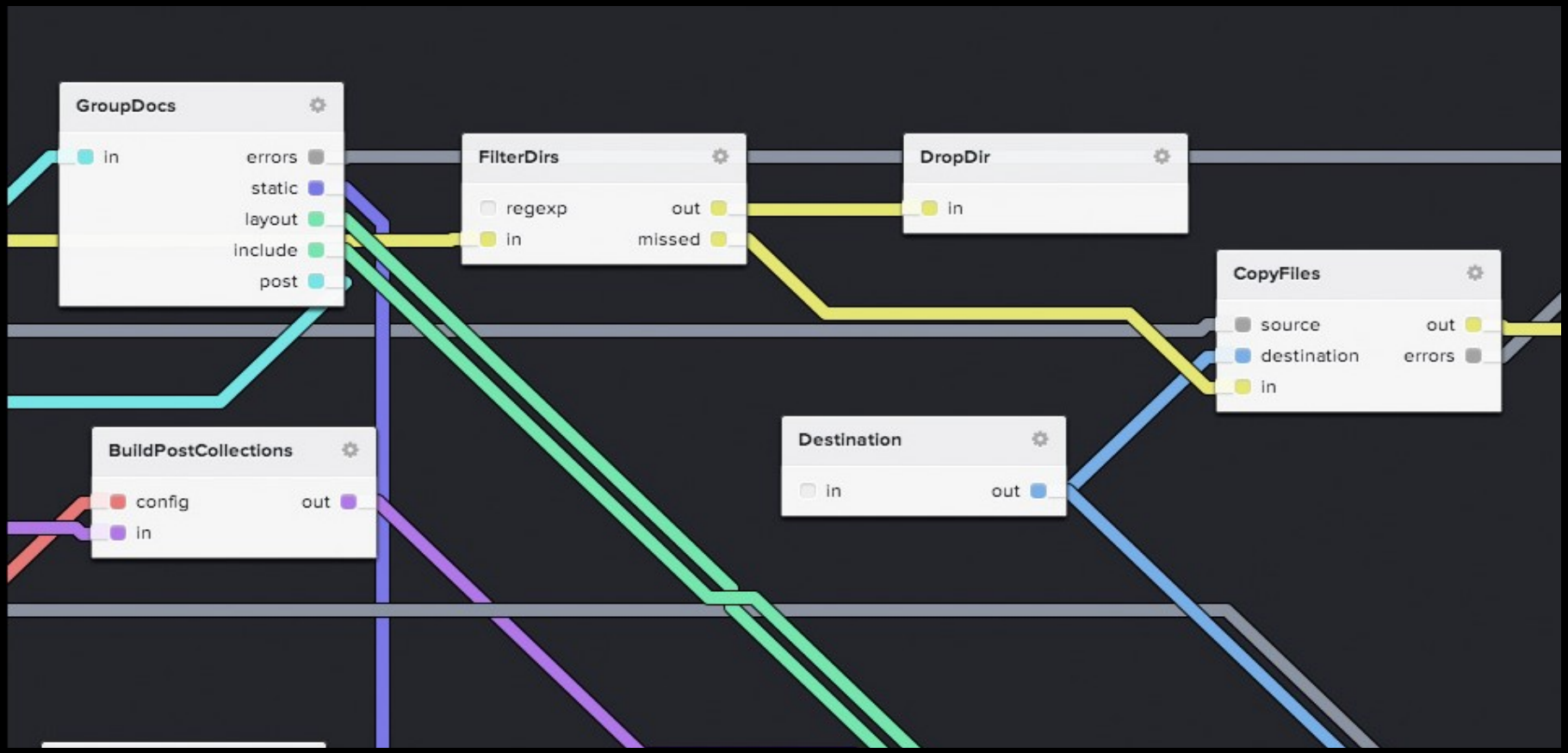
Text

C/C++

Imperative

write→compile→flash→restart→

FBP 101

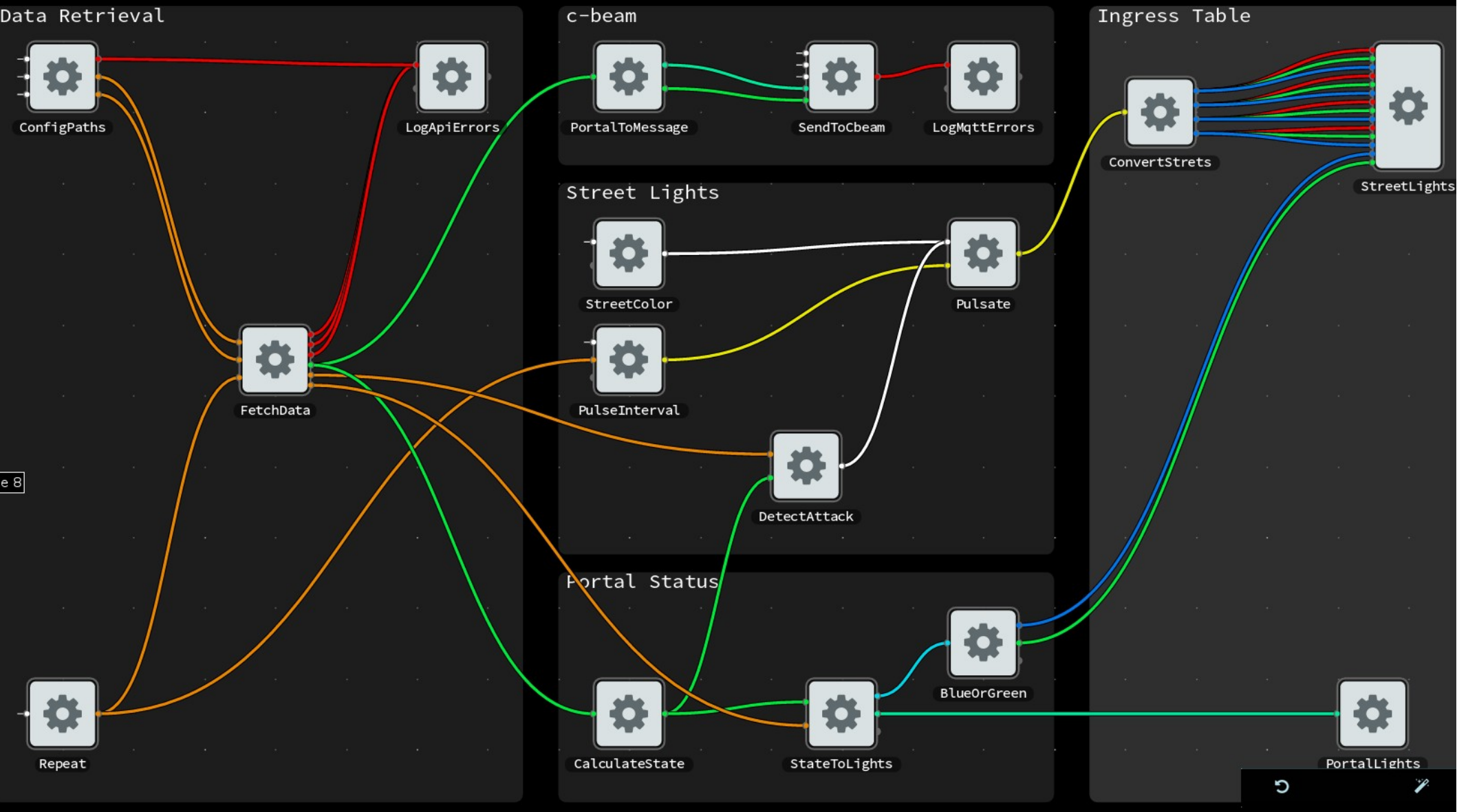


No source code generation!

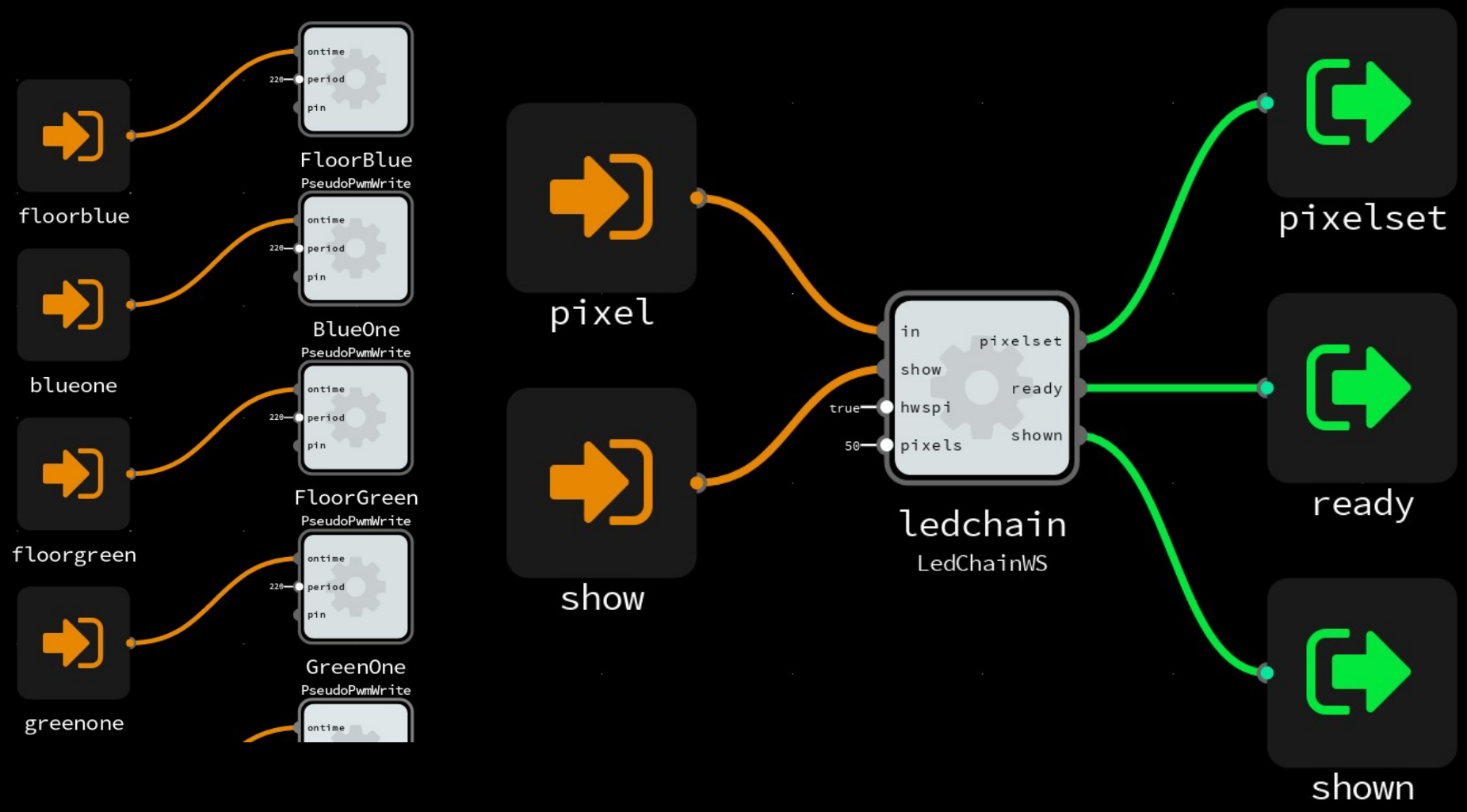
Case: Ingress Table

https://github.com/c-base/ingress-table

On Raspberry Pi



On microcontroller



Inside component

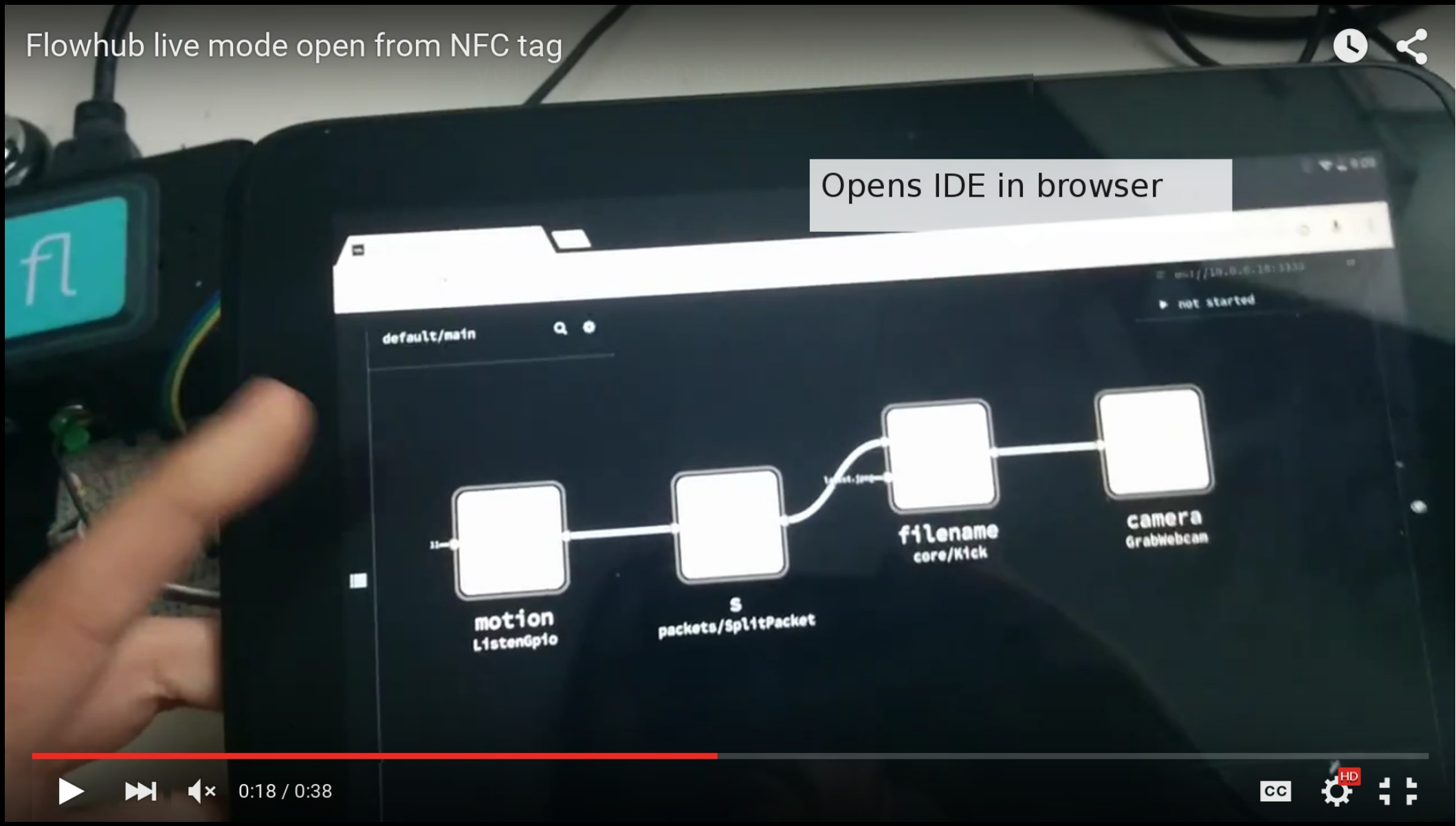
```
/* microflo_component yaml
name: Forward
description: Forward a packet from input to output
inports:
  in:
    type: all
    description: ""
outports:
  out:
    type: all
    description: ""
microflo_component */

class Forward : public SingleOutputComponent {
public:

    virtual void process(Packet in, MicroFlo::PortId port) {

        if (in.isData()) {
            send(in, port);
        }
```

Data-driven testing

```yaml
topic: Forward
fixture:
 type: 'fbp'
 data: |
  # @runtime microflo

  INPORT=it.IN:IN
  OUTPORT=it.OUT:OUT

  it(Forward) OUT -> IN v(Forward)

cases:
-
  name: 'boolean true'
  assertion: 'should be identical'
  inputs:
    in: true
  expect:
    out:
     equals: true
-
```

https://github.com/flowbased/fbp-spec

Live mode



https://www.youtube.com/watch?v=EdgeSDFd9p0

Visual programming optional

```
1 # Thermostat
2 timer(Timer) OUT -> TRIGGER thermometer(ReadDallasTemperature)
3 thermometer() OUT -> IN hysteresis(HysteresisLatch)
4
5 # On/Off switch
6 hysteresis() OUT -> IN switch(BreakBeforeMake)
7 switch() OUT1 -> IN ia(InvertBoolean) OUT -> IN turnOn(DigitalWrite)
8 switch() OUT2 -> IN ic(InvertBoolean) OUT -> IN turnOff(DigitalWrite)
9 # Feedback cycle to switch required for syncronizing break-before-make logi
10 turnOn() OUT -> IN ib(InvertBoolean) OUT -> MONITOR1 switch()
11 turnOff() OUT -> IN id(InvertBoolean) OUT -> MONITOR2 switch()
12
13 # Config
14 '5000' -> INTERVAL timer() # milliseconds
15 '4' -> LOWTHRESHOLD hysteresis() # Celcius
16 '5' -> HIGHTHRESHOLD hysteresis() # Celcius
17 '["0x28", "0xAF", "0x1C", "0xB2", "0x04", "0x00", "0x00", "0x33"]' -> ADDRE
   thermometer()
18 board(ArduinoUno) PIN9 -> PIN thermometer()
19 board() PIN12 -> PIN turnOff()
```

.FBP domain-specific language
+ embedding APIs

Get involved

MQTT workshop at c-base, Monday 18.00

At MeshCon, chat afterwards

Visit flowhub.io microflo.org

Jon Nordby, jonnor.com, @jononor