

6LowPAN in IoT environmental sensor networks

Kirk Martinez

Philip Basford

Graeme Bragg

Tyler Ward

Electronics and Computer Science

Jane Hart

Geography and Environment

Andrew Black, Olivia Bragg

Geography
University of Dundee



What is Internet of Things sensing?

- Emphasis on Internet and Web standards
- Will allow better interoperability
- Should be more usable and “smarter”



Lyric thermostat



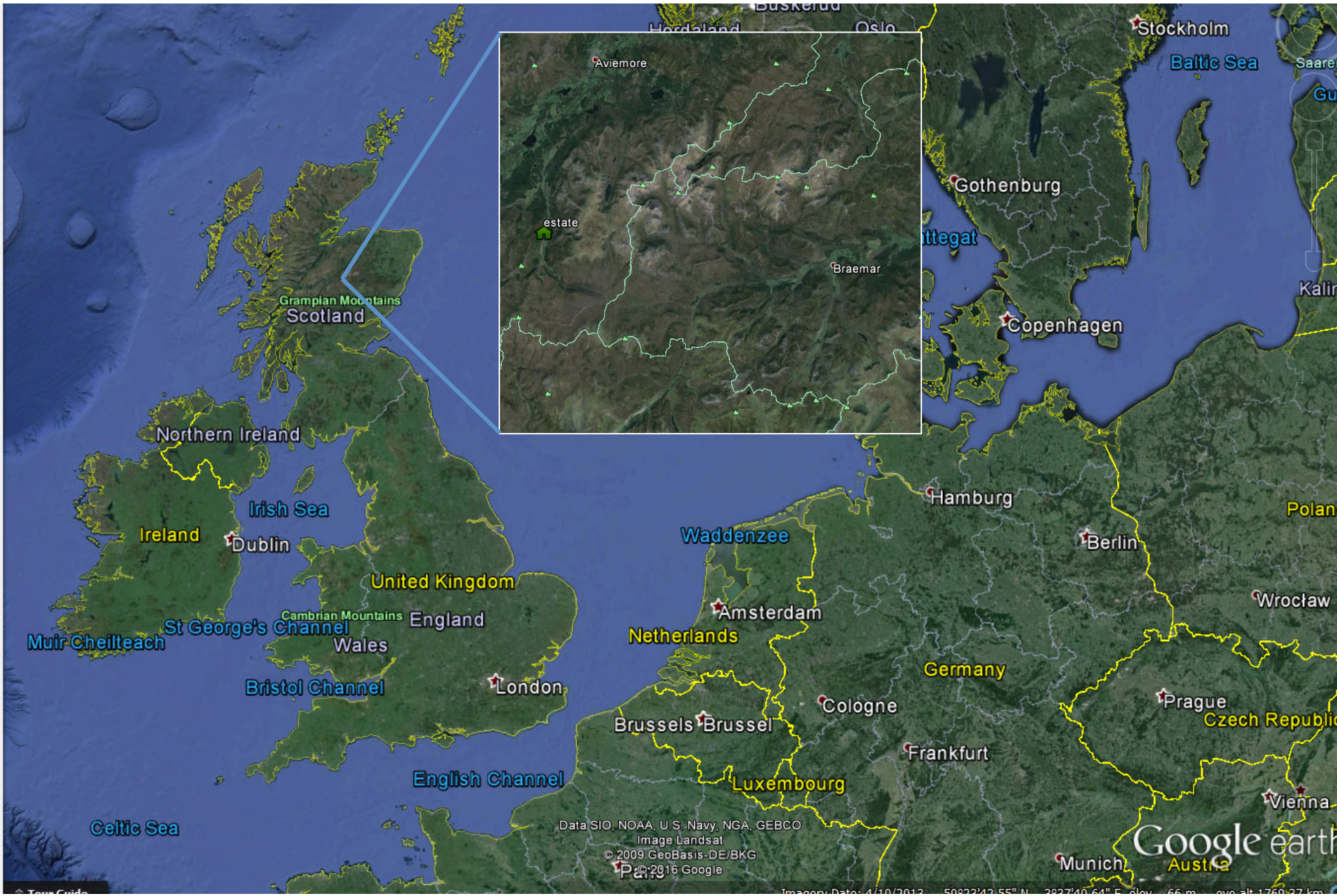
imedipac



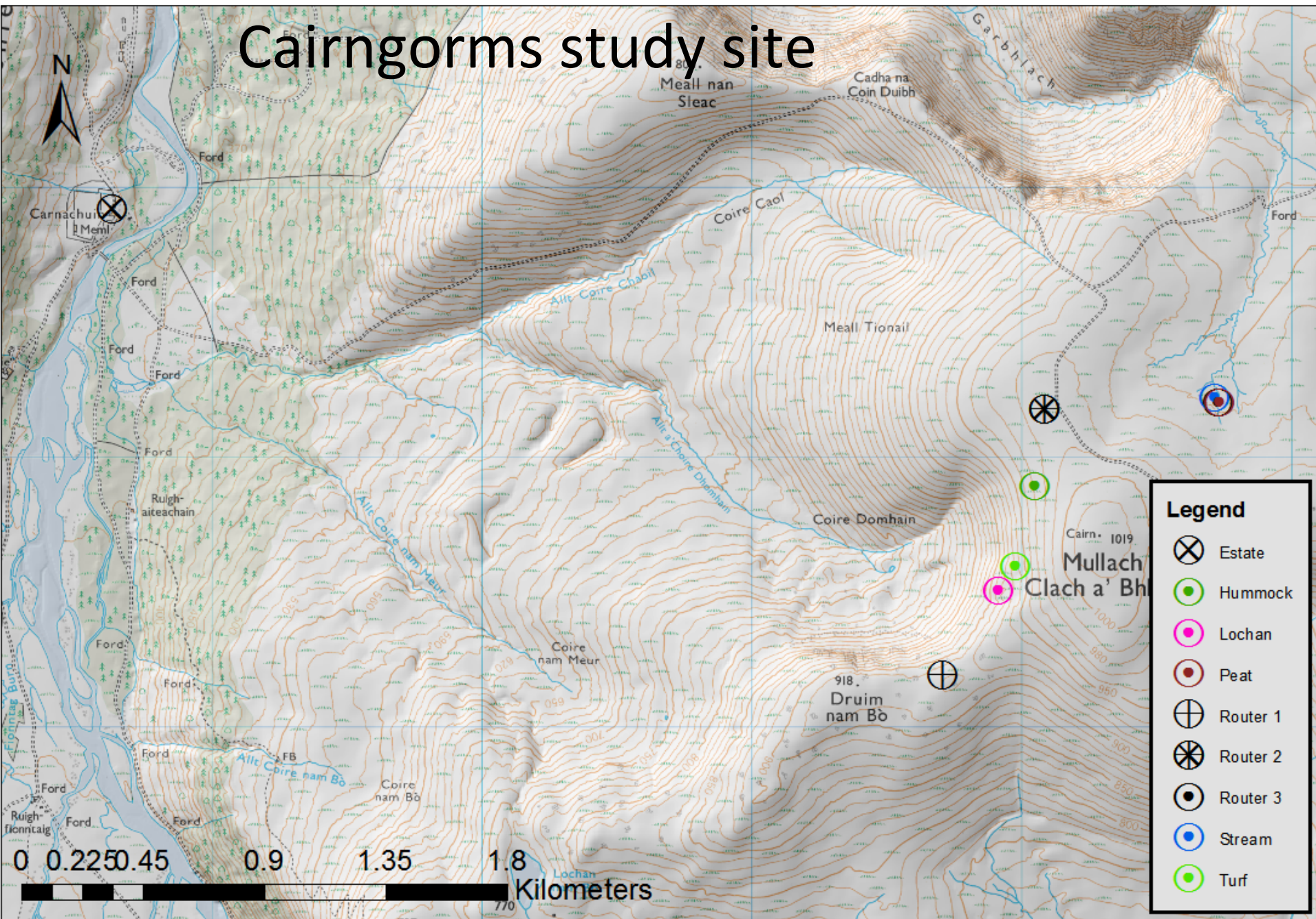
Koubachi
plant care



Field site



Cairngorms study site



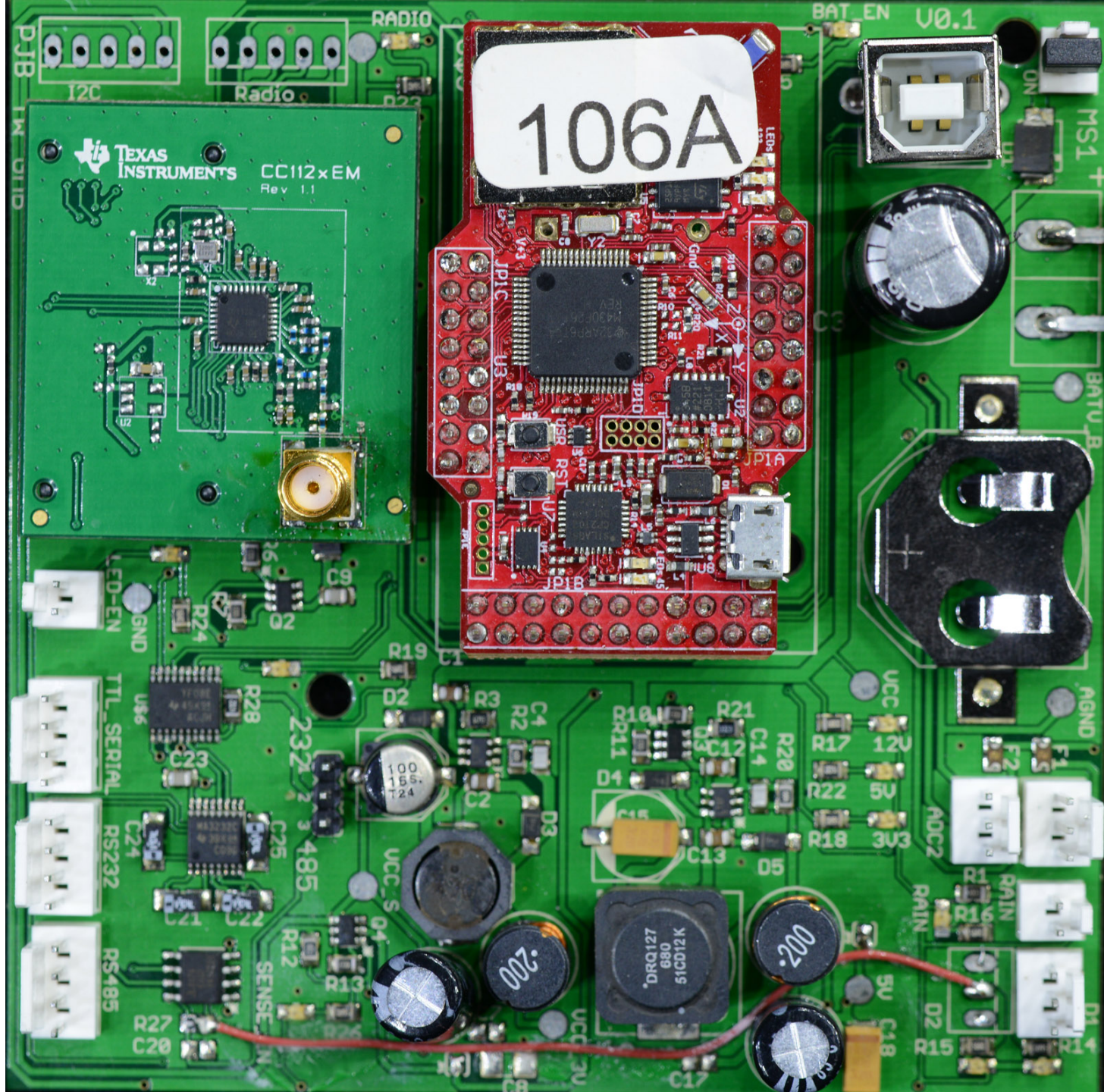
Legend

- ⊗ Estate
- ⊙ Hummock
- ⊙ Lochan
- ⊙ Peat
- ⊕ Router 1
- ⊗ Router 2
- ⊙ Router 3
- ⊙ Stream
- ⊙ Turf

View from the valley



Our “ms1”
node using
Zolertia Z1
25mW
868MHz
radio
ContikiOS

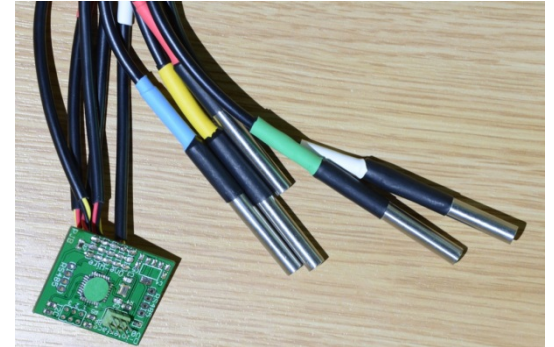


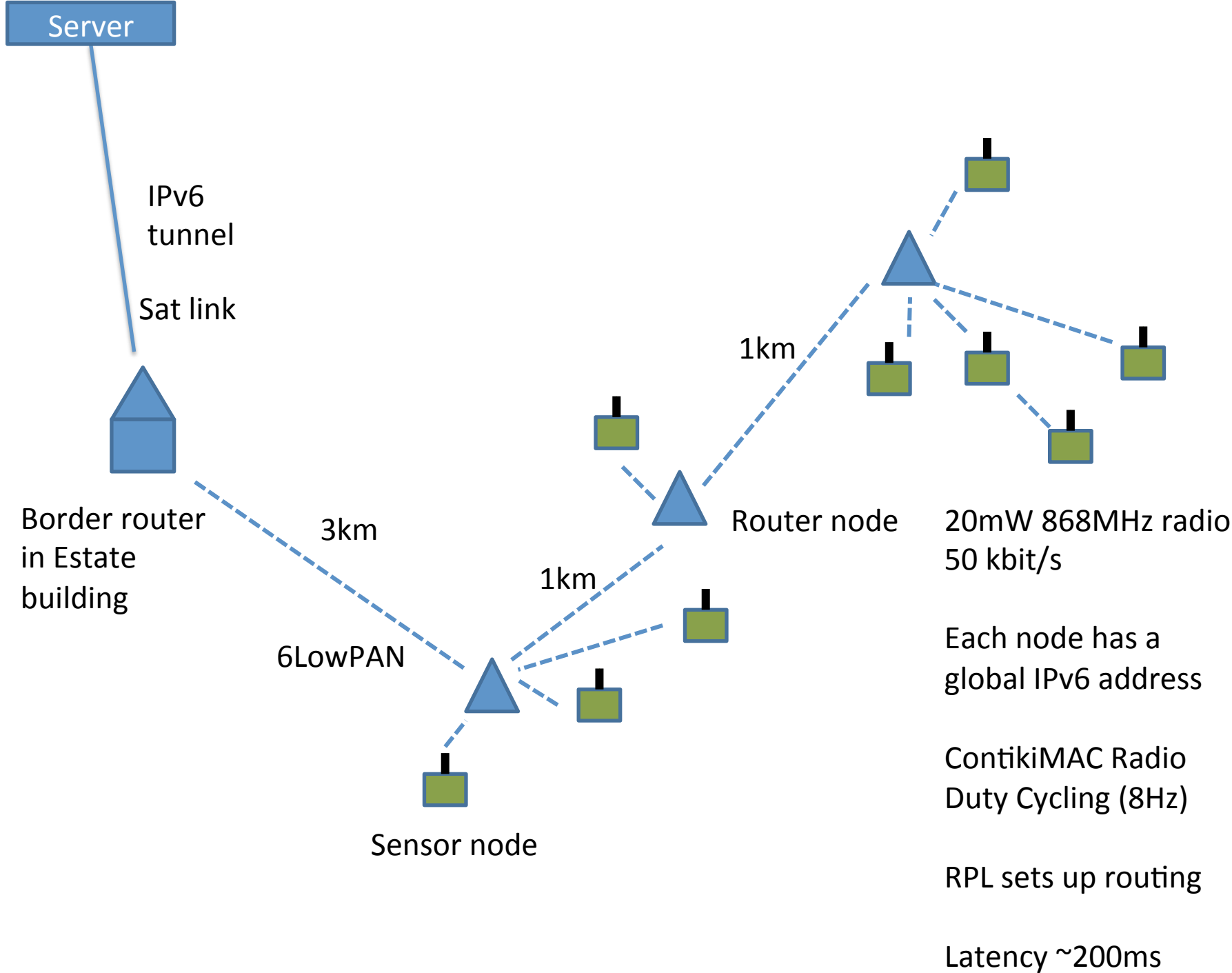
Sensors

- Temperature
- Soil Moisture
- Rainfall

RS485 “smart sensors”:

- Temperature set (5)
- Temperature, Accelerometer chain
- Water depth (2 pressures)





Ping6 a node from my desk!

```
km@env:~$ ping6 -i 10 -s 25 2a01:348:2001:2::1099
PING 2a01:348:2001:2::1099 (2a01:348:2001:2::1099) 25 data bytes
33 bytes from 2a01:348:2001:2::1099: icmp_seq=1 ttl=49 time=875 ms
33 bytes from 2a01:348:2001:2::1099: icmp_seq=2 ttl=49 time=1124 ms
^C
--- 2a01:348:2001:2::1099 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 10009ms
rtt min/avg/max/mdev = 875.375/1000.070/1124.766/124.699 ms
km@env:~$
km@env:~$
km@env:~$
```


CoAP

- RESTful interface for data
- Binary form of HTTP
 - Saves all the ascii format
 - Uses UDP with its own ACKs
 - Can be converted from/to HTTP
- We use Google Protocol Buffers as binary data format rather than custom/JSON

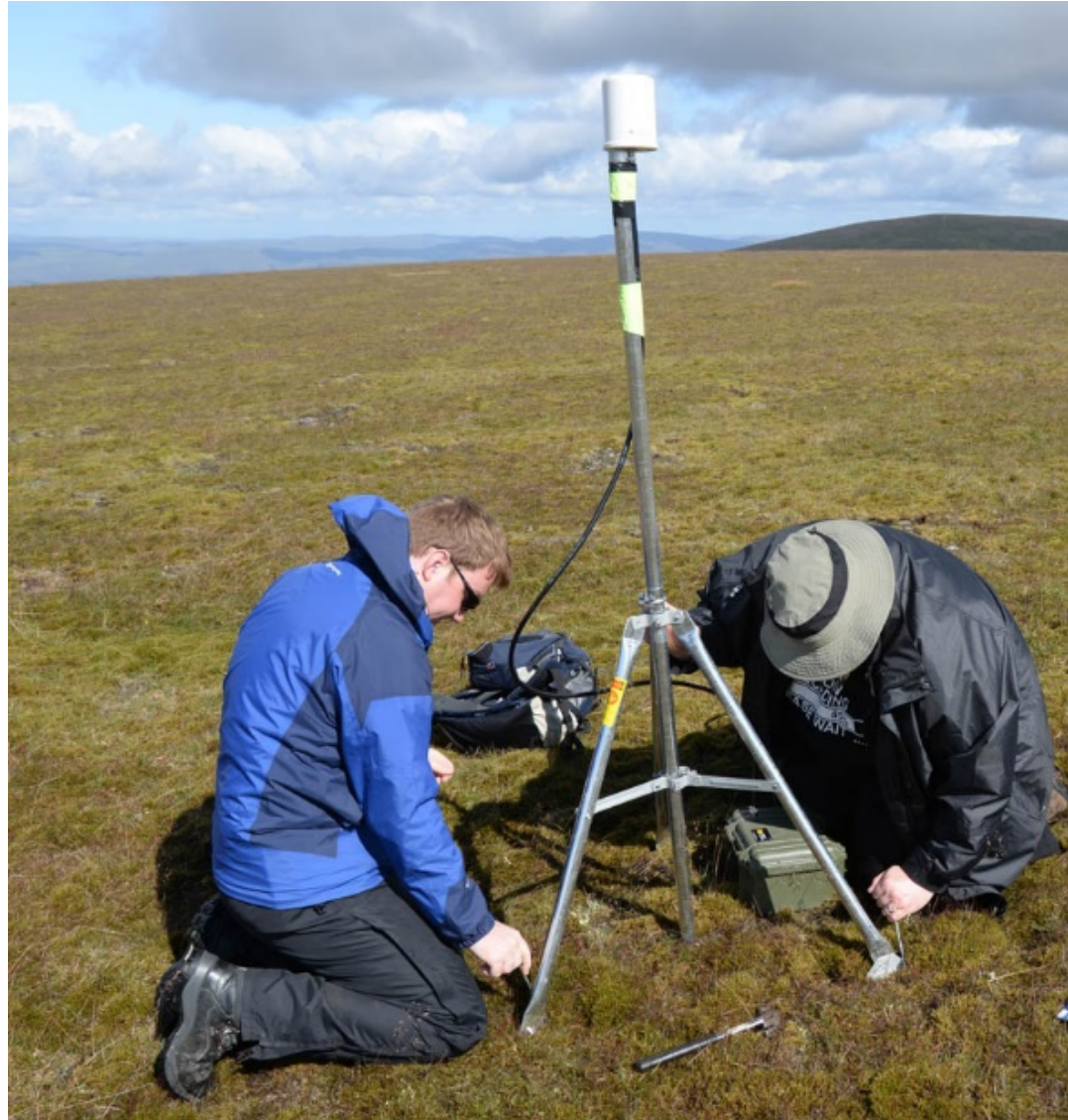
Temperature profile



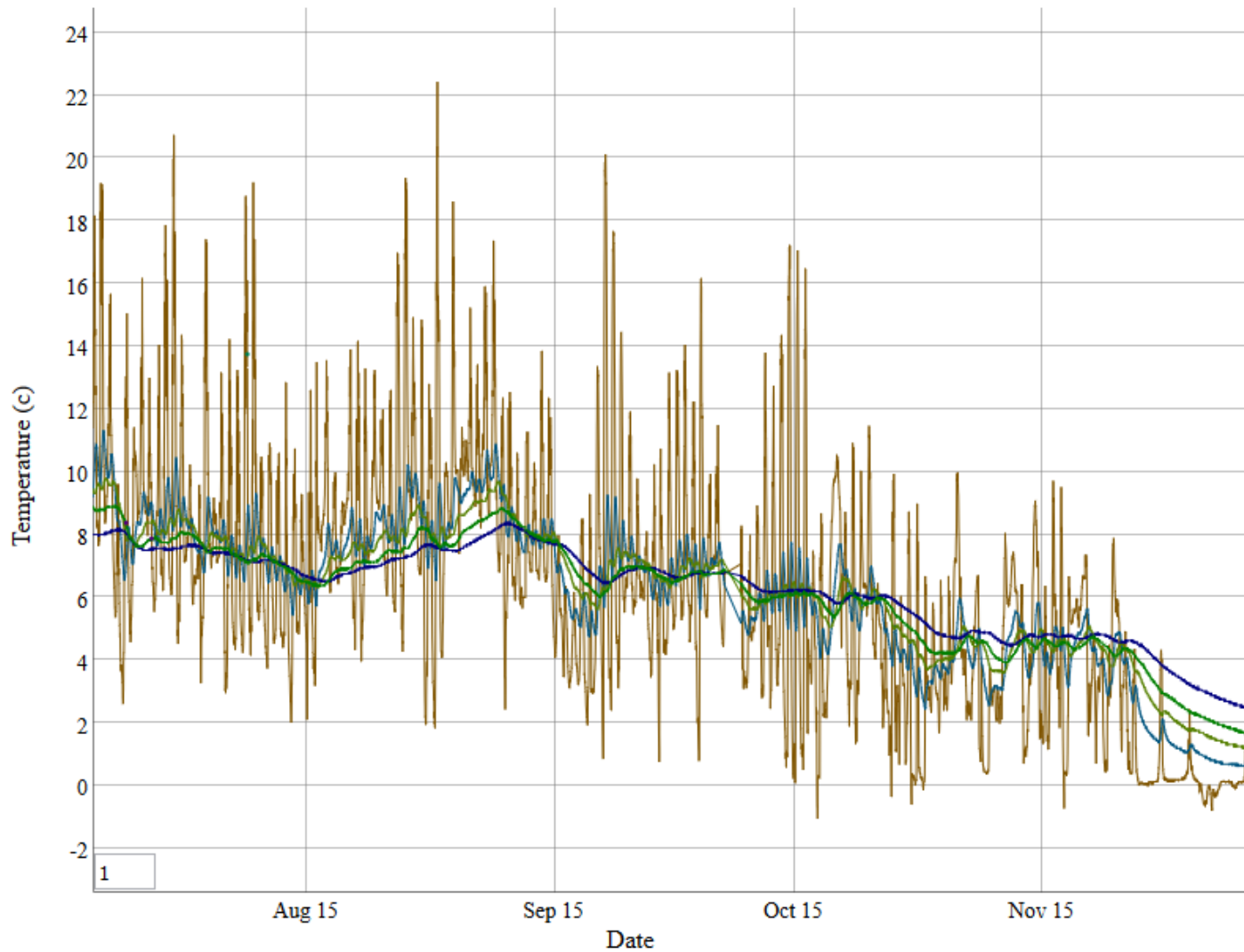


Router nodes

- Same hardware
- Better antenna
- Automatically route data



Sample Data – peat profile



IoT sensing with standards based protocols: 6LowPAN, sub-GHz, CoAP

We think this was the first real sub-GHz 6LowPAN CoAP deployment

The team:

Geography and Environment: Jane Hart

Electronics and Computer Science:

- Kirk Martinez, Philip Basford, Graeme Bragg, Daniel Playle, Arthur Fabre, Tyler Ward
- Dundee Geography: Olivia Bragg and Andrew Black
- Wildland Ltd
 - Sebastian Bader (Mid-Sweden University)



More info: www.mountainsensing.org
k.martinez@soton.ac.uk