

# Community Networking in Scotland

## Networks on the periphery of Europe

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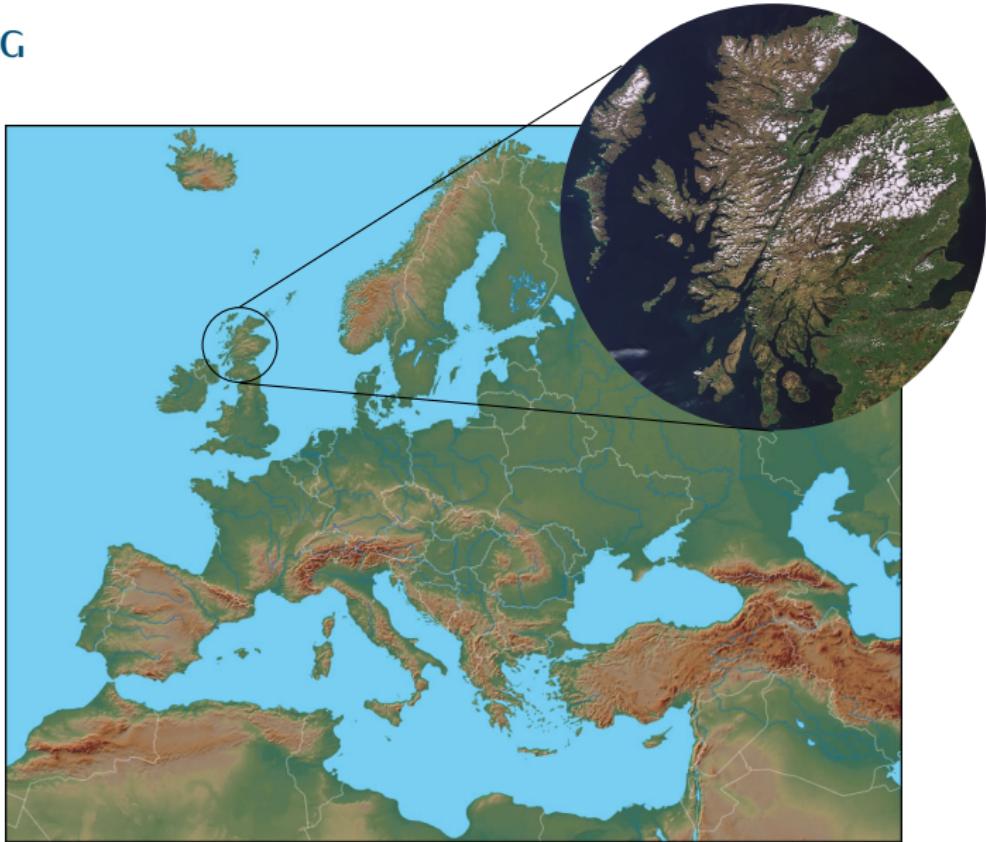
RIPE69 London  
November 3<sup>rd</sup>, 2014



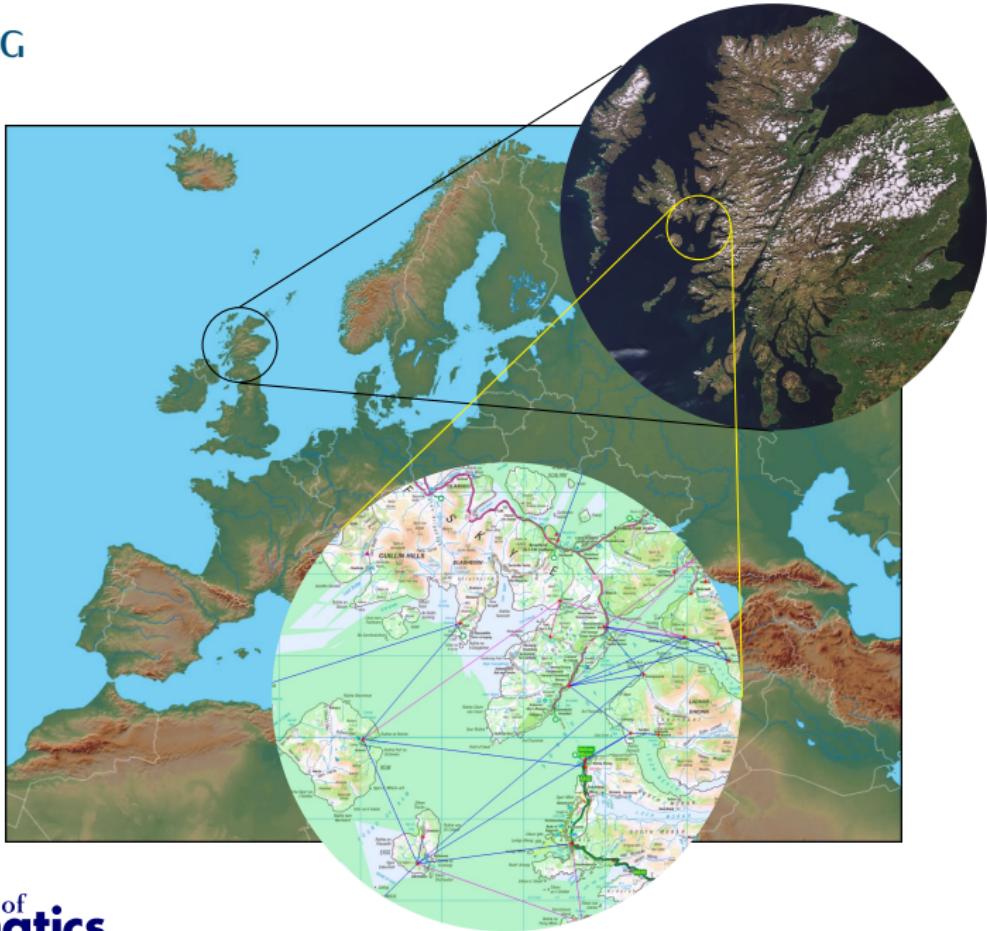
# SETTING



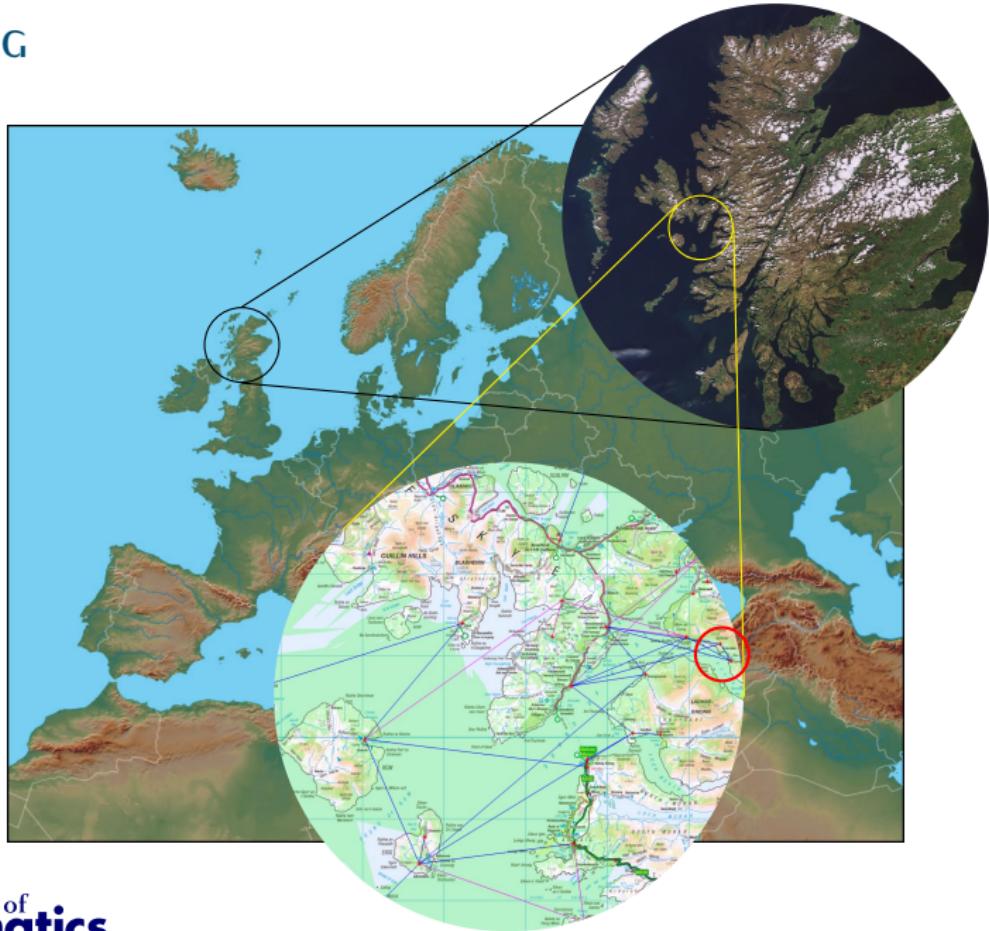
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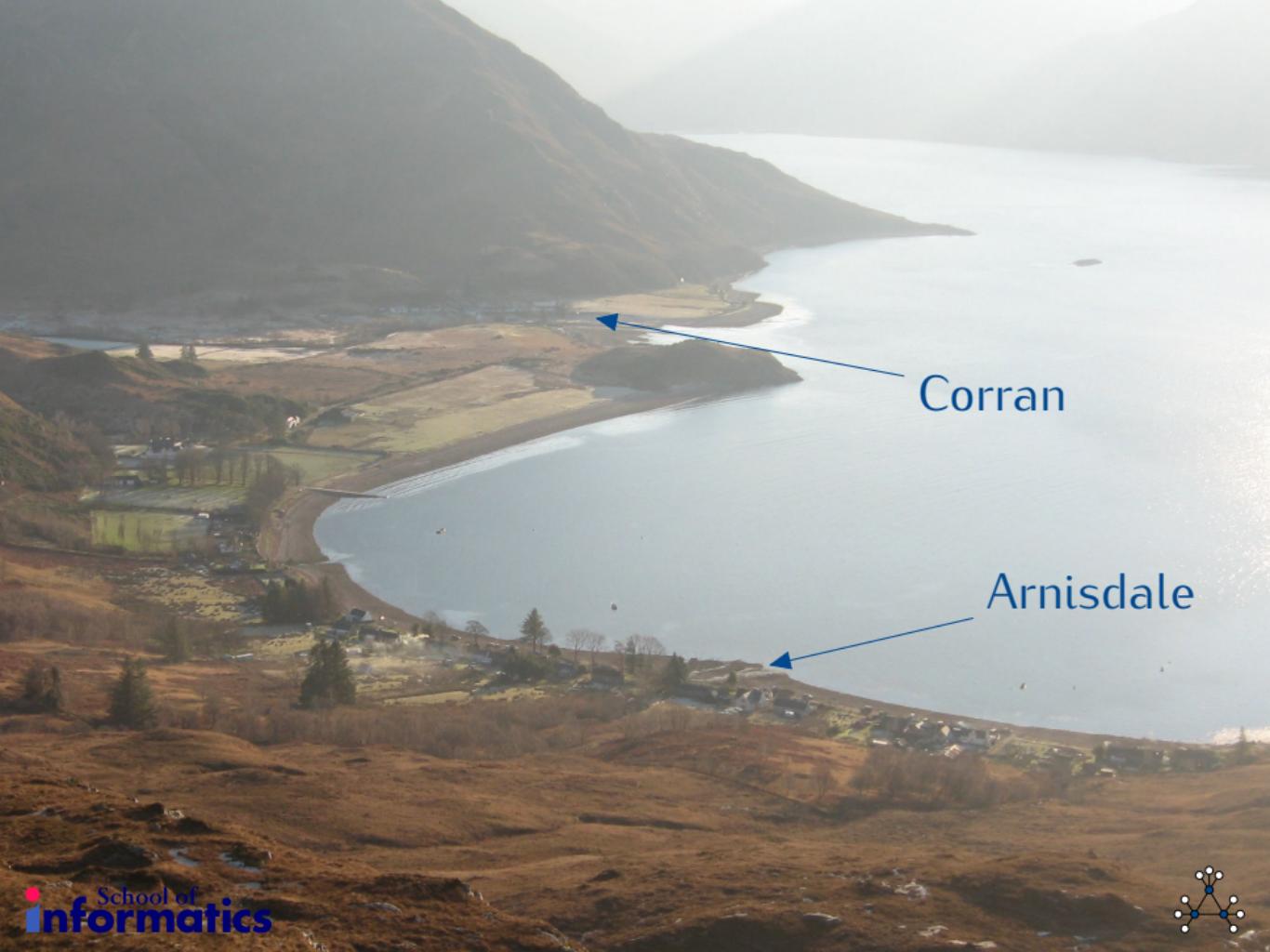


# SETTING



# SETTING





Corran

Arnisdale



# ARNISDALE

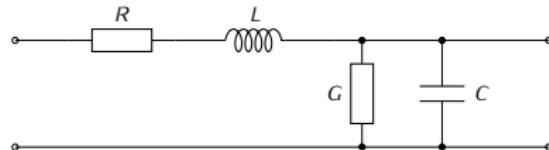
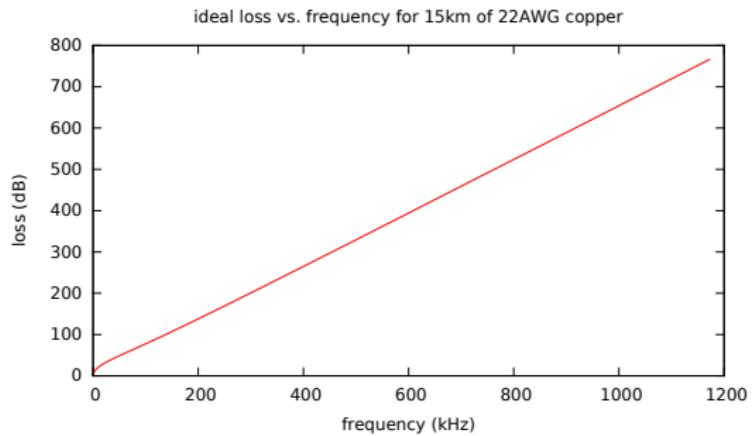


- ▶ 9 miles = 15km from the telephone exchange at Glenelg
- ▶ Copper wire barely good enough for 2400 baud
  - ... Nevermind \*DSL
- ▶ Anyways, Glenelg only has maybe a couple of E1s
- ▶ Ladhar Bheinn blocks satellites (& slow & expensive)
- ▶ Residents wrote many letters to BT, politicians
  - ... to no avail
- ▶ Eventually decided to build a network themselves



# ARNISDALE

9 miles = 15km from the telephone exchange at Glenelg



# TEGOLA<sup>1</sup>

- ▶ Tegola – Loch Hourn from 2008.
- ▶ Trial link from Corran 15km to Isleornsay sharing 512kbps ADSL.
- ▶ Expanded to a ring of six masts
- ▶ Gateworkx, OpenWRT, Quagga, OSPF, 802.11a
- ▶ Giacomo Bernardi, Peter Buneman, Mahesh Marina (UoE)
- ▶ Upstream bandwidth from UHI Sabhal Mòr Ostaig



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<sup>1</sup>An Italian word meaning *tile*, this name is in honour of the effect of wet roof tiles on 2.4GHz RF propagation which beset some early experiments.



# THE NEIGHBOURS

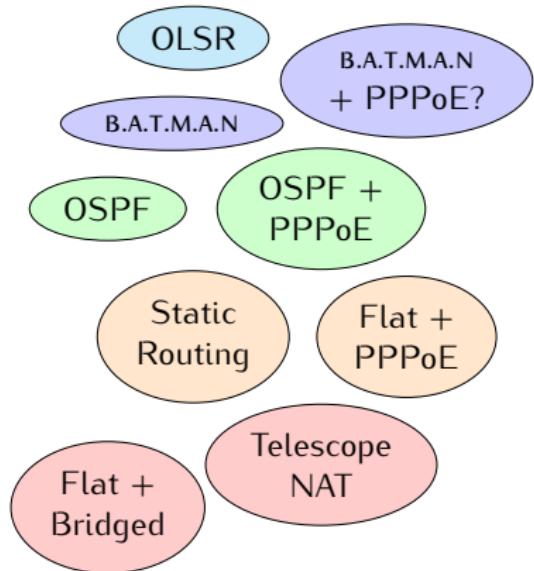


- ▶ Nearby islands **Eigg**, and **Rum** build networks on a similar model with advice from Tegola.
- ▶ **Knoydart** in the next Loch builds theirs with help from Eigg.
- ▶ Later, **Applecross** to the north joins in...
  - ... and **Locheil**
  - ... and northern **Mull**
  - ... and **Sleat**
- ▶ Farther afield **Laggan**, **Lothian** and others...



# MANY ARCHITECTURES

- ▶ Not centrally managed
- ▶ Local networks built according to local skills – *very important*
- ▶ Aversion to dynamic routing
  - ... but we want redundant paths
  - ... more important for remote places – (MTTR, no mobile coverage)
- ▶ Symmetry is appreciated
- ▶ Vendor firmware is limited
- ▶ OpenWRT too high a barrier
- ▶ “serious” routers too expensive
  - ... also too power hungry



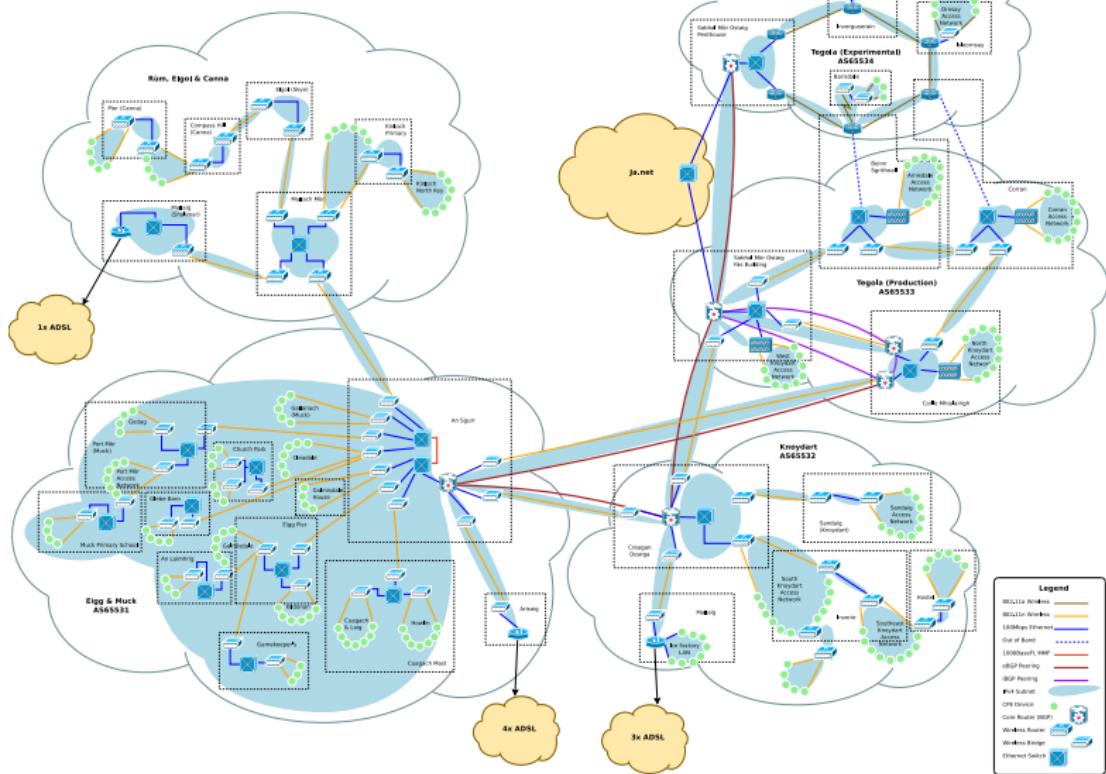
# THE INTERNET IN MICROCOISM



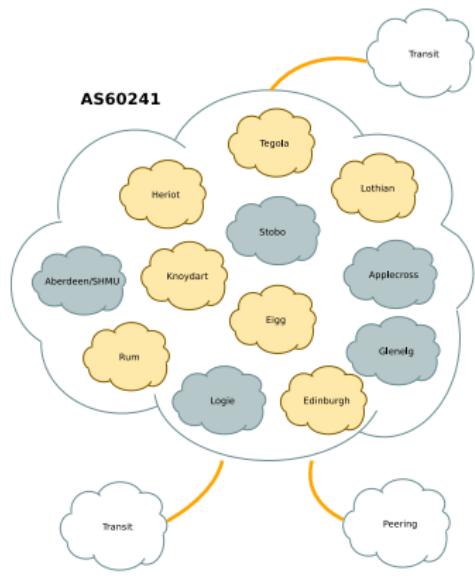
- ▶ Connect adjacent networks
- ▶ Inter-community backbone with BGP
- ▶ Cheap radios only as bridges
- ▶ FreeBSD + bird, or Mikrotik
- ▶ Let individual networks be
- ▶ Redundant paths are good
  - ▶ Fibre cut in Lochcarron takes out all BT services, our network stays up
  - ▶ Power cut takes out Sabhal Mòr Ostaig over the Christmas Holidays
  - ▶ Lightening strike melts phone lines, NHS uses community network



# WEST COAST NETWORK CIRCA 2012



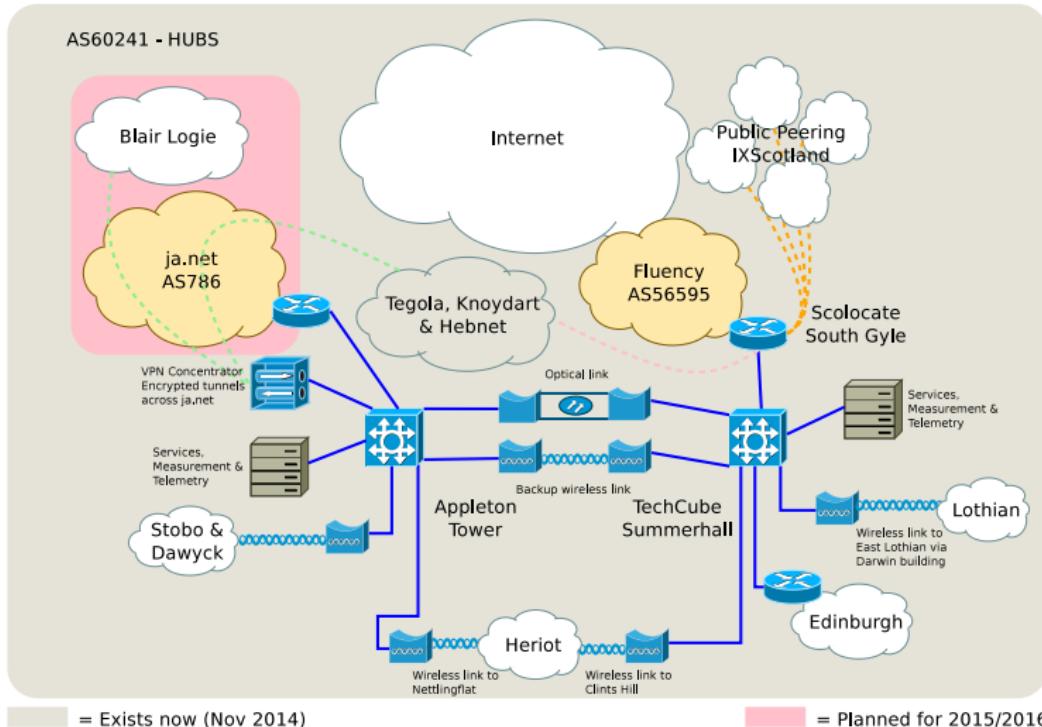
# HUBS: FORMALISING THE MODEL



- ▶ Each community network encapsulated in an autonomous system
- ▶ Retain diverse internal structures according to what the operators are comfortable with
- ▶ Collective negotiation of transit, carrier services
- ▶ Seen by the outside world as a BGP confederation behind AS60241
- ▶ Currently two confederations, the West Coast and South Scotland



# THE HUBS NETWORK (SOUTH)



# IMPACT



- ▶ Distance learning for adults (e.g. UHI)
- ▶ Distance learning for children (e.g. GLOW = Scottish schools national intranet)
  - Children on Eigg schooling even in bad weather.
- ▶ Local businesses no longer disadvantaged
  - ... have even seen *new* ones moving in!
- ▶ Telemedicine starts to be practised



# LAYER $\leq$ 7



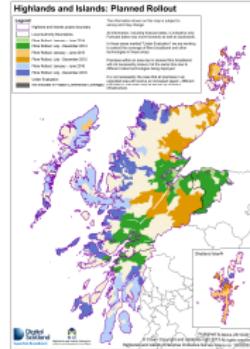
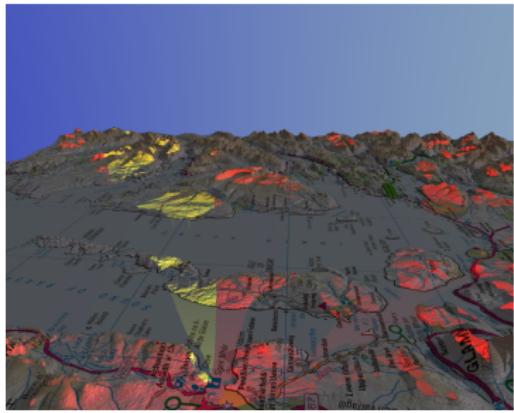
- ▶ Slow IPv6 adoption
- ▶ Variable equipment quality
- ▶ Outgrowing available capacity on the West Coast

- ▶ Heavy use of NAT breaks picocells trying to do IPSec
- ▶ Heavy use of NAT can lead Google to accuse community networks of having worms  
... Similar to anonymity networks like tor
- ▶ RFC1918 address collisions between UHI and the community networks cause pain
- ▶ Use of ADSL lines is *extremely* expensive (cf. BT WBC tariff) and providers notice

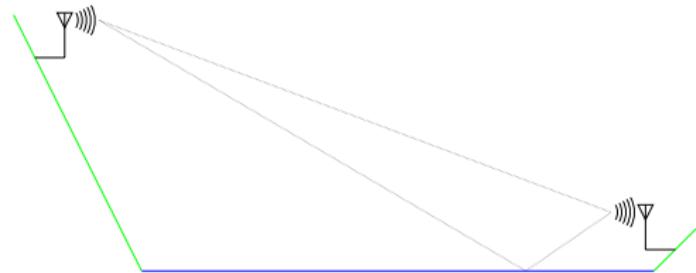


# LAYER $\geq$ 8

- ▶ Step-Change, BDUK and ScotGov funding
  - ▶ Cumbersome process
  - ▶ State Aid & Double Funding
- ▶ BT's network build
  - ▶ Anæmic Open Access
  - ▶ Opaque process
  - ▶ Territorial "disputes"
- ▶ Education – not vendor courses, not "enterprise" courses, but "West Highland (Network) Engineering"
- ▶ **Summer School Next Year – Volunteers to visit & teach?**



# PRACTICAL RESEARCH



- ▶ Tidal fading, periodic multipath reflections, off the water can be mitigated with appropriately spaced antennas on standard 802.11n hardware.
- ▶ 24GHz trials with a non-op license in Loch Hourn
- ▶ Free Space Optics trials in Edinburgh



The background of the slide is a photograph of a serene landscape. On the left, dark, rugged mountains rise from a shoreline. The middle ground shows a wide, calm body of water with several small, light-colored coves or inlets. The sky above is a pale, overcast grey, suggesting a misty or early morning atmosphere.

# Thank you

<http://www.tegola.org.uk/>  
<http://www.hubs.net.uk/>

