Fibre in Pipe Technology

Greg Whitton

CloudNet IT solutions

VENUE: LINX118

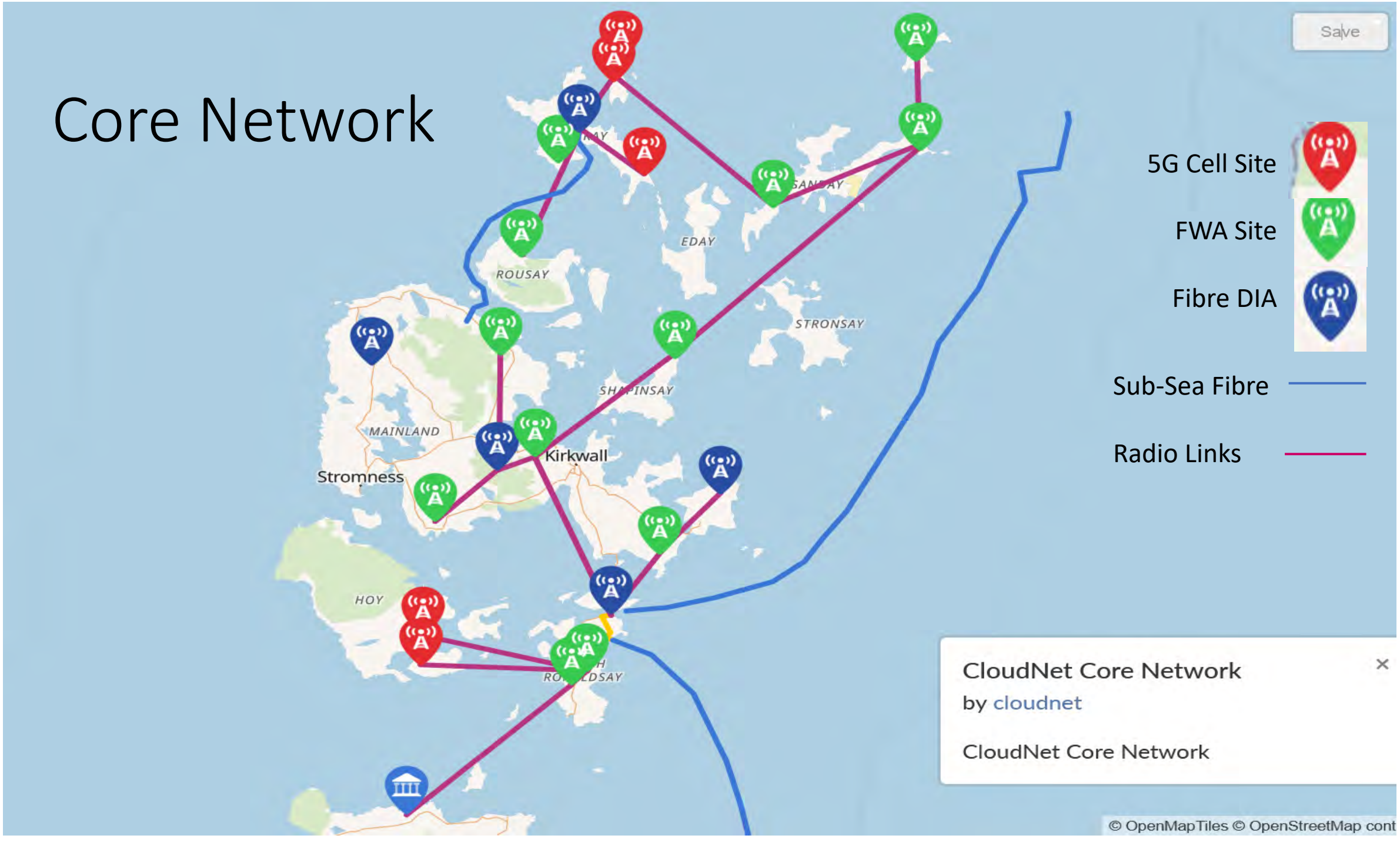
CloudNet – Wireless Internet Service Provider

- Fixed Wireless Access - BDUK/Scot Gov R100 Suppiers
  - Business/Residential Properties
  - Ship to Shore Comms
  - Aquaculture – Salmon Farming Comms and Sensing
  - IoT Gateways and Sensing
- Fibre infrastructure providers
- Innovation Testbed and Trials Location
  - TV Whitespace – Internet Connectivity to Passenger Ferries
  - 5G Trial
    - 5GRuralFirst www.5gruralfirst.org
    - 5GNewThinking www.5gnewthinking.co.uk

So?
Where is Orkney?


N
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image IBCAO
Image Landsat / Copernicus
Google Earth

Core Network



Lets Talk Fibre-in-Water Tech & Why?

- Full Fibre to 100% of Properties - Papa Westray

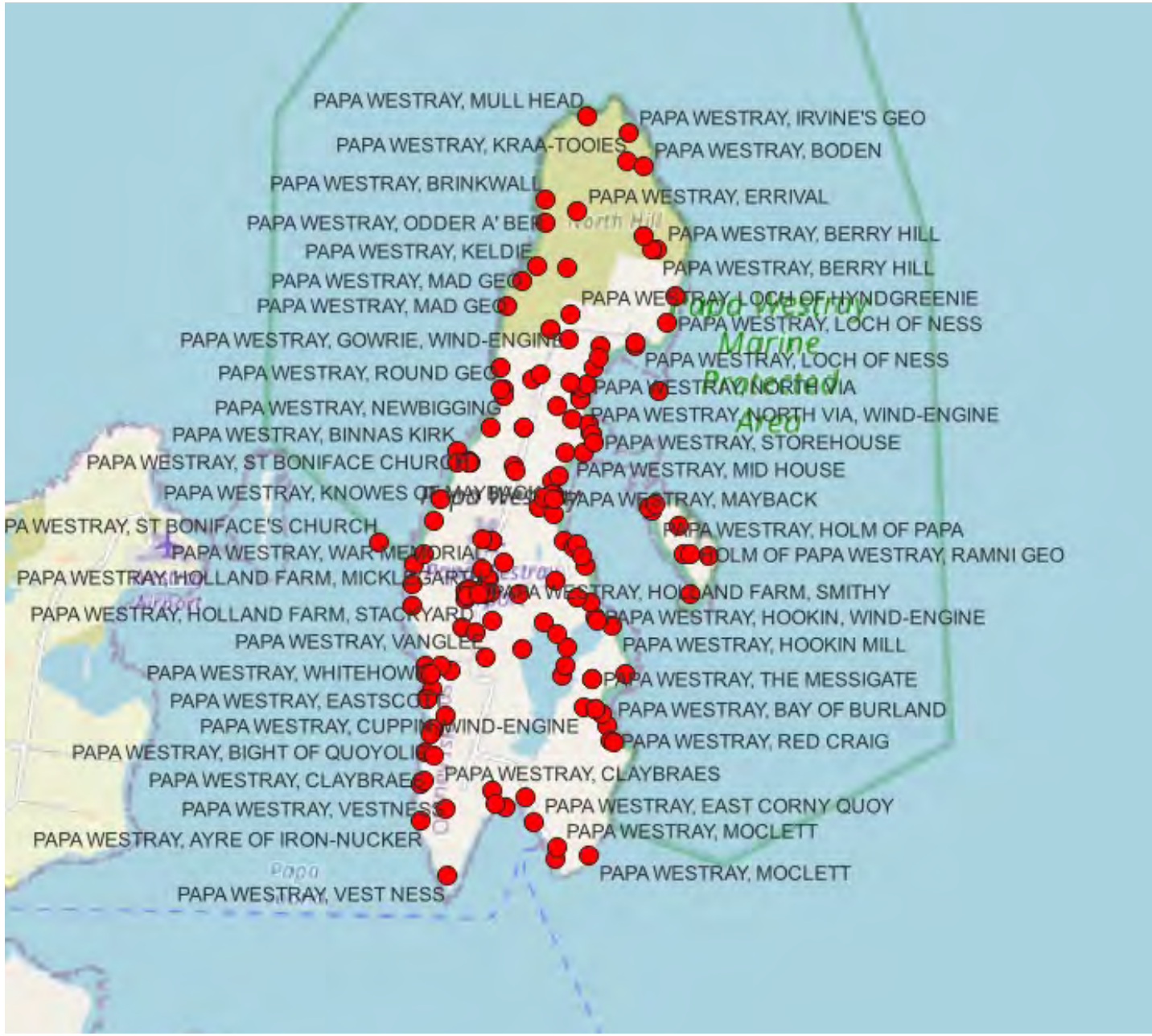
- Challenges with Planning and Archaeology.
- Council Planners – Archaeology - Orkneys neolithic history.
  - Burial tombs
  - Historic Settlements
  - Sites of historic interest
- Council Roads – infrastructure
  - Unwilling to allow us to grass verges
  - Road crossings
  - BT infrastructure

- The solution – Use Water ☺
  - Already there – and everywhere.
  - Council could not say NO!

- **Benefits**
- Reduces the cost of
  - Road Crossings / Road Closures / Excavation

- **Reduce Carbon Footprint, Water Wastage, Improved communications/data for Local Community**

Archaeology on Papay




Papay
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
00:00
Google Earth
Imagery Date: 12/14/2015 59°03'54.38" N 2°56'16.48" W elev 0 m eye alt 204.47 km

Papay Water System

- Island Demographics
  - 60 properties
  - 5 miles long
  - 1 mile wide
- Water supply is a privately managed
  - 1 Header Tank
  - 5 Pump Station with tanks
- Provides 100% of the water to the island


Papa Westray Marine Protected Area
Bewan
Hundland
Gowrie
Clestrain
Ness
Newbigging
Stripes
Rose Cottage
North Via
Quoys
South Via
Cott
Shorehouse
Kimbland
Midhouse
Hinsobrae
Turnstones
Kirkhouse
The Green
Papa Westray
Mayback
Papa Westray Airfield Fire Garage
Skennist
Kelp Store
Papa Westray Airfield And Building
Holm View
Bayview
Holland Header Tank
Nouster
Flat
Aalsker
Daybreak
Papa Westray Primary School
Links
Holland
PoP
Edgeriggs
Breckaskaill
Backaskail
Peatwell
Whitehow
North Rendall
Cuppin
Quoyolie Well
South Rendall
Windy Walls
Gayfield Valves
Southhouse
Fairview
Nistaben
Vestness
Hazedale
Waiting Room And Toilets
Moclett

Pipe Network – Fibre

- 3 miles of water network used

- The pipes used diameter
  - 63mm
  - 32mm
  - 25mm – Home Water Supply

- Fibre 5mm/2.5mm internal dia. – 4-core SM fibre pre-blown
  - However capacity not enough – Blew out the 4-core and blew in 12-core
  - One location, 2 pipes blown to well to double up capacity. 24fu for Network Capacity

- 5 Wells – Fibre to pump stations – IoT Sensors added to monitor water systems

- Network – Designed to deliver fibre as a Backhaul solution with FTTP.

Industry Approved Technology

Fully approved and certified for use in potable water

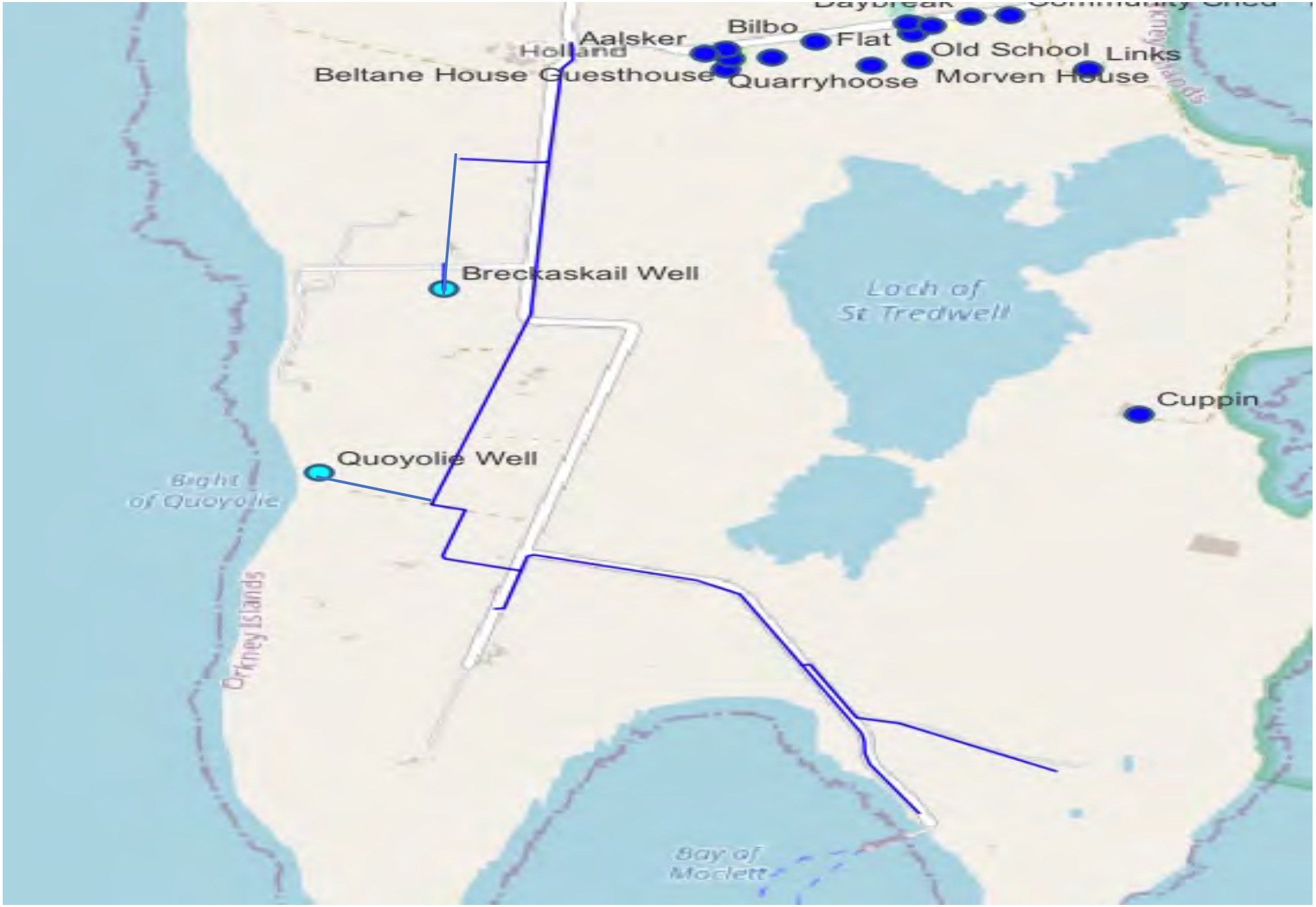
APPROVED FOR USE IN PUBLIC WATER SUPPLIES BY THE SECRETARY OF STATE UNDER
REG.31 and REG.33
APPROVED
REFERENCE: DWI 56.4.1346

WRAS
APPROVED MATERIAL

NSF
Certified to NSF/ANSI 61

NSF
Certified to NSF/ANSI 372


Bewan
Hundland
Gowrie
Clestrain
Whitelooms
Ness
Stripes
Gospel Hall
North Haven
Rose Cottage
Via Well
Orkney Islands


Aalsker
Holland
Bilbo
Flat
Old School
Links
Beltane House Guesthouse
Quarryhoose
Morven House
Breckaskail Well
Loch of
St Tredwell
Cuppin
Quoyolie Well
Bight
of Quoyolie
Orkney Islands
Bay of
Moclett

Installing Fibre into a water network

- Step 1: Know your water network.
  - Importantly
    - Where are valves
    - Joints
    - Air Valves
    - Fire Hydrants
    - Routes and depths etc
    - Valve Designs (Technical Drawings if Possible)
  - Not knowing can cause many difficulties
- Step 2: Excavate the water pipes. Keeping good clearance all around top and bottom.

Installing Fibre into a water network

Installing Fibre into a water network

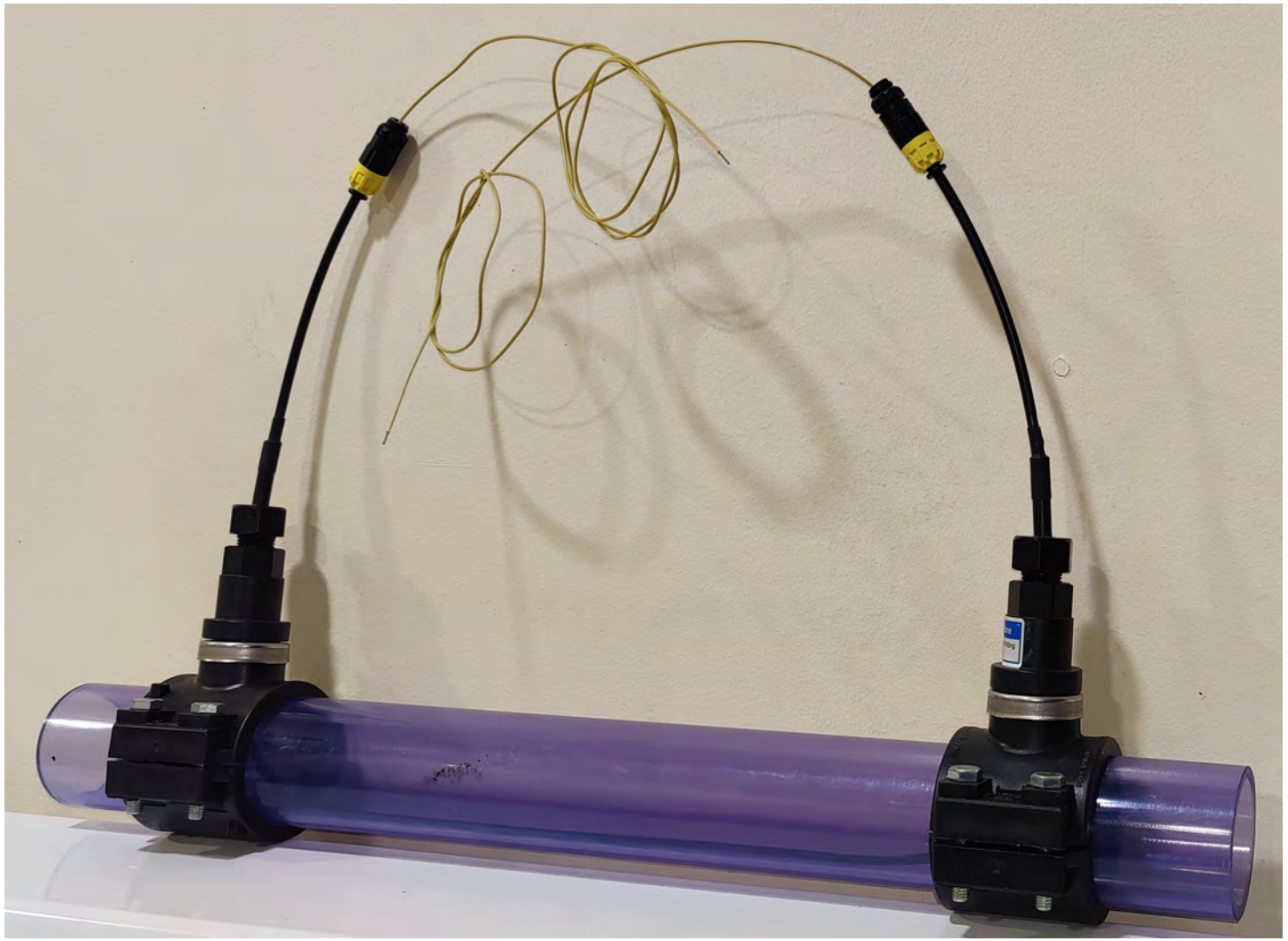
Installing Fibre into a water network

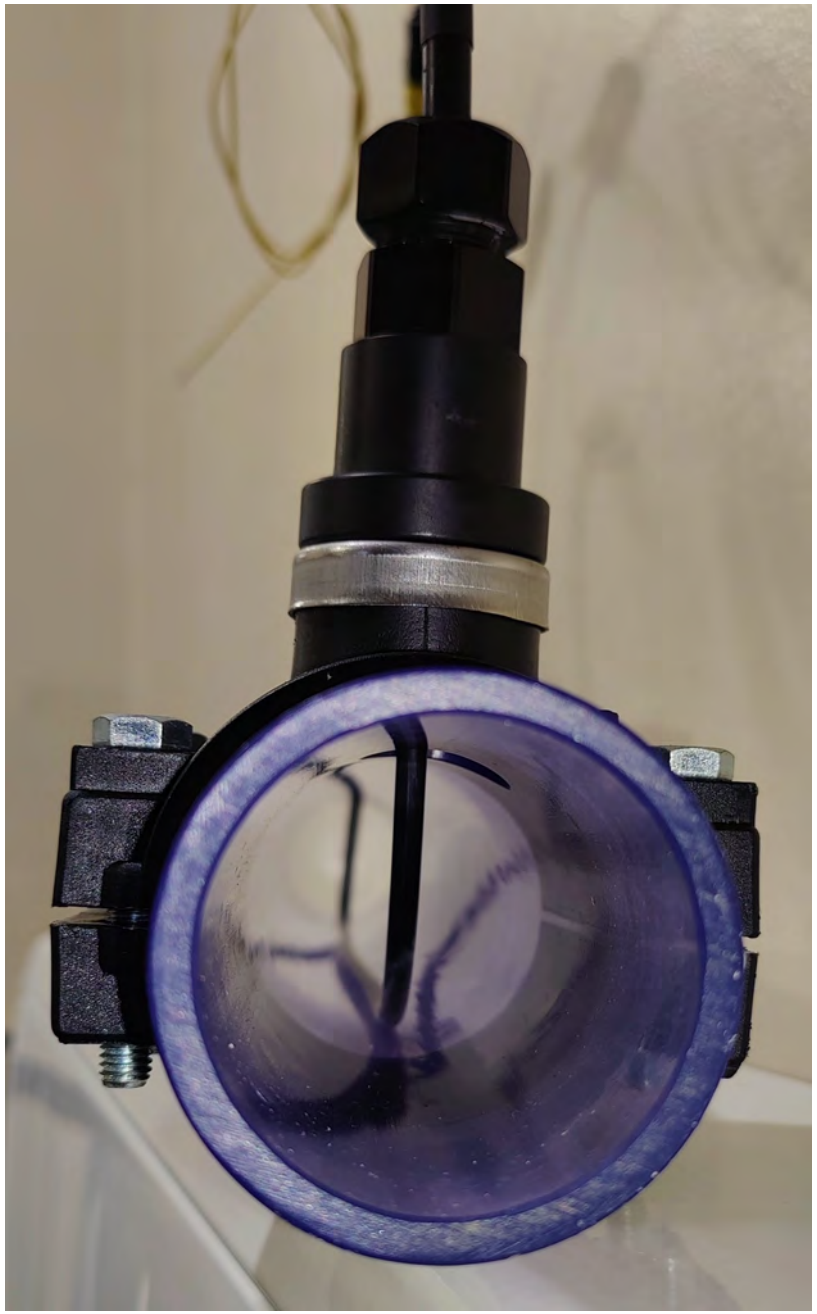
- Step 12: Pressurise the water network turning on water
- Step 13: Receiving end opens water valve – allowing water to flow
- Step 14: Pressure in water network will begin to push the fibre through the network.

- See Video

Installing Fibre into a water network

Sponge, Kite and Chinese Finger





What happens when if goes wrong

- Need to know where the fibre is.
- Can’t detect it, so need to have rough idea where. If network is known,
- Break down network. Open up valves/joints to determine reason.

- Example! Fire Hydrants. Due to the designs, water is expected to exit with maximum force. Sponges can get caught in these.

Thank you

Greg Whitton - greg@cloudnet.scot

Mobile 07725497305

Next Orkney Network Design – Marek Isalski – Faelix

https://faelix.link/linx118

5G & FTTP IN ORKNEY

MAREK ISALSKI, FAELIX
GREG WHITTON, CLOUDNET

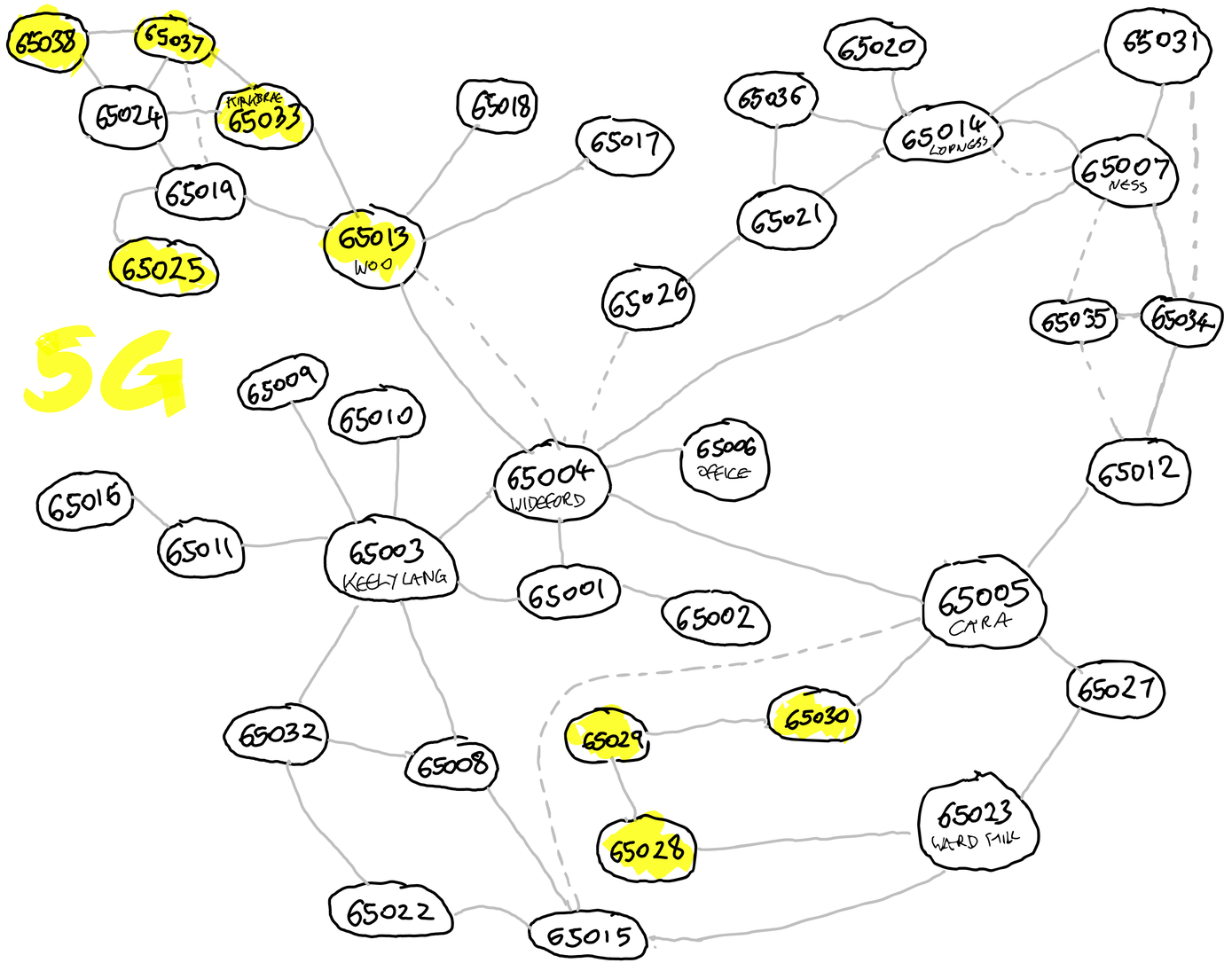
About Marek

- CTO @FAELIX – https://faelix.net/
  - Small consultancy helping alt-nets build and scale
  - LINX ConneXions Partner
- PC @uknof – https://uknof.uk/
- Crew @net_mcr – https://www.netmcr.uk/
- Tweet @maznu — or our mascot @NetworkMoose

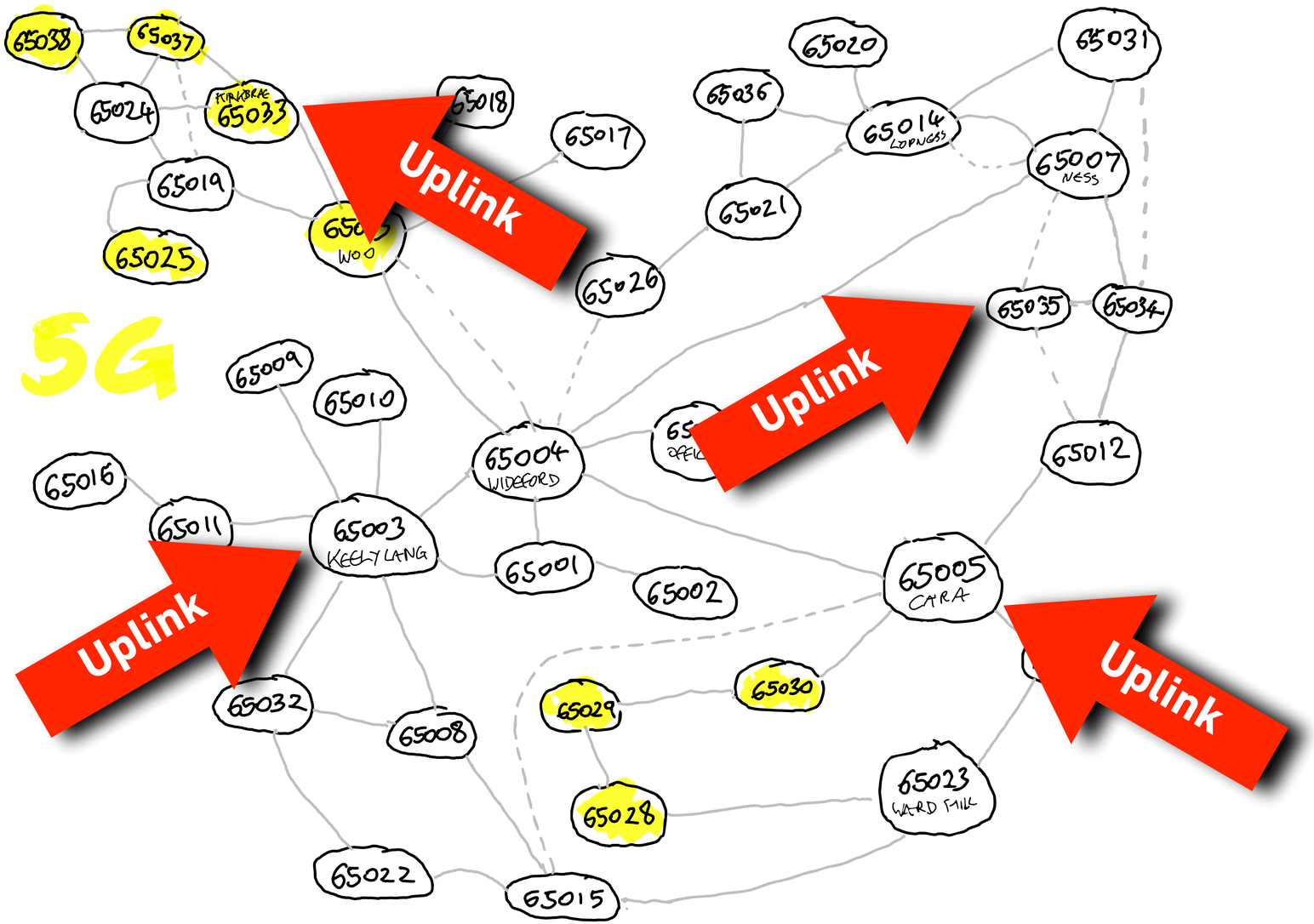
- Joining **Greg Whitton**, of **CloudNet** in Orkney

FWA TO FTTP

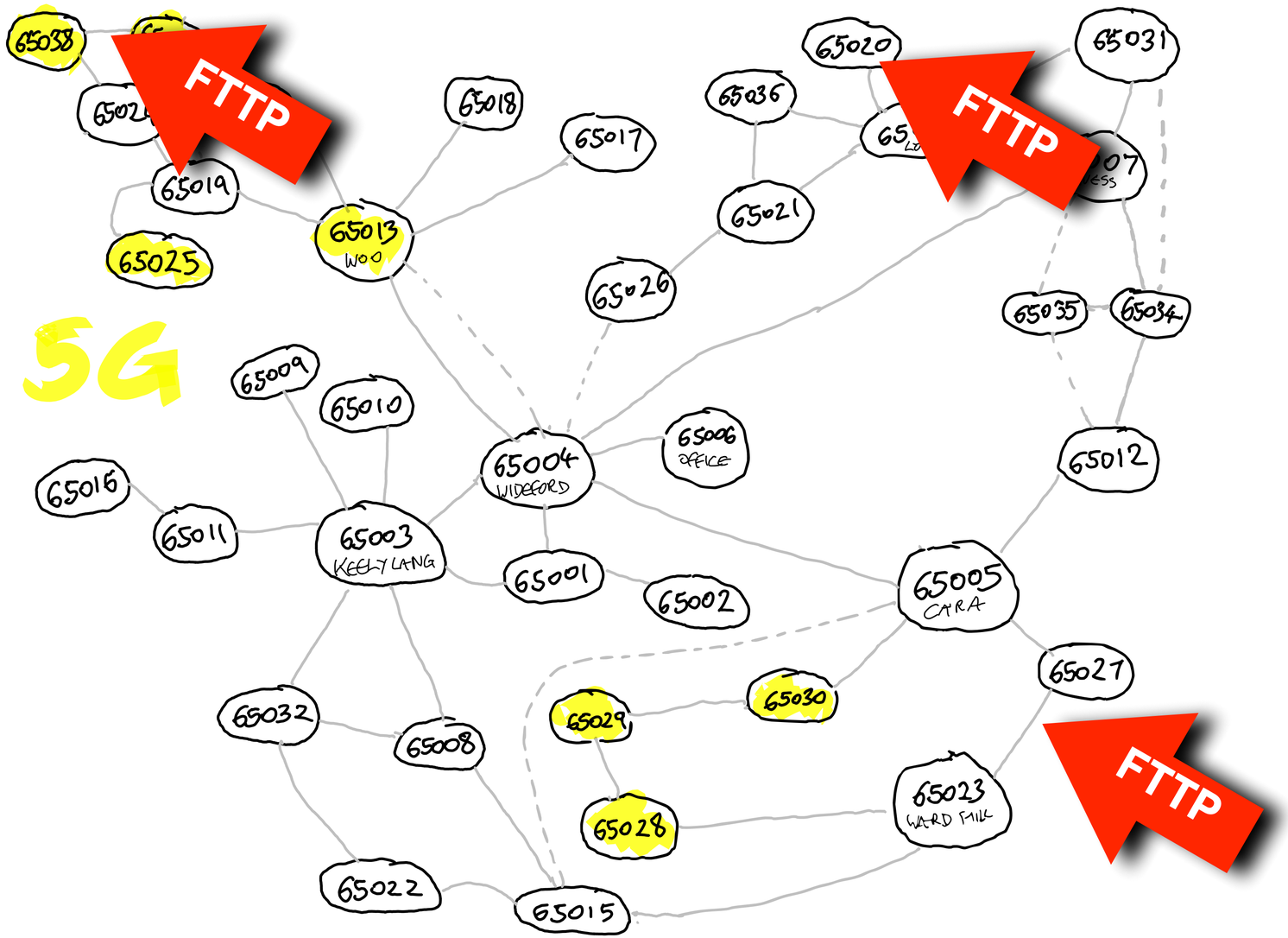
Architecture



Uplinks / Backhaul



Future/Current Builds



No Pets Allowed!

- Same equipment at every site
  - Easier for sparing
  - Easier for automation/configuration
- Same cabling at every site
  - Production-line process for pre-build
- But not every site is identical?
  - LLD is a component-based template
  - What moving parts do we need at this site?

BUILD: A TYPICAL DAY

Grab the Gear


RADIO
MEDIA
PHONE
Dial
GW 1+
vodafone UK
Telephone
TRAFFIC
SETUP

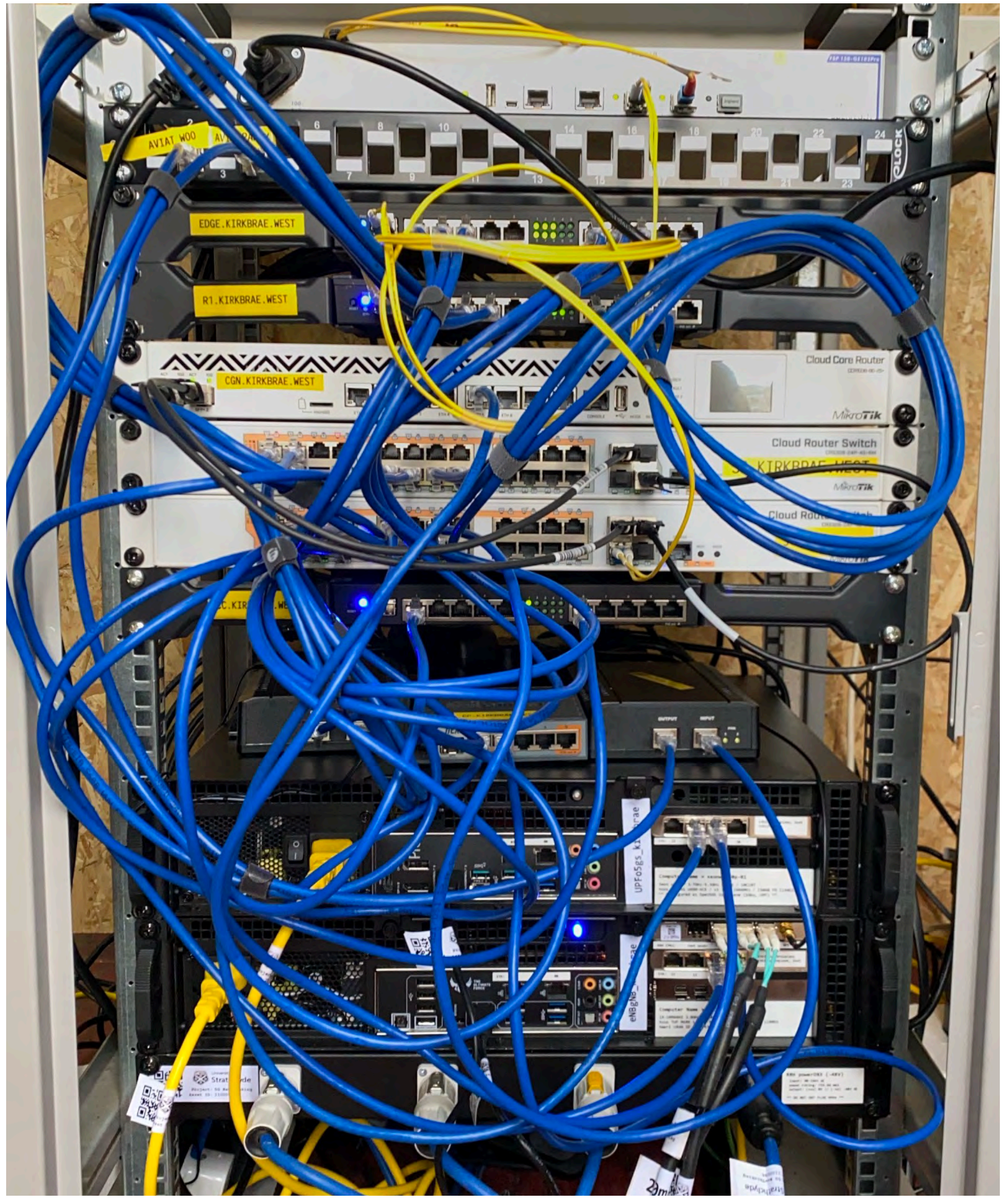

PERIODICAL
INSPECTIONS


Orkney Inter Island Air Service
This is to certify that
@NETWORK MOOSE
has flown on the
World's Shortest Scheduled Air Service
between the islands of
Westray and Papa Westray
as authenticated by Guinness World Records

Get to Site

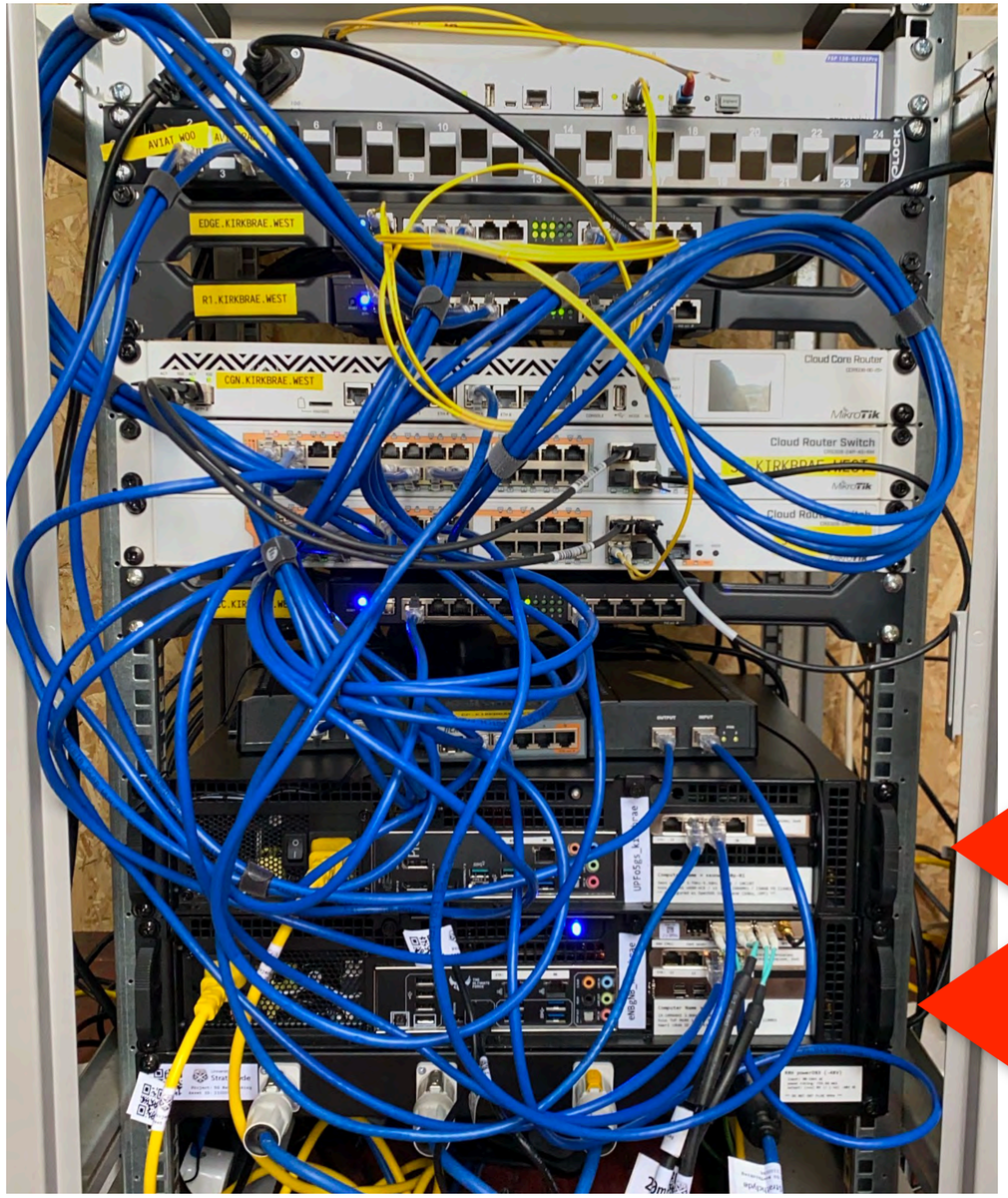
Sunny Day

Nice Day



The Most Complicated POP Site

ISP: Backbone, Backhaul



The Most Complicated POP Site

5G: User Plane (GTP)

5G: RAN (eNB/gNB)

ACCESS TECHNOLOGIES

Shared Medium vs Glass

- When you bring >1Mbit/sec Internet to an area for the first time, users don't immediately have "average utilisation" (no streaming subscriptions)
  - Ofcom 2022 average of 453GB/month (1.5Mbit/sec), with up to 30% growth per year
- 5G shared medium with ~100-300Mbit/sec capacity suffices for ~30-70 homes
  - But for how long?

IPoE or PPPoE?

- Legacy "traditional FWA" network used DHCP
  - Migration to PPPoE to deploy central BSS/OSS
  - Most customers get CGNATv4 and native IPv6
  - For customers who need public IPv4, less subnetting wastage of IPv4 (just 1x /24) via PPPoE
- 5G FWA trial network used SIM authentication
  - 5G core could have authenticated with BSS/OSS via RADIUS, but this was not necessary for trial

Architecture Choice

- Treat FTTP aggregation just like a radio "sector"
  - 1:n if using PON-type technology
  - 1:1 for dedicated fibre (and VLAN) to each customer
- New FTTP build to be a PPPoE-based access network
  - Unplug CPE from radio, plug into media converter
- Gives ability to consume wholesale services from BT
  - Unplug CPE from radio, plug into modem or ONT

Results

- Customer performance significantly improved
  - e.g. one customer regularly hitting 150Mbit/sec
  - (<1Mbit/sec available from $national_incumbent)
- Network manageability should be simplified
  - Customer public/CGN IP allocations from RADIUS
- Loop-free via L3 routing rather than STP
  - Improved resilience for rain/tide fade, failures

The Team

LET'S DISCUSS LAST MILE

E: marek @ faelix . net
T: @faelix
W: https://faelix.net/

E: greg @ cloudnet . scot
T: @cloudnet4
W: https://www.cloudnet.scot/