5G New Thinking: Orkney Network

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Key 5GNT Project Aims

5G New Thinking aims to **empower rural communities to take control of their connectivity.**

❑ We will do this by **developing a 5G community network deployment toolkit** that communities and/or local, non-mainstream network operators can make use of in order to…

❑ **…design, build, and operate commercially viable and sustainable mobile or FWA networks** in areas which none of the mainstream MNOs are serving (i.e. full not-spots) or in areas which one or more, but not all, of the mainstream MNOs are serving (i.e. partial not-spots) and / or in areas where home broadband falls significantly below government minimum guidelines.
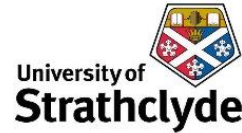
5G new thinking

The 5GNT Consortium

CISCO — Lead Partner

University of Strathclyde — Principal: Engineering / R&D

federated wireless — Spectrum Sharing

CloudNet IT-Solutions Ltd — Rural Deployment

BBC R&D — Broadcast & on-line safety

leapfrog energising communities — Private Finance

Neutral Wireless — 5G NR Technologies

ORKNEY ISLANDS COUNCIL — Civic Lead Partner

The Scotland 5G Centre — Scotland Integration

SHEFA — Managed Telco Services

RuralFirst — BenCom / Cooperative

UNIVERSITY OF SURREY 5GIC — Emergency Network & MNOs

University of Glasgow — Health and Welfare Tech Lead

Borderlands Inclusive Growth Deal — Scottish/English Border

zoetis — Animal Management

Rural Community Network SUPPORTING RURAL COMMUNITIES — N. Ireland

Bogons — Private Fibre Networks
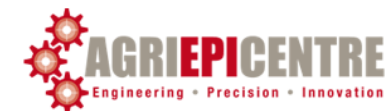
AGRIEPICENTRE Engineering · Precision · Innovation — Agri-Technology Lead

3

Toolkit for Private Community Networks

StrathSDR

5G Rural Toolkit

- **Identifying Your Connectivity Needs**
  - Your Community
  - Aims & Ambitions
  - Usage Scenarios

- **Business Models**
  - Strategy
  - Service Offerings
  - Target Markets
  - Revenue Models
  - Costs

- **Organizational Matters**
  - Company Types
  - Structure & Set-Up
  - People/HR
  - Legal Aspects

- **Funding & Finance**
  - Investors
  - Grant Funding
  - Loans

- **Operations**
  - Network Management
  - Maintenance
  - Billing
  - Customer Relations
  - Subcontracted Services

- **Technology & Engineering**
  - Cellular/5G RAN
  - Backhaul
  - Cores
  - Masts & Power
  - CPE

- **Radio Spectrum**
  - Licensing
  - Regulator
  - Govt
  - MNOs

- **Sites & Planning**
  - Consent Process
  - Local Authority
  - Local Residents

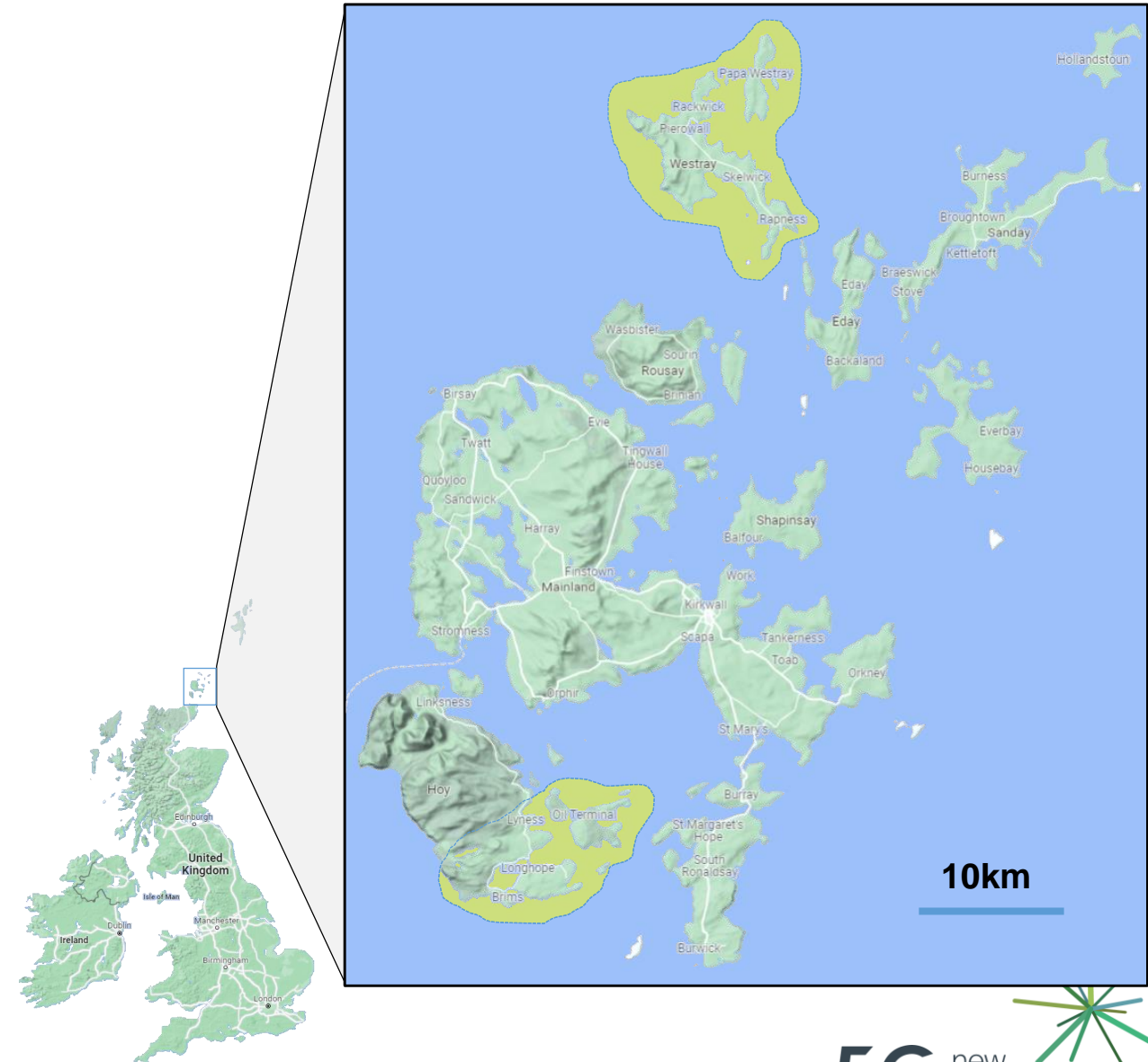5G new thinking

4

Building Private 5G Networks

- Aims and ambitions
  - Why do you *need* 5G?
  - What use cases do you envisage?

- Biz Models, Funding, Finance
  - Strategy
  - Target markets, service offerings
  - Revenue models
  - Investors, grant funding, subsidy schemes

- Legals

- Radio Spectrum
  - RF surveys to identify vacant bands onsite
  - Shared spectrum?
  - Sub-leasing from MNOs

- Understanding of Tech eco system
  - UE band capabilities
  - Radios, core networks, edge capabilities

- Network design
  - Macro/ small cell
  - RF coverage simulations
  - Identify most optimal basestation sites
  - Landowner negotiation
  - Planning permission
  - Backhaul network design, L2/L3 and fibre
  - Cellular traffic routing, VPNs
  - Resulting estimated CAPEX/OPEX costs (feed back to biz model)

Building Private 5G Networks

- Procurement

  – Masts, power, fibre, site office, land

  – 5G radios, antennae, 5G stack servers

  – 5G core, edge user plane servers

  – 5G UEs

  – SIM cards

- Build and Maintenance

  – Civils, logistics, cranes, rigging team

  – 5G RAN and Backhaul network commissioning

  – Network "bring up"

  – Network testing

  – SIM card enrolment

  – Ongoing network health monitoring

- Pre-roll out

  – Billing

  – Customer management

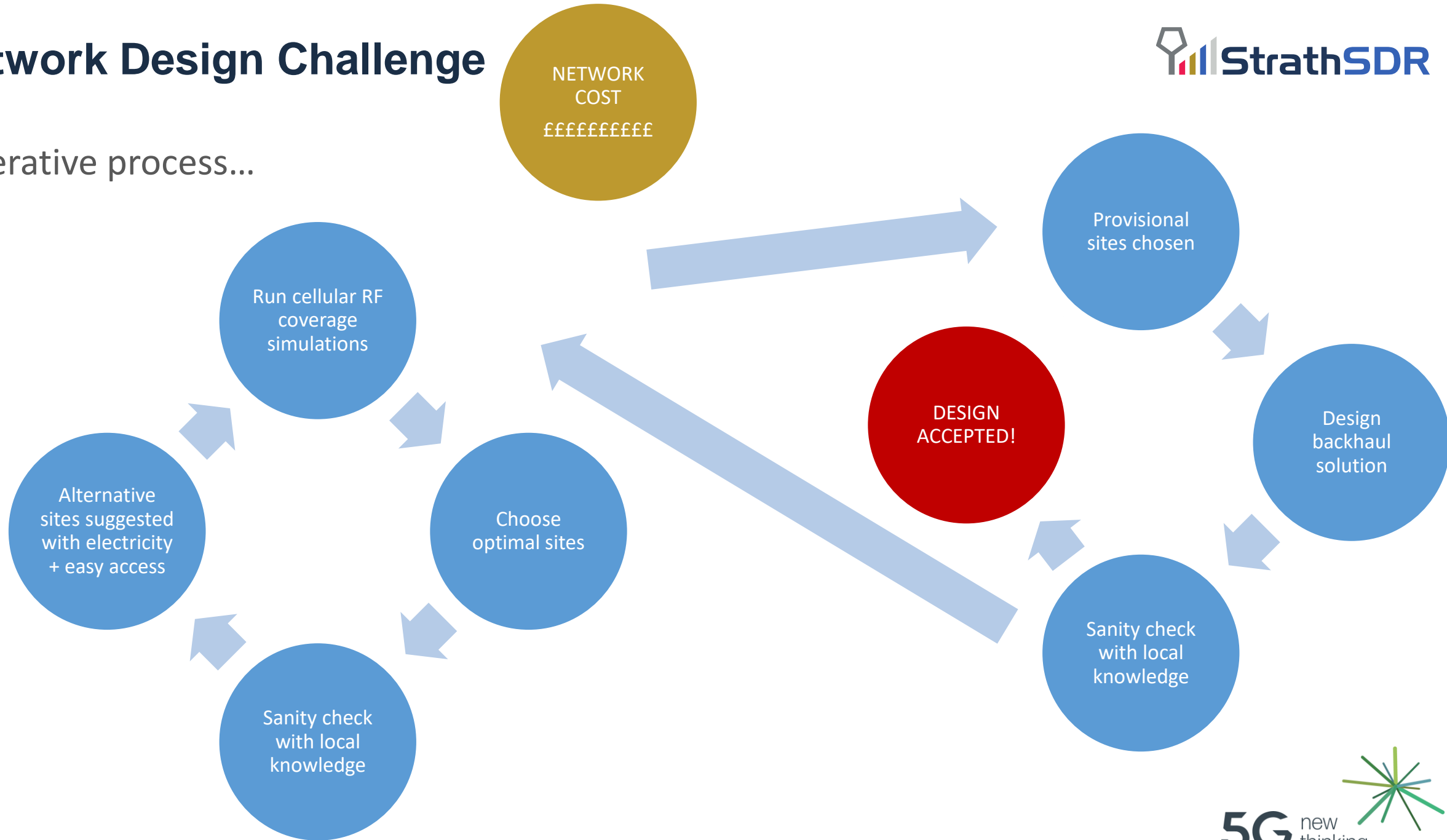 – Subcontracted maintenance services

  – Customer sign up?

- Go live

Orkney Testbed Locations

- Some of the most remote islands in Orkney

- Population densities can be as low as **5 inhabitants per km²**

- Residents currently live with fixed **broadband speeds <2Mbps DL**

- Patchy 4G coverage from **single MNO**, patchy 2G from others

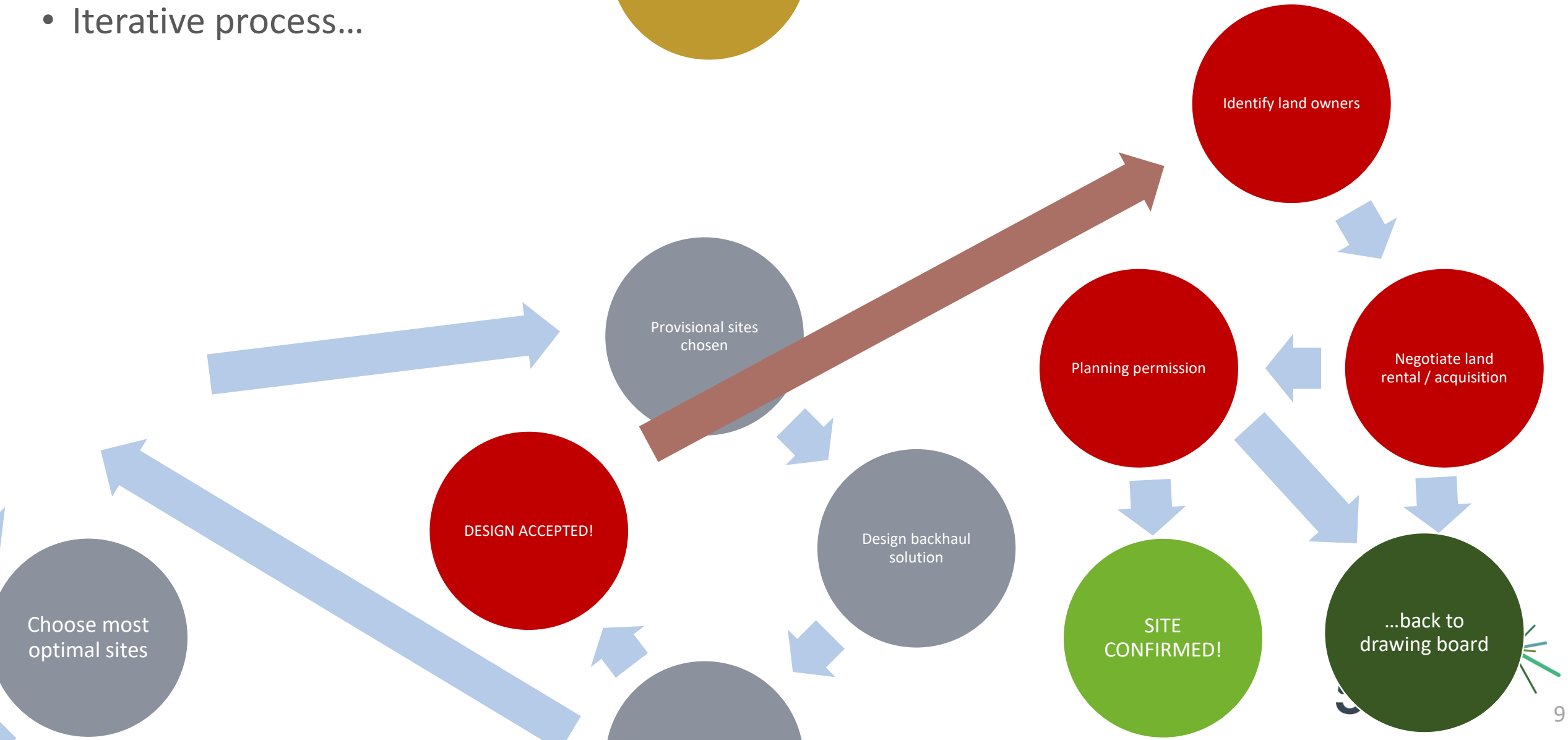- Linked to Wave 1 Rural project

10km

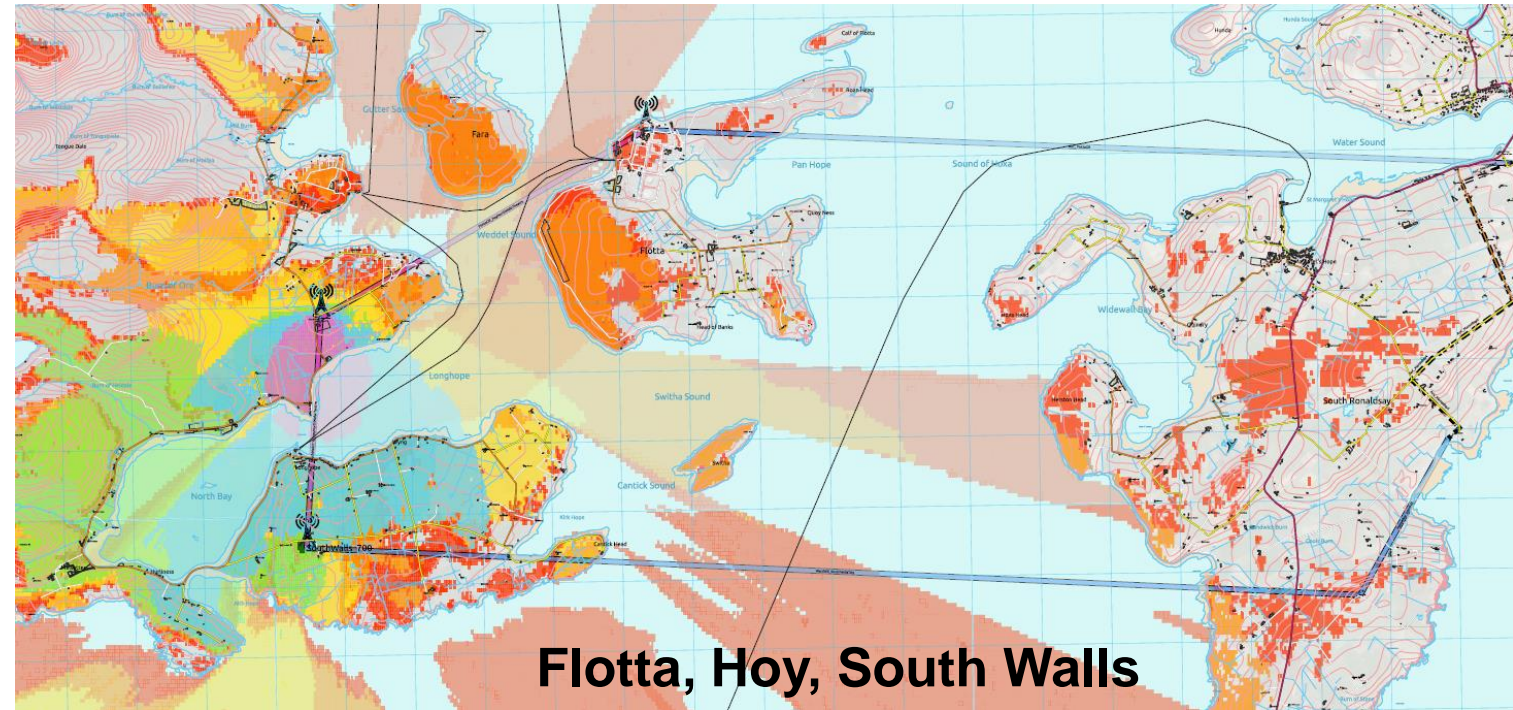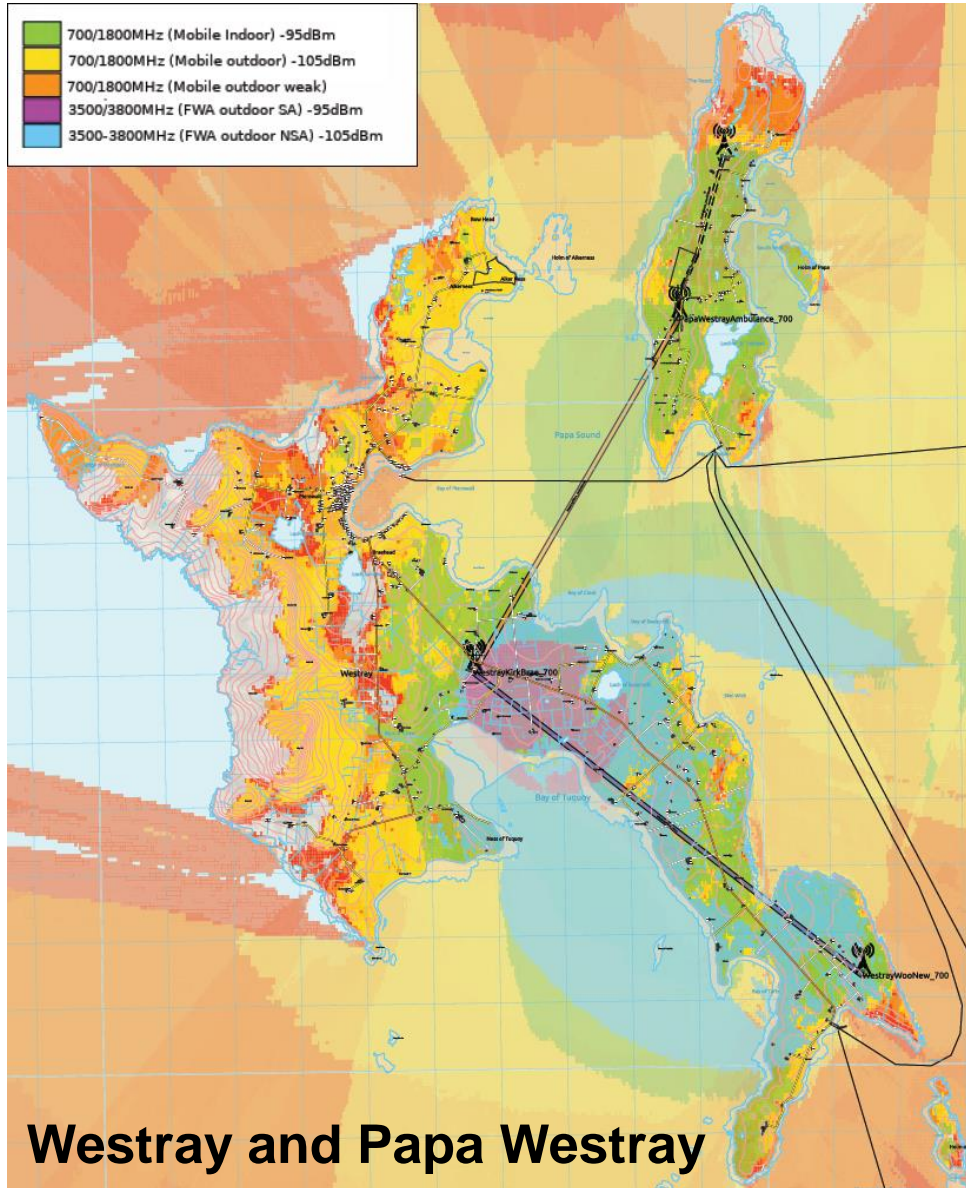# Network Design Challenge

- Iterative process…

NETWORK COST
££££££££££

Provisional sites chosen

Run cellular RF coverage simulations

DESIGN ACCEPTED!

Design backhaul solution

Alternative sites suggested with electricity + easy access

Choose optimal sites

Sanity check with local knowledge

Sanity check with local knowledge

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Network Design Challenge

- Iterative process…

NETWORK COST

££££££££££

Identify land owners

Provisional sites chosen

Planning permission

Negotiate land rental / acquisition

DESIGN ACCEPTED!

Design backhaul solution

Choose most optimal sites

SITE CONFIRMED!
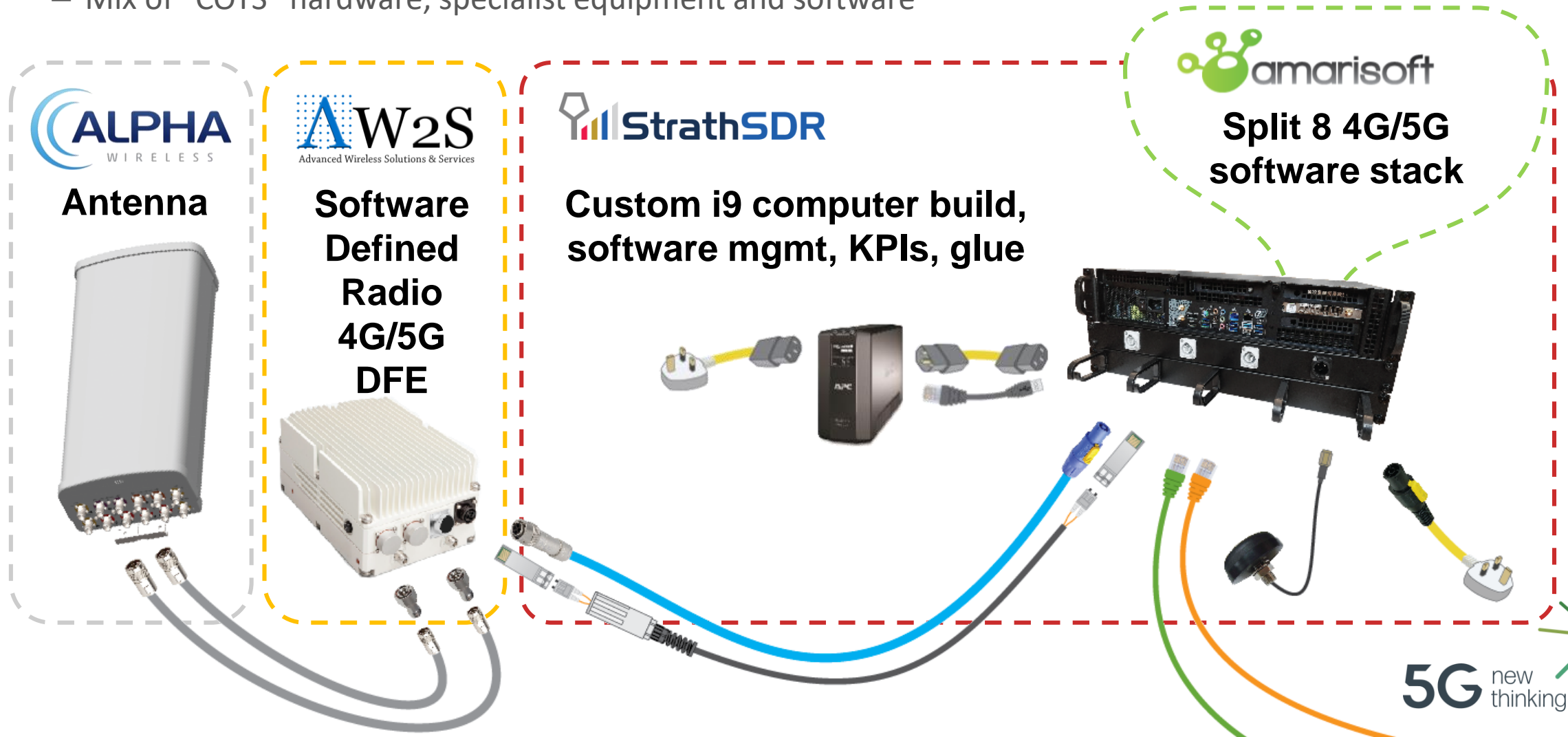
…back to drawing board

Network Design

- Eventually aim to end up with

  – Network design for ***coverage*** (likely a compromise, not the best RF solution)

  – Landowner agreement

  – Planning permission submitted and accepted

  (….basically means your network is good to go)

- Identify potential customer base

  – Contention calculations, work out if additional radios are required for ***capacity***

- Get quotes, complete CAPEX BOM, make the decision about whether to proceed
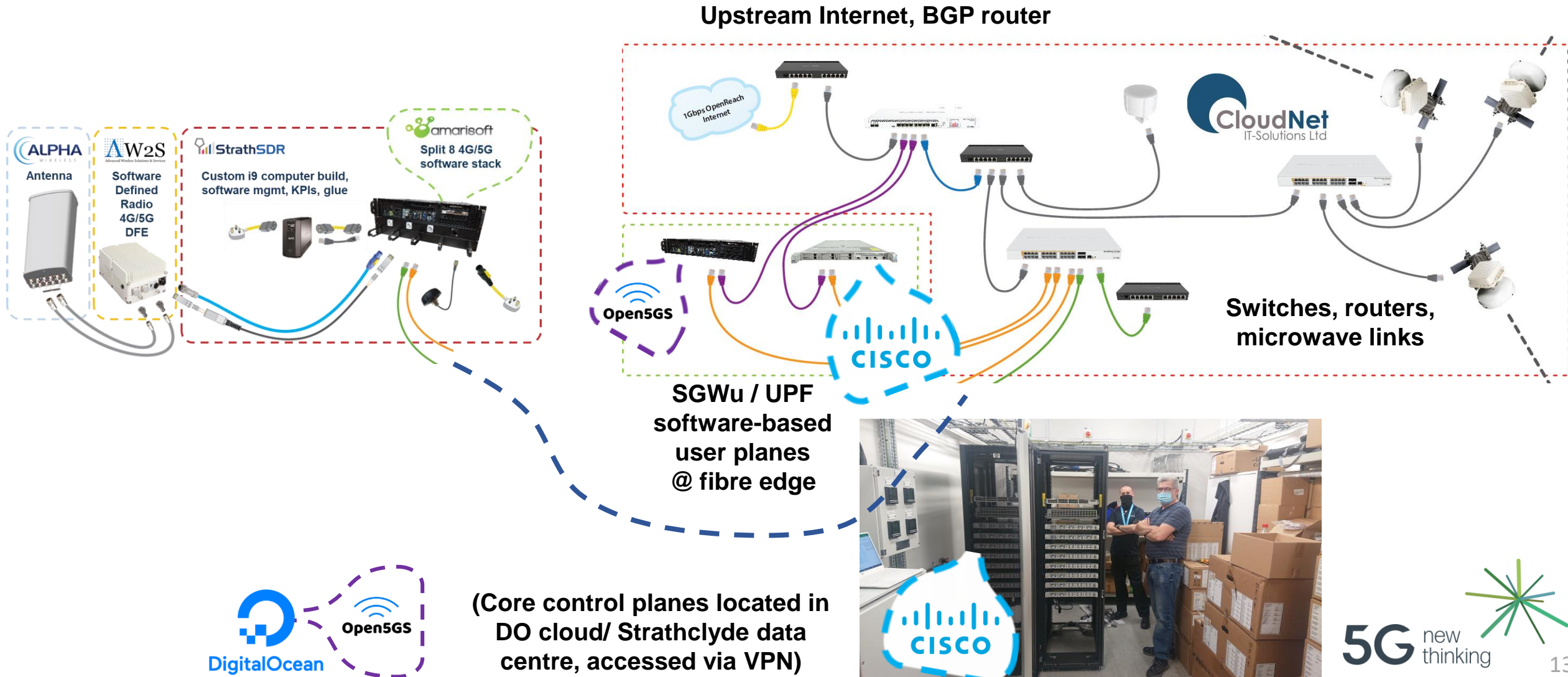
Network Design

Legend:
- 700/1800MHz (Mobile Indoor) -95dBm
- 700/1800MHz (Mobile outdoor) -105dBm
- 700/1800MHz (Mobile outdoor weak)
- 3500/3800MHz (FWA outdoor SA) -95dBm
- 3500-3800MHz (FWA outdoor NSA) -105dBm

Westray and Papa Westray

Flotta, Hoy, South Walls

Network Design

- 5GNT basestation site:
  - Mix of "COTS" hardware, specialist equipment and software

Antenna (ALPHA WIRELESS)

Software Defined Radio 4G/5G DFE (W2S — Advanced Wireless Solutions & Services)

Custom i9 computer build, software mgmt, KPIs, glue (StrathSDR)

Split 8 4G/5G software stack (amarisoft)

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12

Network Design

- Backhaul and core equipment:

Upstream Internet, BGP router

Switches, routers, microwave links

SGWu / UPF software-based user planes @ fibre edge

(Core control planes located in DO cloud/ Strathclyde data centre, accessed via VPN)

Equipment Procurement and Commissioning

Procurement

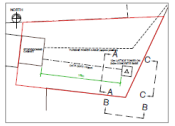*Custom computer build + software orchestration*
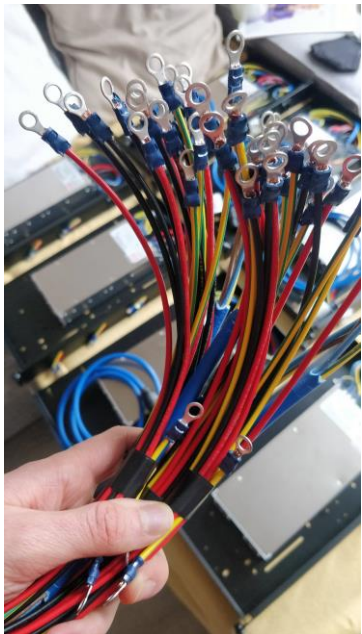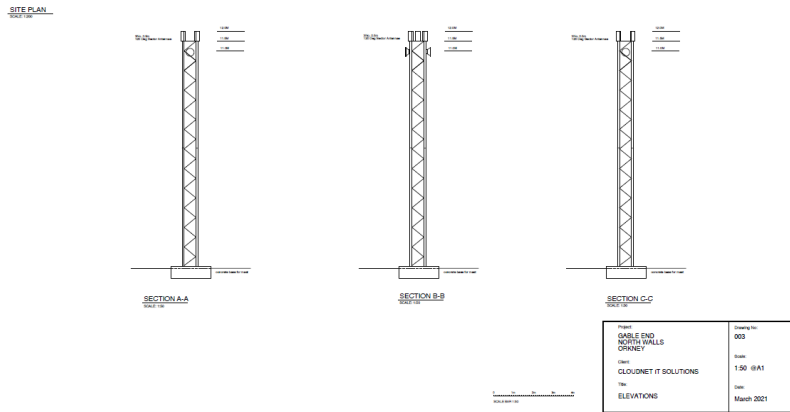
Custom Component Assembly

Lab testing

Network Monitoring

Physical Build
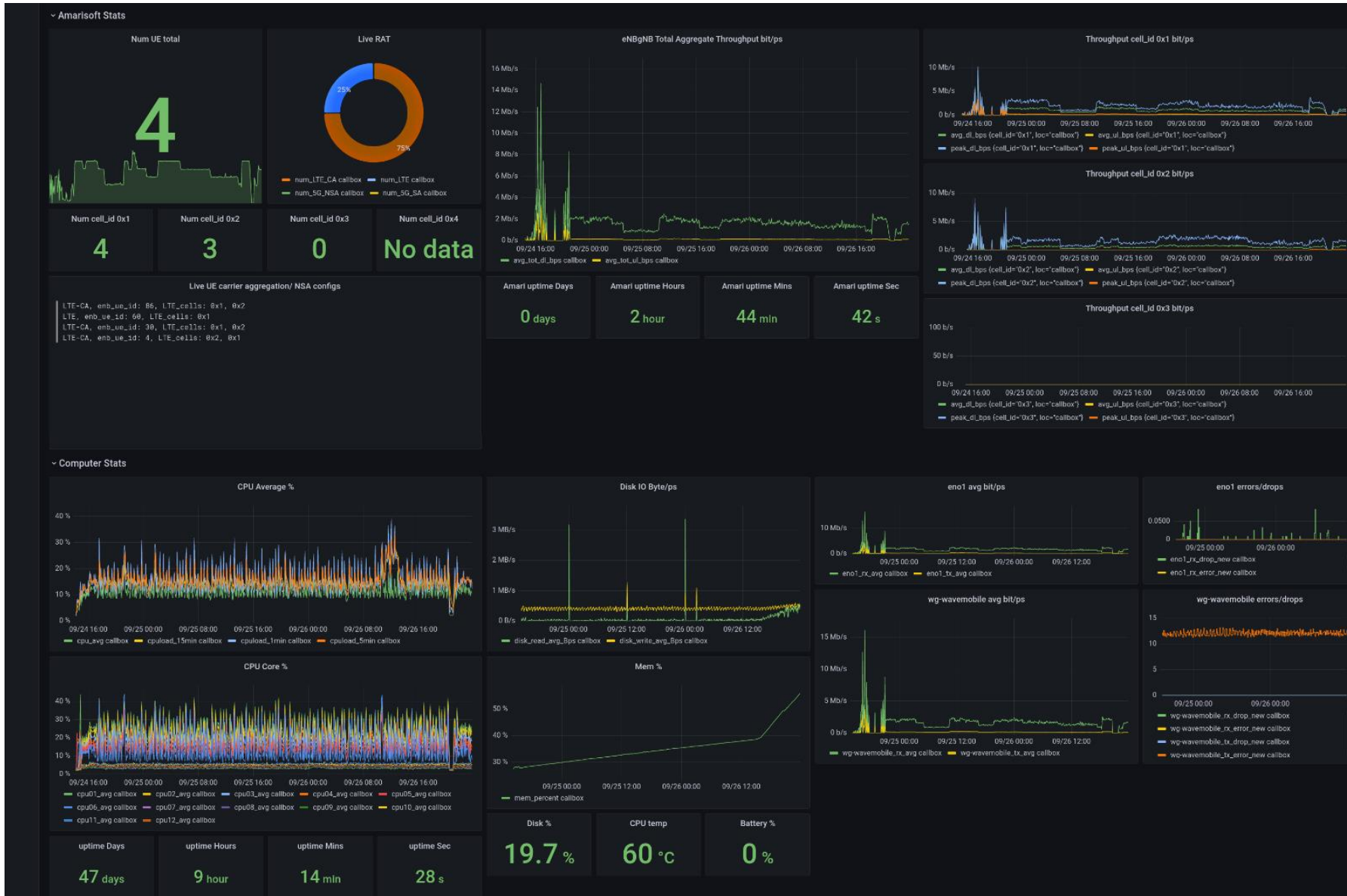
Planning Permission

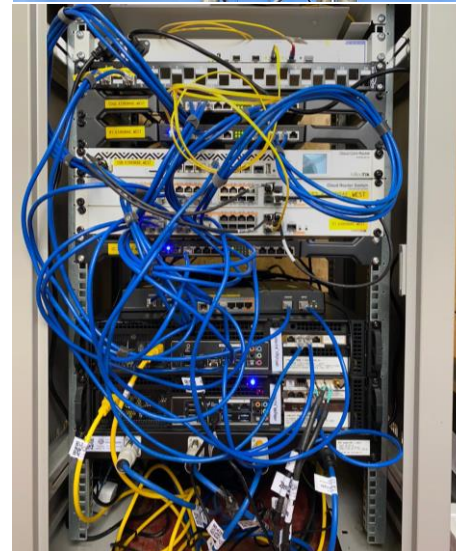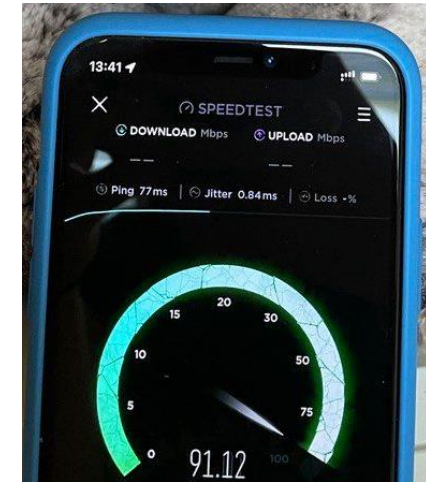*Ducting and fibre runs*

Civils

Network Build

Logistics

Rigging + installs

Initial Testing

Thank You