The evolution of the B4RN Network
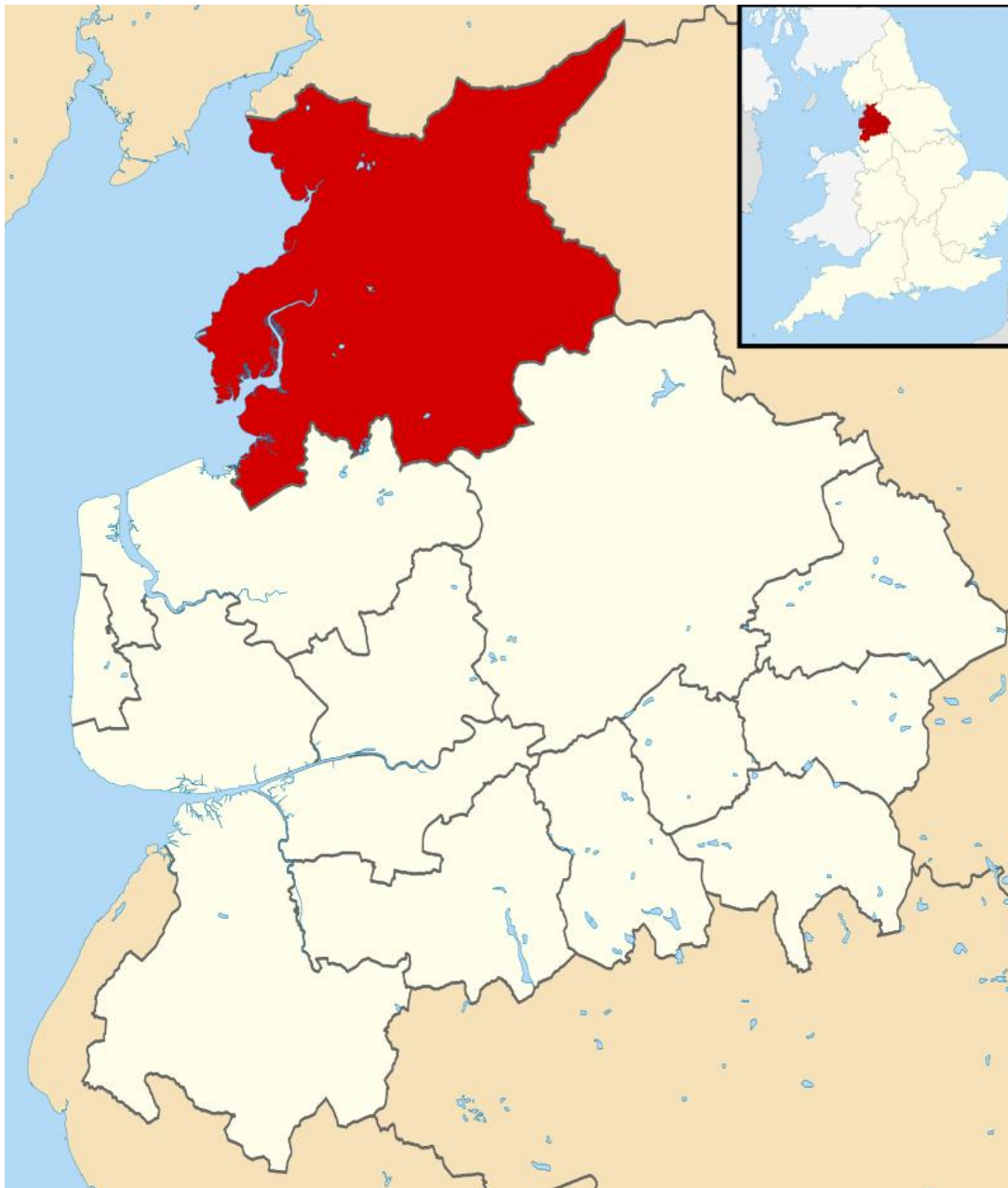
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Lancaster District

Area = 576Km^2
Population = 139,700
Pop Density = 243/Km^2
Properties = 60,761
Prop Density = 105/Km^2

Summary of the B4RN model

- Not for profit community benefit society
  - Set up to provide world class broadband for rural areas in the North West of England
- Provides 1Gbps symmetrical FTTH/P over PtP
- Government grants, although often available, put too many hurdles in the way (process not designed for a community project).
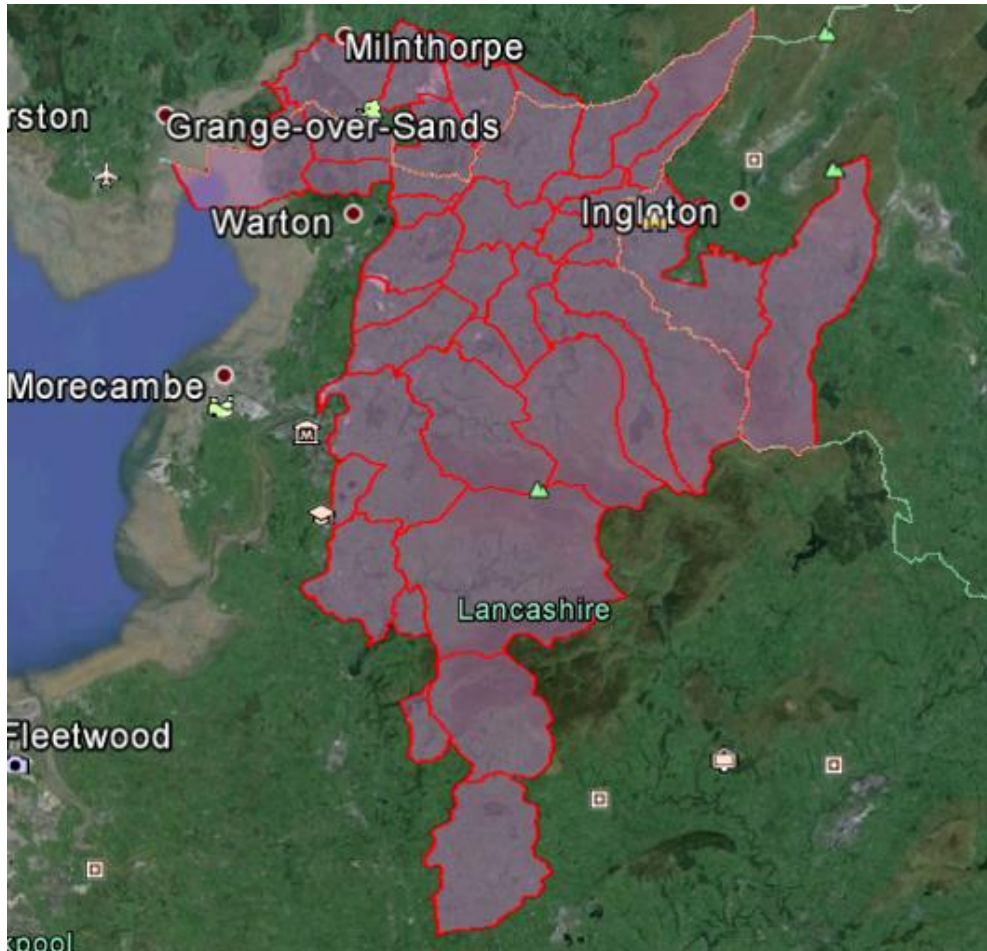- Therefore self funded by the community

B4RN Coverage Area

Area includes the majority of the Lancaster District and now parts of the Wyre, Preston and Craven Districts

B4RN area = ~637Km^2
Properties = ~6000
Prop Density = ~9/Km^2

Rollout Update

- Over 1750 properties connected

- 800km of core fibre installed

- Average take up around 65%

- Total of 778 shareholders holding a total of **£1.5 Million** in shares and another **£1 Million** in loans from the community.

- Originally 16 nodes required, now 24 active nodes with an additional 14 nodes to be installed over the next two years. Total of 38 nodes able to supply over 20,000 properties.

- 8 Full time and 2 part time employees. Hiring another 4 this year to expand the team and build a civils dept.

- **Countless volunteers who drive the project in both their respective parishes and the overall area.**

B4RN Planned Expansion

Network build is heading further into the Craven District and into the Ribble Valley and South Lakeland Districts

B4RN planned area = ~1130Km²
Properties = ~15000
Prop Density = ~13/Km²

For comparison
Gt Manchester area = 1156Km²
Properties = 213529
Prop Density = ~184/Km²
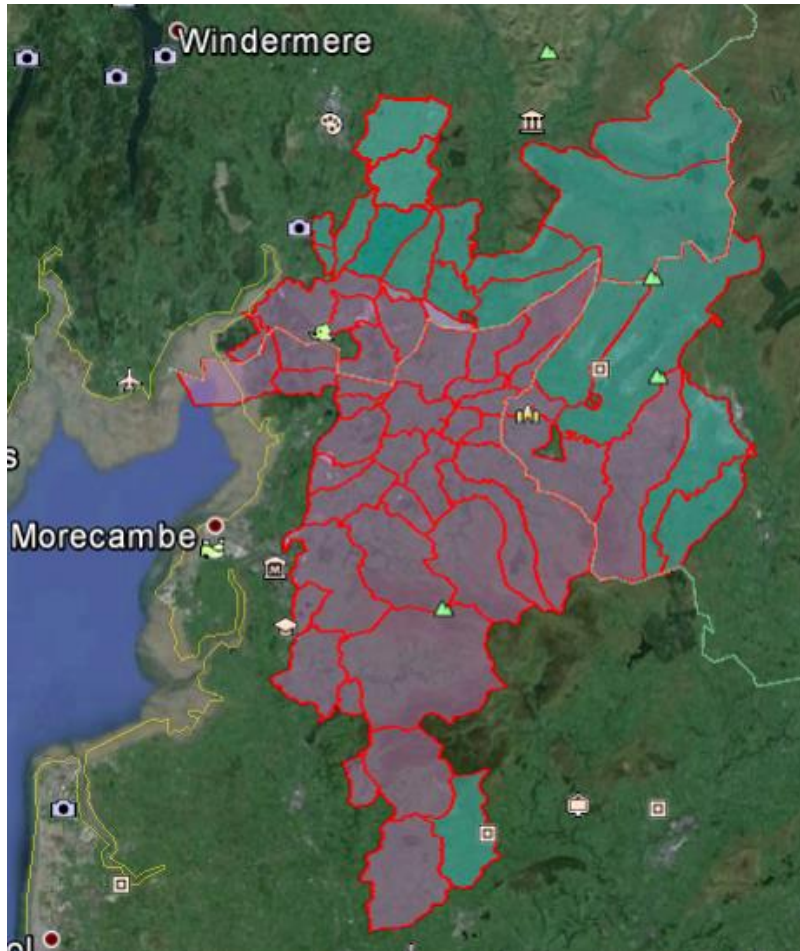
Process of connecting a parish

- Parish requests service – given indicative cost for 100% coverage

- Parish volunteers conduct their own feasibility study

- Parish comes back with an idea of take up and investment pledges

- Network design stage – local volunteers approach Landowners

- Build stage – Farmers dig their own land with the help of volunteers

- B4RN Engineering team install fibre infrastructure to provide end-to-end service

Mole Plough

Trench Digging
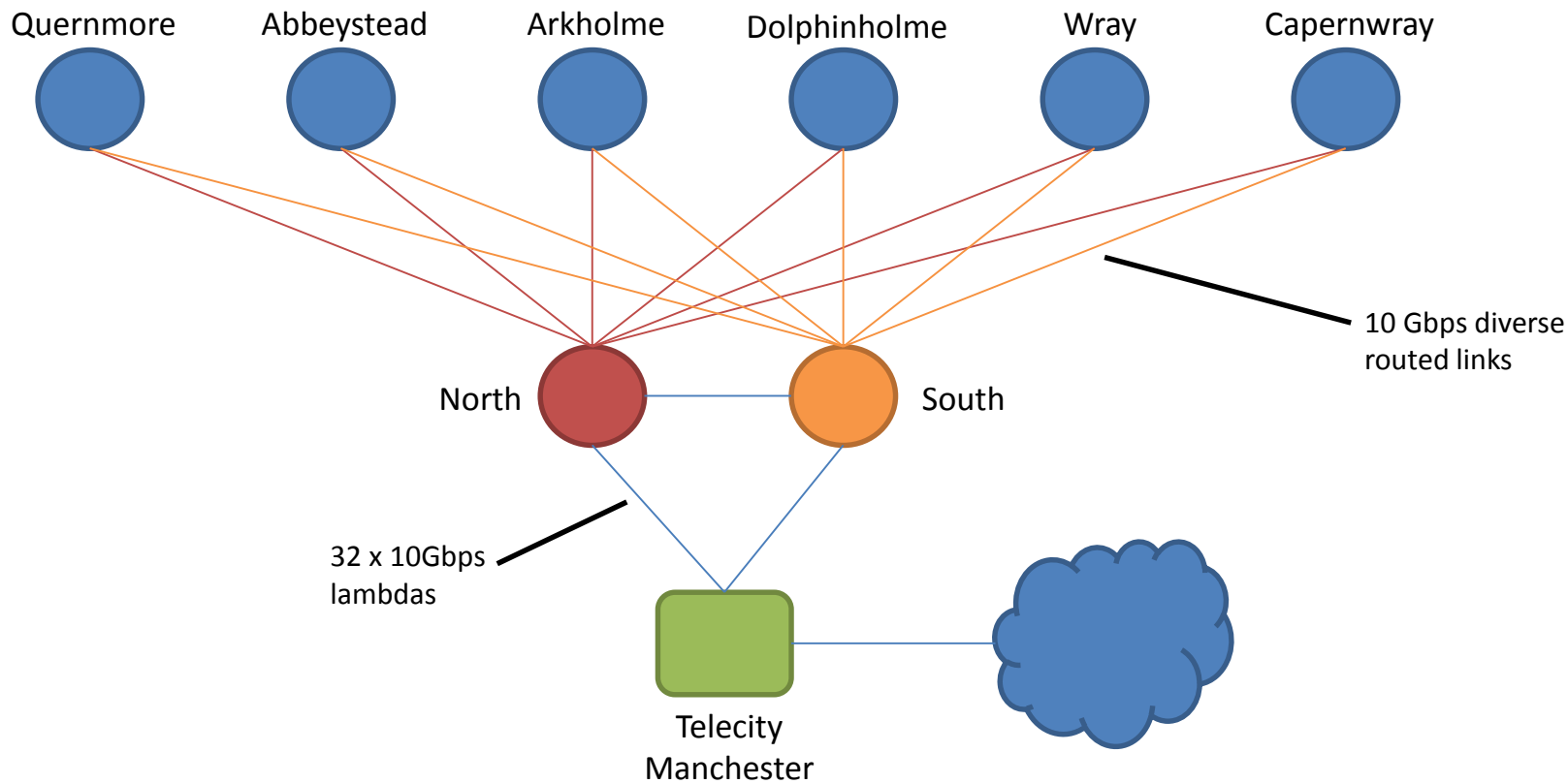
What really powers the troops?

Core Network Design

- Backhaul trunk route follows edge connectivity (dig once)
- Scalability – reserved fibre pairs on core routes
- Current power design – AC based on Enterprise kit
  - Upside, local volunteers can fault find, easy to install
  - Downside, uptime during outages compared to telecoms grade equipment
- Decision not to Carrier NAT - Trade-off between interim solution and ideals. So far doing it the ideal way has won
- Dual stack v4/v6 for the foreseeable future

Core Equipment

- Network border – Juniper MX240
  - M247 Transit peer
  - IX-Manchester
  - LINX Juniper LAN
  - TNP Ltd – Mutual backup peering
- Network core – Juniper EX4550
  - 2x10Gbps uplinks via physically diverse routes providing 20Gbps aggregate to each edge node

Quernmore Abbeystead Arkholme Dolphinholme Wray Capernwray

North South

10 Gbps diverse routed links

32 x 10Gbps lambdas

Telecity Manchester

Edge Equipment

- Costing of Telco grade equipment does not fit the model

- The choice to use Enterprise grade equipment

- Switching
  - Netgear M5300-28GF3
    - 8x24 port stack gives 192 1Gbps SFP ports 2x10Gbps for backhaul

- Power
  - APC - Schneider Electric

Edge Node

CPE Equipment

- Complete control of CPE devices
- Refreshed to keep up with latest technology
  - WiFi, technology available/customer expectations
- Genexis Residential Gateway
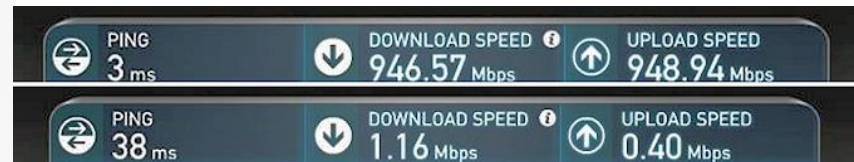
IPv4 Deployment

- Started with /21 block
- Additional /22 block received from RIPE
- With expansion plans, 3072 no longer enough
- Carrier NAT not the ideal solution
- Additional /20 bought through IPv4 Market Group
- 7168 enough to start the next build stage
- What next?!

IPv6 Deployment

- /32 allocated from RIPE
- Each switch stack allocated /48
- Each residential customer allocated /56
- IPv4 and IPv6 CPE allocations match
  - 256 IPv4 addresses per switch stack
  - 256 /56 IPv6 subnets per switch stack
- Businesses allocated /48
- Open to development and change over time

Customer usage patterns

- Bandwidth perhaps not the issue people might expect (at least up to now)

- Digital divide
  - Connecting those who have been used to 150Kbps for a long time.
  - Education of technology available
    - Smart TV
    - Home automation
    - Internet of things
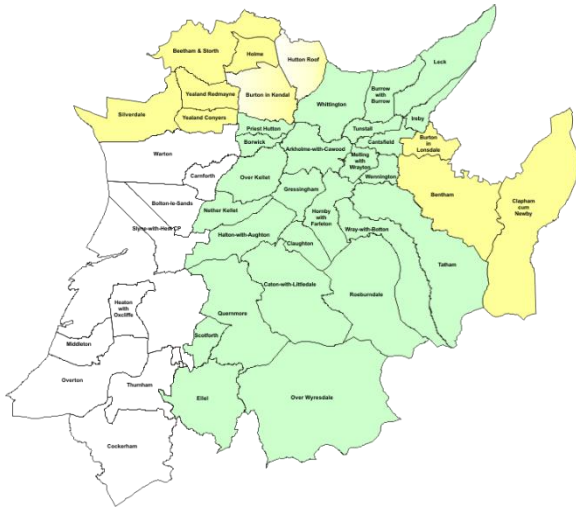
Customer usage patterns

AS	Flows	Bytes	Packets	AS Name
20940	632899	49.08 GB	35607468	Akamai
15169	2076971	38.81 GB	32317605	Google
2906	171565	26.45 GB	19175856	Netflix
22822	157459	11.26 GB	8431025	Limelight
6185	42724	7.53 GB	5417660	Apple
32934	1018810	6.41 GB	5796113	Facebook
3356	82432	5.47 GB	3993075	Level3
16509	980414	4.67 GB	5101504	Amazon
16625	905557	3.05 GB	2834722	Akamai
13285	36761	2.67 GB	2226279	TalkTalk
32590	27137	2.14 GB	1651124	Valve
25460	39881	1.84 GB	2212067	TNP
23456	138466	1.48 GB	1457736	4 byte AS transitional placeholder

Growth Challenges

- Keeping up with demand!
- Core node locations
- Resilient backhaul for core
  - IXScotland
- Edge resilience
- Future expansion

Members of the Most Excellent Order of the British Empire!!

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