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Introduction

- Previous experience: developing the existing 'UHI Network'
- www.uhi.net.uk
- My current project: re-implementation of the UHI Regional Education & Research Network – 'the UHI NGN'
- www.uhi.ac.uk/lis/projects/ngn

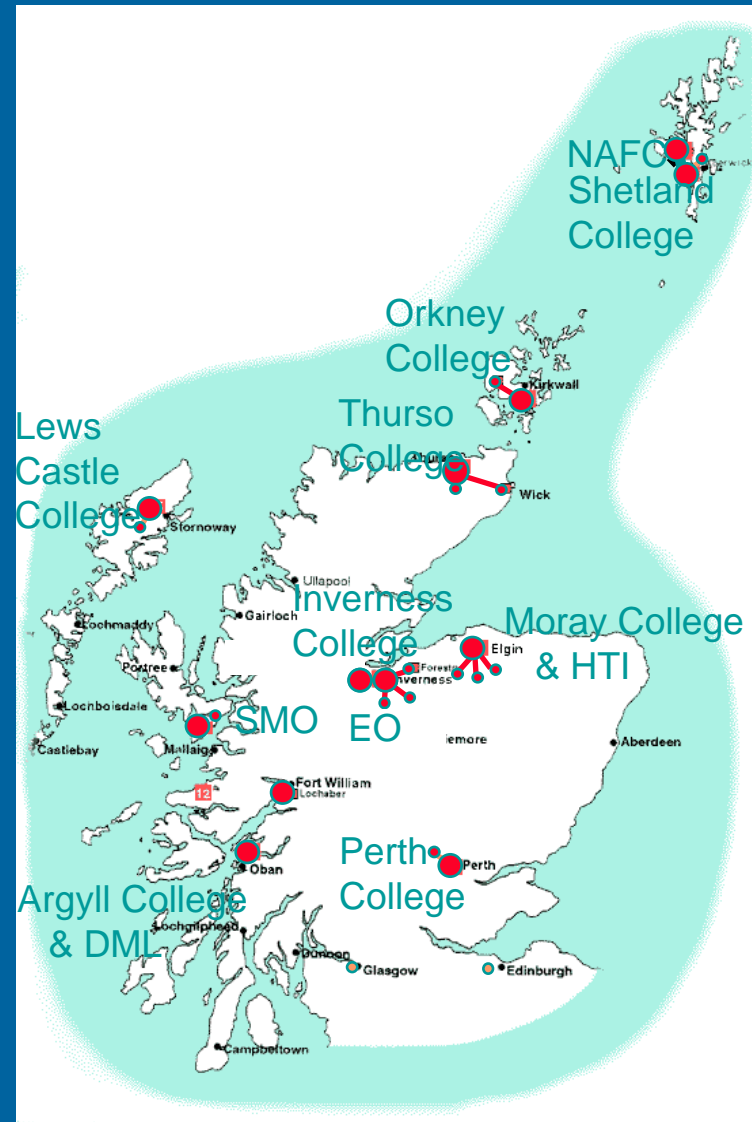
Topics of Discussion

- Our experience of Satellite Internet Access
- Our experience of line-of-sight wireless
- Why the use of these technologies by UHI is limited...
- and
- What niche can these technologies fill for UHI?

The UHI Challenge

today

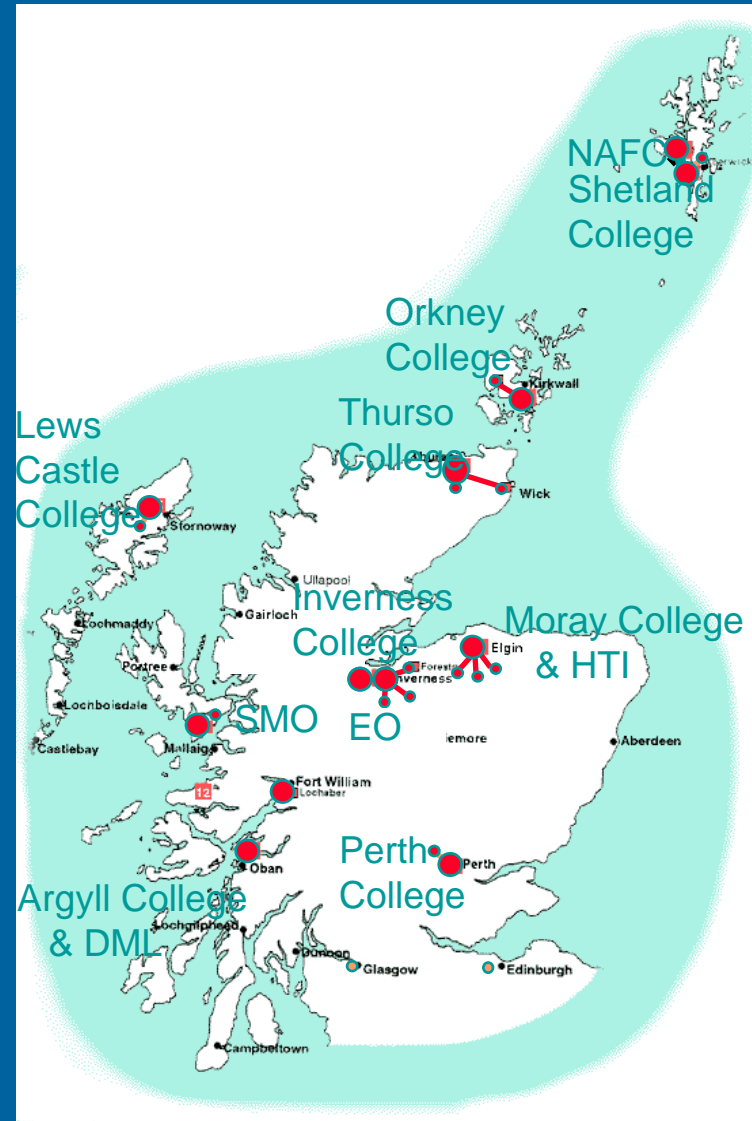
- Distance
- Geography
- Cost
- Service Provision



UK population:
60+million (London:
10m)

Scotland: c. 6m, 1/3rd
of UK land area

Highlands & Islands:
c. 1m



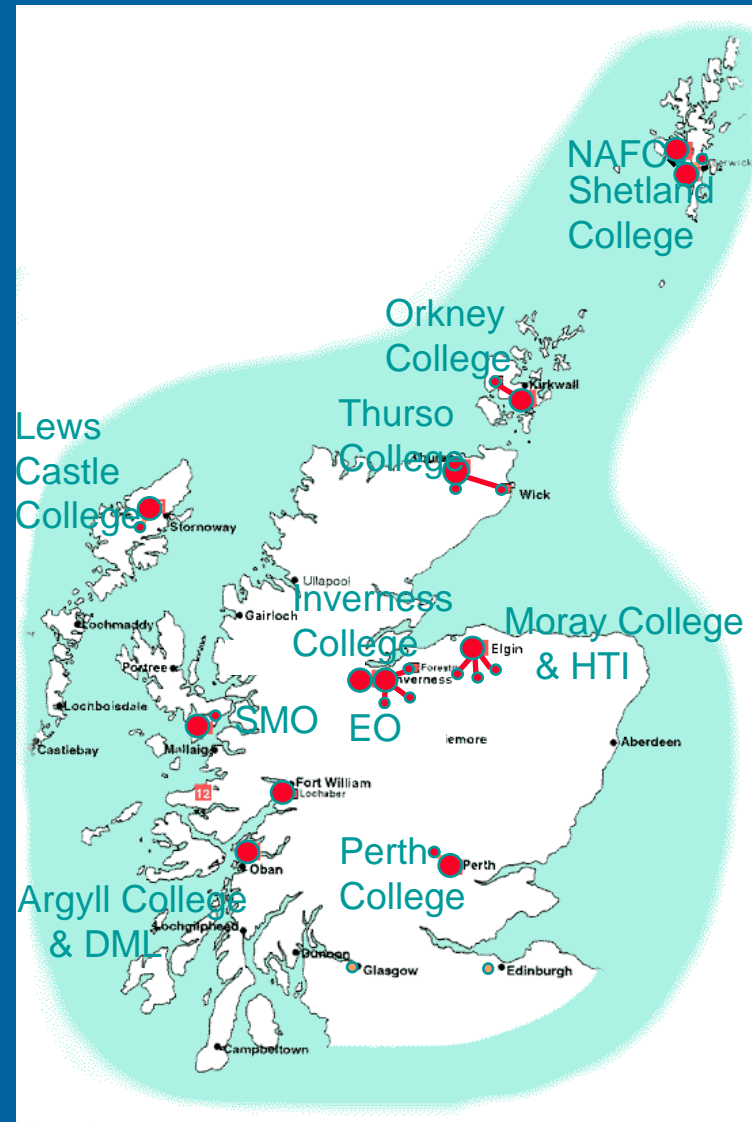
Highlands & Islands

Highlands & Islands: c.
1m population

No major cities

Regional centre:
Inverness <80,000

100+ inhabited islands



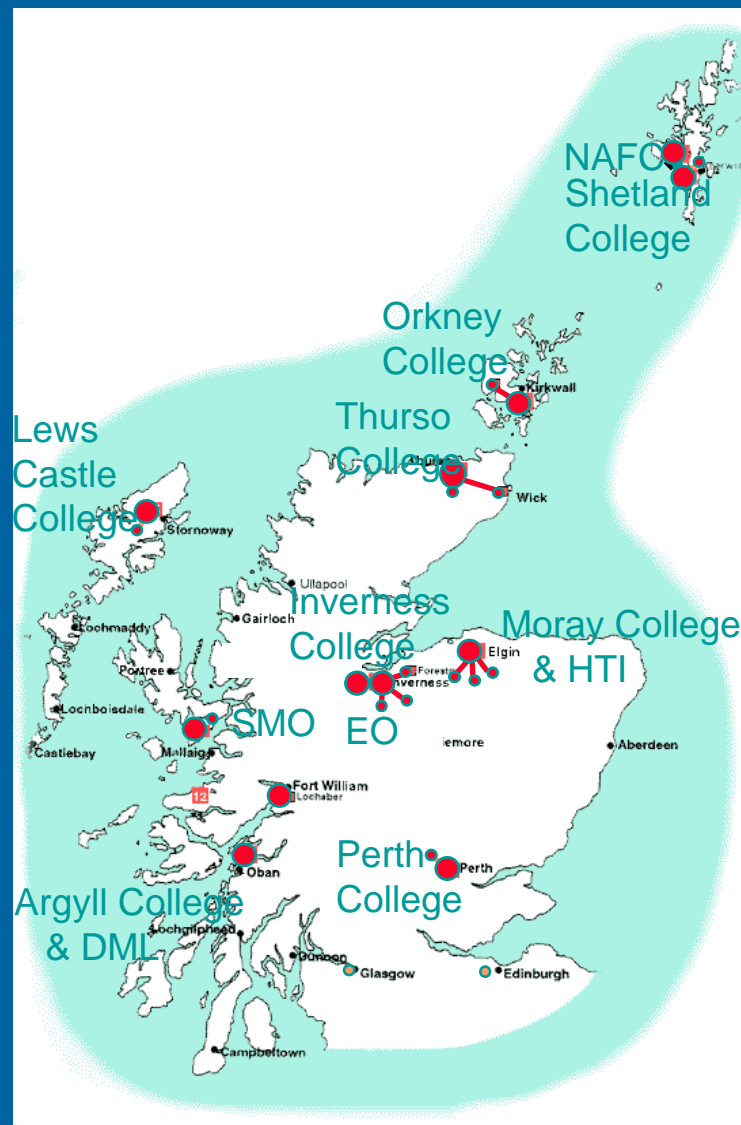
UHI will soon be University of the Highlands & Islands

today

Federation of 15 existing institutions:

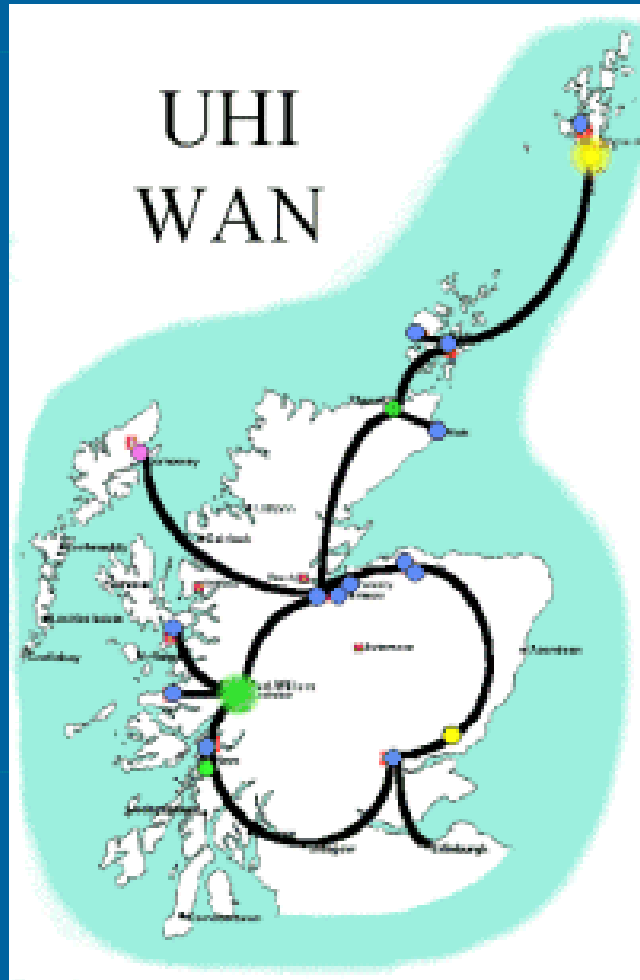
- 4 'small' Further Education Colleges
- 3 'islands' Further Education Colleges
- 1 Gaelic College
- Learning Centre groups
- Research Institutes (DML & NAFC)

Will be a



Check the map scale ...

250 km



UHI's territory
covers over half of
Scotland

- $1/6^{\text{th}}$ of the UK area
- $1/60^{\text{th}}$ of the UK's total population.

UHI characteristics

UHI and its colleges have under 20,000 HE and FE students on around 100 sites across the region ...

About 5 'big' sites – which are small in UK terms

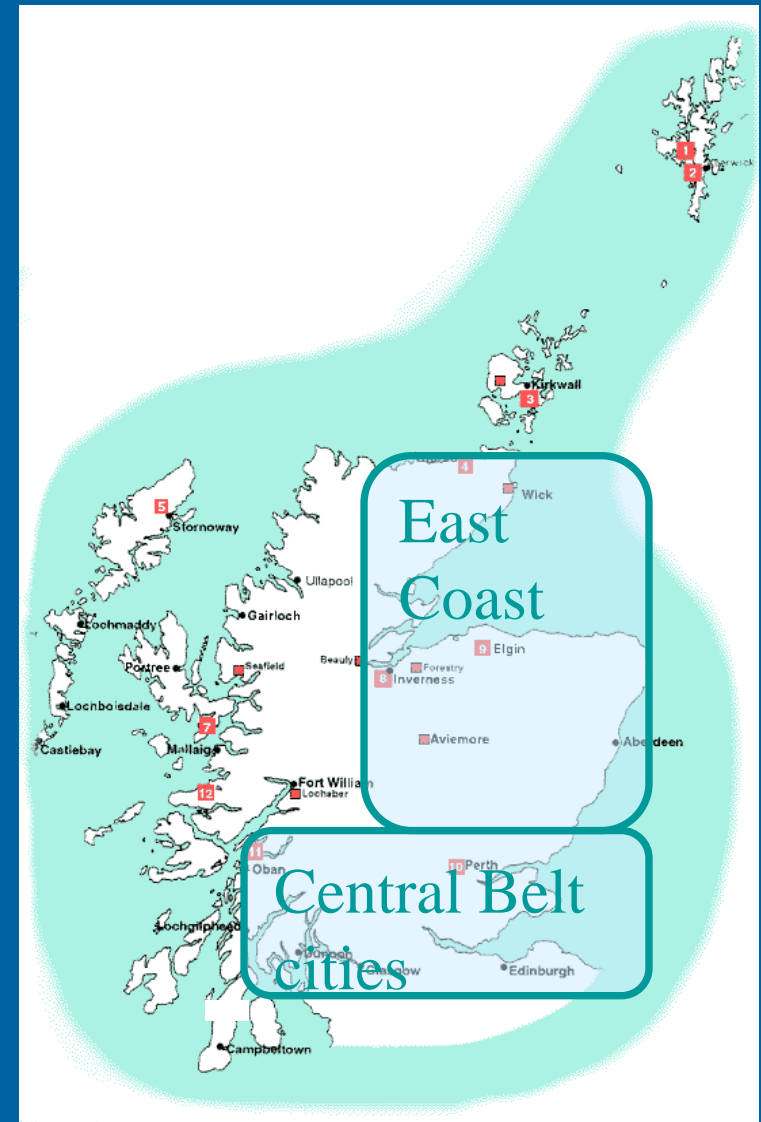
About 50 'medium' – very small in UK terms

About 45 'small' – fewer than 10 PCs

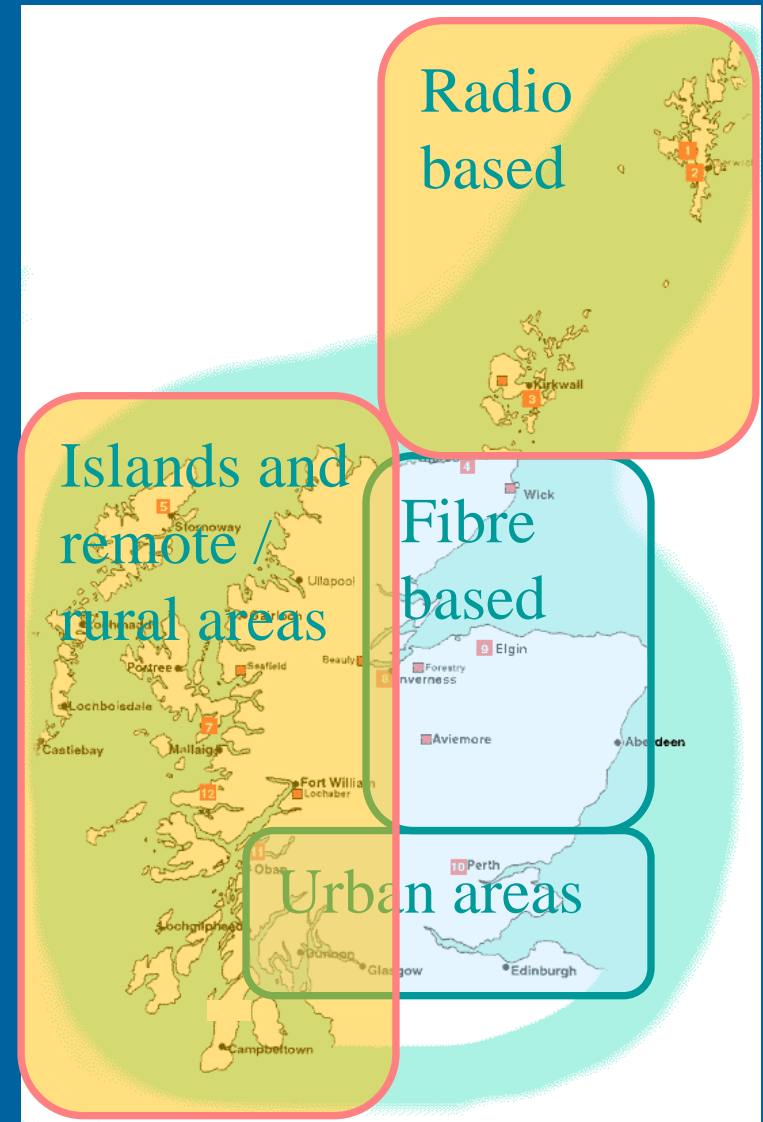
All these sites are there because the communities they serve are small and remote; some are very small and very remote.

UHI Economics do not add up due to the spread of our small user base over a large number of sites.

- East Coast & Central Belt:
- Fibre in the ground



- West & North:
 - Microwave radio networks
- Most UHI territory is in the west and north.



UHI Network requirement

- Big sites need plenty of bandwidth, in the 100Mbps class
- Medium sites also need plenty of bandwidth if possible, but 10Mbps if that is all we can afford
- Small sites need whatever we can get for them, but budget is very limited

Use a small range of 'standard' solutions

This keeps things manageable

Allows for an equipment pool

UHI owns all the CP equipment involved

We can self-maintain, recycle, manage

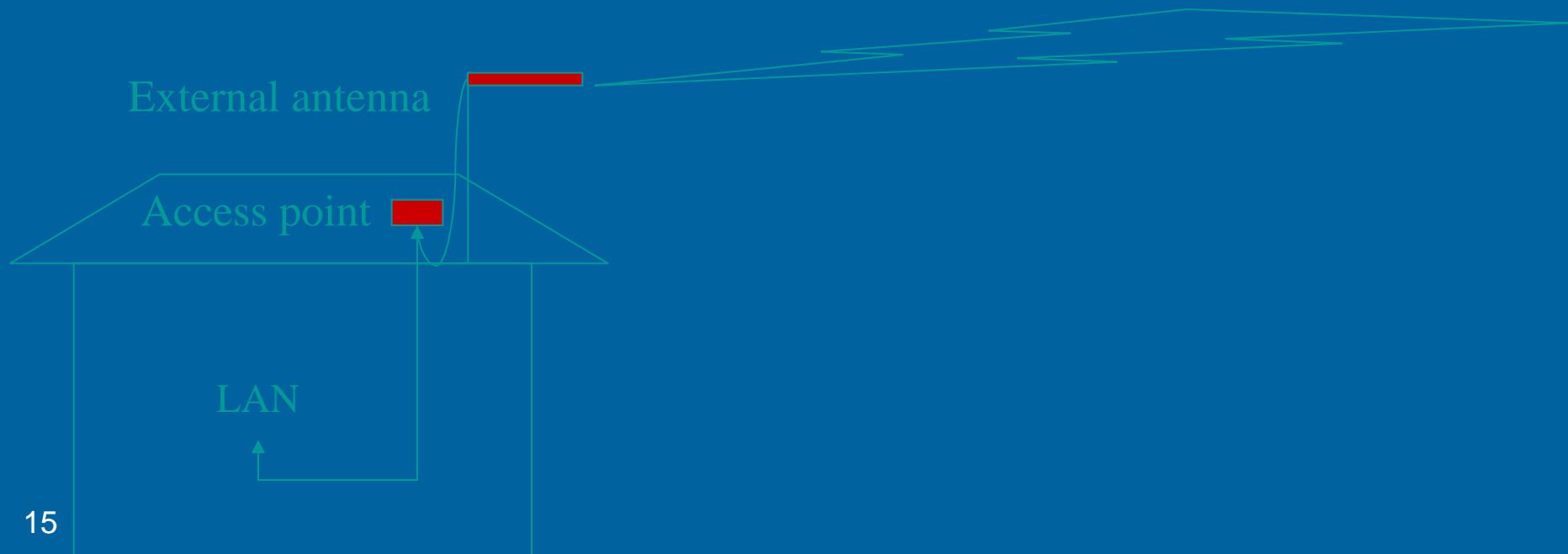
Collect all the work into one place

Staff training concentrated into fewer heads

short access link (up to 10km)

Can you see the far end (from the roof)?

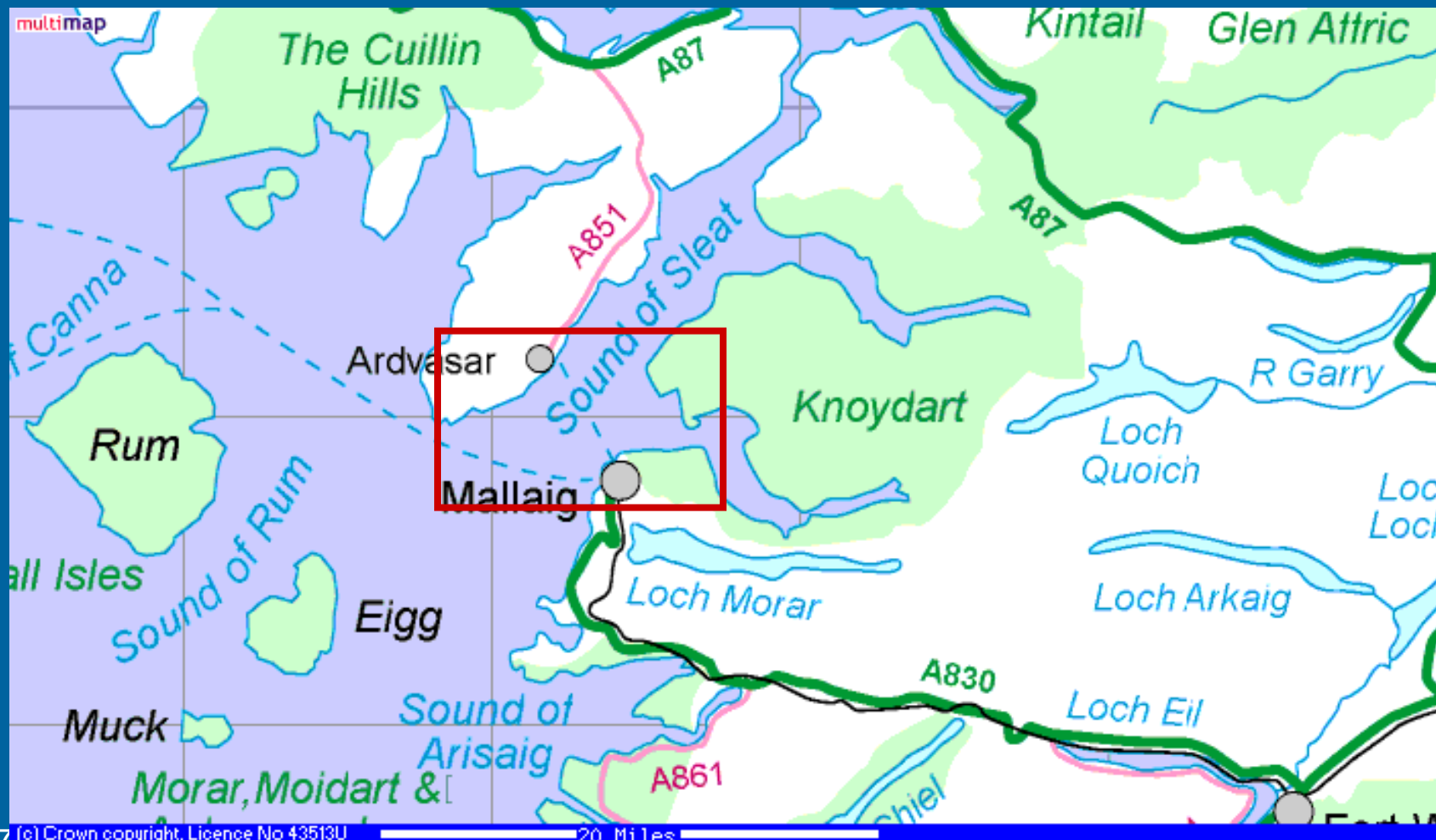
Wireless: native IP, cheap, no recurrent



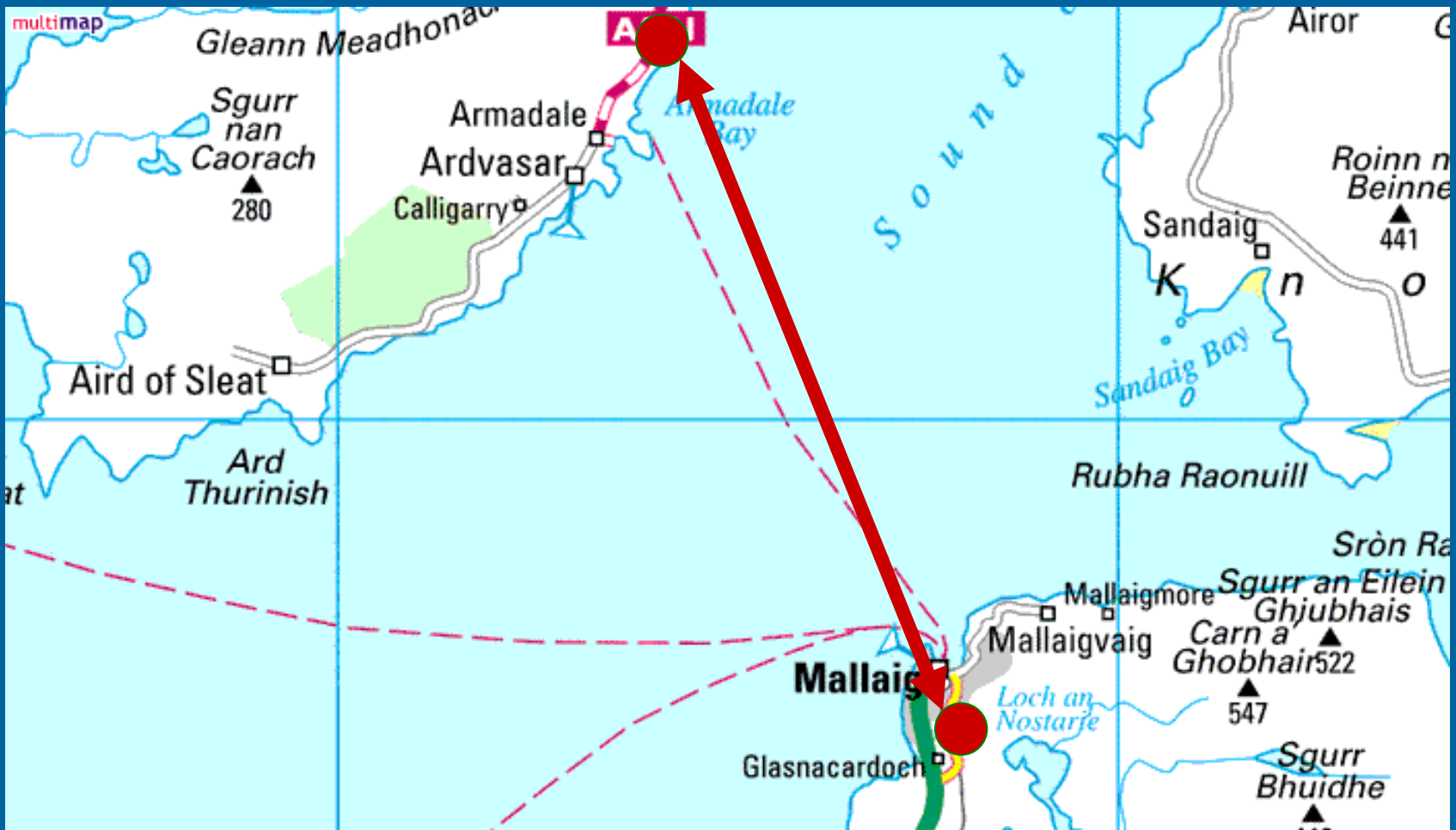
Wireless Example



Wireless Example



Wireless Example



Wireless Example

Fri Jun 14 16:27:38 2002



A-End: Sabhal Mòr Ostaig, looking south to Mallaig and the Ardnamurchan Peninusla.
Go to the [CalMac website](#) to see when the ferry will be visible

Wireless Example

We never got that working reliably but ...

The equipment can be re-used elsewhere;

We didn't spend too much time on it

thankfully despite the ferry journey

between the ends;

We keep looking at this again because

Wireless is obviously the right thing to do.

The JISC Satellite Trial

UHI deployed Satellite links at 5 sites

All were 'ISDN replacement' projects for the duration of the trial

Kept ISDN in case of trouble (but there wasn't any trouble of that kind)

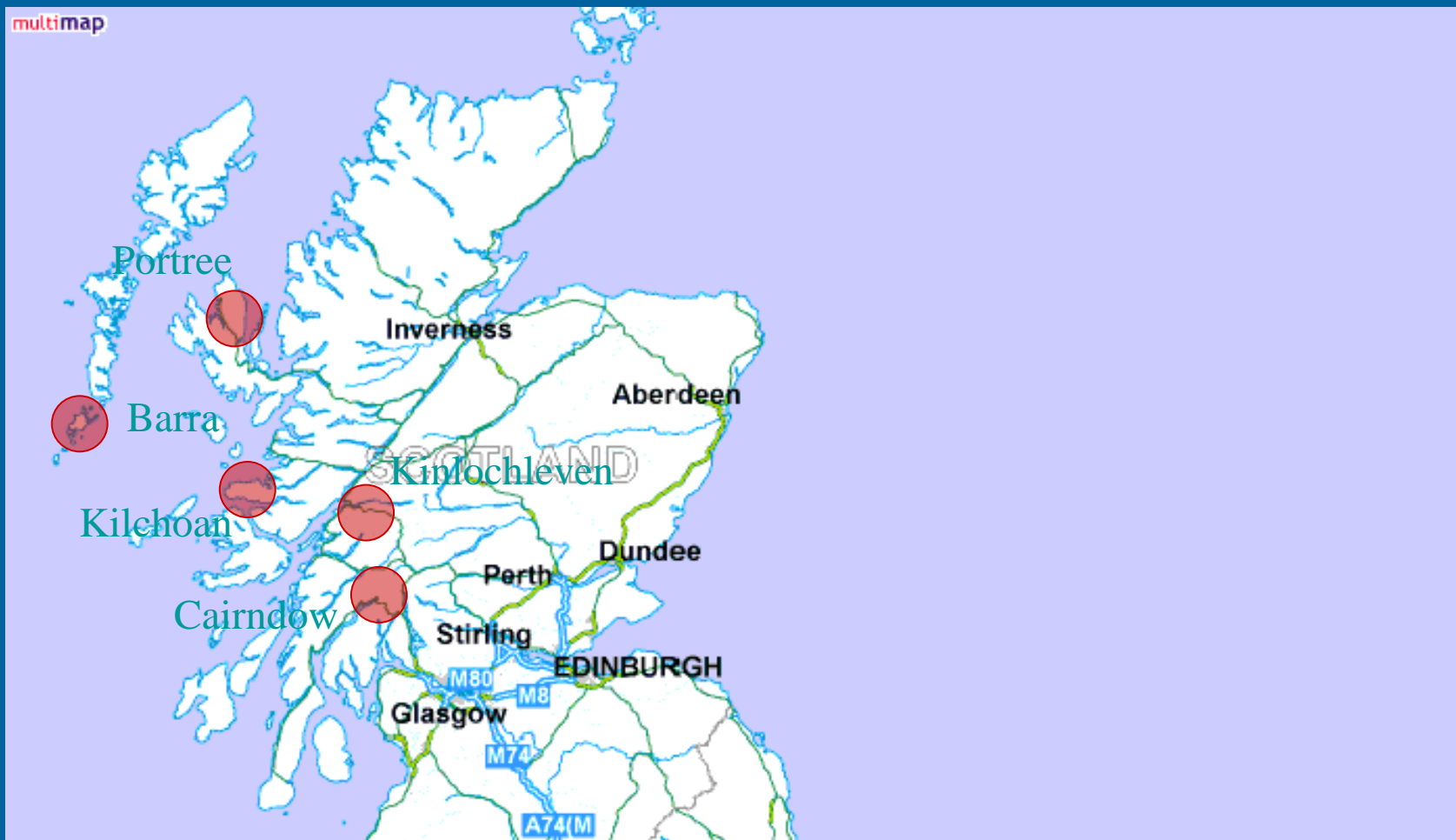
All connect to UHI's private network

Previously dialling to our own ISP facility

Now using a 'tunnel' over the public Internet

Each site has private IP numbering 10.X.X.X

The JISC Satellite Trial



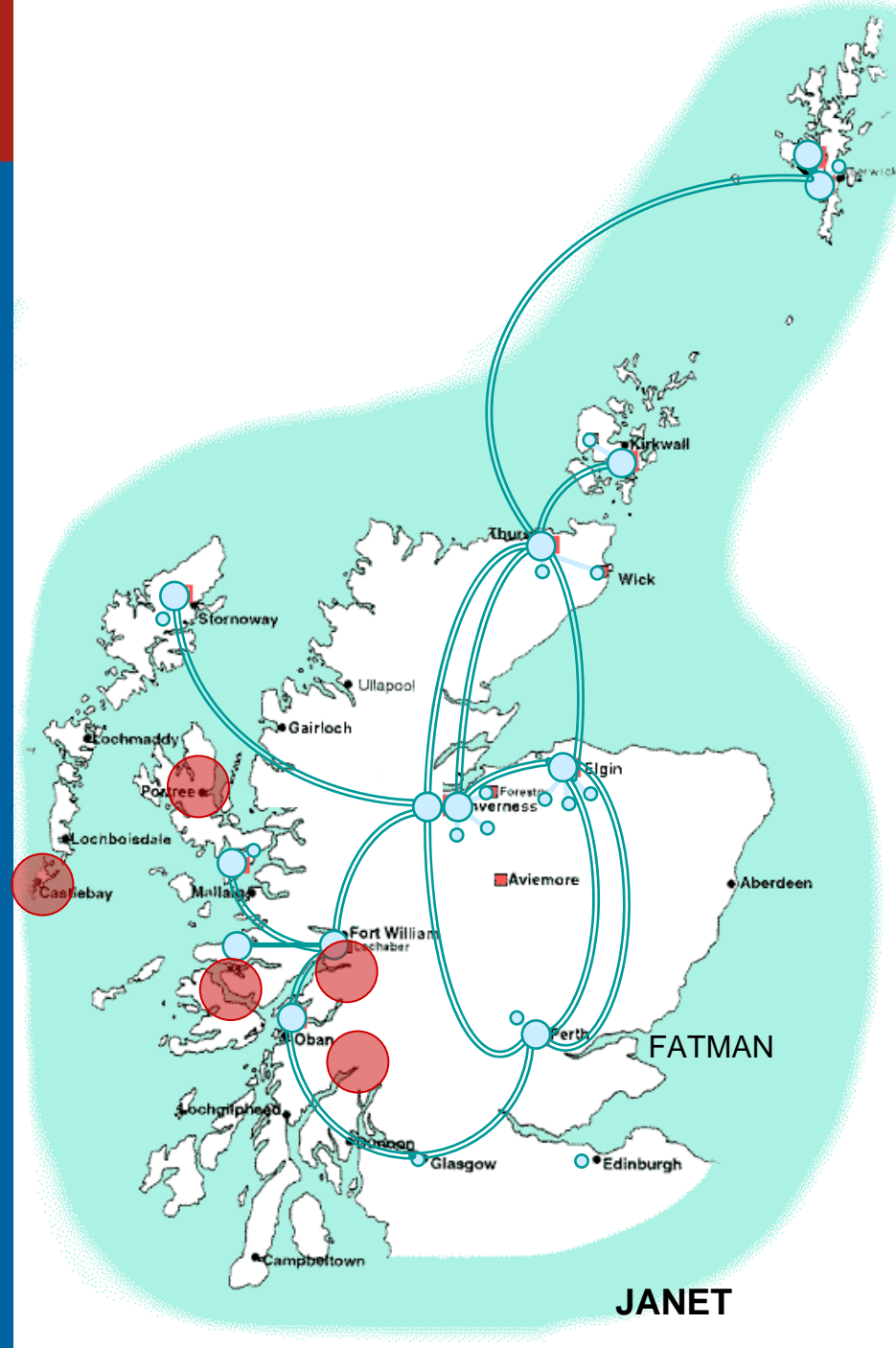
Satellite Trial

Sites are in our region

But remote from our Points
of Presence

Sites need broadband

But have not previously
been able/willing to fund
connections above ISDN



How does Satellite fit in at UHI?

Is this is just a way to provide 'broadband'?

What is the USP ...

Quality: 'better than ISDN' ?

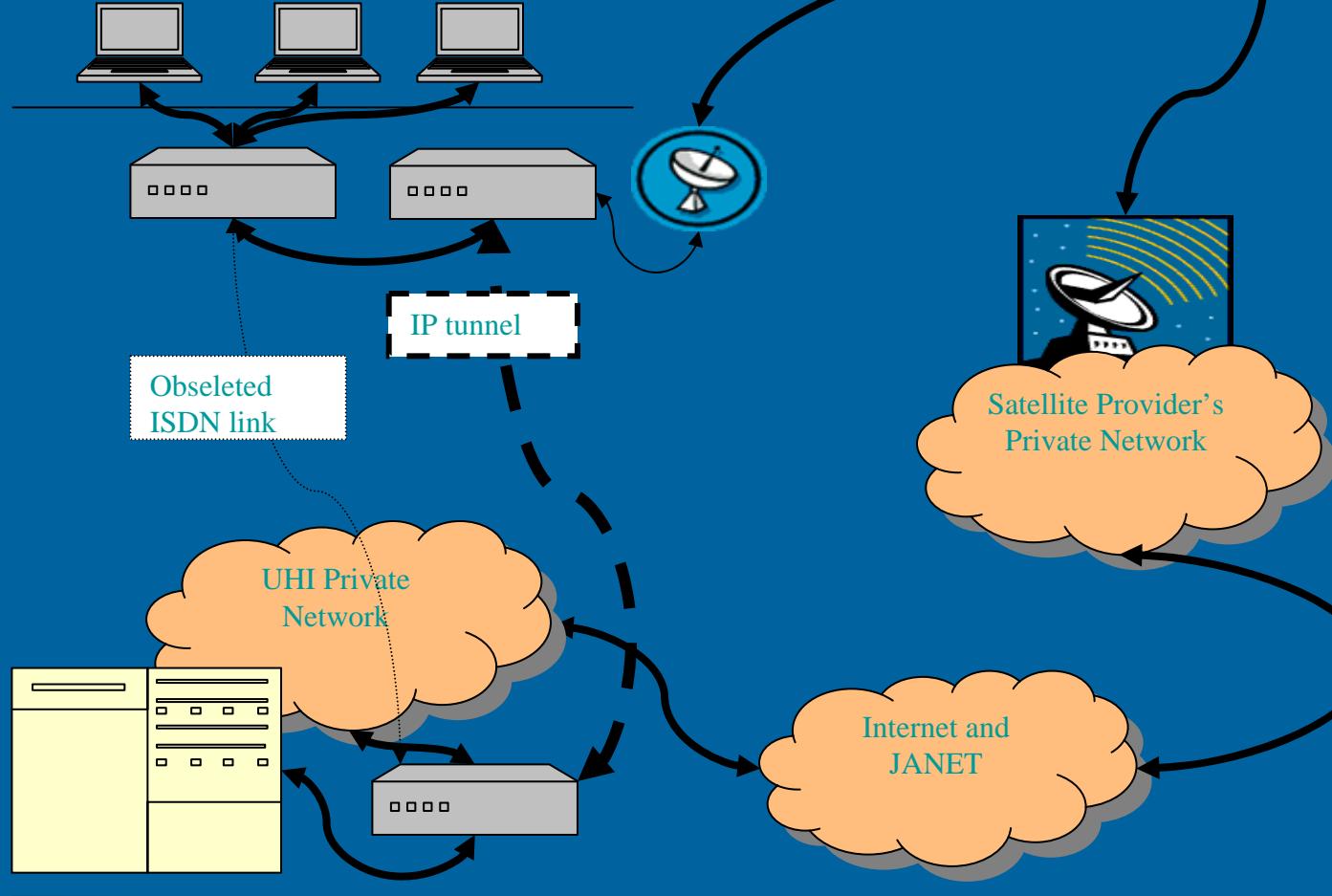
Or price: 'cheaper than MegaStream' ?

A standard item for our service portfolio ?

Or a special: 'Solution of last resort' ?

Satellite-based VPN is poor quality

UHI Private Network Services available at Local Learning Centre

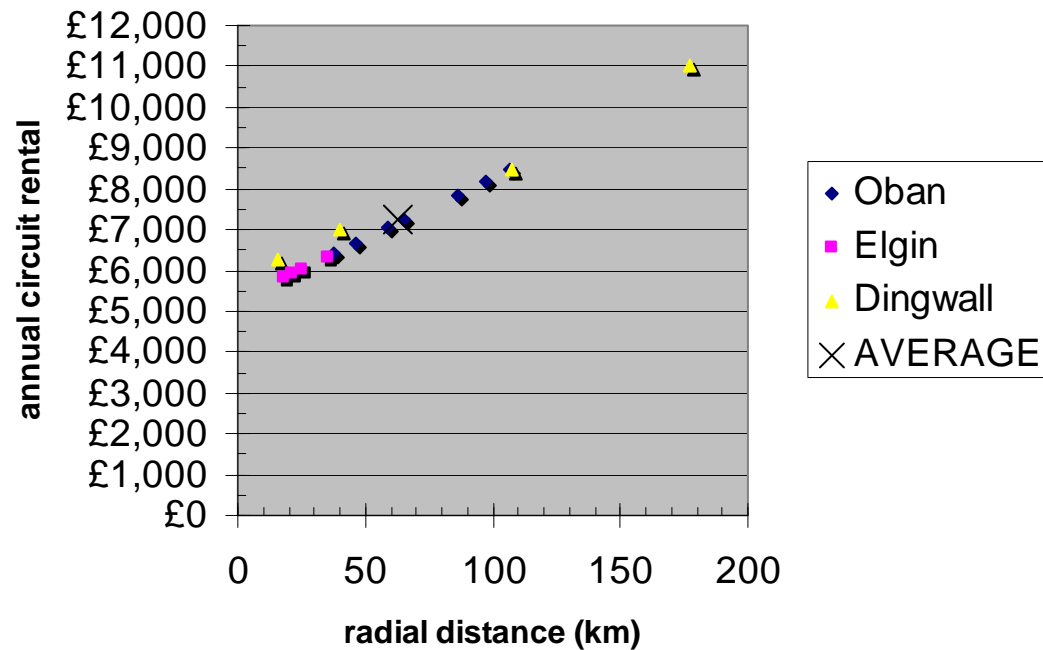


UHI Private Network Services

The JISC Satellite Trial

Compare terrestrial circuit charges

BT LearningStream hubs & circuits

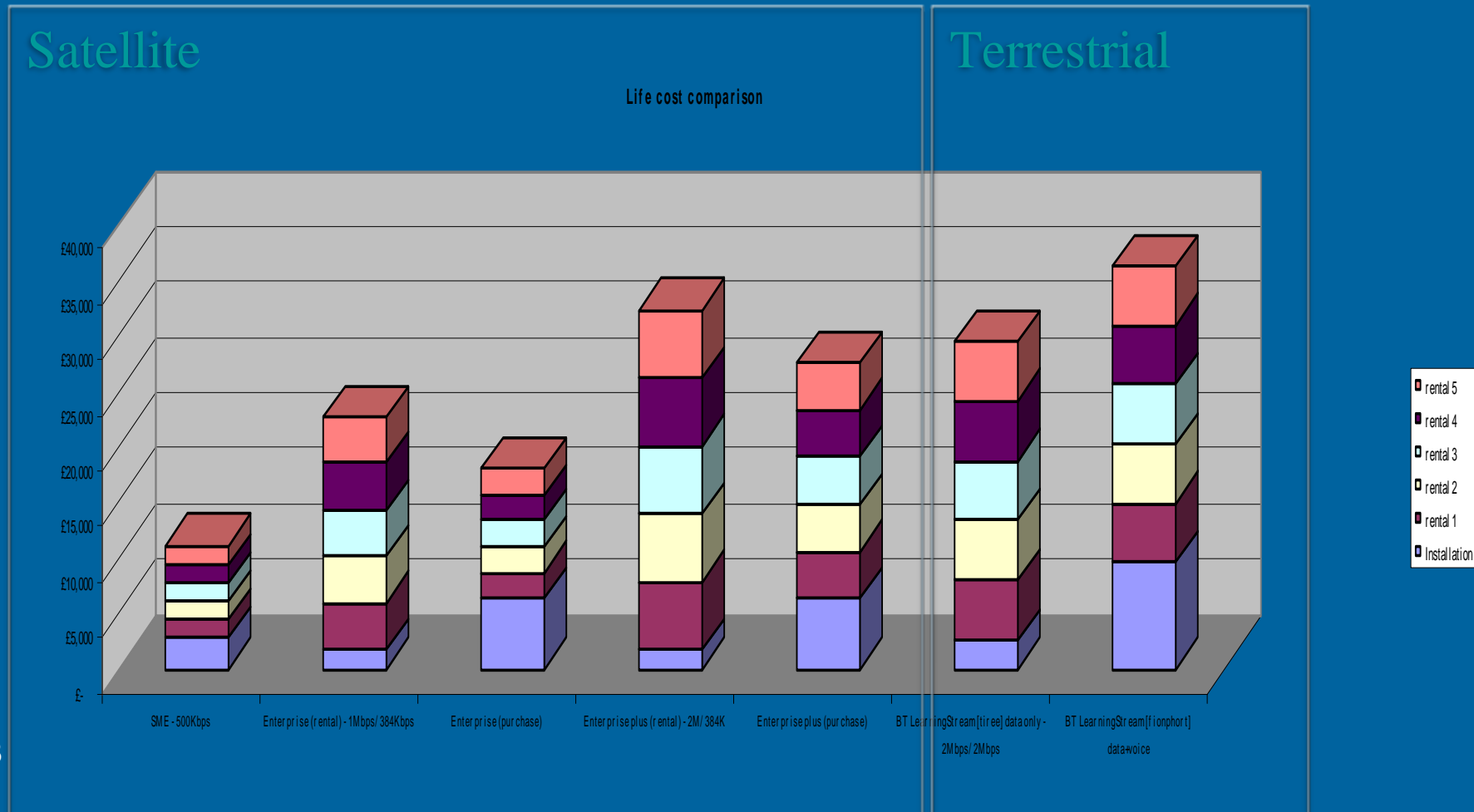


Satellite .vs. Terrestrial costs ...

Package	SME	Enterprise		Enterprise plus		BT LearningStream [tiree] data only	BT LearningStream [fionphort] data+voice
download kbit/sec	500	1,024		2,048		2,048	
upload kbit/sec	150	384		384		2,048	
basis	rental	rental	<i>purchase</i>	rental	<i>purchase</i>		
Installation	£ 350	£ 770	£ 770	£ 770	£ 770	£ 600	£ 600
Purchase	£ 1,495		£ 4,599		£ 4,599		
UHI router / termination	£ 1,000	£ 1,000	£ 1,000	£ 1,000	£ 1,000	£ 2,000	£ 9,000
Total Installation	£ 2,845	£ 1,770	£ 6,369	£ 1,770	£ 6,369	£ 2,600	£ 9,600
Monthly charges	£ 138	£ 350	£ 195	£ 510	£ 355	£ 450	£ 446
Yearly charges	£ 1,656	£ 4,200	£ 2,340	£ 6,120	£ 4,260	£ 5,400	£ 5,350
Year 1 total cost (y1)	£ 4,501	£ 5,970	£ 8,709	£ 7,890	£ 10,629	£ 8,000	£ 14,950
Annual charges year 2 onwards (y2)	£ 1,656	£ 4,200	£ 2,340	£ 6,120	£ 4,260	£ 5,400	£ 5,350
Three Year cost (3y = y1 + 2*y2)	£ 7,813	£ 14,370	£ 13,389	£ 20,130	£ 19,149	£ 18,800	£ 25,650
Annual cost over 3 years (3y/3)	£ 2,604	£ 4,790	£ 4,463	£ 6,710	£ 6,383	£ 6,267	£ 8,550

Life Cost comparison

Terrestrial is not that much more.



The Big Questions

Is higher quality & bandwidth of terrestrial service worth the extra cost?

Internal telephone service seen as very valuable

Standard product for our service portfolio

Would sites stick with Satellite if they have to pay?

The Big Answers

Is even better service worth the extra cost?

Only one of the five eventually upgraded to anything better at their own cost

Would sites stick with Satellite at trial end?

Three downgraded to ISDN on cost grounds

Another two stayed with satellite because:

- (1) new building due soon; wanted to delay hassle of change but then avoid move charges.
- (2) ISDN seen as too unreliable in very remote location, although actual use extremely low.

Core funded this time

- - ability of individual sites no longer such a big problem
- - overall affordability is now the big issue
- - this issue is now centrally managed
- - I spend more time on fund-raising than most 'technical' project managers would expect to have to!

www.uhi.ac.uk/lis/projects/ngn

UHI NGN Project (2)

- Budget of around 5million Euro over 5 years, servicing nearly 100 sites, with significant ERDF support.
- Four major sub-projects:
 - -- Bandwidth contracts
 - -- Router and LAN core equipment
 - -- Telephony integration and extension
 - -- Ubiquitous Wi-Fi service

UHI NGN Bandwidth

Contract placed with Telco for service to most sites

- MPLS IP-VPN using RFC1917 addressing
- Terrestrial circuit at 40+ sites, speeds from 5 Mbps up to 200 Mbps
- Private ADSL solution at about 40 very small sites, using ADSL technology to deliver IP-VPN cheaply
- Wireless IP backbone connections in Western Isles
- Private line-of-sight wireless is a niche solution for fewer than a dozen sites

UHI NGN Bandwidth (2)

Some sites are suited to line-of-sight connection – but really very few

Even when line-of-sight possible, the second site is typically small and Private ADSL solution may be cost-effective

<http://maps.google.com> (search 'UHI Millennium Institute')

<http://tracker.uhi.ac.uk/confluence/display/UHINGN/Google+Map>

What This Means (1)

Satellite 'works' but has the wrong performance characteristics

- Not much use for H.323 VC or VoIP
- Far too expensive
- Inherently a niche solution which can never get market 'traction'



What This Means (2)

Line-of-sight 'works' but far too few sites are suitable ☹️

- Very cost-effective
- Need locations nearer to one another
- Good for multi-sector partnerships with several sites in the same town