



Network deployments for universal connectivity: **new generation access**

- New generation: New age, sharing similar ideas, problems, attitudes
 - Tension: right to participate, vs barriers and the queue of the unconnected
 - Decentralization: my WiFi AP, my community, vs their service
 - Technology gen: faster, cheaper?, simpler?
 - New forms?
 - Documenting as best current practices (BCP)
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G: 1000 M, Generation

- We are 7.5 Giga-humans ...
- Wireless tech generations:
 - 0.0002+ Gbps: (few Mbps) → 3G
 - 0.450 Gbps: IEEE 802.11n → WiFi 4
 - 0.1-1 Gbps: IMT-A LTE mobile 4G
 - 1 Gbps: IEEE 802.11ac → WiFi 5
 - 1-10 Gbps: 3GPP 5 → mobile 5G
 - 10 Gbps: IEEE 802.11ad,ax → WiFi 6
 - 100 Gbps?: IEEE 802.11ay? → 7G

Generation terminology adopted by mobile and Wi-Fi Alliance

Mobility in IEEE 802.11:
s: mesh,
r: roaming,
k: management,
v: config

Radio tech:
OFDMA,
MIMO,
smart antenna,
femtocells,
new radio

3G, 4G, 5G community networks



guifi-net

BCCanBruixa20Rd6

Links (RTT[ms]/Bw[Mbps]/channel/dBm)

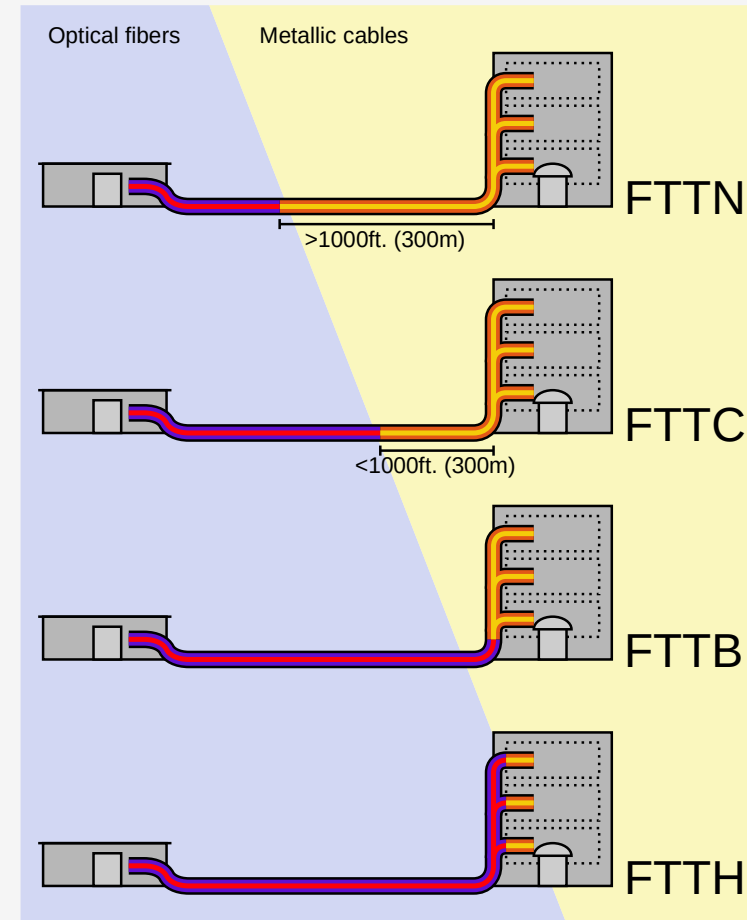
1. BCN-GS-CanBruixa20-NSM5-e48b (0.7/91.6/eth/)
2. BCN-GS-CanBruixa20-RKM5-7bbd (0.8/91.5/eth/)
3. BCNevaristoarnus5-8ed7 (1.3/620/eth/)
4. BCNevaristoarnus5Rd3-Apu (1.2/828.2/eth/)
5. BCNevaristoarnus5Rd3-BPi (1.3/794.5/eth/)
6. BCNevaristoarnus5Rd4-988e (1.3/85.7/eth/)
7. BCNevaristoarnus5Rd9-c239 (1.3/86.2/eth/)
8. BCNRadas83-Edge (3.2/239.5/eth/)
9. BCNRadas83Rd1 (2.1/75.8/eth/)
10. BCNRadas83Rd4 (2.3/87.3/eth/)
11. BCNSants186-EdgePointR6 (1.6/201.3/eth/)
12. GSgranVia255-db37 (2.6/66.5/eth/)

Business/organizational models

- **Operator model**: centralized authority, uniform, corp
 - Fixed or mobile network operator: own or shared infra, licensed spectrum
- **Community model**: distributed, crowdsourced
 - Community networks: regional mesh or p2p, shared infra, unlicensed spectrum
 - Other: Eduroam, Govroam, FON (federated)
- **Home-made model**: decentralized, individual
 - DIY: My own coverage, single-multisite (links, mesh), my own infra, unlicensed spectrum
- **Under a socio-economic-legal-regulatory env**

Fibre access?

- Generations?
- Tech:
 - FTTX ...
 - 0.05..1..10.. Gbps
 - Sharing: mux
- Models: cost of deployment ...
- Planning, investment, sharing, incentives ...



Alternative models

- Fibre operators:
 - B4RN: Lancashire UK – Rural fibre coop, 5000
 - Goufone–guifi.net: Catalonia ES – ...infra sharing
 - ECFibre: Vermont US
- Fixed radio operators:
 - Many CN around worldwide – Wi-Fi mesh
- Mobile operators:
 - Rhizomatica: Oaxaca MX – social licence 20 villages
- Many studies already ... (e.g. netCommons.eu)



Columns

- Community
- Location (central)
- Financing/investment model
- Governance
- Legal representation
- Infrastructure
- Economic model
- License (Resources)
- Stakeholders
- Regulation
- External Incentives
- Savings over commercial model
- Website
- Coverage (area)
- Started (year)
- Scale (homes)
- Existence of Universal Service Funds (USF)
- Influence of USF
- USF related links

Documented towards a BCP

	A	B	C	D	E	F	G	H	I	J	
1	Community	Location (central)	Financing/investment model	Governance	Legal representation	Infrastructure	Economic model	License	Stakeholders	Regulation	External
2	B4RN	Lancashire, UK, rural	Optional community shares, voluntary work, free wayleaves, tax deduction for investment in commons, community loans, a further business development loan from the Esmeé Fairbairn Foundation	Cooperative: board + member assembly (with shares)	B4RN company, social enterprise of public interest (community benefit society with the FSA, under the Industrial and Provident Societies Act 1965)	Active fibre for every parish + backbone with two optical connections to IXPs in Manchester and Edinburgh using leased dark fibre. 1Gbps symmetric for all customers.	Initial fee (300-1500 GBP), initial investment (<100K GBP) + monthly fee (30 GBP/ 1 Gbps)	Registered as telecom provider in the UK, wayleave over private land contributed for free	Investors, landowners, volunteers, contractors, consumers, employees	Telecom operator (member of INCA.coop)	Gigabit Voucher UK, <3K each household installation
3	guifi.net-goufone	Gurb, ES, rural	Private investment mainly (local owners, employees), optional crowdfunding from customers: initial contribution with monthly price reduction	Private company, member of the guifi.net CN	Private company	Fibre, WiFi radiolinks, optical fibre backbone in commons (overseen by guifi.net Foundation)	Service provision: no initial fee, 40 EUR / 1 Gbps	Registered as telecom provider in ES	Consumers, employees, commons (guifi.net Foundation)	Telecom operator (registered in national regulator)	None
4	EC Fibre	Vermont, USA	Investors purchase tax-exempt 15 year promissory notes that effectively earn 6% interest	ECFiber is an InterLocal Contract with a Governing Board composed of a representative from each member town (of which there are 23).							
5											
6											
7											
8											

J	K	L	M	N	O	P	Q	R	S
Regulation	External Incentives	Savings over commercial model	Website	Coverage	Started	Scale (homes)	Universal Service Funds (USF)	Influence of USF	USF related links
Telecom operator (member of INCA.coop)	Gigabit Broadband Voucher Scheme, UK, <3K GBP for each home for installation costs)	Free wayleave for private land, contribution of voluntary work in deployments, parish planning with pre-investment as threshold for feasibility, local investment with community loans and shares, local reinvestment	b4rn.org.uk	https://b4rn.org.uk/b4rn-service/coverage-area/	12/2011	5000	Existing, but given to incumbent only (BT)	Negative (although positive for the GVS)	https://www.ispreview.co.uk/index.php/2017/11/b4rn-fear-10mbps-uk-broadband-usage-may-hamper-rural-ftth-rollout.html
Telecom operator (registered in national regulator)	None	Same conditions (lower cost and higher speed than average commercial services) but new coverage in underserved areas	https://goufone.co	Catalonia, counties of Osona, el Ripollès, la Garrotxa, el Bages, el Vallès Oriental, el Maresme, el Berguedà i el Gironès.	2010	10000 (50% fibre, rest radio)	All operators (over threshold) contribute and given to one (Telefonica) incumbent (18M€ in 2017) for a 1Mbps service	Negative (uncertainty from "privileged" incumbent) or no effect (too slow and fragile service)	https://www.mincotur.gob.es/telecomunicaciones/es-Servicios/InformeUniversal/Paginas/ndex.aspx
			www.ecfiber.net		10/2007				

BCP on Alternative operators

https://en.wikipedia.org/wiki/Best_current_practice

- A Best Current Practice (BCP):
 - A de facto level of performance in engineering and information technology
 - More flexible than a standard, since techniques and tools are continually evolving
 - Carry the endorsement (tech approval) of the Internet Engineering Steering Group (IESG) or IRSG?
- Paired to RFC 7962:
 - *Alternative Network Deployments: Taxonomy, Characterization, Technologies, and Architectures*
 - Organize, summarize, reference practices +/-



Network deployments for universal connectivity: **new generation access**

- Document as best current practices (BCP)
 - Alternative ... fibre, fixed radio, mobile operators
- Understand mechanisms and environmental factors for/against alternative networks → replication
- Makes sense?
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