

Resilient and robust networks in Iceland

Proposed strategy, goals and measurable targets for the next decade

Njordur Tomasson, ECOI, Iceland

BEREC Workshop in Brussels, 19th of November 2024



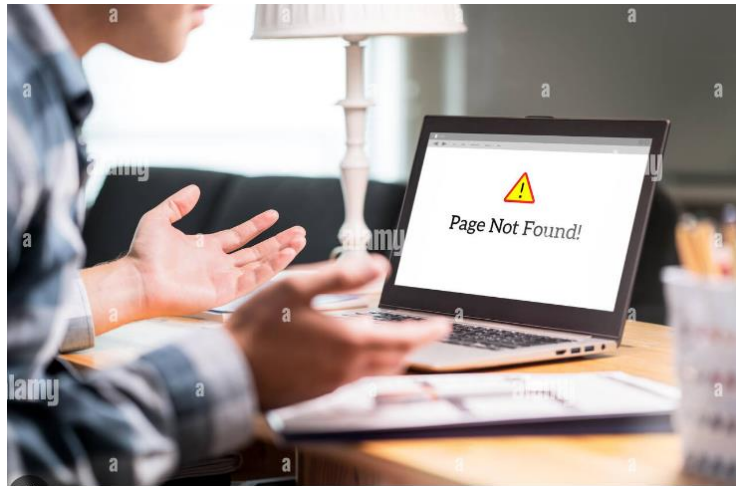
ECOI

Electronic Communications
Office of Iceland



CERT·IS

We are highly dependent on connectivity



Networks tend to break



Innlent | mbl | 1.12.2017 | 18:49

Ljósleiðari slitnaði á Suðurlandi

Slit varð á ljósleiðarahring Mílu, landshring, á Suðurlandi um kl. 18.20 í kvöld. Slitið er á milli Víkur í Mýrdal og Steina undir Eyjafjöllum.



Innlent | mbl | 27.11.2017 | 16:22

Ljósleiðari slitnaði í Kópavogi

Komið hefur upp ljósleiðaraslit í Auðbrekku í Kópavogi. Undirbúningur fyrir viðgerð stendur nú yfir.



Innlent | mbl | 3.11.2016 | 10:16

Algjört sambandsleysi

Um sexleytið í gærkvöldi slitnaði ljósleiðari við bæinn Flögu í Þistilfirði og misstu þá íbúar á Þórshöfn og nærrannabyggðarlögum fjarskiptasamband.



Innlent | mbl | 6.8.2015 | 19:32

Ljósleiðari á Hellsisheiði kominn í lag

Viðgerð er lokið á ljósleiðara Mílu sem slitnaði á Hellsisheiði fyrr í dag. Viðgerð var lokið um sjöleytið, samkvæmt upplýsingum frá Mílu.



Innlent | mbl | 6.8.2015 | 16:54

Ljósleiðari slitnaði við Hellsisheiði

Slit hefur orðið á ljósleiðara Mílu við Hellsisheiði. Viðgerðateymi er komið á staðinn og er unnið að viðgerð, að því er segir í tilkynningu frá Mílu.



Innlent | mbl | 23.6.2014 | 15:16

Geta hvorki verslað né hringt

„Hér virka engir posar, símar eða net. Hvorki bankinn, sjoppa né bensínafgreiðslan geta starfað á meðan þetta er svona,“ segir Líney Sigurðardóttir, fréttaritari Morgunblaðsins á Þórshöfn, en fyrr í dag slitnaði ljósleiðari Mílu milli Húsavíkur og Skúlagarðs. Veldur það því að hvorki síma- né netsamband næst í bænum.



Innlent | mbl | 28.8.2013 | 14:06

Ljósleiðari slitinn

Ljósleiðari Mílu milli Reykjavíkur og Hveragerðis slitnaði um kl. 13.30 í dag. Bilanagreining stendur yfir og mun viðgerð hefjast um leið og þeirri greiningu lýkur.

200 mílur | Morgunblaðið | 30.11.2023 | 6:00 | Uppfært 6:59

Ljósleiðari fór með vatnslögninni



Það var fleira en vatnslögnin sem skemmdist. mbl.is/Óskar Pétur Friðriksson



Morgunblaðið

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Seja bókamerkir

Það var ekki aðeins að vatnslögnin til Vestmannaeyja stórskemmdist þegar Huginn VE dró akkeri skipsins í leiðsluna, heldur slitnaði ljósleiðari Vodafone í leiðinni.

Þá er óttast að einhverjar skemmdir kunni að hafa orðið á einum þeirra þriggja rafstrengja sem liggja frá landi til Eyja. Þó er ekki talið að þar sé um að ræða annan tveggja virkra rafstrengja, líklegra sé að þar sé um aflagðan streng að ræða. Þetta segir Halldór Halldórsson öryggisstjóri Landsnets sem rekur rafstrengina.

Hættuástand almannavarna er í Vestmannaeyjum vegna skemmdanna á vatnslögninni og er lögreglan í Eyjum með málið til rannsóknar sem og rannsóknarnefnd sjósýsa.

Single point of failure the North (City of Akureyri)



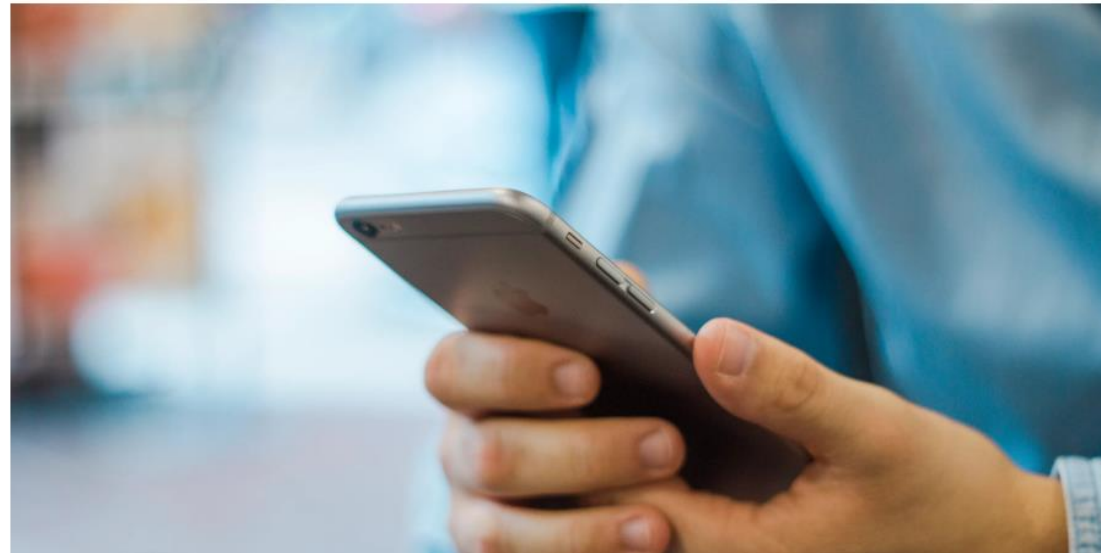
Fjarskipti



Netið, símarnir og TETRA-stöðvarnar tengdust öll sama varaaflinu

Það sýndi sig í gær hve brothætt fjarskiptakerfið er við Eyjafjörð, þegar síma-, net- og TETRA-talstöðvakerfið lá niðri samtímis. Almannaþarnir hafa atvikið til skoðunar.

Ólöf Rún Erlendsdóttir
16. október 2024 kl. 14:54, uppfært kl. 16:45



How do we define robust and resilient networks ?

- The project defines or operationalizes something we call resilient and robust networks
- We present measurable goals and targets for resilient networks
- This project is in the field of „transport networking" and how access or distribution networks are connected in a reliable and robust way to the transport networks.
- A wholistic view where we review all major communications networks in the country and evaluate to what extent they can improve or back up each other
- A national view where we measure reliability of end-users services, in homes and business premises. The scope is public Telecom services
- The assumption is that secure and reliable transport networks lead to secure connections of access or distribution networks, both wired and wireless.

Main Goals : resilient and reliable networks

1) **Build more reliability and greater resilience in transmission networks (trunk)**

- To secure physical separation between different fibers between towns and cities
- Minimum two transport POP's in larger communities to prevent single point of failure in a single transport POP
- To ensure internal multiple redundancy in each active transport network
- To increase the number of nationwide autonomous transmission networks

2) **Mobile and FTTH/B providers use several autonomous transmission networks (backhaul)**

- This target enhances the utilization of several transport networks in every community. This can prevent a total outage in a certain town/city due to a failure of one or more transport network/s.

3) **At least 2 independent broadband connections to households and business premises**

- With a focus on putting requirements on service providers to offer seamless network failover service between those independent connections.

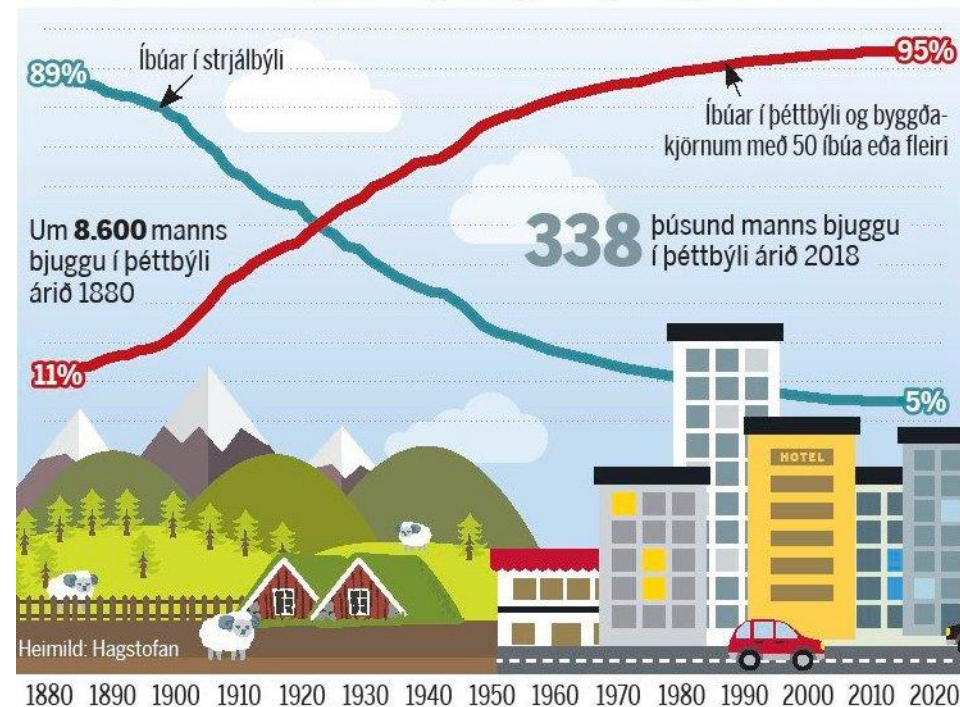
4) **High capacity and resilient International connections to several countries to and from many regions within the country**

- A minimum of 4 International or submarine cables should connect Iceland to ensure redundancy and minimize the risk of a total outage on the Internet
- Use satellite connections for connecting critical infrastructure entities in catastrophic situation and for restoration purposes for minimum household and businesses communications needs.

Population classification of populated areas

- The project measures the status of urban places
- Villages/towns/cities in Iceland are in total **96**.
- In 2023 the number of urban places with more than 200 inhabitants were **63**
- We have categorized these into 3 sizes. villages, towns and cities.

Hlutfall íbúa í þéttbýli og strjálbýli 1880-2018



Policy on reliable and robust networks

Iceland's 63 urban areas



Classification by population

Densely populated areas, 3 types

Category	Description	Number of inhab.	Population ratio	Town ratio
A	Villages and small Towns	200 til 2.000 inhab.	12%	79% (fj=50)
B	Larger towns	2.000 til 20 þús. Inhab.	7 %	11% (fj=7)
C	Cities	20 þús+ inhab.	82 %	10% (fj=6)

1. Section / Goal

„Goals about robust and resilient transport networks“

Project span 10 years (2024 – 2034)

Target 1A, Separated transmission paths

Several physically separated fiber paths for transmission networks to densely populated areas.

Category	Description	Size category	Number of paths
A	Villages and small towns	200 til 2.000 inhab.	2
B	Larger towns	2.000 til 20 þús. Inhab.	3
C	Cities	20 þús+ inhab.	4

The target will ensure that communication to and between densely populated areas is maintained if one or more simultaneous transmission breaches occur, or in the event of the loss of one transmission hub.

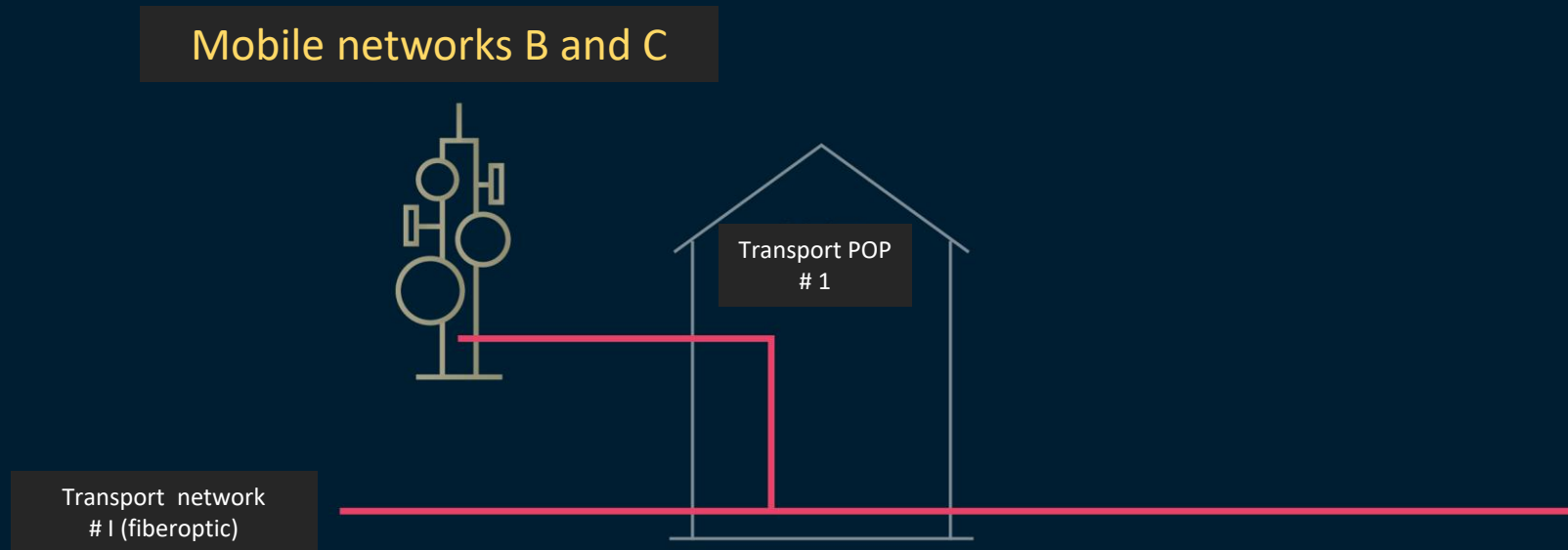
Target 1B, Number of POPs

In larger towns and cities transmission networks should terminate in at least two physically separated transmission hubs.

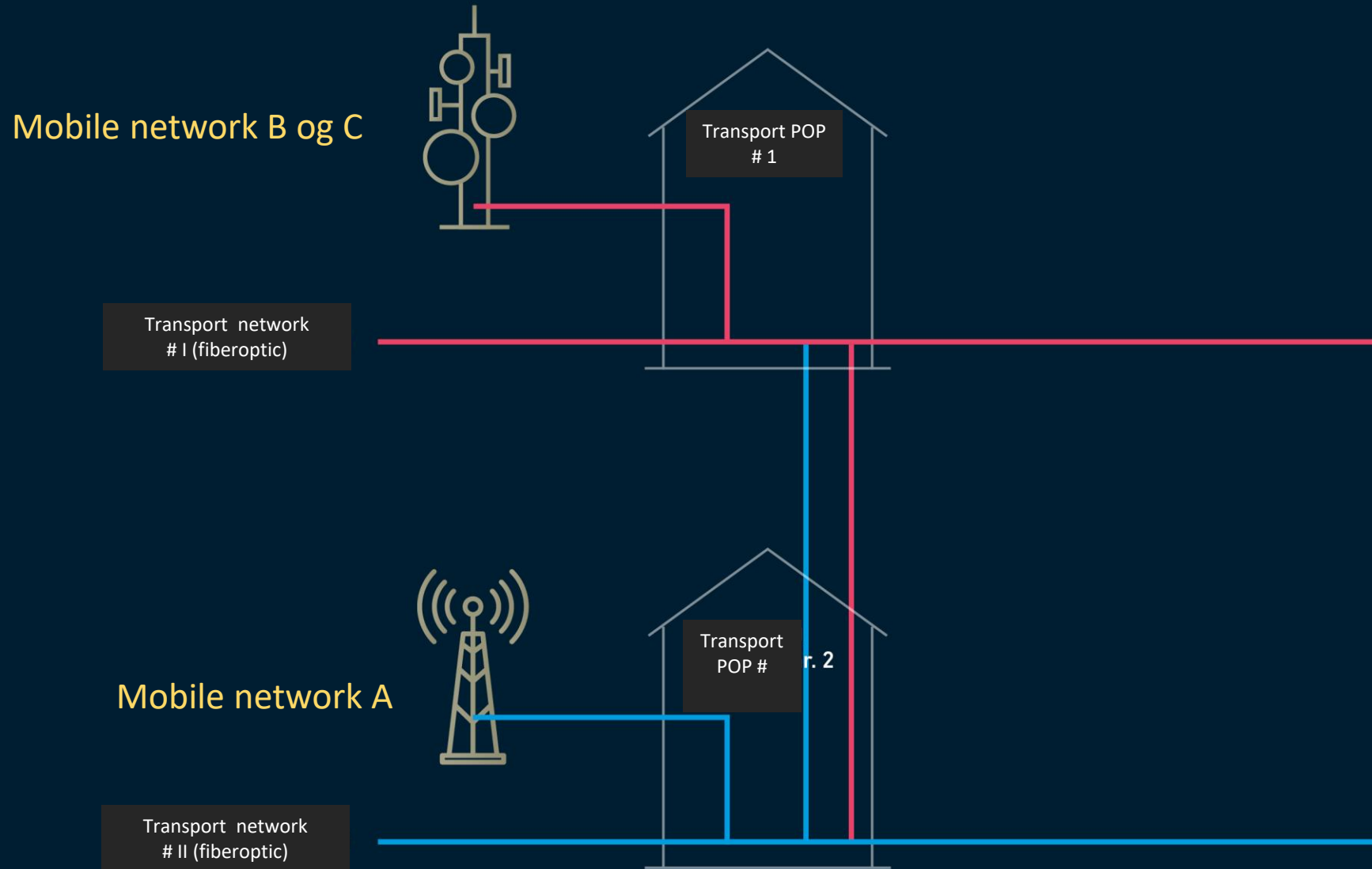
Category	Description	Size category	Number of POPs
A	Villages and small towns	200 til 2.000 Inhab.	1
B	Larger towns	2.000 til 20 þús. Inhab.	2
C	Cities	20 þús+ Inhab.	2

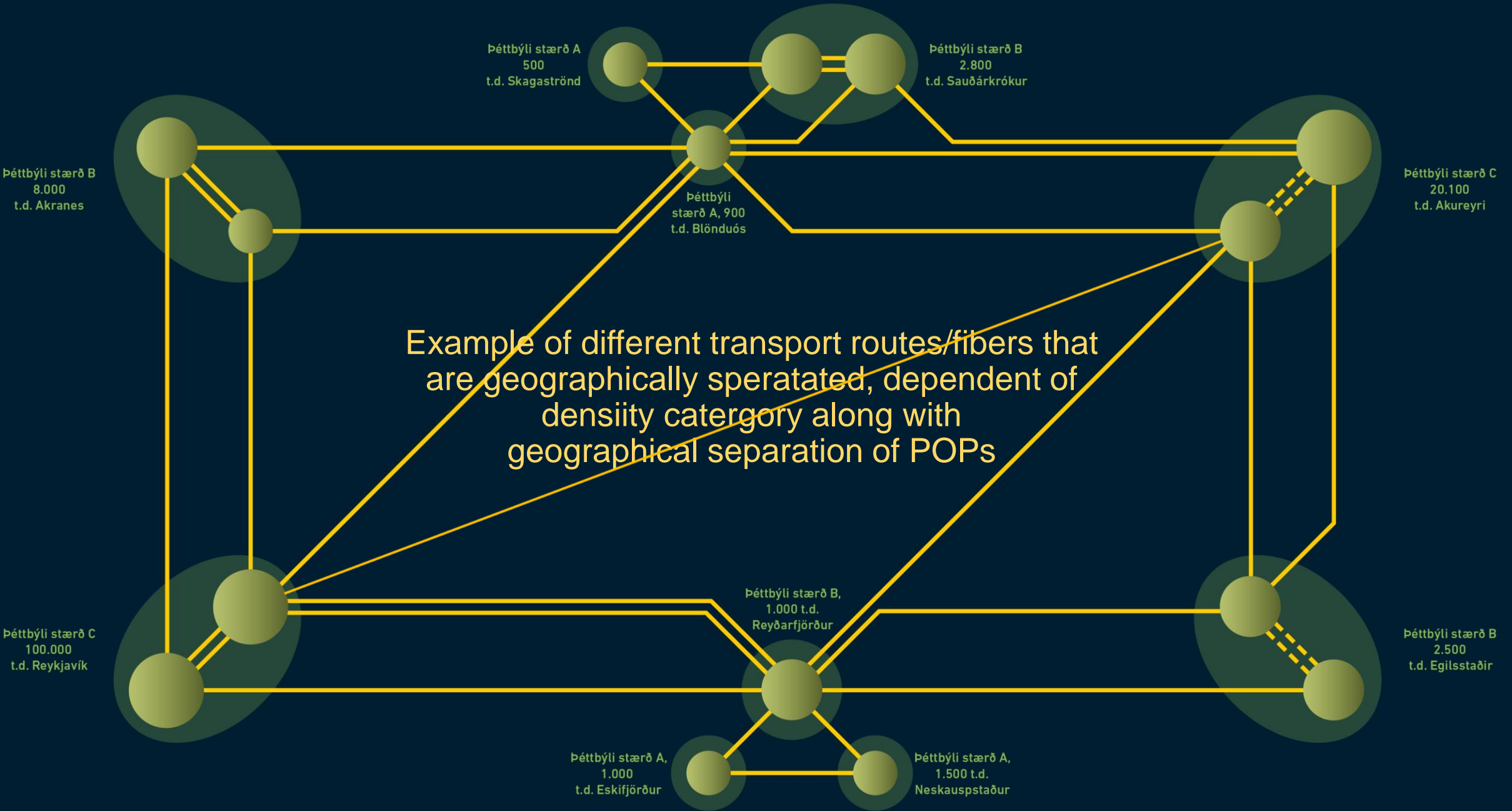
This target can prevent single point of failure incident in larger communities around the country.

Example of a densely populated area, type A 200-2000 inhabitants. I.e. villages and small towns



Example of a densely populated area, type B og C 2.000 to 20.000 inhabitants. I.e. larger towns and cities





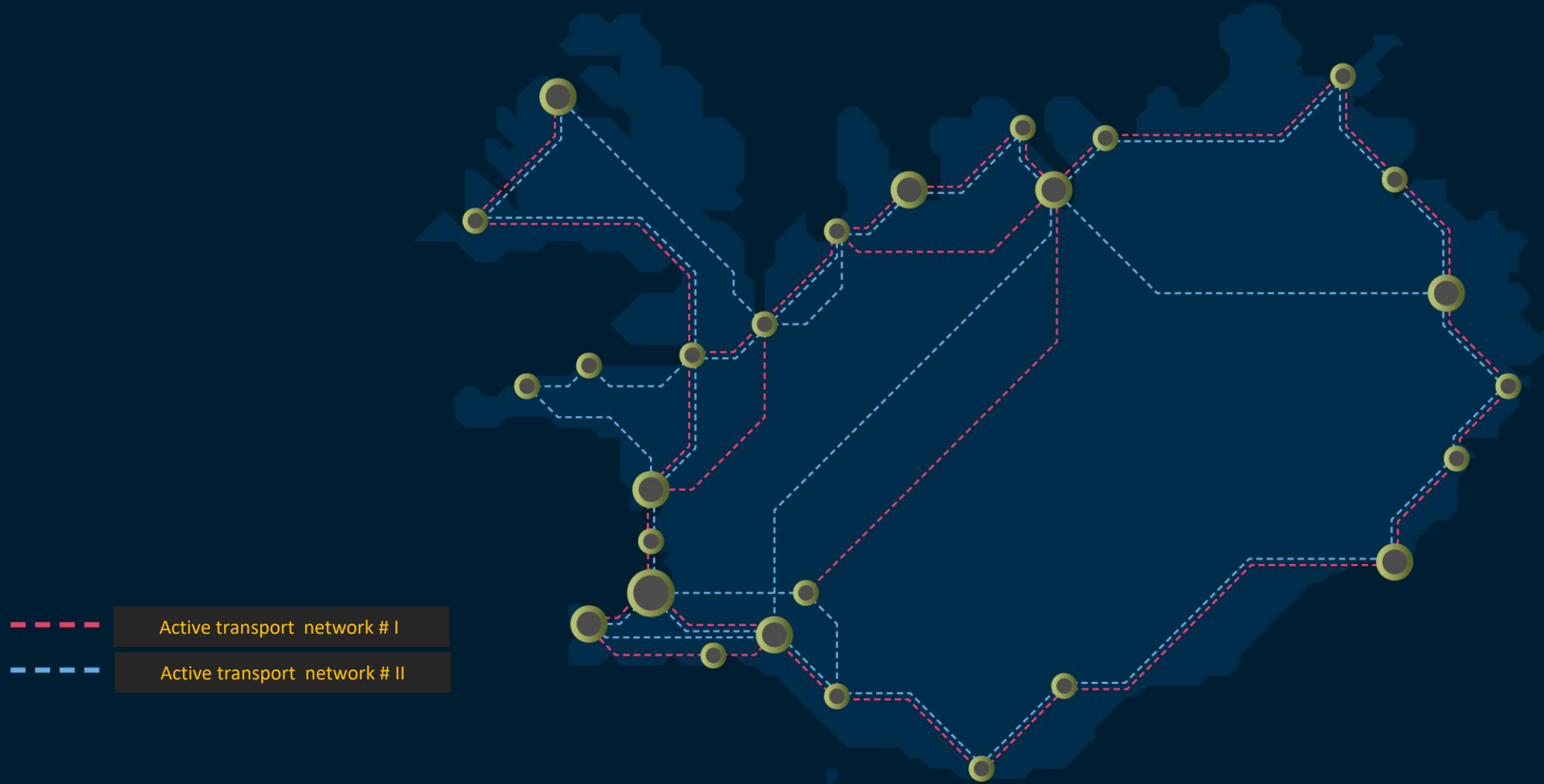
Target 1C, Well-developed redundancy

Each active transmission network has well-developed internal redundancy.

Category	Description	Size category	Number of routes
A	Villages and small towns	200 til 2.000 inhab.	2
B	Larger towns	2.000 til 20 þús. Inhab.	3
C	Cities	20 þús+ inhab.	3

The target will ensure that, in the event of one or more simultaneous transmission breaches in their respective networks, the transmission services of each provider can be maintained to all densely populated areas around the country.

Example of two active transport networks and internal redundancy



Target 1D, to maintain several autonomous transmission networks

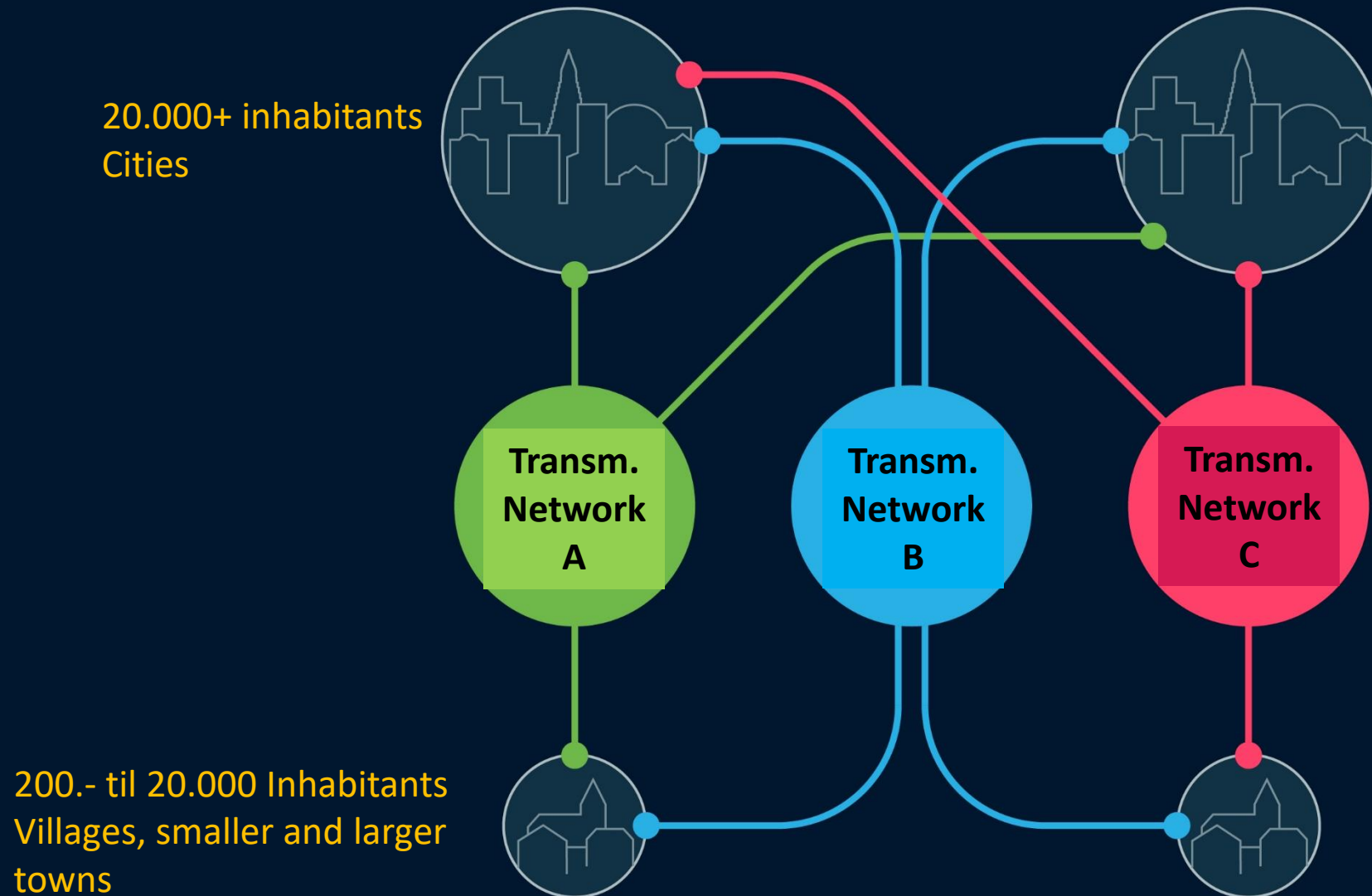
That in Iceland there will be operated minimum 2 or 3 independent nationwide active transmission networks.

Category	Description	Size category	Number of networks
A	Villages and small towns	200 til 2.000 Inhab.	2
B	Larger town	2.000 til 20 þús. Inhab.	2
C	Cities	20 þús+ Inhab.	3

The target will ensure that users (distribution system operators or buyers of transport bandwidth) in different locations in the country have the opportunity to choose from several autonomous nationwide networks.

On top of that this target ensure that if one transmission network fails, there is always another network that connects a certain community and secure uptime for the people living in that area.

Target of number of autonomous transmission networks that offer service in every size category.



2. Section / Goal

„Goals about robust and resilient Access/Distribution Networks“

Project span 10 years (2024 – 2034)



Target 2A, Robust and resilient Access networks

Fixed access networks (e.g. FTTH/B) use at least 2 or 3 autonomous transmission networks.

Category	Description	Size category	Number of indep. networks
A	Villages and small towns	200 til 2.000 inhab.	2
B	Larger towns	2.000 til 20 þús. inhab.	2
C	Cities	20 þús+ inhab	3

This target will prevent that in the case of a outage in one access network in a particular geographical area, that is caused by a failure of transport network, that there will be a failure in another access networks in that same period of time.

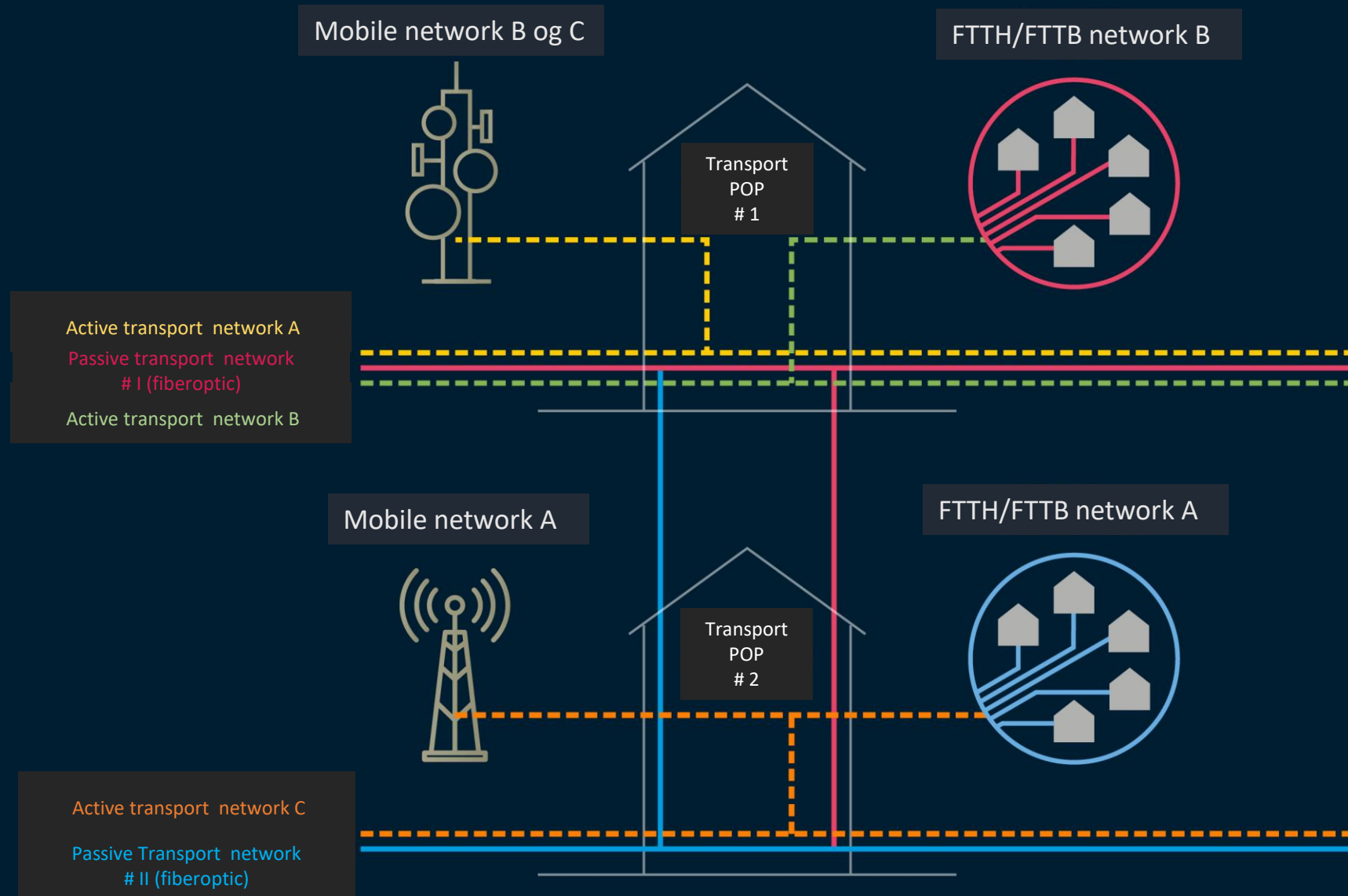
Target 2B, Robust and resilient Mobile networks

That Mobile broadband networks in total use at least 2 or 3 autonomous transmission networks.

Category	Description	Size category	Number of indep. networks
A	Villages and small towns	200 til 2.000 inhab.	2
B	Larger towns	2.000 til 20 þús. inhab.	2
C	Cities	20 þús+ inhab	3

This target will prevent that in the case of a outage in one mobile network in a particular geographical area, that is cause by a failure of transport network, that there will be a failure in another mobile networks in that same period of time.

Example, 3 independent transmission networks and how they ensure resilient upstream connections for the access systems and secure the endusers services in particular towns or cities.



3. Section / Goal

**„Multiple Independent broadband connections
for households and businesses“**

Project span 10 years (2024 – 2034)



Target 3, Households and businesses have access to at least two independent broadband connections

3A To ensure that all residents have at least 2 broadband connections

- This target is aiming for that all residents (including homes and businesses) in the country should have access at least two independent broadband connections irrespective of transport type.

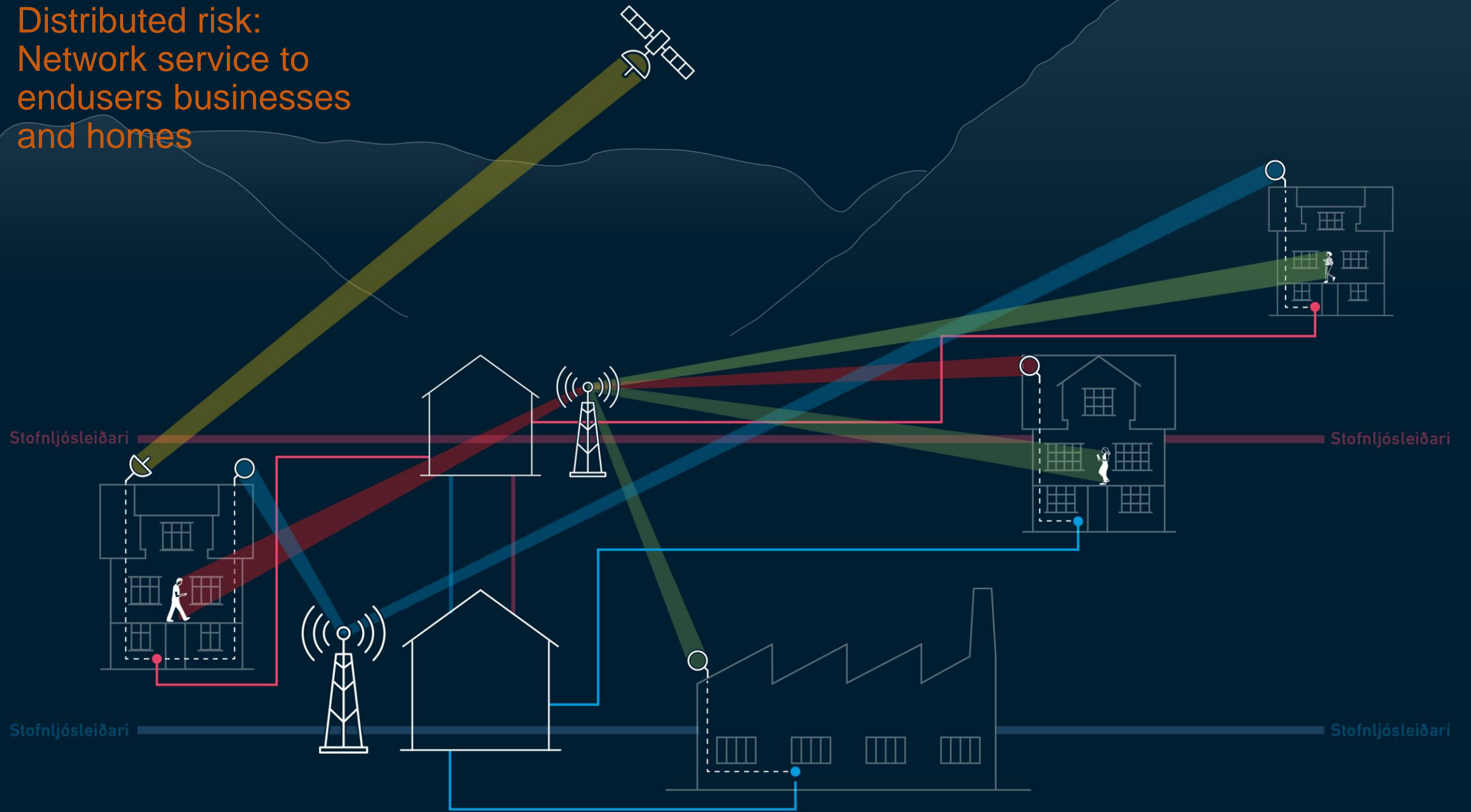
-> Fiber, Copper

-> Mobile Network A, Mobile Network B, Mobile Network C, WIMAX systems, low orbit satellites

-> Point to Point radio Systems

User that require maximum uptime when it comes to network connectivity are in a position to buy connection B on top of connection A via other independent broadband connection for restoration purposes.

Distributed risk:
Network service to
endusers businesses
and homes



4. Section / Goal

“Robust and resilient International connections and Internet service“

Project span 10 years (2024 – 2034)

Target 4, Robust and reliable international connections

4A. To secure a number of submarine cables and landing stations

- Use a minimum of 4 submarine cables and that landing stations are geographically separated.

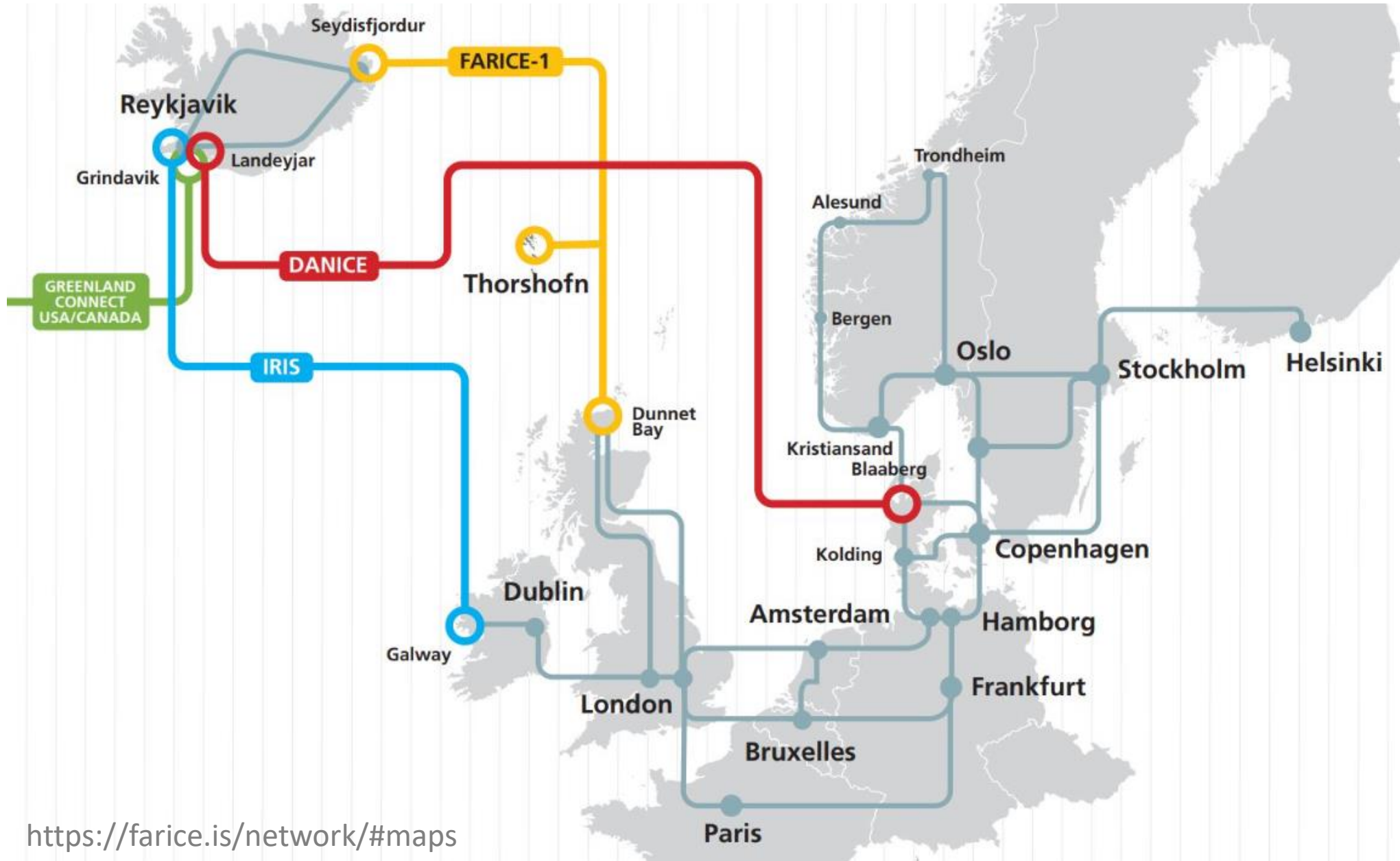
4B. To secure the reliability of backhauls connections

- To secure reliability when it comes to international connections, all backhaul connections should be secured and use at least two different and independent transport vendors.

4C. Distribute international traffic between submarine cables

- This target ensure that International traffic is distributed between international cables to ensure that if one submarine cable fails the other cables will serve as failover.

The FARICE NETWORK including Scandinavia



Target 4 Spreading of International traffic

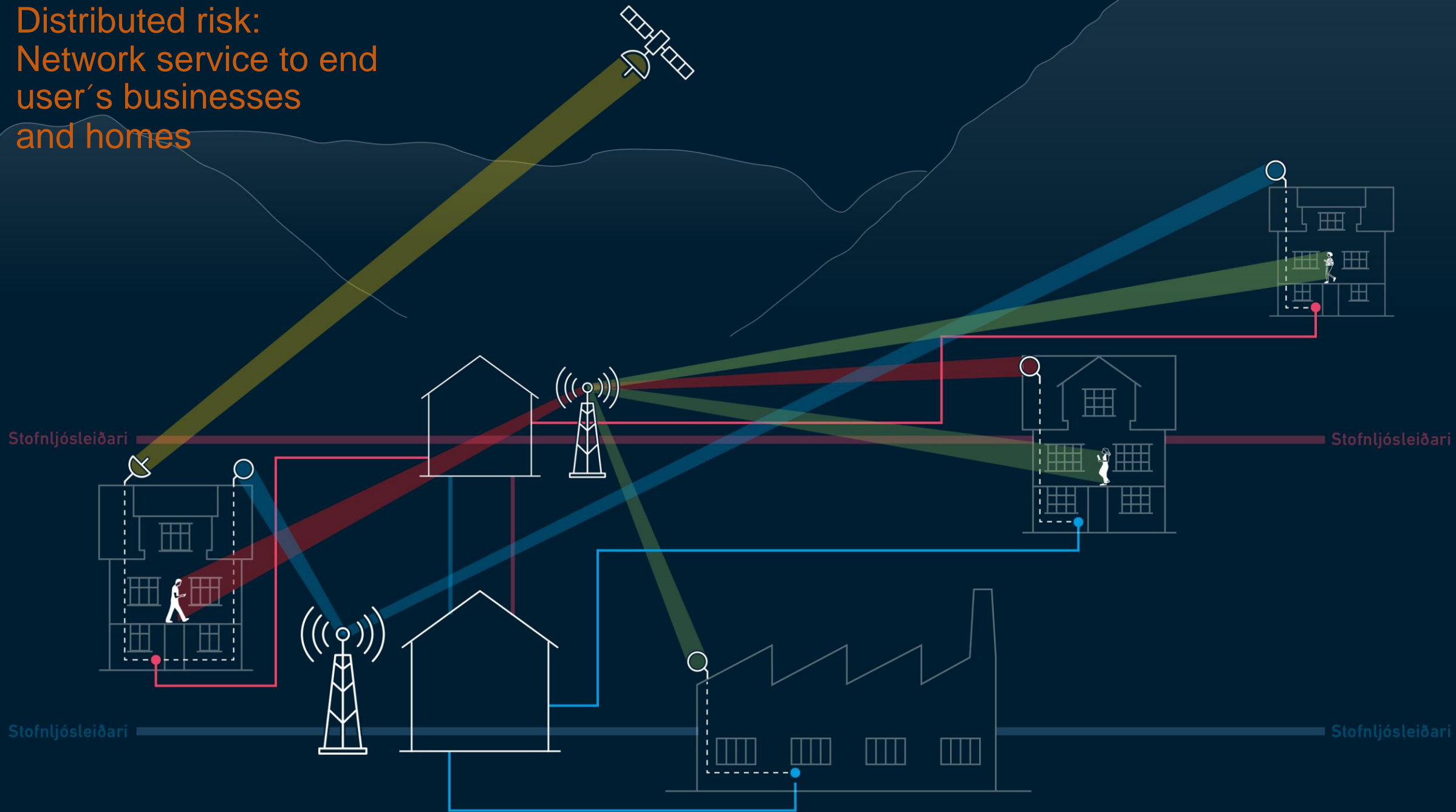
4D. Interconnection places/POPs abroad

- That **service providers** operate certain number of Interconnections for network connectivity and Internet exchange POPs abroad and those interconnections should be **geographically separated between regions and countries** to minimize operation risk (at least 3 within Europe and 1 in other continent or total = 4).

4E. Satellite connections as a restoration routes.

- That **critical entities** will have in all circumstances access to viable and secure **restoration route via satellite** for international connection purposes.
- **Homes and businesses** should **have access minimum communications services (voice and simple text) via satellite** connections for restoration purposes.

Distributed risk:
Network service to end
user's businesses
and homes



5. Measurements

Example of presentation of targets

Project span 10 years (2024 – 2034)

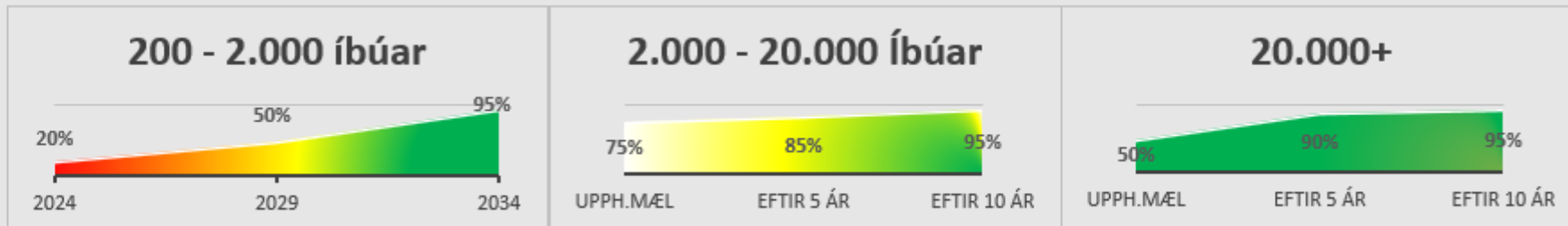
Draft of measureable targets (June 2024)

This is an example.

Base rate measurements have not been executed at this point of time.

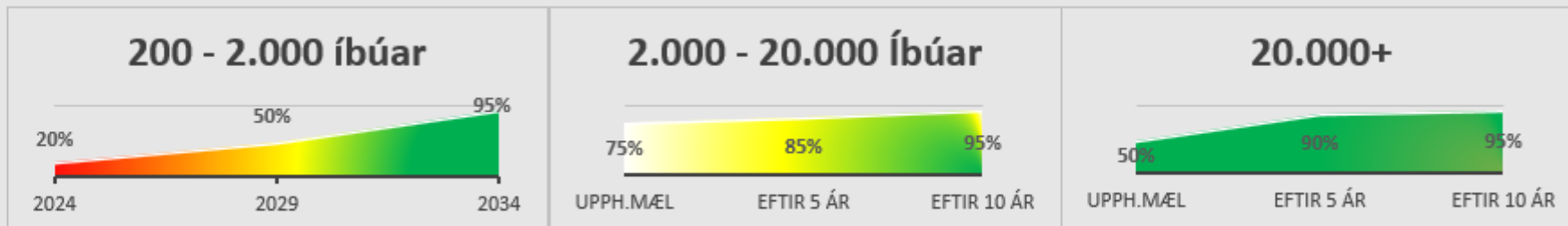
1A

Nokkrar landfr.lega aðskildar stofnleiðir til og frá þéttbýlisstöðum



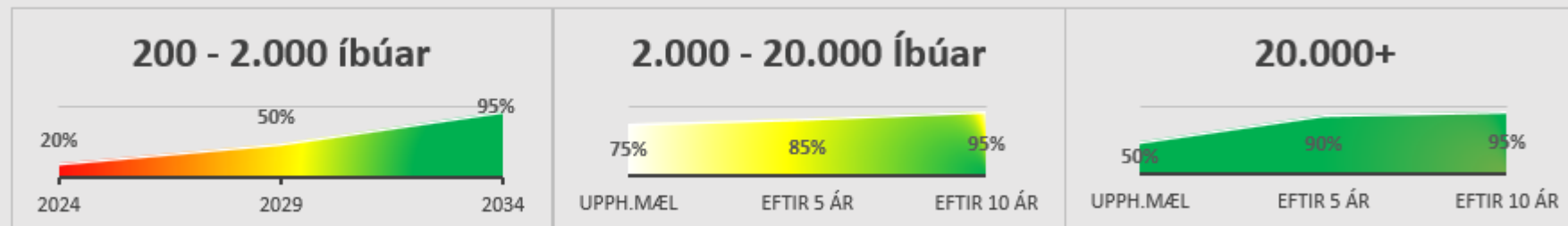
1B

Stök virk stofnet hafa innbyggðar fjarskiptavarnir (varaleiðir)



1C

Nokkuð óháð landsdekkandi Stofnfjarskiptanet



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Strategy, goals and measurable targets for the next decade



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