

# Altibox IPv6 Deployment Real Use Case N:1 Shared Vlan Model

Ragnar Anfinssen  
IPv6 Project Manager



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A night photograph of a cityscape. In the foreground, there is a green lawn and a small pond with a curved path. In the middle ground, there are several traditional houses with lit windows. In the background, there are modern high-rise buildings, some with lit windows and others with balconies. The sky is dark blue.

# Today, Altibox supplies services via fiber optics to more than 215 000 homes and businesses

- TV services and film rental
- Internet
- Broadband telephony
- Mobile phone service
- Alarm services



# Altibox today



239.000 signed customer contracts  
217.000 connected customers



91.700 PVR decoders



740.000 film rentals in 2010



Internet speeds between 30 Mbps and  
400 Mbps



Pure IP-based solution



18.000 mobile phone subscriptions



17.900\* alarm customers

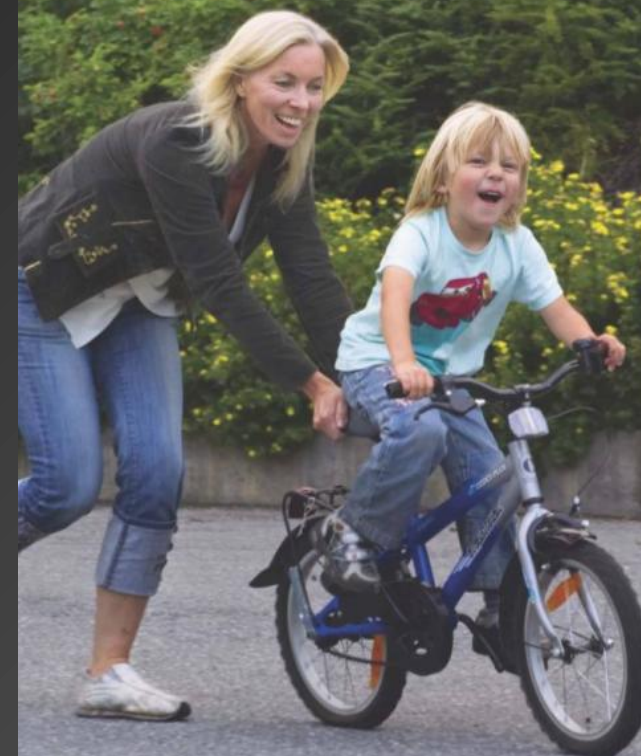


3.750 business customers

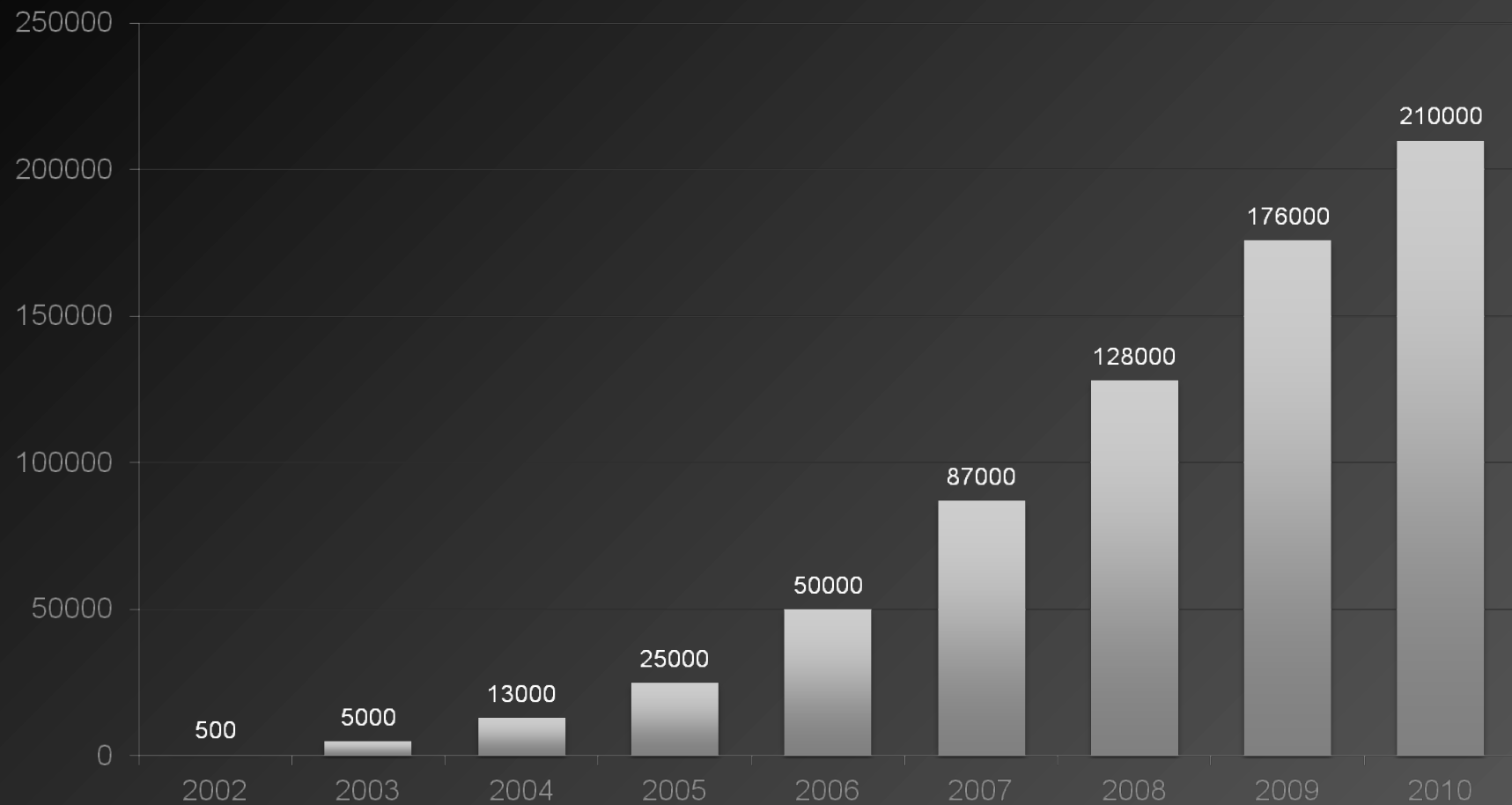
*\*Including Noralarm*



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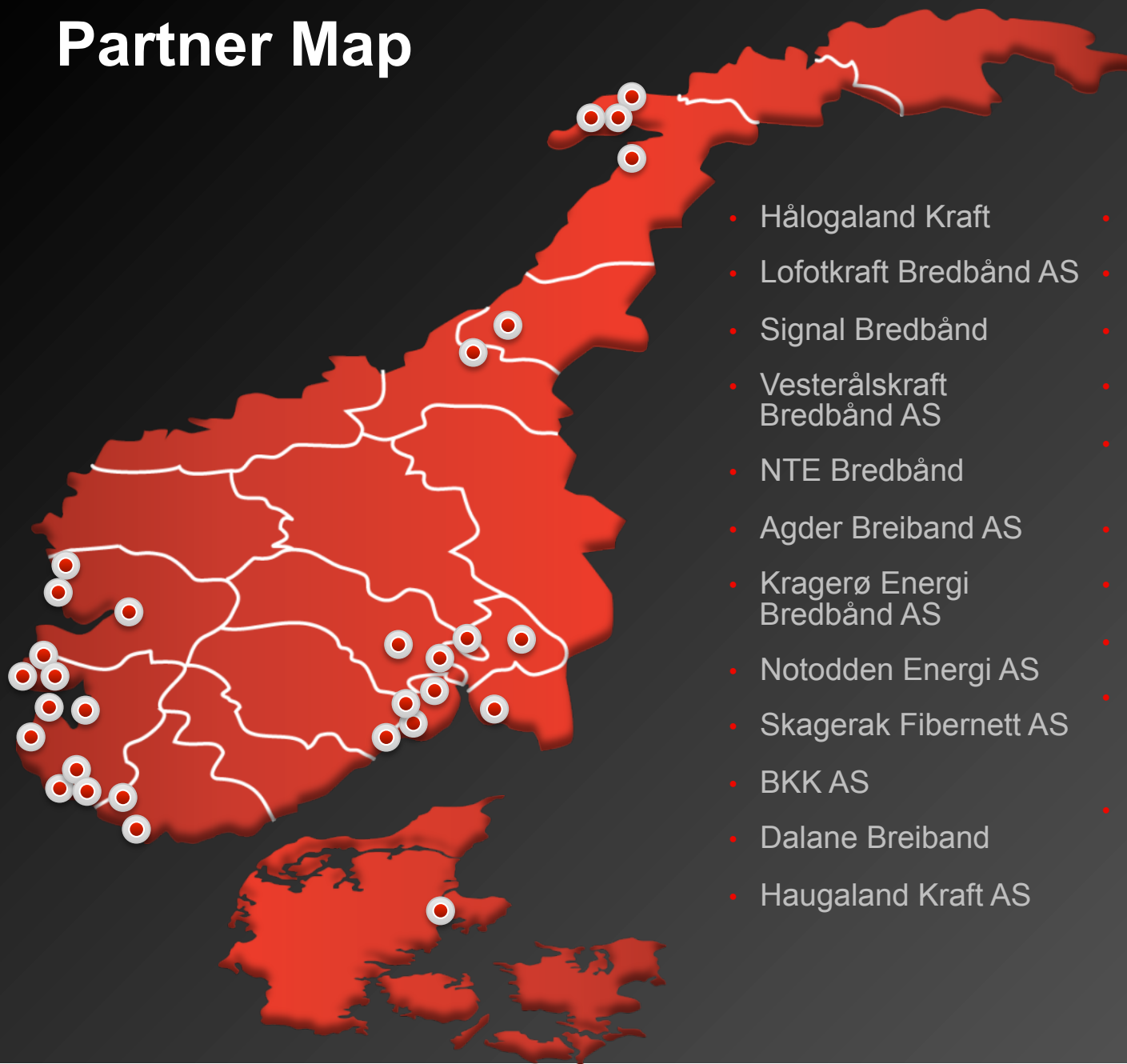
# Altibox subscribers



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# Partner Map

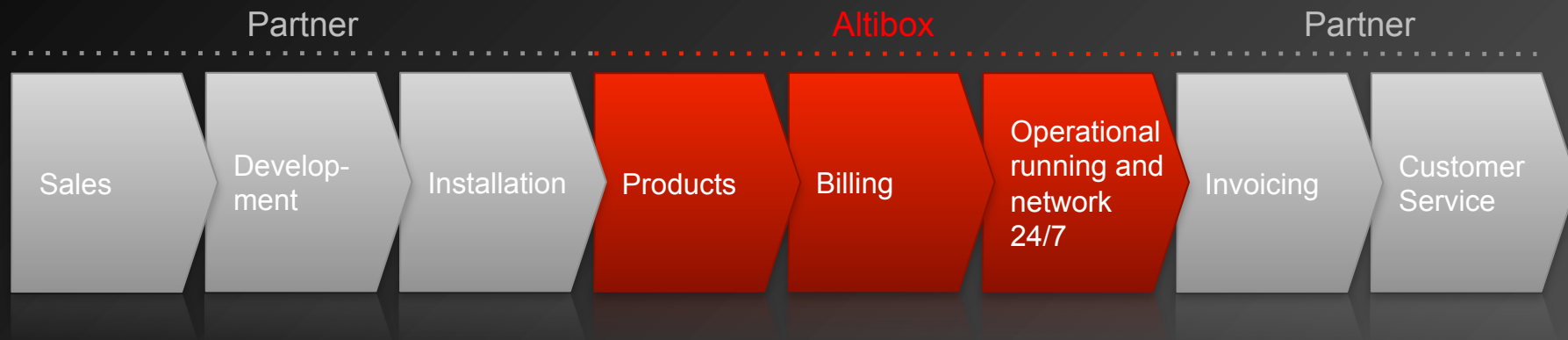


- Hålogaland Kraft
- Lofotkraft Bredbånd AS
- Signal Bredbånd
- Vesterålskraft Bredbånd AS
- NTE Bredbånd
- Agder Breiband AS
- Kragerø Energi Bredbånd AS
- Notodden Energi AS
- Skagerak Fibernet AS
- BKK AS
- Dalane Breiband
- Haugaland Kraft AS
- Klepp Breiband
- Lyse
- SKL Breiband
- EB
- Hadeland & Ringerike Bredbånd AS
- Lier Fibernet AS
- Sandefjord Bredbånd
- Viken Fibernet AS
- Østfold Fibernet AS
- Altibox Danmark



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# Responsibility assignment matrix

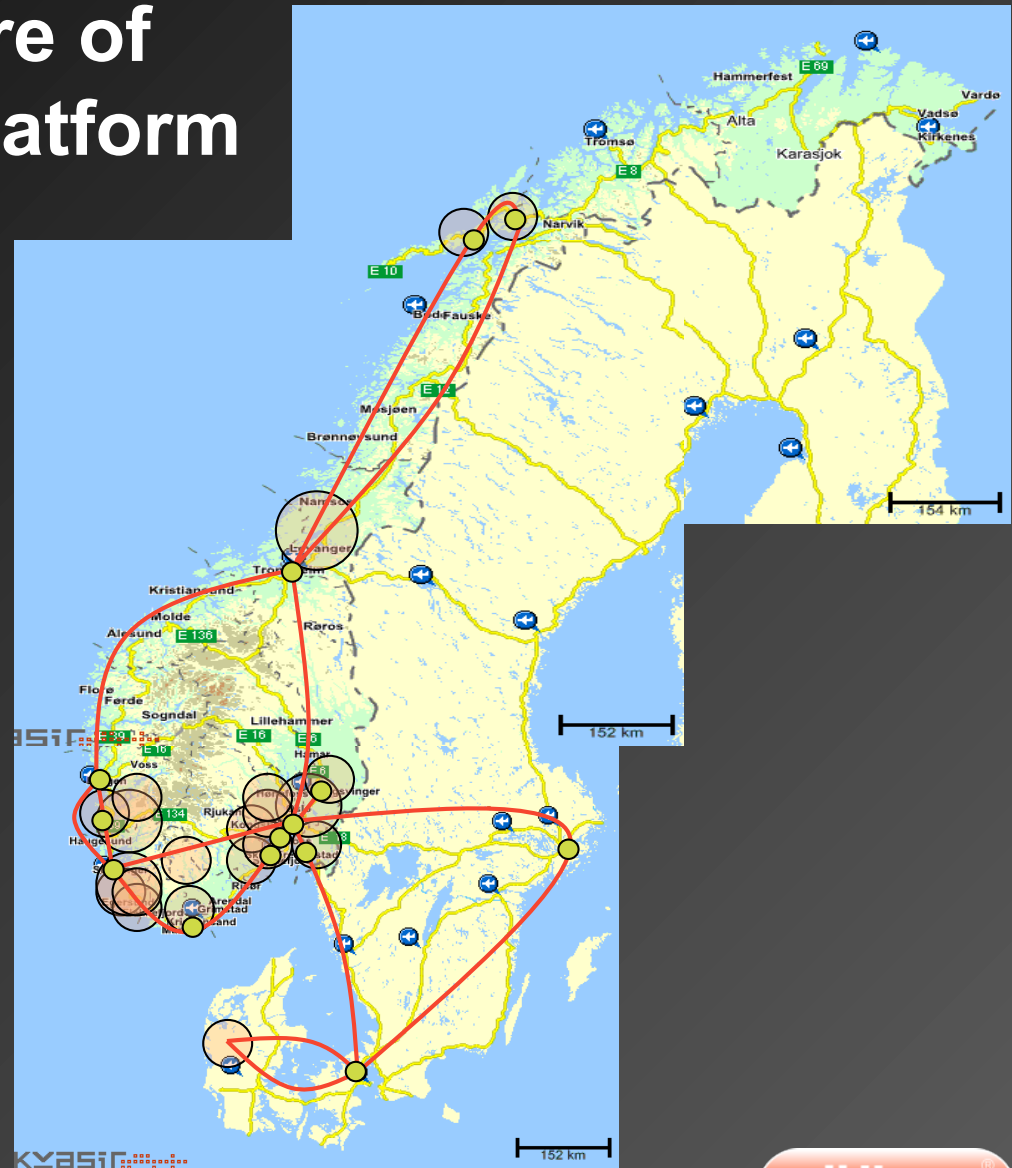


- Responsibilities
- Network
- System and process strategy



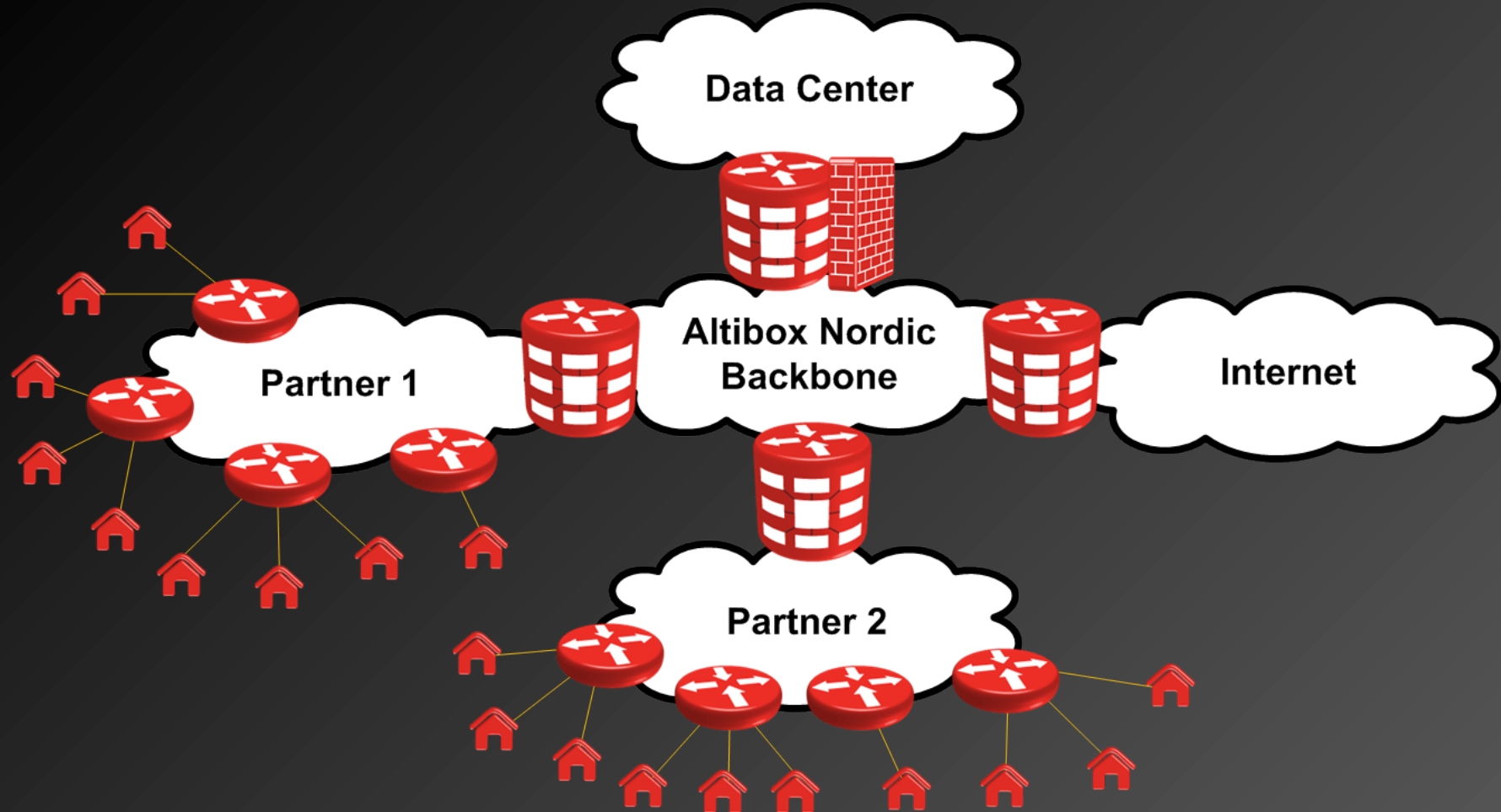
# The network is the core of the service delivery platform

- 40Gbit/s ring in Southern Norway
- 10Gbit/s ring in Middle Norway
- 10Gbit/s ring in Stockholm & Copenhagen
- 2,5 Gbit/s ring in Northern Norway
- Very large IP network based on fiber optics, with 1800 access routers



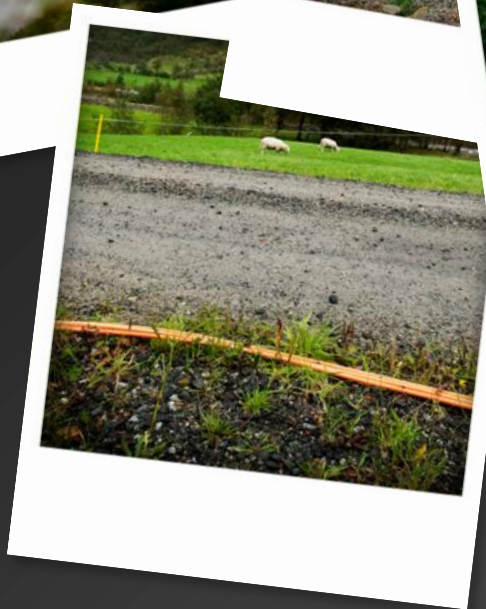
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# Altibox Basic Network Overview



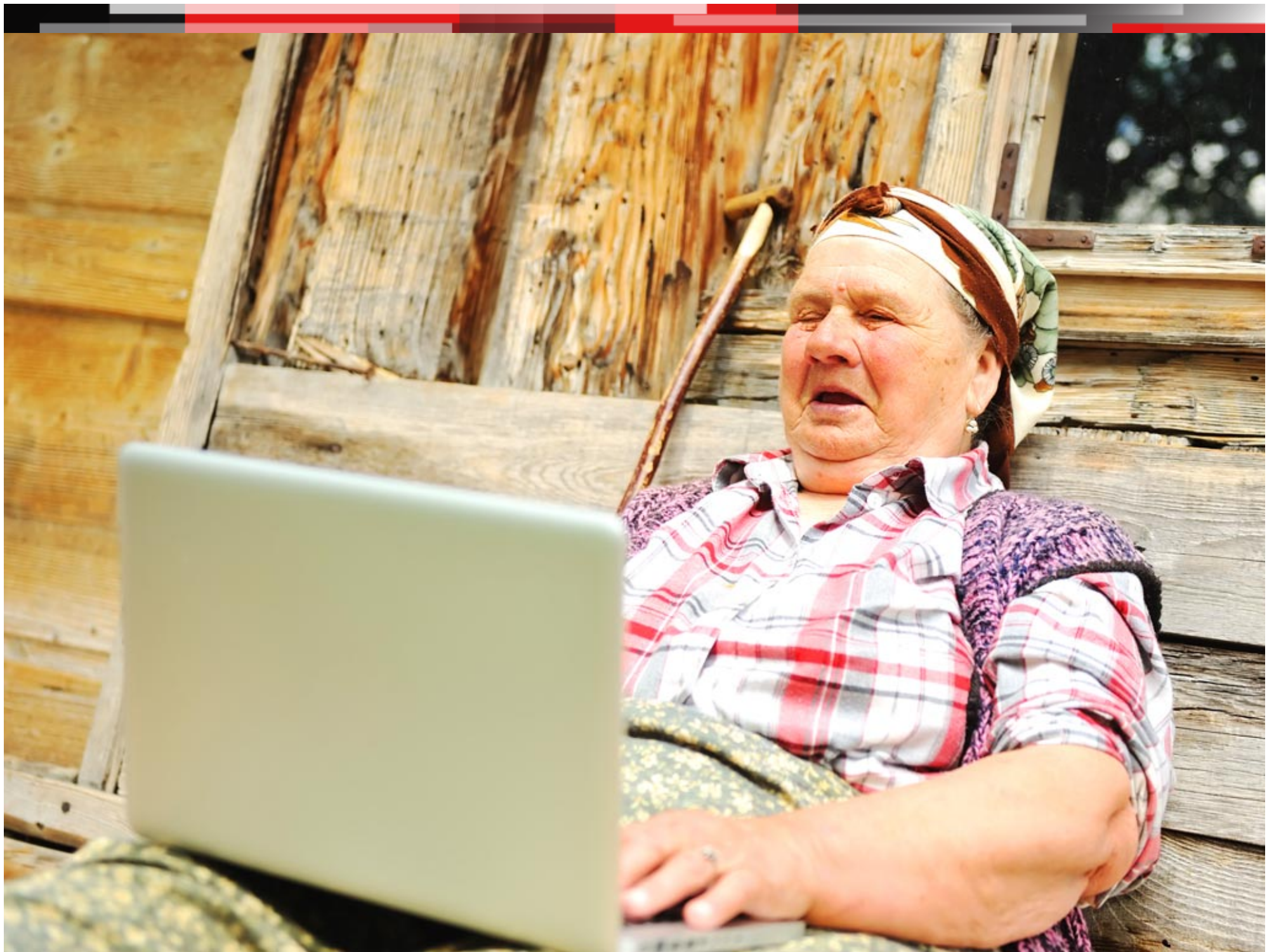


# Trenching and installation



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This part of the  
presentation only covers  
the Internet play

IPv6 for walled garden services will be covered in  
future projects

# IPv4 Address Plan

- In general a /20 pr. partner core. Add /20s when needed.
- Linknets, Loopbacks and customer nets are all taken from the /20s.
- Makes aggregation easy.
- Makes partner growths easy and conserving addresses at the same time.
- CPE linknets varies in size depending on the number of connected CPE's.
- Adds a secondary subnet if more is needed for CPE's.
- This also conserves IP addresses.
- Increased the IP utilization from 43% to 75% using this method.



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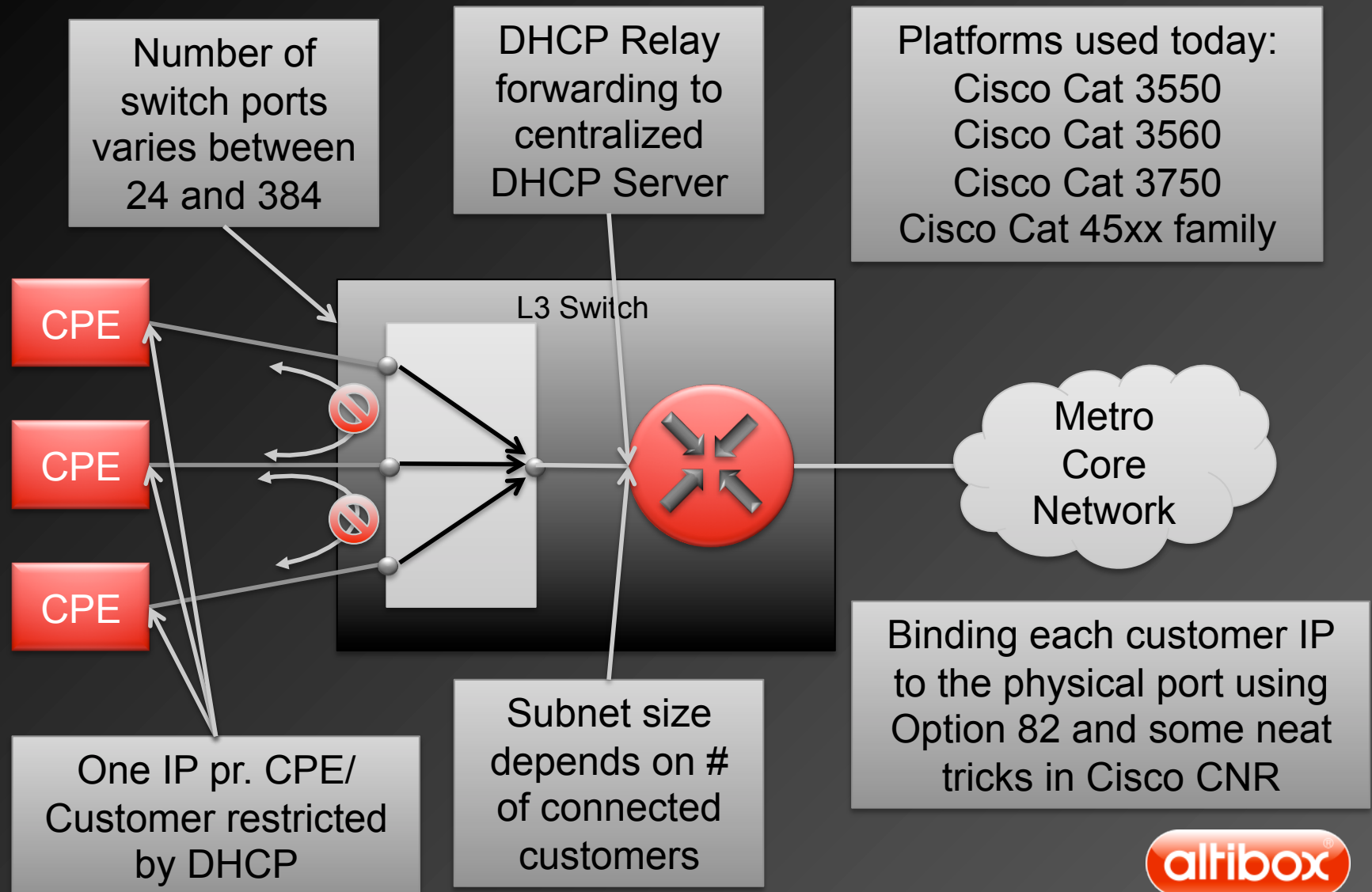
# Access models

- We use different access models for Residential and Corporate customers.
- 1:1 VLAN model for Corporate customers
- N:1 shared VLAN model for Residential customers
- CPEs are owned and managed by Altibox.



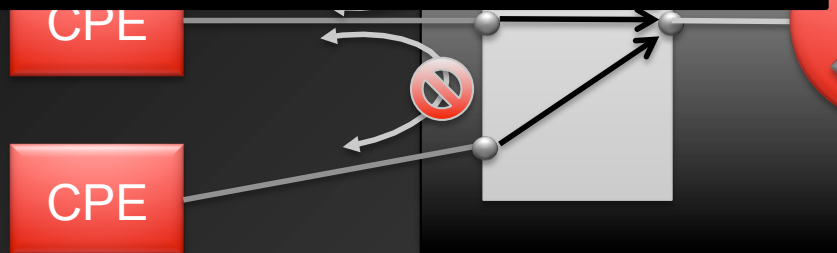
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# Altibox N:1 Shared Vlan explained



# Altibox N:1 Shared Vlan explained

```
interface FastEthernet2/2
description ### Access Port ###
switchport trunk encapsulation dot1q
switchport private-vlan association trunk 90 100
switchport private-vlan association trunk 92 102
switchport private-vlan association trunk 91 101
switchport mode private-vlan trunk
service-policy input res-m2-in-p6
service-policy output res-m2-out-p4
end
```



```
ip arp inspection vlan 91-92
ip dhcp snooping vlan 90-92
ip dhcp snooping database ftp://...
ip dhcp snooping
```

```
interface Vlan92
description ### Internett ###
ip address a.b.c.d 255.255.255.128
ip access-group 133 in
ip helper-address a.b.c.2
ip helper-address a.b.c.10
ip local-proxy-arp
ip route-cache same-interface
private-vlan mapping 102
arp timeout 900
end
```



# Why do we start with IPv6 now?



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***SIMPLE***



# Why do we start with IPv6 now?

- IPv4 depletion
- We increase our customer base with +50K customers pr. year.
- Current estimates shows that our depletion happens in Q1 2012.
- We need to be able to give our customers the best Internet experience we can, and that can only be done on IPv6 in the near future.
- Yes, we need to use transition methods, but more about that later.



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# So, how did we start?

- We started to talk seriously about IPv6 summer 2010!!!
- Once we saw the estimates, all CxOs immediately understood what we had to do.
- Started the IPv6 project in September 2010.
- We used the standard approach:
  - Identify
  - Evaluate
  - Plan
  - Test
  - Implement
- We are currently at the testing phase.



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# Results so far...

- We have split the implementation project into 3 phases:
  1. Enable IPv6 in the core network. Enable IPv6 for all new residential customers. Enable IPv6 for all corporate customers. Enable IPv6 for all Internet facing services. Target Q4 2011.
  2. Implement solutions to handle IPv4 depletion. Target Q1 2012
  3. Implement solutions to enable IPv6 for all legacy Residential customers. Target Q4 2012.
- The identifying and evaluation phase shows that the cost for phase 1 is moderate, around €350K.
- Done POC Lab tests for all relevant network equipment, and found that most units are ready for IPv6.
- Risk with regards to schedule, because of awaiting commitment from vendor for support of new features on all access platforms.



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# Design Principals

- Do everything as simple as possible.
- IPv6 design to be as similar to IPv4 as possible.
- Ensure same security for IPv6 as for IPv4.
- Ensure same redundancy for IPv6 as for IPv4.
- Ensure same traffic patterns for IPv6 as for IPv4.
- Ensure co-existence between IPv6 and IPv4.
- Not do any NAT without also doing IPv6.



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# IPv6 Address Plan

- Following the same principles as for IPv4.
- Allocate at least one /39 pr. Partner. Calculation based on 450 /48 customers and 15'000 /56 customers.
- Using Sparse method when allocating prefixes, so when a partner needs more we shift one bit up. Typical /39 ► /38.
- Allocating a /48 for Partner infrastructure and management.
- Allocating one /64 for Loopbacks.
- All links based on Link Local addressing, except peering/transit links and links between Core and Metro Core network, where we use public addresses.
- On public address links we allocating one /64 pr. linknet, but actually using a /127 on the link itself.



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# IPv6 Address Plan cont'd

- Allocating one /64 pr. Access Router for CPE links (/128 pr CPE).
- All residential customers gets assigned a /56.
- All small corporate customers gets assigned a /56, but will get bigger prefixes on demand.
- All medium and large corporate customers gets assigned a /48.
- Allocating a /49 for Data Center.



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# Altibox National Backbone (Core Network)

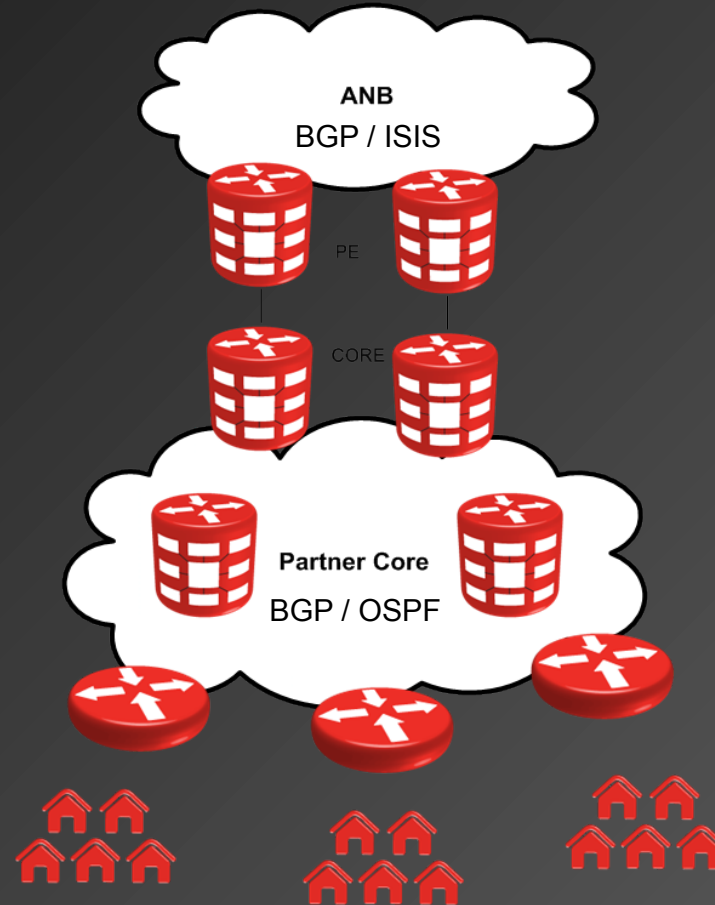
- Tested implementation in POC Lab.
- Have started to implement 6PE on all core routers. Will do 6VPE as well.
- Using BGP and ISIS as routing protocols.
- IPv6 transit up and running.
- IPv6 Peering established on demand.
- Currently peering with IPv6 on NIX. We also have some private IPv6 peering partners.



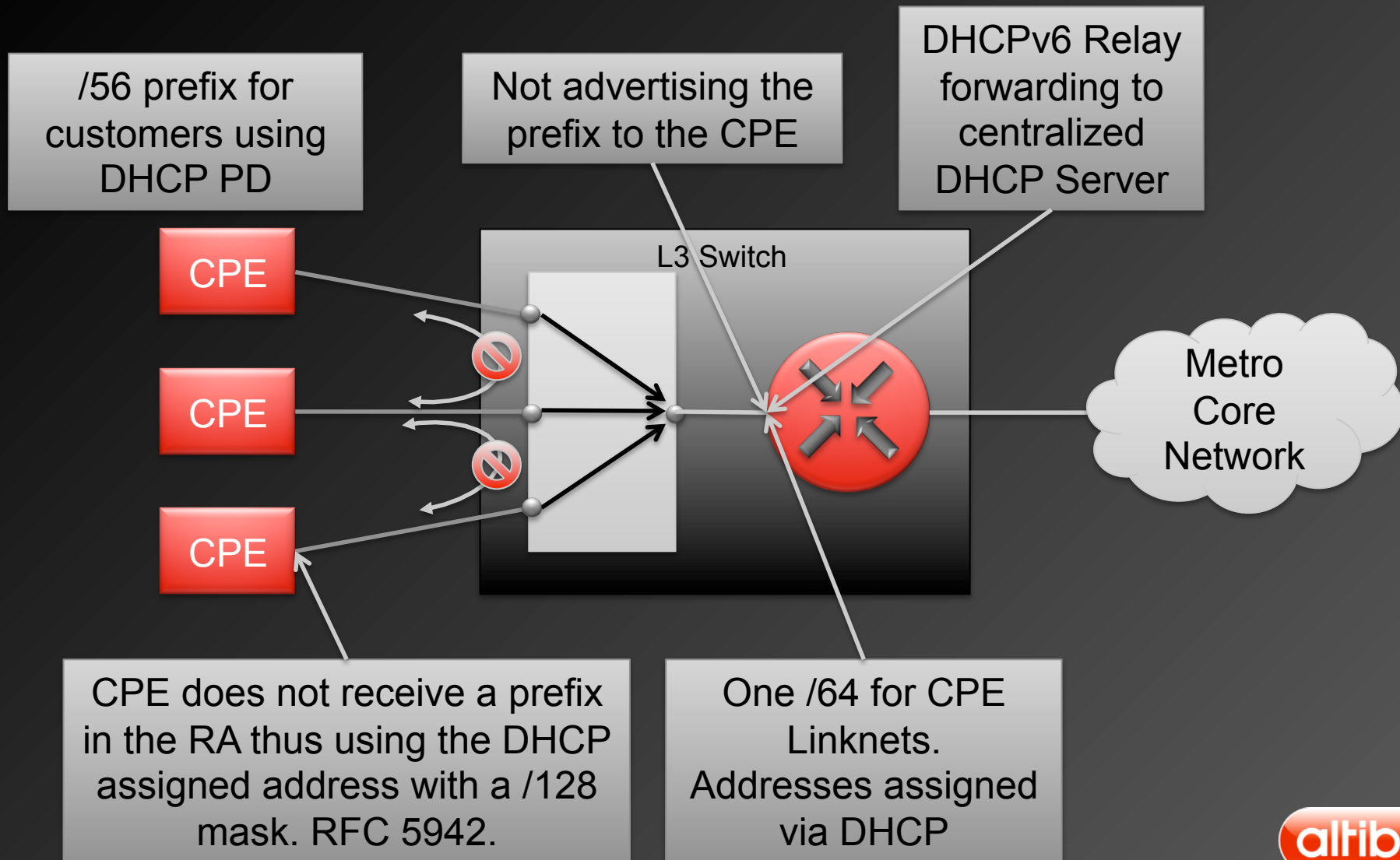
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# Partner Network (Metro Core)

- Some partners have MPLS core, some have routed core.
- Will implement 6PE/6VPE for partner core once core network has been fully implemented.
- All routed links will be dual stack.
- Using BGP and OSPF as routing protocols.

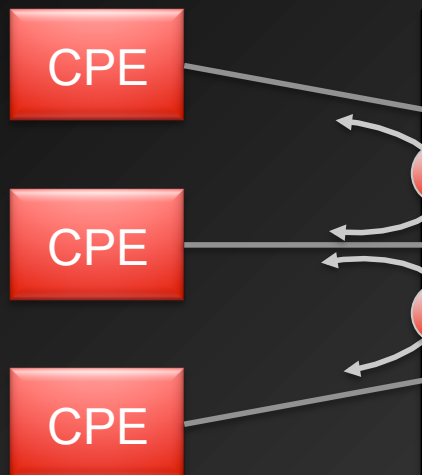


# Dual Stack Access Model





# Dual Stack Access Model



Tested with dev. code  
from vendor.

```
vlan configuration 92,102,2500
  ipv6 nd inspection
  ipv6 glean
  ipv6 destination-guard

interface Vlan92
  description ### Internett ###
  <IPv4 config not shown, see earlier slide>
  ipv6 address 2001:DB8:FEED::1/64
  ipv6 nd dad attempts 0
  ipv6 nd prefix 2001:DB8:FEED::/64 no-advertise
  ipv6 nd managed-config-flag
  ipv6 nd other-config-flag
  ipv6 nd ra interval 60
  ipv6 dhcp relay destination 2001:DB8:DEAD::2
  private-vlan mapping 102
  arp timeout 900
end
```



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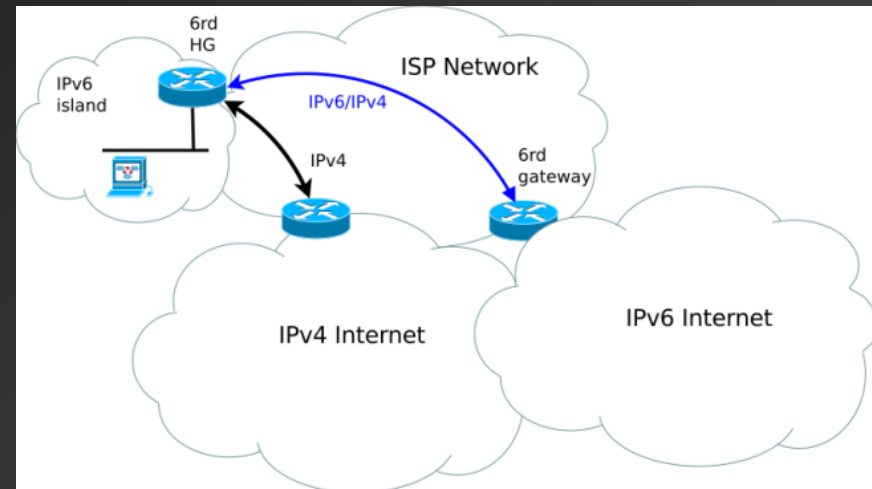
## New features required on Access Router platform

- DHCPv6 RemoteID (Option 82) – Not new feature, just a bug...
- Lock L3 ► L2 mapping, so that no one can take over someone else's CPE address. (= IPv4 DHCP Snooping + ARP Inspection)
- PD ► L3 ► L2 mapping, so that no one can take over someone else's delegated prefix.
- Prevent rogue DHCPv6 and RAs among customers. (= IPv4 ARP Inspection)
- Prevent DAD attacks.
- Waiting for final commitment dates from vendor. Q2 2012 is indicated!!!

# As plan B, in case worst case!

## - 6rd

- Pros for Altibox:
  - Quick way to give IPv6 to residential customers
  - Stateless
- Cons for Altibox:
  - More investments; needs BR units, adapt the provisioning system for 6rd.
  - CPE needs to do tunneling, not able to support all internet speeds.
- 6rd will also be used in the legacy part of the network, but this is in a later phase in the project.

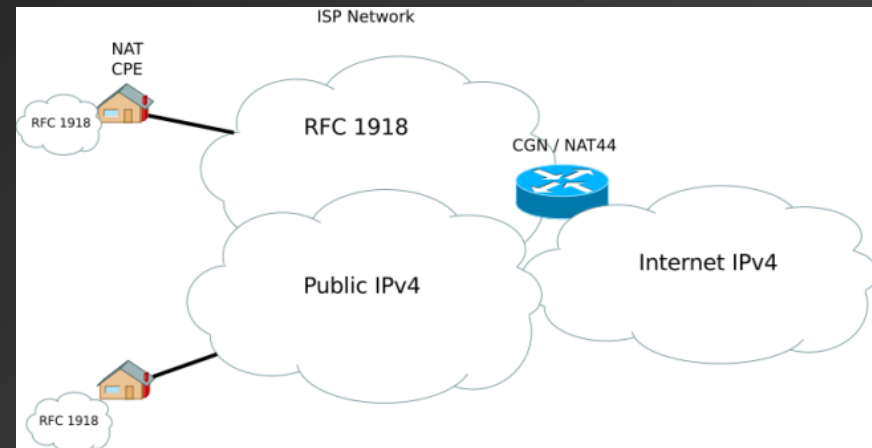


- Due to many IPv4 prefixes we need to do multi domain 6rd.
- Will initially allocate a /38 for 6rd, thus giving a /60 pr. customer.

# But, IPv4 depletion is still coming! Then what?

## - NAT444

- Pros for Altibox:
  - No changes in the provisioning system.
- Cons for Altibox:
  - Must use VRF lite for NAT444 traffic.
  - Large investment in LSN platform.
  - Statefull
  - Unable to allow inbound public traffic to customers.





**Yes, there are other ways too, but we need  
running code, and native IPv6...**

DS-Lite, A+P, 4rd



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# What do we do with regards to CPE?

- Telsey is working hard together with Broadcom to implement all relevant TR124i2 features.
- CPE will also be compliant to RFC6204.
- IPv4 is done in hardware, IPv6 still done in software. Nextgen chipset from Broadcom will support IPv6 HW acceleration.



## Key Features:

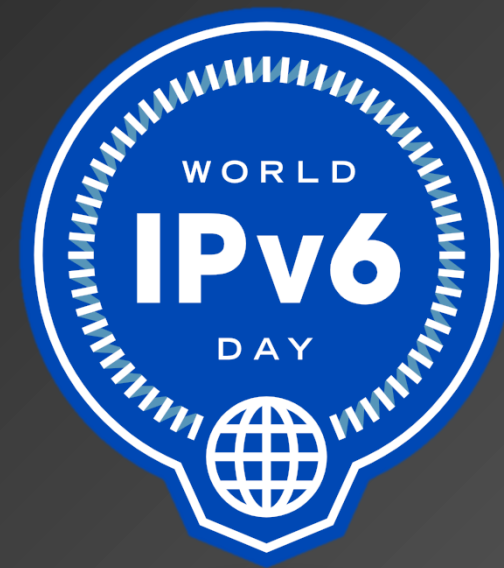
- At least 800 Mbps IPv4 HW accelerated routed throughput, mixed traffic.
- 802.11n, 2,4Ghz and 5Ghz
- SFP 1Gbps/100Mbps uplink
- Dual Core CPU
- At least 100Mbps IPv6 routed traffic.
- At least 60Mbps 6rd traffic.
- IPv6 beta code ready May 5...



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# Well, we also need some services on IPv6.

- All Internet facing services will be dual stacked.
- Redesigning our Data Center network to be fully dual stacked.
- Altibox will participate on World IPv6 Day with [www.altibox.no](http://www.altibox.no).
- Don't worry, our partners websites will not participate, so customer service will still be reachable.



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# Backend systems, what about those?

- Minor adjustments for dual stack support.
- Also minor adjustments for 6rd support.
- Using BT Diamond IP for prefix and address management. Full support for IPv6.
- Installing new NMS system for IPv6 support.



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# Conclusion

- Altibox is very focused on IPv6.
- Will probably be the first large ISP in Norway to support IPv6 for residential customers.
- Some challenges with vendors.
- Working nationally to encourage Content Providers to do IPv6.



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Questions?



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