

# **Multiple Use of Mikrotik in the Wireless Networks of Rural Denmark “The Next Installations”**

**Presentation at the MUM 2007  
in Krakow, Poland**

**By  
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Denmark**

**Representing:**

**non-commercially:**

**DjurslandS.net / DIIRWB.net / WSFI.net / RanumNet.dk**

**Commercially:**

**Powerline ApS / Platform.dk**

## **My apologies**

This presentation contains various updates and additional material...

– but the rest is viciously stolen from my presentations at the Texas MUM's and from a presentation given to the AirJaldi summit October 2006 in Dharamsala, India.

So if you've seen this before... Though luck!

# Who?

- Niels Christian Sørensen
- 16 years of experience in Computer Science
- Wireless pioneer since 2000 together with DjurslandS.net
- Living in “Ranum” - rural area in the northern part of Jutland.
- IT Consultant company: Platform.dk
- Hired by Powerline ApS
- Developing both community and Commercial Wireless solutions

# Why?

- Used Mikrotik for Commercial and community solutions since 2003
- “Network master” for DjurslandS.net from 2003 to 2005
- Founder of RanumNet
- Participating in DIIRWB / WSFII
- MT Wireless Hotspots in harbours
- Developed commercial solutions for Powerline 2004-7 – including VoIP
- Strong believer in Wireless solutions

# **Mikrotik used for Community and Commercial solutions**

- **Communities:**
  - Lack of volunteer experts
  - Tight economy
- **Commerce:**
  - Diverse platforms for infrastructure and CPE solutions
  - Cost effective alternative to Wrap and Soekris etc.

# Denmark - Facts!

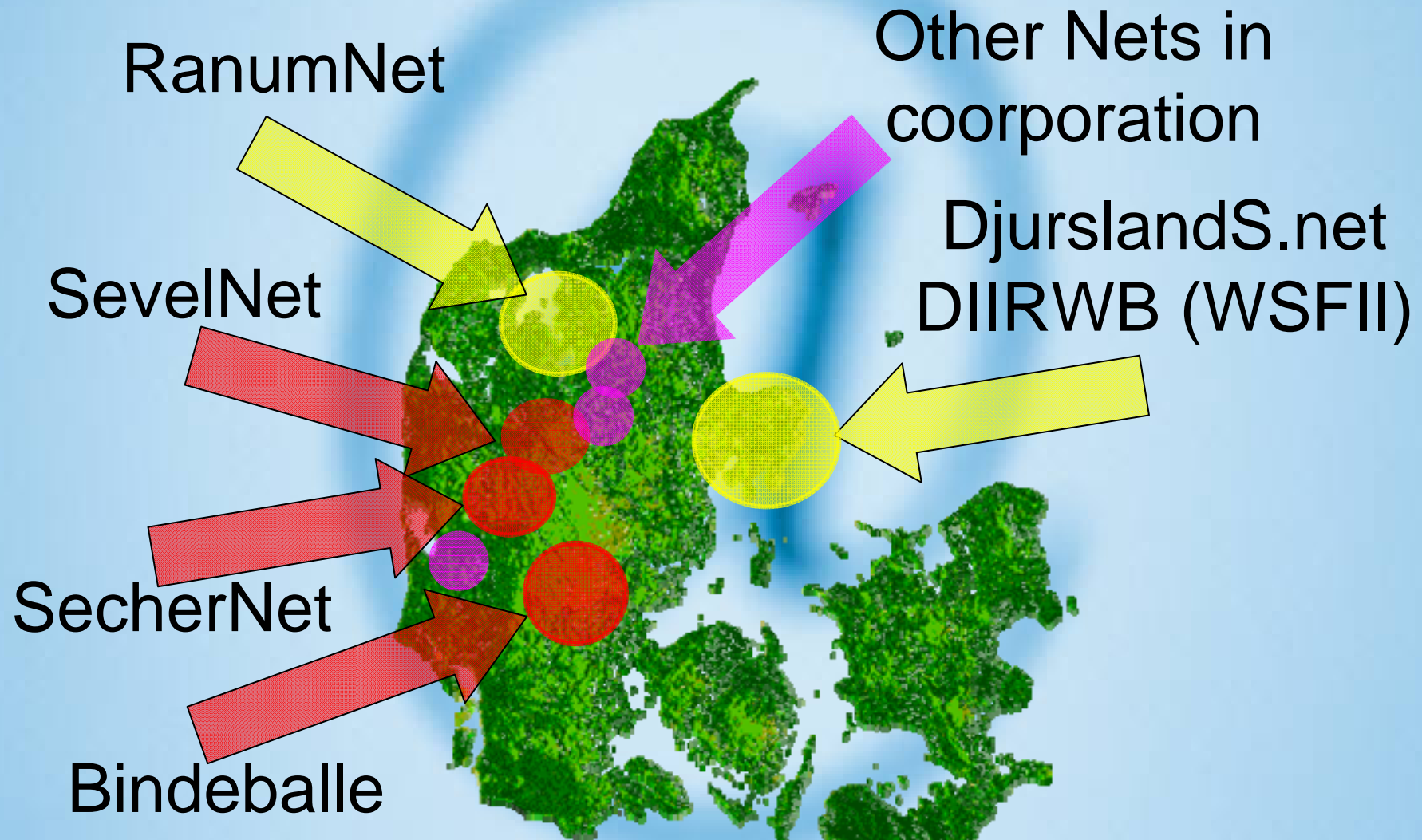


- 5.427.459 (5 mill) people (jan. 06)
  - Highest point 170m (560 feet)
  - High living standard and general social infrastructure
  - High IT infrastructure in urban areas
  - Lower Infrastructure in rural areas
- 
- Government wants to guarantee IT
  - Powercompanies go telecom
  - IT and Telecom is relatively expensive
  - 3.610.100 phonelines
  - 4.785.300 Cell phones
  - 95% DSL coverage

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# My Wireless Denmark



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# Denmark - no internet?

- Generally promise up to 95% DSL coverage by Telecom□
- ~ 81% have a computer
- ~ 83% have Internet-access
- ~ 50% Internet-access at home
- There are rural areas with communities of up to 50.000 with only 75% coverage
- Tendency to “await fiber or WiMax solutions” in rural areas





***Introducing some thoughts:***

***“Cities are an exception on earth.  
Most of the surface of the earth is  
rural district or water”***

...it seems too expensive to create a  
broadband infrastructure, covering  
most of the inhabited surface.

Thus, a division exist between life in  
cities and in the countryside...

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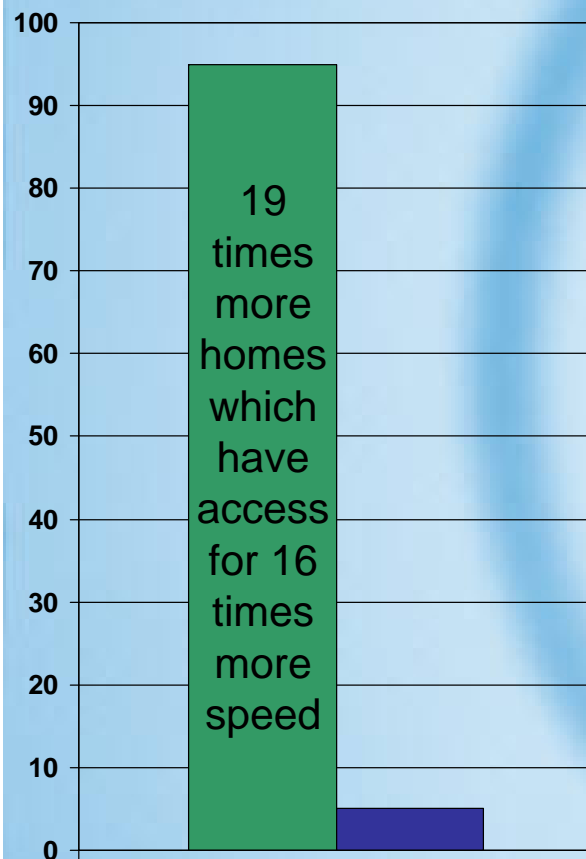
## ***Broadband coverage in Denmark***

- The copper-based infrastructure, gives 95% broadband access through 1600 DSL centrals.
- The remaining 5% would need other 4600 DSL centrals.
- This is not economically feasible
- On Djursland 25% of the population could not get a DSL broadband access
- Similar situation in other parts of Denmark



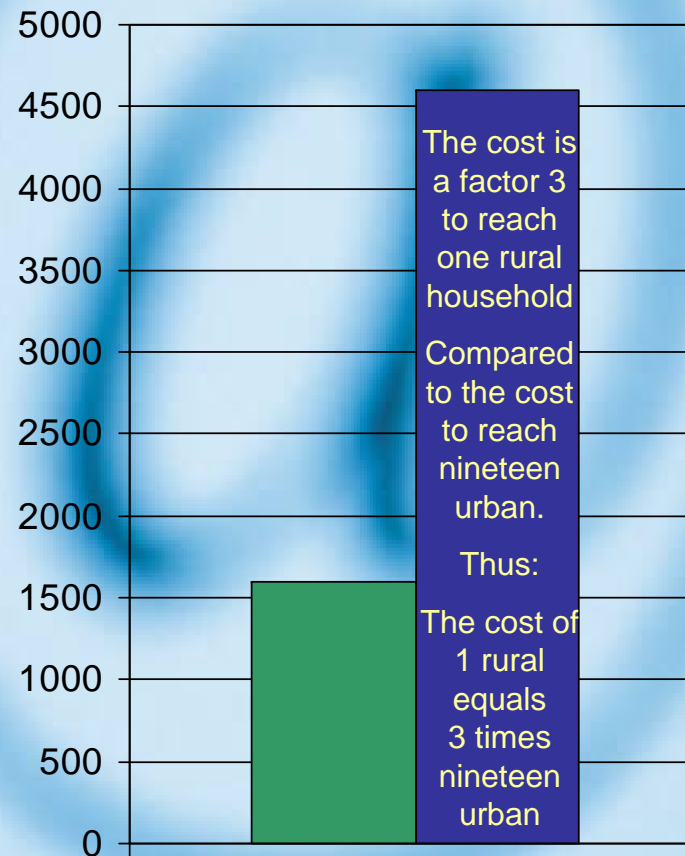
## Internet access through Danish telecom net

% households in Denmark with big and small bandwidth

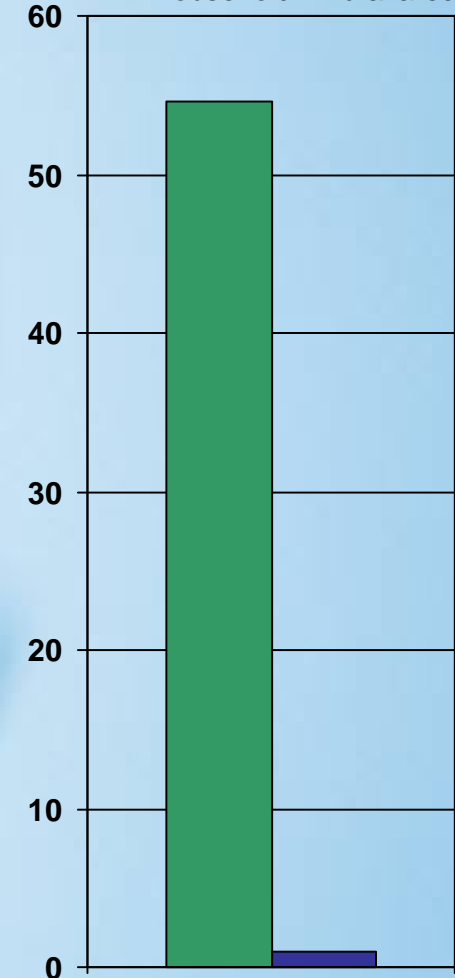


■ up til 2048 Kbit in dense settlement   ■ up til 128 Kbit in dispersed settlement

■ Amount ADSL centrals Urban.  
■ Needed extra ADSL centrals for the last 5% Rural



■ Urban cost of ADSL for 55  
■ 1 household in rural areas



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## ***DSL is too expensive in rural areas***

- 4600 extra ADSL-centrals would amount to € 175.000.000,- (€ 175 million)
- Plus an additional expense of € 150,- for each household to be connected.
- National Telco (TDC) does not find that normal market conditions are sufficient to cover internet-access to rural Denmark.
- However, the EU commission agrees with national government in the decision: “Broadband **must** roll out solely on pure market conditions”

# Why worry?

- IT underdevelopment in rural areas equals de-population
- Social collapse in rural areas
- “The 2 urban cities tendency”:
  - Copenhagen
  - Aarhus
- Commercially unattractive
- Fiber roll-out takes many years (if done)
- WiMax seem to be a hype more than reality!

# Community solutions?

- Volunteer based Communities:
  - Tired of waiting
  - Ready for “do it yourself” (or together)- solutions
  - Heard / read about / seen similar solutions all over the world
  - Unwilling to pay the expensive fiberbased solutions - if it comes
  - Used to TV by satellite
  - Denmark has Community culture

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# DjurslandS.net - Demographics

- Denmark:
  - Population: 5.4 million people
  - Total Area: 43905 m<sup>2</sup>
  - Population density: **124,6 people/km<sup>2</sup>**
- Djursland:
  - Population: 82.420 people
  - Total area: 1.491 km<sup>2</sup>
  - Population density: **57,6 people/km<sup>2</sup>**

**Approx. 1/2 of the general pop. density.**

# DjurslandS.Net

## "What we did"

***Since 2001 volunteers have developed the "Djursland-model".***

*It proved that people in the Danish countryside,  
- through volunteer action - can get comparable broadband  
access  
at 1/3 of the average market price in cities.*

*All done by applying a modified wireless data radio technology,  
based on standardized mass-produced Wi-Fi equipment,*

*Combined with Mikrotik as Infrastructure*

*Mikrotik "saved the project" (more on that later)*

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# *DjurslandS.net - 2006*

*Still run by volunteers only!*

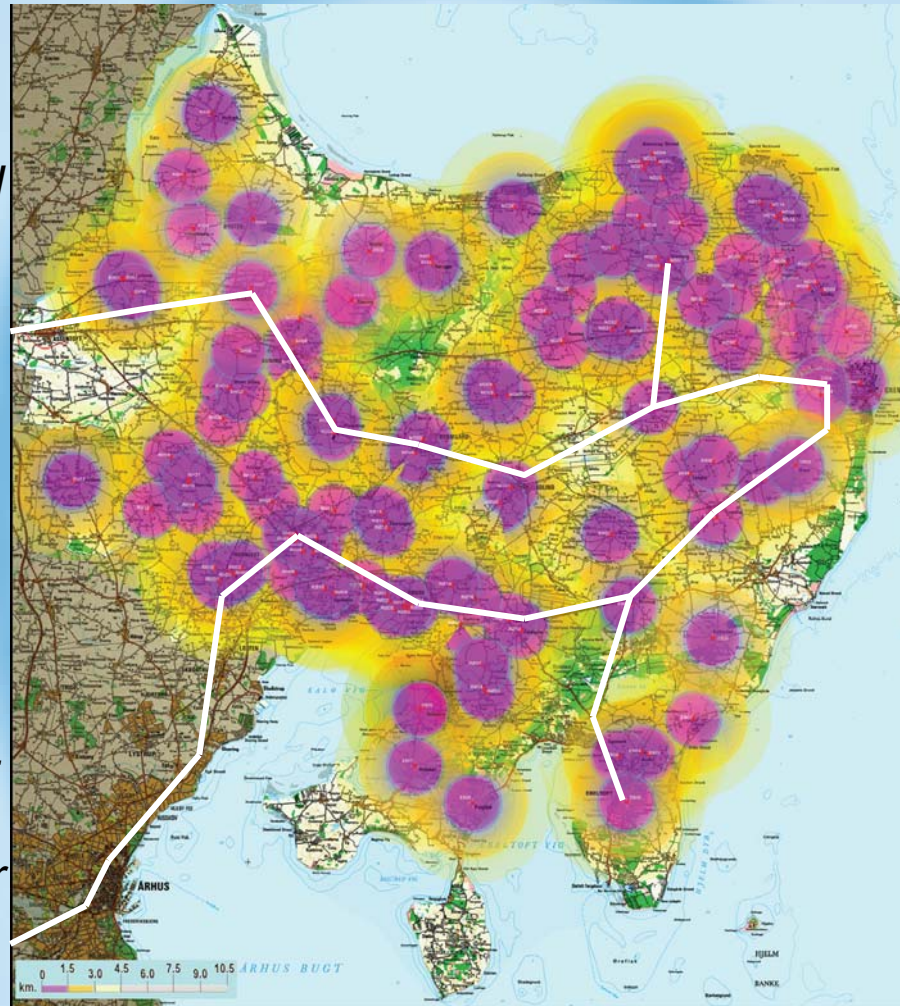
*9 regional net*

*More than 200 central antenna nodes*

*wireless access to more than 5000 rural households, schools, -institutions and -businesses.*

*A one time contribution of € 267,-*

*€ 13,- each month for unlimited access.*



*Bandwidth between 2 and 5 Megabit/sec.*

*150Mbps access to Internet*

*Together the 5000 households save about €2.250.000,- each year, compared to commercial ISPs*

*The first year each new household saves € 275,-*

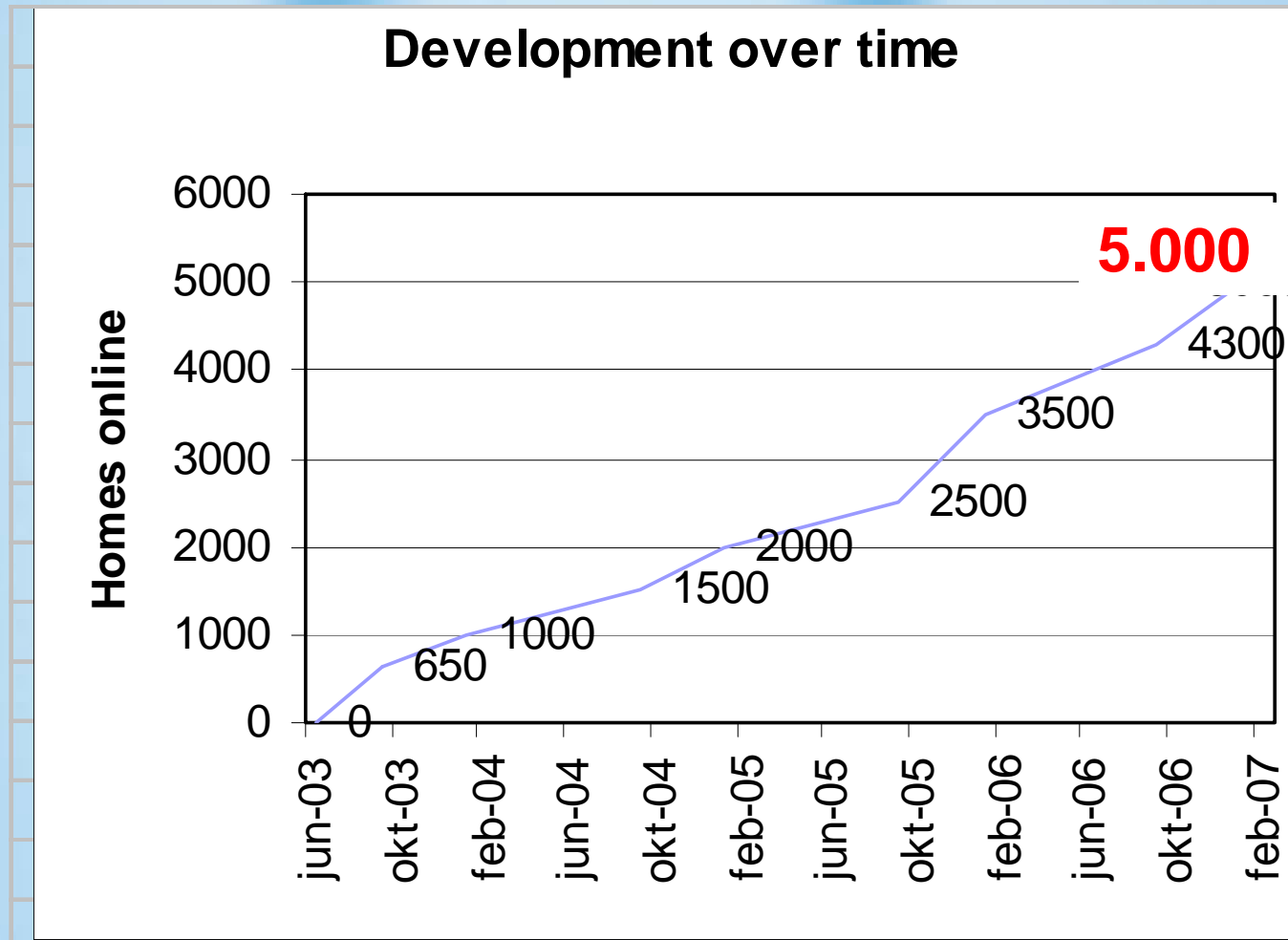
*The following years more than € 500,- each year*

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# DjurslandS.net - Gear talk

- Started with Linksys WAP11 anywhere (“bang for buck” in 2003)
- Backhaul now 5GHz - 802.11a Nstream
- Clients mostly cheap Ovislink (2,4GHz) or Linksys WRT54GL (2,4GHz) (OpenWRT)
- Own production of Biquad CPE antenna – “beyond the Cantenna”
- Replacing and expanding using Mikrotik and 5GHz only in some areas
- Longest link 15km carries 20Mb FD

# DjurslandS.net - Development



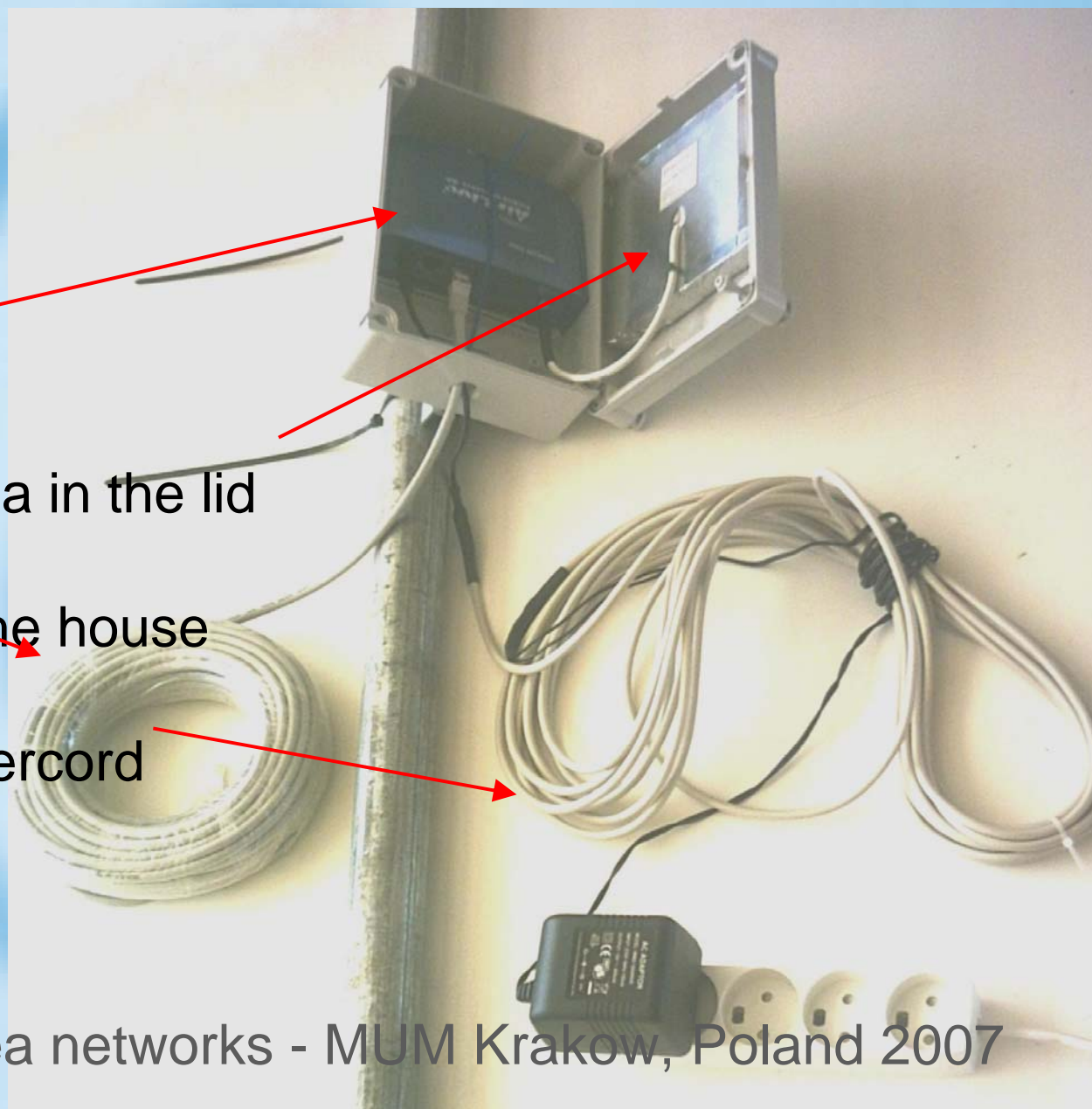
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# DjurslandS.net - CPE

## User installation box

An outdoor box with:

1. An accesspoint
2. A directional antenna in the lid
3. Ethernet kabel for the house
4. An lengthened powercord



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# DjurslandS.net - Visual

Some images from Djursland  
To follow....

# DjurslandS.net - Mikrotik

- As mentioned, Mikrotik “saved” the project
- disagreement on routing platform
- Lack of “Linux nerds”
- Started “borrowing” M\$ server for routing
- Met Dmitry and John, CeBIT 2003
- Moved focus from platforms to the art of routing
- Superusers can easily learn simple tasks in WinBox
- We “nerds” may still “fool around” in shell

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# DjurslandS.net - People

- 100% non-commercial
- 100% build by volunteers
- 100% growth expected the next 2 years
- Users still pay €264,- and €13,- / month
- **STILL NO HIRED STAFF**
- No fond finances, no help from the government
- Locals make “computer clubs all over”

# More community networks

- DjurslandS.Net inspired several rural areas to make similar solutions.
- Generally 2 types:
  - “We do it ourselves” – Requires devoted single persons
  - “We do it together with a professional partner” – an attractive “semi-commercial” solution
- First to another “Do it all net”

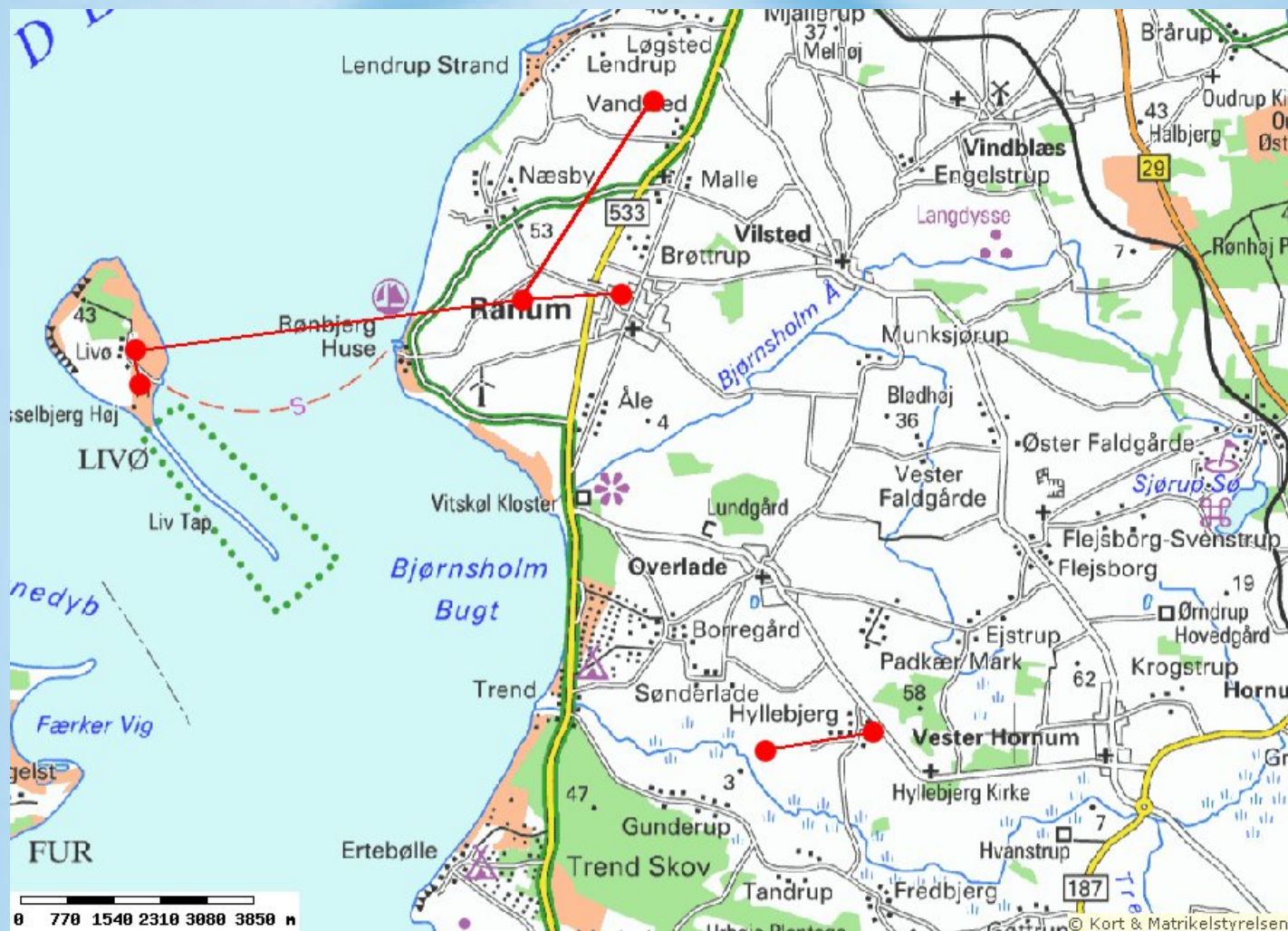
# **RanumNet.dk**

## **non-commercial**

- I moved “back to my new hometown”
- Started with link from my brother to my new house
- The rest of town saw the antennas...
- Founded January 2006
- Cost: €264,- and €13,- month
- Feeds remote island

# RanumNet.dk

## December 2006

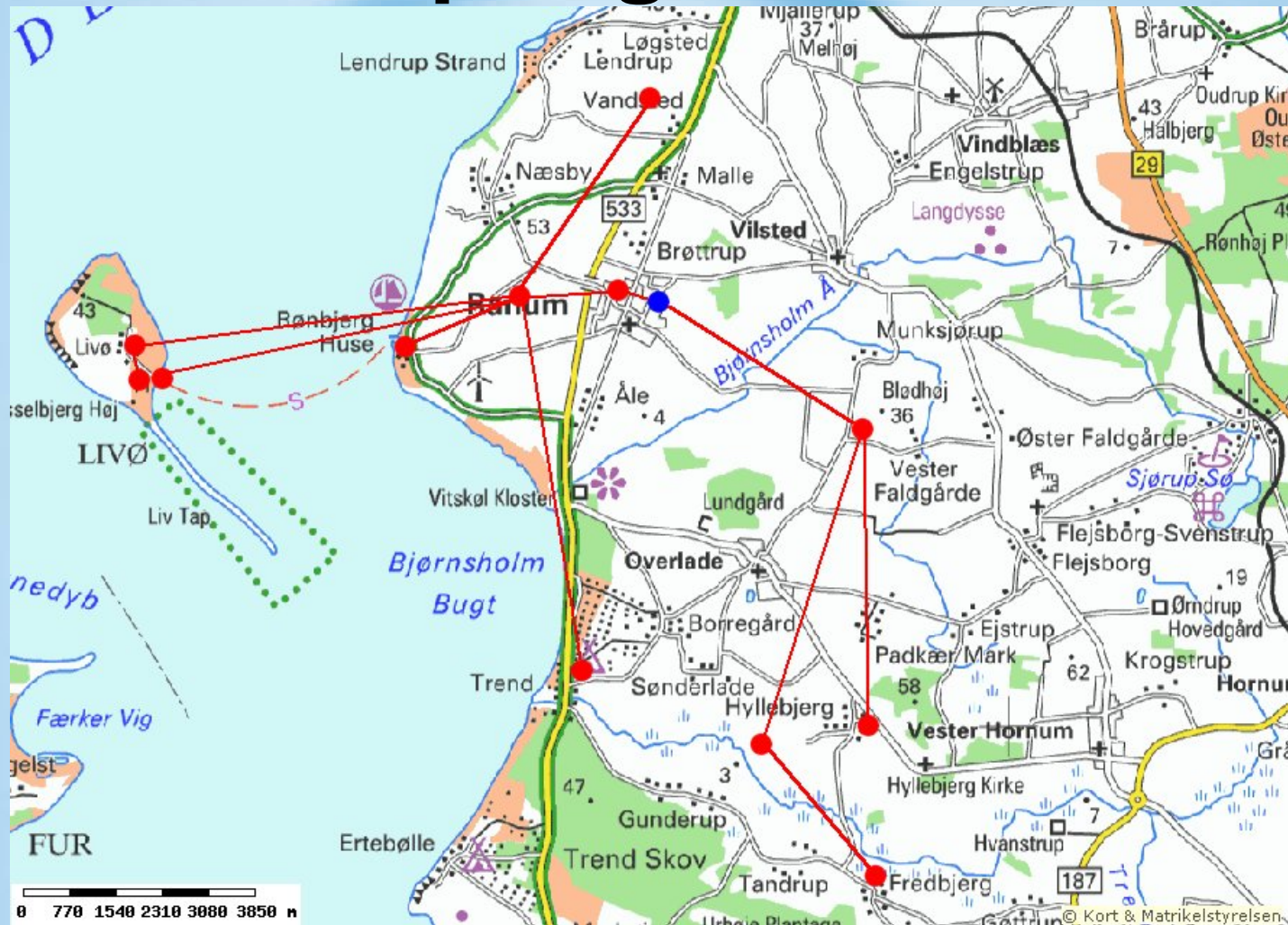


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# RanumNet.dk

## Spring 2007



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# RanumNet.dk

## Spring 2008



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# SevelNet.dk

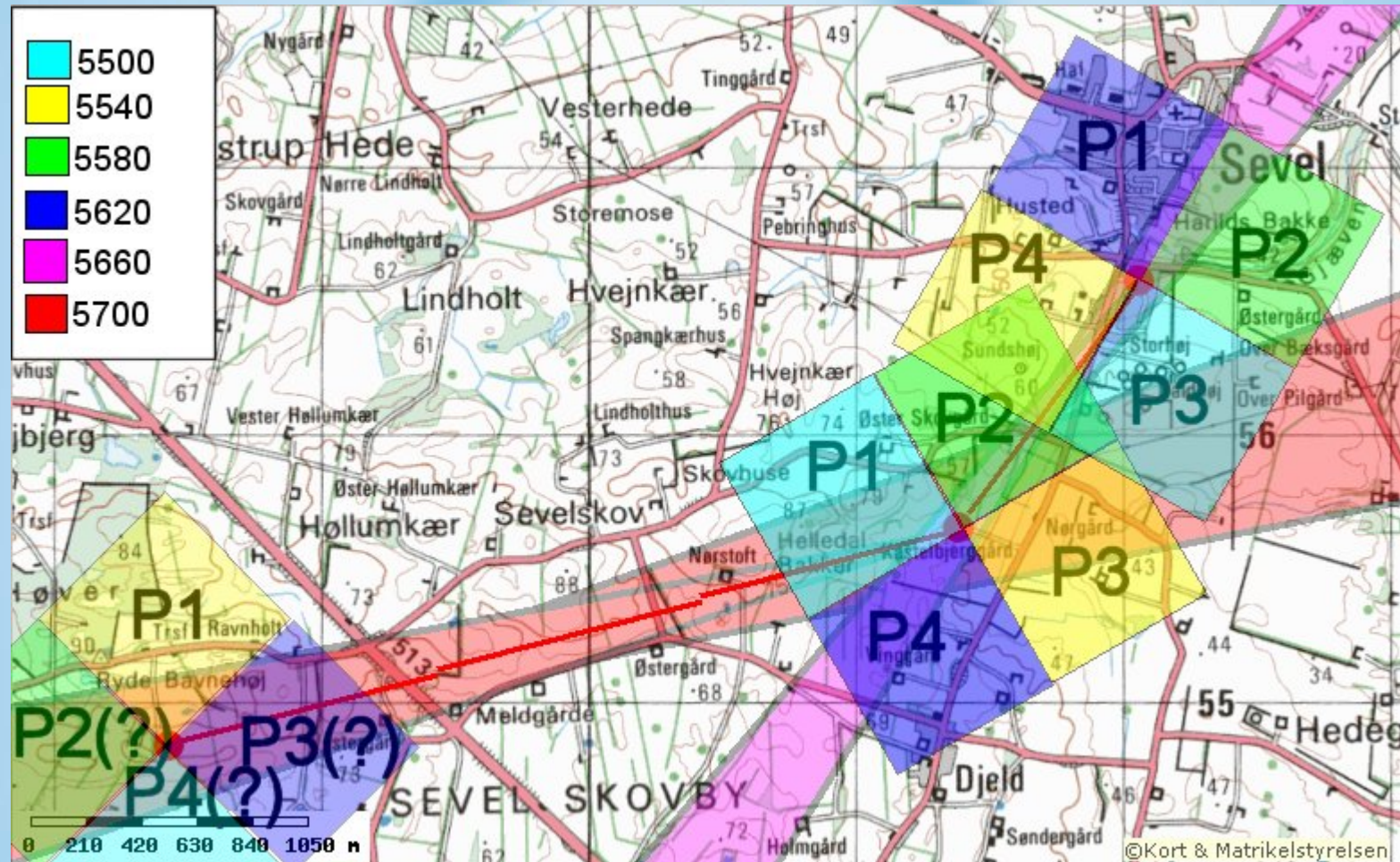
## Semi-Commercial

- Powerline sold solution to the City
- The city had an “Investment community” that wished to finance the infrastructure, ROI = 3 years
- First 75 CPE is running with VoIP
- Cost without Voip: €120,- / €24,- month
- Cost with VoIP: €167,- / €26,- month
- Mikrotik based backhaul and CPE



# SevelNet.dk

## Semi-Commercial



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# **Bindeballe**

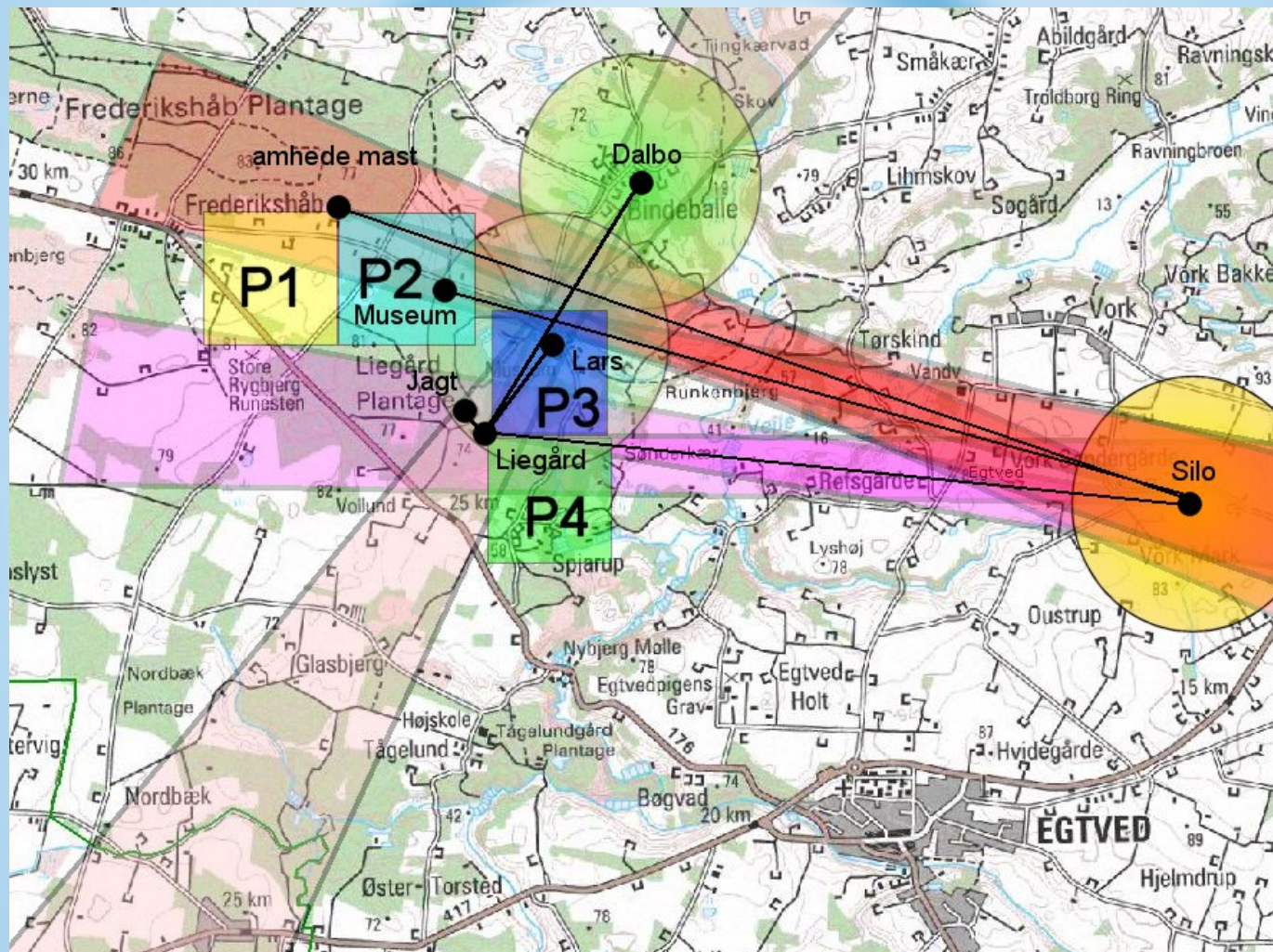
## **Semi-Commercial**

- Powerline sold solution to the Community
- Same setup as “SevelNet”
- First 50 CPE is running with VoIP
- Same cost as “SevelNet”
- Mikrotik based backhaul and CPE



# Bindeballe

## Semi-Commercial



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# SecherNet Commercial

- Powerline sold solution to Local Antenna company
- Same setup as “SevelNet” and “Bindeballe”
- First 10 CPE is running with VoIP
- Cheap alternative to “no net” situation
- Mikrotik based backhaul and CPE

# Broadband in Denmark

- Power companies "go Telecom"
- They use billions of € digging fiber
- States publicly that every home is FTTH enabled within a few years
- Logistically impossible
- Minimum 10 years before the farms in Denmark is FTTH enabled
- Using PON fiber solution
- Still a big market for wireless
- No need yet for TV on demand (illegal)

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# Farmers in Denmark whining

## Træls med landbrug uden bredbånd

af Marie Gang Larsen  
larsen@almind.dk  
© 87 40 55 80

Solveig og Peter Clausen bliver en glød ved Negen med 200 køer og en årlig produktion af 2.000 slagtesvin. Der er tre ansatte på gården.

Solveig Bjørre Clausen arbejder som driftsleder hos Jysk Landboforening i Brønshøj. Her er internettet et helt naturligt og uundværligt arbejdsredskab.

Internettet er også et naturligt arbejdsredskab på et moderne landbrug som Solveig og Peter Clausens. Der er Netbank, afregninger fra slagteri og mejeri, indretninger og ændringer i besætningen, beregning af vandingsbehov og mængde af oplysninger, som landmændene kan finde på nettet på et split-

sekund.  
Hvis altså gården kan få bredbånd.

Langt til central  
På Solveig og Peter Clausens gård kan der ikke etableres en bredbåndsforbindelse, for de bor for langt fra nærmeste central. Derfor foregår deres opkobling til internettet via

en gammeldags og meget langsom (56 K) forbindelse via telefonen og med betaling pr. minut. Men mange af siderne er for tunge at indlæse, og ofte ryger forbindelsen også.

»Jeg kan prøve klokken syv om morgenen og klokken 17 om eftermiddagen og være heldig at få forbindelse til netbank. Men så ryger jeg måske af, ligesom betalingen ved at blive gennemført. Så bliver man i tvivl om, det går igennem eller ej. Det er

hænderende irriterende,« siger Solveig Bjørre Clausen. Så må hun af sted til posthuset og af med 12 kr. for at betale et girokort. Via netbank ville det koste en krone. Så det manglende bredbånd koster ikke kun angrebene og tid men også penge!

Den dårlige netforbindelse betyder for eksempel også, at hun ikke dagligt kan følge med i kontobevægelser, men må i banken eller vente på det kontoudtog, der kommer pr. brev hver tredje måned.

»Og det kan vi jo slet ikke nøjes med,« siger Solveig. Hendes mand Peter Clausen er endnu ikke blevet fortalt med internettet, og det tror pokker, siger Solveig.

»Hver gang han prøver at gå ind på vejsudtagene, bryder det hele jo ned.

**Prøv om et halvt år**  
Hos TDC har svaret på høn-

sen om bredbånd været: »Prøv igen om et halvt år,« men de seks måneder har ikke ændret noget. Solveig Bjørre Clausen har i stedet foretaget et få en trådløs opkobling via Sonofon. Det er

**Her kunne der have været et billede af Solveig og Peter Clausen.**

**Tilladelse til publicering af dette billede er ikke anset for et erfaringsvist er svært at få og da det er irrelevant for artiklens forståelse.**

**Vi henviser derfor til læserens fantasi.**

Solveig og Peter Clausen ægger sig over, at de ikke kan få bredbåndsforbindelse. Det er næsten ikke til at komme igennem på internettet med det moderne, de har. Foto: Anders Brohus/POLIFOTO.

et af de eneste alternativer, der findes til almindeligt bredbånd. Men her lød svaret, at man ikke tager nye kunder ind. Så familien er lige vildt.

Og for landbruget er det en hæmsko ikke at kunne komme på nettet via bredbånd, som giver en hurtig forbindelse til en fast månedlig pris uanset forbrug.

»Og man kan jo ikke lade være med at tænke på, at alle danskere betaler til bredbåndnettet, men uden at vi alle har mulighed for at nyde godt af det,« siger Solveig Bjørre Clausen.

»Santidigt foregår flere og flere ting på nettet, og mulighederne bliver hele tiden udbygget. Men vi er stadig hen-

viset til at foretage dyreregistrering i pigevienningen og sende den med posten til registrerings- og ydelseskontrollen, som skal taste det hele ind. Det er helt vildt frustrerende.

Som udearbejdende er hun i øvrigt også forhindret i at få en hjemmearbejdsplads, så lange familien ikke kan få en bredbåndsforbindelse hjem til gården.

## Folk på landet savner speed på nettet

Homebanking. Indberetning af gødningsregnskabet. Ansøgning om enkeltbetaling. Registrering i husdyrregisteret, CHR. Alle tre ting kan foretages via internettet. Døgnnet rundt og med få klik. Og den mulighed markedsførere som en arbejdsletelse for landmænd.

Og det er det også. Hvis man vil at mærke kan få en hurtig internetforbindelse. I byerne er det en selvfølge med en internetforbindelse,

der arbejder hurtigere end man kan blinke med øjet.

På landet er en del stadig henvist til at trække telefonen ud af stikket og sætte computeren til, og lade maskinen ringe op. Der skal betales for hvert eneste minut, man er på nettet, og det kan godt være længe, for hjemmesiderne med de tunge reklamer kan næsten ikke masser igennem den spinkle internetforbindelse. Flere og flere såder bliver bygget til bredbånd.

Hos Jysk Landbrugsrådgivning kender IT-rådgiverne alt til landmænd, der ikke kan få bredbånd.

Det skyldes, at landmændene bor for langt væk fra en af TDCs centraler.

**De sidste procent**  
I dag lyder det fra TDC, at

det er muligt at få en bredbåndsforbindelse i 98 procent af landet.

»Men de sidste procent, der ikke kan få bredbånd, ligger typisk i de tyndt befolkede

områder, altså lige netop der hvor mange landmænd bor,« fastslår it-konsulent Martin Kristensen, Jysk Landbrugsrådgivning i Give.

»Hele samfundet pålægger den enkelte landmand en masse indregistreringer og opretter muligheden for at klare arbejdet på nettet, men man søger ikke for, at de faktisk kan komme på nettet lige som folk i byområderne.«

I IT-afdelingen har man forskellige løsningsforslag

til de landbrug, der ikke kan få en bredbåndsforbindelse. En er at vælge en ISDN-forbindelse, men her er problemet at der afregnes for hvert minut, man er på nettet.

»Set med vores øjne ville det være en god løsning, hvis TDC tilbød ISDN-forbindelse til en fast pris i stedet for månedsbetaling til de mennesker, der er så uheldige at bo et sted, hvor man ikke kan få en bredbåndsforbindelse.«

Hidtil har det også været

muligt for nogle at få en trådløs internetforbindelse via Sonofon, men den løsning tilbyder telesektoren ikke længere. Desuden kræver sådan en løsning også en god mobildekning i området.

Videokabinsminister Helge Sander (V) har netop sat en undersøgelse i gang, som skal kortlægge hvad det vil koste at få de sidste to procent af landet dækket af bredbånd.

Gang

"Being a farmer without broadband sucks"

"Rural areas need speed on the internet"

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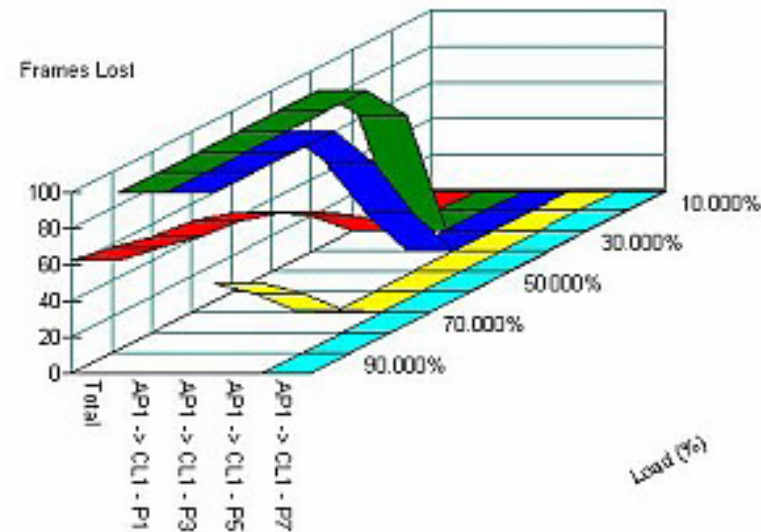
# HiSpeed Internet cost

- Even *IF* the Power/Telecom guys get a fiber internet connection out there, it is still expensive
- Focus on speed, not price, typically twice the price of DSL
- DSL in denmark starts around €50,- / month – flatrate
- Telephone monthly fixed fee is €16,- and then you start paying pr. minute
- "Do it together" wireless solution has an ROI of 1 (one) year in Denmark
- WiMax is still only available in urban areas!
- A commercially solution on 802.11 is absolutely feasible:
  - RouterBoards as hardware
  - MT-OS as firmware
  - 5GHz (802.11a – 1W) radio technology
- WiMax may not be as good as it seems....

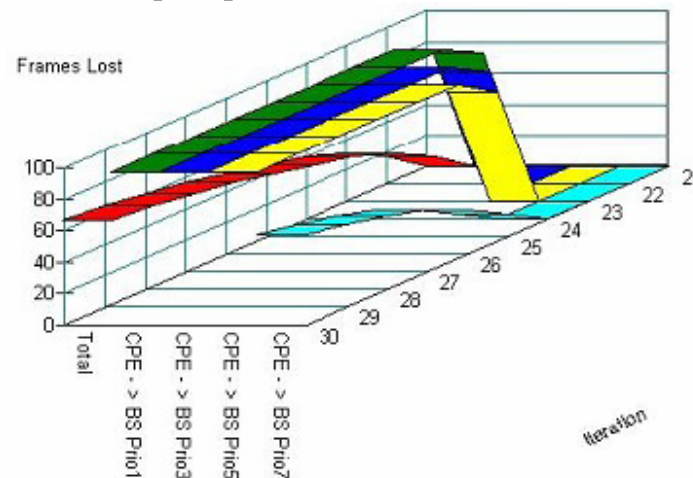
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## Test of QoS in Wi-Fi IEEE 802.11a equipment from Lancom



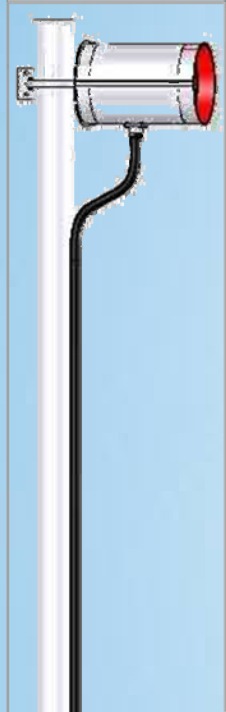
## Test of QoS in WiMax equipment from Redline Communications



*Research was done at DIIRWB's partner: the University of Stralsund*



# Danish / International wireless communities



- **DIIRWB** = “Djursland International Institute of Wireless Broadband”
- **WSFII** = “World Summit on Free Information Infrastructures, supported directly by Kofir Annan
- **“Baltic Rural Broadband Project”**
- **Dharamsala** – “internet for Tibetan children city in India”



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# DIIRWB / WSFII

- DIIRWB = Djursland International Institute of Wireless Broadband
- DjurslandS.net created an education facility
- Teaching internationally how to build Wireless Rural area networks
- “Hands on” courses combined with theory
- EU funding supports the idea
- Part of the Baltic Rural Broadband Project

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## DIIRWB's training- and teaching-disciplines

- 1) Organization
- 2) Campaign
- 3) Administration
- 4) Equipment and tools
- 5) Planning and building networks
- 6) building and maintaining Web-portals
- 7) Maintaining networks and user-support
- 8) Handling routers and servers
- 9) Documentation and evaluation

Normally, groups from the same area are trained, with at least 8 participants.

Sharing responsibility among volunteers makes the establishment, and maintenance, of non-commercial community network realistic.

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- Participated in building Mesh network for Dharamsala in India October 2006, after the “AirJaldi Summit”
- The DIIRWB’s model of education was partly used as role model for the 10 day workshop
- The Dalai Lama supported the project by offering his personal encouragement



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# Summercamps in Denmark

- Every year during the summer an international convent is held on Djursland
- Participate and get “hands on” experience on building Net / Antennas and exchange knowledge
- Follow coming agendas on [www.diirwb.net](http://www.diirwb.net)



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# **DjurslandS.Net – The movie**

If there is still time, German television made  
some movies of the project in Djursland

Interested?



# More Information

(Thank you for listning)

DjurslandS.Net: <http://www.djurs.net> (Danish)

RanumNet: <http://www.ranumnet.dk> (Danish)

DIIRWB: <http://diirwb.net> (English)

WSFII: <http://www.wsfi.org> (English)

AirJaldi: <http://summit.airjaldi.com/> (English)

Baltic rural Broadband project: <http://www.balticbroadband.net/>

Commerciel solutions:



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