IPv6 Made Sexy

How to make it an engaging concern -
A Perspective from Sweden.

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The Positive Side.

- There is, or will be, high bandwidth wired Internet in a majority of homes. 10/100 mbit/s bi-directional. 30-50 Euro/month. Flat Rate.

- The penetration of computers in homes is very high and growing, (much due to the so called "Home-PC subsidies").

- Mobile Phones are ubiquitous, and while we cannot talk more we do want to access the Internet "while mobile".

- Expections on Mobile Internet, while not yet fulfilled. GPRS failure. 3G problem.

The Negative side

We know, that Internet is slowly degrading under the creeping pollution of NAT -boxes and firewalls.

We know, that this creeping degradation gradually **lowers peoples expectations**, and most important, imagination!

Suddenly, no-one even expects low latency, realtime, multicast, peer-to-peer, since **NAT-boxes and Firewalls anyway makes it "unrealistic"** .

IPv6 is therefore not just a another protocol, it ***the opportunity*** we have to clean up Internet.

However, just cleaning is not that sexy, and is hard to sell. What does the user get? Larger packet headers?

The Mission: Upgrading Internet for Mobility!

Build the Mobile Internet in the same spirit as the wired one.

Build a *single wired network* , where radio basestations and regular computers are on equal footing.

- Organic growth. Anyone can add to the complete network.
- Little or no central control. Activating all grassroots.
- Standard off-the shelf components. Bought in computer shop for small cost
- No special variants of services are needed. Just one Internet, access it mobile or not

This would mean a *dramatic paradigm shift in mobility industry*, closing the unreasonable price/perfomance gap between wired and non-wired access.
It also means radically decreasing the expectations on UMTS/3G.

But this requires Mobile IP (v6), "roaming", partner neutral authentication and PKI, and several other mobility supporting services to be integrated in core (?) Internet. The opportunity to do this is when introducing IPv6. Don't miss it!

What is Mobile Internet?

Internet - but wireless and mobile?	**Mobile telephony - but with services like on the Internet?**
Same services and applications as on the Internet	New separate services special to the mobile customer.
Computer companies and universities	Telecom operators
Openness and freedom emphasized	Control, closedness and restrictions
Distributed and "democratic".	Centralized and hierarchical.
Starts from computers as terminals	Starts from telephones as terminals
Simple payment model - usually flat rate.	Complicated payment model - time, volume, person, place, time of day, etc, etc.
Internet Culture	***Telephony Culture***

We stand before a decisive cross-road! The question is of much greater significance than has been observed this far.

Some of us remember a similar situation in the early 90's, but then the issue was fixed networks....

IPv6 Task Force: Swedish Embryo

Little or no operational or commercial IPv6 present. Reasonable educational awareness.
(Address registrations here)

- Skanova, Telia's Network company, announced IPv6 Service one year ago . Howver little heard since then... Mattias Lignell.
- Telia. Promised participation from Telia/Telia Research, (Anders Bergsten).
- KTH, Stockholmopen.net, running parts of its mobile, (WLAN) access network with IPv6. Professor Björn Pehrson joining.
- SUNET, the Swedish NREN, will be represented. Hans Wallberg, one of the high priests of Internet in Sweden. IPv6 provided in backbone, but no, or very little, use.
- ISIC-SE, II-Foundation. Swedish Internet Society organizations.
- SCINT, Swedish Centre for Internet Technology, Lars-Erik Eriksson, Svante B Eriksson. Has IPv6 education and deployment support in its charter.
- CDT & University of Luleå, (Dick Schefström), now setting up a Mobile Internet using IPv6 on greater-campus + central city wide based on RadioSphere plan. Includes deployment of terminals.
- Swedish IT-Commission, which has a high level political mandate. Christer Marking,
- Ericsson, present in several IST IPv6 projects.
- Further operators to be contacted, (Bredbandsbolaget, Tele2, Utfors, Arrowhead, etc, etc). However right now a certain recession lowers action willingness.

Initial charter:

1. Launch pilot tests, (usually with the Mobility aspect).
2. Start R&D projects, (among them 6FP).
3. Arrange public events explaining the need, relevance and benefits.
4. Resources? Have to find. 6FP Network of Excellence to be sought, among other things.

The Background

The last decade of the 20:th century was for any IT professional characterized by the following:

- Extreme boom of Internet. (More material)
- Extreme boom of Mobile Telephony.

So, the obvious "next extreme boom" was expected in their combination: **Mobile Internet.**

Good so far, but for some reason still to be understood this nice service was to be provided by a carrying system called 3G or UMTS.

Was UMTS designed for this? Probably not...

The Expectations

In the year 2000/2001, expectations built up:

- European operators paid in excess of 140 Billion Euro for 3G licence rights!
- Services beyond talking was of course assumed to be the reasoen, but unclear which those actually were. Commercials approaching public promising all you are used to from Internet, but in your 3G phone.
- The completely dominating platform for such services is however Internet, including the most fundamental: mail.

And yes, what should they offer to the user? Faster talking?

But suddenly we realized: It might not work!

- Internet-users have come to expect performance far beyond what UMTS was designed for. (UMTS gives max a few hundred kbit/s).
- The pricing model from the mobile phone world seems to be completely impossible in the Internet culture, (assume, for exampel the 5-10 Euro/mbyte as indicated by GPRS. Reading mail with attachment? Exchanging mp3? Forget it!)
- The natural requirement for small and low-power terminals creates a very difficult challenge for decent user interfaces, (glasses, virtual keyboards, etc, need to be developed).

A Mobile Internet must therefore have about the same price/performance characteristics as the wired one! In other words: many megabit/s for about 50 Euro per month flat rate.

Otherwise, we kill all the fun on the Internet. Its soul and heart is taken out.

You can now react in at least two ways: 1) back out from the idea of Internet and do something "separate", or 2) try to solve the price/performance and user interface problems.

The RadioSphere project takes path 2!

Depressing? Here is some hope.

Instead utilize the following facts, ***both of which are steady long term trends***:

- **There is, or will be, high bandwidth wired Internet in a majority of homes.** 10-100 mbit/s bi-directional. 50 Euro/month. Flat Rate
- **A license-free basestation costs 200-300 Euro.** 11 mbit/s off-the-shelf. 55 mbit/s already in use. Standard consumer electronics. Just connect. Ad-hoc/client-to-client ready. Extremely efficient multicasting.

A simple example of Sweden: Deploying one million licence-free basestations costs 2-3 percent of projected UMTS investment costs => 10 million mbit/s vs 100.000 mbit/s simultaneous capacity. 4-5000 times better price/performance.

Why does it suddenly cost so little?

1. We reuse the wired broadband network that is anyway built to all parts of society, but for dozens of reasons other then mobility.
2. We utilize what usually happens when regulations are removed, in this case radio spectrum: The price of radio access equipment falls dramatically. Performance goes up.

Something Big is going on here! Have deregulations finally reached the Last Bastion of Telecom: The *radio spectrum*?

We hope and believe so, since all forms of licensing of radio spectrum, be it auction or beauty

contest, lead to monopoly, closedness, less competition and then always more expensive but poorer products.

We see a future which does not at all stop with what today is called WLAN, but where its essential characteristics reaches all radio access.

The Proper Role of Radio.

- Until today, mobile systems have been constructed with the radio interface as its starting point.
- This is very strange, since the absolute majority of the system, and complexity, is in the wired network which connects the basestations.
- The role of the radio is to deliver the packets last hop, of many, over the "ether". Nothing more, nothing less. Just like the ethernet card in your computer, but wireless. A localized and limited task. An exchangable component.
- The rest of the work concerning "mobility": identification, authentication, "roaming", "handover", and all else, have little or nothing to do with radio.
- And now, when the Radio basestation was demystified, it suddenly became inexpensive and possible for anyone to own! Soon integrated in every computer.

Imagine now an Internet...

- Where wired broadband is in every house and license-free radio basestations cost very little.
- Where every gasstation, hotel, shopping mall, airport, cafe, conference facilty or kiosk therefore can offer anyone wireless Internet access for very low cost.
- And yes, an Internet where every home has broadband and also licence-free basstation.

Now imagine here a system that allows all these actors to give or sell parts of their capacity to customers and friends. The marginal cost for the service is very low and therefore attractive. *The Light-Weight Operator is born.*

Which gasstation would you use? I do believe one where you could check your mail and your kids could download new music or a game for small cost. Which hotel do you choose? Which restaurant? Which shopping center do you visit, that with Internet access or not? I do believe you join the Peoples Network Movement.

Philosophically explained

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The effects may be very far-reaching.

- The need for special mobile operators may be decreased drastically.
- Less money is around in selling wireless bit-transport, which is very good for society and wealth, but tempararily painful for some mobile operators.
- More and more of radio spectrum is deregulated and is made free as the positive effects become clear.

The Last Bastion of Telecom has fallen.

RadioSphere Research Issues.

Closer analysis do of course show that a long list of problems must be solved. Not at all unrealistic, but just enough challenging.

However, luckily there is at each stage of development anyway a very useful, however incomplete, system in existence!

The list of issues to address includes the following:

1. **Authentication** . For at least two reasons. PKI needed.
2. **Encryption and Privacy.** Can be arbitrarily sophisticated. Care to be tracked?
3. **Customer and group membership management.** Light-weight.
4. **Electronic economic transactions.** In case you have to pay for access it should be electronic.
5. **The Business model.** Less money for bit transport, anyway.
6. **User Interface technology for mobile devices.** You must have it with you.
7. **Mobility of IP-addresses.** MobileIP and assosociated questions.Triangle routing is NOT an option. Multicasting.
8. **Adaptive and self-regulating cell-coverage**. Necessary for consumer electronics scenario.
9. **Mobile Subnetworks.** One Foreign Agent for the whole ship?
10. **Advanced Applications.** The world beyond the web. And the phone. (some here)
11. **Location-aware applications.** Among few geneuinely mobility oriented services.
12. **Integration with broadcast technologies and DVB-T in particular.** (more here)
13. **Application Architectures for Resource Limited Small Computers.** Such as ASP-style.
14. **Service discovery.** Where is a Printer? A CD-Burner?
15. **Context mobility.** Keeping all state, security associations, open files,etc, while moving.
16. **Ad-hoc networking, peer-to-peer and Multicast optimization.** Including walknet.
17. **Quality of Service in Mobile *and* IP networks.** Maintaining reservations while path changes.
18. **Handover management.** To ensure fast and smart handover. IP level probable bottleneck.
19. **Mobile IP telephony**. Header compression.
20. **Smart antennas.** Mobile networks can carry them.
21. **Short range gigabit/s radio.** Some call it "Infostations".
22. **Ipv6.** Is it needed? Must Mobile IPv6 be deployed at same time? Expect lots of unresloved issues.
23. **Interworking between access technologies** . Yes, you can attach a UMTS basestation to the RadioSphere.
24. **Legal Issues**. Can lawyers sabotage bandwidth sharing?. Is FCC/Government regulation

needed?

En article that in more detail develope this: " Architecture of a Mobile Internet ".

http://www.cdt.luth.se/~dick/CDT/RadioSphere/ArchitectureOfAMobileInternet.pdf

Implications for "The Industry".

...like Ericsson, Nokia, Motorola, Siemens, Operators, etc:

- The terminal issue must be approached from the pocket computer side rather than from the mobile phone side.
- Radio basestations become consumer electronics, just as already is the case for computers and phones.
- Equipment for building the consumer network of "broadband to homes and gas-stations" become much more important than the closed transport network behind traditional cellular mobile systems.
- Do not build a future on nursing basestations. Not more so than nursing computers.
- Mobile Operators may not be needed.

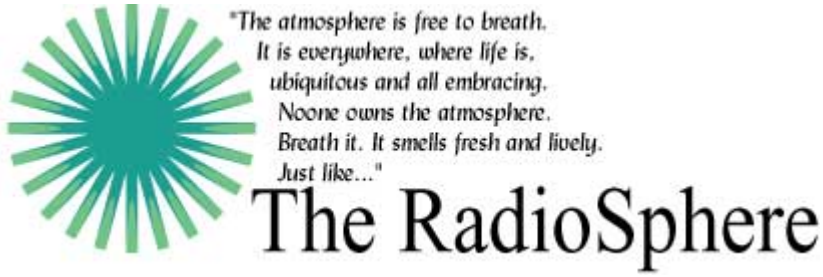
This all harmonizes wired and non-wired systems, with great efficiency gains for society at large. It is certainly an improvement for all of us.

Bottom Line

One network, mobile IP enabled, for both wired and wireless traffic.

Millions of inexpensive, consumer owened, radio basestations.

No strange "services" - straight Internet.



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Mobile Internet Made *Really* Easy...

Almost "For The Dummies":

If mobility means "having your own personal device with you, ready to use at the time and place you like", then you do not need to do much. However...:

1. Want to move physically without restarting session?

2. Want to be called?

...then it becomes significantly more complex.

Some Greetings from the Internet Bay

- There is Wireless Broadband in any place. Communication is usually made from here . And another view .

  Obviously, broadband wirelss is available in our sailing boats .

- How? Lots of RadioSphere friends in the harbour basin .