Open Networks and Testbeds in Sweden

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Outline

- Why Open Networks?
- Openness vs. Integration
- Symmetry

- Some Swedish Testbeds and Open Networks
  - ACREO
  - Community Hub
  - Stockholm Open
    - Sollentuna
    - Vällingby

- Conclusion
The challenge

- **POTS era**
  - Core: 10 Gb, 155 Mb, 56 kb
  - Access: 100 Gb, 1+ Gb, 560 kb

- **DSL era**
  - "First x10": 10 Gb, 155 Mb, 56 kb
  - "Second x10": 100 Gb, 1+ Gb, 560 kb

- **Post-DSL era**
  - 1 Tb, 10 Gb, 6 Mb

Timeline:
- Internet expansion: 1999
- Image services?: 2009
The User Need

Digital Camera/Mobile

HDTV(1080i)
B-DVD

WXGA

HDTV(720p)

PAL-TV, DV, DVD

NTSC

VHS
CD...
Open interfaces

- The user desire is:
  - Service choice
  - Best cost performance
The Network View

<table>
<thead>
<tr>
<th>Internet Café</th>
<th>Mail, games...</th>
<th>End-user</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP connectivity</td>
<td></td>
<td>ISP</td>
</tr>
<tr>
<td>VPN provider</td>
<td>RoW</td>
<td>Enterprise</td>
</tr>
<tr>
<td>Leased Line provider</td>
<td>RoW</td>
<td>Mobile operator</td>
</tr>
<tr>
<td>Infrastructure provider</td>
<td>RoW</td>
<td>Network operator, CLEC</td>
</tr>
<tr>
<td>RoW owner</td>
<td>RoW</td>
<td>Client</td>
</tr>
<tr>
<td>OVPN Provider</td>
<td>All-optical network</td>
<td>Self</td>
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Service interface

Technical interface

- RoW: RoW owner
- Duct, Copper plant
- Duct, Dark Fibre
- Tower, Radio Spectrum
- QPSK, PDH, SDH
- WDM, SDH, Eth VC-4
- ATM, RPR, VLAN...
- ATM, RPR, VLAN...
- IP
- Servers: web, mail, VoIP
- Servers: web, mail, Voice
- Mobile voice, data
- Network operator, CLEC
- "Communication operator"
- "Service Operator"
- L -2
- L -1
- L0
- L1-
- L1+
- L2
- L3
- Service L.
Open interface requirements

For an efficient business exchange, an open interface must be:

- Specifiable
- Verifiable
- Reliable

- Compare to all-optical monitoring & QoS, dark fibre, IP…
Layer & Business Interfaces

Technical interface (data handover)

Leased Line
Eth VLAN
IP Router

Service interface (business handover)

Leased Line
Eth VLAN
IP Router

SLA
Customers
Markets
Standards

Business & Technical interface must support each other!

Choice: Integration or Flexibility?
### Openness vs. Integration

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<th>Service operators</th>
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<th>Enterprise users</th>
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**Network Levels**

- **L-2**
- **L-1**
- **L0**
- **L1-**
- **L1+**
- **L2**
- **L3**
- **Service L.**
Why Testbeds?

- We don’t know what Open Networks will look like
  - Technically
  - Commercially

- General requirements on testbeds:
  - Environment for development of next generation (open) networks
  - Verify equipment interworking (interop)
  - Verify requirements from future advanced services
  - Real end-users
  - Often operates as part of commercial city networks
Some Swedish Testbeds and Open Networks

- ACREO
  - Research institute, two metro networks with 40Gb/s connection
- Community Hub
  - New image services, national size network
- Stockholm Open
  - KTH, Internet and mobile services, trans-baltic fibre
- Välingby
  - Commercial “Fibre-To-The-Home suburb” in Stockholm

See them in the Swedish Pavilion!
ACREO – 1

- Two Metro nets linked by 400km long-haul link
- Part of three EU-IP projects (MUSE, NOBEL, MUPPET).

- Participants
  - Vendors: ≥ 15
  - Providers: ≥ 15
  - Academia etc: 6
ACREO – 2

- Link Stockholm – Hudiksvall, 400 km, 2.5 Gb/s WDM & 40 Gb/s

- Hudiksvall testbed
  - Access centric
  - 200 testpilots
  - IP/Ethernet L2/L3
  - Triple-Play, IPTV, Health...

- Stockholm testbed
  - Network centric
  - Interop testing
  - GMPLS networking
  - Multiple network technologies
  - Open Networking
The “Community Hub” - 1

- Will we have any image services?

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<th>&quot;Person to person&quot;</th>
<th>&quot;Client to Server&quot;</th>
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<td>Entertainment, socialization, &quot;Share experience&quot;</td>
<td>Information seeking, helpdesks, news, &quot;content&quot;, security...</td>
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- MMS
- 3G videophone
- Video chat
- Professional video conf
- Real-time Cinema
- Interactive & digital TV
The “Community Hub” - 2

”Broadband for all”
• 2nd wave/emerging markets
  • Community networks
  • Open networks

”Window to the world”
”Full-presence” video
– eye, size, distance
  • eye-commerce
  • e-government
  • e-healthcare

”Centre Stage”
• e-Cinema
• Real-time events
• Personalized events
• Connection to mobile & 3G
Stockholm Open – 1

BalticOpen.net Latvia – Sweden

- Transborder submarine cable 400 km, GBE
- Research cooperation on optical networking on DWDM, GMPLS, IPv6 and broadband applications
- Distributed courses and Healthcare applications

Stockholm Open Local Internet Exchange

- A distributed Level2 Internet Exchange with five nodes on a 2Gbit/s Ethernet through Stockholm
- Exchange traffic with ISPs, user communities, content providers and others at low cost
Kista - Fiber to the home

- 144 apartments with fiber connection
- An operator neutral network
- The freedom to choose any ISP
- Multiple services such as data, video and voice all over IP

minisip - Secure Mobile VoIP client

- Transparent authentication and protection of privacy
- Messaging, presence information, voice and video conferencing, session mobility between devices
Commercial Open Networks

- **Sollentuna Energi**
  - Municipal energy company with Switched Ethernet network
  - Multiple services, e.g. IPTV – as seen in the exhibition
  - Connection cost ca 1500 Euro, single-mode fibre, individual housing

- **Vällingby**
  - Suburb north of Stockholm, ca 20.000 people
  - Full FTTH approach with airblown fibre (4700 homes)
  - Infrastructure owned and developed by Svenska Bostäder
  - Full separation between
    - RoW and passive network ownership (SB)
    - Active network ownership and operation (TeliaSonera)
    - Independent service providers (multiple)
Symmetry in Networking...

- Mail, ftp...
- Http
- P2P

Internet expansion: 1999, 2004
- First x10
- “Second x10”

Internet expansion: 2004, 2009
- P2P
- Image services?

TeliaSonera
…Affects Network Value

- Symmetry very valuable:
  - Any P2P network
  - Most human communication
- Symmetry irrelevant:
  - Centralized content distribution
…now add this up…

- Industry shift from vertical to horizontal layering
  - New borders & interfaces - business & technical

- Open Networks
  - Stimulates use and services, introduces new actors

- New image communication
  - Old TV is obsolete - new bandwidths

- Symmetric traffic
  - Peer2Peer and full-presence communication

- Convergence
  - Many services on same network – or not?
Conclusion

- Applied research and testbeds are very important, since
  - only real, human behavior counts – not labtests
  - The real, business, layering, and geographical interfaces unknown

- Not uncontroversial, since
  - old monopolies, services, and equipment are not “open”
  - Can end-user revenue support many actors?

- Funding and commitment for testbeds not straightforward…
  - High requirements on clarity in goals and usage
  - Clear, believable, Mission & Vision mandatory!

- Open Networks benefits
  - the end-users through competition
  - the operators through increased usage and services
  - the vendors through increased usage and standardization