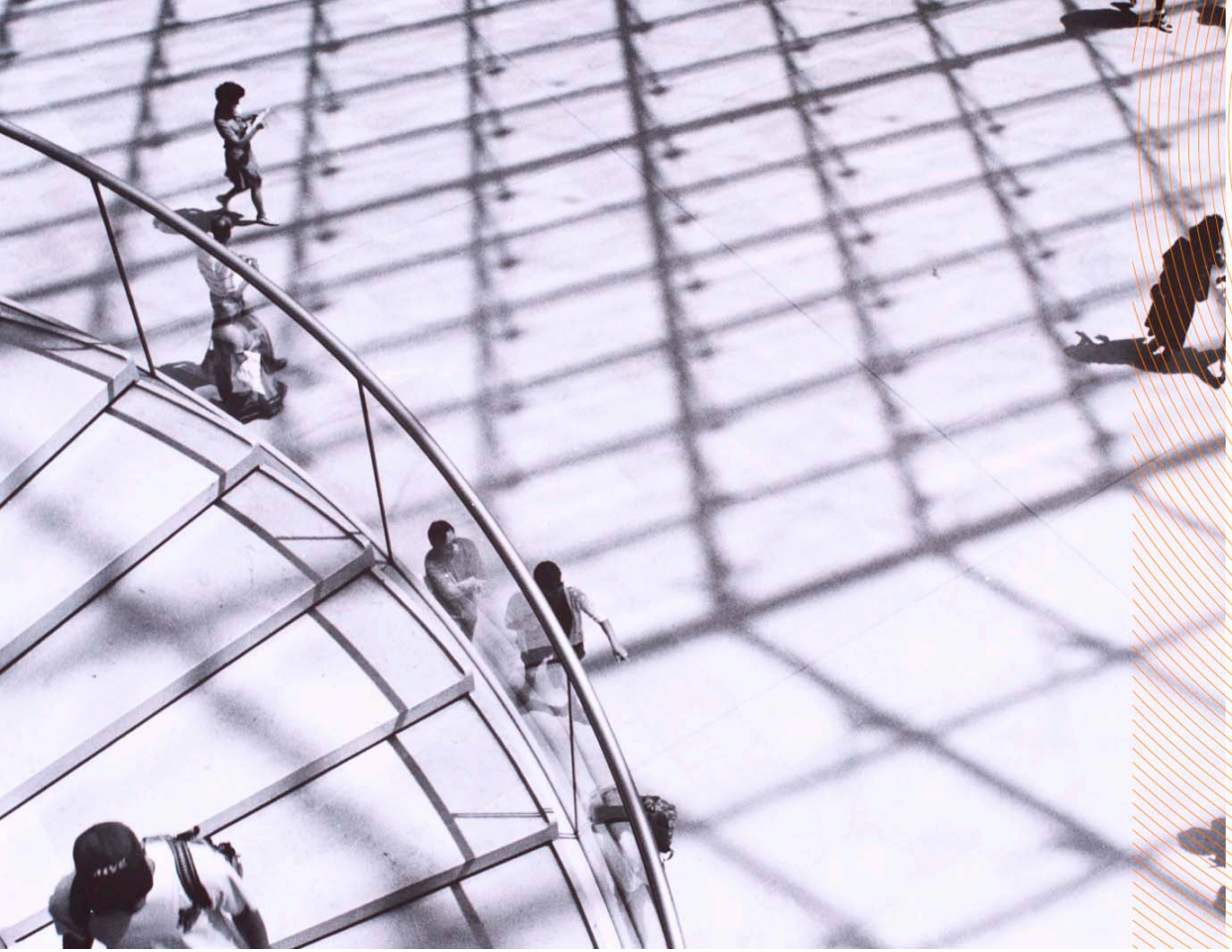


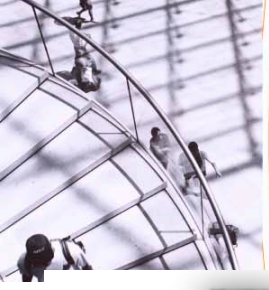
Mobile infrastructures on the campus

Frans Panken, SURFnet

Mobile facts

1. Global mobile data traffic growth nearly tripling for the third year in a row
2. Mobile data traffic in 2010 more than 3 * global Internet traffic in 2000
3. Mobile network connection speeds doubled in 2010
4. Top 1% of mobile data subscribers generate over 20% of mobile data traffic
5. Smartphones ~ 13% of total global handsets but they represent over 78% of total global handset traffic
6. Average smartphone usage doubled in 2010

source: Cisco Visual Networking Index – Feb. 2011



Increased capabilities

SURF NET

Basic Phone

1x
Month

Smart Phone

24x

Gaming Phone

60x

Tablet

122x

Laptop

515x

Source: Cisco© VNI Mobile 2011

SURFnet's wireless ambition

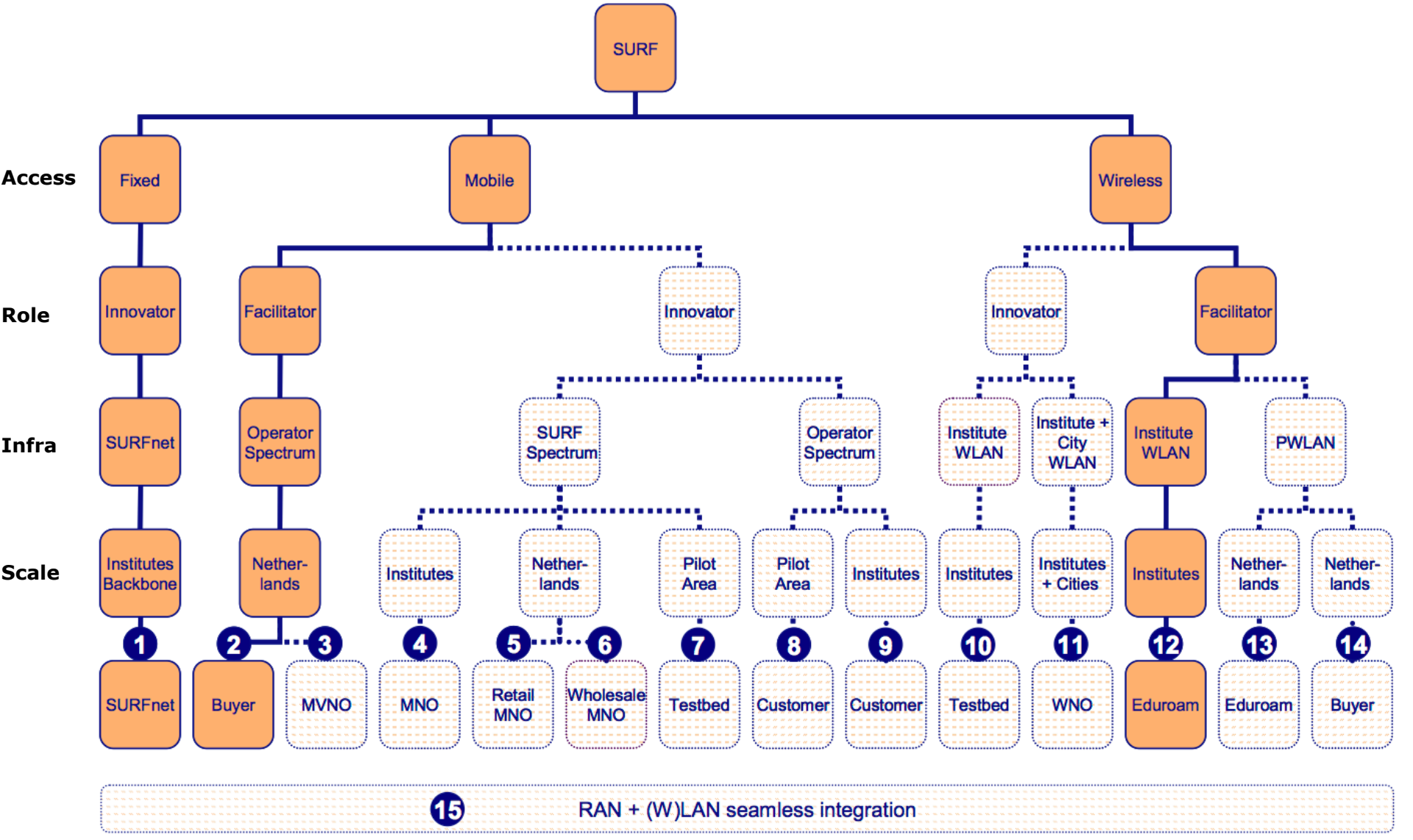
Mission: to allow students, researchers and employees to collaborate, research, learn anytime and anywhere they seem fit!

- Anytime, anywhere, any* are broad concepts

- Access to resources: independent of network technologies & mobile operators (breaking the command & control philosophy)

- Start small and grow later: 4G trial
  - Start on a campus site
  - Partner with a national operator for 4G

Landscape of mobile options



Mobile workshop

What do our customers want?

- Workshop took place on 11 March 2011
- Three user groups were invited:
  1. Researchers
  2. Teachers
  3. ICT departments
- Topics discussed
  - What are the current barriers?
  - What are your mobile desires / where do you dream about?

- Fear for degradation of Wi-Fi network
- Network planning is difficult
- New ways of studying and working; also outside buildings

Conclusions

Translate input to decisions

1. Start with the campus environment
2. Expedite the roll-out of the Wi-Fi **n-variant** for solving urgent pains
3. Work-out solutions to address outdoor coverage and coverage on remote locations
   - LTE, CR,…

Positioning

- Position outdoor solution as add-on to Wi-Fi
- Consider outdoor solution as a macro solution

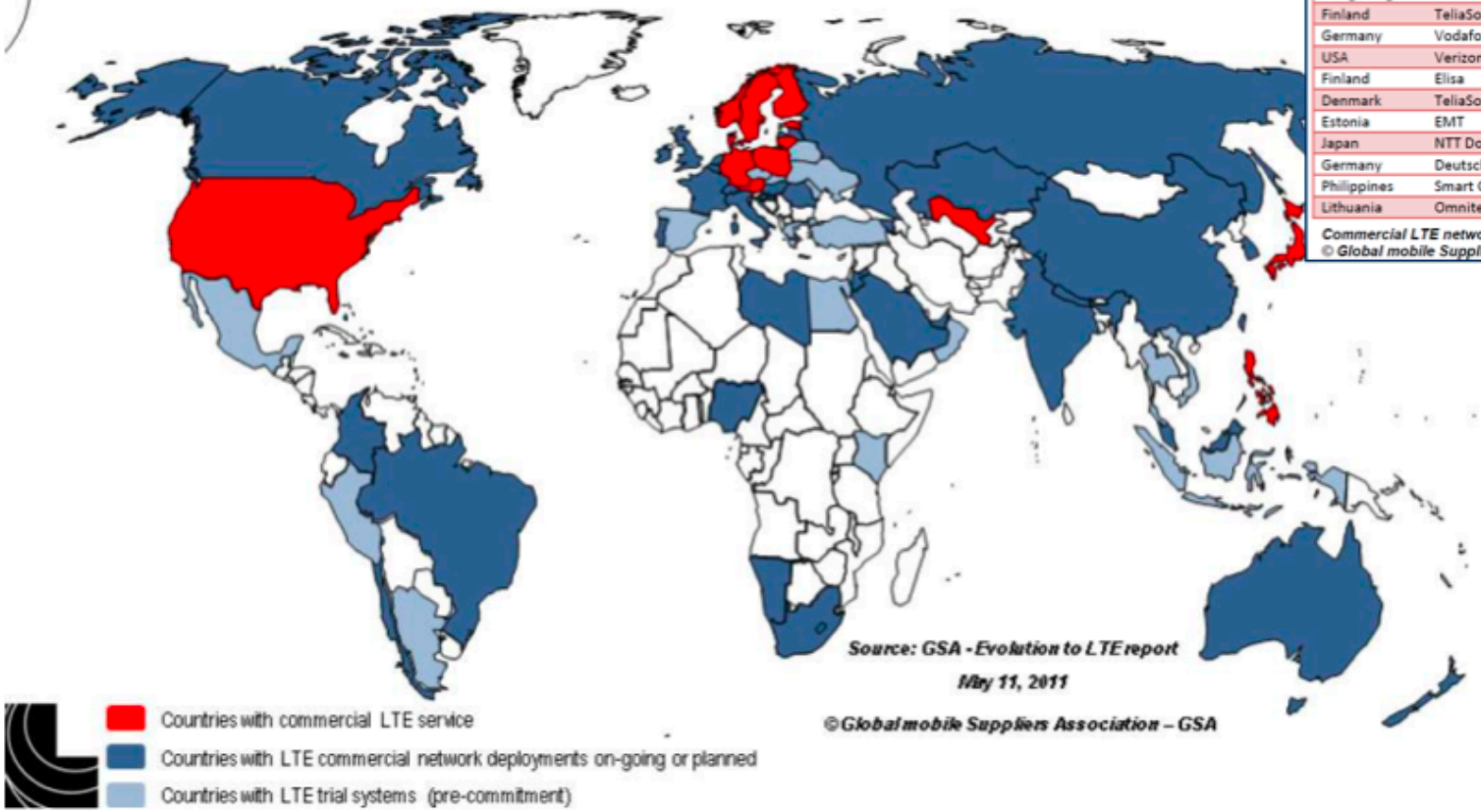
Side conditions

- Take into account student behaviors
- Be aware of SURFnet’s position

4G = LTE
(Long Term Evolution)

208 operators in 80 countries investing in LTE

- 154 commercial LTE network commitments in 60 countries
- *54 pre-commitment trials in additional 20 countries*
- *20 commercial LTE networks launched in 14 countries*



20 commercial LTE networks in 14 countries

Country	Operator	Launche
Norway	TeliaSonera	15.12.0
Sweden	TeliaSonera	15.12.0
Uzbekistan	MTS	28.07.1
Uzbekistan	UCell	09.08.1
Poland	Mobyland & CenterNet	07.09.1
USA	MetroPCS	21.09.1
Austria	A1 Telekom Austria	05.11.1
Sweden	TeleNor Sweden	15.11.1
Sweden	Tele2 Sweden	15.11.1
Hong Kong	CSL Limited	25.11.1
Finland	TeliaSonera	30.11.1
Germany	Vodafone	01.12.1
USA	Verizon Wireless	05.12.1
Finland	Elisa	08.12.1
Denmark	TeliaSonera	09.12.1
Estonia	EMT	17.12.1
Japan	NTT DoCoMo	24.12.1
Germany	Deutsche Telekom	05.04.1
Philippines	Smart Communications	16.04.1
Lithuania	Omnitel	28.04.1

Commercial LTE network launches – May 11, 2011
© Global mobile Suppliers Association (GSA)

Options for 4G on the campus

Meeting with CIO's, 28 June 2011

1. Individual outsourcing: select a mobile network operator who provides 4G coverage on the campus (and beyond)

2. Do it yourself + SURFnet: create 4G infrastructure on the campus and integrate it with Wi-Fi

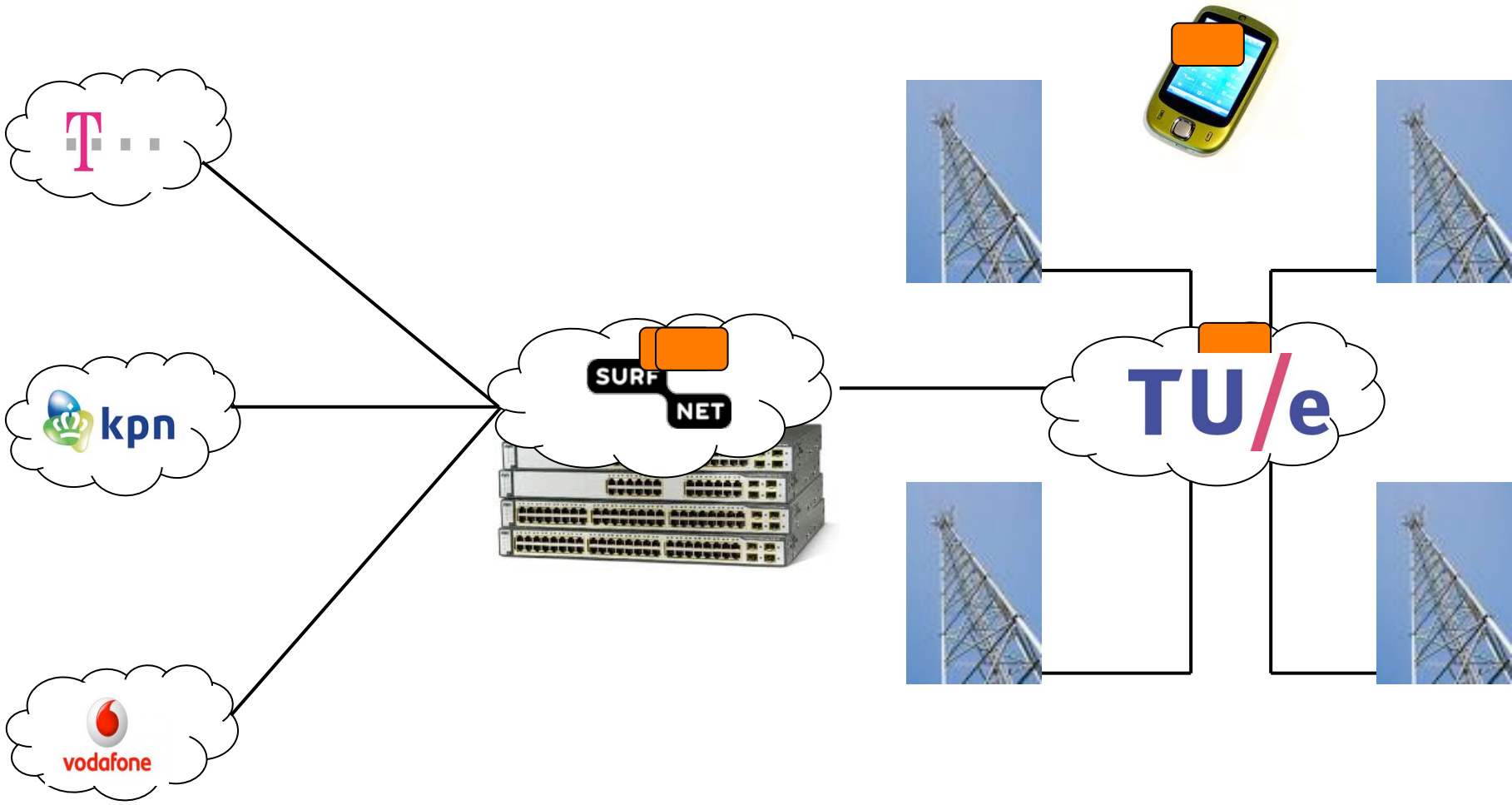
3. Take no action on 4G: rely on Wi-Fi and its evolution

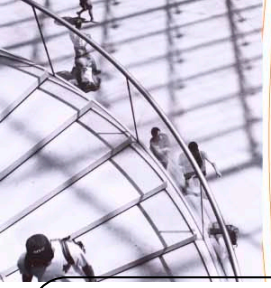
Option 2: "Do it yourself +"

The right time …

1. Install 4G antenna's on strategic locations around the campus
2. The 4G antenna's transmit & receive on frequencies of cooperating Dutch network operators
3. The antenna's are connected to equipment located at SURFnet.
4. Solely data; neither voice, nor text messages

Option "Do it yourself"





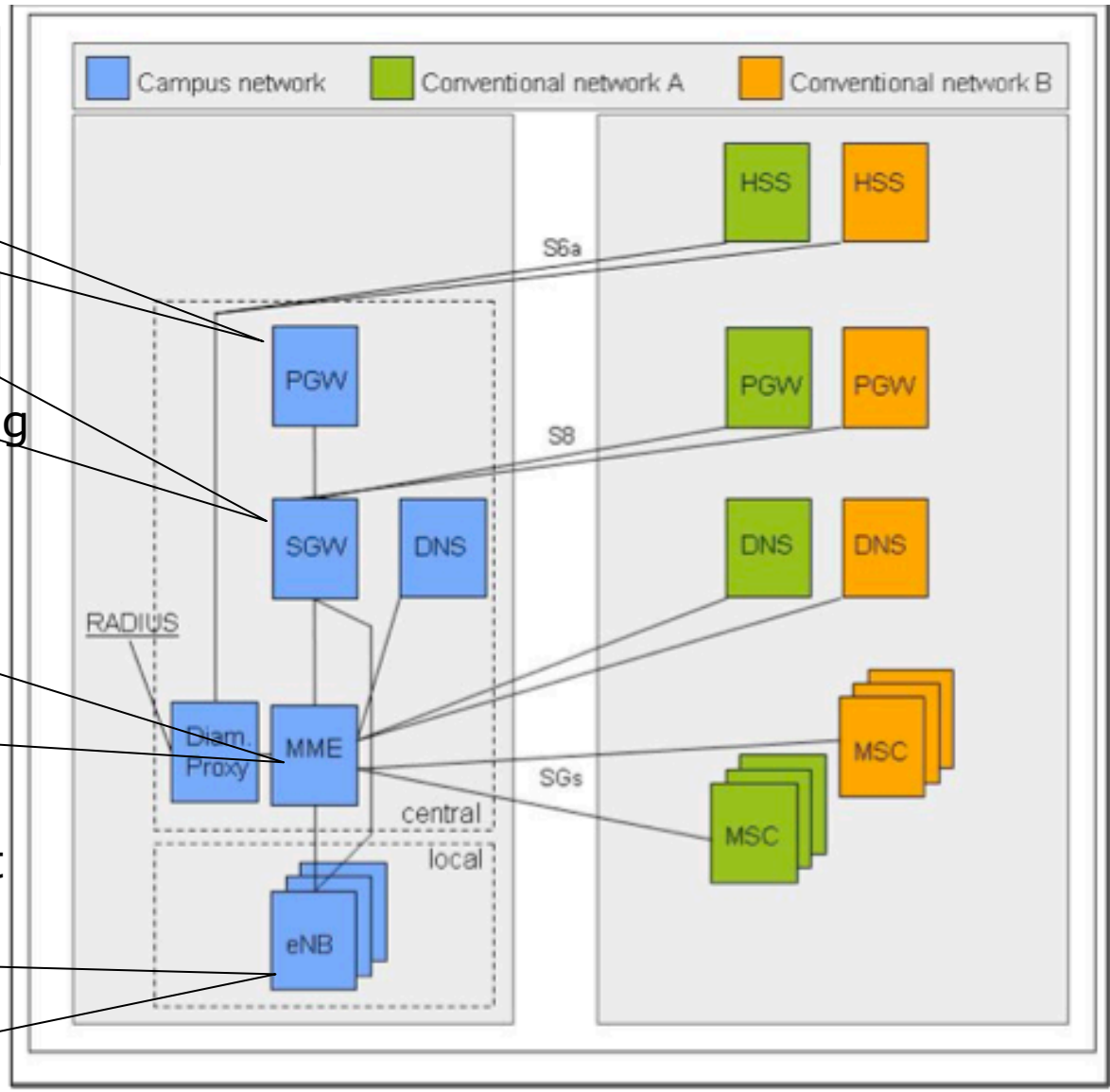
Possible architecture

IP-address allocation, transp. level packet marking, service level charging, rate enforce

Handover, 3G fall-back, initiation of network triggered service requests, Packet routing and forwarding

initiation of network triggered service requests Packet routing and forw., Authentication, roaming, GW selection

Radio Resource Management IP header compression and encryption of user data, measurements,…



Mobile trial (2H2011)

- LTE pilot on campus
  - Group: 50-100 students/employees
  - Education application (for outdoor usage)
  - Explore possibilities for the integration of LTE with eduroam
- Insight in whish lists of students and employees, future scenario’s, business models, roles of institutes / mobile operators and SURFnet, insight in privacy and other formalities,…
- Towards a service that is reproducible to other locations, with other operators

Other options…?

TV white spaces (IEEE 802.11af, 802.22)

Advantages /opportunities

- enabler for dynamic (more efficient) spectrum usage
- evolution of the Wi-Fi installed base

Disadvantages / threats

- TV white spaces are regulated in NL
- no products available that use the IEEE standards
- very little seems to happen in NL (regulation, COST actions IC0902, TERRA,…)
- user group use commercial available devices