

Cellular Protocols in Linux (Cellux)

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Cellux: Overview

- Nowadays there is a high demand to use IP services (WWW, E-Mail, ...) everywhere
- One solution: GPRS (General Packet Radio Service)
 - restriction: limited data rate up to 170kbit/s
 - benefits: wide distribution, mobility management, AAA (authentication, authorization, accounting)
- There are other emerging wireless access technologies (e.g. Wireless LAN, Bluetooth)
 - benefits: support higher data rates (Wireless LAN up to 54 Mbit/s)
 - restriction: lack of mobility management and AAA
- Idea: combine the GPRS network infrastructure with other wireless access technologies



Cellux: Benefits

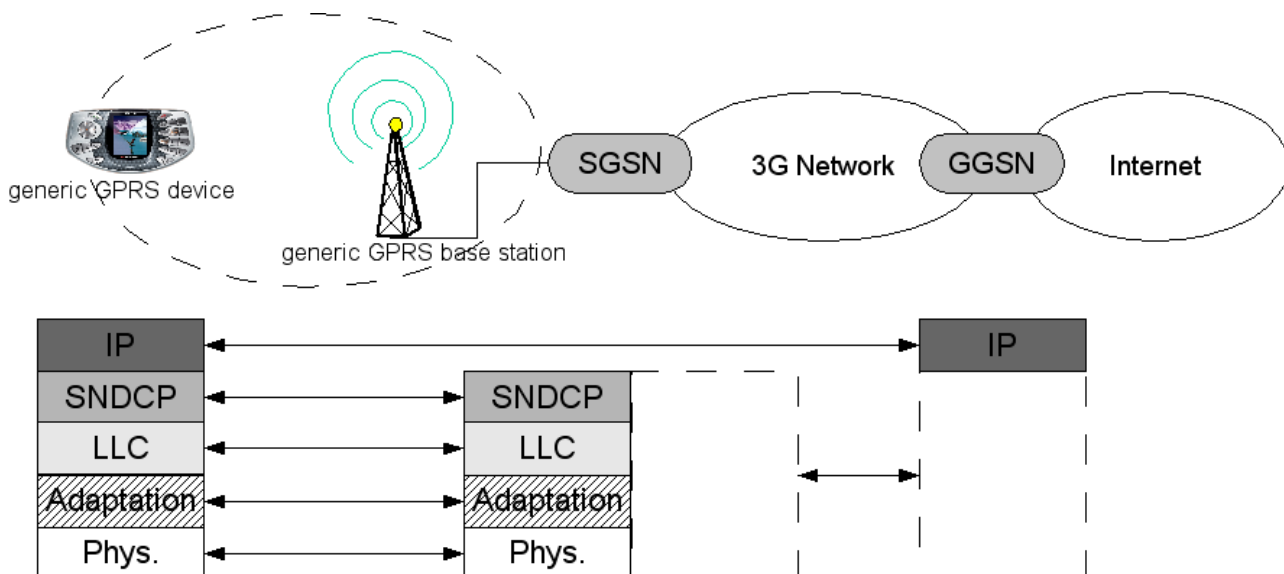
Combination of GPRS with generic bearers

- overcoming GPRS limited data rates by using faster, generic bearers
 - e.g. Wireless LAN, Bluetooth
- using GPRS special benefits over generic bearers
 - e.g. mobility management and AAA

Use Cases

- use Cellux at highly crowded places to enable access to the Internet
 - higher data rates by using faster wireless bearers (Wireless LAN, Bluetooth)
 - use standard billing system of GPRS
- support of special GPRS hardware
 - protocol stack not in hardware
- combination of both to enable seamless services / Roaming

Cellux: Architecture (overview)



- Implementation of GPRS higher layer protocols (LLC and above)
- Adaptation presents a unified view on the access technology

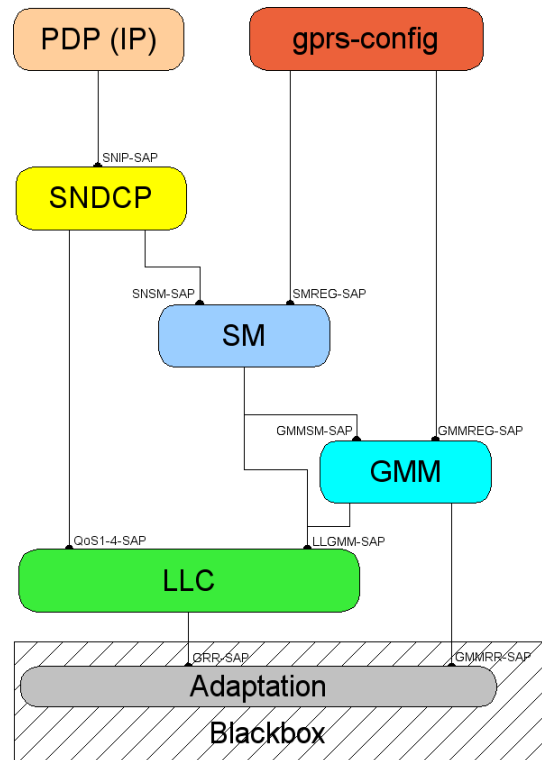
Cellux: Architectural Design

Architectural Design:

- according to ETSI standards in combination with restrictions below
- below LLC bearer specific layers
 - LLC is lowest layer of GPRS stack that is realized
- below LLC adaptation layer, that adapts to GPRS GSM hardware or generic bearers

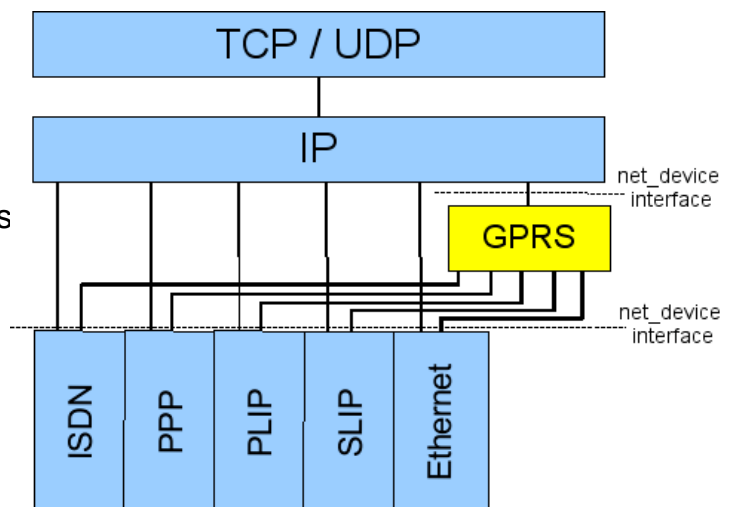
Restrictions: (for the current release)

- realize class C device
- omit SMS (Short Message Service Support) and SS (Supplementary Service Support)
- focus on the mobile station side

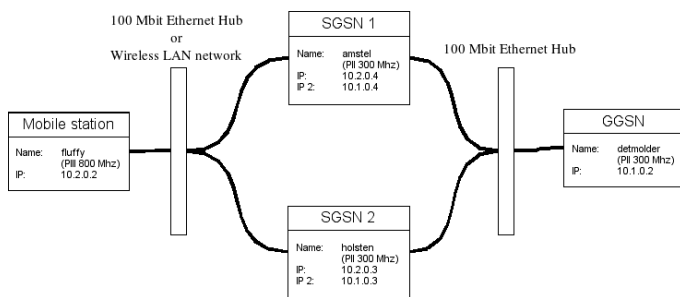


Cellux: Integration into the Linux Network Architecture

- GPRS is service below IP
- in Linux services below IP are regarded as logical network devices
 - implement net_device interface
- GPRS uses services of generic bearers



Cellux: Uni Bonn Laboratory Evaluation



- using Wireless LAN and Ethernet
- performed Routing Area Updates
- measured under high load
- measured when simulating packet loss

Measurements show:

- overhead exists
- it can be minimized by adjusting parameters to new bearers
 - sometimes non-standard-conform values achieve better results



Cellux: Conclusion and Future Work

Summary:

- a combination of GPRS and generic bearers (Wireless LAN / Bluetooth) promises the possibility of overcoming restrictions of the single technologies
- integration into the Linux kernel network architecture was done
- evaluation shows little overhead, when parameters are optimized

Future Work:

- enable roaming between different bearers
- separate our combination of SGSN and base transceiver station
- support compression and ciphering

