Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: Requirements on Wireless Backhauling and Fronthauling

Date Submitted: 11 November 2013

Source: Thomas Kürner Company TU Braunschweig
Address Schleinitzstr. 22, D-38092 Braunschweig, Germany
Voice:+495313912416, FAX: +495313915192, E-Mail: t.kuerner@tu-bs.de

Re: n/a

Abstract: Wireless backhauling/fronthauling is one of the potential applications for a standard on 100G. In this contribution the terms wireless backhauling and fronthauling are explained and requirements coming from recent developments in cellular networks are explained.

Purpose: Information of IEEE 802.15 SG 100G

Requirements on Wireless Backhauling/Fronthauling

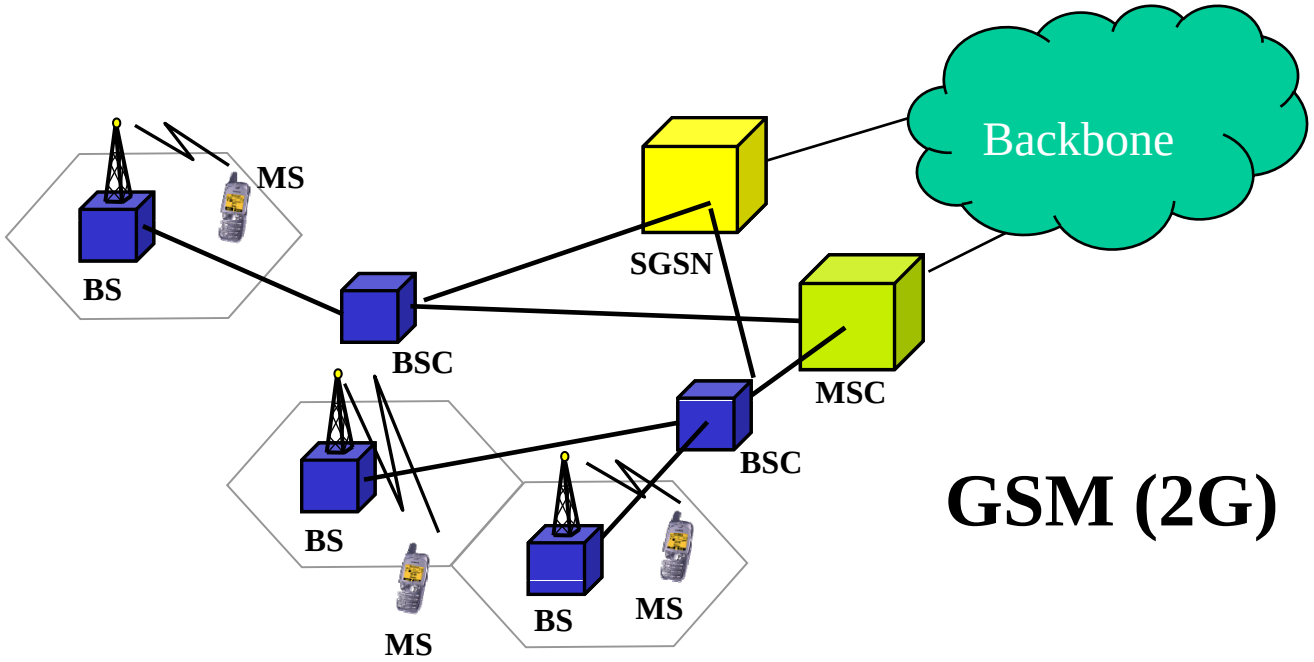
Thomas Kürner

TU Braunschweig

Introduction

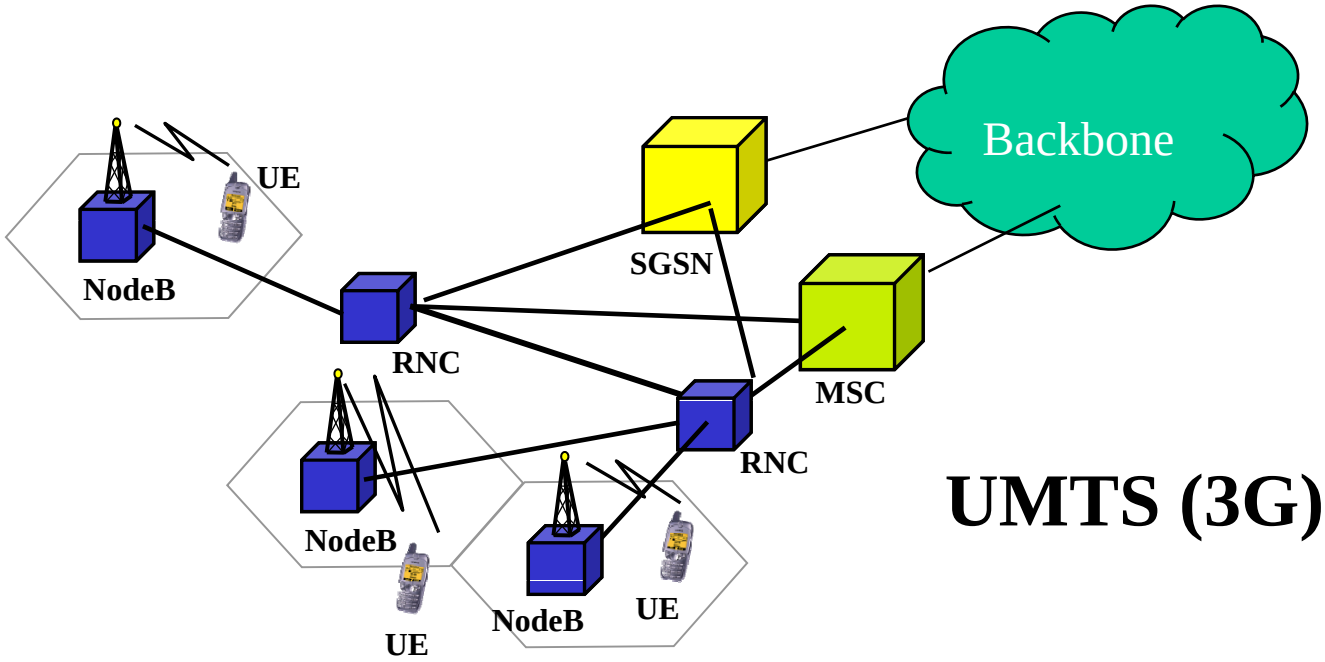
- Wireless backhauling/fronthauling is one of the potential applications for a standard on *100G (100 Gbit/s over beam switchable wireless point-to-point links)*
- In the following the terms wireless backhauling and fronthauling are explained and requirements coming from recent developments in cellular networks are explained.

(Simplified) Architecture of Cellular Networks (1/3)

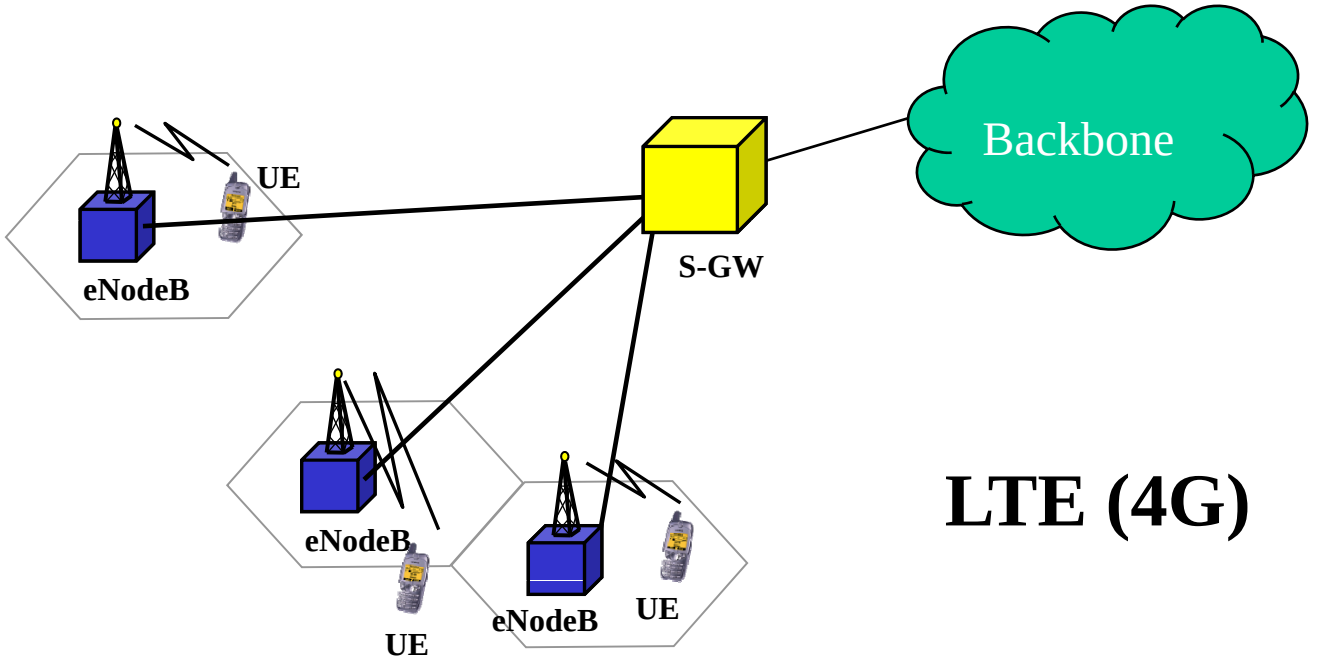


GSM (2G)

(Simplified) Architecture of Cellular Networks (2/3)



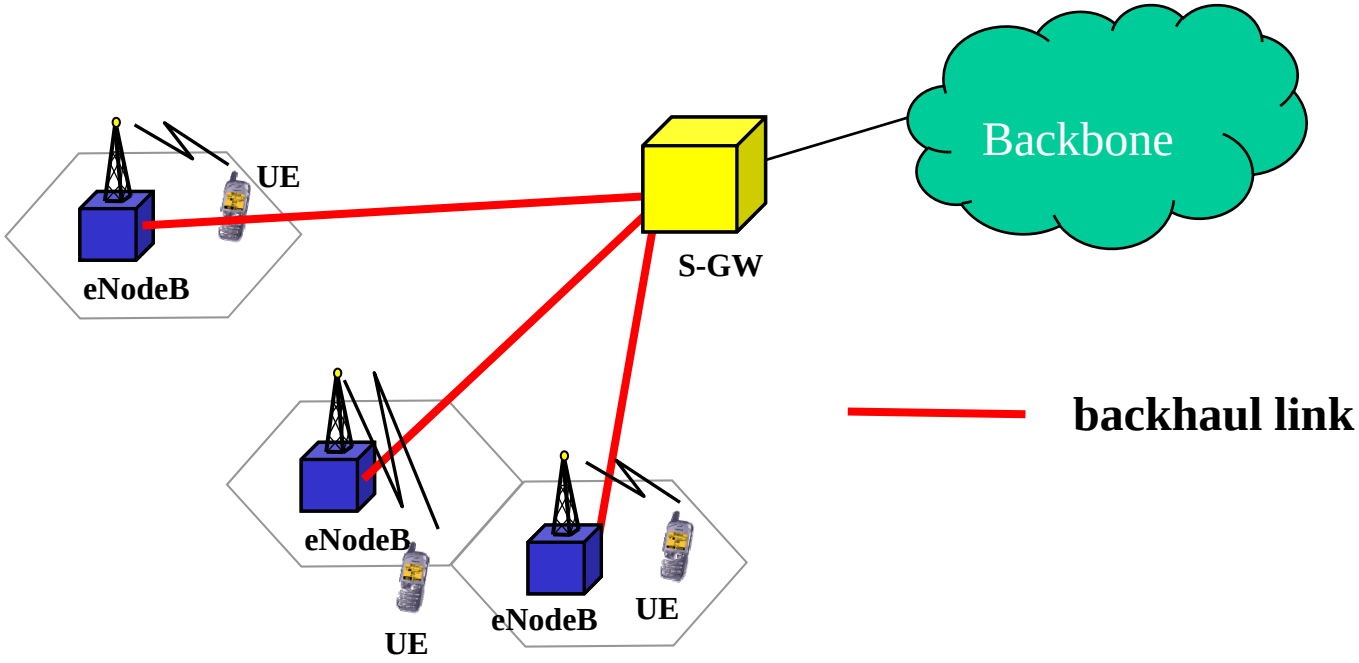
(Simplified) Architecture of Cellular Networks (3/3)



In the following slides the LTE architecture is displayed only

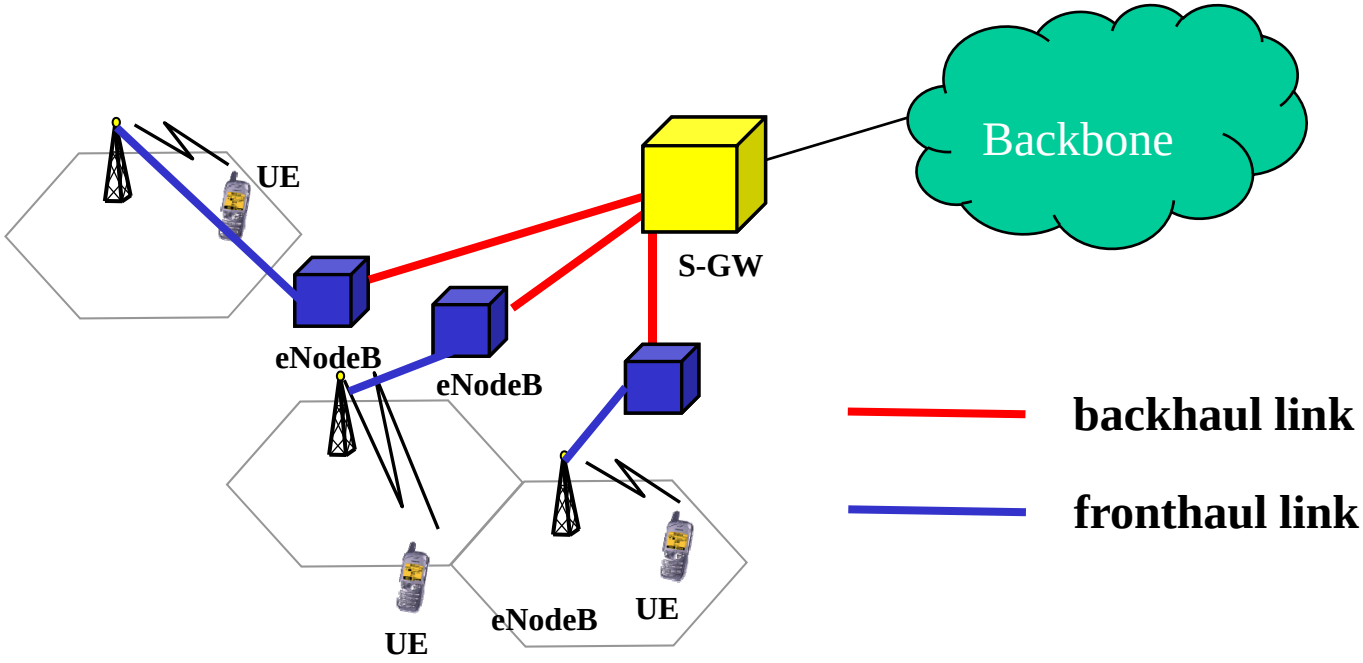
Backhaul Links

- A backhaul link is a connection between the base station and a more centralized network element



Fronthaul Links

- The fronthaul link is the link between the base station and the remote radio head



Increase of Traffic in Cellular Networks

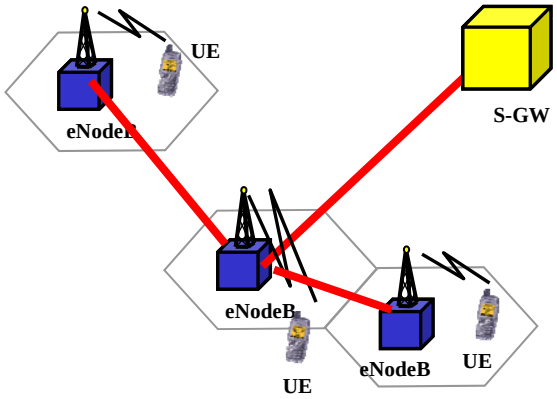
- In the near future an enormous increase of mobile data volumes are predicted, e. g. traffic increase by a factor of 25 by 2016 [5]
- Network operators have to increase the capacity of the networks
- Since the income does not increase in the same way the cost per bit has to be reduced at the same time
- More cost efficient and easy-to-deploy solutions are required.

Technical Trends in Cellular Networks to increase the Capacity

- A couple of new techniques are developed in cellular networks
- Some of them require additional backhaul or fronthaul links
- In the following slides three examples are discussed
  - Deployment of Small Cells
  - Cooperative multi-point transmission (CoMP)
  - Centralized radio access networks (C-RAN)

Massive Deployment of Small Cells

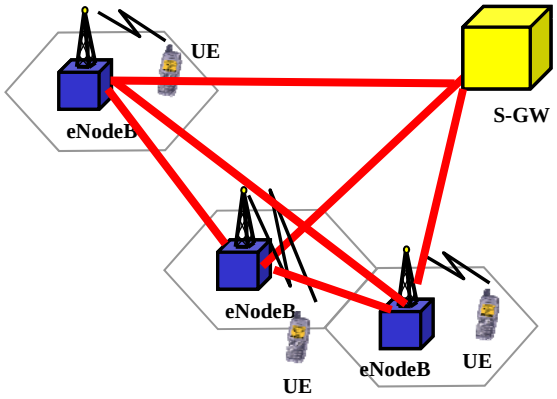
- If cell sizes are getting smaller the capacity per area increases.
- Deployment of small cells with coverage areas similar to those of WLAN APs require a large number of backhaul links
- Possibly aggregated high-capacity backhaul links will be used (e.g. backhauling all small cells form a large multi-storey.building)



Aggregation of backhaul links

Cooperative Multipoint Transmission

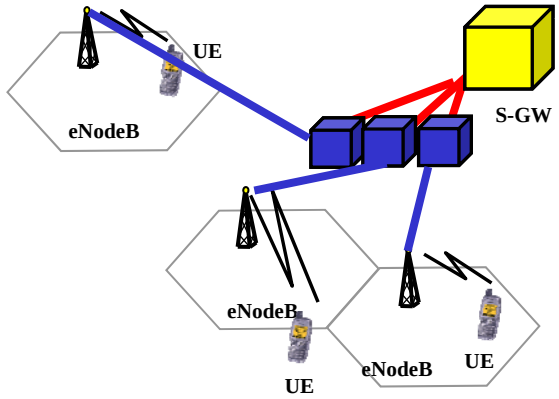
- Tight coordination of transmitted signals by several base stations will reduce interference
- By reducing interference capacity can be increased
- Each base station requires information about about transmision of all other base stations received within a cell
- Requirement for high backhaul capacity currently restricts depolyment of CoMP



Backhauling between base stations

C-RAN

- C-RAN centralises the base band part of all base stations at a centralized place
- Coordination among base stations becomes easier
- C-RAN could be an enabler for more intensive use of CoMP
- Additional fronthaul links will be required.



Additional fronthaul links required

Trends in Backhauling Technologies

- There is a trend that IP/Ethernet gets more importance as a transport technology for backhauling in mobile networks [1,2,3]
- Currently fiber is used as the physical medium
- Sometimes microwave links are used as an alternative, if fiber is not available.
- Backhaul Networking flexibility is critical to successful deployments [1]
- This situation offers opportunities for the application of wireless 100 Gbps links.

Specific Requirements on Fronthauling Links [4]

- Fronthauling links use the CPRI (Common Public Radio Interface)
- This protocol is extremely latency sensitive
- Signal synchonisation has to be tranferred transparently.
- These requirements may be a challenge for wireless 100 Gbps links.

References

[1] Alcatel Lucent Application Note; A New Era of Mobile Backhaul; http://resources.alcatel-lucent.com/?cid=163517

[2] http://www.ericsson.com/ourportfolio/telecom-operators/mobile-backhaul

[3] Transmode Application Note; Ethernet mobile backhaul delivers new services with higher performance and lower costs; http://www.transmode.com/en/resource/application-notes?task=document.download&id=15

[4] Transmode Application Note; Mobile Fronthaul; http://www.transmode.com/en/resource/application-notes?task=document.download&id=901.

[5] Alcatel Lucent Application Note; IP/MPLS Mobile Backhauls for Heterogenous Networks; http://resources.alcatel-lucent.com/?cid=162070

Technical Expectations Document (TED)

All information contained in this presentation is meant to be included in the technical expectations document 15-11-0745-10-0thz-thz-ig-technical-expectations-document-ted.doc.