

Synchronisation Requirements for the Transmission of 3G Wireless Traffic (UMTS Networks) - Infrastructure Manufacturers Perspective

Stefano Ruffini
Ericsson Lab Italy (ERI)
e-mail: stefano.ruffini@ericsson.com

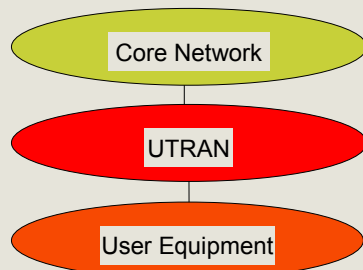
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- UMTS Network Architecture and Applications**
- Comparing different Generations of Mobile Systems**
- Synchronisation Requirements in UMTS**
- Core Network Server Node and Node B Requirements**

Design of Synchronisation functionalities from an Infrastructure Manufacturer's perspective

*Telecom Operators shall be able to perform
accurate synchronisation network planning
in a flexible manner.*

UMTS Network Architecture and Applications



Why UMTS ?

- **Market demands for new services**
- **Opportunity for operator's**
 - that didn't get any GSM license
 - to offer increased bandwidth (as required by customers)
- **Trend: demand for improved capacity**
- **New services offer is a key discriminator between service providers**

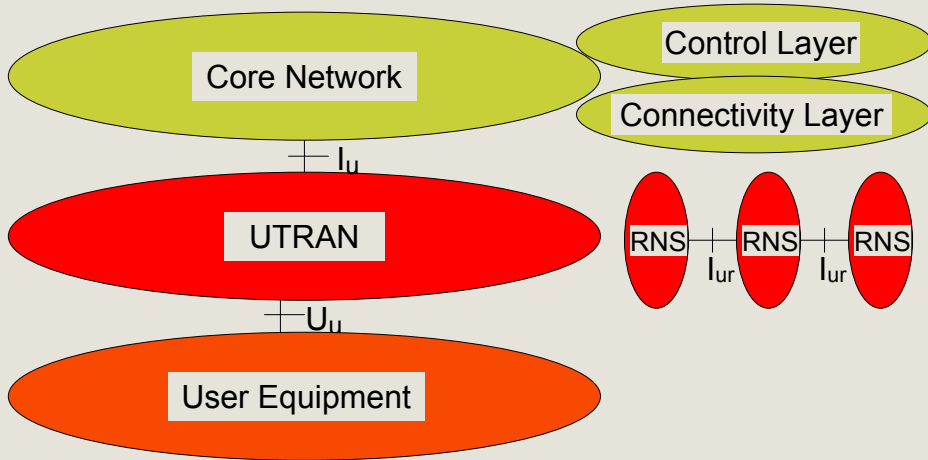
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What is UMTS ?

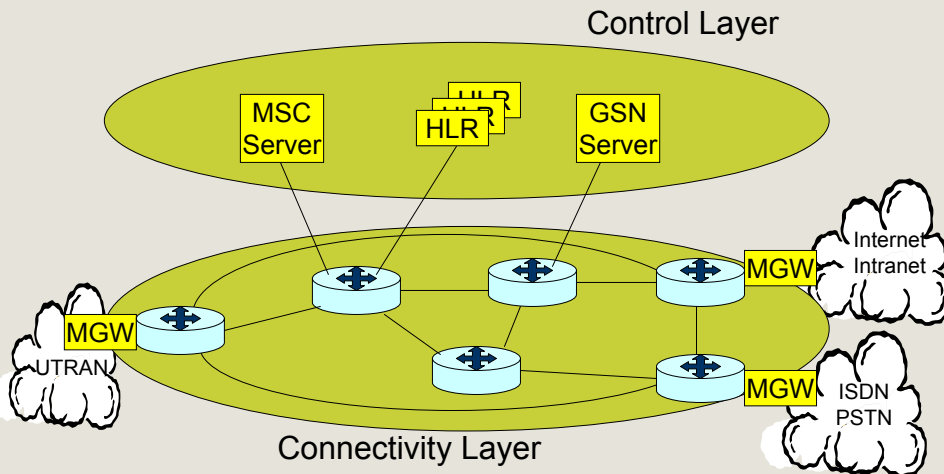
- **A new service concept - Personalized services everywhere**
- **A global standard**
- **A new radio technology (WCDMA) in a new spectrum to support wideband multimedia**
- **Packet based transport network technology**
- **Today more than 10 Million people use 3G/WCDMA networks and devices**

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UMTS Architecture



UMTS Core Network Model



UMTS Terrestrial Radio Access Network (UTRAN) Model

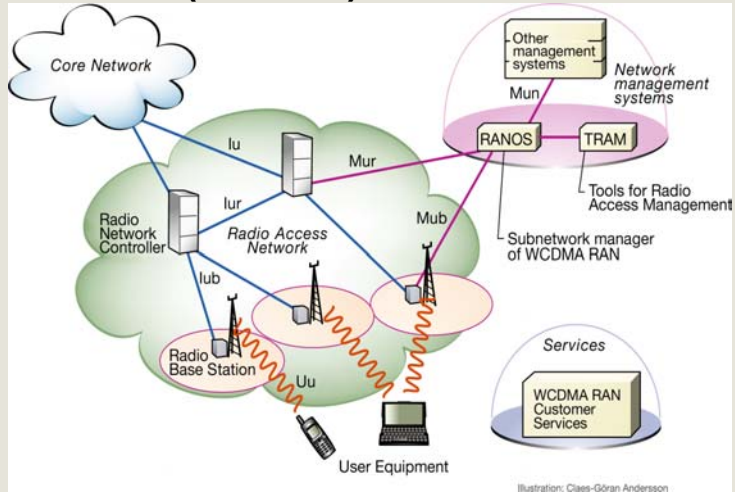
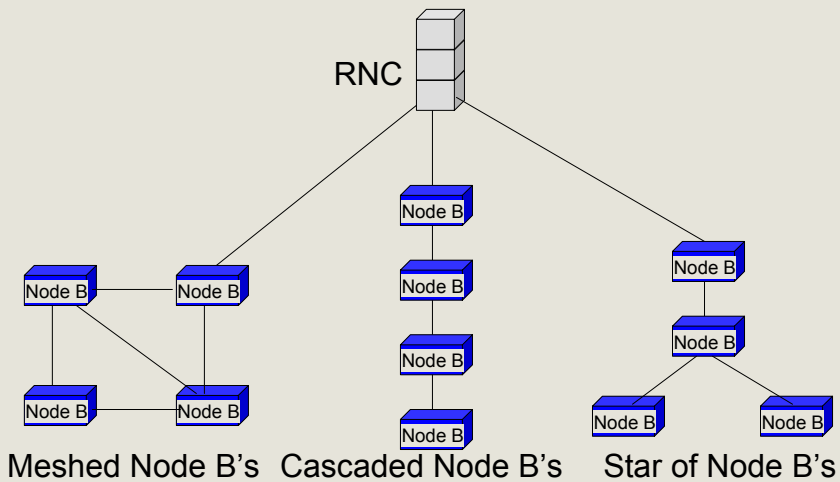


Illustration: Claes-Göran Andersson

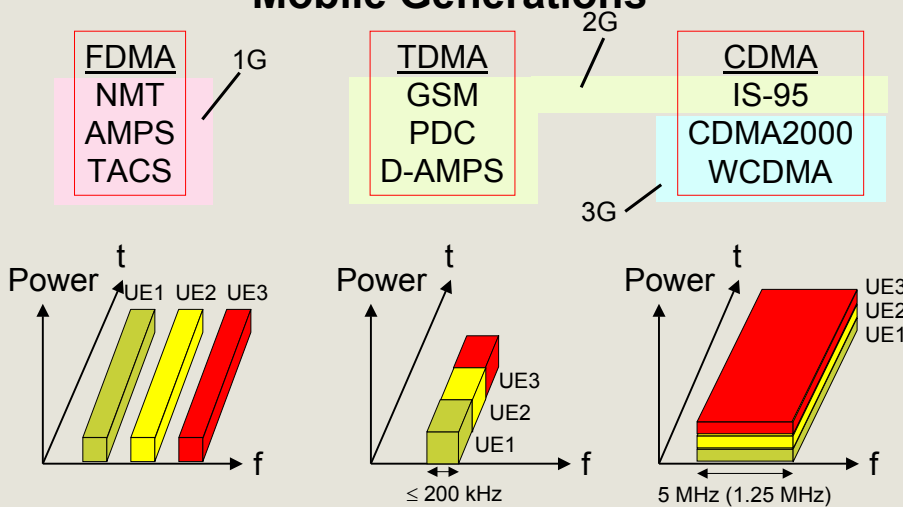
Radio Network System (RNS) Topologies



Comparing different Generations of Mobile Systems

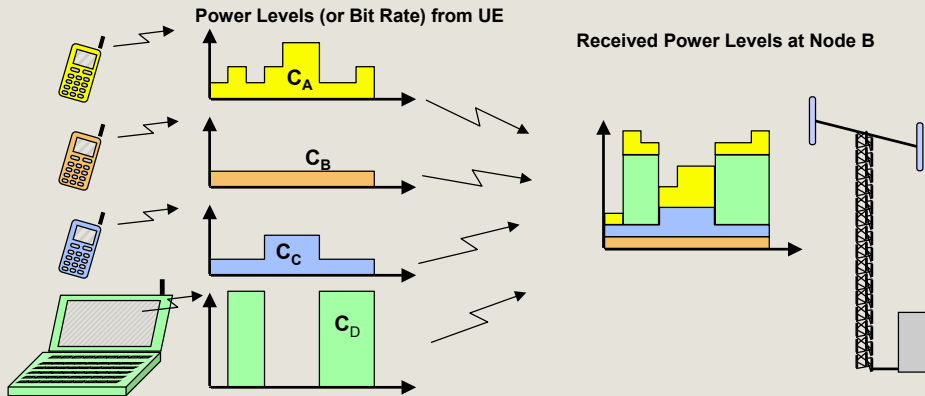


Modulation Techniques and Mobile Generations

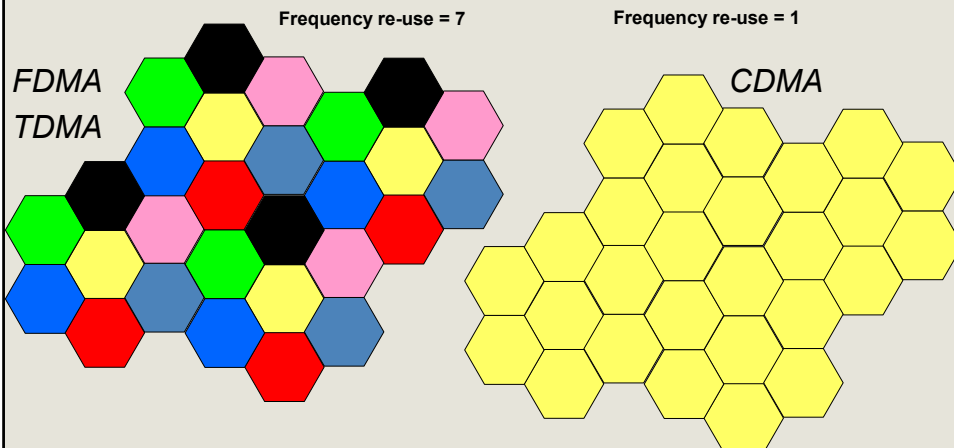


Multiplexing variable bit rate services

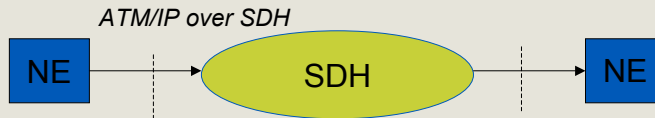
- Services are mixed by power with different codes



Frequency Re-use



Synchronisation Requirements on Equipment



Requirements on the physical layer

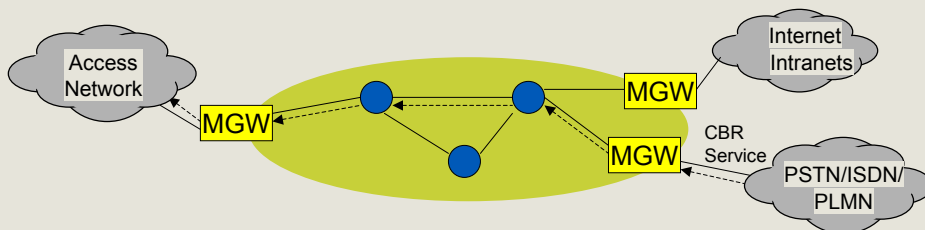
⇒ network interface limits for jitter/wander, as defined in ITU-T G.823, G.824, G.825

Requirements on the frequency accuracy at the interface of a PSTN network

⇒ frequency accuracy according to ITU-T G.811 (to meet ITU-T G.822)

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Synchronisation Requirements on the CN



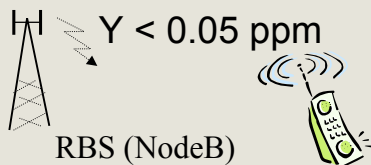
- MGW shall be able to recover the bit rate of the CBR services
- Optionally, the MGW shall re-time the service
- MGW Clock performance according to the specific Access Network: for UTRAN, an accuracy of 0.05 ppm is required if used to synchronize the U_u interface

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Synchronisation in the UTRAN : BS TX Characteristics – Frequency Error

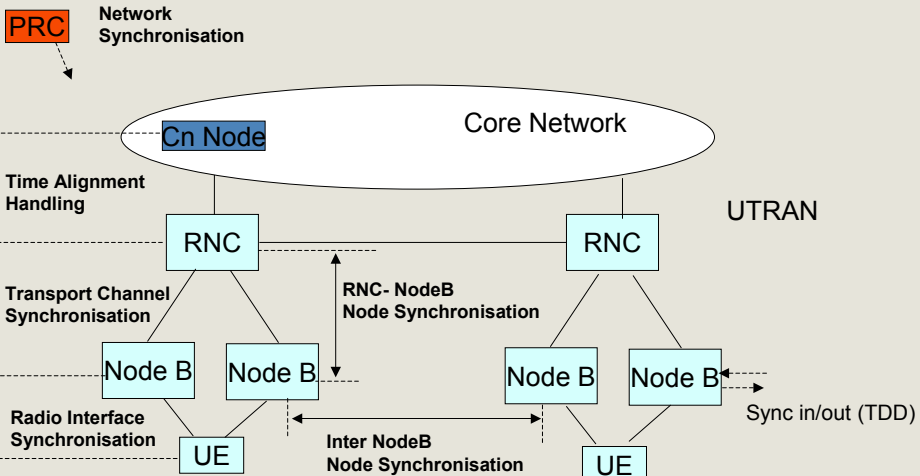
“The same source shall be used for RF frequency and data clock generation.

The modulated carrier frequency of the BS shall be accurate to within ± 0.05 ppm “

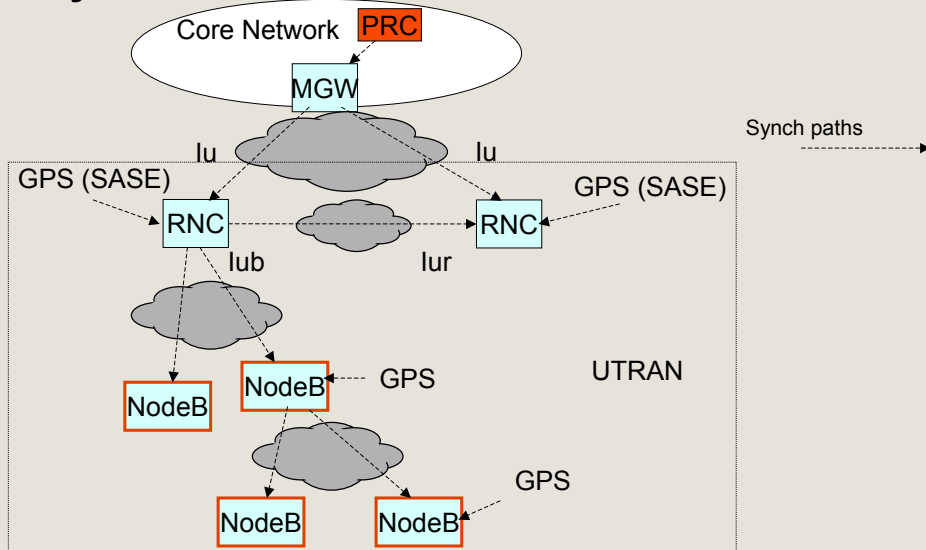


TS 25.104 (FDD)
TS 25.105 (TDD)

TS 25.402: Synchronisation in the UTRAN

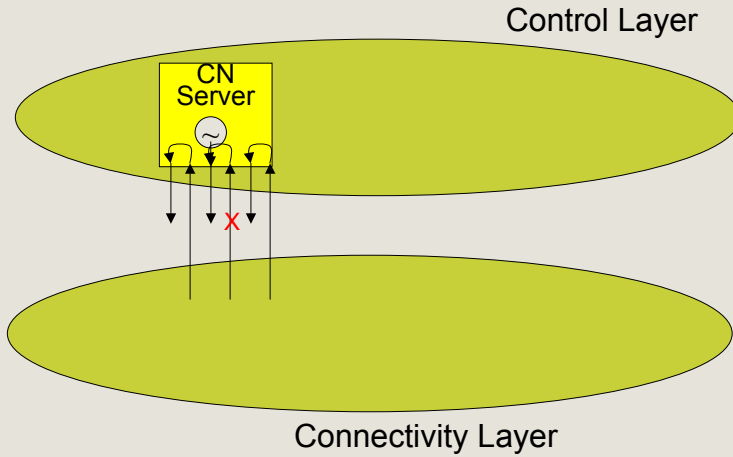


Synchronisation Distribution in the UTRAN

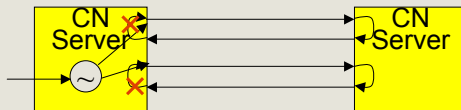


Core Network Server Node and Node B Requirements

CN Server Node Requirements



CN Server Node Requirements

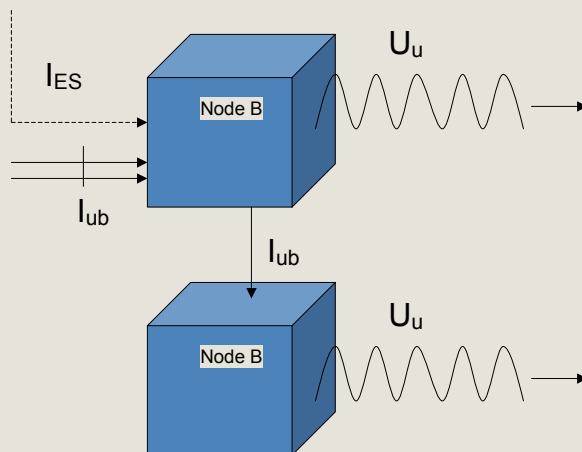


CN Server Node Requirements Summary

- Loop-Timing on all interfaces.
- “Clocks” per such loop-timed interface which can generate AIS according to the particular interface standard.
- Possibility to connect a clock which is a partial-system clock which is used to avoid timing-loops in direct server-server connections.
- A requirement for the partial-system clock is still to be defined but ITU-T G.813 can be sufficient.

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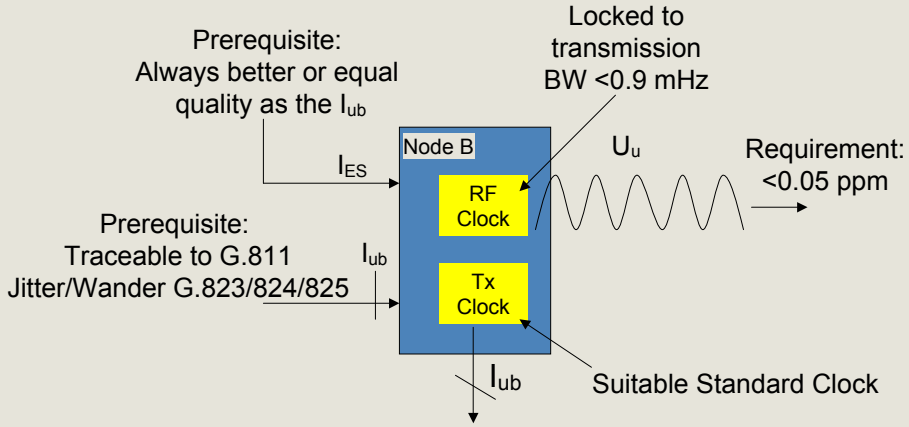
Node B Sync Model



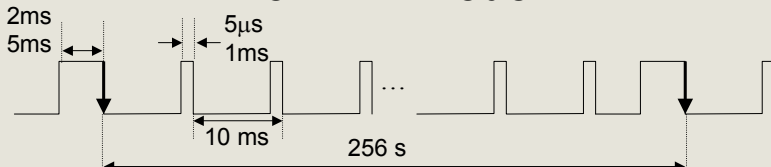
ES = External Sync

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Node B Requirements Summary

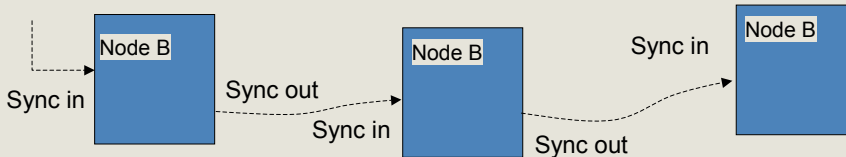


Node B Sync additional requirement for TDD mode



The relative phase difference of the synchronisation signal shall not exceed 2.5 μ s

External sync Source (e.g. GPS)



Summary

- **The main differences between 2G and 3G are:**
 - **CN architecture. Splitting of Control and Connectivity Layers**
 - **Resource allocation in the air interface.**
 - **In 3G, the UE has simultaneous contact with several Node B's (macro-diversity) while in 2G it is only one base station at the time.**
- **No main network synchronisation differences identified.**
- **Minor issues affecting network synchronisation and equipment requirements:**
 - **Differences in CN equipment depending on location in the connectivity layer or in the control layer**
 - **Node B appear in meshed network configurations, affecting requirements on reference selection.**
- **Stricter requirements in TDD if compared with FDD mode**