UMTS R99 Architecture
3GPP Release 99 Reference Architecture
UMTS Terrestrial Radio Access Network (UTRAN)

- WCDMA Radio Interface Key Change from GSM
- UTRAN elements are comparable to GSM BSC & BTS
- Common Interface (Iu) for both PS and CS Core
- Core elements do not change dramatically
  - 3G SMSC/VLR provides ATM based Iu-CS interface
  - 3G SGSN supports ATM based Iu-PS interface
UTRAN Architecture

• Hierarchical Architecture
• Radio Network Subsystem (RNS)
• UTRAN Elements:
  – Radio Network Controller
  – Node B (Base Station)
• One RNC controls number of Node B’s
• Node B is only connected to one RNC
• New interface Iur for Macrodiversity
UTRAN Functions

Functions related to overall system access control
- System information broadcasting

Functions related to radio channel ciphering
- Radio channel ciphering
- Radio channel deciphering

Functions related to handover
- Radio environment survey
- Handover decision
- Macro-diversity control
- Handover Control
- Handover execution
- Handover completion
- SRNS Relocation
- Inter-System handover
UTRAN Functions

Functions related to radio resource management and control
– Radio bearer connection set-up and release (Radio Bearer Control)
– Reservation and release of physical radio channels
– Allocation and de-allocation of physical radio channels
– Packet data transfer over radio function
– RF power control
– RF power setting
– Radio channel coding
– Radio channel decoding
– Channel coding control
– Initial (random) access detection and handling
Node B

- Standardization term (normally called as Base Station)
- Comparable to Base Transceiver Station in GSM
- Responsible for Air Interface Layer 1
- Key Node B Functions:
  - Modulation and spreading
  - RF Processing
  - Inner-loop power control
  - Rate matching
  - Macro diversity combining/splitting inside Node B
Radio Network Controller (RNC)

- Comparable to Base Station Controller in GSM
- Responsible for L2 processing of user data
- Responsible for Radio Resource Management
- Key RNC Functions:
  - Closed loop power control
  - Handover control
  - Admission control
  - Code allocation
  - Packet scheduling
  - Macro diversity combining/splitting over number of Node Bs
Logical role of RNC

- RNC controlling one Node B is indicated as ControllingNRC (CNRC)
- RNC that is in charge of controlling a mobile is called serving NRC (SNRC)
- Any other RNC controlling a cell used by the mobile is called drift RNC (DRNC). It can perform macro diversity combining and splitting of the signals. It does not perform layer 1 processing of the user plane, but instead routes the data transparently via Iur and lub.
Macro Diversity

- Softer Handover
- 1 BS
- 1 RNC
Macro Diversity

- Soft Handover
- Number of BSs
- 1 RNC (MDC)
Macro Diversity

- Soft Handover
- Number of BSs
- 1 Serving RNC (MDC)
- Number of Drift RNC
Macro Diversity

- SRNC Anchoring
Macro Diversity

• SRNC Relocation
Interfaces of UTRAN

• Iub is the interface between Node B and RNC
  – Unlike in Abis interface of GSM interface Iub is open interface and allows the interoperability of different vendors Node-Bs and RNCs.

• Iur denotes the interface between two RNCs and it is utilized to relay data and control information in case of intra-RNS handover.

• Iu-interface connects UTRAN to CN
  • It is notable that the single interface deals with both CS and PS traffic
UMTS protocol internetworking architecture

• Transport network layer is responsible for providing a general purpose transport service (user data and control data) for all UMTS network elements.
  – Physical layer in Uu interface is WCDMA
  – Physical layer fixed network side is based either on pleisochronous or synchronous digital hierarchy (PLH/SDH)
• Radio network layer protocols ensure internetworking between UE and CN on all radio access bearer related aspects.
• System network layer protocols extend from UE until the transit network edge of CN. They ensure internetworking on UMTS communication service related aspects.
UMTS protocol internetworking architecture

• Layers can further be divided into
  – Planes:
    • Control plane: All protocols dealing with control aspects.
    • User plane: All protocols dealing with user data transfer.
  – Domains
    • Circuit switched (CS)
    • Packet switched (PS)
General Protocol model for UTRAN
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Radio Access Network Application Part (RANAP)

- Key RANAP functions:
- Radio Access Bearer (between UE-CN)
- RAB Set-UP
- RAB Modification
- Clearing RAB
- Iu Bearer Release
- SRNC Relocation
- Paging Commands
Iu-CS
Iu-PS
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Iu-BC

• Between RNC and Common Broadcast Center CBC
• Service Area Broadcast Protocol (SABP)
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Radio Network Subsystem Application Part (RNSAP)

Key RNSAP Functions:
• Radio Link
• Management (between SRNC and DRNC)
• Reconfiguration (between SRNC and DRNC)
• Supervision (reports from DRNC to SRNC)
• Common Control Channel (CCCH) Signalling Transfer
• Paging
• Relocation Execution
Iur
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Node B Application Part (NBAP)

Key NBAP Functions:
- Cell Configuration Management
- Common Transport Channel Management
- System Information Management
- Configuration Verification/Alignment
- Measurements on Common Resources
- Radio Link Management & Supervision
lub