



solution

ITSF2004

An examination of the Orange UK transport network and its evolution towards multi-RAN technology support.

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Orange



Contents

- Overview of GSM/GPRS transmission
- Traffic types and aggregation/transport options
- UTRAN architecture and its impact on transmission
- Evaluating the transport architecture options
 - Finding the optimum solution
- Determining the impact of change on network synchronisation
 - New sync architecture
- QoS through a multi-RAN transport network
- ATM v IP in the UTRAN

Overview of GSM/GPRS transmission

- Abis interface
- Ater interface
- Gb interface
- Core transmission
 - Transit

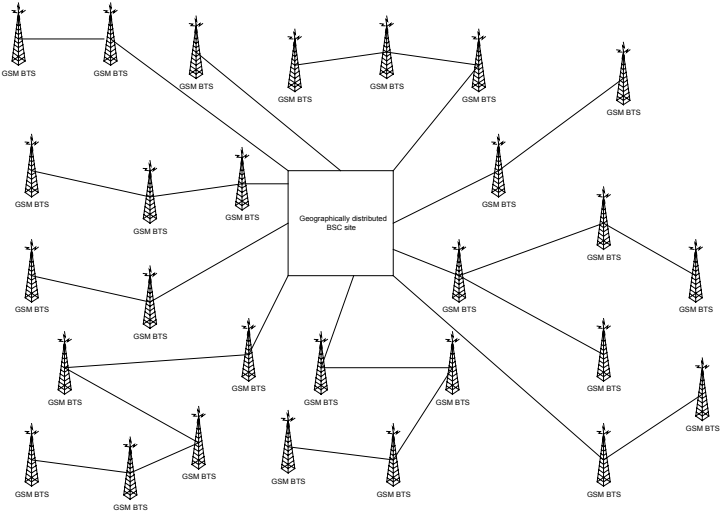


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GSM Abis access

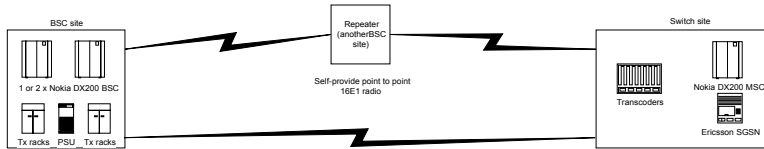


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Ater & Gb backhaul (1 of 4)

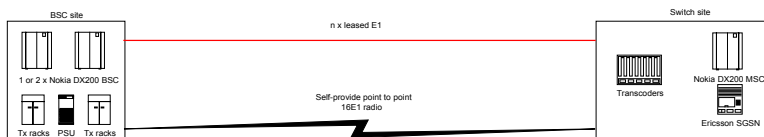


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Ater & Gb backhaul (2 of 4)

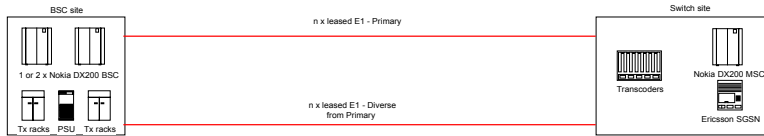


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Ater & Gb backhaul (3 of 4)

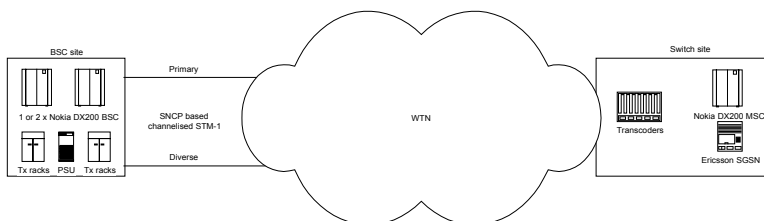


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Ater & Gb backhaul (4 of 4)



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Core Transport Networks

- Initially leased E1's between core sites for all requirements,
 - Signalling
 - Transit
 - Interconnect
- Now - WTN
 - Driven by rapid growth in voice transit traffic (late 90s) to
 - Reduce complexity
 - Uncouple TSC transit layer from n^2
 - Enhance scalability
 - Uncouple opex increase from capacity increase

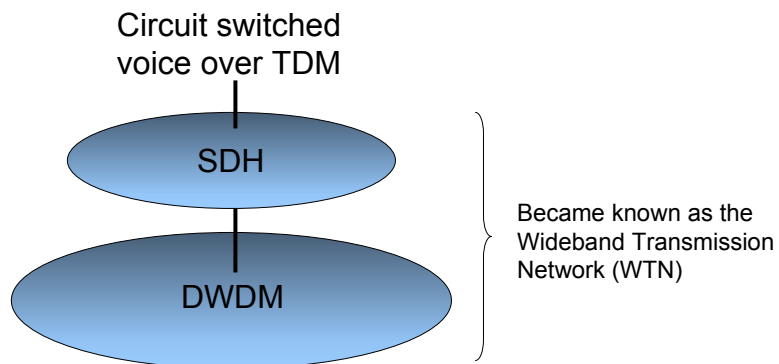
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Core Transport Networks

- The Transit Network



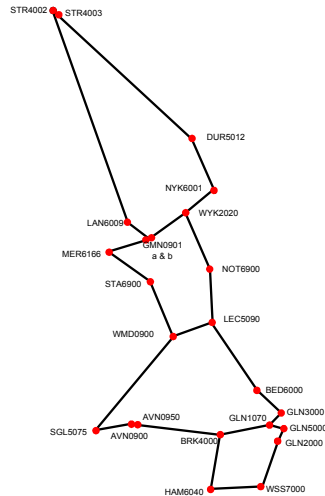
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Core transmission

- Orange Wideband Transmission Network (WTN)
- Optical network connecting all Orange UK core site locations and some remote BSC sites
- Designed to carry all Orange traffic types, not just mobile network
- Over 3000km of fibre and growing....
- DWDM terminals at core sites and OADM's at remote BSC sites
- Up to 80 wavelengths at up to 10Gbps from current optical design



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Core Transmission

- WTN provides a technology independent optical platform that will accommodate future traffic types and capacity requirements
- Open transponder interfaces can accommodate direct optical interconnect to end equipment
 - STM-16, STM-64
 - GE, 10GE
- choice of protection at any layer

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Traffic types

- TDM - GSM (BSS & core)
- FR & IP - GPRS
- ATM - R'99 UTRAN
- ATM/IP - R5 UTRAN
- IP/MPLS - core platform
- IPv6 - IMS
- other access requirements, Corporate GPRS, TDD, WLAN etc.



Aggregation options

- 3rd party solution
 - technical and commercial evaluation
 - technically - feasible
 - Commercially - Not....
- NG SDH platform (MSPP)
 - delivering traditional TDM for 2G backhaul along with 3G ATM backhaul, and ethernet through GFP.
- ATM Platform
 - delivering 2G backhaul via circuit emulation, 3G ATM natively, and ethernet over ATM.

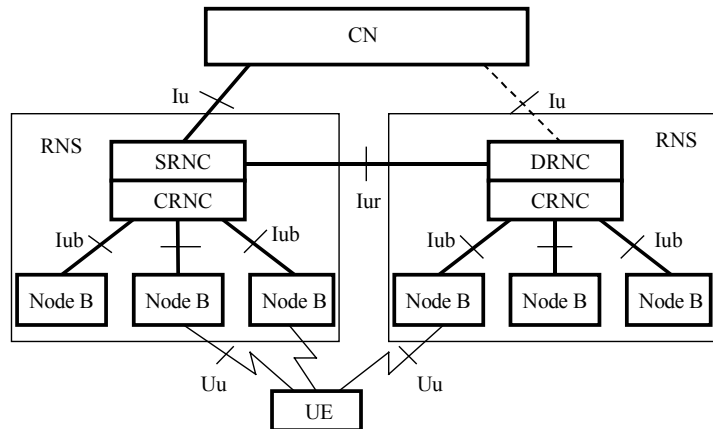
Big question...

- Which traffic type will dominate for the foreseeable future?
 - TDM
 - 2G growth is still evident but levelling
 - FR
 - GPRS services are taking off but FR traffic low in comparison with TDM and not the future of Gb interface
 - ATM
 - £4.095Bn for a 3G licence...
 - Expected to be the dominant traffic type due to "split Iub architecture based upon optimisation of 2G/3G transport requirements
 - Ethernet
 - Limited requirement at this time

UTRAN architecture and its impact on transmission

- Iub interface
- Iu interface
 - CS & PS
- Iur interface
- Design constraints/considerations
- Integration with 2G transport network
- New transport elements

R99/R4 UTRAN architecture



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Iub interface

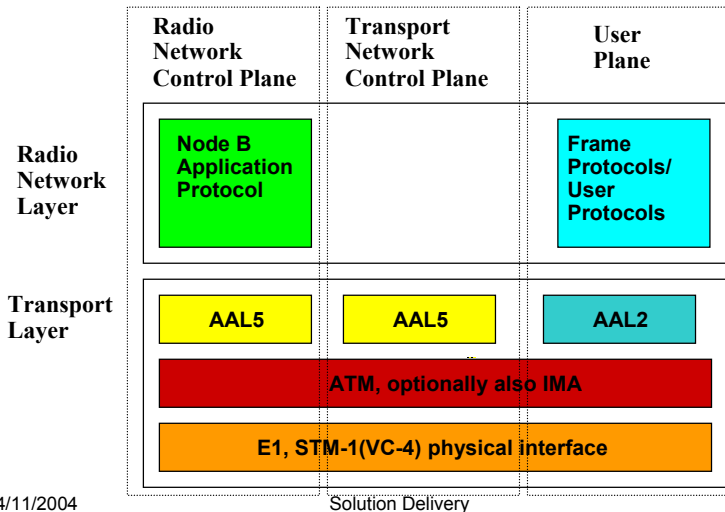
- Node B to RNC
- Delay budget considerations for transport network design
- User plane is AAL-2 CBR (includes NRT data)
- NBAP provides the mechanism to control the transparent transfer of user plane information and all other UTRAN control functionality that is relevant in the radio network layer on this interface

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Protocol architecture 3GPP R'99 for Iub & Iur



Iur interface

- RNC to RNC connectivity
- Relay interface between SRNC & DRNC
- Delay budget considerations for transport network design
- User plane is AAL-2 CBR (includes NRT data)
- All mobility management is within the UTRAN
- RNSAP provides the control within the radio network layer for transferring the transport channels

Iu interface

- RNC to CN
- Logical separation of CS & PS traffic
- Iu-CS user plane - AAL2 CBR
- Iu-PS user plane - AAL5 UBR
- No network delay constraints on the Iu interface
 - Initially no QoS options on Iu-PS
 - Application specific delay constraints in Iu-CS

Iu network architecture

- Solution uses 10 Gbps non-blocking ATM switch in MGW
- Switching fabric comes with min config MGW
- Only additional STM-1 interface cards needed
- Physical layer protection to MGW
- Iu-PS connection is between RNC and SGSN (i.e. it is “transparent” to MGW)
- Multiple 3G core sites equipped with MGW/MSC/3GSGSN

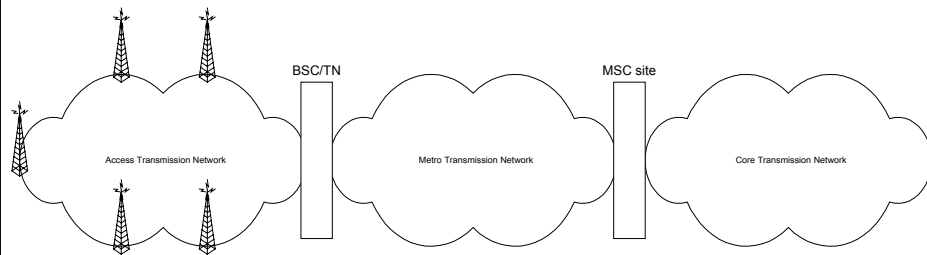
Evaluating the transport architecture options

- Finding the optimum solution - Design constraints/considerations
 - Minimise the cost of deploying a transport solution to support 3G while maintaining the quality of the 2G network...
 - E1 based PDH access network - GSM BSS
 - E1 based SDH core network - GSM NSS
 - ATM based core WAN - limited capacity (STM-4)
 - Node B interface types
 - E1
 - RNC interface types
 - limited E1 and STM-1 (VC-4)

The design

- From access & core to access, metro & core transmission domains
- Introduce AXC (Lucent PSAX2300) into geographically located BSC sites
- Introduce n x AXC (Lucent PSAX4500) into switch sites (n = 2 or 3)
- Change terminology:
 - BSC site = TN (Transport Node)
 - Switch site = Core Site
- Evolve core transport with the introduction on MPLS network
 - GRN (Gigabit Router Network) - Juniper M40e

Transmission domains



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Lucent PSAX 2300/4500

- Initial deployment of 2 x PSAX4500 to all 17 RNC sites.
- Initial deployment of a PSAX2300 to the majority of BSC sites that do not have WTN
- Secondary deployment of a PSAX2300 to BSC sites that have WTN as capacity growth exceeds the 1st STM-1

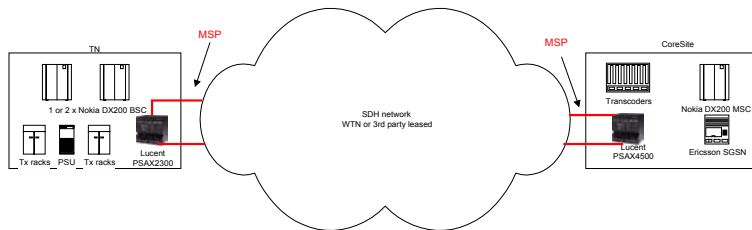


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Ater, Gb & Iub backhaul



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Iu & Iur interface

- RNC's at core sites so implemented via core transport solutions
 - Currently operating over ATM WAN
 - Migration onto GRN planned

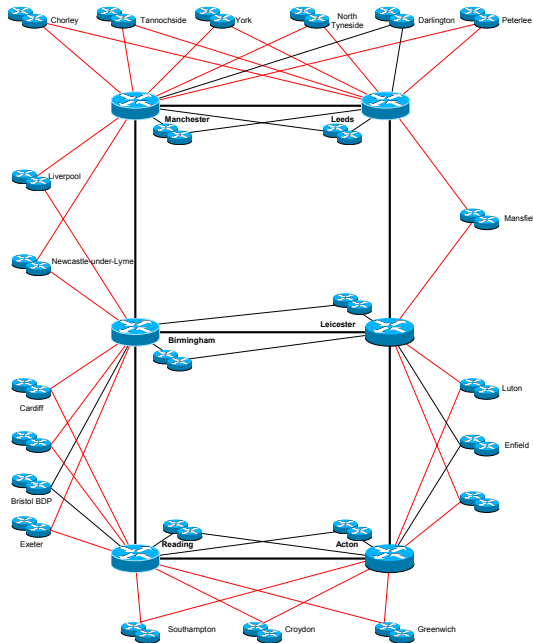
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GRN

- MPLS core routers at 6 sites linked by STM4 but scalable
- 'Provider edge' router pairs at 25 sites linked by STM1
- Routers provide IP services to clients



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Gigabit Router Network

- The GRN offers two main types of service
 - MPLS layer 3 VPN's
 - MPLS layer 2 VPN's
- The GRN supports the following functionality
 - IP routing using ISIS, IGP and BGP
 - MPLS with RSVP and LDP
 - Traffic engineering
 - RFC2547bis MPLS VPN's
 - IPv6
 - QoS/CoS

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Network Synchronisation

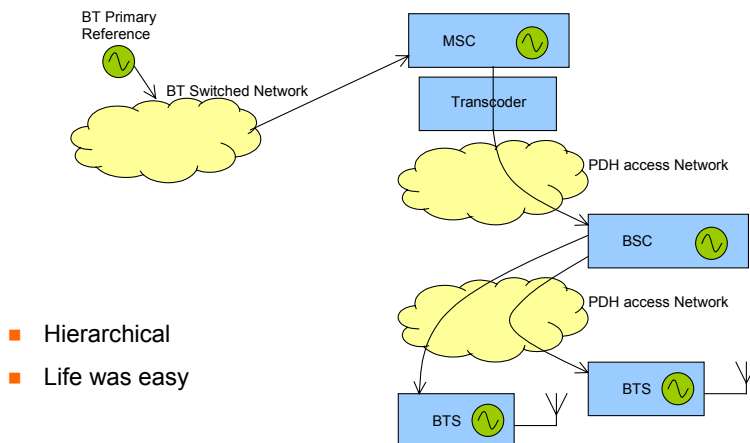
- Current network sync taken from interconnects with BT DMSU
 - Reliance on third parties synchronisation network.
- WTN has 2 dedicated G.811 PRC
- To guarantee network stability we need a dedicated sync network
- ATM is not particularly friendly for transporting sync
- Solution - Flatten the sync architecture
- TN (BSC) sites have GPS sync sources fitted to provide the AXC with a dedicated feed (G.811)
- Introduction of complexity with many new node types on core sites.
- MSC/RNC sites will sync from SSU fed from WTN

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Synchronisation as was



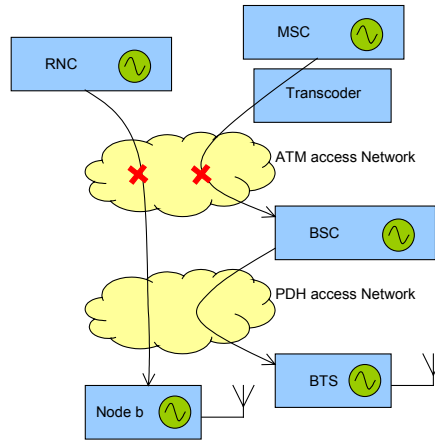
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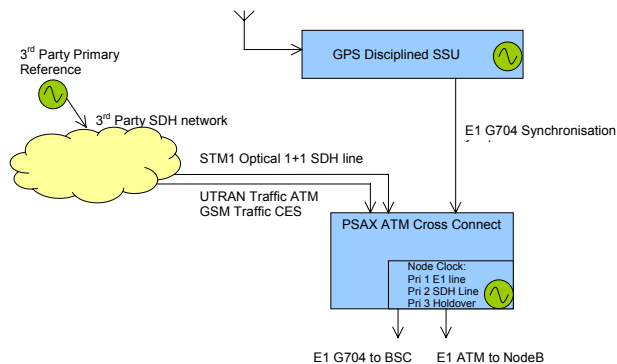
Add 3G and ATM access

- ATM breaks the trail

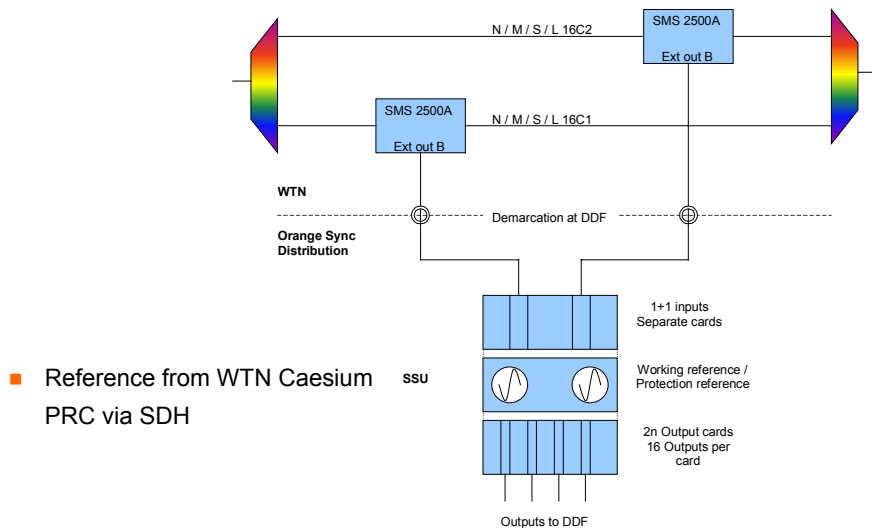


TN Synchronisation

- Local Primary Reference from GPS
- 3rd Party's Reference as a fall back



Core Site Synchronisation



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QoS through a multi-RAN transport network

- dimensioning of interfaces
 - traffic and signalling
- understanding traffic types and ratios
 - application delay, network constraints, CoS
- availability
 - easy to quantify for TDM but for packet services...
 - Of particular importance if leasing packet network functionality - what is the definition of unavailable time?
- Customer perception
 - how non-real time is your non-real time traffic...

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ATM v IP in the UTRAN

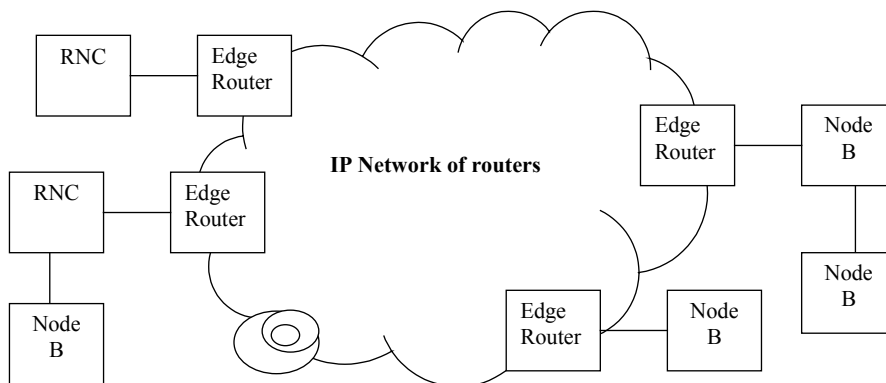
- Where is your starting point!?
 - Different debate for a “legacy R’99” operator compared with an operator who can enter the market with a R5 network
- 3GPP TR 25.933 V5.2.0 (2002-09) IP transport in UTRAN (R5)
 - In Release 5, UTRAN(s) may have both ATM and IP transport networks.
 - The specifications shall ensure the co-existence of ATM and IP Transport options within UTRAN, i.e. parts of UTRAN using ATM and parts of UTRAN using IP transport.
 - In Release 5, ATM and IP Transport Options shall rely on the same functional split between Network Elements.

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Architecture for IP transport network



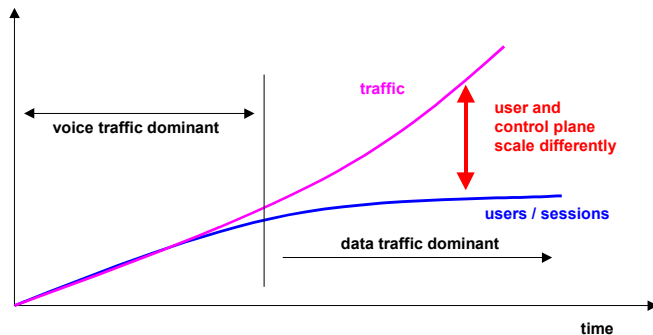
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Evolution of UTRAN architecture

- At the 3GPP TSG RAN#17 meeting, Study item description on “Evolution of UTRAN architecture” was approved.
 - Key driver, the evolution of traffic in mobile networks



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Objectives

- Considering the first step of UTRAN architecture evolution as the introduction of the IP transport in Rel-5, the step taken here is to study the architectural evolution of UTRAN that could lead to improvements in radio performance and transport layer utilisation. The study could for example consider new distribution of RAN functionality's e.g. Node Bs would contain more control operation. Also potential benefits for the radio capacity could be achieved by the proposed methods due to e.g. reduced delay.

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When to jump...

- Based upon current traffic projections there are no compelling drivers to move from a R'99 ATM UTRAN over the next 3 - 5 years
 - However, traffic profiles may change - either way...
- lu-ps would clearly benefit from IP transport before other UTRAN interfaces
- IP RAN functional redefinition of elements should offer transport efficiencies in the longer term (R6/R7?)
 - Move MDC point closer to the edge, reduce SHO overheads on lub etc.
 - Greater scope for traffic engineering closer to the edge

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The level of complexity within the transmission network is increasing:

This brings greater potential for innovative design and optimisation...



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Thanks

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