Autonomic Communications (ACOMM)

On business requirements and impact of autonomics feasibility; implementing autonomics research challenges

A tale of two examples

TELEFÓNICA I+D

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ACOMM - Implementing research challenges

Introduction: the overall picture

- Regarding ACOMM, the overall issue the operators face is determining just what degree of autonomy its networks should have
- Autonomics offer the potential of reduced OPEX, perhaps partially offset by an increase in CAPEX, due to a need for additional *autonomics software*
- And the main criterion to judge its effectiveness, besides economics, is its impact on QoS and network efficiency
  - In mobile communications networks, efficiency in the use of radio resources
- For lack of a comprehensive strategy, challenges have to be studied individually, case by case

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A tale of two examples (I)

There are, certainly, challenges

- But not all challenges are equal
- In general, when detecting and confronting research challenges, the policy is to bring them to an international audience
- Two fora stand out as most appropriate for collaborative work:
  - European projects
  - 3GPP
- Years ago, the fora were somewhat disjoint. Nowadays they tend to keep a closer relationship
  - Frequently the teams attending the two fora intersect

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A tale of two examples (II)

- In principle, European projects deal with long term issues, and 3GPP with short term ones . . .
- . . . But the forced march of 3GPP-LTE sometimes blurrs the time zones
- Two issues - challenges - have recently surfaced, with different reactions
  - Defining Radio Resource Management (RRM) strategies in System Architecture Evolution (SAE)
  - Frequency synchronization in IP connected Radio Access Technologies (RAT)
- Both issues have been brought forward in the FP6 project WWI-WINNER, where major suppliers, operators and academia work together in the definition of B3G radio interfaces

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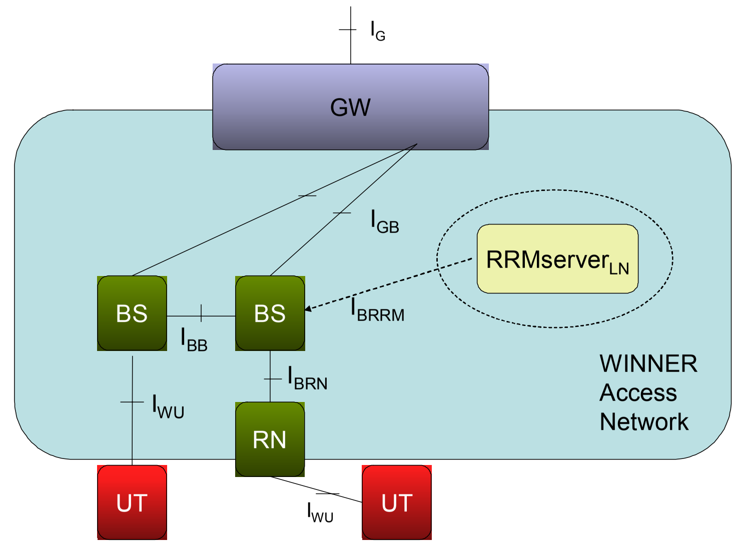
Example I: Scalable and Hybrid Radio Resource Management

- Centralized RRM (extant cellular systems)
  - Possibility to achieve better decisions, considering: inter-cell, inter-mode and inter-system information with more parameters (UT mobility, type of service, positioning, etc), since information for all cells, networks (e.g. network load in different BSs and GWs) and UT information available at one place.
  - In cases of high network load a central RRM entity avoids multiple queries, and their associated delay to neighboring BSs. -
- Decentralized RRM (WLAN)
  - Faster decisions in some cases (e.g. low network load, decisions based in few variables):
  - Lower signalling and delay : no communications with the RRM server needed
  - Higher robustness: no single point of failure
  - Higher flexibility: adaptations and changes could be made locally for each cell without evoking signalling exchange with other cells
  - Better suited for heterogeneous environment: f.e.e if two neighbouring cells belongs to different providers, they can jointly adapt their decisions without relying on a (non-existing) RRM server.



WINNER II logical node architecture

- Hybrid and scalable RRM (B3G)
  - Under normal operation, decentralized RRM
  - In case of high traffic load, consutation to an RRM server for admission control, packet scheduling and interference management

Emilio Mino, Jijun Luo, Elias Tragos, Albena Mihovska,"Scalable and Hybrid Radio Resource Management for Future Wireless Networks", IST Summit 2007, July 1-5, Budapest.

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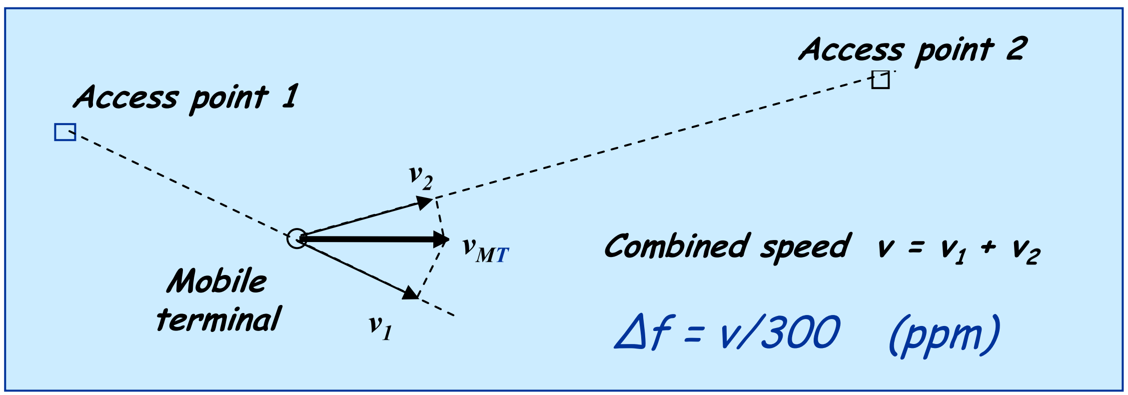
Example II: Frequency synchronization in IP connected RATs

- In UMTS R7, and for LTE, traffic reaches e-Node Bs through IP lines
- In principle, IP lines are not expected to support "good" frequency synchronization
  - Though, of course, they can: IP is a level 3 protocol and synchronization is a layer 1-2 issue
- The consequence is that e-Node Bs, especially micro ones, will not be tightly frequency synchronized (a few ppm instead of around 0.1 ppm)
- LTE is upbeat about this, quote TR 25912 when dealing with handover
  - "The time taken for frequency synchronisation . . . should be very small because the UE has already identified and measured the target cell. Thus, the UE should have somewhat recent frequency synchronization, and the delay caused by this element is then negligible"
  - In the WiMAX community there are already some misgivings



1 ppm is equivalent to a combined speed of 1080 km/h

Frequency synchronization in IP connected RATs

Operator doubts

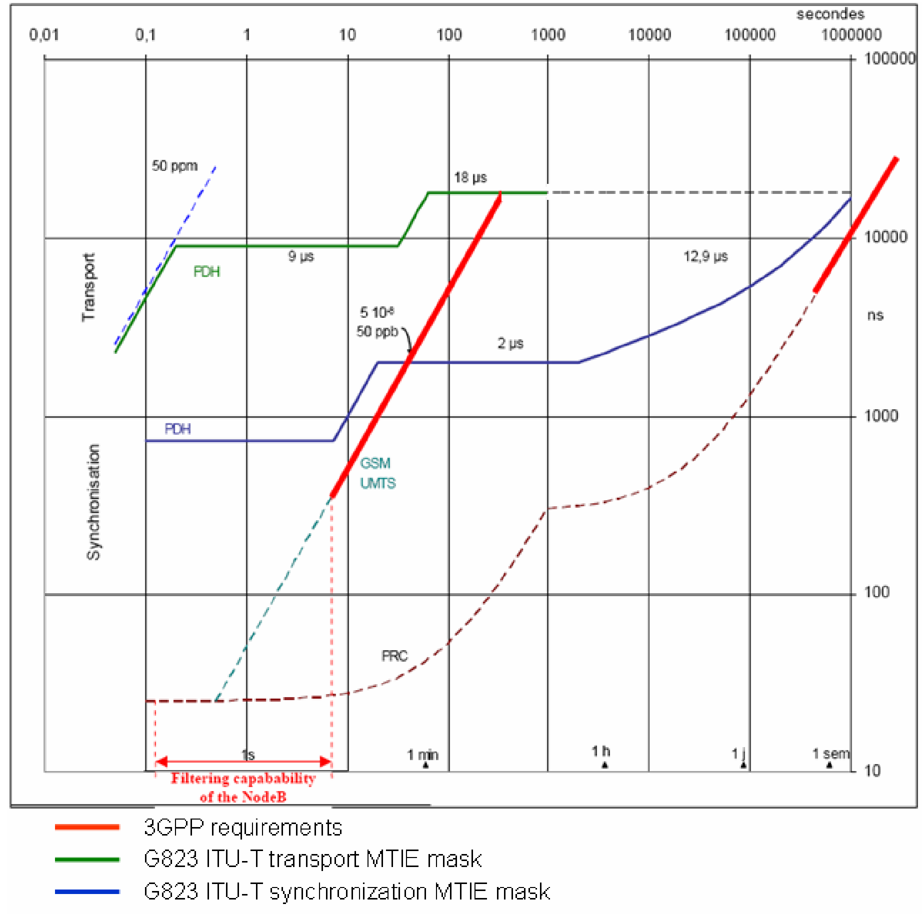
- Three operators (at least) have tried to find reassurance about the practical implementation aspects of *IP lines* for mobile network connectivity
  - To what degree will the e-node Bs be frequency synchronized?
  - Will it be possible for a UT to lock to a *not fully synchronized* frequency in 20 ms?
  - What degree of network idle periods will be required for the terminals to acquire the neighbouring cells *real* frequency?
- These questions have been raised in the reference FP6 project, at both management and technical levels?
  - . . . *it is an interesting issue*

Frequency synchronization in IP connected RATs

Operator doubts presented in 3GPP

- And finally, the question has been taken to 3GPP
  - Just how good, in frequency stability terms, the IP lines have to be?

    " Actually, the issue that is met by operators when migrating to PSN to support Iub flows is that 3GPP has not defined a MTIE mask . . . and there is no existing frequency synchronization stability target that ensures a correct functioning of the UTRAN . . . This lack of information is one of the major brakes on growth of PSN to support the UTRAN TNL"
  - *The subject is postponed . . .*
- The answer . . .



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