



The test and measurement implications of the 2G to 3G transition

In this month's HOT TOPIC we consider the compatibility and performance issues implicit in the 2G to 3G transition and the related test and measurement requirements for handset hardware and software and network hardware and software.

Compatibility and consistent hardware and software performance depends on functional testing and interoperability testing. We need to test how individual hardware and software components perform. We need to test how well individual hardware and software components work with each other.

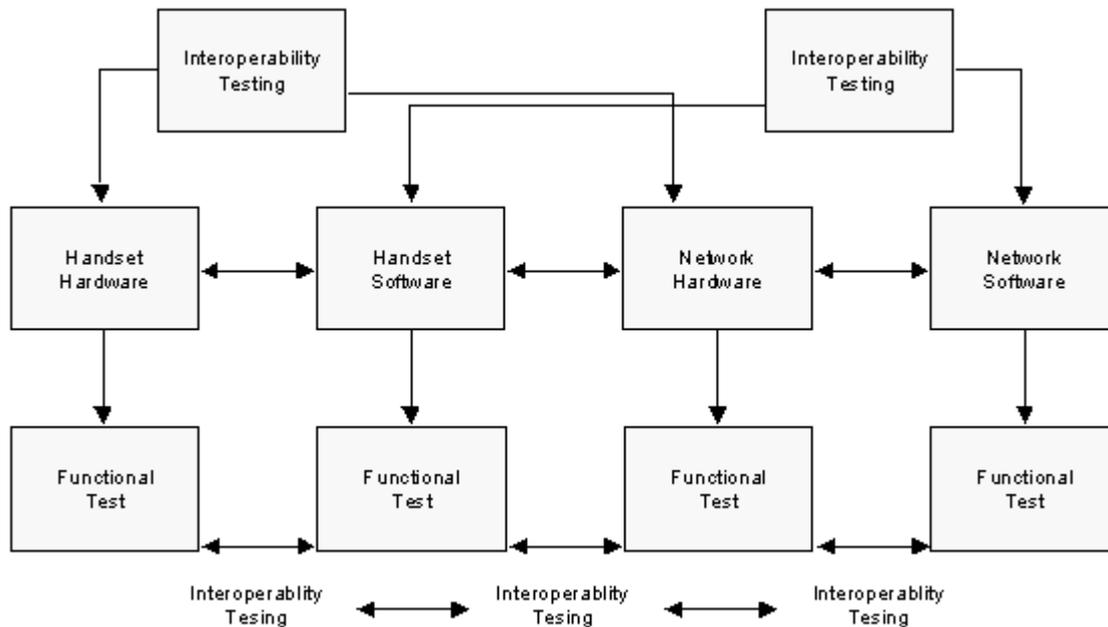


Figure 1

We need to ensure handset hardware works with handset software and that network hardware works with network software (Figure 1). We also need to ensure handset and network hardware compatibility and handset and network software compatibility.

We need multiple vendor (inter-vendor) compatibility for handset hardware and software. Ideally, we also benefit from multiple vendor (inter-vendor) compatibility for network hardware and software. This has been hard to achieve consistently in 2G and 2.5G networks and will be harder to achieve in 3G networks due to the increase in network software component count and complexity.

In general, software is harder to test than hardware. Hardware testing is relatively

deterministic. It either works or it doesn't under a pre-determined set of operational conditions - temperature, humidity. We can drop test, heat test and splash test handset and network hardware. We can test individual hardware components - passive and active components, DSP's, memory and microcontrollers against precise pre-agreed performance specifications.

Software by its nature is less deterministic. We cannot always simulate or predict software behaviour under all operational conditions. The way in which code has been written and compiled by individual vendors may determine the behaviour of the code. Even with 2G handsets, the majority of product recalls and in service problems tend to be related to software implementation. Given that the 2G to 3G transition involves an order of magnitude increase in handset code footprint (from 100,000 to one million lines of code) it is not unreasonable to expect an order of magnitude increase in software related compatibility and performance issues.

Software compatibility and software performance issues remain with us as we move into the network.

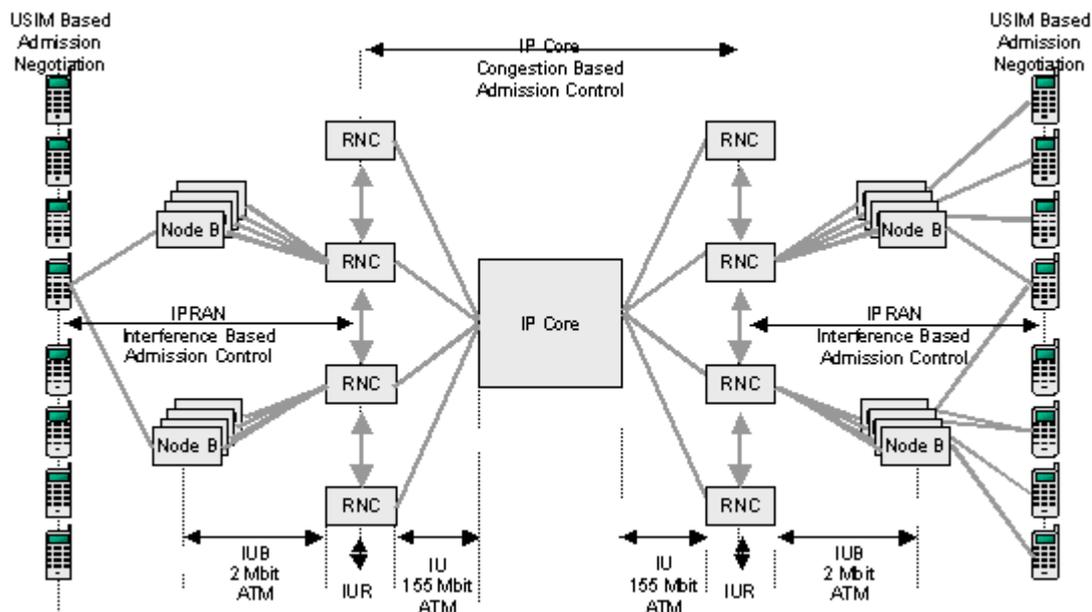


Figure 2

Consider for example the functions that need to be performed by the software in the RNC (Radio Network Controller).

The RNC (Figure 2) accepts and manages traffic to and from the Node B's (base station transceivers) and to and from the core network.

In addition, the RNC has to supervise hard and soft handover and inter-node and inter RNC load distribution.

The RNC is responsible for preserving the 'properties' of the offered traffic going to and coming from each of the users served by each of the Node B's under its control.

This includes arbitrating access and policy rights and managing session quality for

individual users including the allocation of radio and network resources to meet user application needs which are (potentially) constantly changing.

The RNC has to decide on resource allocation and admission on the basis of interference measurements received from the radio physical layer and congestion measurements received from the network core.

This is a dynamic, decision intensive, software intensive process.

Because it is difficult to define all possible loading and operational conditions, it is difficult to define how RNC software will behave. This makes it hard to agree consistent inter-vendor rule sets against which RNC performance can be measured.

It also makes it hard to define specific performance metrics.

If we cannot define specific performance metrics for the RNC, we cannot test the RNC.

Given that the RNC substantially defines network performance (including the quality of service metrics which we are using as the basis for billing), we have by implication an intrinsically untestable network.

Untestable or hard to test networks, or a lack of agreed performance metrics against which network performance can be tested tends to result in performance and payment disputes which are undesirable for all parties involved.

As with handset software, the 2G to 3G transition (from 2G BSC to 3G RNC) implies an order of magnitude increase in RNC software component count and complexity. It is not unreasonable to expect an order of magnitude increase in software related network compatibility and network performance issues. Let's hope this is an overly pessimistic view of what is to come.

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