3G Wireless Broadband

N° and issue date : 1111 - 17/06/2009
Circulation : 5000
Frequency : Fortnightly
3GWrlsBrdbd_1111_4_301.pdf
Web Site: http://www.taylorandfrancisgroup.com/

PRESS INDEX
Page : 4
Size : 95 %
1123 cm2

Support grows for expansion of SONs to cover 3G networks

According to a major vendor, the development of self-organizing networks to support the rollout of LTE provides an opportunity to automate network processes for existing 3G networks, helping operators maintain their opex for network operations and maintenance at current levels. Not all equipment providers say this will be easy to achieve, however.

Network operation and maintenance can be dramatically simplified if the kind of automated configuration and optimization capabilities planned for LTE networks can be applied retrospectively to 3G, Ericsson says. The vendor says it wants to make sure that the standards for self-organizing networks (SONs), which are being developed by the NGMN and standardized in 3GPP, are backward-compatible with HSPA networks.

Networks have become too complicated, and network operation and maintenance lacks clear specifications and is too proprietary, Ulf Ewaldsson, Ericsson's vice president and head of radio products, said at the LTE World Summit in Berlin, held by Informa Telecoms & Media. Work on SON standardization and LTE is set to resolve this, but SON capabilities should be extended to 3G, he said.

The proposal is likely to be welcomed by mobile operators that want to maintain their network costs by reusing cell sites and associated equipment, such as antenna systems, as much as possible for the rollout of LTE. Applying SON features retrospectively to 3G networks could help them do so.

"We don't want to repeat the story that we had with 3G, where we deployed a completely new network overlay," Klaus-Jurgen Krath, executive vice president of radio-network engineering and quality at T-Mobile, told delegates in Berlin. "It has to be very smooth and to utilize what we have as operator assets. There may be some optimization measures that can be done so that you can optimize LTE and 3G in a more-or-less common way."

Hans-Erik Karsten, vice president of network technologies for Telenor R&I, said the operator was eager to explore the ways in which SONs could help it be much more flexible and dynamic in how it organizes its networks. "It's easier to put in a base station in the middle of your network without having to replan the whole use of your frequencies," he said.

Most operators have at least two layers of technology, 2G and 3G, says Chris Larmour, chief marketing officer of network-performance company Actix. "If they add on another one, they're going to increase their opex by between 30 percent and 50 percent, depending on how well they manage to reduce their head count and other costs in their legacy networks," he said. "What they want to do is actually keep costs flat, or even better reduce them. The only way to do that is to automate things and make them more systematic."

Actix is already collaborating with a European tier 1 mobile operator group in research into and development of SONs for HSPA and 4G networks. The two companies are focusing on automating network-status management diagnostics and providing centralized SON systems capable of delivering self-optimization capabilities for 3G and 4G networks.

According to Larmour, 80-90% of the functionality required for a self-organizing network is common to 3G, 3.5G and 4G. "The processes that are built in, such as the diagnostic capability and the ability to send commands out to the network in a controlled fashion, are all very similar amongst the technologies," he said.

The parallel operation of multiple technologies – such as 2G, 3G and LTE – is a key reason for implementing SONs, says Peter Dent, a member of technical staff at Texas Instruments. The features of SONs that enable a base station to self-configure by listening to other base stations could be available in two or three years, though some of the more advanced interference-management and capacity-optimization features of SONs might be up to 10 years away, Dent says (see fig. 1).

According to Larmour, all of the leading network-equipment providers have already demonstrated self-configuring functionality within the eNodeB environment, and he says it will "definitely be delivered" as part of the early-stage deployment of LTE. "There are certain

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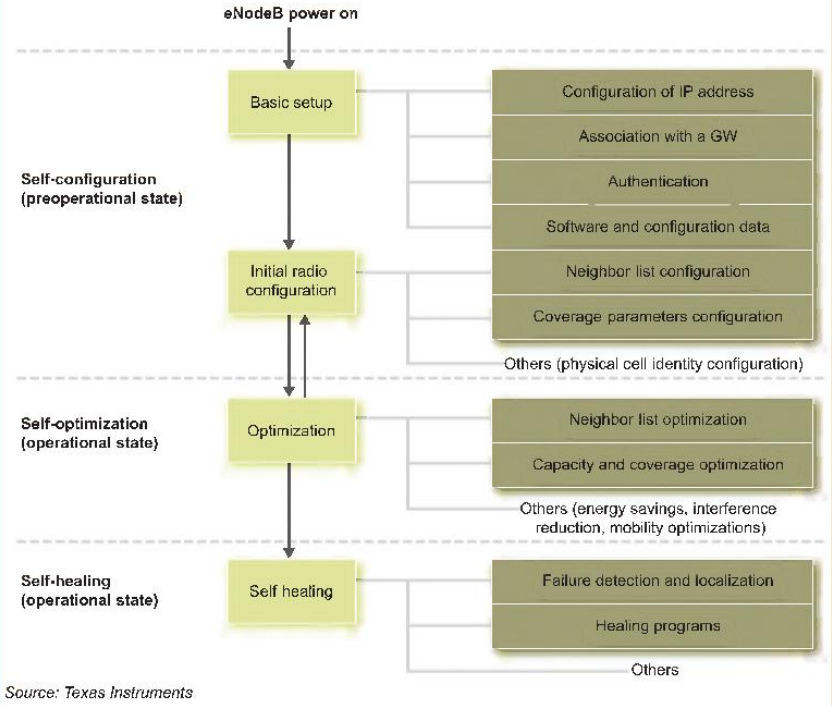
Fig. 1: SON framework for eNodeB



Source: Texas Instruments

tasks that lend themselves very well to being done locally in the eNodeB, and these are typically the self-configuration use cases where you have a plug-and-play base station, like a femtocell, or even a full base station," he says.

The two other key areas of self-organizing networks – self-optimization and self-healing – are not easily implemented in the base station, because the eNodeB doesn't have a view of the entire network, which is why Actix is proposing a centralized SON to carry out these functions, Larmour says.

"That has to be done by something that has a higher view of many, many more sites within a specific area, particularly in a case where you've got multiple eNodeB vendors in the network, which is very common," he says.

Paul Steinberg, chief architect for wireless infrastructure at Motorola, says he is not convinced that it will be possible to make SONs backward-compatible, however. According to Steinberg, the capabilities of the SON are intrinsic to the design of LTE equipment and network architecture. In addition, mobile handsets and user equipment will need to have a role in the organization of the network and some of the sharing of neighbor lists, so the degree to which this can be applied to 3G networks will be limited, he said.

Motorola, which announced the launch of its LTE SON in Berlin, has analyzed 150 operator use cases and categorized them in terms of frequency and cost, Steinberg said. "What we've done is prioritize our feature road map to try to address those more-costly, more-frequent use cases up front, and especially those that are associated with deployment and initial optimization of the network," he said. "So as the network matures, we'll see other use cases come on in later phases of the road map."

Most commentators agree that SON standards are still immature. Marc Fossier, former group CTO of France Telecom/Orange Group, told delegates in Berlin that SONs could save opex but that more standardization was needed. The 3GPP Release 8 specifications included support for only a few SON features, and there are many proprietary implementations in vendors' products, Fossier said. "Release 9 will include a lot more SON features."

Larmour says that the NGMN is doing a lot to define the operator use cases and that those use cases have filtered through into the 3GPP specifications, particularly Technical Specification 36.902, which is the most important with regard to SONs (see fig. 2). The speci-

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Fig. 2: SON use cases in TS 36.902

Use case	Category	Description
Interference reduction	Interference management and capacity optimization	Optimize network resources to minimize intercell interference
Coverage and capacity optimization		Replace drive tests and manual exercises
Energy savings		Reduce energy costs → operator opex/reduce interference
Intercell interference coordination (ICIC)		Intelligent scheduling on physical resource blocks based on neighbor cell indications
Mobility robustness optimization	Mobility optimizations	Choose the preferred neighbors + choice or parameters for cell reselection/handover
Mobility load balancing		Choose neighbors for cell reselection/handover to balance eNB load
Automatic configuration of physical cell identity	eNB ID configuration and optimization	Configure the physical cell identity of a base station
Mobility load balancing		Configuration: Initialize neighbor list Optimization: Dynamic prune/select neighbors in neighbor list
RACH optimization	RACH optimization	Control RACH configuration parameters (number of preambles, ramp up power allocation and number of attempts) → RACH success rate/delay

Note: RACH = random access channel
Source: Texas Instruments

fications are becoming more explicit with regard to base stations, and this work will be taken further in Release 9, he says.

"There's a preparatory stage for SON in Release 8, but Release 9 will be the big step for SON," he says.

Ewaldsson also says SONs will be launched "in parts" and that the main initial objective of the standards will be to simplify the process of commissioning a base station. "For instance, there are clear requirements on how long it will take and how much effort will have to be put in from an operator point of view in terms of getting it started and so forth," he said. "We will need all of those standards when we come out with our equipment."

"For the first time you've got base stations actually communicating with one another, but there's more work required and a different level of interoperability testing required," Steinberg said.

Krath said that starting with early deployments of LTE, T-Mobile hopes to benefit from what has already been studied and implemented with regard to plug-and-play on self-configuration-type base stations. "But I think that this would not be the end," he said. "We expect a lot further in this whole lifetime of equipment for optimization and for self-healing, and that we will have much more automization built into the network components."

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