



Improved Network Analytics with novel feedback quantities for Self Optimized Networks

WINTECHCON 2018

September 28, 2018

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Problem Statement

“AT&T, verizon capex in 2018 higher than expected, says wall street firm”

- Increased Capital Expenditure (CAPEX) is required for newer technologies like the 5G New Radio (NR)
- Operators need to look at reduced O&M, as a way to optimize the Return on Investment (RoI) over several years.



Problem Statement

- **Self Optimizing Networks (SON)** are emerging as a key component for cellular operators for reduction in Operation and Maintenance (O&M) of the operators by automatically enhancing network performance, coverage and capacity.
- Mobile communication networks like GSM, UMTS, LTE and TETRA must be monitored and optimized in order to provide a good network coverage and quality of service.
- So far, operators have spent enormous amounts of time and money to optimize network performance by collecting radio measurements and then analyzing them to derive the optimal parameters to apply to networks.



Problem Statement

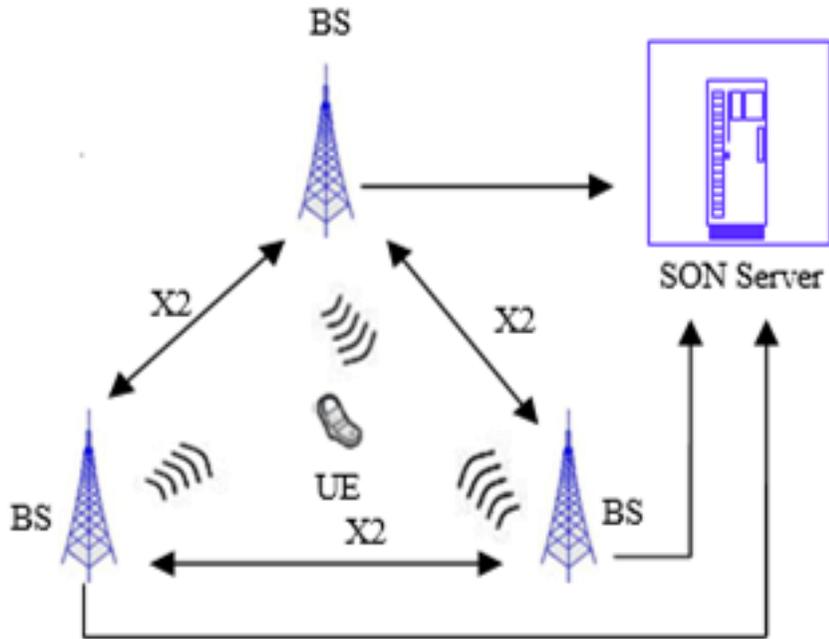


Fig1: Network Analytics by UE assisted measurements in E-UTRAN

- We propose to add new dimensions to SON by incorporating novel measurement quantities in the MDT logging feedback, which serve to enhance the functionality of Network Analytics.
- The use cases of SON discussed in our paper are:
 - *Coverage and Capacity Optimization*
 - *Mobility robustness optimization*

Solution approach

In this paper, we propose to add the following novel parameters to UE assisted measurements for SON which can help to enhance the network coverage and capacity optimizations:

- Idle/Connected mode battery drain rate
- Mobility State of UE
- Cause for Out Of Coverage



IDLE MODE – BATTERY DRAIN REPORT

Battery Drain Rate	Applicable SON Configuration
High	<ul style="list-style-type: none">• Remove Neighbor cells in System Information• Topology change for Detected Cells• Adjust thresholds for measurements• Adjust TAU timer• Adjust RACH TX /Re-TX parameters
Medium	- do-
Low	<ul style="list-style-type: none">• Add neighbor cells (if required)

CONNECTED MODE – BATTERY DRAIN REPORT

Battery Drain Rate	Applicable SON Configuration
High	<ul style="list-style-type: none">• Remove Neighbor cells in Measurement Control (RRM),• Topology change for Detected Cells,• Adjust thresholds for measurements• Adjust RLF timer,• Adjust Connected Mode DRX• Adjust Gap Patterns
Medium	- do-
Low	<ul style="list-style-type: none">• Add neighbor cells (if required)

MOBILITY STATE REPORT

Speed Threshold	SON Configuration/Application
Low	<ul style="list-style-type: none">• Adjust thresholds for speed measurement filter (N_{CR_M}, N_{CR_H} and T_{CRmax})• Adjust scaling factor for idle and connect mode (reselection and handover)• Adjust Gap Patterns based on speed
Medium	- do-
High	-do-

CAUSE FOR OUT OF COVERAGE

We propose to add the following causes to be reported from the UE, if moves to Out Of Service:

- No Frequency found in power scan
- Synchronization channels decode failure
- Broadcast channel decode failure
- No acceptable cell found (e.g. no cell from home and roaming PLMN is available)



Results

Idle/Connected mode battery drain rate

The following use cases for SON are enhanced:

- Coverage optimization:
 1. The network can semi-statically configure the RRM. Too many or too few reselections can be controlled.
 2. A high battery drain rate can also be an indication of a badly planned topology of cells which is leading to a ping-pong effect.



Results

Mobility State of UE

1. Coverage optimization: The network can semi-statically configure Speed dependent scaling factor, which control reselections. Thus, too many or too few reselections can be controlled.
2. Mobility optimization: Speed dependent scaling factor in measurement control can be configured for the UE. Thus, issues of early and late handovers can be addressed.
3. Parameterization for common channels: Random access transmission/retransmission parameters can be made speed dependent, if there are Random access failures reported in a specific mobility state



Results

Cause for Out Of Coverage

1. Coverage Optimization:

- During initial set up, the transmitted power on a cell may not be proper due to which UE is not able to get Broadcast channel information.
- Due to increase in number of customers or construction of infrastructure, interference can increase a lot. The UE might be able to detect some good cells during power on scan but due to interference, UE will not be able to even decode the synchronization channel on those cells.
- In remote areas, it is possible that UE is not at all able to get any frequency during power scan.

2. Common channel parameters: Network can reduce the interference in the common channels by increasing or decreasing the transmitted power levels.

Conclusions

The proposed schemes intend to highly scale up the functionality of Network Analytics in SON for cellular standards by incorporating new measurement quantities in the UE feedback which serve as the basis for enhancing the following qualities without human intervention thereby greatly alleviating the huge costs involved in O&M of the cellular networks:

- Network performance
- Coverage
- Capacity



References

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