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TEMS™ DISCOVERY NETWORK 11.0

(PREVIOUSLY TEMS™ VISUALIZATION PROFESSIONAL, DESKTOP EDITION)

BRIDGING THE OPTIMIZATION GAP

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AGENDA

- Product Overview
- TEMS Discovery Network – System Details
- What's New in TEMS Discovery Network 11.0
- What Was New in TEMS Visualization 10.1
- Feature Overview
- Common Feature Details
- Geo-Analysis Based on Google Maps
- Ericsson WCDMA GPEH Module Features
- Ericsson Tracing (UETR, MTR, UE Trace) Features
- Ericsson LTE Cell Trace Module Features
- NSN Megamon GEO WCDMA Module Features
- Huawei WCDMA Call Trace Module Features
- Huawei WCDMA PM Counter Module Features
- Ericsson GSM R-PMO Module Features
- Conclusion

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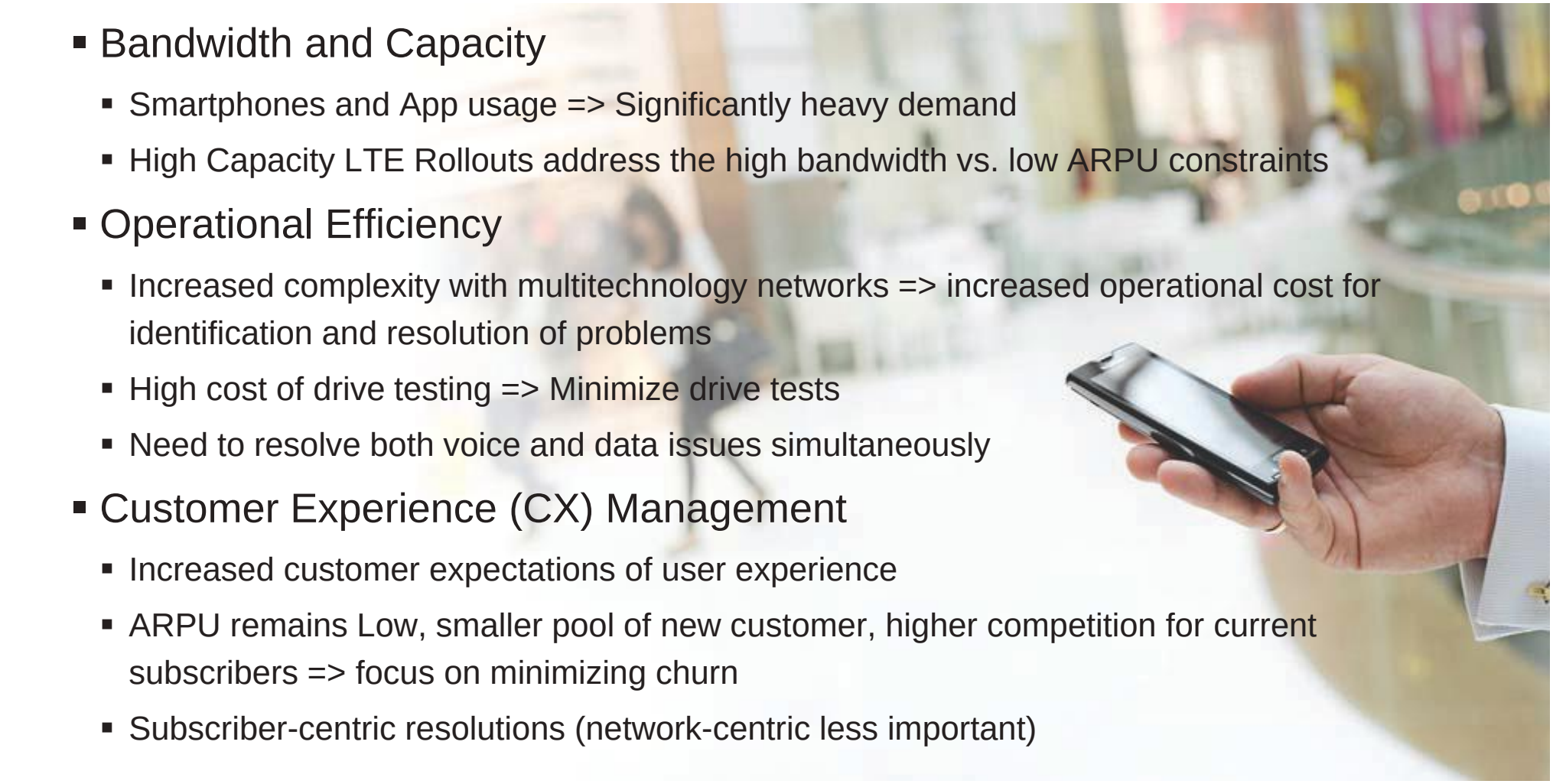
PRODUCT OVERVIEW

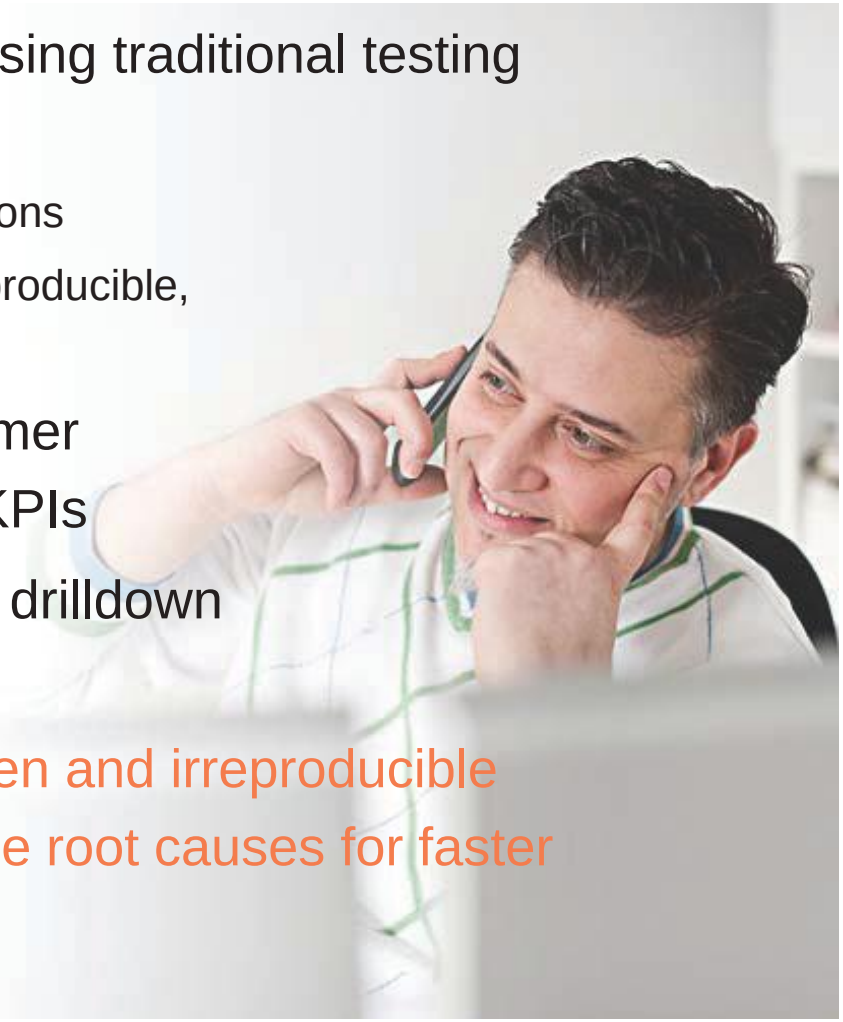
NEW CHALLENGES FOR THE WIRELESS OPERATOR



- Bandwidth and Capacity
  - Smartphones and App usage => Significantly heavy demand
  - High Capacity LTE Rollouts address the high bandwidth vs. low ARPU constraints
- Operational Efficiency
  - Increased complexity with multitechnology networks => increased operational cost for identification and resolution of problems
  - High cost of drive testing => Minimize drive tests
  - Need to resolve both voice and data issues simultaneously
- Customer Experience (CX) Management
  - Increased customer expectations of user experience
  - ARPU remains Low, smaller pool of new customer, higher competition for current subscribers => focus on minimizing churn
  - Subscriber-centric resolutions (network-centric less important)

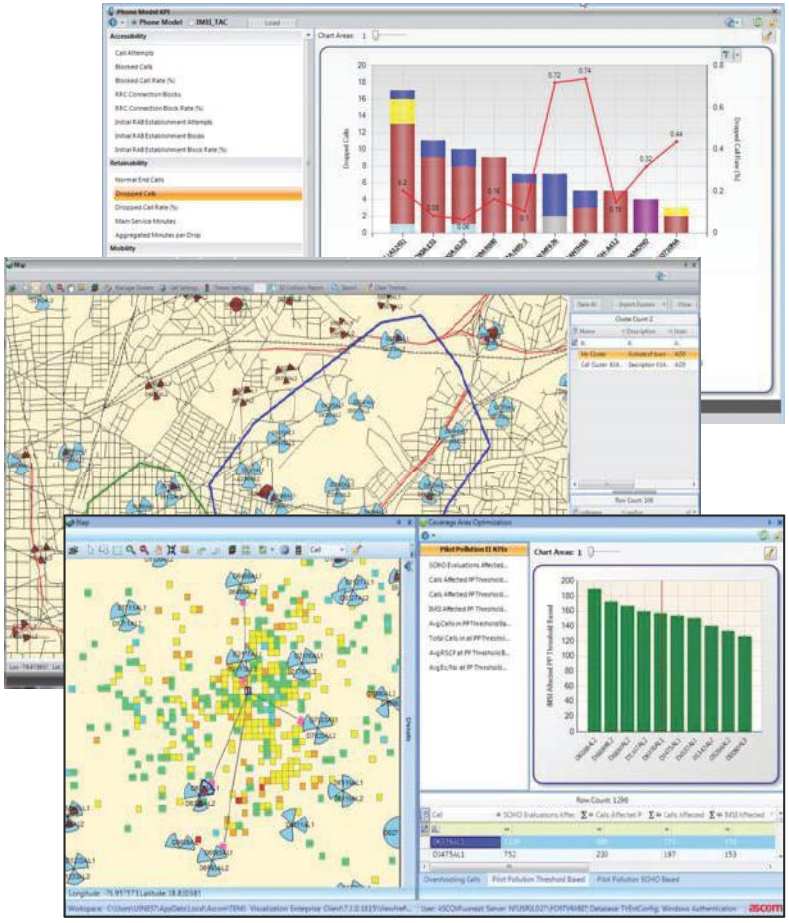
CHALLENGES WITH COMPLEX NETWORK OPTIMIZATION

- Many QoS problems cannot be pinpointed using traditional testing methods and PM counter tools
  - Majority of issues occur in private, inaccessible locations
  - Issues that are ‘sequence of events’ specific are irreproducible, and stay hidden
- MTTR, operational effectiveness, and customer satisfaction suffer, causing churn and poor KPIs
- Statistical performance data do not allow for drilldown to details of individual call QoS issues
- Need: Subscriber-focused visibility into hidden and irreproducible problems, with ability to quickly determine the root causes for faster resolution and optimization



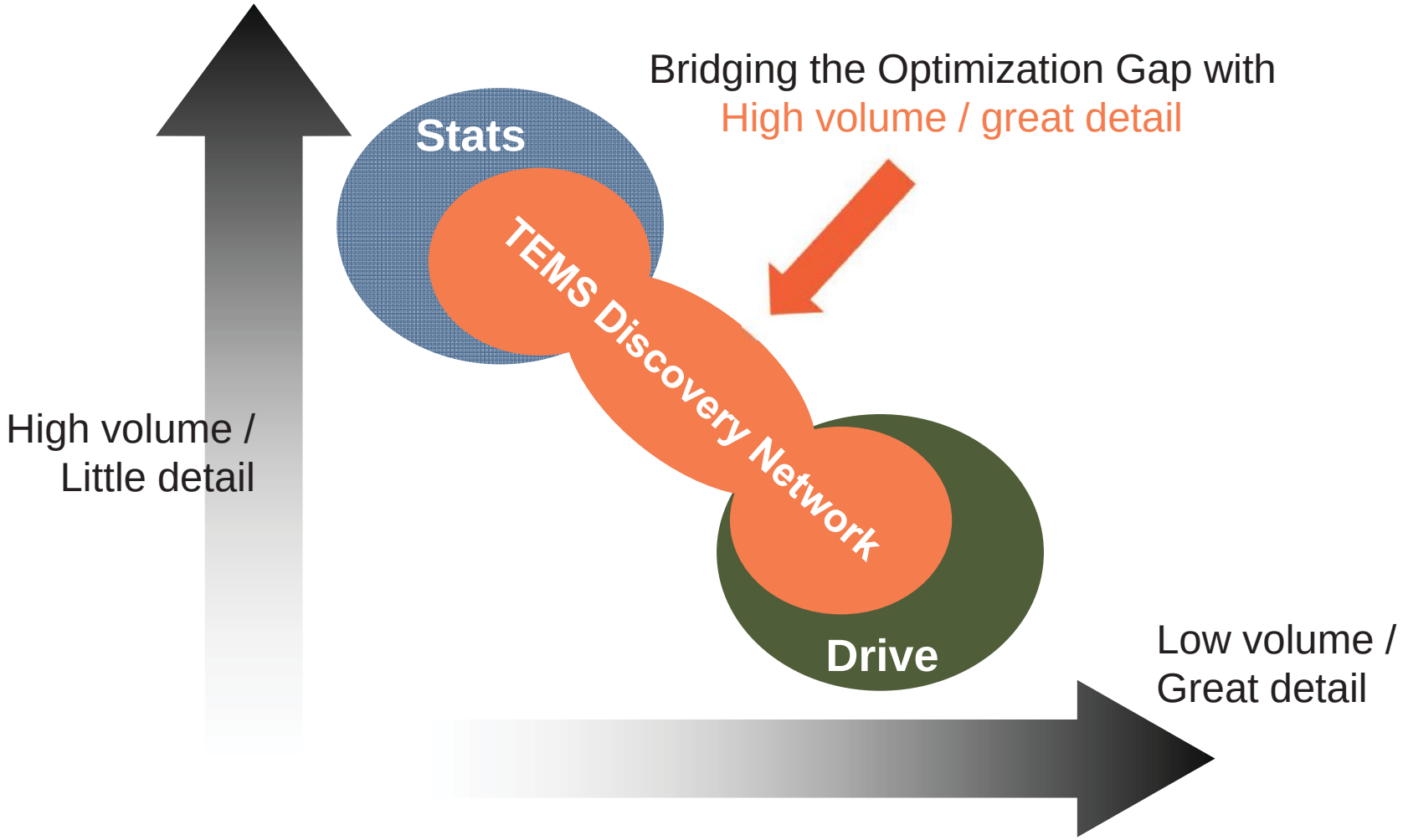
THE SOLUTION: TEMS DISCOVERY NETWORK

- Utilizes event data generated from large volumes of live subscriber traffic
- Bridges the gap between performance management and drive test solutions
- Cell, phone model, subscriber centric, and other advanced analysis, with ability to drill down to and geolocate individual calls
- Prioritize and Resolve larger volumes of problems, impossible to even identify before
- Customer Experience Focused, Operationally Efficient, Multivendor and Multitechnology



Troubleshooting and optimization based on live subscriber traffic

BRIDGING THE OPTIMIZATION GAP



BRIDGING THE OPTIMIZATION GAP

- **TEMS Discovery Network bridges the gap between traditional performance management solutions and drive test solutions**
  - Performance management tools offer an overview of all users, but provide limited levels of detail that are not easily actionable
  - Drive test tools provide a detailed view for troubleshooting but not enough data to ensure that all issues are captured

TEMS Discovery Network gives you access to all users and allows you to drill down to the actual calls or events causing problems. This leads to faster mean time to repair (MTTR) and other operational efficiencies, as well as more satisfied customers.

WHY TEMS DISCOVERY NETWORK

- Call Trace (Event) Data based Tool: Capitalizes on benefits of event data
  - **Optimization value of data source**: Subscriber-centric data allows homing in on issues more directly than w/ proxy subscriber via drive test, for more effective optimization / troubleshooting
  - Large volumes of data with full breadth of locations (indoor, outdoor, private, inaccessible), all phone models, all services, all times of day – resolve previously invisible issues
  - High level of detail with Layer 3 info and vendor's internal events; geolocate and visualize problem events in TEMS Discovery Network (overcomes limitations of cell-centric PM statistics)
  - **Cost effectiveness**: Zero to low cost of data collection helps reduce OPEX
  - **Holistic network view**: Increases operational efficiency by localizing and accurately quantifying problem elements such as cell, phone model, subscribers, services, etc.
- Allows VIP customer troubleshooting – protect revenue and reduce churn
- Prioritize issues based on qualitative and quantitative subscriber impact
  - Captures subscriber and problem density, unlike traditional methods

LOW COST, HIGH IMPACT OPTIMIZATION TOOL

- Free up engineers from routine data collection and analysis to focus on faster implementation of network optimization solutions
  - Reduce Cost of Collection: No cost to collect data
  - Reduce Cost via Automation: Automated data processing, automated analysis
  - Increase Impact:
    - Ability to go from high level statistics to comprehensive call analysis for large volumes of data, all integrated within a single tool
    - Geolocate and visualize subscriber calls and issues
    - Ability to handle large volume of data and longer periods of time needed for certain optimization procedures like neighbor optimization (example: at least a week of data needed to be judicious for neighbor-list changes)
    - Identify, investigate, and resolve hidden problems to reduce churn
    - Multidimensional analysis of issues – subscriber/group/VIP based, cell/cluster geography based, phone model/group based, service based

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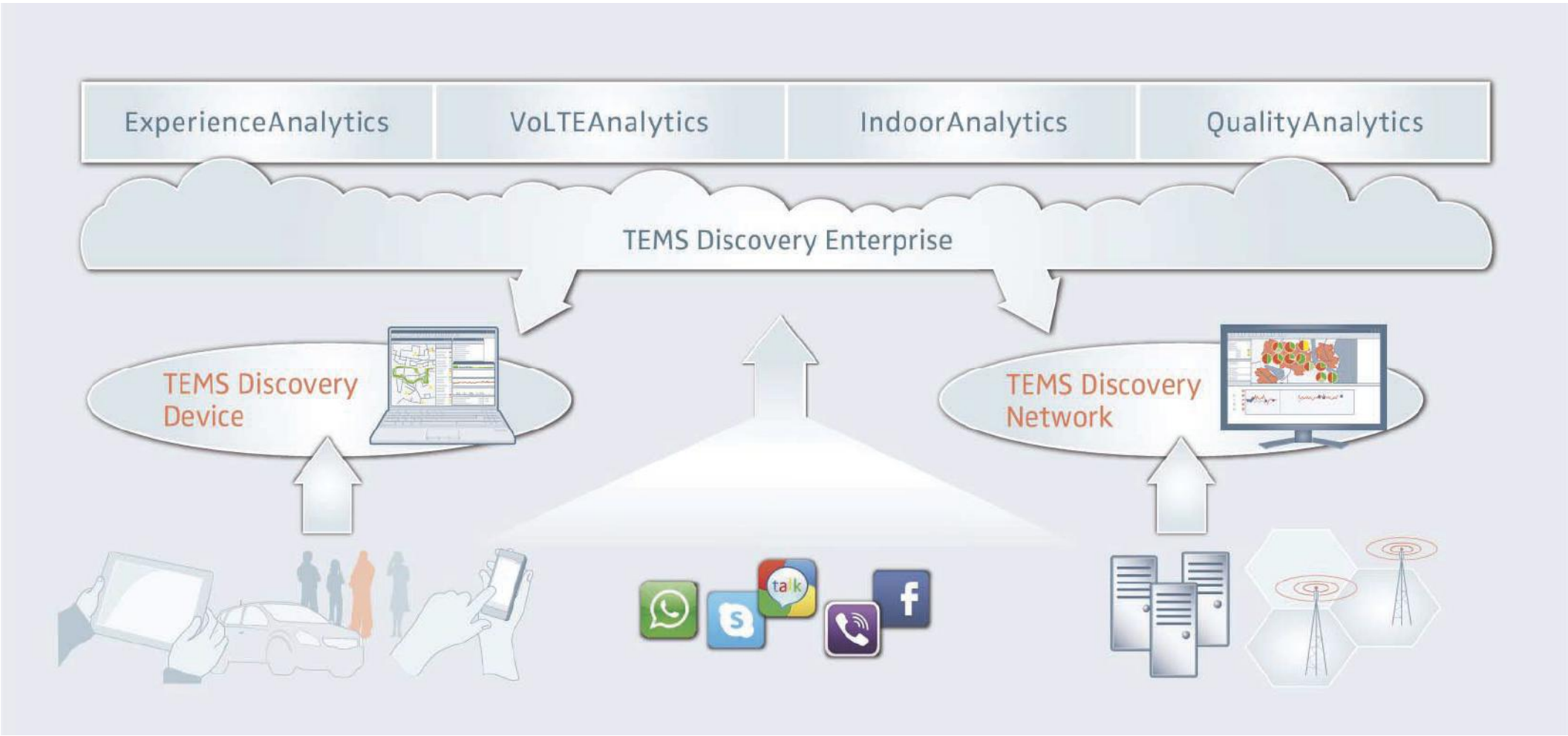
TEMS DISCOVERY NETWORK – SYSTEM DETAILS

TEMS DISCOVERY – PRODUCT SUITE



TEMS DISCOVERY SUITE – TWO PLATFORMS

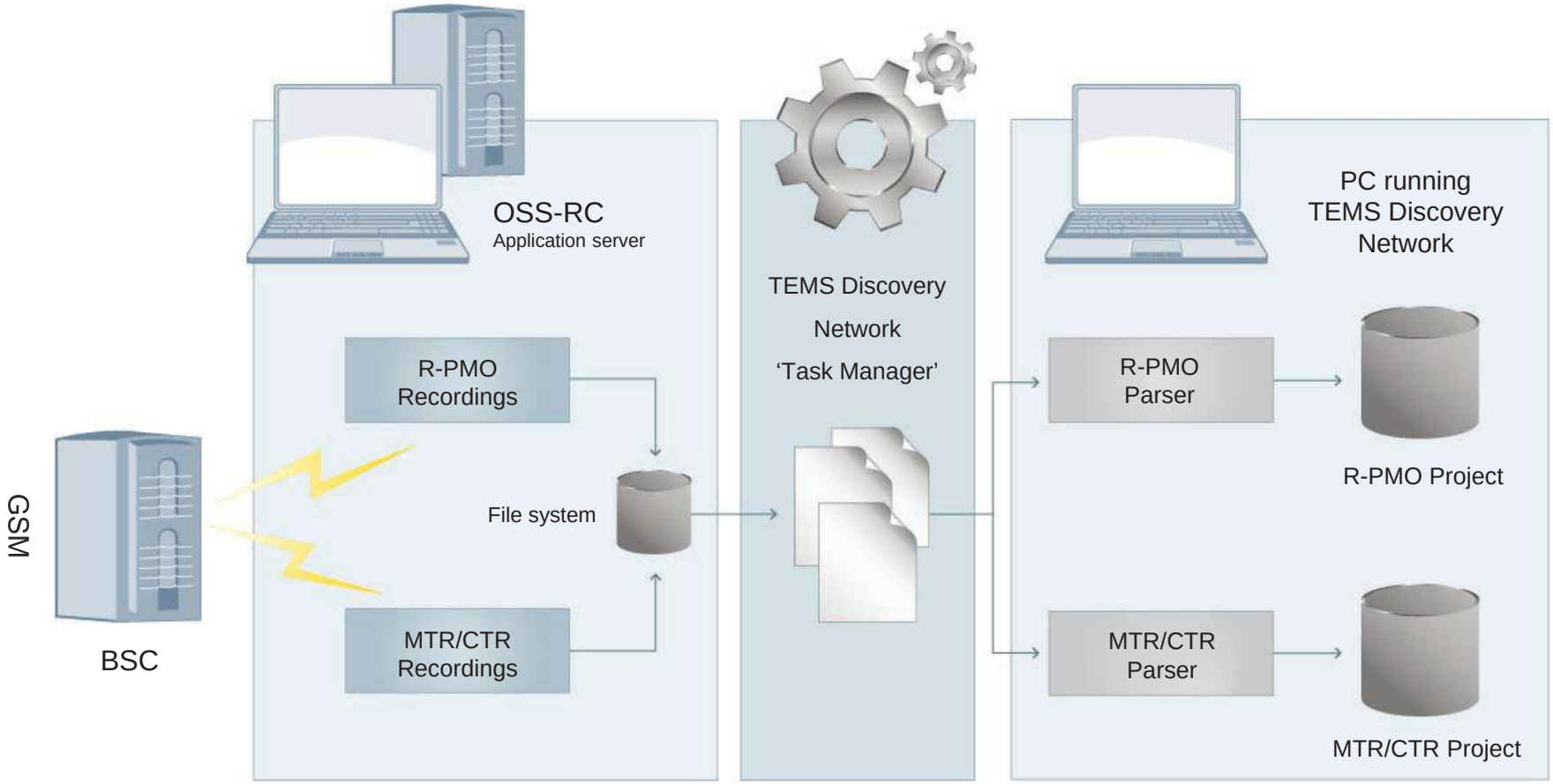
Desktop Platform (Two Editions)	▪ Enables detailed drilldown analysis at call and message level ▪ Projects: One-time processing, Limited time periods ▪ TEMS Discovery Network: Call Traces and other OSS Data ▪ TEMS Discovery Device: Drive Test & Device Measurements
Enterprise Platform (Single Platform with Unified Analytics Dashboard)	▪ Centralized server, Remote client deployment ▪ Scalable System Architecture ▪ 365 x 24 x 7 Monitoring, Processing, Automatic Aggregation ▪ Near Real-time insight into Network and Services ▪ Automated Analysis and Reporting of data from Devices, Network Elements, and Applications via ‘Network’ and ‘Device’ Modules (with Correlation, in future) ▪ Maximizes Operational Effectiveness ▪ Single Overview of Network for Entire Organization ▪ Interfaces with Desktop variants for Troubleshooting and Optimization

TEMS DISCOVERY NETWORK (DESKTOP PLATFORM)

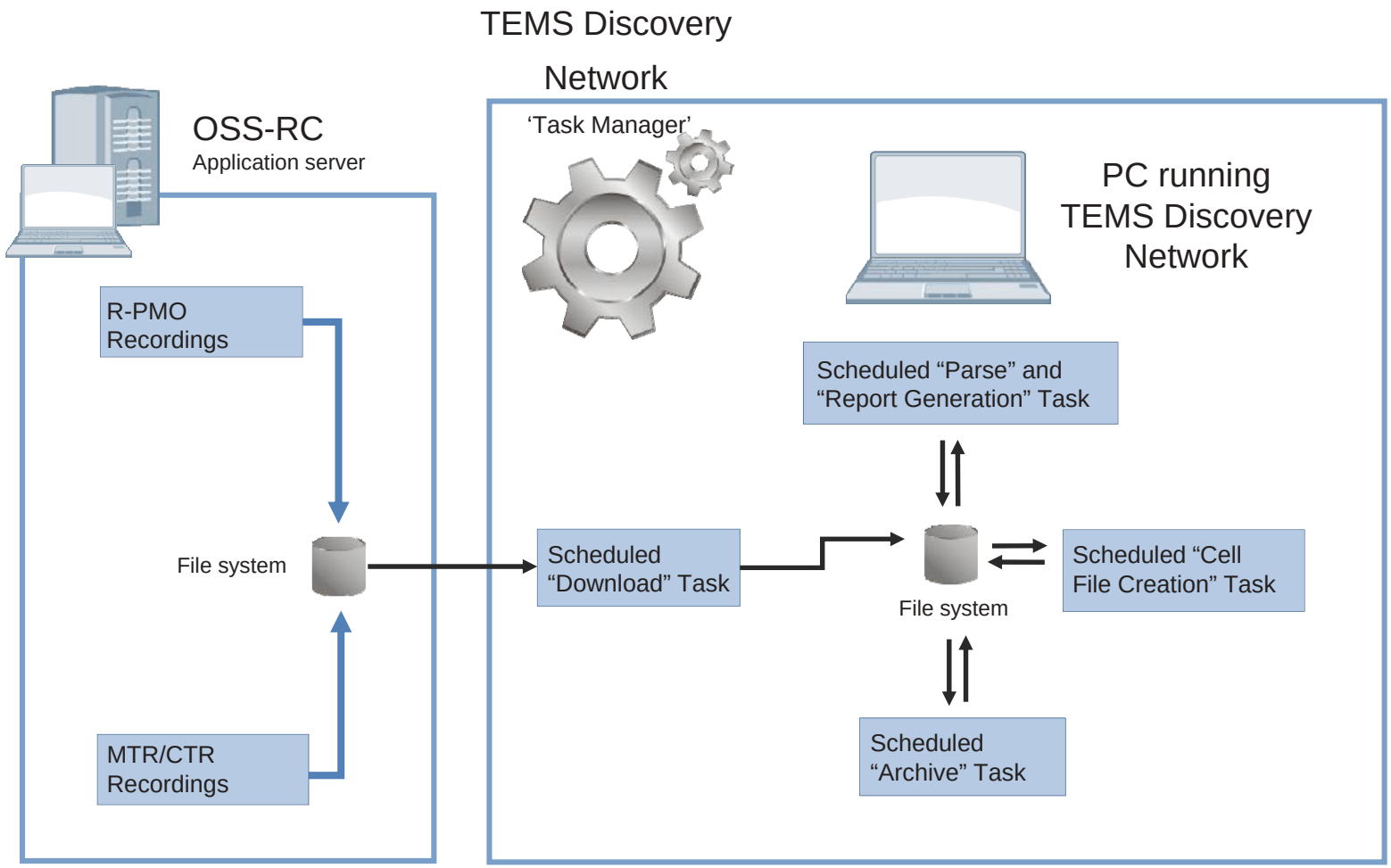
- PC-based, event data analysis tool: stand-alone or pooled options
- Supports GSM/WCDMA/LTE call trace data from Ericsson OSS, Huawei WCDMA call trace and PM counters, and NSN ‘Megamon GEO Interface WCDMA’ in two applications
  - **GSM Application**: Ericsson GSM R-PMO, MTR/CTR with Task Manager
  - **WCDMA, LTE and Tracing Application**: Ericsson WCDMA GPEH and UETR; Huawei WCDMA call trace and PM counters, NSN Megamon GEO Interface WCDMA; Ericsson LTE Cell Trace and UE Trace; and Ericsson GSM MTR (for multitechnology tracing)

Note: Ericsson GSM R-PMO and GSM CTR formats are not supported on the Enterprise platform

TEMS DISCOVERY NETWORK: GSM APPLICATION

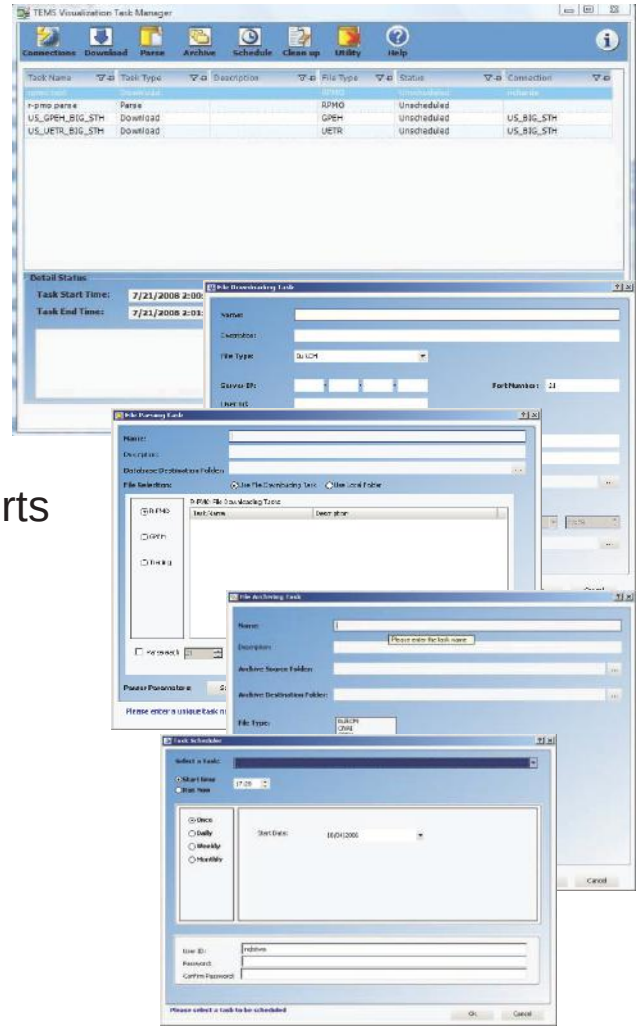


TASK MANAGER IN GSM APPLICATION

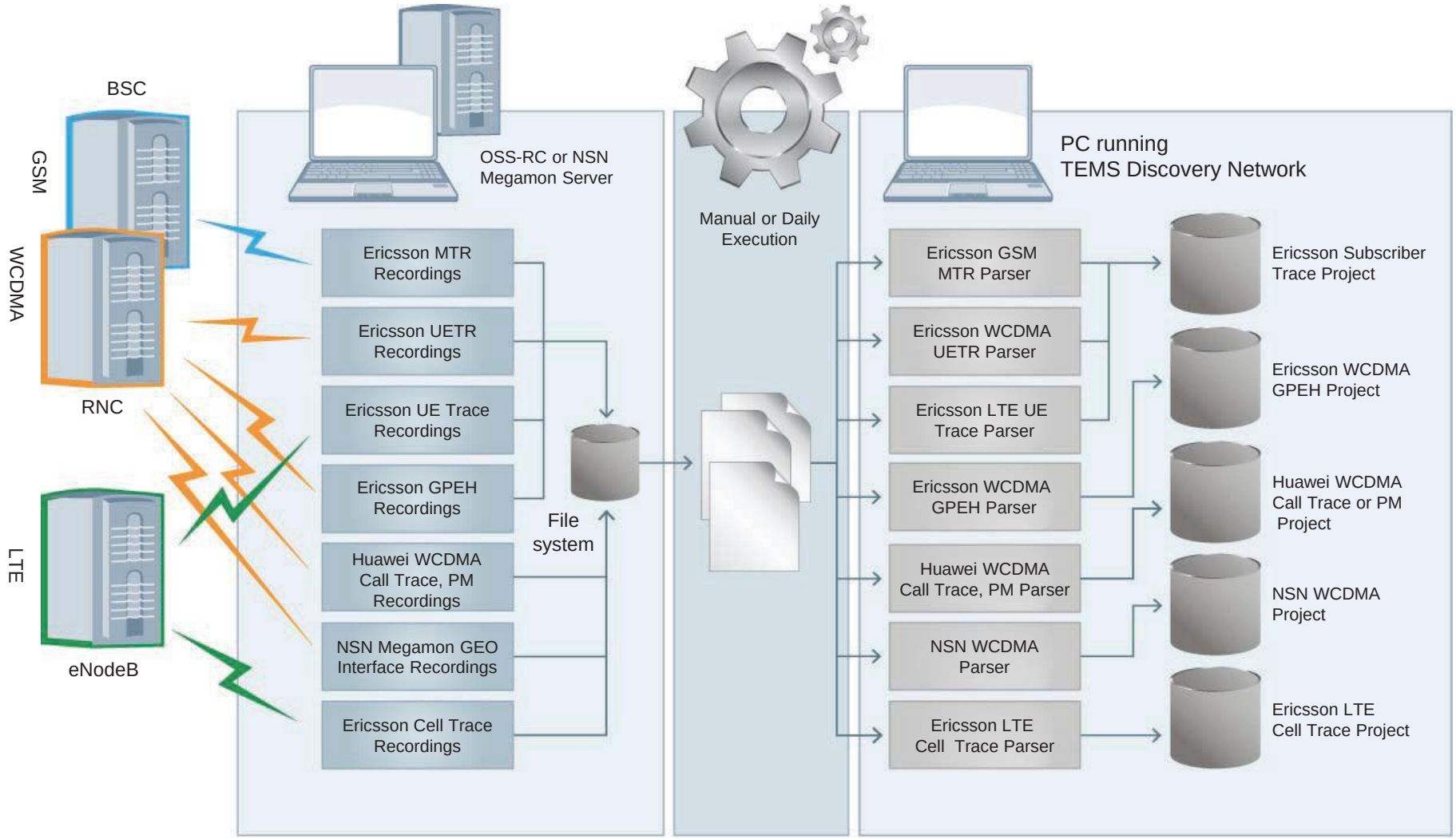


TASK MANAGER OVERVIEW

- Automated functions for improved efficiency
  - Collection of OSS recordings
    - Automatically connect to OSS and collect latest recordings
  - Creation of databases and reports
    - Automatically set up rules for data parsing
    - Automatically create cell files
    - Automatically create database summary and aggregated reports
- Archiving of old data
  - Automatically archive old data for easy housekeeping
- Possibility for centralized data management



TEMS DISCOVERY NETWORK: WCDMA, LTE & TRACE APPLICATION



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TEMS DISCOVERY NETWORK: COMPARISON

	Desktop Edition: TD Network	TD Enterprise (Network Module)
Support for Ericsson WCDMA: GPEH, UETR	X	X
Support for Ericsson GSM: R-PMO, CTR (area formats)	X	
Support for Ericsson GSM: MTR (IMSI format)	X	X
Support for Ericsson LTE: Cell Trace, UE Trace	X	X
Support for Huawei WCDMA Call Trace Format, PM Counters	X	X
Support for NSN WCDMA: Megamon GEO Interface Format	X	X
Additional multivendor, multitechnology (2014-15 development)	X	X
Geolocation of Custom Events, RSCP, EcIo, Traffic with Filters	X	X
Rich Feature Set (e.g., Phone Model KPI, Dropped Call Analyzer)	X	X
Scalable Platform		X
Full Automation, Aggregation with Flexible Data Scope		X
High Performance (Suited for Larger Volumes)		X
Centralized Server-Client Architecture, with Analytics Dashboard		X
Troubleshooting, Optimization, Detailed Drilldown Analysis	X	via PC Client

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WHAT'S NEW IN TEMS DISCOVERY NETWORK 11.0

WHAT'S NEW IN TEMS DISCOVERY NETWORK 11.0

- New system releases supported
  - Ericsson GSM G13B, WCDMA W14A, LTE L14A
  - NSN Megamon GEO Interface WCDMA 1.1
  - Huawei WCDMA call trace recordings (R12-R13), and PM counters (R14-R15)
- Ericsson LTE Cell Trace Module
  - Completion of CSFB report to work from within the product itself
  - Coverage Area Optimization, with Distance vs. KPI Measurement Chart
  - Call Search with Outgoing CSFB and IMS Call Type categories
  - Exception Analysis: Adding LTE Redirection and Dropped Call events
  - Count individual eRAB releases, including VoLTE

WHAT'S NEW IN TEMS DISCOVERY NETWORK 11.0

- Ericsson WCDMA GPEH Module
  - Improved GPEH decoding performance
  - Service Usage Chart for an entire Phone Model Group
  - Maximum items in Phone Model Group and Subscriber Group increased from 250 to 500
  - CSFB in WCDMA: Information element to detect CSFB call added to Call List and Call Search options. Information element regarding redirection to eUTRAN info added to Call List
  - Additional descriptive text included in image export of Geo KPI maps

WHAT'S NEW IN TEMS DISCOVERY NETWORK 11.0

- Ericsson GSM R-PMO Module
  - Flag indicating DTM calls added to Call List and Call Search options.
  - KPIs for DTM Dropped Calls and DTM Drop Rate (%) added to Cell List and Phone List.
  - Tracking of Service during calls added to Call Messages: Tracks changes between Signaling, CS Only and CS + PS (DTM) on a per-message basis.
  - Service Usage Analyzer added: Possible to see Call Time and % Time in Signaling for 'CS Only' and 'CS + PS (DTM)' for selected calls or IMEI-TAC from Phone List.
  - 'Last Speech Codec Type' used in call added to Call List and Call Search options.
  - Added Basic Call Search option for a specific subscriber (full IMEI).
  - Added Advanced Search option for 'Drop after IRAT handover.'
- General
  - Support of TEMS .xml cell file format for GSM, WCDMA, and LTE

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WHAT WAS NEW IN TEMS DISCOVERY NETWORK 10.1

WHAT WAS NEW IN TEMS DISCOVERY NETWORK 10.1

- TEMS Discovery Network (Desktop Edition) is the upgrade path for TEMS Visualization ‘Professional’ users
- New system releases supported
  - Ericsson GSM G13B, WCDMA W13B, LTE L13B releases
  - Huawei WCDMA PM Counters for R14+ releases
- Ericsson LTE Cell Trace
  - Subscriber KPI Analysis
  - CSFB Performance Report
- Huawei WCDMA PM Counter Module
  - RNC KPIs and Time Chart
  - Cell KPIs and Time Chart
  - Capacity Analysis
  - Coverage Area Optimization: Overshooting Cells
  - Neighbor Cell Performance

WHAT WAS NEW IN TEMS DISCOVERY NETWORK 10.1

- Huawei WCDMA Call Trace Module
  - Support for Groups: Phone Model and Subscriber KPIs
- Ericsson WCDMA GPEH
  - RAB Usage Distribution by call and user
  - GPEH-Core Module is no longer available as a separately priced subset-module of the GPEH Module
- Ericsson GSM R-PMO
  - IMEI Based Call Search

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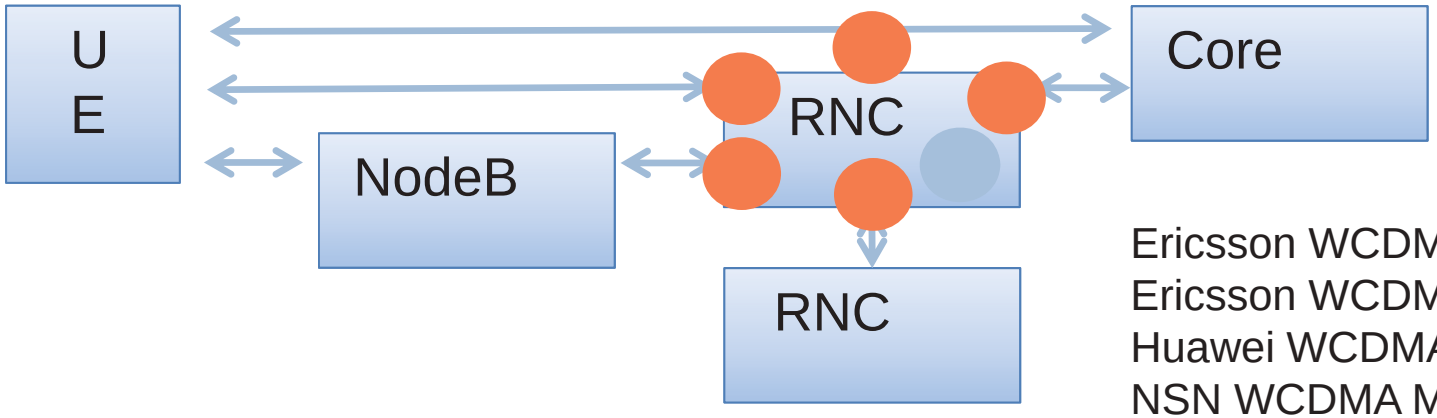
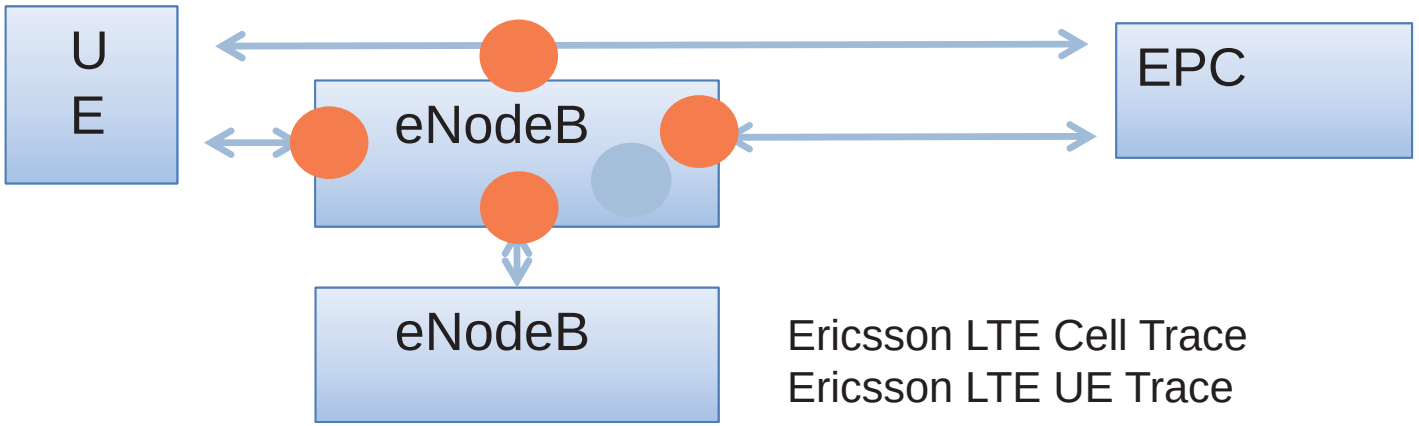
FEATURE OVERVIEW

MAIN DATA SOURCE – EVENT DATA



Ericsson WCDMA GPEH
Ericsson WCDMA UETR
Huawei WCDMA Call Traces (and PM)
NSN WCDMA Megamon GEO



Ericsson LTE Cell Trace
Ericsson LTE UE Trace

Note: 2G Event at BSC not shown in example

- 3GPP Messages (Ericsson, Huawei, NSN)
- Internal Information (Ericsson, some Huawei & NSN)

EVENT DATA – UNIQUE BENEFITS

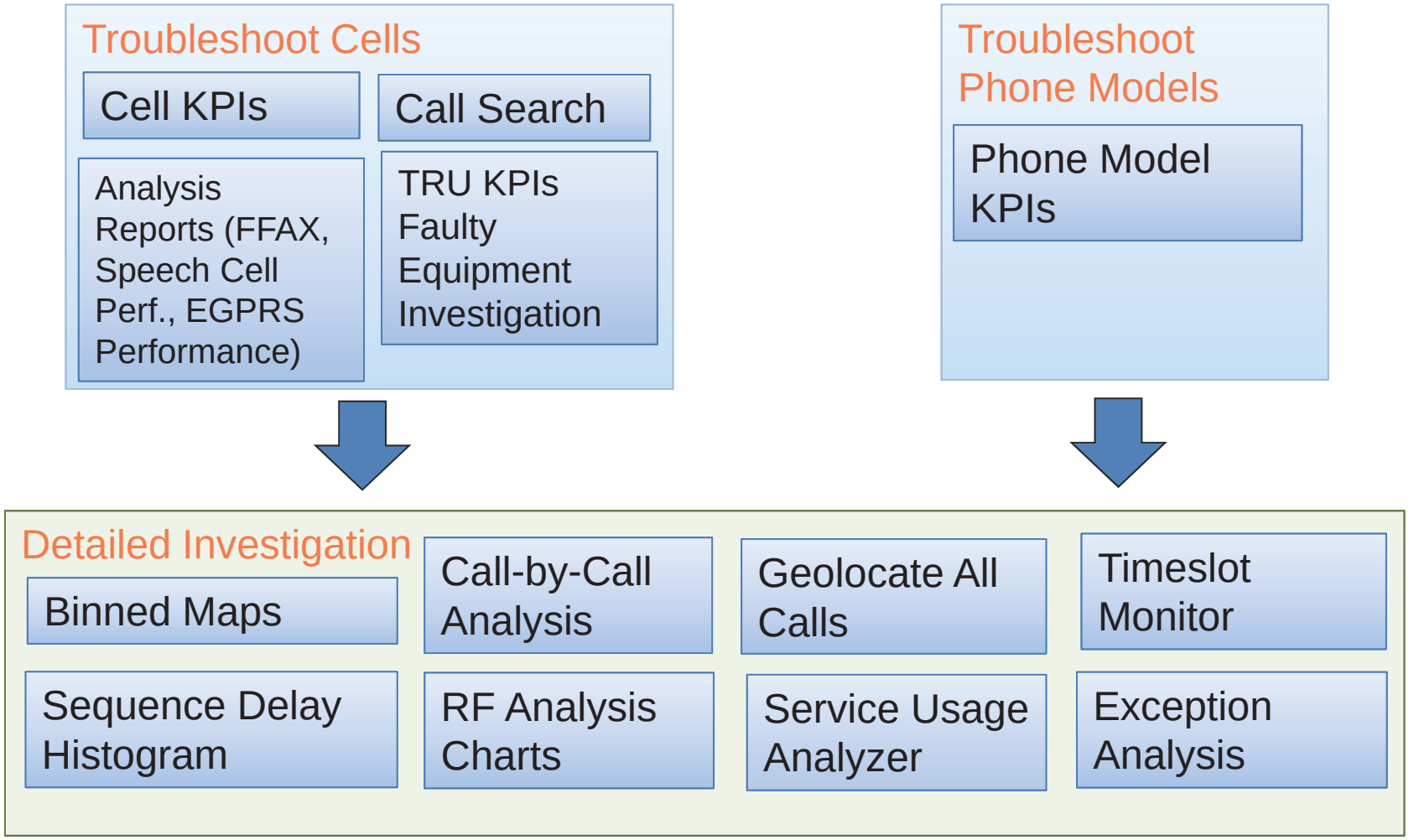
- Subscriber-centric virtual drive test data using all traffic
  - Recording functions **built into** the network nodes (or server in NSN case)
  - Can record **large volumes** of traffic in an area of cells at **minimal costs**
  - **All traffic** – outdoor or indoor, rural or urban, private and inaccessible areas
  - **All services, traffic types**: including CS speech, R99 data, HSPA data
- Highly detailed
  - External events – 3GPP protocol messages (RRC, RANAP, RNSAP, NBAP)
  - Internal events – more details than available from the protocol analyzer
  - Uplink and downlink radio measurements
- Per-call analysis
  - Follow message sequences
  - Correlate information from different parts of a call
  - Analyze details missing from PM statistics counters

ERICSSON GSM MODULES OVERVIEW

- Real-Time Performance Monitoring (R-PMO): Supports binary format output from OSS-RC4 with up to 500 cells per recording
- Mobile Traffic Recording (MTR)
  - Text format from OSS and Binary format from BSC supported
- Cell Traffic Recording (CTR): Text format from OSS supported
- Records event data for traffic in an area of cells (R-PMO) or specific cell (CTR) or specific subscribers (MTR)
- TEMS Discovery Network now post-processes Ericsson GSM 07A – G13B releases
  - Supports R-PMO & CTR (GSM app only); MTR (both TDN applications)

  (TEMS Discovery Enterprise – Network Module: Supports only GSM MTR format)

GSM R-PMO MODULE – TROUBLESHOOTING

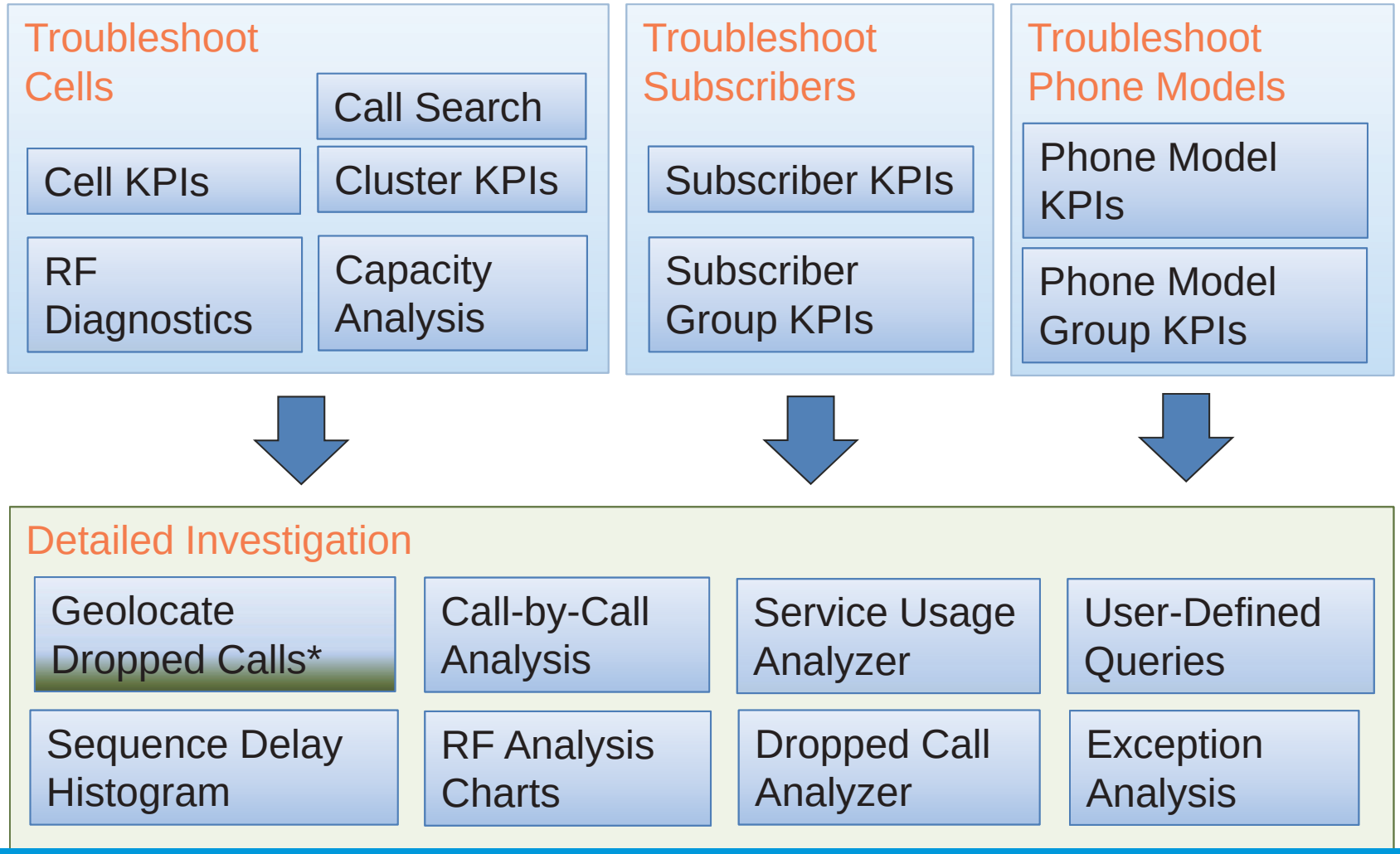


ERICSSON WCDMA MODULES OVERVIEW

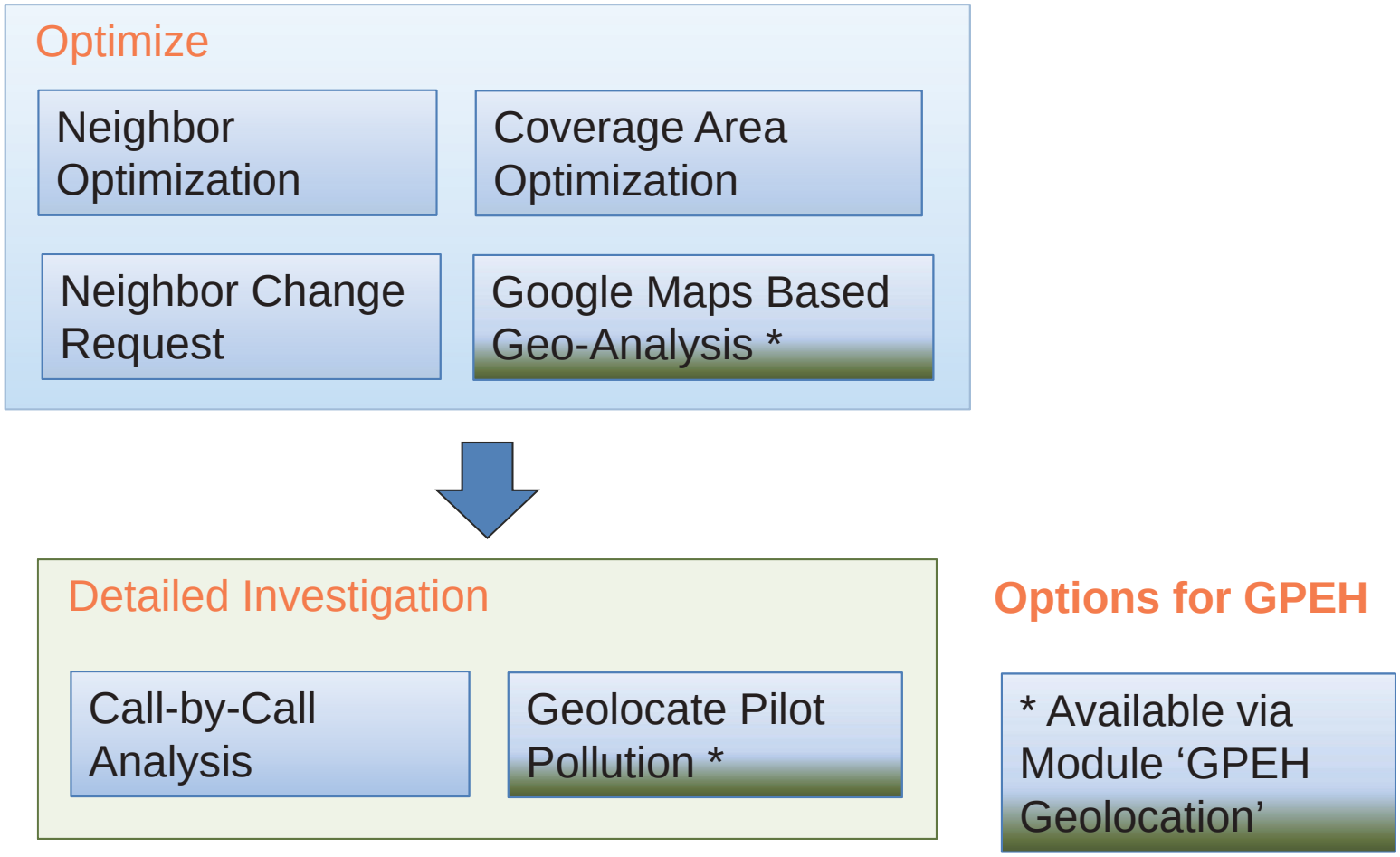
- General Performance Event Handler (GPEH)
- User Equipment Traffic Recording (UETR)
- Event data recording function in the Ericsson RNC and OSS-RC
- Records event data for traffic in an area of cells (GPEH) or specific subscribers (UETR)
- Similar to Iu/Iub/Iur probes but more cost-effective and RNC internal events and information is available

- TEMS Discovery Network now supports GPEH and UETR for W11A – W14A releases.

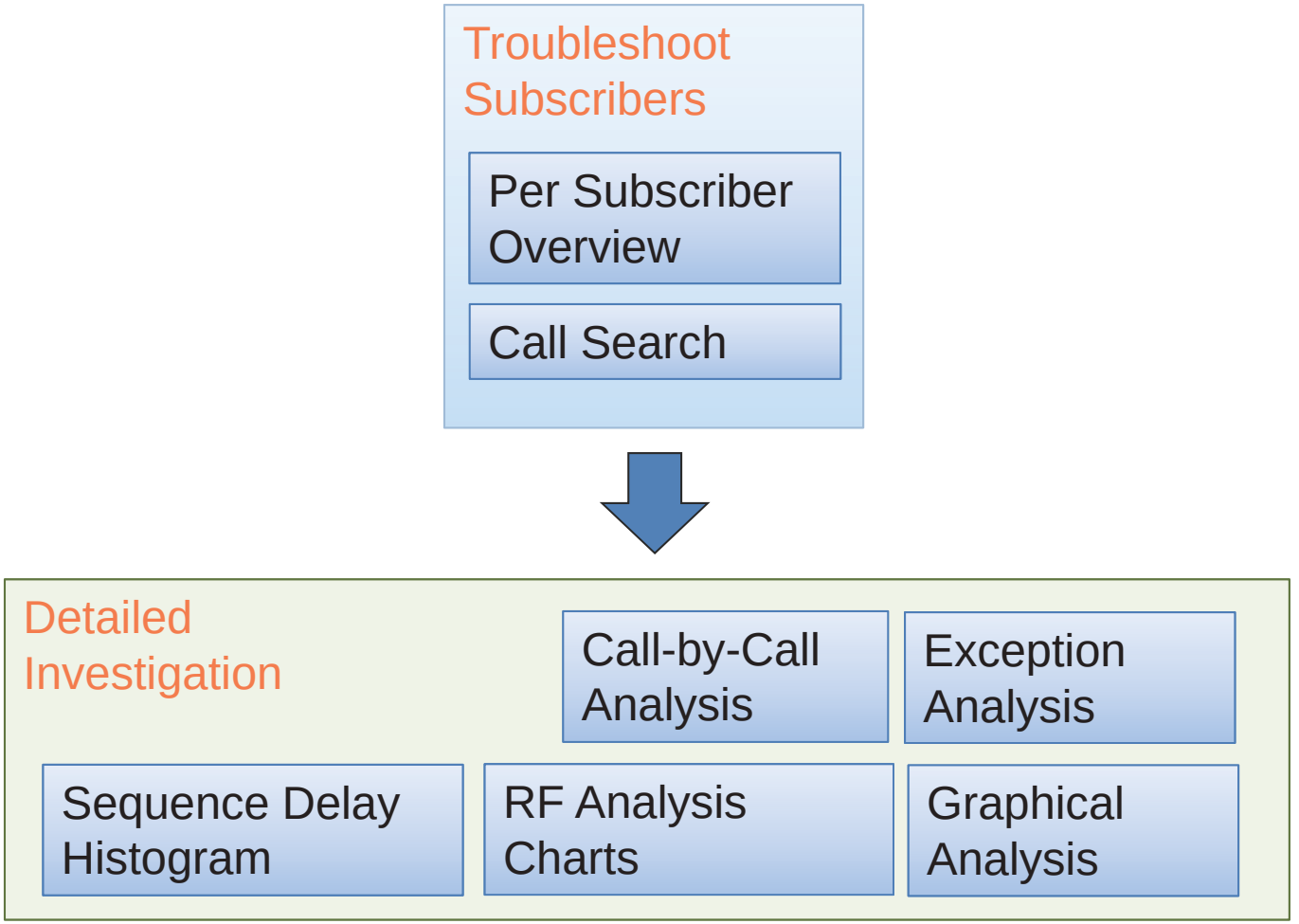
WCDMA GPEH MODULE – TROUBLESHOOTING



WCDMA GPEH MODULE – OPTIMIZATION



WCDMA UETR, LTE UE TRACE AND GSM MTR MODULES – TROUBLESHOOTING



ERICSSON LTE MODULES OVERVIEW

- Event data recording function in the Ericsson eNodeB and OSS-RC
- Records event data for traffic in an area of cells (Cell Trace) or specific subscribers (UE Trace)
- Similar to S1/X1/Uu probes but more cost-effective, and eNodeB internal information is available

- TEMS Discovery Network now supports LTE Cell Trace, UE Trace and LTE MME CTUM (Cell Trace User Mapping) L12B-L14A Format

LTE CELL TRACE MODULE – TROUBLESHOOTING

Troubleshoot

- Call Search
- Cell KPIs*
- Cell Group KPIs

Troubleshoot Phone Models

- Phone Model KPIs*

Troubleshoot Subscribers

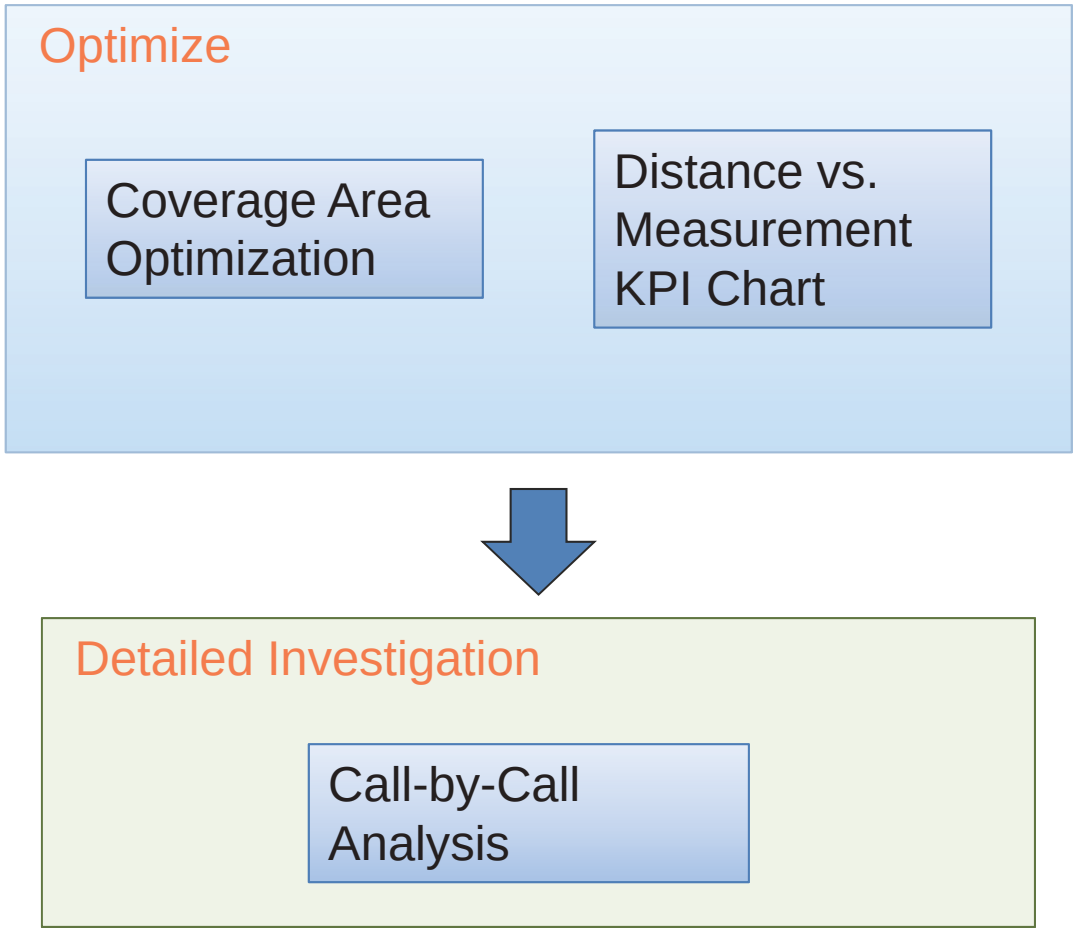
- Subscriber KPIs*

Detailed Investigation

- Sequence Delay Histogram
- Call-by-Call Analysis
- Exception Analysis
- CSFB Perf. Report
- RF Analysis Charts

*Includes VoLTE Analysis

LTE CELL TRACE MODULE– OPTIMIZATION

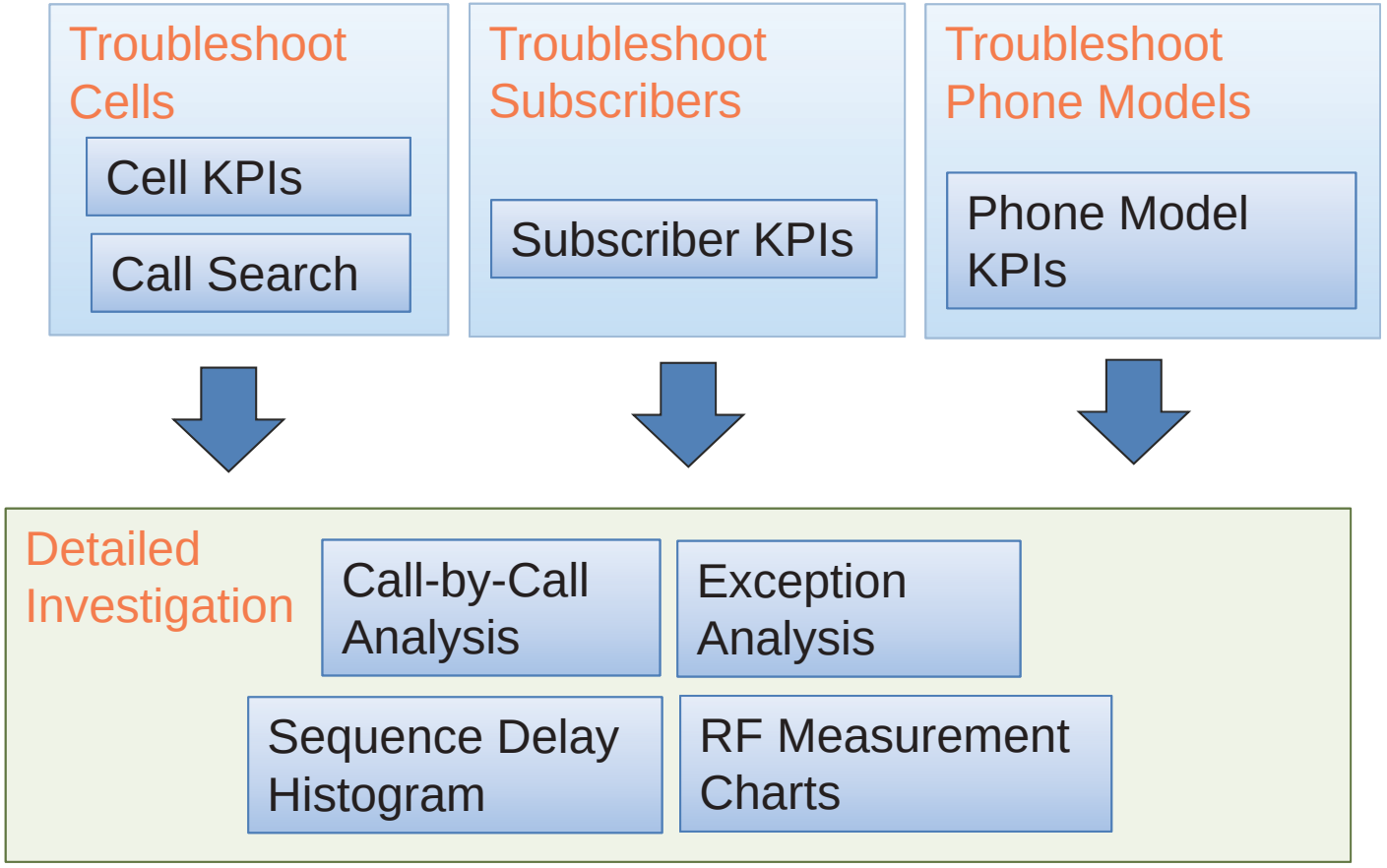


NSN MEGAMON GEO INTERFACE WCDMA MODULE OVERVIEW

- Event data recording function in the NSN Megamon GEO Interface (streaming)
- Records event data for traffic in an area of cells or subscriber recordings
- Similar to Iu/Iub/Iur probes but more cost-effective, and includes some internal information like changes in radio bearers
- TEMS Discovery Network 11.0 supports the NSN Megamon GEO Interface for WCDMA 1.1 release

- **Important:** TEMS Discovery Network can process only the GEO Interface output. It does not process the RNC-ICSU logs or Megamon output directly, and requires the NSN approved GEO Interface method for data collection

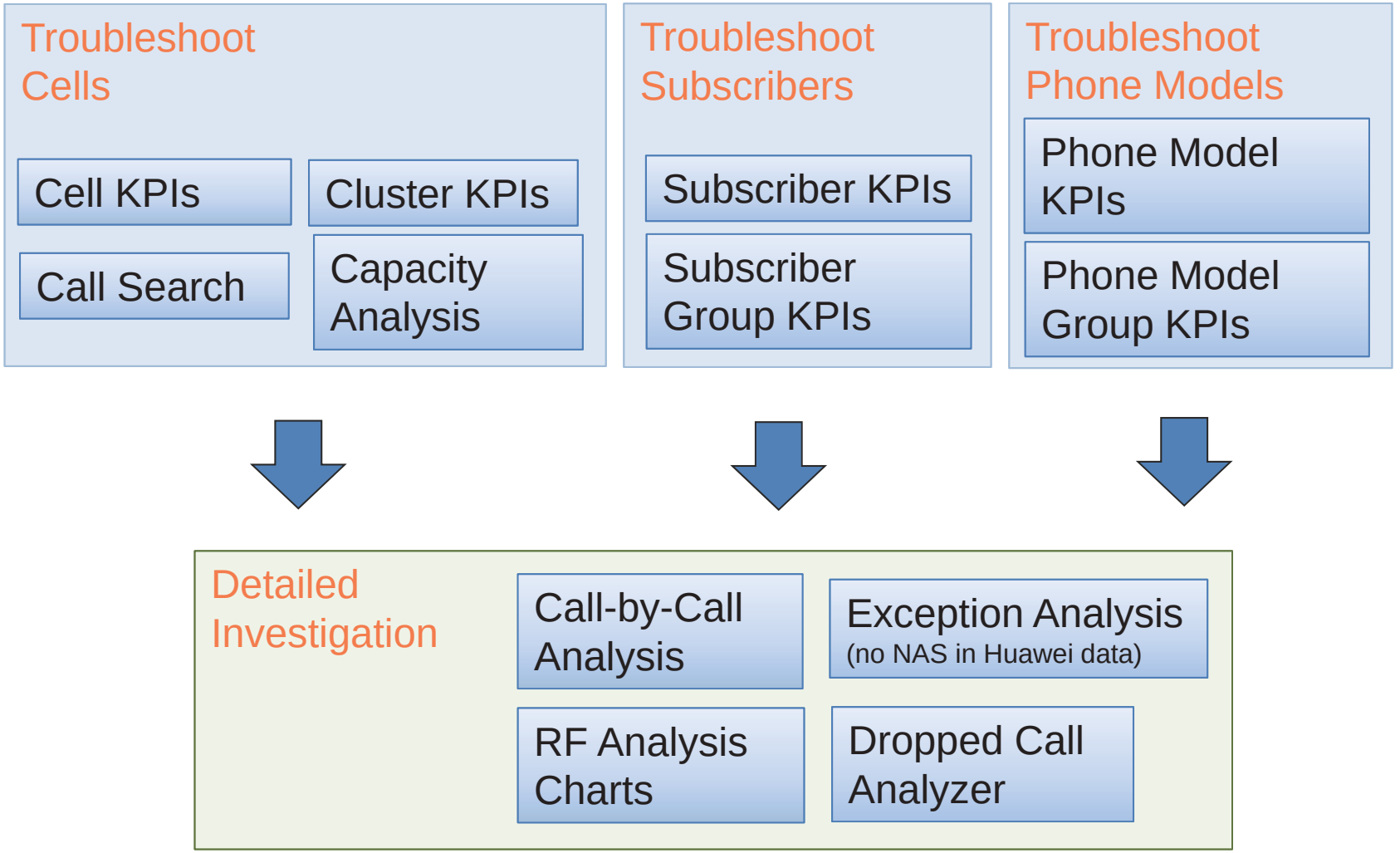
NSN MEGAMON WCDMA MODULE – TROUBLESHOOTING



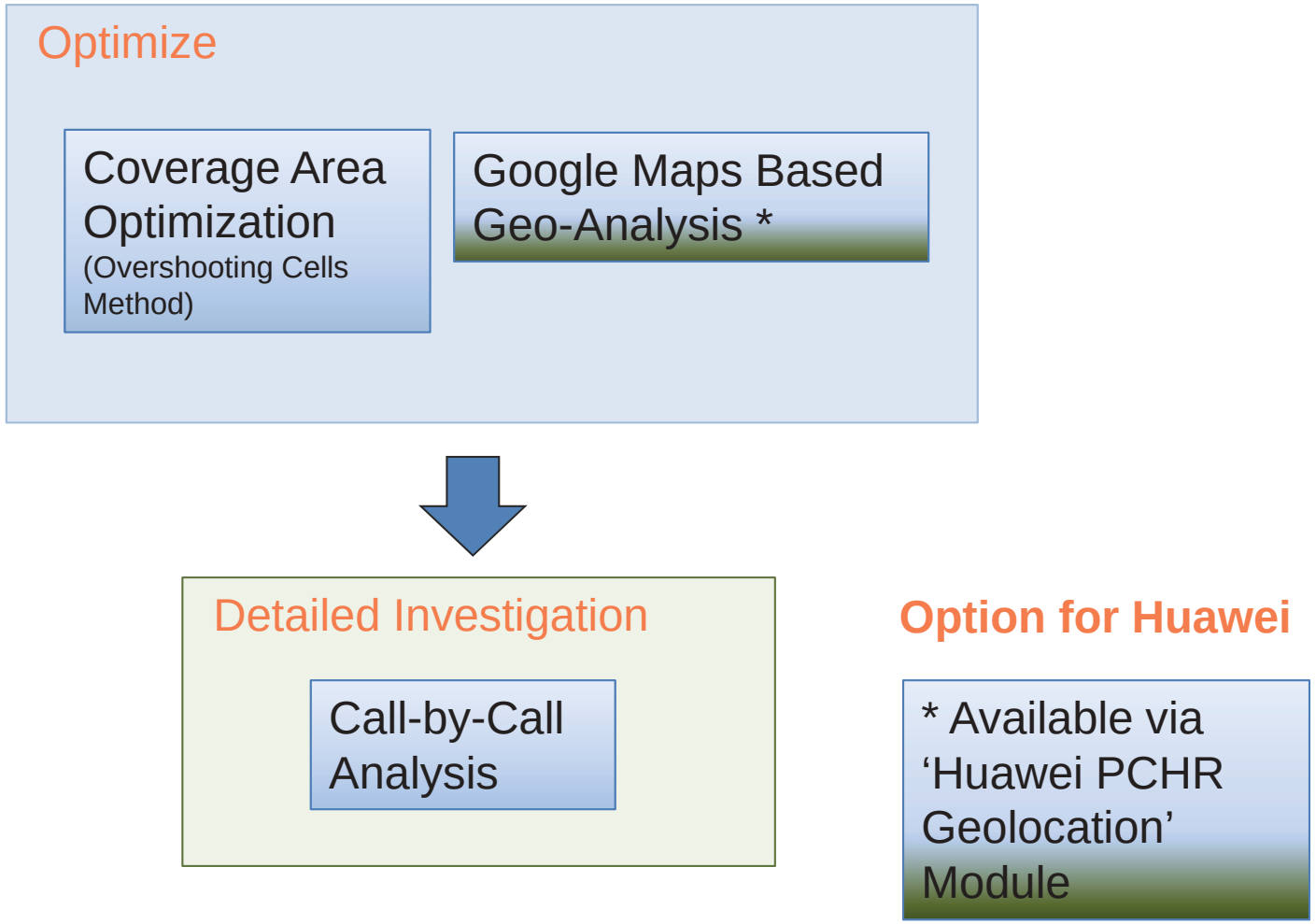
HUAWEI WCDMA CALL TRACE MODULE OVERVIEW

- WCDMA Call Trace data recording at RNC supported (e.g., PCHR, Performance Call History Recordings)
- Records all calls in an RNC, providing a processed call-record with some events
- Similar to Iu/Iub/Iur probes but more cost-effective, and includes some internal information like dropped call causes
- TEMS Discovery Network supports the Huawei WCDMA Call Traces (R12-R13, with integration support)
- **Important:** The call traces supported do not have a dependency on Huawei Nastar (e.g., exported Nastar PCHR call traces), and support the raw call trace data collected at the RNC.

HUAWEI WCDMA CALL TRACE MODULE – TROUBLESHOOTING



HUAWEI WCDMA CALL TRACE MODULE – OPTIMIZATION



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COMMON FEATURE DETAILS

WORKFLOW FOR COMMON FEATURES

- Select area for analysis
- Select time period for analysis

Scope Selection

- Analyze statistics created from events
- Select/search calls for analysis

Cluster/Cell KPI

Phone Model/ Subscriber KPI

Call Search

Exception Analysis

Sequence Delay Histogram

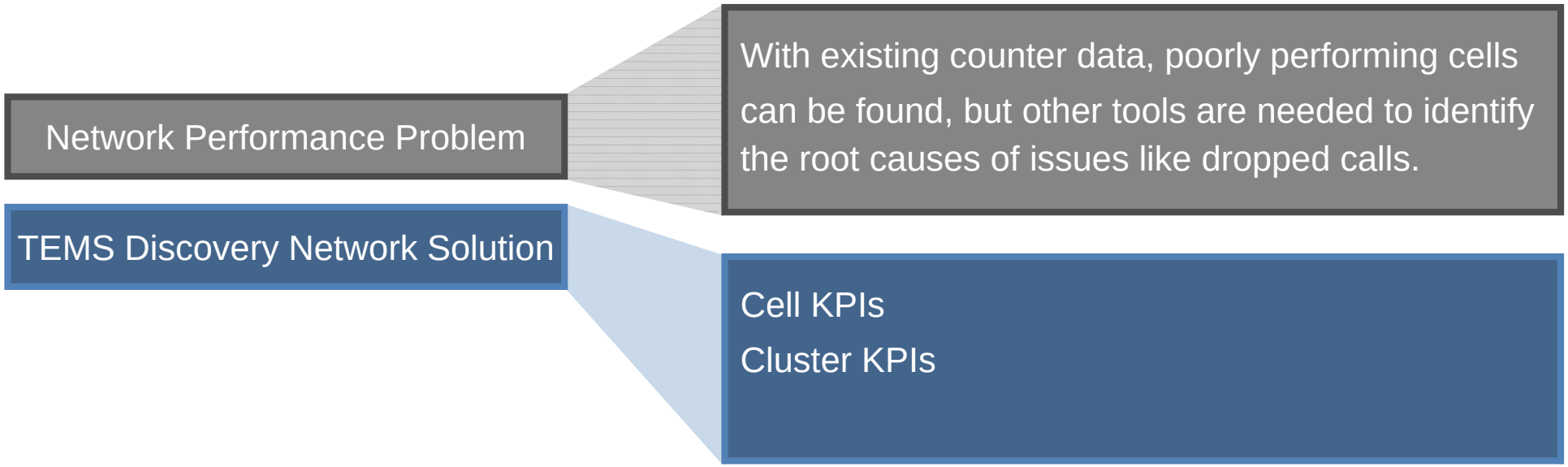
- Quickly find exceptional events
- Time delay between any 2 messages

- Analyze RF performance per cell

RF Analysis Charts

Call-by-Call Analysis

- Analyze calls message by message

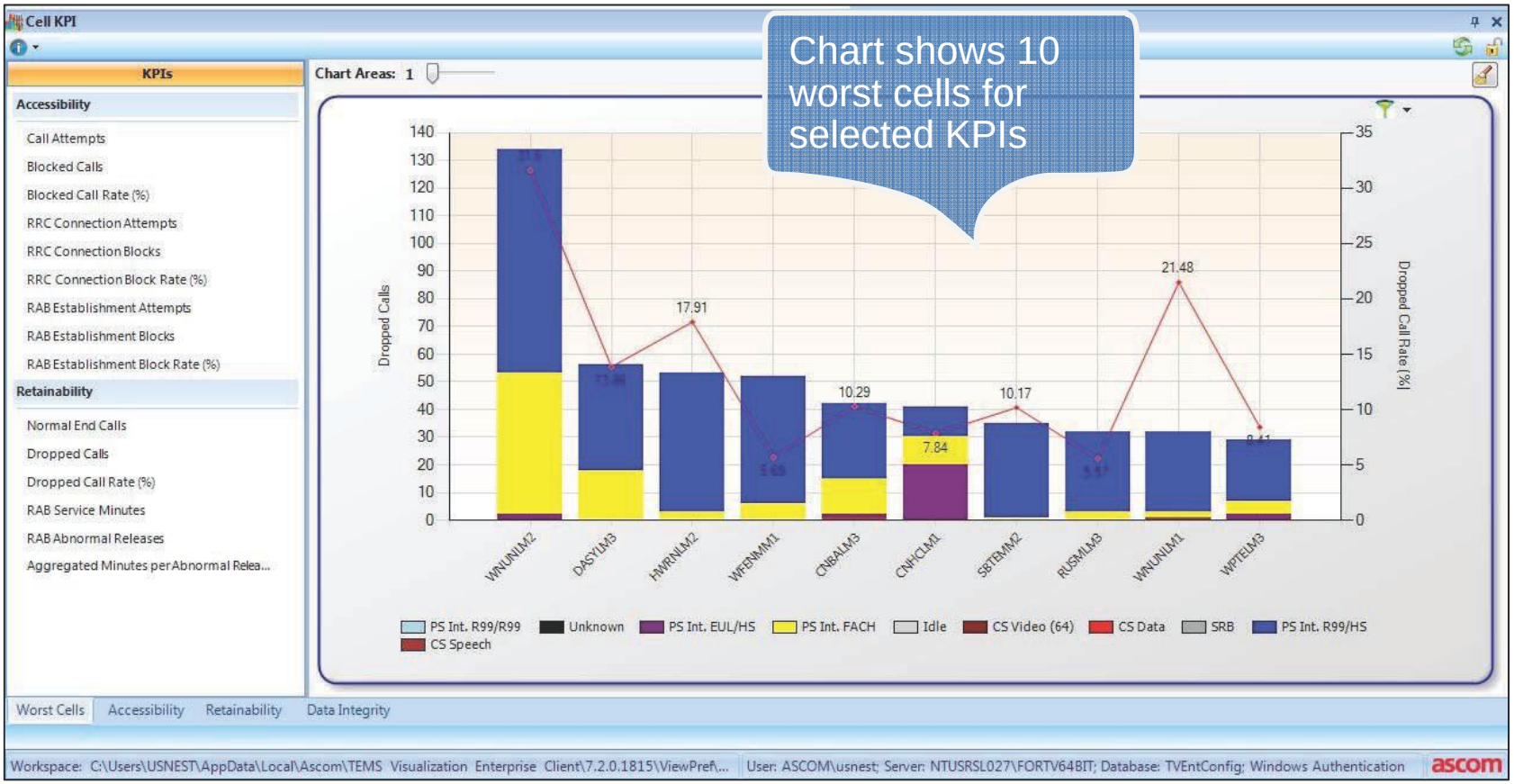

Network Performance Problem
With existing counter data, poorly performing cells can be found, but other tools are needed to identify the root causes of issues like dropped calls.
TEMS Discovery Network Solution
Cell KPIs
Cluster KPIs

CELL AND CLUSTER KPIS (1 OF 4)

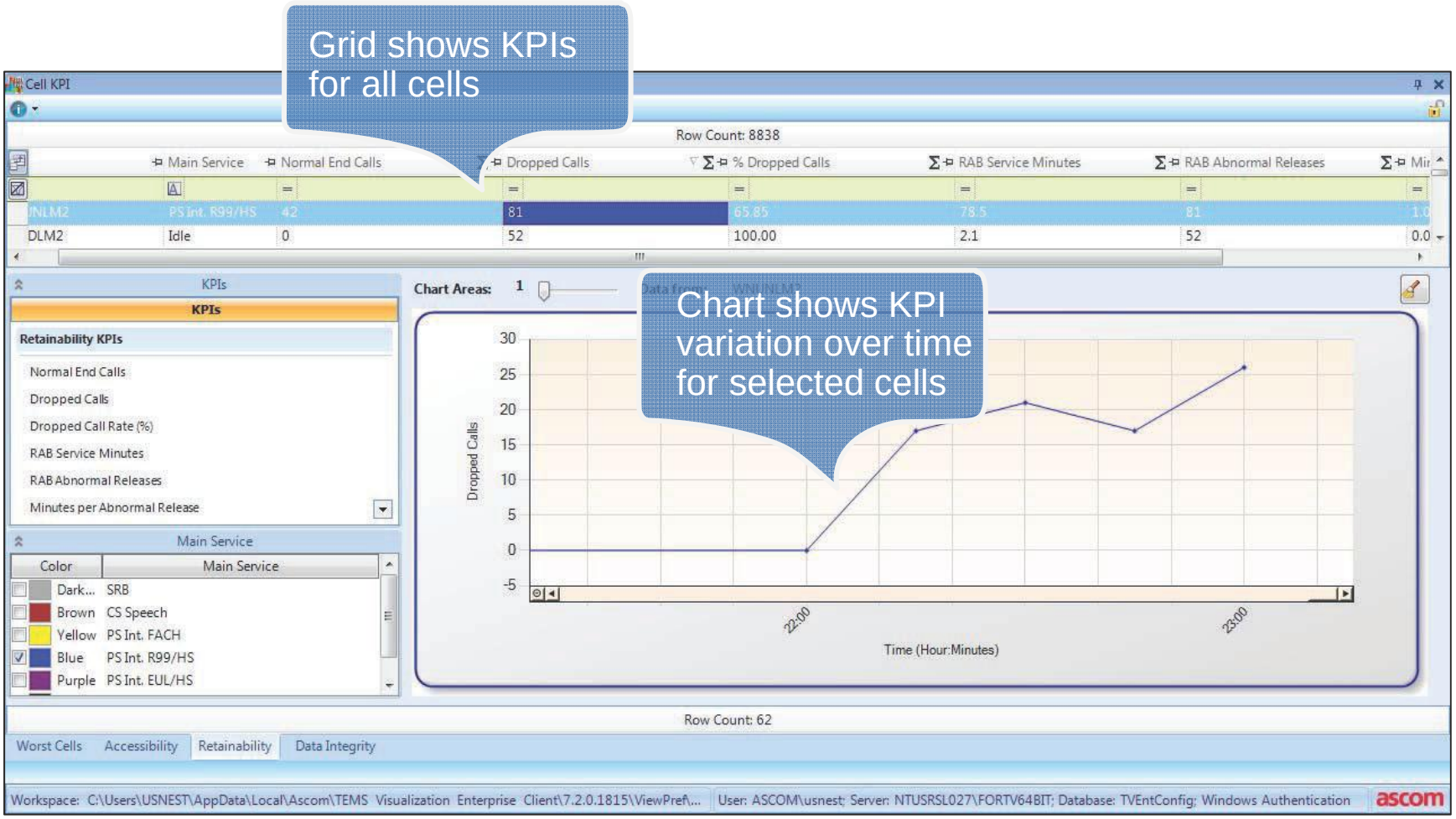
- Quickly identify worst-performing cells and clusters
- Drill down immediately for advanced and detailed troubleshooting
  - KPIs (counters) aggregated from Ericsson GPEH, Ericsson LTE Cell Trace, Huawei WCDMA and NSN WCDMA Megamon GEO Interface data
  - Per cell for:
    - Accessibility
    - Retainability
    - Mobility
    - Data integrity (including high-speed data)
  - Per main service type for WCMDA (CS speech, PS Interactive R99, PS Interactive High Speed, etc.), per CQI for LTE

    For Ericsson GPEH WCDMA, also geolocate dropped calls on the map

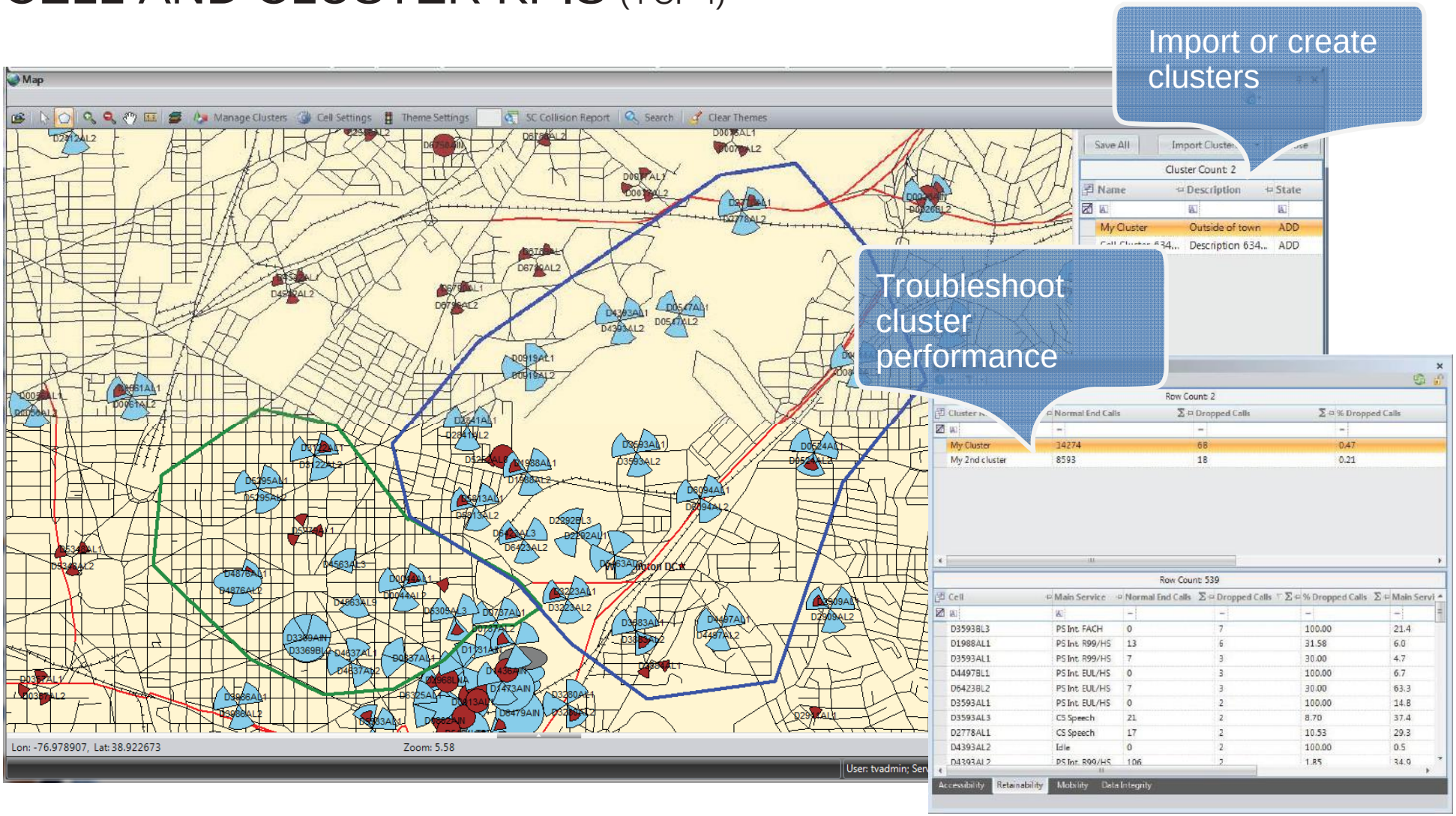
CELL AND CLUSTER KPIS (2 OF 4)

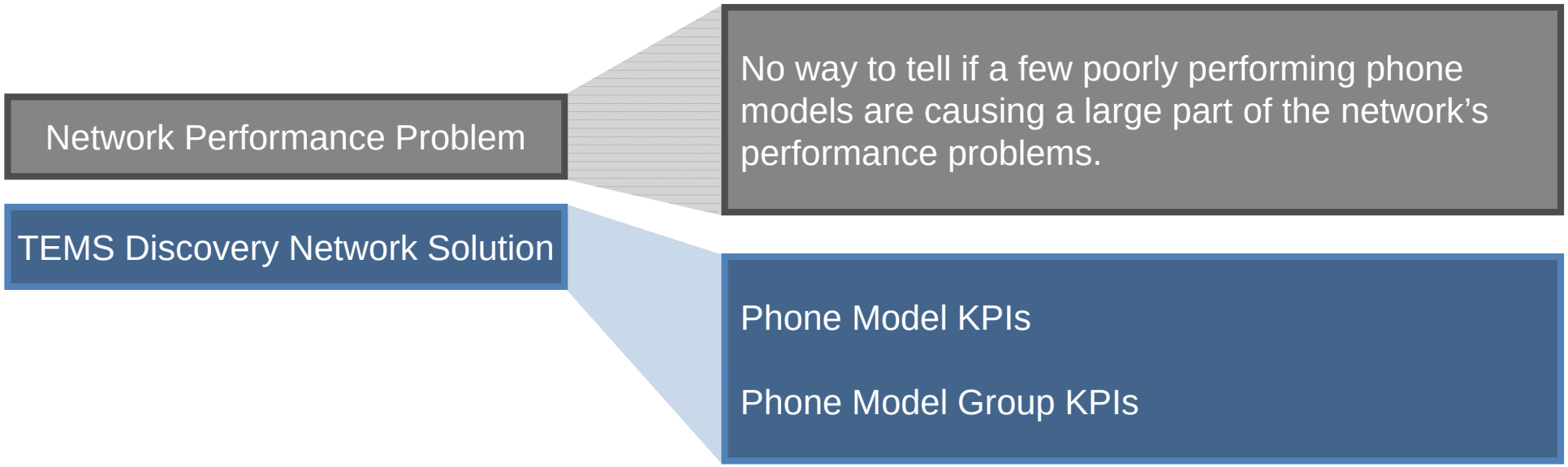


CELL AND CLUSTER KPIS (3 OF 4)



CELL AND CLUSTER KPIS (4 OF 4)



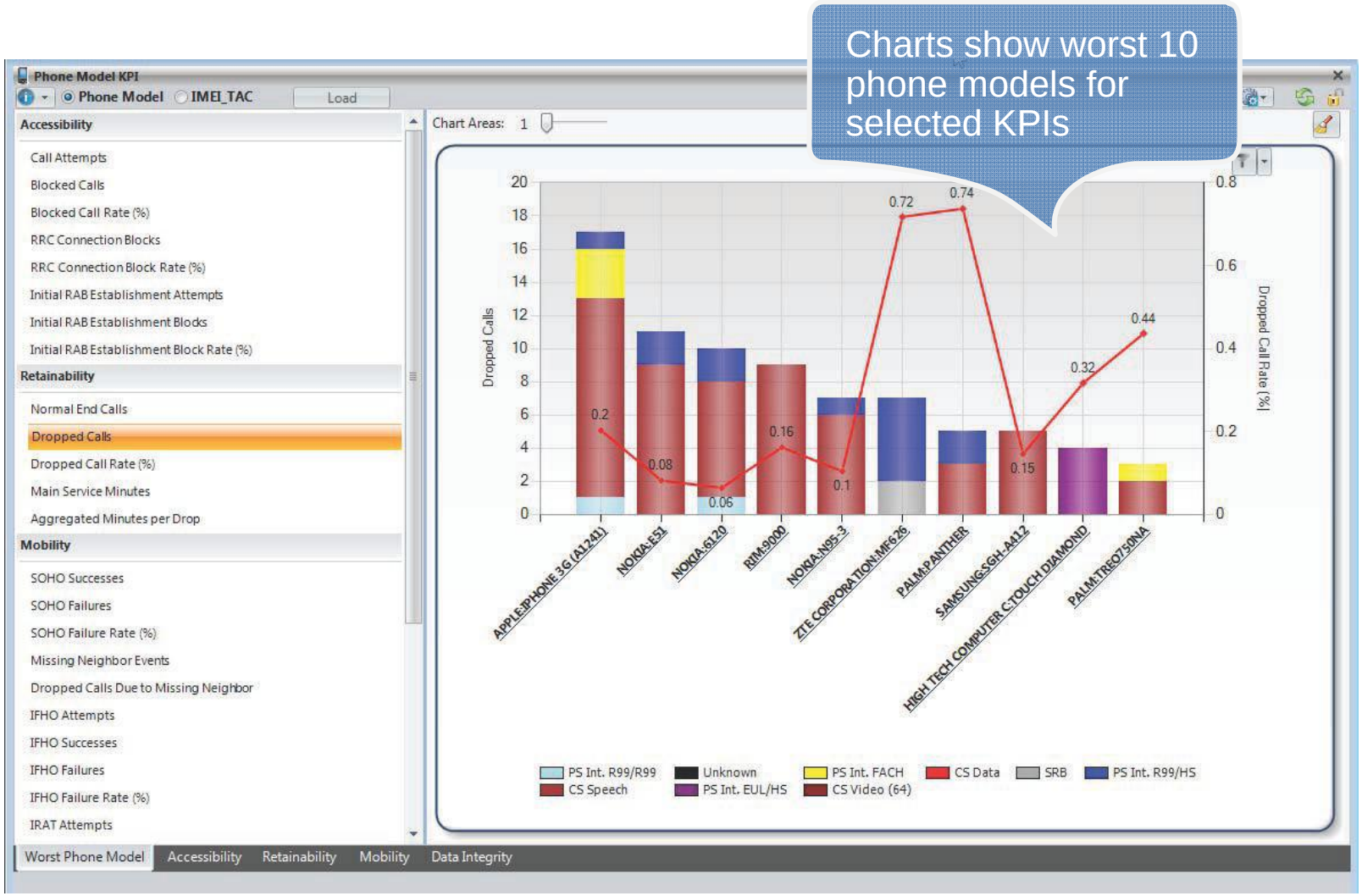

Network Performance Problem
No way to tell if a few poorly performing phone models are causing a large part of the network's performance problems.
TEMS Discovery Network Solution
Phone Model KPIs
Phone Model Group KPIs

PHONE MODEL AND GROUP KPIS (1 OF 3)

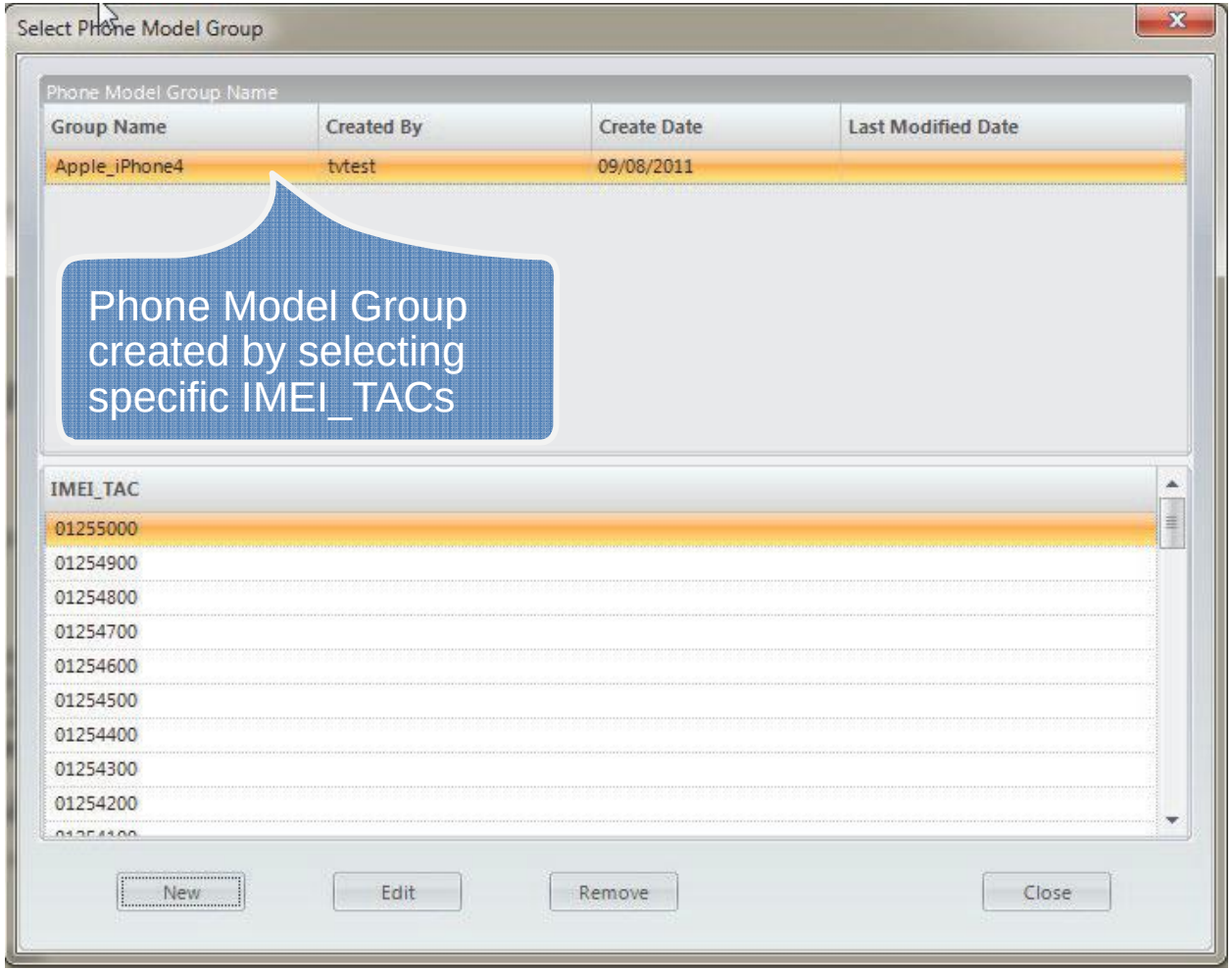
Determine if a minority of phone models are causing a majority of issues

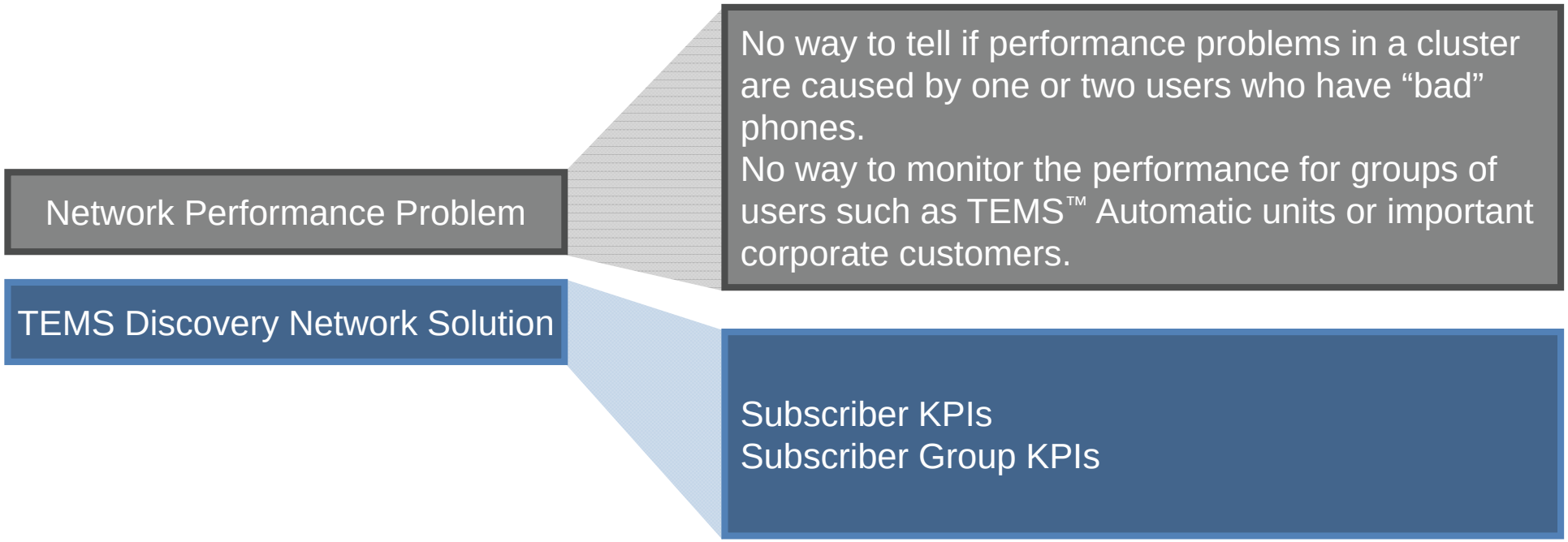
- Same set of KPIs as in cell KPIs
  - Phone Model KPIs available for Ericsson WCDMA GPEH, Ericsson LTE Cell Trace, Huawei WCDMA and NSN WCDMA Megamon GEO Interface data
- Load in phone model lookup file or analyze performance per IMEI-TAC
- Phone model and manufacturer also shown when available
- Investigate performance problems for specific phone models and services/RAB type combinations
- **Phone Model Group KPIs** allow grouping into single category (e.g., certain iPhone models) for grouped analysis
- Same drilldown to other features for advanced and detailed troubleshooting

PHONE MODEL AND GROUP KPIS (2 OF 3)



PHONE MODEL AND GROUP KPIS (3 OF 3)





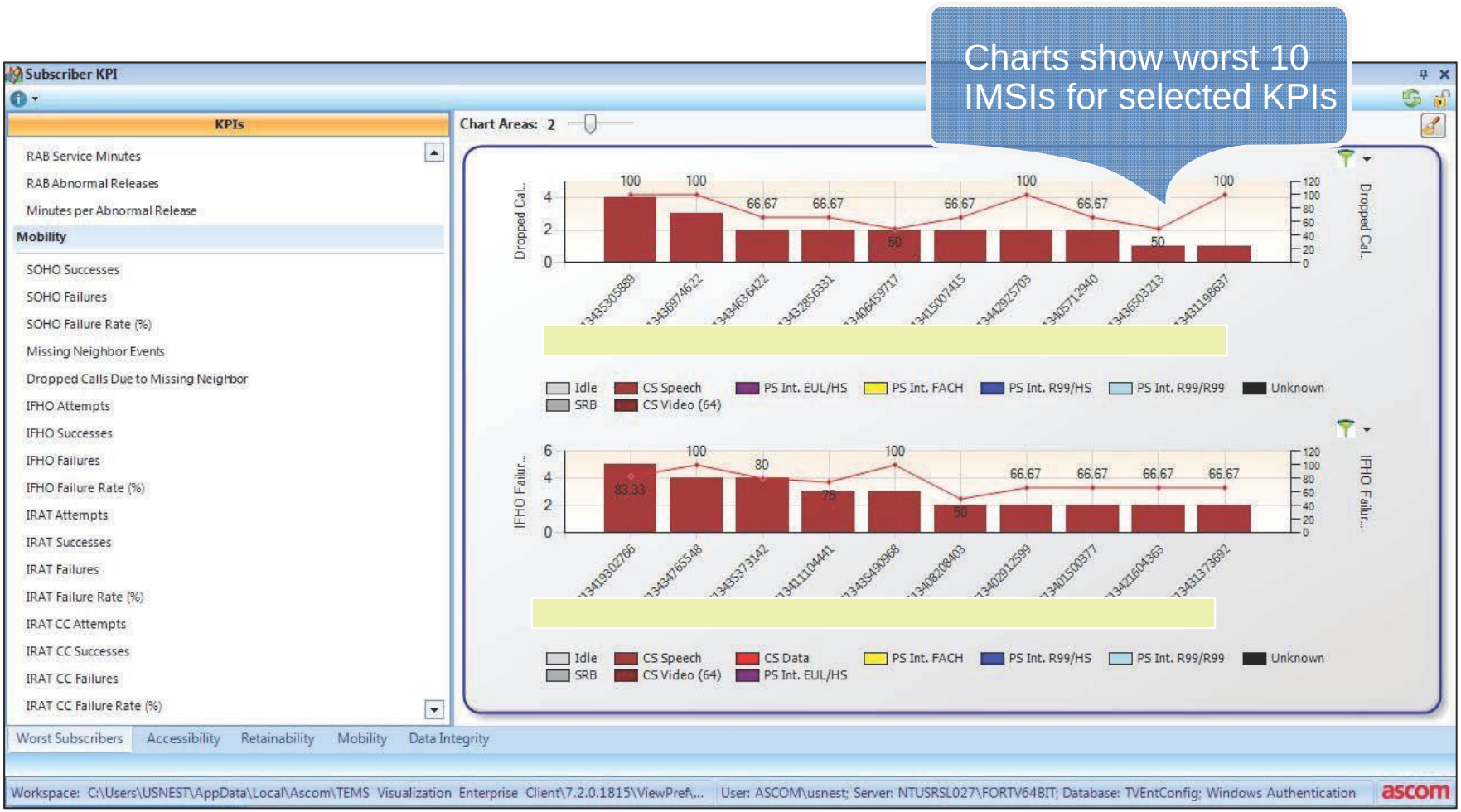
Note: Subscriber KPI feature is now available for Ericsson LTE

SUBSCRIBER KPIS (1 OF 2)

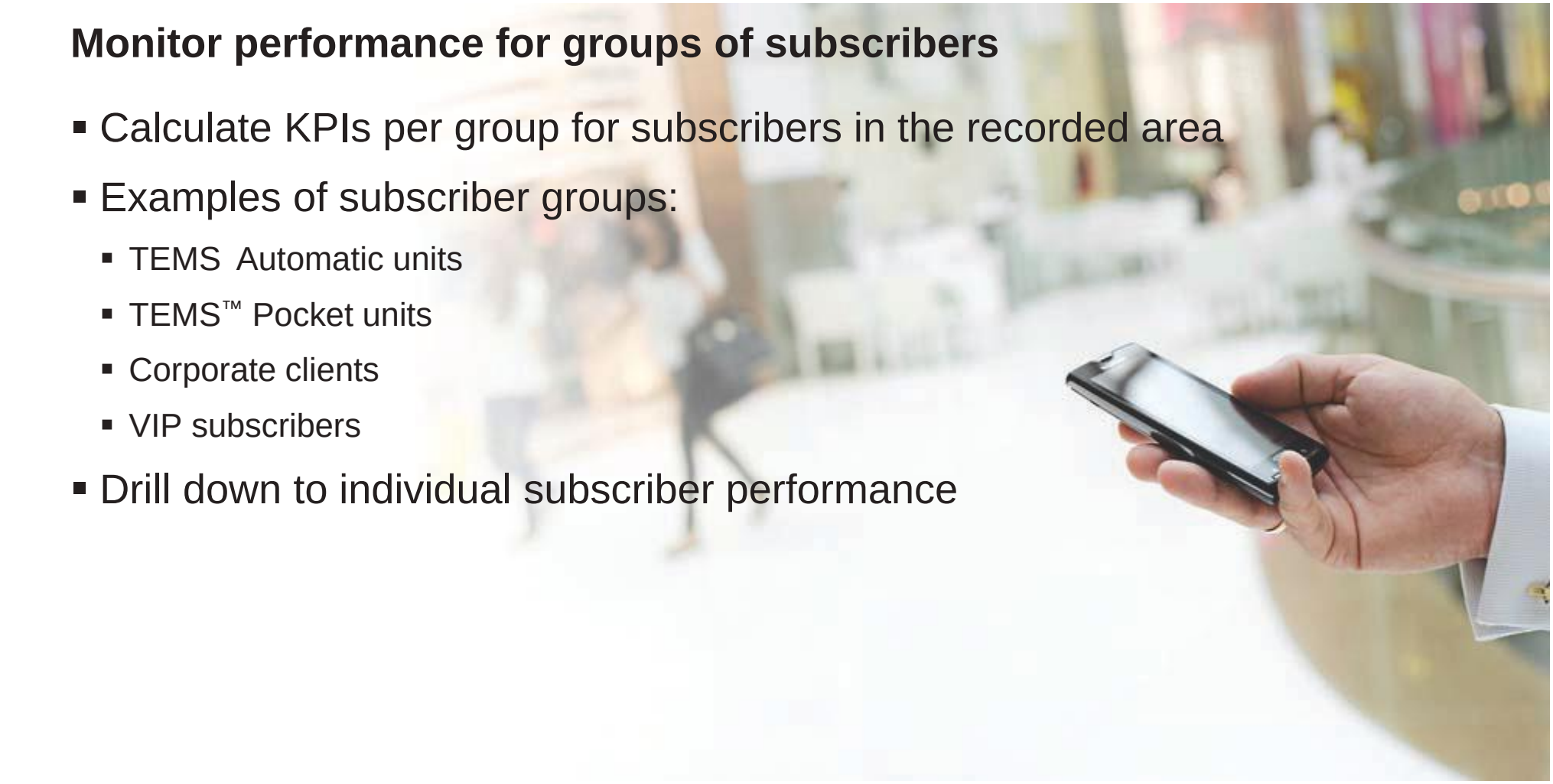
Determine if a minority of subscribers are causing a majority of issues

- Same set of KPIs as in cell KPIs
  - Subscriber KPI Analysis available for Ericsson WCDMA GPEH, Ericsson LTE Cell Trace, Huawei WCDMA and NSN WCDMA Megamon GEO Interface data
- Investigate performance problems for specific subscribers and groups of subscribers, with easy identification of the worst IMSIs
- Same drilldown to other features for advanced and detailed troubleshooting

SUBSCRIBER KPIS (2 OF 2)



SUBSCRIBER GROUP KPIS (1 OF 2)

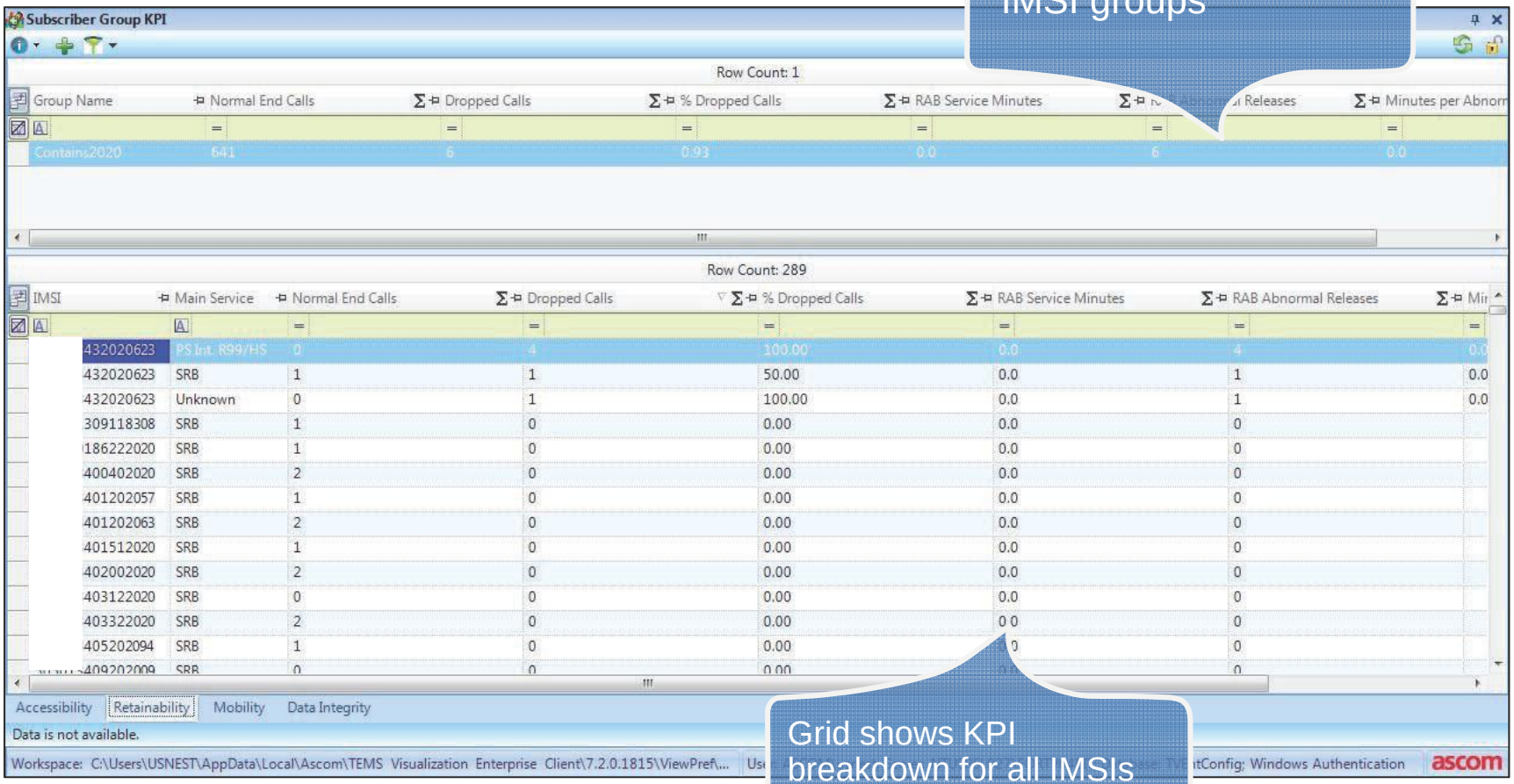


Monitor performance for groups of subscribers

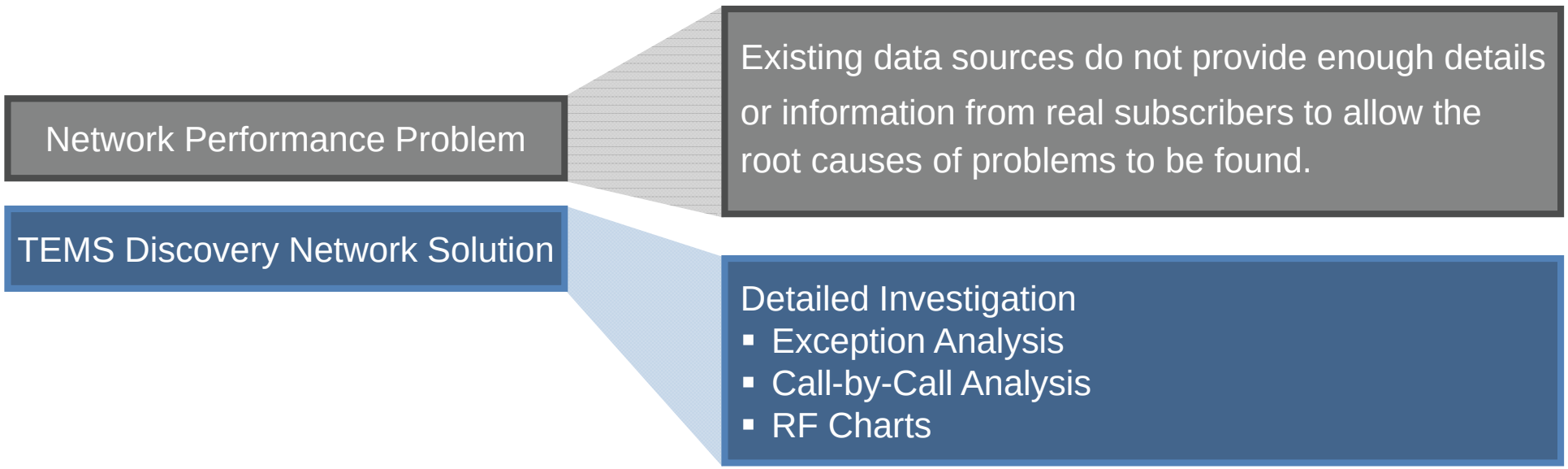
- Calculate KPIs per group for subscribers in the recorded area
- Examples of subscriber groups:
  - TEMS Automatic units
  - TEMS™ Pocket units
  - Corporate clients
  - VIP subscribers
- Drill down to individual subscriber performance

SUBSCRIBER GROUP KPIS (2 OF 2)

Aggregated KPIs for IMSI groups



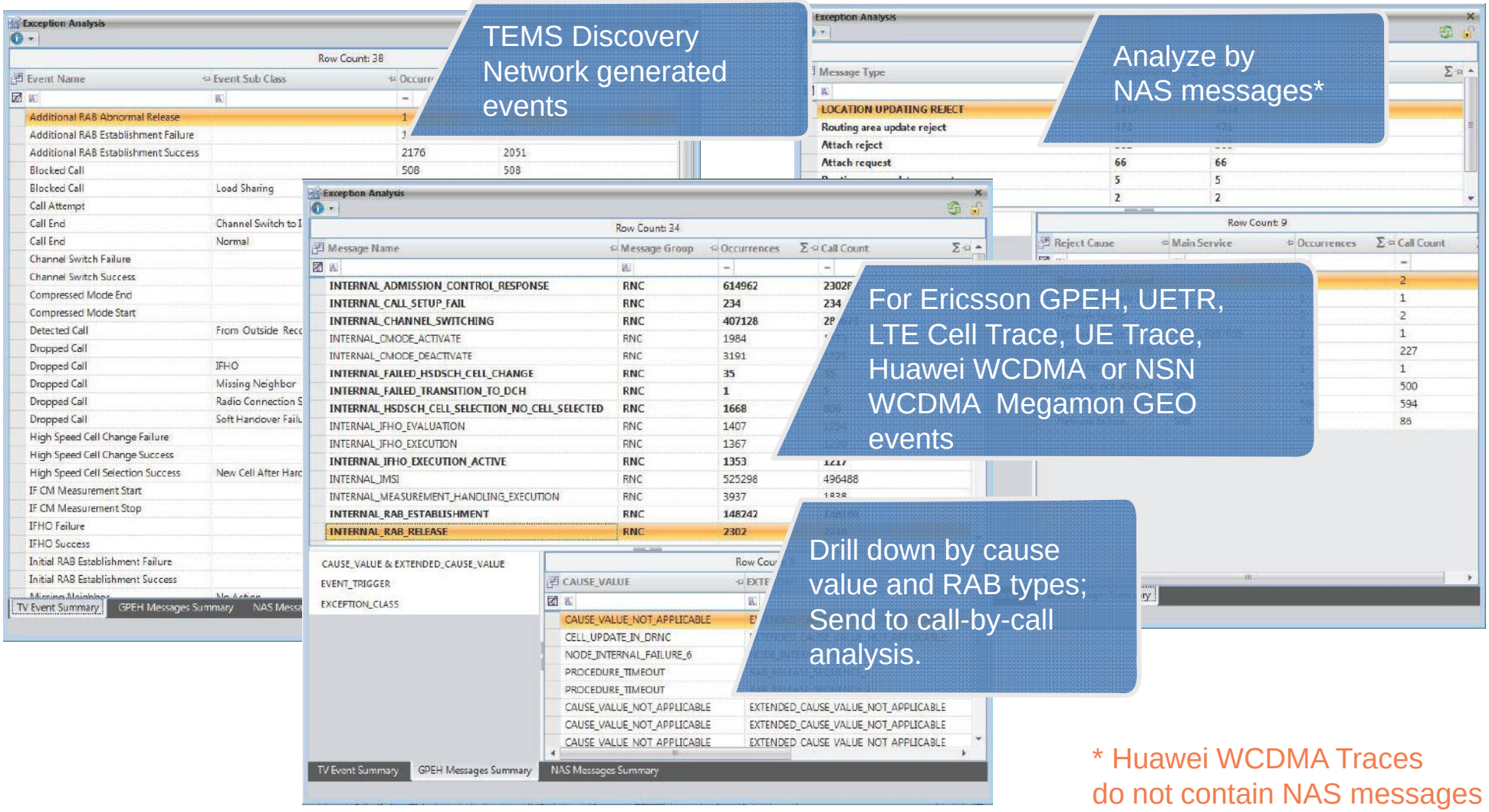
Grid shows KPI breakdown for all IMSIs in selected group


Network Performance Problem
Existing data sources do not provide enough details or information from real subscribers to allow the root causes of problems to be found.
TEMS Discovery Network Solution
Detailed Investigation
▪ Exception Analysis
▪ Call-by-Call Analysis
▪ RF Charts

EXCEPTION ANALYSIS (1 OF 2)

- **Summary of all events in primary databases**
  - Analyze exception events – examples:
    - System release events
    - NAS failure messages
    - System block events
    - Channel switching failures
  - Drill down to determine if problems are for specific:
    - RAB types
    - Exception classes or cause values
    - Mobile phones or mobile types
  - Send to call analysis feature for detailed analysis

EXCEPTION ANALYSIS (2 OF 2)

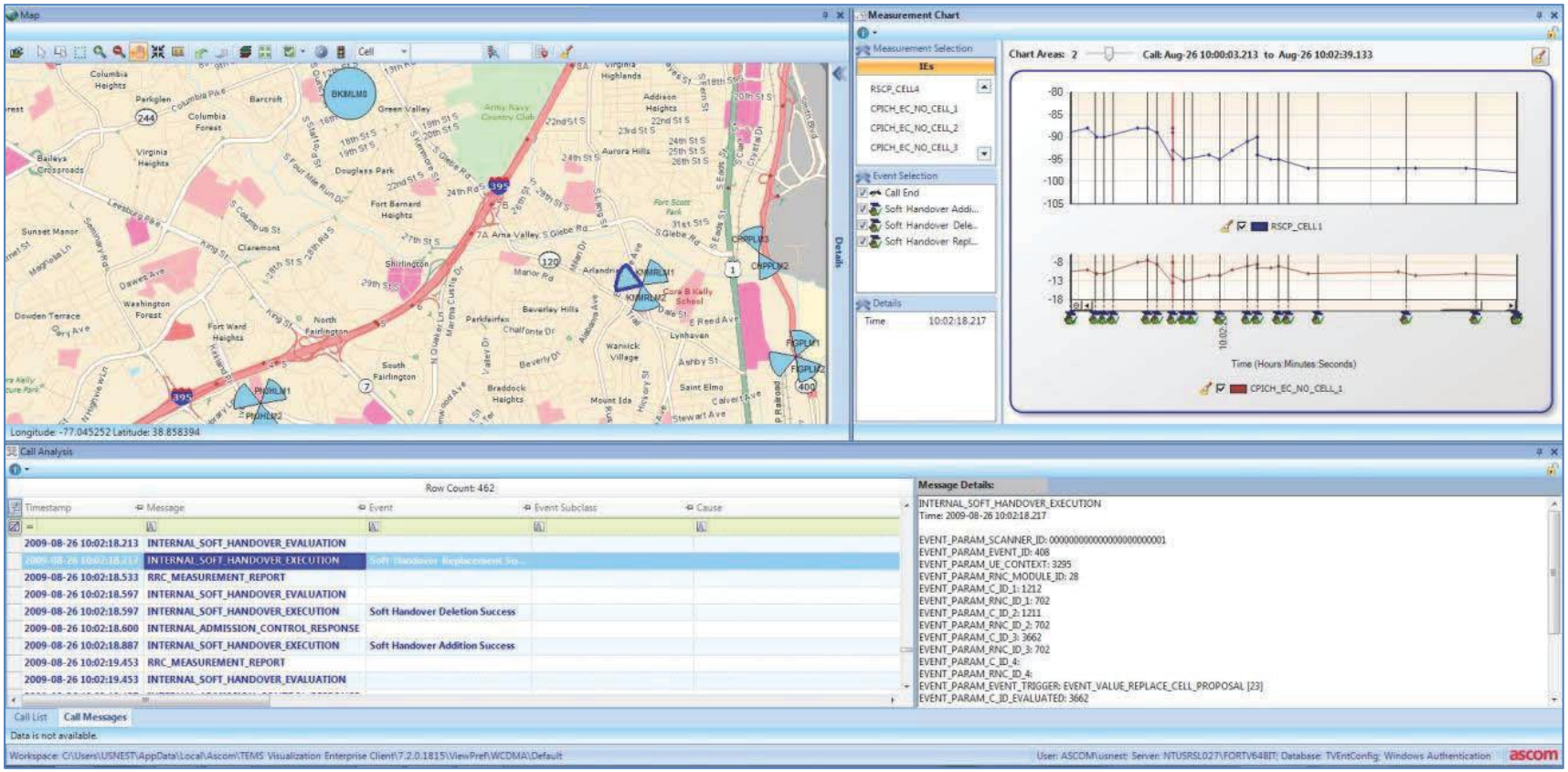


* Huawei WCDMA Traces do not contain NAS messages

CALL-BY-CALL ANALYSIS (1 OF 2)

- Direct drilldown from many other features or result of search for specific calls
- Find patterns in calls and the sources of problems
  - Same users
  - Same message sequences
- Easy-to-use views
  - Call List view gives summary of call-level information
  - Call Messages view allows calls to be followed message by message
  - Measurement view shows timeline of radio quality measurements, data throughput, and events
  - Details view shows full information for individual messages

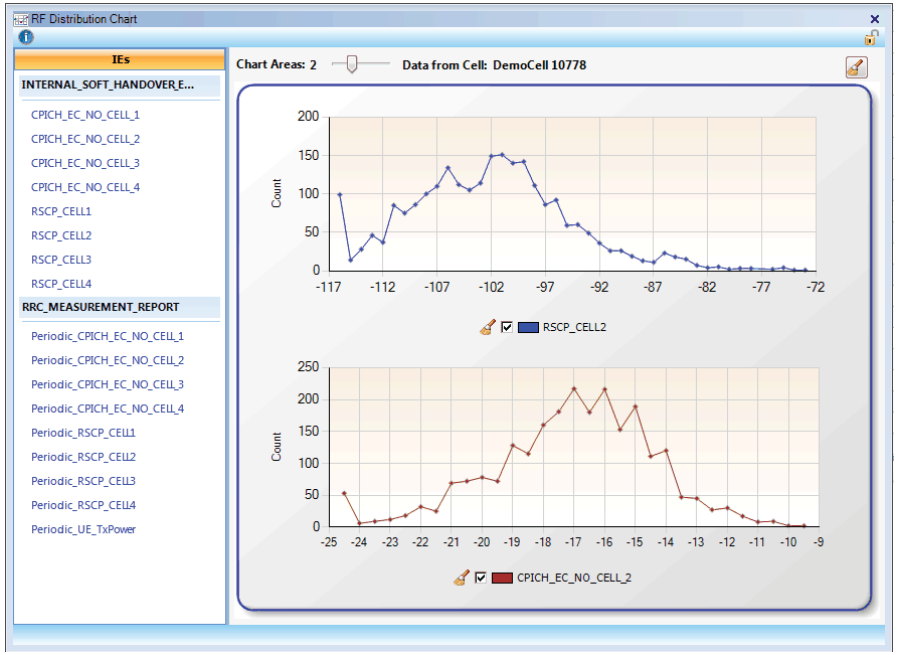
CALL-BY-CALL ANALYSIS (2 OF 2)



RF CHARTS – WCDMA

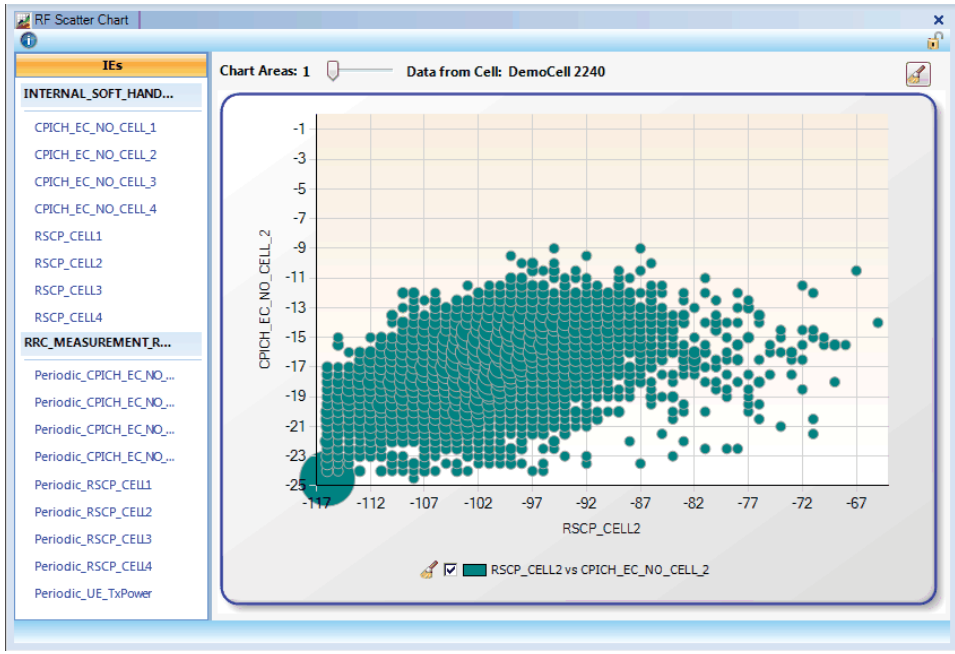
FOR RADIO MEASUREMENT PERFORMANCE EVALUATION

Distribution Chart



- For showing distribution of RF measurements
- Periodic (MRR-W) or from soft handover evaluation

Scatter Chart



- For showing relationship between RF measurements
- Size of bubble shows count of pairs of values
- Periodic (MRR-W) or from soft handover evaluation

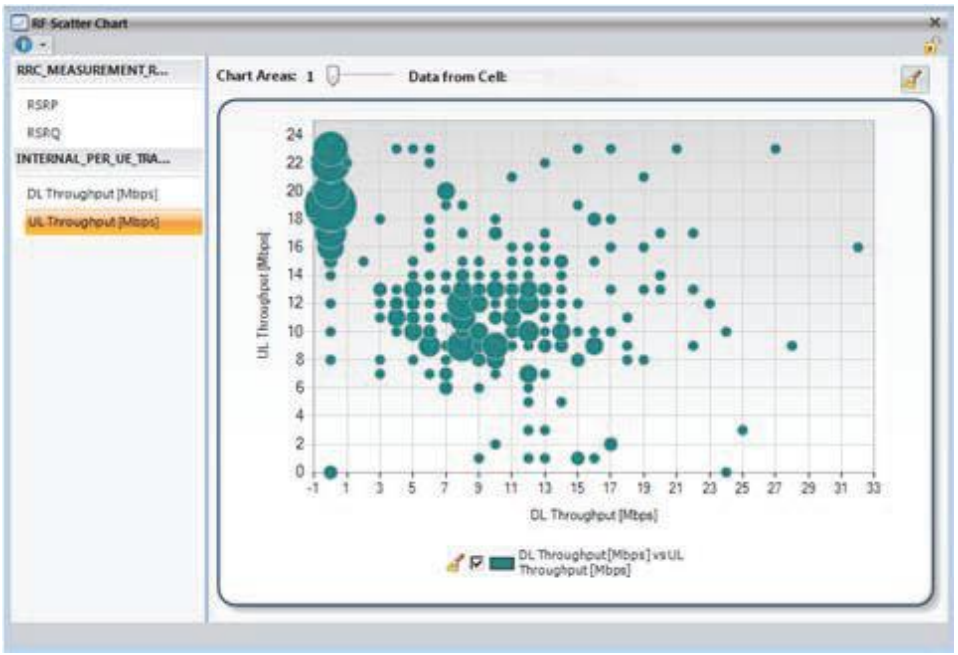
RF CHARTS – LTE

FOR RADIO AND THROUGHPUT PERFORMANCE EVALUATION

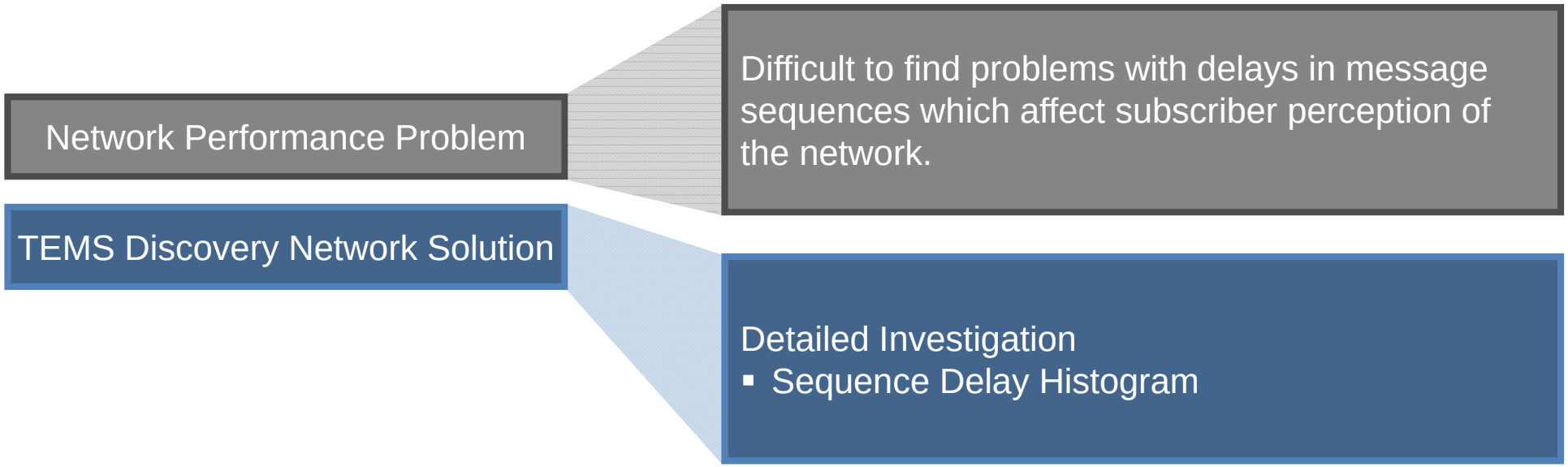
Distribution Chart

- For showing distribution of RF measurements
- Includes throughput measurements

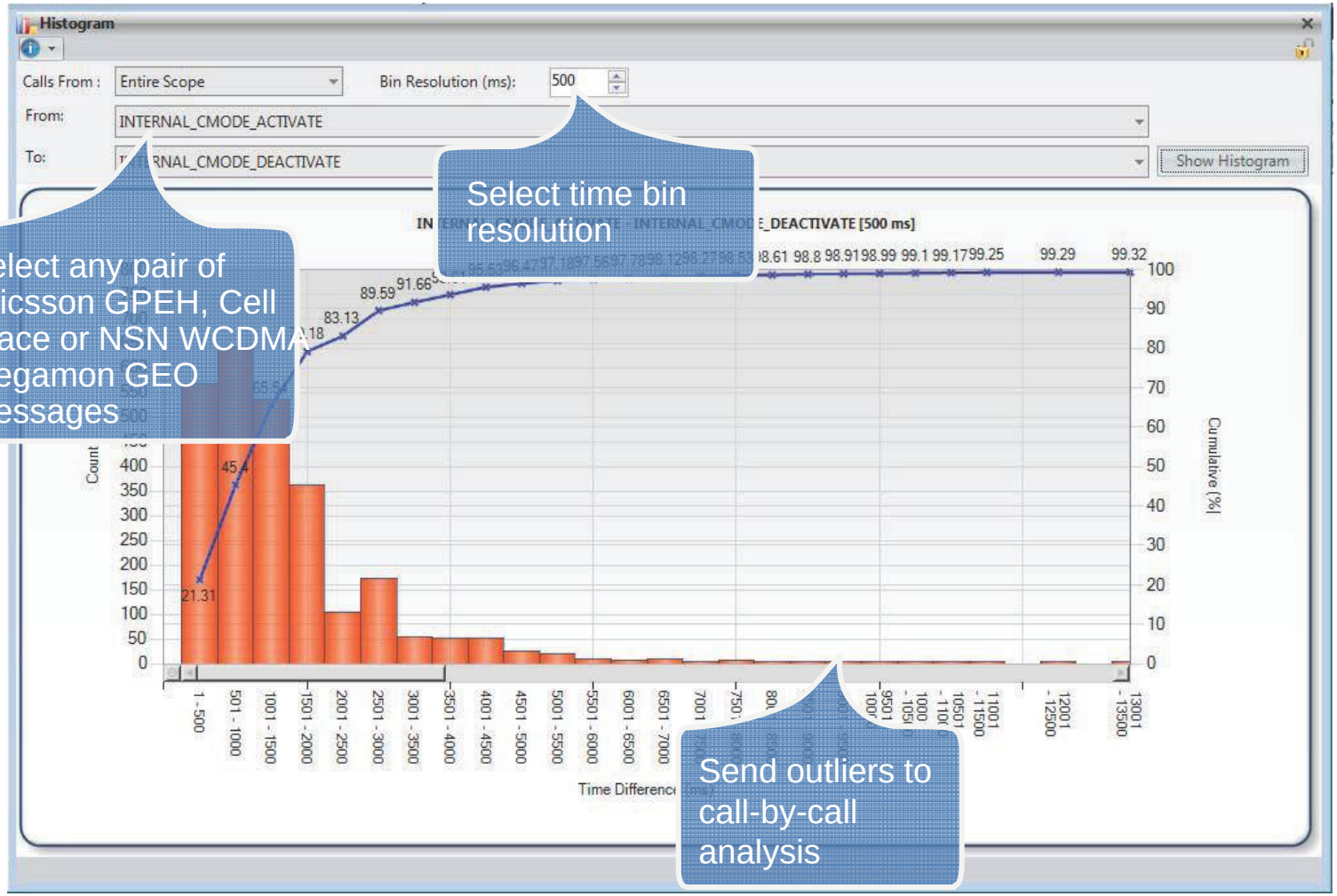
Scatter Chart



- For showing relationship between RF measurements
- Size of bubble shows count of pairs of values
- Includes throughput measurements


Network Performance Problem
Difficult to find problems with delays in message sequences which affect subscriber perception of the network.
TEMS Discovery Network Solution
Detailed Investigation
▪ Sequence Delay Histogram

SEQUENCE DELAY HISTOGRAM



REPORTING AND AUTOMATED SUBSCRIPTIONS

- Reports in Excel, PDF, or Word – Client triggered (also automated subscription managed by server administrator in TEMS Discovery Enterprise - Network)
- Currently available for Ericsson WCDMA GPEH, Huawei WCDMA, Ericsson LTE Cell Trace and Ericsson UETR/MTR formats
- Available Report Templates:
  - Performance Summary Report (Ericsson GPEH and Huawei WCDMA)
  - Cell Performance Report (Ericsson GPEH)
  - Executive Report (Enterprise Only, click-through interactive for GPEH)
  - Subscriber Trace Report (UETR + MTR trace formats currently)
  - CSFB Performance Report (via LTE Cell Trace + WCDMA GPEH combined project analysis)
- Built on SQL Server Reporting Services platform
- Automated, scheduled reports delivered by email (Enterprise – Network only)
- Ad-hoc generation of reports at client for selected project and scope

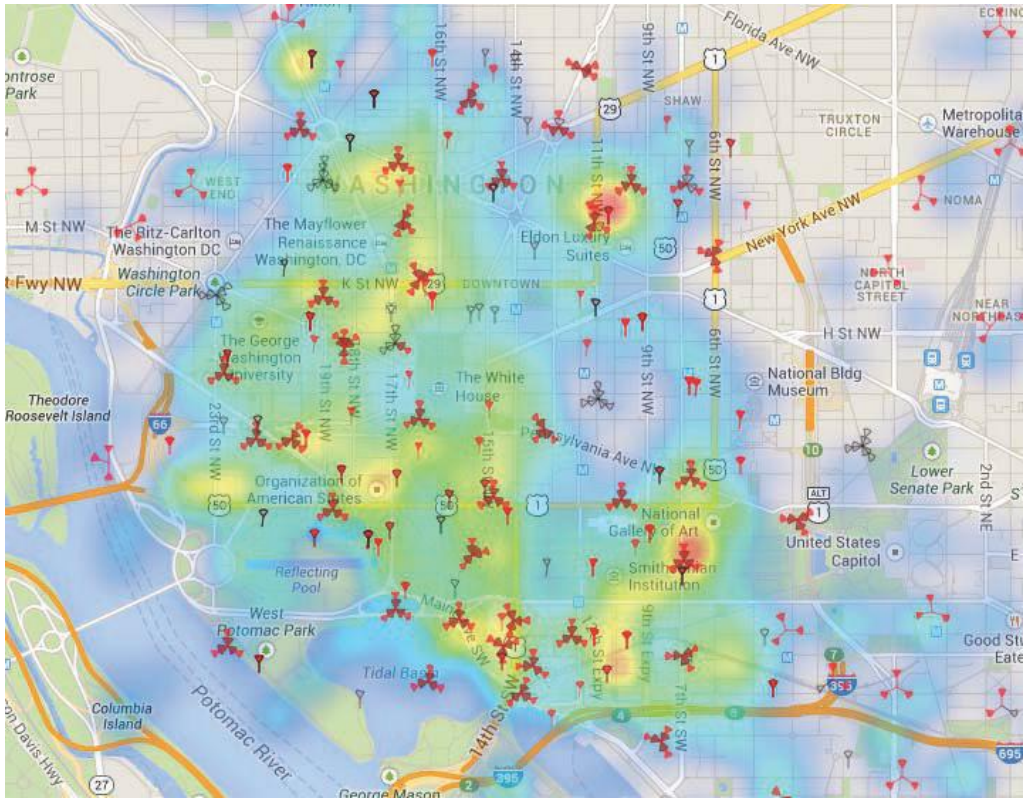
[ ]

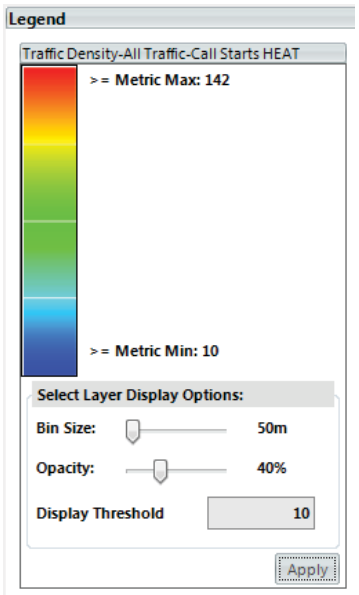
GEO-ANALYSIS BASED ON GOOGLE MAPS

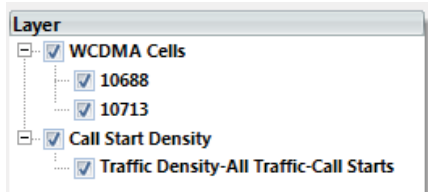
(Currently available in Ericsson GPEH and Huawei WCDMA modules)

GEO MAPS EXAMPLE: TRAFFIC DENSITY

- Heat maps, Binned Maps, Create Custom KPIs, Map Filtered Selection
- Traffic Density (Hot Spots), RSCP, EcIo filtered by Events, Selection

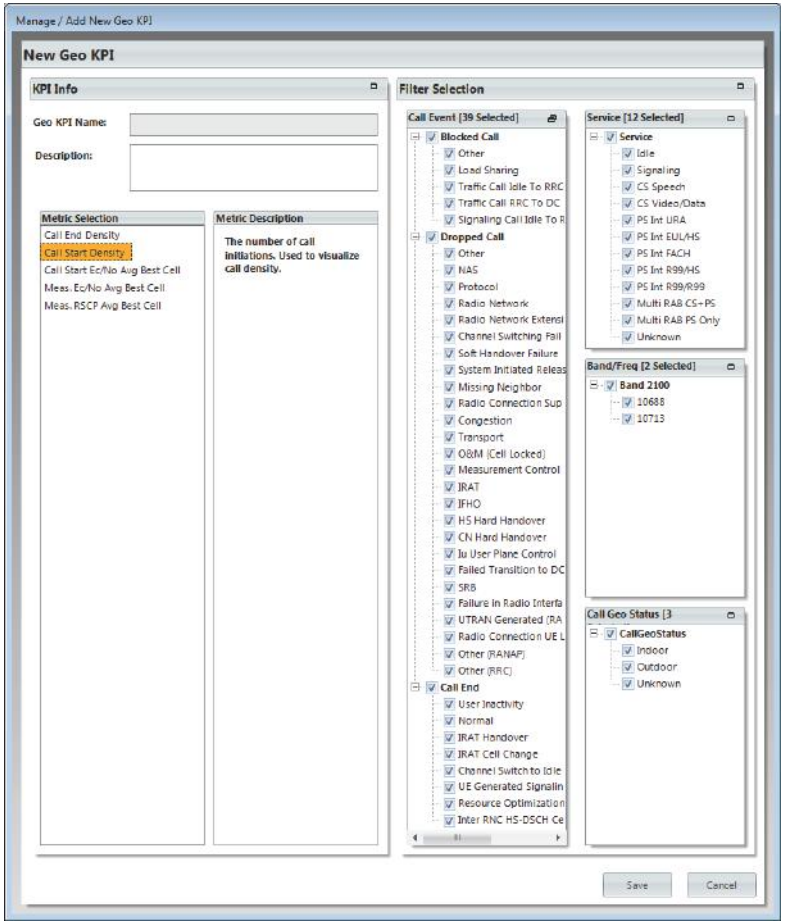


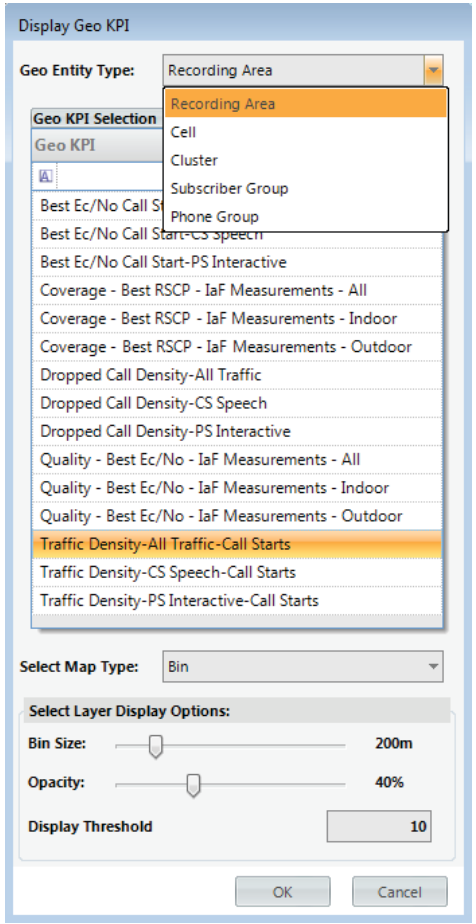




GEO MAPS: USER-DEFINED GEO KPI CREATION

- Select Metric and Filters: Service, Band/ Frequency, Call End Type





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ERICSSON WCDMA GPEH MODULE FEATURES

(Includes some features for Huawei WCDMA)

PERFORMANCE SUMMARY REPORT (1 OF 1)

Report available for Ericsson GPEH & Huawei WCDMA

Performance Summary Report

Report Time: 9/8/2011 4:12:48 PM
Reporting Period: 08/22/2011 ~ 08/22/2011
Project: Demo
Description: Demo

Table of Contents

Retainability Reports

- Worst Cells on Dropped Calls
- Dropped Calls Analyzer (for Top 3 Cells with Worst Dropped Calls)
- All Dropped Calls – Summary by SubClass/End RAB
- Worst Subscribers on Dropped Calls
- Worst Phone Models on Dropped Calls

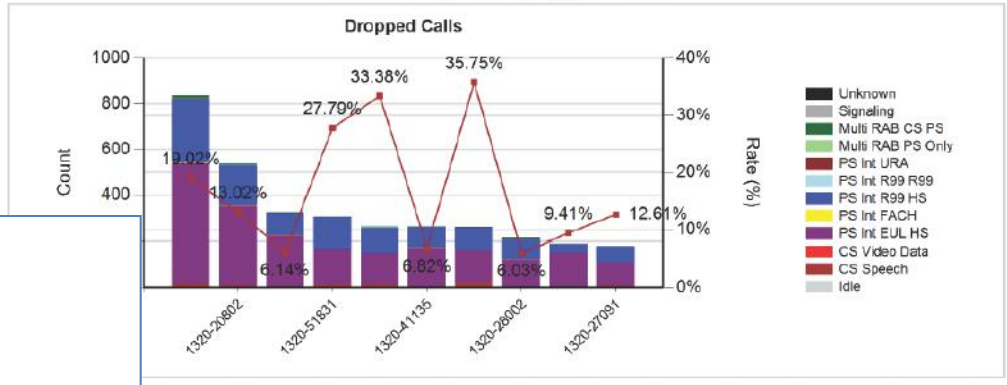
Accessibility Reports

- Worst Cells on RRC Connection Blocks
- Worst Cells on Initial RAB Establishment Blocks
- Worst Subscribers on Initial RAB Establishment Blocks
- Worst Phone Models on Initial RAB Establishment Blocks

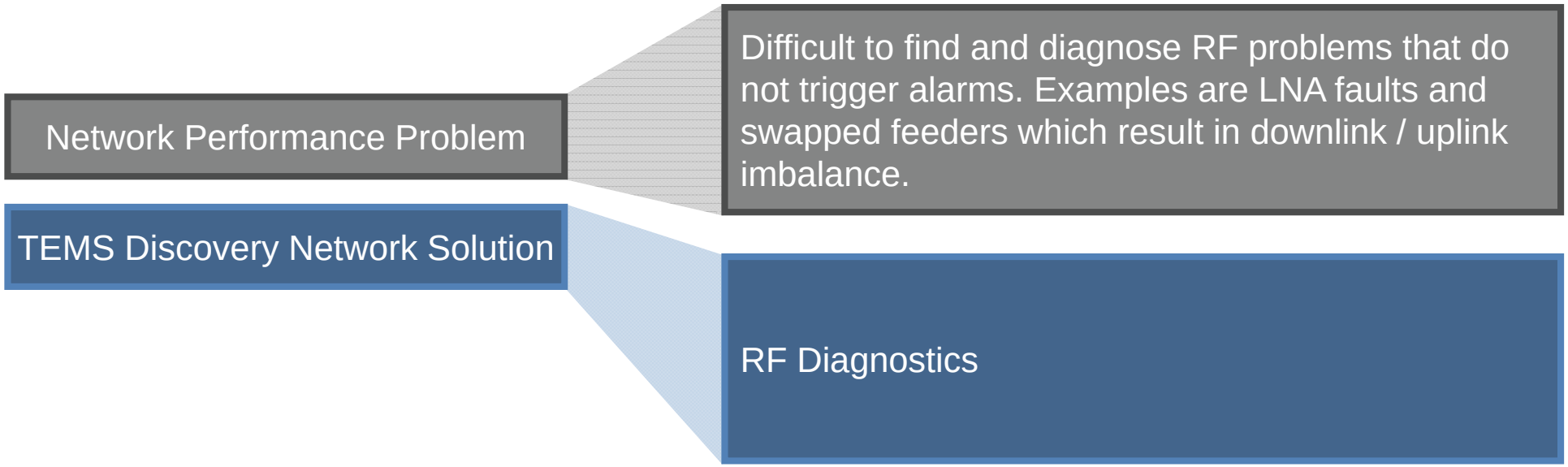
Capacity Reports

- Worst Cells on Peak UL Channel Element Consumption (%)
- Worst Cells on Peak DL Channel Element Consumption (%)
- Worst Cells on Peak UL Interference (dBm)
- Worst Cells on Peak Non-HS DL Power Consumption (%)

Worst Cells on Dropped Calls



...ed s	Dropped Calls (%)	CS Video Data	CS Speech	Idle	PS Int EUL HS	PS Int FACH	PS Int R99 HS	PS Int R99 R99	PS Int URA	Multi RAB CS + PS	Multi RAB PS Only	Signaling	Unknown
...5	19.02%	0	16	0	523	3	281	0	1	11	1	0	0
...0	13.02%	0	9	0	343	2	178	1	1	3	1	0	0
...5	6.14%	0	4	0	221	1	96	0	0	3	0	0	0
...5	27.79%	0	12	0	153	0	139	2	0	0	0	0	0
...0	33.38%	0	14	0	137	0	106	0	0	3	3	0	0
...2	6.82%	0	2	0	174	1	83	0	0	2	0	0	0
...1	35.75%	0	23	0	140	0	96	0	0	2	0	0	0
...5	6.03%	0	1	0	121	1	86	1	2	4	0	0	0
...0	9.41%	0	0	0	153	0	36	0	0	0	0	0	0
...0	12.61%	0	8	0	102	0	68	0	0	2	0	0	0


Network Performance Problem
Difficult to find and diagnose RF problems that do not trigger alarms. Examples are LNA faults and swapped feeders which result in downlink / uplink imbalance.
TEMS Discovery Network Solution
RF Diagnostics

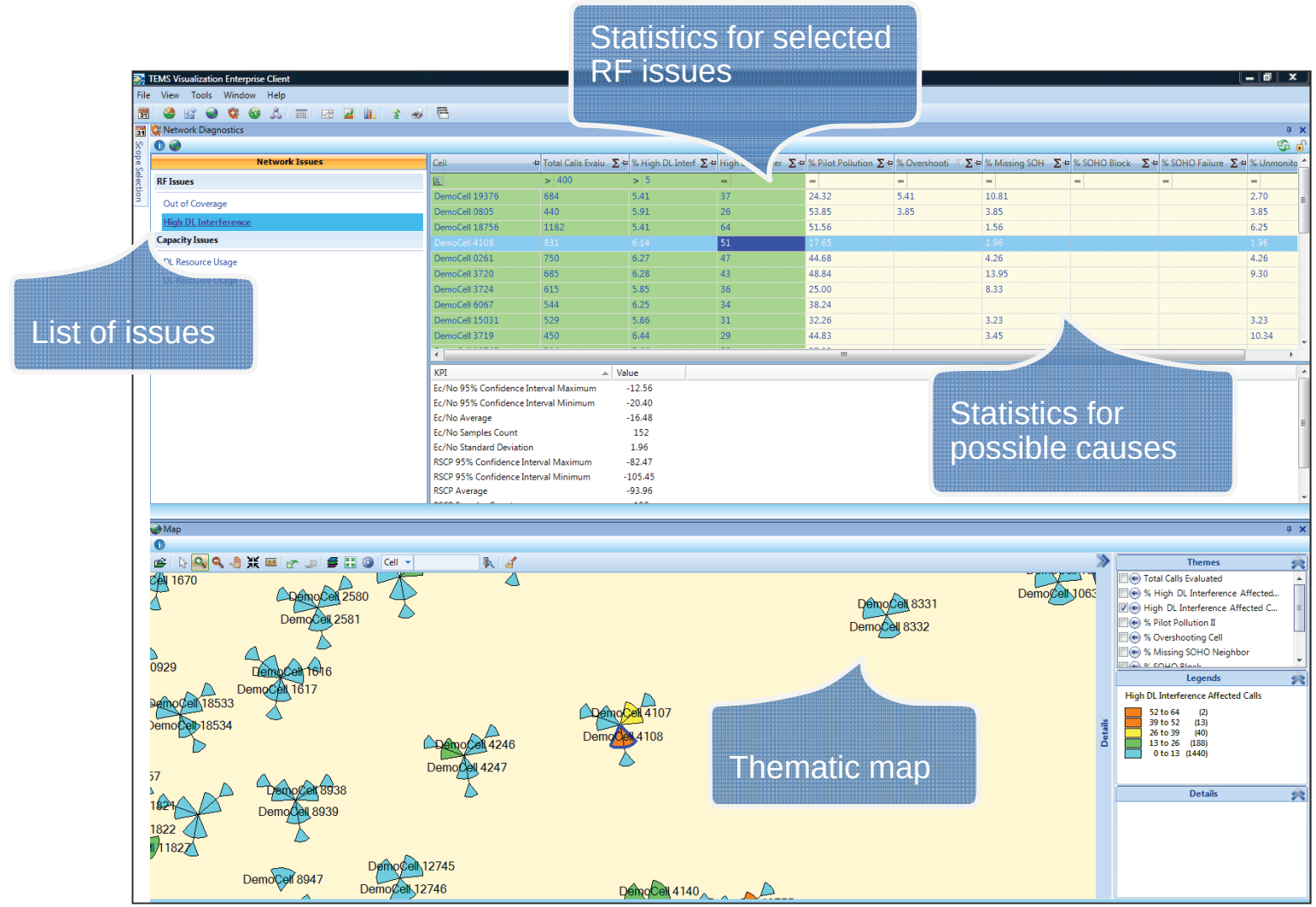
RF DIAGNOSTICS* (1 OF 2)

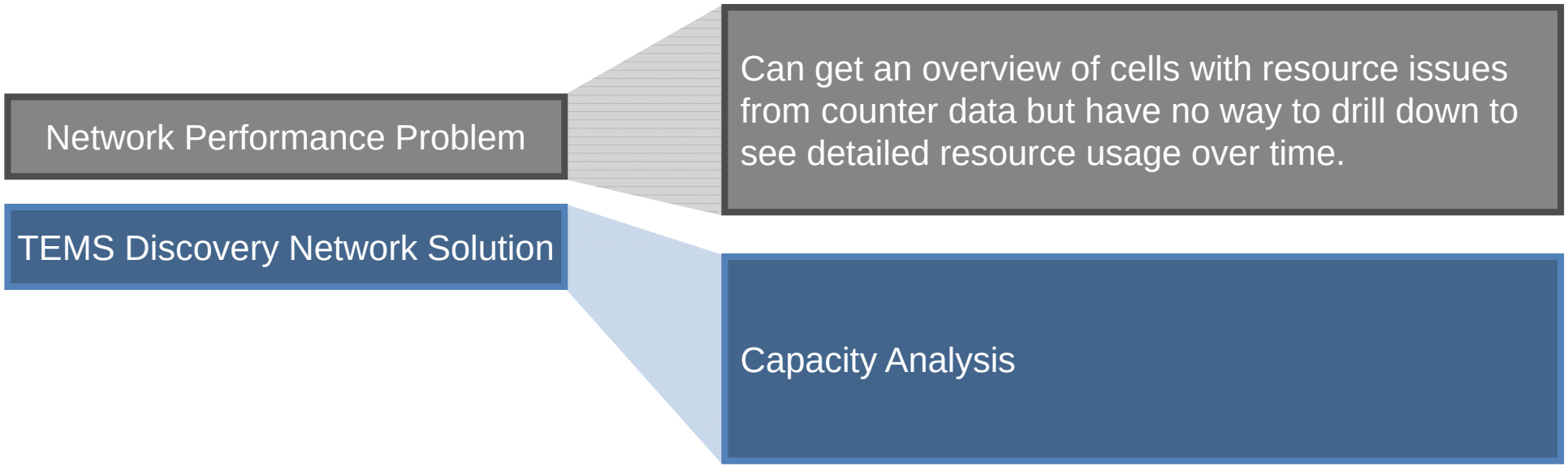
- Cells with RF issues are automatically identified
- For each cell, the number of calls affected by each RF issue is calculated:
  - Out of coverage
  - High DL interference
  - High UL interference
  - UL/DL imbalance
- Possible causes for each RF issue are also evaluated

- Assists with identifying site installation issues, parameter-setting problems, broken equipment, cells covering too far, and handover issues
- Sends affected calls to call analysis for more-detailed investigations

* *Requires the OSS-RC feature MRR-W.*

RF DIAGNOSTICS (2 OF 2)




Network Performance Problem
TEMS Discovery Network Solution
Can get an overview of cells with resource issues from counter data but have no way to drill down to see detailed resource usage over time.
Capacity Analysis

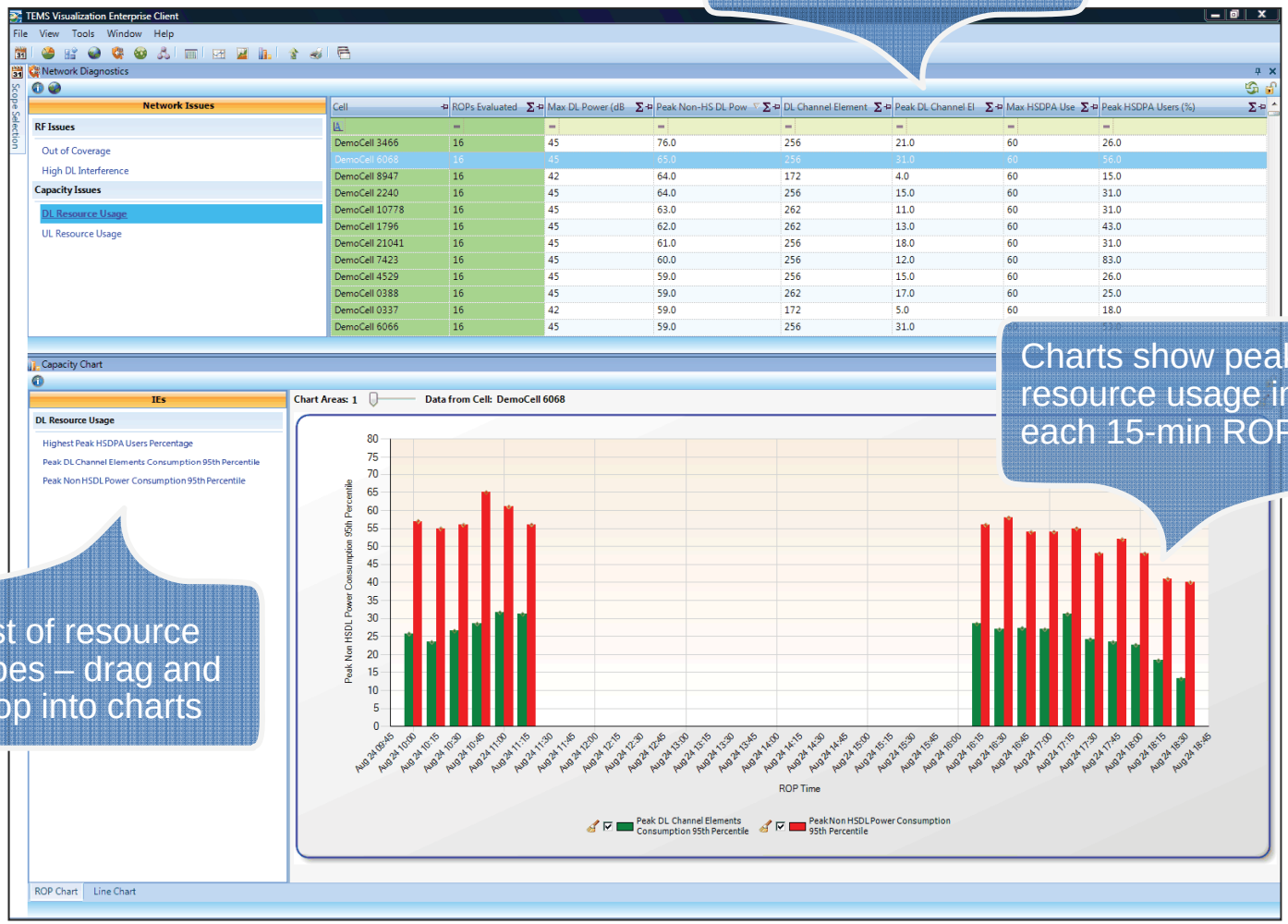
CAPACITY ANALYSIS (1 OF 3)

- Cells with resource issues are automatically identified
- For each cell, peak values are calculated for critical resource types
- Downlink resource types:
  - DL power
  - DL channel elements (hardware)
  - Number of HSDPA users
- Uplink resource types:
  - UL interference
  - UL channel elements (hardware)
  - Number of EUL users
- Drilldown into detailed charts with very high resolution

Note: Capacity analysis available for Ericsson GPEH & Huawei WCDMA

CAPACITY ANALYSIS (2 OF 3)

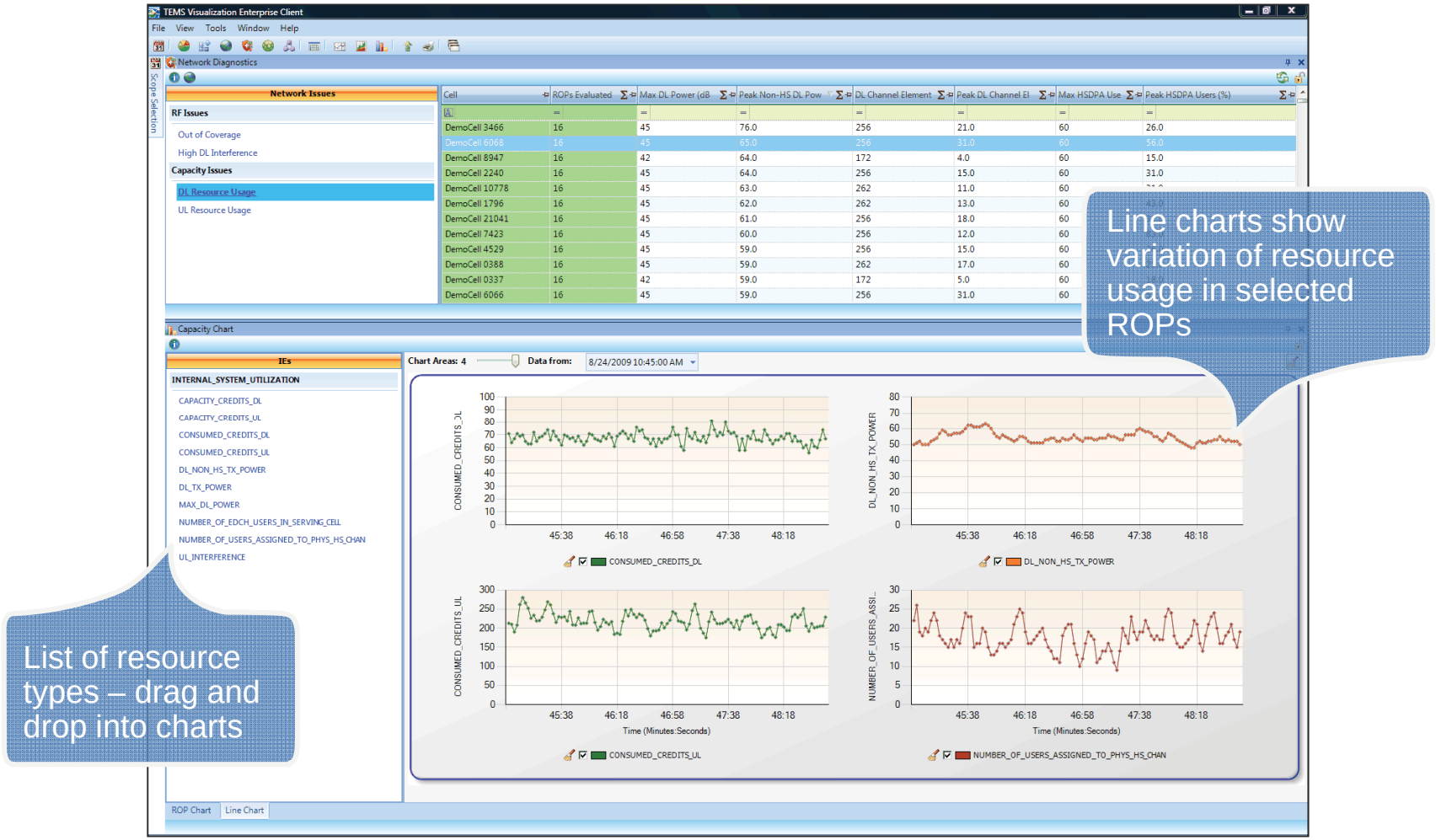
Peak resource usage for each cell during entire scope

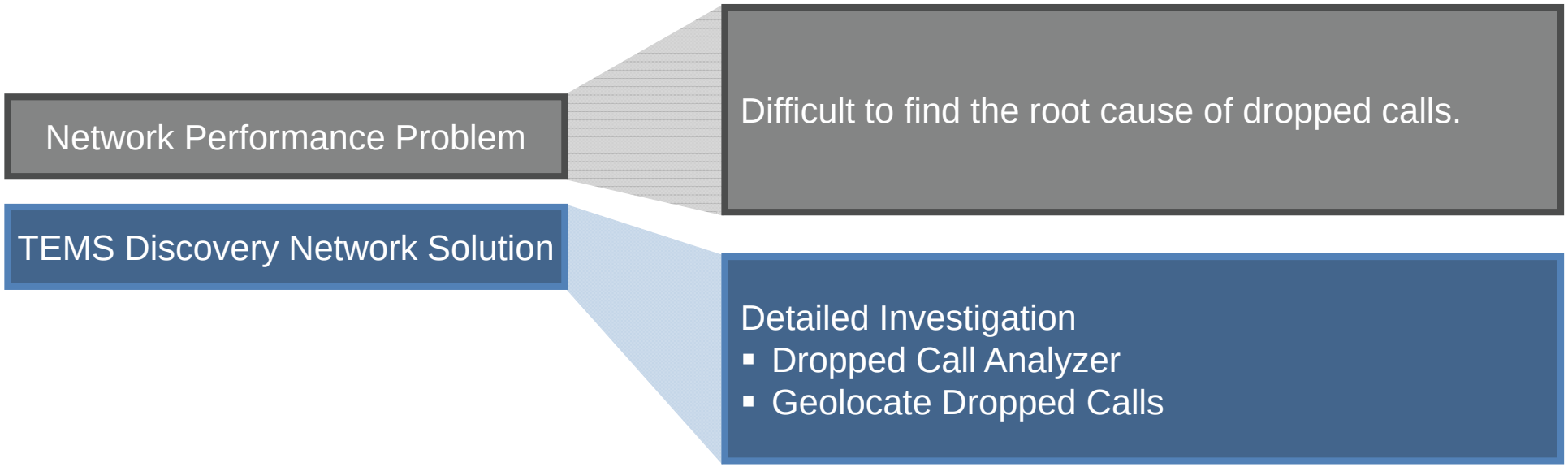


Charts show peak resource usage in each 15-min ROP

List of resource types – drag and drop into charts

CAPACITY ANALYSIS (3 OF 3)

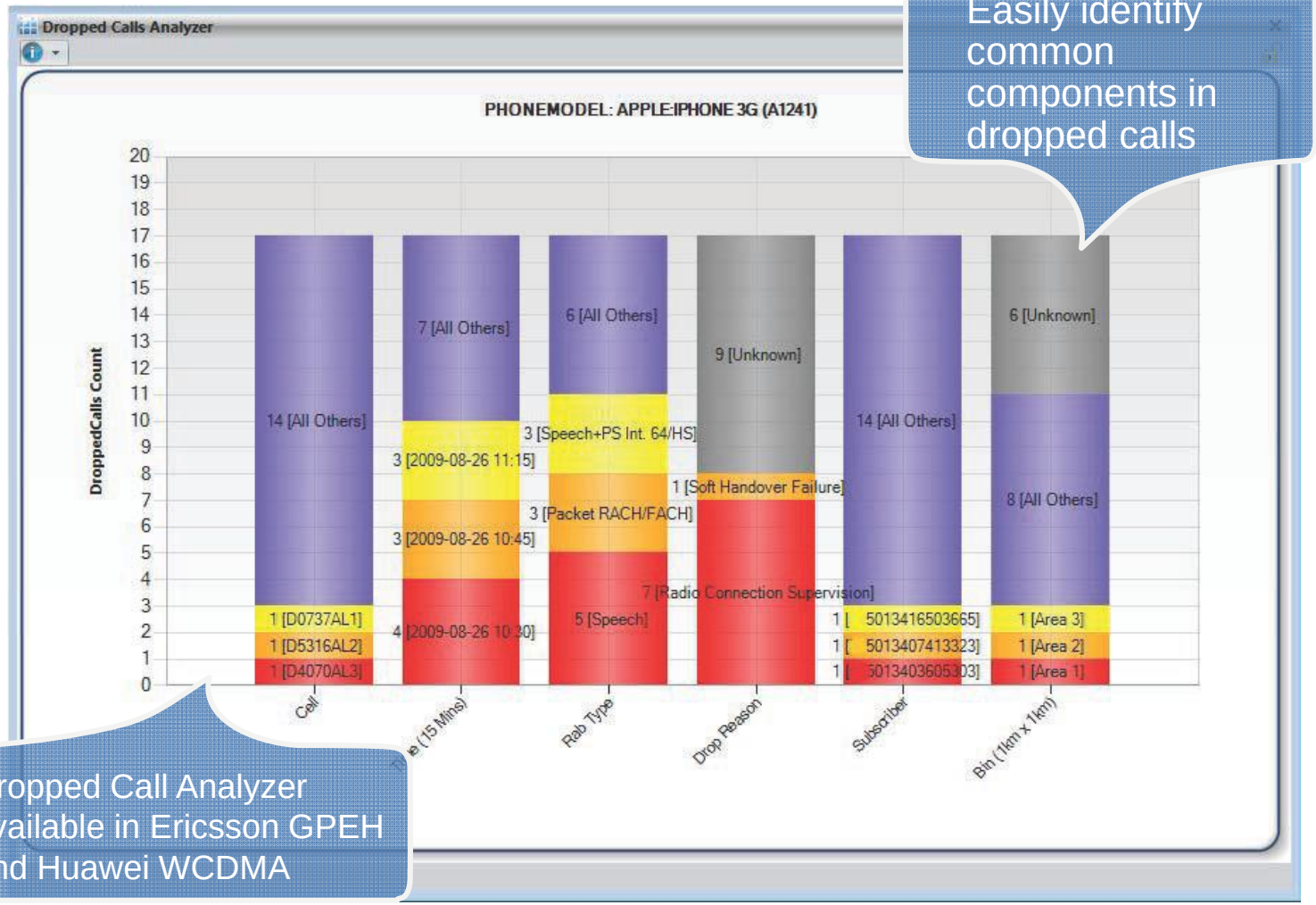



Network Performance Problem
Difficult to find the root cause of dropped calls.
TEMS Discovery Network Solution
Detailed Investigation
Dropped Call Analyzer
Geolocate Dropped Calls

DROPPED CALL ANALYZER (1 OF 2)

- Investigate cells or phone models with a high number of dropped calls
- Efficiently identify common components for the dropped calls. Are all the drops actually for the same?…
  - Cell (when investigating dropped calls per phone model)
  - Subscriber
  - Phone model or IMEI-TAC (when investigating dropped calls per cell)
  - Time period
  - Drop reason
  - RAB type
  - Location (1km by 1km grids)
- Drill down directly for a selected component
  - Geolocate dropped calls
  - Send to call-by-call analysis

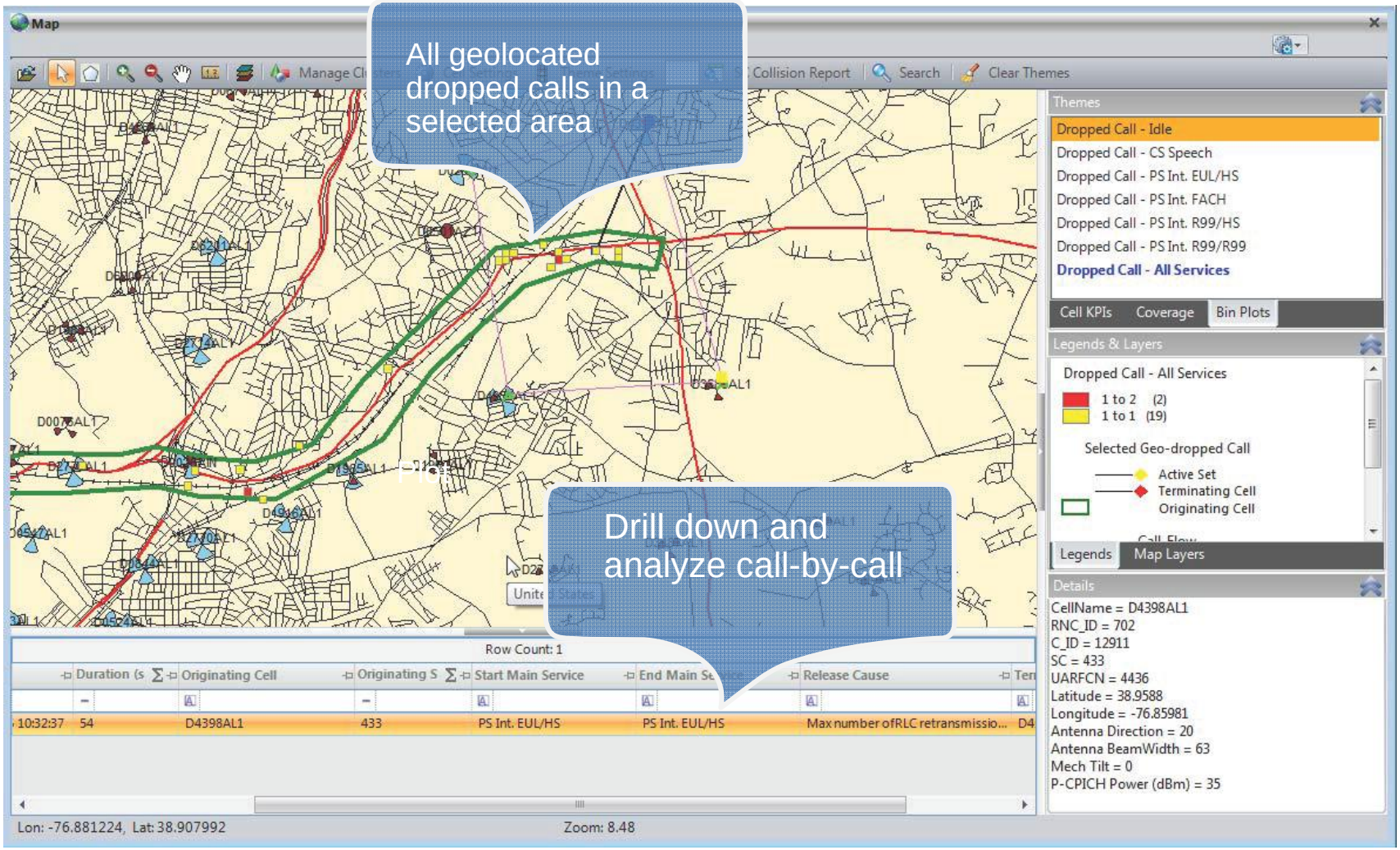
DROPPED CALL ANALYZER (2 OF 2)

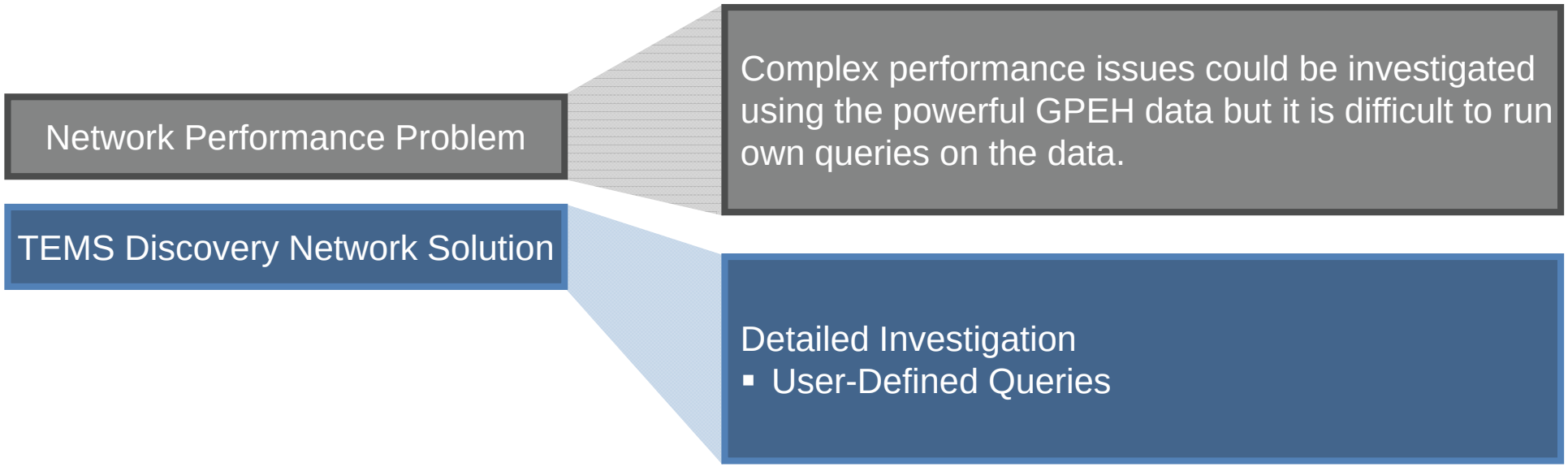


Easily identify common components in dropped calls

Dropped Call Analyzer available in Ericsson GPEH and Huawei WCDMA

GEOLOCATION – VIRTUAL DRIVE TESTS

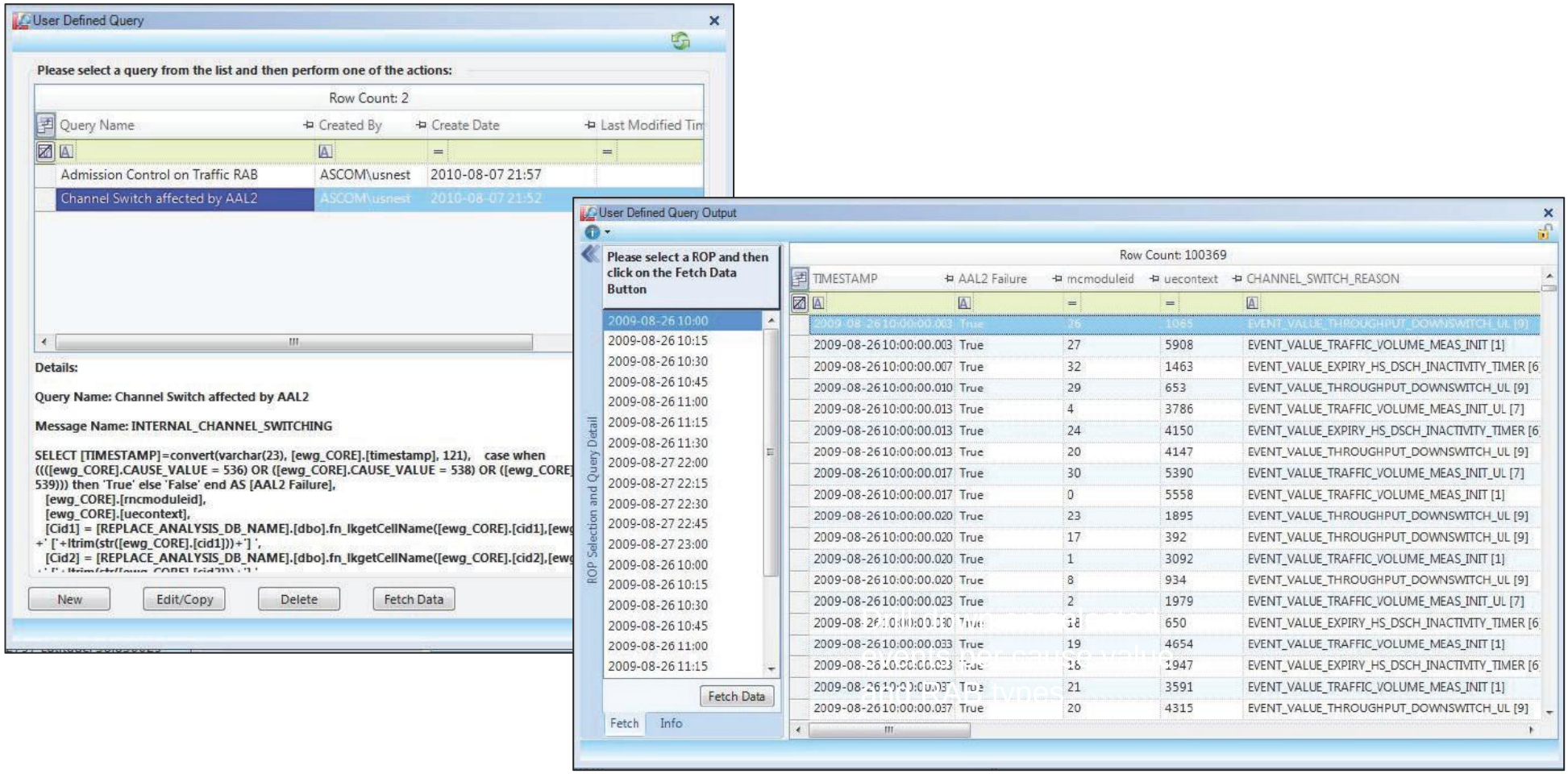


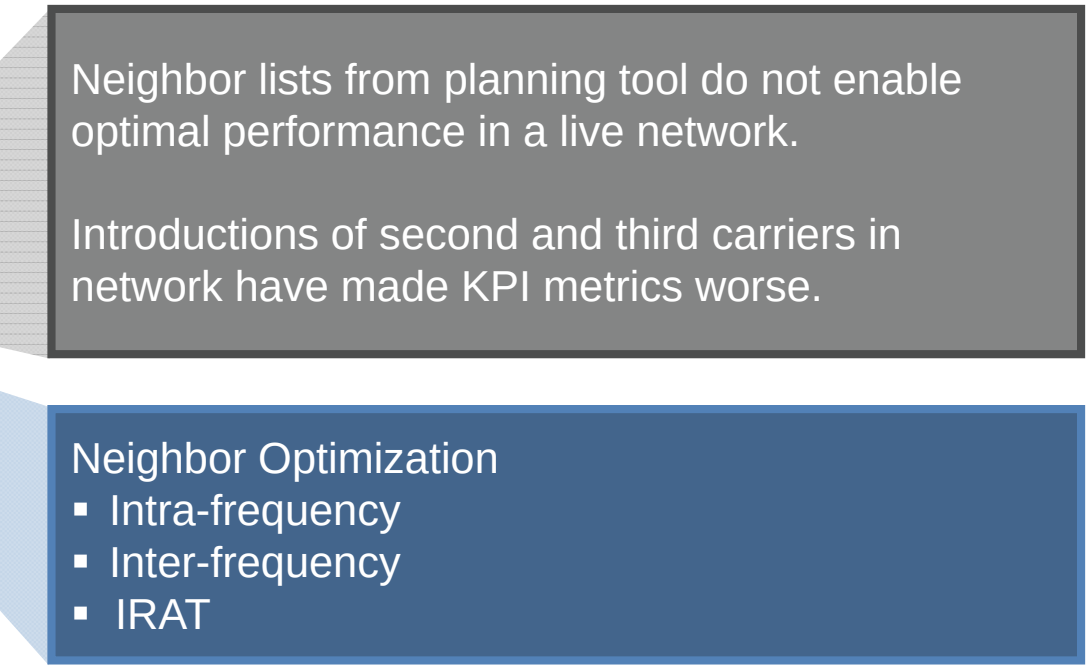

Network Performance Problem
Complex performance issues could be investigated using the powerful GPEH data but it is difficult to run own queries on the data.
TEMS Discovery Network Solution
Detailed Investigation
▪ User-Defined Queries

USER-DEFINED QUERIES (1 OF 2)

- **Create your own queries on raw GPEH events**
  - Query raw data for all occurrences of any decoded GPEH event
  - For each occurrence, determine if expressions are true or false – based on any set of conditions on the information elements
  - Associate call-level information with each occurrence of the GPEH event (IMSI, IMEI-TAC, duration, current cell, etc.)
  - Queries are stored on server and can be shared with other users
  - Examples:
    - All abnormal releases of traffic RABs due to issues related to SOHO
    - All channel switching failures caused by lack of transmission resources
    - All RRC connection requests in a cell with Ec/No < -10 dB

USER-DEFINED QUERIES (2 OF 2)

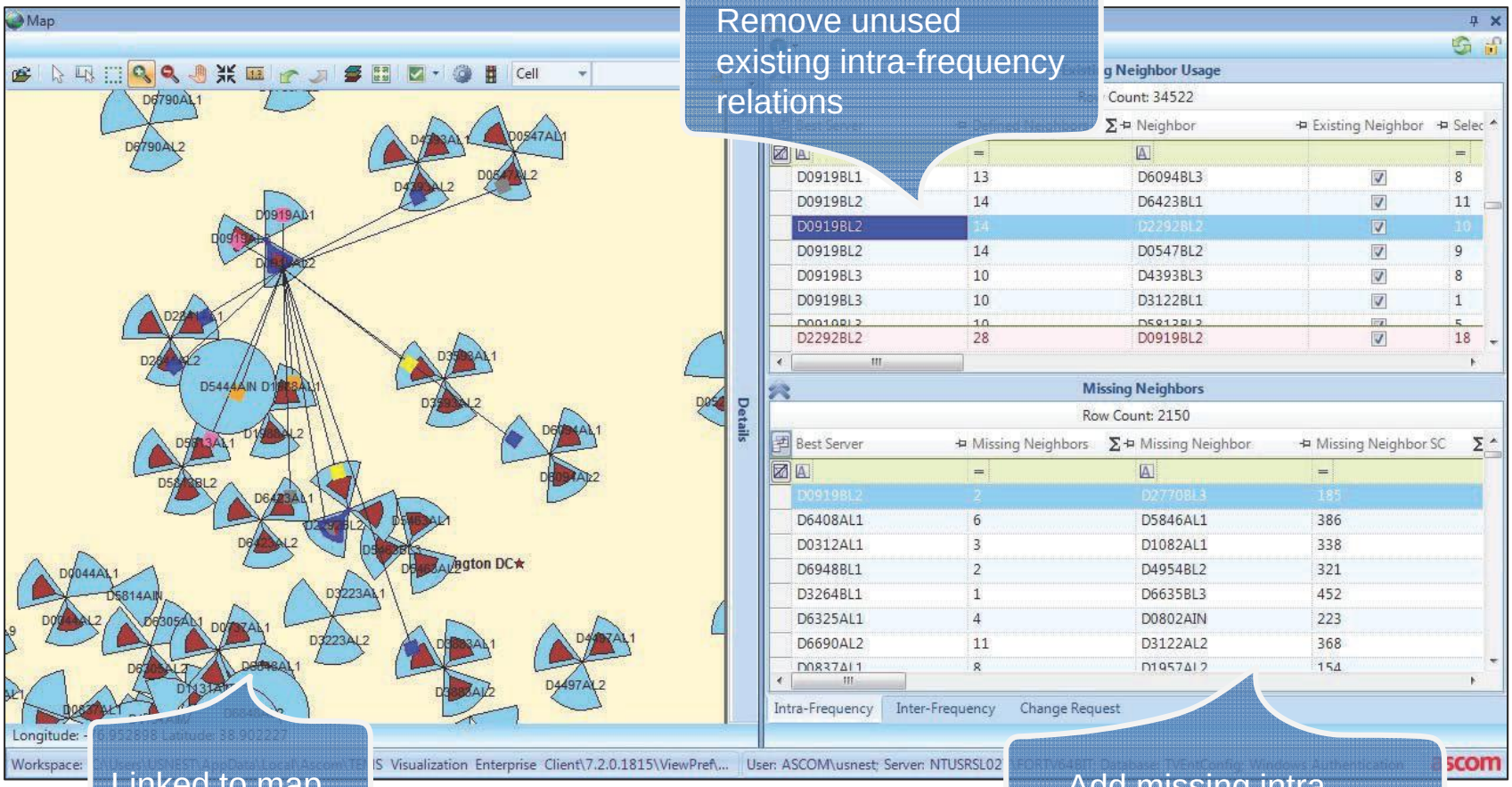



Network Performance Problem
Neighbor lists from planning tool do not enable optimal performance in a live network.
Introductions of second and third carriers in network have made KPI metrics worse.
TEMS Discovery Network Solution
Neighbor Optimization
Intra-frequency
Inter-frequency
IRAT

INTRA-FREQUENCY NEIGHBOR OPTIMIZATION (1 OF 2)

- Optimizing the WCDMA neighbor plan is a central optimization activity that is done using live traffic in TEMS Discovery Network.
  - Existing neighbors section
    - Statistics on existing neighbor usage and unmonitored neighbors
    - Used to delete unused neighbors and optimize selection priority
  - Missing neighbors section
    - Statistics on missing neighbors as reported by mobile phones
    - Used to add missing neighbor relations
  - Statistics for large numbers of busy hours can be accumulated
  - All information is graphically displayed on a map for easy analysis
  - Sends affected calls to call analysis feature if more-detailed investigation is needed

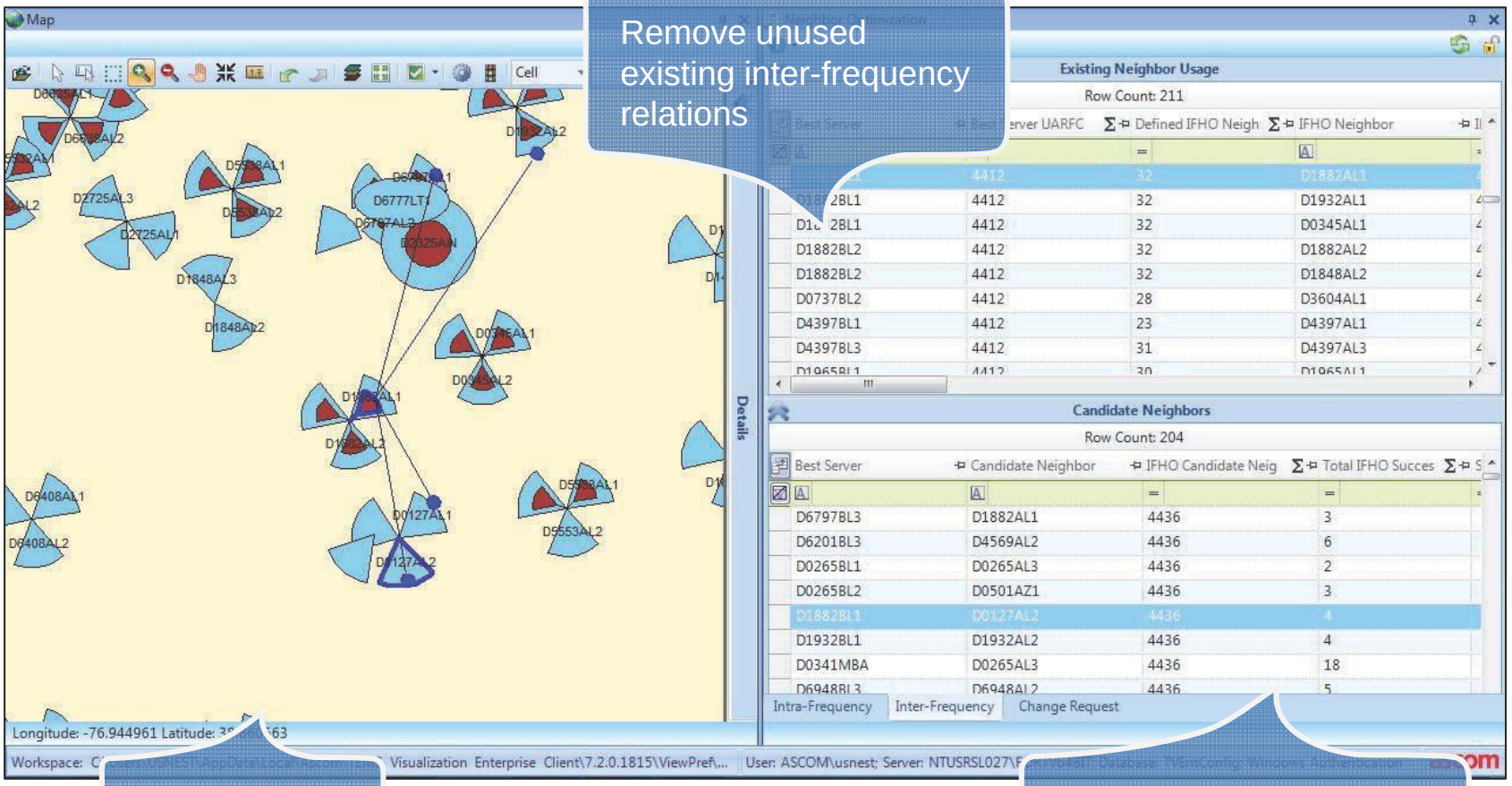
INTRA-FREQUENCY NEIGHBOR OPTIMIZATION (2 OF 2)



INTER-FREQUENCY NEIGHBOR OPTIMIZATION (1 OF 2)

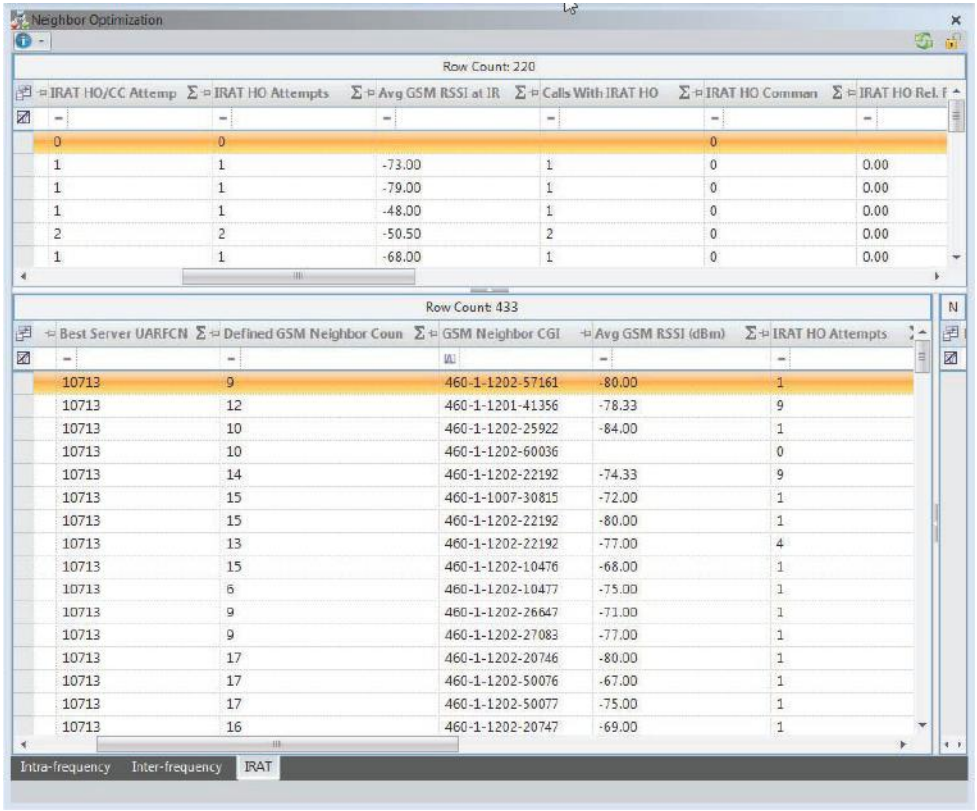
- **Improve second and third carrier performance**
  - Existing neighbors section
    - Statistics on existing IFHO neighbor usage
    - Used to delete unused neighbors and optimize selection priority
  - Candidate neighbors section
    - Algorithm determines if there are missing or down-prioritized IFHO relations
    - Used to add missing neighbor relations or change selection priority
  - All information is graphically displayed on a map for easy analysis
  - Sends affected calls to call analysis feature if more-detailed investigation is needed

INTER-FREQUENCY NEIGHBOR OPTIMIZATION (2 OF 2)



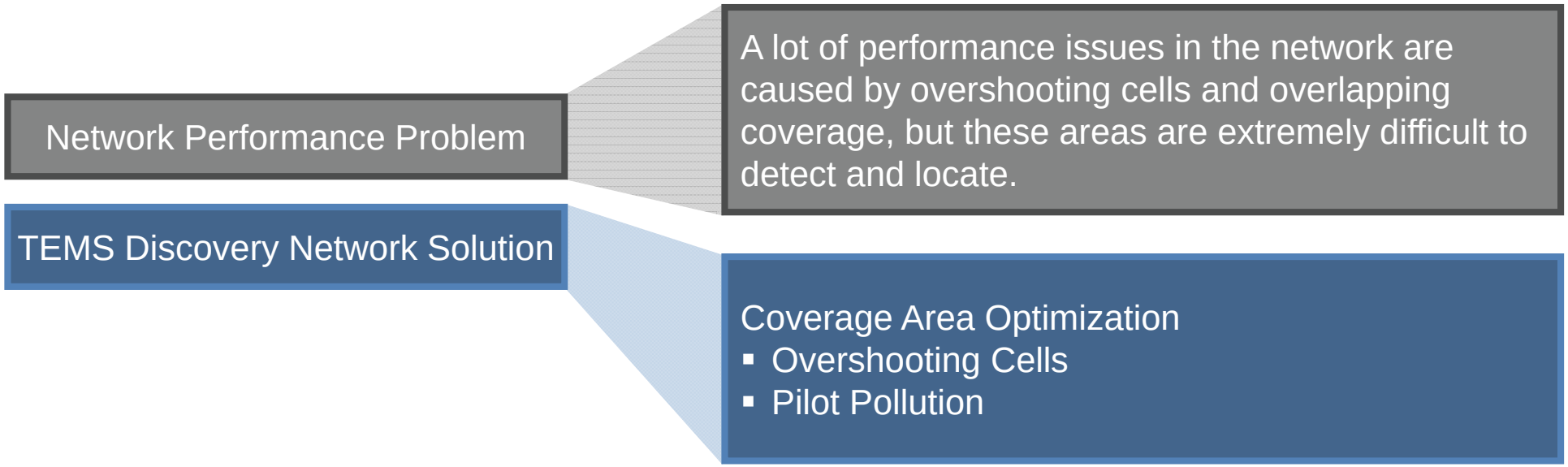
IRAT NEIGHBOR OPTIMIZATION

- **Ensure service continuity across technology border**
  - Identify unused GSM neighbors
  - Identify poorly performing GSM neighbors
  - Identify missing GSM neighbors
  - Geographic representation on map



CHANGE REQUESTS

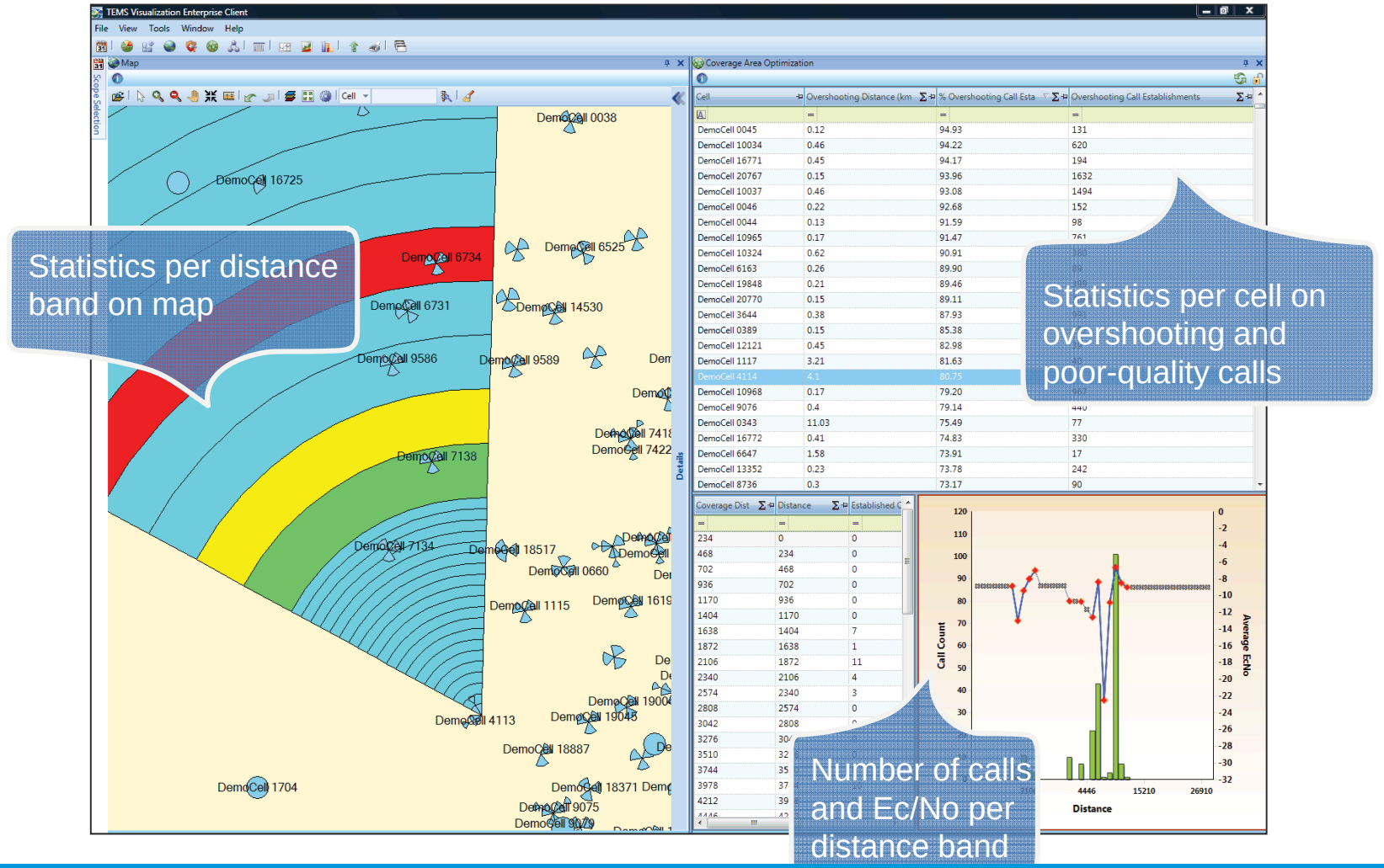
- Collect additions / removals / selection priority changes from other sections
- Generate XML file for direct load into OSS planned area
- Or export to Microsoft Excel for import into other CM tools


Network Performance Problem
A lot of performance issues in the network are caused by overshooting cells and overlapping coverage, but these areas are extremely difficult to detect and locate.
TEMS Discovery Network Solution
Coverage Area Optimization
Overshooting Cells
Pilot Pollution

OVERSHOOTING CELLS (1 OF 2)

- Automatically identifies overshooting cells and helps decide if down-tilt is needed
  - For each cell an estimated overshooting cell distance is calculated
  - For each cell the following statistics are calculated:
    - Number and percentage of overshooting calls – those established farther from the base station than the overshooting cell distance
    - Number and percentage of calls established with poor quality
  - Results are presented on maps and in charts for easy analysis
  - Use together with missing neighbor feature – down-tilt may be needed instead
  - Note: Overshooting Cell Analysis also available in Ericsson LTE Cell Trace and Huawei WCDMA module

OVERSHOOTING CELLS (2 OF 2)

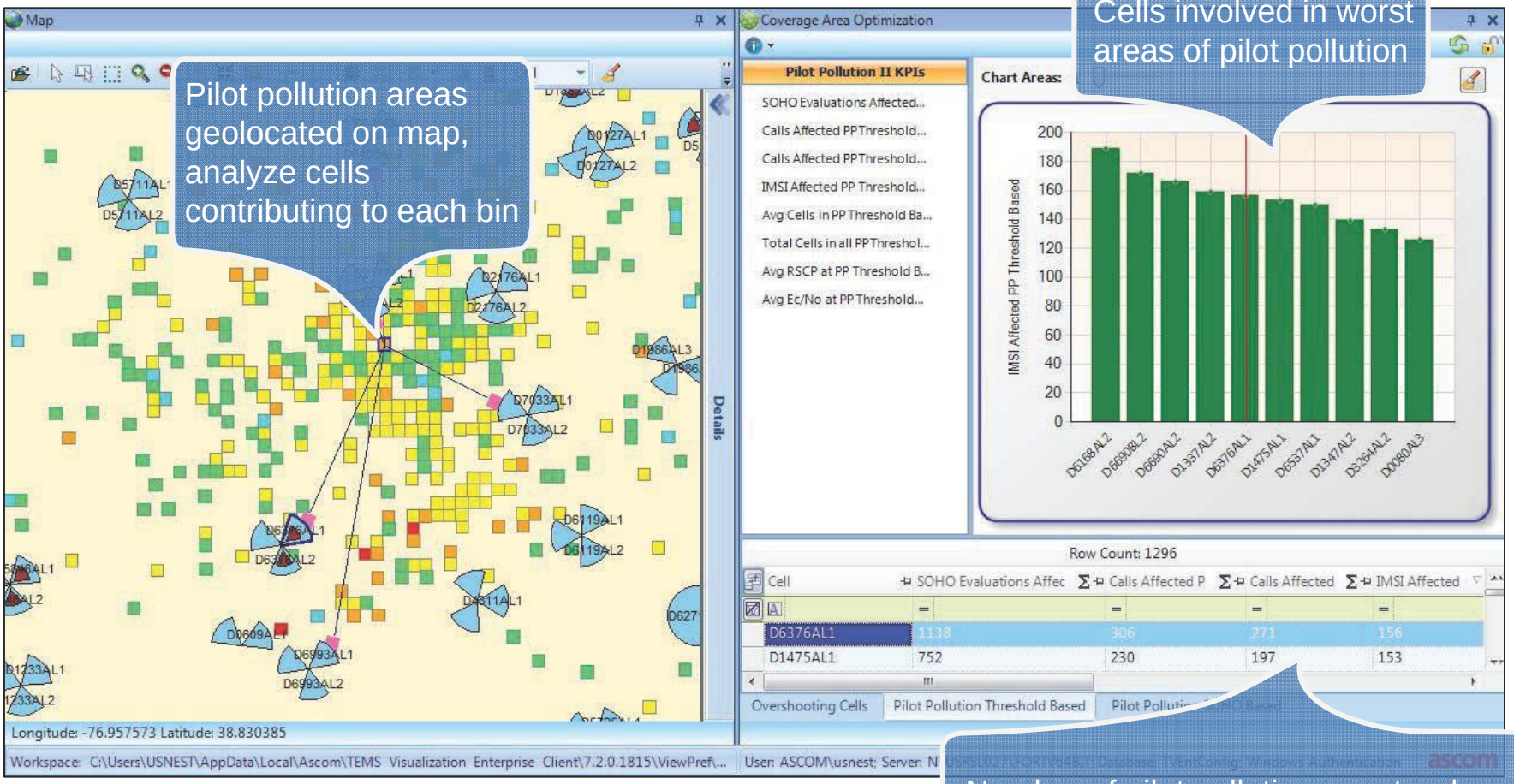


PILOT POLLUTION (THRESHOLD-BASED) (1 OF 2)

- Automatically identifies areas of pilot pollution and allows users to geolocate these areas on the map
  - Based on measurement reports for soft handover
  - Thresholds are numbers of cells within a dB range
    - Example: the existence of four or more cells within 5dB triggers pilot pollution

- Statistics on RSCP and Ec/No help determine if down-tilt or new site is needed

PILOT POLLUTION (THRESHOLD-BASED) (2 OF 2)



PILOT POLLUTION (SOFT HANDOVER-BASED)

Alternative method to identify cells involved in pilot pollution

- Based on soft handover replacement
- Can be used if all measurement report data is not available

- All information is graphically displayed on a map for easy analysis.
- Sends affected calls to call analysis feature if more-detailed investigation is needed.

[ ]

ERICSSON TRACING DATA SOURCE FEATURES

(GSM MTR, WCDMA UETR, LTE UE TRACE)

TRACING DATA SOURCE HIGHLIGHTS

- Support for system release
  - WCDMA UETR W11A - W14A
  - LTE UE TRACE L11A - L14A
  - GSM MTR 07A-G13B text format from OSS
  - GSM MTR 07A-G13B binary format direct from BSCs
  - GSM CTR 07A-G13B text format from OSS

  (TEMS Discovery Enterprise – Network Module supports only UETR, UE Trace and GSM MTR. The Desktop variant also supports GSM CTR format)
- MTR, UETR & UE Trace parsed to same database
  - IRAT trace possibility
  - View MTR, UETR, UE Trace simultaneously
  - Charts: histogram, distribution, scatter
- Follow signaling between mobile and core network
  - Selected decoding of NAS messages in Details view

USING THE TRACING DATA SOURCES

Follows same workflow as Common Features for Area Recording

1

Summary view
Statistical information on:
- Database level
- IMSI level
- Cell level (only GSM)

2

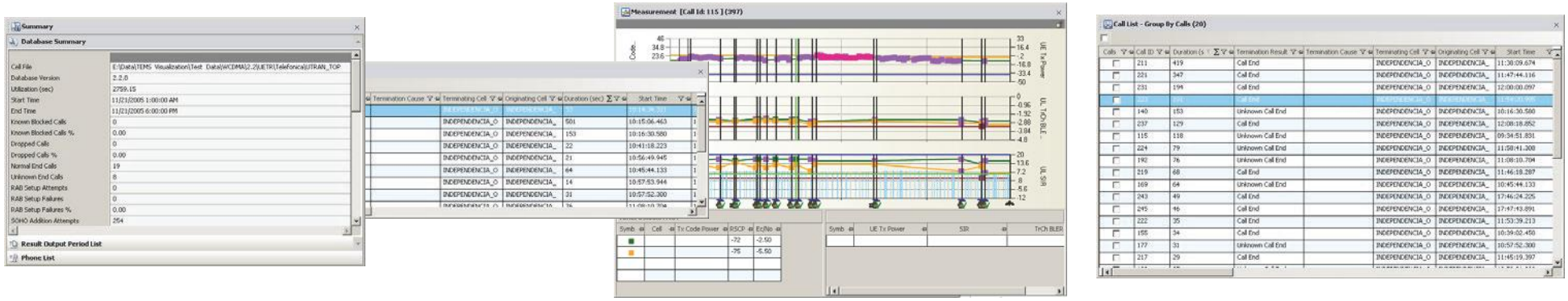
Call view
Statistics on call level

3

Measurement view
View key measurements in a graphical view

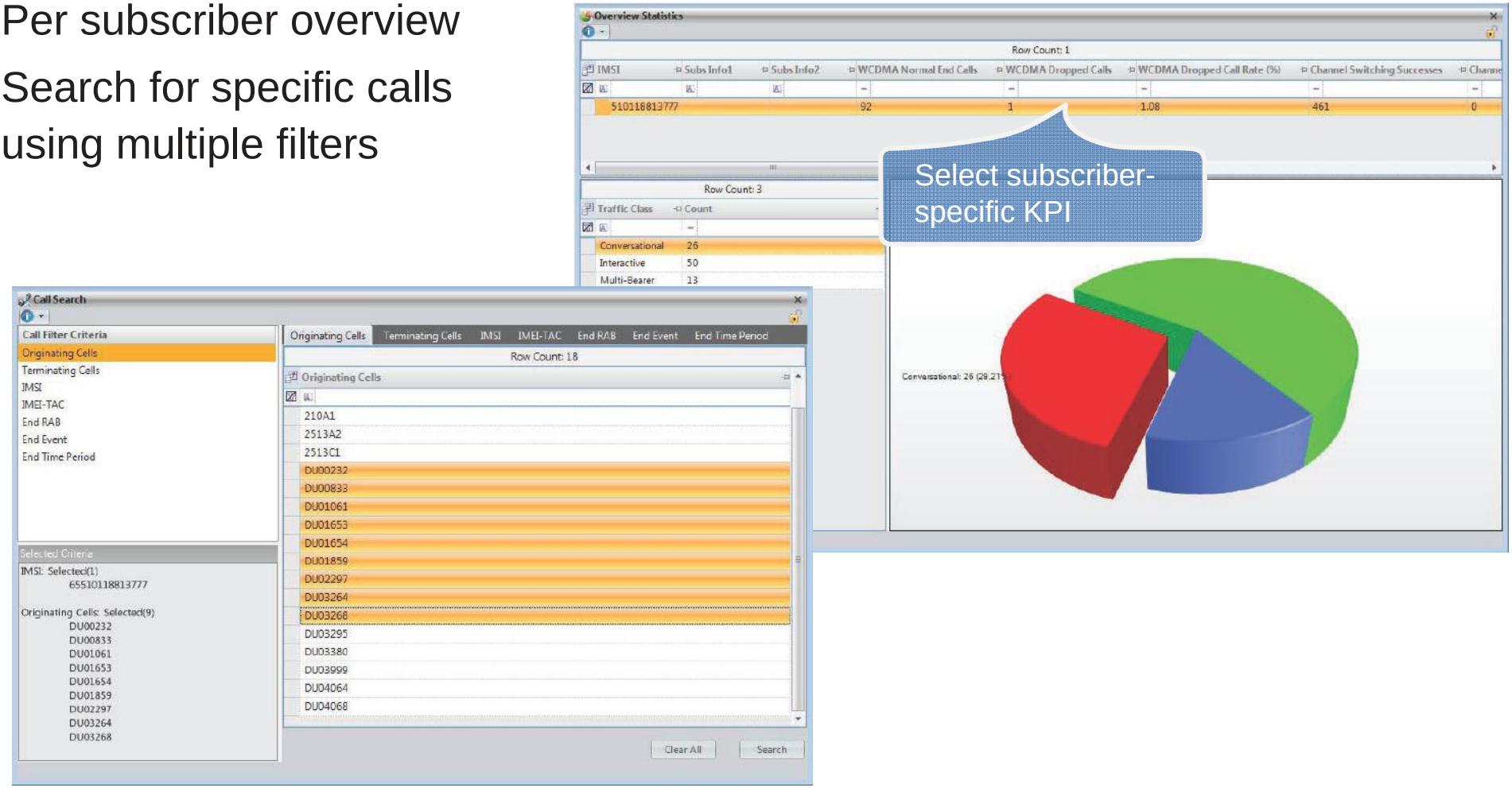
4

Message view
Follow the call message view on a particular call



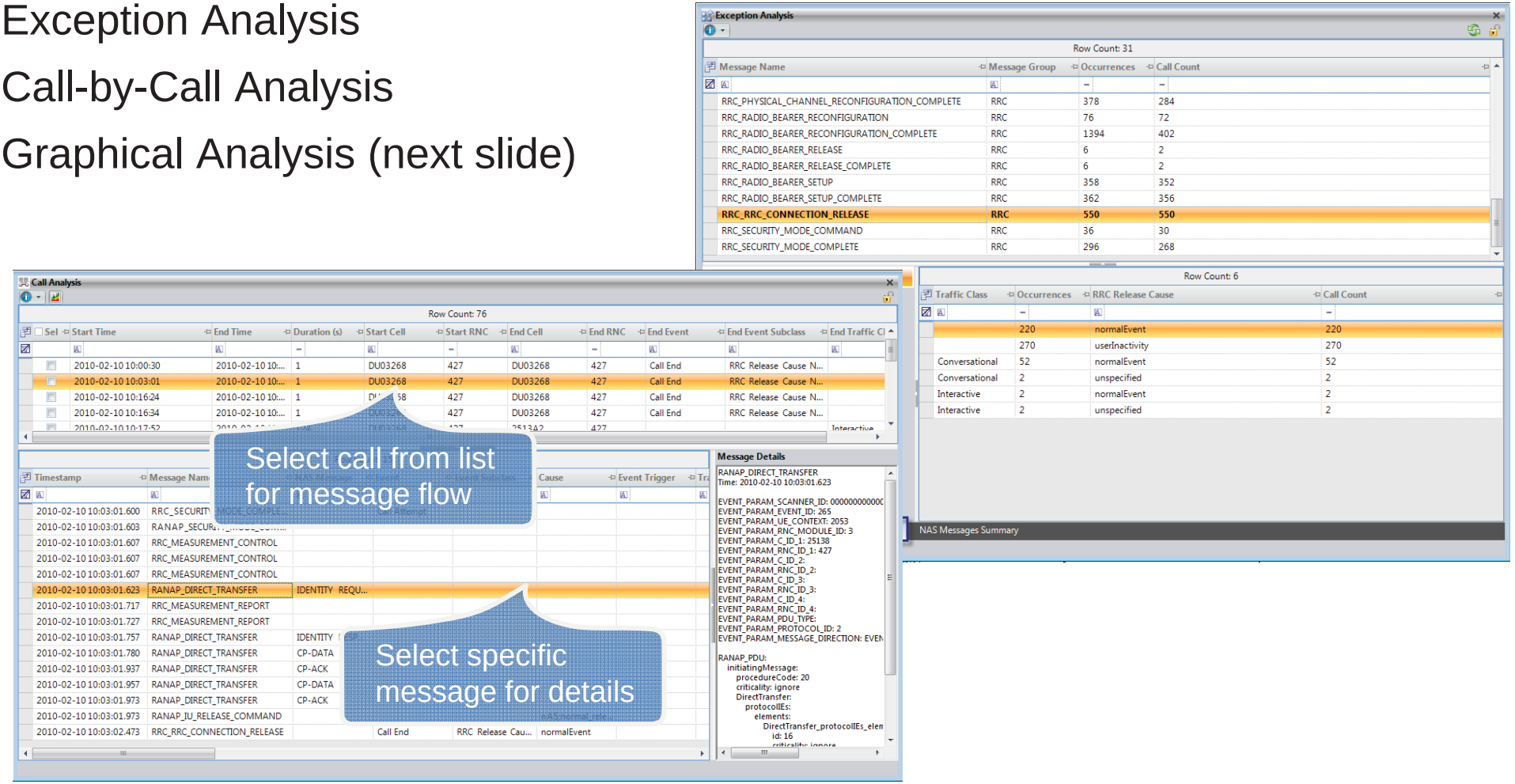
HIGH-LEVEL TROUBLESHOOTING FEATURES

- Per subscriber overview
- Search for specific calls using multiple filters

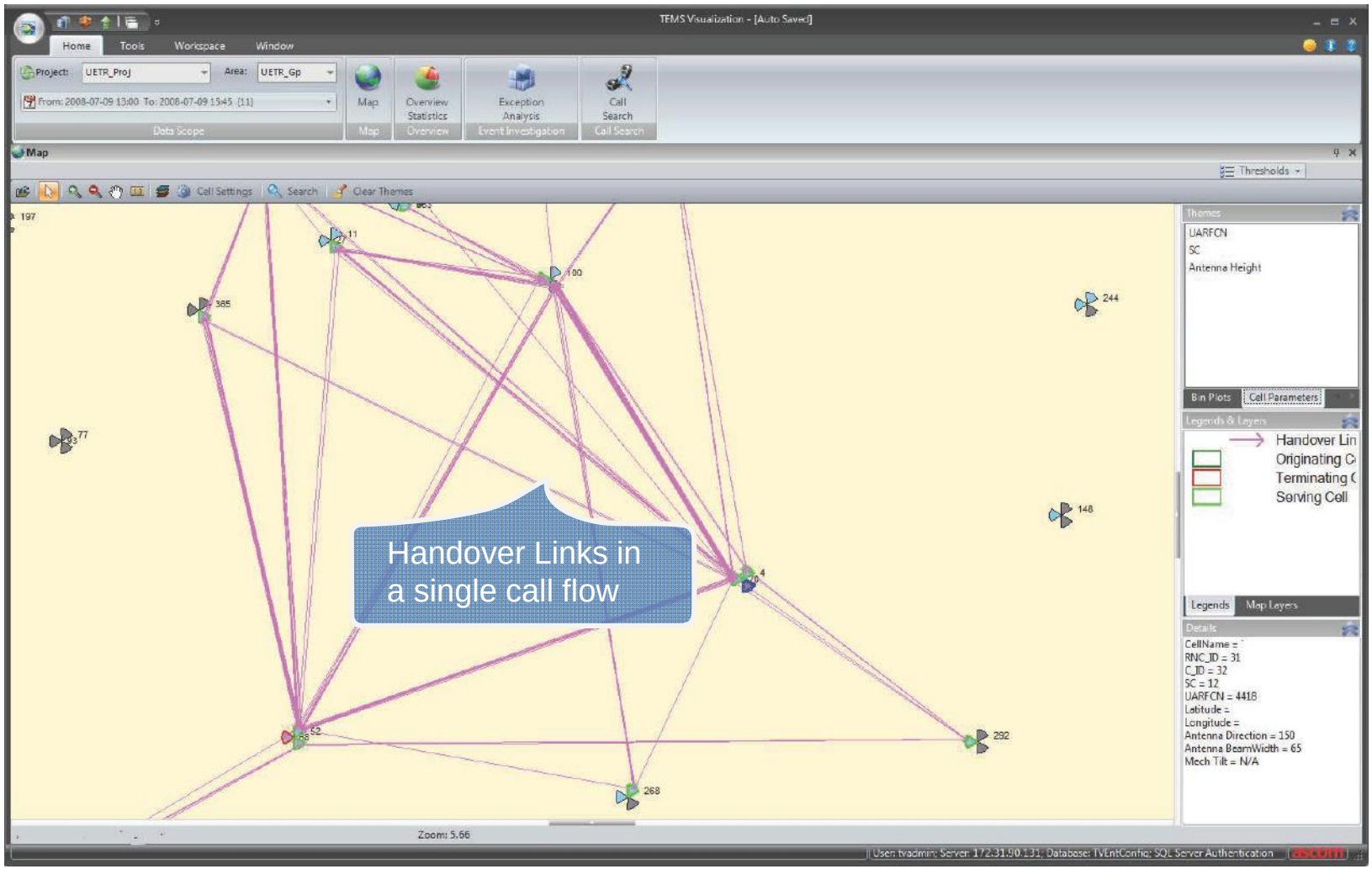


DETAILED INVESTIGATION FEATURES (1 OF 2)

- Exception Analysis
- Call-by-Call Analysis
- Graphical Analysis (next slide)



DETAILED INVESTIGATION FEATURES (2 OF 2)

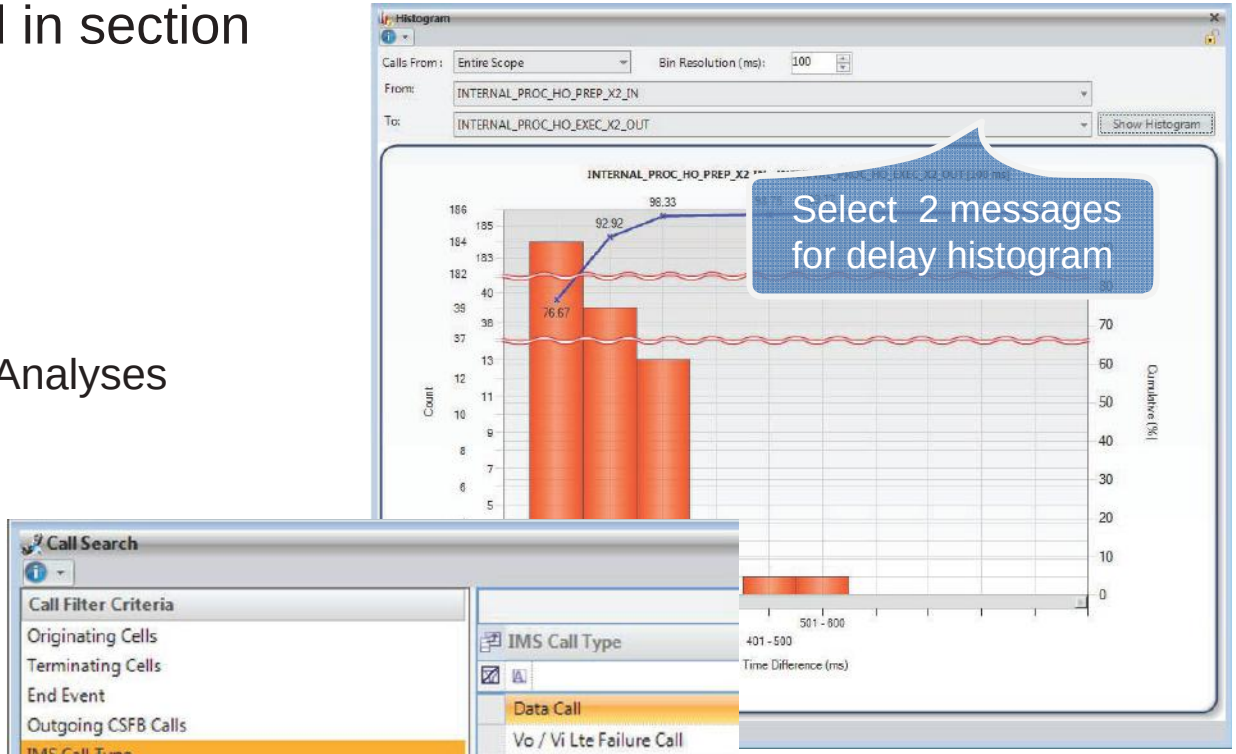


[ ]

ERICSSON LTE CELL TRACE MODULE FEATURES

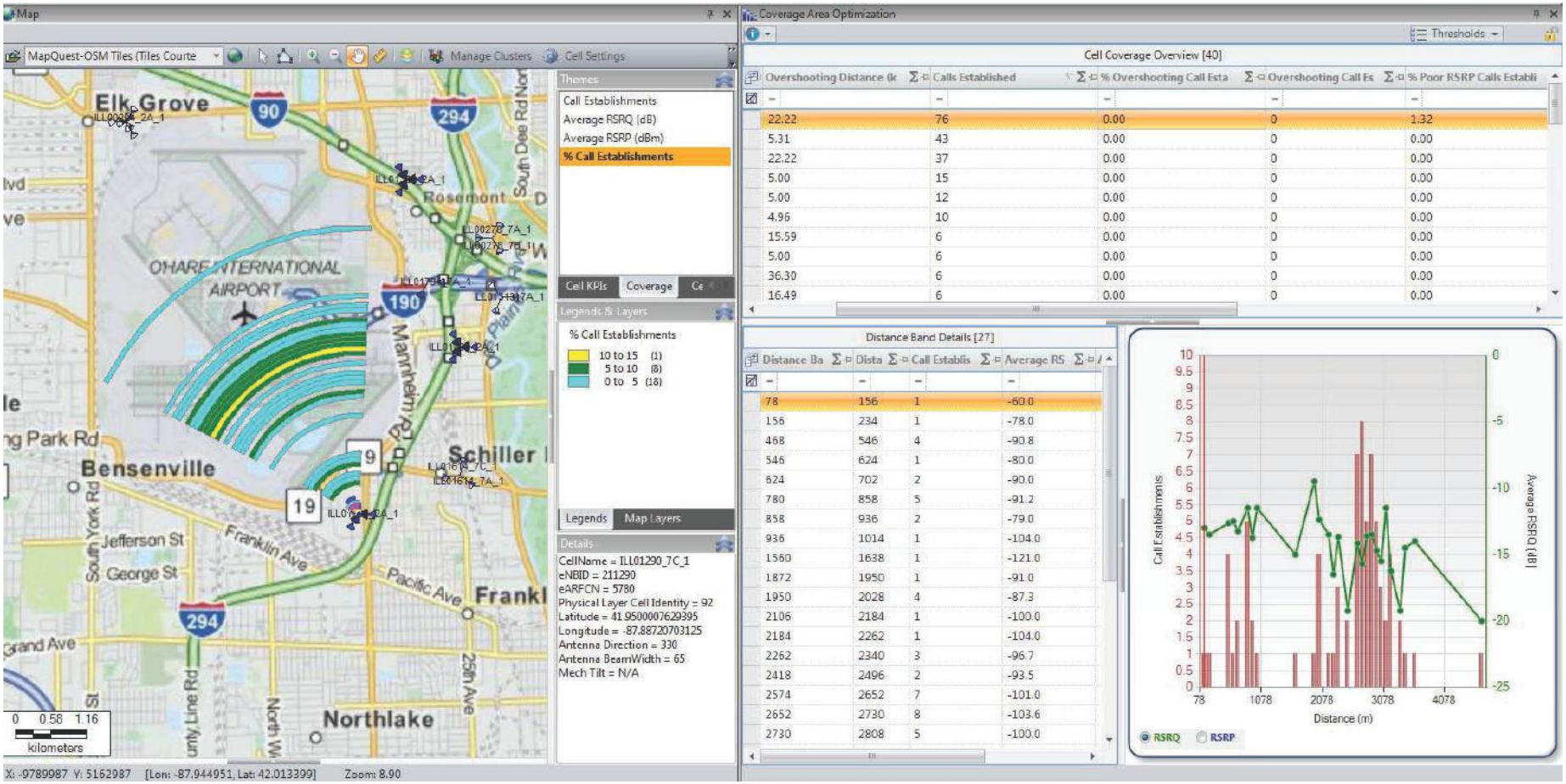
TROUBLESHOOTING AND INVESTIGATION FEATURES

- All features previously listed in section ‘Common Feature Details’
  - Cell and Cell Group KPIs
  - Phone Model KPIs
  - Subscriber KPIs (New)
  - VoLTE Analysis: For above KPI Analyses
  - Call Search
  - Sequence Delay Histogram
  - Call-by-Call Analysis
  - Exception Analysis
  - RF Analysis Charts
  - Coverage Area Optimization
  - Distance vs. KPI Meas. Chart
  - CSFB: Performance Report



LTE COVERAGE AREA OPTIMIZATION

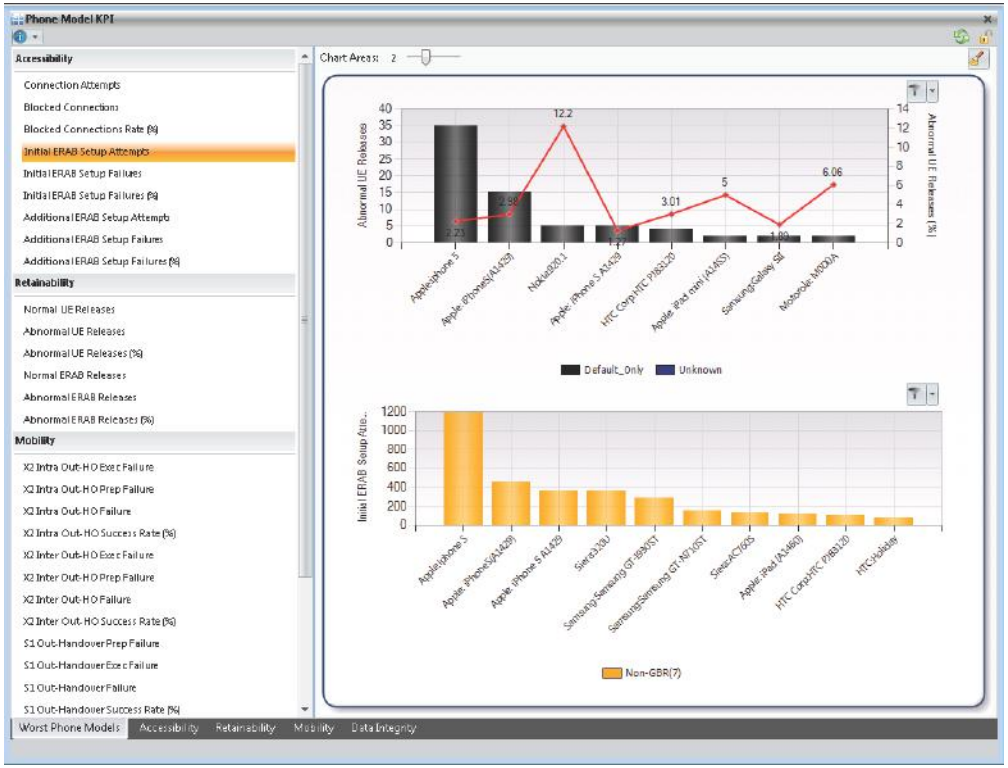
- Similar to 3G Coverage Area Optimization



DISTANCE VS. KPI MEASUREMENT CHART

LTE PHONE MODEL KPI

- Typically, IMEI not known in the eNodeB
- IMEI lookup taken from MME data and correlated with LTE Cell Trace data
- Analyze Performance on per Phone Model basis
- KPIs for whole connection, per Service
- KPIs for individual eRAB per QCI (e.g., for VoLTE, QCI = 1)



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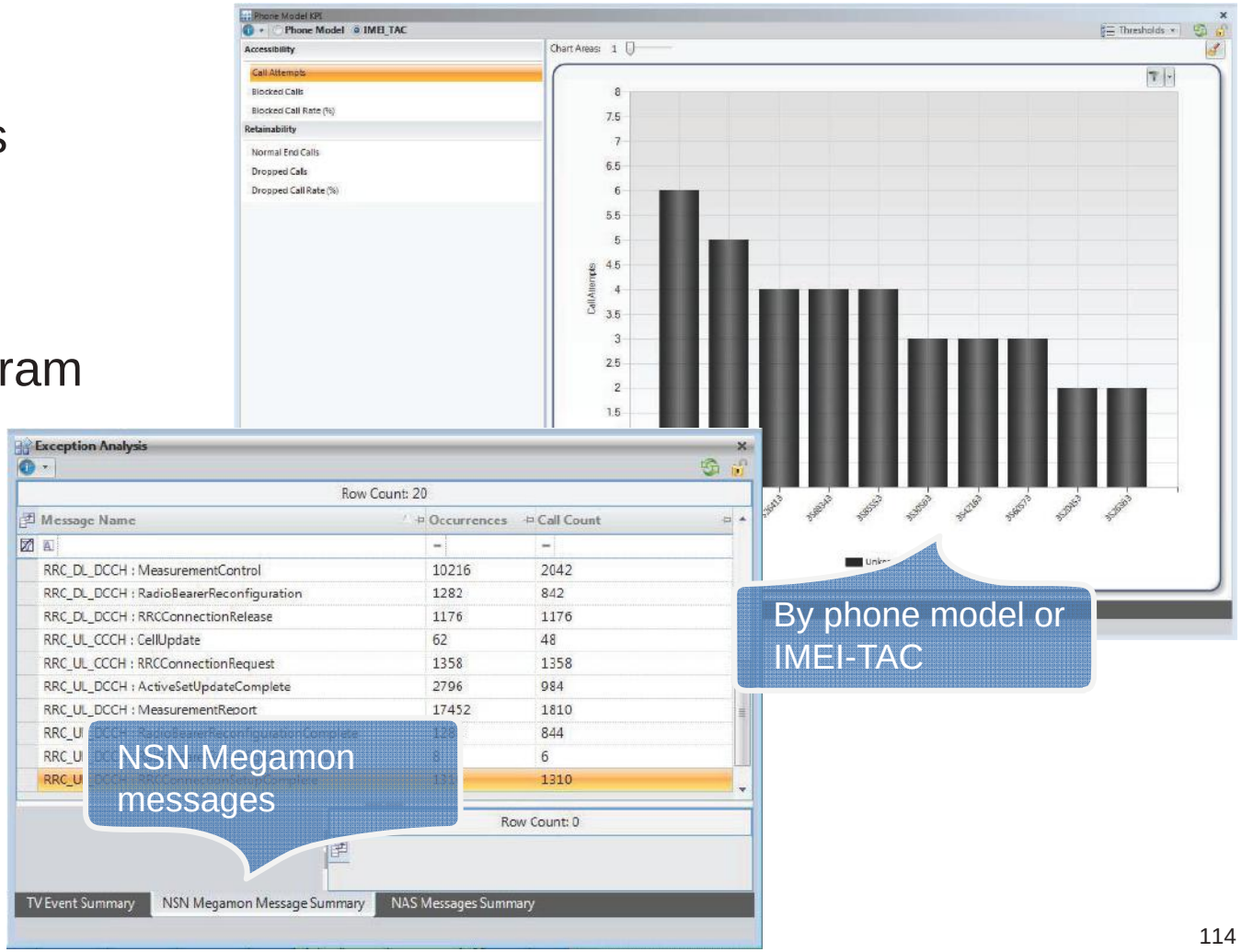
NSN MEGAMON GEO INTERFACE WCDMA MODULE FEATURES

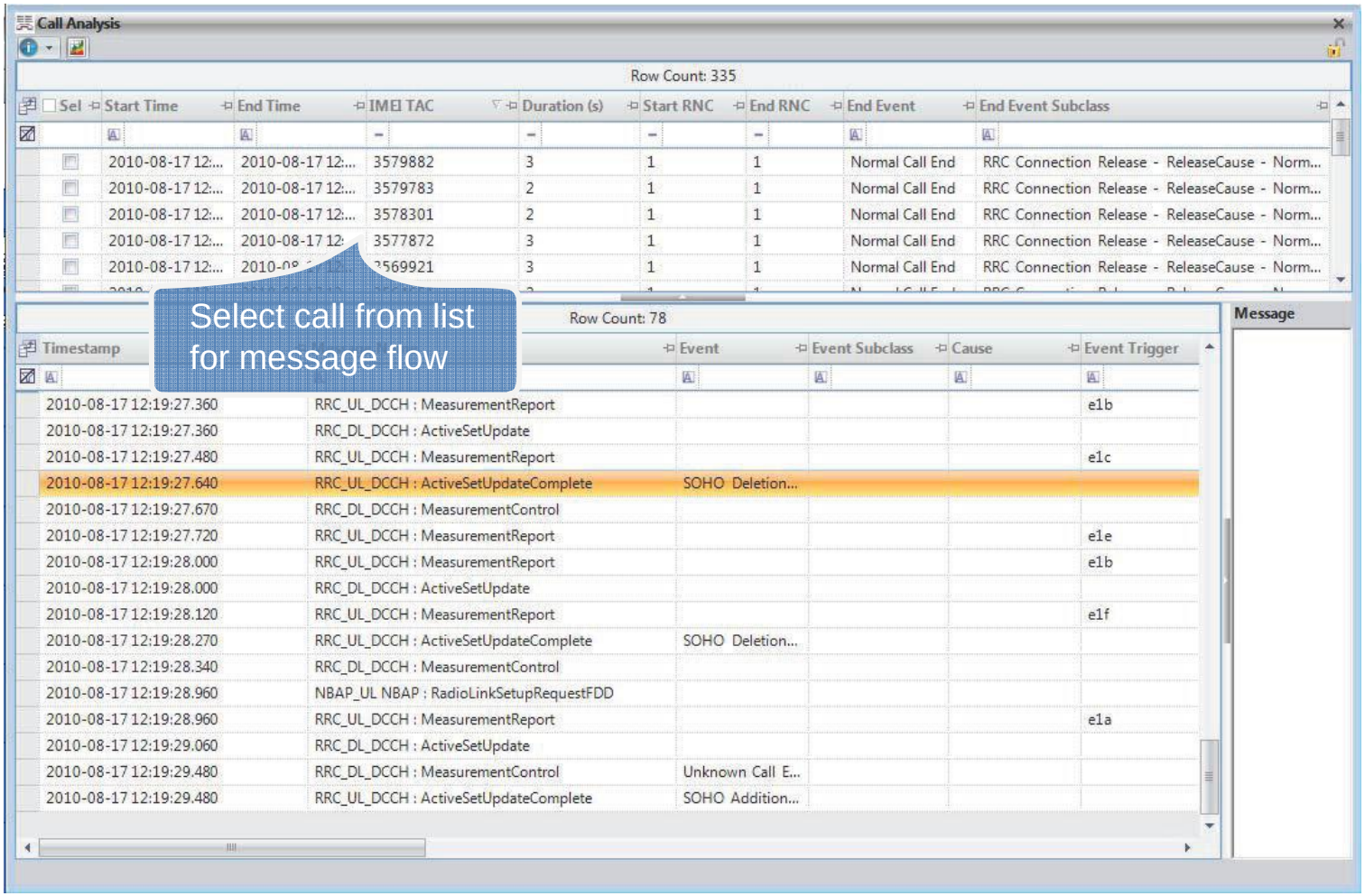
TROUBLESHOOTING AND INVESTIGATION FEATURES (1 OF 2)

- Cell KPI Analysis
- Subscriber KPI Analysis
- Phone Model Analysis
- Overview Analysis
- Sequence Delay Histogram
- Exception Analysis
- Call-by-Call Analysis
- Call Search

(see ‘Common Features’ for details on above listed NSN WCDMA features)



TROUBLESHOOTING AND INVESTIGATION FEATURES (2 OF 2)

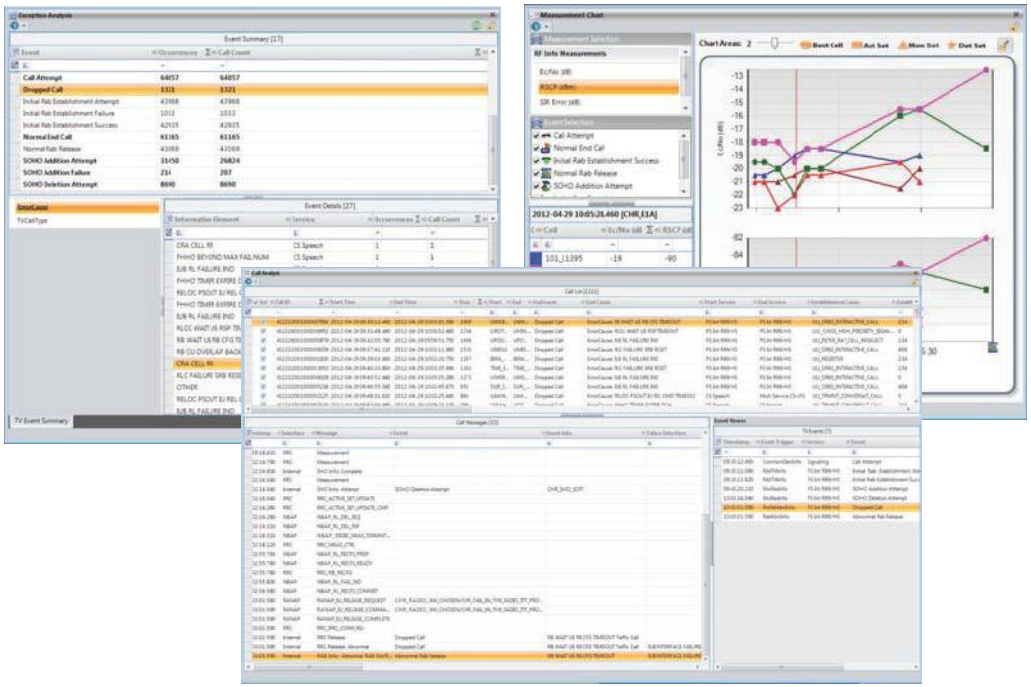


[ ]

HUAWEI WCDMA CALL TRACE MODULE FEATURES

TROUBLESHOOTING AND OPTIMIZATION FEATURES

- Cell KPI Analysis, Cluster KPI
- Subscriber KPI & Group Analysis
- Phone Model & Group Analysis
- Call-by-Call Analysis, Search
- Overview Analysis
- Exception Analysis
- Capacity Analysis
- Dropped Call Analyzer
- Coverage Area Optimization (overshooting cells)
- Geolocation and Geo-Analysis based on Google Maps

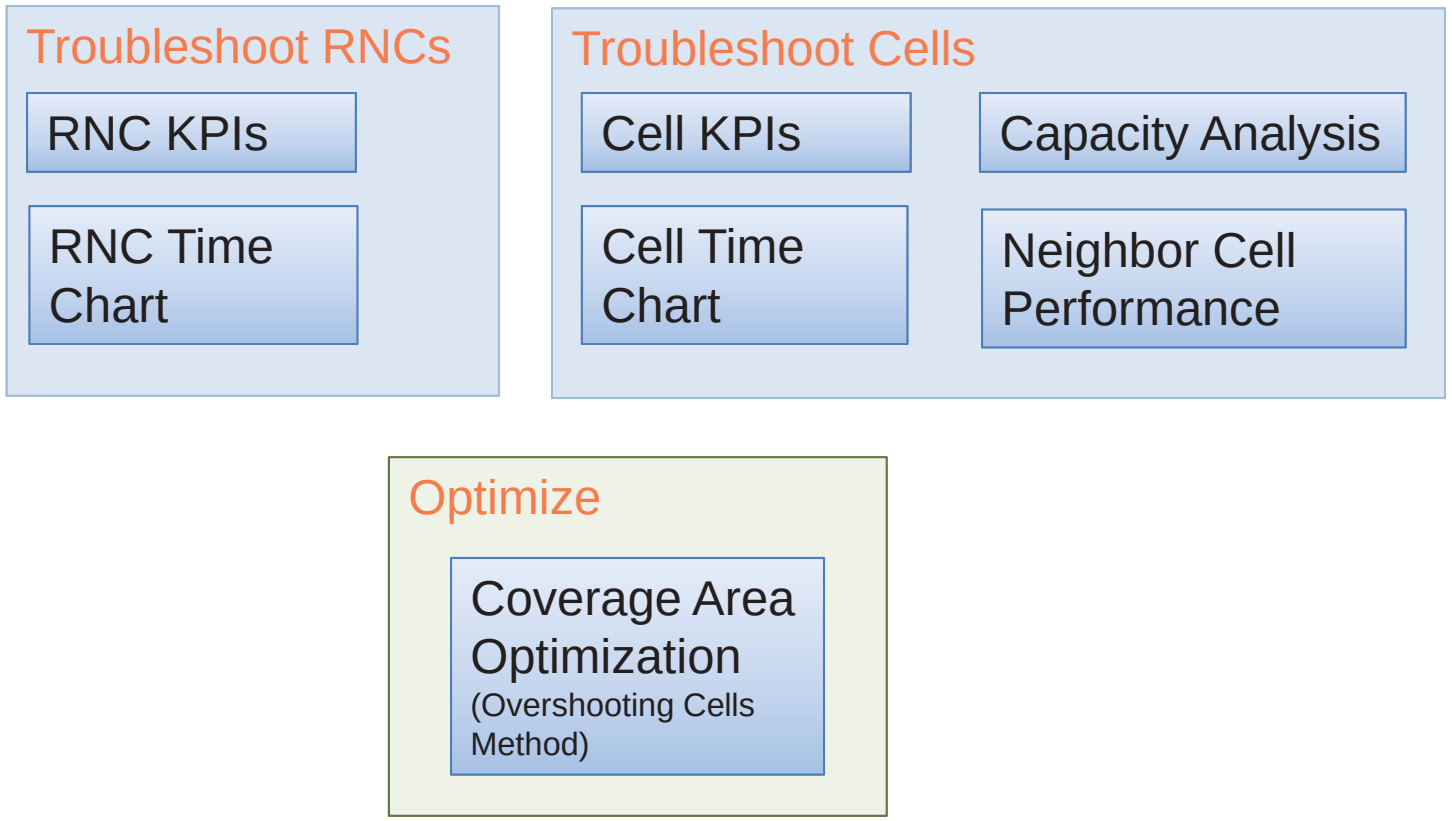


(see ‘Common Features’ and ‘Ericsson GPEH’ section for details on above listed Huawei WCDMA features)

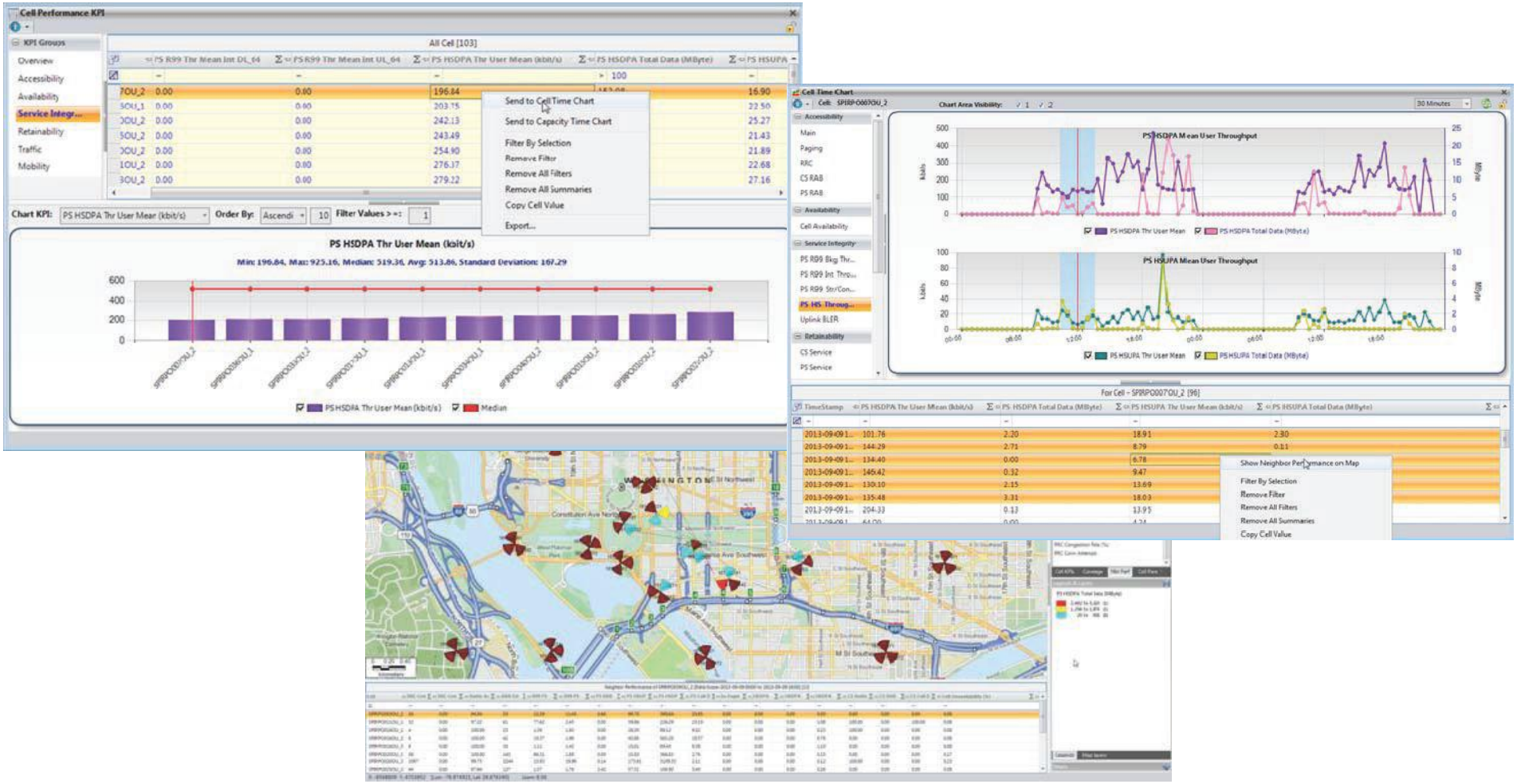
[ ]

HUAWEI WCDMA PM COUNTERS MODULE FEATURES

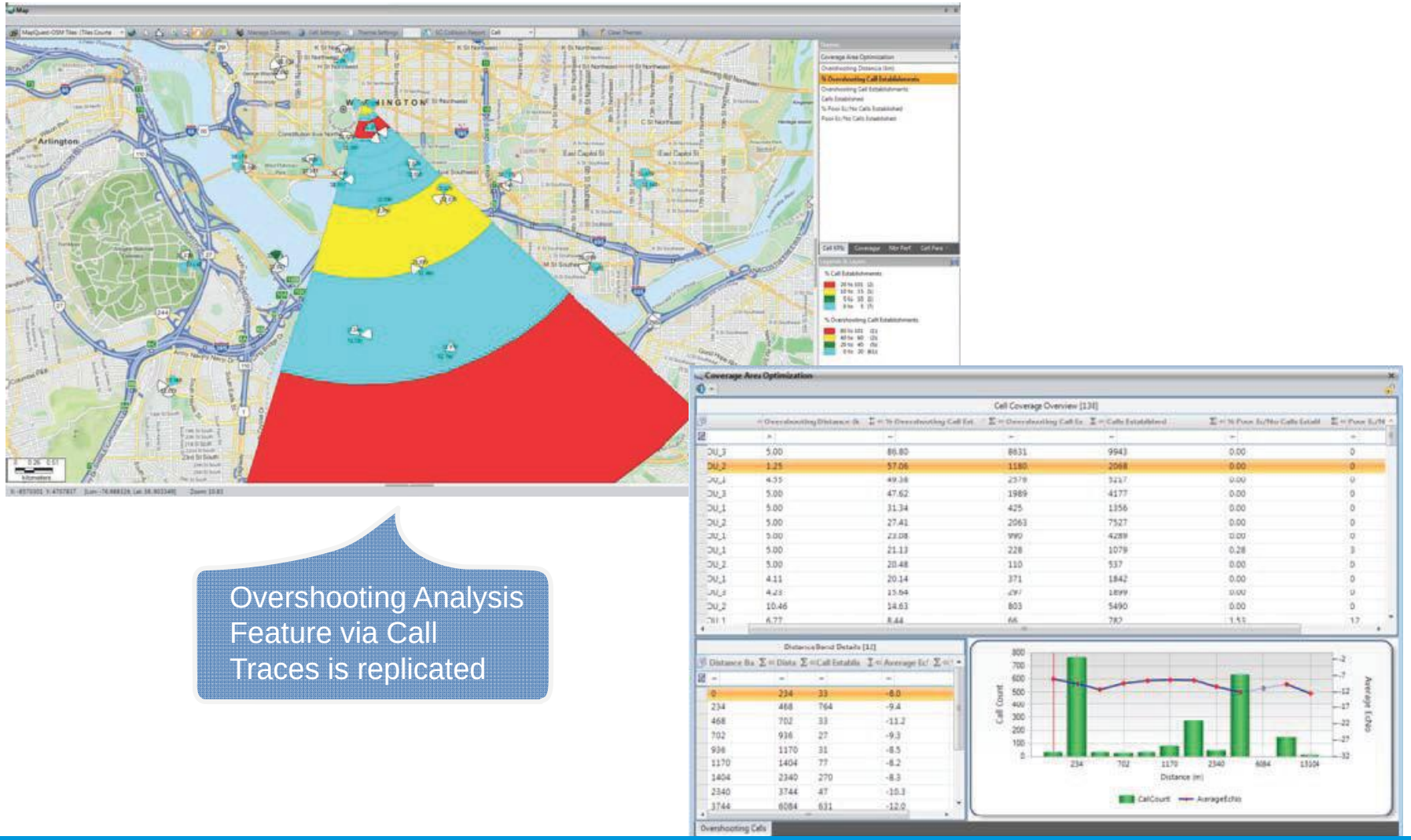
HUAWEI WCDMA PM COUNTERS MODULE



DRILLDOWN: CELL KPI, TIME CHART, NEIGHBOR PERFORMANCE



ANALYZING OVERSHOOTING CELL COVERAGE



Overshooting Analysis Feature via Call Traces is replicated

[ ]

ERICSSON GSM R-PMO MODULE FEATURES

(AVAILABLE ONLY ON DESKTOP PLATFORM OF TEMS DISCOVERY)

BASED ON REAL-TIME PERFORMANCE MONITORING

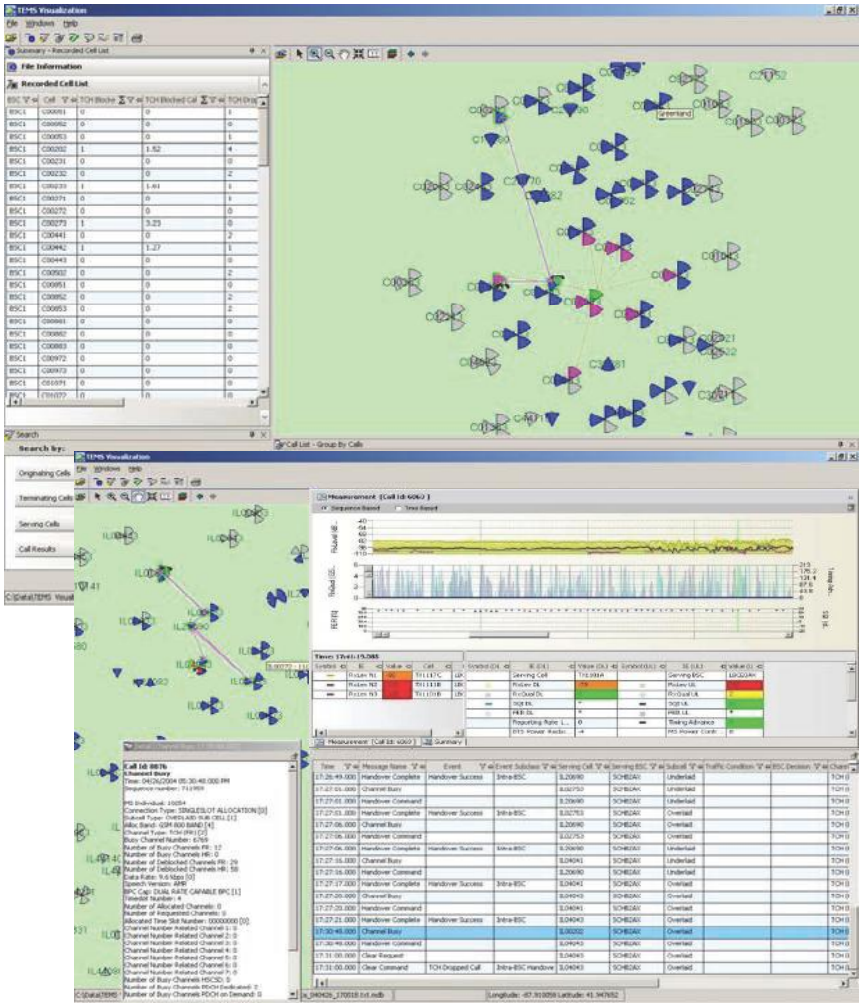
- R-PMO is an optional feature in OSS-RC: collects up to 500 cells per recording
  - Collects event data in real time
  - Displays instant feedback on network performance
  - Instantly shows the effect of troubleshooting efforts
  - Generates large volumes of network data
  - Supported in Desktop Edition: R-PMO & CTR (GSM application), MTR (both applications) for Ericsson GSM 07A – G13B releases
    - Currently Enterprise - Network edition does not support Ericsson GSM R-PMO & CTR formats (Only MTR is supported)
- Gives operators a complete look at network performance, from the statistical level down to individual calls, fast browsing per call and per sector, together with powerful filtering capabilities, to help the user pinpoint problem cells and areas

KEY FEATURES

- Estimated positioning
- Non-air interface dropped call statistics
- Per TX/RX statistics
- Per TX/RX radio performance statistics and charts
- Cell timeslot monitor (including per timeslot statistics)
- Phone list (based on IMEI)
- Distribution and scatter charts for radio measurements
- Histogram for time difference measurements
- EGPRS Performance Analysis
- Pre-defined reports: Cell Performance Report, Database Summary Report (e.g., top 10 cells)

CALL EVENT ANALYZER

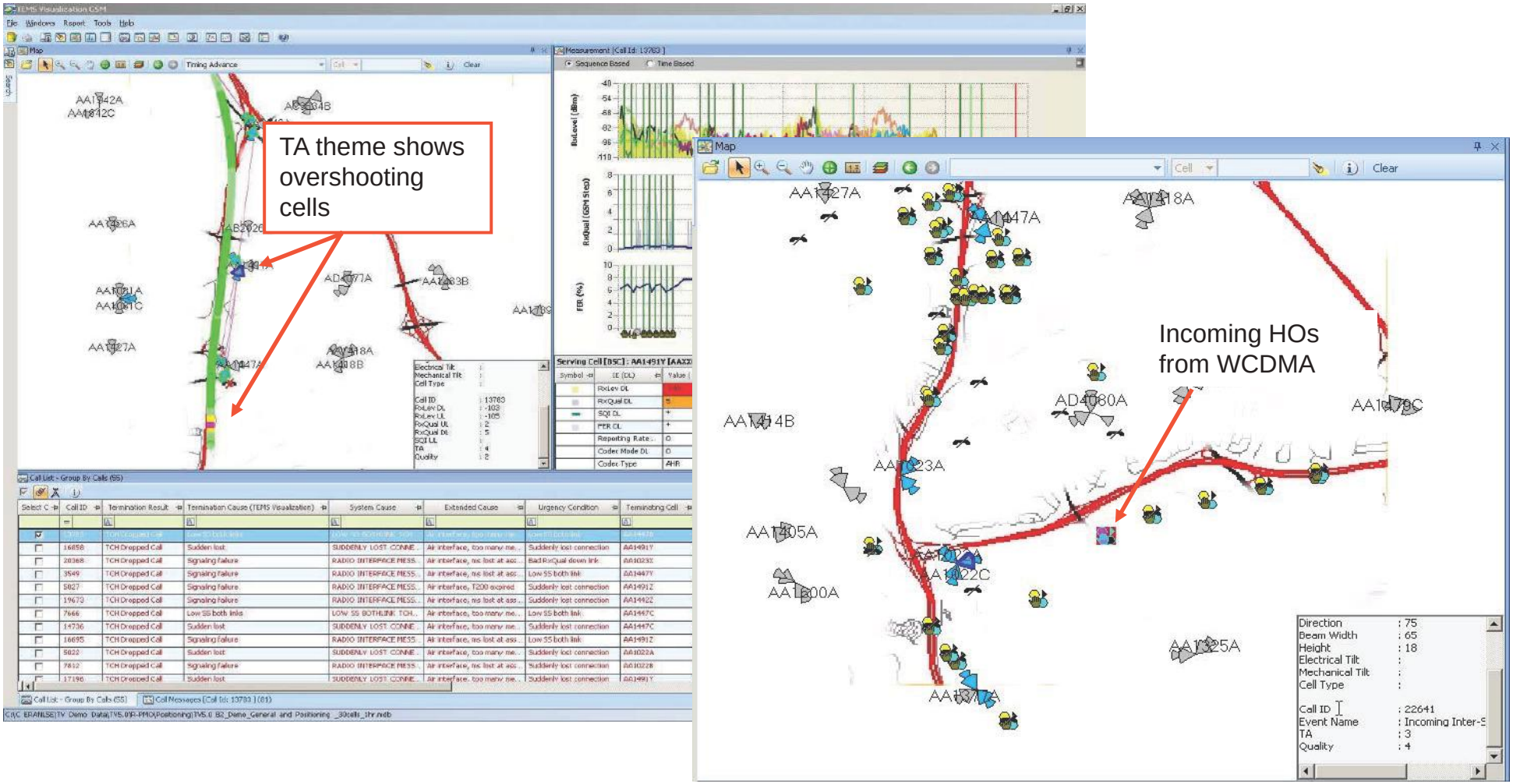
- Analyze individual calls in detail
  - Find calls with problems
    - Dropped calls
    - Handover problems
    - Call-flow problems
    - Quality problems
  - Drill down and track
    - Message sequences
    - Handover sequences
    - Radio measurements
    - BSC internal cause codes



ESTIMATED POSITIONING (1 OF 2)

- Algorithm based on enhanced CGI and Timing Advance (TA) together with recursive smoothing
- Estimated position for every measurement result
  - Plot RxLev, RxQual, SQI, TA every 0.48 seconds
  - For all of the CS traffic recorded in one cell or selected calls
  - Find locations of poor coverage or overshooting cells
- Estimated position for some TEMS Discovery Network events
  - TCH normal call end, TCH dropped call, incoming HO from UTRAN, etc.
  - Find out if all dropped calls in a cell occur in approximately the same position
  - Find locations of poor WCDMA coverage (where incoming handovers from UTRAN occur)

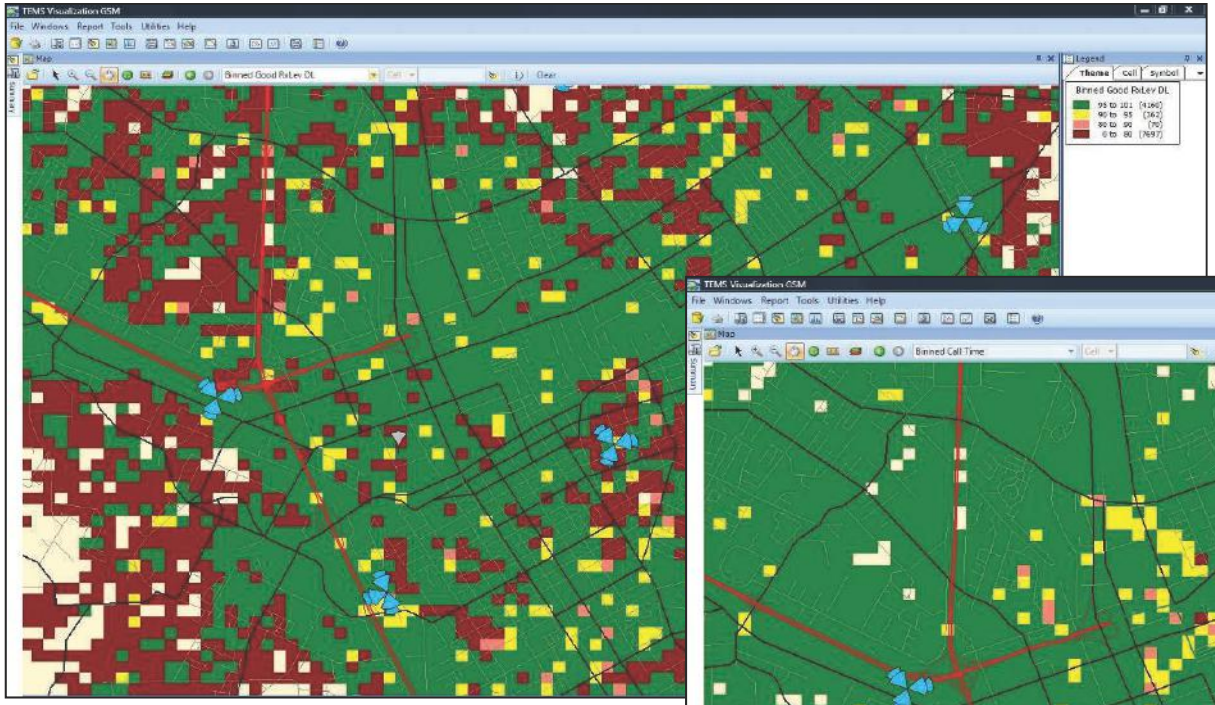
ESTIMATED POSITIONING (2 OF 2)



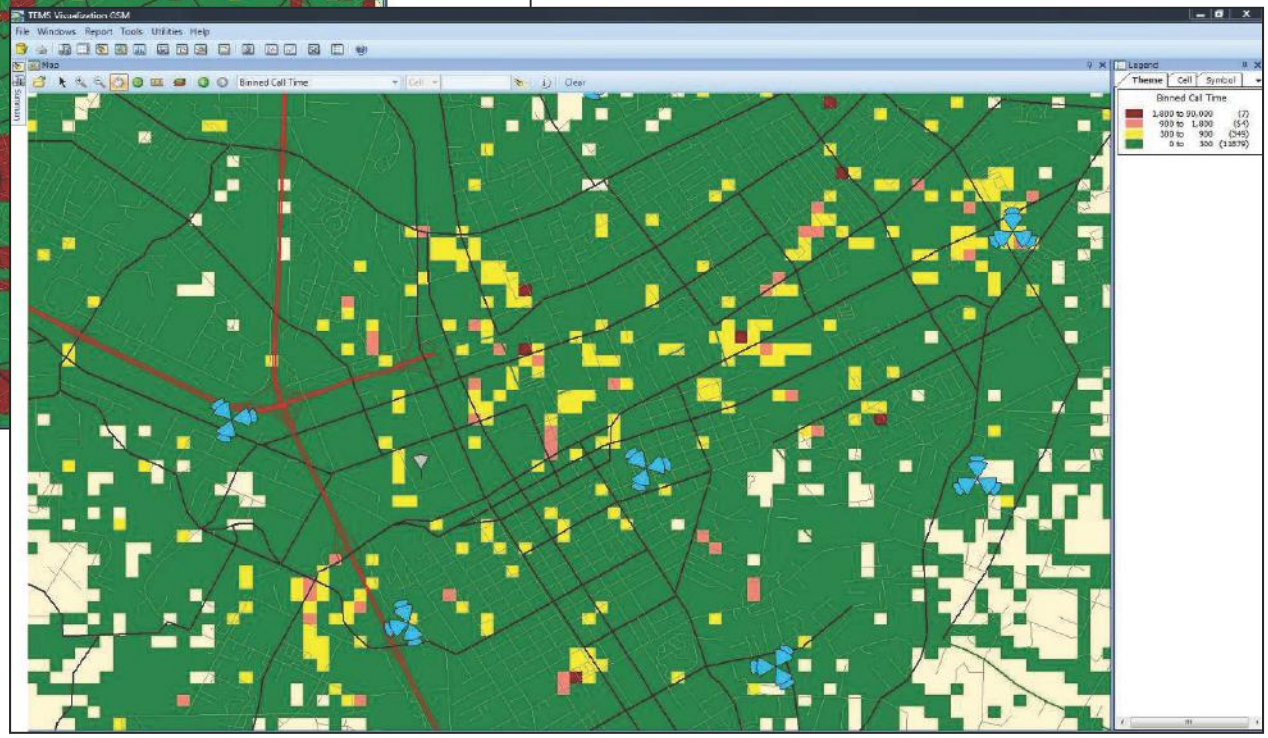
BINNED MAPS (1 OF 3)

- Group estimated position data into geographic bins
- Create binned maps which show the actual:
  - Coverage
  - Quality
  - Uplink speech quality
  - Traffic density
  - Dropped call locations
- Analyze all traffic, including indoor mobile devices, in the recording
- Find locations of poor coverage and high traffic
- Export formats
  - For display in TEMS Discovery Network (MapInfo workspace)
  - For display in Google™ Earth (kml format)

BINNED MAPS (2 OF 3)



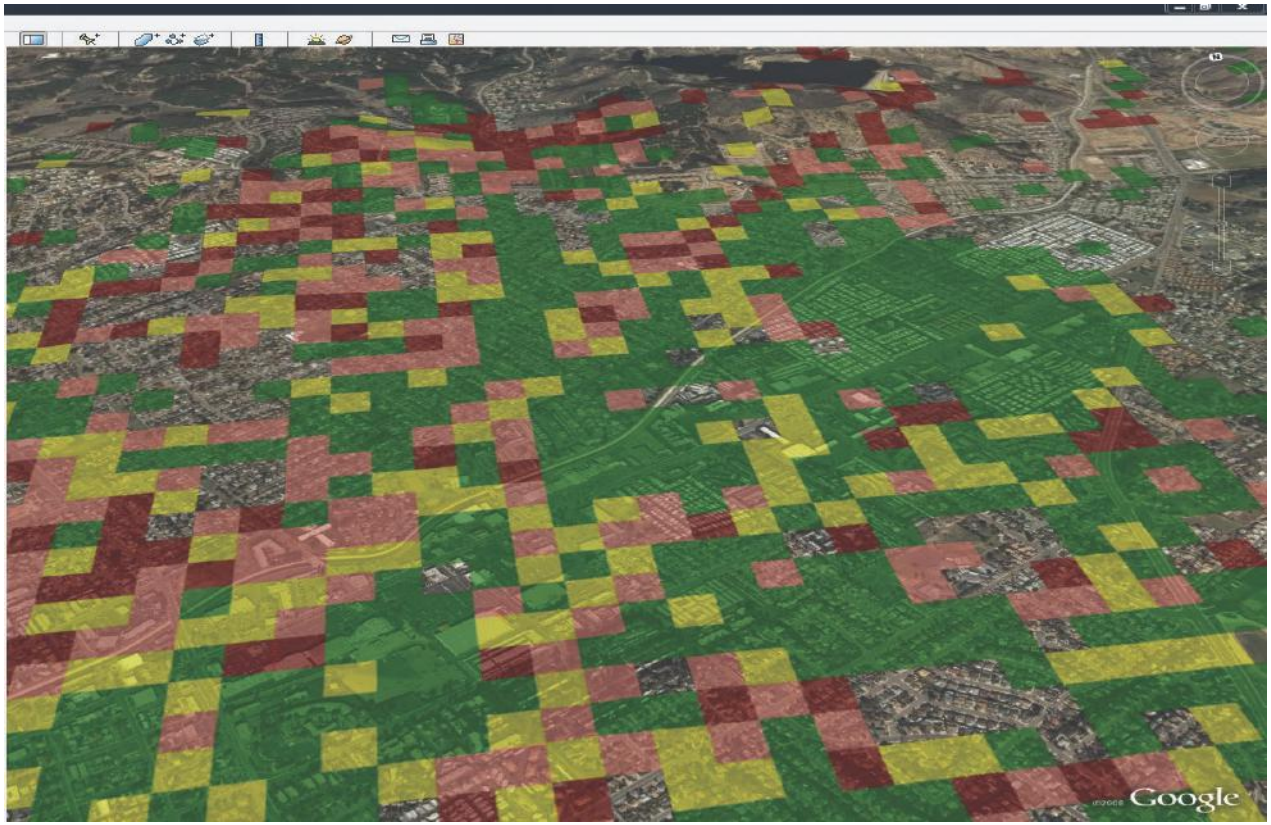
RxLev DL



Call Time

BINNED MAPS (3 OF 3)

In Google™ Earth

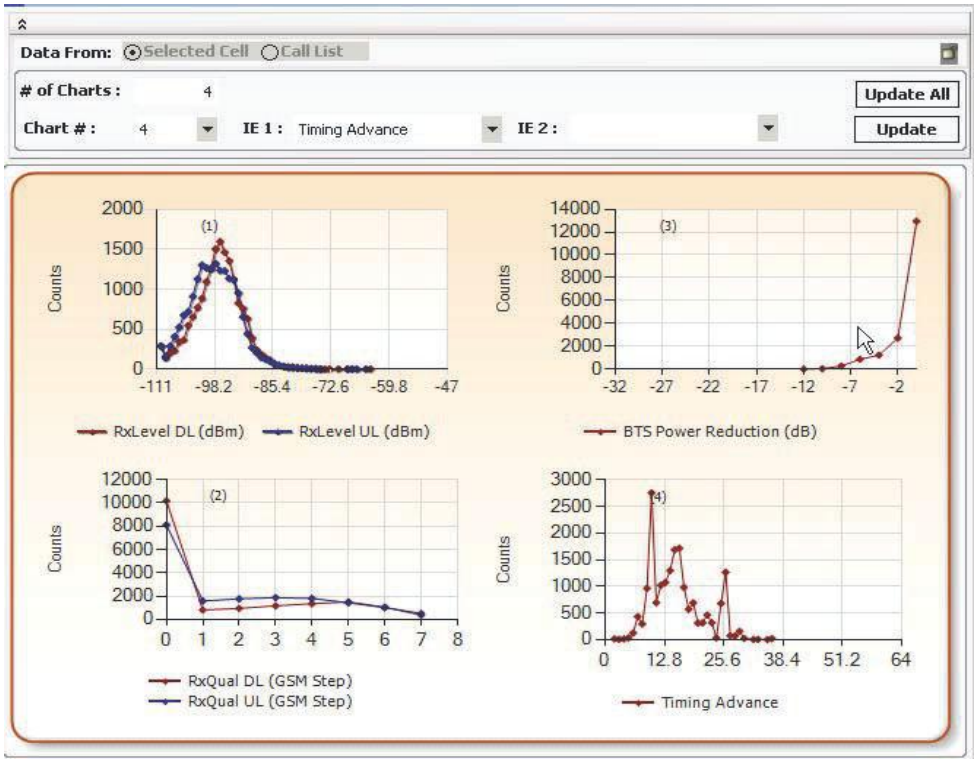


RxLev UL

DISTRIBUTION AND SCATTER

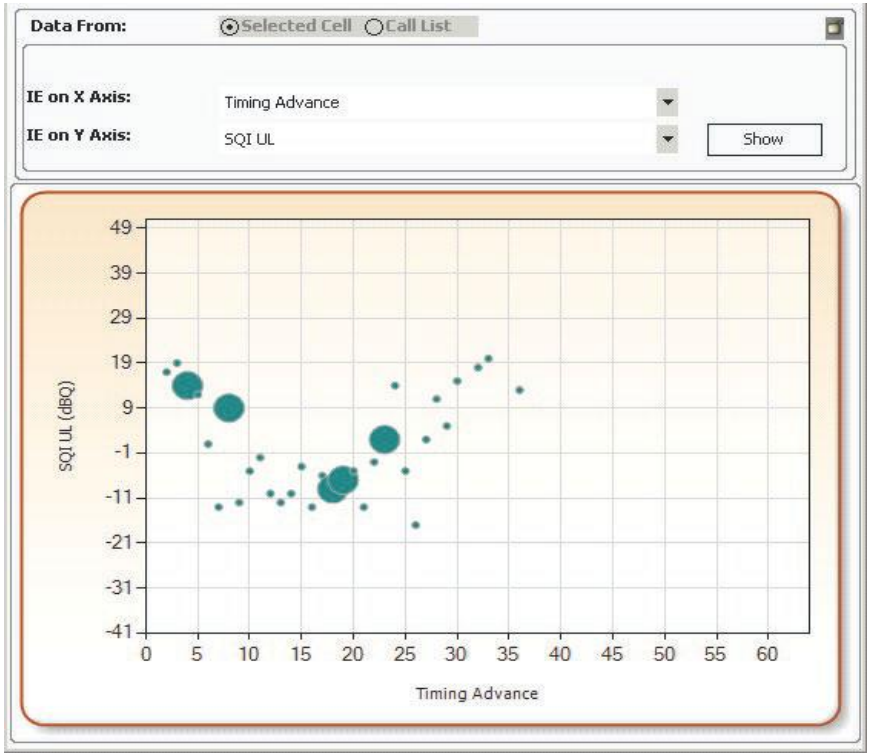
Charts for radio performance evaluation

Distribution chart



Maximum six separate charts

Scatter chart



Size of bubble shows count

FAULTY EQUIPMENT ANALYSIS

Problem	Where Visible
Non-radio problem (e.g., transmission) causing dropped calls	Per-cell statistics for non-air interface dropped calls
Degradation in radio (TX or RX) performance	Per TX and per RX statistics and distribution / scatter charts ▪ Dropped calls and incoming handover failures ▪ Pathloss difference ▪ RxLev A – RxLev B* ▪ RxQual UL and DL Call Event Analyzer for all calls that end on a specific TX or RX

** OSS-RC feature FFAX required*

NON-AIR INTERFACE DROPS

Extended drop causes (R12 and later)

AIR INTERFACE T200 EXPIRED
AIR INTERFACE UNSOLICITED DM RESPONSE IN MULTIPLE FRAME ESTABLISHED STATE
AIR INTERFACE SEQUENCE ERROR
AIR INTERFACE EXCESSIVE TA
AIR INTERFACE TOO MANY MEASUREMENT GENERATIONS MISSING
AIR INTERFACE MS LOST
AIR INTERFACE TOO MANY MEASUREMENT GENERATIONS MISSING AND EXCESSIVE TA
AIR INTERFACE CONNECTION FAILURE TO MS AT HANDOVER

A-INTERFACE TERRESTRIAL RESOURCE UNAVAILABLE
A-INTERFACE TERRESTRIAL RESOURCE ALLOCATED
A-INTERFACE SCCP DISCONNECTION INDICATION
A-INTERFACE RESET CIRCUIT FROM MSC
A-INTERFACE TERRESTRIAL RESOURCE FAILURE
HW TRANSCODER RESOURCE FAULT
HW EQUIPMENT FAILURE
HW GS FAULT
ATER TRANSMISSION SETUP FAILURE RESOURCE NOT AVAILABLE
ATER TRANSMISSION SETUP FAILURE TIME OUT ATER
ATER SCCP CONNECTION FAILURE
ATER RESET CIRCUIT FROM BSC
ATER TERRESTRIAL RESOURCE FAILURE
OTHER OPERATIONAL RECOVERY FAILED
OTHER PREEMPTED
OTHER TRXC IS BEING CREATED OR IS ABOUT TO BE DELETED
OTHER RECONFIGURATION OF BTS EQUIPMENT 1
OTHER RECONFIGURATION OF BTS EQUIPMENT 2
OTHER TAS SYSTEM ERROR
OTHER TRXC FAILURE
OTHER TGC CHANGEOVER FAILURE
OTHER NO RADIO RESOURCE AVAILABLE
OTHER
ABIS LAPD LINK DISTURBANCE
ABIS LAPD LINK FAULT
ABIS TRA OR TRANSMISSION DEVICE FAULT
ABIS BTS FAULT REPORT CLASS1
ABIS TRANSMISSION FAULURE

Non-air interface

Traditional drop causes

EXCESSIVE TA
SUDDEN LOST CONNECTION
LOW SS BOTHLINK
LOW SS DOWNLINK
LOW SS UPLINK
BAD RXQUAL BOTHLINK
BAD RXQUAL DOWNLINK
BAD RXQUAL UPLINK
NO URGENCY CONDITION

PER TX/RX STATISTICS

Stats per TX

TCH drop rate
HO failure rate…

Physical and logical TX

Sub cell	Freq/ MAIO	HOP	0	1	2	3	4	5	6	7
U	0	Y	23029		22444	22613	20682	22958	20508	23016
Abis Rate:										
U	2	Y	22850		19350	21827	13347	20979	20306	
Abis Rate:										

Summary
Database Summary
Logfile List
Recorded Cell List
Phone List
TRU List

BSC	Cell	Subcell	Cha	Freq	HOP	TCH Dropp	TCH Dro
SDCAB05	FF1491Y	Underlaid	1	2	Y	1.54	4
SDCAB05	FF1498X	Underlaid	1	2	Y	1.63	4
SDCAB05	FF1447Y	Underlaid	0	151	N	60.00	3
SDCAB05	FF1447Z	Underlaid	1	2	Y	1.09	3
SDCAB05	FF1491Z	Underlaid	1	4	Y	1.23	3
SDCAB05	FF1023X	Underlaid	1	0	Y	3.85	2
SDCAB05	FF1498A	Underlaid	1	2	Y	2.60	2
SDCAB05	FF1022Z	Underlaid	1	0	Y	4.76	1
SDCAB05	FF1022B	Underlaid	1	0	Y	1.32	1
SDCAB05	FF1023Y	Underlaid	1	0	Y	12.50	1
SDCAB05	FF1023A	Underlaid	1	0	Y	1.49	1
SDCAB05	FF1081Y	Underlaid	1	2	Y	2.04	1
SDCAB05	FF1377Z	Underlaid	1	0	Y	1.47	1
SDCAB05	FF1377B	Underlaid	1	0	Y	1.30	1
SDCAB05	FF1442Y	Underlaid	1	0	Y	1.47	1
SDCAB05	FF1447Y	Underlaid	1	1	Y	3.03	1

Stats per RX

TCH drop rate
HO failure rate…

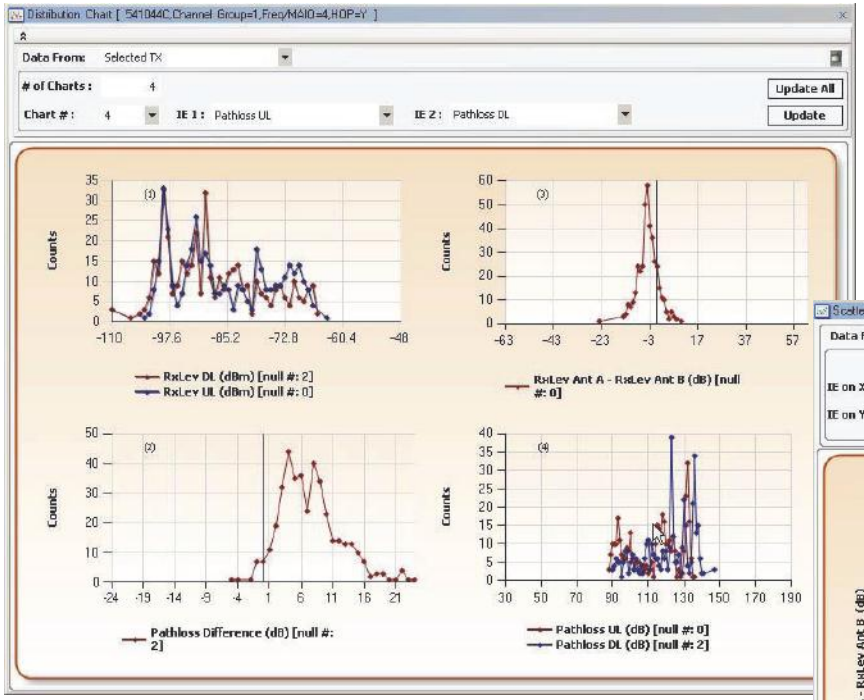
Physical RX

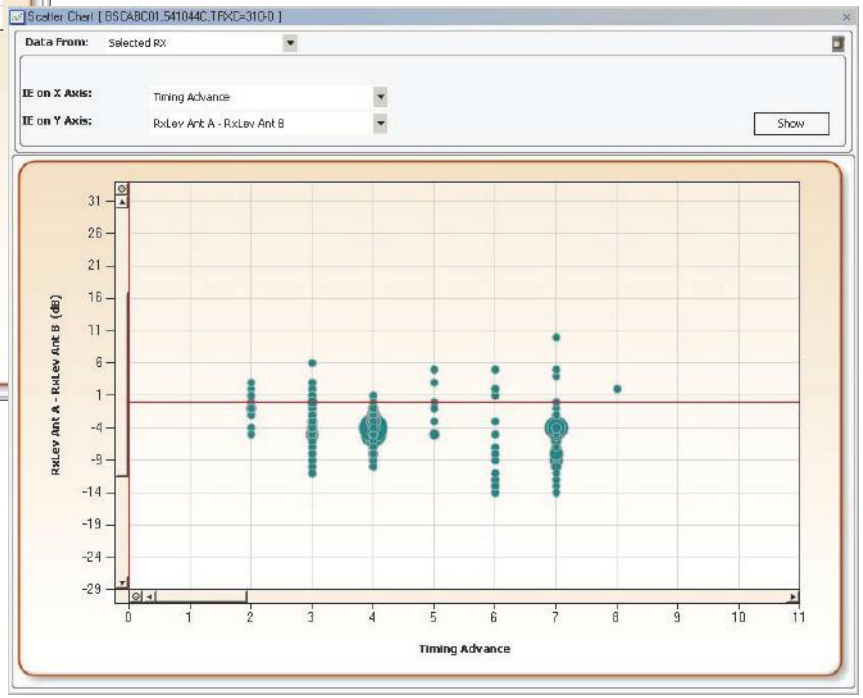
Sub cell	Freq/ MAIO	HOP	0	1	2	3	4	5	6	7
U	0	Y	23029		22444	22613	20682	22958	20508	23016
Abis Rate:										
U	2	Y	22850		19350	21827	13347	20979	20306	
Abis Rate:										

Summary
Database Summary
Logfile List
Recorded Cell List
Phone List
TRU List

BSC	Cell	TRXC (TG-LTRXC)	Cha	TCH Dropped Calls	TCH Dropped Call Rate
SDCAB05	FF1498X	19-2	1	4	1.69
SDCAB05	FF1491Y	52-8	1	4	1.54
SDCAB05	FF1447Y	43-3	0	3	100.00
SDCAB05	FF1447Z	44-6	1	3	1.09
SDCAB05	FF1491Z	56-3	1	3	1.23
SDCAB05	FF1498A	21-2	1	2	2.60
SDCAB05	FF1023X	69-1	1	2	3.85
SDCAB05	FF1442Y	11-5	1	1	1.47
SDCAB05	FF1081Y	27-6	1	1	2.04
SDCAB05	FF1447Y	43-7	1	1	0.55
SDCAB05	FF1447Y	43-8	1	1	3.03
SDCAB05	FF1447Z	44-9	1	1	3.33
SDCAB05	FF1447C	47-1	1	1	0.34
SDCAB05	FF1022Z	65-9	1	1	4.76

PER TX/RX CHARTS



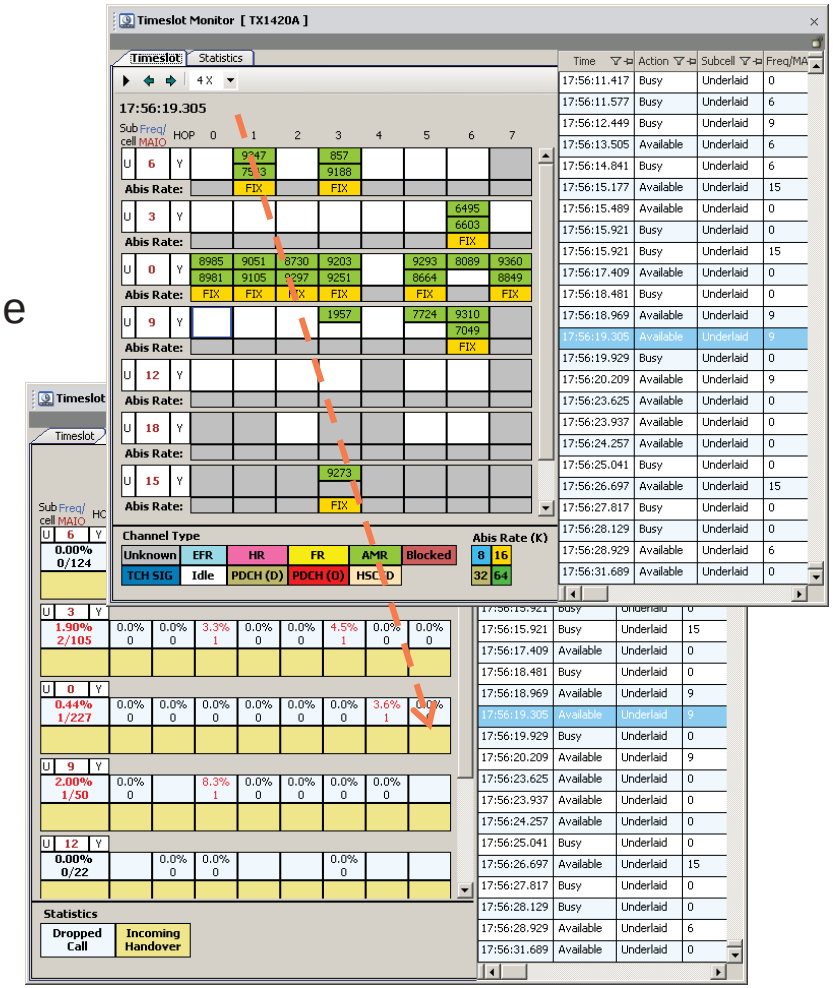


Note: TX statistics not valid for baseband hopping

TIMESLOT MONITOR

Analyze channel allocation down to the timeslot level

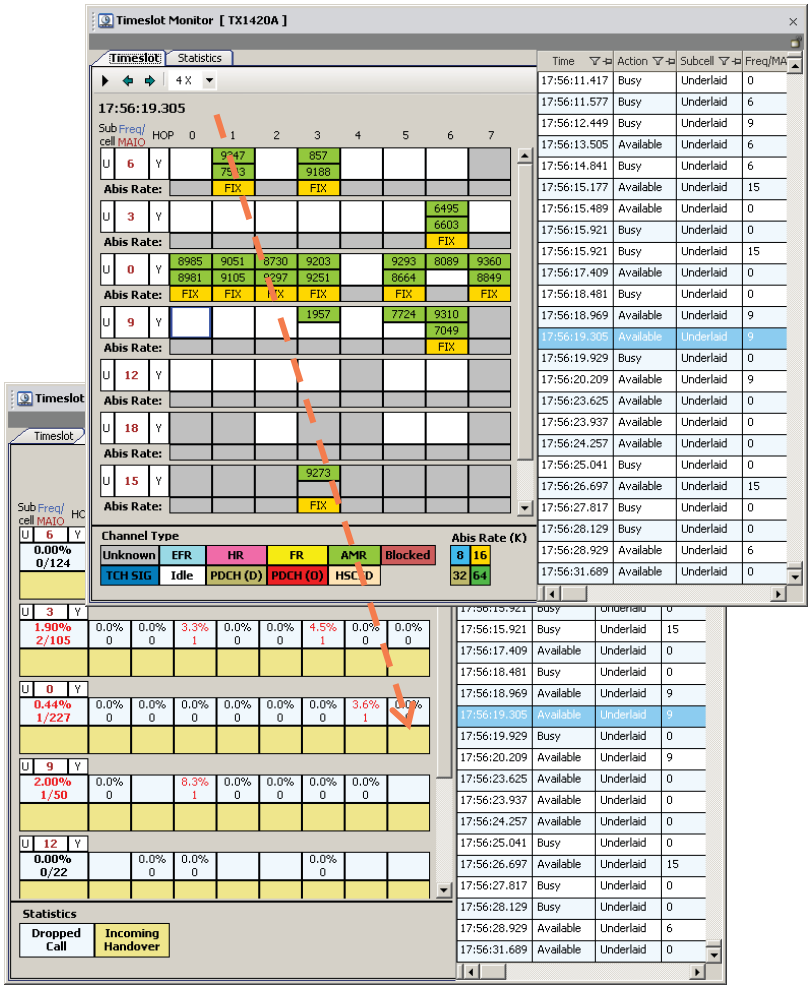
- Timeslot monitor
  - Make sure your AMR, HR/FR, OL/UL are allocating the resources correctly
  - See how the cell behaves when congested
  - Display ABIS rate



TIMESLOT STATISTICS

Analyze channel allocation down to the timeslot level

- Timeslot statistics
  - Identify TRX HW problems
  - Dropped calls/TS
  - Handover failure/TS

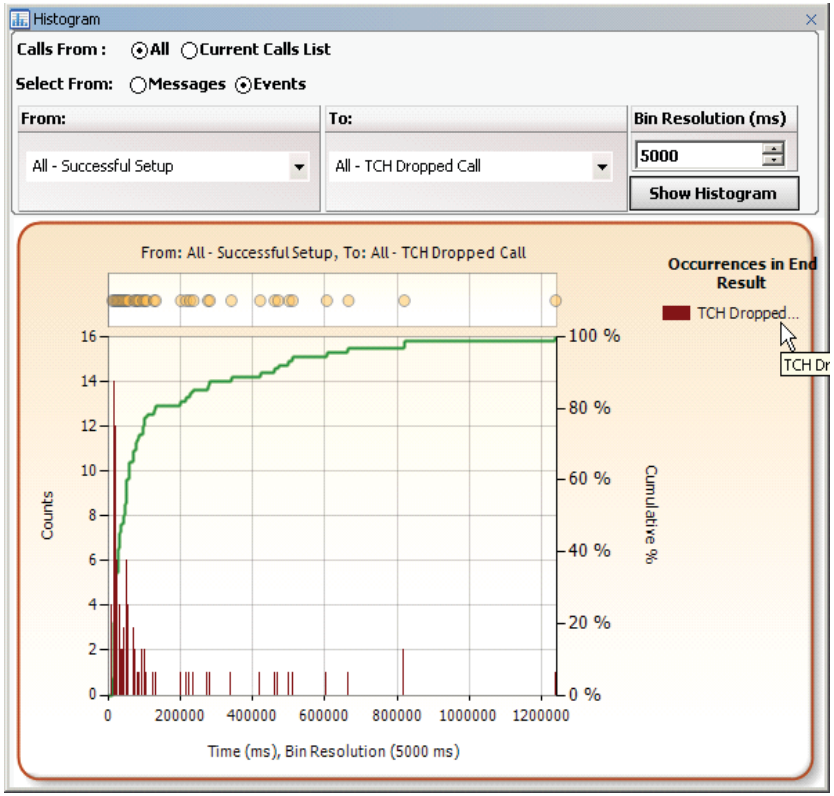


PHONE LIST

- Lookup table translates the IMEI TAC to manufacturer and model
- Summary statistics on IMEI TAC
- Filtering on IMEI TAC

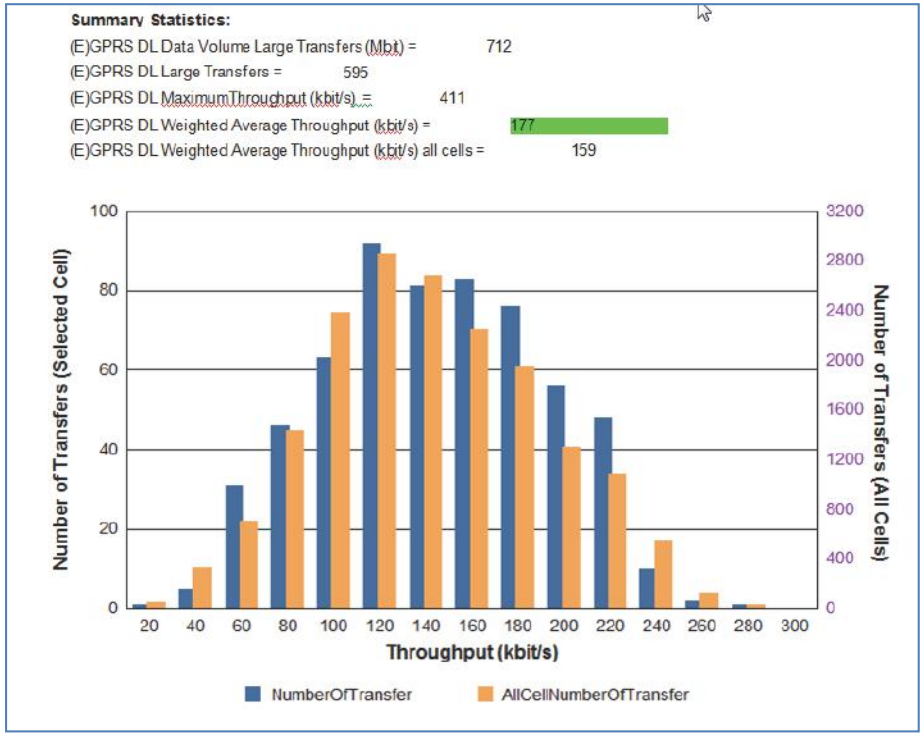
HISTOGRAM

- Chart for time difference calculation
- Analyze the time difference between any two events or messages in the database
  - Average time between handovers?
  - Call setup time?
- Stacked bars based on Call End Result
- Send to Call List



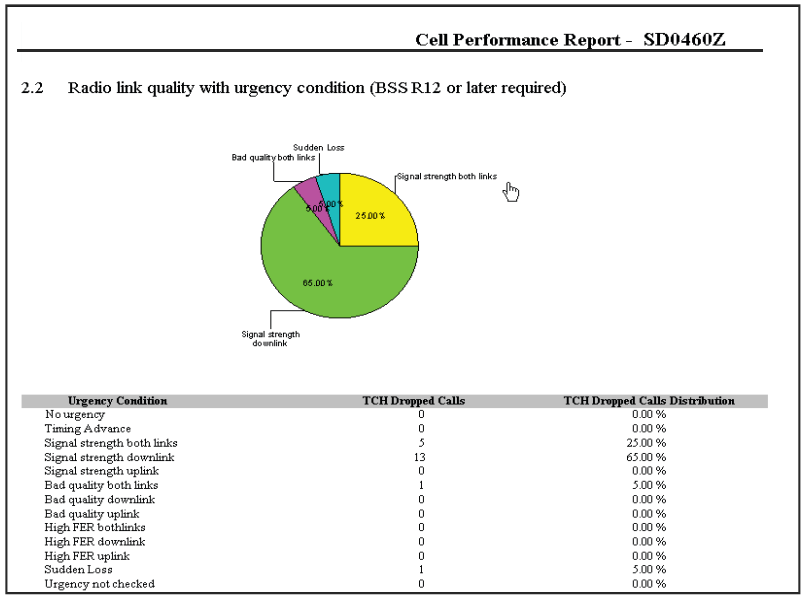
EGPRS AND GPRS PERFORMANCE ANALYSIS

- Summary Statistics per cell for EGPRS and GPRS Performance
- Analyze poor throughput, latency and buffer discard issues



CELL PERFORMANCE REPORT

- Coverage and interference analysis
- Equipment problem analysis
- Drops with same serving cell sequence analysis



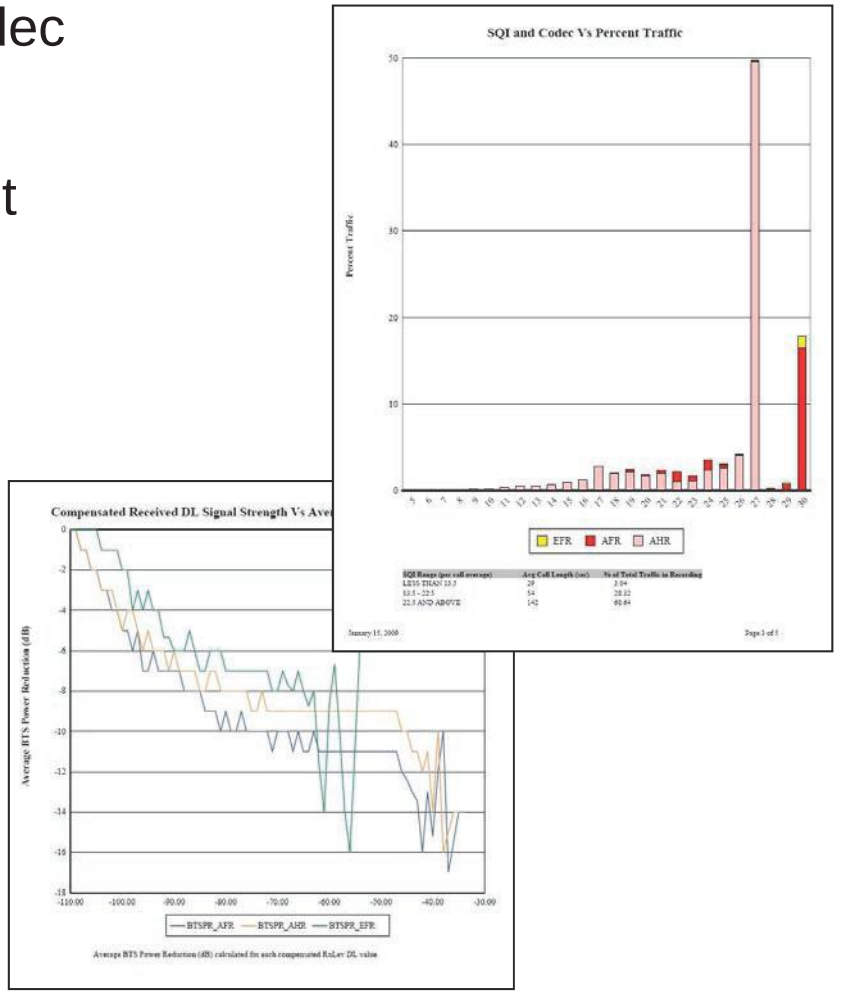
Cell Performance Report - SD0460Z

2.2 Radio link quality with urgency condition (BSS R12 or later required)

Urgency Condition	TCH Dropped Calls	TCH Dropped Calls Distribution
No urgency	0	0.00 %
Timing Advance	0	0.00 %
Signal strength both links	5	25.00 %
Signal strength downlink	13	65.00 %
Signal strength uplink	0	0.00 %
Bad quality both links	1	5.00 %
Bad quality downlink	0	0.00 %
Bad quality uplink	0	0.00 %
High FER bothlinks	0	0.00 %
High FER downlink	0	0.00 %
High FER uplink	0	0.00 %
Sudden Loss	1	5.00 %
Urgency not checked	0	0.00 %

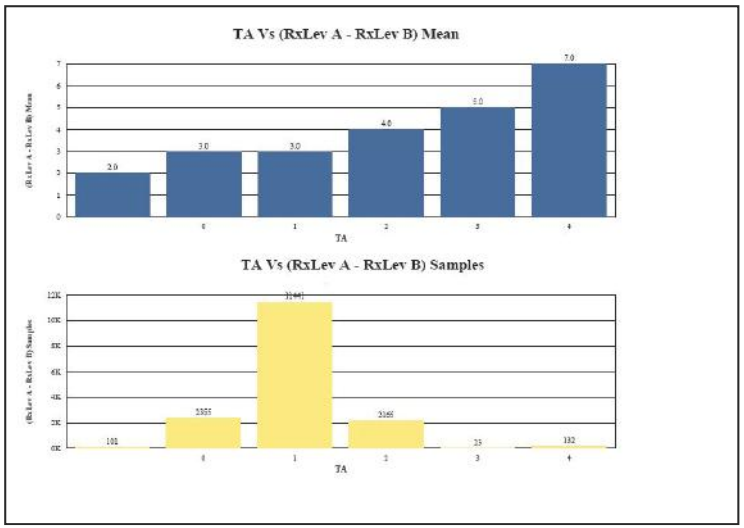
SPEECH QUALITY REPORT

- Analyze speech quality performance per codec for the whole database with AMR codec
- Estimate speech quality performance without AMR codec
- Analyze impact of BTS power control



FFAX REPORT

- Find problems in antennas and feeder branches
- Analysis of differences in signal strength measured simultaneously on the different receive branches
- Reports on different levels
  - Cell level summary (No. of samples, Mean, Std. Dev.)
  - RX level (No. of samples, Mean, Std. Dev)
  - Cell level at each TA value (No. of samples, Mean)
- Indicates vertical misalignment of antennas if difference increases or decreases with TA



Requires FFAX feature to be active in OSS-RC

[ ]

CONCLUSION

CONCLUSION

- TEMS Discovery Network (desktop edition) is primarily based on the event data from network nodes.
- Call-level data for large numbers of subscribers provides powerful troubleshooting and optimization capabilities.
- TEMS Discovery Enterprise (Network Module) takes this to the next level by:
  - Handling increased data volumes with a centralized, scalable server-client architecture
  - Automating data processing, monitoring and analysis: 365 x 24 x 7
  - Interfaces with desktop variants for troubleshooting and optimization
- More cost-efficient, subscriber-centric, operationally effective, and provides more-detailed information than passive probes and other traditional optimization methods to drastically improve KPIs and reduce churn for complex, multivendor, multitechnology networks of today

TEMS Discovery Network – The Solution for Today's Challenges!

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