

# nGenius Subscriber Intelligence

## Highlights

- Unmatched data and control plane session level performance visibility for LTE, UMTS, HSPA+, GPRS, and CDMA2000 mobile operators
- Support for Session Initiation Protocol based IP voice peering environments
- Correlated, multi-protocol, core to access session trace views
- Per session summarized details on subscribers, services, handsets, network elements, handover events, and error codes
- Subscriber activity history
- Rapid data mining and isolation of problems through user-defined filtering
- Directed drilldown to decoded data and control plane packets
- Seamless contextual workflows from alarms and alerts in nGenius Service Delivery Manager and performance views in nGenius Performance Manager

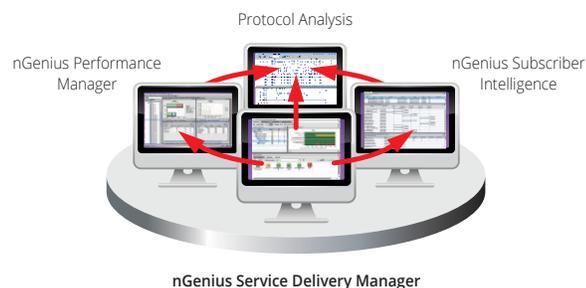
## Product Overview

### Core to Access Session Visibility

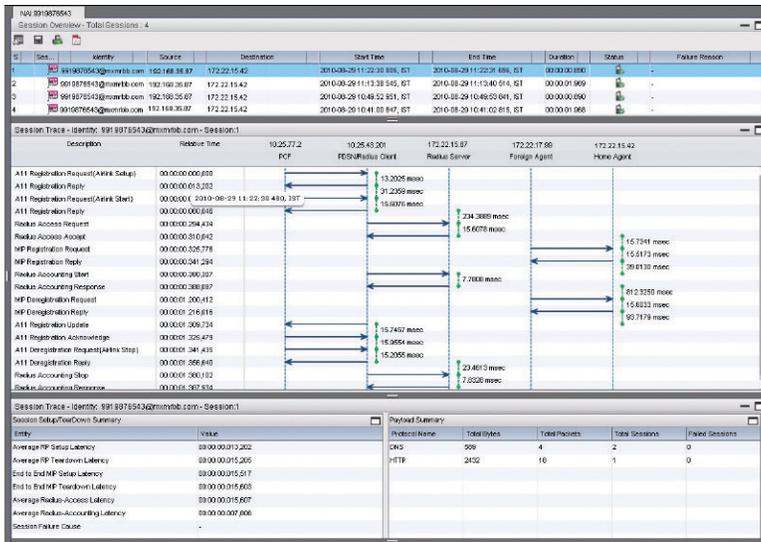
nGenius® Subscriber Intelligence takes IP performance management and analysis of mobile networks to the next level by seamlessly integrating core-to-access data plane and control plane session analysis with deep-dive packet and protocol analysis to enable rapid, more efficient troubleshooting and isolation of user experience problems in today's mobile data networks.

nGenius Subscriber Intelligence performs multi-protocol correlation with network, service and subscriber context of all data plane and control plane IP packets and displays graphical views of end-to-end subscriber sessions in an easy-to-navigate browser-based interface. The result is a highly scalable, real-time solution that provides rapid analysis of service problems through per session details for more efficient troubleshooting and analysis of modern IP networks. Key features include:

- Multi-protocol, core-to-access, correlated graphical views of data and control plane sessions in LTE, UMTS, HSPA+, GPRS and CDMA2000 IP-based networks and support for IP voice peering environments
- Correlated, graphical views of both signaling and media of IP voice sessions with Mean Opinion Score (MOS) and Session Initiation Protocol (SIP) performance metrics
- Advanced data mining with subscriber analysis, failure analysis and direct data analysis workflows to facilitate rapid identification of sessions of interest
- Per session details on subscribers, handsets and devices, services used, network elements traversed, and mobility performance
- Distribution of failures by subscriber, handset, APN (Access Point Name), System Identifier-Network Identifier (SID-NID), Home Agent (HA), AAA server and interface
- Activity history providing a logical grouping of subscriber activity to quickly get to the root of the problem affecting user experience in 3G networks
- Actionable drilldown to packet-level protocol detail



**Figure 1: The nGenius Service Assurance Solution supports contextual launches from the different analysis modules into nGenius Subscriber Intelligence.**



**Figure 2: nGenius Subscriber Intelligence provides correlated session trace and detailed session specific summaries of application performance, elements involved and handset and mobility information all in an intuitive and easy to navigate graphical user interface.**

nGenius Subscriber Intelligence enables service providers to easily sort through the billions of packets of data and control plane traffic on demand to quickly identify and resolve performance problems with complex IP-based services. It can address the challenge service providers have in troubleshooting long running mobile data sessions and provides the means to better and more easily understand application behavior over these persistent sessions. It supports troubleshooting and analysis capabilities with an integrated, end-to-end data and control plane view of all monitored hops of a mobile data session along with correlated views of signaling and media traffic for IP voice peering applications.

**Product Details**

**Powered By ASI™ Technology**

nGenius Subscriber Intelligence leverages Adaptive Service Intelligence™ (ASI) technology from NetScout and deep packet capture and analysis capabilities built into InfiniStream® appliances. Through the application of ASI technology, Adaptive Session Records (ASRs) are generated for each of the monitored protocols that make up a service delivered to a customer. The session records that make up an end-to-end conversation are kept in a distributed fashion in the InfiniStream appliances that monitor

the traffic in the different parts of the service delivery network.

The session records are efficiently sized and readily correlated, reducing the time and bandwidth required in moving the information from the InfiniStream appliances to the nGenius Subscriber Intelligence analysis engine. In this manner, nGenius Subscriber Intelligence can construct on demand, a correlated view of each monitored session that includes both control and data plane or both signaling and media information.

**nGenius Subscriber Intelligence User Interface**

nGenius Subscriber Intelligence enables advanced session analysis for operator networks with a flexible browser-based three panel display user interface.

The navigation panel automatically pulls over the InfiniStream appliances defined in the nGenius Performance Manager. It also includes a list of saved sessions and convenient launch points to the configuration window and subscriber, failure or application analysis workflow filter boxes.

The Subscriber Analysis option allows users to pull Activity History for subscribers within UMTS networks and the Session Trace options assists users with identifying the applicable interfaces to include for session level analysis within UMTS and GPRS networks.

LTE/UMTS/GPRS	CDMA2000	IP Voice
<ul style="list-style-type: none"> <li>Mobile Subscriber ISDN Number (MSISDN)</li> <li>International Mobile Subscriber Identity (IMSI)</li> <li>International Mobile Equipment Identity (IMEI)</li> </ul>	<ul style="list-style-type: none"> <li>Network Access Identifier (NAI)</li> <li>IMSI</li> <li>Mobile Equipment Identifier (MEID)</li> <li>Electronic Serial Number (ESN)</li> </ul>	<ul style="list-style-type: none"> <li>Calling party SIP</li> <li>Uniform Resource Identifier (URI)</li> <li>Called party URI</li> <li>MSISDN</li> </ul>

**Table 1: The subscriber identity information displayed is relevant to the underlying network technology.**

The Main Workspace display panels, based on the workflow selected, can include the following:

- A list of each session matching the data mining filter criteria
- A graphical multi-tier, multi-protocol correlated trace of the selected session
- Associated session summary details and failure distribution summaries

Users can drill-down from a session trace to the corresponding data and control plane packets. This helps operators accelerate the process of identifying, analyzing and isolating subscriber-specific service performance issues rapidly and efficiently.

## Key Capabilities

### Session Overview Panel

The session overview panel lists correlated transactions that meet the analysis filter criteria. The information displayed will be relevant to the troubleshooting workflow selected and the underlying network technology being analyzed. Table 1 provides examples of the subscriber and handset identity information that will be displayed according to the network technology under analysis.

The session duration, start and end times, status, source and destination address along with failure reason are included in the session overview.

### Session Trace Panel

The session trace panel displays a correlated, multi-protocol, multi-hop ladder diagram view of the selected session. The display includes:

- Sequential list of either data plane or control plane messages or signaling and media start and end messages with absolute and relative microsecond granularity timestamps
- Elapsed time between messages with color coded arrows indicating direction of message and error condition
- Network elements traversed including node name, alias and IP address or group of IP addresses
- Hot links to packet decodes

The user can toggle between control and data plane ladder diagrams.

## Subscriber, Failure Analysis and Direct Data Plane Workflows

Subscriber and failure analysis workflows provide visibility into per session details on subscribers, handsets, network elements, mobility performance and services used. Direct application analysis is supported and allows users to go directly to the customer data plane sessions of interest without going first into the control plane traffic to find the associated sessions. The application analysis capability will display correlated data plane messages across the monitored links and nodes carrying user traffic for LTE/EPC, UMTS/GPRS and CDMA2000 networks.

Analysis filters designed specifically for LTE/EPC, UMTS/GPRS, CDMA2000 and SIP based IP Voice peering networks are launched based on the interfaces a user wants to include in the analysis.

Once an analysis filter is selected for a particular technology domain, users can choose a troubleshooting and analysis option and populate specific search criteria to rapidly focus in on the control and data plane sessions of interest out of the millions of transactions occurring in the network.

User selectable filter criteria options are tailored to the specific technology domain and workflow selected. They can include the following options depending on the domain being analyzed:

- Date and time selection: Up to 12 hour window
- Subscriber identity
- Handset type/group
- Location: Tracking area, routing area, service area, SID-NID, or Cell ID
- URI registered domain, APN
- Node IP address, RNC ID
- Error codes, SIP and DNS response codes
- Session status: All, Successful, Failed, Ongoing
- SIP Session type: Call Session, Call events, All

## Network Domain Specific Contextual Information

The summary screens displayed in the nGenius Subscriber Intelligence user interface will depend on the troubleshooting workflow and the network technology the user is analyzing.

### LTE/EPC Failure Analysis Summaries

- Failure summary list detailing protocol, error group, number of failed sessions and number of subscribers involved
- Subscriber list with actionable list of subscribers, the number of failed sessions, and session duration
- List of handsets with associated number of failed sessions and subscribers affected
- Cell based distribution lists the cells with failed sessions and number of subscribers
- Tracking Area Code distribution summarizes failed sessions and number of affected subscribers by tracking area
- Radio access distribution summary lists the number of failed sessions and number of subscribers by Radio Access Technology

### LTE/EPC Subscriber Analysis Summaries

- Subscriber and session identity information includes temporary identities, first cell ID, eNodeB, MME and tracking area
- Session setup/teardown summaries details attach and detach response times and failure
- Mobility summary provides a list of cells and associated tracking areas, RAN and MME node IP addresses and duration time in each cell
- Equipment attach summary provides response times for authentication and service requests, identity and tracking area updates, and security mode procedures
- S1-AP procedures summary details response times for S1-AP procedures including context setup, E-RAB and handover related transactions
- Diameter transactions summary details response times for Diameter procedures
- GTP-V2 transaction summaries include response times for bearer establishment, indication, modification and deletion related procedures

### UMTS/GPRS Failure Analysis Summaries

- GTP-C failure distribution provides metrics on Gn interface transaction failures
- Gb and IuPS failure distribution views
- IMEI failure distribution by Type Approval Code
- Location Area-Routing Area (LA-RA) failure distribution with links to associated session list
- APN failure distribution details failures by APN with links to associated session list

### UMTS/GPRS Subscriber Analysis Summaries

- Session set up and tear down summaries for Gb, IuPS and Gn interfaces including information on Packet Data Protocol (PDP) response time, failure codes and DNS session resolution latency
- Mobility summary for IuPS details the service areas, routing areas, RAN and mobile core nodes and duration associated with a session
- Payload summary includes statistics on data plane applications along with failures per application
- Subscriber equipment detail provides information on handset manufacturer and model type
- Subscriber and session identity provides information on the subscriber including temporary identities along with first routing area, service area and SGSN for a given session
- Equipment attach summary provides average latency metrics on routing area updates (RAU), Packet Temporary Mobile Subscriber Identity (P-TMSI), identity, and authorization related transactions

### Subscriber Activity History - for UMTS and LTE Networks

The subscriber activity summary option allows users to select the MSISDN, IMSI or IMEI for a particular customer and view the associated control and user plane activity of that customer for up to one week. Details displayed include both summarization of activity over the entire time frame and actionable detailed information broken down by hour or the entire day. Summary information includes the session state counts, uplink and downlink control traffic volume, mobility state, failure counts, cell sites visited, and APNs accessed. Detailed summaries can be expanded to provide further information on the following:

Sessions: Sessions summary provides PDP context creation details including setup and modify failure breakdown along with individual session details.

- Mobility: Mobility details include information on subscriber's mobility experience moving between LTE network coverage and legacy UMTS/GPRS or CDMA 2000 networks. It also includes information on subscriber's experience for the time spent in each geography - Tracking Area for a LTE network and Location Area - Routing Area for UMTS network
- Bearer: Bearer details include connection metrics, bearer connections and bearer failure distribution and count
- Events summary: Events are detailed for session management, mobility management, radio access network procedures. The exact messages depend on whether they are shown for LTE or 3G networks
- Events listing: The event list provides a comprehensive breakdown of each event with information on the source, destination, protocol and interface
- Activity map: Provides a granular view of customer activity broken down in 15 second increments detailing customer location, user status, bearer activity and error status to quickly identify when a problem occurred

### Interface Discovery For Session Trace

nGenius Subscriber Intelligence has a streamlined interface discovery tool that can identify applicable Gn and IuPS interfaces based on the subscriber's IMSI or MSISDN. The application automatically identifies the interfaces with traffic associated for that subscriber and additional Gi and Gb interfaces can be selected for more comprehensive data mining.

### CDMA2000 Failure Analysis Summaries

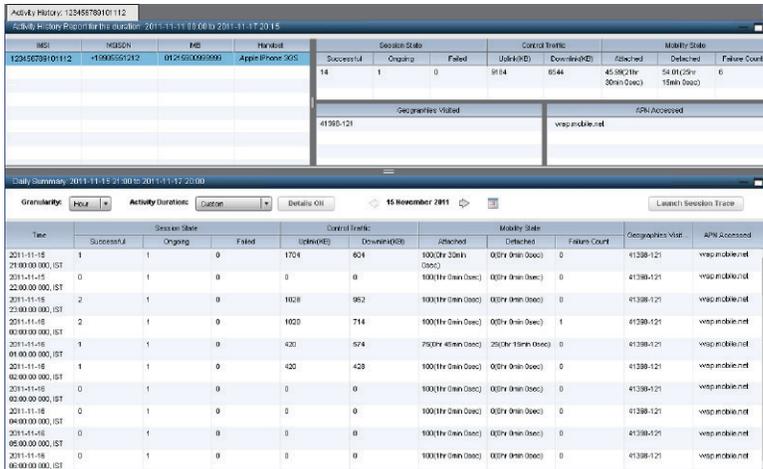
- Failure distribution views on A11 includes information on error codes observed with links to associated session list
- Failure distribution views on Mobile IP (MIP) include failure distribution on error codes with links to associated session list
- Failure distribution views are displayed broken out by R-P, A12 and P-H interfaces and by SID-NID and MEID

### CDMA2000 Subscriber Analysis Summaries

- Payload summary includes statistics on data plane applications along with failures per application
- Session setup/teardown details include session failures for the A11 setup interface
- Subscriber and session details include information on subscriber's MEID, Mobile Station Identifier (MSID), NAI and Home Address
- Mobility summary details on Packet Control Function (PCF), Packet Data Service Node (PDSN), SID-NID, Cell ID, start time and duration per session

### Application Analysis Summaries UMTS/GPRS and CDMA2000

Mobile control plane analysis for Gn, IuPS, R-P, and P-H interfaces include application details on protocols, hosts, URLs and messages; details include traffic metrics by session leg including response time and intersegment delays.



**Figure 3: Intuitive views simplify underlying service and network complexity by logically grouping subscriber activity to help quickly get to the root of the problem affecting user experience in 3G networks.**

**IP Voice Summaries**

Subscriber identity summaries include:

- Session setup/teardown summaries with delay details on session requests, disconnects, duration and Instant Message (IM) requests
- Media/Payload summary with calling and called party IP address, audio port and video port
- DNS summary includes Name Authority Pointer (NAPTR) resolution latency, service resolution latency, node address resolution latency, total DNS resolution summary
- SIP error distribution summary of 4xx, 5xx and 6xx SIP response messages includes number of subscribers involved and total sessions in addition to DNS failures
- SIP control plane summary metrics include Session Establishment Ratio (SER), Session Effective Establishment Ratio (SEER), Session Defects Ratio (SDR), Ineffective Session Attempts (ISA), Session Disconnect Failure (SDF), Session Completion Ratio (SCR), Session Success Ratio (SSR)
- IP voice application analysis summaries includes media metrics (MOS, jitter, dropped packets), payload type and IP metrics

**Actionable Drilldowns to Packet-Level Protocol Details**

- Drill down from ladder diagram legs into decode of control plane packets only or combined data and control plane packets
- Packet decode displays Layer 2-7 protocols for deep dive troubleshooting and analysis
- Side-by-side packet-level comparison

**Interfaces and Protocols Supported**

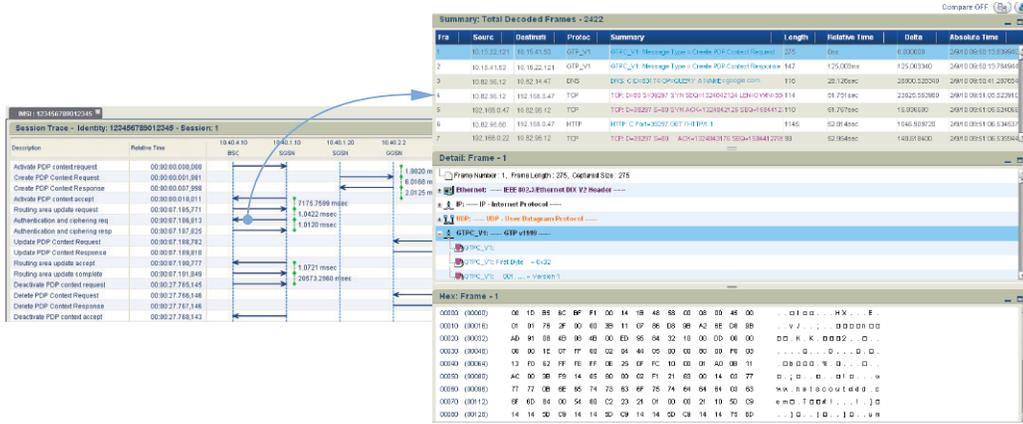
nGenius Subscriber Intelligence supports mission critical mobile interfaces and protocols to provide a comprehensive core to access view of subscriber sessions that include both control and data plane traffic.

**Part of the nGenius Service Assurance Solution**

nGenius Subscriber Intelligence is a core component of the nGenius Service Assurance Solution. Through full integration with other nGenius applications, service providers can support multiple workflow paths for faster detection, analysis, and isolation of service and network problems. Other solution components include the following.

<b>Protocols supported</b>	GTP-V0, GTP-V1, GTP-V2, S1-AP, S1-NAS, Diameter, DNS, Electronic Number (ENUM), Domain Host Control Protocol (DHCP), Radio Access Network Application Part (RANAP), Base Station GPRS Protocol (BSSGP), GPRS Mobility Management (GMM), Session Management (SM), RADIUS, GRE/PPP, MIP, IP/IP, Multimedia Messaging Service (MMS), Hyper Text Transfer Protocol (HTTP), SIP, Real-time Transport Protocol (RTP), File Transfer Protocol (FTP), Post Office Protocol (POP3), Simple Mail Transfer Protocol (SMTP)
<b>Codecs supported</b>	G711a and $\mu$ law, G729, G729a, G729ab, Enhanced Variable Rate Codec (EVRC, EVRC-B), narrowband Adaptive Multi-Rate Codecs (AMR)
<b>Supported IP interfaces</b>	LTE/EPC: S1-MME, S1-U, S11, S2a, S2b, S3/S4, S5/S8, S6a, Gx, S10, SGi; UMTS/GPRS: Iu-PS, Gb, Gn, Gi, Gp, AAA; CDMA2000: R-P (A10/A11), P-H, Pi, A12, PDSN-AAA; IP Voice: Interconnect Border Gateway Function (IBCF) to Border Gateway Control Function (BGCF), IBCF to Media Gateway Control Function (MGCF), Interconnect Border Gateway (IBGW) to Media Gateway (MGW), BGCF to ENUM server, BGCF to DNS server

**Table 2: Protocols, codecs and supported interfaces.**



**Figure 4: Clicking on a leg of a session ladder diagram will launch a decode view of the packets associated with the specific message.**

### nGenius Service Delivery Manager

- Intelligent early warning of performance degradation
- Service-aware dashboard with proactive and predictive alarming and alerting
- Flexible representation of end-to-end services with regional, local or geographic views
- Automatic detection and alarming of anomalous service behavior

### nGenius Performance Manager

- Service and network performance visualization, analysis and reporting
- Mobile data analytics
- Packet flow-based KPIs
- End-to-end performance views
- Proactive identification of subscriber affecting issues

### NetScout Intelligent Data Sources

- InfiniStream appliances and virtual agents
- Highly scalable deep packet capture and analysis of control and data plane traffic
- Packet flow KPIs, Quality of Experience (QoE) metrics, adaptive session records and packet storage
- Local processing and scalable storage options up to 96 TB
- Passive and non-intrusive

### Sniffer Analysis Software

- Packet-level analysis
- Deep dive problem analysis and troubleshooting
- Per-subscriber visibility

Features	Specifications
File System (Windows)	Minimum 30 GB for OS partition NTFS-formatted hard disk
File System (Linux Platform)	Minimum 100MB for boot partition Minimum 10GB for OS
RAID configuration	RAID 5
Hard drive configuration	5x300 GM or 6 x 250 GB
Media Drive	DVD ROM
Network Adapter	One 100/1000 Ethernet adapter
Power supply configuration	Dual redundant power supplies
Java version	JRE v1.6.0_07 (32 or 64-bit); also referred to as Java SE 6, Update 7

**Table 3: nGenius Subscriber Intelligence Server Specifications.**



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