

TNS Identity Protection Services

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Paul Florack, VP Product Development

Lavinia Kennedy, Director Product Management

Jim Tyrrell, Sr. Director Product Marketing

- TNS Identity Protection Services Overview
- TNS Tools to Identify & Block Unwanted Calls
- Call Guardian Authentication Hub - Supporting STIR/SHAKEN Deployments
- TNS Tools to Support Legitimate Enterprises and Call Originators
- TNS User Study on STIR/SHAKEN Caller ID Authentication and Impacts on User Display

TNS Identity Protection Services Overview



Enhanced Call Experience

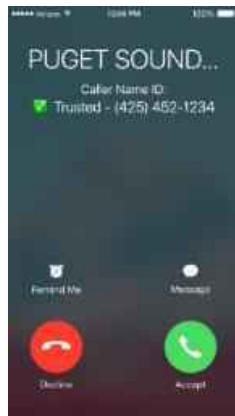
Network Integration

- Signaling Events
- Network Interoperability
- Treatment & Routing
- Call Guardian Authentication Hub



Federated Data Sources

- **Identification**
Person, Business & Category
- **Reputation**
Risk Level & Category



Enriched Experiences

- Android & iPhone
- Pre-Loaded, Downloaded & SDKs
 - Freemium
- Enriched identification
- Post Call Actions
- Marketing Engagement



Analytics Engine :: Big Data Solution, Real-Time Scoring

TNS Network Data Sources

8XX Call
Events CNAM



ENUM/LNP
VoLTE Registry

SS7
Origination

SIP
Origination

Crowd-Sourced
Feedback



Carrier Partner
Data



STIR/SHAKEN
Inputs



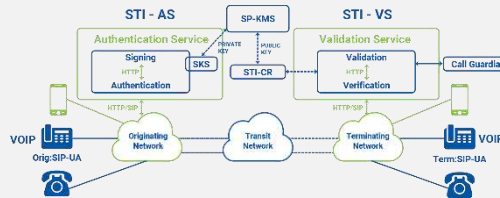
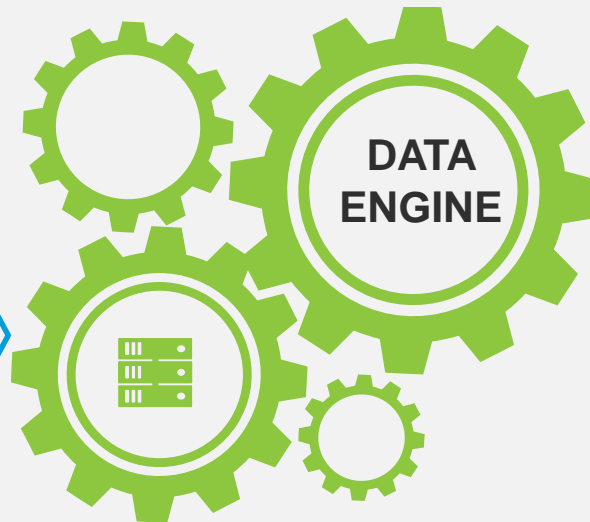
Enterprise
Data



Industry
Databases



1B Signaling + Database Transactions
Per Day from Over 500 Operators



Call Guardian
Authentication Hub



Machine Learning
Algorithm



Carrier Grade
TN Reputation Query
Server



Mobile App



Business
Intelligence Portal

TNS Tools to Identify and Block Unwanted Calls



TNS Call Guardian is an industry leading call analytics solution that uses cross-carrier real-time call events combined with crowd-sourced data to create accurate and comprehensive reputation profiles differentiating legitimate users of telecommunications services from abusive, fraudulent, and unlawful users

Layered Approach to Identifying Bad Actors



Do Not Originate Telephone Numbers



Invalid, Unassigned, Unallocated Telephone Numbers



Crowd-Source Data



STIR/SHAKEN Parameters



Cross-Carrier Origination Visibility of 500+ Operators



Machine Learning Algorithm



Real-Time Scoring of 1.5B TNs

- Supports Multiple Protocols (ENUM, SIP, AIN, REST, Wireless)
- Carrier Deployed Service Model (no OTT)
 - 4 of top 6 wireless carriers
 - Tier 1 landline carrier
 - Active trials with leading cable MSO
- Data Encryption, Consumer & Carrier Privacy Policies Maintained
- Business Intelligence & Insights
- Best In Class Spoofer Identification
- Network Savings
 - Leverage signaling protocols for more scalable approach
 - Helps to reduce network costs rather than adding components

- **TNS Definitions that Guide our Scoring of Bad Actors:**

- **Spoofers**

- Any person knowingly and willfully causing transmission of misleading or inaccurate Caller ID info for which there is suspicious behavior but no confirmed report or calling behavior indicative of malicious intent, which otherwise would cause categorization to graduate to potential fraud.

- **Spammer**

- Any person or entity placing automated telephone calls, telemarketing and informational, in a manner that might not comply with state and federal laws governing the use of auto-dialers. Regulatory violations are normally difficult to prosecute as there is no meaningful disclosure of identity when placing calls.

- **Potential Fraud**

- Any person that appears to be in reckless disregard of state and federal laws governing the use of auto-dialers, or a person using an auto-dialer in the commission of a crime of identity theft or fraud. Typically, deceptive caller ID practices are employed to avoid detection or deceitfully gain caller's trust.

- **Robocaller**

- Robocalls are calls made with an autodialer or that contain a message made with a prerecorded or artificial voice. Offenders are normally straightforwardly identified as reputable entities and most commonly place calls with meaningful disclosure of identity.

2019 TNS Robocall Investigation Report



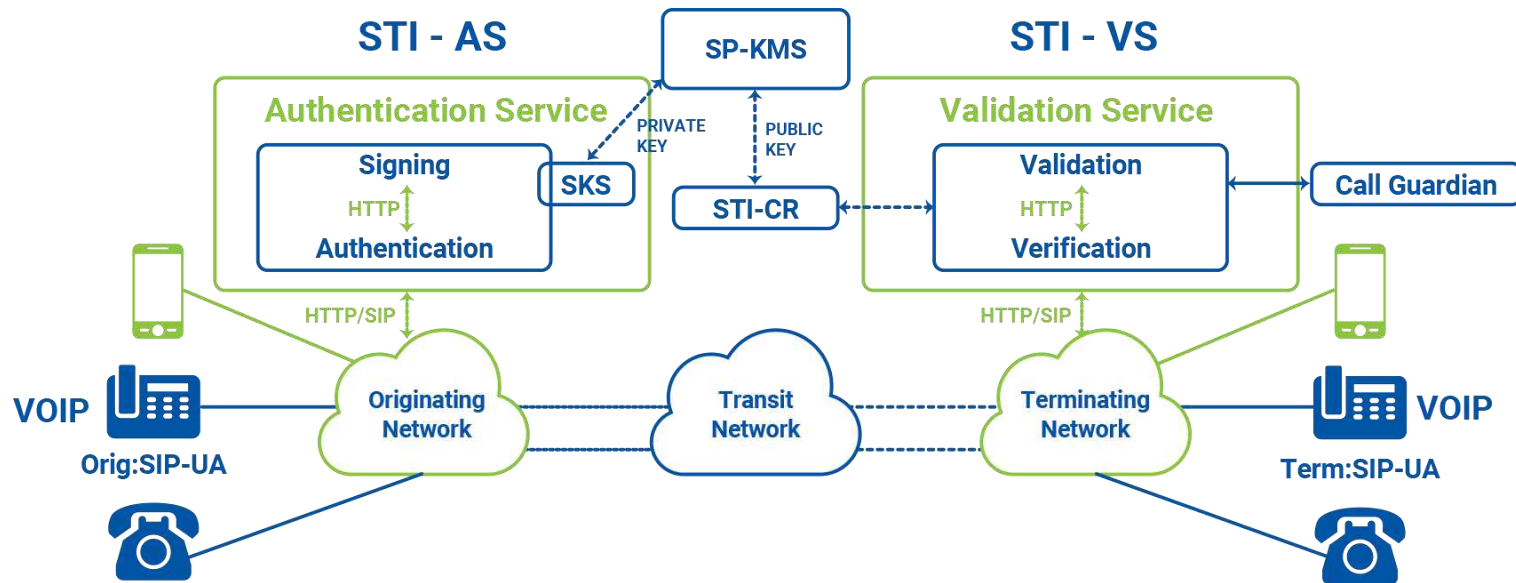
- In-depth report draws on TNS' unique data insights and was published at the end of March. The report is available on request by completing the form on the [TNS website](#).

- **Robocall spoofers hijacking mobile numbers.** 1 in 4,000 mobile numbers are now being hijacked by robocall spoofers every month, causing 20% of people who have had their number hijacked to disconnect their phone.
- **Neighbor spoofing & snowshoe spamming more sophisticated.** High risk (scam/fraud) calls using neighbor spoofing now accounts for 24% of all negative calls - up 5 % from the prior year. Spoofers are also more elusive, using snowshoe spamming to propagate spoofing over several telephone numbers in low volume and rapidly churning through them to evade detection.
- **Legitimate customer care numbers are being spoofed.** More than 2/3 of calls from legitimate toll-free numbers are identified as nuisance or high-risk.
- **Tier 1 carriers aren't the problem.** Almost 3/4 of all calls, positive and negative, come from Tier 1 providers, yet a little over 10% of the calls from those carriers are considered high-risk.
- **Negative traffic from Canada is growing at over 100%.** Originating Canadian inter-carrier calls labeled as nuisance and high-risk saw an increase of over 100% from Q1 to Q4 2018.

Call Guardian Authentication Hub



- TNS Adds AS/VS Function to Include Integration to Call Guardian
 - Leverages TNS Call Guardian reputation score algorithms to influence certificate-based trust
 - Powered by Metaswitch MetaSphere Qcall for STIR/SHAKEN authentication and validation
 - Delivered as a Managed Service
 - Enables fast cloud-based deployment for Tier 2 and Tier 3 providers
 - Provides pre-STIR/SHAKEN out of band capability for TDM carriers



Benefits of Call Guardian Authentication Hub

Block Calls at Network Boundary

- FCC 17-151
- Reduce Network Costs

Trace Calls to Source

- FCC - Urges More in Phone Industry to Join in Tracing Scam Robocalls
- Verstat Parameters from STIR/SHAKEN Provide Origination ID

Ease of Deployment

- Fully Managed Solution - Turnkey End-to-End Solution
- OPEX-based Model - Cloud-based Solution that Scales Up and Down to Any Size Network
- Ubiquitous Solution - Supports Multiple Network Protocols (SIP, AIN, IMS, NGN) and Integrates with All Major Network Elements



Detect Illegitimate Calls With Analytics

- FCC - Urges More in Phone Industry to Join in Tracing Scam Robocalls
- Provide Improved Call Management for Your Subscribers with Attestation

Opt-In Filtering

- FCC - Provide Consumers with Free Robocall Blocking Tools
- Network Level Solution Enhanced Caller ID and Branded Calling

Call Authentication Framework

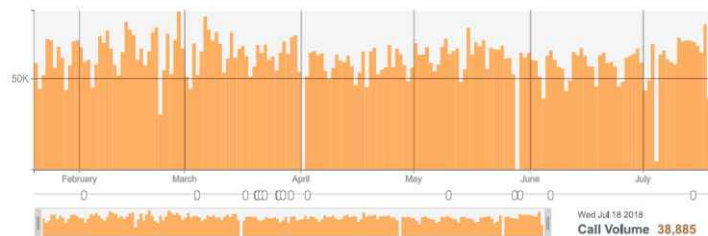
- FCC - Caller ID Authentication Necessary for Consumers in 2019
- Accelerates Timetable for Adoption & Parity with Tier 1 Industry Peers

Support Legitimate Enterprises and Call Originators



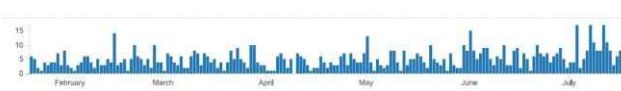
■ Improved Tools for Legitimate Call Originators

Call Volume & Reputation History

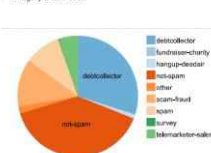


CROWD SOURCE SENTIMENT

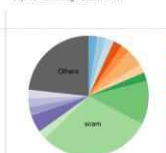
Crowd Source Event Trend



Category Distribution



Top 15 Hash Tag Distribution



Crowd Source Totals

Total Crowd Source Events
1,571
Total Hash Tags
43

Crowd Source Events

Event Time	Reported By	Category	Comment
07/16/2018 16:32:33 1810		detcollector	-
07/16/2018 16:03:01 1203		detcollector	-
07/16/2018 15:16:50 1213		scam-fraud	-
07/16/2018 12:30:06 1209		detcollector	-
07/17/2018 17:51:32 1313		not-spam	-
07/17/2018 15:16:35 1443		detcollector	-
07/16/2018 19:49:58 1214		detcollector	-
07/16/2018 14:37:46 1810		not-spam	-
07/16/2018 13:15:15 1513		hangup-deadair	-
07/16/2018 12:14:06 1449		detcollector	Block them tell you call them back!
07/16/2018 11:50:21 1774		detcollector	-
07/16/2018 05:54:24 1883		detcollector	-

■ Robust Enterprise Registration Process:

- Established relationship with Aggregators
- Direct relationship with Enterprises via reportarobocall.com and carrier channels

■ Available in Market Today for Enterprises and Carrier Partners:

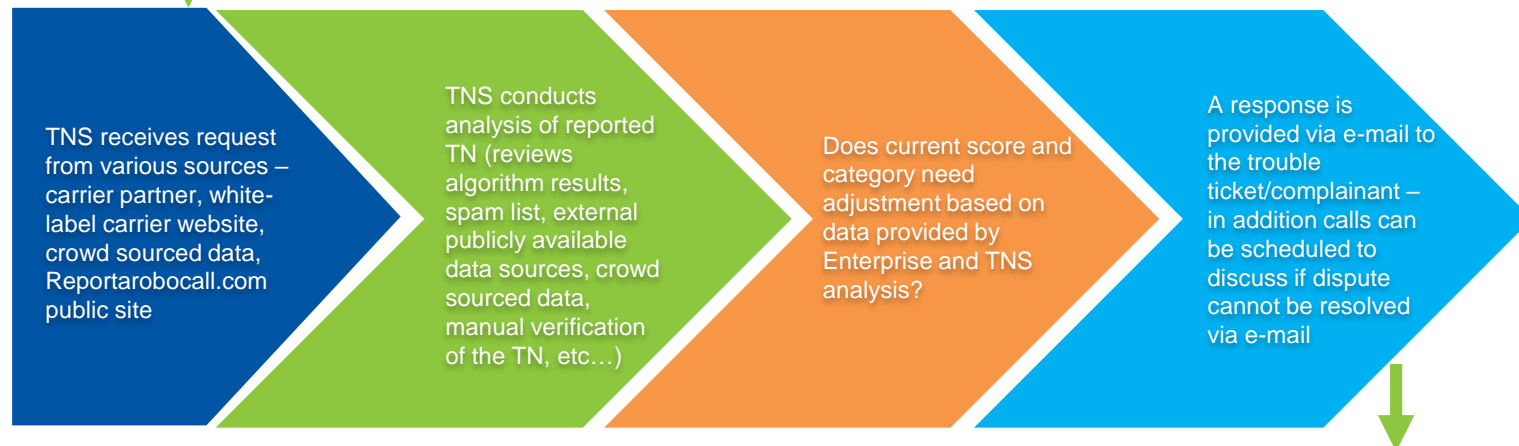
- Registration of telephone numbers
- Ability to provide feedback into TNS Reputation Scoring
- Ability to improve TNS Reputation Scoring
- Notifications when TNS Reputation Scoring changes
- View into crowd sourced feedback
- API for real-time data feeds

Robust Process to Address False Positives

Enterprise contacts TNS:

1. Use reportarobocall.com website
2. Call Customer Support or Enter trouble ticket using TNS' online ticketing tracking and reporting system
3. Send an e-mail to TNS

TNS False Positive Rate is very low, most false positives are caught & adjusted automatically by the Call Guardian machine learning algorithm



Registered Enterprise receives results from TNS. Potential outcomes can include, but not limited to:

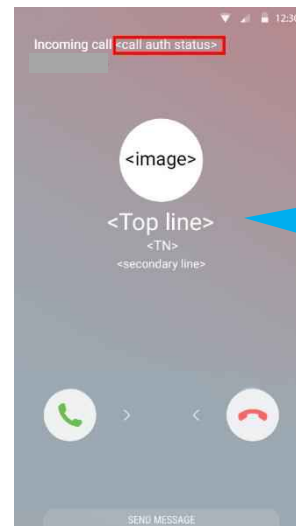
- Adjustment of the current scoring and/or categorization based on assessment of calling pattern and other factors
- A response that the TN score and/or category is reflective of the TN's current calling pattern

User Study on STIR/SHAKEN Caller ID Authentication and Impacts on User Display

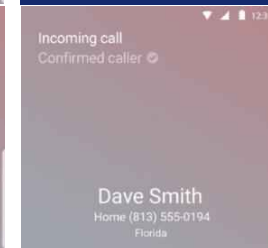
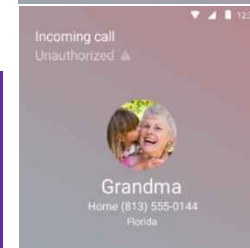
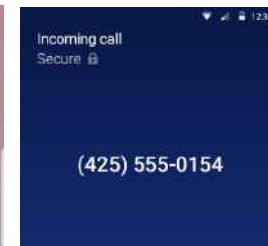
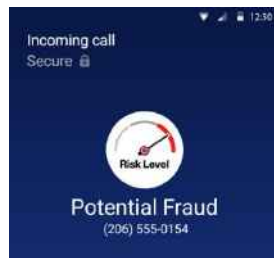
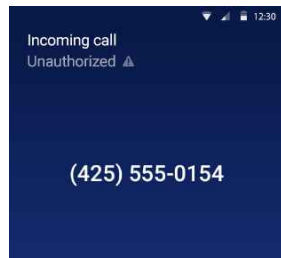


Learnings:

- ❑ Ability to display the identity of the caller and the purpose of the call was a key feature users were looking for
- ❑ Don't show anything related to TN Validation and rely on your analytics to mark calls as "bad"
- ❑ Be as discreet as possible when displaying the TN Validation indicator and be prepared to educate users in order to avoid care calls
- ❑ Users find Accuracy of Analytics important; STIR/SHAKEN puts additional pressure on the Analytics providers to correctly classify/tag the caller



TN Validation is not shown in the "sweet spot", so as to not confuse the Consumer

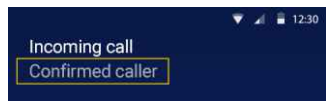
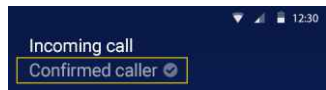


Key Points of Consideration:

- Users did not adjust behavior w/ or w/o TN Validation displayed
- Users found analytics more important than TN Validation
- Ability to display the identity of the caller and the purpose of the call was a key feature consumers were looking for
- Carriers take on greater cost when consumers are confused (i.e.; calls to care), so education is required for any new display – icon or text
- Each provider has a different Analytics Scoring approach, requiring a unique display strategy per Carrier

Observations in Comparing TN Validation Displays

Top display options



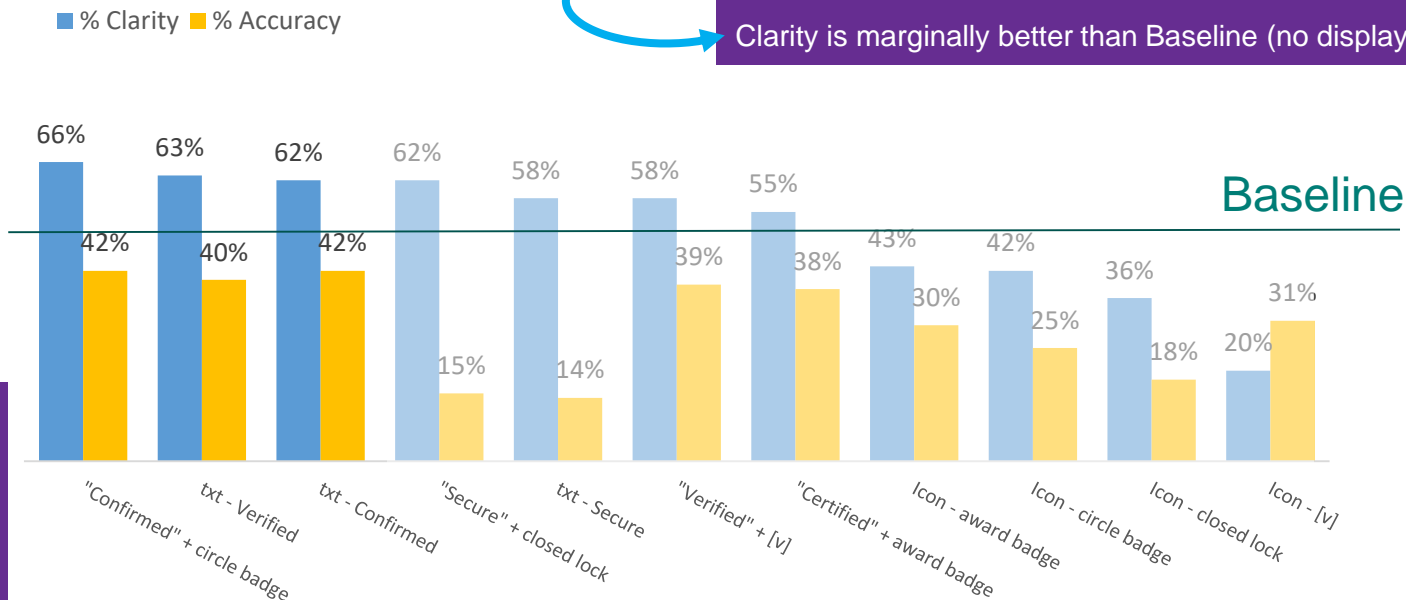
The combination of text and icon for “Confirmed caller” received the highest clarity and accuracy scores of all TN Validation Passed display options tested.

Key Points

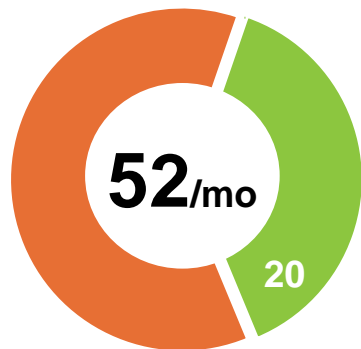
Respondents gave similar ratings on clarity and accuracy for most of the combination text & icon and the text only display options.

Exception is any display w/ the lock icon had the lowest accuracy out of all the options.

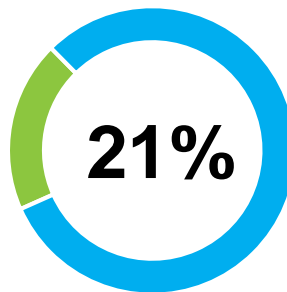
Clarity is marginally better than Baseline (no display).



Missed “wanted” calls w/ Enhanced Caller ID

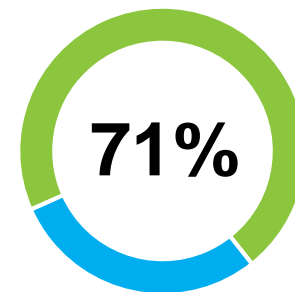


■ Wanted ■ Unwanted



■ Answer ■ Don't Answer

without Enhanced Caller ID



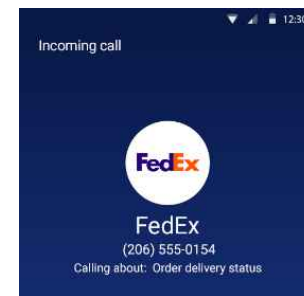
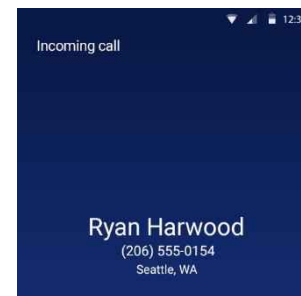
■ Answer ■ Don't Answer

with Enhanced Caller ID

Respondents want to see more information on the identity of the caller and the purpose of the call

79% of wanted calls are **not likely to be answered**;

- A child's school,
- A delivery of your wine,
- A hospital or ...



All Users TN Validation w/ Consumer's Contacts



Call from contact
w/ TN Validation Passed

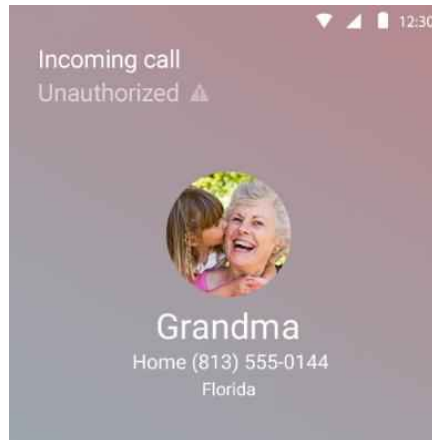


Call from contact
w/ TN Validation None

6 out of 10 calls are likely to have **TN Validation None** information at all.

TN Validation with contact information is confusing. Consumers generally assume they can trust calls from people in their contacts and **TN Validation adds no value.**

"If I see a call from mom, I'm most likely going to answer it whether or not the Confirmed Caller indicator is shown."



TN Validation Failed for calls from contacts is very confusing to consumers. It's not clear to the consumer who is actually calling them or if they should answer or not.

Thank You!



10740 Parkridge Boulevard, Suite 100, Reston, VA 20191, USA



solutions@tnsi.com



+1 703.543.8300



www.tnsi.com