Google

Improving 112 Location by Reducing Android ELS Error Rate

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Agenda

- ELS errors and error rates

- Troubleshooting ELS errors

- One ELS partner's perspective

- Case studies

ELS Errors and Error Rate: Cause & Effect

ELS errors/error rate: what it is, why it happens

Two reasons for ELS errors (failures):

1. No location computed in the message sent to the Endpoint

2. Location computed and transmitted from device but
   - ELS message not received by Endpoint

   or

   - No network acknowledgement within ***30 secs (Data SMS)****

ELS ERROR RATE =

# of Failed ELS messages / Total # of ELS Messages

* HTTP timeout = 10 secs, considered an ELS error if we don't get a 200-299 response

Error rates can vary across and within countries
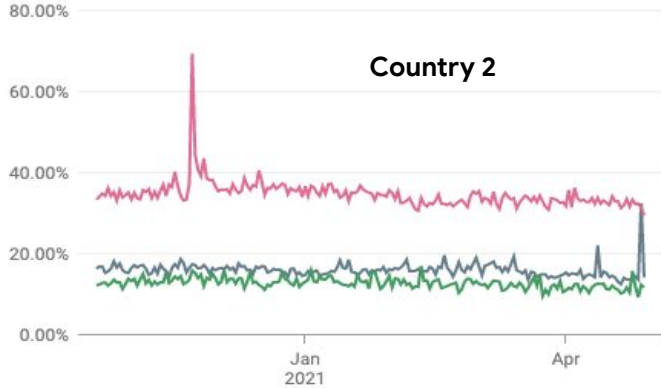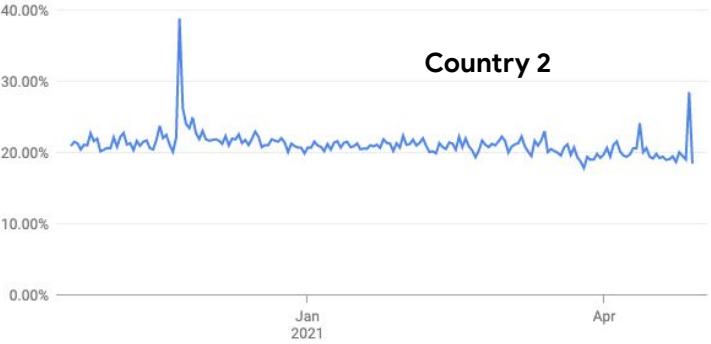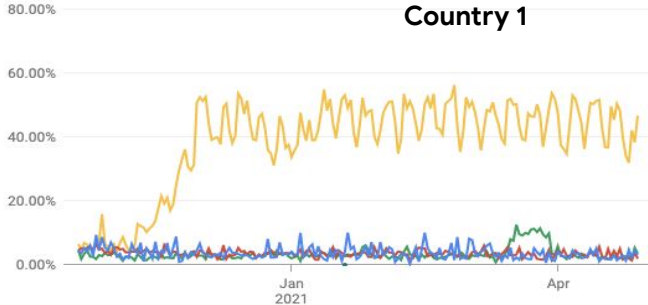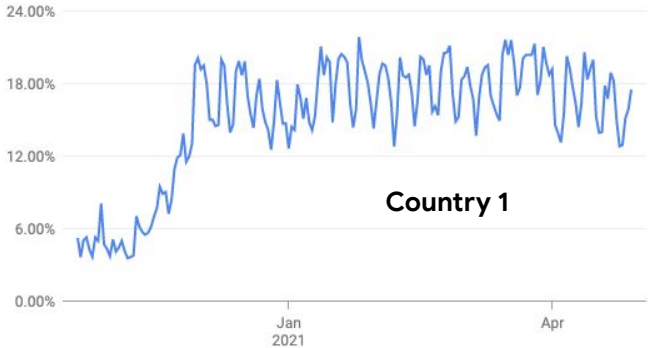
Common root causes behind errors

1. Network/Hardware/Software Policies
   - Some MNOs, SMS infra vendors or device OEMs have configured their systems/devices to hold all SMSes:
     i. During an emergency call
   ii. When device is emergency camped (roaming/in SOS mode)
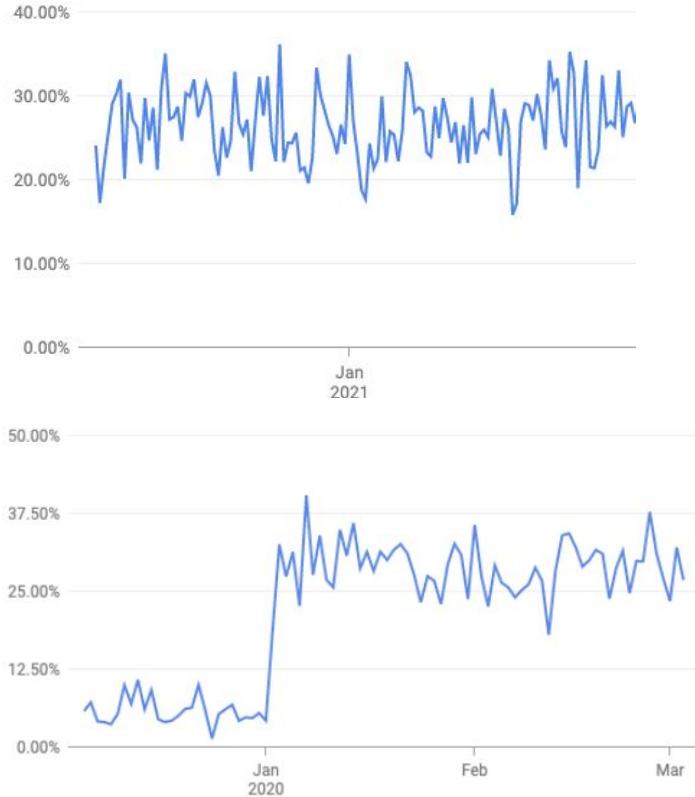
2. Circuit Switched Fallback (CSFB)
   - When an LTE network is not available to make/receive a 112 call or SMS message, the device "falls back" to a more accessible 3G/2G network to finish the call or send the SMS message
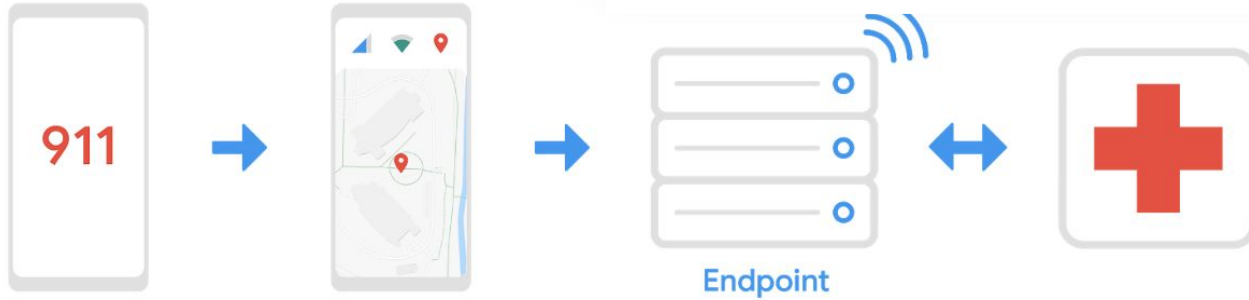
3. SMS-over-IP on VoLTE devices*
   - Some LTE phones don't support SMSoIP > unable to transmit ELS message(s)

Quick & happy fix example (your mileage may vary)
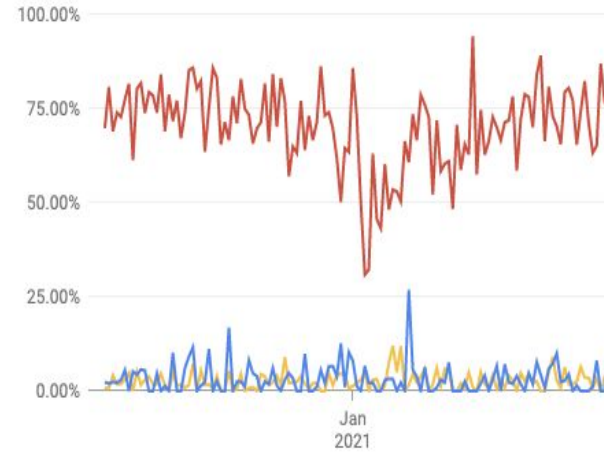
Troubleshooting ELS Errors

ELS data flow primer

911 → [map/location] → **Endpoint** ↔ [emergency cross]

Emergency call initiated by Android device

ELS data *sent directly* to endpoint as Data SMS AML or HTTPS message

Endpoint is *set up and managed* by ELS Partner, who is responsible for making ELS data available to Emergency Services (*push or pull*).

AML - Advanced Mobile Location, open standard for sending emergency location (*supported by Android ELS*)

ELS Endpoint: a *SMSc or HTTPS server* maintained by partner that can receive ELS emergency location data

ELS Partner: carrier/MNO, government or public safety vendor that meets ELS partner requirements

PSAP/ECC (Public Safety Answering Point/Emergency Communications Center): call center & dispatch control for emergency services

Google's Responsibility

Partner's Responsibility

ELS data flow value chain for Data SMS
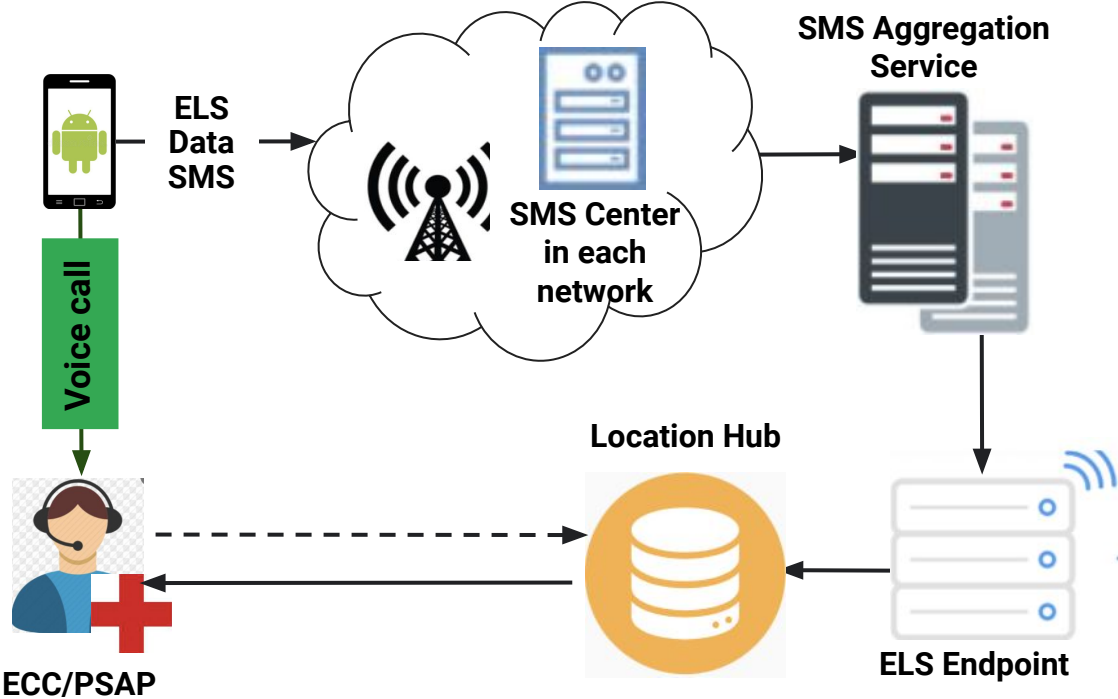
No/Limited E2E visibility for all parties (esp Google!)
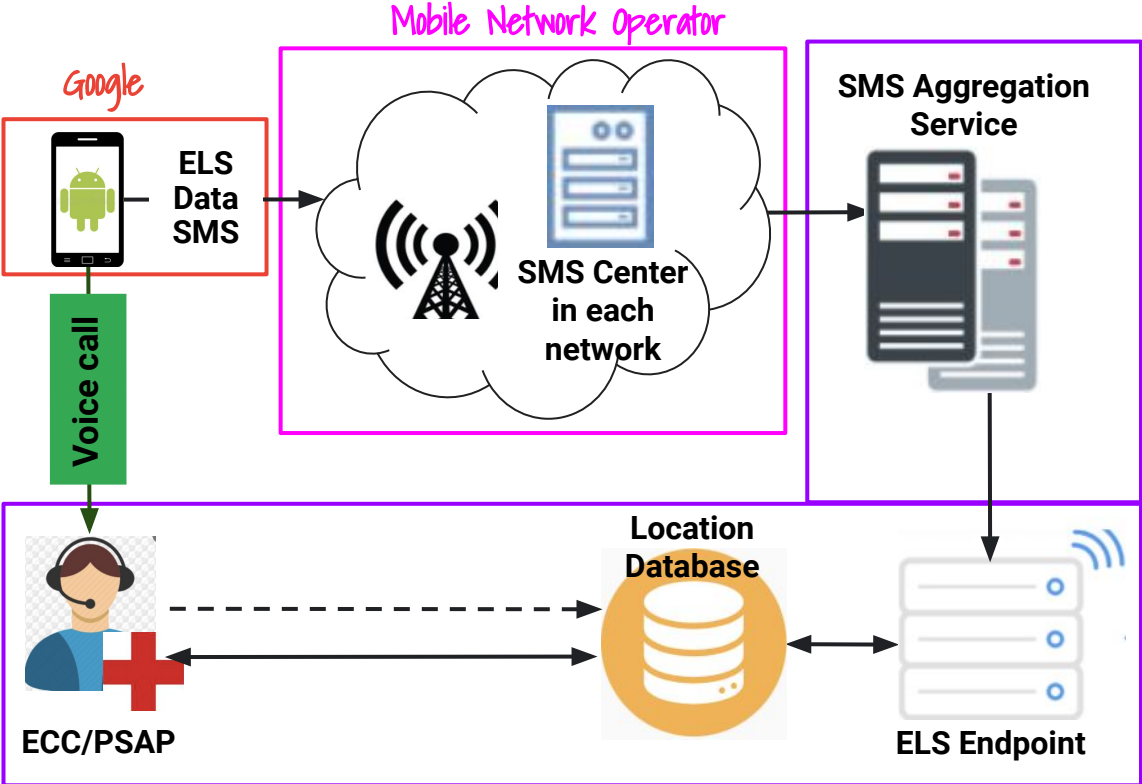
Troubleshooting requires collaboration among all Parties in the ELS data value Chain ...

... driven by the ELS Partner

Troubleshooting 101

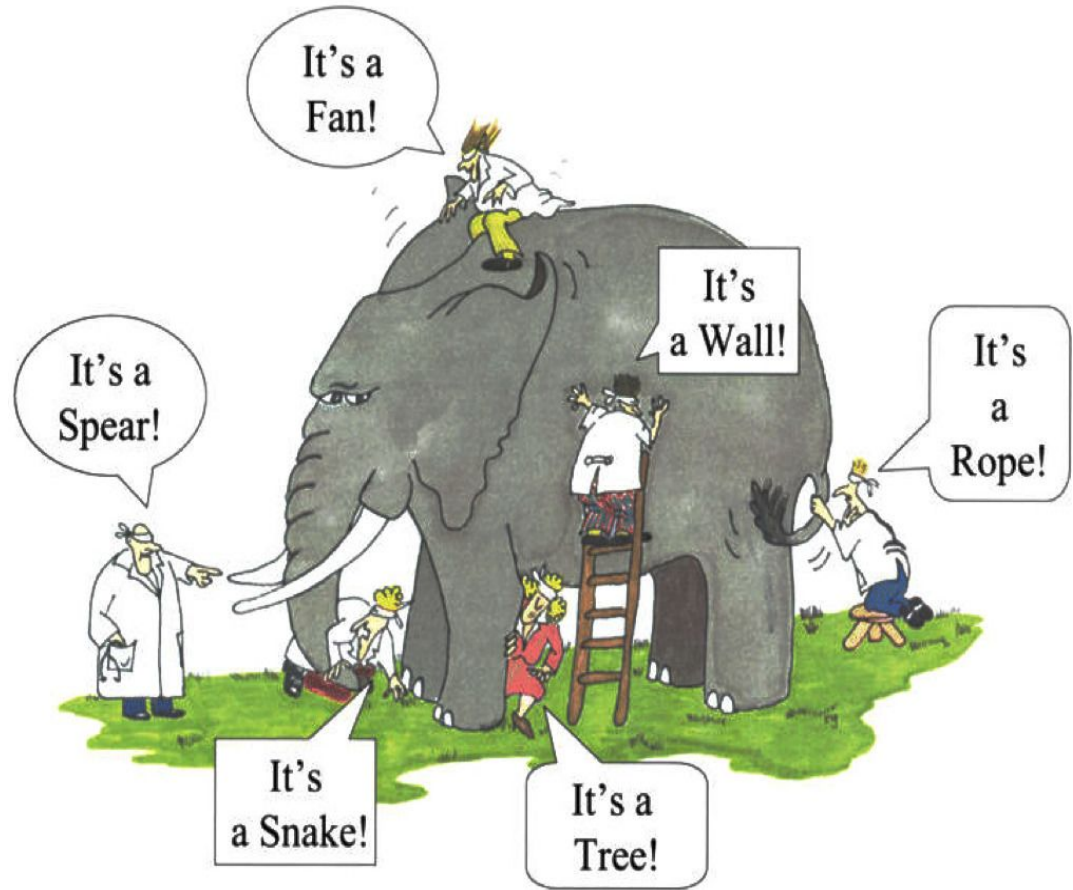**What:** Dedicated debug session with MNO's network elements engineer(s) , ELS Partner and PSAP call taker(s)

How: Make 50-100 emergency calls using the ELS Manager app and a SIM from the MNO

Why: Send & trace the progress of ELS test messages through the mobile network to see if the messages are delivered successfully to/from the Endpoint. If not, *understand **why** and **where in the process/network** issues occur or the ELS message fails.*

Elements for an effective troubleshooting session

	Google	ELS Partner	MNO	PSAP
Role	**Review bug reports of failed messages**	**Manage project, coordinate across all parties**	**Track & interpret incoming/outgoing ELS messages**	**Receive ELS test calls & messages**
Tools		ELS Manager app + Android device in eng/userdebug mode →	Live probes monitoring of Data SMS network element paths	
Key Tasks	Technical consulting re: ELS service & features Analyze bug reports	Monitor status of test calls (successful/ failure reception) → Retrieve logs from device using ADB commands Get PSAP approval for test calls	Capture and share network protocol exchanges Network elements expertise to interpret suspicious messages	Awareness/ ability to recognize a test call

What we're looking for during troubleshooting

Device / Google	- Incomplete/error messages not inline with the feature design - Incoming error messages from network side - Data SMS timings in device logs (to compare with those on the network/Endpoint side) - Call not received by PSAP
Mobile Operator	- Identify & explain generated network errors (if any) - Which network element blocked the incoming/outgoing protocol message(s) - Identify delta between *Fail* and *Pass* scenarios (in case issue is not 100% reproducible) - Confirm that complete protocol exchange went as expected per design (by logging and sharing logs with Google team when needed) - Timing of data SMS received with respect to the timing the SMS was sent from the device (investigating a buffering issue) - Network configuration related to SMS on emergency are well defined
ELS Partner (Endpoint)	- Number of Data SMS messages received by ELS Endpoint per call - Timing of Data SMSes received with respect to the time the SMS was sent from the Device/Mobile Operator network

ELS Partner Perspective: Carbyne