summary

- This Recovery Guideline proposes a number of mitigation actions that helps to restore network level service in VoLTE networks. Along with each proposed action related risk and impact is described.
- A lot of focus is to mitigate mass Registration storm as it is one of the most probable scenario with the biggest impact.
- The listed actions are not in any proposed order. Depending on the network incident an analysis should be done in the recovery team which action would be of most benefit.

Overview

- This table shows which areas the proposed mitigation action is implemented

Mitigation Action	Areas		
	EPC	IMS	UDM
1. SBG throttling		X	
2. MME throttling	X		
3. Disable re-authentication		X	
4. Disable Diameter retry		X	X
5. Increase register refresh		X	
6. Enable Cx/Dx throttling		X	
7. Disable Inflight timer		X	X
8. Multiple Diameter connections		X	X
9. TCP scaling		X	X
10. MTAS TADS CS retry		X	
11. VoLTE to CS fallback	X	X	

1) SBG throttling

- Symptom:
  - During a Major outage resulted in Registration storm, Active Registrations is dropping in the network.
- Action:
  - Check if and how throttling is configured in all SBGs in the network.
    - **Throttling disabled**: Set the value of throttling for REGISTER messages.

      Rule of thumb for fast rate limit activation:

      - 0.4 * (Number of TPs in HSS * Capacity Number of REGISTERS per TP)/ Number of SGCs = Rate Limit (*See table with node capacity for initial registration per TP in later slide)*

      In case recovery time with configured SBG Rate Limit is too long the value can be adjusted by comparing available capacity in network and perform a new calculation described in subsequent slides.

1) SBG throttling

- Action (Cont):
- Throttling Activated: In case throttling is already activated review and adjust the value compared to available HSS and CSCF capacity. In case configured value is lower than the mended then consider lowering the rate limit further (50% reduction).
- Throttling in SBG should be configured in that way so that the total amount of registration requests does not exceed max number of registration requests that IMS core (primarily HSS and CSCF nodes) is dimensioned for.

1) SBG throttling VOLTE Initial Register Capacity

- In emergency the following information is required to calculate a rate limit for improved recovery times compared to default rule (apply factor 0.4 to maximum capacity);
  - The normal node load during busy hour. Busy hour load=Load
  - TSP cluster size of the application. Application Processor=TP
  - Initial register Capacity for bottleneck node (from table) Capacity=Cap_TP.
  - Maximum load used in capacity calculation=Max_Load
  - Number of SBG blade pairs
- Use the information in table and apply a dimensioning margin (Dim=0.8 non HSS-FE, Dim=0.7 for HSS-FE).

  Maximum registration rate=Dim*TP*Cap_TP*(Max_Load – Load)/Max_Load
- Example for a HSS-Mono node with 9 application processors and LTE attach traffic considered. Base load during busy hour confirmed @ 35%.

  Maximum registration rate=0.8*9*80*(75-35)/75

  Maximum SBG rate limit in emergency **307** initial register per second. Divide with number of SBG blade pairs to get rate limit per SBG blade system.
- The recovery rate can be calculated by dividing the number of subscribers with maximum registration rate.

1) SBG throttling

- Risks:
- Depending on how throttling is configured it will take longer or shorter time to register all users.
- Execution time:
- 5 minutes per SGC BS.
- Expected e:
- Reduce traffic towards the IMS core (stabilize network and increased number of successful registrations).
- Network Impact:
- By changing throttling values to lower value IMS core will be off loaded and it will be able to handle all ing registrations. Time until all subscribers are registered depends on configured throttling.

2) MME throttling

Symptom : Major problem for UEs to attach after network outage, increased load in HSS from PC.

From HSS, it is possible to detect if the overload is coming from PC or IMS side. Separate counters exist for the different traffic types, which can help detect if there's a huge surge of messages between two intervals. Counters in S6a or other EPC interfaces in HSS will be one key source.

Action: Controlled opening of LTE Network by changing MME throttling values.

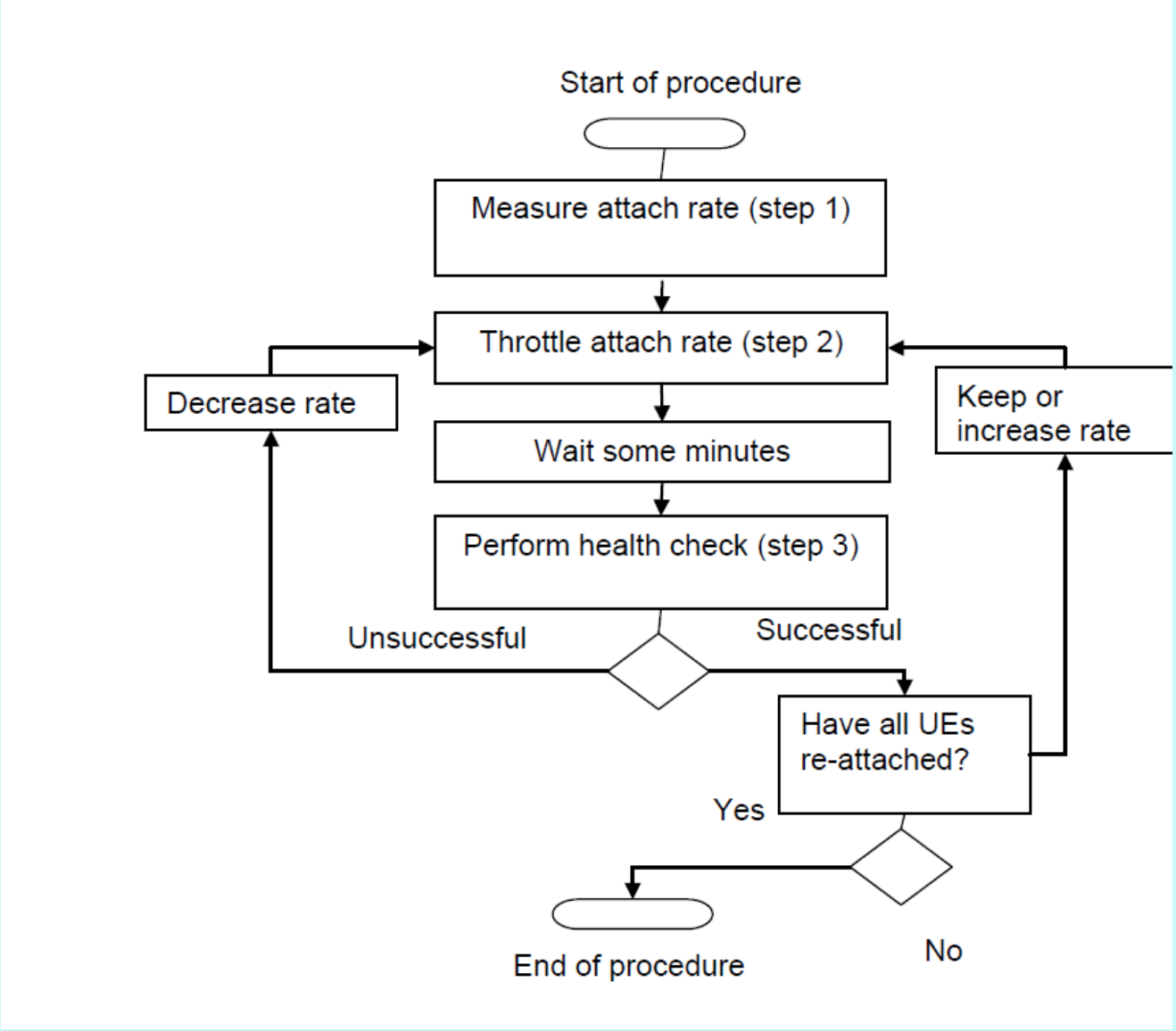
Expected e: Reduced traffic (attach load) towards HSS (stabilize service in network)

Network Impact: Expected to increase efficiency of HSS traffic, slower traffic take up but will reach stability faster.

Risks: None foreseen.

Note: SGSN-MME release 14B onwards there is dynamically adjusting rate limitation of outgoing Diameter messages to HSS

2) MME throttling



3) Turn OFF re-Authentication to reduce load in HSS

- Symptom:
  - UDC overload or congestion in the network causing disturbances related to AKA re-authentication for re-register.
- Action:
  - Check which current value for CscfAkaStalnessTimer is configured in CSCF.
  - Disable re-authentication in S-CSCF by configuring the timer to 0 or an option is to decrease signaling by increasing to the default value 24h (1440 minutes).

3) Turn OFF re-Authentication to reduce load in HSS

- Risks:
- Disables authentication challenge on re-registrations.
- Execution time:
- 10 minutes per CSCF
- Expected e:
- Less impact on re-register due to UDC overload.
- Network Impact:
- IMS core and UDC will be off loaded and it will be able to handle overload situations with less impact on re-registrations. Normally if a protected REGISTER request is received, and the timer for the most recent authentication has expired, then the S-CSCF obtains a new authentication vector from the HSS and challenges the UE with a 401