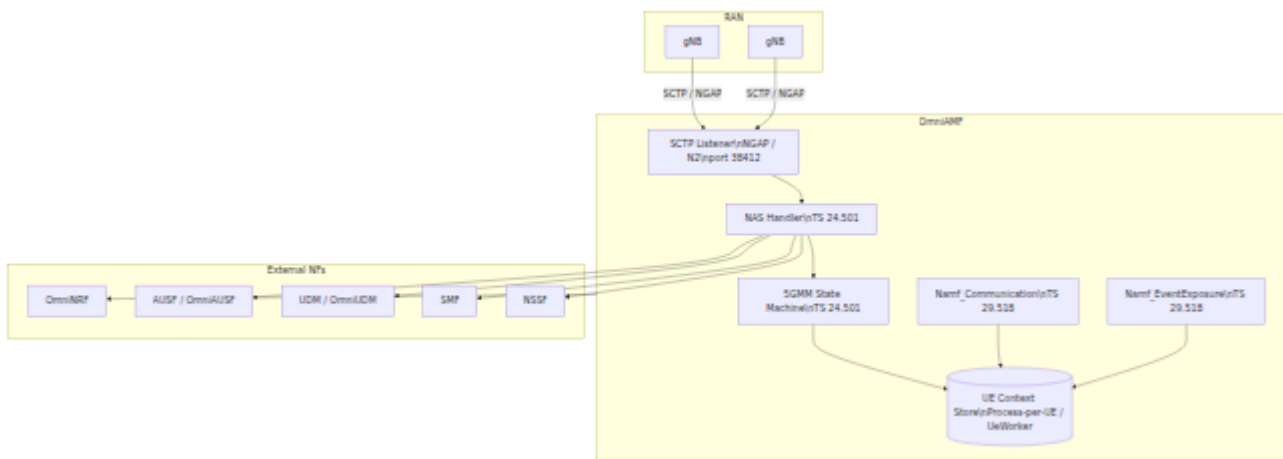


OmniAMF Operations

1. Component Overview

OmniAMF is the Access and Mobility Management Function (AMF) for the Omnitouch 5G core. It is the anchor point for all UE signalling over both the N1 interface (NAS, via NGAP/SCTP from gNBs) and the N2 interface (NGAP). OmniAMF manages UE registration, authentication orchestration, session continuity, and inter-NF communication via the SBI.



2. 3GPP Role and Spec References

Aspect	Reference
AMF functional definition	TS 23.501 Section 6.2.1
Registration procedure	TS 23.502 Section 4.2.2.2, TS 24.501 Section 5.5.1
Authentication (5G-AKA)	TS 33.501 Section 6.1.3, TS 29.509
Security Mode Control	TS 24.501 Section 5.4.2
Deregistration procedure	TS 23.502 Section 4.2.2.3, TS 24.501 Section 5.5.2
Service Request procedure	TS 23.502 Section 4.2.3, TS 24.501 Section 5.6.1
Namf_Communication service	TS 29.518
Namf_EventExposure service	TS 29.518
NGAP / N2 interface	TS 38.413
NGAP transport (SCTP)	TS 38.412
UDM interfaces (N8, N10)	TS 29.503
AUSF interface (N12)	TS 29.509
SMF interface (N11)	TS 29.502
NAS message coding	TS 24.501 Section 8

Aspect	Reference
Key derivation	TS 33.501 Annex A
5GMM timers	TS 24.501 Section 10.2

3. SBI Endpoints

All endpoints are HTTP/1.1 with `Content-Type: application/json`.

Namf_Communication (TS 29.518)

Method	Path	Description	Success
POST	<code>/namf-comm/v1/ue-contexts/{ueContextId}/n1-n2-messages</code>	N1N2 message transfer from SMF	200 OK
POST	<code>/namf-comm/v1/ue-contexts/{ueContextId}/transfer</code>	UE context transfer (inter-AMF)	200 OK
POST	<code>/namf-comm/v1/ue-contexts/{ueContextId}/assign-ebi</code>	EPS Bearer ID assignment	200 OK
POST	<code>/namf-comm/v1/non-ue-n2-messages/transfer</code>	Non-UE N2 message transfer (e.g. PWS)	200 OK

Namf_EventExposure (TS 29.518)

Method	Path	Description	Success Code
POST	/namf-evts/v1/subscriptions	Subscribe to AMF events	201 Created
DELETE	/namf-evts/v1/subscriptions/{subscriptionId}	Unsubscribe	204 Content Deleted

N2 / NGAP (non-SBI)

Transport	Address	Description
SCTP	{ngap_addr}:{ngap_port} (default 0.0.0.0:38412)	NGAP messages from gNBs, PPID 60 per TS 38.412

4. Configuration Reference

OmniAMF is configured via Elixir application environment under the `:omniamf` key.

Example Configuration

```
config :omniamf,  
  sbi_scheme: "http",  
  sbi_addr: "127.0.0.5",  
  sbi_port: 7777,  
  nrf_uri: "http://127.0.0.10:7777",  
  ausf_uri: "http://127.0.0.19:7777",  
  udm_uri: "http://127.0.0.12:7777",  
  smf_uri: "http://127.0.0.4:7777",  
  nssf_uri: "http://127.0.0.14:7777",  
  mcc: "999",  
  mnc: "70",  
  heartbeat_interval: 10_000,  
  amf_id: %{region_id: 2, set_id: 1, pointer: 0},  
  amf_name: "OmniAMF",  
  ngap_addr: "0.0.0.0",  
  ngap_port: 38412
```

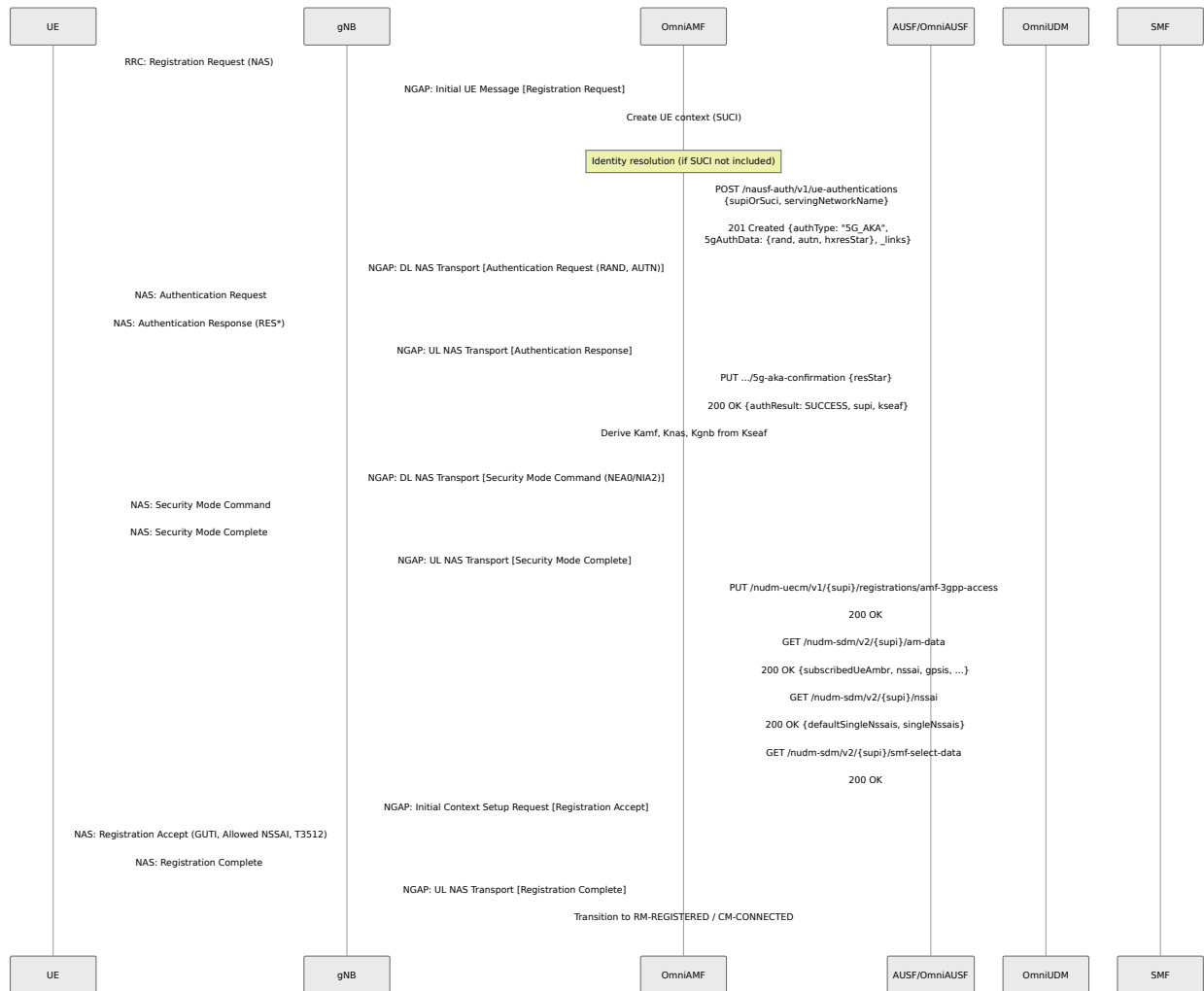
Parameter Table

Parameter	Type	Default	Description
<code>sbi_scheme</code>	string	<code>"http"</code>	URI scheme of the HTTP server
<code>sbi_addr</code>	string	<code>"127.0.0.5"</code>	IP address that the server binds to
<code>sbi_port</code>	integer	<code>7777</code>	TCP port that the server listens on
<code>nrf_uri</code>	string	<code>"http://127.0.0.10:7777"</code>	Base URI of the NRF registration and discovery
<code>ausf_uri</code>	string	<code>"http://127.0.0.19:7777"</code>	Base URI of the AUSF (OmniAUSF) authenticating and authorizing (Nausf_UEAuth). Previously pointed to the locally located AUSF, now points to the OmniAUSF N
<code>udm_uri</code>	string	<code>"http://127.0.0.12:7777"</code>	Base URI of the UDM subscriber data context management
<code>smf_uri</code>	string	<code>"http://127.0.0.4:7777"</code>	Base URI of the SMF PDU session release
<code>nssf_uri</code>	string	<code>"http://127.0.0.14:7777"</code>	Base URI of the NSSF network slice selection

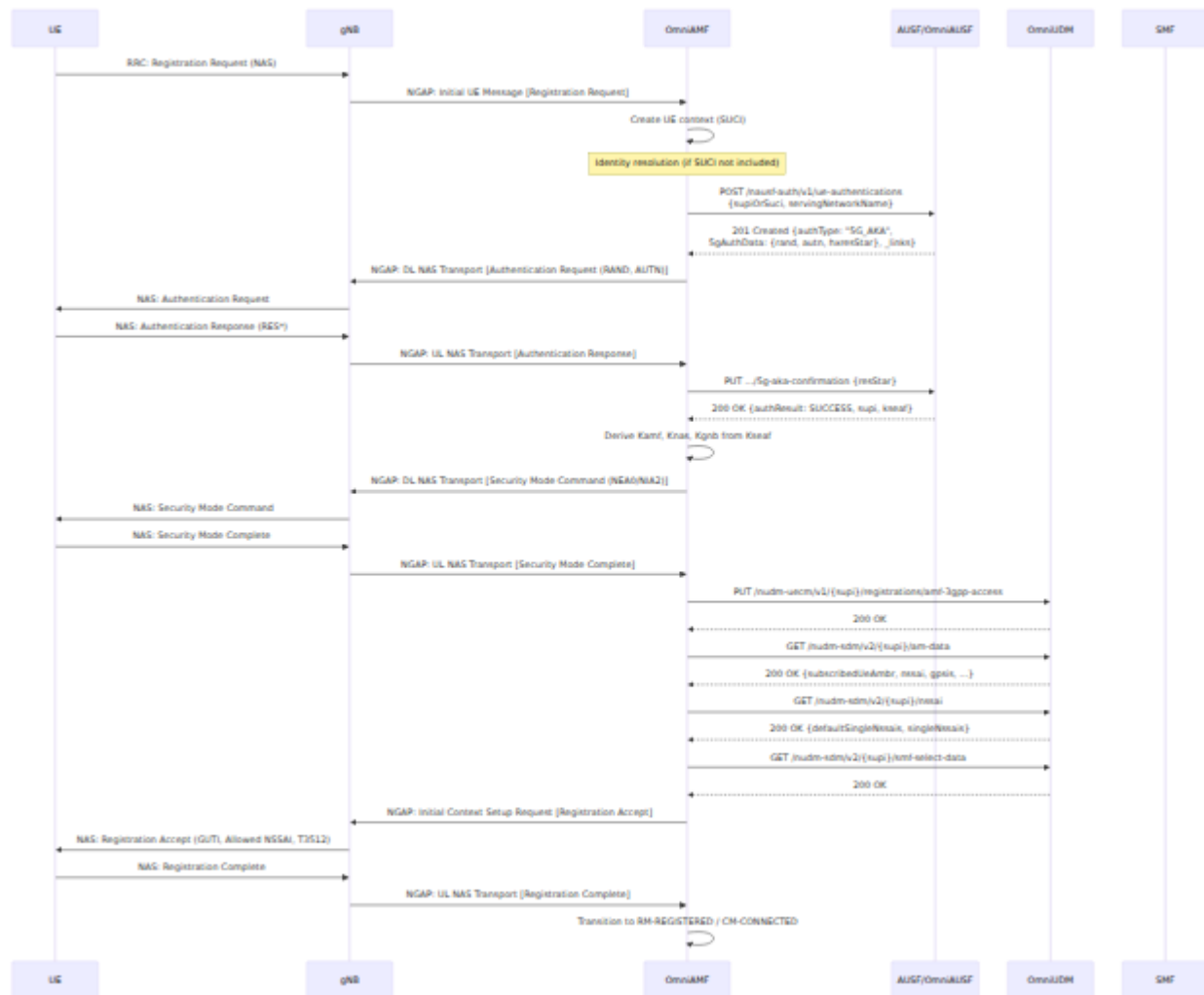
Parameter	Type	Default	Description
<code>mcc</code>	string	<code>"999"</code>	Mobile Country Code of the serving PLMN
<code>mnc</code>	string	<code>"70"</code>	Mobile Network Code of the serving PLMN
<code>heartbeat_interval</code>	integer (ms)	<code>10000</code>	Interval at which the NRF sends heartbeat requests
<code>amf_id</code>	map	<code>%{region_id: 2, set_id: 1, pointer: 0}</code>	AMF identifier. The <code>region_id</code> (8 bits), <code>set_id</code> (10 bits), and <code>pointer</code> (10 bits) form the AMF Identifier used for AMF selection and GUTI allocation
<code>amf_name</code>	string	<code>"OmniAMF"</code>	AMF name registered with the NRF NFPProfile
<code>ngap_addr</code>	string	<code>"0.0.0.0"</code>	IP address that the listener binds to. A specific interface can be specified to restrict gNAP access
<code>ngap_port</code>	integer	<code>38412</code>	SCTP port for gNAP. By default, 38412, the value of <code>ngap_port</code> is 38412

5. Key Procedures

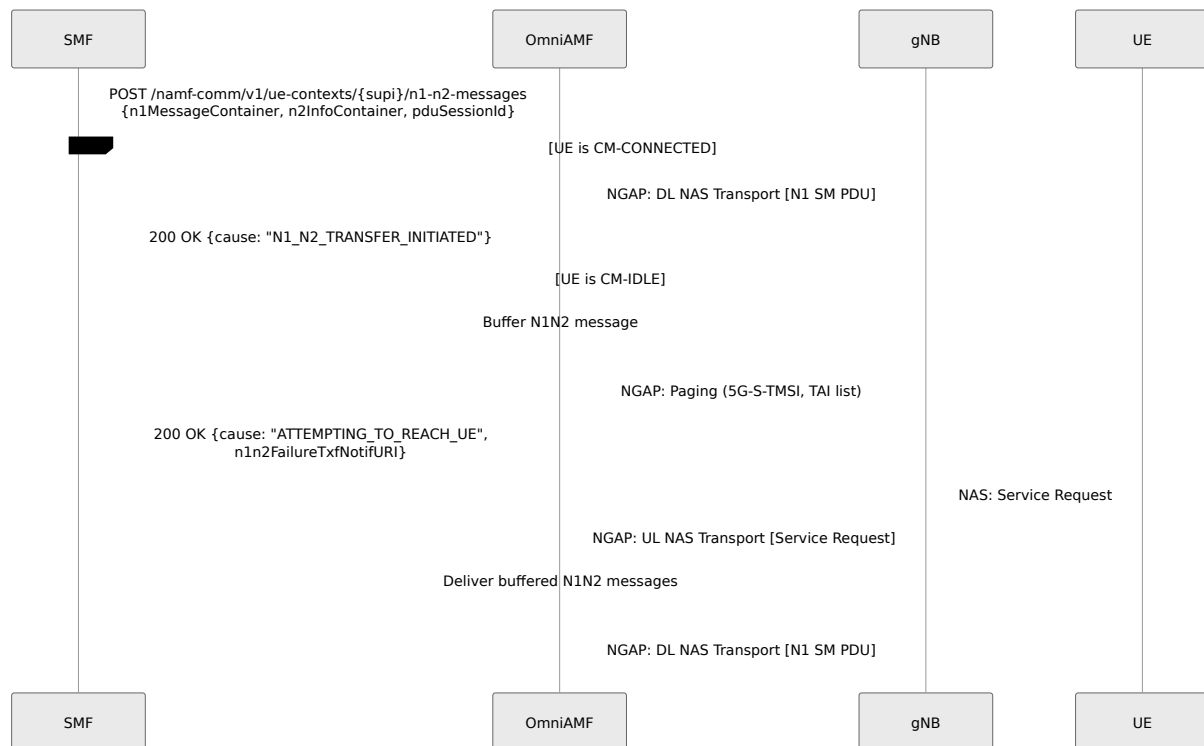
5.1 Initial UE Registration



5.2 UE-Initiated Deregistration



5.3 N1N2 Message Transfer (SMF to UE via AMF)



5.4 5GMM Timer Reference

These timers run per UE context within the GMM state machine (TS 24.501 Section 10.2).

Timer	Duration	Trigger	Action on Expiry
T3512	54 min (sent to UE)	Sent in Registration Accept	UE initiates periodic registration update
T3550	6 s	Registration Accept sent	Retransmit Registration Accept (max 4 retries)
T3560	6 s	Auth Request / SMC sent	Retransmit Auth Request or SMC (max 4 retries)
T3570	6 s	Identity Request sent	Retransmit Identity Request (max 4 retries)
T3513	6 s	Paging initiated	Retransmit paging (max 4 retries), then notify paging failure
T3522	6 s	Network Deregistration Request sent	Retransmit Deregistration Request (max 4 retries)
T3555	6 s	Config Update Command sent	Retransmit Config Update Command (max 4 retries)
Mobile Reachable	58 min (T3512 + 4 min)	UE enters CM- IDLE	Start Implicit Deregistration timer
Implicit Deregistration	58 min	Mobile Reachable expires	Implicitly deregister UE, release sessions

6. Prometheus Metrics

NAS / Registration Metrics

Metric	Type	Tags	Description
omni_amf.registration.requests.count	counter	type	Registration request type
omni_amf.registrations.total	counter	result	Total registration by result
omni_amf.auth.requests.count	counter	suci	Authentication request SUCI
omni_amf.authentications.total	counter	result	Total authentication process result
omni_amf.service_requests.total	counter	result	Total service request
omni_amf.pdu_session.requests.count	counter	supi, pdu_session_id	PDU session request sub
omni_amf.pdu_session_requests.total	counter	result	Total session establishment request

NGAP / SCTP Metrics

Metric	Type	Tags	Description
<code>omni_amf.ngap_messages.total</code>	counter	<code>procedure</code>	Total NGAP messages by procedure
<code>omni_amf.sctp_associations.count</code>	gauge	--	Number of active SCTP associations

UE State Metrics

Metric	Type	Tags	Description
<code>omni_amf.connected_ues.count</code>	gauge	--	Number of connected UEs
<code>omni_amf.cm_connected_ues.count</code>	gauge	--	Number of UEs in CM-CONNECTED state

SBI / NRF Metrics

Metric	Type	Tags	Description
<code>omni_amf.nrf.registration.status</code>	gauge	<code>nf_type</code>	NRF registration status (1=registered, 0=not)

BEAM VM Metrics

Metric	Type	Description
<code>beam.memory.total</code>	gauge	Total BEAM memory in bytes
<code>beam.memory.processes</code>	gauge	Memory used by Erlang processes
<code>beam.memory.processes_used</code>	gauge	Memory actually used by processes
<code>beam.memory.system</code>	gauge	System memory (ETS, atoms, code)
<code>beam.memory.atom</code>	gauge	Total atom memory
<code>beam.memory.atom_used</code>	gauge	Used atom memory
<code>beam.memory.binary</code>	gauge	Binary memory
<code>beam.memory.code</code>	gauge	Code memory
<code>beam.memory.ets</code>	gauge	ETS table memory
<code>beam.processes.count</code>	gauge	Number of Erlang processes
<code>beam.ports.count</code>	gauge	Number of Erlang ports
<code>beam.atom.count</code>	gauge	Number of atoms
<code>beam.vm.uptime</code>	gauge	VM uptime in seconds

7. Known Limitations

ID	Area	Description
AMF-C3	Authentication	HRES* local verification (SHA-256 of RAND RES*) is not performed before forwarding <code>resStar</code> to AUSF. The AMF relies entirely on AUSF's <code>authResult</code> field
AMF-C4	NAS security	NAS integrity protection and ciphering are not applied to outgoing NAS PDUs. The Security Mode Command selects NEA0 (null ciphering) and NIA2, but NAS PDUs are not MAC-protected or ciphered in the NGAP transport
AMF-C6	Paging	Paging NGAP messages are built (<code>build_paging</code>) but not sent over the SCTP association. Paging is logged only
AMF-C7	Handover	Handover state is tracked in the UE context but NGAP Handover Required / Handover Request messages are not sent
AMF-H2	Registration Reject	Registration Reject NAS messages are not sent to the UE on authentication failure or other rejection causes
AMF-H4	PCF AM policy	No PCF AM Policy Association Create (<code>Npcf_AMPolicyControl</code>) call is made during registration
AMF-H5	Allowed NSSAI	Allowed NSSAI returned to the UE in Registration Accept is the default NSSAI from UDM without intersecting against the AMF's served NSSAI

ID	Area	Description
AMF-H7	Auth resync	Authentication failure containing AUTS (SQN resynchronization per TS 33.501 Section 6.1.3.4) is not handled. The AMF does not pass <code>resynchronizationInfo</code> to AUSF on retry
AMF-H8	NAS algorithms	NAS security algorithms are hardcoded to NEA0 (null ciphering) and NIA2 regardless of UE capabilities
AMF-H9	Registration Status Update	<code>POST /namf-comm/v1/ue-contexts/{id}/registration-status-update</code> is not routed in the SBI router
AMF-H10	PDU session params	PDU session establishment uses hardcoded values: <code>pduSessionId=1</code> , <code>sst=1</code> , <code>dnn="internet"</code> rather than values negotiated in the NAS PDU Session Establishment Request
AMF-H11	PDU Session Resource Setup	<code>PDUSessionResourceSetupRequest</code> NGAP message is not sent to the gNB after SMF creates the SM context
AMF-H12	NG Setup validation	NG Setup Request is accepted without validating TAC, PLMN list, or slice support against AMF configuration
AMF-H13	Target gNB resolution	During handover, target gNB resolution returns the first registered gNB rather than selecting based on TAI
AMF-H16	NH derivation	Next Hop (NH) and NCC are never computed. <code>nh</code> in the UE context remains nil
AMF-M1	N1N2 response code	N1N2 Message Transfer returns 200 OK instead of 202 Accepted when paging is initiated (CM-

ID	Area	Description
		IDLE case)
AMF-M14	NRF discovery	NF URIs for AUSF, UDM, SMF, and NSSF are static configuration values. No NRF discovery (Nnrf_NFDiscovery) is performed

8. Troubleshooting

gNB cannot connect (SCTP connection refused)

Verify `ngap_addr` and `ngap_port` configuration. Confirm that the host firewall permits SCTP on port 38412. The AMF logs `[SCTP] NGAP listener active on {addr}:{port}` on successful startup. If the log shows `Failed to open SCTP socket`, another process may be holding the port or SCTP kernel support is missing.

UE registration fails at authentication step

Check reachability of the configured `ausf_uri`. The AMF logs `[NAS] AUSF auth failed with status {n}` on HTTP error responses. If AUSF returns 404, the subscriber IMSI may not exist in the HSS/UDR backend.

UE authentication succeeds but registration does not complete

After Security Mode Complete, the AMF calls UDM for AM data, NSSAI, and SMF selection data in sequence. A timeout on any of these calls will stall the registration. Check `udm_uri` reachability and UDM logs. The AMF logs `[NAS] Failed to fetch AM data for {supi}` or similar on failure.

N1N2 message from SMF is not delivered to UE

If the UE is CM-IDLE, check that paging is reaching gNBs (note AMF-C6: paging NGAP is currently not sent over SCTP). If the UE is CM-CONNECTED, verify the `gnb_assoc_id`, `amf_ue_ngap_id`, and `ran_ue_ngap_id` are populated in the UE context. These are set during NGAP Initial UE Message processing.

UE context not found for incoming SBI request

SBI endpoints identify UEs by SUPI (e.g. `imsi-999700000000001`). If the UE has not completed registration, the context keyed by SUPI will not exist. During authentication the context is keyed by SUCI; it is promoted to SUPI on authentication confirmation. Ensure the `ueContextId` path parameter exactly matches the SUPI stored in the context.

Periodic registration update not received

The T3512 timer value sent in Registration Accept is 54 minutes. If periodic updates are expected sooner, this timer value is currently hardcoded in `build_registration_accept` and cannot be configured at runtime.