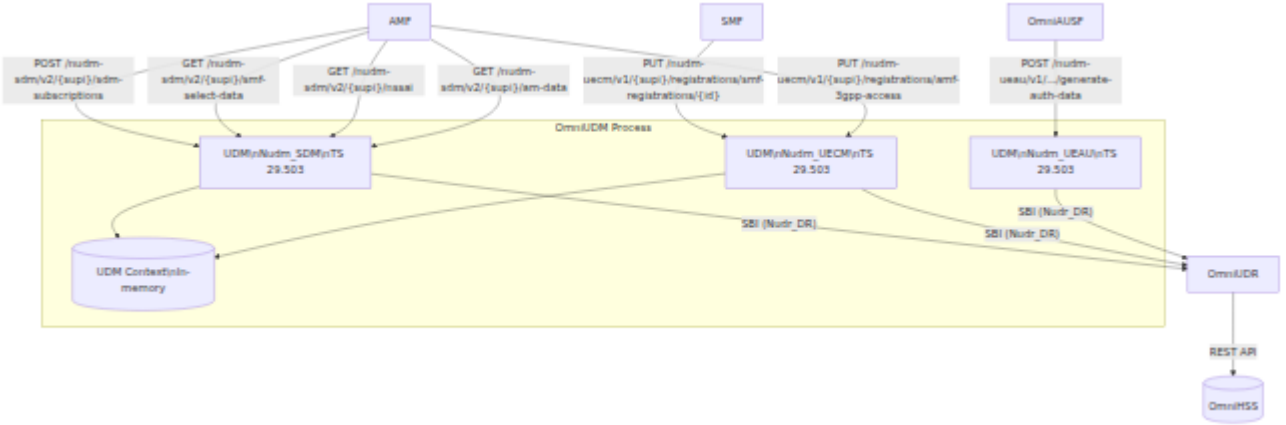
OmniUDM Operations

1. Component Overview

OmniUDM is the Unified Data Management (UDM) function for the Omnitouch 5G core. It provides subscriber data management, UE authentication data generation (Nudm_UEAU), UE context management (Nudm_UECM), and subscriber data management (Nudm_SDM).

Architecture note: AUSF and UDR are now separate standalone NFs (OmniAUSF and OmniUDR respectively). OmniUDM no longer co-locates AUSF or UDR. UDM calls UDR via SBI for all subscriber data retrieval (authentication subscriptions, AM data, SM data). Per-UE runtime state (registration contexts, SDM subscriptions) is held in in-memory Agent processes.



2. 3GPP Role and Spec References

Aspect	Reference
UDM functional definition	TS 23.501 Section 6.2.7
Nudm_UEAU service	TS 29.503 Section 5.2.2
Nudm_UECM service	TS 29.503 Section 5.3
Nudm_SDM service	TS 29.503 Section 5.2.3
Nudr_DataRepository service	TS 29.504
5G-AKA authentication	TS 33.501 Section 6.1.3
Milenage algorithm	TS 35.206
SUCI concealment / de-concealment	TS 23.003 Section 2.2B, TS 33.501 Section 6.12
SQN resynchronisation	TS 33.102 Section 6.3.5, TS 33.501 Section 6.1.3.4
Key derivation (Kausf, Kseaf, HXRES*)	TS 33.501 Annex A

3. SBI Endpoints

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

Nudm_UEAU (TS 29.503 Section 5.2.2)

Method	Path	Description	Success
POST	`/nudm-ueau/v1/{supiOrSuci}/security-information/generate-auth-data`	Generate 5G-AKA authentication vector	200 OK
POST	`/nudm-ueau/v1/{supi}/auth-events`	Store authentication result event	201 Created
DELETE	`/nudm-ueau/v1/{supi}/auth-events/{authEventId}`	Delete authentication event	204 No Content

Nudm_UECM (TS 29.503 Section 5.3)

Method	Path	Description	Success
PUT	`/nudm-uecm/v1/{supi}/registrations/amf-3gpp-access`	AMF registers 3GPP access for a UE	200 OK
GET	`/nudm-uecm/v1/{supi}/registrations/amf-3gpp-access`	Retrieve AMF 3GPP access registration	200 OK
PUT	`/nudm-uecm/v1/{supi}/registrations/smf-registrations/{pduSessionId}`	SMF registers PDU session context	200 OK
DELETE	`/nudm-uecm/v1/{supi}/registrations/smf-registrations/{pduSessionId}`	SMF deregisters PDU session context	204 No Content

Nudm_SDM (TS 29.503 Section 5.2.3)

Method	Path	Description	Success
GET	`/nudm-sdm/v2/{supi}/nssai`	Network slice subscription data	200 OK
GET	`/nudm-sdm/v2/{supi}/am-data`	Access and mobility subscription data	200 OK
GET	`/nudm-sdm/v2/{supi}/smf-select-data`	SMF selection subscription data	200 OK
GET	`/nudm-sdm/v2/{supi}/sm-data`	Session management subscription data	200 OK
POST	`/nudm-sdm/v2/{supi}/sdm-subscriptions`	Subscribe to subscriber data change notifications	201 Created
DELETE	`/nudm-sdm/v2/{supi}/sdm-subscriptions/{subscriptionId}`	Unsubscribe	204 No Content

4. Configuration Reference

OmniUDM is configured via Elixir application environment under the `:omniudm` key.

Example Configuration

```
config :omniudm,
  sbi_scheme: "http",
  sbi_addr: "127.0.0.12",
  sbi_port: 7777,
  nrf_uri: "http://127.0.0.10:7777",
  udr_uri: "http://127.0.0.22:7777",
  mcc: "999",
  mnc: "70",
  heartbeat_interval: 10_000
```

Parameter Table

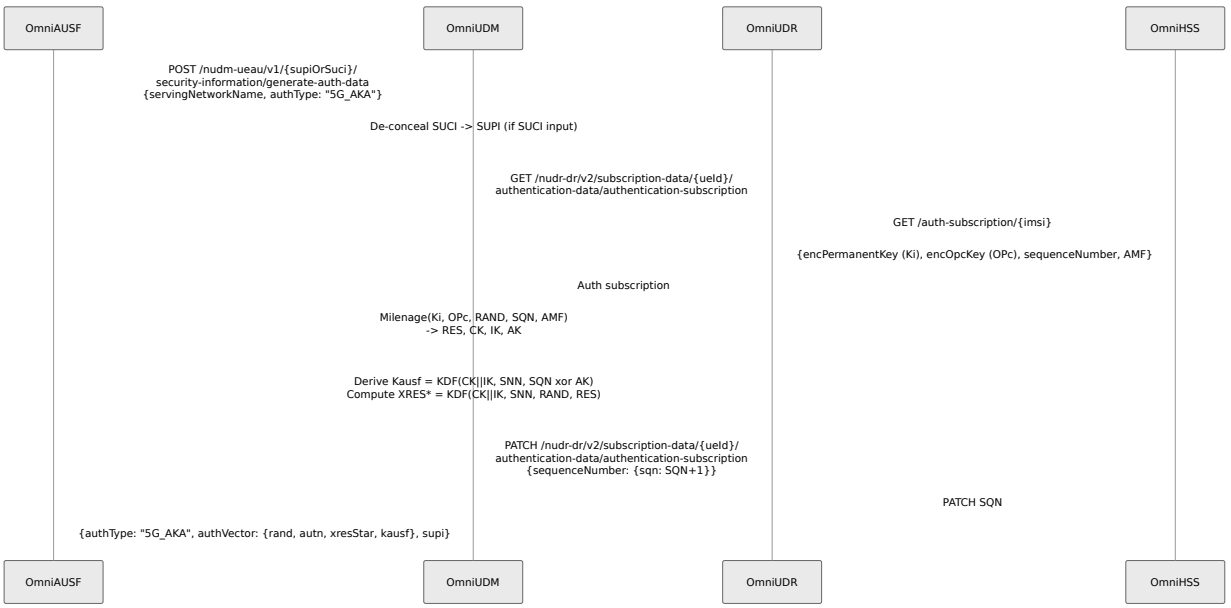
Parameter	Type	Default	Description
`sbi_scheme`	string	`"http"`	URI scheme for the SBI HTTP server
`sbi_addr`	string	`"127.0.0.12"`	IP address th SBI HTTP server binds to
`sbi_port`	integer	`7777`	TCP port the SBI HTTP server listens on
`nrf_uri`	string	`"http://127.0.0.10:7777"`	Base URI of the NRF for NF registration and heartbea
`mcc`	string	`"999"`	Mobile Country Code for the serving PLMN used in serving network nam construction for key derivation
`mnc`	string	`"70"`	Mobile Network Cod

Parameter	Type	Default	Description
			for the serving PLMN
`heartbeat_interval`	integer (ms)	`10000`	Interval at which OmniUDM sends NRF heartbeat PATCH requests
`udr_uri`	string	`"http://127.0.0.22:7777"`	Base URI of the standalone UDR (OmniUDR). UDM calls UDR via SBI for authenticatio subscription data, AM data, SM data, and SQ updates. Previously, a co-located UDR proxy called OmniHSS directly; that functionality is now in OmniUDR

5. Key Procedures

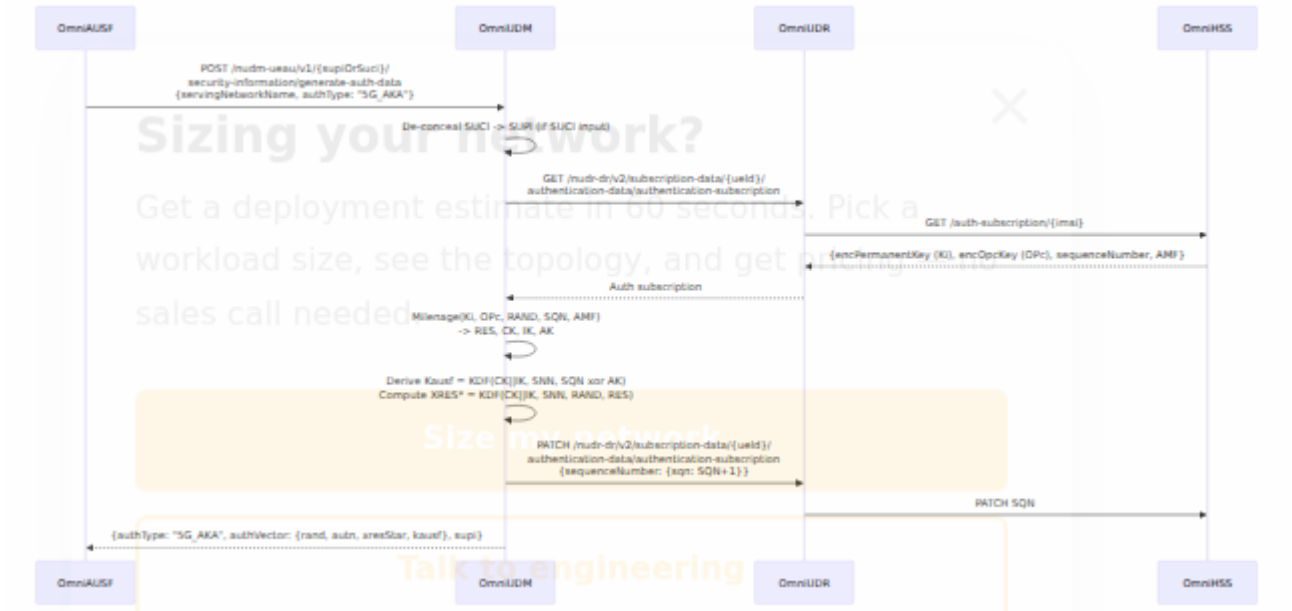
5.1 Authentication Data Generation (Nudm_UEAU)

UDM generates authentication vectors on request from AUSF. AUSF is now a standalone NF (OmniAUSF) and calls UDM over SBI.



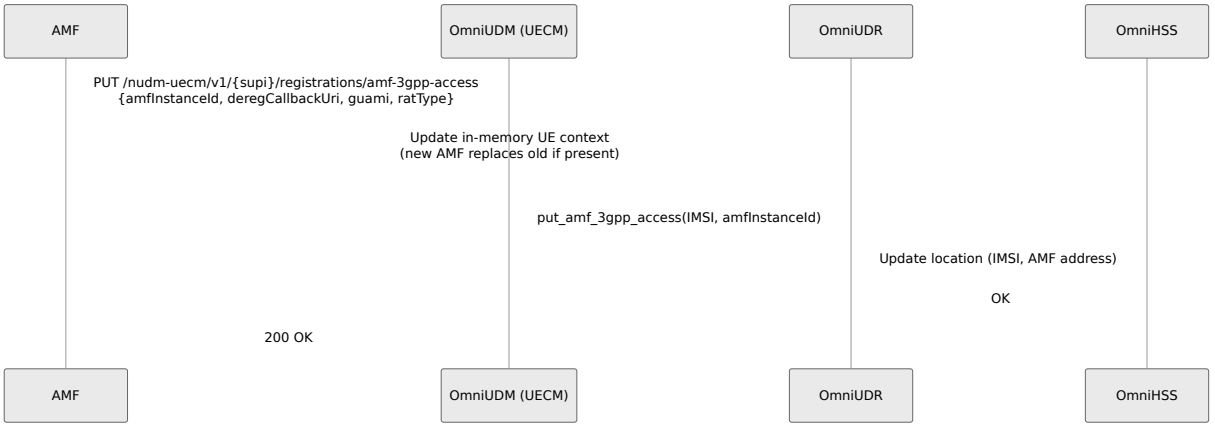
5.2 SQN Resynchronisation

When the UE detects an SQN mismatch it sends an Authentication Failure with AUTS. On the next authentication attempt the AMF includes `resynchronizationInfo` in the `AuthenticationInfo` body.



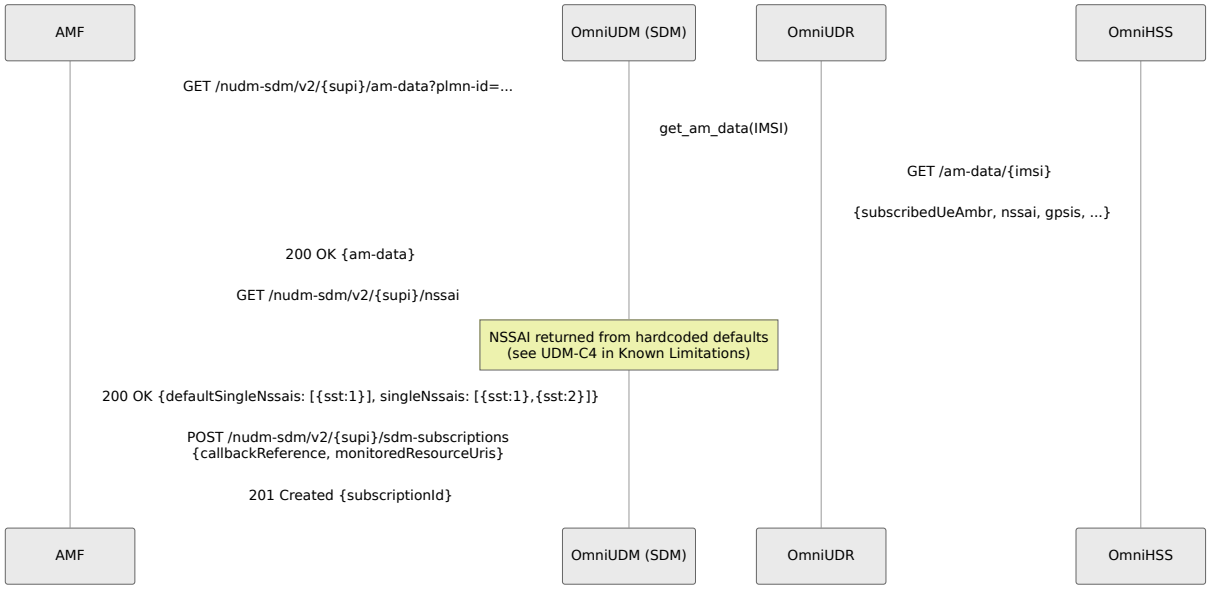
5.3 UE Context Registration (AMF → UDM)

After authentication succeeds and the Security Mode is complete, the AMF registers itself for the UE at UDM.



5.4 Subscriber Data Management (SDM)

After UE context registration, the AMF fetches subscription data.



6. Known Limitations

ID	Area	Description
UDM-M6	In-memory state	All UDM contexts (UE registration, SDM subscriptions) are stored in memory only. State is lost on process restart

7. Prometheus Metrics

UDM Metrics

Metric	Type	Tags	Descr
`omni_udm.auth.requests.count`	counter	`supi`, `result`	Auther data re
`omni_udm.uecm.amf_registration.count`	counter	`supi`	AMF registra reques
`omni_udm.auth.result.count`	counter	`supi`, `result`	Auther result e
`omni_udm.auth_vector_generations.total`	counter	`result`	Total a vector genera attemp
`omni_udm.uecm_registrations.total`	counter	`result`	Total U AMF registra
`omni_udm.sdm_queries.total`	counter	`data_type`	Total S data qu
`omni_udm.active_ue_contexts.count`	gauge	--	Numbe active contex
`omni_udm.nrf.registration.status`	gauge	`nf_type`	NRF registra status

Metric	Type	Tags	Desc
			(1=reg 0=not)

BEAM VM Metrics

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

8. Troubleshooting

Authentication fails with 404 User Not Found

OmniUDM requests auth subscription data from OmniUDR via SBI. Confirm:

1. `udr_uri` is reachable from the OmniUDM host.
2. OmniUDR can reach OmniHSS and the subscriber IMSI exists.
3. The SUCI presented by the AMF/AUSF is correctly formatted. OmniUDM attempts SUCI de-concealment before the UDR lookup; a malformed SUCI will fall back to a raw IMSI lookup which may not match.

Authentication fails with 401 Authentication Failure

The AUSF computed HRES* from the received RES* and it did not match the stored HXRES*. This indicates the UE's Milenage credentials (Ki, OPc) do not match those stored in OmniHSS, or the RAND/AUTN were corrupted in transit.

SQN desynchronisation causes repeated authentication failures

If the UE sends an Authentication Failure with AUTS, the AMF must pass `resynchronizationInfo` in the next authentication request. OmniAMF now handles this (AMF-H7 resolved). The AUSF forwards the resync info to UDM, which recovers the correct SQN via UDR/HSS.

AMF data fetch returns stale NSSAI

The `GET /nudm-sdm/v2/{supi}/nssai` endpoint returns hardcoded NSSAI values (`sst=1`, `sst=2`) regardless of subscriber configuration (UDM-C4). To change the served NSSAI, modify the hardcoded values in `NudmSDM.get_nssai/1`. Per-subscriber NSSAI from OmniHSS is not used until UDM-C4 is resolved.

UE context not found after process restart

All UE context data is in-memory (UDM-M6). After a restart, the AMF must re-register each UE by re-sending `PUT /nudm-uecm/v1/{supi}/registrations/amf-3gpp-access`. UEs will re-register naturally as they send periodic registration updates or power cycle.

SDM data change notification not received

Confirm the `callbackReference` URI in the SDM subscription is reachable from the OmniUDM host. Notifications are sent asynchronously via `Task.start`; check for `SDM notification to {uri} failed` warning log entries. Note that `GET /nudm-sdm/v2/{supi}/sdm-subscriptions/{id}` does not exist (UDM-L3); subscriptions cannot be inspected via SBI.

SMF registration appears lost after restart

SMF registrations are stored in memory only. After a restart, the SMF must re-register its PDU session contexts. This happens automatically when the SMF re-establishes SM contexts following AMF-triggered PDU session re-establishment.