



OmniBSF 配置

在 `omnibsf` 目录下运行 `config/runtime.exs` 文件

```
config :omnibsf,
  sbi_scheme: System.get_env("SBI_SCHEME", "http"),
  sbi_addr:   System.get_env("SBI_ADDR", "127.0.0.15"),
  sbi_port:   String.to_integer(System.get_env("SBI_PORT",
"7777")),
  nrf_uri:    System.get_env("NRF_URI", "http://127.0.0.1:7777"),
  mcc:        System.get_env("MCC", "999"),
  mnc:        System.get_env("MNC", "70"),
  prometheus_metrics_port:
String.to_integer(System.get_env("PROMETHEUS_PORT", "9571")),
  heartbeat_interval:
String.to_integer(System.get_env("HEARTBEAT_INTERVAL", "10000"))

config :logger, :default_formatter,
  format: {OmniLogger.JsonFormatter, :format},
  metadata: :all
```

Table 1

Variable	Unit	Value	Default	Range
sbi_scheme	String	"http"	SBI_SCHEME	
sbi_addr	String	"127.0.0.15"	SBI_ADDRESS	
sbi_port	Integer	7777	SBI_PORT	
nrf_uri	String	"http://127.0.0.1:7777"	NRF_URI	
mcc	Integer	"999"	MCC	
mnc	Integer	"70"	MNC	

項目	名前	単位	値	説明
	prometheus_metrics_port	ポート	9571	PROMETHEUS
	heartbeat_interval	秒	10000	HEARTBEAT

```
runtime.exs  nrf_uri http://127.0.0.1:7777
http://127.0.0.10:7777 NRF_URI
```

ログ

OmniLogger.JsonFormatter JSON API API

設定

TTL runtime.exs

parameter	type	default	description
<code>:binding_ttl_seconds</code>	int positive	86400 24 hours	Time interval between two consecutive PATCH requests to update the binding information.
<code>:binding_cleanup_interval_ms</code>	int positive	60000 60 seconds	Time interval between two consecutive cleanup requests to remove expired bindings.

TTL is the time interval between two consecutive PATCH requests to `UpdateIndPCFBinding` PATCH requests to update the binding information. PATCH requests to update the binding information are sent as PDU sessions. `:binding_ttl_seconds` is the TTL of the binding information. PATCH requests to update the binding information are sent as PDU sessions. 204 No Content is returned after successful PATCH requests.

Binding cleanup is performed by the `[BindingCleaner]` Removed N expired binding(s) is the number of expired bindings removed.

NRF

NF is the OmniBSF. NRF is the `capacity` and `priority` of the NRF. BSF is the `TS 29.510` `priority` and `capacity` of the BSF. OmniBSF is the BSF.

parameter	type	default	description
<code>:nf_capacity</code>	int positive	100	Number of NF instances that can be registered with the NRF. 0-65535.
<code>:nf_priority</code>	int positive	0	Priority of the NF instances that can be registered with the NRF.

API NRF API

SBI OmniBSF

- prometheus_metrics_port 9571 Prometheus
- API OAM NRF API

OmniBSF API

OmniBSF (OAM) API는 RESTful 방식으로 5G SBI를 구현하며, 모든 통신은 HTTPS를 사용합니다.

API는 다음과 같습니다.

API

API	Protocol
API	HTTPS (TLS)
API	8443
API	0.0.0.0

API는 JSON 형식으로 응답하며, 성공/실패 여부를 나타냅니다.

API

API	API	API
GET	/status/api	API 상태를 "ok"로 반환합니다.
GET	/status/nrf	NRF 상태를 반환합니다. nrf_status, nrf_instance_id, nrf_uri, nrf_uri_port, nrf_uri_port 등이 포함됩니다. unknown로 반환될 수 있습니다.
GET	/status/nf	NF 상태를 반환합니다. nf_type, nbsf-management, sbi_addr, sbi_port, PCF 등이 포함됩니다.

GET

Method	URI	Description
GET	/pcf_bindings	Retrieve PCF bindings for a specific UE IP/DNN/S-NSSAI/SUPI/PCF FQDN
GET	/api/bindings	Retrieve UE bindings for a specific DNN/S-NSSAI/SUPI/GPSI and PCF
GET	/api/bindings/{id}	Retrieve binding for a specific ID. If not found, return 404. Response includes supFeat.
GET	/api/statistics	Retrieve statistics for DNN

DELETE

Method	URI	Description
DELETE	/oam/binding/{id}	Delete binding for a specific ID. If not found, return 404.
POST	/oam/binding	Create a new PCF binding. Response includes the created binding details.

API

Method	Path	Request
GET	/oam/config	<code>sbi_addr</code> <code>sbi_port</code> <code>nrf_uri</code> <code>mcc</code> <code>mnc</code> NF <code>capacity/priority</code>
PATCH	/oam/config/{id}	<code>nrf_uri</code> <code>nf_capacity</code> <code>nf_priority</code> <code>log_level</code> 400
POST	/oam/nrf/reregister	NF NF NRF NF ID
POST	/oam/log_level	<code>{"level": "<level>"}</code>

Response

Field	Type	Description
<code>nrf_uri</code>	String	NRF URI
<code>nf_capacity</code>	Integer	NF NRF
<code>nf_priority</code>	Integer	NF NRF
<code>log_level</code>	String	<code>emergency</code> <code>alert</code> <code>critical</code> <code>error</code> <code>warning</code> <code>warn</code> <code>notice</code> <code>info</code> <code>debug</code>

API



OmniBSF 方方方方方

方方 `prometheus_metrics_port` 方方方方方 `9571` 方方

BSF

메트릭 이름	타입	태그	설명
omni_bsf_pcf_binding_register_count	counter	dnn	DNN PCF 등록 횟수
omni_bsf_pcf_binding_discover_count	counter	result	result: success, failure, not_found, timeout
omni_bsf_pcf_binding_deregister_count	counter	binding_id	binding ID 해제 횟수
omni_bsf_binding_registers_total	counter	-	현재 등록된 binding 수
omni_bsf_binding_discovers_total	counter	result	result: success, failure, not_found, timeout
omni_bsf_binding_deregisters_total	counter	-	현재 해제된 binding 수
omni_bsf_active_bindings_count	gauge	-	현재 PCF에 등록된 active bindings 수 [:omni_bsf_bindings :active] 현재 등록된 binding 수 현재 해제된 binding 수 현재 등록된 binding 수 현재 해제된 binding 수
omni_bsf_nrf_registration_status	gauge	nf_type	NRF 등록 상태 = 0: 성공, 1: 실패, 2: timeout

omni_bsf_pcf_binding_deregister_count 统计 binding_id 的 ID 的
的 UUID 的/的
omni_bsf_binding_deregisters_total

omni_bsf_active_bindings_count 统计 [:omnibsf,
:bindings, :active] 的BSF 的
BindingCleaner 的 OAM
的 (GET /api/statistics) 的 NF 的 API

的的的的

OmniBSF 的 :telemetry 的 Prometheus 的
的

的	的	的
[:omnibsf, :pcf_binding, :update]	的 PATCH (UpdateIndPCFBinding) 的	的 的 binding_id
[:omnibsf, :binding, :expired]	的	的 的 TTL 的 的

BEAM VM

項目	タイプ	説明
beam_memory_total	gauge	BEAM の総メモリ
beam_memory_processes	gauge	Erlang プロセスのメモリ
beam_memory_processes_used	gauge	プロセスメモリの使用量
beam_memory_system	gauge	システムメモリ
beam_memory_atom	gauge	アトムメモリ
beam_memory_atom_used	gauge	アトムメモリの使用量
beam_memory_binary	gauge	バイナリメモリ
beam_memory_code	gauge	コードメモリ
beam_memory_ets	gauge	ETS テーブルのメモリ
beam_processes_count	gauge	Erlang プロセスの総数
beam_ports_count	gauge	Erlang ポートの総数
beam_atom_count	gauge	アトムの総数
beam_vm_uptime	gauge	VM の稼働時間

PromQL

以下は DNN の

```
sum by (dnn) (rate(omni_bsf_pcf_binding_register_count[5m]))
```

過去 5 分間の割合

```
sum(rate(omni_bsf_binding_discovers_total{result="not_found"}
[5m]))
/
sum(rate(omni_bsf_binding_discovers_total[5m]))
```

BSF が NRF に登録されている

```
omni_bsf_nrf_registration_status{nf_type="bsf"} == 0
```

Prometheus のクエリで `result` フィールドで `found` / `not_found` を

OmniBSF

OmniBSF 는 5G 네트워크 (BSF) BSF 는 PCF PDU UE (IPv4 IPv6 MAC SUPI) DNN S-NSSAI PCF - AF/NEF SMF PCF - BSF PCF PCF

OmniBSF SBI /nbsf-management/v1 Nbsf_Management (3GPP TS 29.521) ETS (TTL) OmniBSF NRF NF

ETS

ETS			
bsf_bindings	:set	binding_id (UUID)	
bsf_ipv4_index	:set	UE IPv4	binding_id
bsf_ipv6_index	:set	UE IPv6	binding_id
bsf_supi_index	:bag	SUPI	binding_id
bsf_mac_index	:set	UE MAC	binding_id
bsf_dnn_snssai_index	:bag	{dnn, sst}	binding_id

macAddr48 bsf_mac_index DNN+S-NSSAI bsf_dnn_snssai_index {dnn, sst}

sd S-NSSAI

bsf_supindex :bag SUPI DNN PDU SUPI ID supi PcfBinding TS 29.521

3GPP

TS 23.501	- BSF
TS 23.503	-
TS 29.521	Nbsf_Management API (PCF / /) PcfBinding
TS 29.500	5G SBI (ProblemDetails, HTTP)
TS 29.510	NF NRF

PCF BSF PCF PDU AF NEF SMF PCF

SBI

URL {sbi_scheme}://{sbi_addr}:{sbi_port} /nbsf-management/v1

Method	URI	Request	Response
POST	/pcfBindings	PCF PDU Session PCF Location	201 Created
GET	/pcfBindings	PCF	200 OK PcfBind: 204 No Content
PATCH	/pcfBindings/{bindingId}	(UpdateIndPCFBinding) application/merge-patch+json	200 OK PcfBind:
DELETE	/pcfBindings/{bindingId}	ID PCF	204 No Content

404 ProblemDetails

GET

POST -

dnn			
snssai			S-NSSAI (sst sd)
pcfFqdn			PCF FQDN - pcfIpEndPoints
pcfIpEndPoints			PCF IP - pcfFqdn
ipv4Addr			UE IPv4
ipv6Prefix			UE IPv6
macAddr48			UE MAC
supi			
gpsi			
ipv4FrameRouteList			IPv4
ipv6FrameRouteList			IPv6
pcfSetId			PCF
pcfRegionId			PCF
bindLevel			

필드	타입	길이	비고
suppFeat	uint8 (선택) uint8	1	0x01 (BindingUpdate) 0x00 (선택)

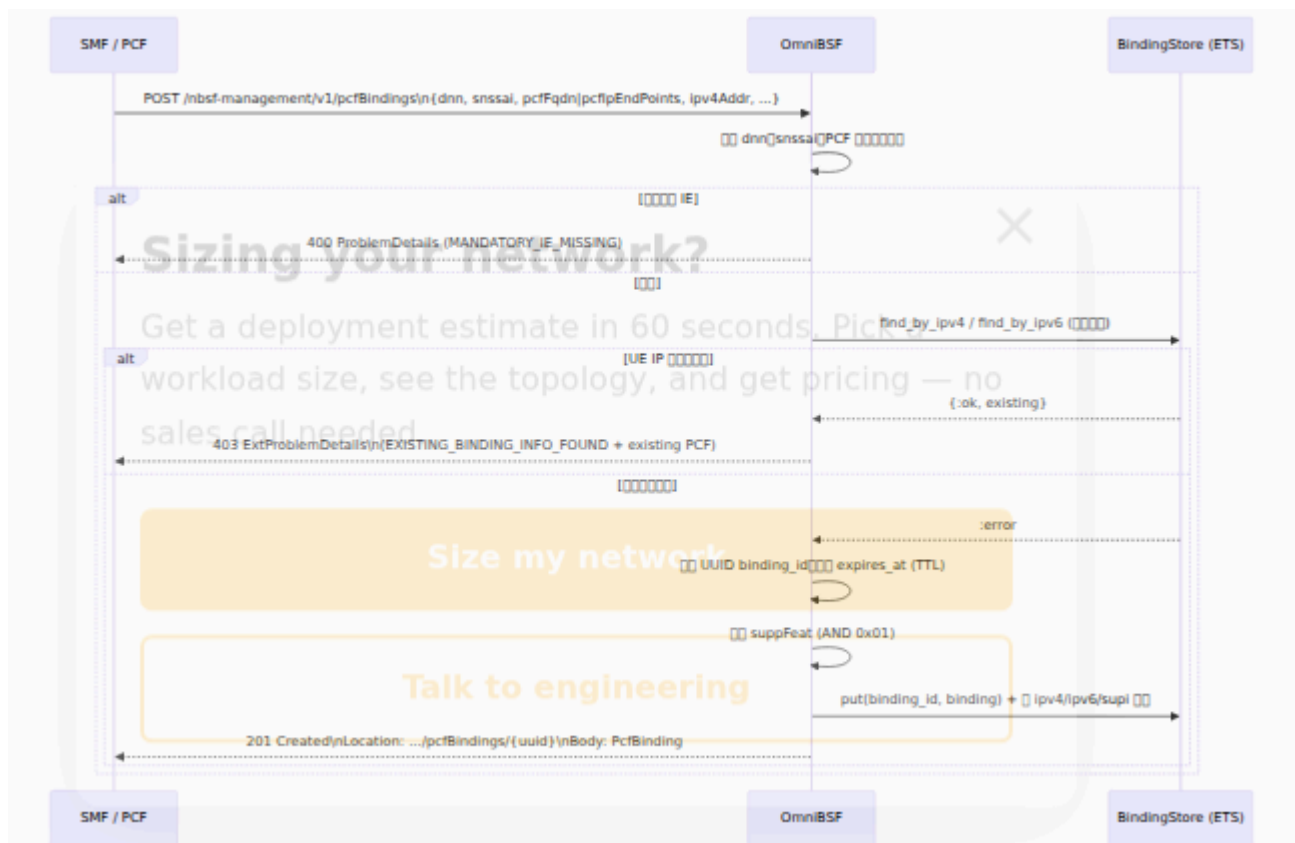
403 ExtProblemDetails (cause = EXISTING_BINDING_INFO_FOUND) PCF { pcfSmFqdn / pcfSmIpEndPoints } TS 29.521

API

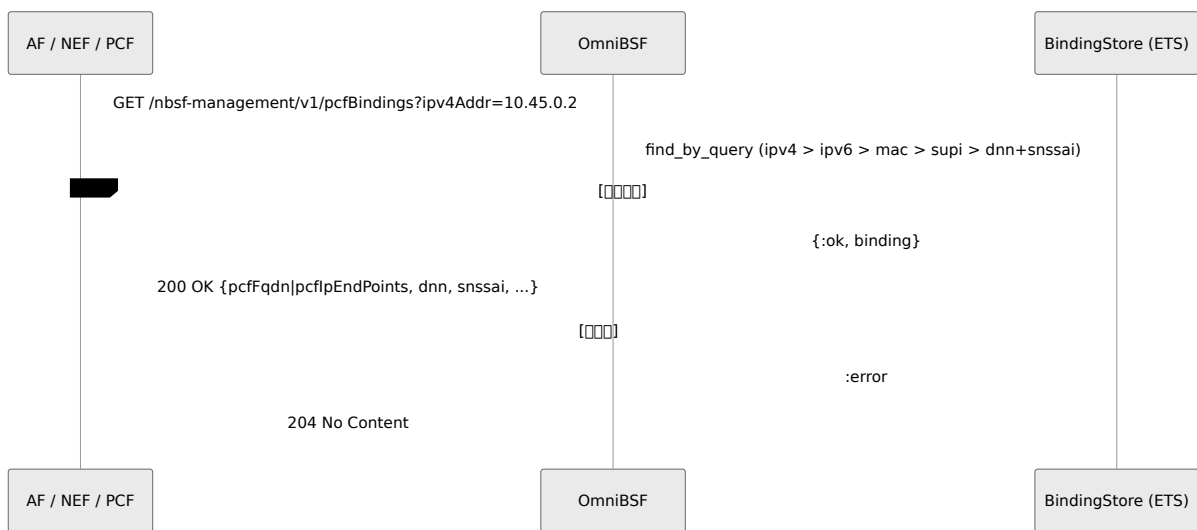
SBI OmniBSF (OAM) REST API / NRF API

API

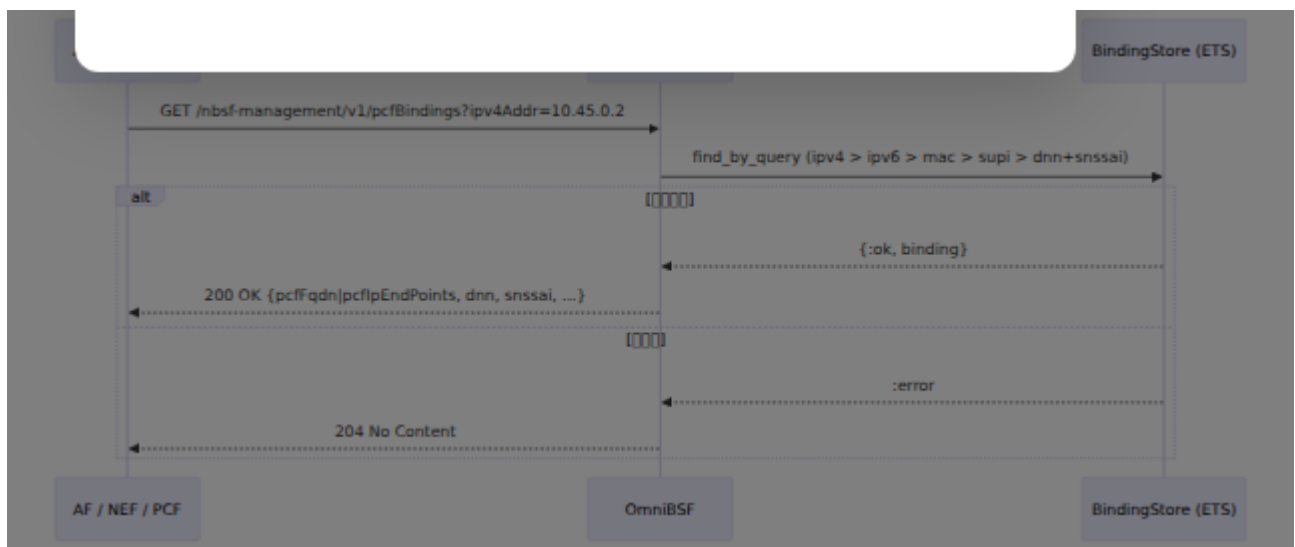
PCF (POST)



PCF 查询 (GET)

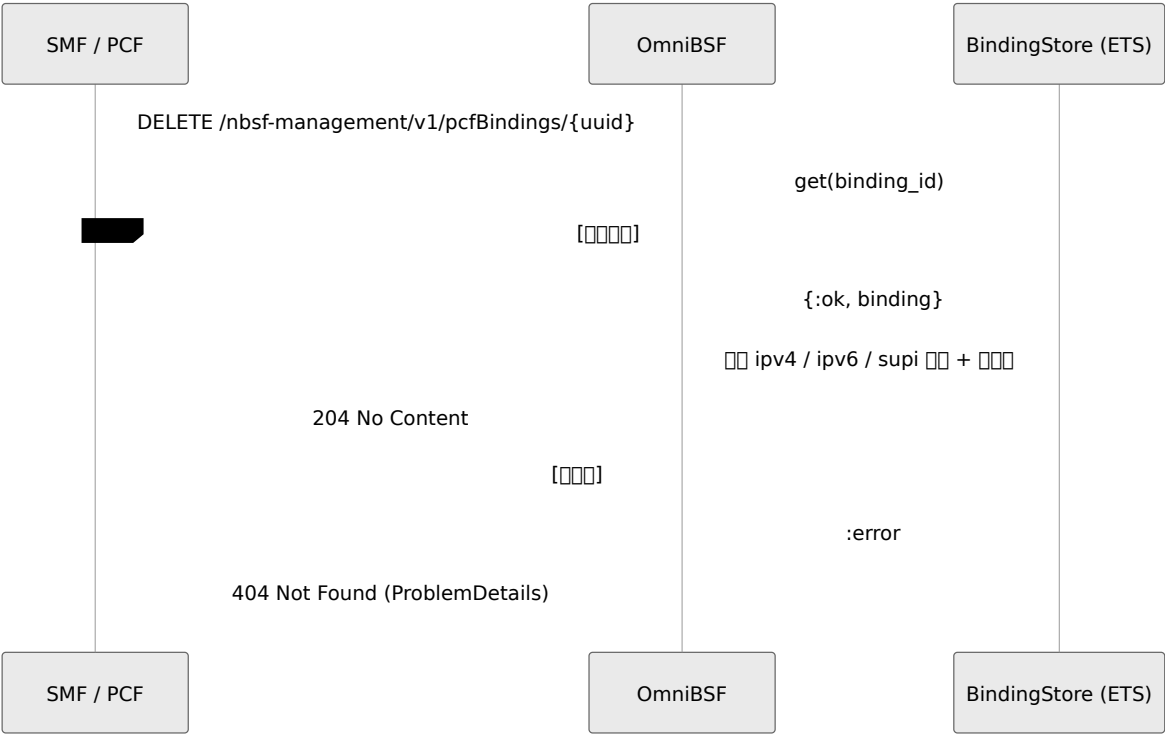


PCF 更新 (PATCH)



Merge-patch 请求体包含 `ipv4Addr` `ipv6Prefix` `macAddr48` `pcfFqdn` `pcfIpEndpoints` 以及 IPv4/IPv6/SUPI/MAC 和 DNN+S-NSSAI 的列表。响应体包含 `binding_ttl_seconds` 和 `expires_at` 字段。

PCF 删除 (DELETE)



NRF 注册

OmniBSF 向 NRF 注册 BSF NF 信息，包括 nrf_uri 和 SBI 接口。注册信息包括 PLMN (mcc/mnc) 和 nbsf-management v1 接口。注册成功后，NRF 返回 heartbeat_interval 信息。NRF 更新 API 接口。

OmniBSF

204

1. `ipv4Addr` `ipv6Prefix` `supi` -
2. `PCF binding not found for query:`
3. `POST` `PCF binding registered:`
4. `DNN+S-NSSAI {dnn, sst}` `sst` `POST`
5. `TTL [BindingCleaner] Removed N expired binding(s)`

POST 403

`ipv4Addr / ipv6Prefix` `ExtProblemDetails` `cause = EXISTING_BINDING_INFO_FOUND` `PCF` `pcfSmFqdn / pcfSmIpEndpoints` `PCF` `DELETE`

POST 400

`IE` `detail` `No DNN` `No S-NSSAI` `No PCF address information (pcfFqdn or pcfIpEndpoints required)` `MANDATORY_IE_MISSING`

DELETE PATCH 404

`ID` `TTL` `OmniBSF` `PCF binding not found for deregister:` `PCF binding not found for update:`

PATCH 415

PATCH Content-Type: application/merge-patch+json
415 Unsupported Media Type

/

omni_bsf_active_bindings_count
OAM GET /api/statistics NF DELETE PDU
TTL PATCH TTL PATCH
:binding_ttl_seconds DELETE PATCH
24 TTL :binding_ttl_seconds
:binding_cleanup_interval_ms API

NRF

omni_bsf_nrf_registration_status{nf_type="bsf"} nrf_uri
mcc/mnc NRF PLMN sbi_addr NRF API

