

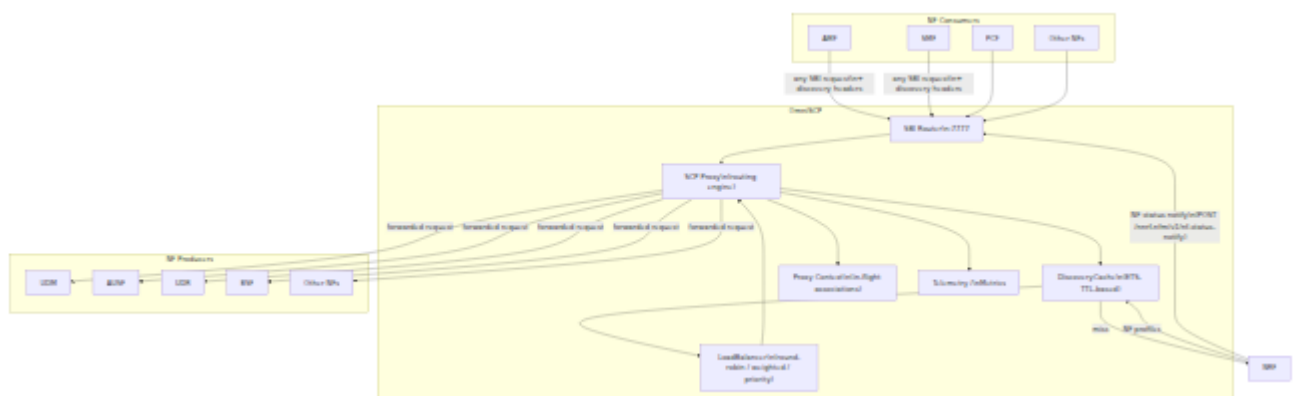
# OmniSCP

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1.
2. 3GPP
3. SBI
4.
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OmniSCP 3GPP TS 29.500 TS 23.501 (SCP) SCP 5G (SBA) NF NF HTTP NRF NF NRF NRF



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SCP ██████████

1. `3gpp-Sbi-Target-apiRoot` `URI` `NRF`
2. `3gpp-Sbi-Discovery-target-nf-type` `3gpp-Sbi-Discovery-service-names` `SCP` `NRF`
3. `SCP` `NF` `/nudm-` `UDM`

# 3GPP

| 구분                      | 구분                        |
|-------------------------|---------------------------|
| SCP NF 구분               | 3GPP TS 23.501 § 7.3      |
| SCP 인터페이스               | 3GPP TS 29.500 § 6.10     |
| 3gpp-Sbi-Discovery-*    | 3GPP TS 29.500 § 6.10.3   |
| 3gpp-Sbi-Target-apiRoot | 3GPP TS 29.500 § 6.10.3.2 |
| 3gpp-Sbi-Producer-Id    | 3GPP TS 29.500 § 6.10.3.3 |
| SCP 인터페이스               | 3GPP TS 29.500 § 6.10.4   |
| NF 인터페이스                | 3GPP TS 29.510 § 6.2      |
| NRF NF 인터페이스            | 3GPP TS 29.510 § 6.3      |
| SBI 인터페이스               | 3GPP TS 29.500            |

**SBI** ☐ ☐

OmniSCP ██████████ NF █████

| Method | URI                           | Response | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------|-------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| POST   | /nnrf-nfm/v1/nf-status-notify | 204      | NRF NF status notification. Response codes: NF_DEREGISTERED, NF_PROFILE_CHANGED. Error codes: 400, 401, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000. |
| *      | /* (Wildcard)                 | —        | Wildcard for all methods and URIs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## Problem Details

SCP ProblemDetails TS 29.500

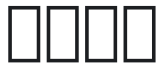
| HTTP Status               | Problem Details         | Notes                                  |
|---------------------------|-------------------------|----------------------------------------|
| 400 Bad Request           | MANDATORY_IE_MISSING    | 3gpp-Sbi-Target-apiRoot is missing.    |
| 502 Bad Gateway           | TARGET_NF_NOT_REACHABLE | Target NF is not reachable. 5xx error. |
| 504 Gateway Timeout       | NF_DISCOVERY_FAILURE    | NRF discovery failure.                 |
| 500 Internal Server Error | SYSTEM_FAILURE          | SCP system failure.                    |

3gpp-Sbi

| 3gpp-Sbi-Target-apiRoot                     |             |
|---------------------------------------------|-------------|
| 3gpp-Sbi-Discovery-target-nf-type           | NF UDM      |
| 3gpp-Sbi-Discovery-service-names            |             |
| 3gpp-Sbi-Discovery-requester-nf-type        | NRF NF      |
| 3gpp-Sbi-Discovery-target-plmn-list         | PLMN NRF    |
| 3gpp-Sbi-Discovery-requester-snsai-list     | S-NSSAI NRF |
| 3gpp-Sbi-Discovery-nf-set-id                | NF ID       |
| 3gpp-Sbi-Discovery-target-nf-instance-id    | NF ID       |
| 3gpp-Sbi-Discovery-requester-nf-instance-id | ID          |

3gpp-Sbi

| 3gpp-Sbi-Producer-Id | NF nfInstanceId TS 29.500 6.10.3.3 |
|----------------------|------------------------------------|



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```
config :omniscp,  
  sbi_scheme:      "http",  
  sbi_addr:        "127.0.0.200",  
  sbi_port:        7777,  
  nrf_uri:         "http://127.0.0.10:7777",  
  mcc:            "999",  
  mnc:            "70",  
  heartbeat_interval: 10_000,  
  discovery_cache_ttl: 60_000,  
  lb_strategy:     :round_robin,  
  max_retries:     1,  
  upstream_timeout: 5_000
```

配置

| 属性                  | 默认值                      | 类型  | 说明                                              |
|---------------------|--------------------------|-----|-------------------------------------------------|
| sbi_scheme          | "http"                   | 字符串 | SBI 协议Scheme                                    |
| sbi_addr            | "127.0.0.200"            | 字符串 | SBI HTTP 服务器地址                                  |
| sbi_port            | 7777                     | 整数  | SBI HTTP 服务器端口                                  |
| nrf_uri             | "http://127.0.0.10:7777" | 字符串 | NRF 服务 URI                                      |
| mcc                 | "999"                    | 字符串 | 中国移动 NR 网络 MCC                                  |
| mnc                 | "70"                     | 字符串 | 中国移动 NR 网络 MNC                                  |
| heartbeat_interval  | 10_000                   | 整数  | NRF 心跳间隔 (ms)                                   |
| discovery_cache_ttl | 60_000                   | 整数  | NRF 服务发现缓存 TTL (ms)<br>service_name} 缓存<br>30 秒 |
| lb_strategy         | :round_robin             | 字符串 | NF 负载均衡策略<br>支持:round_robin<br>轮询               |
| max_retries         | 1                        | 整数  | NF 请求失败重试次数 5xx 错误<br>0 表示无限重试                  |

| 項目               | 値     | 単位 | 説明                        |
|------------------|-------|----|---------------------------|
| upstream_timeout | 5_000 | ms | NF への HTTP リクエストのタイムアウト時間 |

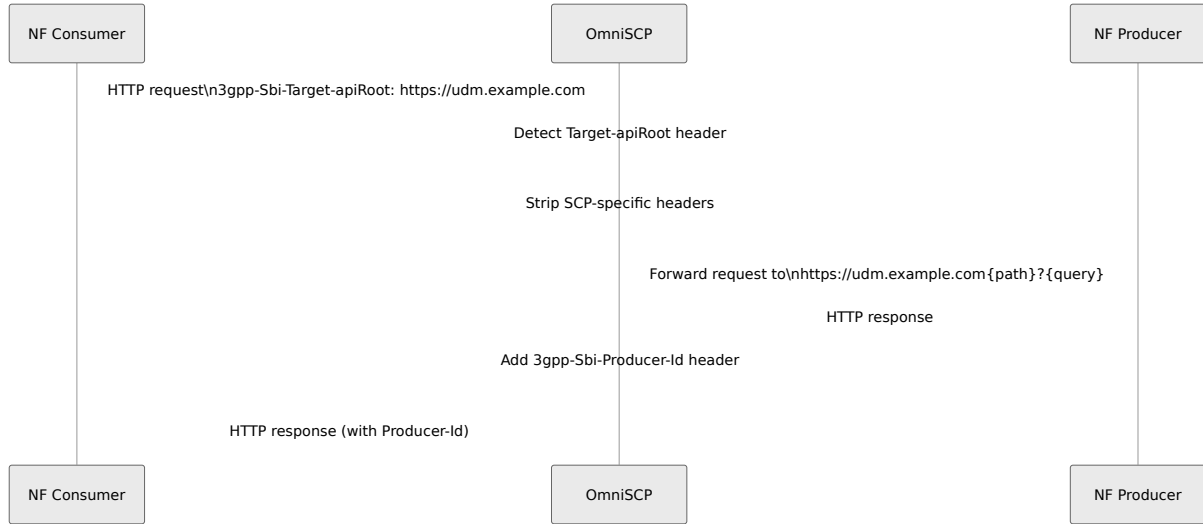
ロードバランシング

| 項目           | 値                                                                      |
|--------------|------------------------------------------------------------------------|
| :round_robin | 各 {nf_type, service_name} に対して、登録された NF を順番にアクセスする                     |
| :weighted    | 各 NF の load - capacity を基準として、NRF から取得した load / capacity の値に基づいてアクセスする |
| :priority    | 各 NF の priority を基準として、優先度の高い順にアクセスする                                  |

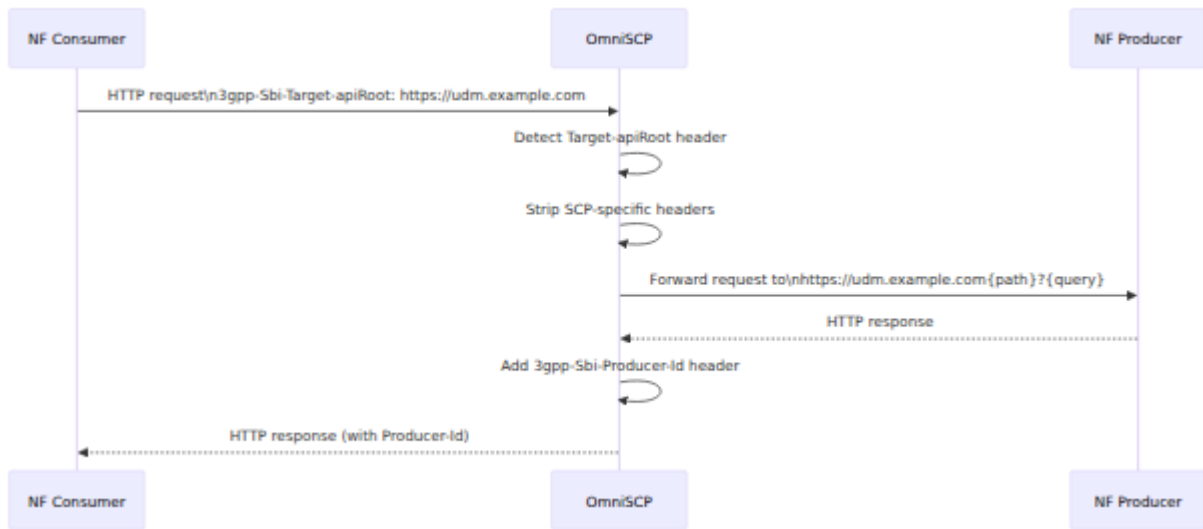
デフォルトは round\_robin であり、3 秒ごとに 30 個の NF をアクセスする

# Sequence Diagram 1

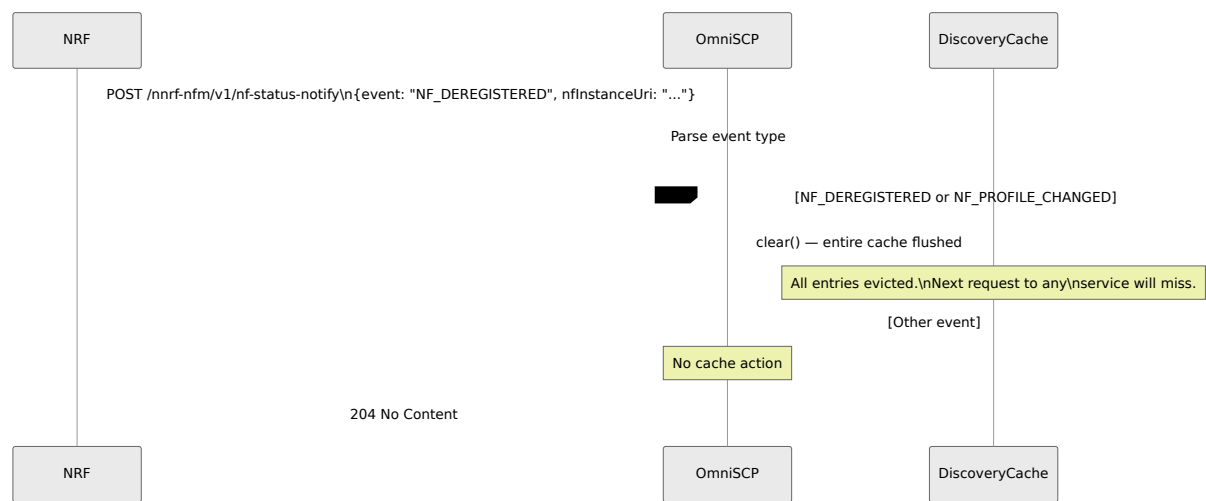
## Sequence Diagram 1



## Sequence Diagram 2



# NRF 注册流程



# 注册流程 3

SCP 注册流程 注册流程 NF 注册

| 注册     | NF 注册 |
|--------|-------|
| nudm-  | UDM   |
| nausf- | AUSF  |
| namf-  | AMF   |
| nsmf-  | SMF   |
| npcf-  | PCF   |
| nudr-  | UDR   |
| nnssf- | NSSF  |
| nbsf-  | BSF   |
| nnrf-  | NRF   |

nchf- nnef- naf- SCP-L1 CHF NEF AF 
3

| [:omniscp, :proxy, :requests]      | count, duration_ms | target_nf_type, result       |               |
|------------------------------------|--------------------|------------------------------|---------------|
| [:omniscp, :proxy, :result]        | count, duration_ms | target_nf_type, result       |               |
| [:omniscp, :discovery, :cache]     | hits, misses       | target_nf_type, service_name | /             |
| [:omniscp, :cache, :hit]           | count              | —                            |               |
| [:omniscp, :cache, :miss]          | count              | —                            |               |
| [:omniscp, :associations, :active] | count              | —                            |               |
| [:omni5g, :nrf, :registration]     | status             | nf_type                      | NRF  (1=, 0=) |

success (2xx/3xx), client\_error (4xx), server\_error (5xx), error ( / )

# Prometheus 简介

## SCP 简介

| 名称                                  | 类型           | 目标类型                   |
|-------------------------------------|--------------|------------------------|
| omni_scp.proxy.requests.count       | counter      | target_nf_type, result |
| omni_scp.proxy.requests.duration_ms | summary      | target_nf_type         |
| omni_scp.proxy_requests.total       | counter      | target_nf_type, result |
| omni_scp.proxy_request.duration_ms  | distribution | target_nf_type         |
| omni_scp.active_associations.count  | gauge        | --                     |

简介

| 名前                                           | タイプ     | ラベル                                                       | 単位                    |
|----------------------------------------------|---------|-----------------------------------------------------------|-----------------------|
| <code>omni_scp.discovery.cache.hits</code>   | counter | <code>target_nf_type,</code><br><code>service_name</code> | 個<br>個<br>個<br>個<br>個 |
| <code>omni_scp.discovery.cache.misses</code> | counter | <code>target_nf_type,</code><br><code>service_name</code> | 個<br>個<br>個<br>個<br>個 |
| <code>omni_scp.cache_hits.total</code>       | counter | --                                                        | 個<br>個<br>個<br>個<br>個 |
| <code>omni_scp.cache_misses.total</code>     | counter | --                                                        | 個<br>個<br>個<br>個<br>個 |

**NRF** 名前

| 名前                                            | タイプ   | ラベル                  | 単位                     |
|-----------------------------------------------|-------|----------------------|------------------------|
| <code>omni_scp.nrf.registration.status</code> | gauge | <code>nf_type</code> | NRF 状態 (1=登録済み, 0=未登録) |

**BEAM VM** 名前

| 項目                         | 単位    | 説明              |
|----------------------------|-------|-----------------|
| beam.memory.total          | gauge | BEAM の総メモリ      |
| beam.memory.processes      | gauge | Erlang のプロセス数   |
| beam.memory.processes_used | gauge | プロセスに使用されているメモリ |
| beam.memory.system         | gauge | システムメモリ         |
| beam.memory.atom           | gauge | アトム数            |
| beam.memory.atom_used      | gauge | アトムに使用されているメモリ  |
| 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 のメモリ        |
| beam.processes.count       | gauge | Erlang のプロセス数   |
| beam.ports.count           | gauge | Erlang のポート数    |
| beam.atom.count            | gauge | アトム数            |
| beam.vm.uptime             | gauge | VM の稼働時間        |

## 로그

| 레벨      | 메시지                                                   | 설명            |
|---------|-------------------------------------------------------|---------------|
| info    | Received NRF status notification                      | NF 상태 알림      |
| info    | NRF notification: event=<E> nf=<URI>                  | NRF 알림        |
| debug   | SCP direct forward: <METHOD> <URL>                    | SCP 1 직전      |
| debug   | SCP delegated forward: <METHOD> <URL> (attempt <N>)   | SCP 2/3 위임    |
| warning | SCP retrying after <STATUS> from <ID>...              | SCP 5xx 후 재시도 |
| warning | SCP retrying after error from <ID>...                 | SCP 오류 후 재시도  |
| warning | SCP cannot determine target for <METHOD> <PATH>       | SCP 3 대상 없음   |
| warning | NRF discovery returned no instances for <NF>/<SVC>    | NRF 발견 실패     |
| warning | All NF instances unhealthy, falling back to full list | LB 전체 목록으로 전환 |
| error   | NRF discovery failed: ...                             | NRF 발견 실패     |
| error   | SCP proxy error: ...                                  | SCP 프록시 오류    |
| info    | NF instance <ID> recovered after cooldown             | NF 인스턴스 복구    |

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|--|--|--|--|

## SCP □□□□□□□□□□

1. `3gpp-Sbi-Target-apiRoot` `3gpp-Sbi-Discovery-target-nf-type` `3gpp-Sbi-Discovery-service-names`

2. 3 SCP-  
L1

## 504 Gateway Timeout — NF\_DISCOVERY\_FAILURE

NRF NF

1. NRF OmniSCP `nrf_uri`
2. NF NRF `GET {nrf_uri}/nnrf-disc/v1/nf-instances?target-nf-type=<TYPE>`
3. NRF `NF_DEREGISTERED` NF

## 502 Bad Gateway — TARGET\_NF\_NOT\_REACHABLE

NF

1. NF NRF SBI
2. `upstream_timeout` NF
3. `max_retries` 0 502
4. `NF instance <ID> marked unhealthy after N failures`

NF NRF SBI URI TTL

1. `discovery_cache_ttl`
2. NF NRF OmniSCP
3. OmniSCP

1. `omni_scp.proxy_request.duration_ms`

2. `omni_scp.cache_hits.total` と `omni_scp.cache_misses.total` の差を計算し、NRF の `discovery_cache_ttl` と比較する
3. `upstream_timeout` — 設定されたタイムアウト時間

## NRF の設定

`omni_scp.nrf.registration.status` の初期値は 0

1. `nrf_uri` の設定は NRF の URL
2. `mcc` と `mnc` の設定は NRF PLMN の識別子
3. `registration_timeout` NRF への登録タイムアウト