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EMS restful interfaces

1. 状态管理

- URI:

```
/api/rest/systemManagement/v1/elementType/{elementTypeValue}/objectType/systemState
```

说明:

```
** elementTypeValue=smf/amf/..查询的网元网元类型
```

- Method:

GET

- Return:

NF -> OMC BE的json结构

```
type SysState struct {
    HostName      string `json:"hostName"` // linux命令: hostname
    OsInfo        string `json:"osInfo"`   // linux命令: uname -a
    DbInfo        string `json:"dbInfo"`   // 网元如果有db, 显示数据库名和版本信息, OMC: mysql --version
    Version       string `json:"version"`  // 软件版本信息: 16.1.1
    IpAddr        []string `json:"ipAddr"`  // 网管的ipv4和ipv6
    Port          uint16 `json:"port"`    // 用于网管的port
    Capability    uint32 `json:"capability"`
    SerialNum     string `json:"serialNum"`
    ExpiryDate    string `json:"expiryDate"`
    HardwareInfo  struct {
        CPUs    int `json:"cpus"` // 主机(裸机/虚拟机)的cpu个数
        Memory  int `json:"memory"` // 主机(裸机/虚拟机): 配置的内存
    } `json:"hardwareInfo"`
    CpuUsage     struct {
        NfCpuUsage  uint16 `json:"nfCpuUsage"`
        SysCpuUsage uint16 `json:"sysCpuUsage"`
    } `json:"cpuUsage"`
    MemUsage     struct {
        TotalMem    uint32 `json:"totalMem"`
        NfUsedMem   uint32 `json:"nfUsedMem"`
        SysMemUsage uint16 `json:"sysMemUsage"`
    } `json:"memUsage"`
    DiskSpace    struct {
        PartitionNum uint8 `json:"partitionNum"`
        PartitionInfo []struct {
            Total uint32 `json:"total"` // MB
            Used  uint32 `json:"used"` // MB
        } `json:"partitionInfo"`
    } `json:"diskSpace"`
    //Timestamp string `json:"timestamp"`
}
```

- Example: OMC BE -> OMC FE

```
"data": [
```

```
{
  "AMF_0": {
    "error": {
      "errorCode": "1",
      "errorInfo": "Internal server error, NF connect refused"
    },
    "ipAddress": "192.168.2.188"
  }
},
{
  "SMF_0": {
    "ipAddress": "192.168.1.232",
    "systemState": {
      "capability": 10000,
      "cpuUsage": {
        "nfCpuUsage": 2,
        "sysCpuUsage": 52
      },
      "diskSpace": {
        "partitionInfo": [
          {
            "total": 1920,
            "used": 0
          },
          {
            "total": 393,
            "used": 13
          },
          {
            "total": 48700,
            "used": 32431
          },
          {
            "total": 1965,
            "used": 0
          },
          {
            "total": 5,
            "used": 0
          },
          {
            "total": 1965,
            "used": 0
          },
          {
            "total": 55,
            "used": 55
          },
          {
            "total": 63,
            "used": 63
          },
          {
            "total": 91,
            "used": 91
          }
        ]
      }
    }
  }
}
```

```
        "total": 49,
        "used": 49
    },
    {
        "total": 55,
        "used": 55
    },
    {
        "total": 73,
        "used": 73
    },
    {
        "total": 91,
        "used": 91
    },
    {
        "total": 1475,
        "used": 206
    },
    {
        "total": 49,
        "used": 49
    },
    {
        "total": 393,
        "used": 13
    },
    {
        "total": 393,
        "used": 0
    },
    {
        "total": 73,
        "used": 73
    },
    {
        "total": 63,
        "used": 63
    }
    ],
    "partitionNum": 19
},
"expiryDate": "2025-02-28",
"memUsage": {
    "nfUsedMem": 163992,
    "sysMemUsage": 1345,
    "totalMem": 4025608
},
"serialNum": "13740126",
"version": "1.5.3.2"
}
}
},
{
    "SMF_1": {
        "ipAddress": "192.168.1.173",
        "systemState": {
```

```

"capability": 10000,
"cpuUsage": {
  "nfCpuUsage": 0,
  "sysCpuUsage": 69
},
"diskSpace": {
  "partitionInfo": [
    {
      "total": 3966,
      "used": 0
    },
    {
      "total": 797,
      "used": 0
    },
    {
      "total": 200559,
      "used": 5968
    },
    {
      "total": 3987,
      "used": 0
    },
    {
      "total": 5,
      "used": 0
    },
    {
      "total": 3987,
      "used": 0
    },
    {
      "total": 797,
      "used": 0
    }
  ],
  "partitionNum": 7
},
"expiryDate": "2024-12-31",
"memUsage": {
  "nfUsedMem": 212136,
  "sysMemUsage": 720,
  "totalMem": 8167360
},
"serialNum": "13740272",
"version": "1.5.3.3"
}
}
}
]
}

```

2 故障管理

2.1 告警上报

- URI

```
/api/rest/faultManagement/v1/elementType/{elementTypeValue}/objectType/alarms
```

- Method

POST

- Relations

NF->OMC

- Body

```
type Alarm struct {
    AlarmSeq      int    `json:"alarmSeq"`
    AlarmId       string `json:"alarmId"`
    NeId          string `json:"neId"`
    AlarmCode     int    `json:"alarmCode"`
    AlarmTitle    string `json:"alarmTitle"`
    EventTime     string `json:"eventTime"`
    AlarmType     string `json:"alarmType"`
    OrigSeverity  string `json:"origSeverity"`
    PVFlag        string `json:"pvFlag"`
    NeName        string `json:"neName"`
    NeType        string `json:"neType"`
    ObjectName    string `json:"objectName"`
    LocationInfo  string `json:"locationInfo"`
    Province      string `json:"province"`
    AlarmStatus  int    `json:"alarmStatus"`
    SpecificProblem string `json:"specificProblem"`
    SpecificProblemID string `json:"specificProblemID"`
    AddInfo       string `json:"addInfo"`
}
```

2.2 获取网元告警

- URI

```
/api/rest/faultManagement/v1/elementType/{elementTypeValue}/objectType/alarms
```

- Method

GET

- Relations

OMC->NF

- Body

n/a

- Return

```
type Alarms struct {
    Alarms []struct {
        AlarmSeq      int    `json:"alarmSeq"`
        AlarmId        string `json:"alarmId"`
        NeId           string `json:"neId"`
        AlarmCode      int    `json:"alarmCode"`
        AlarmTitle     string `json:"alarmTitle"`
        EventTime     string `json:"eventTime"`
        AlarmType      string `json:"alarmType"`
        OrigSeverity  string `json:"origSeverity"`
        PVFlag        string `json:"pvFlag"`
        NeName        string `json:"neName"`
        NeType        string `json:"neType"`
        ObjectName    string `json:"objectName"`
        LocationInfo  string `json:"locationInfo"`
        Province      string `json:"province"`
        AlarmStatus   int    `json:"alarmStatus"`
        SpecificProblem string `json:"specificProblem"`
        SpecificProblemID string `json:"specificProblemID"`
        AddInfo       string `json:"addInfo"`
    } `json:"Alarms"`
}
```

3. 配置管理

3.1 参数配置表

- 类型定义 (type)
 - string

filter指定字符串长度，如：`"filter": "6~100"`，字符串的长度范围，如果单个数字表示最大长度

- ipv4

filter忽略

- ipv6

filter忽略

- int

filter指定整型数的范围，如：`"filter": "100~999"`

- enum

`"filter": '{"0": "http", "1": "https"}'`

- bool

`"filter": '{"0": "false", "1": "true"}'`

- regex

filter为正则表达式

- 可选 (optional)

- **true**，默认值，表示该字段为可选填，没有写该属性项时**optional**为**true**（兼容以前配置文件）
- **false**，表示必填项

- Method

- 字符串`"get,post,put,delete"`，只用于Top Tag字段，默认为支持所有方法
- **get**对应"获取"按钮，**post**对应"新增"按钮，**put**对应"修改"按钮，**delete**对应"删除"按钮
- 配置相应方法，则显示相应的按钮，支持对应的方法

- Example

```
UDM:
system:
  display: "System"
```

```
method: "get,post,put,delete"
list:
  - name: "serviceIP"
    type: "ipv4"
    value: "172.16.5.140"
    optional: "false"
    access: "read-write"
    filter: ''
    display: "Service IP"
    comment: ""
  - name: "servicePort"
    type: "int"
    value: "8080"
    access: "read-write"
    filter: "0~65535"
    display: "Service Port"
    comment: "0~65535"
subsSmfSelection:
  display: "Subs Smf Selection"
  array:
    - name: "index"
      type: "int"
      value: "0"
      access: "read-write"
      filter: '0~15'
      display: "Index"
      comment: "0~15"
    - name: "name"
      type: "string"
      value: 'def_ambr'
      access: "read-write"
      filter: '^.{1,32}$'
      display: "Name"
      comment: "0~32"
    - name: "snssai"
      type: "string"
      value: '1-000001'
      access: "read-write"
      filter: '^\\d{1,3}[A-Fa-f0-9]{6}$'
      display: "Snssai"
      comment: ""
    - name: "dnnList"
      type: "int"
      value: '0'
      access: "read-write"
      filter: '0~3'
      display: "Dnn List"
      comment: ""
      array:
        - name: "index"
          type: "int"
          value: "0"
          access: "read-write"
          filter: '0~15'
          display: "index"
          comment: "0~15"
        - name: "dnn"
```

```
    type: "string"
    value: 'cmnet'
    access: "read-write"
    filter: '^.{1,32}$'
    display: "Dnn"
    comment: "0~32"
  - name: "defaultDnnInd"
    type: "bool"
    value: 'true'
    access: "read-write"
    filter: 'false;true;'
    display: "default Dnn Indicator"
    comment: ""
```

完整文件具体请参考 `udm_param_config.yaml`

3.2 获取参数

- URI

```
/api/rest/systemManagement/v1/elementType/{elementTypeValue}/objectType/config/{paraName}?loc={index0}/{paraName1}/{index1}/...
```

说明

```
elementTypeValue: udm, smf, amf... 网元类型
udm paraName: system, subsUEAmbr, subsSmfSelection ...
非array的参数, 忽略loc
```

- Params

- loc 多层表的定位信息

- Method

GET

- Return

```
/api/rest/systemManagement/v1/elementType/udm/objectType/config/system
```

```
{
  "data": [
    {
      "serviceIP": "172.16.5.140",
      "servicePort": "8080",
      "...": "..."
    }
  ]
}
```

```
/api/rest/systemManagement/v1/elementType/udm/objectType/config/subsSmfSelection?loc=1/dnnList
```

```
{
  "data": [
    {
      "index": "0",
      "dnn": "cmnet",
      "...": "..."
    },
    {
      "index": "1",
      "dnn": "ims",
      "...": "..."
    }
  ]
}
```

3.3 配置参数

- URI

```
/api/rest/systemManagement/v1/elementType/{elementTypeValue}/objectType/config/{paraName}?loc={index0}/{paraName1}/{index1}
```

- Params

- loc 多层表的定位信息

- Method

POST/PUT/DELETE

说明:

单层表不支持POST/DELETE操作

- Body

```
{
  "serviceIP": "172.16.5.140",
  "servicePort": "8080",
  "...": "..."
}
```

说明:

DELETE操作不带Body

3.4 创建/修改网元

- URI

```
/api/rest/systemManagement/v1/elementType/{elementTypeValue}/objectType/config  
/omcNeConfig
```

- Params

N/A

- Method

PUT

- Body

```
type OmcNeConfig struct {
  NeId      string `json:"neId" xorm:"ne_id"`           // 网元标识(内部),
  RmUID     string `json:"rmUID" xorm:"rm_uid"`       // neUID/rmUID 网元
  唯一标识
  NeName    string `json:"neName" xorm:"ne_name"`     // 网元名称/友好名称
  (北向资源/性能等使用)
```

```

PvFlag    string `json:"pvFlag" xorm:"pv_flag"`           // 网元虚实性标识
VNF/PNF: 虚拟/物理
Province  string `json:"province" xorm:"province"`       // 网元所在省份
VendorName string `json:"vendorName" xorm:"vendor_name"` // 厂商名称
// ManagedBy string `json:"managedBy" xorm:"managed_by"` // 管理
ManagedElement的ManagementNode对象类的DN值
Dn string `json:"dn" xorm:"dn"` // 资源里边的ManagedBy, 性能的Dn, 网络唯一标识
}

```

3.5 网元服务启动/停止/重启

- URI

```

/api/rest/systemManagement/v1/elementType/{elementTypeValue}/objectType/service/{action}?neId={neId}

```

action: start/restart/stop

- Relations

OMC FE -> OMC BE -> NF

- Params

OMC-FE -> OMC-BE, neId={neId}, 指定NF的neId

- Method

POST

- Body

```

type NeService struct {
    Action    string `json:"action"` // 动作, start/restart/stop
}

```

3.6 机器开机/重启/关机

- URI

```
/api/rest/systemManagement/v1/elementType/{elementTypeValue}/objectType/instance/{action}?neId={neId}
```

action: reboot/poweroff

- Relations

OMC FE -> OMC BE -> NF

- Params

OMC-FE -> OMC-BE, neId={neId}, 指定NF的neId

- Method

POST

- Body

```
type NeInstance struct {  
    Action      string `json:"action"`           // 动作, reboot/poweroff  
}
```

4 性能管理

4.1 任务管理

- URI

```
/api/rest/performanceManagement/v1/elementType/{elementTypeValue}/objectType/measurementTask?id={taskId1}&id={taskId2}
```

- Method

POST/PUT/DELETE/PATCH

- Params

taskId=1&taskId=2

- POST: 增加测量任务，激活任务，不带id参数，id在body
- PUT: 修改测量任务，激活任务，不带id参数，id在body
- DELETE: 删除测量任务，不需要带body，带id参数，可带多个
- PATCH: 暂停测量任务，不需要带body，带id参数，可带多个

测量任务创建/修改后暂时存储在OMC数据库，激活任务时再下发到网元

- Relations

OMC -> NF/NF -> OMC

- Body

下发测量任务的报文结构

```
type MeasureTask struct {
    Tasks []struct {
        Id int `json:"Id"`

        StartTime string `json:"StartTime"`
        EndTime string `json:"EndTime"`

        Schedule struct {
            Type string `json:"Type"` // 计划类型: Weekly/Monthly, 如果type
            为"", 则任务以StartTime和EndTime为条件进行统计, 否则以Shedule方式进行
            Days []int `json:"Days"` // Weekly: [0,1,...5,6], 0~6表示星期日
            ~星期六, Monthly: [1,2,3,...,30,31]一个月的几天
            Periods []struct {
                Start string `json:"Start"` // 零点或者零点加测量粒度的整数倍
                00:15:00
                End string `json:"End"` // 零点加测量粒度的整数倍 08:45:00,
                16:15:00
            } `json:"Periods"`
        } `json:"Schedule"`

        GranulOption string `json:"GranulOption"` // 测量粒度选项:
        15M/30M/60M/24H

        KPISet []struct {
            Code string `json:"Code"` // 统计编码 如: SMFHA01
            KPIs []string `json:"KPIs"` // 指标项集合
            ["SMF.AttCreatePduSession", "SMF.AttCreatePduSession._Dnn"]
        } `json:"KPISet"`
    } `json:"Tasks"`

    NotifyUrl string `json:"NotifyUrl"` /* 数据上报URL
    "http://x.x.x.x:xxxx/api/rest/performanceManagement/v1/elementType/smf/objectT
```



```
type/measureReport" */  
}
```

- Return

4.2 订阅任务数据上报

- URI

```
/api/rest/performanceManagement/v1/elementType/{elementTypeValue}/objectType/measureReport
```

- Method

POST

- Relations

NF -> OMC

- Body

网元返回测量数据的报文结构

```
type MeasureReport struct {  
    Id          int    `json:"Id"`  
    Timestamp string `json:"TimeStamp"`  
    NeName      string `json:"NeName"`  
    RmUID       string `json:"rmUID"`  
    NeType      string `json:"NeType"`  
  
    Report struct {  
        Period struct {  
            StartTime string `json:"StartTime"`  
            EndTime   string `json:"EndTime"`  
        } `json:"Period"`  
  
        Datas []struct {  
            Code string `json:"Code"` // 统计编码 如: SMFHA01  
            KPIs []struct {  
                KPIID string `json:"KPIID"` // 指标项, 如:  
SMF.AttCreatePduSession._Dnn  
                KPIValues []struct {  
                    Name string `json:"Name"` // 单个的写"Total", 或者指标项有  
多个测量项, 如Dnn的名称写对应的Dnn"cmnet"/"ims"  
                    Value int64   `json:"Value"`  
                }  
            }  
        }  
    }  
}
```

```
        } `json:"KPIValues"`
    } `json:"KPIs"`
} `json:"Datas"`
} `json:"Report"`
}
```

4.3 黄金指标上报

- URI

```
/api/rest/performanceManagement/v1/elementType/{elementTypeValue}/objectType/kpiReport/{index}
```

index取值范围： 0-1439

- Method

POST

- Body

```
type KpiReport struct {
    Timestamp string `json:"TimeStamp"`
    Task      struct {
        Period struct {
            StartTime string `json:"StartTime"`
            EndTime   string `json:"EndTime"`
        } `json:"Period"`
        NE struct {
            NEName string `json:"NEName"`
            RmUID   string `json:"rmUID"`
            NeType string `json:"NeType"`
            KPIs   []struct {
                KPIID string `json:"KPIID"`
                Value int   `json:"Value"`
                Err   string `json:"Err"`
            } `json:"KPIs"`
        } `json:"NE"`
    } `json:"Task"`
}
```

4.4 测量数据主动上报

- URI

```
/api/rest/performanceManagement/v1/elementType/{elementTypeValue}/objectType/measurement/{index}
```

- Method

POST

- Relations

NF -> OMC

- Params

NA

- Body

网元主动上报测量数据的报文结构

```
type Measurement struct {
    Index      int    `json:"Index"` // 1天当中测量时间粒度(如15分钟)的切片索引: 0~95
    Timestamp  string `json:"TimeStamp"`
    NeName     string `json:"NeName"` // UserLabel
    RmUID      string `json:"rmUID"`
    NeType     string `json:"NeType"` // 网元类型
    PmVersion  string `json:"PmVersion"` // 性能数据版本号
    Dn         string `json:"Dn"` // (???)网元标识, 如:RJN-CMZJ-TZ,SubNetwork=5GC88,ManagedElement=SMF53456,SmfFunction=53456
    Period     string `json:"Period"` // 测量时间粒度选项: 5/15/30/60
    TimeZone   string `json:"TimeZone"` // 时区, 如: "UTC+8"
    StartTime  string `json:"StartTime"`

    Datas []struct {
        ObjectType string `json:"ObjectType"` // 网络资源类别名称, Pm指标项列表中为空间粒度 如: SmfFunction
        KPIs []struct {
            KPIID      string `json:"KPIID"` // 指标项, 如: SMF.AttCreatePduSession._Dnn
            KPIValues []struct {
                Name      string `json:"Name"` // 单个的写"Total", 或者指标项有多个测量项, 如Dnn的名称写对应的Dnn"cmnet"/"ims"
                Value    int64  `json:"Value"`
            } `json:"KPIValues"`
        } `json:"KPIs"`
    }
}
```

```
} `json:"Datas"`  
}
```

- Return

Code: 204, no content

4.5 测量数据获取/补采

- URI

```
/api/rest/performanceManagement/v1/elementType/{elementTypeValue}/objectType/measurement/{index}
```

- Method

GET

- Relations

OMC -> NF

- Params

NA

- Body

NA

- Return

网元返回测量数据的报文结构

```
type Measurement struct {  
    Index      int    `json:"Index"`           // 1天中测量时间粒度(如15分钟)的切片索引: 0~95  
    Timestamp  string `json:"TimeStamp"`  
    NeName     string `json:"NeName"`         // UserLabel  
    RmUID      string `json:"rmUID"`  
    NeType     string `json:"NeType"`         // 网元类型  
    PmVersion  string `json:"PmVersion"`      // 性能数据版本号  
    Dn         string `json:"Dn"`             // (???)网元标识, 如:RJN-CMZJ-TZ,SubNetwork=5GC88,ManagedElement=SMF53456,SmfFunction=53456
```

```

Period string `json:"Period"` // 测量时间粒度选项: 5/15/30/60
TimeZone string `json:"TimeZone"`
StartTime string `json:"StartTime"`

Datas []struct {
    ObjectType string `json:"ObjectType"` // 网络资源类别名称, Pm指标项列表
    中为空间粒度 如: SmfFunction
    KPIs []struct {
        KPIID string `json:"KPIID"` // 指标项, 如:
        SMF.AttCreatePduSession._Dnn
        KPIValues []struct {
            Name string `json:"Name"` // 单个的写"Total", 或者指标项有多个
            测量项, 如Dnn的名称写对应的Dnn"cmnet"/"ims"
            Value int64 `json:"Value"`
        } `json:"KPIValues"`
    } `json:"KPIs"`
} `json:"Datas"`
}

```

5 跟踪管理

5.1 订阅管理

- 创建订阅

- URI

```
/api/rest/traceManagement/v1/subscriptions
```

- Method

POST

- Relations

OMC front-end->OMC back-end, OMC -> NF

- Body

OMC front-end->OMC back-end: id 不带 OMC->NF: id必选

```

type TraceTask struct {
    Id int `json:"id"`
}

```

```
TraceType string `json:"traceType"`
StartTime string `json:"startTime"`
EndTime string `json:"endTime"`
Imsi string `json:"imsi"`
Msisdn string `json:"msisdn"`
SrcIp string `json:"srcIp"`
DstIp string `json:"dstIp"`
SignalPort int16 `json:"signalPort"`
NeType string `json:"neType"`
NeId string `json:"neId"`
UeIp string `json:"ueIp"`
Interfaces []string `json:"interfaces"`
NotifyUrl string `json:"notifyUrl"`
}
```

Example:

```
{
  "id": 3,
  "traceType": "Interface",
  "startTime": "2023-07-04 13:00:00",
  "endTime": "2023-07-04 19:00:00",
  "neType": "UDM",
  "neId": "SZ_01",
  "interfaces": ["N8", "N10"],
  "notifyUrl": "gtp:192.168.0.229:2152",
}
```

- Return

Code=204 non-content

- 修改订阅

- URI

```
/api/rest/traceManagement/v1/subscriptions
```

- Method

PUT

- Relations

OMC front-end->OMC back-end, OMC -> NF

- Body

```
type TraceTask struct {
    Id          int      `json:"id"`
    TraceType   string   `json:"traceType"`
    StartTime   string   `json:"startTime"`
    EndTime     string   `json:"endTime"`
    Imsi        string   `json:"imsi"`
    Msisdn      string   `json:"msisdn"`
    SrcIp       string   `json:"srcIp"`
    DstIp       string   `json:"dstIp"`
    SignalPort  int16    `json:"signalPort"`
    NeType      string   `json:"neType"`
    NeId        string   `json:"neId"`
    UeIp        string   `json:"ueIp"`
    Interfaces  []string `json:"interfaces"`
    NotifyUrl   string   `json:"notifyUrl"`
}
```

Example:

```
{
  "id": 3,
  "traceType": "Interface",
  "startTime": "2023-07-04 13:00:00",
  "endTime": "2023-07-04 19:00:00",
  "neType": "UDM",
  "neId": "SZ_01",
  "interfaces": ["N8", "N10", "N11"],
  "notifyUrl": "gtp:192.168.0.229:2152",
}
```

- Return

Code=204 non-content

- 删除订阅

- URI

```
/api/rest/traceManagement/v1/subscriptions?id={id1}&id={id2}
```

- Method

DELETE

- Relations

OMC front-end->OMC back-end, OMC -> NF

- Params

id: 订阅任务id, 支持多个

- Body

NA

- Return

Code=204, non-content

- 查询订阅 (暂不实现, 直接从数据库查询)

- URI 查询单个订阅:

```
/api/rest/traceManagement/v1/subscriptions?id={id}
```

查询所有订阅:

```
/api/rest/traceManagement/v1/subscriptions
```

- Method

GET

- Body

NA

- Return

```
{
  "data": [
    {
      "id": 1,
      "traceType": "Interface",
      "startTime": "2023-07-04 13:00:00",
      "endTime": "2023-07-04 19:00:00",
    }
  ]
}
```



```
    "neType": "UDM",
    "neId": "SZ_01",
    "interfaces": ["N8", "N10", "N11"]
  }
]
```

5.2 消息上报

Example:

```
{
  "id": [1,2],
  "timestamp": "20230413 16:02:27.523496",
  "imsi": "4600001000000001",
  "msisdn": "12307550001",
  "srcAddr": "192.168.1.172:51034",
  "dstAddr": "192.168.1.187:8080",
  "neType": "AMF",
  "neId": "SZ_0",
  "interface": "N8",
  "data": "00002f01040000007f418d0be25c2e3cb8570bcedc780f038345",
  "diagnosis": "It is external debug information",
}
```

6. 操作维护

6.1 MML命令

6.1.1 MML命令格式

- 命令格式

```
oper object:parameter1={value1},parameter2={value2},parameter3={value3};
```

- 操作(operation)

- 根据实际操作可选用如下动作，如果没有合适的可自行增加，要做到简洁直观

```
add: 增加
mod(set): 修改/设置
del(rmv): 删除
dsp(lst): 查询显示
bak: 备份
exp: 导出
imp: 导入
bat: 批量
exec(run): 执行
act/dea: 激活/去激活
```

- 与对象之间采用空格分隔

- 对象(object)

- 操作的对象，如签约数据(sub/udmuser)/鉴权数据(auth/authdat), n7接口(n7server)
- 对象名称用所操作对象的英文名(或缩写), 为字母或者数字的组合, 不含空格, "-", "_"等特殊字符
- 使用":"与参数进行分隔

- 参数(param)

- 参数名采用英文常用名/约定俗成的缩写/缩略语等, 如imsi, msisdn, ip, port等, 为字母或者数字的组合, 不含空格, "-", "_"等特殊字符
- 参数值为字符串, 如有":", ",", ";", "\""字符, 需加\"进行转义
- 参数之间用","进行分隔

- 命令结束符";", 操作/对象/参数均采用小写字母 (HW采用的都是大写字母)

- 目前现有的各个网元的命令格式

除了UDM签约数据/鉴权数据的MML格式和上述格式基本一致, 各个网元的系统参数MML都不一样, 需统一成上述格式

- UDM鉴权数据/签约数据

```
add
authdat:imsi=460000100000030,ki=805DADC6E8A54A0D59D622C7A04D08E0,amf=8000
,algo=0,opc=CF7FD414E05754CFE08B4FE7F2EF2A36
```

- UDM系统参数

```
set n8ip 172.16.5.130
```

- AMF系统参数

```
set n8_ip 192.168.1.121
```

- SMF/UPF系统参数

```
set n7 server <http|https> <ip> <port>
```

6.1.2 MML配置表

- 类型定义（type）

- string

filter指定字符串长度，如："filter": "6~100"，字符串的长度范围，如果单个数字表示最大长度

- ipv4

filter忽略

- ipv6

filter忽略

- int

filter指定整型数的范围，如："filter": "100~999"

- enum

"filter": '{"0": "http", "1": "https"}'

- bool

"filter": '{"0": "false", "1": "true"}'

- regex

filter为正则表达式

- Example

```
udm:
  authdataManagement:
    display: "Authentication Data Management"
    mml:
      - operation: "dsp"
        object: "authdat"
        display: "Display Auth Data"
        params:
          - name: "imsi"
            type: "string"
            optional: "false"
            filter: ""
            display: "IMSI"
            comment: ""
  subscriberManagement:
    display: "Subscriber Management"
    mml:
      - operation: "dsp"
        object: "authdat"
        display: "Display Auth Data"
        params:
          - name: "imsi"
            type: "string"
            optional: "false"
            filter: ""
            display: "IMSI"
            comment: ""
  systemManagement:
    display: "System Management"
    mml:
      - operation: "set"
        object: "n8ip"
        display: "Set N8 IP Address"
        params:
          - name: "ip"
            type: "ipv4"
            optional: "false"
            filter: ""
            display: "IP Address"
            comment: ""
```

6.2 MML接口

- URI

```
/api/rest/operationManagement/v1/elementType/{elementTypeValue}/objectType/mml
?ne_id={neId}
```

- Relations

OMC front-end -> OMC back-end

OSS -> OMC (北向接口)

- Params

ne_id={neId}

- Method

POST

- Body

```
{
  "mml": [
    "date",
    "list ver",
    "list lic",
    "list comm"
  ]
}
```

- Return

```
{
  "data": [
    "2023-05-11 17:52:32.37333745 +0800 CST m+=+28762.188435351\n",
    "16.1.1\n",
    "Expiry date: 2024-12-31, sn: 13740272\n",
    "COMMAND NOT FOUND, opr: list, obj: comm\n"
  ]
}
```

7 北向接口(NBI)

7.1 查询资源数据接口

- URI

```
/api/rest/resourceManagement/{apiVersion}/elementType/{elementTypeValue}/objectType/{objectTypeValue}?rmUIDs={rmUIDValues}&fields={attributeNames}
```

- Relations

OMC -> NF

OSS -> OMC (北向接口)

- Params

- rmUIDs={rmUIDValues}

可携带多额rmUID(统一资源定位符), OMC->NF不带

- fields={attributeNames}

属性域集合={属性名列表}, 指定资源对象多个属性名的英文逗号分割, 一个属性名时无英文逗号。

- Method

GET

- Body

```
GET /api/rest/resourceManagement/v1/elementType/SMF/objectType/ManagedElement?
rmUIDs=1101AGTHXSMF0000015704000100&fields=UserLabel HTTP/1.1
accessToken: 52661fbd-6b84-4fc2-aa1e-17879a5c6c9b
Host: serverIP:port
Content-Type: application/json; charset=UTF-8
Content-Length:...
{
}
```

- Return

```
HTTP/1.1 200 OK
Content - Type: application/json
Content-Length:...
{
  "data": [{
    "rmUID": "1101AGTHXSMF0000015704000100",
    "UserLabel": "SMFRJBJJC01",
    ...
  }]
}
```

8 文件接口

8.1 软件管理

8.1.1 软件包管理接口

- URI

```
/api/rest/systemManagement/v1/{neType}/software/{version}?md5Sum={md5Sum}
```

- Relations

OMC front-end -> OMC back-end

- Params

md5Sum={md5Sum}

- Method

- POST: upload to OMC, 上传文件到OMC, content_type=multipart/form-data
- GET: download from omc, 下载文件到OMC, content_type=multipart/form-data
- DELETE: delete from omc

- Body

POST: 软件包文件, OMC按网元类型存储文件, 如果文件名相同则会覆盖

- Return
 - POST/DELETE: code=204
 - GET: code=200, 返回文件

8.1.2 网元软件包管理接口

- URI

```
/api/rest/systemManagement/v1/{neType}/software/{version}/{neId}
```

- Relations

OMC front-end -> OMC back-end

- Params

- Method

- POST: distribute to NF
- PUT: active
- PATCH: rollback

- Body

NA

- Return

Code: 204 Not content

8.2 License管理

8.2.1 网元License管理接口

- URI

```
/api/rest/systemManagement/v1/elementType/{elementTypeValue}/objectType/licens  
e?neId={neId}
```


- Relations

OMC front-end -> OMC back-end ->NF

- Params

- Method

POST: Upload license to NF

- Body

- licens文件, content_type=multipart/form-data
- 附加license说明字段信息: "comment": "..."

- Return

Code: 204 Not content

9 4A接口

9.1 从账号(user)管理接口

9.1.1 查询全部从账号(user)接口

- URI

```
/api/rest/aaaa/v1/security/users
```

- Relations

4A -> OMC

- Params

- Method

GET

- Body

- Return

9.1.2 单个从账号(user)接口

- URI

```
/api/rest/aaaa/v1/security/users/{id}
```

- Relations

4A -> OMC

- Params

- Method

GET/POST/PUT/DELETE

- Body

- Return

9.2 角色(role)管理接口

9.2.1 查询全部角色(role)接口

- URI

```
/api/rest/aaaa/v1/security/roles
```

- Relations

4A -> OMC

- Params

- Method

GET

- Body

- Return

9.2.2 单个角色(role)接口

- URI

```
/api/rest/aaaa/v1/security/roles/{id}
```

- Relations

4A -> OMC

- Params

- Method

GET/POST/PUT/DELETE

- Body

- Return

9.3 登录认证接口

9.2.1 登录认证

- URI

```
/api/rest/aaaa/v1/security/authentication/token
```

- Relations

4A -> OMC

- Params

- Method

GET

- Body

- Return

10 核心网用户信息接口

10.1 UDM签约用户

10.1.1 查询/增加/修改/删除

用MML接口

- Uri

```
/api/rest/ueManagement/v1/elementType/UDM/objectType/subData/{imsi}?neId={neId}
```

- Relations

OMC -> UDM

- Params

OMC-FE -> OMC-BE, neId={neId}, 指定UDM的neId

- Method

GET

- Body

NA

- Return

```
// SmfUEInfo SMF在线用户信息
type SubData struct {
    IMSI      string `json:"imsi"`           // SIM卡号
    MSISDN    string `json:"msisdn"`
    Amf       string `json:"amf"`           // Amf
    Status    string `json:"status"`       // 状态
    Ki        string `json:"ki"`           // ki
    AlgoIndex string `json:"algoIndex"` //
    Opc       string `json:"opc"`
}
```

```
{
  "data":
  {
```

```
        "imsi": "460000100000010",
        "msisdn": "12307550010",
        "...": "..."
    }
}
```

10.2 UDM鉴权用户

10.2.1 查询/增加/修改/删除

用MML接口

10.3 UE信息

10.3.1 查询SMF在线用户数

- Uri

```
/api/rest/ueManagement/v1/elementType/smf/objectType/ueNum?neId={neId}
```

- Relations

OMC -> SMF

- Params

OMC-FE -> OMC-BE, neId={neId}, 指定SMF的neId

- Method

GET

- Body

NA

- Return

```
// SmFUENum SMF在线用户数
type SmFUENum struct {
```

```
UENum int `json:"ueNum"` // 当前在线用户数
}
```

```
{
  "data":
  {
    "ueNum": 6
  }
}
```

10.3.2 查询SMF在线用户

说明：为了避免在线用户太多，SMF可做限制，如返回不超过100条

- Uri

```
/api/rest/ueManagement/v1/elementType/smf/objectType/ueInfo?imsi={imsi}&msisdn={msisdn}&neId={neId}
```

- Relations

OMC -> SMF

- Params

- OMC-FE -> OMC-BE, neId={neId}, 指定SMF的neId
- OMC -> SMF, imsi={imsi} 或者 msisdn={msisdn}, 可选，如果都不指定，则查询全部ueInfo

- Method

GET

- Body

NA

- Return

```
// SmfUEInfo SMF在线用户信息
type SmfUEInfo []struct {
  IMSI          string `json:"imsi"`
```

```

MSISDN      string `json:"msisdn"`
RatType     string `json:"ratType"`
PduSessionInfo []struct {
    PduSessionID int    `json:"pduSessionID"`
    IPv4         string `json:"ipv4"`
    IPv6         string `json:"ipv6"`
    Dnn          string `json:"dnn"`
    Tai          string `json:"tai"`
    SstSD        string `json:"sstSD"`
    UpfN3IP      string `json:"upfN3IP"`
    RanN3IP      string `json:"ranN3IP"`
    Activetime   string `json:"activeTime"`
} `json:"pduSessionInfo"`
}

```

```

{
  "data": [
    {
      "imsi": "460000100000010",
      "msisdn": "12307550010",
      "pduSessionInfo": [
        {
          "pduSessionID": "1",
          "ipv4": "172.16.5.5",
          "...": "..."
        },
        {
          "pduSessionID": "2",
          "ipv4": "172.16.5.6",
          "...": "..."
        }
      ]
    },
    {
      "imsi": "460000100000238",
      "msisdn": "12307550238",
      "pduSessionInfo": [
        {
          "pduSessionID": "3",
          "ipv4": "172.16.5.7",
          "...": "..."
        },
        {
          "pduSessionID": "4",
          "ipv4": "172.16.5.8",
          "...": "..."
        }
      ]
    }
  ]
}

```


10.4 IMS在线用户信息

10.4.1 查询IMS在线用户信息

说明：为了避免在线用户太多，IMS可做限制，如返回不超过100条

- Uri

```
/api/rest/ueManagement/v1/elementType/ims/objectType/ueInfo?imsi={imsi}&msisdn={msisdn}&neId={neId}
```

- Relations

OMC -> IMS

- Params

- OMC-FE -> OMC-BE, neId={neId}, 指定IMS的neId
- OMC -> IMS, imsi={imsi} 或者 msisdn={msisdn}, 可选，如果都不指定，则查询全部ueInfo

- Method

GET

- Body

NA

- Return

```
// ImsUEInfo IMS在线用户信息
type ImsUEInfo []struct {
    IMSI      string `json:"imsi"`
    MSISDN    string `json:"msisdn"`
    IMPU      string `json:"impu"`
    Barring   int    `json:"barring"`
    RegState  int    `json:"regState"`
    Activetime string `json:"activeTime"`
}
```

```
{
  "data": [
    {
      "imsi": "460000100000010",
      "msisdn": "12307550010",
      "impu": "sip:12307550010@ims.mnc000.mcc460.3gppnetwork.org",
      "barring": 0,
      "regState": 1,
      "activeTime": "2023-07-11 18:26:46"
    },
    {
      "imsi": "460000100000238",
      "msisdn": "12307550038",
      "impu": "sip:12307550238@ims.mnc000.mcc460.3gppnetwork.org",
      "barring": 0,
      "regState": 1,
      "activeTime": "2023-07-11 18:26:46"
    }
  ]
}
```

10.5 基站信息

10.5.1 查询某个AMF下的基站信息

- Uri

```
/api/rest/ueManagement/v1/elementType/amf/objectType/nbInfo?nbId={nbId}&neId={neId}
```

- Relations

OMC -> AMF

- Params

- OMC-FE -> OMC-BE, neId={neId}, 指定AMF的neId
- OMC -> AMF, nbId={nbId}, 可选, 如果不指定则查询全部基站信息

- Method

GET

- Body

NA

- Return

```
// AmfNBInfo AMF的NodeB信息
type AmfNBInfo []struct {
    ID      string `json:"id"`      //NodeB ID
    Name    string `json:"name"`    // NodeB name
    Address string `json:"address"` // 基站地址
    UENum  int    `json:"ueNum"`   // UE数量
}
```

```
{
  "data": [
    {
      "id": "6001",
      "name": "NB6001",
      "address": "192.168.1.245:36412",
      "ueNum": 2
    },
    {
      "id": "6002",
      "name": "NB6002",
      "address": "192.168.1.246:36412",
      "ueNum": 6
    }
  ]
}
```

10.6 N3IWF在线用户信息

10.6.1 查询N3IWF在线用户信息

说明：为了避免在线用户太多，N3IWF可做限制，如返回不超过100条

- Uri

```
/api/rest/ueManagement/v1/elementType/n3iwf/objectType/ueInfo?imsi={imsi}&msisdn={msisdn}&neId={neId}
```

- Relations

OMC -> IMS

- Params
 - OMC-FE -> OMC-BE, neld={neld}, 指定IMS的neld
 - OMC -> IMS, imsi={imsi} , 可选, 如果都不指定, 则查询全部ueInfo

- Method

GET

- Body

NA

- Return

```
// N3iwfUEInfo N3IWF在线用户信息
type N3iwfUEInfo struct {
    IMSI string `json:"imsi"`

    NAI string `json:"nai"`
    RegState int `json:"regState"`
    Activetime string `json:"activeTime"`
}

type N3iwfUEData struct {
    Data []N3iwfUEInfo `json:"data"`
}
```

```
{
  "data": [
    {
      "imsi": "460000100000010",
      "nai": "",
      "regState": 1,
      "activeTime": "2023-07-11 18:26:46"
    },
    {
      "imsi": "460000100000011",
      "nai": "",
      "regState": 1,
      "activeTime": "2023-07-11 18:26:46"
    }
  ]
}
```

11 系统管理

11.1 OMC系统

11.1.1 获取OMC时间接口

- Uri

```
/api/rest/systemManagement/v1/elementType/OMC/objectType/time
```

- Relations OMC FE -> OMC BE

- Params

NA

- Method GET

- Body NA

- Return

```
// OMC time 信息
type OMCLocalTime struct {
    Timestamp int64 `json:"timestamp"` // 时间戳 (单位:毫秒)
    TimeZone int `json:"timeZone"` // 本地时区偏移 (单位: 秒)
}
```

Example:

```
{
  "data":
  {
    "timestamp": "1697101301164"
    "timeZone": "28800"
  }
}
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