Stateless handle and service

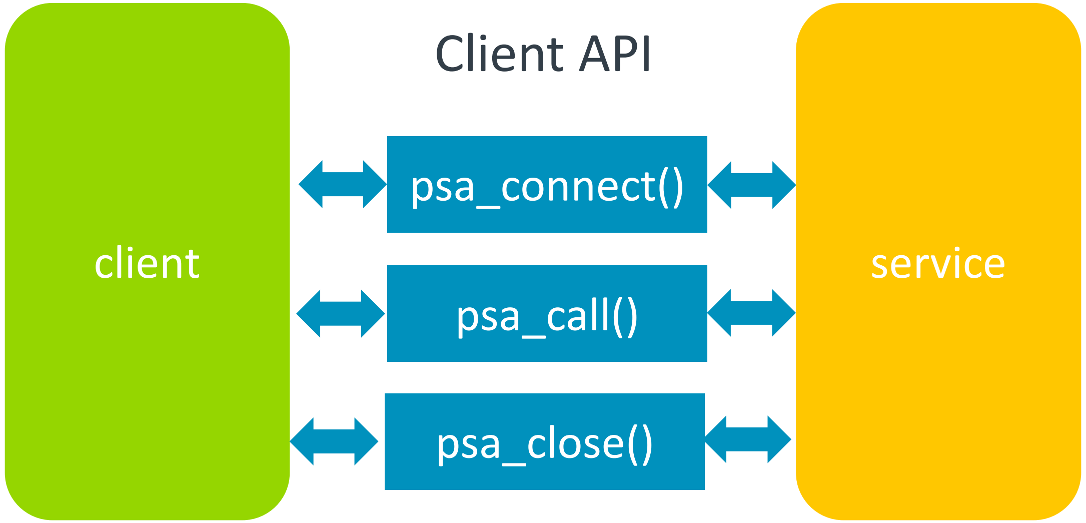
TF-M 1.3 & FF-M 1.1

Mingyang Sun

2021-04-01

FF-M 1.0 – Connection-based services

- Clients make multiple calls to access the service.

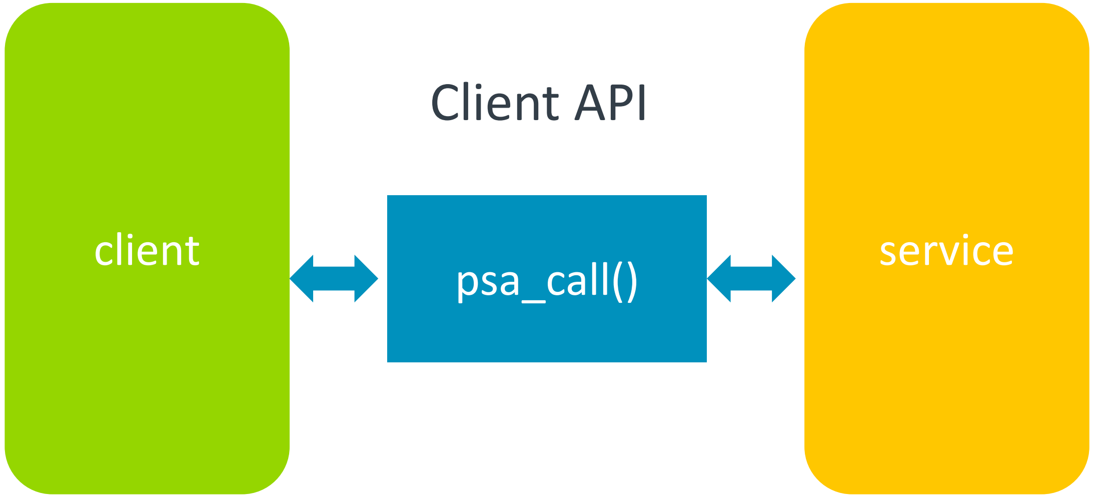


- Some services only need one-shot operation
  - too many calls in each operation, runtime overhead
  - “rhandle” is unnecessary for such one-shot service

FF-M 1.1 - Stateless RoT Service

- Introduced in Firmware Framework for M 1.1, implemented by TF-M 1.3 now.

- Improve efficiency
  - Single call to the stateless service
  - No connection and disconnection messages are passed
  - “rhandle” is kept for compatibility but not accessible when accessing stateless service


Client API

API change

- Clients request the stateless service via “psa_call()” directly
  - Pass in a valid static handle value defined in the “sid.h”
  - “type” must be >= 0
  - Other parameters are the same as in FF-M 1.0

Generated by framework

```
status = psa_call(ROT_SERVICE_STATIC_HANDLE, type,
                  in_vec, in_len, out_vec, out_len);
```

- PROGRAMMER ERROR
  - Calling `psa_connect`( ), `psa_close`( ) or `psa_set_rhandle`( ) is a PROGRAMMER ERROR.

Manifest attributes change – stateless service

- Firmware framework version of partition must be 1.1

- “connection_based”
  - Must be set if partition FF version is 1.1
  - False for stateless services
  - True for connection-based services

- “stateless_handle”
  - Used as index, must be positive from 1 to static handle maximum.
  - Can also set as “auto”. If not set, default is “auto”.

Manifest tool change

- Automation
  - Duplicated and invalid static handle index check for the defined “stateless_handle”
  - Auto-allocate static handle index when “stateless_handle” attribute is set as “auto” or not set in yaml/json file.
  - Stateless handle value encoding – indicator bit, version, index

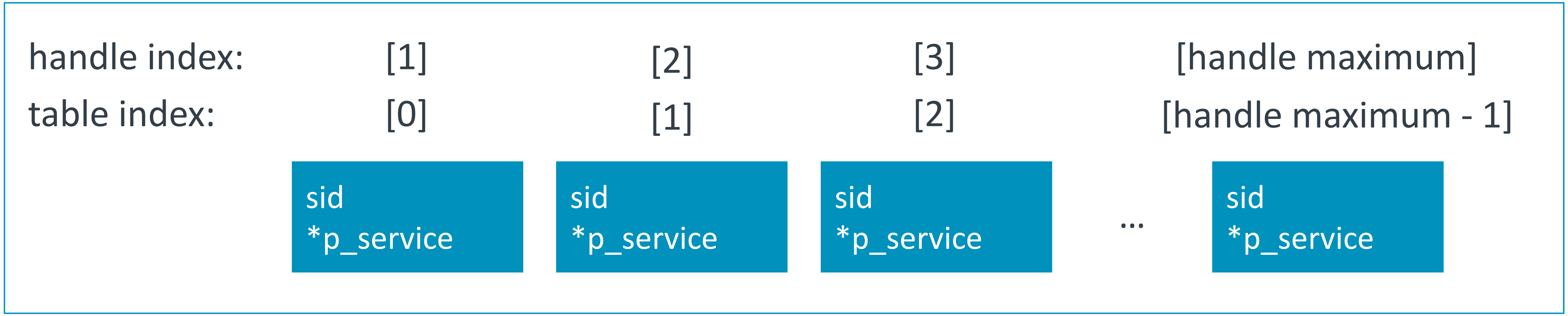
stateless handle indicator bit	bit 30
stateless client version	bit 15 – bit 8
stateless handle index	bit 7 – bit 0

Client handle encoded to RANGE[CLIENT_HANDLE_VALUE_MIN, 0x3FFFFFFF], no overlap with static handle.

Data structure change

- “connection_based” member added in service static data
  - False for stateless services
  - True for connection-based services

- stateless service tracking table added
  - handle index is converted to the table index (minus one).
  - sid is filled by manifest tool, *p_service is initialized while booting up



handle index:	[1]	[2]	[3]		[handle maximum]
table index:	[0]	[1]	[2]		[handle maximum - 1]
	sid *p_service	sid *p_service	sid *p_service	…	sid *p_service

Example – stateless service

- Create a partition and a stateless service. Add yaml file:

```
{
   "psa_framework_version": 1.1,
   "name": "TFM_SP_FFM11",
   "type": "APPLICATION-ROT",
   "priority": "NORMAL",
   "entry_point": "tfm_ffm11_partition_main",
   "stack_size": "0x200",
   "services": [
    {
      "name": "TFM_FFM11_SERVICE1",
      "sid": "0x0000F120",
      "non_secure_clients": true,
      "connection_based": false,
      "stateless_handle": "auto",
      "version": 1,
      "version_policy": "RELAXED"
    },
   ],
}
```

Example – stateless service

- Tool generates static handle and SID

```
#define TFM_FFM11_SERVICE1_SID       (0x0000F120U)
#define TFM_FFM11_SERVICE1_VERSION   (1U)
#define TFM_FFM11_SERVICE1_HANDLE    (0x40000101U)
```

- Create partition and service: print the data received from message

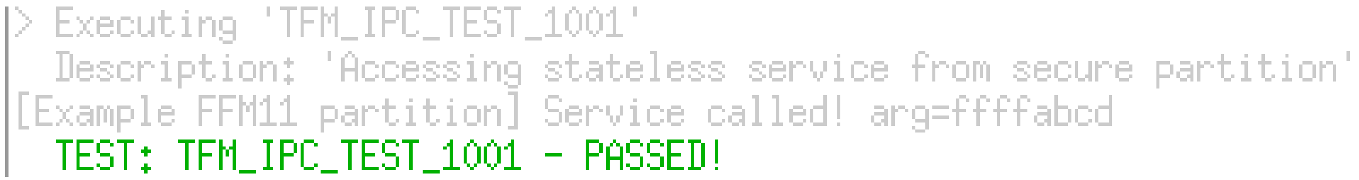
- Put number “0xFFFFABCD” into the “in_vec” argument, call the example service with its static handle.

```
status = psa_call(TFM_FFM11_SERVICE1_HANDLE,
                  PSA_IPC_CALL, in_vec, 1, NULL, 0);
```

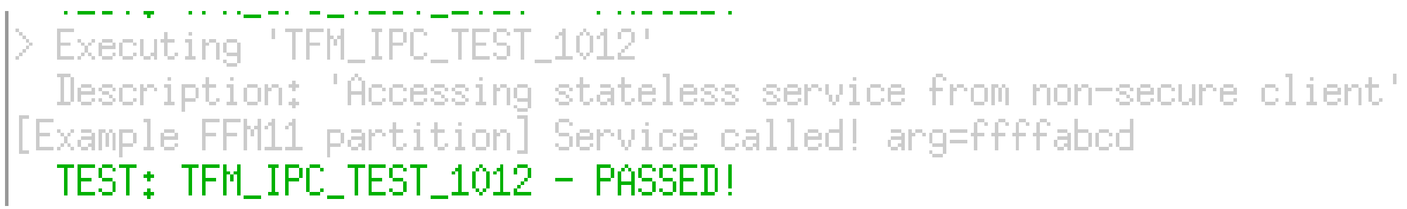
Example – stateless service

- Service receives the message, and outputs information:

```
[Example FFM11 partition] Service called! arg=ffffabcd
```



```
> Executing 'TFM_IPC_TEST_1001'
  Description: 'Accessing stateless service from secure partition'
[Example FFM11 partition] Service called! arg=ffffabcd
  TEST: TFM_IPC_TEST_1001 - PASSED!
```



```
> Executing 'TFM_IPC_TEST_1012'
  Description: 'Accessing stateless service from non-secure client'
[Example FFM11 partition] Service called! arg=ffffabcd
  TEST: TFM_IPC_TEST_1012 - PASSED!
```

Apply stateless service

- Recommended:
  - Services containing entirely stand-alone functions

- Not recommended:
  - API exposes some form of context from the client to be used to manage a connection handle
  - Service manages volatile state for the client – may need “rhandle”

Thank You
Danke
Gracias
谢谢
ありがとう
Asante
Merci
감사합니다
धन्यवाद
Kiitos
شكرًا
ধন্যবাদ
תודה