

KAMAILIO WORLD 2017, BERLIN

KAMAILIO.CFG SCRIPTING LANGUAGES



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- flexible scripting language
 - more data types
 - more extensions
 - ... do not reinvent the wheel
- hot reload of routing rules
 - no restart to apply changes to routing blocks



- introduced in Kamailio v5.0.0
- updated scripting language embedded interpreters
 - Lua
 - JavaScript
 - Python
 - Squirrel
- not yet updated scripting language embedded interpreters
 - Perl
 - Mono (.NET, C#, ...)
 - Java (?)
- native language still available
 - the old kamailio.cfg scripting language is still there

<https://www.kamailio.org/wiki/devel/config-engines>

- over 60 modules exporting to kemi
- many do not need to export anything to kemi
 - db modules, rtimer, qos, dnssec, ...
- exports KSR object
 - from core - many KSR.functionX(...)
 - from core - KSR.hdr.functionX(...)
 - from interpreter module - KSR.pv.functionX(...)
 - from interpreter module - KSR.x.functionX(...)
 - execute any module function: KSR.x.modf(funcname, params...)
 - exit emulation: KSR.x.exit() and KSR.x.drop() - might not be everywhere
- the usual modules
 - exports: KSR.mofname.functionX(...)
 - pv module exports KSR.pvx.functionX(...)

acc
alias_db
app_jsdt
app_lua
app_python
app_sqlang
async
auth
auth_db
call_control
cfgutils
corex
dialog
dispatcher
diversion
domain
enum
evapi
exec
geoip
geoip2
htable
imc
jsonrpcs
kex
maxfwd
mqueue
mtree
nathelper
permissions
pike
presence
presence_xml
pua
pua_usrloc
pv
registrar
rr
rtjson
rtpengine
rtpproxy
sanity
sdpops
siputils
sl
speeddial
sqlops
ss7ops
sst
statistics
statsc
statsd
textops
textopsx
tls
tm
tmx
uac
utils
websocket
xhttp
xlog
xmlrpc

– app_lua

- existing since 2010 offering inline execution of Lua scripts
- https://www.kamailio.org/docs/modules/stable/modules/app_lua.html

– highlights

- very small interpreter, fast
- decent number of extensions (native lua libraries)
- popular in gaming space, also in RTC (Asterisk, Freeswitch)



<https://github.com/kamailio/kamailio/blob/master/misc/examples/kemi/kamailio-basic-kemi-lua.lua>

```
324  -- Routing to foreign domains
325  function ksr_route_sipout()
326      if KSR.is_myself(KSR.pv.get("$ru")) then return 1; end
327
328      KSR.hdr.append_hf("P-Hint: outbound\r\n");
329      ksr_route_relay();
330      KSR.x.exit();
331  end
```

- introduced in Kamailio v5.1 (devel)

- not in stable version
- https://www.kamailio.org/docs/modules/devel/modules/app_jsdt.html

- highlights

- duktape.org engine - small, easy to embed by importing source code files
- very popular scripting language
- no external dependencies
- reload of routing script
- not many extensions



<https://github.com/kamailio/kamailio/blob/master/misc/examples/kemi/kamailio-basic-kemi-jsdt.js>

```
331 // Routing to foreign domains
332 function ksr_route_sipout()
333 {
334     if (KSR.is_myself(KSR.pv.get("$ru"))) { return; }
335
336     KSR.hdr.append_hf("P-Hint: outbound\r\n");
337     ksr_route_relay();
338     KSR.x.exit();
339 }
```

- app_python

- introduced in 2010 for inline execution of Python scripts
- https://www.kamailio.org/docs/modules/stable/modules/app_python.html

- highlights

- popular scripting language with extensive number of extensions
- object oriented, perceived as slower than other scripting languages
- reloading of the routing script not implemented yet



<https://github.com/kamailio/kamailio/blob/master/misc/examples/kemi/kamailio-basic-kemi-python.py>

```
332     # Routing to foreign domains
333     def ksr_route_sipout(self, msg):
334         if KSR.is_myself(KSR.pv.get("$ru")) :
335             return 1;
336
337         KSR.hdr.append("P-Hint: outbound\r\n");
338         self.ksr_route_relay(msg);
339         return -255;
```


– app_sqlang

- introduced in Kamailio 5.1 (devel)
- https://www.kamailio.org/docs/modules/devel/modules/app_sqlang.html

– highlights

- very small interpreter
- embedded by importing its source code
- no external dependency
- reload of scripting script
- pre-compilation options
- ***not stable state yet***



<https://github.com/kamailio/kamailio/blob/master/misc/examples/kemi/kamailio-basic-kemi-sqlang.sq>

```
332 // Routing to foreign domains
333 function ksr_route_sipout()
334 {
335     if (KSR.is_myself(KSR.pv.get("$ru"))) { return; }
336
337     KSR.hdr.append_hf("P-Hint: outbound\r\n");
338     ksr_route_relay();
339     KSR.x.exit();
340 }
```

- same route block

<https://github.com/kamailio/kamailio/blob/master/misc/examples/kemi/kamailio-basic-kemi-native.cfg>

```
298 # Routing to foreign domains
299 route[SIP0UT] {
300     if (uri==myself) return;
301
302     append_hf("P-hint: outbound\r\n");
303     route(RELAY);
304     exit;
305 }
```

- functions with up to six string parameters
- newer versions can accept directly int or pv parameters
- fixup system at startup to optimize parameter values for runtime
- return integer value

```
/*
 * Exported functions
 */
static cmd_export_t cmds[] = {
...
    {"has_credentials",    w_has_credentials,    I,
     fixup_spve_null,    REQUEST_ROUTE},
...
};

/*
 * Module interface
 */
struct module_exports exports = {
    "auth",
    cmds,
...
};
```

```
/**
 *
 */
int w_has_credentials(sip_msg_t *msg, char* realm, char* s2)
{
    str srealm = {0, 0};

    if (fixup_get_svalue(msg, (gparam_t*)realm, &srealm) < 0) {
        LM_ERR("failed to get realm value\n");
        return -1;
    }

    return ki_has_credentials(msg, &srealm);
}
```

- functions with up to six string or int parameters
- optimizations may be done by the scripting interpreter itself
- return integer value
- special functions returning string - KSR.pv.get(...)

```
static sr_kemi_t sr_kemi_auth_exports[] = {  
...  
    { str_init("auth"), str_init("has_credentials"),  
      SR_KEMIP_INT, ki_has_credentials,  
      { SR_KEMIP_STR, SR_KEMIP_NONE, SR_KEMIP_NONE,  
        SR_KEMIP_NONE, SR_KEMIP_NONE, SR_KEMIP_NONE }  
    },  
...  
};  
  
int mod_register(char *path, int *dlflags, void *p1, void *p2)  
{  
    sr_kemi_modules_add(sr_kemi_auth_exports);  
    return 0;  
}
```

```
/**
 *
 */
int ki_has_credentials(sip_msg_t *msg, str* srealm)
{
    hdr_field_t *hdr = NULL;
    int ret;

    ret = find_credentials(msg, srealm, HDR_PROXYAUTH_T, &hdr);
    if(ret==0) {
        LM_DBG("found www credentials with realm [%.*s]\n", srealm->len, srealm->s);
        return 1;
    }
    ret = find_credentials(msg, srealm, HDR_AUTHORIZATION_T, &hdr);
    if(ret==0) {
        LM_DBG("found proxy credentials with realm [%.*s]\n", srealm->len, srealm->s);
        return 1;
    }

    LM_DBG("no credentials with realm [%.*s]\n", srealm->len, srealm->s);
    return -1;
}
```

- estimated 1024 max KSR functions
- auto generated 1024 Lua exports functions
- index KSR functions in one-to-one relation

Exported To Lua	Internal Kamailio Structure
<code>sr_kemi_lua_exec_func_0</code>	<code>sr_kemi_lua_export_t(t_relay)</code>
...	...
<code>sr_kemi_lua_exec_func_100</code>	<code>sr_kemi_lua_export_t(sl_send_reply)</code>
...	...
<code>null</code>	<code>null</code>
...	...


```
static int sr_kemi_lua_exec_func_0(lua_State *L)
{
    return sr_kemi_lua_exec_func(L, 0);
}

...

static int sr_kemi_lua_exec_func_1023(lua_State *L)
{
    return sr_kemi_lua_exec_func(L, 1023);
}

...

typedef struct sr_kemi_lua_export {
    lua_CFunction pfunc;
    sr_kemi_t *ket;
} sr_kemi_lua_export_t;

static sr_kemi_lua_export_t sr_kemi_lua_export_list[] = {
    { sr_kemi_lua_exec_func_0, NULL},
    ...
    { sr_kemi_lua_exec_func_1023, NULL},
    {NULL, NULL}
};
```

```
sr_kemi_t *sr_kemi_lua_export_get(int idx)
{
    if(idx<0 || idx>=SR_KEMI_LUA_EXPORT_SIZE)
        return NULL;
    return _sr_kemi_lua_export_list[idx].ket;
}

...

int sr_kemi_lua_exec_func(lua_State* L, int eid)
{
    sr_kemi_t *ket;

    ket = sr_kemi_lua_export_get(eid);
    return sr_kemi_lua_exec_func_ex(L, ket, 0);
}
```

- using sipp to push REGISTER traffic (-m 1000 -r 50)
- run in a virtual box
 - host macos, guest linux mint
- results in microseconds (1 / 1 000 000 of a second)
- measured the execution of main routing block
 - request_route { ... } or its equivalent

INTERPRETER	-	AVERAGE	-	MIN	-	MAX
NATIVE	-	302.275	-	6	-	3824
LUA	-	308.32	-	6	-	3596
PYTHON	-	393.707	-	23	-	3266



KAMAILIO WORLD

CONFERENCE & EXHIBITION

BERLIN, GERMANY, MAY 8-10, 2017



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Thank you!

Questions?



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Thank you!

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see you at

Kamailio World 2018!



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