

Specifications

- [Brew](#)

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TETRA Homebrew Protocol

Protocol is based on WebSocket version 13 ([RFC 6455](#)) without extensions. It's highly recommended to use socket options [TCP_NODELAY](#) and [TCP_QUICKACK](#).

Endpoint, authentication

To establish a new connection client should make a HTTP GET call to get web socket's endpoint and pass authentication procedure. Authentication is based on *HTTP Digest Access Authentication* ([RFC 2831](#)). As a result of successful authentication server returns HTTP 200 and a URI to an endpoint to be used for WebSocket connection.

```
GET /brew/ HTTP/1.1
```

```
HTTP/1.1 200 OK
```

```
/brew/722e2b04-07ad-4976-ac55-75e845ae4d8a
```

Server supports following response codes: 101 (Switching protocols), 200 (OK), 301 (Moved), 401 (Unauthorized), 403 (Forbidden), 404 (Not found), 426 (Upgrade required), 429 (Too many requests), 500 (Internal server error).

WebSocket transport layer

Client should support following frame opcodes:

- **Close, ping, pong.** Ping and pong messages might contain a payload to measure delays.
- **Single-frame masked and unmasked binary messages.** Server always send unmasked messages, client may send masked messages.

Binary messages

Every message contains two-byte prefix:

1. Message class
2. Message type

All following data has non-aligned values in Little-Endian order

Subscriber control (mobility and affiliation, message class 0xf0)

```
#define BREW_SUBSCRIBER_DEREGISTER 0
#define BREW_SUBSCRIBER_REGISTER 1
#define BREW_SUBSCRIBER_REREGISTER 2
#define BREW_SUBSCRIBER_AFFILIATE 8
#define BREW_SUBSCRIBER_DEAFFILIATE 9

struct BrewSubscriberControlData
{
    uint8_t kind;        // 0xf0
    uint8_t type;        // BREW_SUBSCRIBER_*
    uint32_t number;     // ISSI
    uint64_t time;       // UNIX timestamp
    uint32_t fraction;   // Nanoseconds
    uint32_t groups[0];  // GSSIs (BREW_SUBSCRIBER_AFFILIATE / BREW_SUBSCRIBER_DEAFFILIATE)
} __attribute__((packed));
```

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Call control (message class 0xf1)

```
#define CALL_STATE_GROUP_TX      2 // | Simplified
#define CALL_STATE_GROUP_IDLE   3 // | Group Call

#define CALL_STATE_SETUP_REQUEST 4 // |           | Origin -> Receiver
#define CALL_STATE_SETUP_ACCEPT  5 // |           | Origin <- Receiver
#define CALL_STATE_SETUP_REJECT  6 // | General   | Origin <- Receiver
```

```
#define CALL_STATE_CALL_ALERT    7  // |  Circuit Call | Origin <- Receiver
#define CALL_STATE_CONNECT_REQUEST 8  // |           | Origin <- Receiver
#define CALL_STATE_CONNECT_CONFIRM 9  // |           | Origin -> Receiver
#define CALL_STATE_CALL_RELEASE  10 // |           |
```

```
#define CALL_STATE_SHORT_TRANSFER 11 //
```

```
#define CALL_STATE_SIMPLEX_GRANTED 12 // | Simplex Call
```

```
#define CALL_STATE_SIMPLEX_IDLE   13 // | (on top of Circuit Call)
```

```
#define CALL_STATE_PDP_REQUEST    14 // |
```

```
#define CALL_STATE_PDP_ACCEPT     15 // | Packed Data
```

```
#define CALL_STATE_PDP_REJECT     16 // |
```

```
#define CALL_STATE_PDP_RELEASE    17 // |
```

```
#define PDP_FLAG_IPV4             (1 << 0)
```

```
#define PDP_FLAG_IPV6             (1 << 1)
```

```
struct BrewCircularCall
```

```
{
    uint32_t source;
    uint32_t destination;
    char number[32];    // External number (ASCII)
    uint8_t priority;   // Call priority
    uint8_t service;    // Table 14.79: Speech service
    uint8_t mode;       // Table 14.52: Circuit mode type
    uint8_t duplex;     // Duplex flag
    uint8_t method;     // Table 14.62: Hook method
    uint8_t communication; // Table 14.54: Communication type
    uint8_t grant;      // Table 14.80: Transmission grant
    uint8_t permission; // Table 14.81: Transmission request permission
    uint8_t timeout;    // Table 14.50: Call time-out
    uint8_t t30x;       // T301, T303 - Table 14.51: Call time-out, set-up
    uint8_t ownership;  // Table 14.38: Call ownership
    uint8_t queued;     // Table 14.48: Call queued
} __attribute__((packed));
```

```
struct BrewCircularGrant
```

```
{
    uint8_t grant;      // Table 14.80: Transmission grant
```

```

uint8_t permission;    // Table 14.81: Transmission request permission
} __attribute__((packed));

struct BrewShortData
{
    uint32_t source;
    uint32_t destination;
} __attribute__((packed));

struct BrewPacketContext
{
    uint32_t number;    // ISSI
    uint8_t flags;      // PDP_FLAG_*
    in_addr_t v4;       // IPv4
    struct in6_addr v6;  // IPv6
    uint32_t profile;    // GSM 04.08 QoS Profile
} __attribute__((packed));

struct BrewCallControlData
{
    uint8_t kind;        // 0xf1
    uint8_t type;        // CALL_STATE_*
    uuid_t identifier;   // Call session UUID
    union
    {
        uint8_t cause;  // Table 14.55: Disconnect cause / GTP cause (ETSI TS 29.060 v3.9.0 7.7)
        struct BrewShortData data;
        struct BrewCircularGrant grant;
        struct BrewPacketContext packet;
        struct BrewCircularCall circular;
        struct BrewGroupTransmission group;
    };
} __attribute__((packed));

```

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Voice and data frames (message class 0xf2)

```

#define FRAME_TYPE_TRAFFIC_CHANNEL 0
#define FRAME_TYPE_SDS_TRANSFER    1
#define FRAME_TYPE_SDS_REPORT      2
#define FRAME_TYPE_DTMF_DATA       3
#define FRAME_TYPE_PACKET_DATA     4

struct BrewFrameData
{
    uint8_t kind;    // 0xf2
    uint8_t type;    // FRAME_TYPE_*
    uuid_t identifier; // Call session UUID
    uint16_t length; // Length of following data in bits
    uint8_t data[0];
} __attribute__((packed));

```

FRAME_TYPE_TRAFFIC_CHANNEL

The audio frame contains 60 ms of audio in format, based on STE defined at [ETSI TS 100 392-3-6 V1.1.1 \(2003-12\)](#)

- Octet 0: bit 7 = 1 (0x80), bits 6-2 = 4 STE control bits C1-C5, bits 1-0 = 0
- Octet 1+: 137 bits of ACELP subframe 1
- Octet 18+: 137 bits of ACELP subframe 2 (shifted by 1 bit right)
- Octet 35: bits 7-6 = the rest of subframe 2, bits 5-0 = unused, 0x3f

FRAME_TYPE_SDS_TRANSFER

Data field contains full SDS Type 4 PDU. So the first octet of data should contain protocol identifier, defined at [ETSI TS 100 392-2 V3.9.1 \(2019-01\)](#), Table 29.21

FRAME_TYPE_SDS_REPORT

This frame indicates SDS delivery and **NOT** SDS-TL delivery report. Data contains single-byte status code:

- 0 = Success

FRAME_TYPE_DTMF_DATA

Data field contains single DTMF code encoded in ASCII: '0', '1', '2', '3', '4', '5', '6', '7', '8', '9', '*', '#', 'A', 'B', 'C', 'D'

FRAME_TYPE_PACKET_DATA

Data field contains an IPv4 or IPv6 packet