Binary Floor Control Protocol (BFCP)
Gonzalo.Camarillo@ericsson.com

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What is Floor Control?

- Floor Control: A mechanism that enables applications or users to gain safe and mutually exclusive or non-exclusive input access to the shared object or resource.
- Binary Floor Control Protocol: BFCP is a protocol to coordinate access to shared resources in a conference.

**BFCP: Example of an audio conference**

- Participant A wants to talk: I want to talk
- Participant B wants to talk: Participant B wants to talk
- Participant A wants to talk: Allow participant A to talk
- Participant A has finished speech: I've finished my speech
- Participant B wants to talk: Participant B wants to talk
- Participant B has finished speech: I've finished my speech
- Participant B has finished speech: Now you can talk
- Participant A has finished speech: Now you can talk
Terminology

- **Floor**: A permission to temporarily access or manipulate a specific shared resource or set of resources.
- **Floor Chair**: A logical entity that manages one floor (grants, denies, or revokes a floor).
- **Floor Participant**: A logical entity that requests floors from a floor control server.
- **Floor Control Server**: A logical entity that maintains the state of the floor(s) including which floors exist, who the floor chairs are, who holds a floor, etc.

Packet Format

- Two types of attribute format:
  - Normal attribute format: encoded in TLV (Type-Length-Value) format.
  - Group attribute format: a sequence of normal attributes
  - Example of Group attribute format:
    - BENEFICIARY-INFORMATION
    - FLOOR-REQUEST-INFORMATION
    - REQUESTED-BY-INFORMATION
Packet Format (1)

- **Common Header Format**

- **Attribute Format**
  - BENEFICIARY-ID, FLOOR-ID, FLOOR-REQUEST-ID

- **Packet Format (2)**
  - ERROR-CODE
  - ERROR-INFO, PARTICIPANT-PROVIDED-INFO, STATUS-INFO, USER-DISPLAY-TEXT, USER-URI
Packet Format (3)

- SUPPORTED-ATTRIBUTES, SUPPORTED-PRIMITIVES

- BENEFICIARY-INFORMATION

- REQUESTED-BY-INFORMATION

Packet Format (4)

- FLOOR-REQUEST-INFORMATION
Message Format

**FloorRequest**: Floor participants request a floor by sending this message to the floor control server.

\[
\text{FloorRequest} = (\text{COMMON-HEADER}) \rightarrow (\text{FLOOR-ID}) \rightarrow \text{[BENEFICIARY-ID]} \rightarrow \text{[PARTICIPANT-PROVIDED-INFO]} \rightarrow \text{[PRIORITY]} \rightarrow \text{[EXTENSION-ATTRIBUTE]}
\]

**FloorRelease**: Floor participants release a floor by sending this message to the floor control server.

\[
\text{FloorRelease} = (\text{COMMON-HEADER}) \rightarrow (\text{FLOOR-REQUEST-ID}) \rightarrow \text{[EXTENSION-ATTRIBUTE]}
\]

**FloorRequestQuery**: Floor participants and floor chairs request information about a floor request.

\[
\text{FloorRequestQuery} = (\text{COMMON-HEADER}) \rightarrow (\text{FLOOR-REQUEST-ID}) \rightarrow \text{[EXTENSION-ATTRIBUTE]}
\]

Message Format (1)

**FloorRequestStatus**: Floor control server informs floor participant and floor chair about the status of their floor request.

\[
\text{FloorRequestStatus} = (\text{COMMON-HEADER}) \rightarrow \text{[FLOOR-REQUEST-INFORMATION]} \rightarrow \text{[EXTENSION-ATTRIBUTE]}
\]

**UserQuery**: Floor participants and floor chairs request information about a user.

\[
\text{UserQuery} = (\text{COMMON-HEADER}) \rightarrow \text{[BENEFICIARY-ID]} \rightarrow \text{[EXTENSION-ATTRIBUTE]}
\]

**UserStatus**: Floor control server informs floor participant and floor chair about the status of their user request.

\[
\text{UserStatus} = (\text{COMMON-HEADER}) \rightarrow \text{[BENEFICIARY-INFORMATION]} \rightarrow \text{[FLOOR-REQUEST-INFORMATION]} \rightarrow \text{[EXTENSION-ATTRIBUTE]}
\]
Message Format (2)

FloorQuery: Floor participants and floor chairs request information about a floor.

FloorQuery = (COMMON-HEADER )
* (FLOOR-ID)
* [EXTENSION-ATTRIBUTE]

FloorStatus: Floor control server informs floor participant and floor chair about the status of a floor.

FloorStatus = (COMMON-HEADER )
(FLOOR-ID)
* [FLOOR-REQUEST-INFORMATION]
* [EXTENSION-ATTRIBUTE]

ChairAction: Floor chairs send instruction to floor control servers.

ChairAction = (COMMON-HEADER )
1* (FLOOR-ID)
 (FLOOR-REQUEST-ID)
 (REQUEST-STATUS)
 [STATUS-INFO]
* [EXTENSION-ATTRIBUTE]

Message Format (3)

ChairActionAck: Floor control servers confirm that they have accepted a ChairAction message.

ChairActionAck = (COMMON-HEADER )
* [EXTENSION-ATTRIBUTE]

Hello: Floor Participants and floor chairs checks the liveness of floor control servers.

Hello = (COMMON-HEADER )
* [EXTENSION-ATTRIBUTE]

HelloAck: Floor Control servers confirm that they are alive on reception of a Hello message.

HelloAck = (COMMON-HEADER )
 (SUPPORTED-PRIMITIVES)
 (SUPPORTED-ATTRIBUTES)
* [EXTENSION-ATTRIBUTE]

Error: Floor control servers inform floor participants and floor chairs about errors processing requests.

Error = (COMMON-HEADER )
 (ERROR-CODE)
 (ERROR-INFO)
* [EXTENSION-ATTRIBUTE]
Transaction Format

- There are two types of transactions:
  - client-initiated transactions: they consist of a request from a client to a floor control server and a response from the floor control server to the client. The request carries a Transaction ID in its common header which the floor control server copies into the response. Clients use Transaction ID values to match responses with previously-issued requests.
  - server-initiated transactions (notifications): They consist of a single message from a floor control server to a client. Since they do not trigger any response, their Transaction ID is set to 0.

Operations: Example of an audio conference
Connection establishment in BFCP

- **Offer/answer exchange mechanism:** Floor Control clients establish BFCP connections with the Floor Control server within the context of an offer/answer exchange using SDP.
- **General mechanism:** Floor Control client establishes a connection to a BFCP floor control server outside the context of an offer/answer exchange. This mechanism also specifies a digest authentication mechanism for BFCP based on shared secrets.

### Offer/answer exchange mechanism

<table>
<thead>
<tr>
<th>Floor Participant</th>
<th>Floor Control Server</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIP INVITE</td>
<td>SIP INVITE</td>
</tr>
<tr>
<td>SIP OK</td>
<td>SIP OK</td>
</tr>
<tr>
<td>SIP ACK</td>
<td>SIP ACK</td>
</tr>
<tr>
<td>TCP SYN</td>
<td>TCP SYN</td>
</tr>
</tbody>
</table>

#### SIP INVITE

```
SIP/2.0 200 OK
From: Conference <sips:conference@atlanta.com>; tag=2234
To: Alice <sips:alice@atlanta.com>;tag=1245
Call-ID: a84b4c76e66710
CSeq: 1 INVITE
Content-Type: application/sdp
Content-Length: 131
v=0
o=conference 2890844527 2890844527 IN IP4 192.0.2.1
s=Session SDP
t=2873397496 0
r=setup:active
a=connection:new
a=floorctrl:c-only
m=audio 55000 RTP/AVP 0
```

#### SIP OK

```
SIP/2.0 200 OK
From: Conference <sips:conference@atlanta.com>; tag=2234
To: Alice <sips:alice@atlanta.com>;tag=1245
Call-ID: a84b4c76e66710
CSeq: 1 INVITE
Content-Type: application/sdp
Content-Length: 131
v=0
o=conference 2890844527 2890844527 IN IP4 192.0.2.1
s=Session SDP
a=setup:active
a=connection:new
m=audio 55000 RTP/AVP 0
```
General mechanism: attributes

- DIGEST

```
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
0 0 1 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1

DIGEST

```

- NONCE

```
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
0 0 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0

NONCE VALUE

```

- Definition of Error Specific Details for Error Code 10 (DIGEST Attribute Needed)

```
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1

```

Algorithm ID

```

```

Algorithm ID Algorithm ID

```

General mechanism: Example

**Floor Participant**
- TCP connection establishment
- FloorQuery
- Error
- FloorQuery

**Floor Control Server**

**FloorQuery**
- TransactionID: 254
- UserID: 557
- FloorID: 543

**Error**
- TransactionID: 254
- UserID: 557
- FloorID: 543
- Error Code: 10 (DIGEST Attribute Needed)
  - Digest Algorithm: HMAC-SHA1
  - Nonce: 456789

**FloorQuery**
- TransactionID: 896
- UserID: 557
- FloorID: 543
- Nonce: 456789
- Digest: 556767788