

Making and taking calls with octothorpe

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Introduction

- Matt “zigg” Behrens
- Developing software for 32 years
- Unix/Linux fan since the mid ‘90s
- Currently develop and maintain telephony and communications software for Linux

The Asterisk platform

Asterisk

- Runs on Unix platforms but mostly Linux
- Provides an abstraction to various telephony technologies
 - SIP/RTP
 - DAHDI (analog and digital)
 - Other, more esoteric channel drivers... in various states of maintenance

How to get Asterisk

- From <http://www.asterisk.org/downloads>:
 - Source code, build it yourself
 - AsteriskNOW distribution, install it on your own system
- Add packages to RHEL/CentOS 6; see <https://wiki.asterisk.org/wiki/display/AST/Asterisk+Packages>

Asterisk basics

- Almost all Asterisk configuration lives in `/etc/asterisk`
- `extensions.conf` holds the dialplan, Asterisk's own internal scripting language
- Dialplan is required, but limited in capability

Dialplan example

```
[default]
```

```
exten => 401,1,Answer
```

```
same => n,Playback(silence/1&hello-world&silence/1)
```

```
same => n,Hangup
```

```
exten => 402,1,Answer
```

```
same => n,Playback(silence/1)
```

```
same => n,Dial(SIP/202)
```

```
same => n,Playback(silence/1)
```

```
same => n,Hangup
```

Channels

- A Channel is a dynamic connection between a telephony device and Asterisk
- A phone connected to Asterisk is one channel
- Calling another phone spawns a new channel; the channels are linked or bridged together to create the familiar phone call

Asterisk development options

Modules

- Loadable extension modules written in C
- Subject to GPL
- Most flexible option
- Most of Asterisk's functionality is implemented in extension modules shipped with Asterisk
- Primarily for adding new functionality that does not exist

Asterisk Gateway Interface

- Dialplan AGI call spawns an external process or connects to a listening socket
- Can be written in any language that can handle stdin/stdout or sockets
- One AGI session per call; no cross-channel state or server awareness
- Command set targeted toward interaction

Asterisk Manager Interface

- Client connects to Asterisk on the AMI port
- Global events for the Asterisk system are sent to the AMI client
- AMI client issues actions to Asterisk at any time; Asterisk issues responses
- Command set targeted toward server/channel management

AMI traffic example

```
Action: Login
Username: manager
Secret: secret

Response: Success
Message: Authentication accepted
```

```
Event: FullyBooted
Privilege: system,all
Status: Fully Booted
```

```
Event: PeerStatus
Privilege: system,all
ChannelType: SIP
Peer: SIP/201
PeerStatus: Unregistered
Cause: Expired
```

```
Event: PeerStatus
Privilege: system,all
ChannelType: SIP
Peer: SIP/201
PeerStatus: Registered
Address: 172.20.64.1:64142
```

```
Event: Newchannel
Privilege: call,all
Channel: SIP/201-0000000a
ChannelState: 0
ChannelStateDesc: Down
CallerIDNum: 201
CallerIDName: 201
AccountCode:
Exten: 401
Context: default
Uniqueid: 1395325658.10
```

Which one will you
choose?

AsyncAGI

- Dialplan AGI call to agi:async emits an AMI event and waits for the AMI client
- AGI commands are sent as AMI actions
- Everything continues to run over the AMI socket; no extra processes or listening sockets needed
- But you need a good way to demultiplex all the events, actions, and responses...

The Twisted engine

Twisted

- Python's venerable asynchronous communications library—since 2002
- Includes many common protocols and building blocks for more protocols
- Easy to move between callback-driven and “inline callback” styles as needed

Reactors and Deferreds

- Reactor: supplied by Twisted, calls functions and methods when data is available
- Deferreds: returned by a function when a result is not immediately available; can have callbacks and err backs attached to it
- Deferred chaining: when a callback itself returns a Deferred—highly optimized in Twisted
- Example: `AMIProtocol.loginMD5` from `ami.py`

octothorpe

- An AMI protocol implementation for Twisted
 - AMIProtocol: handles events, actions, and responses, spawns Channels and routes events appropriately
 - AsyncAGIProtocol: all of the above plus support for driving calls via AsyncAGI
- Uses Deferreds to turn actions and responses into function calls

That's enough talk, on
to the demos

Follow along with me

- <https://github.com/zigg/octothorpe>
- All examples demoed here are in `doc/examples`
- If you had a Vagrant box for CentOS 6 handy, you can even run the demos yourself... just `vagrant up`

The setup

- Asterisk from Digium's RPM repositories running inside a CentOS 6 virtual machine
- Minimal configurations (you can see these in etc/asterisk in the source)
- Telephone.app (free in the Mac App Store) connected via host-only network as extension 201
- Digium SIP desk phone connected via bridged network as extension 202

Dialplan

- `etc/asterisk/extensions.conf`
 - 401: say “hello, world!” and hang up
 - 402: dial extension 202 (desk phone), hang up when done
 - 403: go into AsyncAGI mode

amiwatch

- Watch events fly by on the Asterisk Manager Interface
- Handles connection and login
- Doesn't *do* anything with calls—we'll use existing Asterisk dialplan for that

chanwatch

- amiwatch plus Channel spawning
- Shows you how events get routed to Channels
- Shows you some of the built-in functionality of the Channel object, like accumulating channel variables

agihello

- First interactive call demo
- When AsyncAGI starts we:
 - Answer the call
 - Say “Hello, world!”
 - Hang up the call

orighello

- Same as agihello, except in the opposite direction
- Originate is used to spawn a call and then execute the AGI call to go into AsyncAGI mode on that channel when answered
- No dialplan required

dtmf

- Listens for and speaks back DTMF using the `captureDTMF` function
- Introducing: inline callbacks!

ivr

- The biggest example of them all
- Passcode required
- Option 1: call another extension
- Option 2: hang up

Wrapping up

Further reading

- Asterisk: The Definitive Guide: <http://asteriskdocs.org/>
- Twisted: <http://twisted.readthedocs.org/>