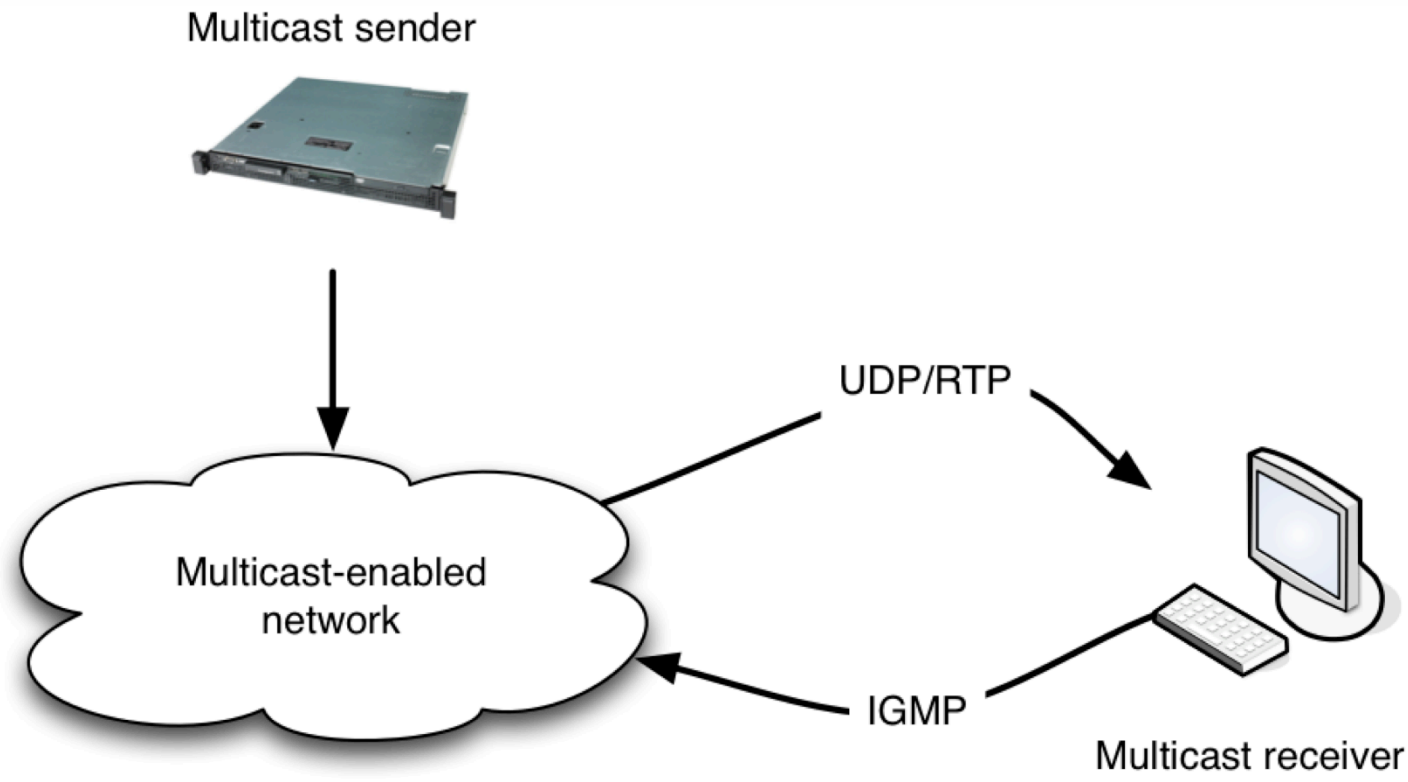
AMT use case: Upipe + Chrome

Christophe Massiot (EBU multicast 2014)

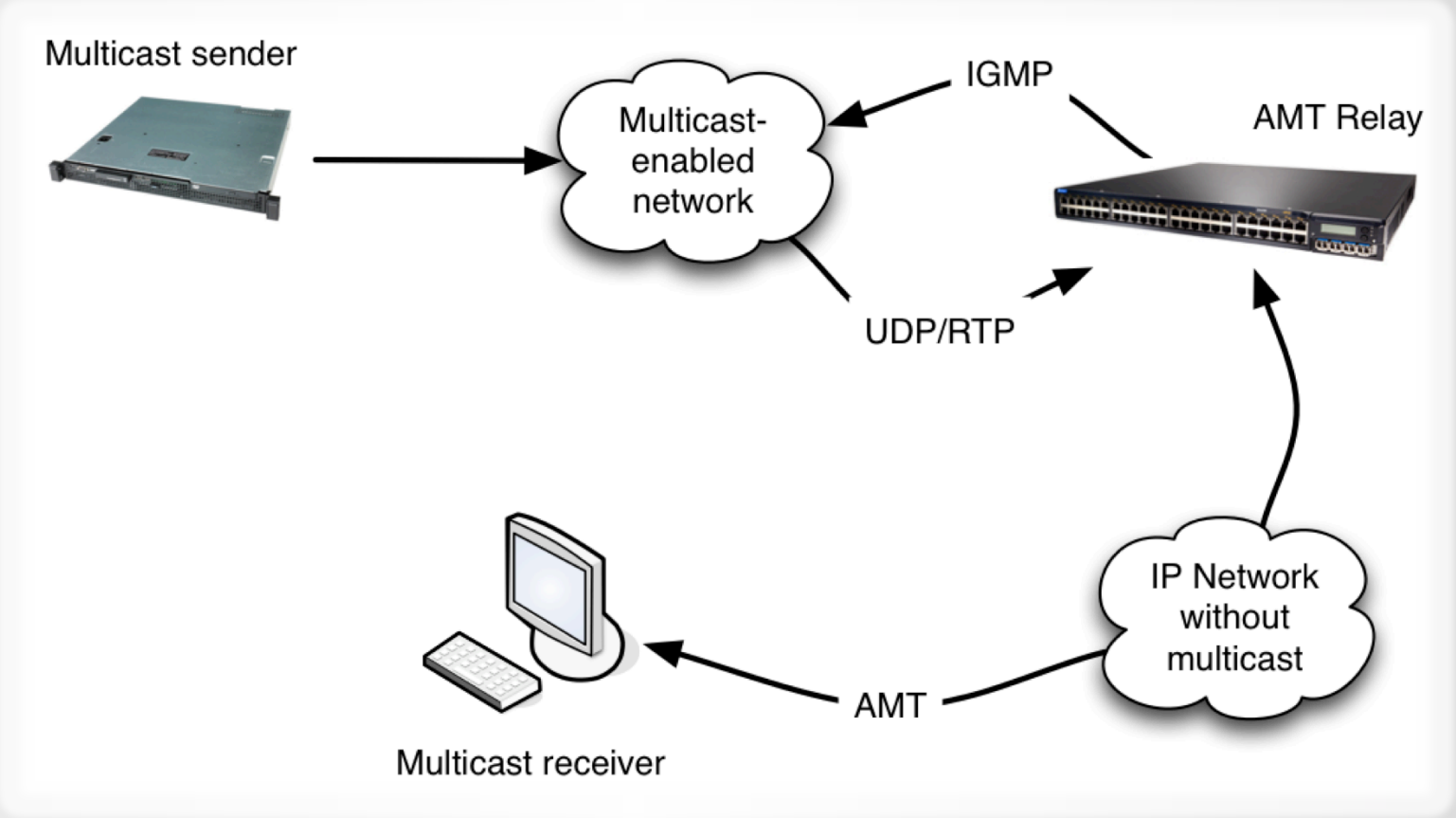
Goal

- Display a multicast stream in a web browser, using AMT if needed
- Without AMT support from the OS, or from a local network equipment

Case 1: Direct access to multicast



Case 2: Use AMT relay



How?

Open source AMT libraries

- Only one: Cisco's
  - Written in C
  - Simple API: open, poll, recv

Display video in a web browser

- The old-fashioned way: NPAPI "Netscape plug-ins"
  - Blatant security hole (no sandbox)
  - Requires user installation
  - Mozilla & Google have announced end of support in 2014

Display video in a web browser

- Media Source Extensions
  - Designed for HLS/HDS/DASH etc.
  - Would have to implement AMT in JS
  - Would need UDP socket support from browser (only supported by Chrome, and for packaged applications)
  - Not as open as “native” extensions

Display video in a web browser

- Microsoft ActiveX
  - Example: VLC plug-in
  - No support for Mac OS X, Linux or embedded devices
  - Security issues

Display video in a web browser

- Google's "PPAPI" and "native client"
  - Open source
  - Supports downloadable native code (C and C++) and dynamic linking
  - Plug-in isolated in a "sandbox"
  - Supported in recent Chrome versions on all operating systems, and plans to port to Android devices
  - Also has support for "portable" bitcode

Knitting the pieces together

- Need a C or C++ framework with demux/decode capabilities
- Must be very flexible: PPAPI has constraints on threading and API calls

Introducing Upipe

- Handles flows of data in a « pipeline »
- Processes them using filters called « pipes »
- Defines APIs:
  - To configure and feed data into pipes
  - To get out-of-band events from pipes
  - To store data in an efficient manner with attributes
  - To interact with an event loop/threads
- Provides a set of basic pipes

Upipe vs. other frameworks

- Flexibility
  - **Lower-level: application decides where to put queues and threads**
  - Keep modules as simple and autonomous as possible (UNIX philosophy)
  - Arbitrary attributes on buffers ➔ better clock management
  - Dynamic pipeline construction

Upipe vs. other frameworks

- Event-driven architecture (upump)
  - Pipes install watchers called back when events occur:
    - File descriptors readable or writable
    - Timers
    - Idlers
  - Non-blocking
  - Unified API for sources/filters/sinks

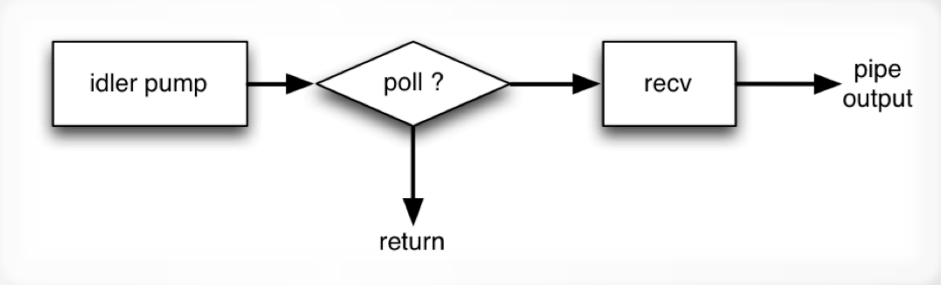
Upipe vs. other frameworks

- Performance
  - Lock-less or wait-less data structures
  - Systematic reference counts on structures
  - Zerocopy, copy-on-write buffer management
- Younger project: fewer modules, fewer users

Which steps?

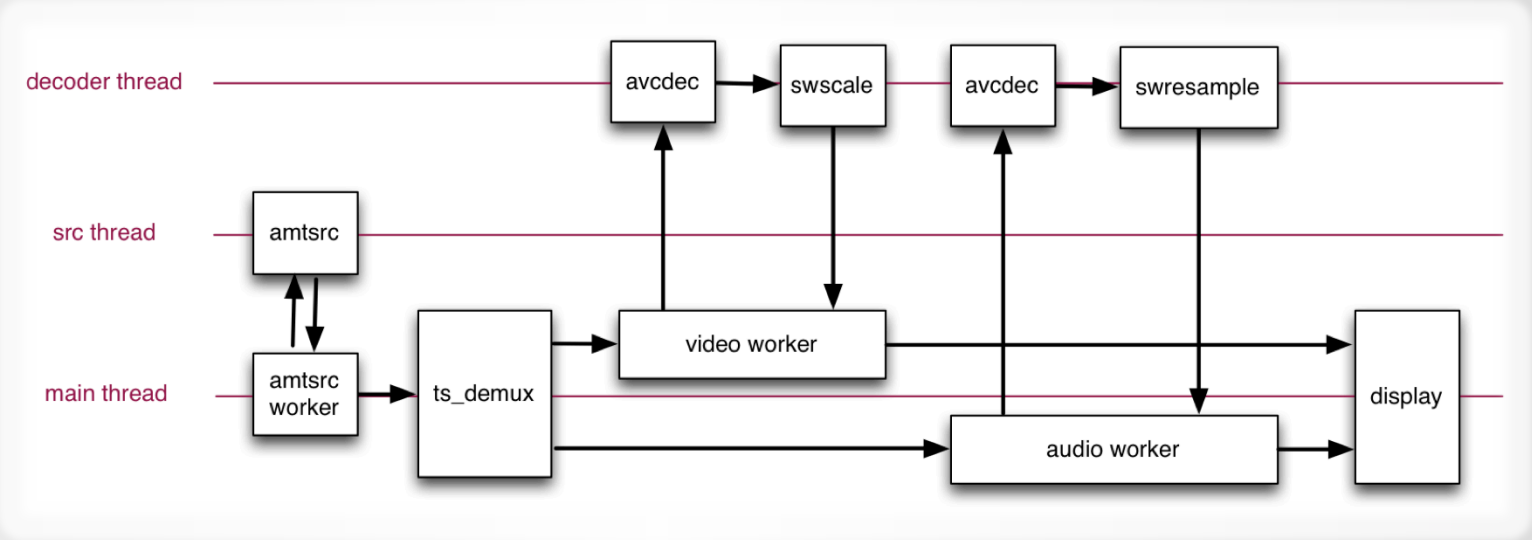
Implementing AMT support

- Source file: lib/upipe-amt/upipe_amt_source.c
- Caveats: libamt not compatible with event-driven architectures, so requires its own thread



A simple AMT-enabled player

- Upipe's example uplay requires a 2-line change to use AMT source



Implementing NaCl support

- BSD sockets are supported with compatibility layer libnacl_io
- Need specific modules for display and sound (lib/upipe-nacl)
- Need a “player” plug-in building the pipeline, based on uplay (examples/chrome/player_chrome)
- Messaging between JS and plug-in

NaCl configuration

- NaCl and pNaCl enabled by default in recent Chrome versions
- Sockets blocked by default
  - chrome://flags only works for “packaged apps”
  - Need to pass command-line option --allow-nacl-socket-api=localhost

NaCl socket support

- Only a subset of BSD sockets API
  - Missing setsockopt options:
    - IP_ADD_MEMBERSHIP / DROP
    - IP_ADD_SOURCE_MEMBERSHIP / DROP
    - IP_PKTINFO
    - …
  - Cannot bind to a multicast address
- AMT provides a work-around

NaCl performance

- “Nearly as fast as native compiled code” but in reality:
  - No assembly allowed (no decoder optimizations)
  - No easy YUV support
- Portable Native Client adds 10 to 25% overhead
- However, support for OpenGL and hardware decoders under way

Hands on!

Installing NaCl SDK and NaCl ports

- https://developer.chrome.com/native-client/sdk/download
- http://code.google.com/p/naclports/
- Need build environment and 32 bits version of standard libraries, in particular lib32z1-dev

Building NaCl ports

- Apply http://upipe.org/downloads/naclports.patch
- export NACL_SDK_ROOT=<path>/nacl_sdk/pepper_35
- NACL_ARCH=x86_64 TOOLCHAIN=glibc ./bin/naclports install upipe
- NACL_ARCH=i686 TOOLCHAIN=glibc ./bin/naclports install upipe

Building and running plug-in

- cd out/build/upipe/upipe-master/examples/chrome/player_chrome
- make
- export CHROME_ARGS="--allow-nacl-socket-api=192.168.0.100,localhost”
- make run

cmassiot@openheadend.tv