Looping Surveillance Cameras

(like in the movies)
Who are we?

- Ordinary law-abiding citizens
- Nothing to see here, move along
- Eric Van Albert <eric@van.al>
- Zach Banks <not-eric@van.al>
Prior Art
(what this isn’t)
Prior Art
(what this is)
Ethernet Anatomy

- Four twisted pairs
- All may be carrying data
- Wide variety of electrical standards
The Tap Board
The Tap Board

- Eight DPDT latching relays
  - Rated for 1 GHz
- Punch-down connectors
- Impedance-matched traces
- Powered and controlled over USB
The Tap Board
Splicing Ethernet
Splicing Ethernet
Splicing Ethernet
Splicing Ethernet
Advanced Tap Board Features

- Tamper-evident
- Fail-safe heartbeat
- Fail-safe power loss
Switching to Active Tap
Switching to Active Tap
The Network Stack

![Diagram of network stack with layers labeled Ethernet, IPv4, UDP, RTP, H.264]
**lens Overview**

- MitM-centric network stack in Python
  - Ethernet, IPv4, TCP, UDP, HTTP, RT*P...
- Designed to be as transparent as possible
  - We need to be able to forge packets as necessary and have them blend in
- Allows for additional “layers” to filter data
  - Ex: turn a video stream into a loop
lens Implementation

Ethernet layer

ARP
ICMP
SSH
Cat GIFs

IP layer

ARP
ICMP
SSH
Cat GIFs

TCP layer

http

HTTP layer

HTML layer

"Partly butty with a chance of rain"

cloud-to-butt filter
s/cloud/butt/g
Looping Video

- RTP: Real Time Protocol
  - RTCP: Control/codec information; over TCP
  - RTSP: Video data stream; over UDP or TCP
- ffmpeg solves all of your (video) problems
  - Looping, masks, transforms, and more!
Looping Video

1. Read video stream from camera over RTP
2. Create new stream using ffmpeg
3. Forge packets from camera of new stream
4. ???
5. Profit!
Potential Extensions

- HTTPS
  - Incredibly tricky to get right in embedded systems
- USB
- HDMI
Check it up!

● Hardware
● Firmware
● Mechanical
● Code

http://github.com/ervanalb/lens