Introduction

- Receive infrared signals
- Decode received signals
- Transmit receive data
- Send infrared signals
Related work

- Commercially available products by Logitech, Philips and others
- Quite expensive
- Proprietary systems
- Limited to provided features

Figure: Logitech Harmony Ultimate Hub

Source: http://www.logitech.com/de-de/product/harmony-ultimate-hub
Infrared Signaling I

- not visible to a human’s eye
- commonly used IR diodes: 840 - 950nm
- cheap IR diodes to receive and transmit
Infrared Signaling II

- transmitting from sender to receiver
- Signal modulation: 36 - 40 kHz
Protocol (NEC)

Figure: 0 and 1 as specified by NEC protocol

Table: mapping of “code send” to “function invoked”

<table>
<thead>
<tr>
<th>Code Send</th>
<th>Function Invoked</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x68 - 0x00</td>
<td>Play</td>
</tr>
<tr>
<td>0x68 - 0x01</td>
<td>Record</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>
ARINA Protocol

- Transmission of recognized protocols
  - NEC, Philips RC-5, Philips RC-6, ...
ARINA Protocol

- Transmission of recognized protocols
  - NEC, Philips RC-5, Philips RC-6, ...
- Transmission of RAW data
Hardware I

- photodiode
- IR diode
- resistor
- cables
- breadboard
- Arduino Mega 2560
- Arduino Ethernet Shield
Hardware II
Evaluation setup
## Evaluation results

<table>
<thead>
<tr>
<th>Device name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Protocol</th>
<th>All keys</th>
<th>Year of purchase</th>
</tr>
</thead>
<tbody>
<tr>
<td>EB-1771W</td>
<td>Projector</td>
<td>Epson</td>
<td>NEC</td>
<td>yes</td>
<td>2012</td>
</tr>
<tr>
<td>UE40EH5000</td>
<td>TV</td>
<td>Samsung</td>
<td>RAW</td>
<td>yes</td>
<td>2012</td>
</tr>
<tr>
<td>BD-E5500</td>
<td>3D-Blu-ray Player</td>
<td>Samsung</td>
<td>RAW</td>
<td>yes</td>
<td>2012</td>
</tr>
<tr>
<td>42LV579S</td>
<td>TV</td>
<td>LG</td>
<td>NEC</td>
<td>yes</td>
<td>2012</td>
</tr>
<tr>
<td>DVX592H</td>
<td>DVD Player</td>
<td>LG</td>
<td>NEC</td>
<td>yes</td>
<td>2012</td>
</tr>
<tr>
<td>Connect ID 32</td>
<td>TV</td>
<td>Loewe</td>
<td>RC-5</td>
<td>yes</td>
<td>2009</td>
</tr>
<tr>
<td>230E</td>
<td>DVD Player</td>
<td>Redstar</td>
<td>NEC</td>
<td>yes</td>
<td>2001</td>
</tr>
<tr>
<td>55FU4243</td>
<td>TV</td>
<td>Thomsen</td>
<td>NEC</td>
<td>yes</td>
<td>2012</td>
</tr>
<tr>
<td>SoundTouch</td>
<td>HiFi</td>
<td>Bose</td>
<td>RAW</td>
<td>yes</td>
<td>2014</td>
</tr>
</tbody>
</table>
Features of ARINA

- supports common IR protocols
- supports RAW data transmission
- small in size
- can be powered by battery (~ 20h)
- PoE ready (single cable for LAN and power)
- materials costs: ~30€
- easy to build on your own
- easy to modify and extend
Future work

- encrypted transmission
- control multiple ARINA
- Web-based control interface
- Smartphone app to control ARINA
Thank you.

Special thanks to Matthias, all reviewers, Prof. Meier

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Questions?