Openwifi

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Content

• The 1\textsuperscript{st} year summary of openwifi online
• Some highlights
• Community engagement
• Low cost hardware
• New feature planned
Explanations – code name of the release

• V1.0.0 Ghent  -- Xianjun Jiao
• V1.1.0 Taiyuan  -- Wei Liu

• V1.2.0 Leuven  -- Michael Mehari
Highlight -- CSI

- CSI – Channel State Information – Available in the chip (more than CSI)

[Diagram showing the process from Transmitter to Receiver via Human Gesture and Raw CSI Measurements]

[Flowchart indicating HOS-Re HGR with Recognition Accuracy Estimation, Classification, Feature Selection, and Feature Extraction]

Highlight -- CSI

- CSI – Channel State Information – Available in the chip (more than CSI)

Privacy concern?

Highlight -- CSI

- CSI – MURDER https://ans.unibs.it/projects/csi-murder/

Random/fake CSI

Sensing won’t work anymore!

Highlight – IQ sample

- Collision capture
- Debug your receiver
- Prepare for MIMO development
Learn from IC company (and srsLTE)
https://github.com/open-sdr/openwifi/tree/master/doc/app_notes

Application notes collect many small topics about using openwifi in different scenarios/modes.

- Use openwifi on the w-iLab.t testbed remotely
- Communication between two SDR boards under AP and client mode
- Communication between two SDR boards under ad-hoc mode
- From CSI (Channel State Information) to CSI (Chip State Information)
- Capture IQ sample, AGC gain, RSSI with many types of trigger condition
- Capture dual antenna IQ for multi-purpose (capture collision)
- IEEE 802.11n (Wi-Fi 4)
- 802.11 packet injection
Highlight – essential update

- FPGA-ARM interface -> streamlined
- Scattered IP -> grouped
- Build SD card -> use script
- Low MAC -> improved
- QoS -> supported
- Beacon -> higher priority
- Different boards -> single SD card
- Build -> more easy
- Frequency offset -> bug fixed
- Collision -> less happen
- Ref design 2018 R1 -> 2019 R1
- FPGA queue 2 -> 4
- Linux 4.9.0 -> 4.14.0
- PHY TX -> less clock
- Vivado 2017.4.1 -> 2018.3
- Driver panic -> fixed
- Debug Verilog -> use macro
- Side channel -> built
- Back off -> more compliant
Highlight – essential update

Which are really important!

- FPGA-ARM interface -> streamlined
- Channel estimation -> more accurate
- Build SD card -> use script
- Low MAC -> improved
- Debug Verilog -> use macro
- QoS -> supported
- Beacon -> higher priority
- Different boards -> single SD card
- Build -> more easy
- Frequency offset -> bug fixed
- Collision -> less happen
- Different boards -> different code
- Side channel -> built
- PHY TX -> less clock
- Vivado 2017.4.1 -> 2018.3
- FPGA queue 2 -> 4
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## Community engagement

<table>
<thead>
<tr>
<th>Project</th>
<th>1st year after online github</th>
<th>Rocket-chip (RISC-V): 2 years; tape out</th>
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<tbody>
<tr>
<td></td>
<td>1.6K stars</td>
<td>1.7K stars</td>
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<tr>
<td></td>
<td>210 forks</td>
<td>680 forks</td>
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<td></td>
<td>91 watch</td>
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<td></td>
<td>37 issues closed</td>
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<td>3 internal developers</td>
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- People are so satisfied with the COTS WiFi card to play with?
- Lacking killer application/feature?
- Linux driver and FPGA are too difficult for many developers?
- Hardware is too expensive (900~3600USD VS 0.5USD)?
Community engagement

Openwifi: 1st year after online github
- 1.6K stars
- 210 forks
- 91 watch
- 37 issues closed
- 5 issues still open
- 3 internal developers
- 3 external contributors (not merged yet)

Rocket-chip (RISC-V): 2 years; tape out
- 1.7K stars
- 680 forks
- 192 watch
- 524 issues closed
- 189 issues still open
- 24 contributors (adding > 500 lines)

People are so satisfied with the COTS WiFi card to play with?
Lacking killer application/feature?
Linux driver and FPGA are too difficult for many developers?
Hardware is too expensive (900~3600USD VS 0.5USD)?

DO COME AND TELL US!
Low cost hardware

The hardware price could be at level of +/- 200 USD
New features planned

• 802.11ax/WiFi6 (Basic PHY TRX in 2021)
• MIMO (STBC/CDD TX, Combined RX)
Breaking news!

Another FPGA WiFi just online at the beginning of 2021
https://github.com/Nuand/bladeRF-wiphy
Running on 720USD bladeRF 2.0 micro xA9
Recap

• Openwifi made lots of progress in the 1st year online

• Will push further for the advanced features
  • Can not be done in one night

• Will try harder to grow the community. (Please help!)

• Glad to see bladeRF delivered another FPGA WiFi
  • means: there is a need!
Thanks!

Questions?