Tweaking ECP Performance: A libRIST Deep Dive

libRIST

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Virtual VidTrans 21

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Tweaking ECP Performance:
A libRIST Deep Dive:

Who is SipRadius and what is libRIST and what do you mean by ECP …

ECP = "Error Correction Protocol" = RIST, SRT, DOZER, etc.

SipRadius

libRIST

Who are we:

SipRadius

- Creators and maintainers of Coral-Linux
- 11+ Years creating network transport products for the broadcast industry.
- Entered the ECP arena 7 years ago with the creation of the patented DOZER protocol.

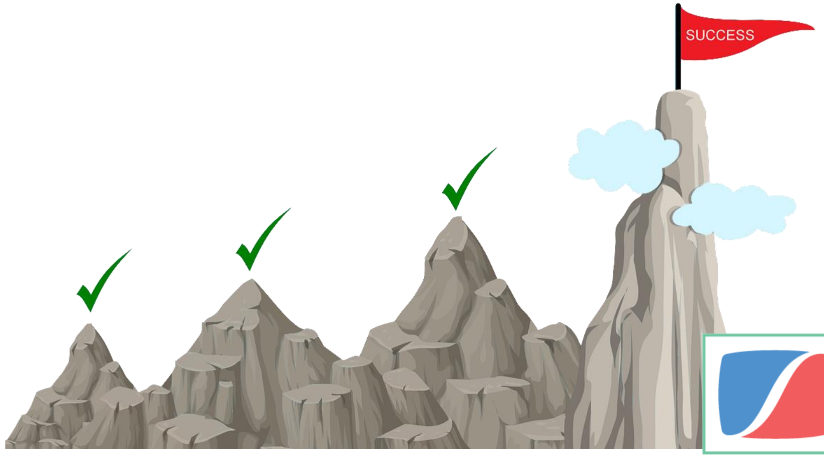
What is libRIST

libRIST

- An open source library used to easily add the RIST protocol to your application or appliance.
- Inherited 7 years of know-how from SipRadius' Dozer protocol.
- Mature, production ready solution with no strings attached (commercial use is allowed and free)

What We'll Discuss Today

+ LibRIST major features
+ Why makes it different that other ECP solutions
+ Live Demo/Stress Test



libRIST, one year later

675 commits after initial public release …

- Reaching Most Platforms
  - Intel x64, ARM, AWS, Azure, VMWare
  - linux, Windows, Darwin, IOS, Android
- Performs at levels beyond many commercial protocols.
- Just released v0.2.0, being integrated into VLC 4.0 and ffmpeg 4.3

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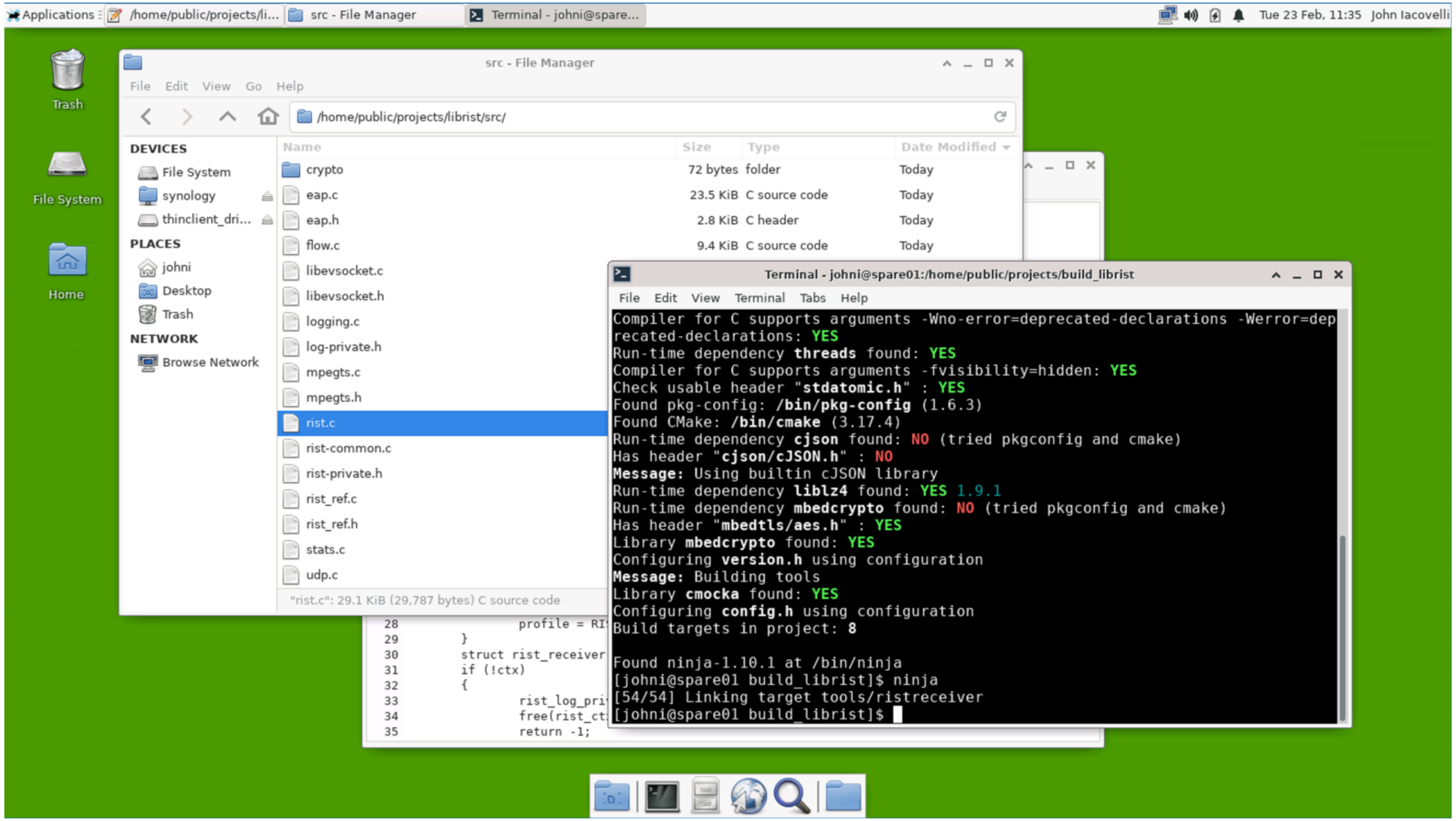
Reaching More Platforms

Building libRIST in a linux desktop



Applications
/home/public/projects/li...
src - File Manager
Terminal - johni@spare...
Tue 23 Feb, 11:35 John Iacovelli
Trash
File System
Home
src - File Manager
File Edit View Go Help
/home/public/projects/librist/src/
DEVICES
File System
synology
thinclient_dri...
PLACES
johni
Desktop
Trash
NETWORK
Browse Network
Terminal - johni@spare01:/home/public/projects/build_librist
File Edit View Terminal Tabs Help

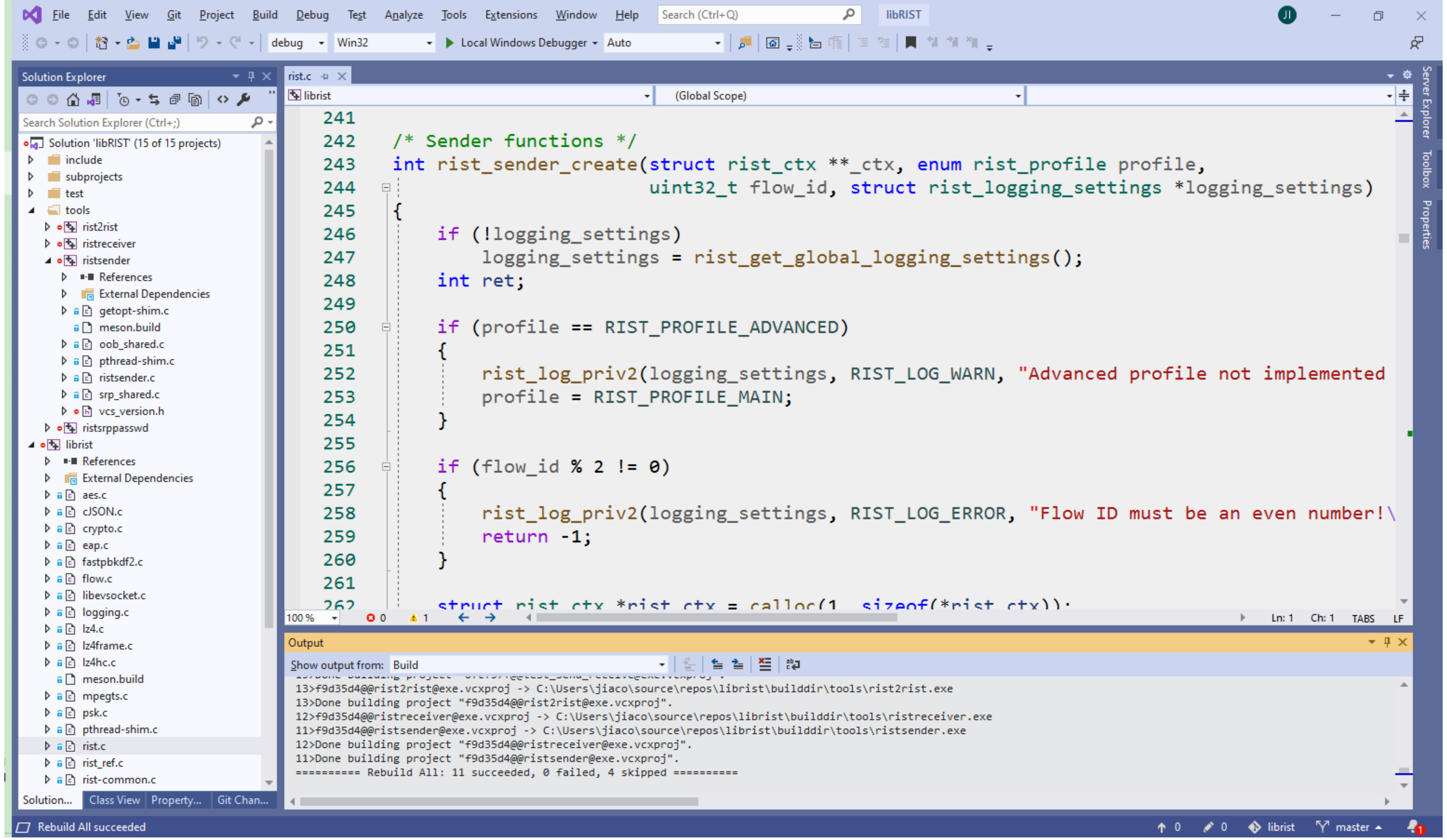
Name	Size	Type	Date Modified
crypto	72 bytes	folder	Today
eap.c	23.5 KiB	C source code	Today
eap.h	2.8 KiB	C header	Today
flow.c	9.4 KiB	C source code	Today
libevsocket.c			
libevsocket.h			
logging.c			
log-private.h			
mpegts.c			
mpegts.h			
rist.c			
rist-common.c			
rist-private.h			
rist_ref.c			
rist_ref.h			
stats.c			
udp.c			

"rist.c": 29.1 KiB (29,787 bytes) C source code

```
Compiler for C supports arguments -Wno-error=deprecated-declarations -Werror=dep
recated-declarations: YES
Run-time dependency threads found: YES
Compiler for C supports arguments -fvisibility=hidden: YES
Check usable header "stdatomic.h" : YES
Found pkg-config: /bin/pkg-config (1.6.3)
Found CMake: /bin/cmake (3.17.4)
Run-time dependency cjson found: NO (tried pkgconfig and cmake)
Has header "cjson/cJSON.h" : NO
Message: Using builtin cJSON library
Run-time dependency liblz4 found: YES 1.9.1
Run-time dependency mbedcrypto found: NO (tried pkgconfig and cmake)
Has header "mbedtls/aes.h" : YES
Library mbedcrypto found: YES
Configuring version.h using configuration
Message: Building tools
Library cmocka found: YES
Configuring config.h using configuration
Build targets in project: 8

Found ninja-1.10.1 at /bin/ninja
[johni@spare01 build_librist]$ ninja
[54/54] Linking target tools/ristreceiver
[johni@spare01 build_librist]$
```

```
                profile = RI
        }
        struct rist_receiver
        if (!ctx)
        {
                rist_log_pri
                free(rist_ct
                return -1;
```

libRIST in Microsoft Visual Studio

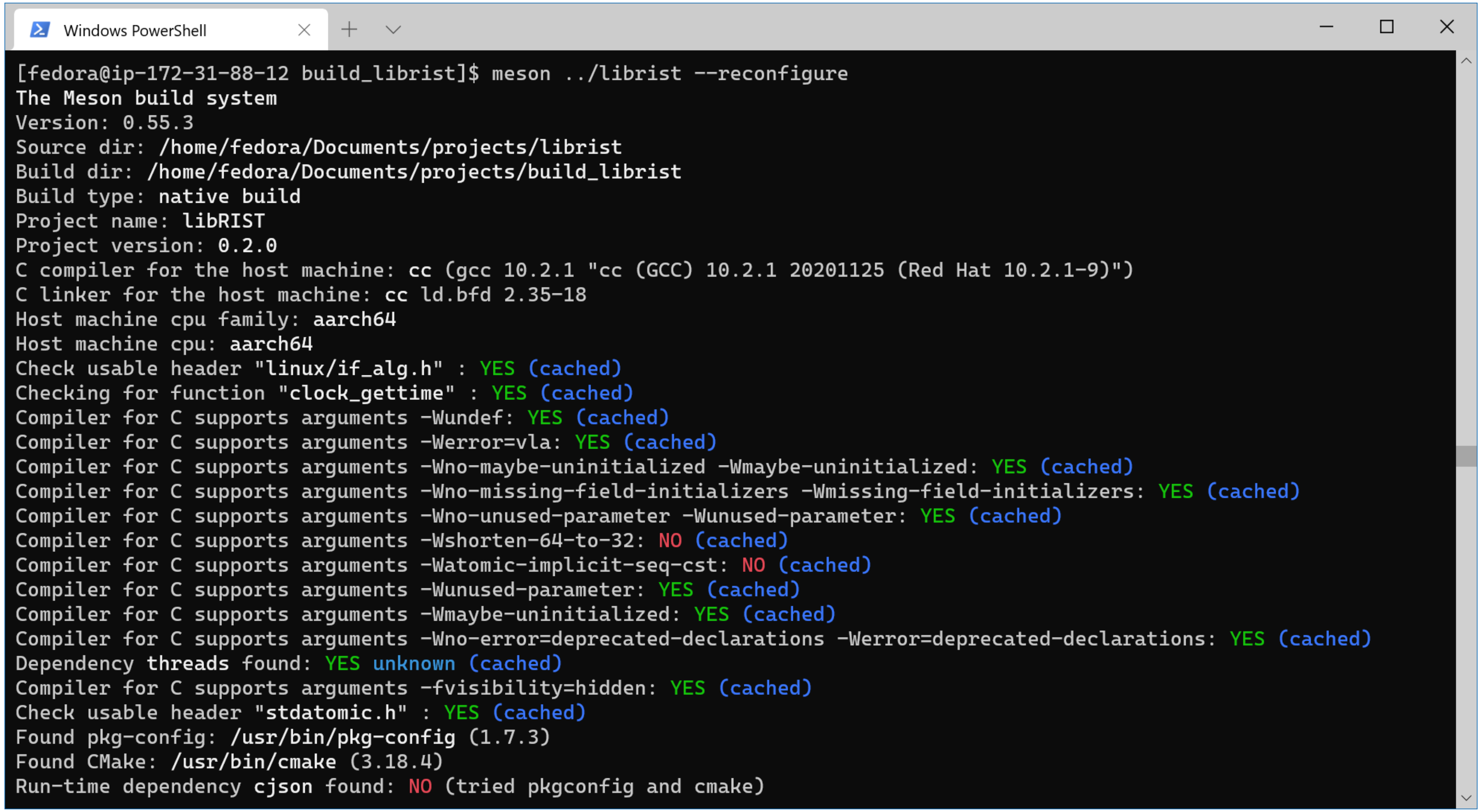


```c

/* Sender functions */
int rist_sender_create(struct rist_ctx **_ctx, enum rist_profile profile,
                       uint32_t flow_id, struct rist_logging_settings *logging_settings)
{
    if (!logging_settings)
        logging_settings = rist_get_global_logging_settings();
    int ret;

    if (profile == RIST_PROFILE_ADVANCED)
    {
        rist_log_priv2(logging_settings, RIST_LOG_WARN, "Advanced profile not implemented
        profile = RIST_PROFILE_MAIN;
    }

    if (flow_id % 2 != 0)
    {
        rist_log_priv2(logging_settings, RIST_LOG_ERROR, "Flow ID must be an even number!\
        return -1;
    }

    struct rist_ctx *rist_ctx = calloc(1, sizeof(*rist_ctx));
```

```
13>f9d35d4@@rist2rist@exe.vcxproj -> C:\Users\jiaco\source\repos\librist\builddir\tools\rist2rist.exe
13>Done building project "f9d35d4@@rist2rist@exe.vcxproj".
12>f9d35d4@@ristreceiver@exe.vcxproj -> C:\Users\jiaco\source\repos\librist\builddir\tools\ristreceiver.exe
11>f9d35d4@@ristsender@exe.vcxproj -> C:\Users\jiaco\source\repos\librist\builddir\tools\ristsender.exe
12>Done building project "f9d35d4@@ristreceiver@exe.vcxproj".
11>Done building project "f9d35d4@@ristsender@exe.vcxproj".
========== Rebuild All: 11 succeeded, 0 failed, 4 skipped ==========
```

Rebuild All succeeded

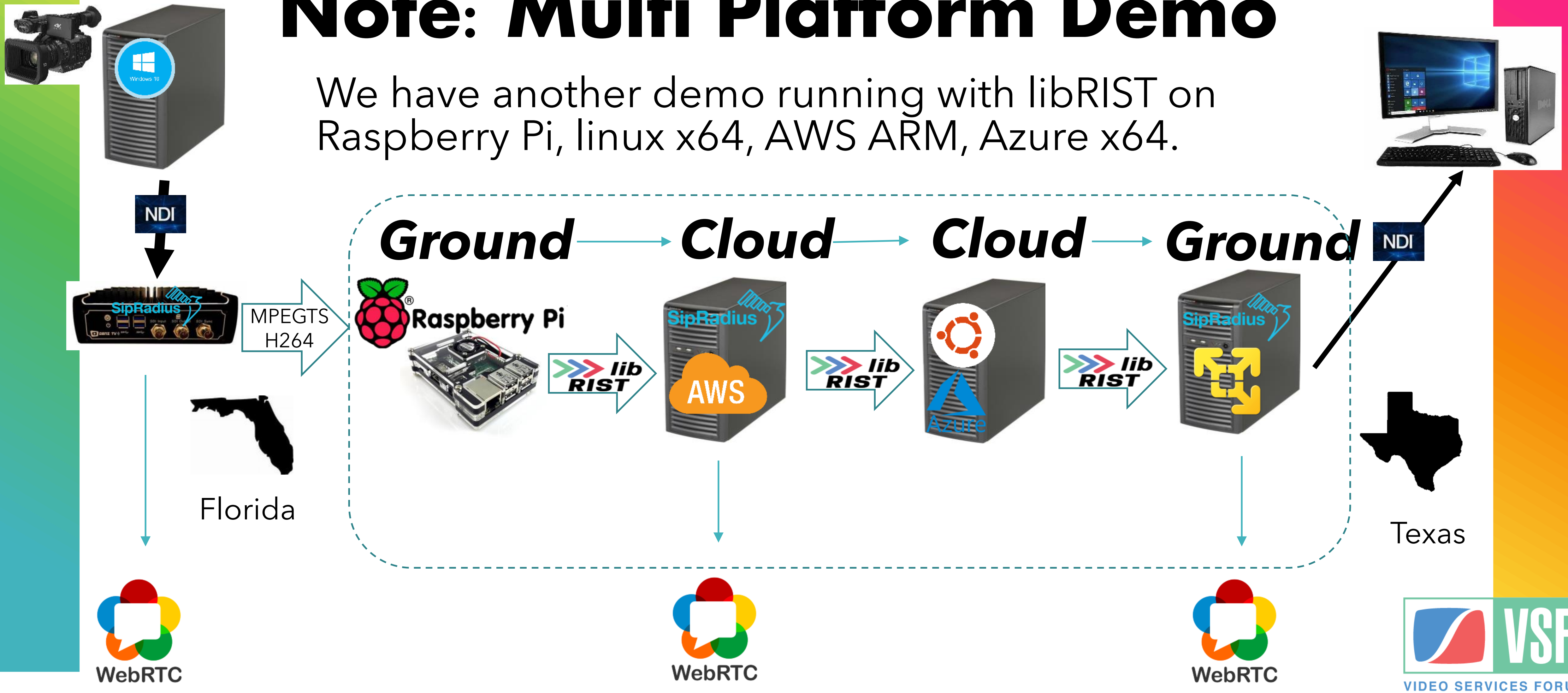
LibRIST in AWS ARM (Gravitron)



```
[fedora@ip-172-31-88-12 build_librist]$ meson ../librist --reconfigure
The Meson build system
Version: 0.55.3
Source dir: /home/fedora/Documents/projects/librist
Build dir: /home/fedora/Documents/projects/build_librist
Build type: native build
Project name: libRIST
Project version: 0.2.0
C compiler for the host machine: cc (gcc 10.2.1 "cc (GCC) 10.2.1 20201125 (Red Hat 10.2.1-9)")
C linker for the host machine: cc ld.bfd 2.35-18
Host machine cpu family: aarch64
Host machine cpu: aarch64
Check usable header "linux/if_alg.h" : YES (cached)
Checking for function "clock_gettime" : YES (cached)
Compiler for C supports arguments -Wundef: YES (cached)
Compiler for C supports arguments -Werror=vla: YES (cached)
Compiler for C supports arguments -Wno-maybe-uninitialized -Wmaybe-uninitialized: YES (cached)
Compiler for C supports arguments -Wno-missing-field-initializers -Wmissing-field-initializers: YES (cached)
Compiler for C supports arguments -Wno-unused-parameter -Wunused-parameter: YES (cached)
Compiler for C supports arguments -Wshorten-64-to-32: NO (cached)
Compiler for C supports arguments -Watomic-implicit-seq-cst: NO (cached)
Compiler for C supports arguments -Wunused-parameter: YES (cached)
Compiler for C supports arguments -Wmaybe-uninitialized: YES (cached)
Compiler for C supports arguments -Wno-error=deprecated-declarations -Werror=deprecated-declarations: YES (cached)
Dependency threads found: YES unknown (cached)
Compiler for C supports arguments -fvisibility=hidden: YES (cached)
Check usable header "stdatomic.h" : YES (cached)
Found pkg-config: /usr/bin/pkg-config (1.7.3)
Found CMake: /usr/bin/cmake (3.18.4)
Run-time dependency cjson found: NO (tried pkgconfig and cmake)
```

Note: Multi Platform Demo

We have another demo running with libRIST on Raspberry Pi, linux x64, AWS ARM, Azure x64.



NDI

SipRadius

MPEGTS H264

Ground → Cloud → Cloud → Ground

Raspberry Pi

lib RIST

SipRadius

AWS

lib RIST

Azure

lib RIST

SipRadius

NDI

Florida

Texas

WebRTC

WebRTC

WebRTC

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Performance Gains

Why do we care?

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Congestion Control

- Many proprietary ECP solutions exist: Dozer, Zixi, LTN, Video Flow, SRT, NetInsight, etc …
- Many vendors have standarized and implemented RIST: SipRadius, Cobalt, VideoFlow, QVidium, NetInsight, Nevion, etc …
- They all work well under well behaved conditions (low packet loss and unlimited bandwidth)

Congestion Control

+ What happens when the network is not well behaved, i.e. internet links?
  - Bursts of high packet loss > 20%
  - Continuous packet loss of 50% or more (bonded solutions in which one or more legs go down).
  - Total available bandwidth is < 20% above the transmission bitrate
+ This is where the different solutions and implementations diverge

Congestion Control - libRIST

+ Implements internal QOS to control max bandwidth used.

+ Measures and uses round trip time (RTT)

+ Spread the retries over time to prevent network collapse (retry queue).

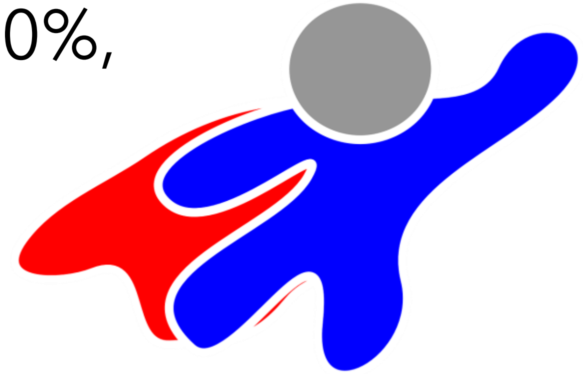
+ Double check data on retry queue before acting on it

Congestion Control - libRIST

- Benefits
  - Less messages mean less congestion
  - Less congestion means more room for new and resent packets
  - QOS means your retry storms will not artificially collapse your links

How Do We Measure Gains?

- Increased ability to withstand random packet loss and corruption under limited bandwidth constraints
  - Previously: no frame drops or corruption up to just under 50% continuous loss
  - Improved performance: up to nearly 70%, which we'll see in the demo, in a short while…



Summarizing the Tweaks

- Most approaches that we know of rely on statistical data being transmitted from client to receiver and vice-versa (RTCP has data for it).
- Our approach is to do it *before* the data aggregation step.
- It may be more work, but the CPU usage for libRIST is so low, there's plenty of leeway.

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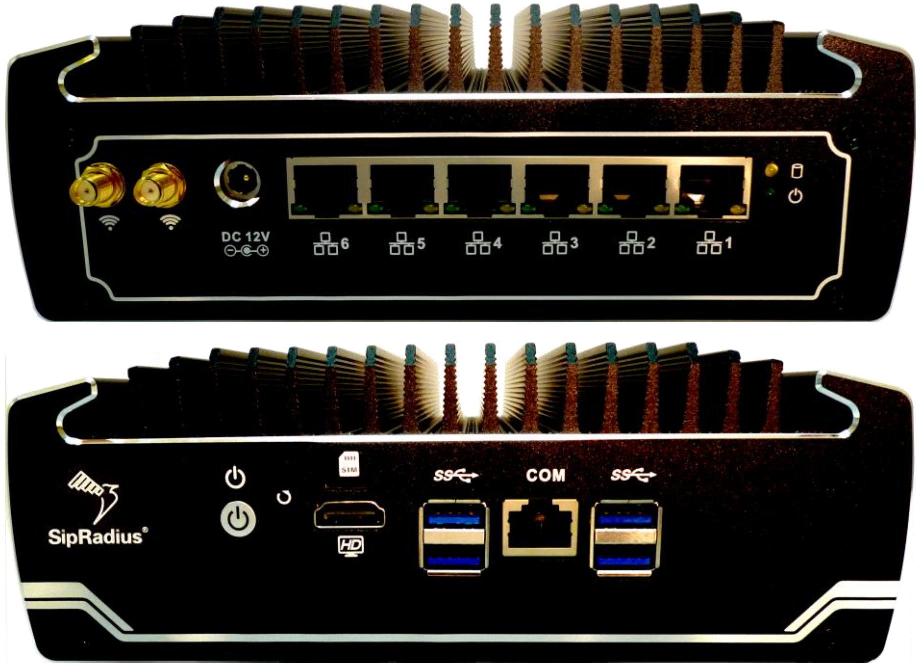
Demo/Stress Test

SipRadius Emulation Platform

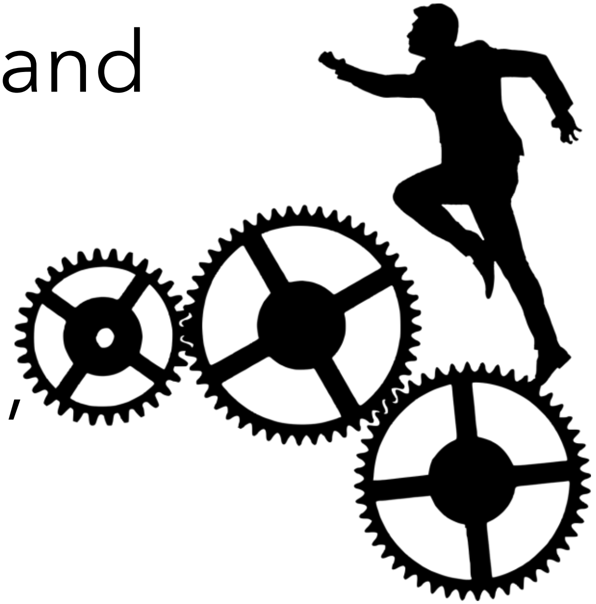
- Core™ i7 Six NIC Fanless Mini PC
- Coral OS linux
- Product: Linkem (link emulator)



[Switch to Demo]

Summary/Conclusion

- libRIST compiles and runs on most platforms
- Code improvements and maintenance are ongoing, focused on efficiency, and meticulously tested
- As a FOSS project, libRIST benefits a wide range of people, organizations and uses



libRIST

Thank You

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