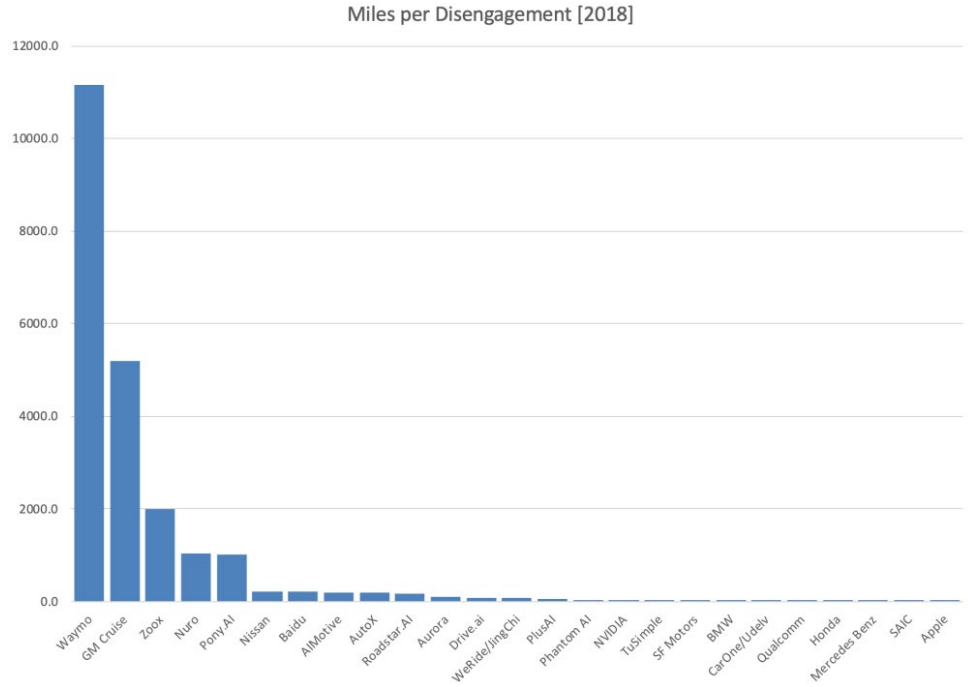
Wait -- I Only Have a 1TB Drive !!!

Welcome to the Age of Autonomous Vehicle Logging

Presented by: Jeff Warra

Log, Computer, Analyze and repeat, that's development

Why do we need to log data everything ?



To properly reconstruct and understand disengagements

https://www.forbes.com/sites/alanohnsman/2019/02/13/waymo-tops-self-driving-car-disengagement-stats-as-gm-cruise-gains-and-tesla-is-awol/#7e559a7031ec

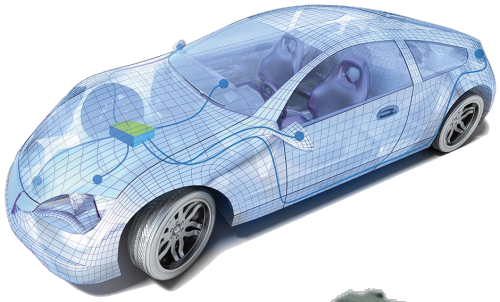
https://9to5mac.com/2019/02/12/apple-self-driving-disengagements/

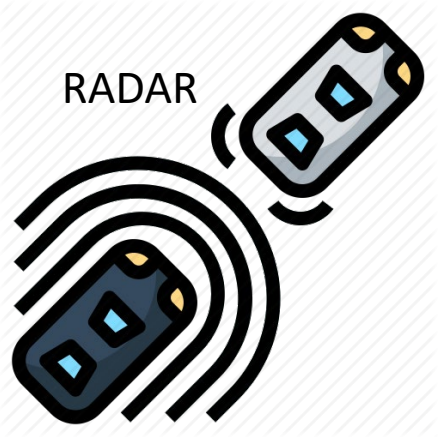
Autonomous Sensors – Data Generators

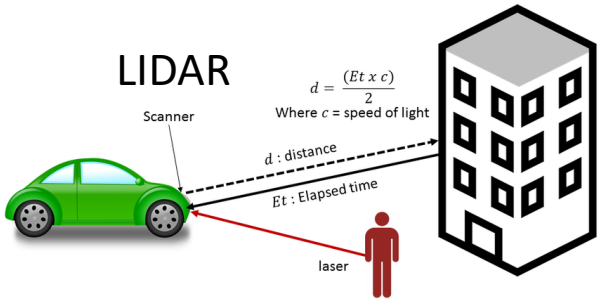
Loads of sensors!

- Cameras
- LIDAR
- RADAR
- Automotive Ethernet
- 10GBASE-T

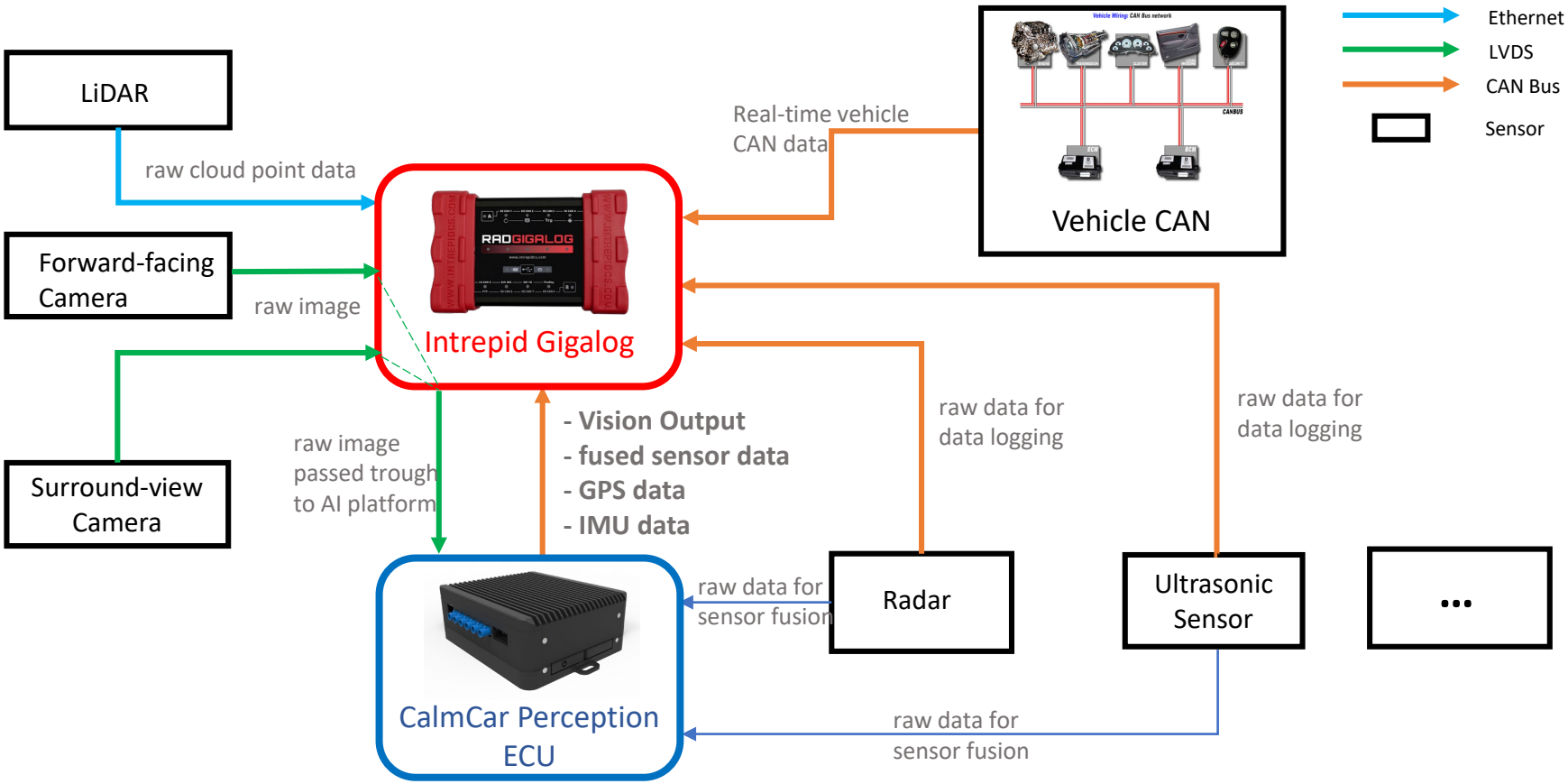
Gigabytes of data per second







Usage Case - AI Enabled Data Acquisition Reference System



The RAW image facts – Bandwidth

Evaluating Data pipe for RAW image transfer and Recording Times

2 Megapixel Camera Resolution 1920x1080 @ 30 FPS

Pixels per second = V Res x H Res x FPS

Transfer rate per image = Pixels per second x Pixels per bit

(16, Camera recording format)

Must have Bandwidth of 995 Mbps for your Camera

The RAW image facts – Adding up the Data

Evaluating Data storage size per image vs time

995 Mbps / FPS (30 FPS) = 33.2 Mbits /8= 4.1MBytes/frame

4.1 x 30 = 123MBytes/sec * 60 = 7,380MBytes/min

7.38G * 60mins = 442.8GBytes/hr * 8 = 3.542TeraBytes/Day

1 Camera Recording in RAW format = 3.5TBytes/Day

Logging High Bandwidth Data

<u>Aggregated Customer Requirements</u>

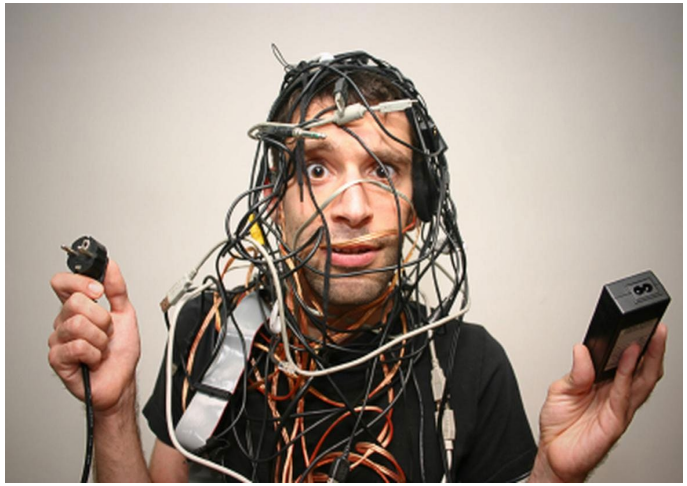
- Several gigabits of data from cameras/sensors

- Want to save everything
  - Need high bandwidth logging
  - Need high capacity storage
  - Need high speed storage (HD, 4K, 8K)

- 6 Gbps fills 6TB in ~2 hours

Consumer Components Unmanageable!

- Off-the-shelf CPUs and hardware are to bulky
- Requires too much power for vehicles
- Separate storage volumes



RAD-Gigalog -Log EVERYTHING 6+ TB storage

- Autonomous controller logging
- Camera/Radar tapping
- CAN logging
- Long-term XCP logging
- Aurora trace logging
- Machine learning data collection

RAD-Gigalog -Log EVERYTHING 6+ TB storage

Logging Interfaces

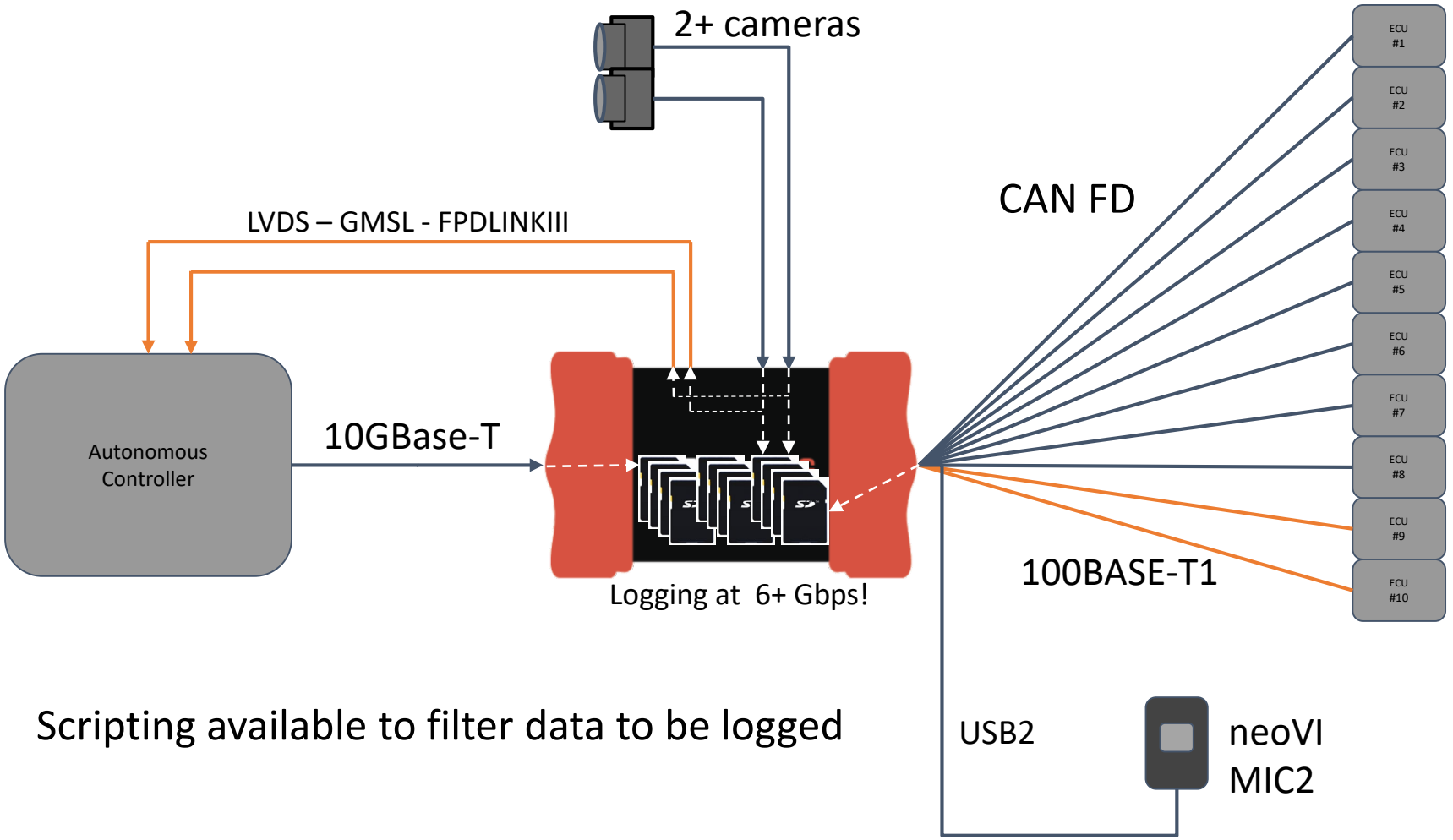
- Ethernet Ports
  - 1x 10GBASE-T
  - 2x 100/1000BASE-T
  - 2x 100BASE-T1
- 4x SerDes High speed FPDIII/GMSL2 interface
- 8x ISO CAN FD channels
- 2x FlexRay receive-only channels

RAD-Gigalog -Log EVERYTHING 6+ TB storage

Key Features

- Low power: 18W (1.5A @ 12V)
- Supercapacitor power failure protection
- USB 3 data offload/config via rugged USB-C connector
- USB 2 host for neoVI MIC2 and other accessories
- Programmable LEDs showing network and storage status
- Time sync with other Intrepid tools and autonomous logger systems (PTP)
- Integral IMU and GPS
- Optional FPGA Video Compression

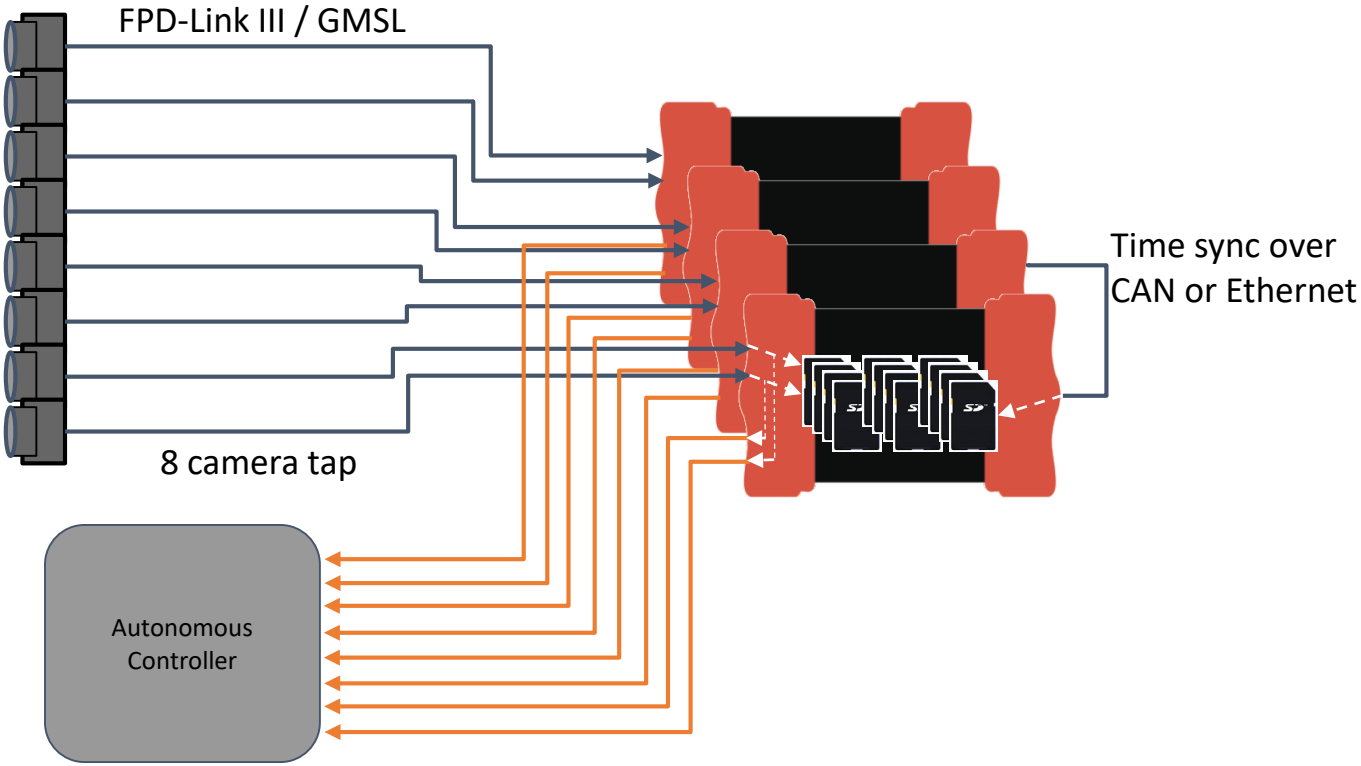
High-Speed Logging



Scripting available to filter data to be logged

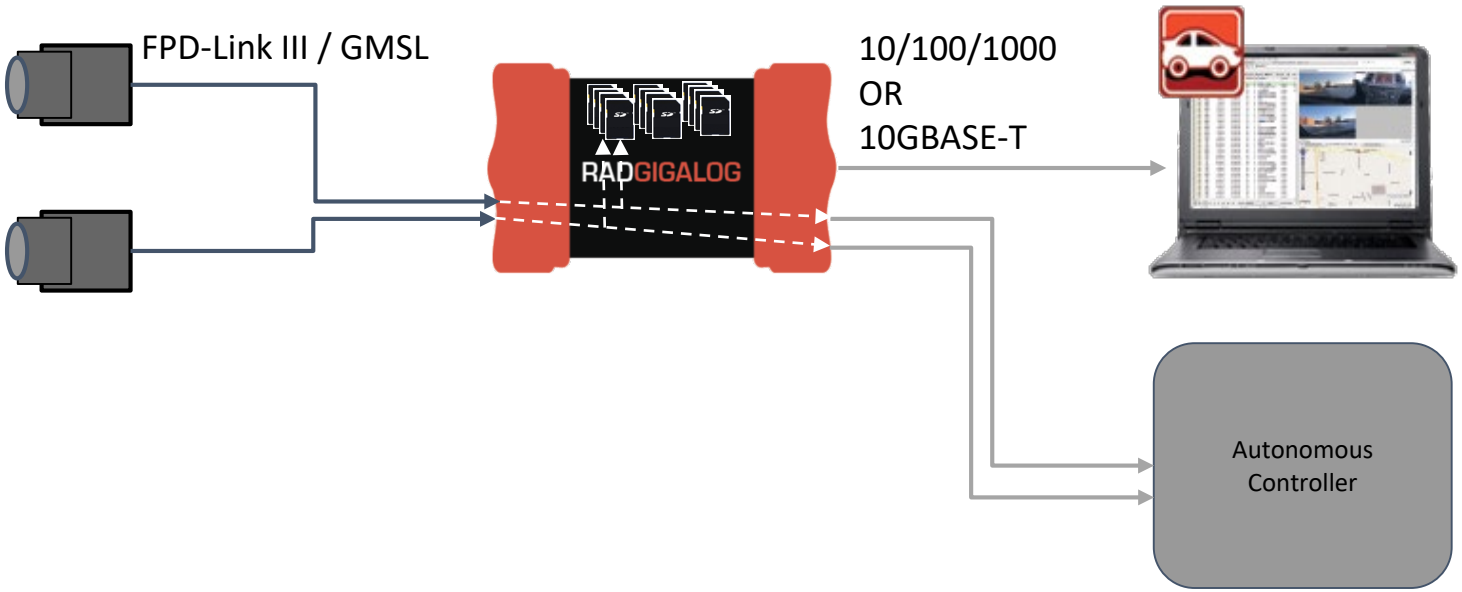
Autonomous Camera Tapping

- Log and forward uncompressed camera data
- Gang together multiple loggers for more cameras + time sync



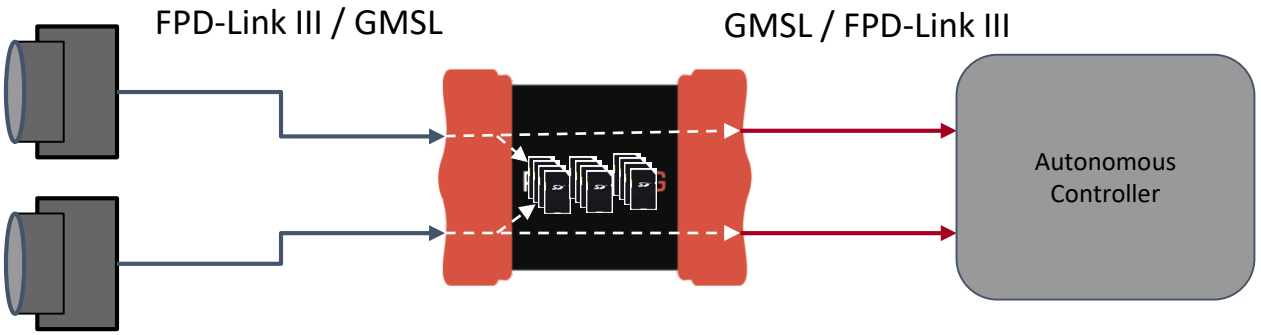
Camera to Ethernet Conversion

- Log, store and forward uncompressed camera data over Ethernet

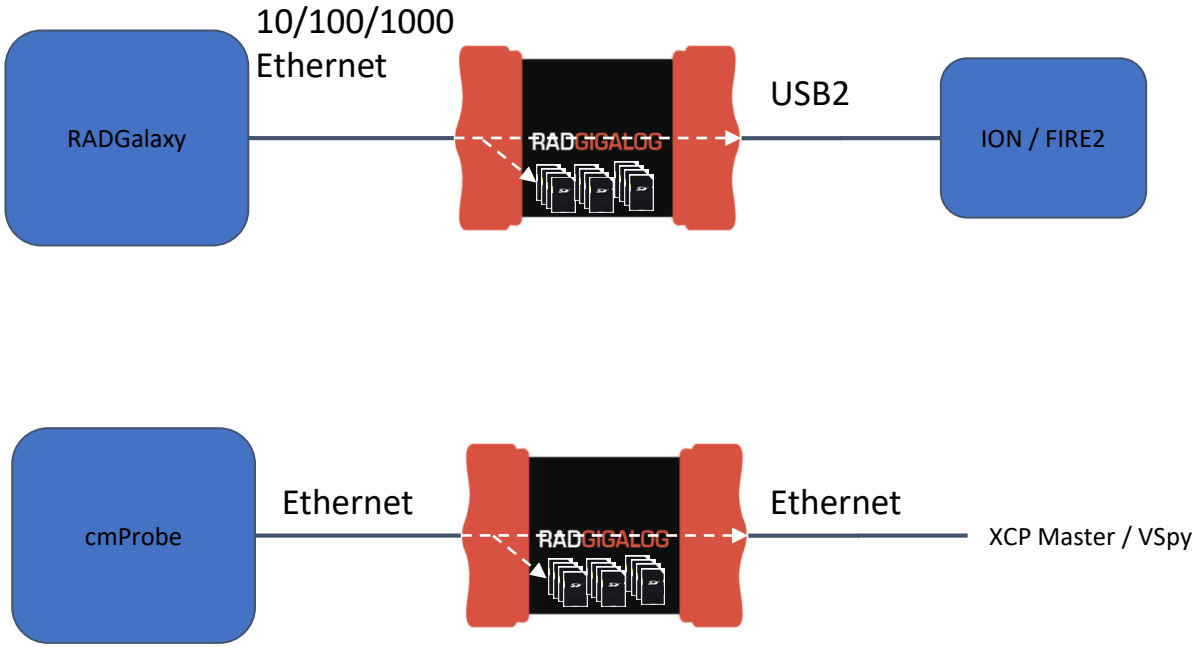


FPD-Link III / GMSL2 Conversion

- Translate between camera standards GMSL to FPD-LinkIII



Storage NAS for Other Devices



Link Multiple Loggers

Camera Options

- Powers Camera
- Configures Camera or allows I2C Passthrough
- Can Log I2C Passthrough
- Same SerDes Module as GigaStar

Questions?

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+1 (586) 731-7950 x 2

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www.intrepidcs.com/support
+1 (586) 731-7950 x 1

103. Automotive Ethernet PHY Linking: The Missing Link! (Jeff W/Keysight)

- Those familiar with Automotive Ethernet know that each connection has a "master" and "slave", and this refers to how they link together. But few fully understand the process of PHY linking and what it can mean for you. This presentation will provide a full overview of the linking process.

- http://www.ieee802.org/3/bp/public/mar15/regev_3bp_01_0315.pdf