

**2021 IEEE Autonomous  
Driving AI Test Challenge**

Co-Sponsored by IEEE AI Test Conference 2021

Aug. 23-26, 2021  
Online (Worldwide)



# LGSVL Simulation

## For 2021 IEEE AD AI Test Challenge

Steve Lemke (3/25/2021)



# Agenda

- Introduction
- Simulation Overview
- Training Materials
- Installation
- Python API
- Demo
- Getting Help
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# Introduction

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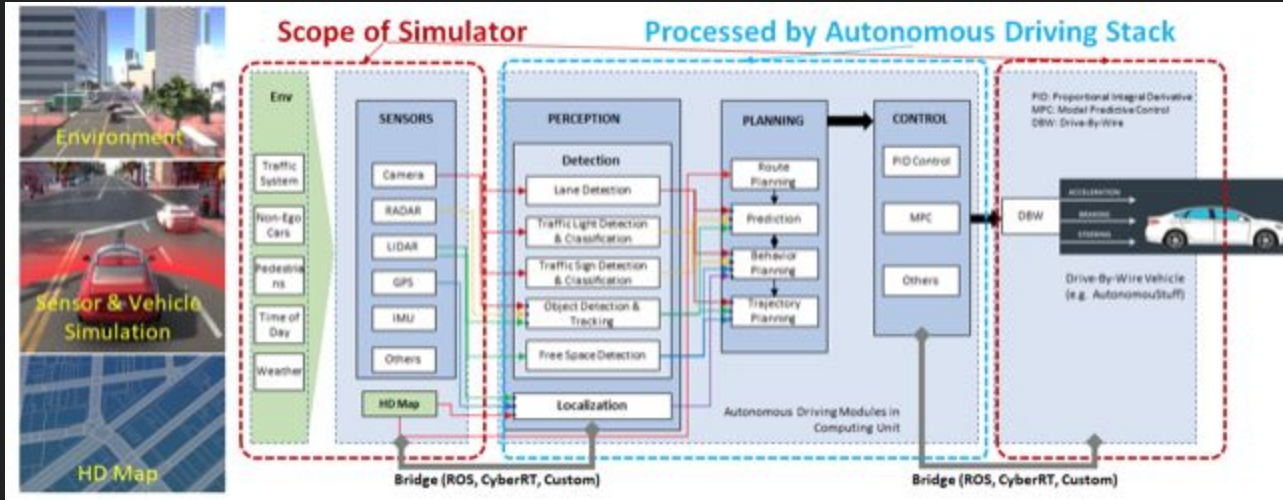
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- Challenge information - see <http://av-test-challenge.org/>
  - First phase challenge submission: April 30
  - Second phase challenge submission: July 15
- Simulator versions:
  - First Phase uses **LGSVL Simulator 2020.06**
  - Second Phase uses SVL Simulator 2021.1 (second training: April 9 and 10)
  - Welcome to try out 2021.1 if interested
  - Next training (April 9 and 10) will cover SVL Simulator 2021.1

# AD Simulation Overview



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**GPU ACCELERATED 128 BEAM LIDAR**





# System Requirements

- Graphics station or gaming laptop
  - ~4GHz, Quad core (or better), 16+GB of RAM
- GPU required for Simulator and for Apollo
  - Nvidia GTX-1080 (“Pascal”) – works with Apollo 5.0 or newer
  - Nvidia RTX-2070/2080 (“Touring”) – requires Apollo 5.5 or newer
  - Nvidia RTX-3060+ (“Ampere”) – requires Apollo 6.1 aka latest Apollo master
  - **8+GB of GPU memory** (large maps and/or sharing with Apollo requires more memory)
- One machine or two?
  - Two is better but one (8GB+ GPU) is usable (with “modular testing”)
- Windows 10 or Linux (Ubuntu 18.04/20.04)

# Training Materials

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- LGSVL Simulator web site just changed for new release
  - “LGSVL Simulator” is now “SVL Simulator” (as of 2021.1, released on 3/25/2021)
  - <https://lgsvlsimulator.com> now redirects to <https://svlsimulator.com>
  - **CAUTION:** svlsimulator.com documents the *new 2021.1 release*
    - (...which we will use for Challenge Phase 2!)
- LGSVL Documentation: Use 2020.06 archive for Challenge Phase 1
  - <https://lgsvlsimulator.com/docs> (now shows 2021.1 docs: new cloud-based UI)
  - **USE ARCHIVE:** <https://svlsimulator.com/docs/archive/2020.06/>

# More Training Materials

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- AVS LGSVL+Apollo hands-on video: ***Please watch this!***
  - YouTube walk-through: [https://youtu.be/Ucr0aM334\\_k](https://youtu.be/Ucr0aM334_k)
  - IMPORTANT: **Grab this updated .md file** with latest links and info: <https://bit.ly/31jmuSy>
- Online AD Course from ExactPro Systems using LGSVL:
  - [https://www.youtube.com/playlist?list=PL8QI2\\_5rYPjgEygg5rDm7DSHWbGmVqYF5](https://www.youtube.com/playlist?list=PL8QI2_5rYPjgEygg5rDm7DSHWbGmVqYF5)
  - <https://exactpro.com/events/external/software-testing-complex-intelligent-systems-and-autonomous-vehicles>





# Installing LGSVL Simulator

- Download **LGSVL Simulator 2020.06** release
  - <https://github.com/lgsvl/simulator/releases/tag/2020.06> (Release notes and download links)
    - <https://github.com/lgsvl/simulator/releases/download/2020.06/lgsvlsimulator-linux64-2020.06.zip>
    - <https://github.com/lgsvl/simulator/releases/download/2020.06/lgsvlsimulator-windows64-2020.06.zip>
- LGSVL Documentation: Use 2020.06 archive for Challenge Phase 1
  - <https://svlsimulator.com/docs/archive/2020.06/>
  - <https://svlsimulator.com/docs/archive/2020.06/getting-started/>
  - Walk-through doc: <https://bit.ly/3tVB5Aa>



# Installing Apollo

- Installing Apollo (get the right version/branch!)
  - Apollo 5.0 (**LGSVL fork**): <https://github.com/lgsvl/apollo-5.0>
    - Apollo 5.0 does NOT support Nvidia RTX-20x0 or 30x0 GPU
  - Apollo 6.0 **branch**: <https://github.com/ApolloAuto/apollo/tree/r6.0.0>
    - Apollo 6.0 does NOT support Nvidia RTX 30x0 GPU
  - Recommend Apollo (**master**): <https://github.com/ApolloAuto/apollo>
    - Supports LGSVL and Nvidia 10x0/20x0/30x0 GPU
    - But: Apollo perception is not working; use LGSVL “modular testing” (aka ground truth)
    - See Apollo notes re: Nvidia drivers/Docker <https://github.com/ApolloAuto/apollo#prerequisites>
- LGSVL + Apollo Documentation (use 2020.06 archive)
  - <https://svlsimulator.com/docs/archive/2020.06/apollo-master-instructions/>
  - <https://svlsimulator.com/docs/archive/2020.06/apollo5-0-instructions/>
  - <https://svlsimulator.com/docs/archive/2020.06/modular-testing/>
  - Nvidia Container Toolkit: <https://docs.nvidia.com/datacenter/cloud-native/container-toolkit/install-guide.html>
  - Walk-through doc: <https://bit.ly/3fkB8RR>



# Choosing Maps, Vehicles, and Sensors

- Should not need to install Unity or re-build simulator from source
  - Of course, LGSVL Simulator is open source; contributions are always welcome!
- Use default maps and vehicles (with Apollo 5.0 sensor config)
  - Can use additional maps from <https://content.lgsvlsimulator.com/>
  - 2021 content store will have even more maps you can use for Phase 2
  -
- Sensor (JSON) configuration
  - Use default Apollo 5.0 sensors; remove camera/lidar if using modular testing (ground truth) sensors
  - <https://svlsimulator.com/docs/archive/2020.06/sensor-json-options/>
  - <https://svlsimulator.com/docs/archive/2020.06/apollo5-0-json-example/>
- LGSVL Documentation (2020.06 archive)
  - <https://svlsimulator.com/docs/archive/2020.06/>
  - <https://svlsimulator.com/docs/archive/2020.06/getting-started/>
  - Walk-through doc: <https://bit.ly/3d7edXF>

# Python API



- Use Python API (@ preview2) as master has been updated for 2021.1
  - <https://github.com/lgsvl/PythonAPI/tree/preview2> - use this for 2020.06
  - `git clone git@github.com:lgsvl/PythonAPI.git`
  - `cd PythonAPI && git checkout preview2 -b preview2`
- Python API Quickstart (Example) Scripts
  - <https://github.com/lgsvl/PythonAPI/tree/2020.06/quickstart>
  - Walk-through doc: <https://bit.ly/39fHtKH>
- Controlling Apollo with `lgsvl.dreamview` API
  - [https://github.com/lgsvl/PythonAPI/blob/master/examples/NHTSA/Encroaching-Oncoming-Vehicles/EOV\\_S\\_25\\_20.py](https://github.com/lgsvl/PythonAPI/blob/master/examples/NHTSA/Encroaching-Oncoming-Vehicles/EOV_S_25_20.py)
- LGSVL Python API Documentation (use 2020.06 archive)
  - <https://svlsimulator.com/docs/archive/2020.06/python-api/>
  - <https://svlsimulator.com/docs/python-api/dreamview-api/>

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# Demo



# Getting Help

- Troubleshooting LGSVL Simulator
  - <https://svlsimulator.com/docs/archive/2020.06/troubleshooting/>
  - <https://svlsimulator.com/docs/archive/2020.06/faq/>
- Apollo Dreamview help:
  - [https://github.com/ApolloAuto/apollo/blob/master/docs/specs/dreamview\\_usage\\_table.md](https://github.com/ApolloAuto/apollo/blob/master/docs/specs/dreamview_usage_table.md)
  - [https://github.com/ApolloAuto/apollo/blob/master/docs/FAQs/Dreamview\\_FAQs.md](https://github.com/ApolloAuto/apollo/blob/master/docs/FAQs/Dreamview_FAQs.md)
- Github issues - search first, then ask
  - LGSVL: <https://github.com/lgsvl/simulator/issues>
  - Apollo: <https://github.com/apolloauto/apollo/issues>



# Troubleshooting Apollo + LGSVL

- Review the walk-through and usage instructions: <https://bit.ly/31jmuSy>
- Dreamview: “Mkz **Lgsvl**” and “Lincoln2017MKZ **LGSVL**” and correct map?
- Check `cyber_monitor` (after: `docker/scripts/dev_into.sh`)
- In Simulator: Press “Play” (if interactive mode; else use API-Only mode for Python control)
  - Should make several channels green: canbus, 5 x gnss, camera, lidar perception, clock (if enabled)
  - Is bridge IP address and port set correctly in Vehicle settings (e.g. localhost:9090 or IP:9090)?
- “Please send car initial position”?
  - Enable **Transform** and **Localization** modules in **Module Controller**?
  - Confirm sensor JSON
- Map rotated or missing in Dreamview?
  - Apollo 5.0: Get latest maps from LGSVL fork
  - Apollo 6.0: Latest Borregas map is in r6.0.0 branch
  - Apollo master: `git checkout 7762c918` (Jan 5 2021, or later)



# Troubleshooting Apollo + LGSVL

- Use Modular Testing (ground truth) sensors instead of Apollo 6.0 perception
  - Perception not working in Apollo master; won't run on single CPU/GPU with Simulator
- No routing path? Won't drive?
  - Enable **Prediction**, **Planning**, **Routing**, and **Control** modules in **Module Controller**?
  - Must cycle **Planning** off and back on after driving away from initial location
  - Modules don't instantly turn off or on (Dreamview switches "bounce")
  - Restart container: `dev_start.sh stop`, and `dev_start.sh` then `dev_into.sh`
- Apollo latency issues?
  - CPU may be too slow to run Apollo and LGSVL on same machine
  - Use Clock sensor: <https://svlsimulator.com/docs/archive/2020.06/sensor-json-options/#clock>
    - Don't forget to set `clock_mode` to `MODE_MOCK` in `cyber.pb.conf`



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# Q & A

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Thanks!