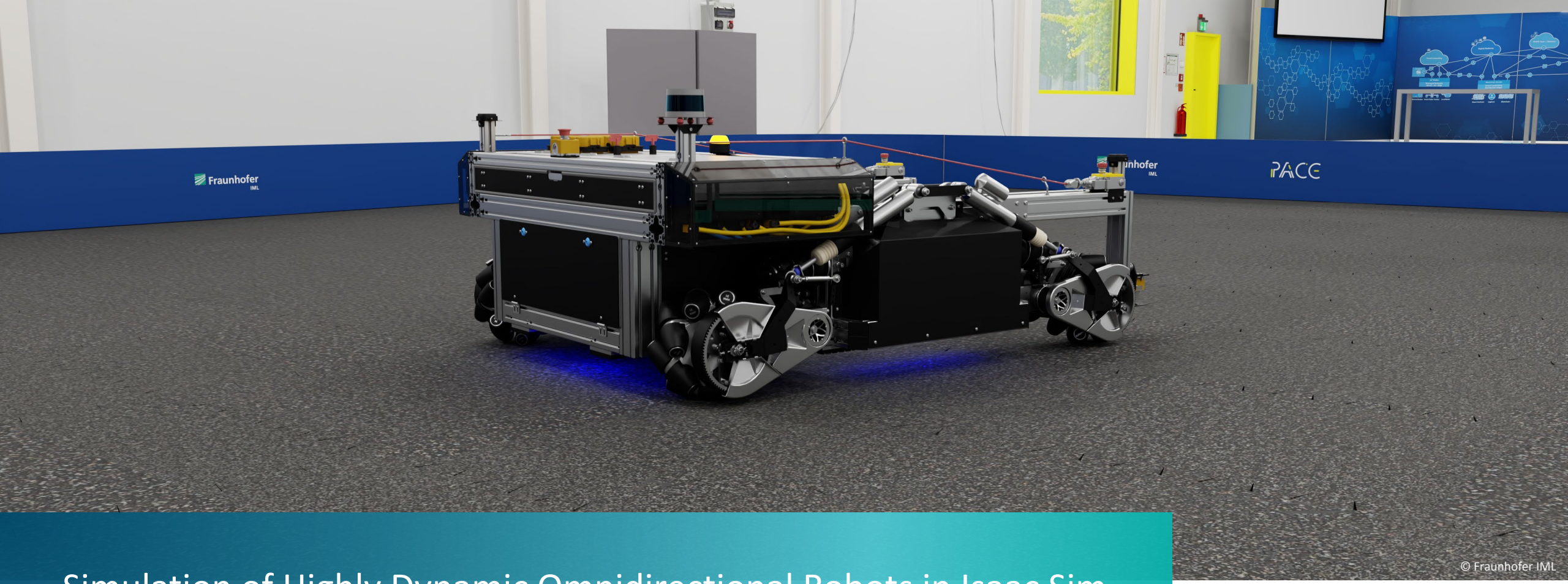

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Simulation of Highly Dynamic Omnidirectional Robots in Isaac Sim

Marvin Wiedemann - Fraunhofer Institute of Material Flow and Logistics

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From Highly Dynamic Omnidirectional Real-World Robots…

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… to Highly Dynamic Omnidirectional Simulation Models!

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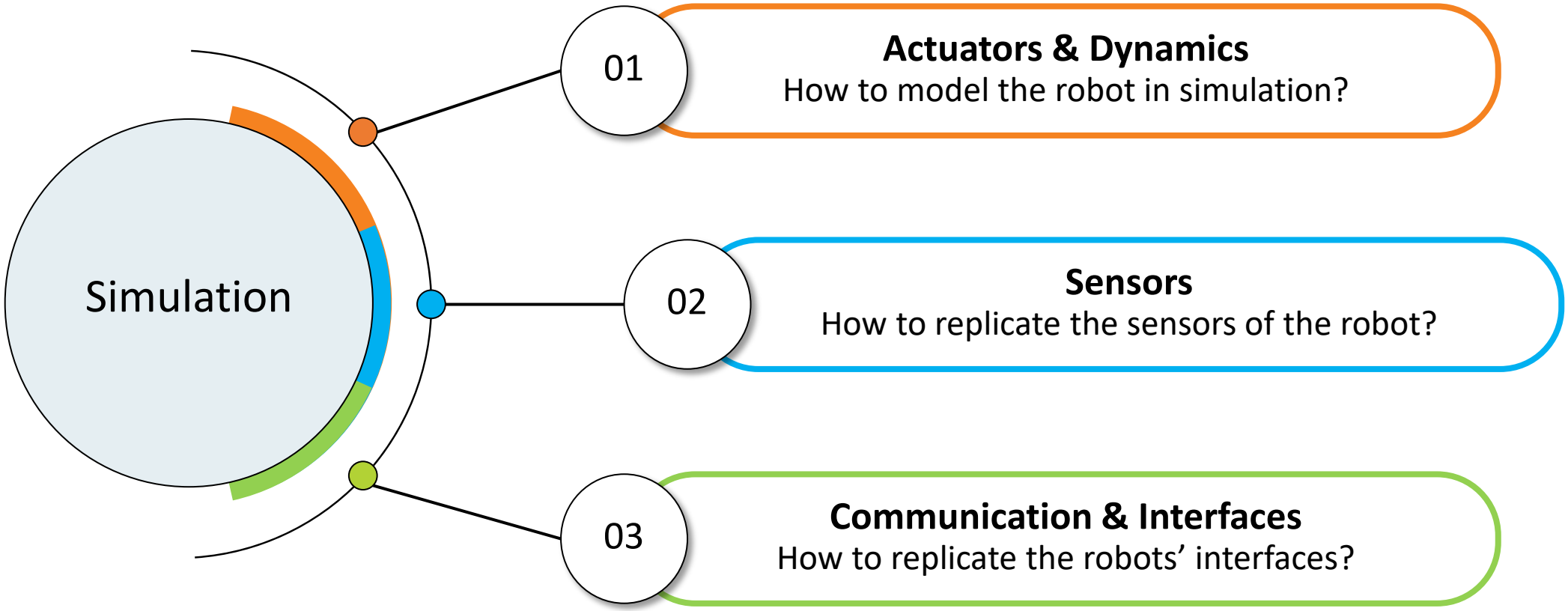

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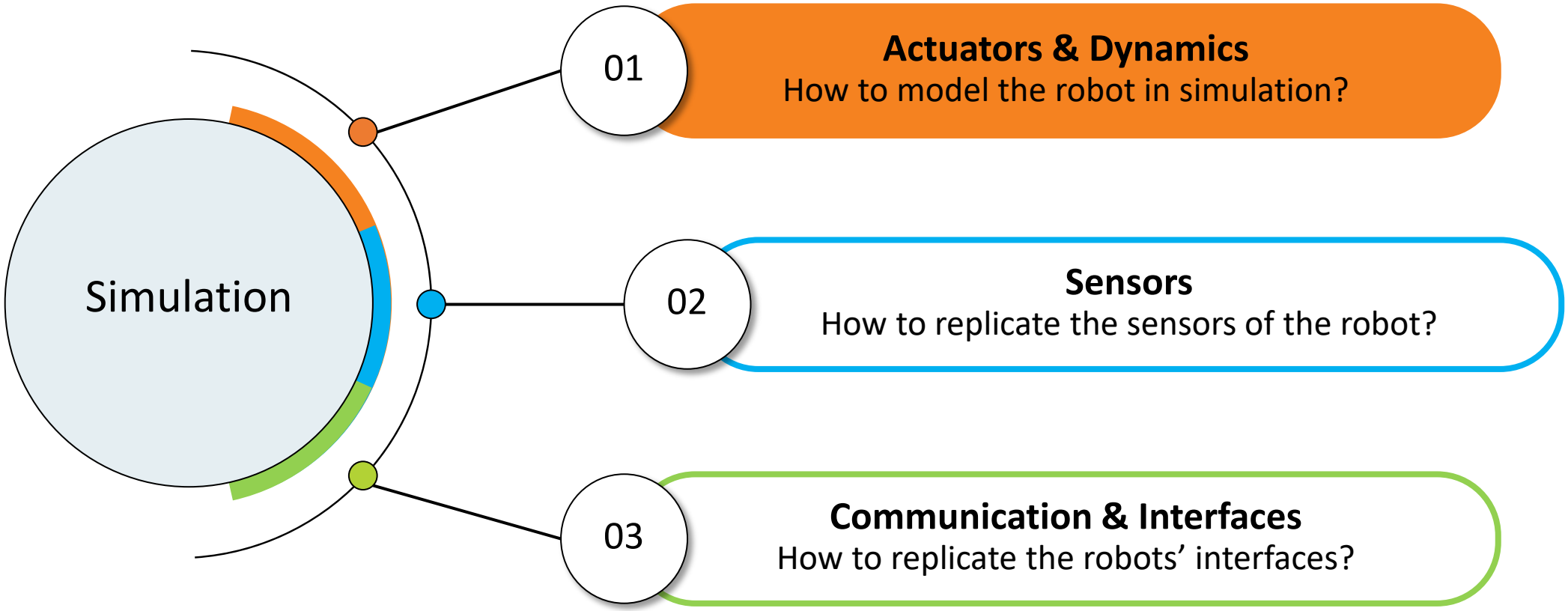

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Get The Robot Into Simulation

Import from CAD data

Import from URDF

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<!-- Dimension XSENS IMU -->
<xacro:property name="IMU_XSENS_dimension_x" value="0.0031" />
<xacro:property name="IMU_XSENS_dimension_y" value="0.0036" />
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<!-- Dimensions of the Sick Tim 571 -->
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<!-- Dimensions of the GPS Antenna -->
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<!-- Dimensions of the Realsense cameras -->
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<!-- Include Robomaster Parts -->
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<xacro:include filename="parts/laserscanners.xacro" />
<xacro:include filename="parts/imus.xacro" />
<xacro:include filename="parts/gps.xacro" />
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<xacro:include filename="parts/cameras.xacro" />
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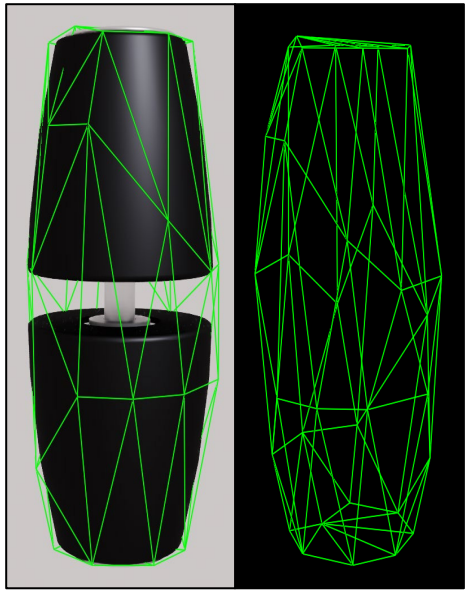
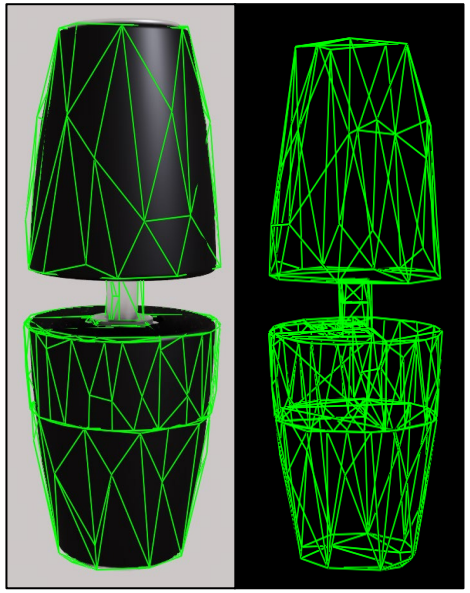
Smoothness is Key: The Roller Colliders

Auto-Generated Meshes

Convex Hull

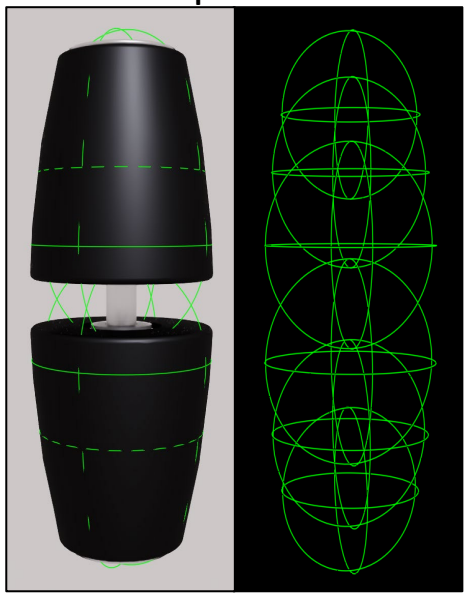


Convex Decomposition

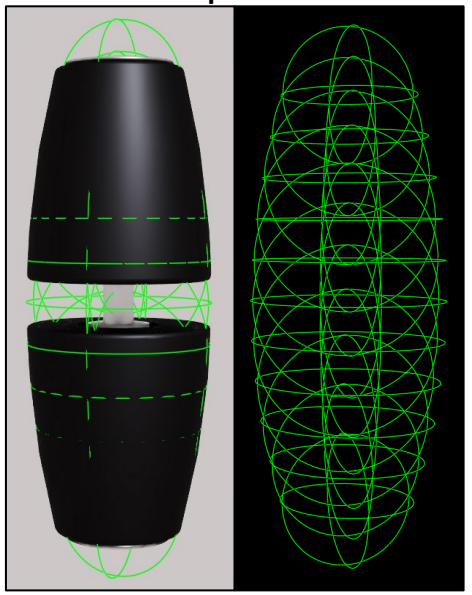


Spheric Colliders

6 spheres



11 spheres



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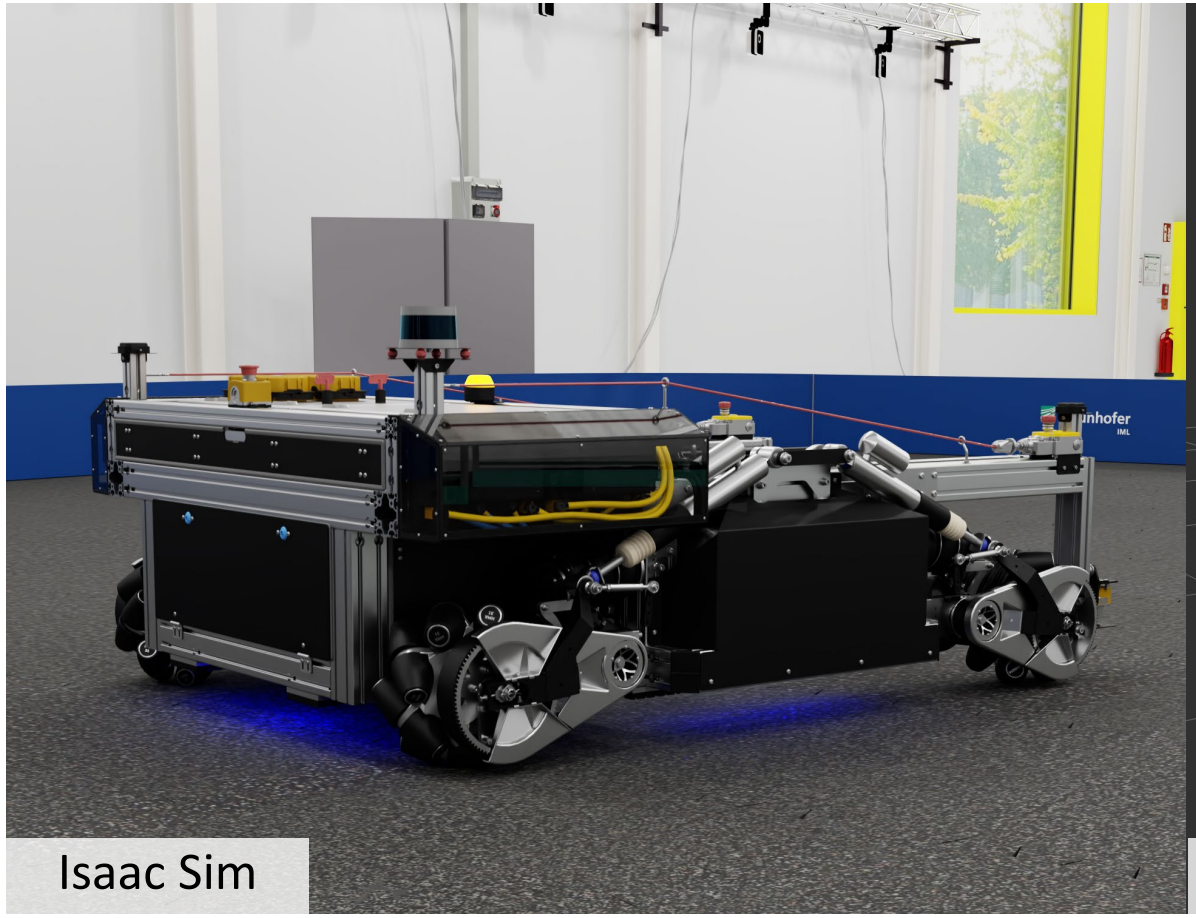
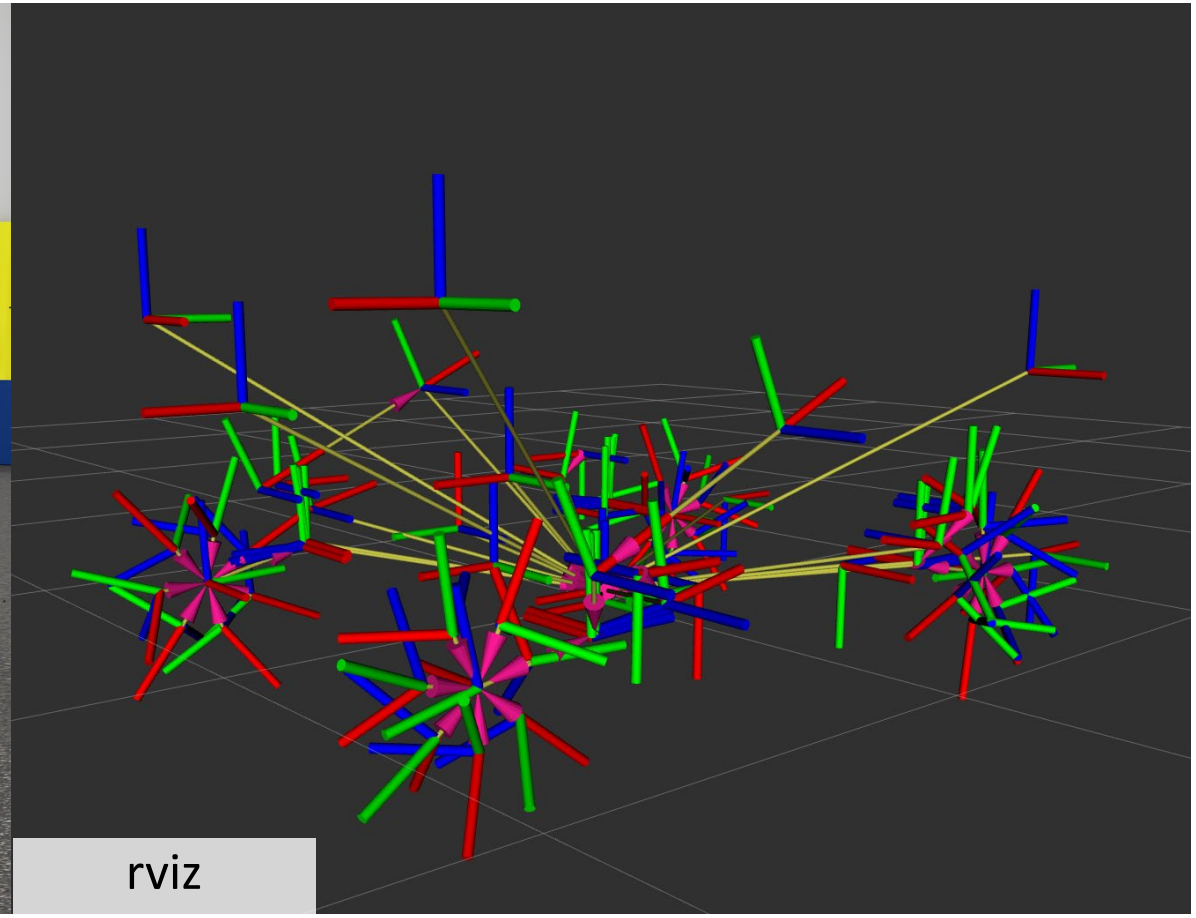
Entering the ROS Ecosystem



Isaac Sim



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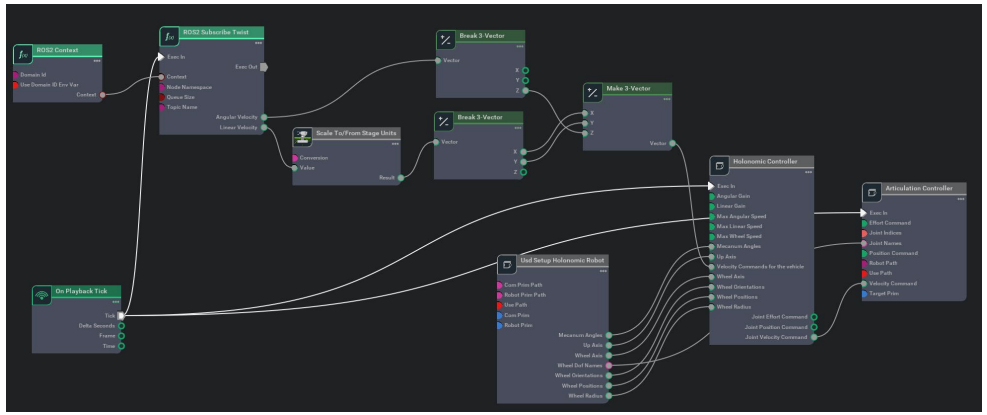
The Robot Base Controller

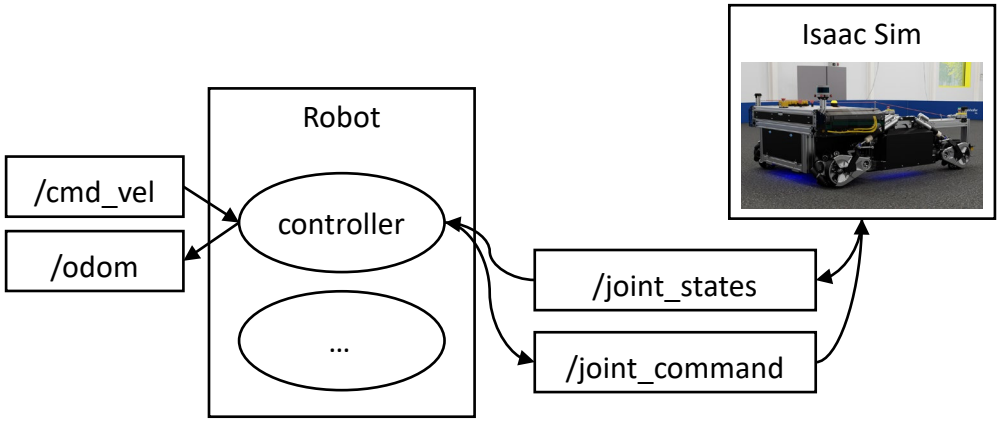
OmniGraph based Controller

- Controller can be built in Isaac Sim
- Visual Scripting Language OmniGraph



Custom Controller

- Implementation via ROS or Python API
- Controller node allows to implement robot specific dynamics & behaviors (e.g., delay)



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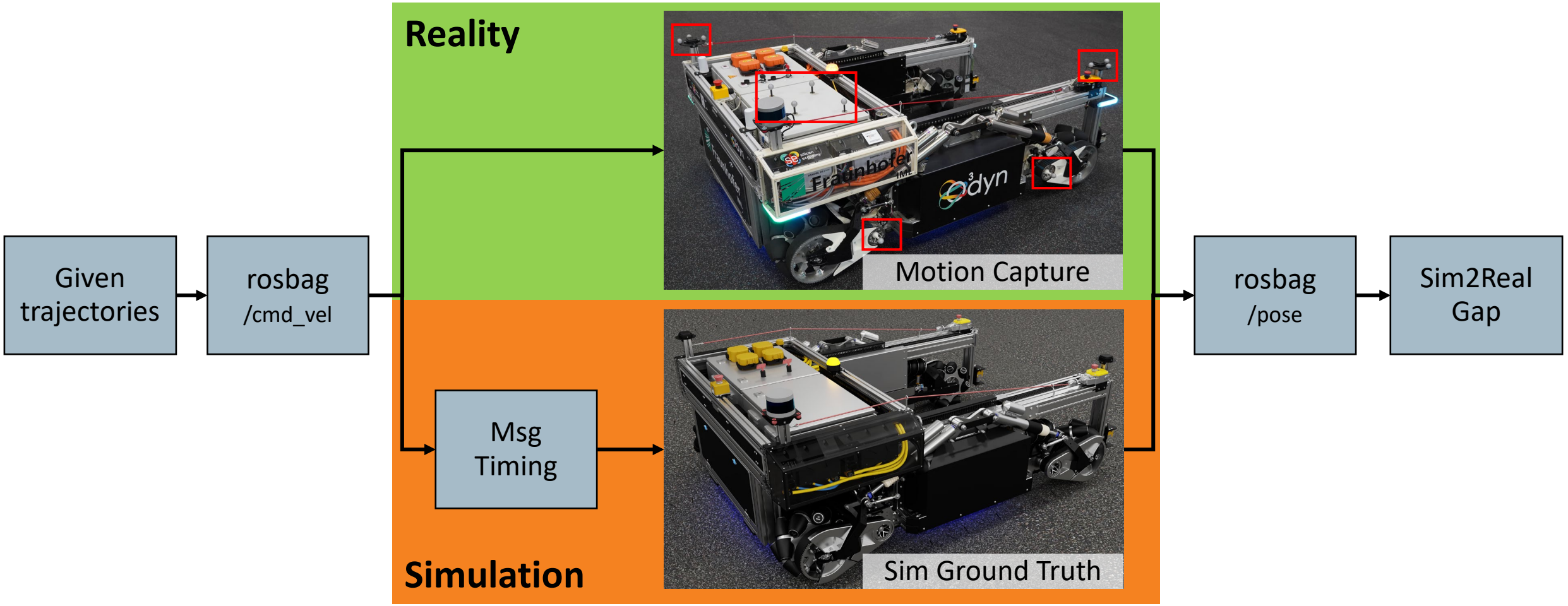
Sim2Real Comparison – Do They Behave Similarly?



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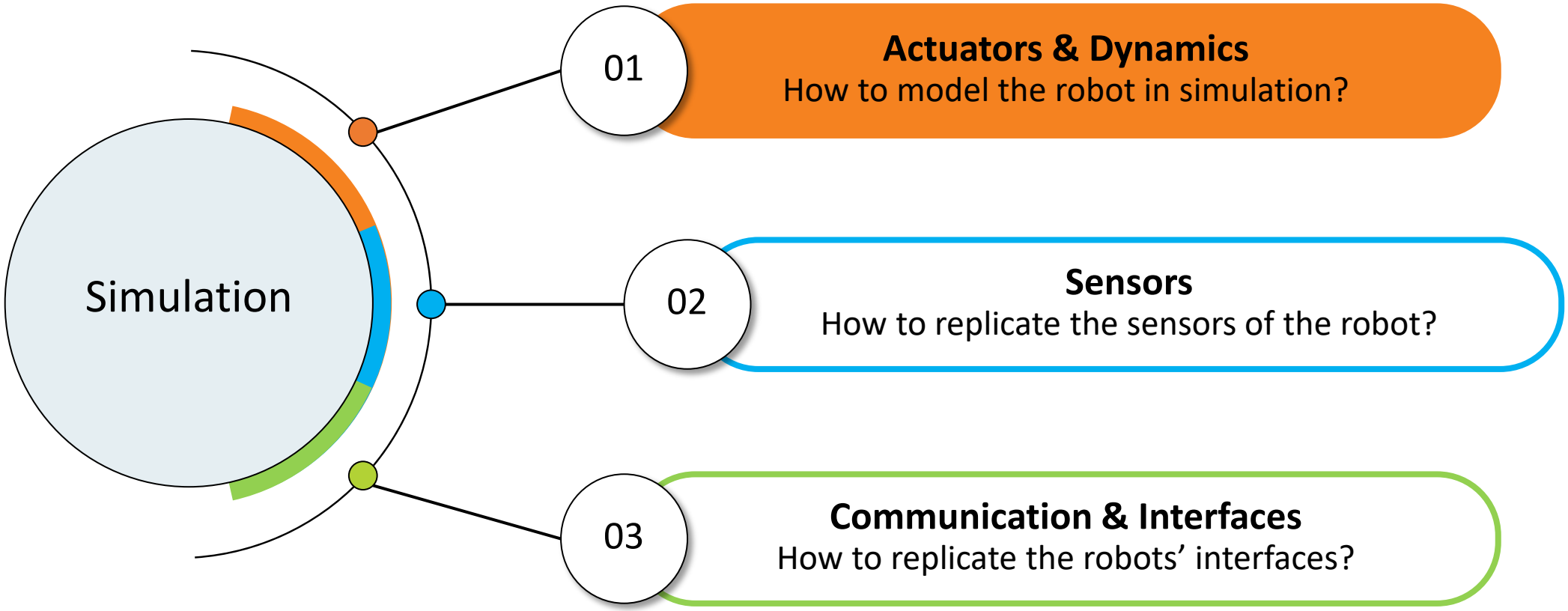

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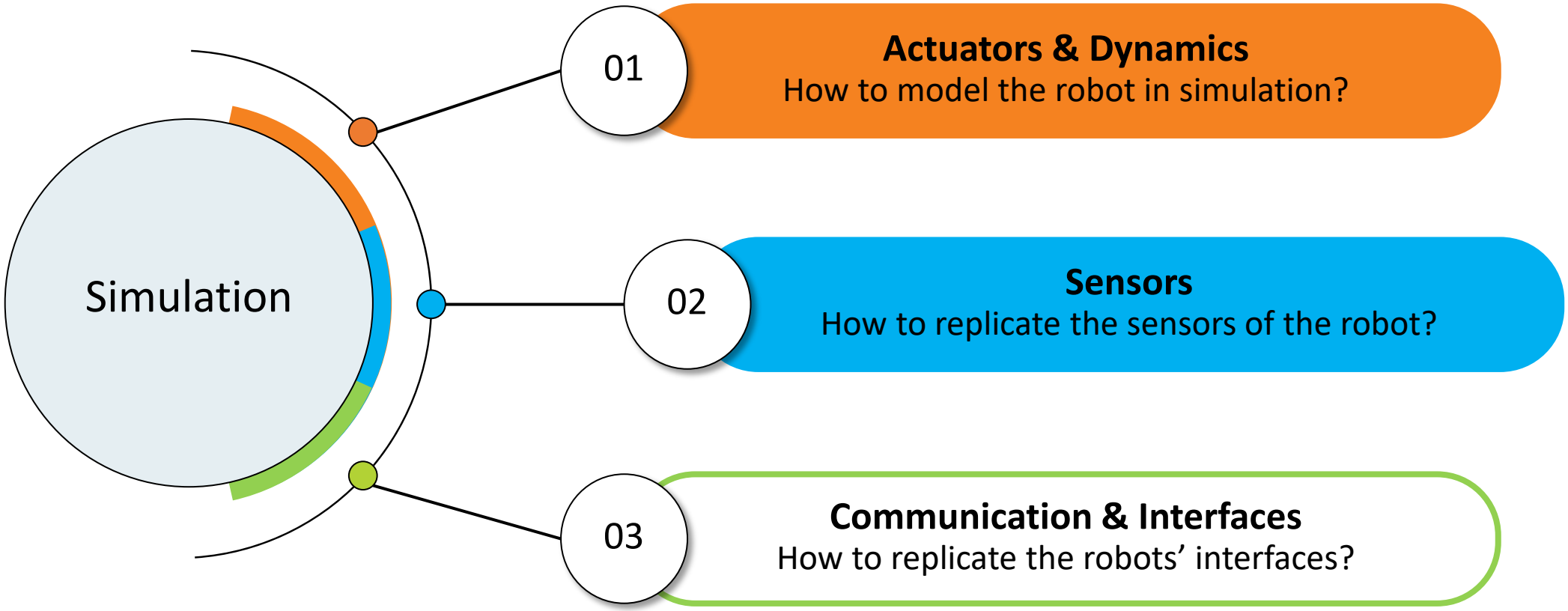

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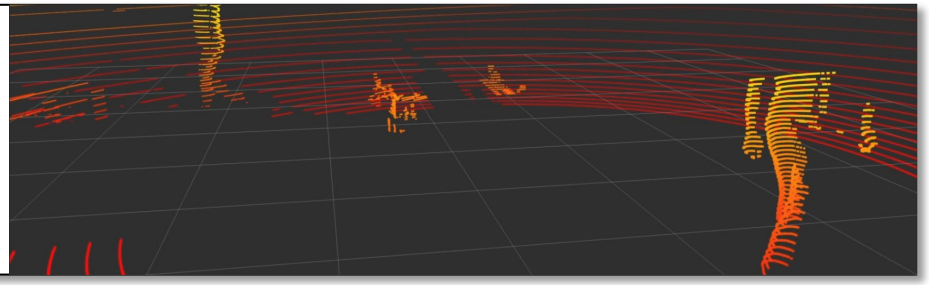
Available Sensor Types

Camera	• RGB camera • Depth camera • Replicator for synthetic data generation
LiDAR	• PhysX-based LiDAR • RTX-based LiDAR
Others	• PhysX-based range sensors (generic, ultrasonic) • Force and contact sensors • IMU • Proximity



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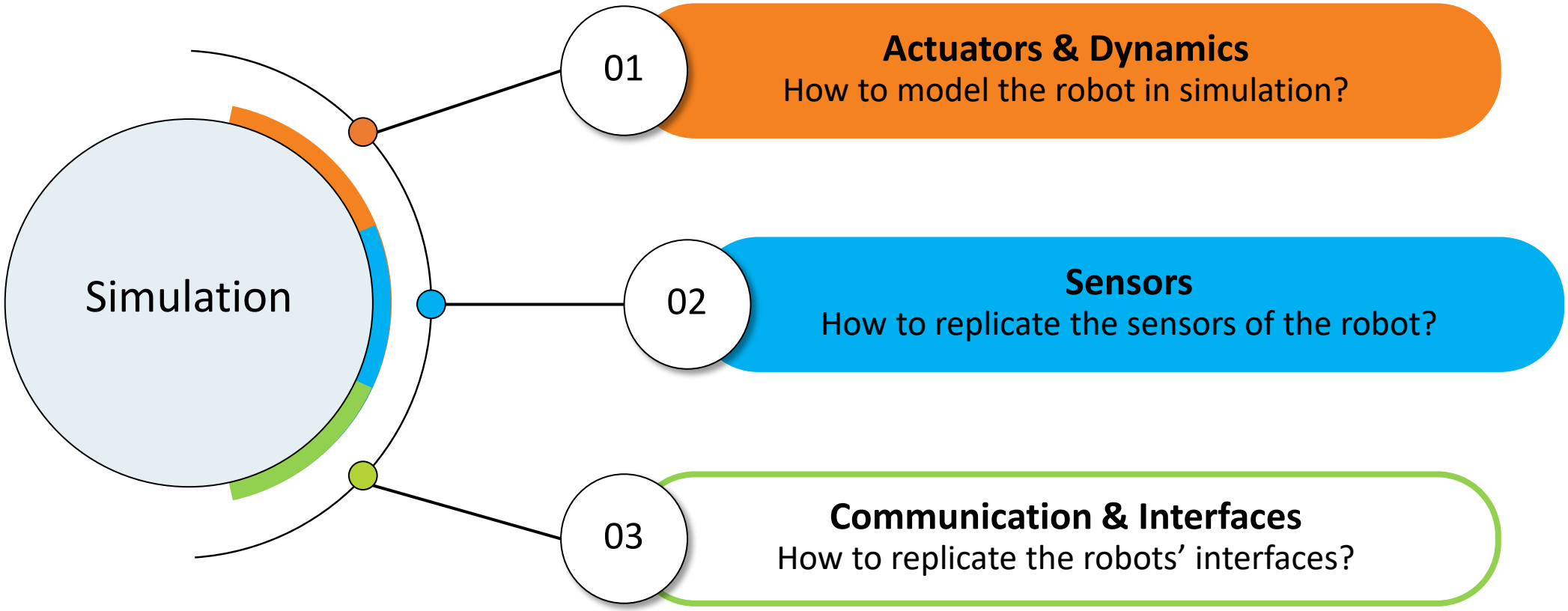

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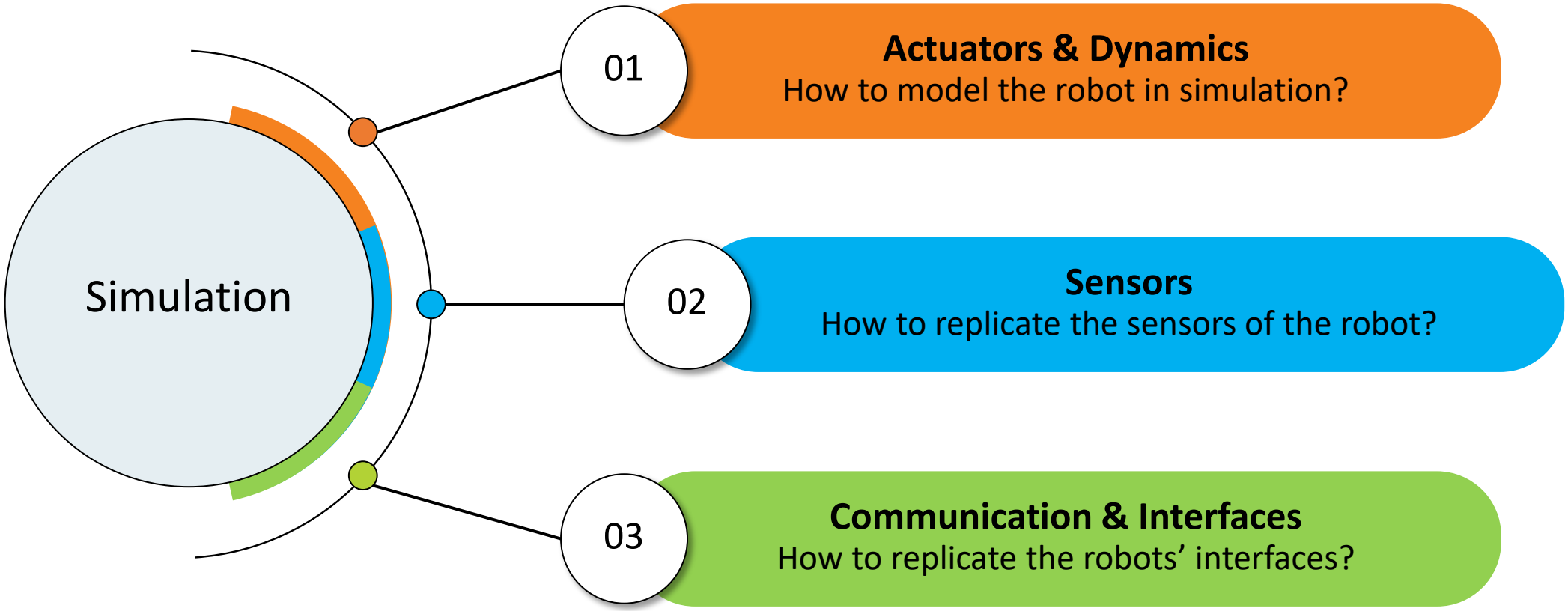

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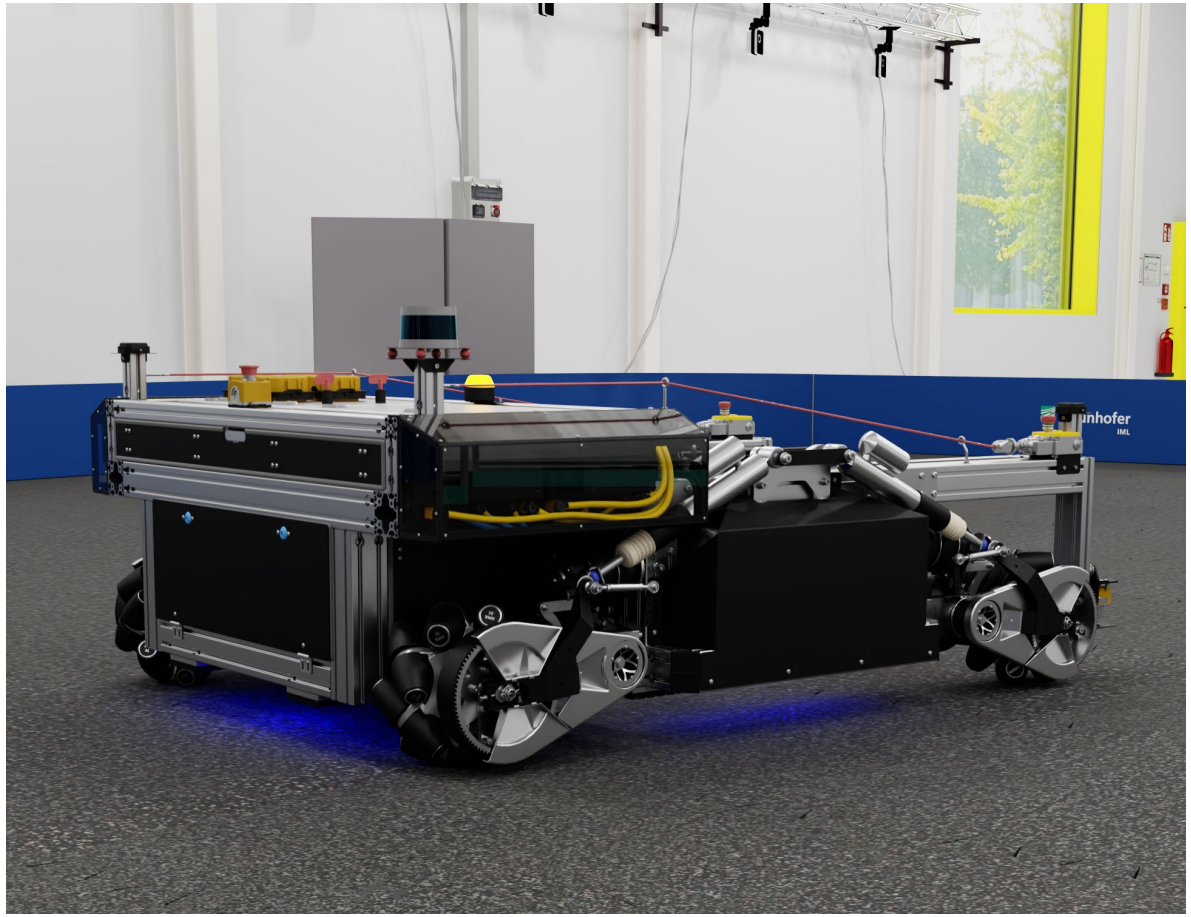
Communication & Interfaces

Topics



Base Controller	/cmd_vel, /odom
Joints	/joint_state, /joint_command
TF	/tf, /tf_static
Sensors	/laser, /point_cloud
Custom Msgs	/battery_soc, …

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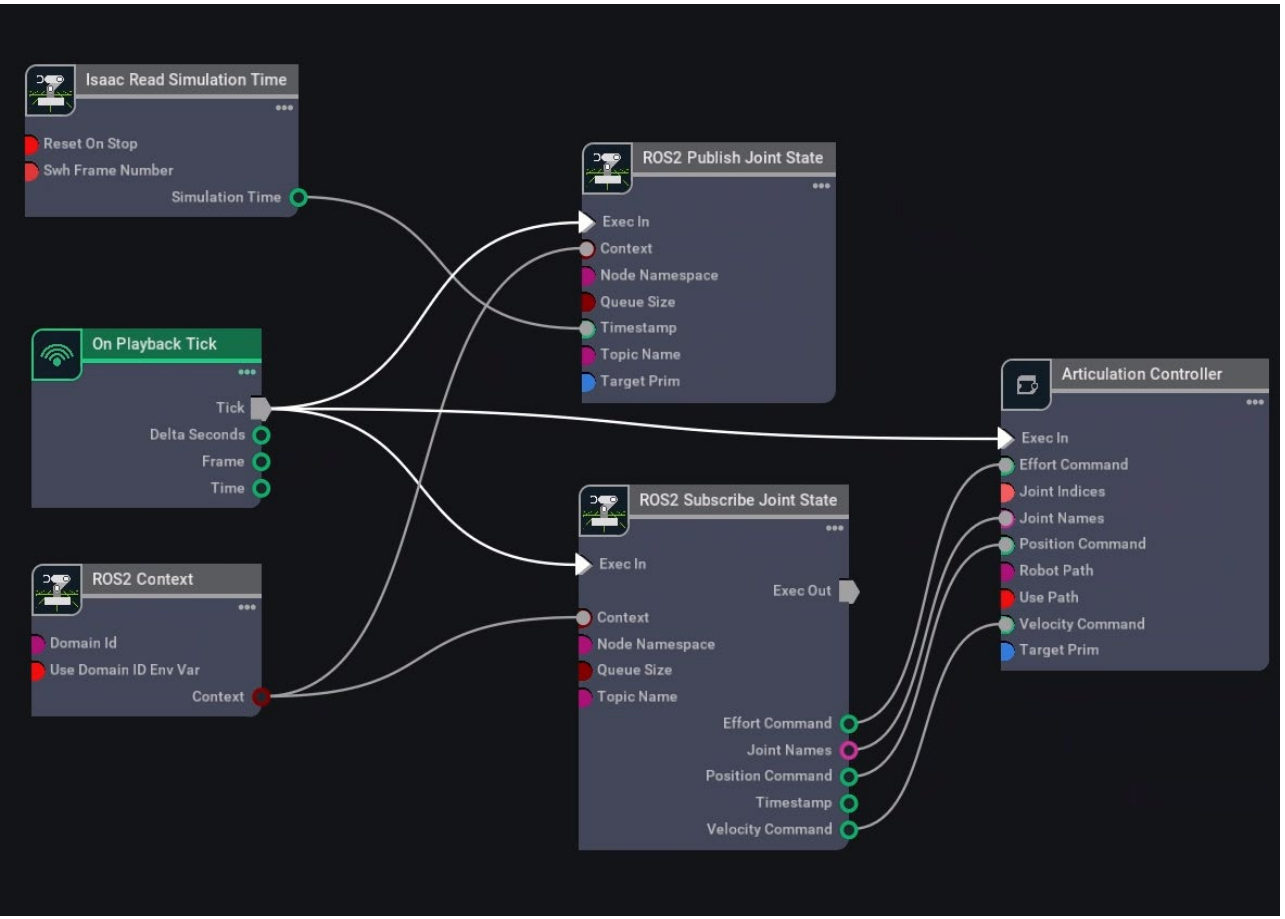
Communication & Interfaces

Topics



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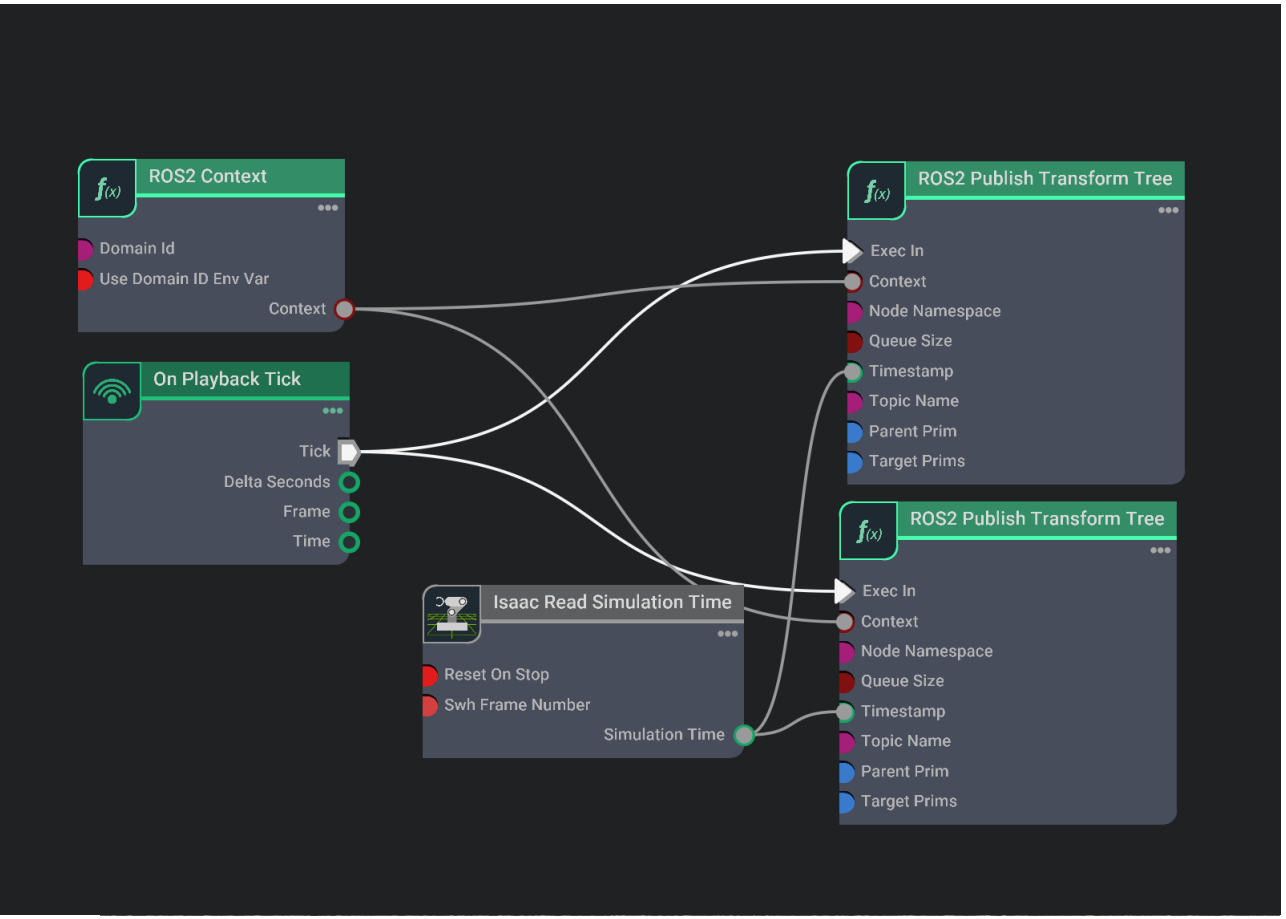
Communication & Interfaces

Topics



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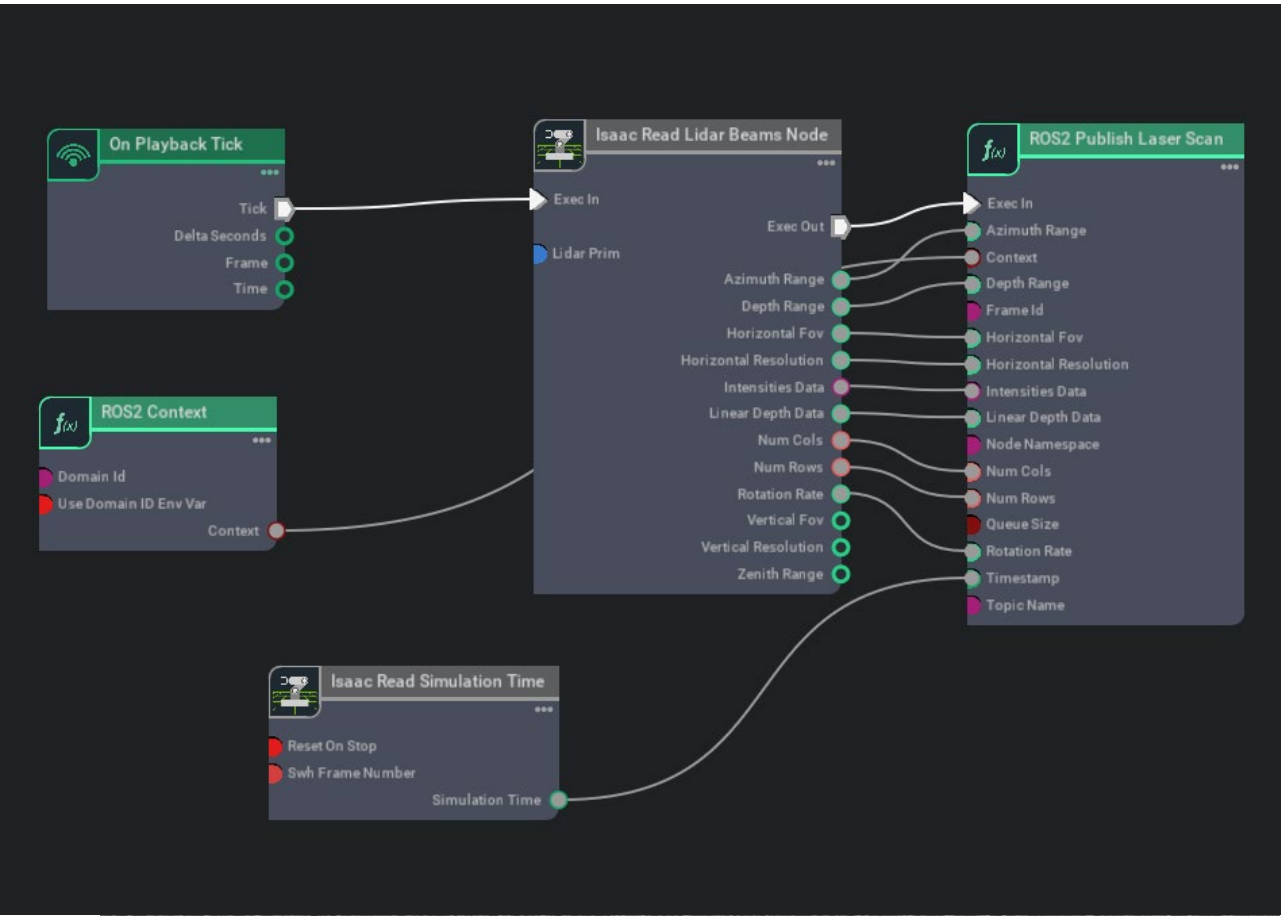

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Joints	/joint_state, /joint_command
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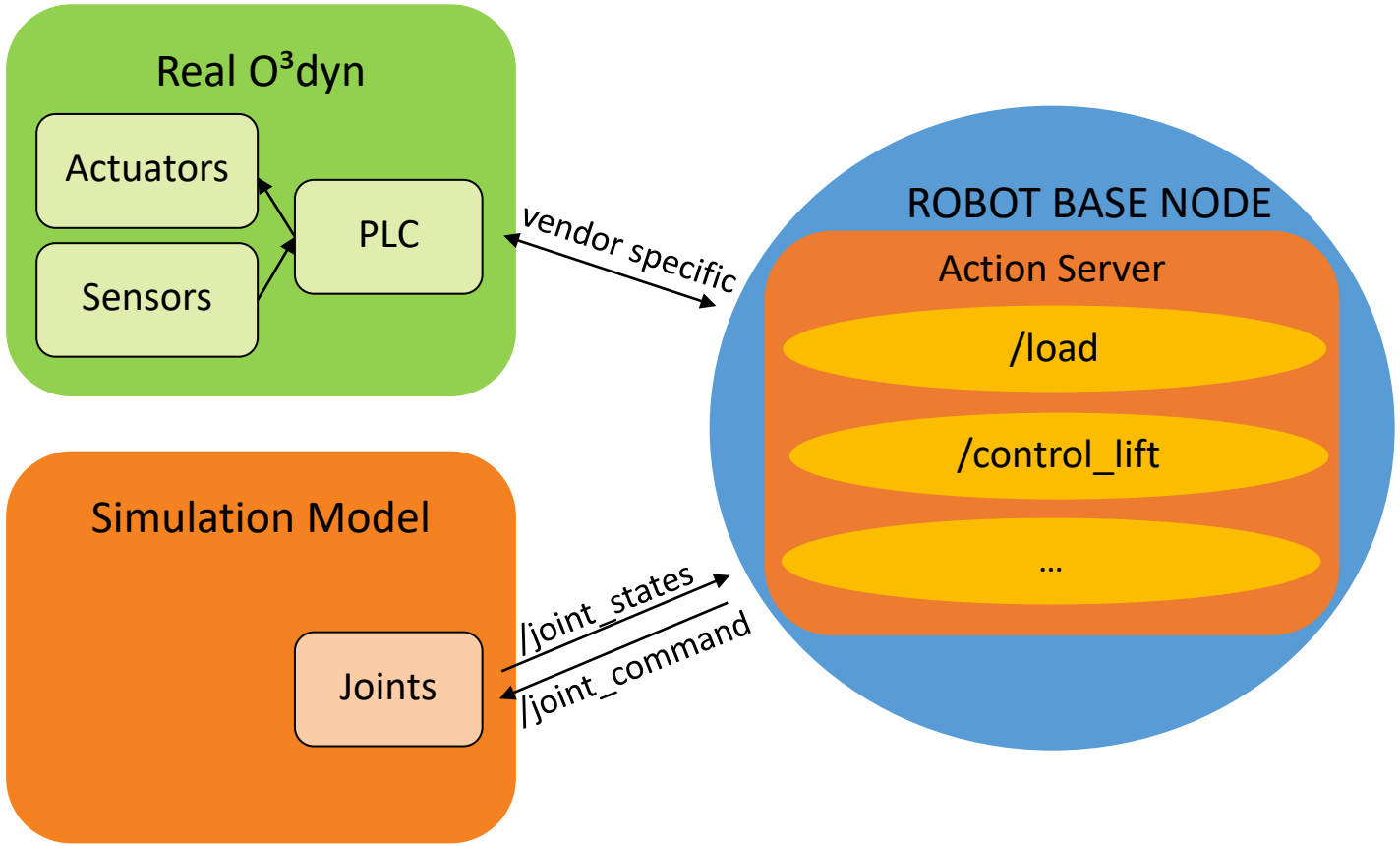
Actions and Services



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Conclusion

Simulation of highly dynamic robots is challenging – but possible! Take care of the collider modeling and use real-world data.

Isaac Sim offers a lot for robotics and has its strength within the GPU usage mainly for sensor simulation and rendering.

ROS is the bridge between simulation tools and the reality.

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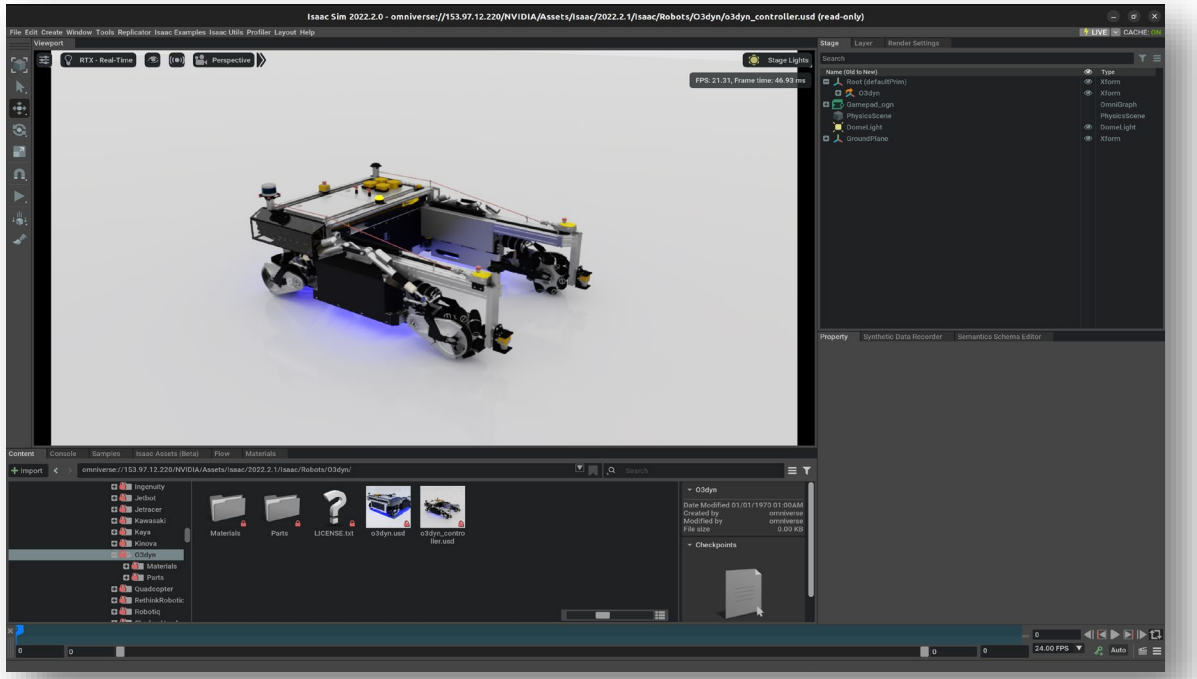
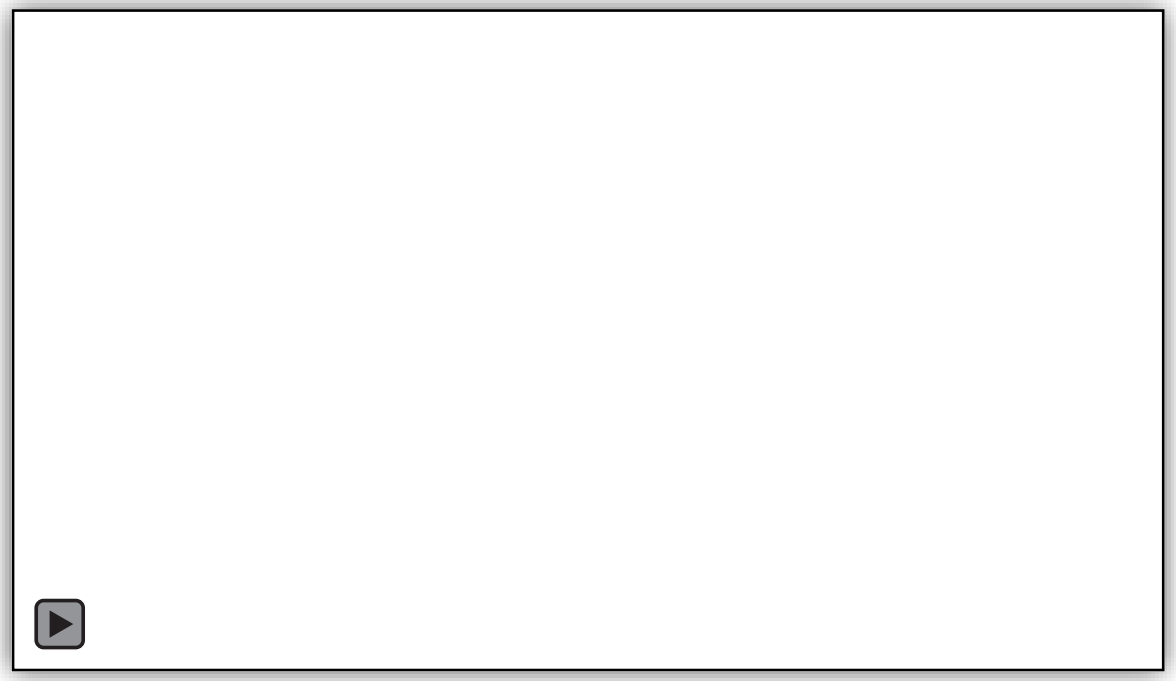
Check Out the O³dyn Simulation Model at Home!





O³dyn on your Nucleus

omniverse://localhost/NVIDIA/Assets/Isaac/2023.1.0/Isaac/Robots/O3dyn

Open source @ Open Logistics Foundation

https://git.openlogisticsfoundation.org/silicon-economy/simulation-model/o3dynsimmodel/

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AI and Autonomous Systems
marvin.wiedemann@iml.fraunhofer.de

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Thanks to:
Renato Gasoto[2], Ossama Ahmed[1], Anna Vasileva[1], Elisabeth Drache[1], Steffen Daniel[1], Mrunal Hatwar[1], Jan Finke[1], and Sören Kerner[1]

[1] Fraunhofer IML
[2] Nvidia

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