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Azure Edge Robotics

A stylized illustration of a person wearing a VR headset, set against a dark teal space background. The background features a large orange planet, a ringed planet, a satellite, and various stars and nebulae.

Mixed Reality Toolkit with ROS2

Azure Edge Robotics

- ROS Nodes for Azure & Windows
 - ONNX (ML) Inferencing
 - Windows Camera + RTSP
 - Language Understanding
 - Azure Kinect
 - Azure IoT Hub
- Azure 'RoboOps'
 - VMs for ROS
 - Github/Azure DevOps
- VSCode ROS Extension
 - 120,000+ Installs
- ROS on Windows
 - 190,000+ Installs
- Community Engagement
 - ROS 2 Technical Steering Committee
 - ROS Industrial Consortium
 - ROSCon Sponsors

<http://aka.ms/ros>

What is the
Mixed Reality Toolkit?

- User Interface Toolkit
 - Cross Platform
 - Supports AR & VR
- <http://aka.ms/mrtk>
- Unity & Unreal Game Engines
- Develop with Visual Studio 2019

Hololens + ROS

ROS1

- ROS#
 - <https://github.com/siemens/ros-sharp>
- ROS Bridge
- Web Socket

ROS2

- ROS2.net + MRTK
 - https://github.com/ms-iot/ros_msft_mrtk
- ROS2 runtime UWP native
- Direct DDS deserialization
- ROS2.net for Unity
- Investigating ROS MRTK for Unreal

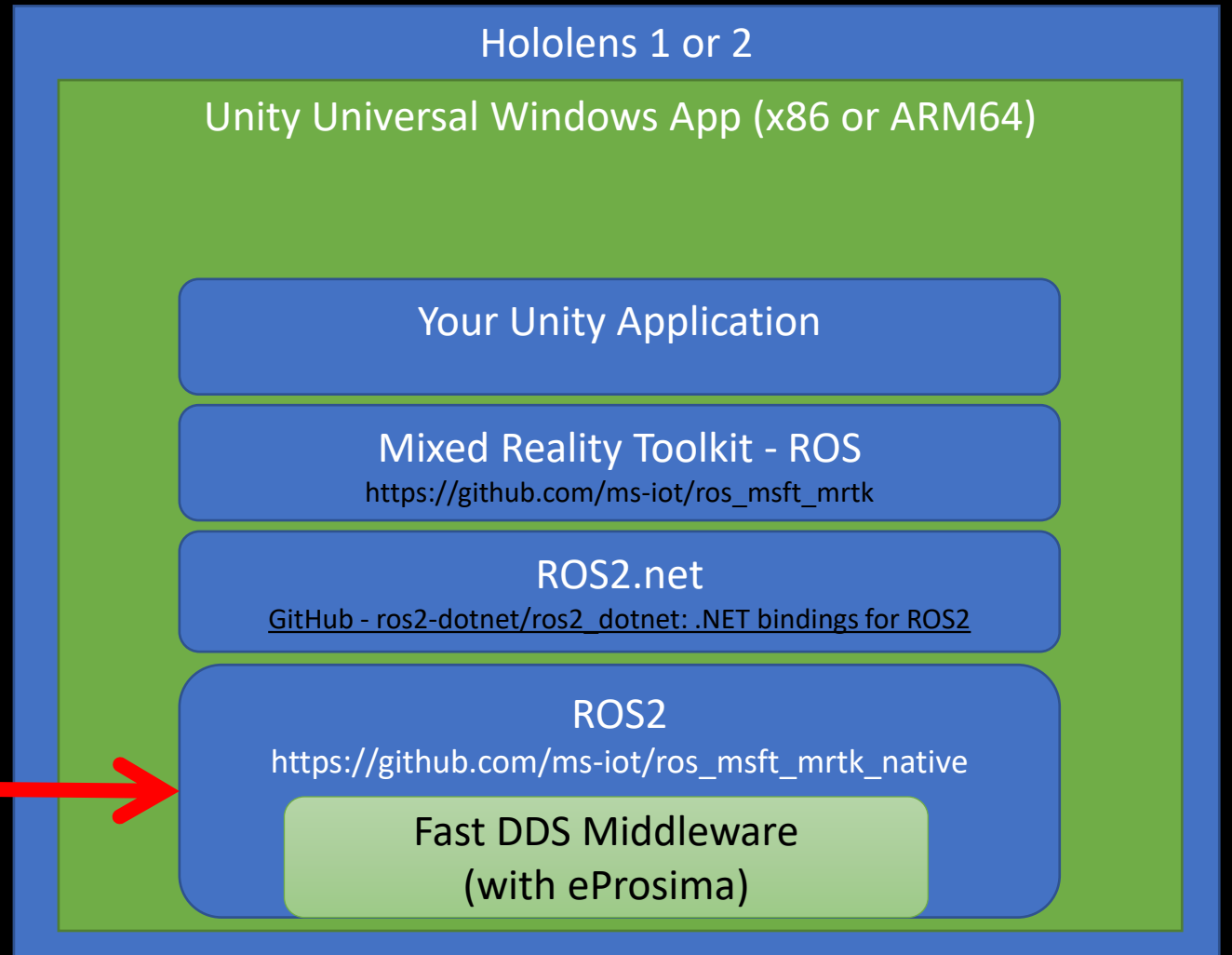
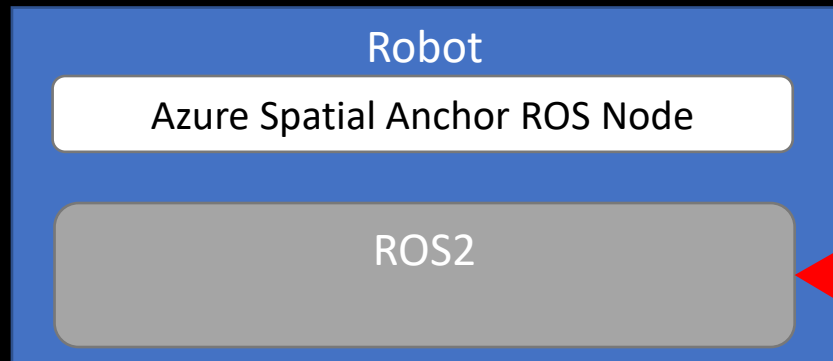
Challenges

- Hololens requires UWP
 - Small subset of Win32 APIs
- Resource Constrained
- Capability Constrained
- ARM64
- Spatial understanding mismatch
- Dev iteration

Resources

- <https://aka.ms/ros/mrtk>
 - In development
 - Migrating to Foxy
- https://aka.ms/ros/mrtk_native
 - In development
 - Migrating to Foxy
 - ROS2 nuget for UWP
 - ROS2 + ROS2.net UPM for Unity

Software Stack



Spatial Pinning

Spatial Pinning via QR Code or Azure Spatial Anchors

TF2 Spatial translation from Robot through world to HoloLens

Visualization Assets

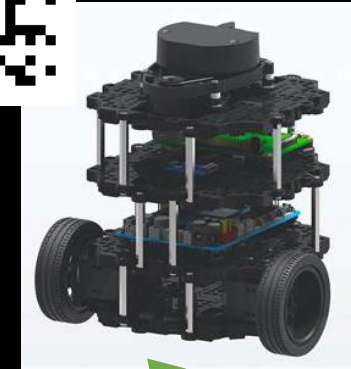
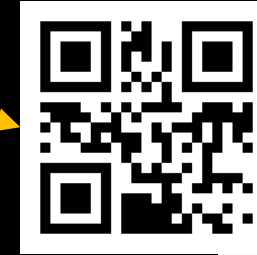
Interaction Assets

Changing from Apriltag to QR Code



Use QR Code to estimate the pose of the fiducial tag attached to the robot relative to the HoloLens camera.

The pose of the QR Code relative to the odom frame in the URDF.



Use tf2 to get the transform between the fiducial tag and ROS world zero.

ROS World Zero

Use **tag offset from camera** + **tag offset from ROS world zero** to calculate the location of the **MRTK world anchor** in Unity space.

Once the MRTK anchor is placed, QR Code is no longer needed. All updates to robot pose can be pulled from tf2.

Thank you

<http://aka.ms/ros>

