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**Designing Software for Metrology-Driven Control  
in Multi-Robot Manufacturing Cells**

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# About Us



- Founded in 2013, Highly specialist team based in Bristol, UK
- Metrology and automation expertise
- Portfolio of products focused on automation performance improvement
- Experience across a range of sectors, primarily Aerospace, Automotive and Nuclear



We offer a unique blend of expertise in  
high-value manufacturing, metrology and  
automation

... leaders in robot-improvement  
technology and related services.

## PRODUCT



Automation Monitoring & Control:  
IONA™ & ORA

## SERVICES

- Metrology Services and Consultancy
- Robot diagnostics and calibration
- Research and Development

# Significant Trend Towards Intelligent Automation

Manufacturing methods need to be:

- More autonomous
- More flexible
- Deliver higher performance



*THE SOLUTION: Provide robots with context, awareness and feedback from the process*

## Unique Intelligent Automation Solutions

- **IONA** – Robot Tracking and Guidance Technology  
Combined Hardware Sensors and Software. Unique solution providing accurate tracking and guidance for industrial robots. Improves flexibility for robot applications and enhances accuracy.
- **ORA** – The Live Digital Twin with Real Time Control  
Global coordinate frame management, allowing visualization, correction and measurement of coordinate frames from sensors, robots, fixtures and other key datums
- **Renishaw** – Robot Verification and Calibration Tools  
Re-seller for Renishaw automation products. Robot health check, diagnostic tool and calibration tools.

I O N A



ORA



**RENISHAW**  
apply innovation™



INSPIHERE has recently undertaken a re-engineering of our software platform: ORA.

During this development we encountered some unique challenges – some resolved, some ongoing – and we thought we would share.

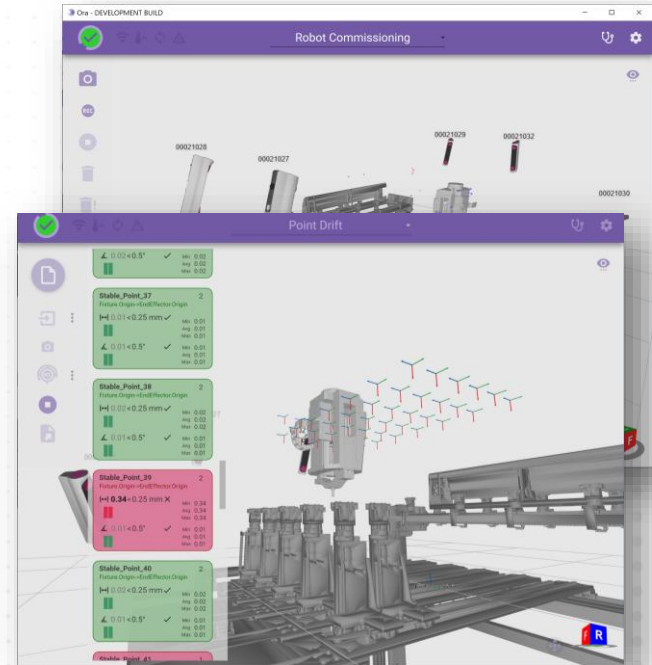
# What is ORA?



- Originally designed to accompany our sensor technology IONA.
- Where ORA handles the various calculations, spatial transforms and interactions using IONA data.
- ORA subsequently serves data to robot controllers, PLCs, or industrial comms.

The main functions are:

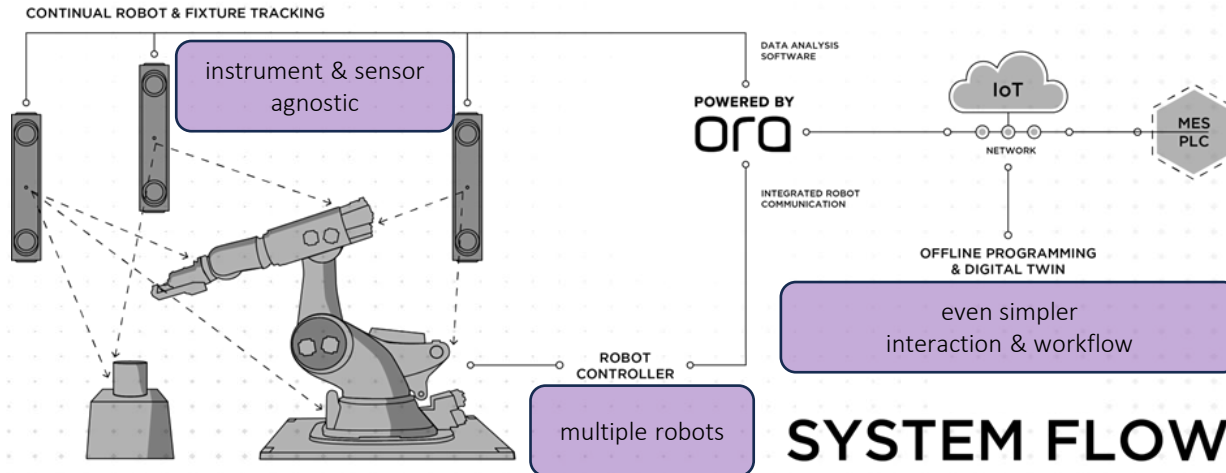
1. Active datum update
  - Maintains robot Tool and Base relationship as well as workpiece relationship
2. Active robot correction
  - Real time adjustments to points
3. Robot performance monitoring
  - Verification and monitoring of robot paths using Red Amber Green indicators
4. Data and comms integration
  - Major robot programming languages, ROS
  - Industrial Comms protocols - MQTT, OPC-UA



# Why Overhaul ORA?



- Our Robot API receives positive customer feedback – being easy to adopt and use in typical workflows.
- Our customers wanted expand ORAs capability: to control multiple robots from multiple sensor inputs, all within a single environment.
- ORA had many of the elements in place, but a ground-up build was required to create truly flexible platform.

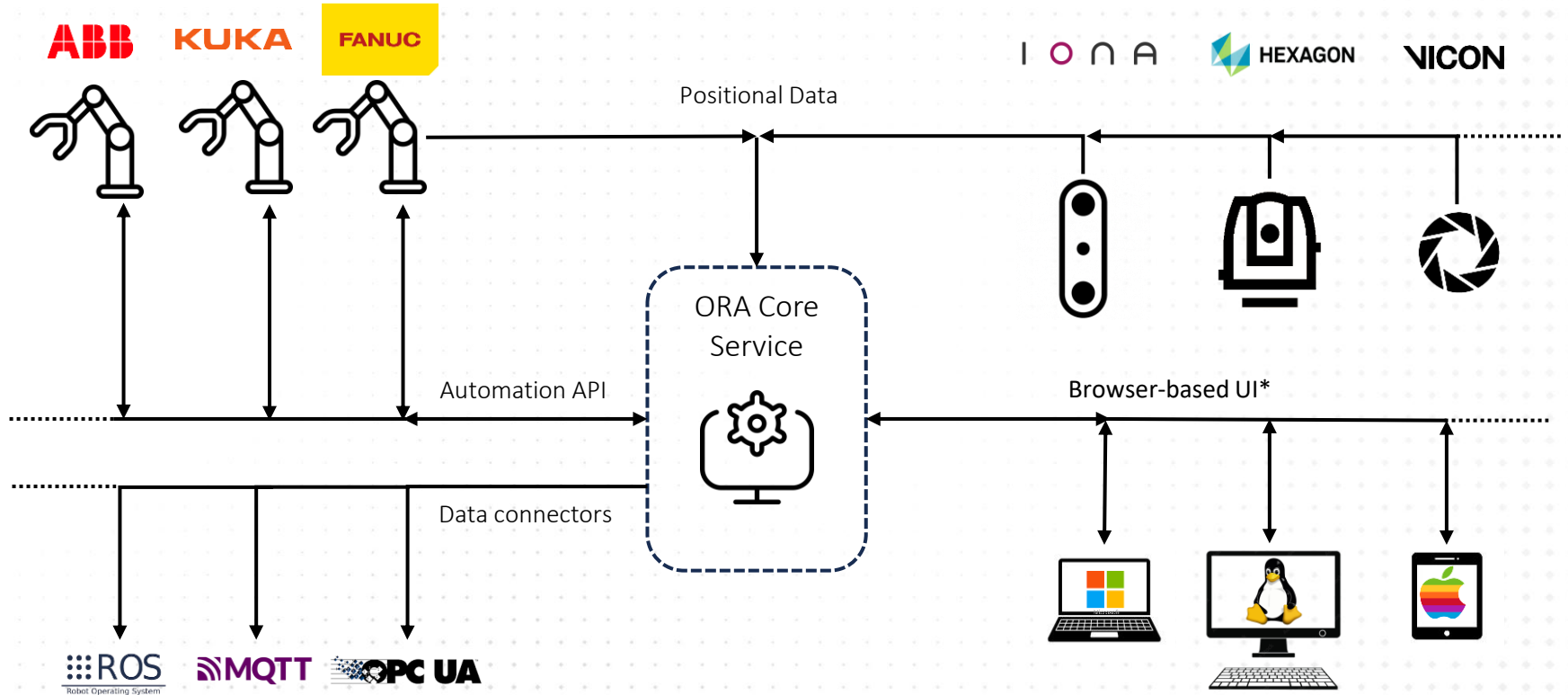


This presentation covers our approach to overcoming the practical and system-level challenges faced when integrating multiple metrology systems into the control loop of multi-robot manufacturing cells.

Key challenges include:

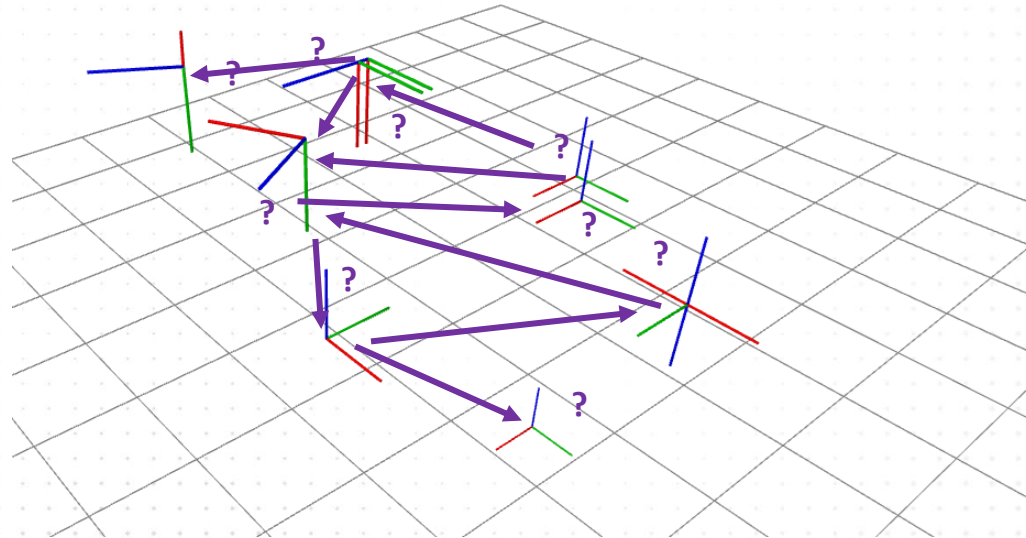
- frame management and spatial context
- managing measurement integrity across multiple instruments
- designing data pipelines

We began by designing a framework to accommodate these elements...



\* UI for visualisation & configuration, not required for operation (headless)

*Frame management and spatial context—dealing with robot coordinate systems, global references, and local sensors, and making sure all data lands in the right frame before it is used in control logic.*

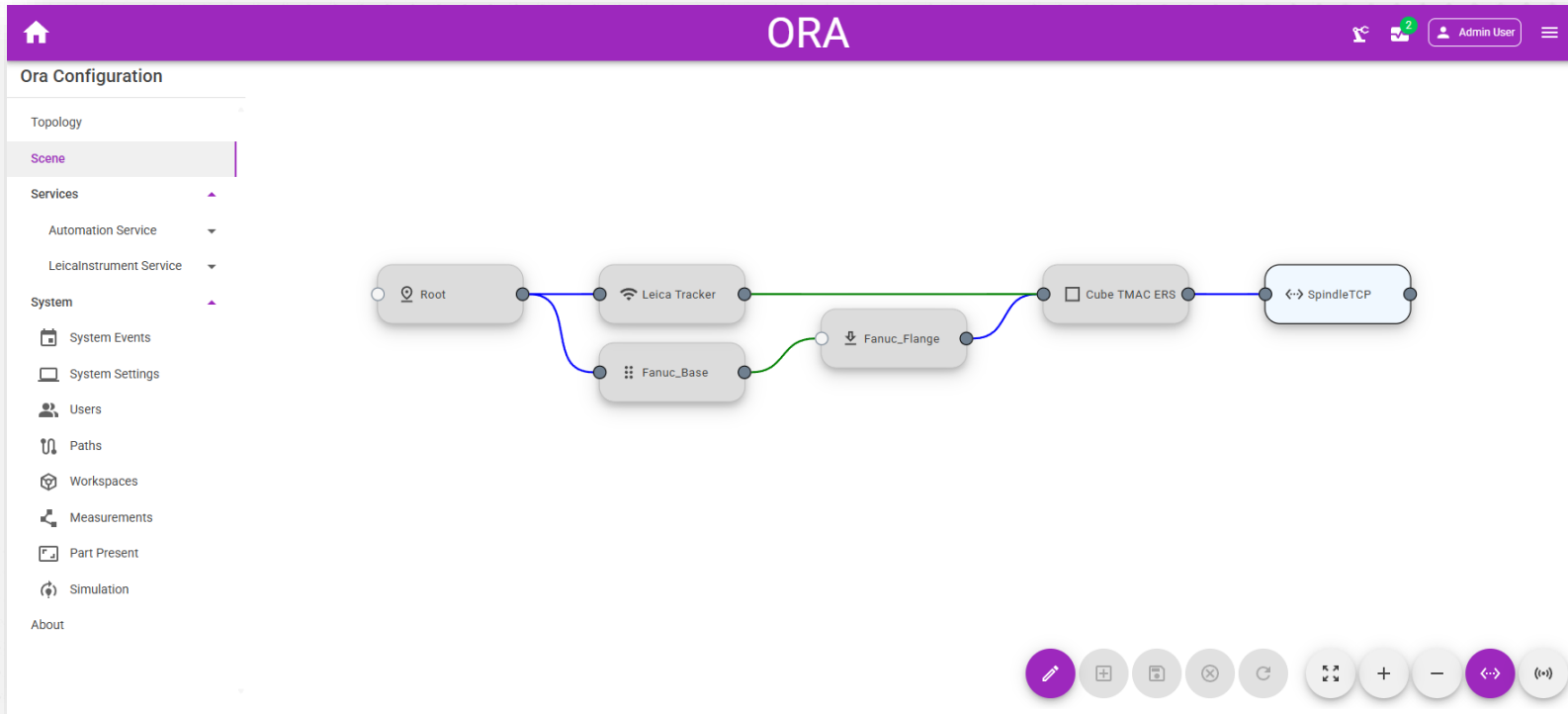


**Simplify how a user defines complex spatial interactions**

# Frame Management: The Scene-graph



Simplified frame management interface:

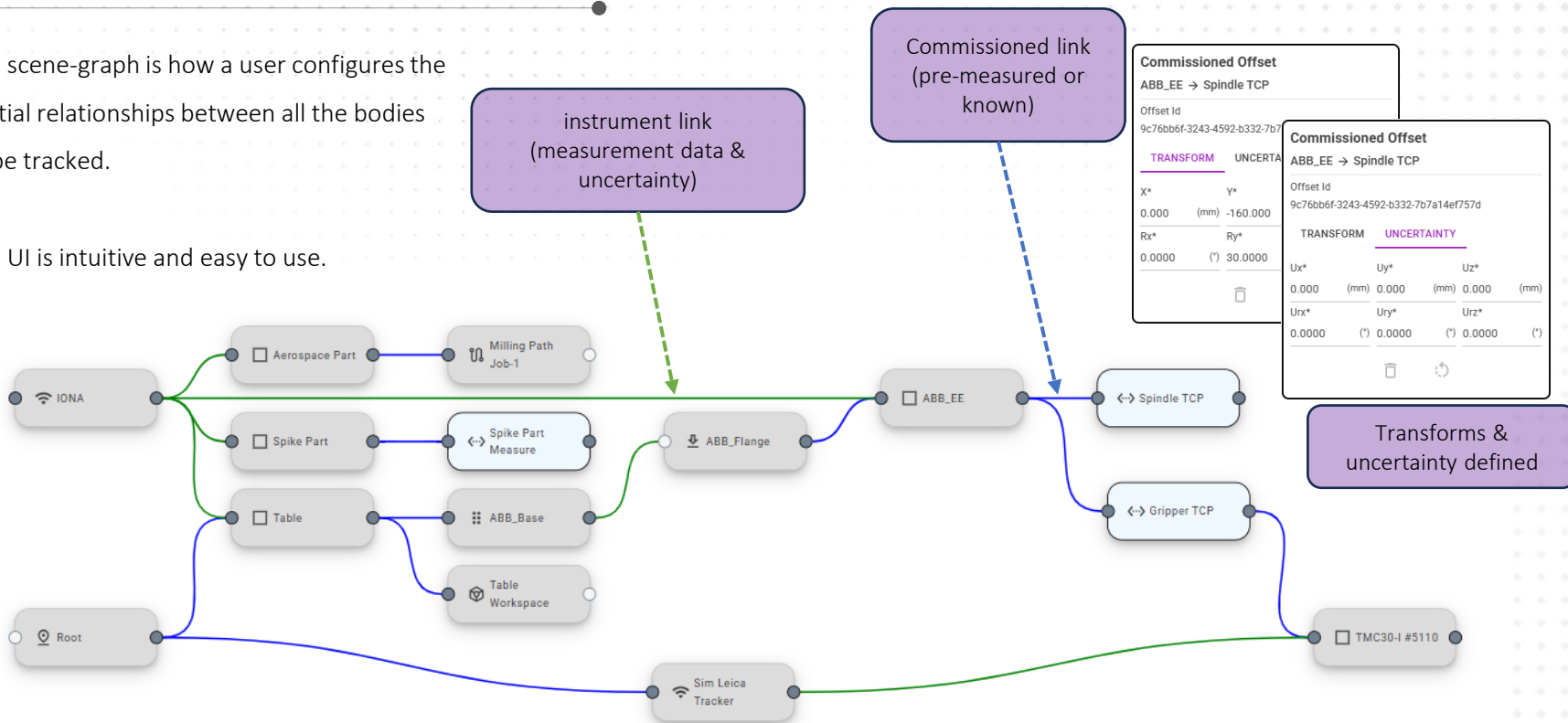


# Frame Management: The Scene-graph



The scene-graph is how a user configures the spatial relationships between all the bodies to be tracked.

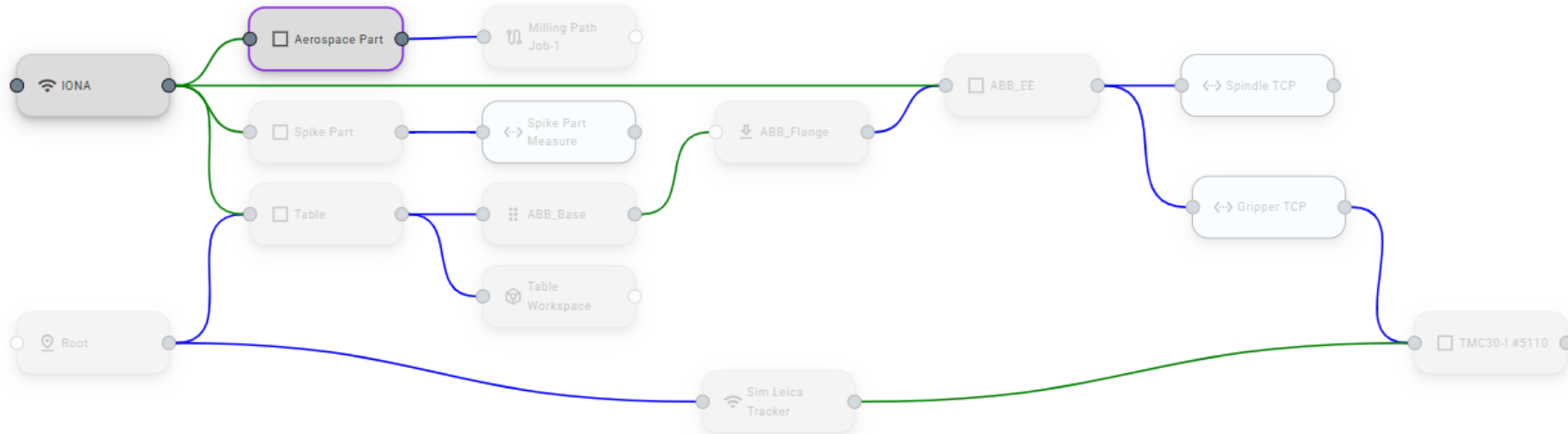
The UI is intuitive and easy to use.



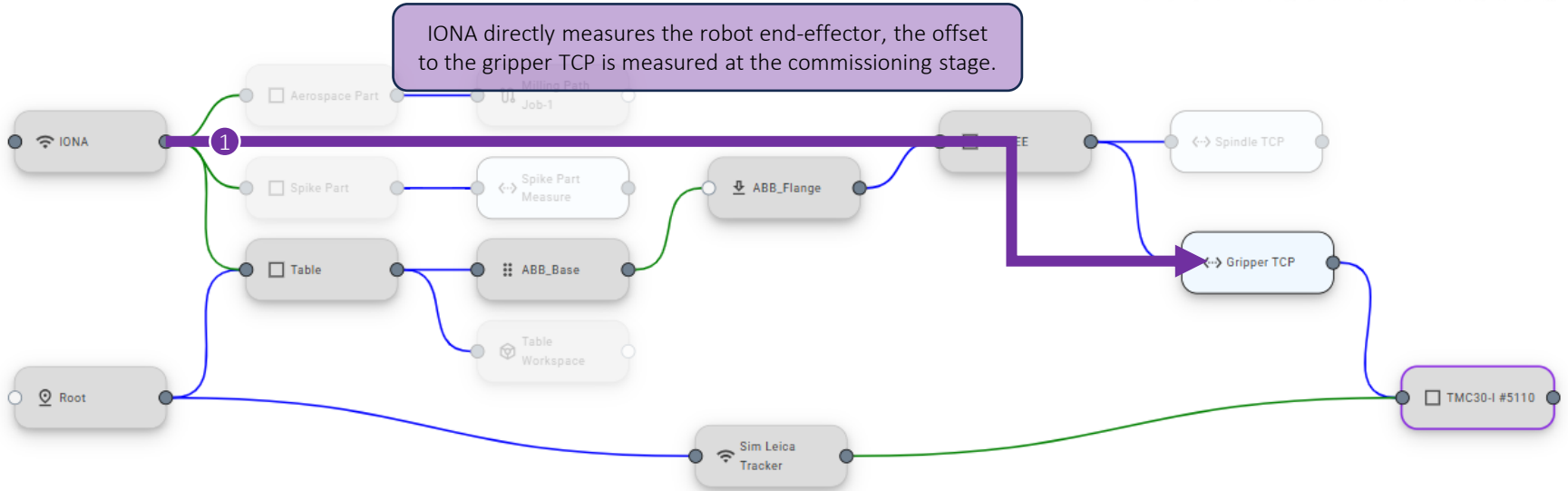
# A single path graph-node



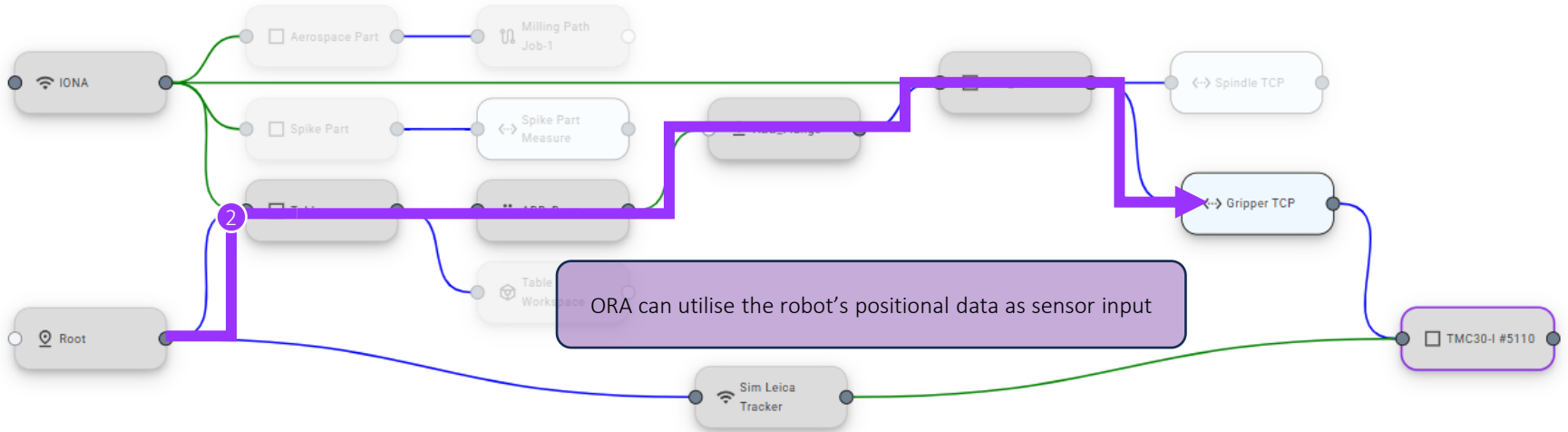
IONA is the only path – measured or commissioned – to the “Aerospace Part”



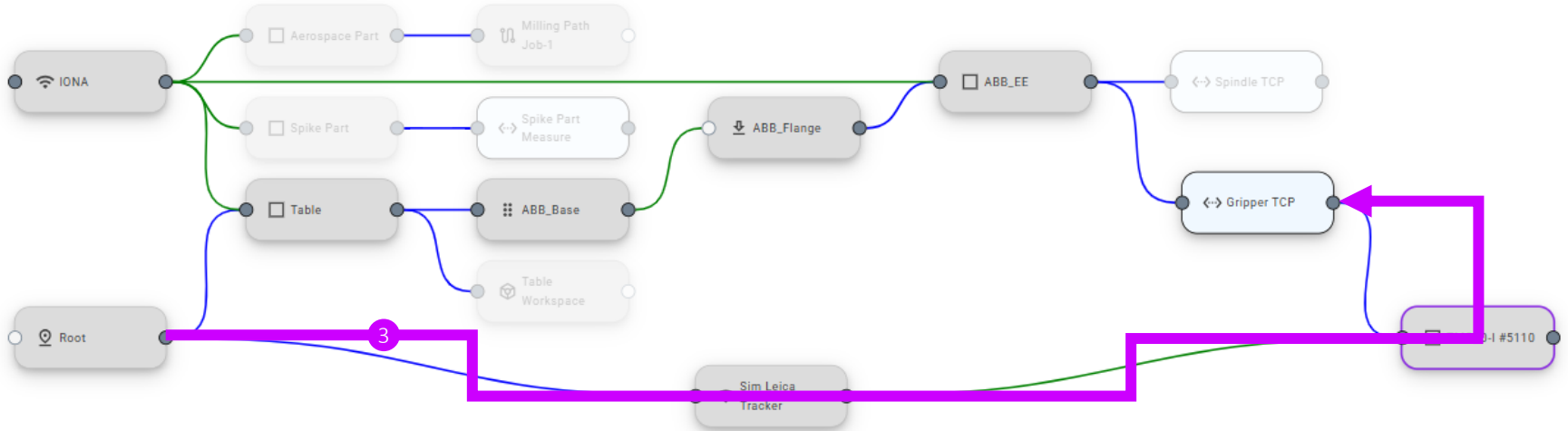
# Multi-path graph-node



# Multi-path graph-node



# Multi-path graph-node



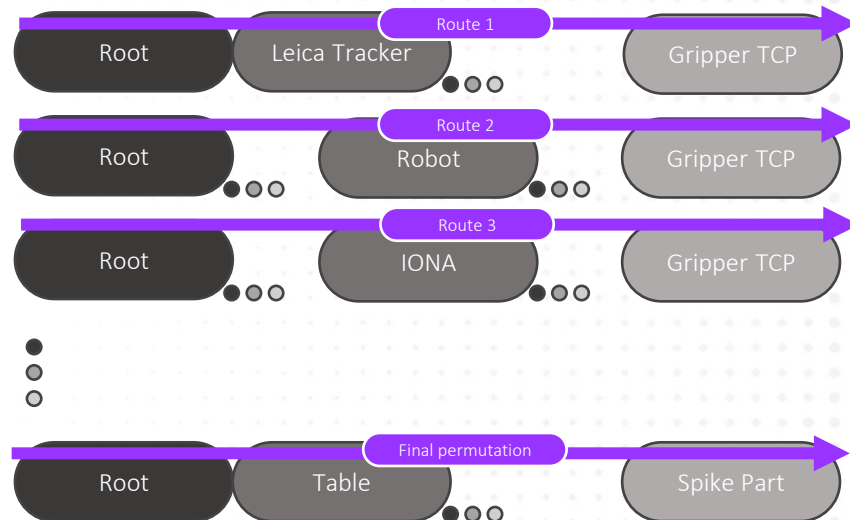
The laser tracker also has a path to the Gripper TCP via a T-Mac & commissioned offset

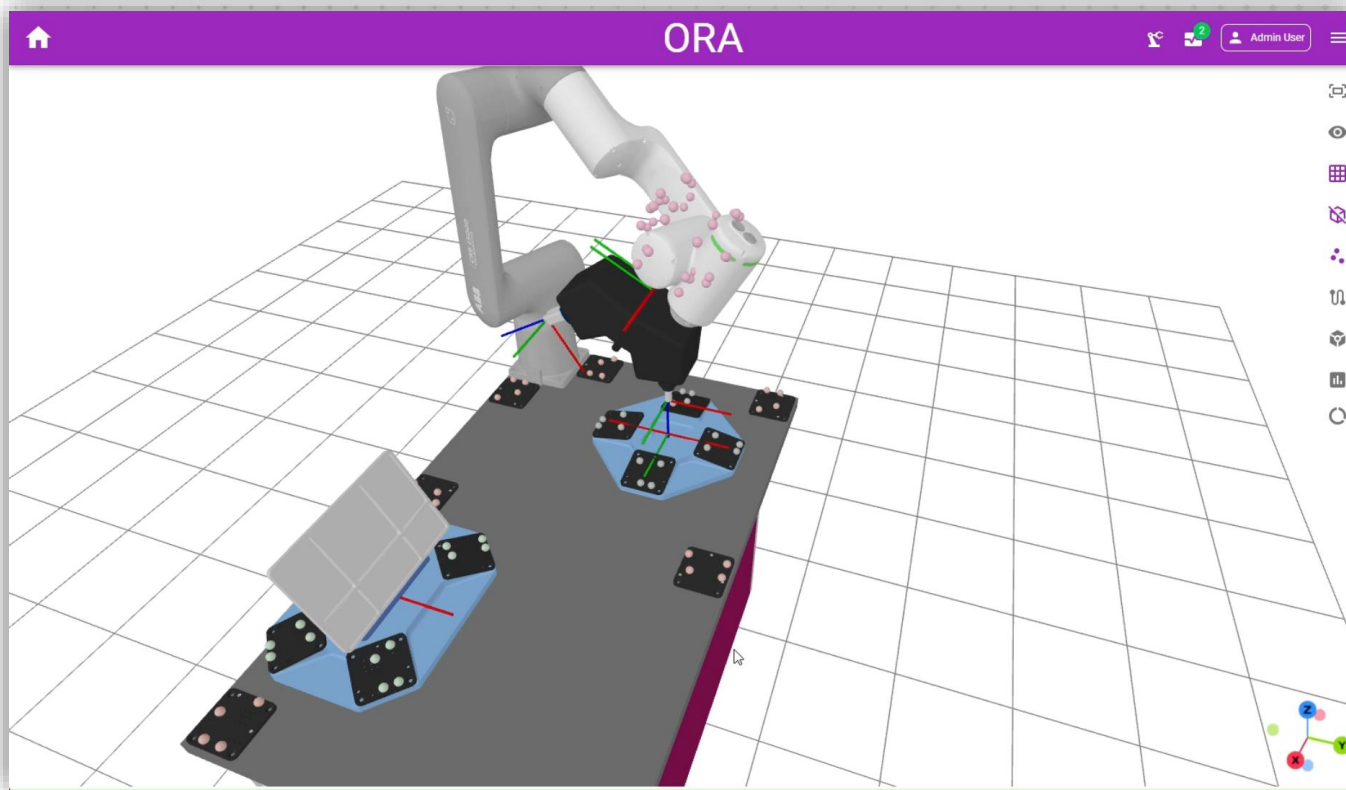
# Frame Management: The Scene-resolver



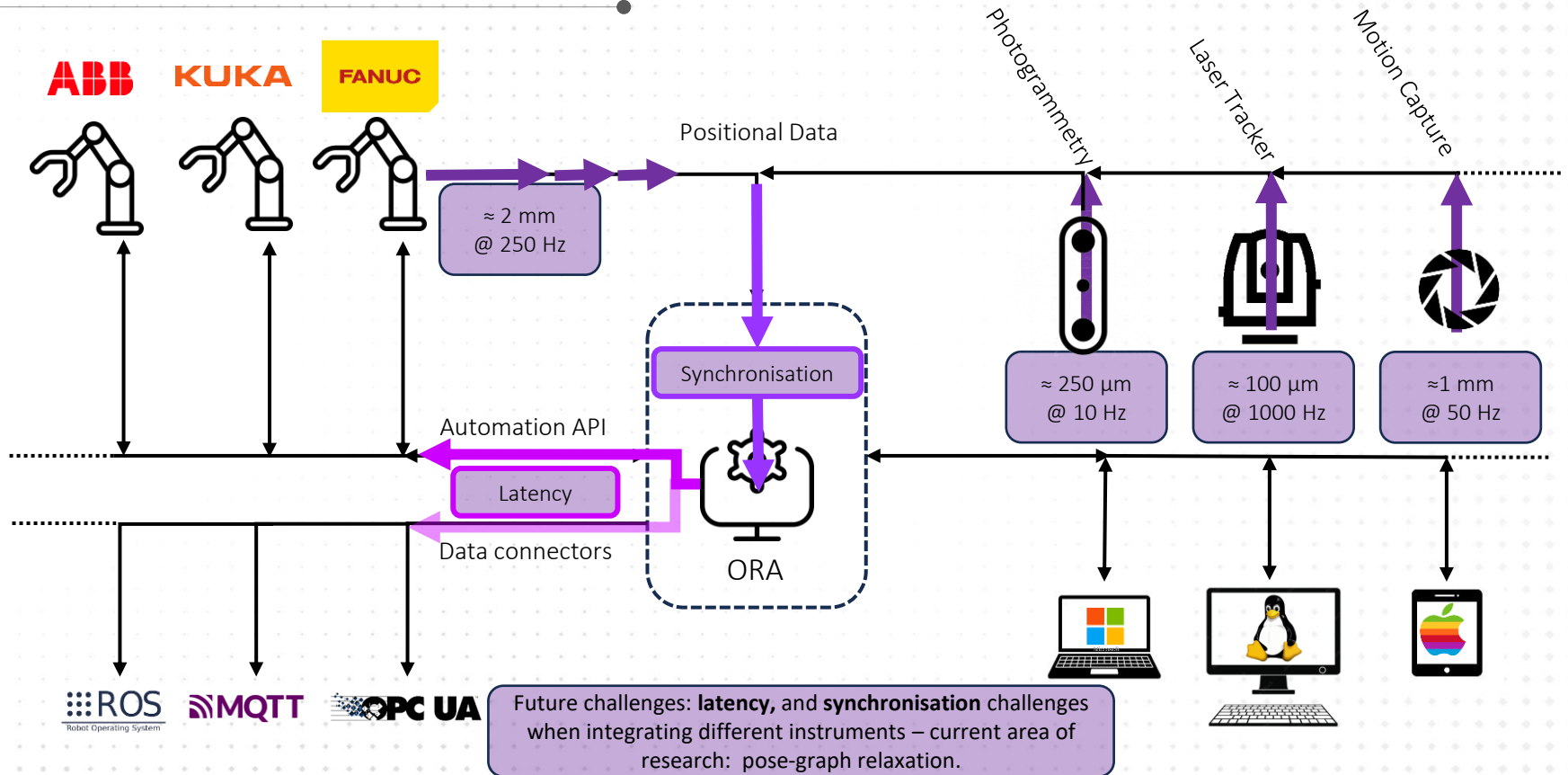
*Managing measurement integrity across multiple instruments—laser trackers, photogrammetry, vision systems—each with their own strengths, update rates, and uncertainty models.*

- Our current approach flattens the structure, for each graph-node and map the path from the root.
- The **transformation path** is **calculated**, and the **uncertainty** is **propagated**.
- An **optimal route search** for the path that takes the **least uncertainty** to a node is calculated.
- The resolver frequency is currently set to match the instrumentation in the scene.

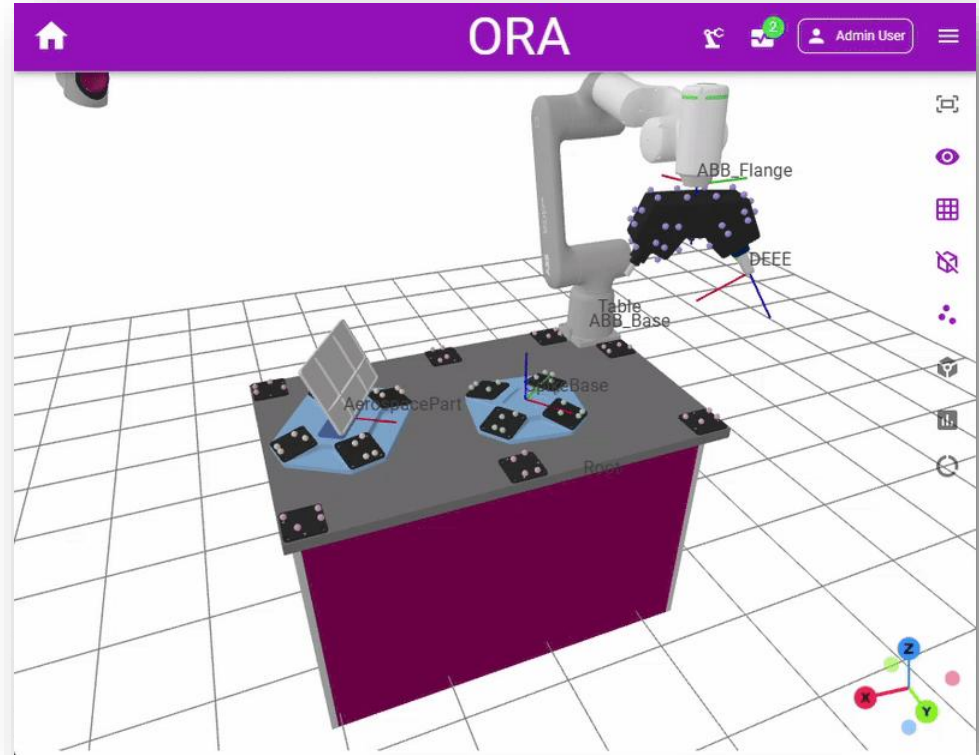




# Future Scene Resolver Challenges



- New scalable Architecture
- Simple scene graph interface for configuring complex cells
- Scene resolver determining optimal measurement positions
- Capacity and structure for utilising data to further reduce uncertainty in future.
- Challenges with data synchronisation as processes become more dynamic.





## Measurement



Automation

Services

Training

Consultancy

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