



ELYSIUM

**POINT CLOUD
MANAGEMENT: AN
OVERVIEW OF CURRENT
PRACTICES AND
TECHNOLOGY**

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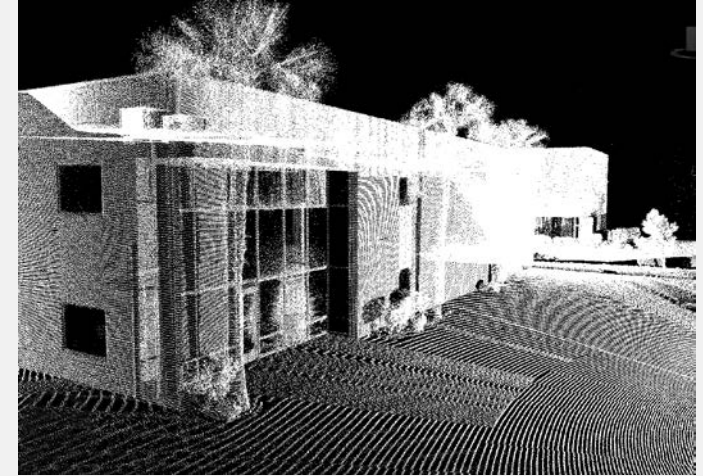




OVERVIEW



What is a point cloud?



Types of scanners

Hardware implications



Working with a point cloud



Outputs from a point cloud



Takeaways

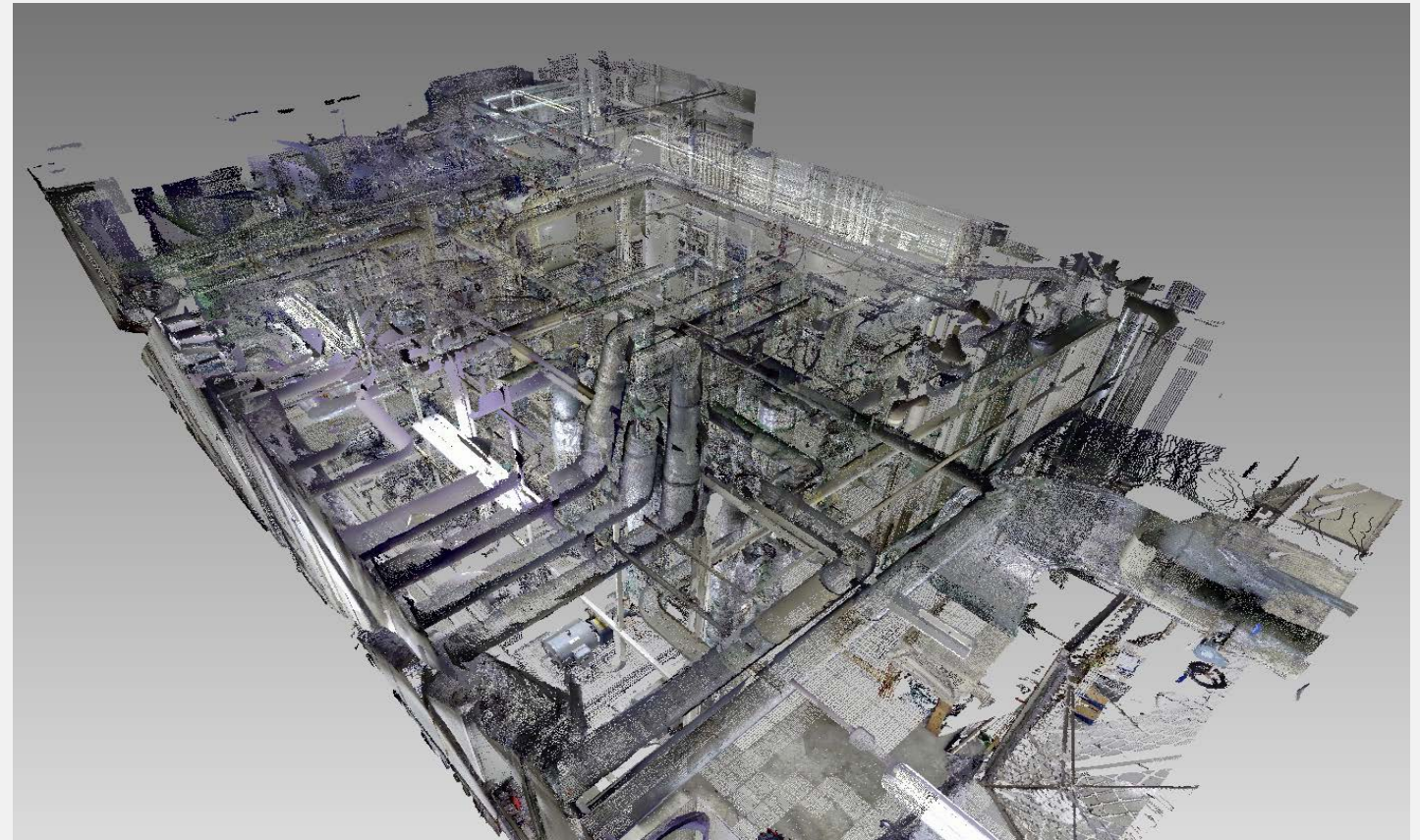




WHAT IS A 'POINT CLOUD'?

Point clouds are the millions of points created by a scanner, all clustered together to form an environment or definition of a three-dimensional space.

Point clouds are formed through many different methods.





PHOTOGRAMMETRY

- Software used to assemble images
- Used for generating 3D models and/or point clouds
- More sophisticated versions can yield results that are as accurate as LIDAR
- Requires illumination
- Significant cost savings over LIDAR in most cases





STRUCTURED LIGHT SCANNERS

- Project patterns of light
- Using cameras and software, interpret the alteration of the pattern
- Generate models and/or point clouds
- 2 scanner primary types
 - Static
 - Handheld





SONAR SCANNERS

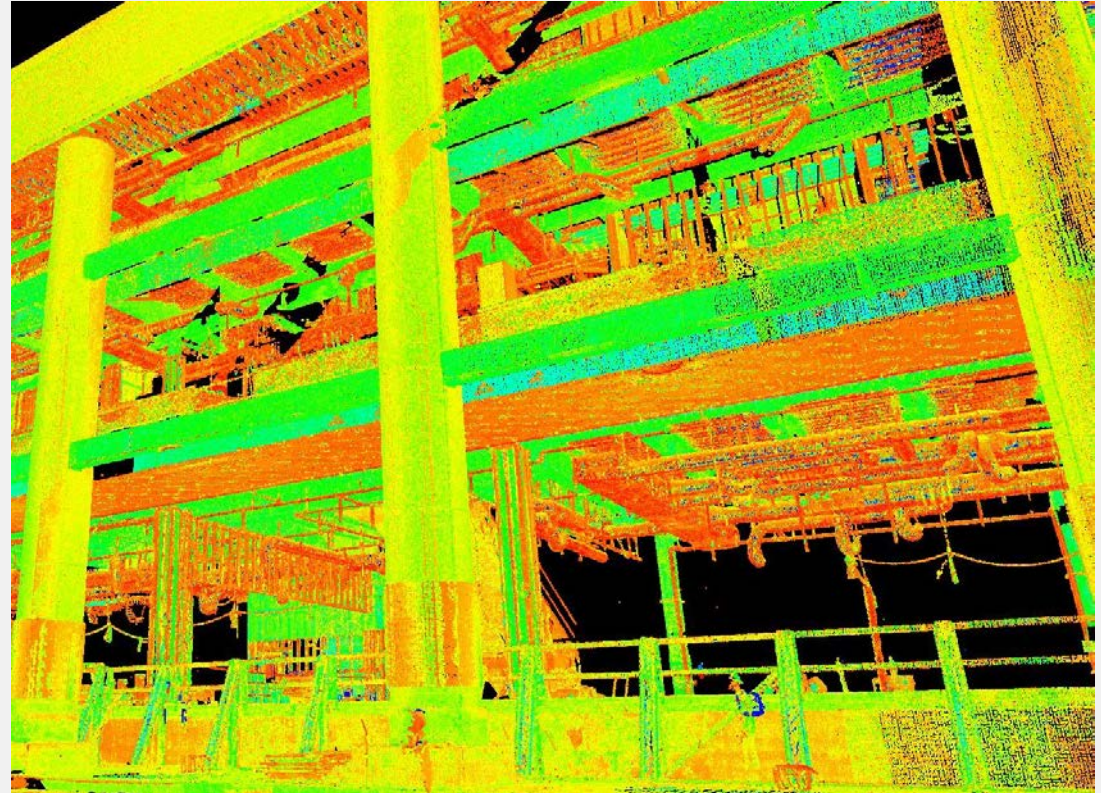
- Generate point clouds from software interpretation of sound waves
- Different configurations can generate greater accuracy, cover larger areas, or get live 3D images
- Sound wave interpretation allows the gathering of point cloud data that would otherwise be unreachable by other scanner types





LIDAR SCANNERS

- Emission of laser pulses and recording what happens to those pulses
- Two types
 - Time of flight (pulse based)
 - Phase based (continuous beam)
- Mobile scanning
 - Airborne; typically time of flight waveform processing
 - Ground based





POINT CLOUD TYPES

Structured vs. Unstructured and why it matters

- **Unstructured Point Clouds**
 - A collection of points gathered using previously mentioned methods
 - No intelligence between the points, it's the same as having a photograph, what you see is what you have.
 - Unable to leverage point cloud processing software
- **Structured Point Clouds**
 - Include relational information from point to point along with the positional information that is always collected
 - Can contain multiple properties including XYZ, RGB, intensity, and normal values along with relational information
 - Point cloud processing software can be leveraged
- **Why does it matter?**
 - Depending on intended use of point cloud, software can denoise the project, generate CAD from the environment, import external geometry, run tests and projections, etc.
 - This enables a user to perform a variety of project-enhancing operations

HARDWARE RECOMMENDATIONS

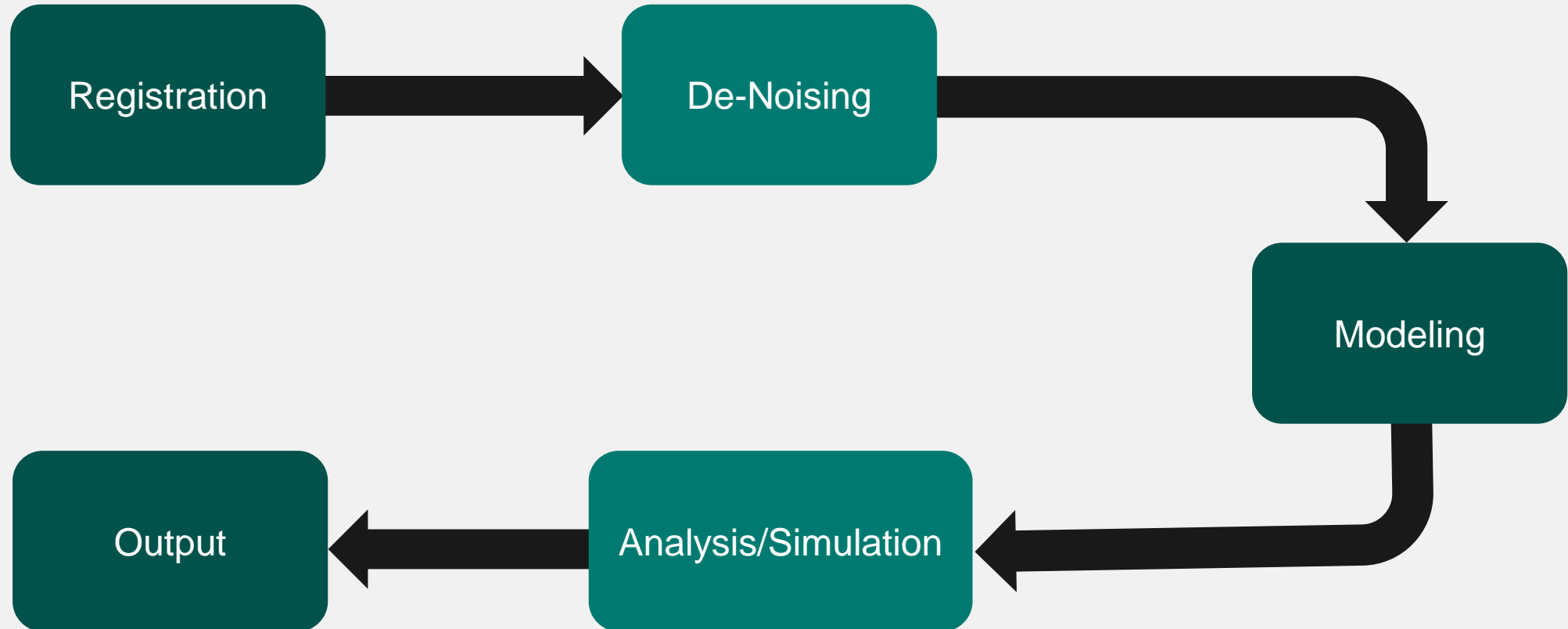


- More RAM is a plus
- A dedicated graphics card helps guarantee a smooth experience
- Disk type and space matters
 - SSDs are better than HDDs (faster read/write speeds)
 - Point cloud projects can get very large very quickly, so the more space the better
- A scanner of some kind is necessary to gather point cloud data, whether it's through photogrammetry, LIDAR, Sonar or others, a scanner will be necessary to capture the environment





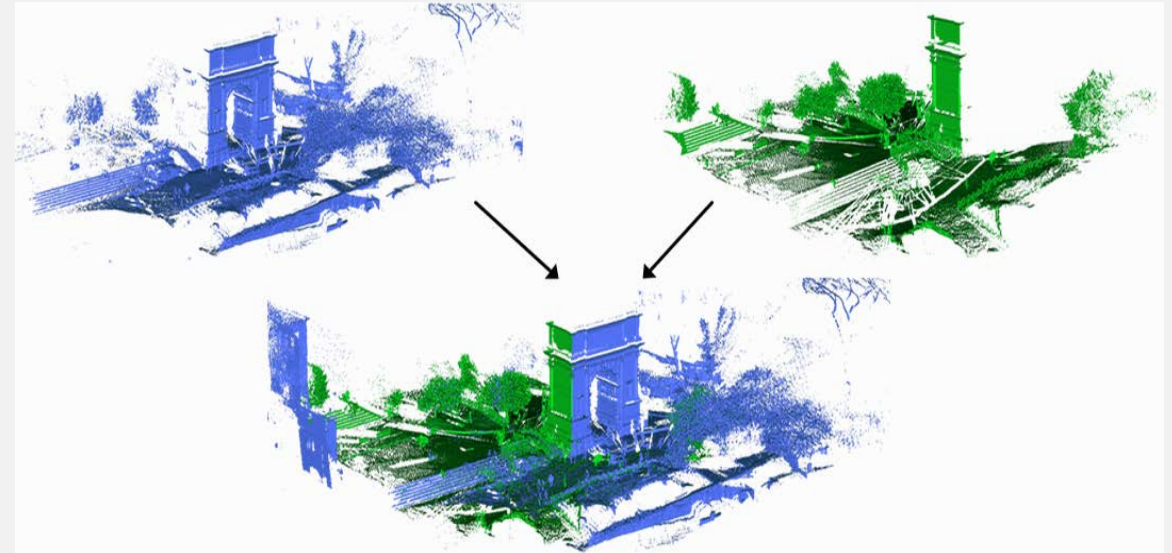
FIVE PROCESSES FOR UTILIZING A POINT CLOUD





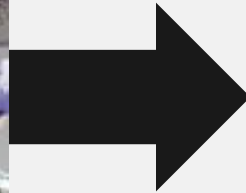
REGISTERING A POINT CLOUD

- This is the first step in the process of utilizing a point cloud
- The points captured are oriented correctly, different scans are overlaid or lined up, and a coordinate system is established if not already present





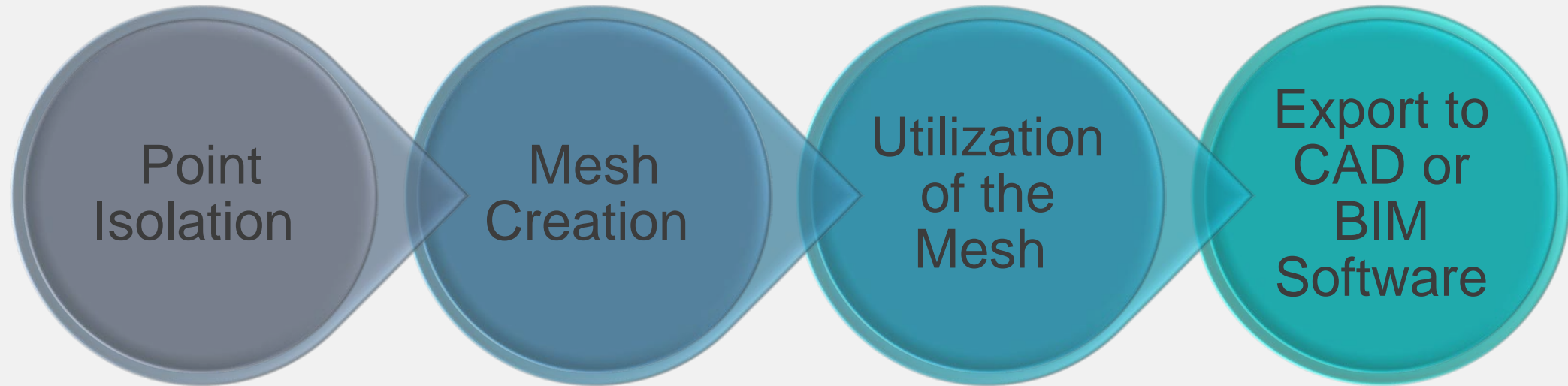
DE-NOISING A POINT CLOUD



- When scanning an environment, sometimes the same area is captured multiple times, generating noise. De-Noising a point cloud makes the environment smoother and lighter.
- Kinetic noise is often a problem as well. When someone or something passes through a scan, it can generate random clouds of points that cause unnecessary noise.



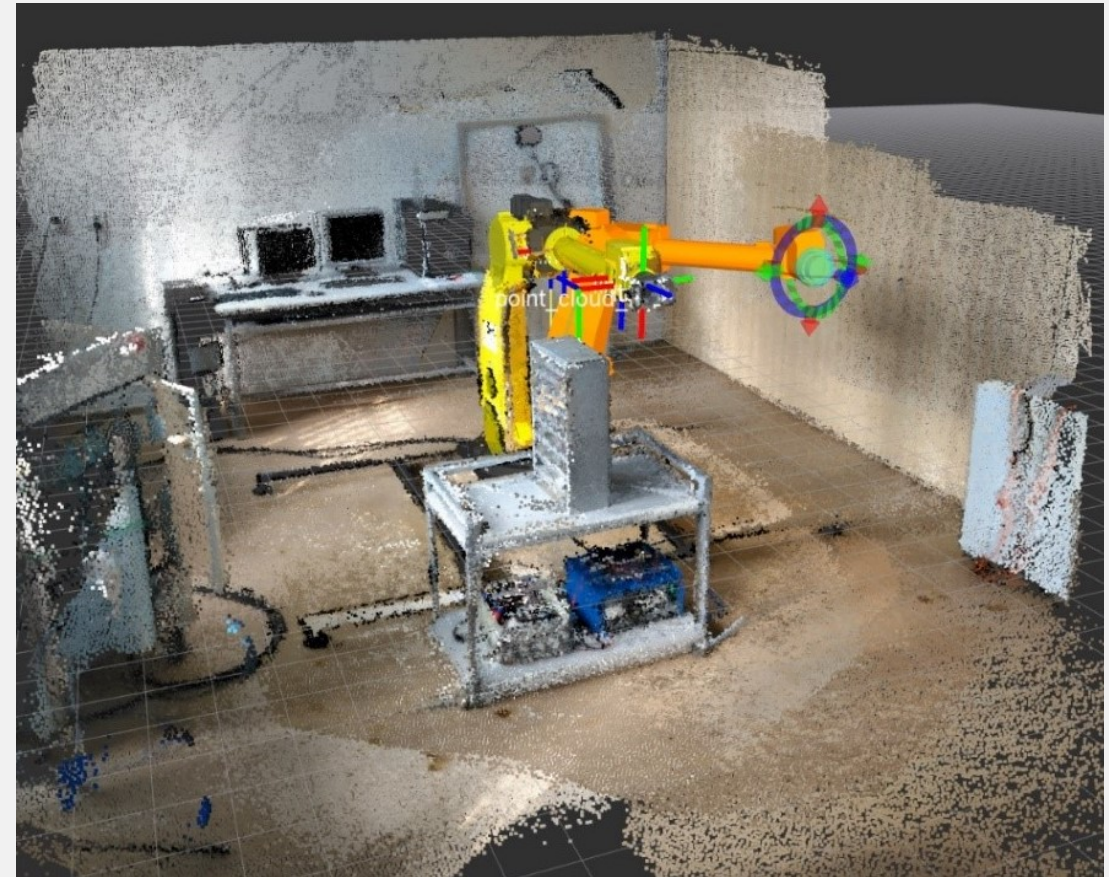
MODELING WITHIN A POINT CLOUD





ANALYSIS/SIMULATION UTILIZING A POINT CLOUD

- As built vs as designed validation
- Collision detection
- Interference checking
- Layout planning





OUTPUTS FROM A POINT CLOUD

- 3D models and mesh models
- 2D drawings
- BIM environments
- Fly through videos
- Server based web viewing and collaboration





TAKEAWAYS

- Point clouds provide digital environments that allow for multiple use cases that enable more efficient workflows
 - As built vs as designed comparison
 - Layout planning
 - Digital measurements
 - And more
- Point clouds should not feel intimidating
 - Typically a 5 step process from import of the captured data to export of the desired output
 - Hardware makes a big difference



CONCLUSION

- There are multiple methods of capturing point clouds
 - LIDAR
 - Sonar
 - Photogrammetry
 - Etc.
- There are two primary forms of point clouds
 - Structured
 - Unstructured
- Point clouds fulfill many industry use cases making workflows easier and time to delivery shorter



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Thank You!

QUESTIONS?