ODA PLATFORM · SIG PROGRAM

SCAN-TO-BIM SDK DEEP DIVE

An open, vendor-neutral SDK for converting point cloud data into BIM models.

● BETA | APRIL 2026 | FOR ENGINEERING EVALUATION

Open Design Alliance

Non-profit · 1200+ member companies

Developed under the ODA Strategic Interoperability Group (SIG)

OPENDESIGN.COM/SCAN-TO-BIM

WHAT THE SDK DOES

Point clouds in, BIM models out — with architectural semantics preserved.

The Scan-to-BIM SDK takes point cloud data from laser scans and produces IFC models with classified AEC objects: floors, walls, openings, and sloped roofs. Developed under the ODA **Strategic Interoperability Group (SIG)** program. Beta status, active development.

PLATFORM & REQUIREMENTS

C++ API

Desktop only · C++

All core functionality: point cloud processing, planar region calculation, BIM object recognition, Mesh-to-B-Rep conversion.

Runs without Docker or Python. The ML stage is optional — the C++ pipeline is fully functional on its own.

ML INFRASTRUCTURE

Docker + Python

Required only for ML-based semantic segmentation. Can also be used independently from the C++ API — for model training and inference without the rest of the pipeline.

GPU required. Training: Nvidia H100 (runpod.io, per-hour rental). Inference time depends on scan size and hardware.

The two parts are independent: the C++ pipeline works without Docker/Python (no ML), and the ML inference server works without the C++ API.

TWO INDEPENDENT DIRECTIONS

DIRECTION A — CORE

Point Cloud → BIM

Recognizes architectural objects — floors, walls, openings, sloped roofs — directly from point cloud data and exports to IFC.

DIRECTION B — INDEPENDENT

Mesh → B-Rep

Converts polygonal mesh into precise B-Rep geometry through segmentation and canonical surface recognition. Uses the ODA Lightweight B-Rep Modeler.

SUPPORTED FORMATS

IMPORT · POINT CLOUD

.RCP / .RCS — Autodesk ReCap
.LAS — ASPRS LiDAR
.PTS — Leica
.PCD — Point Cloud Library
.XYZ — Generic

EXPORT

.IFC — Open BIM standard

NOT SUPPORTED

~~.E57~~ ~~.PTX~~

.E57 — possible in future via libE57Format. .PTX — technically feasible, not yet implemented.

Point cloud format support is provided at the ODA Platform level, not by the Scan-to-BIM SDK itself.

THREE STAGES · THE FIRST IS OPTIONAL

How the pipeline works.

Stage 1 (ML segmentation) is optional. Stages 2 and 3 are always executed. Semantic labels from Stage 1 — when present — filter noise early and enable downstream improvements.

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STAGE 1 · OPTIONAL

Semantic segmentation

An ML model labels each point with a semantic category — **wall, floor, ceiling, or other** — so the next stages can ignore non-structural points (furniture, radiators, equipment) and focus on building elements.

> **Why it matters.** Without segmentation, the pipeline extracts planar regions from tables, chairs, beds, bathroom fixtures — producing false walls and floors. Segmentation filters this noise early.

Models: Point Transformer V2 and PointMLP (extended variants). **Training data:** S3DIS plus our own annotated point clouds, using our own annotation tool.

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STAGE 2

Planar region calculation

Extracts planar surfaces from the point cloud — raw, or ML-segmented if Stage 1 ran. Three steps:

- **Supervoxel clustering + region growing** — initial oversegmentation. Avoids undersegmentation, which would merge distinct surfaces.
- **RANSAC plane detection** — iteratively detects planes. Results refined and extended via region growing.
- **Boundary recognition** — 3D points projected to 2D images (top-down, side-view); boundaries analyzed and mapped back into 3D for precise extraction even on complex rooms.

> **Third-party vs. ODA code.** Supervoxel clustering, region growing, and iterative RANSAC use the Point Cloud Library (PCL). Everything after — refinement, extension, boundary recognition, and BIM recognition — is ODA's own code.

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STAGE 3

BIM object recognition

Planar regions from Stage 2 assembled into building elements:

- **Floor recognition** — horizontal regions identified as IfcSlabs. Coplanar slabs merged, fragments connected, small segments filtered.
- **Wall recognition** — analogous procedure for vertical regions.
- **Floor–wall linking** — spatial relationships established; geometry adjusted so walls and slabs align.
- **Roof recognition** — sloped regions detected as roof elements.
- **Opening recognition** — voids identified as windows or doors. ML segmentation filters false openings caused by missing points behind furniture. Without ML, this filter does not operate.

Output: IFC file with classified AEC objects.

HONEST ABOUT WHAT THE PIPELINE DOESN'T CATCH

When manual correction is needed.

The pipeline produces good automatic results on clean scans of simple spaces. In more complex cases, manual correction is required. The sample application (**OdaScan2BimApp**) provides the tools — undo/redo, operation history, profile editing, element move/resize, point-cloud overlay for visual comparison, and selective hiding of geometry at each stage.

- **Closed doors during scanning.** Door surfaces become indistinguishable from walls, leading to missed openings.
- **Dense furniture.** Even with ML segmentation, some non-structural objects produce false regions — or hide structural elements during scanning, resulting in incomplete slab or wall geometry.
- **Incomplete scans.** If some rooms or corners of the building are not fully scanned, the resulting structural geometry may be incomplete.
- **Complex geometries.** Non-rectangular rooms, curved walls, multi-level spaces require operator review.

MESH → B-REP · INDEPENDENT DIRECTION

Entirely ODA's own code. Converts polygonal mesh into precise boundary representation (B-Rep) geometry in two stages. Results can be exported to DWG.

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STAGE 1

Segmentation

- Initial segmentation by **curvature analysis** and sharp edge detection.
- **Planar region extraction** — flat surfaces recognized with high precision.
- **Canonical surface recognition** — each segment classified as plane, cylinder, sphere, or cone.
- **Segment extension** — segments expanded to include neighboring areas consistent with the identified surface type.

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STAGE 2

B-Rep construction

Each segmented region is converted into its analytical surface representation. Intersection curves between adjacent surfaces define edges. Surfaces are trimmed, faces defined, and all elements assembled into a complete B-Rep solid body.

BASE APPROACH · IMPLEMENTED

Triangle-by-triangle fallback

Each triangle in a non-canonical segment is converted to an individual planar face in B-Rep. Brute-force — it increases face count but guarantees a valid B-Rep model.

EXPERIMENTAL

Spline-based surface fitting

Promising results for a limited set of cases. Robust reconstruction for arbitrary segments remains an open problem.

WHERE WE ARE TODAY

Current limitations.

- **B-Rep: automatic mode only.** No interactive or manual segmentation editing yet.
- **ML training data is limited.** S3DIS plus our own dataset — still too monotonous. More diverse real-world scans would improve generalization.
- **Opening detection struggles with closed doors.** Filtering of false openings is an ML-enabled capability; without ML, false positives from dense furniture are not filtered.
- **Non-canonical mesh segments** rely on the brute-force fallback. The spline-based approach is experimental.
- **Large point clouds.** ML segmentation support for large clouds is in the 2026 roadmap.
- **IFC export only.** No other export formats planned currently.

SAMPLE APPLICATION · ODASCAN2BIMAPP

The primary entry point to the project. Three operational modes: **Point Cloud → BIM**, **Mesh → B-Rep**, and **Point Cloud → Mesh**.

REVIEW & QC

Overlay the original point cloud onto the BIM model for visual comparison. Selective show/hide of geometry, classes, and visualization modes at each stage.

EDITING

Full undo/redo and operation history. Delete, move, and resize elements. Edit polygonal profiles. Perform operations on selected entities only.

STATE MANAGEMENT

Save and load intermediate pipeline states — useful for long-running ML plus region calculation runs.

SELECTIVE UNDO

Undo the last operation for a specific object, rather than the entire pipeline. Fine-grained correction without losing work.

ROADMAP · 2026

- Building element identification enhancements
- Large point cloud support for ML
- Automatic room detection
- Mesh segmentation improvements — torus recognition, manual editing
- Point cloud to mesh for non-structural objects

Roadmap priorities are shaped by SIG members.

TWO ACCESS TIERS

How to get access.

The SDK is available through the **ODA Scan-to-BIM SIG** — the Strategic Interoperability Group that steers its development. Trial membership gives 60 days of free access, open to everyone. Full SIG membership includes voting rights on roadmap priorities and direct engineering access.

TRIAL SIG

60 days · free

Open to everyone — no ODA membership required. Evaluate the SDK, sample application, and the full pipeline.

FULL SIG MEMBERSHIP

Voting rights · engineering access

Participate in roadmap decisions, direct engineering access, and close collaboration with the core team. Active participants span CAD/BIM platform vendors, construction equipment manufacturers, and technology consortia.

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Evaluate the SDK

Full technical documentation, sample code, and trial SIG sign-up are available on the ODA website.

opendesign.com/scan-to-bim

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Open Design Alliance · Non-profit membership organization
Mission: Complete interoperability for CAD & BIM