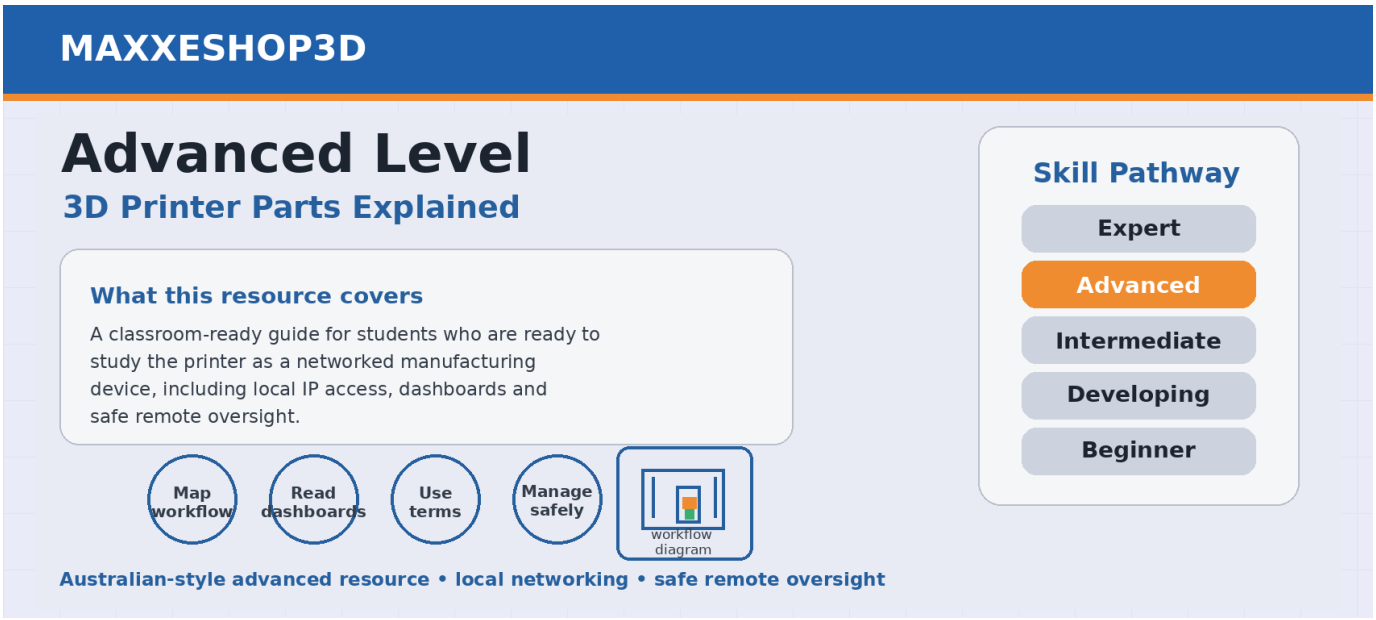


Advanced Level • 3D Printer Parts Explained

Suitable for students ready to understand connected printing workflows and safe remote access

Advanced guide to how printer hardware, firmware, network services and remote monitoring fit together.

Resource overview

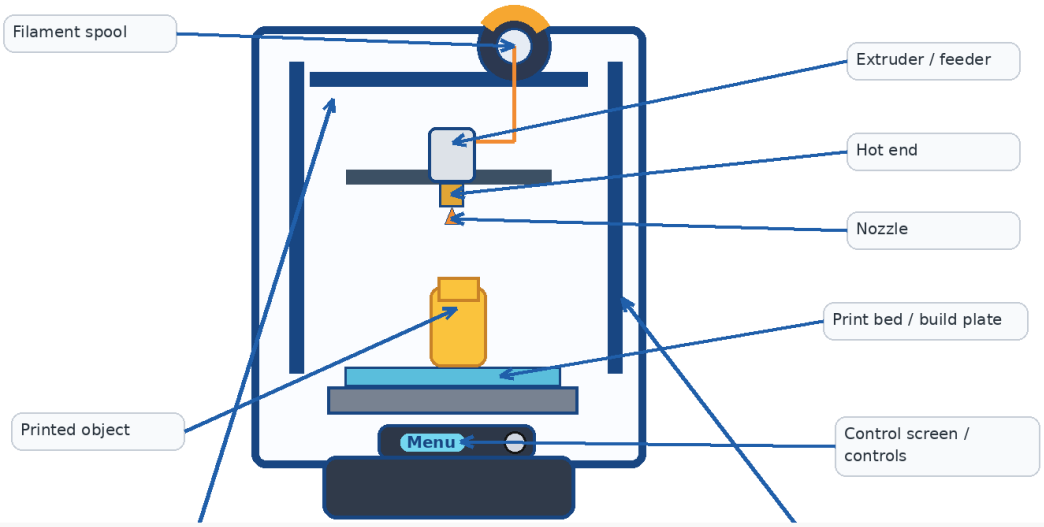
This resource builds on expert-level hardware knowledge by exploring the digital path around the printer. Students look at how a model becomes G-code, how that file reaches the printer, how dashboards and cameras support supervision, and why permissions and local network structure matter in a safe workflow.

Indicative level	Advanced
Suggested use	Senior STEM lesson, networked print demo, or connected workflow discussion
Best suited to	Students ready to link slicers, controllers, dashboards and local network access
Learning focus	Explain file flow, controller logic, local IP access and safe remote oversight
Related resource areas	Troubleshooting • Safety & Setup • Networking basics

Meet the Printer: firmware, dashboards and connected operation

At advanced level, the printer is studied as part of a larger workflow that includes slicing, file transfer, local network access and monitored control.

Diagram 1 • Main Parts of a Classroom FDM 3D Printer



Advanced tip: connected printing adds file transfer, local IP access and dashboards, but it still depends on correct setup, safe permissions and physical supervision.

Main parts and what they do

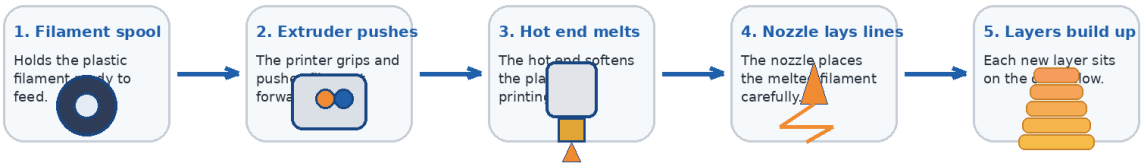
System	Advanced focus	Why it matters
Digital file path	A model is sliced into G-code and sent to the printer or print server.	Mistakes before printing can appear later as motion or extrusion faults.
Controller board	Interprets commands and coordinates motors, heaters and sensors.	It is the decision point between the file and machine action.
Firmware and limits	Firmware sets motion rules, protections and machine behaviour.	Safe settings help prevent crashes or unsafe heating.
Local IP connection	A printer or print server may appear as a device on the local network.	Correct addressing allows upload, monitoring and status checks.
Dashboard / camera	Web dashboards can show files, progress, temperatures and live views.	Monitoring improves supervision and response time.
Permissions	Accounts, trusted devices and network boundaries limit who can interact.	Remote convenience should never bypass safety.
Physical print system	Extrusion, motion, adhesion and cooling still decide print quality.	Digital control helps, but the machine must still be mechanically sound.

How the printer works together

An advanced view of 3D printing follows the full chain from design file to monitored job. The slicer produces instructions, the network or local storage delivers them, the controller and firmware run them, sensors report conditions, and the operator supervises through local controls or a dashboard.

Safety reminders	Quick classroom activity
• Remote access should supplement, not replace, safe local supervision. • Use trusted networks, strong accounts and limited permissions. • Confirm stop methods and heater protections before using dashboards. • Networked control does not remove risks from hot surfaces or moving axes.	1. Draw the path from CAD/STL file to slicer to G-code to printer. 2. Label where the local network, dashboard and camera sit in that path. 3. Explain what telemetry can show and what still needs physical inspection. 4. Compare the risks of local-only printing and network-connected printing.

Diagram 2 • How Filament Moves Through the Printer



Useful classroom language: slicer • G-code • local IP • dashboard • telemetry • permissions

At advanced level, students should explain how a print moves through the digital workflow into safe remote supervision.

Vocabulary focus

Slicer Software that turns a 3D model into printable toolpaths.	**Local IP address** The network address used to identify a device on a local network.	**Dashboard** A web or app interface used to upload, monitor or manage jobs.
Telemetry Live status data such as temperatures, progress and messages.	**Permissions** Rules controlling who may view, upload or issue commands.	**Print server** A connected device or service that sends jobs to the printer and reports status.

Simple teacher prompt

Ask students to explain the full connected workflow from slicer to printer dashboard and identify which steps are digital, which are physical, and where safe supervision must still happen. Strong responses should mention local IP addressing, permissions, controller logic and the limits of remote access.