

Security Implications of Malicious G-Codes in 3D Printing

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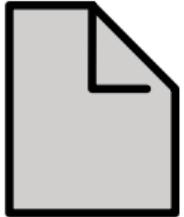
USENIX '25, August 13–15, 2025



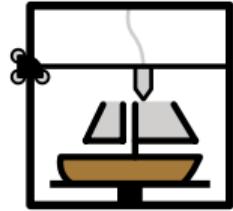
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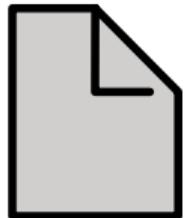




3D Model File



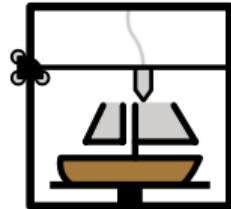
3D Printer



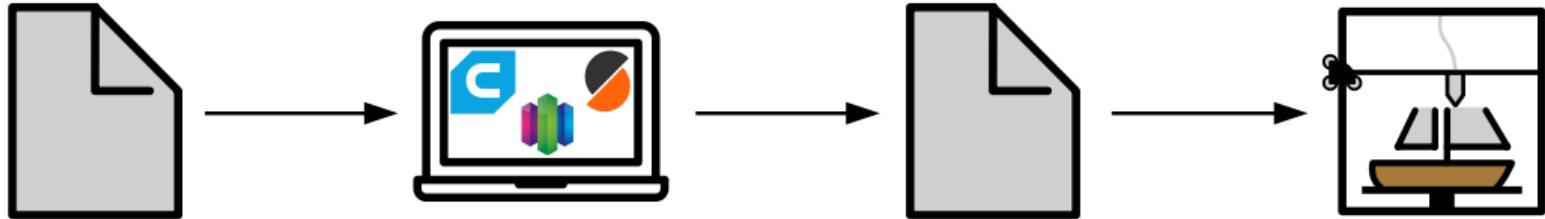
3D Model File



Slicer



3D Printer

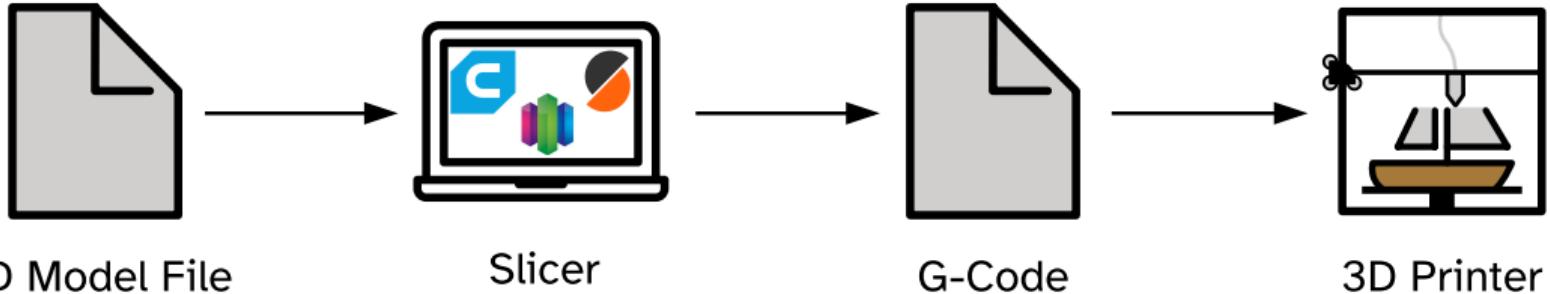


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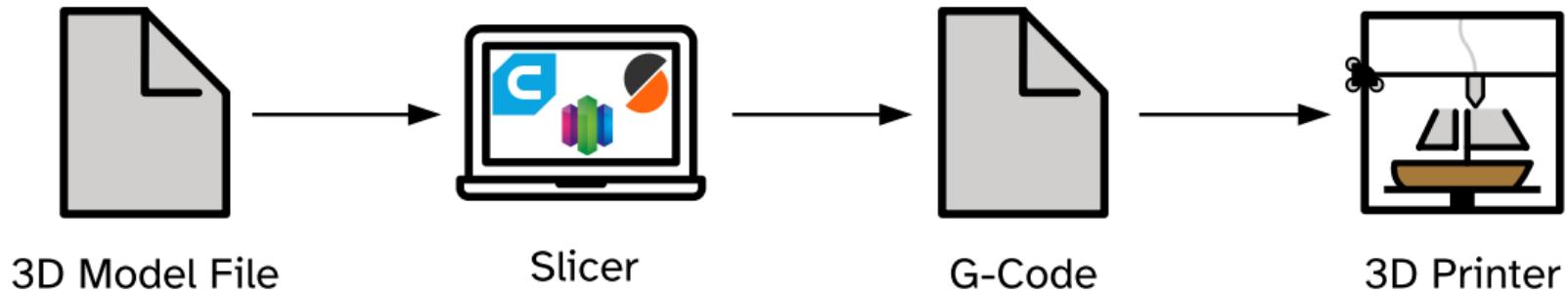
Slicer

G-Code

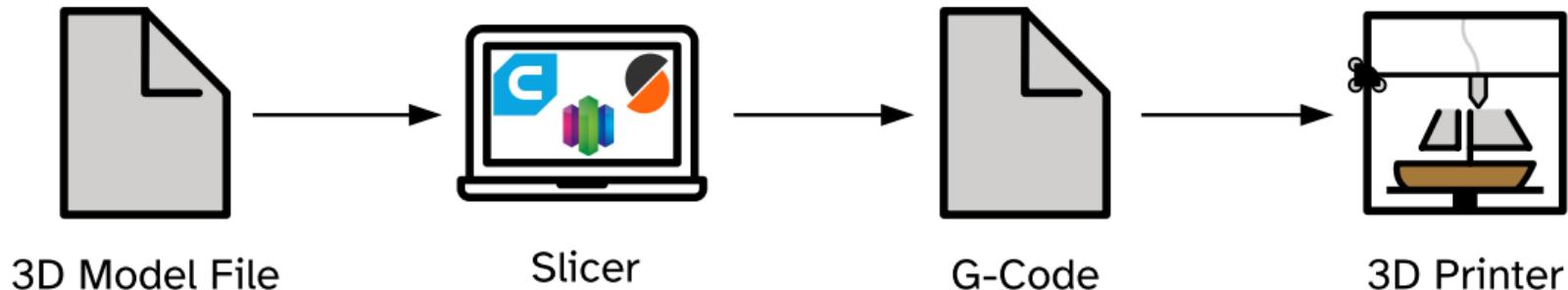
3D Printer



What are G-Codes?

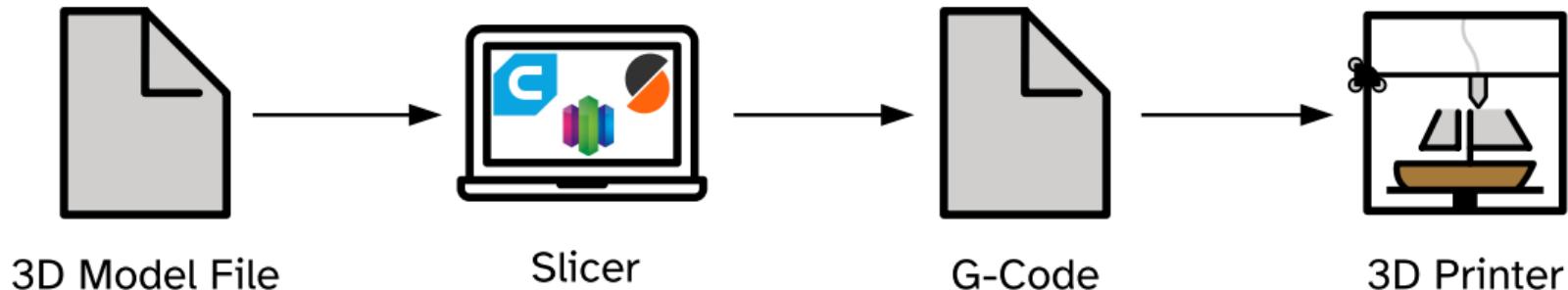


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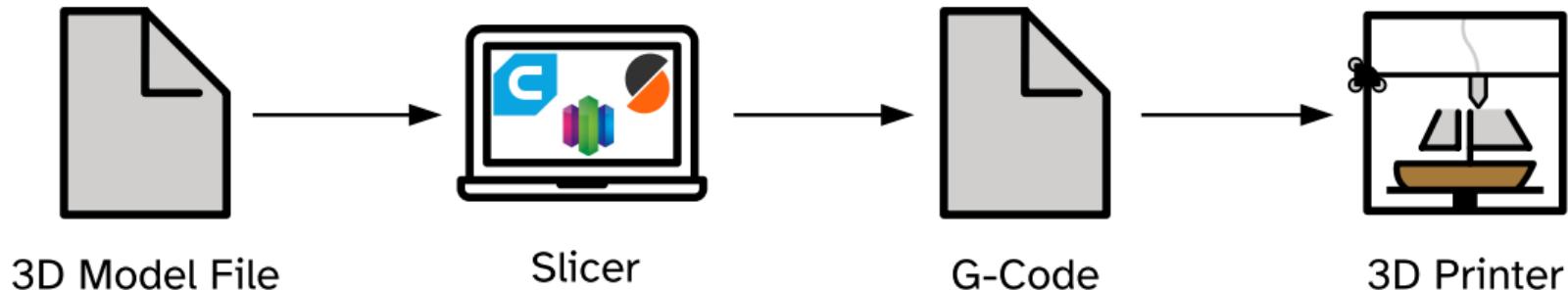
G1 Move print head



What are G-Codes? → text-based control language

G1 Move print head

M104 Set extruder temperature

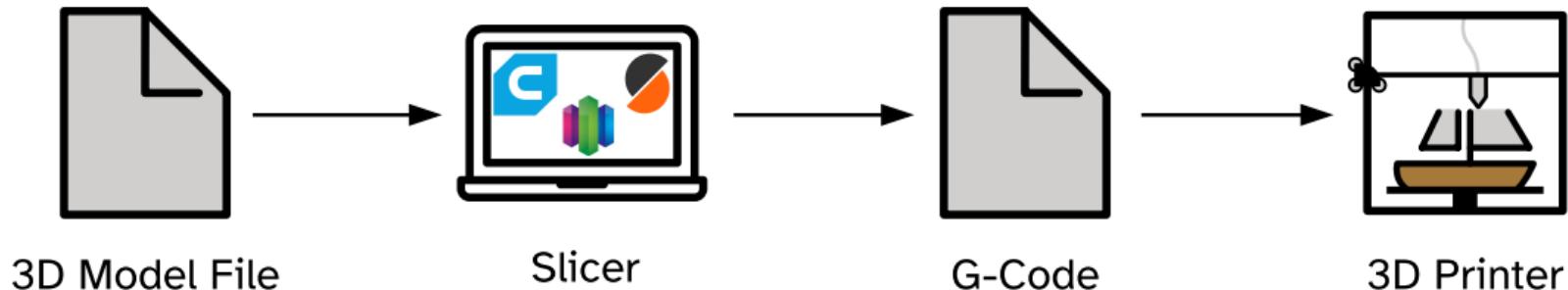


What are G-Codes? → text-based control language

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M104 Set extruder temperature

M500 Save current configuration



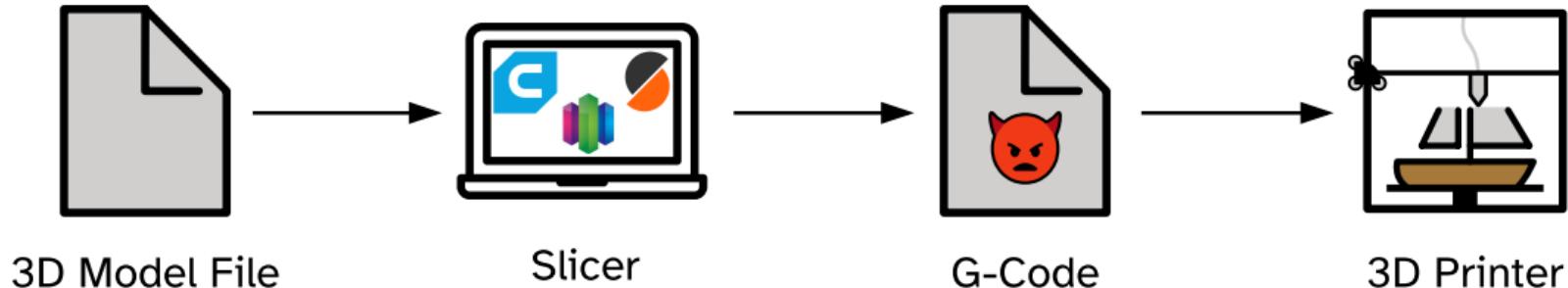
What are G-Codes? → text-based control language

G1 Move print head

M104 Set extruder temperature

M500 Save current configuration

M997 Update firmware



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- Gather and analyze existing G-Codes.

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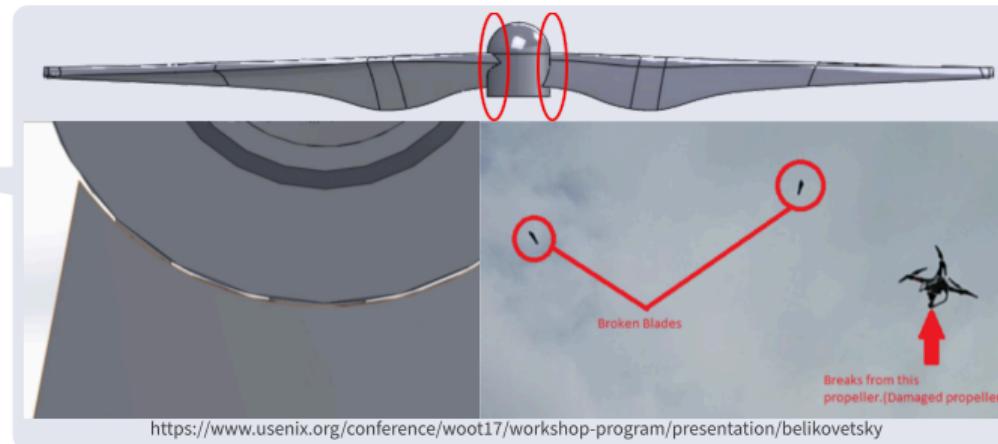
- Gather and analyze existing G-Codes.
- Extract attacks in the categories
 - Information Disclosure
 - Denial of Service, and
 - Model Manipulation.

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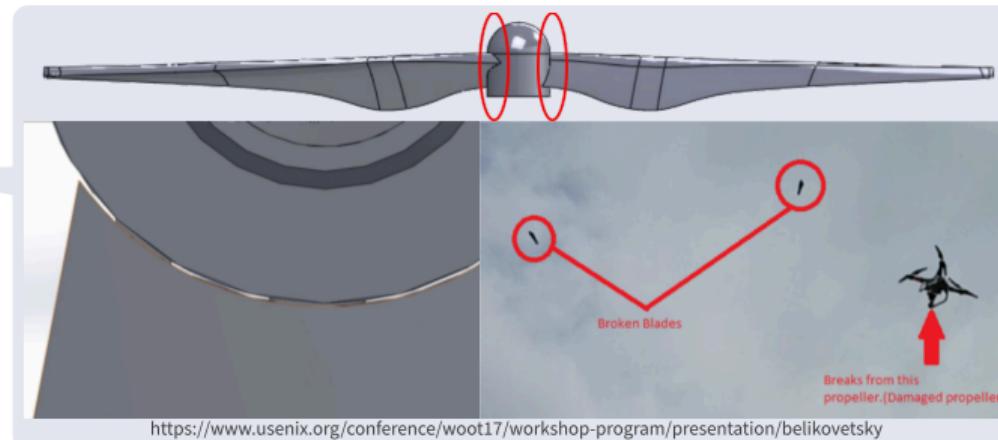


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What can an attacker with limited capabilities achieve?

- Gather and analyze existing G-Codes.
- Extract attacks in the categories
 - Information Disclosure
 - Denial of Service, and
 - Model Manipulation.
- Evaluate attacks on printers.



Results

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- Details:

