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A JOB TREE STRUCTURE TO TRACK AUTO GENERATED BUILD ENVELOPE STATUS AND CONSUMPTION

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A Job Tree Structure to Track Auto Generated Build Envelope Status and Consumption

Abstract

When a 3D printer user wants to print a job and do an external cooling, he needs to indicate this prior to sending the job to the printer, so the system can behave accordingly to ensure the best part quality possible. One of the actions of the system consists in generating a build envelope to physically protect the build content when it is transferred to the external cooling unit. The user always wants to have some information about all the printed parts, including the autogenerated ones. Thus, we need to provide a mechanism to be able to track what happens with the build envelope, whether it is printed correctly, track the printing consumption (ink, material, …), etc.

In our solution, the job to print consists of the original build package, specified by the 3MF content file, and the autogenerated build envelope. This is organized as if the job has two build packages, the original 3MF and a second autogenerated package containing the build envelope. This way the second build package containing the envelope has its own information and consumption, which can be individually processed and tracked, separated from the information of the original job parts.

Problems Solved

Currently, the build structure contains the build tree with all the parts submitted in the 3MF sent by the external software. The printer can track the status of those parts and the overall build to report status and consumption. But this build structure does not consider any internal part or build envelope that could be generated by the printer.

The second problem solved is to be able to report separately what is the status and consumption of the individual build envelope separated from the user parts.

Prior Solutions

As far as we know, previously there were no mechanism for a 3D printer to automatically generate a build envelope for the printed job, so there was no need to track the consumption of parts which are automatically generated by the printer.

Description of the solution

The job to print is sent from an external software, typically containing a single 3MF [1] build package which has the description of all the parts to print. The parts might or might not be organized as assemblies or as a plain parts structure. The individual parts, the build package and the build can be tracked in terms of their structure, status and consumptions.

When generating a build envelope, if added in the same build package as the user job content, it would distort the results obtained for the build package. For example, the build size and consumption of the user build package would be bigger, making the analysis of the results harder.

Our 3D printing systems use a virtual a structure that tracks the build envelope into a separated build package of type AUTO (designed for autogenerated content). This way it is possible to track separately both build packages, including their respective status and consumption. That consumption is integrated at the top build level to provide the overall results. This allows to separate the consumption of the build envelope from the submitted job.
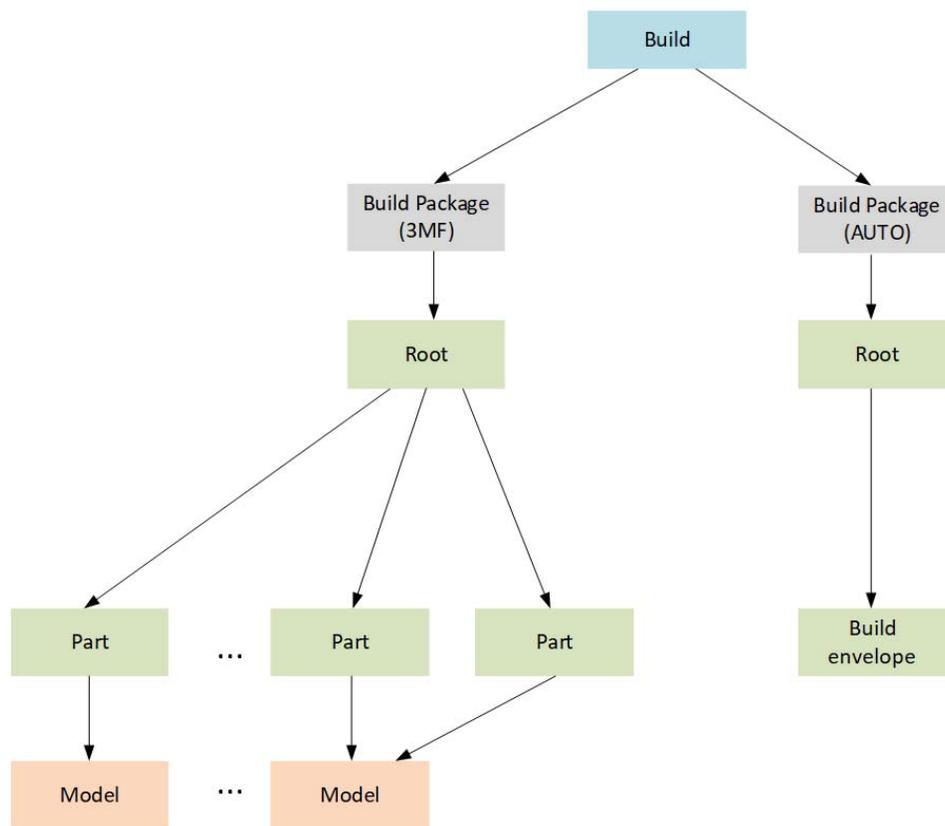

Figure 1. Example of build tree structure after adding the build envelope in a separated build package of type AUTO.

On the left branch there is the 3MF build package submitted by the external software and on the right one the autogenerated build package with the build envelope node. In this case, the envelope has no explicit model describing it, since it is procedurally generated. However, it does not prevent in the future to use an explicit model, which could also be modified on the fly.

The build envelope has an associated ID, which is used to identify the consumption of that object. While printing, all the fired drops are counted and associated to the corresponding part using the part ID of the voxel where the drops were fired. This way, at the end of the printing, every part (including the build envelope) gets the amount of ink consumption used to print it. Finally, once the job is printed, all this information can be queried via the printer Web Service public API, which published and endpoint for the job completion details, containing all the information related to the job.

Advantages

The proposed solution has several advantages:
- It creates a structure where it is easily identifiable what is user content and what is content internally generated by the printer.
- The ability to individually track status and consumption of every part and the aggregated for the user content, separated from the information for the autogenerated content.
- Consolidate the overall build status and consumption as a whole.
- It is detectable as long as the build envelope consumption can be reported separately from the user content consumption.

References

[1] http://3mf.io

Disclosed by Jordi Gonzalez, Yngvar Rossow, Leticia Rubio, Alex Carruesco, Jordi Raventos, Sergio Gonzalez and Jaime Machado, HP Inc.