September 28 - October 2, 2020

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Improving 3D printing of garments

by using HPC Cloud

3D printed fashion

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RB

- Easier to work with
- Sustainable
- Eco-friendly
- Customizable

Photo Credit: Vita Zamchevska

Photo Credit: Travis Fitch

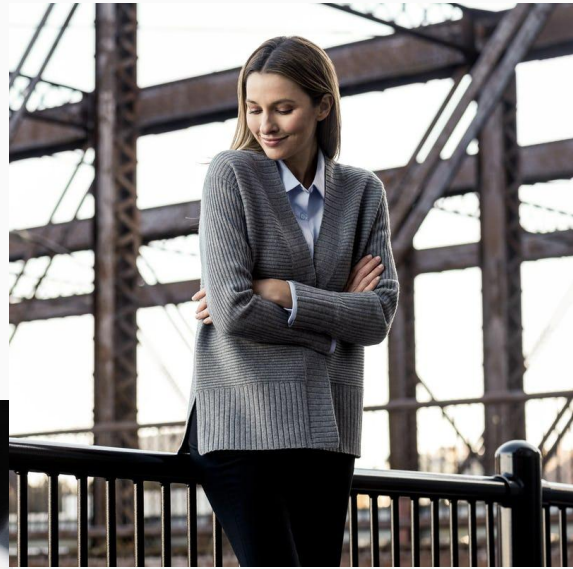
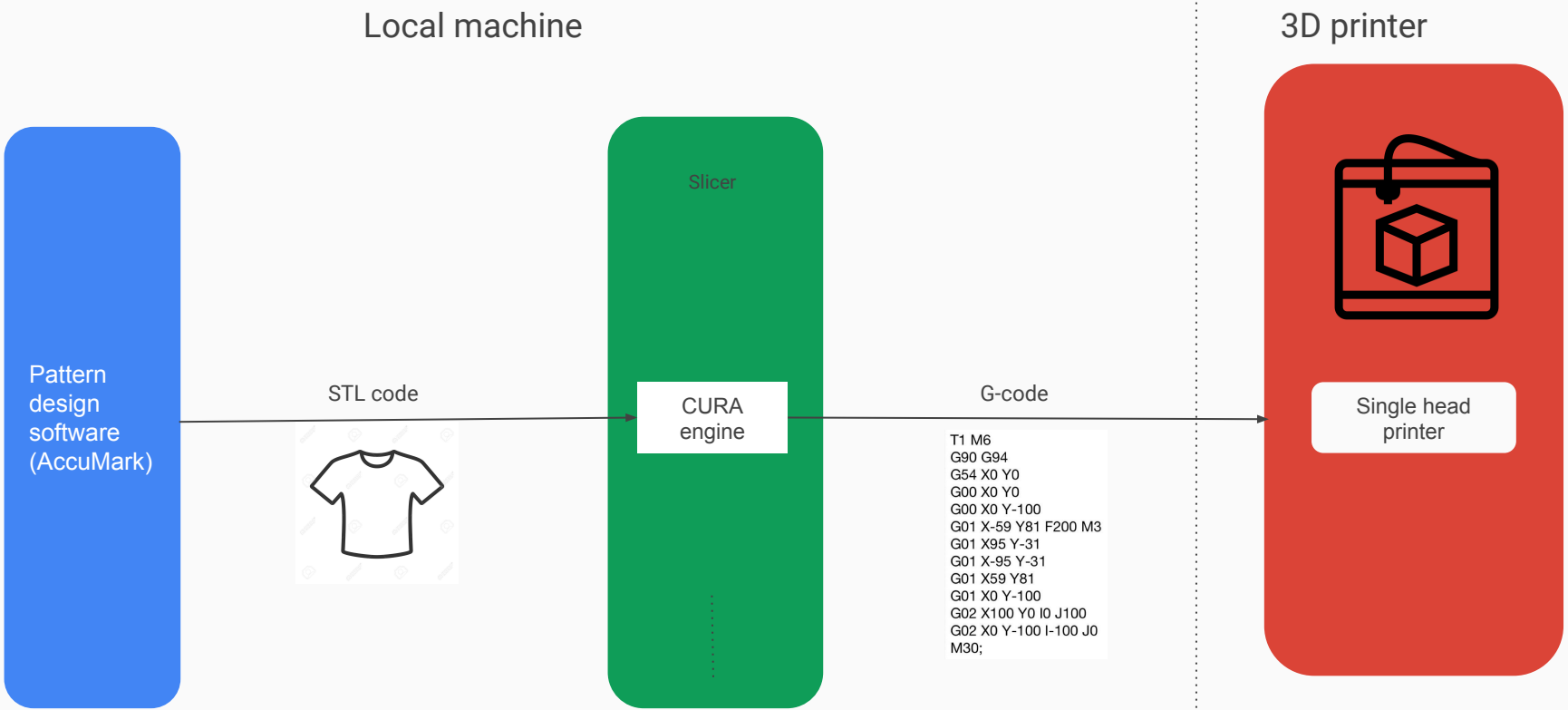


Photo Credit: Ministry of supply

Printing process



Challenges

Slow printing speed.

Small printing area.

Danit Peleg spent about 2,000 hours printing her collection, and Julia Daviy 6 months.

Possible solution

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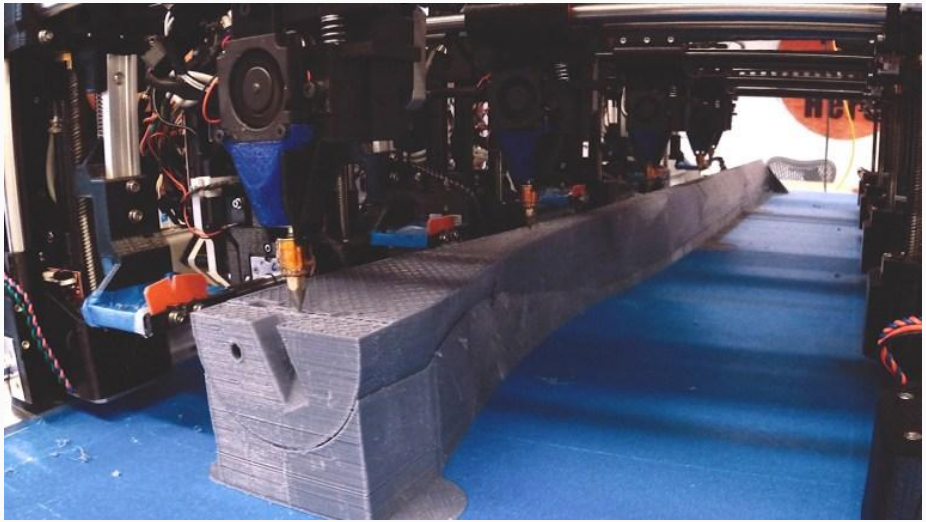
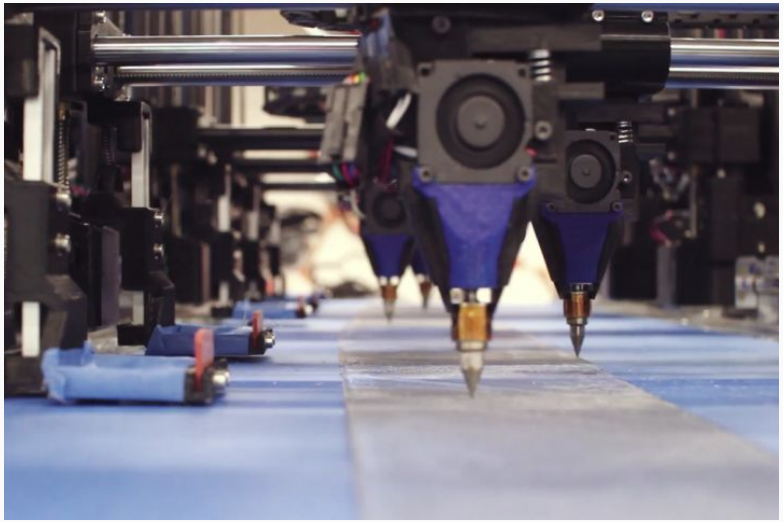
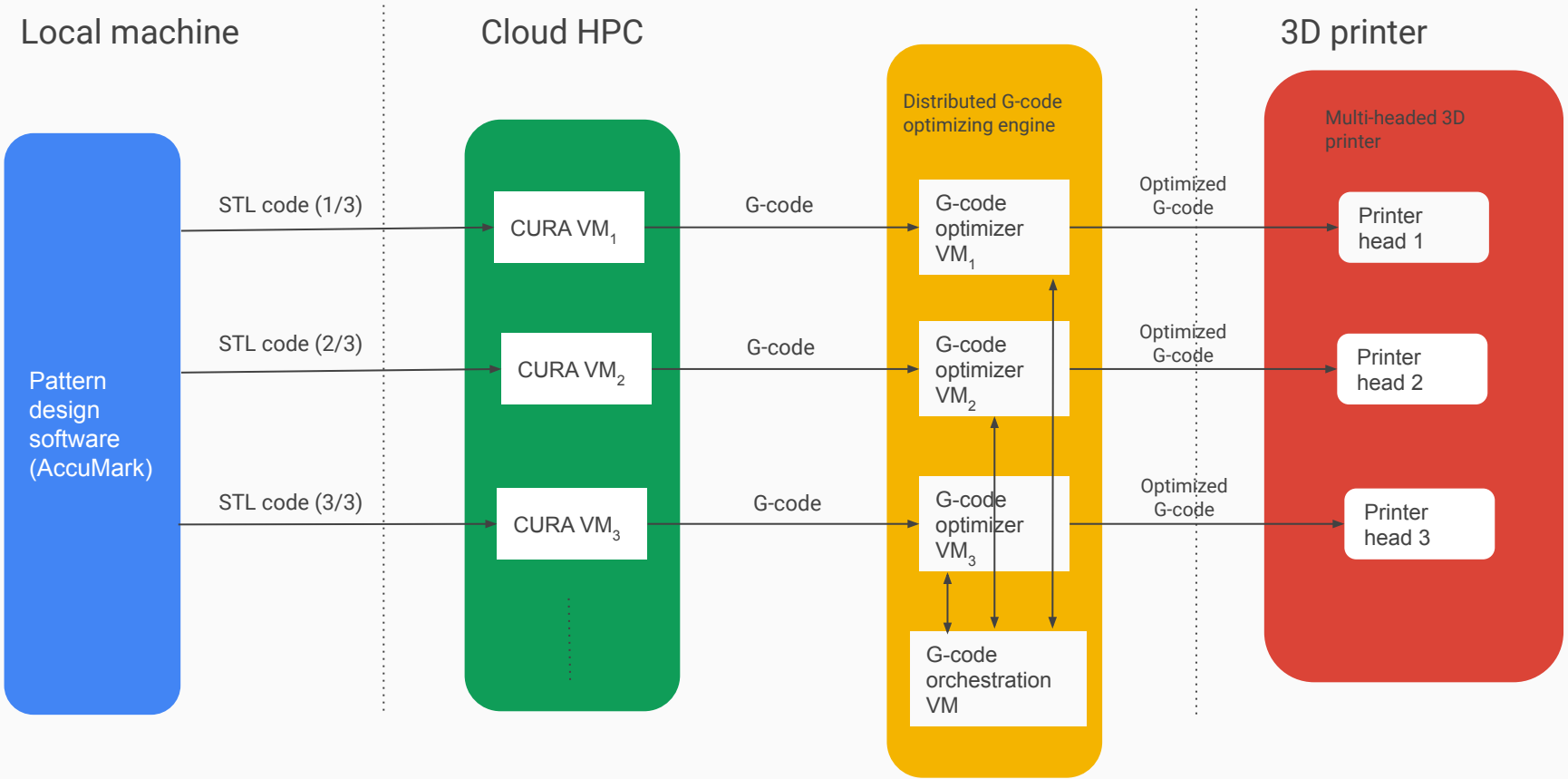
- Multi-headed printer
- HPC cloud





AutoDesk's Project Escher can have an (endless) amount of 3D print heads to create larger objects.

Parallel printing process



Optimization step 1/2

Movement of single head:

$$h_m = f_m(A); m = 1, \ldots, M$$

Total distance per head:

$$H_m = \sum_{i=1}^{N_m} h_m$$

Total number of printed points by all heads is:

$$N = N_1 + N_2 + \ldots + N_m$$

Distributing load across all heads:

$$minimize(H_m) w.r.t. N_1 = N_2 = N_3 \ldots = N_m$$

Optimization step 2/2

Number of computational steps $$NCS = K_m^{N_m}$$

Number of communications between tasks: $$NC = M!$$

$$NCS >> NC$$

Conclusion

- 3D printing is a slow process
- Possibility of multi-headed printing (with long pre-processing time)
- Pre-processing can be done in parallel on HPC

Q&A