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[2] Perm Regional Museum / branch Museum of Permian Antiquities,
Monastyrskaya Str., 11, 614000, Perm, Russia

Scientific Visualization System on a Chip with Tangible User Interface

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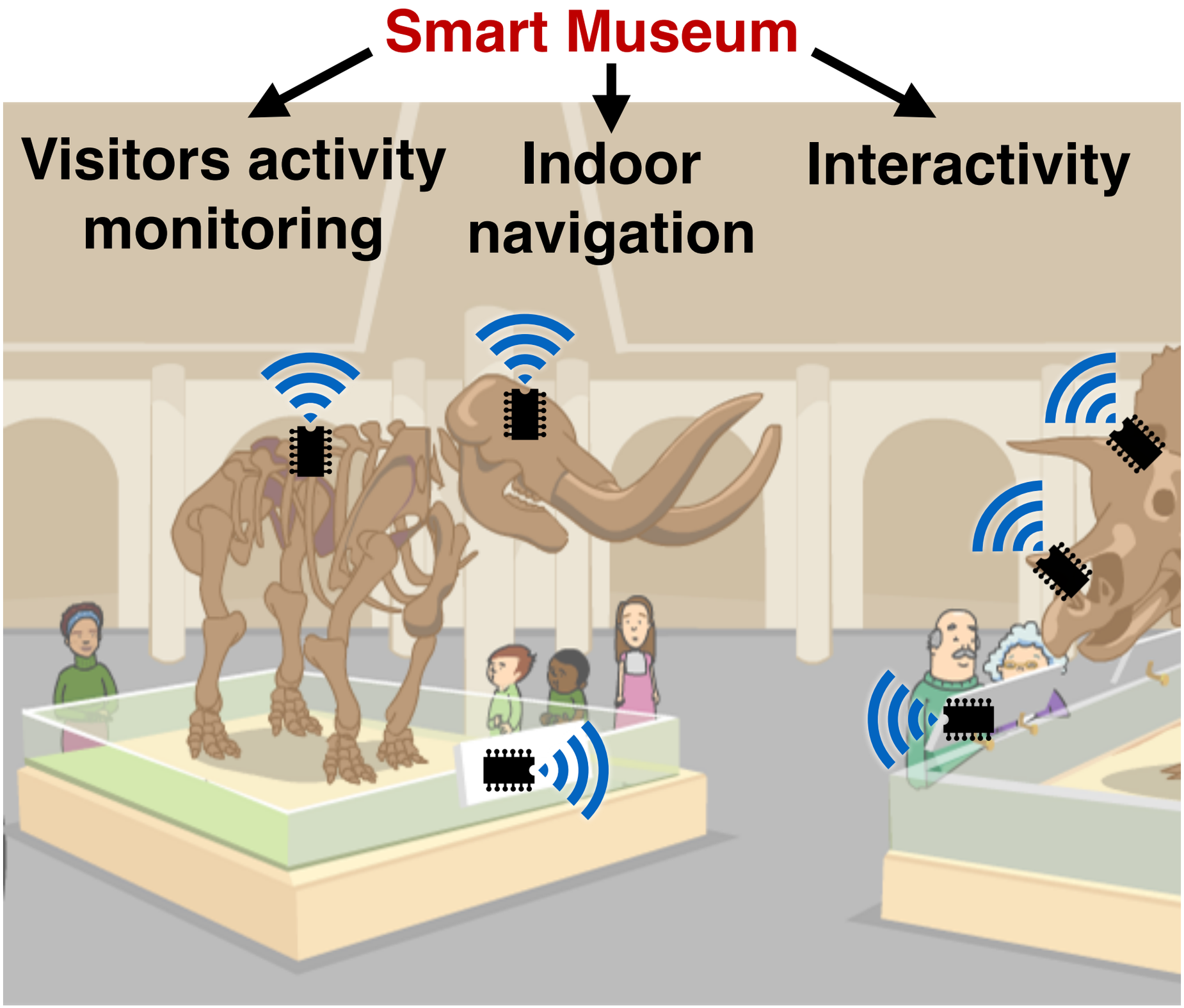
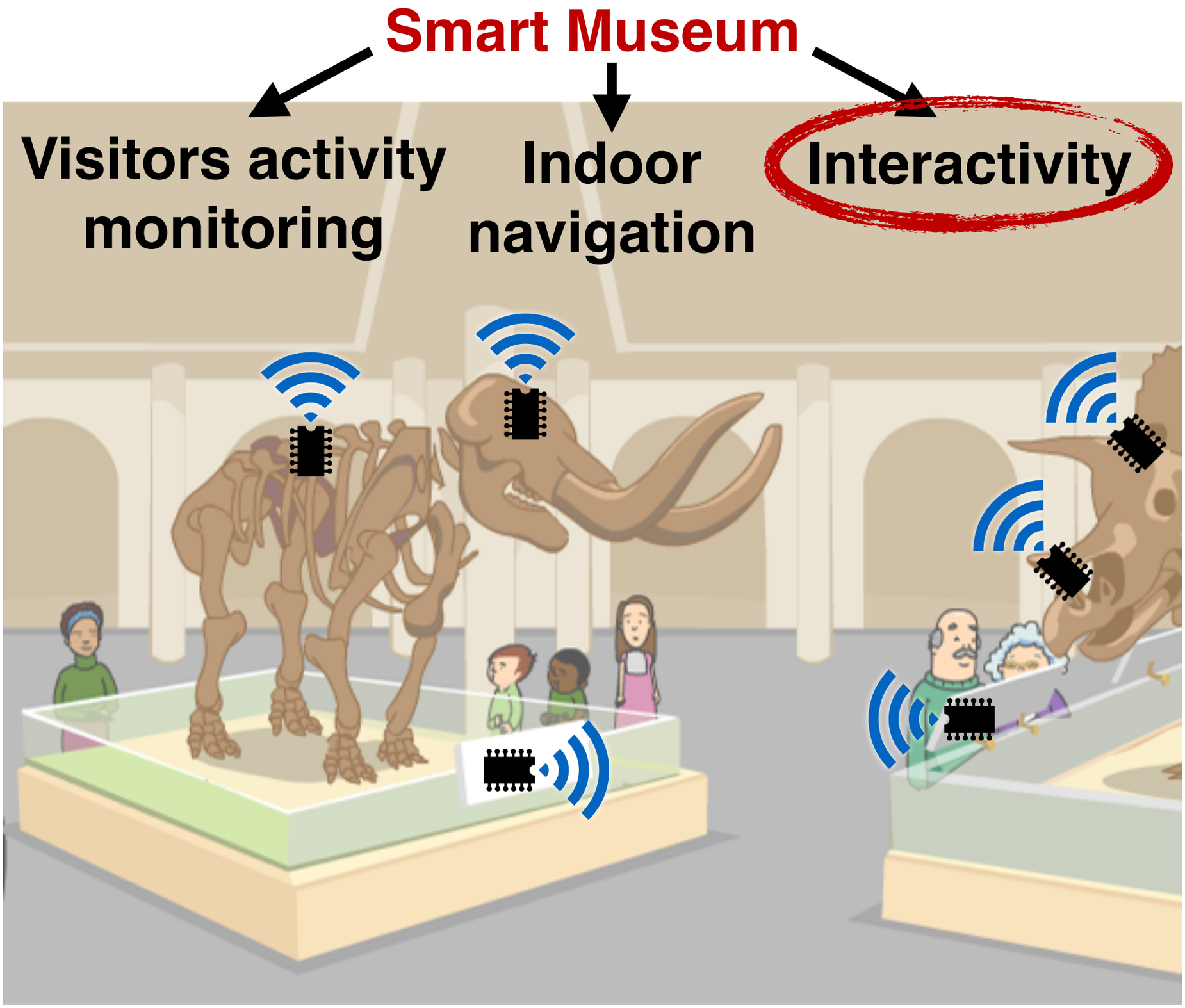
Saint Petersburg – 2020



K. Ryabinin[1], M. Kolesnik[2] | [1]Perm State University, [2]Perm Regional Museum | Scientific Visualization SoC with TUI



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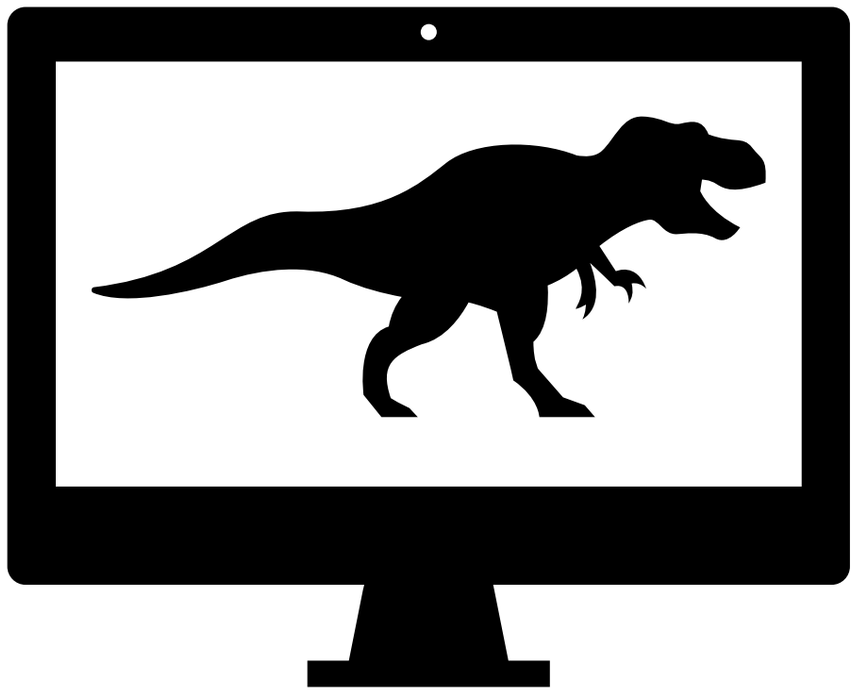
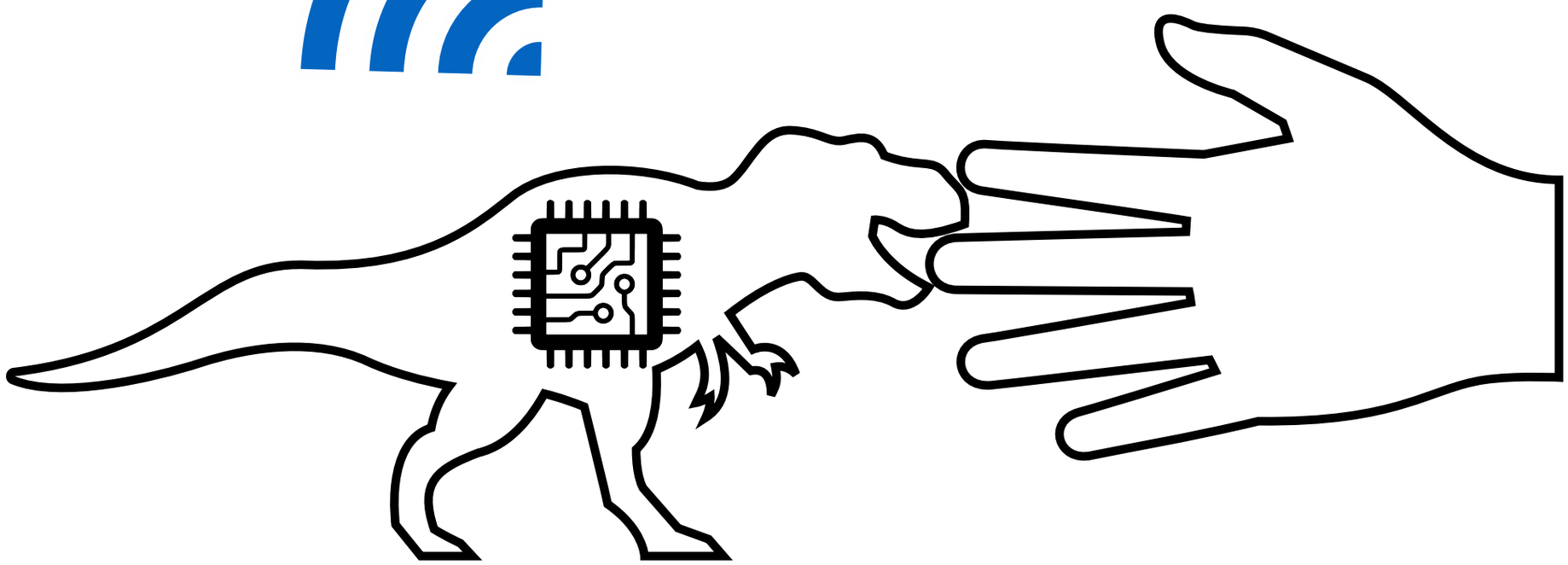


Tangible User Interface:
Touching the virtual objects via their physical avatars beyond pushing buttons



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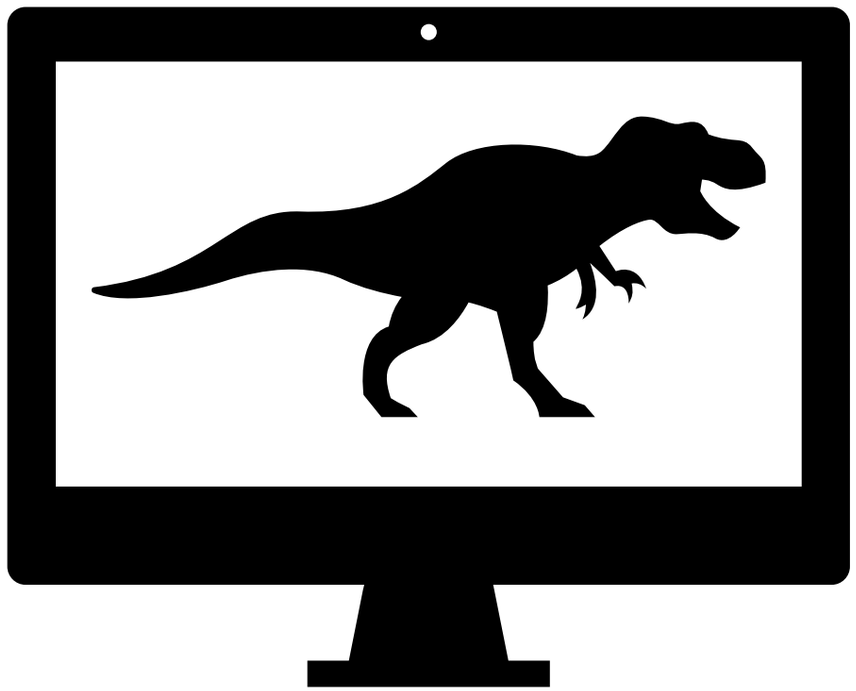

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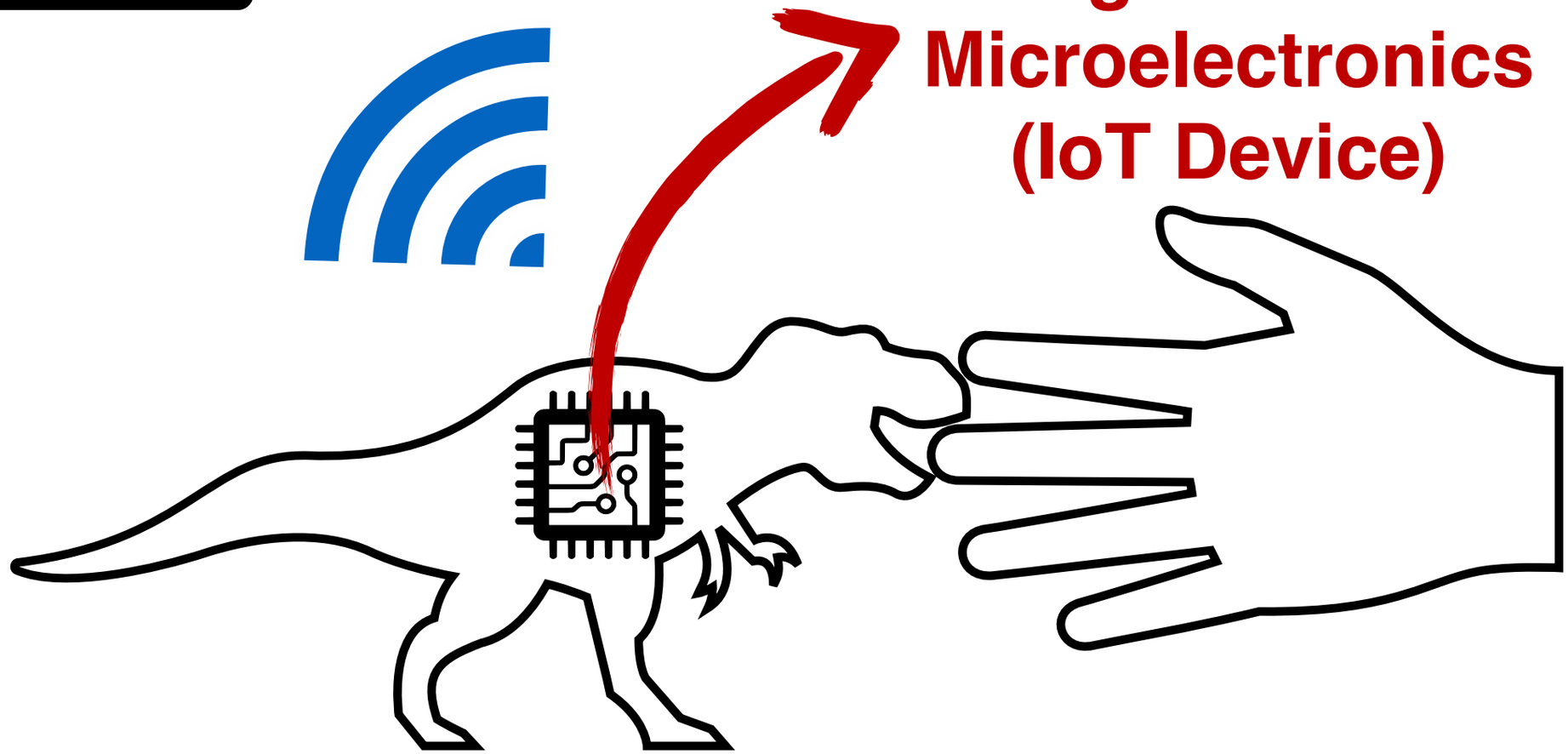
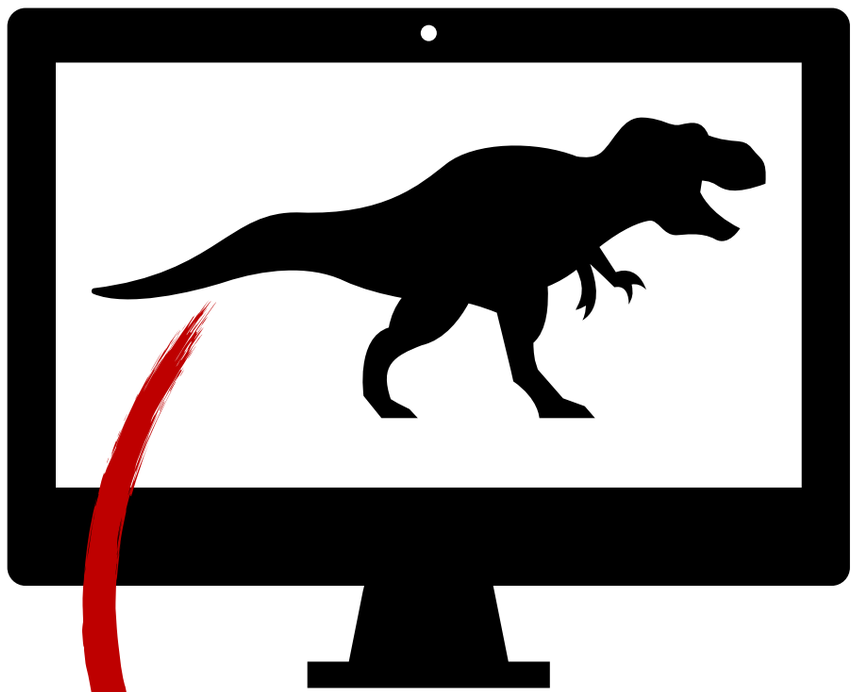
Programmable Microelectronics (IoT Device)





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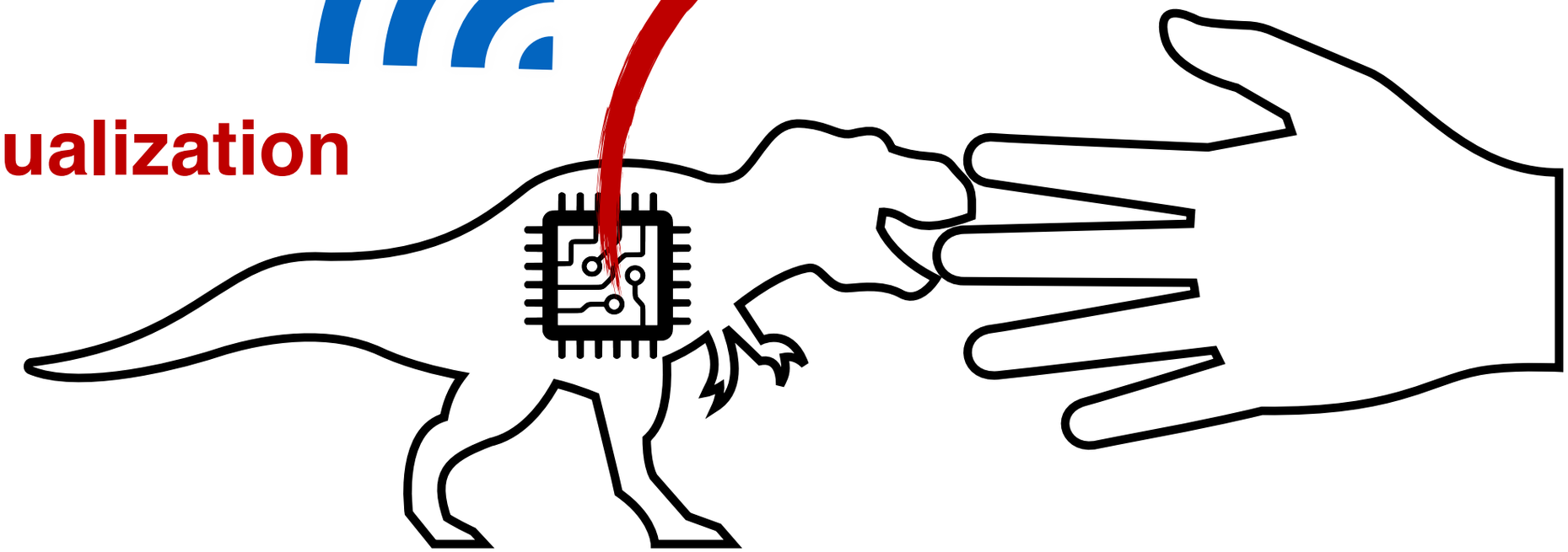
Scientific Visualization



Visualization Requirements

1. Fast & easy building
2. Fast & easy deploy
3. Fast & easy startup / shutdown
4. Standalone functioning
5. Intuitive interface
6. Low cost
7. Exchangeable parts
8. Reconfigurability

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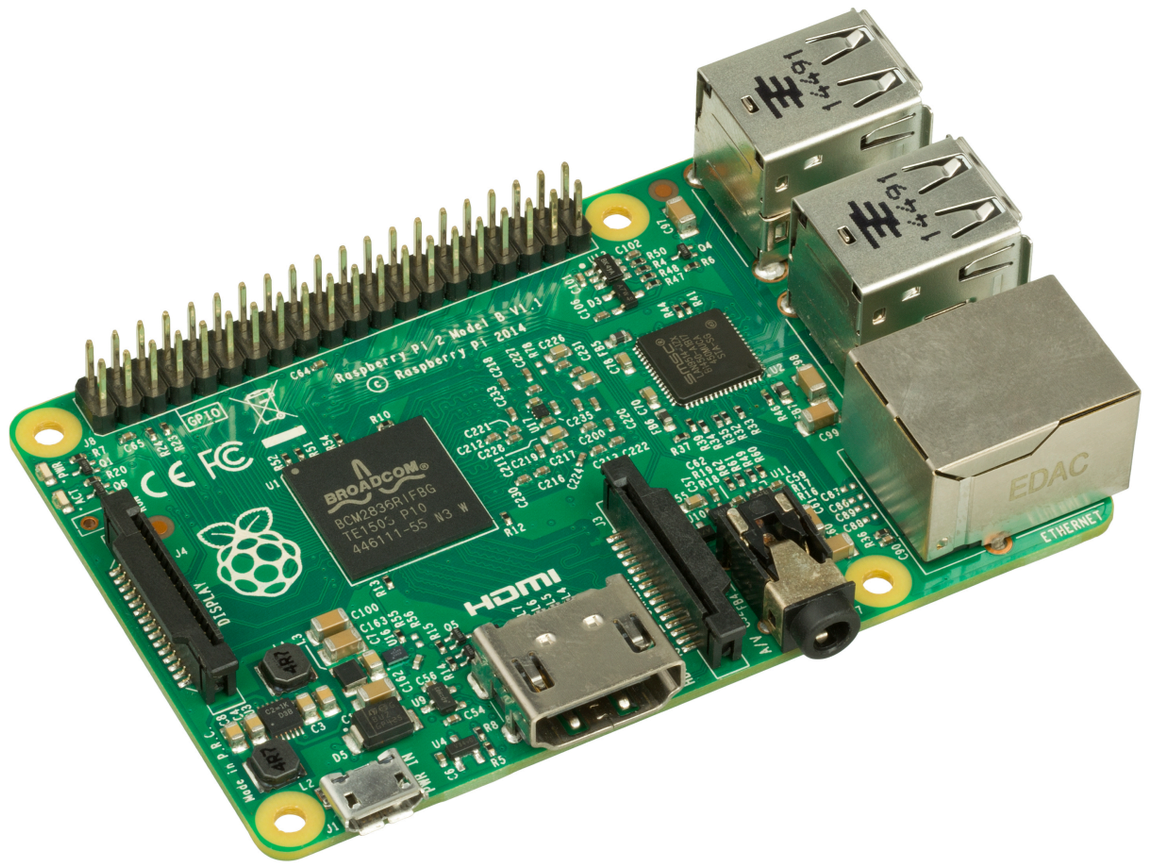

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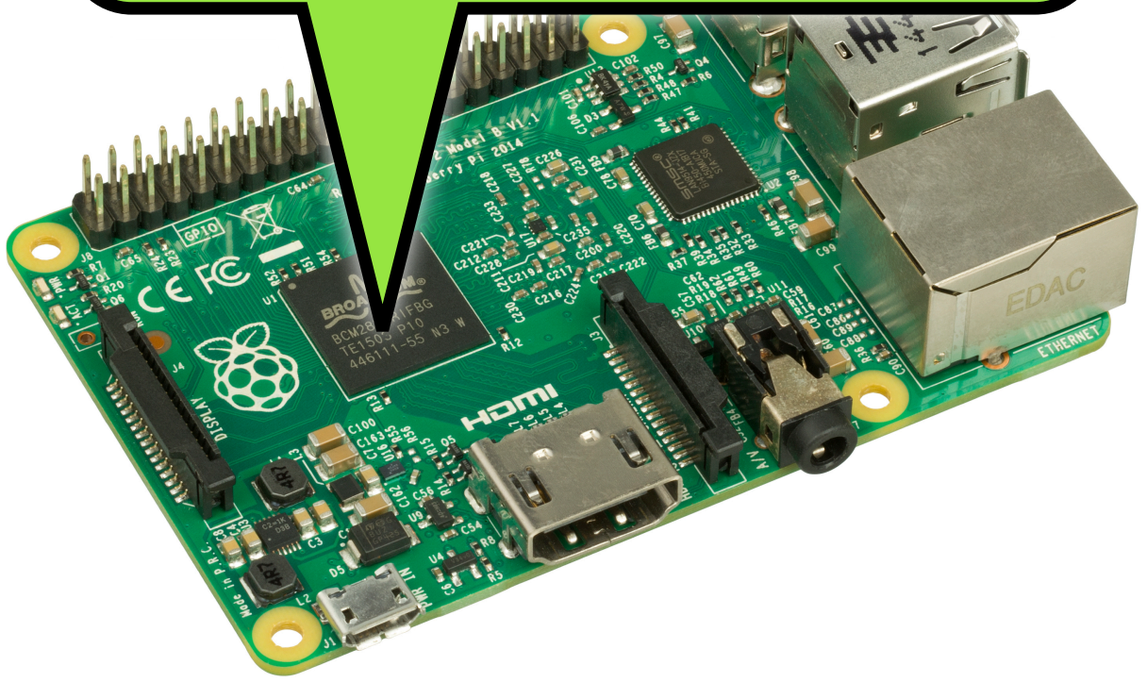
Programmable SoC can meet them all



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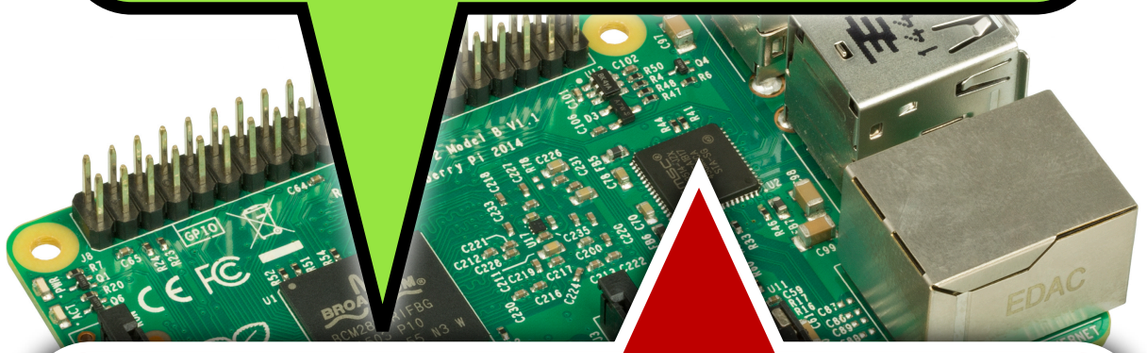
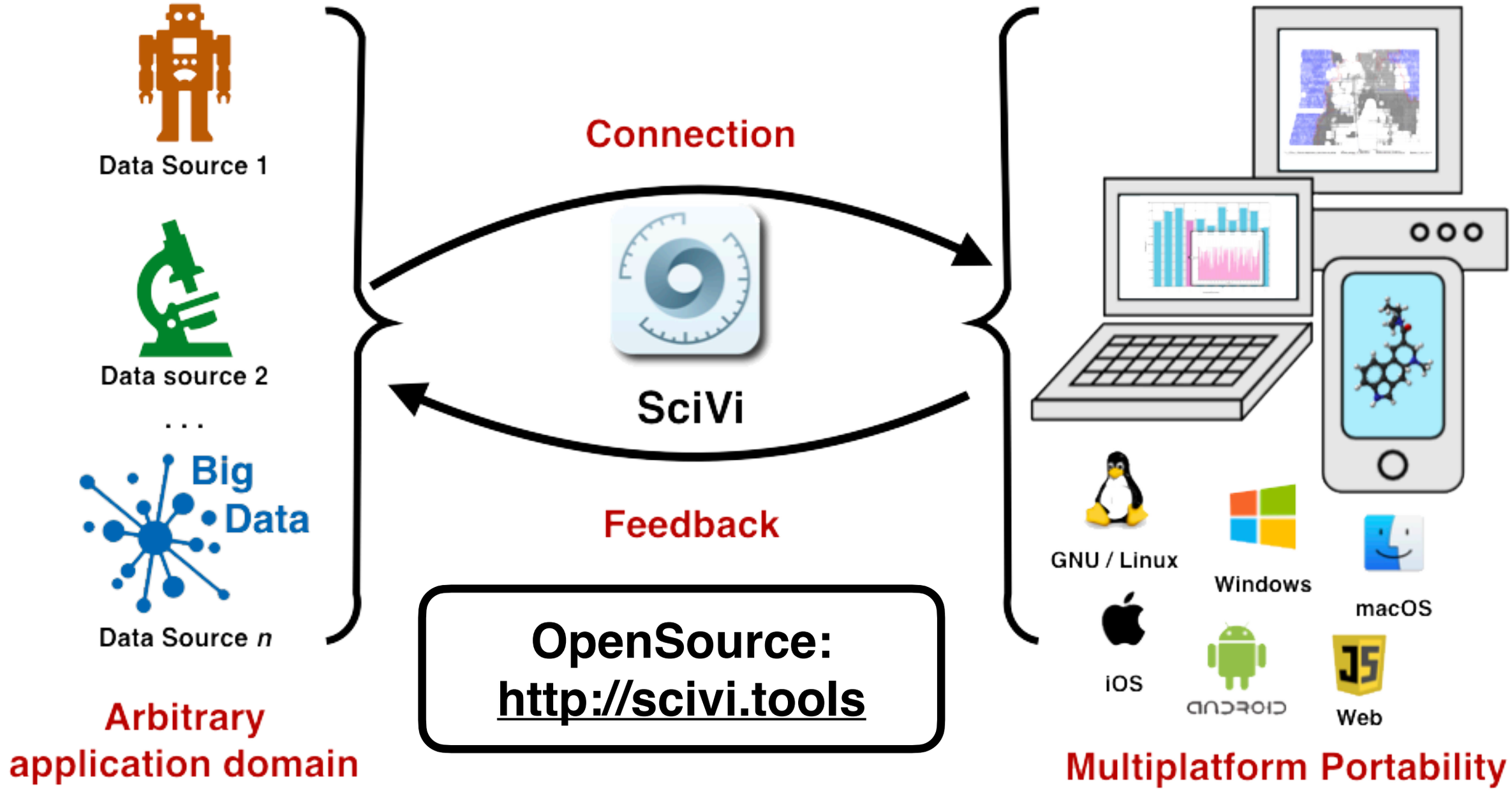


However...
How to program this?

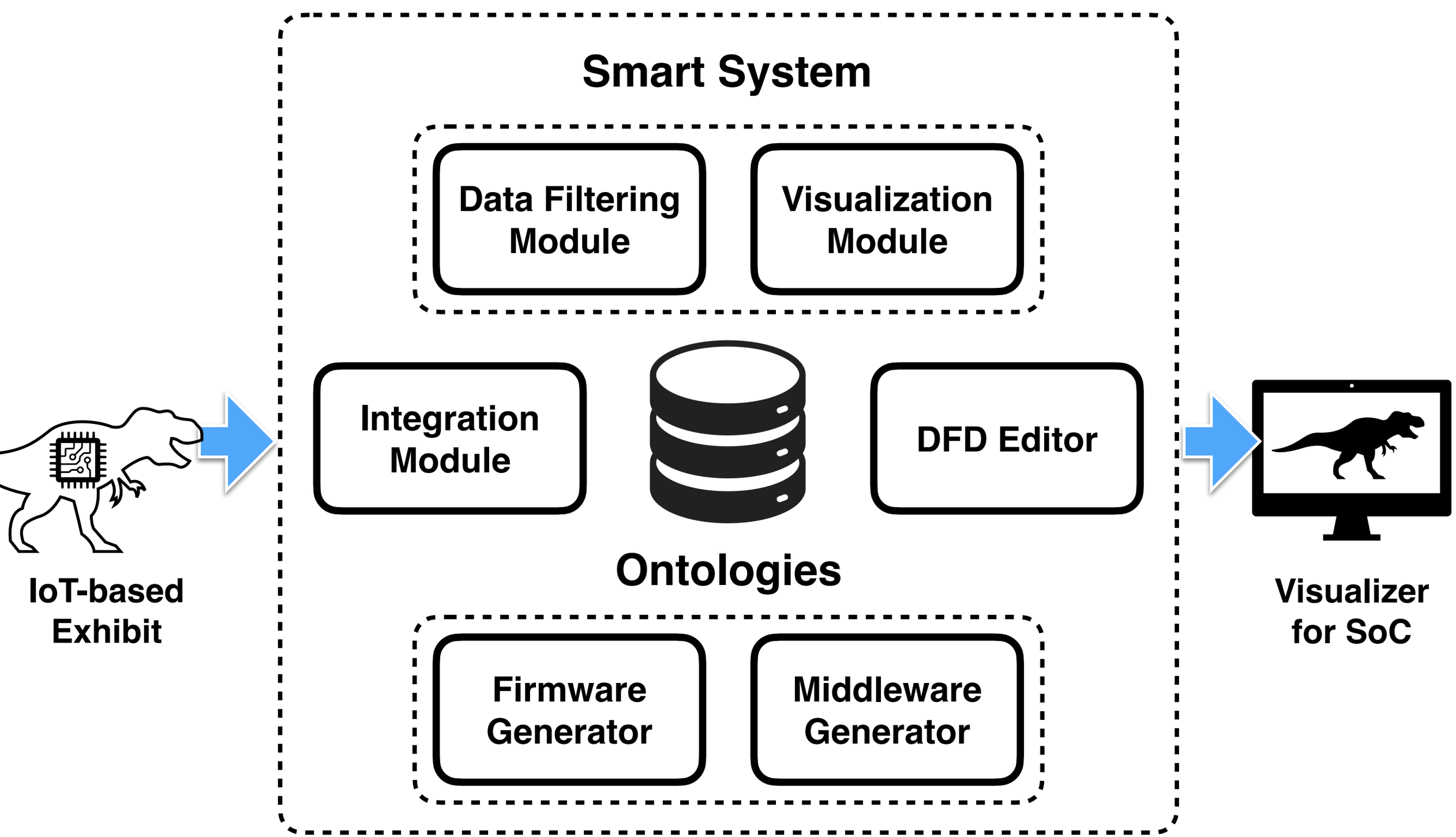
Background: SciVi Platform

Multiplatform client-server adaptive scientific visualization system SciVi

Ryabinin, K., Chuprina, S.: Development of Ontology-Based Multiplatform Adaptive Scientific Visualization System. Journal of Computational Science 10, 370–381 (2015). https://doi.org/10.1016/j.jocs.2015.03.003



SciVi Platform



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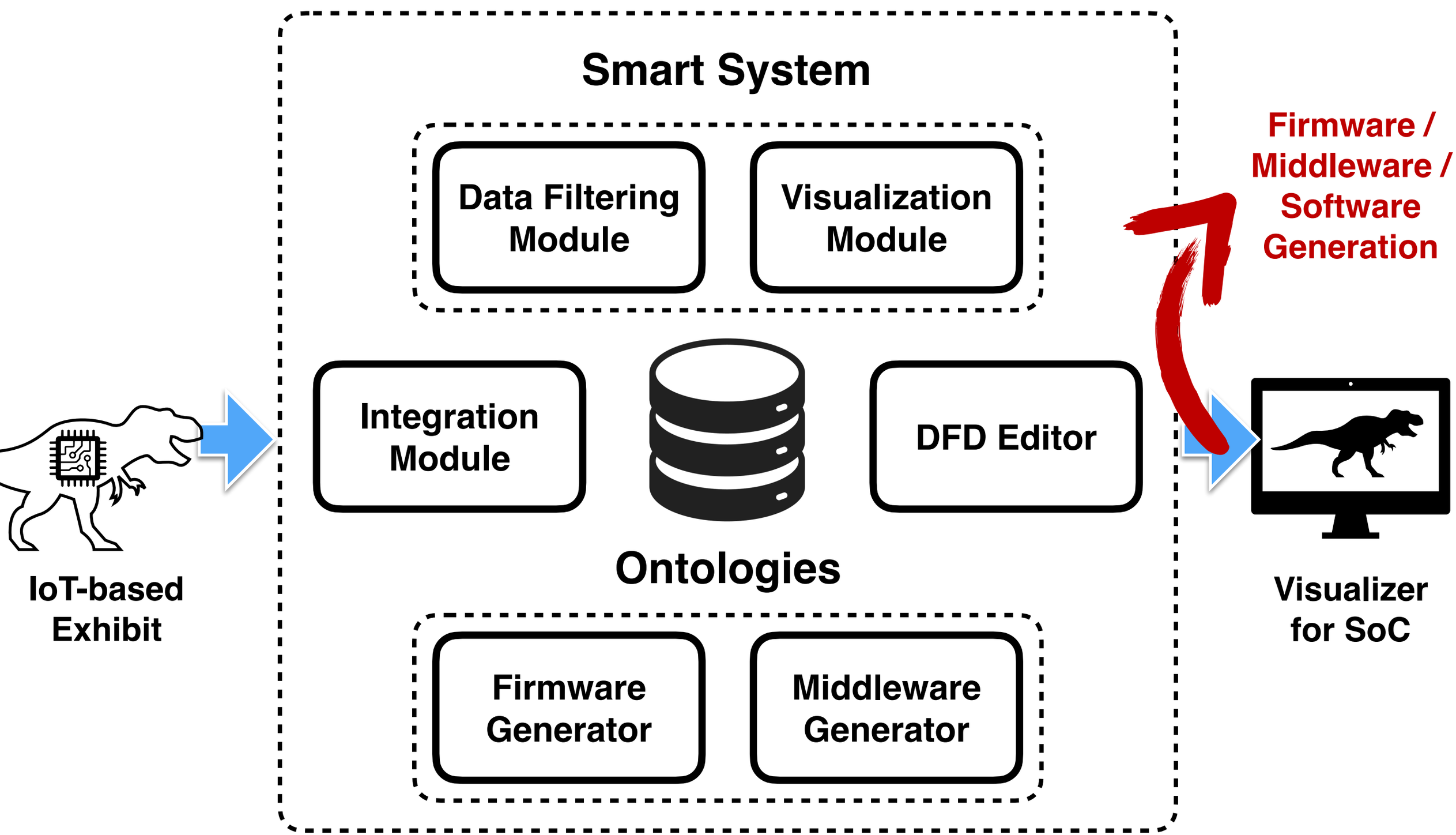

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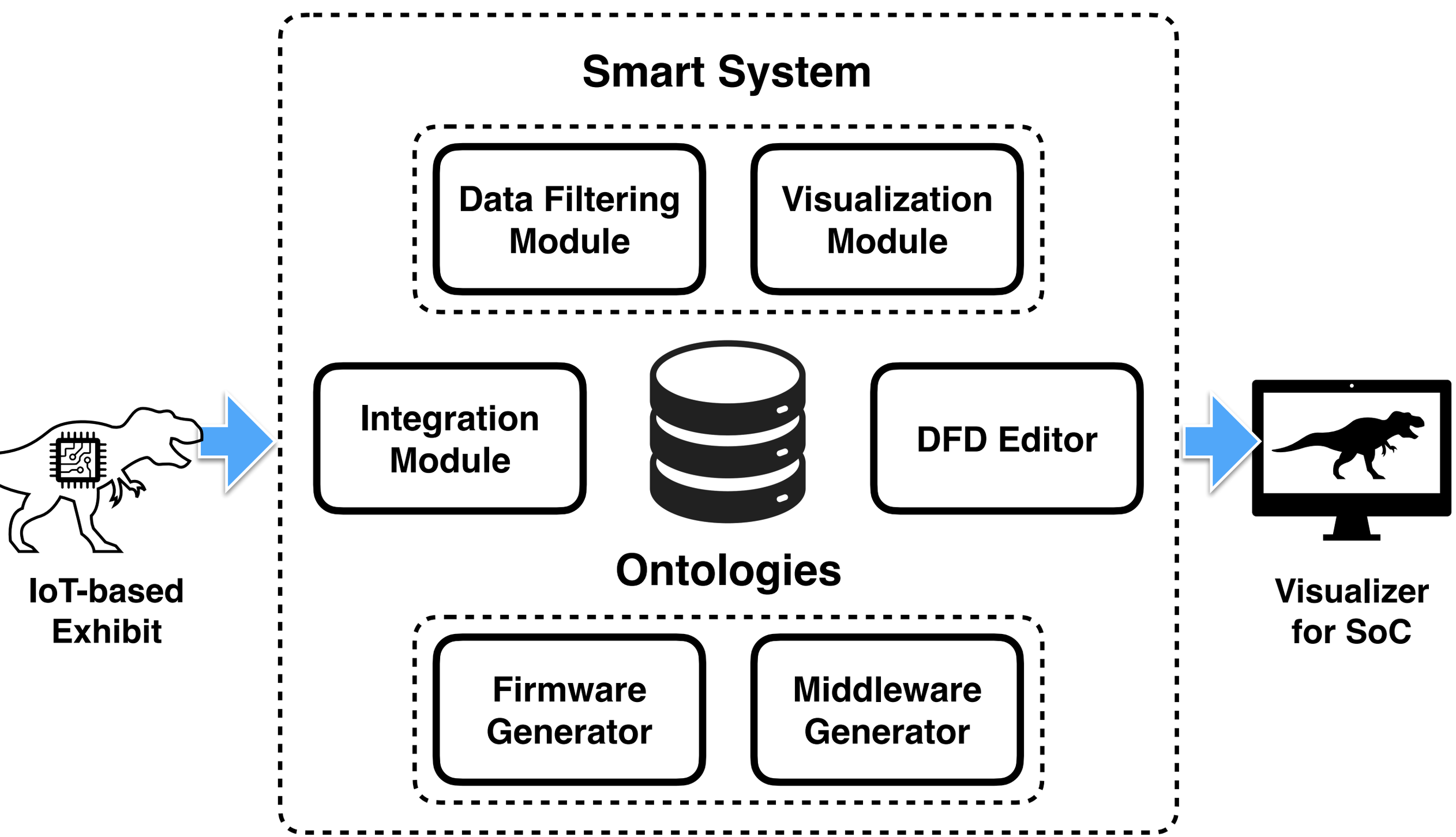


SciVi Platform

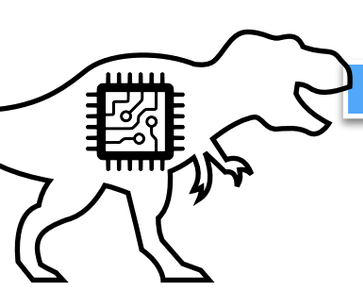
Ontology – formal model of application domain
(T.R. Gruber, 1993)

$O = \langle T, R, A \rangle$

T – thesaurus of application domain concepts

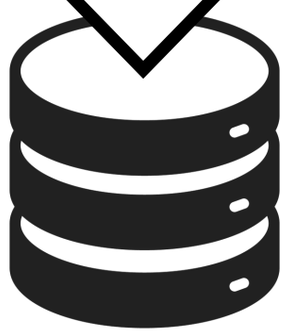
R – set of relations between concepts

A – set of axioms

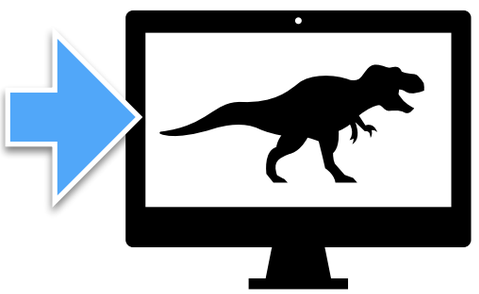


IoT-based Exhibit

Integration Module



DFD Editor



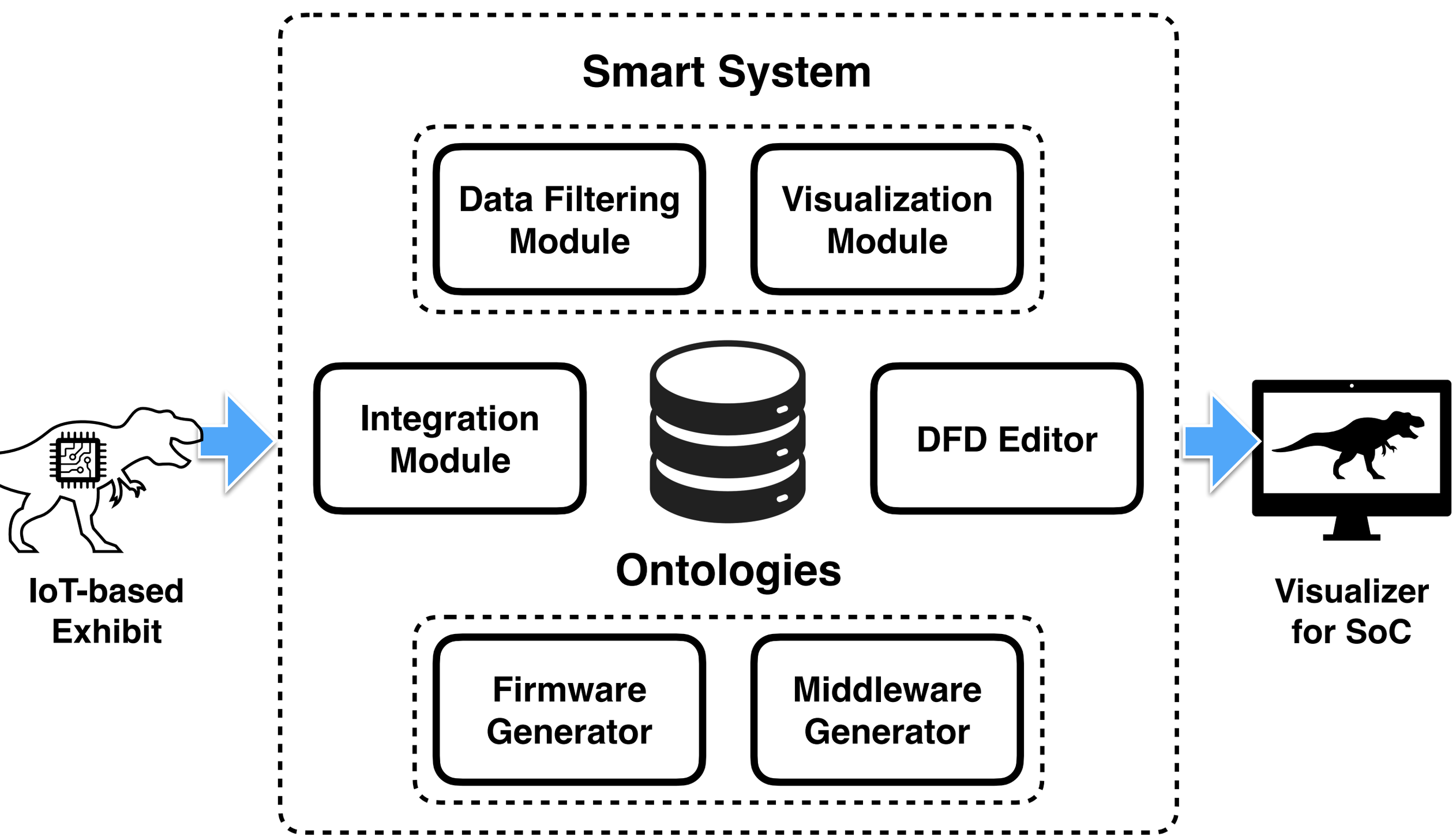
Visualizer for SoC

Ontologies

Firmware Generator

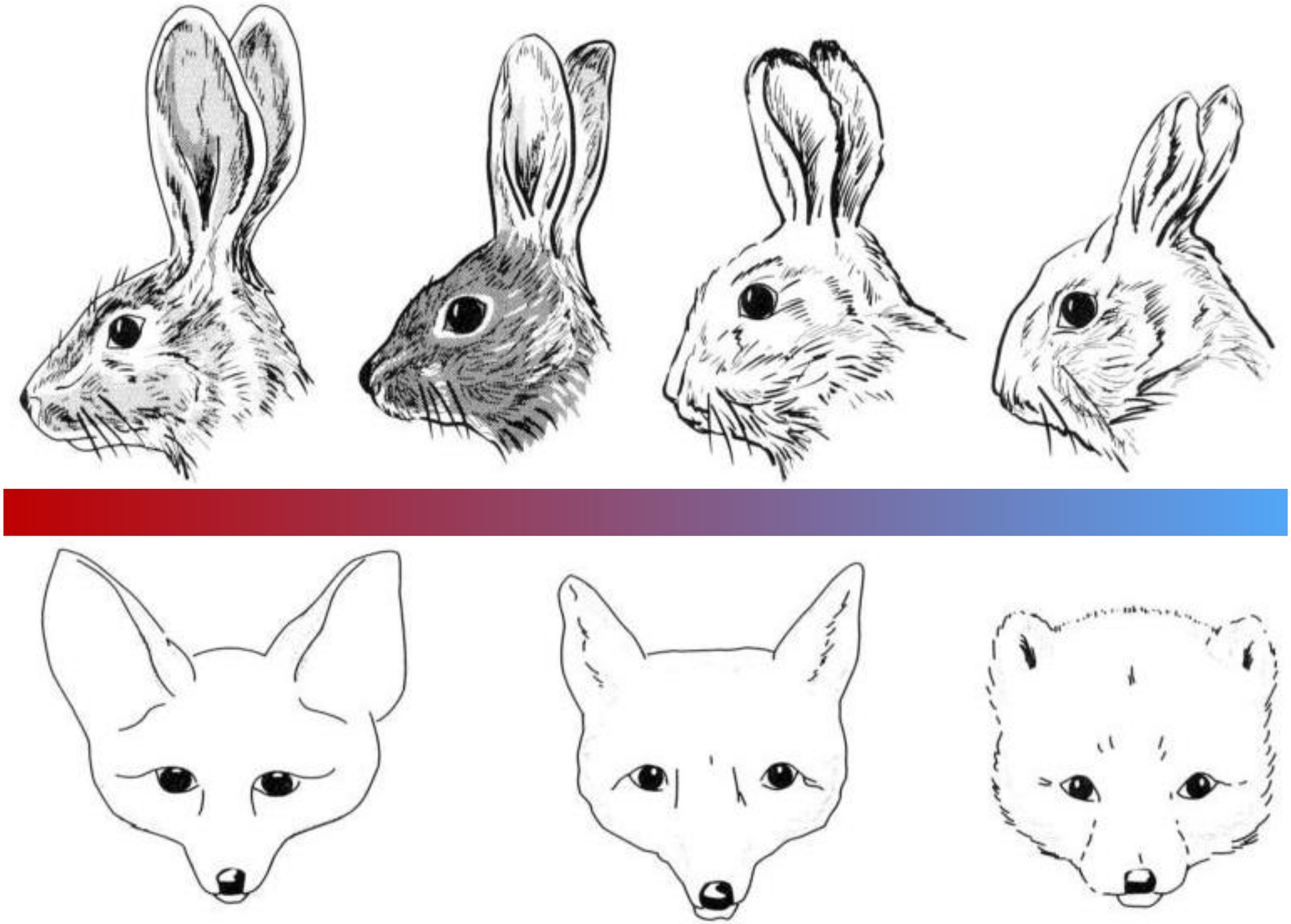
Middleware Generator

SciVi Platform



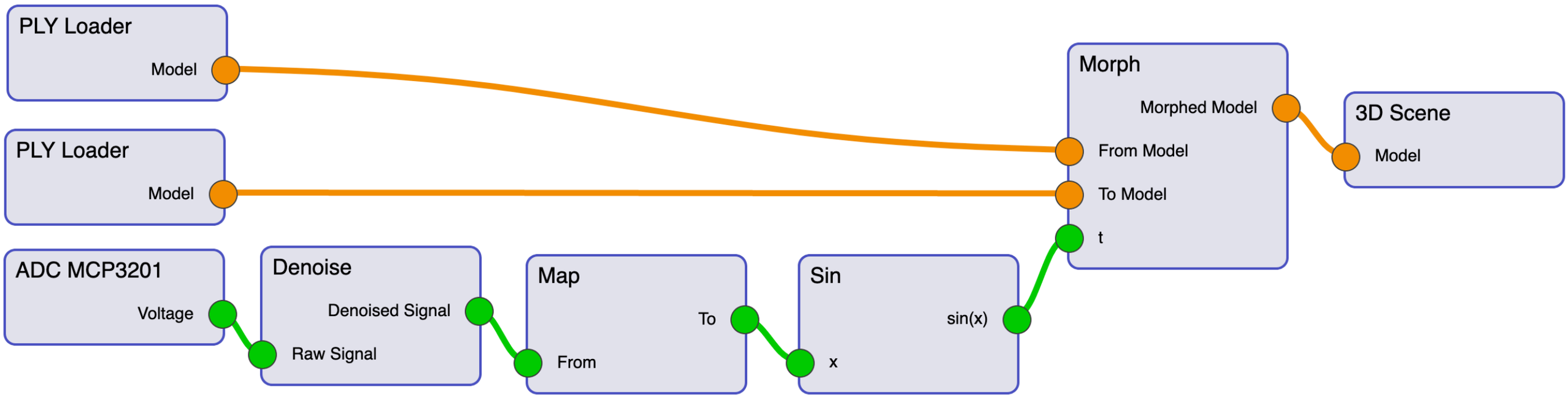
Test Case: Allen's Rule Demonstration

Hot Desert



Cold Tundra

Behavior Declaration via Onto-Driven DFD



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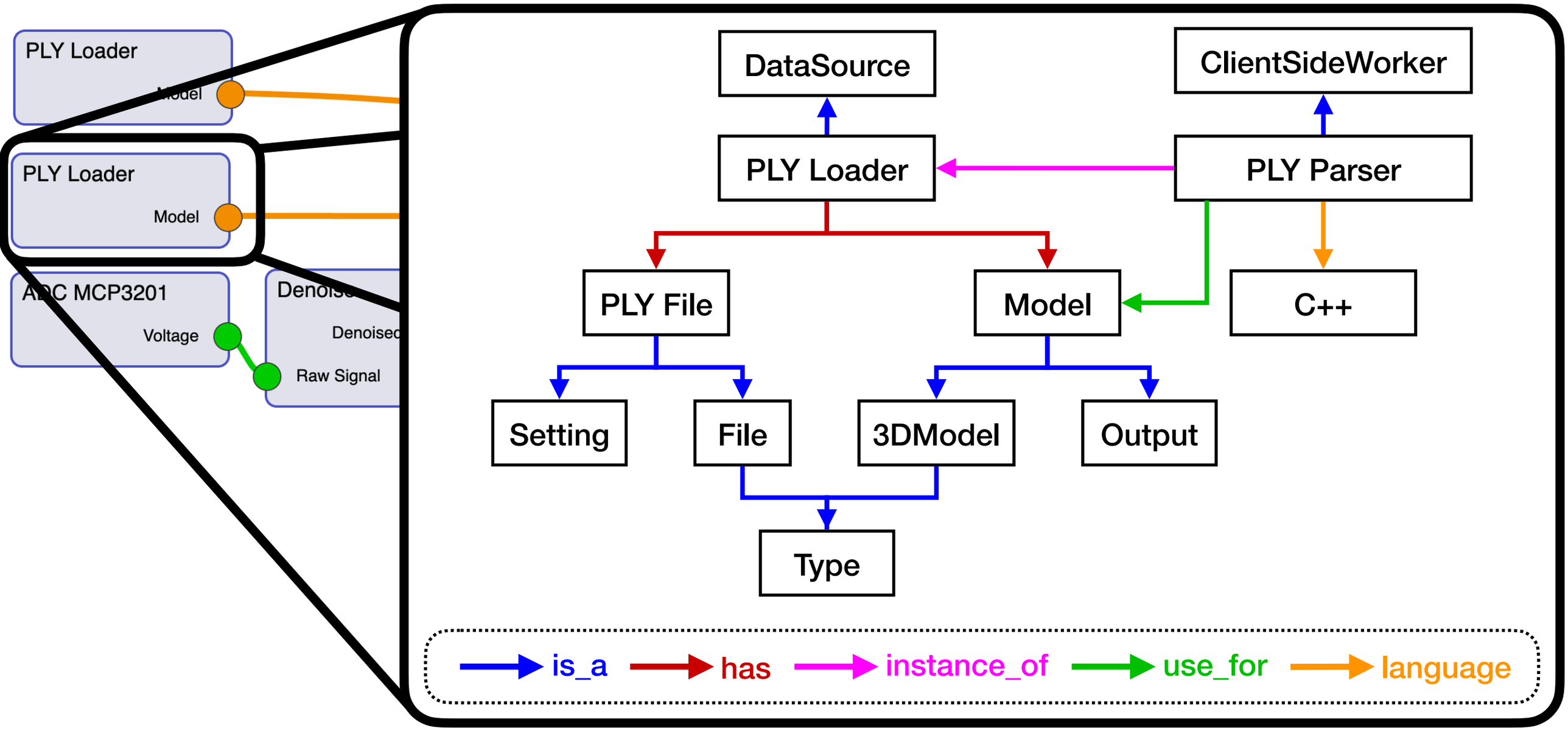

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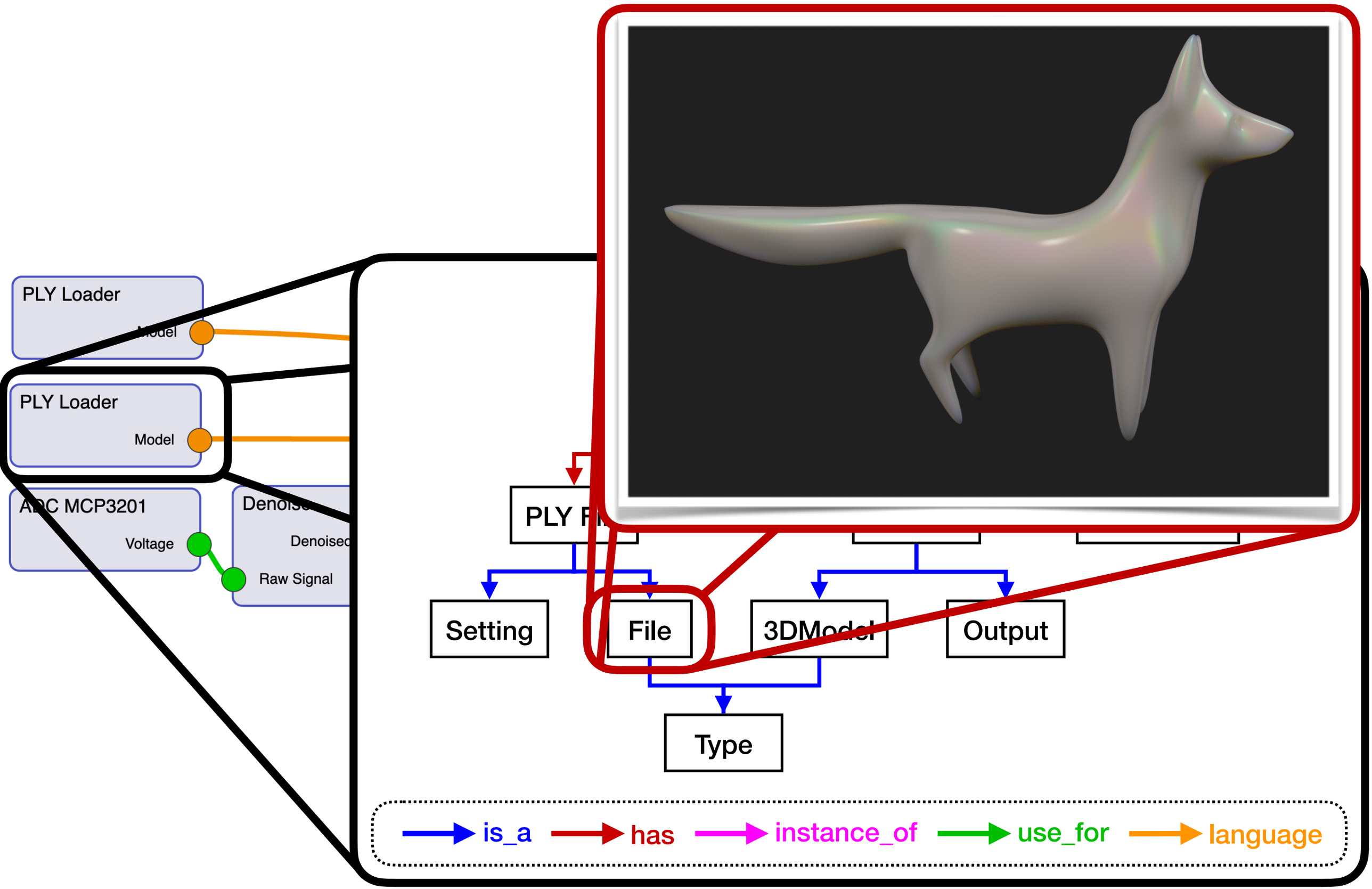

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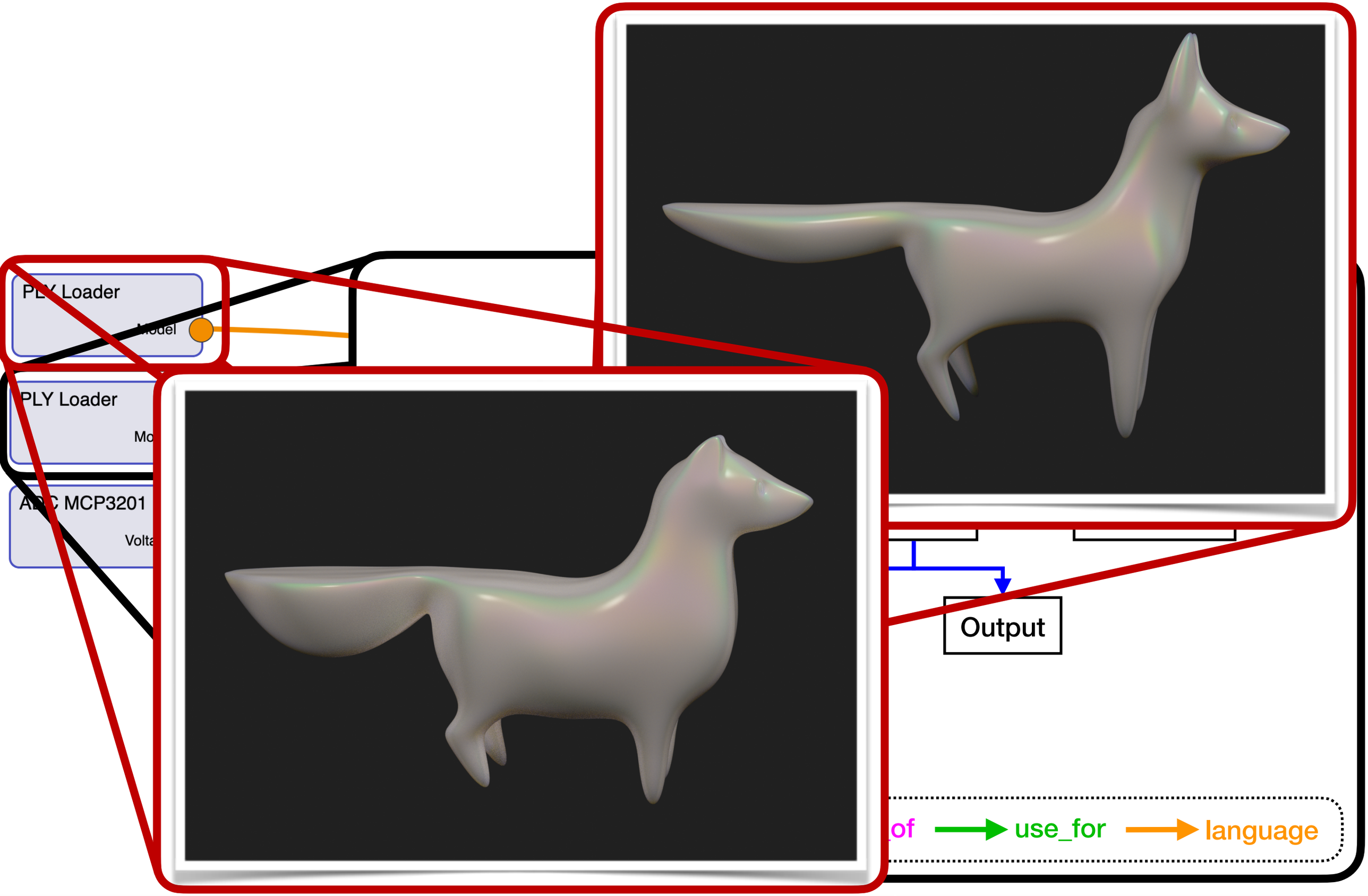
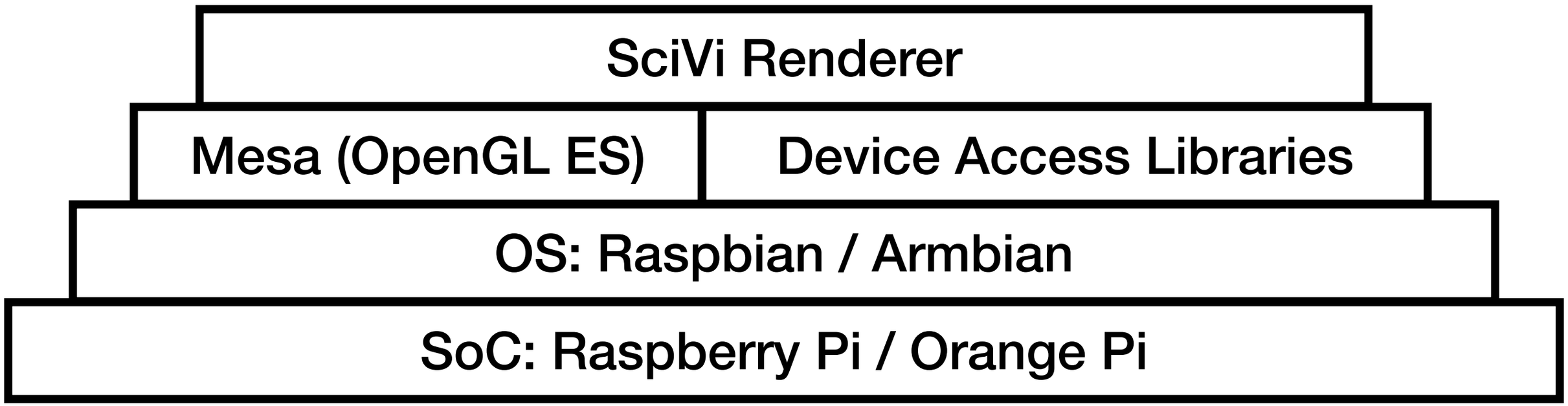


Visualizer Generated



```
$ ./configure
$ make
# make install
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Root required to configure system:

1. Switch on all the needed periphery (SPI, ...)
2. Modify boot options and kernel modules
3. Install autorun
4. Configure read-only root file system

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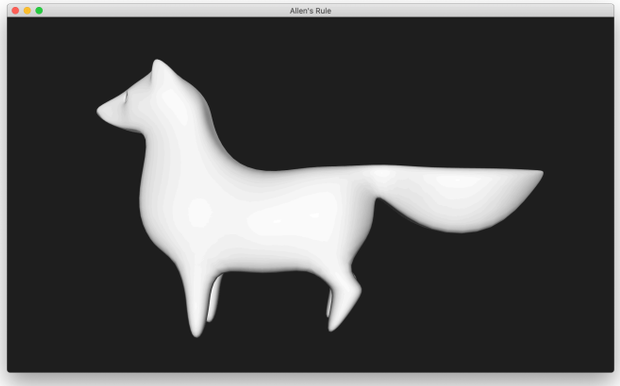
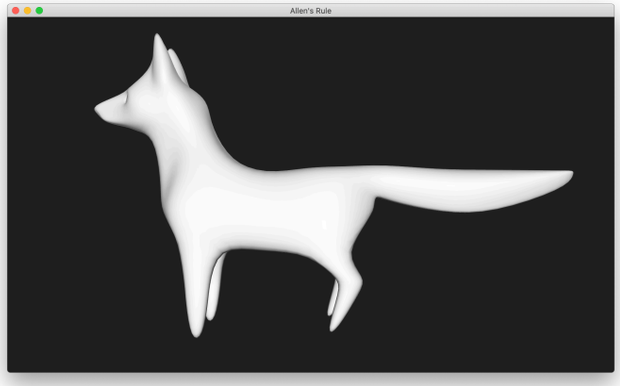
This turns clean SoC into fully functional virtual exhibit

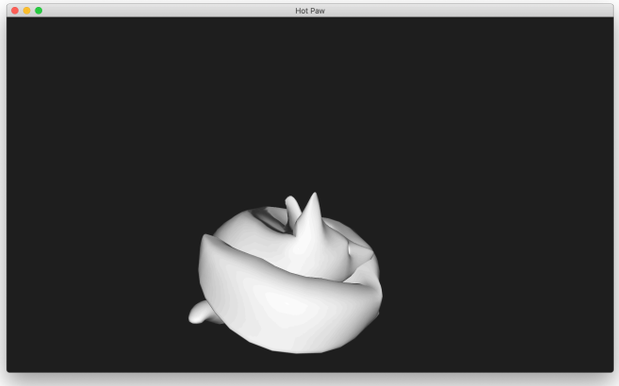
Conclusion: Achieved

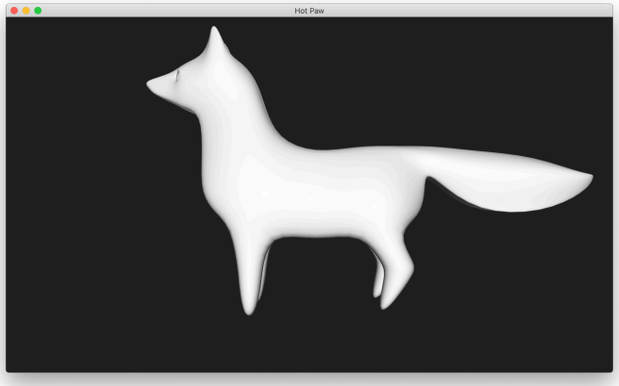
1. Methods and high-level means to create SoC-based virtual exhibits with TUI

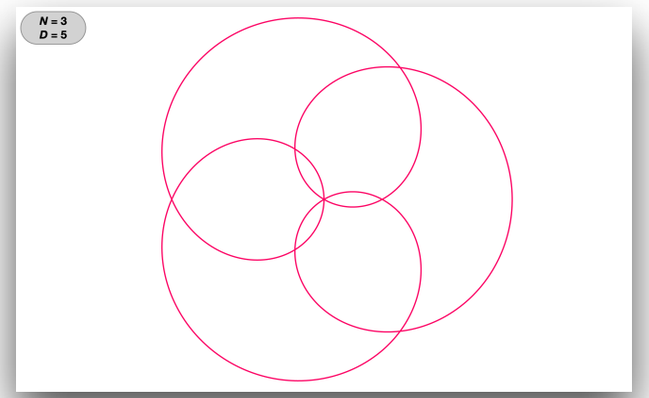
2. 3 virtual exhibits for the "Transmutations" exhibition within Kidsmuseum, branch of Perm Regional Museum











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Scientific Visualization SoC with TUI

1. Rendering optimization
2. Code generation improvements

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Thank you for attention!

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