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BUILDING THE DIGITAL INFRASTRUCTURE FOR FAB CITIES

White Paper

INTERFACER

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Consortium Partners

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Table of Contents

01 BACKGROUND

The Fab City concept provides a promising pathway towards a more resilient and ecological mode of production and consumption.

Globally connected cities and regions share data, information and know-how and collaborate on the development of physical goods in the form of Open Source Hardware, whereas the creation, repair and recycling of those physical goods and artifacts happens in the local sphere close to the place of need and by means of digital production technologies, e.g. freely accessible in Fab Labs.

While the global movement around Fab Cities, Fab Labs and the maker scene is growing, there is a digital infrastructure missing enabling a data-based circular economy on both the global and local sphere.

The need to reorganize globalized value creation and production systems and to establish sustainable and synergetic production processes worldwide is the starting point for the INTERFACER project.

02 VISION

Enabling a data-based circular economy via global collaboration and local production

Our vision is to promote a circular, resilient, and digitally-based mode of production and consumption that enables the greatest possible sovereignty, empowerment and participation of citizens all over the world.

We want to support Fab Cities to produce everything they consume by 2054 based on collaboratively developed and globally shared data as commons on the web.

03 MISSION

Connecting Fab Cities via a federated digital network

The goal of the INTERFACER project is to build, test and validate an open-source digital infrastructure in the form of a federated network to build up and run a local and yet globally connected value creation system.

Along the concept of commons-based peer production and throughout the product life cycle, the so-called **Fab City OS** (OS = Operating System) shall enable cities and regions to bundle, systematize and share data, information and knowledge generated in global networks and communities of practice in order to produce physical artifacts locally in a distributed, sustainable and resilient manner.

Fab City OS helps **cities and regions** to set up and run a decentralized local value creation system by matching local demand for physical artifacts represented in an online store that features globally sourced digital designs with local production capacities (e.g. SMEs or Fab Labs) and other services (e.g. repair, adaption). It furthermore enables partly automated tracking and tracing applications of physical resources and thus material flows on the local level by means of digital product passport functionalities (DPP) and provides production resource planning capabilities with IoT (Internet of Things) applications in the local area.

Fab City OS connects **hardware designers and producers** and provides economic incentives for collaboration on a global scale. Based on distributed ledger technologies (DLTs) and a git-based versioning system of hardware design documentation, inventors and contributors may benefit financially any time physical artifacts based on this documentation will be sold in a Fab City. Any contribution and enhancement will be tracked and value that is captured be distributed among the people involved in the design process.

Fab City OS empowers **citizens** to participate in value creation and sustainably consume by giving them full access to the documentation and thus control over the products they may buy, build, adapt, use or repair.

04 APPROACH

Building the digital Infrastructure to run a Fab City

In the EU EFRE-funded project INTERFACER, four partners teamed up to develop, test, publish and run the Fab City OS and collaborate on related issues, e.g. promoting circular design or improving the Open Source Hardware tool chain.

Existing open source solutions and software applications will be further developed and systematically integrated.

The focus is on the identification, definition and design of interfaces between systems, networks and physical artifacts, from which the project title INTERFACER is derived.

Helmut Schmidt University

leads the consortium with a research-driven approach and strong focus on value co-creation, bottom-up economics and open source hardware.

Fab City Hamburg e. V.

is the perfect use case and thus partner to develop the user interfaces and create a unique user experience.

Dyne.org

foundation has a great track record on building open source software in Europe for decades which greatly benefits the project.

The Hamburg Institute of Value Creation Systematics and Knowledge Management (HIWW)

provides expertise to the consortium in the field of innovation and knowledge management.

05 KEY CONCEPTS

We embrace **co-creation** by collaborating with experts from the field and (potential) users on different levels from hardware designers over Fab City administrators to local governments. We open up the development process by publicly sharing our development repositories and project communication channels.

We strongly believe in the power of **Open Source** and thus apply corresponding licensing regimes to all of our software and hardware developments and applications. As a result, a digital commons is created - a public, non-exclusive good. This form of the underlying rights of disposal structure fundamentally enables and promotes the open transfer of knowledge and technology without neglecting copyrights. Users of our code and data receive full access and thus control over the technology.

Another key concept is **federation** in the sense that we build a digital infrastructure that can be hosted by souverain nodes like a Fab City while being able to connect and exchange data with other Fab Cities.

Finally, we make use of distributed ledger technologies (DLTs) and crypto functions to enable smart contracts and **secure transactions** among the network.

06 RESEARCH & DEVELOPMENT

While the development of Fab City OS is at the heart of the INTERFACER project, we also engage in related issues that can make an impact on the dissemination of Open Source (Hardware), on circular design and circular economy practices. Below, we will introduce a selection of projects we work on:

Fab City OS - Software Kit

> The Fab City Software Kit enables Fab Cities to build a community and share knowledge within their city and with others. It comprises a set of open source software components bundled and packed to be installed on a local instance by a Fab City with features that enable local community building, communication and collaboration.

Fab City OS - Core

Fab City OS is a central component of the digital infrastructure of a Fab City and can be easily installed and used by users as part of the Fab City Software Kit. It enables the efficient production and marketing of Open Source Hardware at all levels of the value chain of distributed production.

The technological basis is Reflow OS, majorly developed by dyne.org in a EU-funded project which enables modelling of economic exchanges to promote trustworthy circularity at a generic level. We focus this feature set on workflows related to Open Source Hardware and distributed production workflows.

Part of this backbone is also a digital product passport (DPP) with two dimensions, namely to track and trace material flows on the local level and capturing flows of (design) data to foster global collaboration. Fab City OS will allow designers to exchange and contribute to each other's designs and bring manufacturing and design closer together with a set of suitable metadata and user interfaces.

The software development will also be accompanied by a policy and user research process resulting in an economic framework.

Open Source Software for Open Source Hardware

Key to a seamless workflow from digital files to physical artifacts is a fully functional open source tool chain from hardware design and development over engineering to production.

We address current shortcomings in this realm by developing a software prototype to automate the documentation process of an Open Source Hardware Project which has the potential to leapfrog collaborative development.

Besides, we will develop a set of OS tools for project management of hardware projects and build a foundation that promotes the development of Open Source Software for Open Source Hardware development.

Outreach activities

With different formats and approaches, we reach out to potential users, facilitators and stakeholders both on the local level within Fab City Hamburg as well as in the global context via the Fab City Foundation to raise awareness on the project, to gather expert insights and to build up user and expert communities.

Together with these communities, we want to elaborate circular design principles and innovation best practices that are appropriate to spark inventive, collaborative and sustainable behaviour and practices among citizens globally and thus foster the dissemination and adoption of Fab City OS.

07 OUTCOMES

Here you find a selection of outcomes that we anticipate in the course of the project.

Fab City OS - Software Kit

Find all the digital tools you need to set up and run a Fab City in one kit to be installed on your local server. Besides setting up Fab City OS, other OS features will be included among which are means for communication, information and collaboration in a Fab City community.

Fab City OS - Core

A digital and federated infrastructure upon which an economy of Fab Cities and regions will unfold covering the value chain from design over production to sales. Hosted by local Fab City administrations, designs from the global commons may enter the local sphere where they can be converted into physical artifacts by Fab Labs and SMEs for users and customers of the products.

Digital Product Passport

The Digital Product Passport (DPP) comprises two dimensions: Tracking and tracing of material flows on the local level to enable circular practices on the one hand and capturing flows of (design) data on the other hand to foster global collaboration and provide opportunities to participate in value creation for different actors.

Green paper

In collaboration with city administrators and policy makers, we elaborate a technological and economic framework for Fab City OS.

Fab City Index

Testing and reviewing a method to evaluate and monitor the circularity status of a Fab City.

The Open Toolchain Foundation

Promoting and supporting the advancement of open source software needed to develop open source hardware.

Fab Access

Further developing a federated access and machine control system for participatory communities such as Fab Labs.

Circular Design Principles

Elaborating circular design principles by means of deep dive events gathering experts from the field from both academia and practice.

Maker Challenge

Run an innovation competition on the local level to build up an innovation community and collect new ideas for open source hardware products to be developed further into functional physical prototypes.

Fab City Micro Factory concept

Conceptualizing and testing how local manufacturing can be realized in a highly modular and flexible micro factory.

Build Workshops

For testing and validation purposes, a series of build workshops will be hosted on the local level applying the different functionalities of Fab City OS.

Final Conference

In a two day conference, we will present the major outcomes of the INTERFACER project to the public and discuss the findings with major stakeholders from the local and global community.

08 COMMUNITY

We regard ourselves as part of a global community of like-minded people with the same mission. Learn here about our network of partners, stakeholders and related projects:

Fab City Foundation

The Fab City Foundation is at the heart of the Fab City Global Initiative and supports it through the development of projects and educational programs that are focused on building the capacity of cities and their communities. The foundation is a key stakeholder and facilitates our outreach activities with access to the Fab City network.

Open Source Ecology Germany e. V.

Open Source Ecology Germany (OSEG) is a non-profit organization that aims at the development and dissemination of sustainable Open Source Hardware projects. The community around OSEG comprises potential users of Fab City OS and experts in the field of Open Source Software and Hardware and thus it can be considered an important stakeholder.

Verbund Offener Werkstätten e. V.

Verbund Offener Werkstätten (VOW) is another non-profit organization with access to a large number of Fab Labs and makerspaces in Germany and beyond. We regard VOW as a gateway to the maker scene and collaborate in outreach activities.

The New Production Institute

The New Production Institute (NPI) is an interdisciplinary think tank and research institute at Helmut Schmidt University that studies new patterns of value creation. In particular, the researchers focus on open, decentralized and collaboration production practices. They support the project with insights from academia and methodological knowhow.

REFLOW

The EU-funded project REFLOW seeks to understand and transform urban material flows, co-create and test regenerative solutions at business, governance, and citizen levels to create a resilient circular economy. Centerpiece of the project is the development of Reflow OS that serves as a technical backbone of Fab City OS.

CENTRINNO

CENTRINNO is a EU-funded research project focused on industrial historical sites under transformation. It will showcase the potential of these cultural landscapes to become new and inclusive hubs of entrepreneurship for city residents while fostering sustainability. The project provides promising use cases and access to experts who may contribute to our project in many areas.

dtec.bw Fab City

The interdisciplinary research project “Fab City” of the program dtec.bw at Helmut Schmidt University aims to understand and describe local and decentralized production approaches in Fab Labs and Open (Source) Labs in Hamburg. It furthermore promotes the development of the Open Lab Starter Kit, a set of Open Source Production machines necessary to run a Fab Lab. Exchange with those researchers will generate useful insights for the development of Fab City OS.

CONTACT

Get in touch via email with the INTERFACER team for more information about future projects, financing, requests or collaborations:

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