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Creating (''Making'') a Planetary Nervous System as Citizen Web

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The goal of the Planetary Nervous System is to create an open, public, intelligent software layer on top of the "Internet of Things" as the basic information infrastructure for the emerging digital societies of the twenty-first century.

After the development of the computer, Internet, the World Wide Web, smartphones and social media, the evolution of our global information and communication systems will now be driven by the "Internet of Things" (IoT). Based on wirelessly connected sensors and actuators, it will connect "things" (such as machines, devices, gadgets, robots, sensors, and algorithms) with things, and things with people.

Already now, more things than people are connected to the Internet. In 10 years time, it is expected that something like 150 billion sensors will be connected to the IoT. Given such masses of sensors everywhere around us—sensors in our coffee machine, our fridge, our tooth brush, our shoes, our fire alarm etc.—the IoT could easily turn into a dystopian surveillance nightmare, if largely controlled by one company or by the state. For the IoT to

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be successful, people need to be able to trust the new information and communication system, and they need to be able to exert their right of informational self-determination, which also requires the possibility to protect privacy.

Most likely, the only way to establish such a trustable, privacy-respecting IoT is to build it as a Citizen Web. Citizens would deploy the sensors in their homes, gardens, and offices themselves, and they would decide themselves what sensor information to open up (i.e. decrypt), and for whom (and for how long). In other words, the citizens would be in control of the information streams. A software platform such as open Personal Data Store (openPDS) would allow everyone to manage the access to personal data produced by the IoT.

13.1 What are the Benefits of Having an "Internet of Things"?

1. One can perform real-time measurements of the (biological, technological, social and economic) world around us.
2. This information can be turned into (real-time) maps of our world and serve as compasses for decision-makers, enabling them to take better decisions and more effective actions, considering externalities
3. One can build self-organizing and self-regulating systems, based on real-time feedback and adaptation. Uses of these kinds will be enabled by a software layer that we call the "Planetary Nervous System" (PNS) or just "Nervous". It offers new possibilities that will allow humanity to overcome some long-standing problems (such as systemic instabilities or "tragedies of the commons" like environmental degradation, etc.), and to change the world to the better.

13.2 Basic Elements of the Planetary Nervous System

1. Sensor kits and smartphones, to measure the environment
2. Algorithms and filters to encrypt information or degrade it such that it is not sensitive anymore
3. Ad hoc network/mesh net (e.g. firechat) to enable direct communication between wirelessly communicating sensors
4. Server architecture to collect, manage and process data
5. A data analytics layer and possibly a search engine and Collective Intelligence/Cognitive Computing layer on top
6. An open Personal Data Store (such as openPDS) to empower users to exercise their right of informational self-determination
7. An app-store-like Global Participatory Platform (GPP) to share data, algorithms, and ratings
8. An editor allowing non-expert users to combine inputs and outputs in playful, creative ways
9. A multidimensional reputation and micro-payment system
10. A project platform to allow the Nervous community to coordinate and self-organize their activities and projects

We will build two variants of the Planetary Nervous System App for smart devices such as smartphones: Nervous and Nervous+. While Nervous would not save original sensor data, Nervous+ would potentially do so. Nervous is thought to be for users that are concerned about their personal data, while Nervous+ offers additional functionality for people who are happy to share data of all kinds. Hence, the users can choose the system they prefer.

Both Planetary Nervous System Apps would offer a rich Open Data stream accessible for everyone. They would build something like a "real-time data streaming Wikipedia", offering people and companies to build services and products on top. The PNS is hence an attempt to enable and catalyze new creative jobs in times

where the digital revolution is expected to eliminate about 50 % of the conventional jobs of today.

13.3 Creating a Public Good, and Business and Non-Profit Opportunities for Everyone by Maximum Openness, Transparency, and Participation

The main goal of the PNS project is to create a public good, namely the basic information infrastructure for the emerging digital societies of the twenty-first century. Besides providing Open Data streams, the Planetary Nervous System may nevertheless offer some premium services to people and/or institutions, who pay for the services or have qualified to receive them for free (such as committed scientists or citizens). "Qualification" means contributions made to the components of the Planetary Nervous System, but also a responsible use of the information services. In this way, we want to reduce malicious uses of the powerful functionality of Nervous+ as much as possible.

The profits created by the PNS would be managed, for example, by a benefit corporation, which is committed to improving social and/or environmental conditions. The largest share of the profits should be used to promote the science, research and development promoting the PNS and services built on top of it. Profits created with inventions of the PNS shall also be used to support the PNS project.

As the PNS project wants to grow into a public good for everyone, the Planetary Nervous System project is committed to opening up its source codes, as much as this is not expected to create security issues or dangers to human rights. Depending on

the competitive situation the PNS is in, the publication may be done with a delay (usually less than 2 years). To minimize delays we will create incentives for early sharing.

The goal of this strategy is to catalyze an open information and innovation ecosystem. Others will be able to use our codes (and other people's open source codes), modify them and share them back. The same will apply to data, Apps, and other contributions. In this way, the Nervous community will benefit maximally from contributions of other Nervous members, and everyone can build on functionality that has been created by others.

Contributions of volunteers will be acknowledged by mentioning the respective creators by name (if they don't prefer to stay anonymous or pseudonymous). In addition, contributions will be rewarded by ratings, reputational values, or scores, which may be later used to get access to premium services. These would include larger query or data volumes ("power users") or an earlier access to codes that will be publicly released with a delay, or further benefits. The PNS project may also hand out medals or prizes for outstanding contributions, or highlight them in social or public media.

13.4 The Role of Citizen Science

For the Planetary Nervous System to be successful, it is crucial to develop a large community of users, but the underlying logic of sharing, bottom-up involvement and informational self-determination demands that everyone is encouraged to contribute to the creation of the system itself. The system would hence be built similar to Wikipedia or OpenStreetMap. In fact, the success of OpenStreetMap is based on the contributions of 1.5 million volunteers worldwide.

This is, why the Nervous project wants to engage with Citizen Science, to grow the Planetary Nervous System as a Citizen Web. As basis of citizen engagement, the Nervous Team will provide (a) kits containing sets of sensors and actuators (e.g. a basic kit, and several extension kits) and (b) a GPP portal, where people can download (and upload) algorithms ("Apps"), which will run on the sensors and thereby produce certain kinds of functionalities.

The Citizen Science community will be engaged in certain measurement tasks (e.g. "measure the noise distribution in your city as a function of time", or "measure data enabling weather predictions"). It will also be engaged to come up with innovative ways to use sensor data and turn them into outputs (i.e. to produce new codes or modify existing ones, thereby creating new Apps). For this, the PNS team will provide tools (such as an editor), allowing non-expert users to transform inputs into outputs in playful, creative ways. Playfulness, fun and reputation are hence offered in exchange for contributing to the development and spreading of the PNS. As a result, we will get new measurement procedures for science, and adaptive feedback processes to create self-regulating systems.