



Activity Report 2016

Team DICE

Data on the internet at the Core of the Economy

Inria teams are typically groups of researchers working on the definition of a common project, and objectives, with the goal to arrive at the creation of a project-team. Such project-teams may include other partners (universities or research institutions).

RESEARCH CENTER
Grenoble - Rhône-Alpes

THEME
Security and Confidentiality

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Team DICE

Creation of the Team: 2013 February 01, end of the Team: 2016 December 31

Keywords:

Computer Science and Digital Science:

- 1.2. - Networks
- 1.2.4. - QoS, performance evaluation
- 1.2.9. - Social Networks
- 2.1.10. - Domain-specific languages
- 2.6.2. - Middleware
- 3. - Data and knowledge
- 3.1.8. - Big data (production, storage, transfer)
- 3.2.2. - Knowledge extraction, cleaning
- 3.5. - Social networks
- 3.5.2. - Recommendation systems
- 5.1.1. - Engineering of interactive systems
- 5.2. - Data visualization

Other Research Topics and Application Domains:

- 6.3. - Network functions
- 6.3.3. - Network Management
- 6.3.4. - Social Networks
- 8. - Smart Cities and Territories
- 8.2. - Connected city
- 8.5. - Smart society
- 8.5.1. - Participative democracy
- 8.5.3. - Collaborative economy
- 9.5. - Humanities
- 9.5.3. - Economy, Finance
- 9.5.9. - Political sciences

1. Members

Research Scientist

Stephane Grumbach [Team leader, Inria, Senior Researcher, HDR]

Faculty Member

Stephane Frenot [INSA Lyon, Associate Professor, HDR]

Engineers

Auguste Caen [Inria, until Oct 2016]

Damien Reimert [INSA Lyon]

PhD Students

Etienne Brodu [INSA Lyon, Atos, granted by CIFRE, until Jun 2016]

Robert Riemann [Inria]

Post-Doctoral Fellow

Aurelien Faravelon [Inria]

Administrative Assistant

Sylvie Boyer [Inria]

Other

Billel Lasledj [Inria, until Apr 2016]

2. Overall Objectives

2.1. Overall Objectives

The DICE team has been created in February 2013 as an "action exploratoire" of Inria to initiate multidisciplinary research on the economy of data resulting from the digital revolution and its impact on all sectors of our society including its political organization.

With the growth of Web 2.0 systems, social data has become a fundamental resource of the economy, much like raw materials. A resource, which is as essential as crude oil, and on which our societies now fully rely. Data is harvested and transformed by industries that grow at an unprecedented pace. Digital corporations offer extremely valuable services, which attract hundreds of millions of users. These corporations generate ecosystems, which become as essential as public utilities and support millions of developers. The new utilities also challenge societies by making obsolete fundamental aspects of their organization, and by generating new imbalances at global scale. At the heart of these changes, is the new capacity to intermediate on two-sided markets, purely in the cloud, that is without having any presence in the physical world were the interactions are taking place.

The objective of DICE is to study the complex dependencies between technological, social and economic systems of the digital age, and to propose technical contributions as well as socio-political analyses. We aim to further investigate the impact of the digital revolution on political systems, anticipated by the French philosopher Michel Serres as expressed in Inria's 2020 Plan. *"if the vast volume of global data [...] were to become accessible to as many people as possible [...], such an event would be liable to put political institutions and the sciences that study them on a new path, perhaps more quickly than we expect."* Michel Serres also insists on the role of computer scientists in studying this revolution and its social impact.

Our contributions target both technical and theoretical aspects of the economy of intermediation platforms. Such platforms are digital intermediaries between users and services. They work on a global scale.

Our aim is threefold:

- We study from technological as well as social, economic, political, and geopolitical points of view, the new ecosystems emerging from the services offered by platforms based on mediating social data, which are reshaping the very form of our organizations;
- We propose technological solutions that answer some of the challenges faced by our societies, such as the concentration of data, the resulting asymmetry of information, and the subsidiarity of computation, that could contribute to better distribute the knowledge among stakeholders;
- We contribute to improve the knowledge of the information society and its implications among specialists as well as non specialists, in the public opinion as well as at the political level.

3. Research Program

3.1. Introduction

Our goal is to address technological issues as well as investigate their impact on society. We believe that addressing both directions simultaneously is essential. More precisely, we focus on the following two objectives:

- Technologies for global intermediation platforms, at reach for unbounded number of users;
- Trans-disciplinary investigations on the global impact of the new intermediation means.

We focus on intermediation platforms, for their increasingly fundamental role in our societies. Intermediation platforms are online systems which offer services to their users, which are well-tuned with their expectation, thanks to the knowledge the platform has accumulated on usage. Search engines and social networks are fundamental examples of intermediation platforms. More generally, intermediation platforms intermediate between producers of services and consumers of services in two-sided markets, with generally one side subsidizing the other. Intermediation will generalise beyond people to things, such as producers or consumers of energy for instance. The capacity to intermediate "in the cloud" with no presence in the physical world in which the market is deployed, by working purely on data with algorithms and in particular learning techniques, is at the heart of the revolution which reshapes our societies.

Platforms ensure a gatekeeping function, always in direct contact with their users, providing them with the most relevant information or contact. They also generate an ecosystem. To do so, platforms allow existing industries as well as new applications proposed by developers to build new services on top of their API. Their impact goes far beyond the Web, while they disrupt step by step all sectors of the economy, transportation, press, education, to name a few.

So far as computer science is concerned, we focus on the technologies used for intermediation, which are at the basis of the largest existing online systems. For the transdisciplinary questions, we focus mostly on the new equilibria that is resulting from the evolution of power balances due mostly to intermediation platforms.

3.2. Intermediation technologies

DICE focuses on intermediation platforms because of the central role they play in the emerging economy.

Intermediation platforms connect users to one another, or users to services with a very high accuracy. They rely on both technological and social innovations. These innovations were unthinkable only a decade ago, when platforms such as Facebook started. They allow communication and interaction between billions of users, gathered in the same digital space, both producers and consumers of data and services. State-of-the-art intermediation platforms include Facebook, Google, Twitter, GitHub, as well as Wikipedia, StackOverflow or Quora. These systems share a common design and their market penetration follows the same pattern. They are built around an initial minimal viable product based on a somehow naive low-tech implementation, which evolves after a few years of improvement to Web giants. Their domination now contributes to standardize the web industry, that means in particular:

- Gatekeeping, a direct relation with users together with services satisfying users' needs;
- Continuous data flows mapped to users' profiles;
- Search engines associating, in a relevant manner, producers, consumers and services.

These common characteristics lead to new software architectural standards, which are shared by all these systems, and used in the peripheral services developed in the ecosystem on top of their API:

- Authentication systems: openId, OAuth, ...
- Object graphs: opengraph, follower/followee scheme, ...
- DataFlow engines: Twitter storm, Google millwheel, ...
- Databases: noSql, keyValues stores, ...
- Application development: javascript, dart, MEAN (Mongo, Express, Angular, Node),...

These architectural components impact the whole digital world. DICE targets systems that use standard architecture services but preserve some aspects we consider as disruptive ones: *data concentration*, *data symmetry* and *computational subsidiarity*. Our current research activity includes the following directions:

- Peer-to-peer design for preserving users' primary data;
- Third parties based organic systems providing subsidiary data computation hosted at peer sites;
- In-Browser applications that impact mobile device and demonstrate instantaneous usability;
- Flow-based computing enabling a stream based exchange of information between peers at runtime.

3.3. Economy of intermediation

The recent neologism *uberization* coined after the name of *Uber*, a young intermediation platform, may summarize the effects of the digital revolution. This revolution is impacting all sectors of our societies such as organizations, education, energy, transportation and health, to name a few. This revolution results in a serie of what Schumpeter calls *creative destruction*. As traditional sectors disappear, new ones are created. Our societies, which did not anticipate the depth of the changes, have to struggle to adapt to the pace of the development of the industry. Legal reforms in various important sectors including taxation are at stake. Some countries, more reactive than others, are clearly leading the changes, exploiting the benefits for businesses and the capacity to generate information and value, while others are trying to catch up with the global trends.

Data form the bricks of the information society, and their flows between users and services constitute the blood of the industry. We focus in DICE on the strategic role of data in this revolution, and in particular on the systems that harvest the data and concentrate it. In particular, we focus on *intermediation platforms*. Doing so, we investigate the issues they raise and the disruptions they entail.

We are especially interested in the global political impact of intermediation platforms. The settlement of the *right to be forgotten* in Europe, for instance, exemplifies the new roles platforms are playing: they are both targets of complaints from institutions and mandatory partners in the governance of the world in the digital era. Indeed, they deeply revolutionize the relations between governments and citizens. If privacy is the focus of considerable attention, together with the state surveillance, in Europe in particular, it is only one aspect of the new knowledge made available. Social media produce considerable knowledge not only on individuals, but on populations as well, their economic fate, their political orientation, etc. On the other hand, open data from governments allow citizens to monitor the action of their governments, as well as to contribute to it. The digital revolution, with the capacity to access information in ways unthinkable in the recent past, modifies completely the balance of powers between citizens, states and corporations.

We investigate the digital world, and more precisely the power relations, from an interdisciplinary perspective. We simultaneously quantify power relations by studying data flows and the rise of intermediation platforms and produce an economical, political and ethical analysis of this new state of affairs. Namely, we show that areas such as the US or China dominate the digital world when others, such as Europe, do not succeed in proposing widely used intermediation platforms. This situation generates several conflicts between countries and companies and prevents *weak* countries from promoting their values and policies.

A new trend is emerging in the humanities, around in particular the digital studies, which promote the cooperation between computer scientists and specialists of social sciences. Among them, the Berkman center for Internet and Society in Harvard, the Medialab at MIT, or the Web Science Institute in the UK have gained strong visibility. They address positive as well as negative externalities of IT for societies, that is the new potentials offered as well as their risks. The Center for Information Technology Research in the Interest of Society in Berkeley also addresses fundamental political impacts on democracy, which can be enhanced by open data as well as another philosophy of political power as currently implemented in the State of California for instance. The Open Data Institute in the UK is also a leading center for political issues in Europe. France should catch up on these research trends, at the intersection of different scientific fields.

4. Application Domains

4.1. Two-Sided Market

Intermediation platforms operate in two-sided markets, that is in environments with two types of actors, producers of good or services on one side, and consumers on the other side. Intermediaries play a fundamental role by allowing the connection of both thypes of actors. If intermediaries already existed in the pre-digital era — banks constitute a historical example of intermediaries — it is really only the advent of digital technologies which boosts the development of intermediation. A large number of activity sectors fall in such a framework, including transportation, press, education, health, etc. We decided to focus on some of them in greater details for their particular relevance.

4.2. Education platforms

Education institutions are at stake because of the new technologies that not only change the access to knowledge, and therefore the traditional equilibrium between teachers and students, but also provide new means to produce knowledge, and share studying experiences.

Our objective is to develop a platform - called Jumplyn - that offers disruptive services for students, helps them produce their work, connects them to other students in the same area, and preserves their contribution online. The platform targets students. It also aims at offering services on the other side of the education market, i.e. to institutions, by allowing them to organise the work of their students, as well as their evaluation. Jumplyn is accessible online and, as other platforms, evolves continuously.

4.3. Decentralised Voting

Online voting systems are controversial. They are advocated for their simplicity, which could contribute to enhance participation, but criticised for their failure to ensure the same properties as traditional voting systems. We propose an alternative path to online voting relying on decentralised systems with no concentration of data. A patent is under evaluation for the BitBallot protocol.

4.4. City Administration

The team is actively participating to the Inria International Project Lab IPL CityLab on smart cities. We work also with the metropole of Lyon, and its Chief Data Officer in particular, to better understand the equilibrium between online platforms and the public administration, and the policy regarding data and its accessibility to other parties.

4.5. Metrics for digital economy

While economic metrics based on trade of goods and services, as well as financial exchanges are well-established, exchanges of data, and more generally transborder activities on platforms are not included in standard economic measurements. Defining such metrics both theoretically and practically with means to evaluate them is of great relevance in economy, and beyond.

5. New Software and Platforms

5.1. BitBallot

FUNCTIONAL DESCRIPTION

The BitBallot voting protocol is designed to target large scale communities. The protocol allows users to share only restricted amounts of their data and computation with central platforms as well as other peers. Convinced by the need of new election mechanisms, to support emerging forms of more continuous democracy, we are developing BitBallot, to allow elections to be organized independently of any central authority. The protocol guarantees the following properties, anonymity of the data sources, non interruptible run-time, global access to results, and non predictability of results through partial communication spying.

- Contact: Stéphane Grumbach, Stéphane Frénot, Damien Reimert, Robert Riemann

5.2. C3PO

FUNCTIONAL DESCRIPTION

Social networks put together individuals with common interests and/or existing real-life relationships so that they can produce and share information. There is a strong interest of individuals towards those networks. They rely on a stable, centralized network infrastructure and a user will always be provided with the same services no matter what their current context is. By contrast, the C3PO project aims at promoting “spontaneous and ephemeral social networks” (SESN), built on top of a peer-to-peer distributed architecture leveraging ad-hoc mobile networks and the resources and services offered by mobile devices. As with traditional social networks, SESN can put together nomad individuals based on their affinities and common interests so that they can collaboratively work on tasks as part of a SESN.

- Contact: Stéphane Frénot, Damien Reimert

5.3. Jumplyn

Jumplyn is a student project delivery platform. It offers a service based on three features: the ongoing management of the project, resources recommendation, and enhancement of the activity. Like any intermediation platform, it speaks directly to its users, students, and puts them in relation to relevant information.

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- Contact: Stéphane Frénot, Stéphane Grumbach
- URL: <http://www.jumplyn.com>

6. New Results

6.1. Intermediation platforms

Our study of the geopolitics of intermediation aims at grasping the balance of power between platforms, as well as between states - in their relation to platforms - and between platforms and states. We have extended our studies with insights from law in [1] and economics in [2]. We have tuned the metrics we already had in order to better grasp the economic weight of intermediation economy. As we did so, we improved our understanding of the social weight of intermediation platforms and the legal issues which they raise.

Our focus has turned to the analysis of public and private policies and their relation to the development of intermediation platforms. In [3], we study a set of cases ranging from the Safe Harbour to the right to be forgotten. Using the “coalition framework” as our analysis framework, we identify the actors influencing policy-making and potential reasons for the success or failure of policies. Such failures include forbidding innovation or preventing public bodies from stepping up their digital capabilities.

Our work has been intrinsically interdisciplinary, the main result of our work is a global model of intermediation platforms and their economy, presented in [6]. This model helps to understand the current issues raised by the uberization for instance.

6.2. Development of platforms

Dice team designs software architectures for intermediation platforms. C3PO and BitBallot targets spontaneous and ephemeral social networks whereas Jumplyn focuses on pure central based system. All these architectures share a common JavaScript layout both at the client and the server sides. In the research context we validate state-of-the-art technologies promoted by web leaders such as Google AngularJS, Facebook ReactJS and many others such as Netflix, Walmart, or the Linux foundation for node.js. The Web environment raises many big issues since all equipments are basically connected to the Internet and the balance between end-user equipment cost and processing power is still a work in progress. Our main research track in such context is to find proper software toolkits hiding Web complexity. We mainly focus on time jitter, cornerstone of Web

development, since it implies both end-user and network TCP indecisions. Due to this jitter combination the Web programming model has mutated toward the promises paradigm. It is a complex event based development model provided without external API help. It handles future execution whether successful or not, in a time jittered context. AngularJS, ReactJS, CoffeeScript, NodeJS, MongoDB, ElasticSearch are all time jitter compliant technologies designed for the Web constrains and revolutionising the way we build intermediation platforms.

In C3PO, we tested application in real conditions during the marathon of Vannes and the semi-marathon of Beaune. A few hundred users have downloaded and use the application. The returns on this one are rather positive. [4].

Our joint work with Worldline explores the promises paradigm model to enable automation extraction of independent micro-service. These micro-services called fluxion [9], from the contraction of flow and functions, may be dynamically and transparently moved over a cluster of servers. Our novelty resides in the fact that the original code is not redesigned for the cluster architecture. Fluxion are extracted from the initial code, and an equivalence is maintained between the initially promissified code and the fluxionized one. Code has two facets, a promise one, used to express software services and a fluxion one, used to express software bottlenecks [5].

Eventually our work with Jumplyn explores complex centralised social network. We want to design a software system to later support our technical research hot topics. The target theme is a software platform that helps students handle their projects. University depends more and more on external resources to teach students. Theses resources are both known by students and their teachers, and the pace and range of explored technologies leads to difficulties in teaching state-of-the-art subjects. The more dedicated a professor needs to be in his research activity, the more broad knowledge he has to teach. For instance 20 years ago one could cope software development teaching with one or two programming languages. Nowadays, a single code involves more then four programming languages to be fully understood. This technology spreading issue stands still in many teaching domains, since past technologies are still actives and future one are promising. We build Jumplyn to cope with this unbalanced game. To help student improving their project and avoid working with obsolete technologies, and to help teacher face the universal and inexpensive availability of knowledge. Jumplyn is a complex JavaScript development stack that collects resources for improving student work and providing services to help them from day to day activities. The current stack integrates the following technologies : MaterialDesign, AngularJS, CoffeeScript, NodeJs, MongoDb, ElasticSearch. Managing and developing software service above this stack is a complex research issue for a small sized development team. We do not have any publication on Jumplyn since our first goal is to build a support intermediation platform to study classical issues such as recommendation or web crawling, scraping and indexation with our own sources of raw data.

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Worldline Wordline is a leader in B2B applications development, and is in the front line to provide new technical solution in the Web 2.0 era. We have a CIFRE partnership contract on the study of flow based architectures both at the data centers and at the Web browser level.

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. IXXI

The Dice team is hosted in the Rho[^]ne-Alpes Institute for Complex Systems, IXXI, located in Ecole Normale Sup[^]rieure de Lyon. IXXI is promoting trans-disciplinary research, in particular with social sciences, thus facilitating the establishment of connections with researchers in fields such as economics, history, law, etc.

8.1.2. ARC 6 "Innovative Services for Social Networks"

DICE is involved in a regional project of the Rhône-Alpes region, ARC6 "Innovative Services for Social Networks", with Telecom Saint Etienne.

8.2. National Initiatives

8.2.1. ANR

DICE is involved in an ANR project, which started at the end of 2013

- C3PO, on Collaborative Creation of Contents and Publishing using Opportunistic networks, with LT2C Telecom Saint-Etienne, INSA LYON, IRISA, ChronoCourse, et Ecole des Mines de Nantes.

8.3. European Initiatives

8.3.1. FP7 & H2020 Projects

DICE is involved in the CSA project "Big data roadmap and cross-disciplinary community for addressing societal Externalities (BYTE)", Objective ICT-2013.4.2 Scalable data analytics (c) Societal externalities of Big Data roadmap.

8.4. International Initiatives

8.4.1. Inria International Labs

Dice is involved in IPL CityLab@Inria which studies ICT solutions for smart cities. Dice takes part in the Platforms and City Governance theme. Dice focuses on analysing and forecasting the role of intermediation platforms in the governance.

9. Dissemination

9.1. Promoting Scientific Activities

9.1.1. Scientific Events Organisation

9.1.1.1. Member of the Organizing Committees

- Stéphane Frénot, French Tech, représentant de la COMUE de Lyon
- Stéphane Grumbach, ANR, Comité de Pilotage Scientifique du Défi 8 « Sociétés innovantes »
- Stéphane Grumbach, scientific committee Global Forum
- Stéphane Grumbach, scientific committee Collège des Bernardins, Journalisme et bien commun à l'heure des algorithmes

9.1.2. Scientific Events Selection

9.1.2.1. Chair of Conference Program Committees

Stéphane Grumbach has been chair of the following conferences:

- From data on ecosystems to ecosystems of data, Seminar in cooperation between ENS and EPFL, Lausanne, 21 October 2016
- Seminar Intermediation and Smartness, Anthropocene Curriculum, The Technosphere Issue, Haus der Kulturen der Welt, Berlin, 15-23 April 2016

9.1.3. Invited Talks

Stéphane Grumbach has given the following talks:

- Panel The Transatlantic Data War, obama2016: L'héritage Obama. Tensions et reconfigurations après la présidentielle, Paris, 12-14 déc. 2016
- Panel L'impact des algorithmes sur les media et la culture, Entretiens Jacques Cartier, Lyon 21 novembre 2016
- The Datasphere, in control of ecosystems, The 136th RIHN seminar, Research Institute for Humanity and Nature, Kyoto, 18 November 2016
- Digital Platforms, Europe Asia, Diverging Spaces?, The Relevance of Area Studies for the Sciences and Public Policy, DIJ, Tokyo, 14-15 November 2016
- Platforms vs Administrations, The mutation of data driven government, , ECNU, Shanghai, 9 November 2016
- Panel The Data Revolution, Global Forum, Digitalization: the global transformation, Eindhoven, 19-20 September 2016
- Innovation, pouvoir et territoires, Summer School Cespec 2016, (IX Edizione) Futuri. Immaginare il mondo di domani, Cuneo-Savigliano-Alba-Mondovì, 13-17 settembre 2016
- Révolutions dans la culture et la transmission des savoirs à l'heure du numérique, TUBA'X-PERTS, Lyon, 9 juin 2016
- Conférence "Grand Témoins" : le BIG DATA, Grand rendez-vous de la Métropole, Lyon, 23 mars 2016 video
- Géopolitique du numérique : enjeux des plateformes globales pour la région, LeLabIdF, ThinkLab de la Région Île-de-France, Paris, 17 mars 2016
- Intelligence artificielle, le pouvoir aux machines ? Collège des Bernardins, Paris, 11 février 2016

9.1.4. Research Administration

Stéphane Grumbach is director of IXXI, the complex Systems Institute.

9.2. Teaching - Supervision - Juries

9.2.1. Teaching

Master : Stéphane Grumbach, Guerre, climat et enjeux de l'Anthropocène, 2h, M1, ENS de Lyon, France

Master : Stéphane Grumbach, La révolution numérique et les difficultés d'ajustement des administrations françaises, 2h, M1, ENTPE, France

Master : Stéphane Grumbach, Réseaux sociaux et Nouveaux Outils de Communication, 2h, M1, INSA Lyon, France

Master : Damien Reimert, - Bitcoin, 24h, M1, INSA de Lyon, France

Master : Damien Reimert, Javascript, 43h, M1, Télécom St-Étienne, France

Licence : Damien Reimert, Développement Mobile, 39h, L3, Télécom St-Étienne, France

Licence : Aurélien Faravelon, HTML5 CSS3 Javascript, 24h, L3, IUT 2 Grenoble, France

Master : Aurélien Faravelon, Economie de l'intermediation, 2h, M2, Ecole centrale de Lyon, France

Licence : Robert Riemann, INSA, Algorithmique et programmation 1, 27HETD, L1, INSA Lyon, France

9.2.2. Supervision

PhD : Etienne Brody, DataFlow compilation from JavaScript, INSA Lyon, 21 Juin, Stéphane Frénot

PhD in progress : Robert Riemann, systemes de vote decentralise's, sept 2014, Stéphane Grumbach

9.3. Popularization

Aurélien Faravelon: 12/05/2016, Débats Citoyens, Musée Galo Romain de Lyon

Robert Riemann: 28/12/2016, Chaos Communication Congress/We fix the Net assembly, Hambourg

10. Bibliography

Publications of the year

Articles in International Peer-Reviewed Journals

- [1] J.-S. BERGÉ, S. GRUMBACH. *La Sphère des Données : Objet du Droit International et Européen*, in "Journal du droit international (Clunet)", 2016, <https://hal.inria.fr/hal-01359798>
- [2] A. FARAVELON, S. FRÉNOT, S. GRUMBACH. *Chasing data in the Intermediation Era: Economy and Security at stakes*, in "IEEE Security and Privacy Magazine", January 2016, <https://hal.inria.fr/hal-01107365>

International Conferences with Proceedings

- [3] A. FARAVELON, S. GRUMBACH. *The Complexity of Public and Private Policies for Big Data*, in "22nd ICE/IEEE ITMC International Technology Management Conference", Trondheim, Norway, IEEE, June 2016, <https://hal.archives-ouvertes.fr/hal-01404281>

Conferences without Proceedings

- [4] A. BOUTET, S. FRÉNOT, F. LAFOREST, P. LAUNAY, N. LE SOMMER, Y. MAHÉO, D. REIMERT. *C3PO: A Network and Application Framework for Spontaneous and Ephemeral Social Networks.: [this paper ha been published in WISE2015 conference]*, in "Ubiquité et mobilité 2016", Lorient, France, July 2016, <https://hal.archives-ouvertes.fr/hal-01384311>
- [5] E. BRODU, S. FRÉNOT, F. OBLÉ. *Transforming Javascript Event-Loop Into a Pipeline*, in "SAC", Pisa, Italy, April 2016 [DOI : 10.1145/2851613.2851745], <https://hal.archives-ouvertes.fr/hal-01238895>
- [6] A. FARAVELON, S. GRUMBACH. *Platforms as Governments*, in "The Internet, Policy & Politics Conferences", Oxford, France, September 2016, <https://hal.archives-ouvertes.fr/hal-01404295>

Scientific Popularization

- [7] S. GRUMBACH, P. VALDURIEZ. *Les données en question*, in "Interstices", March 2016, <https://hal.inria.fr/hal-01350453>