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Towards Self-Service Government – A Study on the Computability of Legal Eligibilities

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Abstract: In this paper we present a novel model for governing societies based on modern information technology, which neither relies on manual bureaucratic labour, nor depends on process-based e-government services. We analyse the flaws of the latter and argue that e-government is not feasible for sustainable governance due to permanently changing regulation; instead we propose a model in which people can govern themselves in a self-service manner by relying on constellations of data stored in a network of governmental databases to which citizens and government agents have read- and write access under conditions defined by then-valid regulation.

Keywords: Self-Service Government, e-Government, Relational Algebra
Categories: D.J.1, H.1, H.m

1 Introduction

In "The Necessity of eGovernment", Fenwick *et al.* [Fenwick et al. 2008] apply Coase's theorem of transaction costs and Dahlman's theory of social transaction costs to rigorously argue that traditional government, orchestrated by humans, is unsustainable and technologically deprecated. Their basic observation is that "governance becomes increasingly complex in a society with a substantial number of daily transactions", whereby the burden on governance is disproportionally higher than the corresponding number of transactions.

Increased computerization of society has resulted in a significantly increased speed and quantity of transactions, which are subject to governance. Increased political self-awareness and demands for a more and more transparent governing on the other hand have further amplified the demand for fast and accurate communication between those who govern and those who are being governed.

Besides requiring to administer the increasing complexity of legal relations of a participation-demanding clientele, European governments are faced with tackling the consequences of the economic crisis through austerity measures such as budget cuts, public sector layoffs and welfare-cuts. Without regard to whether the current crisis is about to continue or not, future governments shall be expected to provide faster and more flexible governance to an increasingly participative population, while at the same time lowering their costs in order to be able to secure welfare for generations to come.

Following the success of office-automation/e-commerce systems in business, governments are now extensively using e-government systems in order to easier

manage their workload. Unlike however automation in industry and business, where the introduction of novel technology led to novel forms of organization, government organizations keep relying on traditional bureaucratic networks for operation, whereby e-government systems often assume only supportive roles to human bureaucrats.

Needless to say, compared to machines (of any kind, including mechanical machines, ICT systems, etc.), human workers are inferior in efficiency, are subject to natural needs such as sleeping and resting, and bear the potential for corruption.

In this article we shall explore the possibilities to sustainably remove the imperfect and potentially corrupt human factor from governance by means of information technology. Our claim is that it is possible to establish a distributed information system, which would allow subjects to manage most of their legal relations themselves – in a "self-service" manner, being constrained only by the technical rules of such information system, which' behaviour would be non-discriminative and equal to every request. We claim that such a system would liberate governments from the need to themselves actively collect and analyse data required for governance, resulting in a significant reduction of transaction costs.

We shall use the design-science research methodology [Hevner et al., 2004] to search for (and describe) a model for an information system that would allow self-service government according to hereinabove-defined hypothesis. Rather than relying on empiric research, design-science focuses on the *design* of novel artefacts that are created to solve heretofore-unsolved problems. The validity of research is thus grounded in both the relevance of the problem and the feasibility of the offered solution.

In this article we describe the general architecture and specific characteristics of self-service government (ss-Gov), further we describe its stakeholders and their roles. The outline of the article is as follows: in the introduction we define the theoretical framework for our research and emphasize the unsustainability of e-government as the main competitor to our model. In chapter 2 and its subchapters we describe the concept and vision behind ss-Gov as a novel model for governance based on constellations of legal relations; thus, in chapter 2.1 we describe the idea behind ss-Gov based on a realistic scenario, and in chapter 2.2 we describe the conceptual architecture of the ss-Gov model and its stakeholders, while drawing analogies between governance of real-world societies compared to virtual communities in online games. Finally, in chapter 3 we will try to evaluate the feasibility of ss-Gov against two common real-world scenarios.

1.1 Theoretical Framework

Human society is a dynamic system of subjects, which is controlled by a certain authority and organized according to specific rules. The society as a system behaves chaotically (in terms of the scientific definition, as used by e.g. Lorenz [Lorenz 1963]), and it is impossible to predict its state in the future despite available knowledge on its state in the past. Nonetheless, certain laws of nature exist in accordance to which this system behaves, which are subject to research of social- and legal sciences.

Thus, political philosophy teaches us that the beginning of a society is the *social contract* – an implicit agreement amongst the members of a community, which

regulates how the society will be governed. Social contract theory [Hobbes 1651] [Locke 1689][Rousseau 1762] – which is yet today one of the most influential modern theories [Friend 2004], teaches us that the society is a system that consists of (i) *subjects*, which are governed by (ii) the *sovereign*, as well as (iii) *rights*, which the sovereign – as the origin of all rights, grants to its subjects [Rousseau 1762, bk.1, ch.9].

Also modern legal theory uses this knowledge from social contract theory [Jellinek 1905, 32][Boyle 1993] to model the relations among the members of a society. In jurisprudence, every subject (natural person, company, club, state, etc.) has legal subjectivity, which means that it can have (legal) rights and be subject to duties [Cerar 1996, n.4]. Legal subjectivity is granted by the sovereign to people or associations [Jellinek 1905, 77] in form of a *legal status* – an attribute that allows subjects to get rights [Jellinek 1905, 78–79][Bauböck 2010]. *Rights* (as well as all legal relations) in mainstream legal theory – as defined by Hohfeld, are relations between exactly two subjects [Hohfeld 1923][Lazarev 2005][H.E. Smith 2011] whereby one direction of such relation defines the entitlement (to claim protection by the sovereign [Jellinek 1905, 77]) while the other defines the corresponding duty [see Vodinelić 1976 in: Cerar 1996, 10].

In modern developed countries, the sovereign is the democratic state, which acts through its institutions [see Kersten 2000, 253–61]. The sovereign is the source and protector of all legal relations as well as the origin of citizenship and other legal statuses. The management of those and the protection of their integrity is therefore the topmost priority of the sovereign – it is an essential task of governing.

Based on these premises we may abstract society to being a network of subjects, which are bound to each other through Hohfeldian legal relations, the so-called "bundles of sticks" – or "bundles of rights" [Smith 2004, esp. n.30][Johnson 2007], whereby the crucial task of governance is the protection of the integrity of this *network of legal relations*.

1.2 Government Corruption and the Human Factor

The network of legal relations, as defined above, is traditionally governed by state officials of varying ranks, constituting the system of *public administration*. Human-based public administration was until recently the only plausible way to manage complex reasoning needed for governing human relations – simply because no other way existed to intelligently capture, communicate, store and interpret information required for governance.

1.2.1 Corruption

An important factor in human-based administration however is corruption, which influences the accessibility, timeliness, quality and cost of government. Government corruption is a well-studied topic, which is subjectively perceived as an either positive or negative factor, depending on the point of view.

Colombatto [Colombatto 2003] for instance aims to explain the positive side of corruption from the perspective of a functioning society. He argues that government corruption is part of the unwritten laws that govern societies and a factor for

balancing interests and keeping social peace, whereby as such it is tolerated in any modern form of government.

Thus, in developed, industrialized countries, wide-spread corruption takes place at the level of policy-making, as well as through political parties. At the level of policy-making producers "induce policy-makers to become dependent on illegal income flows. As a result, their behaviour becomes more predictable and the transaction costs connected with normal business practice are ultimately reduced." [Colombatto 2003] Further corruption occurs at the level of political parties, who provide crucial manpower for running the society. Thus, Colombatto notes, "in many Western European developed countries bribes have therefore become a tolerated – if not outright accepted – instrument to finance a party-controlled institutional framework."

While in developed countries corruption takes place in spheres far away from the ordinary person (as long as not involved in party politics) and is indirectly financed through taxation, totalitarian and transitional regimes deploy *street-level* corruption to satisfy the requirements of the administration. In such conditions, civil servants are "offered a minimum, but secure income, and also the possibility to make extra money or – more generally – enjoying extra benefits through corruption, conditional upon the benevolence of the ruling class." [Colombatto 2003]

This form of street-level corruption can be, as Shleifer & Vishny [Shleifer and Vishny 1993] note, quite clear and fair: "In the old-time Communist regimes, and in regions dominated by a single mafia [,] it is always clear who needs to be bribed and by how much. The bribe is then divided between all the relevant government bureaucrats, who agree not to demand further bribes from the buyer of the package of government goods, such as permits. […] Any deviation from the agreed-upon pattern of corruption would be penalized [and] once a bribe was paid, the buyer got full property rights over the set of government goods that he bought."

Monopolistic corruption is bound to a central authority (such as party or mafia), which guarantees stability and fairness. Once such authority is taken out of power, the system collapses and a multitude of independent bribe-takers at various levels of government emerge, who fail to provide the quality and stability of monopolistic corruption. This, Shleifer & Vishny note, has happened for example in post-Communist Russia, in many African countries, or India.

Government corruption is essentially an underground market for property rights, which is possible as governments have the monopoly of "assigning, reassigning, modifying, or attenuating property rights" [Benson and Baden 1985]. (What is termed in this source *property rights* may be understood as a synonym to *legal relations*, which we used before. For sake of comprehensibility, we shall continue using the more neutral term 'legal relations'.) Corrupt officials enable the trade of modifications of legal relations, as they have been endowed with appropriate discretionary power to create, modify and destroy legal relations. Needless to emphasize, discretionary power is greater the more unclear government regulations are.

In both developed and developing countries, corruption is thus an important enabler of stability and balance between various interests, an efficient mechanism to impose informal policies upon outsiders of the system and a way to curb competition within the system itself. Aside from this aspect however, corruption remains a

significant burden for those governed subjects who are only passively involved with the government apparatus, or worse, are outsiders of such systems.

To create rents for stakeholders profiting from the system, governments, according to Parkinson's laws [Parkinson 1955][Bryan and Locke 1967][Breton and Wintrobe 1979], need to create work and revenue, which they do by imposing new regulations [Shleifer and Vishny 1993, 616] and new forms of taxation. The system of public administration and its dependent stakeholders thus increases in size, resulting in a complex ecosystem that lives from public capital, foremost taxes; Walter [Walter 2011, 9], himself once a public official, describes the modern German public administration as an inbred system in which "everyone works as much as they like to and as good as they can".

Within the government ecosystems, due to a lack of clear hierarchy, informal networks take control, which Banfield [Banfield 1975] terms "machines". These machines are communities, which exist based on a system of exchanges of favours (such as jobs, opportunities to make money by legal or other means, perks, etc.) amongst officials or external interest groups. Such hierarchies, which "arise from extra-legal, if not illegal, arrangements, are *ad hoc*, and must be continually renewed by 'deals' in order to prevent them from collapsing." [Banfield 1975]

At the beginning of this chapter we noted that corruption might function as a stabilizer for relations within a society and as means for establishing loyalty to a government or leader. We may even say that corruption is a requirement for symbiosis between various interest groups in societies. This symbiosis however relies on sufficient revenue provided by governed subjects in form of taxes (including bribes) and from the perspective of such social peace, Walter [Walter 2011, 66] asks rhetorically: "How much more incompetence, thirst for power and excessive costs are we prepared to pay as a price for democracy?"[1]

An increasingly demanding government system is, as history teaches [Adams 1993][Köchli 2006], an everlasting issue in any civilization. Limits of bearable growth (of government requirements, manifested through taxation) however are easily reached and, as Adams [Adams 1993] argues, have caused the dusk of many once strong civilizations, including Ancient Egypt, Greece, Rome, the Aztec Empire, and the European Empires.

As Adams implies, the sustainability and success of civilizations lies in the capability of their government systems to sustain a symbiotic relationship with their subjects with focus on efficiently providing stability, justice and economic freedom.

1.2.2 Responsiveness

Apart from institutionalized corruption, a far more banal set of human characteristics play an important role in the quality of government provided: forgetfulness, fallibility, prejudice, incompetence, slowness, etc.

Each human in the public administration through whose hands a case that requires a decisions traverses, is a potential source of errors and a sure source of time loss in the case dealt with. As Parkinson [Parkinson 1955] argues and Walter [Walter 2011]

[1] »Heute stellt sich vielmehr die Frage, wie viel ‚Unfähigkeit, Herrschsucht und übermäßige Kosten' (cit. Ellwein 1994: *Einführung in die Regierungs- und Verwaltungslehre*) wir gewillt sind, als Preis für die Demokratie zu bezhalen.«

confirms, many of the hands involved throughout the decision-making process exist solely for the reason that a loyal person has a job, rather than to improve government efficiency.

We shall shortly outline two cases that illustrate how requests traverse modern government systems before the decision is made. We argue that in both cases the requests could have been technically solved without any interaction of bureaucrats:

Case I: Request for Public Data

In a survey conducted in 2010 [Paulin 2010a], we sent emails to several hundred Slovenian public legal entities (including ministries, municipalities, local administrative units, universities, etc.) requesting them to send us information about the names, the amount of the total remuneration received and the full work report for each of their employees in the year 2009. We were not interested in the answers though – what interested us was the way how the requests will be dealt with (if at all).

We found that the majority of requests were handled in a procedure involving typically the following six distinct steps: first (1), the request was received and filed; next (2) deliberation took place how to deal with the request (where to get the data, is it at all legal to provide such data?), whereupon Slovenia´s information commissioner recommended to all requesters, that the request must be granted; then (3) the Ministry of Finance, which, as we learned, holds the data regarding remuneration, prepared reports which it sent to the organizations; having received the data, the organizations (4) transformed the data to be visually more pleasing, then (5) authorized the data by putting on a stamp, and finally (6) dispatched the report as a scan or by post. A few of the addressed organizations engaged in a legal dispute whether or not they are supposed to release such information, which however only delayed their reply.

We conclude that as the requested information was readily available as computerized information at the Ministry of Finance, it could have been technically doable that the data would be *pulled* by the requester without any action by the bureaucracy. Instead however, an estimated three thousand hours paid out of taxes were consumed to deliver the requested information.

Case II: Residence Permit

In autumn 2012 we were observing an administrative proceeding in Austria in which the applicant, citizen of a non-EU state, requested a residence and work permit required for an employment as academic researcher in Vienna. Austria encourages immigration of highly-qualified people and hence law mandates that valid requests shall be granted "immediately, or at latest within eight weeks" (i.e. 56 days) from the date of application.

The application has to be filed at an Austrian embassy, which instantly rejects incomplete applications. Complete applications are received (in the case of Vienna) by the municipal council, which has to request without hesitation from the national employment service AMS a confirmation that the applicant may be accepted to enter the job market. Provided latter being positive, the municipality council grants the request and issues the residence permit. The applicant then has to apply for a dedicated visa to pick up the residence permit in Vienna.

In the proceeding which we observed, the applicant was aided by a legal representative, who monitored the proceeding and undertook significant effort to

speed up the process, which included frequent telephone calls to all responsible officials, e-mail petitions urging to speed up, personal visits, and complaints to superiors.

Once filed at the embassy, the application was sent with the regular messenger and arrived at the foreign ministry on the 12th day. From there it was picked-up by the municipality on the 13th and reached the responsible department on the 16th day. Only on the 21st day, after the applicant intervened at the legal department, the application was assigned to an official and received a reference number. Twenty days later, on day 41, the file was assigned to a new official, as previously it was assigned to one not competent for handling such cases. The new official immediately requested allegedly missing documents, which however, as it turned out in the next days, have been already supplied. After this, the file was sent to the AMS, however on the 47th day the file has not yet arrived there. On the 58th day the municipal council received the confirmation from the AMS and ten days later, on day 68, the request was granted. It took more 18 days for the applicant to receive the required dedicated visa (despite a valid visa for the Schengen Area) and to pick up the residence permit on the 86th day.

In this case only at two points decisions had to be made by officials: first, at the filing of the request, where the embassy could *immediately* reject the request if unjustified, and second, at the AMS, whose task is to examine the case and who could decide that the applicant does not fulfil the conditions for entering the Austrian job market. It took the AMS less than one working week gross to decide. The rest of the time – i.e. at least 80 days, were spent with transportation or the file being idle.

We shall return to this case in chapter 3.2, to analyse how this scenario would be handled by the model we propose in this article.

1.3 Unsustainability of E-Government: Legal Certainty and Corruption

Fenwick *et al.* [Fenwick et al. 2008] see as the solution to the above-described problems the use of e-government (e-Gov). E-Gov denotes the use of ICT systems for delivering a wide range of services to citizens [Marche and McNiven 2003, 75][Al-Sebie and Irani 2003]. Such services can be applications to search for employment [see Celino et al. 2010], public information catalogues [see Veljković et al. 2011], municipal Twitter-feeds [see Mambrey and Dörr 2011], government registries [see Lenarčič 2009], legal information systems [see Lesjak and Jagodnik 2009], or even governmental surveillance tools like e.g. the German Bundestrojaner[2] [see Berlit and Wegewitz 2008], or the US-American Prism [Greenwald and MacAskil 2013].

E-Gov systems can be used as tools for government agencies to optimize information gathering and communication, or as fully-automated systems that manage certain bureaucratic processes without requiring officials to make decisions. Bovens & Zouridis [Bovens and Zouridis 2002] call the former *screen-level bureaucracy* and the latter *system-level bureaucracy*. In general, e-government authors agree that system-level bureaucracy is the ultimate and most desirable stage (the 'transactional' stage) of e-Gov evolution [see Irani, Al-Sebie, and Elliman 2006], as it fully eliminates the human factor.

[2] lit.: federal Trojan horse

From the user perspective, research shows that e-Gov is not well accepted. Cordella [Cordella 2007][Cordella and Iannacci 2010] reports that 70-85% of all e-Gov projects were failures and considers e-Gov in general to bear new potential for discrimination. Similar issues pester electronic identity e-Gov initiatives, with as low as 0.1% acceptance rates [Rissanen 2010][Kubicek 2011]. Besides the issue with user-uptake, System-level, i.e. fully transactional e-Gov systems bear hazards bound to the circumstance that they are modelled after law:

Hazard I: Expiration Date

At the design-time of an e-Gov system, only valid law can be taken into consideration (needless to say, it is impossible to predict which regulations will be in force in the future) and hence, changes in law will require a change of such system. Thus, Bezeljak [Bezeljak 2009] describes the development of an e-justice system for handling insolvency proceedings according to the then-valid regulation; Horvat [Horvat 2011] describes the design of a population registry in Montenegro, which integrated various administrative proceedings as individual workflows according to the then-valid law.

Renovations of deprecated systems that were required due to changes in law are for example reported by Naraks & Golob [Naraks and Golob 2009], Kolar [Kolar 2009] and Kos & Zorman [Kos and Zorman 2009]. Kolar reports further of problems with a "continually changing legislation" during the process of development, while Naraks & Golob's system required repair due to "the quantity of changes in law" – implying that redesign was delayed until the system became unbearable.

Hazard II: Monopolization, Corruption and Exclusion

Several instances of e-Gov systems are open to integration with other systems, often with the intent to be designed by many independent parties. This is the case e.g. in the European electronic identity framework or the Slovenian system for electronic registered mail delivery. In both cases, law provisions the required functionality that instances of such systems must provide, whereby it allows that independent parties opt-in by providing their competing solutions to the end-user.

We found [Paulin 2012][Paulin and Welzer 2012, 214–5] that in both cases the law provides a large sphere of discretion for designing technical infrastructure such as interfaces and algorithms deployed. This fostered the emergence of clans, who due to an advantage in knowledge and amicable connections to law-makers, established control over which technical requirements became de-facto conventions used by government agencies.

While such clans can be considered as benevolently-corrupt entities that fill areas which the law-maker failed or is not able to define, outsiders are excluded, facing difficulties to comply with requirements that are neither available publicly, nor documented at all [RS-AC 2011].

Thus, we conclude, law makers which aim to regulate e-Gov rather than regulating give up regulative competences to clans with no law-making mandate. This conclusion is in-line with the observation of Bovens & Zouridis [Bovens and Zouridis 2002], who argue that discretionary power and with it the potential for its misuse shifts from public officials to system designers and –administrators. While this works within national borders due to monopolized clans, cross-border interoperability fails

as these national monopolies are not compliable with each other; this happened e.g. in the case of the European e-ID legal provisions [Paulin 2012].

Legal Certainty

Legal theory distinguishes between public law and private law, whereby public law regulates the relations between the state and its citizens – ergo relations between the sovereign and its subjects, while private law regulates relations amid the subjects based on their will [see Toplak 2008, 23][Horwitz 1982]. A major difference between public and private law is that private law restricts the freedom of the subjects, while public law empowers the sovereign.

In societies that adhere to the rule of law, the sovereign (ergo the state through its bodies) operates in accordance to the principle of legality, which means that every action and every decision made by the state must be explicitly defined by law. This applies both to stated decisions, as well as the procedures that lead to them [Jerovšek 2000, 28–29]. This fundamental legal principle allows subjects not only to exercise control over the sovereign, but guarantees also legal certainty, which makes the sovereign's actions transparent and foreseeable. Legal certainty prevents the state's bodies (e.g. government, police, judges, etc.) to act or decide arbitrarily, which is crucial, as state arbitrariness would break other crucial legal principles, such as the equality before law [Šinkovec 1998, 31].

The advent of e-Gov applications challenges the principle of legality, as it delegates government *behaviour* to machines. From a technical perspective, services offered through e-Gov may be procedures that the subject can trigger (and communicate with) remotely, whereby such procedures are executed on the sovereign's server. The communication between the subject and the sovereign thus is channelled through technical communication between the terminal equipment of the subject and the serving terminal of the sovereign.

Unlike human-to-human communication, which is based on the interpretation of analogue messages, the digital communication is discrete, exact and unambiguous. Human communication for example does not rely on strict grammar or correct pronunciation of words – two foreigners will be able to perfectly communicate in English despite their ignorance of its grammatical rules. Also general human perception is based on the interpretation of analogue, ambiguous information – we can visually recognize e.g. a car even though we have never seen it in the exactly same environment, angle, shape, etc. However, it is impossible for two computers to communicate without adhering to strict protocols that regulate the exact semantics of the transmitted signals and information. We can say that human interaction is analogue and computer interaction is digital – the former is ambiguous and therefore must be interpreted while the latter is unambiguous by nature.

Also e-Gov should adhere to this digital nature of machine interaction, which brings us back to the problem of legal certainty:

In the real/analogue world the interactions are subject to interpretation, legal certainty can be achieved by defining spaces of discretion within which interaction takes place. Thus, an administrative proceeding is initiated by submitting a written and signed application to the responsible government agency; there are no legal provisions defining the material the application must be written on, the font that must be used, or the exact formulation – as the interaction takes place in the analogue

dimension, it can be reasonably expected from the addressee to be able to understand the request. If the application however is an electronic document sent to an endpoint of an e-Gov system, then in such case the structure and semantics of the administrative application need to be rigorously defined.

Ever since law has been governing merely relations between human beings: by limiting the freedom of its subjects, the sovereign regulated their behaviour. Lessig [Lessig 1999, 506–7] describes four constraints to regulate[3]: laws, social norms, the market and architecture. Law regulates by ordering people to behave in a certain way and threatening non-compliance with punishment – e.g. we may drive our car on the highway only within a certain speed limit, if we exceed it, we risk getting fined. Also social norms regulate by threat of punishment (e.g. social isolation), but unlike laws they are not imposed "top-down" by the authority (sovereign), but by the community itself. Markets regulate through the offer/demand ratio and the sovereign can influence them by e.g. forbidding imports or imposing taxes.

The fourth modality is architecture, which regulates by restricting the physical environment. In the real world, these are streets, which divide neighbourhoods, bridges that connect shores or squares where people meet. Regulation through architecture was used e.g. to prevent uprisings in Paris [Lessig 1999, n.18], corruption in Germany [Lessig 1999, 507] or child prostitution in Vienna [News.at 2008].

According to Lessig, the architecture of the cyberspace is its "code", by which he means "*the software and hardware that make cyberspace the way it is*". Lessig strictly distinguishes "code" – ergo the architectural characteristics of any information system [Lessig 1999, 507–10], from law and in an earlier work he asks rhetorically [Lessig 2006, 323]: "if code is law, then obviously the question we should ask is: Who are the lawmakers? Who writes this law that regulates us? What role do we have in defining this regulation? What right do we have to know of the regulation? And how might we intervene to check it?"

Lessig's questions however remain unresolved. Besides, as his work focuses on intellectual property and privacy on the Web, he does not deal with the legality of public "code". He does however demand transparency for the FBI's e-mail surveillance system "Carnivore" [Lessig 2006, 141]. Also the broader research community did so far not deal with legality aspects of e-Gov. Biegel [Biegel 2003] and Lastowka & Hunter [Lastowka and Hunter 2004] for example discuss merely authorities' tendencies to regulate cyberspace, while Lundblad [Lundblad 2007] is interested in whether governments are allowed to hide government data from search engines.

Lessig's understanding of the cyberspace as code is only partly correct. Wrongly he mixes all layers of the *Open Systems Interconnection* (OSI) reference model[4] with the business logic, databases and interfaces of applications into one big entity, which he names "code", while it would be right to separate them and treat them individually. As "code" – ergo *architecture* of cyberspace, only the layers of the OSI model could qualify, as it describes the complete infrastructure (starting virtually with bits over cupper cable) of an information system in terms of potentially standardisable communication protocols.

[3] See [Mayer-Schönberger 2008] for a critical response.
[4] ISO/IEC standard 7498-1:1994

Electronic applications that can be consumed over the Internet or Web on the other hand are logically separate information systems that reside on top of the OSI model, which they utilize only to communicate with different systems – e.g. to receive requests and issue responses to the client.

If a user (the client) interacts with an e-Gov service, then this interaction is an exchange of electronic messages, which accords to a particular schema that the serving endpoint (the server) understands. An example interaction with a Web-based e-Gov service would look as follows: the user first sends a HTTP[5] message (request) to the web server of the e-government application; the server responds by sending her the HTML[6] Web page, which the user's terminal equipment may (or may not!) visualize and present as a user interface for further interaction. Over a series of such requests, the user *consumes* the e-Gov service, whereby the server has neither influence on how the client treats the response, nor does it know whether the response was received at all.

The exchange of messages – the user's requests and the server's responses, in the e-government interaction is not architecture any more, but rather an administrative proceeding, initiated by the citizen with the goal to influence her legal statuses, rights or to just receive information[7].

The aim of system-level e-Gov is to replace officials through automated systems. In the same way however as the public official is obliged to follow strict formal procedures that are transparent and known in advance, also e-Gov services must be rigorously defined in a transparent way. Unlike in the analogue world where it is sufficient to define mere goals of legal proceedings, the digital world due to its architecture requires an unambiguous definition of procedure, protocols, and also other details, such as the location of the system on the network, etc.

2 The Principles of Self-Service Government

In the previous chapter we argued that e-Gov is no sustainable option to replace established bureaucracy, due to issues with legal certainty, clan-based corruption and a lack of ability to respond to legislative changes. At the end of the day, e-Gov systems remain dependent on the existence of bureaucratic governmental organizations.

The reason why e-Gov failed to provide a sound and sustainable alternative lies in its level of abstraction. E-Gov systems, even if offering fully transactional self-service, are monolithic systems that provide a pre-defined set of possible interactions and use-cases. Any ways of using such system that have not been engineered at design-time, are not possible at run-time. For such non-supported cases, a fall-back to traditional bureaucratic approaches is required.

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[5] The *Hypertext Transfer Protocol* is a de-facto standard protocol for the communication with Web servers.

[6] The *Hypertext Markup Language* is nowadays just one of many standards for digital documents. It was initially developed to semantically describe content accessible over the Web.

[7] An often overseen detail of governing is the communication with citizens – be it in terms of providing access to data under the freedom-of-information legislation (FOIA), or just by answering requests. As recent research shows [Pinterič 2010][Paulin 2011a, 8–12], citizen requests are often being simply ignored despite strict legislation.

This issue of flexibility has been already prominently emphasized by O'Reilly [O'Reilly 2011] who uses Kettl's metaphor of the vending machine [Kettl 2008] that offers a limited set of overpriced items and compares it to the blossoming market-place of Raymond's [Raymond 1999] bazaar or its digital alternatives, like iPhone's market for applications, which allows commercial providers to use the phone's infrastructure for delivering new and better services.

The here proposed concept of self-service government (ss-Gov) therefore (and in contrast with e-Gov) focuses away from what Reinders *et al*. [Reinders et al. 2008] name *technology-based self-service*, where users access automated services such as ATMs or vending machines that have predefined and thus limiting functionality. Our understanding of self-service government takes a *rudimentary* approach with the vision to provide the user full flexibility in crafting its own results based on a dynamic set of atomic parts. This kind of self-service can be compared to assembling LEGO toys from generic bricks, where the player is free to build up its own world without restrictions.

SS-Gov must neither be confused with decision-support systems, nor by automated reasoning. It is not uncommon in e-Gov applications to make automated decisions based on various interlinked sources of information. (In theoretical literature, automated reasoning is often categorized as the transactional stage of e-government maturity [Irani, Al-Sebie, and Elliman 2006].) Dunleavy *et al.* [Dunleavy et al. 2006] for example report a case where an insurer got all data required for managing their client's relations from existing third party sources. However, such "mash-ups" in e-Gov are individually engineered systems, which use individual web services for data exchange. SS-Gov however systematizes and abstracts *constellation-based-reasoning* to a level where no custom links need to be engineered for each interoperability link required.

Another popular approach to automated reasoning relies on the logic of decision-support systems. This approach has been for example chosen by Berčič [Berčič 2006], who tried to convert Slovenia's criminal law into an automated reasoning system, similar to Kowalski's [Kowalski 1992] translation of British immigration law into a logic program.

The difference between these approaches and ss-Gov is that the former rely on explicit procedural logic and calls to functions to determine eligibilities, while ss-Gov deducts eligibilities mathematically using set theory. Procedural logic relies on explicit "if-else-then" conditions, which are easy to address and maintain as long as they are of manageable quantity. The drawback of such approach however is that all constraints must be handled at design-time, which is why ss-Gov rejects this classic approach and relies on constellation-based reasoning.

2.1 Constellation-Based Eligibility Evaluation in ss-Gov

SS-Gov is therefore not the use of TBSS in governance and/or government (this would be e-Gov), but rudimentary access to those factors that constitute them. As argued in chapter 1.1, a crucial task of government is the management of the network of legal relations between subjects in a society.

The idea behind ss-Gov involves maximum delegation of executive administrative tasks to the user, who thus becomes independent from the pace of the bureaucracy. The desire for independence from government bureaucracies is not new

and has been dealt with in New Public Management (NPM). NPM splits government duties into making policy-decisions (the so-called "steering") and service delivery ("rowing"), whereby "rowing" can be outsourced (privatized) to the private sector[8] [Osborne and Gaebler 1992][see Rhodes 1996, 655][Bevir 2009]. NPM however focuses on the macro view on governance, i.e. policy-making/norm-setting and execution, while the management of micro-relations has to our best knowledge not been studied yet.

Osborne & Gaebler's metaphorical boat-ride is not detailed enough to provide the picture of the whole society, as it has only two stakeholders – the captain, who dictates the course and the slaves who do the rowing and who could be more efficiently replaced by modern engines.

To demonstrate the ss-Gov idea, we shall extend their metaphor and imagine a passenger ship, which not only transports its passengers overseas, but offers them also food, accommodation, security and entertainment according to the afforded travelling category. The passengers of such a ship are a distinct community bound to a specific territory (the ship). They are governed by the crew, which upholds order during the trip and provides the passengers with the contractually agreed services. The relation between the crew and the passengers is similar to the relation between the sovereign and the society: in both cases the member of the community is the subject recognizing authority and paying a certain fee for being governed and provided with services. (And if the governing and service become unbearable, the passengers will eventually start a mutiny and take matters into their own hands.)

Based on this new metaphor, we may analyse what is needed for governing this community. Let us assume a family (father, mother, 13 year old child, which will turn 14 in two days) travelling second class from Slovenia to Iran (arrival in Iran's territorial waters on the 5th day). The ship features a wellness-centre with swimming pool and sauna, whereby the latter is charged extra to those not travelling first class and entrance is not permitted to children younger than 14 years. In Iranian territorial waters only single-sex usage of the sauna is allowed, whereby the age limit is 20 years. In Iran a person younger than 20 years can enter the sauna only if accompanied by a close relative of the same sex.

In this example, we have a fixed community of subjects (the passengers) and a fixed government structure (the crew), but we have to deal with many dimensions: Every member of this society has a status based on several relevant personal attributes: sex, age, booked travel category and relation to other travellers. This status entitles passengers to receive service and use the facilities. One attribute of the passengers – namely their age, is subject to time, which is relevant, as the child – let's name her Eve, will become 14 and will thus become entitled to enter the sauna on the third day of voyage. When the ship will enter Iranian territorial waters, the legal frame will change, which will influence also the passenger's legal situation, while their attributes will remain the same. Thus, on days 1-2, Eve must not enter the sauna, because she is to young; on days 3-4 she can go to the sauna, as she is now 14 already; from the 5th day on, she can go to the sauna only together with her mother, but not her father, due to the Iranian restrictions.

[8] Some authors, however, indicate that privatization of certain public services can be questionable from legitimacy perspective [Pinterič 2011, 245–46].

This example shows that the bundle of rights of each subject is determined by the context and the legal frame. If Eve tries to enter the sauna, then whoever controls this facility must grant or deny Eve access based on the available information about her age, family relations and the information whether she has paid the entrance fee; the action of checking these being essential to government.

The bundle of rights is not something that can be efficiently stored, but must be interpreted every single time *based* on (i) the legal frame of the political community, (ii) data about the subject and (iii) the context of the given situation. Let us define – inspired by Leibniz' appeal "*Calculemus!*"[9], the bundle of rights as B, the subject as S, the legal frame (L) of the political community P as L_P, and the legal context (C) of the particular request R (e.g. the request to enter the sauna) as C_R. For each subject we have data about the subject, d_S and based on this data, we can calculate its legal status (ς) in the given legal frame:

1) $\varsigma_S = \varsigma(L_P, d_S)$

The legal status determines which bundle of rights somebody can have in a given legal frame, e.g. in a given country or other form of society. Thus, the bundle of rights of somebody in a foreign country is different from their bundle of rights in her home country. We can therefore say that both the subject's status (ς_S) and the legal frame (L_P) determine the subject's bundle of rights:

2) $B_S = B(L_P, \varsigma_S)$

In order to determine if somebody is permitted to action R, we must first find the set of rights required to perform it. This set of rights or eligibilities (E) is determined by C – the context of the given request, which is dependent on the general legal frame (L_P). To calculate set E for a given action R, we perform:

3) $E_R = E(C, R)$, where $C \subset L_P$

If we now want to find if S has permission (Y) to a specific action R, then we must check if the set of required rights/eligibilities to perform R is contained in her bundle of rights B:

4) If $B_S \supset E_R$ then Y_R is true, else false

As we see, making governing decisions (based on finding Y_R) and thus governance as such, depends on information available to the system (d_S). Thus, if the available information about Eve's age would be mistakenly stored as > 20, then she could go to the sauna every day, despite the biological truth. Also, as her family travels 2nd class, she must pay every time for her sauna visit, which she would not have to do if the stored information would be different.

[9] »... quando orientur controversiae, non magis disputatione opus erit inter duos philosophos, quam inter duos computistas. Sufficiet enim calamos in manus sumere sedereque ad abacos, et sibi mutuo (accito si placet amico) dicere: c a l c u l e m u s.« [Gerhardt 1890, 7:200]

A change of information regarding the legal status of a subject ς_S and data about the subject d_S, available to the sovereign results in a different bundle of rights B_S. Therefore in order to reach self-service in government we need to be able to manipulate ς_S and d_S directly ourselves, or more precise: we must be able to manipulate d_S, because the legal status (ς_S) is determined by the data, which is the only tangible variable independent of the legal frame (L_P).

In a bureaucracy, manipulation of d_S is performed by the bureaucratic apparatus: in order to change our name, address, or marital status, we have to fill in forms and wait for applications to be processed. (Compare also [Klischewski and Ukena 2010] for an attempt to optimize the process using semantic technologies, albeit unrelated to our research.) The same is true if we want to receive child support, get permission to drive a car or become owners of real estate.

Bureaucracy – both the traditional Weberian model, as well as its machine-supported successor, use a multiple-process-based approach to effectively determine Y_R. Thus, through a series of partly autonomous processes (both customer-facing processes and internal business processes [see Leben and Vintar 2003]), ς_S (e.g. adulthood) and d_S (e.g. name, date of birth, address of residency) are gathered and Y_R (e.g. the eligibility to change address / name / ownership of real estate) is determined.

In contrast to the process-based approach of traditional government, ss-Gov bases on states, resp. constellations. SS-Gov deliberately rejects finding Y_R through a series of cascading processes and sub-processes, as each process takes valuable time and is vulnerable to errors. Instead, we propose the manipulation of d_S based on the ad-hoc calculation of $Y_R - R$ being the permission to manipulate d_S, done in one logical step.

Constellation-based reasoning[10] can be compared to a key opening a pin-tumbler lock, where the key due to its specific shape moves the pins into the right constellation, which allows the lock to be opened. Thus, the "key" for Eve, who wants to enter the sauna, would be the appropriate constellation of the information available about her (age, sex and whether she has a valid ticket or not) in the given context, while in contrast to this, process-based finding of Y_R would be like a doorman in front of a nightclub deciding about whom to let inside based on his own interpretation of the house rules.

SS-Gov requires both read- and write-access to d_S, which shall be enabled directly by using the "key". Based on this self-service manipulation with the data needed for government, the sovereign can provide its subjects all services needed to fulfil its obligations from the social contract, while being free of the burden to provide "services" that only serve to read or write data.

2.2 The Architecture of ss-Gov and its Stakeholders

Let us imagine living in a society managed through ss-Gov: How does the "state" look if we can manage our relations by ourselves? Who makes ss-Gov possible? And How?

[10] A similar technique to what we call "constellation-based reasoning" was also applied by Bob Kowalsky, e.g. [Kowalski 1992], in his works regarding legal reasoning; compare also [Prakken and Sartor 2002].

2.2.1 The Electronic Registries

The idea behind ss-Gov is, that the state (the sovereign) hosts a collection of registries, which contain data about its subjects, much like data is stored today in the civil registry, cadastre, or business register. Based on these collections of data, our specific legal status and bundle of rights can be determined given a specific context or situation. These registers are to be defined in electronic form and must be accessible through the Internet. The entry point to each of those collections of electronic data must comply with the following requirements:

1. The interface to the system – including the location of the interface in the network (e.g. IP address or URL/URI), must be defined through law.
2. The format of incoming and outgoing messages must be legally defined.
3. The procedure how the incoming message is handled must be legally defined.
4. Reading and writing data must be done in an analogue manner, which means that only the grammar and semantics for defining the commands for accessing data can be defined.
5. Legally significant and non-repudiable communication between the sender and the server must be ensured.
6. Users have full access to the core data within legally imposed restrictions.

The requirements #1-3 ensure that everybody can know where and how to reach the endpoint of the ss-Gov system, as well as how the request will be processed. Thus, the user is not bound to use specific terminal equipment or interface to interact with the system, but can hypothetically built such a system herself. These requirements can be achieved by rigorous technical standards incorporated into the legal system.

Requirement #4 can be achieved by defining an artificial language for reading and writing data, or using an existing standard. Examples of contemporary artificial languages that enable read- and write-access to data would be SQL or SPARQL/Update [Seaborne et al. 2008]. In a previous work [Paulin 2011b] we described an early ss-Gov prototype using SQL for both manipulating data and defining access restrictions.

Requirement #5 is essential for "mashing-up" data from different sources, which are not originally linked. Let us imagine a private-sector bank, which we trust to execute a payment to our business partner only under certain conditions – e.g. our business partner must first prove that she has transferred ownership of a real estate to our name before we pay her the purchase price. The bank could provide a web application, which would receive the information from the land registry, verify it and then conduct the transaction. The bank must therefore be able to fully trust the integrity and correctness of the information. On the other hand, the ss-Gov system receiving the request must be able to be absolutely sure about the identity of the sender and the integrity of the request. In [Paulin and Welzer 2012] we describe a technique for *fair non-repudiable* message exchange that could be used to satisfy this requirement.

The 6th requirement gives the subjects inhabiting the system the maximal freedom to design their legal relations in accordance with the surrounding legal frame. This freedom gives rise to new, so-far impossible uses of the state. Thus, we could imagine

high-frequency trading [see Gomber et al. 2011] of real estate square meters, a market for university places, and absolutely transparent, if not even liquid-democratic public spending.

2.2.2 Lessons from MMORPG

The computerized society has many similarities with computer games in which the player's character collects items, grooms its environment and interacts with other characters. Lastowka & Hunter [Lastowka and Hunter 2004] extensively describe the close relation between players of MMORPGs[11] and their virtual alter egos from the legal perspective.

Both the "real" society and "virtual" communities are cybernetic systems in which we can have capital, do trade, have social and legal statuses, and enjoy our rights in accordance to rules provided by the sovereign. The differences between both systems could be regarded as insignificant, if not non-existent at all. Thus it is interesting to note that in the year 2003 the size of economy of Norrath – the virtual world inside Sony's Everquest, was larger than the economy of Bulgaria; furthermore, the effective pay per hour of work was at that time 3,42 $, which was more than the pay in India or China [Lastowka and Hunter 2004, 49].

From a technical perspective, a MMORPG is an information system that resides on the game-provider's server and with which players interact through specific graphic user interfaces that render to them the experience of the game. The gaming process is a permanent exchange of electronic requests and responses between the player and the server, through which the player manipulates with its character's legal status, rights and other data relevant for the gameplay (e.g. position and appearance). Virtual real estate and other valuables are in fact only entries in the system's database [Lastowka and Hunter 2004, 51], and also trading between characters is nothing more but changing stored information. Nonetheless, the way in which the players perceive these bits and bytes creates in them the feeling of genuine possession and property.

Thus, Lastowka & Hunter [Lastowka and Hunter 2004, 45] cite Lessig's report of a "nasty and protracted battle" in the virtual world of LambdaMOO between neighbours Martha and Dank. The dispute was about Dank's dog being repeatedly poisoned and killed by the flowers Martha grew in her garden. Although it is not known whether the dispute was settled before court, Lessig reports that both parties invested in the dispute the kind of passion and righteous indignation usually reserved for real world "across-the-fence" property disputes.

Both MMORPGs and the legal system of a society are based on abstractions of the real world [Lastowka and Hunter 2004, 42][Jellinek 1905, 21]. Both systems can be seen as virtual constructs that provide a platform for managing rights[12] and ensuring (legal) protection. However in contrast to the "real world", the rules in online multiplayer games are not subject to politics, democratic decisions or revolutions, which makes it possible for the authors of those virtual worlds to hard-code the rules in an absolutistic, god-like fashion.

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[11] »Massive multiplayer online role-playing games« are online games, where multiple players from all over the world simultaneously play in the same virtual environment.

[12] For further reading about rights, trade and reality in virtual worlds we recommend the works of Edward Castranova and Tom Boellstorff.

2.2.3 Stakeholders and Roles

MMORPGs and other online-societies like e.g. virtual currency systems, know two distinct stakeholders: the sovereign – which is the corporation that operates the systems, and the subject, who is the player or the user of a system.

Each interaction between both roles is regulated by the system's architecture, whose design is at the sole discretion of the provider and generally hidden from the public. The code of such platform is at the same time law, jurisdiction, public administration and government.

"Real world" societies on the other hand are based on rules, which are subject to changes that have to be politically proposed and (democratically?) legitimated and which must be transparent in order to conform to the principles of legality. These rules determine how rights are created and manipulated and they define which information is needed for such actions.

To handle such changes in a legitimate way, further stakeholders are required. Dependent on how much perfectly ss-Gov should be implemented, a society would require either one of two following groups of stakeholders:

a) SS-Gov with Liquid-Democratic Decision-Making

In the first mode we assume a "blank slate" society, which decides to govern itself democratically through ss-Gov with the minimum required human presence. In this scenario decisions about rules and regulations (law), governmental registries, public spending, assignment of public mandates, etc., are made through liquid democracy. Liquid democracy [Paulin 2010b][Ford 2002] is a weighted way of making political decisions, which does not depend on elected representatives. Instead, each member A of a society can delegate her power to another member B (and withdraw it again at any time), whereat A – assuming each member's power is v and the sum of all v is V, has thus $(v_A-v_A=0)/V$ influence on voting on a decision, while member B thus has $(v_A+v_B)/V$ influence on voting on a decision made by all who are eligible to influence the given decision.

This mode would require two main stakeholders:

(i) *Subjects*, who would interact with the ss-Gov system in order to propose and vote about new rules and registries, about the access to public money, about assigning mandates, etc. Subjects would further interact with the ss-Gov system to influence their legal relations and –statuses, to exercise their participative rights, to assume mandates, to request and receive public funding for their projects and public assignments, etc.

(ii) *Service providers* would aid subjects in their use of ss-Gov by providing user-friendly means for interaction, such as interactive graphic user interfaces, agencies for human-mediated interaction, or application programming interfaces for developers.

The technical integrity and security of the ss-Gov system should be further assured by (iii) *administrators* – subjects with mandates for maintaining the technical infrastructure, who however are no active stakeholders but mere aides to the system.

b) Hybrid ss-Gov

In the hybrid mode we assume that ss-Gov is to be introduced gradually into existing societies. A society governed trough ss-Gov in hybrid mode will require the following stakeholders/roles:

(i) *Politicians*: people, who design (descriptive) rules how the society should be regulated. These rules can be laws or other kind of policies, i.e. NPM's "steering". In the next step, these policies must be translated in a form that can be handled electronically.

(ii) *Officials*: people, charged with executing law and policies, which they do in ss-Gov by centrally defining the electronic registries and by defining the rules for their read/write access. Thus, their role remains similar to their role today. As the gap between the descriptive rules and their electronic implementation is bridged by human labour, which is not unmistakable, disputes could arise regarding the correctness of the implementation of law into the digital realm.

(iii) *Judges*: to resolve such conflicts, ss-Gov relies on *judges*, who – unlike today's judges, must have profound knowledge of both law and informatics.

(iv) *Administrators*: The technical security of the ss-Gov system is the responsibility of *administrators*, who however only take care for the technical integrity of the system, while they must not interfere in any way with their content and logic.

(v) *Subjects*: Most interaction in ss-Gov takes place between *subjects* and the ss-Gov system. Subjects interact with the system in order to read, write or change information from which their eligibilities are derived. They can either manipulate with the data directly by sending commands in the respective commanding language, or they can help themselves with services provided by *service providers*.

(vi) *Service Providers*: facilitate the interaction with the data. Service providers can help on different levels: they could provide programming libraries for developers of software, web applications for graphic interaction, or even human "user interfaces", whereby the subject would interact through a human facilitator like e.g. a notary.

3 Evaluation of ss-Gov

In this chapter we shall evaluate ss-Gov in two real-world scenarios to validate its overall feasibility, as follows:

The first scenario deals with receiving child benefit payments in Slovenia. We shall analyse how a simple data model of a government registry would look like to determine ad-hoc whether a request for a financial transaction is legitimate or not. The second scenario deals with determining valid residency and access to the job market for non-EU citizens under Austrian law. For this scenario, we remain on an abstract level, but shall model the concept using a dedicated visualization technique. For both we will first analyse the constellations of data required for the right to emerge and then describe how specific eligibilities could be exercised based on the stored data in ss-Gov.

The bureaucratic approach would be to issue a token expressing the respective right (i.e. a decree granting the right to child benefit payments, or an ID-card representing the residence permit would be issued). The ss-Gov approach however omits any such token and hence the eligibility is calculated ad-hoc from the stored data.

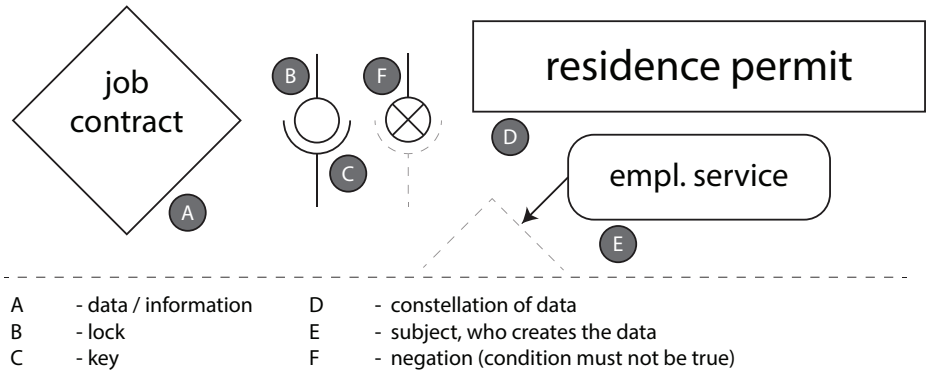

Figure 1: Elements to visually describe the determination of a constellation of data (D) in ss-Gov. Based on the determined constellation, eligibilities can be exercised.

Figure 1 shows the elements that will be used to visually model the constellations of data required for the residence-permit scenario: Element [A] is the core data or data derived from rudimentary data through logical comparisons, which is stored in the governmental data registry. Only this information is available in a "physical" form and is entered into the system by subjects (element [E]) that are eligible to write it. Element [D] denotes a constellation of data, which can be derived based on the stored data. The lock [B], key [C] and negated lock [F] define the conditions which must be fulfilled so that a constellation can be "unlocked". The lock [B] denotes a condition that must be true (such as the existence of an enabling information), while [F] denotes a condition which must be false (e.g. the non-existence of data that would render a right void). The locks mandate either the existence of data [A] or the validity of constellations [D].

The feasibility of ss-Gov will be proven if a right's validity can be determined alone based on factual data (such as information about age, residency, nationality), existing legal relations (e.g. contracts), and data from appointed experts (such as examination results), whereby the generation of data and the determination of the right's validity can be conducted without supervision that would require tacit knowledge. On the other hand, if any supervision of a kind is required, which cannot be outsourced to an appointed expert (hence, the tacit knowledge of the bureaucrat would be crucial), ss-Gov is rendered unfeasible.

3.1 Child benefit payments

Child benefit is a social security payment distributed usually to parents as an aid in raising their children. In Slovenia, the following conditions[13] apply:

a) The applicant is either the parent of the child, or the child herself. In the latter case, the child must be older than 18 and live in a separate household.

[13] http://e-uprava.gov.si/e-uprava/dogodkiPrebivalci.euprava?zdid=1064&sid=881. The conditions stated here are partly simplified or omitted in order to enhance comprehensibility.

b) The child's registered place of permanent residence must be in Slovenia.
c) The child must not be employed or registered as self-employed.
d) The child must not be married.
e) The child must be less than 27 years old.

Let us assume a civil registry *RC*, which holds the following data fields: national identification number – *RC.nin*, age – *RC.age*, address of permanent residence – *RC.adr*, and information about the relationship status to other persons –*RC.child_of* and *RC.married_to*. Further, we will need an employment registry *RC*, which holds information about who is employing whom. To define such registries in a modern relational database we could write the following SQL statements[14]:

```
1.      CREATE TABLE rc (nin, age, adr, parent_of, married_to);
        CREATE TABLE re (boss, empl);
```

Given these two registries and the defined data fields, we can instantly calculate if somebody (*@claimant*) is eligible to receive child support (for @child) as follows:

```
2.      SELECT COUNT(*) > 0          /* "true" (1) or "false" (0) */
        FROM rc INNER JOIN re ON nin = empl
        WHERE nin = @child           /* the entitled is the child */
        AND age < 27                 /* if the child is not yet 27 */
        AND child_of = @claimant     /* entitled is child of cl. */
        AND married_to IS NULL       /* if she is not married */
        AND boss IS NULL;            /* if she is not employed */
```

The "right to periodically receive child support" has the effect of transferring a certain amount of money from the state budget (based on the demand of the rightful claimant) to any bank account within a given period of time (e.g. within a month). This is a typical "key & lock" situation, where the bundle of rights needed to execute the right – i.e. the transfer of money from the budget to one's bank account, is definable by existing government data. Thus, to receive child benefit through ss-Gov, the claimant issues a request for money transfer and the transfer is immediately conducted, given that the constellation of data meets the conditions of the eligibility.

3.2 Residence and work permit

In chapter 1.2 we described the case of an administrative proceeding in which a non-EU citizen requested a residence and work permit for Austria. The proceeding from submitting the application until the point where the applicant could start exercising her right took 86 days[15], which was one full month longer than what law provisions and as we found, most of that time the case was simply idle, due to lengthy transportation, bureaucratic errors and an overstrained bureaucracy[16].

[14] Data definitions intentionally omitted.
[15] This time does not include preparations of the applicant, such as gathering the required documentation.
[16] Once the file has reached the responsible department in Vienna, the local legal representative of the applicant met with the head of the department. As he learned that the file has not yet been assigned to an officer, he reminded the head of department that a decision has to be made "immediately, or at latest within 8 weeks". The head of the department responded: "Well, then come back in eight weeks and file a complaint!"

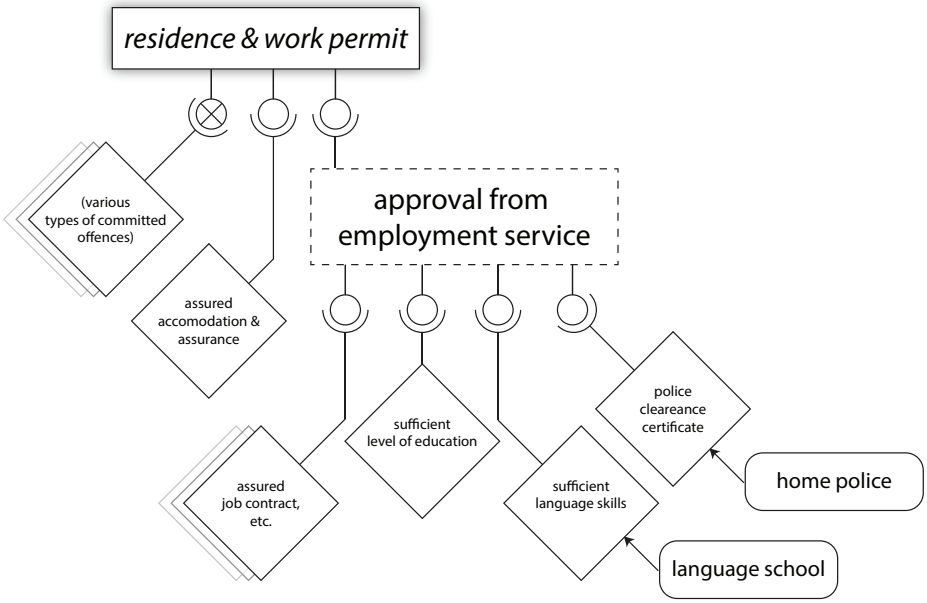

Figure 2: The constellation of data required to receive a residence permit.

Here we shall examine whether it would be possible to determine the eligibility of foreigners to live and work in Austria through ss-Gov[17]. While in the bureaucracy the objective of applying for a residence permit is to receive a *right* (which can be manifested in the form of a tangible token, in this case as an ID-card), in ss-Gov the eligibilities associated with such right derive from the required constellation of data, which can be ad-hoc verified any time necessary. For sake of comprehensibility, we analyse only the case as described earlier and do not deal with the full complexity of Austrian immigration law.

In the description of the case in chapter 1.2 we outlined the workflow of the administrative proceeding in which the file traverses three government agencies – the embassy, the responsible local administrative unit in Austria, and the employment service. The procedures are regulated primarily by two laws: the *Settlement and Residence Act* (NAG) and the *Employment of Foreign Nationals Act* (AuslBG). According to the NAG, the embassy receives the application (§21/I NAG) and after making sure that it is complete and correct (§22 NAG), it delegates the file to the responsible local administrative unit, which immediately (§12d/II AuslBG) delegates the file to the employment service. The latter finally is responsible to decide whether or not the conditions for a residence and work permit are fulfilled.

Figure 2 depicts the requirements that need to be fulfilled for an applicant to be granted a residence and work permit, as in the case described. The applicant has to prove an assured accommodation, an assured job providing a certain minimum level

[17] We deliberately ignore that foreigners might not have an a-priori right to receive a residence permission.

of income, social insurance, high education, sufficient language skills, etc. All this is either data about existing legal relations in the addressed country, data generated by experts (proof regarding the language skills), or interlinkable data (the police clearance certificate) from foreign official sources.

Also in this case, tacit knowledge is not required in order to enable highly-qualified foreigners to live and work in Austria. The requirements can be easily mapped into an electronic realm and the eligibilities to work, live and cross the country borders could be thus determined based on the information provided by trustworthy sources.

In ss-Gov, the applicant would not require to initiate a procedure at the embassy, but instead would have to take care that the data required to provide all "keys" to open the "locks" for the residence and work permission are stored at the host country's government system. At the very instance once all data has been provided and valid, this person would be eligible to legally assume work, enter the country and register its address in the new city of choice.

4 Discussion

Both scenarios evaluated in previous chapter show that bureaucratic agents can be excluded from the process of generating legal relations / property rights. Instead of depending on a state bureaucracy, subjects in ss-Gov obtain, change and dispose legal relations by making sure that the required constellation of data is stored within a state information system. The rules for writing and reading such data can be enforced through appropriate technical measures and must be themselves stored as data in such system, so as to be dynamically modifiable in the very same way as any other data.

SS-Gov thus results in a fully non-modifiable framework that handles read- and write-requests to the data it hosts according to the hosted rules. This framework can thus be regarded as a kind of "super-constitution" that defines the code of interaction between subjects and the state.

The scope of one's read/write access to the data would then depend on its Jellinekian legal status, which itself would be determinable from the very same data. Thus, an expert entering data into such system would be eligible to write-access based on the constellation of data that would define her as an eligible expert. Experts remain necessary and their role is to apply reasoning where tacit knowledge is required[18], such as in resolving legal disputes, assessing students, or in various police activities.

Although feasible, ss-Gov bears certain implications that we discuss below.

4.1 Challenging current thinking

From today's perspective, fully-featured ss-Gov is an idea for future generations rather than a model applicable to the modern society.

One reason is that ss-Gov implies a level of IT literacy which today is reached only by students of computer science and informatics or technology-oriented

[18] Zuboff [Zuboff 1988] explored the history of automation and its limits and found that know-how can be transformed only to some extent. Certain skills – so-called *tacit knowledge*, cannot be transformed for automation at all, which is the reason why action-centred skills need to be learned through experience [Zuboff 1988, 186ff]; this applies e.g. to managers, teachers, salesmen, helicopter pilots, etc.

vocational schools. The requirement for broad advanced IT literacy however could be easily circumvented by a layer of private service-providers who would mediate the interaction, similarly to Scribes in Ancient Egypt.

A second and probably much stronger reason why ss-Gov would not be applicable immediately is the existence of a strong bureaucratic culture, which was able to survive through centuries independently from changes in regimes or constitutions [Walter 2011, 23–8]. Thus, a significant part of the population earns a living as bureaucrats, as party politicians, or from work directly or indirectly created by bureaucracy and party politics – either legally or through corruption. But also the modern woman and man are so used to be governed by public officials, to apply for rights, to patiently wait for decrees and to complain to superior institutions, that it might be hard for them to consider alternatives. As applied ss-Gov might shift political decisions away from party politics to liquid democratic collaborative decision making, implications of this model might challenge its comprehensibility even further.

On the other hand, ss-Gov would introduce new dynamics to politics and economy, boost technology and science, and raise new social and legal challenges.

4.2 New intransparencies and discrimination through technology?

SS-Gov implies that proper use of technology can prevent corruption, which is a claim that seems to contradict with the findings of e.g. Schelling (1980), who inter alia argued that technology increases opportunistic behaviour instead of preventing it, or the findings of Luhman [Luhman 1997], who theorized that the use of technology contributes to new intransparencies.

Luhman however bases on the assumption that the users of such technology are mere consumers without the ability to understand what is going on behind the scenes; our model on the other hand bases on the implied assumption of a general level of computer literacy much higher than it was the case in the time of Schelling and Luhman. If we assume that the main stakeholders are sufficiently literate to have good command of specific computer languages, ss-Gov would be a feasible vision of the future. The literacy barrier we are facing today in this regard is comparable to the literacy barrier humanity was facing each time a new writing system was introduced and enforced. If we assume that future generations could grow up learning programming languages like they are today learning foreign languages, mathematics and the general use of ICTs, we can assume that they will be able to understand and use regulations, restrictions and legal relations expressed in digital structures.

It goes without saying that technology may create confusion and thus intransparencies among its non-professional users, and it may be true also that a lay perception of technology increases the possibilities for professionals to take unfair advantage of such situation; however this does not mean that technology as such creates intransparencies or increases opportunistic behaviour. On the contrary – any *digital* system (in contrast to analogue systems) can be by definition fully understood and controlled. It is logical that the possibility to fully understand a system makes such system potentially fully transparent – provided, naturally, one's know-how to understand it.

4.3 New forms of corruption, security threats and a new form of state?

The potential for corruption in the system-level-bureaucracy is a significant flaw of e-Gov, which our model tries to resolve. System-level-bureaucracies cannot prevent corruption, because the information systems which it requires, are designed as interpretations of rules and instructions they incorporate. These information systems incorporate rules, which are *modelled after*, but are not *identical* to the lawmaker's rules. It is inter alia this duality of rule-making competences that our proposed model aims to eliminate. We achieve this by proposing a solution which would allow the lawmaker (who can be even the nation as a whole) to describe rules in digital structures that can be directly used without any non-automated translations.

By merging the competences for rule- and system-design, we further resolve the issue of accountability – i.e. the question, how accountability can be provided for the functioning of software systems designed to automatize legal provisions and processes.

Aside from this however, ss-Gov bears a new quality of security threats. As it lays crucial focus on a single information system containing data essential to the functioning of its society, any interruption of this system or corruption of its data might have devastating consequences. In theory, ss-Gov assumes the role of the administrator with no possibility to manipulate with the data. In reality however, this might not be easily achieved and hence, potential for corruption through the administrators would remain.

On the other hand, already today global systems exist, that store data of a similar sensibility – one such system for instance is the SWIFT global banking network [Guldentops 1991] through which the majority of financial transactions worldwide is conducted. Also here, hypothetically, administrators who have access to the SWIFT databases, could misuse their power.

SS-Gov thus implies a significant shift in power away from bureaucracies to organizations that would host the ss-Gov systems. Again, this would be not a new phenomenon but rather a continuation of the trend laid down by global Internet players, such as ICANN, W3C, Google, Facebook, various telecommunication operators, etc. This opens the question of what consequences such power might imply – would the administrators eventually become greedy and misuse their monopoly? Would they compete by providing better services? Or would it be possible to provide ss-Gov through a decentralized or peer-to-peer network in order to prevent monopolies to emerge in first place?

5 Conclusion and outlook

In this article we described Self-Service Government (ss-Gov), a model how societies can govern themselves without requiring a bureaucracy as middle management. We argued that bureaucracies due to corruption, which is an ever-present and necessary part of that system, create higher and higher transaction costs, which increasingly burden the governed subjects through taxation and injustice. We argued that e-government tools and systems, which aid established bureaucracies by automatizing existing processes cannot sustainably improve bureaucracies, as they introduce novel

forms of corruption, break core legal principles, and require high maintenance costs as soon as the law changes.

We had a look on research of massive multiplayer online role-playing games (MMORPGs), who have strong resemblances to real world economies and found that they are governed by information systems that base on the same principles as ss-Gov. In real-world societies however, unlike in MMORPGs, the governing rules are created and modified through collaborative decision making, hence for ss-Gov we had to take this aspect into consideration.

The core of ss-Gov is an information system administered by the sovereign, which stores data about facts, from which legal relations and legal statuses of the governed subjects can be calculated using set theory. This data is entered by subjects themselves, provided that they have the necessary eligibilities for write-access to the system. We argued that through such mathematical approach one's eligibilities in a certain context can be calculated ad-hoc, which levitates the need to explicitly define rights through bureaucratic administrative proceedings.

We demonstrated that governing can be abstracted to reasoning based on constellations of data stored in a governmental data network, which entitle people to do actions and enjoy rights. Such constellation-based government is superior to service-based government, as it is agnostic to changes in the surrounding legal context, because the dimensions of legal relations are a result of information available to the government.

By evaluating the model based on real-world scenarios, we found that ss-Gov is conceptually feasible, although it bears significant challenges if it had to be introduced into the modern Western society. For the evaluation however we deliberatively omitted technical aspects and potential problems related to them.

A technical proof-of-concept of the presented model is subject to our still ongoing research and will be presented to the research community later.

Aside from this, many new research questions arise that need to be handled in the future. For example, it needs to be clarified how to enact and modify legal rules through collaborative decision making (such as voting, or liquid democracy), how to incorporate versioning/history of the stored data, which technologies and conventions to choose for structuring and communicating data, how to ensure fair non-repudiation of message exchange, how to sustainably incorporate identity, how to ensure system and data integrity, etc.

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