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New regulatory challenges from cloud computing as a public utility perspective

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Abstract

This paper builds up a vision for regulatory framework for ICT markets from a public utility perspective. Cloud computing is considered as a tool for serving small and medium enterprises and distributed intelligent applications like intelligent transport services, health care information services or distance learning services. These applications are to be the modern service infrastructure both for business- or public- usages. Dependency of the individuals, communities and businesses is growing from the availability, affordability, safety and security of the ICT infrastructure. An innovation based, four phased business model for the infrastructure is shown. Voluntary industrial based communities may regulate themselves. Standardisation is shown as a measure for regulation to achieve a trusted agent position.

Keywords: Infrastructure regulation, Cloud computing, Standardisation, Innovation

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New regulatory challenges from cloud computing as a public utility perspective

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Abstract:

This paper builds up a vision for regulatory framework for ICT markets from a public utility perspective. Cloud computing is considered as a tool for serving small and medium enterprises and distributed intelligent applications like intelligent transport services, health care information services or distance learning services. These applications are to be the modern service infrastructure both for business- or public- usages. Dependency of the individuals, communities and businesses is growing from the availability, affordability, safety and security of the ICT infrastructure. An innovation based, four phased business model for the infrastructure is shown. Voluntary industrial based communities may regulate themselves. Standardisation is shown as a measure for regulation to achieve a trusted agent position.

1. Definition of a cloud computing service

Cloud is the new hype and many people seem to understand what it means. The best definition can be found in a standardisation document of US.

“Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.” [1]

This document shows the main features of a cloud, which can be considered the extension of the well known outsourcing service-model combining with the technical management model of grid-computing. Essential characteristics of a cloud are: *self-service, network access, resource management, elasticity, measured service*. There are different serving models in a cloud: *SaaS=software as a service, PaaS=platform as a service, IaaS=infrastructure as a Service*. Regarding the users served by the information system, deployment can be: *private, community, public or hybrid of the previous forms*. The first two types can be on-site or outsourced. So we can see the following types of the clouds:

Cloud type	Users	Served by	Serving models can be
Private on-site	One organization	Internal system	SaaS, PaaS, IaaS
Private outsourced		External system, distance	SaaS, PaaS, IaaS
Community onsite	More than one, but limited number of user organizations	Internal system	SaaS, PaaS, IaaS
Community outsourced		External system, distance	SaaS, PaaS, IaaS
Public cloud	Non limited number of organizations, open access to join	External system, distance	SaaS, PaaS, IaaS
Hybrid cloud	Open and closed part of the cloud, may differ on user policy	External system, distance	SaaS, PaaS, IaaS

Table 1. Cloud Types

Ongoing European research and industrial initiatives to develop new clouds for multi purposes¹

- Networked European Software and Services Initiative (NESSI) http://cordis.europa.eu/technology-platforms/nessi_en.html
- European Grid Initiative (EGI) <http://www.egi.eu/>
- The Resources and Services Virtualization without Barriers Project (RESERVOIR) is a European Union FP7 funded Grid Computing project. <http://www.reservoir-fp7.eu/>

Some Global initiatives with participation of European players

- Open Cirrus is Global with some European partners among many others <https://opencirrus.org/>
- Open Networking Foundation (ONF) a new approach to networking called Software-Defined Networking (SDN). <http://www.opennetworkingfoundation.org/>

2. Cloud as a business and a business infrastructure

Service provider and the subscriber make a contract on *SLA*=service level agreement, which has promises from the provider, limitations and obligations for both parties.

The promises are related to reliability of the service and technical information from the provider side. The limitations are related to system maintenance, and some expectance toward the users' behaviour (not to disturb other users with hacking or spamming, not to spread illegal content, etc.). The obligations are related to payment from subscriber side, and some trust building rules for the provider side. The *SLA* seems to be a bilateral, market based service agreement for B2B services, which may become part of the business infrastructure.

Service environment of a business need more than one element: energy system, office buildings, transport of tangible products, banking system, legal framework for businesses, managerial services like accounting or staff seeking. Each part of the business infrastructure can influence the return on investment in a business. Some of them are essential, others are optional. Technically handled information is a basis for *IT based management* which can be the competitive edge of the enterprises, and may grow effectiveness of public services too.

Cloud computing is considered as a tool for serving small and medium enterprises and distributed intelligent applications like intelligent transport services, health care information services or distance learning services. These applications are to be the modern service infrastructure both for business- or public- usages.

If a business line becomes part of the business infrastructure (like energy, water supply, sewerage, transport, postal services, banking) emerges the idea to consider it as a public utility or not.

3. Public utility approach to business infrastructure

Public utility has a good definition in American Heritage Dictionary:

„ A (private business) organization, subject to governmental regulation, that provides an essential commodity or service, such as water, electricity, transportation, or communication, to the public. “²

This definition shows the American approach, where the basic is to start with private business, and later regulate the market if it is necessary.

¹ Source: <http://www.cloudbook.net/directories/research-clouds/>

² Source: <http://www.answers.com/topic/public-utility>

The European historical approach used to be to build up a non-profit, publicly owned organization to serve large scale of customers (business-, private- and government organizations or individuals) without any restrictions or discriminations.

The mayor difference in these approaches is that *who owns* the infrastructure needed, and *who should invest into it*.

- In case the organization is a *private business*, the market should allocate the capital to invest, and the innovation can be fast, the variety of products could be wide. The profit oriented private company intends to respond the new challenges of the market, use innovative (sometimes non-standardized) technologies in order to win in competition. In this case, the public utility regulation compensates the market failures, like monopolistic situation, asymmetric information situation for the customer, and cooperation to build a network.
- In case the organization is a *publicly owned* one, the source of investment can be not only the income from the customers, but also external funds can be also used, like tax or state-subsidies, or state guaranteed loans too. On the other hand, the prices may go down, lower than in business based case. (There is a theoretical possibility to use prices higher, but it would imply business-based entry legal or illegal if it is technically possible.) As a consequence, larger proportion of the society will be able to use the service, build other businesses on it, and benefit from it. There is a social benefit on public investments.

There are also mixed systems between the two above mentioned end of the scale:

- Private ownership of the infrastructure, with strong public utility regulation;
- Private and public common ownership of the infrastructure together with mild regulation;
- Public ownership with the market opening to private firms, with elements of regulation
- Private Public Partnership constructions, with private contracts between the private investors and the state(budget), with some elements of regulations

Each model has its own benefits and drawbacks. We could see many examples of forms and measures in CEE countries in the last twenty years of the transformation period toward the market economy.

World Bank advisors emerged an idea about the public utility privatization and secularization wheel. The concept is that there are periods of privatizations and there are periods of secularizations in an industry, and the idea changes periodically, the time of the cycle is about fifty years.³

My main thesis is, that *the applicable business model for infrastructure providing infrastructure depends on the innovation period of the technology*.

4. Innovation-based infrastructure with merging value chains

In each industry there are fast technology-developing disruptive periods, where a variety of new technologies step into the market, compete, the investment is risky, but the return may be high. There are spreading periods, when there are new built capacities, so the prices go down, the service spreads into new industries. Next figure shows the innovation periods, the type of the curve is well known.

³ See more ideas on <http://warrington.ufl.edu/purc/>

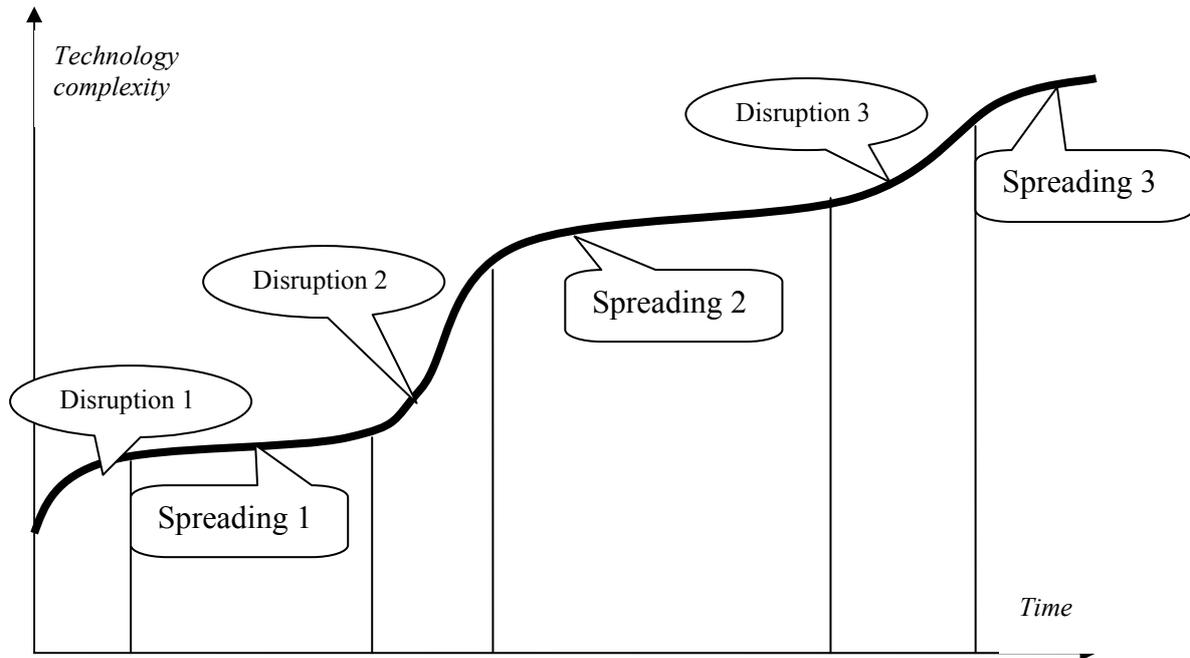


Figure 1. Innovation flow in many industries

Let us to combine this innovation model with the industrial value chain model of the technology based infrastructure.⁴

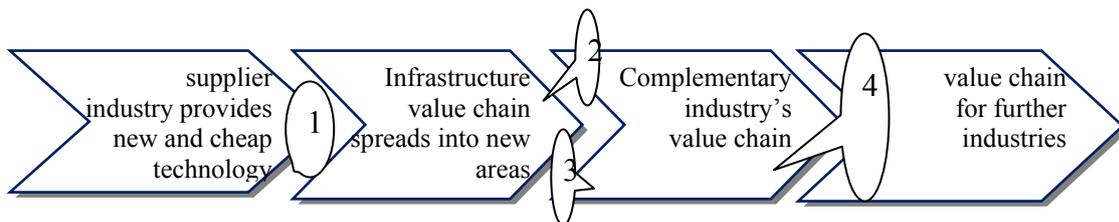


Figure 2. Value chain model of the technology based infrastructure

The technology innovation forms a four-phase engine within the industrial value chain, and the effect spreads from the supplier toward end-users.

- First phase (1): the infrastructure is spreading into new business areas, based on the new technologies the quality rises, the prices diminish, investment is needed into infrastructure.
- Second phase (2): some complementary industries build in their services the already existing infrastructure.
- Third phase (3): the value chains merge, and form a new one together, providing a new compound service for the customers.
- Fourth phase (4): when the new compound service itself becomes the basis for other industries as a business infrastructure.

5. *The four-phase infrastructure business model*

What is the better model for infrastructure providing? Depends on which phase we are.

⁴ See the model Porter, M.E. (1985) *Competitive Advantage*, Free Press, New York, 1985.
<http://hbr.org/product/strategy-seeking-and-securing-competitive-advantage/an/2437-SRN-ENG?N=4294841678&Ntt=Porter&Nao=0>

In first phase, when there are new technologies for the infrastructure, the essential need for further development is fast investment into infrastructure. Public-service business model has a state budget limits to invest. Mixed model can be private-public partnership or partial privatization leading to mixed ownership. Private-service business model need assurance of return on investment, like concession or other means.

In second phase, when infrastructure services spread into new business areas, the essential need for further development is to provide new service products for complementary industry. Public-service business model may extend geographical coverage served with basic products, but with a narrow range of services. Mixed public and private business model may provide open market to new entrants (with regulation holiday), beside the public-based basic service. Private-service business model may lead to more choice for the customer need.

In third phase, when the value chains merge providing a new compound service for the customers, the essential need for further development is to ensure reliability, security, low prices and customer-neutrality. Mixed public and private business model can be handled through price regulation and universal service obligation. Private-service business model would lead over-dependence from some private firms, and cause security worries

In fourth phase, when the new compound service becomes a business infrastructure, essential need for further development is to investments into compound infrastructure. Public-service business model would need a selective investment policy by the state budget. Mixed public and private business model can be handled by strong regulation on reliability; but governments often build up closed solutions for government purposes. Private-service business model reacts to the need for further investment, with capital concentration (global alliances, mergers).

The overview of the ideas is shown on the next table.

Phase	Essential need for further development	Public-service business model	Mixed public and private business model	Private-service business model
First	Fast investment into infrastructure	<i>State budget limits to invest</i>	PPP or partial privatization	Assure ROI (concession?)
Second	New service products for complementary industry	Extending geographical coverage served with basic products	Open market to new entrants (regulation holiday)	More choice for the customer need
Third	Reliability, security low prices, neutrality	Universal service providing	Price and USO regulation	<i>Over-dependence from private firms, security worries</i>
Fourth	Investments into compound infrastructure	<i>Selective investment policy by the state or community budget</i>	Strong regulation on reliability closed solutions for government	Capital concentration (global alliances, mergers)

Table 2. Infrastructure business models in different innovation phases

6. The business model for ICT and Clouds

The public utility business model described above, intend to be general. Where are we just now in this table in ICT industry? My opinion is that we are about at the third phase and we can influence the near future of the fourth phase. We can see along the arrows, the history of the info-communication sector regarding the business model and the innovation phases. (The CEE Countries went through the discursive arrow-flow, due to the transitory period in the

nineties.) Cloud computing can be considered as a complementary industry for information communications, and becoming a compound business infrastructure for IT-based management services and knowledge based other industries like: accounting, e-commerce, distance working, content providing, e-learning, virtual collaboration, etc. The existing business model at global level can be considered more or less private-service model, and in some countries and regions there are mixed public and private models.

In this phase of ICT innovation, regarding Cloud Computing, it would be better to move the business models toward a public-private mixed or public-service model. This shift would cause positive external influences in other sectors, when the majority of the society will be able to use cloud infrastructure. But the model described above can shift only on cell in a short period. And there is a spontaneous process of the market players to build up strategic alliances or mergers, any kind of capital concentration. Main message is: *go on with strong regulation on strong regulation on reliability*.

7. Public investments into clouds?

Sometimes local authorities apply for EU subsidies to build up publicly owned ICT infrastructure. This can be part of the selective investment policy by the government (or community) to build up new public clouds. Those clouds should achieve social benefit for the community, who invest into them. This can be the second step, after the strong regulation on reliability.

8. Dreams and fears regarding the cloud computing

There are several political dreams and fears from the Cloud computing. First of all, benefits are supposed at small and medium enterprises, local governments, distributed public services (like intelligent transport, e-learning or e-health). The expectations are high; it is a typical hype, what we can see. There are several National and Community strategies how to accelerate the spreading and the exploitation processes of the new technology. [12], [2], [8] On the other hand, there are voices with fears and worries about the dependency, data security and privacy issues. [13], [14], [15], [16], [17], [18], [19], [20]. It is interesting to see, that the worries in North America is more about on customer dependency from a service provider in a monopolistic situation, the fears in EU is more on privacy defending in a cloud located physically in a third country. This slight difference shows differences in value approach, historical experiences and also market power.

9. Dependency of the user in a cloud

Dependency of the individuals, communities and businesses is growing from the availability, affordability, safety and security of the ICT infrastructure. What should a regulatory body do in order to balance the dependency of the user, the customer, not to become the loser?

The US regulator has prepared a recommendation [1] as a standard to build up general commercial behavior to use Clouds. Cloud computing raises several issues regarding to: computing performance, reliability, economic goals, completing legal expectations and security. These issues lead to several recommendations in about management, data governance, reliability and security, virtual machines, software and application.

There are general statements of customers' dependency from their cloud

- customer still depend on accessing network to the cloud,
- subscribers still need IT skills to use clouds services,
- workload (of locations and premises) are managed hidden from clients,

- workloads of different clients may run on the same system and local network
- there should be data import/export, and performance limitations for the customers

10. Source and role of regulation

What can be the source of power to achieve any kind of measures decided? First of all, there are questions: who can be the regulator, what are the remedies to be applied, is there any possibility to enforce the rules?

There are *industrial based global communities* to regulate themselves:

- The most powerful organisations are the global business communities, like standardisation bodies, or common voluntary industrial platforms. They may build up internal rule of behaviour, and the largest threat is not to cooperate with the violator of the common rules. [21]
- The other regulators can be Global International Organizations, like WTO, ITU, OECD,... which are based on a written constitution, and under the membership there is a possibility to achieve written multilateral agreements. These agreements go into the law-force through member states, and the governments will have the power to enforce the rule.
- There are also Communities of States like European Union, which has a strong internal regulation system. US Federal regulation has even more means to regulate the internal market, which is one of the largest.
- There are also regional agreements in a networked industry

As we see, regulation is based on *voluntary partnership* as a basis. This partnership is mostly built up by the incumbent industrial players or governmental parties. The common interest is, to extend business, achieve social benefits, and avoid common risks.

Other type is the *government based regulation*, which is part of the country governance. The role and scope of the government based regulation depends on the administrative culture of the country: idea of the role of government in general, habit to fulfil the legal orders, and imposition of penalties. The government may also - as a punishment - exclude the market player from the limited resources like frequency band or other ones.

The *self regulation of the smaller organisations* is part of the cohesion they build up among themselves. The rules should serve the common goals and interests to gain business or social benefits or prevent some risks and losses.

11. Regulatory means for Cloud Computing

How the regulator should intervene in the service providing process, in order to inform the possible customers before, and defend them after joining to a certain cloud? From regulatory side to help the safety and security of the cloud computing service provider there are some possibilities:

- *Enforce the transparency of the service* can be made by independent auditing expert mechanism, and the result can be published.
- *Control terms of delivery*: customer need some help to understand the terms of delivery, it should be provided by the service provider, and the control mechanism can monitor it randomly.
- *Build up customer defence institutions*: Customer should get procedures in case of injustice and unfairness and get compensation to it, by a court, by a tribune or by an agency.
- *Prevent the monopolization of the market*: The market should be open to new entrants and new innovation technologies; because the incumbent providers intend to exclude newcomers. The standardization process also should be monitored, to prevent excluding standards (see next).

12. Standardization as a process of self-regulation

In the Globalized ICT network, the global agreement of service providers can achieve the reliability and certain transparency of the service. The standardization institutions are able to build up these measures. The national or supranational institutions can use the technical measures at standardization bodies; extend them towards customer care and self declaration obligations. How to enforce the regulatory measures in case of conflict of interests?

Standardization is always the interest of the main industrial players, when they are at least three⁵ or more in a market segment. They have a common interest to achieve interfaces to connect subsystems in order to sell their own products to others customers too. The addressable market is growing in case of standardised systems and products. So there is a hope the main players can agree with each others, but the smaller ones should control the standardization process of the big ones. Governments should help smaller players to participate in this process with information, training, mandating or travel funding. The SME-s are the players, who might prevent the excluding standards. Excluding standard means, that incumbent industrial players raise the technical level unnecessary, in order to exclude newcomers, and the low-income customers do not find the cheaper products which would fit their needs. The standardization can also help the trust building process to the customers.

13. Trusted Agent

How to avoid or prevent incidents, how to diminish the loss of the users in case of incidents? Cloud provider should become a trusted agent, who is reliable, transparent, standardized and audited by certain bodies: similar to electricity, gas, postal service or banking. Taking it seriously, it could be and somehow should be regulated as a real public utility. The trusted agent should provide assortment of standardized products. Users will be able to know these products, use these products, and build into their business processes or everyday life. What can be the real benefit from the user's side to use an ICT tool as service? On the other hand, what can be the real risk to use a cloud? The answer should be clear in a knowledge-based society, where we are evolving to.

Summary

There is a hype on cloud computing, the expectations are high, but the technology is fast developing. We can differentiate six different types of clouds technically: private on-site, private outsourced, community onsite, community outsourced, public cloud, hybrid cloud; but all of them can provide software-, platform- or infrastructure as a service. Cloud becomes a part of the business infrastructure, and a basis for IT-based management services. So in the mid-term the dependency of the economy would grow from cloud providers. We have seen a model about the business model approaches to an infrastructure in a technology based, merging industry. The presented model shows, that public utility approach and private business approach are not absolute categories, but they would be part of a cycle drifted by innovation and the value chain merging. Regulation can be based on voluntary partnerships of the major industrial players, to achieve transparency, reliability. Government agencies or other self-regulatory bodies should build up processes for customer help and defence. To prevent the monopolization of the market, it should be open for new technologies. Standardization process can be the major route, which may lead to the expected results. Governments should help the participation of the smaller players in the standardization process. Cloud computing provider should become a trusted agent in the knowledge based society.

⁵ The number comes from game theory

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