Moving E-Commerce Towards E-Commodity

A Consequence of Cloud Computing

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***Abstract*—Many people believe that nowadays everything can be purchased online, but the reality could not be further from the truth. A recent survey that we have conducted in two medium-sized German cities revealed that only about 12% of all businesses are able to accept online orders. While 100% of all large enterprises run their own online store, only 6.9% of all micro, small and medium enterprises are able to receive online orders. The obvious outcome of such an e-commerce disparity is that consumers can only very rarely place online orders at their favorite local stores. In this article, we will describe the idea of providing electronic commerce as a commodity service to micro, small and medium enterprises. We will identify business-side as well as technology-side problems that exist in current e-commerce and discuss strategies to mediate them.**

Keywords-E-commerce; e-commodity; micro small and medium enterprises; cloud computing; product definition; agile e-commerce.

I. INTRODUCTION

In the Internet era, electronic commerce (e-commerce) plays an important role for both consumers as well as suppliers. E-commerce enables individuals to purchase goods from their computers at home and get them delivered to their address. Suppliers on the other hand benefit from a distribution channel that is cheap and very close to the customer.

The number of internet users has increased considerably since the mid-1990s. At the same time, the revenue that is generated by internet-based e-commerce has increased steadily and keeps increasing [1]. While this development is remarkable, contemporary e-commerce is limited to goods that are easy to describe, standardized and that have low asset specificity [2]. Adler adds that products that qualify best for e-commerce are so called "search products", which can be purchased based only on search qualities [3]. Products and services that do not meet above requirements or are no search products and are not frequently or not at all traded on the internet.

Especially, so called micro, small and medium enterprises (MSMEs) -that are enterprises with less than 250 employees [4]- do not very often draw benefit from the development that has taken place in e-commerce. Reasons for that can be found in MSMEs (especially micro enterprises) often dealing with goods and services that are considered as being difficult to trade on the internet as well as in the complexity and cost related to the maintenance of e-commerce systems.

With 99% of all European businesses being MSMEs [4] and the vast majority of them not being able to accept online orders, end-consumers are seldom able to purchase those goods online which they normally buy from local stores around the area they live in. Goods that consumers buy on a daily basis (e.g., groceries, toiletries, etc.) are not yet often to be found on the internet. Appointments with local craftsman, practitioners, barbers or other service providers can still not be booked online. We have referred to a kind of e-commerce where those products and services that individuals buy on a daily basis can be purchased online as day-by-day e-commerce (DBDE-Commerce) [5].

In accordance with our vision of DBDE-Commerce, throughout this article we will provide a new perspective on how to turn e-commerce into commodity ("e-commodity"). We will refer to the concept of making e-commerce available to each and every business as E-Com-E-Com ("e-commerce as e-commodity"). Inspired by the fundamental ideas behind cloud computing to make computational power become utility (similar to electricity out of a socket), we will introduce a prototype for an intelligent cloud platform that aims at providing virtual storefronts to businesses as commodity service.

II. OVERVIEW AND RELATED WORK

The development which has taken place in the field of electronic commerce goes back to the progress of the World Wide Web. With the upcoming of hypertext and hypertext-enabled web browsers it became possible to provide product information online and to conduct purchases as well as sales over the internet. In the period between 1994 and 1999, many enterprises have moved to the internet while they were expecting an increase in sales caused by their online shops [6]. Amongst these enterprises, only a few succeeded in establishing a global platform for international trade with a diverse variety of products and services that can be

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purchased online. The most prominent examples can be found in the US-based enterprises eBay or Amazon, which at the moment can be considered as leaders in their field of business.

Both the internet as well as internet-based commerce keep growing continuously and the number of people who have access to web-based virtual storefronts is increasing steadily. According to a report of the German federation of information technology, telecommunication and new media (BITKOM), currently two thirds of all German individuals have permanent access to the internet [7]. Furthermore, the E-Commerce Guide, published by a consortium of different members who are engaged in e-commerce, mentions that about 70% of all German individuals with broad band connection are frequently purchasing goods and services online [8]. The business volume of electronic commerce in 1999 summed up to 1.3 billion €. In 2009, it rose up to 17.3 billion € while the 2014 sales forecast for Germany predicts 27.2 billion € worth of online orders [9]. The Online Shopping Survey (OSS) of the GfK, the largest German market research institution, revealed that the most popular products of electronic trade in 2009 were books (14,9 million individuals), clothes (14,7 million individuals), event tickets (12,5 million individuals), music (8,5 million individuals) and hotel reservations (7,4 million individuals) [10].

Given the Online Shopping Survey of the GfK, it appears that today's e-commerce is dominated by easy-to-describe search products [2]. Though we believe that it is more difficult to also expand e-commerce into those product domains that deal with more complicated products and services, we are convinced that it is possible.

III. FEATURES OF TODAY'S E-COMMERCE

Different e-commerce suites have different functionality, but in general all of them provide certain base level features. These features include:

- Product/service information
- Usability
- Customer support
- Order fulfillment and payment
- Logistics
- Marketing
- Trust with security and privacy

When consumers browse websites with the intent to conduct online purchases, it is important to provide them with rich product and service information. Today's online shops have a lot of features for product presentation. Among the most popular ones are high-resolution images, webcasts or video tours for product configuration engines and online showrooms. Pricing information is always up to date and can change on a daily basis.

Primary reasons for leaving a website are due to long load time, poor navigation, inconvenient coloring or bad page design. To improve the duration of stay of a visitor on a website, developers are given tools and guidelines to create their design in a robust and appealing manner. Many storefronts support multiple languages to reach a large number of customers in different countries. Options for searching, filtering and sorting of product information enhance the end-user experience and provide for an easier way of finding the desired item.

Reoccurring product-related questions are addressed in frequently asked questions (FAQs). In addition, hotlines, web forms or live chats are available to customers for getting in contact with the vendor. In case of asynchronous communication, replies are normally guaranteed to be sent within 24 - 48 hours. Weblogs aim at equipping customers with an instrument to obtain information on products while those are still under development or for trouble shooting after the product was purchased.

Advanced online shops have an integrated order and payment system or at least feature the possibility to connect an order and payment system via certain interfaces. Today's online shops track shopping baskets throughout the entire session of the customer and at the end of the online purchase gather logistics and payment information. Several online payment options exist (e.g., invoice, prepayment, debit entry, cash on delivery, credit card, PayPal or Click & Buy).

Many shops provide fast delivery services offered by partnering logistics enterprises. Most frequently mentioned are DHL, UPS, or GLS. This way, it is possible to dispatch orders within 24 hours and provide order tracking services. Furthermore, certain enterprises (e.g., Alternate) offer short message services to confirm the order or to inform the customer about the status of the delivery.

While several aspects of traditional commerce had to be adapted to new and different requirements in online commerce, marketing also had to come up with new selling strategies. Marketing techniques for online commerce include search engine optimization (SEO) to be ranked among the top entries of search engine results. Cross selling aims at recommending similar or complementary products to the customer. Google has developed AdWords to include semantic information in the placement of ad banners, so that users of a website get presented advertisement that corresponds with the semantic context and topic of the site. Several enterprises have started integrating social media, such as twitter or Facebook, in their online marketing. Others provide shopping club memberships (e.g., Limango or brands4friends), which suggest potentially interesting offers or hot deals to members. Word-of-mouth recommendation (e.g., TRND) is a new way of electronic product marketing, where members are given the opportunity to test products and recommend them to their friends. Members can test products, share them with friends and post the results on trnd.com. Another online marketing strategy is based upon enterprise coupon services, where every day vendors provide a new "Deal of the Day" (e.g., DailyDeal, CityDeal or Groupon).

Finally, most online shops have features that aim at establishing a feeling of trust, security and privacy to their customers. To build up trust, online shop providers use seals of quality, such as Trusted Shops or Safer Shopping. Another helpful instrument to establish trust are guest books where customers can leave comments and feedback regarding previous purchases. Additionally, online shop owners use

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digital security certificates to protect users against data theft or interception.

Together, all of the features above form an all-in-one package to earn user satisfaction and establish a long-lasting customer relationship. Though e-commerce in general and e-commerce technology in particular have made an impressive development over the last two decades, we still do not see e-commerce having become commodity. E-commerce is yet too much driven by industry and there are still too many factors within an organization that determine whether or not to run a virtual storefront. The end-user experiences supported by most online shops might seem acceptable to the majority of online customers, but at the same time this is where the caveat lies. If future e-commerce technology was capable of attracting a more diverse group of online customers while providing a larger number of products and services online, the functionality and features of today's e-commerce would expand even further into our daily shopping experience. Towards the end of this article, we are going to provide a list of novel features which we are going to support with our next generation e-commerce platform "Goliath".

IV. E-COMMERCE AS E-COMMODITY STUDY

In June 2010, we have reviewed 1859 (Table 1) enterprises in two German cities, namely Magdeburg and Freiburg. We have chosen Magdeburg (population 230.000) and Freiburg (220.000) since both have a similarly big population, a similar number of businesses and since we have researchers in both areas who conducted the analysis. We have split the enterprises in both cities into 1757 MSMEs as well as 102 large enterprises (LE). For the classification of MSMEs and LEs, we have employed the European Commission's definition, where MSMEs are considered as enterprises with <250 employees and LEs as enterprises with >=250 employees [4]. Table 1 features the percentages of MSMEs with no own website (38.4%), enterprises with own website but now online shop (53.6%), enterprises with online shops (6.9%) and enterprises that use their website to promote special website deals (1.1%).

TABLE I. NUMBER OF ANALYZED MSMES

Information	*Magdeburg MSMEs*	*Freiburg MSMEs*	*Total MSMEs*
No website	199	475	674
Only website, no online shop	629	312	941
Online shop	52	70	122
Special deals	20	0	20
Total	900	857	1757

Out of the 900 MSMEs reviewed in Magdeburg, 199 (22.1%) have no own website, 629 (69.9%) have an own website but are not able to accept online offers, 20 (2.2%) have a website to inform about special offers and deals (or limited features) and only 52 (5.8%) enterprises run their own electronic storefront (Figure 1).

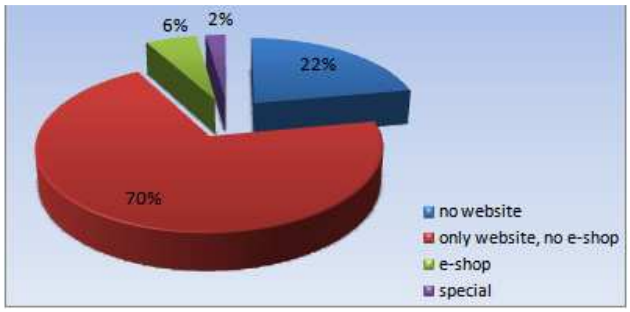

Figure 1. MSME e-commerce in Magdeburg.

In case of the city of Freiburg, out of 857 MSMEs 475 (55.4%) have no own website, 312 (36.4%) have an own website but do not accept online offers and only 70 (8.2%) have an online shop (Figure 2).

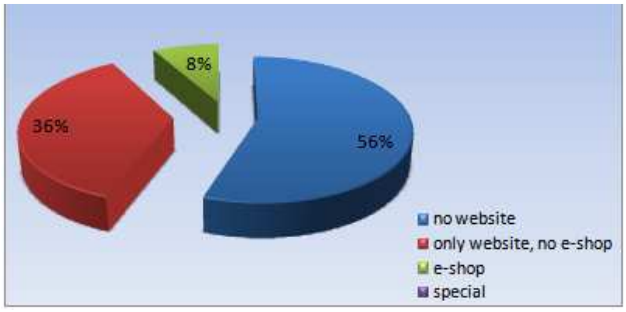

Figure 2. MSME e-commerce in Freiburg.

With merely 5.8% of all MSMEs in Magdeburg and 8.2% in Freiburg being able to accept online orders, the results are very similar. It is also important to note that out of the 1859 enterprises reviewed in both cities, only 102 (5.4%) can be considered as large enterprises that in one way or another act as retailers. Among those large enterprises, the websites of all 102 businesses (100%) feature an online ordering system.

While 93.1% of all MSMEs (together in Freiburg and Magdeburg) not being able to accept online orders seems to be quite a large percentage, we are next going to hypothesize in our KULI model reasons for MSMEs to yet reject the option of electronically exposing their products and services on the internet.

V. BUSINESS-SIDE E-COM-E-COM FACTORS

When enterprises consider the introduction of an electronic storefront for their business, there are many aspects that play into the decision making process. An online shop might, for example, only be feasible for enterprises which do not depend too much on drop-in customers,

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enterprises which offer products that are easy to describe or enterprises which have access to appropriate logistics facilities or logistics service providers. Another problematic aspect is that, as most enterprises do not have IT as their major field of business, a significant portion of MSMEs might lack the knowledge and technical understanding that is required for running e-commerce. Others might be too focused upon maintaining their existing business infrastructure to investigate the possibilities of e-commerce or might simply lack the time to take related initiatives. Again others might find e-commerce to be an appealing option for extending their market, but might have products that require certain agility from logistics service providers (e.g., perishable goods, such as food). Last but not least, running an online shop might simply be too expensive for certain MSMEs (cp. TCO of e-commerce in [5]) where this could mean that -due to the structure and products of the business- the e-commerce facility does not generate enough return on investment (ROI) to be an option to pursue or to even come up for the running cost of the online shop.

VI. KULI MODEL OF E-COMMERCE MATURITY

In our KULI model, we have picked up above thoughts, whereby KULI stands for Knowledge, Unawareness, Logistics and Investment. With KULI, we try to raise attention for the problems and difficulties MSMEs might face with respect to a possible adoption of e-commerce.

Knowledge: In order to setup, run and maintain an online shop, a variety of technical skills is required. Starting with the creation of a database and the setup of a web server towards the installation of the online shop software and the deployment to the web server, the majority of MSMEs would already get lost before they have specified even their first online product. Enterprises could compensate their lack of technical expertise by purchasing service hours of specialized companies and consultants. As we will see later, the cost for outsourcing the technical administration represents another major barrier for MSMEs towards the adoption of e-commerce.

Unawareness: As we have indicated earlier already, many MSMEs might simply be unaware of the chances e-commerce could bring to their business. We hypothesize that this is most often due to the size and the limited revenue MSMEs operate upon, so that no or only very limited resources exist within the organization that could deal with strategic questions and new technologies. To our opinion, it has always been and it will always remain a core problem of all e-business related research to communicate the many benefits of e-commerce to MSME decision makers in a way, so that they can access them and clearly identify where information system technology could add value to their organization.

Logistics: The third aspect the KULI model tries to point out is logistics. If enterprises depend on an own logistics facility in order to dispatch their online products, they will in most cases have to run their own fleet. Running an own fleet, however, is expensive and thus most enterprises would immediately withdraw this option, if no positive ROI was within sight. For certain businesses, however, it turned out to be an appealing extension of their business model to run e-commerce in addition to their traditional distribution channel. Pizza deliveries, restaurants or even pharmacies, for instance, offer to immediately dispatch their orders by using their own fleet. Businesses that wanted to online expose their products to a local market (as in the case of the pizza delivery) would also need to be able to rely upon an own fleet, or at least a logistics service provider that is capable of rapidly dispatching orders to local customers [11]. In this context, one should also evaluate the feasibility of a shared logistics provider or fleet that could be owned by a conglomerate of local businesses. This way, local MSMEs could share the cost for a fleet, which might at the same time be a solution for overcoming the cost barrier of an instantaneous dispatch handling. For many MSMEs, a shared logistics model could even represent the enabler for a future e-commerce go-live.

Investment: Last but not least, the KULI model of e-commerce adoption points out the role of the initial investment that is to be brought up for introducing e-commerce in an enterprise. Though several MSMEs might already have thought about adding e-commerce to their order handling, another significant number might find the investment for software, hardware, administration and consulting services to be out of proportion in the respective case of their business. In an earlier work, we have referred to this phenomenon where MSMEs might be attracted by the chances and possibilities of e-commerce, but on the other hand might not be able to bring up the initial investment as "MSME dilemma" [12]. Though critics might argue that nowadays there exists a variety of open source online shop software that can be procured for free, we would like to emphasize that MSMEs would still need to know how to set up the software (refer to "KULI/Knowledge"). Though so called rental shops, which represent online shops that are deployed and hosted by specialized companies, eliminate the procurement and installation of soft- and hardware on the MSME's side, the majority of enterprises will still not know how to customize the software to reflect their individual requirements or how to model products in their online shop. Again, the services of administrators or companies specialized on content management would need to be purchased. One large-enterprise real-world example for this can be found in the German T-Systems that not only hosts large-scale e-commerce suites, but also handles the content management for their customers. Though similar service providers have appeared in the small and medium segment (e.g., Open IceCat), services offered might yet be too expensive, of a limited functional scope or simply assume MSMEs to at least have basic level of information system support available in their organization.

We have summarized all four KULI factors in Figure 3, where we propose one question for each KULI factor. Only if all four questions are answered with "Yes", an MSME is mature enough to start running an online shop or engage in e-commerce.

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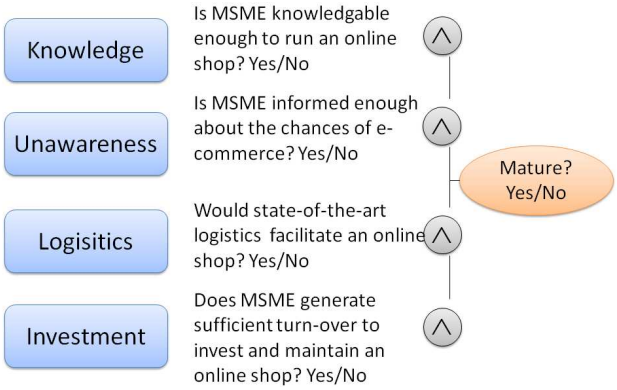

Figure 3. KULI model of e-commerce maturity.

With the questionnaire above, MSMEs are given a tool to evaluate and review their KULI maturity. Enterprises with a positive KULI maturity (overall "Yes") should seriously start considering an introduction of e-commerce to their business. Enterprises with a negative KULI maturity (overall "No") should start analyzing how to increase their maturity by, for example, increasing their knowledge or awareness. Furthermore, MSMEs with a negative KULI maturity should evaluate how to deal with "logistics" or how to bring up the funds necessary for the initial investment.

VII. TOWARD AN E-COM-E-COM DESIGN MODEL

In the previous section, we have introduced a model for outlining the reasons of why traditional e-commerce technology is not yet accepted at large scale by micro businesses. In a related work, we have talked about Organic Product Catalogs (OPCs) [13] that aim at providing a smooth entry for MSMEs to electronic commerce. Throughout this section, we are going to detail the behinds of organic product catalogs and will demonstrate how a cloud platform serves as the ideal platform to develop upon.

VIII. ORGANIC PRODUCT CATALOGS

The concept of organic product catalogs (OPCs) tries to provide a platform that is very close to the end-user and operates at minimum cost. The closeness is expressed as OPCs being driven by their user community; their content is made by the community for the community. The general intention behind this closeness argument is that if person A has created something in the OPC that could be useful for person B, B can very easily reuse this for his purposes. We will later detail how this could look in practice.

One fundamental requirement to an OPC is universality: No matter how easy or complicated a product or service is, it must be describable in the OPC. Therefore, OPCs at their very basis expose a universal product definition language (PDL) to the user that allows for the description of any arbitrary product or service. The assumption that underlies the PDL is that each and every product can be expressed in hierarchical form as a composition of attributes. In accordance with the "divide-and-conquer" principle, complex products are expressed as a hierarchical composition of attributes. Figure 4 is featuring a simple PDL tree of a car that consists of the attributes "make", "cost", "color" and "engine", whereby some of the attributes have one or multiple child attributes.

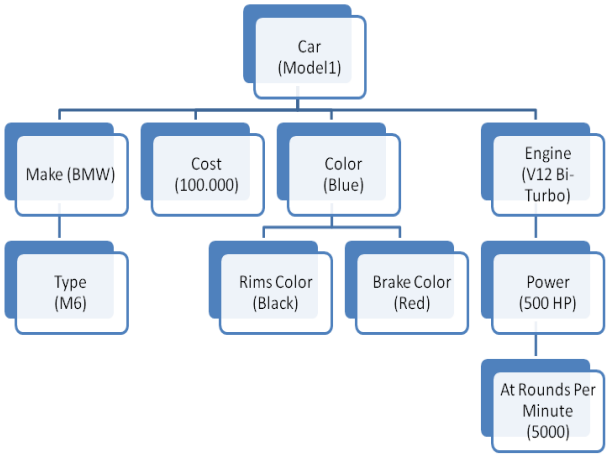

Figure 4. A sample PDL tree featuring a car.

Furthermore, the PDL allows for an on-attribute-level specification of dynamic behavior. When designing a product description for a product or service, users can bind so called attribute handlers to each and every attribute. The attribute handlers modify, update or interpret the attribute value before it gets returned to the calling instance. Attribute handler definitions are available in the OPC's attribute handler repository and can be freely bound to each attribute. In above example, the attribute "cost" could, for example, have an attribute handler "GetInCurrency" that returns the cost of the car in a user-specified currency by applying always up-to-date exchange rates.

While the PDL corresponds to the universality requirement, at the same time it violates another requirement: ease of use. Even though users are now given a tool to describe whatever product they have, most of them will most likely not "speak" the PDL. It is complicated, it is complex and it is something that needs to be learned. In order to design the OPC in a way so that it is usable for the majority of potential users, templates of commonly defined product descriptions are generated from the PDL. Hence, users, if they want to input their products into an OPC, first of all try to find a template that corresponds well with their product. In the next step, they customize the template (e.g., provide concrete values for placeholders) and save it to the OPC.

If a template for a product does not yet exist, the user can author a new template by using the PDL. He can submit the template to the OPC where it is going to be automatically reviewed and possibly added to the standard template base. This way, the own-authored template of one user becomes available to the whole community. If similar templates already exist, the OPC suggests using those or will try a merge resulting into a new template. As over time, users keep providing new or modifying existing product templates,

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the repository of product templates gains momentum. It is unpredictable how many templates the OPC will consist of and with that which products are maintained at a time t. The closeness to the community ensures that OPCs continuously reflect what is required by their users.

IX. CLOUD IMPLEMENTATION PLATFORM

So far, we have discussed how OPCs can add value to MSMEs. We have, however, not shown yet how OPCs can ensure a minimum cost for participation, so that they are accessible to every business, regardless of the size. Our solution to the problem of minimizing the cost for participation aims at minimizing the Total Cost of Ownership (TCO) of OPCs.

Ensuring easy-to-access maintenance and extension for future efforts [14] is one component of optimizing the TCO. Building OPCs as applications in the cloud, however, would probably grant the major portion of cost benefits. Figure 5 depictures that we designed our reference implementation as a cloud application as we are convinced by the many benefits of this paradigm with respect to the OPC scenario.

Figure 5 provides two perspectives on a cloud-hosted OPC. In the horizontal perspective, based on the cloud platform, the tenant layer ensures that each participant has access to an own customized content area.

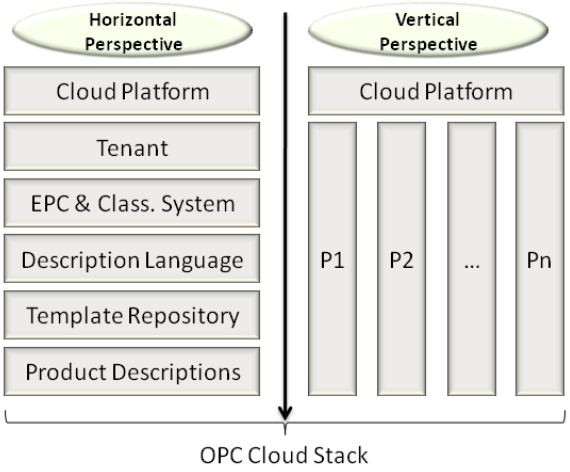

Figure 5. Cloud stack of an OPC [13].

The actual EPC distinguishes and individually manages the product descriptions for each client separately and thus provides full support for multitenancy. Multitenancy means enabling many "tenants" to use a central utility, in this case the OPC. The rationale behind multitenancy is scaling: In applications that are built to scale well, the operating cost for each client (the per-tenant TCO) will drop as more clients are added [15]. Furthermore, the OPC provides a general purpose product description language (PDL) that can be used to describe the products and services of each tenant. In most cases, however, tenants will use templates that were created by other tenants earlier for describing their products. Finally, the bottom-most layer of our OPC centrally stores all product descriptions that a tenant is maintaining. The vertical perspective (or the per-tenant perspective) visualizes that on each layer in the horizontal perspective, tenants are provided with their own customized (multitenant) experience.

X. PROJECT GOLIATH – THE DIGITAL CITY

Inspired by the idea of providing MSMEs with an instrument to easily and cost-effectively model and expose their products and services on the internet, we are now planning the rollout of our OPC prototype to a delimited economic entity, such as the city of Magdeburg or Freiburg.

We refer to this effort as the "Goliath Project" [11] where we will eventually be trying to capture and "digitize" all products and services provided by the businesses in one city ("The Protocity") and make them available for online purchase.

For that, we are adding a website frontend to our OPC that will allow citizens of the Protocity to browse through all online offerings and place orders. If physical goods are ordered, another, not yet raised issue is complicating things: logistics. Up to now, we were only dealing with the software side and have completely neglected the fact that the orders would also need to get dispatched in a timely manner. In reality, however, we would need to be able to support a variety of logistics-related scenarios. Hot food, for example, would need to get dispatched within a very short time, medicine ordered from an online pharmacy maybe even faster. For that reason, we have developed a model that tries to reflect the different requirements of physical goods that could potentially be purchased online.

As the main focus of the Goliath project lies upon the technology that is necessary for "digitizing" a city, we were looking for an elegant way to deal with the logistics problem. Part of our solution was to leave the intelligence that is required for route planning and way optimization to the logistics service providers (LSPs) themselves. The LSPs on the other hand can offer their parcel services on the Goliath platform by modeling them with our PDL, just like every other service would be modeled. While Goliath provides the information system infrastructure for LSPs to offer their services and get booked for a delivery, it is our hope that from an LSPs' point of view Goliath will become an interesting market to advertize their services. In this sense, we would in particular encourage semi-LSPs (fleet owners that do not primarily act as LSPs (e.g., pizza deliveries, pharmacies)), as well as smaller local LSPs to take their chances and expand their markets into the Goliath business network. Though we would appreciate large LSPs, such as DHL, UPS or Fedex, to also participate in Goliath, we believe that as they would need to bring up significant investments to create an agile and locally operating fleet that can dispatch orders within minutes, in the beginning large LSPs will rather hesitate to join the Goliath effort. For this reasons, we anticipate the first LSPs to adopt Goliath being local LSPs or semi-LSPs that would like to expand into new markets.

XI. CONCLUSION AND FUTURE WORK

In this article, we have introduced an approach to turn e-commerce into e-commodity and referred to this as E-Com-

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E-Com. We have argued that the fundamental idea of E-Com-E-Com is to provide e-commerce as a commodity service to micro, small and medium enterprises with the intention to one day cover the vast majority of all products and services offered in a city.

With our KULI model of e-commerce maturity, we have tried to outline the business-side E-Com-E-Com factors that determine an MSME's e-commerce readiness. Though we believe that the only way for MSMEs to achieve KULI maturity lies in the businesses adjusting the factors they are short on by themselves, we have also stated that technology-side E-Com-E-Com factors can at least make it easier for MSMEs to achieve KULI maturity.

While having local businesses equipped with e-commerce technology would allow end-consumers to benefit from a variety of new and exciting digital shopping experiences (e.g., order delivery at a specified time by a local retailer), there are also aspects we need to carefully consider when continuing our work on E-Com-E-Com, OPCs and the Goliath project.

One of the biggest challenges we will be facing is providing local retailers with a way to dispatch their orders in an agile and timely manner to their customers. Though we have ideas of how to mitigate this problem (e.g., binding semi-LSPs and other local ISPs to our platform), we are not sure yet whether the business model behind will work out in practice. Another problem that might evolve from our approach of how to deal with logistics is trust. We need to find a way to ensure that those businesses that offer to dispatch orders for other businesses become a reliable and trustworthy part of the Goliath business network.

Since the development of our OPC and the preparations for Goliath are still under development, we plan on rolling out our platform to the first tier of MSMEs in the beginning of 2011.

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