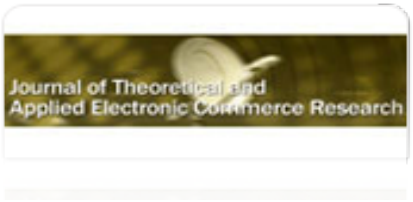

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Business Model Scenarios for Remote Management

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Abstract

This article critically appraises business model challenges in implementing remote management functionalities. Remote management is believed to create new service opportunities and foster convergence between previously dissociated islands of end user devices. Conflicting business logics from disparate industries, however, run counter to this attempt at centralization. We introduce a generic business modeling methodology that aims to move beyond traditional ICT investment appraisal techniques by combining four critical dimensions of design. We develop four business model scenarios based on the organizational design choice of 'degree of vertical integration' and the product design choices of 'degree of product modularity' and 'distribution of intelligence' and offer a description of the effect of these design choices on the intended customer value.

Key words: Business Modeling, Business Scenarios, Remote Management, Product Modularity, Vertical Integration

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1 Introduction

1.1 The Problem

Our research problem originated from considering the architectural premise that several technical islands of user devices (for example, the television set, the personal computer, or even the electricity meter) could generate a variety of remotely managed services such as video-on-demand, music-on-demand, personal video recorder (PVR), or remote metering, and thus could be remotely managed. Providing these services would require implementing a remote service platform (or autoconfiguration server) that performs functions such as service quality control, punctuality and integrity, or installs entirely new functionalities. As an increasing number of electronic devices are being remotely managed through a variety of techniques, it is clear that the introduction of remote device management is primarily a technology driven evolution. This article focuses on the business model aspects of implementing forms of remote management.

Remote home device management is believed to reduce complexity and cost for users, operators and/or service providers. The goal is to relieve end users of the burden of having to personally (re)configure these devices. In the field of ICT, associations and interactions between different business actors distinctly show an evolution from vertically organized offerings (consumer electronics, telecom industry or mass media style) to more hybrid, modular solutions (information technology style) [4], [12], [13]. As the technical silos of end user devices are breaking down, industrial actors are moving from closed loop installations models to customer driven service models. Consequently, the proposed business model scenarios offer a continuum, in which business models vary from closed loop models to customer driven and on demand models. Colleen [2] defines an on demand business as “an enterprise whose business processes, integrated end-to-end across the company and with key partners, suppliers and customers, can respond with speed to virtually any customer demand, organizational requirement, market opportunity or external threat”. The on-demand business model allows for a more focused, responsive, variable and resilient response to sudden changes in demand.

The question at hand is the following: which industry actors will perform this remote management function, and for what reasons will they do so? Within the scope of this article, we are only concerned with making explicit business models that are relevant for remotely managed end user support services using a home gateway, where a separate remote management layer supports service quality, performance and delivery. The contribution of this paper may reside in a broadening of the investment appraisal techniques currently employed in ICT investment research. Most IT/IS evaluation research is situated at the intra-company level, focusing on how a technology will add to the bottom line. We concur that, during the introduction of a cross-industry technology, most IT/IS evaluation methodologies focus on the project management level, as exemplified by [21]. Our goal is to move beyond the focus on the investment decision as an internal decision-making process and expand field horizons by creating awareness of the industrial ecology that surrounds an investment decision. This move seems to be in line with strategic management literature advising companies to strive for a strategic fit between the company’s external environment and its internal competences [19].

1.2 Remote Management of End User Devices: The Industry Context

The growing complexity of networked home devices provides companies with new market opportunities for an integrated service management solution that offers the customer the option of remote device management. The technical solution could be a source of both process and product innovations. Process innovation and simplification could give rise to better internal management and reduce costs for network access providers, content providers, and software application providers. For example, actors implementing the remote management layer will be able to cut costs of physical upgrade cycles by replacing them with remote digital upgrade cycles. Help desk costs could be cut by automating support services or complementing them with user managed processes. At the level of product innovations, new revenue streams could be generated or existing streams extended through remotely managed services such as home security, automation, and device management. For example, the possibility of offering richer functionalities at a premium price can translate into new revenue streams.

Supplying remotely managed applications, media content or other services in the networked home can be a revenue driver for both network equipment providers, service providers (including application, content and network access providers), and actors from traditional consumer electronics industry. That being said, several old industry strategies will have to change. Traditionally, consumer electronic companies created media-specific platforms and standards (e.g., audio tapes, video tapes, dvds) that allowed media content and entertainment corporations (e.g., music and film distributors) to provide their consumer products and services on widely accepted standardized physical carriers. In the past, this worked well because the industry operated in its own silo, independent of the rest of the information technology and telecommunication industry.

In order to create service values such as improved information, raised productivity, and enhanced in-home entertainment and ease of living, business actors from disparate industries will have to work together. They will need

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to review the key bottlenecks in technology and content delivery and look for ways to cut across industry barriers by closing partnerships with other players. Adopting a remote management solution may lead to higher levels of organizational agility and adaptability to changing service configurations, such as a higher degree of integration and compatibility of a company's service offerings. Better and more punctual customer information is another possible outcome of such a move, while at the same time opportunities are created to introduce innovative services in the market.

In the coming years, several technical islands are bound to coexist, without any of them acquiring absolute dominance in the end user home. Because interactive and content services will be a key to future growth for service providers, and because many traditional network access providers do not own the unique competences (content development, distribution and marketing) that media and entertainment industry actors own, the network access providers will have to strike alliances and coalitions with service and content providers on the supply side and ensure compatibility with the plethora of devices on the demand side.

Whether a single actor will acquire the function of *gatekeeper*—occupying a position in the service value network which all other services must pass—will be of primordial strategic importance. All actors must realize that consumers might veer away from a closed solution fencing off intercommunication between services, applications and devices. For example, if the network access providers take the risk of offering only a closed solution to the customers, other service providers may hit the market with their own access solutions, thus bypassing network access providers.

2 The Business Modeling Approach

In order to take into account the different interests, resources and competences of the different actors from these disparate technical domains, we adopt the methodology of business modeling. Business modeling is defined as "the description of the organizational prerequisites/requirements necessary for the creation of a specific product/service, the technical characteristics/architecture of that product or service, the roles and relations between the company, its customers, partners and suppliers, and the different value-creating—be it physical, virtual or financial—flows between them."

Business modeling is multidimensional and strategic in character by incorporating the multidimensionality of Kaplan and Norton's balanced scorecard view [22], the resource-based view of Jay Barney [6]-[8], and the strategic management insights of Gary Hamel [16]. According to Barney [7], companies must first mobilize their available resources and capabilities in order to produce a portfolio of products and services and bring it to the market. Next, those products/services that create customer value acquire a certain financial value that can be reinvested back into the capabilities of the firm.
We retained four dimensions from Barney's model: his 'resources and capabilities' are an instance of 'organization design,' his 'products and services' an instance of 'technology design', his 'customer value' corresponds to 'service design' and his 'financial value' with 'finance design.' Consequently, the four business modeling design phases we will use to describe the business modeling scenarios are:

1. Organization design phase. The organizational design involves defining a business scope (who are customers we will try to reach and how will we do this?), identifying distinctive competences, and taking business governance decisions (make versus buy decisions) [18].

2. Technology design phase. The technology design involves defining the technology scope (what technical design are we trying to develop and how will we do this?), identifying the systemic competences that will contribute to the business strategies, and deciding on the IT governance (how will we develop or acquire the needed technical competences?).

3. Service design phase. The service design involves offering a specific value proposition towards the end user. On the demand side, firms have to make a choice about the delivery channels they will follow. The organization can calculate the share of the overall profitability of each sales channel, but has to keep in mind that sales channels with a higher cost structure might also be more important to the overall business if an important customer segment prefers this costlier alternative. Companies have to take into account the degree of flexibility of each channel, i.e. whether channels can be expanded and/or reconfigured depending on the customers' expectations. Finally, the company should gain knowledge of each channel's bottlenecks and their effect on discontinuations of daily operations.

4. Financial design phase. In a final phase, the financial prerequisites for the interlocking roles are written down in a financial model. In this stage, the financial modalities are formalized in binding contracts that clearly describe each partner's responsibilities and the financial or other benefits they will receive in return. Depending on the legal structure of the partners involved, different forms of financial exchanges will take place.

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In this study, the focus will remain on the description of the impact of interrelated organization, technology and service design aspects on business model scenarios for remote management of in-home devices, since the project partners considered the financial design issues to be confidential.

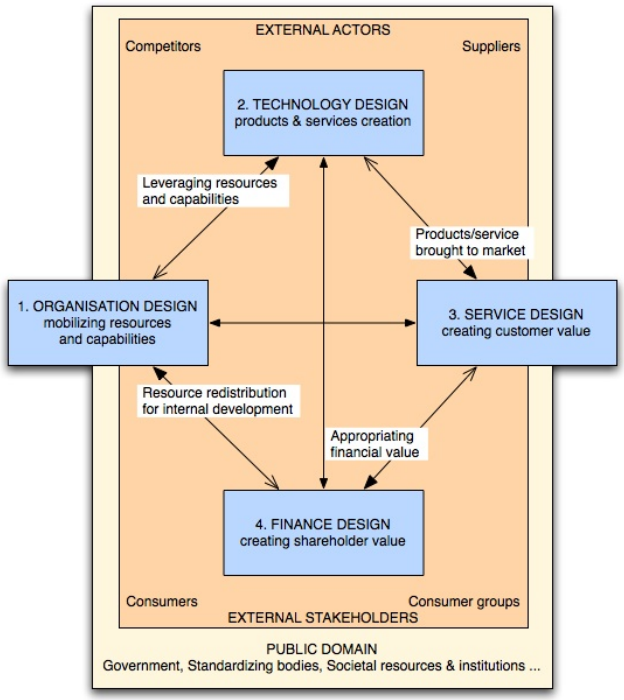

Figure 1: Business modeling cycle

2.1 Organization Design: Vertical Integration and Combination of Assets

The organization design phase of business modeling involves a description of possible associations, affiliations and interactions between different business actors and of their respective roles. We move beyond value chains, and focus on cross-industrial value networks. In organization design, value networks are constructed with three main building blocks: business actors, business roles and relationships. **Business actors** may comprise physical persons or corporations. There are several forms of organizational constellations, such as the vertically integrated organization, the M-form organization, the joint venture, etc. Business actors participate in the creation of economic value, through the mobilization of tangible or intangible resources within a business relationship network. **Business roles** are logical groups of business processes fulfilled by one or more actors. Business actors provide value to or derive value from the business roles they play. The concept of 'roles' is basically synonymous with the concept of 'capabilities' deriving from competence-based literature [25]. While resources are defined as anything tangible or intangible that is available and/or could be useful to an organization in carrying out its value-creating activities, capabilities are defined as repeatable patterns of action in the use of assets. Hence, capabilities emerge when the resources are mobilized into business actions [20]. Here, we define business roles as the bundle of business actions undertaken by corporate actors with the aim of creating customer and shareholder value. Finally, we restrictively define **business relationships** as the contractual exchanges of products or services for financial payments or other resources.

In the organization design phase, business modeling attains a cross-industrial view by describing the value network that surrounds the service ecosystem. Business modeling is situated on a higher level of abstraction than business process modeling, which focuses on the flow or progression of activities within a company or within one specific industry. Similarly, business modeling is situated above the company level of business planning, although business modeling also includes an analysis of the potential risks, benefits, costs, obstacles and opportunities of certain investments [5], [14], [15].

Following Christensen et al [13], we consider the fundamental driver of innovation within an established paradigm to be the producers' aim and ability to meet the customers' demands with respect to improvements in cost and performance. However, in times of cross-value network upheaval, it may be harder to predict the link in the value network extracting the most value by creating the highest efficiencies.

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2.2 Technology Design: Modularity and Distribution of Intelligence

Companies will have to take into account increasing modularity and increasing deverticalization of their industry's value networks.

Simultaneously with the increasing digitalization of a variety of services, previously vertically integrated value chains exhibit a decreasing competitive advantage vis-à-vis modular value chains and value networks. We reserve the term value chain for an intra-industry flow of products, services and revenues, while the term value network is used to denote inter-industry flows. Not only does the modularization of value chains lead to the disintegration of previously vertically integrated industries, it also creates opportunities in terms of cooperations between previously separate value chains into a more complex value network.

2.3 Service Design: Intended Value

For the purpose of describing the intended value of a remote management platform, we can employ Treacy and Wiersema's [28] framework of 'value disciplines.' This framework states that, when choosing how to approach its end customers, a company has to make a trade-off between three basic strategic thrusts: product leadership, operational excellence, or customer intimacy. These three dimensions are customer driven and customer defined, because they sum up the three basic reasons why and when consumers will adopt a new product.

- When aiming for operational excellence, a company attempts to attract a critical mass of consumers through cost-advantages allowing the price of the product/service to drop below that of competitors;
- When opting for product leadership, the service or product offered is of premium quality as well as innovative and comes at a premium price;
- When adopting the customer intimacy strategic thrust, the consumer is shown the advantage of having a more intimate relationship with the provider of said products/services, and is found willing to relinquish an amount of privacy and independence in exchange for a custom-made solution.

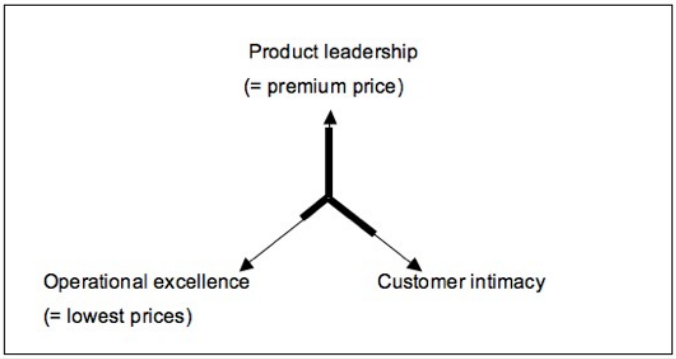

Figure 2: Treacy and Wiersema's [28] value disciplines

It is impossible for a company to excel in all three areas, and very difficult to excel in two areas at the same time. For example, combining a high score on two of the three dimensions by pairing product innovation with cheap prices will cut into a firm's profits or lead to an unfocused identification by potential consumers. As a result, a company needs to make a trade-off between these dimensions.

3 Research Methodology

After having conducted a literature review of existing business cases that are relevant for the study of remote management, we provided exploratory questionnaires (see appendix) to all company partners of the cross-industrial project [9]. These companies had notably different industrial backgrounds, varying from the telecommunication sector, the consumer electronics industry, the electrical appliances industry, to the field of application service provisioning and network infrastructure. The answers supplied by the companies served as a first input in formulating the business requirements, critical resources and actor interactions. By using the questionnaires, we managed to gain an initial understanding of the perspectives of all stakeholders.

Subsequently, we organized individual expert interviews and brainstorming sessions with representatives from each company partner organization. Bogner & Menz [10] argue for the use of explorative expert interviews to collect technical knowledge, systematizing expert interviews to obtain process knowledge, and to conduct theory generating expert interviews to collect explanatory knowledge. An expert, according to Meuser & Nagel [24] is a person who is

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responsible for the development, implementation or control of solutions/strategies/policies, and who has privileged access to information about groups of persons or decision processes. We conducted explorative expert interviews with the goal of defining the technical scope of the field, in order to better structure the business aspects that needed to be explored. We questioned the experts about the ways in which their current business models operate, about the possible business requirements they deemed necessary in view of this remote management technology, and about their imagined views of the other participants' business models.

The input acquired by way of the business case studies and expert interviews served as a basis for our description of the identified actors, roles and requirements, as well as for the several business scenarios that vary from closed-loop to on-demand business models. Finally, we solicited all project partners' feedback and used it to make last-minute changes to the different proposed business scenarios. For this article, it was not possible to include any information on the financial design because of confidentiality agreements. As a result, the following section only focuses on the first three stages of business modeling, that is: organization design, product design and service design.

4 Business Modeling for Remote Management

4.1 Organization Design

At the level of organization design, we distinguish the different actors and roles that are active within a given value network. 'Actors' are typified representations of real-life economic agents; 'Roles' refer to discrete value-adding activities; 'products or services' are defined as tangible or intangible artifacts delivered to a customer. The following categorization of actors and roles is based on the categories of Camponovo and Pigneur [11].

a) The first category, that of **technology**, consists of those players that provide the hardware and software infrastructure needed to offer the remote management service to the end user.

- Network Equipment developers: Actors that develop the network equipment, and therefore own the intellectual capital (patents, trademarks) necessary for the manufacturing of network equipment. Sometimes these actors manufacture the network equipment themselves, but just as often they outsource the manufacturing process to third parties.

- Network Infrastructure Integrators: Actors that purchase network equipment from the network equipment developers, with the aim of providing integrated network solutions to network operators/network access providers.

- Content/Application Developers: Actors that develop the content or applications that will be delivered to the end customer by the content/application service providers.

- End user device manufacturers: If the devices manufactured operate in a technical silo (cds, dvds), these are defined as Consumer Electronics device manufacturers. Also included in this category are personal computer manufacturers, digital peripheral manufacturers (digital cameras, printers), and telecom device manufacturers.

b) The category of **services** includes both content service providers and application service providers. These actors are responsible for providing value added services by means of available content and applications.

- Content/Application Service Providers: Actors that sell integrated and branded packages of content/applications to specific end customer market segments.

- Aggregators: Actors that aggregate the wide variety of applications and/or content available on the network, usually through a combination of search technology and portal presence.

c) A third group of actors consist of **communication providers**. These players provide the end user with access to communication services, networks and the internet. Throughout this document, we simplify the complexity of this field by disregarding the difference between internet service provider and network providers.

- Network operators: Within the scope of our project, this term refers to all network operators that at least perform the role of network access provider.

d) The **end user** can refer to both businesses and retail customers. Because each value chain is directed at delivering value to these end users in return for a revenue stream, the importance of this party is fundamental.

- End user: An individual, group of people, or a company that is the final link in the service value chain and consumes the services created and offered by the various previous links in the service value chain.

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e) Although Camponovo and Pigneur [11] do not consider the role of the advertiser, we do include it in all business model scenarios. Conversely, while they did include the roles of the regulator and the payment service providers, we did not consider these groups of actors in the project.

- Advertisers: Actors that mobilize marketing budgets in order to have advertising appearing alongside content or applications while these are served by the content/application service providers to the end users.

Figure 3 shows a generic value network that delineates the chronological order of the phases of production, integration, delivery/distribution and end usage. Although the home gateway is physically located in the customer's premises, the remote management of this home gateway is by and large the responsibility of industrial actors. As a result, the home gateway is usually situated in the delivery phase.

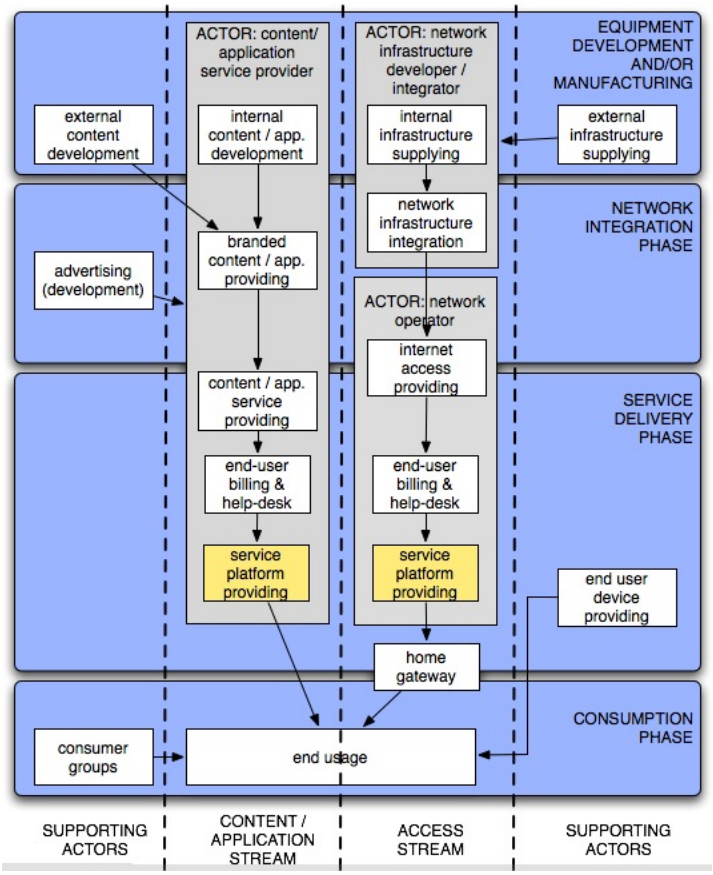

Figure 3: Generic service value chain

This general value network serves as the foundation for a variety of business model scenarios. In each of the business scenarios developed further on, one or more of the mentioned roles were assigned to specific actors by the project participants. Depending on the expert that was interviewed, the remote management layer was situated within different actors or within different domains. While all participants accepted that the network operator would always retain some form of remote management, if only to remotely manage its gateway devices in the customer's premises, there was a distinct variation on the question whether the content service providers, the application service providers, the aggregators or the infrastructure manufacturers also offer some form of remote management.

4.2 Technology Design

For this research project, the technical architecture considered three main technical domains:

- Subscriber loop: The integrated network access solution as provided by the network access providers, with the aid of infrastructure providers.

- Access and service gateway: The home or **access gateway** contains the routing/bridging function as well as the modem function. The **service gateway** is a platform on which the provider(s) deploy services. This may be an open platform like OSGi or a vendor specific one (most set top boxes).

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- End user devices (in technical jargon also known as 'customer premises equipment' or 'terminal devices') in the home network (LAN): The end user device which is used to consume the service (tv, pc, pda, IP-phone…). This can be an IP-enabled device (pc, game station) or a non-IP device (tv, telephone).

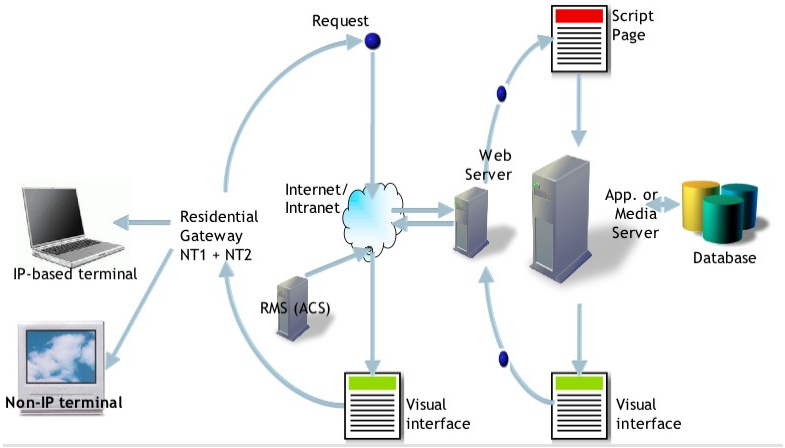

Figure 4: Technical architecture; gateway position, auto-configuration server, and (non-)IP terminals

Just as the access gateway (NT1) and service gateway (NT2) can be hosted in one box, depending on the chosen architecture (figure 4), the gateways and terminal device can also be combined in one box. Yet, at the level of a business model, it is better to consider these as separate, since management, cost and implied responsibilities of these functionalities may be situated among different actors.

This separate management layer retains the initiative of upgrading, patching, or adding new functionalities. With a 'separate management layer' we mean that our scope explicitly excludes all technical solutions of which the initiative for local device or software functionality management is singularly taken by the end user. In this case, it is the user that initiates the download or activation (or any other term appropriate) of the added functionality, upgrade, or patch, and no intelligence is required in the network that makes remote management of the home network device(s) possible.

Considering the outlined architecture, the business models scenarios will have to take into account:

a) Different models for remote and local management. This will depend on the position of the auto-configuration server and the remote management system.

b) Different models for application and content service provision. What the customer will adopt as preferred content or application delivery method will influence the strategic position these service providers occupy, and any shared responsibilities that may exist with regard to remote service management.

c) Models that allow the execution of supporting services, such as installation, software upgrade, reconfiguration, diagnostics and monitoring.

4.3 Service Design

Six groups of remotely managed technical services can be considered: installation, software upgrade, reconfiguration, diagnostics, monitoring and data collection. Firstly, installation involves the installation of the appropriate software and configuration parameters. Second, software upgrade may entail both software upgrades and/or software bug fixing (automatic or semi-automatic), necessary for service delivery, service upgrades and QoS. While software upgrades are necessary to allow upgrading of existing services, *adding* new services is considered as installation. Third, the upgrading of home network topologies, user profiles or services will result in a necessary reconfiguration of the service, a device or even a set of devices. Fourth, diagnostics refers to tests launched in the home network before the service is installed, either to determine whether the home network is suited for deployment of that service at a specific moment during the life cycle of a service, or to find the cause of a service disruption at a particular time during the life cycle of a service, or to allow early detection of problems. The user or the service provider may trigger tests. Fifth, monitoring involves keeping an eye on the operation of devices and services installed in the home during the service delivery. By monitoring devices and services in the home network, the user or the service provider will be able to react, at an early stage, on an event or a series of events. Problems may be identified and a solution provided before they will cause operation disturbance of other devices and services.

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5 Business Model Scenarios

Although the final research project report [9] included a total of 8 scenarios, we will limit ourselves to highlighting four business model scenarios, since the remaining four all exhibit overlapping with the four mentioned here. These serve as good examples of the industry forces that are currently at play. We distinguish them along two dimensions: whether they adopt a vertically integrated as opposed to a modular service development approach, and whether they retain full remote management control or delegate responsibilities to the end-user.

Table 1: Four business model scenarios

	Vertical service development	**Modular service development**
Strong remote management	Network Access Provision	Pure Service Provision
Soft remote management	Information Aggregation	Hybrid Service Provision

In the **Network Access Provision** business model scenario a network operator sells connectivity through subscription based packages and remotely manages all applications and/or content.

In the **Pure Application/content Service Provision** business model scenario, business actors focus on content or application hosting, delivery, billing and support.

In the **Hybrid Service Provision** business model scenario, alliances are struck 'across the isle' between content and application service providers, with one side of the alliance achieving relative dominance through the business platform [26], [27]. In the **Information aggregation** business model scenario, new entrants position themselves between the service providers and the end customers by offering a best-of-breed search or portal solution.

5.1 Business Model Scenario 1: Network Access Provision

In this scenario, the network operator provides a unifying platform for external content or application providers in the form of a 'walled garden'. On this platform, a selection of content and application service provisions are offered, while a revenue sharing model is set in place. Users pay a one time subscription fee, and/or a pay-per-use fee depending on the services provided and the payment formula offered. Here, the network operator positions itself as a trusted platform serving as a base for services of external application and content service providers.

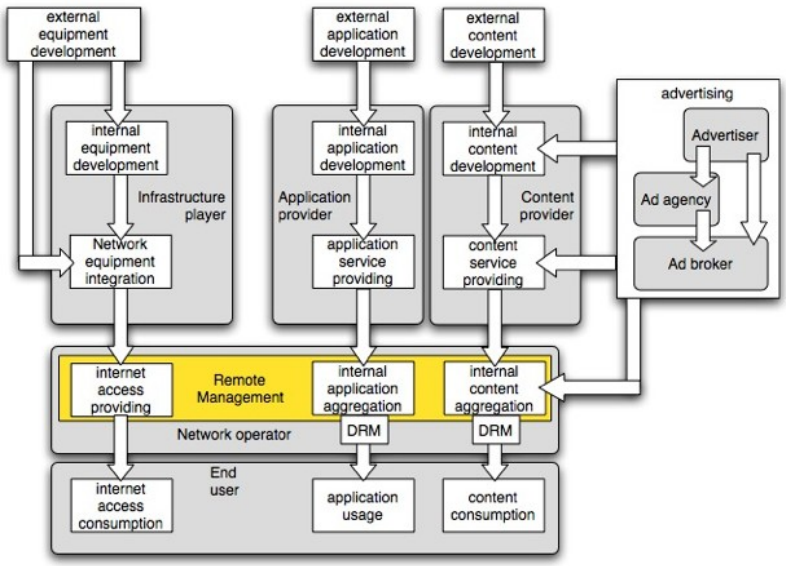

Figure 5: Network access provision business value network

The network operator remotely manages both its network access services and the third party service provisions, and performs monitoring, upgrading and installing of the offered services. The external content or application service providers do not have control of the remote management layer independently of the network operator. External

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service providers that choose to remain outside of the network operator's walled garden may experience markedly lower levels of service quality, unless they independently invest in their own remote management layer.

This solution allows the network operator to maintain full control of, as well as responsibility for, service quality, performance and delivery, being also suitable for the delivery of critical high end business software such as human resource management software, enterprise resource planning software, sales or supply chain management software. For the network operators, the main advantage of becoming a critical gateway for other service providers derives from the operators' sizeable installed customer base, the formidable marketing power, the relationship of trust established with customers over the years, and the direct contacts and experience they have with other actors within the telecom field [29].

As far as revenue and service flows are concerned, revenue flows exist between the end customer and the network operator for the internet access. The consumer subscribes to content or applications via the network operator, and all consumed services appear on one telecom bill. The network operator charges the third party content or application service providers for the use of the remote management functionality, and transfers income from end consumers to the content/application providers.

While the content or application owners capture the bulk of the advertising revenues, it is possible that the network operator, as a platform owner, can sell some advertising space around the services offered. For example, a small advertisement could be placed in the short time span before the streaming of video content starts, during which software the remote management layer carries out patching/upgrading.

5.2 Business Model Scenario 2: Pure Application (or Content) Service Provision

In this scenario, both the content and the application service provider remain completely independent from each other, from the network operator and from any device manufacturer. Good examples are Salesforce.com, with regard to application service provision, and MovieLink, with regard to content service provision. While Salesforce.com proved to be detrimental to Siebel's market share in Customer Relationship Management software, Movielink's initiative—an online video rental service co-owned by five major studios, namely MGM, Warner, Sony, Universal and Paramount—does not allow a global roll-out of movies, since the business model is hampered by the movie industry's adherence to the method of 'windowed releases'.

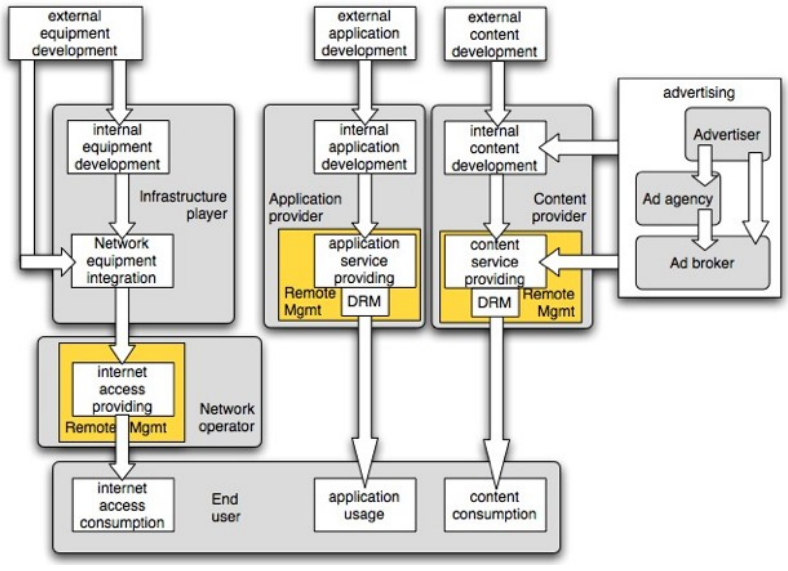

Figure 6: Pure application service provision business value network

Here, the application or content service providers perform the remote management of their own application or content delivery themselves. In comparison with the above walled garden solution, and depending upon the infrastructural investments made by the application or content service provider, the remote management will have restrictions regarding functionalities. The system will not be able to perform upgrades of the home gateway hardware (i.e. modem firmware), unless the network operator outsources this functionality to the hardware supplier. The system will only allow for remote management of specific client applications for which the external service provider holds administrator rights or is granted administrator rights by the end user. In some cases, these administrator rights are granted during a first time approval procedure, after which all future software upgrades are automatically executed. For example, Windows XP based Microsoft client software will occasionally connect to the Microsoft autoconfiguration server in order to install patches and upgrades.

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Between the consumer and the network operator revenue flows are established with regard to internet access provision and the implied remote management functionality. Because the customer buys his or her content or applications directly from the content or application providers, it is impossible for advertisers and network operators to generate advertising revenues. The third party content/application providers bear full responsibility for good QoS. The service providers aim for lower quality mass market reach through low pricing. If the network operator fails to suggest them to end users, third parties will usually obtain their customers by way of a content aggregator or a search engine page (see last business model scenario).

5.3 Business Model Scenario 3: Hybrid Application (or Content) Service Provision

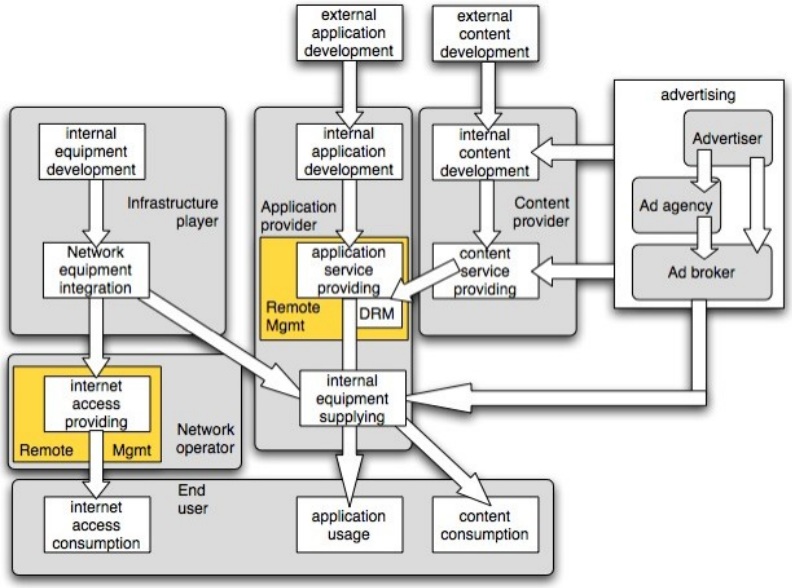

Figure 7: Hybrid content service provision business value network

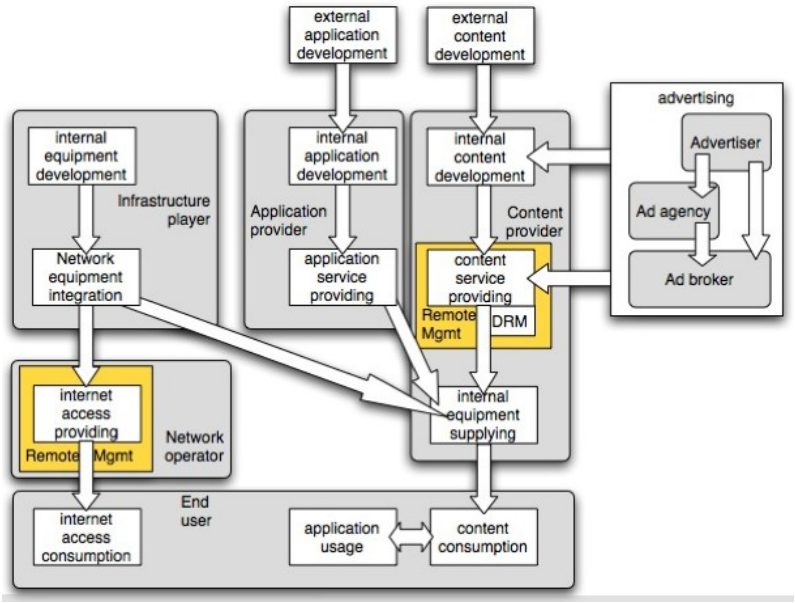

Figure 8: Hybrid application service provision business value network

In this scenario, a service provider develops and markets an application or content service platform through alliances with content owners/application owners and uses its control of the delivery channel to create an attractive customer value proposition. This solution can lead to a 'content walled garden': only certified content, protected through proprietary DRM, will be consumable. By way of an integrated hardware-software solution, a dominant hybrid service provider becomes a critical gateway for content developers in delivering their content to the public. For example,

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Apple (essentially an independent device manufacturer) has managed to leverage its iPod hardware solution and iTunes software solution through carefully crafted business alliances with content providers from the music recording industry. Apple realizes its profits on its hardware, producing for example the iPod Nano for $99 and selling them for $199 in retail, which equalizes a 40%-50% profit margin after marketing and retail distribution costs [1]. The music is sold on the iTunes platform at almost no profit margin, introducing a so-called 'reversed razor and blades' business model and providing a special example of how to straddle a two-sided market that subsidizes one side by charging the other, as theorized in [26] and [27].

The presence of Sony in this field is equally relevant, in that the company owns both the content and the hardware platforms of music players and Playstation, which could provide them with enough leverage to create a dominant standard. Sony's biggest weakness seems to be its very limited capabilities in application development, yet another time demonstrated by the company's attempt to impose all consumers buying a Sony music CD the installation of root kit software.

As far as revenue and service flows are concerned, the network operator maintains control and remote management of internet service provision and reaps the income from these services. Content service provision and affiliated advertising income, however, can be captured by the content service provider.

5.4 Business Model Scenario 4: Information Aggregation

In this scenario, a content aggregator will attempt to position itself as the preferred partner for content and application retrieval with or without the use of a proprietary digital rights management (DRM) solution. The content aggregator will only utilize a remote management layer for its DRM client software [29].

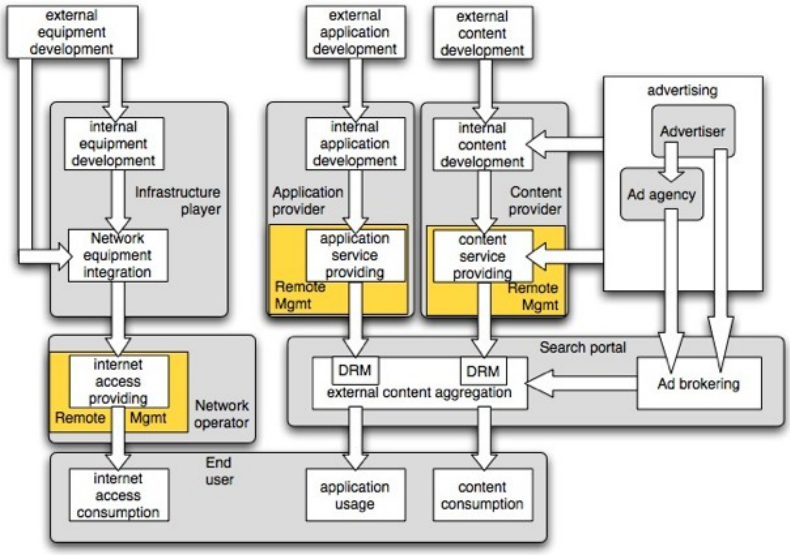

Figure 9: Information aggregation business value network

Revenue and service streams are limited to what the network operator is paid by the customer for internet access. There are no revenue flows between content or application providers and network operators, but the content/application providers could pay for a premium position on a portal that performs content aggregation (e.g. Yahoo!, MSN). Depending on the content or the application, this revenue stream may turn around if content or application providers can prove that it is their content that attracts customers to the portal, and that it is their content that generates ad attraction and hence leads to advertising revenues for the portal.

Both content and application service providers and the content aggregator capture a part of the generated advertising revenue. If the portal has sufficient critical mass, the marginal loss of advertising income to the content aggregator could be subverted up by the raised number of content/application downloads. Consequently, offering third party services through a portal can result in a win-win situation for all parties involved, especially if one is active in a content or application niche.

6 Conclusion

Each business model scenario outlined in this paper has its unique value proposition and holds risks and opportunities for all stakeholders involved, depending on the service development and centralization of management choices made during the business model development process.

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In the first scenario, the gateway is controlled by the network access provider. The main value proposition of this scenario is the possibility to supply an integrated offering. Its main risk is that it has the slowest market growth potential, since it offers the least choice to consumers. The second 'pure service provision' scenario is best suited for fast introductions aimed at large markets. Since business actors work independently, the offered product may internally score high on product leadership, but score low on cross-industry product leadership (such as products that attempt to cross the aisle between content and application standards). If the service providers work independently, customers may also be locked in by proprietary standards. In the third 'hybrid service provision' scenario, coalitions are struck across the aisle of the content and application industrial field, whether voluntary alliances or cooperations created by a dominant actor. This scenario may enjoy fast adoption growth through the portability of applications or content to different devices, but will experience the greatest difficulties as far as political economy is concerned, since the dominance of single actors will push potential competitors to the go-alone solution of the second scenario, or the fourth 'aggregation' scenario. The 'information aggregation' scenario has the advantage of the least potential customer lock-in by proprietary standards, a transparent cost structure and self-evident customer value. Drawbacks are the privacy concerns, since advertisement-based business models are built on expensive customer data collection.

Table 2 provides a summary of the degree of centralization of the business model and the basic strategic thrust that characterizes each scenario. These dimensions will affect the choices to be made by all stakeholders involved in the value networks.

Table 2: Centralization and strategic thrust of considered business model scenarios

	Vertical service Development	**Modular service development**
Strong remote management	Strongly centralized within the network operator domain. Product leadership: ++ Customer intimacy: - Operational excellence: +	Rather decentralized: Each application/content service provider works independently. Product leadership: - Customer intimacy: + Operational excellence: ++
Soft remote management	Strongly decentralized: Search/aggregator portal sells ads around search results, but does not interfere with service delivery. Product leadership: ++ Customer intimacy: + Operational excellence: -	Rather centralized: Service delivery mechanism centrally governed by one service provider for all other service providers. Product leadership: + Customer intimacy: - Operational excellence: ++

This table shows that the degree of centralization, antithetical to the degree of openness of a business model, depends on both the modularity of the product design as well as on the adopted form of remote management. Decentralization occurs when soft remote management is combined with vertical service development, and where strong remote management meets modular service development. Conversely, centralization appears when vertical service development is coupled with strong remote management, and where modular service development is combined with soft remote management.

At the level of the strategic trade-off, higher modularity tends to go with a relatively lower degree of 'product leadership' and a higher degree of 'operational excellence.' Yet, it remains difficult to discern what comes first: the product design strategy or competitive pressures on price? Does the adoption of a modular product design strategy lead to the adoption of a cost-leadership model (i.e. does relinquishing central product development automatically enable efficiencies that allow for lower prices?), or does price competition in highly competitive markets lead to modular product design? Here, Apple can serve as a case, focusing on product leadership and strong centralization of product design when it lost the pc-war against the modular IBM-Intel-Microsoft triumvirate with its focus on operational excellence and accompanying price leadership,.

The dimension of 'customer intimacy' is not as good a discriminatory variable as the other two strategic thrusts. This is partly so because customer intimacy is realized during service delivery, while the other two dimensions occur in the earlier stage of product development. In addition, over the recent years, customer intimacy has become the focus of companies that embrace product leadership as well as operational excellence (at least judging from nebulous strategic mission statements), since the price of personalization has dropped through the use of information technology such as CRM and ERP. Further research will be needed to turn 'customer intimacy' into an industry level discriminator. Distinguishing between the pre-sales aspect (product customization tailored to specific customer

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segments) and after-sales aspect (intensive support and help-desk) of customer intimacy may very well offer a solution for the current confusion.

6.1 Feasibility of the scenarios

Whether the proposed scenarios are feasible can further be assessed by focusing on the two main questions that surround the value proposition of a remote management system. The first: which stakeholders are most likely to install and manage the remote management solution? The second: to what extent is it possible to bypass the service platform and what could be the remote management owner's reaction to this?

First, the scenarios demonstrate that it is feasible for various stakeholders to install and manage service platform and remote management functionalities. Network access operators present the primary and most obvious choice, because of their traditional core business of managing and controlling network transport and service delivery and because of their existing relationships with customers. However, several scenarios also point to a continued decentralization of remote management platforms, where external application and content service providers manage application or content delivery independently of network access providers. The tendency to decentralize can be qualified as strong because of the essential openness of the internet architecture at the level of networks, with the intelligence residing at the network end nodes.

Second, with respect to the risks of the remote management platform being bypassed, we have described several bypass scenarios in this paper. It is likely that external application and content service providers bypassing internet based platforms will persist and even increase.

Digital service providers will have to take into account that the dominant consumption model of media content appears to be moving away from a non-ownership broadcast oriented model towards a digital ownership on demand model, characterized by the consumer's flexibility to archive and watch the downloaded content whenever and how it suits him or her. Despite efforts of some media concerns, ownership based and portable solutions appear to be preferred by the consumer, as illustrated by the successful adoption of Apple's iTunes versus the slower adoption rates of competing services such as RealNetworks' RealPlayer, despite of the fact that songs are 50% less expensive on RealNetworks' platform.

We can expect the desired service quality levels, and therefore the probability of a closed solution to rise concomitantly with the service offerings becoming more business critical/professionally oriented. As a result, given the fact that the entertainment cluster is witnessing the fastest growth and represents the best business case, it may be the productivity cluster and the home management cluster that will create the initial demand for a remote management layer, since these demand the highest levels of accuracy, punctuality and reliability.

Yet, this poses something of an economic conundrum, since the slowest paths to profitability may require the highest levels of remote management functionalities, while the fastest paths to profitability are situated in a sphere of activity where the consumer has come to regard always-on-connectivity and dynamic upgrading and patching functionalities as a given. Although remote management appears to be equally important in the entertainment cluster, the analysis we presented suggests that it is less feasible to charge premium rates for remote management functionalities to consumers in this cluster. One solution may be found in the integration of basic remote management functionalities in entertainment service offerings within existing subscription plans, and the simultaneous expansion of these functionalities as professional services to high end customers.

6.2 Implications for Remote Management

Given the likely decentralization of remote management functionalities towards content or application service providers**,** we can predict a split in remote management functionalities between network-specific functionalities (residing in the network access provider domain) and content or application related functionalities (residing in either the network access provider domain, or in a variety of third party domains). Related to service gateway upgrades, the network access operator is most likely to develop a remote management layer, regardless of bypass threats or cross-selling opportunities, since it provides the network access provider with the possibility of longer hardware life cycles. This will translate into cost-cutting opportunities in terms of lower staff levels necessary for hardware maintenance and upgrades, and will allow raised levels of service quality and new service introductions towards the customer base without additional hardware roll outs [23]. That being said, these are mainly internal, operational advantages of installing a remote management platform. Whether external actors will consider it in their best interest to make use of the remote management layer, is an entirely other matter.

Most notably in the first stages of growth, external service providers may tend to count on basic service delivery levels from network access providers and avoid incurring additional costs by not implementing additional levels of service quality. Only the largest of content or application service providers may sign contracts with network access providers for additional support, if they fear that their high volumes of bandwidth consumption are likely to diminish their service quality. Moreover, the largest of content or application service providers will gain the benefits of having access to network access providers' customer bases by way of establishing marketing alliances. Given the

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bargaining power of such large content or application providers, attractive revenue sharing models will have to be in place. In addition, as stated above, it is likely that these stakeholders will perform some (application or content related) remote management functionalities themselves, implying the need for interfaces between different remote management modules.

Given the bypass scenarios by external service providers, duplication of remote management functionalities is to be expected, as well as strategies by network operators to strengthen customer relationship and to aggregate and support attractive content and applications. Application and content service providers stand to gain from the expanded selling opportunities on a widening array of platforms. On the other hand, market analysts today remain quite pessimistic about the strategic position network operators will occupy in the years to come, increasingly considering telecom players as 'commodity plays'.

The remote management architecture should be sufficiently flexible in view of keeping the most feasible future business options open, depending on what scenario will turn out to be dominant. Network operators will have to decide to what degree they are willing to open their architecture to external partners. One potential implication of the scenarios examined is that network operators, while offering advanced levels of remote management to selected external content providers and application providers in a 'closed', end-to-end manner, at the same time open up the service gateway to additional content and application providers using just a minimal set of remote management functionalities offered by the operators.

Finally, future research will have to go deeper into whether the service providers will continue to fulfill most of these functions, or whether the management of these devices will increasingly be conducted by end users. While pure end-to-end (E2E) services push the management effort, together with total cost of ownership (TCO), to the end user (or, in the case of businesses, to the IT department), remote management can relieve the end user of part of this cost and redirect it to the service provider. The service provider may be enabled to reduce installation and helpdesk costs, assure improved service quality or utilize the platform to offer new services.

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Appendix: questionnaire for expert interviews

0. Function of interviewee in the company

E.g. Project manager

1. Potential Applications
- Please shortly describe two applications of remote management and networked devices, that are of direct interest to your organization

2 Assets
- Which (market or technological) breakthroughs need to be realized so that these applications can become a reality?
- Would you consider your company as an 'initiator' (takes the initiative to realize a breakthrough), an 'intermediary' (adapts the breakthrough to a specific context and brings it to the market) or a 'user' (uses the results of the breakthrough) of these breakthroughs?
- What are the assets (specific strengths) of your company to produce/adapt/use these breakthroughs?
- Which relevant assets does your company lack?

3 Distribution of Roles
- What role(s) would your company play in the production and commercialization of the applications you listed under question 1?
    - content provider
    - content aggregator
    - application developer
    - application provider
    - service platform provider
    - service provider
    - payment provider
    - internet access provider
    - network operator
    - end user device provider
    - equipment provider
    - other, i.e.:

What are the assets (specific strengths) of your company to take on these roles successfully?

4 Control and Customer Ownership
- Which role(s) would be in your view the controlling role in the overall value chain? Please indicate in the list with "N" and indicate why.
- In terms of customer ownership, what actors have the direct relationship with the customer? Please indicate in the list with "C" and indicate why.
    - content provider
    - content aggregator
    - application developer
    - application provider
    - service platform provider
    - service provider
    - payment provider
    - internet access provider
    - network operator
    - end user device provider
    - equipment provider
    - other, i.e.:

5 Intelligence, Integration and Interoperability
- For the applications you listed, would your company prefer the intelligence (processing of information, storage of data and profiles) be located centrally (i.e. in a central server) or locally (i.e. in the end user device). Why?
- Would the system supporting the applications you listed be open or closed to different service or content providers? Why?
- What other/existing systems and applications would the application need to be integrated into?
- What other/existing systems and applications would the application need to be interoperable with?

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Appendix: questionnaire for expert interviews (cont.)

6 Efficiency and Performance

- Which of the following factors would be crucial for the applications you listed? Who would be responsible for them?
  - Quality of Service
  - Security
  - Scalability
  - Other, i.e.
- Which assets of your company promote the factors above?

7 Applications and Functionality

- Which of these attributes would be crucial for the applications you listed? Who would be responsible for them?
  - Personalization
  - Time-sensitivity
  - Usability
  - Other, i.e.
- Which assets of your company contribute to the elements above?

8 Customer Value

- How would remote management improve the value of the applications you listed?
- How would the assets of your company increase the value of these applications?
- What other/existing applications would compete with the applications you listed?

9 Cost Structure and Revenue Generation

- For the applications you listed, what would be your company's main
  - deployment costs
  - operating costs
  - revenue sources