

# ENABLING SECURE EBUSINESS BASED TELECOMMUNICATIONS MANAGEMENT

## *a new Paradigm beyond TMN*

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**Abstract:** With the emergence of eBusiness within the Telecoms sector, there is a growing need to reformulate our existing understanding of the nature of the industry so as to provide an adequate basis for the development and deployment of the necessary support infrastructure. The purpose of this paper is to identify what some of the core issues are if this transition is to be performed and to indicate some of the changes that are needed if they are to be satisfactorily resolved. The paper argues that the established functional architecture provided by the Telecommunications Management Network (TMN), although useful for the Telecoms industry, is no longer sufficient. Proposals are made for improved architectures and frameworks that are based in part on lessons learnt from examining the nature of established service-based industries. Their structure implies that there is a need to emphasise process groupings that are dedicated to service integration. It is suggested that a key issue within this revised framework will be the delivery of content, and it is shown how recognition of this can provide the basis for a richer variety of secure and high-value added services. The paper concludes by identifying further work that needs to be undertaken.

## 1 INTRODUCTION

The telecommunications industry, stimulated by the introduction of competition and the convergence of technology, has started undergoing far-reaching changes in recent years. Previously it was an industry characterised by massive monolithic operators that supplied essential “infrastructure” type services that changed little over time. In today’s eBusiness environment the ability to rapidly and efficiently create new and modify existing services by bringing together components from a variety of ever-changing partners is becoming paramount if a Service Provider (SP) is going to be able to continue to compete and survive in the market.

To accommodate these changes a shift is needed within the Telecoms sector towards business models similar to those that have been developed by other long-established service-focused industries. Such industries, for example tourism, tend to consist of a

number of closely linked but distinct organisations, each specialising in a different area that is relevant to the industry’s core theme. Figure 1 shows the tourism industry’s value chain. Partnerships are crucial enabling Tour Service Integrators to bring together the different resources needed to build specific products. The Tour Service Integrator also interfaces with customers, both to understand the products that they need and to supply them with any associated services that they require.

The structures used to support inter-working enable a diverse range of resource providers to be accommodated and make it easy to add new resource providers to the mix. This contributes to a Service Provider’s ability to offer a range of attractive products which both stimulate their business and enhance customer satisfaction.

Well developed service-oriented industries including Tourism point the way for the

telecommunications sector. Partnerships are essential if efficient end-to-end services are to be realised. To support this, a common business process framework needs to be established. The standardised ways of interacting supported by this framework will allow communities of collaborating partners to interact more easily, permitting new combinations of partners with appropriate skills and resources to come together quickly and effectively.

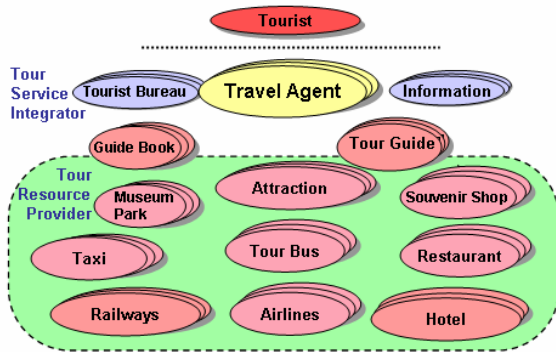


Figure 1: Tourism Value Chain

The objective of this paper is to make some proposals about how existing Telecommunications Management needs to be enhanced if eBusiness is to be properly accommodated. A first step towards this is a brief exploration of the structure of some service-centric industries that are already well established. These have moved beyond using business models that are based primarily on price as a differentiator to ones that include product variety, time to market and sophisticated support services. This is seen as indicative of the future direction of Telecoms and is used as a basis for proposing changes to existing frameworks that will leave the Telecoms sector better positioned to accommodate future changes. An improved and extended architectural framework is proposed that enhances the existing TMN architecture (ITU-T, 2000 [M3010]). An outline Business Process Model is then introduced which incorporates the idea of "Service Integration", a function that is key in other service-focused sectors. The paper continues by introducing a framework for Security-related services, an area that is important for the industry and which requires a strong "Security Integration"

capability if products tailored to customers' needs are to be made available. The paper finishes by drawing some conclusions on what the key areas are, requiring rapid research and development if Telecoms is to be able to make the transition to eBusiness in a smooth manner.

## 2 EBUSINESS MANAGEMENT ARCHITECTURES

Changes in the Telecommunications sector are driving a shift in emphasis away from equipment and networks upon which they used to be focused, towards both services and the customers to whom they are delivered. With this shift comes a need to generate a new framework based on an analysis of IP/eBusiness services and existing value chains. To start this analysis we shall first consider the types of service that are now offered.

Telecom service types have been discussed previously (Ejiri, 1994) where two main groupings are identified. "Information transmission services" hereafter called "Transport Services", responsible for transporting information between different locations, and "Operations Services" which are primarily responsible for a SP's interactions with its customers. In this paper an additional service type is proposed - "Content delivery Services". These are responsible for delivering information (content) tailored to customers needs via Transport Services that have already been established.

This type of distinction is also present in other existing Service-based industries. For example, the logistic companies that transport goods for consumers and small businesses within the Japanese market. Collection of goods from location A and their delivery to location B is an underlying raw and fundamental transport service but this is supplemented by a range of associated services (Operations Services) that focus on making the underlying service easy to use and are applicable in a wide variety of circumstances. For example, a local convenience store can act as a mediator for collections, deliveries can be arranged in agreed time-windows and information can be provided immediately about the whereabouts of goods.

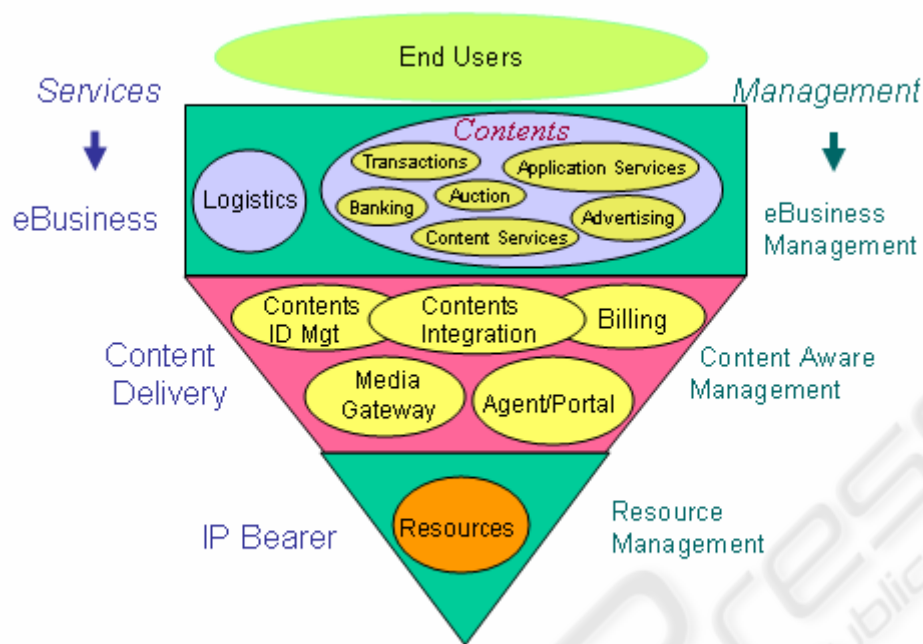


Figure 2: eBusiness Services and Management Architecture

In addition, perishable goods such as fish or fruit can be transported using a cold-storage service, and delicate goods can be transported using a hanging service or with special protection against breakage, etc... These additions (Content Services) all add value to the basic underlying transport service and enhance the ability of the Service Provider to compete with other SPs that are also trying to find ways of making their offerings more attractive to the customer.

Based on the distinction between Content delivery and Transport services, an eBusiness Services and Management Architecture is proposed in Figure 2 which shows End Users who enjoy the benefits of eBusiness positioned above a three-layered architecture. The End Users are serviced by the eBusiness Management layer which is responsible for the creation and transfer of content used in trading, banking, auctioning, and similar eBusiness-based services and for the logistics of the physical delivery of items where this is a consequence of the content exchanged. Delivery and exchange of this content is made possible by "Content-Delivery" SPs who are responsible for integrating and adding value to the underlying basic transport services (resources) supplied by the "IP-Bearer" layer. Value is added by the use of components such as content gateways, for exchanging different content types, and directory

and naming support services for enabling the location of and access to a variety of different content types.

The eBusiness, Content Delivery and IP-Bearer areas all need to be managed. The TMN is well established and is the basis for much work in the Telecoms area. However, the TMN needs to be enhanced or modified to address (i) the new distinction that is emerging between content delivery and content and (ii) the need for multiple organisations to work together to deliver services. Although previous work (Willetts, Adams 1997), (Braun, Guenter, Khalil, 2001), has explored possible enhancements to TMN to cover business process automation and extended interfaces, these issues have not been addressed.

In terms of Figure 2, the TMN is restricted to management of resource. It provides a Network-Element/Network centric view of operations focused on the management of resources in the network and how these need to be configured and monitored to supply basic transport services to customers and guarantee their ongoing performance. Although the TMN does support some functionality in the area of managing services and customers, this needs to be extended.

The TMN perspective (Sidor, 1998), although valid, is no longer sufficient for the continuing rapid

development of the telecommunications industry. The supply of basic equipment from which network infrastructure is constructed is becoming increasingly commoditised, and the issues around its deployment and use in supporting services to end-users are becoming well understood.

The concerns of the industry have started turning away from the management of networks and towards transforming itself into a provider of services with the customer as its focus. To do this effectively requires efficient interaction with a wide variety of suppliers and partners. Perspectives focused on customer, service and partner/supplier are complementary to the TMN's focus on the network, and any new proposal should accommodate all these views.

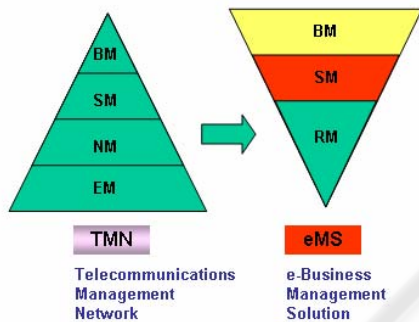


Figure 3: TMN to eMS

The manner in which TMN needs to be extended can be better understood by reference to Figure 3. The concept shown has been introduced previously (Ejiri, Iseda, Hamada, 2000) but only in abbreviated form.

The figure shows the relationship between the traditional TMN pyramid and the e-Business Management Solution (eMS) which is proposed as an alternative and more meaningful way of viewing Telecommunications Management today. From an eBusiness point of view it shows that the TMN Business Management (BM) area responsible for directing the business of an SP needs to be extended so that it becomes responsible for managing eBusiness as a top layer where eBusiness acts as a customer for underlying services. Service Management (SM) is repositioned within the eMS as a middleware platform between Resource and Business management, whose responsibilities include the delivery of content while Resource Management (RM) includes not only networks and specifically IP bearer services, but also other

resources that services may be constructed from. The TMN pyramid for conventional services can be considered as being included and is still relevant here.

### 3 A PROCESS FRAMEWORK FOR EMS

TMN is primarily concerned with functional architecture and components (ITU-T, 2000 [M3400]). Q and X interfaces are also defined and are effective when considering existing networks, as has been discussed elsewhere (Birch, Ejiri, 2000). TMN does not, however, address the manner in which functional components are linked together into process flows. It is important to understand how these flows are constructed for both internal use and for enabling interactions with external entities.

It is widely recognised that a framework that captures process flows has two key benefits: (i) it provides a basis for efficient software development by encouraging the reuse of software components, and (ii) it facilitates inter-operability between partners which simplifies the process of bringing services to market. With the increased emphasis in eBusiness on multiple Supplier/Partner interactions, this second consideration becomes crucial.

Consider the roles that a Service Provider can perform. It has been demonstrated elsewhere (Ejiri, 1997) that a Service Provider within a value chain can be viewed as acting simultaneously as supplier, partner and customer. In eBusiness several SPs can act as suppliers or partners to a single organisation. When this occurs there must be a strong emphasis within the organisation on both Supplier/Partner Management and Integration. For effective Integration, a strong Process Framework is required that can provide a basis for bringing together and integrating service components that are owned by both a Service Provider and its partners.

Any work related to process interactions within the Telecoms industry needs to be considered in the context of the Telecom Operations Map (TOM) and the enhanced TOM developed by the TeleManagement Forum (TMF, 2000) and (TMF 2002), and the contribution that these initiatives have made to the understanding of Business Processes within the Telecoms sector.

The enhanced TOM (eTOM) is a hierarchical business process framework that covers, in varying levels of detail, all the activities that need to take place within a Telecoms-based SP. Although

activities such as the Development of Resources and the Management of Products are included, the emphasis is on understanding those processes involved in the day to day activities of providing services to customers and the necessary interactions with customers, suppliers/partners and equipment/networks to ensure that this happens effectively. eTOM has been successful in expanding the discussion of Business Processes to all areas of a SP and in emphasising the importance of supplier/partner management, a topic that is also being addressed actively by organisations such as the Supply Chain Council and RosettaNet. However, although eTOM is still being extended, it isn't currently addressing the increasingly complex needs in the area of Service Integration necessitated by eBusiness.

Referring to Figure 1, the role of "Service Integrator" is vital. Its smooth operation allows SPs in the tourist industry to rapidly assemble new product offerings in response to opportunities that arise. A similarly effective Service Integration capability is needed in the telecommunications industry.

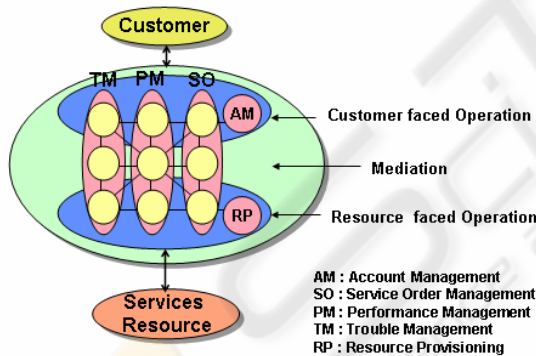


Figure 4: Process Flows and Components in Resource Operations

Service Integration hasn't been identified as an important area by previous work on process decomposition. The related area of Mediation (Ejiri, 1998, 2002) has however been highlighted. Consider Figure 4. This is a previously published figure (Ejiri, 2002) that shows a proposed internal structure and decomposition for processes within a SP organisation. Vertical flows, important for delivering capability to the customer, appear together with horizontal flows that represent the integration needed if capability is to be delivered effectively. A bridge is provided between the Customer and

Resource horizontals by an area that, as well as supporting mediation, is also associated with integrating components at the resource level to present them as a coherent whole to the customer.

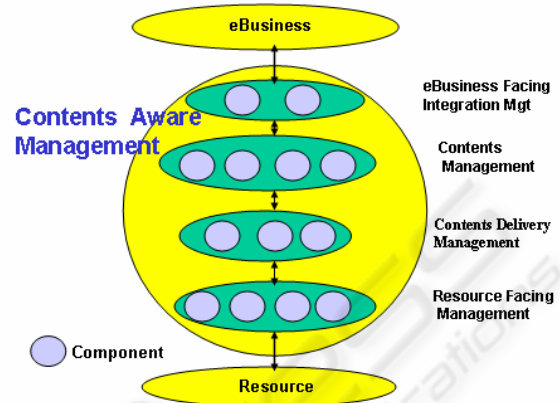


Figure 5: Contents Aware Process Management Framework

Consider now Figure 5. This shows a proposed framework for eMS processes that provides a better basis for considering Service Integration. The services delivered into the eBusiness environment are created by a four-level process framework. The first level – eBusiness Facing Integration Management - is primarily concerned with integrating components from below and mediating between Contents Management and eBusiness. Contents Management organises the supply of content needed by business applications such as banking, trading, auctioning, etc... whereas Contents Delivery Management is focused on supplying the transport infrastructure needed to deliver the different types of content. It is here that content delivery mechanisms such as directory, gateway and other similar services are managed. The resources used for actually performing delivery are managed from within Resource Facing Management which hides the differences between various types of transport from the layers above. The emphasis in Resource Facing Management is again on Integration and Mediation with mediation being particularly important in this context.

With reference to Figure 2, the Content Aware Management layer is expanded from its previous role of facilitating the fulfilment and assurance of services with its emphasis on vertical process linkage to a layer that provides the "glue" for managing the assembly and integration of a wide variety of both physical and logical resources into products under guidance from the eBusiness Management layer, ready for delivery to end users.

## 4 TOWARDS A SECURE EMS

Security is a crucial issue for eBusiness and Telecommunications Management, and any architecture that is developed should be capable of taking account of the variety of security requirements that customers are likely to have. Section 2 above identifies three distinct service types and each service type needs to address specific security requirements. Operations services should address customer privacy, Transport services should address access control and attacks based on intrusion and jamming as well as eavesdropping and Content Delivery services should support features that address content integrity, confidentiality and authentication as well as being instrumental in providing protection against viruses, worms and similar.

TMN (M3400) lists security functions and these cover to an extent, Transport and Operations services but do not address Content Delivery services sufficiently. The approach used by TMN needs to be extended so that end to end, secure services can also be supported as contents-related security will be crucial for eBusiness. It is therefore important to start developing a framework that can cover this area.

The security mechanisms available today to support service features are provided by a SP as a set of options from which a customer is constrained to select. The options supported by the SP are based on researching the likely requirements of customers but with the onset of eBusiness the inter-related areas of, the telecoms services offered, the threats that the services might face, and the needs of customers, are all subject to increasing rates of change. In this context, a SP who can understand and respond to each customer's specific security needs will be at a competitive advantage. In eBusiness there will therefore be a shift away from existing SP-driven security towards a customer-driven approach. When this occurs a framework will be needed to assist with mapping between the specific features a customer needs (e.g. guaranteed privacy for certain categories of data) and the security mechanisms (e.g. encryption techniques, prevention of access to equipment and cables carrying the data) that are available or that need to be developed.

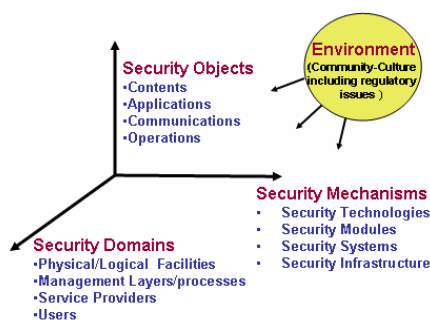


Figure 6: Three Dimensional Security Management Framework

Figure 6 proposes a Three Dimensional Security Management Framework to help understand this mapping. Three security dimensions are identified and are labelled as Objects, Domains and Mechanisms. Security Objects represent both the customers' concerns and the things that customers want to protect, for example, viruses, confidentiality, wire-tapping and copyright violation. Each Object may be present in one or more Security Domains corresponding to locations such as terminal equipment, routers, partners and other recognised organisations and individuals. Customers and SPs will discuss the Objects that need to be protected, the Domains in which protection needs to be applied and the Security Mechanisms, e.g. cryptography, biometrics, and protocols that need to be deployed if protection is to be provided.

Content Aware Management, see Figure 2, will be central in supporting the combination and integration of items from the three dimensions to build and fine-tune the specific security services that customers require. The security services delivered will also need to take account of the culture of the community into which they are to be deployed accommodating both local regulations and social conventions. When security services are created they will be constructed from commonly provided security mechanisms where-ever this is possible, but customer and culture specific mechanisms may also need to be developed and supplied.

Security is a topic that requires further extensive study, and it is important that an exhaustive framework is developed. The initial analysis presented above may provide a basis for starting this work.

## 5 CONCLUSIONS

Given the current direction of the Telecoms industry we should be mindful of lessons already learned by other industries that have been focused for some time on (i) the delivery of services, and (ii) the provision of customer satisfaction, and which have developed frameworks for conducting business that make it straightforward to integrate new components with existing service offerings.

The existing TMN architecture isn't sufficient to support these new trends. A structure is needed that addresses Customers and Services more adequately and that takes into account eBusiness and the need for a distinct content-delivery function as proposed for the eMS in Section 2. It should also recognize the importance of capturing how functional units are linked together within the process flows needed by a business to meet its business goals including those process flows related to interactions with partners and suppliers and the integration of the components that they provide. The eTOM has provided a good starting point for the analysis of process flows but this initial work needs to be extended. The key area that has to be addressed is Service Integration and the processes that are needed if eBusiness requirements are to be met flexibly and on time. This paper has introduced some initial perspectives that may help us to understand the nature of this area but detailed work is urgently required to provide a basis for a common understanding within the industry as the progress of eBusiness oriented initiatives accelerates.

In addition, this paper has also drawn a distinction between different categories of service. Operations, Transport and Content Delivery are identified as categories that require different resources and hence need to be supported in different ways by their organisations. This distinction is not reflected in currently available frameworks, and it is proposed that categorising services in this way may start to provide a richer basis for understanding future service offerings and how these will need to be managed. This is also an area that will benefit from further detailed study.

Finally this paper has discussed security issues that are crucial in eBusiness and has suggested for consideration a framework for security that will help to clarify and understand both the security requirements for eBusiness and the mechanisms that SPs need to support if those requirements are to be met. Further detailed study is again required.

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