Michael L. Sena Consulting AB
Position Paper

The Dis-Integration of the Mapping Industry

And Where the Money Will Flow in the Emerging Location-based Services Industry

Author:	Michael L. Sena
Original Date of Writing:	November 28, 2001
Revision Date:	December 15, 2001
Number:	POSP005
Recipient:	Lantmäteridagarna
Date Provided:	1 December 2002

(REF: \GENERAL\POSP005)

Note: This Position Paper is provided to the recipient on the condition that it is not copied or distributed in any form without the express written consent of the author. The Position Paper is **Copyrighted © Michael L. Sena.**

Preface

Location-based services deliver information and assistance to individuals who use position-enabled devices to communicate their location via a wireless network to service and content providers. Content, Device and Network: These are the three necessary components of location-based services. The device can be a wireless handset with position determined by identifying the network cell from which the call is made. It can be a dedicated in-vehicle device (telematics) with a more exact GPS receiver. Without minimising the importance of the Devices and Networks, it is the Content that is the determining factor in the success or failure of a location-based service. Whatever the device and whatever the network technology (AMPS, GSM, GPRS, UMTS), location-based services are fundamentally about having mapping information of sufficient detail and accuracy to place the incoming caller at a specific location—on a street, at an address in the correct part of the world. And it is having service locations positioned on these detailed maps in their exact locations so that the caller can be given directions to them, or so that the services can find the caller.

Communicating location-based content over wireless devices is a relatively new industry. The goal of this paper is to identify where the business and investment opportunities will be in this industry during its early, middle and late growth stages. I will do this by defining the links in the location-based services value chain, identifying the types of business models that are likely to control these links, and estimating the prospects for each business model type generating profits in one or more of the link areas.

Observing where the location-based services (LBS) industry is at present, and where it is going, must begin with a glance back at where the mapping industry has been. LBS may be a business area that the wireless and electronics industry are trying very hard to enter, but they did not invent it. It is the mapping industry that has built the foundation for location-based services. It didn't intend to do so, at least not at first. In 1978, when my Esselte Map Service research and development group in Boston produced the first commercially printed maps that were made using digital mapping techniques, I explained to the management of the company in Stockholm that we were building databases, and we should be thinking about how this data could potentially have more value in the future than the printed products. "We're a map company. We make printed maps," they said. "It is sufficient that we now can substitute digitising workstations for scribing tables and digital raster production of film for the photographic stripping process. Esselte will now be able to make maps faster and less expensively than its competitors." That was their answer. And Esselte did make maps faster and less expensively than its competitors—for awhile. Within fifteen years, most map production, public and private, was digital, and the techniques used were far faster and less expensive than those we used in 1978.

The mapping industry looks a great deal different today than it did twenty-or-so years ago. But so does practically every industry that is still in existence. Players change and industries evolve. They do so in fairly

predictable ways.[1] Christensen, et al have researched this topic extensively and show in their research how and why this evolution occurs. In the early stages of an industry, large, vertically integrated companies control the complete value chain and dominate their industries. "This is because," according to the authors, "the products are immature, not yet good enough for the mainstream market. Competitive pressures force engineers to focus on wringing the best possible performance out of each succeeding product generation by developing and combining proprietary components in ever more efficient ways. To make the highest-performing products possible, companies typically need to adopt interdependent, proprietary architectures." The authors offer as examples "IBM dominating the computer industry in the early 1980's with 70% of the mainframe market and 95% of its profits; Ford and General Motors, as the most integrated automakers, dominating their industry during the early days before car manufacturing became component assembly; RCA, Xerox, AT&T, Alcoa, Standard Oil and U.S. Steel dominated their industries. Their products were based on the sorts of proprietary, interdependent value chains that were necessary when pushing the frontier of what is possible."

What happens over time is that the performance of these products goes beyond what the mainstream customers can use. To stay competitive, say the authors, companies "must bring more flexible products to market faster and customise their products to meet the needs of customers in ever smaller market niches. To compete in these new dimensions, companies must design modular products in which the interfaces between components and subsystems are clearly specified. Ultimately, these interfaces coalesce into industry standards. Once modular architecture and the requisite industry standards have been defined, integration is no longer crucial to a company's success. In fact, it becomes a competitive disadvantage in terms of speed, flexibility, and price, and the industry tends to dis-integrate as a consequence."

The mapping industry has evolved, like other mature industries, from vertically integrated to dis-integrated, and it is in the process of merging with a new industry called Location-based Services (LBS). This new industry will also evolve along patterns followed in other industries. It too will look different in five, ten or twenty years. It will use different processes, deliver services in different ways. Assuming that people will still want to get from where they are to somewhere else—and they are not sure of where that somewhere else is—the location-based services industry will probably continue to exist in one form or another for a long time to come. There will be new business and investment opportunities during its evolution for those who know when and where to look for them. Let's see if we can use the approach outlined by Christensen and his fellow authors to find where the money will most likely flow in this industry's future.

[1] This Position Paper owes a large debt to an article that appeared in the November 2001 issue of the Harvard Business Review by Clayton M. Christensen, Michael Raynor and Matt Verlinden titled *Skate to Where the Money Will Be*.

Michael L. Sena Consulting AB

Position Paper

The Dis-Integration of the Mapping Industry

And the Where the Money Will Flow in the Emerging Location-based Services Industry

The mapping industry has been dis-integrating during the past decade. The term dis-integrating refers to the de-coupling of the industry's constituent parts, not their erosion or destruction[2]. Pre-1990, companies like Rand McNally in the US and Maiers, Esselte Map Service, Kümmerly+Frey and Bartholemew in Europe, controlled the complete value chain as *vertically integrated* companies. The value chain consisted of:

- Content Source: Assembly of field data, maps, photographs, lists and all other materials from original and secondary sources.
- Content Aggregation: Content definition for specific products, manuscript preparation, selection and review of content for the products.
- Design: Content specification for particular products, colour and text specifications, page and sheet layout, editorial layout.
- Production: Creation of the artwork for maps, indexes, illustrations and covers, and writing of all editorial material.
- Manufacturing: Printing preparation, printing, binding, folding and packaging.
- Distribution and Sales: The marketing, logistics and sales methods for moving the products from manufacturing to the retail chains and finally to the consumers, and distributing the income for the products.

The integrated processes of the vertically integrated companies provided superior performance and higher profitability because of the interdependencies of each link in the value chain. Distribution depended on tight integration with manufacturing schedules; manufacturing depended on strict adherence to production schedules; production required internal controls over design; content was aggregated for specific products according to strict internal standards.

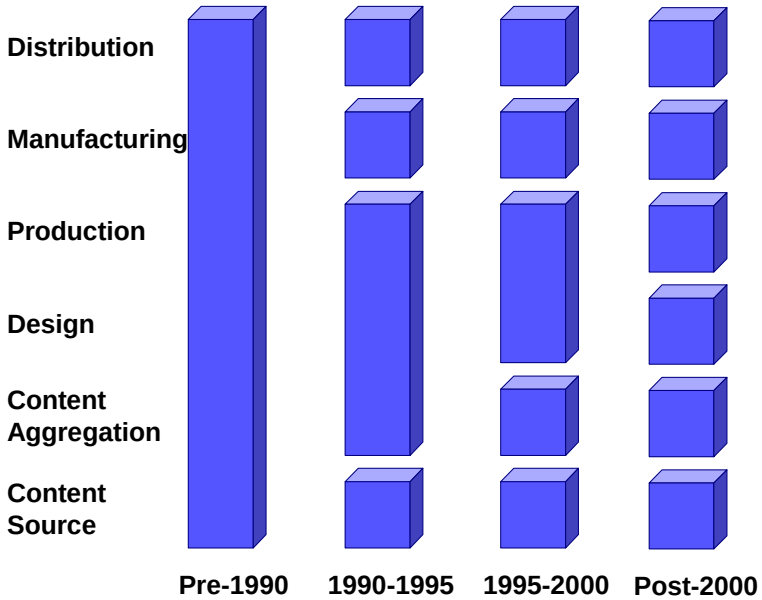
As the individual links in the value chain became more modular and their interfaces to other links became more clearly specifiable, verifiable and produced predictable results, there was no longer a need for integration. New companies emerged who could manage the independent processes better than the integrated companies. These companies performed some

[2] When dis-integration occurs, according to Christensen, et al, dominant, integrated companies are displaced by specialists that compete in horizontal strata within the value chain.

of the processes in-house and outsourced others. Instead of concentrating on all of the links in the value chain, they focused on one or two. They challenged the established players by providing more customisation, faster delivery and greater convenience for their suppliers and their customers. Companies like GeoSystems (MapQuest), DeLorme and Lovell Johns were among the early movers in this phase of development that proceeded through the early part of the 1990's.

Digital map production was a pre-condition for the dis-integration of the mapping industry, but it was not sufficient. As long as maps were distributed as paper products, efficiencies in production methods using digital mapping techniques strengthened the established and dominant industry companies. It allowed them to create more maps from a single database, eliminate expensive photographic techniques, and deliver finished film or even data files for printing. The appearance of two new distribution systems, the PC and the in-vehicle navigation system, continued the dis-integration process. As digital content became less dependent on a specific production method and manufacturing process (i.e. it could be a printed map, a PC map, a navigation display image), specialist companies, focusing only on this link, provided superior performance to the map producers. Navigation Technologies, AND Mapping, Etak and Geographic Data Technology were the early movers in this space, and they have been joined by scores of others.

The Dis-Integration of the Mapping Industry Value Chain – Vertical Integration to Dis-Integration



The mapping industry is not yet completely dis-integrated. Design and production are still combined for delivery of maps on both the Web and on in-vehicle navigation media. Proprietary formats remain the rule because the systems that are used to deliver the map data are not yet good enough to be modularised. Their developers continue to push for faster performance, smaller data sizes, greater integration of real-time data using their proprietary techniques and formats. Each navigation system manufacturer or Web-based mapping company license original or

aggregated content and deliver finished maps in the form of a CD/DVD disk, or an image to a screen via a browser.

Wireless services will enable the final dis-integration of the mapping industry by allowing design to move to the user. It will be the user who creates the rules for each map by specifying the criteria for what will be displayed, and who provides the locations for the mapped data. Distribution will be de-coupled from production by the use of standard formats. Proprietary data storage formats will be replaced by standard databases, such as Oracle Spatial 9i. Content aggregation will provide live data feeds using still other standards (e.g. XML/GML).

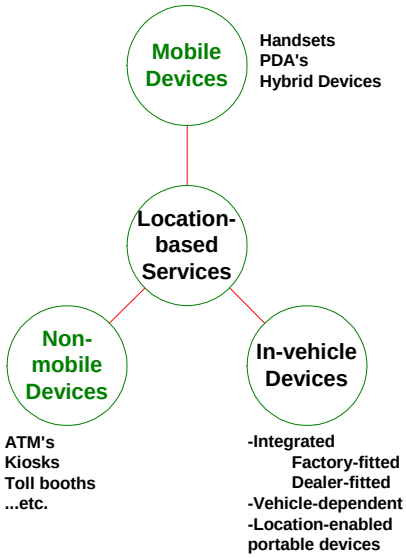
Mobile Services, that is, services delivered to wireless devices, include location-based services as one of the most important. Location-based services are currently estimated to be ranked fifth in popularity among the constellation of seven primary mobile services (Source: ARC Group: Future Mobile Handsets; 2001 ed.) The same report projects that by 2006 these services will be ranked first, with approximately 24% of mobile users accessing them.

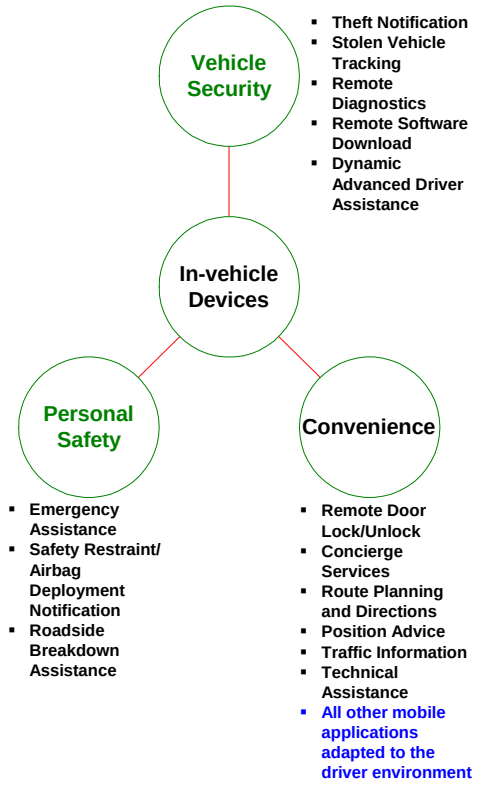
Location-based services are delivered to three types of devices:

- Mobile Devices, such as handsets, PDA's and hybrid appliances.
- Non-mobile devices such as ATM's, information kiosks, toll booths and other stationary devices that are more conveniently connected via wireless technologies than fixed lines
- In-vehicle devices

There are three types of in-vehicle devices:

- Devices integrated with the vehicle's systems and are an integral part of the vehicle's design
- Devices that are portable and can be installed in any vehicle, but which are dependent on connections to the vehicle's systems for their operation
- Portable devices that can be taken in and out of the vehicle and require no connection to the vehicle's systems





There are three principal groupings of services for in-vehicle devices:

- Personal Safety - these include services related to potential life-threatening situations, such as accidents or vehicle breakdowns. These services are the single most important reason that drivers in the US choose to install systems in their new vehicles.

- Vehicle Security - these are services that are primarily for the care and protection of the vehicle, but also provide the owner with added peace of mind.

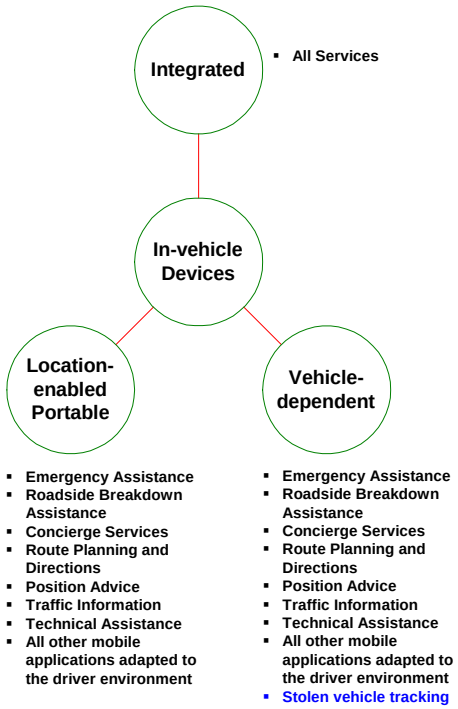
- Convenience - these are services that enhance the driving experience, save the driver time, or provide information when it is most useful. Route planning and directions and traffic information are the services most valued in European markets.

Integrated devices have the advantage over vehicle-dependent devices in being able to delivery the full range of services, including vehicle security, personal safety and convenience.

Integrated systems can access the OEM's internal data bus to receive information from the vehicle's sensors, to send commands to internally-controlled systems, and to share devices that are used for other applications devices.

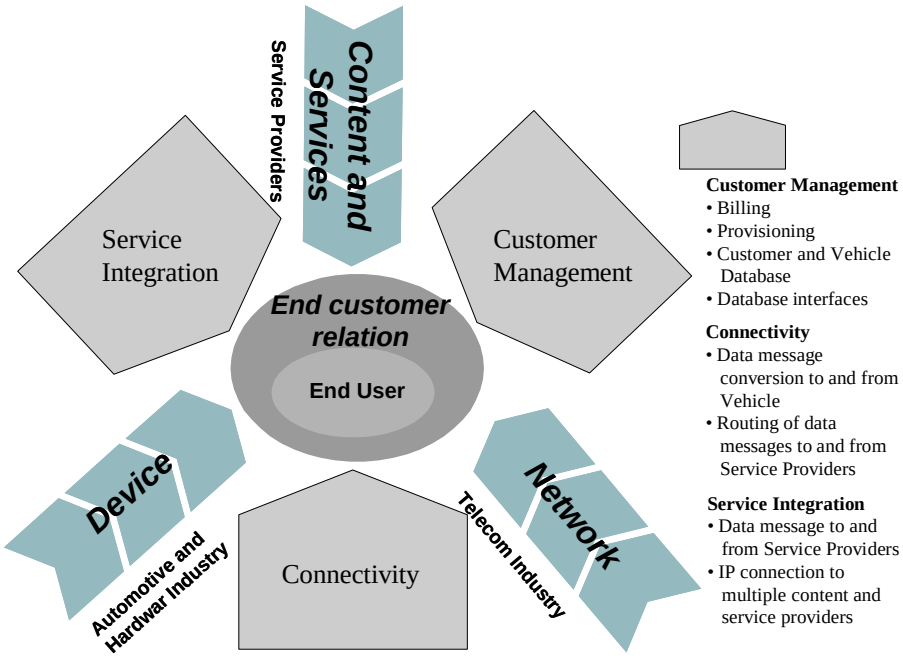
Vehicle-dependent devices require installation to connect to the vehicle's battery and loudspeakers, but must include built-in GPS, GSM, microphone and display. Connection to internal systems is not currently possible. Most of the vehicle security and airbag deployment notification services are also not possible.

Portable devices that are location-enabled (i.e. Have some form of positioning capability) can provide limited in-vehicle services, similar to those proviced outside the vehicle environment.



With the final dis-integration of the mapping industry, it is becoming part of the location-based services industry, comprising in-vehicle applications (a.k.a. telematics), other mobile device-based applications (wireless handsets and PDA's), and wireless-enabled stationary devices (e.g. vending machines, ATM's, information kiosks). There was a brief period in the early '90's when some companies and organizations attempted to use the term geographic information services (GIS) or GI Industry to define the entire mapping industry, but there was not widespread support for this. Location-based services describes the purpose and function of many map products, especially street and highway maps, and products that incorporate maps as part of their information presentation.

The Location-based Services Value Chain



The location-based services industry has its own value chain. Its three major components are:

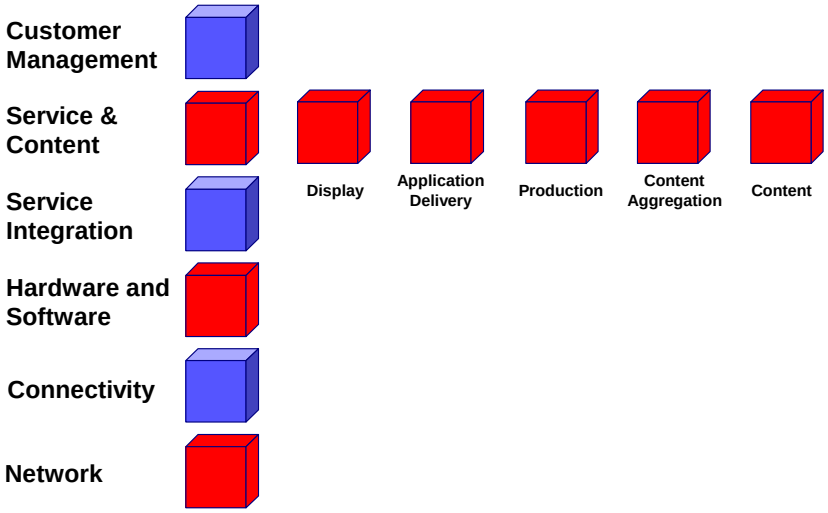
- Services and Content delivery;
- Hardware and Software; and,
- The Network.

Each of these components can be mixed and matched according to various business models to create interdependent architectures. For example, NTT DoCoMo, a Japanese wireless network operator that has popularised Internet connectivity on wireless devices with its i-mode service and is one of the first companies to deliver content on 3G networks, combines device, network and specialised links to service and content providers to internalise all profit possibilities. It bears no cost for the services and content, but takes a 10% fee for providing the connectivity links. It does not manufacture its own devices, but brands and sells devices which it specifies.

The vehicle OEM's who have thus far introduced telematics systems offer a complete and branded service to their customers. The OEM's buy network access, purchase and install the devices, and contract for services and content. Some OEM's have built subsidiaries or contracted with internal organisations who provide the services and content. GM's OnStar and DaimlerChrysler's Tegaron are examples of such organisations. The OEM's can therefore control up to two of the major components, but they cannot control the network.

In between the three major components are the links that make possible the service delivery to the on-board device or other wireless devices via the network. Connectivity is needed to match the device with various network standards. It is needed to ensure that the data messages are delivered to the appropriate service providers. Service integration provides for the conversion of device protocols to formats that can be understood by service providers. Customer management provides billing and invoicing services, vehicle and customer data management, provisioning services, and customer care services. The delivery and use of mapping data for location identification, way finding and place finding becomes a subset of service and content delivery with dependencies on the device for identifying the user's location, and the network for carrying that location and delivering the map data for display back to the device.

Location-based Services and Mapping Industry Value Chains



The new mapping industry value chain, dis-integrated and incorporated into the location-based services value chain, consists of content and content aggregation, as in the old value chain. Production includes the assembly of the data in a server environment that is able to deliver static and dynamic data to applications, which in turn deliver data to end user devices for display. Companies no longer compete between the links in the value chain, but within each link: NavTech competes with Tele Atlas in the area of content: Rand McNally competes with DeLorme in the area of content aggregation; old and new map companies compete in the area of production; MapQuest competes with Vicinity in the area of applications

delivery; and dozens of start-ups compete with each other for delivering a viewable map to the consumer.

There are three categories of companies attempting to build businesses around these services, and there are three basic business models that are evolving for the delivery of location-based services. The companies are:

- Network operators;
- Vehicle OEM's; and,
- Companies that have LBS services as part of their core business.

Network operators, particularly those that have acquired 3G licenses, are building the capability to deliver all types of services, especially those that are location-based. They are doing this primarily in order to increase traffic to their networks. They have a major advantage over the other two categories of companies because they can, in theory, control the entire value chain. At best, other companies can control everything but the network, but there are few companies who have attempted to do so.

Vehicle OEM's have been offering telematics systems and services to their car buyers since 1996 when both Ford and GM introduced systems and services. The OEM's primary objective is to increase the desirability of their core products (i.e. vehicles) and establish closer and more long-term connections to their customers to increase the rate of repeat sales. While they have talked about new revenue generation channels, there is little evidence that the business models they have adapted offer significant income generating opportunities for the OEM's compared to their core business. However, the businesses set up to run these services, like OnStar, have shown potential.

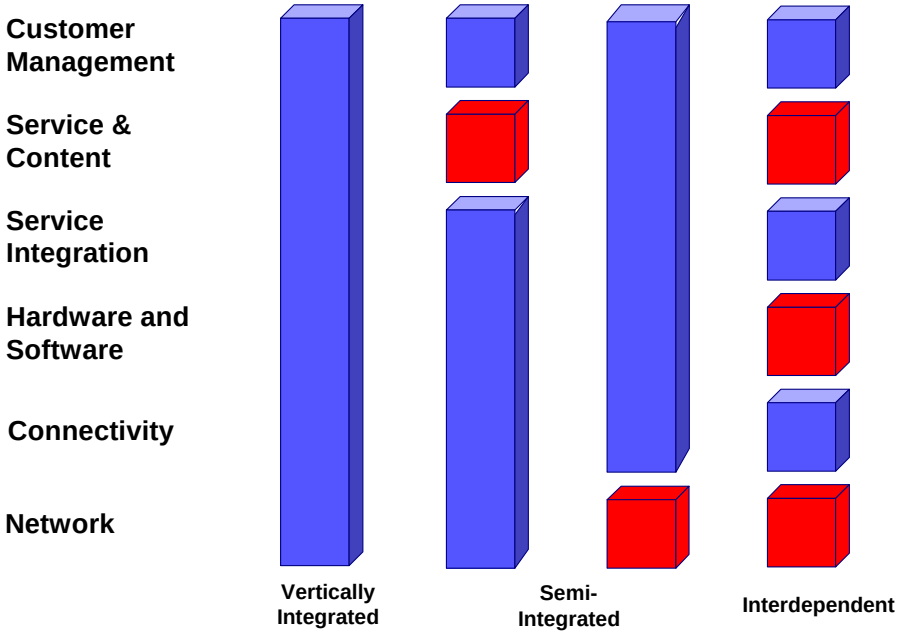
Automobile clubs and emergency services companies are already in the business of providing services and content that are in large part related to location. These types of companies have a strong interest in incorporating LBS into their operations, and most are already doing so. The European automobile clubs have established links with the dominant club in the US, American Automobile Association, and with clubs in other parts of the world to form a global telematics alliance.

Some network operators, like Hutchison3G and Orange, are pursuing a completely vertically integrated approach. They are acquiring the technology and data to build their location-based services business in-house. They are creating proprietary processes for their value chain and taking advantage of the modular, dis-integrated links in the mapping industry value chain to build their own vertically integrated systems. They can choose the best data suppliers, content aggregators, mapping and routing processing systems, geocoders and map display engines. They are doing this because they believe the location-based services industry is not yet at a stage where the individual links in the value chain can be specified, verified and delivered in a predictable enough manner to satisfy customer needs. In Christensen's terms, these links are not yet "good enough" for the mainstream market.

The second model is semi-integrated. NTT DoCoMo's model separates service and content delivery from the other parts of the value chain. This means that they have decided not to build their own location-based services system, nor any other type of service delivery system. They allow their customers to choose service providers from a list of pre-qualified companies. The service providers agree to conform to NTT DoCoMo's standards and compete with each other for NTT DoCoMo's customers on the basis of price, speed, convenience, customisation and quality. GM's OnStar in the US and DaimlerChrysler in Germany are also pursuing a semi-integrated model, taking in-house all components except the one that it cannot control, the network.

A major disadvantage of the first two models is that the customer is tied to a specific device and a specific network. The vertically integrated models tie the customer even further to specific content and services. The customer is dependent on the company to constantly upgrade content and services, the network and the device. This is the case for customers who attach themselves to any type of vertically integrated company. They do so because the alternatives are not perceived to be good enough.

Current Location-based Services Value Chain Business Models



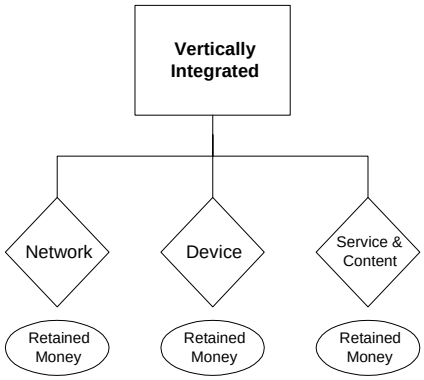
The third model is an interdependent one in which one or more specialised integration providers fills the gaps between the device, the network and the service and content provider. This model allows multiple service providers to communicate with multiple devices over multiple networks. Since there are as yet no standards for these interfaces, each one is defined separately for each combination of device, network and service. A service provider, such as an automobile club, would specify its own internally consistent interface to an external device and to a network. The integration provider would translate that interface for use with multiple networks and devices. An example of a company providing connectivity,

service integration and customer management in the vehicle LBS industry is WirelessCar.

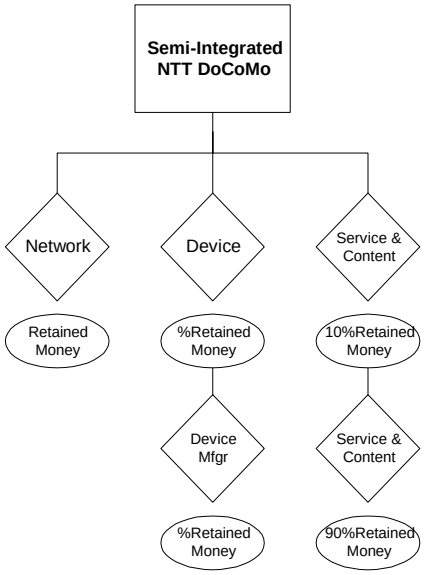
Where the Money Flows

Where will the money be made in the location-based services business with a dis-integrated mapping industry? Referring again to Chistensen's research, those who control the interdependent links in the value chain capture the most profit. "When product functionality is not yet good enough"—which is where we currently are in location-based services—"integrated companies that design and make end-use products typically make the most money for two reasons: First, the interdependent, proprietary architecture of their products makes differentiation straightforward. Second, the high ratio of fixed to variable costs, which is inherent to the design and manufacture of architecturally interdependent products, creates steep economies of scale. Larger companies can amortize high fixed costs over greater volume, giving them strong cost advantages over smaller competitors." When the mapping industry was vertically integrated, companies like Rand McNally generated the largest profits.

As the links between subsystems standardize, the subsystems that have internal architectures that are technologically interdependent are those where the money flows. So MapQuest developed internally interdependent processes to deliver map data to the Web in the form of standard HTML formats. DeLorme developed proprietary formats to deliver the world in digital format on CD-ROM to standard PC's. Bosch and Siemens VDO and a long list of other electronics system developers created internally interdependent processes to deliver mapping and routing data to in-vehicle navigation systems.

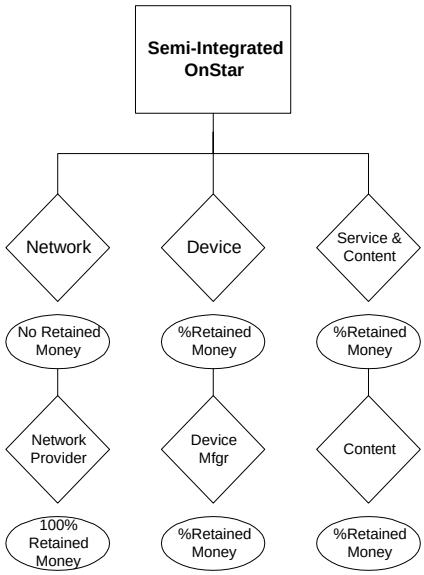


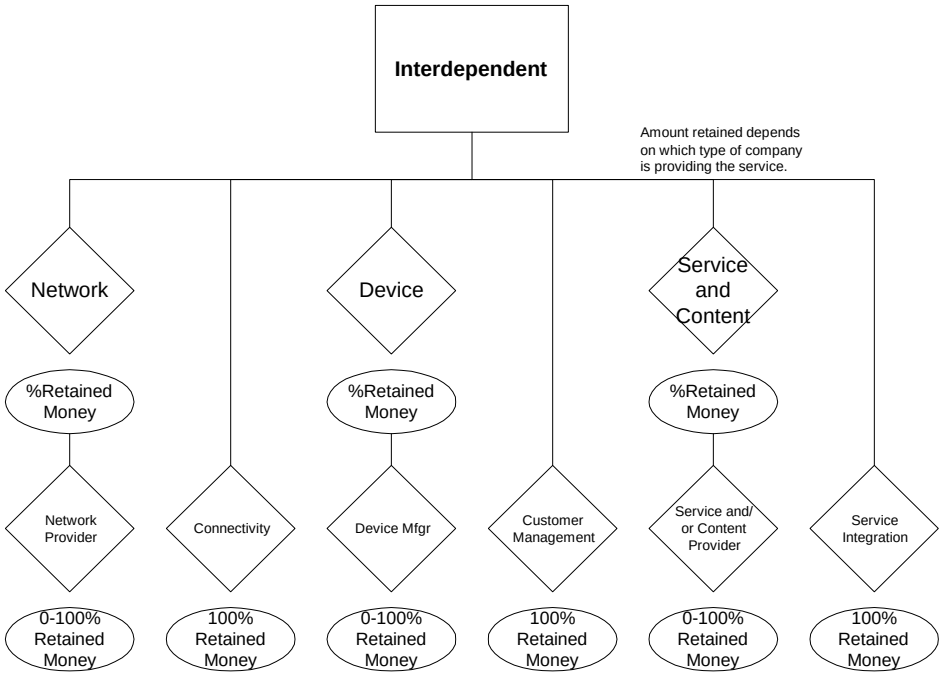
The objective of vertical integration it to retain as much profit as possible inside the company by outsourcing as little as possible, and converting whatever is outsourced to an internal component by re-branding it. The network operators who are creating location-based services have the best opportunity to retain profits in all three areas: network, device and content. To do this they must also build their own connectivity, service integration and customer management systems. As long as there are no standards for network connectivity, device interoperability and customer interchangeability, these companies can retain their dominance. They can brand the device and re-brand content and services and sell their own network time.



NTT DoCoMo and GM's OnStar division in the US are examples of semi-integrated companies. NTT DoCoMo can retain all of the money for its network, although it must pay a portion of its customer usage fees to the fixed line company, NTT. Matsushita Communications Industrial (MCI) and NEC are two of the principal suppliers of handsets to NTT DoCoMo. They are paid for their hardware, but it is NTT DoCoMo who brands and sells the devices. NTT DoCoMo's policy on services and content might appear unusual given that they could certainly have created their own location-based and other service and content infrastructure like their rival J-Phone. They retain only a 10% fee for enabling the connectivity between the consumer and the service and content supplier, but this strategy has created a wealth of willing suppliers.

OnStar is not currently billing for airtime. It pays the network operators directly out of the subscription fees it receives from its customers. The in-vehicle telematics device is built to OnStar specifications by different suppliers, Delphi, formerly part of GM and now an independent automotive Tier 1 supplier, and Motorola. The systems are branded OnStar and OnStar retains a portion of the profit from their sale. They also retain a portion of the intellectual property rights in these systems. OnStar has built its own location-based service center with automated and operator-based services. It has licensed mapping technology from MapQuest, licenses and integrates data from among others, Navtech.





The Interdependent model is a move in the direction of dis-integration. The Volvo On Call telematics service, now operational in Sweden and soon to be introduced in the US, is a prime example of the interdependent model. Volvo has contracted separately with the network provider (Vodofone Europolitan); the device manufacturer (Tier 1 automotive supplier Autoliv); and the service and content supplier (roadside assistance, emergency assistance and security services company Falck). These companies on their own cannot delivery a telematics services. Volvo has contracted with a fourth company, WirelessCar, to provide the needed connectivity, customer management and service integration. It is clear that in this model the money flows from the company selling the service to all the companies providing the actual services or systems. Depending on the billing approach, the company selling the service can retain a portion of the money received for network services, the device and the services and content. Volvo, in contrast with other automotive OEM's offering telematics, has a flexible subscription, service and transaction charging system that allows it to retain a portion of the three primary components. WirelessCar, because it is providing interdependent services, is able to retain all of the money charged for its services.

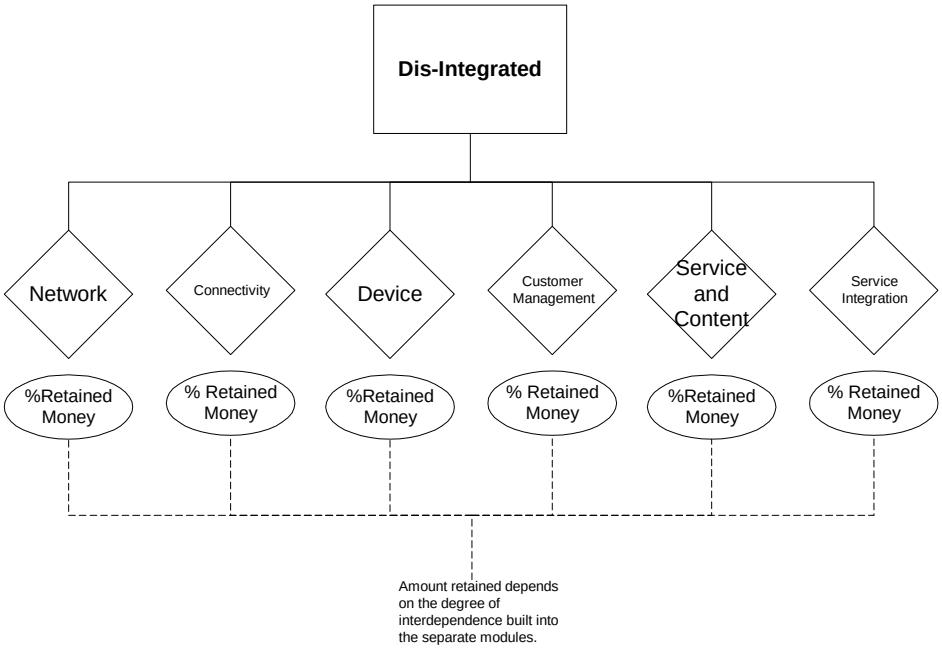
Vertical Integration to Dis-Integration

If the LBS industry follows other industries, the vertically integrated model will initially be the most successful. Those companies who adopt it will hold on to the largest profits. By default, the network operators have the clear advantage. NTT DoCoMo may yet decide to internalise service and content delivery as its competitor in Japan, J-Phone, has done. Or their model may be the first sign of dis-integration. It will be difficult for suppliers to the vertically integrated companies to generate high profits since they will be pressed to compete with one another on price to get the business. This applies to every link in the mapping industry value chain feeding into the LBS Service and Content component, from content suppliers to technology developers. However, this competition will spawn new ventures that build technology that can be sold to multiple vertically integrated LBS companies. Companies such as Telcontar, Telmap, Maptuit, Xmark, Infogation and Yeoman are examples of companies competing in the mapping and routing space. Competition among the vertically integrated companies will create demand for more content, delivered faster, more conveniently and with more possibilities for customisation—and this will drive technology innovation even further.

Eventually, the links in the LBS chain will become more modular and standardised, and the industry will dis-integrate. The power to make money will shift, according to Christensen, "away from companies that create the end-use product toward the back end of the value chain to those companies that supply subsystems with internal architectures that are still technologically interdependent. The vertically integrated companies will either sell off their components—if they are technologically superior—or they will dismantle them. These companies should now be building their internal systems as products so that they can be sold off at

a profit, or provide the base for an internal business that offers services to the external market, including competitors. New companies will form around the modularised technology, and opportunities for acquisition and investments will arise.

In the dis-integrated LBS industry, profits will fall to the companies that have the greatest control over the interdependent links in the dis-integrated value chain. For example, content that can be delivered to multiple devices over multiple networks without requiring expensive and time-consuming conversion to intermediate formats will be the most valuable. Navtech is preparing for this with their Real Time Map Service that will deliver data from their database that is constantly updated directly to devices or application servers. Increment P Corporation, one of the two data suppliers to the Japanese navigation system market, has created a specialised format, called i-Format, that will provide maps and routes to on-board devices. Another example of a valuable component is map display software that resides on the user's device, independent of device, service and content supplier or the network. Yeoman and Telmap are companies that are developing such technology.



In a dis-integrated LBS industry, the role of the integration provider, like a WirelessCar, will change from providing specific links between proprietary processes and systems, to modularising its processes and building industry-standard products for customer management, connectivity and service integration. These companies are well-positioned to identify the most profitable and interdependent parts of the value chain because they will have worked with most of the system, data and network protocols and service interfaces. They should now be preparing for making products of their services by identifying unique intellectual property that maintains the interdependencies within a standardised and modularised industry. They will be joined by other specialist companies who will compete within the lateral parts of the value chain.

Recapitulation

1. Location-based services is a new and emerging industry.

2. Location-based services are enabled by wireless telecommunications, satellite and other positioning technologies and mobile device technology, but most of all, it is based on developments in the mapping industry that provide the essential content for the services.

3. The evolution of the mapping industry from vertically integrated to dis-integrated businesses, providing selectable content and device-independent applications and services, is the foundation for delivering location-based services.

4. The location-based services industry will follow a similar path of evolution from vertically integrated to dis-integrated as that of the mapping industry as the individual components in its value chain become modular and standardised.

5. The dis-integration of the LBS industry will offer new investment and business opportunities, and these can be identified by studying the interdependencies among the components of its value chain.

Is the lesson this: Standardisation is bad for business? In a way, yes, and yet standardisation seems to be the natural evolution of industries as companies attempt to satisfy customers. Purchasing agents like standardisation because they can then choose from among many suppliers and define selection criteria. Consumers thrive on standardisation because it drives down prices and increases choice—including cheap knock-offs. The in-vehicle systems developers resisted standard CD/DVD formats and will profit from this lack of standardisation. However, the customer, dissatisfied with out-of-date data and lack of interoperability, will force new developments leading to some form of off-board navigation in which the system developers will gain no profit from the data. Then the profits will shift to the companies that can deliver this data to the new in-vehicle systems in the best possible way, using complex, interdependent integration. If they can make the shift in time, the established developers can well become the new developers. They had better start making the shift very soon. There are companies already working on replacement systems using next generation telecommunications network technology. They are creating their own complex, interdependent, integrated systems. Most of these companies are vertically integrated. They will inevitably dis-integrate. The opportunities are many.

Notes: