



mAutomotive

Split Charging & Revenue Management Capabilities for Connected Car Services



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Executive summary

Automakers are planning to aggressively deploy connected car services: The GSMA forecasts that embedded solutions will be in more than 20% of new vehicles by 2015 and over 90% of vehicles in 2025.¹

Automakers are also using innovative business models, which generate revenues from third parties, to improve the business case for new services, enabling them to expand their service portfolio. These strategies reflect both growing consumer demand to be connected and technological advances. As the market for connected car services evolves, split charging and billing capabilities are becoming a fundamental cornerstone for the viability of embedded connectivity solutions, as they provide the mechanism by which:

- Different service beneficiaries (i.e. automaker, consumer or third party) can be allocated charges and revenues for their respective connectivity elements;
- Different revenue streams are managed across stakeholders for emerging service categories (such as app stores and e-books).

Automakers have complex requirements to support these new service deployments, such as:

- Greater flexibility in the calculation of connectivity costs, according to event, time and volume for different service typologies;
- Back-end analytics to monitor and manage connectivity, content costs and revenue streams;
- The management of interfaces with businesses and customers.
- Defining appropriate payment methods across different geographies, to respond to the national differences in culture, finance, and legislation.

Mobile operators are well positioned to support many of automakers' requirements, given their sophisticated charging and billing engines, which can be used to manage automakers' connectivity components and content and revenue requirements.

Split charging, revenue management and billing capabilities will enable the adoption of innovative new business models that reshape the value chain for the delivery of these new services. The balance between automakers, telematics service providers and operators in providing these capabilities will depend on the automaker's strategy and key service characteristics, including:

- The complexity of the connectivity elements to be coordinated across beneficiaries and services;
- The level of dynamic, interactive management required for revenue streams and costs;
- The complexity of the business rules for service processing, service delivery, and third party content;
- The importance and sophistication necessary to ensure traceability of queries and back-end analytics;
- The diversity of billing options (to minimise the need to issue "another" bill);
- The variety of payment options offered for services (e.g. pre-paid account, post-pay, credit card). This factor could be important for the integration of external party services looking to leverage payment options;
- The customer relationship management (CRM) strategy and the different instruments for providing this capability.

¹ Source: 2025 Every Car Connected: Forecasting the Growth and Opportunity, GSMA 2012

An urgent need exists for automakers and operators to better understand the match between requirements and capabilities. This whitepaper, combined with the GSMA's mAutomotive activities, are seeking to reduce this gap, such as including cross-industry trials demonstrating operator capabilities to support emerging connected car services. However, further additional challenges remain with direct opportunities for cross-industry action, including the utility of a standardised definition for charging & rating information exchange.

The white paper will have two versions, in accordance with the work on the GSMA trials.

- The first version seeks to contextualise the issue of billing and charging capabilities for connected vehicle services.
- The second version will expand the discussion on requirements, capabilities and challenges, based upon the findings from the first phase of the trial.

The paper seeks to educate the ecosystem on requirements, capabilities and challenges in this field. It also aims to highlight the importance of these capabilities for the overall success of innovative business models for embedded connected devices. Moreover, it discusses potential common areas for joint work to support the development of these services. The scope of this whitepaper, however, does not address the business case details needed to justify the investments required by the different parties (including mobile network operators).

This paper's target audience includes:

- **Mobile operators:** To understand automotive requirements for charging and billing capabilities, the functionality and their priority use cases.
- **Automakers:** To provide information on operator capabilities that can support emerging requirements for connected car services from back-end analytics to business-to-business functionality to consumer-facing functionality.

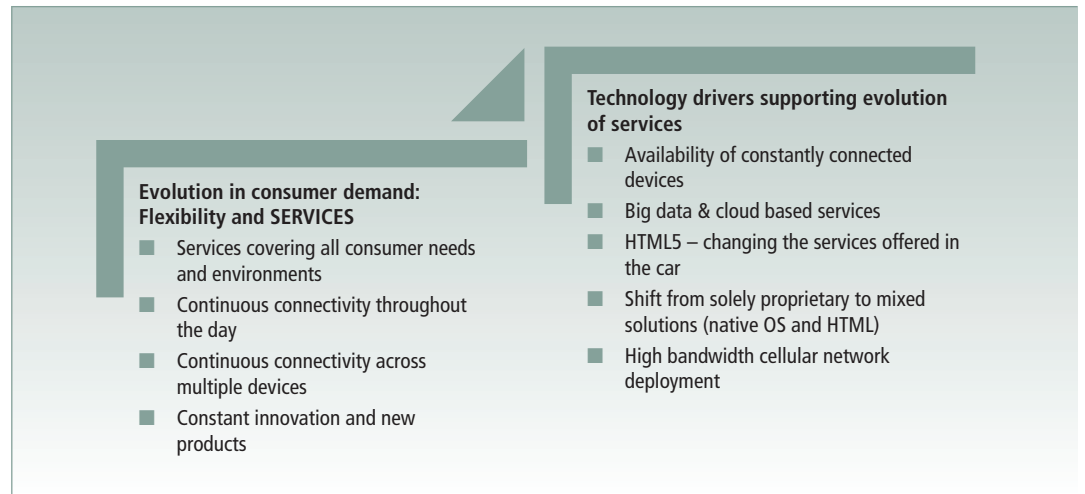
Why are Charging and Billing Capabilities Important for Connected Car Services?

Consumer Demand is Changing the Game

Ubiquitous and Diverse Connected Car Services

Technological developments in the consumer electronics sector and consumer demand to be continuously connected (see Figure 1) are having a major influence over the evolution of connected car services.

Figure 1: Drivers for Evolution in Service Development and Deployment (GSMA 2012)



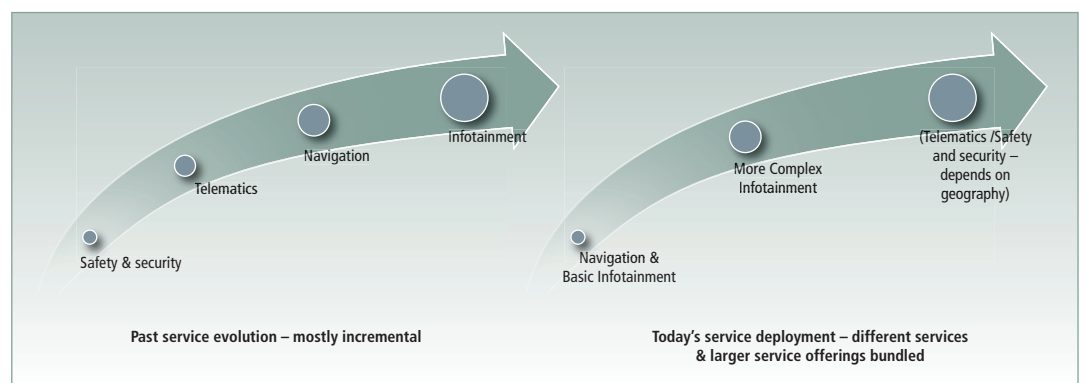
Source: GSMA 2012

These drivers provide a significant opportunity to expand the scale, variety and ubiquitous nature of service usage.

Service Evolution

Automakers are now using infotainment, convenience and navigation services to attract consumers to connected car services, as opposed to the historic approach of emphasising safety and security services (see Figure 2). However, significant regional variations exist in the importance of the different service categories.

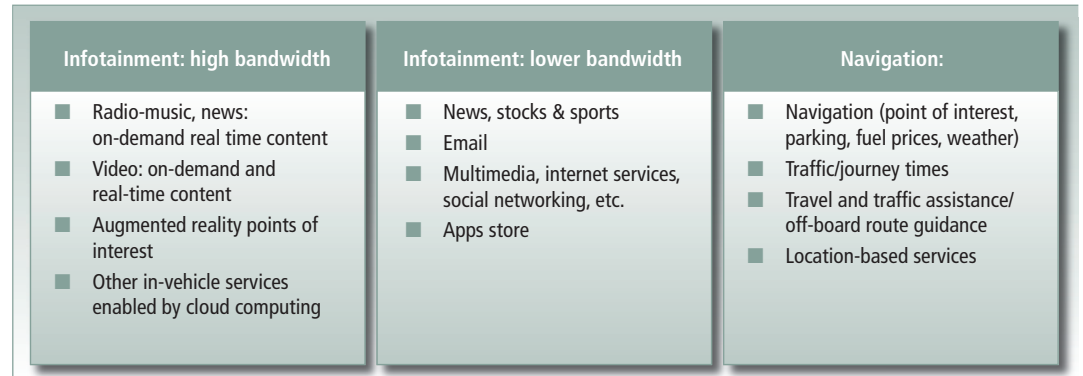
Figure 2: Service Deployment Changes: More Importance on Infotainment and Navigation Services



Source: GSMA 2012

Many different infotainment and navigation services are being deployed. The principle types are highlighted in Figure 3.

Figure 3: Sample Services for Infotainment and Navigation



Source: GSMA 2012

Changing Connectivity Characteristics of Services

These new services have very different connectivity characteristics than previous telematics services. These include:

- High bandwidth requirements;
- Potentially frequent use;
- Highly-elastic demand (i.e. unpredictable use and costs);
- Direct interest to the consumer (as opposed to the automaker).

With this evolution in services, automakers face important strategic questions on a variety of fronts, driven largely by the need to change business models and to evaluate the trade-offs in the various connectivity solutions.

Embedded connectivity has the fundamental appeal of simplicity: It just works 'out-of-the-box' for consumers, encouraging service utilisation. Embedded solutions currently focus on vehicle-centric, high-reliability and high-availability apps. An embedded solution is a requirement for some services, such as stolen vehicle tracking and remote door unlock, and can enhance the performance of safety-based services, such as eCall.

The viability of extending embedded systems for infotainment and navigation services depends in part in the ability to:

- Differentiate charging and split billing for service beneficiaries (e.g. automaker vs. the driver) and
- Manage multiple revenue streams across value-chain actors so as to improve the business case of connected car services through innovative business model deployment.²

² Without these split charging and revenue management capabilities, automakers will likely:
Only embed those services for which they are the direct beneficiary (such as remote diagnostics);
Rely on tethering (IP sharing) and smartphone integration to allocate connectivity costs to the user, even though there are inherent limitations due to the:
- Increased driver distraction possibilities;
- loss in ease of use to consumers;
- Inappropriateness of these connectivity solutions for many services;
- Technical difficulties which lead to the inability to pair or tether;
- Inconsistent availability of supporting business models and policies for tethering, etc.

Consumer Preferences on Billing and Payment

Consumers expect a variety of ubiquitous connected car services, yet these expectations are accompanied by equally demanding requirements on the:

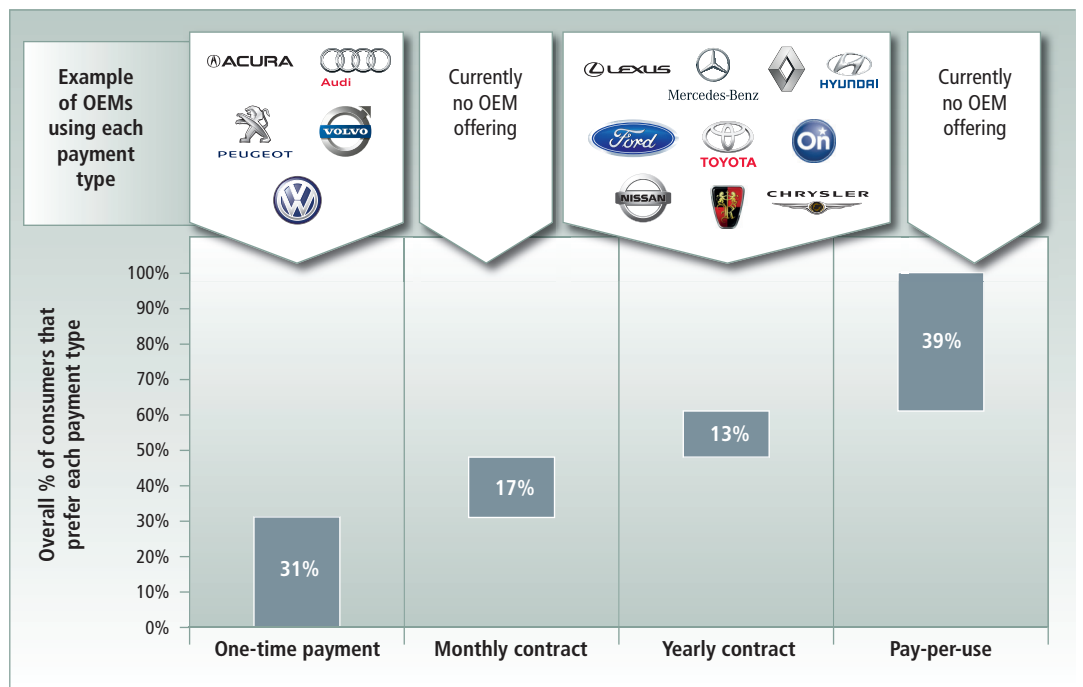
- Pricing of connected car services reflecting the value consumers attribute to services (e.g. convenience, savings, peace of mind, and must haves);
- Size of the individual charges;
- Number of bills issued (e.g. customers are seeking one basket for multiple items);
- Ease of payment.

The transaction process needs to be simple, avoid extensive interaction and generally not result in an additional bill: For many consumers, the addition of another regular bill would represent an undesirable commitment and hassle. The success and failure of connected services in other sectors have shown the importance of convenience and micropayments, as well as the ability to trial services before commitment.

Consumer research confirms these factors also apply to telematics services globally, with most people declaring a preference for pay-per-use models (see Figure 4). This preference runs counter to the historical practices for telematics and infotainment services, which have relied on long-term upfront payments and subscriptions.³

The consumer is looking for a straightforward payment process and prices that represent the value that they attribute to the service. In fact, not all the charging events for the array of connected car services will result in a cost to the end-user, as other value chain stakeholders will cover the costs of different aspects of the services.

Figure 4: Declared preferences of consumers for charging models for telematics



Source: SBD, 2011

³ There is often a difference between declared value and actual behaviour of consumers. Even real-time traffic services, which are generally declared as being rated very valuable by end users, actually have relatively low re-subscription rates (often below 20%). This contrast between declared value and real behaviour could be due to many factors. Consumer research has struggled for a means to distinguish between declared values and actual consumer behaviour.

Changing Business Models

The historic reliance on subscription-based models for connected car services was motivated by the desire to:

- Make it simple to purchase services at the dealerships;
- Minimise the number of transactions involved in the management of the services;
- Provide automakers with a relatively easy way to predict revenues.

However, subscription-based models are:

- Unable to address consumers' desire to:
 - Trial services before purchasing;
 - Tailor service bundles throughout the lifetime of the vehicle;
 - Maintain flexibility on service commitments;
- Unable to strengthen the business case for connected car services by opening up new revenue streams and adapt to the differing connectivity usage levels for all services

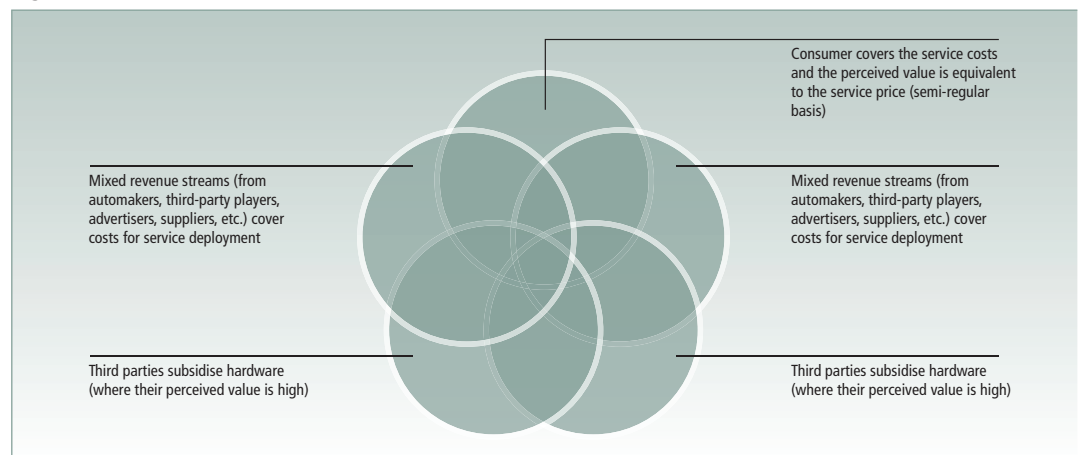
For these reasons, business models for connected car services are moving towards those which:

- Facilitate the entrance of new revenue streams (and actors);
- Allow for differential allocation of service costs to beneficiaries (split charging and billing);
- Foster flexibility in adding new services in the future;
- Are used in other consumer electronics sectors (such as apps stores and e-books).

Revenue Models

Five potential revenue models underpin the deployment of telematics and infotainment services (see Figure 5). These different solutions could be employed in parallel to optimise the market appeal of the services and to keep the final service prices competitive. Historically, automakers relied on the first three options, while, today, third party players are playing a more significant role in the direct definition and provision of new connected car services.

Figure 5: Potential revenue streams for connected car services



Source: GSMA 2012

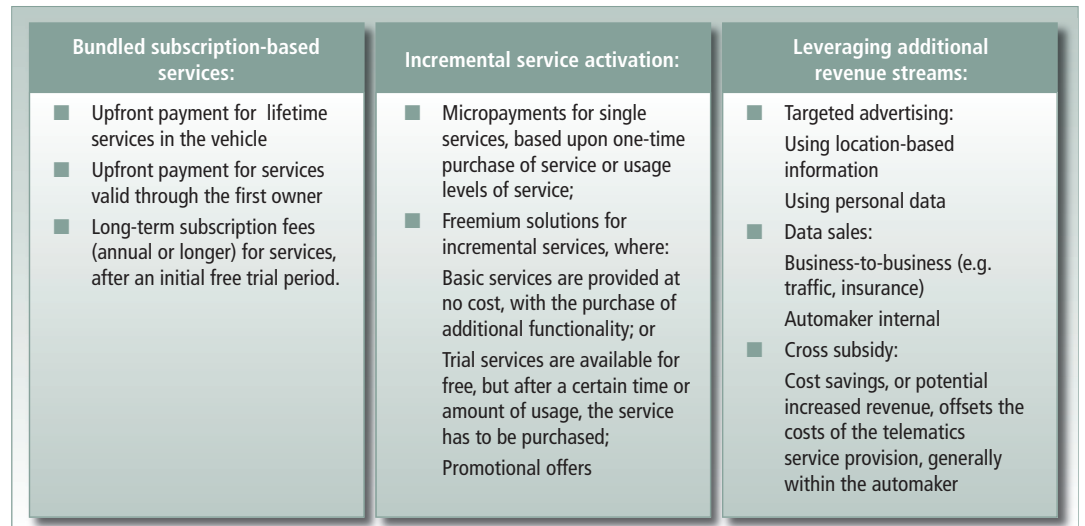
Business Model Evolution

There is an evolution from traditional “simple” linear business models, based upon internal automaker subsidies and consumer payment for subscriptions, to much more complex, inter-dependent and sophisticated bundles of services and business models.

Although the possible configurations and combinations of business models for connected car services are limited only by the imagination of the designer, they typically fall into one of the following broad categories:

- Bundled subscription-based services;
- Incremental service activation;
- Leveraging advertising, sale of data on travel/usage patterns, and cross-subsidies;

Figure 6: Business model options for connected car services



Source: GSMA 2012

However, the deployment of sophisticated business models is only possible if new capabilities for charging, revenue management and billing are used to support the suite of connected car services.

How will Connected Car Services Change?

Expanded Value Chain

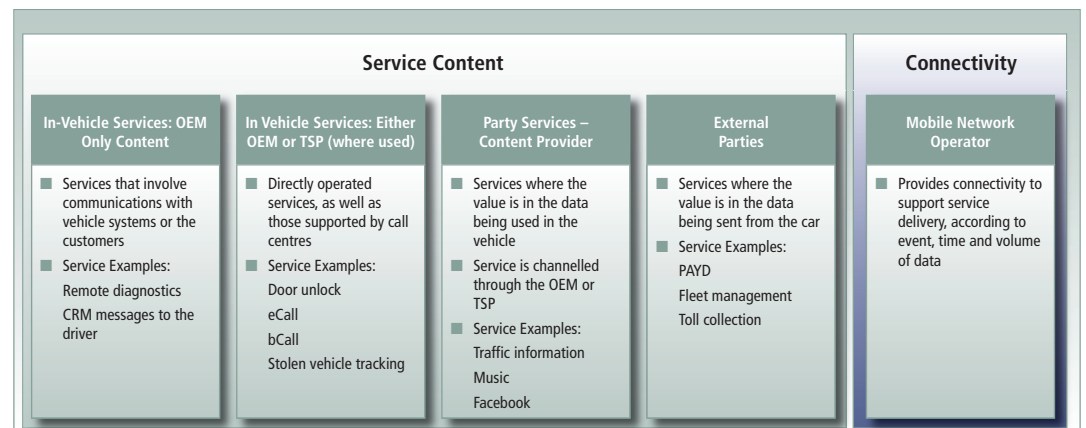
Historically, the value chain for connected car services included relatively few players:

- Automakers - service delivery and processing
- Telematics service providers (where automakers use TSPs for service delivery) - service delivery and processing
- Third party content providers - providing content
- Mobile network operators - providing connectivity

This value chain is expanding to incorporate:

- New third party content providers, as infotainment, convenience and navigation services become more diverse;
- External parties, which could provide additional services through data received from the vehicle (such as insurance companies);
- More services in general from all players.

Figure 7: Value Chain Roles for Service Delivery



Source: GSMA, 2013

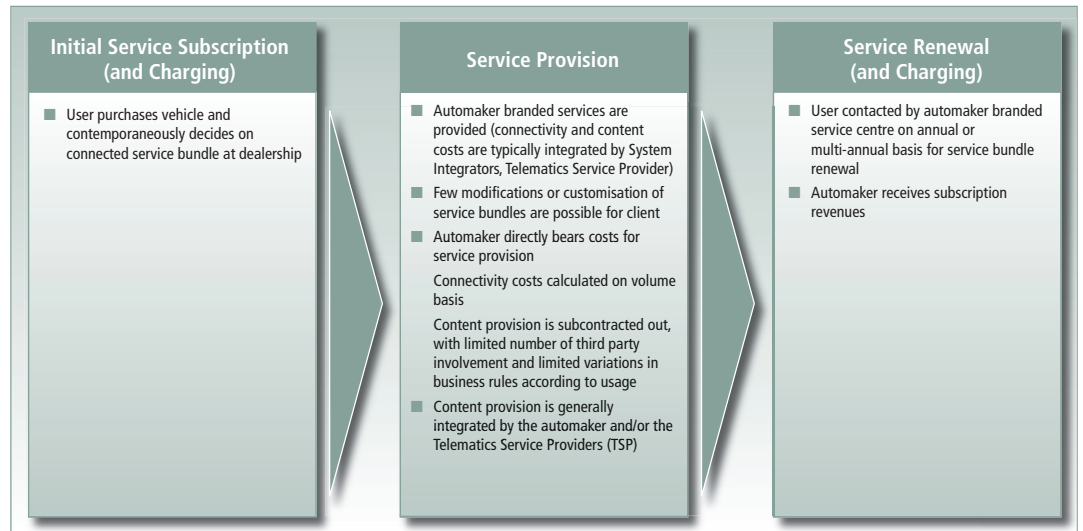
Service Activation Process Evolution

The activation of services historically has occurred when the consumer purchased their vehicle and simultaneously decided upon their bundle of services. The process was characterised by:

- Long-term subscriptions;
- Relatively high up-front costs for service bundles;
- Infrequent payment process;
- Limited variation in subscription options;
- Limited availability of service configurations;
- Limited number of actors in value chain;
- Few interdependencies between value chain actors for service payments.

An illustrative service subscription process is shown in Figure 8.

Figure 8: Historical Process for Service Subscription

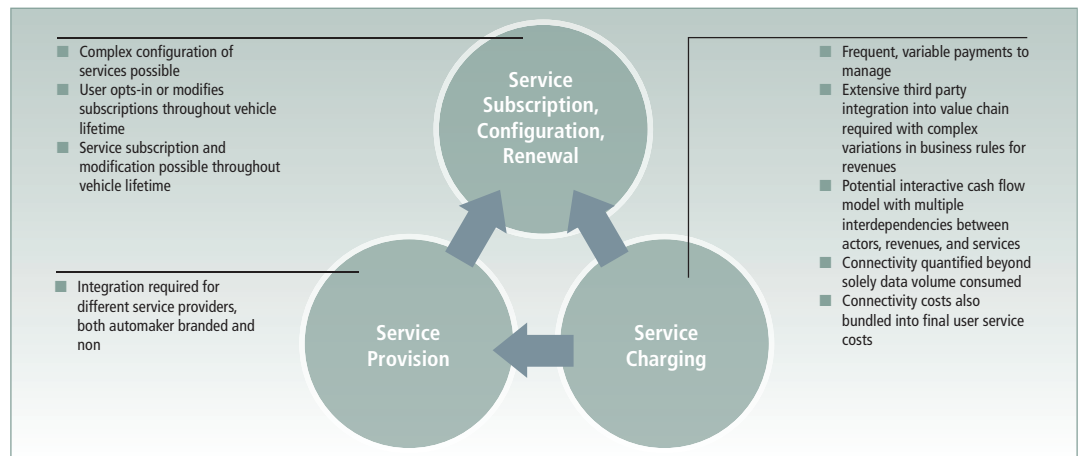


Source: GSMA 2012

This historical process is expected to evolve significantly in line with trends in consumer electronics and app stores, such as:

- Variable service activation and subscription durations (in-car, on-line, etc.);
- Incremental micropayments complementing bundled subscriptions;
- Simple and flexible payment options triggered by new service configurations (i.e. potentially more frequent than historic models);
- Variation in subscription options;
- Multiple service configurations;
- New actors in the value chain.

Figure 9: Evolving Service Activation and Management Process



Source: GSMA 2013

What are Automaker High-Level Requirements for Charging?

Automakers are seeking to play a key role in the service delivery of this expanded array of connected car services.

Automakers are looking to:

- Increase their direct service portfolio for those services to which consumers attribute significant value;
- Centralise the delivery of all the services, i.e. coordinating the various parties so as to manage the cross-revenue possibilities from the different services and ultimately strengthen the overall business case for connected car services;
- Directly manage the customer relationship. Automakers want to establish a direct relationship with the service users, in order to better understand the profiles of their customers and to interact directly with them.

Evolution of Connectivity Charges

As the types of services deployed change, automakers are seeking to change the way they manage connectivity costs.

Automakers are looking to bundle connectivity costs into the service costs (to be offset where possible with alternative revenue streams), as opposed to charging for the service cost + the eventual connectivity associated with delivering the service.

In order to support the bundling of connectivity costs, automakers are seeking differential means to quantify connectivity costs: i.e. cost calculations based upon:

- Event (e.g. per download);
- Time period (e.g. variation for specific periods of time during the day, discounted access or trial periods);
- Volume of data (e.g. kilobytes consumed for recurrent services with little variation in bandwidth utilization).

Different means to quantify connectivity costs are particularly helpful in fostering the different service requirements of infotainment and navigation services, as well as facilitating end user flexibility in terms of:

- Trial service periods;
- Irregular usage of services (e.g. services needed on an occasional basis);
- Promotional and temporary discounts for services.

Automakers are also very interested in being able to allocate recurrent connectivity costs for services where the user is the ultimate beneficiary to the consumer's data plan.

Regional Solution Coverage

Automakers generally have unified commercial offerings for services across whole regions (if not globally). This requirement means that they are seeking charging and billing capabilities that are able to support their entire regional footprint, rather than being limited to the operator’s individual operational footprint.

At the same time, automakers need to manage legal and privacy concerns, which vary greatly across national borders and will have implications on the exact configuration of deployments.

Automakers are also seeking to have a single connectivity cost independent from roaming fees.

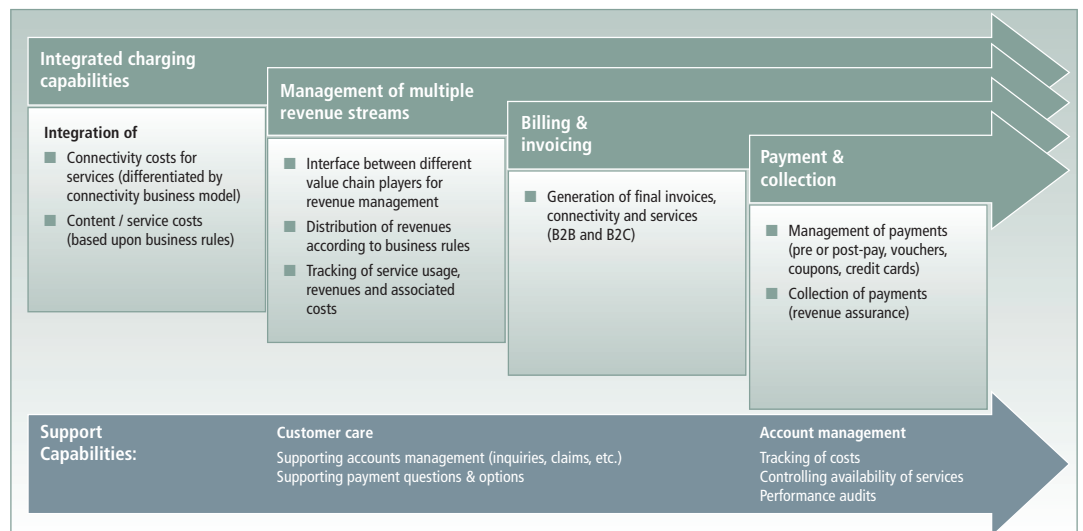
Moreover, as interoperable remote provisioning of the SIM⁴ becomes a reality, the charging and billing solution would ideally support a degree of interoperability across the region. This requirement has implications for potential future cross-industry work items.

High-Level Capabilities for Charging, Revenue Management & Billing:

With the simultaneous evolution in consumer demand, value chains, and business models, automakers require robust, sophisticated charging and billing capabilities to support service deployment, including:

- Integrated charging capabilities, i.e. the ability to identify, calculate and monitor the different costs in delivering each service, from connectivity costs to content and service costs;
- The management of multiple revenue streams for the different value chain actors;
- Billing and invoicing to the different business-to-business (B2B) components, as well as the final end user;
- Payment and collection;
- Support capabilities, such as customer care, for charging and billing.

Figure 10: Charging & Billing Capabilities Required to Support Innovative Business Models for Embedded Systems



Source: GSMA 2013

These capabilities are important to all connected car services, especially those which leverage innovative business models, as highlighted in the following table (Figure 11).

⁴ The GSMA’s vision is a world empowered by the capability to remotely provision mobile operator credentials onto a SIM to support the burgeoning M2M market opportunity. To deliver this, GSMA is working with operators and SIM suppliers from around the world to create a common, secure, interoperable architecture to facilitate the commercial deployment of systems that enable remote over the air provisioning and management of the SIM.

Figure 11: Complexity of Charging & Billing Capabilities for Innovative Business Models

Business Model Typologies			Complexity of Charging & Billing Capabilities to Support Business Models							
			Integrated Charging Capabilities	Management of Multiple Revenue Streams	Billing & Invoicing		Payment & Collection		Customer Care	Account Management
					B2B	B2C	B2B	B2C		
Bundled Subscription Based Service	Upfront	■	■	N/A	■	N/A	■	■	■	
	Subscription after Free Period	■	■	N/A	■	N/A	■	■	■	
Incremental Service Subscription	Micropayments	Apps (incl. One time in-app purchases); Profit share with developer (one time payment for app)	■	■	■	■	■	■	■	■
		Content: Profit share with provider (based on usage - time using service, not a one off payment)	■	■	■	■	■	■	■	■
	Freemium	Based on time (30 days free + then pay)	■	■	■	■	■	■	■	■
		Based on usage (4 times and then pay)	■	■	■	■	■	■	■	■
Targeted Advertising	Using Location	■	■	■	■	■	N/A	■	■	
	Using Personal Data	■	■	■	■	■	N/A	■	■	
Sell-Data	B2B (eg. Traffic)	■	■	■	■	■	N/A	■	■	
	OEM Internal	■	■	■	■	■	N/A	■	■	
Cross-Subsidy	e.g. Dealer Servicing	■	■	■	■	■	N/A	■	■	
External Parties: Data Collection	Tolling, Insurance	■	■	■	■	■	N/A	■	■	

Key
■ Higher Complexity
■ Lower Complexity

Source: GSMA 2013

Charging capabilities, therefore, represent a critical enabler for the evolution of services and for:

- Automakers to define more sophisticated and sustainable models for service deployment
- Mobile operators to leverage core capabilities, building upon existing connectivity services, to play a greater role in the connected vehicle value chain

If these capabilities are not appropriately deployed, automakers will face:

- Limitations on the services they offer through embedded solutions (likely leading to increased reliance on tethered or smartphone integration solutions);
- Static service configuration for the lifetime of the vehicle (difficulty in evolving the service bundles over the vehicle's lifetime);
- Difficulties in leveraging additional third party stakeholders in the building of a sustainable business case.

4 USB cable – A wired solution that connects the phone to a USB connection in the car

BT DUN (Dial-Up Networking) – A Bluetooth profile that allows a device to use the phone to make a data connection.

BT PAN (Personal Area Networking) – A Bluetooth profile that allows one or more connected devices to share the phone's connection to the internet

BT SAP (SIM Access Profile) – A Bluetooth profile that makes a temporary copy of the SIM credentials from one device to another (e.g. copy the SIM from a handset to an embedded modem in a car).

BT SPP (Serial Port Profile) – A solution that uses compatible apps, on the phone and in the car, to by-pass tethering restrictions. Data is downloaded from the internet to the app on the phone, from where it is side-loaded to the car using SPP.

BT HFP (Hands Free Profile) – This profile is used to enable a voice call that the car can then use to transfer very small amounts of data using in-band modem technology (data-over-voice).

WiFi – The car is able to connect to the internet over WiFi if the phone is put into a portable hotspot mode.

Transversal Capabilities

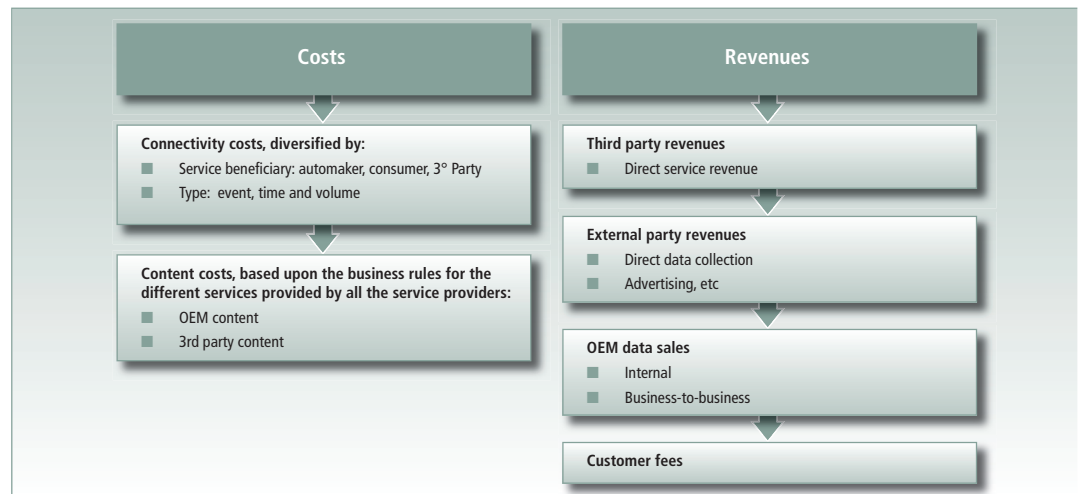
As well as supporting the direct services being offered, it is important that billing and charging solutions have the ability to provide:

- Back-end capabilities to monitor and assess the net return on the services (after balancing the different revenue streams and costs), the usage of services and the bundling of services (so as to ensure the balancing of costs in line with the value perceived by the end-user);
- Different interfaces needed for services delivery:
 - More diverse (and likely complex) business-to-business interactions (so as to balance relations with the multitude of new third party content providers, as well as leverage the different revenue streams possible to minimise the end price to the user);
 - Direct business-to-consumer (B2C) service management for the whole suite of services, as well as the supporting infrastructure for charging, billing, payment and support mechanisms.

Balancing Costs and Revenues: Centralising B2B and B2C Elements

Automakers need to make a fundamental shift in how they handle revenues and costs for connected car services, incorporating new actors for diversified revenue streams, while balancing the costs of external content and connectivity (see Figure 12).

Figure 12: Balancing Costs & Revenues Across Value Chain Players



Source: GSMA 2013

This balancing will need to be centralised across all the value chain players, based upon the prioritisation that the individual automaker places on the different service features and their complexity.

What are Primary Automotive Use Cases for Charging & Billing Capabilities?

Automakers, through the GSMA's Connected Car Forum, have prioritised five use cases where advanced charging and billing capabilities from mobile network operators would be necessary for successful deployment:

- Bundled services;
- Service upgrade;
- Sponsored connectivity;
- Third party infotainment content;
- Multiple devices with common data.

Description of the Primary Use Cases

Bundled Services

This use case focuses on differentiating between service beneficiaries for charging of connectivity, i.e. services where:

- The automaker covers the recurrent connectivity costs (e.g. remote diagnostics);
- The end-customer pays for the connectivity costs (e.g. navigation).

Service Upgrade

This use case builds upon the differentiation of service beneficiaries, with the focus on upgrading services by either:

- Increasing bandwidth thresholds for data consumption, or
- Adding new services to the subscriptions

The use case includes a scenario where the end-customer receives an alert, warning on over-spending and offering an upgrade when they reach a certain data consumption threshold.

Sponsored Connectivity

Building upon the ability to differentiate between service beneficiaries, this use case envisages third parties sponsoring certain services (so no charge for the end customer), as an addition to a basic series of connected car services paid for by the end customer.

Some examples of sponsored scenarios include:

- **Rewards scenario:** A customer receives a certain volume of data for connected car services for free if they use the automaker's maintenance service centre. The cost of providing the additional data is internally billed to the automaker or directly to the dealership/service centre.
- **Advertising scenario:** A customer receives either:
 - An amount of data for their connected car service as part of a sponsored advertisement; or
 - Access to a specific service for a limited time period as part of the advertisement.
- **Reverse billing scenario:** A customer selects a service, where the connectivity costs and eventual fees are reversed billed to a third party.
- **Sponsored internet navigation to specific IP addresses:** The automaker sponsors internet access to their online user manual (to avoid printing the user manual).

Third Party Infotainment Content

This use case focuses on the ad hoc ability of the end-customer to select a service provided by a third party content supplier for audio or video downloads. In this use case, the customer has a set of connected car services activated and opts into an incremental purchase of content. This use case addresses the revenue management capabilities between the automaker and the third party content provider.

Multiple Devices with Common Data

This use case involves the end-customer activating a shared data plan to cover in-car service connectivity, as a complement to on-going connected services paid for by the automaker (such as remote diagnostics).

Today, this use case would require the consumer and the automaker to use the same mobile operator or two different embedded modules. Automakers stress the importance of inter-operator settlement as a pre-requisite for this use case to be valid on the market.

Mapping of Required Capabilities to Use Cases

The charging and billing capabilities required to support the use cases outlined above are shown in Figure 13 (with the exception of the multiple devices with common data, since this use case is not supported by inter-operator settlement).

Figure 13: Mapping of Capabilities for Each Use Case

Capabilities	Use case				
	Service bundles	Service upgrade	Sponsored connectivity	3* party infotainment content	
Charging capabilities					
Differentiation of connectivity (event, time, volume)	■	■	■	■	
Monitoring of differentiated connectivity types (location, service)	■	■	■	■	
Charging for differentiated connectivity	■	■	■	■	
Management of multiple revenue streams					
Interface between different value chain players for revenue management			■	■	
Distribution of revenues according to business rules			■	■	
Tracking of service usage, revenues and associated costs			■	■	
Billing & invoicing for differentiated types of traffic					
Generation of final invoices, connectivity and services	■	■	■	■	
Payment & collection					
Management of payments (pre or post-pay, vouchers, coupons, credit cards)	■	■	■	■	
Collection of payments (revenue assurance)	■	■	■	■	
Customer care					
Supporting accounts management (inquiries, claims, etc.)	■	■	■	■	
Supporting payment questions & options	■	■	■	■	
Account management					
Tracking of connectivity usage	■	■	■	■	
Controlling availability of services (access to services/data limits/upgrade/control access according to payment status)	■	■	■	■	
Alerts on data usage (incl. Thresholds, outliers)	■	■	■	■	
Performance audits	■	■	■	■	
Key					
	■	Focus of use case			
	■	Necessary MNO charging for service but not the focus of the use case			
	■	Necessary capability for complete end to end service			

Source: GSMA 2013

What are the Relevant Operator Capabilities?

Operators have core asset capabilities for charging, revenue stream management, billing, payment and support (see Figure 14), which closely match the evolving automaker requirements with respect to:

- The deployment of innovative business models and
- Leveraging of third party players for connected car services and associated external party services (such as, insurance, floating car data, etc.).

Figure 14: Core Operator Capabilities for Charging & Billing

<p>Charging capabilities</p> <ul style="list-style-type: none"> ■ Differentiation of connectivity (volume, event, time) ■ Monitoring of differentiated connectivity types, location, service ■ Allocation of charging for differentiated connectivity
<p>Management of multiple revenue streams</p> <ul style="list-style-type: none"> ■ Interface between different value chain players for revenue management ■ Distribution of revenues according to business rules ■ Tracking of service usage, revenues and associated costs
<p>Billing & invoicing for differentiated types of traffic</p> <ul style="list-style-type: none"> ■ Generation of final invoices, connectivity and services
<p>Payment & collection</p> <ul style="list-style-type: none"> ■ Management of payments (pre or post-pay, vouchers, coupons, credit cards) for B2B or B2C ■ Collection of payments (revenue assurance)
<p>Customer care</p> <ul style="list-style-type: none"> ■ Supporting accounts management (inquiries, claims, etc.) ■ Supporting payment questions & options
<p>Account management</p> <ul style="list-style-type: none"> ■ Tracking of connectivity usage ■ Controlling availability of services (access to services/data limits/upgrade/control access according to payment status) ■ Alerts on data usage (incl. Thresholds, outliers) ■ Performance audits

Source: GSMA 2013

These operator capabilities enable the differentiation between charges associated with:

- Events (e.g. per download);
- Selected time periods (e.g. variation for specific periods of time during the day, discounted access or trial periods);
- Volume of data (e.g. kilobytes consumed for recurrent services with little variation in bandwidth utilization).

This connectivity charging is one of the key building blocks for automakers to use in designing their services according to innovative business models, together with third parties. In fact, these capabilities are necessary to deliver the automotive use cases previously discussed.

Automakers clearly have the need to manage all three types of relations (internally, B2B and B2C) with regards to both connectivity costs, as well as the integration of the different content and business rules for the services. Operator charging and billing capabilities can support automotive requirements with regards to:

- Internal back-end analytics on the different connectivity types;
- Supporting or managing business-to-business interactions on connectivity, as well as the services themselves;
- Supporting the automaker’s interface with the customer on connectivity, as well as the services themselves.

An overview of the operator capabilities mapped to the different interfaces needed in automotive is provided in the following table (Figure 15).

Figure 15: Mapping of Operator Capabilities as a Support to Necessary Automotive Interfaces

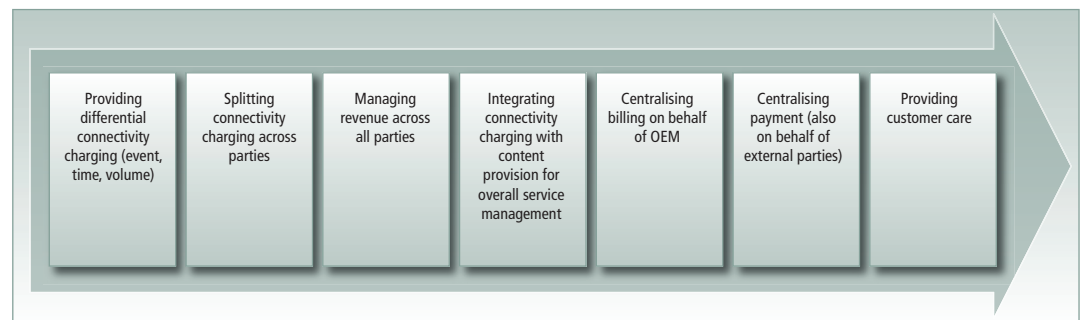
Capabilities	Back-end analytics	B2B functionality	Customer facing functionality
Charging capabilities			
Differentiation of connectivity (event, time, volume)	■	■	
Monitoring of differentiated connectivity types (location, service)	■	■	
Charging for differentiated connectivity	■	■	
Management of multiple revenue streams			
Interface between different value chain players for revenue management	■	■	
Distribution of revenues according to business rules	■	■	
Tracking of service usage, revenues and associated costs	■	■	
Billing & invoicing for differentiated types of traffic			
Generation of final invoices, connectivity and services		■	■
Payment & collection			
Management of payments (pre or post-pay, vouchers, coupons, credit cards)	■	■	■
Collection of payments (revenue assurance)		■	■
Customer care			
Supporting accounts management (inquiries, claims, etc.)	■	■	■
Supporting payment questions & options		■	■
Account management			
Tracking of connectivity usage	■	■	■
Controlling availability of services (access to services/data limits/upgrade/control access according to payment status)	■	■	■
Alerts on data usage (incl. Thresholds, outliers)	■	■	■
Performance audits	■		

Source: GSMA 2013

What is the Potential Future Path for Deploying Operator Capabilities to Support Connected Car Services?

With the wide variety of capabilities and interfaces involved, many opportunities exist for operators to play a significant role in charging and billing for connected car services. Each automaker has its own unique requirements and service sets. Nonetheless, there is a general progressive path of operator involvement in delivering charging and billing capabilities, as a support to connected car services. This path, portrayed in Figure 16, focuses on the different possible roles, but does not have any implications for the branding of the support role.

Figure 16: Progressive Value Chain for Operator Involvement in Charging & Billing



Source: GSMA 2013

Note, automakers need to be front-and-centre in the interface with the final customer. This aspect will result in some combination of:

- Automakers directly managing all the customer-facing functionality vs.
- Seeking support from other parties, but ensuring that the support services will be automaker-branded to the final customer and will feed into the automaker's CRM strategy.

Independent of the branding, a number of factors will impact the degree of involvement of operators in the charging and billing value chain for connected car services, including:

- The complexity of the connectivity elements to be coordinated across beneficiaries and services;
- The level of dynamic, interactive management required for revenue streams and costs;
- The complexity of the business rules for service processing, service delivery and third party content;
- The importance and sophistication necessary to ensure traceability of queries and back-end analytics;
- The diversity of billing options (in order to minimise the issuing of "another" bill);
- The variety of payment options offered for services (e.g. pre-paid account, post pay, credit card). This option could be important for the integration of external party services looking to leverage payment options;
- The customer relationship management (CRM) strategy and the different instruments for providing this capability.

Clearly, mobile operators are well positioned to support the splitting of connectivity charging, from the back-end, B2B and B2C. The remaining value chain positions could be covered by other stakeholders, such as the automaker, a telematics service provider (TSP) or a systems integrator. However, operators are in a particularly good position to leverage these capabilities where:

- There is complexity with respect to:
 - Connectivity types and service beneficiaries;
 - Traceability of queries and back-end analytics;
 - Dynamic revenue management;
 - Multiple billing and payment options.
- Business rules around service delivery are straightforward;
- On-bill charging for external services is important.

The automaker (or the TSP on its behalf) could decide to maintain the charging integrator role in-house, especially where:

- Complexity is limited to the business rules around the service content;
- Charging and revenue management is simple and not excessively dynamic;
- Few billing and payment options are offered (at the risk of issuing a new bill to the end customer).

The factors influencing this division of responsibilities depends upon:

- The automaker's individual strategic priorities;
- The variety of the suite of the services offered;
- The degree of innovative business models employed;
- The number and degree of involvement of external parties in the service delivery;
- The existing infrastructure in place.

What is the GSMA doing to Support these Deployments?

Automakers and mobile operators have come together in the GSMA's Connected Car Forum (CCF) to work on overcoming the challenges facing embedded connectivity in the mid-to long-term, as well as addressing immediate obstacles to wireless tethering (IP sharing). This twin-track approach aims to help support both the short-term and long-term deployment of telematics and infotainment services.

Detailed Requirements

In its work to overcome the challenges related to embedded connectivity, the GSMA's mAutomotive initiative is focused on fostering the deployment of innovative business models for connected car services, through advanced split charging and billing mechanisms. This opportunity is a win-win situation for the industry and for the end customer, as it provides the flexibility necessary to offer new services in a seamless manner to all vehicle categories.

To date, the GSMA's mAutomotive activities have focused on:

- Defining the emerging automotive requirements in terms of capabilities and functionality;
- Identifying the matching operator capabilities;
- Delineating the prioritised use cases for charging and billing for emerging service categories;
- Identifying potential areas for future cooperation to increase the interoperability of services.

Building on these activities, the mAutomotive initiative is now building mutual understanding of operators' capabilities and automakers' requirements so as to:

- Foster new service typologies, and
- Leverage the large potential ecosystem of third party actors and revenue streams.

Remaining Challenges for the Future

The next stage of the GSMA's mAutomotive activities include:

- Defining more detailed functionality requirements for common connected car services, so as to provide insight into the level of commonalities across automaker requirements and further define the opportunity;
- Examine specific deployment scenarios, including the potential requirements of third parties for common connected car services;
- Showcasing capabilities targeted at the automotive sector. These demonstrations stimulate and promote innovation in the industry.

Open Questions for the Future

Additional areas of potential work have been identified and are being discussed within the GSMA's mAutomotive workstream:

Standardised Format for Information Exchange

A potential cross-industry work item for the future is the definition of a standardised format for information exchange between:

- Operators in roaming cases and/or
- Operators and the automaker for automaker-based charging and rating mechanisms.

As common interfaces are less expensive than bespoke interfaces for the industry as a whole, a standardised format for information exchange could play an essential role in enabling interparty business cases to come to market with minimal overhead costs.

The definition of such a format would also facilitate inter-operator settlement, both by guaranteeing enlarged footprints for solutions and by future-proofing solutions to be compatible with the forthcoming interoperable remotely provisionable SIM.

The GSMA's mAutomotive workstream is discussing the utility of investing in this activity.

Integrated Billing & Payment

Given that consumers are seeking to have as few bills as possible, the best means for providing integrated billing across services (and connectivity) remains an open question. What is the most unobtrusive manner to bill and pay for connected car services? Will this option remain a differentiator or will a common approach be utilised across automakers?

Business Case Details

The viability of these innovative business models also depends upon the business case around providing split charging, revenue management and billing capabilities. The development of common, standard automaker requirements on core functionality will enable a better analysis of the resource required to provide the needed capabilities. Furthermore, the analysis of the opportunity of leveraging these capabilities in other machine-to-machine sectors could contribute to a sustainable business case.

The GSMA's mAutomotive workstream will evaluate the opportunity to provide some initial thoughts on market sizing of this opportunity, after the next stage of activities.

Other Necessary Elements for Embedded Connectivity

Charging and billing capabilities are a critical part of enabling embedded solutions but additional elements are necessary to optimise the opportunities for embedded connectivity. In particular, embedded connectivity remains a challenging one-size-fits all solution for many concerns, including questions on the:

- Initial fitment:
 - Initial hardware costs;
 - The need for connectivity solutions to be as future-proof as possible for the lifetime of the vehicle in a timely and cost-effective manner
 - Existing solutions prohibitive costs and logistics difficulties associated to changing operators after production & during the lifetime of the vehicle
 - Need to Leverage Existing Consumer Mobile Services in Vehicle
- Sustainability of Operations
 - Limited deployment of connectivity models, which directly encourage the car to be part of the universe of “everything connected”. This issue is particularly compelling since consumers are showing little propensity to pay for new contracts for additional devices.
 - Operational Costs for high-bandwidth services, especially given the automakers’ need to provide global/regional solutions which often rely on permanent roaming solutions

These embedded connectivity barriers are expected to be reduced through a series of future developments, including the:

- regulatory fitment of embedded devices in many regions,
- standardisation activities (including the remotely provisionable SIM) and the
- evolution of connectivity business models.

The GSMA's Broader mAutomotive Priorities

The high-level objectives of the GSMA's mAutomotive workstream are to foster a positive outlook for embedded connectivity and facilitate additional opportunities for operators to provide value-added services. The programme is currently addressing additional barriers to embedded connectivity by:

- Supporting automotive use cases for remotely provisionable SIMs, including an automotive proof of concept;
- Further demonstrating requirements and capabilities for split-charging and revenue management as enablers for innovative business models for telematics and infotainment services;
- Supporting regulatory deployment for embedded module fitment. The GSMA is working to support the evolution from policy to regulatory deployment of recent telematics mandates (including: European eCall; ERA-GLONASS; SIMRAV), as well as facilitating value-add opportunities for new service development where possible.

The mAutomotive initiative is also working on:

- Improving interoperability of tethering for Bluetooth PAN/Dun profiles for IP Sharing;
- Building industry agreement on a single technical solution for next generation tethering, for which WiFi Direct appears to be a front-runner.
- Potential future programme activities include business development opportunities, such as:
 - High bandwidth connected car services and
 - The role of big data in improving and developing connected car services.

mAutomotive white papers published by the GSMA in 2012/13:

(<http://www.gsma.com/connectedliving/mautomotive/>):

- **Connecting Cars: the Technology Roadmap**, which outlines primary automotive and mobile network operator industrial characteristics, available resources for service deployment and the requirements for these services, both with respect to the current context and likely future developments. The document also explores the existing barriers to wider deployment of telematics and infotainment services and the opportunities offered by greater cooperation between automakers and mobile network operators.
- **2025 Every Car Connected: Forecasting the Growth and Opportunity**, which analyses the potential growth in in-car connectivity between now and 2025, as well as the types of connectivity that will eventually become predominant.
- **Connected Cars: Business Model Innovation**, which examines the basic constructs of business models for telematics and infotainment services, highlights some of the emerging trends, and explores the unique role mobile operators can play in this value chain.
- **Connecting Cars: Bring your Own Device – Tethering Challenges**, which highlights existing tethering challenges and identifies potential opportunities for cross-industry action to overcome these challenges, in the hopes of bringing connected car services a little closer to working out-of-the-box for consumers, whilst still making a positive contribution to the business of mobile operators.



About the GSMA Connected Car Forum

The GSMA Connected Car Forum (CCF) is a platform for sharing information between the automotive sector and mobile network operators. It is designed to enable joint cooperation and foster activities that may not be possible through existing bilateral business discussions in a timely manner. The Forum is a response to the explicit need, expressed by both automakers and mobile operators, to remove current barriers and to improve the speed and take up of telematics and infotainment services.

To demonstrate their joint commitment towards achieving results, many GSMA CCF members are laying the groundwork for connected cars to become ubiquitous. Targets include:

- More than 20% of vehicles sold worldwide in 2015 to include embedded connectivity solutions;
- More than 50% of vehicles sold worldwide in 2015 to be connected (either by embedded, tethered or smartphone integration);
- Every new car to be connected in multiple ways by 2025.

In order to achieve these ambitious goals, the global GSMA Connected Car Forum addresses cross-industry initiatives of international relevance, focusing on:

- Enablers for telematics service deployment;
- Current operative deployment problems;
- Strategic opportunities for the deployment of new services.

The global players participating in the GSMA Connected Car Forum are:

- Mobile operators: AT&T, Bell Canada, China Unicom, Deutsche Telecom, KDDI, KPN, KT, NTT Docomo, Orange, Rogers, Softbank, Telecom Italia, Telefonica, Telenor, Telstra, Turkcell, Verizon Wireless, Vodafone.
- Automakers: Audi, BMW, Chrysler, Fiat, Ford, GM, Honda, Hyundai, Jaguar Land Rover, Mazda, Nissan, Peugeot, Renault, Toyota, Volvo, VW.

About the Connected Living programme

Connected Living is a market development initiative whose mission is to help mobile operators accelerate the delivery of new connected devices and services. Our target is to assist in the creation of 700 million new mobile connections, whilst stimulating a number of service trials and launches in the Automotive, Education and Healthcare sectors. The Connected Living programme is also working with the city of Barcelona, the Mobile World Capital, to develop and showcase smart city services.

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