White Paper on the M-Commerce Landscape

Approved – 21 Dec 2005

Open Mobile Alliance

OMA-WP-McommerceLandscape-20051221-A

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1. Scope

The scope of the document is to describe a snapshot of the m-commerce landscape as at June 2003, with the aim of identifying the work of then existing specifications groups and industry fora. This formed the basis for analysis to identify overlaps where multiple fora were addressing the same areas, and gaps where no forum was addressing an m-commerce need.

The scope of this document is not to describe which type of interface should be used between different stakeholders, or express any type of requirements on the interfaces or the stakeholders.

2. References

[OMA] Open Mobile Alliance™ Technical Plenary, URL: http://www.openmobilealliance.org/

3. Terminology and Conventions

3.1 Conventions

This is an informative document, which is not intended to provide testable requirements to implementations.

The choice of terminology in generating a cross industry functional model is a delicate issue. One may focus on the difficulties in having a common language, or focus on the issues needing to be solved. For the sake of being able to make any kind of statements there need to be some kind of decision on what terms to use.

As a result of recording service usage, for real time usage of a service or as the means of exchanging funds to receive some kind of content, (either digital or physical), bills or direct payments (towards for example, credit cards or prepaid accounts) may be issued. The operation to tie the event to the interaction may be called remittance.

For remittance[1], the terms "payment," "charging" or "billing" may be used instead; however depending on the background of the reader these terms may convey different meanings. For simplicity, this report uses "payment" as the generic term for remittance but thereby not excluding or not taking a position to reduce the importance of any of the terms or systems.

3.2 Definitions

M-Commerce	Mobile Commerce The definition of Mobile Commerce is the exchange or buying and selling of services and goods, both physical and digital, from a mobile device. This means in this context, the concept of capabilities for a consumer to engage in commerce from a non-fixed location and without physical transfer of monies or the monetary equivalent. Specifically the ability to use a device that can easily be moved and can perform the financial transaction using a stored/aggregated account like an operator managed billing system, or without the physical presence of monetary instrument like cash, credit or debit card issued by a bank or a financial institution.
Commerce	The exchange or buying and selling of goods and services.
Payment	Is used as a general term including charging, billing etc. It is the mechanism by which funds are moved from the customer to the merchant in exchange for goods and/or services. It may be on a per transaction basis, or may be aggregated over a number of transactions.
Authentication	A property by which the correct identity of an entity or party is established with required assurance. Depending on the context, it also can be the process of verification of the identity of a person or process. In a communication system, authentication verifies that messages really come from their stated source.
Merchant	The entity offering goods or services. The merchant receives a payment from the customer in return for the goods or services.
Issuer	The entity that provides the customer with payment credentials. The payment credentials are usually specific to a particular payment system, and are used to make a payment with that payment system.
Acquirer	The entity to which the merchant provides the transaction credentials in order to receive the funds.
Local Payment	This is when the customer, buyer, has to be at merchants place, the place of the sale.
Remote Payment	This is when the customer does not have to be at the merchants place, the place of the sale.
Peer-to-Peer Payment	This is when a customer could act as merchant for another customer.
Identity	A collection of attributes which together specify a unique individual or entity.

[1] Or in plain words, to exchange funds for services, digital or physical goods.

Customer	The person or entity making use of the m-commerce system for the purpose of obtaining and paying for goods or services.
Charging	A function whereby information related to a chargeable operation is formatted and transferred in order to make it possible to determine usage for which the charged party may be billed.
Payment system	A physical realisation of a payment or charging method.
Payment scheme	The entity which governs, that is, defines the interfaces and rules for a payment system.

3.3 Abbreviations

3GPP	3rd Generation Partnership Project
3GPP2	3rd Generation Partnership Project 2
API	Application Programming Interfaces
AS	Application Server
ASP	Application Service Provider
CDG	CDMA Development Group
CDMA	Code Division Multiple Access
CPCF	Content Provider Charging Function
CS	Circuit Switched
ECBS	European Committee for Banking Standards
EDGE	Enhanced Data rates for GSM Evolution
ETSI	European Telecommunication Standardisation Institute
FDD	Frequency Division Duplex
FFS	For Further Study
FSP	Financial Service Provider
GBA	Global Billing Association
GPRS	General Packet Radio Service
GSM	Global System for Mobile communication
GSMA	GSM-Association
ID	Identity
IM	Instant Messaging
IMS	IP Multimedia Subsystem
IMSI	International Mobile Subscriber Identity
IP	Internet Protocol
IPR	Intellectual Property Right
IR	InfraRed
ISDN	Integrated Services Digital Network
ISV	Independent Software Vendors
IVR	Interactive Voice Response
IrDA	Infrared Data Association
IrFM	Infrared Financial Messaging
JPEG	Joint Photographic Experts Group

JVM	Java Virtual Machine
LAP	Liberty Alliance Project
MCC	OMA M-Commerce and Charging Working Group
MCIG	Mobile Commerce Interest Group
MCOM	OMA M-Commerce Working Group – the former name for the OMA M-Commerce and Charging Working Group
MID	Mobile Information Device
MMS	Multimedia Messaging Service
MPF	Mobile Payment Forum
MRFC	Media Resource Function Controller
MSISDN	Mobile Subscriber ISDN
MeT	Mobile electronic Transactions
OMA	Open Mobile Alliance
OSA	Open Service Access
PC	Personal Computer
PDF	Portable Document Format
PIN	Personal Identification Number
PKI	Public Key Infrastructure
PLMN	Public Land Mobile Network
POS	Point Of Sale
PS	Packet Switched
PSP	Payment Service Provider
PTD	Personal Trusted Device
SA5	Systems Aspects working group 5
SCCF	Subscriber Content Charging Function
SE	Security Element
SGML	Standard Generalised Markup Language
SOAP	Simple Object Access Protocol
SSO	Single Sign-On
SWB	Sub-Working Group
TC	Technical Committees
TCP/IP	Transmission Control Protocol / Internet Protocol
TDD	Time Division Duplex
TP	Technical Plenary
UE	User Equipment
USSD	Unstructured Supplementary Service Data
UTRA	Universal Terrestrial Radio Access
WAP	Wireless Application Protocol
WLAN	Wireless Local Area Network
XML	eXtensible Markup Language
t^2r	Trusted Transaction Roaming

4. Introduction

4.1 Objective

Multiple standards bodies, specifications, papers, industry organisations and companies have all addressed aspects of mobile commerce (m-commerce). Many are providing unique solutions on aspects of the m-commerce process, there is the potential for the duplication of work on several aspects of the m-commerce process. This duplication of work is viewed as fragmentation of the standards community surrounding not only m-commerce but also mobile services, or wireless, as a whole.

With the Open Mobile Alliance (OMA) an attempt is being made to harmonize, and where it makes sense consolidate, the fragmented work of the application layer of mobility. The Mobile Commerce and Charging Working Group, formerly known as the M-COMMERCE Working Group (MCOM), within OMA was chartered to evaluate the multitude of standards setting groups and specifications to provide a landscape view of the work achieved and currently in progress. To assist in this effort, a questionnaire was developed within the working group to solicit information from the various groups about their work, which could then be consumed and structured for analysis. The outcome of the analysis is this mobile commerce landscape report with recommendations backed by a framework of the processed input, gap analysis of the framework, a cross-link of requirements with work achieved, and a cross-link of requirements to groups with missions which could fulfil the requirements where no work was currently underway to fulfil the requirements.

This document intends to present the reader with a snapshot of the M-Commerce landscape as at June 2003.

4.2 Criteria for Choosing Target Forum or Organisations

The Mobile Commerce and Charging WG (MCC) charter identified a non-exclusive list of groups working with different aspects of M-Commerce. Sending a landscape questionnaire targeted these groups directly. The questionnaire was also made publicly available on the external OMA web site, and received answers were solicited into the analysis phase.

The target was standardization organisations and industry fora and not individual solution providers.

4.3 Methodology of Data Gathering

The MCC mapped the answers from the different organizations into a general functional model. In the functional model, based on the gathered responses, the roles involved were identified and described.

The group extracted from the Questionnaire the objectives that are covered by the different organizations such as working on requirements and/or specifications.

The group used the respondees' input to map their areas of activities to an OMA Architectural model, covering any area of requirements and any specifications from the different organizations.

4.4 Responses from Groups

Many answers were received. The answers in general were very detailed.

The table below shows the status of the responses received from the different fora.

3GPP	Answer and references to the specifications received from the SA5 SWB within 3GPP.
3GPP2	Answer and references to the specifications received from 3GPP2 TSG-X.
CDG	Answers received.
ECBS	Cover letter and two specifications received.
ETSI	No answer received.

FINREAD	No answer received.
GBA	Answer together with a presentation received.
GSMA	Answer and a white paper received.
IrDA	Answers received.
Liberty Alliance Project	Answers received.
MeT	Answer and white papers received.
Mobey Forum	Answer together with a presentation received.
Mobile Payment Forum	Answer and a white paper received.
Parlay	Answers received.
PayCircle	Answers and specifications received.
Radicchio	Answers together with use cases and best practice received.

5. Scope and Output of Groups Activities

The MCC extracted the focus and output of the different organisations from the received responses to the questionnaire, the result of this activity can be found in the table below.

The column "requirements available", indicates that requirements on external entities are available from the forum. The MCC group does recognize that each forum must have requirements of internal nature within their respective scope. Requirements aimed for internal use do not show up as YES in the table.

	Focus of the group	Output	Requirements available	Specifications available
3GPP (SA5 SWB)	Network specifications-charging/billing	Specifications and requirements	YES	YES
3GPP2 (TSG-X)	Technical specifications for the evolution of the cdma2000®[2] technology.	Specifications and requirements	YES	YES
CDG	Micro-payments	Requirements	NO	NO
ECBS	Banking infrastructure	Guidelines for implementation	YES	UNKNOWN
	-	-	-	-
GBA	Business focus, billing, 3G issues	Whitepapers, reports - focus on business models	NO	NO
GSMA	Browsing, and micro-payments	Requirements	YES	NO
IrDA	Transport, local data transfer	Requirements and specifications	YES	YES
Liberty Alliance Project	Privacy and identity	Specifications / framework	NO	YES
MeT	Terminal applications	Specifications and best practices	NO	YES
Mobey Forum	Mobile banking, payments services and authentication	Requirements and implementation guidelines	YES	NO
MPF	Mobile payments building blocks, front end	Requirements and optionally specifications	YES	NO
Parlay	Open, tech. independent API's	Specifications	NO	YES
PayCircle	Open payments API	Specifications	NO	YES
Radicchio	Identity framework	Requirements	YES	NO

[2] cdma2000® is the trademark for the technical nomenclature for certain specifications and standards of the Organizational Partners (OPs) of 3GPP2. Geographically (and as of the date of publications), cdm2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA) in the United States.

6. Reference Model

6.1 General Reference Model for Mobile Commerce

Mobile Commerce brings together a number of industries with different terminology, understandings of, and underlying architectures for, payment, charging and billing. In addition, each of the fora working within mobile commerce has developed different terminology and architectures. Evaluating the landscape of mobile commerce is simplified if a reference model for mobile commerce is developed onto which mobile commerce systems may be mapped.

A functional reference model has been developed withinMCC. This is an abstract model which identifies the four key roles in any mobile commerce transaction. In practice, one or more roles may be played by a single entity (for example, an operator may play the role of issuer and acquirer in a charging system), or the functions of a role may be distributed between more than one physical entity (for example, a consumer may delegate some of the functionality to a wallet).

The model is designed to be as general as possible, and to be applicable to all forms of payment and charging. The model does not imply a particular order in which the functions occur, nor does it indicate over which channel each of the functions takes place. In a given payment or charging system (that is, a physical realisation of the payment or charging part of the mobile commerce model) some of the functions may be implicit.

The four roles identified by the general reference model are:

- The Customer who wishes to obtain goods or services
- The Merchant who provides goods or services
- The Issuer who provides the consumer with a means to pay for the goods or services
- The Acquirer with whom the merchant interacts to receive funds for the goods or services

The model is described in more detail below.

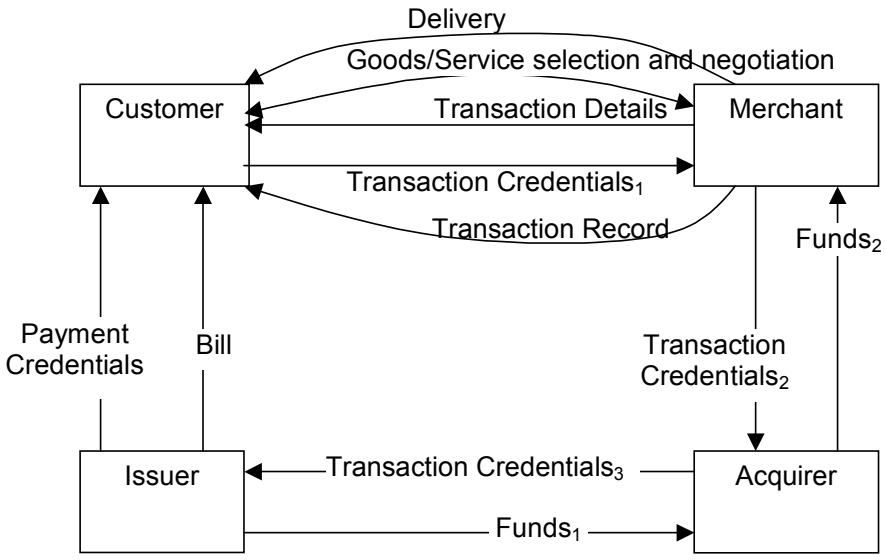

Figure 1: M-Commerce Reference Model

6.1.1 Negotiation and Delivery

The customer and the merchant must interact in order for the customer to select services, and for the two entities to negotiate goods and services required, the conditions under which the goods and services are provided, and the price for the goods and

services. This phase includes *advertising* or *discovery*, by which the availability of goods and services is made known to the customer by the merchant. It also includes a selection phase where the customer indicates to the merchant what goods and services are desired. The customer and merchant also negotiate the price of the goods and services, as well as the terms and conditions.

The merchant delivers the goods and/or services to the customer (Delivery). The means of delivery vary depending on the nature of the goods/services, for example digital goods may be delivered over the mobile channel, whereas physical goods must be delivered physically. In a subscription model, the services may be delivered over a period of time after the purchase of the subscription.

Associated with the delivery is payment for the goods and/or services. The relative timing of the delivery and payment can vary depending on the type of goods and services, the type of payment, and the rules of the payment scheme.

6.1.2 Payment Credentials

In order to allow the customer to make payments, the issuer must first provide *payment credentials* to the customer.

The nature of the *payment credentials*, and the method by which they are conveyed, may vary between payment systems, and they need not have any intrinsic value (although in some systems they may).

6.1.3 Transaction Credentials

The payment credentials are then used to execute a transaction with a merchant. After a phase of negotiation between the customer and the merchant, in which the goods or services and associated price are determined, the merchant provides the customer with the *transaction details*. The customer then responds to the merchant with *transaction credentials*$_1$.

The transaction credentials are derived from the payment credentials but with potentially more information. The transaction credentials need to convey to the issuer's satisfaction that the customer was entitled to make use of the payment credentials, and that the customer approved the particular transaction. Thus the transaction credentials are formed from a combination of the payment credentials, the transaction details, and some authentication of the customer.

The form of the transaction credentials, the extent to which customer authentication is required, and the type of authentication all vary from one payment system to another. Further, it should be noted that, while the authentication is for the benefit of the issuer, the issuer might delegate the authentication function to another party.

The merchant needs to ensure to their satisfaction that the transaction credentials provided to them are valid since they expect to receive funds on the basis of transaction credentials.

The transaction credentials may contain sufficient information to provide validation (for example, a bank note contains many features to verify it is genuine), or it may require additional steps to verify the credentials (for example, the merchant may request an authorization of a credit card transaction). The need for, and the means of, validation vary from payment system to payment system, and may vary from merchant to merchant.

The merchant provides some derivative of the transaction credentials (indicated in Figure 1 as *Transaction Credentials*$_2$) to the acquirer, in order to request funds. The means by which the *Transaction Credentials*$_2$ are sent, and the form are dependent upon the payment system.

The merchant provides a *Transaction Record* providing information about the transaction details and the status of the transaction to the customer.

The acquirer passes a derivative of the *Transaction Credentials*$_2$ received from the merchant (indicated in Figure 1as *Transaction Credentials*$_3$) to the issuer. On the basis of *Transaction Credentials*$_3$ the issuer releases *Funds*$_1$ to the acquirer, who in turn provides the *Funds*$_2$ to the merchant. The issuer also sends a *Bill* to the customer.

Note that the description above provides an abstract view of what information is passed between the various parties to the transaction. It does not indicate any particular ordering of the information flow. For example, for a stored value system or cash, the issuer obtains funds from the customer at the time of issuing the credentials.

The sending of transaction credentials may be done in multiple steps, or only performed based on various conditions. The particulars are specific to a payment system.

6.2 Mapping

To have a common understanding of the different fora working areas they are all mapped to the same functional model for mobile commerce.

6.2.1 3GPP

General information provided by 3GPP:

The original scope of 3GPP was to produce globally applicable Technical Specifications and Technical Reports for a 3rd Generation Mobile System based on evolved GSM core networks and the radio access technologies that they support (i.e., Universal Terrestrial Radio Access (UTRA) both Frequency Division Duplex (FDD) and Time Division Duplex (TDD) modes). The scope was subsequently amended to include the maintenance and development of the Global System for Mobile communication (GSM) Technical Specifications and Technical Reports including evolved radio access technologies (e.g. General Packet Radio Service (GPRS) and Enhanced Data rates for GSM Evolution (EDGE)).

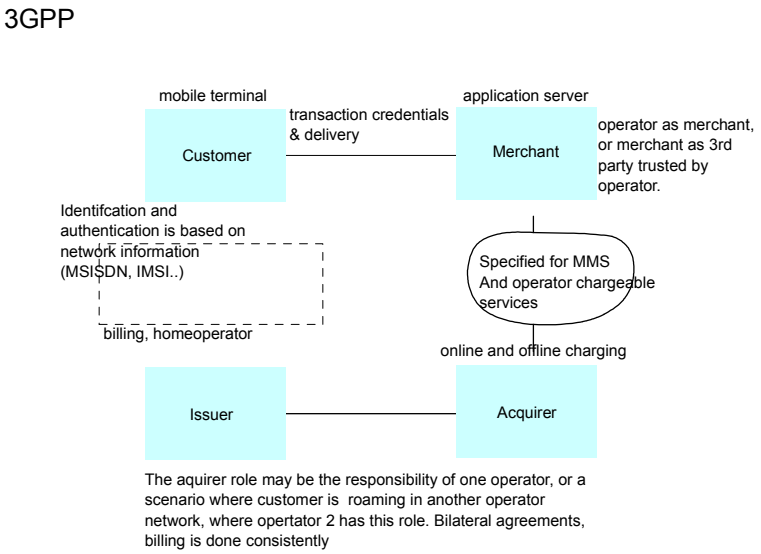

Figure 2: 3GPP Mapping to M-Commerce Reference Model

By looking at the 3GPP charging architectures, the following roles can be mapped to the functional model.

Customer: Customer can be a mobile terminal user using, for example, a GPRS or WLAN access to connect to the service.

Merchant: Merchant is providing the service. In the 3GPP charging architectures the Application Server (AS) has this role. 3GPP defines the charging data for application services. Currently only the description of the MMS charging data (off-line) is being defined. For the on-line charging of application services, 3GPP has introduced the content provider charging function (CPCF). The CPCF is defined as follows:

"The **Content Provider Charging Function (CPCF)** manages the account that is maintained for the content provider. Upon receipt of a charging request from the AS/MRFC (Media Resource Function Controller), the CPCF processes the request and relays it to the SCCF (Subscriber Content Charging Function). The CPCF modifies the account of the content provider accordingly.

In particular, the CPCF has the following responsibilities:

- To handle charging requests from the AS/MRFC.
- To interact with the SCCF that manages the communication with the subscriber's account. This interaction may include requests to the SCCF to charge or to credit the account of the subscriber.

As it is not expected that every content provider have a business relationship with every IMS network operator, the CPCF may be located in the operator network or in another network such as for example a Service Provider network that supports the AS/MRFC. However, the second case (CPCF outside of the IMS network operator domain) is not specified in Release 5 of this specification."

Acquirer/Issuer: In the 3GPP charging model the charging and the billing systems (on-line or off-line), is taking the roles of both the acquirer and the issuer. It must be noted that 3GPP is considering mostly the charging aspects, not the implementation of the billing system.

6.2.2 3GPP2

General information provided by 3GPP2:

The role of 3GPP2 is the development of the technical specification for the evolution of cdma2000®[3] technology. Some technologies specified by 3GPP2 may prove useful for the development of m-commerce products and services, but 3GPP2 does not establish a position on future deployment scenarios. M-commerce applications have been successfully deployed in cdma2000 networks®[3].

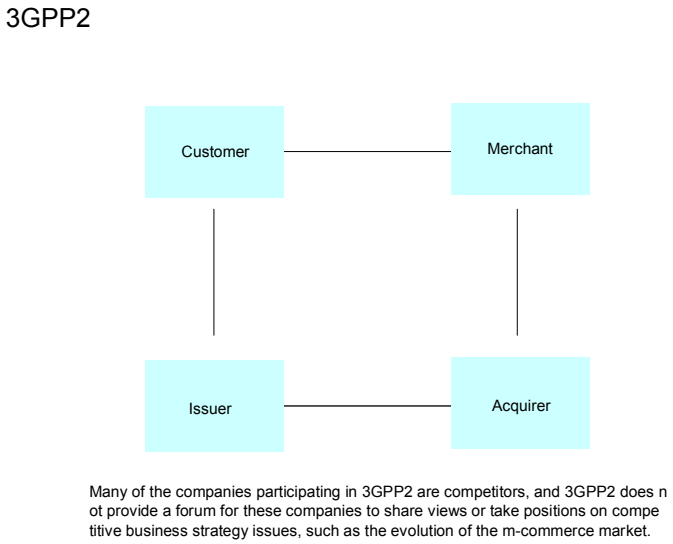

Figure 3: 3GPP2 Mapping to M-Commerce Reference Model

Accounting is the term used in 3GPP2 to describe the process of gathering data about resource usage for a user of the network. The data collected includes (but is not limited to) the amount of time a user is connected to the network, the amount of data the user sends to and receives from the network, and the quality of service (resources consumed) for the user's

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network traffic, This accounting information is delivered to a network entity (typically an Authentication, Authorization and Accounting Server) for storage until forwarded to a billing center.

6.2.3 CDG

General information provided by CDG:

The CDMA Development Group (CDG) is an international consortium of companies who have joined together to lead the adoption and evolution of CDMA wireless systems around the world.

The CDG is comprised of the world's leading CDMA service providers and manufacturers.

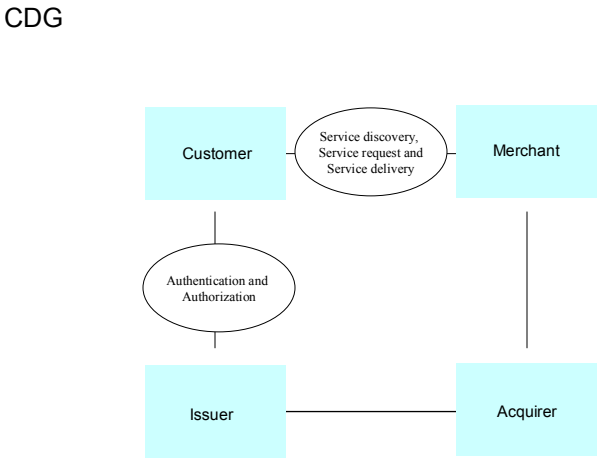


Figure 4: CDG Mapping to M-Commerce Reference Model

In CDG's view, the customer is also a subscriber to the mobile network service. Thus the issuer in the figure above is the mobile network operator. In order for the customer to discover and purchase a product/service from a merchant, the merchant and the issuer must have an already established business relationship. Even though the role of the acquirer is recognized, at present, the mobile network operator acts as the issuer, on the basis of the pre-established business relationships.

6.2.4 ECBS

General information provided by ECBS:

The European Committee for Banking Standards (ECBS) was formed in December 1992 by Europe's three credit sector associations, the Banking Federation of the European Union, the European Association of Co-operative Banks, and the European Savings Banks Group (collectively known as the European Credit Sector Associations or ECSAs).

ECBS' primary aim is to enhance the European technical banking infrastructure by developing standards once clear business and commercial interests have been identified. ECBS produces technical reports and standard implementation guidelines aimed at assisting the European banking sector's application of relevant standards. It is the body for creating awareness of the European banking sector's opinion on relevant matters to the various standards and industry bodies.

The work of ECBS is divided between four technical committees. Electronic services, administered by TC6, have a working group (WG4) which was created in mid-2001 to work on mobile payments. This group has defined the requirements of the banking community in a technical report entitled "Business and Functional Requirements for Mobile Payments", which was published in March 2003 and is available on the ECBS web site (http://www.ecbs.org). Their next main objective is to produce implementation guidelines for these requirements.

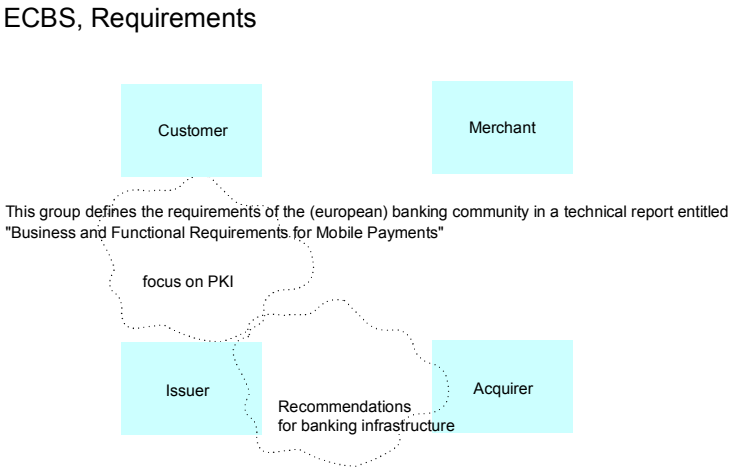


Figure 5: ECBS Mapping to M-Commerce Reference Model

ECBS defines the requirements of the (European) banking community in a technical report entitled “Business and Functional Requirement for Mobile Payments”. One of the main ECBS focus area lies on security issues like Public Key Infrastructure.

6.2.5 GBA

General information provided by GBA:

Most important point about the GBA is that whilst Billing is its central focus, it strives to give Billing Managers a view of what challenges lie ahead, and therefore has a very wide, business focus for its discussions.

No specific roles identified as affected in the received response from GBA. The answer from GBA does state however, that within its scope, one of the most important things that the GBA sees, is the need for being able to discover content on the network [service discovery] - stated here because it is explicitly mentioned.

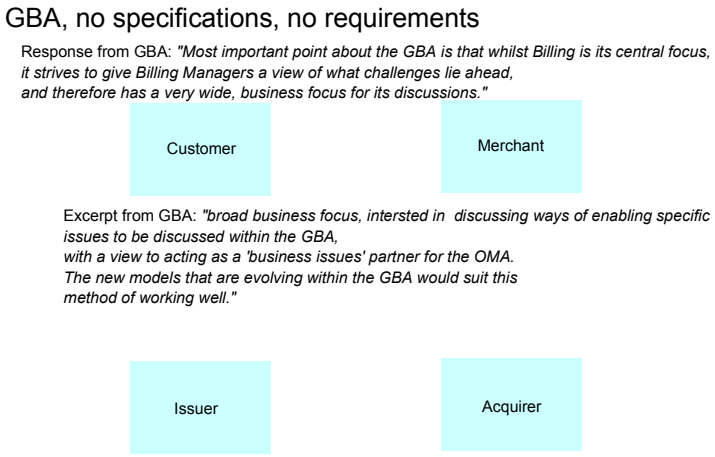


Figure 6: GBA Mapping to M-Commerce Reference Model

No specific description to reference model picture for this organisation.

6.2.6 GSMA

General information provided by GSMA:

The GSM-Association MCIG Task Force has been set up to examine what are key enablers to ensuring operators are well positioned to deploy new advanced user services and to ensuring operators are well placed to capitalise on opportunities to deliver new services in the emerging M-Commerce arena. The scope of work will include, amongst others, developing operator requirements in a number of areas, including the standardisation of browsers, ensuring those requirements are actioned by the appropriate standardisation bodies and ensuring that accessing a full complement of new advanced services will be a reality for roaming subscribers.

MCIG currently focuses on the area of micro-payments, addressing several possible technical models, legal and regulatory issues, fraud and security, and roaming implications.

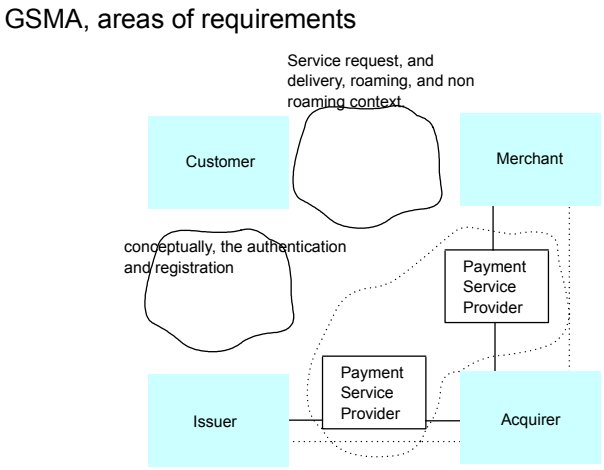


Figure 7: GSMA Mapping to M-Commerce Reference Model

According to the requirements presented by the GSMA, the Merchant establishes a business relationship with an entity offering connectivity to the Mobile Operator micro-payment services at registration (acquirer). This entity is depending on the deployment model considered.

Customer registration is the responsibility of the Mobile operator, which maintains the business relationships with the mobile subscriber.

Customer can request services over any channel, including mobile, Internet and unattended POS. MCIG focuses on the issues with service request interoperability when roaming across different networks.

6.2.7 IrDA

General information provided by IrDA:

The focus of IrDA's IrFM specification is to establish a standard method for communicating payment data and related data (coupons, tickets, vouchers, identification, etc…) between a mobile device (Personal Trusted Device – PTD) and a terminal (POS or payment terminal in most cases, but includes any type of terminal that would want two-way exchange of payment or related data). The objective is to change as little as possible the current infrastructure on both the PTD and terminal.

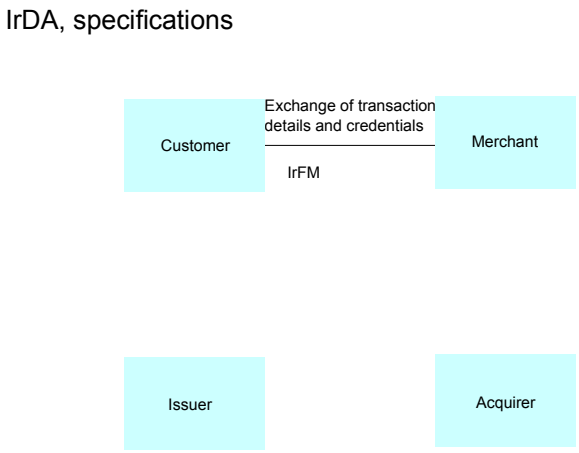


Figure 8: IrDA Mapping to M-Commerce Reference Model

The Figure 8 depicts the mapping of activities of IrDA the interaction is between the consumer and the merchant as a stand-alone application, exchanging details of a peer-to-peer transaction.

6.2.8 Liberty Alliance Project

General information provided by Liberty Alliance Project:

Liberty Alliance Project is not specifically concerned with mobile commerce, but with e-commerce at large. The Liberty Alliance Project specifications do address mobile specific issues. Liberty Alliance Identity Federation Framework 1.1 (ID-FF 1.1) specification is part of the OMA MWS OWSER 1.0 specification set.

Liberty Alliance Projectcan be understood as two frameworks:

- Liberty Federated Identity Framework for federated identity and single sign-on
  - Consists of Identity Federation Framework (ID-FF) 1.1/1.2 and OASIS Security Services Technical Committee (SS TC) Security Assertion Markup Language (SAML) 2.0 specifications
    - SAML 2.0 is a converged specification including ID-FF 1.1/1.2 features
- Liberty Identity Web Services is providing a framework for Discovering, Invoking and defining Web Services.

Liberty Alliance specifications are available at:
http://www.projectliberty.org/resources/specifications.php

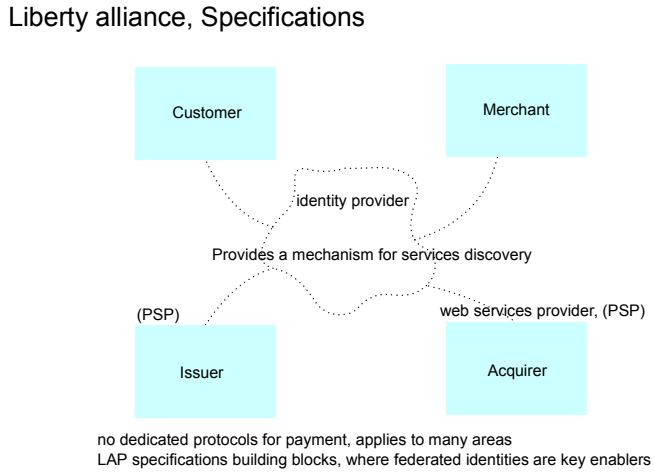


Figure 9: Liberty Alliance Project Mapping to M-Commerce Reference Model

In comparison to M-Commerce reference model Liberty Alliance Project introduces one new role:
Identity Provider: This entity provides authentication (and possibly) discovery service for the principal that can be used by the service provider (including the web service provider).

The architecture used by Liberty Alliance Project describes PSP as Web Service Provider that is used by the Merchant (Service Provider). The issuer can be understood as identity provider in the case of authentication but if mapped solely in the context of payment the issuer is another service provider (and web service provider) that can utilize external identity provider for the identity federation.

6.2.9 MeT

General information provided by MeT:

MeT primarily seeks to create an open framework for mobile electronic transactions, relying on existing specifications wherever possible. However, it does issue specifications covering areas that are not fully covered by existing specifications. Three sets of specifications have been released to date: Releases 1.0, 1.1 and 2.0. MeT also produces marketing white papers which describe its view of the likely (and preferred) evolution of the m-commerce landscape.

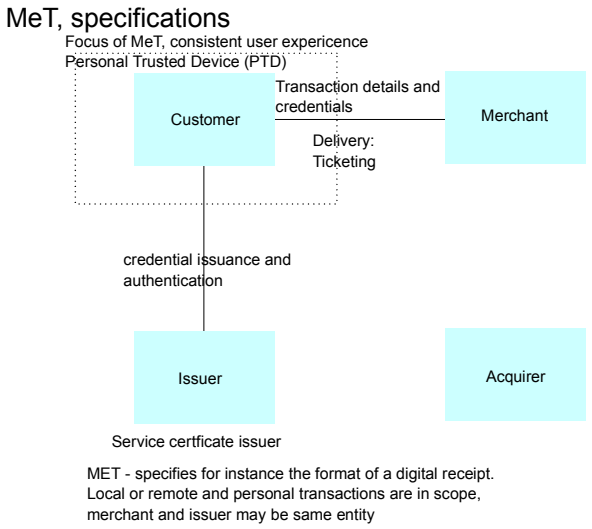


Figure 10: MeT Mapping to M-Commerce Reference Model

The Figure 10 is a generic model, but in many MeT scenarios the issuer, acquirer and/or merchant can be reduced to two or to even one entity. MeT also classifies different environments in which MeT –enabled transactions will occur: remote, local and personal. In the remote environment PTD (Personal Trusted Device) uses the PLMN (Public Land Mobile Network), e.g. GSM, to connect to the Content server. In the local environment a short-range wireless technology, e.g. Bluetooth, is used. In the personal environment PTD is used to enable a secure transaction while using another communication device, e.g. a PC.

6.2.10 Mobey Forum

General information provided by Mobey Forum:

The scope is covering wide range of mobile financial services starting from mobile banking (such as information services, bill payments, stock trading), remote and local payments (with and without credit cards, ranging from micro to macro) and ID services (authenticating customers for 3rd parties, e.g. public authorities and other service providers)

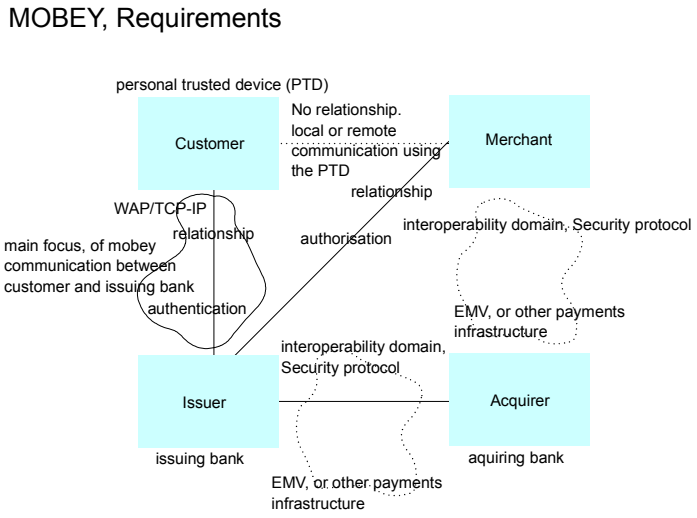


Figure 11: Mobey Forum Mapping to M-Commerce Reference Model

Figure 11 shows the generic model with the three most important elements of the Mobey Forum model. They are:

- Authentication mechanisms. How the issuer authenticates the customer securely in different situations. Issues such as Personal Trusted Device (PTD), Security Element (SE, place where the credentials are stored), PKI, etc. relate to this subject.
- Server Based Wallets in remote payments. Payment products reside in a server managed usually by Issuer. In local payments the payment method resides in the mobile device (is possible in remote payments as well).
- Secure Interoperability Domain. This enables the secure interoperability between different entities.

Additionally, Mobey Forum has evaluated how different technologies can be used to offer mobile financial services securely and conveniently for the consumer. The key element, which is used in evaluations and in model structuring, is the requirements that Mobey Forum has formulated. They apply both to business and technological issues.

6.2.11 Mobile Payment Forum

General information provided by Mobile Payment Forum:

The MPF has limited its scope to mobile payments, and to the "front end." That is, the interaction between the user and the merchant, and possibly the issuer for payment (note that these parties may delegate some of the interaction to other entities in order to simplify the payment process).

The exact nature of these interactions is generally dependent on the payment scheme which sets the rules for the transaction processing, but there are many areas, or building blocks, which are common to multiple schemes (for example, authentication). The MPF is concentrating on these building blocks.

The initial priority of the forum has been on card payments over the mobile channel; however as the building blocks are being developed, these may also be applicable to all types of payment. The MPF has not excluded any particular types of mobile payments from its scope.

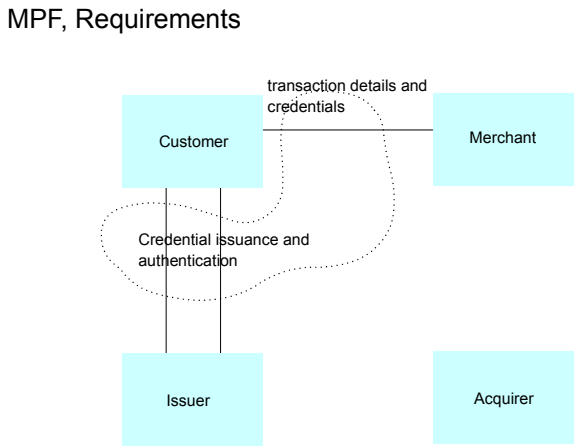


Figure 12: Mapping to M-Commerce Reference Model

Figure 12 depicts the mapping of the activities of the MPF. Note that this is a mapping of the functional activities – it does not necessarily identify the entities which actually perform the roles. The MPF in general does not constrain who may play each role (issuer, acquirer, etc), however some of the specific activities are most suited to specific entities playing a particular role.

The work of configuration and maintenance of the mobile device as a payment instrument maps onto the issuing of credentials for mobile payment.

The process activities are concerned with the exchange of transaction related information and credentials between the merchant and the customer. This includes the generation of transaction credentials, which may require authentication by the issuer.

The authentication activities are concerned with authentication of the customer by the issuer.

The MPF does not specify and end to end payment solution. Rather it is working on building blocks which may be used to deploy a mobile payment solution. The work of the MPF is concerned with the interaction between the customer and the merchant, and possibly the issuer for payment (note that these parties may delegate some of the interaction to other entities in order to simplify the payment process).

6.2.12 Parlay

General information provided by Parlay:

The Parlay Group is an open multi-vendor consortium formed to develop open technology-independent application programming interfaces (APIs) enabling: technology, Internet and eBusiness companies, independent software vendors (ISVs), software developers, network device vendors and providers, service bureaus, application service providers (ASPs), application suppliers, and large and small enterprises to develop applications and technology solutions that operate across multiple networking platform environments.

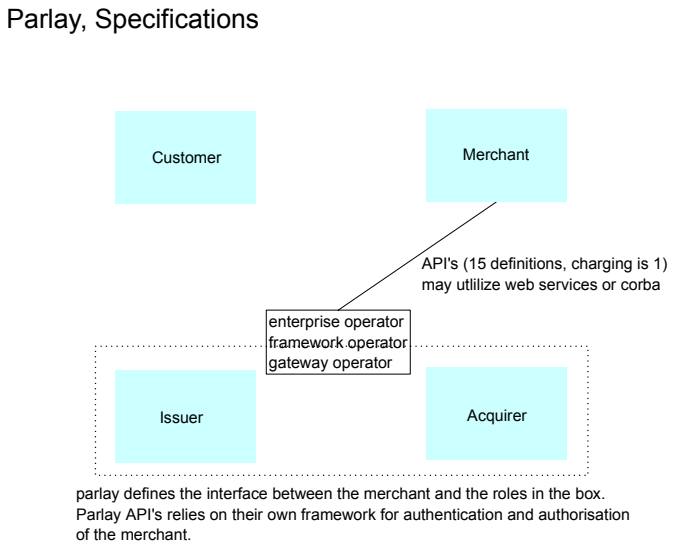


Figure 13: Parlay Mapping to M-Commerce Reference Model

Parlay defines user or consumer of service which is equivalent to customer in the m-commerce reference model. The issuer and acquirer roles are not defined in Parlay instead Parlay defines the enterprise, framework and gateway operator which is similar to the issuer and acquirer roles. There are also service supplier, retailer and subscriber roles defined in Parlay, these roles could be mapped to the m-commerce model but on another abstraction level. For clarity, these roles has been left out of the figure. The roles could be mapped in a similar way where the service supplier and retailer are mapped to the acquirer and issuer role and service subscriber to the merchant role.

6.2.13 PayCircle

General information provided by PayCircle:

Its main focus is to accelerate the use of payment technology and develop or adopt open payment APIs (uniform Application Programming Interfaces) based on XML, SOAP, Java and other Internet languages.

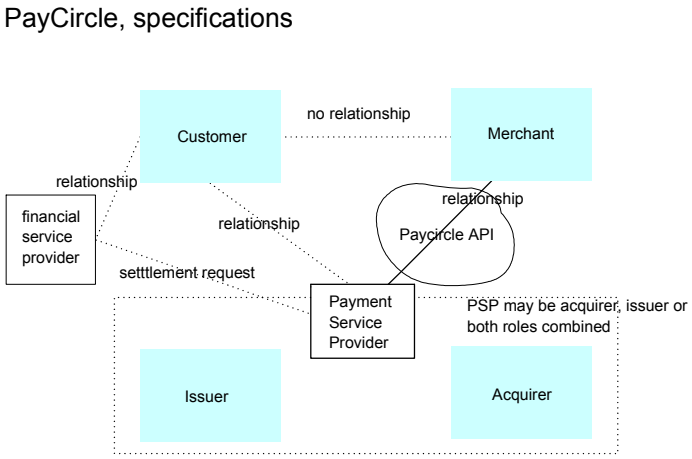


Figure 14: PayCircle Mapping to M-Commerce Reference Model

In comparison to the m-commerce reference model PayCircle does not explicitly distinguish between Issuer and Acquirer. Both of these roles are functions of PayCircle's PSP. The roles are not static; a PSP may act as an Issuer in one concrete scenario and as an Acquirer in another. This is reflected by the terms Subscriber Charging Function and Content Provider Charging Function, originally introduced in 3GPP Rel. 5. The interaction between them is out of scope for PayCircle.

Note however that the PayCircle model introduces the additional role of an FSP (a bank). PayCircle feels that this is an important role together with the associated settlement functionality.

6.2.14 Radicchio

General information provided by Radicchio:

Radicchio's focus is **"Trusted Transaction Roaming - t²r"**. t²r defines an identity framework, which enables mobile operators, financial institutions, governments and other service providers to strongly identify the end-user via the user's mobile device, and thereby lower the risk and cost of e-commerce services. It comprises transactions in a broad/general sense, for example, strong end-user identity could reduce the risk of chargeback for merchants and could enable authenticated access to services such as corporate and government portals. The identification framework works across both national and network borders, even while outside the home operator's network.

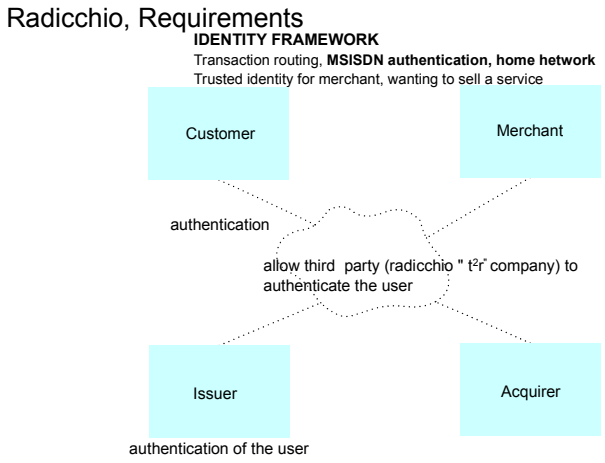


Figure 15: Radicchio Mapping to M-Commerce Reference Model

For Radicchio the Reference Model can be viewed in the model with additional descriptions of elements of the t^2r framework. These elements allow a trusted exchange of identification to be provided to an ID service requestor. The resulting exchange can be ultimately reduced to a the classic flow of exchange between the 4 components of our model but key is the addition of a higher layer of exchange placed on the 4 components by introducing agents of an issuer. This is viewed as trust worthier and more capable of authentication than between current components. By having layers of certification mapped to a risk model for transactions allows the higher-level infrastructure to provide a one-stop shop of certification no matter the risk of the transaction. By placing a higher-level infrastructure in place creates a less stringent flow of communication between the 4 players of our model by allowing different flows between the players depending on the type of certification needed for a transaction.

6.3 Summary of Functional Model Mapping Aspects

The following table describes which fora focus on which interaction in the m-commerce reference model. The main scope / leading activity is indicated by an "X" in the table. This is derived directly from the questionnaire answers.

	Transaction details Consumer / Merchant	Transaction Credentials Merchant / Acquirer	Acquirer / Issuer	Issuer / Consumer	Billing
3GPP (SA5 SWB)		X	X		X[4]
3GPP2 (TSG-X)					
CDG			X		X
ECBS			X	X	
GBA					X
GSMA			X		X
IrDA	X				
Liberty Alliance Project					
MeT	X[5]			X[6]	
Mobey Forum				X[7]	
MPF	X			X[8]	
Parlay		X[9]			
PayCircle		X[10]			
Radicchio				X	

[4] Charging and billing mechanisms and data to be able to charge for network usage.

[5] Delivery - ticketing is getting goods that you buy.

[6] Credential issuance and authentication - based on the PTD concept, and functionality.

[7] Credential issuance and bank authenticated customers.

[8] Provisioning payment credentials for use of mobile payments.

[9] This is similar focus area as PayCircle API.

[10] This is similar focus area as Parlay X Payment API (i.e. 3GPP TS 29.199-06).

7. General Analysis for Landscape Mapping

7.1 Operator/Banking Based Infrastructure

Many of the fora that have submitted responses use either operator or banking infrastructure as a base for their requirements, specifications, or best practice. The use of the same infrastructure by different fora does not imply that their requirements, specifications, or best practice will be on the same type of interface or function. There may be overlaps between fora that uses different infrastructure. Still this will give a quick overview of where the requirements are coming from.

The following fora use mainly banking infrastructure:

- ECBS
- IrDA
- Mobey Forum

The following fora use mainly operator infrastructure:

- 3GPP
- 3GPP2
- CDG
- GBA
- GSMA
- Parlay

The following fora do not reference to a specific infrastructure, i.e. they try to incorporate both the banking and the operator infrastructure:

- MeT
- MPF
- PayCircle
- Radicchio

Liberty Alliance Project model is not associated with any infrastructure and it should be possible to use it with any infrastructure.

7.2 Type of Payment

The payments have been divided in three different types: remote, local and peer-to-peer.

The MCC analysis has placed the different fora into remote, local and peer-to-peer payment areas of interest. A further distinction is made between their main focuses or simply applicable for that area of interest.

For 3GPP2 it was quite difficult to place where it could be applicable from the answers.

7.2.1 Remote Payment

The following fora have the remote payment as a focus:

- 3GPP
- CDG
- GSMA
- MeT
- Mobey Forum
- MPF
- Parlay

- PayCircle

The output of the following fora is applicable to remote payment:

- ECBS
- GBA
- Liberty Alliance Project
- Radicchio

7.2.2 Local Payment

The following fora have the local payment as a focus:

- ECBS
- IrDA
- MeT
- Mobey Forum
- PayCircle

The output of the following fora is applicable to local payment:

- GBA
- Liberty Alliance Project
- MPF
- Radicchio

7.2.3 Peer-to-Peer

The following fora have the peer-to-peer payment as a focus:

- IrDA
- MeT

The output of the following fora is applicable to peer-to-peer payment:

- ECBS
- GBA
- Liberty Alliance Project
- Mobey Forum
- MPF
- Radicchio

7.3 Common Functionalities

7.3.1 Identity and Authentication

There are a number of fora that have identity and authentication in their scope.

3GPP is defining identity management for the user equipment (UE) e.g. mobile devices. Identification and authentication is based on network information (MSISDN and IMSI).

CDG assumes and requires the CDMA operators to provide the necessary mechanisms to identify their subscribers. This unique identity is also used in m-commerce transactions.

GSMA has requirements for the use of MSISDN and the storage media. The GSMA is not going to work on an identity specification.

Liberty Alliance Project defines an identity framework for communicating identity.

MeT has specific requirements for authentication.

Mobey Forum is not enforcing or recommending any specific technology for identity, but there are requirements for the management of identity in a secure manner. Mobey Forum is also setting requirements for authentication. The mechanism could be different in different environments and services, i.e. authentication mechanisms may be PKI, MSISDN, PIN codes etc.

MPF is looking at authentication mechanisms for payments.

Radicchio defines business rules and specific implementation guidelines and infrastructure for creating a trusted authentication transaction and communicates authentication.

7.3.2 Transport

There following fora have the transport mechanism as a focus in their scope:

3GPP defines network specifications for charging and billing.

3GPP2 defines network specifications for call detail recording.

IrDA defines the exchange of transactions details and credentials typically used over IR, but is applicable over other transports as well such as Bluetooth. Focused on technologies around local exchange of information.

8. Compatibility Aspects

In the process of processing the different questionnaire responses from the organisations, there were identified commonalities between solutions, dimensions and layers. Several different technical layers may exist. For example one forum may define technical functionality and another forum defines an implementation for it.

From the different answers, it is necessary to analyse how the different fora are compatible with each other.
Two examples are given below, one on layered compatibility, where apparent overlap is an issue, but by analysing the answers it can be determined that although Radicchio and Liberty Alliance work on the same issues in the same space, they focus on different layers of a solution, and Radicchio has now been incorporated with Liberty Alliance.

The other example is of Parlay, and PayCircle who complement each other within the same technical logical layer.

These two samples, should be treated as examples of compatibility aspects, further study is necessary in the form of a GAP analysis to determine overlaps, and gaps between solutions, as well as complementing work between the different organisations.

Liberty Alliance Project and Radicchio

Examination of Liberty Alliance Project's implementation shows a framework for providing the Identify of players in a financial transaction. Requesting identity, delivery discovery, and mapping an identity is clearly described in their specification.

Radicchio describes an implementation model which provides for the use of identity in authentication schemes. It does not itself describe the particulars of the identity framework. The Radicchio model is also communicated as an implementation guide, business model and best practices guide. In several places Radicchio identifies a dependency on Liberty Alliance Project framework for implementing an authentication scheme.

Radicchio has merged with Liberty Alliance and their solutions have been merged into a single solution, thus there is no overlap or dependencies anymore.

Parlay and PayCircle

Parlay and PayCircle share their main scope "transactions credentials / merchant acquirer". Both fora announced 27 May 2003 to be jointly working on a Payment web service, which is now published as 3GPP TS 29.199-06. Within The Parlay Group, this specification is part of a whole set of web services published by 3GPP as TS 29.199 parts. Alignment between Parlay and PayCircle is thereby ensured.

9. OMA Architectural Model

9.1 General Architectural Model

Figure 16 represents OMA's Basic Architecture that was available at the time of writing this document. It represents a top-level architecture although seen as the initial OMA architecture.

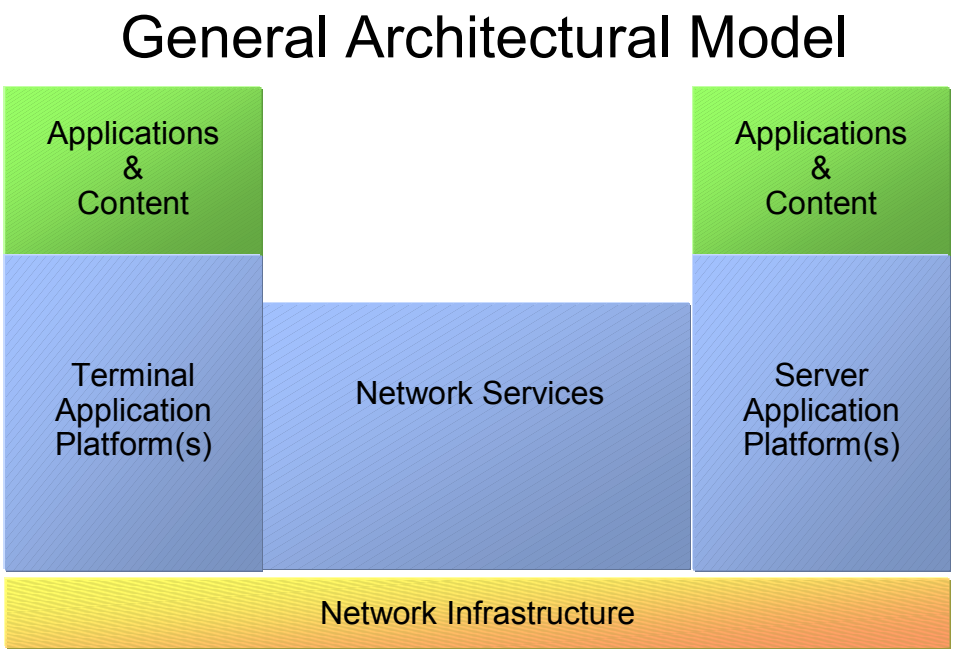


Figure 16: General Architectural Model

The main elements of this top level architecture are:

- The Network Infrastructure, which supports connectivity, primarily over IP but possibly using other protocols. While the focus of the architecture is above the Network Infrastructure, it is conceivable that the architecture may need to influence certain aspects of the Network Infrastructure.
- The Terminal element is both a logical and a physical component of the architecture, since a user needs a physical device in order to access services and applications. The terminal itself is composed of two logical elements:
  - an Application Platform on which applications and content can be hosted. It may contain a JVM for downloading and running MIDlets and other Java applications, a push agent for receiving push messages and directing them to applications, and APIs for other services like database and communications access.
  - hosted Applications and Content , e.g. an MMS agent, an IM agent, a browser for rendering content, JPEG images. These applications will be built on and use the functions provided by the Terminal Application Platform.
- The Server element is a logical component of the architecture, and like the terminal is composed of two logical elements:
  - an Application Platform on which content and applications can be hosted. Examples of elements that an Application Platform might contain could be a web server for hosting content, a web services gateway, and APIs for services like database and communications access.
  - hosted Applications and Content, e.g. Portal, Travel Booking Service, Video-on-Demand. These applications may be built on and use the functions of the Server Application Platform
- The Network Services element is a logical component of the architecture. A Network Service provides an interface through which the terminal or server can access the functionality of the service. Possible examples of Network Services are Location, Authentication, and Charging.

9.2 Mapping

9.2.1 3GPP

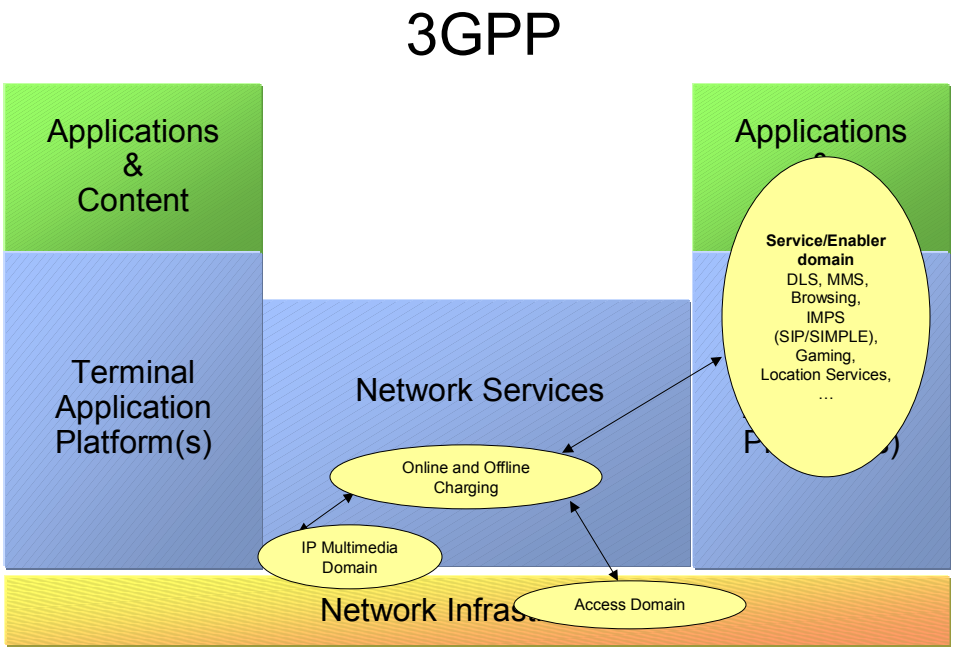


Figure 17: 3GPP Mapping to General Architectural Model

While mapping the 3GPP architecture to the OMA basic architecture, the 3GPP architecture can be divided to access domain (CS, PS, WLAN), IP Multimedia domain (IMS) and Service/Enabler domain (AS). Figure 17 illustrates a very high level mapping of these domains to the OMA basic architecture.

9.2.2 3GPP2

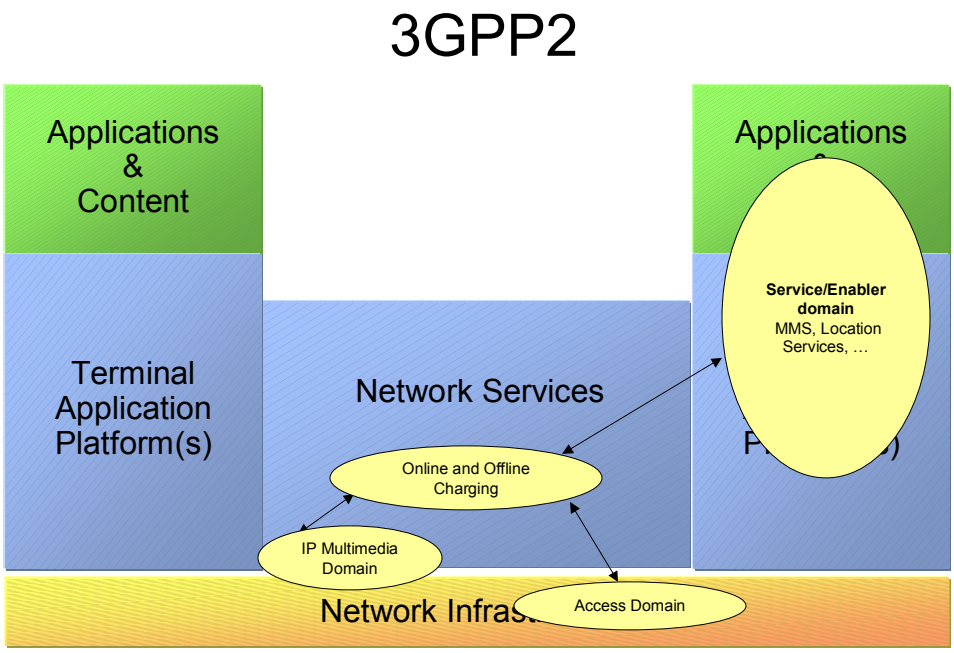


Figure 18: 3GPP2 Mapping to General Architectural Model

While mapping the 3GPP2 architecture to the OMA basic architecture, the 3GPP2 architecture can be divided to access domain (circuit/packet) IP Multimedia domain (MMD) and Service/Enabler domain (AS). Figure 18 illustrates a very high level mapping of these domains to the OMA basic architecture.

9.2.3 CDG

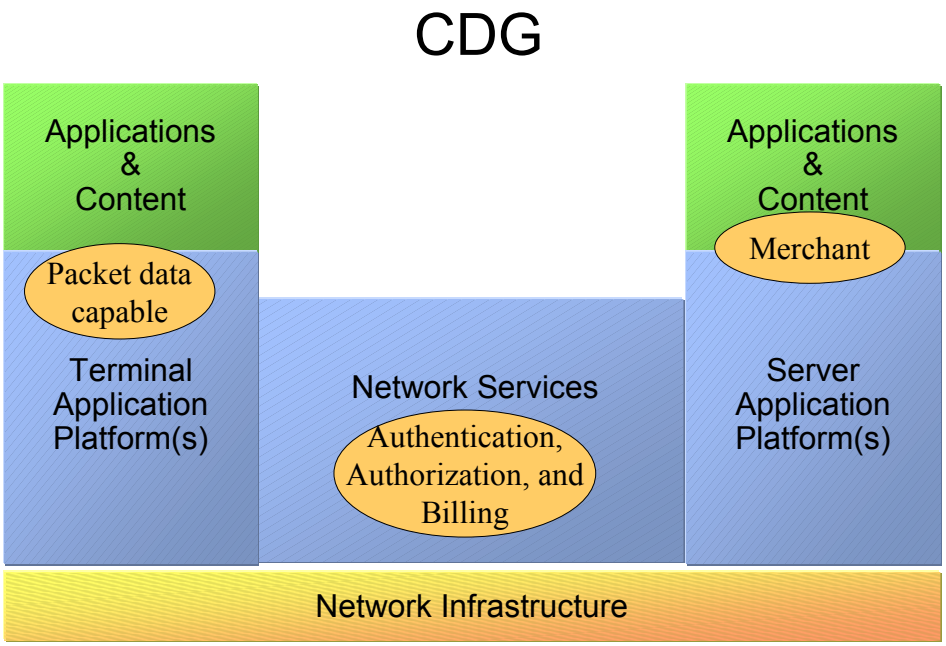


Figure 18: CDG Mapping to General Architectural Model

The CDG assumes that the authentication, authorization and the m-commerce transaction takes place over the packet data network; however, other delivery mechanisms are not precluded.

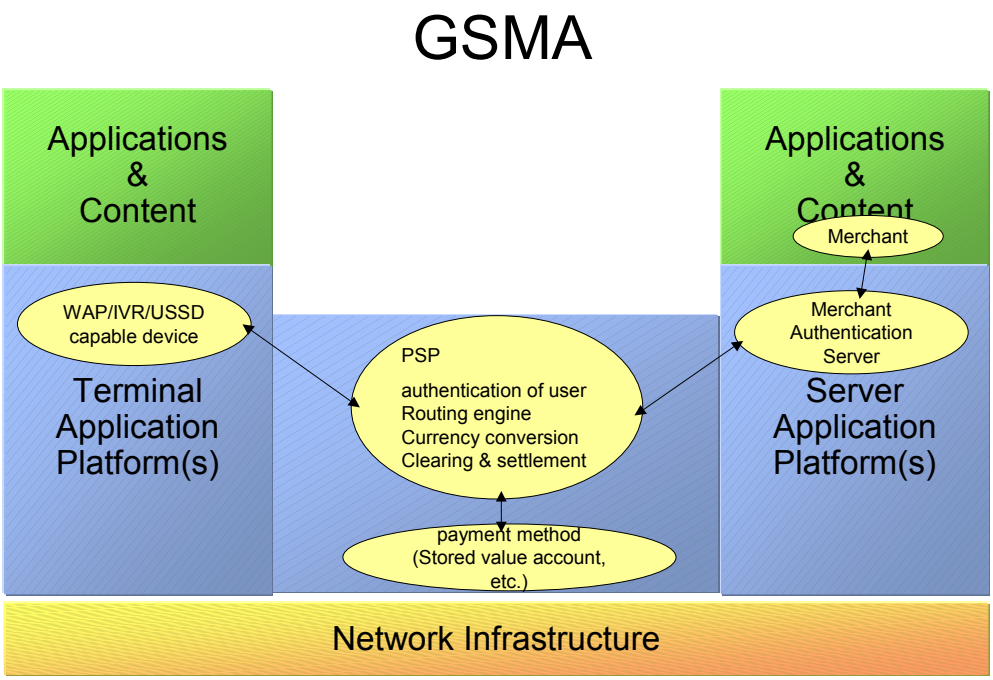
9.2.4 ECBS

Not available.

9.2.5 GBA

Not applicable, the GBA is only concerned in business issues.

9.2.6 GSMA



The GSMA intends for services to be requested over any channel, including mobile, Internet and unattended POS. Focus is also on service request interoperability when roaming across different networks.

9.2.7 IrDA

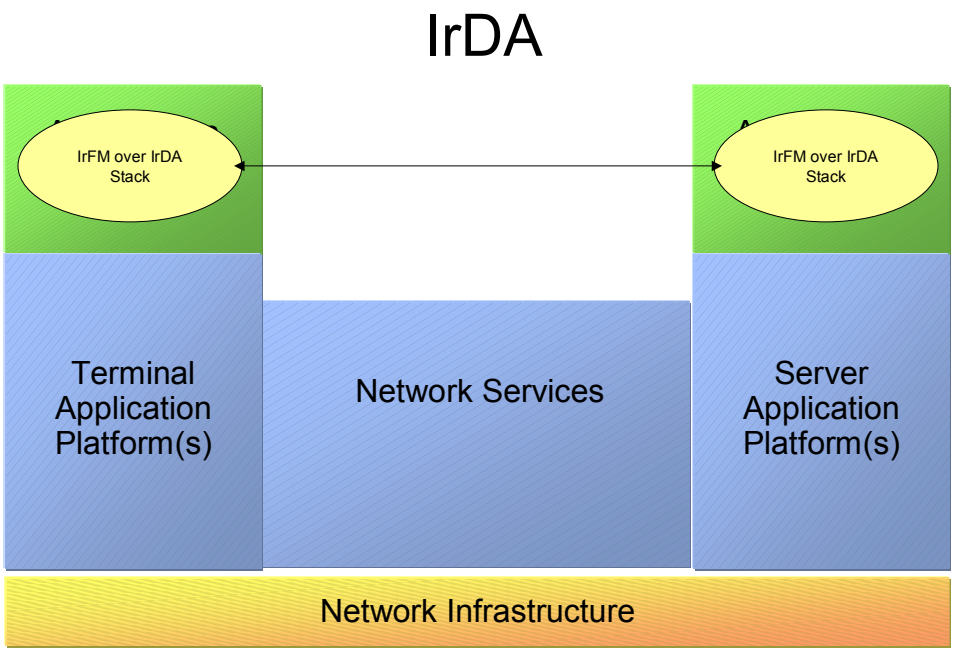


Figure 19: IrDA Mapping to General Architectural Model

IrDA uses a peer-to-peer connection.

9.2.8 Liberty Alliance Project

Mapping of Liberty Alliance Project (LAP) to the OMA basic architecture is not applicable. The architectural key take-away for the OMA m-commerce landscape assessment work is that the LAP provides mechanism for SSO using federated identity and identity web services framework which allows for service discovery, invocation and creation. Payment/Charging is one of the relevant services for this framework.

9.2.9 MeT

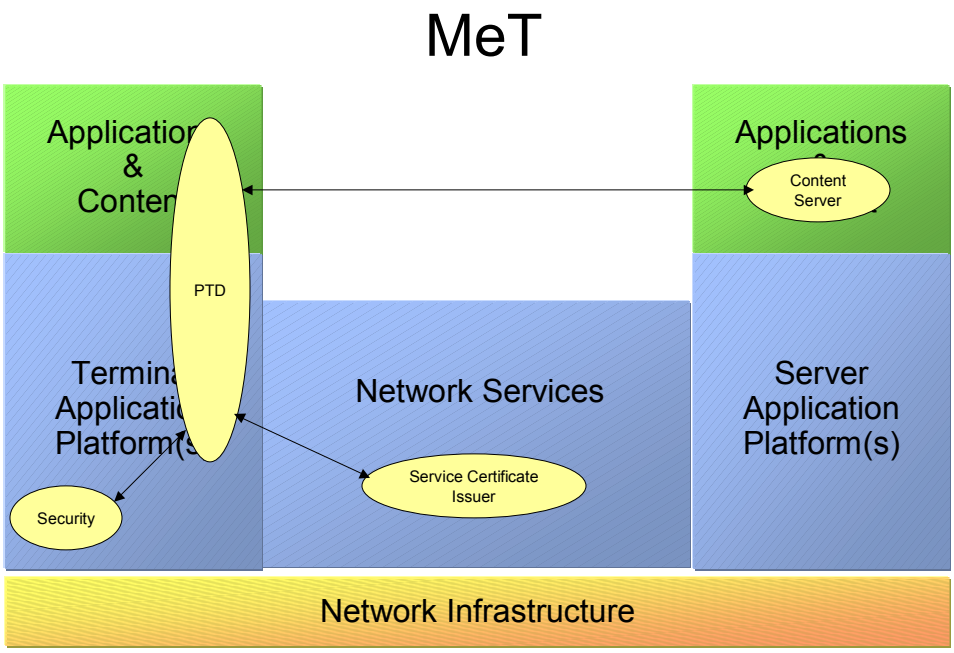


Figure 20: MeT Mapping to General Architectural Model

The MeT focuses on the terminal (PTD) applications. In Figure 20, the Personal Trusted Device (PTD) is the user's terminal. The arrows between the different stakeholders, PTD, Content Server, Service Certificate Issuer, Security, represent the interfaces being specified by MeT.

9.2.10 Mobey Forum

Not available.

9.2.11 Mobile Payment Forum

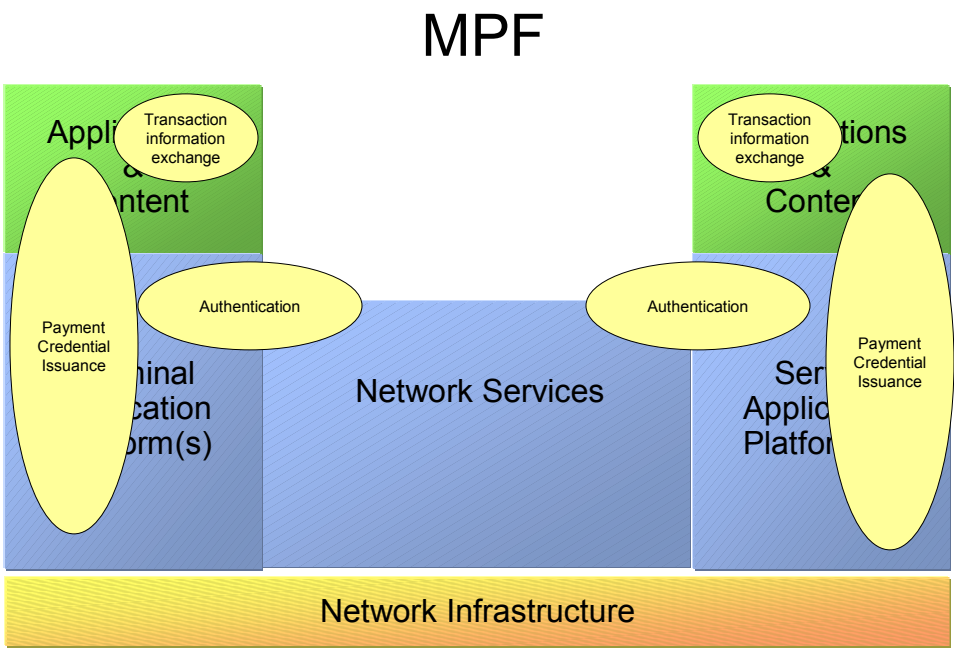


Figure 21: MPF Mapping to General Architectural Model

Credential issuing: The MPF is dealing with both the application level of payment credential issuance, as well as the requirements of the terminal application platform and server application platforms for the issuance.

Authentication: The MPF is considering authentication applications, but also the use of network services in authentication, and the transport of the authentication information between the relevant parties.

Transaction information exchange: Information concerning the transaction (transaction details, credentials and records) are being considered at the application level.

9.2.12 Parlay

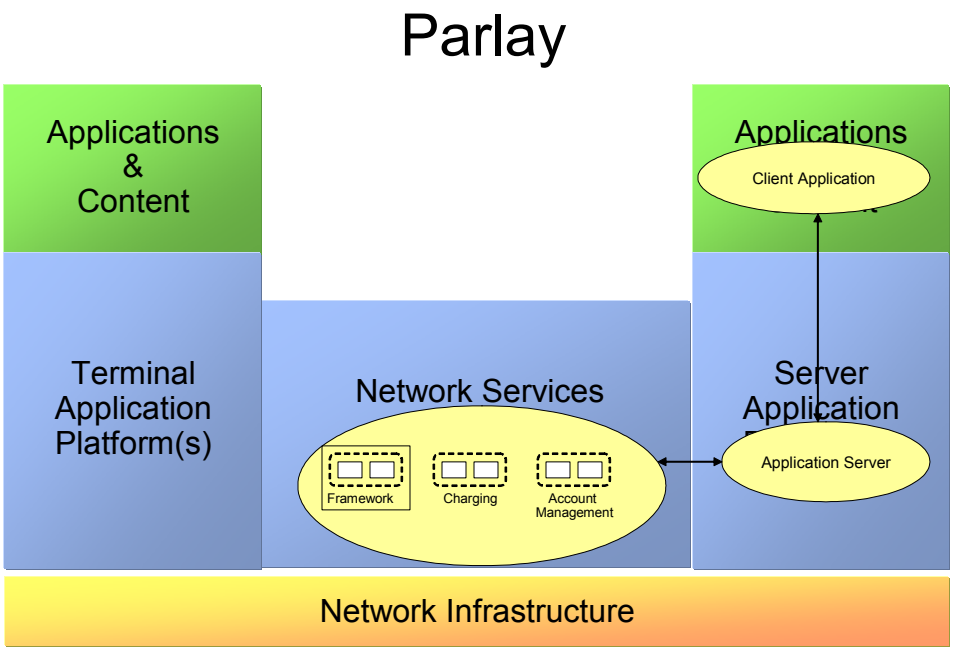


Figure 22: Parlay Mapping to General Architectural Model

The main components of the Parlay/OSA architecture are the Service Capability Feature and the Framework. The Service Capability Feature is functionality offered by service capabilities that are accessible via the standardised Parlay/OSA application interface which reside in the network services part of the OMA architecture. Examples are the Charging and Account Management service capabilities features.

The framework provides applications with basic mechanisms that enable them to make use of the service capabilities in the network. Before an application can use the network functionality made available through Service Capability Features, authentication between the application and framework is needed. After authentication, the discovery function enables the application to find out which network service capability features are provided by the Service Capability Servers. Application, implemented in one or more Application Services makes use the define Parlay/OSA API to access the service capabilities. It should be noted that in the Parlay/OSA model, applications interact with the service and the framework is usually more of a gateway or proxy application - serving/forwarding requests coming from what is traditionally referred to as client applications accessed by customers (but outside the Parlay model).

9.2.13 PayCircle

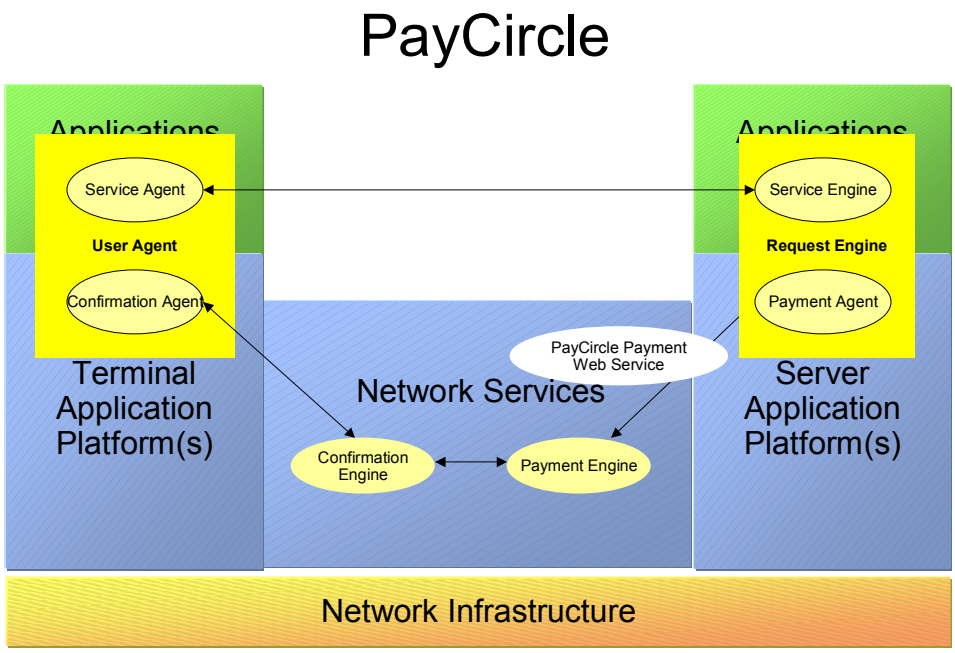


Figure 23: PayCircle Mapping to General Architectural Model

The PayCircle functional entities are part of all layers and components of the OMA architectural model, the focus being on the interaction between the Payment Agent and the Payment Engine. The payment engine uses this interface to initiate the settlement processes. Depending on the concrete setup, the payment engine may request money from a subscriber's bank account to pay the last month's bill, or to recharge a prepaid account.

Note that the PayCircle entities "Rating Engine" and "Settlement Engine" are not mapped since they are currently out of scope for OMA M-Commerce.

9.2.14 Radicchio

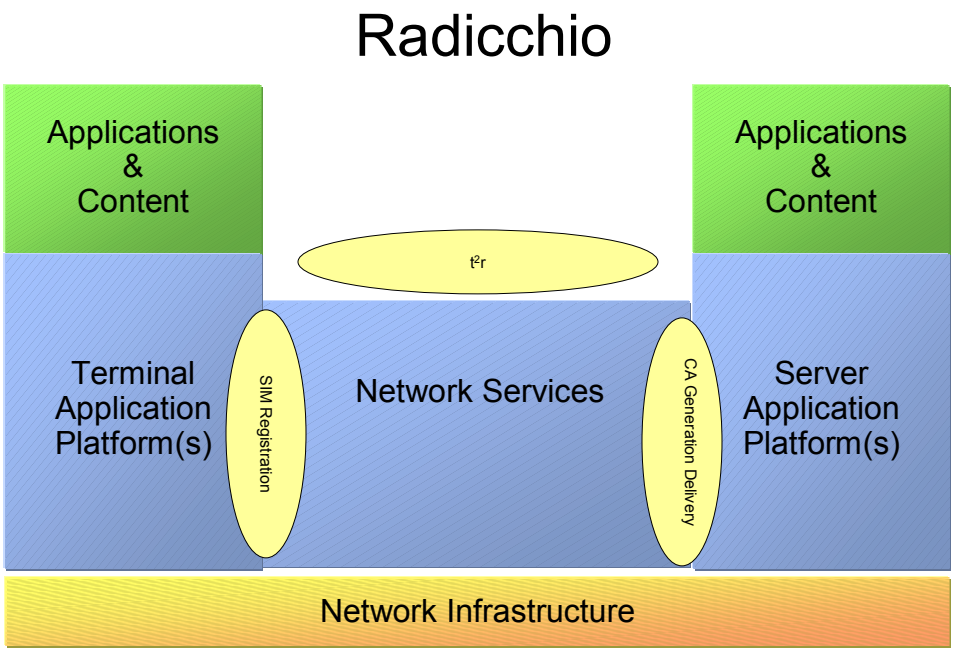


Figure 24: Radicchio Mapping to General Architectural Model

The Mapping of the t²r in the OMA architecture is probably best viewed as a straight forward overlay onto the Network Services function. A different model that would have Middleware components riding on top of Network and sometimes shared with Terminal or Server apps, would lead to different mapping. But given the model the result is Network Services.

9.3 Summary of Architecture Mapping Aspects

Providing that OMA approves another architecture model the mapping that the MCC has done may be remapped to that architecture.

10.Conclusions

This report gives the reader a compiled picture of the different responses received from the organisations listed. The answers have been processed, and mapped into a reference model, as well as fitting them into an OMA architecture picture.

Prior to this work there were many preconceived notions, e.g.:

- Many fora performing the same function, and lots of overlap.
- Many specifications.
- There were contradictory messages on the market.
- There are a lot of solutions on the market.
- ...

After analysing the work of the different fora it can be noted that:

- There are not many open specifications that are specifically related to m-commerce.
- The specifications that have been found related to m-commerce appear not to be overlapping, but this needs further analysis.
- There are overlapping requirements.
- Many of the fora address different aspects of the m-commerce landscape.
- There still remain contradictory messages on the market.
- There are a lot of solutions on the market, that do not follow open specifications.
- There is a need to promote an understanding of the current m-commerce landscape amongst the industry players showing that any stand-alone solution would prove insufficient for complete m-commerce.

This would mean that no one forum is currently covering the whole m-commerce area.

Appendix A. Change History (Informative)

Document Identifier	Date	Sections	Description
OMA-RPT_McommerceLandscape-V1_1-20041111-A	11 Oct 2004	all	Initial report resulting from analysis of questionnaires.
OMA-WP_McommerceLandscape-20051221-A	21 Dec 2005	all 1, 3.3, 4, 5, 6.1, 7.2, 9.3	Document transferred to White Paper template. One Class 3 CR incorporated: OMA-MCC-2005-0238R02-New-introduction-to-m-commerce-landscape

Appendix B. Addressed Organizations

3GPP	www.3gpp.org
3GPP2	www.3gpp2.org
CDG	www.cdg.org
ECBS	www.ecbs.org
ETSI	www.etsi.org
FINREAD	www.finread.com
GBA	www.billing.org
GSMA	www.gsmworld.com
IrDA	www.irda.org
Liberty Alliance Project	www.projectliberty.org
MeT	www.mobiletransaction.org
Mobey Forum	www.mobeyforum.org
Mobile Payment Forum	www.mobilepaymentforum.org
Parlay	www.parlay.org
PayCircle	www.paycircle.org
Radicchio	www.radicchio.org

Appendix C. Questionnaire

M-Commerce
Landscape questionai