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A White Paper by the NGMN Alliance

API Standardisation and Access to 'Data Gems'

next generation mobile networks

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the NGMN Alliance

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Access to 'Data Gems'

Document Information

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Version:	1.0
Document Status:	APPROVED
Date:	08-OCTOBER-2010

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1 INTRODUCTION

1.1 Preface

This document presents the problem and opportunities around publishing content and services across mobile operators. It presents existing solutions driven by external SDOs, with recommendations and guidelines for NGMN members

1.2 Problem Statement

Since the introduction of the ringtone market in the mid-1990s, mobile operators have supported the market for multimedia content purchase to their subscribers. Most mobile operators are not content producers themselves, and have hence relied on partnerships with content and service providers (CSPs) in order to bring benefits to both sides: the operators as sales channels to a large (and growing) subscriber base with a direct billing relationship, and the producers as a means to improve the user-perceived benefits of the mobile phone. As device capabilities improved, this relationship expanded to include logos/wallpapers, games, and video clips and music tracks delivered via download and streaming

Two factors dominate the implementation of this relationship: firstly, the so-called 'walled-garden' retail channel that the operators offer, whereby partners needed close-integration with each operator in order to be promoted via the handset WAP portal store. And secondly, the operators are in control of what the partners delivered – only the agreed range of content-types could be developed and sold. This has hindered innovative services emerging.

The result was that many content publishers encounter high 'barriers-to-entry'. Publishing mobile content often involving lengthy negotiations and proprietary technologies, which means it is difficult to develop code that can be deployed across operators.

Many mobile operators have reinvigorated their strategy to mitigate the barriers-to-entry for 3rd party mobile development and deployment, namely lengthy time-to-market brought about by porting, testing and certification across multiple operators, runtime environments and devices. These barriers particularly affect SMEs, mobile hobbyists and Web developers who lack the resources to publish across all such domains.

Although operators are exposing network APIs to stimulate such development; the capabilities exposed, API definitions and registration processes remain fragmented – and hence 'developing with mobile' still involves multiple silos, unlike the fixed Web. This continued fragmentation risks developers ignoring the capabilities of a mobile network, and utilizing instead Web-workarounds to locate, message and charge subscribers.

1.3 Opportunity Statement

Therefore there remains potential to monetize secure access to network functions and 'data gems'. Research and collaboration with content providers has identified areas from which they can streamline production and provide a better user experience via operator networks. The 'data gems' can be defined as the knowledge held by a mobile network regarding its subscribers. In some cases these capabilities are not available over the 'fixed Web', such as the core network's awareness of subscriber context and activity/purchase history across content providers. Implementation of access to such context would of course need to adhere to territorial regulation and legislation around subscriber privacy and consent; and prevent the 'data gems' being simply given away over time.

The opportunity is therefore to unlock the value of mobile networks in a fashion which will attract and stimulate innovation. If this can be achieved in alignment with technologies that have helped underpin the huge success of the World Wide Web, then new players from the Web can join incumbent mobile developers in reaping the benefits.

1.4　Why the time is right to act now

Several factors are key to driving the mobile industry to realizing the opportunity now:

- The explosion in the number of powerful connected devices (smartphones and laptops)

The number of mobile devices accessing the Internet is expected to pass the one billion mark by 2013 [*IDC research*]. This, in addition to Web access from PCs and online-enabled games consoles, would result in approximately 2.7 billion people accessing the Web from one or more devices at that time. Therefore mobile networks can seize the opportunity to not just deliver the large increase in data traffic, but to also offer services and enabler functions that enrich the Web applications themselves. Such services include traditional Web browsing – expected to be in 85% of handsets shipped globally by 2011 [*Gartner*], as well as a rising amount of HTTP streaming of music and video to mobile.

- The rising share of Web consumption via mobile devices

Namely, the rising availability of mobile broadband and share of web consumption and mobile applications via mobile devices. All global regions are showing a rise in mobile Web consumption:
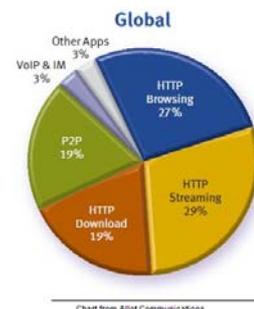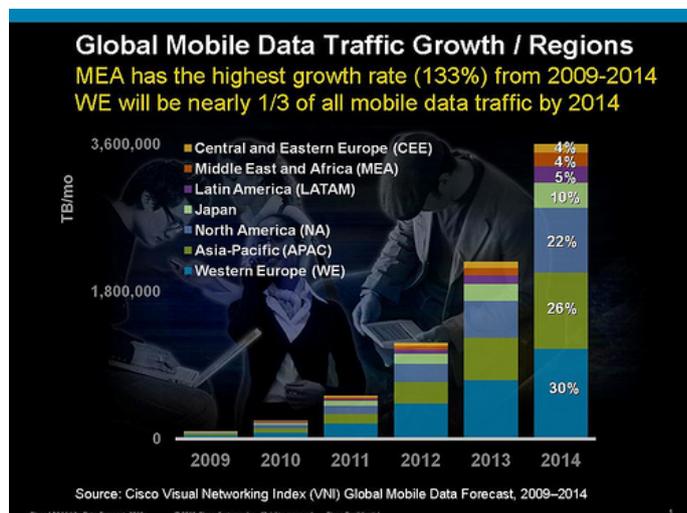
[*sources: Cisco; Allott communications*]

Emerging and developing economies have been slower to adopt fixed internet access due to the time and cost of infrastructure deployment and maintenance, and the dependency on an 'always on' electrical power connection.

Meanwhile in developed economies M2M technology, such as agricultural sensors connected wirelessly to a server application, is growing at over 30% per year [*Gartner*]. This can benefit from a wide-area wireless internet, rather than fixed, connection for the same reasons. The ability to monitor, query or instruct M2M deployments remotely can be a further benefit enabled through network APIs.

- The success of easy-to-use Web APIs

Web players have been rapidly exposing aspects of their application functionality, and backend enabler logic, via APIs built on top of HTTP and other standards. This has resulted in a vibrant ecosystem whereby Web developers can easily mash-up functions from many providers with browser features in order to create new services quickly. In turn these services can expose their own APIs for yet more innovation. Since the launch of Amazon Web Services in 2002, initially exposing catalogue services, the registered developer base has grown to approx 375,000. Facebook, Twitter, Google, Yahoo! Have all heavily promoted their APIs with the result that a rich Web application is now easy to build quickly, leveraging assets from major Web players – including their subscriber base. Finally efforts such as OAUTH and OpenID have provided non-functional enablers for identity and authentication in order to consume the APIs safely.

Network operators therefore have the opportunity to also provide their own capabilities as simple plugins to Web applications, enriching them with a mobile context which can provide unique benefits to Web developers. If provided in Web-friendly code bindings, such as AJAX, then network APIs can be mashed-up with Web APIs to enable new service scenarios.

- Multi-context access

The number of users using multiple Web-enabled devices, and the growth of Web-accessible Cloud services, will see a rise in services accessed across various devices. Users will benefit from the ability to continue a session started on one device (such as a fixed PC) on another (such as a mobile when leaving the home or office). Use cases include gaming – tapping into the 12m+ subscribers of *World of Warcraft* for example; also IPTV viewing in several short blocks. Network APIs should play a major part in this emerging area – as well as providing seamless hand-off as described by the Heterogeneous Networks Task Force; network APIs can also expose information and functions regarding the user, device and connection context.

2 ECOSYSTEM

2.1 Players in the mobile content and services ecosystem

Content publishers and communication **service providers (CSPs)** utilise **developers** to produce their mobile applications: these include native applications tailored for a device OS or middleware (Symbian, Java etc.) as well as Web-applications tailored for mobile consumption via standard Web runtimes or browsers.

The developers will utilise **tools providers** to facilitate development and testing. This is especially important due to the fragmentation across device hardware and software.

The CSPs may partner with **advertising providers** for additional revenue opportunities and to support an ad-funded business model, wherein the service is free and costs are recouped through advertising revenue share.

Operators provide access to a **subscriber base**, as well as transport via radio access and internet backhaul. They may also provide operational services such as updates over-the-air to help distribute new functionality and bug fixes of CSP software. Typically operators also expose network functionality such as billing and messaging to trusted partners, via a Service Delivery Platform, or API service, provided by a **vendor**.
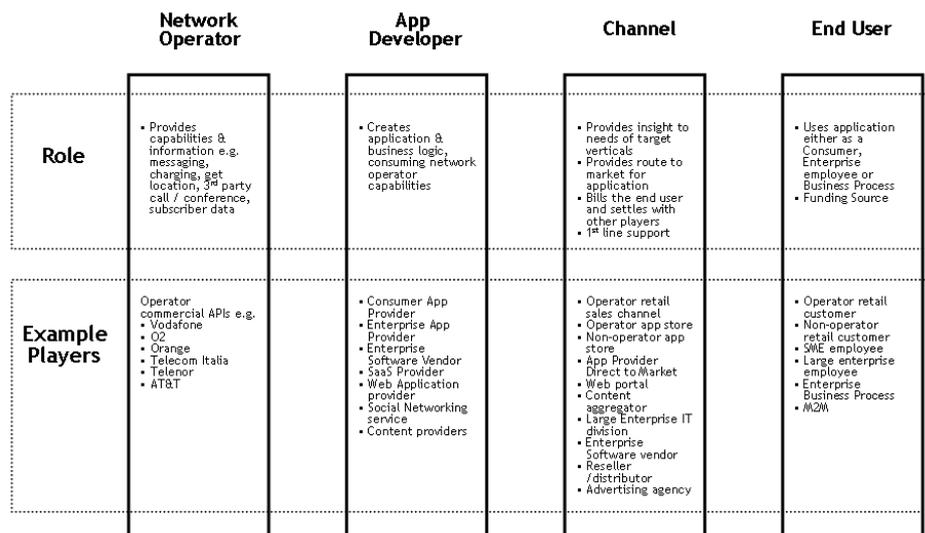
Aggregators have traditionally fulfilled two roles: first, to provide access to operator capabilities that they are unwilling to expose themselves to untrusted developers; and secondly to provide developers with facilitated access to multiple operator capabilities.

On the retail side, **operator portals** and **3rd party app stores** such as Getjar and Handango provide a means for subscribers to discover and purchase the **CSP** services, with the CSP sharing revenue with these channels in exchange for greater product visibility.

Finally, **regulators** aim to prevent legal and policy issues in the industry, via Codes of Practice and regional legislation.

2.2 Value chain

2.2.1 Roles of ecosystem players in the value chain

	Network Operator	App Developer	Channel	End User
Role	• Provides capabilities & information e.g. messaging, charging, get location, 3rd party call / conference, subscriber data	• Creates application & business logic, consuming network operator capabilities	• Provides insight to needs of target verticals • Provides route to market for application • Bills the end user and settles with other players • 1st line support	• Uses application either as a Consumer, Enterprise employee or Business Process • Funding Source
Example Players	Operator commercial APIs e.g. • Vodafone • O2 • Orange • Telecom Italia • Telenor • AT&T	• Consumer App Provider • Enterprise App Provider • Enterprise Software Vendor • SaaS Provider • Web Application provider • Social Networking service • Content providers	• Operator retail sales channel • Operator app store • Non-operator app store • App Provider Direct to Market • Web portal • Content aggregator • Large Enterprise IT division • Enterprise Software vendor • Reseller /distributor • Advertising agency	• Operator retail customer • Non-operator retail customer • SME employee • Large enterprise employee • Enterprise Business Process • M2M

2.2.2   Generic value chain including transport/delivery
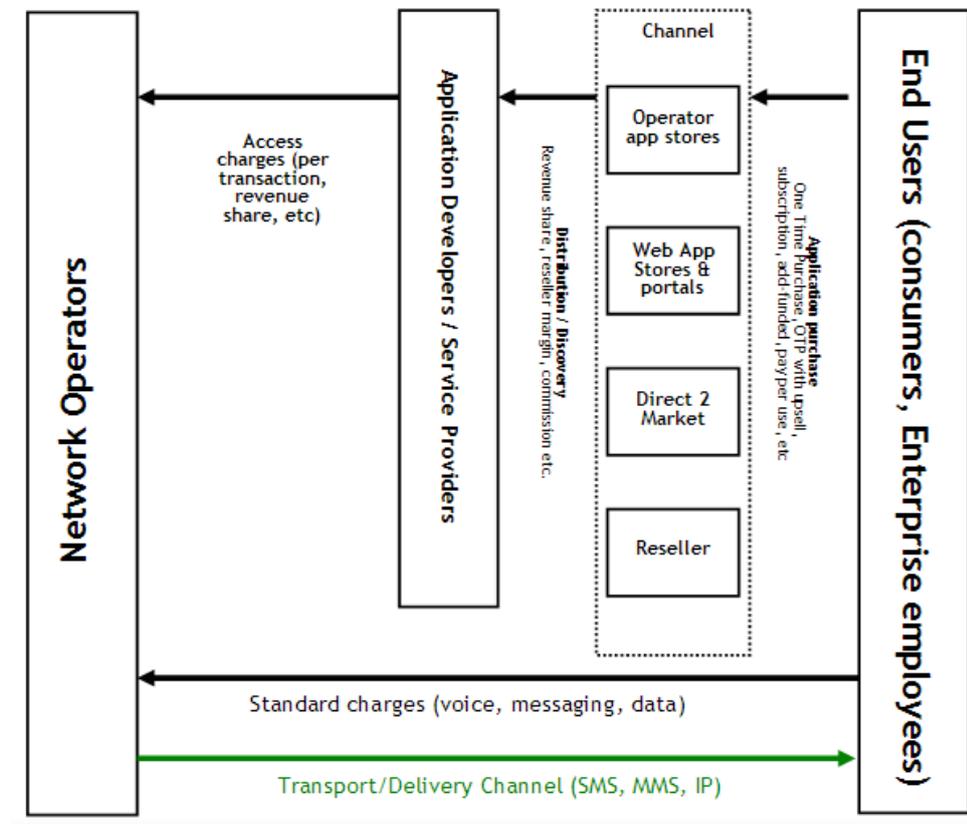
2.3   Why Content/Service Provider utilise enablers

The following enabler usage scenarios have been sourced by the Task Force members from their customers, and from the GSMA Access group research.

1. **Control**
   > Bandwidth Management and QoS for optimized video delivery
   > Application identification
   > Policy Management
   > App Monitoring for mobile broadband management
   > Digital Home Management

2. **Content**
   > Content & Storefront provisioning
   > Content Distribution
   > Content access and rights management
   > Ads & Offers
   > Acquisition of user-generated content

3. **Communication**
   > Call Control and Conferencing
   > Rich Voice
   > Rich Messaging

4. **Context**
   > Location
   > Universal Address Book & Presence
   > Subscriber context data monetization
   > Payment

2.4 Workarounds: why involve the operator at all?

The list above shows the drivers for CSPs utilising enablers: however in many cases the desired functionality may be realised through Web equivalents of network APIs. In other cases the network APIs provide a unique capability. The following matrix shows a comparison of the enablers:

Function	Network	Web APIs
Payments	✓ Also provides billing ✓ Implicit authentication X Slow to pay partners (~55 days) X Reconciliation erratic	X Billing requires financial partnership (card, bank) X Authentication by login (disruptive) ✓ Fast to pay partners (~5 days) ✓ Typically better reconciliation
Push notifications	*SMS, MMS, AJAX, WAP Push* ✓ Robust store-and-forward	*AJAX, HTML 5 Web Sockets* ✓ Rich libraries available X Require application to be running to be alerted X Polling drains battery
Location	✓ Works anywhere with network signal	✓ Can register with many location sources X Often inaccurate if based on unofficial Cell-ID lookup
User context (used with user consent)	✓ Can analyse usage patterns across multiple services and contacts ✓ Can provide tailored user experience ✓ Focussed advertising and promotion ✓ Granular user presence (connection/location)	X Only basic cookies and manually registered static preferences X No sharing of preferences/history across services X 'best guess' advertising based on keywords X Presence based on login
Call management	✓ Network ownership and control on call quality	✓ Protocol-agnostic 'smart switches' cater for mobile/PSTN/VoIP terminals
QoS	✓ Network ownership and bitrate management ✓ Possible to use 3G video call channel for end-to-end delivery control	X 'best effort' control at internet bitrate management, variable in a session

This table shows that both network and Web APIs can offer strengths to support any weaknesses in the other. Together they can provide a rich, adaptable functionality suite to developers. However, the major strength of Web APIs is that *they work across the Web* – there is far less fragmentation than in the mobile space. In order for network APIs to become part of the Web developers toolkit, they need to be Web-friendly, and available across a critical mass of network operators in a common format.

3 BUSINESS RATIONALE

3.1 Unlocking 'data gems' and enabling two-sided business models.

Network operators have managed to maintain an authentication, identity and billing relationship with their subscribers in a way that Internet Service Providers have not. This is in addition to the 'push to subscriber' functionality offered by messaging and voice services, and subscriber location determined from cell presence or triangulation. As such the networks are aware of a substantial amount of contextual data for their subscribers, including

- Demographic group
- Home location
- Roaming status
- Current and historical location
- Purchase history
- Contacts (and by extension, the contacts purchase history, location etc.)

The storage and data-mining of this information via APIs can lead to two main benefits: firstly, the personalisation of a service depending upon the context in which it is consumed. Traditionally this has meant shuffling content menu choices so that the most popular is highlighted for subscribers in a given demographic. However if further considerations are taken into account, services can be further tailored – for example, when visiting an airline Website, users often select a language and then browse flights. This is not ideal if accessing the same website from a mobile device in a taxi en route to the airport – when you are more likely to be checking flight times.

The second benefit is in marketing: rich user context means focussed targeting of promotions and services. This context can be based upon any or all of the data gems listed above. Due to subscriber privacy regulation, it is essential that the technical framework under which such APIs are utilised ensures that subscribers are informed of any request to personalise a service or marketing material based on their data, and that consent is obtained as per the Code of Practice/Legislation for the relevant territory.

This utilisation of telco assets in a new way is referred to as a 'two-sided business model', as promoted by Telco 2.0 (industry analysts): http://www.telco2.net/blog/2sided_business_models/

Finally it is important to consider how an API exposes such information to 3rd parties. A 'low level' API that passes back raw data on demographics/activity is likely to broach privacy regulations, and also risk leaking operator-sourced value out of the network. Rather API design can consider how to provide value to a CSP without these disadvantages: for example, a request to an operator API for a 'suitable advert for this user' can allow the operator to internally analyse the user context and return a URL of an advert; if clicked then the CSP can share revenue for the referral.

3.2 Addressing industry verticals

As well as supporting developers of consumer applications with a network API toolkit, it is important to also recognise the value to Enterprise. Industry verticals (such as healthcare, travel etc.) have been well-served with voice, mobile data push email services; however these are generic services applicable to any industry. Enhancing the business propositions with tailored services can ensure that those verticals can offer richer services to their customers (B2B2C) – and provide new revenue opportunities for operators selling enablers for these services.

Network APIs not only allow enablers and services to be consumable by verticals, they also allow technology partners to build new services based on network, Web and device APIs.

Some examples of industries that can be enriched by network APIs this way:

- Construction industry. Desktop browser-based field-force/logistics applications can track and message delivery drivers and workers via their cell phones. They can also receive live video/pictures from MMS sent to the Web application. If a standard network API is used, then sub-contractors not on the same network operator can also be incorporated.
- Travel industry. Airports would like to detect and inform passengers of services available, such as hotels, car hire etc. This can include dynamic information such as available meeting rooms in the area, travel disruption etc. Hotels could offer to offset the cost of roaming for their premium customers, and provide a 'concierge' application with maps/advice that did not incur data costs on the user's bill – rather it would be paid by the hotel.

- Health. Remote healthcare monitoring by tracking presence/location of a SIM can reduce the costs to healthcare authorities; SMS-based checking of a pharmaceutical's authenticity; and many more.

By exposing enablers via APIs, the network operators can potentially empower many verticals, especially with the partnership of existing VAS providers. This example shows how a network video API (based on the 3G video call channel) can be beneficial to many verticals:
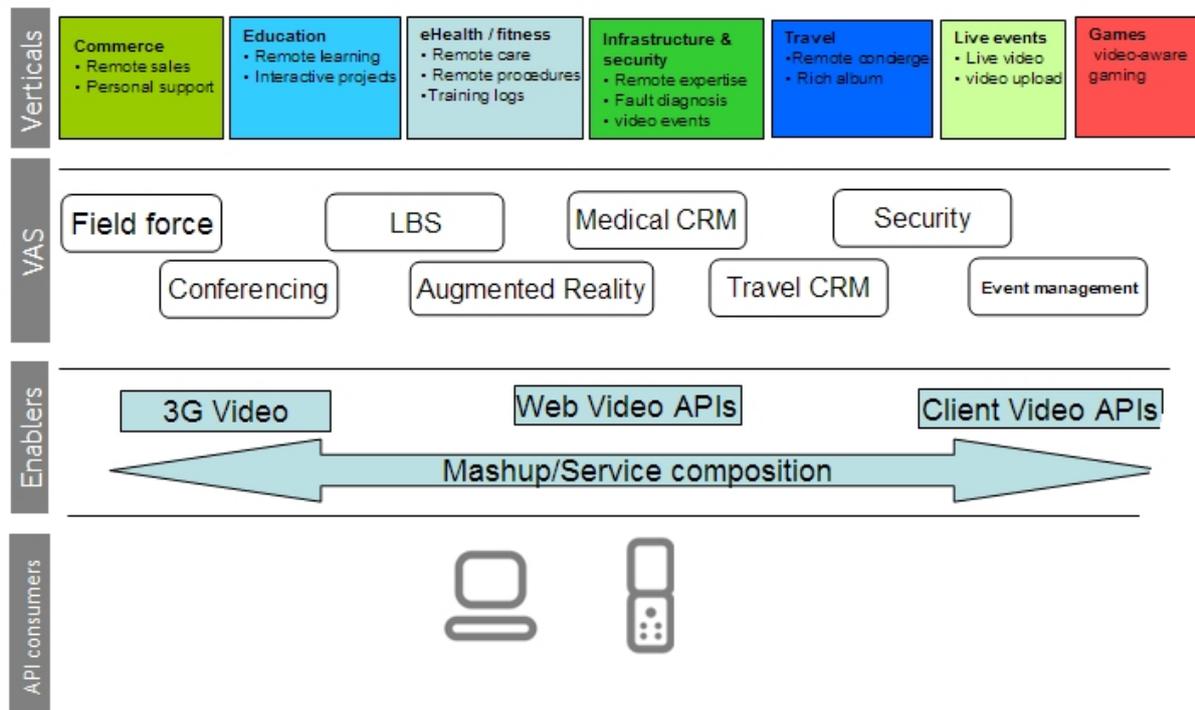
3.3   Why have commonly-supported APIs?

The industry verticals described want to address the largest market. Whilst the internet presents a single entry point, with no consideration of the ISP of the end user; mobile presents fragmentation at the network and device level. By implementing a commonly-supported network API, operators can also present a simple way to deliver and enrich content services. This cross-operator support shows consistency and provides confidence to CSPs and developers – and can still allow for competition. This in turn makes network APIs an attractive option and keeps operators in the value chain, with the possibility for new revenue streams based on cross-operator services.

3.4   New customers for APIs

As well as attracting innovation for industry verticals by reducing the time and testing effort of integrations, standard network APIs enable SMEs and individual developers to overcome the barrier-to-entry to mobile development. Standard APIs can therefore enable the 'Long Tail' of application developers: that is the many producers of niche applications, which taken as a total, can produce a significant complement to revenue generated by major CSPs. Whether or not the Long Tail can generate more revenue than the Head is less important than enabling it cheaply via an industry standard.

The other opportunity is attracting developers of desktop/laptop applications to enrich their products with a mobile aspect. This means embedding network functions into these applications – for example easily messaging or locating mobile devices via a desktop map, or in future pushing a video feed to a terminal. For this opportunity to be realised it is critical that standard network APIs use standard Web technologies that can integrate easily with server-side programming languages.

3.5   How can operators compete using standard APIs?

During the last decade many operators exposed interfaces allowing CSPs to deliver content services via operator-managed portals: the so-called 'walled garden' model. Over the last two years these have evolved to a more open approach, whereby marketing channels outside of the operator channel have been supported. In order to enable these 'off portal' providers to enrich their services with network functions, network functions have been exposed as APIs using the operators own definitions.

The industry bodies looking at network API defragmentation (section 5) are not attempting to replace these APIs: that would cause problems for existing partners, and also force a homogenous ecosystem with no ability to compete. Rather the standard network API can be commonly-supported as a complement to existing, operator-owned APIs. This allows developers an easy route into producing applications that work across operator, but also allows the operators to produce richer, premium APIs that offer far more. This ensures competition as well as supporting interoperability on basic enabler APIs.

3.6   Operator consumption of APIs

Network operators can themselves benefit by exposing their enablers via APIs. An API specification allows an enabler to be accessed and reused by the operator's own services, thus reducing internal development time and cost. The introduction of new customer-facing services in the Web domain can also be facilitated this way, for example by offering a Web interface for a subscriber to check and top-up their credit online.

Currently operators interconnect on voice, SMS/MMS and data roaming. Enabler APIs would allow operators to interconnect on these functions as well, thus offering the ability to service each others API requests, such as location of a roaming user or providing a high-quality video feed where that is the best available to the subscriber at that moment.

3.7   Benefit to end users

APIs themselves allow previously locked-away functionality to be utilised to deliver innovative services, thus offering users new and improved products. Standard network APIs can also allow such services to be deployed rapidly across multiple operators, and to include all mobile users within their scope. With the growth of social networking, both as applications and as a feature within other services, it is important to ensure inclusion regardless of mobile network.

3.8   Implementation considerations

- *Native:* An SDP allows core network enablers to be exposed via APIs. These APIs are subject to AAA and policy enforcement, which is usually decoupled to allow policies to apply to individual APIs and CSPs. For example, an operator may wish to 'tier' access so that premium CSPs are allowed a higher usage threshold and are assured of faster responses.
- Standard network APIs can be integrated alongside existing operator APIs on the same SDP. This is known as a 'shim' pattern, whereby API calls made by the standard syntax are mapped to the same enablers as for the operator APIs. The responses are transformed on the return path to the desired standard API format.
- *Aggregator:* Operators may wish to hand-off the exposure of their enablers to an aggregator who will perform the integration to the network enablers and manage the CSPs that use them.
- *Hub:* Operators in the same region may wish to collaborate with a technology partner to provide a single hub through which CSPs can access all the networks through a single API.

4 REGULATORY LANDSCAPE

The mobile network stores information about, and enables functions to be performed within the context of, end users. Therefore it is essential to understand of the regulatory and legal impact of exposing enabling functions as regards to subscriber privacy and fraud protection.

APIs differ from services in that an API can provide functionality, but is not in and of itself a service (i.e. it cannot be used on it's own to provide a user consumable service, but may be used as one or more steps in delivering that service).

The GSMA OneAPI group performed a regulatory study which concluded that whilst services may be (and are) regulated, APIs themselves are not: an operator may expose APIs but should not do so in a way that can enable 3rd parties to broach user privacy or produce malicious applications.

Operators will enforce their own policies on API consumption, such as throttling, security/AAA, content standards, etc. This will likely be used to ensure compliance to regulations for services that consume the APIs. However it is out of the scope of the Access project to attempt to normalise such policies.

Further information on regulation can be found at the GSMA OneAPI wiki.

4.1 End-user privacy and consent

As noted above, functions that involve a subscriber are typically subject to regulation and legislation. Codes of practice and regional legislation govern the network capabilities of billing, location and any CRM-function exposing user data. Therefore it is essential that the functional-flow of a service utilising APIs enforces such rules and policies, and that user consent is audited where possible. This area is recognised by the industry fora looking at API defragmentation, and must be considered when exposing any APIs to 3rd parties.

5 EXISTING DEFRAGMENTATION INITIATIVES

5.1 OMA ARC

The OMA Architecture group [ARC] provides two work items to refresh existing network API standards (Parlay X) into Web-friendly code bindings. Parlay X is a set of Web Services that allow network enablers to be consumed using SOAP (Simple Object Access Protocol). This method allows a Web Service Definition to be hosted at a network operator interface, and be discoverable by a 3rd party. The 3rd party uses this definition to perform functions on the underlying enabler, sending instructions in XML over SOAP.

Historically the uptake of Parlay X was lower than expected due to the complexity of the interface. Therefore the OMA are now refreshing the definitions into simpler Web Services [PX PROF] and RESTful definitions [Parlay REST]. A RESTful interface simply exposes URLs to network services. Operations are performed on these URLs through standard HTTP verbs; allowing 3rd parties to perform queries (get location) and create resources (send a message, charge a user). RESTful interfaces are preferred by many Web developers as they may be easily invoked within Web applications by standard scripting libraries.

The first release of Parlay REST and PX PROF is due May 2010.

5.2 GSMA/OMA OneAPI

The GSMA OneAPI (Open Network Enablers, [OneAPI]) encourages network operators to implement an industry standard network API. This is to reduce the barrier-to-entry to smaller mobile developers, who are hindered by the cost and time taken to develop across different operators; and secondly to encourage Web developers to utilise network resources in their Web applications. OneAPI incorporates major network operators and vendors, and collaborates with Web and mobile developers to gather requirements on what network functions are useful and relevant

OneAPI is an official OMA standard profile of Parlay REST, and is an OMA candidate release approved June 2010. There is also an official OMA SOAP OneAPI profile, utilising a subset of Parlay X.

OneAPI goes beyond standardisation to provide a "Go To Market" programme: operators are helped and encouraged to expose OneAPI, in order to attain a critical mass of implementations. This will allow developers to code once across multiple operators, and deliver cross-operator services to reach all subscribers.

Therefore OMA ARC can be seen as providing the technical foundation for OneAPI. OneAPI provides market-sourced requirements for the APIs, and promotes the relevant profile of the OMA specifications to operators, vendors and developers. This profile is fully supported by OMA, thus meaning that OneAPI is the first cross-fora, cross-operator and cross-vendor network API based on developer and CSP requirements.

5.3 Mobile Device

W3C Device APIs and Policy [DAP] creates client-side APIs to allow Web applications and Widgets to interact with device services (calendar, contacts, camera etc.). In this context a widget is a Web-enabled application that utilises a Web runtime deployed on the client, but does not run within the browser window.

The [DAP] remit has overlap with that of OMTP BONDI [BONDI] which specifies a security framework to allow access to such device services via a JavaScript API.

The Java Application Terminal Alignment Framework [JATAF] program collaborates with developers to address fragmentation across Java ME implementations, and hence reduce testing costs and deployment time for Java ME applications.

5.4   Wholesale Application Community

The Wholesale Application Community [WAC] is a global alliance of network operators and leading device manufacturers. It aims to allow developers to deploy a single application across multiple devices and multiple operators, without having to change code interfaces in each case. It intends to use existing open standards (such as [BONDI] [DAP]) as well as API submissions from members.

As well as promoting defragmentation across device platforms, WAC also supports the OneAPI initiative, and the underlying OMA enablers, to do the same across network APIs. This will complement the WAC device strategy with an opportunity to expose network capabilities in a consistent fashion to Web application developers.

6   RECOMMENDATIONS AND GUIDELINES

The following recommendations are targeted towards all NGMN members but especially to operators

6.1   Expose network functions and data gems as APIs

Locked-away capabilities are only of benefit to the operator. The explosion in Web applications on the back of Web APIs has shown that innovation is best encouraged by exposing capabilities in a secure and managed way, with consideration towards user privacy and legislation. The utilisation of 'data gems' referring to user context and history can result in tailored services and marketing partnerships, but it is crucial to follow Codes of Practice in this area. As such engagement with industry bodies such as the GSMA Mobile Advertising initiative is recommended.

6.2   See Web APIs as an opportunity

Although Web APIs can be seen as a direct threat to the uptake of network APIs, it is their very nature of being easy to combine with other APIs that makes them attractive to developers. A developer will not necessarily be loyal to 'Web' over 'Network'; rather they are looking for a particular tool for a particular context. By ensuring that network APIs are available in Web-friendly formats, and then they are more likely to be included in the developer toolkit. This can also result in a new breed of hybrid Web/network enabled services.

6.3   Collaborate with defragmentation initiatives

The network API standardisation initiatives will only be of benefit to the industry and broader ecosystem if they receive support and adoption. As the number of operators exposing standard APIs grows, it moves toward a critical mass which makes developing with the network highly attractive for the CSPs and SME developers. Therefore NGMN members are encouraged to contact the OneAPI, OMA ARC and WAC groups for further information on how to collaborate. Future API requirements, based on the capabilities of Next Generation networks, should be provided to the OMA Next Generation Service Interfaces group [NGSI] via direct NGMN member collaboration.

7 APPENDICES

7.1 Acronyms, abbreviations, definitions

API – Application Programming Interface
RESTful – an API conforming to REST principles: simple interaction via HTTP standard commands and responses.
SaaS – "**S**oftware **a**s **a S**ervice"**,** software provided on demand, usually a Cloud service accessed remotely by API over HTTP
NaaS – "Network **a**s **a S**ervice", exposing network capabilities in a SaaS fashion.
B2B2C – "**B**usiness to **B**usiness to **C**onsumer". Wherein a business uses the services of another business in order to directly provide new services to their own customers.
CSP - **C**ontent/**S**ervice provider. A 3rd party that produces a service consumed by an end user and involving the operator for transport and added functions.
SME – **S**mall/**M**edium **E**nterprise. A CSP with a low number (~30 to 80) employees.

7.2 External References

[BONDI] , http://bondi.omtp.org/default.aspx , JavaScript libraries to securely expose native phone functions (calendar, camera etc.) to Web applications
[DAP], http://www.w3.org/2009/dap/ ,W3C Device APIs and Policy working group, client-side APIs to securely expose native functions. Includes BONDI as one of its inputs.
[JATAF] , http://www.jataf.com/ , aiming to solve fragmentation across Java ME runtimes.
[OneAPI], http://www.gsmworld.com/oneapi , GSMA Access group OneAPI (Open Network Enablers); cross-operator and vendor group to promote network API defragmentation utilising OMA produced specifications.
[Parlay REST], http://www.openmobilealliance.org/Technical/release_program/parlayREST_v1_0.aspx , a reformatting of Parlay X network APIs based on RESTful principles.
[PX PROF], http://www.openmobilealliance.org/Technical/docs/CopyrightClick.aspx?pck=PXPROF&file=V1_0-20100406-C/OMA-RRP-PXPROF-V1_0-20100406-C.zip , a profile of Parlay X featuring only the functions required by OneAPI.
[WAC], http://www.wholesaleappcommunity.com/ ,cross-operator group aiming to work with vendors to drive deployment of standard device and network technologies across the mobile industry.