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Chapter extract from the book

Implementing Mobile Web 2.0 by Ajit Jaokar

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Introduction

Overview

This document outlines a chapter in the book Implementing **Mobile Web 2.0** by Ajit Jaokar published by futuretext (Feb 2009). It is released separately as a stand-alone chapter. Here, we discuss the role of the

next generation SIM (Subscriber Identity Module) card, referred to as SCWS (Smart card web server) SIM within Mobile Web 2.0.

To explain the background, this document includes other sections from the book so that it becomes as complete document in itself.

Synopsis and key ideas

The key ideas behind this chapter are:

- Web 2.0 has already evolved to Cloud computing.
- Inspite of the notion of a 'Web only' processing, the cloud needs a client (as is now apparent from the deployment of a browser like Chrome from Google).
- For a mobile ecosystem, there are two possibilities for a Cloud client; The device or The SIM since both are at the edge of the network(for simplicity we discuss a cellular network only i.e. not Wimax, WiFi etc)
- From a network Operator perspective, the SCWS SIM offers a possibility to be the client for the mobile cloud for reasons that we discuss in this chapter.
- The SCWS SIM technology also offers the possibility of accessing mass market devices.

Notes:

1) This chapter is written from a Telecom Operator perspective. There are other implementations of Mobile Web 2.0 which are non Operator specific
2) We use the term SCWS technology to refer to Smart Card Web Server technology and SCWS SIM as the next generation SIM card incorporating SCWS technology

Web 2.0 and Mobile Web 2.0

Web 2.0

There are many definitions of 'Web 2.0' – but at a minimum, we all agree that Web 2.0 can be characterised by four properties

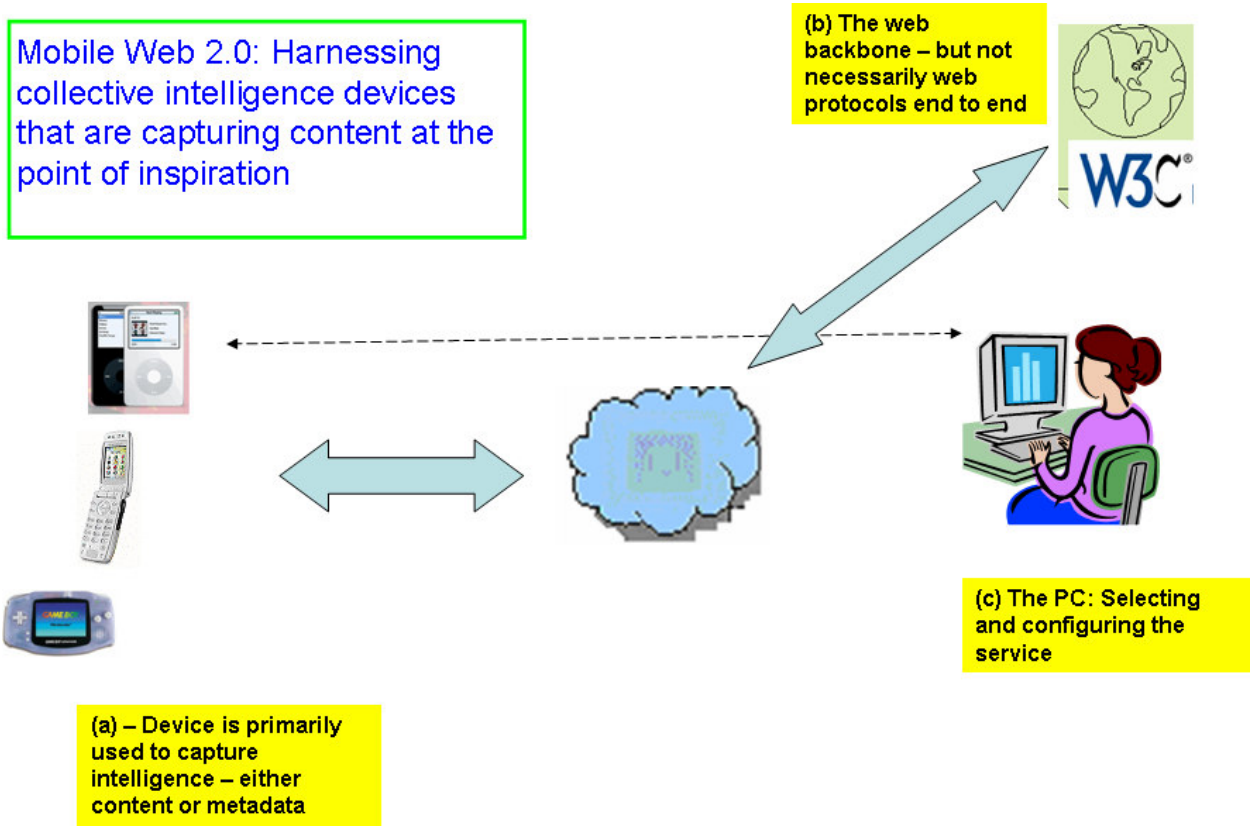
a) The use of the Web as a backbone
b) Harnessing collective intelligence
c) Creating a database/body of data that becomes richer as more users contribute to the system.
d) The dominance of User generated content(as opposed to packaged content like songs, movies etc)

From this perspective, we see that the mobile device is very relevant to Web 2.0 since it is the primary avenue for most people to capture content (videos, pictures etc). Hence, if we extend the idea of Web 2.0 to a mobile ecosystem, then at a minimum, we get a service that

a) Uses the device to capture content

b) Uses the PC to configure and resynchronize the service with the desktop and

c) Uses the Web as a backbone i.e. a primary storage of content



From a mobile perspective, there are a few problems with this picture:

a) It lacks the 'Uniqueness of mobile' – we can also call it the 'Deep blue sea' problem. In other words, if all the mobile industry is doing is: Sending content to the 'Deep blue sea' of the Web, Where is the business model and the unique leverage for the Mobile data industry?

b) Secondly, elaborating on the idea of a business model, the Telecoms business model is based on ARPU (Average revenue per user) – the Web business model is different (mainly advertisement funded). So, how do these two areas meet?

c) How many such Web sites should the Operator integrate with and how? The rate of change on the web is a lot higher. This means that there will always be hundreds if not thousands of web 2.0 /social networking sites which will want to 'integrate' with mobile. Yes, they can always be off-portal and that's a good initiative. But, ideally, they would like to be On-device and have capabilities to access the network APIs. This is the Holy Grail for ALL the approaches to Mobile Web 2.0(not just SCWS SIM). From the mobile ecosystem, the problem is: working with Long tail (i.e. many applications on the Web) is not easy; integrating all these on the device is even worse – since the device and the network ecosystems are not in sync. However, the customers want services like accessing a range of social networking sites

d) Also, there is the issue of Web weaknesses. Just because the Web is the dominant model, does not mean that it is perfect. In fact, when it comes to security, Identity etc – the Web has many limitations and indeed these areas are the core strength of the mobile ecosystem. So, the Mobile ecosystem can actually enhance the Web and overcome its limitations?

e) How can we address emerging markets(where the Web is lacking and mobile is dominant)

f) As of the time of writing, Web 2.0 itself is two years old. The future, beyond Web 2.0 is cloud Computing. How does Cloud computing integrate with Mobile devices?

It is against this backdrop that Mobile Web 2.0 is significant. And we must look at the SCWS SIM technology with the same mindset.

Implementing Mobile Web 2.0 – The touch points between Web and Mobile

So, what is Mobile web 2.0 and how can it be implemented? To understand this question, we have to take the principles of Web 2.0 'across the telecoms stack'. Doing so then gives us concrete 'touch points' where the web and the mobile ecosystems interact.

There are at least twelve ways to implement Mobile Web 2.0 i.e. for mobile to add a unique element to Web 2.0. These include:

1) The Network implementation: This will probably be based on IMS/SDP.

2) The handset implantation: This approach is best indicated by Nokia's Ovi strategy and the iPhone.

3) The Enterprise network strategy: Best portrayed by Cisco's foray into Web 2.0 based on recent acquisitions such as Tribes and Five Across

4) The Web players coming to mobile: for example Google's Android strategy.

5) Mobile Web 2.0 and Devices: for example Amazon Kindle

6) SCWS (Smart card web server): which we discuss in this chapter.

7) Identity and Security: Identity and Security can complement almost any service and a telecoms network has an advantage there.

8) Browser APIs/DOM extensions: for instance Google Gears for mobile or OMTP Android

9) Voice Call detail records to create social graphs

10) Make it quicker / easier: users will always pay extra for the small improvements which make their life easier even when other (more cumbersome) ways exist which may be cheaper.

11) Mobile social networks: social networks that span the Web and the Mobile Web and

12) The converged address book

In this chapter, we discuss the SCWS SIM implementation

The history and evolution of the SIM card

The history of the SIM card

As we explore the interfaces between the Web and Telecoms environments, each element of the Telecoms stack can offer different benefits to the Web. In fact, that concept is the theme of this book i.e. how do various elements of the Telecoms stack benefit the Web.

The core benefits for SCWS SIM technology to the Web i.e. the Mobile Web 2.0 role of SCWS SIM are:

a) A mass market service
b) Oriented towards Operators
c) A secure environment
d) Access to device APIs
e) Client side processing
f) A client for the Cloud(i.e. for Web apps)

In adopting this role, the SIM has evolved from its original role (as a means to authenticate to the network) into a new role as an applications development platform as we shall see below.

The SIM is an operator-owned smart card used to

- Ensure a secure authentication on the operator network
- Configure the device with operator network settings (SMSC parameters, roaming rules etc)
- Store user personal data (for example on the SIM phonebook)
- Run simple text-based operator applications (M-banking etc)

It is the only physical device totally owned by the operator in end-users' hands. It can be remotely managed over-the-air

The evolution of the SIM card

The SIM card has evolved into an application development platform. Depending on the context, we refer to the enhanced SIM card as 'Next generation SIM card' or interchangeably as 'SCWS SIM' when we are referring to its role as the Smart Card Web Server.

Leveraging the handset browser, Smart Card Web Server enables users to run offline web apps as the cards can host a real web server. In addition, the SCWS SIM card has upto 1 G of onboard memory. This factor makes SCWS SIM technology suitable for deploying operator managed client side web apps. In other words, SCWS SIM can be the client for the Mobile Cloud.

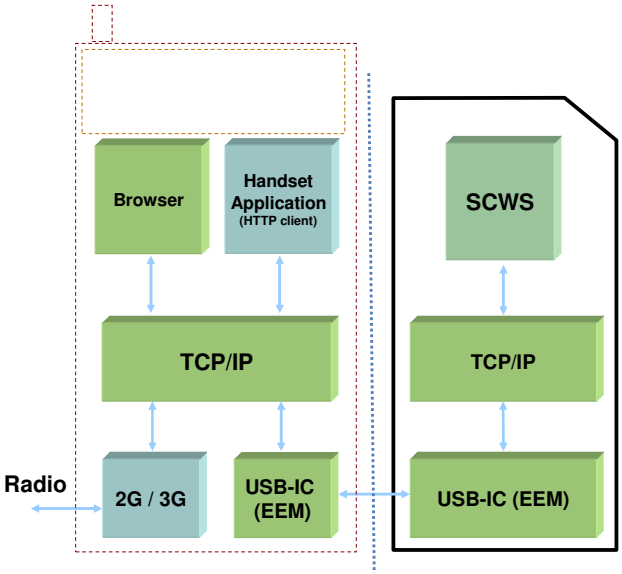
The evolution of the SIM card to the next generation SIM card (Next generation SIM card) is a significant leap involving a number of technical enhancements – both for the card and for the handset. For next generation SIM technology like SCWS to be deployed in handsets, it must be integrated into the handset. The technology that enables this integration between the handset and the next generation SIM is called USB-IC (Universal Serial Bus Inter-Chip).

The USB-IC is the evolution of the USB 2.0 approved by the USB Implementers Forum and endorsed by ETSI (European Telecommunications Standards Institute). When introduced in a USB-IC enabled handset, it provides 3 subclasses of communications:

- ICCD to transport APDU over USB-IC (for example to access ETSI 2G-3G File Systems)
- EEM to transport TCP-IP over USB-IC(for example to access Smart Card Web Server pages). TCP-IP connectivity between the SIM card and handset has been standardized by the ETSI on the Specification TS 102 483. This TCP-IP connectivity allows taking full benefits from High Speed Protocol SIM cards and "Internet" like use cases based on SmartCardWebServer
- Mass Storage(for example to access Multimedia content such as music, picture, video).

Note: APDU(Application Protocol Data Unit) is a communication unit between a reader(in this case – the device) and the card(in this case, the SIM) http://www.jguru.com/faq/view.jsp?EID=470744

An implementation of TCP-IP over USB-IC is as below

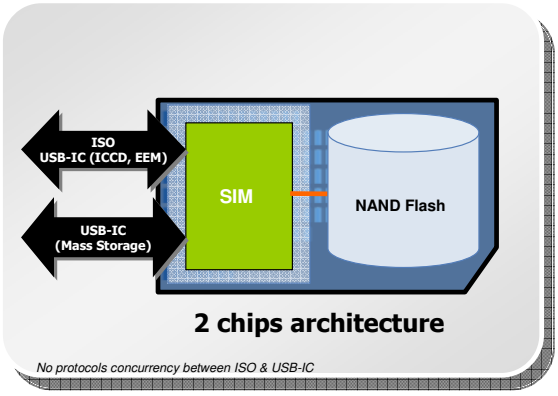


Increased memory in next generation SIM cards

The Next generation SIM card is based on a two-component architecture offering a larger secure and controlled memory.

2-chips architecture includes

- SIM controller including NAND flash controller
- External NAND flash (from 128MB to GB)



In this case, the functionality is distributed as follows:

SIM controller

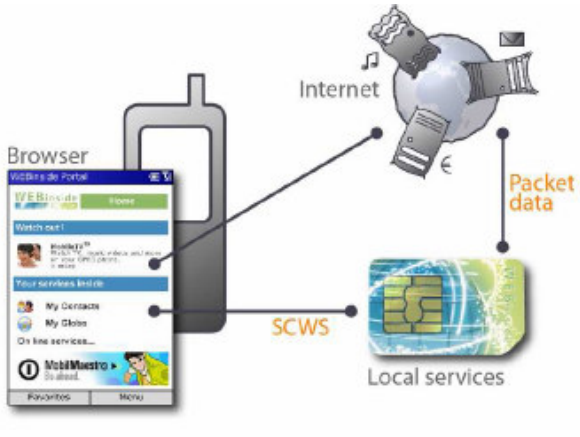
- **ROM :** Stores the Operating System and part of applications such as SmartCardWebServer
- **Non Volatile Memory :** Stores the mobile operator's subscription-related data, 2G-3G file systems, and applications

NAND flash memory

Stores the operator's data using Next generation SIM card applications such as SmartCardWebServer, Advanced Phonebook; end-user will also be able to store Multimedia personal content such as pictures or music.

The Smart Card Web Server(SCWS)

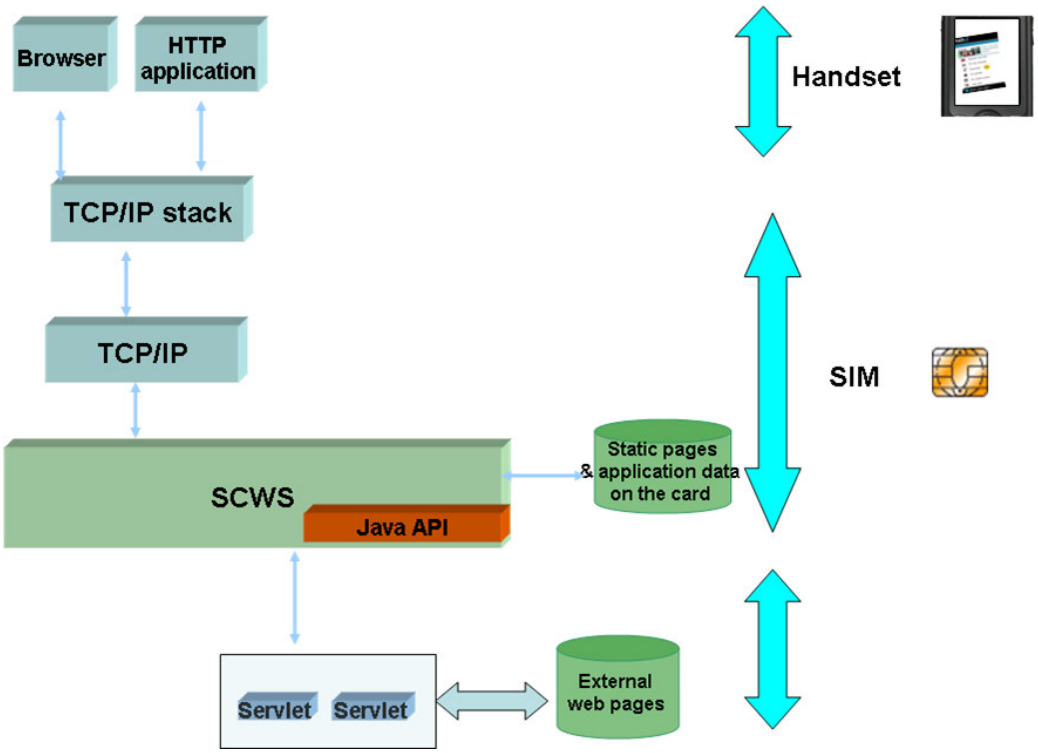
The Smart Card Web Server(SCWS) is specified by the Open Mobile Alliance and consists of a server application based on the SIM able to respond to HTTP1.1 requests such as xHTML pages and multimedia content, which will be displayed by the WAP/Internet browser located in the mobile phone.



Based on the SCWS HTTP - xHTML capabilities, servlets can be developed using ETSI standardized APIs in TS 102 588 to enable new multimedia services.

SCWS or servlets data can also be remotely managed as we explain below.

The interplay between SCWS SIM and the Mobile browser can be explained as follows:



The Web server in the SIM SCWS is implemented using the HTTP1.1 protocol. In response to a HTTP request from the handset browser, the SCWS SIM web server sends back to the browser either the requested static content (i.e. static HTML, GIF images, ...) or dynamic content (i.e. generated by an application running inside the SIM). Because the SWCS SIM application has access to the secure SIM device APIS, these APIs can be used to access device functionality.

For instance, if we have a SCWS application that needs to send a SMS:

- The browser sends the request to SCWS
- The SCWS application sends the SMS using SIM device APIs (to be more specific, this is the "SendSMS" command of the "Sim Toolkit framework").
- These device APIs have been standardized for more than 10 years as part of the SIM toolkit. These APIs include voice calls, SMS, location information, GPRS connection, Phonebook access, Local storage, Pop-up browser and others
- The SCWS application sends back to the browser a page that explains to the end-user that the SMS has been sent (if the end-user needs to be aware of this)

Significance for the mass market

With the significance of emerging markets, the need to address the mass market has become important. Here, the concept of 'mass market' is to be viewed from the Mobile Network Operator perspective. Considering the fragmentation in the handset market and the need to have a uniform user experience across the handsets, there are two potential ways to integrate – either vertically(at the application layer and across the device stack) or horizontally(i.e. across devices for one Mobile Network Operator).

Traditionally, device vendors have strived to achieve vertical integration i.e. across the device stack. This includes approaches from Apple(iPhone), Google(Android) and Nokia(Ovi). However, these approaches, by definition, do not cater for horizontal integration i.e. across the different devices for a given Operator. They also have limitations which include: Only addressing a limited range of (high-end) handsets, Not aligned with operators strategies, fragmented technologies, limited billing integration(or no billing integration).

The traditional way to address horizontal integration i.e. the mass market for an Operator has been via handset customization programs.

The concept of handset customization arose in Japan where the Operators worked closely with device manufacturers to create a customised handset for their subscriber base. The Operator's goal in most cases is not cost reduction but rather differentiation. However, outside of Japan, the concept has had little success because although it appears interesting in principle, handset customization programs have some limitations. Handset customization programs are complex and expensive, they have limited support from device manufacturers since they lead to smaller volumes and greater complexity, they lead to fragmentation and finally they only work in handsets sold from the Operator's shop i.e. not across the whole distribution chain. As a result, the addressable market for devices is affected and we have a range of devices which include full fledged signature devices (Connectivity settings, HomeScreen, Operator applications), light customization(Connectivity settings, Shortcut to WAP site) to no customization(in a majority of cases). Thus, in Europe you get the best case scenario from the Operator standpoint of 70% of the devices going via the Operator – of these only a faction (say 60%) get customised – to the case of non subsidised markets where a vast majority of devices are not Operator branded.

The Operator's problem in this case becomes – how to cost effectively load Operator applications and brand devices and yet address the mass market.

In this context, the SCWS SIM technology can play a role. SCWS SIM presents a standardized way to extend the Operator application to the Gray market i.e. the handsets sold outside their distribution channel and for Operators who do not have a handset customization program.

From an Operator standpoint, the benefits for mass market via SCWS SIM could include:

- Standardized applications with no deployment of an application on the handset
- Use of existing browser technology
- Rich and evolutionary UI incorporating JavaScript, Ajax etc
- Leveraging web runtime extension like Adobe Flash
- Access to Device APIs that are already standardised and available
- Portable and personalized i.e. can be ported from one handset to another
- Remotely Manageable applications can be transparently and remotely managed by the operator

SCWS - Services and applications

SCWS SIM applications include a range of applications that can be run from a browser. But they also include a class of applications that include a secure service. For instance:

- Banking applications
- Social networks
- Converged address book
- Widgets/RSS,
- Enhanced voice applications"
- Mcommerce
- Applications catalogs
- NFC
- Unified communications clients etc
- On SIM helpdesk

Synergies and relationship with other applications development platforms

SCWS SIM technology has a rich Web based UI which should evolve with enhanced browser capabilities (Javascript, Ajax etc) and will also leverage Web runtime extensions like Adobe Flash. More than the capabilities of the Web itself, the SCWS SIM could provide an integrated application development environment including access to device APIs, remote management of applications, helpdesk etc.

In contrast to other architectures, the SIM can give to the device the order to launch the Web browser, and provide a local SIM address for the URL. This can be triggered by a secure SMS from the operator.

SCWS APIs

Access to network APIs is a key requirement for applications. However, security considerations are important here to protect end-user and devices from malicious Web sites and applications. Hence, access to device APIs is always associated to complex security schemes requiring applications to be certified and signed on each device and end-user feedback when the right level of certification is not granted. In the SCWS environment, as the operator is fully under control of the content of their SIM cards, SCWS applications are already trusted, which means that they don't need to be certified and there is no need for end-user confirmations when SIM device APIs are used.

The SCWS environment offers access from the browser to SIM device APIs that are standardised and already available in mass market devices. In contrast, standardisation of access to device APIs in a browser environment is still an on-going work, with proprietary implementations appearing and creating fragmentation

Some of the SCWS APIs include:

- Outgoing voice call: ability to trigger a voice call from a SCWS application
- Incoming voice call: ability to trigger a SCWS application on an incoming call (or a missed call)
- Outgoing SMS: ability to send a SMS from a SCWS application
- Incoming SMS: ability to trigger a SCWS application on an incoming SMS
- Location: ability for a SCWS application to retrieve location information such as cell ids or roaming information
- Local storage: ability for a SCWS application to read and write data on the SIM
- Data connection: ability for a SCWS application to open a data connection to a server in the cloud (this can also be done in background, invisibly for the end-user, so SCWS application data are always synchronised with server-side data)
- Phonebook access: ability for a SCWS application to access to SIM phonebook
- Pop-up browser: ability for a SCWS application to pop-up the Web browser (for instance after having received a SMS)

Cloud computing

Extending the evolutionary role of the SCWS SIM to the Web discussed above, SCWS SIM technology becomes relevant in context of Cloud computing – specifically as a client for the mobile cloud. In this section, we explore the idea that

a) The cloud needs a client

b) SCWS SIM could be the client for the cloud

What is Cloud Computing?

Cloud computing is a paradigm in which information is permanently stored in servers on the Internet and cached temporarily on clients that include desktops, entertainment centers, table computers, notebooks, wall computers, handhelds, etc.

With cloud computing, the browser is becoming a platform to run Web apps. By Web apps, we mean that an application that runs mainly on the Web. However, the browser was never meant to take that role i.e. the browser has evolved into this role overtime by chance. The browser has had many cosmetic features (Dials, UI etc) and the UI has been the emphasis of the Browser vendors. But increasingly, UI alone is not enough if the browser can run Web apps. The browser needs some key elements of the Operating system to be a true (ground up) platform to run web apps

Does the Cloud need a client?

The question is: Does the Cloud (i.e. webapps) need a client?

Ray Ozzie of Microsoft alluded to this principle first when he essentially redefined the SAAS paradigm to Software plus service [1] - in effect incorporating the role of a client for the cloud. This belief was further reinforced with the launch of the Chrome browser[2] from Google.

The Chrome is an Open source, free web browser released by Google in Sep 2008. If we put the Chrome announcement in perspective, then it is like swinging a sledgehammer to the browser paradigm i.e. it is a VERY heavy duty approach to adopt for a browser alone and the Chrome web site provides a clue about the architectural approach which Google has taken. Essentially, Chrome tries to create a browser from first principles, as per Google's stated vision for Chrome[3]

Since we spend so much time online, we began seriously thinking about what kind of browser could exist if you started from scratch and built on the best elements out there. What we really needed was

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[1] http://en.wikipedia.org/wiki/Software_plus_services

[2] http://en.wikipedia.org/wiki/Google_Chrome

[3] http://www.google.com/chrome/intl/en/why.html?hl=en

not just a browser, but also a modern platform for web pages and applications, and that's what we set out to build.

Chrome innovations include three specific developments (besides the UI obviously)

a) Sandbox processes: Chrome splits each task into a separate process ('sandbox') (process management)

b) Security: Chrome enforces a simple computer security model whereby there are two levels of multilevel security

c) A high performance V8 Javascript engine: Chrome introduces a high performance V8 Javascript engine)

So, it would appear that the resultant entity (Chrome) is a hybrid between a browser and an operating system - and potentially the consistent with the philosophy that the Cloud needs a client.

The other motivation is: the cloud is fragmenting whether we like it or not.

Amazon S3, EC2; Google AppEngine, Facebook and Salesforce.com are not interoperable and are not likely to be as well. Differentiation will be based on service (cloud i.e. server side) but ALSO on the client.

Nor is this approach (client heavy cloud) confined to Google and Microsoft alone. Others have adopted a similar philosophy - for instance: Microsoft with Dynamics CRM, Microsoft Outlook, Adobe with their Air (Adobe Integrated Runtime); Adobe bringing Flash, Action script and MXML to the desktop; Salesforce.com with Appexchange; Google with Android, and Chrome

The next logical question is: If we accept that the Cloud needs a client, then what could be the Mobile client for the cloud?

Is SCWS SIM technology the client for the Mobile Cloud?

Let us look at the Mobile ecosystem and ask ourselves: Where is the edge of the network? (For simplicity - I am considering only the Operator network in this discussion)

There are two possibilities, the device (which includes the browser of course) and the SIM.

Much progress has been made with the device through initiatives like OMTP BONDI, Google Gears etc but still much more needs to be done. The second possibility is the SCWS SIM. In its full implementation, SCWS SIM will incorporate at least the following

a) A complete Web server

b) Upto 1G of memory

c) A full browser standards based application development environment

d) Capability to run offline web applications

e) Access to device APIs

f) A trusted ecosystem

In other words, it has all the elements to potentially be the client for the Cloud from an Operator standpoint. There is one key advantage for the Operator i.e. while roadmaps for devices and browsers may deviate from Operators; roadmap for SCWS SIM is much more aligned by Operator (since the Operator controls the SIM)

So, the Operator vision could be:

a) SCWS SIM becomes the client for the cloud

b) Operator adds value since single point of contact for many cloud services (a place to store logins) is managed through SCWS technology

c) We include Security, Javascript engine etc all of which are compatible with SCWS SIM

d) It mirrors a wider strategy of the web

e) Client side processing is enabled by faster, local, secure execution and it is still standards based.

Note: This is not an Open/Closed issue since that decision is a commercial one and not a technical implementation one.

Remote management and the Push Web (waking up the device)

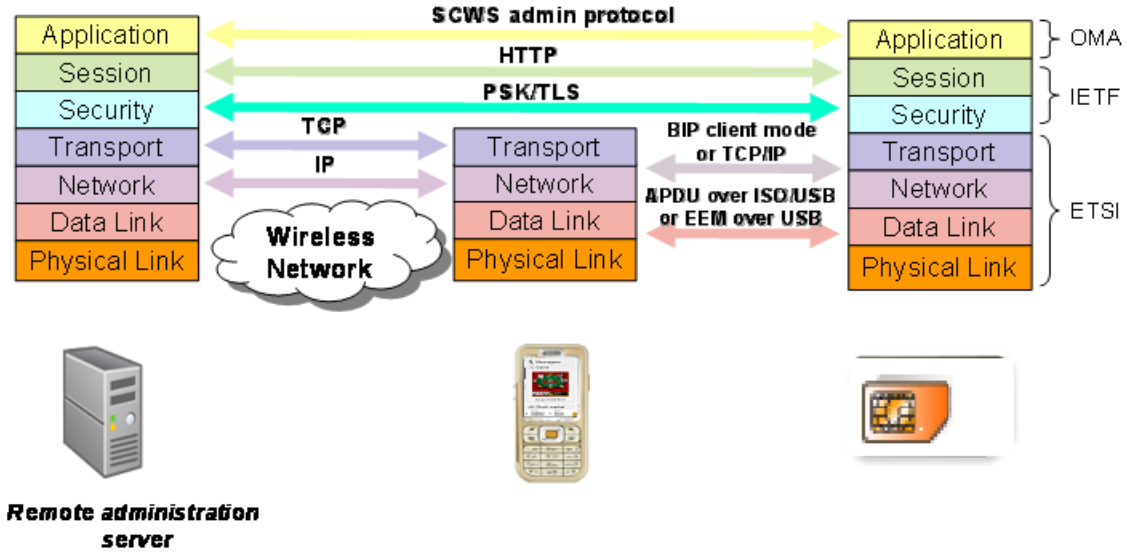
One of the benefits of the SCWS technology lies in the creation of a Push Web. The concept of the Push Web is very simple: The Web as it stands, operates primarily in the Pull mode. This means, information is requested by the User first and in response to that request, the response is delivered. In contrast, the Mobile Web may well potentially Operate in a Push mode i.e. information is delivered to the User in response to a request. This simple distinction between Push and Pull is significant because the Push model adds convenience – and therefore, potentially a premium for the content being delivered. In other words, the same content may be delivered for a price even if it is available for free on the Web. Ofcourse, the Push mode may also utilise a 'subscribe' model – which is an enhanced form of Push.

The SCWS SIM has two technologies that lend itself to this model: Remote management and the ability to Wake up the device. We shall discuss these briefly below:

Remote management: SCWS and its servlets can be managed remotely, to modify, add to or adapt their content. For the dynamic management purposes a new protocol has been defined and standardized at OMA (OMA/SCWS), to open a secure pipeline between the SCWS in the card and the Over-The-Air platform to enable remote management of SCWS local pages and any secure interaction between the card and a telecom operator server

The main characteristics of this protocol are:

- The card is seen as a client
- The OTA platform is seen as a server
- The card communicates with the OTA platform using Web protocols (HTTPS)
- Security layer is “Transport Layer Security” (the “S” in HTTPS), in a “Pre-Shared Key” mode
- Part of the intelligence is switched to the client (for example - retry management)



The ability to wake up the device: Leveraging the above architecture, the SIM can give to the device the order to launch the Web browser, and provide a local SIM address for the URL. This can be triggered by a secure SMS from the operator.

Conclusions

Despite the success of the iPhone and other devices, from an Operator perspective, the mass market is critical. The SCWS SIM technology allows the Operator to leverage their strengths and access the mass market by leveraging the power of their existing assets i.e. the SIM card which is ubiquitous across devices. In addition, SCWS SIM offers the possibility of a mobile client for cloud computing.