

Web 2.0 Applications on a Next-Generation Java Card[™] Platform

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TS-5203



Goal of This Talk

Learn how to build a Web Application with a Next-Generation Java Card[™] platform

Understand the value of Next-Generation Java Card technology-based Web applications (Java Card Web applications) in the context of Web 2.0



Agenda

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Next-Generation Java Card Platform NG Java Card Technology and Web 2.0 Demo: A NG Java Card technology-based Web 2.0 PIM Under the hood of the demo

Conclusion and perspectives

Java JavaOne

Agenda

Next-Generation Java Card Platform

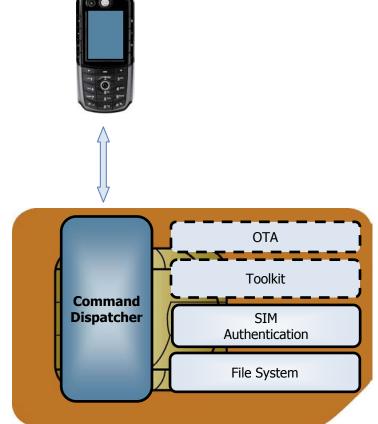
- NG Java Card Technology and Web 2.0
- Demo: A NG Java Card technology-based Web 2.0 PIM
- Under the hood of the demo
- **Conclusion and perspectives**





90's: Proprietary OS Cards

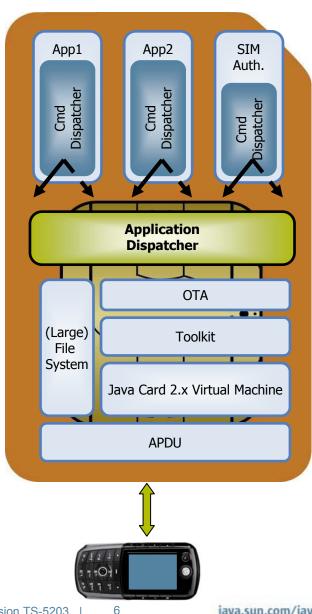
- 1st generation of SIM cards
 - OS architecture = applicative command dispatcher + authentication module + file system
- Major evolutions
 - Proprietary interpreter: 1st step of toolkit services
 - Over the Air (OTA) access: way for operators to manage cards remotely
- Market driven by the boom of mobile communications





Java Card Platform: Open OS Era

- 2nd generation of SIM cards
 - OS architecture = dispatching to applets running on top of Java Card Virtual Machine (VM)
- Key benefits
 - Interoperability across card • manufacturers
 - Post-issuance downloading
- Major evolutions
 - Interoperability
- Market driven by demand for interoperability and memory capacity



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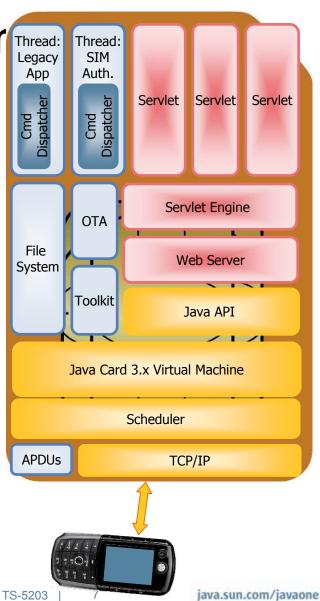
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Next-Generation Java Card Platform: A Connected Platforr

- 3rd generation of SIM cards
 - OS architecture = multithreaded Java[™] Virtual Machine (JVM[™]) + TCP/IP + general purpose APIs
- Key benefits
 - New application model: Web Apps
 - Network aware (TCP/IP)
- Major evolutions
 - USB high-speed protocol
 - NAND Flash mass storage

NG Java Card is still a work-in-progress, not final specifications. The terms "Java Virtual Machine" and "JVM" mean a Virtual Machine for the Java™ platform.





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Next-Generation Java Card Platform for Java Card Developers

- Backward compatibility
 - javacard.framework is still supported
 - Applets and APDUs are still supported
 - APDUs are messages of the legacy smartcard application protocol
 - Applets are Java Card 2.x instances for smartcard applications
 - Same memory model (with an automatic GC)
 - The firewall is still enforcing the security rules
- New features
 - Multithreading, String, long
 - TCP/IP connectivity, abstracted by streams
 - Web application support: HTTP Servlets in addition of Applets, to dynamically extend the embedded web server behavior

NG Java Card is still a work-in-progress, not final specifications





Next-Generation Java Card Platform for Web Developers

- Well-known application model
 - Servlet 2.4 API subset
 - Applications are packaged in .jar files (classes and files)
 - CLDC Generic Connection Framework (GCF)
 - SSL/TLS capable
- Additions and enhancements
 - Dedicated crypto API
 - Firewall enforces isolation between applications
 - Persistent operating system: the Java Card VM never stops
- New features
 - New descriptors, to manage new deployment and security aspects
 - The smallest server you can imagine ;-)

NG Java Card is still a work-in-progress, not final specifications



Agenda

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Next-Generation Java Card Platform **NG Java Card Technology and Web 2.0** Demo: A NG Java Card technology-based Web 2.0 PIM Under the hood of the demo

Conclusion and perspectives



Web and Java Card Technology

More and more convergence

The Web

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Before 2000:

- 90's: Rapid deployment
- 1995: Java technology Applet for the Web
 - Secure mobile code for the Web
- 2000: Internet bubble (Web 1.0)

Since 2000:

- Web everywhere for everything: DSL, WiFi, 3G, VPNs, VoIP,...
- Plethora of smart technologies: FF, CSS, DOM, JavaScript[™] technology (AJAX), RSS, XML, SOAP (Web Services)
- Web 2.0: Richer applications, WebMail, blog, calendar, Social Web sites, Mashups

The Smart Card Before 2000:

- 90's: worldwide deployment
- 1997: Java Card Applet for Cards
 - Secure code for smartcards
- 2000: WAP for mobile phones

Since 2000:

- Java Card[™] 2.x SIM mass deployments
- Many applications: large SIM cards, EMV Migration, emerging security and ID businesses
- Novelties: larger memories, USB, TCP/IP, Next-Generation Java Card platform with Servlet engine





Web 2.0 and Next-Generation Java Card Platform

The right time to meet

- Web 2.0: a more ubiquitous Web than ever
 - Desktop applications are moving to the Web
 - Richer and dynamic Web applications (AJAX)
 - Web applications on mobile phones
- NG Java Card platform: embeddable Web applications
 - TCP/IP + HTTP(S) over high-speed protocol (USB)
 - Static (files) and dynamic (Servlet) content served by an embedded Servlet engine with mass-storage available
 - Security enabler for Web applications
 - Personal web server opportunities



Web 2.0 and NG Java Card Platform: Opportunity #1

Beyond SIM Toolkit menus

- Thanks to the embedded HTTP server, pages will be provided to the mobile browser
 - Text-based SIM Toolkit menus replaced by rich HTML-based GUI



SIM application Toolkit is an API used to create card applications that can display text and menus on the phone screen





Web 2.0 and NG Java Card Platform: Opportunity #2

Local Web applications

- NG Java Card platform = a local Web server serving operator's Web applications
 - The more capable the browser in the phone, the richer the card Web applications
 - Support for CSS, JavaScript technology,
 - DOM, XHR, etc
 - Fast and secure access to on-card content
 - An alternative to remote server hosting (personal) content
 - Runs offline





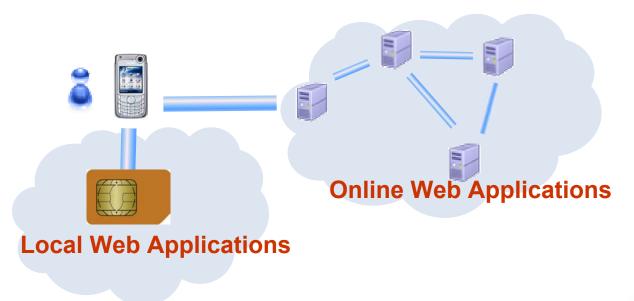




Web 2.0 and NG Java Card Platform: Opportunity #3

Connected local Web applications

- Local Web applications can mashup with online Web applications
 - Local applications enriched with online content
 - Online applications personalized with local content



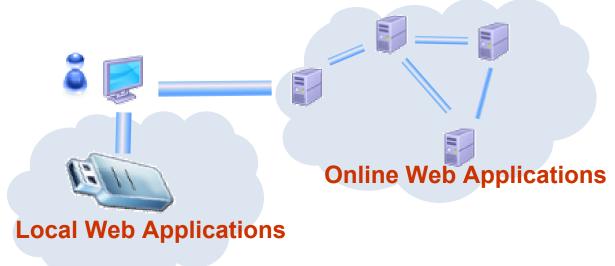




Web 2.0 and NG Java Card Platform: opportunity #4

Beyond SIM cards

- Embedding NG Java Card technology into a smart USB Flash Drive
 - Smartcard secure microcontroller + Flash memories
 - Serving multimedia data, rich personal and secure Web applications







A New Kind of Application

Serving Web applications from a NG Java Card technology-based device (Java Card device)

- Allow to make personal Web applications portable across system and devices
- Maintain privacy of personal data in a controlled local Web server
- Benefit of richer Web applications look and feel
- Work even if offline
- NG Java Card platform local Web applications can be mixed with online services using Web mashup techniques
- NG Java Card platform local Web server is remotely manageable



Technical architecture

- Characteristics of NG Java Card devices
 - Limited processing power, bandwidth and memory space
 - Web 1.0 architecture not relevant: involves important resource utilization at each page refresh
- Making rich NG Java Card Web 2.0 applications
 - A 3-tier architecture
 - AJAX development methodology
 - Web Mashup capabilities





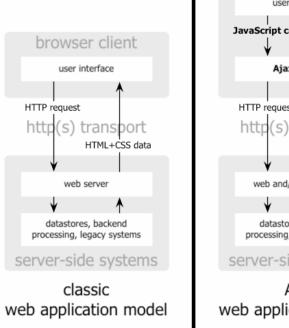
Leveraging on a 3-Tier architecture

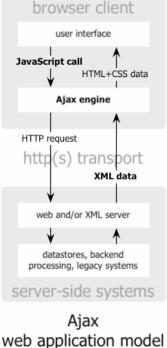
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language to decode and inject		POJOs in
data into the page		Java Card VM
(DOM object creation or innerHTML)		persistent heap
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AJAX = a set of browser technologies

- HTML and CSS for presenting
- JavaScript technology for local processing
- DOM (Document Object Model) to access data inside the page
- XMLHttpRequest for asynchronous data retrieval





Source: http://www.adaptivepath.com/publications/essays/archives/000385.php





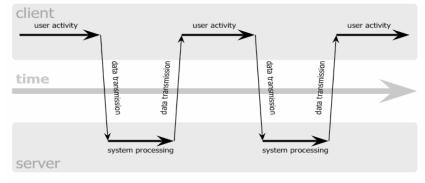
XMLHttpRequest = no more single request/response

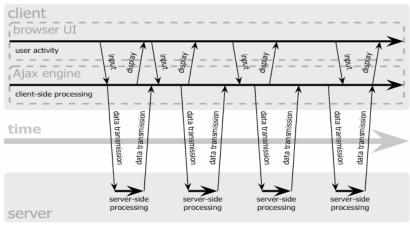
- Sends and reads data on the server asynchronously
 - Flexibility to get the data from the server only when needed
 - Flexibility to get only the needed data (and no more)

• Asynchronous mode means

- Server response processed when available
- No need to wait and to freeze the display of the page

classic web application model (synchronous)





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Ajax web application model (asynchronous)

Source: http://www.adaptivepath.com/publications/essays/archives/000385.php





Leveraging on AJAX development methodology

- To build a fast and dynamic website
 - Selective update of page elements (JavaScript technology+DOM) with data provided by the server (XHR)
 - No whole page reload required (XHR)
- To save resources by using the power of the client browsers
 - Processing on client (JavaScript)
 - Small data provided by the server only when needed (XHR)
- Intensively use AJAX to save NG Java Card platform server resources while developing fast and dynamic applications





Web mashup capabilities

- "A mashup is a Web application that uses content from more than one source to create a new service" Source: Wikipedia -- http://en.wikipedia.org/wiki/Mashup (web application hybrid)
- Relies on public Web service API
 - Google Maps, Yahoo! Maps, Amazon, Flickr, del.icio.us, etc.
- New applications created by reusing existing services





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FromCraigList

Mashup implementation



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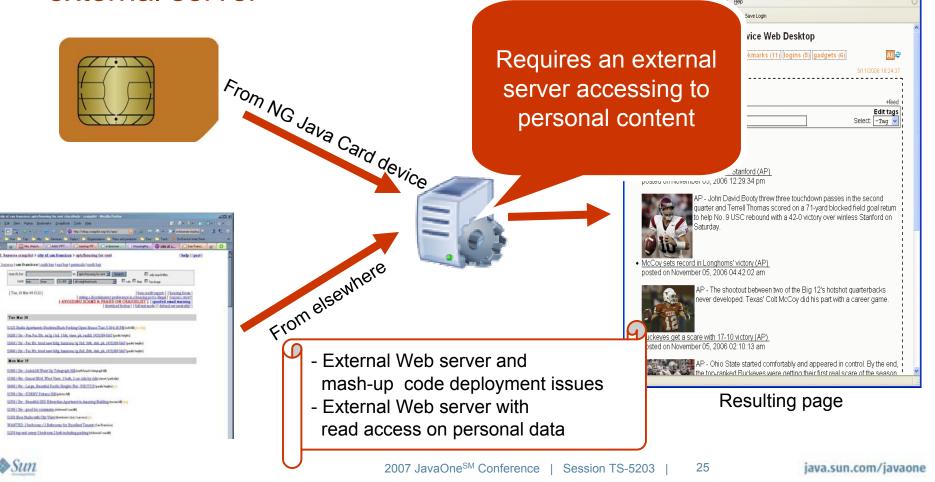
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Building a NG Java Card Web 2.0 Application

Mashup with a NG Java Card Web application: in an external server

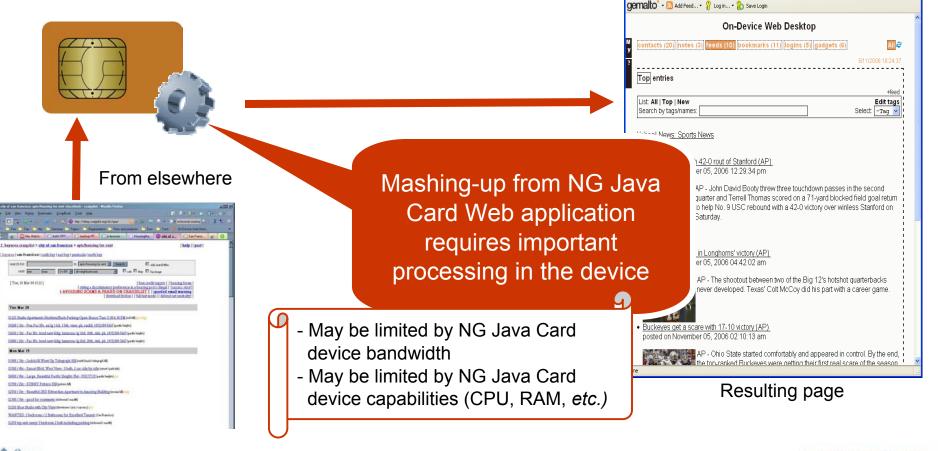




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Building a NG Java Card Web 2.0 Application

Mashup with a NG Java Card Web application: in NG Java Card device

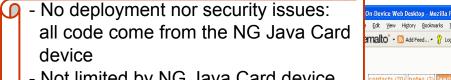




Mashup with a NG Java Card Web application: in-browser



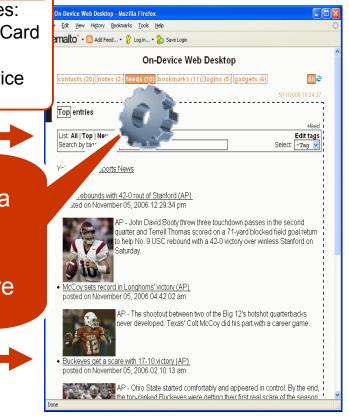
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- Not limited by NG Java Card device capabilities

Mashing-up inside the browser from the NG Java Card device provided JavaScript technology: - gets data from elsewhere - injects data to the page

From elsewhere



Resulting page



Leveraging on Web mashup capabilities

- Best solution = "in browser" mashup
 - Self-contained and safe: does not require an external server
 - Runs in the browser: saves NG Java Card platform server resources
- Issue with the "in-browser" mashup solution
 - Browser prevents XHR calls from outside the origin domain of the page (aka "same origin policy")
 - NG Java Card device-originated JavaScript technology codes cannot request content from "elsewhere"
- Solution: use of external content formatted as JavaScript technology code (a.k.a. "on-demand JavaScript" technology)
 - Loading dynamically JavaScript technology code from another domain is not forbidden
 - Web ads use intensively this technique
- Intensively use on-demand JavaScript programming language technique to save NG Java Card platform server resources while enriching the application with mashups





What makes an NG Java Card application "Web 2.0"!

- Design a 3-tier architecture to embed only the vital part of the application
 - Business logic in Servlet codes
 - Persistent data for free with NG Java Card technology memory model
- Use AJAX to save resources on the NG Java Card platform server
 - HTML pages don't need to be generated by Servlet codes
 - With **XMLHttpRequest**, limit exchanges to on-user-demand need for data
 - Use simple data formats: plain text, XML, JSON, etc.
- Use AJAX to make the Web application responsive and dynamic
 - **XMLHttpRequest** prevents the pages from freezing
 - JavaScript technology and DOM allow for limited page updates
- Enrich your application with online content
 - Prefer in-browser mashup to save server resources



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Next-Generation Java Card Platform NG Java Card Technology and Web 2.0 Demo: A NG Java Card technology-based Web 2.0 PIM Under the hood of the demo Conclusion and perspectives





NG Java Card Technology-Based Web 2.0 PIM

An embedded Web Personal Information Manager

User's personal information



On a personal device



Accessible from any host (online or offline)





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NG Java Card Technology-Based Web PIM

Application features

- Rich user experience: use of AJAX for better responsiveness
- Rich content: mashup of information from different sources
- Ubiquity: available offline
- Privacy: personal data is under user's control
- Security: login/password management and antiphishing solution





NG Java Card Technology-Based Web PIM

User's data GUI

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NG Java Card Technology-Based Web PIM

User-friendly interface to edit personal data

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NG Java Card Technology-Based Web PIM Mix personal data with online content RSS Feeds Google Gadgets

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•	AP - John David Booty threw three touchdown passes in the second quarter and Terrell Thomas scored on a 71-yard blocked field goal return to help No. 9 USC rebound with a 42-0 victory over winless Stanford on Saturday.
	AP - The shootout between two of the Big 12's hotshot quarterbacks never developed. Texas' Colt McCoy did his part with a career game.
•	Buckeyes get a scare with 17-10 victory (AP) posted on November 05, 2006 02:10:13 am
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The demo is a prototype anticipating some NG Java Card technology-based functionalities



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DEMO

A Next Generation Java Card Technology-Based Web PIM The Web PIM application is called EWD (Embedded Web Desktop)

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Next-Generation Java Card Platform NG Java Card Technology and Web 2.0 Demo: A NG Java Card technology-based Web 2.0 PIM **Under the hood of the demo** Conclusion and perspectives

The demo is a prototype anticipating some NG Java Card technology-based functionalities



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Responsibilities

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Coope Coope Coop	 ✓ Quick link to PIM ✓ Shortcuts to add personal data 	 ✓ Queries EWD to insert / edit personal data in HTML pages ✓ Mashes-up EWD provided personal data and Remote web server provided public data 	 ✓ TCP/IP Web server ✓ Stores personal data ✓ Serves EWD application files: JS CSS, HTML, images ✓ HTTP API to get, add, delete personal data

In-browser Mashup: Overcome Same-origin Policy **On-Device Web Desktop**

From EWD

Principles

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- A single web page: EWD
- Information from another server: RSS feed content From Yahoo! News
- Issue: Same origin policy
- Solution: On-demand JavaScript programming language
 - Instead of issuing an XMLHTTPRequest, insert a script tag in the HTML page (no same origin policy)
 - The script URL points to a online service, and contains the URL of the requested information
 - The obtained script contains the "write" directives to insert the feed content into the page



<script src=</pre>

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Room for Improvement

- This demo is a proof-of-concept
 - Illustration of the guidelines: design 3-Tier, use AJAX and in-browser mashup
 - Illustration of interesting functionalities: rich user experience, rich content, offline and online mix, privacy and security
- Some additional functionalities to experiment
 - Login/password management and secure login
 - Embedding existing online applications to get same user-experience offline and online
 - Synchronizing embedded and online content
 - Smarter solutions to in-browser mashup of content
 - List not closed...

The demo is a prototype anticipating some NG Java Card technology-based functionalities

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Next-Generation Java Card Platform NG Java Card Technology and Web 2.0 Demo: A NG Java Card technology-based Web 2.0 PIM Under the hood of the demo **Conclusion and perspectives**





Summary: A New Platform

What you've learned from this session

- Next-Generation Java Card technology is a fullfledged Java platform for embedded Web applications
- Major evolution of the Java Card platform with a Java Servlet engine for dynamic Web application
- Ready for devices with standard high-level connectivity: USB, TCP/IP, HTTP(S)





Summary: New Web 2.0 Opportunities

What you've learned from this session

- NG Java Card Web 2.0 Applications
 - Alternative to personalized applications on remote servers
 - Privacy of personal data: personal secure storage, not transmitted to remote third-parties
- Additional benefits
 - Offline experience
 - NG Java Card Web applications can be as rich as RIAs





Summary: Guidelines for Efficiency

What you've learned from this session

- Building rich Internet applications with a NG Java Card device is possible
- 3-Tier architecture to limit the charge in the NG Java Card device
- AJAX development methodology to meet highlevel user experience
- In-browser mashup of local and remote content to maintain privacy





Perspectives

New opportunities

- Hoping this talk has given you ideas of novel Web applications
 - With the Next-Generation Java Card platform
 - In the context of Web 2.0 and beyond...
- NG Java Card platform availability
 - Public Release of specifications scheduled by start 2008
 - Products to follow in 2008





For More Information

- TS-5686: Next Generation Java Card Technology For Secure Mobile Applications
 - Saqib Ahmad, Sun Microsystems, Inc.; Eric Vetillard, Trusted Labs; Florian Tournier, Sun Microsystems Inc.
- BOF-5368: A Raconteur's Tour of Java Card Technology Development
 - Seth Meltzer, U.S. Treasury/IRS; Doris Baker, dmb
- Sun Booth: Gemalto's NG Java Card Technology demo
- http://java.sun.com/products/javacard/





Thank You!

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Web 2.0 Applications on a Next-Generation Java Card[™] Platform

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