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Oracle Java for TEE
Enhanced Security for Mobile Applications

CREATE THE FUTURE

Dmitry Barinov
SecureKey

Michele Sartori
Oberthur

Eric Vétillard
Oracle

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Speakers

- **Dmitry Barinov**
  - CTO, SecureKey
- **Michele Sartori**
  - System Security Engineer, Oberthur
- **Eric Vétillard**
  - Sr. Principal Product Manager, Oracle

Program Agenda

1. Oracle Java for TEE
2. Developing applications with the SDK
3. SecureKey: Application and return from experience
4. Oberthur: The OJTEE backend
5. Closing and Q&A

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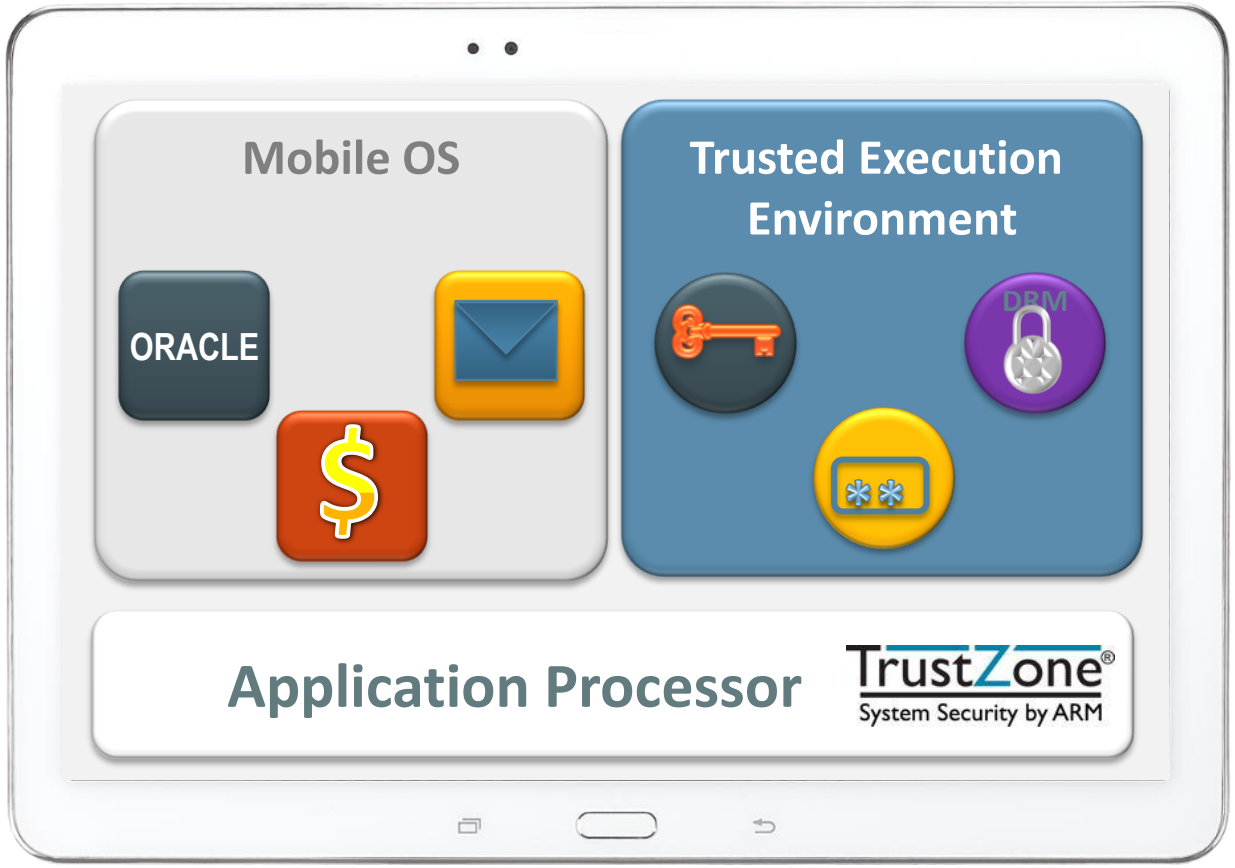
The need for mobile security

- Mobile apps have become pervasive
  - Lots of games and fun stuff
  - More and more serious stuff
    - Money, enterprise data, personal data
- Mobile apps are becoming targets
  - Phishing
  - Malicious apps
  - Attacks on stored data
- Some questions are open
  - How do I protect my user's credentials?
  - How do I get non-repudiation?
  - How do I get beyond passwords?
  - How do I protect my company's data?
- Good answers exist
  - They require a security foundation

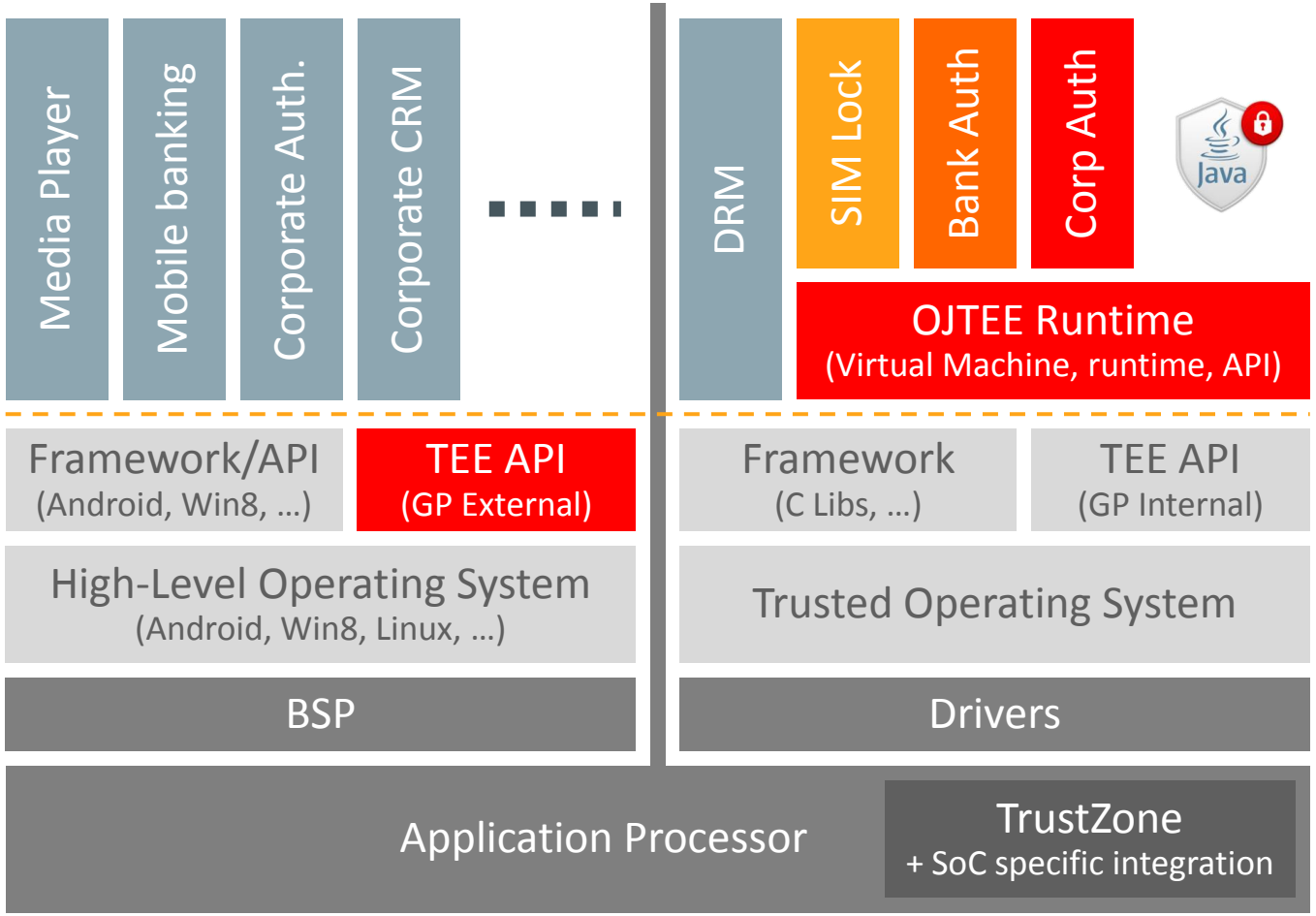
What is a TEE ?

A Trusted App Environment within a mobile processor

- Separated from the mobile OS with a hardware-based protection
- Runs in parallel with the standard mobile OS
- Storage & management of secrets and credentials, away from logical attacks
- Secure communication channel with the backend



Oracle Java for TEE architecture



- OJTEE introduces binary-level portability for Trusted Apps (TAs)
  - Abstracts native OS & HW from Services
  - Reduced porting and integration costs
- OJTEE offers an open and flexible deployment model for Trusted Apps
  - Flexible deployment infrastructure
  - All interfaces will be standardized, allowing competition to exist at all levels
- OJTEE is a separated environment
  - Specific Java APIs and VM
  - A constrained development environment

Technical Benefit of Java TEE

A unique blend of security and flexibility for secure mobile service

- **Portable applications** across devices and architectures
  - Open specifications, free and powerful Java development tools
  - Full interoperability guaranteed, up to binary format
  - Reduced testing and certification efforts
- **Dynamically manageable** trusted services
  - Interoperability simplifies the deployment and lifecycle management of security services
- Proven **security**
  - Shares principles with Java Card platform, deployed on billions of devices
  - Market-tested security model

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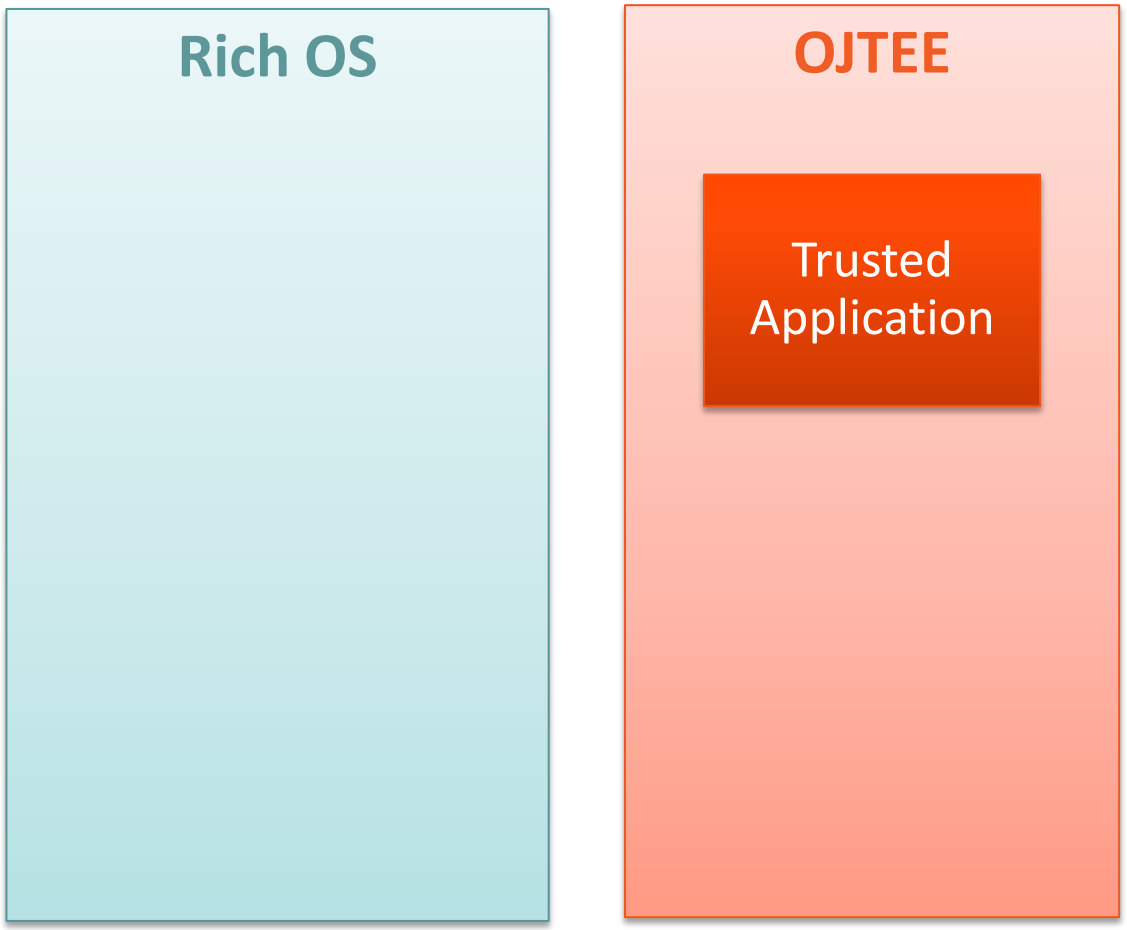
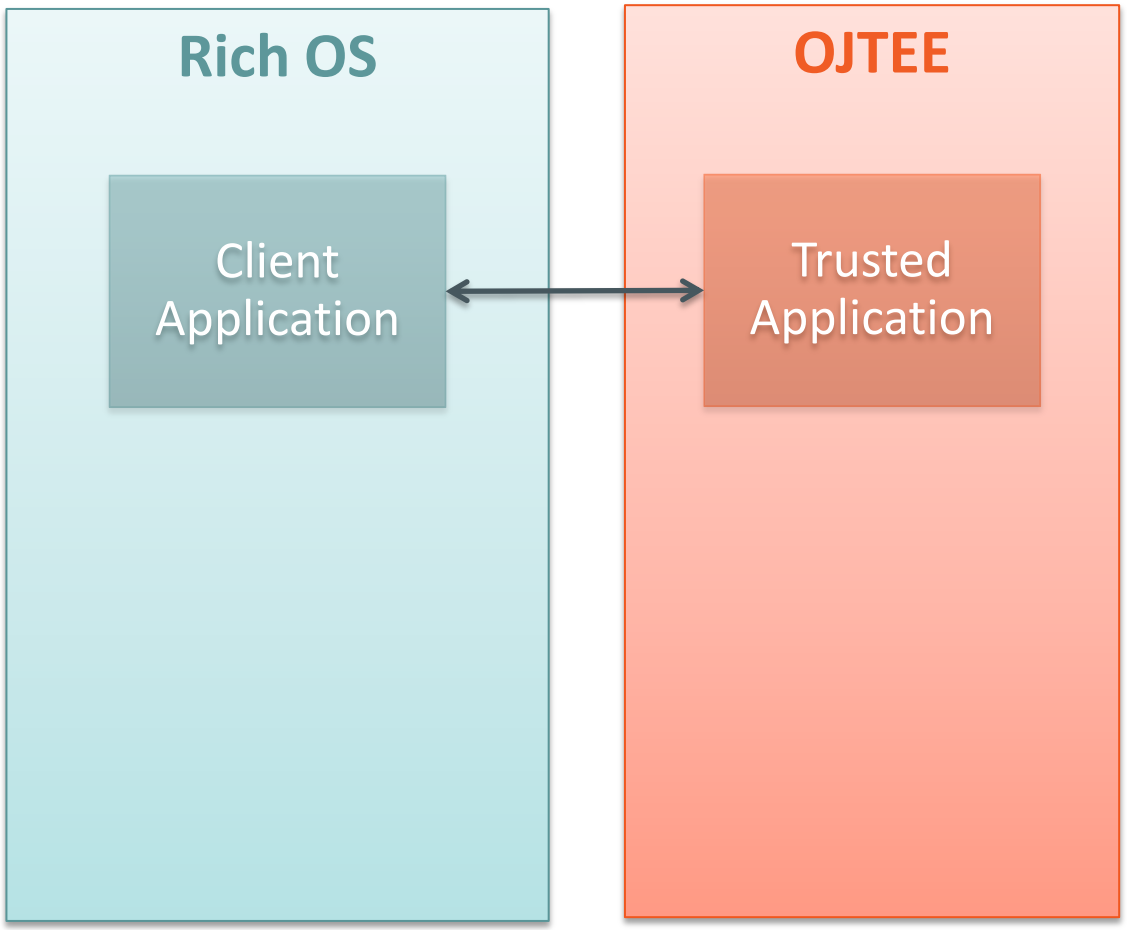
So, what do we develop?



A Trusted Application

- Implements basic security functions
  - Protecting sensitive assets
  - Making crypto computations
  - Interacting with user thru Trusted UI
- Very limited in scope
  - Only includes sensitive operations
- Built on OJTEE
  - Using a specific Java runtime

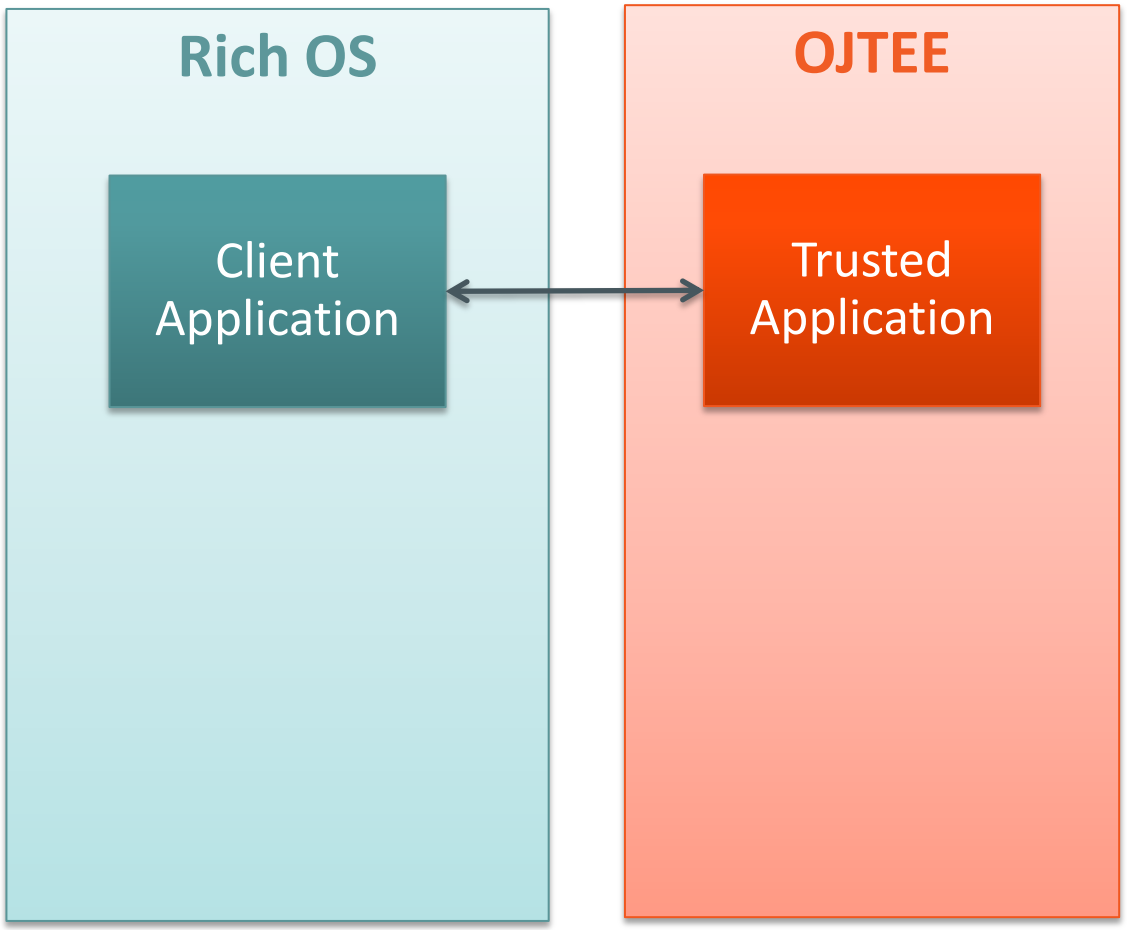
So, what do we develop?



A Service Protocol

- The interface to the TA
  - Based on a basic comms protocol
  - As defined by GlobalPlaform
- Crucial for security
  - Attack surface for the TA
  - Bad design introduces vulnerabilities
- Also important for usability
  - Practical aspects must be considered

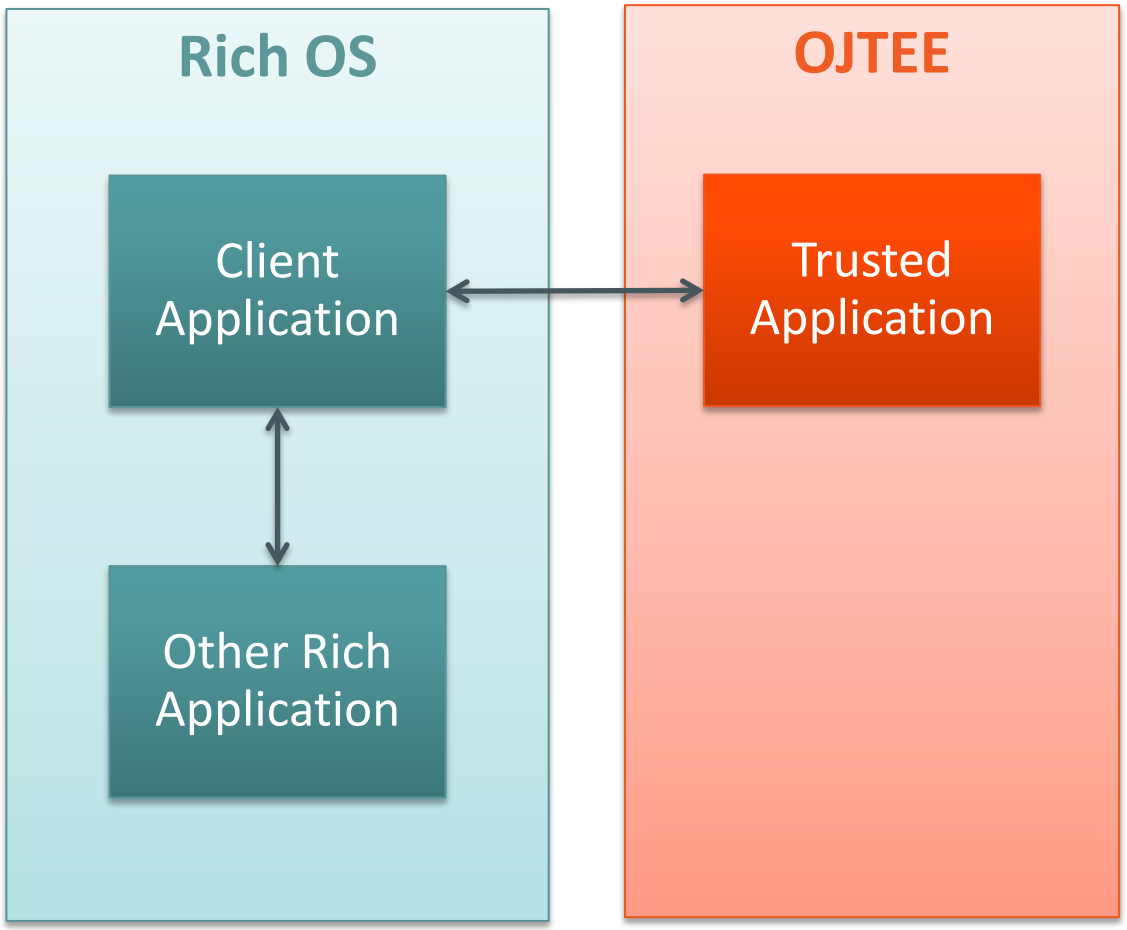
So, what do we develop?



A Client Application

- Implements the service protocol
  - From the client side
- Uses it to build a security service
  - Building on the TA's security features
  - Transforming into a practical app
- Built on a Rich OS
  - Depends on the target OS
  - For now, we support Android

So, what do we develop?



A Rich OS Service

- Making a security service available
  - Leveraging OJTEE and a TA
  - Hiding all complexity
  - Providing a high-level service
- Must be very simple
  - Targeting all mobile developers
  - Providing access to security functions

What skills are required?

Trusted Application	• Strong security skills • Oracle Java for TEE skills
Service Protocol	• Strong security skills • Previous protocol design experience
Client Application	• Some security skills • Some knowledge about Trusted Application management
Rich Application	• No specific security skills • No knowledge of Oracle Java for TEE

SDK Tools for Developers

TA Development

- An IDE plug-in
  - Ready to use with Eclipse IDE and Android Development Toolkit
  - With generation of specific binary format
  - With basic Trusted Application Management

TA Debug and Test

- Some simulators
  - Running on Windows and Android
  - Including Trusted UI simulation
- Some testing utilities
  - Client API extensions
  - Trusted UI automation

Client Development

- A client API
  - Available on Windows and Android
- A basic management API
  - To perform basic management operations

SDK Demo

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Briidge.net Connect

Protection for all your service channels on all customers touch points

Provides the best user experience AND the strongest authentication.

- ✓ No OTP Entry
- ✓ Enables sign on and high value transfers
- ✓ Strong Assurance

Provides strong 2FA for your mobile app while making the app easier to user

- ✓ Transparent device authentication
- ✓ Fully unique Device ID
- ✓ QuickCode for easy password entry

Leverages strong credentials, secure and trusted execution environments and proximity protocols

Connect features

GOALS:

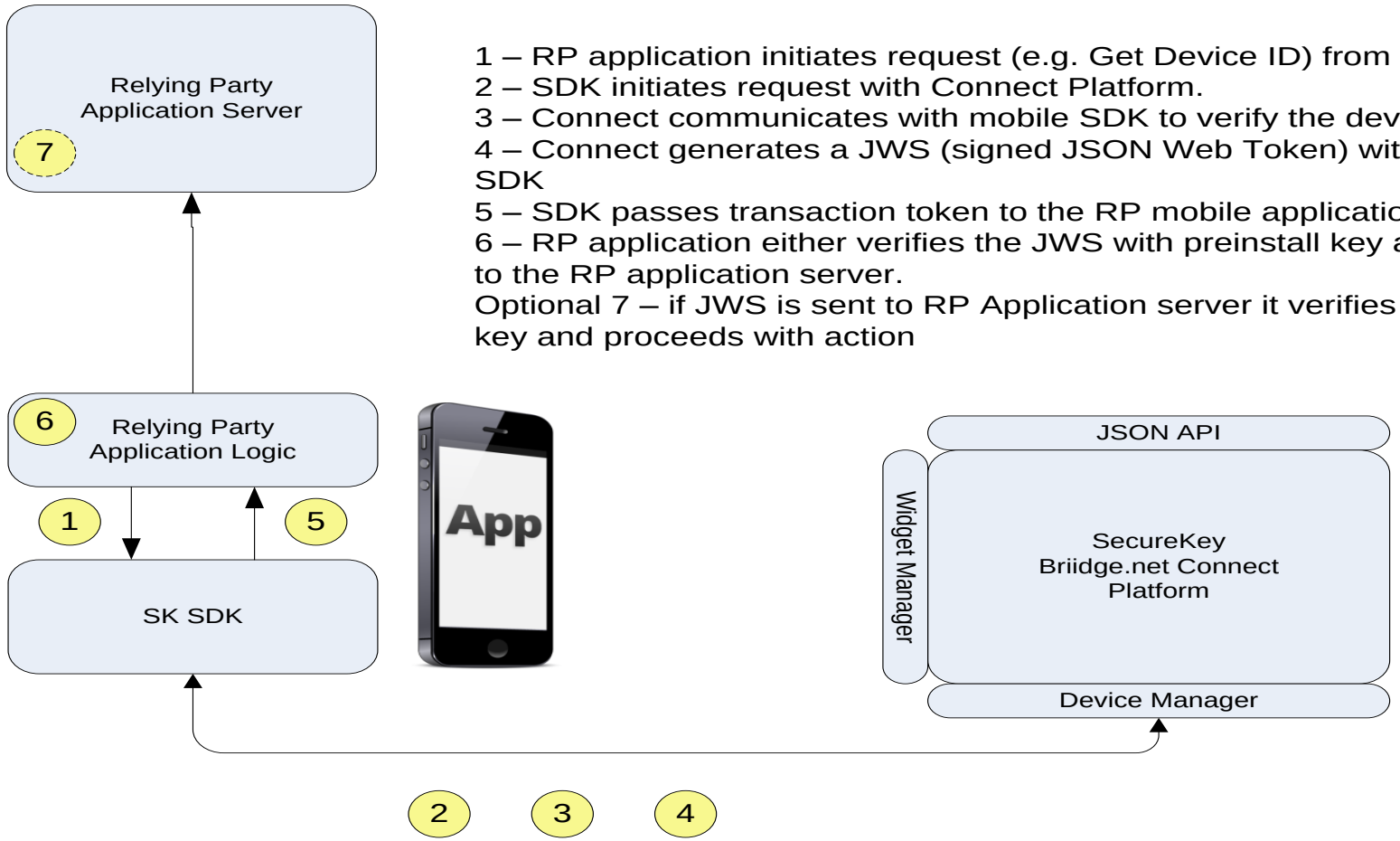
- Enable device as a strong credential or its proxy
- Provide easy integration for Relying Parties that consume assertions and attributes

- Strong anchor for device verification and User authentication.
- Server issued assurance.
- Runs on consumer devices:
  - Devices with hardware/embedded SE/TEE.
  - In software (mobile, PC).
  - In browsers.

- Additional features:
  - Biometric authentication – iOS, Android
  - Remote notification.
  - Card read and emulation.
  - Attribute management.
  - Modern protocol support (OATH, OpenID Connect, JWT).
  - On device signing

Solution Architecture:
Transaction Flow – Device verification

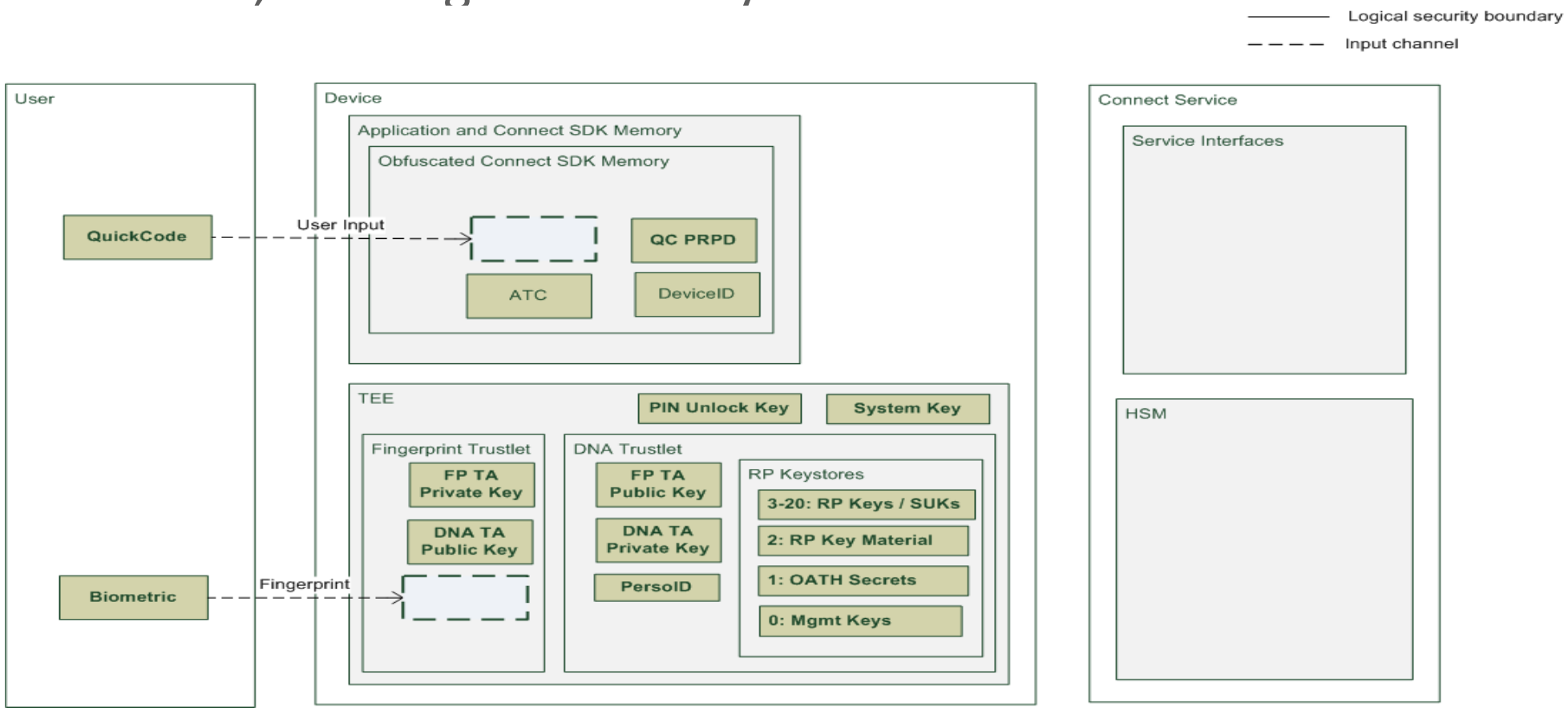
Passing Assertion to the client



1 – RP application initiates request (e.g. Get Device ID) from SDK.
2 – SDK initiates request with Connect Platform.
3 – Connect communicates with mobile SDK to verify the device credential.
4 – Connect generates a JWS (signed JSON Web Token) with assertion of verification and passes it on to SDK
5 – SDK passes transaction token to the RP mobile application.
6 – RP application either verifies the JWS with preinstall key and proceeds with action or passes the JWS to the RP application server.
Optional 7 – if JWS is sent to RP Application server it verifies the JWS with pre-exchanged verification key and proceeds with action

Security Features

- Keys, Identifiers, and Logical Security Domains



Leveraging the TEE

- Mobile apps with crypto all have same potential security issues in app sandbox. Exposure to malware is an ongoing concern.
- TEE provides secure execution environment
  - Enables secure storage of keys.
  - Requires higher privilege than other apps to access.
  - Enables gatekeeper functionality via TEE services.
- The above allows for interesting use cases:
  - Strong identity claims
  - Facilitation of payment tokens,
  - Biometric- enabled signatures.
- Simplification of development efforts (e.g. Is WBC really needed in TEE?)

Lessons Learned

- Code size limitation for a package is 64K, not yet documented.
- Debugging within the libraries is not available
- Logging for debug purpose is not available in TA.
- More than one package in same project is not supported, not yet documented
- Calling a TEE api within an inner class gives verifier error, after moving the class out works fine.
- Documentation about the important build related settings is in build.xml and jtee-ant.xml files.
- EA3 has all new development settings, setting up the custom built process is bit tricky
- EA3 added an Android simulator, provides real time working scenario
- TEE Internal API - Method required to retrieve Try counter in the Authenticator interface.

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OT Offers End-to-end Solutions

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DIGITAL IDENTITY

SMART TRANSACTIONS

TRANSPORT AND ACCESS CONTROL

MACHINE-TO-MACHINE

MOBILE FINANCIAL SERVICES

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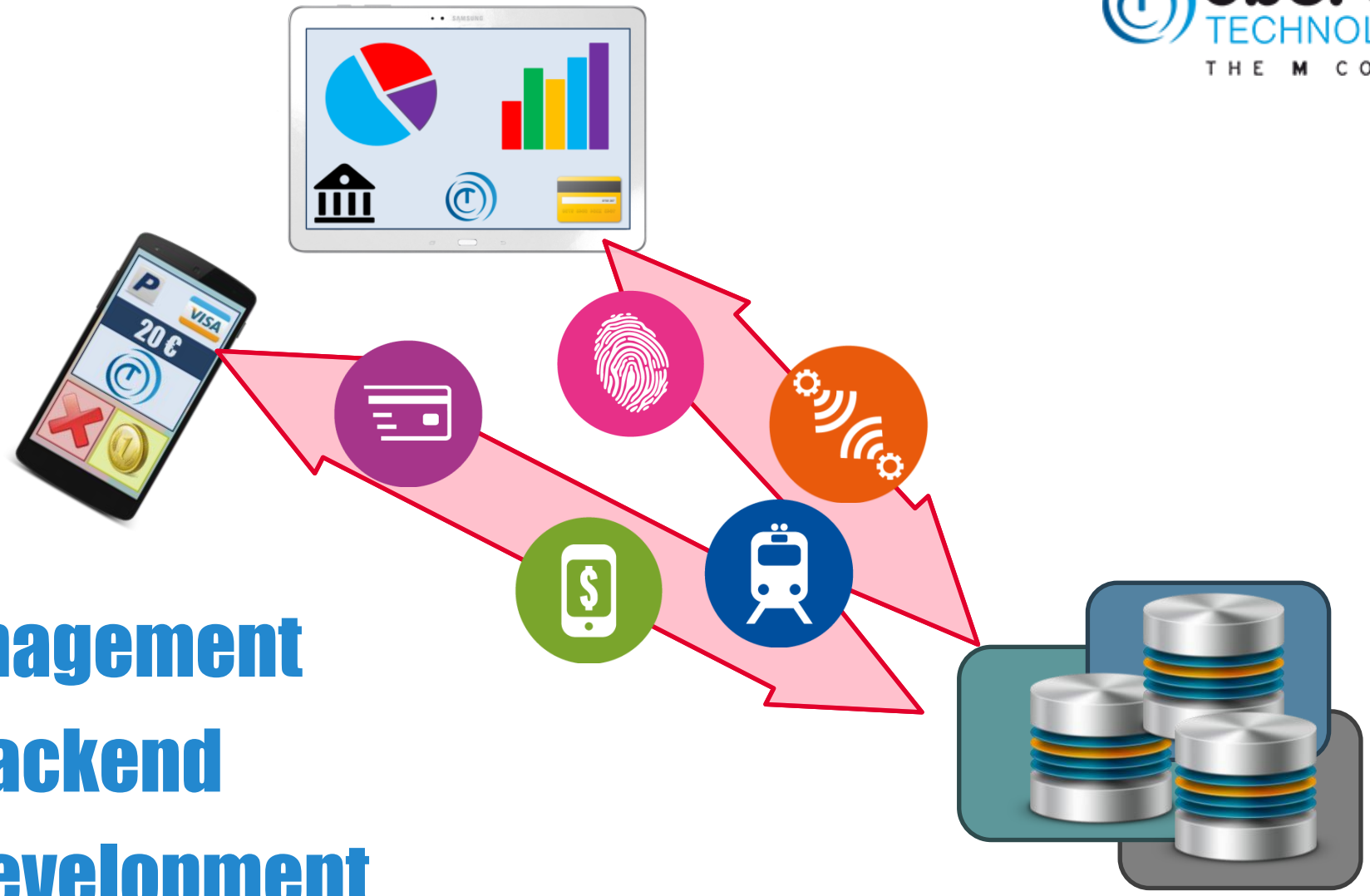

- Device Management
- Services Backend
- Services Development

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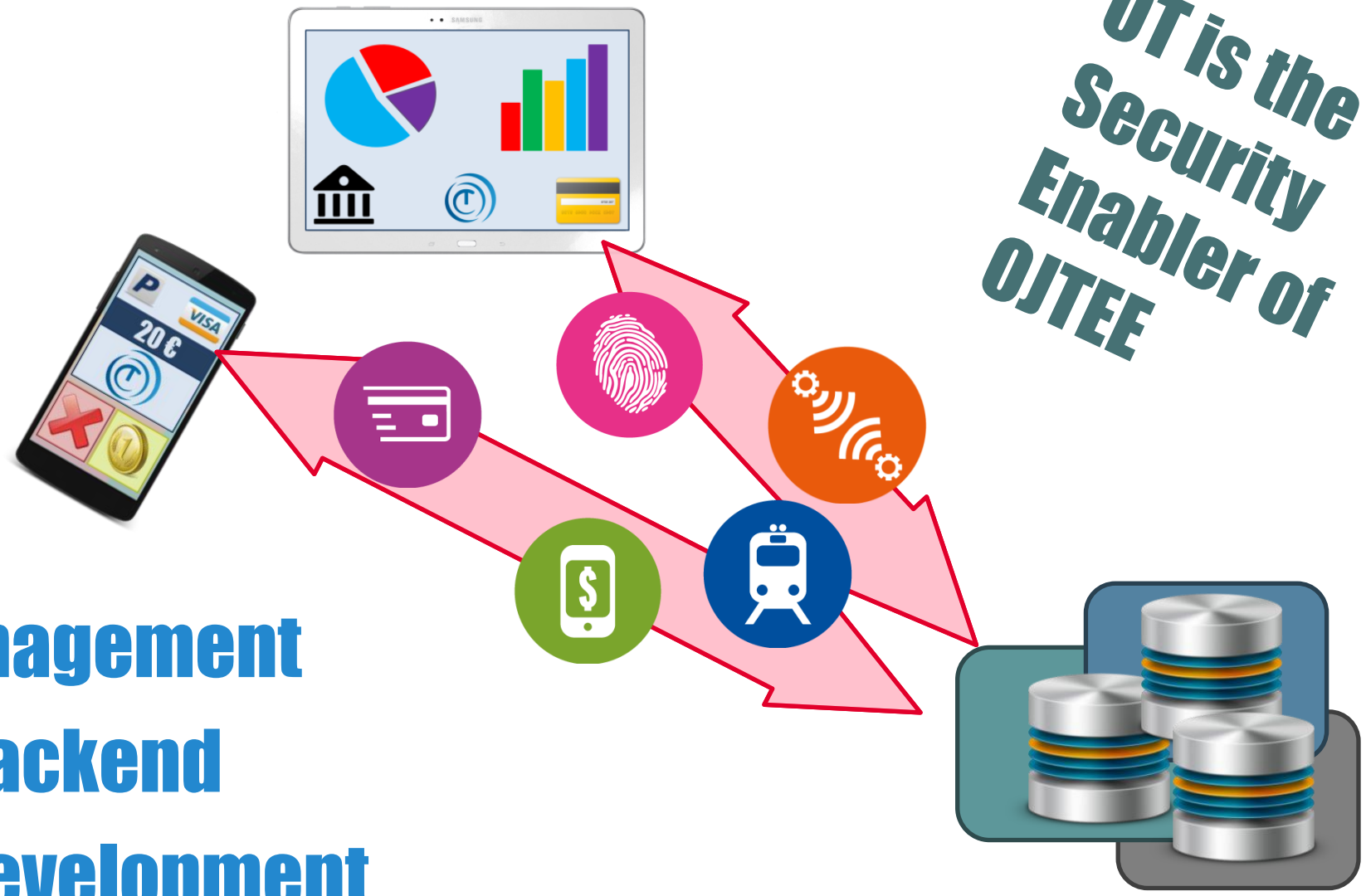
OT is the Security Enabler of OJTEE



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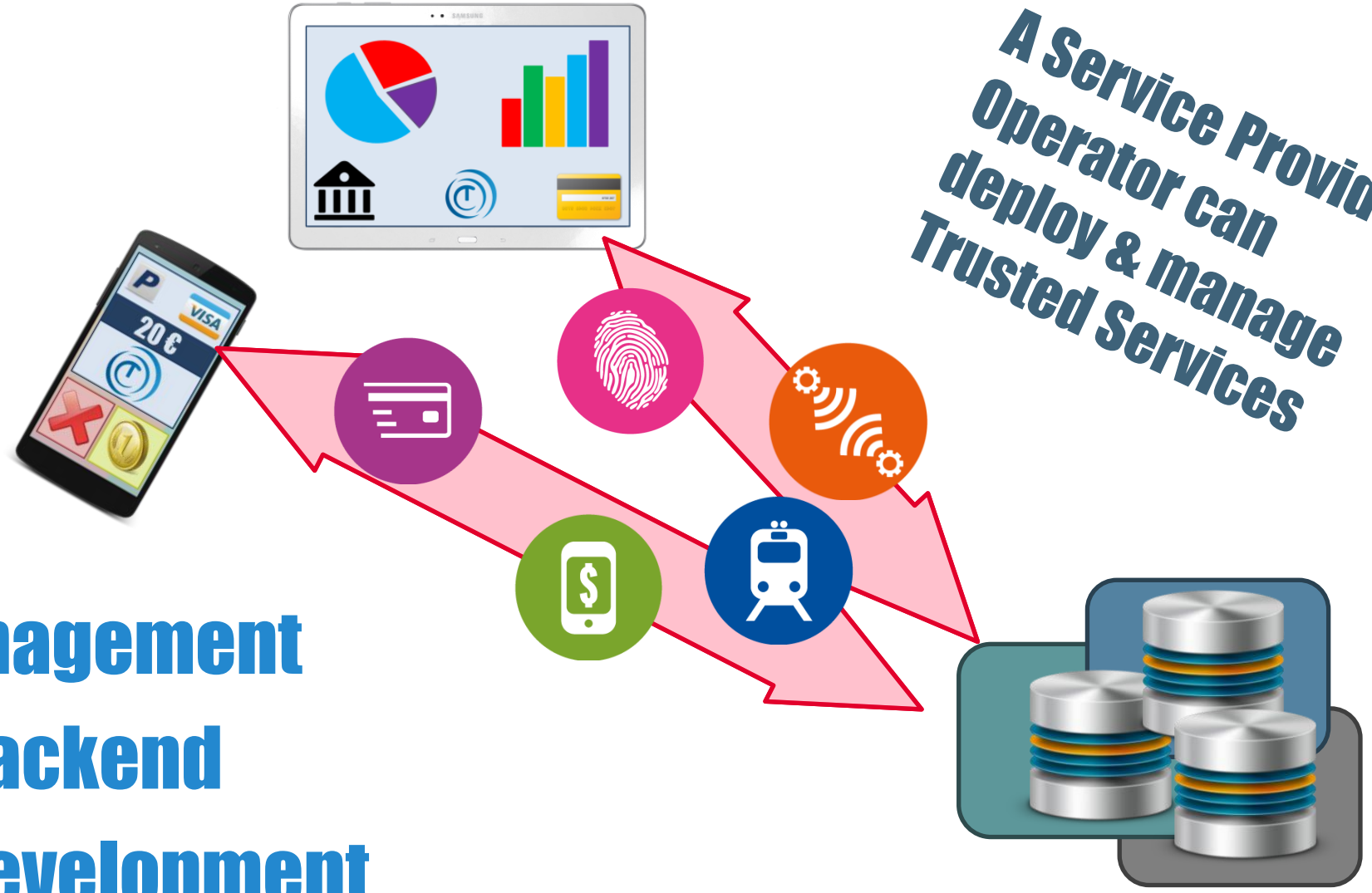

- Device Management
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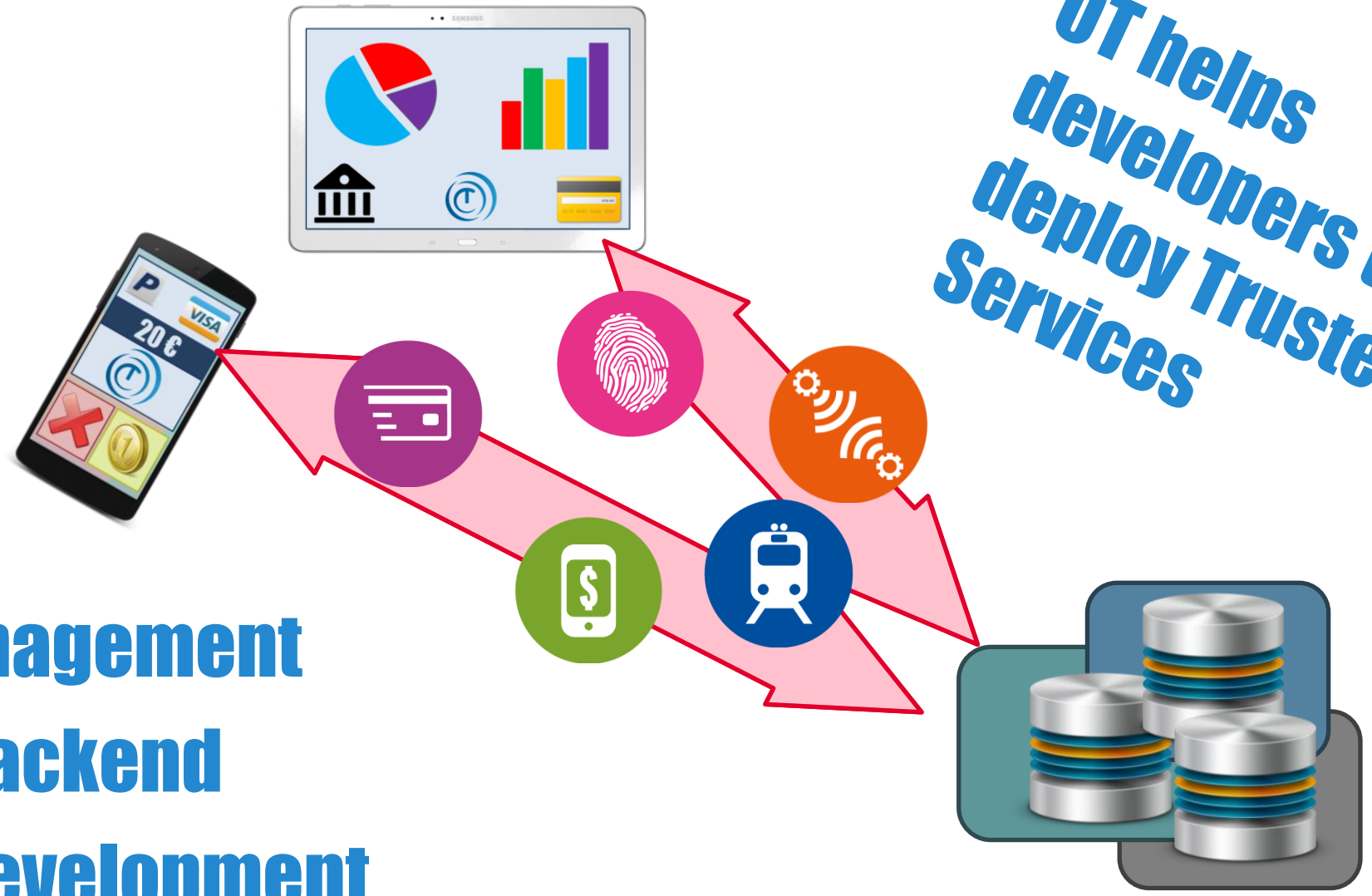
OT helps developers to deploy Trusted Services



- Device Management
- Services Backend
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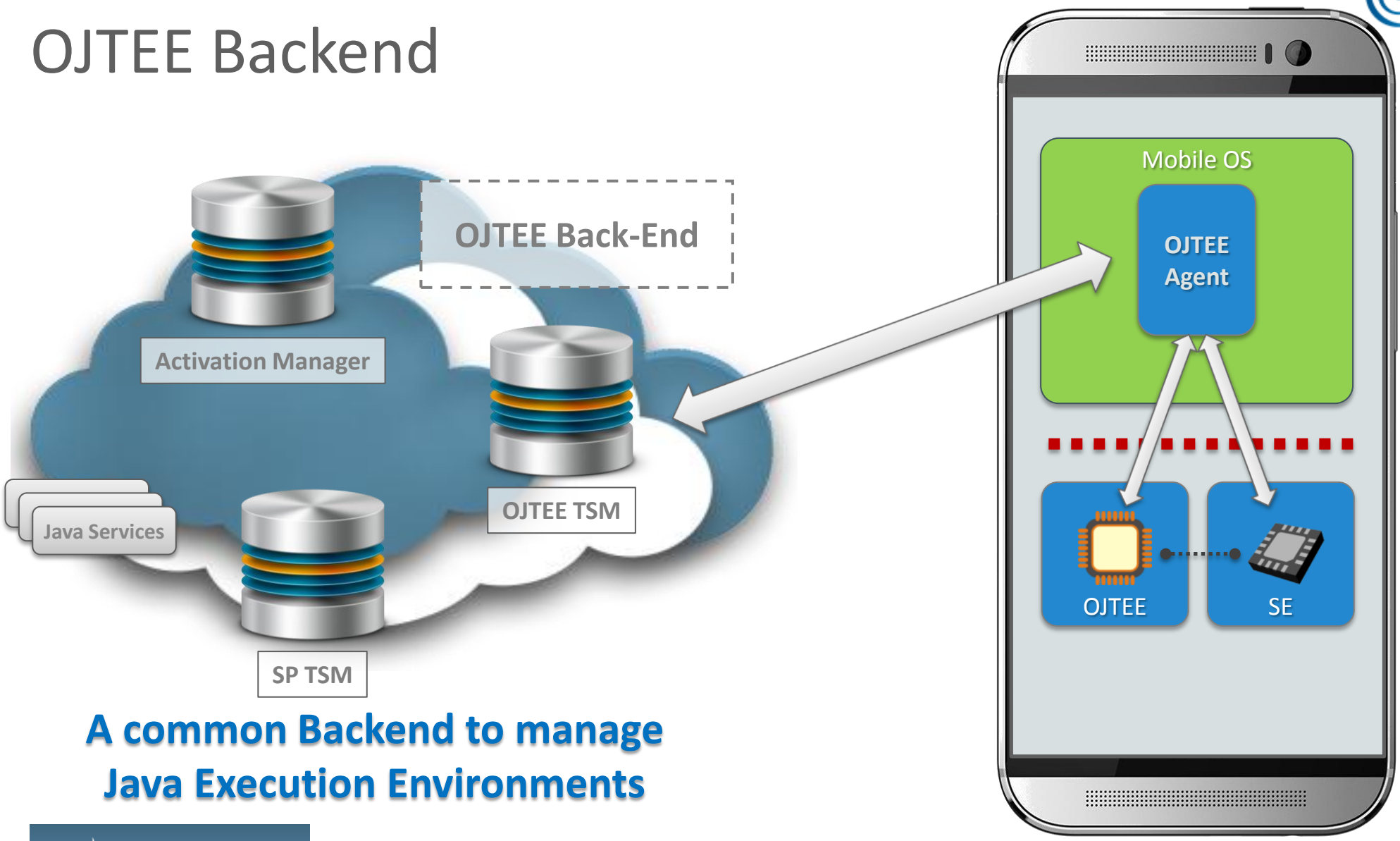
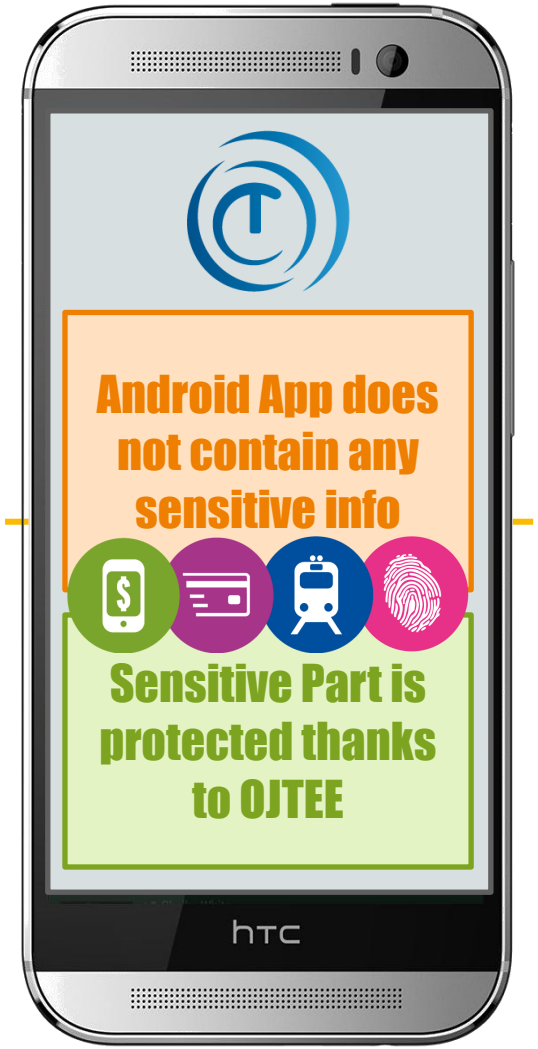
OJTEE Backend



A common Backend to manage Java Execution Environments

The Developer Perspective

Trusted Application Development

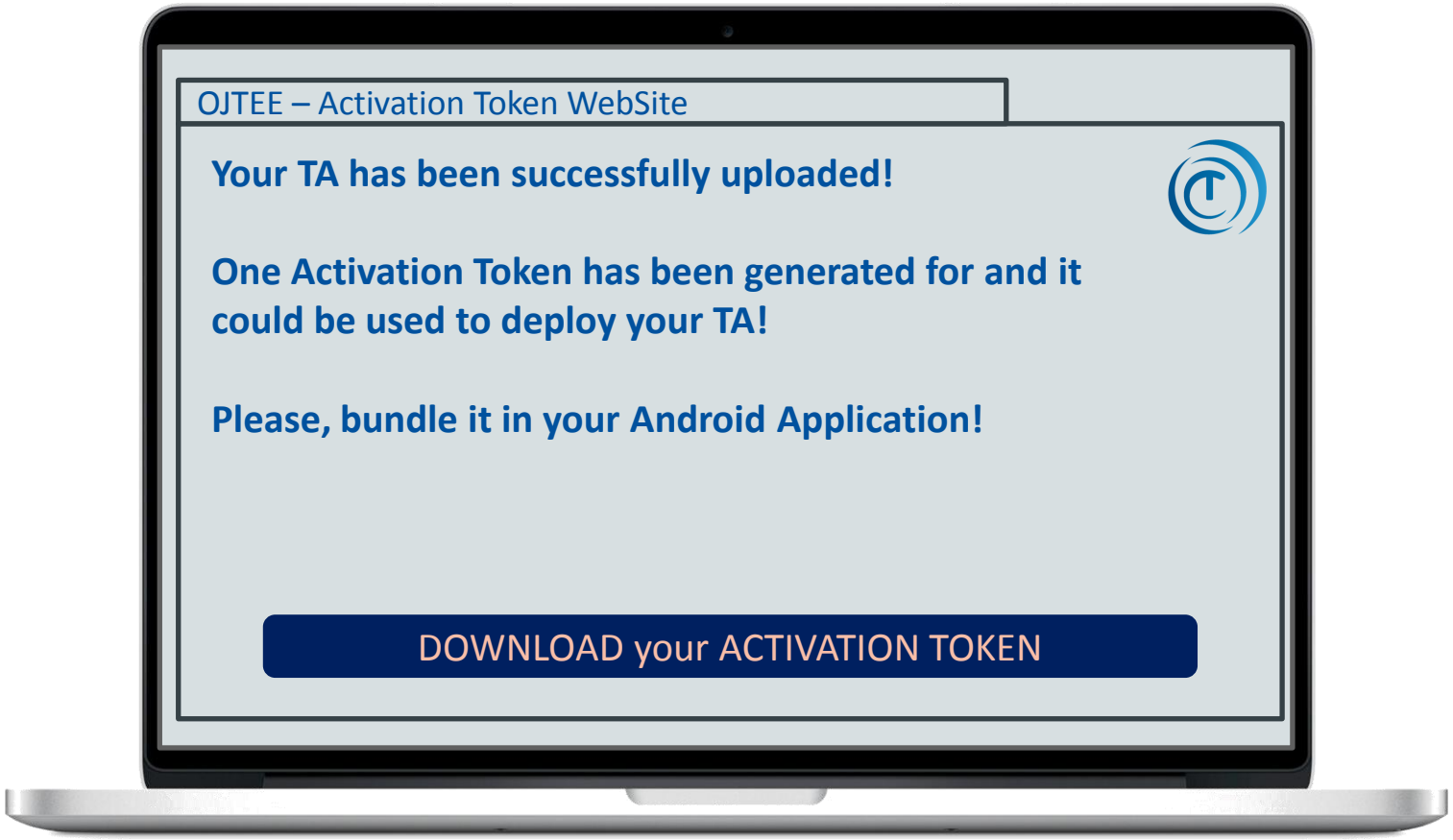


- Configuration files
- Images / Videos
- General data

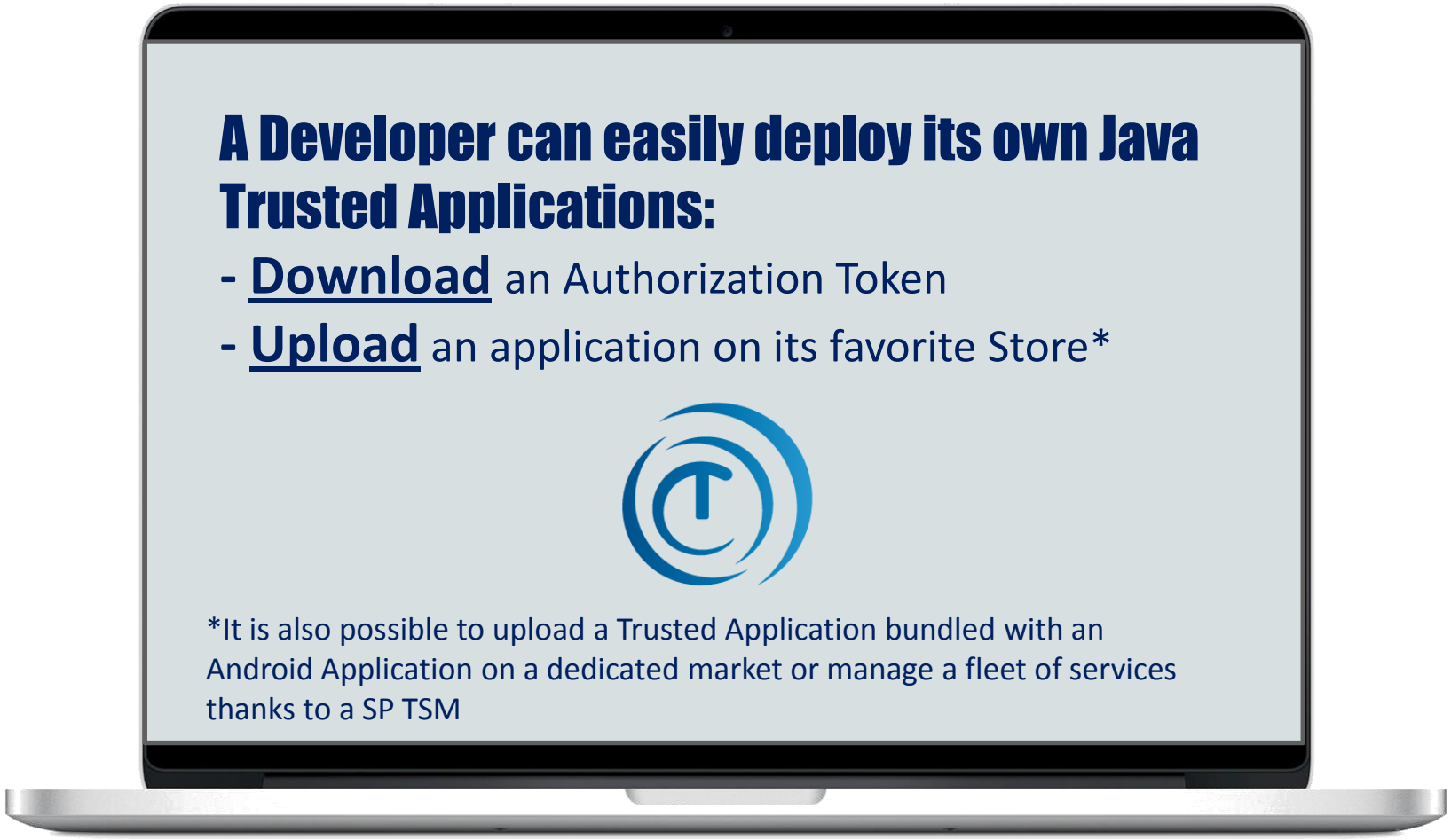
- Trusted User Interface
- Secure Storage of Sensitive data
- Cryptographic algorithms

Trusted Application Verification

Trusted Application Activation Token



Trusted Service Activation and Deployment



OJTEE Backend Control Panel

The User Perspective

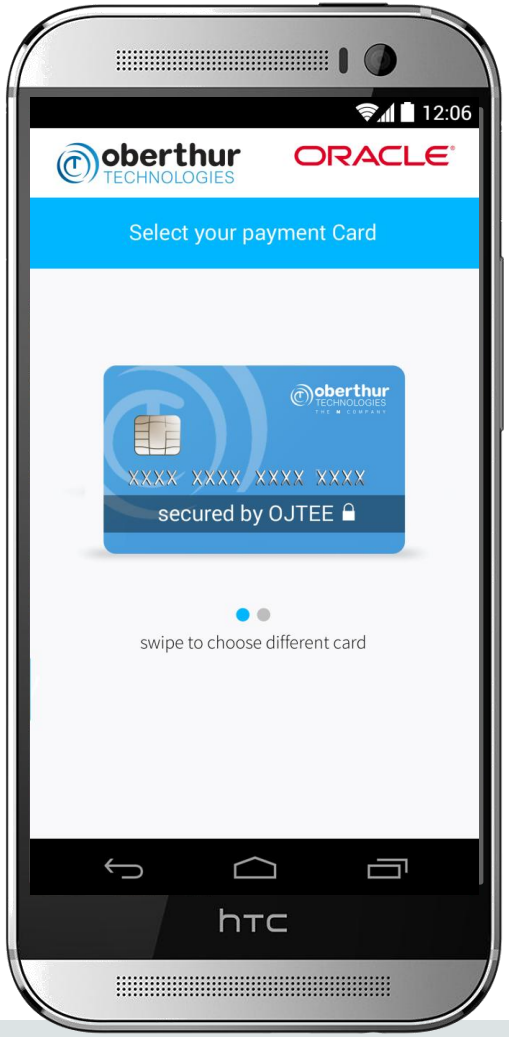
Trusted Application Download

- Trusted Services are bundled with a classical Mobile Application
- The installation process is completely transparent for the end user

User Authentication and Trusted Input

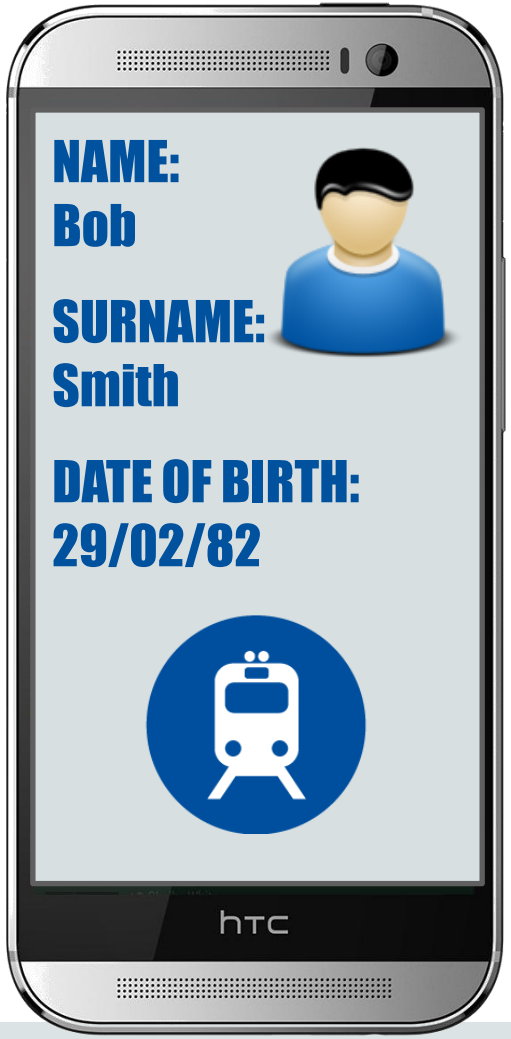
- Thanks to OJTEE, malware applications cannot intercept user inputs
- Thanks to OJTEE backend, the developer can finally trust the link between user and device

Trusted Storage



- Thanks to OJTEE, card information is stored in a secure manner
- Thanks to OJTEE Backend, card credentials can be remotely and dynamically changed

Trusted Display



- Thanks to OJTEE, information displayed on the screen can be trusted.
- Thanks to OJTEE backend, User Information can be pushed directly to a target device.

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Project Status & Call to Action

Oracle Java for TEE

- Oracle Java for TEE is under development at Oracle
  - Undergoing Beta testing with selected partners
- Objective: release progressively in the upcoming months
  - Platform details and development tools initially
  - Devices and deployment infrastructure through 2015
- Today: Come see our demos and chat with us
  - Learn about Java Card on OTN
  - Register interest for SDK and Device availability

Getting more information

At JavaOne

- CON3165. Oracle Java for TEE: Bringing Trust to Mobile Devices
  - Thursday, Oct. 2, 1:00PM - 2:00PM – Hilton – Yosemite B/C
- Oracle Java for TEE demo
  - On the DemoGrounds

Questions?

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Engineered to Work Together

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