Large-Scale Deployment Using Java™ Web Start Software

Matthias Schorer

Technical Chief Architect
FIDUCIA IT AG
http://www.fiducia.de

TS-3212

Goal of the Talk

Learn about the benefits of Java™ Web Start software and how it can be used to deploy complex software in a large environment

Agenda

Who is FIDUCIA IT AG

Java Web Start software in a nutshell

Challenges for Java Web Start software

How we made Java Web Start software work for us

The Java Network Launching Protocol and API (JNLP) Runner

How to use Pack200 to improve downloads

How to enable your software for Java Web Start

Common pitfalls

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Who Is FIDUCIA

The Company

- FIDUCIA is the largest IT-Full service provider for the German cooperative banks
- 3,480 employees
- 728M € turnover
- 920 individual banks rely on our service

Who Is FIDUCIA

The Big Irons

- z/Series mainframe with 110 CPUs
  35,000 MIPS
- 2,068 Sun Servers
- SAN Storage 207 TB
- Tape Storage 2,800 TB, 18,000 cassettes

Who Is FIDUCIA

Data and Traffic

- 53M customer accounts
- 3B Transactions/year
  almost 100% created through Java technology!
- 105,000 PC workstations
- 11,100 ATMs
- 12,050 statement printers

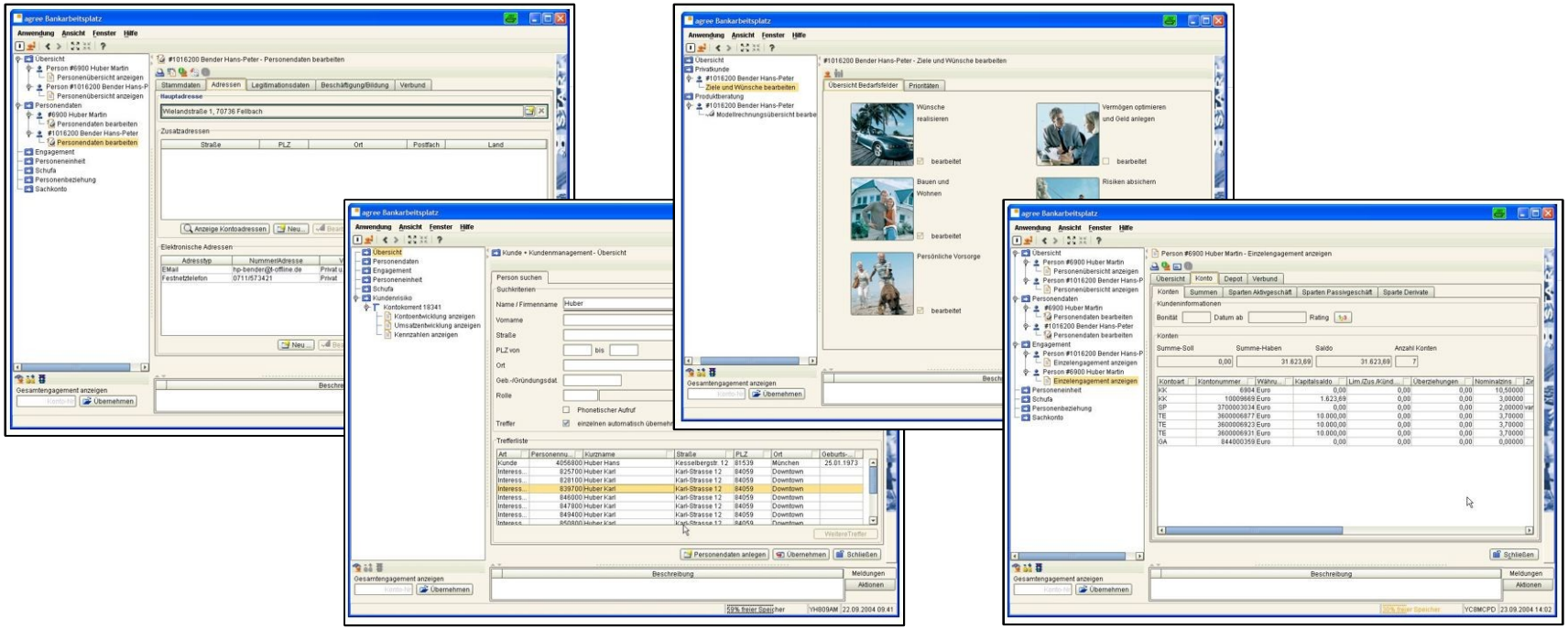
Who Is FIDUCIA

Our Java History

- 1996: Fiducia wrote the first home banking Java-based applet
- 1998: Fiducia started development of the Java-based Banking Framework JBF
- 1999: Fiducia decided to rewrite the whole Software Stack using JBF, including brokerage, ATM, self service, etc.
- 2000: First two Java-based applications deployed
- 2002: First use of Sun Java Web Start for deployment of 5 Java-based applications

2003: The Application-BAP

Banking Work Place



Rolling Out a Massive System

GEBOS assets

CReOS, Navigator, Rubin

BAP 1.0
Kunde
Kompetenz
Aktivitäten
12/2003

BAP 1.01
Aval-
verwaltung
Formular-
management
02/2004

BAP 1.1
Zahl.verkehr
Schalter/Kasse
Dauerauftrag
SB-Karte
§18 KWG
04/2004

BAP 1.2
Konto St.1
SIS
Produkt
Beratung/
Verkauf
Meldewesen
06/2004

BAP 1.3
Konto St.2
Kunde St.2
Rechnungs-
Wesen
Derivate
Produkt St.2
Aufbauorga
Bediener-
einstellungen
Wechsel
VAP (BSH)
11/2004

BAP 1.4
Kunden- /
Konto Historie
KBS
Vertr.Manag.
Gewinnsparen
ZAST
Beratung/
Verkauf St.2
Schalter/
Kasse St.2
§18 KWG St.2
DIAFIZ
3270-Anw.
Bedienerverw.
12/2004

BAP 2.0
Kunde
(Verbund).
Konto St.3
Zahl.verkehr
Steuerung d.
Eingangsliste
Vertr.-
Managt. St2
Beratung and
Verkauf St. 3
Textbaust.
Aktennotizen
06/2005

BAP 2.1
Kundenverw.
Konto St. 4
Beratung/
Verkauf
SB-Kasse
Vorgang
Forderungs-
Mgmt.
Kredit-
sicherheiten
10/2005

Project BAP

Why Is It Massive?

- 640 developers
- 6,200 man-months
- 18 Million lines of code
- 3,000 Java packages
- 71,300 Java classes
- 785,700 Java methods
- 791 user accessible functions
- 2,100 services
- **236 MB in 865 JAR files must be deployed**

Why So Many JAR Files?

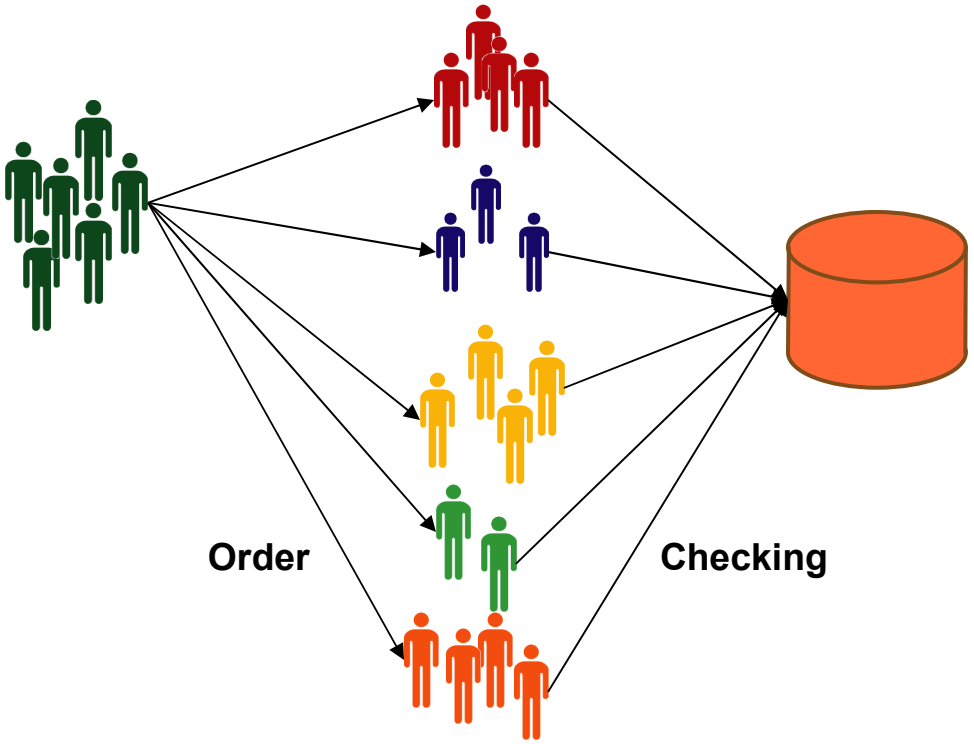
Product Management

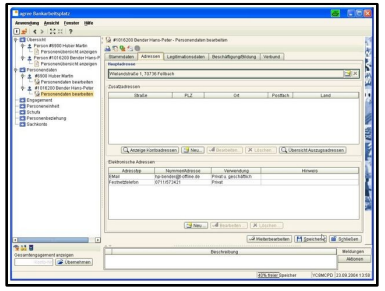
Development Teams

Central Repository

Central Build

Central Deployment





Each Function Goes Into One JAR File!

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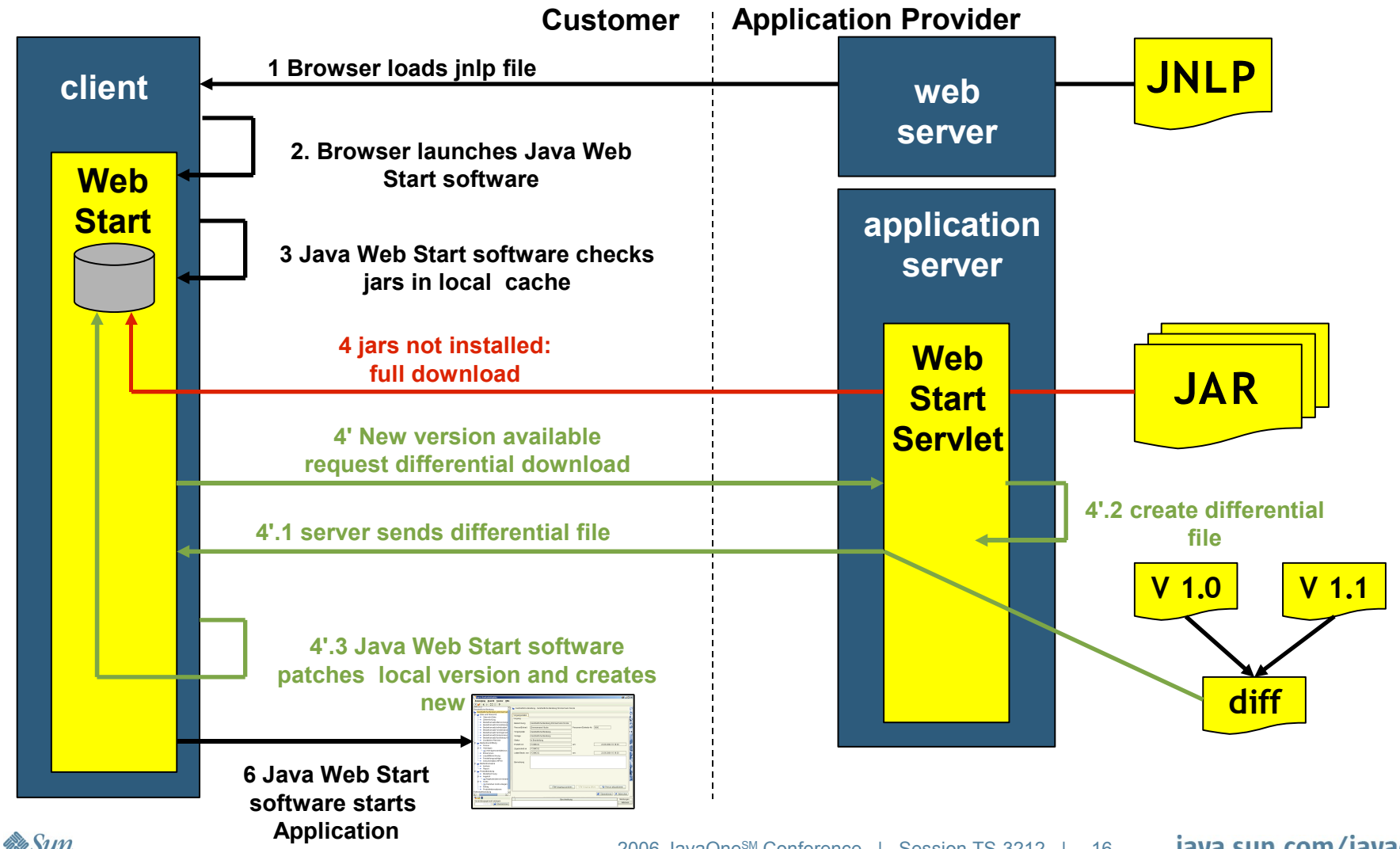
Java Web Start Software—Features

- Based on the Java™ Network Launching Protocol and API (JNLP)
- Centralized Configuration of application via Java NLP-File
- Supports differential downloads for updates
- Even installs native code
- Software gets cached on client
- Java Web Start software is part of the JRE since 1.4
- Applications may use different Java VMs on one client

A Sample Java NLP File

```
<?xml version="1.0" encoding="ISO-8859-15"?>
<jnlp codebase="$$jbf.codebase$$">
   <information>
    <title>"BAP  1.30"</title>
    <vendor>FIDUCIA IT AG</vendor>
    <description>"agree Banking Workplace"</description>
    <icon href="images/bap.gif"/>
   </information>
   <resources>
    <jar href="jbf/jbf_cli.jar" version="4.12"
              download="eager"/>
   </resources>
    ...
 <application-desc main-
class="de.rbg.nbs.app.ApplicationManagerClient">
   <argument>de.fiducia.agree.BAP</argument>
</application-desc>
```

How Does Java Web Start Software Work?



Assumptions Java Web Start Software Makes I

- Client has a high-speed connection to the application provider
- One Java NLP file identifies one application
- One Java NLP file identifies one set of JAR files
- Each jar file has its own version number

Assumptions Java Web Start Software Makes II

- Every client always wants to download the latest version of the application
- There is always a user sitting in front of the computer
- Garbage Collection doesn't need tuning
- Java VM does not have to be parameterized (up to J2SE™ 1.4)

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The Challenges for Java Web Start Software I

Why the FIDUCIA Environment Is Different?

- Hundreds of clients share one connection, with bandwidths ranging from 256KB to 2 MB
- BAP is one application, but with hundreds of independent functions
- All of the JAR-Files have different versions

The Challenges for Java Web Start Software I

Why the FIDUCIA Environment Is Different?

- The banks decide when to upgrade to a new version of BAP
- Fixes must rapidly be deployed to 100.000 workstations and 22.000 self-service terminals
- There is nobody sitting in front of the ATMs to confirm Java Web Start Software Dialogs

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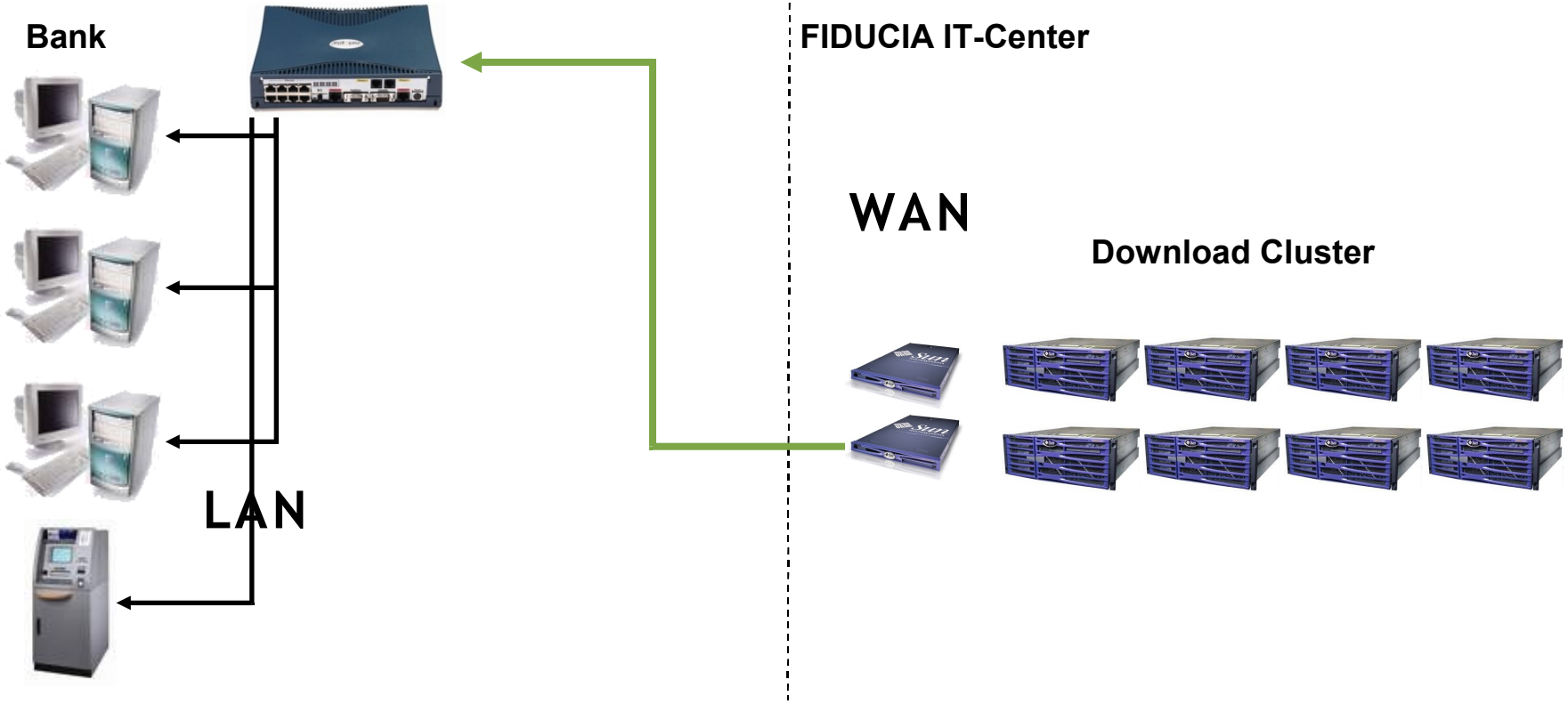
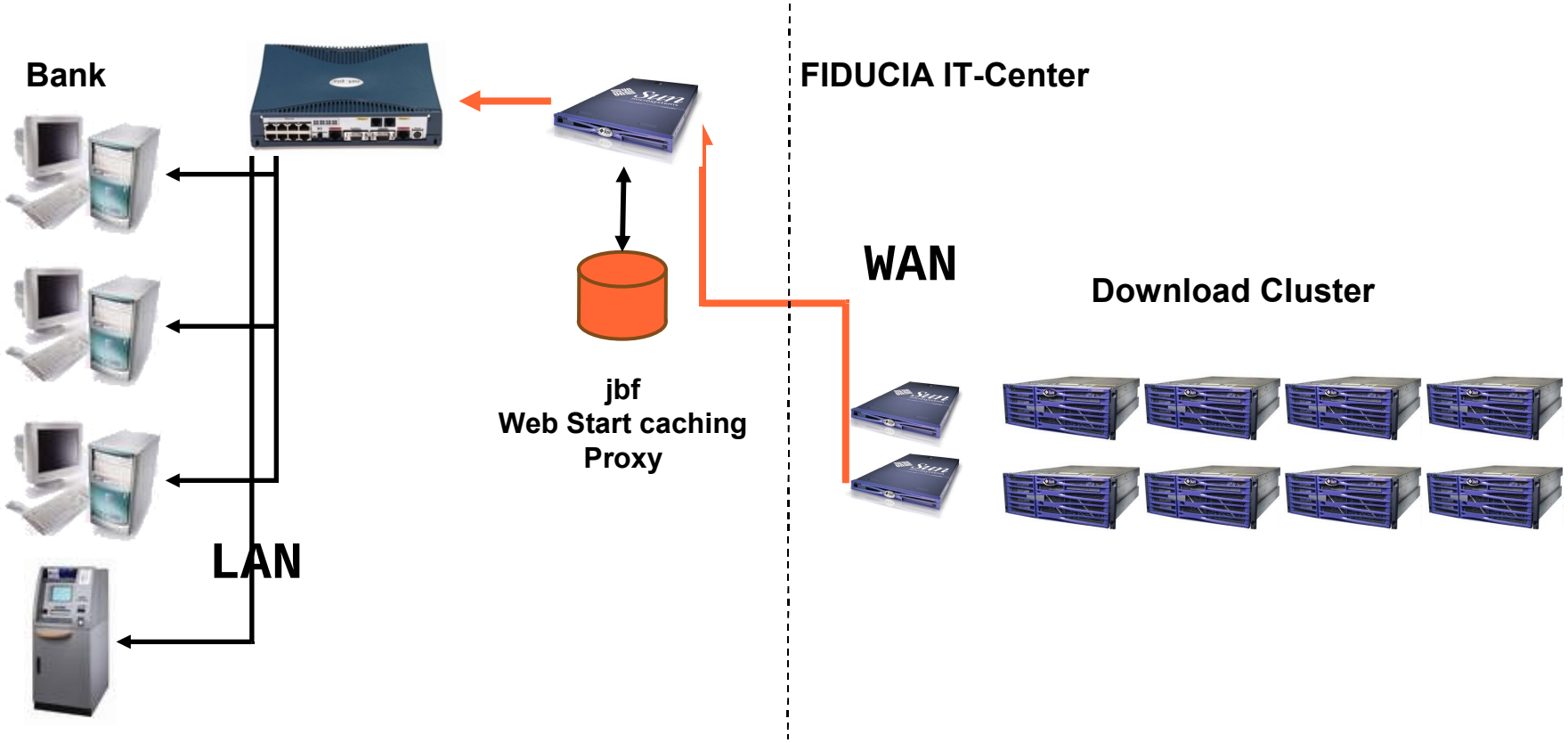
The Bandwidth Problem

Java Web Start Software Is Not Conservative About Bandwidth

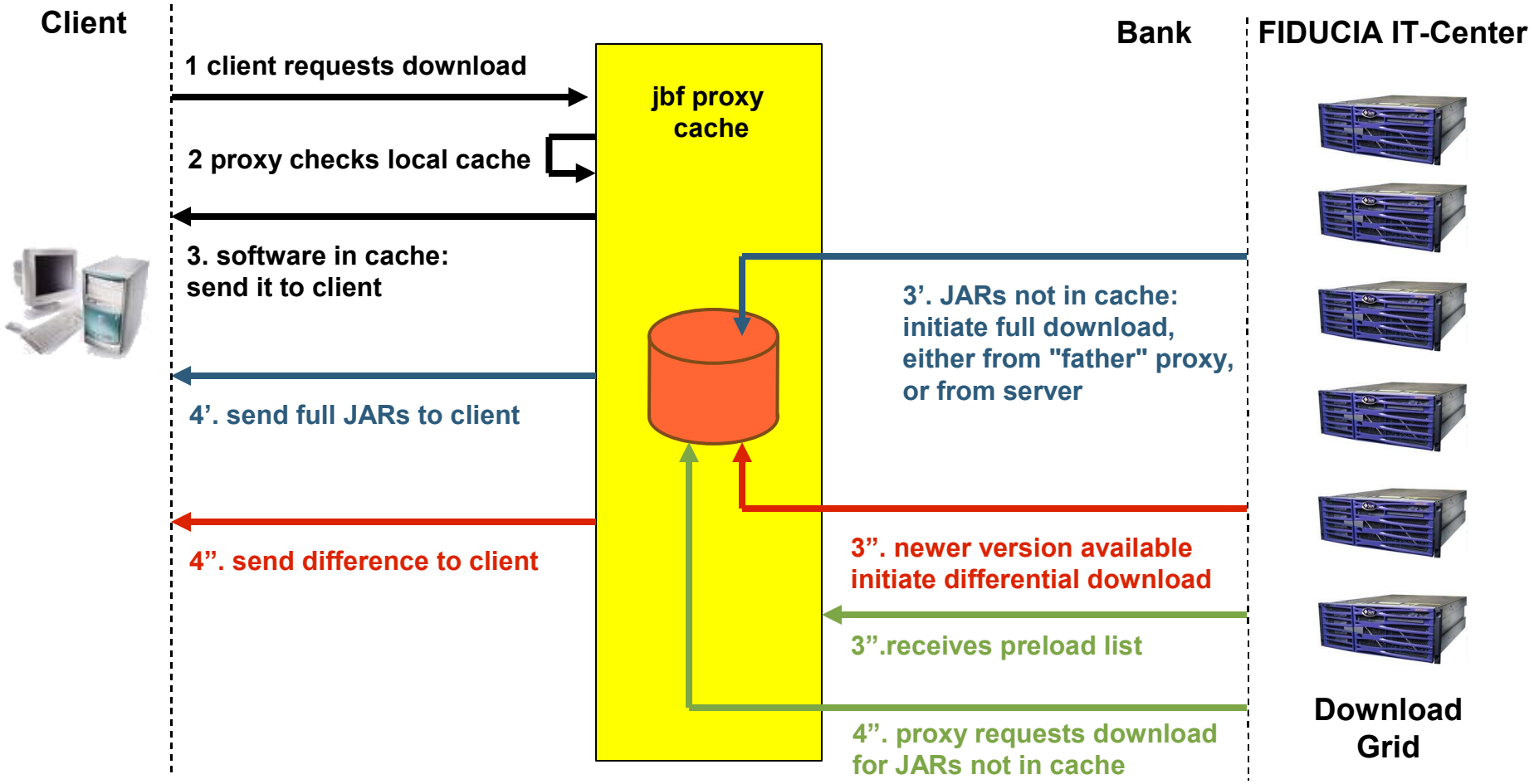


The Solution

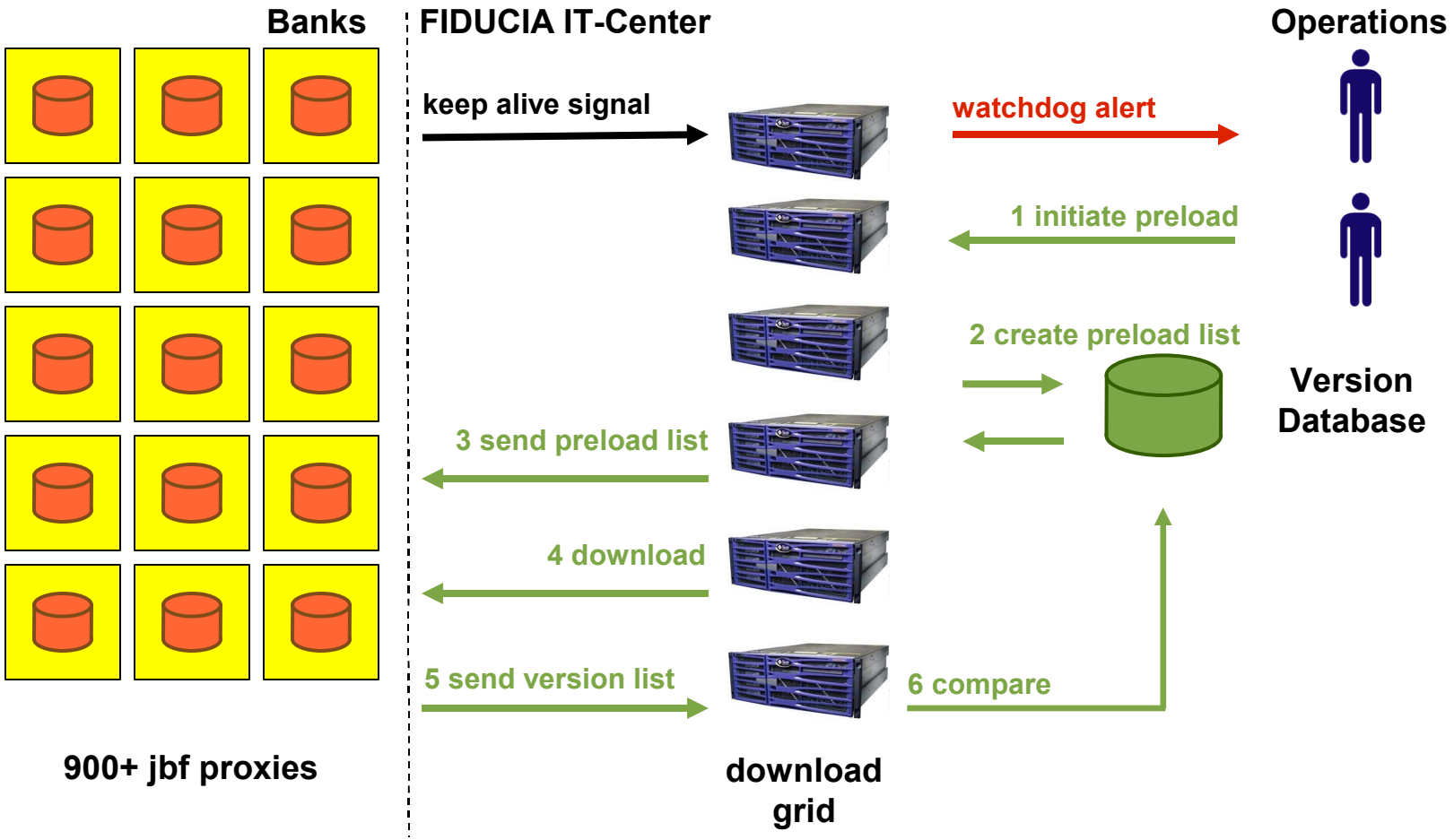
The Java Web Start Software Caching Proxy



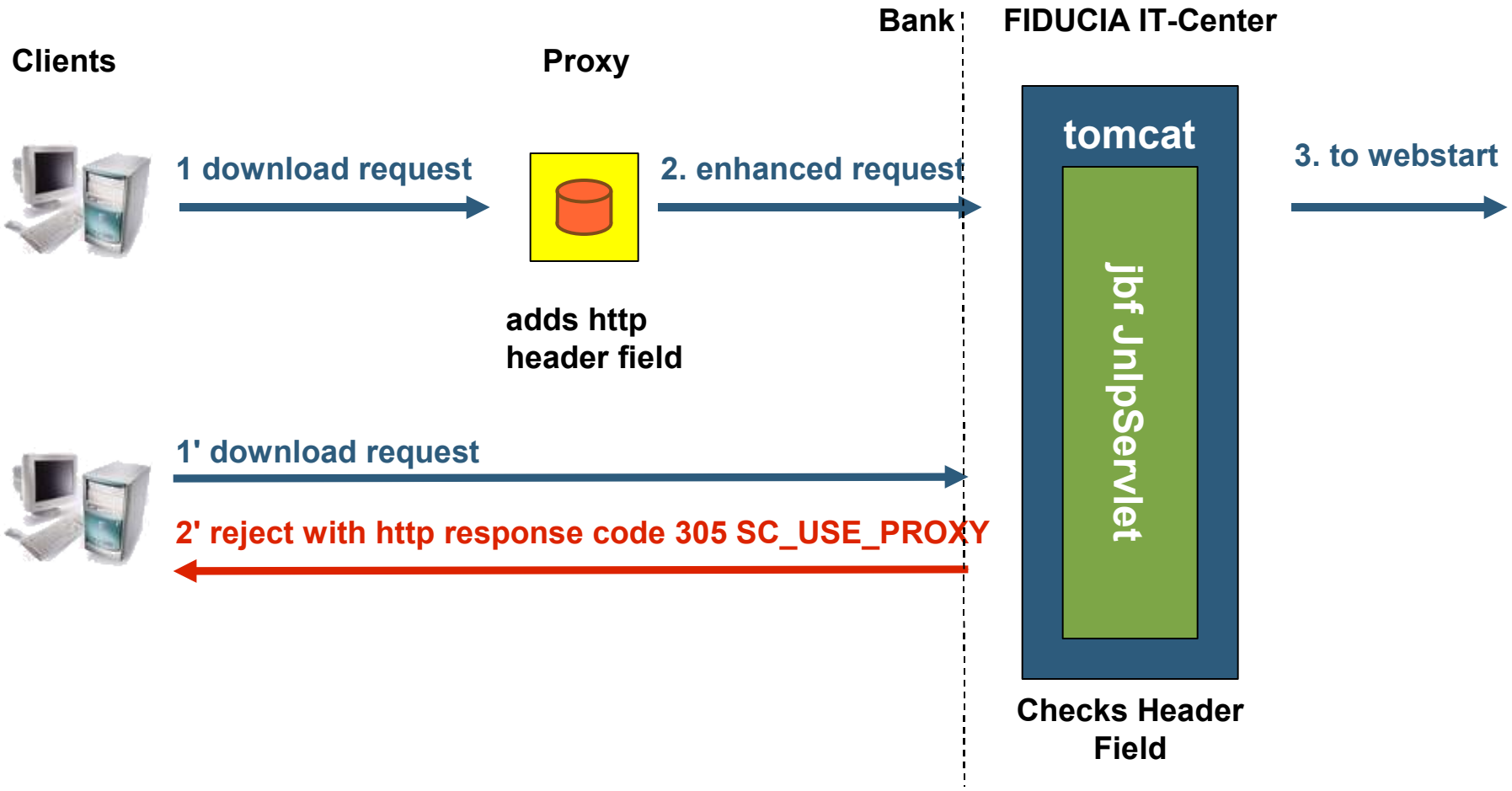
The Inner Workings of the Proxy



Preloading and Controlling the Proxy



How to Prevent Non-Proxy Downloads

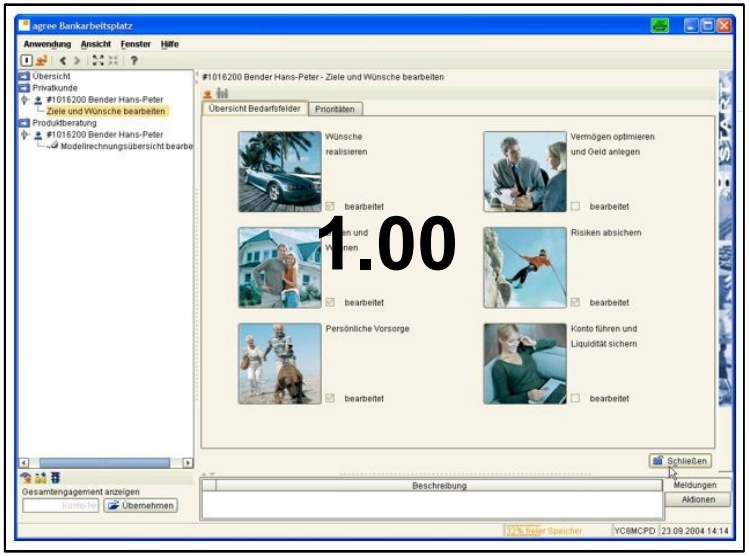


Features of the Java Web Start Software Proxy

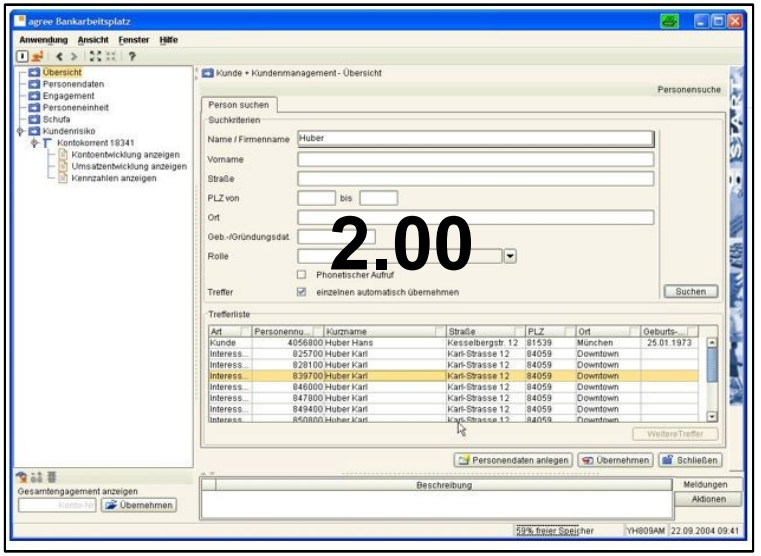
- Entirely written in Java programming language
- Deployed and updated using Java Web Start software
- Runs as a process on file server
- Minimizes traffic over WAN link
- Can be pre-loaded in the night
- Caches all downloads on local disk
- Can be “daisy chained” in bank branches

The Version Problem

Different Banks Need Different Software Versions



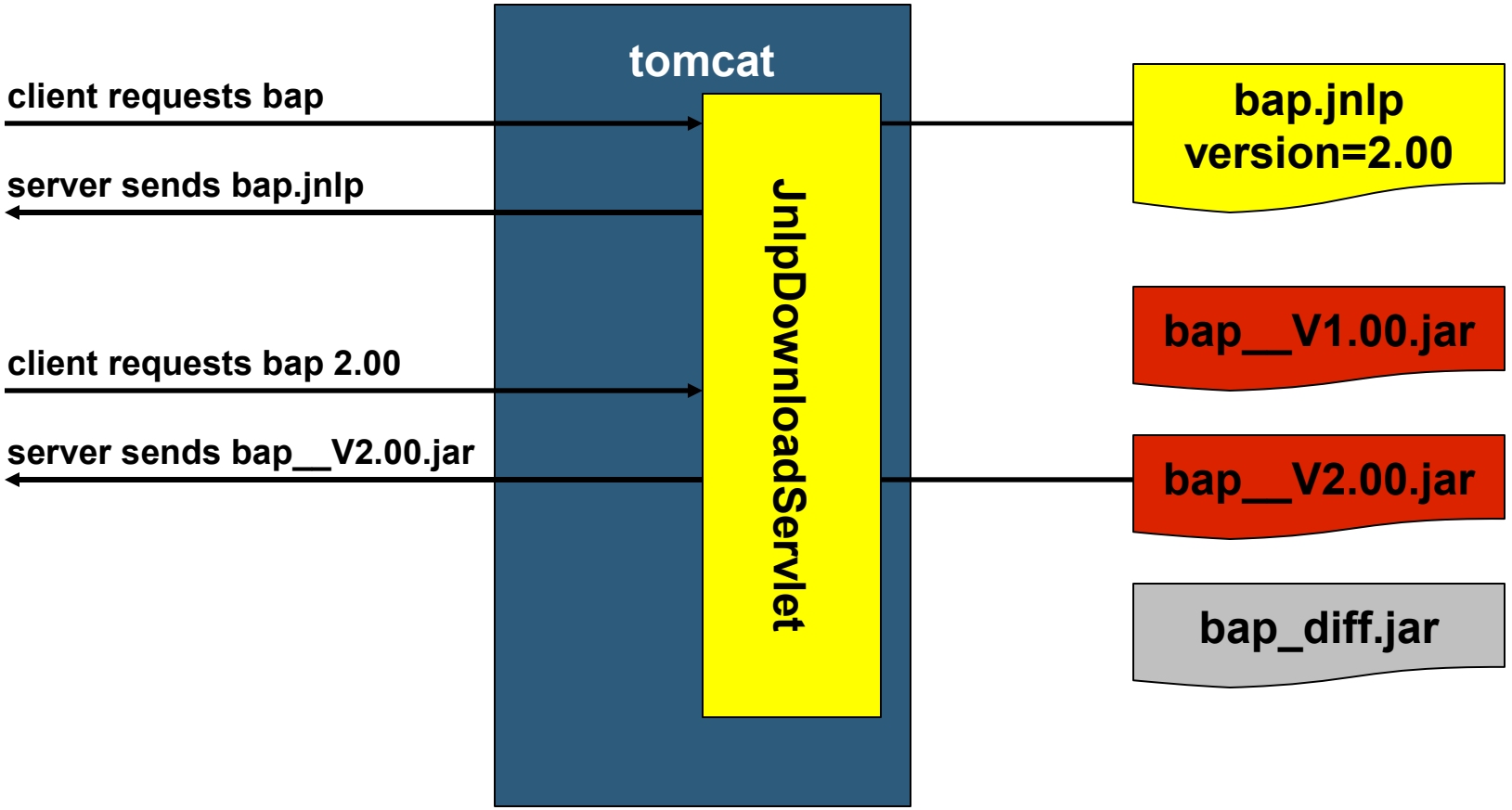
bank id. 1000



bank id. 2000

Basics

How the Java Web Start Software JnlpDownloadServlet Works



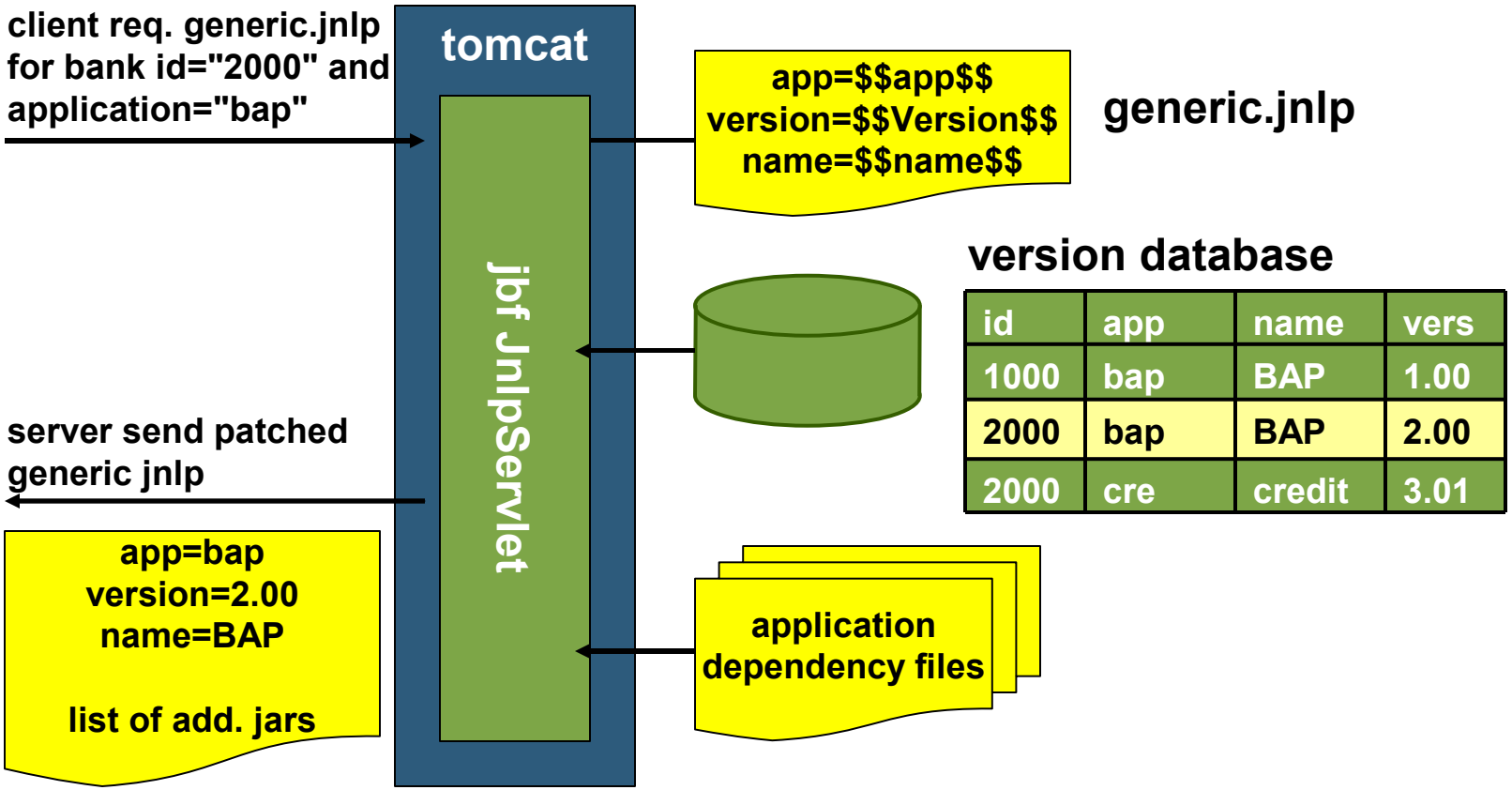
Solution Part 1:

The Improved Java NLP File

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<jnlp codebase="$$jbf.codebase$$">
 <information>
    <title>$$application.long.name$$ $$version$$</title>
    <vendor>$$app.vendor$$</vendor>
    <description>$$application.long.name$$</description>
    <icon href="images/$$application.short.name$$.gif"/>
 </information>
 $$jbf.application.resources$$
 <application-desc main-class="$$client.main.class$$">
        <argument>$$application.main.class$$</argument>
        <argument>"$$application.long.name$$"</argument>
        <argument>$$application.short.name$$</argument>
        <argument>$$application.width$$</argument>
        <argument>$$application.height$$</argument>
 </application-desc>
```

Solution Part 2:

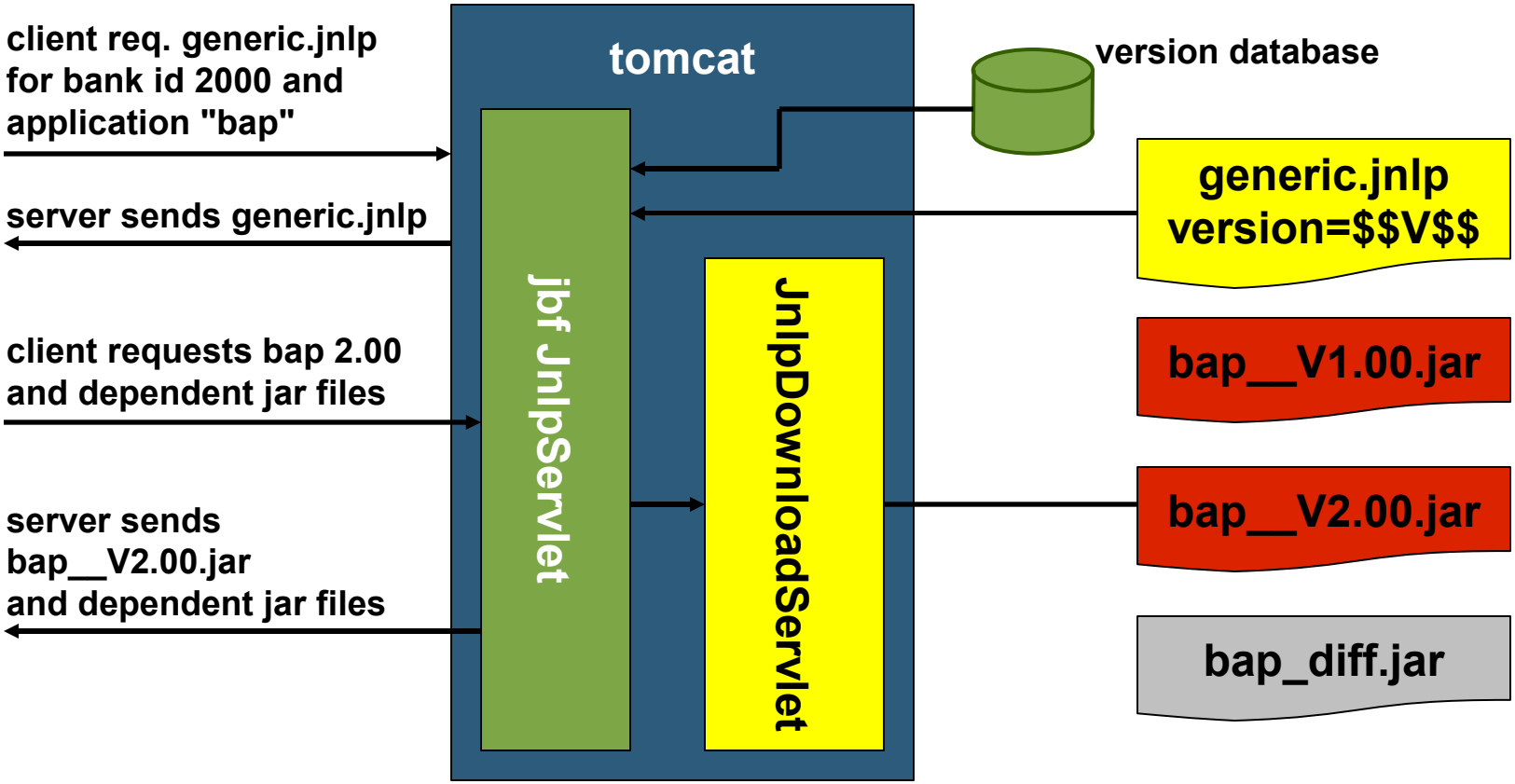
The Version Database and Dependency Files



id	app	name	vers
1000	bap	BAP	1.00
2000	bap	BAP	2.00
2000	cre	credit	3.01

Solution Part 3:

The improved Java NLP loading mechanism



The Improved Java NLP Mechanism

- It allows FIDUCIA to do roll outs in stages
- It gives our customers the flexibility to upgrade when it is convenient for them
- Having only one Java NLP file simplifies deployment
- The database simplifies version changes
- Roll backs are as simple as a database change
- Client-side Java VM can be parameterized

Special Case ATMs

- We have pre-installed the FIDUCIA certificates on the ATM's internal PC
- We use a modified version of Java Web Start software which does not have any kind of pop-up windows

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The JNLP Runner

Challenges Developers Faced With Java Web Start Software

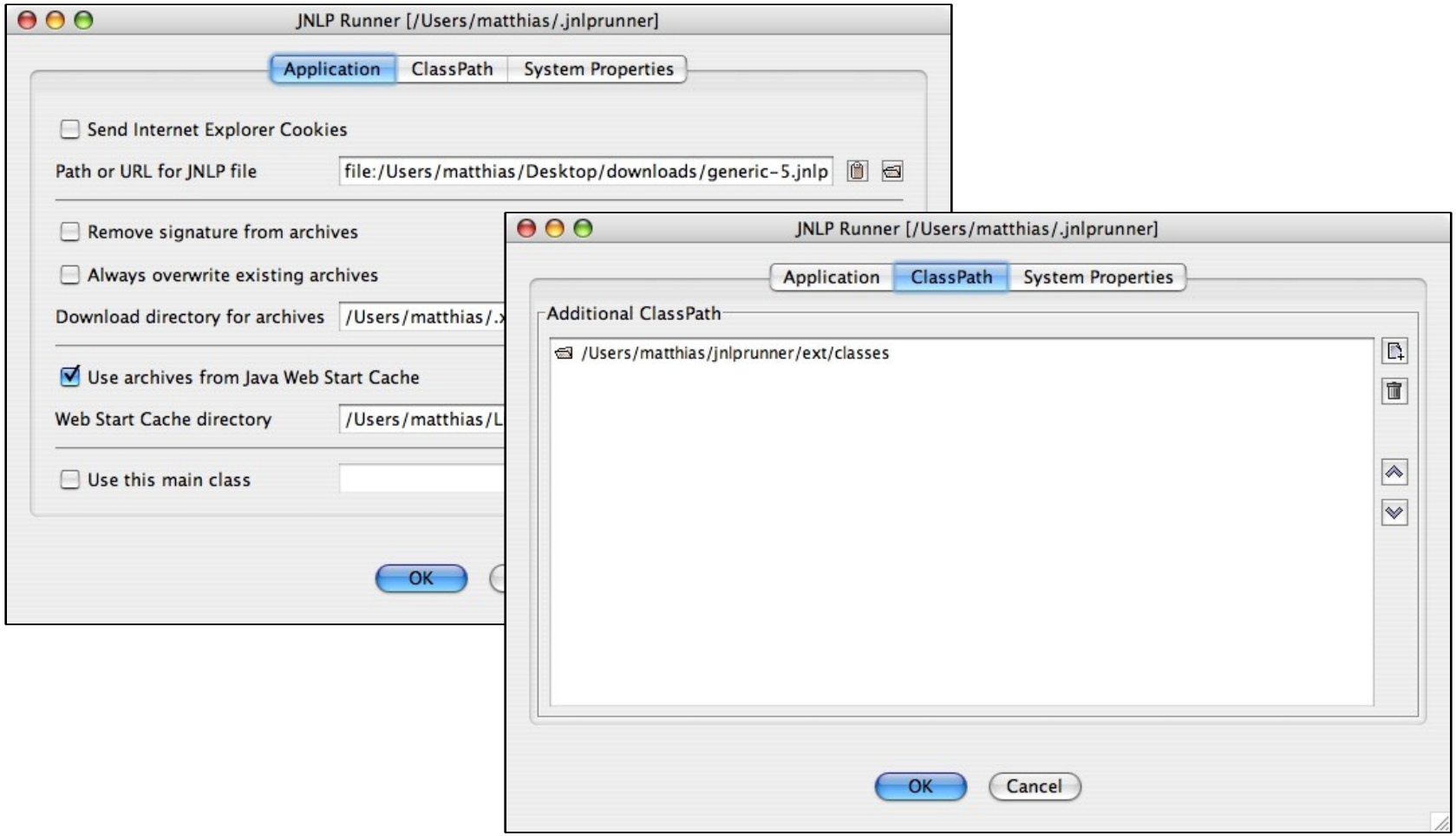
- To download the application, developer must logon onto download grid
- JAR files are signed
- Java Web Start software does not allow to mix signed and unsigned code
- Testing out parts of the code without creating a JAR file is not possible
- Remote debugging of a Java Web Start software application is a problem (how to set debug flags?)

The JNLP Runner

Java Web Start Software for Developers

- Once the JNLP file exists on local machine, the application can be started many times, no browser needed!
- JAR files can automatically be unsigned
- Special classloader allows to mix signed and unsigned code
- Changes class path to always use local classes first
- Allows any Java-based property to be set
- Saves and reuses configurations

The JNLP GUI


JNLP Runner [/Users/matthias/.jnlprunner]
Application
ClassPath
System Properties
Send Internet Explorer Cookies
Path or URL for JNLP file
file:/Users/matthias/Desktop/downloads/generic-5.jnlp
Remove signature from archives
Always overwrite existing archives
Download directory for archives
/Users/matthias/.x
Use archives from Java Web Start Cache
Web Start Cache directory
/Users/matthias/L
Use this main class
OK
JNLP Runner [/Users/matthias/.jnlprunner]
Application
ClassPath
System Properties
Additional ClassPath
/Users/matthias/jnlprunner/ext/classes
OK
Cancel

And the Good News Is…

- We have made JNLP Runner available as binary download
- Get it at http://www.jbfone.de/jnlprunner

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What Is Pack200

- Part of Java technology since J2SE 5.0
- Specialized packing mechanism for class files
- Supports gzip for additional compression
- Reduces JAR file size up to 1/9
- Java Web Start software recreates the JAR files out of the Pack200 compressed files

How to Use Pack200

- Consider content of the JAR files
  - Content mostly class files: use Pack200
  - Content mostly resources: use gzip
- Set Pack200.Packer.SEGMENT_LIMIT to prevent high memory consumption during unpacking
- Repack signed JAR files!
- Do not pack dynamically upon request!

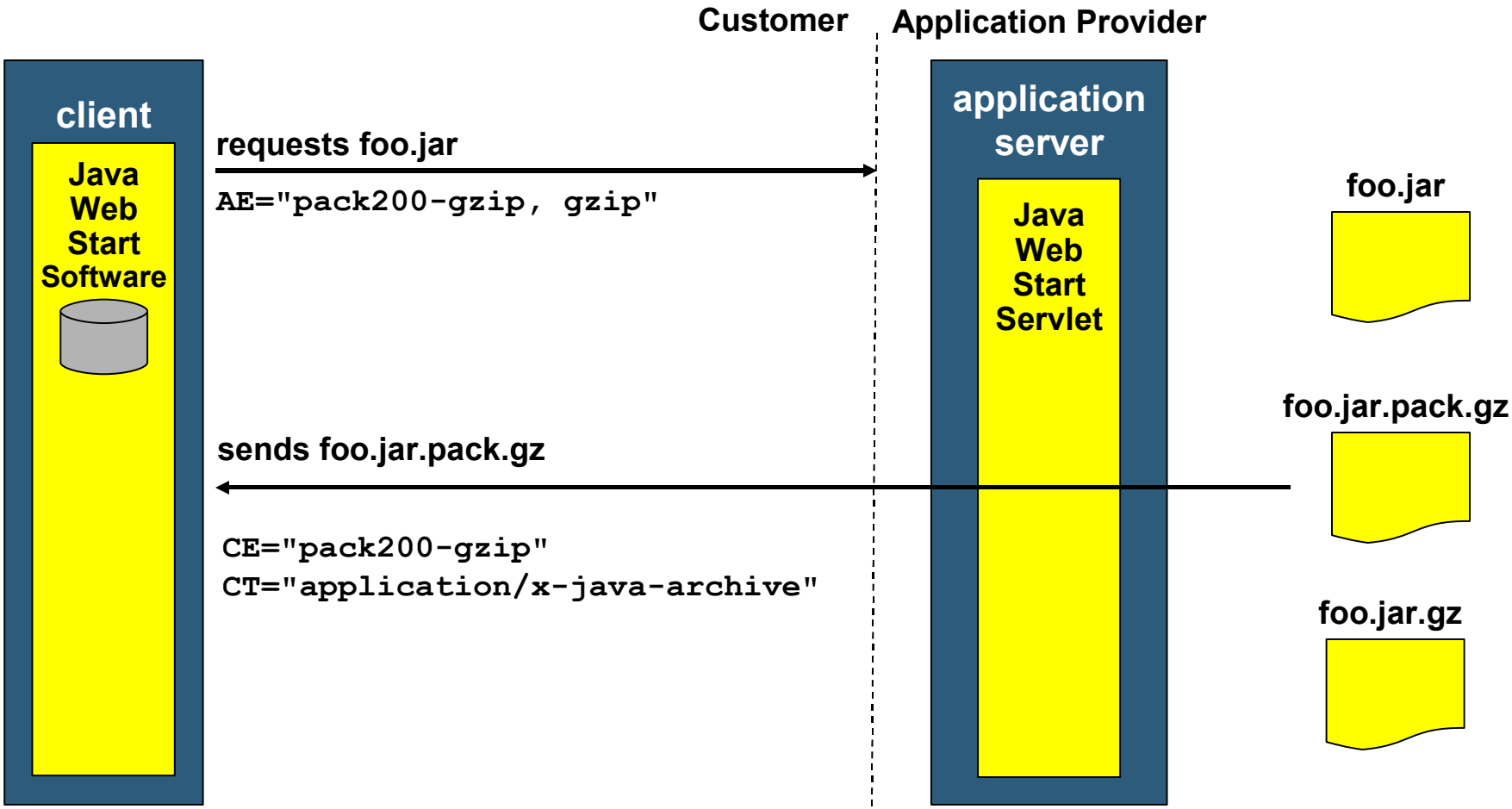
Example 1/2

```
Step 1:  Repack the file to normalize the jar.
% pack200 --repack HelloWorld.jar

Step 2: Sign the jar after we normalize using repack.
% jarsigner -keystore myKeystore HelloWorld.jar ksrini

Verify the just signed jar to ensure the signing worked.
% jarsigner -verify HelloWorld.jar

Ensure the jar still works.
% Java -jar HelloWorld.jar
HelloWorld

Step 3: Now we pack the file.
% pack200 HelloWorld.jar.pack.gz HelloWorld.jar
```

Example 2/2

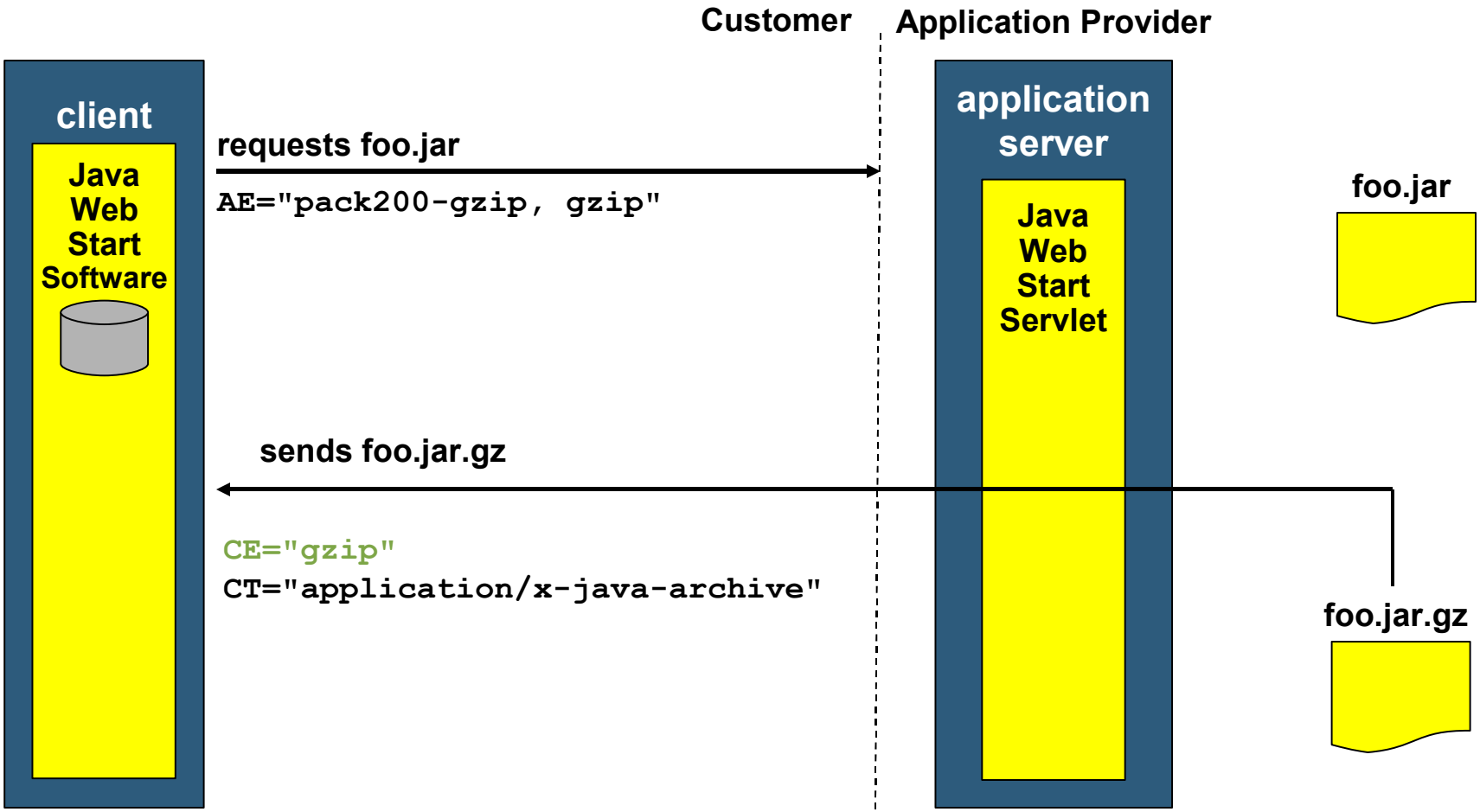
```
Step 4: Unpack the file.
% unpack200 HelloWorld.jar.pack.gz HelloT1.jar

Step 5:  Verify the jar.
% jarsigner -verify HelloT1.jar
jar verified.

// Test the jar ...
% java -jar HelloT1.jar
HelloWorld
```

Java Web Start Software and Pack200



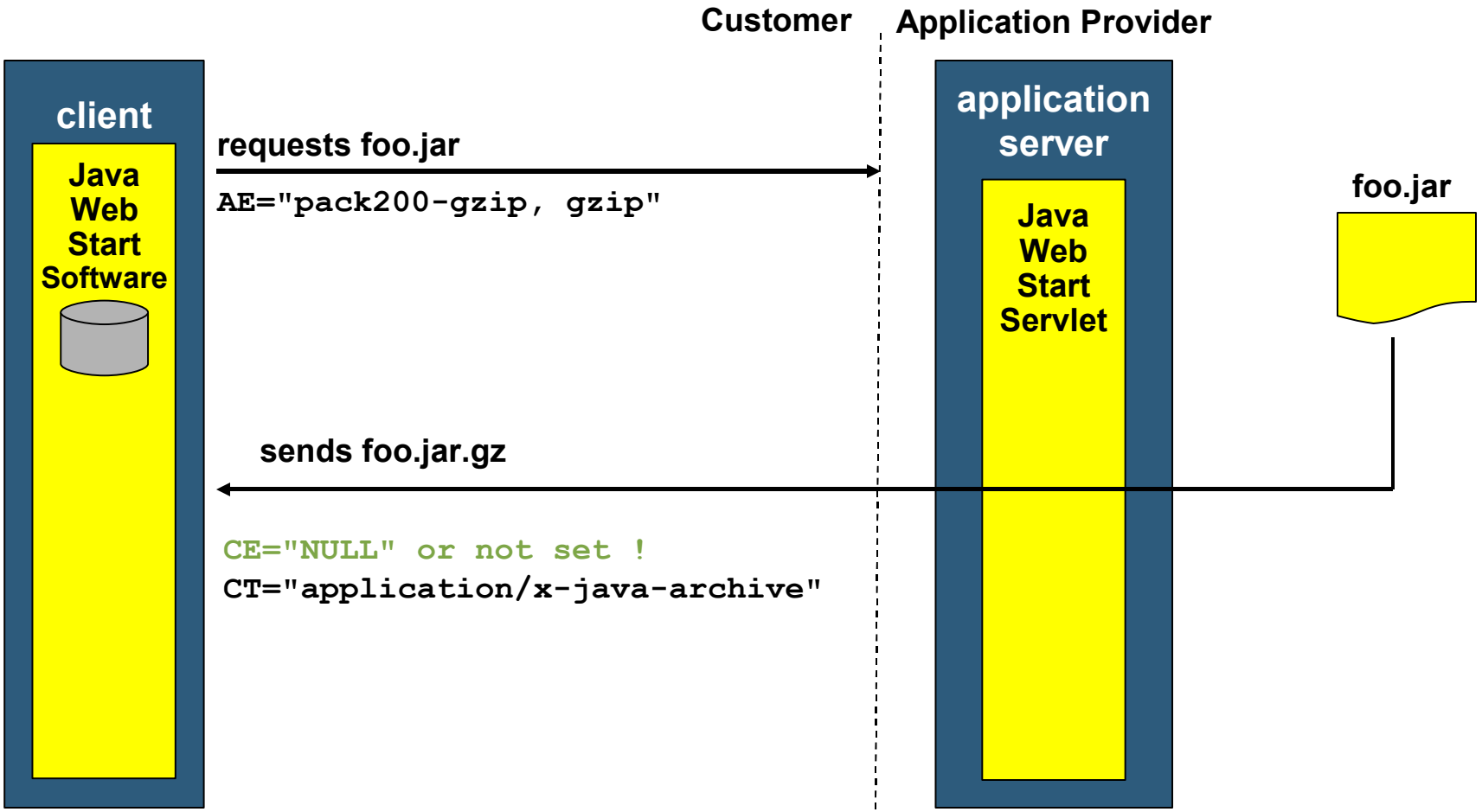
Java Web Start Software and Pack200

File foo.jar.pack.gz Unavailable



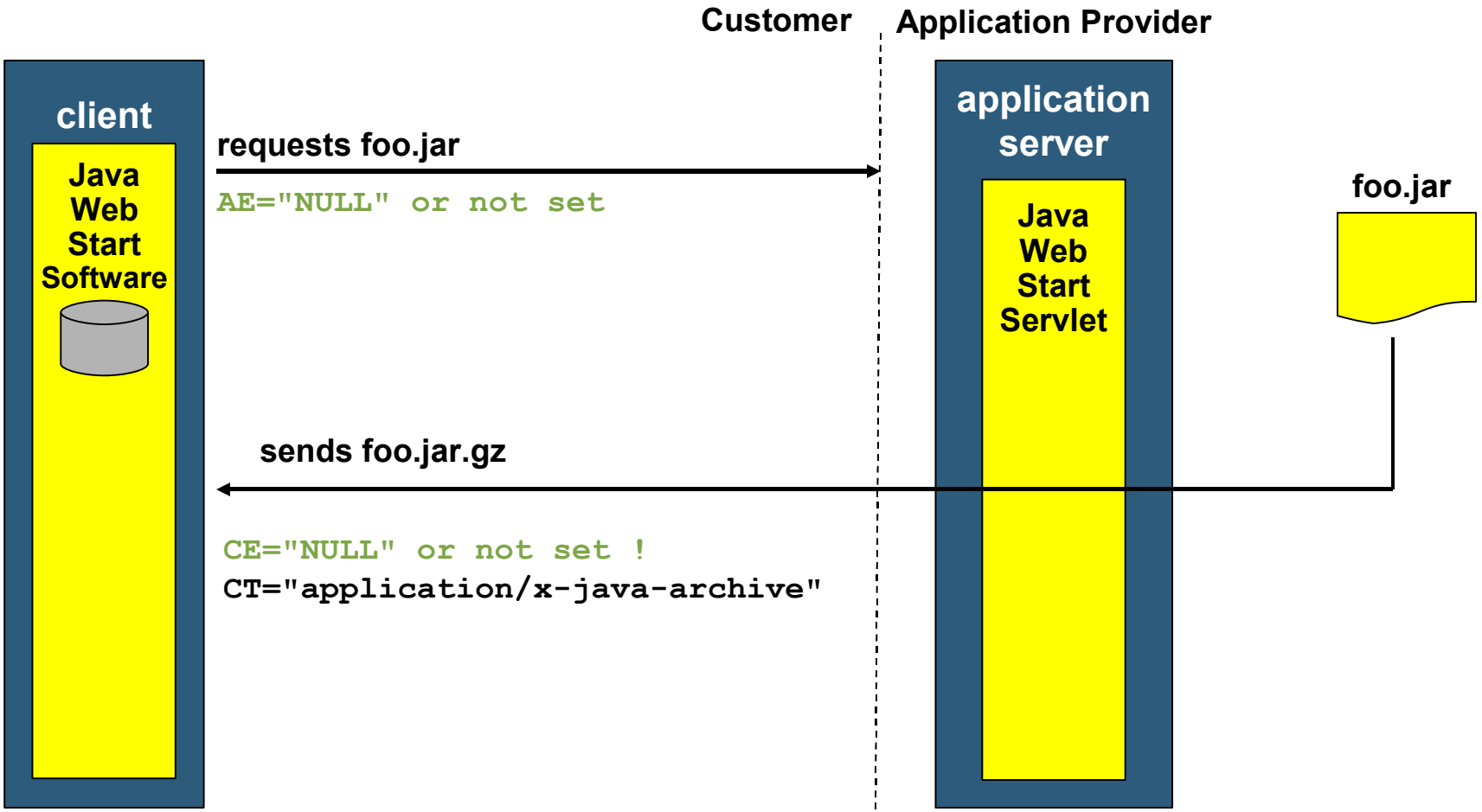
Java Web Start Software and Pack200

File foo.jar.pack.gz and foo.jar.gz Unavailable



Java Web Start Software and Pack200

Requests by “legacy” Applications



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How to Enable Your Software for Java Web Start

- Try to split application function blocks
  - Store those blocks in different JAR files
- Read and write files platform independent
  - Consider using Java-based properties like “user.home” (unix users don’t like C/\TEMP\LOG.TXT in their root!)
- Resources may only be read from JAR files

```
// Get current classloader
ClassLoader cl = this.getClass().getClassLoader();
// Create icons
Icon saveIcon= new ImageIcon(cl.getResource("images/save.gif"));
Icon cutIcon = new ImageIcon(cl.getResource("images/cut.gif"));
```

How to Enable Your Software for Java Web Start (Cont.)

- Use UTF-8 to encode your Java NLP files
- Sign JAR files only if necessary
  - Note: signed more space in Java VM

```
keytool -genkey -keystore myKeystore -alias myself

keytool -selfcert -alias myself -keystore myKeystore

jarsigner -keystore myKeystore test.jar myself
```

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Common Pitfalls

- No special characters in file names allowed, differential downloads may not work!
- Lazy loading does not work when introspection/bean info is used
- Try not to sign jar files
  manifests take up lots of valuable space in Java VM
- Separate download server and application server; Creating differential jars uses lots of CPU
- Apache 2.0 prevents progress bar from being displayed!

Summary

- Java Web Start software worked out for FIDUCIA IT AG
- Large applications can be deployed
- Java Web Start software could be easily adapted to our needs
- Java Web Start software works on Windows, Linux, Mac OS X, and even OS/2
- The Java Web Start software team at Sun has been very cooperative in doing enhancements for Java Web Start software

For More Information

- http://java.sun.com/products/javawebstart
- http://java.sun.com/products/javawebstart/download-spec.html
- http://java.sun.com/j2se/1.5.0/docs/guide/deployment/deployment-guide/pack200.html
- http://www.vamphq.com
- http://developer.apple.com/java/javawebstart
- http://www.jbfone.de/jnlprunner

Q&A

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Matthias Schorer

Technical Chief Architect
FIDUCIA IT AG
http://www.fiducia.de

TS-3212