MobiCents™

Mobicents Open Source VoIP Platform

http://www.mobicents.org

JavaPolis, Antwerp, 2005

Ivelin Ivanov, JBoss, Inc.

What are we going to talk about?

- VoIP Background
- JSLEE in the industry
- Mobicents Architecture
- Demo
- Roadmap

VoIP Background

A quick poll

- Do you know what VoIP is?
- Are you developing VoIP apps?
- Why not?

You are not developing yet because

- Internet is ubiquitous and bandwidth is abundant, but
- There is no equivalent of a public Web layer
- There are many proprietary islands:
  - Skype, Google Talk, FWD, Yahoo Messenger, MSN Messenger, etc.
- Ironically …bridged by the Plain old Telephone Network
- What is needed is a public IP communications network that you can write apps for
  - See Mobicents Google Talk Bot example
- Java…is behind in standardization and OSS implementations
  - VoIP is top level category at SourceForge
  - At java.net it is a subset of the communications community
  - JAIN is unfinished business

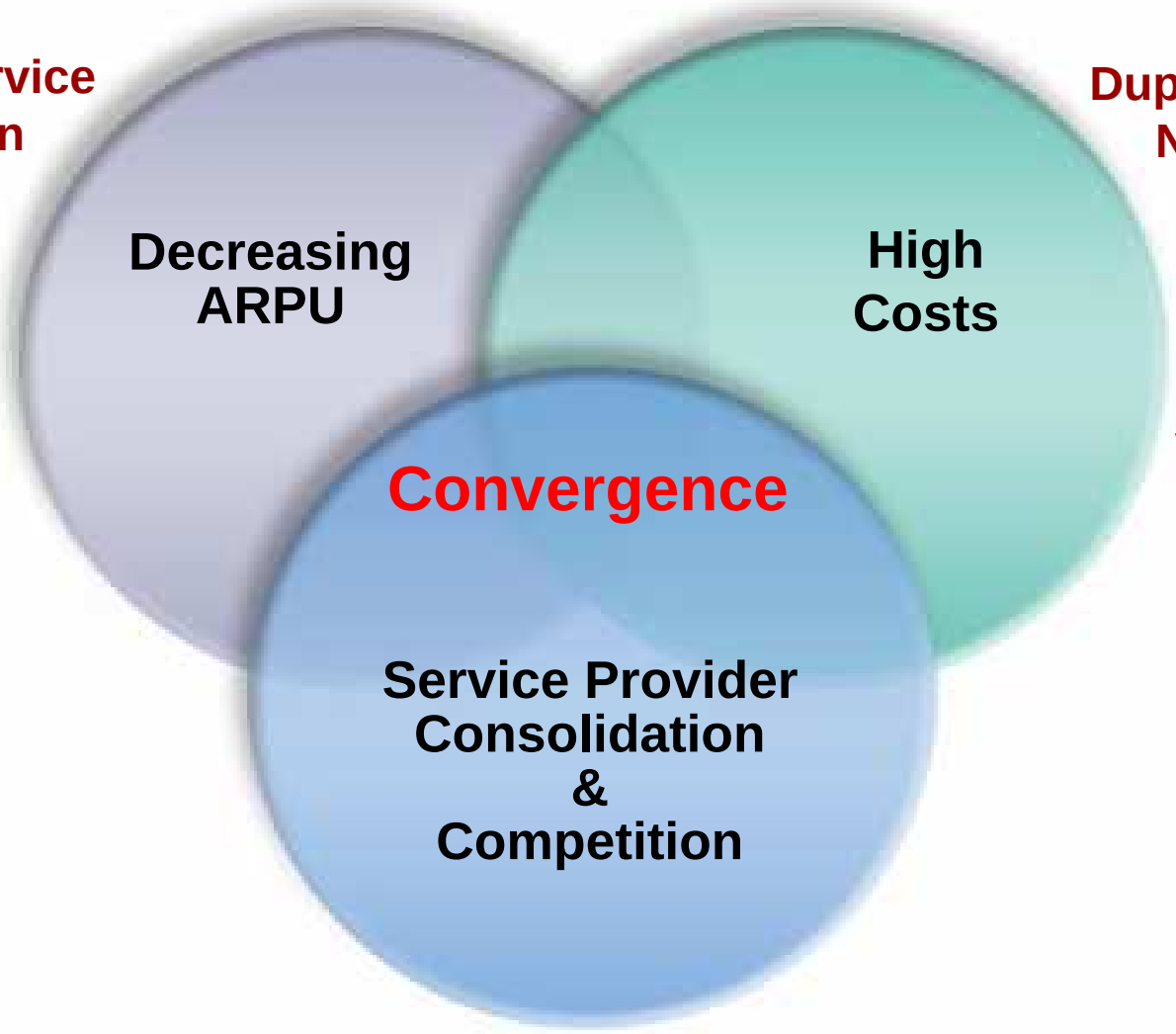
So what are we going to do about it?

- We will do the unthinkable
- Build Open Source, Open Standards Java VoIP platform
- With buy-in from telco vendors and operators
- Why will this work?...
  - let’s look at the telco landscape today

Java VoIP Industry Realization and Trends

Telecom Industry Challenges

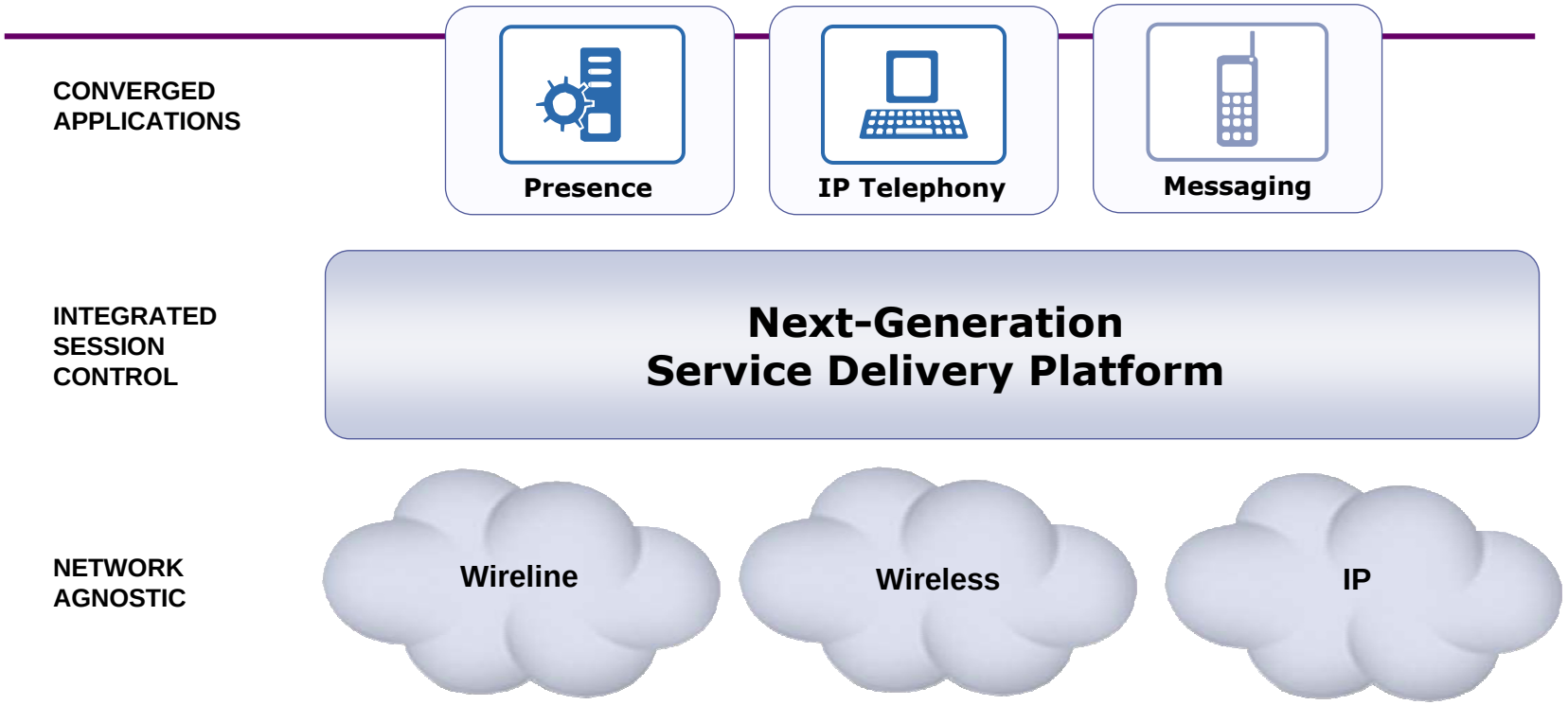
Single Service Orientation
- Voice
- Internet
- Wireless
- Wi-Fi
- Cable
- VoIP
- Media



Duplicative Network Infra For Each New Service

Consolidation of Networks, Bandwidth, Subscriber Base

Next-Generation Service Delivery Platform

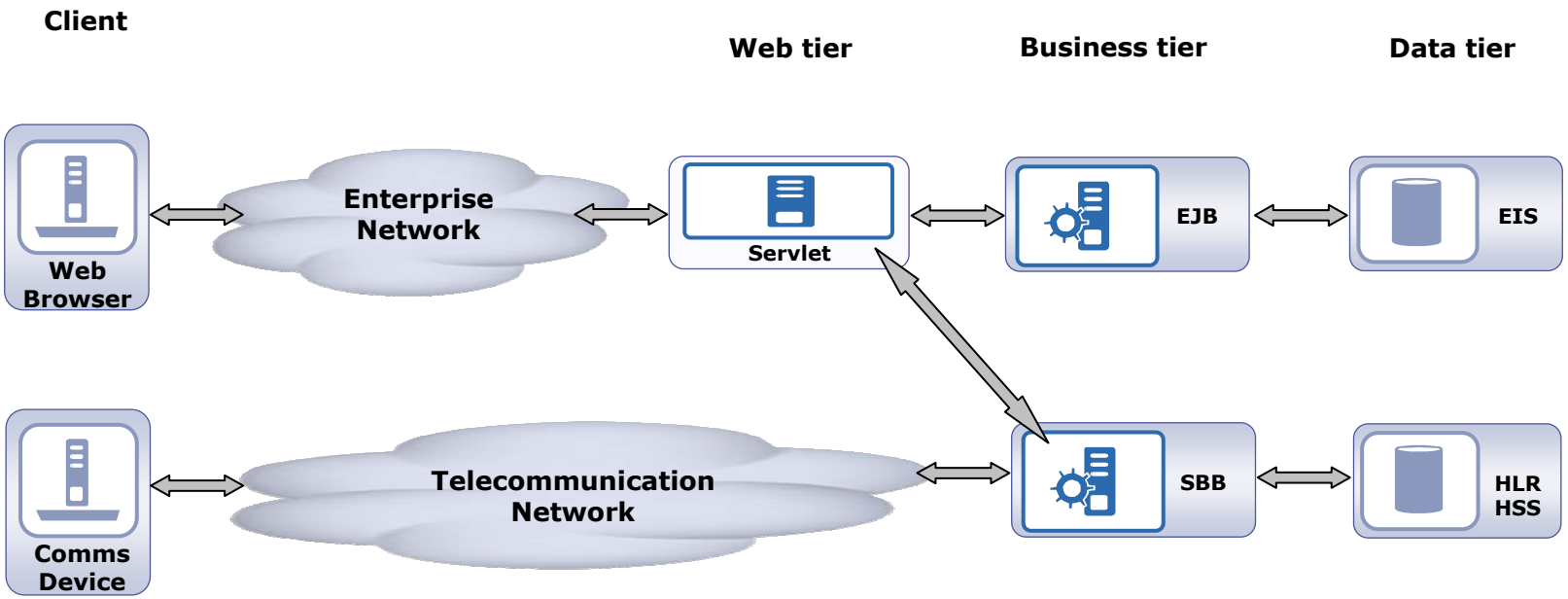


- Evolution to an all-IP network
- Well-defined, standardized interfaces through 3GPP, OMA and IETF
- Based on standard communication protocols – SIP, XMPP
- Common abstracted network service interfaces

Example value add applications

- Meet people with similar interest in the same area, German Retailer
- Baby tracker, Canadian telco
- Airfare deal notifier, Southwest Airlines
- Corporate conferencing
- Wake up caller with hunting
- Personalized ring profile
- Business process integration, decision making over the phone
- …no one knows what's possible…think TCP/IP…

J2EE and JSLEE



J2EE vs. JSLEE principles

Criteria	**J2EE**	**JSLEE**
Average Transaction Span	< 2 seconds	< 100ms
Transaction Volume	1’000s/sec	10’000s/sec
Persistence	Wide range	Read mostly
Uptime	99.9% (9 hours/year)	**99.999%** (5min/year)

Benefits

- Traditional of-the-shelf software
  - Leverage IDE's for Service creation
- Co-location of services
  - Reduce latency and resource consumption
- Open programming environment
  - Tools can be leveraged by developers
  - Leverage the best of the enterprise patterns
  - Event driven design base
  - Profile interface to subscriber/service data

Barriers

- No backing by large software providers yet
- NEP’s resisting adoption
  - Spoils business model
- New technology
  - Will developers pick up programming model
  - Requires investment
- Bad press
  - ISV’s competing for business – trashing technologies
  - Competing architectures from different standards bodies

What changing in the industry?

- Operators reluctant to upgrade capacity from older black box solutions to new black-box solutions
  - NEP's are losing business they typically secured
- NEP's have in-house development of technology
  - Near tipping point
- Key operators are still applying pressure
  - Willingness to invest in standard based middleware
- Open source environment gaining traction
  - Communities speak volumes

Keep it real

- July 5, 2005

  Vodafone Spain Proves Software Portability for Programmable Network Services

  MADRID, Spain (July 05, 2005)-While the telecommunications industry readies for the deployment of truly programmable network services that provides service portability in both IN and 3G/IMS, Vodafone Spain has already successfully used JAIN SLEE (Java) technology to deploy and run a real life commercial IN service on two different vendors platforms.

- 17 March, 2005

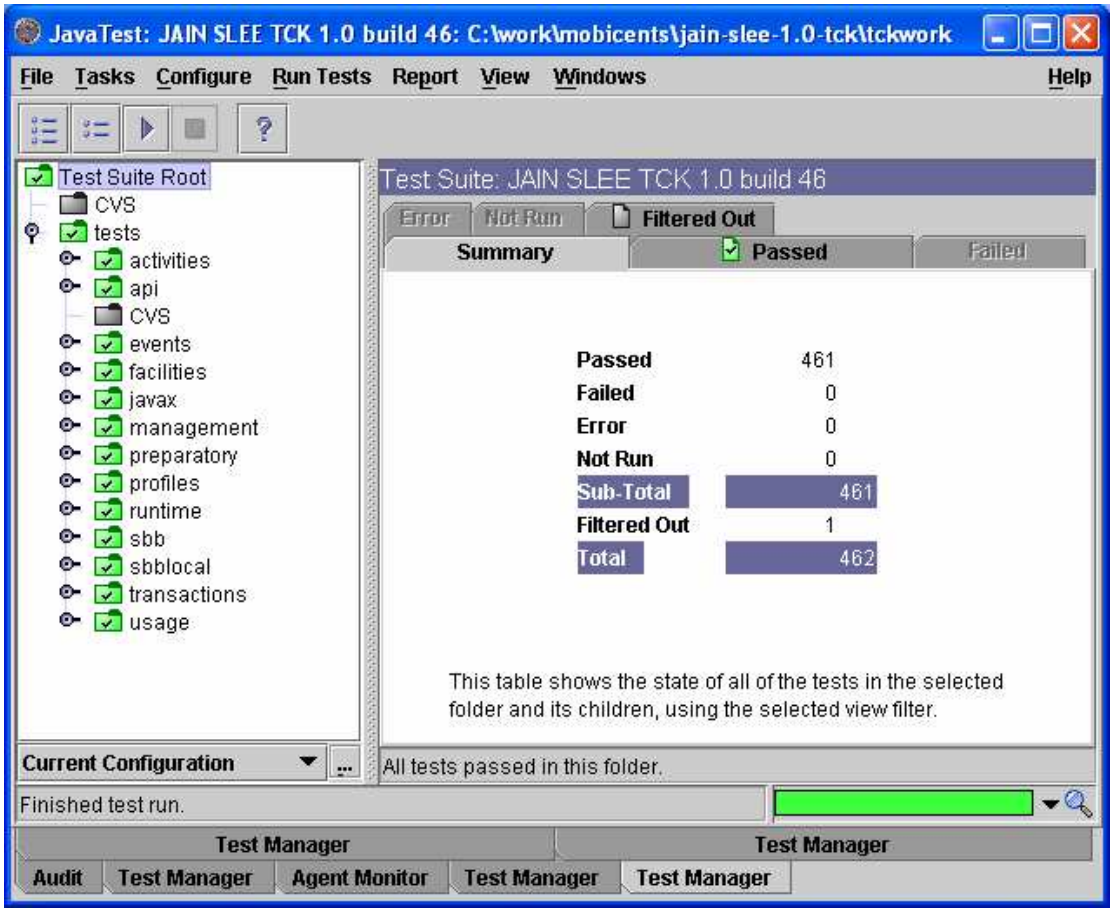
  Rogelio Martinez, head of the Centre of Competence for JSLEE technologies of Vodafone Spain, said:

  "Ensuring the success of our MMS network is a business-critical priority for us. The NetSpira ECS-MMR provides a way to eliminate bottlenecks in our MMS network. NetSpira has proved once again that it is ahead of the game - anticipating the needs of mobile and cellular operators and developing must-have products." The trial used several value-added services running on the top of Open Cloud Rhino's 1.2, a JAIN™ SLEE standards compliant service logic execution environment for carrier grade implementations.

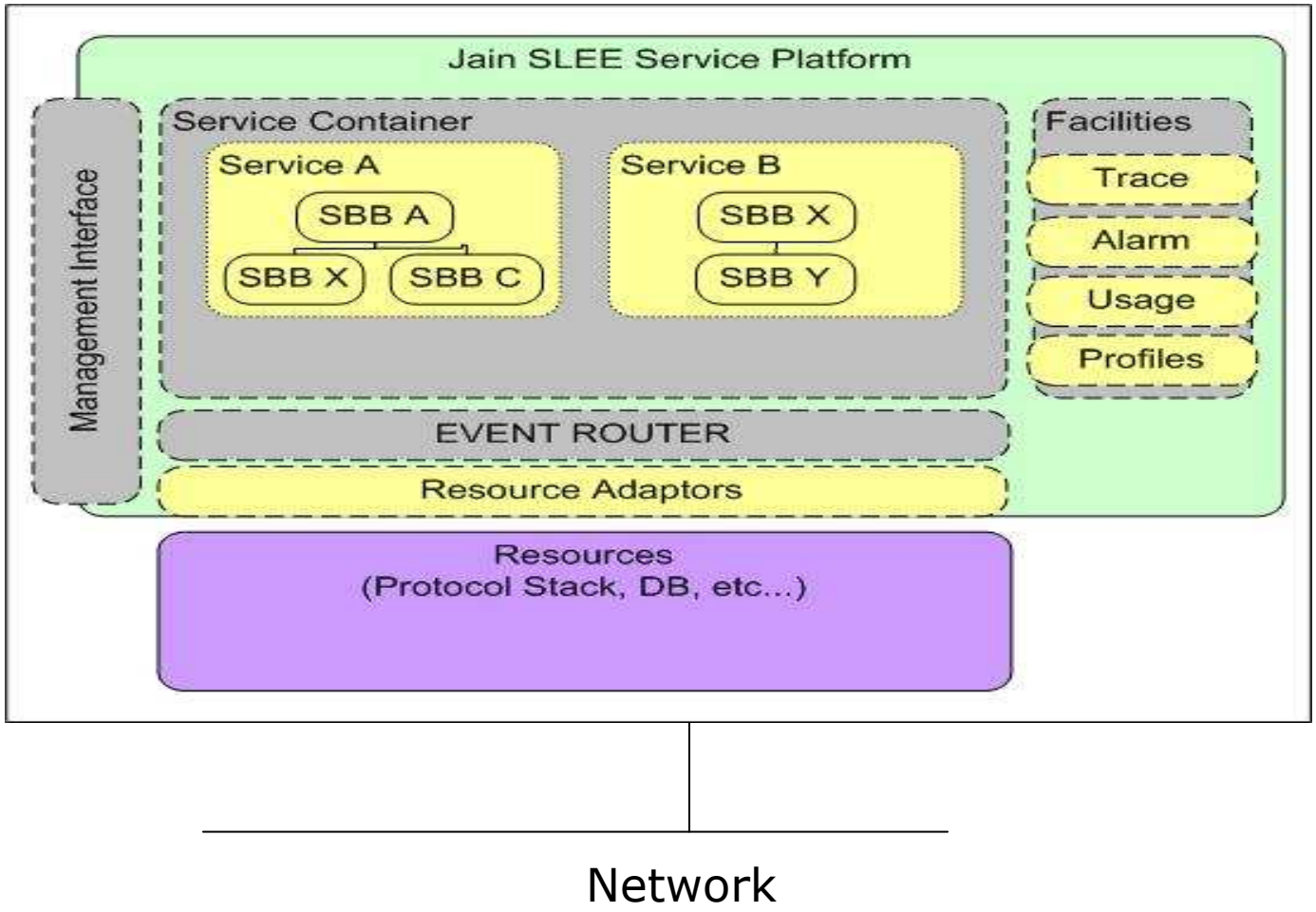
Mobicents Architecture, Implementation and Examples

First and Only Certified OSS JSLEE

- **JAIN SLEE 1.0 Certified since v1.0a**
- Rigorous and thorough spec helps a lot
- Great TCK coverage
- Leverage solid JBoss microkernel and plug-ins

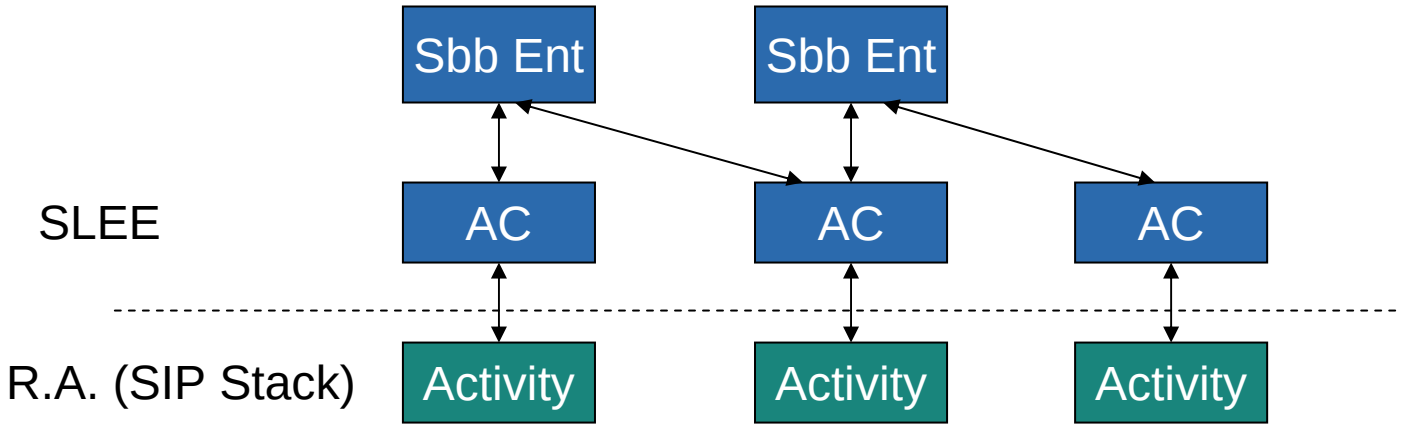


Simplified JAIN-SLEE Architecture



Some Details

- The SLEE abstracts the notion of an Event bus and event triggered pieces of code (Called SBBs).
- The event bus is called an Activity Context (AC).
  - An Activity is a stream of related events.
  - One-to-one mapping between Activities (Resource Adaptor domain) and Activity Contexts (SLEE domain).
  - Activity Context is an Event Channel.

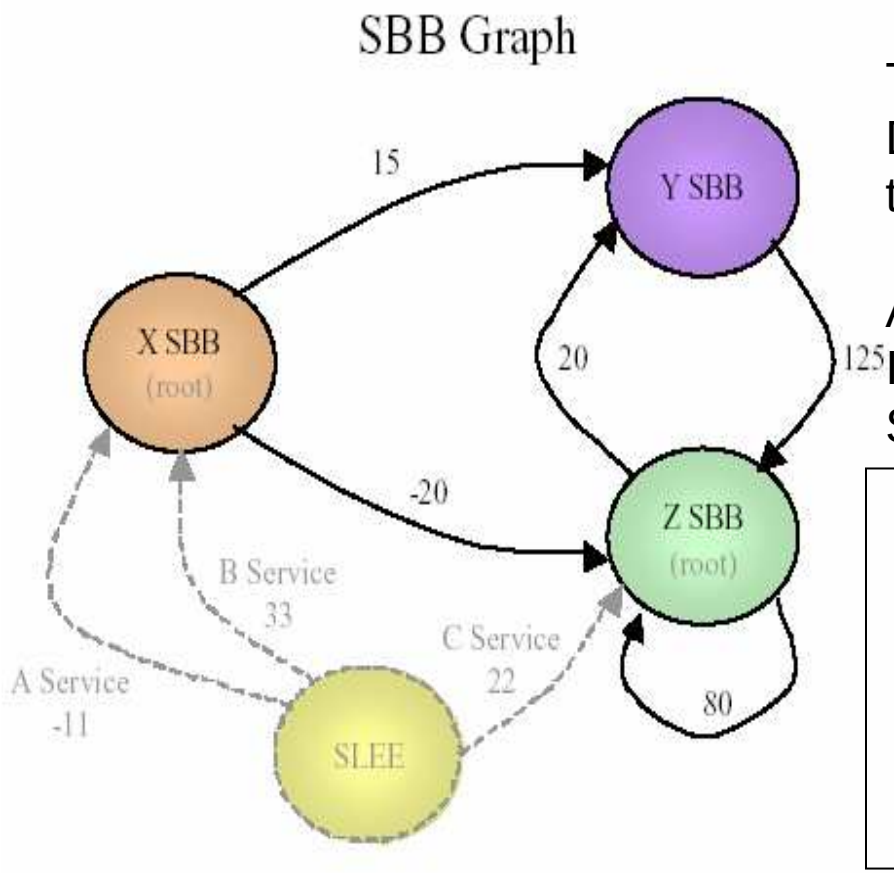


SLEE Building Blocks

- Event Type
- SBB
- Service
- Profile Specification
- Usage parameters interfaces
- JMX management clients

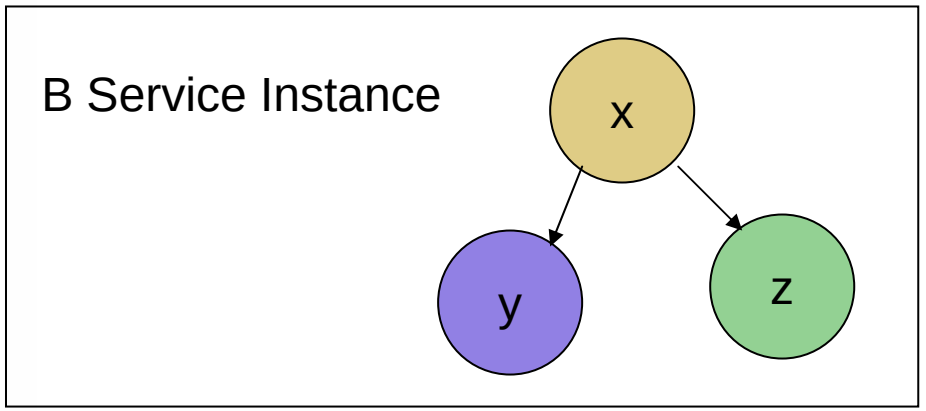
Service instantiation

(graphic re-used from JAIN-SLEE Tutorial with permission)



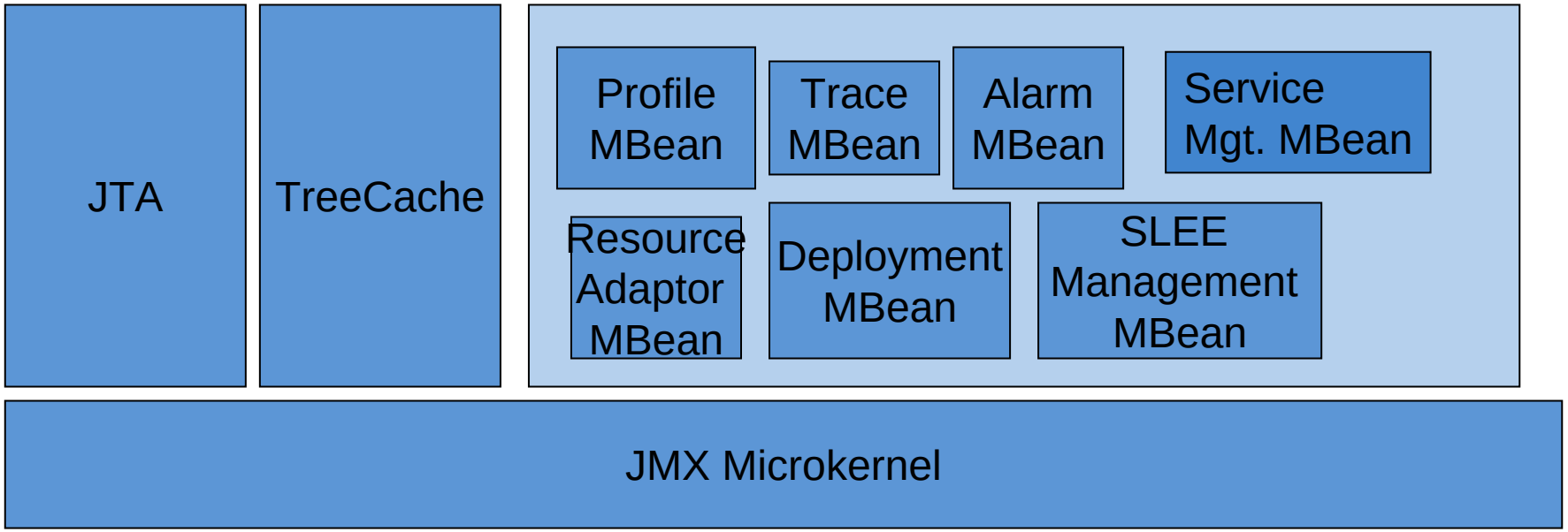
These are the SBBs known to the SLEE
This picture is known at Deployment time (through the deployment descriptors).

At run time, the service Instantiates a traversal of a Sub-graph of this sbb graph.



SLEE (JSR 22) as a JBoss Service

JBoss Microkernel architecture is a natural fit for building the SLEE

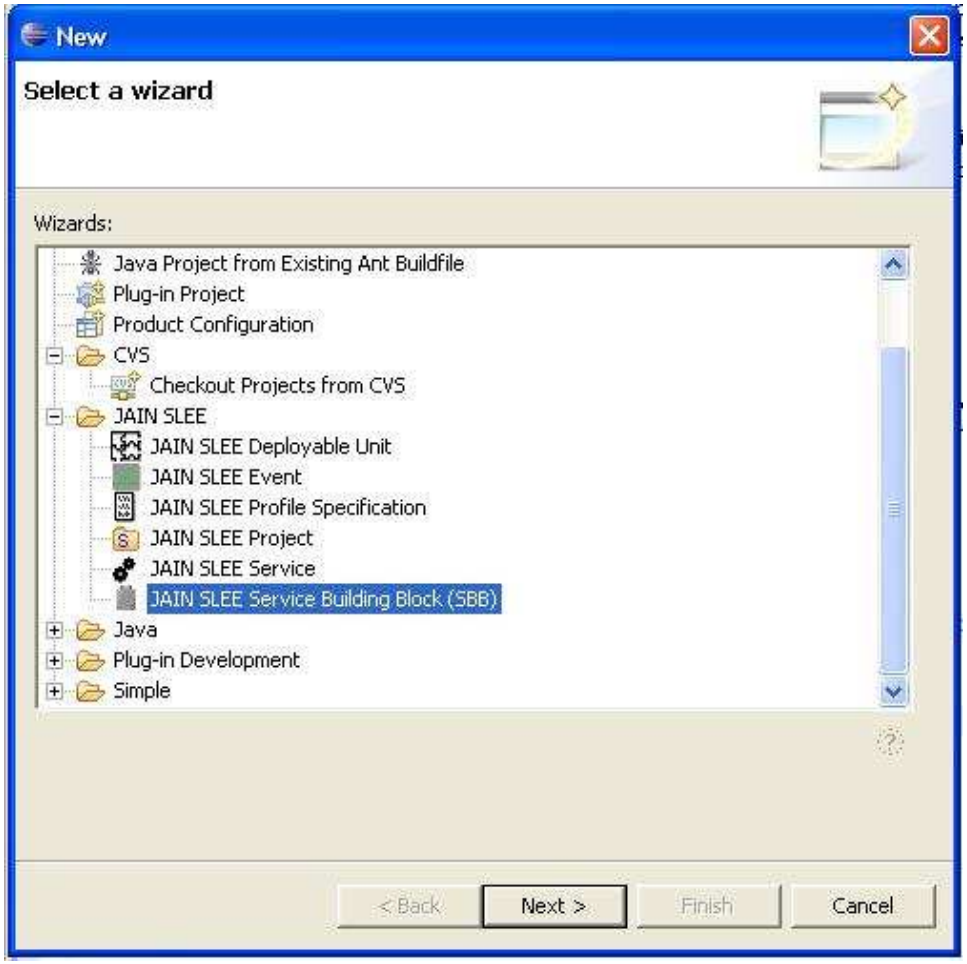


jboss-service.xml for Mobicents

```
<mbean code="org.mobicents.slee.container.management.jmx.SleeManagementMBeanImpl"
   name="slee:service=SleeManagement">
      <depends optional-attribute-name="AlarmMBean">slee:name=AlarmMBean</depends>
      <depends optional-attribute-name="DeploymentMBean">
            slee:name=DeploymentMBean</depends>
      <depends optional-attribute-name=
            "ServiceManagementMBean">slee:name=ServiceManagementMBean</depends>
      <depends optional-attribute-name="TraceMBean">slee:name=TraceMBean</depends>
      <depends optional-attribute-name=
            "ProfileProvisioningMBean">slee:name=ProfileProvisoningMBean</depends>
      <depends optional-attribute-name=
            "ResourceAdaptorMBean">slee:name=ResourceAdaptorMBean</depends>
       <depends>slee:name=TransactionManagerMBean</depends>
      <depends>jboss.cache:service=TreeCache</depends>
      <depends>jboss.cache:service=DeploymentTreeCache</depends>
      <depends>jboss.cache:service=ProfileTreeCache</depends>
      <depends>slee:service=SleeProfileManager</depends>
      <depends>jboss.cache:service=RuntimeTreeCache</depends>
  </mbean>
```

EclipSLEE plug-in project

- EclipSLEE project on java.net
- Subproject of Mobicents
- OpenClouod Contribution
- The plug-in provides a user friendly service creation environment for JAIN SLEE.



Minimal SBB xml & code

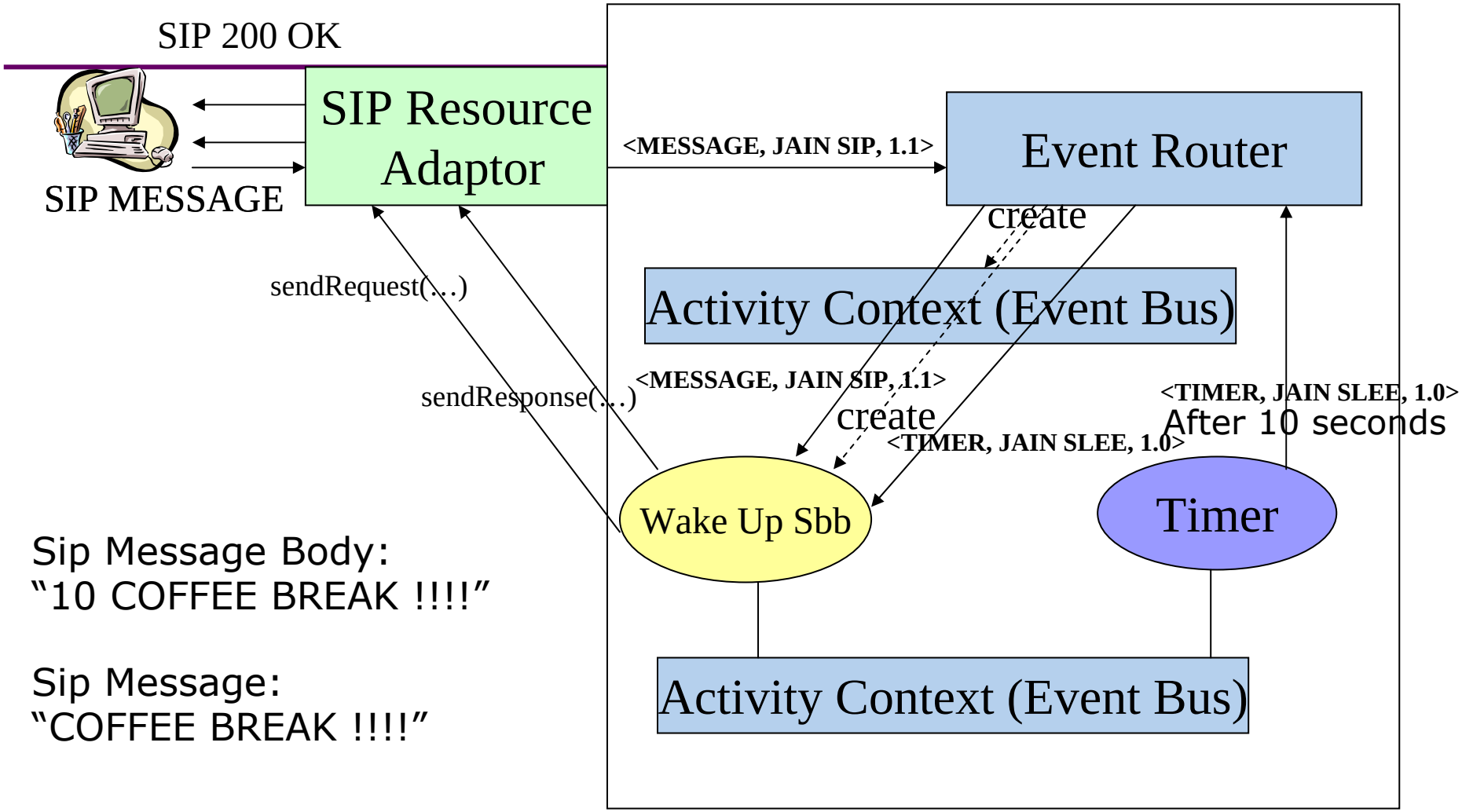
```xml
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE sbb-jar PUBLIC "-//Sun Microsystems, Inc.//DTD JAIN SLEE SBB 1.0//EN"
                         "http://java.sun.com/dtd/slee-sbb-jar_1_0.dtd">
<sbb-jar>
    <sbb>
        <description>This Sbb send a wake up call to the user.</description>
        <sbb-name>Wake Up Sbb</sbb-name>
        <sbb-vendor>NIST</sbb-vendor>
        <sbb-version>1.0</sbb-version>
        <sbb-classes>
            <sbb-abstract-class>
                <sbb-abstract-class-name>
                    org.mobicents.slee.examples.wakeup.WakeUpSbb
                </sbb-abstract-class-name>
            </sbb-abstract-class>
        </sbb-classes>
    </sbb>
</sbb-jar>
```

```java
package org.mobicents.slee.examples.wakeup;

import javax.slee.*;

public abstract class WakeUpSbb implements javax.slee.Sbb {
    // TODO: Perform further operations if required in these methods.
    public void setSbbContext(SbbContext context) { this.sbbContext = context; }
    public void unsetSbbContext() { this.sbbContext = null; }

    // TODO: Implement the lifecycle methods if required
    public void sbbCreate() throws javax.slee.CreateException {}
    public void sbbPostCreate() throws javax.slee.CreateException {}
    public void sbbActivate() {}
    public void sbbPassivate() {}
    public void sbbRemove() {}
    public void sbbLoad() {}
    public void sbbStore() {}
    public void sbbExceptionThrown(Exception exception,
            Object event, ActivityContextInterface activity) {}
    public void sbbRolledBack(RolledBackContext context) {}

    protected SbbContext getSbbContext() {
        return sbbContext;
    }

    private SbbContext sbbContext; // This SBB's SbbContext

}
```

Service descriptor

```
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE service-xml PUBLIC "-//Sun Microsystems, Inc.//DTD JAIN SLEE Service 1.0//EN"
                             "http://java.sun.com/dtd/slee-service_1_0.dtd">
<service-xml>
    <service>
        <description>Wake up service</description>
        <service-name>Wake Up Service</service-name>
        <service-vendor>NIST</service-vendor>
        <service-version>1.0</service-version>
        <root-sbb>
            <description>This Sbb send a wake up call to the user.</description>
            <sbb-name>Wake Up Sbb</sbb-name>
            <sbb-vendor>NIST</sbb-vendor>
            <sbb-version>1.0</sbb-version>
        </root-sbb>
        <default-priority>0</default-priority>
    </service>
</service-xml>
```

Wake Up Service



Sip Message Body:
"10 COFFEE BREAK !!!!"

Sip Message:
"COFFEE BREAK !!!!"

Event handlers

```
<event event-direction="Receive" initial-event="True">
    <event-name>MessageEvent</event-name>
    <event-type-ref>
        <event-type-name>javax.sip.message.Request.MESSAGE</event-type-name>
        <event-type-vendor>javax.sip</event-type-vendor>
        <event-type-version>1.1</event-type-version>
    </event-type-ref>
    <initial-event-select variable="ActivityContext"/>
</event>

<event event-direction="Receive" initial-event="False">
    <event-name>TimerEvent</event-name>
    <event-type-ref>
        <event-type-name>javax.slee.facilities.TimerEvent</event-type-name>
        <event-type-vendor>javax.slee</event-type-vendor>
        <event-type-version>1.0</event-type-version>
    </event-type-ref>
</event>
```

```
public abstract class WakeUpSbb implements javax.slee.Sbb {

    public void onMessageEvent(javax.sip.RequestEvent event, ActivityContextInterface aci) {

    public void onTimerEvent(TimerEvent event, ActivityContextInterface aci) {
```

SIP MESSAGE event handler

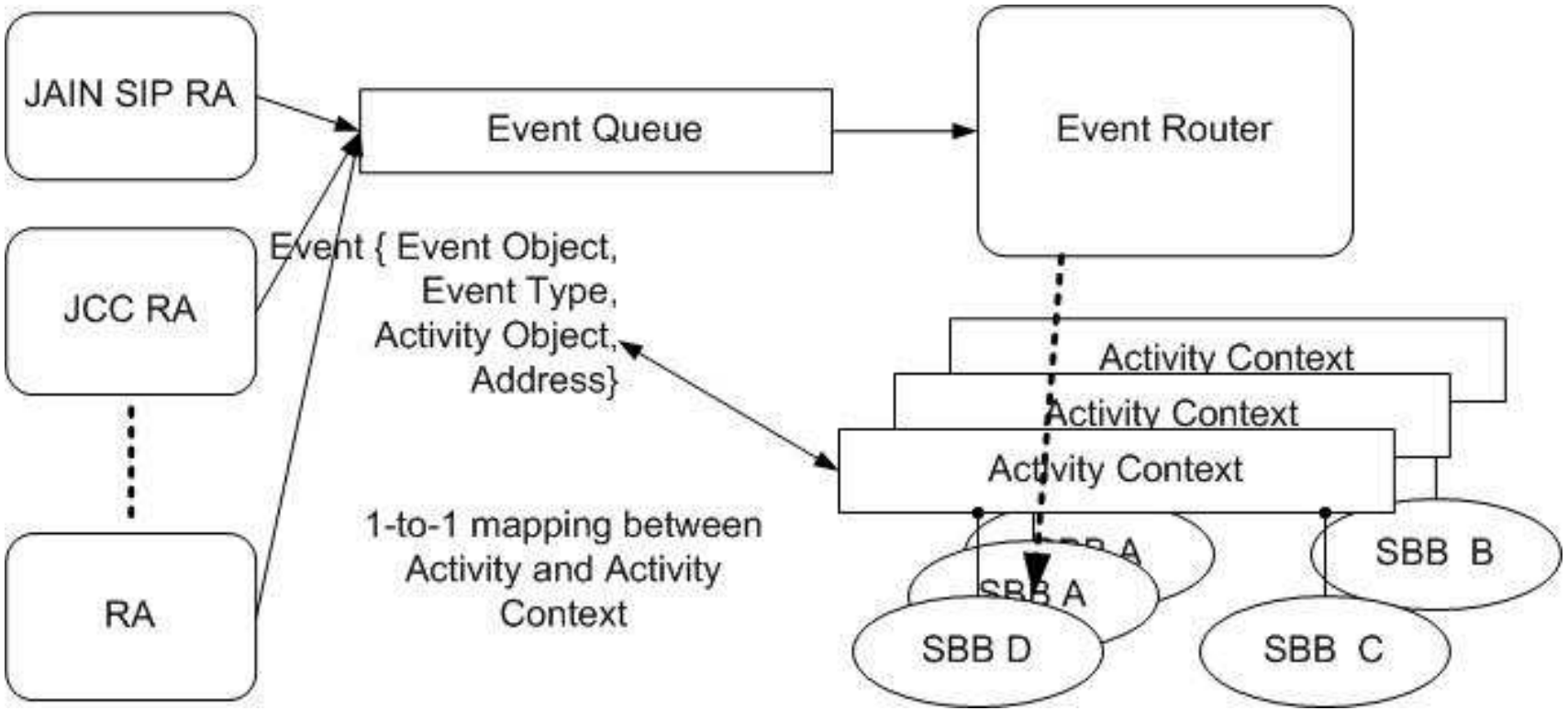
```
public void onMessageEvent(javax.sip.RequestEvent event, ActivityContextInterface aci) {
Request request = event.getRequest();

try {
        // PARSING THE MESSAGE BODY
        String body = new String(request.getRawContent());
        int i = body.indexOf(" ");
        String timerValue = body.substring(0,i);
        int timer = Integer.parseInt(timerValue);
        String bodyMessage = body.substring(i+1);

        // SETTING VALUES ON THE ACTIVITY CONTEXT
        // USING THE SBB CUSTOM ACI
        WakeUpSbbActivityContextInterface myViewOfTimerBusACI =

        // SETTING THE TIMER BY USING THE VALUE
        // IN THE SIP MESSAGE BODY
        TimerOptions options = new TimerOptions();
        options.setPersistent(true);
        this.timerFacility.setTimer(timerBusACI,
                null,
                System.currentTimeMillis()+timer*1000,
                options);

                        "Exception while retrieveing Activity Context Interface: ", e);
                }
        }
```

Timer Event Handler

```
public void onTimerEvent(TimerEvent event, ActivityContextInterface aci) {
    // RETRIEVING STORED VALUE FROM THE ACTIVITY CONTEXT INTERFACE
    WakeUpSbbActivityContextInterface myViewOfACI =
        this.asSbbActivityContextInterface(aci);
    Header contact = myViewOfACI.getContact();
    String body = myViewOfACI.getBody();

    // SENDING BACK THE WAKE UP CALL
    sendWakeUpCall(contact, body);
}
```

Some Implementation Details

Event Delivery



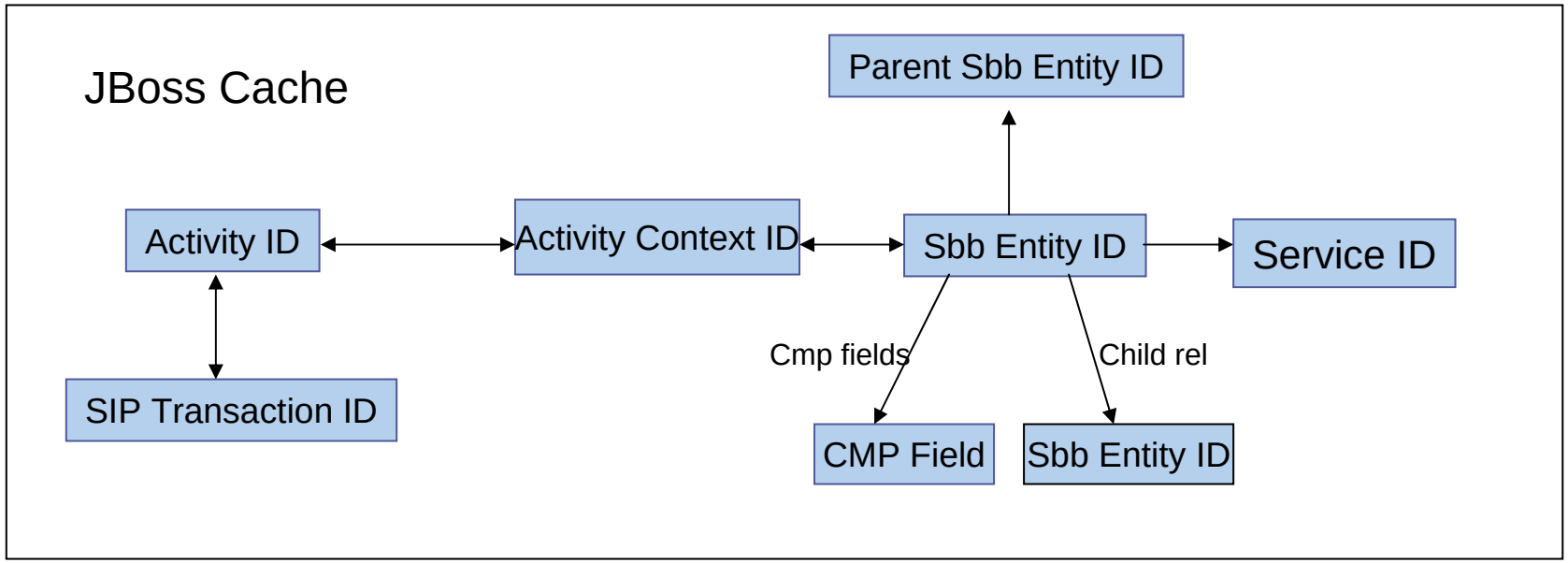
"Heart" of the SLEE is the Event Router. Each AC is an event queue.

Concurrency And Consistency

- SLEE spec is defined using a SERIALIZABLE consistency model.
- This implies that for concurrent event delivery the final state of the SLEE after consumption of these events should be achievable through some serial ordering of event delivery.
- Can be achieved using either optimistic or pessimistic concurrency control.
- Current version of Mobicents uses pessimistic concurrency control.
- Concurrency is at a per activity level.

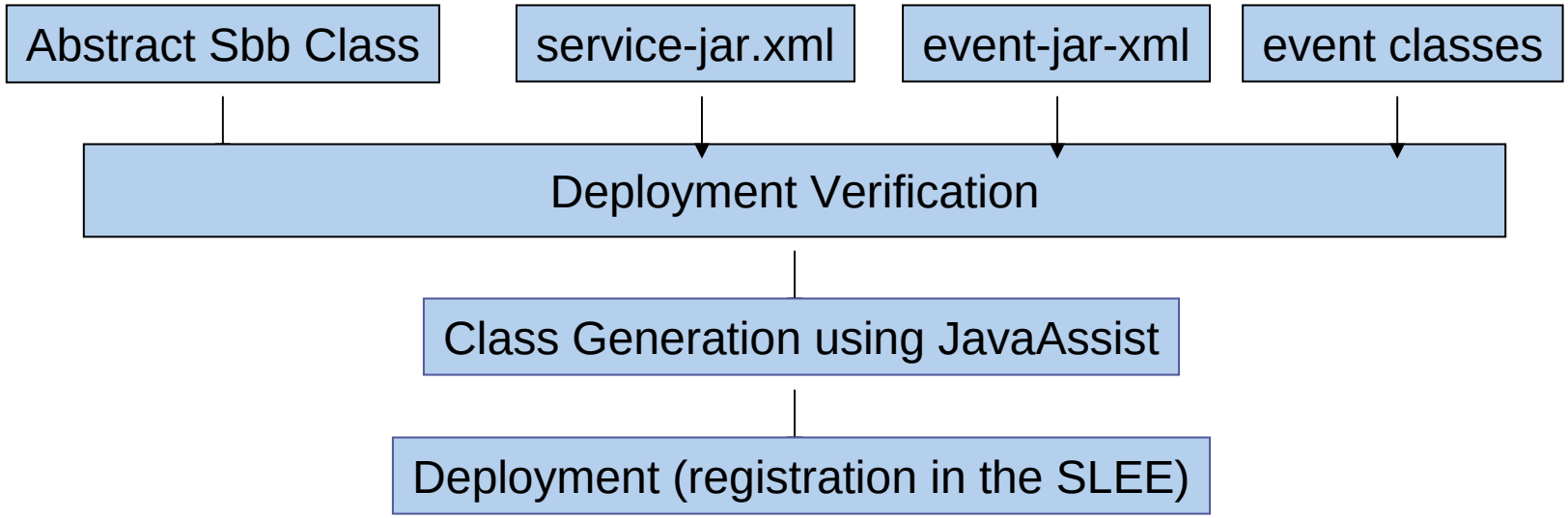
Cached and Replicated Structures

- ACs and Sbb Entities need to be replicated on Tx boundaries
  - ACs are visible to applications and represent a transitory event bus.
  - SBB Entities are the in memory representation of an SBB in use
  - JBoss Cache is very handy for this –provides transactional replication.



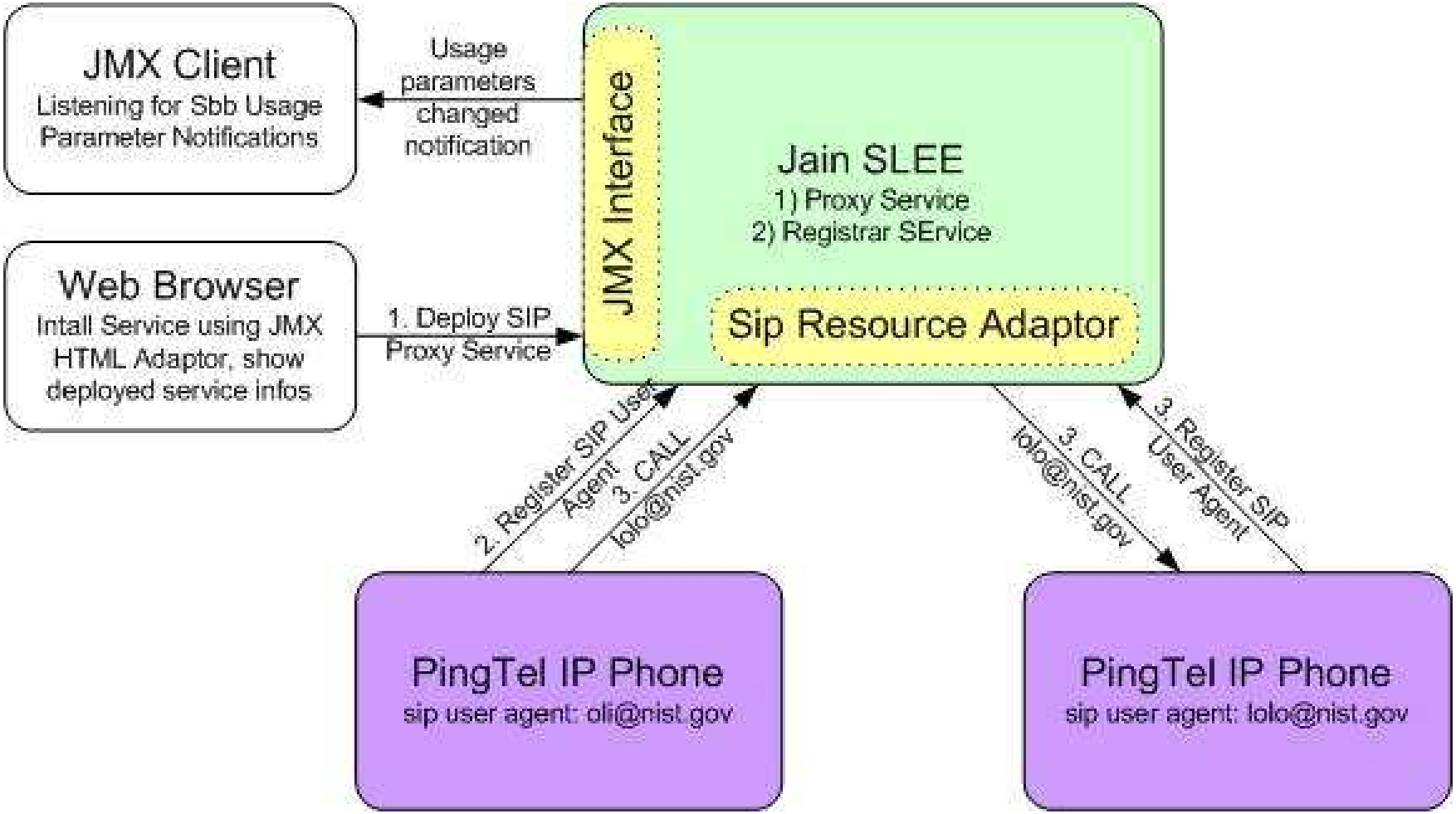
Deployment

A deployable unit may contain Services, SBB jar files, Event jar files, Profile Specification jar files.
Each sbb has abstract methods for various operations: onXXX, CMP fields accessors. Profile CMP accessors, usage parameters. These are generated at deployment time to access container facilities for actually performing the operations.

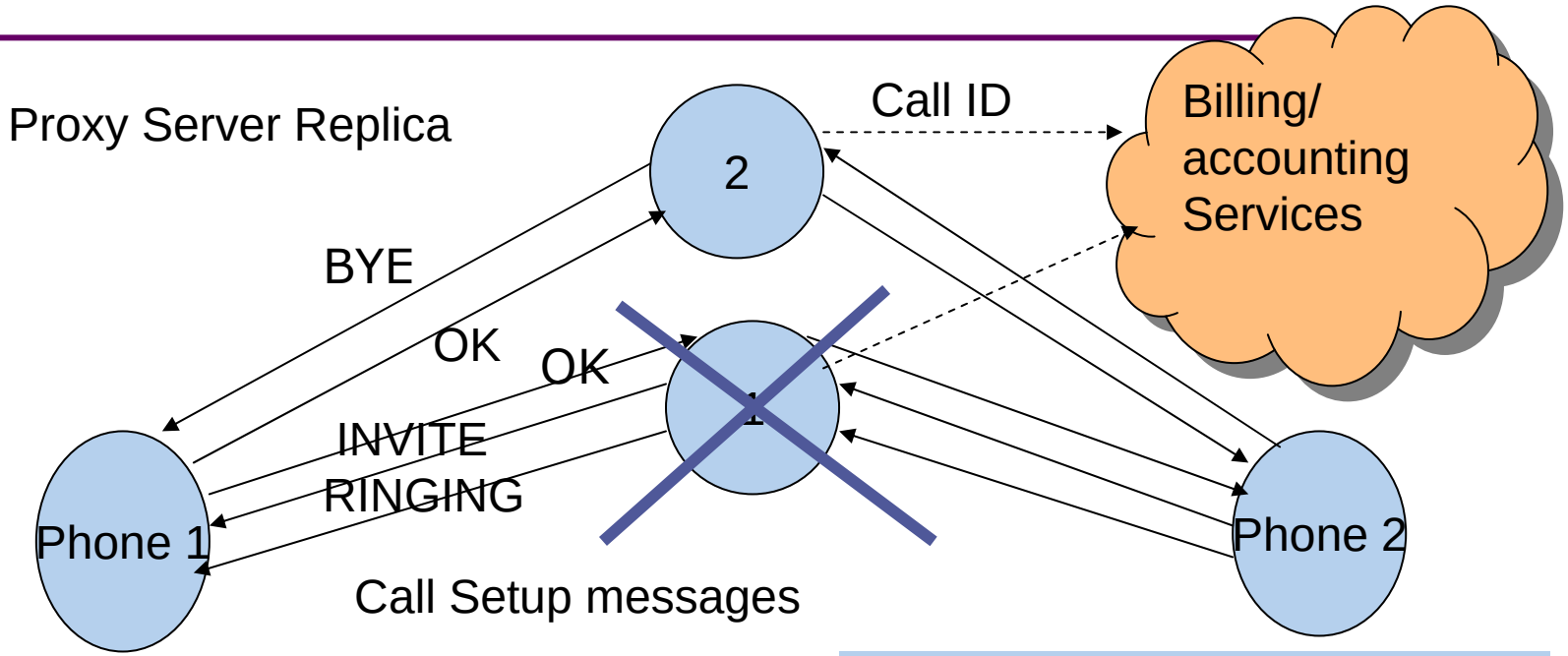


A More Sophisticated Example:
SIP Proxy Server With Failover Support.

SIP Proxy as a SLEE Service



Replication and Persistence

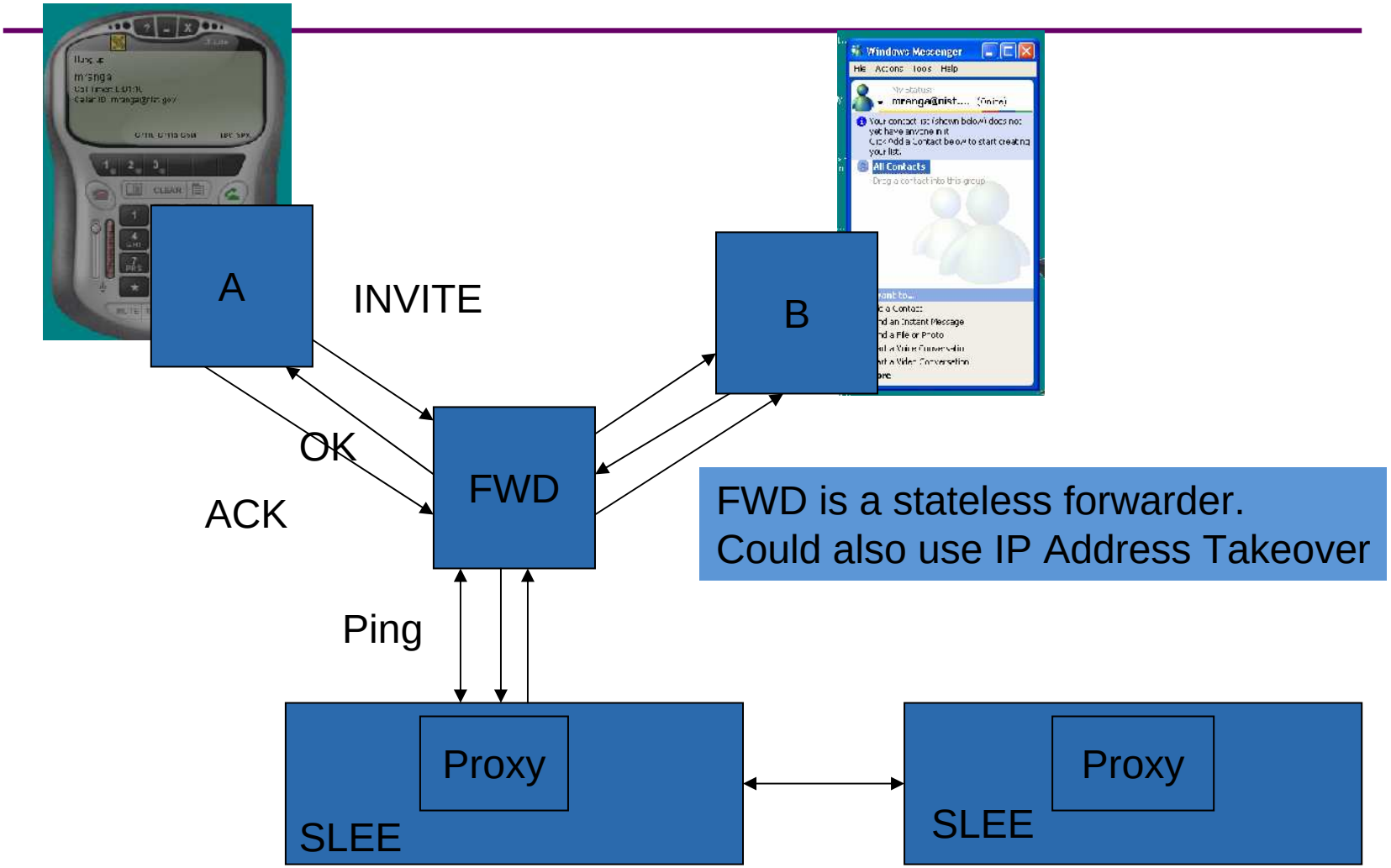


Convergence name = CallID

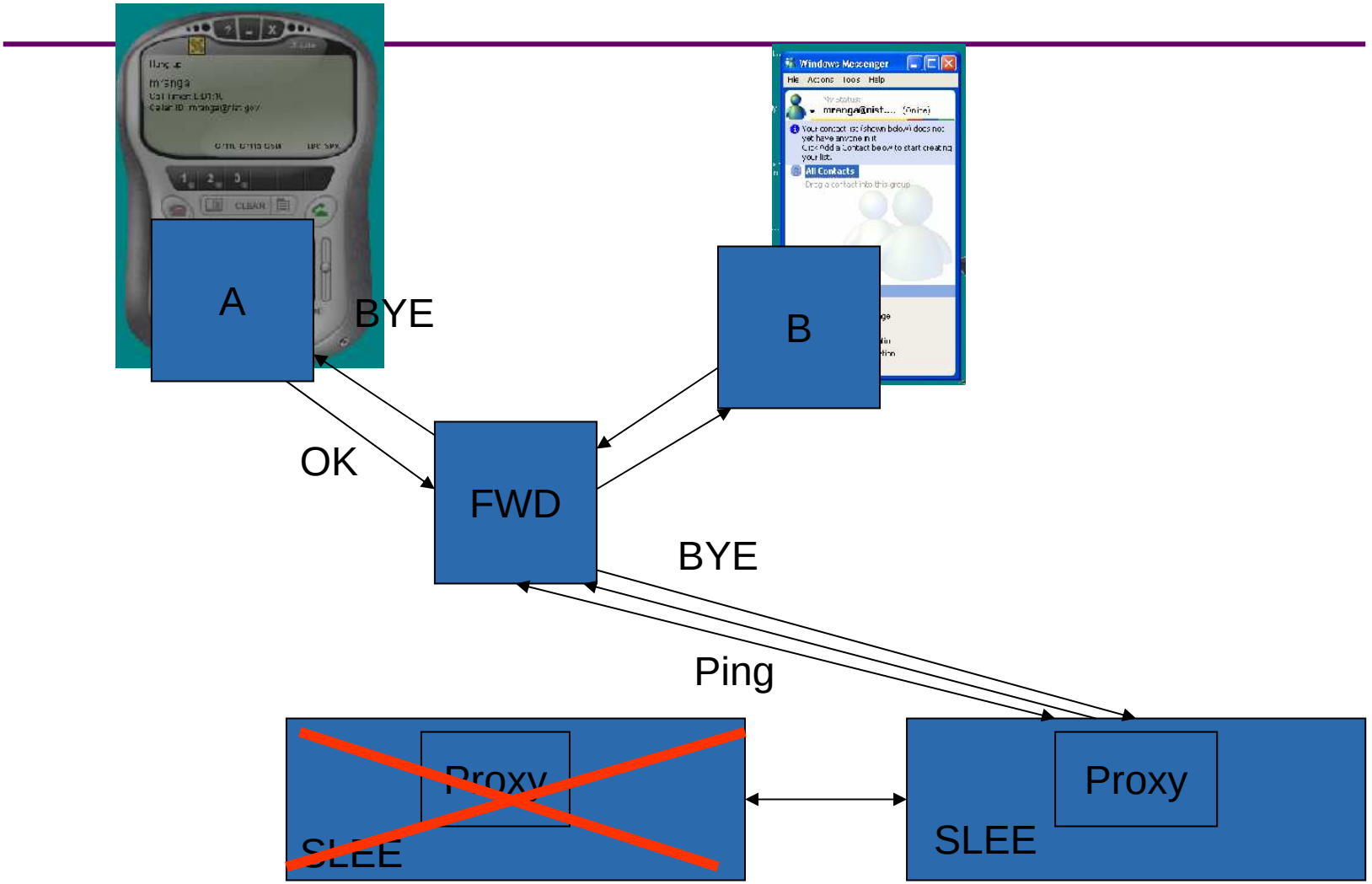
- Server 1 fails after call setup
- Server 2 takes over for Server 1
- Server 2 needs to replicate the same service structure
- Server 2 needs to know about the call (Call ID)
  that server 1 was handling and map it to the same Service

HA is still a work in progress

Demo Outline



Demo Outline (*cont'd*)



Demo Outline (*cont'd*)

- B registers with the proxy server.
- A calls B via the proxy.
- Proxy crashes replica takes over
- Hang up the call
  - Show that the Service survives the crash.
  - The initiator gets the BYE.
- Re initiate the call from A to B
  - Illustrates that the registrar survived the crash

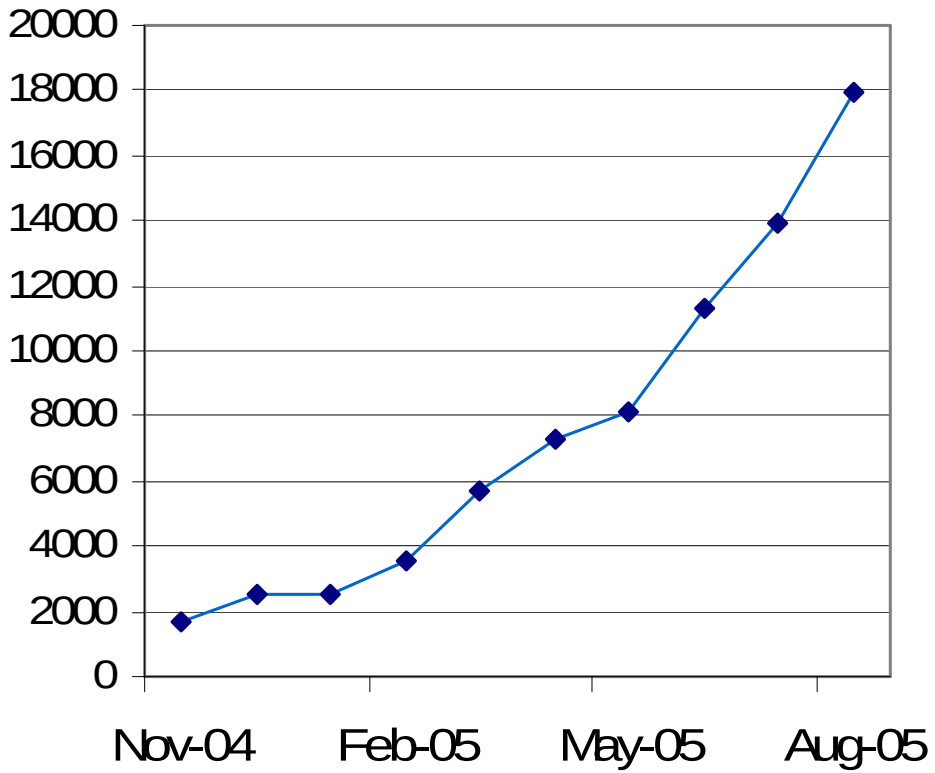
Mobicents Community and Roadmap

Project Status

- 1.0b1 release
- Beta quality
- More stable SLEE core
- Basic failover for SIP
- Much better performance ~ 15cps/CPU
- Profile persistence
- Auto deployment

What makes it possible?

- Committed Leadership
- Vibrant Community
  - 20+ registered developers
  - Daily forum discussions
  - Increasing Wiki Views



Mobicents Community

- NIST: Contributed SIP Stack, development of core platform
- University of Genoa: Core contributor.
- Luis Pasteur University: Continuous build and TCK runs
- Java.net: project hosting
- Portugal Telecom Innovacao: Asterisk RA, XMPP RA
- Lucent: Performance, profiling, HA
- Open Cloud: EclipSLEE, SIP RA
- Vodafone R&D: Examples, XMPP RA,
- <*Tier 1 Telco*>: Diameter RA
- <*VoIP vendor*>: Parlay/Parlay-X RA
- ZyXEL: WiFi SIP Phone Prototype
- JBoss, Federation membership
- Several independent VoIP vendors

Major Contributing Individuals: M. Ranganathan, Francesco Moggia, Ivelin Ivanov, Jean Deruelle, Ralf Siedow, Buddy Bright, Leon Do, Marco Montiero, Luis Tiexeira, Tim Fox

Community feedback

- **Roadmap visibility and predictable timelines**
  - Most popular demand by far!
- Carrier grade quality
- Higher Availability
- Better performance - 100+ cps
- More modules – XMPP, JCC, Parlay, Skype, Asterisk, Diameter
- Sophisticated Administration GUI
- Tools for Rapid Service Development

What's next?

- Continue active development
  - HA, performance, new RAs
  - Enhance test framework
  - Implement JSLEE 1.1 (JSR 240) when spec is final
- Scale project coordination
  - Add new contributors
  - Preserve synergy and productivity
  - Ensure ongoing module integration
- Consider ideas for formal organization
  - Predictable roadmap
  - Measurable commitments by members
  - Professional support channels

Q&A