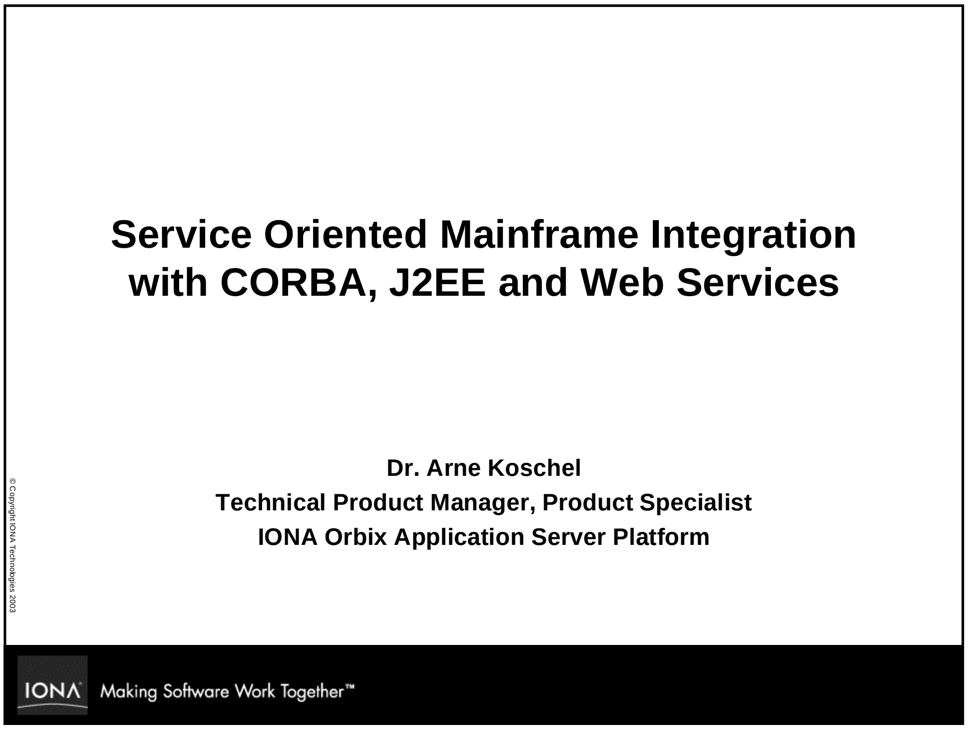
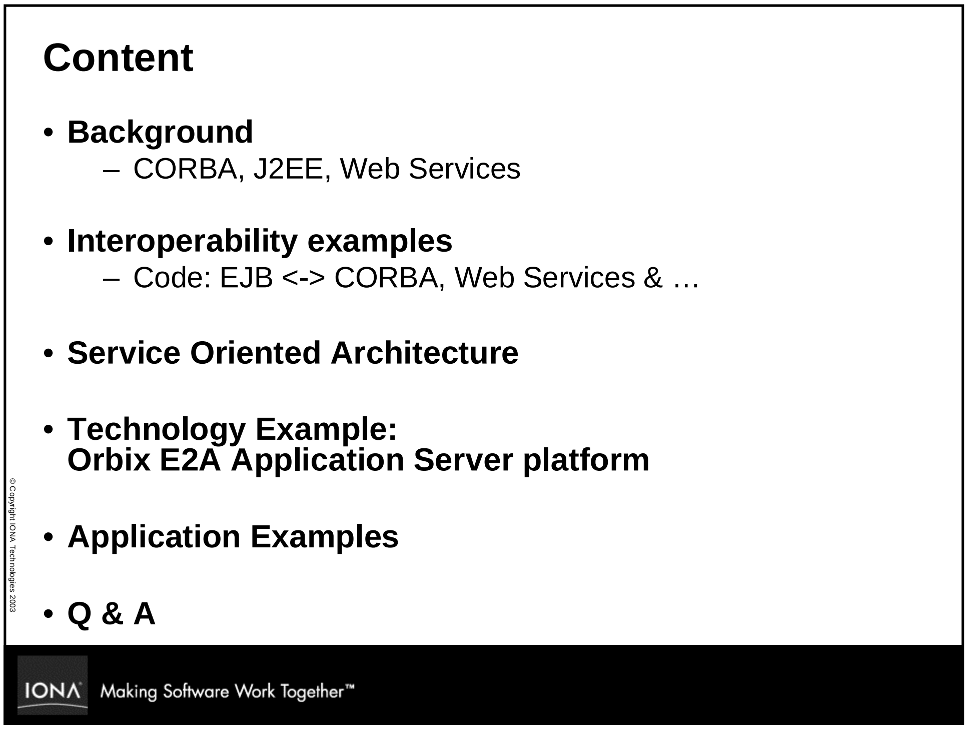


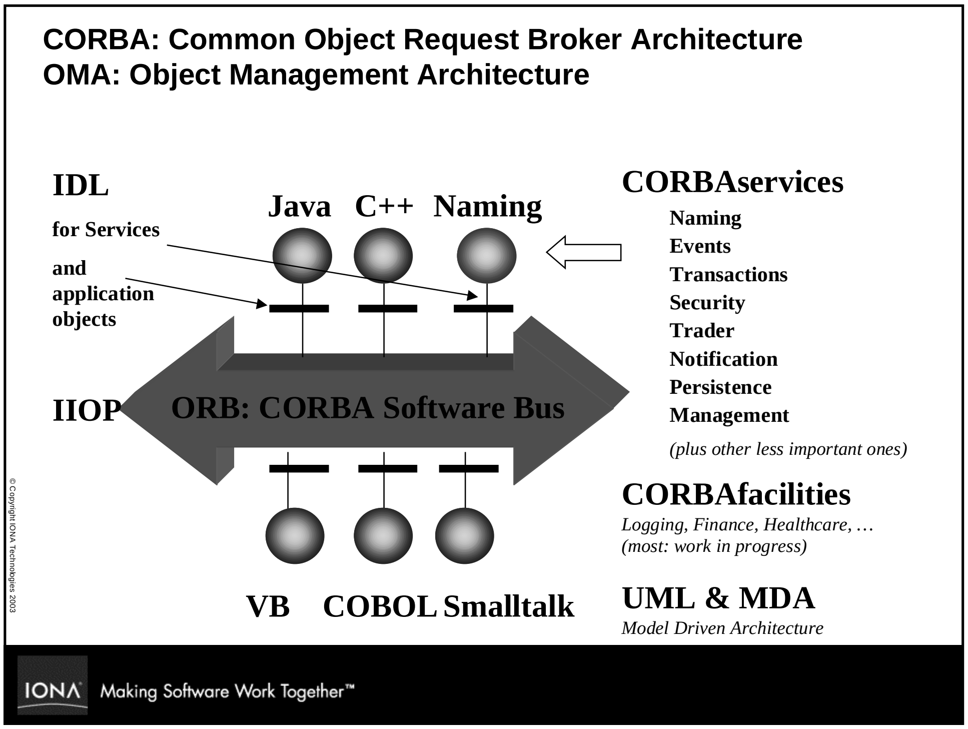
Service Oriented Mainframe Integration with CORBA, J2EE and Web Services

Dr. Arne Koschel
Technical Product Manager, Product Specialist
IONA Orbix Application Server Platform



Content

- **Background**
  - CORBA, J2EE, Web Services
- **Interoperability examples**
  - Code: EJB <-> CORBA, Web Services & …
- **Service Oriented Architecture**
- **Technology Example: Orbix E2A Application Server platform**
- **Application Examples**
- **Q & A**



CORBA: Common Object Request Broker Architecture
OMA: Object Management Architecture

IDL

for Services

and application objects

Java C++ Naming

IIOP

ORB: CORBA Software Bus

VB COBOL Smalltalk

CORBAservices

- **Naming**
- **Events**
- **Transactions**
- **Security**
- **Trader**
- **Notification**
- **Persistence**
- **Management**

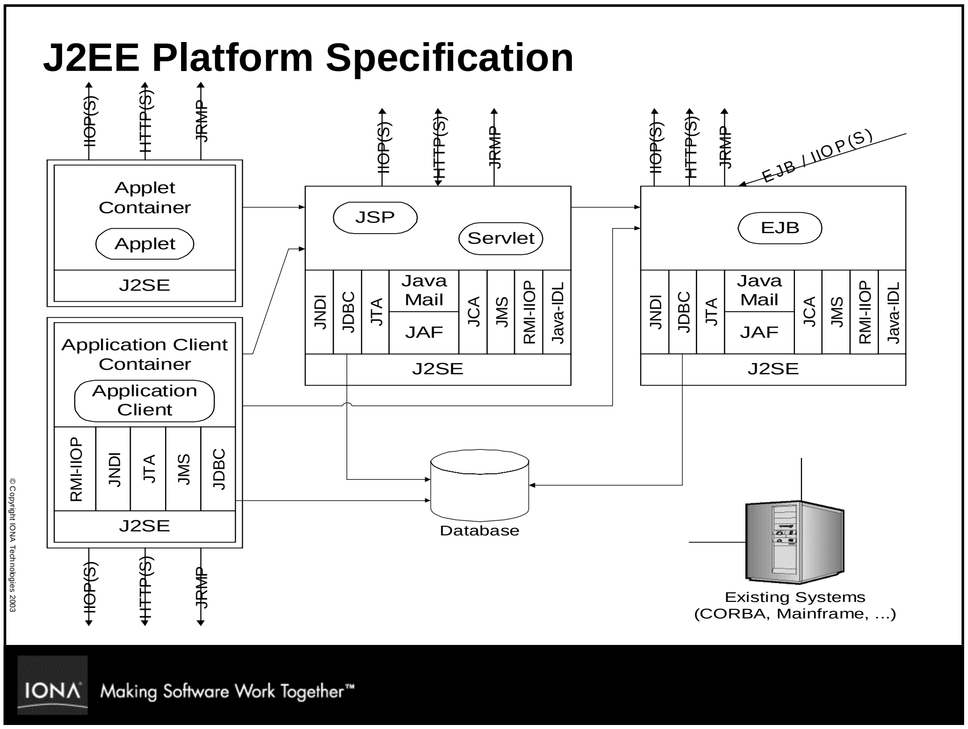
(plus other less important ones)

CORBAfacilities

Logging, Finance, Healthcare, …
(most: work in progress)

UML & MDA

Model Driven Architecture



J2EE Platform Specification

IIOP(S) HTTP(S) JRMP

Applet Container

Applet

J2SE

Application Client Container

Application Client

RMI-IIOP JNDI JTA JMS JDBC

J2SE

IIOP(S) HTTP(S) JRMP

IIOP(S) HTTP(S) JRMP

JSP Servlet

JNDI JDBC JTA Java Mail JAF JCA JMS RMI-IIOP Java-IDL

J2SE

IIOP(S) HTTP(S) JRMP

EJB / IIOP(S)

EJB

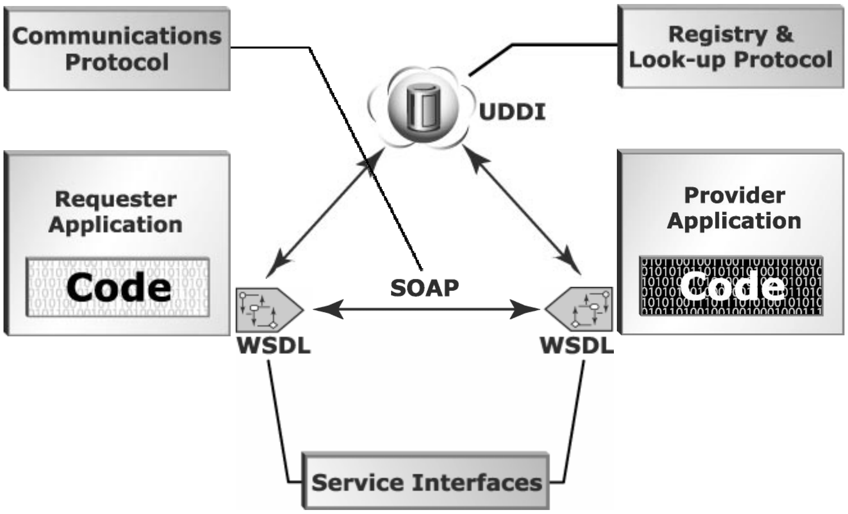
JNDI JDBC JTA Java Mail JAF JCA JMS RMI-IIOP Java-IDL

J2SE

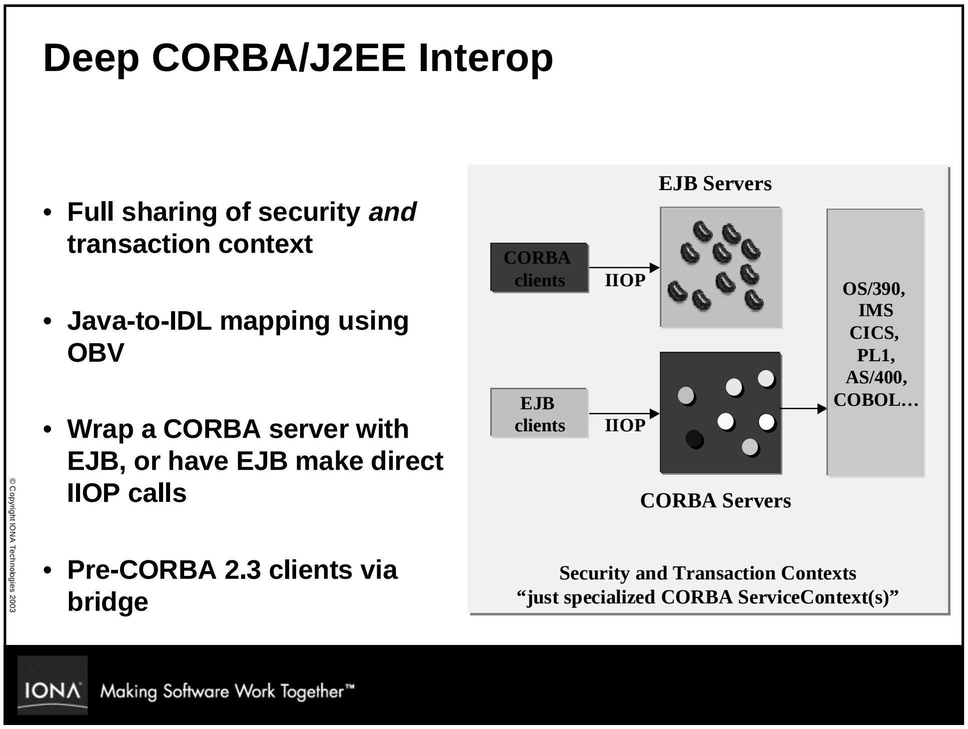
Database

Existing Systems
(CORBA, Mainframe, …)

Web Services “Core”



Interoperability examples

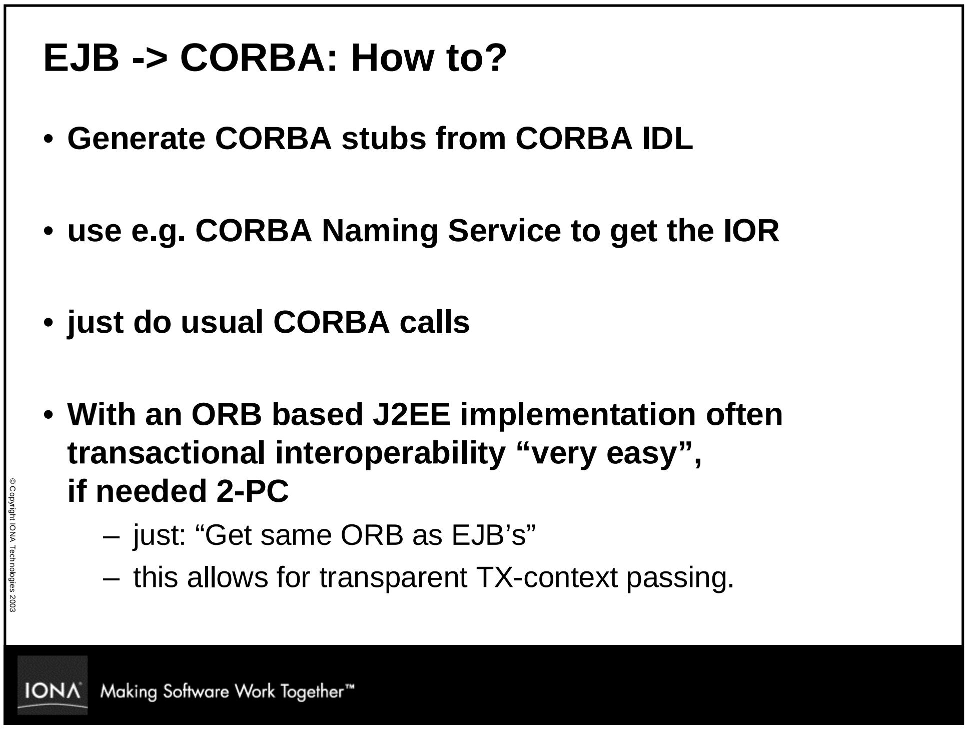


Deep CORBA/J2EE Interop

- **Full sharing of security *and* transaction context**
- **Java-to-IDL mapping using OBV**
- **Wrap a CORBA server with EJB, or have EJB make direct IIOP calls**
- **Pre-CORBA 2.3 clients via bridge**

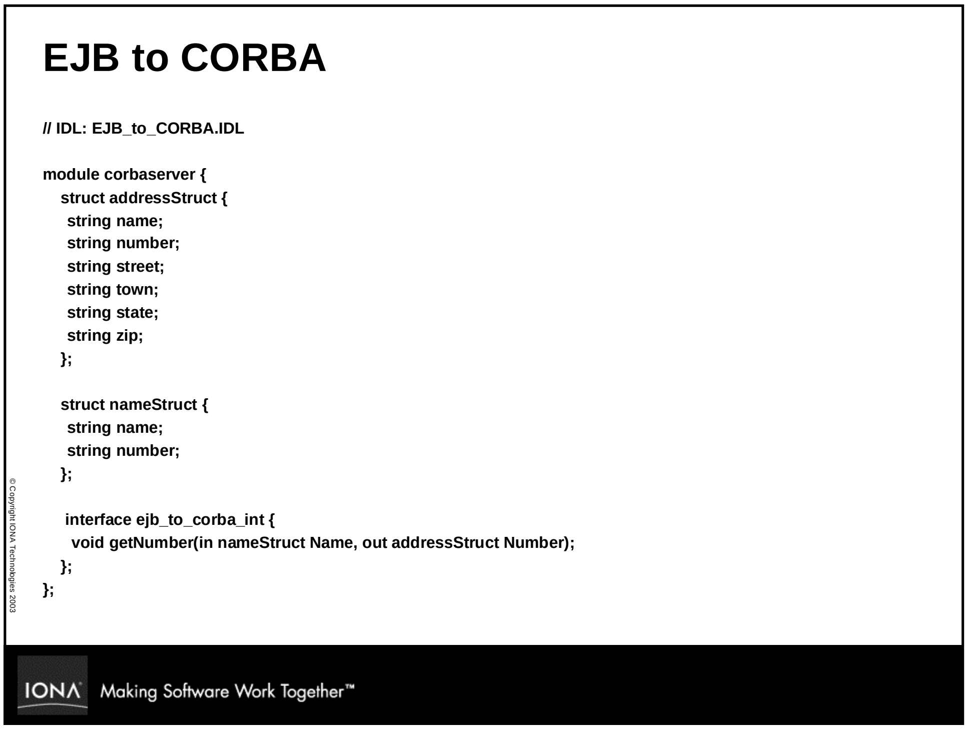
EJB Servers
CORBA clients
IIOP
OS/390, IMS CICS, PL1, AS/400, COBOL…
EJB clients
IIOP
CORBA Servers

Security and Transaction Contexts
“just specialized CORBA ServiceContext(s)”



EJB -> CORBA: How to?

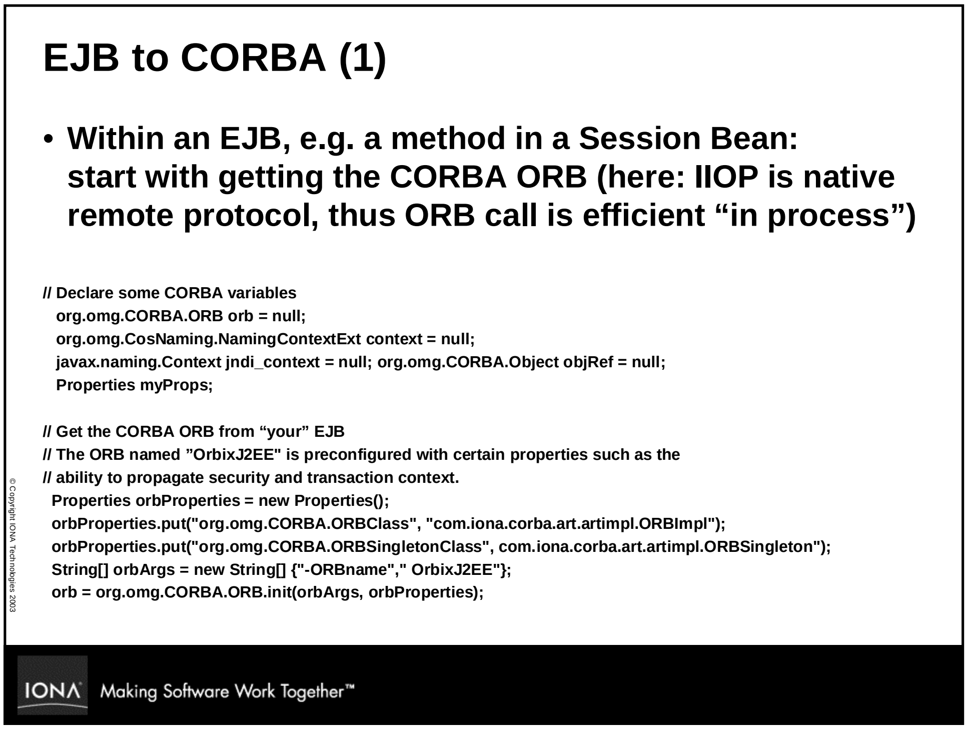
- **Generate CORBA stubs from CORBA IDL**
- **use e.g. CORBA Naming Service to get the IOR**
- **just do usual CORBA calls**
- **With an ORB based J2EE implementation often transactional interoperability “very easy”, if needed 2-PC**
  - just: “Get same ORB as EJB’s”
  - this allows for transparent TX-context passing.



EJB to CORBA

```
// IDL: EJB_to_CORBA.IDL

module corbaserver {
   struct addressStruct {
    string name;
    string number;
    string street;
    string town;
    string state;
    string zip;
   };

   struct nameStruct {
    string name;
    string number;
   };

    interface ejb_to_corba_int {
     void getNumber(in nameStruct Name, out addressStruct Number);
   };
};
```

IONA Making Software Work Together™

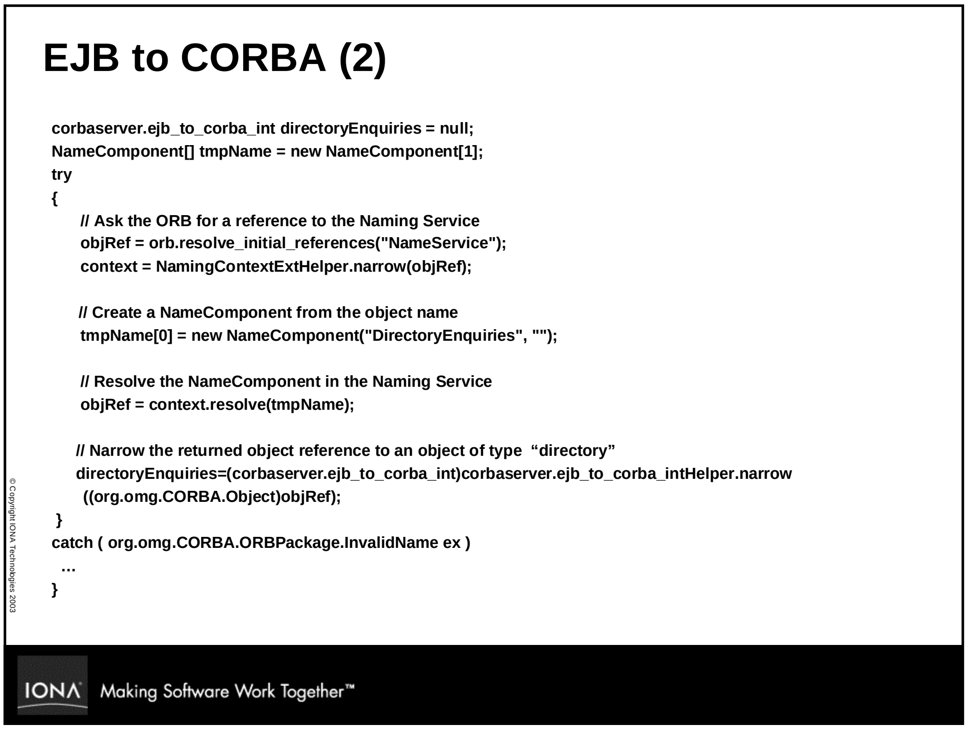


EJB to CORBA (1)

- **Within an EJB, e.g. a method in a Session Bean: start with getting the CORBA ORB (here: IIOP is native remote protocol, thus ORB call is efficient “in process”)**

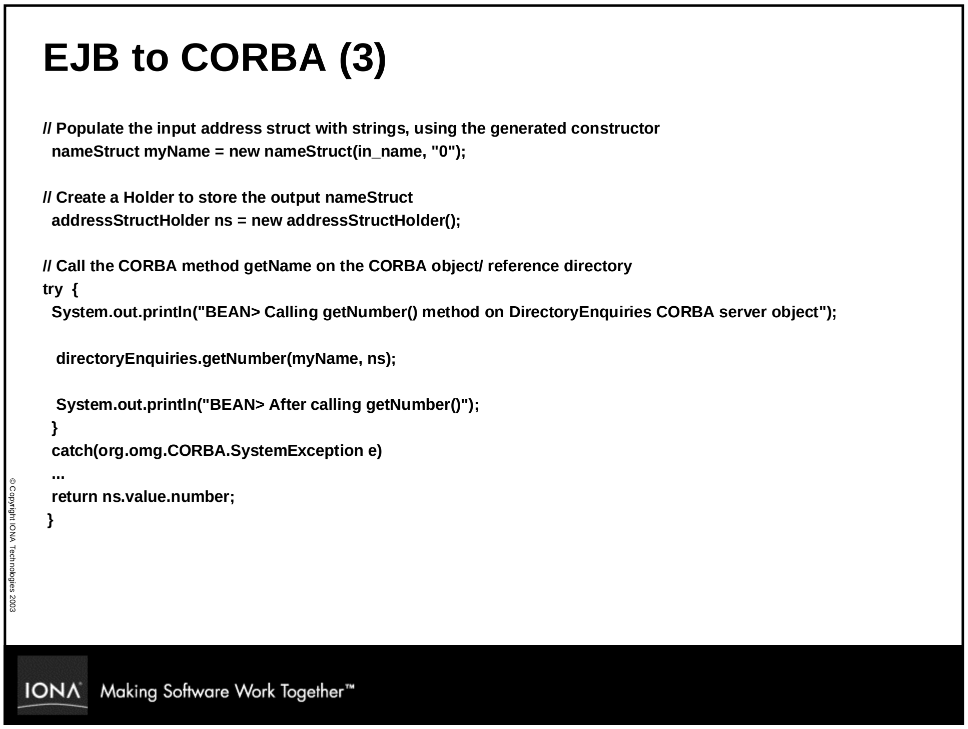
```
// Declare some CORBA variables
  org.omg.CORBA.ORB orb = null;
  org.omg.CosNaming.NamingContextExt context = null;
  javax.naming.Context jndi_context = null; org.omg.CORBA.Object objRef = null;
  Properties myProps;

// Get the CORBA ORB from “your” EJB
// The ORB named ”OrbixJ2EE" is preconfigured with certain properties such as the
// ability to propagate security and transaction context.
 Properties orbProperties = new Properties();
 orbProperties.put("org.omg.CORBA.ORBClass", "com.iona.corba.art.artimpl.ORBImpl");
 orbProperties.put("org.omg.CORBA.ORBSingletonClass", com.iona.corba.art.artimpl.ORBSingleton");
 String[] orbArgs = new String[] {"-ORBname"," OrbixJ2EE"};
 orb = org.omg.CORBA.ORB.init(orbArgs, orbProperties);
```

IONA Making Software Work Together™



EJB to CORBA (2)

```
corbaserver.ejb_to_corba_int directoryEnquiries = null;
NameComponent[] tmpName = new NameComponent[1];
try
{
      // Ask the ORB for a reference to the Naming Service
      objRef = orb.resolve_initial_references("NameService");
      context = NamingContextExtHelper.narrow(objRef);

      // Create a NameComponent from the object name
      tmpName[0] = new NameComponent("DirectoryEnquiries", "");

      // Resolve the NameComponent in the Naming Service
      objRef = context.resolve(tmpName);

     // Narrow the returned object reference to an object of type  “directory”
     directoryEnquiries=(corbaserver.ejb_to_corba_int)corbaserver.ejb_to_corba_intHelper.narrow
      ((org.omg.CORBA.Object)objRef);
 }
catch ( org.omg.CORBA.ORBPackage.InvalidName ex )
  …
}
```



EJB to CORBA (3)

```
// Populate the input address struct with strings, using the generated constructor
  nameStruct myName = new nameStruct(in_name, "0");

// Create a Holder to store the output nameStruct
  addressStructHolder ns = new addressStructHolder();

// Call the CORBA method getName on the CORBA object/ reference directory
try  {
  System.out.println("BEAN> Calling getNumber() method on DirectoryEnquiries CORBA server object");

   directoryEnquiries.getNumber(myName, ns);

   System.out.println("BEAN> After calling getNumber()");
  }
  catch(org.omg.CORBA.SystemException e)
  ...
  return ns.value.number;
 }
```

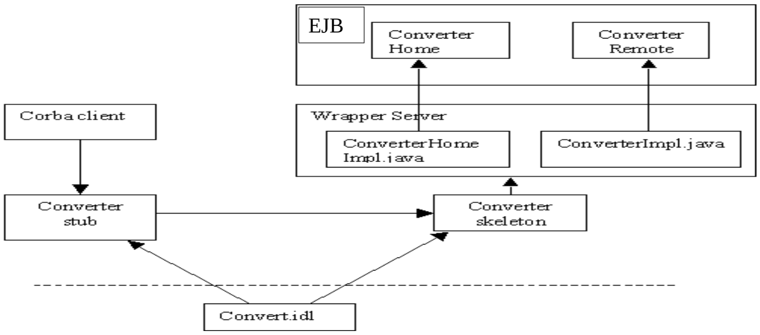
CORBA to EJB (1)

- **Pure CORBA clients can call EJB's**
- **Standard RMI/IIOP / reverse Java way:**
  - – use "JDK rmic" to generate IDL from EJB's, e.g. take an EJB "Sample"
    rmic -idl SampleHome Sample
  - – use pure CORBA client to call the generated interface to "Sample"

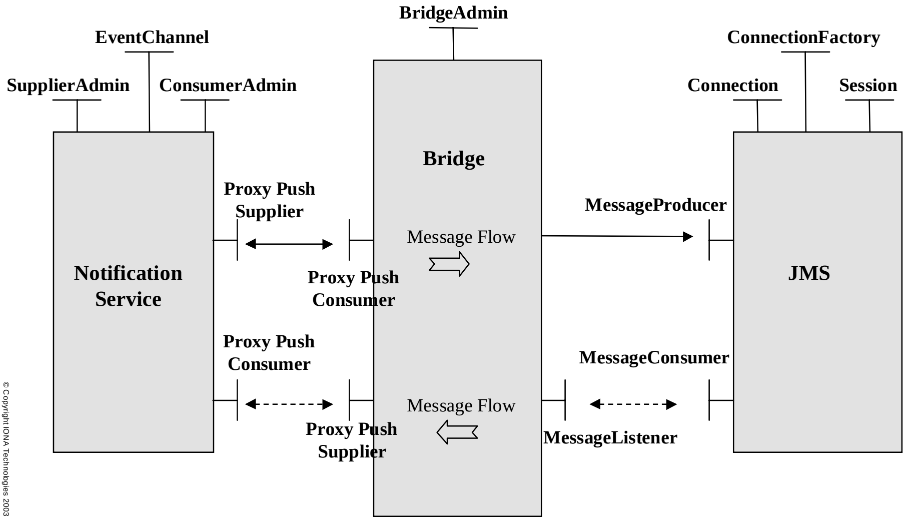
- **Problem:**
  - – standard mapping exposes "value types" an awful lot, which results in very ugly IDL

CORBA to EJB (2)

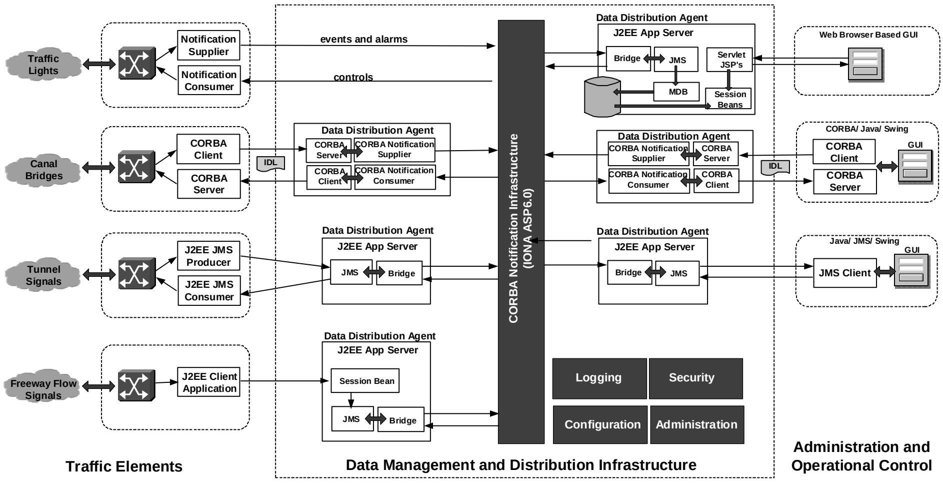
- **Proposal: CORBA friendly EJB's**
- **restrict datatypes in order to limit value types; use automatic wrapper for calls**
- **note: with both approaches Orbix E2A CORBA & J2EE allow TX/Sec-context passing**



Asynchronous CORBA & J2EE interop.: Bridging Notification and JMS



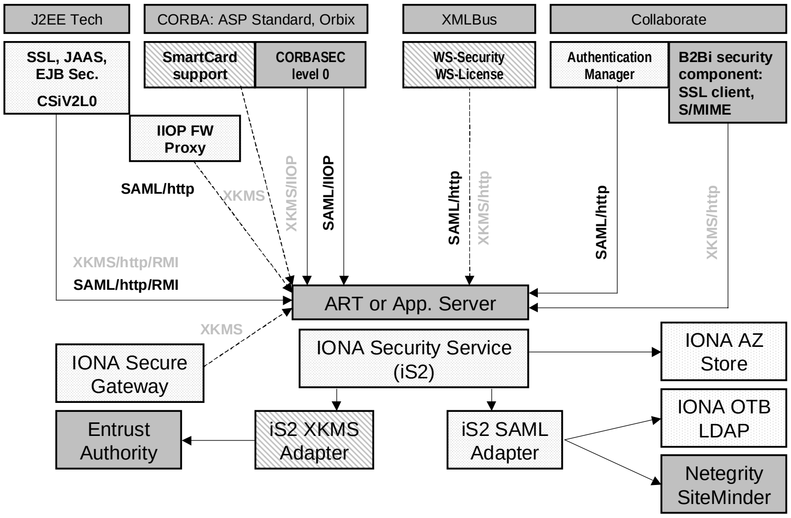
J2EE/ CORBA Interworking in Practice



EJB & CORBA: Security - cont’d

- **Encryption:**
  - J2EE: HTTPS, RMI-IIOP over TLS
  - CORBA: TLS/SSL, CSIv2
- **Credentials / Interceptors**
  - HTTPS & Pluggable Authentication “get X.509 certificate in Servlet” (alternative: direct CORBA client call)
  - J2EE “hook” to set own EJB-Principal for “Servlet --> EJB call”
  - Principal passed as “CORBA Service Context”
  - EJB --> EJB and EJB --> CORBA calls pass Service Context “under the hood”
  - final ART-Plugin: “Principle propagator”: “set CORBA User Principal” based for IONA IMS-Adapter to provide OS-390 RACF authentication

IONA Security Services



J2EE Tech

CORBA: ASP Standard, Orbix

XMLBus

Collaborate

SSL, JAAS, EJB Sec.

CSiV2L0

SmartCard support

CORBASEC level 0

WS-Security WS-License

Authentication Manager

B2Bi security component: SSL client, S/MIME

IIOP FW Proxy

SAML/http

XKMS

XKMS/IIOP

SAML/IIOP

SAML/http

XKMS/http

SAML/http

XKMS/http

XKMS/http/RMI

SAML/http/RMI

ART or App. Server

XKMS

IONA Secure Gateway

IONA Security Service (iS2)

IONA AZ Store

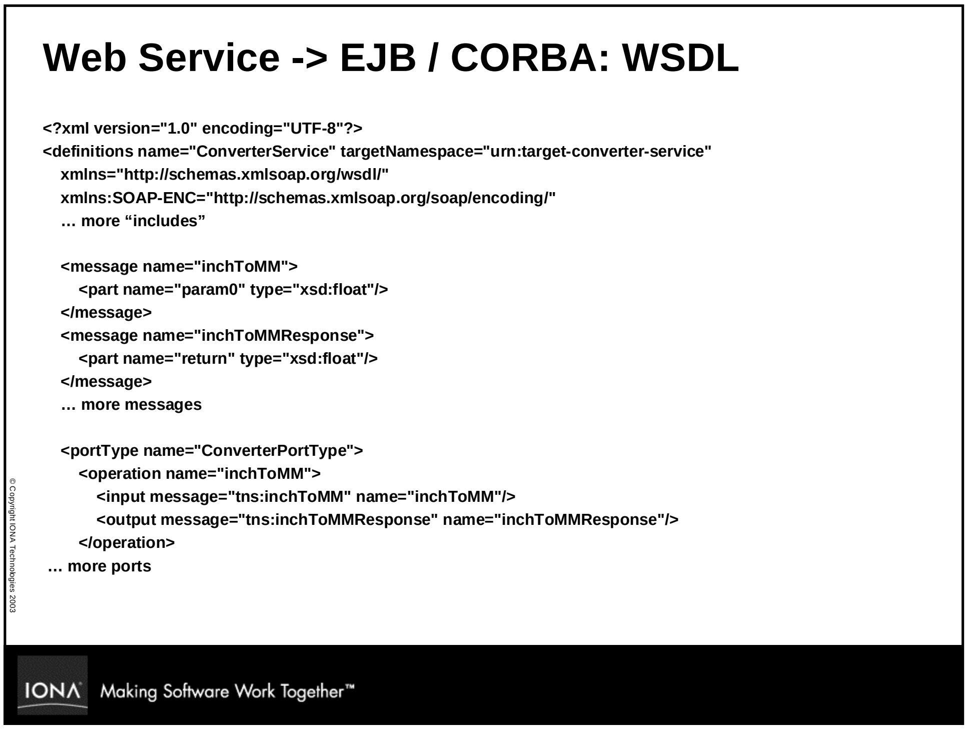
Entrust Authority

iS2 XKMS Adapter

iS2 SAML Adapter

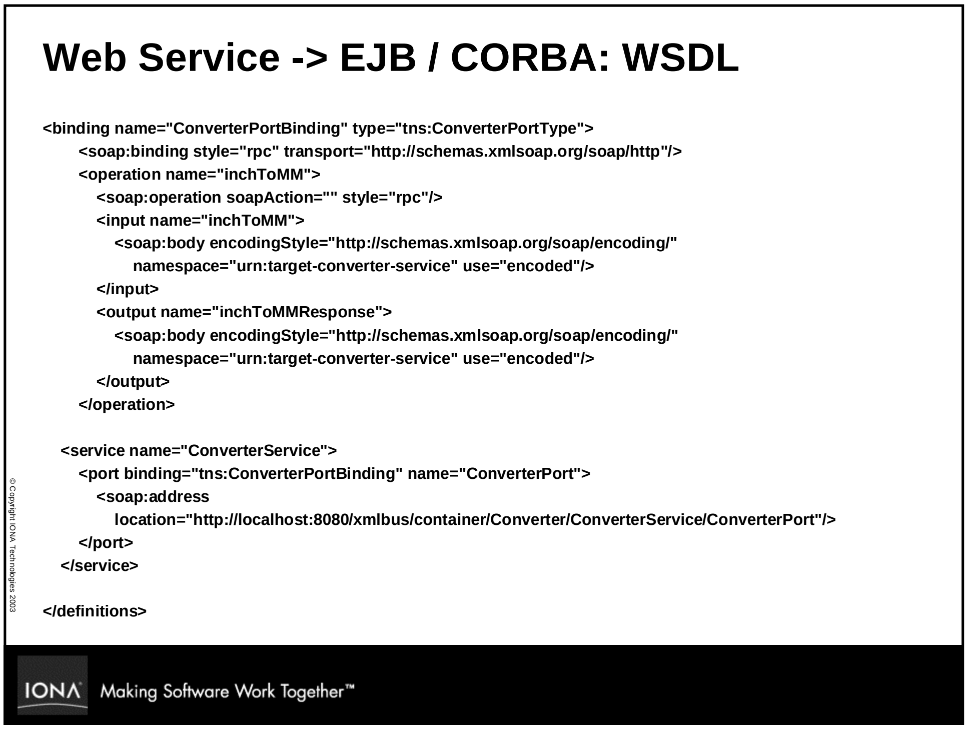
IONA OTB LDAP

Netegrity SiteMinder



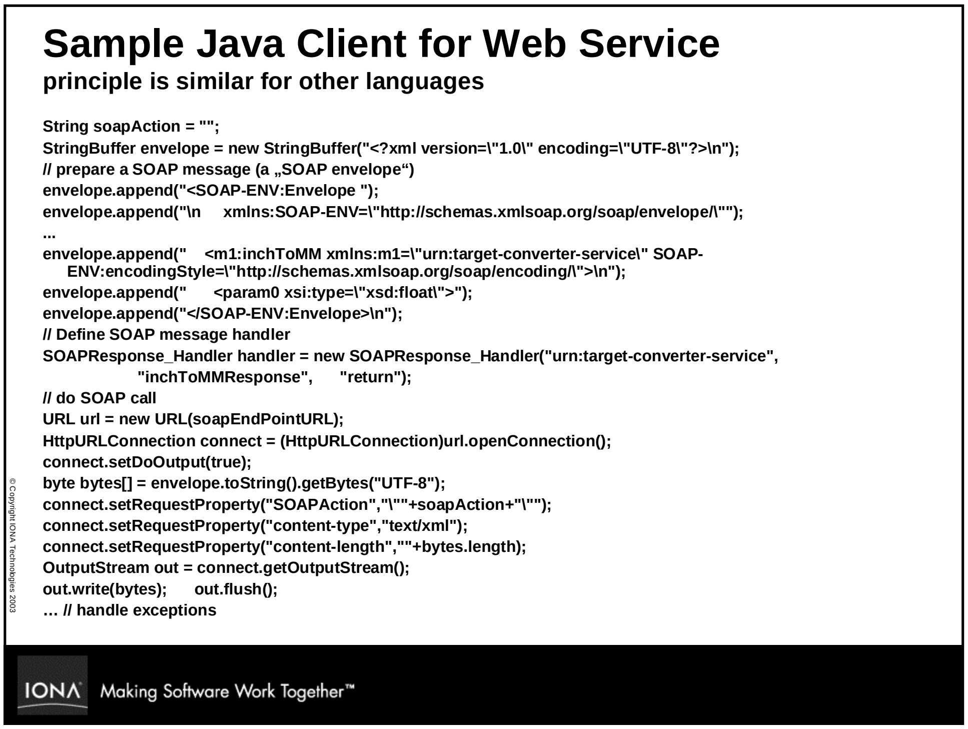
Web Service -> EJB / CORBA: WSDL

```
<?xml version="1.0" encoding="UTF-8"?>
<definitions name="ConverterService" targetNamespace="urn:target-converter-service"
   xmlns="http://schemas.xmlsoap.org/wsdl/"
   xmlns:SOAP-ENC="http://schemas.xmlsoap.org/soap/encoding/"
   … more “includes”

   <message name="inchToMM">
      <part name="param0" type="xsd:float"/>
   </message>
   <message name="inchToMMResponse">
      <part name="return" type="xsd:float"/>
   </message>
   … more messages

   <portType name="ConverterPortType">
      <operation name="inchToMM">
         <input message="tns:inchToMM" name="inchToMM"/>
         <output message="tns:inchToMMResponse" name="inchToMMResponse"/>
      </operation>
 … more ports
```



Web Service -> EJB / CORBA: WSDL

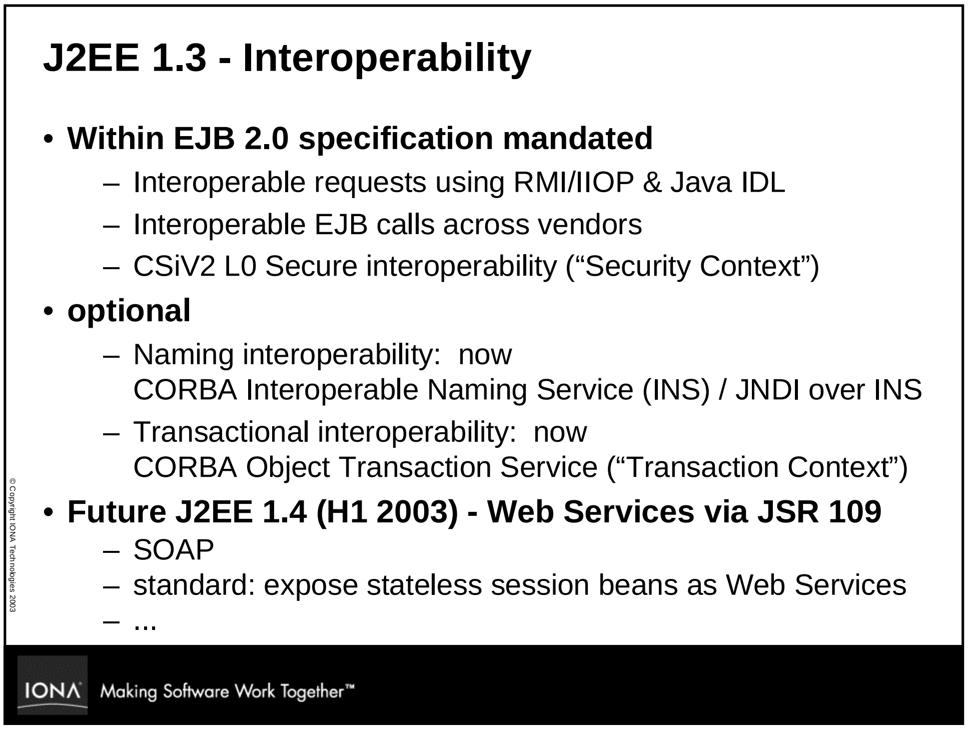
```
<binding name="ConverterPortBinding" type="tns:ConverterPortType">
      <soap:binding style="rpc" transport="http://schemas.xmlsoap.org/soap/http"/>
      <operation name="inchToMM">
         <soap:operation soapAction="" style="rpc"/>
         <input name="inchToMM">
            <soap:body encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
               namespace="urn:target-converter-service" use="encoded"/>
         </input>
         <output name="inchToMMResponse">
            <soap:body encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
               namespace="urn:target-converter-service" use="encoded"/>
         </output>
      </operation>

   <service name="ConverterService">
      <port binding="tns:ConverterPortBinding" name="ConverterPort">
         <soap:address
            location="http://localhost:8080/xmlbus/container/Converter/ConverterService/ConverterPort"/>
      </port>
   </service>

</definitions>
```



Sample Java Client for Web Service

principle is similar for other languages

```
String soapAction = "";
StringBuffer envelope = new StringBuffer("<?xml version=\"1.0\" encoding=\"UTF-8\"?>\n");
// prepare a SOAP message (a „SOAP envelope“)
envelope.append("<SOAP-ENV:Envelope ");
envelope.append("\n     xmlns:SOAP-ENV=\"http://schemas.xmlsoap.org/soap/envelope/\"");
...
envelope.append("    <m1:inchToMM xmlns:m1=\"urn:target-converter-service\" SOAP-
    ENV:encodingStyle=\"http://schemas.xmlsoap.org/soap/encoding/\">\n");
envelope.append("      <param0 xsi:type=\"xsd:float\">");
envelope.append("</SOAP-ENV:Envelope>\n");
// Define SOAP message handler
SOAPResponse_Handler handler = new SOAPResponse_Handler("urn:target-converter-service",
                  "inchToMMResponse",      "return");
// do SOAP call
URL url = new URL(soapEndPointURL);
HttpURLConnection connect = (HttpURLConnection)url.openConnection();
connect.setDoOutput(true);
byte bytes[] = envelope.toString().getBytes("UTF-8");
connect.setRequestProperty("SOAPAction","\""+soapAction+"\"");
connect.setRequestProperty("content-type","text/xml");
connect.setRequestProperty("content-length",""+bytes.length);
OutputStream out = connect.getOutputStream();
out.write(bytes);      out.flush();
… // handle exceptions
```

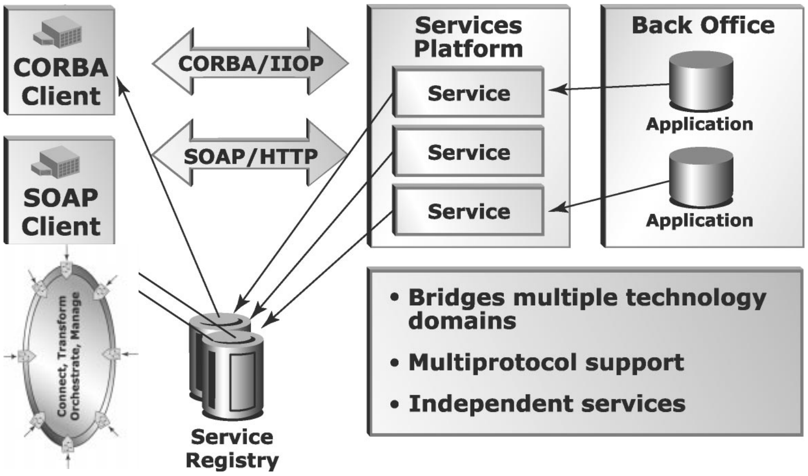


J2EE 1.3 - Interoperability

- **Within EJB 2.0 specification mandated**
  - Interoperable requests using RMI/IIOP & Java IDL
  - Interoperable EJB calls across vendors
  - CSiV2 L0 Secure interoperability (“Security Context”)
- **optional**
  - Naming interoperability: now
    CORBA Interoperable Naming Service (INS) / JNDI over INS
  - Transactional interoperability: now
    CORBA Object Transaction Service (“Transaction Context”)
- **Future J2EE 1.4 (H1 2003) - Web Services via JSR 109**
  - SOAP
  - standard: expose stateless session beans as Web Services
  - ...

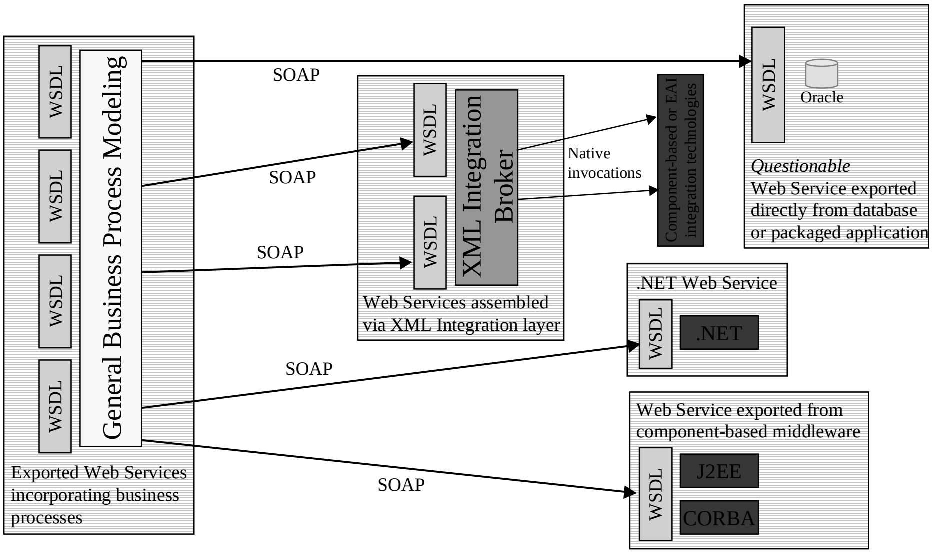
Service Oriented Architectures

Service Oriented Architecture



- Bridges multiple technology domains
- Multiprotocol support
- Independent services

… thus: (Web) Services need Multiple Granularities



WSDL

WSDL

WSDL

WSDL

General Business Process Modeling

Exported Web Services incorporating business processes

SOAP

SOAP

SOAP

SOAP

SOAP

WSDL

WSDL

XML Integration Broker

Web Services assembled via XML Integration layer

Native invocations

Component-based or EAI integration technologies

WSDL

Oracle

Questionable
Web Service exported directly from database or packaged application

.NET Web Service

WSDL

.NET

Web Service exported from component-based middleware

WSDL

J2EE

CORBA

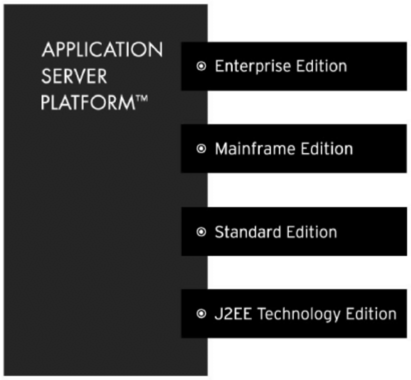
Service oriented Design

- **Rough design notes:**
  - large scale enterprise applications need service oriented architectures with true “peer to peer” views from
    EJB <-> CORBA and - with *suitable* granularity - Web Services
  - this needs clearly defined, semantically rich “rich enough” interfaces like
    EJB home/remote, IDL, WSDL
  - For example
    - within departments use EJB / CORBA, as proven scalable solutions
    - between departments / enterprises expose Web Services interfaces as well

Orbix Application Server Platform

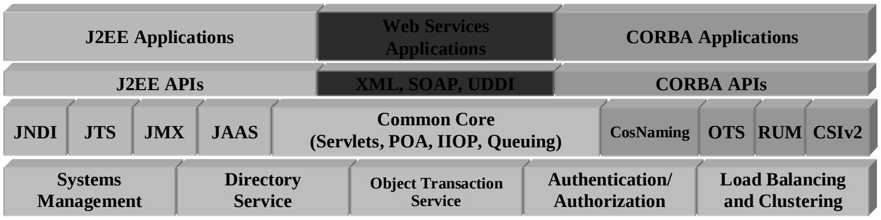
IONA’s core for interoperability of CORBA, J2EE, Web Services & “the Mainframe”

Orbix E2A Application Server Platform



- **Three integration technologies**
  - The world’s leading provider of *CORBA* solutions
  - Technically superior *J2EE* app server, ranked 4th by Gartner
  - Award-winning *Web services* products
- **One Integration Platform**
  - Best-of-breed products, wholly integrated, with common enterprise qualities of service

Adaptive Runtime Technology



J2EE Applications | Web Services Applications | CORBA Applications

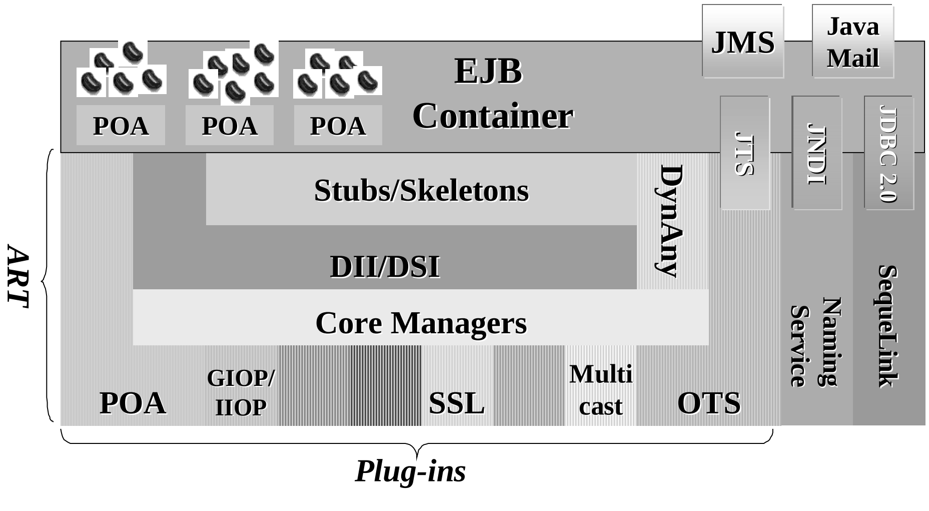
J2EE APIs | XML, SOAP, UDDI | CORBA APIs

JNDI | JTS | JMX | JAAS | Common Core (Servlets, POA, IIOP, Queuing) | CosNaming | OTS | RUM | CSIv2

Systems Management | Directory Service | Object Transaction Service | Authentication/ Authorization | Load Balancing and Clustering

- Distributed computing engine (C++ and Java versions available)
- Supports multiple “interface personalities”
- Easily tailored via plug-in architecture, letting us add new integration approaches easily
- Supplies essential enterprise app features (load balancing/fault tolerance, transactions, managed persistence, security, etc.)

J2EE Tech Edition Architecture

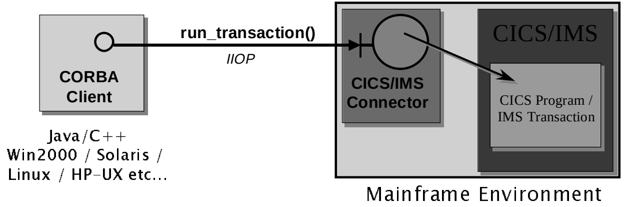


Orbix E2A - CORBA

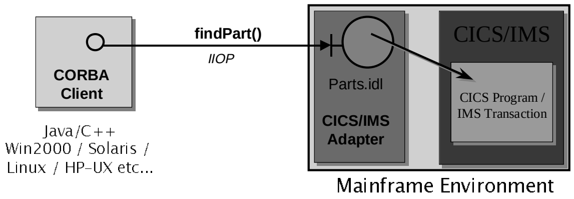
- **Diverse heterogeneous distributed computing systems are here to stay**
- **CORBA is all about integration and flexibility**
  – widely-applicable interface typing system
  – flexible remote invocation semantics
  – multiple language mappings
  – extensive platform coverage
  – suitable for wrapping old programmes and for writing new ones
  – many enterprise CORBA services

Mainframe Edt.: IMS/CICS Connectors and Adapters

- **Connector: “raw” use of existing IMS/CICS transaction**

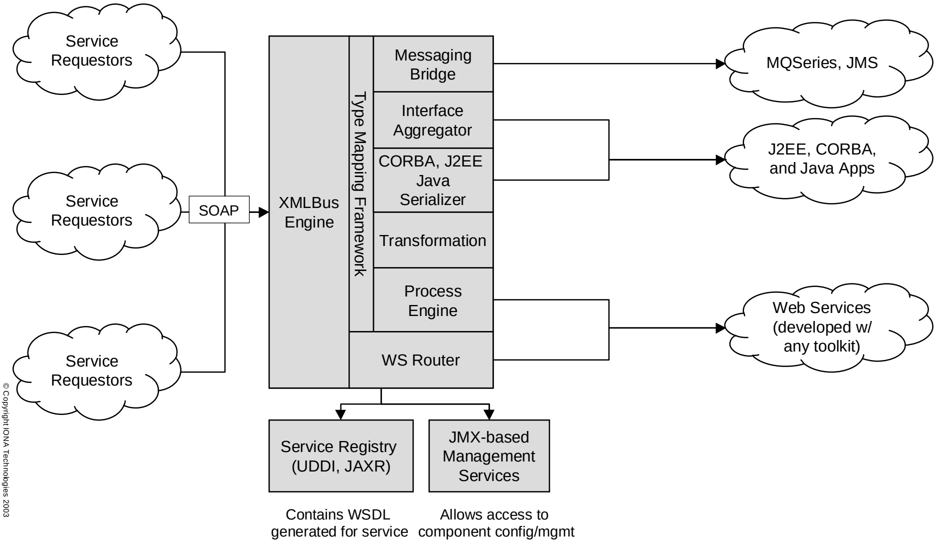


- **Adapter: full COBOL/PL-I support; peer-to-peer**



- **both: “just” CORBA client/servers (2-PC Tx, secure if needed)**

Architecture - ASP Web Services on XMLBus Technology
“Expose CORBA-Servers (incl. IMS/CICS) and EJB’s as Web Services


Service Requestors
Service Requestors
Service Requestors
SOAP
XMLBus Engine
Type Mapping Framework
Messaging Bridge
Interface Aggregator
CORBA, J2EE Java Serializer
Transformation
Process Engine
WS Router
MQSeries, JMS
J2EE, CORBA, and Java Apps
Web Services (developed w/ any toolkit)
Service Registry (UDDI, JAXR)
JMX-based Management Services
Contains WSDL generated for service
Allows access to component config/mgmt

Application examples

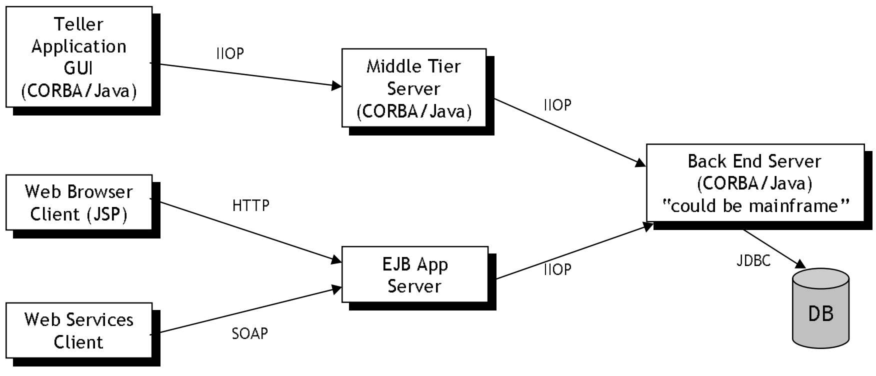
First Northern Bank (FNB) Demo

- **Demonstrates CORBA, EJB and Web Services parts of Orbix E2A ASP all working together**

- **The basis of IONA's Orbix E2A Standard & Enterprise Edition "Out Of The Box" demo (full source code)**

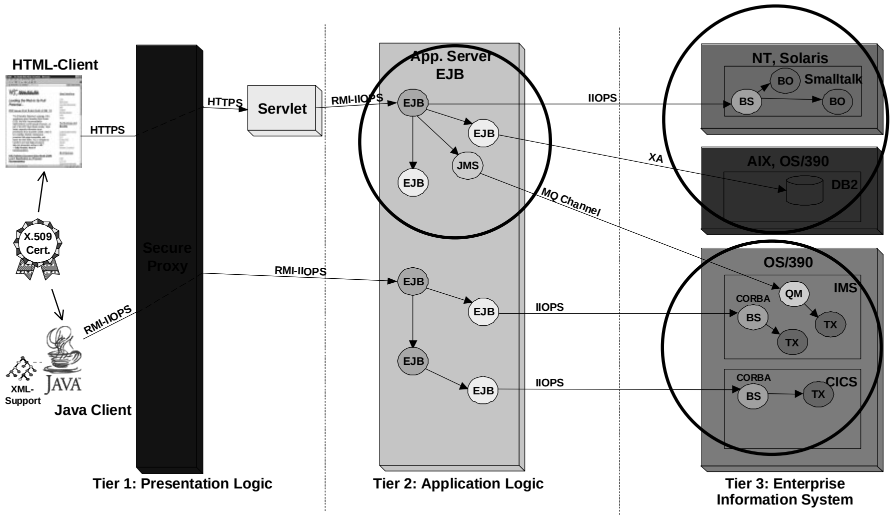
- **Have a look at**
  - www.iona.com - to get an eval. licence => FNB source
  - www.iona.com/docs -> ASP 5.1 -> Tutorials incl. FNB

Structure of the FNB Demo


Teller Application GUI (CORBA/Java)
IIOP
Middle Tier Server (CORBA/Java)
IIOP
Back End Server (CORBA/Java) "could be mainframe"
Web Browser Client (JSP)
HTTP
EJB App Server
IIOP
JDBC
DB
Web Services Client
SOAP

Winterthur e-Platform

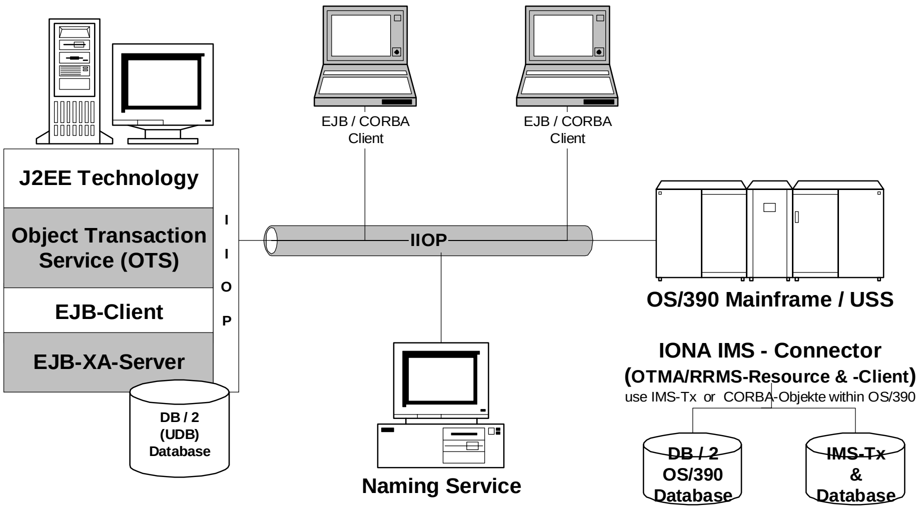
X509-based security from HTML/Java -> …. -> OS/390



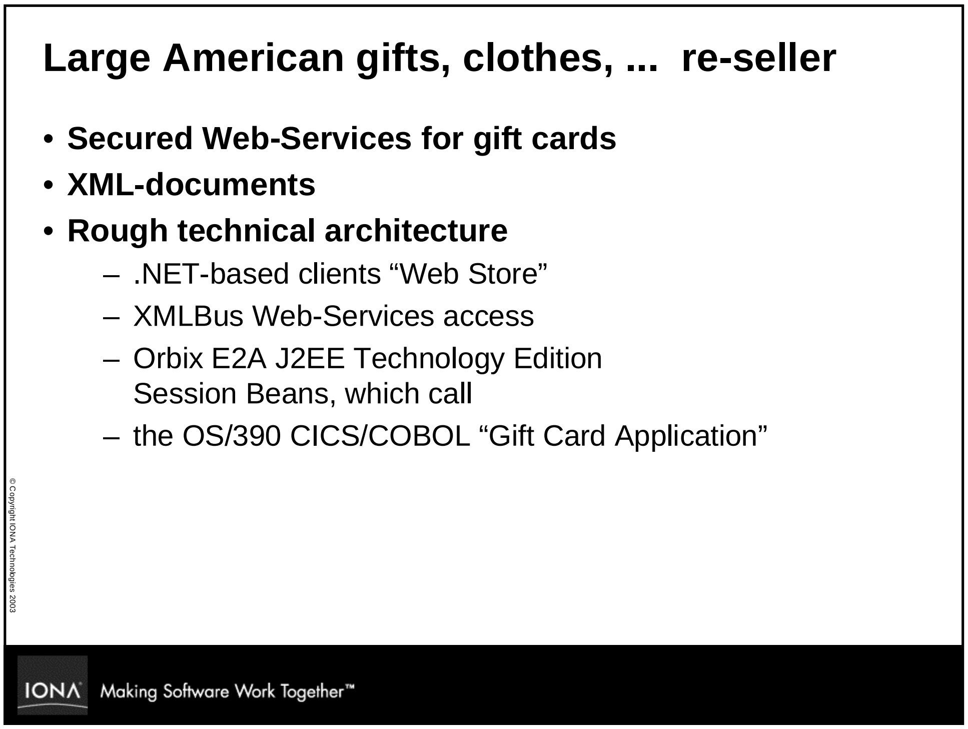
IONA Making Software Work Together™

Large German bank computing centre

architectural goal: true service oriented transactional/secure peer-to-peer view of participating systems



IONA Making Software Work Together™



Large American gifts, clothes, ... re-seller

- **Secured Web-Services for gift cards**
- **XML-documents**
- **Rough technical architecture**
  - .NET-based clients “Web Store”
  - XMLBus Web-Services access
  - Orbix E2A J2EE Technology Edition
Session Beans, which call
  - the OS/390 CICS/COBOL “Gift Card Application”

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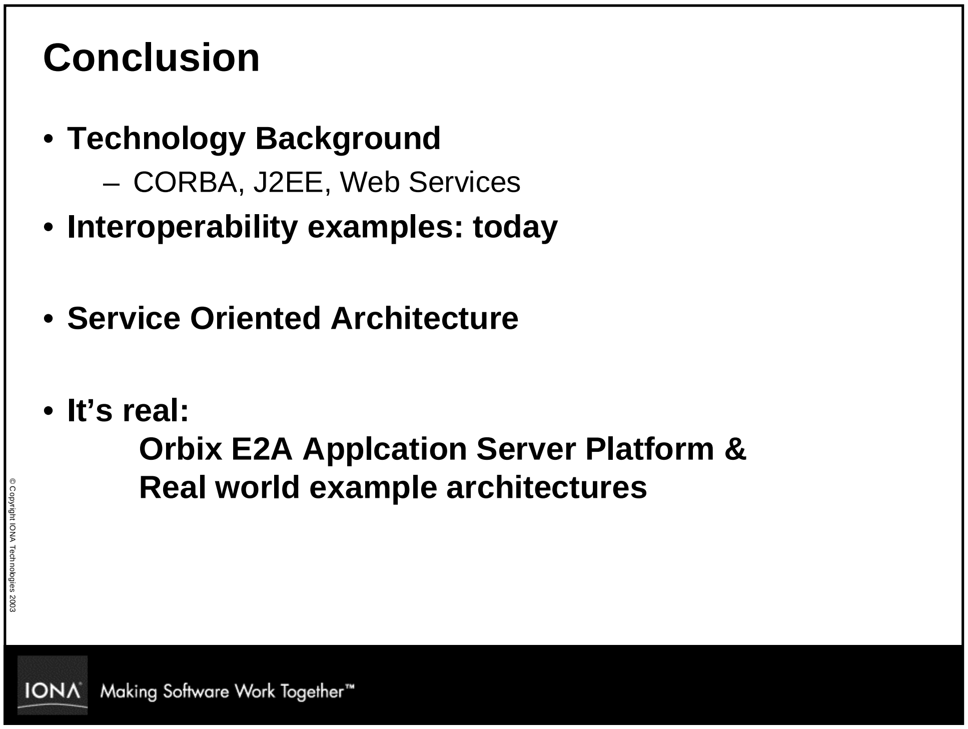

Conclusion

- **Technology Background**
  - CORBA, J2EE, Web Services
- **Interoperability examples: today**

- **Service Oriented Architecture**

- **It’s real:**
  Orbix E2A Applcation Server Platform &
  Real world example architectures

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Q & A

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