IT Anwendungsmodernisierung -
The Story of the Youth Who Went Forth to Learn What Fear Was [loosely based on Grimm Brothers]
Ein Zwischenbericht aus einem großen Modernisierungsprojekt auf Basis zWebSphere. Die Erneuerung der technologischen Basis einer zentralen geschäftlichen Kernanwendung stellt alle Beteiligten vor große Herausforderungen. Es gilt das Moderne mit dem Machbaren zu verknüpfen und dabei stets die Kosten und die Stabilität des Existierenden im Auge zu behalten. Nebenbei müssen Dienstleister und eigene Mitarbeiter auf eine Expedition in unerforschte Welten mitgenommen werden.
Hapag-Lloyd at a Glance

- One of the leading global container shipping companies
- Extensive service network with 101 services around the globe
- 154* modern container vessels with a capacity of 777,469* TEU
- Around 708,000 containers with more than 1.1 million TEU capacity
- Global presence with more than 330 sales offices in 112 countries
- Employees: 6,971

*including 1 vessel chartered out
Worldwide Service Network covering all Tradelanes

101 Services around the Globe

Europe – North America: 20 Services
- 8 North Europe – North America
- 6 Mediterranean – North America
- 6 Intra North Europe

Europe – Asia / Oceania: 11 Services
- 7 Europe – Far East
- 3 Europe – Middle East / Ind. Subcontinent
- 1 Europe – Australia / New Zealand

Intra Asia: 14 Services
- 8 Asia – Australia / New Zealand
- 4 Middle East / Indian Ocean – East Asia
- 2 Intra East Asia

Latin America: 15 Services
- 5 Europe – Latin America
- 5 North America – Latin America
- 3 Asia – Latin America
- 2 Intra Latin America

Africa / Med: 14 Services
- 4 Mediterranean – North Europe
- 1 Mediterranean – Africa
- 3 Intra Mediterranean
- 2 North Europe – Africa
- 1 Asia – Africa
- 1 North America – Africa
- 2 Latin America – Africa

Asia / Oceania – North America: 27 Services
- 16 Asia – North America WC
- 8 Asia – North America EC
- 3 Australia / New Zealand – North America

Status: June 2014
IT-Competence

IT Infrastructure

- Global IT managed centrally in Hamburg
- Development and maintenance is mainly handled in-house
- System and network operations provided by IBM and SITA/Orange
- 24 hours / 7 days service
- Service quality ensured by service level agreements with providers

Four Key IT Systems

- SAP: Used for Finance, Controlling, Treasury and Purchasing
- Freight Information System (FIS): Supports all operations & business processes
- COMPASS: The central data warehouse and the steering tool for our processes
- Information Services: For internal and external information exchange
Hapag-Lloyd’s FIS - One File-System

Export Region

Only One Shipment File

Simultaneous Access

Import Region
Integrated ocean carrier transport and logistics system

Covering the entire transport chain and interfaces with all other IT systems

Using one transport file worldwide for each transport in a central database

Real-time access to all data for every order, irrespective of the location

Highest reliability and availability

The Key to the Organisation’s Success
Freight Information System: 3.5 tier Architecture

<table>
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<tr>
<th>Defined User</th>
<th>Users per Day</th>
<th>Concurrent Users</th>
<th>Transactions per Day</th>
<th>Reports per Day</th>
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<tr>
<td>~8300</td>
<td>~5500</td>
<td>~3400</td>
<td>~7,5 Mio</td>
<td>~200,000</td>
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User Interface

Presentation
Preparation & Integration of other Services

Business Logic

Database

Application systems

Application framework

Middleware

Infrastructure/OS

Defined User | Users per Day | Concurrent Users | Transactions per Day | Reports per Day |
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Application systems

Application framework

Middleware

Infrastructure/OS

* "Win 7" on HL Standard Platform, "Any" for Agents, Customers & Suppliers
Project “FIS Java Enablement”

Application Architecture

Client

Middle Tier

Backend

Data

Source

Target

FIS DATABASE
Project “FIS Java Enablement”

Project Motivation & Business Case

- move workload from general purpose processor to special purpose processor
- gain platform independence
- prepare the core enterprise system for cloud readiness
- increase integration / interfacing capabilities
- ease utilization of 3rd party libraries
- provide modern GUI based debugger for CA GEN pseudocode
- enable true local / offline development
- “FIS to GO“ as training system
Project “FIS Java Enablement”

Ideal starting position !?!

- Well known current setup
- Well defined Scope
- No operational problems on current system
- No issue on maintainability of current system
- Proven source and target Environment
- Only one capable partner: IBM !? ??…
Project “FIS Java Enablement”

Current System Key Figures

- ~ 8300 Users in total, ~ 3400 Users in peak hours
- ~ 800 CICS transactions, ~ 25,000 distinct CICS modules
- ~ 400,000 transaction calls within peak hour, high I/O load on DB2
- 2 LPAR SYSPLEX with data-sharing across two data centers, high scalability
- CICSPLEX with two TOR regions and 8 AOR regions
- Transaction mix from sub second to several minutes
- High reliability & availability based on SYSPLEX, CICSPLEX and z/DB2
- Central Monitoring via Omegamon, ITM6 and TEC Alerts
To Be Scenario

- CICSplex \( \Rightarrow \) WebSphere cluster
- CICS transactions \( \Rightarrow \) J2EE EJB modules (~800 EJB’s)
- Number of modules will rise to \(~100,000\) classes
- Classes will be structured to OSGi business bundle archives
- Joint security realm between middle tier and backend WebSphere
- Utilization of IBM PureQuery for static database access
- Shift as much workload from GPPU to SPPU (ZIIP, ZAAP)
- The functional & non functional requirements are given by the current setup
Project “FIS Java Enablement”

Challenges during Pilot Project

- Deployment & build
- Operational stability & processes
- Standards like OSGi
- Monitoring
- Verification of business case
- Operational know how
- Security setup

- Suitability of pre-elected software stack was questioned!
Lessons Learned

- OSGi
- static vs. dynamic SQL
- Operations & Monitoring
- Deployment
- Timeout’s & other Stuff
What about OSGi?

- Hot Deployment
- Resource Consumption
- Strategic Decision
- Assets
- Monitoring
- OSGi
- Application Bundles
- Component Bundles
- Bundle Repository
- Shared vs. Isolated Bundles
- Compatibility
What about OSGi?

Why the hack use OSGi?

- Straightforward modularization concept & well defined Glossary
  - replace naming conventions by structure

- Solve problem of so called ‘JAR hell’ (utilization of multiple JAR versions at a time)

- Dynamic reloading – no outage

- Services for better modularization beneath the SOA level

- Well known and established standard
What about OSGi?

Module Manager ("Server")
CICS: Transaction
WAS: EJB Definition in OSGi
Application Bundle

PStep
CICS: one Module
WAS: three Classes

Module (Actionblock) : Interface that defines this POp
CICS: one Module
WAS: three Classes within Interface Bundle

Module (Actionblock) : Mapper
CICS: one Module
WAS: three Classes within Impl. Bundle
Maps Business Vocabulary used by the interface to implementation Vocabulary

Component:
Object Like Encapsulation of Business Functionality operating on one single part of the data model.
Represented by several POP's.
CICS: no representation
WAS: two OSGi Bundle JARs

Public Operation (POp)
CICS: some Modules
WAS: part of Component JARs

One POP may call other POP's

Non POP Module (Actionblock)
CICS: one Module
WAS: three Classes within legacy Bundle
What about OSGi?

- **.eba (1 x)**
- **EJB.JAR (1 x)**
  - only Descriptors, No Implementation
  - ca. 800 EJB's

---

**isolated component- & runtime-bundles**

- **Application.jar Bundles**
  - max. 26 (A-Z)
  - max. (n<=26*26*2)
  - i.e. per Component (n recent ~160)

- **XX.jar**
  - Component Bundle Interface (POps)

- **XX_IMPL.jar**
  - Component Bundle Implementation

- **Legacy.jar Bundle**
  - 1

- **Runtime, Resources, etc.**
  - 1

---

**isolated application-bundles**

- **.eba (1 x)**
- **EJB.JAR (1 x)**
  - only Descriptors, No Implementation
  - ca. 800 EJB’s

---

**~100.000 classes**
What about OSGi?

- **OSGi is strategic for IBM**
  - Just like the *Java® Virtual Machine* (JVM™) itself, OSGi is a *key base technology* for IBM
  - >150 IBM products are based on Eclipse™ Equinox, the IBM-sponsored implementation of the OSGi core framework
  - IBM has been a top tier sponsor of *every single* public conference that the OSGi Alliance has ever held
  - IBM took a 10,000,000 lines of code Java program (WebSphere® Application Server) and fully modularized it with OSGi (Liberty Profile)
  - The commitment behind this investment is not going to change in the foreseeable future

Source: Daniel Bandera, IBM Software Group, Strategy, Program Director, Java & OSGi Standards
Why is static SQL mandatory?

- Static SQL
- Avoid SQL Injection
- Performance
- Resource Consumption
- Monitoring
- stable Access Path
- Singleton Select
- Authorization
Why is static SQL mandatory?

Is static SQL really mandatory?

- Our generators generate dynamic SQL statements – as most current tools do
- There is an IBM Product that can ‘statify’ dynamic SQL
  - The idea behind the product is brilliant the current implementation is …
- SQL injection can also be avoided by strict use of programming pattern
- The DB2 concept of ‘plan authorization’ is unbeatable - but a restricted technical user for pooled database access can also be fine
- The performance and resource consumption issue becomes more and more obsolete
- There are monitoring tools out there

- NO this is not a OSGi problem!
Business as usual?

Operations & Monitoring

- Omegamon
- WebSphere
- ITM
- MQ
- Dynatrace
- MBeans
- DB2
- WLM
- Sysplex
- failover
- zero downtime deployment
- zero downtime deployment
Business as usual?

Is Operations & Monitoring with WASz Business as Usual?

- Automate as much as you can afford!
- Architecture Design is essential.
- Sometimes you have to think twice about a product or solution.
- No environment is identical to another – PMR’s are daily business.
- There are monitoring tools out there.
- NO this is not a OSGi problem!
Business as usual?

Nodes:
- Node kswfosa0FisProdNode01
- Node kswfosz0FisProdNode01

Appservers:
- WebSphere Cluster
  - Short Running Transactions
  - WebSphere Cluster
  - Long Running Transactions / Batch

Daemons:
- BBDMNP0
- BBMGRP0
- BBDMNP1
- BBMGRP0

Deployment Managers:
- DMGR Node
- DMGR Peer Recovery

Node Agents:
- BBNODP0
- BBNODP1

Business as usual?
It’s no trick its automation!

Build & Deployment

Source Code Management
WebSphere
Jenkins

Timeouts

DB2
compile
PureQuery
Scripting

bind
automate
MBeans
It’s no trick its automation!

Java Task on z/OS

- Generate Java Sources
- Trigger Build Server
- Download Generated Java Sources
- Copy Additional Java Sources
- Copy External Libraries
- Post Process Java Sources
- Compile

Jenkins Build Server

- Check In Java Sources To ClearCase
- Generate PureQuery XML
- Upload PureQuery XML
- Build OSGI Bundles
- Generate EJB Stubs
- Deploy EJB Stubs (WAS AIX)
- Update Asset (WAS z/OS)
- Activate New PureQuery Repository Version
- Update BLA (WAS z/OS)
It’s no trick its automation!

Automation is possible but requires resources & time

- Automate as much as you can afford!
- The challenge is to identify the right skill!
- NO this is not a OSGi problem!
Spend Time on Timeouts!

Timeouts

DB2: T2: deadlock

WebSphere

MQ

JDBC Connection

protocol dispatch

outbound IIOP

Connection Pool

transaction lifetime

WLM

transaction_maximum
### Conclusion

**Did the Business Case Work out?**

- **Project is ongoing**
- The know how transfer in both directions was tremendous
- We feel well prepared for the future

- **The selected Software Stack is state of the art and production ready!**
Thank You for Your Attention!

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