Using Java in Credit Suisse
Introduction to CS Standard Platforms

Infrastructure Architecture & Strategy,
Susanne Cech Previtali (KIVO) and Peter Schnorf (KIVB)
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Credit Suisse Group today – Key Facts (02/2013)

- **Global bank** headquartered in Zurich, serving clients in private banking, investment banking and asset management.

- **Registered shares** of Credit Suisse Group AG (CSGN) are listed in Switzerland (SIX) and as American Depositary Shares (CS) in New York (NYSE).

- Total number of **employees**: 47,400.

- The Group’s **long-term ratings** are: Moody’s A2, Standard & Poor’s A, Fitch Ratings A.
Outline

1. Credit Suisse Platforms
2. Java Application Platform
3. Our Vision: JAP in the Cloud
4. A Customer’s Perspective
Motivation Behind Platforms

Recurring themes in application development and operations

- What infrastructure software (SW) components to use (and which versions)?
- How to monitor correct behavior and find/fix incorrect behavior?
- How to communicate with other application components?
- Which hardware (HW) components and system setup to use to achieve the necessary performance, availability, stability, security, IT DR level, etc. at the right price?
- How to stay current in technology life cycle and avoid out-of-support legacy?
- Which infrastructure SW component features to use?
- How to manage changes to infrastructure SW components as well as to application components?
CS Platforms – Motivation and Definitions

*Infrastructure: Standardize, Build Once, Automate, Reuse*

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**Application Specific Logic**
GUI, Business Logic, DB Schemas, Configuration, etc.

**Infrastructure Design/Configuration**
HW, OS, Middleware, Network
System Management setup and processes
Operating manual
Development tools and processes
Security concept and processes
Integration concept and processes

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**CS Platform**
Set of integrated technical components, processes, guidelines for the development and operation of applications

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**Application Platform (AP)**
specialized for similar applications, built on hosting platforms

**Hosting Platforms**
provide generic services
- computation CHP
- persistence DHP

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standardize build once automate reuse
CS Platforms - Portfolio Management Drivers

Benefits of managing a platform lifecycle include increased stability and reduced cost

Applications

Infrastructure SW Components

Core OS

Hardware

Uncoordinated lifecycles in technical stack → Combinatorial explosion of dependencies, support, and maintenance costs

Managed stack → No dependency explosion, increased stability, capacity management, less maintenance costs, less support

Key Benefits of Platform Lifecycle Mgmt.

- Applications (and platforms) stay in technology lifecycle and mainstream (no "rotten" components)
- Technical upgrades due to lifecycle mgmt. of platform are combined with update on business functionality
- Constant decommissioning of out-dated platform releases identifies out-of-use applications
- New releases of platforms (with new features) have no impact on productive applications (no need to migrate; no stability impact due to changes)
CS Platforms Overview

- **Application Platforms (JAP, DAP, DWH)**
  - Specialized for application areas with similar needs
  - Support standardized application development and operations
  - Provide enhanced and additional services on top of generic Hosting Platforms
  - Platform costs are amortized by cost savings across large enough application portfolio using it

- **Database Hosting Platform (DHP)**
  - Offer DB service and backend system with decoupled life cycle

- **Compute Hosting Platform (CHP)**
  - Underlying infrastructure basis for directly deployed applications (typically 3rd party), Database Hosting Platforms as well Application Platforms
  - Abstraction of infrastructure services for independent lifecycles of infrastructures and applications

Reduce development risk by offering standardized, integrated, and tested infrastructure stack and related processes.
CS Platform Benefits

*Benefits of standardization and upfront investment in infrastructure stack/processes*

**Objectives**

- Design, build and test standard infrastructure stack (including middleware) once
  - “Sharing the stack”: Amortize over many applications
- Standardize interfaces between applications and infrastructure
- Design well-defined, highly automated processes using standardized ecosystems
- Strict release and whole platform lifecycle management (all components/processes at once)
- Global availability

**Benefits**

- Lower cost
  - Reduced development, maintenance, and support cost for applications and infrastructure
- Better quality
  - Increased infrastructure and application stability
- Lower risk
  - No end-of-life technologies and components in data center
  - Increased application security
  - Reduced development risk
- Enhanced capability
  - Shorter time-to-market
  - Global deployment of applications

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**Platform Contract: Adherence to Platform Release and Lifecycle Management**

- New applications and application upgrades must use the latest major platform release available
- All applications using a platform release x must migrate to the latest platform release before the end-of-life date of release x is reached

→ *Use the roadmaps to plan the releases of the applications*
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JAP Facts and Figures

- JAP is an Application Platform based on Java EE standards specialized for Web applications (both Intranet and Internet facing) and transactional systems.
- JAP is providing services to more than 300 applications of all sizes, worldwide and across all business units.
- Geographical presence
  - Platform centrally managed out of Zurich
  - 4 hubs providing consulting services as well as complete integration test, UAT and production environments.
- Lifecycle & Availability
  - 3 major releases in parallel
  - AR 7 is the most recent release
  - AR 5 release in phase out.
JAP Model

- **Services provided by JAP**
  - **Platform Product Mgmt. & Governance:** Drives product development and release & lifecycle
  - **Application Development Support:** Consultants guides projects through entire development processes, Java development support and trainings
  - **Platform Operations:** Cost-efficient standardized and/or automated processes according to a defined set of OLA’s

- **Key components to provide these services**
  - **Technical Components:** Java EE based software stack pre-integrated with security, middleware, databases etc.
  - **Hosting:** Shared hardware resources according to production guidelines
  - **Tool-chain:** Automated processes from configuration management, centralized builds, package generation to deployment
  - **Architecture, Guidelines & Documentation:** security, IT-DR, HA designed and provided for all applications, transaction processing incl. patterns, scalability via LBs and scale-out
Platform Lifecycle in Action

- Applications benefit in terms of
  - Reduction of 30% on project costs (CTB budget)
  - Reduction of 35% on operating costs (RTB budget)

- JAP Hub Zurich realized
  - Yearly cost avoidance of 48.5 mCHF
  - 1 to 7 consolidation ratio on shared servers
JAP Technical Stack (JAP AR 7)

Layer 3  Application and Other Libraries

- Application (Code and Configuration)
- Optional Components/Extensions

Layer 2  JAP Technical Infrastructure Package (TIP)

Common CS Internal and 3rd Party Libraries

<table>
<thead>
<tr>
<th>Core Services</th>
<th>Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oracle DB 11g Client</td>
<td>Web Entry API</td>
</tr>
<tr>
<td>JMS 1.1</td>
<td>OnePKI 3.0 (Single Sign On)</td>
</tr>
<tr>
<td>IBM MQ Series</td>
<td></td>
</tr>
</tbody>
</table>

JEE Runtime

<table>
<thead>
<tr>
<th>Oracle WebLogic Server (WLS) 11g</th>
<th>Oracle WebLogic Portal (WLP) 11g *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Java Runtime Environment (JRE)</td>
<td>Java Development Kit (JDK)</td>
</tr>
</tbody>
</table>

Layer 1  Infrastructure

- Red Hat Linux 5
- VMWare ESX
- X86 Hardware

Ecosystems

- Monitoring Services
  - I3 Java Agent
  - I3 URL Monitoring
  - BMC Patrol
  - SiteScope

- Build & Deployment
  - SSDS
  - JAP Ordering Tool
  - QMB Build Server

* on exceptional basis
JAP Reference Architecture

**Legend**
- Internal
- External
- Optional

**Remarks**
Communication subject to further restrictions
* Strong authentication based on CS PKI certificates

**Internal Applications**
- Strong Authentication *
- Web Pages (Intranet)

**Internet facing Applications**
- Customer Strong Authentication
- Public Anonymous
- Web Pages (Internet)

**Entry Tier**
- Entry Server

**Presentation Tier**
- Servlets

**Business Tier**
- Enterprise Beans
- CSXB synchronous, asynchronous, bulk services
- DHP Databases

**Data and Service Tier**
- DHP Databases

**Client Tier**
- JSF Pages
- Intranet

**DMZ**
- Public Data
- DMZ Public
- DMZ Public Data

**Enterprise Beans**

**CH: SeSZ/BaSz**

**RoW: Intranet**

**IntraNet**

**Internet**

**JAP Reference Architecture**

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May 15, 2013
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General Cloud Characteristics*

- self-service
- rent/return capacity
- pay as you go

- rapid provisioning
- elasticity for applications
- measured usage

Economy of Scale (larger workload, more variability)
- peak of the sum <= sum of the peaks
- aggregate demand typically smoother than individual
  build for average demand rather than peak!

- process automation
- sharing/virtualization
- standardized machines & stacks

* NIST: High Scalability, Rapid Elasticity, Sharing and Multi-Tenancy, Measured Usage, Self-Service On-Demand

by Amazon, Google, Microsoft, etc.
Cloud is *More than Virtualization!*
Impact for Application Development

<table>
<thead>
<tr>
<th>Cloud Aspect</th>
<th>Paradigm Shift for AD</th>
</tr>
</thead>
</table>
| Resource abstraction/simplification towards clients (compute, storage, network resources) | - Order capacity instead of HW  
- Choose from simple, standard options  
- Make no assumptions about placement (e.g. host names) |
| Rapid provisioning with self-service                                         | - Test early, test often, explore  
- Test individually in entire application context  
- Rapid prototyping → early business feedback |
| Reproducible provisioning, configuration & deployment (persistent specifications with infrastructure service APIs) | - fully automatable 'on demand' test cycles (provision & build entire test env, run tests, decommission test env)  
- quickly reproduce production problems in UAT  
- exploit horizontal elasticity in production and maintenance |
| Rental model (pay as you go)                                                 | - Significantly lower entry cost (start small and quick)  
- Order and pay only what you need  
- Return what you currently do not need anymore |
| Elasticity (grow and shrink capacity on demand)                              | - Horizontal scalability  
- Statelessness  
- Fast startup, graceful shutdown of components |
## PaaS – Platform as a Service
Cloud for Development and Operation of Applications

<table>
<thead>
<tr>
<th>PaaS</th>
<th>IaaS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application services based on high-level domain abstractions (reference architectures, container frameworks, progr. lang. artifacts, etc.)</td>
<td>Generic infrastructure services based on low-level HW/OS abstractions</td>
</tr>
<tr>
<td>manage entire blueprints</td>
<td>manage single, unrelated VMs</td>
</tr>
<tr>
<td>rely on IaaS for capacity mgt → provide planning input to IaaS</td>
<td>capacity mgt of large server park → support different classes of reqs</td>
</tr>
<tr>
<td>horz. elasticity per application → capacity range as hint to IaaS</td>
<td>horz. elasticity within server park → minimize free pool</td>
</tr>
<tr>
<td>HA in middleware</td>
<td>HA on HW, hypervisor or OS level</td>
</tr>
<tr>
<td>IT DR in middleware</td>
<td>IT DR in hypervisor and storage</td>
</tr>
<tr>
<td>monitoring &amp; logging for PaaS components</td>
<td>monitoring &amp; logging for IaaS components (hypervisor, OS, ...)</td>
</tr>
<tr>
<td>high-level measurements → # requests, E2E</td>
<td>low-level measurements → CPU, memory, I/O</td>
</tr>
<tr>
<td>manage PaaS CMDB items → blueprints &amp; PaaS specific components</td>
<td>manage IaaS CMDB items → VMs &amp; IaaS specific components</td>
</tr>
</tbody>
</table>

### PaaS (e.g. JAP)

- JAP components & blueprints
- example WS: JAP order
  - single JAP VM
  - fixed-size memory
  - server anti-affinities
  - DC affinities
  - no HA
  - no IT DR

### IaaS (e.g. CHP)

- CHP components & VMs
- Web services
- events

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May 15, 2013  slide 19
PoC Demo – Order/Provision JAP Blueprint

Use Case: Order Capacity in Dev/Test

- **self-service**
- order *entire blueprints* along JAP reference architecture incl. presentation, business, and data tier *interactively or programmatically*
- specify *elasticity* requirements
- *simplified* specification choices only
- *very fast* order fulfillment (seconds/minutes)
- blueprint *specifications* can be stored/reloaded
- **result**: number of virtual servers running order compliant JEE or DB stacks configured / interconnected according to reference architecture and ready for application component deployment
PoC Demo – Deploy Application to Blueprint

Use Case: Deploy Application Components in Dev/Test

- **self-service**
- specify deployable *application and configuration components* per blueprint tier
- deploy components per tier or for entire blueprint
- **very fast** deployment and activation of components (seconds/minutes)
  - *interactively or programmatically*
- **semi-automated component wiring**
  - automated remote call setup when possible
  - manual conflict resolution
  - manual specification for missing standards
- component **specifications** are **reproducible** (can be stored/reloaded); several deployable to same blueprint
- **result**: specified application components deployed to specified tier(s), wired up, and activated (ready to be used in application client requests)
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Is Java EE ready for the Cloud?
A Customer's Point of View – Some Questions

- Is VM template cloning supported?
  - burnt-in assumptions about machine-specific configurations? (e.g. hostname hardwired in scripts)

- Is elasticity supported? (in general: dynamic automated blueprint management)
  - Growing: create and add instance to blueprint
    - rapid provisioning of a new instance (incl. application components) - e.g. VM template cloning helps
    - reproducible stack and configuration with own identity
    - after provisioning: startup of container and of application should be fast
    - KPI: how long does it take until new instance is ready to accept application requests
  - Shrinking: shutdown and remove instance from blueprint
    - block any new requests (not belonging to active sessions)?
    - session migration on demand? (some state might be hard to migrate to a different instance, e.g. distributed trx state or local cache)
    - other graceful starvation/shutdown measures? (incl. standard events to application?)
    - KPI: how long does it take until an instance's capacity can be given back?
  - Connection/environment management
    - can connection pools gracefully and transparently grow and shrink? (i.e. without application involvement)
    - load balancer, monitoring, log file mgt., etc. adjustable automatically?
  - Clustering
    - dynamic ad hoc adding/removing of an instance to/from a container cluster?
    - avoid cross-site clusters (operational independence!); avoid clustering anyway as much as possible (except for HA)?
Is Java EE ready for the Cloud?
A Customer's Point of View – Some Questions (cont.)

- **Maintenance supported?**
  - in place patching
    - guaranteed backwards compatibility
    - without reboot?
  - rolling upgrade (similar to elasticity!)
    - add new upgraded instance, then shutdown an old one - or the other way around
    - again: session migration on demand or other graceful shutdown measures?

- **Resource management in shared environments?**
  - heap size adjustable?
  - CPU and I/O requirements expressible by container? -> standard way to pass that to JVM and from there to OS and to hypervisor
  - in general: standard indication to hypervisors about memory usage for code that can be potentially shared across VMs