Continuous Delivery at SAP:
From dinosaur to spaceship

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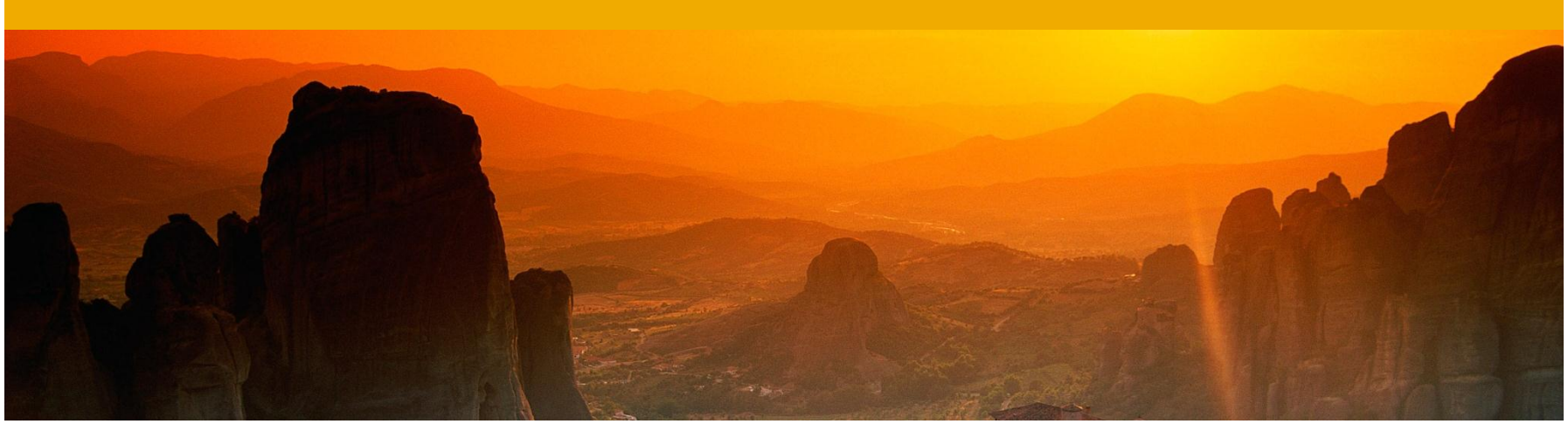
Public

FLOWCON
CONTINUOUS DESIGN DELIVERY DATA

Agenda

The 6 stages of SAP IT's journey to Continuous Delivery:

- **Dinosaur Age**
- **Stone Age**
- **Agricultural Age**
- **Industrial Age**
- **Jet Age**
- **Space Age**



The Dinosaur Age

Ageing technology, semi-waterfall processes

About SAP

World leader in enterprise applications

- Founded in 1972
- Vision: **Help the world run better**
- Innovation focus:
  Mobile, Cloud, In-memory
- Over 232,000 customers, 130+ countries
- Over 65,000 employees in 50+ countries
- Suite database schema: 30,000+ tables

SAP customers produce 70% of the world's chocolate & 72% of the world's beer

The way we were in SAP Global IT – early 2010

Ageing platform from previous projects

- Java 1.4 – over a year since End of Life in 2008
- Monolithic J2EE 1.3 application server
- Code deployed to physical hardware during downtime

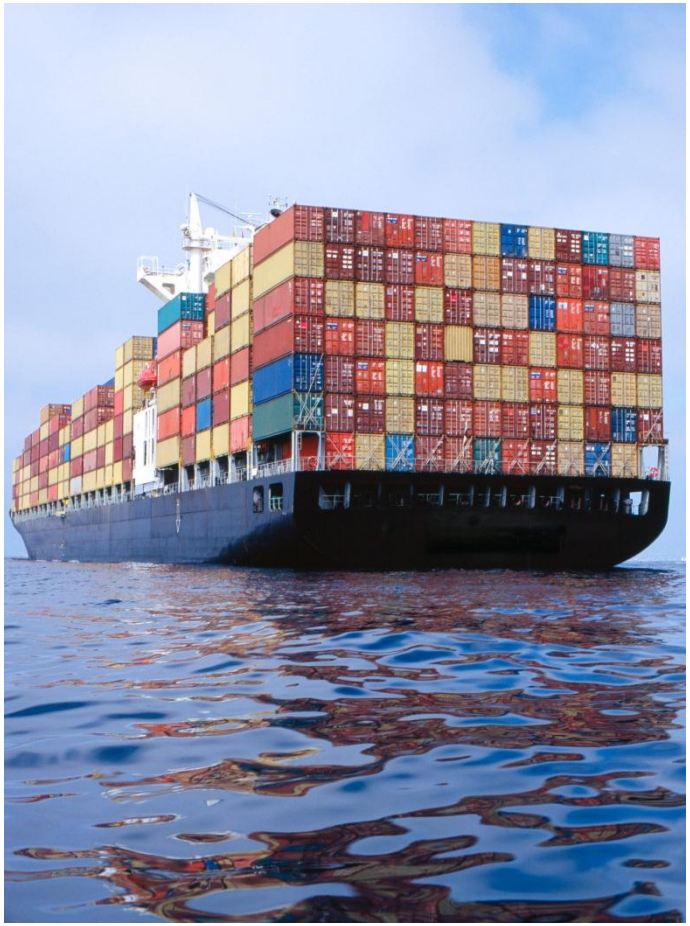
Semi-waterfall

- Good:
  - Source control
  - Issue tracking
  - Build automation
  - Monthly releases
- Not so good:
  - Months-long lead time for new hardware
  - Labour-intensive & error-prone deployment
  - Labour-intensive QA cycle
  - Development, Ops & Infrastructure in different business units

The Challenge

2010 capacity

- 20000 PD of people available



2010 demand

- 60000 PD of project effort estimated

The Stone Age

A new project, a new platform

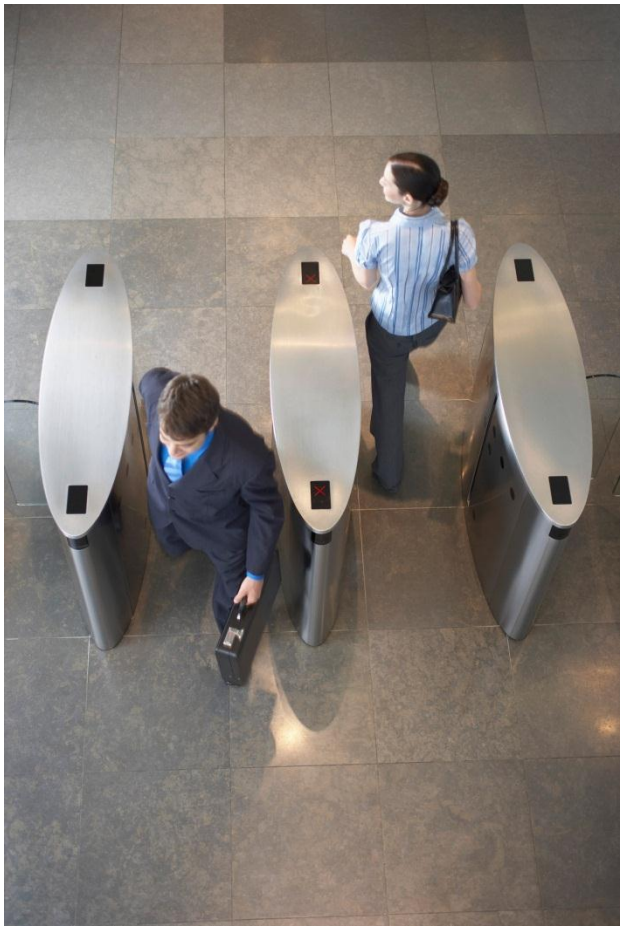
SAP ID Service project

Unified SAP web experience

- One single account for SAP web users
- Seamless sign-on to all SAP sites
- Social sign-on and integration with 3rd party apps
- Identity Provider for SAP's Cloud & Mobile customers

Scale & reliability

- Over 4 million users today
- 20+ million coming from recent acquisitions
- Target of 1 billion users by 2015



SAP ID Service Project Team

Cross-functional

- Product Owner
- Scrum Master
- UI / UX designers
- Java developers & architects
- Infrastructure engineers
- QA specialists

Geographically distributed

- Germany
- Bulgaria
- UK
- Russia
- Israel

Tools & platform for the new project

New Platform: SAP Lean Java Server

- Same foundation as SAP NetWeaver Cloud
- Runs on SAP JVM 6 (server-optimised JavaSE 1.6)
- Up-to-date version of Tomcat app server
- OSGi platform for modular development
- Quick to install & restart

Same Toolkit:

- JIRA for issue tracking
- Bamboo for continuous integration
- Perforce for version control
- Eclipse for IDE
- Ant & Ivy for build / dependency management

Agricultural age

DevOps Tools: Monsoon, Chef, Selenium, Cocktail

Vision & Cultural Change

Chief Architect (my boss)

- Promoted concepts of Continuous Delivery
  - Automate everything, especially testing
  - Version control everything
- “Hey everyone: read the Humble & Farley book”
- SAP ID Service as pilot project

Director of Web & KM unit (his boss)

- Provided trust
  - 10% of unit’s effort for continuous delivery
  - Codename: “Monsoon”
- Provided cover
  - 10% “taxed” from project budgets
  - Not an explicit line item

Monsoon Phase 1: Virtualization & Chef

Virtualization

- Dev, QA & Production – all virtualized
- Private Dev server VM per developer
  - VMs allocated by infrastructure team member
  - VM requests serviced in hours, not months

Chef

- Install Chef client on VM
- Central Chef server for all projects & landscapes
- Just run “chef-client” to install & configure apps
- Eliminates manual deployments

DevOps skills needed

- Some (all?) team members need to learn Chef & Ruby

Sample of a Chef recipe

default.rb

```
# check if OS version is supported and install required packages

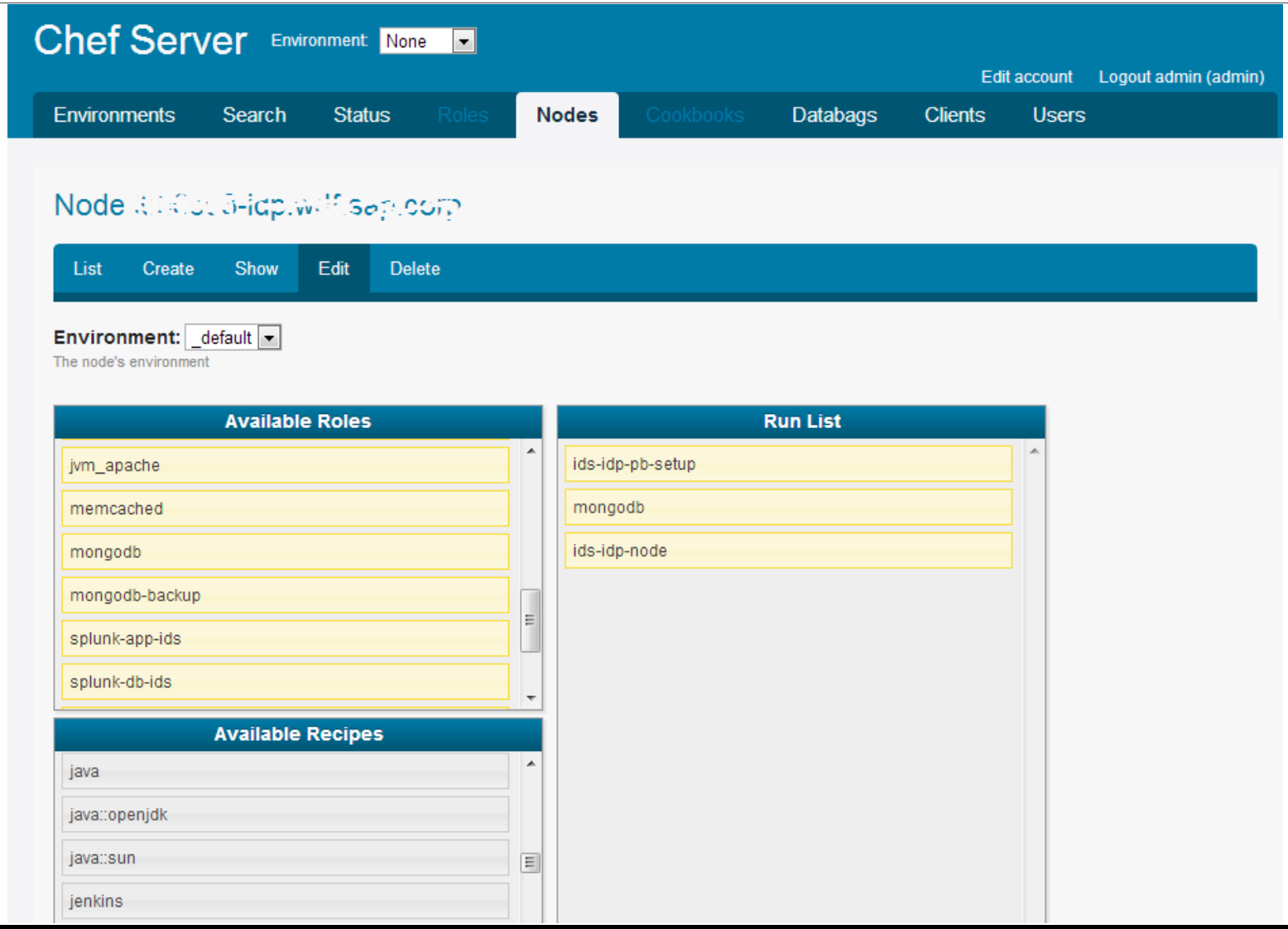
if platform?("redhat")
  case node['platform_version']
  when /^6/
    package "compat-expat1" do
      action :install
  end
  # let's set to 2.2.22 for new RedHat 6 template
  node.default[:apache_httpd][:version] = "2.2.22"
  end
  log("==> Your platform is supported by this cookbook.")
  else
  log("==> Sorry your platform is not supported by this cookbook. Take care!") { level :warn }
end

# check if path to installation tmp exist, create if not

directory "#{node[:apache_httpd][:install_tmp]}" do
  mode "0777"
  owner "root"
  group "root"
  action :create
  recursive true
end

# check if path to installation root exist, create if not
```

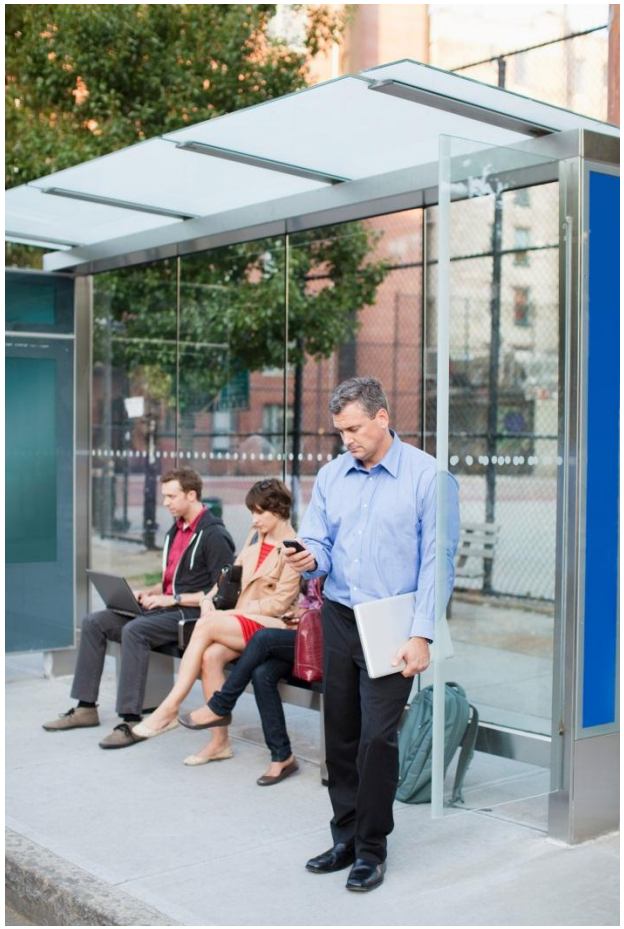
Chef server



Automated Testing: Originally, not much

When we started:

- No culture of developer-created tests
- Some automated regression tests from QA team
- Tests run once a month after QA deployment
- Developers fix bugs for previous cycle when they should be working on next



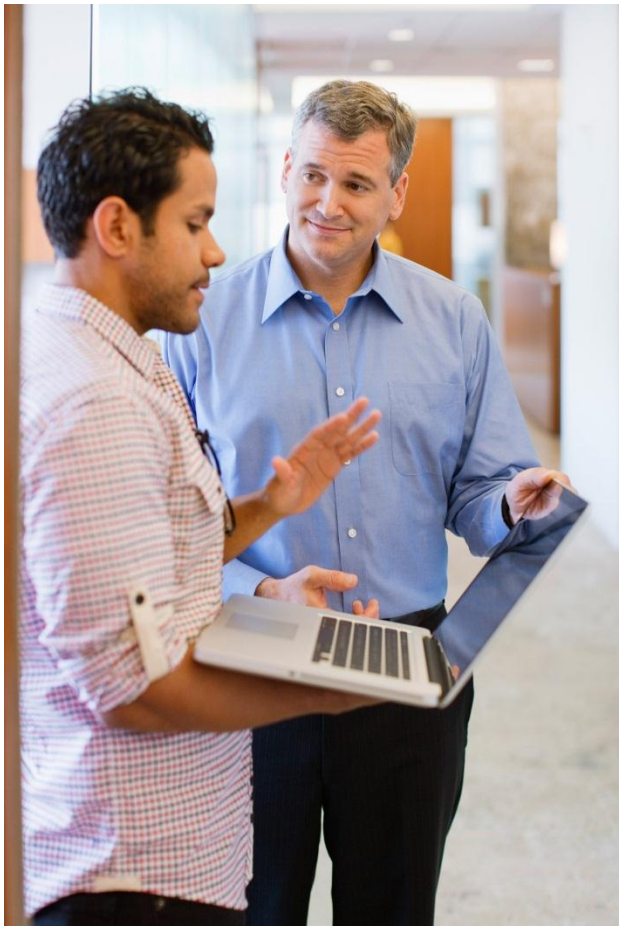
Slow progress, waiting for the release train

Developer frustration

Stakeholder frustration

Selenium: Browser-scripted Testing

- Developers & QA work together
- Record simple scripts in the browser
- Develop more complex scripts in Java
- Tests can be run from JUnit
- Run during the build by Bamboo
- Developer gets feedback in minutes



Better quality scripts by working together

No waiting for the release train

Monthly QA cycle much shorter

No nasty surprises

Cocktail: automated test & deployment

To get SAP ID Service running:

- Create virtual machines
- Register each VM with Chef server
- Execute chef-client
- Validate the installation (ping ports, etc)
- Test functionality via Selenium scripts

An internal tool called Cocktail was developed to automate all these actions.

Able to create a complex multi-server landscape with a handful of commands

Industrial age

Behaviour-driven testing with Cucumber

Cucumber: Behavior-driven Testing

- Product owner works with team
- User stories from JIRA transformed into Gherkin:

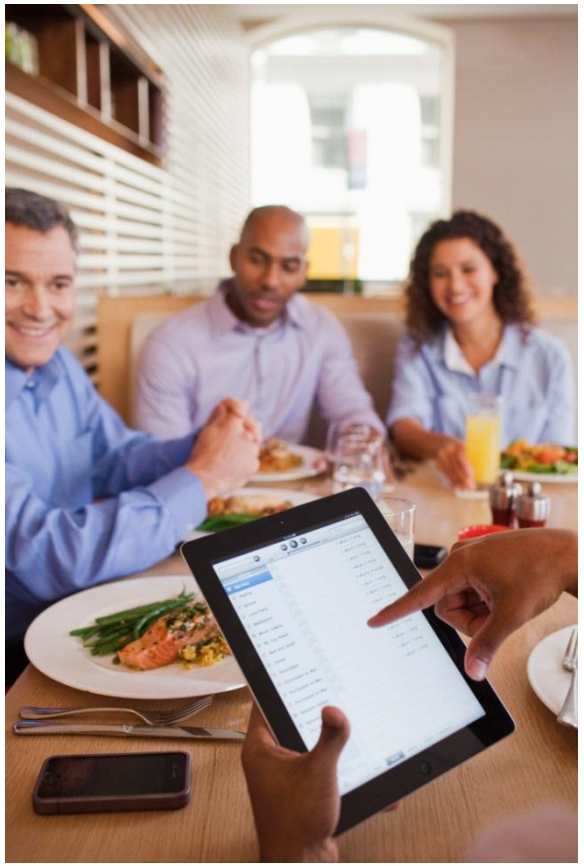
```
@UserStory("MOCPS-1522")
Scenario: Log on success for SAP Store user

  Given I am using a SAP Store active test user

  When I try to access protected content of the SAP Store
  Then I should see the "SAP Store" login overlay

  When I login using my valid credentials
  Then I am logged in
  And the main SAP Store page is displayed
```

- Gherkin steps pattern-match to Java methods
- Feature files mapped to JUnit stub classes
- **"Definition of done" includes Cucumber creation**
- Product owner gets fast feedback



Gherkin lines pattern-match to Java methods

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```

```
@When("^I login using my valid credentials$")

public void loginUsingValidCredentials() {

    String loginName = getTestUserProfile().get(USER_PROFILE_ID);

    String password = getTestUserProfile().get(USER_PROFILE_PASSWORD);

    ((LoginPage) getWebPage()).login(loginName, password);
}
```

Annotations drive reporting


```
@UserStory("MOCPS-2062")
Scenario: Proxying to external identity provider
    Given IdP Z uses name-id format unspecified
    When IDS receives an authentication request f
    Then IDS should issue a valid authentication
    When IDS receives a valid response with asser
    Then IDS should open a new session for caller
    And user in session should be the one receive
    And IDS should issue a valid response with as
```

Status	User Story	Automated Test Qualifier	Automated Test Name	Execution Time	Type	Log	Timestamp
	MOCPS-2062	Name-id format support when proxying to external identity providers	Proxying to external identity provider with no scoping element	0.725282	CUCUMBER	N/A	Fri Nov 01 15:30:02 UTC 2013
	MOCPS-2062	Proxying scenario to external identity provider MS ADFS	Proxying to MS ADFS	0.575359	CUCUMBER	N/A	Fri Nov 01 15:30:02 UTC 2013
	MOCPS-2062	Name-id format support when proxying to external identity providers	Proxying to external identity provider with specific SAML2 acs endpoint in the request	1.040432	CUCUMBER	N/A	Fri Nov 01 15:30:02 UTC 2013

Jet age

Evolving Continuous Delivery with Barkeeper and Bamboo

Monsoon Phase 2: Barkeeper

MONSOON
CONTINUOUS DELIVERY

- **Allocates VMs via Cloud API**
- **Manages Chef servers**
  - One Chef server per project landscape
  - Central library of cookbooks
- **Project self-service**
  - Create an entire project (Dev, QA, Prod servers) in one config file
  - Developers create own servers on demand
- **Web UI and REST API**
- **Everything under version control**

Project landscape definition

MONSOON
CONTINUOUS DELIVERY

```
description: SAP ID Service

chefrepo: git@github.wdf.sap.corp:ids/chef-repo.git

cloudprovider: sap-id-service

template: RedHat.5.WDF.internal.general.V2.1

network: BSS General Monsoon

bootstrap:
  - recipe[monsoon]

runlist:
  - recipe[monsoon]

landscapes:

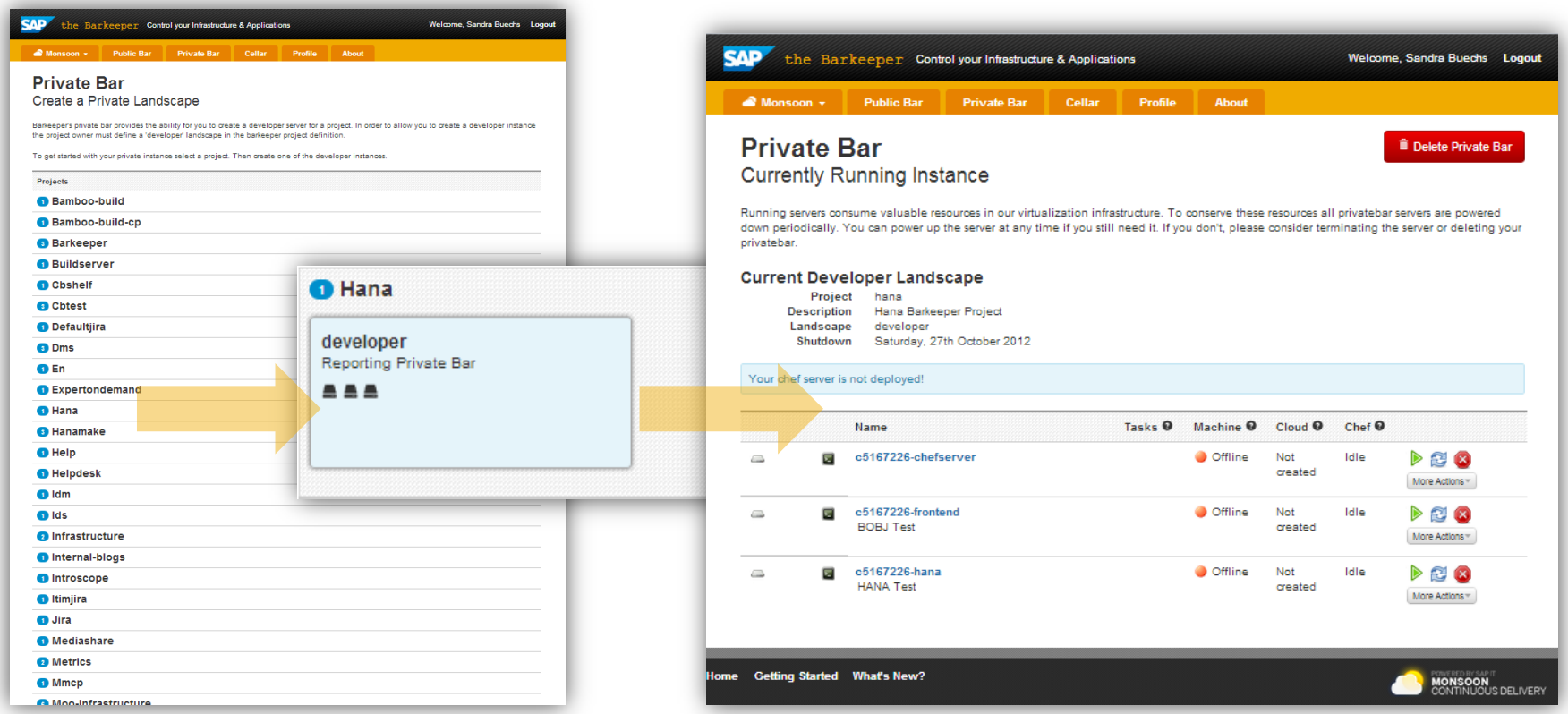
  - name: test
    description: SAP ID Service Test Landscape
    chef_sync_control: PIPELINE
    chefserver:
      runlist:
        - recipe[monsoon]
        - recipe[f5::manager]
        - recipe[hyperic::setup_monitoring]
    servers:
      - name: idp
        description: Identity Provider
        tags: appserver
        runlist:
```

DevOps core concept: Infrastructure as code

```
- name: prod
  description: SAP ID Service Production Landscape
  chef_sync_control: PIPELINE
  template: RedHat.5.WDF.allnet.V2.1
  network: BSS SCN IDMZ Monsoon
  bootstrap:
    - recipe[monsoon]
  chefserver:
    tags: f5manager
    runlist:
      - recipe[monsoon]
      - recipe[f5::manager]
      - recipe[hyperic::setup_monitoring]
  servers:
```

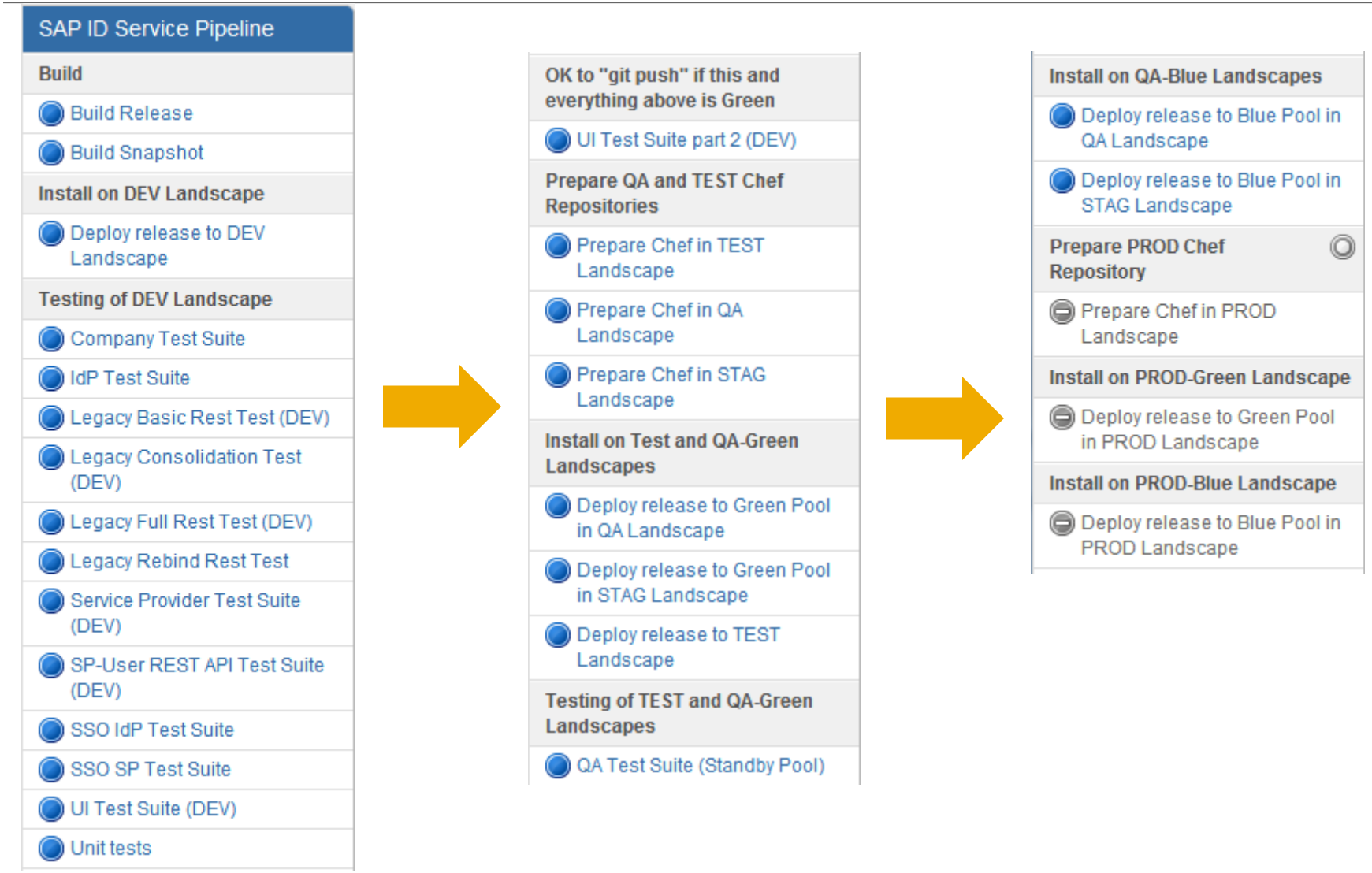
Private Bar

Speedy self-service for developers



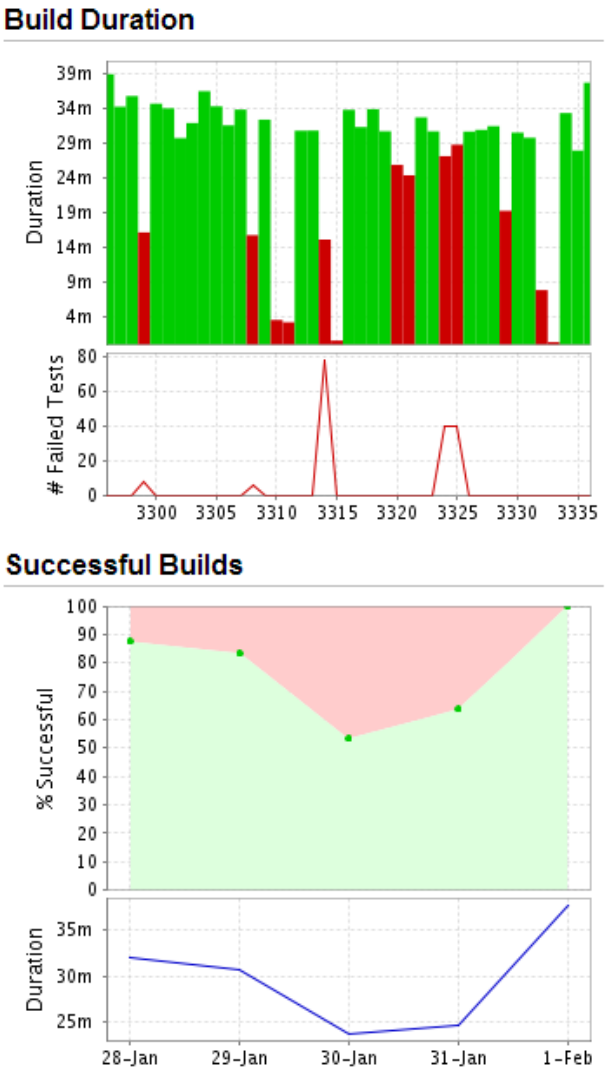
With Monsoon Barkeeper's **Private Bar** functionality a developer can quickly spawn a private development or try-out server.

Build pipeline for Continuous Delivery



Cycle time is critical

- **Minimise the time from commit to green build**
- **Continuously monitor & improve build performance**
  - < 10 minutes for developer build, deploy & test
  - < 30 minutes for central build & deploy to QA
- **Parallelisation is key, especially for tests**
  - We have over 700 scenarios and 9000 steps
  - Aim to keep each suite to < 3 minutes
  - If a suite exceeds this, split it
  - Multicore developer machine helps
    - 4 cores => 8 parallel threads for the test suite



Recap: Impact of Continuous Delivery

- **Before**: Production releases ~monthly
- **Now**: Production release ~twice a week

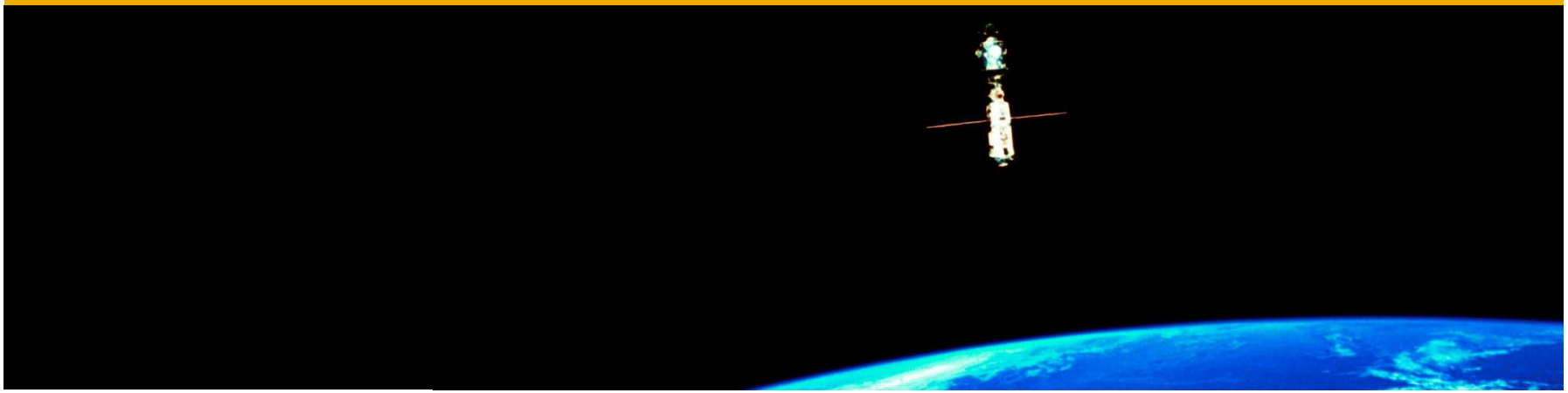
- **Before**: Pre-release QA cycle 1-2 weeks
- **Now**: QA cycle < 1 day

- **Before**: Error in Prod? Lots of stress, late night
- **Now**: Switch to Blue in <1 minute, fix next day

- **Before**: Project idea to go-live in 6-12 months
- **Now**: New project can be in Production in 1 week

- **Before**: Business stakeholders frustrated
- **Now**: Business stakeholders happy

Technology supports all this, but the team still has to deliver working code.



Space age

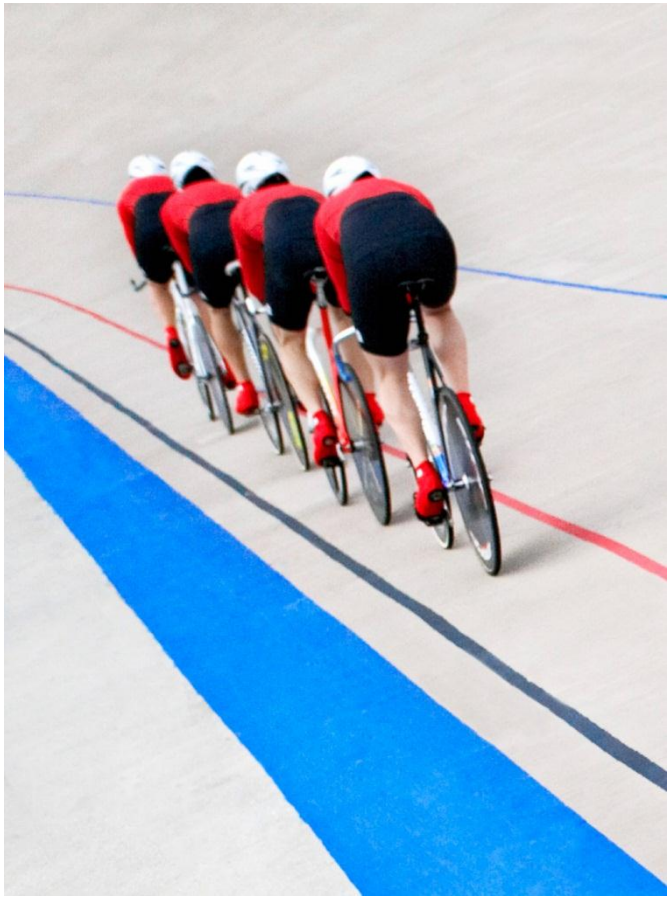
Transforming the team, To Boldly Go…

Attempting to Transform the Team

- **2010-11: Waterfall with monthly iterations**
  - Developers each with own competence & codebase
  - Everyone commits code “when it’s ready”
    - Typically on the deadline day before QA begins
  - Very little communication
    - Communication when integration problems occur
    - Lots of blaming
- **2011 – early 2012: Team adopts Scrum(-ish)**
  - Everyone thinks they know Scrum
  - Scrum = daily call, not much else
  - Slightly better communication
  - Daily calls often taken over by single “big issues”
  - Otherwise, not much difference

Really Transforming the Team

- **May 2012 – Scrum Training**
  - Investment in an external Scrum trainer/Agile coach
  - Entire team together for 1 week in Berlin
    - Except 1 team member in London
  - Deep learning about Lean principles
    - Lots of games, colours & Post-its®
    - Focus on continuous team self-improvement
- **Results**
  - Pair programming, shared ownership
  - DevOps & Cucumber help remove silo thinking
  - Product Owner orders backlog & shields team
  - Scrum Master runs Daily Scrum, Sprint Planning, Sprint Review & Sprint Retrospective
  - **Radical difference in team productivity**



Culture of Continuous Improvement

- **Team is always working to improve itself**
- **Retrospective at the end of each sprint**
- Several improvement suggestions each time
- Vote on top 3-5 to implement in next sprint
- Focus on team behaviours, not product scope
- **Evaluating new tools & techniques:**
- Gerrit for code review
  - Initially for regulatory “4 eyes” control
  - Extremely useful for distributed pairing
  - If pair programming, almost zero review overhead
- Pomodoro technique
  - Break work into 25-minute chunks
  - Lots of mini deadlines improve productivity
  - Alleviates intensity of pair programming

Latest improvement experiment – “ProdOps”

- **Problem: to deploy to Production, Product Owner has to email Ops:**

```
Hi Ops guy,

Could you deploy build #5345 to Production please?

Thanks,
Product Owner
```

- **This is just another manual step that we can automate, creating a bit of fun as we do so…**

Deploy Button

Thank you

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