Application Deployment

Software Engineering II
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Enterprise Platform and Integration Concepts

Datacenter Work by Leonardo Rizzi (CC BY-SA 2.0)
Agenda

1. **DevOps**
2. Application Hosting Options
3. Automating Environment Setup
4. Deployment Scripting
5. Application Monitoring
6. Continuous Deployment and Scrum
Development vs. Operations

Development

- Dev A
  - Development Working Copy
  - Repository
    - All Code
- Dev B
  - Development Working Copy

Operations

- Users
  - Production
    - Current Release
- Code
- Build
- Development Data
- Test Data
- Production Data
Problems

- Software needs to be operated
  - Developers vs. Admins
- Short deployment cycles
- Maintain quality standards

DevOps

- Formalized process for deployment
- Focus on communication, collaboration, and integration between Dev and Ops
Not DevOps

Dev A
Repository
All Code

Development
Working Copy

Dev B

Development
Working Copy

Operations

Users
Production
Current Release

Development

Code
Build

Development Data
Test Data
Production Data
Terminology

Release
- **Planned state** of the application
- Set of requirements
- Examples
  - Next big version with new shiny features
  - Urgent hotfix
  - Anything in-between

Version
- Could be anything
- A release has a **version number**
Terminology

Build
- Attempt to implement a release
  - Snapshot of application
- Often the output of the build tool
  - Not: the build script/tool/process
- Version number is
  “<Release Number>.<Build Number>”
Environment
- A system on which the application can be deployed and used

To promote
- To deploy a build on the next environment

To release
- To promote a build to production
- Thereby finishing the release
Overview of Environments

Development
managed by developers

Development
■ Where the developers work
■ One per developer (if possible)

Integration
■ Runs all tests
■ A try-out version

Quality Assurance
■ Professional manual testing

Operations
managed by admins

Staging
■ Clone of production system
■ Final rehearsal

Production
■ The live system
■ Failures are expensive here
Example

Release 3.7

Build 5
Integration

Build 5
Quality Assurance

Staging

Production

Build 1

Build 4

Build 2

Build 3
Example

- Build 8
- Developers changing Code

Release 3.7
- Build 7 Integration
- Build 5 Quality Assurance
- Build 5 Staging
- Production

Build 1
Build 2
Build 3
Build 4
Build 5
Build 6
Workflow

1. Define Release
2. Change Code
3. Assemble Build
4. Promote & Test
   - Accept
   - Reject
5. Release
Implications

Builds are immutable
- If changed, previous testing was pointless
  ➔ Even the smallest change has to go through all environments

Many systems required
- Each environment has to be maintained
- Automation?

Deployment overhead
- Manual steps are potential for human failure
- Automation?

Remainder of this lecture
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Choice of hosting options is driven by a variety of parameters

- Initial setup effort, cost, and required expertise
- Operational costs and effort
- Targeted service level agreements (SLAs)
- Legal considerations (data privacy, liability, etc.)
Platform as a Service (Paas)

Providers deliver OS, execution environment, database, web server, monitoring, etc.

Advantages
- Minimal effort and knowledge required for setup
- Only platform development knowledge (e.g. Python, Ruby) needed, no need for hardware / OS maintenance
- Possibility to scale up quickly and easily

Disadvantages
- Usually fixed environment with little variation points
- Provider SLA targets might differ from yours, e.g. downtime, response times
- Limited technical support

Examples: Heroku, Azure Compute, Google App Engine
Infrastructure as a Service (IaaS)

Providers deliver virtual private servers (VPS) with requested configuration. Setup of execution environment, database servers, etc. is up to customers.

Advantages
- Flexibility regarding execution environment
- Avoid management of underlying hardware
- Dynamic on-demand scaling of resources

Disadvantages
- Server administration know-how and efforts required
- It’s still a VM: Potential performance drops, Disk I/O, etc.

Examples: Amazon EC2, Google Compute Engine, Rackspace Cloud, DigitalOcean
Dedicated Hosting

Providers allocate *dedicated* hardware, classical approach

**Advantages**
- Complete control over server, down to bare metal, full power always available
- No virtualization-related performance issues
- More control over network configuration
- Dedicated SLAs

**Disadvantages (compared to Iaas)**
- No easy scaling of resources
- Administration efforts for servers, e.g. monitor disk failures

**Examples:** Hetzner, OVH, Rackspace, Host Europe
Own datacenter

You host your own servers

**Advantages**
- Complete control over data, security, operations, network etc.
- Custom designed servers possible
- Add cabinets in available space with low cost

**Disadvantages**
- Huge upfront costs, e.g. space, cooling, fiber, hardware
- Expanding the space of the datacenter is expensive
- Provide around the clock support, monitoring, personnel, etc.
- Not feasible for small companies

**Examples:** Google, Facebook
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1. DevOps
2. Application Hosting Options
3. Automating Environment Setup
   - Virtualization
   - Provisioning
4. Deployment Scripting
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Setting up an Environment

Main challenges in preparing infrastructure:
■ Minimize the effort required to repeatedly setup identical execution environments
■ Without relying on “administration gurus”

Solutions:
■ *DevOps*, i.e. a strong collaboration between the development and the operations team
■ A strong bias towards automation
Where to Start With "Deploying"?

- Hosted solutions aren't always feasible for initial experiments
- Maintaining local installs of server stacks in different versions can get cumbersome
- Development vs. production environment differences result in "it works on my machine" problems
- Don't want to force all developers to use same development environment (e.g. choice of OS)

Possible solution: VirtualBox + Vagrant (https://www.vagrantup.com/)
- "Deploy" to a virtual machine on your local OS for development

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Virtualization software provides a VM. Provisioning tools configure it, e.g. install required software.

Why not provision manually?

- Error prone, repetitive tasks
- Documentation has to be kept up-to-date
- Explicit knowledge transfer required if Admin changes

One provisioning tool example: Chef (http://chef.io, https://github.com/chef/chef)

- Formalize software install and configuration state into recipes
- Recipes are shared (https://supermarket.chef.io/cookbooks)
- Ensure software is installed based on dependencies
- Ensure that files, packages, and services are in the prescribed state

Common alternative: Puppet (https://puppetlabs.com/)
Provisioning Summary

Create your VM, e.g. describe it with Vagrant.

**Using provisioning tools, you can:**

- Define the required packages for all required servers
- Install and configure necessary services
- Create the directory structure for your application
- Create custom configuration files (e.g., database.yml)

**Not touched here but also possible:**

- Use templates to create different files based on variables
- Environments (staging vs. production)
- Central management of configuration files that are automatically transferred to clients
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Environment is set – How to deploy?

**Necessary steps after the server is configured:**

- Checkout code changes
- Update your dependencies (i.e. gems)
- Run database migrations, restart application servers
- Optional: Restart index servers, setup new Cron jobs, etc.

**Remember: Automation!**

- Easiest: **Travis CI** supports deploying to many hosting providers ([http://docs.travis-ci.com/user/deployment/](http://docs.travis-ci.com/user/deployment/))
  - Deploy after all the tests pass
- Alternative: Capistrano ([https://github.com/capistrano/capistrano](https://github.com/capistrano/capistrano))
  - Prepares the server for deployment (possibly using provisioning tools)
  - Deploy the application as updates are made
Deployment with Travis CI

Travis Continuous Integration and Deployment Workflow:

1. before_install
2. install
3. before_script
4. script
5. after_success or after_failure
6. after_script
7. before_deploy
8. deploy
9. after_deploy

A non-zero exit-status in these phases means the build is marked as "failed." The build is not deployed to the hosting provider. Otherwise, it is deployed in the deploy step.

- A custom after_success step can be used to deploy to own servers (http://docs.travis-ci.com/user/deployment/custom/)

http://docs.travis-ci.com/user/build-lifecycle/
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Monitoring your servers and application

Keep an eye on server health and applications:
- Get alerts when components fail or exceed predefined thresholds
- Examples:
  - Uptime Robot—HTTP GET / ping every 5 mins ([https://uptimerobot.com/](https://uptimerobot.com/))
  - Nagios—Monitor infrastructure, down to switches and services ([http://nagios.org](http://nagios.org))

Monitor application errors and performance bottlenecks:
- Monitor errors that happen at runtime, discovered by users
- Notifications upon application errors, slow downs
- Good idea: Protocols for error fixing!
- Examples:
  - Errbit—Collect and organize errors ([https://github.com/errbit/errbit](https://github.com/errbit/errbit))
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Deploying 50 times a day? Continuous Delivery

Advantages:
- Users get a sense of “something happening” frequently, shorter feedback loop
- Business value of features immediately present
- Deploy scripts used often, less likely to contain errors
- Reduced amount of code changes per release → faster fixes, less downtime

Prerequisites/Disadvantages:
- Only feasible with extensive set of good tests
- Tests / deployment need to run fast (Continuous Integration)
- Additional training for developers (DevOps) required
- May not be feasible for applications that require planning or long-term support (e.g. operating systems)

Discussion:
Operating systems feature both CD (rolling releases) and classical approaches (LTS releases)
How do 50 deployments a day fit into Scrums notion of Sprints?

Some ideas (let’s discuss):

- Intermediate Reviews for individual stories by the PO
  - At sprint review, each finished story is already running in production
  - Review meetings become shorter, more of a high level overview
- Get faster feedback from stakeholders for next Scrum meeting
- Deploying to staging or testing systems becomes part of the definition of done
- Acceptance of features not only based on PO approval but stakeholder approval?
  - A/B testing?
- "Working software is the primary measure of progress" — *Agile Manifesto*
  - Is software that is not deployed *working*? (*DevOps*)
Summary

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Conclusion: **Automate everything!**
Image Credits

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