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DevOps-Continuous Integration

Baisic DevOps tools

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Overview

- **Version Control**
- Provisioning tools
- Configuration Management Tools
- Configuration Parameters
- Managing Secrets

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Version Control Systems (VCS)

- Maintains textual information
- Shared among team members
- Centralized or distributed
- Three functions
  1. A check-out/check-in process
  2. A branch/merge process
  3. Tagging or labeling versions

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Centralized version control system

- A centralized VCS has a central repository.
- Users must connect to that central repository to check in or check out files. I.e. internet connection is required.
- System can maintain knowledge of who is working on which files.
  - Allows informing team members if another member checks out a file
  - Allows locking of files or locking of check in.
- Subversion is common centralized VCS.

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Distributed VCS

- A distributed VCS also has a central repository but interactions are different from centralized VCS
- User gets a copy of the repository for local machine
- Check in/check out of a file is from local copy.
- Does not require internet connection to check out
- System has no knowledge of which team member is working on which file.
- Git is common distributed VCS.

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Check in/Check out

- Check out results in a local copy
- User can modify local copy.
- Check in copies it back to repository – local or central.
- New version gets new number.
- VCS can perform style checks on check-in

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Branch process

- Repository is structured as a tree with branches
- Files exist on a branch
- New branches can be created with a duplicate set of files. Allows for different tasks on same file. E.g. adding features and performing bug fixes. These actions might be done on different branches.
- Each branch has a purpose and the files on one branch are isolated from the files on a different branch.

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Merge process

- Two branches can be merged.
- Differences in two versions of the same file must be resolved.
- Best practice is to merge frequently since reduces number of differences that must be resolved.

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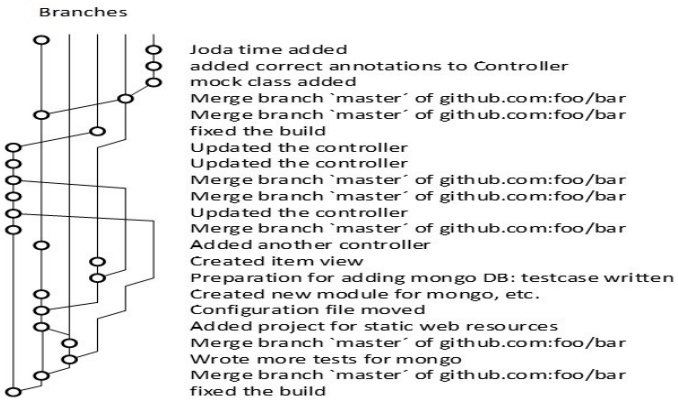
Sample branch structure



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Best practices for version control

- Use a descriptive commit message
- Make each commit a logical unit
- Avoid indiscriminate commits
- Incorporate others' changes frequently
- Share your changes frequently
- Coordinate with your co-workers
- Remember that the tools are line-based
- Don't commit generated files

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Consistency is important

- Consistency on platforms reduces error possibilities.
  - Different team members should develop on the same platform
  - Development platform should be consistent with the production platform
  - Updates should be applied to all machines in a fleet automatically
  - Replicas across data centers should have same software installed down to version and patch numbers.

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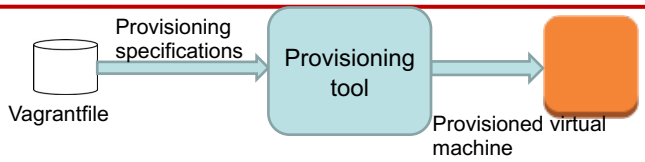
Provisioning tool



- Provisioning tool takes a specification for a provisioned VM and produces such a VM on a provider such as VirtualBox
- Specification is version controlled and shared among team members through version control system
- Result is a common environment for development and production

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Common provisioning tools

- Vagrant – can have targets of Virtual box, AWS, VMWare, etc
- Cloud Formation – AWS specific
- Azure Resource Manager – Azure Specific

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Configuration Management (CM) Systems

- A CM system is essentially a copier. It copies files from one server to a variety of other servers.
- The purpose of a CM system is to maintain consistency across a set of machines.
- Common tools are:
  - Chef
  - Puppet
  - Ansible

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Actions of a CM tool

- A CM tool resides on a server
- Controls collection of other machines – virtual or physical
  - Identified by IP addresses and grouped by functions. E.g. Web server, Development platform, DB server
  - Copies them through SSH (mostly) from CM server to clients
- Extensible through plug-ins

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Specification

- Specification of actions is done through scripting language
- E.g. “make sure all web servers have latest patch for nginx 15.8”
- Specification should be version controlled.

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Configuration parameters

- A configuration parameter is a parameter set by system administrator
- . E.g., logging level, DB URL, background color
- As service moves from development to production, different values will be used for configuration parameters.

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Management of configuration parameters

- Incorrect parameters are a major source of errors
- Libraries exist for some types of checking. E.g.
  - Values have been specified
  - Range of value is correct
- URLs for external entities should be checked during startup to ensure
  - They are accessible from current environment
  - They are of the correct type.
- Need to worry about maintaining confidentiality of secret configuration parameters.

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Getting parameter values to application

- Resource file. Read by app, typically on initialization
- Environment variables. Set in operating system and used by name in app.
- Database. Read by app.
- Specialized tool. Used prior to invocation to set parameter values.

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What parameters should be configuration parameters?

- Developers decide which parameters are configuration parameters.
- Form of late binding.
- Any parameter can be made a configuration parameter
  - Must have default value if not set
  - Value must be checked for reasonablenesss
  - Possible to have too many configuration parameters, e.g. >10,000 in some systems.

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- **Managing Secrets**

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Credentials as configuration parameters?

- It is tempting to make credentials, e.g. passwords, keys, be configuration parameters
- Making a credential a configuration parameters will expose secrets too broadly.
- Configuration parameters show up in textual scripts. Means anyone with access to script has access to credentials. May be stored in public repository such as Github.

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Managing credentials

- Credentials should be treated differently from other parameters.
- Credential management covered in Applied Distributed Systems
  https://youtu.be/cvxAOp5Hl1g

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Summary

- Version control systems enable controlled sharing and modification
- Provisioning tools create an environment
- Configuration management systems maintain consistency of software and versions across classes of machines
- Configuration parameters are a form of deferred binding.
- Credentials should not be made configuration parameters.