Continuous integration, delivery and deployment

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Quick poll
Safe?

Are you using version control?
Quick?

Can you release new version of your software in one day?
Quick and safe?

Can you release new, **well-tested** version of your software in one day?
Development now

- Each developer has feature branches
  - *If* the version control is used at all
- Features are deployed when completed
- Integration issues

- Small test suite
Problems

- Bringing software into production is hard
- Takes a lot of time
- Error prone
Solution – Continuous Integration
Continuous Integration?

“Continuous Integration is a software development practice where members of a team integrate their work frequently, usually each person integrates at least daily - leading to multiple integrations per day. Each integration is verified by an automated build (including test) to detect integration errors as quickly as possible.”

- Martin Fowler
Change the workflow!

- Checkout/update
- Code
- Build & test locally
- Update (merge)
  - Retest if changed
- Commit
- Continuous Integration server takes over …
Change the versioning!

- No ‘feature’ branches
- Temporary ‘developer’ branches
- Good to test crazy ideas
  - Branch and throw away
- Trunk must always compile
- Avoid big scary merges
How to handle features

• No ‘feature’ branches
• Features can be toggled on and off via deployment or compilation configuration
  – Also helps with Continuous Delivery/Deployment
• Keep features small
• Improve features interactively
  – Introduce early, then improve
Sidenote – Version control systems

• History
  – Log
  – Blame

• Revert to version
  – Bug-finding tool

• Branches
  – Tag/mark every release

• Always use VCS – even for single-person projects!
<table>
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<th>Author</th>
<th>Date</th>
<th>Message</th>
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<td>8. november 2013 18:28:03</td>
<td>* TM ainSTTWINForm.MyException first logs the exception, then does everything else so we always get a log file * printing **</td>
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<td>8. november 2013 15:59:45</td>
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<td>! corrected cursor positioning and writing outside of margins! ctrl+q now closes page if it is empty and contains no subpages!</td>
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<td>ClipSelToMargins also regulates cursor positioning when not in FSubtitle mode</td>
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<td>11667</td>
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<td>changed parameter order (code is only used in Ettwin)</td>
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<td>! Another bugfix.</td>
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<td>! No Range check on ATC reading.</td>
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<td>7. november 2013 13:36:12</td>
<td>* updated automation test xml files * using a CS in DirectShowFeeder around FLastPacket * better handling of stopping automatic tests *</td>
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<td>! FXP XML Export writes alignment into correct XML node</td>
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<td>+ backup</td>
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<td>+ default editor font can be set</td>
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```
Blame

TKMFrameInfo = record
  AspectRatio_H : integer;
  AspectRatio_V : integer;
  DisplayHeight : integer;
  DisplayWidth  : integer;
  DisplayXOffset: integer;
  DisplayYOffset: integer;
  Dropframe    : boolean;
  Duration     : integer;
  DurationActual: integer;
  Errors       : TKMErrorInfoArray;
  EstimatedGOPFrames: int64;
  EstimatedNumFrames: int64;
  FrameRate    : real;
  HasANCDataTrack: boolean;
  HasVEIDataTrack: boolean;
  IsD10        : boolean;
  IsD2        : boolean;
  IsD3        : boolean;
  IsD4        : boolean;
  LastProducer : String;
  MpegData     : TMpegFrameData;
  MpegDataPresent: boolean;
  FECPresent   : boolean;
  StartTimeCode_f : int64;
  StoredHeight : integer;
  StoredWidth  : integer;
  TimecodeBase : word;
  TimecodePresent: boolean;
  VideoAFD     : integer;
  VideoType    : TKMFVideoType;
  TMKFKey      = (kyInvalid, kHeaderPartition, kBodyPartition, kFooterPartition, kFiller, kPrimerPack, kPreface, kRandomIndexPack, kIndexTableSegment, kMetadata, kControlData, kSystemMetadata, kIdentification, kMaterialPackage, kSourcePackage, kContentStorage, kTrack, kEventTrack, kStaticTrack, kSequence, kSourceClip, kTimecodeComponent, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplication, kTileReplica
```
Testing

- Automate everything
  - If it hurts, do it more often. Continuously.
  - Fail fast.
- Integration testing
- Unit testing
- Functional testing
- Application testing
- Mobile testing

- Whatever you don’t test against, **will** happen
Requirements
Requirements

• Source code repository (version control)
  – SVN, Git, Mercurial, …

• Project build
  – MSBuild
  – …

• Testing

• Continuous Integration server
CI server in essence

while true do
begin
  if change_checked_into_vcs then
  begin
    if not build then
      report_error;
    if not test then
      report_error;
  end;
  sleep;
end;
CI servers

• **Jenkins**
  – Hudson fork
  – Java
  – Commercial support - Cloudbees

• **CruiseControl.Net**
  – C#
  – XML configuration :(

• **FinalBuilder, Automated Build**
<cruisecontrol xmlns:cb="urn:ccnet.config.builder" xmlns="http://thoughtworks.org/ccnet/1/6">
  <cb:define name="fabsvn">
    <sourceControl type="filtered">
      <sourceControlProvider type="svn">
        <trunkUrl>svn://srv2.de.fab-online.com/fabttx/</trunkUrl>
        <workingDirectory>c:\build\trunk\</workingDirectory>
        <executable>c:\Program Files\TortoiseSVN\bin\svn.exe</executable>
        <username>build</username>
        <password>builder%12</password>
        <revert>False</revert>
        <forceUpdate>True</forceUpdate>
        <tagOnSuccess>False</tagOnSuccess>
        <timeout units="Minutes">15</timeout>
      </sourceControlProvider>
      <exclusionFilters>
        <pathFilter>
          <pattern>/fabttx/branches/**</pattern>
        </pathFilter>
        <pathFilter>
          <pattern>/fabttx/tags/**</pattern>
        </pathFilter>
        <pathFilter>
          <pattern>/fabttx/common/config/**/*</pattern>
        </pathFilter>
      </exclusionFilters>
    </sourceControl>
  </cb:define>
</cruisecontrol>
Project monitoring
CI recommendation

- Use a separate server (or VM)
  - For CI, or
  - For CI + build, or
  - For CI + build + test
Central dogma

• Build early, build often
  – On every checkin
  – Check in early, check in often
Benefits

• Brings order into chaos
• Everything could be achieved without the Continuous Integration, but …
• CI is the great enforcer
Benefits

• Code is always in the consistent state
• Code always compiles
• Automatic tests
• Automatic feedback on production readiness
everyone is responsible for the project

"You broke the build!"

I pity 'da fool

Who breaks the build
Code always compiles

• Code should **always** build and test.
  → Continuous Delivery
Continuous Delivery
“The essence of my philosophy to software delivery is to build software so that it is always in a state where it could be put into production. We call this Continuous Delivery because we are continuously running a deployment pipeline that tests if this software is in a state to be delivered.”

– Jez Humble, Thoughtworks
• CD = CI + fully automated test suite
• Not every change is a release
  – Manual trigger
  – Trigger on a key file (version)
  – Tag releases!

• CD – It is all about testing!
Consider this

“How long would it take your organization to deploy a change that involves just one single line of code?”

- Mary and Tom Poppendieck, Implementing Lean Software Development
Cont. Delivery vs. Deployment

Continuous Delivery

build -> unit tests -> integration tests -> validation tests -> MANUALLY deploy to production

Continuous Deployment

build -> unit tests -> integration tests -> validation tests -> AUTOMATICALLY deploy to production
Continuous Deployment
Continuous Deployment
A word of warning

• Continuous delivery is doable.
• Continuous deployment is a hard problem.
Deployment schedule

- Release when a feature is complete
- Release every day
Deployment strategies

• Zero-downtime deployment (and rollback)

• Blue-green
  – Two environments
  – Install on one. Switch. Switch back on problems.

• Canary release
  – Deploy to subset of servers

• Real-time application state monitor!
Problems

• Technical
  – Databases
    • Schema migration
    • Revert!
    • Change management software
  – Configuration

• Human
  – Even more important
  – Automatic deployment = great fear
  – Customers don’t want software to constantly change
Transition
How to introduce

• Gain expertise
  – First step accomplished – you are here
• Automate the build
• Introduce tests
• Prove the concept
  – Introduce CI system
  – Run it in parallel to existing infrastructure
  – Give it time
  – Show the win-win
What we found

• Continuous Integration is relatively easy
  – It is all about communication

• Continuous Delivery is harder (but we are getting there)
  – Some things are hard to test automatically
  – You need dedicated tests-writing people

• Continuous Deployment is not a requirement
  – Customers don’t want it
  – Mission critical systems
Sidenote - VCS rules!

- Disks are large, store as much as possible in the VCS
- Continuous Integration server configuration should be stored in the VCS
- Should be able to restore complete build system from the VCS (after installing necessary software)
Implementation

• Run everything in VM
• Backup!
It is all about the people!
Software

- Jenkins
  http://jenkins-ci.org

- CruiseControl.NET
  http://www.cruisecontrolnet.org

- Final Builder
  http://www.finalbuilder.com/finalbuilder.aspx

- Automated Build Studio
  http://smartbear.com/products/
Books

- Continuous Delivery
  http://www.amazon.com/dp/0321601912
- Continuous Integration
  http://www.amazon.com/dp/0321336380
- Implementing Lean Software Development
  http://www.amazon.com/dp/0321437381
- Release It!
References

- http://martinfowler.com/articles/continuousIntegration.html
- http://continuousdelivery.com
- http://edn.embarcadero.com/article/40962