CLOUDFOUNDRY

Cloud Foundry Developer

Instructor Notes

Teaching this course

Version 2.0.a

Pivotal

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Chapter 1. Pivotal Trainers Guide

1.1. Pivotal Trainers Guide

This guide applies to Pivotal Instructor-Led Training (ILT) courses and is in addition to the specific Instructor Guide of each course. It provides general information on:

- Course structure and pacing
- Student registration
- Feedback
- Certification

1.2. General Introduction

Most of out courses are deliberately intense. Students should feel they covered *almost* too much information. There is more than enough content for an average group and sufficient optional content for more capable classes.

The following includes our recommendations for the average class - pace the course your own way once you get the hang of it. Correct pacing can be hard because abilities in the group can vary so much. Better to risk the abler students getting a bit bored (you can always set them an extra credit problem to keep them going) than to have a less able group that are lost throughout the course. A course where some students never finish any lab will just leave them discouraged.

In this document, each slide deck (and its accompanying lab), is termed a "Topic". Not all Topics have labs, some may have more than one.

In general each day consists of 4 full Topics (with labs) or 5-6 Topics (not all with labs). Few classes will manage more per day.

1. Some general tips:
    - Run the class at a pace that most of the students can handle.
    - The labs are the best part of the course. Don’t rush them.

- The lab durations stated are a minimum for most groups, you will not make up time by trying to cut lab times without skipping part of the lab as well.
- If you're running out of time, a good way to make it up is to replace a lab with a demo.
- A very smart class can get through more than the normal content and, where possible, some topics contain extra advanced material at the end (after the Lab slide) and/or optional topics that you can use. Another option may be to bring in related topics from another class.
- Find out early what sections, if any, students are particularly interested in and give them priority, truncating others or skipping labs to make time (but don't forget most topics are needed for Certification).
- With a slow class you may need to keep labs to time aggressively and/or skip some labs completely or Day 4 is too rushed and leaves a bad impression of the course (and bad feedback in the course review).
- Some students may need to leave early on the last day (to get transport), find this out ahead of time and compensate accordingly
- Students concentrate best in the morning. Consider moving a harder topic to before lunch for this reason.

Note: the accompanying Certification Exam (if there is one) *only* asks questions about *required* sections. Advanced/optional notes (any slides after the Lab slide) are *not required* for certification unless specifically indicated.

Exception: The PCF Administration course does not (Q4 2017) cover all topics needed for Certification.

1.3. Instructor Guides

In addition to these general notes, each course comes with a dedicated Instructor Guide. It covers course contents in detail and provides a recommended day-to-day schedule.

You will see that we sometimes advise you to skip a lab or a presentation. We may also recommend you to talk about some topics that are not explicitly in the slides (background, related information, best practices).

Each course has to cover a wide range of abilities and our Guides are intended to give you, the trainer, scope to give the course in a way that works well for you.

We encourage comments on the material in anticipation of future changes. Please provide feedback on the course so we can make it better. Please use our Instructor Forums (Google Groups) to discuss any course:

- Dev Forum: For Spring, Pivotal Cloud Foundry, Rabbit MQ …

  - https://groups.google.com/a/pivotal.io/forum/?hl=en-GB#!forum/data-pivotal-instructors-forum

- Data Forum: Greenplum, Gemfire/Geode, PHD/HAWQ, Hadoop …

  - https://groups.google.com/a/pivotal.io/forum/?hl=en-GB#!forum/pivotal-instructors-forum

1.4. Pacing the Course

The timings in each Instructor Guide *are a guide* for the typical classes we teach. Experienced trainers tend to have their own schedule. However, the guidelines are recommended for new instructors until they get their own rhythm.

Please note:

- Courses are assumed to run for 8 hours per day with 2 hours of breaks.
- In our proposed schedules, we have assumed 9am-5pm each day with two refreshment breaks (30 minutes each around 10:30 and 3:00) and a lunch break of 1 hour around 12:30 to 1:30. Exact timings will depend on the venue.*Try not to skip breaks, as they restore concentration.*
- You may get some time back by cutting lunch to 45 mins and other breaks to 15 mins although students will probably push against this and take longer anyway.
- Lunch hours vary from one country to another.
  - In some countries it is acceptable to just have a sandwich whereas others (France, India, Japan) expect to go to a restaurant/canteen each day.
  - It is important to adapt your schedule to local customs (especially if you’re not teaching in your home country).
  - If you are not sure what’s best, discuss it with the course administrator, the venue staff or your students at the start of the course.
  - Getting students to leave the training facility for lunch is generally better as it forces them to move around and get some exercise – they will be less restless and concentrate better after lunch.
- Some countries may prefer to vary the start-time of the course - this is especially true in India where starting at 9am is almost impossible due to traffic. Either you or your course co-ordinator should agree times with the customer/venue beforehand.

- Most of our courses are modular and each lab is designed to be self-contained. If a student doesn't finish a particular it doesn't prevent them continuing onto the next one.
- For each lab two projects are normally provides - one for students to work and a worked solution for reference after the course. Make sure students don't work with the solution by mistake (it happens).
- Add, move or remove topics to suit any particular class as necessary
  - This is especially true for on-site teaching where courses are often customized.
    - However there is less flexibility when teaching a public course where you*must* teach the advertised material.
  - Also, be aware that some topics do depend on others.
  - If need be skim a topic to cover just what is needed later - whiteboarding the important points or taking students through the solution are other options.
- Certification requires students to know *all* the non-optional topics. However, especially when teaching on-site, students may be more interested in some topics than others. Just warn them that by skipping/skimming one topic to spend more time on another that they will need to go over and learn the skipped topic for themselves.
- If running behind with a slow group, the Instructor Guide for the course will discuss which topics and/or labs can be cut or curtailed.
- The notes on each slide are intended for Instructors not students.-*Please read them*!
- There may be a *Known Issues/Suggestion/Errata* document that will be kept up to date. Check **Files Anywhere** for updates periodically.

1.5. Attendance and Evaluation

You may be required to manage attendance and/or register students for the course. This varies considerably across our partner trainers.

When teaching on-site you may be required to maintain a register and.or get students to sign an attendance record for their company.

Please consult with your course administrator to determine whether your courses are registered with the *Pivotal Academy*. If not, you will have your own mechanism for course registration and evaluation. Please skip to the "**Retrospective**" section.

1.5.1. Pivotal Academy: Registration and Role Call

Our Learning Management System (LMS) based on *Litmos* is being used to manage courses. The old VMware *MyLearn* has been phased out. All Pivotal employed trainers and most partners should be using this system.

Below is the procedure for courses registered in our Pivotal Academy. As previously mentioned, when teaching on-site or at a partner training-center, they may have their own attendance and feedback forms. We request that you use the Academy as well.

The course should have already been entered into the system before the first day (please contact your training coordinator if you are not sure or if this is not the case).

You should have access to the course you are teaching in Litmos:

- Login at https://pivotal.litmos.com
- Switch to *Learner View* (green button top-right)
- Click on *Instructor* in the menu bar (immediately under Pivotal Academy logo)
- Find your course and click **Roll call** button. If your course is not there, you will need to ask your coordinator to set it up.
- We would ask you to do a roll call every morning. Students must attend all 4 days to be eligible for Certification. Extenuating circumstances like illness may be considered on a case-by-case basis.
- On the last day, all students who have attended every day can be “Marked Complete” – this means they can login to the LMS themselves and get an *Attendance* Certificate (this is *not* Certification, it just says they took the course).

1.5.2. Pivotal Academy: Evaluation

We ask that students do a feedback evaluation just before finishing, however it may be a good idea to go through the last set of notes (*completed*) and get them to do the evaluation before doing the last lab or even before all of the last topic. Especially if you are running late and/or people need to leave early.

The Feedback URLs can be found on the Pivotal Instructors Forum for Developer Courses at Google Groups:

https://groups.google.com/a/pivotal.io/forum/?hl=en-GB#!forum/pivotal-instructors-forum

Scroll up until you find the *Course Evaluation Links*. If your company is not listedm please check with your training coordinator.

When filling in the evaluation, students must then enter:

- The email address the student was registered with in the LMS. You have this information on the roll-call screen (discussed above). This is optional if they wish to remain anonymous. However when the trainer receives the evaluations, they will not see student names anyway.
- The name of the course – make sure they pick the right one, several courses have similar names
    - *The scroll bar is broken/missing on this page, so the Submit button may appear off the bottom of the page. Get students to enlarge the browser window and/or shrink the text in the window to make it appear*.
- The name of the trainer (or trainers if more than one)
- Then they answer feedback questions.

1.6. Retrospective

We encourage trainers to also run a "*Retrospective*" at the end of the course, just after the evaluations. This should only take 5-10 minutes.

Divide the whiteboard into three panels: *Good*, *OK* and *Bad*. Taking each panel in turn ask the students:

- What worked well, what they liked most (*Good*)
- What was OK but could be better/deeper/shorter (*So-so, "Meh"*)
- What they felt didn't work, what was missing, what was unnecessary (*Bad*)

This feedback can include the course materials, the labs, you(!), the venue, the equipment – any aspect of the course. Please feedback information relevant to the course contents (slides, labs) to Pivotal.

A number of online Restrospective tools are available - see here for more details: http://www.scrumexpert.com/tools/free-retrospective-tools-for-distributed-scrum-teams/

1.7. Certification

Students *must purchase* the exam from Pivotal website:

- Go to https://pivotal.io/training/certification

- Select the exam by name on the left
- Click the Purchase Exam button on the right (scroll down if need be).
- As at October 2017, the exam costs $200.
- A Study Guide should also be available (on the right-hand side) - but not all courses have one yet. We hope to fix that by Q1 2018.

Certification is now being handled by *Innovative Exams* (part of *PSI* group) instead of *Pearson-Vue*:

- Students can take the exam in their own home or office, provided they can set themselves up with the right equipment (in particular a web-cam – so we can see if they are cheating!)
- The website is https://www.examslocal.com/
- For full details see: http://it.psionline.com/exam-faqs/pivotal-faq.

There is an appendix at the end of the Student Handout on Certification (if there is certification for that course).

Chapter 2. Cloud Foundry Developer - Instructor's Guide

2.1. Overview

Course is available online at: https://cf-developer.pal.pivotal.io

Credentials to access are: username *pivotal*, password *keepitsimple*

Here is the basic schedule. (*NL = no lab*, *OL = optional lab*, *OPT = optional section*, XP = lab does *not* run on PWS).

Day 1	**Day 2**	**Day 3**
Course Orientation (NL)	12 Factor Applications	TCP Routing (NL)
CF Motivations (NL)	Log Drain Review	UAA & OAuth2
Basic Definitions (NL)	App Execution & Security Groups	Cloud Native (NL)
Tech Overview	Staging & Running	Cascading Failure
Core Themes	Microservices	Distributed Tracing (NL)
Logging & Metrics	Route Services	App Lifecycle (XP)
Resiliency	Docker (XP)	Non-Breaking Changes (NL)
Services		CI/CD Automation (NL)

Warning: This schedule applies to an *average* group. It also leaves time for the instructor to add examples, demos and answer questions. You may be faster or slower than what is described in this schedule.

If you encounter any errors in this document or if you have any suggestions/comments please contact us at eduction@pivotal.io.

2.2. Overview

About the course …

- The course is only available online. There are no PDF documents or installers for the students - they use the same web-site we do.
- Slides use *reveal.js* and can be viewed in a standard Web Browser. to move between slides use the left/right arrow keys or the page up/down keys. Clicking the mouse does not do anything.
- The course is not developed by Pivotal and we have limited control over its content. In particular the *reveal.js* slides are minimal in the extreme. Fundamentally this is an e-Learning course not intended for Instructor Led Training.
- A lot of very useful information is in the "E-Learning" popup (press 'e' in any slide) that does not appear in the actual slides.
- When you are presenting, the Summary popup (press 's' in any slide) is useful for reference. If you have two screens, show the slides on the projector and the popup on your own screen. As you move from slide to slide, they stay in sync.

This document augments the online materials for instructors. Additional PowerPoint slides (from our original PCF Developer course) are also provided as extra source material.

2.3. Prerequisites and Setup

Students are not required to develop in any particular language. The applications they need are pre-written for them. This is really "CF *for* Developers" not "Developing with CF". Make sure students are clear on this.

Students will need to have the following installed before the course, although you can talk them through it on the first day.

- The Cloud Foundry `cf` command-line interface: https://github.com/cloudfoundry/cli#downloads
- The `curl` utility. Curl for Windows is here: https://curl.haxx.se/download.html. Many Windows users find the Postman application easier: https://www.getpostman.com (it is available for Windows, MacOS or Linux).
- There is no `watch` utility on Windows. However it can be simualted using a script. Save the following as `watch.bat`. Run using `watch <some-command>` and it will run that command every second:

```
@ECHO OFF
:loop
  cls
  %*
  timeout /t 1 > NUL
```



```
goto loop
```

- A Cloud Foundry account is required. Either students use their own CF setup or PWS can be used (but a couple of the labs, like the Docker lab, can't be run on PWS).
- Logging in and targeting an organization and space is not covered in the introduction
  - So you must take students through this. The original slides from the PCF Developer course that went through this are in `slides/02-getting-started-cli.ppt`, if you wish to use them.

2.4. The Course

The slides for this course are minimal. Feel free to add your own slides as appropriate to bring out important points. Slides from the former PCF Developer are perfectly reusable when presenting this course and are provided for you convenience in the `slides` directory. They have been updated for PCF V2.

Most of the labs are shorter than our traditional courses. However several ask students questions at the end. Go over these questions with the students at the end of the lab.

Day 3 has fewer labs so you can afford to run behind and make it up in the last day.

2.4.1. DAY 1: Basic Usage

Basic setup and usage of Cloud Foundry.

Get the class to introduce themselves, supply some background, what language do they develop in, have they used CF (or anything similar before) and what are they expecting to get from the course.

Suggestion: As they introduce themselves, write all the names down on a sheet of paper in the same arrangement as the desks. If teaching overseas, get one of the students to write names on the whiteboard for you (again in desk order) so that you don't end up stumbling over and misspelling unfamiliar names. Write the names down afterwards, in case some helpful person cleans the whiteboard overnight!

Slides	Approx Times	Notes	Lab
Course Orientation	*9:00-9:30*	Sets the scene and the philosophy behind the content. Feel free to skim or even skip this content. It is just an introduction. An alternative introductory deck is `slides/00-introduction`.	NONE

Slides	Approx Times	Notes	Lab
		Before or after these slides introduce yourself, then go around the room to let the students introduce themselves.	
CF Motivations	*9:30-10:00*	Overall background to Cloud Foundry and why you need it. More marketing than technical, skim or augment with your own knowledge and arguments. The Tech Overview has more "meat". The original overview from the PCF Developer course has been updated for PCF V2: `slides/00-overview`.	NO
Basic Definitions	*10:00-10:30*	Short section defining CF specific concepts like organizations, spaces and services. The original concepts slides are provided if you prefer: `slides/01-concepts.ppt`.	NO
BREAK	*10:30-11:00*		
Tech Overview	*11:00-11:45*	Basic technical overview of Cloud Foundry. In addition take students through logging in and selecting a space. Use these slides from the old PCF Developer course `slides/02-getting-started-cli.ppt` if you wish.	YES (push an app) *11:45-12:30*
LUNCH	*12:30-1:30*		
Architecture (EXTRA)	45-60 minutes	The new course does not really go into the architecture of the PAS, but most students are keen to know what is going on "inside the box". Depending on the group, and time available, you may wish to go through `slides/03-architecure.ppt`.	NO
Core Themes	*1:30-1:45*	Minimal slide deck that you can skip through quickly.	YES (scaling) *1:45-2:05*
Logging & Metrics	*2:05-2:30*	Minimal slide deck providing a brief overview of logging and the Loggregator subsystem. A whiteboard discussion of how the Loggregator works would be useful here. Alternatively the logging slides from the old course are in `slides/03-logging.ppt`.	YES (logging) *2:45-3:00* (after break)

Slides	Approx Times	Notes	Lab
BREAK	*2:30-2:45*		
Resilience	*2:45-3:15*	Short section on the "4 levels of HA". Again go to the whiteboard to explain more or use `slides/05-high-availability.ppt`	YES (kill an app) *3:15-3:30*
Services	*3:15-3:45*	Minimal overview of Services and how they work. Feel free to use the services slides: `slides/06-services.ppt`.	YES (services) 3:45-4:15

If you have been using the extra slides you will probably not finish early. The next two days are short, so it is OK to run over today.

2.4.2. Day 2: Cloud Native Applications

Slides	Approx Times	Notes	Lab
12 Factor Apps	*9:00-9:30*	As the slides say these are recommendations - *not* a 'religion'. Many are developer common sense, a few are due to writing for a cloud environment. The summary lists the important ones, For more details see `slides/07-twelve-factor.ppt`. VI. Execute the app as one or more stateless processes - *note however that using persistent sessions is easier than rewriting your application to be stateless. For Java applications, Spring Session makes this easy using a Filter to save sessions to Redis, Gemfire, MongoDB or an RDBMS (Java buildpack can set this up automatically).* VII. Export services via port binding - *actually not necessarily so, the Java buildpack, for example, supports both JAR and WAR applications.* IX. Maximize robustness with fast startup and graceful shutdown - *containers are disposable and could be shitdown at any time. Even if they don't fail, they could get scaled down*	YES 9:30-10:00 (env vars & manifest)

Slides	Approx Times	Notes	Lab
		instead. XI. Treat logs as event streams - *can no longer write to log files*. The lab uses environment variables and a manifest. Neither of which are explained in the slides. Use `slides/08-manifests-env-vars.ppt` if you wish.	
Log Drain Review	*9:30-10:00*	Slides belatedly describe the Loggregator architecture but do not describe log draining, the subject of the lab. `slides/09-log-drain.ppt` are available.	YES (log draining) 10:00-10:30
BREAK	*10:30-11:00*		
Manipulating Routes	*11:00-11:30*	Overview of routes and blue-green deployment. Use `slides/10-blue-green.ppt` if you prefer. There are two labs - manual blue-green deployment, then using the `cf` CLI blue-green plugin.	2 LAB (blue-green, CLI plugin) *11:00-11:30*
App Security Groups	*11:30-12:00*	Controlling outbound ("*egress*") access *from* your application to the outside world - in addition to any firewalls you may have. Alternative slides are `slides/11-app-security-grps.ppt`. Lab involves monitoring with New Relic which is not covered by the slides. Use `slides/12-app-perf-mgmt.ppt`.	LAB (monitoring) *12:00-012:30*
LUNCH	*12:30-1:30*		
Staging & Running	*1:30-2:15*	Buildpacks. The original buildpack slides are in `slides/13-buildpacks.ppt`. Lab deploys a Ruby application (Web-UI) that uses CUPS to access the Roster application as a service - similar to the old Articulate and Attendee applications. Lab also asks students to push the Web-UI again, this time using the static buildpack instead.	YES (use ruby & static buidpacks) *2:15-2:45*

Slides	Approx Times	Notes	Lab
BREAK	*2:45-3:15*		
Microservices	*3:30-4:15*	The original microservices slides are in `slides/14-microservices.ppt`. The lab uses `cf ssh` which is not covered by any slides.	YES (cf ssh) _3:15-3:30 _
Route Services	*3:15-3:35*	Slides are actually reasonable, but click 'e' to show the details of what each slide is trying to show - especially for the 2 diagrams. Lab deploys a rate-limiting route service (same as PCF Developer course).	YES (rate limiting) *3:35-4:00*
Docker	*4:00-4:30*	Using Docker in PAS - this is *not* about PKS. Lab cannot be done if using PWS.	2 Labs (XP - deploy and use Docker app) *4:30-5:00*

2.4.3. Day 3: Advanced Features

This day covers many interesting topics that we never had time to include in the PCF Developer course but the slides will not help you much. Consider presenting from the slides popup (hit 's' in any slide) due to the extra depth of information.

Slides	Approx Times	Notes	Lab
TCP Routing	*9:00-9:30*	Supporting protocols other than HTTP. Most commonly used to send HTTPS directly to your application or by IoT devices using various protocols. Additional `slides/15-routing.ppt`.	No
UAA & OAuth2	*9:30-10:00*	A good grasp of OAuth2 is required here and the slides don't really go into depth. If you have OAuth2 slides, use them. The lab notes state: *A compiled version of the UAA, and a*	2 Labs (using UAA)

Slides	Approx Times	Notes	Lab
		corresponding deployment manifest have been made available. This sentence contains two links - one to the UAA app and one to its manifest - not obvious. Lab first deploys the UAA application and then sets up a route service to use it. A great example, but challenging.	*10:00-11:30* (incl break)
BREAK	*10:30-11:00*		
Cloud Native	11:00-11:20	Very high-level. Lots of motherhood statements but not much practical guidance. Augment with any additional material you may have.	NONE
Cascading Failures	*11:20-11:40*	Discusses high availability in a microservices environment and a brief overview of the circuit breaker pattern. The Web-UI application has circuit-breaker functionality built-in and is used in the lab.	YES (circuit breaker demo) *11:40-12:00*
Distributed Tracing	*12:00-12:30*	Minimal overview.	NONE
LUNCH	*12:30-1:30*		
App Lifecycle	*1:30-2:00*	Deploying applications to multiple spaces to reflect the application lifecycle - dev to testing to QA to UAT …to production. The slides show all this happening in a single CF Foundation (installation). In practice we recommend making production a separate foundation for obvious security reasons. Lab shows using multiple domains so an extra domain must have been setup in advance. Lab will not work on PWS.	YES (XP - multiple domains) *2:00-2:30*
BREAK	*2:30-3:00*		
Non-Breaking Contracts	*3:00-3:30*	Microservices rely on the interface between different processes remaining constant - the protocol and data-representation must stay the same. Doing this is hard and this section offers some guidance.	NO

Slides	Approx Times	Notes	Lab
CI/CD Automation	*3:30-4:00*	Building automated deployment pipelines. Important topic but few slides.	NO
Completed	*4:00-4:30*	The online course has no end of course slides - so use `slides/50-completed.ppt`. The course is preparation for the CF Foundation's certification process. Don't forget your evaluation.	NO

