



WHITE PAPER

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Carl Baatz
CTO, Better AG

A MODERN APPROACH TO E-LEARNING DEVELOPMENT, DELIVERY AND EVALUATION

EXECUTIVE SUMMARY

- **Note: the technology discussed in this white paper has been invented and developed at Better over the past two years. The company has pending patents for several key parts of the software.**
- Corporate e-learning is challenged by a changing technology landscape and higher expectations from users. A diversity of devices, operating systems, and screen sizes are making existing Flash- and HTML-based courses obsolete. In addition, the lack of adaptivity and modern interfaces mean that user expectations are not met.
- Four key strategies are proposed to bring e-learning up to par with current technology and also allow it to continue to evolve and remain relevant:
 - a. Semantic: Separate course matter from user interface in order to allow the user interface to adapt to different devices and to allow for powerful adaptivity.
 - b. Cloud: Move courses to the cloud instead of keeping them as packages of hard-coded files. This approach is backwards compatible with SCORM and offers a number of benefits to development and delivery.
 - c. Framework: Give course authors a powerful framework to build on, one that delivers adaptive learning, analytics, and multi-device compatibility for free in each course. Authors can deliver courses quicker and with higher quality than before.
 - d. Workflow: Automate workflows to save costs, time, effort, and to make it feasible to add functionality without undue burden on authors and managers.
- It is argued that the only significant disadvantage of this approach is the cost to build a first version of such a software system, but that it will start to pay off immediately when put to use.

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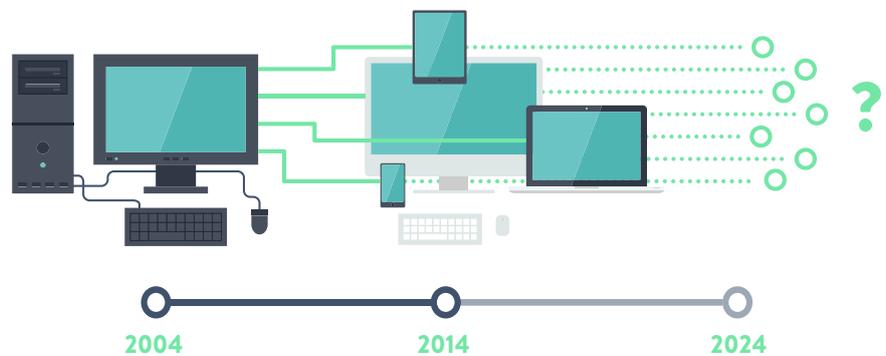
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INTRODUCTION

E-learning today is built on legacy technology. Many courses are completely custom-built using PowerPoint-like tools that encourage instructional designers to focus on layout and styling more than their core expertise: content and didactics.

In the last few years, devices in common use have become more diverse. A decade ago, almost everyone used Windows on a stationary computer. Today, there are a number of device types, screen sizes, and operating systems in common use. This diversity of devices poses critical challenges and offers new opportunities for corporate e-learning. It begs the question:

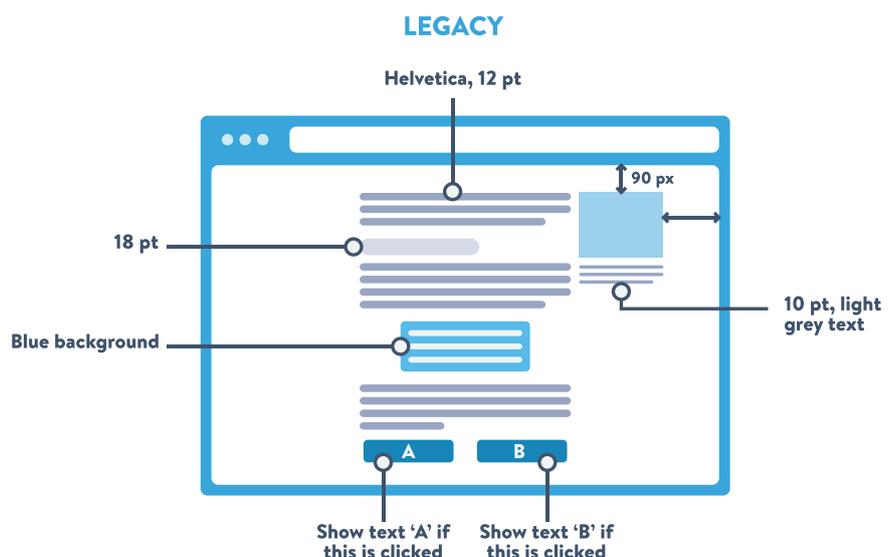
How can we adjust our approach to e-learning development and delivery to catch up with the rapid pace of technological change and reap the corresponding benefits?



SEPARATE COURSE MATTER FROM USER INTERFACE

Traditional courses are built by hardcoding the course matter and the user interface into one package. By course matter we mean both content, such as explanatory texts, hint texts, illustrations, videos and course mechanics, such as how many questions a learner needs to answer correctly to pass and whether they have to do parts of the course in order or not. By user interface we mean styles, colours, layout and controls that don't change the essence of what it means to take and pass a course.

In a current e-learning development tool, an author might create a side-note by putting text in the top right corner, giving it a yellow background, and adding a link which shows the learner an image scaled to 200 pixels. Regardless of whether this course is taken on a phone, a computer, or the learner is color-blind, the behavior and look remain the same. Another author might have put the note at the bottom, made it pink, and used a larger version of the image. The different styling would have affected the user interface, but not the course matter. Each styling may have different advantages and disadvantages depending on how the course is consumed.

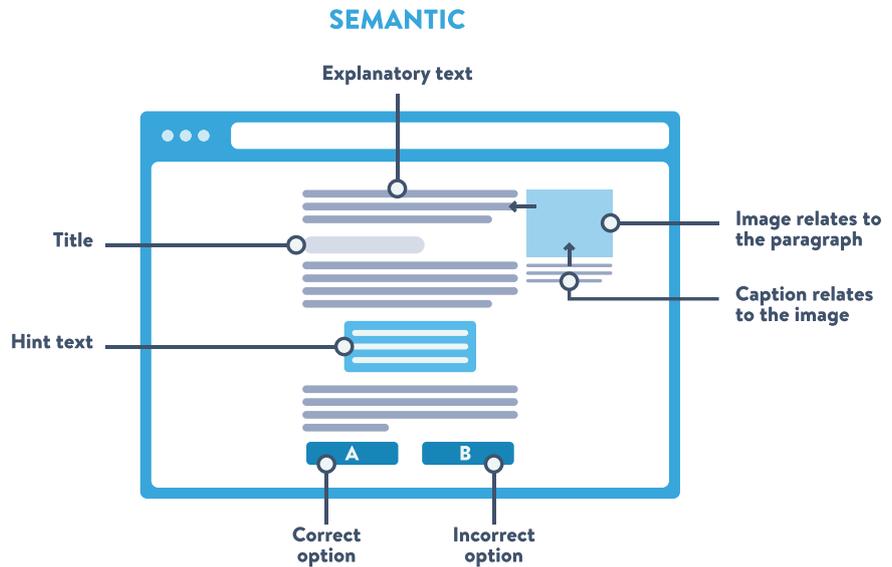


A smarter way to build courses is to specify the course matter separately from the user interface, layout, and styling details. Under this paradigm an author would specify that a page starts with a paragraph of text, that a particular image is associated with that paragraph, and that it is followed by a multiple-choice exercise with particular options and hints. It is unnecessary to specify whether the image is below or besides the paragraph, whether the

Depending on which device a learner takes the course on, the interface can be adapted to suit the available input methods and screen size.

As an aside, if you know about responsive design in HTML5, this semantic approach is similar but takes things a step further - it allows us to tailor the content for native iOS or Android apps and not just for other sizes of web browsers. With more meaning attached to content, it becomes possible to run the course in native apps and give the learner an interface optimized for the device. For example, in a mobile app side-notes could be collapsed behind an icon, images scaled down, navigation with swiping motions enabled, and web-controls replaced with native operating system controls.

hints are shown in yellow or blue, or whether the options are iPhone checkboxes or Internet Explorer checkboxes. Depending on which device a learner takes the course on, the interface can be adapted to suit the available input methods and screen size.



We call this way of separating course matter from user interface a semantic approach. Semantic is a word used to describe something that relates to meaning. In our context, it refers to the course author expressing something about the meaning of the content - this paragraph is an explanation, that paragraph is a hint, and this image belongs to the previous paragraph. The software uses this meaning to adapt the formatting, layout, and presentation of the content to make it as clear as possible, whether the learner is on a small-screen device, have poor eyesight, is colorblind, or does not have sound on their device, for example.

DON'T AUTHORS LOSE FLEXIBILITY WITH THIS SEMANTIC APPROACH?

One question you might ask is whether this will limit the author's flexibility? The answer is both yes and no:

Yes in the sense that this approach will not allow authors to create any type of layout imaginable. This can be a constraint in special cases, though we have found that more often than not it is rather a relief for authors to not have to worry about aligning a picture exactly, getting consistent looks on different pages, or figuring out how to get the same page to look good on different screens.

No in the sense that this approach gives authors more powerful abstractions that they can use to quickly create higher quality courses than they otherwise could within the budget and time constraints they have. They can spend their time on what they do best: designing a didactic approach, writing clear copy, producing great videos to explain concepts, and developing engaging exercises. The courses will automatically work well on different devices and screen sizes without additional author effort.

For some big-budget courses that require specialized functions such as an interactive simulation of a stock exchange or disease propagation, this approach would be too constraining. However, for the vast majority of courses

with budgets under a few hundred-thousand dollars, this approach of separating content and layout pays off immediately.

DOES THIS HAVE ANYTHING TO DO WITH ADAPTIVITY?

Adaptivity simply means that the software adapts to each individual learner's needs and abilities. This can come in many forms, ranging from basic branching to advanced probabilistic knowledge models.

What all approaches have in common is that they require the software to understand something about what user actions mean, which is exactly what a semantic approach affords. With information about what content means and how different pieces of content relate to each other, the software can use the learners' interactions with the course to inform teaching decisions like requiring a remedial lesson or offering learners to skip a section because they already know enough.

Legacy tools do sometimes offer limited types of adaptivity like branching or adaptive testing, but in these cases the necessary semantic information has to be added as an additional layer on top of the course, thus requiring a much larger authoring effort. Also, more advanced forms of adaptivity are very difficult to realize this way.

In contrast, a semantic foundation can support a wide range of powerful adaptivity models, which makes this approach future proof.

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WHAT DOES THIS MEAN FOR ENGAGEMENT?

A common conception is that a course needs to be rich in graphics and animations to be engaging. While visual and auditory aids can indeed improve learning significantly, research has shown that careless use of voiceover, graphics and visualisations can also be detrimental. Even the best-looking page-turning animation quickly becomes a nuisance for most learners who just want to acquire the necessary knowledge and get back to work.

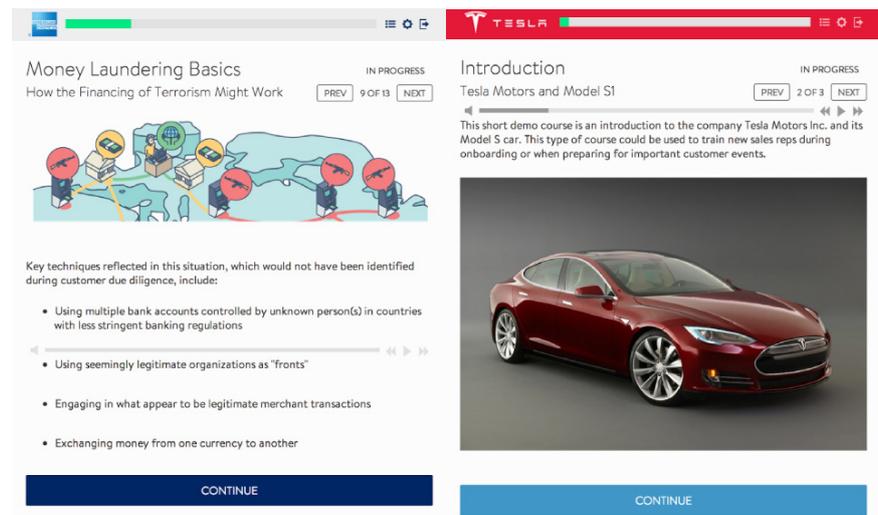
A more important factor for engagement is the quality of the content. As an illustration of this, think about the many books that engage people deeply despite their lack of graphics and animations and, in contrast, boring games and movies that are full of visual effects.

Semantic courses can natively offer a range of commonly used interactions and support media like images, video and audio. Should a learning situation require a more custom treatment it is also possible to embed non-semantic widgets. The concession authors have to make with this approach is the loss of precise control over user-interface behavior.

Thus, a semantic approach does not automatically increase or decrease engagement. It offers nearly the same scope to supplement text-based learning materials with other media and at the same time restricts the use of distracting elements like user interface animations. Furthermore, the semantic authoring approach affords the author more time to focus on how to structure the topic, produce relevant illustrations, and iterate on the explanations, instead of fiddling with layout or implementing multiple versions for different platforms.

CAN WE STILL STYLE COURSES TO MATCH COMPANY IDENTITIES?

Many companies want their branding to be reflected in courses they ask their employees to take, even if they buy off-the-shelf courses. With a semantic approach this is easy to achieve since course matter is so well separated from the details of the UI colors and layout. That is, the course styling can be set to reflect the corporate identity of the learner’s company. These company skins allow for quick and easy adjustment of color schemes, logo, and fonts. Deeper adjustments to layout are also possible.



HOW DOES THIS ALLOW US TO DELIVER EACH COURSE ON MULTIPLE DEVICES?

Different devices have different user interface styles, conventions, screen sizes, and constraints (like touch-screen only). To deliver great user experiences we must develop tailored interfaces to suit each context. On mobile, well-designed native apps are generally considered to provide better user experiences than web-apps running in a mobile browser.

With a semantic approach the course matter can be sent to a native mobile application which interprets it and presents it to the learner using native controls like swiping to change page and in a layout optimized for the screen size. These courses would behave more like iPhone games in that they would be completely native, not just HTML5 courses running inside an app wrapper.

Further advantages of running courses in a native app are the possibilities of integrating LMS functionality and offering offline learning, thus enabling learners to consume courses hassle free on the go.

WILL WE HAVE TO UPDATE EACH COURSE WHEN NEW PLATFORMS APPEAR?

Courses don’t need to be updated to support new devices. The split between course matter and user interface affords a process closer to how the Amazon Kindle works. When a new platform comes out, a new app is built for it

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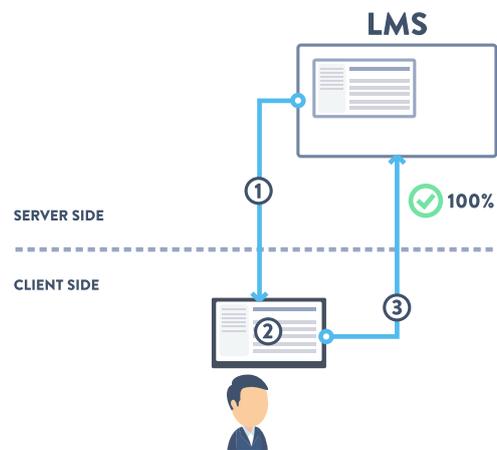
WHAT IF WE WANT A NEW TYPE OF BEHAVIOR IN OUR COURSES?

Adding new types of content, like new exercise types, is a matter of extending the semantics of the courses. In other words, giving authors a way to express new types of meaning and making all parts of the software understand this new meaning. This is associated with some up-front development cost for software developers and interface designers, but once done, it pays off quickly. To make use of the new feature, authors just have to express what they mean and are guaranteed reliable functionality and great interfaces on all devices.

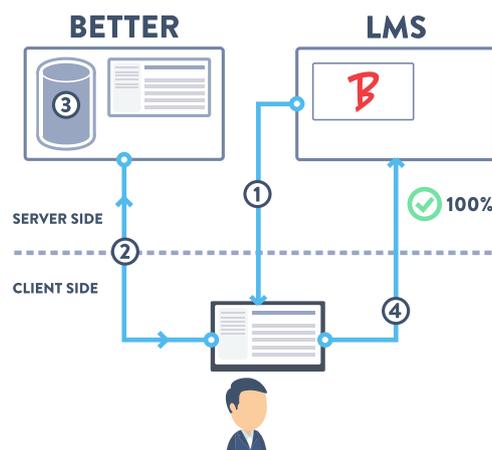
MOVE COURSES TO THE CLOUD

1. At the start, the learner's computer downloads the entire course from the LMS.
2. The course is self-contained, and thus doesn't really communicate with the server during the learning interaction. Everything happens inside the learner's browser.
3. At the end, the course sends a completion message to the LMS.

Today, courses are usually self-contained packages that consist of a Flash program or HTML pages. Such packages are uploaded to a Learning Management System (LMS) for delivery, but the original, editable version lives on the author's local computer. Each learner downloads the fixed course package from the LMS and then runs it locally on their computer, tablet, or smartphone. When they complete the course, the package reports the result back to the LMS via the Internet.



1. At the start, the learner's computer loads the course wrapper from the LMS. This wrapper points to Better and loads the course from there.
2. The course is dynamic, i.e. the entire learner interaction is dynamically controlled and adapted through continuous communication between the learner's computer (or smartphone, tablet) and Better.
3. We model the learner's knowledge on individual questions and concepts based on what they've read, how they answer questions, etc. All such actions are recorded and can be analyzed or audited.
4. Once Better marks the course as finished, the course wrapper sends a completion message to the LMS.



The alternative approach is to let the full course live in the cloud (on a server), allowing both authors and learners to interact with the course via the server instead of a static package of files. This is the approach Dropbox, Box, online accounting software, Google Docs, and other modern and popular tools have taken because of the many advantages associated with this. As we will see in this section, this approach has several advantages.

WHAT ABOUT SCORM COMPATIBILITY?

SCORM is a popular standard protocol that courses use to report progress and completion status to LMSs. If we move courses to the cloud, will this still work?

Yes, cloud-based courses still work with SCORM-based LMSs. LMS administrators add cloud based courses just like they add legacy courses to the LMS - by uploading a package. The difference is that for cloud-based courses this package contains enough information to run the course from the cloud, but

Yes, cloud-based courses still work with SCORM-based LMSs.

not the full course content. The user does not experience any direct difference however.

CAN CLOUD-BASED COURSES BE ACCESSED VIA MOBILE?

When courses live in the cloud and have a clean separation between interface and course matter as discussed in the previous section, they can also be accessed via native mobile apps. After the user identifies themselves to the mobile app, it downloads the list of assigned courses and current progress in each one, offering the user to continue where they left off, even if they previously took the course via an LMS. If they then take the course from the LMS again, they will continue from where they left off on the mobile app.

The only thing that needs special integration is reporting mobile completions automatically to the LMS. This integration only needs to be solved once for each company and does not require any learner or author action at all. (Alternatively, completion achieved on a mobile device will be reported to the LMS as soon as the learner launches the course from the LMS.)

DOES THIS MEAN THERE IS NO OFFLINE MODE FOR MOBILE?

Cloud-based courses sound good so far, but what about learning offline? On mobiles we sometimes have slow or even no Internet connection - does that mean learners can't take the course?

Cloud-based courses can support offline learning. We need an Internet connection to load and report progress and completion, just like we do when taking courses from an LMS today. This is to be expected since courses can change and we want to make sure we collect data for generating analytics and visualizations.

Mobile offline mode would have the app download the latest version of the course and the learner's progress when it is online. It then uses a runtime built into the course app to let the user take the course. As it does this, the app locally stores the user's actions which it will automatically synchronise with the cloud when it next has an Internet connection. This way, we get the best of both worlds.

WHAT SECURITY IMPLICATIONS DOES THIS HAVE?

Cloud-based courses store both the course itself and the learners' progress in the cloud. This is of course password protected, just like your email or online documents. If security requirements are particularly high, the course server can even be set up behind a company's firewalls. (We have, however, found that this is usually not necessary.)

Cloud-based courses have a noteworthy advantage in another aspect of security. Because these types of cloud-based courses synchronise learner actions on a detailed level, we get a better understanding of what the learner has actually done. This is in contrast to SCORM reporting which usually just

It turns out that legacy SCORM courses are vulnerable to a very simple hack that reports full completion to the LMS despite the learner having seen only the first page.

reports a single number to the LMS in a way that is easy for learners to fake.

It turns out that legacy SCORM courses are vulnerable to a very simple hack that reports full completion to the LMS despite the learner having seen only the first page. Cloud-based courses have resilience against this hack because they store a detailed record of actions against which the LMS record can be compared for verification. You can read more about this at <http://better.com/en/secure-compliance-training/>.

HOW DO YOU UPDATE CLOUD-BASED COURSES?

One of the key advantages of cloud-based courses is that corrections or updates are quick and easy to make and deploy. If a typo is discovered in an Italian translation or if a sales course needs a new section added because of a last-minute change to the company's latest offering, that can be done via the online interface and released to all learners immediately, without any re-uploading of a package to the LMS. The cloud service will simply start serving the new version as soon as the authors approve the change.

This is a significant time-saver for authors and ensures that learners always have the latest and most up-to-date information available.

One could also take this further and add more advanced features so that learners get automatic notifications when new content is added to a course they are taking or an important correction is made to material they have already learnt.

PROVIDE AUTHORS WITH A POWERFUL FRAMEWORK

By letting authors build courses on a framework that provides adaptivity, multi-device compatibility, and analytics for free in every course, we significantly increase their productivity and ability to produce great learning experiences.

By framework we mean tools, building-blocks, and infrastructure that course authors can leverage. Concretely, this is a cloud-based web-service that provides interfaces for authors to create, edit, and test courses, export SCORM packages, view analytics, expose learner APIs, and other things that give each course rich functionality as standard. It is infeasible for individual authors to develop all this functionality for each course; this is why the framework approach is so valuable.

DON'T AUTHORS ALREADY HAVE THIS WITH PROGRAMS LIKE ARTICULATE AND CAPTIVATE?

Articulate and Captivate provide standard components like templates, question types, and other “patterns”. However, the end result is still a fixed package where the course matter is mixed with the interface. This means you lose the benefits associated with a semantic approach, such as built-in adaptivity, quick and easy updates, automatic analytics, possibility of direct learner feedback, true multi-device support, or streamlined workflows.

You can think of these legacy programs like PowerPoint specialized for creating SCORM courses that are only meant to be run in the browser. They are good at what they aim to do, but that is rapidly becoming obsolete in the heterogeneous, demanding, and connected world we have seen emerge recently.

HOW CAN YOU GET ADAPTIVITY “FOR FREE” IN EACH COURSE?

By providing authors with carefully thought-through course structures, we can provide adaptive logic to learners without authors programming this adaptivity themselves. Instead, authors write questions and specify how these relate to course knowledge which the adaptivity logic uses to provide

appropriate behavior.

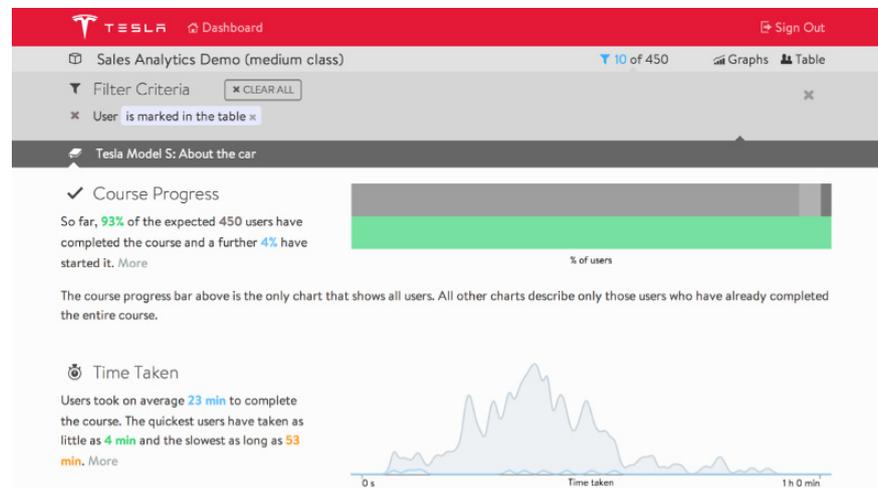
It is worth noting that the design of adaptive behavior needs to not only generate behavior that makes sense to learners, it also needs to make it easy for authors to express their intentions, and provide analytics that can be interpreted by managers. Thus, it makes more sense to invest in developing each of these behaviors once and then reuse them in different courses (with different content and configuration of course) than to write custom adaptive behavior for each course.

WHAT KIND OF ANALYTICS WOULD YOU GET FOR A COURSE?

By analytics we refer to insights and information about how learners perform in the course. This can be presented to authors and managers as interactive charts that can be filtered and drilled down into, but the data could also be exported in raw form to be analyzed with tools like Excel. Examples of information that analytics might show are:

- Which questions do learners most frequently get wrong?
- Which wrong answers are the most common?
- How long does it take learners to complete the course?
- How much time do learners spend on a particular page or section?

Because of the clear separation between course matter and interface, these analytics can be generated regardless of whether the learner takes the course via SCORM, web, or mobile.





ALRIGHT, BUT ARE THERE NO DOWNSIDES TO A FRAMEWORK APPROACH?

The downside to the framework approach is that the up-front costs to design and build the framework are significant. Similarly, far-ranging changes to the framework can be expensive. However, additions and adjustments can be comparatively cheap if the framework is designed with such changes in mind.

Once the framework has been built, the payoffs are significant and immediate. A simple analogy would be a car assembly line or a printing press - to build these up in the first place is expensive, but when they have been built they produce higher quality cars or books more cheaply and in a fraction of the time it would otherwise take.

STREAMLINE COURSE PRODUCTION

Professional course production involves several people in different roles: instructional designers, subject-matter experts, legal reviewers, translators, voice-over artists, illustrators, and testers, to name a few. Coordinating this work can be a time-consuming and error-prone process for legacy courses. For example, it is common for coordination to rely on emailing course files with names like *ComplianceCourse-EN-DE-ZN-v3-20140912-fixed-James.zip* back and forth with comments and corrections spread over emails, course files, and verbal conversations.

A cloud-based framework allows us to streamline this process with significant time and quality benefits. Because courses live in the cloud, changes to them are immediately visible to others and permissions and interfaces are tailored to people's roles.

WON'T QUICKER COURSE PRODUCTION HARM QUALITY?

No, because the things that take the most time in course production today are not directly related to the quality of the course, but instead relate mostly to coordination. By improving this coordination, we can reduce the time required to produce a course while actually increasing its quality thanks to fewer mistakes, faster updates, and freeing up time to spend on course matter development rather than coordination.

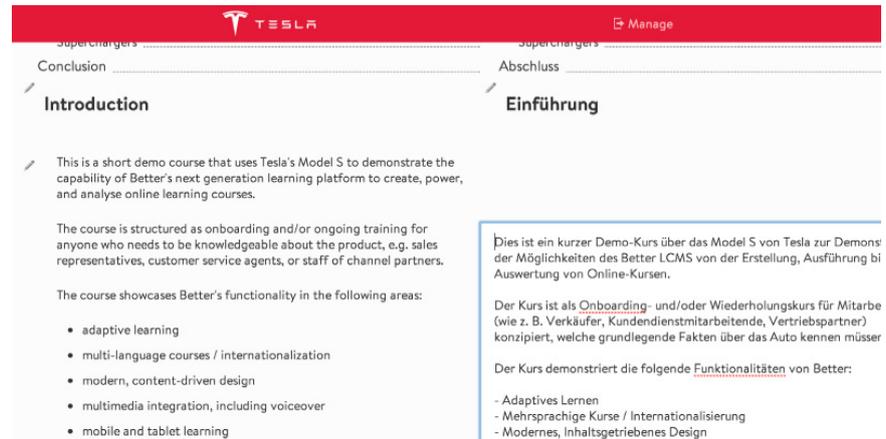
WHAT DOES THIS MEAN FOR LANGUAGE TRANSLATIONS?

One of many opportunities to streamline course production is in the handling of language translations. A translation agency, or even individual translators, can be assigned an account and a task by the course author. They log in and are told which translations are to be done. Translators then have full context, have the ability to enter their translations directly, are told where the original content has changed since their latest translation, and get feedback from customer testers and reviewers. This avoids most of the version coordination hassle common in translations today.

We can easily see that similar functionality can be added for voice-over art-

ists or illustrators, for example.

Example of an interface to edit translations.



WHAT DOES THIS MEAN FOR MANAGING SIGN-OFF AND UPDATES?

Another opportunity to improve workflow is to specify exactly which people have the right to sign off on updates. For example, the compliance officer can get an email when the course author thinks that an update is ready to be deployed. The compliance officer clicks a link in the email which takes them to a page where the change is highlighted and they have the option to approve or reject the change. If they approve it, the course is updated and from then on all learners will get the latest version automatically.

WHAT OTHER WAYS ARE THERE TO IMPROVE THE WORKFLOW?

The approach described in this white paper allows for several other ways to improve the workflow. Possible examples include: issue tracking with comments, a beta-tester role, making “living courses” that stay assigned to learners and adapt over time as the topic changes (say as a product gets new features), or re-using different parts of courses to produce different variations for different target groups.

CONCLUSION

The four strategies discussed in this paper - semantic, cloud, framework, and workflow - have the potential to radically improve how we build, deliver, and manage e-learning. They form the foundation of bringing e-learning into the modern multi-device era and bring with them a whole set of advantages in addition to device compatibility: adaptivity, detailed analytics, reduced development costs, and higher quality courses stand out as the most prominent benefits among many others.

Better is the first company to have developed course software based on this approach and we have seen all the benefits expected from it as discussed in this white paper. Since we have found that most customers would prefer to purchase our product as part of a larger offering with services, content libraries, or a broader talent software offering, we are now looking for the right partner to commercialize the technology.

If you represent a company in the training or software business and want to find out more about whether this kind of software could benefit your offering, we will be delighted to speak with you.

