CASE STUDY 9

EPUB 3

The Birth and Adolescence of an Unusually Visible Standard

BILL KASDORF

Most standards are invisible to those who benefit from them; and, usually, this is a good thing. We don't normally worry about the spacing of the steps in a staircase. We notice, in a very old one, when the spacing is not what we expect, but even then not one person out of a thousand will realize that we have a standard to thank for the fact that we rarely stumble, we just step. We're conscious of the need for standards to accommodate those to whom steps are a barrier—ramps for accessibility have become commonplace—but we're oblivious to the standards for the steps themselves.

EPUB, the standard single-file format for e-books and other digital publications, has, in contrast, provided a highly visible, very public opportunity for people to witness the creation, implementation, and evolution of a standard that has come to touch the majority of the literate public. E-books are everywhere today; some books from major publishers sell as many copies of the title as e-books as they do in all other formats combined. Only a few years ago such e-books were a pipe dream.

Why has the EPUB *standard* become so visible? Because the ecosystem is so messy without one. Publishers want to make one file that works for all retailers and platforms; booksellers want to get predictable, reliable files from publishers; librarians want to be able to lend books that patrons with any e-reading device can access; readers want books that provide experiences as rich and

flexible as those they have come to expect from the Web. That's the promise of EPUB 3,[1] the current generation of the e-book standard. We are still watching, and waiting, for it all to work. The standard is growing up before our eyes.

Standards Don't Come Out of Nowhere

Like most standards, EPUB 3 was created in response to a need. As can be readily inferred from its number, it is the third generation of its recent lineage. Its immediate predecessor, EPUB 2.0.1, was a successor to the Open E-Book standard (OEB), which was created in 1999 for an early, short-lived burst of enthusiasm for e-books (remember the Rocket eBook?). OEB provided the basis for a gradual, but mostly behind-the-scenes, evolution of the standard, which was renamed EPUB in 2007, the same year that Amazon introduced the Kindle—a hugely popular but highly proprietary e-reader, which did *not* use the EPUB format.

The Kindle succeeded in igniting the market, making it easy to acquire and read books in electronic form on a handy, relatively inexpensive device. The subsequent proliferation of e-readers made the need for a standard obvious: publishers simply could not afford to make and manage multiple unique proprietary versions of each book. And the EPUB standard had gained some important adherents, most prominently Google, who made millions of books available in the EPUB format. By 2010, EPUB had evolved to version 2.0.1, which is the format in which the majority of e-books are still created.

But there was a much more prominent watershed event in 2010: Apple's release of the iPad. In its famous product introduction, Steve Jobs featured its use as an e-book reader—in fact, iBooks, Apple's e-book marketplace, was introduced at that same time, and thankfully, it was based on EPUB. But book reading was only one of many exciting capabilities of the new tablet. You could watch movies on it. You could play games. You could surf the Web, e-mail your friends, and do pretty much anything else you could do online. And like the iPhone, it quickly made thousands of apps available.

This was a wake-up call to the publishing industry. Until the iPad came along, e-readers were basically limited to working for trade books—fiction and straightforward, text-based non-fiction. That's basically what EPUB 2.0.1 had come to be used for. But now, with the iPad and its rapidly proliferating competitors, there was a demand for digital versions of many different types of publications for which the then-standard e-readers, and EPUB 2.0.1, were inadequate but for which tablets were ideal: textbooks, children's books, cookbooks, magazines, and other publications with complex layouts and that benefitted from scripting, interactivity, and multimedia.

Collaboration as a Foundation for Differentiation

While work to advance beyond the EPUB 2.0.1 standard had already begun, the launch of the iPad galvanized it. The International Digital Publishing Forum (IDPF),[2] the custodian of the EPUB standard, formed the EPUB 3 Working Group and chartered it with an extremely ambitious mandate: to update the EPUB standard to accommodate audio, video, scripting, interactivity, sophisticated typography, complex layout, all in an accessible manner and with global language support, while preserving backward compatibility with the millions of EPUB 2.0.1-based e-books then available. *Quickly.*

Unlike many other standards organizations, the IDPF is built to be agile. Its membership is open to any organization, commercial or noncommercial. Its standards are developed and approved by its members, who vote to approve them; and its governance rules are designed to enable it to respond relatively rapidly to the needs of the marketplace.

The EPUB 3 Working Group attracted a large and diverse group of participants: from the largest trade and educational publishers to the smallest scholarly ones; publishers of all types of publications, from reference books and cookbooks to magazines and manga; and many other participants, from individual programmers to technology companies like Google and Adobe, retailers like Barnes & Noble and Apple, distributors like VitalSource and CourseSmart. It was truly a peaceable kingdom of erstwhile competitors working together for the common good.

The dynamic is interesting, and instructive. While all of the nearly 170 organizations involved in the working group had particular interests, many of them proprietary, they all recognized that unless there was a firm, non-proprietary standard to build on, they would have to reinvent too many wheels and the market would fragment. If it didn't scale, it would not succeed, and it could not scale without a nonproprietary foundation. So they worked together, in a totally open, public mode—all drafts, all e-mails, were publicly visible, with no intellectual property claims on the result—to create a standard that they all could use to accomplish their own individual goals.

Basing a Standard on Standards

One of the fundamental mandates was that EPUB 3 would be standards-based. What is often emphasized is that it is based on HTML5, which is the standard for modern web technology. But that is only part of the story: EPUB 3 is based on a very rich complement of standards, and it's designed to evolve as the standards it's based on evolve.

What is commonly thought of as HTML5 is really a combination of three fundamental standards: HTML5[3] for structural and semantic markup, Cascading Stylesheets (CSS3)[4] for presentation, and JavaScript[5] for functionality. At a more technical level, what is generically referred to as HTML5 and more accurately characterized as the open Web platform is actually composed of many different standards and specifications used by modern Web technology, like MathML[6] for math and Scalable Vector Graphics (SVG) for graphics.[7]

And HTML5 is not the only standard on which EPUB 3 is based. Fonts can be OpenType[8] or WOFF.[9] Images can be JPEG,[10] TIFF,[11] PNG,[12] or SVG. The metadata model is based on Dublin Core;[13] but it also enables an EPUB to include a MARC[14] record, an ONIX[15] file, and other standard resources. EPUB 3.0.1 added support (because HTML5 did) for RDFa[16] and microdata, most notably accommodating schema.org[17] metadata. For accessibility, the DAISY standards[18,19] are fundamental to EPUB 3.

In general, the principle was this: if there is an existing, widely used standard, especially as used in modern Web technology, that addresses some requirement of EPUB 3, then adopt it, do not reinvent it. For a standard to work well, and to be widely adopted, it needs to work and play well with all the other standards it relates to.

Standards Can Be Moving Targets

Making this even more interesting, many of those standards themselves are in a process of evolution. Most importantly in the context of EPUB 3, the formal HTML5 specification from the W3C, while already the basis for modern browser technology and an increasingly large share of websites worldwide, was not expected to be a formal, finished recommendation until at least a couple of years after the publication of EPUB 3.0. In this case study, *EPUB 3* refers to the standard generally while *EPUB 3.0* or *EPUB 3.0.1* refer to specific version instances of the standard.

As one might imagine, this prompted intense discussion in the EPUB 3 Working Group. Compromises needed to be made. For example, EPUB 3.0 could not specify a video codec (a codec is an encoding format used for a video, and there are many of them) because HTML5 is agnostic on that point.

Another example comes from the metadata side. The early drafts of the metadata model in EPUB 3.0 used a mechanism based on RDFa, which had been a fundamental aspect of HTML5; but at the time EPUB 3.0 was being drafted, there was a debate in the HTML5 community as to the commitment to RDFa, the possible shift to microdata and microformats, or some

other solution. The EPUB 3 Working Group decided to use neither RDFa nor microdata in EPUB 3.0 because the risk of picking the wrong one and winding up in conflict with HTML5 was too great. Instead, it decided to align with HTML5 whenever HTML5 resolved the issue. As mentioned previously, the new EPUB 3.0.1 spec accommodates both, because HTML5 now does.

Filling in the Missing Pieces

Even when standards are available that address fundamental needs, they do not always do everything you need. EPUB 3 is not just an assemblage of existing standards; it uses those standards in a systematic way, but it also augments them when necessary.

HTML5, for example, is more inherently semantic than its predecessors, and EPUB 3 makes great use of that, recommending that HTML5's semantics be used whenever possible. So while it is still permissible to use the common element for a section of content (which is, fundamentally, nothing more than a generic container, not a particular kind of container), EPUB 3 strongly prefers the use of HTML5's <section> element for the hierarchical components of the main narrative flow of a document, and its <aside> element for things like sidebars and footnotes that are outside that linear flow.

But to provide the level of semantic clarity needed for accessibility, EPUB 3 had to go beyond what is built into HTML5. A Structural Semantics Vocabulary[20] was created—in general, a subset of the DAISY 4 vocabulary for accessibility[21]—that enables a publisher to specify, for example, in a standard vocabulary, that a particular <aside> is a footnote, and a different <aside> is a sidebar. To do this, a new attribute was created, epub:type, which is not part of HTML5. That way, HTML5's class attribute can still be used to govern style sheet rendering via CSS, as it is designed to do, while the new "epub:type" attribute provides structural semantics that are primarily for use by assistive technologies (though the richer semantics, like most accessibility features, provide obvious value in general: knowing that a footnote is a footnote and not a sidebar is clearly a good thing).

Why the Surprise That It Doesn't All Work Everywhere at First?

EPUB 3.0 was released to the world on October 11, 2011, to high expectations. The working group had met an extremely aggressive schedule. The publishing

industry was grateful for the clarity. Many jumped on the bandwagon—which seemed to just sit there, as if somebody forgot to hook up the horses.

Admittedly, the pace of adoption has been slower than anticipated. But what is often forgotten is that it was essential to get the specification done before the technology evolved past the point of no return. The specs had to come first; then, the technology companies, the retailers, and the device manufacturers needed to develop and refine their platforms and systems and devices to take advantage of them.

This actually did happen. Gradually, more and more systems became more and more EPUB 3 compatible. But the early perception that "it doesn't work anywhere yet" became so ingrained and entrenched that publishers often failed to see how far adoption had progressed. Another lesson in standards development: sometimes psychology is as important as technology.

Making the Standard Evolvable

EPUB 3.0, unlike its predecessors, was designed as a modular, not a monolithic, standard. Just as EPUB 3 was committed to being backward-compatible with EPUB 2.0.1, it is committed to maintaining its stability as additional features and functionality are added. Soon after EPUB 3.0 was published, additional IDPF Working Groups were formed to address needs that were not addressed in the initial release.

One of the first issues to be addressed was the surprising demand for fixed-layout e-books. EPUB is fundamentally and inherently a reflowable format: it enables a single EPUB to render well on a wide range of devices, from laptop and desktop computers to tablets to smartphones. This is arguably its most useful aspect; unlike PDF, it can take advantage of the layout possibilities of larger screens while adapting to the limitations of small ones. But certain types of books—most prominently, at first, children's books—have inherently page-based designs that simply cannot reflow. This wasn't evident until the tablets came along, which made it possible to deliver fixed layout publications legibly, which the previous e-readers could not do. As it turned out, there was nothing in the EPUB 3.0 specification that prohibited or prevented fixed layout. A working group was formed that quickly produced an informational document that offered a solution, primarily in providing the metadata necessary to manage fixed-layout publications. This was then subsequently incorporated into the EPUB 3.0.1 release.

Two other working groups quickly formed as well: one devoted to dictionaries and glossaries and the other devoted to indexes. Both of those working groups produced specifications that added to the basic EPUB 3.0 spec to

accommodate the special needs of those types of content in a standardized way. Other such working groups have been formed, and new ones will come up from time to time.

The idea is to make EPUB 3 better and better without producing an unstable foundation. The standard as published—with the exception of bug fixes and spec clarifications—is stable, but that doesn't mean new functionality can't be added.

Becoming the Basis for Other Standards

In confirmation of the need for EPUB 3, it has quickly been adopted as a basis for other standards.

Because accessibility was a fundamental design concern for EPUB 3 in the first place, it has turned out to be very useful to the accessibility community. Accordingly, the DAISY Consortium[22] has adopted EPUB 3 as standard for the delivery of new DAISY 4 accessible files. This is enormously important, enabling publishers to use the same format for delivery of accessible content as they do for digital publications in general.

As another example, IDEAlliance,[23] the organization responsible for many of the standards used by the magazine and commercial publishing world, developed a new generation of their important PRISM[24] standard in an initiative called nextPub[25] that was explicitly designed to be compatible with, and complementary to, EPUB 3. This resulted in a new standard for source content for publications called PRISM Source Vocabulary (PSV)[26] that is engineered to optimize the creation of EPUB 3 as a way to deliver publication content.

The IDPF is actively involved in developing "EPUB Profiles" that provide specifications for the use of EPUB 3 to address the needs of specific types of publications or particular interest groups. Currently, work is actively underway to develop "EDUPUB," an EPUB Profile for educational content, and an EPUB Profile for Magazines. These two profiles should provide models for the creation of EPUB profiles that will help expedite the implementation of EPUB for many other types of publications in the future.

It Works Right Now—But Work is Ongoing

Just as reading systems are rapidly adopting the EPUB 3.0 standard, the standard itself is continuing to evolve in important ways. The IDPF EPUB Working Group produced an update to the standard, EPUB 3.0.1.[27] While

this revision mostly focused on bug fixes and spec clarifications, it includes some important improvements to the basic standard.

For example, it was recognized that there is a need for the *Structural Semantics Vocabulary* to be updated and expanded on an ongoing basis, rather than waiting for new formal versions of the spec to be issued. It was clear that the initial vocabulary did not, for example, adequately address the needs of educational content; and the work on indexes and dictionaries produced important new vocabularies as well. The revised spec both accommodates additional vocabulary terms and also makes it easier for specific user communities to associate other vocabularies with EPUB.

In another important development at the time of this writing, EPUB 3 is in the final stages of becoming an ISO (International Organization for Standardization) technical specification. This is important for many reasons, but two stand out: it puts a truly global seal of approval on it, and it makes EPUB much more likely to be officially adopted by various institutions, organizations, and countries.

And the IDPF realizes that making a standard like EPUB successful requires more than just writing and publicizing the standard; it requires support. An EPUB Samples Project[28] has been created, to provide authoritative examples of how EPUB 3 has been used in actual publications. A Conformance Test Suite[29] has been developed to provide a set of files that systematically test reading system compliance with each aspect of the EPUB 3 spec, and the BISG (the Book Industry Study Group) has collaborated with the IDPF to provide systematic testing and publication of the results as a next generation of its popular BISG EPUB 3 Support Grid.[30] EPUBCheck software[31] has been created to enable publishers to test their EPUB files for compliance. And the Readium Foundation[32] has been established to continue to refine the browser-based open source implementation of all EPUB 3 features, known as ReadiumJS,[33] and expand it to create a library of open source tools for the creation of EPUB 3-compliant devices, systems, and platforms, known as Readium SDK.[34]

Lots of Lessons Learned

What lessons can we derive from watching the ongoing evolution of the EPUB standard? I would suggest the following as a good starting list:

- Standards must address real-world needs—when they're needed.
- Standards can't exist in a vacuum—they're part of a larger standards ecosystem.

- Basing a standard on standards is best; but sometimes you need to compromise.
- Broad participation in the creation of a standard encourages broad adoption.
- Standards need to evolve as the ecosystems they work in evolve.
- Adoption takes time; slower-than-expected adoption does not mean failure.
- Adoption is not always all-or-nothing; sometimes it is a matter of degree.
- It takes work to encourage and facilitate adoption.

There are many more. EPUB promises to continue to be a widely used, highly visible standard—in fact, a good number of people reading this book may be reading it as an EPUB. While we might hope that at some point in the not-too-distant future, EPUB will become as taken for granted as the standards for staircases, more work needs to be done before we'll get there. The good news: that work is ongoing; but EPUB works right now.

REFERENCE NOTES

1. *EPUB 3*. IDPF Recommended Specification. International Digital Publishing Forum, October 11, 2011. http://idpf.org/epub/30. [See ref. #27 for EPUB 3.0.1.]
2. International Digital Publishing Forum (IDPF). http://idpf.org/
3. *HTML5: A Vocabulary and Associated APIs for HTML and XHTML*. W3C Candidate Recommendation. World Wide Web Consortium, December 17, 2012. http://www.w3.org/TR/html5/
4. *Introduction to CSS3*. W3C Working Draft. World Wide Web Consortium, May 23, 2001. http://www.w3.org/TR/2001/WD-css3-roadmap-20010523/
5. JavaScript is codified in: *Information technology—Programming languages, their environments and system software interfaces—ECMAScript language specification*. Edition 3. ISO/IEC 16262:2011. Geneva: International Organization for Standardization, May 25, 2011. http://standards.iso.org/ittf/licence.html [Also issued as ECMA-262, version 5.1.]
6. *Mathematical Markup Language (MathML)*. Version 3.0. W3C Recommendation. World Wide Web Consortium, October 21, 2010. http://www.w3.org/TR/MathML3/
7. *Scalable Vector Graphics (SVG) 1.1*. Second Edition. W3C Recommendation. World Wide Web Consortium, August 16, 2011. http://www.w3.org/TR/SVG11/
8. *OpenType Specification*. Version 1.6. Microsoft Corp. and Adobe Systems, 2009. http://www.microsoft.com/typography/otspec/ [Also published as: *Information technology—Coding of audio-visual objects—Part 22: Open Font Format*. ISO/IEC 14496–22. http://standards.iso.org/ittf/licence.html]
9. *WOFF [Web Open Font Format] File Format 1.0*. W3C Recommendation. World Wide Web Consortium, December 13, 2012. http://www.w3.org/TR/WOFF/
10. *Information technology—Digital compression and coding of continuous-tone still images: Requirements and guidelines*. ISO/IEC 10918–1:1994. Geneva: International Organization for Standardization, 1994. http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=18902

11. *Graphic technology—Prepress digital data exchange—Tag image file format for image technology (TIFF/IT)*. ISO 12639:2004. Geneva: International Organization for Standardization, 2004. http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=34342
12. *Information technology—Computer graphics and image processing—Portable Network Graphics (PNG): Functional specification*. ISO/IEC 15948:2004. Geneva: International Organization for Standardization, 2004. http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=29581
13. *The Dublin Core Metadata Element Set.* ANSI/NISO Z39.85-2012. Baltimore, MD: National Information Standards Organization, February 25, 2013. http://www.niso.org/standards/z39-85-2012
14. MARC Standards. Library of Congress. http://www.loc.gov/marc/
15. *ONIX for Books*. Release 3.0. EDItEUR, April 2009. http://www.editeur.org/12/About-Release-3.0/
16. *RDFa 1.1 Primer: Rich Structured Data Markup for Web Documents*. W3C Working Group Note, June 7, 2012. http://www.w3.org/TR/2012/NOTE-rdfa-primer-20120607/
17. Schema.org. https://schema.org/
18. *Specifications for the Digital Talking Book (DAISY 3)*. ANSI/NISO Z39.86-2005 (R2012). Bethesda, MD: National Information Standards Organization, April 12, 2005; reaffirmed April 16, 2012. http://daisy.niso.org/#dtb
19. *Authoring and Interchange Framework for Adaptive XML Publishing Specification (DAISY 4)*. ANSI/NISO Z39.98-2012. Baltimore, MD: National Information Standards Organization, July 9, 2012. http://daisy.niso.org/#aiframework
20. *EPUB 3 Structural Semantics Vocabulary*. International Digital Publishing Forum, November 11, 2013. http://www.idpf.org/epub/vocab/structure/
21. *Z39.98-2012 Structural Semantics Vocabulary*. DAISY Consortium, December 19, 2012. http://www.daisy.org/z3998/2012/vocab/structure/
22. DAISY Consortium. http://www.daisy.org/
23. IDEAlliance. http://www.idealliance.org/
24. *Publishing Requirements for Industry Standard Metadata (PRISM)*. Version 3.0. Alexandria, VA: IDEAlliance, October 4, 2012. http://www.idealliance.org/sites/default/files/PRISM_3.0_0.zip
25. nextPub. http://www.idealliance.org/specifications/nextpub/about-nextpub
26. *PRISM Source Vocabulary (PSV)*. Version 1.0. Alexandria, VA: IDEAlliance, September 27, 2012. http://www.idealliance.org/sites/default/files/PSV_V1.0.zip
27. *EPUB 3.0.1*. Recommended Specification. International Digital Publishing Forum, June 26, 2014. http://idpf.org/epub/301
28. *IDPF Announces EPUB Samples Project*. International Digital Publishing Forum Press Release, February 12, 2012. http://idpf.org/news/idpf-announces-epub-samples-project
29. *EPUB Reading System Conformance Test Suite Project Kicks Off*. International Digital Publishing Forum Press Release, October 25, 2012. http://idpf.org/news/epub-reading-system-conformance-test-suite-project-kicks-off
30. *EPUB 3 Support Grid*. Book Industry Study Group, June 19, 2012, initial publication; continually updated. http://epubtest.org/
31. EPUBCheck 3.0. http://code.google.com/p/epubcheck/wiki/EPUBCheck30
32. Readium Foundation. http://readium.org/
33. ReadiumJS. http://readium.org/projects/readiumjs
34. Readium SDK. http://readium.org/projects/readium-sdk