The System Architecture and Tools of the Partnership for Assessment of Readiness for College and Careers

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This paper is a supplement to an earlier paper on the systems being developed by the multi-state assessment consortia funded under the Race to the Top Assessment Program titled "Leveraging the Systems and Applications Being Developed by the Race to the Top Assessment Consortia to Advance Teaching, Learning and Assessment in Content Areas Other Than English Language Arts and Mathematics" available at www.k12center.org.

PARCC Architecture Overview

The open-source PARCC system, as described below, will be accessible to PARCC states, districts, and educators via the web in the fall of 2015. It includes an *assessment delivery platform* (ADS; created by contractor Breakthrough Technologies, LLC), an *assessment content repository* (Breakthrough Technologies, LLC), a *data management and reporting system* (DMRS; created by Amplify Education, Inc.), and a *partnership resource center* (PRC; Breakthrough Technologies, LLC).

Each PARCC component is described in greater detail below:

- *The ADS* provides the PARCC states with the functionality to deliver formative, diagnostic, speaking, and listening, K-2, performance-based and end of year assessments, as well as midyear performance-based modules. Assessments will include nonsummative, diagnostic assessments including math comprehension, math fluency, English language arts (ELA) reading comprehension, vocabulary, decoding, writing to sources, reading fluency, and reading motivation survey. The ADS platform includes the delivery of necessary student accommodations, as well as student registration and scheduling, and temporary storage of results.

- *The assessment content repository* includes an item bank and a test bank. All PARCC assessment content will be stored here, including test specifications, forms, and test items with their associated media components. The assessment content repository will allow administrators to import assessment content from within PARCC as well as from third-party content repositories and developers, to produce test packages, and to export tests to the ADS.

- *The DMR* provides PARCC with secure, post-assessment data storage, management, reporting, and analysis, including both statistical and psychometric analyses. The system includes a *data warehouse*, which will allow the import of assessment results as well as exportation to external test analysis systems, and a *reporting engine*, which allows both static and dynamic report generation, report templates, and exportation of reports to PARCC states. The DMR will interface with the ADS described above as well as with the shared technology components of the PARCC system (see below). The DMR will also interface with the summative ADS developed by Pearson and will integrate the data generated from the summative tests with the formative and diagnostic data generated within the PARCC system.

Privacy and data security are critically important to the partnership and its member states. The DMRS will comply with the PARCC Data Privacy and Security Policy, which includes the following requirements:

- Strictly limited access to the data warehouse by PARCC and PARCC contractors.
- Each PARCC member state will retain control of and responsibility for their data. Data will not be shared by PARCC with outside entities, including the federal government.
- All data will be encrypted, including internal and external communications.
- Strong authentication protocols will be in place for system and test access.

- The *Partnership Resource Center (PRC)* will include a *digital library* for storage of multimedia content and its associated metadata, a *website* for searching and browsing of the digital library, and a *professional learning center* with interactive professional development content and limited learning management system functionality. Finally, a *PRC Toolkit* will allow educators to interact with and disseminate public assessment items and resources through the PARCC website, and educators will be able to create or modify assessment items to build their own assessments (see the Item Banking, Creation, and Customization section below). The PRC will permit storage, access, collaboration, supplementation and rating/evaluation of curated PARCC resources as well as external resources, via the use of social media tools (see the Educator Collaboration section below).

- *Shared technology services* will be provided across all platform components. These services support the overall PARCC technology platform and include logging and monitoring functions, system alters, authentication management (single sign-on), and interoperability conformance testing.

Access to the PARCC Tools, Resources, and Materials

While many resources are already available on the PARCC website (http://www.parcconline.org), multi-tenant, interoperable tools will be accessible to PARCC states, districts, and educators via a public website in the fall of 2015. See Figure 1.
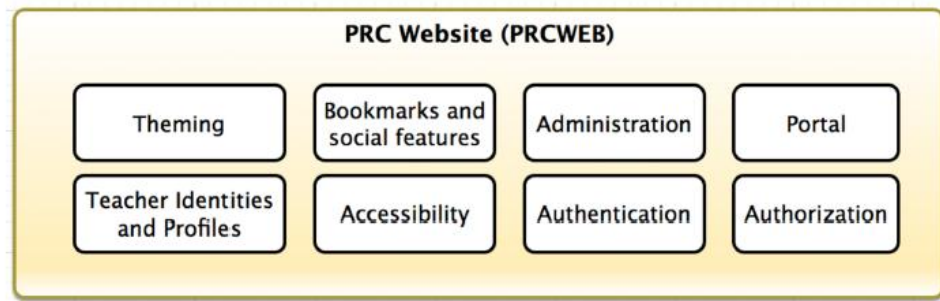

Figure 1. Partnership Resource Center (PRC) website.

In terms of multi-tenancy and system architecture, all PARCC states (*tenants*) will be able to access the tools online simultaneously, but proprietary assessment items, assessments, and digital library resources will not necessarily be shared with other states. Each state will be given digital access to their state data, and each state will individually determine what level of access to provide to district administrators and teachers.

Currently, there is no access for parents and students to the PARCC system. Parents and students will initially be provided with paper reports generated from the DMR system, and future possibilities include providing parent and student access to individual student data online.

Data Management and Reporting (DMR)

Access to the DMR will be limited and based on the permissions granted to users by each PARCC state. Generally, teachers will be able to generate individual student reports and compare them with other student and class reports within their school and between schools in their district. School and district administrators will be able to generate individual and comparative reports on school and district performance throughout the state, and state administrators will be able to generate reports comparing PARCC states. These reports will be available to the partnership and each state can decide which of these reports to make available to the public.

Item Banking, Creation, and Customization

The *item bank* is part of the assessment content repository and will be accessible through the PRC.

The item bank will be used to perform the following tasks:

- store and retrieve assessment items;

- store and retrieve metadata related to the assessment items (such as when the item was created and by whom, to which Common Core State Standard the item applies, etc.);

- create, edit, and store an unlimited number of items; and

- provide a search and filter capability.

The item bank will contain test items developed *exclusively* by content experts/educators and/or curated by PARCC. All items will be tied to the Common Core State Standards. These test items will be considered PARCC-certified and, late in 2015, they will be released to teachers through the PRC for direct, as-is use, or for downloading into a local learning management system (such as Moodle or Sakai) for customization. They system's in-depth search capabilities will allow teachers and district administrators to search for items and mix and match them to create their own formative assessments for use whenever they wish.

PARCC educators will be able to create their own items for their own use, but initially they will not become part of the PARCC item bank. Only content experts from PARCC will create all PARCC-certified items. However, there are initial plans underway to use a crowdsourcing approach, in which groups of teachers will be invited to submit formative test items that will then be evaluated by the PARCC content experts for potential inclusion in the item bank.

As described above, PARCC-certified items and practice tests can be downloaded by teachers to an external learning management system and then customized. The exact parameters of these possibilities are currently being discussed and finalized by the consortium. While ETS and Pearson will play a role in this work, all test items will ultimately be owned by PARCC.

Partnership Resource Center (PRC)

The PRC will be developed by Breakthrough Technologies, LLC, and, as mentioned earlier, it will contain a *digital library* and a *professional learning center* (PLC), as well as a *PRC toolkit*. See Figure 2.
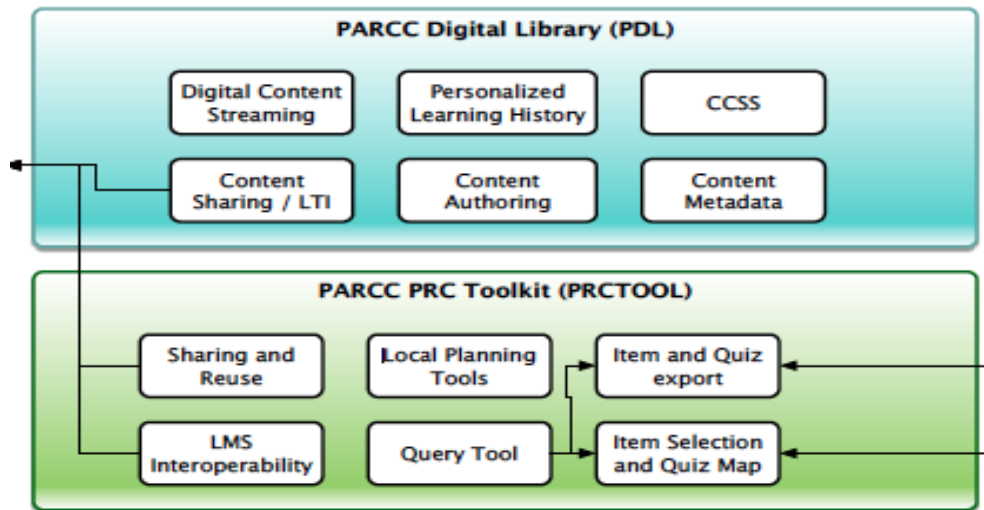
Figure 2. The PARCC digital library and the PARCC PRC toolkit.
CCSS = Common Core State Standards, LMS = learning management system,
LTI = learning technology initiative, PRC = Partnership Resource Center.

These components will all be accessible through the PARCC website, which will be the main portal for teachers and administrators. The website will include light learning management system functions to facilitate searching, discovery, resource evaluation and ranking, and educator collaboration. The PRC will support the integration of other open-source learning management systems including Moodle, Sakai, and Canvas, which are systems many teachers and administrators already use. In addition, the PARCC learning management system within the PRC will be interoperable with most major external interactive learning modules and courseware. Using this component, for example, teachers will be able to collect assessment items and assemble them into practice tests using an *item player* tool (which is connected to the item selection and quiz map component shown in Figure 2). Then practice tests can be saved and distributed on the PRC website or even on a teacher's own website.

The content in the *digital library* will include web content, digital learning, and professional development resources, as well as computer-based assessment items, multimedia files (text, image, audio, video and animation) and their accompanying metadata. Statistics such as item difficulty and samples of student responses including exemplary student work will also be available, which will help teachers contextually place these materials in their curricula and assessments. Teachers will be able to search for both internal and external resources based on keywords, metadata, content area, title, grade level, media format, and the Common Core State Standards, and then collaborate with other teachers as described in the next section.

Educator Collaboration

PARCC state and district administrators and educators will be able to view, search, download, and contribute educational materials and resources to the system and collaborate on evaluating those resources. Depending on state-level permissions, teachers and administrators will be able to specify whether a new resource they contribute should be kept for individual use, shared only with a small group of users (e.g., a group within a subject area, within an individual district or state), or shared more widely (e.g., across PARCC states). In addition to the extensive search, browse, filter, and discovery capabilities of the PRC, educators will be able to share, rate, and evaluate both PARCC resources, their own resources, and other publicly available materials. The intention is to allow both a rating (via stars or thumbs up or something similar) as well as text evaluations and comments on the resources, such that those materials receiving the highest ratings will be given priority within search results. Social media tools will permit teachers and district administrators to share ideas and collaborate as a group on a particular content area, grade level or the Common Core State Standards (similar to creating a group page on Facebook or a pin on Pinterest). Bookmarking and interaction with major blogging platforms will also be possible.

Professional Learning Center (PLC)

PARCC has developed the first two of a series of professional development modules to help teachers, counselors, and testing coordinators understand the new assessment system, read the results, and identify learning gaps to inform instructional decisions. The first two modules are the PARCC Assessment Overview (Theory and Practice) and the PARCC Accessibility System (Theory and Practice). Additional modules on the formative components of the system (K-2 Formative Instructional Tasks, Diagnostics, and Speaking and Listening Tools) are planned. These modules are not aimed at the public but rather for state and school use.

PARCC is also seeking additional partnerships with vendors and providers of professional development resources that can be used to help PARCC educators effectively apply the Common Core State Standards and the new assessment systems. Rather than re-invent the wheel by creating only new modules, they are hoping to find and evaluate existing professional development resources for inclusion in the *Professional Learning Center (PLC)*.

There is as yet no specific plan for training teachers in the use of the PRC, PLC, and other components outside of the main formative and summative assessment system. PARCC developers are investigating this need and expect to come up with a plan later in 2015.

For Stakeholders in Content Areas Other Than

English Language Arts (ELA) and Mathematics

Currently, all PARCC components are designed specifically to focus on support of ELA, literacy, and mathematics, as those subject areas are the focus of the Common Core State Standards. However, according to PARCC experts, there are plans to expand the reach of the system components more widely to other content areas, such as science, the arts and social studies. As the entire PARCC system is open-source, it will very likely be possible for member states to take and adapt components such as the item bank and item player for use with items from additional subject areas. The states can then begin to build the foundation of assessment items, practice tests, and professional development modules in these subject areas for individual PARCC states or for the entire consortium's use.

The Center for K–12 Assessment & Performance Management at ETS creates timely events where conversations regarding new assessment challenges can take place, and publishes and disseminates the best thinking and research on the range of measurement issues facing national, state and local decision makers.

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Invitational Research Symposium on
Science Assessment