

2006-2586: E-STADIUM: REAL-TIME GAME STATISTICS, HIGHLIGHTS, AND ENTERTAINMENT

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e-Stadium: Real-Time Game Statistics, Highlights, and Entertainment

Purdue football e-Stadium³ has garnered significant media attention by delivering interactive content that users want to receive during live-game attendance. Students, faculty, and staff have worked together for the 2005-2006 season to implement many new features releasing one new feature at each home game of the '05-'06 season. It has been recognized by *The Exponent* as, “the ultimate football experience¹,” and gained further exposure in a PurdueSports.com article, *e-Stadium: Fans have the game in the palms of their hands*⁴ and a Cedar Rapids Gazette article, *Hold a Jumbotron in palm of hand*⁵.

In today's economy, access to information through the use of mobile devices like PDA's, Tablet PC's and cell phones are becoming more useful by the increase in wireless network availability – both private and public. Experiments like e-Stadium demonstrate how to develop and prototype new systems and applications in a variety of areas. Obviously, systems such as e-Stadium can be used in similar sporting events such as basketball, tennis, baseball, and many others to provide information and entertainment associated with the games such as player bios, past and current player statistics and game statistics, video replays and a variety of other sports-related information. Furthermore, the ideas and the fundamentals of a system such as e-Stadium could easily translate into other communication areas where a mix of real-time and stored information would enhance an information space or an experience.

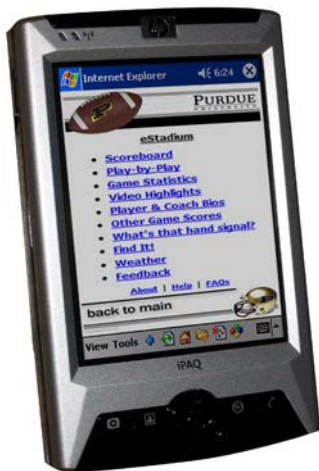


Figure 1. e-Stadium application.

The e-Stadium application (see Figure 1) is written in ASP.NET using C# with a SQL Server relational database. The adaptive rendering capabilities of ASP.NET Mobile Forms, which supports over 200 different handheld devices from a single application, are used to deliver content to handheld devices. As a game progresses, statisticians generate an XML document containing individual plays, statistics, drive summaries, scoring summaries, and much more. Every few seconds the XML file is captured via a .NET windows service, parsed, and imported into a local SQL Server database instance. The mobile application refreshes itself, pulling updated information from the database and reformatting it for display. Concurrent with the play-by-play information, highlights of video are captured, encoded, and saved to the video server, allowing users to stream or download within the stadium during the game. A web administration portal for managing and maintaining the abundant data is under continual development. It provides a mechanism for tasks to

be farmed out to developer teams throughout the University and Athletics. For every aspect of the e-Stadium application there are data that must be managed. These details are delegated to strategic personnel allowing either automation or easy management of that sub-application. Wireless applications such as e-Stadium are only the beginning of what is certain to be a new age of experience-based applications for sporting and other venues.



Figure 2. Restaurant Locator.

Included among e-Stadium's many application features are the restaurant and hotel locators. The e-stadium restaurant locator shown in Figure 2 allows users to search local restaurants by cuisine, restaurant name, city, or driving distance from Purdue's stadium. Each restaurant entry provides a business logo, address, telephone number, website URL, price guideline, driving distance from the stadium, and directions. For those football fans that have traveled to Purdue and plan on staying overnight, the e-Stadium application provides a hotel locator to help them find ideal hotels by hotel name, city or driving distance from the stadium. Each hotel entry provides similar information to the restaurant entries, while both utilize MapQuest.com to acquire driving distances and dynamically generated maps to specific locations.

Complexities of a football game

On the surface it may appear that the structure of a college football game is rather simple. College football games, by NCAA rules, are comprised of four quarters, each fifteen minutes in length. There are two teams and the team with the highest score at the end of four quarters wins the game. At first glance it seems that simple, but when attempting to create a database structure that replicates all the nuances of a football game, storing player and team statistics and game video, the idea of a football game being simple is quickly abandoned. Add in the ability to store the statistics and video for every player and every game over multiple seasons and the structure gets complicated very quickly.

E-Stadium is designed to bring real-time statistics (see Figure 3) and video to mobile devices inside Purdue University's Ross-Ade stadium. In order to deliver these statistics, data is pulled from an XML file generated by Ross-Ade statisticians and stored in a database so it may be read by an ASP.NET application. The database designed for e-Stadium is not only designed to store game and player statistics, but also to store that data in a manner that allows player, team and game data to be tracked across teams and seasons.

Team Level

The highest level in this data structure is the team. The team is actually a surprisingly organic concept; teams are in constant evolution. Players come and go, coaches change, and even a team's home field is not always constant. Since teams change so much from season to season, the team must be the overall piece that unites players, games and statistics together.

PURDUE UNIVERSITY		
PUR	37	ILL 3
Team Comparison		
Page reloads every 30 secs		
	VS	
26	First Downs	15
7-14	3rd Down Efficiency	6-19
0-0	4th Down Efficiency	0-1
391	Total Yards	265
201	Passing Yards	97
18-26	Comp-Att	11-28
7.7	Yards per pass	3.5
190	Rushing Yards	168
47	Rushing Attempts	42
4.0	Yards per rush	4
9-58	Penalty Yards	11-96
2	Turnovers	7
1	Fumbles lost	4
1	Interceptions	3
32:26	Time of possession	27:34
Refresh Play-by-play More Statistics		
back to main		

Figure 3. Team Statistical Comparison.

Season Level

Once a team is created in e-Stadium it is associated with the next level, the season. The season is independent of the team, but when coupled with a team allows data such as rosters and schedules for a particular team to be tracked over a season. Schedules and player/coach rosters are created by tying games back to a team/season combination. A new instance of a player or coach is created for each season, so individual season statistics can be tied back to a particular player. The player's statistics over a career can be tracked by this association back to a team.

Game Level

As stated earlier, games are grouped by a team/season combination. For statistical purposes, the games are divided up into drives, plays, scoring drives, overall-game player statistics and overall-game statistics. These comprise the heart of the statistics and mirror the structure of the XML file that delivers the data.

Furthermore, each drive stores statistical data related to each team's possession of the ball while each play represents a down during a given drive. Videos are then linked to a given play, allowing the videos to be grouped by a particular game, season, and team through the hierarchy.

Planning for the Unexpected

What further complicates the process of creating e-Stadium's database structure is planning for the unexpected. Football games are not always four quarters: sometimes the game goes into overtime and occasionally there are multiple overtimes. While games are comprised of quarters, a drive can span multiple quarters, requiring data structures for both quarters and drives to exist. Having the independent quarters structure allows for the flexibility to handle multiple overtimes and the ability to tie statistics back to extra quarters.

Unexpected situations like handling multiple overtimes prove that there can never be enough research and testing. More research and testing, coupled with the constant addition of administrative pages to control the data, help ease the magnitude of unexpected issues.

Fan Expectations

"1-2-3-4-First Down!" is the mantra visitors of Ross-Ade know all too well, but may leave new fans in a quandary for those who have not experienced it. In addition, some fans love to cheer for their favorite team, but are unaware of the rules being enforced when a referee grabs his wrist to indicate an infraction. Every weekend during the football season, thousands descend upon Ross-Ade stadium to cheer on their favorite team. For those fans that need a little help remembering the verses of the fight song or fans that want to review the rule for a flag that was thrown, e-Stadium offers helper applications such as History and Traditions to acclimate oneself to the environment and Rules and Regulations for those penalties. With a handheld device and just a few clicks the users can look up lyrics to all the Purdue songs, get an explanation for the referee's call, view the play-by-play, navigate directly to a video of a play that a player made,

then immediately jump to that player's biography, check the weather, and even find the nearest concession stand to satisfy themselves.

New Features

New features that have been implemented and are constantly evolving include: new interface designs for the informational site and the .NET application; restaurant and hotel finders to assist fans in pre- or post-game activities; rules and regulations with descriptions of penalties and hand signals (see Figure 4); interactive season schedules to allow fans to view past, present, and future games; user feedback forms; trivia about sports, Purdue, and more; first aid and other service finders to assist fans with game-time needs; a customized Content Management System for data maintenance and manipulation; a helpdesk complete with users, staff, and administrators for tracking and fixing issues. Future development may include: driving directions and alternate routes to help alleviate traffic congestion; a game ticker that displays vital statistics, scores, and alerts pushed to the device like a stock ticker.

Recent Developments and Future Implications

E-Stadium has been developed by students, faculty, and staff from Purdue University over the past 3 years. In recent news, some new developments in mobile technologies are being embraced, progressing the technology forward. Since 2004, ESPN has been developing its new technology, ESPN Mobile, when it joined forces with Sprint² and is due to release its new phone early in 2006. At least initially, ESPN Mobile will only be available on select Sanyo devices⁷. Verizon Wireless recently released V CAST, calling it the next generation of wireless technology. While V CAST shows promise, it is currently only available in 171 major metropolitan areas due to its reliance on wide area, broadband networks in addition to cellular networks⁸. In late 2005, the National Football League (NFL) announced that NFL Mobile would be available for phones using the Sprint wireless service⁶. While this appears to be the least restrictive option in terms of technology and phone selection, its content is limited to only one sport.

A football game is more than just winning, for the fans it is the overall experience that counts. E-Stadium was created to enhance the fans' game day experience through the use of wireless technology. It has steadily grown from offering just a few basic features to an all inclusive application bringing the game to the palm of a user's hand. It has even grown beyond the gates of Ross-Ade allowing users to search for hotels and restaurants in the area.

The possibilities are seemingly limitless as PDA's, Blackberry's, and cell phones begin to merge together into one powerful and useful device that everybody will want and need. The future of e-Stadium is bright as preparations for the 2006-2007 season ensue, striving to provide fans with the best live-game supplemental information available on the Web. Wireless applications such as e-Stadium are only the beginning of what is certain to be a new age of experience-based

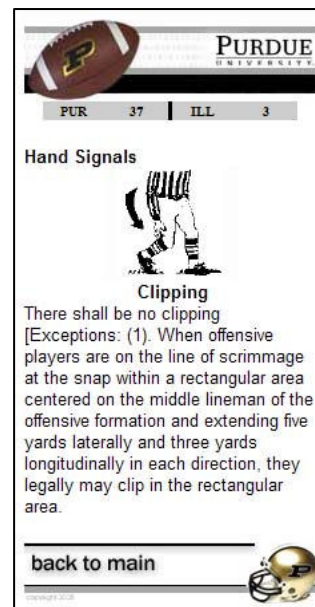


Figure 4. Rules and Regulations.

applications for sporting and other venues. For more information about Purdue Football e-Stadium, direct your web browser to <http://estadium.purdue.edu>.

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