The Promise and Challenges of mPathology

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Disclosures

• All
  – Digipath, Inc. Medical Advisory Board
  – Digipath, Inc. Shareholder

• Relevant
  – None

Objectives

• At the conclusion of this activity, the learner should:
  – Understand options for application deployment
  – Understand the current state of mobile pathology ("mPathology") applications
  – Recognize challenges to the creation and use of mPathology applications, including technical and regulatory challenges
  – Recognize future areas for expansion of mPathology applications
Background
Development
Deployment
Challenges
Current
Future

Alan Kay

- Proposed the Dynabook in *A Personal Computer for Children of All Ages* (August, 1972)
- Xerox PARC scientist and principle designer of Smalltalk, the first true object-oriented programming language
- The Dynabook was never built
The PDA Era

- 1984: Psion Organizer II
- 1991: Psion Series 3
- 1992: “Personal Digital Assistant” coined to describe Apple Newton
- 1994: IBM releases a PDA/phone hybrid, Simon
- 1996: Nokia releases the 9000 communicator, a landmark PDA Phone
- 1996: Palm releases the Palm Pilot
- 1996: Microsoft debuts WinCE
- 1999: RIM releases the BlackBerry 850, an email pager

The Early Smartphone Era

- 2000: Ericsson R380 is marketed as a “smartphone”
- 2003: BlackBerry “Quark” with integrated phone
- 2003: PalmOne Treo
- 2003: Windows Mobile debuts
- 2007: iPhone
- 2007: Android

Apple iOS

- Steve Jobs led the team that extended the iPod platform to create the iPhone (2007) and later the iPad (2010)
- These were market-defining mobile devices
- Created the mass market for modern smartphones and tablets

Abundance of mobile devices

- According to Pew Research, as of January 2014:
  - 58% of American adults have a smartphone
  - 42% of American adults own a tablet computer
- http://www.pewinternet.org/fact-sheets/mobile-technology-fact-sheet/
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<th>Q4 2012 Units</th>
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<td><strong>178,052.7</strong></td>
<td><strong>100.0</strong></td>
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Source: Gartner (November 2013)

Who develops mPathology apps?

- Publishers
- Individuals
- Academic centers
- Reference labs
- Private labs
- “Digital Pathology” vendors
- EMR vendors
- LIS vendors
Mobile development

• Three types of mobile app development:
  – Native apps
  – Cross-platform toolkits
  – Web apps

Native app development

• Native apps are written and compiled to target the specific device they are running on
• iOS: Objective-C, Android: Java
• Pros:
  – faster execution
  – full access to hardware and native APIs
• Cons:
  – have to re-code an app for each mobile platform

Cross platform development

• Use of third party toolkits that create native hybrid apps that run on multiple platforms
• ex. PhoneGap, Titanium
• Pros:
  – Code once
  – Can access hardware features
  – Often indistinguishable from a native app
• Cons:
  – May not support all hardware features on every platform
Web apps

- Use of HTML (usually HTML5) to create apps to run on multiple platforms
- Target mobile devices using mobile specific versions or so-called responsive design
- Pros:
  - Code once
  - Works for non-mobile applications
  - Consistent look and feel across platforms
  - Instantly update code
- Cons:
  - No access to hardware features
  - Getting web apps to render well on all devices is not trivial

Which approach is used?

- Most apps are native apps, but you can’t really know which are built with cross platform
- Most LIS vendors tend to not have native apps, and instead rely on web portals that may or may not be mobile-friendly
- Another approach is to skip mobile development all together and use a Citrix or RDP client on the mobile device
iOS deployment

• Apple App Store
• The Volume Purchase Program
  – Private business-to-business apps
• Ad hoc
  – up to 100 devices per developer license
• In-house development & distribution
  – “Distributing in-house apps can be done either by hosting your app on a simple web-server you create internally, or by using a third-party Mobile Device Management solution.”

Android App Deployment

• Google Play
• Google Play Private Channel
  – choose which users can access your Private Channel to download internal applications
• 3rd party marketplaces
• Open distribution, a.k.a. “sideloading”
  – Direct installation of an app via APK format

Web App Deployment

• Nothing special is needed for deployment
• Serve content from standard webserver/web framework
Challenges in mPathology

- Security/privacy
- Data connection coverage
- Data connection bandwidth
- Hardware interfacing
- Employer vs. employee devices
- Regulation of medical apps (FDA)
- User interest
Current mPathology apps

- Education
- Reference/Clinical decision support
- Societies/Meetings
- Virtual microscopy
- Marketing
- Provider ordering and resulting
  - Lab-based CPOE and reporting
  - EMR-based CPOE and reporting
  - LIS-based CPOE and reporting
- Patient portal
Education

Reference / CDS

• Apps providing reference information or in some cases interactive clinical decision support (CDS)

Society meetings
Journals

Virtual microscopy

Aperio ePathViewer

- Connect to an eSlideManager or slide sharing service
- Navigate a whole slide image using the touch UI
Teleconsultation

- Take an image with an iPhone and upload it to the UPMC digital consultation site

Marketing

- Solstas Lab Finder uses location data to help patients find the nearest Solstas Lab Patient Service Center
Lab-based CPOE and resulting

- Lab-specific mobile apps
- All support resulting, some support ordering
Beacon: LabCorp

- Beacon allows providers to review LabCorp results as they become available

EMR-based CPOE and Reporting

- EMR vendor supplied mobile apps
- All support resulting, some support ordering

Epic Canto

- Secure access to Epic EMR information including lab results, patient lists, health summaries, and notes. Canto also supports dictation and In Basket access
Bedside POC verification

- Mobile app for medication administration, specimen collection
- Other mobile solutions for this exist

Epic Rover

- Rover supports medication administration, specimen collection, vitals, and I/O at the bedside.

LIS-based CPOE and Reporting

- LIS vendor-supplied mobile apps
- PathX is for AP report; Pathology, Inc is for Atlas LabWorks (?middleware)
- Web-based portals discussed later
Web-based physician portals

- **Sunquest** – physician portal: place orders and electronically view results necessary
- **SCC SoftLab** – SoftWeb: electronically view results
- **Meditech** – Mobile rounding: electronically sign orders/reports and review results
- **Orchard Software LIS**
  - Webstation: for Orchard Harvest LIS; web access to users within one entity
  - Copia: for labs doing reference lab work from multiple customers
Patient Portal

- LIS vendor-supplied mobile apps
- PathX was the only example found and is for AP report

Epic MyChart

- MyChart gives each patient access to the complete medical record, including lab results

Background
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Future

• mPathology is in its infancy
• Areas for improvement:
  – Tools for closed-loop reporting of patient results, but especially of critical action values
  – Improved tools for telediagnostics
  – Clinical decision tools integrated with mobile access to lab results