Current State of Learning Technologies

National Research Council Canada

Conseil national de recherches Canada

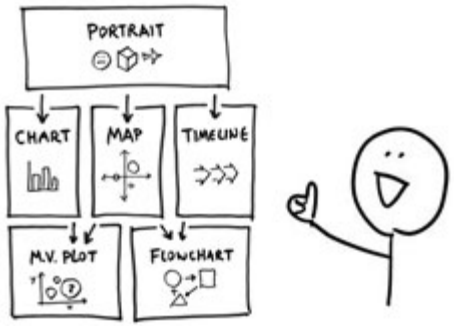
Objectives of the Session

- The purpose of the project as a whole is to map the state of the art at CSPS with that of the field as a whole
- The long term outcome will be suggestions for a description and roadmap for future modernization of CSPS offerings

Outline

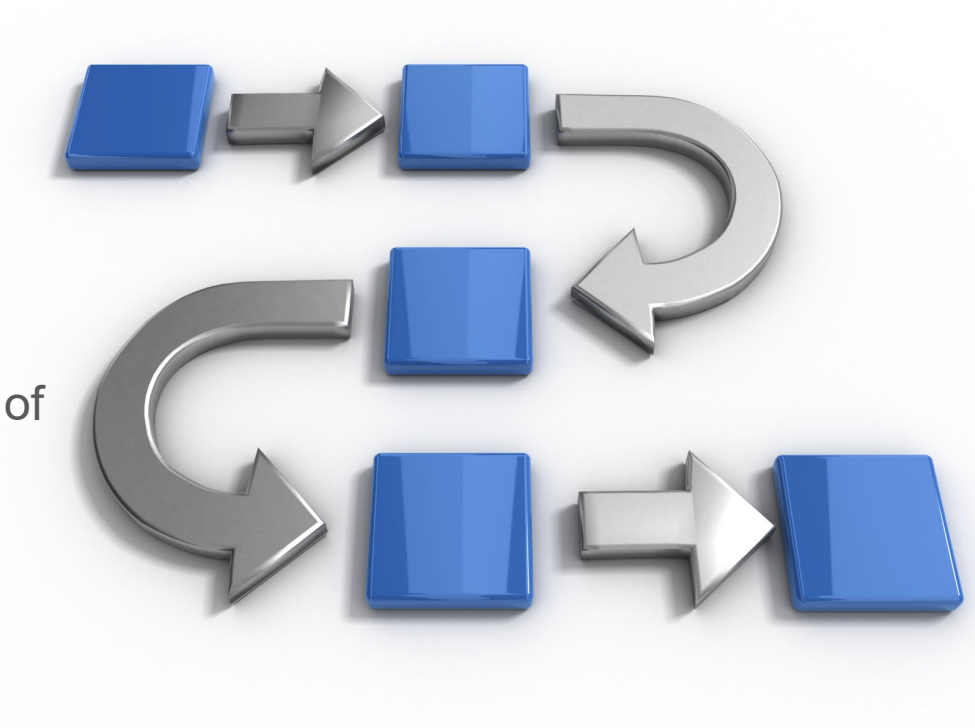
1. Mobile Learning
2. Personalized Learning
3. Shared Learning Space / Crowd-Sourcing
4. Virtual Library
5. Integration with Social and Collaboration Platforms

For each:
- 25 minutes of presentation
- 20 minutes of discussion
- Short break



Methodology

- Academic literature search in relevant areas
- Trade literature and product identification
- Hands-on experience with many of the technologies
- LPSS projects with deep dive in some subject areas



Part One: Mobile Learning

1.1 What is Mobile Learning?

- *The mobility of the device* - includes learning enabled with mobile phones, tablets, laptops, and other devices

- *The mobility of the learner* - includes the “embeddedness of the learner in the real environment or in context”

- *The mobility of the information* - includes the concepts of just-in-time learning and performance support

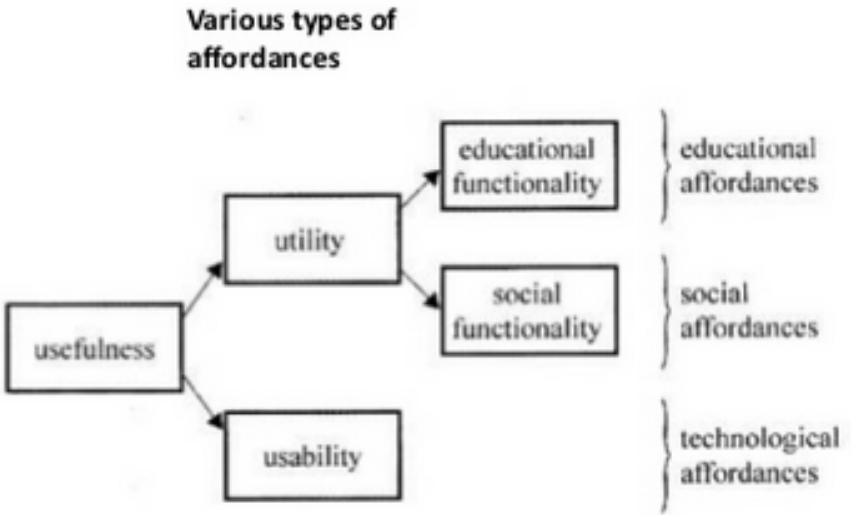
What does mobile make you think of…?

personal, spontaneous, opportunistic

informal, pervasive, situated

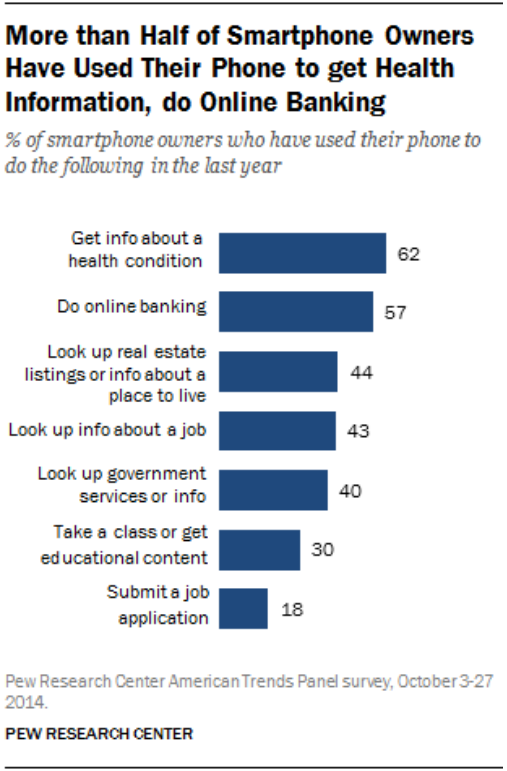
private, context-aware

bite-sized, and portable



Jari Laru

Adoption of Mobile Learning

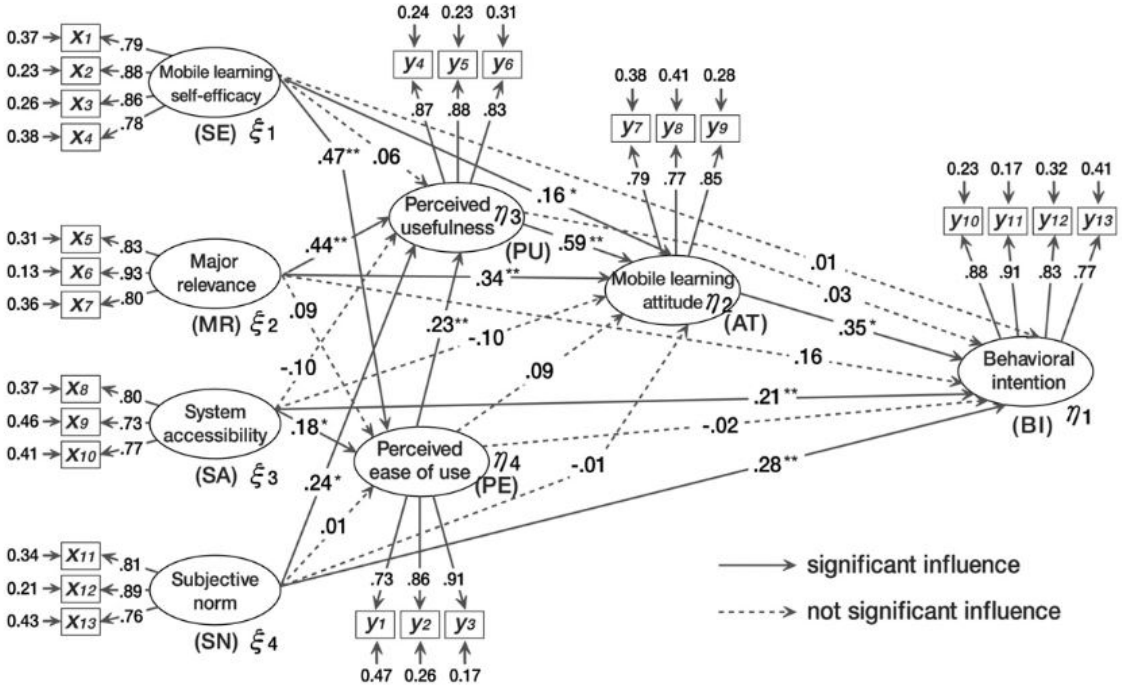


30% or more of smartphone owners used their device to access a class (Pew)

74% of learners used mobile devices for eLearning (Ambient)

Mobile learning is one of the top three learning priorities for companies in the coming year

But companies are lagging; 30 percent have limited mobile learning while 25% have none at all (Brandon Hall)



Park, Nam and Cha

What factors are relevant to technology acceptance of mobile learning?

Mobile Learning Policy Framework

- Rationale
- Roadmap
- Partnerships
- Access and Security
- Devices
- Pedagogy
- Resources
- Assessment
- Administration

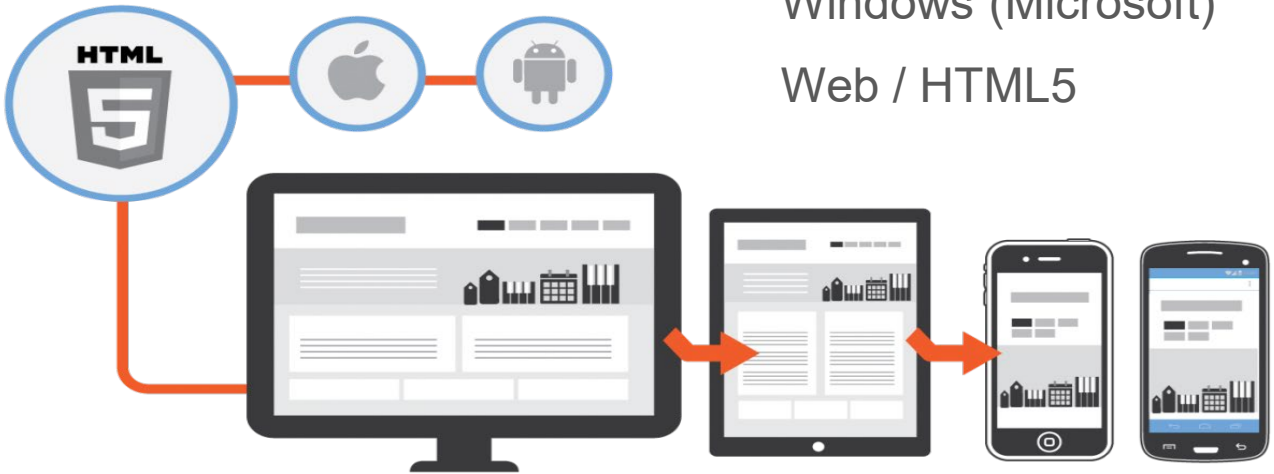
Mobile Development and Delivery Standards

Delivery:

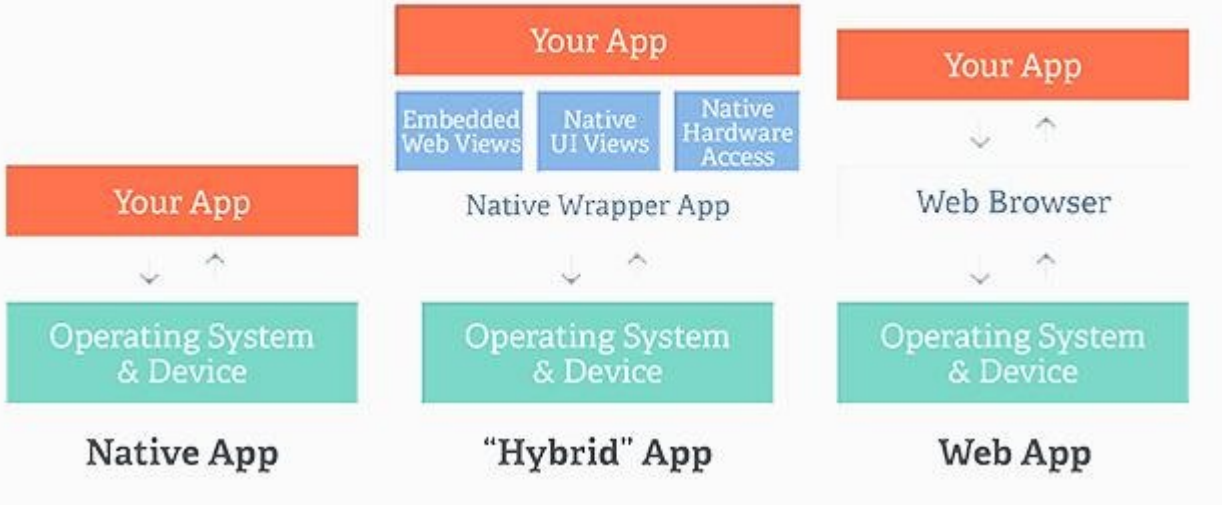
- IEEE 802.11 (wifi)
- 3G, 4G, LTE (mobile)

Development:

- iOS (Apple)
- Android (Google)
- Windows (Microsoft)
- Web / HTML5



Mobile App Technology Stacks



multiple platforms?

Base: all who develop for mobile, n=2309

Mobile Device Management

WindowsIT Pro

BYOD - Bring Your Own Device

COPE (CYOD) - Corporate Owned Personally Enabled

DBYOD - Don’t Bring Your Own Device

BYOD policies will vary across departments and institutes

Mobile learning policies will need to anticipate and adapt to a wide range of devices and associated policies

Global Knowledge

Learning With Mobile Technology

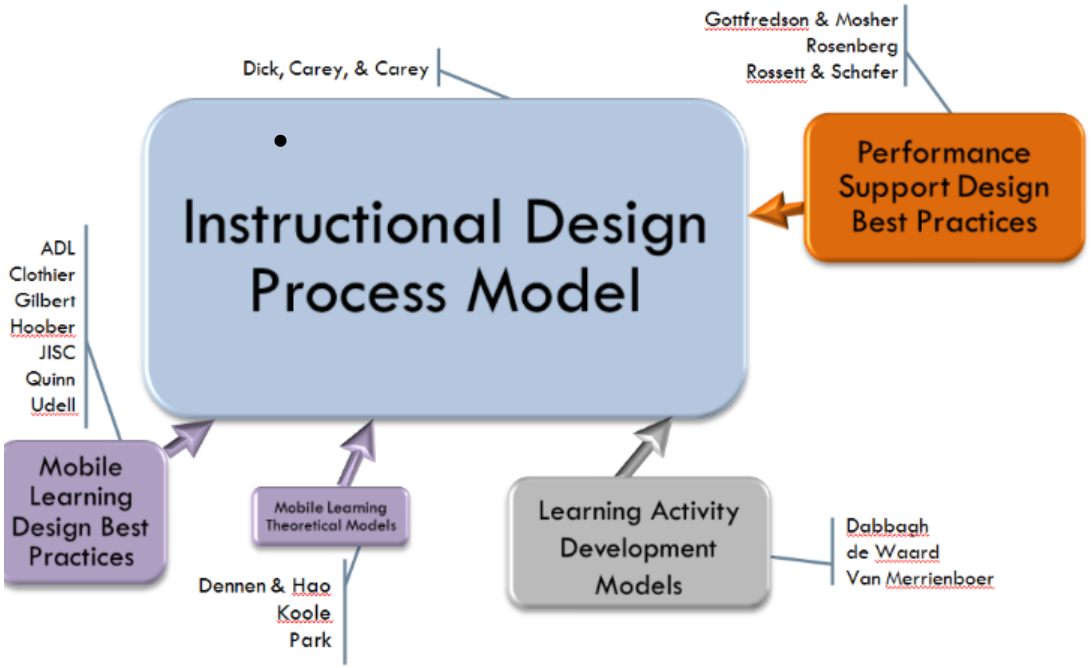
Students cannot be assumed to have mobile-learning skills based on their experience with other forms of learning.

Churchill, Fox & King, 2013

Mobile Learning Framework

- Planning learning experiences
- Using personal mobile devices professionally and safely
- Initiating dialogue
- Establishing networking activities
- Creating learning activities on the go
- Deepening reflection
- Considering issues of time and place

Content Authoring for Mobile



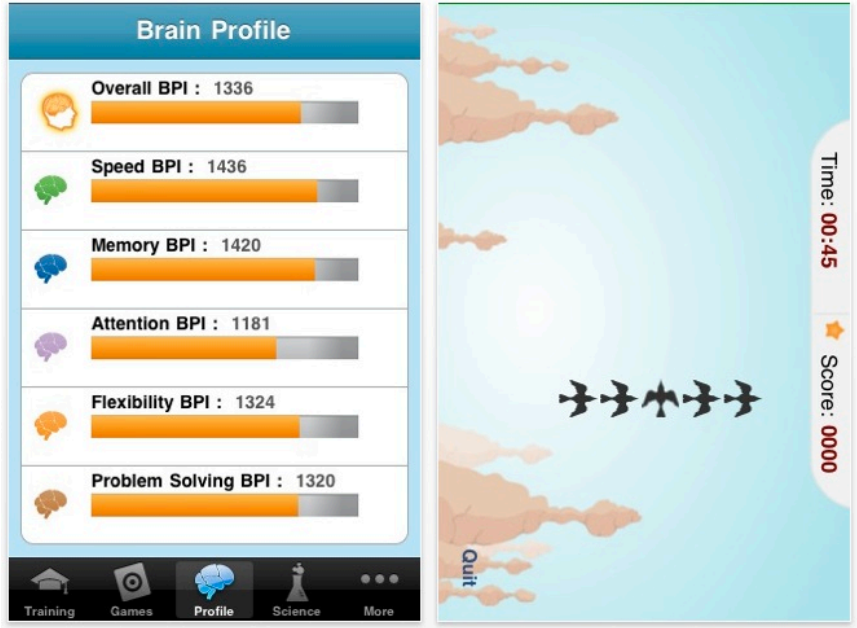
Mobile Learning Resource Authoring Systems

- Adobe Captivate
- Articulate Storyline 360
- Composica
- Elucidat
- iSpring Suite
- Lectora Inspire / Online
- Microsoft (LCDS)
- Raptivity
- Xerte - Apereo Foundation

Berking & Haag, 2015

Criticisms and Failures

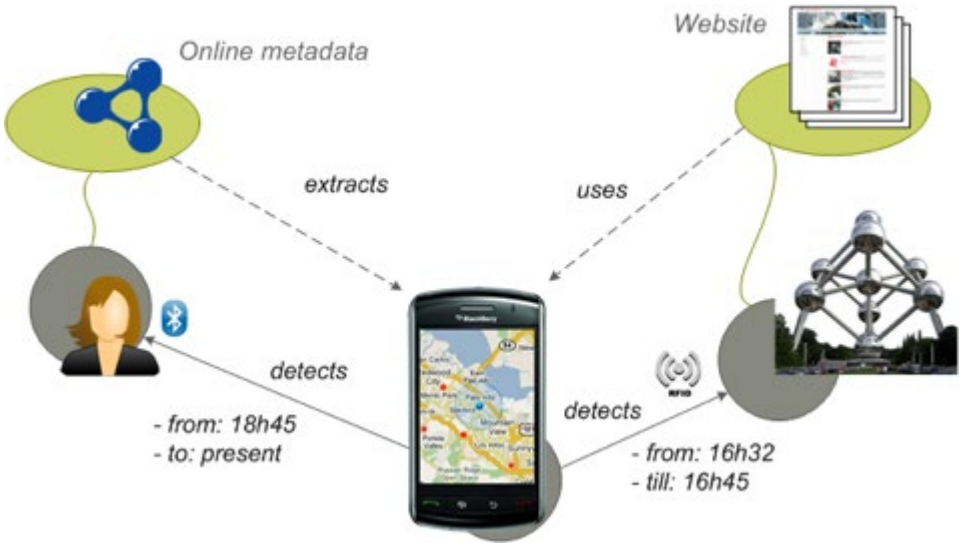
- Need to verify learning effect
- Questionable claims by vendors
- Need learner-generated content
- Need to structure student experiences



Lumosity, 2010

Future of Mobile Learning

- Development of context-based applications
- Embedding of mobile technology in applications

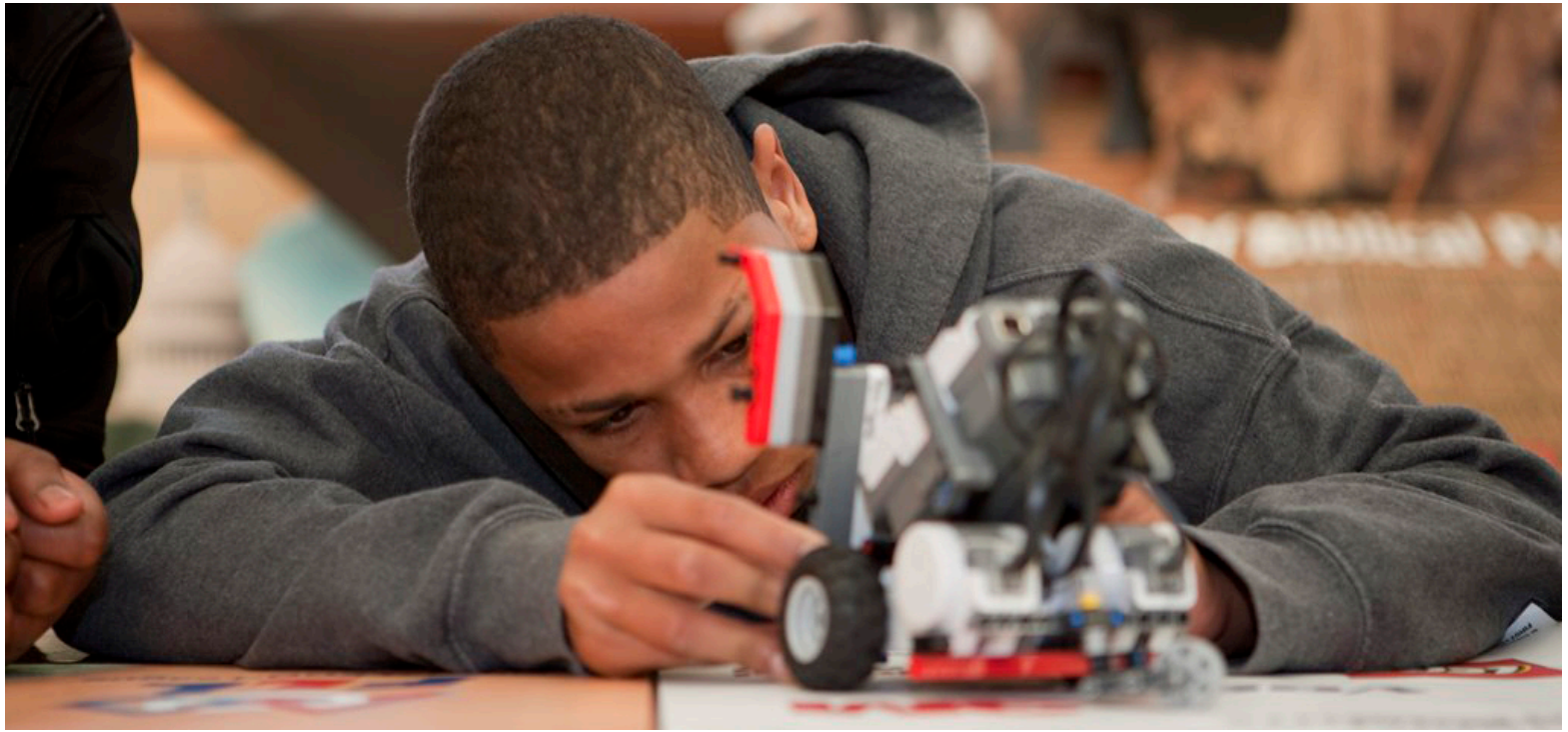


WISE Research group, 2017

Research Questions

- What elements defined mobile learning for CSPS?
- What data is there on mobile device employment in the Canadian public service
- Are mobile policy frameworks in place, or, what would the process be for developing one?
- Has CSPS adopted mobile delivery standards? Are others extance in the Canadian public service?
- Do the resources exist for device provision, or can accommodations be made for BYOD (Bring Your Own Device)?
- What pedagogical principles inform CSPS, and are they consistent with mobile delivery?
- Does CSPS have the capacity and tools to author for mobile (eg., for Apps? for HTML5)?
- Do existing CSPS assessment and quality control standards map to mobile learning?
- Does CSPS have the capacity to adapt to future technologies, such as embedded software or context-aware devices?

Part Two: Personalized Learning



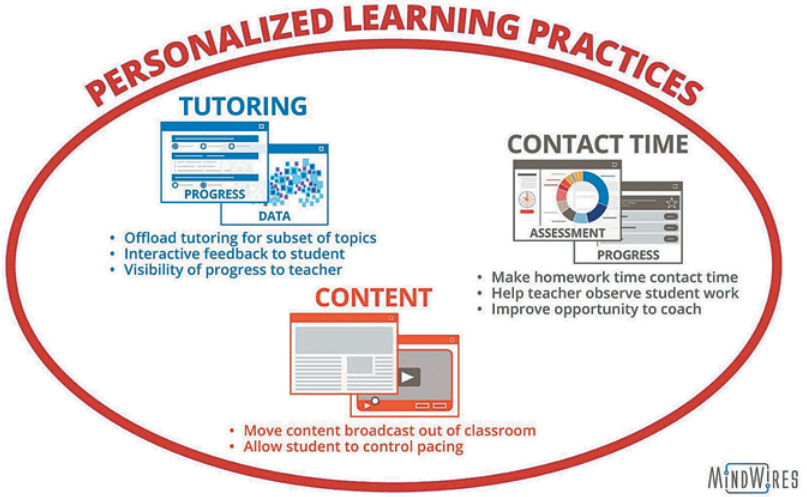
Gates Foundation

What is Personalized Learning?

Practices:

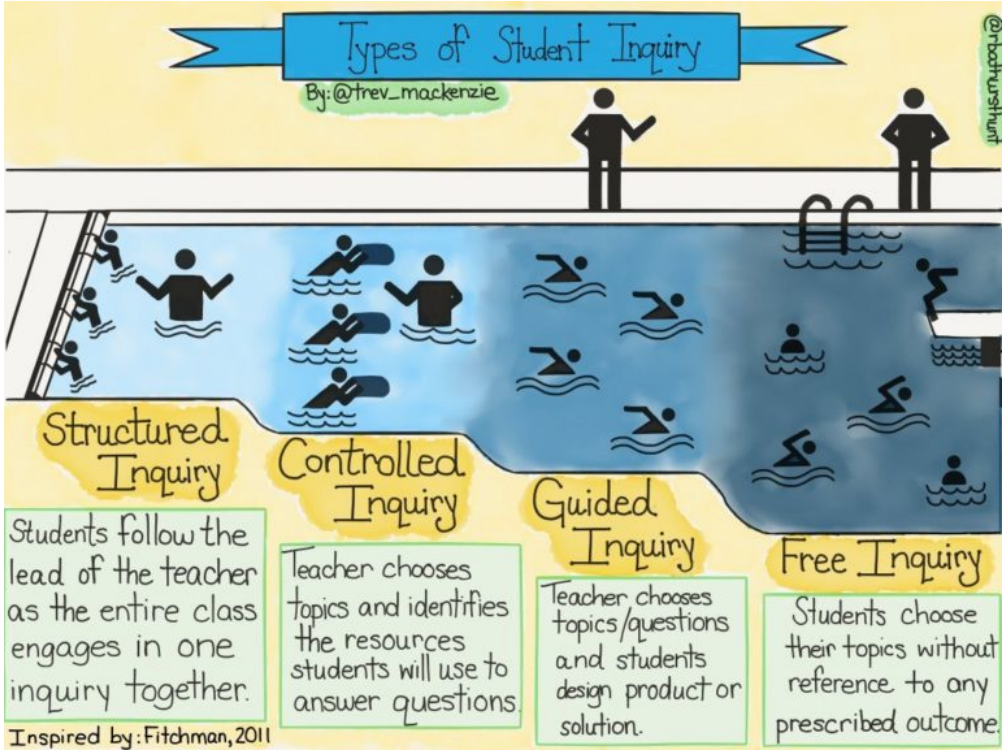
- Moving content broadcast out of the classroom
- Turning homework time into contact time
- Providing tutoring

"…a delicate balance between student autonomy and instructor-led direction and scaffolding…"



Feldstein & Hill (2016)

A range of approaches (after Dana Fichtman, Thomas & Boynton, 2011, *Inquiry: a districtwide approach to staff and student learning*)



Innovation and Investment Drivers

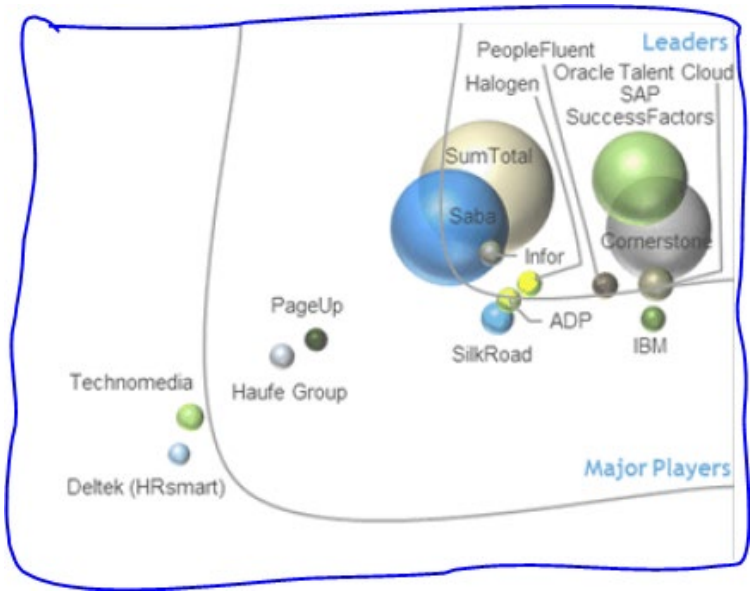
PERFORMANCE

- more frequent employee check-ins
- better employee/manager communications
- increased peer-to-peer feedback and engagement
- addition of more social and informal feedback support
- improved goal visibility

TOOLS

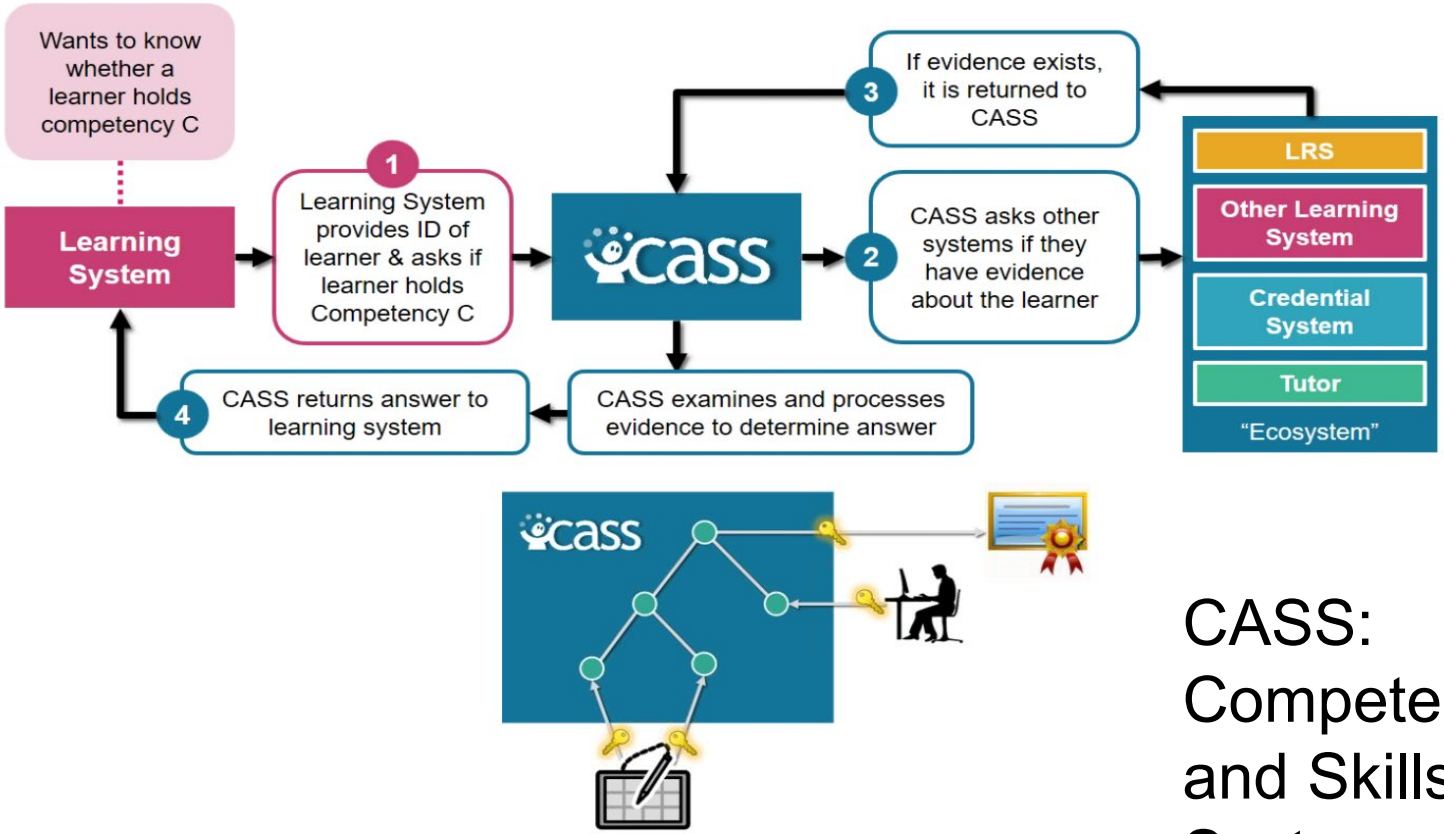
- new tools for coaching and mentoring, for social and video-based learning
- new platforms that support the capture and sharing of recognition moments and/or foster wellness

Competencies and Talent Management



Composed of four or more of the following applications:

- Workforce Planning
- Recruiting and Onboarding
- Performance and Goal Management
- Learning Management
- Career and Succession Planning
- Compensation Management



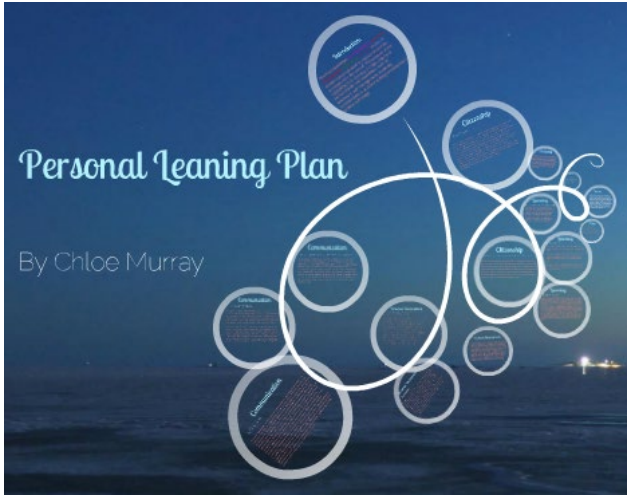
CASS: Competencies and Skills Systems

ADL, 2016

Competency Frameworks

- Australian qualifications framework
- General capabilities in the Australian Curriculum
- Australian curriculum
- NRC Competency Profiles
- OECD Core Competency Framework - (Also)
- European Competency Framework
- IEEE Software Engineering Competency Model - Presentation
- IBM Kenexa Competency Frameworks
- ONet Online & CareerOneStop
- Competency Model Clearinghouse
- CareerOneStop pyramid model
- National Occupational Classification 2011 the authoritative resource on occupational information in Canada
- Mission essential competencies. Air force- Marine operations
- TRADEM-SEM - - validate domain and expert models
- Association of American Colleges & Universities - Value Rubrics

Personal Learning Plan & Learning Path



Chloe

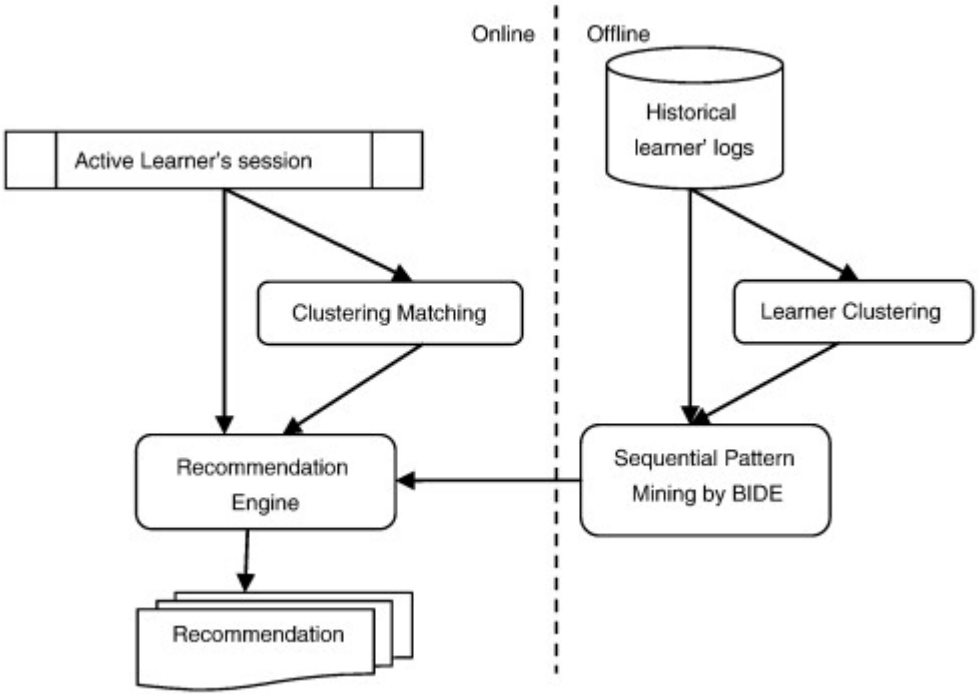
Illuminate Education - data-based learning path

FilterED Global Filter - specializes in rapid personal path creation

MiCLUES - creates personal learning paths through museums and exhibits

ItsLearning - learning platform

Apereo OpenSSP - student success plan

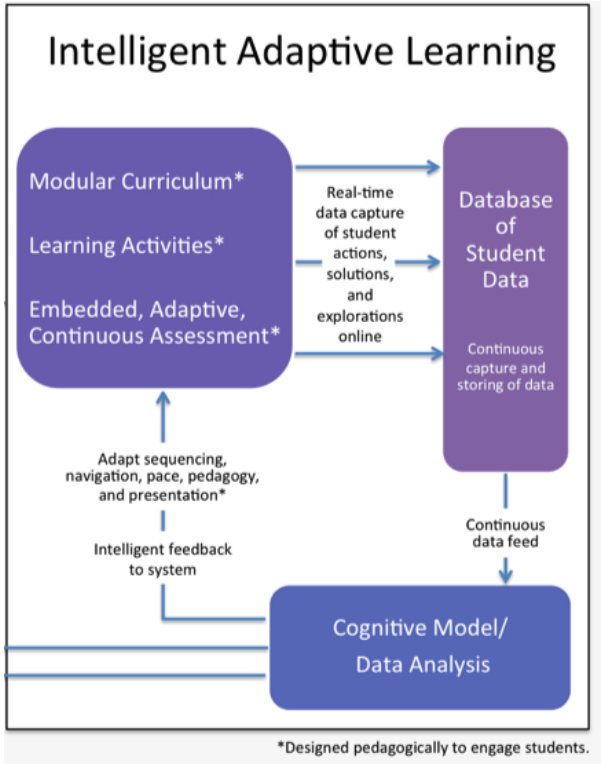


Salehi, 2013

Resource Recommendation

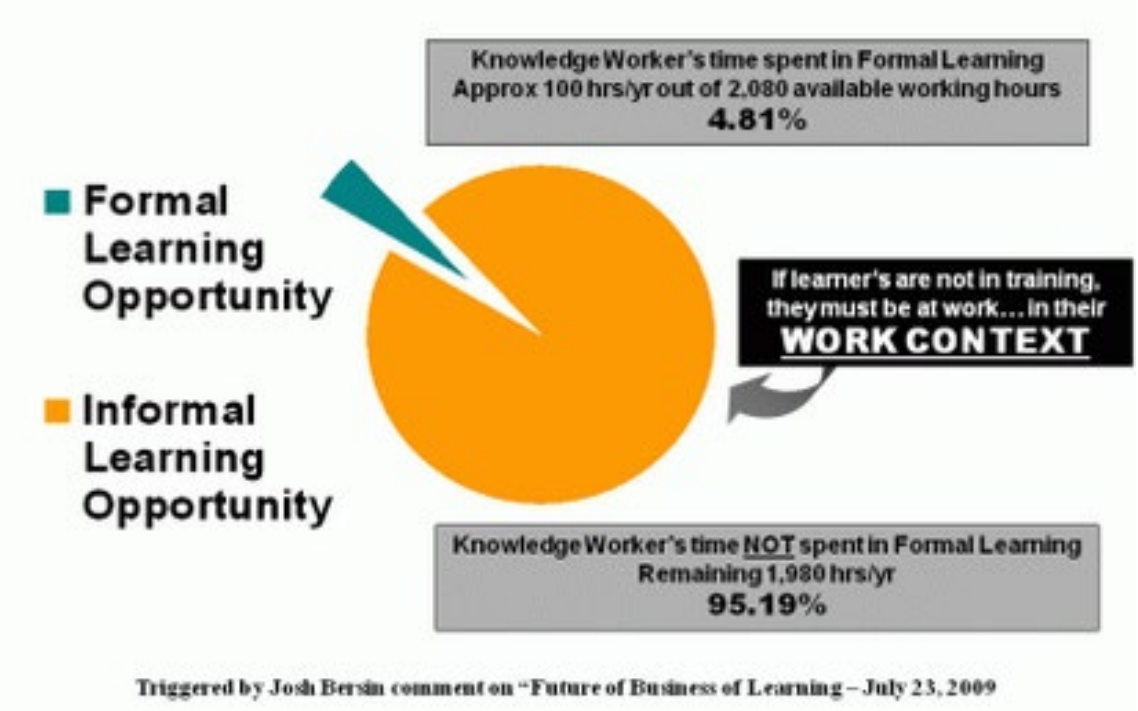
- Collaborative filtering
- Human cognitive modeling
- Content analysis
- Self-assessment
- Sensor & data analysis

Adaptive Learning



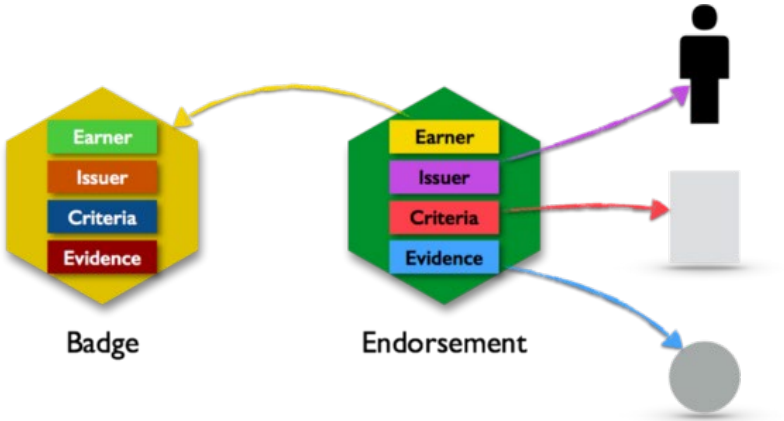
- Prodigy - math game that adjusts questions (Prodigy Blog, 2016)
- ClassK12 - prepare for standardized tests such as SBAC, PARCC
- McGraw-Hill - has included products like ALEKS and Connect
- Knewton - adaptive learning path platform
- Brightspace LeAP - spots difficulties and recommends resources
- Dreambox - presentation of materials based on student input
- LoudCloud - collaborative open content recommendation
- RealizeIt - mastery-based personal learning path
- Fulcrum - competency-based premium content

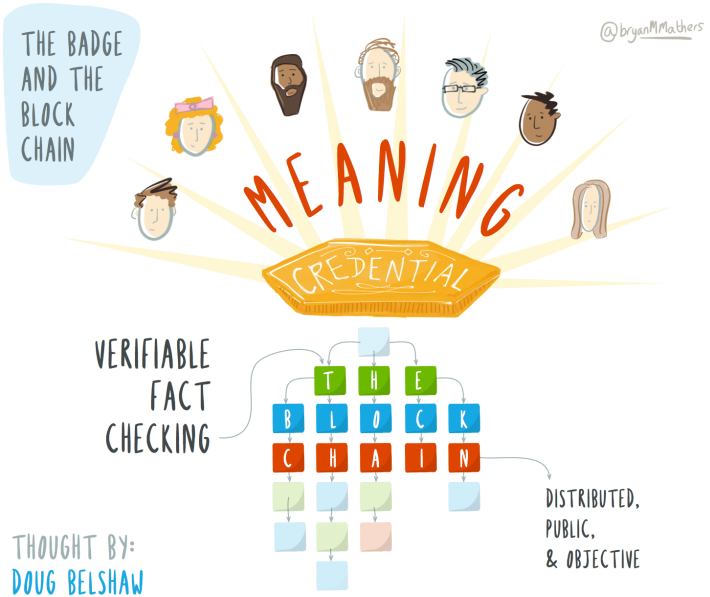
Informal Learning



Jarche, 2012

Credentials and Badges



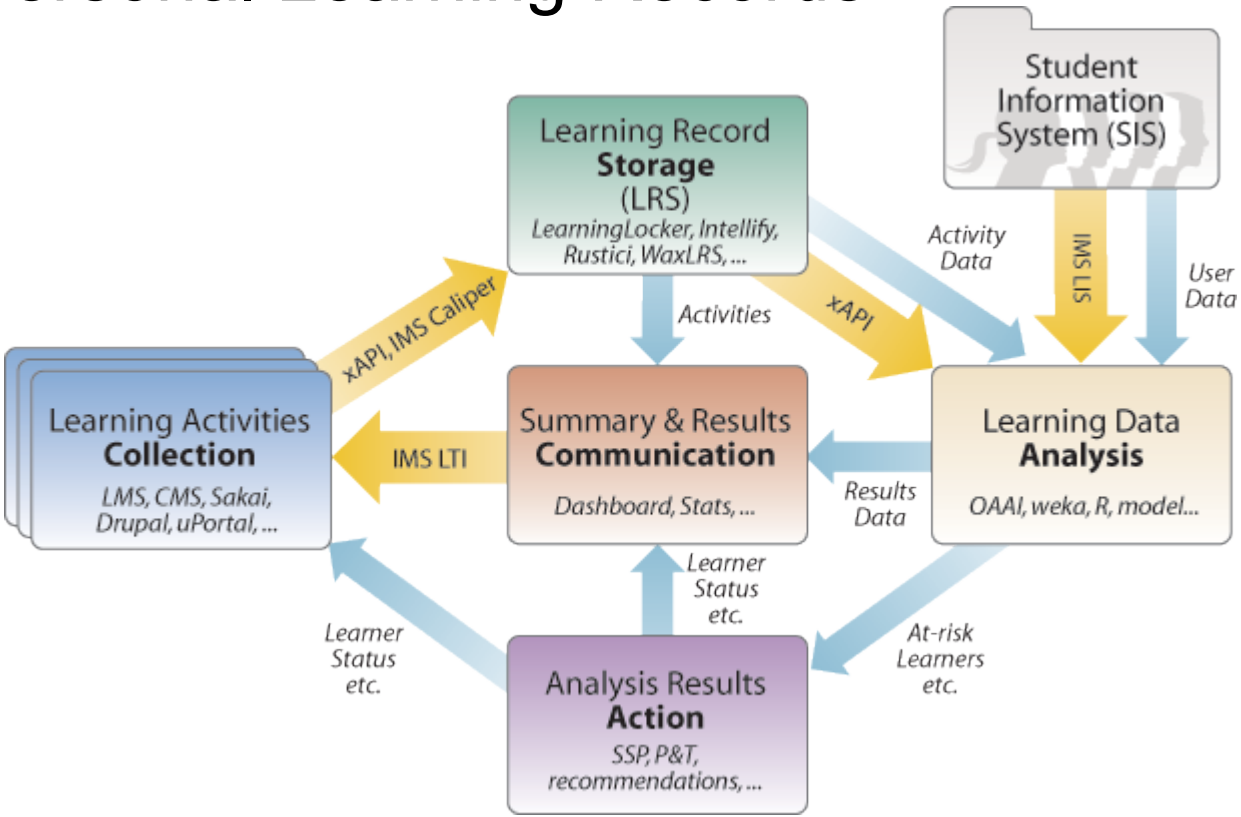


Open Badges are the substratum from which ePortfolios grow organically, like a beehive out of the activity of the bees — bee-badges for hive-portfolios!

Ravet, 2016

Mathers, 2016

Personal Learning Records



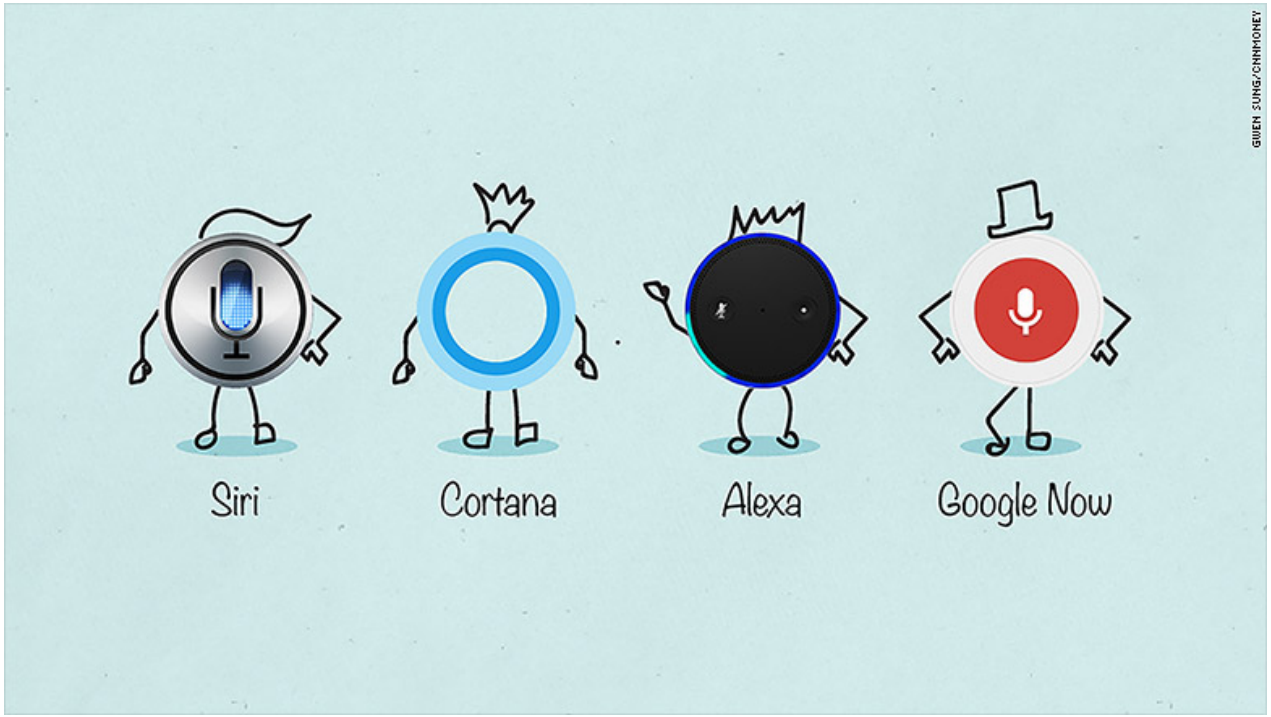
Gilbert, 2015

Personal Digital Archiving

Description of store	***Description of collection***	***Why it has been put here***
PC with new upgraded hard drive; the PC has a DVD burner	Photo collection; other local files are pending restoration after webcam is installed	This is the computer she uses to edit photos and connect to the Internet
Mac (not currently working)	Novel in progress	This is where she worked on the novel
Personal website	Web pages and photos	She publishes material related to her performance art
DVD	Files that used to be on her PC	Files backed up pending installation of new hard drive and webcam
Secondary website	Celebrity-related art project (she manipulates the photos of the celebrity in question)	Material specific to the project
Old hard drive now installed on another friend's PC	All of the files that used to be on her PC, including her photo collection and digital videos	Hard drive was too small to support her current projects
At least three email separate accounts on Yahoo, AOL, and HotMail	She attaches photos to email messages and emails material for her websites as attachments; She has also emailed her novel to a friend so he could print it for her	This is how she shares photos with individuals and collaborates on websites with her partner
DV tapes	She has video projects she stores on the tapes; they're on her old hard drive too	She finds the tapes easy to manipulate and thinks of them as a secure store
A friend's Macintosh	Digital music she composed	Friend's computer is powerful enough and has the right apps to compose computer music
Paper	Photos are printed; novel is also stored on paper	The photos go into a scrapbook; the novel is printed as backup

Marshall, 2008

PLE and Personal Assistant



CNN, 2015

Research Questions

- how does CSPS define personalized learning, or is there a working definition in place?
- what existing tools does CSPS employ for performance management, and learning and development?
- has CSPS adopted a talent management framework or management system?
- what definitions or management frameworks (if any) for competencies does CSPS employ?
- are CSPS talent and competency management systems linked to external services, such as job or placement-finding sites?
- can CSPS support and manage personal learning plans or learning paths? Automated?
- what approach to and/or technology does CSPS support for content & learning recommendations?
- What support does CSPS currently provide to support informal learning?
- does CSPS support personal learning records, and to what granularity (eg., do they store activity records? personal portfolios?)
- does CSPS provide upload or storage for personal profiles or personal data archiving?
- are there automated mechanisms in place for profile creation and assessment?

Shared Learning Space / Crowd-Sourcing

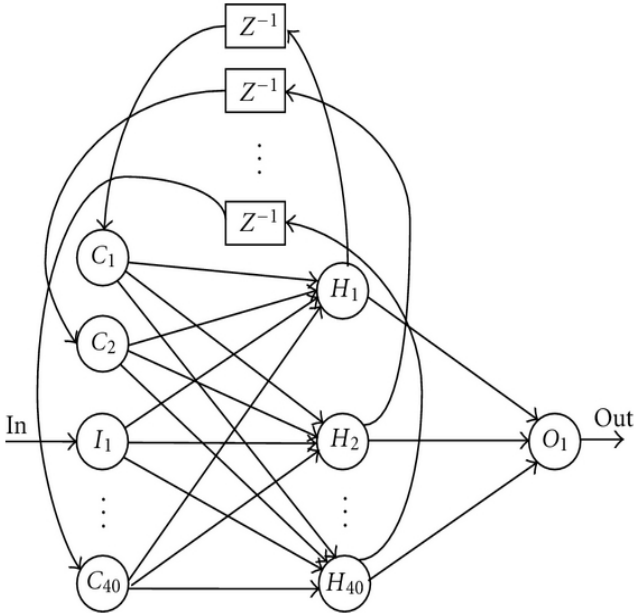
FT - Owen Humphreys/PA Wire

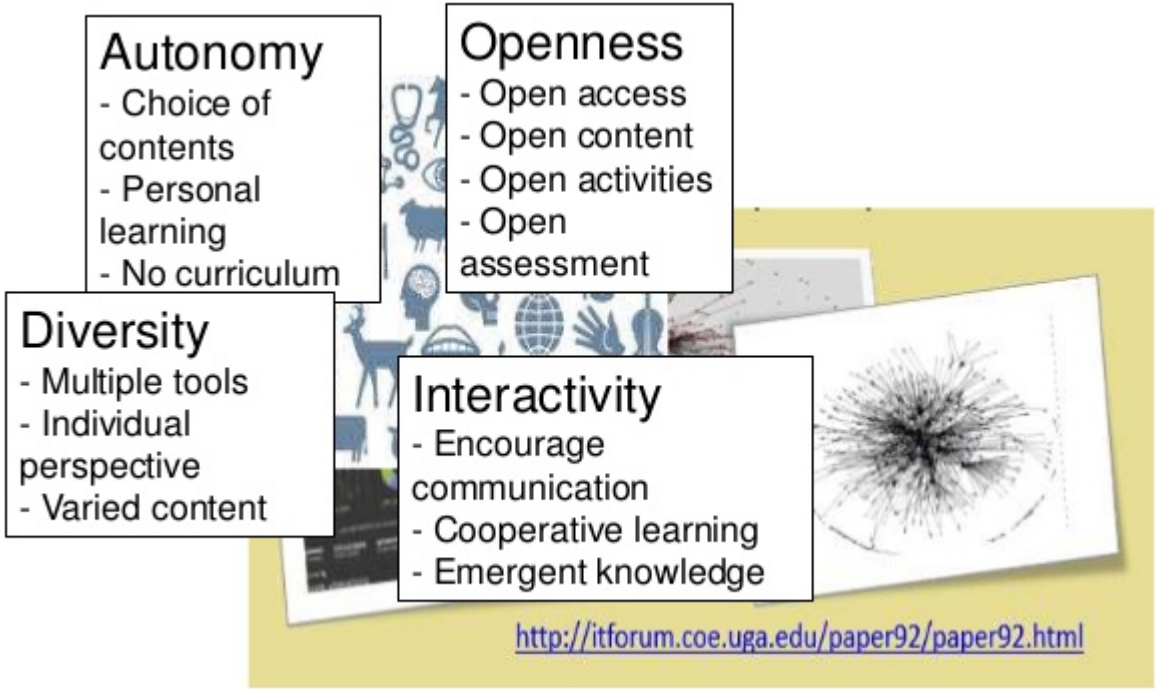
What is Shared and Crowdsourced Learning?

- Open learning
- Shared environments
- Social networks
- Co-production

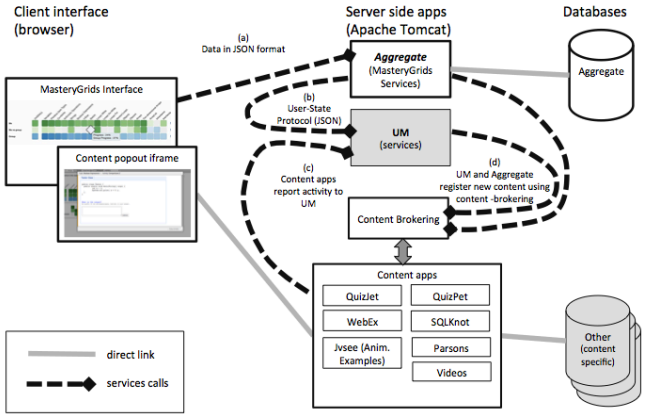
Phillips, 2014

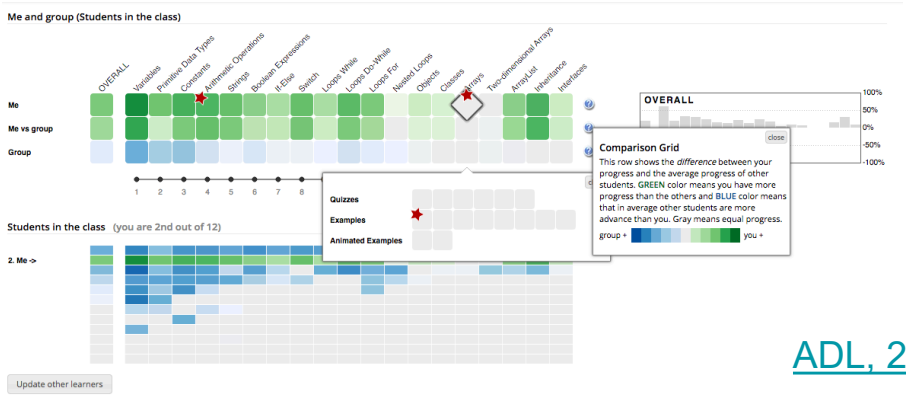
The Wisdom of Crowds





Models





ADL, 2016

- Seek Sense Share framework - (Jarche, 2014)
- ADL Open Social Learner Model (OSLM) - (ADL, 2015)
- IEEE Resource Aggregation Model for Learning, Education and Training (RAMLET) - (Verber, et.al., 2016)
- ARRFF - Aggregate, Remix, Repurpose, Feed Forward (Downes, 2016)

Environments

Open learning, eg., Apereo Open Academic Environment

Cloud Technologies, eg. IBM Kenexa, Oracle Taleo

Virtual Classrooms, eg. Connect, Collaborate, Cisco (Spark, WebX)

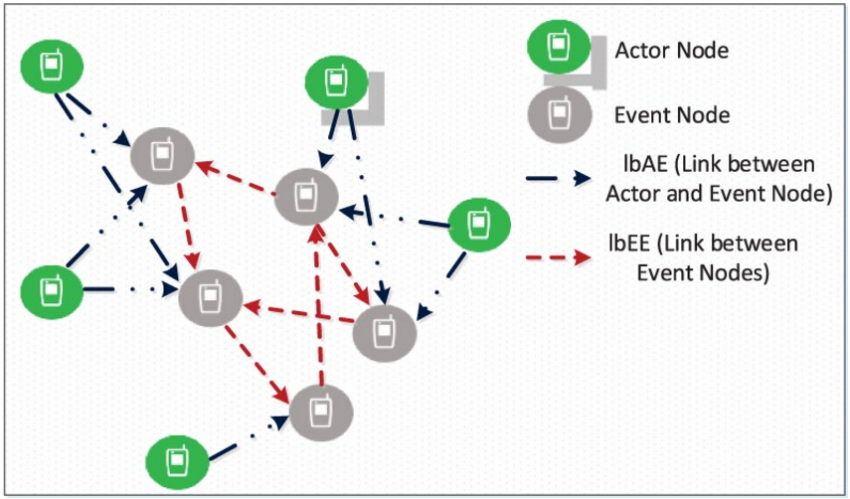
Social networks for learning, eg. Elgg

MOOCs, eg. gRSShopper, Udemy

Various contribution-based open course libraries (via MOOCLab)

- Coursmos -micro-learning platform
- Eliademy - free & paid online courses with real-time discussions and task management
- iTunes U - free educational app with audio and video resources from top universities
- Open Education powered by Blackboard - Free online courses from Blackboard's global community of clients
- OpenLearning create, run and enrol in a course.
- Udemy create and run online courses.
- YouTube Edu - video-based courses

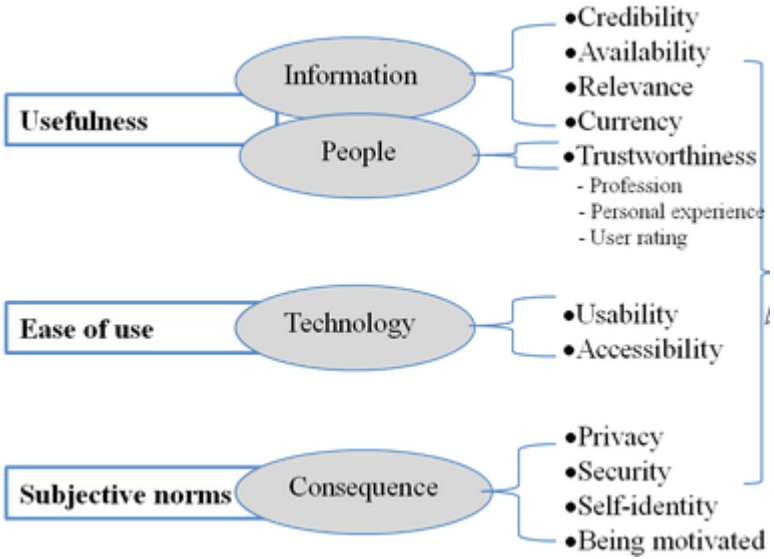
Social Network Formation and Management



A significant area of research exists in the area of automated social network creation and management. There are two major approaches to automated social network formation: collaborative filtering, and privacy preserving.

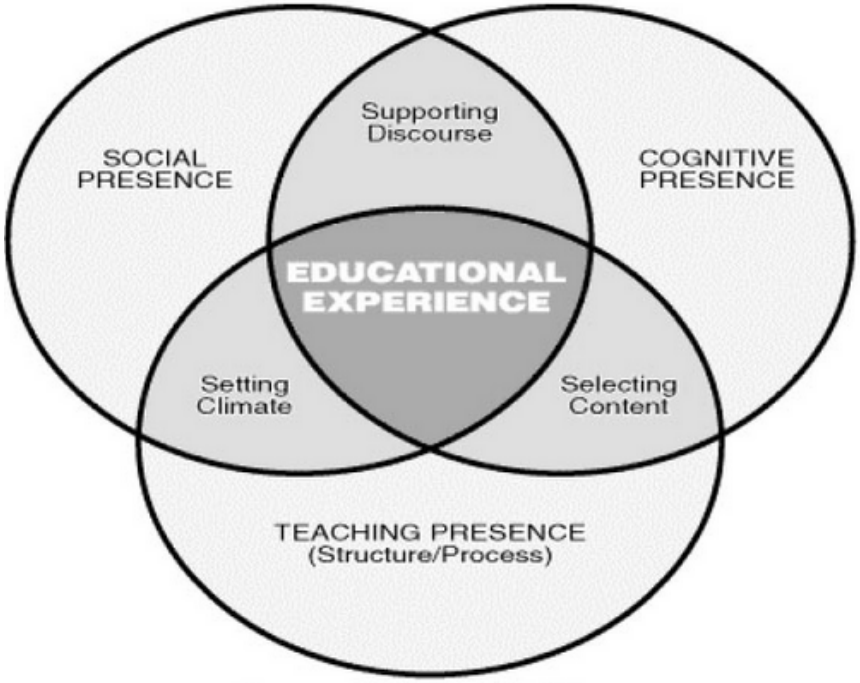
Applications of Crowd-Sourcing

- Crowdsourcing for publicengagement
- Social bookmarking and search
- Social learning, properly so-called
- Project teaming and collaborative learning
- Social media for research dissemination
- Supporting shared spaces
- Scientific research



Zhang, 2013

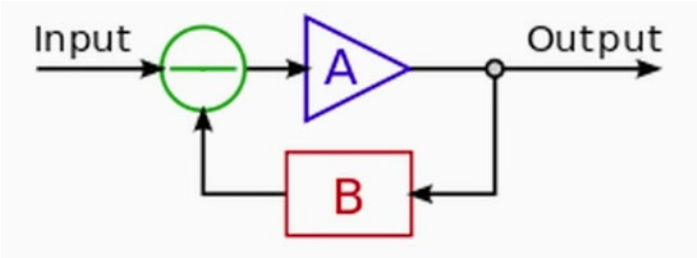
Social Presence



Technology standards for collaboration in learning

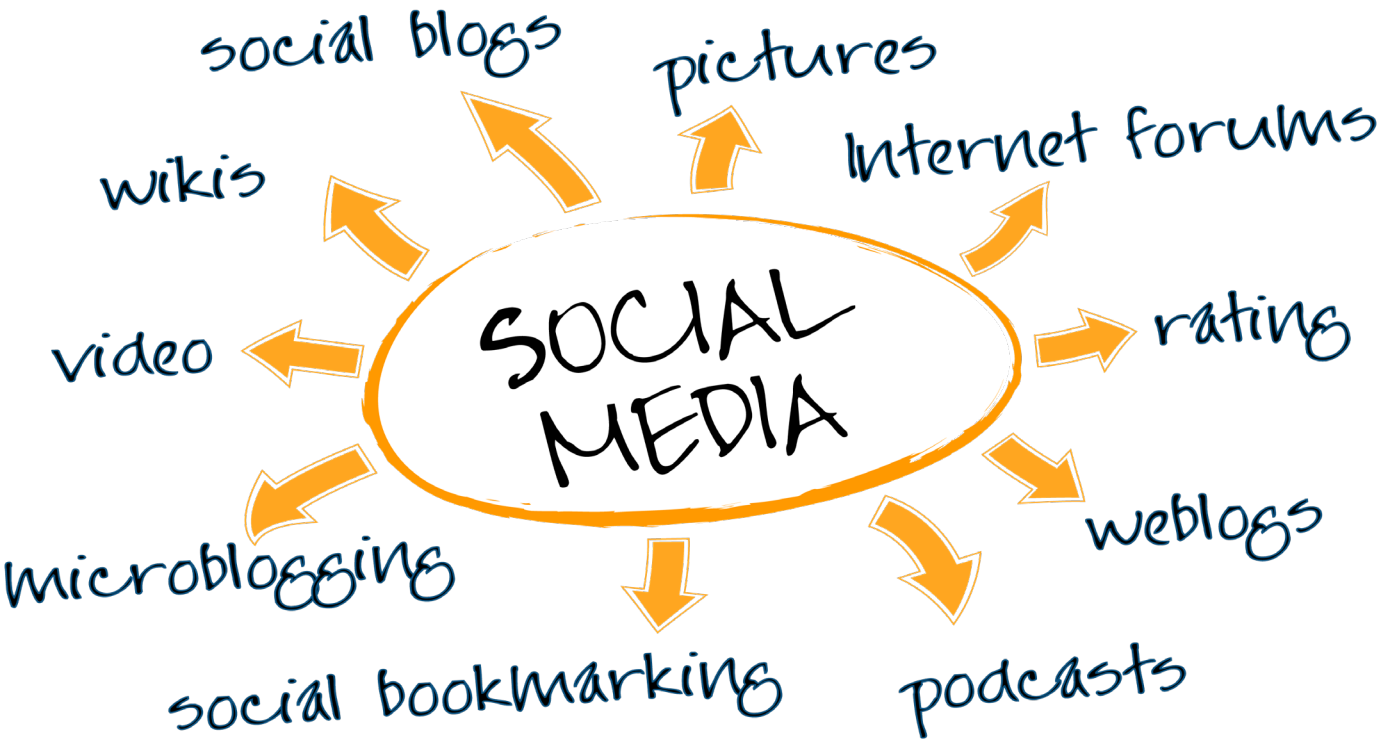
Things like….

- Open CODECs
- Signal envryption
- Echo cancellation
- Screen sharing
- Video smoothness



WebRTC, 2016

Privacy and Security Issues



Research Questions

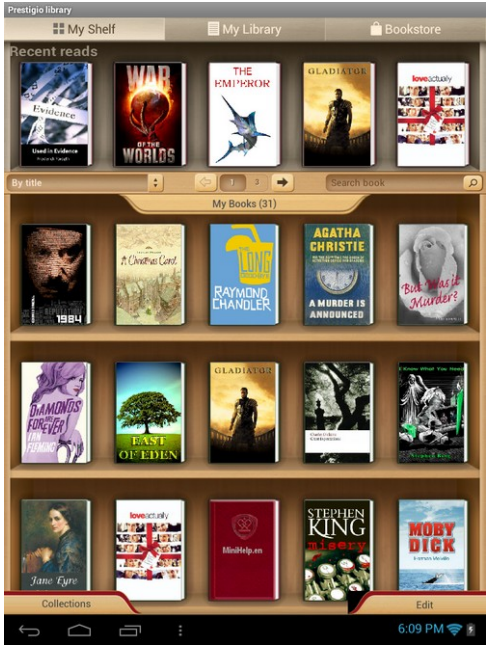
- What principles underlie the CSPS understanding of crowd-sourcing? Open, shared, social and crowdsourced?
- If there familiarity with crowd-sourcing models (eg. Open Social Learner Model), or endorsements of any?
- What open, shared, social and crowdsourced learning environments are currently supported?
- Are there tools and/or support for automated social network formation and management?
- What applications of crowd-sourcing are envisioned? (eg. public engagement, problem solving, knowledge bank)
- Does CSPS employ teaming environments (Jira, Slack, Git, Trello) and/or offer support for these?
- What provisions are there for authorship, sharing, annotation and ratings within the CSPS social environment?
- What role does social presence and/or social presence theory play in CSPS pedagogical approaches?
- Does CSPS support common messaging, communications, or other networking protocols?
- What security and privacy constraints apply to CSPS and other GoC environments? Bilingualism?

Virtual Library

Second Life

What is a Virtual Library?

- Acquisitions & Deposits - eg. GoC Depository Services
- Recommendations and surveys - eg. Hill Noters
- Browse categories - eg. McGill's Ecological Agricultural
- Search - eg., IEEE Xplore at Athabasca University
- Classifications - eg. WWW Virtual Library - http://vlib.org/
- Inquiry - eg. Library of Congress Ask a Librarian
- Tools - eg., Public Health Ontario MediQAT critical appraisal tool
- Read / View - eg. the British Library's Turning The Pages

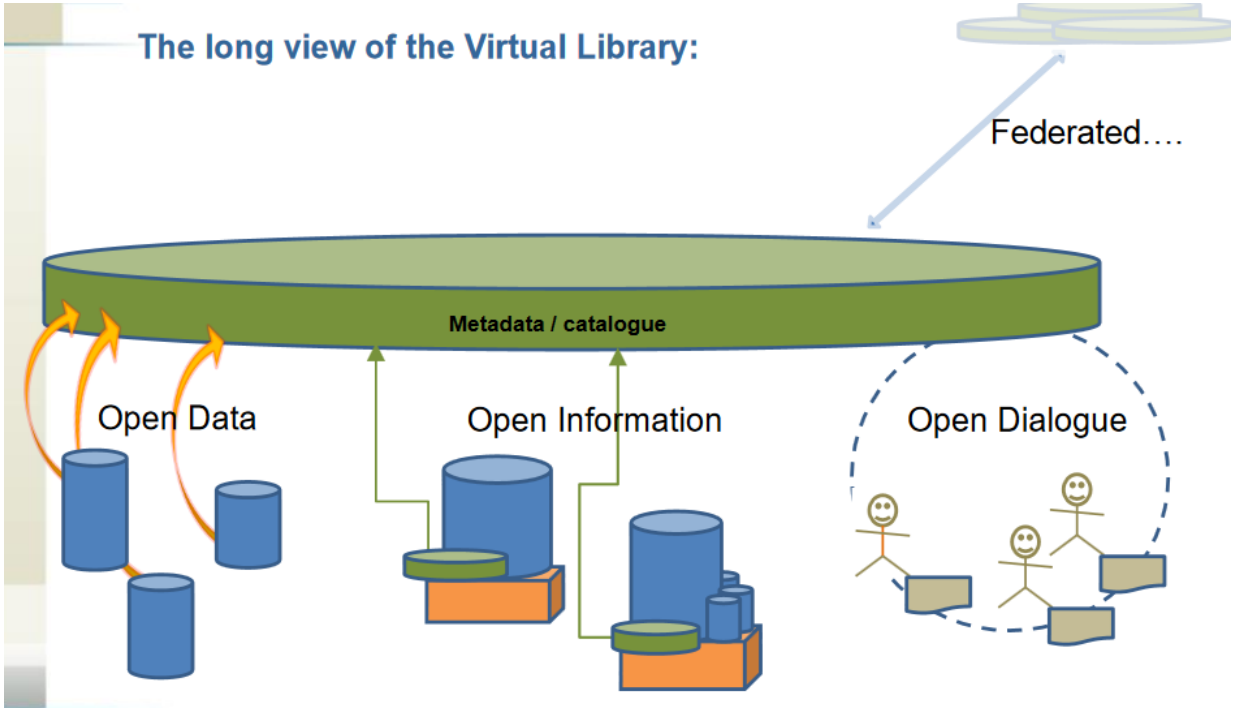


Some Canadian Examples

- Canada Revenue Agency - virtual reading room
- Open Government VL component - 2012
- Canadian Armed Forces virtual library -
- Department of fisheries and Oceans Virtual Library and WAVES access point
- Judicial Affairs - virtual library
- National Research Council
    - nPARC - staff publications
    - CODES / GUIDES
    - Virtual store
- Library and Archives Canada (LAC)
    - Library and Archives Canada Action plan on open government -
    - Virtual Gramophone - Canadian Historical Sound Recordings

- Federal Science Library (FSL) portal
    - Agriculture and Agri-Food Canada (AAFC)
    - Environment and Climate Change Canada (ECCC)
    - Fisheries and Oceans Canada (DFO)
    - Health Canada (HC) / Public Health Agency of Canada (PHAC)
    - National Research Council Canada (NRC)
    - Natural Resources Canada (NRCan)
    - Health Canada (HC) / Public Health Agency of Canada (PHAC)

- Vital Statistics - births, marriages and deaths



TBS, 2009

Open Government

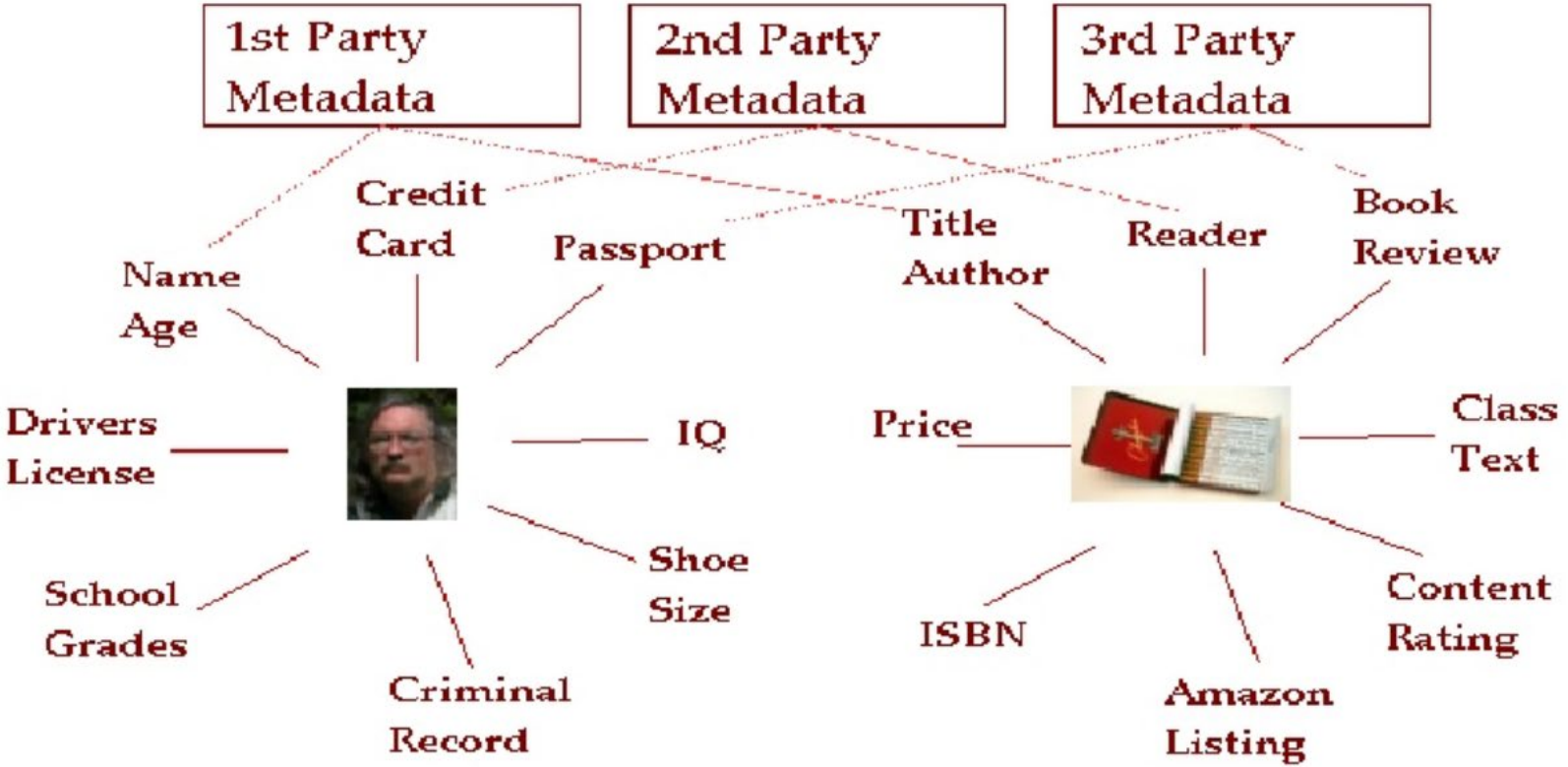
- Open data and open information
- Use of open data on GoC websites
- Inventories of data and information
- Removal of access restrictions

Standards and Metadata

Metadata Type	Example Properties	Primary Uses
Descriptive metadata	Title Author Subject Genre Publication date	Discovery Display Interoperability
Technical metadata	File type File size Creation date/time Compression scheme	Interoperability Digital object management Preservation
Preservation metadata	Checksum Preservation event	Interoperability Digital object management Preservation
Rights metadata	Copyright status License terms Rights holder	Interoperability Digital object management
Structural metadata	Sequence Place in hierarchy	Navigation
Markup languages	Paragraph Heading List Name Date	Navigation Interoperability

- Government of Canada Core Subject Thesaurus
- Library and Archives Canada Controlled Vocabularies
- The Depository Services Program (DSP)
- About ISBNs
- About Government of Canada Catalogue Numbers
- ISSNs
- Cataloguing in Publication (CIP)

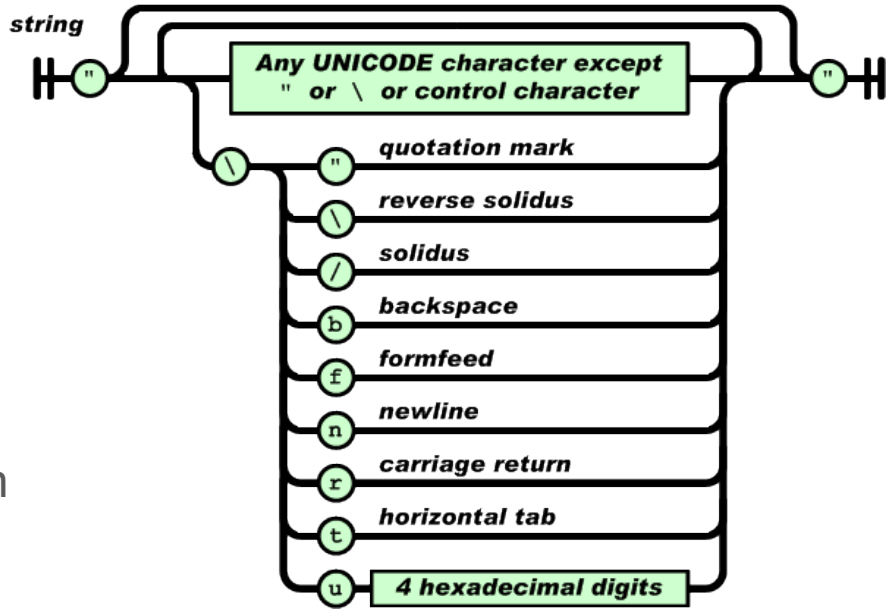
Resource Profiles



Downes, 2006

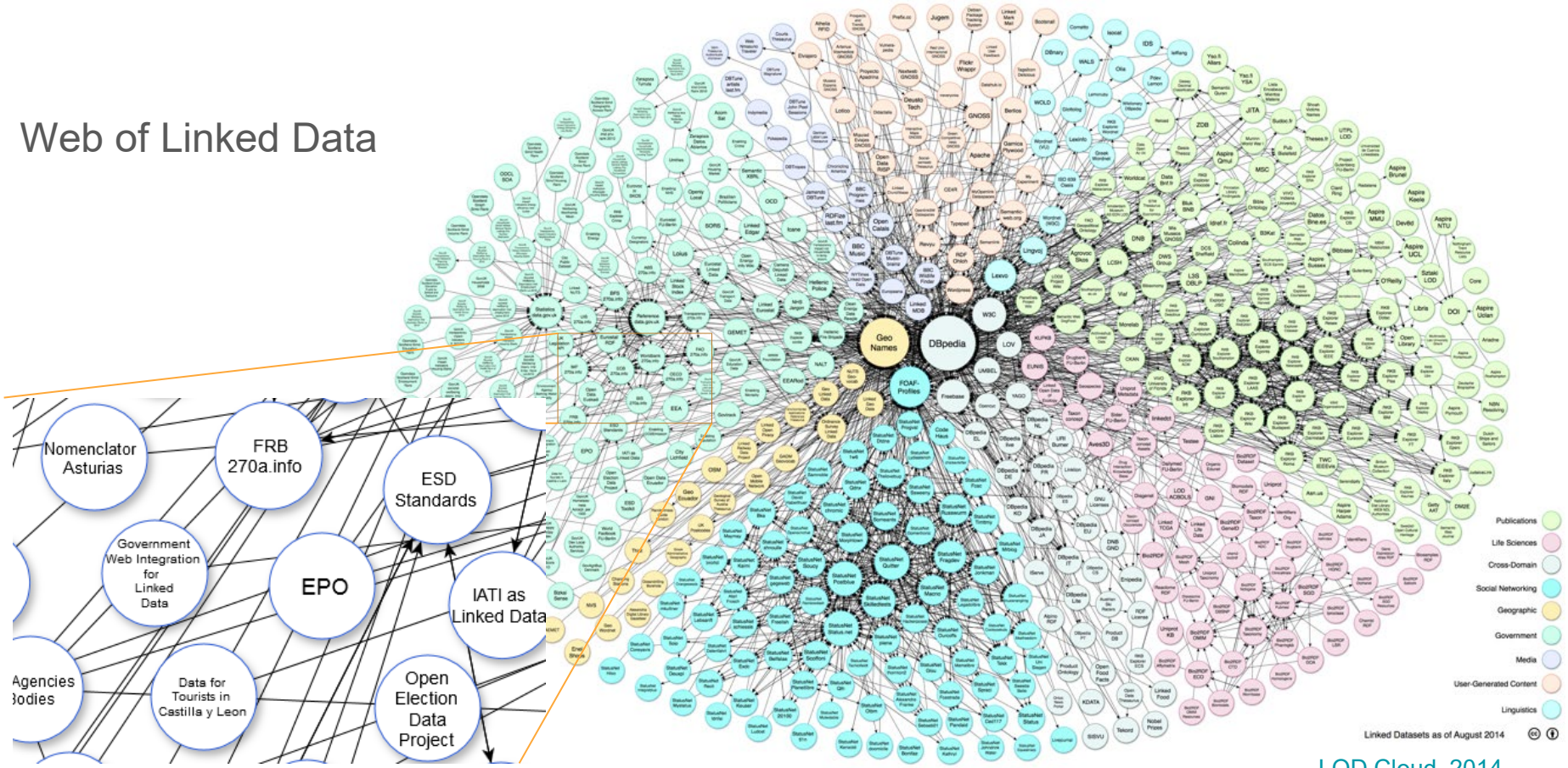
Metadata Representation / Serialization

- Plain text (eg., VCard)
- Databases (relational databases (MSSQL, MySQL, PostGre), non-relational database (Mongo), graph databases (Neo4J)
- XML
- Linked Data and Resource Description Format (RDF)
- Javascript Object Notation (JSON)



JSON

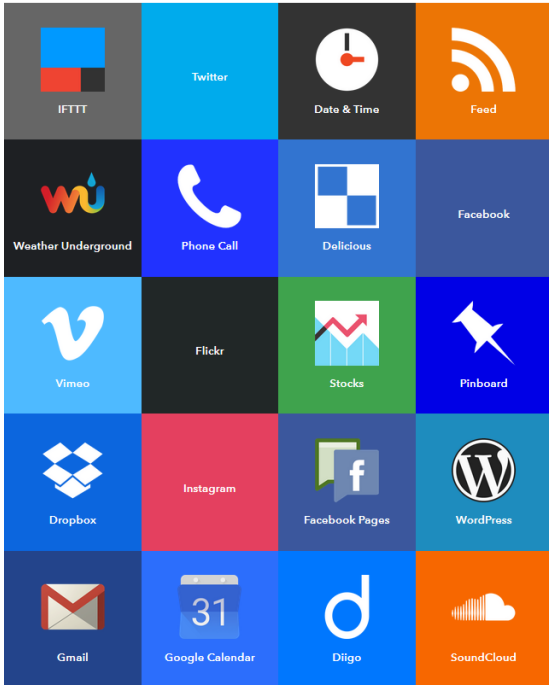
Web of Linked Data



LOD Cloud, 2014

Metadata and Resource Aggregation

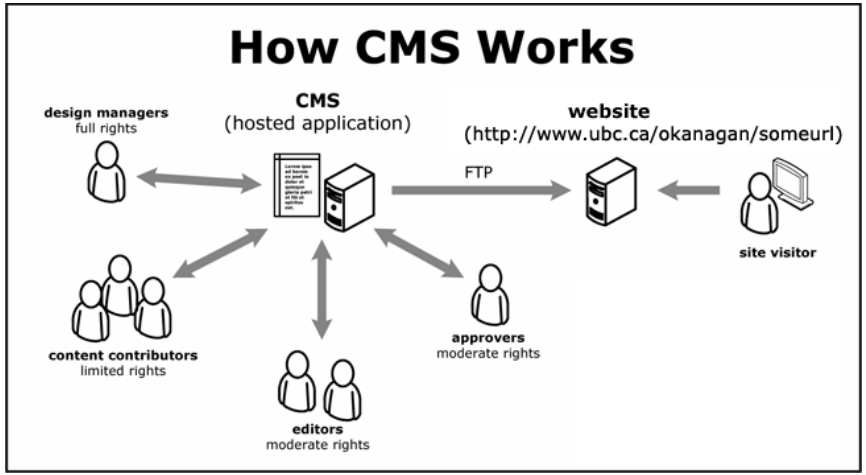
- Spiders and crawlers / scrapers
- RSS / AtomPub
- Open Archives Initiative / DSpace
- Application Programming Interfaces (APIs)
- Integration Systems (eg., IFTTT, Zapier)



IFTTT Channels, 2017

Content and Information Management

- CMSs, such as OpenText, Lexmark
- eBooks and Textbooks / Open eBooks
- Databases – Proquest, JSTOR, etc etc
- Course Libraries
- GCcampus tools (Moodle, Drupal, Saba)
- EPSS – Electronic Performance Support
- Media servers, such as Plex, Kaltura, Kodi
- App Marketplaces and Servers

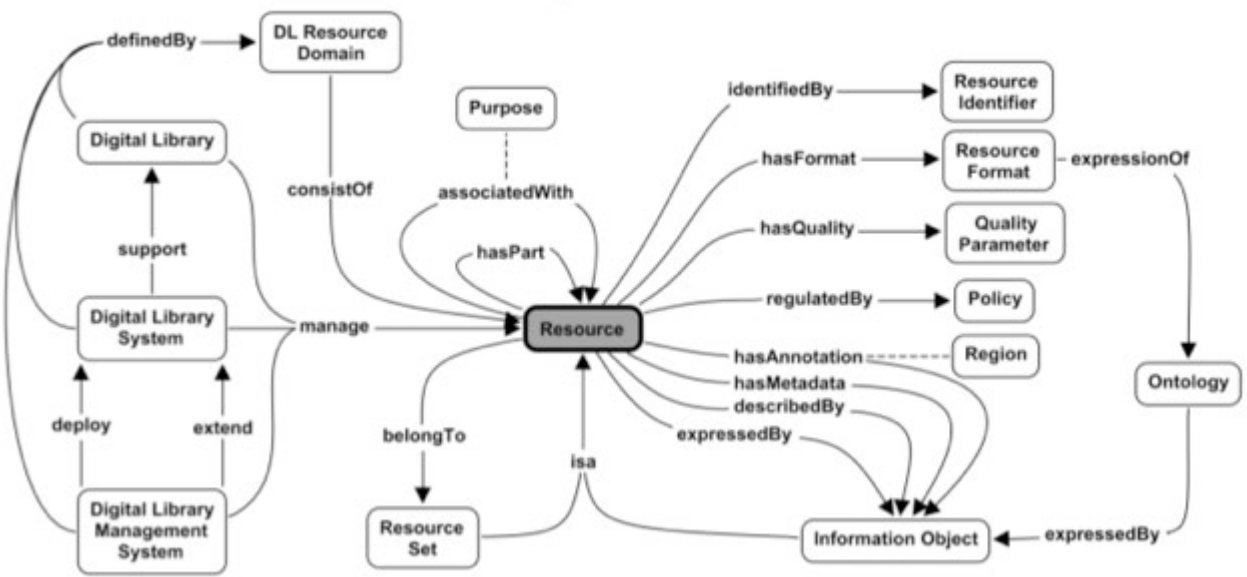


Brainsins, 2017

Virtual Library Platforms

- ACM - Association for Computing Machinery - proprietary system that is wholly developed, hosted, and maintained by ACM - open source (?)
- EPrints - open source software used to manage the EPrints publication library
- Fedora - modular open source repository platform
- Library for All - cloud-based low-bandwidth virtual library system
- Greenstone - can publish on DVD or USB stick
- MyCoRe - open source framework for management of digital content
- Public Knowledge Project - Open Journal Systems
- Omeka - designed for scholars, museums and libraries

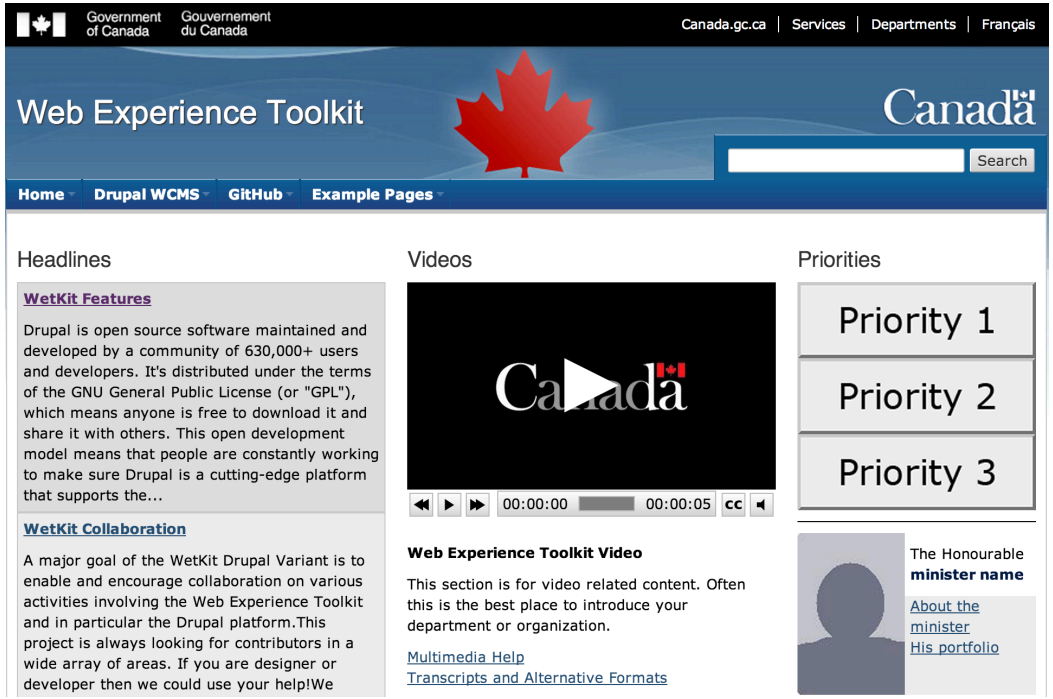
Assessments and Quality Control



Gazan, 2008

Social annotations in a virtual library

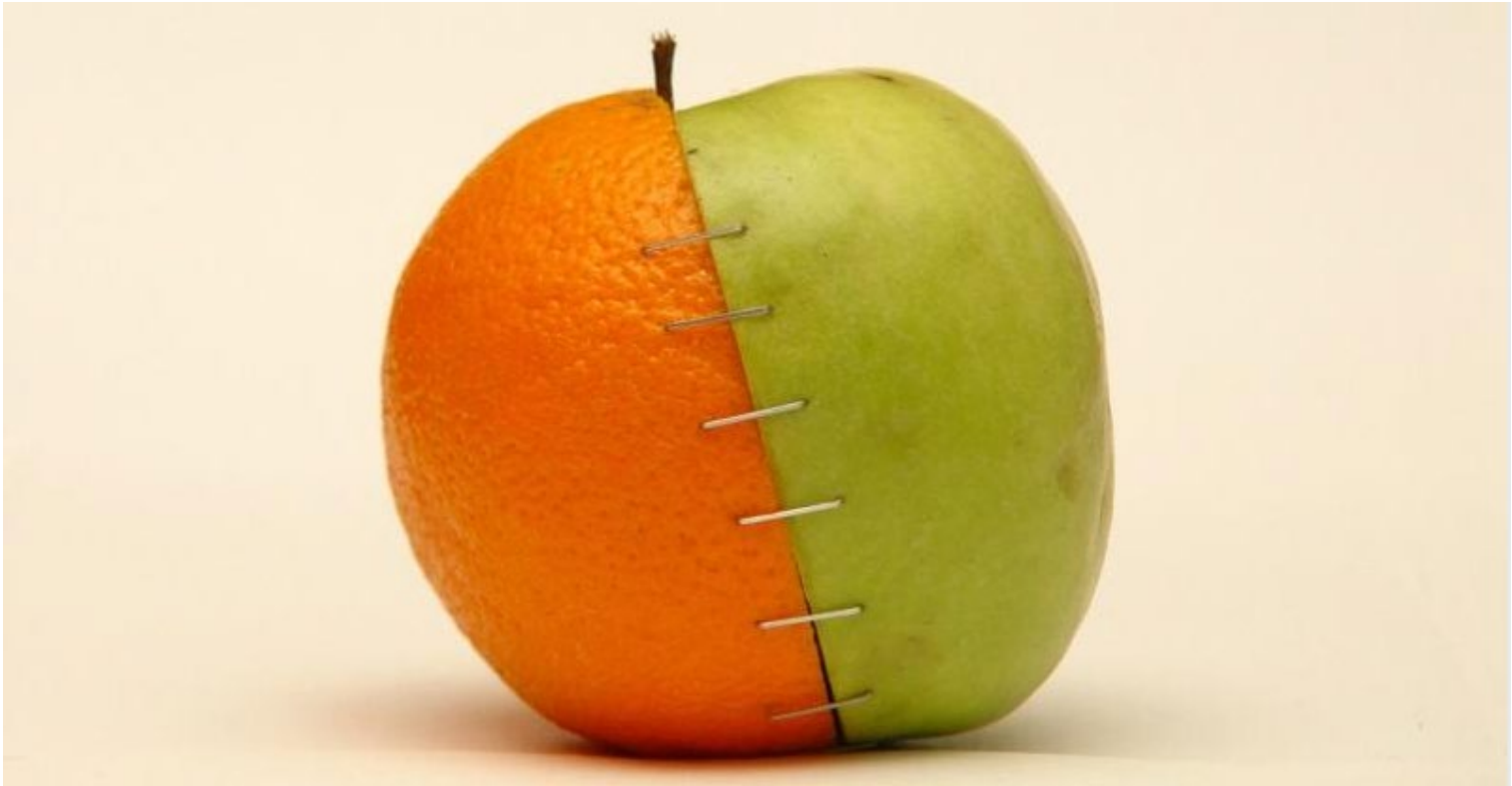
Rights / Language / Accessibility



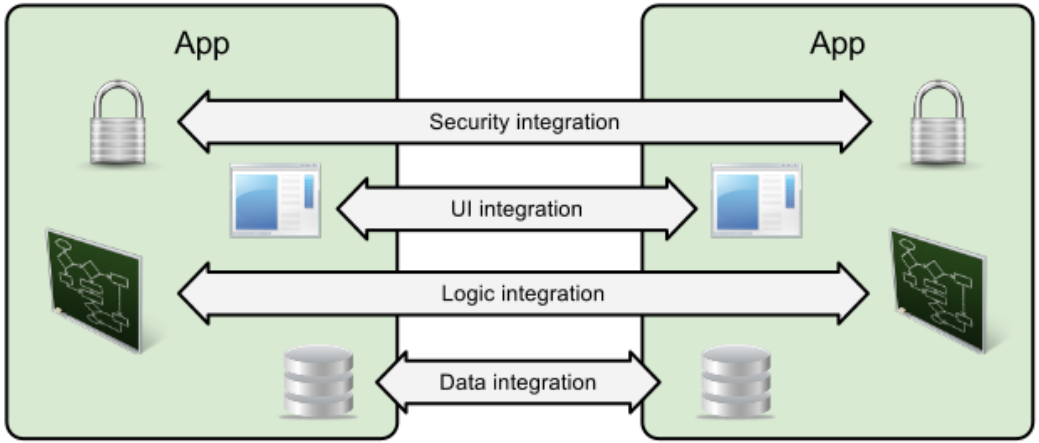
Research Questions

- How does CSPS define a virtual library, and what major functions does it envision a VL supporting?
- To what degree does CSPS leverage and/or is integrated with existing VLs in the GoC
- Would CSPS consider a VL to be part of Canada's wider Open Government initiative?
- What linkages does CSPS have to the GoC and wider library community?
- Has CSPS adopted internal resource metadata standards and/or tools for implementing those?
- Can other CSPS tools read, recognize and employ VL metadata records?
- What is CSPS's information and/or content management environment?
- Does CSPS employ or provide access to publication databases? If so, which?
- Does CSPS employ and/or provide access to internal and external course libraries?
- To what degree does CSPS employ open educational resources, and is there a policy regarding them?
- Does CSPS currently participate in shared library services?
- What mechanism, tools and/or standards does CSPS provide for material assessment and quality control?
- How does CSPS manage Rights / Language / Accessibility

Integration with Social and Collaboration Platforms



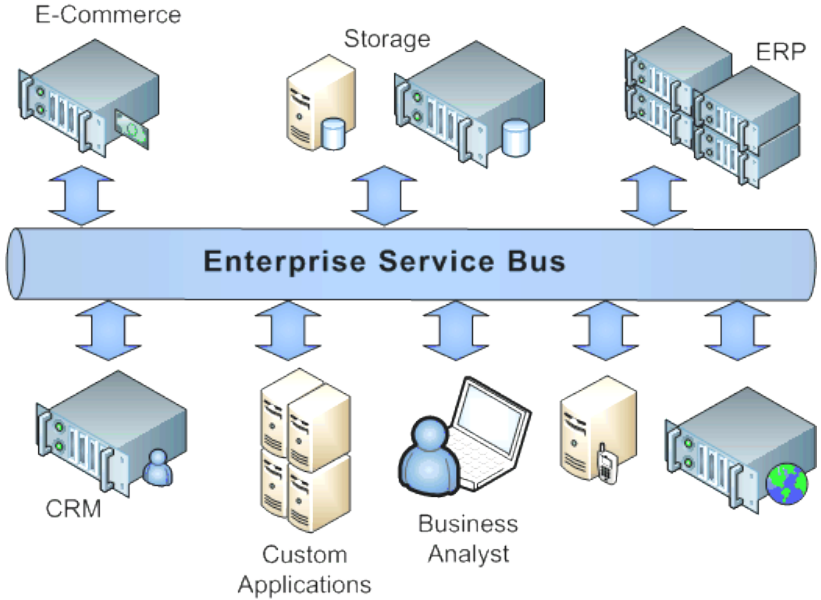
What Does Integration Mean?



Salesforce

- Full integration into a single management system
- Platform-based integration, with external services
- Custom integration with specialized bus
- Cloud-based integration with services and APIs
- Loose integration with services, APIs and middleware

- Inbound and outbound messaging
- SOAP APIs and toolkits, such as the Mobile SDK, AJAX Toolkit, Java, .NET, PHP and Adobe Flex integrations
- HTTP and REST integration using Application Programming Interfaces (APIs)
- Data aggregation and syndication using RSS, JSON, Open Archives Initiative (OAI)
- Authentication and identity federation



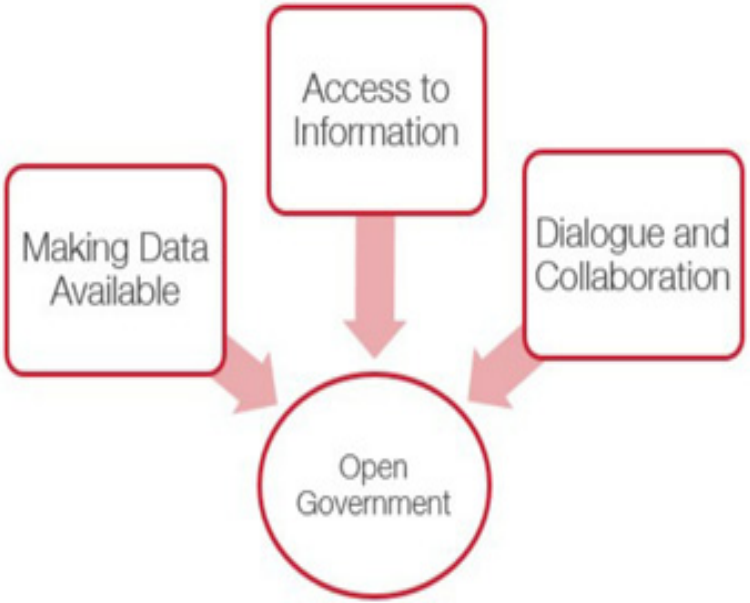
Centeractive

GoC Platforms – what's out there

- BuyAndSell - single source for government contracting, sales and services - https://buyandsell.gc.ca/
- GCCampus - the Canada School of Public Service online learning platform, front-ended with Drupal and incorporating Saba, Kaltura, and other back-end services - https://learn-apprendre.csps-efpc.gc.ca/
- GCPedia - Wikipedia-like repository of information and resources, accessible to members of the public service - http://www.gcpedia.gc.ca
- GCConnex - Elgg-based social networking service for members of the public service - https://gcconnex.gc.ca/splash/

- GCCollab - Newly launched Elgg-based social networkings service for members of the federal public service, provincial public service, and college and university members - https://gccollab.ca/newsfeed/
- GCTools also include GCintranet and GCdirectory
- National Science Library - as described in the 'Virtual Libraries' section above, a single interface to virtual libraries hosted by six of Canada's science-based departments - http://fsl-bsf.scitech.gc.ca/eng/intranet/home/
- GoC webex - common conferencing system used by many government of Canada staff and departments - https://pwgsc-nh.webex.com
- Open government portal - access to data sets, dialogue on open government, and information requests - http://open.canada.ca/en
- Job Bank - www.jobbank.gc.ca

Integration Drivers

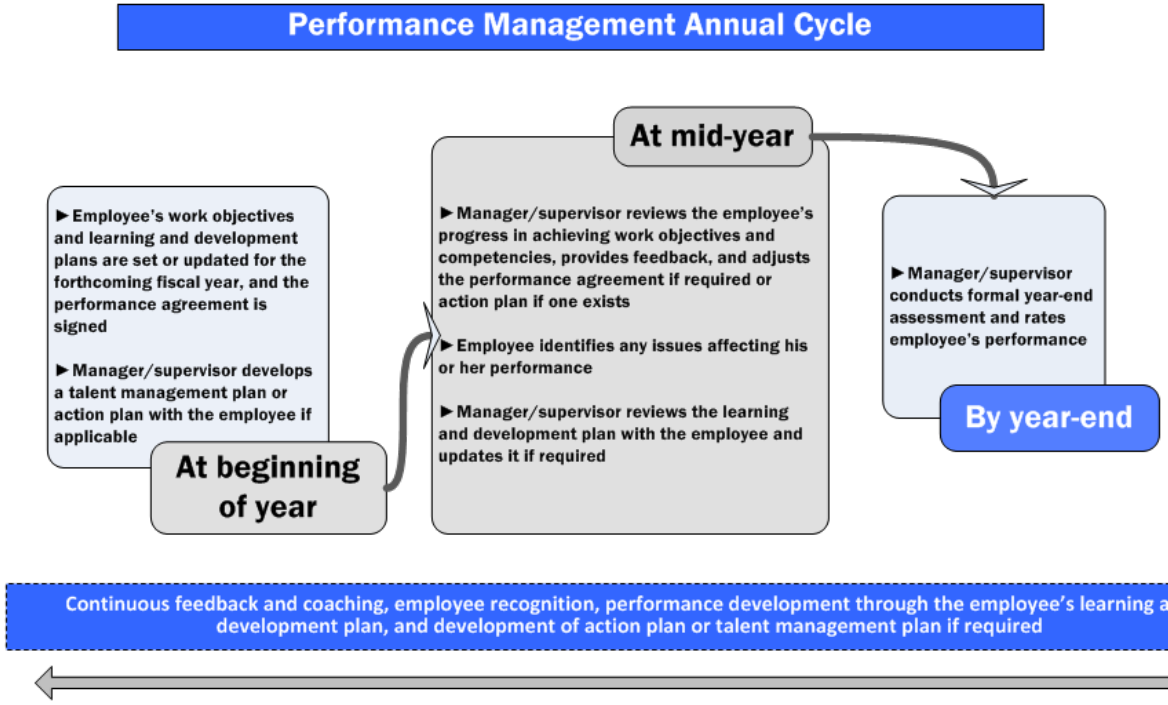


- Engages staff and partners
- Enhances service delivery
- Makes smart use of new technologies
- Creates a high-performing workforce

Blueprint 2020

Canada's Draft Plan on Open Government (2016-2018) (GoC, 2016) initiative also envisions linking services and opening access to the public, as evidenced by the 2016-2018 roadmap

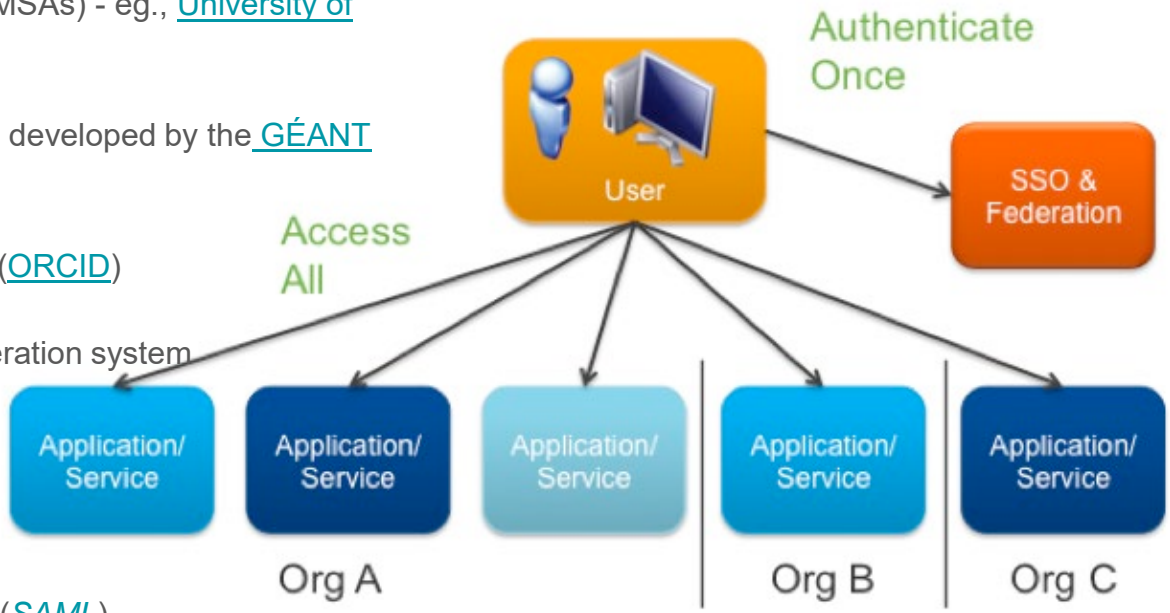
Employment and Occupations



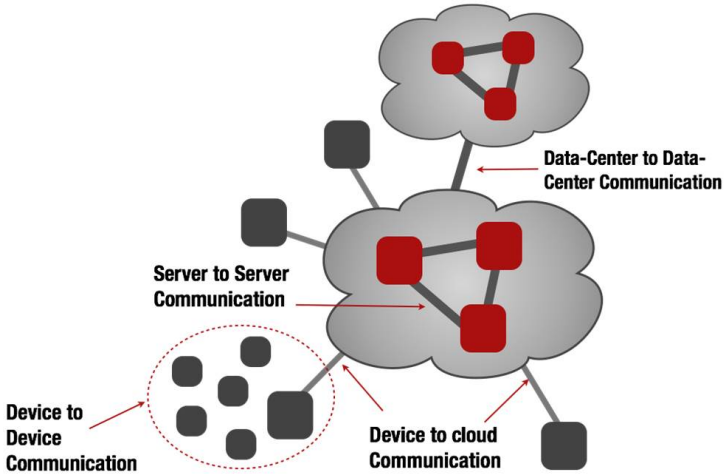
[TBS, 2017]

Authentication and Single-Signon

- Group Managed Service Accounts (gMSAs) - eg., University of Washington
- EduRoam - worldwide academic login developed by the GÉANT network in Europe
- Open Researcher and Contributor ID (ORCID)
- Shibboleth - open source identity federation system
- Trulioo - for APIs and applications
- OpenID-like authentication
- Security Assertion Markup Language (*SAML*)



Distributed Platforms and Cloud Computing



ISO/IEC JTC 001/SC 38 "Cloud Computing and Distributed Platforms" manages standards related to:

- Service Oriented Architecture (SOA)
- Service Level Agreement
- Interoperability and Portability
- Data and their Flow Across Devices and Cloud Services

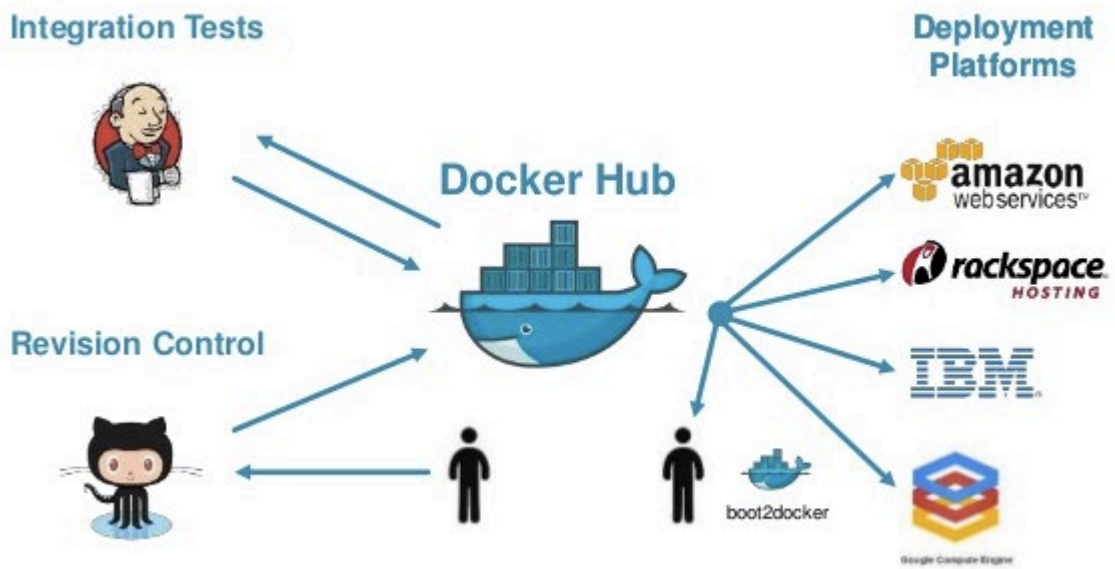
[Wolfram Alpha]

Environments: VMWare Fusion, VirtualBox

Provisioners: Docker, Vagrant

Providers: AWS, MS Server

Services: MS Cognitive, Wolfram Alpha, Segment



Some Applications

- Distributed social networking
- Expert search
- Second screen
- Cloud-based Simulation

Corona Aerospace

Research Questions

- What constitutes 'other platforms' for the purposes of this project?
- What does 'integration' mean?
- What knowledge of other platforms within GoC does CSPS have?
- Does CSPS environ and/or support linkages with employment and occupational platforms?
- How does CSPS support identification and single sign-on, and are these compatible with external systems?
- Could CSPS support changing the SSO mechanism with existing technology?
- Does CSPS have expertise and/or support for distributed environments, virtualized environments, and on- and off-campus provisioning?
- How would CSPS work with GCCollab? With public interactions?

Project Team

Stephen Downes – principle investigator

Bruno Emond – project lead

Hélène Fournier – research officer

Irina Kondratova – research officer

Shirley MacLeod – knowledge management

National Research Council Canada
Conseil national de recherches Canada