Cloud First Application Development

Lunchtime Learning

July 20, 2017

Bryan Hopkins, Lisa McBriar, Sam Donnelly

ISC's Cloud First Program

Cloud First AppDev Team

Not everyone is speaking, but this is <u>everyone's</u> work

- ❑ Tim Bouffard, Application Architect
- ❑ Dave Curran, Sr. Business Systems Analyst
- ❑ Sam Donnelly, Sr. Application Developer
- ❑ Bryan Hopkins, Sr. IT Project Leader
- ❑ Anome Mammes, Sr. Application Developer
- ❑ Lisa McBriar, Sr. Business Systems Analyst
- ❑ Frank Nguyen, Sr. Application Developer
- ❑ Matt Schleindl, Application Architect

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Today

- ❑ Stack vs. Framework
- ❑ Technology: Closer look at the cloud stack
  - ➢ How does each help?
- ❑ Processes: Agile and Test Driven Development
- ❑ Putting it in your hands
- ❑ What's on your mind?

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What goes into an app

✓ A user interface
What people see

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Behind the scenes

- ✓ User interface
- ✓ Business logic
- ✓ Authentication and security
- ✓ Persistence and data stores
- ✓ Integration points
- ✓ Testing
- ✓ Source repository
- ✓ Deployment pipeline
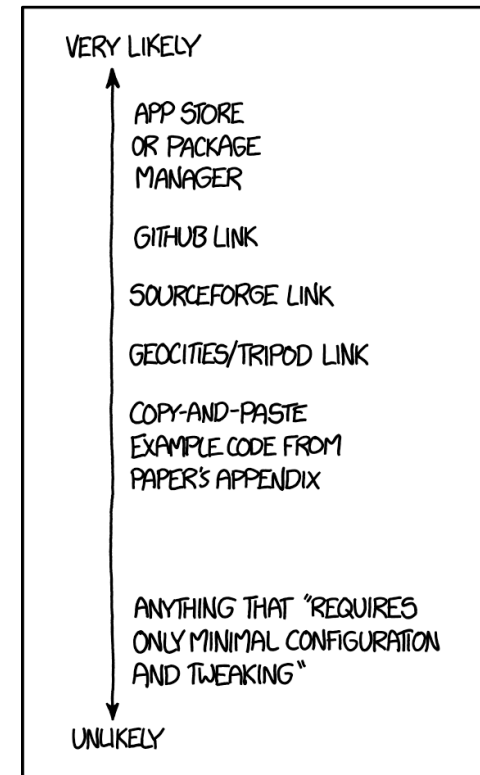- ✓ Platform
- ✓ Process and SDLC

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Cloud First Principles

❑ Choose simplicity, speed, and iterative improvement over up-front completeness and strict controls.

❑ Continuously iterate and re-evaluate decisions; nothing is beyond question.

❑ Be mindful of increasing technical debt.

❑ Choose automated solutions over manual ones, but respect the implications to manual process owners.

❑ Use tools and technologies "off the shelf" in secure ways and as the provider intended.

LIKELIHOOD YOU WILL GET CODE WORKING
BASED ON HOW YOU'RE SUPPOSED TO INSTALL IT:

VERY LIKELY

APP STORE
OR PACKAGE
MANAGER

GITHUB LINK

SOURCEFORGE LINK

GEOCITIES/TRIPOD LINK

COPY-AND-PASTE
EXAMPLE CODE FROM
PAPER'S APPENDIX

ANYTHING THAT "REQUIRES
ONLY MINIMAL CONFIGURATION
AND TWEAKING"

UNLIKELY

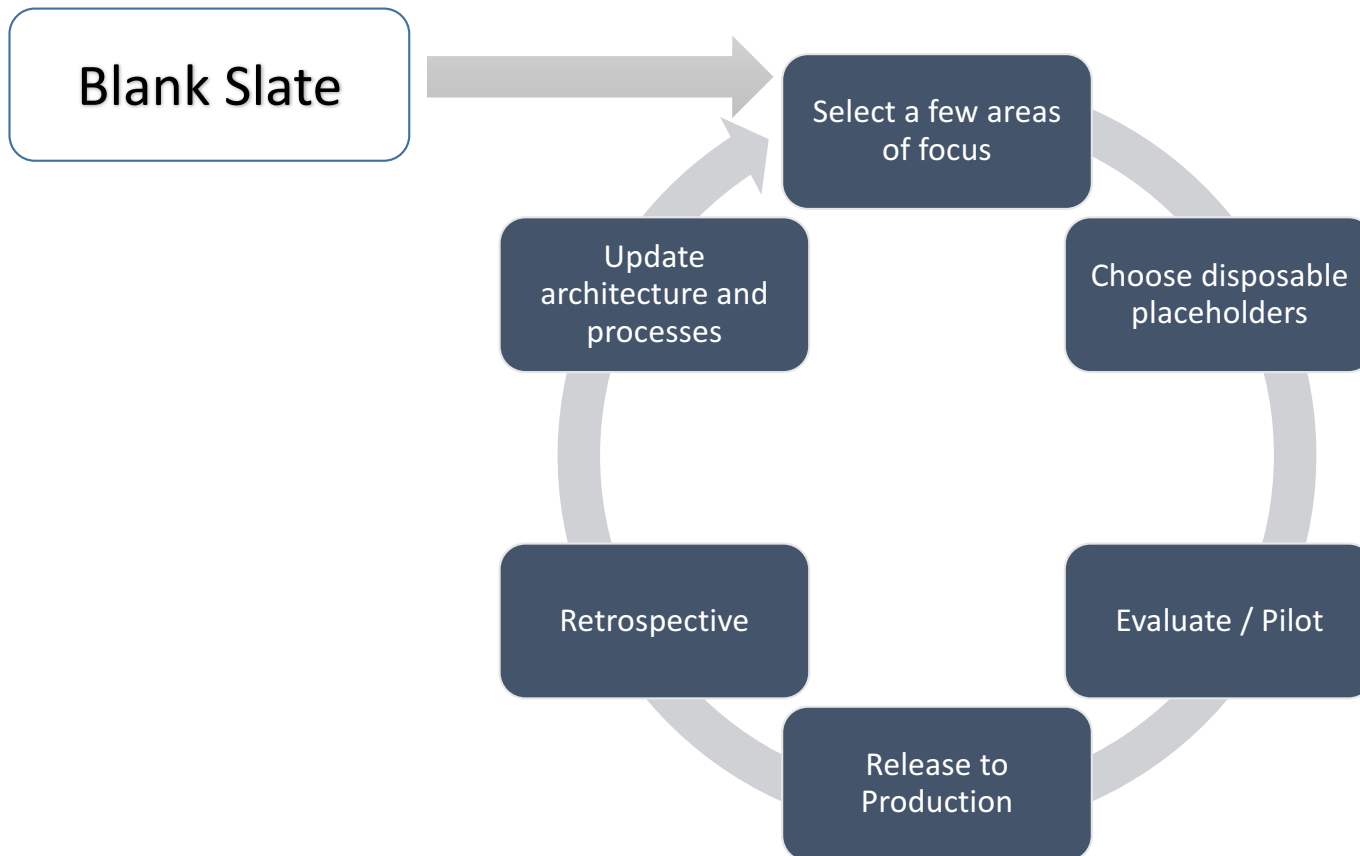Credit XKCD.com https://xkcd.com/1742/

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So how does that translate?

- ➢ Assembling a stack
- ✓ Prioritize
- ✓ Evaluate
- ✓ Integrate
- ✓ Automate

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Our Process

Blank Slate

Select a few areas of focus

Choose disposable placeholders

Evaluate / Pilot

Release to Production

Retrospective

Update architecture and processes

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Where do we stand?

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User Interface

	For Developers…	For Analysts…	For Project Managers…
AngularJS / Bootstrap	• Full framework • Thousands of components • Readily available examples • Data binding	• <u>Responsive</u> by default • <u>Accessible</u> components • Cleaner, simple UIs • UX vision more achievable	• Open source • From Google and Twitter • Easy to find resources
JetBrains Webstorm	• In-browser debugging • Angular-aware code completion • Variable completion with typing with JSDoc		• Inexpensive • Contractors already know it

University of Pennsylvania ISC: Cloud First

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Business Logic

JetBrains PyCharm

	For Developers…	For Analysts…	For Project Managers…
	• Full framework • Thousands of packages • Readily available examples • Simple and powerful: few lines of code	• Self documenting APIs • Automatically generated test interfaces	• Open source • Tremendous campus presence • Very easy to learn • Easy to find resources
	• Django-aware code completion • Great Django Testing integration		• Inexpensive with a free tier

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Authentication and Security

	For Developers…	For Analysts…	For Project Managers…
	• Thousands of packages • Readily available examples • Incredible I/O performance • Full stack	• No effort PennKey login with Shibboleth	• Open source • Easy to find resources
	• Framework-aware code complete • Fullstack debugging with AngularJS		• Inexpensive with a free tier

JetBrains Webstorm

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Data Store

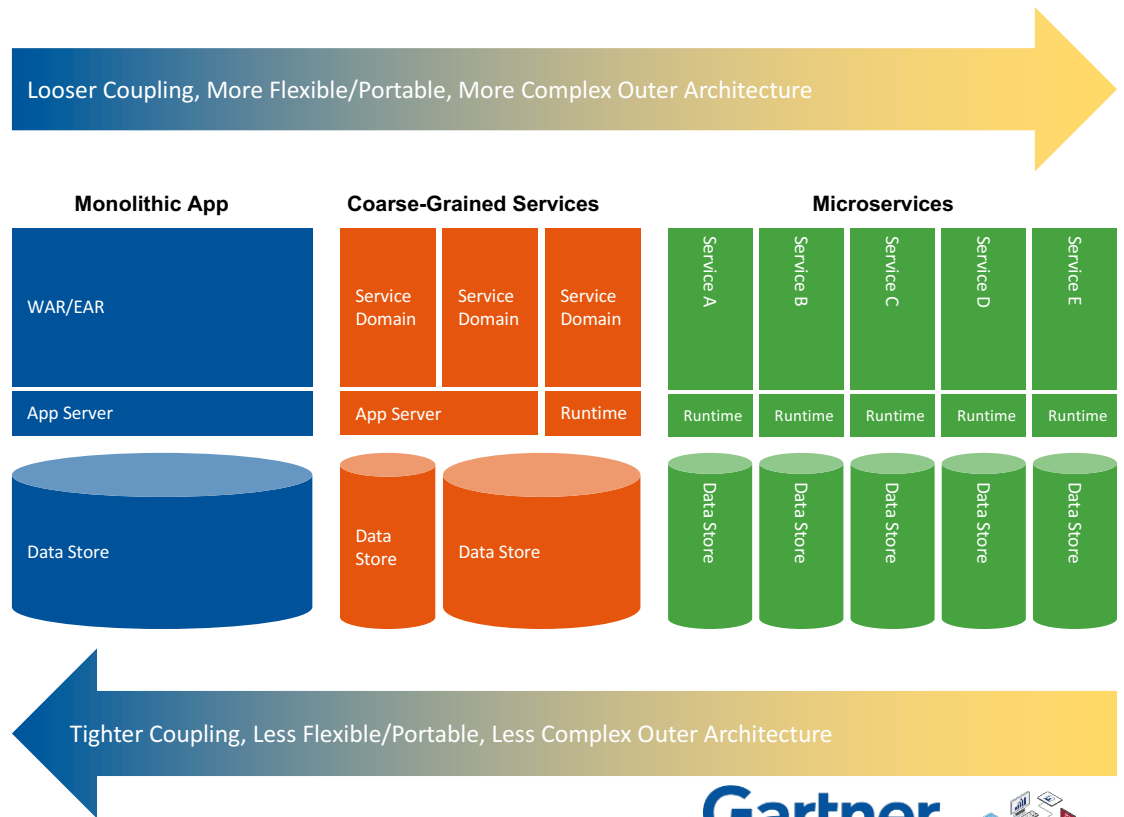|	For Developers…	For Analysts…	For Project Managers…
PostgreSQL	• Oracle-like features • That actually work! • Highly performant • Relational AND NoSQL	• Drop-in replacement for Oracle • Works great with Talend • DB of choice for warehousing	• Open source, ethical, and Free • Strong local presence
JetBrains DataGrip	• Works with every RDBMS • Powerful autocompletion	• Very easy to use • Don't need to know SQL	• Inexpensive

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Integration

	For Developers…	For Analysts…	For Project Managers…
API Gateway	• Fully supported SDK in every language • Easy to follow examples • Framework and platform agnostic • Built in DDoS protection	• Powerful and flexible security models • API Keys and Usage plans • Configurable "stages"	• Incredibly cheap • Fully managed • Serverless • Taggable for cost transparency • Service orientation
Amazon SQS	• Fully supported SDK in every language • Failure tolerant • Limitless scalability	• Works with Mule	• Inexpensive • Taggable for cost transparency

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Closer Look: Microservices and SOA

- ➢ No longer self-contained
- ➢ Think service areas
  - ❑ DAR
  - ❑ Finance
  - ❑ Student systems
  - ❑ HR
  - ❑ Research
- ➢ Composed of small pieces
  - ❑ Reusable
  - ❑ Built that way
  - ❑ Deployed that way

Looser Coupling, More Flexible/Portable, More Complex Outer Architecture

Monolithic App

WAR/EAR

App Server

Data Store

Coarse-Grained Services

Service Domain | Service Domain | Service Domain

App Server | Runtime

Data Store | Data Store

Microservices

Service A | Service B | Service C | Service D | Service E

Runtime | Runtime | Runtime | Runtime | Runtime

Data Store | Data Store | Data Store | Data Store | Data Store
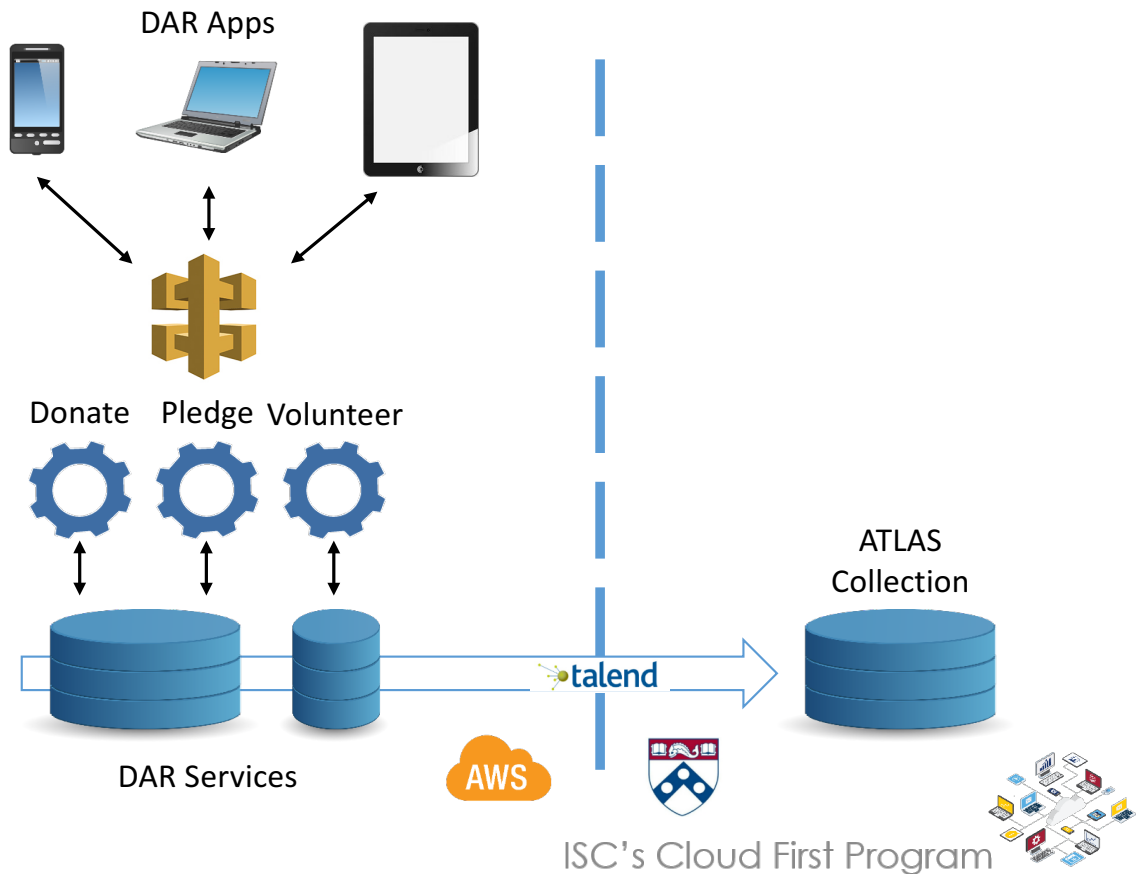
Tighter Coupling, Less Flexible/Portable, Less Complex Outer Architecture

Gartner

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Closer Look: Microservices and SOA

- ➢ No longer self-contained
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  - ❑ Deployed that way

DAR Apps

Donate   Pledge   Volunteer

ATLAS Collection

talend

DAR Services

AWS

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Testing

	For Developers…	For Analysts…	For Project Managers…
	• Confidence in the spec	• Easy to create and understand • Fully automated regression tests	• Bugs caught early take 10x less time
KarmaJS	• Built for AngularJS • Easy stubbing and mocking with Sinon		
DJANGO TESTCASE	• Straightforward • Like Junit • **_Easy_** to test WebServices: no setup		

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Source Repository

	For Developers…	For Analysts…	For Project Managers…
Gitlab Cloud	• Offline work • Easy branches and merging • Webhooks for CI/CD integration	• Create documentation developers actually use • Intuitive web interface to browse files	• Open source • Universal adoption (git)

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Deployment Pipeline

	For Developers...	For Analysts...	For Project Managers...
Jenkins	• Automate with Python • Developers' Swiss Army knife	• More frequent deployment • Automated tests run on each build • Slack Integration	

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Platform

	For Developers…	For Analysts…	For Project Managers…
Amazon Lambda	• Serverless • <u>Only worry about code</u> • Provisioned as code • Isolated microservices • Easy DRF integration with Zappa		• Incredibly cheap • Nothing to patch • Massively scalable • Taggable for <u>cost transparency</u>
docker	• Can run any docker image • Service isolation • Blue-green deployments		• Can be sized and scaled to order • Taggable for <u>cost transparency</u>

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Platform

	For Developers...	For Analysts...	For Project Managers...
Amazon RDS	• Fully Managed Service • Provisioned as code	• Access like any other database	• Fully managed • Nothing to patch • Scalable • Taggable for <u>cost transparency</u>

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Closer Look: Infrastructure as Code

➢ Everything about your app is just code

➢ Creating it defines and documents it

➢ No patching. Delete and re-create.

➢ No waiting!
No manual action!
Right the first time!

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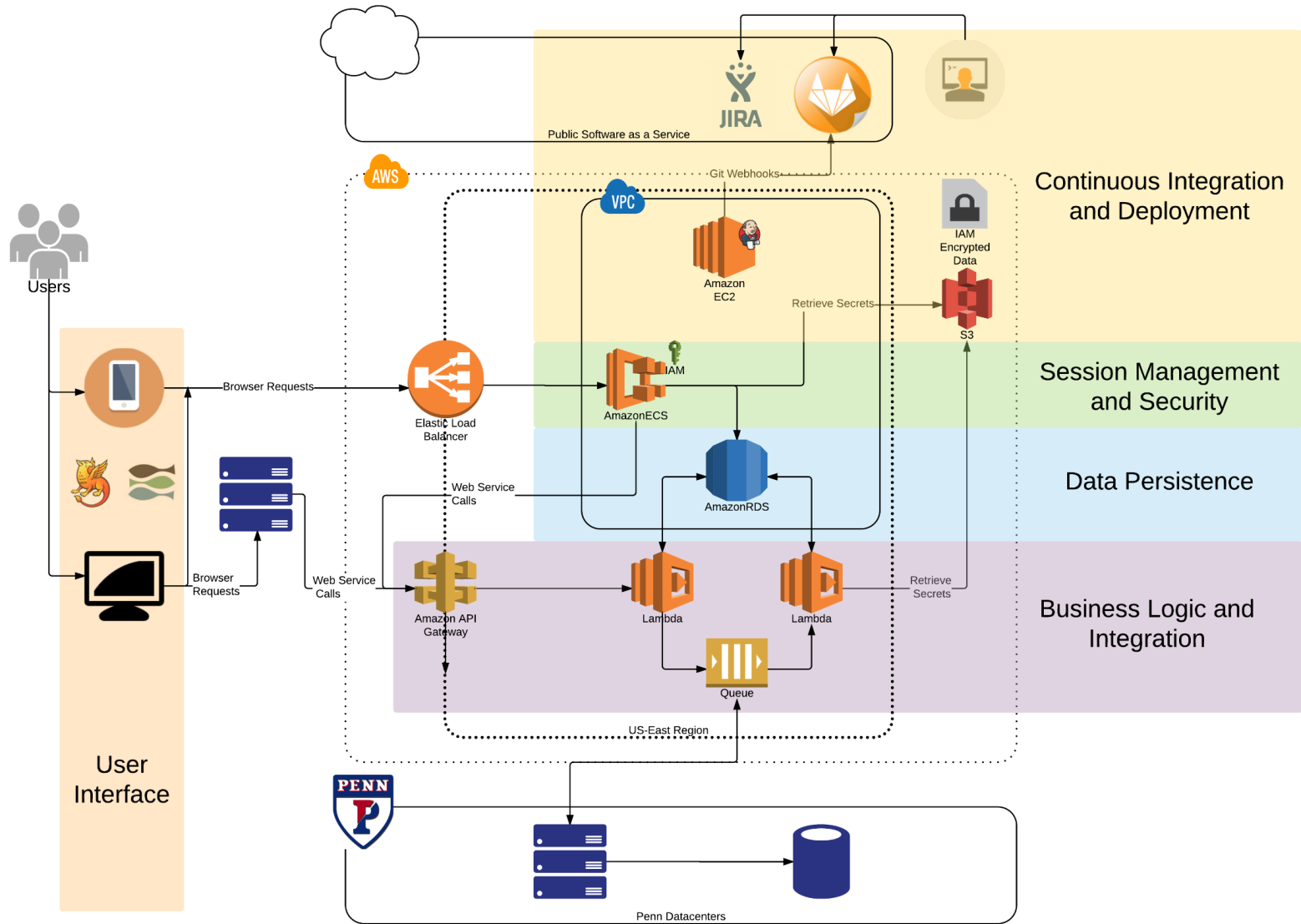
Closer Look: Infrastructure as Code


```
"MyDB" : {
 "Type" : "AWS::RDS::DBInstance",
 "Properties" : {
     "DBSecurityGroups" : [
        {"Ref" : "MyDbSecurityByEC2SecurityGroup"}, {"Ref" : "MyDbSecurityByCIDRIPGroup"} ],
     "AllocatedStorage" : "5",
     "DBInstanceClass" : "db.m1.small",
     "Engine" : "MySQL",
     "MasterUsername" : "MyName",
     "MasterUserPassword" : "MyPassword"
 },
 "DeletionPolicy" : "Snapshot"
}
```
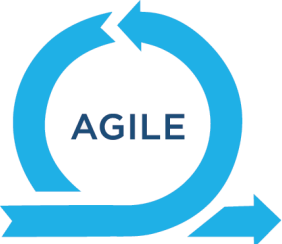
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How does the tech fit together?

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Continuous Integration and Deployment

Session Management and Security

Data Persistence

Business Logic and Integration

Users

User Interface

Browser Requests

Browser Requests

Web Service Calls

Web Service Calls

Public Software as a Service

JIRA

Git Webhooks

AWS

VPC

Amazon EC2

IAM Encrypted Data

Retrieve Secrets

S3

Elastic Load Balancer

AmazonECS

IAM

AmazonRDS

Amazon API Gateway

Lambda

Lambda

Retrieve Secrets

Queue

US-East Region

PENN

Penn Datacenters

University of Pennsylvania

What about process?

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Process and SDLC

	For Developers...	For Analysts...	For Project Managers...
JIRA	• Familiar tool • Easy to use • Highly collaborative	• Plugin store • Dependency tracking • Drag and drop prioritization	• Transparency • Reports and progress-at-a-glance • Collaborate externally
AGILE	• Focus on only a few details at a time • Frequent feedback and adjustment	• Focus is on "Yes" • Rely on domain knowledge and organization • No document writing	• Speed and time-to-value • Responsive to changes in priorities

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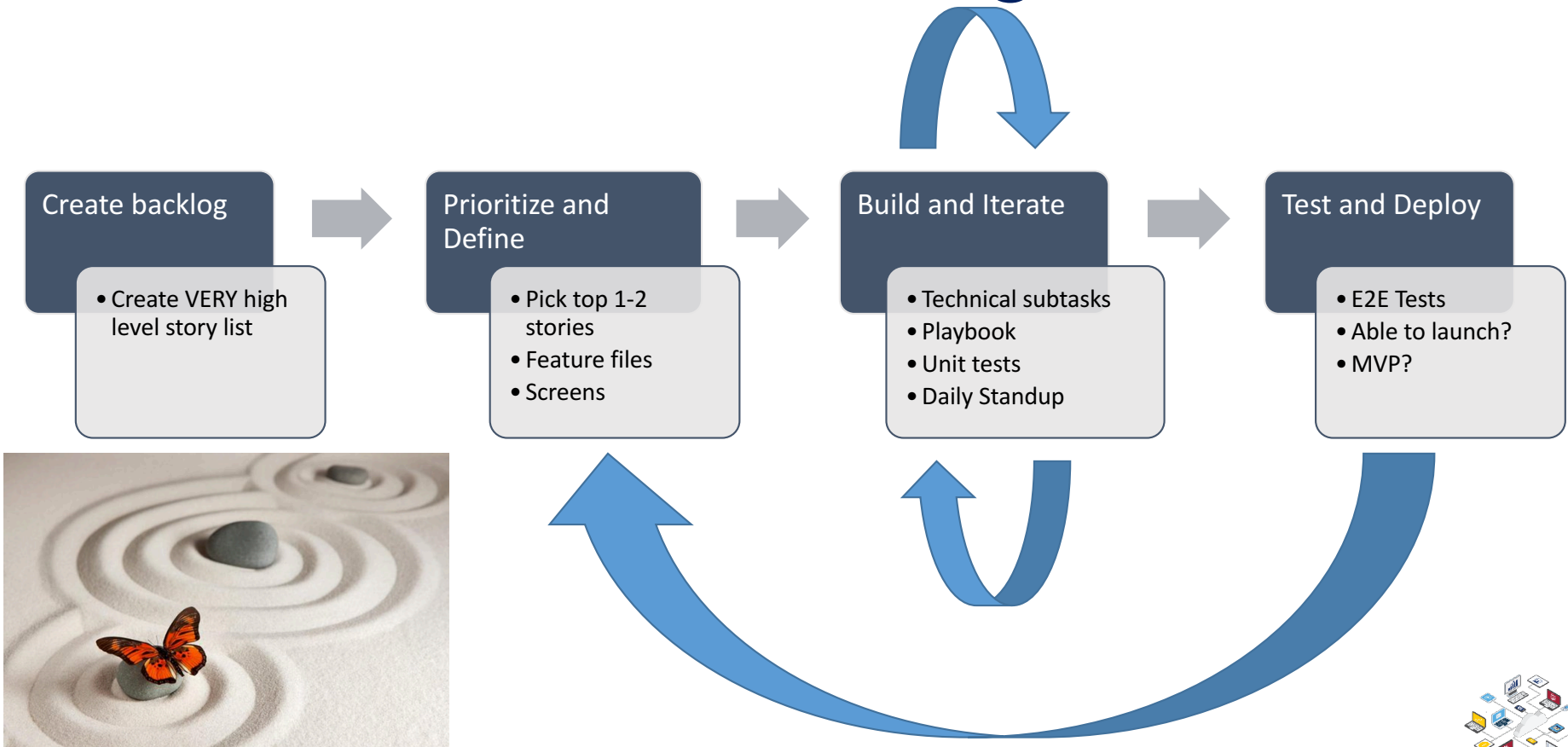
Closer Look: Cloud First Agile

Terminology

➢ **Backlog**

Sorted list of everything the clients want.
Things at the top are better defined than things at the bottom.

➢ **Sprint**

Period of time where the team focuses on implementing the clients' top priorities.

➢ **User story**

The basic unit of work capturing a feature or requirement from the end user's perspective.

➢ **Epic**

A collection of User Stories that together define a significant feature or business process

Product backlog items

Small size
Lots of details

Worked on soon

Large size
Few details

Not worked on soon

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Closer Look: Cloud First Agile

Create backlog	Prioritize and Define	Build and Iterate	Test and Deploy
• Create VERY high level story list	• Pick top 1-2 stories • Feature files • Screens	• Technical subtasks • Playbook • Unit tests • Daily Standup	• E2E Tests • Able to launch? • MVP?
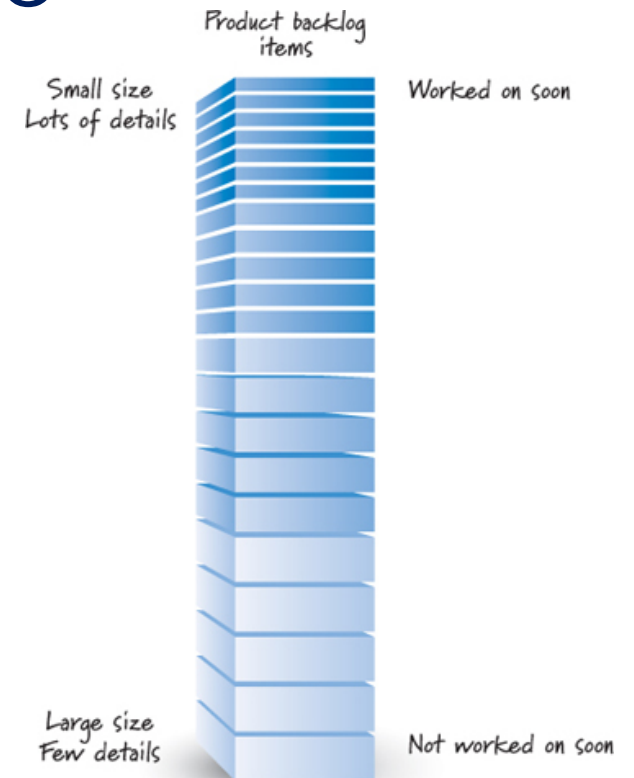
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Closer Look: Cloud First Agile

Backlog drag and drop example

https://penn-isc-es.atlassian.net/secure/RapidBoard.jspa?projectKey=APND&rapidView=21&view=planning

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Closer Look: Cloud First Agile

User Story Playbook

✓ Feature File

✓ Screen Mockups

✓ Architecture
- ❑ Swagger
- ❑ Diagram
- ❑ Review with partners

✓ Unit Tests

✓ E2E Tests

✓ Code Review

✓ Accessibility Testing

- The checklist will be used by the developer assigned to the story to review standards agreed upon and keep track of progress.
- ⚠ = In progress
- ✅ = Done/complete
- ➖ = Skip based on dev and architect agreement
- Once the developer is ready for 5.6 Code Review and 5.7 Dev team UNIT load testing, the jira can be reassigned to whomever will help with these.
- For 5.8, AFTER it has been deployed and checked in AWS TEST, the jira can be assigned to the analyst for functional testing.

5.0		*DEVELOP* ONCE a SPRINT BEGINS
✅	5.1	As part of Story Prep (4.0) in a previous Sprint, the devs and architects will review each story for questions and make clarifications. This step is as the Sprint begins, to make sure all questions have been answered. STORY JIRA and dev subtasks are moved to 'Selected for Development' column at this time.
✅	5.2	Test Driven Development (TDD) & Unit Testing Guidelines
		Developer is responsible for defining UNIT tests to be created for each module, these will be verified through code review (see

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Closer Look: Cloud First Agile

Feature Files

➢ Easy to read

➢ Used to create Selenium tests


```
#UX_1_J#
Scenario Outline:
Once a user has registered 5 devices, both input fields are disabled,
the register button is disabled and a message displays about not being
able to have more than 5 devices registered.
  Given user is on the Penn Device Portal Personal Page
    When    User has registered 5 devices
    Then    input fields are disabled
    And     Register button is disabled
    And     a message indicating 5 devices are registered
```

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Boards!

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Boards: Example

GIVING Sprint 5

🕐 4 days remaining | Complete sprint | ...

QUICK FILTERS: Only My Issues   Recently Updated   **QUICK FILTERS:** Only My Issues   Recently Updated

To Do	Selected for Development	In Progress	Testing / Feedback	Done

▾ 🟩 GIVING-103 TO DO 4 sub-tasks UX-4 Personal Information Form

To Do

CORS error loading assets on fund search page
None
None
🟥 ↑ ○○○   GIVING-124 😀

Selected for Development

API- Cybersource
APIs
GIVING-60
☑ ↑ ○○○○   GIVING-61

In Progress

Capture items for deployment playbook
None
ADR-226, GIVING-45, VDIORDER-339
☑ ↑ ●●●●   GIVING-17 😀

Create Angular Service for static selection (reference) data
None
None
☑ ↑ ●○○○   GIVING-72 👤

Need S3 creds for giving test and prod image folders
None
None
☑ ↑ ●○○○   GIVING-93 👤

Testing / Feedback

Create referential integrity (foreign key) constraints in reference tables
None
None
☑ ↑ ●●●●   GIVING-70 👤

Need PostgreSQL service account and creds for aws test and prod
None
None
☑ ↑ ●○○○   GIVING-94 😀

Done

Giving Form SETUP
Giving FORM
None
GIVING-83, GIVING-96
☑ ↑   GIVING-84 😀

PREP in form fund search page SETUP
Giving FORM
None
GIVING-86
☑ ↑ ●○○○   GIVING-85 😀

In form fund search page SETUP
Giving FORM
None
GIVING-89, GIVING-85
☑ ↑ ●○○○   GIVING-86 😀

PREP UX-2 Giving In-Form Fund Selector
Giving FORM

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Boards

❑ Two Modes
  ➢ Scrum Board: Active development in sprints
  ➢ Kanban Board: Expediting support work
  ☞ The only real difference is timeframe

❑ Transparency
  ➢ Team members see what each other are up to
  ➢ Stakeholders can see what our priorities are – and give input
  ➢ Support the standup meeting and client meetings

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UX Design: My Journey

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UX Design

❑ What is UX Design?

"The process of enhancing user satisfaction by improving the **usability**, accessibility, and pleasure provided in the interaction between the user and the product." --Wikipedia

https://uxmag.com/articles/explaining-ux-design-to-your-team

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UX Design

❑ Why is UX Design important?

➢ Drives client and team conversations about USABILITY; most importantly, **accessibility** and **responsiveness**

➢ Enables early design of UI components meeting Web Compliance Accessibility Guidelines (WCAG) 2.0 Level AA

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Accessibility design principle example

https://www.w3.org/WAI/gettingstarted/tips/designing.html

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Responsiveness design principle example

Create designs for different viewport sizes   ◁ SHARE

Consider how page information is presented in different sized viewports, such as mobile phones or zoomed browser windows. Position and presentation of main elements, such as header and navigation can be changed to make best use of the space. Ensure that text size and line width are set to maximize readability and legibility.

Example: Content and navigation adapt to smaller mobile screen
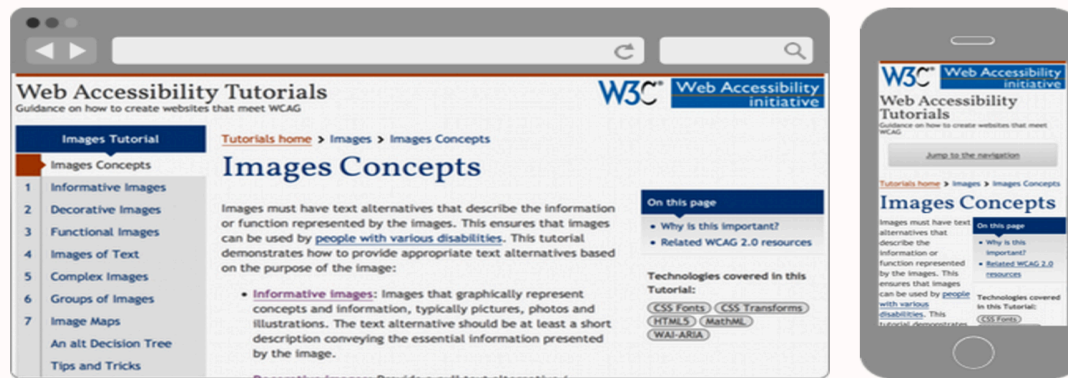
Display in a wide window with small text uses multiple columns for primary content, visible navigation options, and visible secondary information.

Display in a narrow window, such as a mobile phone, or with large text uses single column for primary content, navigation options are revealed using an icon, and secondary information is also revealed via icon.

https://www.w3.org/WAI/gettingstarted/tips/designing.html

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UX Design

❑ Why is UX design helpful?

  ➢ Something to show clients QUICKLY
  ➢ Something for clients to show their users
  ➢ Something to easily change; frequently

❑ How is our UX design process evolving?

  ➢ Torchbox wireframes & components (VDI)
  ➢ Torchbox wireframes & prototype app (GIVING)

  ➢ Penn Mockups (VDI, GIVING, PennDevice)

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UX Desgin: Virtual Desktop (VDI)

Torchbox Wireframe

Penn Mockup (Lucidchart)

Screenshot from Torchbox component demo

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UX Design: GIVING

Torchbox Wireframe

Penn Mockup (Lucidchart)

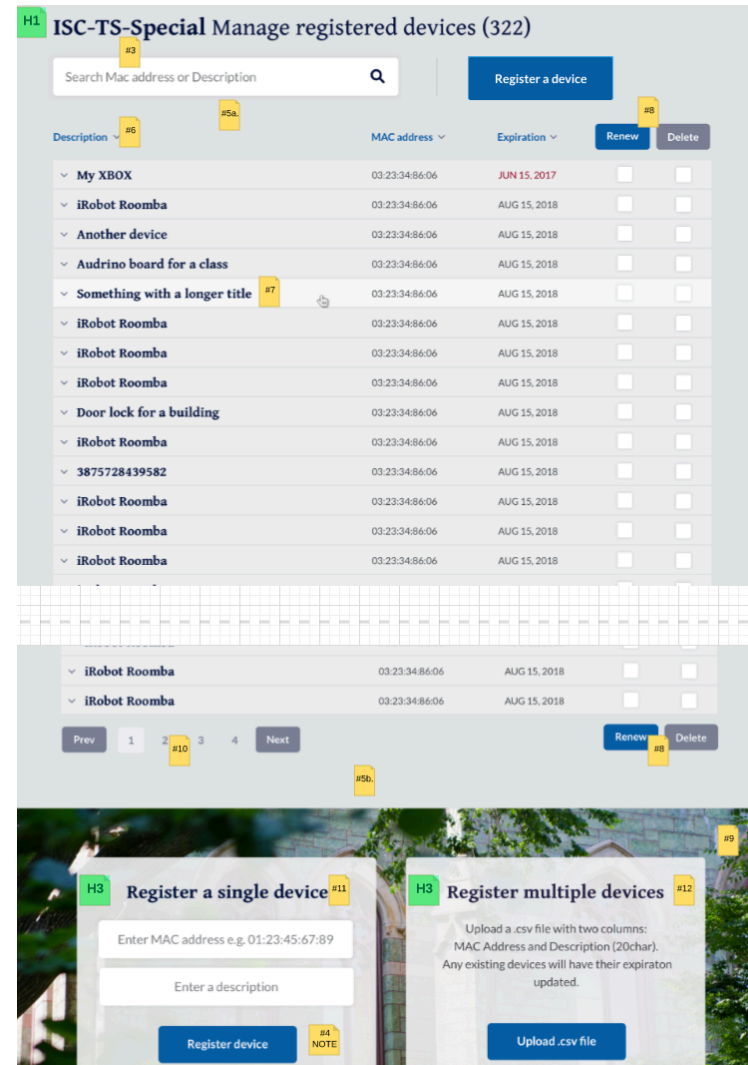Screenshot from Torchbox prototype app

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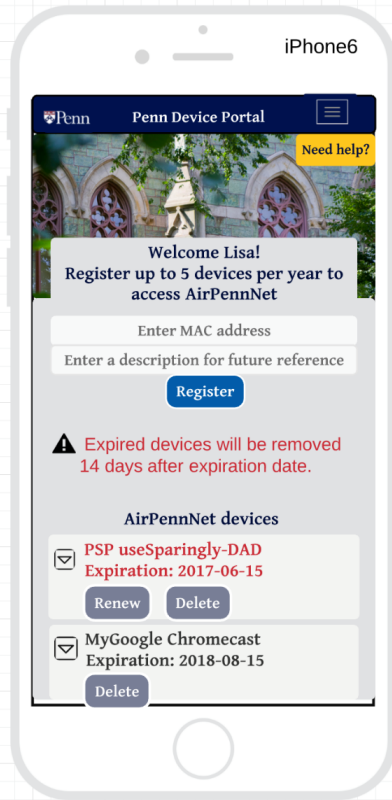
UX Design: Penn Device

- Users: Students, Faculty, Staff

- Call to actions

- Lucidchart shape templates

- Collaborative editing with clients

- Client-User reviews (screenshots or pdfs)

- Torchbox feedback

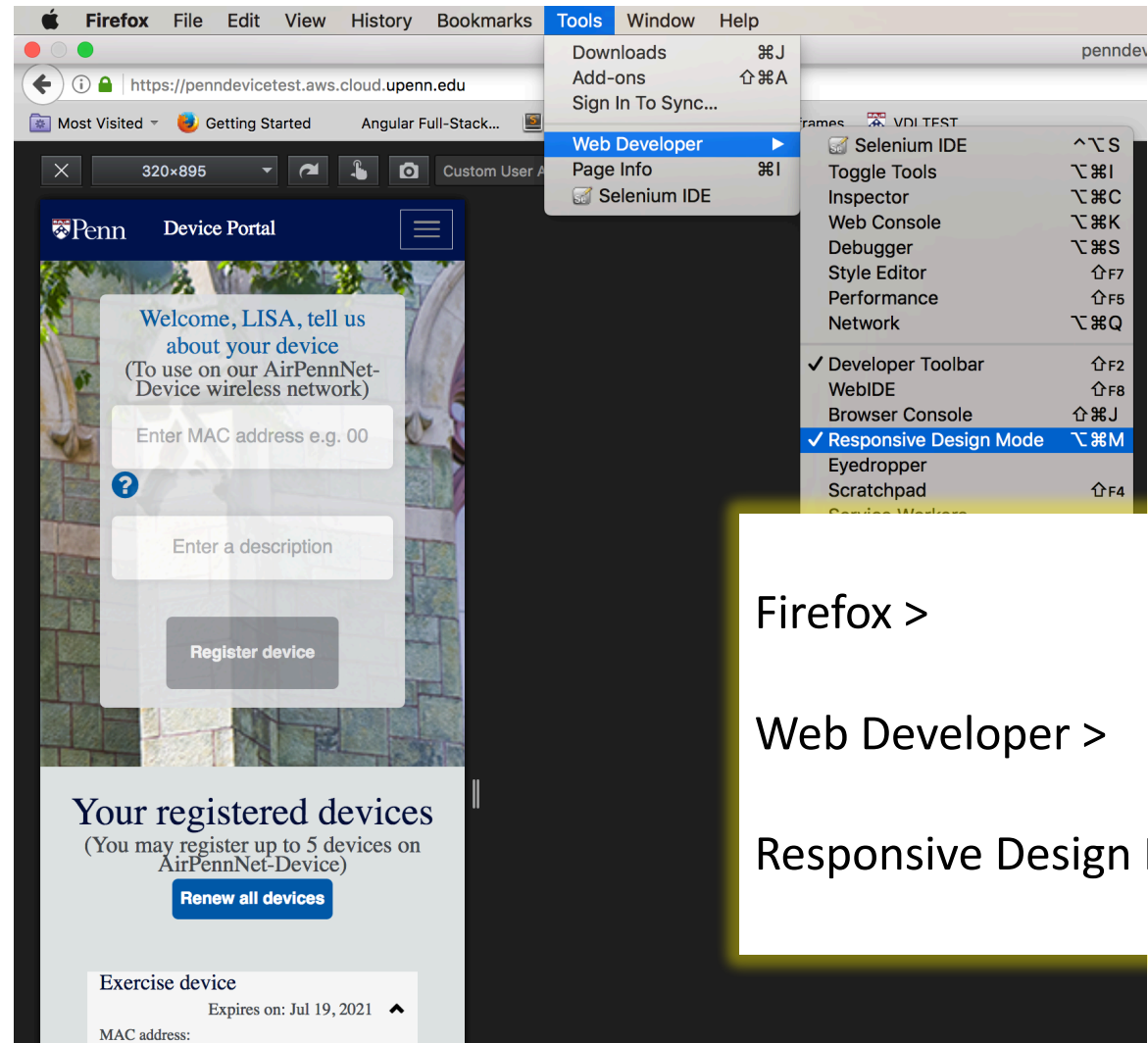- Styleguide

- Easy integration w JIRA

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UX Design: Responsiveness

➢ Develop
➢ Check page
➢ Adjust design
➢ Repeat…

Firefox >

Web Developer >

Responsive Design Mode

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UX Design: Accessibility

➢ Develop
➢ Check page
➢ Adjust design
➢ Repeat…

Chrome WAVE Plugin

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Iterating with confidence:
Test Driven Development Demo

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Putting it all Together

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We are being judged…

❑ Increasingly for our…
  ➢ Speed!
  ➢ Accessibility (usability for those with disabilities)
  ➢ Responsiveness (usability on a wide range of devices)
  ➢ Cost transparency

❑ Less for our…
  ➢ Risk profile
  ➢ Meticulous custom services

☞ Less is not none!

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A shift in risk, not a magic bullet

AWS S3 Outage – 2/28/2017

- Bad day for the cloud
- Developers in the dark
- Apps couldn't restart
- Images didn't load

AWS's S3 outage was so bad Amazon couldn't get into its own dashboard to warn the world

Websites, apps, security cams, IoT gear knackered

By Shaun Nichols in San Francisco 1 Mar 2017 at 03:00   SHARE ▼

Credit: The Register https://www.theregister.co.uk/2017/03/01/aws_s3_outage/

Data Center Outages – 6/21,28/2017

- Good day for the cloud
- Developers unaffected (but it was dark)
- Apps ran and could be built (thanks to Shibboleth distribution)
- Campus integrations degraded gracefully

is shib hosed? wasn't aware of that, checking

its fine

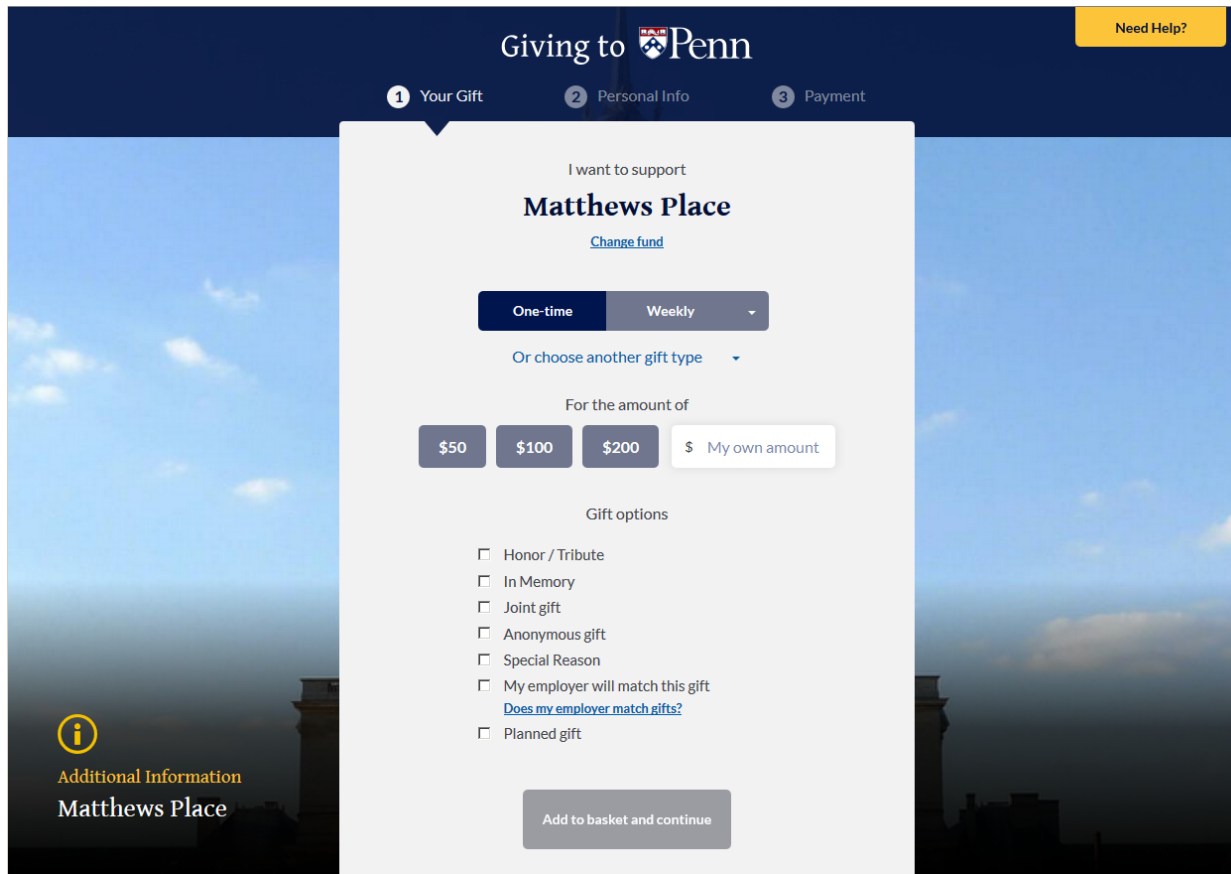afaik we are 100% unaffected

Credit: Matt's iPhone

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Summarizing the Upside

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We want to let you build this

Consistent

Accessible

Responsive

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And never again see this:

FAST Error!

https://pto.apps.   150%   Search
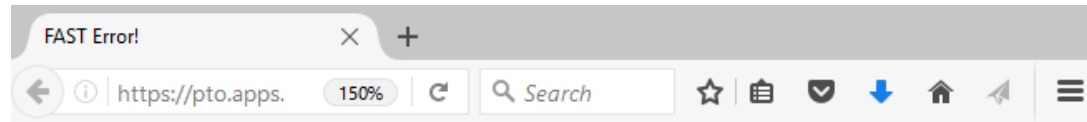
Problem with looping trying to login, are cookies enabled in the browser, and is the URL protected by the web server (ask Chris or Bryan to add your app to the web server config)?

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Because you should never feel like this:
54

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… you should feel like this!

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How to start?

❑ Many already have, that's great!

❑ Think of it as learning to learn, not learning a framework or frameworks

❑ Almost everything you've seen here is open source and free. Try it out!
  ➢ Python / Django REST
  ➢ PyCharm Community Edition
  ➢ AngularJS
  ➢ Bootstrap
  ➢ NodeJS
  ➢ PostgreSQL
  ➢ Gitlab

❑ https://www.isc.upenn.edu/cloud-developer-curriculum

❑ Share and ask questions in #cloud-first on Slack
  ➢ http://upenn-isc.slack.com

❑ Join Dev-SIG on Slack (#dev-sig) and Gitlab
  ➢ http://upenn-it.slack.com
  ➢ https://gitlab.com/upenn-dev-sig

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What's next…

❑ Lowering the barrier of entry for API Services
❑ Improving test automation
❑ Improving build automation
❑ Improving deployment automation
❑ Improving agile processes

… and whatever's on your mind. Thank you!

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Special Thanks and Credits

James Choate
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Isobel Thompson
Namitha Venkatesh
Mathias Wegner

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