Open Data Kit: Building Mobile Application Frameworks for Disconnected Data Management

Waylon Brunette

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Open Data Kit has a team of contributors and my research would not be possible without the team's hard work.

OPEN DATA KIT

change
http://change.washington.edu

University of Washington Computer Science & Engineering

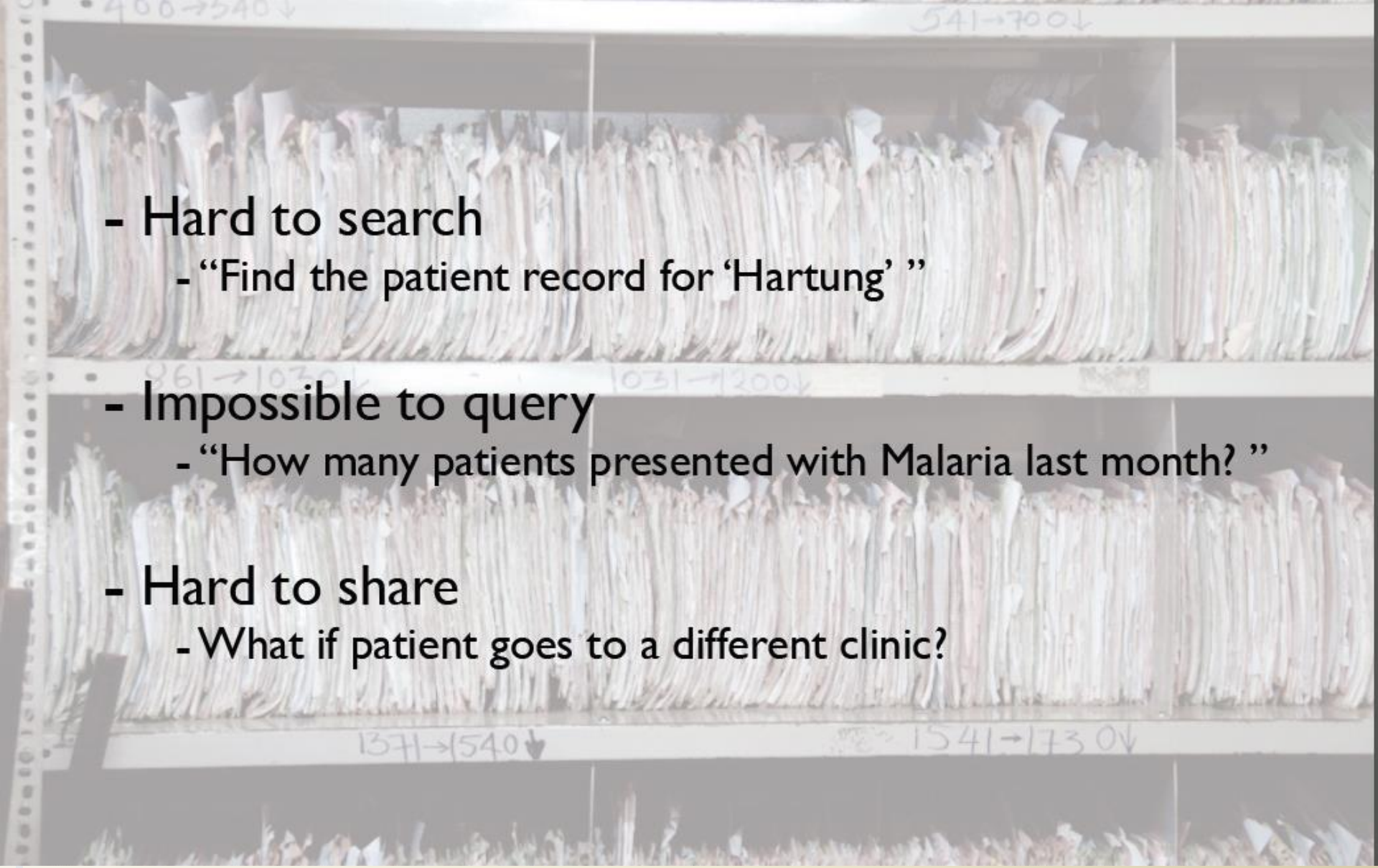
PHOTO: Carl Hartung

Organizations working in developing regions rely on field workers to collect data

Paper Methods

- Paper-based forms – ad hoc design
- Long time-lag to usable data
- Little or no historical data

Paper Systems are difficult to Search and Transport



Paper Systems are difficult to Search and Transport

e-IMCI on a PDA

Brian DeRenzi, Neal Lesh, Tapan Parikh, Clayton Sims, Werner Maokla, Mwajuma Chemba, Yuna Hamisi, David S hellenberg, Marc Mitchell, and Gaetano Borriello. **e-IMCI: Improving pediatric health care in low-income countries.** In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 2008. ACM.

PHOTO: Carl Hartung


Learn
YouTube


Learn
You

PHOTO: Carl Hartung

PHOTO: Brian DeRenzi

PHOTO: Carl Hartung

PHOTO: Carl Hartung

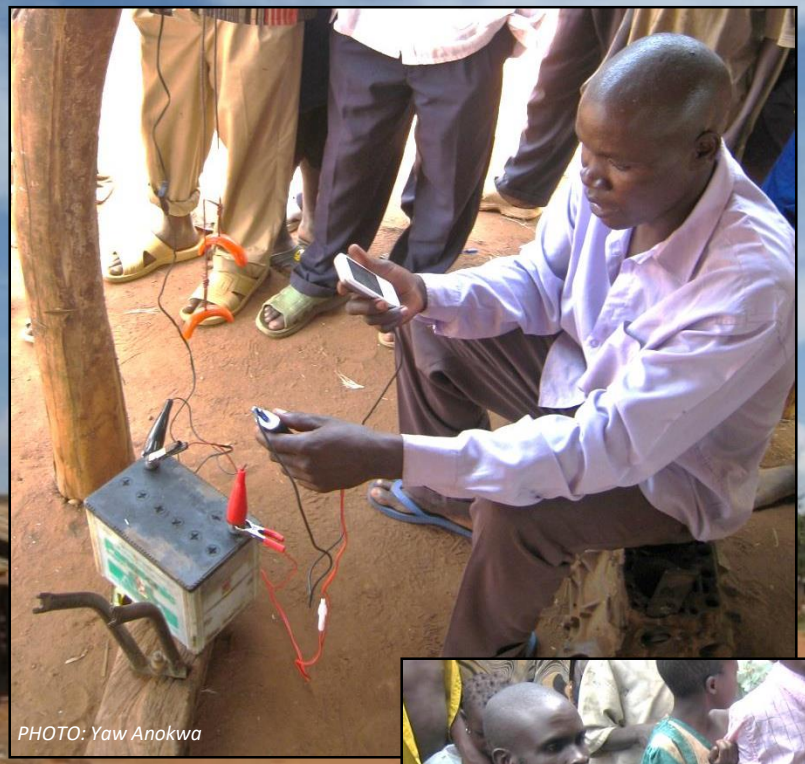


PHOTO: Yaw Anokwa

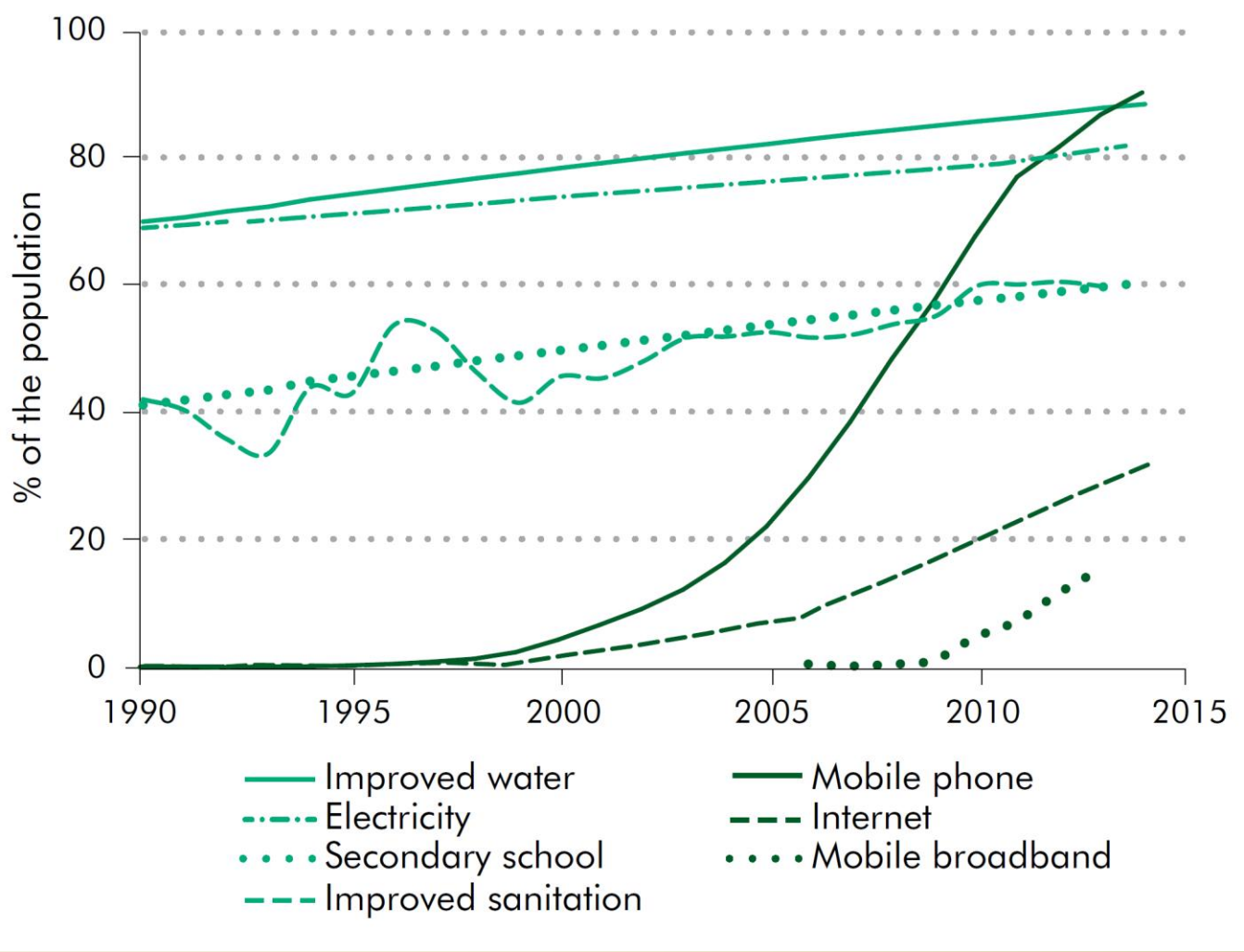
PHOTO: Trevor Perrier

PHOTO: Yaw Anokwa

PHOTO: Carl Hartung

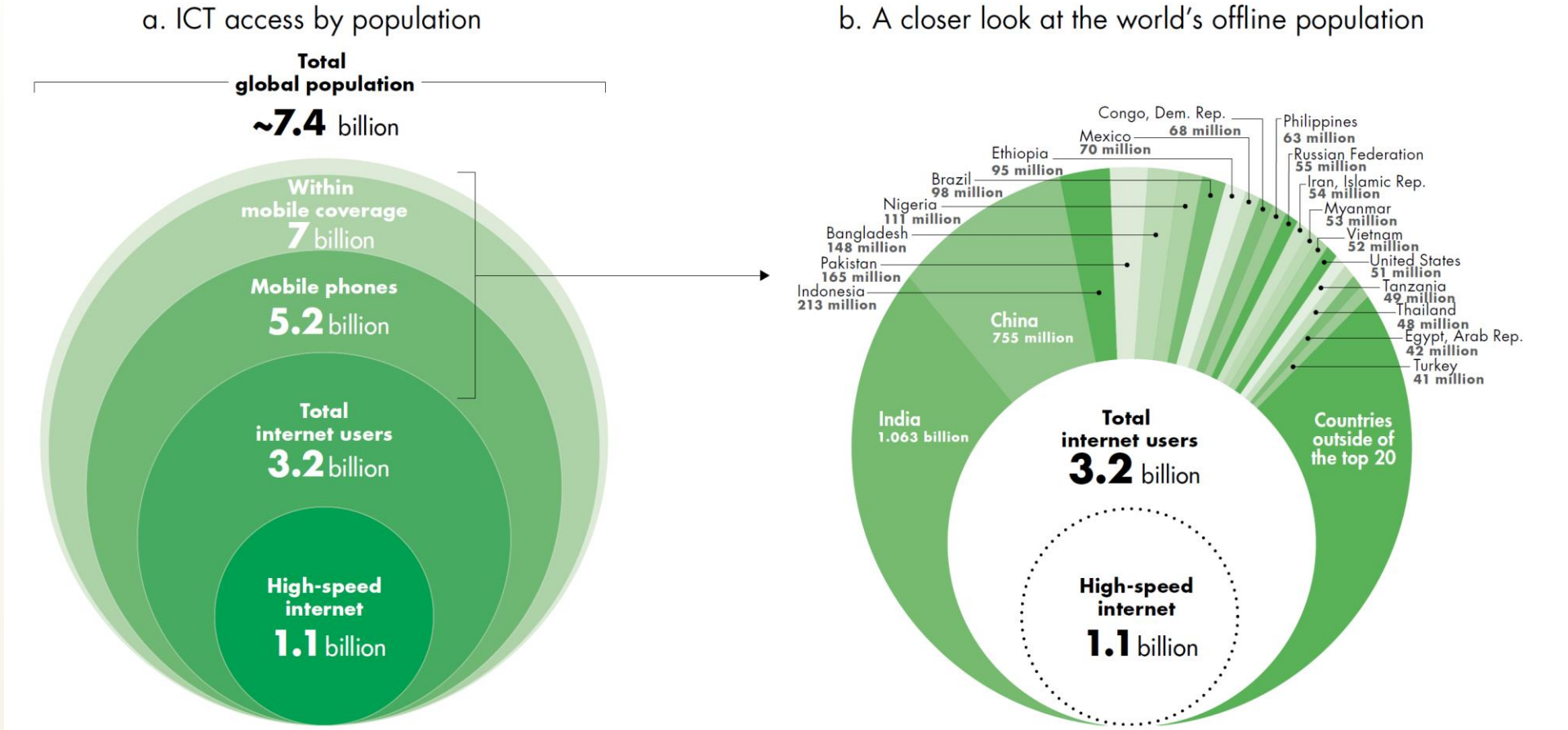
Mobile Device Expansion

Mobile Device availability DOES NOT equate to Internet Access



Graph from: *World Development Report 2016: Digital Dividends. International Bank for Reconstruction and Development(World Bank), 2016.*

Limited Internet Access



Sources: World Bank 2015; Meeker 2015; ITU 2015; GSMA, https://gsmaintelligence.com/; UN Population Division 2014. Data at http://bit.do/WDR2016-FigO_5.

Note: High-speed internet (broadband) includes the total number of fixed-line broadband subscriptions (such as DSL, cable modems, fiber optics), and the total number of 4G/LTE mobile subscriptions, minus a correcting factor to allow for those who have both types of access. 4G = fourth generation; DSL = digital subscriber line; ICT = information and communication technology; LTE = Long Term Evolution.

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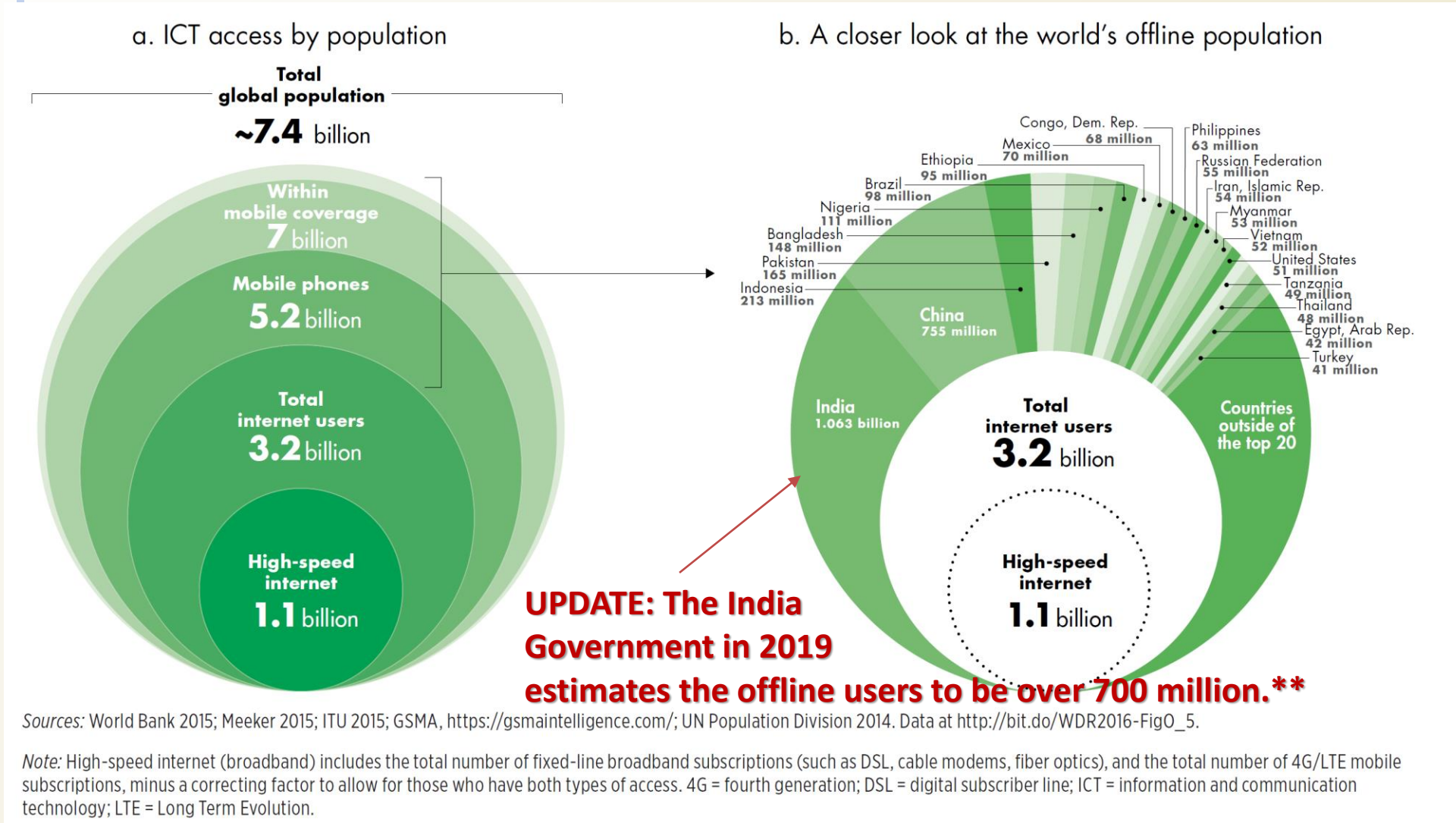
Limited Internet Access



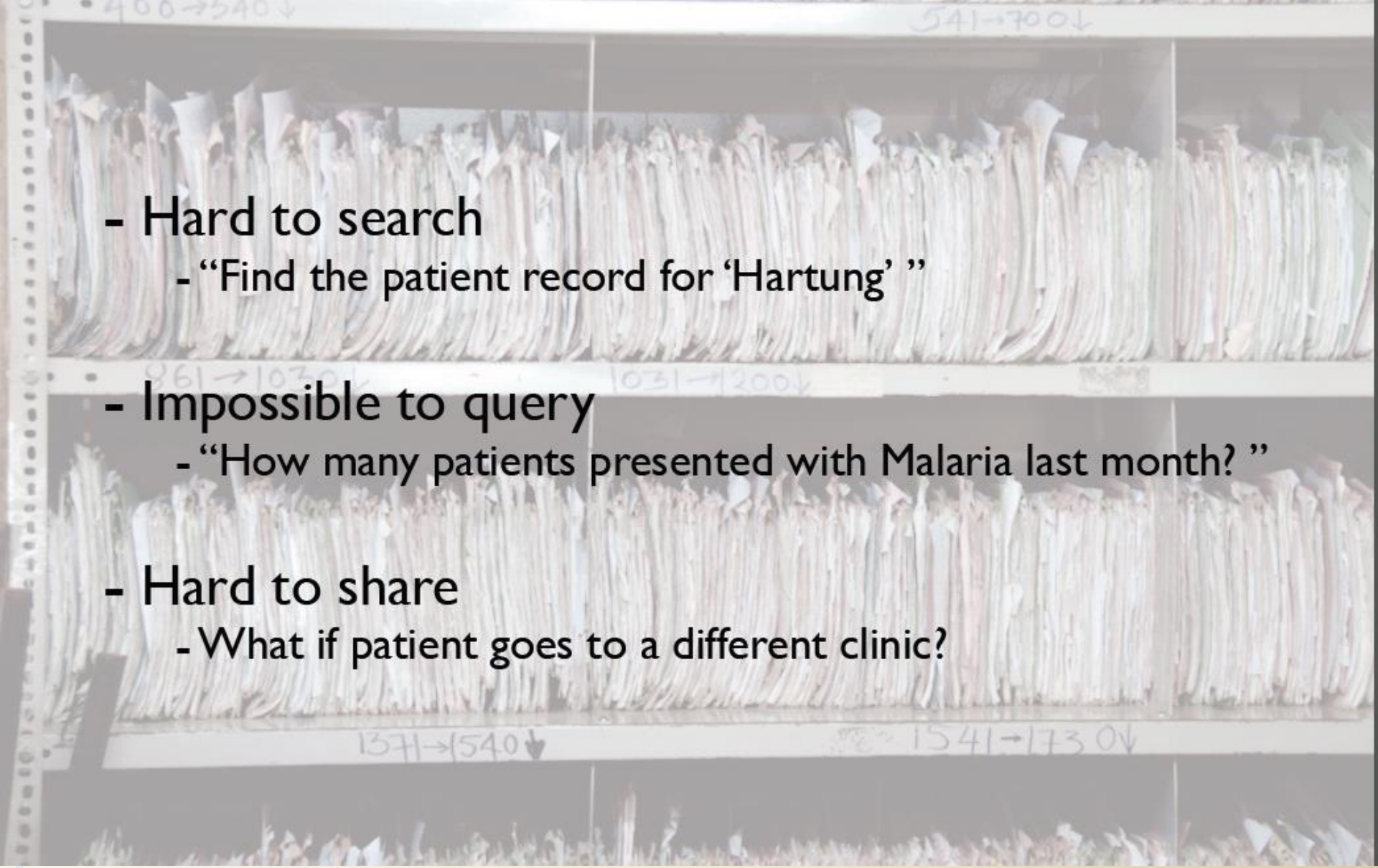
UPDATE: The India Government in 2019 estimates the offline users to be over 700 million.**

Sources: World Bank 2015; Meeker 2015; ITU 2015; GSMA, https://gsmaintelligence.com/; UN Population Division 2014. Data at http://bit.do/WDR2016-FigO_5.

Note: High-speed internet (broadband) includes the total number of fixed-line broadband subscriptions (such as DSL, cable modems, fiber optics), and the total number of 4G/LTE mobile subscriptions, minus a correcting factor to allow for those who have both types of access. 4G = fourth generation; DSL = digital subscriber line; ICT = information and communication technology; LTE = Long Term Evolution.

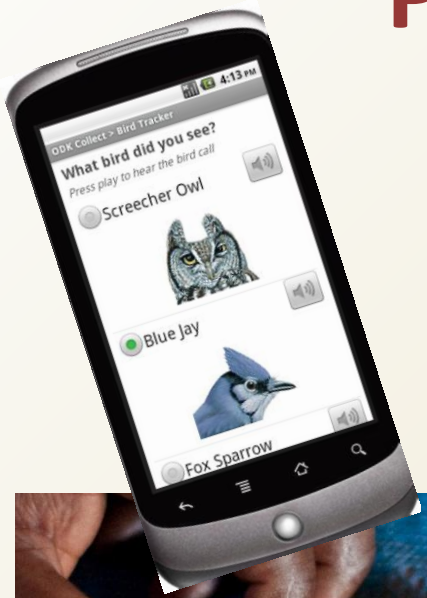
Graph from: *World Development Report 2016: Digital Dividends. International Bank for Reconstruction and Development(World Bank), 2016.*

**Update from: *The Indian Telecom Services Performance Indicators. https://main.trai.gov.in/sites/default/files/PIR08012019.pdf, January 2019*



Paper Systems are difficult to Search and Transport

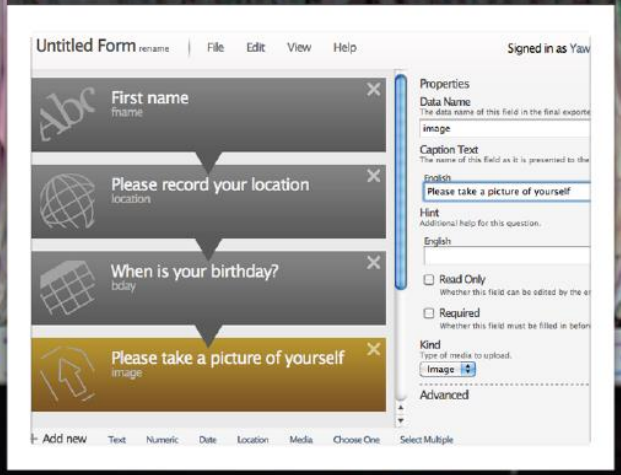
Platform Shift from PCs to



Smart Phone + Cloud

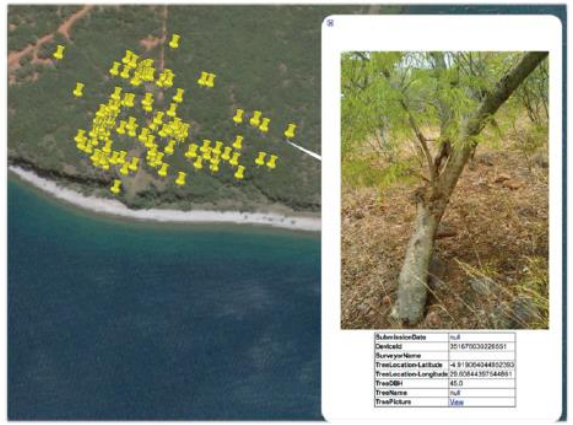
PHOTOs: Yaw Anokwa, Brian DeRenzi, Gaetano Borriello, Waylon Brunette, Carl Hartung

1. Build form



2. Collect data

3. Aggregate results



http://opendatakit.org

GOAL: *Magnify human resources through technology*

- C. Hartung, Y. Anokwa, W. Brunette, A. Lerer, C. Tseng, and G. Borriello. Open Data Kit: Tools to Build Information Services for Developing Regions. In Proceedings of the 4th ACM/IEEE International Conference on Information and Communication Technologies and Development, ICTD '10, 2010.

Open Data Kit (ODK)

- First release in 2009 (started in 2008)
- Mobile data collection tools for Android devices
- Modular, open architecture
- Open source (Apache 2 license)
- **KEY FEATURES TO SUCCESS:**
  - **Domain Independent Tools**
  - **Disconnected Operation**

GOAL: ***Magnify human resources through technology***

ODK Videos

- Surui
  - http://www.youtube.com/watch?v=_gKkYc9ntHQ
- Reproductive Health Vouchers
  - http://vimeo.com/38123850







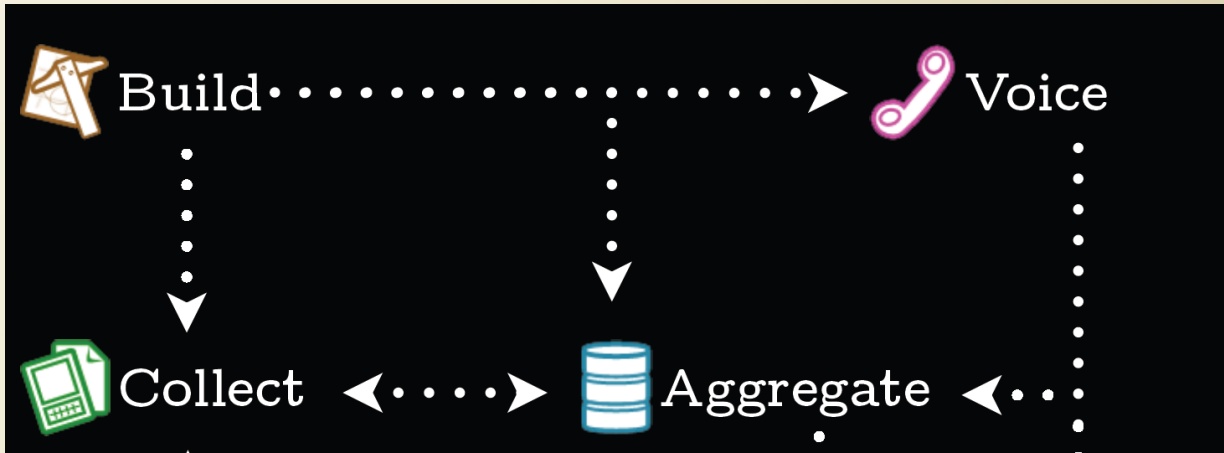

PHOTOs: Yaw Anokwa, Brian DeRenzi, Gaetano Borriello, Waylon Brunette, Rohit Chaudhri, Carl Hartung

**Camille Cobb, Samuel Sudar, Nicholas Reiter, Richard Anderson, Franziska Roesner, and Tadayoshi Kohno. 2016. Computer Security for Data Collection Technologies. In *Proceedings of the Eighth International Conference on Information and Communication Technologies and Development* (ICTD '16)

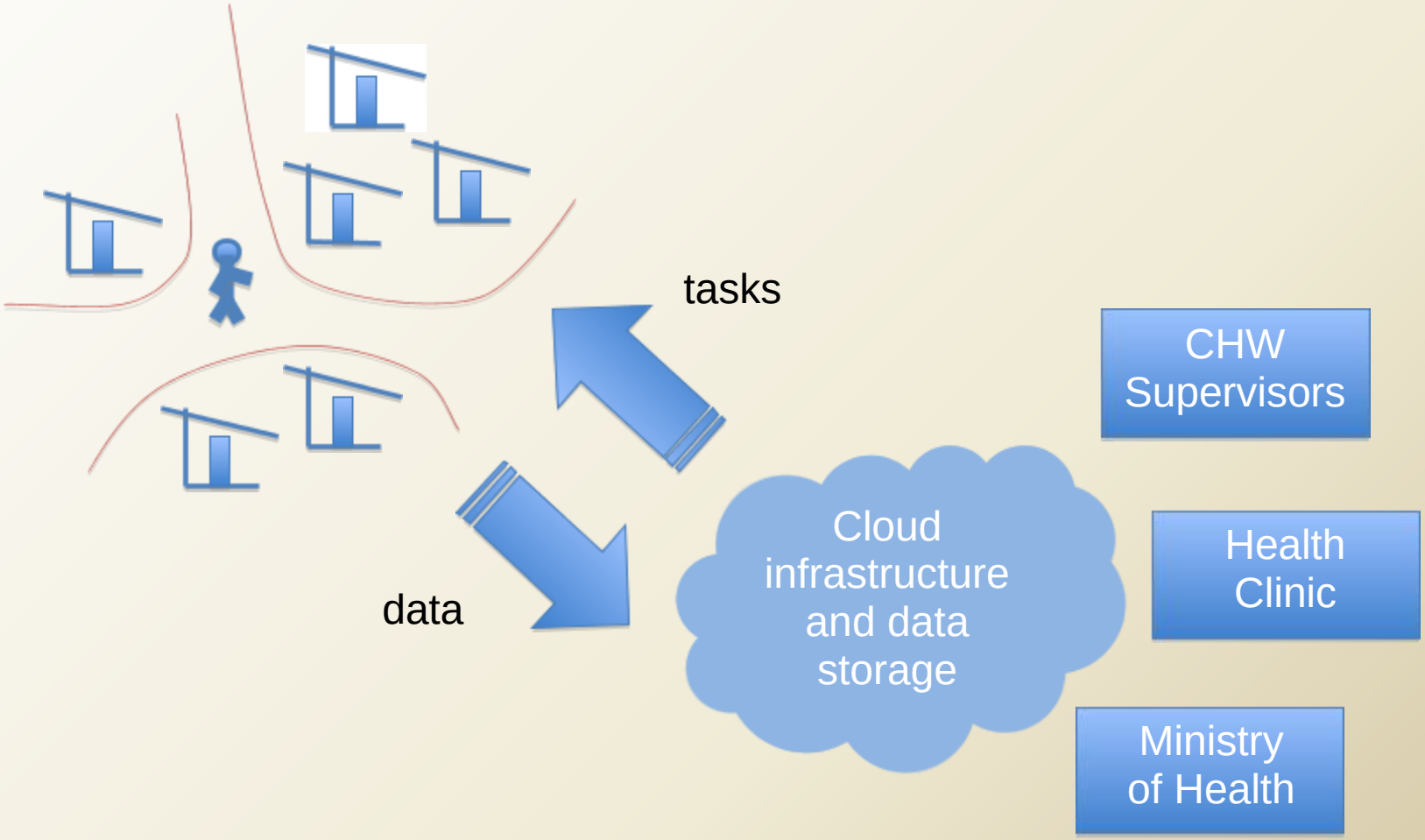
PHOTOs: Yaw Anokwa, Brian DeRenzi, Gaetano Borriello, Waylon Brunette, Rohit Chaudhri, Carl Hartung

Open Data Kit

- Make tools highly modular and customizable
  - Enables organizations to compose tools that are appropriate for their deployments
- Exploit open interfaces and standards
  - Avoid “silo-ed” monolithic proprietary solutions
- Allow organizations to leverage evolving technologies
  - Avoid early obsolescence



Health Model



Generic Model

tasks

data

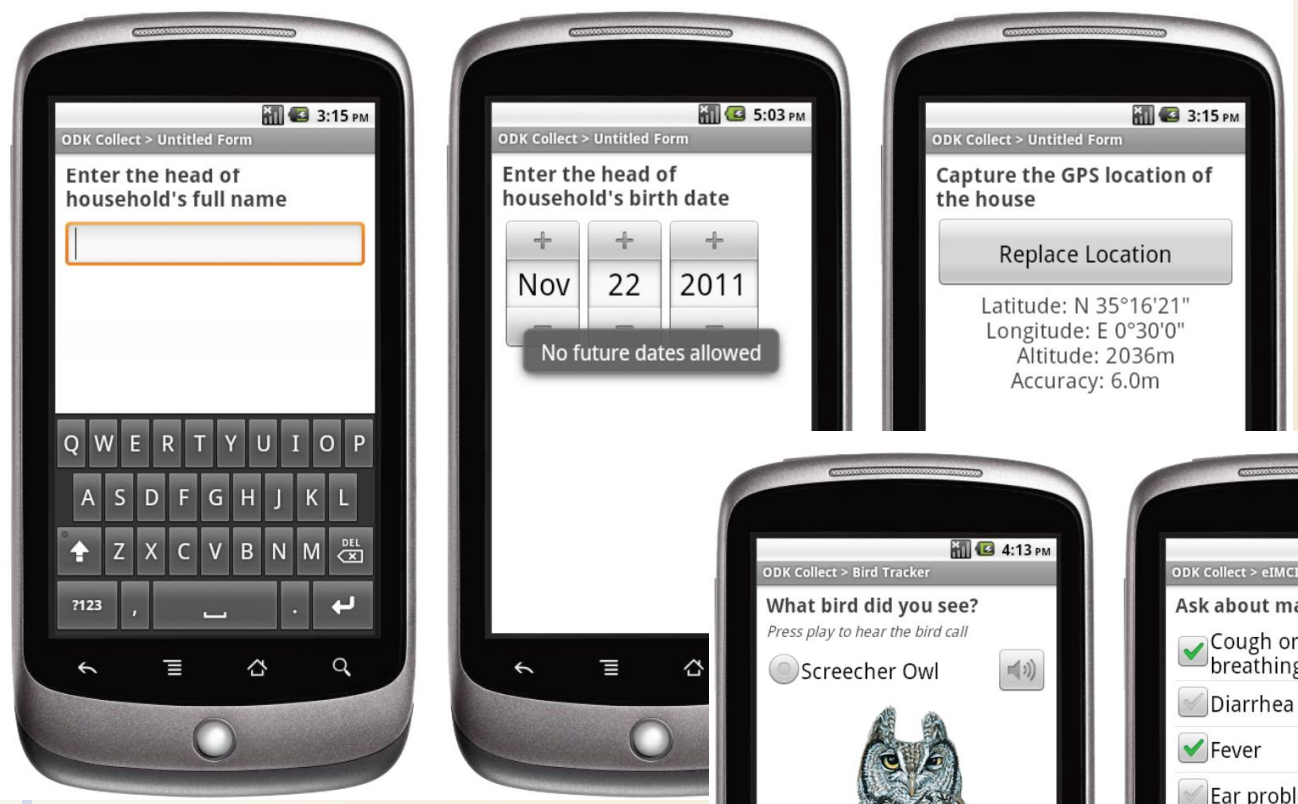
Cloud infrastructure and data storage

Forest Wardens

Response Teams

Environment Ministry

ODK Collect

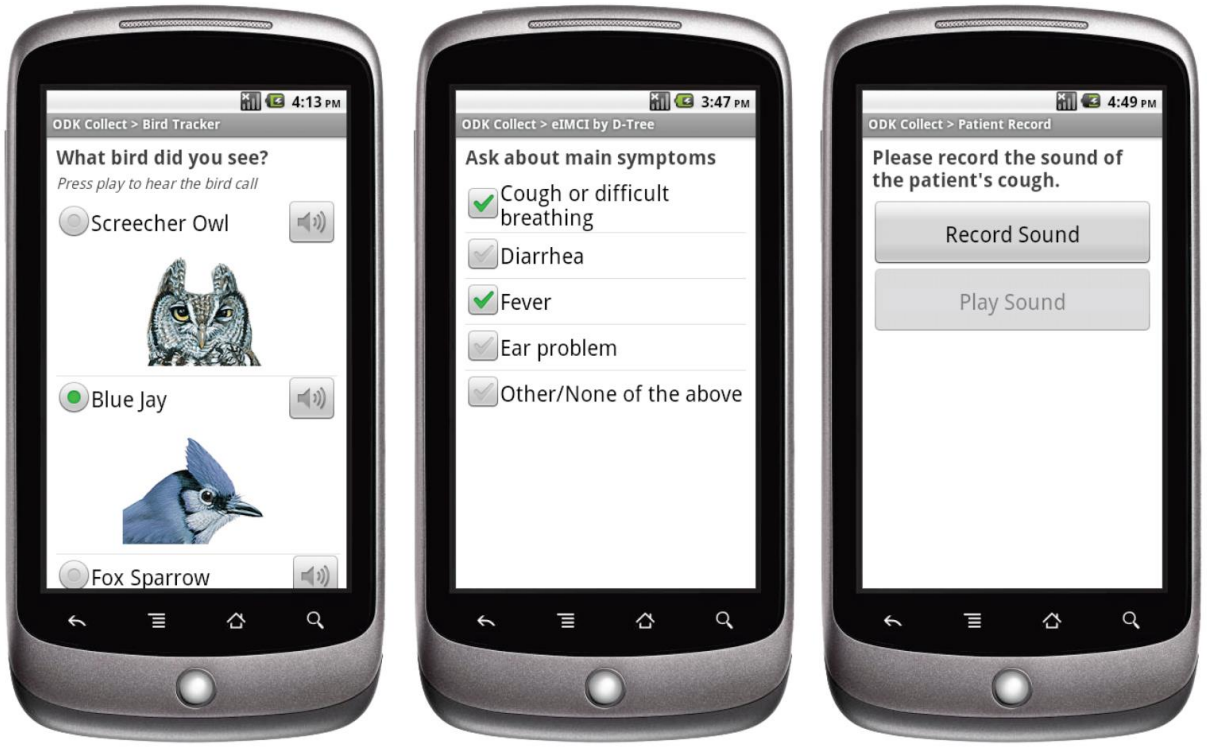


Automated Survey Renderer with enhanced data types

- Pictures, Video

- GPS

- Barcode



XForms

Describes the Form logic and Data Schema

```
<?xml version="1.0"?>
<h:html xmlns="http://www.w3.org/2002/xforms" xmlns:h="http://www.w3.org/1999/xhtml" xmlns:ev="http://www.w3.org/2001/xml-events"
xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:jr="http://openrosa.org/javarosa">
  <h:head>
    <h:title>Geo Tagger</h:title>
    <model>
      <instance>
        <geotagger id="geo_tagger1" >
          <timestamp />
          <device_id/>
          <subscriber_id/>
          <image/>
          <geopoint/>
          <string/>
        </geotagger>
      </instance>
      <bind nodeset="/geotagger/timestamp" type="dateTime" jr:preload="timestamp" jr:preloadParams="start"/>
      <bind nodeset="/geotagger/device_id" type="string" jr:preload="property" jr:preloadParams="deviceid"/>
      <bind nodeset="/geotagger/subscriber_id" type="string" jr:preload="property" jr:preloadParams="subscriberid"/>
      <bind nodeset="/geotagger/geopoint" type="geopoint"/>
      <bind nodeset="/geotagger/image" type="binary"/>
      <bind nodeset="/geotagger/string" type="string"/>
    </model>
  </h:head>
  <h:body>
    <upload ref="image" mediatype="image/*">
      <label>What do you see?</label>
    </upload>
    <input ref="geopoint">
      <label>Where are you?</label>
    </input>
    <input ref="string">
      <label>Any other thoughts?</label>
    </input>
  </h:body>
</h:html>
```

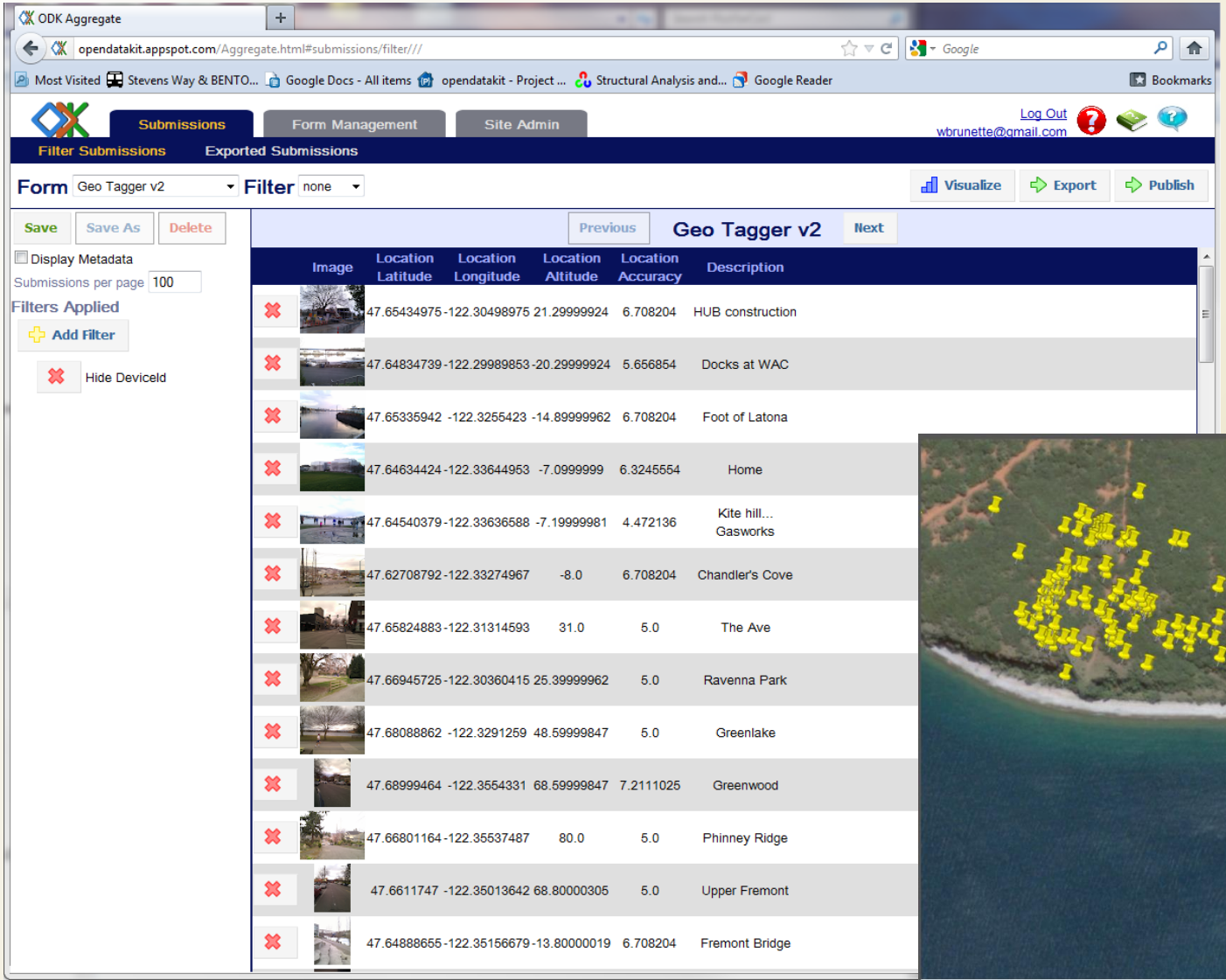
Building XForms

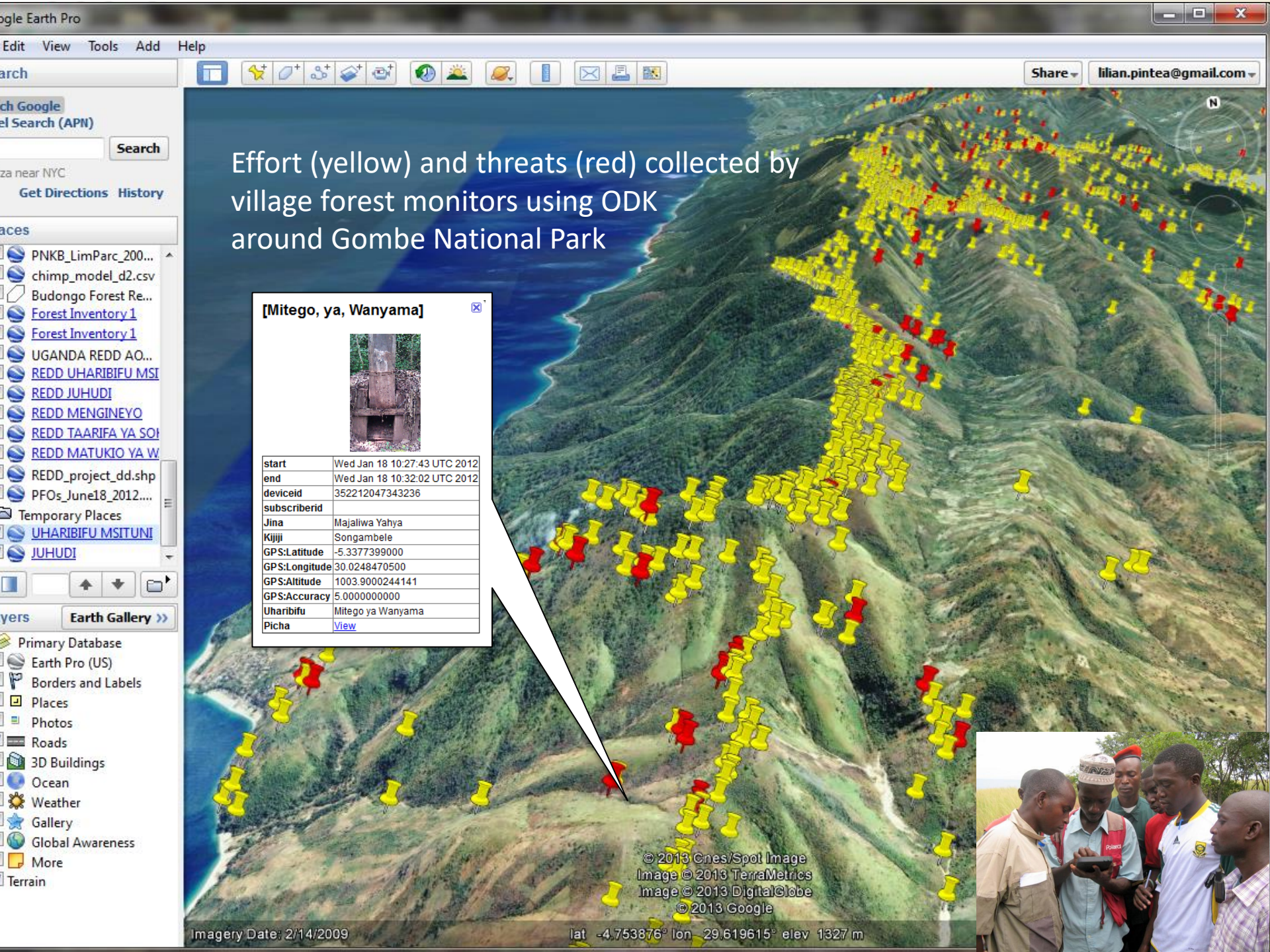
- **ODK Build**
  - Drop-n-Drag UI for creating form

- **ODK XLSForm**
  - Use a Excel to enter form information
  - Tool transforms the xls file into Xform

ODK Aggregate

Stores or forwards data to external systems




Effort (yellow) and threats (red) collected by village forest monitors using ODK around Gombe National Park
[Mitego, ya, Wanyama]
start | Wed Jan 18 10:27:43 UTC 2012
end | Wed Jan 18 10:32:02 UTC 2012
deviceid | 352212047343236
subscriberid |
Jina | Majaliwa Yahya
Kijiji | Songambele
GPS:Latitude | -5.3377399000
GPS:Longitude | 30.0248470500
GPS:Altitude | 1003.9000244141
GPS:Accuracy | 5.0000000000
Uharibifu | Mitego ya Wanyama
Picha | View
© 2013 Cnes/Spot Image
Image © 2013 TerraMetrics
Image © 2013 DigitalGlobe
© 2013 Google
Imagery Date: 2/14/2009
lat -4.753876° lon 29.619615° elev 1327 m

Deployment Concerns

Network connectivity is a ***PERSISTENT*** concern

ORGANIZATION'S CONCERNS:

- Need to be able to share data between devices
- Often sparse connectivity in rural environments
- Type of connectivity varies by location
- Data transmission costs (can be high)
- Administrative concerns restrict how data can be transmitted or stored

Limiting factors

- Power
- Cost
- Expertise

- Waylon Brunette, Mitchell Sundt, Nicola Dell, Rohit Chaudhri, Nathan Breit, and Gaetano Borriello. 2013. Open Data Kit 2.0: expanding and refining information services for developing regions. In Proceedings of the 14th Workshop on Mobile Computing Systems and Applications (HotMobile '13).

Expanding & Refining ODK

- ODK 1 deployed successfully around the world
- Lots of requests for more features & expansion

ODK 1

(DUCES: less challenging, forms, uni-directional, *disconnected*)

versus

ODK X (formerly ODK 2)

(DUCES: more challenging, bi-directional, more expertise) - *FLEXIBLE*

- Samuel R. Sudar and Richard Anderson. 2015. DUCES: A Framework for Characterizing and Simplifying Mobile Deployments in Low-Resource Settings. In Proceedings of the 2015 Annual Symposium on Computing for Development (DEV '15)

CASE STUDY: EU Refugee Crisis

https://www.youtube.com/watch?v=Vwe2AgerqYs

CASE STUDY: EU Refugee Crisis

Photos Courtesy of the International Federation of Red Cross and Red Crescent Societies

CASE STUDY: EU Refugee Crisis

Photo Courtesy of the International Federation of Red Cross and Red Crescent Societies

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Photo Courtesy of the International Federation of Red Cross and Red Crescent Societies

CASE STUDY: World Mosquito Program

- **World Mosquito Program** - uses naturally occurring bacteria (*Wolbachia*) to reduce the ability of mosquitoes to transmit viruses (e.g., dengue, chikungunya, Zika)
- **Using ODK-X** in Brazil, Columbia, Indonesia, Australia, and Vietnam
- Program Manager Feedback:
  - *"quite easy to use and we haven't had any acceptance issues."*
  - *"the app is scaling quite well"*

World Mosquito Program™

PHOTO: World Mosquito Program

CASE STUDY: HIV Patient Tracking

- Adaptive Strategies for Preventing and Treating Lapses of Retention in Care (AdaPT-R)
  - UCSF Randomized Control Trial in Kenya

- ODK-X deployed in 5 clinics for multiple years
  - Clinics serve 65,000 patients
  - 17,000 HIV Patients
  - 18 clinical employees using ODK 2.0

"We needed a solution for capturing data from multiple forms and that would allow longitudinal follow-up of individual patients. We had experience with earlier versions of ODK, so the new features of 2.0 made it the only option for us if we wanted phone-based longitudinal form completion. Would definitely recommend ODK 2.0!" - Primary Investigator

ODK-X Case Studies

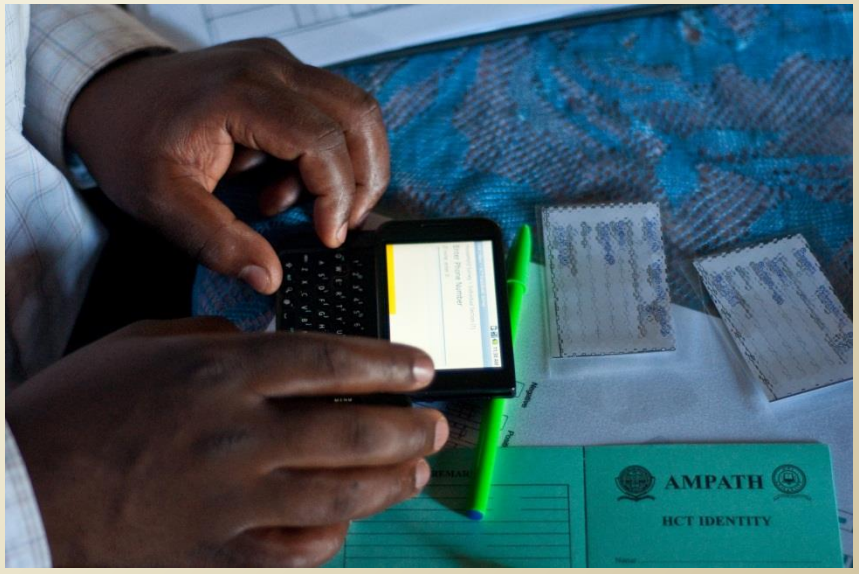
- ODK-X had an iterative requirements gathering process
  - Surveys
  - Pilot deployments in 18+ countries by a variety of organizations,
  - The ODK-X tool suite went through a significant redesign from the original ODK-X vision
- To validate the derived requirements we **examined 6 case studies**

Table 3: Case Study ODK 2.0 Feature Requirement Summary

	Childhood Pneumonia	*Chimpanzee Behavior Tracking*	*HIV Clinical Trial*	*Disaster Response*	*Mosquito Infection Tracking*	*Tuberculosis Patient Records*
Complex / Non-Linear Workflows	X	X	X	X	X	
Link Longitudinal Data To Collected Data	X		X	X	X	X
Data Security and User Permissions	X		X	X	X	X
Reuse of Data Fields Across Forms			X	X		
Bidirectional Synchronization	X		X	X	X	X
Customizable Form Presentation	X		X	X		
Custom JavaScript Apps		X	X	X	X	X
Sensor Integration	X					
Paper Digitization						X
Custom Data Types Update Multiple Fields in a Single User Action	X	X		X	X	

Missing capabilities

- Updating data on the mobile device
  - Allow users to view and edit collected data
- Customizing applications to different situations without recompiling
- Collecting information from various sensing devices
- Usage of cheaper technologies (e.g., paper, SMS)



ODK-X Design Improvements

- Improve data management on mobile device
  - Better ability to modify previously collected data
  - Custom data views on mobile device (no PC)
- Use a row as the basic data structure to move and use across applications and client devices
  - Flat data structures (eliminate xml)
  - Synchronize data between devices and cloud
  - Data should be easily exportable to common formats
- Favor runtime languages
  - Easier to deploy customizations (no recompiling)
  - Easier for individuals with limited programming experience
- Increase diversity of input types
  - Enable new data input methods from built-in and external sensors
  - Reduce human data entry

Based on feedback from ODK users

Problem ODK is solving

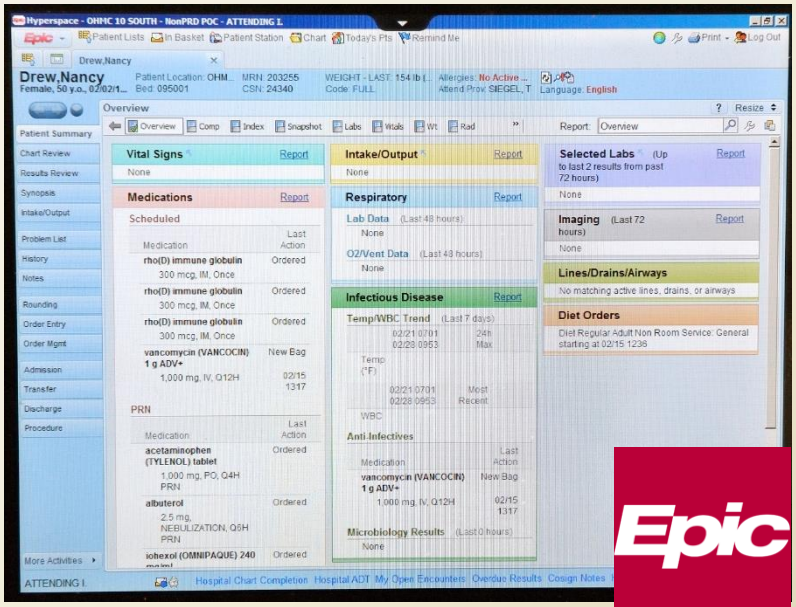
- Many existing mobile frameworks are generally aimed at developers or users with significant technical skills and/or financial resources, making it difficult for organizations in resource-constrained communities to adapt to context dependent field deployments.

- Often mobile apps & frameworks assume connectivity or only short amount of time offline

TENSION: Generic vs. Customized

Office

Versus

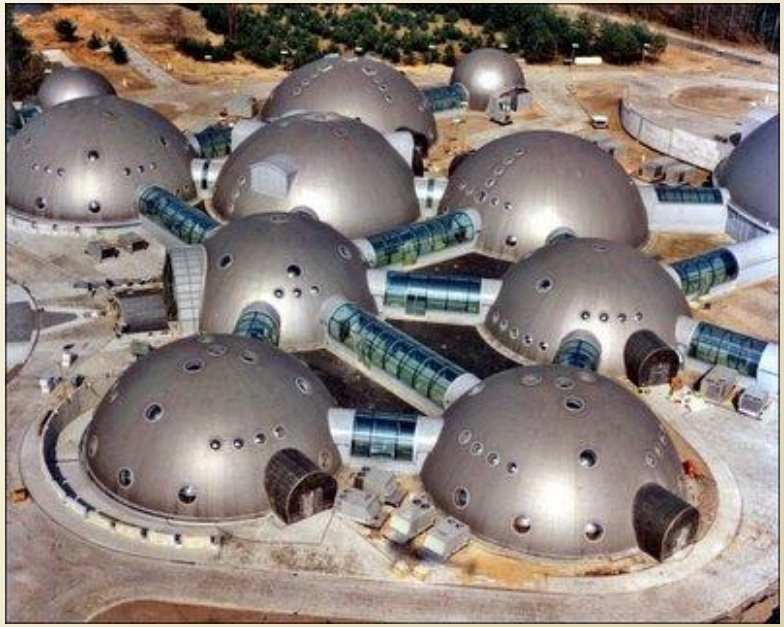


- Domain-specific/customized tools can be inflexible
  - Encourages the proverbial "re-inventing wheel"
  - Tool often cannot be reused in another similar domain
  - Keeps data siloed
- Users & Developers often find custom solutions easier
  - Can be modified to do exactly what the user wants
  - Developers can optimize performance and workflows

TENSION: Monolithic vs. Modular

Picture from: https://www.justproperty.com/en/blog/wp-content/uploads/2016/10/burjkhalifa.jpeg

Versus



Picture from: http://www.bldgblog.com/2005/12/the-monolithic-dome-institute/

Modularity for Open Source Ecosystem

- Make tools highly modular and customizable
  - Enables organizations to compose tools that are appropriate for their deployments
- Keep design modularized so others can reuse code
  - People can start with the basics already
  - Enables customization for specific use cases
  - Apache 2 License
- Simplifies parallel development
  - Avoid having to deliver everything at once
- Companies can add features and create value

SurveyCTO KoBo Toolbox CommCare ENKETO

Different Constraints Exist

- Until universal connectivity is a reality intermediate software solutions are needed
- Various ICTD research projects focus on extending Internet infrastructure
  - e.g., long distance WiFi, village base stations, mesh networks


PHOTO: Kurtis Heimerl

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PHOTO: Kurtis Heimerl

Software Approach:

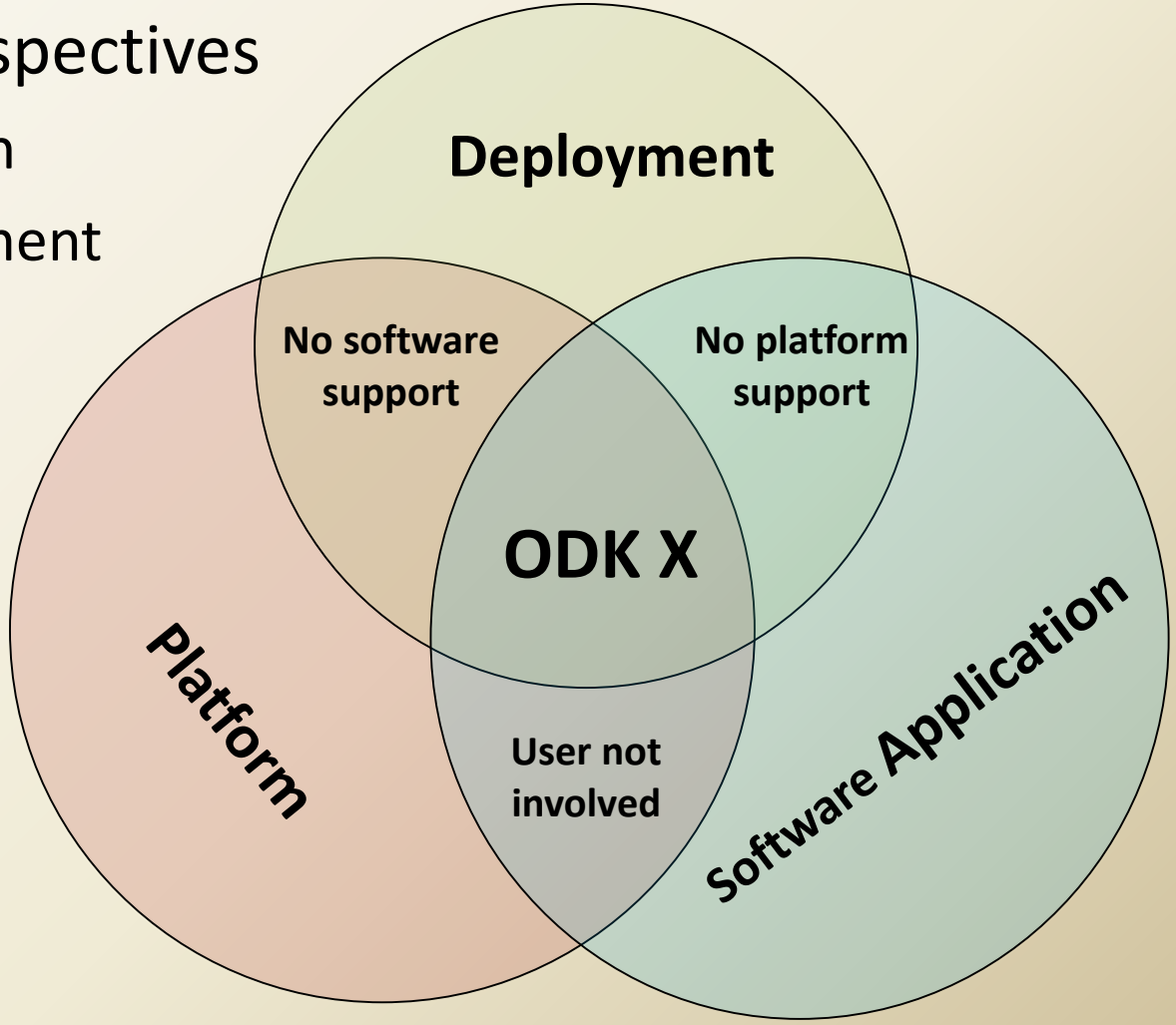
- Create customizable frameworks that are **designed for disconnected operation**
- Adjustable frameworks that **leverage heterogeneous connectivity** and adjust to changing networking conditions **based on a deployment requirements**.

EXAMPLE: Problematic Mobile Developer Paradigms/Assumptions

- **Uniform Data** – Existing transmission/routing paradigms assume inherent data qualities are sufficient to make decisions
- **Single-Task Mobile App** – Apps for mobiles are designed differently than PC utility programs (e.g., MS office)
  - Compete for resources
- **Similar Transmission Cost** – Assumption that transmission costs are similar everywhere (e.g., TCP/IP costs same everywhere)

Perspectives

- Single concept of “Application Layer” not sufficient
- Split to create Deployment & Application
- Examine from 3 perspectives
  - Software Application
  - Application Deployment
  - Platform



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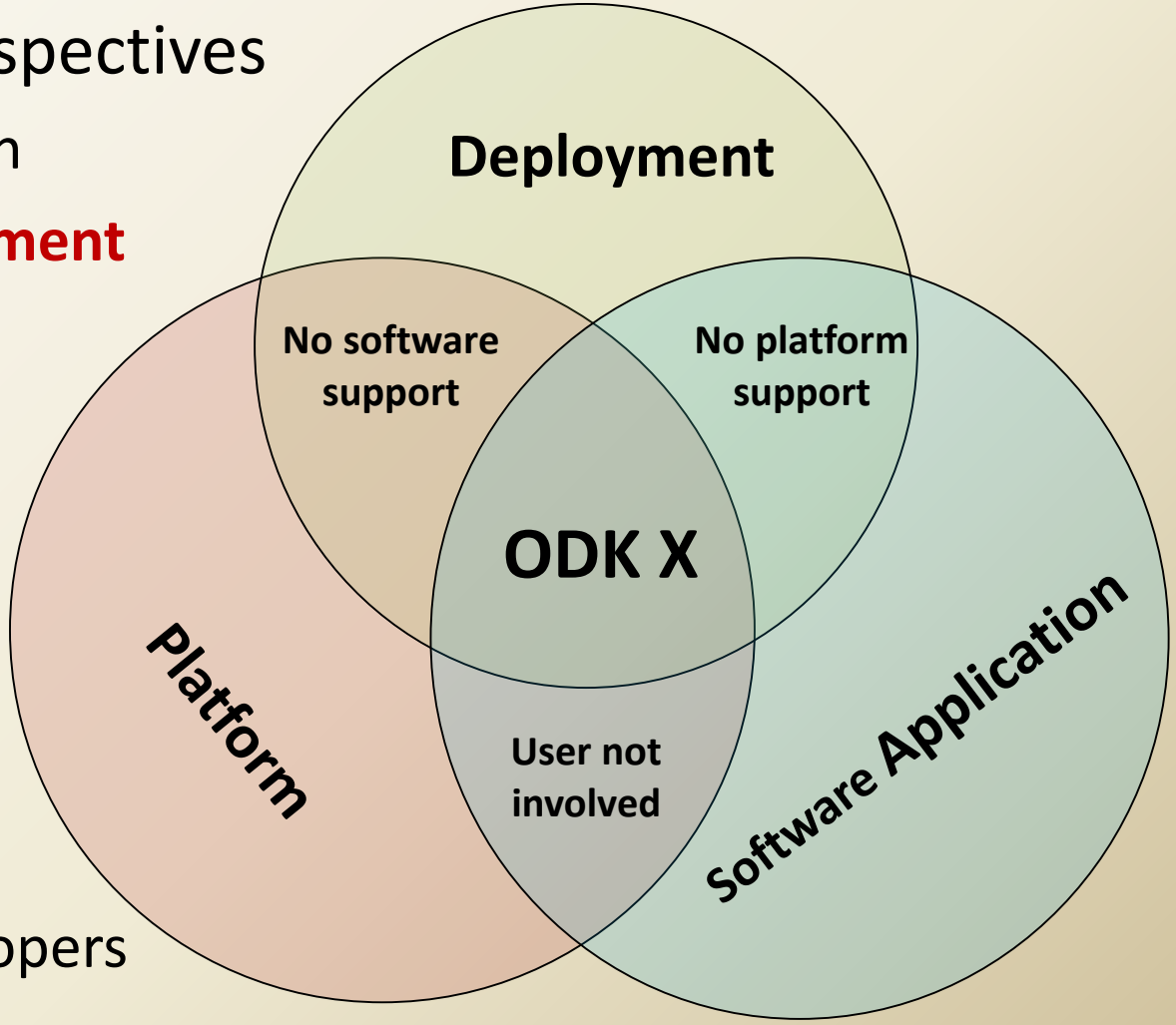
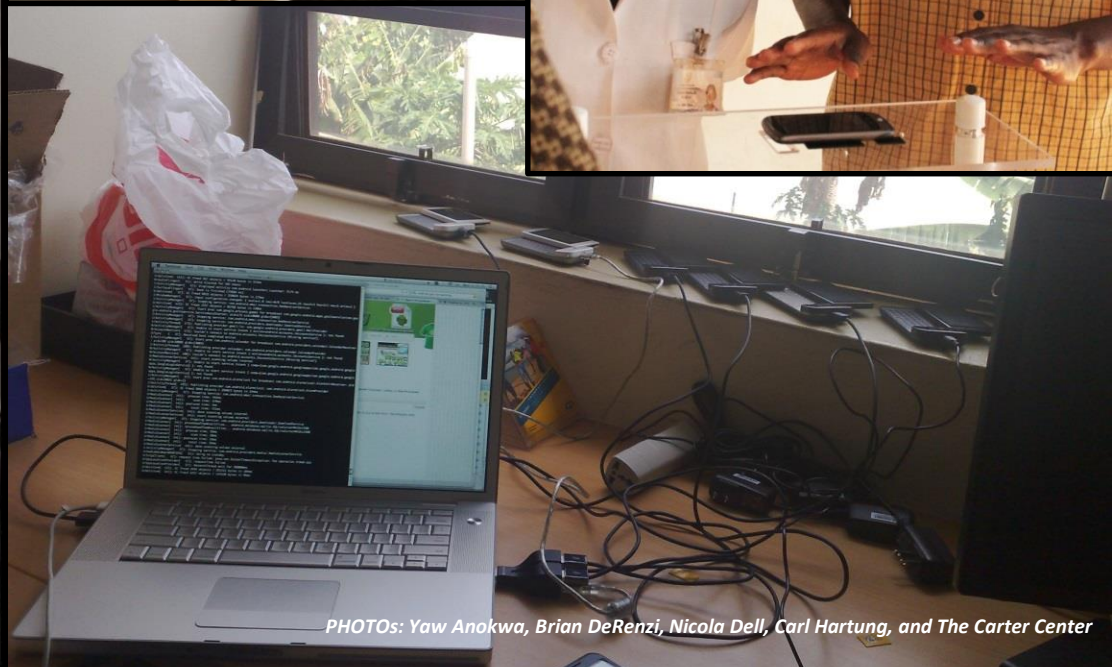


Recognized 4 roles:

- *End-Users*
- *Deployment Architect*
- *Programmers*
- ODK Framework Developers

Deployment Architect

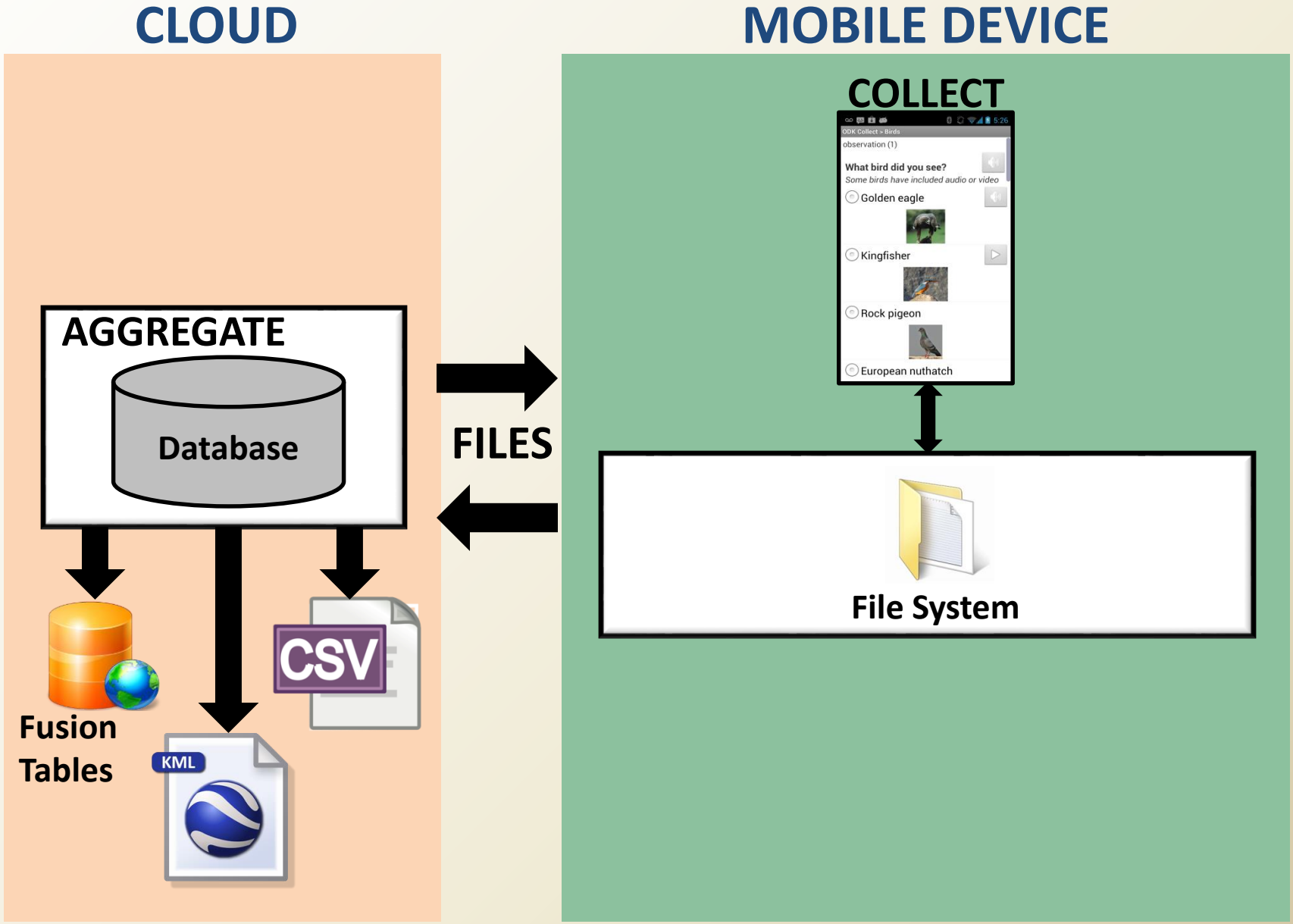


PHOTOs: Yaw Anokwa, Brian DeRenzi, Nicola Dell, Carl Hartung, and The Carter Center

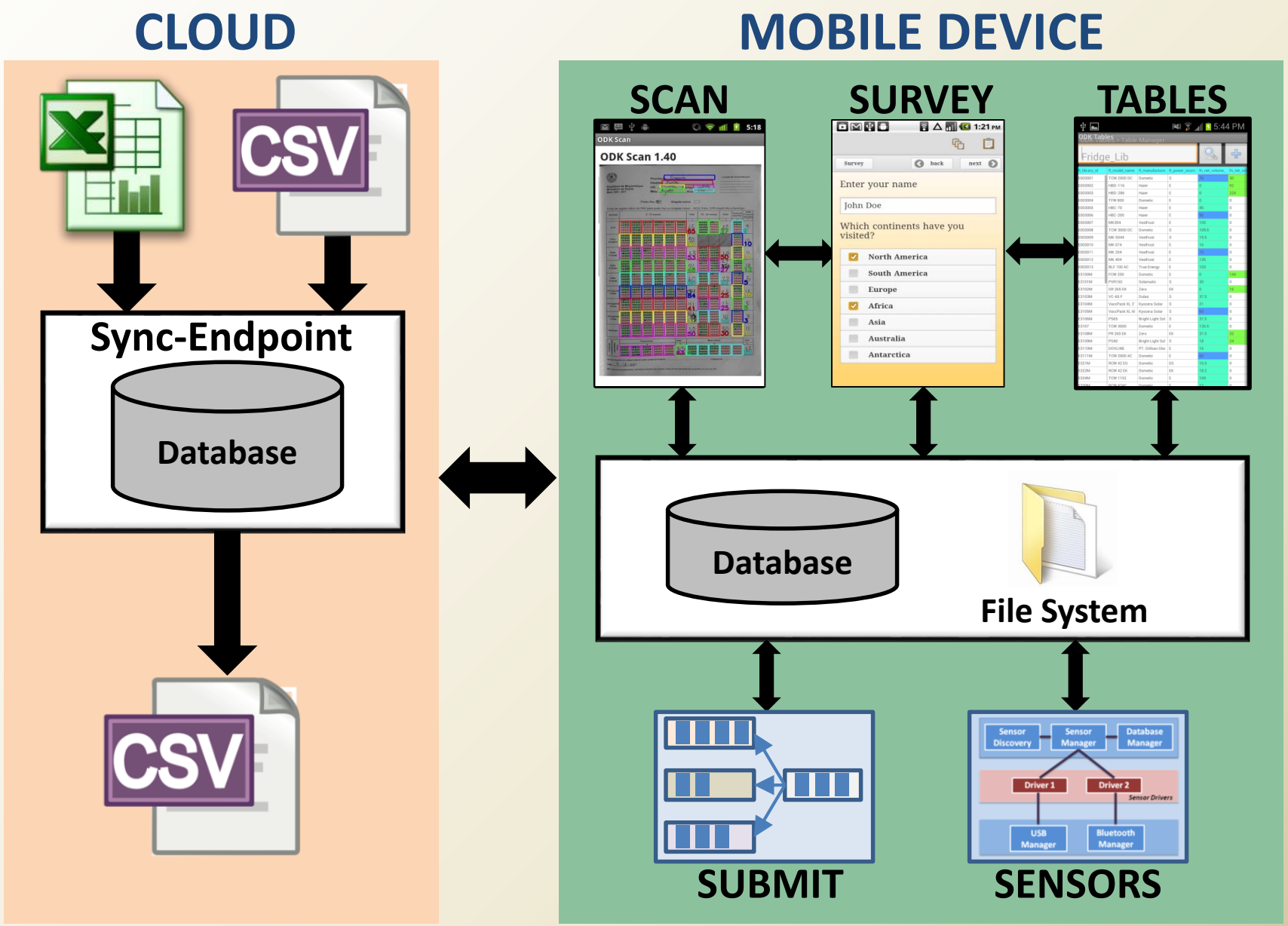
Deployment Architect

- **GOAL: Enable *'Development Architects'* to adapt ODK to their deployment contexts by configuring multiple reusable frameworks**

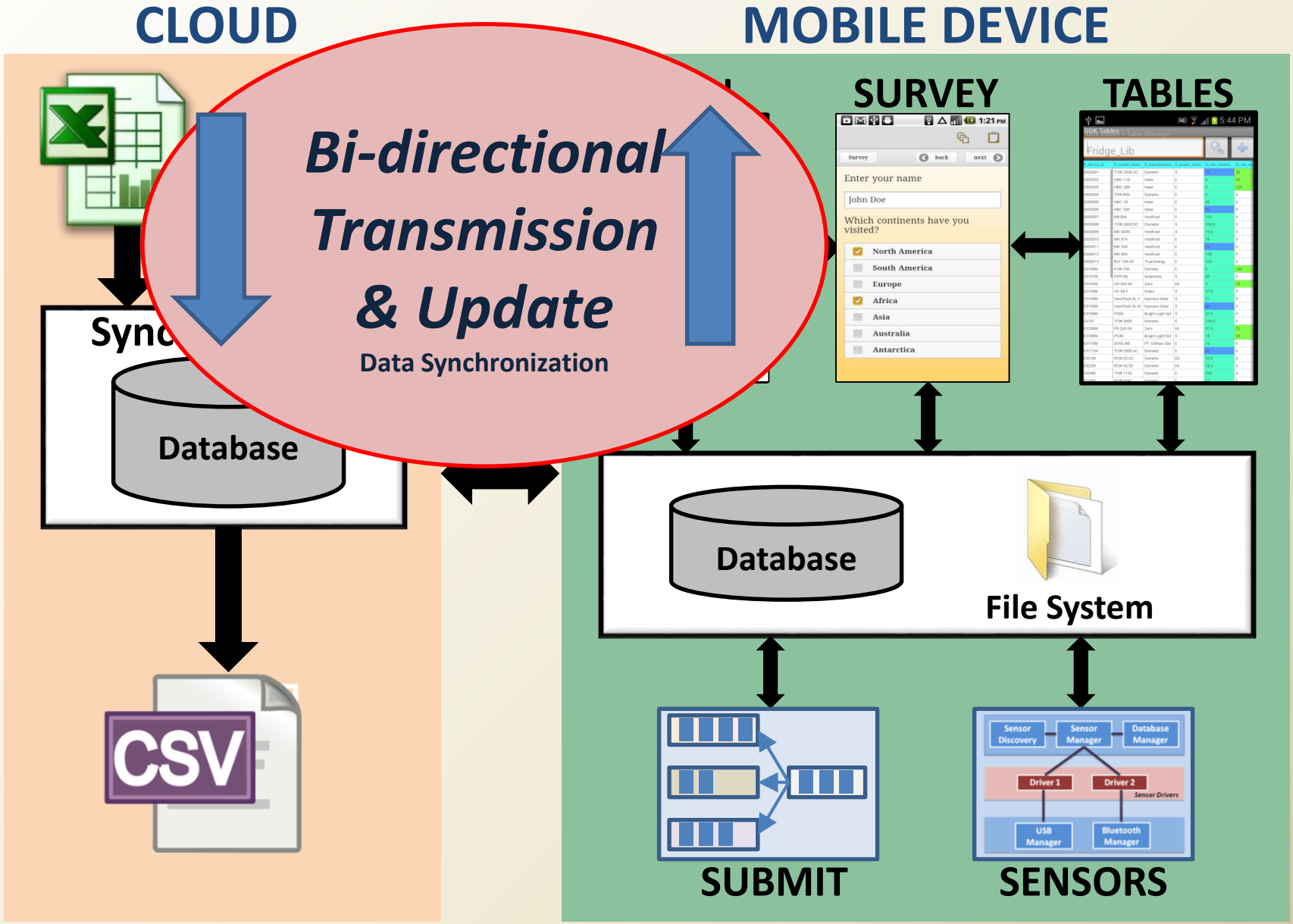
ODK 1.0 Architecture



ODK 2.0 Architecture



ODK-X Architecture



ODK Frameworks

- **Collect**
  - XForm-based mobile client for data collection, verification, and workflow
- **XLSForm**
  - Spreadsheet-based form authoring tool

ODK 1

- **Survey**
  - Mobile client framework for collecting rich data using complex workflows
- **XLSXConverter**
  - Spreadsheet-based form authoring tool
- **Sensors**
  - Framework to enable organizations to connect external sensors/hardware
- **Submit**
  - Framework to enable organizations to optimize transmission
- **Tables**
  - Framework to enable organizations to view and curate data on disconnected device
- **Scan**
  - Framework to enable organizations to bridge paper to digital *(outside my PhD work).*

ODK X

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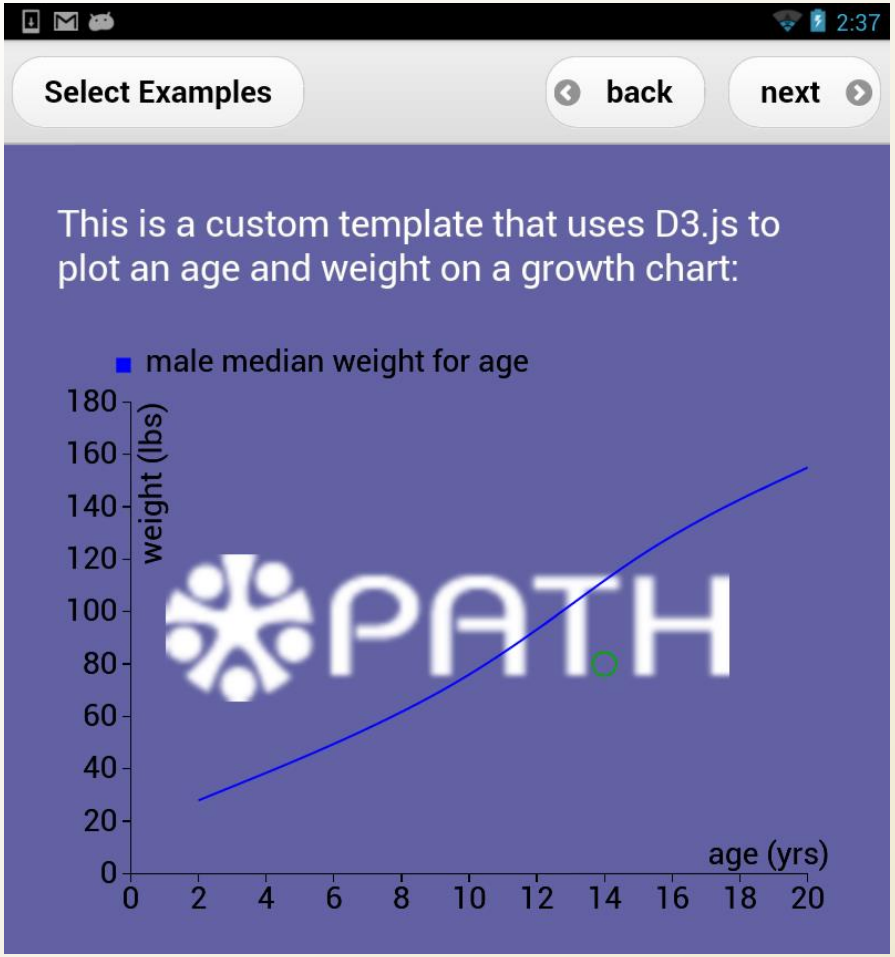
ODK-X

Framework Requirements

- Enables organizations to leverage mobile devices to build *customizable information systems*.
- Isolates the *user-configurable portion* of the framework from the *reusable system components*
  - *Create abstractions that are flexible and adaptable enough to support many different types of workflows from different subject domains.*
- Facilitates the *integration of new capabilities* into the framework.
  - *Integrating new sources of information (e.g., surveys, sensors) should be as simple as adding configuration files and data-handling routines to the framework.*

ODK-X: HTML on the Device

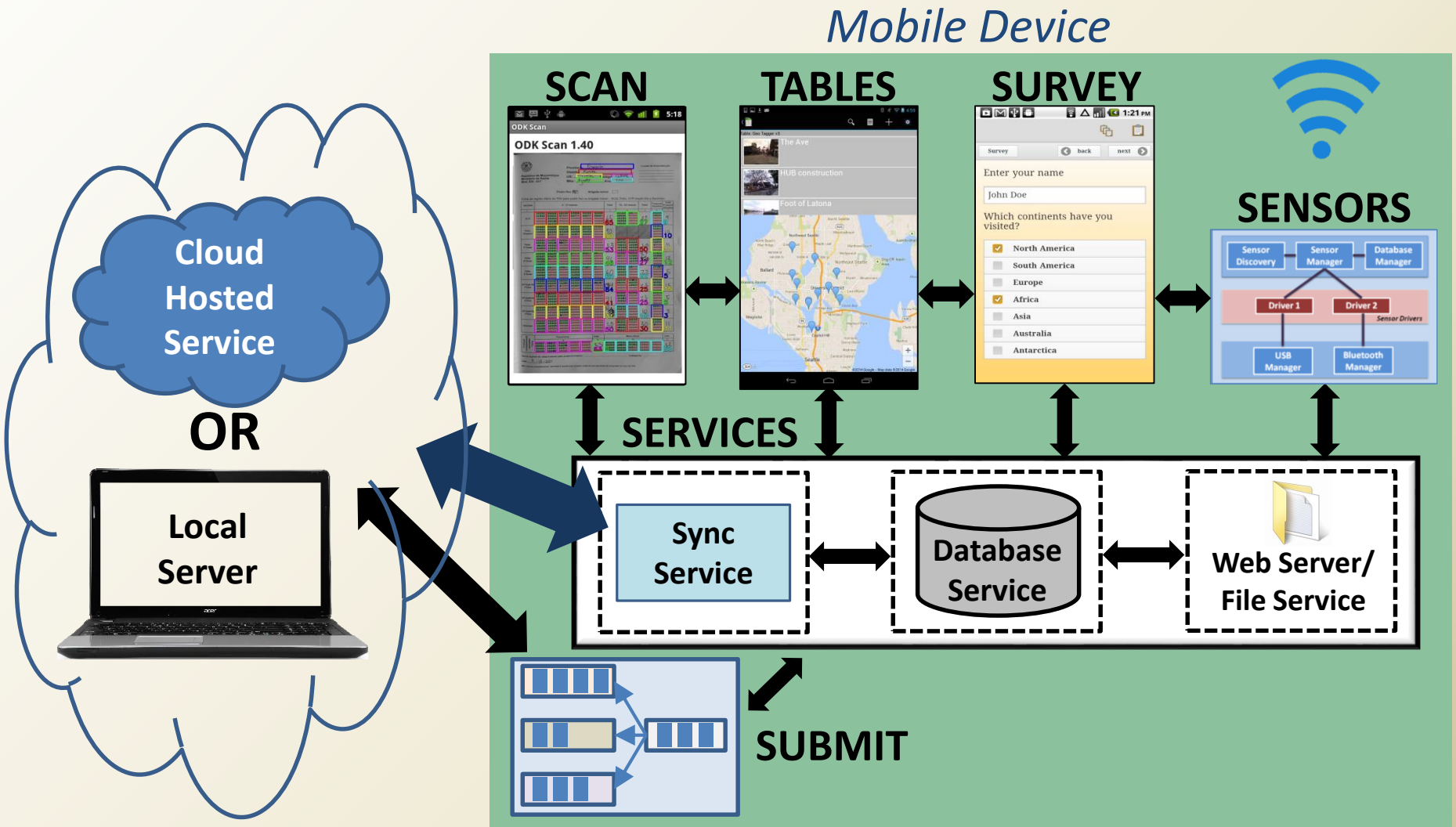


- Highly Customizable
- Dynamic Graphs
- Watermarks
- Access Server Content (AJAX)

Only WebDev Skills

Redesign

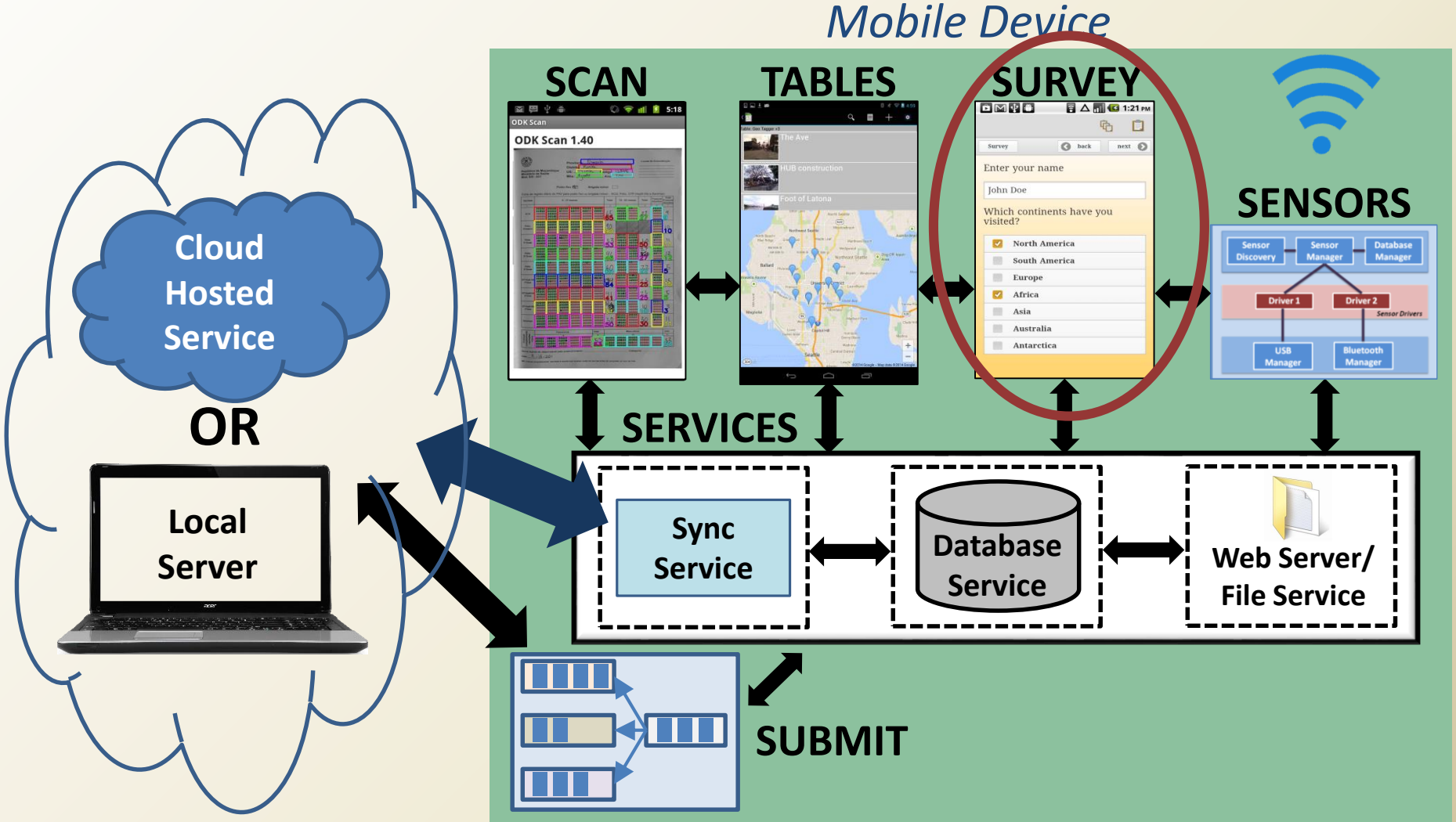
ODK-X Architecture



ODK-X Architecture

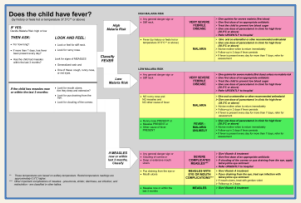
Survey Framework:

Framework for collecting data with verification using arbitrary workflows



ODK-X Survey

- Mobile framework for:
  - Collecting strongly typed data
  - Directed navigation
  - Rendering complex workflows
- Different approach than ODK Collect (1.x)
  - Easier customizations
  - Easier branching and workflows
  - Easier to access databases
- ***Example:*** Pneumonia Detection (Ghana & India)



IMNCI

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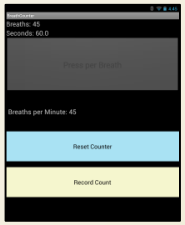
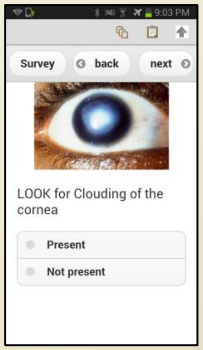
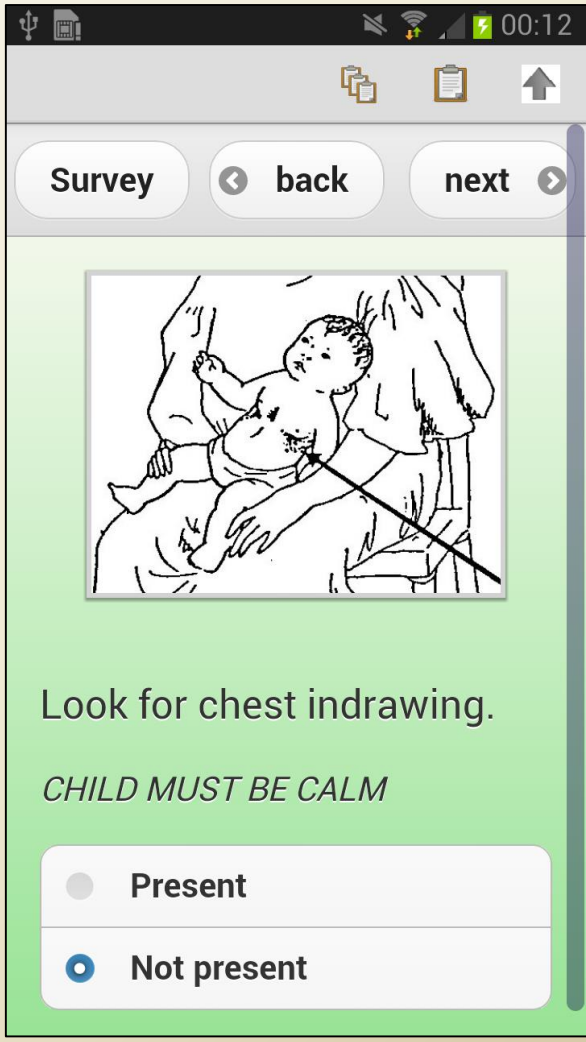


Respiratory Rate Counter

+

Pulse Oximetry



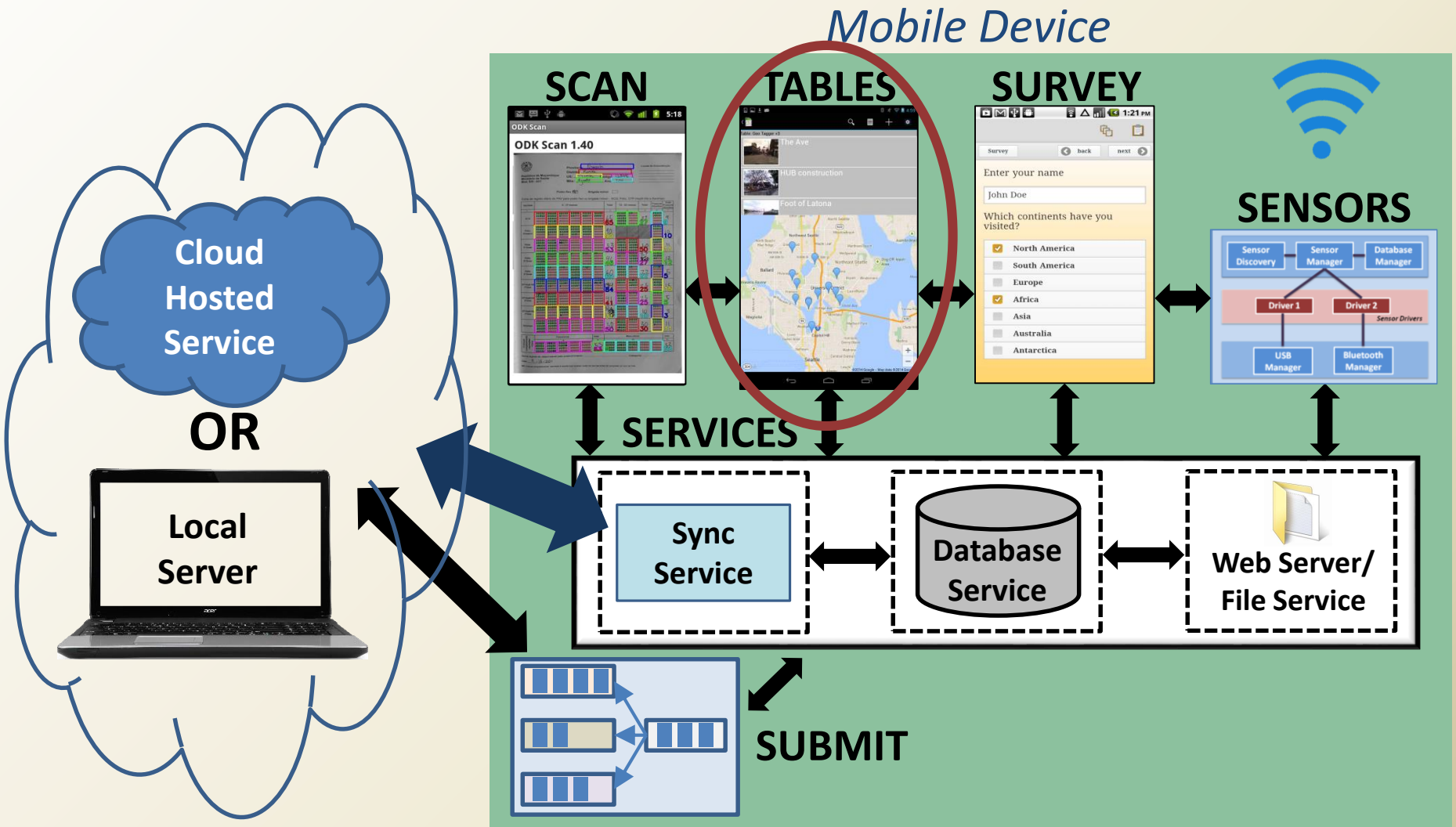


- A. S. Ginsburg, J. Delarosa, W. Brunette, S. Levari, M. Sundt, C. Larson, C. Tawiah Agyemang, S. Newton, G. Borriello, and R. Anderson. mpneumonia: Development of an innovative mhealth application for diagnosing and treating childhood pneumonia and other childhood illnesses in low-resource settings. PloS one, 10(10), 2015.
- A. S. Ginsburg, C. Tawiah Agyemang, G. Ambler, J. Delarosa, W. Brunette, S. Levari, C. Larson, M. Sundt, S. Newton, G. Borriello, and R. Anderson. mpneumonia, an innovation for diagnosing and treating childhood pneumonia in low-resource settings: A feasibility, usability and acceptability study in Ghana. PLOS ONE, 11(10), 2016.

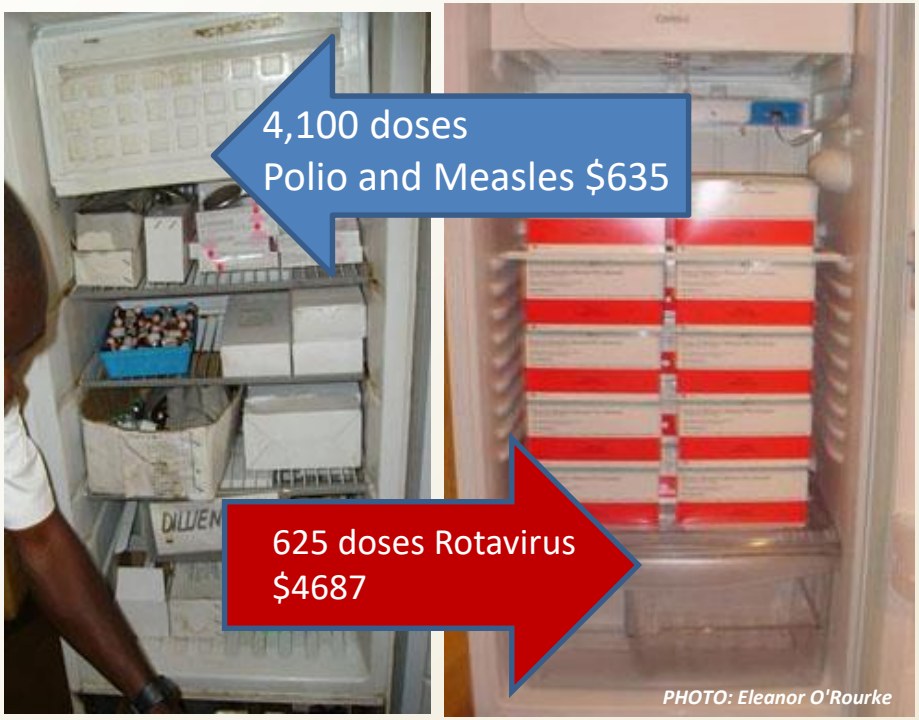
ODK-X Architecture

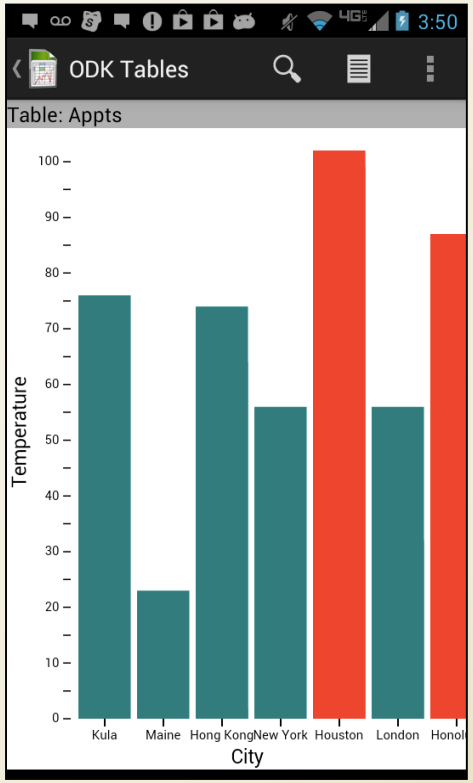
Tables Framework:

Framework to enable viewing and curating data on a disconnected device

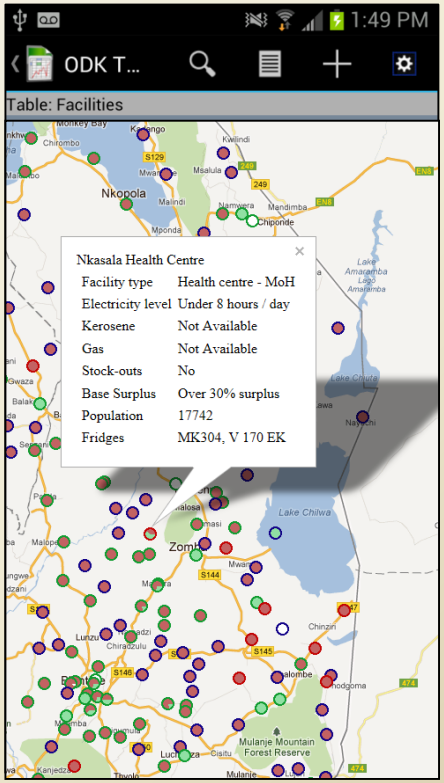


ODK-X Tables





Graph View



Map View

- Visualization of underlying database
- Provide users different looks at data
- User interface customizable in HTML/JavaScript
- ***Example:*** Cold chain monitoring

- W. Brunette, S. Sudar, N. Worden, D. Price, R. Anderson, and G. Borriello. ODK Tables: Building easily customizable information applications on androidbdevices. In Proceedings of the 3rd ACM Symposium on Computing for Development, ACM DEV '13, 2013.

ODK 2.0 Architecture

Sensors Framework:

Framework to enable organizations to connect external sensors/hardware

Mobile Device

SCAN

TABLES

SURVEY

SENSORS

Cloud Hosted Service

OR

Local Server

SERVICES

Sync Service

Database Service

Web Server/ File Service

SUBMIT

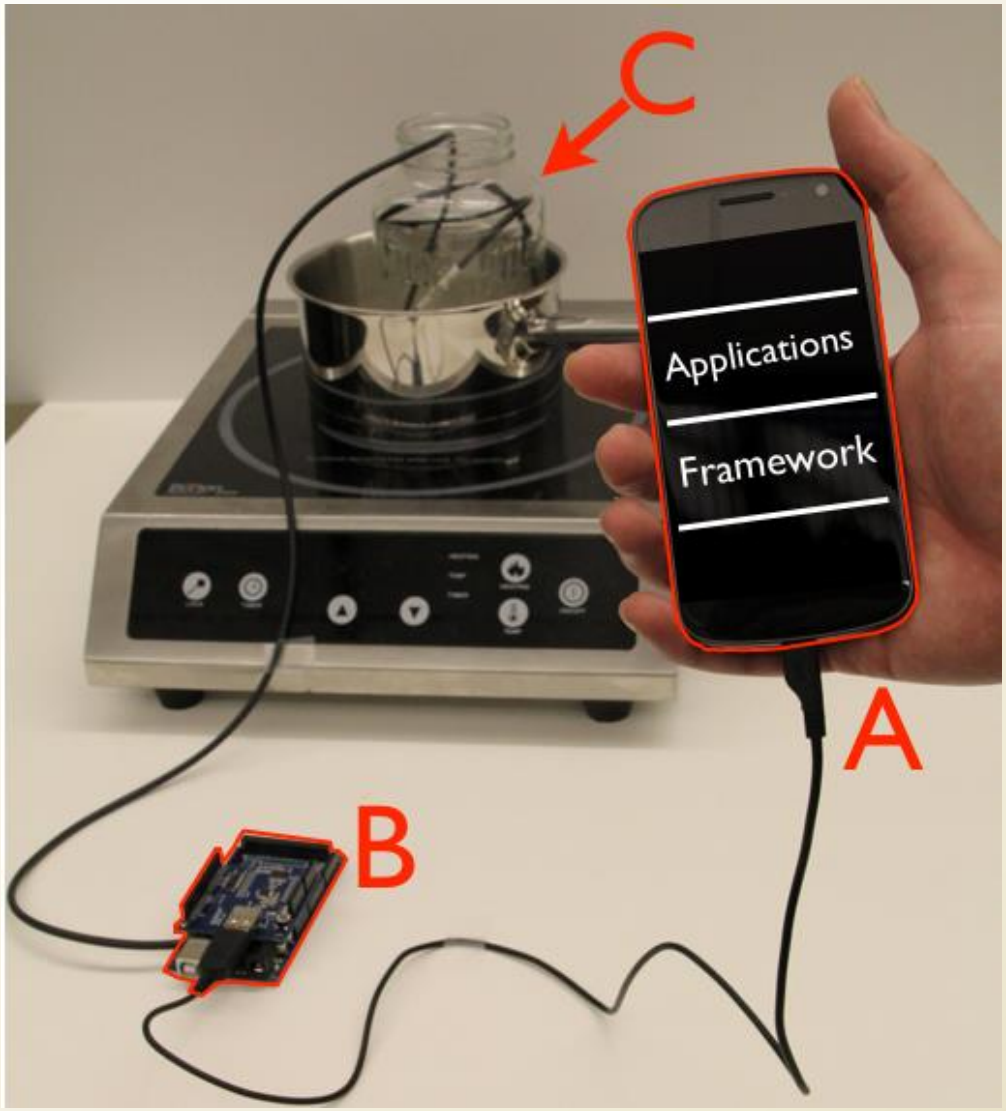
Sensor Diversity

- **Sensors differ by**
  - Communication Channel (e.g. Bluetooth, USB, NFC)
  - Type of data collected
  - Configuration
- **Four representative applications**

APPLICATION	COMMUNICATION	CONFIGURATION	DATA STYLE	SENSOR RATE
Medical *(Heart rate monitor)*	Bluetooth	Calibrate	Real-Time Single Reading	~ 1.5 packets / sec
Milk Bank *(Temperature sensing for milk pasteurization quality control)*	USB	Sampling Rate	Real-Time Time-Series	~ 1 packet / sec
Vaccine *(Temperature monitoring and alerts for vaccine quality control)*	USB	Alerts Sampling Rate Snapshot Size	Snapshot Time-Series	~ 1 packet / sec
Water Time *(Sensor to record movement intervals)*	Bluetooth	Identifier Calibrate	Historical Time-Series	~ 50 packets / sec

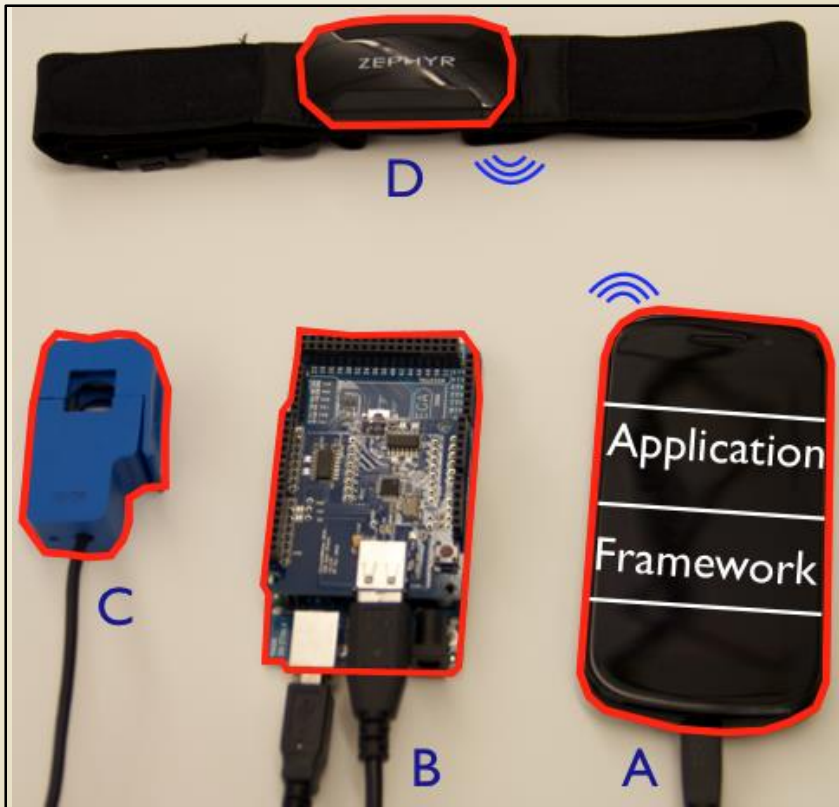
End-User View

Two Android “Apps”
- User Application App
- Framework App



Hardware Pieces

A. Android Phone
B. Arduino Board (USB Bridge)
C. Temp/Current Sensor (I2C)
D. Heart Rate Sensor (Bluetooth)

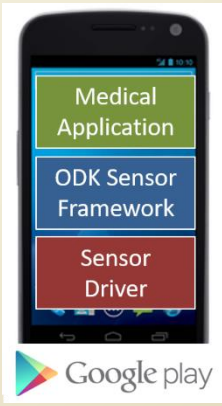


ODK-X Sensors

GOAL: Enable a market of *reusable application components* that can be easily integrated by non-technical users to create and deploy sensing applications.

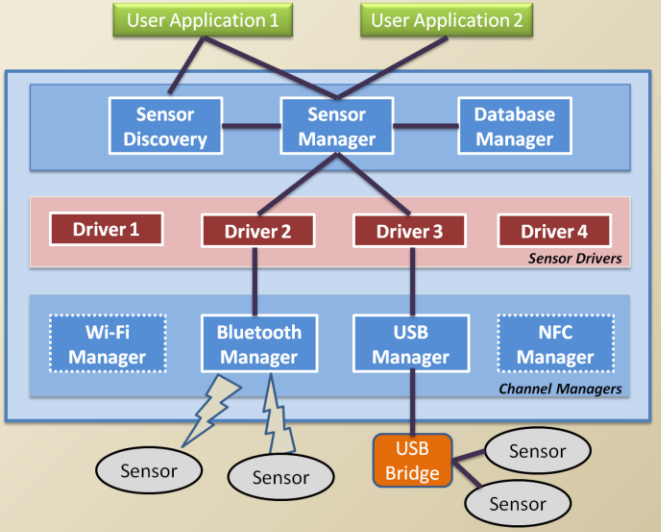
Make it *EASY* to: Connect sensors of any type

- Deployable to *any* Android consumer device
- Drivers should be easy to add and auto-upgrade (e.g. Windows Update)



SOLUTION: *Framework with "User-level" sensor drivers*

- No operating system modifications
- Allows convenient reuse between applications
- Distribution through existing app store model
- Create a single sensor interface
- Separate concerns (Drivers vs Framework)
- Framework handles all STATE MANAGMENT



- W. Brunette, R. Sodt, R. Chaudhri, M. Goel, M. Falcone, J. Van Orden, and G. Borriello. Open data kit sensors: A sensor integration framework for android at the application-level. In Proceedings of the 10th International Conference on Mobile Systems, Applications, and Services, MobiSys '12, 2012.

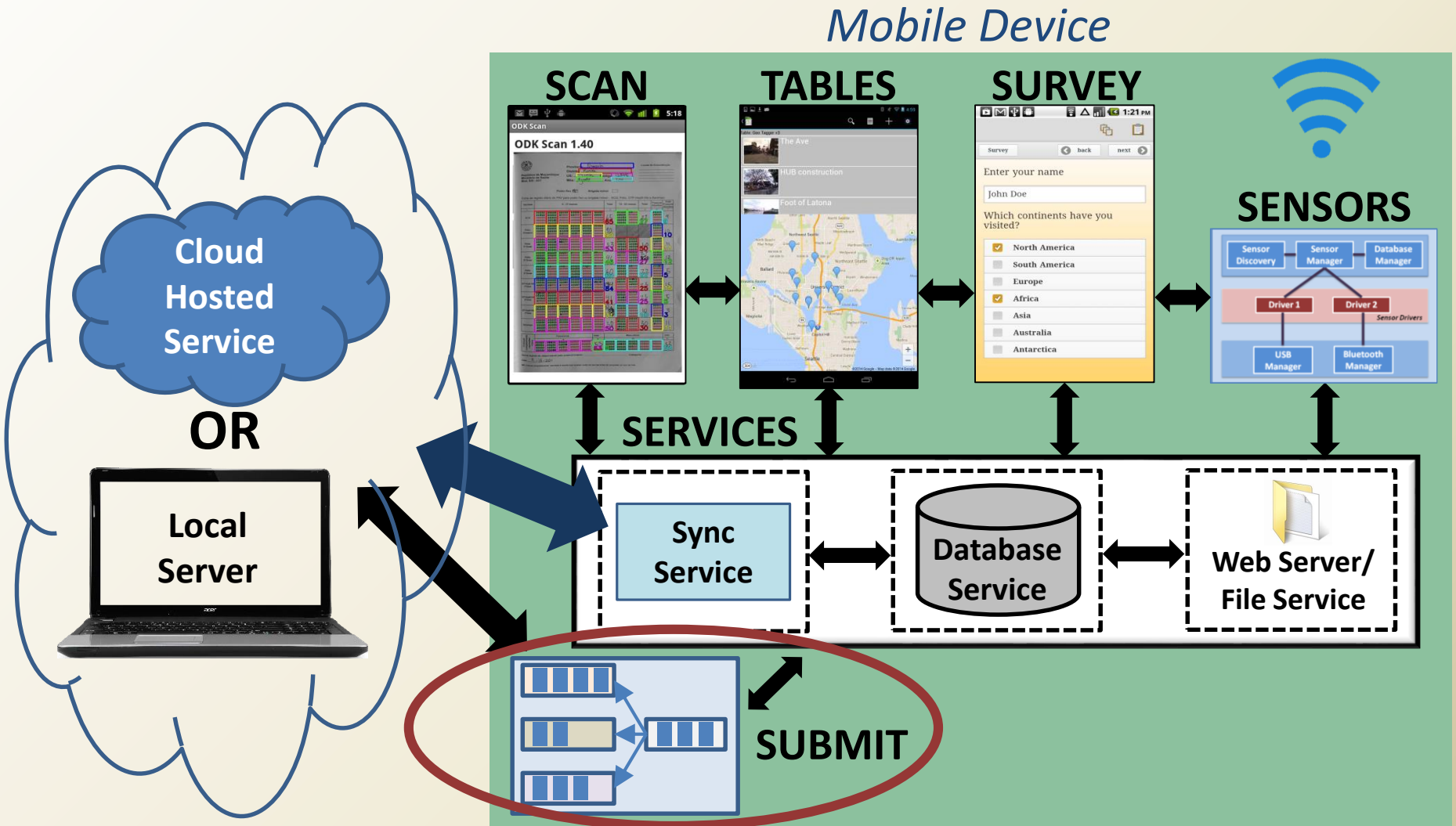
Separation of Concerns

- Application Developer
  - implements top-level user applications
- Driver Developer
  - creates sensor-specific processing and control modules
- Framework Developer
  - Absorbs as much work as possible
  - provides the BT/USB HW Setup, Threads, Sockets, Buffers, etc

ODK-X Architecture

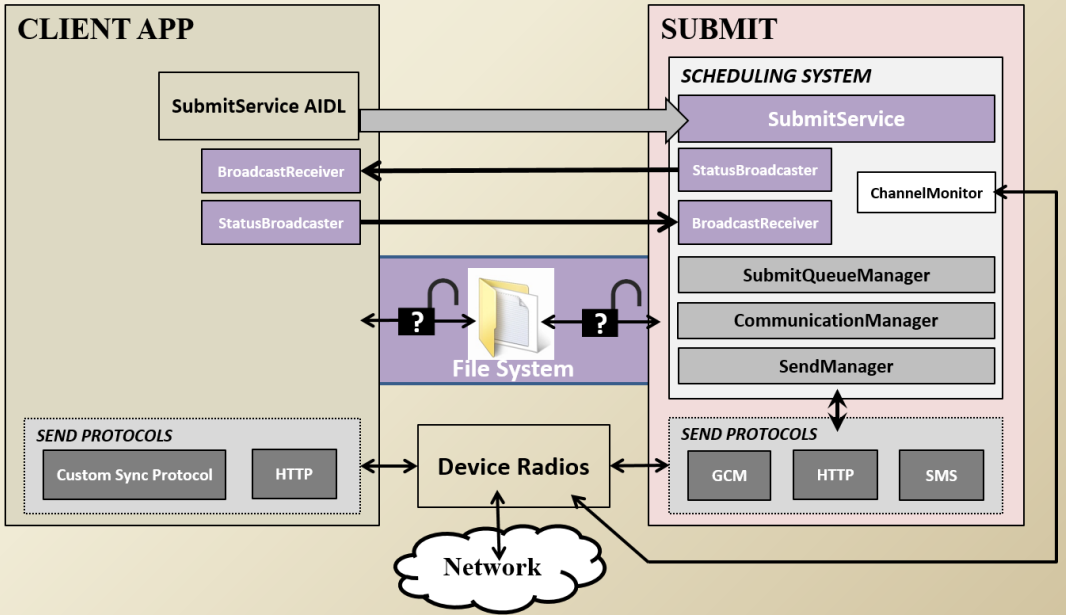
Submit Framework:

Framework to enable organizations to optimize data transmission



ODK-X Submit

- **Flexible data transmission *framework***
  - Enables *Deployment Architects* to optimize data transmission to contexts
  - Common network abstractions
    - *Unify* many different data transmission channels
    - *Hide* peer-to-peer channel details
    - *Simplify* app development (can use multiple channels to send data)
      - Avoids additional software development by leveraging submit framework
  - Expose a *simplified* set of data characteristics
  - Optimize communication based on contextual requirements.



- W. Brunette, M. Vigil, F. Pervaiz, S. Levari, G. Borriello, and R. Anderson. Optimizing mobile application communication for challenged network environments. In Proceedings of the 2015 Annual Symposium on Computing for Development, 2015.

Peer-to-Peer Transfer

- Facilitate network connectivity in remote regions using peer-to-peer communication
- GOAL: Enable *'Deployment Architects'* to adjust P2P to contextual requirements
  - Examine 5 different Android P2P transfer methods

ODK-X TOOL SUITE

To validate the derived requirements, ODK-X has been tested in 6 case studies.

CASE STUDY ODK-X FEATURE REQUIREMENT SUMMARY

	Childhood Pneumonia	Chimpanzee Behavior Tracking	HIV Clinical Trial	Disaster Response / RC2 Relief	Mosquito Infection Tracking	Tuberculosis Patient Records
Complex/Non-Linear Workflows	X	X	X	X	X	
Link Longitudinal Data to Collected Data	X		X	X	X	X
Data Security and Use Permissions	X		X	X	X	X
Reuse of Data Fields Across Forms			X	X		
Bidirectional Synchronization	X		X	X	X	X
Customizable Form Presentation	X		X	X		
Custom JavaScript Apps		X	X	X	X	X
Sensor Integration	X					
Paper Digitization						X
Custom Data Type Update Multiple Fields in a Single User Action	X	X		X	X	

OVERVIEW

RC² Relief **improves relief cycle** processes from emergency assessment through to distribution, reporting, and monitoring.

Adaptable for a variety of humanitarian contexts including **cash transfer** programming and the **distribution of relief items**.

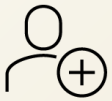
OVERVIEW

RC² Relief Tool is applicable to many scenarios:

- Basic delivery using a re-usable barcode (e.g., serving a meal)
- Registration of "Beneficiary Entities" with criteria based on delivery of relief items.
- Multiple individuals can be grouped in "Beneficiary Entities" (e.g., households)
- Beneficiary follow-up for long-term rebuilding programs

THE ADVANTAGES

Streamlines the collection and use of information though **bidirectional synchronization** of data.



User profiles aligned with the structure of the organization control access to increase **data security and privacy** for the assisted people.

The mobile application can **store data** on past assistance, **without the need for an Internet** connection.

The **ability to custom workflows** based on field conditions **reduces errors and data duplication**.

THE ADVANTAGES

Improves efficiency of field workers, allowing more people to be reached in situations with limited resources.

Facilitates accountability through **improved record-keeping**.

Adaptable for a variety of humanitarian contexts including **cash transfer** programming and the **distribution of relief items**.

ODK-X TOOL SUITE

It is an open-source suite of tools that helps organizations create, administer, and manage mobile data collection solutions.

ODK-X had an iterative requirements gathering process:

- Surveys
- Pilot deployments in 18+ countries by a variety of organizations,
- The ODK-X tool suite went through a significant redesign from the original ODK-X vision

DESIGNED FOR FLEXIBILITY

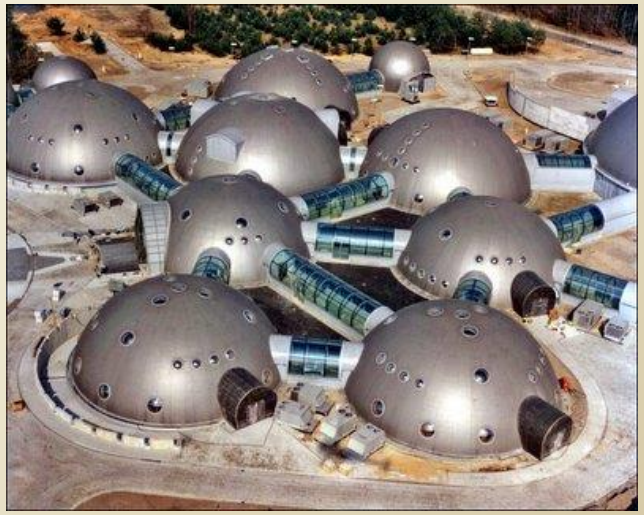
A design priority was making the RC² Relief tool **flexible** so National Societies could customize RC² Relief based on their available resources

Modular design for changes to "disaster distribution pipelines."

- Enables each National Society to customize or share their forms and templates
- Multiple output stages as simple CSVs for human customization in the field
- Enables innovation as small changes to based on the needs of the disaster response or other field conditions can easily introduced
- Future modules can incorporate varying business logic while still remaining compatible with the rest of the application

Challenges/Lessons Learned

- Challenges involved in designing six mobile frameworks to work together seamlessly on the mobile device
  - *Part of modularity and open source ecosystem goal*
  - *Goal frameworks can work independently or together to make a more complex system*



Picture from: http://www.bldgblog.com/2005/12/the-monolithic-dome-institute/

LESSON: Schema helped

- ODK 2.0 is database-centric instead of file-centric
  - DB rows are the basic unit of storage of ODK 2.0
  - View definitions and settings stored in files (not data)

- *Helps Deployment Architects understand how to use the 5 frameworks together because they are in control of the common DB schema for all tools/frameworks*
  - Also helps with deployment issues
    - Pushes *Deployment Architects* to avoid collecting data and not understanding how to process the data
    - *Deployment Architects* can avoid conflicting disconnected updates between users in rows by separating data tables
    - Can easily separate out important data to transmit more quickly rather than data that is less important

Roadblocks are not what you expect!

Contribution Summary

- Open Data Kit (ODK) enables organizations to create domain independent mobile information management solutions by providing customizable mobile frameworks that
  - are designed to adapt to challenged mobile networking conditions.
  - create new abstractions that are usable by non-programmers with limited technical expertise (e.g., Deployment Architects)
  - are modularized to enable interoperability of tools that can be used together or separately to simplify customization


Questions?
Thank you for your attention.
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Computer Science & Engineering
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