



# OPEN DATA KIT:

## *Building and Refining Information Services for under-served Populations*

**Waylon Brunette**

**Department of Computer Science & Engineering**

**The work being discussed was done by a LARGE TEAM in UW-CSE.**





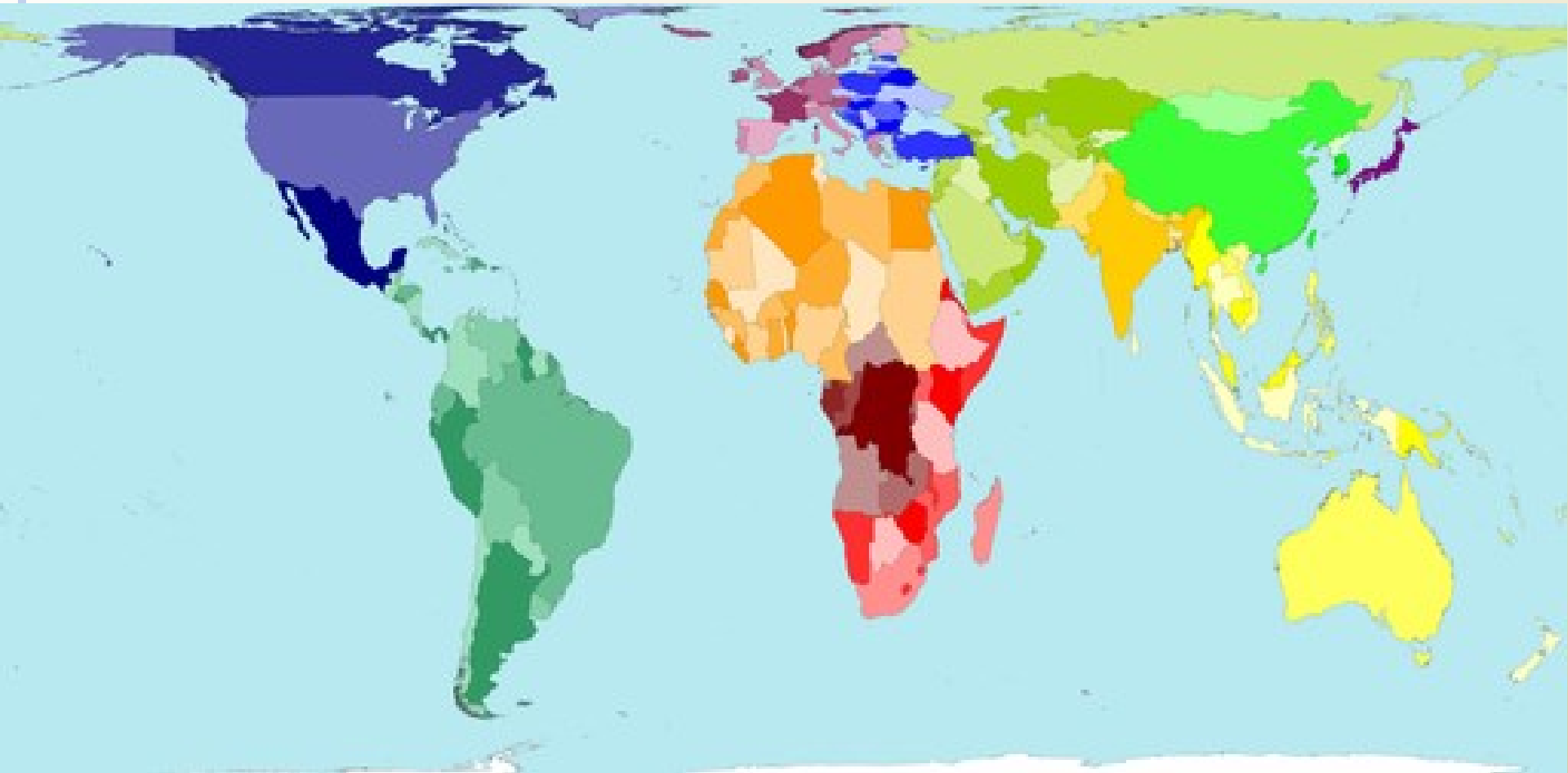
## *In Tribute...*

- Remembering Prof. Gaetano Borriello
- Open Data Kit's visionary and leader





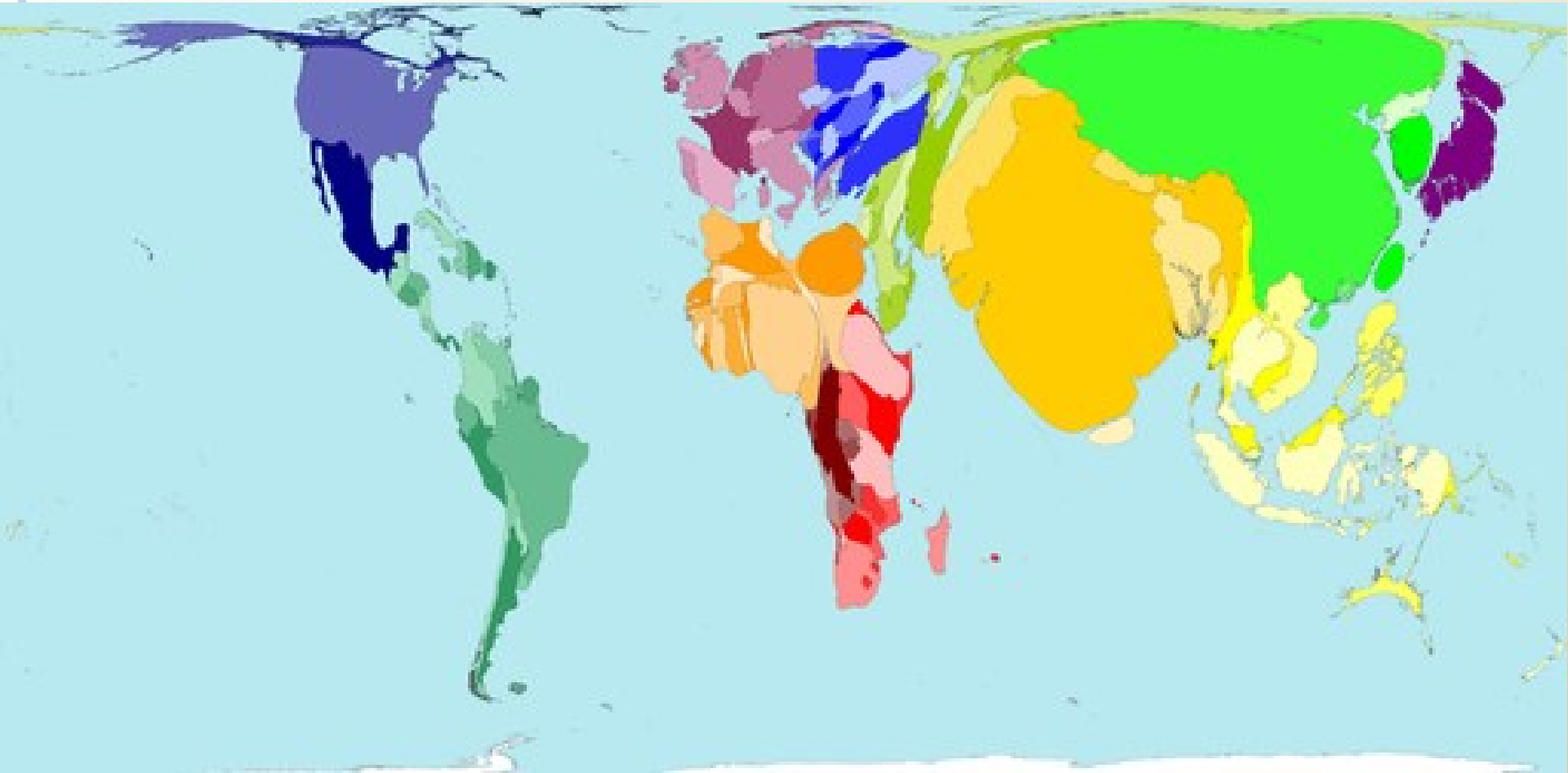
# World Map



SOURCE: [www.worldmapper.org](http://www.worldmapper.org)



# Population View

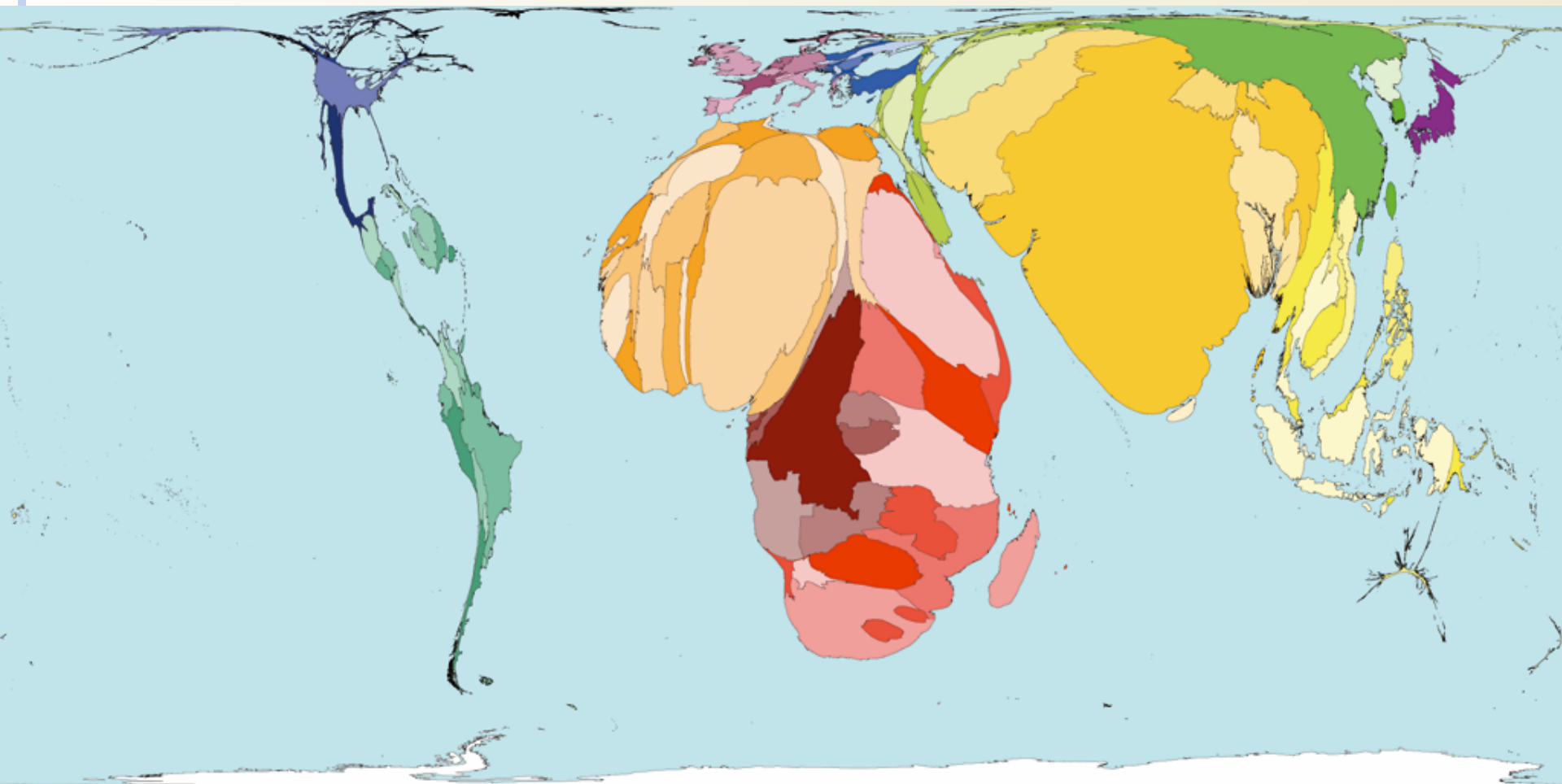


SOURCE: [www.worldmapper.org](http://www.worldmapper.org)





# Often Preventable Deaths 2002

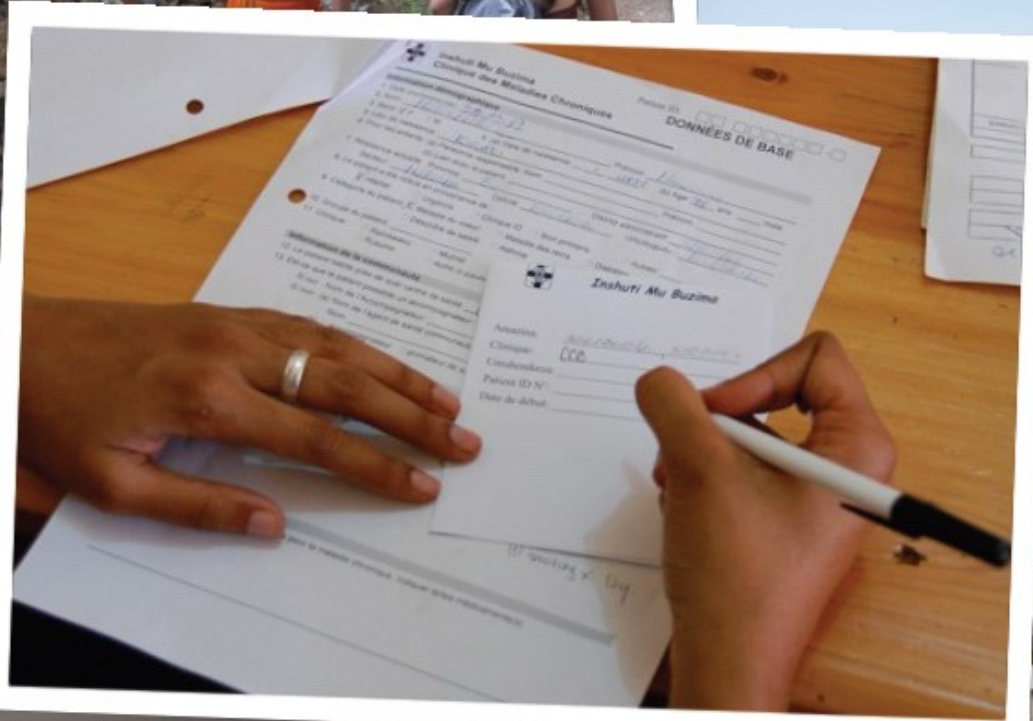


SOURCE: [www.worldmapper.org](http://www.worldmapper.org)





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

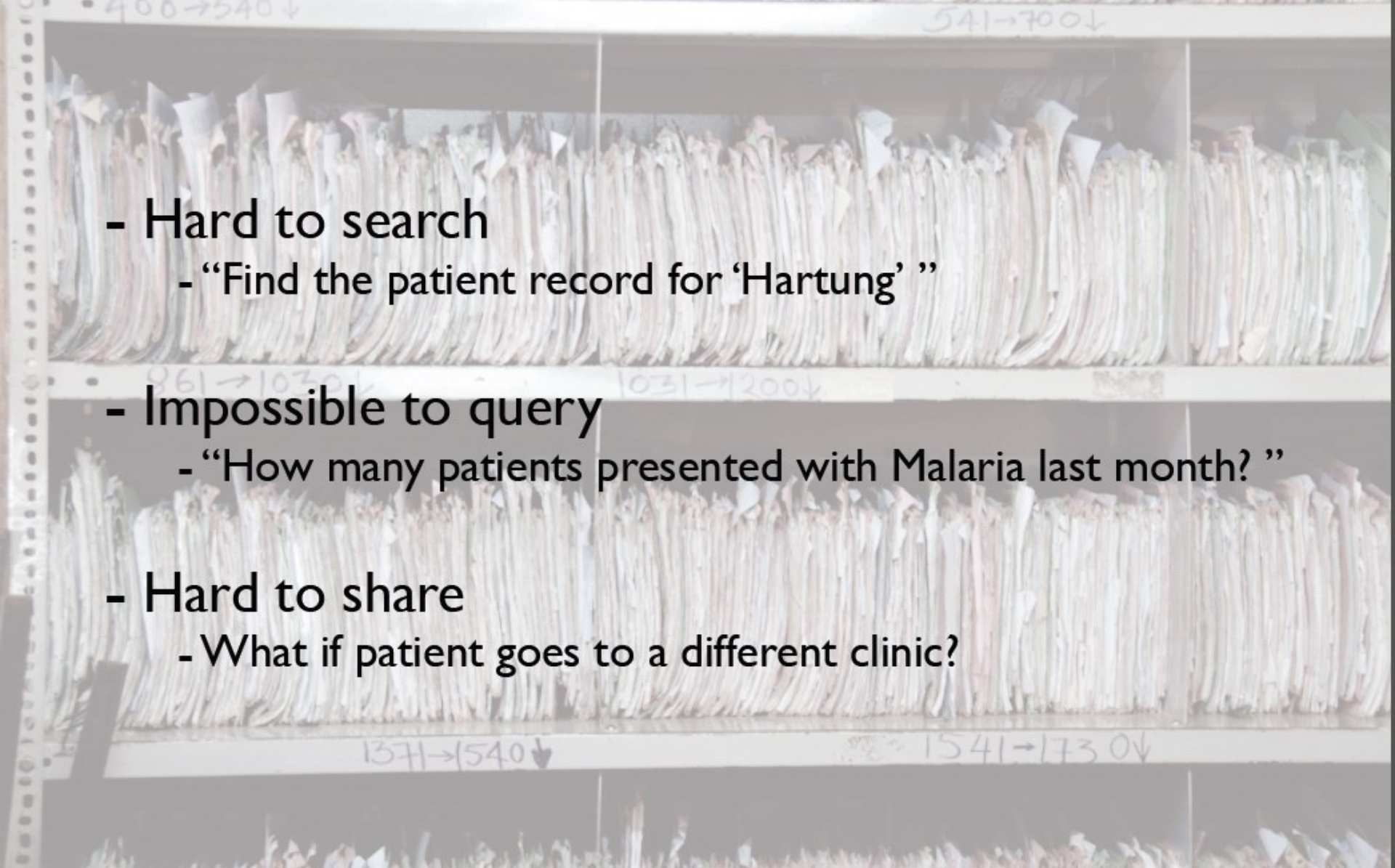






**Paper Systems are difficult to Search and Transport**





- Hard to search

- “Find the patient record for ‘Hartung’ ”

- Impossible to query

- “How many patients presented with Malaria last month? ”

- Hard to share

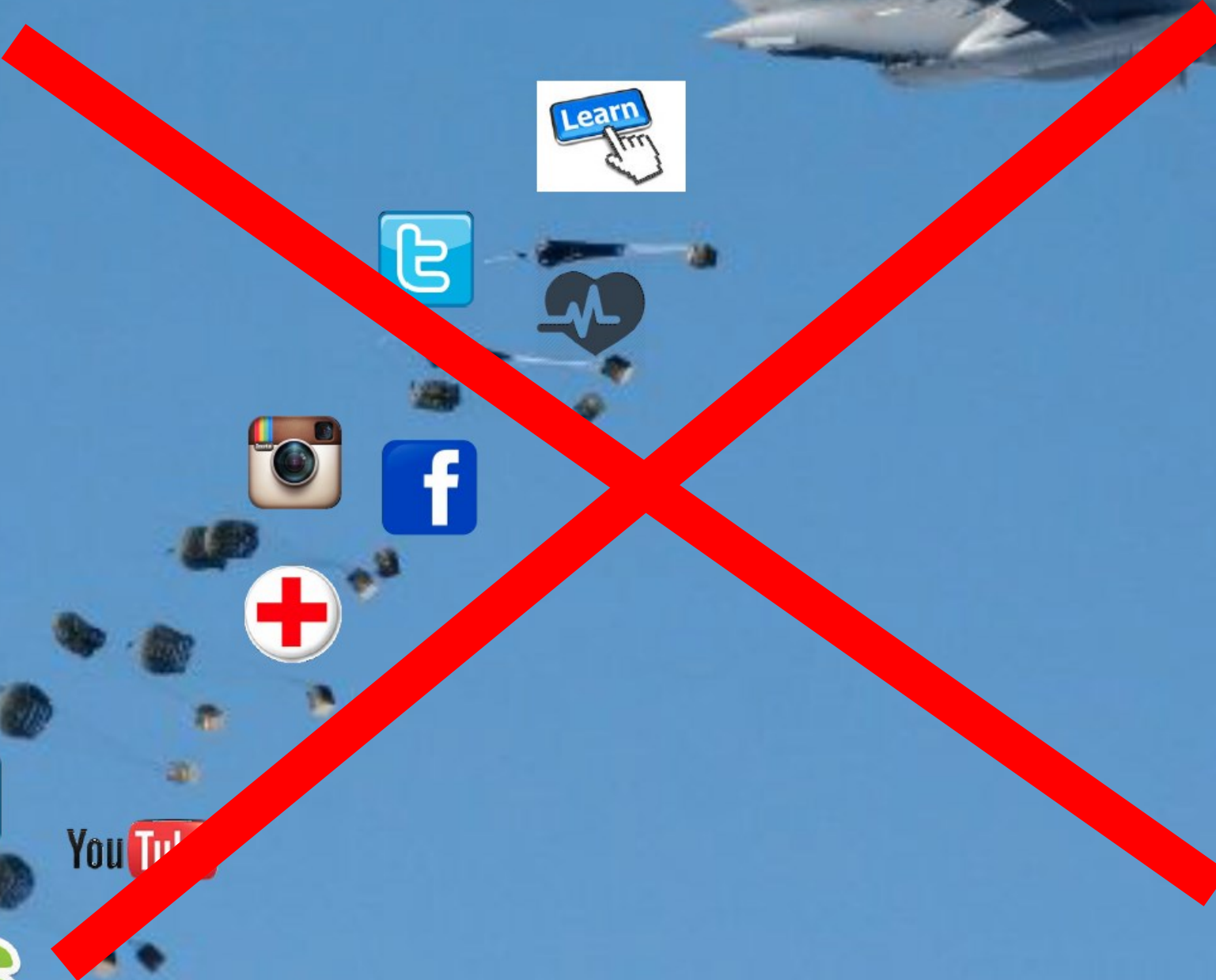
- What if patient goes to a different clinic?

**Paper Systems are difficult to Search and Transport**











# Ideas that shaped ODK

- Technology by itself is generally NOT a solution
- Magnify *Human* resources through Technology
- Technology requires support infrastructure















# Open Data Kit (ODK)

- **Project started in 2008-09**
- **Mobile data collection tools for Android devices**
  - There was too much focus on clumsy J2ME devices
  - Not enough focus on the trajectory of technology
- **Modular, open architecture**
  - Too many stove-piped solutions
  - Large commercial enterprise systems
- **Open source (Apache2)**



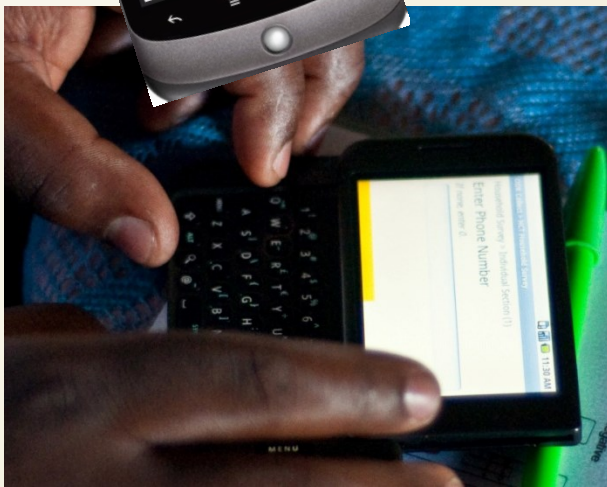
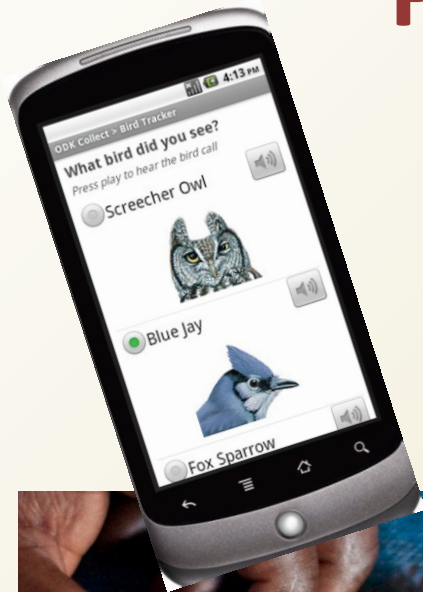
***GOAL: Magnify human resources through technology***





**Platform Shift from PCs to**

**Smart Phone + Cloud**





## 1. Build form

Untitled Form rename | File Edit View Help Signed in as Yaw

Properties

Data Name: The data name of this field in the final export

Image

Caption Text: The name of this field as it is presented to the user

English: Please take a picture of yourself

Hint: Additional help for this question.

English:

Read Only: Whether this field can be edited by the user

Required: Whether this field must be filled in before moving to the next question

Kind: Type of media to upload.

Image

Advanced

First name fname

Please record your location location

When is your birthday? bdy

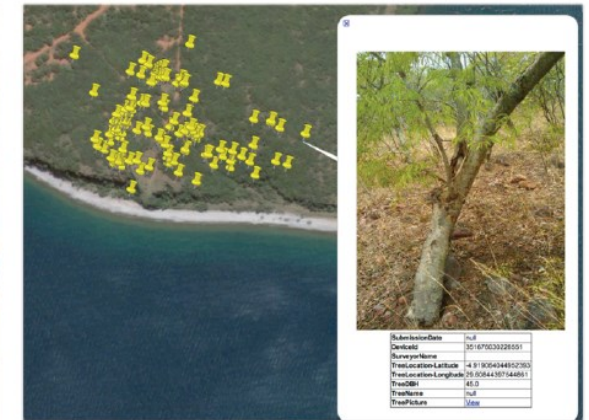
Please take a picture of yourself image

← Add new Text Numeric Date Location Media Choose One Select Multiple

## 2. Collect data



## 3. Aggregate results



<http://opendatakit.org>

**GOAL: Magnify human resources through technology**





# ODK 1.x: Data Collection

## ODK Collect

- Renders question prompts defined by the user

ODK Collect > household member

Demographics

**Data for household:**

Replace Barcode

735854100070

**Enter the name of the household member:**

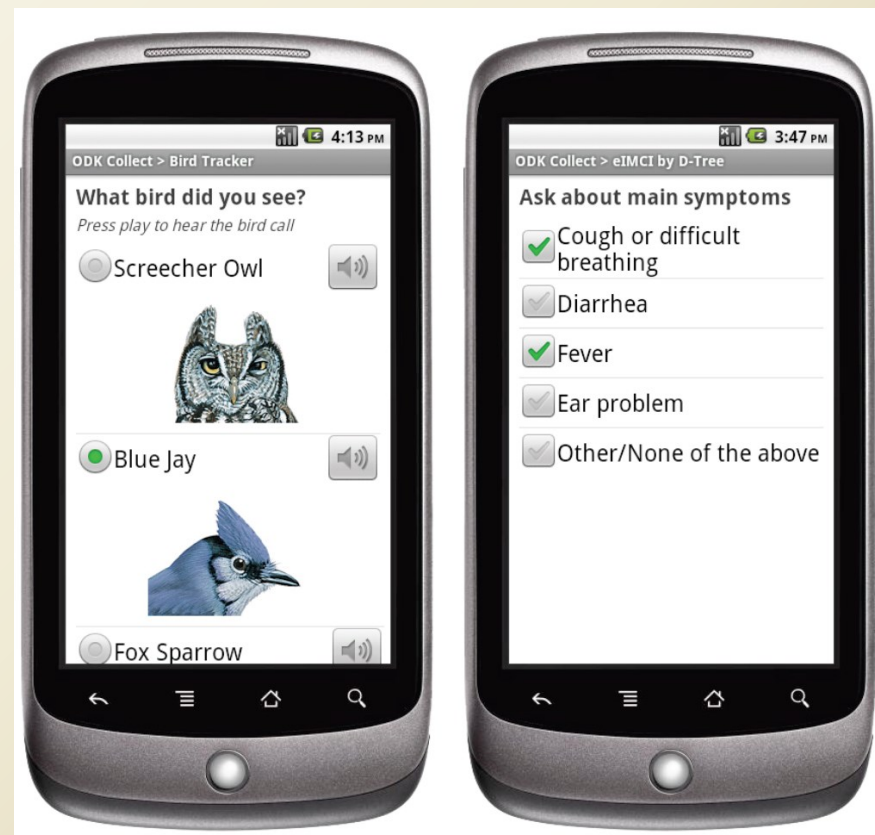
Fred

**Enter age of**

**Ender sex of**

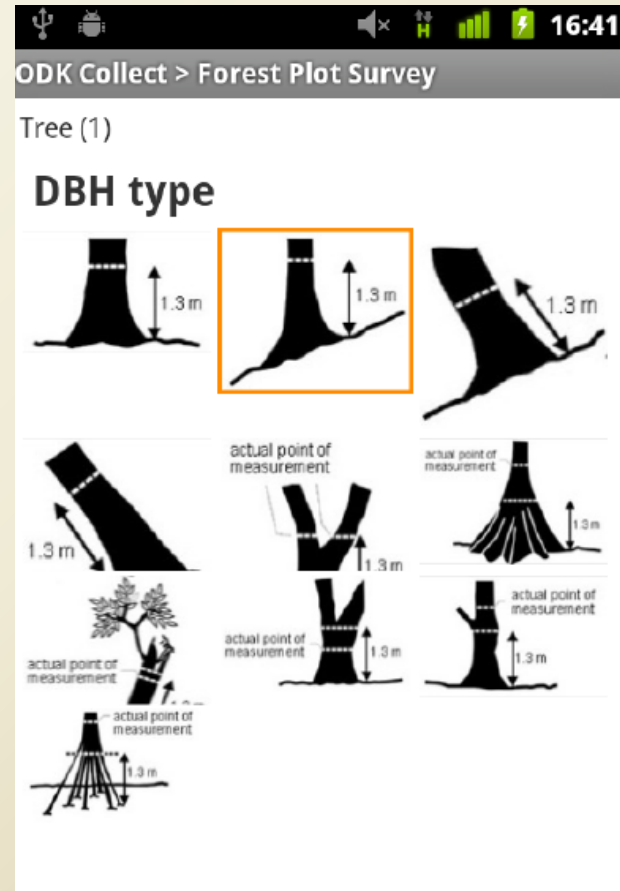
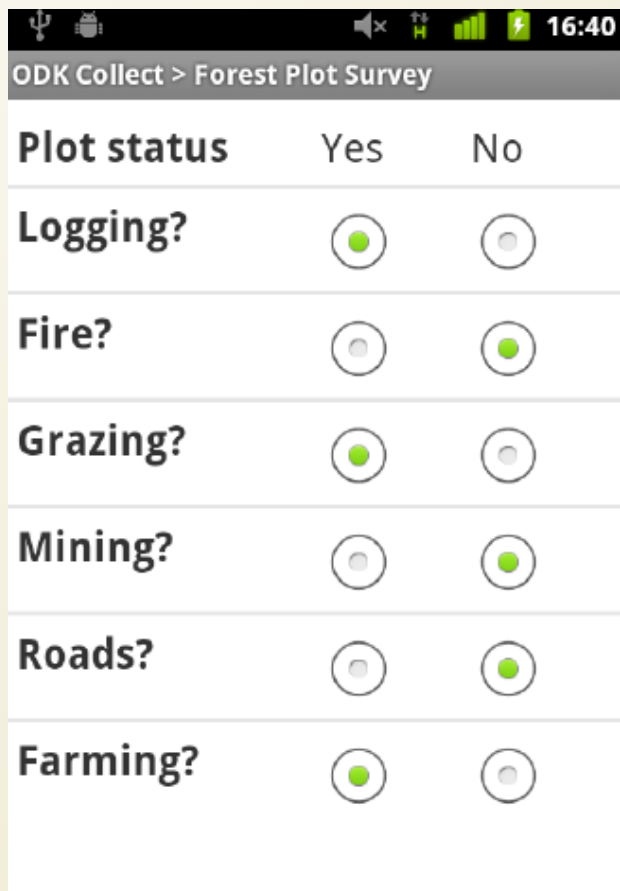
Male

Female



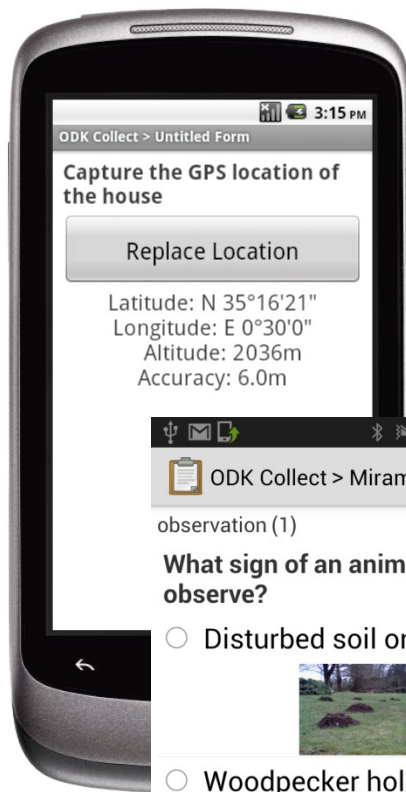


# ODK Collect Question Layouts



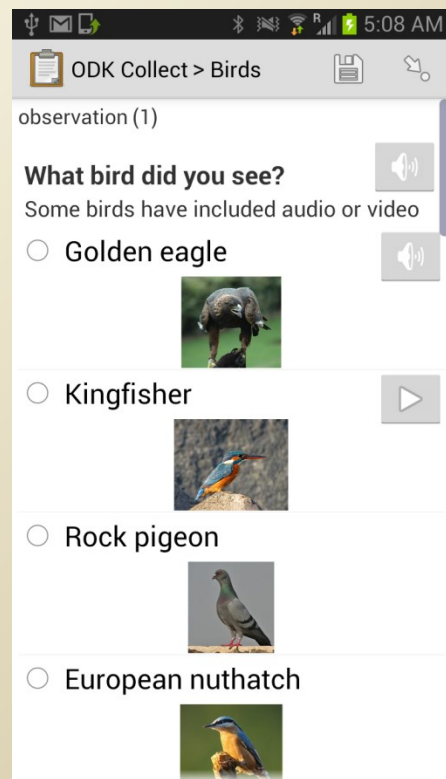
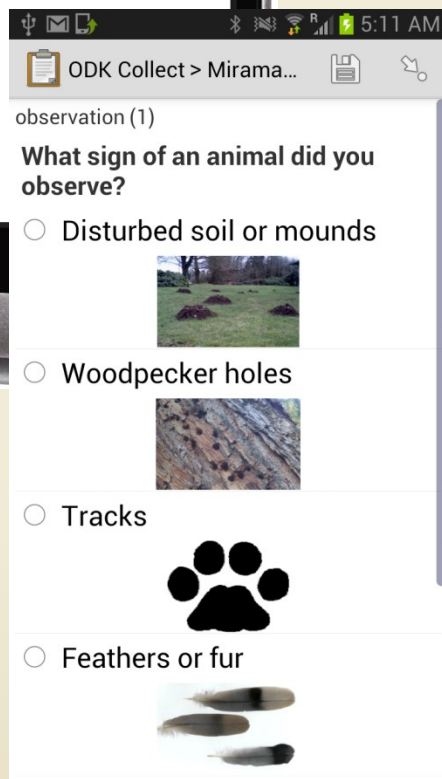


# ODK 1.x: ODK Collect



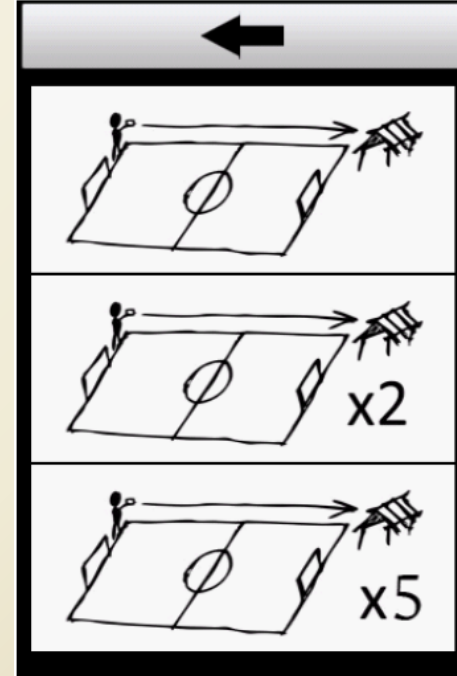
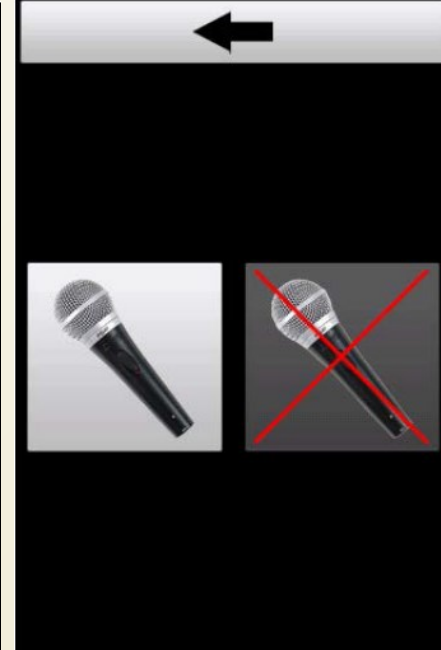
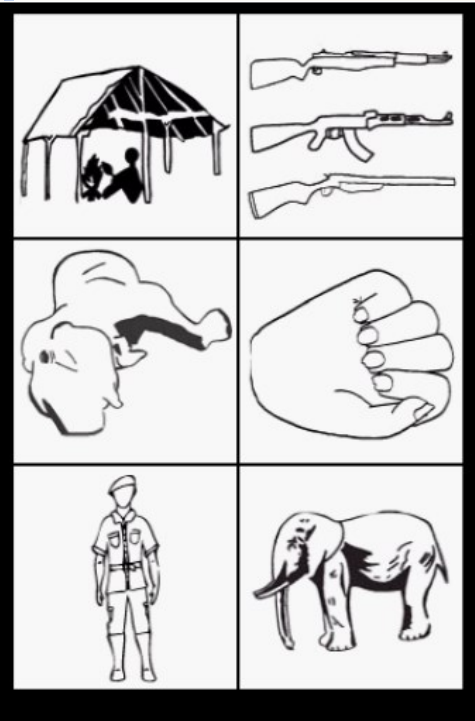
*Automated Survey Renderer with enhanced data types*

- Pictures, Video
- GPS
- Barcode





# Icon Example

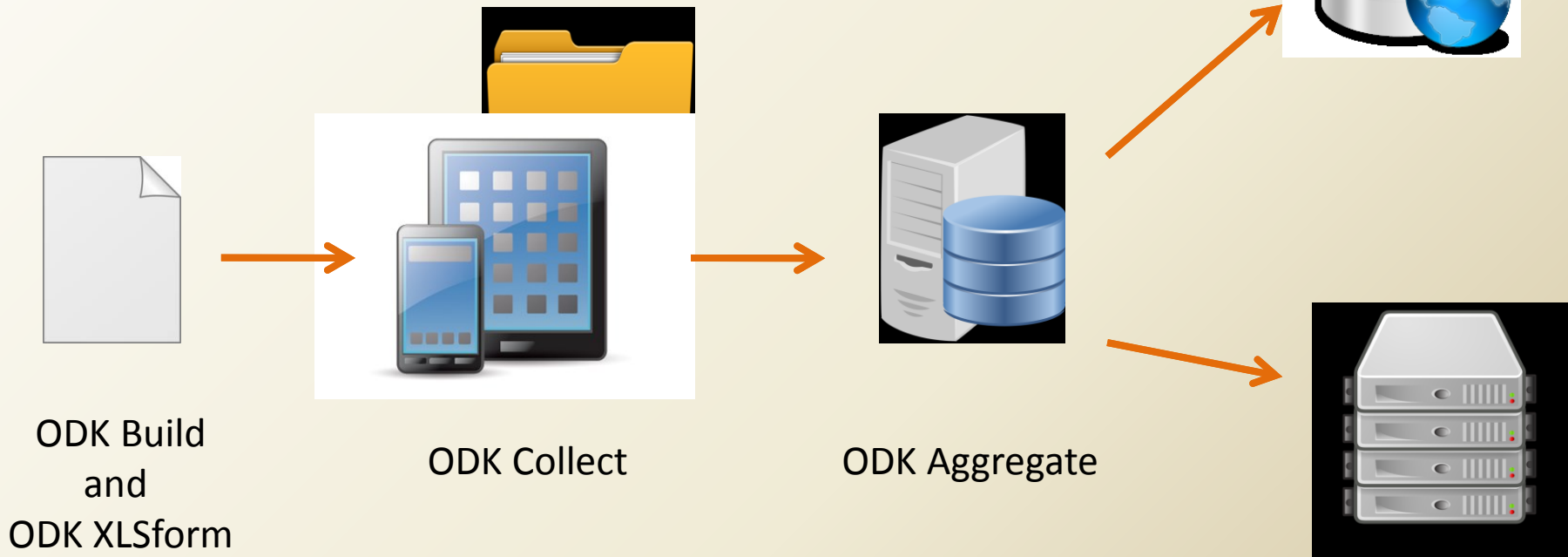


- University College London project
- Goal to have indigenous population report poachers.



# ODK 1.x

- Focus on data collection







# ODK Video

- <https://www.youtube.com/watch?v=CHyUS4JnAjM>

*“Features sometimes trump cost...we needed to get more out of the phone and ODK allowed us to do that.”*

**D-Tree International**





*“It is relatively easy to train using ODK...even for people who have little or no computer experience.”*

**Berkeley Human Rights Center**



*“[Health workers felt] the system facilitated their home visits and allowed them to collect higher quality data. We actualized higher cost savings over our previous PDA-based system.”*

USAID-AMPATH





# USAID-AMPATH

- Began using ODK in 2009
- Provides care to over 160K HIV patients in Kenya
- Enrolls about 2K new patients a month
- In 2014, had over 1 million entries with ODK





# Other Deployments

- Neglected Tropical Diseases Support Center
  - Based at the Task Force for Global Good
  - Collected 50 million data points across 200 projects in 20 countries







# Election Monitoring



The Carter Center uses ODK as part of their ELMO software to monitor elections.





Training in Gombe National Park






- PNKB\_LimParc\_200...
- chimp\_model\_d2.csv
- Budongo Forest Re...
- Forest Inventory 1
- Forest Inventory 1
- UGANDA REDD AO...
- REDD UHARIBIFU MSI
- REDD JUHUDI
- REDD MENGINEYO
- REDD TAARIFA YA SOI
- REDD MATUKIO YA W
- REDD\_project\_dd.shp
- PFOs\_June18\_2012....
- Temporary Places
- UHARIBIFU MSITUNI
- JUHUDI

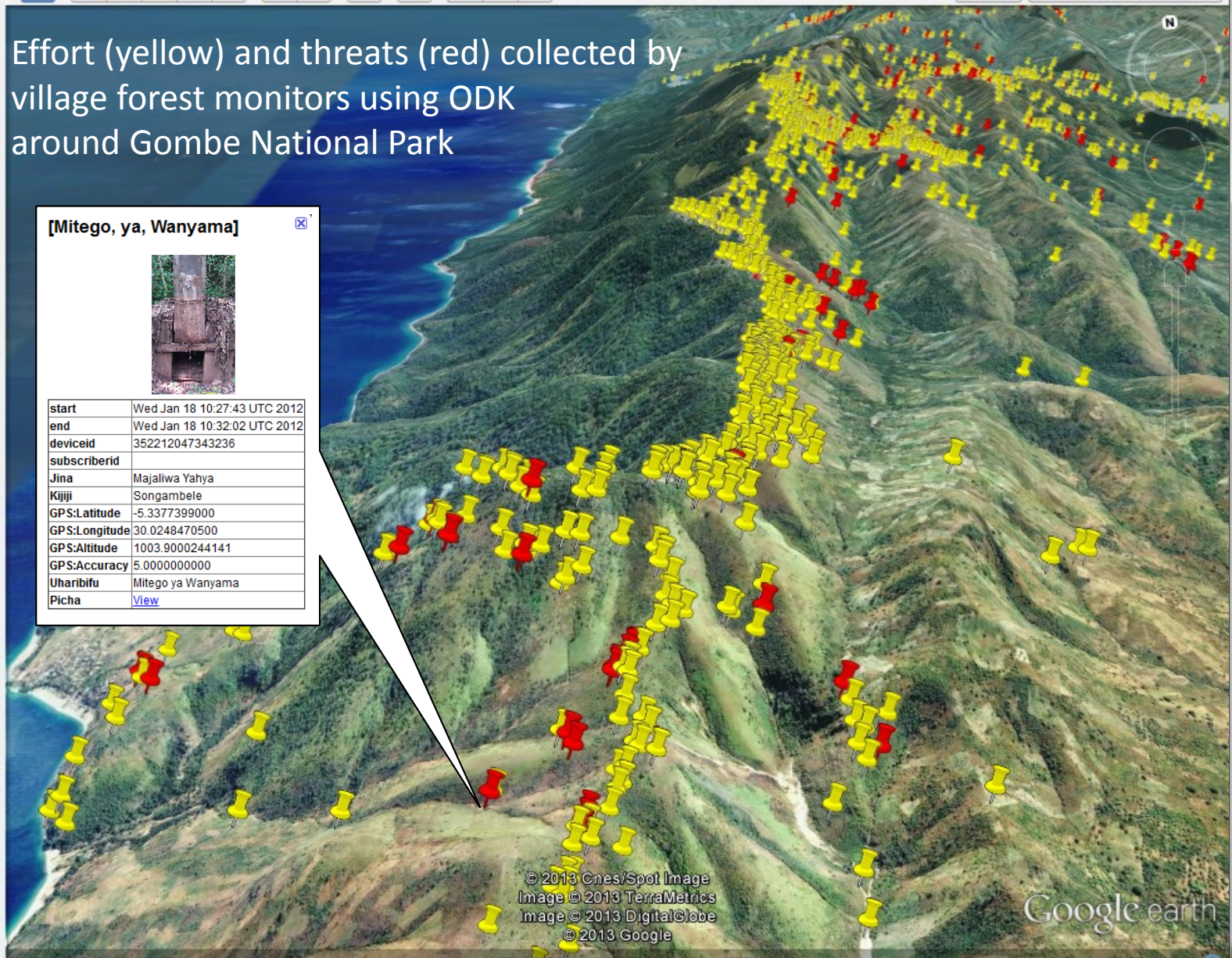
- Primary Database
- Earth Pro (US)
- Borders and Labels
- Places
- Photos
- Roads
- 3D Buildings
- Ocean
- Weather
- Gallery
- Global Awareness
- More
- Terrain

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	Songambebe
GPS:Latitude	-5.3377399000
GPS:Longitude	30.0248470500
GPS:Altitude	1003.9000244141
GPS:Accuracy	5.0000000000
Uharibifu	Mitego ya Wanyama
Picha	<a href="#">View</a>





## Carbon market certification and indigenous culture



Training with Surui



# Videos

- Reproductive Health Vouchers
  - <http://vimeo.com/38123850>





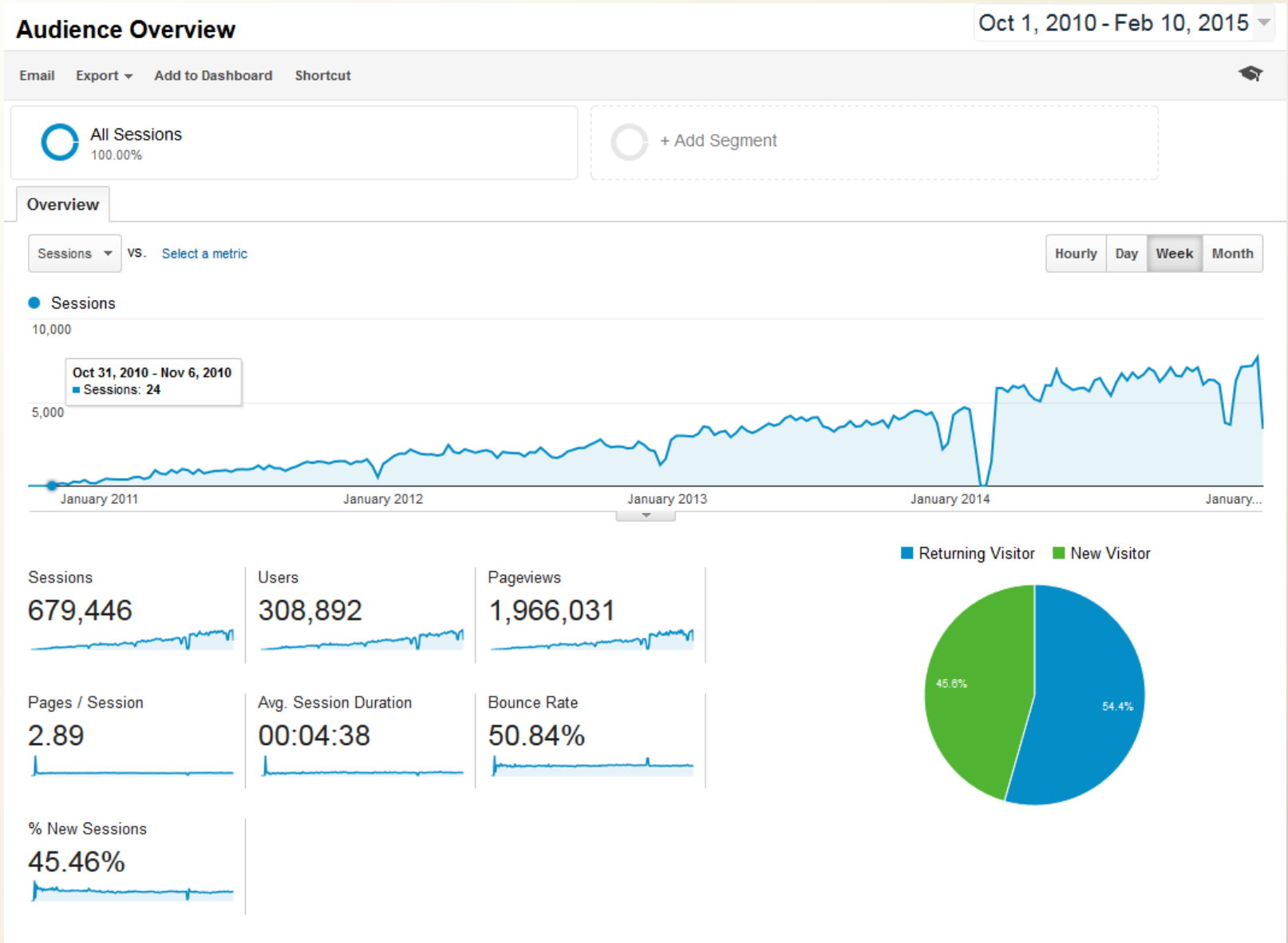
# ODK's Usage







# ODK Growth



Over 300,000 unique visitors from 225 countries/territories (Average of ~27,000 hits a month)



# Community

— Many consulting companies (50+) “support” ODK tools

— Nafundi

— Dimagi

— SurveyCTO

— MANY MORE



Product Pricing FAQ About us Support Contact us

Collecting high-quality data is hard.  
We make it **easier**.



Learn more

Sign up (free)

Take a tour

Forms Users About Help

**USING SURVEYCTO**  
Within these FAQs, you will find answers to the most commonly asked questions. If you have a question that is not answered here, you can contact support.

**FAQ's:**  
Using SurveyCTO  
Managing Forms  
Managing Users  
Using Collect  
[View all FAQs](#)

**Questions:**  
What is SurveyCTO?  
How do I get started?  
How do I contact support?  
Does SurveyCTO support non-English languages?  
Where do I learn more about managing my forms?  
Where do I learn more about managing my users?  
How do I use SurveyCTO Collect?  
How do I use the SurveyCTO Client?  
How can I audit my surveyors to monitor for quality?  
Can I use ODK Aggregate?  
Can I use ODK Brackets?

## Simple

SurveyCTO has been designed to make sophisticated, high-quality electronic data-collection as simple as possible – for academic research, M&E, mHealth, market research, and more.

Use Excel spreadsheets to define your survey forms, use SurveyCTO expression-builders to easily define field validation and skip logic, and use automatically-generated templates for processing in Stata or mail-merging into Word.

Synchronize, decrypt, export, and process data with two simple clicks.

## Secure

SurveyCTO has been built with data-security (and Institutional Review Boards) in mind.

With 2048-bit encryption from the point of data-collection to the point of data-processing, you can be sure that your data is secure.

For your most highly-sensitive data, SurveyCTO also makes it easy to synchronize encrypted data with a cold-room computer. That way, sensitive data is never accessible from an Internet-exposed computer.

Username:

Password:

**Data destination**

Local CSVs     External drive     Local

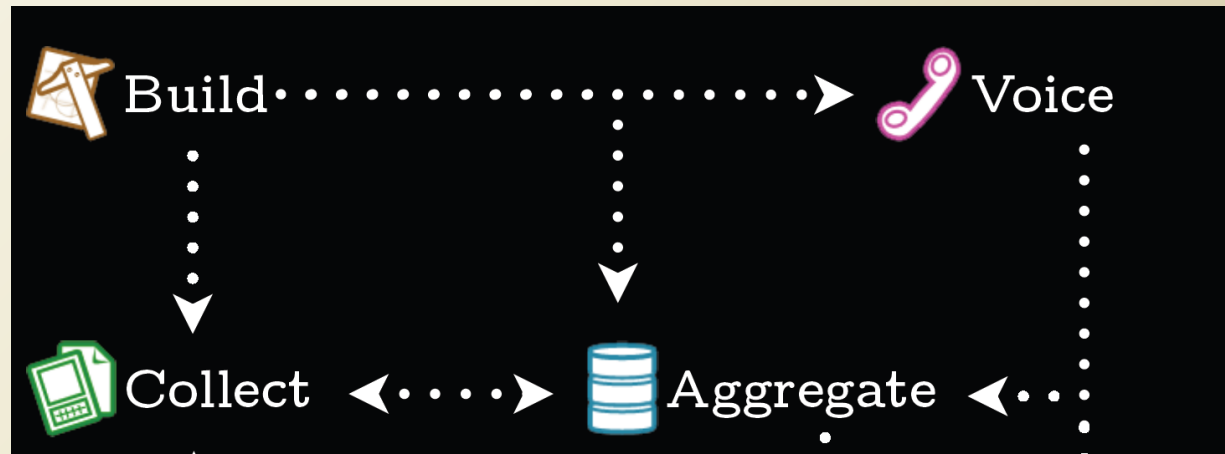
Export to:

Private key file:



# 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







# 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 Versions

**CURRENT TOOLS**

(Referred to ODK 1.x)

versus

**NEW TOOLS**

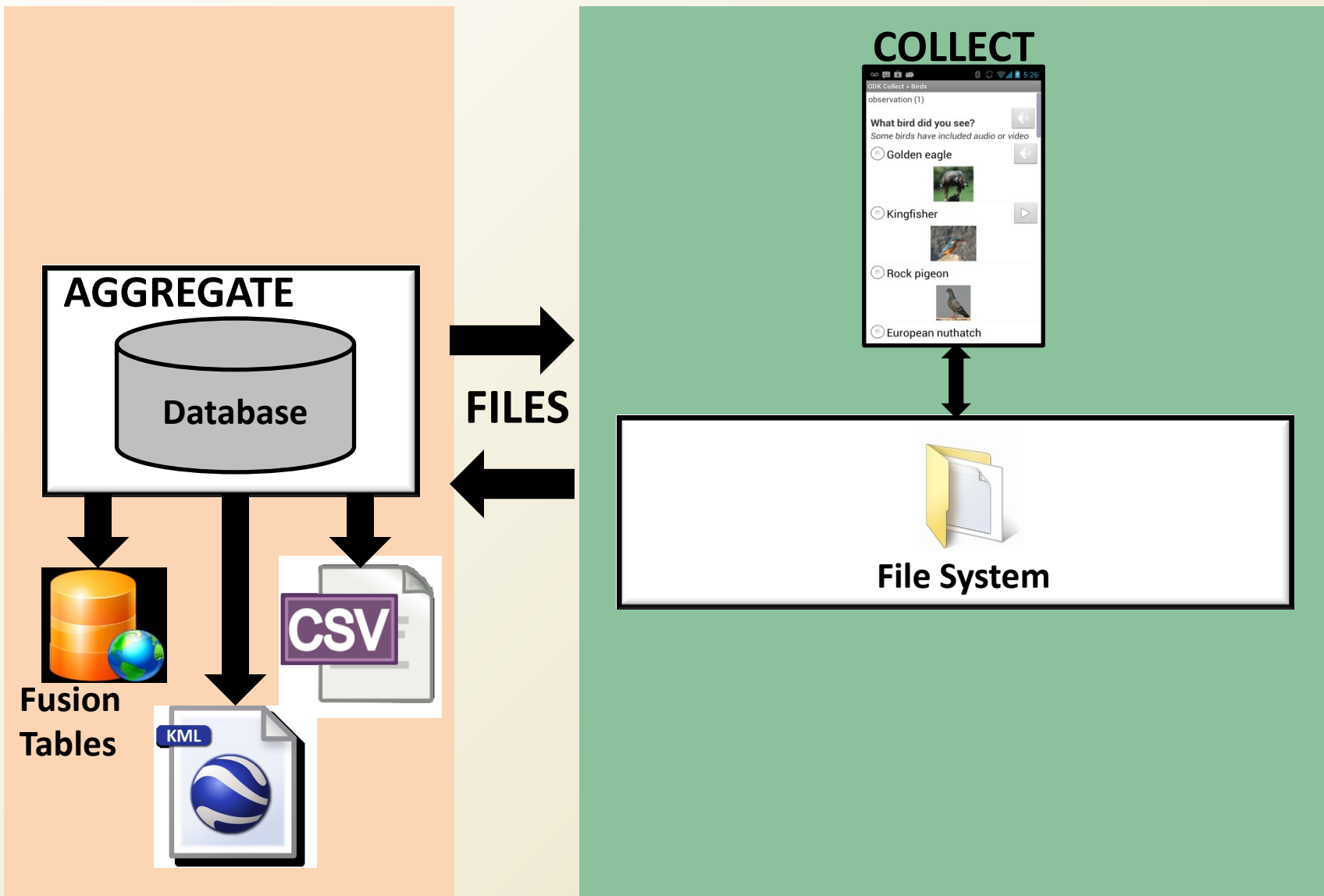
(Referred to ODK 2.x)



# ODK 1.0 Architecture

## CLOUD

## MOBILE DEVICE



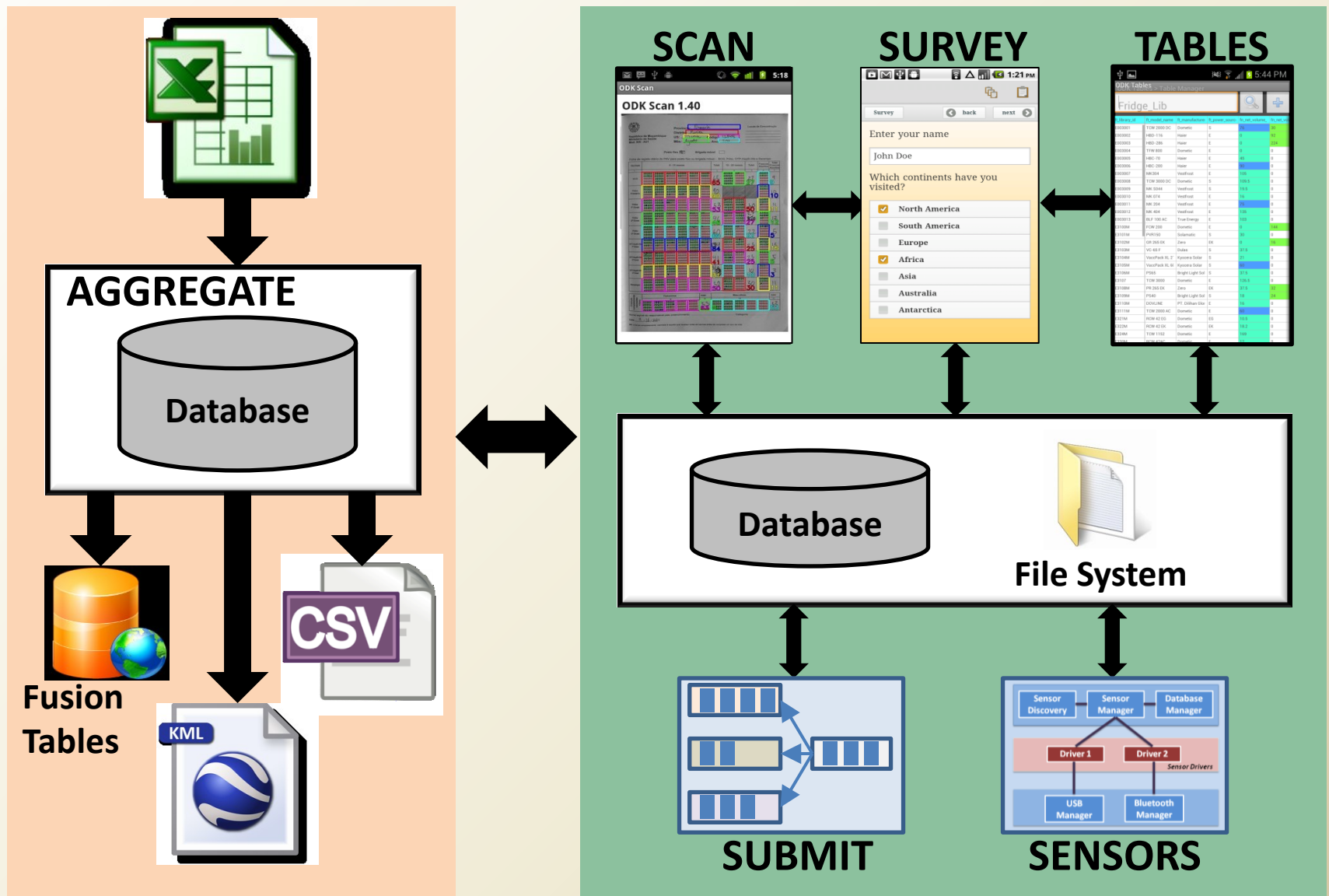




# ODK 2.0 Architecture

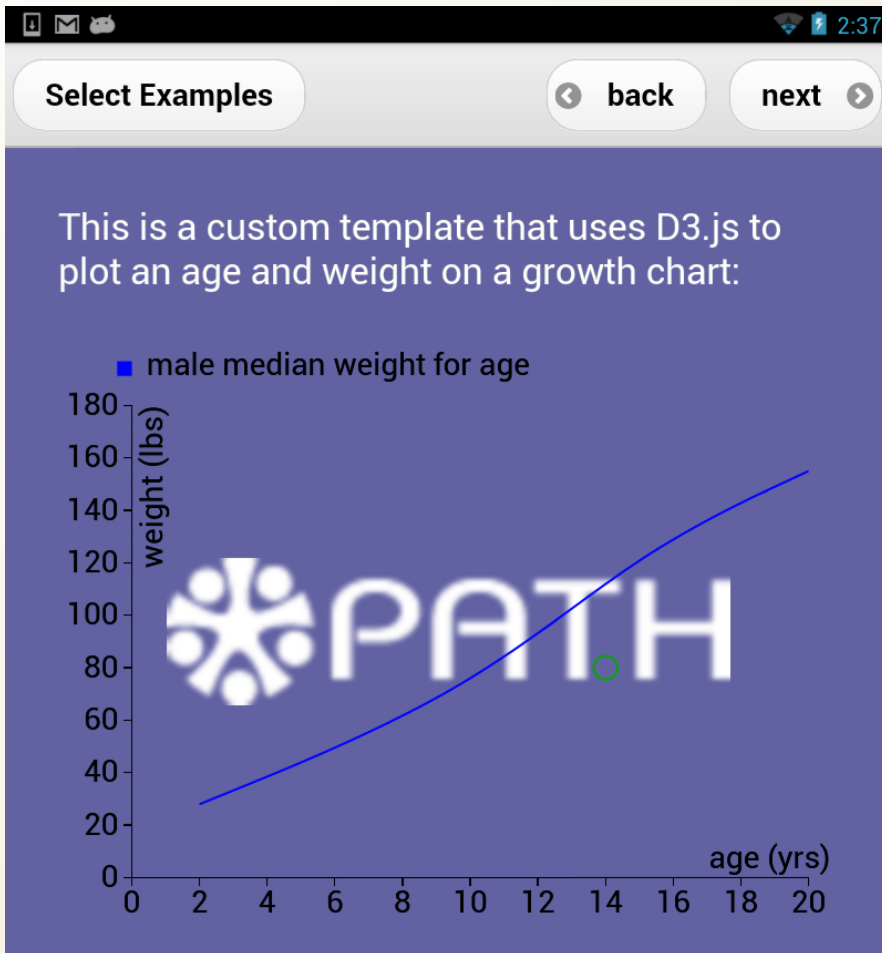
## CLOUD

## MOBILE DEVICE





# ODK 2.0: HTML on the Device



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

*Only WebDev Skills*

*Redesign*



# ODK 2.0: Data Collection

Household Member Survey

back next

Data for household: 73854100070

Enter the name of the household member:

Fred

Enter age of Fred:

Enter sex of Fred:

male

female

- Collect while disconnected
- Submit opportunistically

## ODK Survey

(Android Cellphone / Tablet)



## Local and Remote

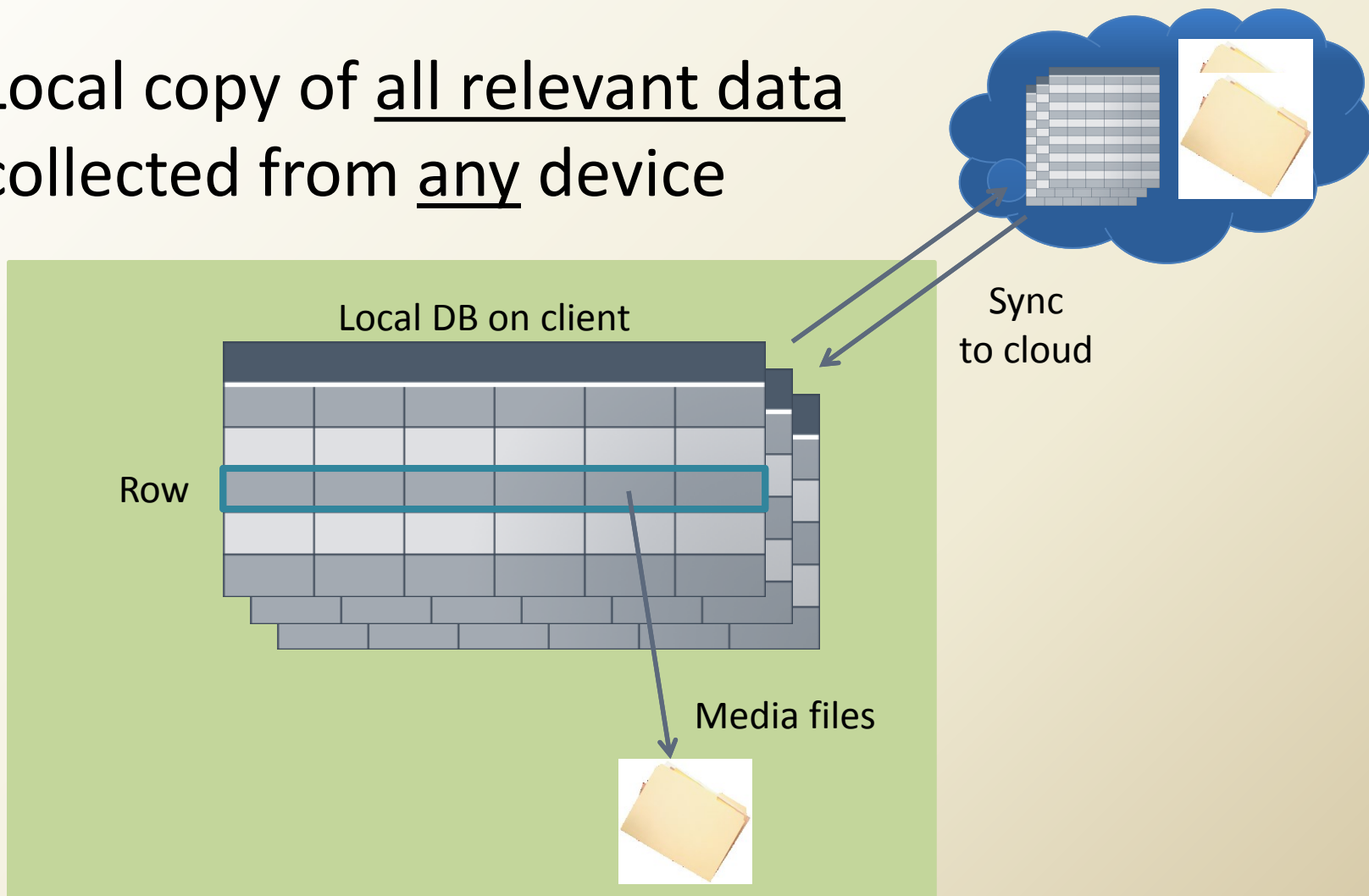
(various tools)





# Data Architecture of ODK 2.0

Local copy of all relevant data collected from any device





# ODK 2.0: Survey

- Complex workflows and technology assisted trainings
- Different approach than ODK Collect
  - Easier customizations via HTML and CSS
  - Easier branching and workflows
  - Easier to access databases that are synced with server

Select Examples back next

Please enter your name:

Please select your region:

Eastern Mediterranean

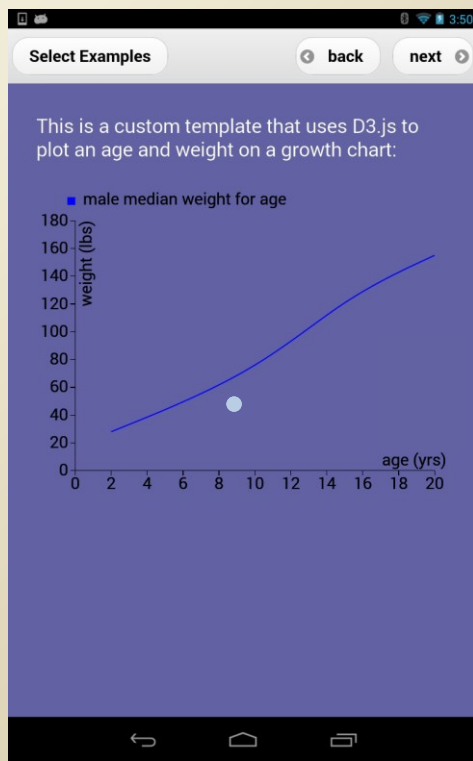
Please select your country:

Afghanistan

Select Examples back next

Which bird did you see?

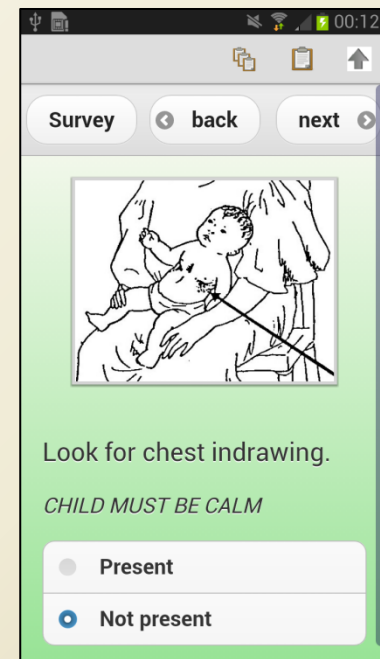
Eagle selected





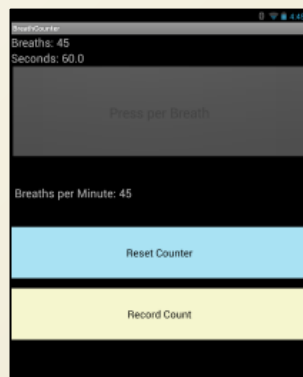
# ODK 2.0 Example

- **Pneumonia Detection** (Ghana & India)
- Digitize complex WHO-IMCI workflows
- Guide and assist user obtaining proper patient measurements
- Display treatment based on IMCI guidelines



Does the child have fever?		IMCI	
<p><b>IF FEVER:</b> Has the child a fever?</p> <p><b>OVER-AGE:</b></p> <ul style="list-style-type: none"> <li>• No fever</li> <li>• Fever (Step 1) (Step 2) (Step 3)</li> </ul> <p><b>Under-AGE:</b></p> <ul style="list-style-type: none"> <li>• No fever</li> <li>• Fever (Step 1) (Step 2) (Step 3)</li> </ul>	<p><b>High Moderate Fever</b></p>	<p><b>VERY SEVERE DISEASE (RED)</b></p>	<p>• One or more of the following:</p> <ul style="list-style-type: none"> <li>• Convulsions</li> <li>• Severe dehydration</li> <li>• Severe malnutrition</li> <li>• Severe anemia</li> <li>• Severe respiratory distress</li> <li>• Severe diarrhea</li> <li>• Severe vomiting</li> <li>• Severe bleeding</li> <li>• Severe jaundice</li> <li>• Severe other</li> </ul>
	<p><b>Low Moderate Fever</b></p>	<p><b>VERY SEVERE DISEASE (RED)</b></p>	<p>• One or more of the following:</p> <ul style="list-style-type: none"> <li>• Convulsions</li> <li>• Severe dehydration</li> <li>• Severe malnutrition</li> <li>• Severe anemia</li> <li>• Severe respiratory distress</li> <li>• Severe diarrhea</li> <li>• Severe vomiting</li> <li>• Severe bleeding</li> <li>• Severe jaundice</li> <li>• Severe other</li> </ul>
<p><b>If the child has respiratory distress or other clinical features:</b></p> <ul style="list-style-type: none"> <li>• Look for chest indrawing</li> <li>• Look for fast breathing</li> <li>• Look for stridor</li> <li>• Look for wheezing</li> <li>• Look for cough</li> <li>• Look for nasal flaring</li> <li>• Look for grunting</li> <li>• Look for retractions</li> <li>• Look for cyanosis</li> <li>• Look for other</li> </ul>	<p><b>Low Moderate Fever</b></p>	<p><b>VERY SEVERE DISEASE (RED)</b></p>	<p>• One or more of the following:</p> <ul style="list-style-type: none"> <li>• Convulsions</li> <li>• Severe dehydration</li> <li>• Severe malnutrition</li> <li>• Severe anemia</li> <li>• Severe respiratory distress</li> <li>• Severe diarrhea</li> <li>• Severe vomiting</li> <li>• Severe bleeding</li> <li>• Severe jaundice</li> <li>• Severe other</li> </ul>
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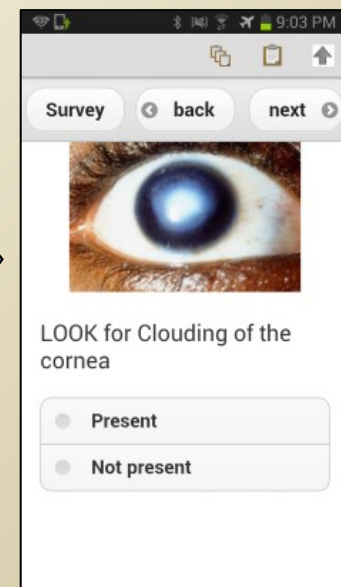
IMNCI



Respiratory Rate Counter



Pulse Oximetry

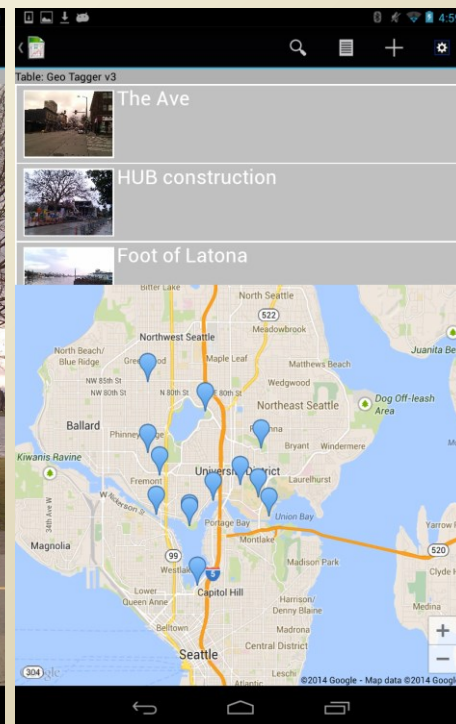
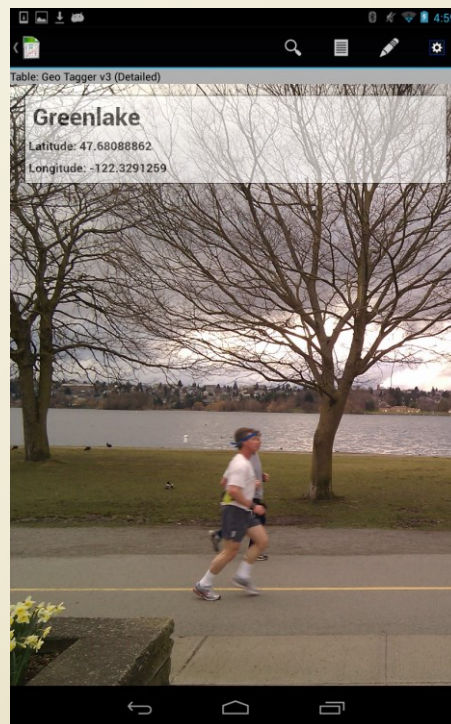
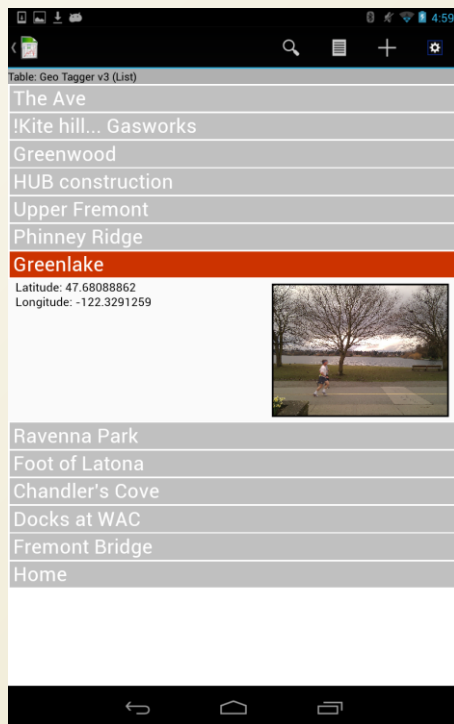






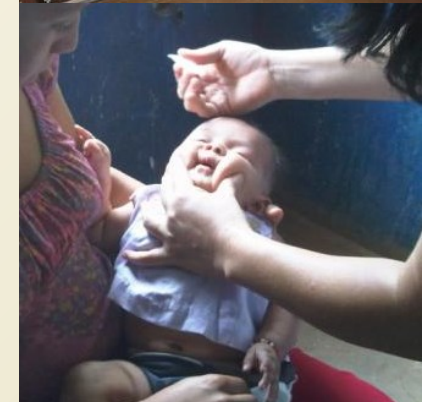
# ODK 2.0: Tables

- Gap in Open Data Kit's tool suite
- Needed a flexible tool for applications where previously collected data is often revisited and updated.





# Vaccine Cold Chain





# Cold chain end-points



4,100 doses  
Polio and Measles  
\$635

625 doses  
Rotavirus  
\$4687







# ODK 2.0: Tables

Table: Facilities (List)

<b>Kandi Relais</b>	Dépôt Relais Alibori Kandi
<b>Atacora Donga Dds</b>	Direction Départemental de la Santé Atacora Natitingou
<b>Tchikandou</b>	Centre de Santé d'Arrondissement Borgou Nikki
<b>Sakabansi</b>	Centre de Santé d'Arrondissement Borgou Nikki
<b>Bouanri</b>	Centre de Santé d'Arrondissement Borgou Bembereke
<b>Ouerankili</b>	Dispensaire Isolé Borgou Bembereke

## List View

Table: Facilities (Detailed)

**Tchikandou**

Centre de Santé d'Arrondissement  
 Departement: Borgou  
 Commune: Nikki  
 Zone sanitaire: Nikki-kalalé-Pèrè  
 Arrondissement: Ouenou  
 Total Population: 4687  
 Grid Electricity: None

Latitude (GPS): 9.84234  
 Longitude(GPS): 3.36392

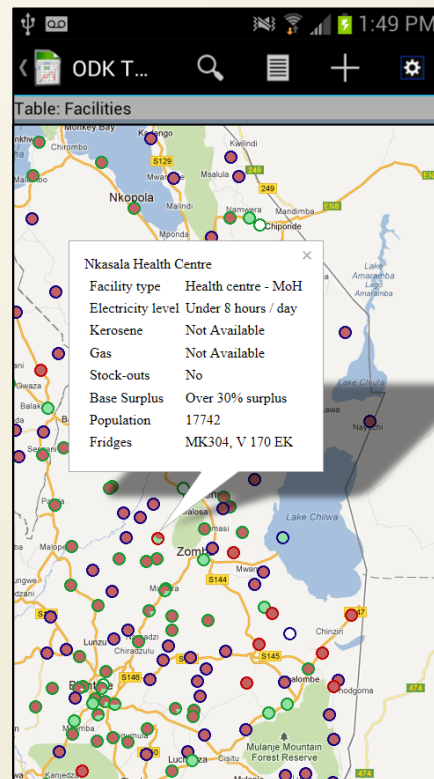
Cold Chain Function:

- Storage
- Static Delivery
- Outreach Delivery
- None

**Contact Information**  
 Person in charge: KARIMOU BATA C. MAKO  
 Mobile number: 97951246

[2 Refrigerators](#)

## Detailed View



## Map View

Table: Facilities

Facility Name	Births	Pregnant	Total Pop	Child
Kandi Relais	27916	34896	62812	1468
Atacora Donga Dds	48188	60234	108422	2528
Tchikandou	187	234	4687	984
Sakabansi	840	1051	21012	4418
Bouanri	533	667	13336	2808
Ouerankili	533	667	13336	2808
Guessou Sud	305	382	7635	1608
Gamia	1234	1542	30848	6478
Beroubouay	655	819	16386	3448
Goua	305	382	7635	1608
Ina	305	382	7635	1608
Sonsoro	526	657	13142	2768
Kandi 3	475	594	11882	2498
Gansosso	452	565	11304	2378
Tasso	511	639	12773	2688
Sam	332	415	8304	1748
Alfa Koara	226	283	5661	1188
Fouet	226	283	5661	1188
Angaradebou	226	283	5661	1188
Thya	226	283	5661	1188
Bensekou	209	261	5218	1098
Saah	297	371	7417	1558
Donwari	707	883	17669	3718
Kassakou	453	567	11337	2388
Tankougou	332	415	8304	1748

## Spreadsheet

- Visualization of underlying database
- Provide users different looks at data
- **Example:** Cold chain monitoring





# Varying Domains

House\_id:t2

Table: Tea Inventory (List)

<b>Ching Shih</b> Tea House: Tea for All Type: Oolong	>
<b>Pirate Junks</b> Tea House: Tea for All Type: Oolong	>
<b>Widow Zheng He</b> Tea House: Tea for All Type: Oolong	>
<b>Moontea</b> Tea House: Tea for All Type: Herbal	>

Table: Tea Houses (Detailed)

**Tea for All**

Tea House ID: t2  
State: Ulong  
Region: Cascadia  
District: Magdalene  
Neighborhood: Capitol Hill

Specialty: Oolong

Opened: 6/28/2010  
Number of Customers: 176  
Total Number of Visits: 2762

Latitude (GPS): 10.304162  
Longitude(GPS): 1.37962

Services:

- Iced
- Hot
- WiFi

**Contact Information**  
Owner: Miss Tealicious  
Mobile Number: 5558778

Table: Tea Houses

<b>Trinity's Spies</b> Specialty: White St John's University	>
<b>The Buttery</b> Specialty: Oolong St John's Fremont	>
<b>The Tower</b> Specialty: Rooibos	>

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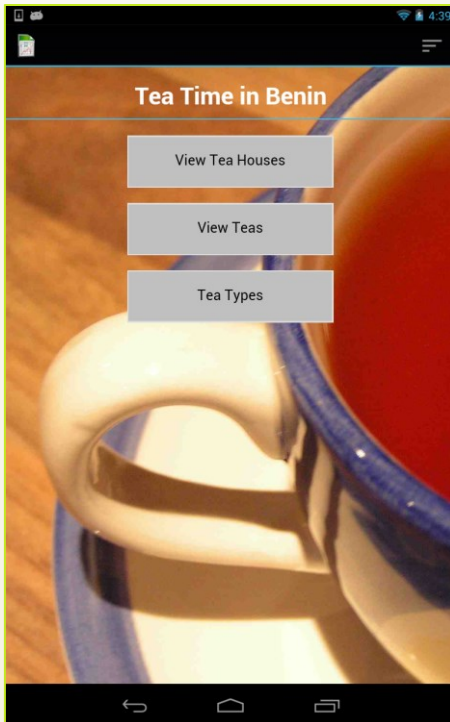


Table: Tea Houses (List)

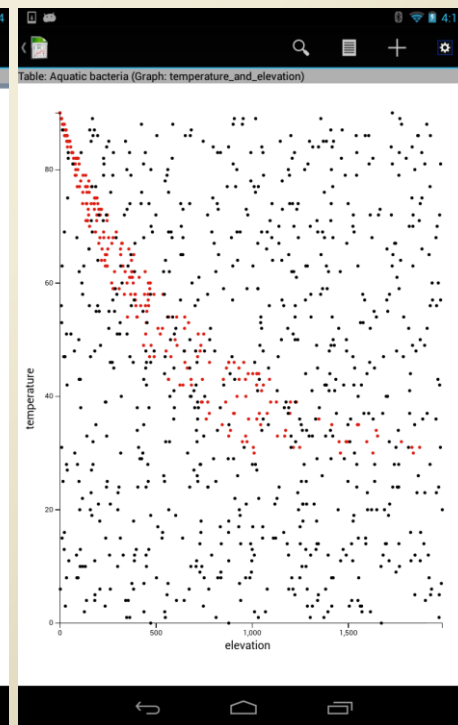
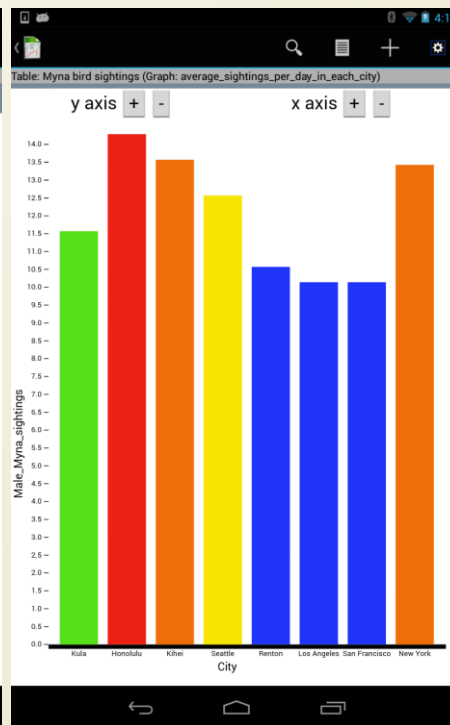
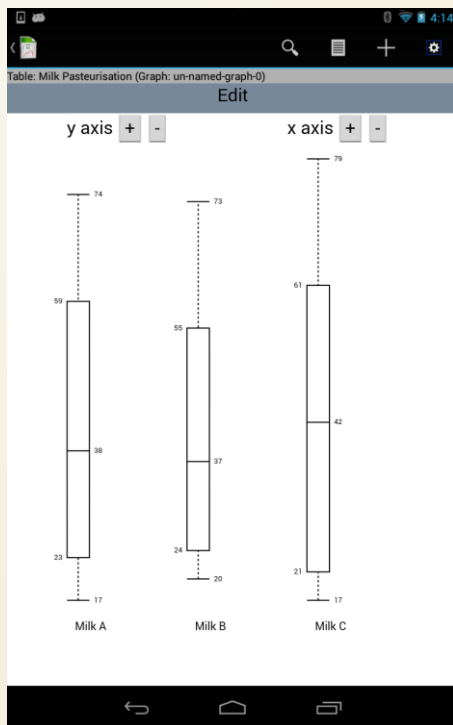
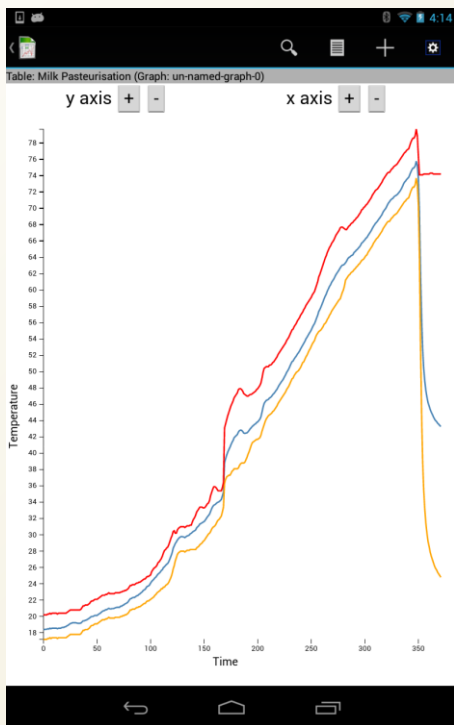
<b>Tibbins House on Kingsley</b> Specialty: Oolong Magdalene Capitol Hill	>
<b>Tea for All</b> Specialty: Oolong Magdalene Capitol Hill	>
<b>Green with Tea-envy</b> Specialty: Green Magdalene First Hill	>
<b>Read the Leaves</b> Specialty: Green Magdalene First Hill	>
<b>Trinity's Spies</b> Specialty: White St John's University	>
<b>The Bridge of Sighs</b> Specialty: Gunpowder St John's University	>
<b>Kitchen Court</b> Specialty: Gunpowder St John's Fremont	>
<b>The Buttery</b> Specialty: Oolong St John's Fremont	>

Table: Tea Inventory

Name	Type_id	House_id				
Tientai's Best	1	t1				
Hangzhou's Owl	1	t1				
Reddy or Not	5	t10				
Leaf it Be	5	t11				
Oxidn't Do It	5	t11				
Allo, Guvnah	6	t11				
Picard's Own	6	t12				
Gandall's Cloak	6	t12				
Earl Good	6	t12				
Chamomile	7	t13				
OoYum	1	t14	2.75	3.0	3.25	Yes
ChamoSmile	7	t15	1.0	2.0	3.00	Yes
Licorice	7	t15	2.0	2.0	2.00	Yes
Guhn POW Duh	2	t16	3.0	3.1	3.20	Yes
Brrrrrlong	1	t16	2.05	2.06	2.07	No
Girl Grey	6	t17	2.0	3.0	4.00	Yes
Manborg Locut	6	t17	5.0	6.0	7.00	No
Grasshopper	2	t17	0.25	0.5	.75	Yes
Cannon	4	t17	0.85	1.0	1.15	Yes
Ching Shih	1	t2	1.4	1.8	2.20	No
Pirate Junks	1	t2	3.3	3.6	3.90	Yes
Widow Zheng H	1	t2	4.9	5.1	5.20	Yes
Moontea	7	t2	10.0	15.0	20.00	Yes
Cold Mountain	1	t3	3.4	4.0	4.60	No
Stonehouse	1	t3	2.0	3.0	4.00	No
Du Fu's Brew	1	t3	1.8	2.2	2.40	No
Pickup	1	t3	3.0	3.2	3.40	Yes
Big Stick	1	t3	2.5	3.2	3.90	No
Kablooey	4	t3	1.3	1.6	1.90	Yes
Replicated	6	t3	2.0	2.2	2.40	Yes
Nunia	7	t3	4.0	5.0	6.00	Yes
Dragonwell	2	t3	2.14	2.15	2.16	Yes



# ODK Tables and D3







# ODK Tables – Hope Study App

**Hope Study**

Screen Female Client

Follow Up with Existing Client

Send Data

Table: Female Clients (List)

Enter Client ID... Search

Add Client

Graph View

<b>14752</b> Age: 21 Randomization: Control	>
<b>88563</b> Age: 20 Randomization: Control	>
<b>98563</b> Age: 29 Randomization: Control	>
<b>25364</b> Age: 19 Randomization: Control	>
<b>23456</b> Age: 23 Randomization: HOPE	>
<b>36985</b> Age: 36 Randomization: HOPE	>

Table: Female Clients (List)

**Intervention Arms**

Ineligible: 24%
Hope: 35%
Control: 41%

**HIV Status**

Not Tested: 24%
HIV+: 16%



# Focus of ODK Research

- Clinic decision support
- Mixing paper and digital
- Rapid diagnostic tests
- Internal sensors - spirometry
- External sensors – cold chains,  
milk pasteurization

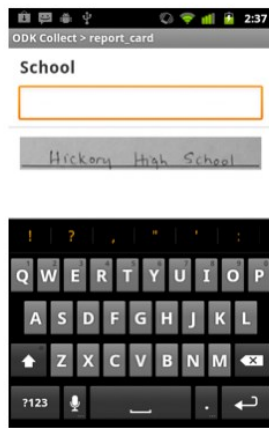


# ODK SCAN

## Vaccine logistics in Mozambique



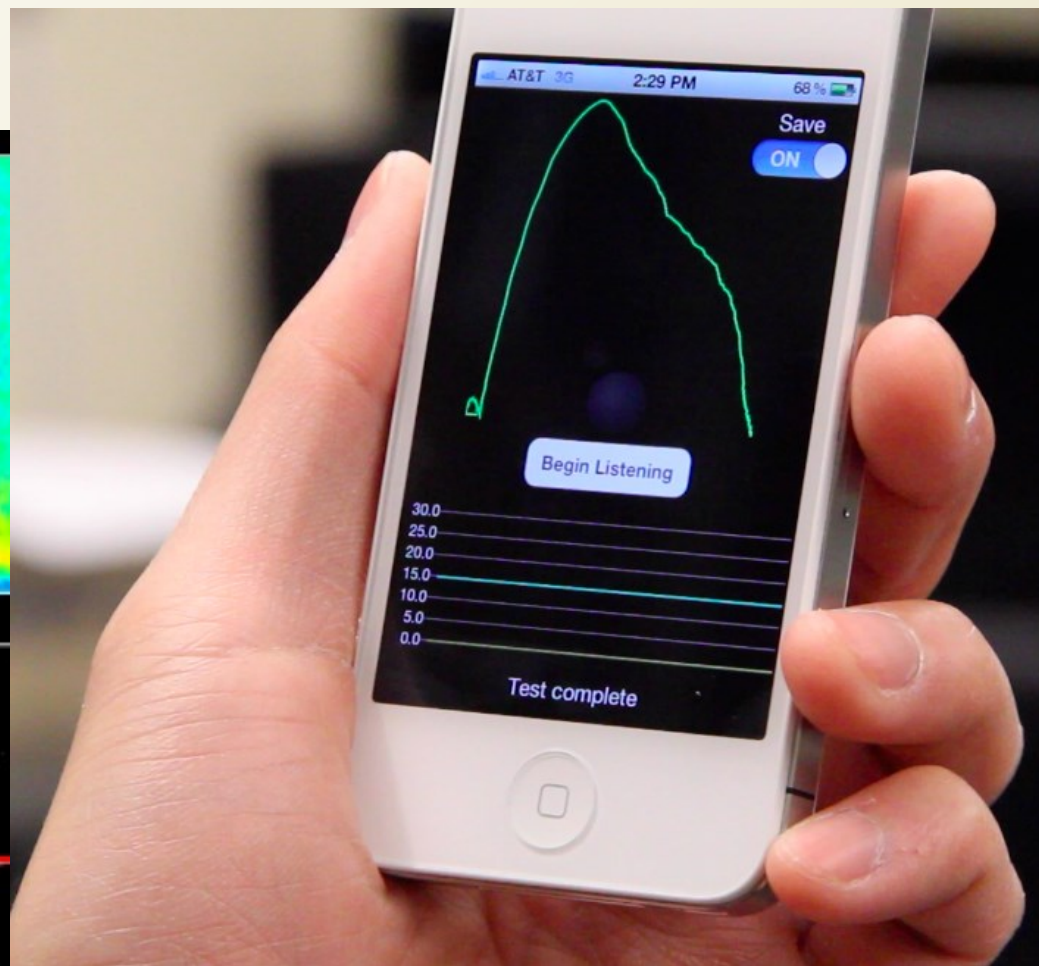
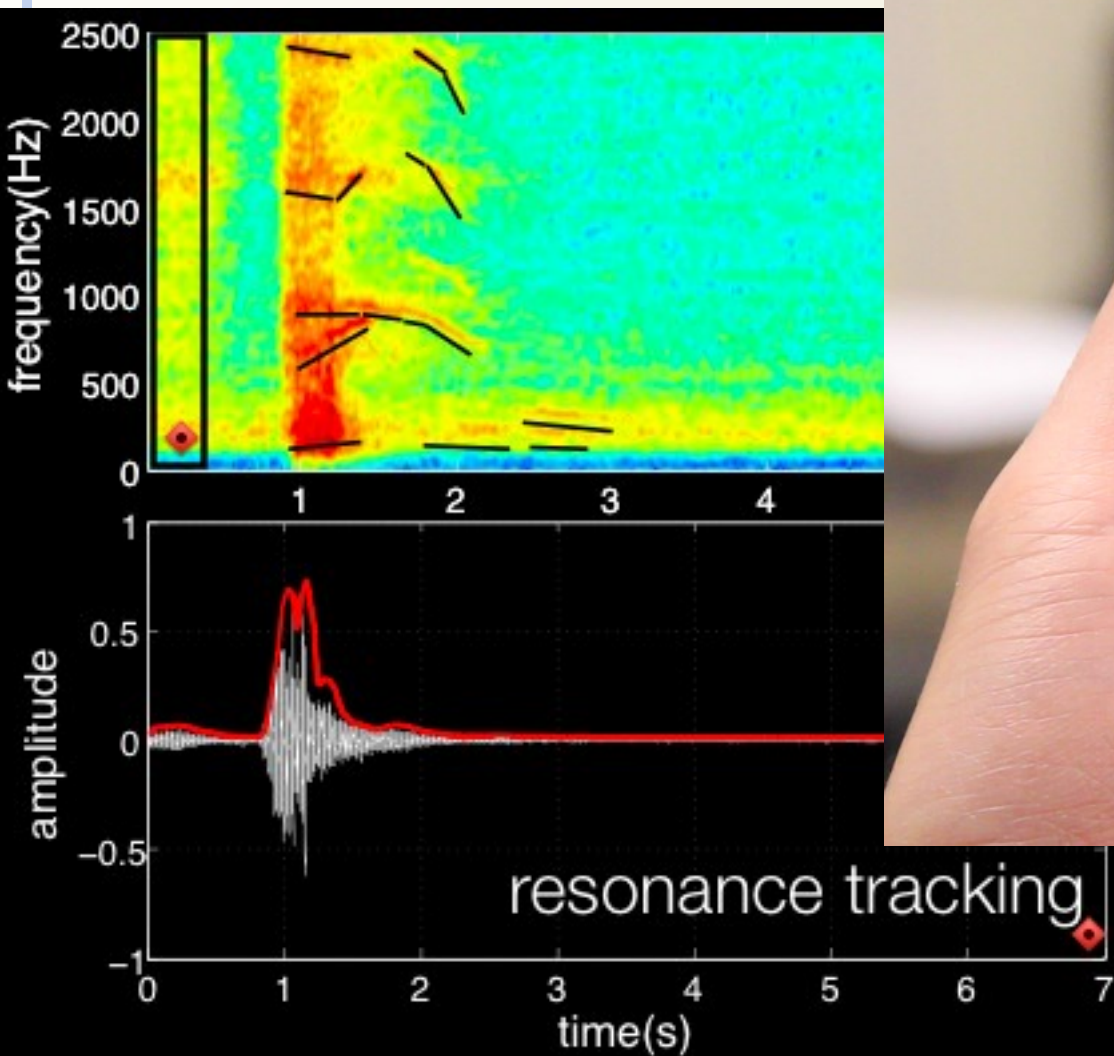
Student Name	Gender	Total absences in April
<input type="text"/>	female	2
Alexis Rogers	Male <input type="checkbox"/> Female <input checked="" type="checkbox"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
<input type="text"/>	male	1
Andrew Kelly	Male <input checked="" type="checkbox"/> Female <input type="checkbox"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>





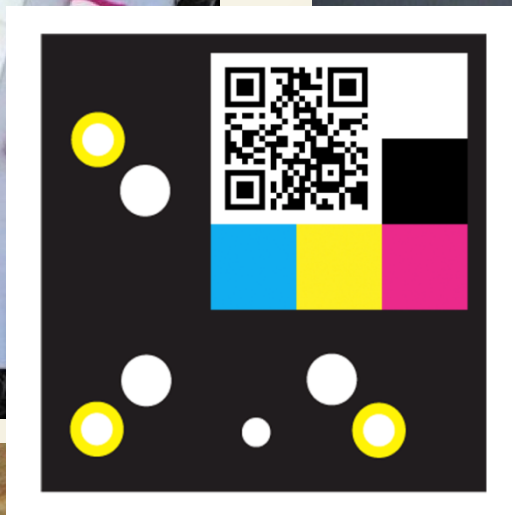
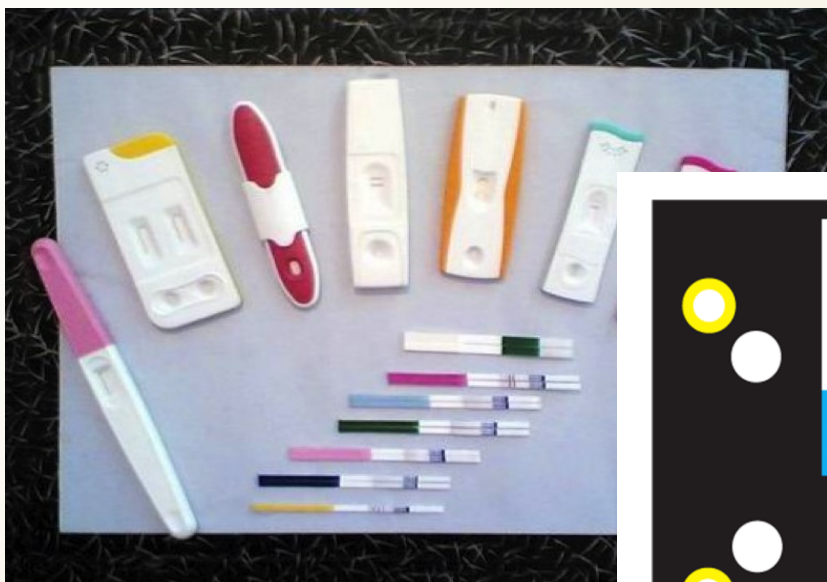


# SpiroSmart





# ODK Diagnostics

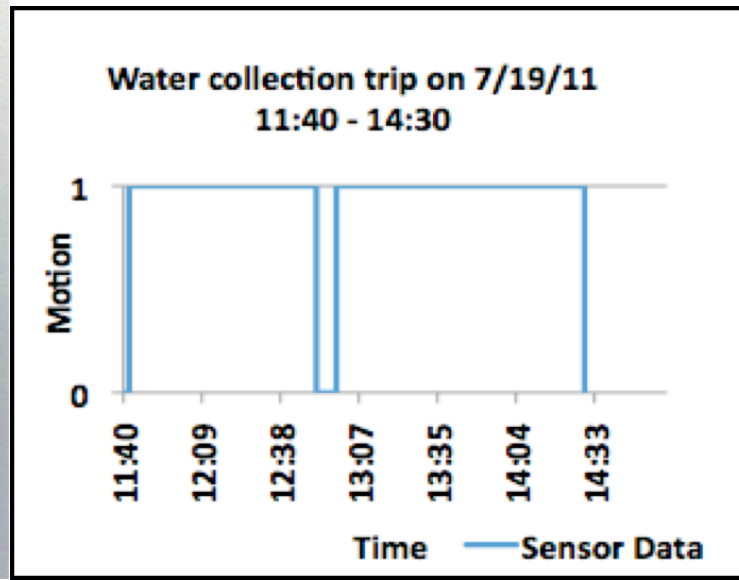
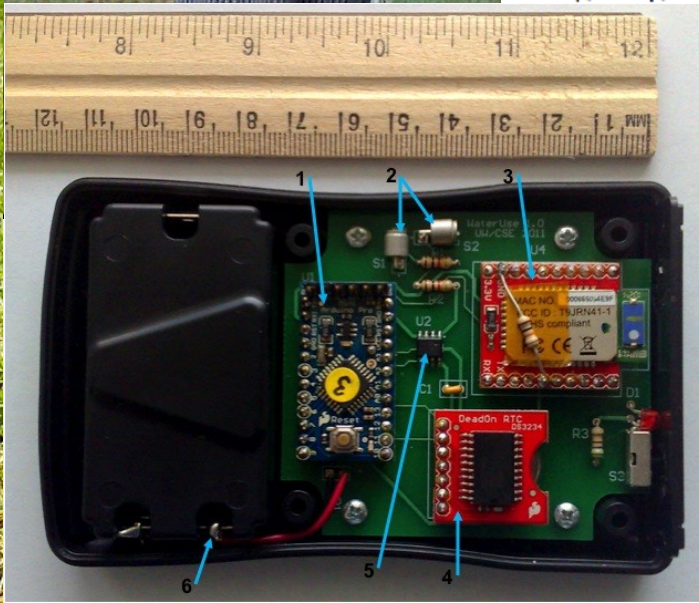
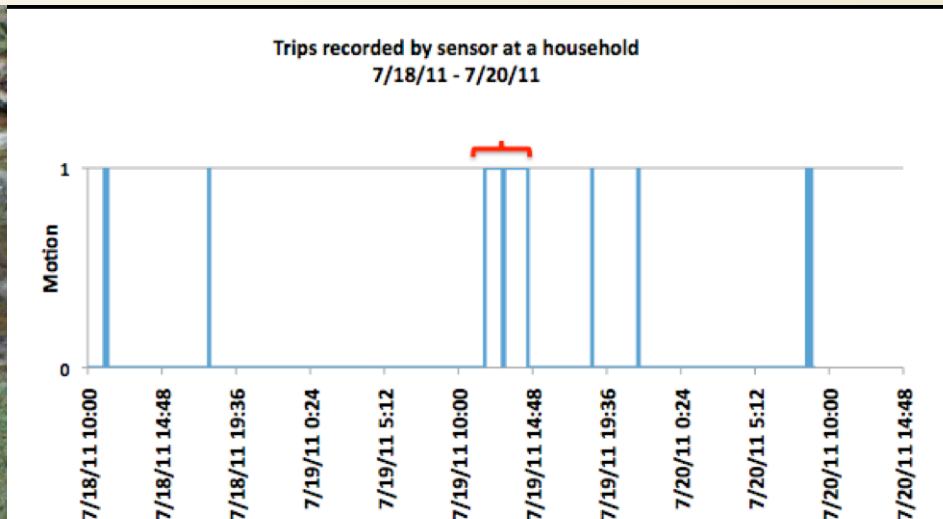






# ODK SENSORS:

## Time spent gather water in Ethiopia



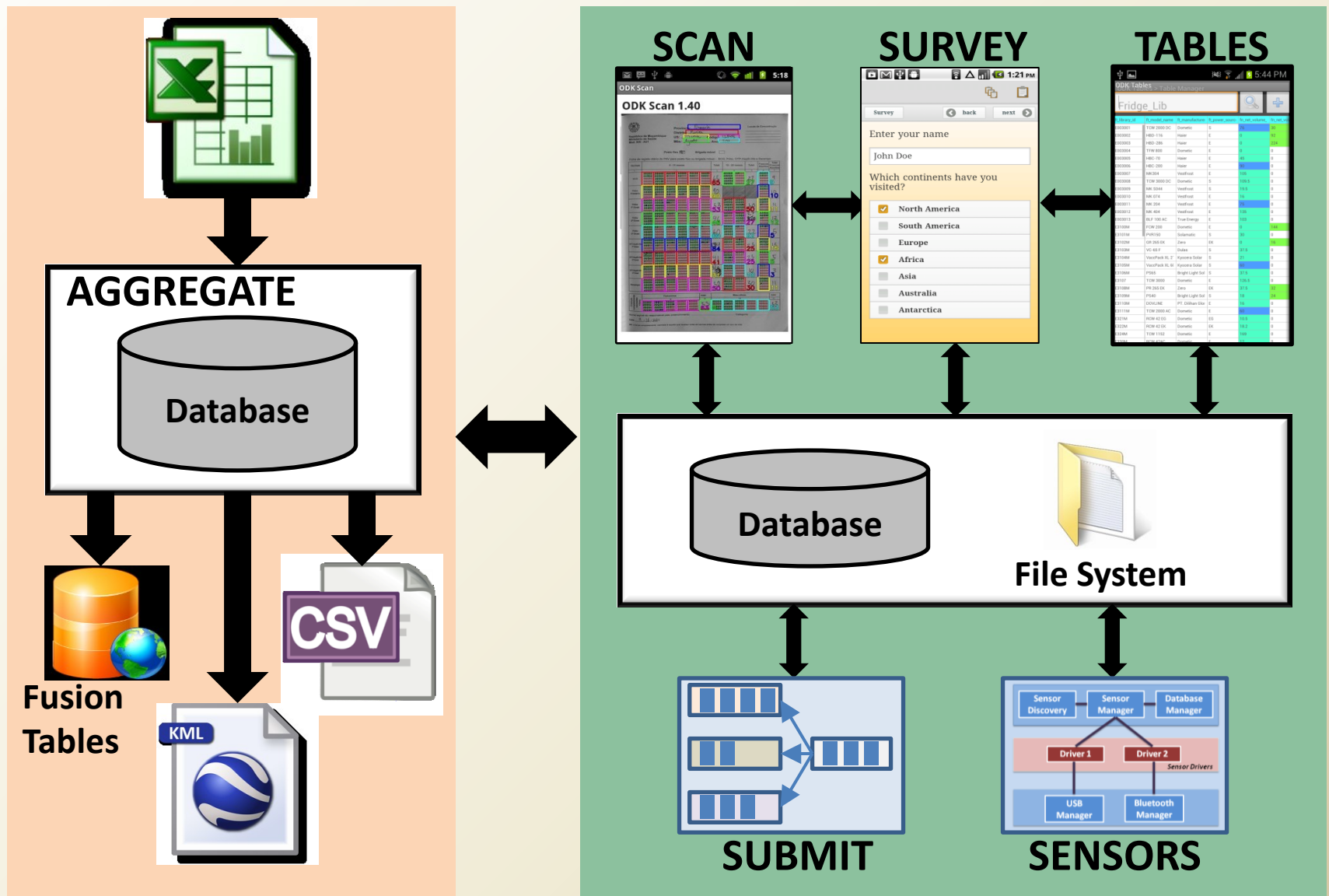




# ODK 2.0 Architecture

## CLOUD

## MOBILE DEVICE



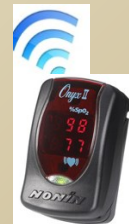
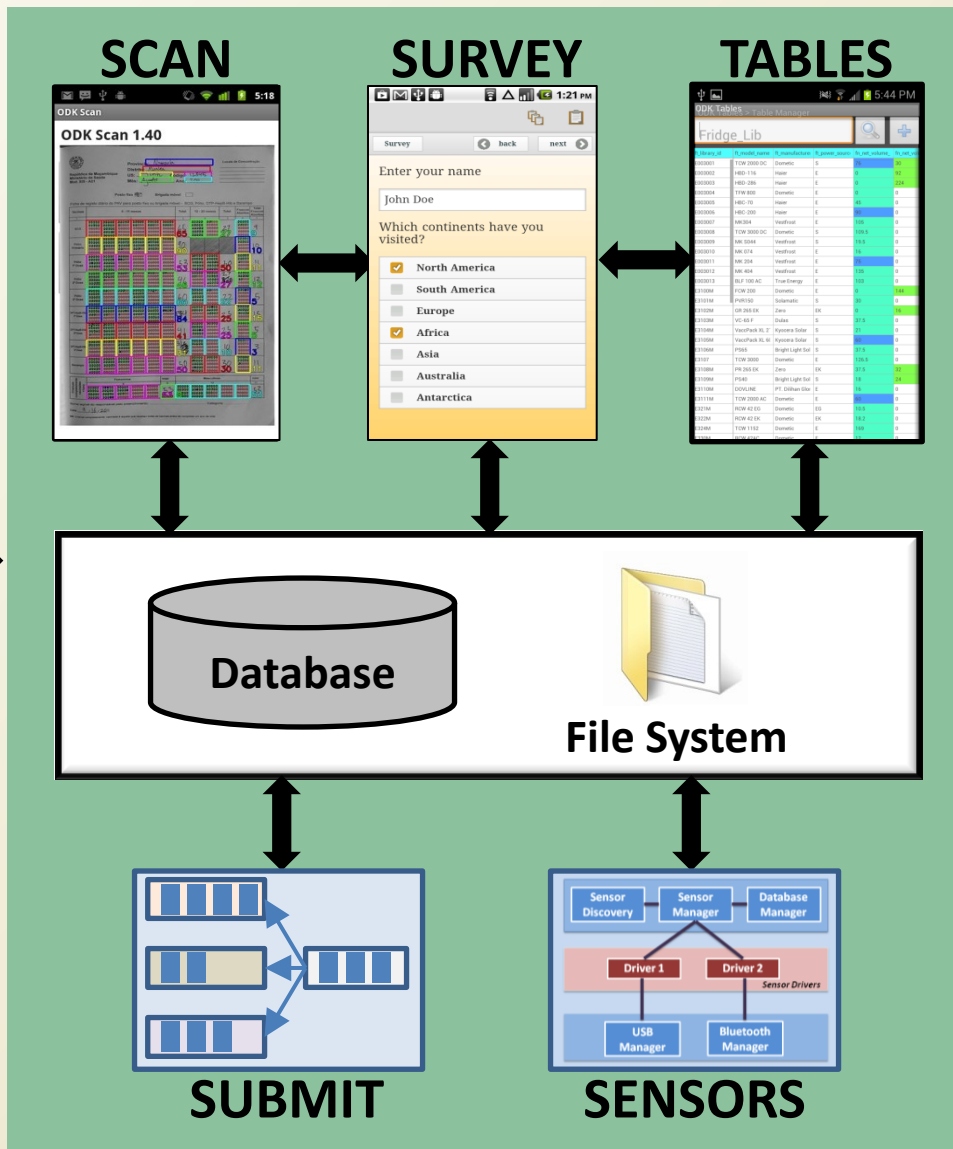


# ODK 2.0 Architecture

CLOUD

MOBILE DEVICE

**MEZURI  
PLATFORM**





# ODK 2.0 Architecture

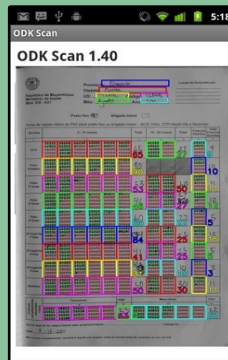
## CLOUD

## MOBILE DEVICE

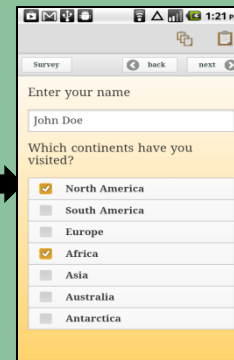
### MEZURI PLATFORM

- Track provenance of collected data
- Customizable dashboard for projects
- Data sharing capabilities with built-in security

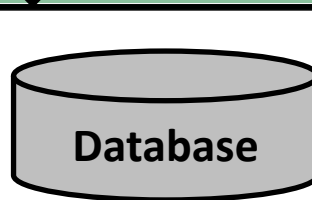
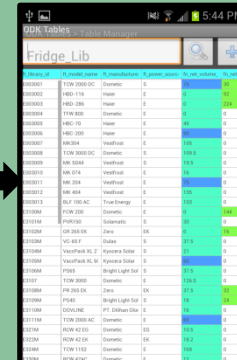
### SCAN



### SURVEY



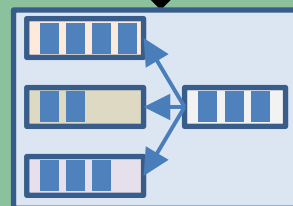
### TABLES



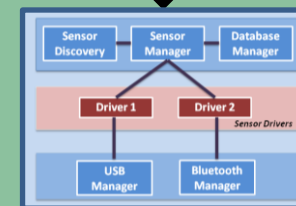
Database



File System



SUBMIT



SENSORS







# Planned activities

- Interactive voice response (IVR)
- P2P data transfer
- SMS connections
- Active scripts within Tables
- Develop/deploy several complete apps using 2.x toolset



# Thank you to our partners!

- ***Our NGO Partners:***

PATH, AMPATH, VillageReach, GSID, Jane Goodall Institute, Google Earth Outreach, ....

- ***Our Funding Partners:***

NSF, Google, USAID, DARPA, NIH, Gates Foundation, Samsung, Microsoft

# Questions?

*Thank you for your attention.*

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