

# Expanding DCAS for Survey Data Collection on Mobile Platforms

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Section: Survey Management Technologies

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- Originally developed as CHITA for the NYC HANES and NHANES (National Health and Nutrition Examination Survey) for CDC/NCHS in 2003
- Enhanced to support NHANES protocol and data collection components integrated with bio-medical equipment in 2005
- Enhanced to support text-to-speech technology for the Pubertal Maturation Study self-assessed interviews in 2008.
- Adopted by the National Children Study (NCS) Vanguard Study in 2008
- Evolved into DCAS (Data Collection Application Suite) to support NCS MIMS study protocols and recruitment strategies in 2010
- Integrated with Case Management systems to create end-to-end solution in 2012.



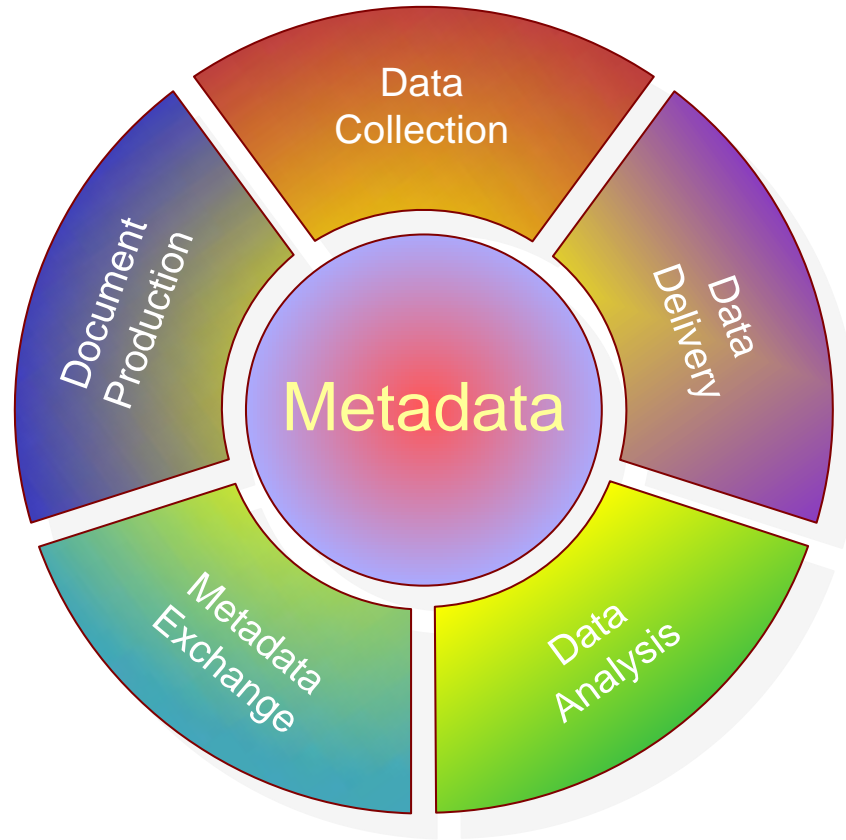
# DCAS Main Features

Data Collection Application Suite

- DCAS (data collection application suite) is a government (NIH/NICHD) owned off-the-shelf product (GOTS)
- DCAS is FISMA compliant suite of applications for health studies support
- DCAS bridges all elements of health study including content development, data collection, data management and data delivery
- DCAS was used to produce 100+ data collection instruments in collaboration between geographically distributed multiple study centers and study contractors with minimum IT personnel involvement
- CHITA/DCAS is used by multiple Study Centers with different recruitment strategies in production since 2008
- DCAS is integrated with multiple open source Case Management tools



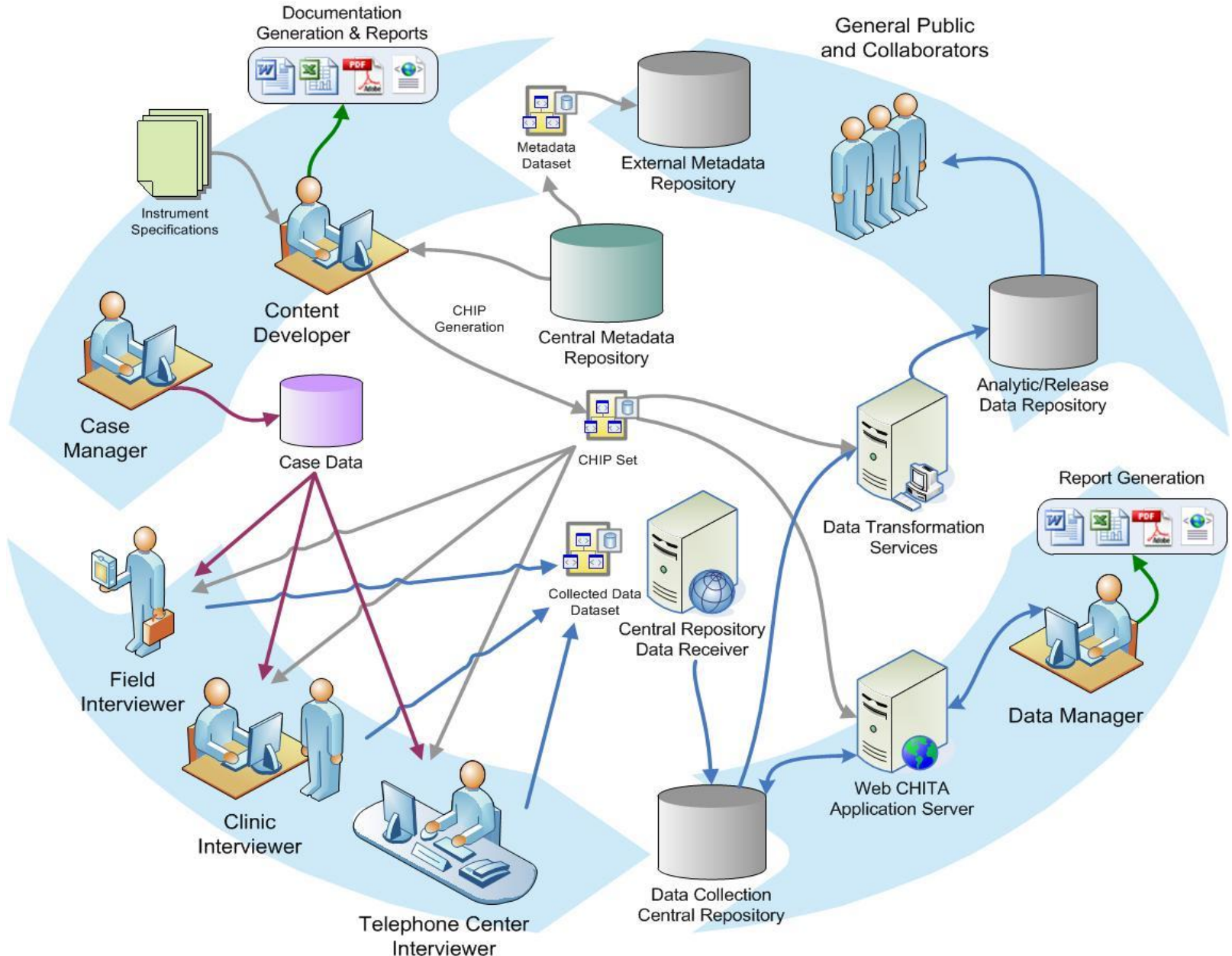
- Meta Editor – content authoring and survey documentation production tool
- Meta Viewer – content research tool
- Survey Data Collection Instruments:
  - Questionnaires
  - Examination components
  - Specimen components
  - Environmental components
  - Bio-medical components (with bio-medical equipment integration)
- Data Editor - survey data editing tool
- Data Viewer - survey data viewing tool
- Data Factory - survey data delivery tool



- Transparency – survey logic accessible to both technical and non-technical users
- Maintainability – easy GUI for both technical and non-technical users
- Robustness – contains all elements and hierarchy to describe necessary processes and data
- Documentability – to produce user friendly reports
- Extensibility – easily extendable metadata structure
- Exchangeability – data exchange support between multiple repositories in distributed environment
- Standardization – support health data standards
- Platform neutral – to be consumed by multiple data collection instruments on different platforms (Windows, Web and mobile)

# DCAS Data Flow

Data Collection Application Suite



- DCAS required a data collector to be present at a time of data collection, even for ACASI based SAQ, therefore:
  - Data could not be collected at Participant's convenience
  - Equipment required to be brought to the data collection site
  - Data collection must be scheduled in advance
  - Data cannot be collected at many locations, such as doctor's office, restaurant, etc.
- Instrument updates need to be installed on every data collection machine
- Software updates need to be installed on every data collection machine
- Cannot be used for diaries and repetitive questionnaires
- Cannot collect additional types of data, such as images, or geo-location without integrating additional equipment.

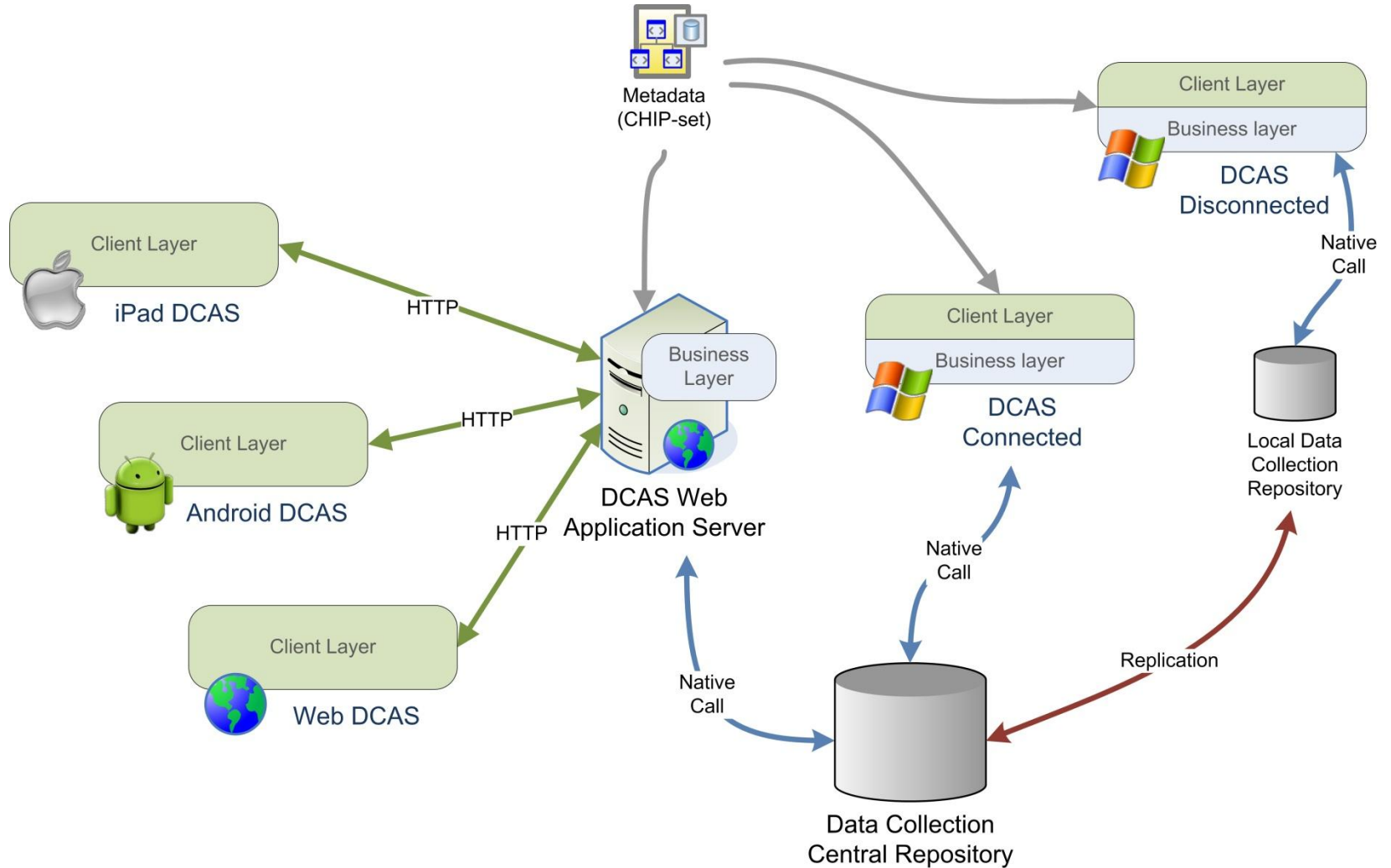


# SAQ Benefits

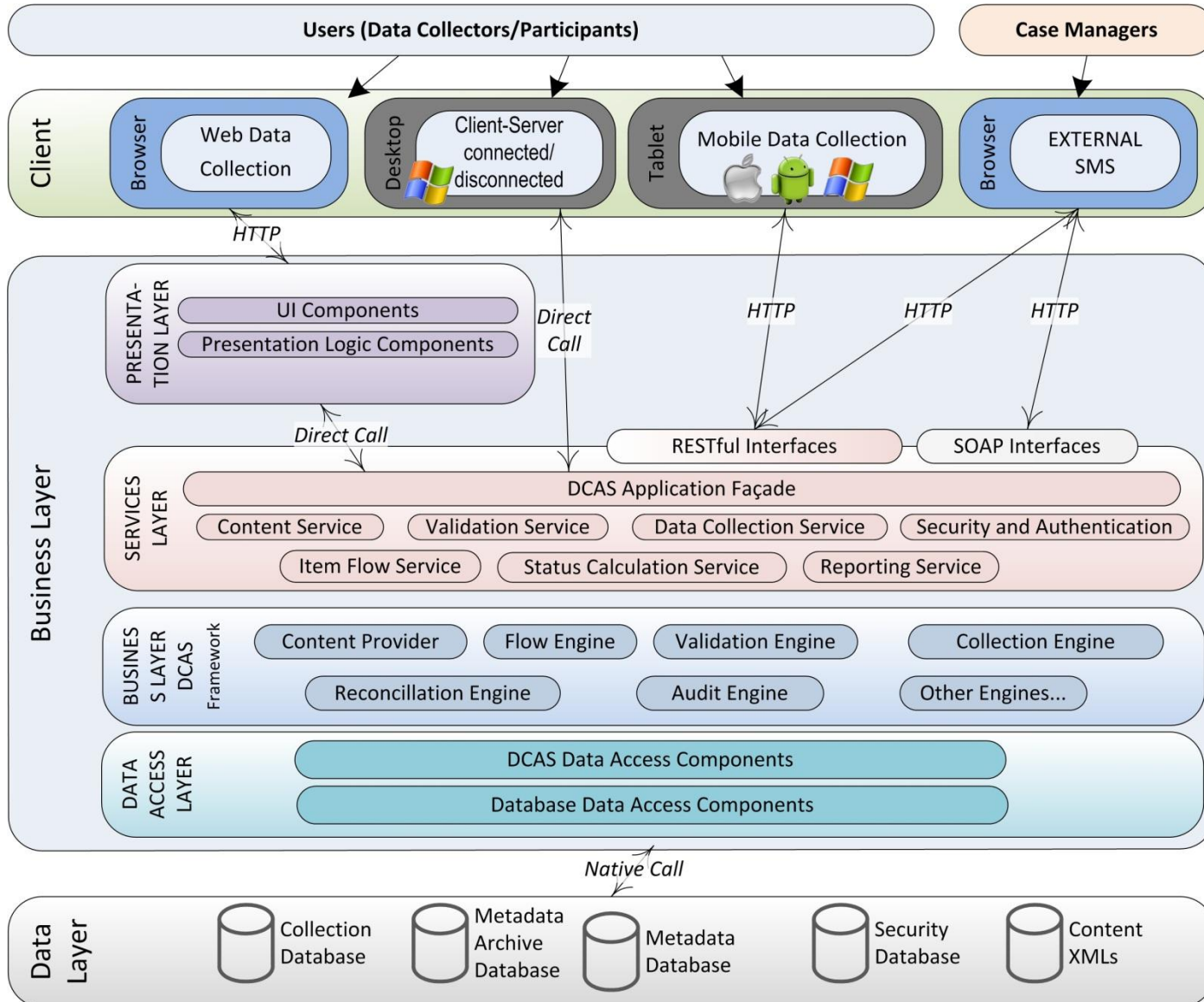
- Participants are more likely to provide responses to sensitive questions, such as drug use, sexual behavior, etc.
- Collecting short questionnaires on a repeatable basis (diaries) are not feasible with a data collector mode, for example answering a few questions about meals every day for several weeks
- Stress related questionnaires are proved to provide more accurate results if collected in a close proximity to the stressful event occurrence
- Response rates can be improved as participants are more likely to provide responses at their own home/time, no appointments needed
- Costs of electronic SAQ data collection is minimum as there is no data collector involvement required

- Goals to Expand DCAS for SAQ on Web and mobile platforms:
  - Expand DCAS data collection platforms to Web platform
  - Expand DCAS data collection platforms to iOS tablets/phones
  - Expand DCAS data collection platforms to Android tablets/phones
- Approach to reuse DCAS existing functionality and data structures:
  - Fully reuse DSAS middleware engines and collection databases
  - Reuse existing metadata (survey content)
  - Minimize device footprint to rendering functionality only
  - Balance client-side validation (simple, format based) and server-side validation (sophisticated, rules-based)
  - Achieve full interoperability between all platforms (reuse the same metadata, collected data compatibility, break-off/resume functionality)
  - Consume RESTful/JSON, SOAP and MVC interfaces by mobile devices

# Multi-Mode Data Collection



# SOA Architecture



- iOS: Objective C, Android: Java, Web: C#
- Mobile: Landscape or portrait? Locked or unlocked mode?
- Different screen resolution and real estate on Web, Android, iPad, Windows
- Different screen resolution and real estate on phone and tablet on the same OS
- How to deal with data collection patterns that require big dictionaries to download?
- Paradigm shift: from “RPC-based architecture” to “Service-Oriented architecture”
- Paradigm shift: from stateful to stateless architecture”
- Paradigm shift: from data collection widgets generated on the client to data collection widgets pre-generated on the server (to make a client lighter)
- No out-of-the-box JSON serialization/deserialization support on iOS (Java and C# have it)
- DCAS Application Façade stateless support for light SOAP, REST, Web-App(MVC) interfaces

- Apple products (fewer models of hardware)
  - iPad 1, iPad 2: 1024 x 768
  - iPad 3: 2048 x 1536
  - iPhone 3: 320 x 480
  - iPhone 4: 640 x 960
- Android devices (multiple vendors/devices/screen resolutions).  
Recommend resolutions to support:
  - xlarge screens: 1280 x 800 (Galaxy Tab 10.1 tablet)
  - large screens: 800 x 480 (HTC Thunderbolt phone)
  - normal screens: 480 x 320 (LG Optimus phone)
  - small screens: 320 x 240 (Motorola Flipout phone)
- MVC client
  - Can specify a recommended/minimal window size and employ fluid-design approach which allows to adapt to any window size/screen resolution

- User data protection
  - No data (no PII, participant data or responses) stored on the device
- Protection of data in transmission (available for Web, iOS and Android)
  - Can use HTTPS protocol as a transport
  - Can use VPN solution as a transport
- Authentication
  - Can be declaratively configured using .NET standard mechanisms (Windows, Forms, Custom authentication)
- Authorization
  - Can be declaratively configured using .NET standard mechanisms
- Comply with OWASP's "Web Application Security Design Guidelines"



# **Web and Mobile Data Collection Screen Examples**



# Data Collection WEB: Multi-Selection Item

The screenshot shows a web browser window with the URL `http://localhost/DcasSoa/Instrumer` and a tab titled "Demographics Questionnaire". The page header includes the "DCAS Data Collection Application Suite" logo and the title "Demographics Questionnaire". On the right side of the header, there are dropdown menus for "Instrument" (set to "Instrument") and "admin" (set to "admin").

Below the header, the respondent information is displayed: "Respondent: Rita Grey | Female | 11 Nov 1980 | 30 years |". A navigation bar contains buttons for "Start", "Fast Forward", "End", "Clear", "Don't Know", "Refuse", "Notes", "Previous", and "Next".

The main content area is divided into two columns. The left column contains a question: "Please give me the group that represents Rita Grey's Hispanic origin or ancestry. Please select 1 or more of these categories." Below the question is a yellow box with the text "HAND CARD DMQ4. SELECT 1 OR MORE." At the bottom left of the main area, there are two progress indicators: "Demographics Questionnaire" (a thin blue bar) and "Demographics Information" (a thicker blue bar).

The right column contains a list of checkboxes for selecting Hispanic origin categories:

- Puerto Rican
- Dominican
- Mexican/Mexicano
- Mexican American
- Chicano
- Cuban
- Cuban American
- Central or South American
- Other Latin American
- Other Hispanic

At the bottom right of the main content area, there are "Previous" and "Next" buttons. The footer of the page contains the text "Copyright | Contact Us".

# Data Collection WEB: Single Selection Item

The screenshot shows a web browser window with the URL `http://localhost/DcasSoa/Instrumer` and a tab titled "Demographics Questionnaire". The page header includes the DCAS logo and the title "Demographics Questionnaire". Below the header, the respondent information is displayed: "Respondent: Rita Grey | Female | 11 Nov 1980 | 30 years |".

The main content area contains a question: "What is the highest grade or level of school Rita Grey has completed or the highest degree he has received?". To the right of the question is a list of radio button options:

- Never attended/Kindergarten only
- 1st Grade
- 2nd grade

An "Item Help (DMQ140)" dialog box is open, displaying detailed text about the education system in the United States. The text describes the public sector, compulsory education, school districts, and the structure of education from kindergarten to high school. It also mentions post-secondary education, including associate, bachelor's, master's, professional school, and doctoral degrees.

At the bottom of the dialog box, there is a list of radio button options for higher education levels:

- Associate degree: occupational, technical, or vocational program
- Associate degree: academic program
- Bachelor's degree (example: BA, AB, BS, BBA)
- Master's degree (example: MA, MS, MEng, MEd, MBA)
- Professional school degree (example: MD, DDS, DVM, JD)
- Doctoral degree (example: PhD, EdD)

The interface includes navigation buttons: "Start", "Fast Forward", "End", "Clear", "Don't Know", "Refuse", "Notes", "Previous", and "Next". A progress bar at the bottom indicates the current position in the questionnaire.

# Data Collection WEB: Gate Item

The screenshot shows a web browser window with the URL `http://localhost/DcasSoa/Instrumer` and a tab titled "Demographics Questionnaire". The page header includes the DCAS logo and the title "Demographics Questionnaire". Below the header, the respondent information is displayed: "Respondent: Rita Grey | Female | 11 Nov 1980 | 30 years |". A navigation bar contains buttons for "Start", "Fast Forward", "End", "Clear", "Don't Know", "Refuse", "Notes", "Previous", and "Next".

The main content area is divided into two columns. The left column contains the question "How tall is Rita Grey without shoes?" and a yellow instruction box that says "ENTER HEIGHT IN FEET AND INCHES OR METERS AND CENTIMETERS". The right column contains two radio button options: "Enter height in feet and inches" (unselected) and "Enter height in meters and centimeters" (selected). Under the first option, there are two input fields for "ft" and "in". Under the second option, there are two input fields for "m" (containing the value "1") and "cm" (containing the value "70").

At the bottom left, there are two progress indicators: "Demographics Questionnaire" and "Demographics Information". At the bottom right, there are "Previous" and "Next" buttons. At the bottom center, there is a footer that says "Copyright | Contact Us".

# Data Collection WEB: Grid Item

http://localhost/DcasSoa/Instrumer Demographics Questionnaire

**DCAS** Demographics Questionnaire Instrument admin

Respondent: Rita Grey | Female | 11 Nov 1980 | 30 years |

Start Fast Forward End Clear Don't Know Refuse Notes Previous Next

How satisfied are you with this survey?

	Completely Satisfied	Somewhat Satisfied	Neither Satisfied or Dissatisfied	Somewhat Dissatisfied	Completely Dissatisfied	RF	DK
Easiness of use and navigation	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
Questionnaire complexity	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
Application performance	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>

Demographics Questionnaire Demographics Information

Previous Next

Copyright | Contact Us

# iPad Data Collection: Single Selection

Respondent: Rita Grey | Female | 11 Nov 1980 | 30 years |

What is the highest grade or level of school Rita Grey has completed or the highest degree he has received?

**HAND CARD DMQ1 READ HAND CARD CATEGORIES IF NECESSARY. ENTER HIGHEST LEVEL OF SCHOOL.**

*Education in the United States Education in the United States is mainly provided by the public sector, with control and funding coming from three levels: federal, state, and local. Child education is compulsory. Public education is universally available. School curricula, funding, teaching, employment, and other policies are set through locally elected school boards with jurisdiction over school districts with many directives from state legislatures. School districts are usually separate from other local jurisdictions, with independent officials and budgets. Educational standards and standardized testing decisions are usually made by state governments. The ages for compulsory education vary by state. It begins from ages five to eight and ends from ages fourteen to eighteen.[3] Compulsory education requirements can generally be satisfied by educating children in public schools, state-certified private schools, or an approved home school program. In most public and private schools, education is divided into three levels: elementary school, middle school (sometimes called junior high school), and high school (sometimes referred to as secondary education). In almost all schools at these levels, children are divided by age groups into grades, ranging from kindergarten (followed by first grade) for the youngest children in elementary school, up to twelfth grade, the final year of*

10th grade

11th grade

12th grade, no diploma

High school graduate

Ged or equivalent

Some college, no degree

Associate degree: occupational, technical, or vocational program

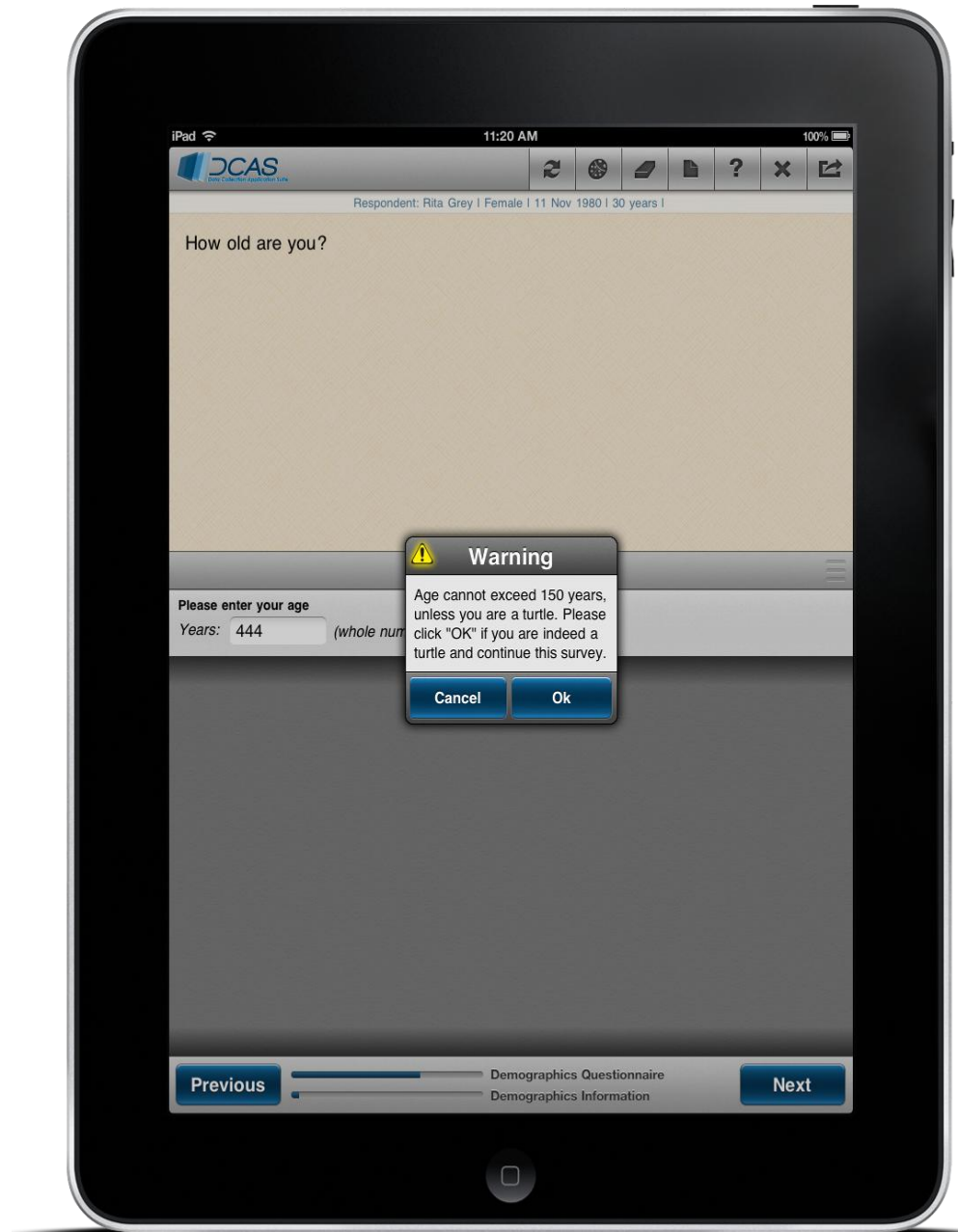
Associate degree: academic program

Previous Demographics Questionnaire Demographics Information Next

# iPad Data Collection: Grid Item



# iPad Data Collection: Text Input, Validation



# Android Data Collection: Single Selection

Data Collection Application Suite (DCAS)

Current Participant: Rita Grey

Question:

**IS RESPONDENT MALE OR FEMALE?**

- SELECT BY OBSERVATION/LISTENING.
- IF UNABLE TO DETERMINE, ASK "Just to confirm, are you male or female?"

Selected:  
**FEMALE**

Clear Selected

Refused

Don't know

MALE

FEMALE

Not Ascertained

Refused

Don't Know

Section Progress / Total Progress

Previous Next

CATI of Pregnancy Screener Interview LI Phase 2

8:32



# Android Data Collection: Multiple Edit

Data Collection Application Suite (DCAS)

Current Participant: Rita Grey

Question:

**What is your date of birth?**

Selected:

Clear Selected

Refused

Don't know

MONTH

1

Input Format: 99

DAY

2

Input Format: 99

YEAR

1980

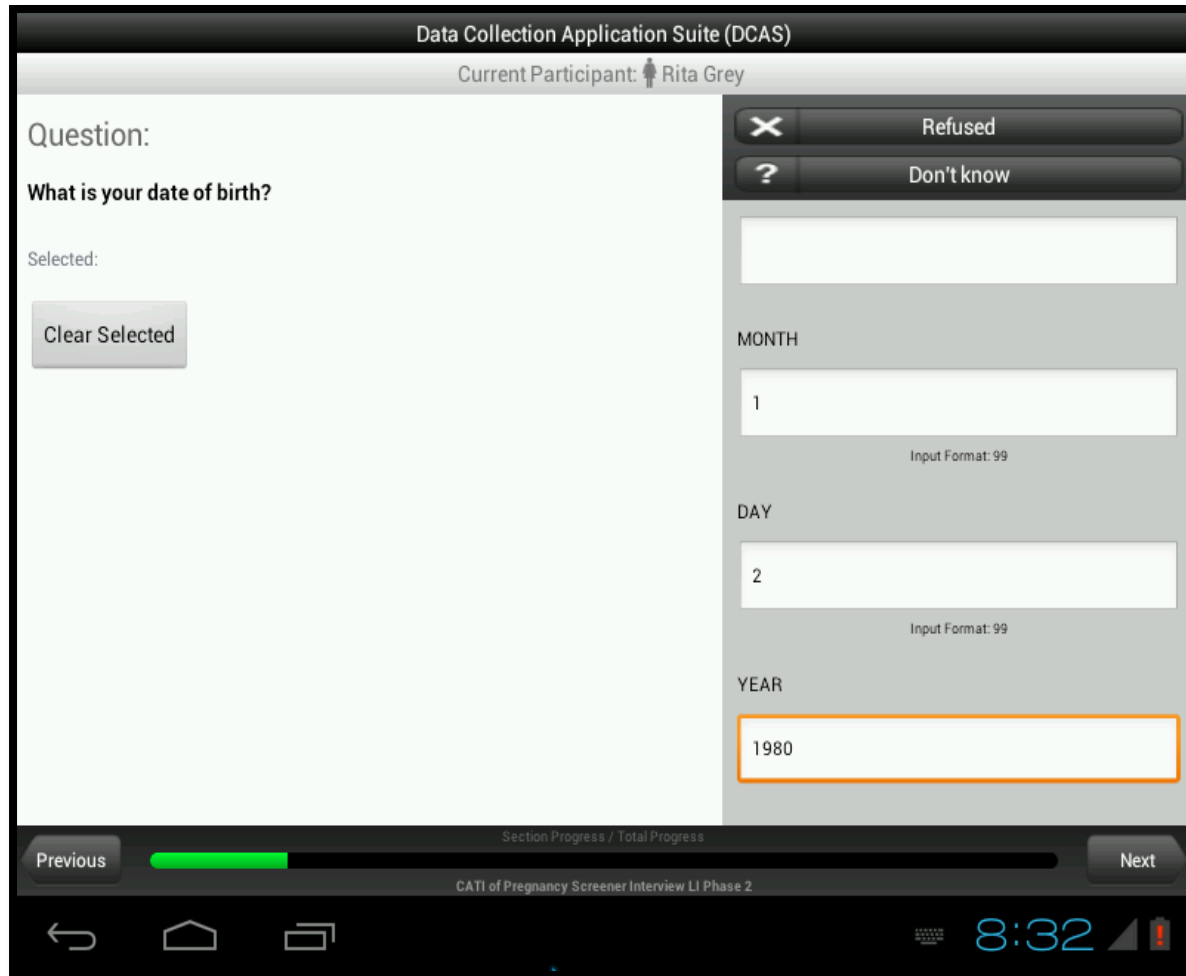
Section Progress / Total Progress

Previous

Next

CATI of Pregnancy Screener Interview LI Phase 2

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# Android Data Collection: Text Input, Validation

