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AnthroCloud

SOFTWARE MODERNIZATION FOR CLOUD-BASED PEDIATRIC ANTHROPOMETRY



Background

ANTHRO is a 1990 DBASE collaboration between the CDC and WHO

ANTHROPOMETRIC DATA									
NAME/ID				SEX		F			
AGE		mos 56.27 yrs		BIRTHDATE		07/30/??			
				VISITDATE		04/08/82			
WEIGHT		kilos 16.50 lbs ozs		PERCENTILE		Z-SCORE		%MEDIAN	
		HT for AGE		HAP 9.78		HAZ -1.29		HAM 94.78	
HEIGHT		cm 100.80 ft in		WT for AGE		WAP 36.64		WAZ -0.34	
				WT for HT.		WHP 70.90		WHZ 0.55	
						WHM 105.90			
Record Flag 0									

NAME: All entries allowed
FIND: [F1]-1st [F2]-Rec# [F3]-Prev [F4]-Next BROWSE: [F7]-Prev [F8]-Next [Ctrl-N] Rec= 11

WHO ANTHRO is a desktop application published in 2006

Anthropometric calculator

Help

Date of visit: 7/29/2019

Sex: ☒ Female ☐ Male

Weight (kg): 9.00 BMI: 16.9

Length/height (cm): 73.00

Date of birth: 7/29/2018

☐ Approximate date

☐ Unknown date

Measured: ☒ Recumbent ☐ Standing

Oedema: ☒ No ☐ Yes

Age: 11mo

Head circumference (cm): 45.00

MUAC (cm): 15.00

Triceps skinfold (mm): 8.00

Subscapular skinfold (mm): 7.00

Results

	Percentile	z-score		Percentile	z-score
Weight-for-length	61.4	0.29	HC-for-age	53.1	0.08
Weight-for-age	51.9	0.05	MUAC-for-age	74.3	0.65
Length-for-age	34.8	-0.39	TSF-for-age	49.9	0.00
BMI-for-age	64.1	0.36	SSF-for-age	65.0	0.38



Background (continued)



Functional Requirements Document (FReD) 2.0

- 3.1.3.2 Calculate Body Mass Index and Produce Automated Growth Chart (Maximus, 2008)



A feasibility study for California Department of Public Health (CDPH) eWIC MIS itemizes development costs for an automated growth chart at \$201,720 described here:

- System must plot all entries of weight (BMI, height, length, etc.), calculate and plot automated growth chart based on categorical scenario (CDPH, 2014)



The CDC recommends health care providers use WHO Growth standards for infants and children 0 to 2 and CDC growth standards for children age 2 and older (Grummer-Strawn et al., 2010).



WIC systems do not share a common calculator between them. Participating states "transfer or replicate an existing SAM or non-SAM system [to] save on technology expenditures" (Geller et al., 2017).



Objectives

Choose an **application platform** to improve the ability of the calculator to change to new specifications or operating environments.

Design software that decouples the application into **components** to reduce the effort necessary to change the calculator.

Provide a **common interface** to better exchange data between calculator components.

Build a **test suite** to reduce the effort necessary to verify calculator changes.



Outputs

The following deliverables were produced in accordance with project objectives:

Source Code

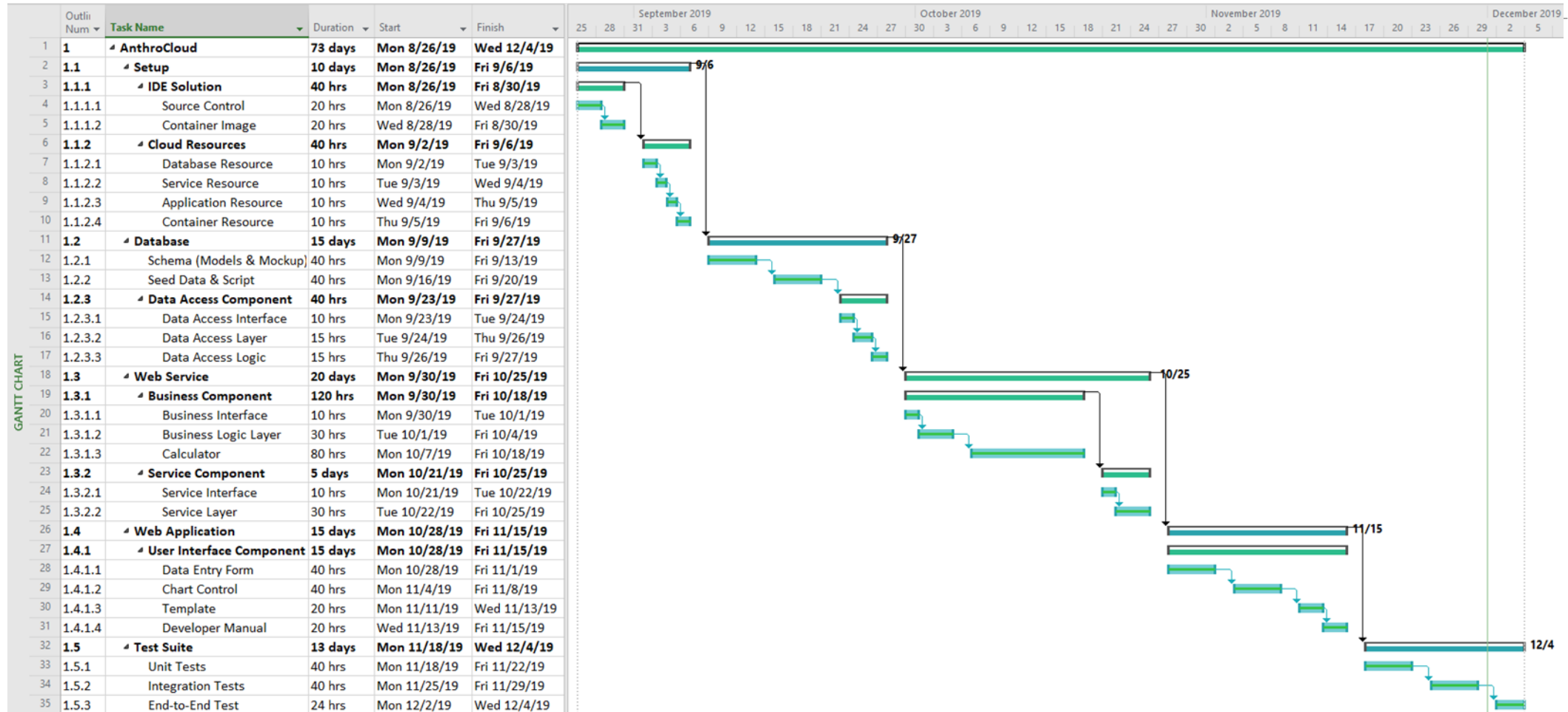
- IDE Solution
- Database Script
- Web Service Project
- Web Application Project
- Test Project

Documentation

- Data Model
- Architecture Model
- User Interface Mockup
- Developer Manual
- Minimum Project Documents



Schedule



Process Tools

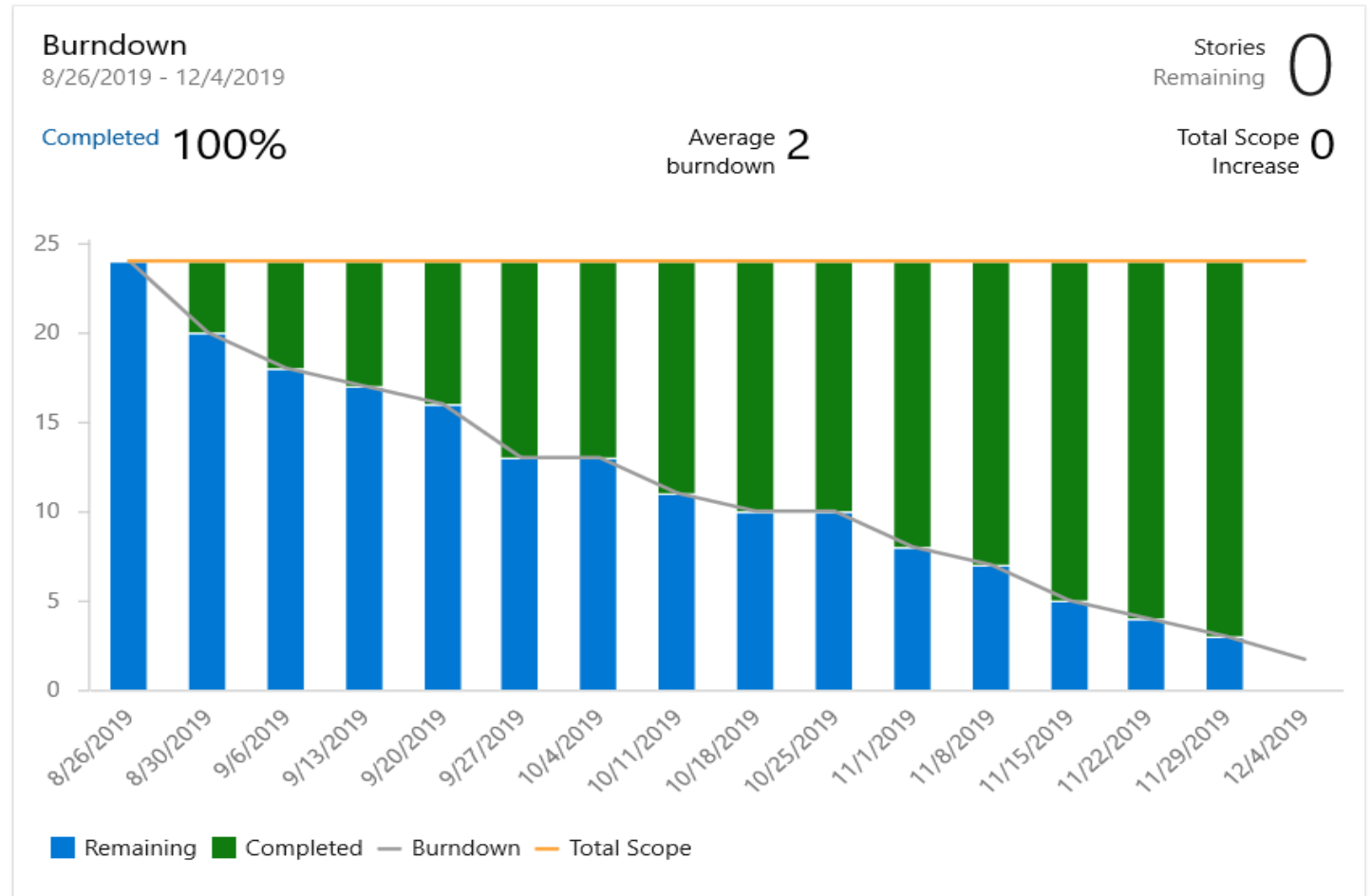
AZURE DEVOPS

AZURE BOARDS

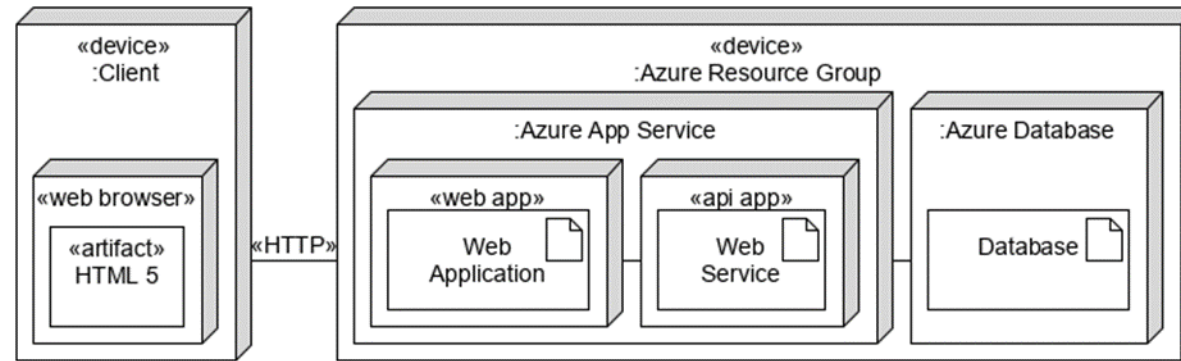
AGILE PROCESS TEMPLATE

GITHUB INTEGRATED

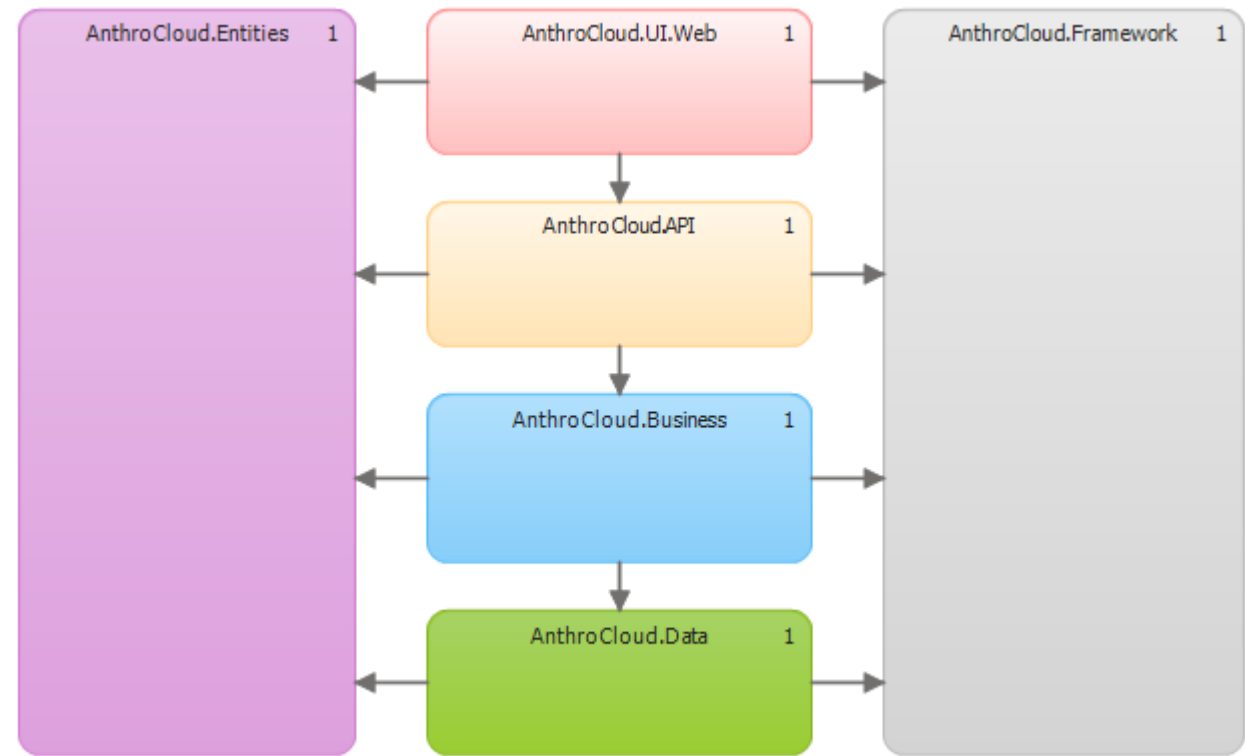
MICROSOFT PROJECT INTEGRATED



Design



Architecture



Technology

Layer	Technologies
Presentation	.NET Core 3, ASP.NET Core MVC 3, Google Charts, HTML5, JavaScript
Service	ASP.NET Core Web API 3
Business	C# 8
Data	Entity Framework Core 3
Database	Azure SQL Database

Data

LengthHeightForAge «table»	WeightForLength «table»	WeightForHeight «table»	WeightForAge «table»	BMIForAge «table»	HCFforAge «table»	MUACForAge «table»	TSFForAge «table»	SSFForAge «table»
PK Month: smallint PK Sex: tinyint L: tinyint M: decimal(7,4) S: decimal(6,5) SD3neg: decimal(6,3) SD2neg: decimal(6,3) SD0: decimal(6,3) SD2: decimal(6,3) SD3: decimal(6,3) P3: decimal(6,3) P15: decimal(6,3) P50: decimal(6,3) P85: decimal(6,3) P97: decimal(6,3)	PK Sex: tinyint PK LengthInCM: decimal(4,1) L: decimal(5,4) M: decimal(7,4) S: decimal(6,5) SD3neg: decimal(6,3) SD2neg: decimal(6,3) SD1neg: decimal(6,3) SD0: decimal(6,3) SD1: decimal(6,3) SD2: decimal(6,3) SD3: decimal(6,3) P3: decimal(6,3) P15: decimal(6,3) P50: decimal(6,3) P85: decimal(6,3) P97: decimal(6,3)	PK Sex: tinyint PK HeightInCM: decimal(4,1) L: decimal(5,4) M: decimal(7,4) S: decimal(6,5) SD3neg: decimal(6,3) SD2neg: decimal(6,3) SD1neg: decimal(6,3) SD0: decimal(6,3) SD1: decimal(6,3) SD2: decimal(6,3) SD3: decimal(6,3) P3: decimal(6,3) P15: decimal(6,3) P50: decimal(6,3) P85: decimal(6,3) P97: decimal(6,3)	PK Month: smallint PK Sex: tinyint L: decimal(5,4) M: decimal(7,4) S: decimal(6,5) SD3neg: decimal(6,3) SD2neg: decimal(6,3) SD0: decimal(6,3) SD2: decimal(6,3) P3: decimal(6,3) P15: decimal(6,3) P50: decimal(6,3) P85: decimal(6,3) P97: decimal(6,3)	PK Month: smallint PK Sex: tinyint L: decimal(5,4) M: decimal(7,4) S: decimal(6,5) SD3neg: decimal(6,3) SD2neg: decimal(6,3) SD1neg: decimal(6,3) SD0: decimal(6,3) SD1: decimal(6,3) SD2: decimal(6,3) SD3: decimal(6,3) P3: decimal(6,3) P15: decimal(6,3) P50: decimal(6,3) P85: decimal(6,3) P97: decimal(6,3)	PK Month: smallint PK Sex: tinyint L: tinyint M: decimal(7,4) S: decimal(6,5) SD3neg: decimal(6,3) SD2neg: decimal(6,3) SD1neg: decimal(6,3) SD0: decimal(6,3) SD1: decimal(6,3) SD2: decimal(6,3) SD3: decimal(6,3) P3: decimal(6,3) P15: decimal(6,3) P50: decimal(6,3) P85: decimal(6,3) P97: decimal(6,3)	PK Month: smallint PK Sex: tinyint L: decimal(5,4) M: decimal(7,4) S: decimal(6,5) SD3neg: decimal(6,3) SD2neg: decimal(6,3) SD1neg: decimal(6,3) SD0: decimal(6,3) SD1: decimal(6,3) SD2: decimal(6,3) SD3: decimal(6,3) P3: decimal(6,3) P15: decimal(6,3) P50: decimal(6,3) P85: decimal(6,3) P97: decimal(6,3)	PK Month: smallint PK Sex: tinyint L: decimal(5,4) M: decimal(7,4) S: decimal(6,5) SD3neg: decimal(6,3) SD2neg: decimal(6,3) SD1neg: decimal(6,3) SD0: decimal(6,3) SD1: decimal(6,3) SD2: decimal(6,3) SD3: decimal(6,3) P3: decimal(6,3) P15: decimal(6,3) P50: decimal(6,3) P85: decimal(6,3) P97: decimal(6,3)	PK Month: smallint PK Sex: tinyint L: decimal(5,4) M: decimal(7,4) S: decimal(6,5) SD3neg: decimal(6,3) SD2neg: decimal(6,3) SD1neg: decimal(6,3) SD0: decimal(6,3) SD1: decimal(6,3) SD2: decimal(6,3) SD3: decimal(6,3) P3: decimal(6,3) P15: decimal(6,3) P50: decimal(6,3) P85: decimal(6,3) P97: decimal(6,3)
+ «Constraint» PK_LHFA_Age_Sex	+ «Constraint» PK_WFL_Sex_Length	+ «Constraint» PK_WFH_Sex_Height	+ «Constraint» PK_WFA_Age_Sex	+ «Constraint» PK_BFA_Age_Sex	+ «Constraint» PK_HCA_Age_Sex	+ «Constraint» PK_MUAC_Age_Sex	+ «Constraint» PK_TSF_Age_Sex	+ «Constraint» PK_SSF_Age_Sex



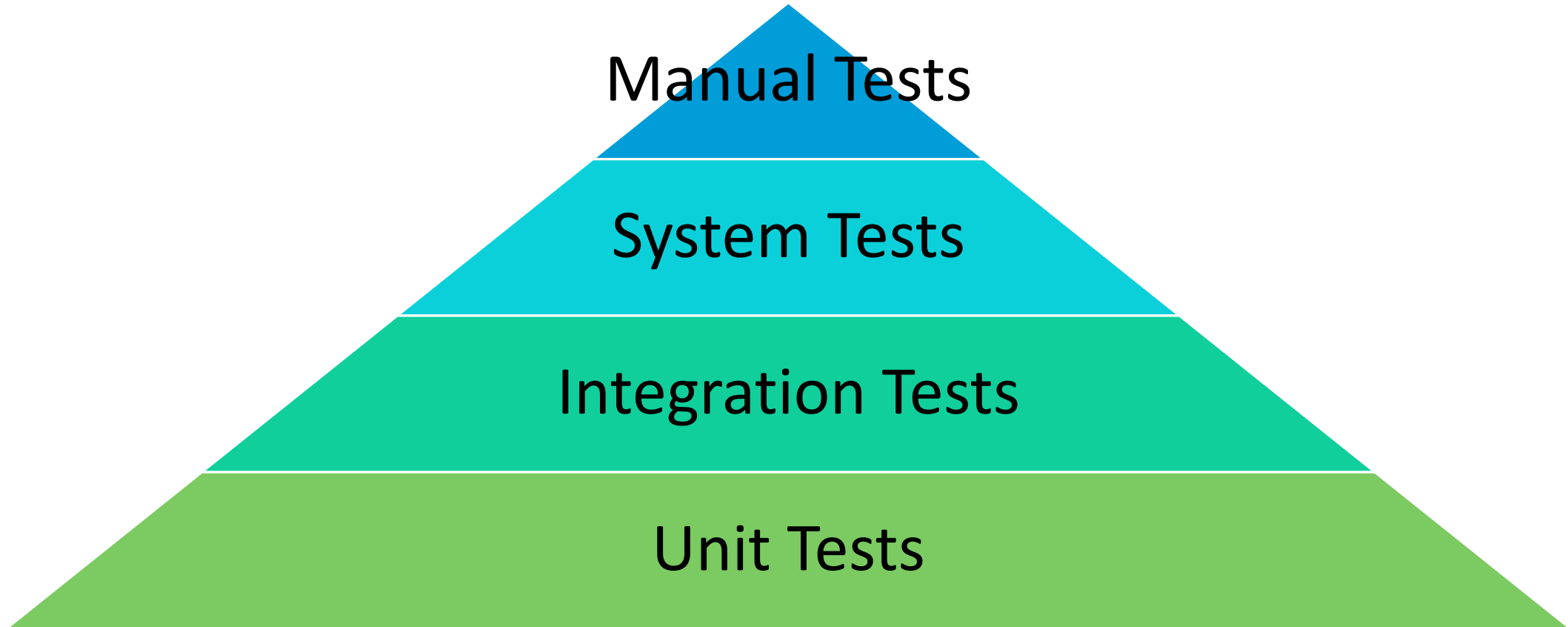
Service

AnthroCloud Rest API

Resource Type	HTTP Verb	Resource API	Description
Anthro	GET	/ANTHRO/AGE/{birth}/{visit}	Returns a human readable string in either Months or Year-Month (TotalMonths) format.
Anthro	GET	/ANTHRO/AGE/DAYS/{birth}/{visit}	Returns string of age in total days.
Anthro	GET	/ANTHRO/AGE/MONTHS/{birth}/{visit}	Returns string of age in total months.
Anthro	GET	/ANTHRO/AGE/YEARS/{birth}/{visit}	Returns string of age in total years.
Anthro	GET	/ANTHRO/ BMI {weight}/{height}	Returns BMI rounded to tenths.



Tests



DEMO - AnthroCloud



Outcomes

The .NET Core development platform improves the ability of the calculator to change to new specifications or operating environments.

The layered architecture decouples application components to reduce the effort necessary to change the calculator.

ASP.NET Web API framework enables a RESTful API to communicate via a common HTTP interface to better exchange data between calculator components.

The Test Suite reduces the effort necessary to verify calculator changes.

References

California Department of Public Health (CDPH). (2014, March 19). *WIC Management Information System (eWIC MIS): Reportable Feasibility Study*. Retrieved May 31, 2019, from <https://projecttracking.technology.ca.gov/Download?documentid=4376feb9-9eb1-4054-86f8-b6a8e27b4ff9&projectid=3808>

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Questions

