DHS SCIENCE AND TECHNOLOGY

2018 Biometric Technology Rally

November 29, 2017

Participant Technical Training Webinar

Homeland Security

Science and Technology

Overview

- **Biometric Rally Testing**
  - Maryland Test Facility
  - Rally Physical Layout
  - Rally Process
  - Submitting System Data
  - Biometric Gallery
  - Rally Metrics
  - Rally Participant Responsibilities
- **Biometric Rally Selection Process**

Maryland Test Facility (MdTF)

- The Biometric Technology Rally will be held at the MdTF
  - Located just outside the DC Metropolitan Beltway, near Fedex Field
  - Designed for testing large groups of volunteers in configurable scenarios
  - Provides software API for integrating biometric systems

- To date, tested more than 2458 volunteers
  - Aged 18-80
  - 67 different countries of origin

Test Process

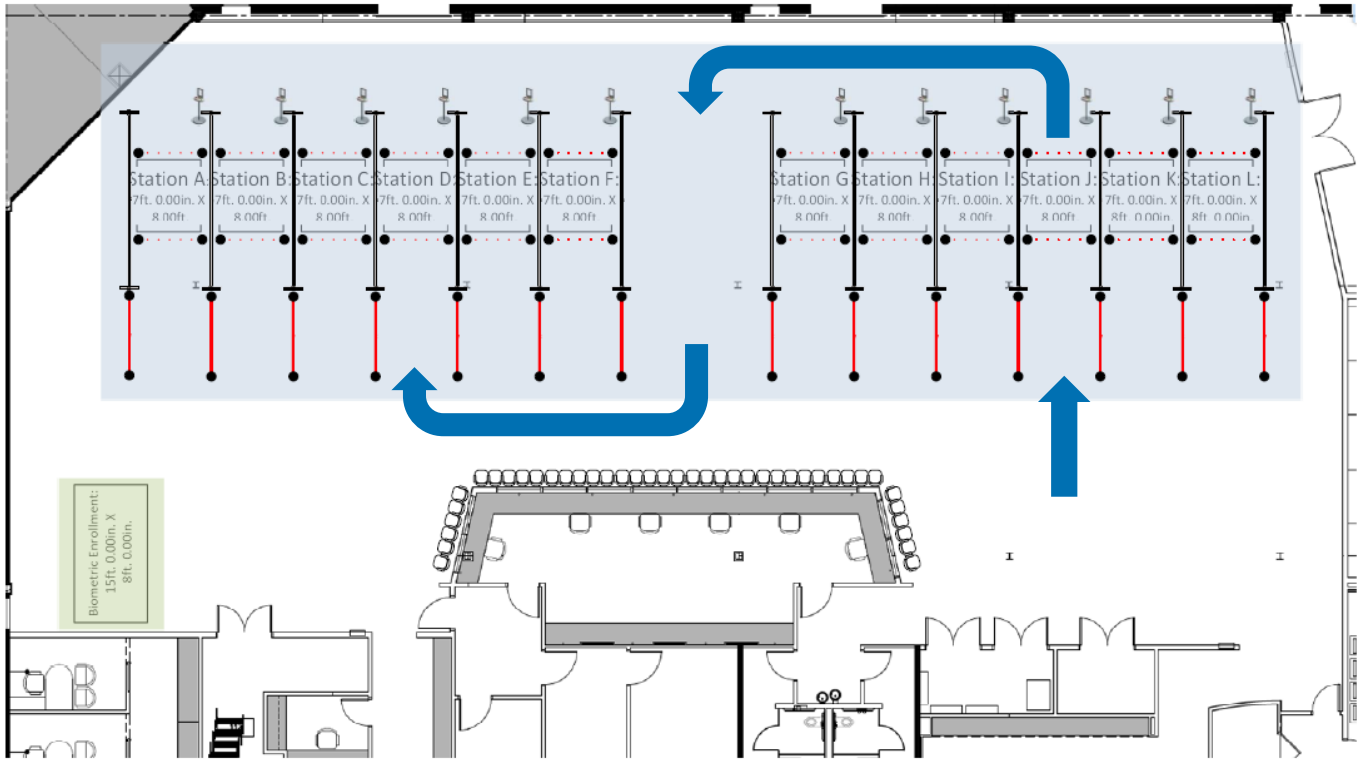
Testing Process – Rally Test

- Rally Systems will be tested with demographically diverse volunteers
  - Many volunteers will have some prior experience with biometrics
  - Volunteers will not be briefed on how to use the rally systems
  - The purpose of the rally is to identify fast and intuitive systems

- Volunteers will be divided into multiple groups, each led by a test guide
- Test guides will move each group between Rally Systems in a unique order
  - Order will be counterbalanced across all rally systems
  - Test guides will direct volunteers to use the rally systems one at a time

- Timing will be automated
  - Each group will be allotted a fixed amount of time with each rally system
  - Systems maintaining a 10 second transaction time will be able to process the full group
  - The group will move to the next system when the time has expired even if the system failed to process everyone

Rally Physical Layout

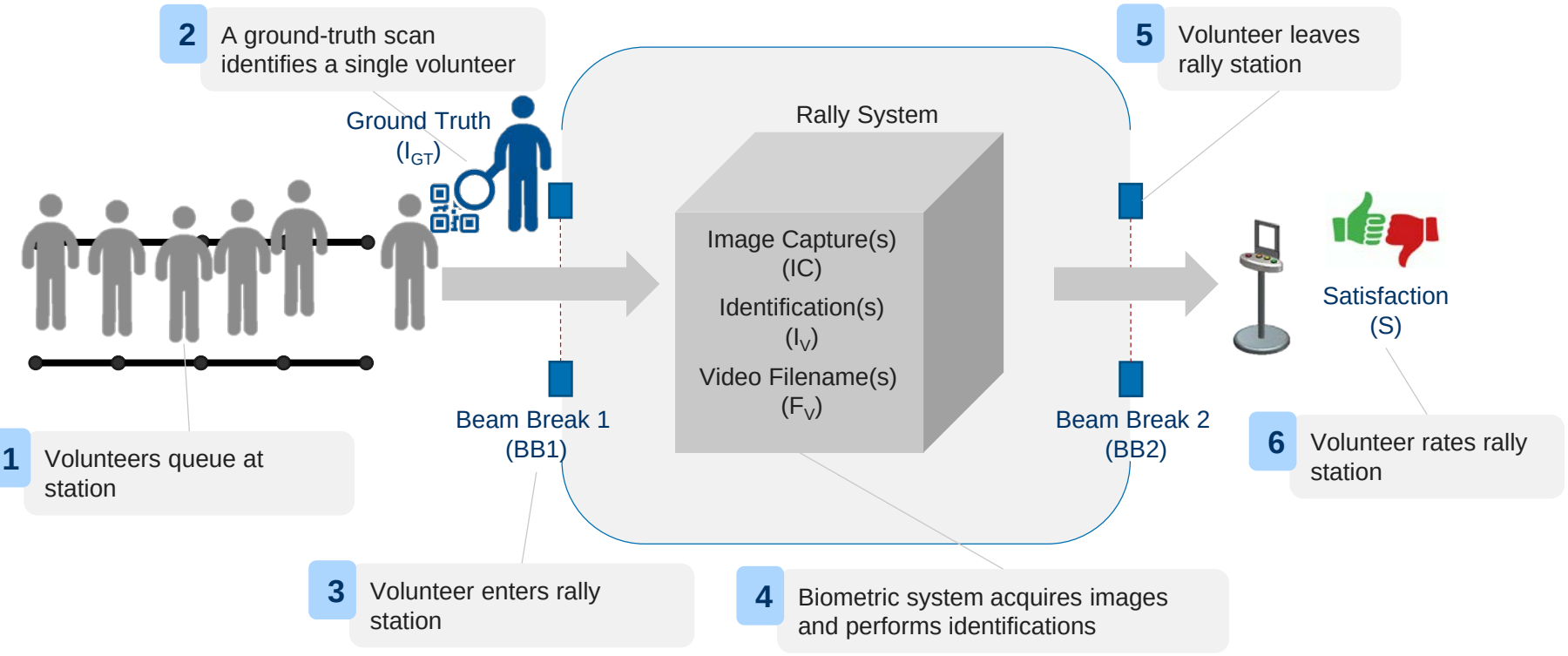


Legend

Rally Station locations

Enrollment Station location

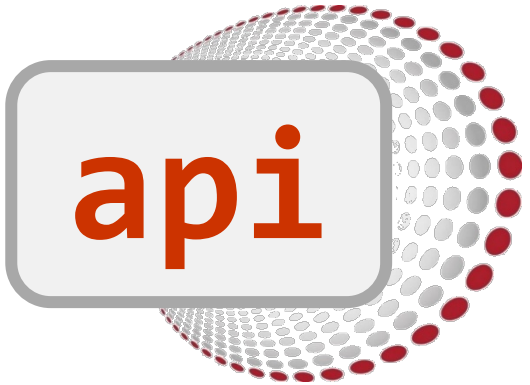
Testing Process – Rally Station



Submitting System Data (MdTF API)

MdTF – API Overview

- Rally Systems have five “provides” requirements & options during the rally
  - *provide* at least **one facial biometric probe image** per volunteer **(Required)**
  - *provide* **up to 3 face biometric images** per volunteer **(Optional)**
  - *provide* **up to 3 pairs of iris biometric probe images** per volunteer **(Optional)**
  - *provide* **identifications** using a provided gallery of faces **(Optional)**
  - *provide* up to **10 seconds of video** per volunteer **(Optional)**
- All data for a given volunteer must be submitted prior to the next volunteer entering the station
- The MdTF will provide a RESTful, HTTP based API to facilitate these actions
- To help Rally Participants integrate with the MdTF API, the MdTF will provide
  - Detailed API documentation
  - An API instance available publically for testing / debugging prior to the rally
  - Limited troubleshooting support
- During the rally, the API will be available only on the MdTF local area network
  - Rally stations must be able to configure the API server address and their Station ID
  - Access to the internet will not be provided



MdTF – API Functionality – Face Capture

- *provide* at least **one facial biometric probe image** per volunteer **(Required)**
- *provide* **up to 3 face biometric images** per volunteer **(Optional)**
  - Rally Participants must capture one facial image
  - Failure to capture a facial image will result in a failure to acquire for that volunteer
  - Rally Participants can capture up to 2 additional face images
  - Facial imagery must be submitted through the API
  - Calls to this endpoint > 3 per volunteer will be ignored

POST /v1/face-captures

```
{
   “StationID”: “string”,
   “ImageEncoding”: “PNG”,
   “FaceImageData”: “string”
}
```

MdTF – API Functionality – Iris Capture

- *provide* **up to 3 pairs of iris biometric probe images** per volunteer **(Optional)**
  - Rally Participants have the option of collecting iris imagery
  - Iris Imagery can be provided through the API
  - Can submit up to three pairs of images per volunteer
  - Calls to this endpoint > 3 per volunteer will be ignored

POST /v1/iris-captures

```
{
   “StationID”: “string”,
   “ImageEncoding”: “PNG”,
   “LeftIrisImageData”: “string”,
   “RightIrisImageData”: “string”
}
```

MdTF – API Functionality - Identifications

- *provide* **identifications** using a provided gallery of faces **(Optional)**
  - Rally Participants have the option of doing *onboard matching* against a provided gallery
  - Rank one identifications can be provided through the API
  - Can submit up to 3 identifications per volunteer
  - Calls to this endpoint > 3 per volunteer will be ignored
  - Gallery specifics are discussed in future sections

POST /v1/identifications

```
{
   “StationID”: “string”,
   “SubjectID”: “string”
}
```

MdTF – API Functionality – Video Files

- *provide* up to **10 seconds of video** per volunteer **(Optional)**
  - Rally Participants have the option of collecting a 10 second video
  - Video will be uniquely tagged (named) and stored locally on Rally Participant systems
  - Unique tags can be provided through the API
  - Video files will be manually transferred off Rally Participants' system each day
  - Tags should be unique for the entire test, not just a given test day

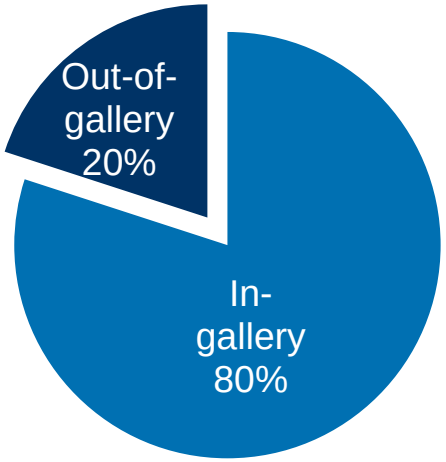
POST /v1/video-filenames

```
{
   "StationID": "string",
   "VideoFilename": "string"
}
```

Biometric Gallery

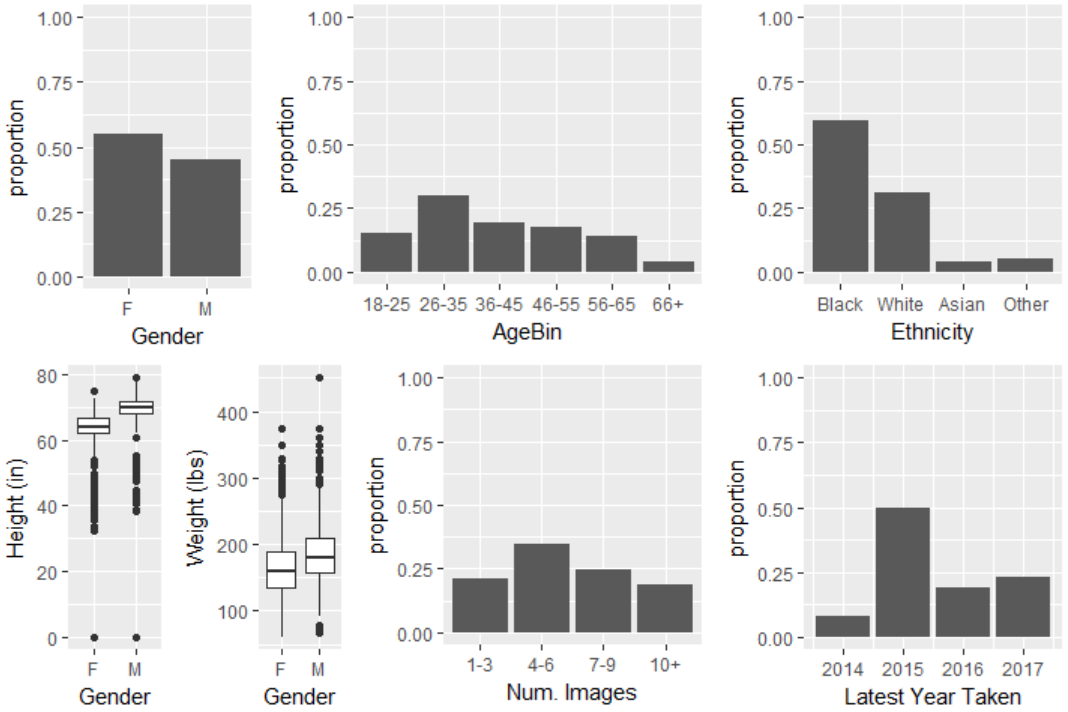
Biometric Gallery – Overview

- A gallery of biometric images will be provided ahead of testing
  - Can be used for any on-line matching at the rally station
- The gallery will contain images for 80%-90% of the volunteers that will use Rally Systems during testing
  - Expect 10%-20% of the volunteers to be out-of-gallery
  - Expect 10%-20% of the volunteers in the gallery to not actually participate in the test
- If performing matching operations, Rally Participants should:
  - Provide an identification for each volunteer entering the rally station
    - Gallery ID for each in-gallery volunteer
  - Be prepared to report out-of-gallery volunteers as specified in the API documentation



Gallery - Demographics

- Gallery will demographically diverse
  - Male/Female
  - Ages (18-80)
  - Ethnicity
  - Height
  - Weight
- There may be multiple images per volunteer
- Age of newest image for each volunteer will vary
- Some volunteers will not be in the gallery



Gallery – Images

- The gallery will contain:
  - 300-400 unique volunteers
  - ~1000-3000 face images
  - up to 50MB per image
  - All images will be in **bmp/png/jpeg** format
- Gallery will be provided on removable media several days prior to the beginning of evaluation
- Sample images will be provided upon request

Rally Metrics

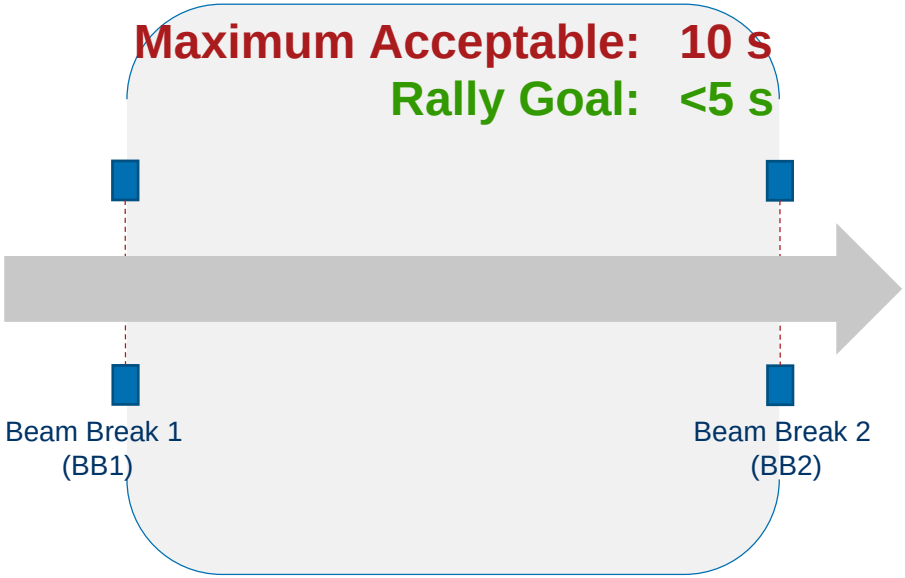
Evaluation – Metrics

- Biometric Rally Metrics
  - Focus on **tradeoff** between biometric efficiency and effectiveness both **within and across systems**
    - Efficiency – the amount of time required to complete a biometric transaction
    - Effectiveness – performance of the biometric, encompassing any failures to acquire, process, and match within a given time interval
  - Gauge volunteer satisfaction with the system
  - Allow technology to be matched against different use cases

- Systems are expected to meet minimum quantitative requirements:
  - Effectiveness:
    - Systems are expected to identify at least 95% of all volunteers
  - Efficiency:
    - Maintain average transaction time of 10 seconds
    - Maximum transaction time of 20 seconds
    - Data collection will be stopped if allotted time is exceeded

Evaluation – Average Transaction Time

- **Average Transaction Time**
  - The time volunteers spent using the system (entrance to exit). Calculated by the difference between the exit beam break time (t_{BB2}) and entry beam break time (t_{BB1}).



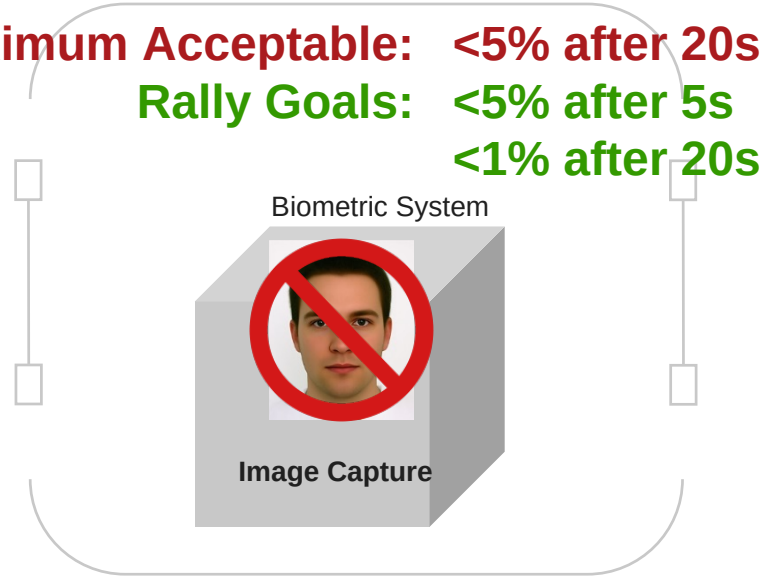
Evaluation – Acquisition

- **Failure to Acquire Rate (FtAR)**
  - Percentage of transactions that result in a **failure acquire or process** image captures within a given time interval.

Maximum Acceptable: **<5% after 20s**

Rally Goals: **<5% after 5s**

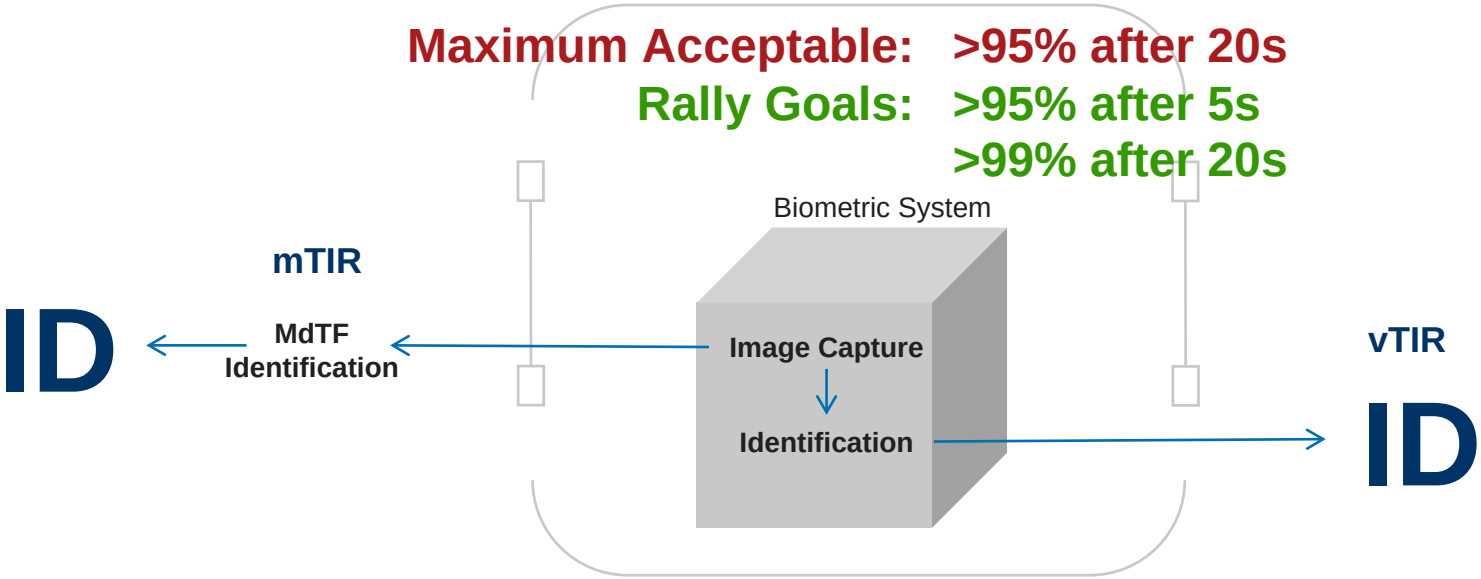
<1% after 20s



Evaluation – Matching

- **MdTF True Identification rate (mTIR)**
  - Percentage of transactions providing correct identity within a given time interval calculated by the **MdTF matching engine.**
    - Face Required, Iris (optional)
- **Vendor True Identification Rate (vTIR)**
  - Percentage of transactions providing correct **vendor-reported identity** in a given time interval (optional)

Maximum Acceptable: >95% after 20s
Rally Goals: >95% after 5s
>99% after 20s



Evaluation – Metrics

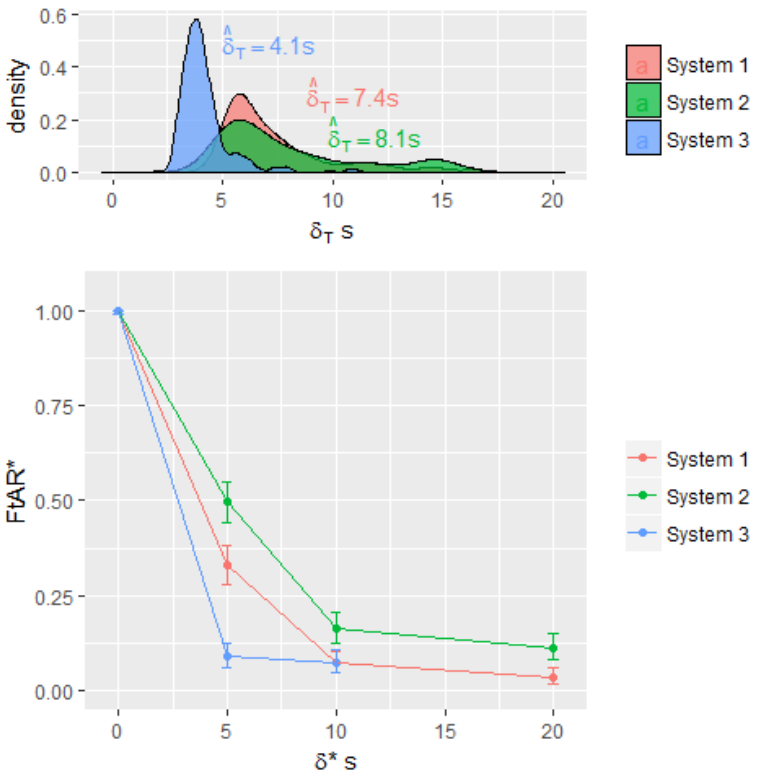
- **Percent Satisfaction** – Proportion of **positive satisfaction** scores as rated by volunteers immediately following station use.

Minimum Acceptable: >90%

Rally Goal: >95%

Example Performance

- Data from 3 systems tested at the MdTF:
  - $\widehat{\boldsymbol{\delta}}_{\boldsymbol{T}}$ - average transaction time
  - $\boldsymbol{FtAR}^{*}$ - failure to acquire rate
- Systems provided only a single image
- $\boldsymbol{FtAR}^{*}$ decreases with $\boldsymbol{\delta}^{*}$
  - reveals system suitability
  - System 3 *capture* performance is suitable for highest speed applications
- Full snapshot of system performance will also consider
  - $\boldsymbol{mTIR}^{*}$, $\boldsymbol{vTIR}^{*}$, and $\boldsymbol{S}_{\boldsymbol{positive}}$



Rally Participant Responsibilities

Rally Participant Responsibilities: Before Testing

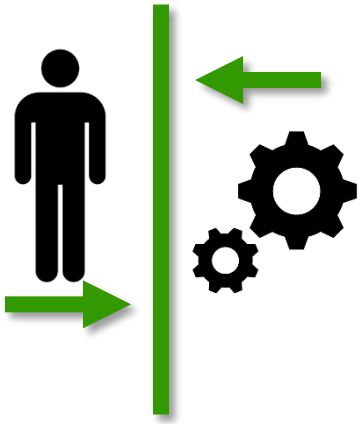
- Rally Participants are responsible for:
  - acquiring all hardware to maintain and operate their system
  - integrating their device/system within the API developed by the MdTF. Minimal assistance from the MdTF staff to Rally Participants will be provided
  - any/all hardware/software testing, including proper communication with the MdTF API
  - the full installation and breakdown of their own equipment within the MdTF
  - integrating a match schema internally to their system

Rally Participant Responsibilities: During Testing

- During testing, transactional data will be available from each Rally Participant station
- Rally Participants will be able to view data acquired by the MdTF API following each volunteer transaction at their Station
- Rally Participants will be responsible for informing MdTF of any issues with their system's performance during testing
  - The MdTF will log these issues and determine whether intervention is allowable
  - Rally Participants will be given a chance to make up to two usability / human factors adjustments to their systems during the first two days of the rally
  - Rally Participants may make repairs to their systems in case of breakage
  - Any system modification must be made when volunteers have left the test environment

Human Factors Considerations

- In order to meet Requirement 3, the system should include some form of instructions to volunteers
  - *Requirement 3: The system shall direct volunteer interaction to achieve requirements 1 and 2*
- Assistance from test guides/staff will not be provided to volunteers if they ask for help
- Consider the following when creating instructional signage:
  - Size of display
  - Complexity of instructions
  - Amount of text
  - Complexity of text
  - Location of signage in relation to the system



Selection Process

Selection Process

- DHS will have sole discretion in selecting participants. DHS S&T will down-select the number of Rally Participants to a maximum of 12. DHS will be advised in this process by a panel of biometric experts.

- Whitepapers and videos will be judged along the following criteria:
  - The system is capable of collecting high quality face images
  - The system can operate within the required time constraint
  - The system has a process that does not require staffing
  - The system can be integrated into the test environment
  - The system can be applied to known DHS use-cases