DHS SCIENCE AND TECHNOLOGY

The 2019 Biometric Technology Rally

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Homeland Security
Science and Technology

MdTF

Biometrics & Identity Technology Center
Department of Homeland Security
Science and Technology Directorate

Biometrics & Identity Technology Center

Vision

- Provide S&T's core biometric RDT&E capability to drive enduring efficiencies and biometric & identity innovations across the HSE
- Facilitate accelerated adoption for emerging DHS use cases
- Follow "Build one, use widely" approach

Goals

- Support cross cutting methods, best practices, and solutions across programs to **drive efficiencies**
- Provide objective biometric & identity **test and evaluation** services to DHS
- **Engage Industry** and provide better feedback
- **Encourage Innovation** across the HSE

Biometrics Technology Rallies

- **Challenge industry** to meet specific DHS use-cases
- **Foster innovation** and create partnerships across government and industry
- **Inform DHS procurement activities** such as operational tests, pilots, and system acquisitions
- Participation provides industry:
  - An opportunity to collect and retain biometric data for research purposes
  - Obtain user feedback
  - Receive a performance report
  - Showcase system performance to potential customers

The use-case for the 2018 Biometric Technology Rally was to identify users in a high-throughput security environment with unmanned face/iris systems.

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BIOMETRIC TECHNOLOGY RALLY

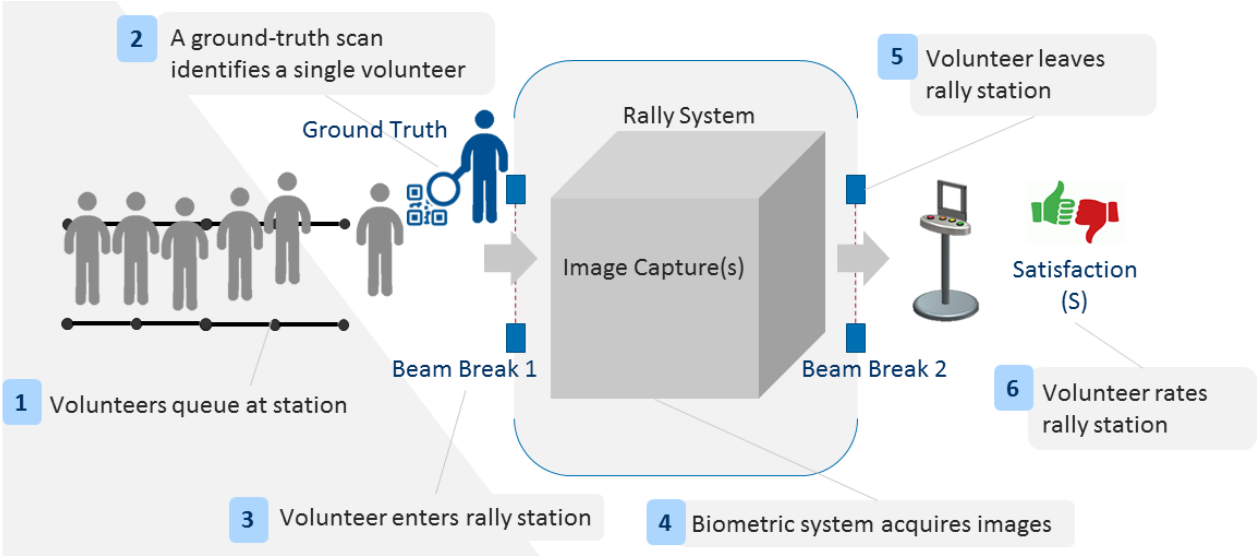
Goals for the 2019 Biometric Technology Rally

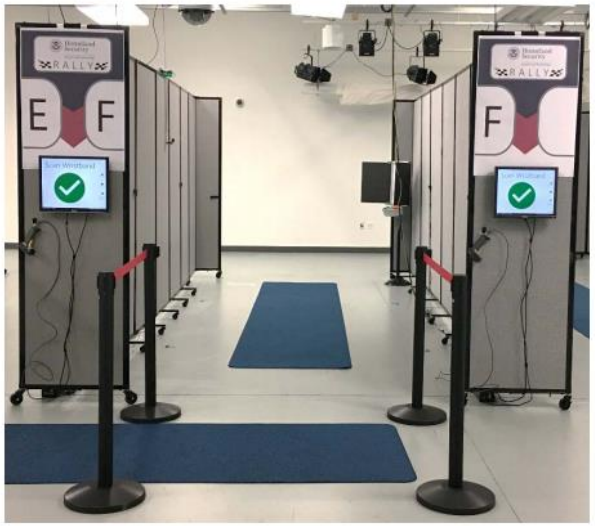
- Target the “high-throughput” use case
  - Face, fingerprint or iris imagery
  - Acquisition systems and/or matching algorithms
- Measure progress from 2018 Rally in regards to efficiency effectiveness and satisfaction
- Measure (for the first time) high-throughput fingerprint systems
- Access the ability of acquisition systems to capture images that work across algorithms
- Access the ability of algorithms to work across acquisition systems
- Collaborate and guide promising technologies, share information via Cooperative Research and Development Agreements

2019 Biometric Technology Rally System Requirements

- Who will be able to participate:
  - Vendors of face, iris, fingerprint or multi-modal biometric *acquisition systems*
  - Vendors of face, iris, fingerprint, or multi-modal biometric *matching algorithms*
- Minimum requirements for *acquisition systems*:
  - Operate in an unmanned mode, i.e. without an operator/instructor
  - Operate within the physical footprint and infrastructure defined by the MdTF (6'x8')
  - Collect biometric imagery to support identification operation
  - Provide at least one biometric image per Test Volunteer
  - Process and submit biometric data within defined time constraints (TBD – still H.T.)
- Optional
  - Provide up to three images per modality per Test Volunteer
- Minimum requirements for *matching algorithms*:
  - Provide a software library that confirms to the MdTF Simplified Biometric Algorithm Interface (MSBIA)
  - Operate within some computational limits (RAM/CPU usage, speed, etc. TBD)

Acquisition Systems





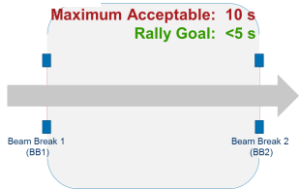
- Systems may submit face, iris, or fingerprint* samples or some combination thereof (multimodal)
- Can submit up to three samples per “type” (face, left iris, left little finger, etc.) per subject
- Systems are no longer required to submit face image(s)*

* Indicates a change between 2018 Rally and 2019 Rally

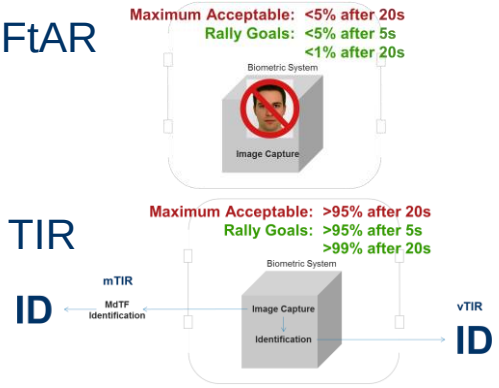
Acquisition Systems Evaluation Metrics

- Efficiency (overall)
  - Refers to the amount of time required to use each biometric system
  - Quantified as average transaction time (beam-break to beam-break) for Test Volunteers at each Rally System
- Effectiveness (per modality)
  - Refers to the accuracy and completeness with which users are identified.
  - Measured in two time intervals:
    - By 5 seconds after the entry beam break
    - By 20 seconds after the entry beam break
  - Failure to Acquire Rate (FtAR) for images
    - Proportion of Test Volunteers for whom no images were captured
  - True Identification Rate (TIR) for images
    - The proportion of Test Volunteers correctly identified
    - MdTF matcher (for 2018 Rally comparison) and other matchers
- Satisfaction (overall)
  - Refers to Test Volunteers' positive attitudes toward the Rally Systems
  - Measured using a 4-button kiosk from Very Happy to Very Unhappy
  - Quantified as proportion of Happy or Very Happy responses

Efficiency



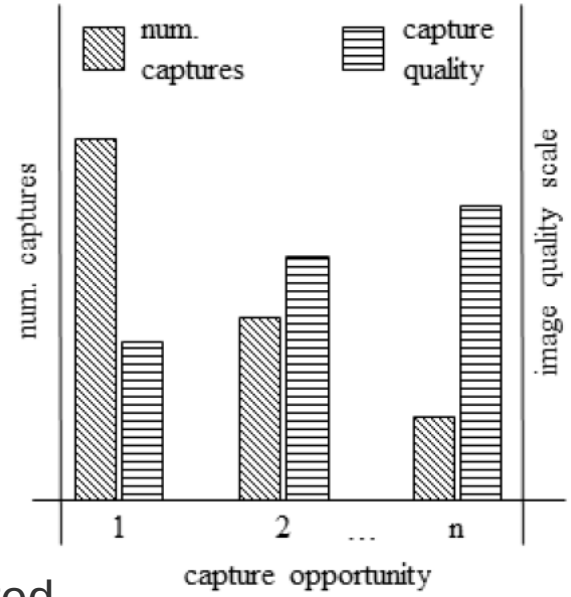
Effectiveness:



Satisfaction

Acquisition System Evaluation Metrics

- Systems are expected to meet minimum requirements:
  - **Identify at least 95% of all volunteers**
  - Maintain **average transaction time of 10 seconds**
    - Maximum transaction time of 20 seconds
    - Data collection will be stopped if allotted time is exceeded
  - Average top-box **satisfaction score of > 90%**



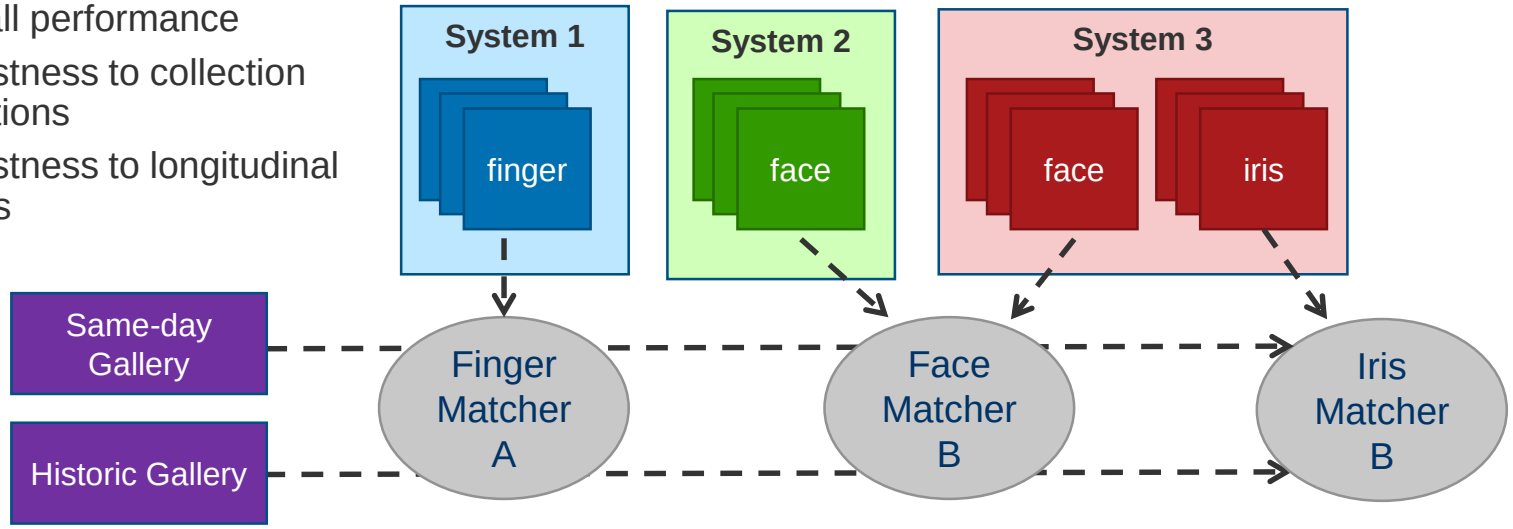
- **Recognize** when **quality** sample has been collected
- **Adjust** when better samples are needed.
- Given multiple attempts to capture a sample, Systems should:
  - Have a decreasing number of overall captures per opportunity (*recognize*)
  - Have increasing relative quality in latter capture opportunities (*adjust*)
  - Performance will be assessed based on the last image sent

Matching Algorithms

- Provides a new option to apply to participate in the Rally
- Selected face, finger, or iris algorithms will need to conform to a simplified common interface
- We will use your algorithm to match biometric samples from 2018 and 2019 Rallies
- Matching algorithm vendors are not required to provide a biometric acquisition system
- Biometrics acquisition system vendors are not required to provide a matching algorithm

Matching Algorithm Evaluation Metrics

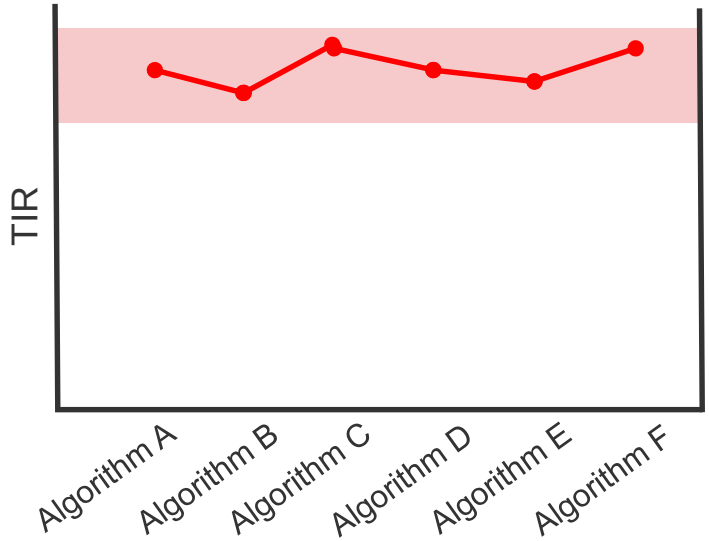
- Each acquisition system will collect images from 300-400 test subjects
- During the test, test volunteers will participate in a manned enrollment to create a same-day gallery of face, finger, and iris samples
- Most test volunteers have previously provided face, finger, and iris samples which are part of the historic gallery
- Each algorithm will be used to compare samples from the acquisition systems to the same-day and historic galleries
- Results will show:
  - Overall performance
  - Robustness to collection conditions
  - Robustness to longitudinal effects

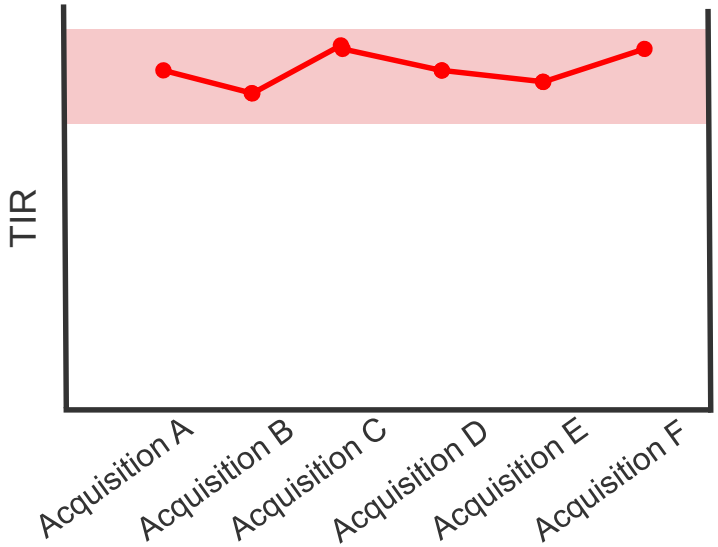


Acquisition and Algorithms – What is the additional challenge?

Acquisition system:

- High match rate with your acquired images across matching algorithms
- Robustness to matching algorithm





Matching algorithm:

- High match rate from your algorithm across all acquisition systems
- Robustness to capture conditions

Why participate in the 2019 Rally?

- For Acquisition System Participants…
  - Acquisition system participants will get statistics and videos of error cases to help improve their products
  - Acquisition system participants will get samples collected by their system on a diverse population of 300-400 people
  - 82% of Rally Participants learned something about their systems during the Rally and 64% plan to make improvements so that their systems are better suited to DHS use-cases
- For Matching Algorithm Participants…
  - Algorithm participants will get enrollment images and metadata for the diverse rally volunteers
  - Algorithm participants will receive results of their algorithm per rally volunteer, per Rally acquisition system to enable better understanding of variation in algorithm performance
  - Opportunities to partner with acquisition system participants

Why participate in the 2019 Rally?

- Industry Recognition – Aliased Reporting
  - Over 2,250 visitors to mdtf.org/rally since November 2017
  - 72 different countries, 40% of traffic is non-US
  - Visitors spent on average 3 minutes digesting results
  - Linked to by dozens of press releases, news articles, social media, etc.
- Showcase systems via VIP day
- On-going Cooperative Research and Development Agreement with DHS S&T

Acquisition System Application Package

- **Submission deadline:** 11/30/2018
- Provide an application package (limit 5 pages), in the form of a white paper, that addresses the following:
  1. Overview of the acquisition system
     a) Description of modalities acquired, cameras or sensors utilized, and other equipment necessary (computers, flow management hardware, etc.)
     b) Expected layout of all equipment within constrained space (6'x8')
     c) Network and power requirements
     d) Example use case and workflow
  2. Descriptions of the complexity and maturity of the acquisition system
     a) When was the system first conceived and developed? Is it still under development?
     b) Known acquisition issues (height, weight, or disability restrictions, etc.).
     c) Has a third party integrated your system into a larger system? If so, how much effort was needed?
     d) Describe any past or present operational deployments.

Acquisition System Application Package

3. Descriptions of the imagery acquired by the system
   a) Sample types produced (slap vs four single print for example)
   b) Formats (jpg, png, wsq, etc.)
   c) Quantity and Quality
4. Description of user interaction with the system
   a) Actions the users perform to complete a transaction
   b) Instructions / feedback provided to users
   c) Are there any exception processes?
5. Estimates of Performance
   a) Estimated failure to acquire rate
   b) Estimated true positive identification rate using a top 3 recognition algorithm
   c) Estimated transaction time

Acquisition System Application Package

6. System safety information, including eye safety
    a) Demonstrate why system is safe for human users
    b) Does your system use specific wavelengths for illumination?
    c) Are there any sources of exposed current?
    d) Are there any exposed sharp edges or moving parts that could cause physical harm?
7. Demonstration video of system functionality
    a) Provide up to 2 minutes of video demonstrating your system in use.
    b) Should reflect information included in white paper.
    c) If video is too large to include in an email, provide a URL for reviewers to access.

Matching Algorithm Application Package

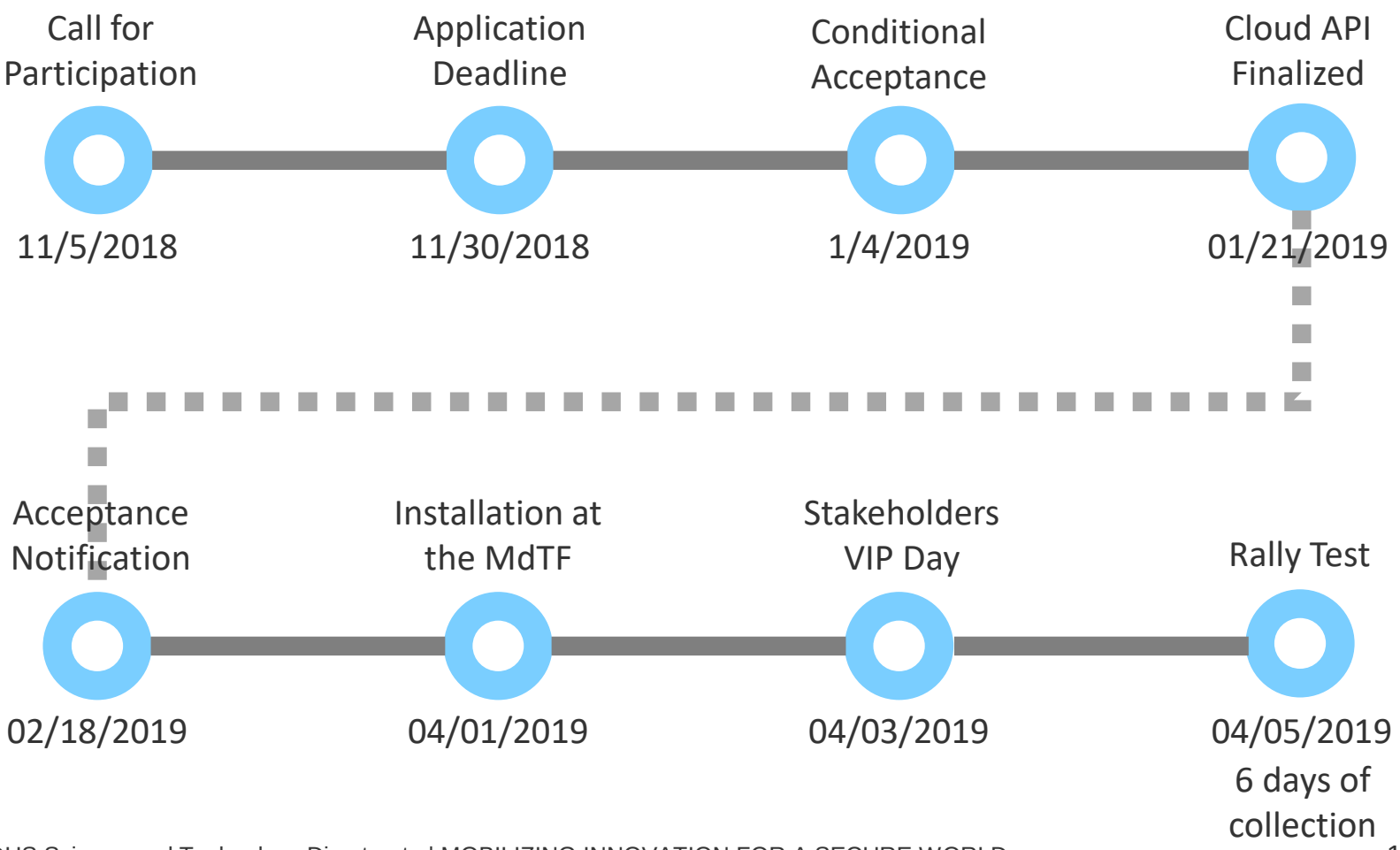
- **Submission deadline:** 11/30/2018
- Provide an application package (limit 5 pages), in the form of a white paper, that addresses the following:
  1. Overview of the matching algorithm
     a) Modalities and acceptable biometric sample types (slap vs. individual finger for example)
     b) High level overview of the underlying technology (CNN, Gabor wavelets, Haar cascades, etc.)
     c) Recommended CPU*, RAM, disk, operating system and runtime dependencies.
     d) What programming languages does the algorithm SDK support?
  2. Descriptions of the complexity and maturity of the matching algorithm
     a) When was the algorithm first conceived and developed? Is it still under development?
     b) Known processing issues (image size, pixels between the eyes, occlusion, pose, or gaze angle restrictions, etc.).

* Algorithms that require GPUs for execution are out of scope for 2019 Rally.

Matching Algorithm Application Package

2. Descriptions of the complexity and maturity of the matching algorithm
    c) Has a third party integrated your algorithm into a larger system? If so, how much effort was needed?
    d) Has the algorithm been a part of any formal, public testing, such as NIST FRVT?
    e) Describe any past or present operational deployments.
3. Estimates of Performance
    a) Failure to Process Rate (unable to create a template)
    b) True Match Rates and matching thresholds for the following False Match Rates:
        i. @ 1:10,000 FMR. What is the match threshold and the expected TMR?
        ii. @ 1:100,000 FMR. What is the match threshold and the expected TMR?
        iii. @ 1:1,000,000 FMR. What is the match threshold and the expected TMR?
    c) Estimates of algorithm stability to pose, motion blur, low contrast and images from a diverse range of acquisition systems

What to Expect (Acquisition and Matching Systems)



What to Expect

- Upon submitting an application package, you will be notified on whether your system has been accepted for participation in the 2019 Biometric Technology Rally approximately 5 weeks after the deadline.
- An accept into the Biometric Technology Rally will be considered **conditional** until…
  - A Cooperative Research and Development Agreement (CRADA) has been signed by both your organization and DHS S&T.
  - You have demonstrated proper integration into the MdTF API.
  - You have provided the proper safety certifications/documents.
  - Members of your team who will be present at the MdTF during testing have:
    - completed the proper human subject testing training.
    - completed any MdTF specific training.

Thank You!

- Questions?
  - peoplescreening@hq.dhs.gov
- For more information:
  - peoplescreening@hq.dhs.gov
  - http://mdtf.org
    - All 2018 Biometric Technology Rally Results
    - Material from all webinars, briefings, outreach
    - Announcements about future Rally's