1 IT Administrator Survey

1.1 General Questions on Wi-Fi instructions

1. Do you consider yourself to be familiar with Wi-Fi confi gurationon consumer devices in general?

   ○ Yes, I do ○ No, I don't

2. The Wi-Fi configuration instructions (for different operating systems) at your institute were written by different staff members.

   ○ True ○ False ○ I don't know

3. The Wi-Fi configuration instructions (for different operating systems) at your institute were written by staff members that have left the institute.

   ○ True ○ False ○ Some of the instructions were written by former staff members and some by current staff members ○ I don't know

4. Your institute currently supports/is planning to support eduroam.

   ○ True ○ False ○ I don't know

5. In order to use eduroam while travelling, your staff/students should follow the instructions prescribed by the host institute that they are visiting.

   ○ True ○ False ○ I don't know

6. Your institute is using/going to use the eduroam Configuration Assistant Tool (CAT).

   ○ True ○ False ○ I don't know

7. Why eduroam CAT is not adopted at your institute?

   ○ Never heard of eduroam CAT before ○ The CAT user interface is not user-friendly enough ○ Other reasons (please specify in the text box below)

8. It is possible for users to connect to a third-party Wi-Fi network that broadcasts the same SSID as your institute's.

   ○ True ○ False ○ I don't know

9. Setting up a rogue third-party Wi-Fi network with the same SSID as your institute's is too costly, and therefore it is not a practical threat worth considering.

   ○ True ○ False ○ I don't know

10. Do you have any comments regarding campus Wi-Fi and/or eduroam user configurations? Have you faced any challenges in educating your staff/students? Please feel free to share with us in the text box below.

1.2 General Questions on certificates and WPA2-Enterprise

1. What do you think is the purpose of the public key certificate in the context of WPA2-Enterprise?

   □ To enable encrypted communication □ To protect the authentication server from □ To authenticate the authentication server □ Others

2. Certificate validation should be disabled on the client-side in order to make WPA2-Enterprise connection successful.

   ○ True ○ False ○ I don't know

3. The authentication server at your institute uses a self-signed certificate.

   ○ True ○ False ○ I don't know

4. Please evaluate the following statements, assuming that your institute's authentication server is using a certificate signed by a trustworthy commercial Certificate Authority (CA).

   (a) If an operating system complains about the certificate it recevied being invalid, it's a false alarm that can be safely ignored.
   (b) If an operating system rejects the certificate it received (without warnings), it is a bug within the operating system.
   (c) Users need not to worry about the validity of the certificate received by their devices.
   (d) Users are not required to inspect information of the certificates received by their devices.

   ○ True ○ False ○ I don't know

5. The client device (supplicant) should not verify the hostname information on the server certificate.

   ○ True ○ False ○ I don't know

6. If the server certificate has a valid signature from a trusted CA, then hostname information does not need to be verified.

   ○ True ○ False ○ I don't know

7. Do you have any comments regarding the management and usage of public key certificates for WPA2-Enterprise? Please feel free to share with us in the text box below.

   <open question>

1.3 OS-specific questions

1. The remainder of the survey includes a few questions about connecting to WPA2-Enterprise on three sets of operating systems (OS). Please indicate the sets of OS for which you are willing to answer additional questions. (you can pick more than one set)

   □ Android and Chrome OS □ iOS and Mac OS □ Windows 7 and Windows 10

1.4 Questions on Android/Chrome OS

1. A configuration instruction based on Android 6 is also applicable to users with newer versions of Android (7 or above).

   ○ True ○ False ○ I don't know

2. For each of the OS below, please identify whether it is possible for users to install a certificate and use it as the "CA certificate" in the Wi-Fi configuration.

   (a) Android 6 (or below)
   (b) Android 7 (or above)
   (c) Chrome OS

   ○ True ○ False ○ I don't know

3. Asking a user to install a CA certificate is not worth it, as the trouble outweighs the benefits.

   ○ True ○ False ○ I don't know

4. The image below shows a Wi-Fi configuration that will be accepted by the Android UI (please assume proper <username> and <password> have been typed in). Do you think it is secure?

   ○ Yes, it is secure ○ No, it is not secure ○ I don't know

5. Why do you think it is not secure?

   ○ It is not clear whether the server certificate is signed properly ○ Hostname of server certificate is not properly validated ○ Other reasons (please specify in the text box below)

6. The image below shows a Wi-Fi configuration that will be accepted by the Android UI (please assume proper <username> and <password> have been typed in). Do you think it is secure?

   ○ Yes, it is secure ○ No, it is not secure ○ I don't know

7. Why do you think it is not secure?

   ○ It is not clear whether the server certificate is signed properly (1) ○ Hostname of server certificate is not properly validated (2) ○ Other reasons (please specify in the text box below) (3)

8. The image below shows a Wi-Fi configuration that will be accepted by the Chrome OS UI. Do you think it is secure?

   ○ Yes, it is secure ○ No, it is not secure ○ I don't know

9. Why do you think it is not secure?

   ○ It is not clear whether the server certificate is signed properly ○ Hostname of server certificate is not properly validated ○ Other reasons (please specify in the text box below)

10. The image below shows a Wi-Fi configuration that will be accepted by the Chrome OS UI. Do you think it is secure?

    ○ Yes, it is secure ○ No, it is not secure ○ I don't know

11. Why do you think it is not secure?

    ○ It is not clear whether the server certificate is signed properly ○ Hostname of server certificate is not properly validated ○ Other reasons (please specify in the text box below)

12. Please evaluate the claims given in the table below.
    Leaving the "Phase 2 authentication" as "None" in Android and "Automatic" in Chrome OS (see examples above):

    (a) Android
        i. is easier for the user.
        ii. is better for the sake of compatibility.
        iii. has no implications on security.

    (b) Chrome OS
        i. is easier for the user.
        ii. is better for the sake of compatibility.
        iii. has no implications on security.

    ○ True ○ False ○ I don't know

13. It is fine to not verify the hostname of the server certificate as the Wi-Fi configuration UI does not provide an input box for entering the expected domain.

    (a) Android 6 (or below)
    (b) Chrome OS

    ○ True ○ False ○ I don't know

14. The "Default" option for "Server CA certificate" (see example below) means that the incoming server certificate will be validated using the CA certificates that are shipped with and trusted by Chrome OS.

    ○ True ○ False ○ I don't know

15. Certificate Authorities (CAs) getting compromised/going rogue is not a concern, hence validating server certificates using the system's CA certificates is good enough.

    (a) Android 7 (or above)
    (b) Chrome OS

    ○ True ○ False ○ I don't know

16. Do you have any comments on the Android/Chrome OS Wi-Fi configuration UI (e.g., what to add/remove from the UI, how to make it more usable, etc.)? Please feel free to share with us in the text box below.

1.5   Questions on iOS/macOS

1. On macOS, after clicking on the preferred network from the list of SSID (and entering user credentials), a "Verify Certificate" window (example below) popped up. Should the user click the "Continue" button immediately?

   ○ Yes ○ No ○ I don't know

2. Why should the user click "Continue" immediately?

   ○The certificate is already validated by macOS ○ The certificate details (shown after clicking "Show Certificate") can be safely ignored ○ Other reasons (please specify in the text box below)

3. Why do you think the user should not click "Continue" immediately?

   ○ The user should immediately click "Cancel" ○ The certificate details need to be manually validated before clicking "Continue" ○ Other reasons (please specify in the text box below)

4. It is only possible to instruct the user to click "Trust" without further verifying the certificate as iOS marks all certificates as "Not Trusted" (see example below).

   ○ True ○ False ○ I don't know

5. The fingerprint (hash digest) of the server certificate can be found on the "Verify Certificate" window of macOS and the "Certificate" prompt of iOS.

   (a) macOS
   (b) iOS

   ○ True ○ False ○ I don't know

6. On macOS and iOS, asking the user to check the certificate fingerprint is unproductive.

   ○ True ○ False ○ I don't know

7. If checking fingerprint is useful for achieving security, then it should not be hidden by default on the certificate verification window.

   ○ Agree ○ Disagree ○ I don't know

8. Asking users to match the subject name shown on the certificate verification window alone (see examples below; left: macOS, right: iOS) can sufficiently guarantee the trustworthiness of the server certificate.

   (a) macOS
   (b) iOS

   ○ True ○ False ○ I don't know

9. Asking the user to match the issuer name shown on the certificate verification window alone (see examples below; left: macOS, right: iOS) can sufficiently guarantee the trustworthiness of the server certificate.

   (a) macOS

(b) iOS

○ True ○ False ○ I don't know

10. Asking the user to match both the issuer name and subject name shown on the certificate verification window (see examples below; left: macOS, right: iOS) can sufficiently guarantee the trustworthiness of the server certificate.

    (a) macOS
    (b) iOS

    ○ True ○ False ○ I don't know

11. Do you have any comments on the iOS/macOS Wi-Fi configuration UI (e.g., on what to add/remove from the UI, how to make it more usable, etc.)? Please feel free to share with us in the text box below.

    <open question>

1.6 Questions on Windows 7 & 10

1. On Windows 10, the thumbprint (hash digest) of the server certificate can be found in the "Continue connecting?" alert shown below.

   ○ True ○ False ○ I don't know

2. Asking the user to check the certificate thumbprint on Windows 10 is unproductive.

   ○ True ○ False ○ I don't know

3. If checking thumbprint is useful for achieving security, then it should not be hidden by default on the "Continue connecting?" alert on Windows 10.

   ○ Agree ○ Disagree ○ I don't know

4. On Windows 10, asking the user to match the subject name shown on the "Continue connecting?" alert alone (see example below) can sufficiently guarantee the trustworthiness of the server certificate.

   ○ True ○ False ○ I don't know

5. On Windows 10, asking the user to match the issuer name shown on the "Continue connecting?" alert alone (see example below) can sufficiently guarantee the trustworthiness of the server certificate.

   ○ True ○ False ○ I don't know

6. On Windows 10, asking the user to match both the issuer name and subject name shown on the "Continue connecting?" alert (see example below) can sufficiently guarantee the trustworthiness of the server certificate.

   ○ True ○ False ○ I don't know

7. The "Continue connecting?" alert on Windows 10 (see example below) can be disabled through certain configuration options.

   ○ True ○ False ○ I don't know

8. On Windows 10, if the "Continue connecting?" alert is enabled, then the settings made on the configuration window (left of the example below) can be overridden and bypassed by the user with a click to the "Connect" button on the "Continue connecting?" alert (right of the example below).

○ True ○ False ○ I don't know

9. On Windows 7, if the user sees the "Windows Security Alert" window (see example below) when connecting to WPA2-Enterprise mode Wi-Fi, should the user click "Connect" immediately?

○ Yes ○ No ○ I don't know

10. Why do you think the user should click "Connect" immediately?

○ The server certificate is already adequately validated by Windows ○ The additional certificate details can be safely ignored ○ Other reasons (please specify in the text box below)

11. Why do you think the user should not click "Connect" immediately?

○ The user should immediately click "Terminate" instead ○ The certificate details need to be manually validated before clicking "Connect" ○ Other reasons (please specify in the text box below)

12. The "Windows Security Alert" alert on Windows 7 (see example below) can be disabled through certain configuration options.

○ True ○ False ○ I don't know

13. On Windows 7, if the "Windows Security Alert" is enabled, then the settings made on the configuration window (left of the example below) can be overridden and bypassed by the user with a click to the "Connect" button on the "Windows Security Alert" window (right of the example below).

○ True ○ False ○ I don't know

14. The "Verify the server's identity by validating the certificate" (WIndows 10) / "Validate server certificate" (Windows 7) checkbox (see examples below; left: Windows 10, right: Windows 7) should be unchecked.

(a) Windows 7
(b) Windows 10

○ True ○ False ○ I don't know

15. Why do you think it should be unchecked?

○ To make the setup more likely to function as expected. ○ Our school uses a trusted certificate so there's no need to verify it again. ○ Other reasons (please specify in the text box below)

16. On Windows, the "Connect to these servers" checkbox is by default unchecked when the configuration window pops out (see examples below). Should it be left unchecked?

○ Yes, it should be unchecked ○ No, it should not be unchecked ○ I don't know

17. On Windows, all the certification authorities are unchecked by default when the configuration window pops out (see examples below). Should they be left unchecked?

    ∘ Yes, they should all be unchecked ∘ No, at least some of them should be checked ∘ I don't know

18. Why do you think they should all be unchecked?

    ∘ To make the connection more likely to function properly ∘ Windows will automatically determine the correct certificate authorities to trust ∘ Other reasons (please specify in the text box below)

19. Should all of them be checked?

    ∘ Yes ∘ No, only some but not all of them ∘ I don't know

20. On Windows, it is not possible for a user to install a CA certificate and then choose to use it as the trust anchor in the Wi-Fi configuration.

    ∘ True ∘ False ∘ I don't know

21. On Windows, asking a user to install a CA certificate is not worth it, as the trouble outweighs the benefits.

    ∘ True ∘ False ∘ I don't know

22. Do you have any comments on the Windows 7 or 10 Wi-Fi configuration UI (e.g., on what to add/remove from the UI, how to make it more usable, etc.)? Please feel free to share with us in the text box below.

    <open question>

1.7   Demographics

1. How many years of experience do you have in IT support/management?

   ∘ More than 10 years ∘ More than 5 years ∘ More than 3 years ∘ 2 to 3 years ∘ 1 to 2 years ∘ Less than 1 year

2. Which of the following categories best describes your current employment status?

   ∘ Full-time employment ∘ Part-time employment ∘ Others ∘ Prefer not to answer

3. What is the highest level of school you have completed or the highest degree you have received?

   ∘ Less than high school degree ∘ High school degree or equivalent (e.g., GED) ∘ Some college but no degree ∘ Associate degree ∘ Bachelor degree ∘ Graduate degree ∘ Prefer not to answer

4. What is your age?

   ∘ Under 18 ∘ 18 - 24 ∘ 25 - 34 ∘ 35 - 44 ∘ 45 - 54 ∘ 55 - 64 ∘ 65 - 74 ∘ 75 - 84 ∘ 85 or older ∘ Prefer not to answer

5. What is your native language?

   <open question>

6. Which gender do you identify most with?

   ∘ Male ∘ Female ∘ Others ∘ Prefer not to answer

7. Please specify your ethnicity.

   ○ African American ○ Asian ○ Hispanic or Latino ○ Middle Eastern ○ White or Caucasian ○ Multiple races ○ Others ○ Prefer not to answer

1.8 Suggestions

1. Did you find the questions in this survey to be understandable?

   ○ completely understandable ○ mostly understandable ○ neutral ○ mostly not understandable ○ completely not understandable

2. Do you recall question(s) that was not understandable to you or you had difficulty understanding the question(s)? In the text box below, please feel free to write down the question(s)/keyword(s) as you remember.

   <open question>

3. Do you have any suggestions for improving this survey? Please feel free to share with us in the text box below.

   <open question>

2 User Study Questionnaire for SEQR and UI^B

2.1 System Usability Scale Questionnaire.

For each of the following statements, participants were asked to indicate how much they agreed or disagreed on a scale ranging from 1 to 5: 1 being strongly disagree and 5 being strongly agree.

1. I think that I would like to use this UI frequently.

2. I found the UI unnecessarily complex.

3. I thought the UI was easy to use.

4. I think that I would need the support of a technical person to be able to use this UI.

5. I found the various functions in this UI were well integrated.

6. I thought there was too much inconsistency in this UI.

7. I would imagine that most people would learn to use this UI very quickly.

8. I found the UI very cumbersome to use.

9. I felt very confident using the UI.

10. I needed to learn a lot of things before I could get going with this UI.

2.2 NASA Task Load Index Questionnaire

For each of the following questions participants were asked to indicate how much task load they felt about the UI in consideration on a scale ranging from 0 to 20, where 0 indicated the lowest task load and 20 indicated the highest task load.

1. Mental Demand: How mentally demanding was the task?

2. Physical Demand: How physcially demanding was the task?

3. Temporal Demand: How hurried or rushed was the pace of the task?

4. Performance: How successful were you in accomplishing what you were asked to do?

5. Effort: How hard did you have to work to accomplish your level of performance?

6. Frustration: How insecure, discouraged, irritated, stressed, and annoyed were you?

2.3 Demographics and Others Questionnaire

1. How many years of experience do you have in using Android?

   ○ 0 years ○ 1-4 years ○ 5-8 years ○ 9-12 years ○ 13-16 years ○ More than 17 years

2. Have you ever used WPA2-Enterprise Wi-Fi?

   ○ Yes ○ No ○ I don't know

3. Which of the following categories best describes your current employment status?

   ○ Full-time employment ○ Part-time employment ○ Others ○ Prefer not to answer

4. What is the highest level of school you have completed or the highest degree you have received?

   ○ Less than high school degree ○ High school degree or equivalent (e.g., GED) ○ Some college but no degree ○ Associate degree ○ Bachelor degree ○ Graduate degree ○ Prefer not to answer

5. What is your age?

   ○ Under 18 ○ 18-24 ○ 25-34 ○ 35-44 ○ 45-54 ○ 55-64 ○ 65-74 ○ 75-84 ○ 85 or older ○ Prefer not to answer

6. What is your native language?

   <List of languages to choose from along with text input option>

7. Which gender do you identify most with?

   ○ Male ○ Female ○ Others ○ Prefer not to answer

8. Please specify your ethnicity.

   ○ African American ○ Asian ○ Hispanic or Latino ○ Middle Eastern ○ White or Caucasian ○ Multiple races ○ Others ○ Prefer not to answer

9. If you were possible to use a QR code to configure your Wi-Fi network, how well would you accept such a configuration way?

10. Did you encounter any difficulties when working on the tasks?

    <open question>

11. Do you have any suggestions for improving this Human Intelligence Task (HIT)? Please feel free to share with us in the text box below.