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| **Lesson Title : Summarizing Network Traffic with Statistics** | **Unit #:**  **1** | **Lesson #:**  **1** | **Activity #:**  **2** |
| **Activity Title: Analyzing Network Traffic** |

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| **Estimated Lesson Duration:** | **15min** |
| **Estimated Activity Duration:** | **35min** |

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| **Setting:** | **Classroom** |

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| **Activity Objectives:**  **I can calculate specific parameters to summarize the network activity and then identify any anomalies.**  **I can compare my (parameters) results with other members of my group for accuracy.** |

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| **Activity Guiding Questions:**  **What all is sent in a packet?**  **Are all packets the same?**  **What are protocols?**  **How do computers know who they are communicating with?** |

| **Next Generation Science Standards (NGSS)** | |
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| **Science and Engineering Practices (Check all that apply)** | **Crosscutting Concepts (Check all that apply)** |
| ☒ Asking questions (for science) and defining problems (for engineering) | ☐ Patterns |
| ☐ Developing and using models | ☐ Cause and effect |
| ☒ Planning and carrying out investigations | ☐ Scale, proportion, and quantity |
| ☒ Analyzing and interpreting data | ☒ Systems and system models |
| ☒ Using mathematics and computational thinking | ☐ Energy and matter: Flows, cycles, and conservation |
| ☐ Constructing explanations (for science) and designing solutions (for engineering) | ☒ Structure and function. |
| ☐ Engaging in argument from evidence | ☐ Stability and change. |
| ☒ Obtaining, evaluating, and communicating information |  |

| **Ohio’s Learning Standards for Science (OLS)** |
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| **Expectations for Learning - Cognitive Demands (Check all that apply)** |
| ☐ Designing Technological/Engineering Solutions Using Science concepts **(T)** |
| ☒ Demonstrating Science Knowledge **(D)** |
| ☒ Interpreting and Communicating Science Concepts **(C)** |
| ☐ Recalling Accurate Science **(R)** |

| **Ohio’s Learning Standards for Math (OLS) and/or**  **Common Core State Standards -- Mathematics (CCSS)** | |
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| **Standards for Mathematical Practice (Check all that apply)** | |
| ☒ Make sense of problems and persevere in solving them | ☒ Useappropriate tools strategically |
| ☐ Reason abstractly and quantitatively | ☒ Attendto precision |
| ☐ Construct viable arguments and critique the reasoning of others | ☐ Look for and make use of structure |
| ☐ Model with mathematics | ☐ Look for and express regularity in repeated reasoning |

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| **Unit Academic Standards (NGSS, OLS and/or CCSS):**  Constructing and interpreting graphical displays of distributions of univariate data (dotplot, stemplot, histogram, cumulative frequency plot)  Summarizing distributions of univariate data  Describe key protocols and underlying processes of Internet-based services (e.g., http/https and SMTP/IMAP, routing protocols) |

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| **Materials**:  Introduction to Intrusion Detection Reading  Reading Quiz  Analyzing Network Traffic Activity Worksheet  Wire Shark .pcap Handout |

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| **Teacher Advance Preparation:**   * Teachers must have fundamental knowledge of the Networks and Protocols. They should also be comfortable discussing packets and protocols such as TCP, UDP, HTTP etc. A video series produced by code.org can be found at <https://www.youtube.com/playlist?list=PLzdnOPI1iJNfMRZm5DDxco3UdsFegvuB7> to prepare teachers who are unfamiliar with these concepts. |

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| **Activity Procedures:**  Prior to the activity, the following concepts should be taught and discussed:   * Packet Contents - Measures of Center (Mean, Median) * Packet Transfer - Measures of Spread (Range, Interquartile Range, Standard Deviation) * Wireshark - Measures of Position (Quartiles, Outlier) * Protocol * IP Address   For this activity, students will examine the contents of a Wire Shark Packet Capture File. Students will be asked to calculate specific parameters to summarize the network activity and then identify any anomalies.  Break students into groups of 3-4. Each student should be given both the .pcap file from Wire Shark and the Summarizing Network Traffic with Statistics Worksheet.  Students will calculate the parameters individually for the first 15 minutes of work time. After they have calculated the parameters, they will compare their results with other members of their group to ensure accuracy, and then go on to answer the follow up questions. |

**Formative Assessments:** Summarizing Network Traffic with Statistics Worksheet

**Summative Assessments:** Intrusion Detection Reading Quiz

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| **Differentiation:** Grouping – Students will be grouped homogeneously so when circulating, I will be able to focus my attention on the groups that are struggling. |

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| **Reflection:**  **This activity gave students an appreciation for the power of computers. Counting and calculating packets that all look very similar was challenging and frustrating for some students. However, the repetition engrained the process of calculating descriptive statistics in their heads so they will not forget come time for the AP test.** |