Opportunity Title: Trust Mechanisms for Software Defined Networking
Opportunity Reference Code: IC-16-30

Organization Office of the Director of National Intelligence (ODNI)

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Complete your application – Enter the rest of the information required for the IC Postdoc Program Research Opportunity. The application itself contains detailed instructions for each one of these components: availability, citizenship, transcripts, dissertation abstract, publication and presentation plan, and information about your Research Advisor co-applicant.

Application Deadline 4/15/2016 6:00:00 PM Eastern Time Zone

Description There is currently no method available to verify the trustworthiness of devices in the Software Defined Network (SDN) infrastructure. The goal of this research is to develop and apply methods that provide a Root of Trust (RoT) for all SDN entities back to a common point for trust establishment.

Assume an SDN is operational and a new switch connects to the network. Before that switch is allowed to route network packets, it must be validated that the new switch is in a known trusted state. The new device boots, collects measurements of its BIOS, operating system, and applications and updates Platform Control Registers (PCR) within the switch's TPM. The switch sends a message to the trusted device requesting connection to the network. The trusted device queries the new switch its measurements from the PCR's through a Measurement and Attestation (M&A) protocol. The switch assembles and encrypts the information with the nonce provided and sends it to the trusted device that examines the returned contents. Upon satisfactory information being provided, the trusted device signals the SDN controller that the switch may join the network and route packets.

Research is needed to develop and analyze the protocols for the exchanges and evaluation. If the returned values are satisfactory, operation of the switch proceeds. If the values indicate a problem, processes that deny connection are instituted. This process is also applied for revalidation during operation in which the switch will be queried periodically for trusted operation. Should corruption be apparent, the device is disconnected from the network and quarantine procedures take place for evaluation. Other devices within the SDN infrastructure are also updated that the corrupted device is no longer part of the network.

Example Approaches:

Scenarios to consider include making sure that all SDN entities are vetted; one method is through M&A protocols using the Trusted Platform Module (TPM) on the device remotely by a trusted entity. Upon establishment of trust, the entity is permitted to join the network. Periodic M&A activities could revalidate that the entity is in a trusted state.

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Entities typically associated with the SDN in this research include SDN Controllers, applications servers, white switches, hybrid switches, M&A networks, and other support applications. Most of the devices run a Linux OS upon which all applications are run in Virtual Machines (VM's) or containers. Each physical device contains a TPM, and each of the VM's has an associated virtual TPM (vTPM) for trust establishment.

Communications among the physical and virtual devices is via secure channels. Numerous protocols travel among the communications paths among the entities that necessitate a formal analysis of the messages exchanged for non-interference verification.

Eligibility Requirements

- **Citizenship:** U.S. Citizen Only
- **Degree:** Doctoral Degree.
- **Discipline(s):**
  - **Business** (11)
  - **Chemistry and Materials Sciences** (12)
  - **Communications and Graphics Design** (6)
  - **Computer, Information, and Data Sciences** (16)
  - **Earth and Geosciences** (21)
  - **Engineering** (27)
  - **Environmental and Marine Sciences** (14)
  - **Life Health and Medical Sciences** (45)
  - **Mathematics and Statistics** (10)
  - **Other Non-Science & Engineering** (13)
  - **Physics** (16)
  - **Science & Engineering-related** (1)
  - **Social and Behavioral Sciences** (28)