Department of Atomic Energy

DAE has been engaged in the development of nuclear power technology, applications of radiation technologies in the fields of agriculture, medicine, industry and basic research. They have identified 16 problem statements to be addressed in the Smart India Hackathon 2017.

Vulnerability analysis in 64-bit Linux binaries

#DAE17

Total Submissions : 2

Analysing binaries of programs for security vulnerabilities is extremely important when they are used in critical applications. Since computers execute binaries, not source code, analysing binaries gives more truthful results compared to analysing source code. However, binary analysis is challenging task, particularly due to the lack of higher-level semantics information such as type information in the binaries.

This challenge aims at developing a software application that analyses security vulnerabilities in 64-bit linux binaries.

The following templates that indicate security vulnerabilities should be identified

Decryption loop in a polymorphic virus/binary – In malicious binary, decryption loops may appear (may search for email addresses in a user's mail folder or may decrypt the contents of the .rodata or .text section in ELF binaries). For example, figure below demonstrates a possible

Buffer overflow vulnerability – In malicious binary or binary (where secure coding rules are not followed), when a program writing data to a buffer, overruns the buffer's boundary and overwrites adjacent memory location and user can execute any unwanted code by properly crafting the buffer. The challenge is to track the tainted memory locations (when a register or a memory location is getting affected by the user input; called as tainted locations) in the binary which may cause buffer overflow.
Format string vulnerability – This vulnerability occurs from the use of unchecked user input as the format string parameter in certain C (like all printf family, syslog etc.) functions which performs formatting. A malicious user may use the %x format token, or others, to print data from the call stack or possibly other locations in memory. One may also write arbitrary data to arbitrary locations using the %n format token, which printf() family write the number of bytes formatted to an address stored on the stack. The challenge is to do taint analysis in all the functions in the binary for possible vulnerability.
List of Tools that may be used for development of the software – i) Objdump, ii) Gdb, iii) strace

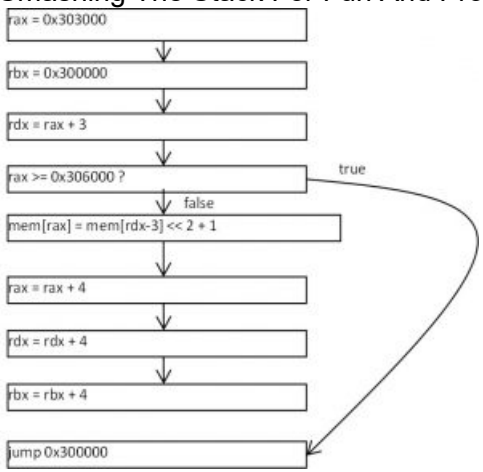
Target system – x86_64 Linux

The challenge is to develop an software application which may use the above mentioned tools and perform the taint analysis on the input executable. The command may be developed as

Cbinana <input program> -o <Taint analysis report>. If –o option is not given, the output will be on stdout.

References –

ERESI – The ELF reverse engineering system interface
Exploiting Format String Vulnerabilities by teso team
Smashing The Stack For Fun And Profit by Aleph one



Sample data: Yes; Contact Shri A.K. Bhattacharya, anup@barc.gov.in

Radionomics is extraction of information from imaging and relating them to diseases and outcomes. The information to be extracted is evolving and web /cloud based tools are being developed that could extract these epitomes without extracting exact data including patient information. This would make large scale data analysis and integration possible, for better resource management.

Sample data: Test data can be provided; Contact Prof V Rangarajan rangarajanv@tmc.gov.in

PARTICIPATE

Programming Guideline checker for C programs

#DAE15 Total Submissions : 12

Embedded systems are ubiquitously programmed using the C programming language. As some of these systems perform tasks important to safety (viz. Cruise Control in Cars, Automation in Power Plants etc), a major requirement of the software for these systems is absence of any runtime errors. A method of assuring excellent code quality is through strict adherence to pre-established programming guidelines.

The purpose of this challenge is to develop a framework that takes as inputs

A C program
A set of programming guidelines from the user and checks if the given program follows the given set of programming guidelines. Any fragment of the program that do not satisfy these guidelines should be identified and flagged.
Example guidelines include:

There should not be unsafe type conversions such as “float” to “integer”, “int” to “char” etc.
Statements that evaluate differently left to right and right to left should not be allowed. eg: statements like a = b[j] + j++;
Bitwise operations are not allowed on signed data types.
Assignment statements in expressions resulting in Boolean value are not allowed. eg: if(b = a)
Comparisons between floating point values are not allowed.
4. Global variables in function parameters are not allowed. It is required to develop a framework called as “Ccheck” in which the programming guidelines will be given as a file and input program in a separate file. The challenge is to output the same program file with coloured annotation (either in text editor or web browser) where it violates the specified guidelines. The interface should be something like this

Ccheck < Specification file> < input program file> -o <output program file>

The team may use any open source software components such as CLANG/LLVM/FLEX-BISON etc., to build such a tool on Linux OS.

Sample Data: Yes; contact Shri A.K. Bhattacharya, anup@barc.gov.in

GOVERNMENT OF INDIA

#DAE14 Total Submissions : 4

Can you device an algorithm to de-duplicate from a billion sets (given that the parameters in the set may slightly vary)? Use searching / Sorting / Approximations / statistics (When can you say TWO sets are more or less same?).

Sample Data: Can be provided; contact Shri B.S. Jagadeesh, jag@barc.gov.in or click below link

https://drive.google.com/file/d/0B2_0rPOtUNpPSm9mSWIwZkdJaDA/view?usp=sharing_eixpa_nl&ts=58761b7d

PARTICIPATE

GPS mapping of resources for Crisis management

#DAE13 Total Submissions : 23

GPS location of important entities/ elements like ambulance, police vehicle, fire brigade, buses and other vehicles can be made available through an app to coordinating agencies across government departments to address requisitioning needs during emergencies. It will help in implementing DAE's Crisis Management Plans.

Sample data: Yes; contact Dr Anil Rawat, rawat@rrcat.gov.in

PARTICIPATE

To make a Cancer Staging and Management App

#DAE11 Total Submissions : 6

To make a Cancer Staging and Management App for management guidelines to be used in and out of Tata Memorial Hospital, based on the Stage of the patient. Kindly refer to the TNM Staging App already implemented on Android smart phones, and then link treatment algorithm to each of these stages.

Sample data: Algorithms for deciding the treatment will be provided. Contact Dr M.H Thakur, thakurmh@tmc.gov.in

PARTICIPATE

GOVERNMENT OF INDIA

To create a Tata Memorial Hospital App, for perusal of the patient while he is at TMH. Not all patients understand the use of website and online access, but they are well versed with Smartphone use.

Citing an example of a workflow of a patient visiting TMH, and is sent for a Radiological investigation.

Once patient registers, along with the file and smartcard, the App is self generated with the file number and App link is sent on patient's phone. Patient may have a choice of language.

Autolink of patient's hospital registration number with Aadhar number which can create background national registries.

The App is also connected to the Smartcard after security pin login, where patient can make all his payments through the App (the way paytm works)

TMH App may be linked with inbuilt positioning system like GPS to show real time destinations to patients from one department to another.

The patient goes to his respective OPD.Here; the clinician enters the clinical details; asks for investigations and sends for further referrals.

This is auto entered into the App
The App page will have a To Do list :
Show where to go for the next appointment/referral.
Show which investigations, for each investigation :
-Fact sheet about the preparation for the investigation as required is popped, followed by an option of 'I Agree' (This improves the likelihood of reading).

-The dates available where patient can choose the slot.

With slot choice, the App asks for Payment for the procedure through the smartcard service linked.
This confirms his appointment and the appointment is registered with the worklist in Radiology Information System (RIS).

The App should send auto reminders to the patient on the day prior to his scheduled appointment along with auto reminder of the preparation at the hospital.

The report is reflected on the App, after entering a security passcode.

Sample data/information: Yes, contact Dr M.H Thakur thakurmh@tmc.gov.in

Patient treatment statistics of Tata Memorial Centre, Mumbai during January, 2016 to June, 2016	https://data.gov.in/catalog/patient-treatment-statistics-tata-memorial-centre-mumbai
Patient treatment statistics of Tata Memorial Centre, Mumbai during January, 2015 to December, 2015	https://data.gov.in/catalog/patient-treatment-statistics-tata-memorial-centre-mumbai

GOVERNMENT OF INDIA

Blood bank App

#DAE9 Total Submissions : 45

Mobile App for real time inventory of blood availability during disasters, in the affected area or close proximity and for contacting blood and platelet donors when needed to donate at the nearest blood bank utilizing geo tracking

Geographic mapping of blood banks and blood storage centers in the country to provide better access to blood

Sample data: Yes; contact Prof S.B. Rajadhyaksha, rajadhyakshasb@tmc.gov.in

PARTICIPATE

Need of a software for Radiation dose monitoring

#DAE8 Total Submissions : 2

The radiation exposure to patients in diagnostic radiological exposure needs to be monitored as annual, 5 yrs and life time cumulative dose.
The data for individual patient for each investigation is available in DICOM format on CT scan, Angiography and digital radiography.
The data for each patient needs to be collated in software which will automatically push the DICOM data to a central server so that overexposure to the patient can be avoided.
So there is a need for availability of a user friendly software and apps for all standard radiological equipments which will have following features:

Linking it to the UID number.
Collecting the information for repeated investigations.
Providing the radiation exposure related information to regulatory authorities like Atomic Energy Regulatory Board.
To come out with focused area wise & disease wise radiation exposure registries that will help to decide the reference dose levels.

Sample data required: yes; contact Prof SB Rajadhyaksha rajadhyakshasb@tmc.gov.in and Dr M.H Thakur thakurmh@tmc.gov.in

PARTICIPATE

Cyber Attacks Threat Map

#DAE7 Total Submissions : 4

very useful in Security Operation Center (SOC) for taking any corrective/mitigation action.

Sample data required: Yes; contact Shri Pradyumna Joshi, joshi@barc.gov.in

PARTICIPATE

Software for Face Recognition out of CCTV footages:

#DAE6 Total Submissions : 21

CCTV cameras are dumping the video footages out of their cameras and we need an application to automatically recognize a given facial image in that database or in online footages. It will be useful to have such an application in following manners:- (i) Security Section can use it to locate the position of any suspected person/visitor in the premises by supplying a photo of the targeted person as input. (ii) In general too, the application can be used to locate the position of a staff in BARC premises, who is not on his seat and he is required to be reported urgently at some place.

Sample data required: Yes; test data can be provided. Contact Shri Kislay Bhatt, kislay@barc.gov.in

PARTICIPATE

Personnel Identification System

#DAE5 Total Submissions : 8

Device a scheme/algorithm to identify persons loitering around a sensitive installation. (Given, RFID parameters, Time stamps, Zone information, Previous data of about a year or so, use Data Analytics. This can be extended to any other sensitive installation. The identification methods/ devices may change.

Sample data required: Yes; dae5_detailed_problem-statement ; dae5_sample_data

PARTICIPATE

Machine learning based control strategy development for plant status monitoring and detection of OFF-Normal conditions

conditions using multi variable analysis. One such requirement is for automation of plant operations which presently heavily depend on the design fixed parameters and or operator's experience of operation under the safe conditions. The machine learning platform may accept multivariable data in suitable form such as 1D,2D,3D…matrices per parameter and generate abstract relations from them to indicate OFF normal and normal conditions of plant, which are defined by operators on the go. The generic machine learning platform can be put to use in any process plant to read from a set of variables and generate abstracted unique patterns for operators to distinguish visually the normal conditions from off normal conditions quickly.
One such example of machine learning is auto pilot and driverless car. If the machine learning platform is applied to the variables of these control applications then it will generate abstract of the conditions for drivers to distinguish the normal and off normal conditions of fleet. The final decision of pattern being off normal or normal is dependent on the control room operator in the case of this problem statement.
It is applied to the process applications where the mathematical models for control are not easily available and or the process is highly depended on fixed operating parameters such as IMPUREX reprocessing control system. With lab scale model of such process one can generate enough data to feed the required machine learning platform and then abstract the control strategy for automation of process control.

Sample data required: Yes; example_dataset_hackathon2017 , hackathon2017

PARTICIPATE

Head Counter

#DAE3 Total Submissions : 14

Real time WEB based Head counter software inside the campus/ buildings for handling the emergency situation. Sensing entry and exit can be taken from any Entry/ Exit sensors.

Sample data required: Yes; contact Shri G.H. Gangoor, ghgangoor@mum.hwb.gov.in

PARTICIPATE

Digital Public Outreach Platform For Nuclear Energy

#DAE2 Total Submissions : 6

Myths and unsound information about the different phases in production of Nuclear Power is a huge impediment in wide spread adaptation of Nuclear Power as a healthy mix of the Power generation spectrum due to paranoia. Lack of widespread education across the masses also leads to backlash and unfounded fears when the topic of Nuclear Power is raised. The stringent quality assurance and safety procedures followed by the Designers and Operators of Nuclear Power Plants are often the best in the world, but are quickly forgotten in the face of misleading claims by some proponents against the use of Nuclear Technology for societal benefits.

3. Information on Measures of Quality Control used in the design of Nuclear Power Plants.
4. Current Installed capacity of Nuclear Power Plants and present power generation. This may be made based on real time data.
5. Display of background radiation data. This may be based on real time data.
6. Information on other uses of Nuclear technology such Isotope Production and use in Medical and NDT, Water desalination etc.

The App can be developed both for Android and iOS platform.

Sample data required: Yes; Content material will be provided; contact Dr A.K. Bhattacharya, anup@barc.gov.in

PARTICIPATE

Personal radiation dosage calculator

#DAE1 Total Submissions : 12

This mobile application can be used as a tool to educate the general public that we live in a radioactive world, and radiation has always been all around us as a part of our natural environment. It will be shown that the amount of radiation that we receive from a nuclear power plant is much less than the amount of radiation dosage that we receive as a result of cosmic radiation, presence of radon in air etc. This will help in reducing irrational fear of nuclear radiation to some extent in the minds of Indian public. It is planned to do radiation dosage calculation based on US-NRC at: https://www.nrc.gov/about-nrc/radiation/around-us/calculator.html and later on tweak/use the figures provided by BARC/AERB.

Sample data required: Yes; can be provided; contact Shri P. Joshi, joshi@barc.gov.in

PARTICIPATE