Department of Information Technology

Academic Year: 2022-23 **Semester: V**
Class / Branch: TE IT Subject: Security Lab (SL)
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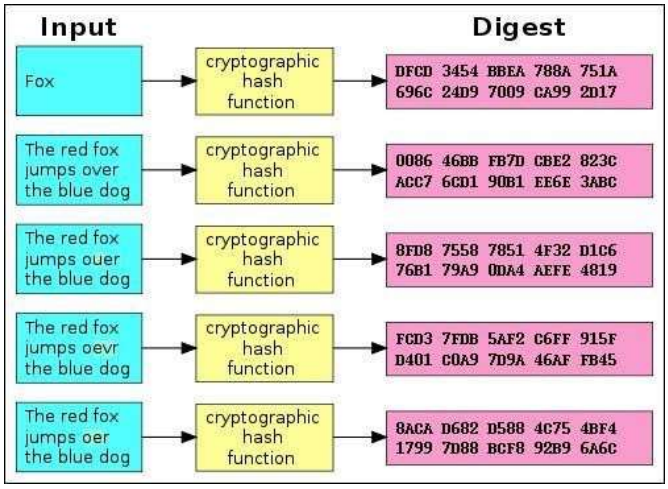
Experiment No. 10

1. **Aim: To study and test message integrity by using MD5, SHA-1 for varying message sizes.**
2. **Software Required : Ubuntu 14.04 OS**
3. **Theory :**

Hashes are the products of cryptographic algorithms designed to produce a string of characters. Often these strings have a fixed length, regardless of the size of the input data. Take a look at the above chart and you'll see that both "Fox" and "The red fox jumps over the blue dog" yield the same length output.



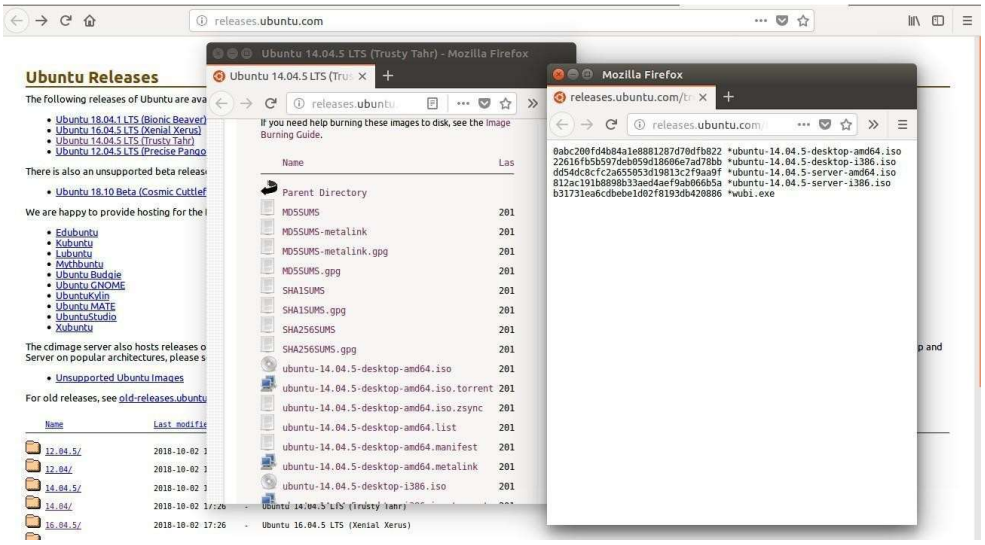
Now compare the second example in the chart to the third, fourth, and fifth. You'll see that,despite a very minor change in the input data, the resulting hashes are all very different from one another. Even if someone modifies a very small piece of the input data, the hash will change dramatically.

MD5, SHA-1, and SHA-256 are all different hash functions.

Here is the comparison between MD5 and SHA1. You can get a clear idea about which one is better.

Keys For Comparison	MD5	SHA
Security	Less Secure than SHA	High Secure than MD5
Message Digest Length	128 Bits	160 Bits
Attacks required to find out original Message	2^{128} bit operations required to break	2^{160} bit operations required to break
Attacks to try and find two messages producing the same MD	2^{64} bit operations required to break	2^{80} bit operations required to break
Speed	Faster, only 64 iterations	Slower than MD5, Required 80 iterations
Successful attacks so far	Attacks reported to some extents	No such attach report yet

Software creators often take a file download—like a Linux .iso file, or even a Windows .exe file—and run it through a hash function. They then offer an official list of the hashes on their websites.



That way, you can download the file and then run the hash function to confirm you have the

real, original file and that it hasn't been corrupted during the download process. As we saw above, even a small change to the file will dramatically change the hash.

These can also be useful if you have a file you got from an unofficial source and you want to confirm that it's legitimate. Let's say you have a Linux .ISO file you got from somewhere and you want to confirm it hasn't been tampered with. You can look up the hash of that specific ISO file online on the Linux distribution's website. You can then run it through the hash function on your computer and confirm that it matches the hash value you'd expect it to have. This confirms the file you have is the exact same file being offered for download on the Linux distribution's website, without any modifications.

Verify Data Integrity :

The checksum is used to verify the correctness of a file. It can be described as a digital fingerprint of a file. By verifying the Checksum value we can determine the correctness of a file while it's been transferred from one location to another. The checksum is a long string of data containing various letters and numerals. All popular software downloading websites provides a checksum value for the downloaded file with which we can confirm our data by verifying the checksum value.

Generating Checksums

A checksum is generated by a checksum algorithm. It generates a checksum value by taking the file as input. MD5 and SHA (Secure Hash Algorithms) are the most popular algorithms used for generating the checksums.

Command-line Checksum tools

Almost all Linux distribution provides the command line tools for various checksum algorithms. You can generate and verify checksum with them. Some of the standard command-line checksum tools used nowadays are the followings:

MD5 checksum tool is called: md5sum

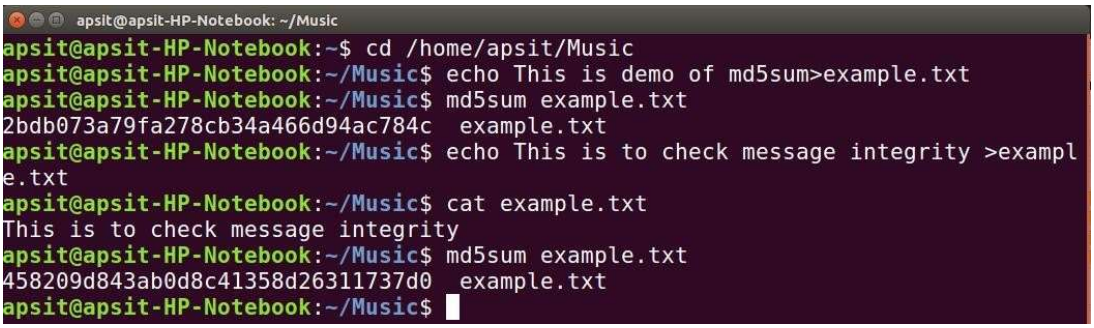
SHA-1 checksum tool is called: sha1sum

SHA-256 checksum tool is called: sha256sum SHA-384 checksum tool is called: sha384sum

SHA-224 checksum tool is called: sha224sum SHA-512 checksum tool is called: sha512sum md5sum: MD5 is an algorithm that is used to verify data integrity through the creation of a 128-bit message digest from a data input that is claimed to be as unique to that specific data as a fingerprint to a specific individual.

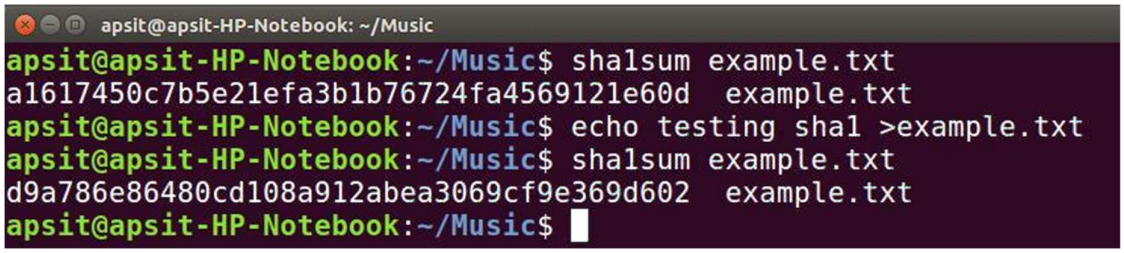
On Linux, access a Terminal and run the following commands to view the hash for a file :

Even a small change to the file will dramatically change the hash. We try to make changes and view the hash values again.



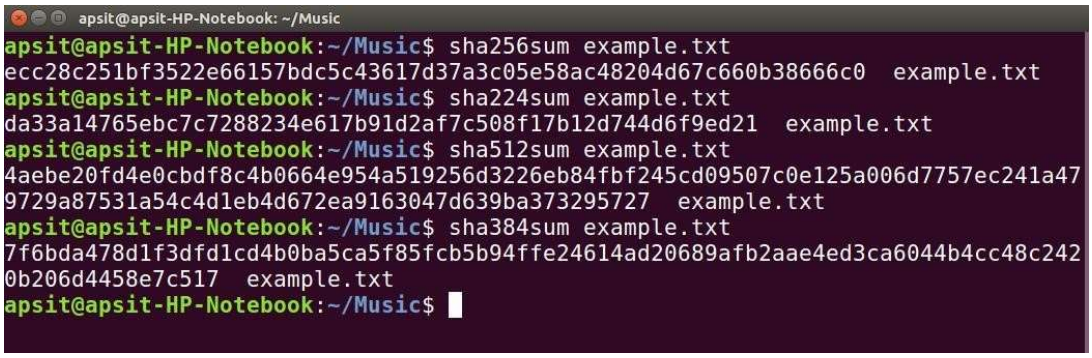
sha1sum:

SHA-1 (Secure Hash Algorithm 1) is a cryptographic hash function designed by the United States National Security Agency. SHA-1 produces a 160-bit (20-byte) hash value known as a message digest. Please see the sha1 hash value for the same file.



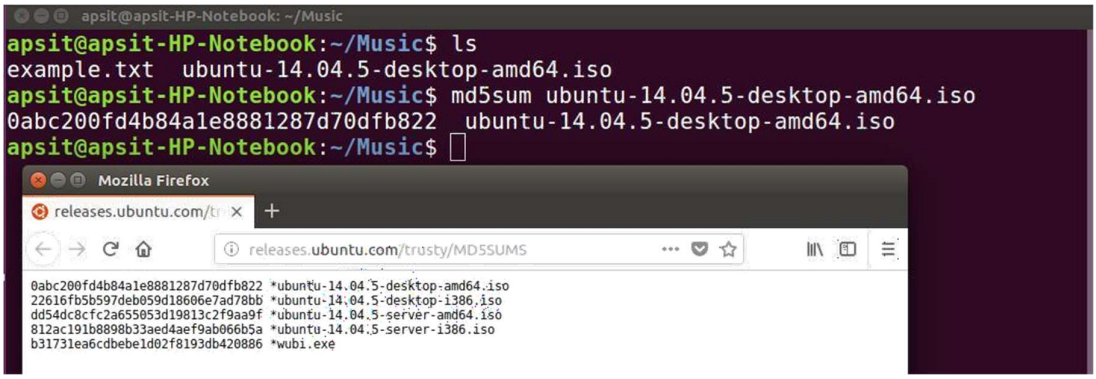
sha256sum/sha512sum/sha224sum/sha384sum:

SHA-2 is a family of two similar hash functions, with different block sizes, known as SHA-256 and SHA-512. They differ in the word size; SHA-256 uses 32-bit words whereas SHA-512 uses 64-bit words. There are also truncated versions of each standard, known as SHA-224, SHA-384, SHA-512/224 and SHA-512/256.SHA-256 algorithm generates an almost-unique, fixed size 256-bit (32-byte) hash. Hash is a one-way function, which cannot be decrypted back. We can generate the hash value using this SHA-256 algorithm for the same file using the command below:



You can confirm the correctness of your downloaded ISO by comparing the checksum value here. It appears to be same, which means you've downloaded the exact file.

If you delete or change even one character from any one of the text files inside the iso image, the checksum algorithm will generate a totally different checksum value for that changed iso image. And that will definitely not match with the checksum provided on the download page.



While hashes can help you confirm a file wasn't tampered with, there's still one avenue of attack here. An attacker could gain control of a Linux distribution's website and modify the hashes that appear on it, or an attacker could perform a man-in-the-middle attack and modify the web page in transit if you were accessing the website via HTTP instead of encrypted HTTPS.

That's why modern Linux distributions often provide more than hashes listed on web pages. They cryptographically sign these hashes to help protect against attackers that might attempt to modify the hashes.

4. **Conclusion** : We have seen how checksum are generated for MD5 and SHA. You can make use of this Checksum method as a redundancy check to detect errors in data. Hence. ensure the integrity of data portions for data transmission or storage.