Project Title

Optimized File Synchronization and Remote Mirroring with `rsync` over SSH

Objective

To build proficiency in high-performance file transfer and synchronization using `rsync`, covering local and remote syncing, safe mirroring with deletion, and SSH-based bandwidth-optimized transfers.

Skills Learned

- Local and remote directory synchronization
- Recursive file copying and syncing with progress indicators
- Using `--delete` for true mirroring and understanding associated risks
- Secure file transfer using `rsync` over SSH
- Using compression and bandwidth-limiting options to optimize in constrained environments
- Real-world backup and deployment automation practices

Tools Used

- **Operating System:** Kali Linux (or any Linux distro)
- **Primary Utility:** `rsync`
- **Secure Protocol:** SSH (`rsync -e ssh`)
- **Options Used:** `-avz`, `--delete`, `--progress`, `--bwlimit`, `-e ssh`

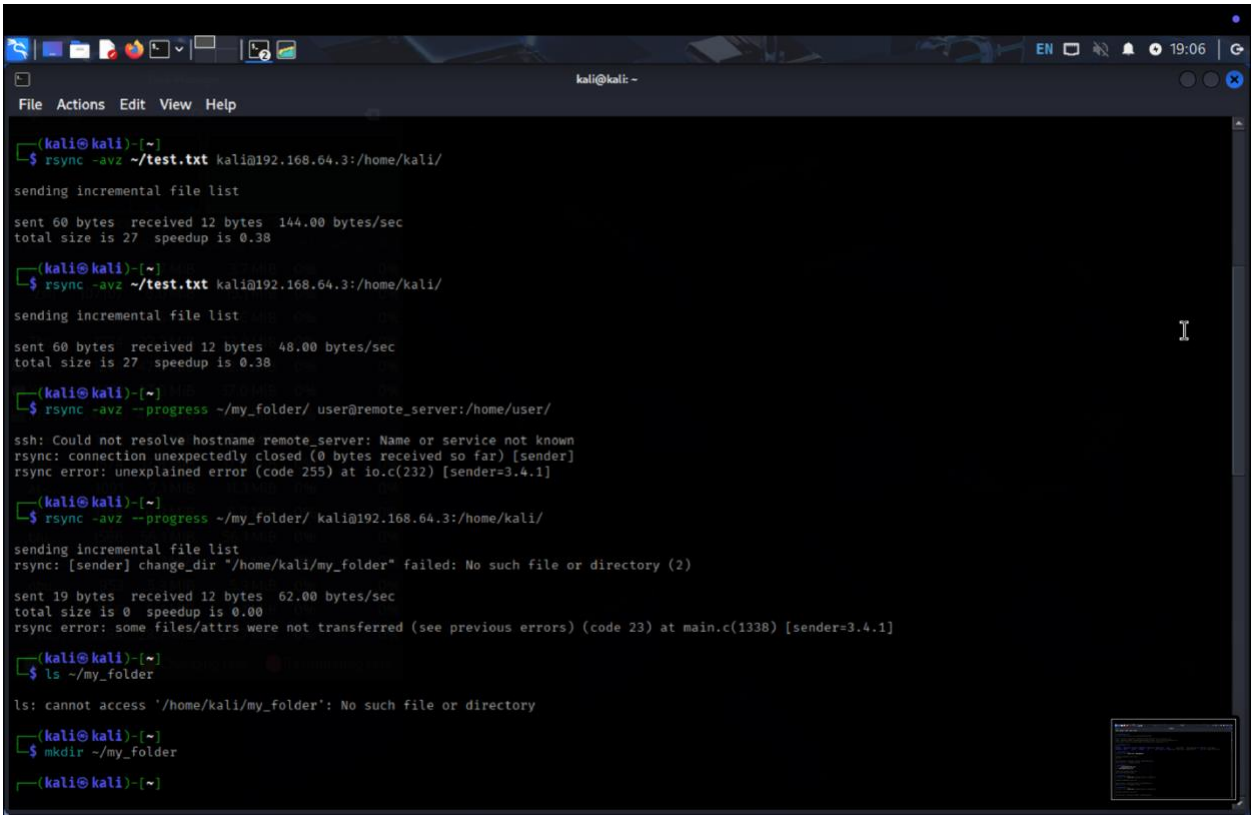
Tasks Performed

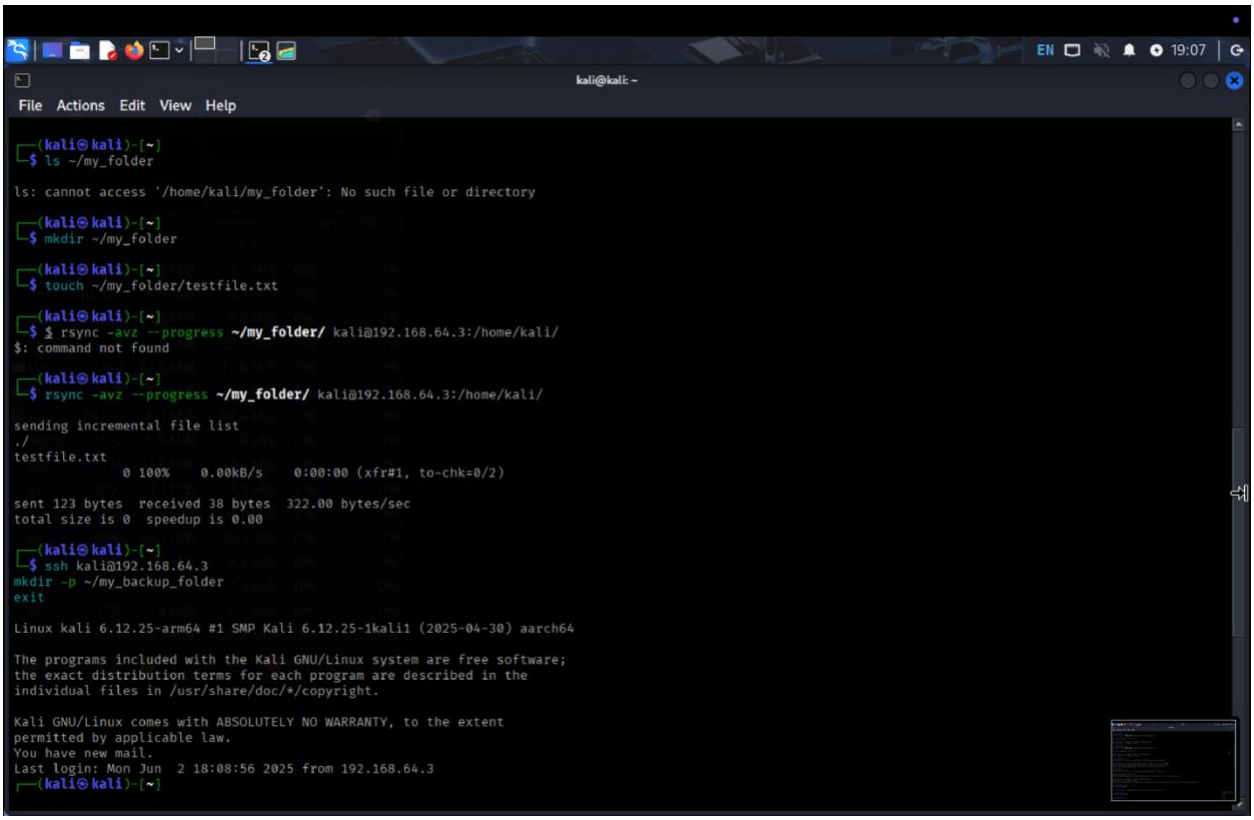
Level	Description
🟢 **Basic**	Copied a file from one local directory to another using `rsync -av file.txt /destination/path`.
🟡 **Intermediate**	Transferred a directory to a remote server via SSH with live progress using `rsync -avz --progress folder/ user@remote:/path`.
🔴 **Advanced**	Used `--delete` to sync and clean the destination directory, making it an **exact mirror** of the source. Discussed risks like accidental data loss.
🔴 **Advanced**	Executed `rsync -az -e ssh --bwlimit=1000` to transfer with compression and limited bandwidth in low-bandwidth scenarios.

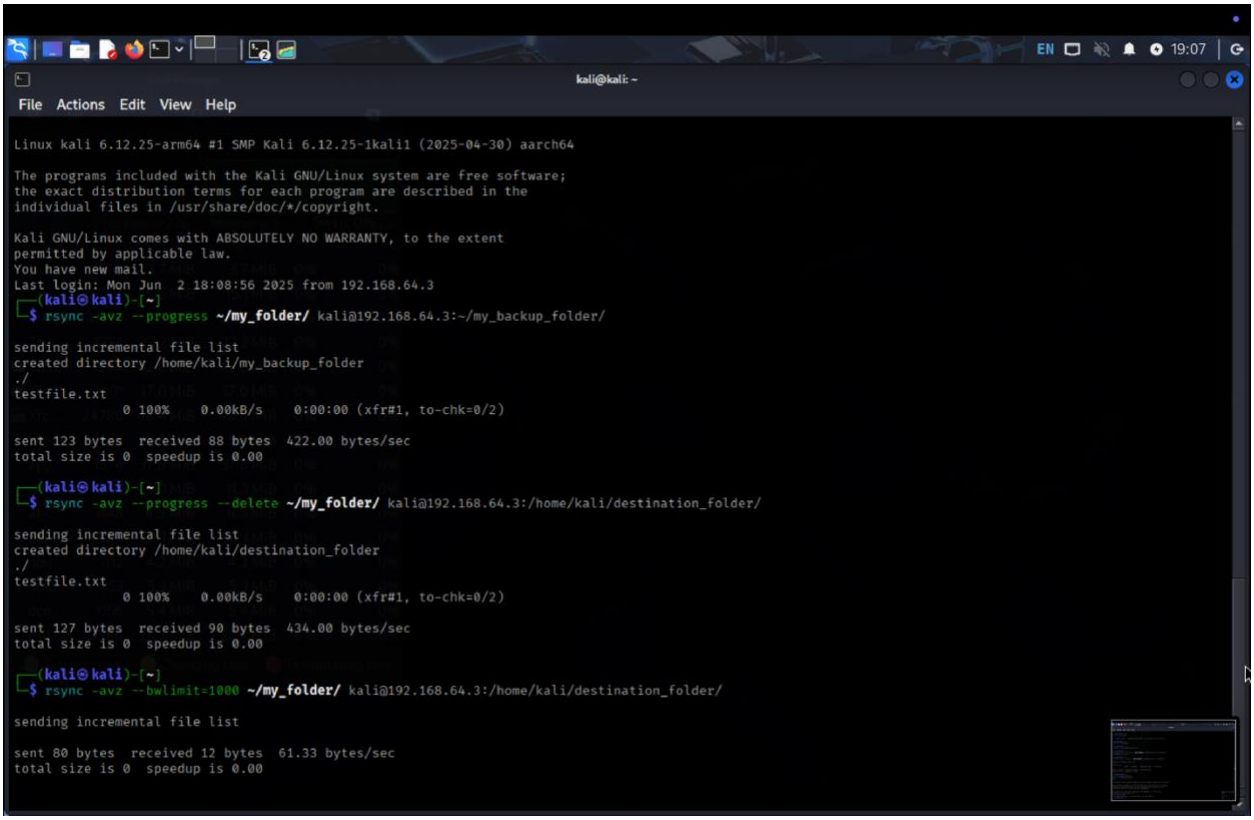
Why This Matters (Real-World Impact)

`rsync` is a go-to tool for **IT professionals**, **SOC analysts**, and **DevOps engineers** when managing backups, deploying updates, or synchronizing logs across environments. Its power lies in **efficiency and safety**—only changes are copied, and it can preserve ownerships, permissions,

and timestamps. Mastering it means you can build robust, bandwidth-optimized syncing systems that scale securely across any infrastructure.




EN
19:07
kali@kali: ~
File Actions Edit View Help
(kali㉿kali)-[~]
$ ls ~/my_folder
ls: cannot access '/home/kali/my_folder': No such file or directory
(kali㉿kali)-[~]
$ mkdir ~/my_folder
(kali㉿kali)-[~]
$ touch ~/my_folder/testfile.txt
(kali㉿kali)-[~]
$ $ rsync -avz --progress ~/my_folder/ kali@192.168.64.3:/home/kali/
$: command not found
(kali㉿kali)-[~]
$ rsync -avz --progress ~/my_folder/ kali@192.168.64.3:/home/kali/
sending incremental file list
./
testfile.txt
0 100% 0.00kB/s 0:00:00 (xfr#1, to-chk=0/2)
sent 123 bytes received 38 bytes 322.00 bytes/sec
total size is 0 speedup is 0.00
(kali㉿kali)-[~]
$ ssh kali@192.168.64.3
mkdir -p ~/my_backup_folder
exit
Linux kali 6.12.25-arm64 #1 SMP Kali 6.12.25-1kali1 (2025-04-30) aarch64
The programs included with the Kali GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
Kali GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
You have new mail.
Last login: Mon Jun 2 18:08:56 2025 from 192.168.64.3
(kali㉿kali)-[~]


EN
19:07
kali@kali: ~
File Actions Edit View Help
Linux kali 6.12.25-arm64 #1 SMP Kali 6.12.25-1kali1 (2025-04-30) aarch64
The programs included with the Kali GNU/Linux system are free software;
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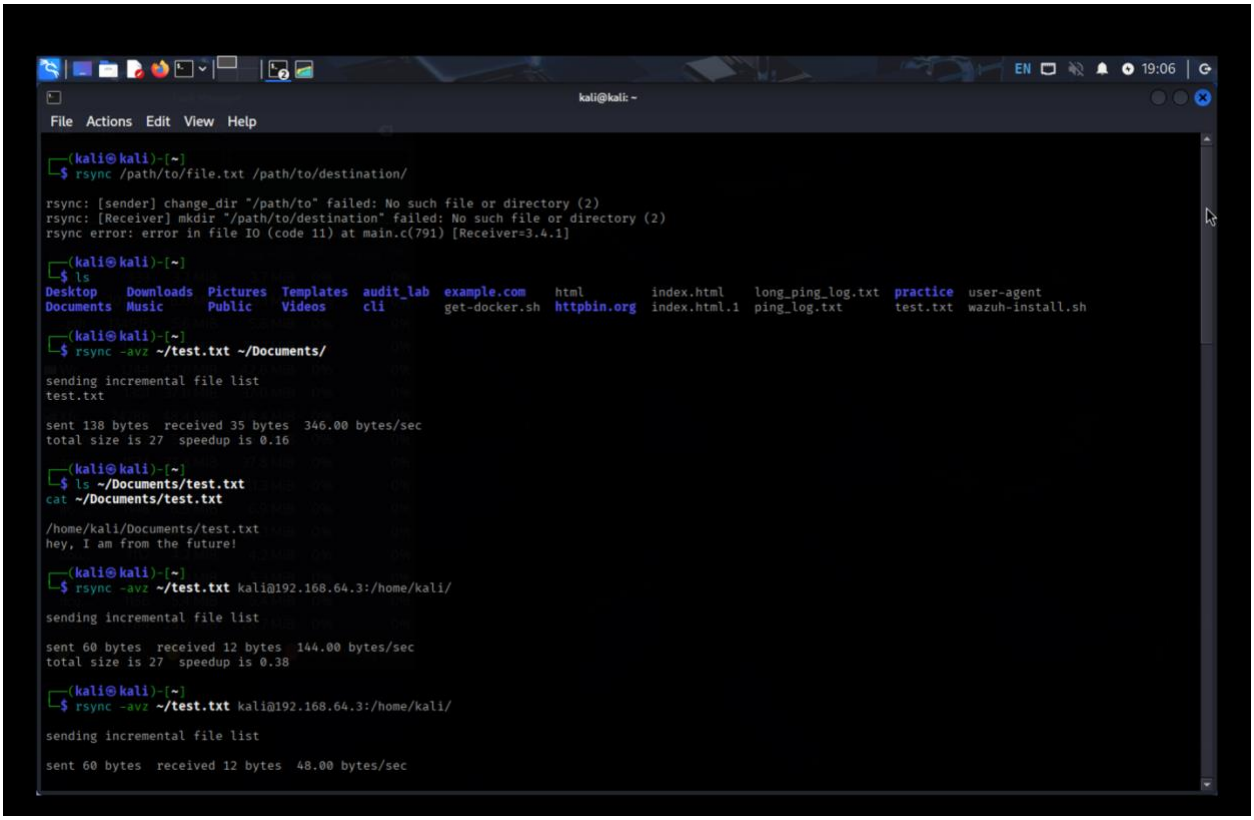
Kali GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
You have new mail.
Last login: Mon Jun 2 18:08:56 2025 from 192.168.64.3
(kali㉿kali)-[~]
$ rsync -avz --progress ~/my_folder/ kali@192.168.64.3:~/my_backup_folder/
sending incremental file list
created directory /home/kali/my_backup_folder
./
testfile.txt
0 100% 0.00kB/s 0:00:00 (xfr#1, to-chk=0/2)
sent 123 bytes received 88 bytes 422.00 bytes/sec
total size is 0 speedup is 0.00
(kali㉿kali)-[~]
$ rsync -avz --progress --delete ~/my_folder/ kali@192.168.64.3:/home/kali/destination_folder/
sending incremental file list
created directory /home/kali/destination_folder
./
testfile.txt
0 100% 0.00kB/s 0:00:00 (xfr#1, to-chk=0/2)
sent 127 bytes received 90 bytes 434.00 bytes/sec
total size is 0 speedup is 0.00
(kali㉿kali)-[~]
$ rsync -avz --bwlimit=1000 ~/my_folder/ kali@192.168.64.3:/home/kali/destination_folder/
sending incremental file list
sent 80 bytes received 12 bytes 61.33 bytes/sec
total size is 0 speedup is 0.00


EN
19:06
kali@kali: ~
File Actions Edit View Help
(kali㉿kali)-[~]
$ rsync /path/to/file.txt /path/to/destination/
rsync: [sender] change_dir "/path/to" failed: No such file or directory (2)
rsync: [Receiver] mkdir "/path/to/destination" failed: No such file or directory (2)
rsync error: error in file IO (code 11) at main.c(791) [Receiver=3.4.1]
(kali㉿kali)-[~]
$ ls
Desktop Downloads Pictures Templates audit_lab example.com html index.html long_ping_log.txt practice user-agent
Documents Music Public Videos cli get-docker.sh httpbin.org index.html.1 ping_log.txt test.txt wazuh-install.sh
(kali㉿kali)-[~]
$ rsync -avz ~/test.txt ~/Documents/
sending incremental file list
test.txt
sent 138 bytes received 35 bytes 346.00 bytes/sec
total size is 27 speedup is 0.16
(kali㉿kali)-[~]
$ ls ~/Documents/test.txt
cat ~/Documents/test.txt
/home/kali/Documents/test.txt
hey, I am from the future!
(kali㉿kali)-[~]
$ rsync -avz ~/test.txt kali@192.168.64.3:/home/kali/
sending incremental file list
sent 60 bytes received 12 bytes 144.00 bytes/sec
total size is 27 speedup is 0.38
(kali㉿kali)-[~]
$ rsync -avz ~/test.txt kali@192.168.64.3:/home/kali/
sending incremental file list
sent 60 bytes received 12 bytes 48.00 bytes/sec