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# Backup and Update Support in Mobile Computing

## Industry Trends and Needs

The space of mobile computing is continuously evolving, and it is doing so rapidly. Therefore, it is important to consider the robustness and capabilities of one's update and backup solutions. Industries such as healthcare, finance, online commerce and others rely more and more on mobile applications and mobile devices for critical tasks .[1]. This has in turn heightened the need for good security. It is commonly known that cyber threats are ever increasing and that mobile devices are some of the most vulnerable. That is why keeping them both updated to mitigate vulnerabilities and backed up in the inevitable event that something happens. In a report by Mordor Intelligence, strong growth is predicted in the cloud backup market [2]. This goes hand in hand with the way the industry is trending and how trends indicate greater reliance on the cloud as well as on mobile devices.

## Current Solutions

Various current solutions exist in this space. Cloud based backups, Over-the-air (OTA) updates, as well as third-party backup solutions. Cloud based solutions such as those offered by Google, Microsoft, and Apple iCloud allow individual users to back up their data easily. All these services make use of encryption to secure data. These types of backup solutions are referred to as off-site backup solutions and transfer the risk to another party [3]. There is also the option for local backup solutions such as using a Synology NAS to setup a local backup for those that are more technologically inclined [4]. There are also solutions tailored more towards enterprises. These include for instance AWS Backup that provide cloud backup to larger operations and these also offer integration with other tools based in the cloud [5].

For updates of mobile devices, the primary current solution is over the air updates. These are utilized by all current mobile operating systems including iOS and Android to be able to deliver firmware as well as software updates [6]. This solves the problem of having to deliver updates via physical media, which in the past was the only way to update a product after it was shipped. With regards to app updates, some platforms have support for differential updates or delta updates to reduce download time by only downloading parts of the update that has changed instead of redownloading everything [7]. This can reduce the size of an update by as much as 50 percent greatly improving update speed [7]. This solves the problem of having to redownload and consume more bandwidth while updating on mobile devices that already have limited bandwidth.

**Critical Analysis**

| Solution | Pros | Cons |
|---|---|---|
| Cloud Based Backups | Advantages for cloud based backups include their ability to be low cost, having faster recovery times for smaller data sets, as well as them being able to prevent disruptions that occur as a result of outages in the local storage [8]. In addition to this, cloud based backups allow for data to be consolidated from various different locations on both local and global scales [8]. Cloud based backups also allow for increased accessibility as data assets can be reached from anywhere or device that has internet connection [8]. | Disadvantages for cloud based backups include long back up times for the first initial backup, as well as limitations on how much data can be backed up to the cloud [8]. Additional disadvantages include loss of the users control over the data that has been moved to the cloud, which also impacts the security of the uploaded data assets [8] |
| Over-the-air Updates | Advantages of OTA updates include its ability to be updated remotely, its use of modular updates that require lower energy consumption in comparison to total firmware updates, and its ability to provide support for integration new functionalities [6]. OTA updates also have enhanced security capabilities, as they provide security patches and fixes to bugs, which make for improved device integrity and the reduction of vulnerabilities . | Disadvantages of OTA updates include them causing additional network traffic during the update process, which causes increased latency, as well as being resource intensive due to its use of strong encryption and authentication methods [6]. |
| Differential Updates | Advantages of differential updates include having a lower energy consumption, lower cost, and quicker update times [9]. | Disadvantages of differential updates include the potential for security risks in instances where the differential update mechanism is implemented |

| | | |
|---|---|---|
| | Additionally, differential updates minimize bandwidth usage due to lower data transmission quantities, which also result in having less network congestion [10]. | poorly, as well as being dependent on the original firmware version [10]. Another disadvantage of this method include having a more complicated process when it comes to generating and applying updates, which means that flaws in the update could corrupt the software [9]. |

**Proposed Solution**

In order to mitigate the limitations faced by cloud-based backups, I suggest using an optimized cloud-based backup framework as a replacement. The optimized cloud-based backup I am suggesting would be able to perform the initial backup to a local device, which decreases the amount of time that it would take to complete the initial backup had it been done using a non-optimized cloud-based backup method. Additionally, optimized cloud-based backup has the option of hybrid storage, where data that is frequently accessed is stored in the cloud, whereas older data is stored locally, which helps to mitigate against the issue of slow data retrieval and lower the strain on the cloud storage capacity [11]. Furthermore, this solution would encrypt all data on the device of the user prior to being uploaded to the cloud, which helps to secure and maintain the integrity of the data. This method would increase redundancy and speedup initial backups

The main problem with OTA updates is increased network traffic and resource usage [6]. To overcome these issues, I suggest implementing the following framework. One of the primary things that will help is rolling out updates in smaller batches, thus limiting the impact to the network [12]. Additionally, focusing updates based on their importance would help target resource usage. Prioritizing the pushing of updates that are critical for security as soon as they become available while leaving big feature updates for low usage periods such as overnight when a device may be charging would likely be best. Finaly, I would propose integrating light weight authentication processes such as using pre-shared device credentials as this would reduce the processing burden during updates while still allowing for some security during the update process [13].

In order to mitigate against the limitations of differential updates, I propose an improved differential update framework. Differential updates are prone to security risks, as they only download parts of the software that have been altered. I propose this to be improved by utilizing hash-based checks that will guarantee that updates have maintained their integrity [14]. Additionally, I would include in my framework support for version rollback. This would allow reverting devices to previous versions in the event that un update becomes corrupted or is otherwise unsuccessful [13]. I would also propose offloading the strenuous weight of processing from the device that is being updated by pre-processing differential updates on the server. This

would allow the challenges regarding computation of the differences to be calculated by the server instead of limited resource mobile devices [13].

**Conclusion**

The mobile computing space is rapidly evolving and has seen widespread adoption. This has created more of a need to address problems with update and backup mechanisms. This paper proposed optimized frameworks with respect to the challenges existing within OTA updates, cloud-based backups, and differential updates. A solution that balances initial backups, frequent accesses in the cloud, and user-end encryption will make for a fast and secure backup in a hybrid cloud-based solution. OTA updates can be improved by issuing updates in smaller batches, prioritizing critical updates, and utilizing lightweight authentication processes that can ease network and resource intensive issues. Lastly, differential update enhancements through hash-based integrity checks, version rollback support, and server-side pre-processing ensure secure and efficient deployments of updates. Together these three frameworks will hopefully strengthen update and backup systems for mobile devices

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