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DOCKING STATION WITH ON-DEMAND PHYSICAL MEMORY (RAM) ENHANCE PROCESSING POWER AND USER EXPERIENCE

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Title: Docking Station with on-demand Physical memory (RAM) enhance processing power and user experience.

Abstract:

Notebook computers conventionally operate on volatile memory that is RAM for accessing multiple programs at once with Speed and efficiency, as RAM is significantly faster than hard disk. When operating a device with multiple heavy application that requires heavy usage of volatile memory to process information immediately, RAM helps to succeeded with the task when there is enough of memory available with the device's RAM.

In designing notebook computers, there is trade-off between the size of the RAM to be fitted for performing better operations. Often devices have limited RAM and the applications that are being used/ operated needs more memory for faster operations, this requirement may not be fulfilled by the volatile memory present in the device. Although there have been many advances in the technology over the years to solve this issue, providing external RAM for uninterrupted services is still a challenge.

To provide high volatile memory space for faster operations, many manufacturers provide additional slots to add RAM to their devices for increasing the performance of the devices for performing various tasks, but this comes with the cost of hardware changes which have some cons associated with it.

Also, when the extended capacity of RAM is not needed it should be plugged out and the actual RAM of the device should be used, which is not possible in case if additional RAM is added to the device in its hardware circuitry. Unfortunately, notebook computers often cannot make changes in the hardware circuitry to meet with the requirement of the RAM.

So, as to address this problem we are proposing to modify the design of the docking stations. We are proposing to add RAM to dock in docking stations, when an external high capacity volatile memory will be connected to the notebook computer which can be used whenever required without making change in device hardware. This will also provide an additional interface between the notebook computer and the docking station for sharing volatile memory. These modifications are often implemented at the expense of the ergonomic layout of the docking station and/or additional equipment and cost.

Problem Solved:

Currently Docking Stations are manufactured and supplied by numerous manufactures based on the requirements of compatibility with devices/ peripherals. It may be desirable to provide additional components for better and advanced functioning of docking station. Also, docking stations themselves may include circuitry that may be powered by the docking station itself responsible for carrying out various operations helping the primary notebook computer to carry out faster operations. RAM are responsible to carry out such operations for multiple programs, but the RAM are only limited to the primary devices due to limitation of speed; as they are significantly faster than a hard disk. The typical data transfer rate of the RAM is ranges around 5gbps to 20gbps. Due to this high transfer speed there are various limitations for using an external volatile memory. This can be solved by using thunderbolt cable interface between the docking station and the notebook computer.

A docking station is an external plug and play device connected to the primary source that is notebook computer. Usually there is a limitation of RAM for the primary devices, which can result in lowering the device performance in terms of many factors such as speed, operations etc. RAM of a docking station can help in overcoming this situation and can make the primary device to deliver better results in terms of the performance.

Detailed Description:

RAM for the Docking Station:

There are two types of computer memory, namely physical and virtual memory. The RAM chips attached to your motherboard represent the physical memory, whereas the virtual memory comes from the reserved space within your hard drive. When a program is not in use but open, the Windows system uses the virtual memory to store its data.

Now, if you have a notebook computer with little RAM, less than 8GB, to be precise, then you need to upgrade your device by increasing virtual memory using your external hard drive. There are a lot of untrustworthy theories about boosting this and that on your computer to make it better. In most cases, the misleading of readers comes from the wrong presentation of information, whether intentional or unintentional. For instance, in this case, increasing virtual memory will not increase the memory inside the RAM chips. The RAM chips' capacity cannot be changed unless they are taken back to the manufacturing company for reconstruction. Therefore, this disclosure is focusing on adding secondary physical memory fitted into the docking station to which the primary notebook computer with primary physical memory is connected. So, how does using an external source secondary memory increase RAM and improve performance?

Well, with more physical volatile memory, a computer is able to multitask, therefore completing tasks faster. If a program is open but idle, the computer can shift its data to this secondary physical memory, thus relieving the physical RAM. Thus, when properly configured, the notebook device will improve its performance. Now, for you to understand things better, let's first explain how this secondary physical memory works before diving deep into the setup procedure.

Secondary physical memory will be kept in a system file called page file or paging file. Secondary physical memory is not accessible to the user and can only be accessed under two circumstances: when the physical RAM is overloaded and when there are programs that are open but idle. So, the first scenario is common among notebook devices that have little primary physical RAM. When your notebook device is running low on physical memory, the newly generated data from programs that are being opened still needs to go somewhere. You may wonder, why not just increase physical RAM? Remember, old notebooks have a limited RAM volume, i.e. on some old notebooks, motherboards can only take up to 4GB of RAM. Therefore, you are only left with secondary physical memory. So, once the physical RAM is left with no space, Windows turns to paging files, which opened programs will use as if they were physical memory. When an open program is minimized or not in use for some time, its data is moved from primary physical memory RAM to secondary physical memory fitted inside the docking station, hence space for other applications and important system operations. This, in turn, helps the whole computer system to run efficiently. This secondary physical memory fitted inside the docking station plays a pivotal role in keeping your notebook computers operations smooth.

The other facts that is needed to be consider when it comes to secondary physical memory before setting it up. The secondary physical memory is the thought that it operates the same way as physical RAM. However, there is a misconception that secondary physical memory cannot substitute RAM, and it is slower. Even if used on the fastest solid-state drive, it will remain slower than physical memory.

RAM is a crucial piece of hardware. It is used by the processor and other components to store their processes, and vital data. it does not need to be 'physically' close to the processor. The electrical signals, that carry your data travel fast enough that you won't notice the difference.

The main aim of the RAM is to provide faster operations. RAM fitted inside a docking station has to transfer the data at a faster speed which can be achieved by the thunderbolt cables. Overcoming the misconception that secondary physical memory cannot substitute RAM.

Description of Thunderbolt cables

Type: Thunderbolt Cables
Technology: Thunderbolt; USB 3.1 (Gen 2)
Connector 1: (1) USB C (MALE)
Connector 2: (1) USB C (MALE)
Length (m): 2.00 - 4.59
Data Transfer Rate: up to 40 Gbps

Analysis for transferring data at a high-speed rate:

Interfaces, like USB, have varying supply across different ports, which enables you to share power supply among multiple connected devices. This will be a major issue, since RAM is volatile and an undermined supply will affect the operations, and ultimately your crucial data, which your processor needs. Moreover, interfaces like USB offer very low data rates as compared to the interface which the RAM uses. A USB 3 is limited to 5Gigabits/second a theoretical max data transfer rate of about 620 MegaBytes/second.

The slightly older DDR2 RAM even the slowest DDR400 has a peak data transfer rate of 3200MegaBytes a second. which as you can see is still massively faster. The slowest DDR3 RAM PC3-6400 is still 6400MegaBytes peak transfer rate per second. So, USB 3.0 is 5780megabytes/s slower. Thunderbolt cables with a data transfer rate upto 40 gbps can help in solving this data transfer rate issue.

Therefore, if your computer is slow due to not having enough physical RAM memory, having sufficient amount of secondary physical memory provided via docking station along with a well-setup paging file system will help in stabilizing and bettering its performance and will definitely make it much faster. The amount of secondary Physical memory need depends on your user needs. To be precise, the amount of secondary Physical memory you need depends on the amount of physical RAM you have and how much memory you usually use.

Application based working of Docking Station RAM (secondary RAM):

In the Task Manager user can see a list of Application that are consuming the physical memory i.e. RAM, based on their memory consumption the applications can be divided into two categories. First being those application that requires varying amount of RAM that is the memory consumption is not constant and the requirement fluctuates a lot, these are the active application that the user is using frequently on their primary device.

Second types are those application which requires a constant amount of RAM (consumption may fluctuate but very less), these are the application that are very rarely used by the user or these can also be the background application.

We have secondary RAM (fitted in docking station) connected to our primary device that is laptop having primary RAM through thunderbolt cable, so when the secondary RAM is connected to the primary device the application that requires kind of uniform RAM will be shifted to the Secondary RAM this will free up the space of Primary RAM which can then be used by the live application that are being used currently by the user. This have several advantages, the major being the speed-up of

the device, beside this the free up memory can help in lowering the power usage trend of the application which can help in maintaining optimum temperature of the device.

Analytics for Docking Station:

The docking station needs to be monitored to provide ease of operation and uninterrupted experience without any glitch. This is possible if the health of the docking station is continuously monitored and actions are taken to avoid failures and take steps accordingly. For this we are coming up with the Analytics for the Customized Docking Station.

STEP 1: Data Collection

Docking Station is a Plug and Play device. Data Acquisition software will be responsible for collecting all the data for the components and peripherals that are present inside the proposed Customized Docking Station. As an example consider the data collection of battery to monitor the battery health, there are temperature sensors for battery which provides the its operating temperature, so our data acquisition software will collect the relevant battery temperature data which will be stored as logs.

STEP 2: Feature Engineering

Data collected will be stored in the data class and based on that data feature vectors will be derived to act further on the data. The feature vectors are assigned weight which contributes to deriving the health status of the docking station

Feature Vectors are as follows:

Sr. No.	Table Name	Column Name	Weightage
1	ah_pnpdevice	serialnumber	100
2	ah_pnpdevice	productid	100
3	ah_pnpdevice	uuid (class guid)	100
4	ah_pnpdevice	Unitmodel	100
5	ah_pnpdevice	devicedetected	100
6	ah_pnpdevice	devicename	100
7	ah_pnpdevice	deviceservice	100
8	ah_pnpdevice	Devicepnpid	100
9	ah_pnpdevice	Parentpnpid	100
10	ah_pnpdevice	Devicestatus	100
11	ah_pnpdevice	Pnpdeviceclass	100
12	ah_pnpdevice	Manufacturer	100
13	ah_pnpdevice	Hardwareid	100
14	ah_pnpdevice	Pnpfirmwareversion	100
15	ah_pnpdevice	pnppowerstatus	100
16	ah_pnpdriver	driverdetected	100
17	ah_pnpdriver	version	100
18	ah_pnpdriver	driverinf	100

STEP 3: Data Wrangling and Reports based on the data

Now for different ports and components /peripherals inside the docking station the health metrics data (data to inspect how healthy the component is; which includes its hrs of operation, temperature, usage of peripherals, software/ drivers installed etc). These health metrics will then be computed to provide the health report of the docking station through dashboards/ charts or some survey reports.

Analytics will provide more power to the Customized Docking Station as we will be able to tell what is wrong, what will be wrong, what to do to ensure ease of operation by capturing health metrics and carrying out data computation using various statistical and probabilistic methods. (To provide clearer view on capturing health metrics: we will be predicting the timeframe in which any component inside the docking station can run out of use or needs replacement or needs upgrade (consider ram as an inference).

Advantages:

1. Plug and Play Secondary Physical memory (RAM) for better and faster performance of the notebooks.
2. Additional RAM providing more power to the device.
3. Analytics on the data collected from the peripherals inside the docking station for better performance and derivation of useful insights.

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