

Industry Perspectives Video Translation

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Hi, my name is Monica Alderighi.

大家好，我的名字是Monica Alderighi。

I am a researcher of the Italian National Institute for Astrophysics and I am going to talk about radiation-induced faults in terrestrial applications.

我是義大利國家天體物理學實驗室的研究員。我將陳述有關輻射引發故障，對地面應用的影響。

Radiation induced faults are well known to represent a serious issue in space applications.

輻射引發故障是在太空應用上，廣泛已知代表性的問題。

Suitable methodologies and techniques have been developed to cope with this issue.

有許多方法及技術已經被發展出，以解決此問題。

In terrestrial applications, phenomena have traditionally been considered less severe due to atmospheric shielding.

在地面應用中，這種現象通常被認為造成較小的影響，主要是基於大氣層的保護。

However, because of the progressive reduction of feature sizes and operating voltages, this might no longer be true.

但是，因為隨著物件特徵逐漸縮小，以及操作中電壓的降低，大氣層減低輻射引發故障影響還是存在著。

In terrestrial applications, the predominant radiation issue is the soft error that happens when a single radiation event modifies a data bit stored in a device until new data are written.

在地面應用中，輻射產生軟性錯誤，通常發生單個比特受到輻射影響，而改變了儲存數值，直到有新的寫入資訊。

Radiation interacting with devices and integrated circuits usually originates from cosmic radiation entering the earth atmosphere.

輻射對積體電路及相關設備的作用，通常起源於宇宙輻射線進入地球大氣所致。

As cosmic radiation strikes ions and molecules of the atmosphere, it produces a wide variety of particles, including neutrons.

當太空輻射撞擊了大氣層中的離子及分子時，產生了各種的粒子，其中包含中子。

Neutrons are responsible for soft errors.

中子是造成軟性錯誤的主因。

If we consider a generic microelectronic device, the probability that it fails because of a neutron induced faults is very low.

如果我們以一個普通的微電子設備為例，該設備因為一個中子出錯的機率是非常低的。

If a soft error occurs in our personal computer, usually it does not cause big damages.

當軟性錯誤在個人電腦上導致錯誤時，有時也未必造成大破壞。

We barely realize it, and at most we lose some work.

我們通常幾乎不察覺，最多也只是失去部分的工作內容。

Computers are also present in many non PC products of our daily life, such as cell phones and music players.

除了個人電腦外，電腦技術也用於其他日常生活用品中。例如，手機以及音樂播放器。

Also in those cases, soft errors don't cause big troubles.

當然在這些生活用品上，軟性錯誤通常不致造成大錯。

Let us make another example and consider another technology and a common device, one flash based disk, one terabyte size.

我們來看另一個例子，也來考慮另一種技術以及常用的設備。例如，一個T字節的快閃儲存碟。

The probability of a soft error is again very low, about one error every three years.

軟性錯誤的機率還是非常低的，大約是每三年一次錯誤。

But now let us consider an installation, such as a data center, with one hundreds disks, functioning in parallel.

但是，讓我們考慮一個軟件的安裝。例如，在資料中心中，上百個磁碟並行運算的軟件。

In that case, to calculate the soft error rate, it is necessary multiply the soft error rate of one error every three years, by the number of disks in the installation.

在這個例子中，計算軟性錯誤的機率，我們必須把每三年出錯一次的機率，乘上上百個磁碟的數量。

This results in one error every ten days, instead of the previous one error every three years for one disk.

結果是每十天有一次錯誤，而非先前的在一磁碟上每三年出錯一次。

Moreover, the intensity of neutrons in the atmosphere varies with altitude and latitude.

另外，大氣中中子的強度會隨著經緯度及海拔高度而改變。

For instance, if we consider two locations at ground level, New York City and the Alps 4500m, height,

例如，以二個地表上不同位置或城市而言，紐約市區及四千五百公尺高的阿爾卑斯山。

the intensity of neutrons in one square centimeters per second, on the Alps is roughly twenty times higher than that we find in New York City.

中子在每平方公分每秒的強度，在阿爾卑斯山上約是紐約市中的二十倍。

This has consequences on the soft error rate of devices.

此現象對軟性錯誤發生機率有顯著的不同。

If we bring our one terabyte disk to the Alps, we could expect about one soft error every three months, instead of three years.

如果我們將T字節的快閃儲存碟放到阿爾卑斯山上，我們可預期約是每三個月一次的軟性錯誤，而非每三年。

Soft errors are also a great concern in life-critical and safety-critical electronic systems.

軟性錯誤對生命攸關及安全攸關的電子系統，也造成極大的影響。

Examples are chemical implants, nuclear energy centrals, aircraft flight control systems and pace-makers.

多種例子包含化學植入物，核能控制中心，飛行控制系統，及心臟起搏器等。

In conclusion, soft errors in commercial single user applications are often not a concern.

總而言之，軟性錯誤對於單一使用者之商用應用軟件大致不會有大影響。

For high reliability applications making a massive use of memory, some techniques to reduce or tolerate soft errors are needed.

但對需高可靠性及高記憶體需求性的設備，我們需要減低錯誤發生的技術。

Luckily, experiences and knowledge acquired for the space environment can be used to cope with such effects on ground, as well.

有幸的是，從太空科技研發上取得的經驗及知識，也可以被用於地表上。

Thank you for your attention.

感謝大家聆聽。