

# IT Technology Behind the Visual Spectacle of the Beijing Winter Olympics: DELL Technologies Group Ultra HD Solution Postprint

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## Abstract

The ultra-high-definition television broadcast of the Beijing Winter Olympics was spectacular, further demonstrating the tremendous driving force of technological advancement on industry development. Constructing ultra-high-definition systems necessitates the complete replacement of previous IT equipment that supported high-definition standards. DELL Technologies has had the privilege of participating in numerous large-scale ultra-high-definition projects domestically, accumulating substantial experience and providing comprehensive solutions spanning from client-side to backend core storage infrastructure. This article provides a technical analysis of this solution for readers' reference.

## Full Text

### Preamble

**IT Technology Behind the Visual Spectacle of the Beijing Winter Olympics—Dell Technologies' Ultra-High-Definition Solution**  
(*Dell Technologies Group, Beijing 100020*)

**Abstract:** The ultra-high-definition television broadcasting of the Beijing Winter Olympics was spectacular, further demonstrating the tremendous driving effect of technological progress on industry development. Building UHD systems requires complete replacement of IT equipment previously used for HD broadcasting. Dell Technologies has had the privilege of participating in many large-scale UHD projects in China, gaining extensive experience and providing complete solutions from client devices to core backend storage systems. This paper analyzes these solutions from a technical perspective for readers' reference.

**Keywords:** Ultra-High-Definition; High-Performance Workstation; Storage; Precision; PowerScale

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## 1. Overview

The opening ceremony of the Beijing Winter Olympics on February 4, 2022, allowed people to rediscover broadcasting technology. With technological support, Chinese broadcasters presented a stunning visual feast. Whether viewed on television, computers, or mobile devices, the exquisite, crystal-clear, and dynamically magnificent footage of various competitions amazed audiences. Through live broadcasts, it became evident that traditional television remains the optimal viewing medium. While new media is innovative in technology and distribution, its content still originates from traditional broadcasting institutions.

Undoubtedly, the Beijing Winter Olympics became the most “technology-driven” Olympic Games in history. Reviewing IT-related technological innovations: all events utilized 4K UHD signal production, fully implementing UHD (Ultra-High-Definition) + HDR (High Dynamic Range Imaging) broadcasting across all programs; the backbone system achieved IP-based architecture; 8K public signals were provided to rights-holding broadcasters, with 8K production or live broadcasting for the opening/closing ceremonies, figure skating, short track speed skating, and ski jumping; AI technology enabled dynamic recognition and automated editing; production and distribution were based on 5G and cloud services; for 8K UHD transmission and terminal presentation, the Beijing Winter Olympics Organizing Committee implemented the “Hundreds of Cities, Thousands of Screens” initiative to broadcast Winter Olympics programs full-time.

As early as February 28, 2019, the Ministry of Industry and Information Technology, the National Radio and Television Administration, and China Central Television jointly released the “Ultra-High-Definition Video Industry Development Action Plan (2019-2022).” By 2022, China’s UHD video industry total scale would exceed 4 trillion yuan. UHD will greatly satisfy people’s growing needs for a better life and drive video-centric industry intelligent transformation. For the broadcasting industry, continuous advancement in UHD television content construction, innovative content production, and abundant UHD television program supply is required.

The difficulty of UHD lies in the high bit rate and large capacity of raw footage,

imposing extreme technical requirements and cost increases on post-production workstations and storage systems. Additionally, sports broadcasting involves extensive field operations and OB van equipment. Even the International Broadcasting Center (IBC) may be temporarily constructed, with computer room environments unable to meet standard television station requirements, creating completely different demands for on-site IT equipment.

## 2. Complete IT Solution for Winter Olympics UHD

The UHD production and broadcasting requirements for the Beijing Winter Olympics mainly included: rapid creation capabilities including graphics, video processing, and visual effects; secure storage of massive UHD data with fast access; low total cost of ownership; and support for new application scenarios in remote production, collaboration, and transmission in the cloud and 5G era.

### 2.1 UHD Production System

Entering the UHD era, improvements in resolution, frame rate, and quantization depth bring enormous challenges. Data and graphics processing volumes, data throughput, and other parameters increase dramatically, making existing HD and UHD systems unable to support UHD operations. This manifests in several aspects: **Workstations:** Computational and graphics processing capabilities require substantial improvement, along with support for 4K/8K displays; **Network Bandwidth:** Traditional gigabit networks to the desktop cannot carry 4K signals, requiring at least 10GbE upgrades, with 25GbE recommended for 8K support; **Storage Capacity:** For 4K at 500Mbps, one hour requires 225GB, and 24-hour program storage needs 5.4TB. Considering footage ratios and other factors, capacity grows geometrically; **Storage Throughput:** For a 40-station production island with four layers of 4K editing, at least 10GB/s bandwidth is required, necessitating a new generation of high-performance storage to support the entire workflow.

For 4K/8K UHD production systems, Dell Technologies provides: High-performance NAS storage PowerScale/Isilon, such as the F800, which delivers up to 15GB/s bandwidth and 924TB capacity in a single 4U chassis; network equipment supporting 10G/25G/40G/100G; Precision workstations as the tool of choice for UHD production, notably the T7920 tower workstation, which has received industry certification, along with mobile workstations; and displays supporting 4K/8K and HDR.

### 2.2 VDI and Cloud Production

To enable remote editing and meet the needs of converged media services, IT must evolve toward virtualization and cloud. Numerous television stations have already adopted virtualization, VDI, and other technologies to build cloud production systems. After technical validation at major domestic television institutions, Dell Technologies' VDI and cloud desktop solutions have proven to be

efficient, secure, mature, leading-edge, and simple to deploy.

### 3. High-Performance Workstations Empower UHD Production

Media creators need capable tools to express their inspiration. The transition from HD to UHD places higher demands on Dell Precision workstations in several areas: higher-performance CPUs with higher clock speeds and more cores; support for high configurations and multiple high-performance graphics cards/GPUs; need for faster local storage, typically multiple SSDs; need for higher-speed data transmission channels; more effective long-term operation security; more effective platform management and rapid performance optimization.

The new-generation full-featured film and television production workstation, based on the Dell Precision hardware platform, provides broadcast-grade post-production at a relatively accessible price. The product adopts new-generation “CPU+GPU+IO” acceleration technology to meet the needs of editing, 3D, compositing, special effects, color grading, and stereoscopic applications in film and television creation. The full-featured post-production system can handle video production from DV to HDV, from 2K, 4K/8K, to 3D stereoscopic.

#### 3.1 The Tool for UHD Video Editing—Desktop Workstation T7920

**3.1.1 Powerful Performance and Scalability** To address UHD video data processing capabilities at the desktop, the Dell Precision T7920 tower workstation adopts the new generation of dual Xeon processors, supporting up to 56 cores. With six-channel memory technology, it supports up to 3TB of memory capacity. For high-quality processing needs, the T7920 workstation can support up to three top-tier GPU graphics cards. M.2 ultra-high-speed SSD deployment solves data processing bottlenecks caused by hard drive speed limitations. The third-generation Thunderbolt 3 expansion card helps media professionals solve external Thunderbolt storage device expansion issues. Front-mounted dual hot-swappable M.2 ultra-high-speed solid-state drives with maximum capacity of 4TB enable rapid video material storage and mobile sharing.

**3.1.2 Wide Interface and Software Support** The T7920 workstation provides comprehensive video interface support with high-performance design meeting the highest cinematic quality requirements. It supports SDI and HDMI 4K interfaces, full Ultra HD 4K capture and output, and can complete full-resolution color RGB 4:4:4 capture and output. Other interfaces include analog component, composite, and S-video interfaces, supporting AES and analog balanced audio, 16-channel SDI audio, and meeting numerous broadcasting professional requirements.

The T7920 professional video workstation supports WDM, DirectShow, and QuickTime, making it extremely versatile software on Windows systems. For

editing, it supports Avid Media Composer, Avid News Cutter, Adobe Premiere Pro, Sony Vegas Pro, Corel VideoStudio, CyberLink Power Director, and MAGIX Video Pro. For visual effects, it supports After Effects, The Foundry Nuke, Adobe After Effects, and Adobe Photoshop. For audio software, it supports Steinberg Nuendo and Cubase. For streaming playback, it is compatible with Flash Media Encoder, Xsplit Broadcaster, Wirecast, and Livestream Pro-caster.

**3.1.3 Long-Term Safe Operation Guarantee and Performance Optimization** UHD video material editing, compositing, and rendering consume considerable time. Ensuring hardware platform stable operation over long periods is critical, placing higher demands on workstation core components—memory stability. All Dell Precision series workstations feature Intelligent Memory Error Correction Reliable Memory Technology (RMT) Pro, which works with Error Correction Code (ECC) memory to reduce memory-related errors and blue screens. The system can monitor memory health status anytime, anywhere, and when physical damage occurs to memory chip particles, it can physically isolate damaged sectors or memory chip particles, ensuring the system uses only properly functioning memory during editing, compositing, and rendering states to guarantee stable operation.

During professional design software applications, Dell Precision series workstations provide professional performance optimization and management tool software Dell Optimizer for Precision. This software can automatically monitor the operation status of professional video editing software, 3D software, and special effects processing software from companies like Adobe and Autodesk installed on the workstation in a non-intrusive state during device usage. It provides effective performance optimization for specific application function modules and offers quick, concise device usage status reports for later operation, maintenance, and hardware upgrades.

### 3.3 Mobile Editing Workstations

The Beijing Winter Olympics saw increased field and mobile working environments. Having a powerful mobile workstation is the desire of all media professionals. Media industry workers need to carry complete equipment to complete field tasks within limited load capacity—the smaller, lighter, and more functional each device, the better. Based on this, Dell Technologies has comprehensively built an ecosystem for multi-tasking, multi-functionality, mobile shooting, and mobile editing. This ecosystem relies on powerful mobile workstations to comprehensively solve multi-tasking work requirements for field news journalists. In the 4K UHD video editing field, Dell recommends 15-inch and 17-inch mobile workstation products for media industry professionals based on different material bit rates and application requirements.

### 3.4 Complete Ecosystem and Professional Certification

Media users need a complete set of creative tools. Dell workstations maintain close cooperation with major software and system providers in the industry, including international and domestic vendors. Extensive testing and certification work has been completed, with optimized configurations recommended specifically for 4K non-linear editing.

## 4. UHD Workflow Requires High-Performance Storage Support

### 4.1 Scale-Out NAS Storage

For television station UHD systems, storage must meet requirements for high performance, large capacity, high security, scalability, and balanced maturity and advancement to support the entire production and broadcasting workflow. Using scale-out, high-performance NAS storage (clustered NAS) becomes the best choice. It can simultaneously solve performance and capacity problems to the maximum extent and provide convenient support for system expansion through continuous scalability of a single file system. Dell Technologies' PowerScale OneFS scale-out storage solution is specifically designed for scenarios requiring high performance and high scalability. It is powerful yet simple to install and manage, and can scale to almost any size. Including PowerScale all-flash nodes and Isilon all-flash nodes, hybrid nodes, or archive nodes, it can meet various demanding business requirements in the media industry.

### 4.2 Advantages of PowerScale/Isilon Storage in UHD Applications

In UHD production and broadcasting system storage selection, storage platform support capability is crucial. On one hand, sharing is needed to support complete production and broadcasting workflows of domestic television institutions; on the other hand, exceptionally high requirements are placed on storage throughput capacity. Additionally, massive expansion capability, security, reliability, and ease of management are important technical requirements.

PowerScale/Isilon offers extreme high performance and high capacity support. Its symmetrically balanced cluster architecture enables linear performance improvement with capacity; single cluster throughput reaches 945GB/s; single cluster file system size exceeds 93PB with unified namespace; online upgrade capability facilitates upgrades and expansion, providing investment protection; high availability features up to N+4 and maximum 8-copy protection; single, convenient management capability; support for transparent migration to cloud; and enterprise storage software features—all well meeting UHD system requirements.

## 5. Practical Applications

China Central Television (CCTV) began building a trial environment for 8K UHD television channel production and broadcasting in 2020. Based on the characteristics of large 8K video broadcasting bit rates, high read/write bandwidth requirements, and extremely high stability requirements for television broadcasting systems, Dell Technologies provided Dell PowerScale F600 and F200 two distributed all-flash NAS storage test prototypes to build the storage core of the trial environment.

The nation's first 8K television channel—“CCTV-8K UHD Channel”—was officially launched on February 1, 2021, and has operated stably. The system adopted the new PowerScale F600, supporting Olympic event broadcasting. Notably, through the SmartPools function, it successfully completed perfect migration and switching from trial equipment to final engineering equipment with zero data loss and zero business interruption.

Seizing the opportunity of the Beijing Winter Olympics, Beijing Radio and Television Station officially began constructing the world's first city-level 8K broadcasting system in 2021, and officially launched China's first provincial-level 8K channel—BRTV Winter Olympics Documentary 8K—on December 31, 2021, becoming an important component of Technology Winter Olympics. With its industry-leading performance, stability, and reliability, PowerScale won recognition, with PowerScale F600 building the BRTV Winter Olympics Documentary 8K UHD television channel broadcasting storage platform in a highly reliable manner.

UHD program production and broadcasting processes place higher demands on IT equipment compared to traditional HD/SD systems. The Beijing Winter Olympics live broadcast viewing experience improved significantly, particularly with UHD's substantial improvements in resolution, quantization precision, and frame rate, allowing more sports details to be truly visible. This is inseparable from the unremitting efforts of broadcasting professionals and technological advancement.

## References

- [1] Julia Palmer, Jerry Rozeman, Chandra Mukhyala, Jeff Vogel, Magic Quadrant for Distributed File Systems and Object Storage[R]. Gartner, October 1, 2021.
- [2] Wang Chao. Even Ice Flowers Are Clear: PowerScale Powers the “Clearest” Winter Olympics in History[EB/OL]. [https://mp.weixin.qq.com/s/z26L\\_1JIWgvk5A11ohCvrQ](https://mp.weixin.qq.com/s/z26L_1JIWgvk5A11ohCvrQ), 2022-02-28.

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*Note: Figure translations are in progress. See original paper for figures.*

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