10 Backup Solutions And Its Applications

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Foreword

- This module mainly describes about the related knowledge of backup solutions, including:
  - The Concepts of Backup Solutions.
  - The System Architecture of Backup Solutions.
  - The Components of Backup Solutions.
  - The Related Technologies of Backup Solutions.
  - The Typical Application Cases of Backup Solutions.

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Objectives

- Upon completion of this module, you will be able to:
  - Describe the related technologies of Storage Backup Solutions within the Datacenter.
  - Understand the technical differences of Backup and Disaster Recovery solutions.
  - Learn how to deploy a Backup Solution through application cases.

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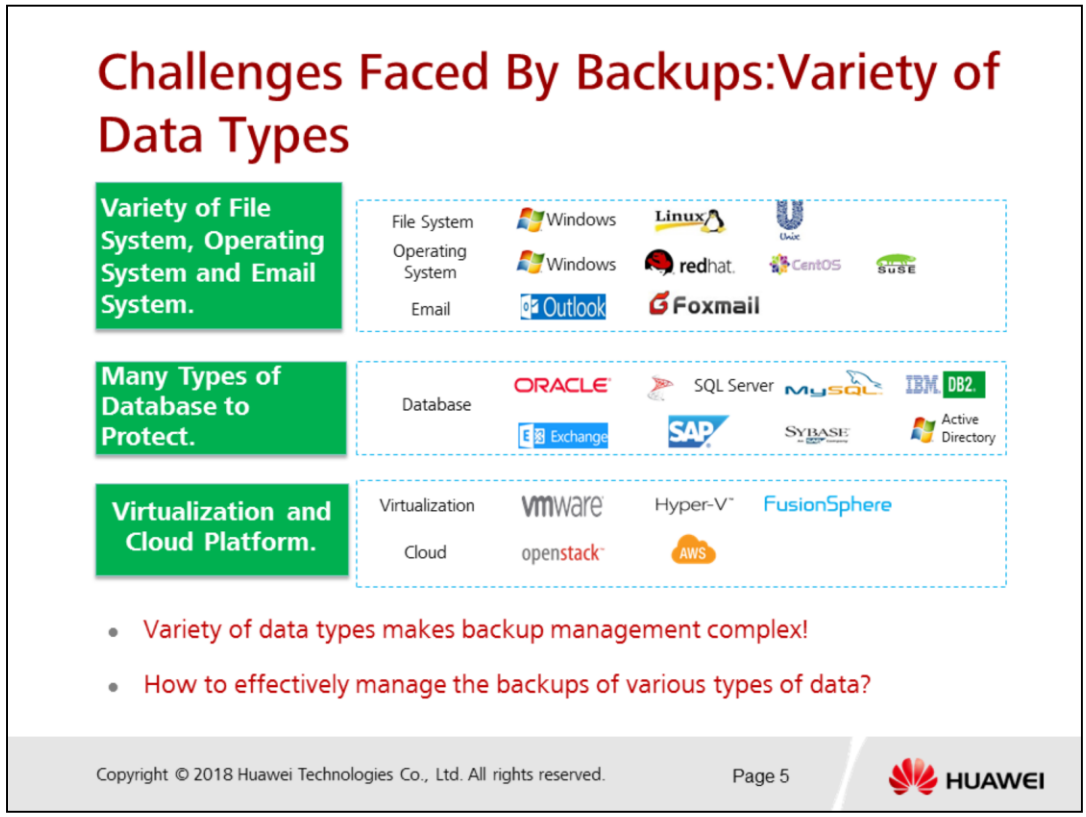
Contents

1. **Overview Of Backup Solutions.**
2. Architecture Of Backup Solutions.
3. Common Backup Networks.
4. Common Backup Technologies.
5. Application Cases Of Backup Solutions.

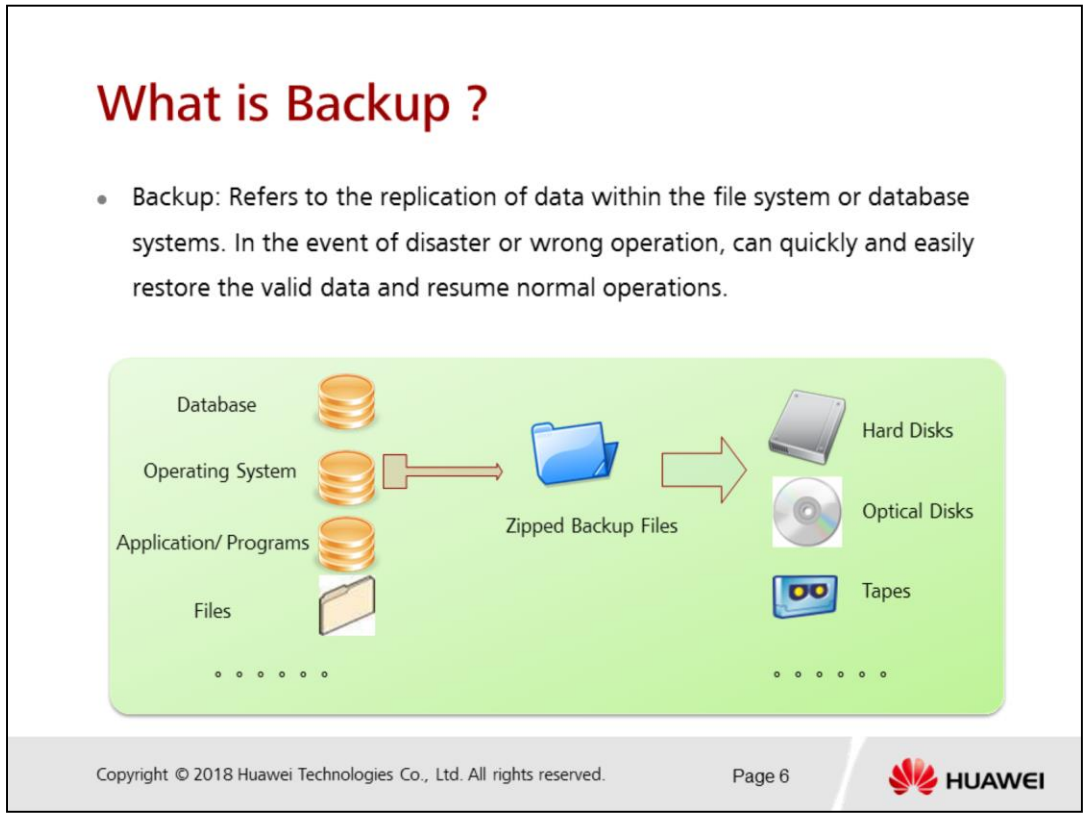
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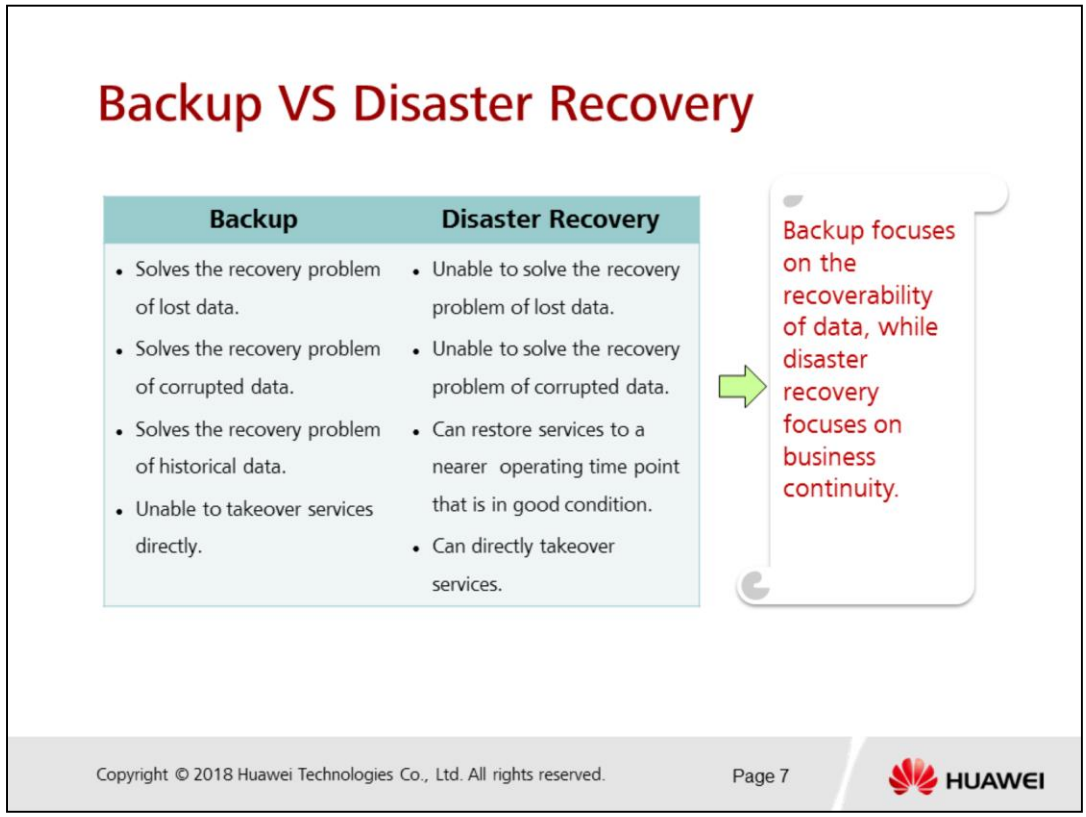
- Data backup is the last line of defense in data protection.
- Compared to the developments of IT environments, the growth and development of backup software are lagging behind in pace.
- Regular backups are an insurance policy for your business. With so much of the modern business supported by computer networks, a loss of your network data can have a crippling financial effect on your business.
- Backups help ensure that regardless of your current security strategy, you have secure and clean data to keep your business running in the case of data loss, a hack/virus attack or even a natural disaster.



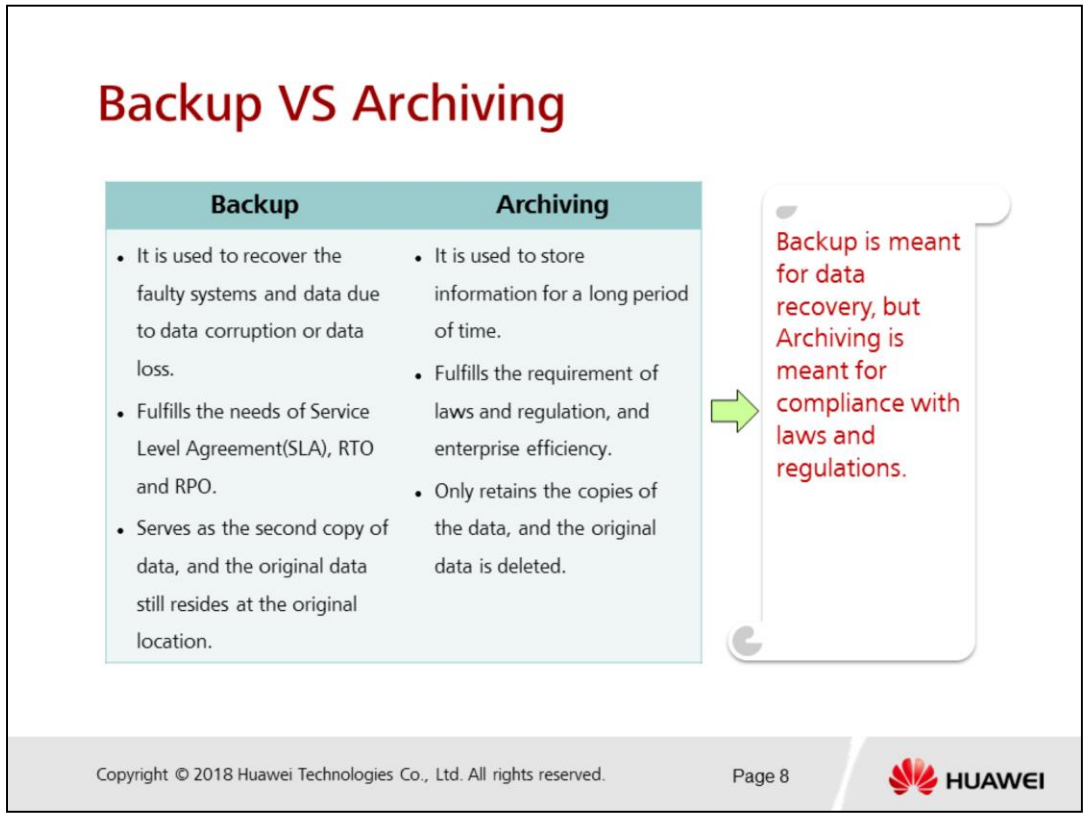
- The variety of data types made the backup process complicated. We are no longer dealing with single format or type of data, but are facing with myriads of data types and applications running on physical, virtualized or cloud environments.
- For backup administrators, this serves as a challenge to manage the different types of data format, and ensuring that all backup tasks are completed and valid.
- Normal backup solutions may work for small and medium enterprises, but for large scale enterprises, backup becomes very complex and require solutions that provides unified management of backup tasks for many types of data and application.



- Definition of Backup:
  - Replication of data within the storage device to another mass storage device such as tapes to cope with the incidents of files or data loss.
  - Backup in reality is just a type of "replication" operation, and data backups usually are stored in a another format.
  - The purpose of backup is for recovery of data in the incident of disasters.
- Commonly, the following components are within a set of backup systems:
  - Backup Servers: It is the host for the backup software, and generally are PC servers or minicomputers.
  - Backup Software: Its the core of backup system. It copies the production data to the storage media, and manages the data backups. Examples of backups software are, Symantec Backup Exec and NetBackup etc.
  - Storage Device: The device where the backup data is stored, commonly are disk arrays, physical tape libraries or virtualized tape libraries.



- Backup is the basis of disaster recovery.
- Many tends to think that backup and disaster recovery are the same, but each of them has their own merits and differences.
- Backup in simpler terms refers to the process of copying the data to another location for recovery in the event of data loss or corruption.
- Disaster recovery refers to the process of maintaining business continuity in the event of a disaster.
- Disaster recovery can be considered as a set of policies and procedures which focus on protecting an organization from any significant effects in case of a negative event, which may include cyber attacks, natural disasters or building or device failures. Disaster recovery helps in designing strategies that can restore hardware, applications and data quickly for business continuity.



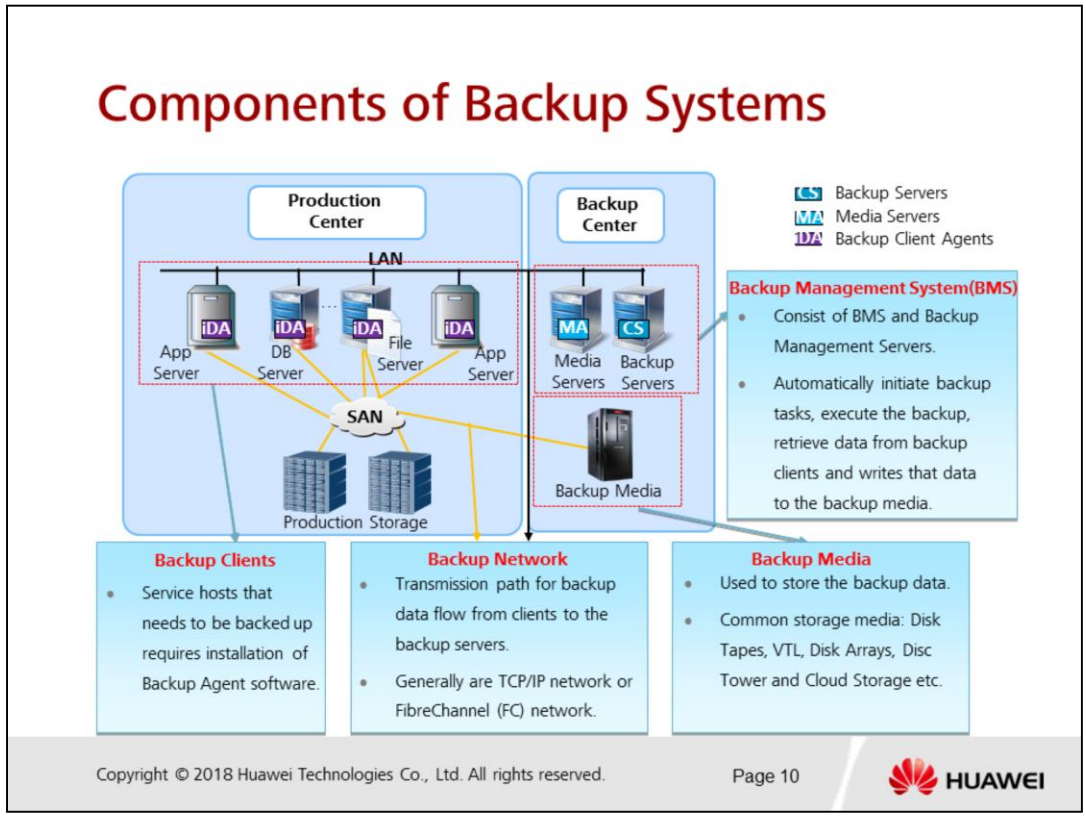
- Data archiving is the process of moving data that is no longer actively used to a separate storage device for long-term retention. Archive data consists of older data that is still important to the organization and may be needed for future reference, as well as data that must be retained for regulatory compliance. Data archives are indexed and have search capabilities so files and parts of files can be easily located and retrieved.
- Data archives are often confused with data backups, which are copies of data. Data backups are used as a data recovery mechanism that can be used to restore data in the event it is corrupted or destroyed. In contrast, data archives protect older information that is not needed for everyday operations but may have to be accessed occasionally. The data archives serve as a way of reducing primary storage consumption and related costs, rather than acting as a data recovery mechanism. Some data archives treat archive data as read-only to protect it from modification, while other data archiving products treat data as read / write. Data archiving is most suitable for data that must be retained due to operational or regulatory requirements, such as document files, email messages and possibly old database records.



Contents

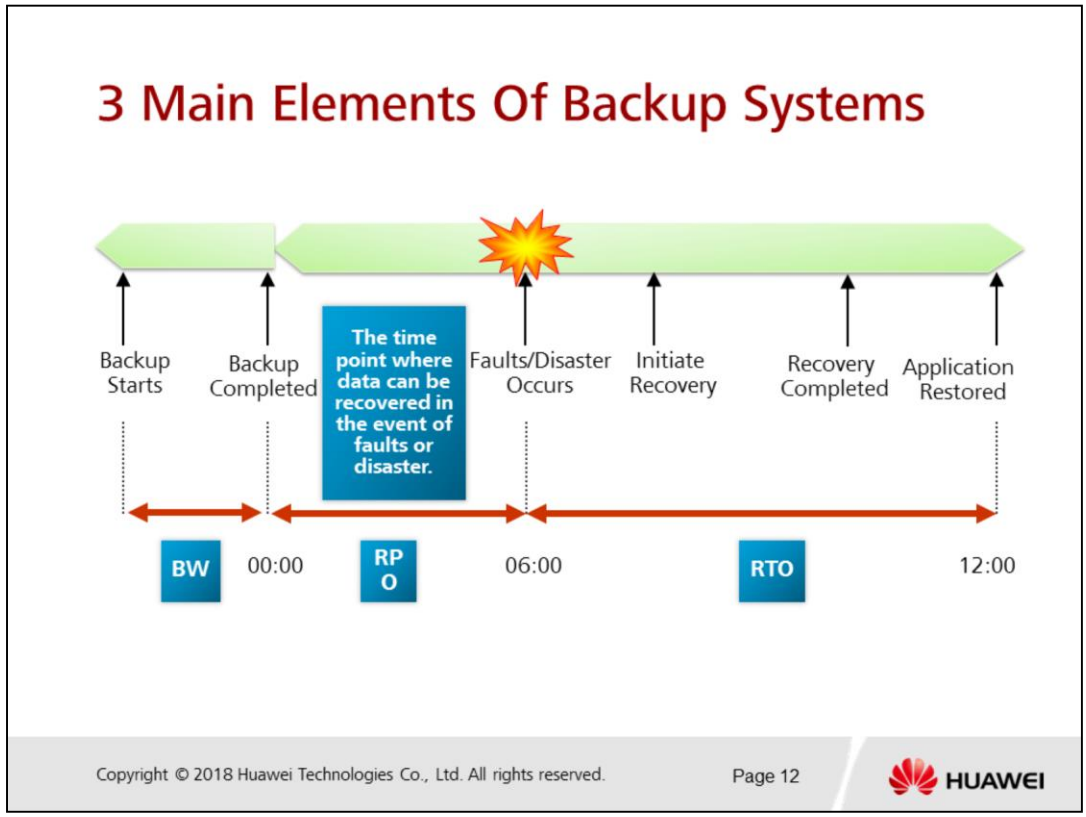
1. Overview Of Backup Solutions.
2. **Architecture Of Backup Solutions.**
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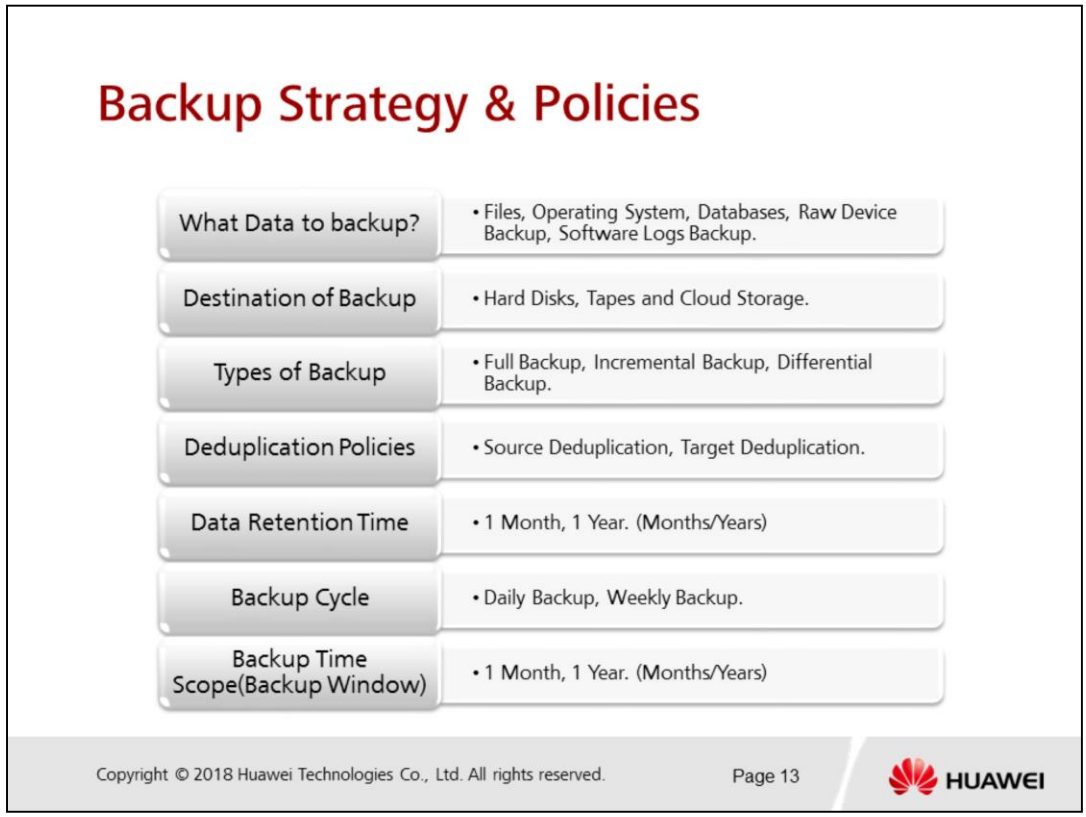


- Backup server: Maintains all the configuration information (such as information on clients, media agents, backup devices, etc.), and manages all the job and historical task records, and provides GUI/WEB and other management interfaces.
- Media server: Responsible for managing the data transmission between the physical storage device and its corresponding clients and agents.
- Backup media:
  - Disk array: It is applicable and useful in occasions where the backup data volume is large and the backup window is relatively small, which requires high performance and reliability of the backup device, such as within data centers. Examples of suitable products are Huawei OceanStor V3 series and 18000 series.
  - Tape library: It is suitable for scenarios where the backup data volume is small, the time window is large, or in the case where you want to save the data offsite for a long period of time. Examples of such products are HPMSL6060, IBM TS3310 etc.
  - Virtual tape library: It is applicable in the scenario where it is necessary to inherit the enterprise's original tape backup architecture and policies, but at the same time also need to improve the backup speed. Products such as Huawei VTL6900 are suitable in these scenarios. (VTL: Refers to Virtual Tape Library. It can be integrated into existing tape backup environments and used along with tape products to form a solution that combines the advantages of both tape and disk technology.)

    - CD-ROM towers, CD-ROM Libraries: It is suitable for scenarios when the backup speed requirements are not high, the capacity is small, and do not have to often erase the data such as in the field of education, archives, libraries, radio and television and other industries. Example products of this type is SONYPDJ-1080.
    - Cloud storage: It is suitable for services with a small amount of backup data such as OceanStor 9000 and FusionStorage.
    - Converged Backup Device: It integrates the main server, media server, and backup media onto one physical device. For example: HDP3500E.
- The *i*DataAgent (iDA) provides an unique, simplified end-to-end backup and recovery solution for data in your enterprise. It provides more granular backup and recovery of specific data files and logs. It can also be used to perform both full system rebuilds and granular recovery of the data.

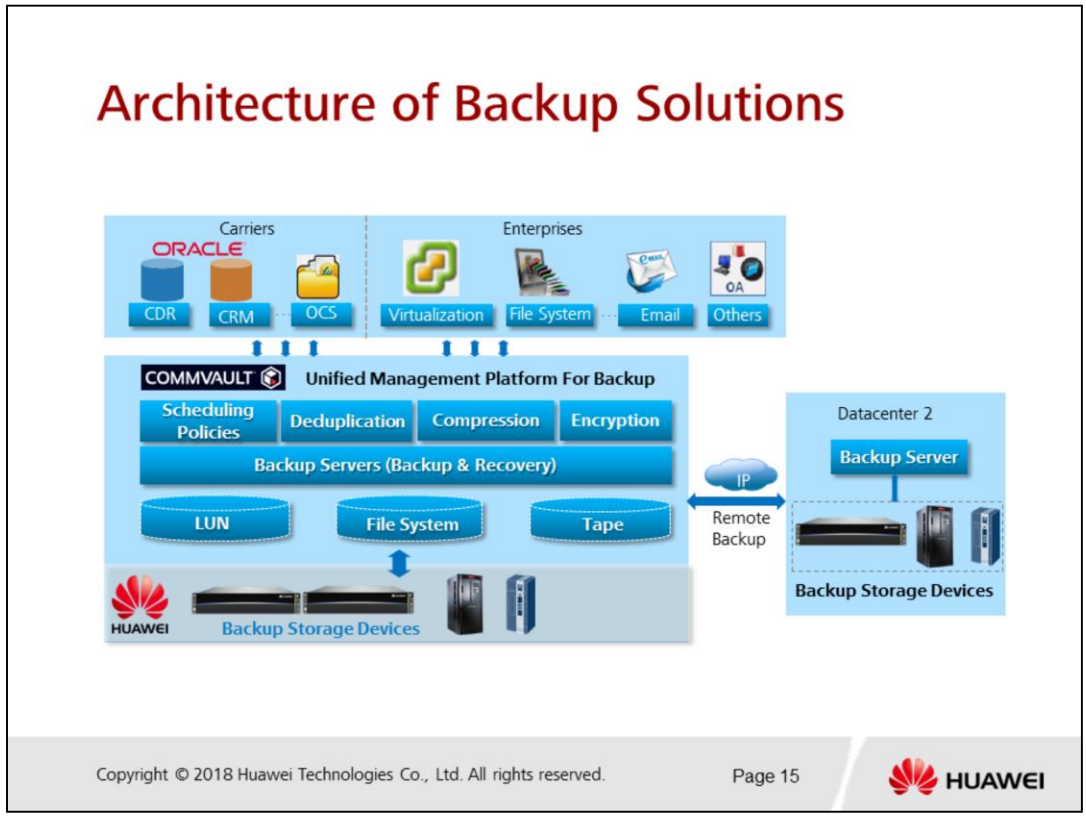


- BW (Backup Window): The length of time for a backup to be completely backed up in a work cycle.
- RPO (Recovery Point Objective): The maximum amount of data loss that can be tolerated.
- RTO (Recovery Time Objective): The longest downtime that can be tolerated.

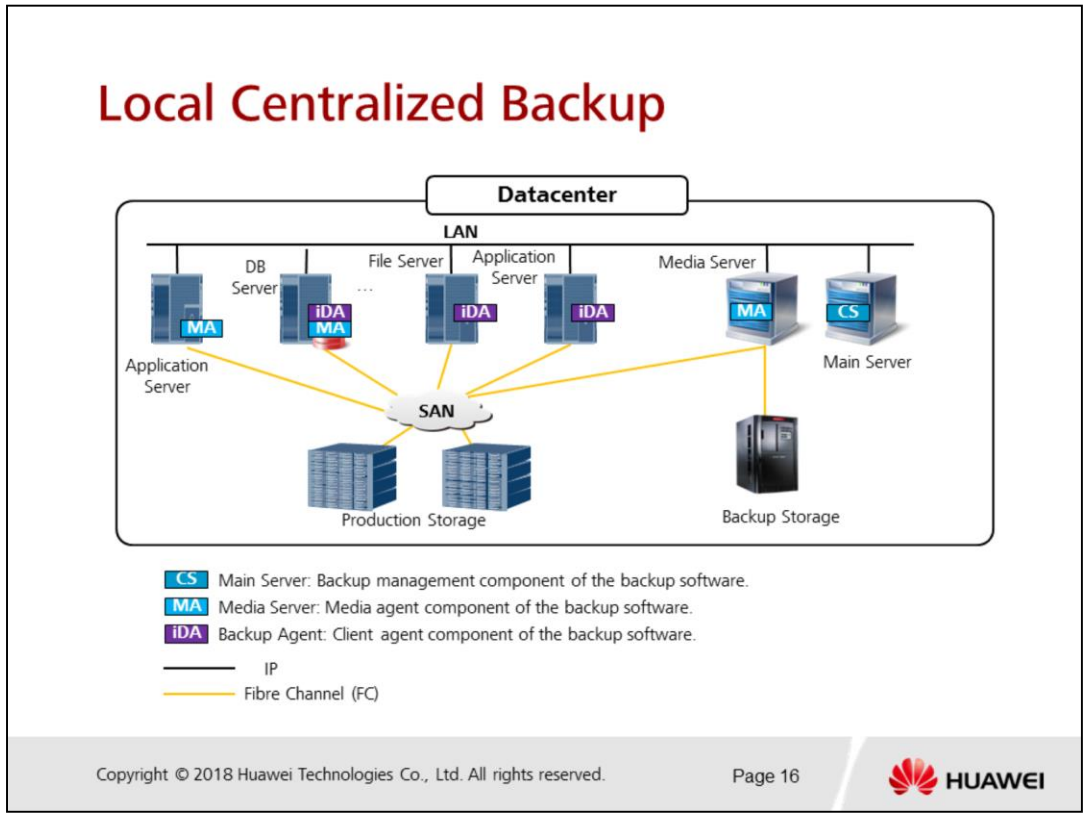


- Backup strategy and policies option:
  - More inclined towards the operating system and application software, which performs a full backup after each system update or installation of new software.
  - For critical application data, which involves a large numbers of daily data updates, but the total amount of data is not very large. Thus, we can make a full daily backup when users just uses a relatively small amount of data in this scenario.
  - For critical applications, where the total amount of data has only a small amount of data updates every day. Thus, we can do a full backup on a monthly or weekly basis, and on an incremental basis, we can do incremental backups at a series of shorter intervals of time.
- Typical backup type:
  - Full backup: full daily backup.
    - Advantages: Ability to quickly restore data based on the last full backup, with a small recovery window.
    - Disadvantages: It takes up a lot of storage space. Each backup takes a long time and the backup window is large.

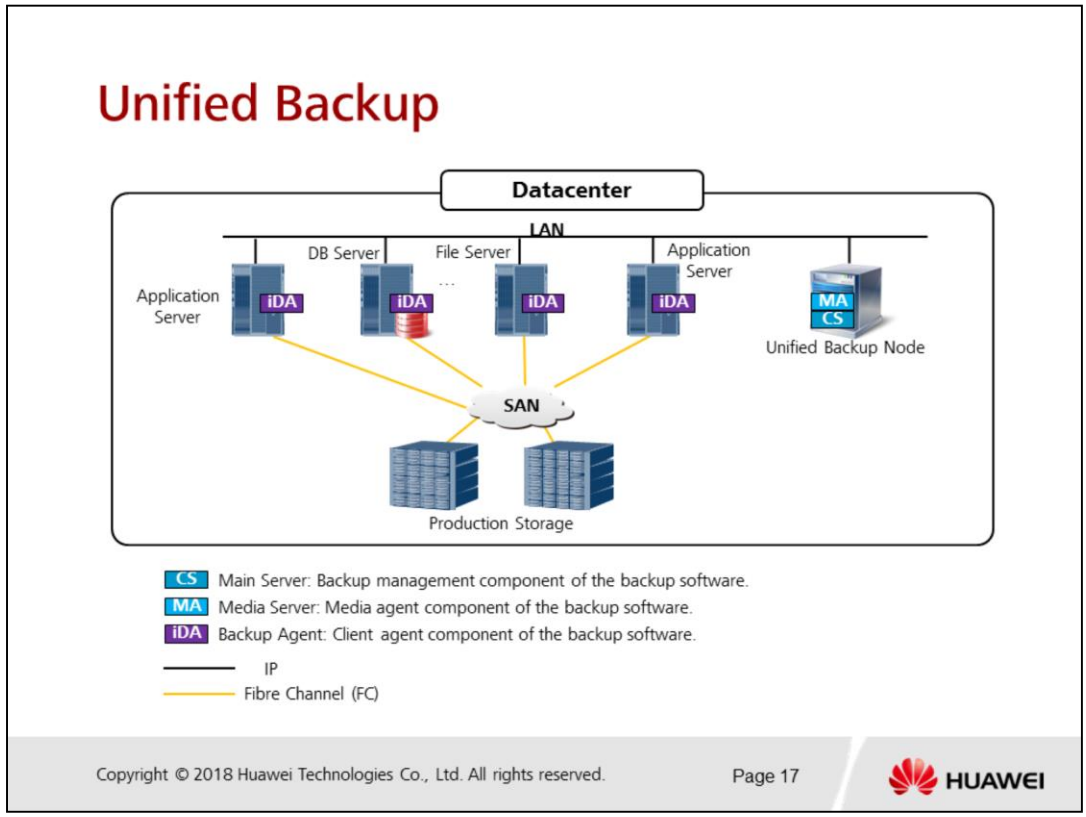
    - Cumulative incremental backups: The full backup is done weekly, but only the changed data from the rest of the week compared to the last full backup is backed up daily.
        - Advantages: Compared to a full backup, each incremental backup saves the storage space worth of 1 full backup. It has a smaller backup window and a smaller recovery window since it only backups the changed data after the last full backup.
        - Disadvantages: When recovering, you must rely on the last full backup and all the cumulative incremental backups to restore the data completely. The recovery time is shorter than the differential incremental backup.
    - Differential incremental backup: Weekly full backup, and the differential data between the daily backup and full backup of the rest of the week.
        - Advantages: It can save storage space to the maximum extent and the backup window is small.
        - Disadvantages: Data recovery must rely on the last full backup and differential incremental backup each time to complete the data recovery, data reconstruction is slower during recovery process, and recovery time is longer.
- A differential backup is a cumulative backup of all changes made since the last full backup, which is the differences since the last full backup. The advantage to this is the quicker recovery time, requiring only a full backup and the last differential backup to restore the entire data repository. The disadvantage is that for each day elapsed since the last full backup, more data needs to be backed up, especially if a significant proportion of the data has changed, thus increasing backup time as compared to the incremental backup method.
- An incremental backup is one in which successive copies of the data contain only that portion that has changed since the preceding backup copy was made. When a full recovery is needed, the restoration process would need the last full backup plus all the incremental backups until the point of restoration. Incremental backups are often desirable as they reduce storage space usage, and are quicker to perform than differential backups.



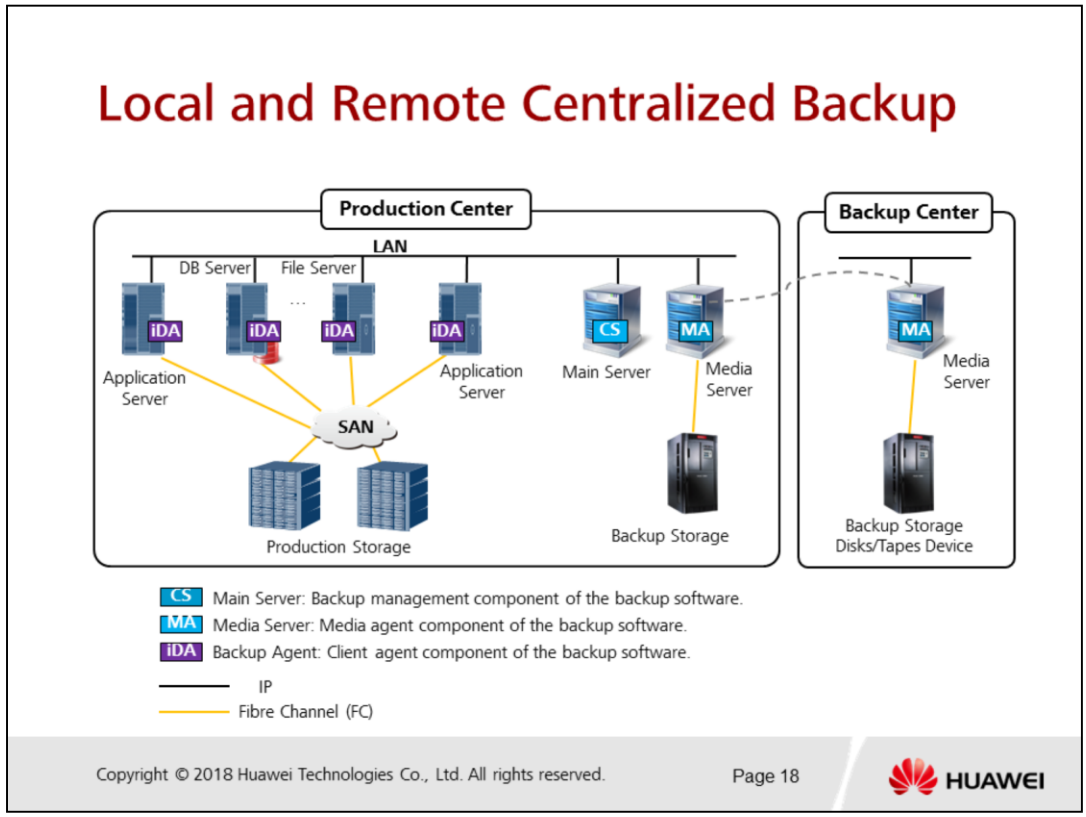
- The diagram above shows the overview of the architecture of backup solutions.
- Backup solutions actually consists of one or more components in design to provide the best backup performance to meet customer requirements. The components can be software or hardware or external platforms such as the cloud.
- Backup solutions need to be designed with the specified requirements in mind, and flexible in expansion to cater with the growth of data. Thus, the components chosen in the backup solutions needs to be compatible with each other to gain maximum performance and maximize the value of investment.



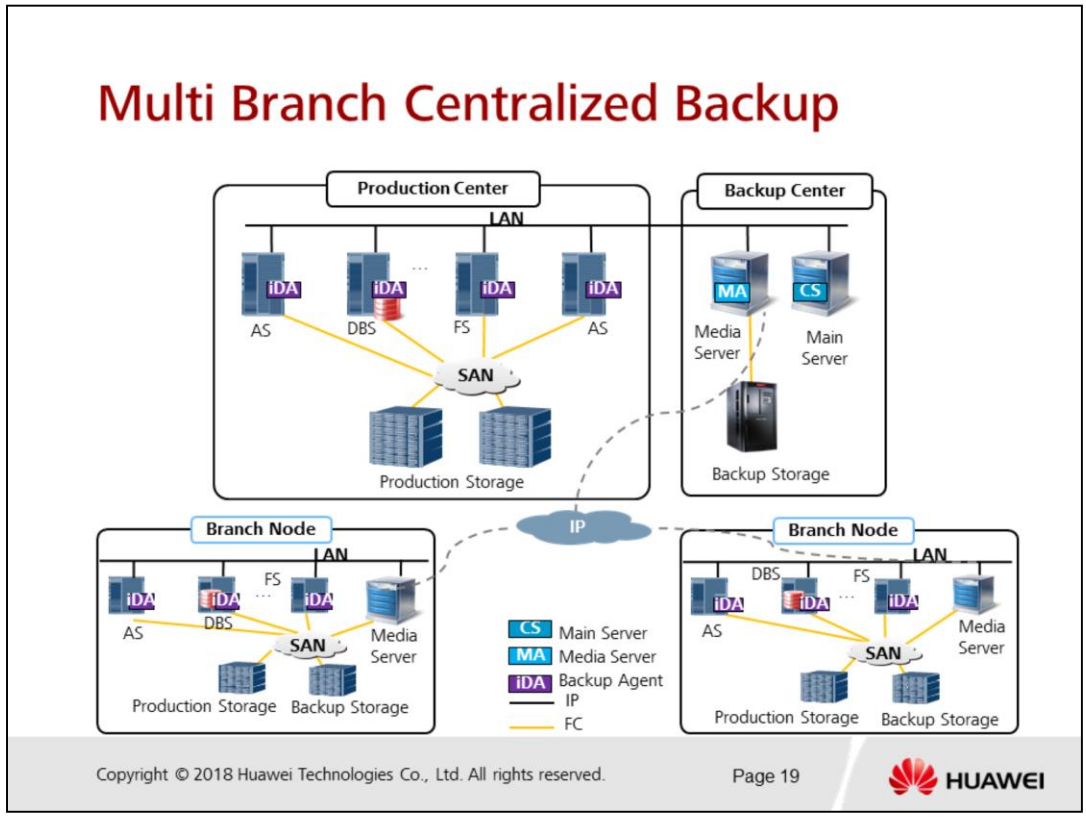
- Scenario: Used for Local DC Centralized Backup, Carrier, and Enterprise, etc.
- Supported platforms:
  - Supports file and application backups for Windows, Linux, and UNIX platforms.
  - Support backups for VMware, Hyper-V, and FusionCompute virtualization platform.
- Highlights of the solution:
  - Supports parallel deduplication, saving more backup storage space.
  - Supports hardware based snapshots of Huawei storage arrays for data backup, zero service impact, and second-level recovery.
  - Full graphical GUI unified management, there is no need to write any script, and has simple operation and maintenance.



- Scenario: Usage for Local backup of SMB and branch offices that small amount of data.
- Supported platforms:
  - Supports file and application backups for Windows, Linux, and UNIX platforms.
  - Support backups for VMware, Hyper-V, and FusionCompute virtualization platform.
- Highlights of the solution:
  - Backup server and backup storage integration, allows equipment and maintenance costs to be reduced by 50%.
  - Full graphical GUI unified management, there is no need to write any script, and has simple operation and maintenance.



- Scenario:
  - Used for Local DC Centralized Backup, Carrier, and Enterprise, etc.
  - Remote Backup.
- Supported platforms:
  - Supports file and application backups for Windows, Linux, and UNIX platforms.
  - Support backups for VMware, Hyper-V, and FusionCompute virtualization platform.
- Highlights of the solution:
  - Supports parallel deduplication, saving more backup storage space.
  - Supports hardware based snapshots of Huawei storage arrays for data backup, zero service impact, and second-level recovery.
  - Full graphical GUI unified management, there is no need to write any script, and has simple operation and maintenance.



- Scenario:
  - Local DC Centralized Backup, Carrier and Enterprises.
  - Unified Management.
- Supported platforms:
  - Supports file and application backups for Windows, Linux, and UNIX platforms.
  - Support backups for VMware, Hyper-V, and FusionCompute virtualization platform.

- Highlights of the solution:
  - Supports parallel deduplication, and saves backup storage space.
  - Unified management of multiple backup domains, allows equipment and maintenance costs to be reduced by 50%.
  - Supports hardware based snapshots of Huawei storage arrays for data backup, zero service impact, and second-level recovery.
  - Full graphical GUI unified management, there is no need to write any script, and has simple operation and maintenance.
- Note:
  - AS: Application Server.
  - DBS: Database Server.
  - FS: File Server.

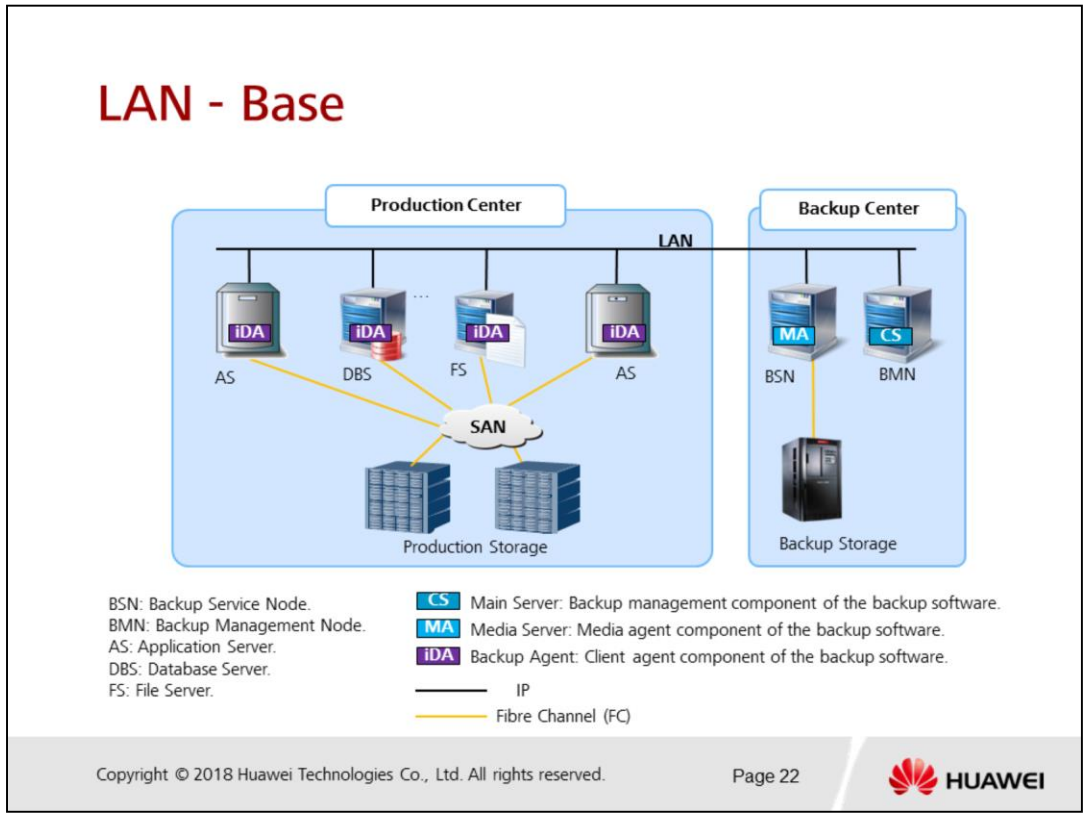


Contents

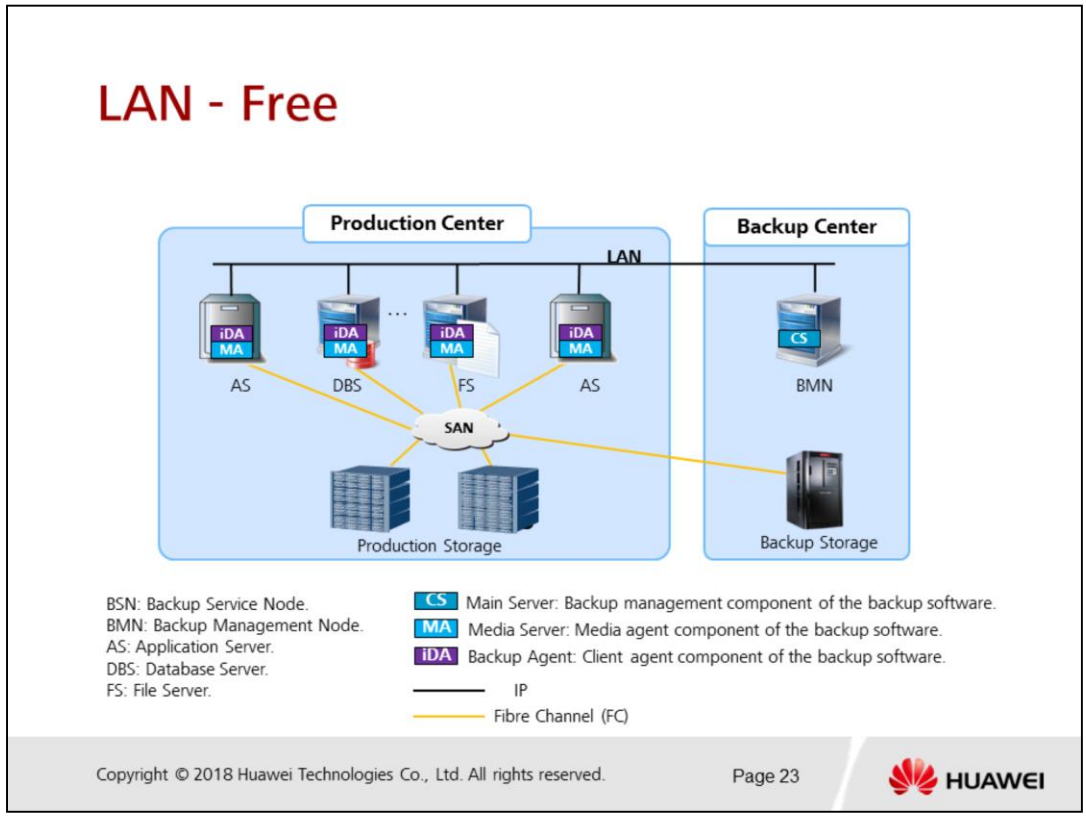
1. Overview Of Backup Solutions.
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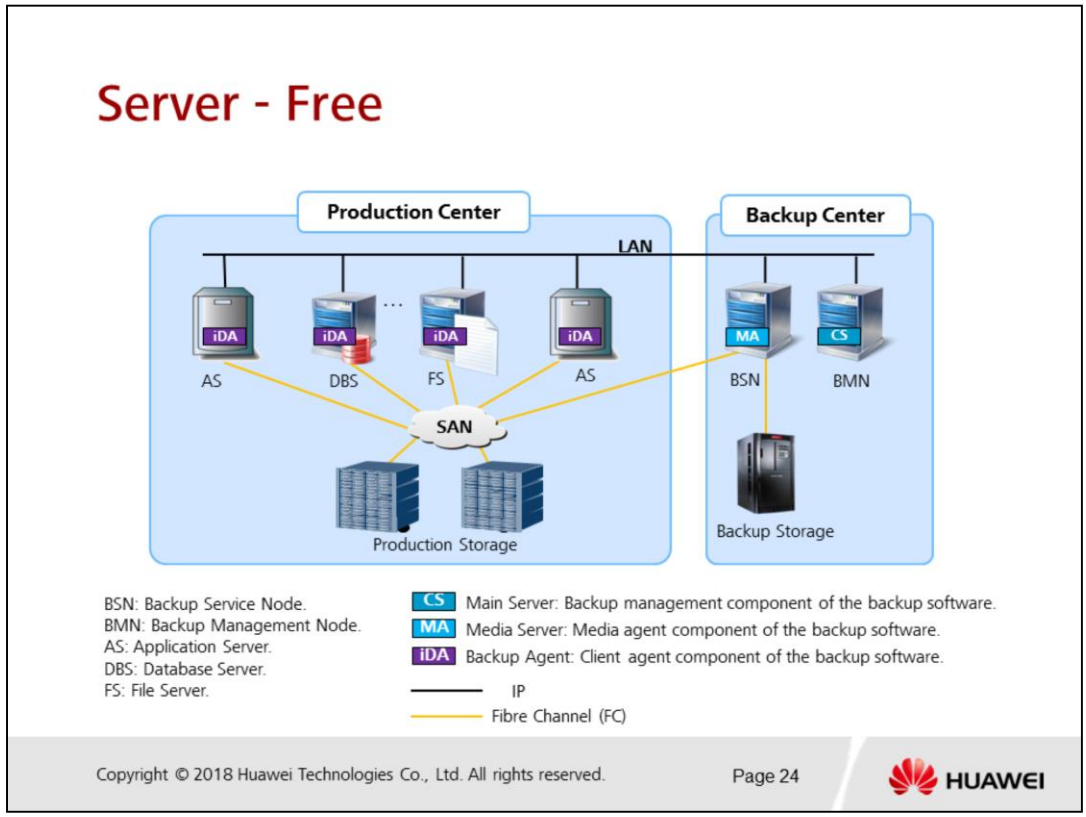
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- LAN-Base: The backup data stream is transmitted over the existing LAN network.
- Advantages:
  - Make full use of existing networks and save investment.
  - Low equipment requirements.
- Disadvantages:
  - Takes up existing network bandwidth.
  - Backup performance is limited.
  - Has a certain influence on the host application.



- LAN-Free: The backup data stream is transmitted over the SAN network.
- Advantages:
  - Small impact on existing business networks.
  - Good backup performance.
- Disadvantages:
  - Larger investment in networks.
  - High requirements for equipment.



- Server-Free: The backup data stream does not go through the production server but is transmitted over a separate network.
- Advantages:
  - Little impact on business hosts.
  - Little impact on existing business service networks.
  - Good backup performance.
- Disadvantages:
  - Larger investment in networks.
  - High demand for equipment.

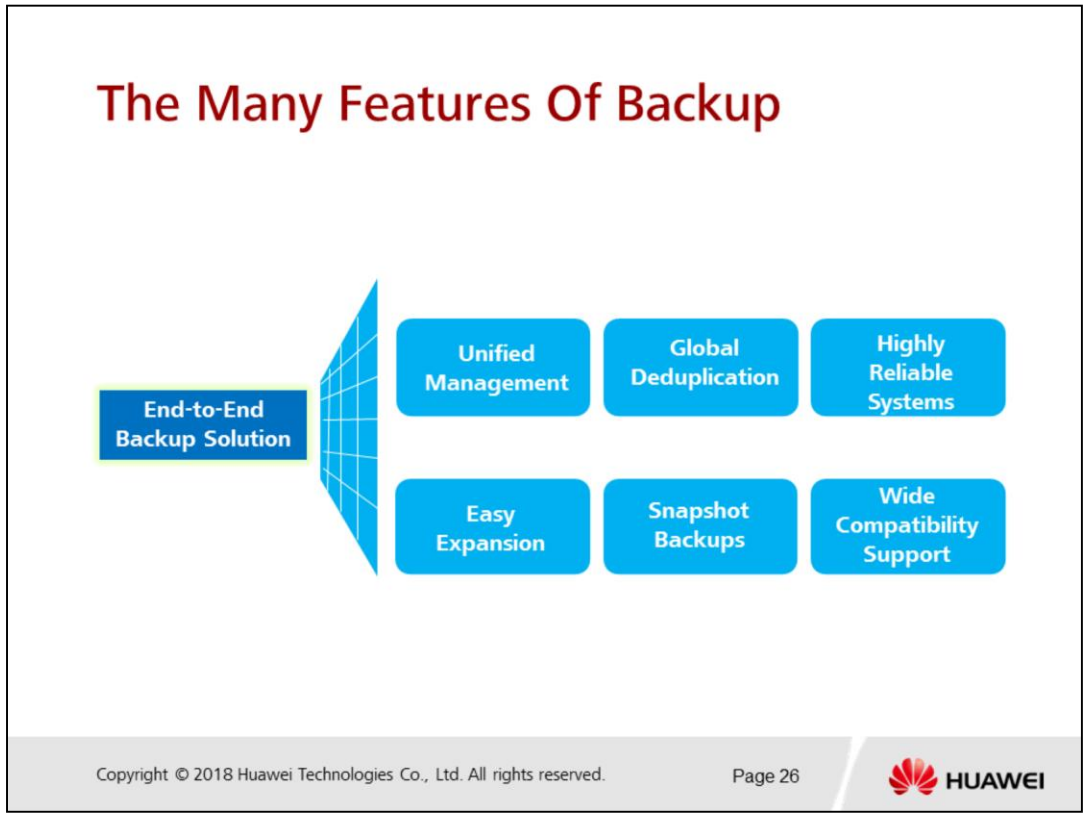


Contents

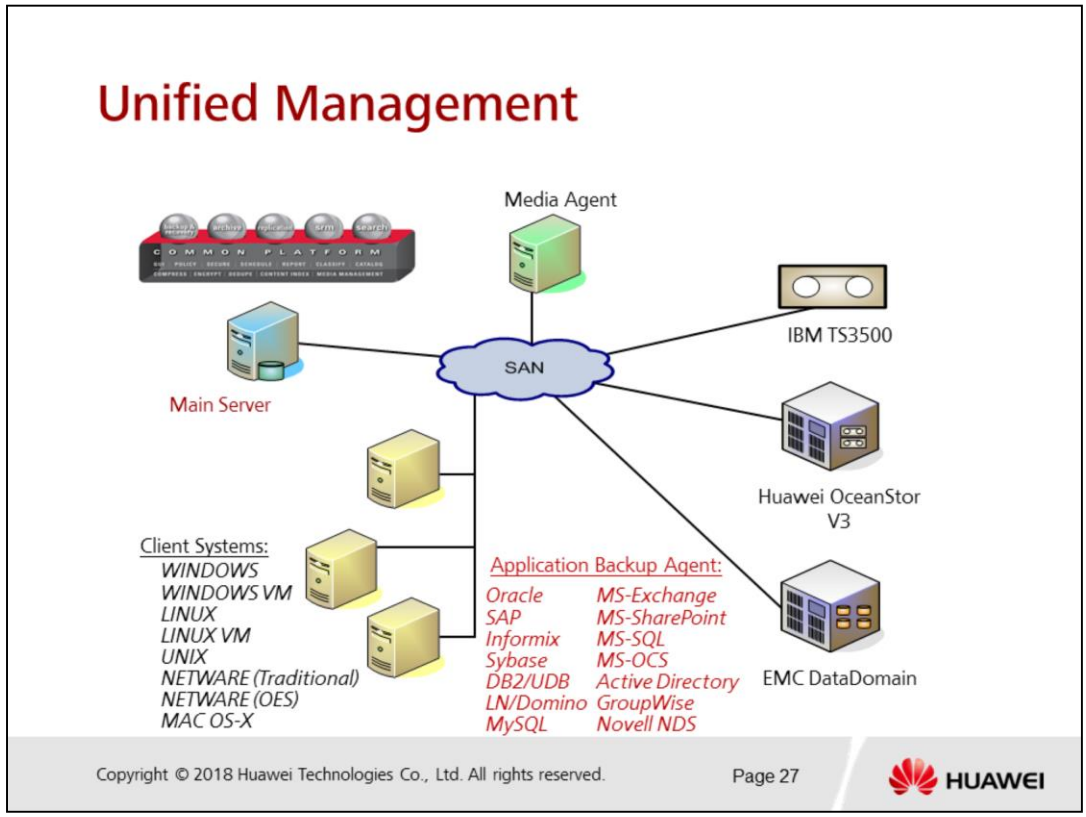
1. Overview Of Backup Solutions.
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4. **Common Backup Technologies.**
5. Application Cases Of Backup Solutions.

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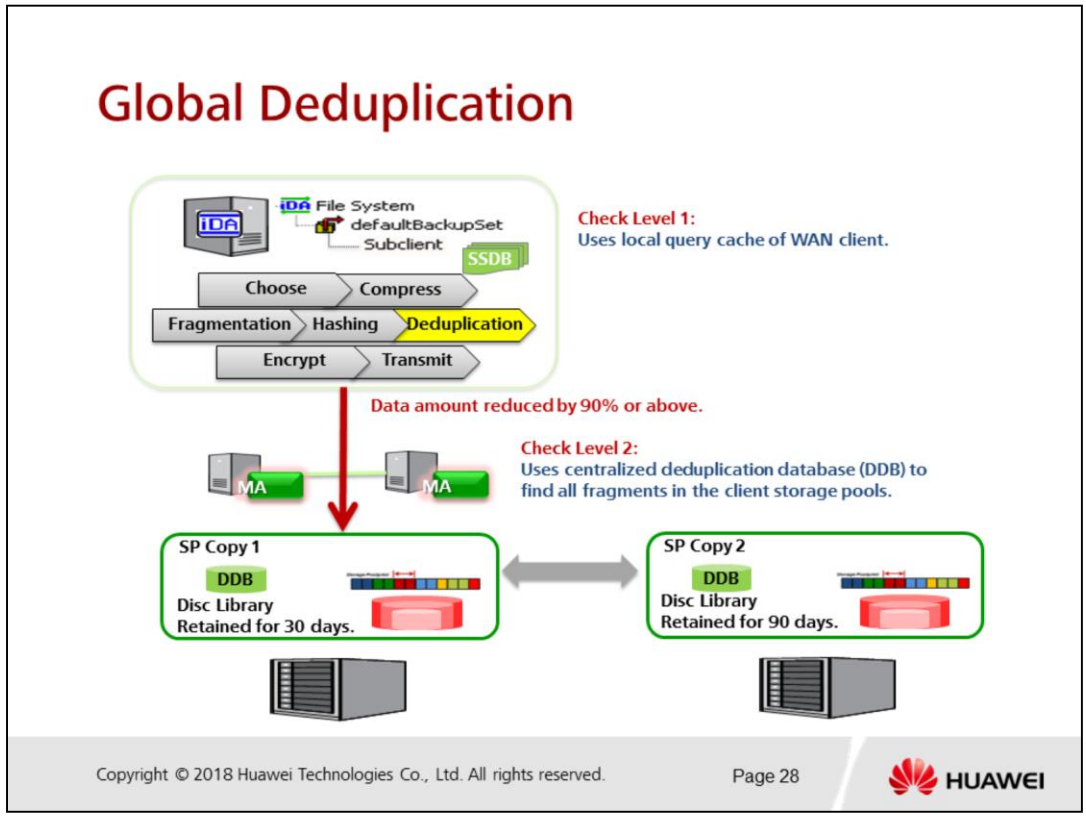
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- A good backup solution has many desirable features that not only maximize the backup efficiency but also provides easy operation and maintenance.
- An end to end backup solution must have a unified management interface to easier management of multiple components and backup tasks, easily expandable, highly reliable and has wide compatibility support.
- Features such as global deduplication and snapshot backups allows the increase in backup efficiency and saves on the consumption of storage space for backups.

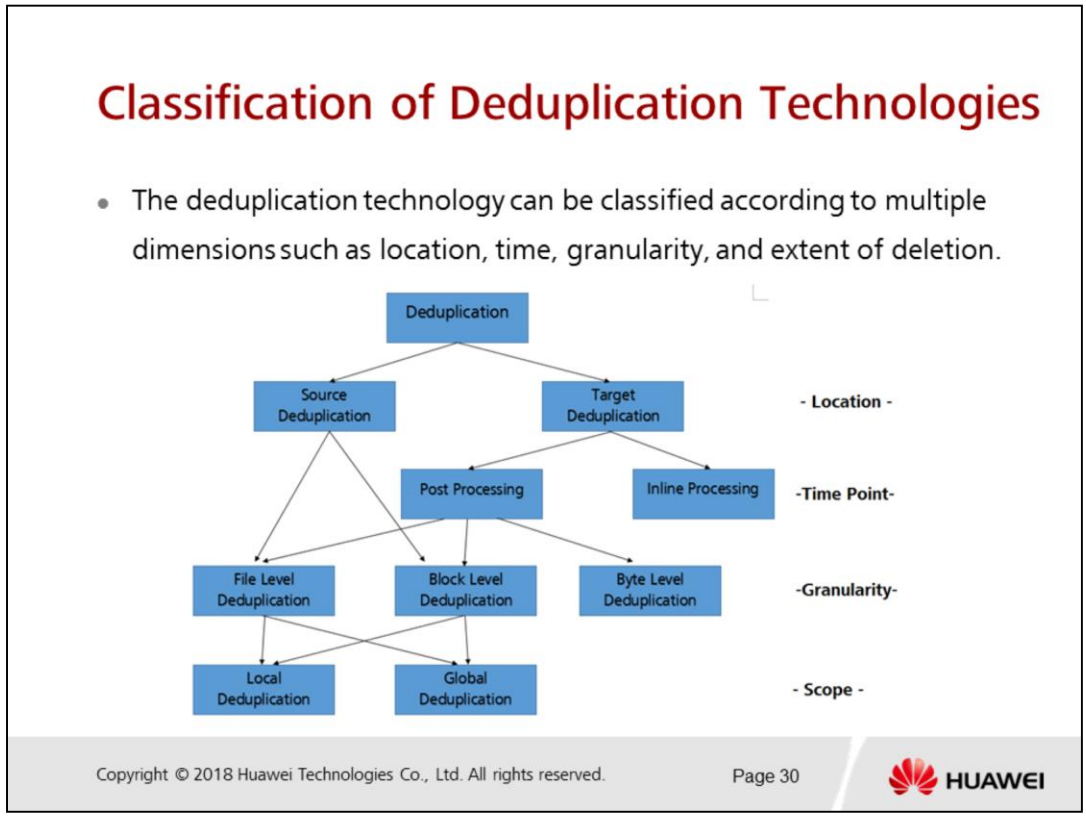


- Centralized management targets includes the enterprise's main server, all media agents, storage devices, and client agents.
- The unified management includes:
  - Unified performance management, such as historical performance statistics and performance data export etc.
  - Unified monitoring and management, such as real-time monitoring of system status and query of resource service status etc.
  - Unified device management, such as physical device management, simple configuration wizards etc.
  - Unified resource management, such as unified storage resource management, unified management of physical disks and shared storage space etc.



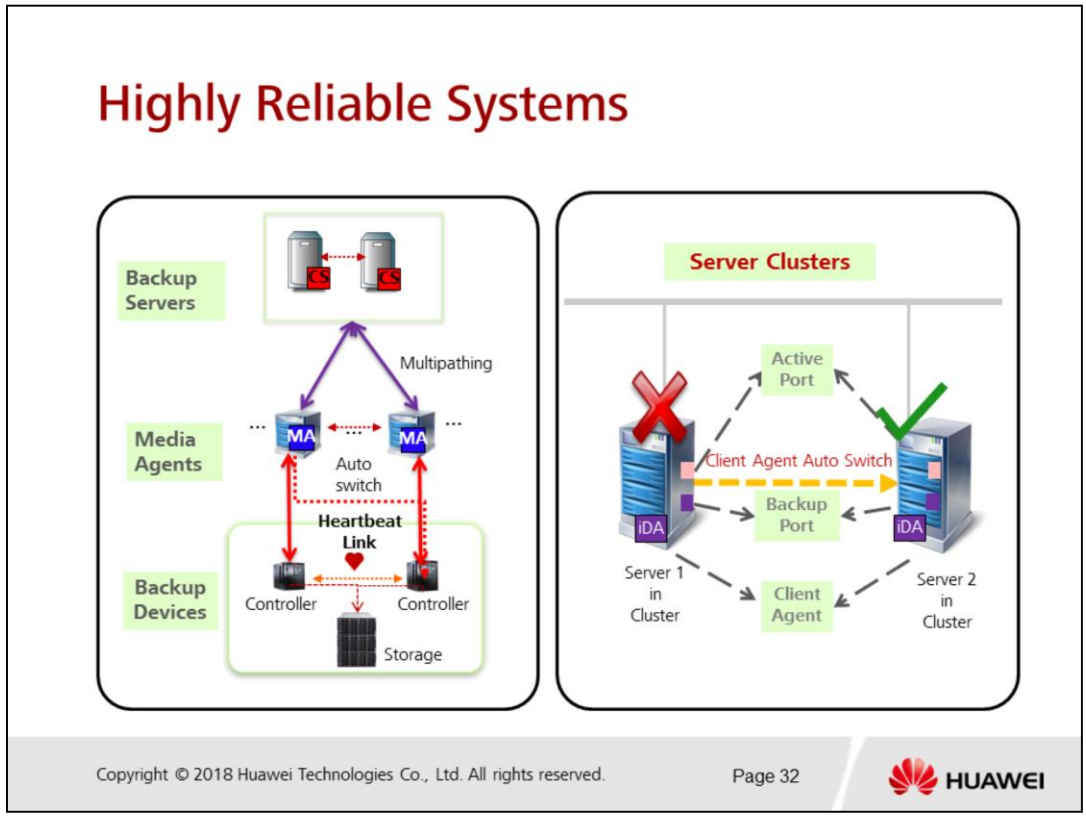
- Deduplication technology, in simple terms, refers to the technology that eliminates duplicate data. It uses software or hardware to process stored data to eliminate redundant data, thereby reducing the storage space occupied by data. .
- Implementation process of deduplication: The data that needs to be stored is compared with the hash unit by block, and the data block that is already stored previously is no longer stored again, and only the index is used to record the data block. The new data blocks that are not stored previously are physically stored and then indexed so that the same data blocks are physically stored only once. Through the index, you can see the complete logical view of the data, but in reality there is just little physical storage of data.
    - Raw data is stored on the media.
    - In the case of deduplication, comparisons are performed in units of a certain block size.
    - Only the unique data block is stored in the storage space after deduplication. The following data is compared with the unique data. Duplicate data is then deleted, and the Index and Metadata are stored in the specified space.
    - Data without duplicates are kept as the unique data in the storage space after deduplication, and the Index and Metadata are written at the same time.

- The Value of Backup:
  - It can save more storage space, greatly improve the utilization of storage, and reduce the user's TCO.
  - Reduce the backup window.
- Benefits:
  - Embedded: Includes source and destination deduplication.
  - Work faster and smarter: Online processing speeds up backup by 50% and the network simplifies the process by 90%.
  - Built-in copy: Create an offsite/remote copy using by using deduplicated copies of data for replication.
  - Network Optimization: Use Local Query Cache to maintain WAN connection performance.

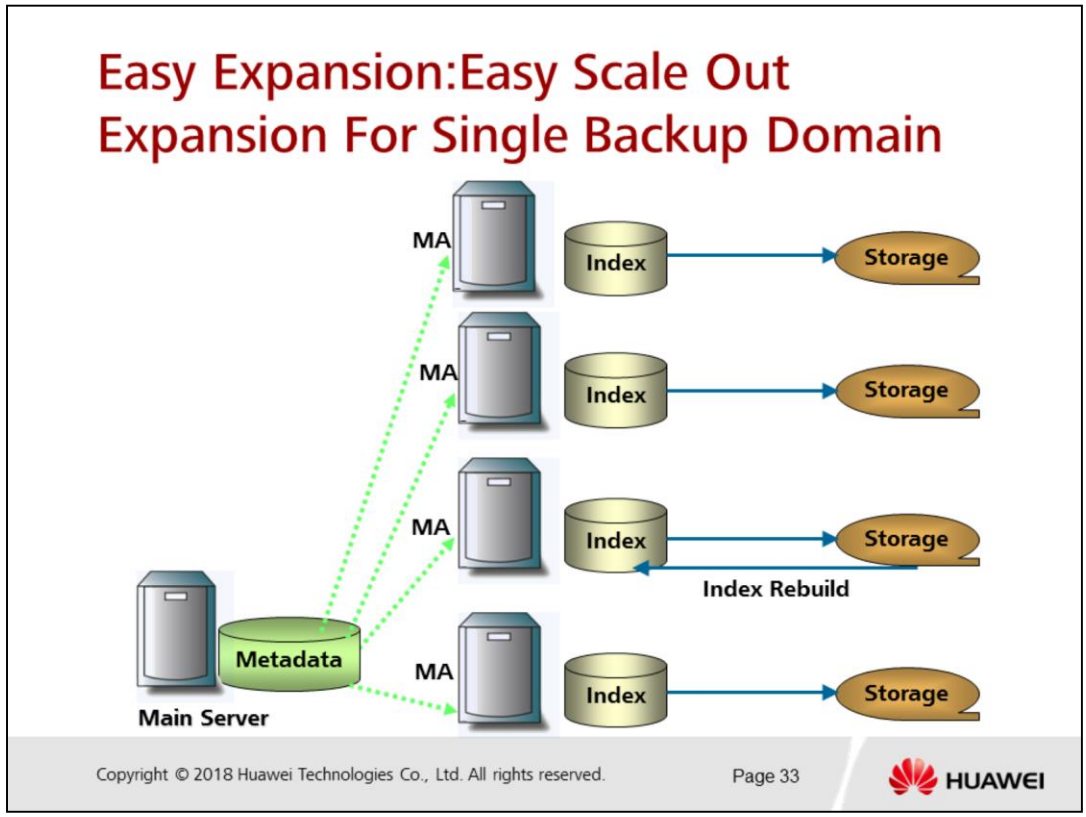


- The deduplication technology can be classified according to multiple dimensions such as location, time, granularity, and extent of deletion.
    - Source Deduplication: Delete duplicate data first and then sends the data to the backup device. Which means that, when the data is transmitted from the "source" to the "target", the transmitted data block is first hashed at the source end. If the data block has been previously transmitted, only the transfer hash is needed to be transmitted. If the data block has not been previously transmitted, then the data block is transmitted and the hash value of the data block is recorded. Advantage: It can save transmission bandwidth. Disadvantages: Occupy source resources for deduplication.

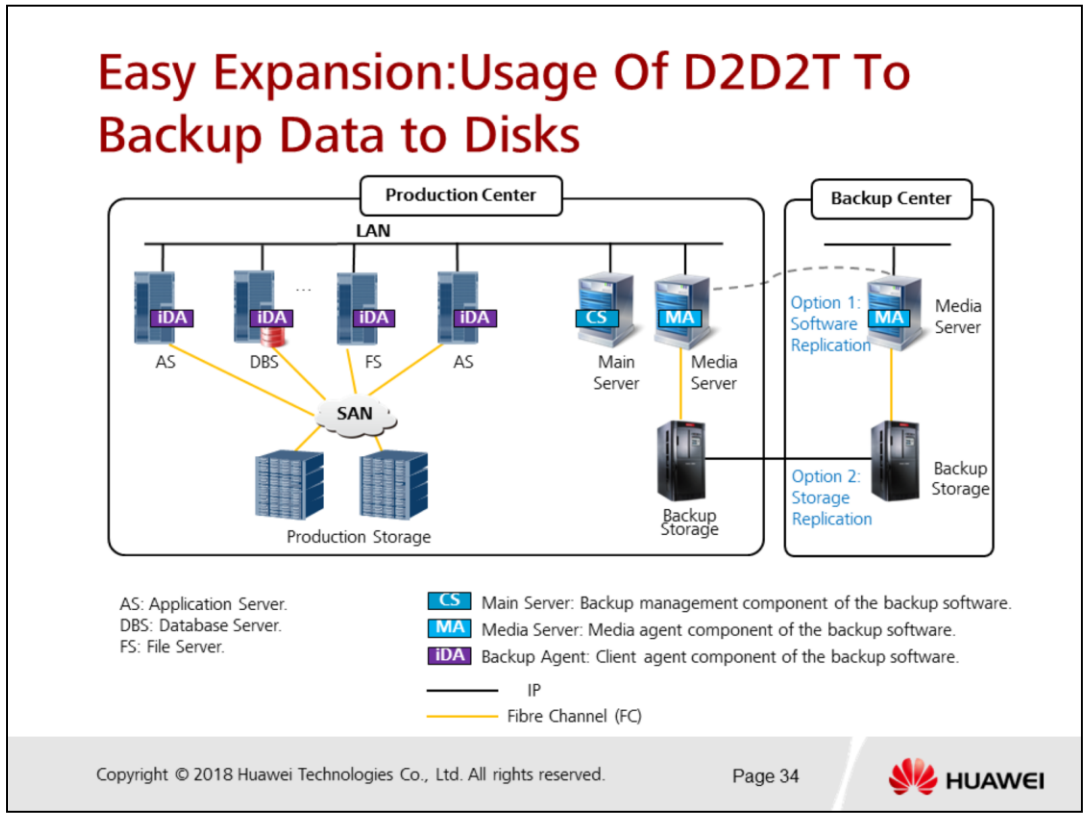
    - Target Deduplication: Data is transmitted to the backup device first, and duplicate data is deleted when it is stored. Which means that, when the data is transmitted from the "source" to the "target", the data block is transmitted to the target and the target performs deduplication on its side. Advantages: Does not occupy the resources of the source. Disadvantages: Cannot save transmission bandwidth. There are two ways to deal with the target deduplication:
        - In-Line Processing: De-duplication processing before data block is stored has the advantage of occupying less storage space. The disadvantage is that it affects data transmission performance.
        - Post-Processing: The data block is stored in the cache first, and then the heavy processing is performed when the system is idle. The advantage is that it does not affect data transmission performance. The disadvantage is that it requires additional storage space.
- Inline Deduplication: Data undergoes deduplication before it is written to disk.
- Post-processing: After data is written to disk, then only the deduplication process starts.
- Adaptive Data Deduplication: Inline deduplication is used in environments with low performance requirements, and post-processing deduplication is used when performance requirements are high.
- File-level deduplication: It is also known as single-instance storage (SIS), it checks the attributes of the files that need to be stored with the index, and compares with the attribute of the stored files within the index to see if there is the same file. If there is no same file exists, then the file is stored and the index is updated. If not, it will store a pointer towards the location of the already stored file.
- Block-level deduplication: The file/object is decomposed into blocks of fixed length or indefinite length, and then the data block is hashed, and compared with the hash value of the stored block. Only the uniquely hashed data block is stored.
- Byte-level deduplication: It finds and deletes the duplicate content from the byte level, then the user data is generally compressed and stored by a compression algorithm.
- Local deduplication: When looking for duplicate data, its only compares with the data in the current storage device.
- Global deduplication: When it looks for duplicate data, it compares the data with all storage devices in the entire deduplication domain.



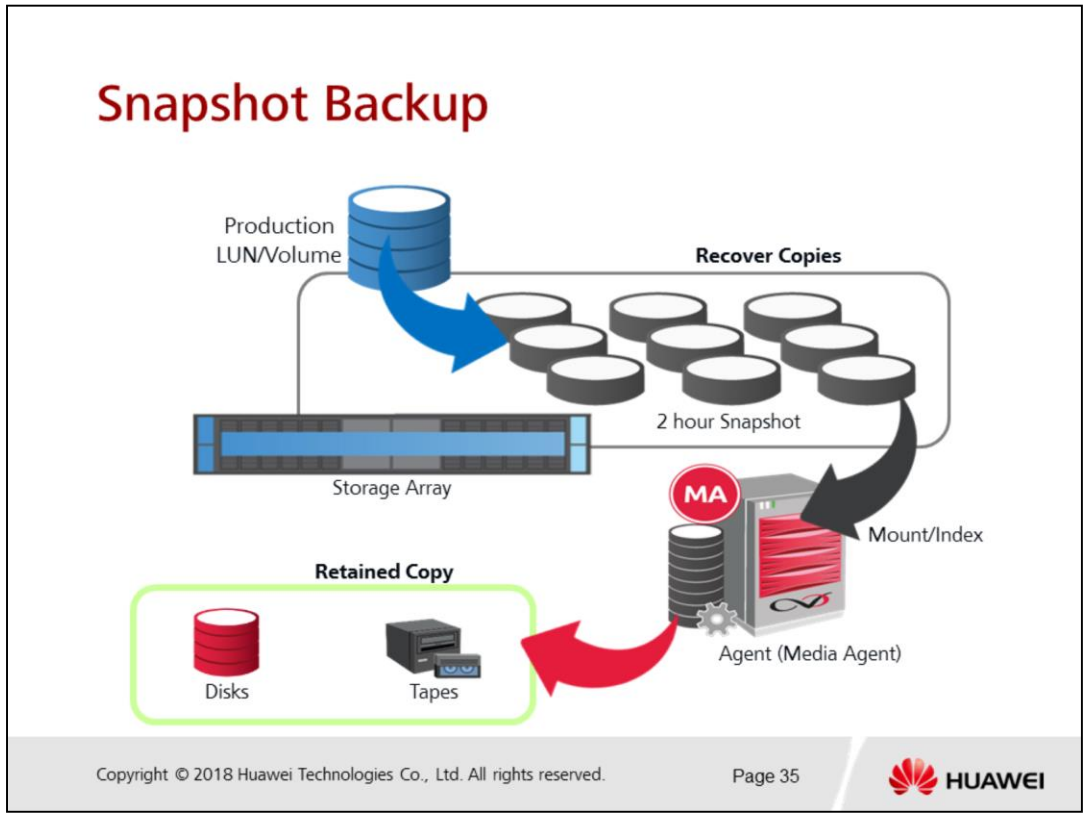
- All three layers of high availability design in the backup solution design ensures that the daily backup tasks can be completed without any system damage.
  - Backup server HA: Two backup servers can be deployed in HA mode to improve reliability.
  - Multipath in transmission media: All storage media agents work in Active-Active (A-A) mode and have multipath support for load balancing and switching.
  - Dual controllers: Dual controllers for storage devices make storage devices more stable and reliable.
- The backup client automatically switches to another server in the cluster through server switching.
  - Automatic switching: Automatically detect the status of the cluster and switches automatically.
  - Fast switching: Quickly restore backup jobs after the server switches.
  - Less maintenance work: No need to constantly monitor status of backup jobs, allows reliable backup, and less maintenance work.



- Manage the entire data protection of the enterprise in a single domain. It has good scale-out capabilities. Media agents maintain granular index information to support millions of objects.
    - Centralized management: Uses split indexes to centrally manage all information. There is no extra maintenance cost for this process.
    - High flexibility: Media agents are easily expanded to support more data.
    - Large-scale: Supports 10,000 clients, about 100 times more than a centralized index.
    - Granular recovery: Granular recovery of individual objects which is suitable for VMs, files, Exchange, SharePoint, and Lotus Notes.

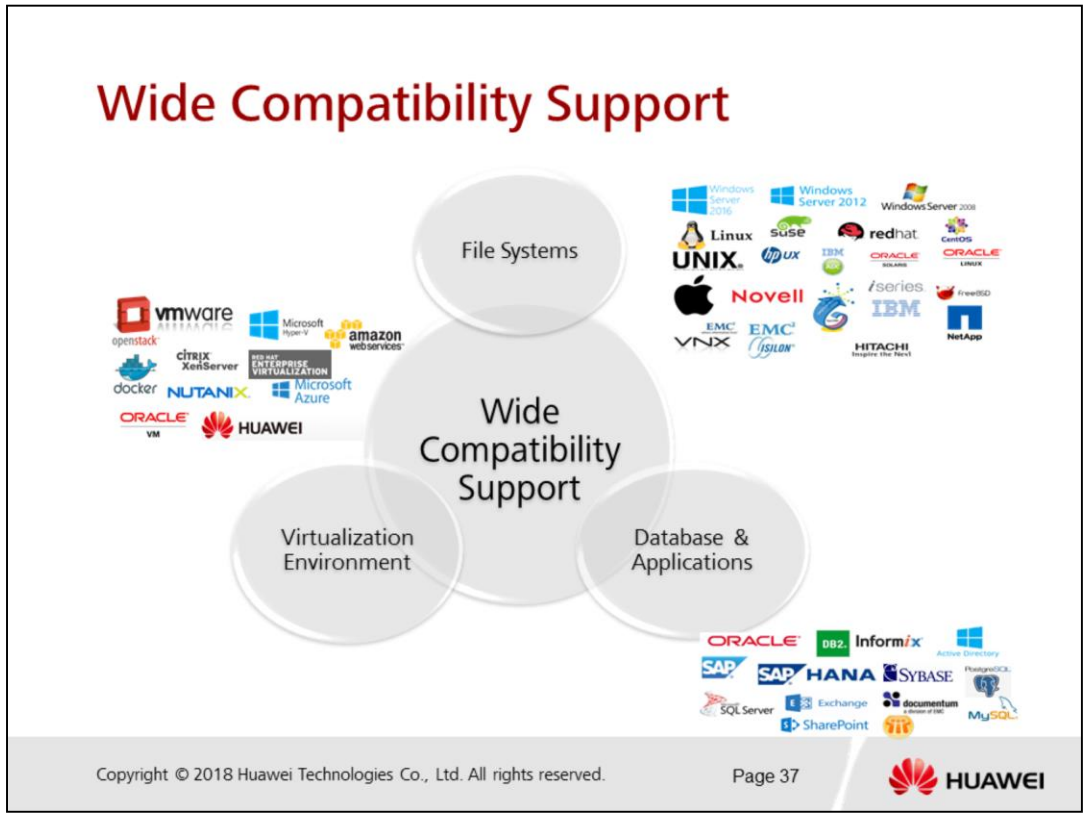


- Software Replication:
  - Advantages: Easy to manage, and supports recovery/restoration of backup data directly from backup center.
  - Disadvantages: Software replication requires a license.
- Storage replication:
  - Advantages: No software license required.
  - Disadvantages: Complex management.
- Disk-to-disk-to-tape (D2D2T) is an approach to computer storage backup and archiving, in which data is initially copied to backup storage on a disk storage system and then periodically copied again to a tape storage system.



- Supports storage arrays with snapshot integration feature.
- Supports off-host agent-based backups.
- Equipped with fast recoverability:
  - Browse the contents of the backup to quickly restore the selected object.
  - Combine incremental backups into full backups in the background to quickly restore data.
  - Restoring data from hardware snapshots, and can also use snapshots for fine-grained recovery.
- Recovery copy:
  - Storage array protection: Supports native format, storage auto-discovery, its fully integrated (no scripts), and with snapshot support.
  - Storage array recovery: Restore volume, clone/mount, copy data back from backups.

- Keeping a copy (optional):
    - Reserved copy with index: Protect all data or only save related data. All layered options (disk/cloud/tape). Aligns retention and recovery strategies.
    - Out-of-array retention: Data deduplication, compression, and encryption options. Storage and location are independent from each other.
    - Full recovery options: Rely on agents, cross-server, full-quantity (BMR) to granular recovery.
    - Content Index Awareness: Agent/Particle options for indexing of data.
- Bare-metal restore(BMR) is a technique in the field of data recovery and restoration where the backed up data is available in a form which allows one to restore a computer system from "bare metal", e.g. without any requirements as to previously installed software or operating system.



- For more information, please refer to : http://documentation.commvault.com/commvault/v11/article?p=landing_pages/c_backup_agents.htm.
- Wide File System compatibility support:
  - Windows: 2016, 2012, 2008, 2003, 10, 8, 7, Vista, XP.
  - Linux:
    - Asianux, Debian, Fedora, Gentoo, Mandriva, NeoKylin.
    - OpenSuSE, Red Flag, Red Hat, Scientific, Slackware.
    - Source Mage, SuSE , Ubuntu, Z-Linux, Oracle.
  - Unix: IBM AIX, HP-UX, Oracle Solaris, FreeBSD
  - Other OS: Mac, IBM iSeries, OpenVMS, Novell OES
  - Storage:
    - Dell, EMC, Hitachi, Huawei, IBM N-Series
    - NetApp, NextaStor, Nexsan, Oracle ZFS, Stratus

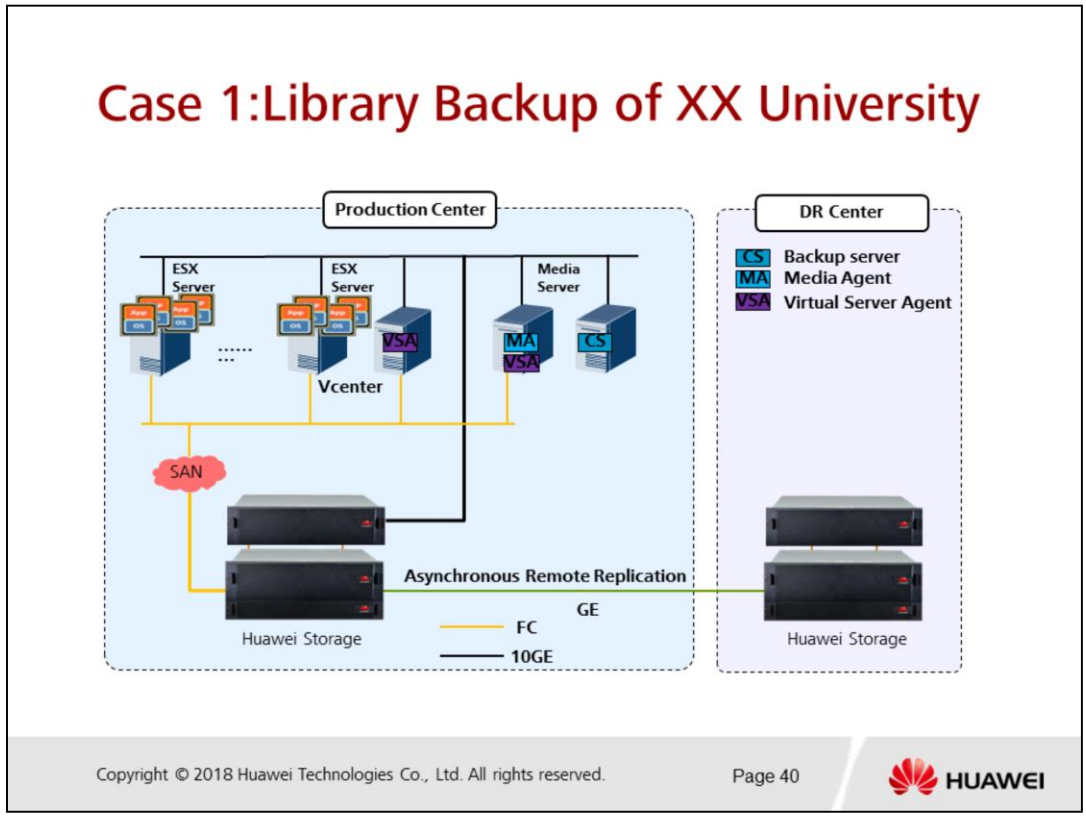
- Wide databases and application compatibility support :
  - Oracle、Oracle RAC
  - SAP for Oracle、SAP MaxDB、SAP HANA
  - SQL Server、SQL Server Always On
  - Exchange、Active Directory、SharePoint
  - DB2、DB2 MultiNode
  - Sybase
  - Informix
  - MySQL、PostgreSQL
  - IBM Domino
  - Documentum
- Wide compatibility support for virtualization environment :
  - VMware
  - Hyper-V
  - OpenStack
  - Xen Server
  - RED HAT Enterprise
  - Nutanix
  - Huawei
  - Docker
  - Oracle VM
  - Azure
  - Amazon

Contents

1. Overview Of Backup Solutions.
2. Architecture Of Backup Solutions.
3. Common Backup Networks.
4. Common Backup Technologies.
5. **Application Cases Of Backup Solutions.**

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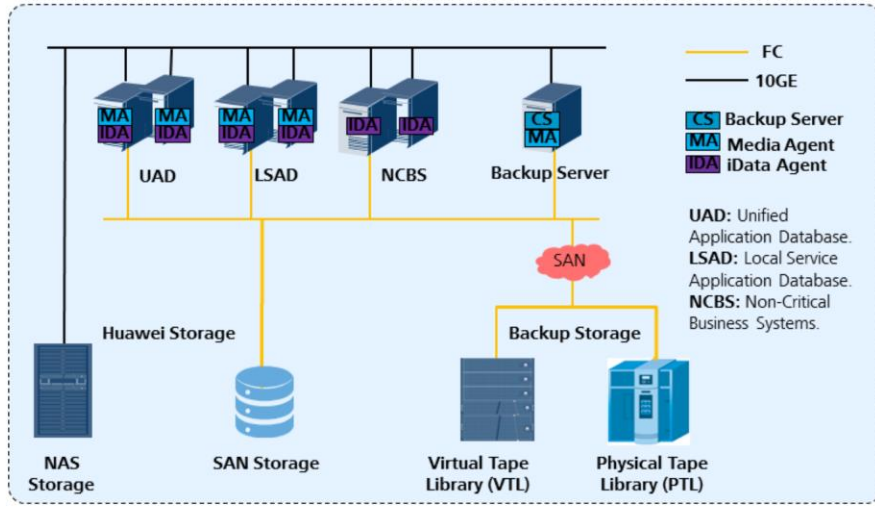
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- Business Challenges:
  - The existing network applications are based on virtual machine platforms and have low backup performance.
  - There are a large number of library books and there is a lack of a unified backup platform.
  - An off-site disaster recovery center needs to be established to ensure the security of backup data.
- Solution:
  - Use the LAN_Base networking mode to deploy and use the Enterprise centralized backup solution.
  - Simpana is used as the backup software. Huawei storage is used as a backup medium for local and offsite disaster recovery centers.

- Customer Benefits:
  - It is not necessary to install agent software on each virtual machine, and it automatically discover new virtual machines in time to ensure efficient backup of the virtual machine platform.
  - The use of deduplication technology greatly reduces the consumption of storage resources.
  - Remote replication technology enables fast and reliable backups.

Case 2:Backup of XX Procuratorate

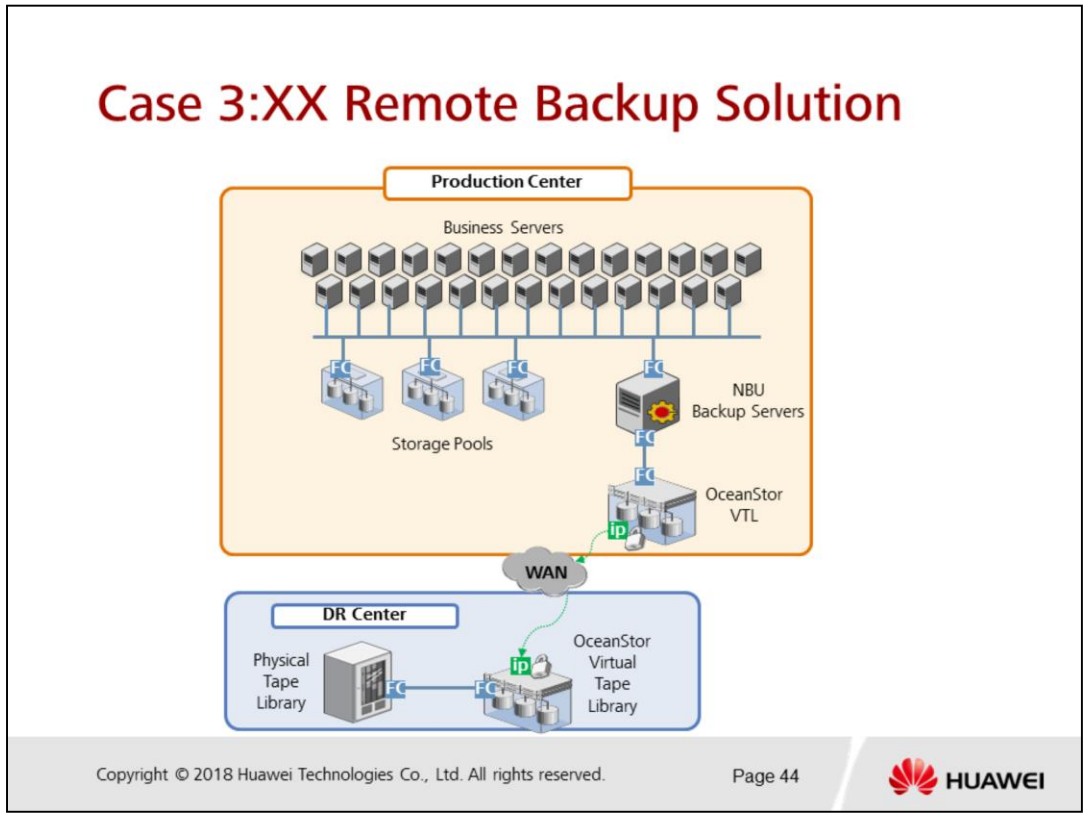


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- Business Challenges:
  - Prosecution service data has grown rapidly and management work has been difficult.
  - Lack of unified service application platform for service backup.
  - It is hoped that a backup system will be built to enable the service backup platform to exchange data with the superior and the subordinate units.
- Solution:
  - Build a unified backup platform, use Simpana as backup software, and VTL6900 as a backup medium.
  - Deploy LAN_Base and LAN_Free hybrid networking to maximize the usage of existing network resources.
  - Use deduplication technology to reduce storage space consumption.

- Customer Benefits:
    - Achieve high-performance backup of the high-precision unified service database, local service application database, application servers and non-critical business service systems.
    - The new unified service backup platform fully meets the data exchange requirements of the upper and lower levels.
    - Unified backup management for the ever-increasing data, and the backup system supports elastic expansion.
    - Deduplication reduces the consumption of bandwidth and storage devices.
- Production Storage: Data storage for unified business application software uses the SAN+NAS storage architecture. The structured data is stored in the SAN manner, and unstructured data in files is stored in the NAS mode to implement a large centralized storage of data.
- Backup uses near-line backup and offline backup:
    - Near-line backup, which is mainly used to restore data of services, can be implemented in a virtual tape library to complete large-capacity data backup tasks within a specified time. Due to the fact that the virtual tape library supports compressed storage and deduplication, the data compression rate for such data blocks with high repetition rates for law case data can reach up to the ratio of 10:1 or higher.
    - Offline backup is implemented by physical tape library. LTO5 tape drives can store 1.5TB of data without compression. Generally, offline backup is calculated according to 7 times of storage quantity, i.e. 45*7=315TB, and the required slot number for tapes should not be less than: 315/1.5=210.
- The unified application database and local service application database uses LAN-FREE backup networking.
- Non-critical business service systems uses LAN-BASE backup networking.



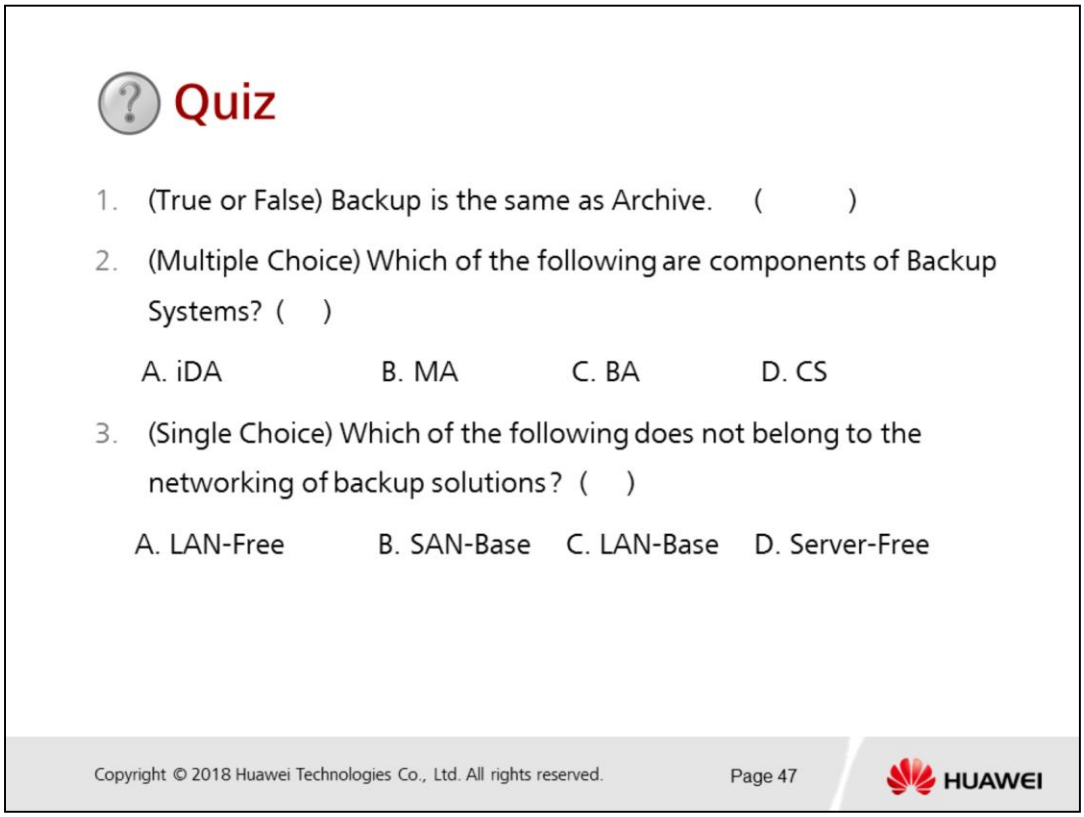
- Business Challenges:
  - Existing DAS storage architecture, storage expansion difficulties, and high management costs.
  - No centralized backup system, requires manual operation, and low reliability.
- Huawei Solution:
  - Production Center deploys a NBU + VTL Backup System.
  - Disaster Recovery Center deploys a VTL(Virtual Tape Libraries).
  - Remote backup and data replication for disaster recovery between the VTL of production center and disaster recovery center through IP network.

- Value to Customers:
    - RTO and RPO are days, when the production center fails, all data can be restored to the last backup point, reducing the company's direct economic losses and reputation losses.
    - Less investment, local protection and remote disaster recovery.
    - Realize online dynamic expansion of storage and reduce maintenance costs.
- NBU (Veritas NetBackup):
    - A product that lets you back up, archive, and restore files, directories, or raw partitions that reside on your client system.

Summary

- This module mainly introduces the contents of the following topics:
  - Concepts, Policies and Key Technologies of Backup Solutions.
  - Architecture and Components of Backup Solutions and the Structure of Backup Systems.
  - The Common Backup Networking in Backup Solutions.
  - The Typical Application Cases of Backup Solutions.

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- Answers:
  - False.
  - ABD.
  - B.

Thank You

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