



IBM System Storage

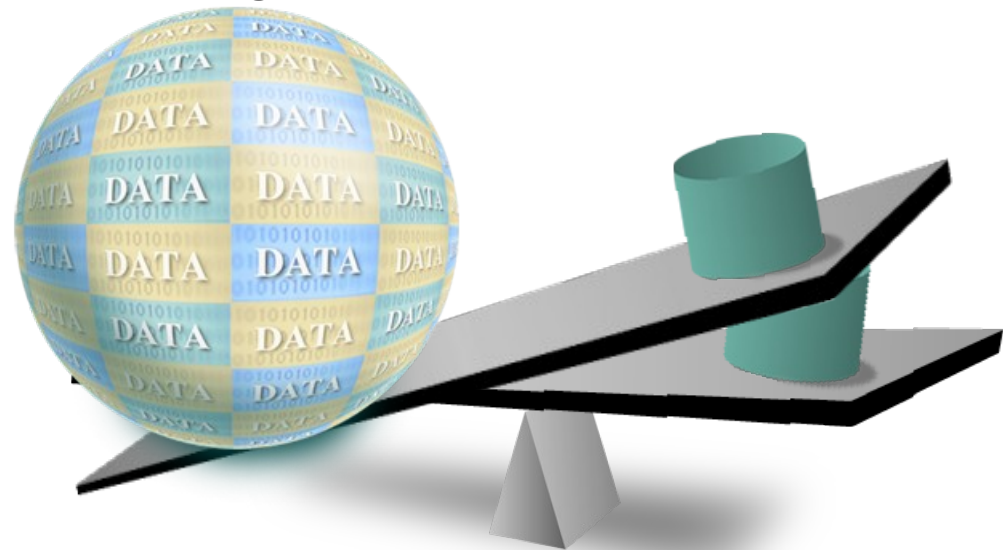
TS7650 with ProtecTIER™

Data Deduplication in a Virtual Tape Library Environment

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Agenda

- **Data Deduplication Demystified**
- **Data Deduplication Considerations and Value Proposition**
- **Data Deduplication Approaches in Practice**
- **ProtecTIER powered by HyperFactor**
- **TS7650G Gateway**
- **TS7650 Competitive Landscape & Positioning**

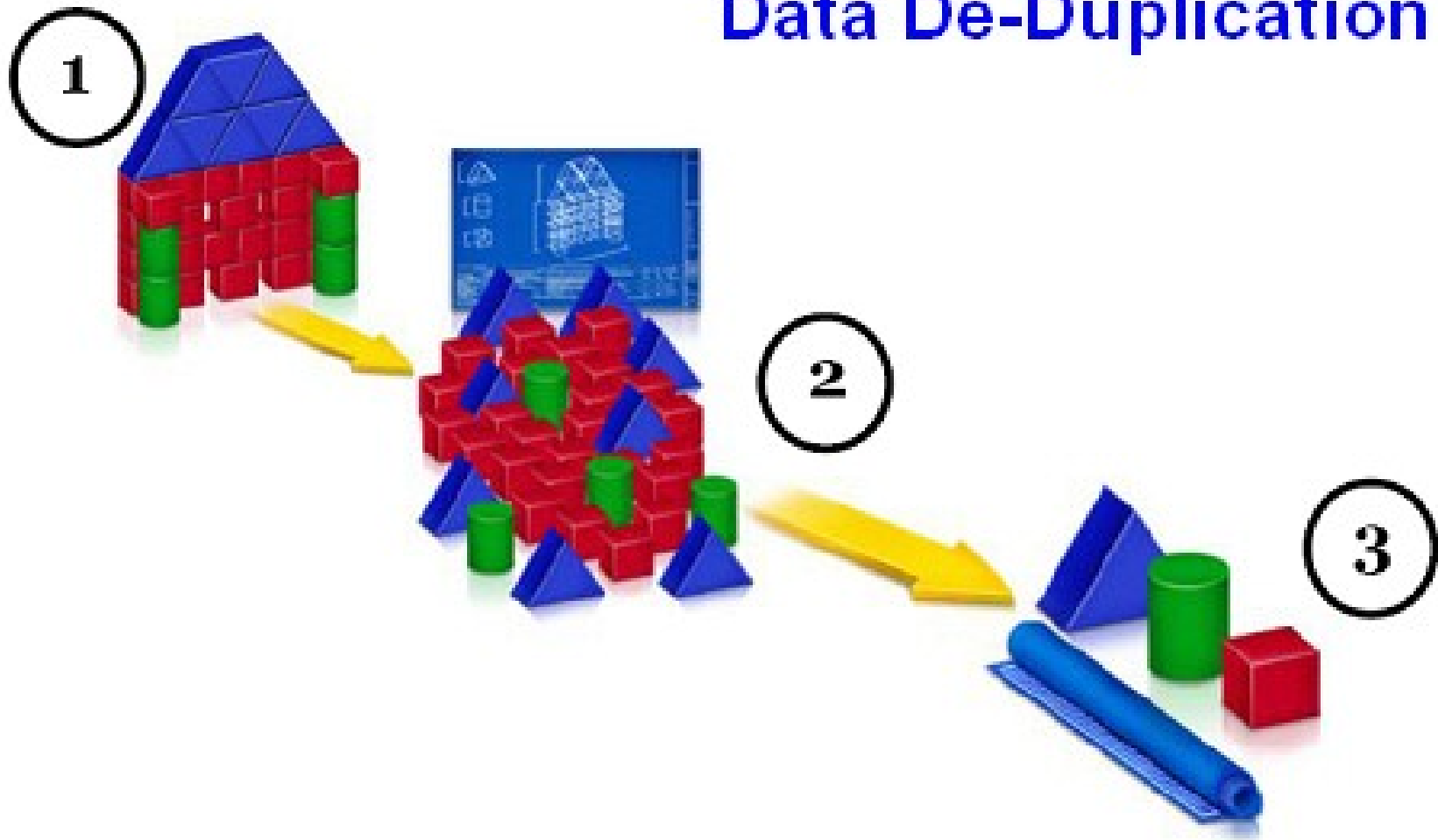




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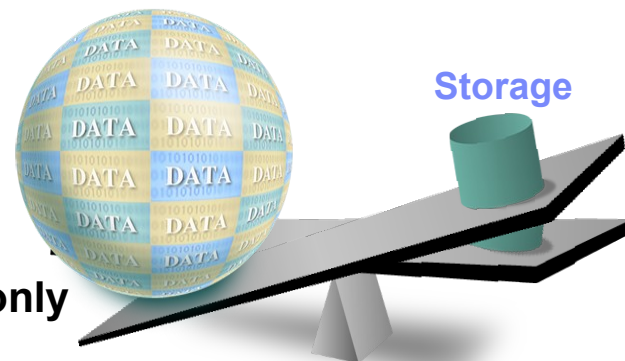
Data Deduplication Demystified

Data De-Duplication



What is Data Deduplication?

- **Repeated instances of identical data are identified and only one instance is stored**
 - ▶ Identical data points to a single instance (Single Instance Store)
- **Maintain transparency to application/end-user**
- **Compared to compression data is not changed**
 - ▶ Compression can be combined with deduplication
- **Saves storage capacity for the same data**
- **Save network bandwidth because less data might be transmitted**
 - ▶ Dependent of where the deduplication occurs



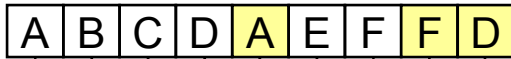
Data Deduplication Process (simplified)

Data Object / Stream

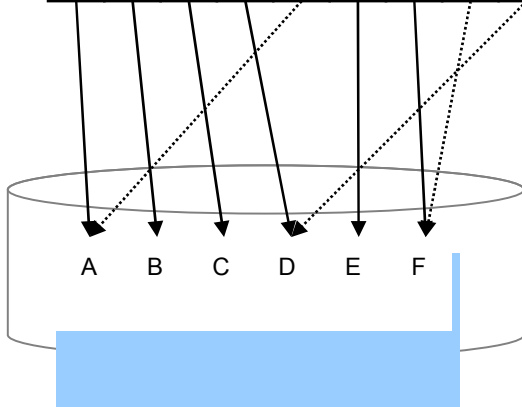
Data object or stream is subject for deduplication



Data object is split in chunks (fixed or variable size) - **chunking**



For each chunk an identity characteristic is determined

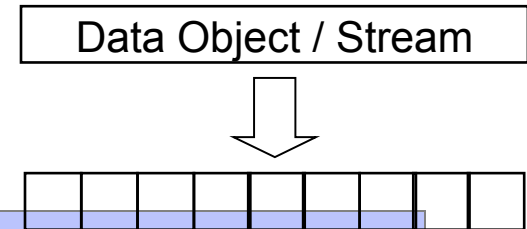


Determine duplicate chunks

- Identical Chunks are referenced (pointer, reference)
- Non-identical chunks or single instances are stored
- Compression may be performed in addition.

Identical Chunks

Methods for Data Chunking



1. File based

- One chunk is one file, most appropriate for file systems

1. Block based

- Data object is chunked into blocks of fixed or variable size
- Used by block storage devices

1. Format Aware

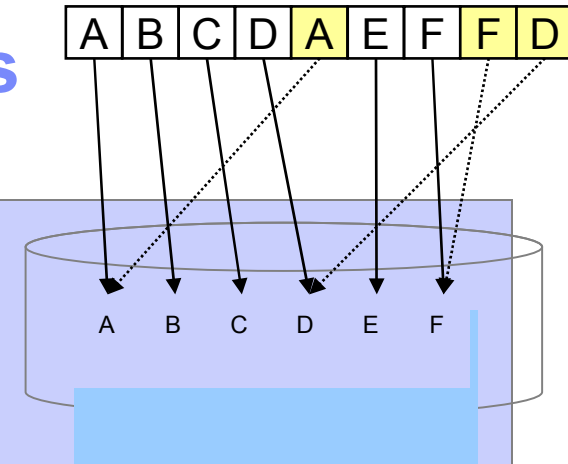
- Understands explicit data formats and chunk data object according to the format
- Example: Breaking a PowerPoint presentation into separate slides

1. Format agnostic

- Chunking is based on an algorithm that looks for logical breaks or similar elements within a data object

➔ **Chunking method influences deduplication ratio**

Method for Determining Duplicates



1. Hashing

- Computes a hash (MD-5, SHA-256) for each data chunk
- Compare hash with hash of existing data
 - Identical hash means most likely identical data
- Hash Collisions: identical hash but non-identical data
 - Must be prevented through secondary comparison (additional metadata, second hash method, binary comparison)

1. Binary comparison

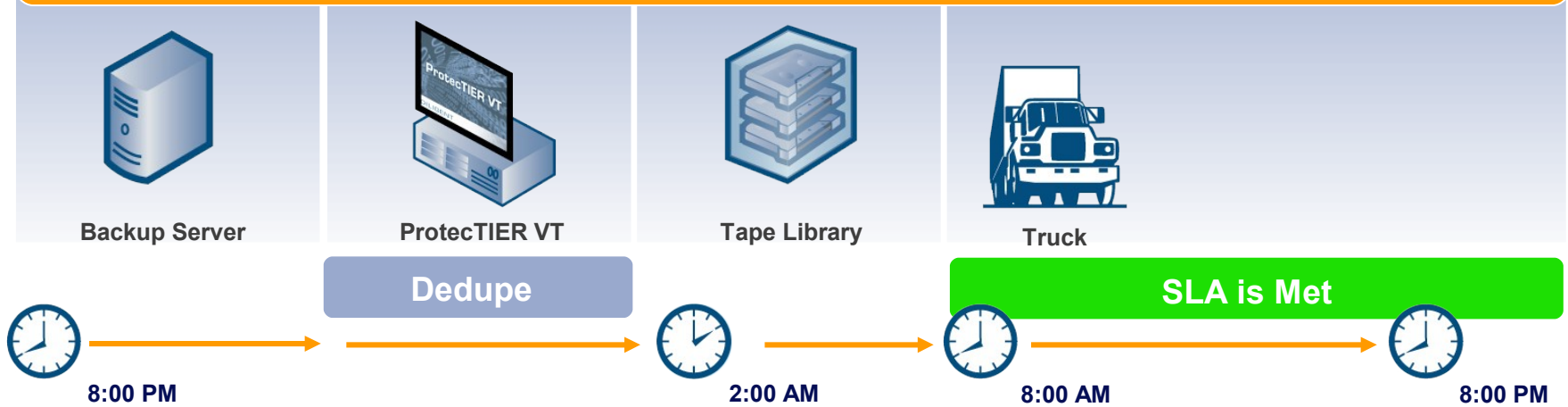
- Compare all bits of similar chunks

1. Delta Differencing

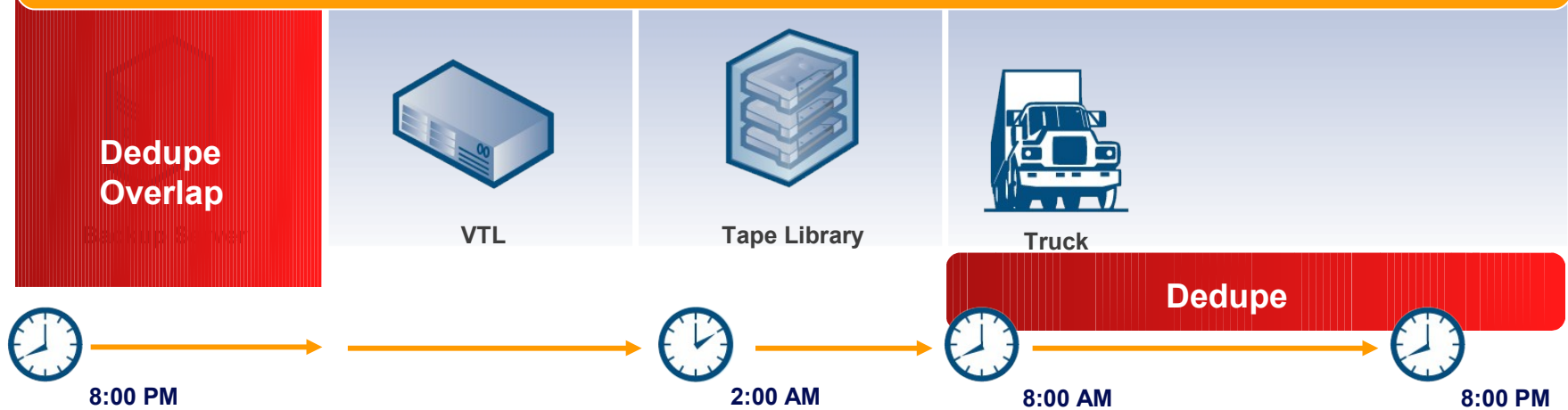
- Computes a “delta” between two “similar” chunks of data where one chunk is the baseline and the second is the delta
- Since each delta is unique there is no possibility of collision
- To reconstruct the original chunk the delta(s) have to be re-applied to the baseline chunk

➔ Method for determining duplicates influences performance

Inline Processing



Post Processing





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Data Deduplication Approaches in Practice

Three Basic Approaches Talked About Today in The Industry:

HyperFactor

A different approach based on an agnostic view of data

Hash based deduplication

Sometimes referred to as a Content Addressable Storage approach

Content Aware

Assumes the best candidate to dedupe against is an object with the same properties (name etc.)

HyperFactor Approach

- **HyperFactor has two indexes**
 - ▶ **HyperFactor index used for backup**
 - Fixed size of 4 GB, stored in memory
 - Contains references to data elements already stored in the repository
 - Used to filter out similar elements from data stream

 - ▶ **Restore Index used for restore**
 - Dynamic index, growing
 - Includes references to deduped data elements/objects
 - Stored on disk system

Assessment for HyperFactor

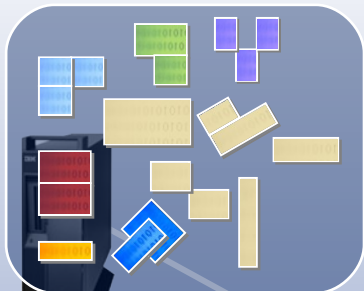
- **No Hash Table required**
 - ▶ No scalability issues
 - 4 GB index references 1 PB of physical data

- **No dependency of data format and application**
 - ▶ Very flexible

- **HyperFactor index always fits in memory**
 - ▶ Enables in-band deduplication

- **Eliminates the phenomenon of missed factoring opportunities**
 - ▶ Looks for similarity between data not on exact chunk matches

New Data Stream



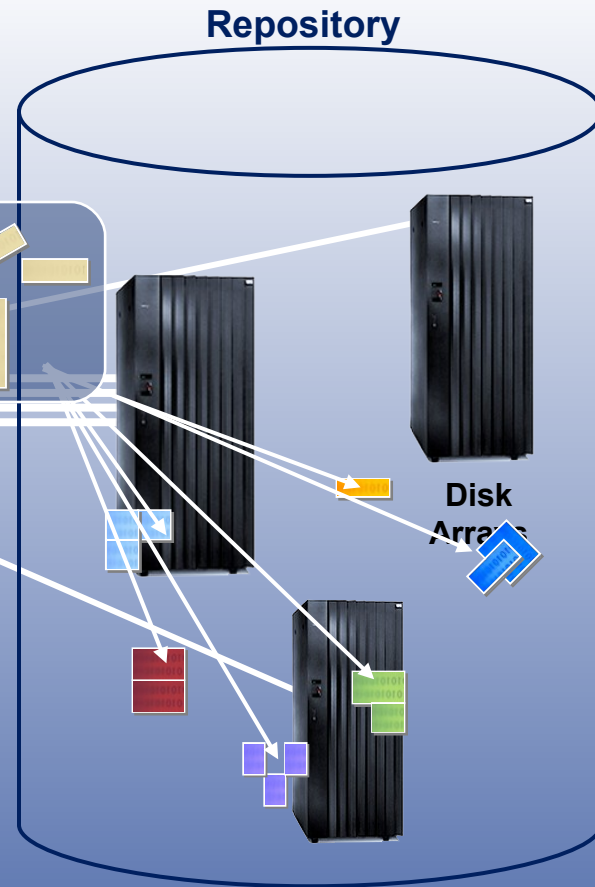
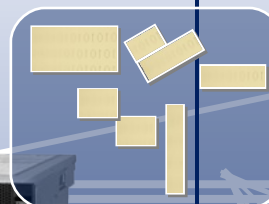
Backup Servers



FC Switch

Memory Resident Index

TS7650G

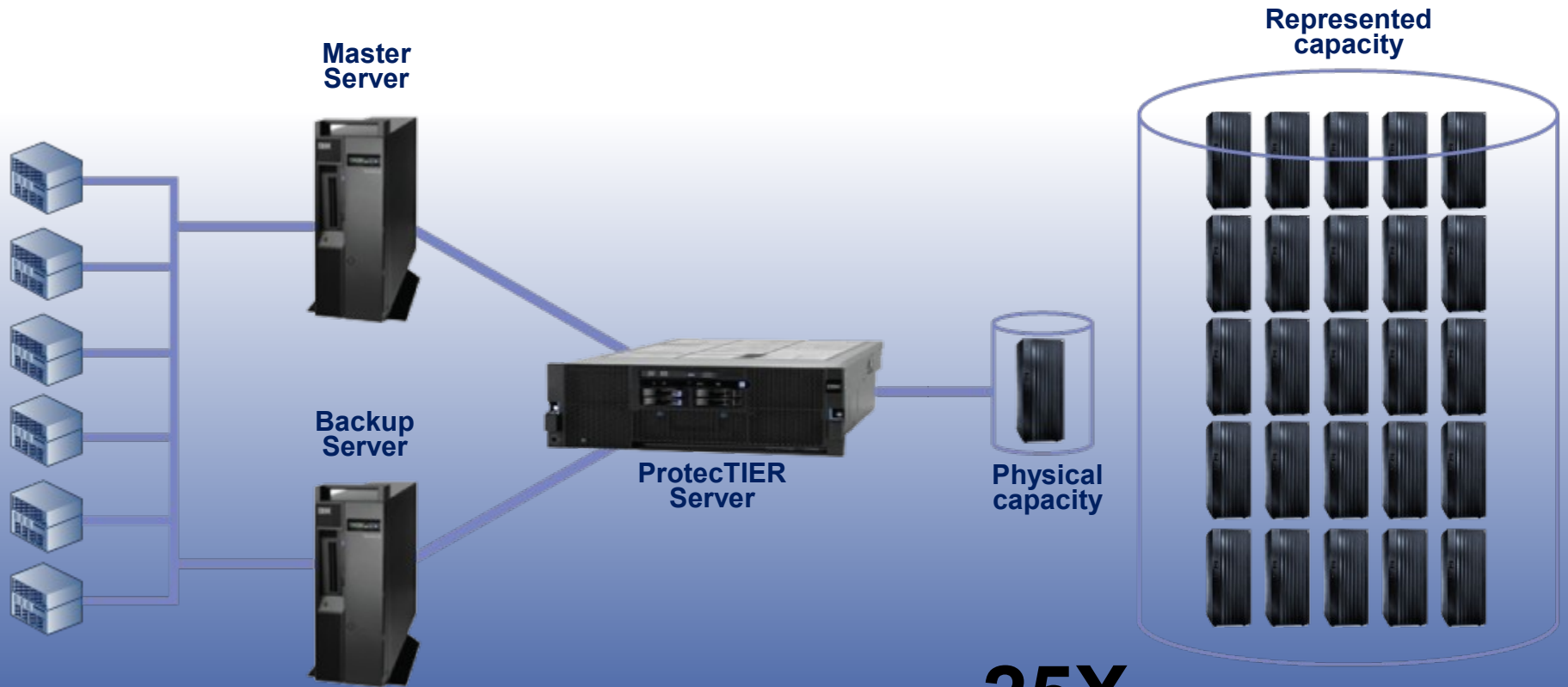


Ratio of Repository to Index: 250,000 : 1

“Filtered” data



The Impact of HyperFactor



Up to **25X** the physical capacity

Sample Customer HyperFactor Results

- **ProtecTIER achieves high factoring ratios**
 - ▶ stores up to 25x more data than the used physical capacity

Customer Scenario	Nominal Capacity	Physical Capacity	Factoring Ratio
Largest US Wireless Carrier	190 TBytes	13 TBytes	~15:1
F100 Retail Distributor	880 TBytes	40 TBytes	~22:1
F100 Financial Institution	850 TBytes	50 TBytes	~17:1
F100 Manufacturing	450 TBytes	37 TBytes	~12:1



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ProtectTIER™ powered by HyperFactor™



IBM ProtecTIER Overview

- **ProtecTIER with HyperFactor is a software running on Red Hat Linux**

- **ProtectTIER provides tape library emulation via FC**
 - ▶ Library Emulation
 - ATL P3000
 - IBM TS3500 (only together with LTO3)
 - ▶ Drive Emulation
 - IBM LTO2
 - IBM LTO3 (only together with IBM TS3500)
 - QUANTUM DLT7000

- **HyperFactor provides data deduplication**
 - ▶ Format agnostic chunking
 - ▶ In-band data deduplication

- **Deduplicated data and metadata are stored on disk systems**
 - ▶ also called repository

IBM ProtecTIER Highlights

Performance	Up to 450 MB/s per node, performing <u>inline</u> data de-duplication
Scalability	Up to 1 PB physical capacity per system (up to 25 PT nominal capacity with a HyperFactor of 25)
100% data integrity guarantee	Binary diff process during data de-duplication ensures 100% data integrity
Data agnostic	Not sensitive to data type, file name, or data structure of the specific backup application (unlike content-aware approaches)
Higher availability	Clustered configuration available to provide hardware redundancy in the event of a node failure
No impact to existing daily operations	Inline data de-duplication eliminates need for significant secondary processing
Non-disruptive Integration	Seamless integration in existing backup environment and infrastructure

IBM TS7650 ProtecTIER® Deduplication Family





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TS7650G Gateway

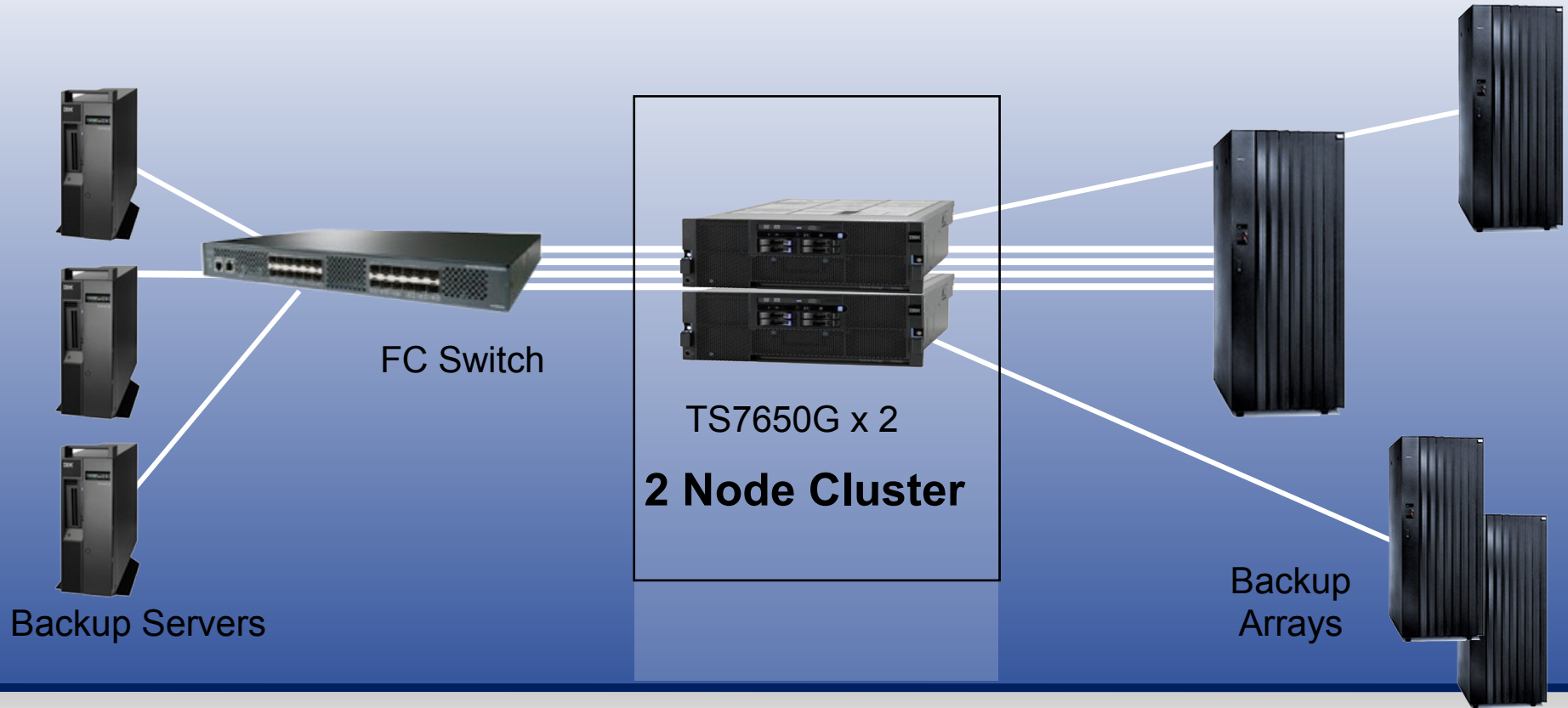
Announced:	Aug 26, 2008
Available:	Aug 29, 2008

TS7650G ProtecTIER Overview



- Software solution that resides on standard Linux server
- Emulates a tape library unit, including drives, cartridges and robotics
- Uses FC-attached disk array as the backup medium

TS7650G – ProtecTIER De-Duplication Gateway, Clustered



- Active-active true clustered nodes
- High performance (900MB/s sustainable)
- Highly available

- High capacity, highly scalable
- Easily manageable
 - two nodes working together
 - one repository



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TS7650 Competitive Landscape & Positioning

ProtecTIER's Market Presence

- **Only Enterprise Data-Center inline data deduplication platform**
 - ▶ Performance
 - ▶ Scalability
 - ▶ Data Integrity

- **Launched in Q4 2005 (over 36 months in production)**
 - ▶ 3 of the Top 10 Global Telecommunications Companies
 - ▶ 3 of the Top 10 Global Media & Entertainment Companies
 - ▶ 3 of the Top 10 Global Consumer Electronics Companies
 - ▶ 2 of the Top 10 Government Agencies
 - ▶ Top 10 Global Commercial Banking Firm, Global Investment Firm, Global Cellular Company, Global Healthcare Service Provider, Global Car Manufacturer

- **Vital Stats**
 - ▶ Over 200 Customers worldwide; over 500 systems in production
 - ▶ Over 20 PB of disk capacity under management

Enterprise Deduplication Requirements

Performance

Data is growing, backup windows are shrinking. Solutions must allow customers to process more data faster

Capacity

Business needs and regulation are driving the need for long term on-site disk-based data retention. Solutions must allow for large and growing (hundreds of TB) repositories

Data Integrity

Information is the company's lifeblood. Data integrity is essential

Non-Disruption

The solution must fit with existing practices, policies and SLAs

ProtecTIER Differentiators

Performance

Sustainable 500 MB/s per node (1000 MB/s two node cluster), performing *inline* deduplication

Capacity

Up to 1 PB physical capacity per node

Enterprise-Class Data Integrity

Binary diff process during dedupe designed for the highest data integrity

Non-Disruption

Daily Operations
Inline deduplication eliminates need for significant secondary processing

Implementation
Integrates well with existing backup environment and infrastructure



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Thank You!

Bu sunum 22 Ekim 2009 tarihinde İstanbul Swisotel the Bosphorus'da yapılan Yazılım Zirvesi 2009 için hazırlanmıştır.

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