



Advanced Technical Skills (ATS) North America

Tivoli Storage Manager for z/OS Media

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Agenda

- **TSM for z/OS Media (Media Server) Goals**
- **Design for Accessing z/OS Media**
 - Client to Server Data Flows
 - Media Server Functions
 - TSM Server to Media Server Connections
- **Basic Solution Configuration**
 - Configuring z/OS Components
 - TSM Server Definitions
- **Configuration for Storage Agent Technology**
 - Data Flows
 - Configuring Server and Storage Agent

Media Server Goals

- **Exploit legacy FICON tape infrastructures**
 - TSM supports FICON infrastructure only on z/OS
 - z/OS installations have significant investment in FICON
 - TSM on 'open systems' requires FCP infrastructure
- **Media Server solution provides:**
 - Ability to allocate new *SCRATCH* tape and sequential *FILE* volumes
 - Support for Storage Agent connection to Media Server
 - Support for TCP/IP IPv4 & IPv6 communication
 - Authentication of resource access via RACF

Media Server Deliverables

1. Media Server

- Performs allocation and I/O to tape and enhanced file device class
- Uses same interfaces to z/OS tape management system as TSM V5 on z/OS
- Supports z/OS security mechanism, ie. RACF
- Exploits DFSMS for sequential *FILE* storage
 - Dynamic allocation eliminates JCL for *FILE* volume allocation
 - Transparent performance benefit of VSAM striping

1. TSM V6.3 Servers

- Linux for System z and AIX servers have added function to access z/OS media via Media Server

1. TSM V6.3 Storage Agents

- AIX, zLinux, xLinux, Solaris and Windows have added function to access z/OS Media via Media Server



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Design for Accessing z/OS Media

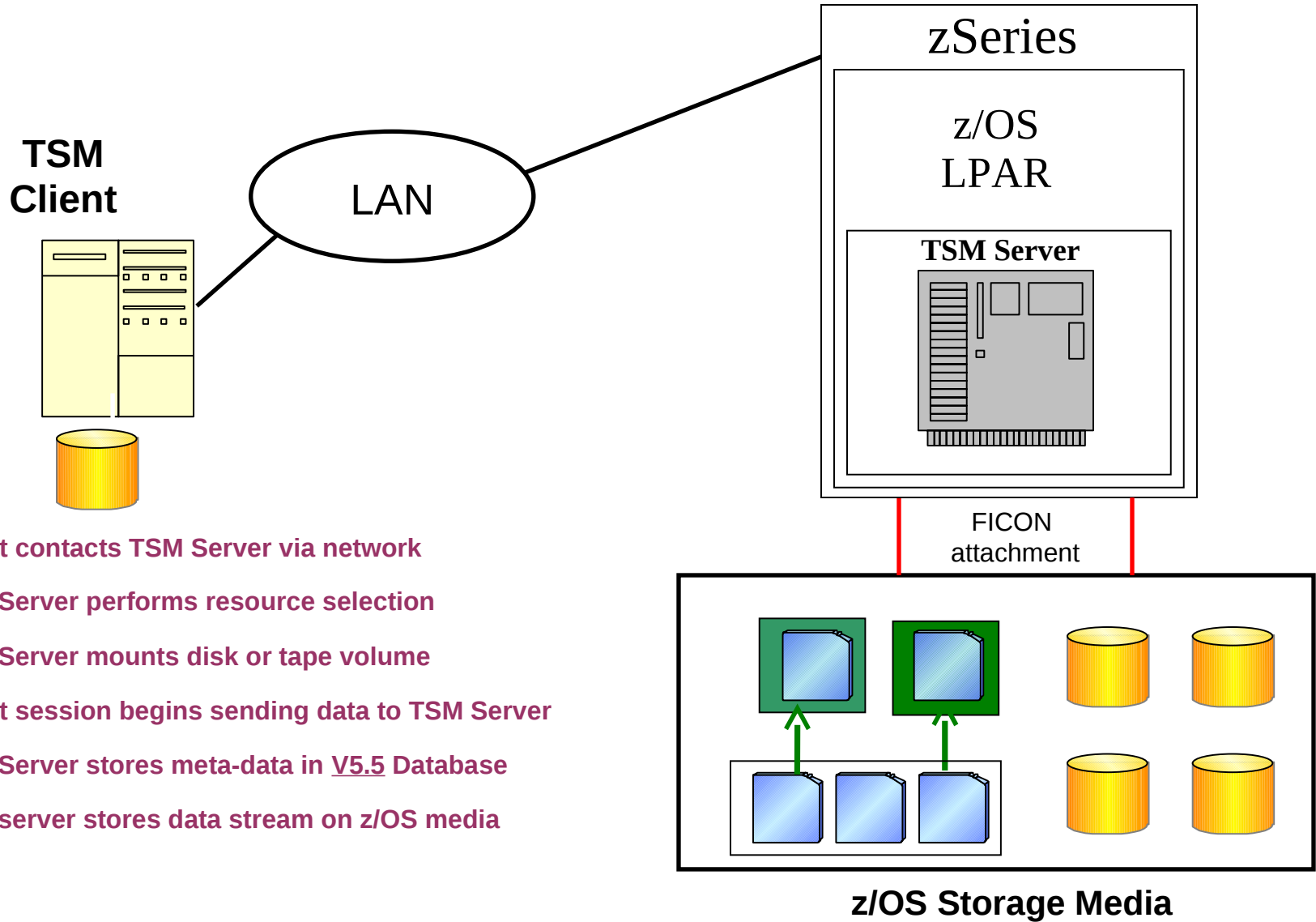
Client to Server Data Flows
Media Server Functions
TSM Server to Media Server



New Features

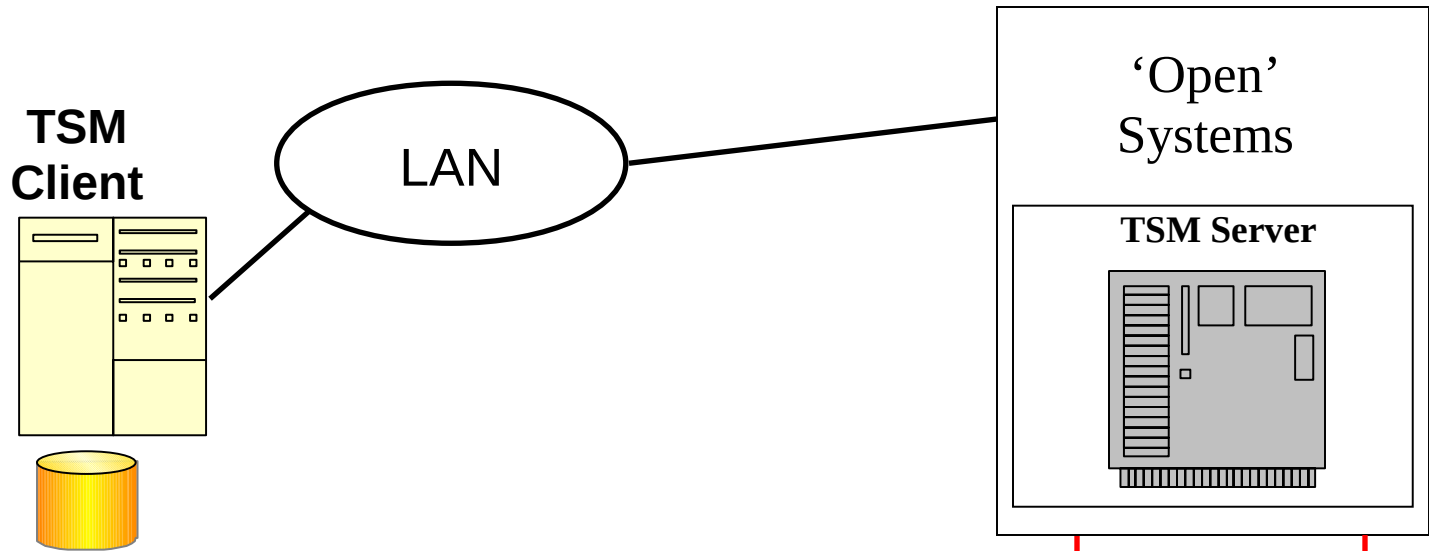
- **New library type of *ZOSMEDIA***
 - Shared library (shared only with Storage Agents)
 - TSM Server acts in limited capacity of Library Manager (volume selection)
- **z/OS device class integration**
 - TAPE device classes
 - *3592, 3590, ECARTRIDGE, CARTRIDGE*
 - Same as z/OS TSM 5.5 devclass
- **Enhanced *FILE* device class**
 - Adjustable *MAXCAP*
 - Format/Write via Media_Manager to VSAM LDS (format not required)
- **Library must be defined first (*LIBTYPE=ZOSMEDIA*)**
 - Uniquely identifies library as *ZOSMEDIA* (exclusive)
 - Before devclass

TSM V5: TSM Client to TSM z/OS Server



1. Client contacts TSM Server via network
2. TSM Server performs resource selection
3. TSM Server mounts disk or tape volume
4. Client session begins sending data to TSM Server
5. TSM Server stores meta-data in V5.5 Database
6. TSM server stores data stream on z/OS media

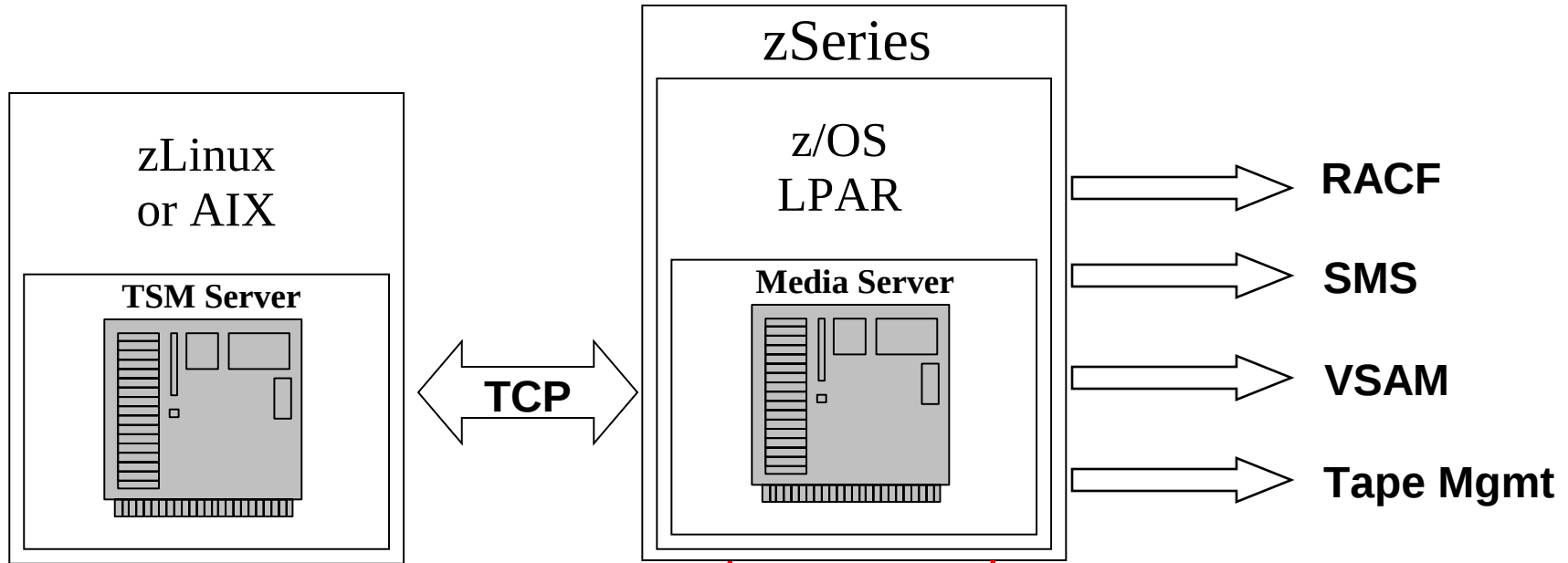
TSM V6.3: TSM Client to non-z/OS TSM Server



1. Client contacts TSM Server via network
2. TSM Server performs resource selection
3. TSM Server mounts disk or tape volume
4. Client session begins sending data to TSM Server
5. TSM Server stores meta-data in DB2 Database
6. TSM server stores data stream on 'open systems' media

FCP Storage Media

Media Server Configuration

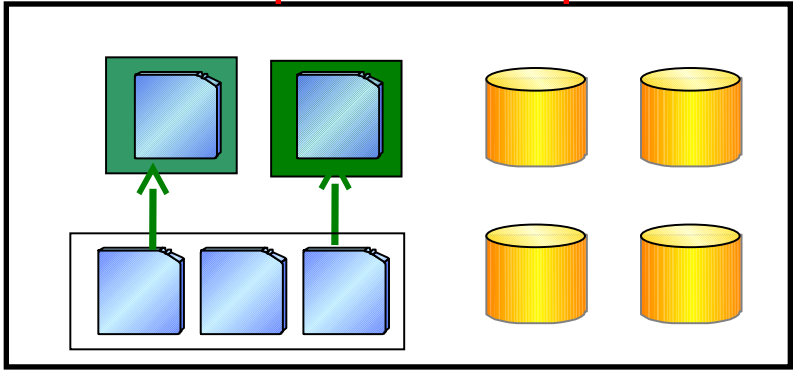


Provide z/OS Storage Media Access:

- TSM Servers on zLinux and AIX
- IPv4 and IPv6 TCP
- Disk and Tape Access through Media Server

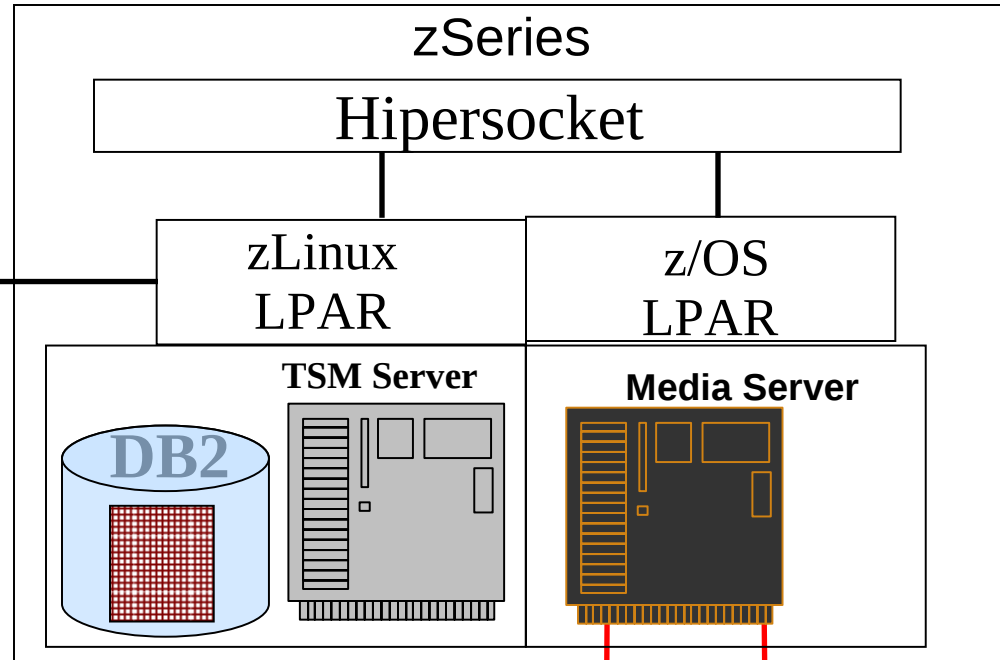
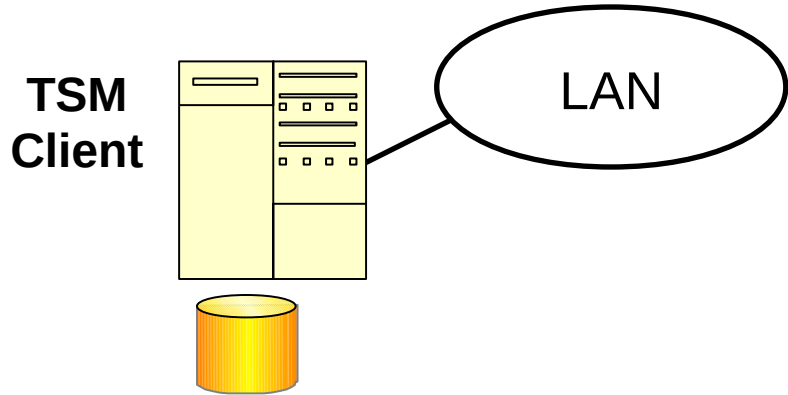
Utilize Standard z/OS functions for:

- Media Access Control
- Resource Allocation
- Tape Mgmt interface
- Perform I/O to both Disk and Tape

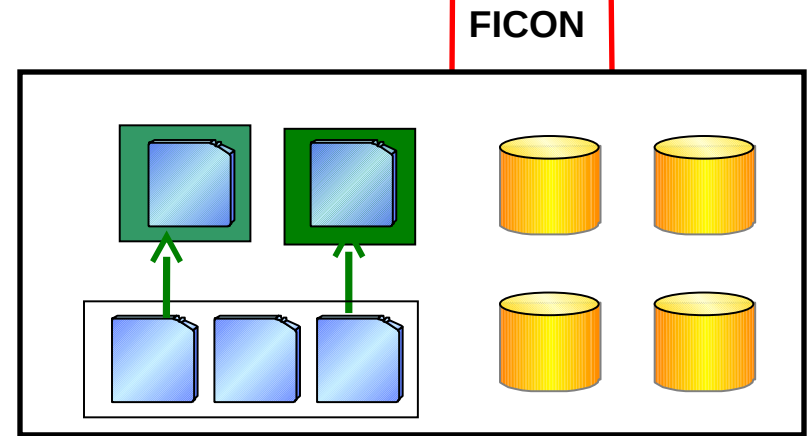


z/OS Storage Media

Data Flows: zLinux with Media Server

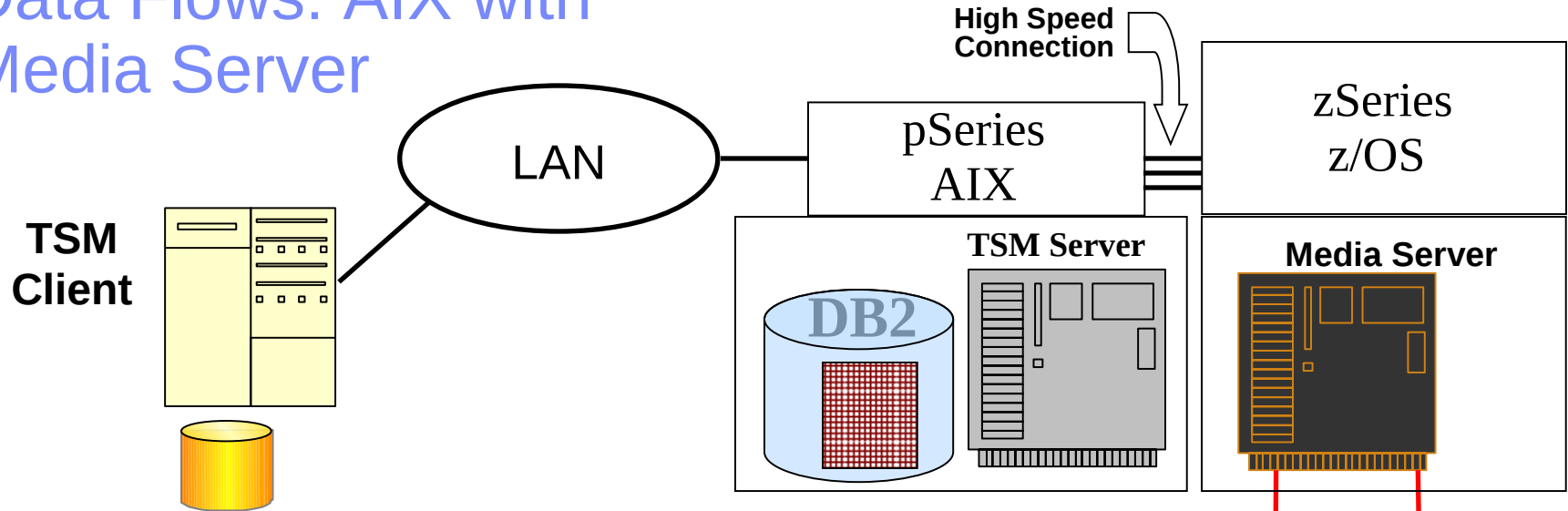


1. Client contacts TSM Server via network
2. TSM Server performs resource selection
3. ** TSM Server engages MS for specific volume mount*
4. ** MS Mounts disk or tape volume*
5. ** MS responds with mount satisfied*
6. Client session begins sending data to TSM Server
7. TSM Server stores meta-data in DB2 Database
8. ** TSM Server sends client data to MS*
9. ** MS stores data stream on z/OS media*

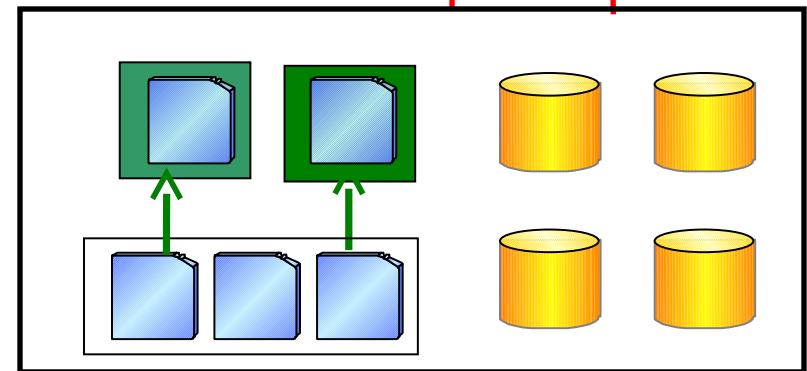


z/OS Storage Media

Data Flows: AIX with Media Server

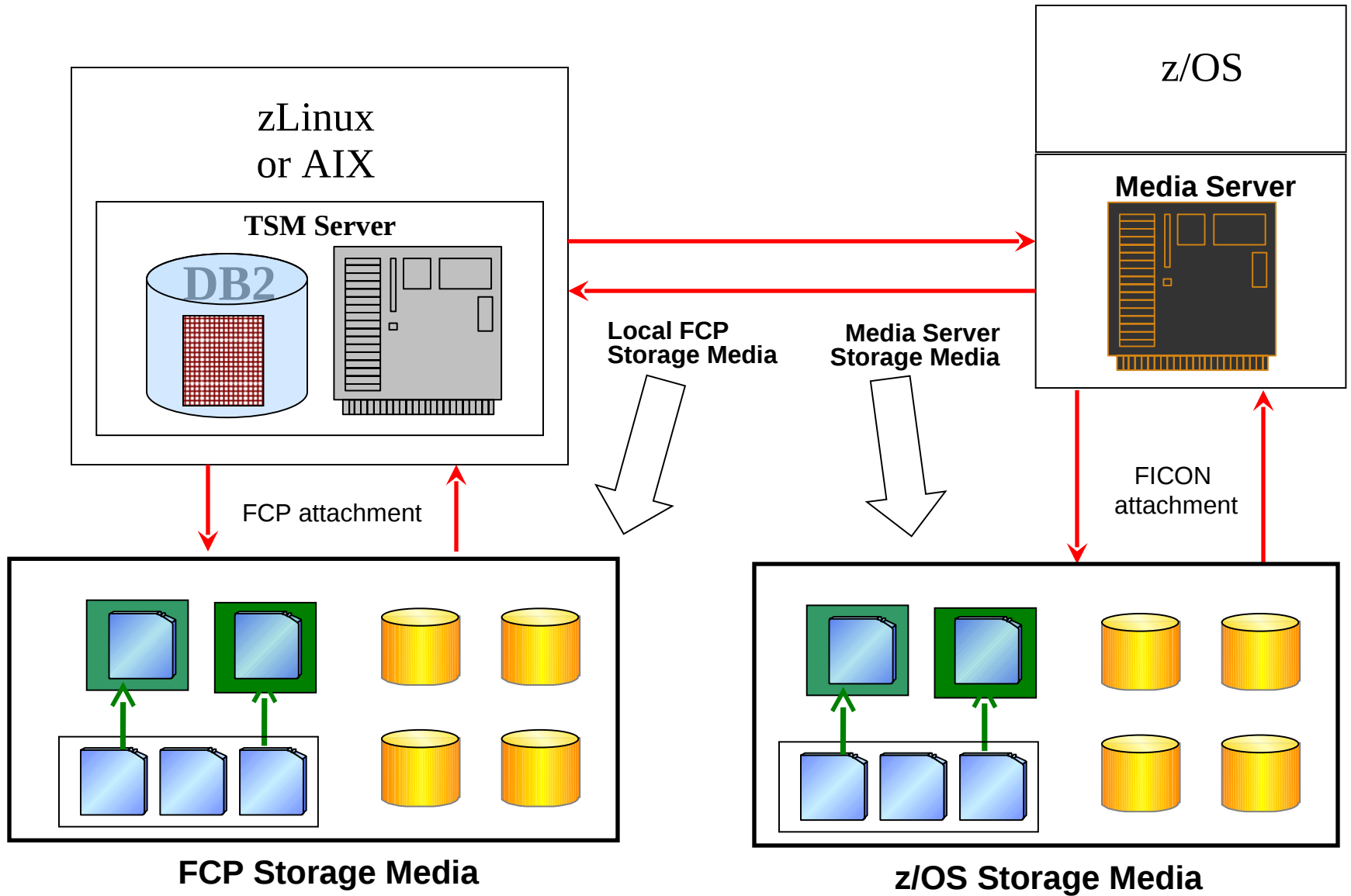


1. Client contacts TSM Server via network
2. TSM Server performs resource selection
3. ** TSM Server engages MS for specific volume mount*
4. ** MS Mounts disk or tape volume*
5. ** MS responds with mount satisfied*
6. Client session begins sending data to TSM Server
7. TSM Server stores meta-data in DB2 Database
8. ** TSM Server sends client data to MS*
9. ** MS stores data stream on z/OS media*

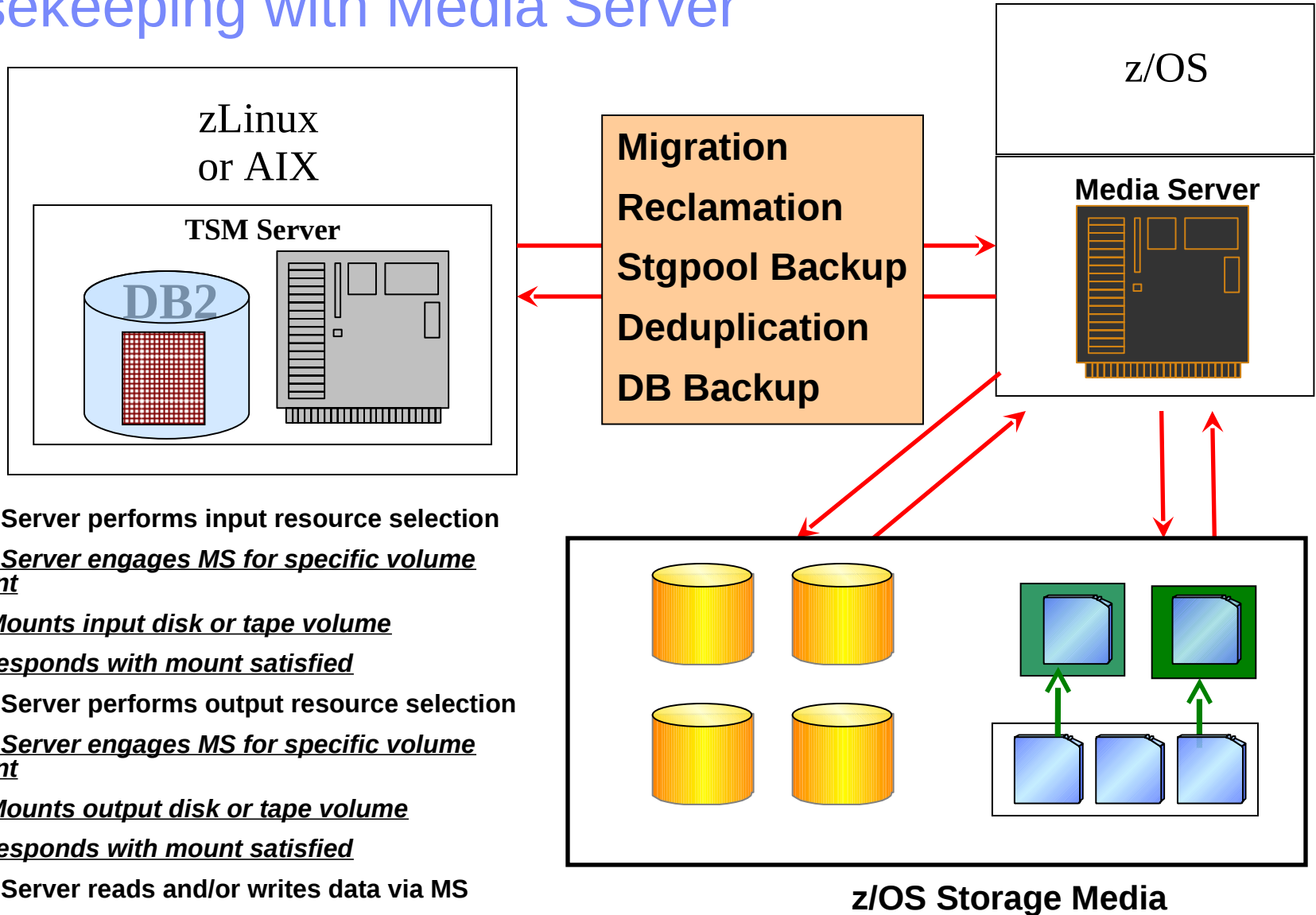


z/OS Storage Media

Both Storage Media Types



Housekeeping with Media Server



1. TSM Server performs input resource selection
2. *TSM Server engages MS for specific volume mount*
3. *MS Mounts input disk or tape volume*
4. *MS responds with mount satisfied*
5. TSM Server performs output resource selection
6. *TSM Server engages MS for specific volume mount*
7. *MS Mounts output disk or tape volume*
8. *MS responds with mount satisfied*
9. TSM Server reads and/or writes data via MS
10. TSM Server updates meta-data in DB2 Database



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Configuring Media Server Solution

Configuring z/OS Components
TSM Server Definitions



Components of Media Server Solution

1. Media Server

- Resides on z/OS
- Enables access to z/OS media
- Provides consistent function within TSM server for media access

1. TSM 6.3 Server and Storage Agent Enhancements

- Library, Path, Device Class
- Authenticates with Media Server
- Transmits media requests and data to Media Server
- **TSM internal function - Not externalized or documented**

Installing the Media Server on z/OS

- Normal SMP/E install
 - Media Server executables must be installed in APF authorized library

- Can run as started task

- Sample JCL:

```
//MEDIASVR EXEC PGM=ANZSRVR, REGION=0M, COND=(0, NE, BIND)
//*STEPLIB DD DSN=TSBXA.TSM.LOAD, DISP=SHR
//SYSPRINT DD SYSOUT=*
//SYSTEM DD SYSOUT=*
//TSMOPTS DD DSN=TSBXA.TSM.OPTIONS, DISP=SHR
//TSMMSGGS DD SYSOUT=*
//TSMTRACE DD SYSOUT=*
//CEEDUMP DD SYSOUT=*
```

Customizing Media Server Options

- Media Server options file (DDname 'TSMOPTS')

TCPADDR **192.168.20.208**

TCPPORT **1555**

TAPEDELEXIT **ARCTVEXT**

PASSPHRASE **password (from TSM 6.3 server)**

- TCPADDR, TCPPORT and PASSPHRASE will be used by TSM Server
- TAPEDELEXIT
 - Tape mgmt exit to delete scratch tapes
 - Same function as DELETIONEXIT on TSM V5
- Modifiable from console, for example:
 - **F procname, SET MSGSUPPRESS 2**

z/OS and SMS Considerations

■ ACS routines same as for z/OS TSM Server

- Device specific info passed to Media Server from calling TSM server

Such as:

- Esoteric name (From 'device class')
- DSN prefix (From 'device class')
- Resource owner (From 'define server')

■ Set up Media Server as External Data Manager (EDM) to tape management system

- Allocation data from TSM server such as esoteric name, DSN prefix, device type, and owner
- Executable 'ANZSRVR'

Defining Access / Connection on TSM Server

- **Media Server is defined as a 'SERVER' to TSM**
 - RACF used to validate access to z/OS resources
 - Userid and Password stored in TSM database
 - Userid and Password passed to Media Server during connection establishment
- **Define server syntax**
 - DEFINE SERVER srvr1ZOS SERVERPASSWORD=secretpw
HLADDRESS=192.168.20.208 LLADDRESS=1777
 - HLA / LLA is TCP address and port of Media Server
 - On z/OS Media Server the ddname file should be RACF protected
 - User srvr1ZOS
 - Passphrase secretpw

Note: RACF routines are not specifically called by MS. The MS options file should be a protected dataset since the PASSPHRASE is stored unencrypted. Other security utilities, e.g. "Top Secret", should be compatible if they adequately protect the dataset, and MS can open it for R/W.

Considerations for Connection to Media Server

■ **Hipersockets on zLinux**

- High speed zSeries memory transfer from LPAR to LPAR
- Separate network from OSA connections
- MTU can be 56Kb
- TCPIP checksumming can be “off” for better performance
- Use large TCPW 256k+

■ **Multihomed network**

- HLADDRESS to Media Server can have multiple addresses
 - Comma separated list such as:
HLA=192.168.20.208,192.168.30.208,192.168.40.208
- TSM Server will distribute the traffic across multiple paths (round robin selection)

Defining Tape Access on TSM Server

■ Library definition on zLinux or AIX

- Library is control point for media operations
- Same functionality as Open systems 'library'
 - No drives or libvolumes on Media Server library
- Syntax:

```
Define Library ZOS3592lib LIBTYPE=ZOSMEDIA
```

■ Define linkage to Media Server for resources

- "PATH" provides access through previous "SERVER" definition
- From TSM (tsmsrvr1) to Library (ZOS3592lib) on z/OS (srvr1ZOS)
- Syntax:

```
define path tsmsrvr1 ZOS3592lib srctype=server  
desttype=library ZOSMEDIAserver=srvr1ZOS
```

Defining Tape Characteristics on TSM Server

- **Device class defines characteristics of tape device**

- Syntax:

- ```
Define devclass ZOStape library=ZOS3592lib devtype=3592
format=3592C unit=tape3592 mountlimit=5 prefix=adsm.s1
```

- Library 'ZOS3592lib' references previous library definition

- **Tape device types available on z/OS media**

- 3590 / 3592 / CARTRIDGE / ECARTRIDGE

- Format value depends on device type

- **Use MOUNTLIMIT to control concurrent mounts**

- Library has no drives

- Limits mount request to the Media Server

# Other z/OS Specific Tape Settings

- **z/OS options now on zLinux and AIX device class**
  - These options exist on TSM V5 on z/OS
  
- **COMP**ression                      **yes|no**                      **IDRC capable drives**
- **EXPI**ration                        **date**                        **Similar to JCL parm**
- **RET**ention                         **duration**                    **Similar to JCL parm**
- **PRO**tection                        **yes|no|auto**                **RACF profiles for volumes**
  
- **Unit** is esoteric name on z/OS for allocation
- **Prefix** is high level qualifier for DSN
  - Maximum of 8 characters
  - For 'prefix=adsm' tape dsn becomes 'adsm.bfs'
- **Tape mgmt system should assign tape volumes as EDM managed**



# Storage Pools using a Tape Device Class

- **Storage pools are the same as on existing TSM servers**
  - No change to basic storage pool definitions
  - Storage pools are a part of TSM server, not Media Server
    - Media Server provides access to volumes within a storage pool

- **Storage Pool definition syntax**

Define stgpool ZOStapepool ZOStape

MAXSCRatch=99            Maximum number of volumes

REUsedelay=2            Days to delay empty tapes going scratch

RECLAIMPRocess=2      Maximum number of reclamation processes

- ❖ **‘ZOStape’ in above example references a TSM device class**

# z/OS File Device Class Support

- **Enhanced File Device Class**
  - Improved performance and space utilization for disk storage
- **Uses VSAM LDS**
  - Extended Format VSAM LDS datasets
- **Exploits SMS and dynamic allocation**
  - SMS must be active, using device class settings
  - Allows secondary extents for disk volumes
- **When used with Media Server**
  - Requires Server definition
  - Requires Library definition
  - Uses new parameters on device class definition

# Defining File Access on TSM Server

- **Library definition on zLinux or AIX**
  - Library is control point for media operations
  - Similar functionality as Tape library
  - Define Library ZOSFILELIB LIBTYPE=ZOSMEDIA
  - Does not create drives as a file library does on 'open systems'
  
- **Define linkage to Media Server for resources**
  - Access is through previous 'server' definition
  - From TSM (tsmsrvr1) to Library (ZOSfilelib) on z/OS (svr1ZOS)
  - Define Path tsmsrvr1 ZOSfilelib srctype=server desttype=library ZOSMEDIAserver= svr1ZOS
  
- ❖ **Note that there is nothing device specific in 'server', 'library', or 'path' definitions**
  - A single library could be used for both disk and tape access on Media Server

# Device class FILE

- **DEFine DEVclass ZOSfile DEVType=FILE**

LIBRARY=ZOSfilelib

MOUNTLimit=20 MAXCAPacity=4G

PRIMARYalloc=2600M SECONDARYalloc=2600M

PREFIX=ADSM.SERVER1.FILES

- Prefix for file can be up to 32 characters

- **z/OS Allocates with primary and secondary parms**

- SMS required to provide allocation details via ACS routines

- **No need to predefine volumes**

- Predefined volumes is recommended on open systems due to filesystem fragmentation

# Storage Pools using a FILE device class

- **File storage pools are similar to tape storage pools**
  - No change to basic TSM storage pool definitions
  - Storage pools are a part of TSM server, not Media Server
    - Media Server provides access to volumes within a storage pool

- **Storage Pool definition syntax:**

Define stgpool ZOSfilepool ZOSfile

MAXSCRatch=99                      Maximum number of volumes

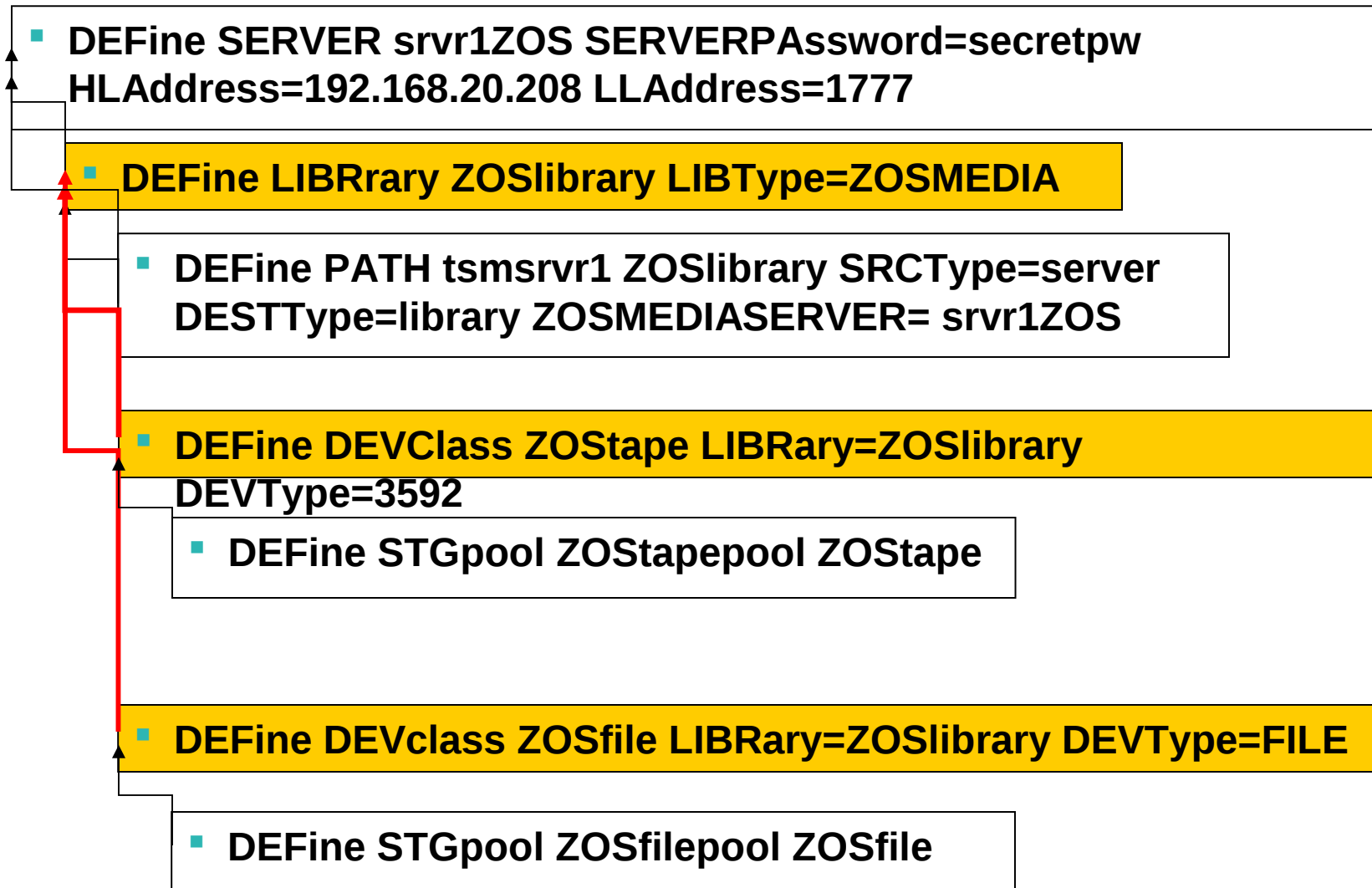
REUsedelay=2                      Days to delay empty tapes going scratch

RECLAIMProcess=2                Maximum number of reclamation processes

- **'ZOSfile' in above example references previous device class**

- **Sequential access pool – not random disk**
  - All TSM server functions available for sequential file pools

# A simpler configuration using a single library





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# Configuring for Storage Agent Technology

Data Flows  
Configuring Server and Storage Agent  
Not in Initial Beta Deliverable

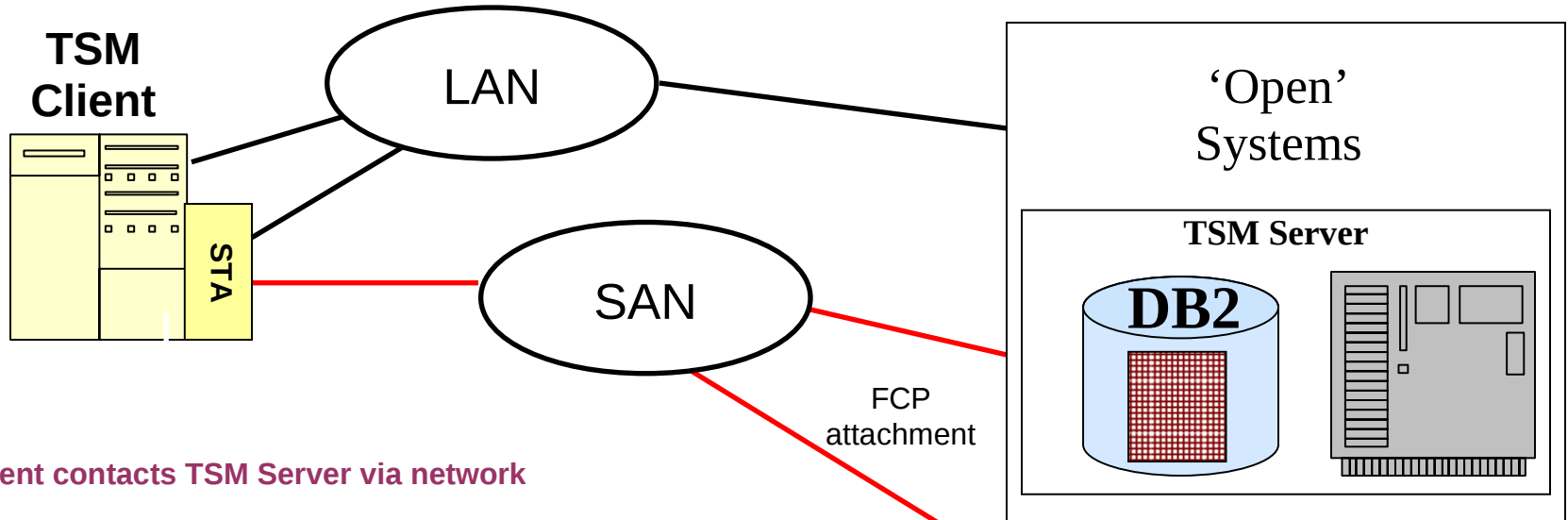


# Storage Agent with Media Server

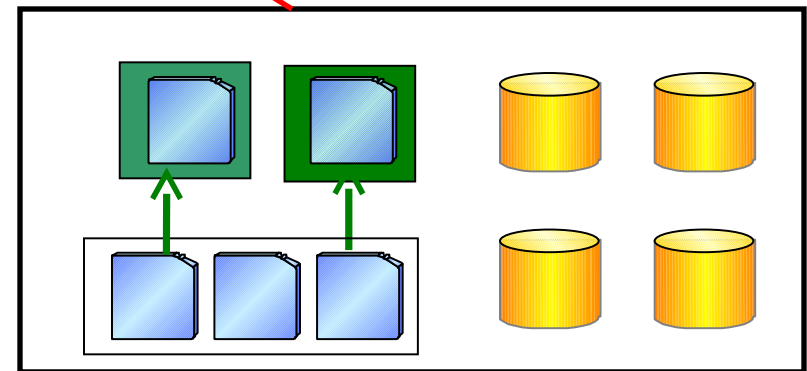
- **Exploit z/OS Media via TSM Storage Agent**
- **Media Server performs I/O on z/OS**
  - Both Tape and File resources can be used
- **TSM Server provides same function as before**
  - Performs volume selection
  - Provides storage agent with access information
- **Storage Agents enhanced with Media Server Communications Link interface**
- **Path from storage agent to z/OS resources is via TCP**
  - Not FCP attached devices



# Storage Agent using FCP media

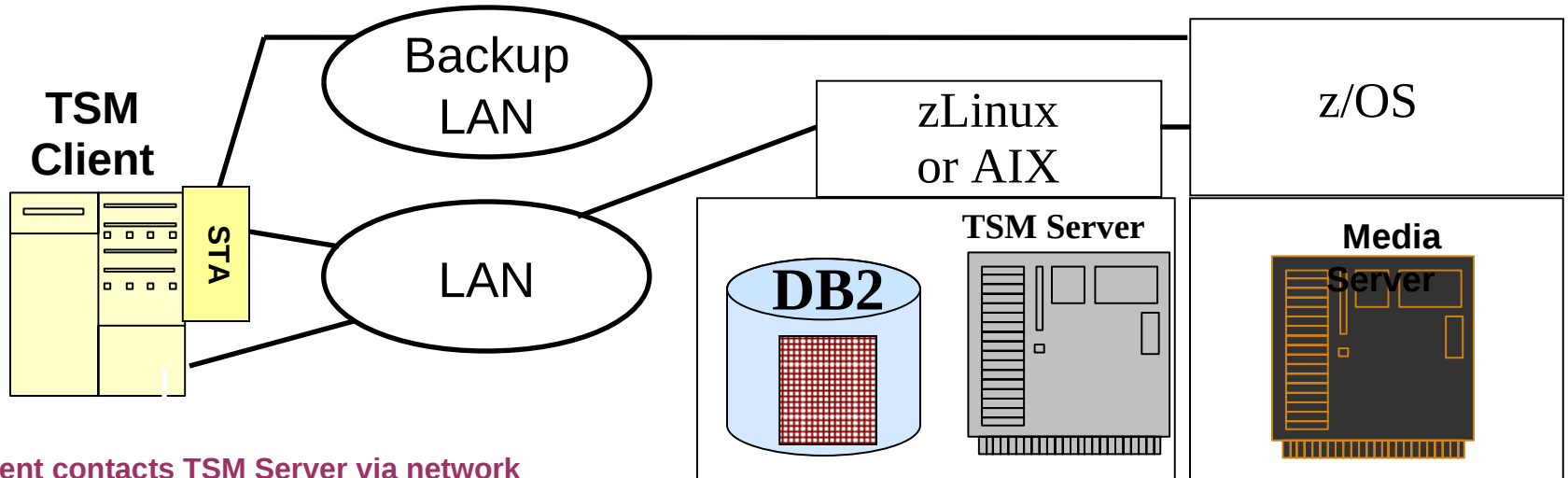


1. Client contacts TSM Server via network
2. Client contacts Storage Agent, which contacts TSM server requesting a resource
3. TSM Server performs resource selection and mounts tape volume
4. Storage Agent opens tape volume
5. Client session sends meta-data to TSM Server
6. Storage Agent stores client data on tape

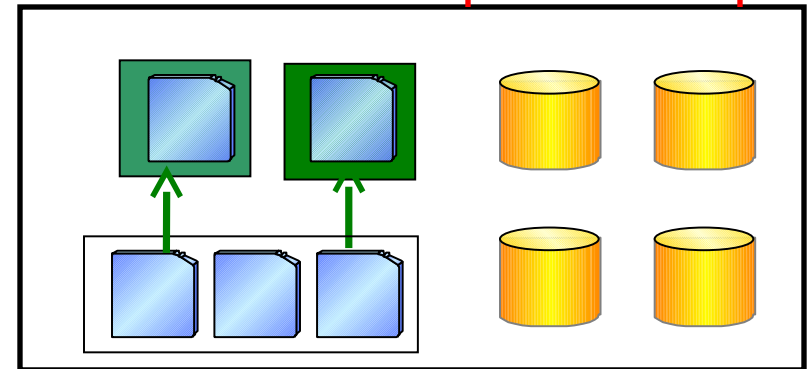


**FCP Storage Media**

# Storage Agent using z/OS media



1. Client contacts TSM Server via network
2. Client contacts Storage Agent, which contacts TSM Server requesting a resource
3. Server performs resource selection and passes Media Server credentials to storage Agent
4. Storage Agent opens volume through Media Server connection
5. Media Server mounts disk or tape volume
6. Client session sends meta-data to TSM Server
7. Storage Agent send client data to Media Server



**FICON Storage Media**

# Storage Agent Definitions – Previous Definitions

- **Previously Defined Server for Media Server**

- DEFINE SERVER srvr1ZOS

- **Previously Defined Tape Library**

- Define Library ZOS3592lib LIBTYPE=ZOSMEDIA

- Define Path tsmsrvr1 ZOSfilelib ZOSMEDIAServer= srvr1ZOS

- Define devclass ZOStape library=ZOS3592lib

- Define stgpool ZOStapepool ZOStape

- **Previously Defined File Library**

- Define Library ZOSFILELIB LIBTYPE=ZOSMEDIA

- Define Path tsmsrvr1 ZOSfilelib ZOSMEDIAServer= srvr1ZOS

- DEFINE DEVclass ZOSfile DEVType=FILE LIBRARY=ZOSfilelib

- Define stgpool ZOSfilepool ZOSfile

# Storage Agent Specific Definitions on TSM Server

- **Storage Agent technology requires additional settings on TSM server**

- Storage Agent appears as a 'server' to controlling TSM server

- **Define TSM server name and password**

- Set servername tsmsrv1

- Set serverpassword serverpw

- **Server definitions for Storage Agents**

- DEF SERVER sta1 serverpa=secret01 HLA=192.168.20.8 LLA=1500

- DEF SERVER sta2 serverpa=secret02 HLA=192.168.20.9 LLA=1500

- DEF PATH sta1 ZOS3592lib srctype=server desttype=library  
ZOSMEDIAserver=srv1ZOS

- DEF PATH sta2 ZOSfilelib srctype=server desttype=library  
ZOSMEDIAserver=srv1ZOS

# Configuring the Storage Agent on the Client

- **Install Storage Agent on client system**

- Configure to connect to TSM server
- TSM Server will pass address and credentials to Storage Agent for connection to Media Server

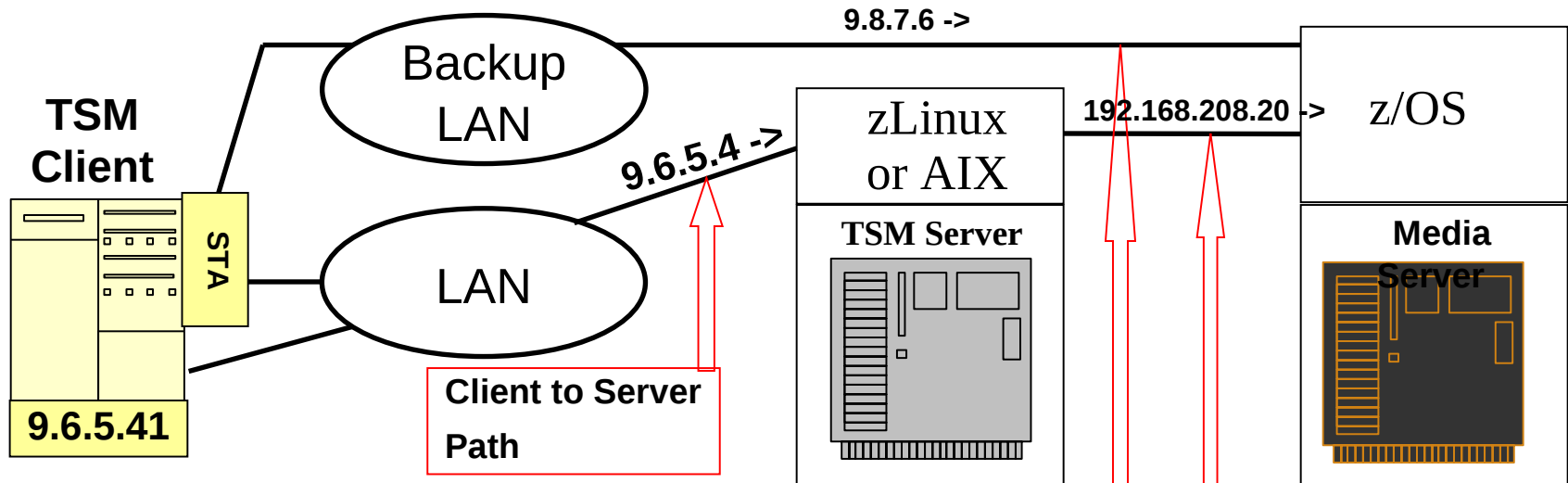
- **Storage Agent configuration command**

```
dsmsta setstorageserver myname=sta1 mypassword=secret01
myhladdress=192.168.20.8
servername=tsmsvr1 serverpassword=serverpw
hladdress=192.168.20.208 lladdress=1500
```

- **TSM Client Options**

- ENABLELANFREE YES
- Communications to Storage Agent:  
Lanfreecommmethod, Lanfreeshimport, Lanfreetcport, Lanfreetcpserveraddress

# Storage Agent Networking Considerations



## ★ Server to Media Server

```
DEF SERVER srvr1ZOS SERVERPASSWORD=secretpw
HLADDRESS=192.168.20.208 LLADDRESS=1777
```

```
DEF PATH tsmsrvr1 ZOS3592lib ZOSMEDIAserver=
srvr1ZOS
```

## ★ Storage Agent to Media Server

```
DEFINE SERVER srvr1alt SERVERPASSWORD=secretpw
HLADDRESS=9.8.7.6 LLADDRESS=1777
```

```
DEF SERVER sta1 serverpa=secret01 HLA=9.6.5.41
LLA=1500
```

```
DEF PATH sta1 ZOS3592lib srctype=server desttype=library
ZOSMEDIAserver=srv1alt
```

## Example Testing Results – Backup / Restore

- Large files, max sustained multi-client BU TP: 730 GB/hr
- Large files, max sustained multi-client RES TP: 1170 GB/hr
- Max sustained MIG, disk to tape TP: 995 GB/hr
- Max sustained SP BU TP: 885 GB/hr

Note: In all above, the SP disk subsystem was the bottleneck

- Large files, the max sustained multi-client BU TP (single 10Gb OSA-Express3, absence of the SP bottleneck): 1,830 GB/hr.
- Small files, max sustained multi-client sel BU TP: 24 m files/hr
- Max sustained multi-client incr BU TP: 2.0 m files/hr
- Max sustained multi-client restore throughput from the TSM server was 16.0 million files per hour.

## Example Testing Results – Deduplication

- Server-side deduplication, max sustained ID dup TP: 900 GB/hr or 18.2 m files/hr (4 ID processes running concurrently)

It is likely that increasing the number of identify processes would increase the aggregate throughput until the read I/O bottleneck on the storage subsystem was reached.

- Client-side deduplication, the BU elapsed time decreased by up to 84% in an environment with a network bottleneck as long as the data contained significant duplicate data content.

The backup elapsed time increased by up to 89% for small file workloads or in environments without a network bottleneck.



# Summary of Media Server

- **Provides the ability to use z/OS media with zLinux and AIX TSM Servers**
  - z/OS media such as FICON tape and enhanced sequential file devclass
  - Exploits SMS and z/OS tape management system
- **Media Server functions as a library to TSM Server**
- **Interface in TSM server to access z/OS Media**
  - Linux for zSeries and AIX only
- **Interface in TSM storage agent to access z/OS Media**
  - Multiple storage agent platform support

# Media Server Reference Material

- **Tivoli Storage Manger for z/OS Media**

- <http://www-01.ibm.com/software/tivoli/products/storage-mgr-z/OS-media/>

- **IBM Tivoli Storage Manager Version 6.3 Information Center**

- <http://publib.boulder.ibm.com/infocenter/tsminfo/v6r3/index.jsp>

- **Networking on z/OS Hipersockets**

- <http://publib.boulder.ibm.com/infocenter/z/OS/basics/index.jsp?topic=/com.ibm.>