Web Site Migration to OpenVMS

A Case Study

Presented by

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- Download Presentation
  - http://www.parsec.com/public/web_migration.pdf

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Web Site Migration to OpenVMS

- **Initial Environment**
- Target Environment
- Planning
- Migration Steps
- Maintenance
- Final Results

Initial Environment

- Microsoft Windows XP Server
- IIS Web Server
- VB Script (ASP)
- Microsoft SQL Server

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The Numbers

- **3 Interrelated Web Sites**
  - 232 dynamic pages
  - 15 static pages
- **Purposes**
  - Public web site
  - Intranet
  - Support call tracking system
- **2 Databases**
  - 244 tables
  - 97 views

Purpose

- Improve Security
- Increase Reliability
- Increase Availability
- Decrease Maintenance
- Practice What I Preach

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Target Environment

- OpenVMS Cluster
- Secure Web Services
- Multi-Platform Supported Language
- MySQL on OpenVMS

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OpenVMS Cluster

- Reliable
- Secure
  - Secure by design
  - Secure by obscurity
- High Availability Provided by Cluster
- Low Maintenance
  - Provide by OpenVMS
  - Enhance by cluster

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Secure Web Services

- Based on Apache
  - The most commonly used web server on the Internet
  - Open source
- Provided by and Supported by HP
  - http://h71000.www7.hp.com/openvms/products/ips/apache/csws.html
- Robust Development Support
  - Several programming options

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Supported Languages

- Static Pages
- PHP
- Perl
- Tomcat (JAVA or JSP)
- CGI
  - DCL
  - Compiled language (Fortran, C, etc.)
- Others Available from Other Sources
  - Python

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MySQL

- Popular Open Source Database
- Supports Standard SQL Queries
- Supports Transactions
- Multiple Storage Engines
- Available at:
    - http://www.vmsmysql.org/FrontPage

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MySQL Storage Engines

- Innodb – Transaction Safe
- MyISAM - Fast
- MRG_MyISAM – Merge MyISAM Tables
- BlackHole – Bit Bucket
- CSV – Comma Separated Fields
- Memory – In Memory
- Federated – Remote Tables
- Archive – Small Space, No Indexes

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Planning

- Select Languages
- Select MySQL Storage Engines

Languages Considered

- PHP
- Perl
- Java Server Pages (JSP)

PHP

- **General Purpose Scripting Language**
  - Web pages
  - Batch scripts
- **High Level of Compatibility on Different Platforms**
- **Fast**
- **Extensions Available**
  - 23 from HP
  - Others include Ingres and RDB
  - Expandable

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PHP Scripts

- Many scripts and classes publicly available for use
  - Usually without changes
- Simple scripts to send an email or work with date and time
- Complex scripts to manage a database or database connection
- Complete web sites such as a CMS
- No need to "Reinvent the wheel"

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Perl

- **General Purpose Scripting Language**
  - Web pages
  - Batch scripts
- **Medium Level of Compatibility on Different Platforms**
- **Supports Scripts and Modules**
- **Fast**
- **Many Scripts Available on the Internet**

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Java Server Pages

- Web Page Scripting Language
- High Level of Compatibility on Different Platforms
- Relatively Slow

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Storage Engines Considered

- Innodb
- MyISAM
- Memory

Innodb Storage Engine

- **Transaction Safe**
  - Commit
  - Rollback
  - Crash recovery
- **Reliable**
- **Supports Foreign Keys**
- **Best Performance for Large Data Sets**

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MyISAM Storage Engine

- Fast
- Efficient for Smaller Tables
- Supports Full-Text Searching
- Less Reliable
  - Flush local table …

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Memory Storage Engine

- Very Fast
- Schema Preserved Across Restarts
- Data Lost with MySQL Restart
- Efficient for Smaller Tables

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Migration Steps

- Install and Configure PHP on IIS
- Convert ASP to PHP
- Database Abstraction Layer
- Install and Configure MySQL
- Migrate MS SQL SERVER to MySQL
- Install and Configure Secure Web Services
- Install and Configure PHP on SWS
- Migrate from Microsoft IIS to OpenVMS Apache

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Install PHP

- Install PHP on Current Web Server
- Microsoft IIS Server Supports Both ASP and PHP
- Eases Migration Process

Configure PHP

- **Configuration File**
  - php.ini
- **Enable Extensions as Needed**
  - Only enable extensions available on both current server and OpenVMS
- **File Uploads**
  - upload_tmp_dir
  - upload_max_filesize
- **Minimize Error Messages to Users**
  - error_reporting = E_COMPILE_ERROR | E_ERROR | E_CORE_ERROR

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Convert ASP to PHP

- May Convert One Page at a Time
- PHP and ASP Use Different Session Information
- PHP and ASP Can Share Database Information but not Connections

Database Abstraction Layer

- Use Database Abstraction Layer in PHP
- Provides Consistency for Accessing Databases
- ADOdb
  - Supports MS SQL, MySQL and others
  - Provides database backed sessions
  - http://adodb.sourceforge.net/

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ADOdb Features

- Database Independence Provided by Using Functions to Hide Differences
- qstr – Quote Strings
- SQLDate & DBDate – handle dates
- Concat – append strings
- Insert_ID – get last autoincrement value
- ErrorMsg – get error message text

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MySQL Connection on Windows

```php
$db = NewADOConnection ('mysql');
$db_host = array ('vmspr1.parsec.com',
    'vmspr2.parsec.com',
    'openvms.parsec.com');
foreach ($db_host as $mydb_host)
    {
    if (@$db->Connect ($mydb_host, 'someone', 'wrong', 'parsec'))
        {
        $_SESSION['vms_db'] = $mydb_host;
        break;
        }
    }
if (!$db->IsConnected()) die ('DB Connection Error');
$db->SetFetchMode (ADODB_FETCH_ASSOC);
$db->disableBlobs = true;
$ADODB_COUNTRECS = false;
```

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Sample SELECT Using AdoDB

```php
$sql = 'SELECT * FROM www_news WHERE DispDate<='
    . $db->DBDate(date('Y-m-d'))
    . ' AND Status>=1 AND Status<50 '
    . 'ORDER BY Status DESC, DispDate DESC, NewsId DESC';
$row = $db->GetRow ($sql);
if ($row === false)
    {
    report_db_error ($db, $sql);
    }
else
    {
    print "<h2 style='margin-top:0'><a name='"
        . $row['NewsId'] . "'>" . $row['Title'] . "</a></h2>"
        . '<p>' . $row['Summary'] . "</p>";
    }
```

Install and Configure MySQL

- **Install MySQL on OpenVMS**
- **Configuration File**
  - mysql051_root:[vms]my.cnf
- **Case Sensitive Table Names Default**
  - lower_case_table_names=1
- **Innodb vs MyISAM tables**
  - default_table_type=InnoDB
- **Full Text Search**
  - ft_min_word_len=3 (for TLAs)

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MySQL General Configuration

```
# The following options will be passed to all MySQL clients
[client]
#password        = your_password
port             = 3306
socket           = /tmp/mysql.sock
```

MySQL Server Configuration

```
# The MySQL server
[mysqld]
port            = 3306
skip-locking
datadir=/mysql_data/data/
tmpdir = /mysql051_root/mysql_server/tmp/

# Logging settings, prefer safety over performance
sync_binlog = 1
binlog_cache_size = 1M
log-bin=mysql-bin
log_slow_queries
long_query_time = 2
log_long_format

# Connection settings, increase network buffer size for large packets from PHP
net_buffer_length = 128K
back_log = 50
max_connections=100
max_connect_errors = 10
max_allowed_packet = 32M

# Memory utilization
sort_buffer_size = 2M
query_cache_size = 8M
query_cache_limit = 2M
join_buffer_size = 2M
tmp_table_size = 4M

# Other settions, using case insensitive file system & lots of TLAs
lower_case_table_names = 1
table_cache = 128
ft_min_word_len = 3
default_table_type = InnoDB
transaction_isolation = REPEATABLE-READ
```

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MySQL MyISAM Configuration

```
#*** MyISAM Specific options

# Size of the Key Buffer, used to cache index blocks for MyISAM tables.
key_buffer_size = 16M

# Size of the buffer used for doing full table scans of MyISAM tables.
read_buffer_size = 2M

# Buffer used to read rows in sorted order for ORDER BY.
read_rnd_buffer_size = 8M

# Size of cache used for bulk inserts.
bulk_insert_buffer_size = 4M

# Size of buffer to rebuild the index in REPAIR, OPTIMIZE, ALTER table statements
myisam_sort_buffer_size = 32M

# The maximum size of the temporary file MySQL is allowed to use while recreating the index.
myisam_max_sort_file_size = 10G

# If the temporary file used for fast index creation would be bigger than using
# the key cache by the amount specified here, then prefer the key cache method.
myisam_max_extra_sort_file_size = 10G

# If a table has more than one index, MyISAM can use more than one thread to repair them.
myisam_repair_threads = 1

# Automatically check and repair not properly closed MyISAM tables.
myisam_recover
```

MySQL InnoDB Configuration

```
# *** INNODB Specific options ***

# Memory utilization
innodb_additional_mem_pool_size = 8M
innodb_buffer_pool_size = 64M

# File system usage
innodb_data_file_path = ibdata1:100M:autoextend
innodb_data_home_dir = /mysql_data/data/
innodb_file_io_threads = 4

# Transaction logs
innodb_log_buffer_size = 8M
innodb_log_file_size = 32M
innodb_flush_log_at_trx_commit = 1
innodb_log_files_in_group = 3
innodb_log_group_home_dir = /mysql_data/data/

# Number of threads allowed inside the InnoDB kernel.
innodb_thread_concurrency = 8

# Maximum allowed percentage of dirty pages in the InnoDB buffer pool.
innodb_max_dirty_pages_pct = 90

# How long an InnoDB transaction should wait for a lock to be granted
# before being rolled back.
innodb_lock_wait_timeout = 120
```

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MySQL Other Configuration

```
[mysqldump]
quick
max_allowed_packet = 32M

[mysql]
no-auto-rehash
# Remove the next comment character if you are not familiar with SQL
#safe-updates

[isamchk]
key_buffer = 20M
sort_buffer_size = 20M
read_buffer = 2M
write_buffer = 2M

[myisamchk]
key_buffer = 20M
sort_buffer_size = 20M
read_buffer = 2M
write_buffer = 2M

[mysqlhotcopy]
interactive-timeout

[mysqld_safe]
# Increase number of open files allowed per process. Warning: Make sure you set the global
# system limit high enough! The high value is required for a large number of opened tables
open-files-limit = 8192
```

Create Connection to MySQL

- Create 2nd ADOdb Connection for MySQL
- On Microsoft Windows
  - Attempt connection to each server
  - May save last valid connection in file to speed subsequent connections
- On OpenVMS
  - Use logical name (getenv) to find server in cluster

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MySQL Connection on OpenVMS

```
if (getenv('vmsdb') != '') $mydb_host = getenv('vmsdb');
else $mydb_host = 'vmspr1.parsec.com';
$adodb_dsn = "mysql://someone:wrong@$mydb_host/parsec";
$db = NewADOConnection ($adodb_dsn);
$db->SetFetchMode (ADODB_FETCH_ASSOC);
$db->disableBlobs = true;
$ADODB_COUNTRECS = false;
```

Move Data

- **Create Tables**
  - Use Innodb engine for most tables
  - Use MyISAM for tables requiring full-text searching
- **Move Data with PHP**
  - May automate with DESCRIBE statement
- **Create Views**
- **Create Procedures**

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Example of DESCRIBE Statement

```
mysql> describe jokes;
+----------+---------+------+-----+---------+----------------+
| Field    | Type    | Null | Key | Default | Extra          |
+----------+---------+------+-----+---------+----------------+
| JokeID   | int(11) | NO   | PRI | NULL    | auto_increment |
| SchLast  | int(11) | NO   |     | 0       |                |
| Schedule | int(11) | NO   |     | 0       |                |
| Joke     | text    | NO   |     |         |                |
+----------+---------+------+-----+---------+----------------+
4 rows in set (0.26 sec)
```

Migrate Database

- Use 2nd ADOdb Connection
- Date Format may be Incompatible
- Concat vs + for Strings
- MyISAM Tables
  - Change SQL for full-text searches
  - Flush local table ... after insert and updates

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Sessions

- **Use Database Backed Sessions**
- **Easy with ADOdb**
- **Allows Multiple Web Servers to be Transparent to Users**
- **May Register Call-back Function to be Notified when Session Ends**
  - Allows additional actions to be taken as needed

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Authentication Options

- **OpenVMS**
  - Module mod_auth_openvms
- **LDAP**
  - Module mod_ldap
- **Kerberos**
  - Mod_auth_kerb
- **POP**
  - PHP script with socket communication
  - Cache in session or database

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Install and Configure SWS

- **Install Secure Web Services on OpenVMS**
- **Configuration Files**
  - apache$common:[conf]httpd.conf
  - apache$common:[conf]httpd_vhosts.conf
  - apache$common:[conf]ssl_vhost.conf
- **Set Default Page(s)**
  - DirectoryIndex index.php index.html
- **Verify SWS has Read Access to Web Site Files**

Site Configuration

```
# www.parsec.com
<VirtualHost *:80>
    ServerName www.parsec.com
    ServerAlias test.parsec.com
    DocumentRoot /web_sites/www
    DirectoryIndex index.php
    ErrorDocument 404 /about/sitemap.php
</VirtualHost>
```

Configure SSL Support

- **Purchase Certification from a Certificate Authority**
- **Or Move Existing Certificate from IIS**
  - http://jamesrossiter.wordpress.com/2010/10/20/transfer-ssl-certificates-from-microsoft-iis-to-linux-apache/
- **Configure SSL Support**
  - apache$common:[conf]ssl-vms.conf
  - SSLCertificateFile
  - SSLCertificateKeyFile

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Use Existing SSL Certificate

- Export Certification from IIS into .pfx File
  - Use the certificates snap-in in mmc
  - Wizard prompts you through the process
- On a System with OpenSSL (MS Windows)
  - Export private key from pfx file
  - Export certificate from pfx file
  - Remove passphrase from private key
- FTP Private Key and Certificate to OpenVMS

Extract SSL Keys from IIS

```
D:\work>openssl pkcs12 -in www.pfx -nocerts -out www.pem
Enter Import Password:
MAC verified OK
Enter PEM pass phrase:
Verifying - Enter PEM pass phrase:


D:\work>openssl pkcs12 -in www.pfx -clcerts -nokeys -out
    www.crt
Enter Import Password:
MAC verified OK


D:\work>openssl rsa -in www.pem -out www.key
Enter pass phrase for www.pem:
writing RSA key
```

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Extract SSL Keys from IIS Continued

```
D:\work>dir
 Volume in drive D has no label.
 Volume Serial Number is E4D9-A7F0


 Directory of D:\work

09/09/2011   09:06 AM    <DIR>                   .
09/09/2011   09:06 AM    <DIR>                   ..
09/09/2011   09:06 AM                1,776 www.crt
05/28/2011   09:58 PM    <DIR>            hoeganaes
09/09/2011   09:06 AM                1,679 www.key
09/09/2011   09:05 AM                2,035 www.pem
08/25/2011   08:45 AM                3,877 www.pfx
              4 File(s)              9,367 bytes
              3 Dir(s)   437,448,503,296 bytes free
```

SSL Configuration

- **Apache$root:[conf]ssl_vhost.conf**

```
#    SSL Engine Switch:
SSLEngine on

#    SSL Engine Options:
<Files ~ "\.(cgi|shtml)$">
    SSLOptions +StdEnvVars
</Files>
<Directory "/apache$root/cgi-bin">
    SSLOptions +StdEnvVars
</Directory>

#    SSL Protocol Adjustments:
SetEnvIf User-Agent ".*MSIE.*" nokeepalive ssl-unclean-
    shutdown
```

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Secure Site Configuration

```
# www.parsec.com
<VirtualHost *:443>
    ServerName www.parsec.com
    ServerAlias test.parsec.com
    DocumentRoot /web_sites/www
    DirectoryIndex index.php
    ErrorDocument 404 /about/sitemap.php

    Include /apache$root/conf/ssl_vhost.conf
    SSLCertificateFile /apache$root/certs/www.crt
    SSLCertificateKeyFile /apache$root/keys/www.key
</VirtualHost>
```

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Install and Configure PHP

- Configuration File
  - php_root:[000000]php.ini
- Enable Extensions as Needed
- File Uploads
  - upload_tmp_dir
  - upload_max_filesize
- Minimize Error Messages to Users
  - error_reporting = E_COMPILE_ERROR | E_ERROR | E_CORE_ERROR

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PHP Extensions

```
; Uncomment any extension below to have them automatically loaded by PHP
;extension=php_bcmath.exe
;extension=php_bz2.exe
;extension=php_calendar.exe
extension=php_ctype.exe
;extension=php_dba.exe
;extension=php_exif.exe
;extension=php_ftp.exe
;extension=php_iconv.exe
;extension=php_ldap.exe
extension=php_mhash.exe
extension=php_mysql.exe
;extension=php_oci8.exe
extension=php_odbc.exe
extension=php_openssl.exe
extension=php_openvms.exe
;extension=php_oracle.exe
extension=php_pcre.exe
;extension=php_posix.exe
extension=php_session.exe
extension=php_sockets.exe
extension=php_xml.exe
;extension=php_zip.exe
;extension=php_zlib.exe
```

PHP Configuration

```
; Resource Limits ;
;max_execution_time = 30 ; Maximum execution time of each script, in seconds
;max_input_time = 60      ; Max amount of time script may parse request data
memory_limit = 1024M      ; Maximum amount of memory a script may consume (8MB)

; File Uploads ;
file_uploads = On         ; Whether to allow HTTP file uploads.
upload_tmp_dir = "/$1$dga101/scratch/"   ; Temp directory for uploaded files
upload_max_filesize = 15M ; Maximum allowed size for uploaded files.

; Paths and directories
; list of directories for include, require and fopen_with_path functions
include_path = ".:/web_sites_root/tpglib/:/web_sites_root/hoeglib/"

; Fopen Wrappers
allow_url_fopen = On           ; allow fopen on ftp: and http:
default_socket_timeout = 60    ; timeout for socket based opens

; Mail function
SMTP = smtp.parsec.com      ; target server for SMTP mail
```

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PHP Error Configuration

```
; Error reporting ;
; E_ALL              - All errors and warnings
; E_ERROR            - fatal run-time errors
; E_WARNING          - run-time warnings (non-fatal errors)
; E_PARSE            - compile-time parse errors
; E_NOTICE           - run-time notices
; E_CORE_ERROR       - fatal errors that occur during PHP's initial startup
; E_CORE_WARNING     - warnings that occur during PHP's initial startup
; E_COMPILE_ERROR    - fatal compile-time errors
; E_COMPILE_WARNING - compile-time warnings (non-fatal errors)
; E_USER_ERROR       - user-generated error message
; E_USER_WARNING     - user-generated warning message
;
;    - Show only errors
error_reporting = E_COMPILE_ERROR|E_ERROR|E_CORE_ERROR
```
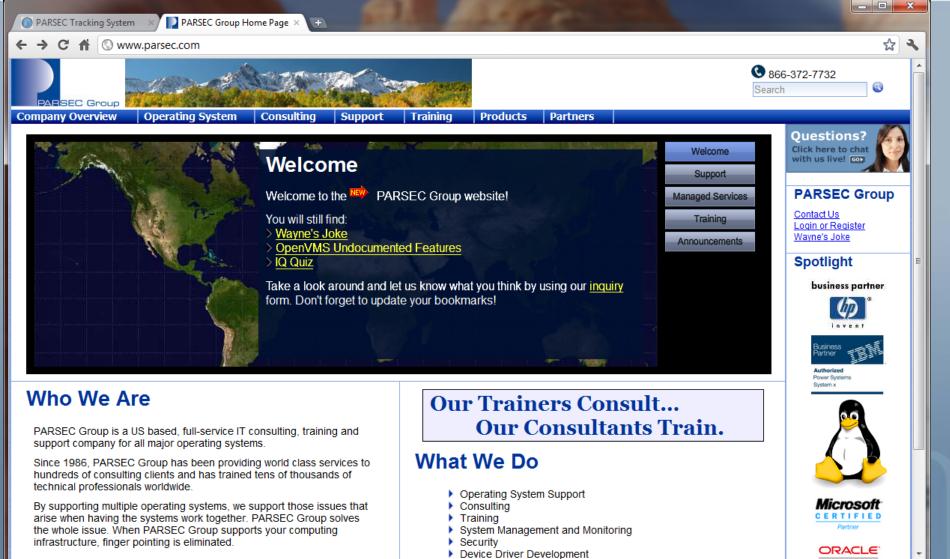
Migrate From IIS to Apache

- **Upload Site to OpenVMS**
- **Configure Site with an Alias**
  - ServerAlias test.parsec.com
  - Add alias to DNS
- **Test Using Alias**
  - Warnings will be displayed if using SSL
- **Change Address of Primary Site in DNS**

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Migrate From IIS to Apache

Maintenance

- Database Maintenance
- Database Backup
- MySQL Failover

Database Maintenance

- **Regularly Scheduled Batch Job**
- **Manage Binary Logs**
  - mysqladmin flush-logs
  - mysqladmin refresh
  - purge master logs before ...
- **Verify Database**
  - mysqlcheck –a –c –e "-A"
  - Extended check and repair of all tables

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Database Backup

- **Regularly Scheduled Batch Job**
- **Flush all Tables to Disk**
  - mysqladmin flush-tables
- **Export MySQL**
  - mysqldump

MySQL Failover

- **Started as Batch Procedure**
  - Sets proper user name for job
- **Runs Detached Job to Start Monitor**
  - Sets process name for identification
  - Check for executing server
  - If found – sleep and retry
  - Define cluster-wide logical name pointing to server
  - Change process name
  - Start MySQL server

MySQL Startup Procedure

```
$ set noon
$ write sys$output "Running run_mysqld.com"
$ save_verify = f$verify (0)
$! Run in stand-by mode while another instance is running
$ set process /name="MYSQL_STANDBY"
$check_server:
$ pid = f$trnlnm ("mysql_pid")
$ if pid .eqs. "" then goto start_server
$ mpid = ""
$ define /user_mode sys$output nl:
$ define /user_mode sys$error nl:
$ mpid = f$getjpi (pid, "pid")
$ if mpid .eqs. "" then goto start_server
$ if mpid .nes. pid then goto start_server
$ wait 0:0:03
$ goto check_server
```

MySQL Startup Procedure Continued

```
$start_server:
$ write sys$output "Starting mysql server"
$ Identify this process as active
$ svprv = f$setprv ("sysnam")
$ define /cluster mysql_pid 'f$getjpi("","pid")'
$ define /cluster vmsdb 'f$getsyi("nodename")'
$ svprv = f$setprv (svprv)
$ set process /name="MYSQL051_SERVER"
$ set on
$ save_verify = f$verify (save_verify)
$!
$ set process/parse=extend
$ mysqld :== $ mysql051_root:[vms.bin]mysqld
$ define sys$scratch mysql051_root:[mysql_server.tmp]
$ define /noLOG TMPDIR "/mysql051_root/mysql_server/tmp"
$ define /noLOG DECC$EFS_CASE_PRESERVE enable
$ define /noLOG DECC$EFS_CHARSET enable
$ define /noLOG DECC$READDIR_DROPDOTNOTYPE enable
$ define /noLOG DECC$FILENAME_UNIX_REPORT enable
$ define /noLOG DECC$FILE_SHARING enable
$ define /noLOG DECC$EFS_CASE_SPECIAL disable
$ define /noLOG DECC$FILENAME_UNIX_ONLY enable
$ define /noLOG DECC$ALLOW_REMOVE_OPEN_FILES enable
```

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MySQL Startup Procedure Continued

```
$ define /noLOG TCPIP$SELECT_ABORT_ON_SIGNAL enable
$ define /noLOG DECC$FD_LOCKING enable
$ define /noLOG DECC$POSIX_SEEK_STREAM_FILE enable
$ set rms/ext=20000
$ if f$trnlnm("LIBZ_SHR32") .eqs. "" then $ define LIBZ_SHR32 -
            mysql051_root:[vms.lib]libz_shr32.exe
$ if f$trnlnm("LIBZ_SHR64") .eqs. "" then $ define LIBZ_SHR64 -
            mysql051_root:[vms.lib]libz_shr64.exe

$!
$! All options except ansi defined using configuration file my.cnf
$!
$! mysqld  --ansi
$ mysqld --ansi --log-bin
$ if f$search ("mysql051_root:[mysql_server.tmp]*.*;*") .nes. ""
$ then
$       delete mysql051_root:[mysql_server.tmp]*.*;*
$ endif
$!
$ set process /name="MYSQL_EXITING"
$ define /user_mode sys$output
$ svprv = f$setprv ("sysnam")
$ deassign /cluster mysql_pid
$ svprv = f$setprv (svprv)
```

Final Result

- **OpenVMS Cluster**
  - Two nodes for production
  - One node for maintenance and quorum
- **Secure Web Services (Apache)**
  - Active on both nodes
- **PHP**
- **MySQL on OpenVMS**
  - Active on one node
  - Automatic failover to other node

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Other Services on OpenVMS

- DNS – TCP/IP Services for OpenVMS
- Spam Filtering – Precise Mail Anit-Spam Gateway (PMAS) from Process Software
- FTP – TCP/IP Services for OpenVMS
- DHCP – TCP/IP Services for OpenVMS

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Benefits

- If one node goes down, production continues uninterrupted
- Web site is compatible with OpenVMS and Microsoft allowing development and production to exist on separate platforms
- Database export from production may be imported on development for full-scale testing

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Questions?

- **Presentation Available**
  - http://www.parsec.com/public/web_migration.pdf

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