Business Overview

Technical Overview

Q & A

Motorola Flat Panel Display Division Information Technology

Lessons Learned from Implementing High Availability ERP Systems

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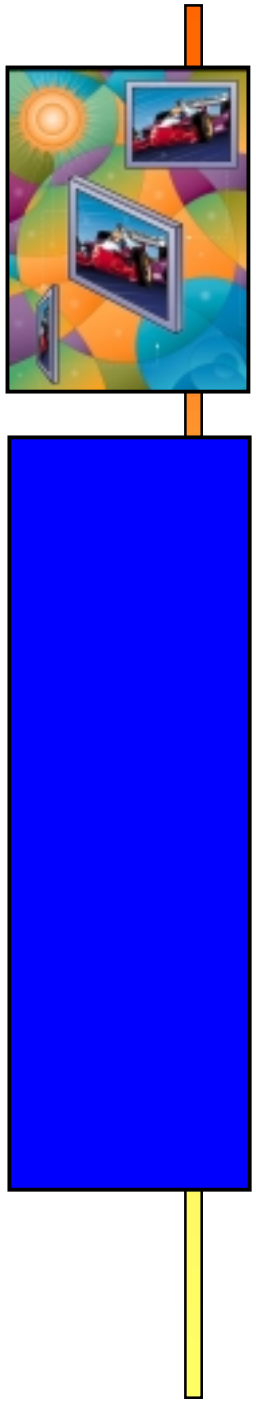


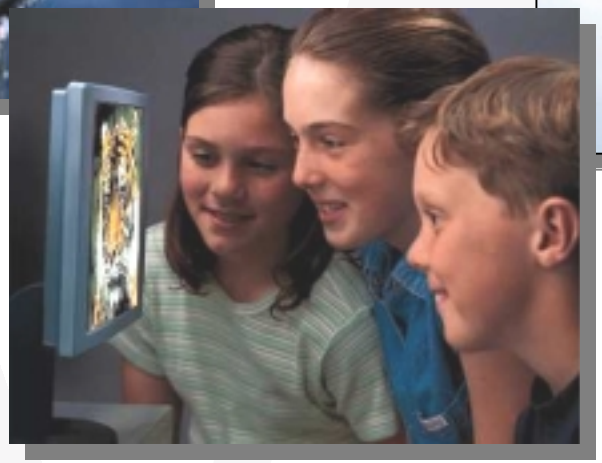
Business Overview

- What is “Motorola Flat Panel Display” ?
- Why High Availability ?
- Business Systems Investment

Digital DNA from Motorola

What is Motorola Flat Panel Display?

- Factory
- Display Technology
- Markets



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Flat Panel Display Division

www.flatpanel.motorola.com

Why High Availability?

Top 10 Reasons for Implementing HA

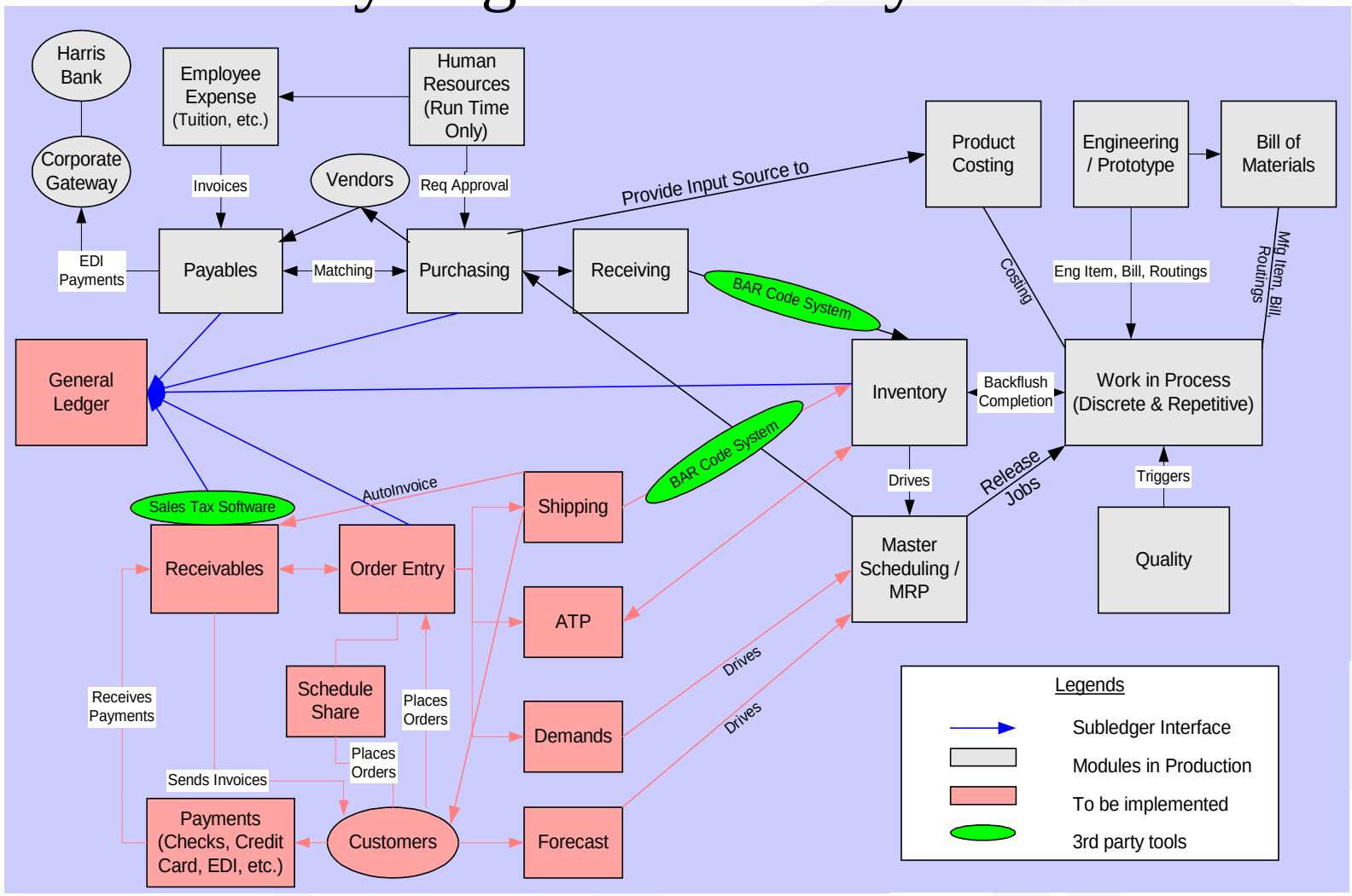
1. Because the System Admin Said So
2. Competitive Advantage
3. Creates New Business Opportunities
4. Cost of Entry Business Requirement
5. Integrated ERP Systems are a Single Point of Failure
6. Limit Risk in A Resource Constrained Environment
7. Improved Customer Satisfaction
8. Leverage Hardware Investment
9. Cost / Performance is better vs Fault Tolerant Systems
10. Reduce/Eliminate System Outages

Financials

Manufactur-ing

Order Fulfillment

Why High Availability?



Oracle Financial Project - FPDD implemented on July 1st, 1998; CTC implemented on July 4th, 1999
Oracle Manufacturing Project - FPDD Implemented on March 18th, 1999; CTC Implemented on October 4th, 1999
Oracle Order Fulfillment project includes Order Entry, ATP, Shipping, and Receivables. Target implementation is May 1st, 2000.

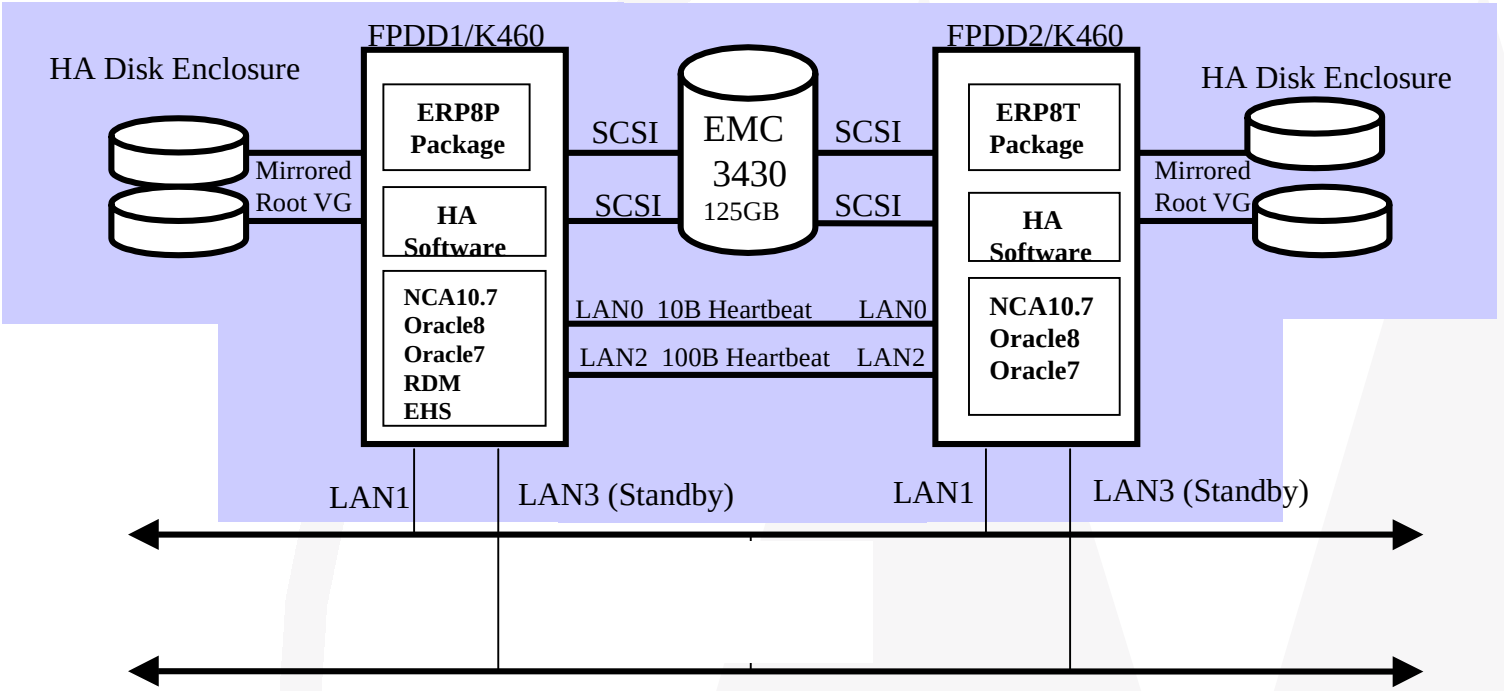
Technical Overview

Setting Up a HA Cluster

Xiaolin Zhuo

- Hardware
- Software

HA Architecture Design



High Availability Components:

- **Dual Heart Beat LAN connections**
- **Stand By 100/BASE LAN card**
- **Mirrored Root VG within HA Disk Enclosure w/ Dual F/W SCSI Adapters**
- **MC/ServiceGuard (software) with fail-over packages (scripts)**
- **Dual F/W SCSI adapters with Pvlinks (alternate links) connected to EMC 3430**
- **UPS with separate power outlets**

Preparation for MC/ServiceGuard Configuration

- /etc/lvmrc
  AUTO_VG_ACTIVATE=0
  add non-MC/SG VG's, excluding VG00 in custom_vg_activation():

- /sbin/vgchange -a y -s /dev/vg01

- /etc/rc.config.d/cmcluster
  AUTOSTART_CMCLD=1

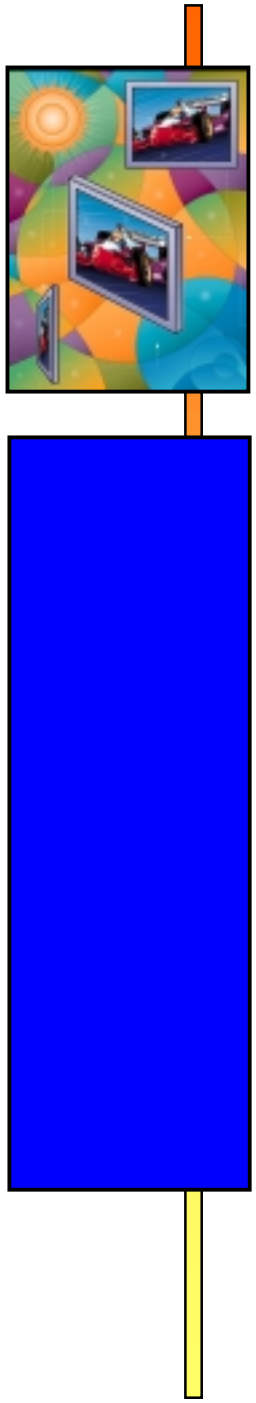
- /etc/rc.config.d/cmsnmpagt
  AUTOSTART_CMSNMPD=1

- Unique VG group minor number within the HA cluster
  node1:0x**1**10000, **node2**: 0x**2**10000, etc

- Duplicate MC/SG file system directories on every node

- Create node entries in every node /.rhosts file, or in /etc/cmcluster/cmclnodelist

- If possible, install application software on every node
  - easy for future upgrade
  - multiple instances can share the software

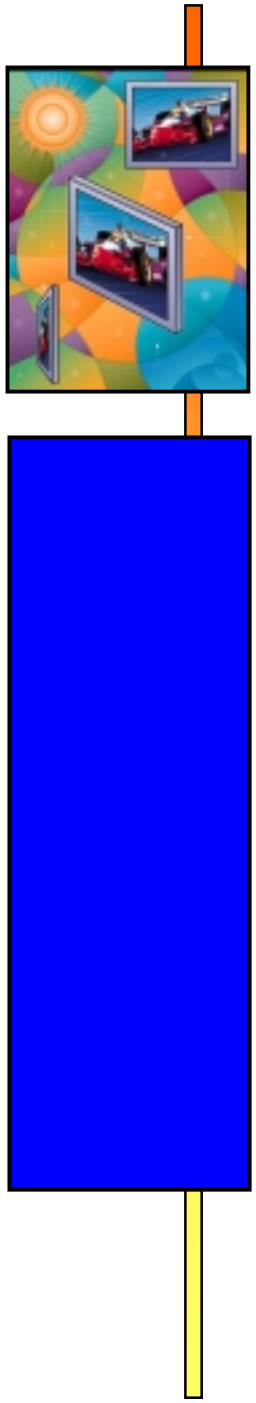


Preparation for MC/ServiceGuard Configuration

- Keep Oracle Database/Applications dependant directories/files on MC/SG VG's:
  - -Oracle Database files
  - -Oracle redo log directory
  - -Oracle archived redo log directory
  - -$ORACLE_BASE/admin/SID_NAME
  - -Oracle Application log/out directories
  - -Oracle Applications customized directories

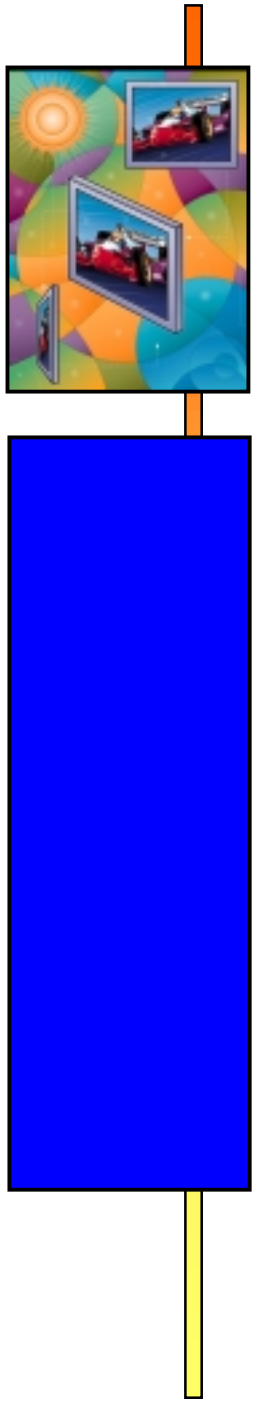
- Symbolic link applications log/out directories:
  - -Oracle Applications log/out directories
  - -$ORACLE_BASE/admin/SID_NAME
  - -Oracle Database init/config files
  - -Oracle Application customized directories

- Duplicate important files/symbolic links on every node:
  - -Oracle password file
  - -$ORACLE_BASE/admin/SID_NAME symbolic links
  - -Oracle Applications log/out directories symbolic links
  - -Oracle Applications customized directories symbolic links



MC/ServiceGuard NETWORK REQUIREMENT

- Data traffic between nodes within the cluster must be on the same subnet
- A node can’t have multiple **configured** NIC on the same subne
- STANDBY NIC must be on the same subnet as PRIMARY NIC
- At least one Heart beat connection between nodes, although two is recommended
- Put dedicated Heart beat NIC on a different subnet than PRIMARY NIC
- IP addresses can’t not be used in cluster configure file, only node names



HA Cluster Configuration File: cmclconf.ascii

```
CLUSTER_NAME                    fpdd.cl
FIRST_CLUSTER_LOCK_VG           /dev/vg1_R0+1_1     # Cluster lock VG
NODE_NAME                       fpdd1
    NETWORK_INTERFACE           lan2
          HEARTBEAT_IP          10.1.1.1            # Dedicated heart beat
    NETWORK_INTERFACE           lan3                # Blank, Standby
    NETWORK_INTERFACE           lan0
          HEARTBEAT_IP          15.1.1.1            # Dedicated heart beat
    NETWORK_INTERFACE           lan1
          STATIONARY_IP         222.117.10.1        # Dedicated data
    FIRST_CLUSTER_LOCK_PV       /dev/dsk/c0t0d0     # Cluster lock disk
NODE_NAME                       fpdd2
    NETWORK_INTERFACE           lan2
          HEARTBEAT_IP          10.1.1.2            # Dedicated heart beat
    NETWORK_INTERFACE           lan3                # Blank, Standby
    NETWORK_INTERFACE           lan0
          HEARTBEAT_IP          15.1.1.2            # Dedicated heart beat
    NETWORK_INTERFACE           lan1
          STATIONARY_IP         222.117.10.2        # Dedicated data
    FIRST_CLUSTER_LOCK_PV       /dev/dsk/c0t0d0     # Cluster lock disk
HEARTBEAT_INTERVAL              2000000             # microseconds
NODE_TIMEOUT                    12000000            # microseconds
AUTO_START_TIMEOUT              600000000           # microseconds
NETWORK_POLLING_INTERVAL        2000000             # microseconds
MAX_CONFIGURED_PACKAGES         4                   # up to 30 max
VOLUME_GROUP                    /dev/vg1_R0+1_1     # FPDD1 VG
VOLUME_GROUP                    /dev/vg1_R1_1       # FPDD1 VG
VOLUME_GROUP                    /dev/vg2_R0+S_1     # FPDD2 VG
VOLUME_GROUP                    /dev/vg2_R1_1       # FPDD2 VG
```

Package Configuration File erp8p.conf

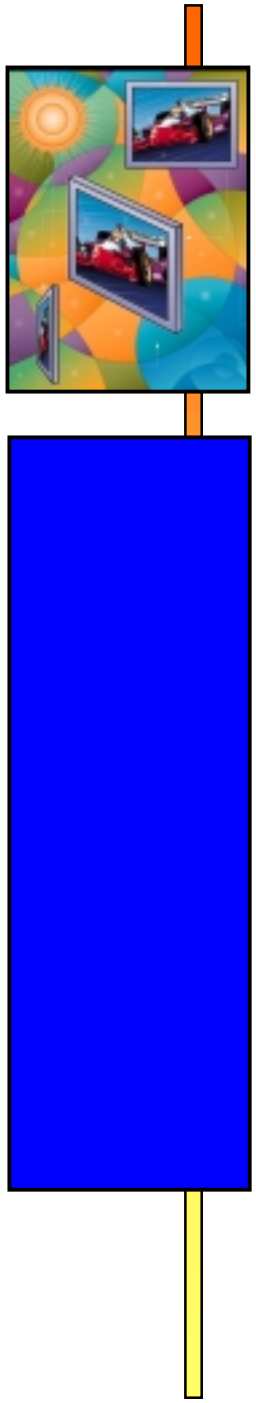
```
PACKAGE_NAME                    erp8p.pkg    # must be unique within a cluster

NODE_NAME                       fpdd1        # The order is important, the original node first
NODE_NAME                       fpdd2        # The first adoptive node second, etc…..

RUN_SCRIPT                      /etc/cmcluster/ERP8P/erp8p.cntl
RUN_SCRIPT_TIMEOUT              300          # in seconds
HALT_SCRIPT                     /etc/cmcluster/ERP8P/erp8p.cntl
HALT_SCRIPT_TIMEOUT             600          # in seconds

SERVICE_NAME                    erp8p.ser    # must be the same as in erp8p.cntl
SERVICE_FAIL_FAST_ENABLED       NO           # Service failure will not cause TOC panic
SERVICE_HALT_TIMEOUT            200          # in seconds

SUBNET                          222.117.10.0 # must correspond to pkg control script

PKG_SWITCHING_ENABLED           YES          # Allow the package fail-over to other node

NET_SWITCHING_ENABLED           YES          # Allow IP address switch to Standby LAN card

NODE_FAIL_FAST_ENABLED          NO           # Node failure will not cause TOC panic
```

Customize Your Package Control Script

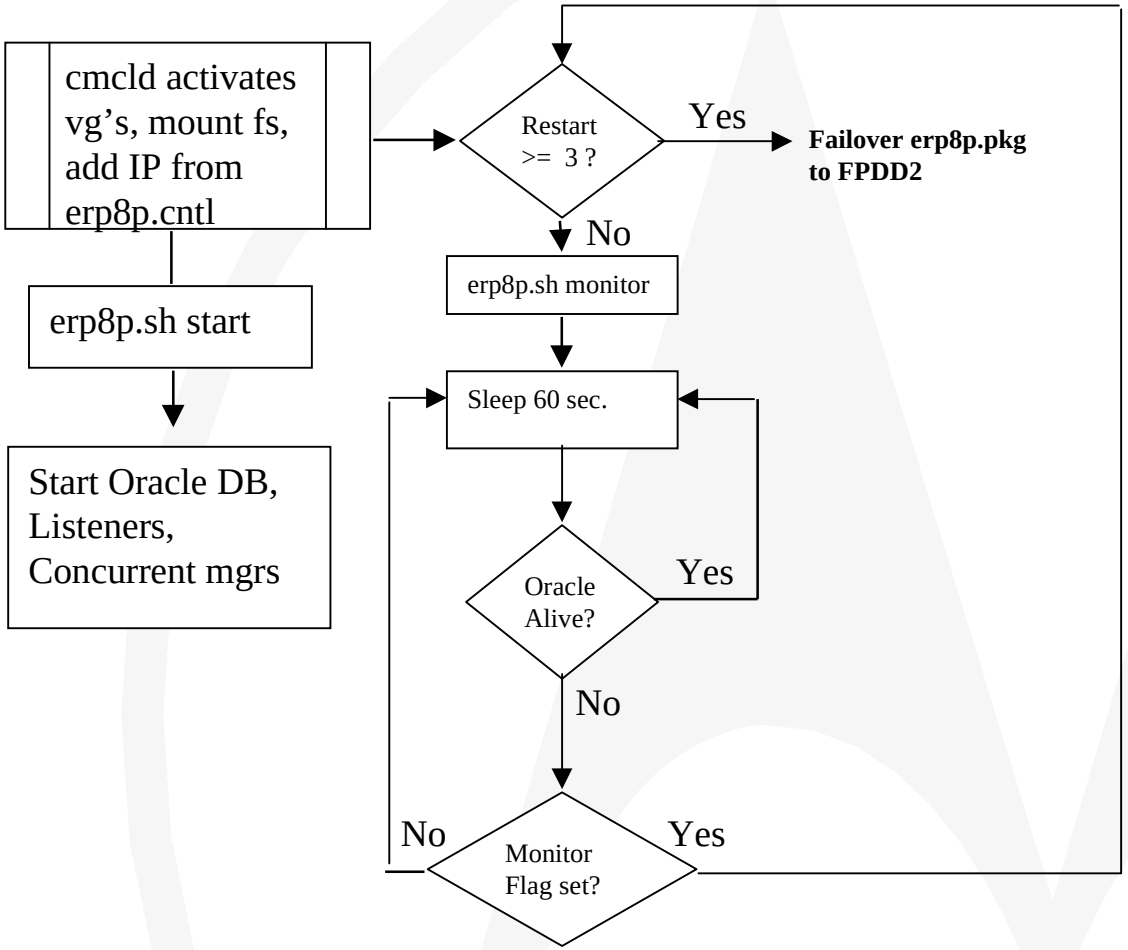
```
VG[0]="vg1_R0+1_1"                                          # FPDD1 VG for this package
VG[1]="vg1_R1_1"                                            # FPDD1 VG for this package

LV[0]="/dev/vg1_R1_1/lv1_redo1";   FS[0]="/u1_redo1"        # lv and fs
LV[1]="/dev/vg1_R0+1_1/lv1_dbf1"; FS[1]="/u1_dbf1"          # lv and fs
LV[2]="/dev/vg1_R1_1/lv1_arch1";   FS[2]="/u1_arch1"        # lv and fs

IP[0]="222.117.10.10"                                       # package floating IP address
SUBNET[0]="222.117.10.0"                                    # must correspond to pkg configuration file
SERVICE_NAME[0]="erp8p.ser"                                 # name must be identical as in erp8p.conf
SERVICE_CMD[0]="/etc/cmcluster/ERP8P/erp8p.sh monitor"      # full path required
SERVICE_RESTART[0]="-r 3"                                   # restart package 3 times before failover

function customer_defined_run_cmds
{
        set -m
        /etc/cmcluster/ERP8P/erp8p.sh start
        set +m
        test_return 51                                      # call test_return if “erp8p.sh start” fails
}

function customer_defined_halt_cmds
{
        set -m
        /etc/cmcluster/ERP8P/erp8p.sh halt
        set +m
        test_return 52                                      # call test_return if “erp8p.sh halt” fails
}
```

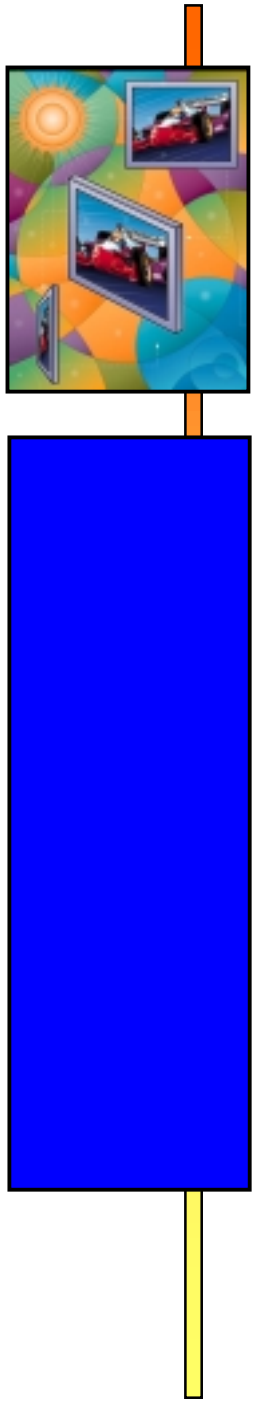
Oracle Database and Oracle Applications Toolkit

- Why do we need another customized script?
  - cmcld only monitor service process ID, not Oracle Database processes
  - You can not spawn Oracle Database Processes directly
- How can we resolve this problem?
  - Create a monitor process to monitor health of Oracle Database Processes
  - Let cmcld watching this monitor process
- Define monitor process as service command in package control file:
  - SERVICE_CMD=”/etc/cmcluster/ERP8P/erp8p.sh monitor”
- Start applications before cmcld starts service process
  - Oracle Database
  - Oracle TNS listeners
  - Oracle Applications Concurrent Managers
- Re-start failed applications on local node before cmcld fails over the package
  - Human errors maybe the cause
  - Avoid minor errors to trigger package failure
  - Restart can be defined in package control file:
  - SERVICE_RESTART[0]=”-r 3”
  - or, control restart logic in a customized script
- Advantages of a customized script
  - Prevent minor errors before turn control to cmcld
  - Highly customizable than package control file



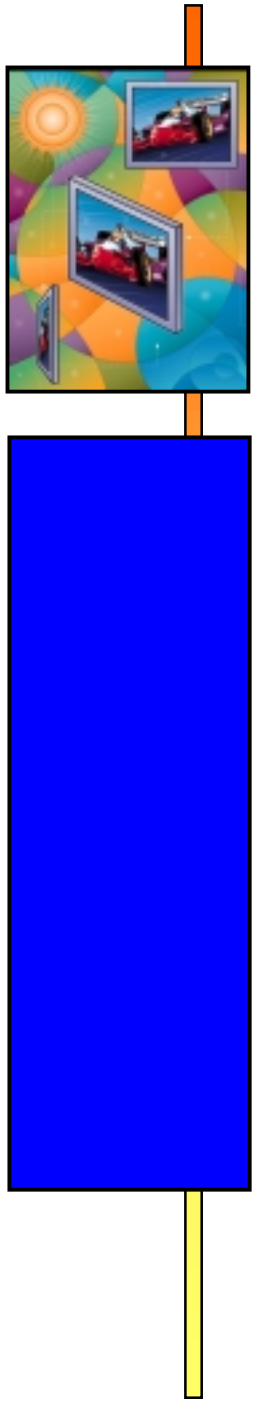
Process Monitoring Script Logic





Monitor Cluster, Node, and Packages: cmviewcl –v

```
CLUSTER     STATUS
fpdd.cl     up

  NODE     STATUS     STATE
  fpdd1    up         running

    Network_Parameters:
    INTERFACE   STATUS     PATH       NAME
    PRIMARY     up         8/12/2/0   lan2
    PRIMARY     up         10/12/6    lan0
    PRIMARY     up         8/12/1/0   lan1
    STANDBY     up         10/4/16    lan3

    PACKAGE     STATUS     STATE      PKG_SWITCH   NODE
    erp8p.pkg   up         running    enabled      fpdd1

      Script_Parameters:
      ITEM      STATUS  MAX_RESTARTS  RESTARTS  NAME
      Service   up      3             0         erp8p.ser
      Subnet    up                              222.117.10.0

      Node_Switching_Parameters:
      NODE_TYPE   STATUS     SWITCHING   NAME
      Primary     up         enabled     fpdd1    (current)
      Alternate   up         enabled     fpdd2

  NODE      STATUS     STATE
  pdd2      up         running

    Network_Parameters:
    INTERFACE   STATUS     PATH       NAME
    PRIMARY     up         8/12/2/0   lan2
    STANDBY     up         10/4/16    lan3
    PRIMARY     up         8/12/1/0   lan1
    PRIMARY     up         10/12/6    lan0

    PACKAGE     STATUS     STATE      PKG_SWITCH   NODE
    erp8t.pkg   up         running    enabled      fpdd2

      Script_Parameters:
      ITEM      STATUS  MAX_RESTARTS  RESTARTS  NAME
      Service   up      3             0         erp8t.ser
      Subnet    up                              222.117.10.0

      Node_Switching_Parameters:
      NODE_TYPE   STATUS     SWITCHING   NAME
      Primary     up         enabled     fpdd2    (current)
      Alternate   up         enabled     fpdd1
```



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Questions??

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