99 Ways to Crash

PUG Challenge 2016

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A Few Words about the Speaker

• Nectar Daloglou; Progress & QAD since 2000.
• Performed specialized services at more than 60 Progress customer sites:
  • Progress Database Administration
  • Install/Upgrades/Migrations of Progress and QAD Applications
  • Technical Audits / Performance Tuning
  • Business Continuity Strategies
• Now part of White Star Software
• Recently helped migrate 70 Progress environments from AIX to Linux

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99 Ways to CRASH!

• Don’t try this at home!
• Learn from mistakes of others
• Goal: Show you a crash you can prevent
• Crash: DB ceases to respond
• Why 99?
Agenda

• The “Human” Factor
• Database Management
• Operating System
• Beyond our control
• Questions
Human Error

**Human error** means that something has been done that was "not intended by the actor; not desired by a set of rules or an external observer; or that led the task or system outside its acceptable limits". **In short, it is a deviation from intention, expectation or desirability.**

The Human Condition

Human Error

Skill-based errors

- Slips of action
- Lapses of memory

Mistakes

- Rule-based mistakes
- Knowledge-based mistakes

Accidental File Delete

• Delete .d’s (and .db, .d1, etc....whoops!):
  − `rm * .d`*

• Delete development environment
  − `rm -rf /dev`*

• Unintentional file redirect
  − `> _mprosrv db`
Accidental rm

- Use *root* or privileged user only when necessary
- List the files first

- `ls filestodelete*`
- `pwd`
  `/db/prod`

- Extra caution with root or privileged user
Accidental Server Shutdown

• Fat thumb:
Accidental Server Shutdown

- Communication breakdown between teams
  - “Unplanned” planned outage
  - Server decommission
- Point and click VM shut down
Monitor your servers’ upstatus

- Use monitoring tool or scripts to poll server status and alert/page you (From another server!)
Proshut User Disconnect

- Disconnect a user safely
Avoid Being Prone to Human Error

- Uh-oh!
Avoid Being Prone to Human Error

1. Remove the “2” key:

2. Or Use:

   _mprshut db –C list
   _mprshut db –C disconnect userid
Agenda

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• Operating System
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Abnormal Shutdown

• Terminating a shared memory process holding latches will crash the database:

  [2016/06/17@11:39:57.214-0400] P-241778 T-1 I WDOG 6: (2522) User 22 died holding 1 shared memory locks.
  [2016/06/17@11:39:57.214-0400] P-241778 T-1 I WDOG 22: (5029) SYSTEM ERROR: Releasing multiplexed latch. latchId: 3096224748304416
  [2016/06/17@11:39:57.347-0400] P-1134704 T-1 I BROKER 0: (2249) Begin ABNORMAL shutdown code 2

• A UNIX kill command or Windows End Task

• An excellent read on safe kill’s & free kill script: “How do I kill thee”:
Abnormal Shutdown

- Killing an agent from OpenEdge Management
Abnormal Shutdown

- Closing a shared-memory window or logging off from Windows
Windows Log off

• Logging off / Signing out from Windows will effectively terminate all your Progress running processes:
  – Example: _mprosrv; replserver; prowin32, etc..

• Use OpenEdge Explorer, dbman, or Task Scheduler to run server processes in background
Excessive BI Growth

- Oops! No –bistall or -bithold:

[2014/08/14@16:05:03.105+0200] P-2300 T-4592 I ABL 8: (10601) SYSTEM ERROR: Attempted to exceed maximum size on file \prod\prod.b2.

[2014/08/14@16:05:03.120+0200] P-2300 T-4592 F ABL 8:

(854) ** Insufficient disk space to extend the before-image file.

[2014/08/14@16:05:03.167+0200] P-3360 T-604 I SRV 3: (2520) Stopped.

[2014/08/14@16:05:03.214+0200] P-2304 T-2312 I SRV 1: (2520) Stopped.

[2014/08/14@16:05:03.214+0200] P-3320 T-776 I SRV 4: (2520) Stopped.

[2014/08/14@16:05:04.261+0200] P-2300 T-4592 I ABL 8: (5028) SYSTEM ERROR: Releasing regular latch. latchId: 4

[2014/08/14@16:05:04.261+0200] P-2300 T-4592 I ABL 8: (5028) SYSTEM ERROR: Releasing regular latch. latchId: 1

[2014/08/14@16:05:04.433+0200] P-2300 T-4592 I ABL 8: (453) Logout by batch on CON:

[2014/08/14@16:06:05.511+0200] P-2496 T-2500 I BROKER 0: (2249) Begin ABNORMAL shutdown code 2

[2014/08/14@16:06:05.511+0200] P-2496 T-2500 I BROKER 0: (2251) Destroyed user 10 pid 3236.

[2014/08/14@16:06:06.511+0200] P-2496 T-2500 I BROKER 0: (2527) Disconnecting dead user 10.

[2014/08/14@16:06:08.527+0200] P-2496 T-2500 I BROKER : (334) Multi-user session end.
Excessive BI Growth

• Possible Causes:
  – Largely scoped transactions
  – Long running transactions
  – Bad Code

• Consider:
  – -bistall -bithold
  – Monitor long transactions and BI size

• 90% Warning in .lg not always enough notice:

  [2015/02/25@12:57:10.468+0800] P-7475 T-140691071489824 I ABL 55: (9240) BI File size has grown to within 90 percent of the threshold value of 2.0 GBytes.
  [2015/02/25@13:04:21.953+0800] P-21931 T-139708899522336 I ABL 58: (9239) BI File Threshold size of 2.0 GBytes has been reached.
Cannot Switch to Empty AI Extents

• Again no stall (-aistall)

[2008/03/04@18:39:35.796-0500] P-868468 T-1 I Usr 46: (3773) Can't switch to after-image extent /reg04/dbs/ai/qadprd04.a1 it is full.
[2008/03/04@18:39:35.799-0500] P-913610 T-1 I FMAGENT11: (453) Logout by DB_Agent on /dev/pts/50.
[2008/03/04@18:39:35.803-0500] P-868468 T-1 I Usr 46: (5350) Database Server shutting down as a result of after-image extent switch failure.
[2008/03/04@18:39:35.826-0500] P-3633292 T-1 I RPLS 5: (10672) The Source database is crashing. Fathom Replication cannot continue.
Cannot Switch to Empty AI Extents

• Possible Causes:
  – AI management script or AIMGMT process not running
  – Out of disk space
  – OE Replication: Not synced to target DB(s); AI files “Locked”

• Consider:
  – -aistall
  – Use AIMGMT utility
  – Monitor empty extents and AI archive disk space
ProTop AI Alert
OE Replication: Stall by Full –pica queue

• Communication queue between the RDBMS and the replication server
• Full queue causes a performance stall
• Restarting the replication server will flush queue
• Monitor using Promon:
  – R&D>1>16

10/18/08 Status: Database Service Manager
00:20:44
Communication Area Size : 1000000.00 KB
  Total Message Entries : 9142822
  Used Message Entries : 9141908
  Service Latch Holder : -1

• Or get alerted by ProTop

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Calulating -pica

-pica = (Total AI Writes/Block count) * 1.25

Total AI writes can be determined with promon
promon → R&D → Option 2 (Activity) → Option 6 (AI Log)

*Note: Gather Total AI writes at the busiest update portion of the day

Block count in version 10+ = 9.16

When in doubt set it larger (memory is cheap)
Maximum value for -pica

256 (9.1E, 10.0B, 10.1A),
1024 (9.1E04),
512 (10.0B05),
8192 (10.1A02, 10.1B01),
1000000 (10.2B08, 11.2, and 11.3)
2GB File Limit

- Large Files Not Enabled:

   [2008/11/26@05:58:42.874-0500] P-2510996 T-1 F Usr 6: (8897) SYSTEM ERROR: Unable to extend database within area HISTORY.
   [2008/11/26@05:58:43.710-0500] P-2510996 T-1 I Usr 6: (2252) Begin transaction backout.
   [2008/11/26@05:58:43.711-0500] P-2510996 T-1 F Usr 6: (2255) SYSTEM ERROR: Incomplete microtransaction.
   [2008/11/26@05:58:43.711-0500] P-2510996 T-1 I Usr 6: (439) ** Save file named core for analysis by Progress Software Corporation.
   [2008/11/26@05:58:43.888-0500] P-2211938 T-1 I BROKER 0: (2249) Begin ABNORMAL shutdown code 2

Use: proutil <DB> -C EnableLargeFiles
No variable extent

• Similar issues when fixed extent fills up:

  [2008/11/26 05:58:42.874-0500] P-2510996  T-1  F  Usr  6: (8897) SYSTEM ERROR: Unable to extend database within area HISTORY.
  [2008/11/26 05:58:43.711-0500] P-2211938  T-1  I  BROKER 0: (2249) Begin ABNORMAL shutdown code 2

• Ensure every area has a variable extent:

  d "TRGLDET":27,64 ./db f 512000
  d "TRGLDET":27,64 ./db
  
  d "TRGLDET_IDX":28,32 ./db f 512000
  d "TRGLDET_IDX":28,32 ./db

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Infinite (-l) increases

- Process eventually consumed all the memory

[2014/03/17@12:02:46.754-0400] P-8573096 increasing from 3323700 to 3323710.
[2014/03/17@12:02:46.760-0400] P-8573096 increasing from 3323710 to 3323720.
[2014/03/17@12:02:46.767-0400] P-8573096 increasing from 3323720 to 3323730.
[2014/03/17@12:02:46.773-0400] P-8573096 increasing from 3323730 to 3323740.

- Monitor and consider -hardlimit
Lock Table Overflow (-L)

• Hitting the max will eventually consume all shared memory

Begin transaction backout. (2252)
Lock table overflow, increase -L on server (915)
Out of free shared memory. Use -Mxs to increase. (6495)
SYSTEM ERROR: mtlatch <latch-num>, holding <lock>. (3712)
SYSTEM ERROR: Releasing regular latch. latchId:<latch-num> (5028)
SYSTEM ERROR: Releasing multiplexed latch. latchId:<latch-num> (5029)
User <num> died holding <num> shared memory locks. (5026)

• Monitor open transactions and record lock counts

• Use: proutil db –C increaseto –Mxs #
Failed DB File Move

- `mv /db/prod.d1 /db1/prod.d1`
- `prostrct repair prod`
- **Oops! What happened?**

```
Error
Last open date mismatch. (9215)
Extent has a different last opened date Fri Jun 24 00:40:39 2010, (9213)
Control Area has a last open date of Fri Jun 24 00:41:08 2010. (9217)
Probable backup/restore error. (605)
Database is damaged, see documentation. (1486)
```

- Rename .db before and after, to prevent accidental logins

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No integrity (-i) crash

• Prepare to restore
• Back up DB beforehand
• Should be used as a last resort
• Used to extract and salvage as much data as possible
• Use ASCII Dump/Load
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Linux Out of Memory Killer

- A self-preservation mechanism that terminates a process when memory is over committed.
- OOM will kill the most memory consuming process

/var/log/messages:
Oct 22 16:05:48 s619784dc3vl42 kernel: Out of memory: Kill process 5995 (_mprosrv) score 421 or sacrifice child
Oct 22 16:05:48 s619784dc3vl42 kernel: Killed process 5995, UID 65535, (_mprosrv) total-vm:34767444kB, anon-rss:12680kB, file-rss:31617936kB

- Can control likelihood by setting oom_adj (Valid range -16 to +15; -17 to exempt):
  - Example: echo -17 /proc/5995/oom_adj
Host name Change

• A simple host name change:

  > hostname slv8002

  [2008/09/24@08:48.790-0400] P-10817782  T-1  I BROKER  0: (4192)  /reg01/dbs/qaddb/qadprd01.lk:

  HOSTNAME is slv8002, expected slv8000.

  [2008/09/24@08:48.790-0400] P-10817782  T-1  I BROKER  0: (4196)  /reg01/dbs/qaddb/qadprd01.lk is not a valid .lk file for this server.

  [2008/09/24@08:48.790-0400] P-10817782  T-1  I BROKER  0: (2249)  Begin ABNORMAL shutdown code 2

• .lk file contains host

  > cat qadprd01.lk

  slv8000
Out of disk space

- Out of disk space

[2016/05/04@00:31:13.741+0800] P-14609 T-139953801205536 I ABL 23: (9450) bkioWrite:Insufficient disk space during write, fd 119, len 16384, offset 13520, file /reg12/dbs/ai/r12prd3.a1.

[2016/05/04@00:31:35.563+0800] P-14609 T-139953801205536 I ABL 23: (9450) bkioWrite:Insufficient disk space during write, fd 119, len 16384, offset 13520, file /reg12/dbs/ai/r12prd3.a1.

[2016/05/04@00:31:35.563+0800] P-14609 T-139953801205536 I ABL 23: (9450) bkioWrite:Insufficient disk space during write, fd 119, len 16384, offset 13520, file /reg12/dbs/ai/r12prd3.a1.

[2016/05/04@00:31:35.563+0800] P-14609 T-139953801205536 I ABL 23: (4163) Insufficient disk space.

- Monitor disk space
- Track database growth rate
- Segregate DB files from application, home/work directories
- Do not store anything under / <root> or C:\
Unintended Java update

• A Linux Kernel patch updated java
  – Used to be: /usr/java/jdk1.5.0_22/
  – Now /usr/java/jdk1.6.0_10
  – Progress likes its java a certain way
Agenda

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Hardware Failure

SYSTEM ERROR: wrong dbkey in block. Found <dbkey1>, should be <dbkey2> (1124)
SYSTEM ERROR: read wrong dbkey at offset <offset> in file <file> found <dbkey>, expected <dbkey>, retrying. (1152)
SYSTEM ERROR: read wrong dbkey at offset <offset> in file <file> found <dbkey>, expected <dbkey>, retrying. (9445)
SYSTEM ERROR: Database block <nbr> has incorrect recid: <nbr>. (355)
SYSTEM ERROR: wrong dbkey (1067)
BROKER 0: rlrdnxt: note prefix and suffix lengths don't match 8224 48
SYSTEM ERROR: The broker is exiting unexpectedly, beginning Abnormal Shutdown. (5292)

- Disk Subsystem
  - SAN Controller
  - RAID Controller
- CPU
- RAM
- Power Supply
- Motherboard
- UPS
- Network

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Other Disasters

- Natural Disaster/Extreme Weather
- Power outage
- Flood
- Fire
- Utility outage (Excluding Fire)
- Cyber attack
- Supply chain distribution
- Terrorist event
- Employee health and safety incident
- Epidemic/Pandemic
- Sabotage
- Environmental accident
- Others...
Review/Update Business Continuity Plan
Progress Bugs

- **Database crash after Lock Table Overflow**

  Lock table overflow, increase -L on server (915)
  Begin transaction backout. (2252)
  Transaction backout completed. (2253)
  SYSTEM ERROR: mtlatch <latch-num>, holding <lock>. (3712)
  SYSTEM ERROR: mtlatch 7, holding 0x40. (3712)
  ** Save file named core for analysis by Progress Software Corporation. (439)

- **Truncate after Emergency Shutdown corrupts BI**

  rmUndoLogicalChange: recid <RECID> area <Areanum> txn <Transnum> updctr <n>
  rmFetchRecord returns <n1> expected <n2>

- **LKRELS Errors in 10.1B**

  SYSTEM ERROR: lkrels record <recid> not locked. (435)
Stay current with your OpenEdge version:

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<th>Product Version &amp; Current Service Pack (SP)</th>
<th>Life Cycle by Product Release</th>
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BONUS!

- Ensure you have a valid backup
- Not valid if it’s not tested
Conclusion

- Human errors can be managed with some situational awareness and behavior change
- A good monitoring and alerting tool can help avoid outages
- Stay current and learn to avoid DB crashes
- Have an up-to-date disaster recovery plan (And good backup!)
Questions?
Questions

• Questions or comments? Feel free to e-mail me:

Nectar Daloglou: nd@wss.com
Thank You!
Try ProTop Free

The #1 FREE OpenEdge Database Monitoring Tool

http://dashboard.dbappraise.com/

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