



Lotus Domino Performance Tuning

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Agenda

- What does impact a Domino performance?
- Tools to identify problems
- OS tuning, services
- Domino database tuning
- @Time functions
- Agents, subforms, Tables, icons,
- Domino 6.x, 7.x, 8.x, 8.5.x improvements



What impacts Domino performance

- Hardware
 - CPU (Agents, Indexes, LotusScript)
 - HDD (RAID) Data read/write
 - RAM (Virtual Memory)
- OS
- Domino configuration
- Database
 - Design
 - Full-Text Index
 - View
 - Private
 - Public



Tools to identify problems

- User complains
- OS/Domino statistics
- Lotus Domino Domain monitoring
- Log files/debug parameters
- Agent Profiler (Domino 7.x)
- 3rd party tools (Profilers)



Domino server tuning guide

- 1. RAID tuning
- 2. Hardware tuning
- 3. OS tuning
- 4. Domino server configuration tuning
- 5. Enable Transactional Logging
- 6. Database tuning
- 7. View tuning
- 8. Column, agent, script tuning



RAID

- 6 disks
 - 1. OS RAID 1, 18GB,
 - 2. DATA RAID 1, RAID 1E, 72GB-240GB Stripe size 16KB
 - 3. Transactional Logging,
 - Circular uses max 4GB, 18GB
 - Archive uses the whole disk, 36GB-72
- Transactional Logging should be pointed to a separated disk
- TL significantly reduces restart time after fault
- Works together with View Logged views (\$Users, others)



RAID (cont.)

- Stripe size should be 16K

| Data to store | RAID level | Size | Speed |
|-----------------------|---------------|------|-------|
| OS | RAID 1 | 18GB | 15K |
| DATA | RAID 1, 5, 10 | | |
| Transactional Logging | RAID 1 | 18GB | 15K |

Basics | Security | Ports... | Server Tasks... | Internet Protocols... | MTAs... | Miscellaneous | Transactional Logging | Shared Mail | DB2 | Lotus Traveler | Administration

Basics

Transactional logging: Enabled

Log path: E:\LOGDIR\

Logging style: Circular

Use all available space on log device: Yes No

Maximum log space: 4096 MB

Automatic fixup of corrupt databases: Enabled

Runtime/Restart performance: Favor runtime

Quotas

Quota enforcement: Check file size when extending the file



Transactional Logging

- TL – Improves performance
- TL - Reduces server restart time
- - Separate disk is necessary
- TL Best Practice
<http://www-1.ibm.com/support/docview.wss?uid=swg27009309>
- TL should be disabled on Clubusy.nsf, log.nsf, mail.box, check notes.ini
<http://www-1.ibm.com/support/docview.wss?uid=swg27009309#INI%20file>
- TL on SAN <http://www-1.ibm.com/support/docview.wss?uid=swg27009309#SAN>

| | Recovery Time | Response Time | CPU load |
|----------------|-----------------|---------------|--------------|
| DISABLED | 01:40:40 (100%) | 233ms (100%) | 48.9% (100%) |
| Standars | 00:17:43 (17%) | 216ms (93%) | 46.3 (95%) |
| Favor Runtime | 00:33:24 (33%) | 172ms (74%) | 41.0% (84%) |
| Favor Recovery | 00:12:35 (12%) | 223ms (96%) | 46.7% (96%) |



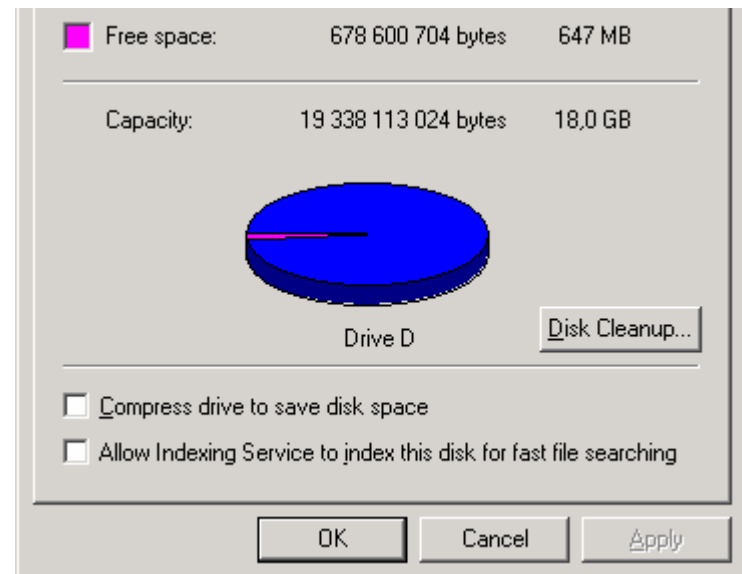
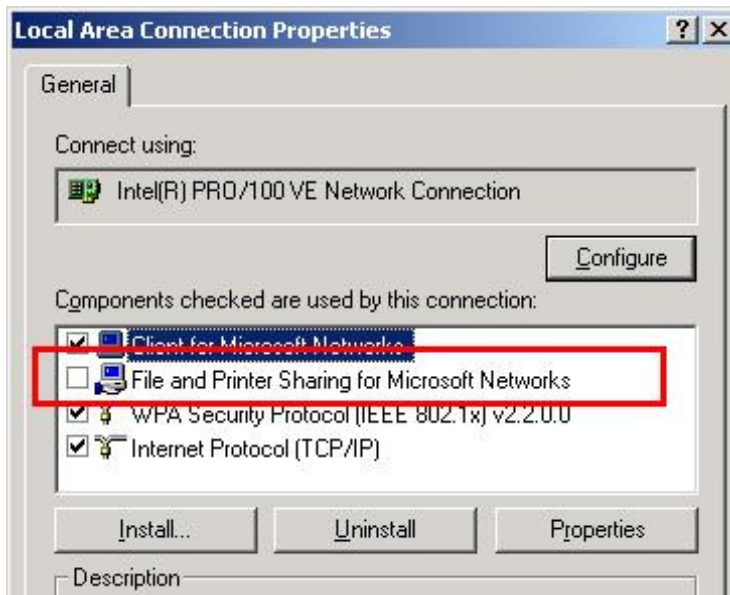
Server type

- Mail – needs more memory (to convert emails)
- Apps – needs more CPU (LotusScripts, indexes require CPU resources)
- CLUSTER – need more MEMORY and CPU 😊
- Use IBM calculators, as well you can use similar environments that runs well



Basic OS tuning (Windows)

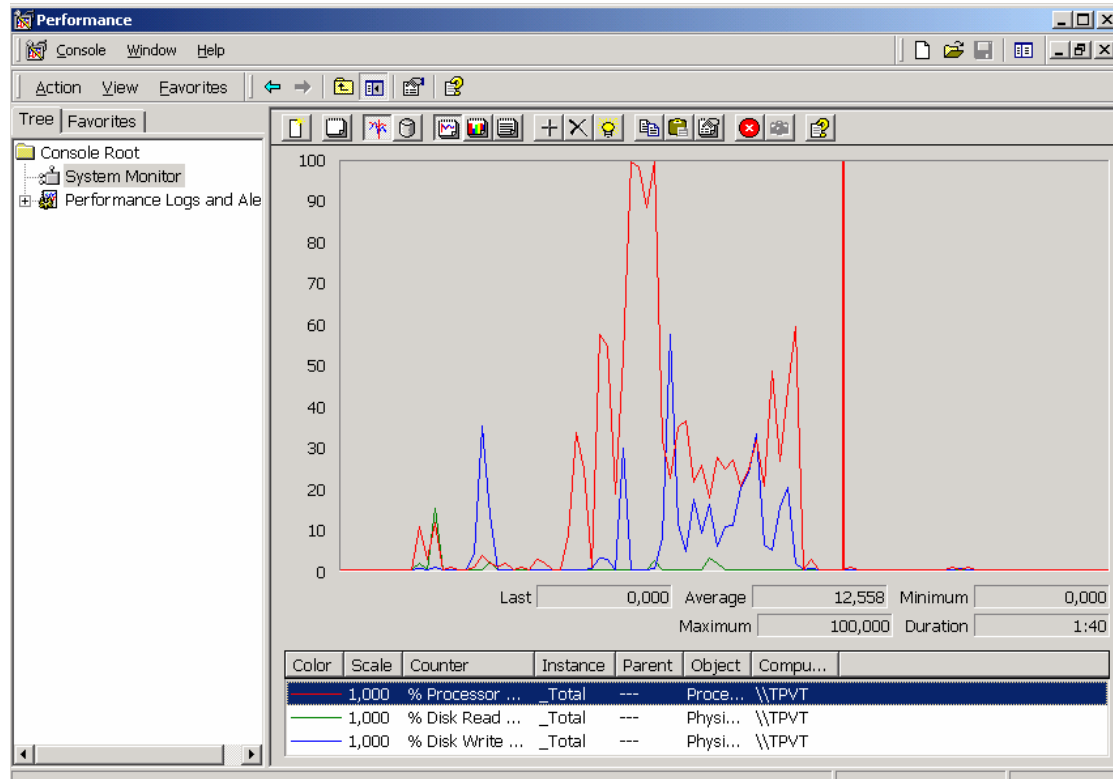
- Disable “File and Printer Sharing”
- Disable unused server services (Print Spooler)
- Disable Disk Indexing





Windows Performance tools

- Start with Performance Monitor to identify a bottle neck
- Same tools are available on other OSES





WebAdmin.nsf

People & Groups | Files | Server... | Messaging... | Replication | Configuration | Logout Preferences

Status | Analysis | Statistics

Server **Platform Statistics**
Release 6.5.6FP3 on Windows 2003 Server

- All Server Tasks
- Notes Users
- Database Users
- Internet Users
- Quick Console
- Live Console
- HTTP Statistics
- Schedules
- Operating System
 - Platform Statistics
 - Services
 - Processes

Last sampled: 11:09:28, sample interval is every 1 minute(s) Last update

| CPU Statistics | |
|----------------------|--------|
| Current utilization: | 20 % |
| Average utilization: | 3.4 % |
| Domino utilization: | 24.7 % |

| Memory Statistics | | | | |
|-----------------------|--------------|-------|--------|--------|
| | Total | Min. | Peak | Avg. |
| Installed: | 4096 MB | | | |
| Available: | (7 %) 254 MB | 40 MB | 3 MB | 591 MB |
| Pagefile utilization: | | | | |
| | 15.7 % | | 23.4 % | 8.6 % |

| Network Adapter Statistics | | |
|--|----------------|-----------|
| Intel(R) PRO_1000 EB Network Connection with L_O Acceleration: | | |
| Bandwidth utilization: | NIC Speed: | |
| 0 % | 1,000 MBit/sec | |
| Total/sec: | Received/sec: | Sent/sec: |
| 0 bytes | 0 bytes | 0 bytes |

| Disk Statistics | | | |
|-----------------|--------------|-------|--------|
| Drive name: | Utilization: | | |
| | Current: | Peak | Avg. |
| C | 37.5 % | 100 % | 19.5 % |
| D | 20 % | 100 % | 12.6 % |
| F | 0.4 % | 67 % | 0.3 % |

| | | |
|------------------------|---------------|----------------|
| Bandwidth utilization: | NIC Speed: | |
| 0.2 % | 100 MBit/sec | |
| Total/sec: | Received/sec: | Sent/sec: |
| 23,328.6 bytes | 6,138.7 bytes | 17,189.9 bytes |



Lotus Domino/Lotus Notes tuning



Precision powered innovation





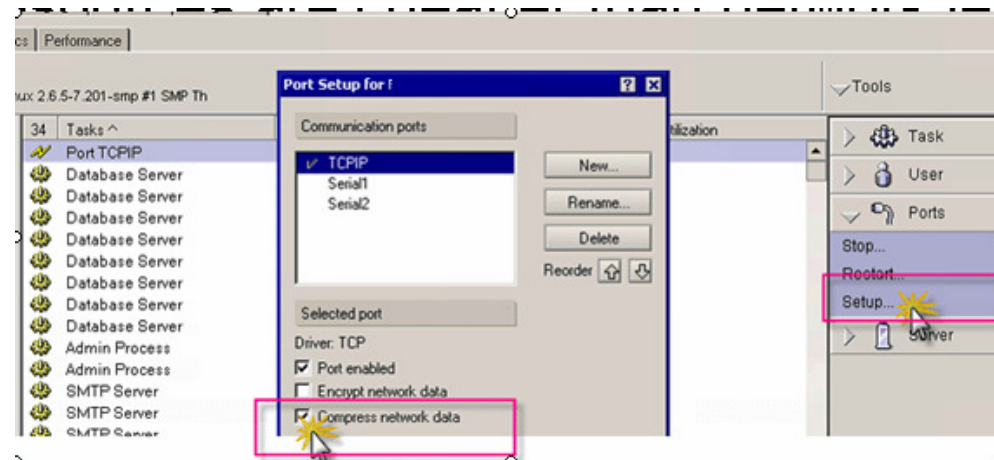
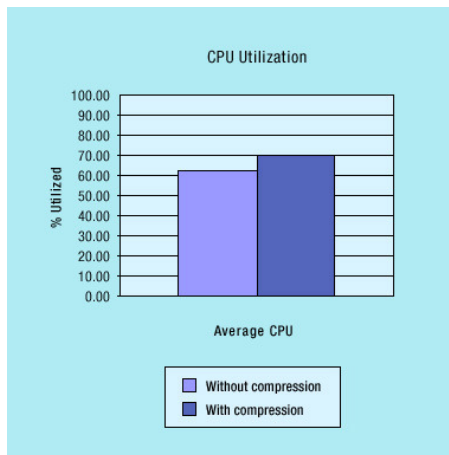
Server Tasks that impact performance

- Remote Debugger (should not be used on production server)
- Server port encryption
- +++ Traffic Compression (Lotus Domino, Lotus Notes)
- Debug parameters (only if adviced by support)
- INDEXer (Full text indexer)



Traffic Compression (LN 6.x, 7.x, 8.x, 8.5.x)

- Should be enabled in a client, and a server
- Only if both sides support compression, it works
- Processor resources are cheaper than network lease costs



| Database | Size before network compression (MB) | Size after network compression (MB) | Percent reduction |
|--|--------------------------------------|-------------------------------------|-------------------|
| db1.nsf (no compression) | 106 | 51 | 52% |
| db2.nsf (R5/Huffman compression) | 81 | 54 | 34% |
| db3.nsf (Notes/Domino 6/LZ1 compression) | 79 | 52 | 35% |



ODS – On Disk Structure

- ODS 17 Domino 3.x
- ODS 20 Lotus Domino 4
- ODS 41 Lotus Domino 5 (soft deletions)
- ODS 43 Lotus Domino 6x, 7.x (LZ 1 attachment compression, Cluster unread marks)
- ODS 48 Lotus Domino 8.x (Create_R8_Databases=1, design compression, data compression, don't allow simple search)
- ODS 51 Lotus Domino 8.5.1 (Create_R85_Dataatabases=1)

- compact, after every migration all databases should be upgraded to new ODS, to take benefit from new release features.
- If necessary, you can downgrade ODS to the previous version using compact -r (-r=revert)
- LZ1 attachment compression



Use DDM, Luke!



DDM

- My Events
- By Severity
- By Date
- By Type
- By Server
- By Assignment
- Open Configuration

Open Events | Recent Events | All Events

All open events, sorted by severity

Refresh | Assign... | Change State | Add Comments...

| # | Date | Server | Open Events By Severity |
|-----|------|--------|--------------------------|
| 2 | | | Fatal |
| 1 | | | Database |
| 1 | | | Database: Compact |
| 99 | | | Failure |
| 3 | | | Application Code |
| 1 | | | Database |
| 89 | | | Messaging: Ro |
| 2 | | | Operating System |
| 2 | | | Replication |
| 1 | | | Server |
| 1 | | | Server: Adminis |
| 197 | | | Warning (High) |
| 3 | | | Database |
| 194 | | | Security: Acces |
| 50 | | | Warning (Low) |
| 4 | | | Database |
| 4 | | | Database: Com |
| 21 | | | Security |
| 21 | | | Security: Acces |
| 348 | | | |

Monitoring Configuration

- DDM Configuration
 - DDM Probes
 - By Author
 - By Probe Server
 - By Type**
 - DDM Filters
 - Server Collection Hierarchy
 - Open Monitoring...
 - Setup Wizards
 - Event Handlers
 - By Server
 - By Type
 - By Severity
 - By Action
 - By Author
 - Event Generators
 - Console Attributes
 - Filters
 - Log Filters
 - DDM Filters
 - Statistic Collection
 - Advanced
 - Names & Messages (Advanced)

DDM Probes: All By Type

| Total | Enabled | Type | Probe Description | Last Modified By | Last Modified Date/T |
|-------|---------|-------------------------|--|----------------------------------|----------------------|
| 7 | 0 | Application Code | | | |
| 4 | 0 | Database | | | |
| 10 | 0 | Directory | | | |
| 12 | 0 | Messaging | | | |
| 4 | 0 | Operating System | | | |
| 1 | 0 | CPU | Default Operating System/CPU Probe | Lotus Notes Template Development | 21.07.2005 18:02:31 |
| 1 | 0 | Disk | Default Operating System/Disk Probe | Lotus Notes Template Development | 21.07.2005 18:02:31 |
| 1 | 0 | Memory | Default Operating System/Memory Probe | Lotus Notes Template Development | 21.07.2005 18:02:31 |
| 1 | 0 | Network | Default Operating System/Network Probe | Lotus Notes Template Development | 21.07.2005 18:02:31 |
| 2 | 0 | Replication | | | |
| 5 | 0 | Security | | | |
| 1 | 0 | Server | | | |
| 2 | 0 | Web | | | |
| 47 | 0 | | | | |





Domino 8 performance improvements

- Database design element compression
- On-demand collations
- Prevent Simple Search (for database which has no Full Text Index)



Domino 8.5 performance improvements

- New ODS
- DAOS (reduce DB size 50-70%) thus reducing db read time, disk overall load

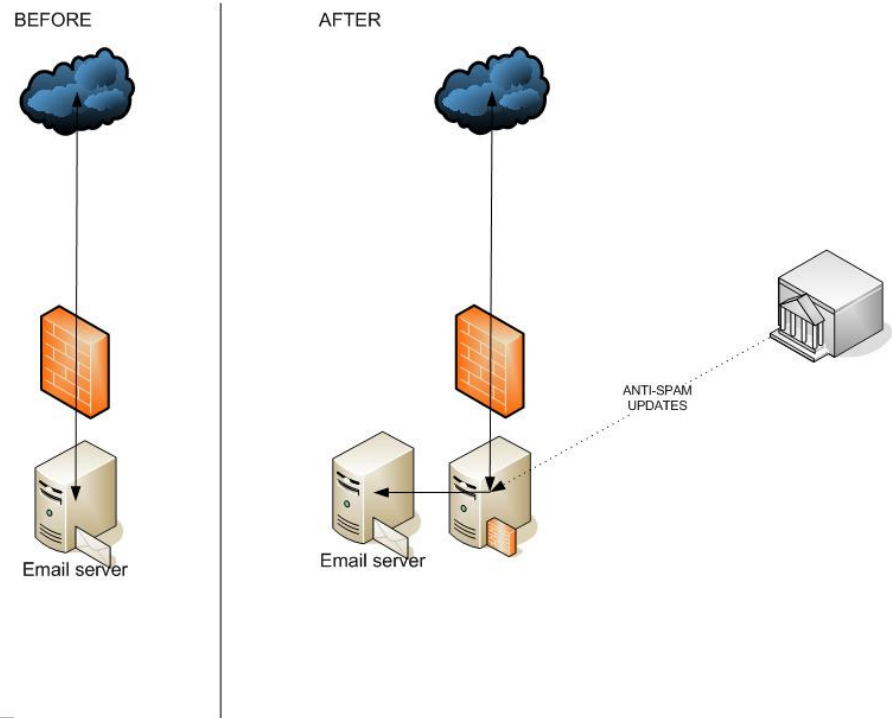
Use DAOS estimator

- GZIP compression 8.5.1



Separate ANTI-SPAM

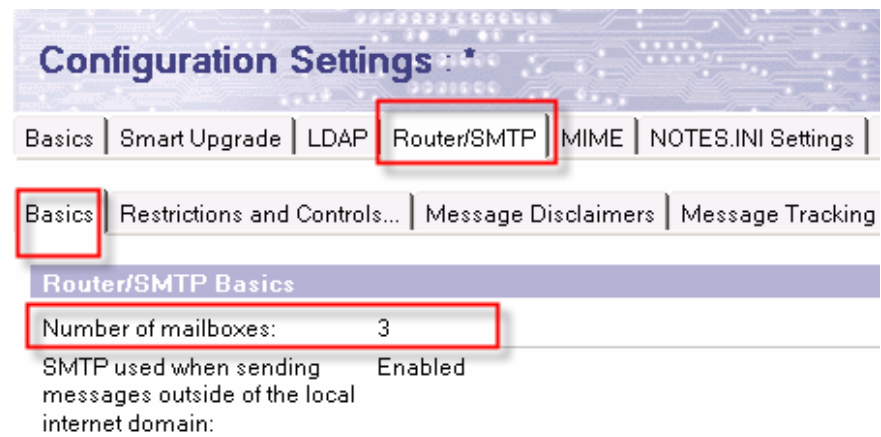
- Implement “Verify Local Recipient exists in Domino Directory”
- Implement BlackLists (if there is no Anti-SPAM)
- 90% of all emails – SPAM





Mail Routing tuning

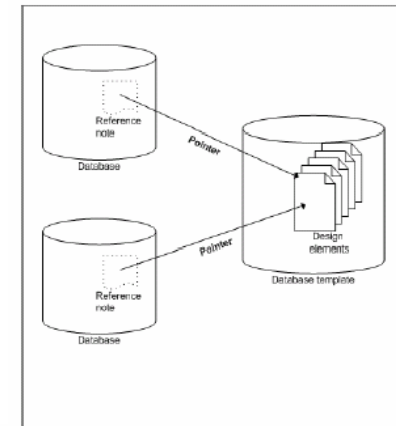
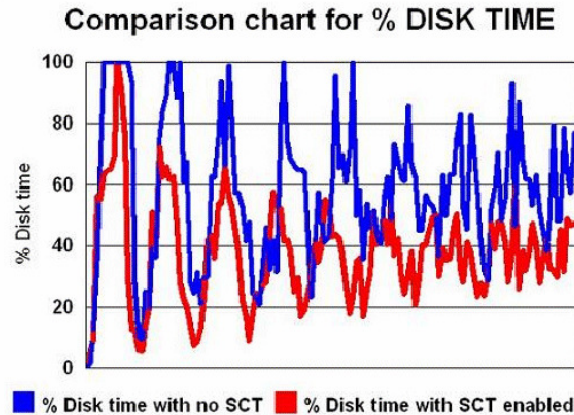
- Server should have at least 3 mailboxes
- Router when delivers mail, locks a mail.box, thus implementing 3 mailboxes improves mail delivery.
- If one mailbox is corrupted, mail flows through other mailboxes





Single Copy Template (6.x, 7.x, 8.x)

- Improves read performance for mail servers
- saves ~10MB of space per user,
10 users-100MB, 100user-1GB, 1000-10GB.
- When user count is more than 500, you may create various STC, in case if STC template is corrupted, only part of users is not working
- After upgrade, you should re-enable STC in a Template





Domino performance depending on version

- Domino 8.5/8 is 50%-75% faster than Domino 7.x
- Domino 7.x 50% faster than Domino 6.x
- Domino 8.5,8,7.x uses CPU more effectively
- Less disk usage (caching)
- Can serve more users than Domino 6, and Domino 5





Things to get home

1. Configure separate disk, configure Transactional Logging, RAID 1
2. Transactional Logging - Favour RunTime
3. RAID 1, RAID 10
4. Disks 10K rpm->15K rpm
5. Enable traffic compression (traffic)
6. On email servers, enable SCT (single Copy Template)
7. Archive databases (split database into two big&slow, and small&fast)
8. Perform OS tuning (Sharing, Spooler, ...)
9. OS monitoring
10. `DEBUG_CAPTURE_TIMEOUT`, `DEBUG_SHOW_TIMEOUT`, `DEBUG_THREADID` (should consult someone)
11. Don't run Oracle or other software on same box with Domino
12. Implement `VIEW_REBUILD_DIR` (for index rebuilding, else DATA disk will be used)



Application tuning





Database size depends on the size of

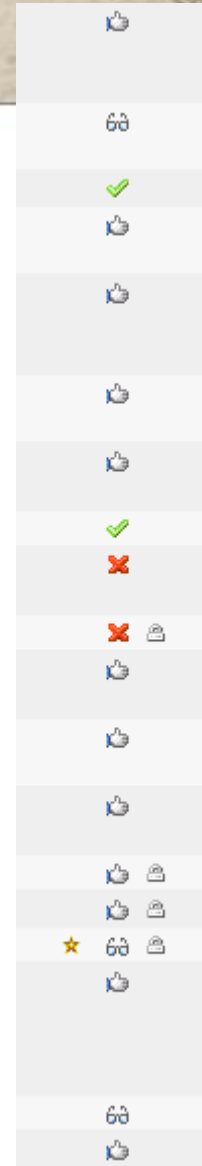
- Database design
- Documents
 - Document data
 - Attachment
 - Agent Log (!!!!)
 - Unread Marks
- View Indexes
- View indexes may occupy 60-80% of database size.
- View could should not exceed 50 views per database,





View icons -> impacts view index

- @IF(Status="Status_1";1;
@IF(Status="Status_2";90;
@IF(Status="Status_3;55))
- This function is calculated EVERY time, when user opens a View, this function is applied to EVERY SINGLE document. Imagine a database with 40'000 documents, x3 nested @IF
- Solution, calculate function in a document, and store result in this field will store icon number, 1, 90, or 55.
- Tremendously decreases size of View INDEX





Database View count < 50 views, View Index size

The screenshot shows a database management interface. A context menu is open over a list of databases, with 'Manage Views...' selected. A dialog box titled 'Manage the views of this database' is displayed, showing the selected database 'requests.nsf' (1.9 GB) and a summary of view index usage: 'The view indexes of this database consume 334 MB of disk space, which is 17% of the entire space used by this database.' Below this, a table lists individual views and their sizes.

| View name | Size | Owner | Refresh | Discard | N |
|----------------------------|-------------|-----------------|-----------|----------------------|---|
| Problēmas | 102 738 200 | Template Develc | Automatic | If inactive for 45 d | ▲ |
| Pēc projekta, klienta\stā | 62 556 008 | Template Develc | Automatic | On Server After 5 | □ |
| Pēc projekta, klienta\stā | 52 858 664 | Template Develc | Automatic | On Server After 5 | □ |
| Pēc projekta, klienta\stā | 52 210 296 | Template Develc | Automatic | On Server After 5 | □ |
| Pa projektiem, statusiem | 22 077 280 | Template Develc | Automatic | On Server After 5 | □ |
| Pa projektiem, prioritātēm | 19 683 840 | Template Develc | Automatic | On Server After 5 | □ |
| Pēc projekta\statusa | 18 523 720 | Template Develc | Automatic | On Server After 5 | □ |
| (Pēc pieteikuma koda - u | 9 557 688 | Template Develc | Automatic | If inactive for 45 d | ▼ |
| (Pieteikuma kodi) | 6 513 232 | Template Develc | Automatic | If inactive for 45 d | ▼ |





Show database <path\database_filename.nsf>

show database XYZ\requests.nsf

Remote console command issued by Vladislavs Tatarincev/OrgX: show database XYZ\requests.nsf

show database XYZ\requests.nsf

DB Requests

| Document Type | Live | Deleted |
|----------------|--------|---------|
| Documents | 30 634 | 7 |
| Info | 1 | 0 |
| Form | 33 | 0 |
| View | 61 | 0 |
| Icon | 1 | 0 |
| Design | 1 | 0 |
| ACL | 1 | 0 |
| Help Index | 0 | 0 |
| Help | 1 | 0 |
| Macro | 80 | 0 |
| Shared Field | 1 | 0 |
| Repl. Formula | 2 | 0 |
| Private Design | 0 | 0 |
| Unknown | 71 | 0 |

View sizes

Bytes

Pēc projekta\klienta problēmu kodi 0
Pēc projekta\prioritātes - ar dienām 185 080
Pēc projekta\statusa, risināšanas ilguma 185 256
Pēc projekta, klienta\stāvokļa, atbildīgā 52 210 296
(Pieteikumu kodi) 6 513 232
Problēmas 102 738 200
(Pēc pieteikuma koda - uniq) 9 557 688





UNREAD MARKS

- Unread Marks – enabled by Default
- Each user has his own set
- 10 users-10 sets, 1000-1000sets
- Before the 6th version, unread marks where stored in Workspace file, starting from 6.x in database
- 70% applications don't use UM, but by default they are calculated

| View | | |
|------|----------|---|
| # | | |
| 1 | Document | 1 |
| 2 | Document | 2 |
| 3 | Document | 3 |
| 4 | Document | 4 |
| 5 | Document | 5 |

| User 1 | | |
|--------|----------|---|
| # | | |
| 1 | Document | 1 |
| 2 | Document | 2 |
| 5 | Document | 5 |

| User 2 | | |
|--------|----------|---|
| # | | |
| 1 | Document | 1 |
| 2 | Document | 2 |
| 3 | Document | 3 |
| 4 | Document | 4 |
| 5 | Document | 5 |

| User 3 | | |
|--------|----------|---|
| # | | |
| 1 | Document | 1 |
| 2 | Document | 2 |
| 3 | Document | 3 |

| user 4 | | |
|--------|----------|---|
| # | | |
| 1 | Document | 1 |
| 2 | Document | 2 |
| 4 | Document | 4 |
| 5 | Document | 5 |

| User 5 | | |
|--------|----------|---|
| # | | |
| 1 | Document | 1 |
| 3 | Document | 3 |
| 5 | Document | 5 |





VIEW Sorting

- Two-way sorting for columns

Creates a 2^n tables, where n is sortable column count, and only one subset will be displayed to a user

Alias 

Last Modified 

Last Modified By 





Categorization

- Don't use more than 3 categorized columns in a view. Categorized columns are performance killers.

The screenshot shows a software interface with a tree view on the left and a database properties dialog box on the right. The tree view shows a hierarchy: Performance_demo > main > 1999 > 11 > 30 > 12 > 2000 > 2001. The database properties dialog box is titled 'Database' and contains the following information:

| Property | Value | Action |
|--------------|-------------------------------|----------------|
| Size | Disk space: 18 MB | % used |
| | Documents: 30 000 | Compact |
| Activity | Created: 09.10.2004 20:32:42 | User Detail... |
| | Modified: 09.10.2004 21:45:19 | |
| Replica ID: | C2256F28:006060AC | |
| ODS version: | 43 | |





@Time functions

| YEAR | MONTH | DAY | TIME |
|------|-------|-----|------|
| 1999 | 11 | 30 | |

Database

Size: Disk space: 43 MB 98.8% % used
Documents: 10 000 Compact

Activity: Created: 09.10.2004 20:32:42 User Detail...
Modified: 13.10.2004 21:18:08

Replica ID: C2256F28:006060AC
ODS version: 43

| YEAR | MONTH | DAY | TIME |
|------|-------|-----|------|
| 2001 | 1 | 1 | |

Database

Size: Disk space: 27 MB 98.8% % used
Documents: 10 000 Compact

Activity: Created: 09.10.2004 21:50:10 User Detail...
Modified: 13.10.2004 21:22:48

Replica ID: C2256F28:0067786D
ODS version: 43

YEAR (Column) : Column Value

Display Simple Function Field Formula

@Year(Date)

YEAR (Column) : Column Value

Display Simple Function Field Formula

year



Calculate @Time functions in a form, and in the view just display results





Tip of the Year!

- Instead of using @Today, create an agent that stamps today's date to a field fld_Today, then use this field instead of @Today
- Benefit from this:
Calculate once per night, use it all the day long





Full-Text index

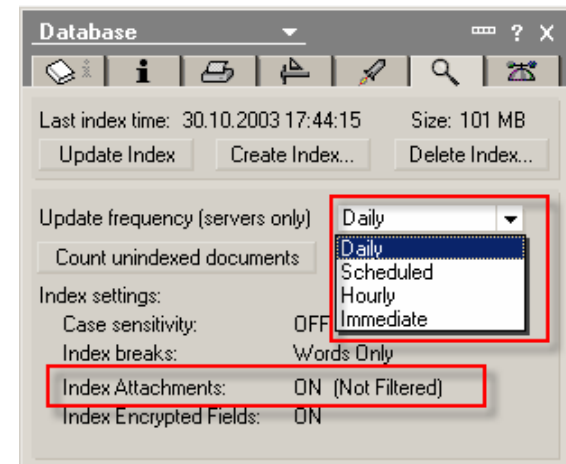
- By default index trigger is IMMEDIATE
- Index can occupy space that is close to db size
- Better use Daily trigger

notes.ini

```
UPDATE_NO_FULLTEXT=1
```

TN #1092096

- VIEW_REBUILD_DIR notes.ini



Use LotusScript Agent to cycle through NotesDb directory,
and change trigger (on mail servers)





Attachment compression

- LZ1 should be enabled only when clients are 6.x, or 7.x, don't try this in a mixed environment (5.x)
- Better enable this when all clients are at least 6.5.5 or 6.5.6 (previous versions have some bugs)
- You can convert existing attachments

Load compact -ZU mail\filename.nsf

Don't run this command during office hours... ☺

Upgrading existing attachments from Huffman to LZ1 compression

<http://www-1.ibm.com/support/docview.wss?uid=swg21256241>





Agent Profiling

Agent

Run as web user
 Run on behalf of:
 Allow remote debugging
 Allow user activation
 Profile this agent
 Set runtime security level: (1 = most secure)
 1. Do not allow restricted operations

Default access for viewing and running this agent

All readers and above
 OtherDomainServers
 Raphael Saviz/Westford/IBM
 Raphael Saviz/LSDevelopment

Allow Public Access users to view and run this agent

Slow Mail Agent (ByViewEntryCollection) Profile

02/10/2005 06:31:47 PM EST
 Elapsed time: 76800 msec
 Total measured time: 75499 msec

| Class | Method | Operation |
|---------------------|--------------------|-----------|
| View | GetAllEntriesByKey | |
| Database | Open | |
| DbDirectory | GetNextDatabase | |
| Database | GetView | |
| DbDirectory | GetFirstDatabase | |
| Database | Title | |
| Database | FilePath | |
| Database | Size | |
| ViewEntryCollection | Count | |

Slow Mail Agent (GetMail_ftSearch) Profile

02/10/2005 06:17:14 PM EST
 Elapsed time: 3400179 msec
 Total measured time: 3375808 msec

| Class | Method | Operation | Calls | Time |
|--------------------|------------------|-----------|-------|---------|
| Database | FTSearch | | 27 | 3312723 |
| Database | Open | | 76 | 48044 |
| DbDirectory | GetNextDatabase | | 76 | 8292 |
| DbDirectory | GetFirstDatabase | | 1 | 3204 |
| DocumentCollection | GetNextDocument | | 243 | 2402 |
| Managers | Get | | 27 | 761 |
| GetFirstDocument | | | 26 | 261 |
| Server | Get | | 1 | 101 |
| Title | Get | | 76 | 10 |
| Size | Get | | 243 | 10 |
| FilePath | Get | | 76 | 0 |
| Size | Get | | 76 | 0 |
| CurrentDatabase | Get | | 1 | 0 |
| GetDbDirectory | | | 1 | 0 |

Slow Mail Agent (AllDocs) Profile

02/10/2005 10:19:16 PM EST
 Elapsed time: 1675560 msec
 Total measured time: 1460396 msec

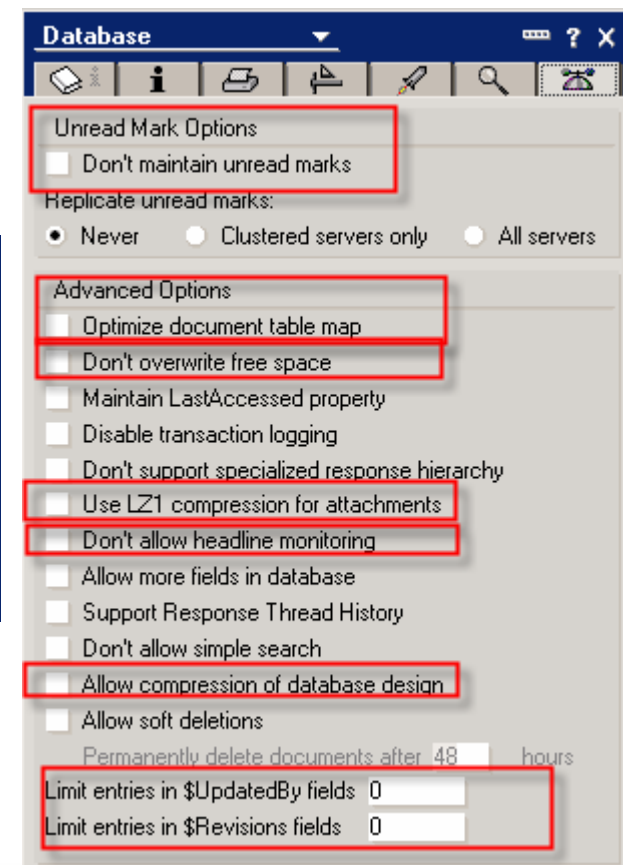
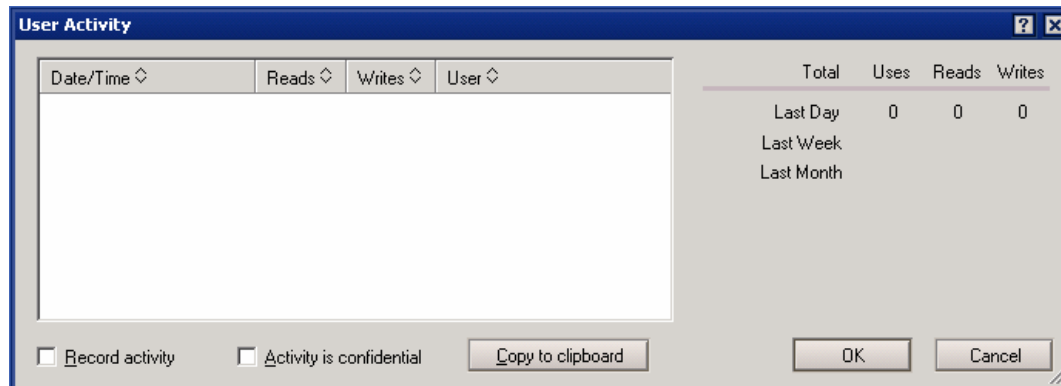
| Class | Method | Operation | Calls | Time |
|--------------------|------------------|-----------|---------|---------|
| DocumentCollection | GetNextDocument | | 1300359 | 1403516 |
| Document | Size | Get | 1300359 | 40625 |
| Database | Open | | 89 | 14182 |
| DocumentCollection | GetFirstDocument | | 31 | 1663 |
| DbDirectory | GetNextDatabase | | 89 | 380 |
| DbDirectory | GetFirstDatabase | | 1 | 20 |
| Database | Title | Get | 89 | 10 |
| Database | FilePath | Get | 89 | 0 |
| Database | Size | Get | 89 | 0 |
| Database | AllDocuments | Get | 31 | 0 |
| Session | CurrentDatabase | Get | 1 | 0 |
| Session | GetDbDirectory | | 1 | 0 |
| Database | Server | Get | 1 | 0 |





Database Advanced Settings

- DB Advanced settings impact performance
- User Activity Logging





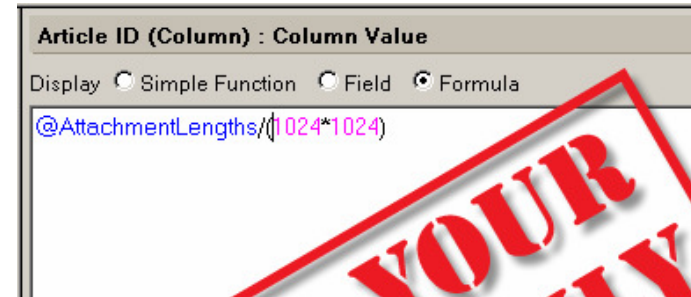
Performance Nightmare stories





Performance Worst Practice

- A developer created a column to depict a document size in megabytes.
- To be sure how many bytes in one megabyte he multiplied (1024*1024)
- Multiplication took place for 32'000 documents, for EACH !!! document





Performance worst practice (cont)

- CPU spikes on mail server every 5 minutes (3000 users)
- Every Spike is about 2 minutes when CPU utilized for 100%

- A cause of the problem:

One mail files, of a department manager, db.size=1GB,
with

Full-text index IMMEDIATE





Things to get home

1. Disable Unread Marks (if possible)
2. All calculations perform in a form, not in a view
3. Disable two-way sorting
4. Minimize a category/view/column count
5. DB.Views.Count should be less than 50
6. Full-TEXT index trigger= Hourly/Daily, not Immediate (default)
7. Advanced Database settings
8. Action buttons should call agents or functions from ScriptLibraries
9. Working with a Collection don't use GetNthDocument, use getNextDocument(doc) instead
10. Use AgentProfiling
11. Don't write comments in columns, don't use "REM".





Internet resources

<http://www.redbooks.ibm.com/redpapers/pdfs/redp4182.pdf>

- <http://www.ibm.com/developerworks/lotus/library/domino7-enterprise-performance/>
- RedPaper – Lotus Domino Domain Monitoring

<http://www.redbooks.ibm.com/redpapers/pdfs/redp4089.pdf>

Domino Tuning Parameters in notes.ini

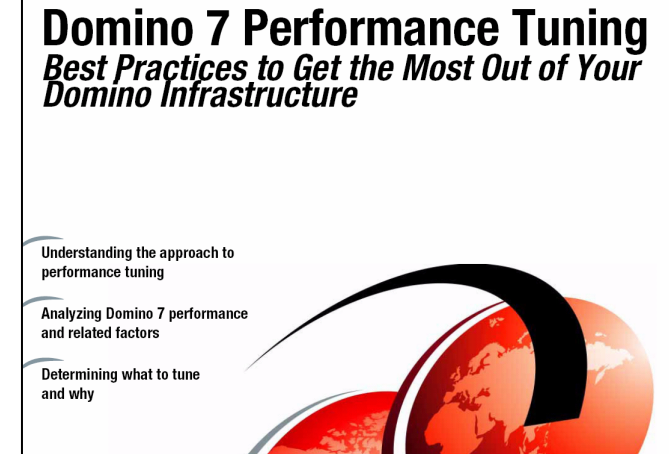
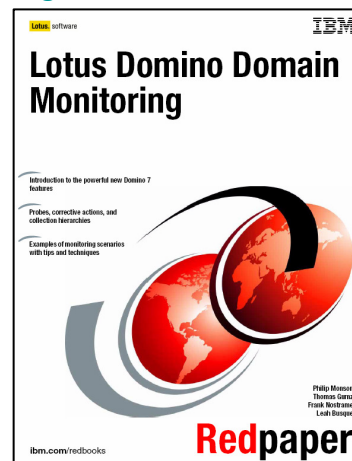
<http://www.redbooks.ibm.com/abstracts/tips0421.html?Open>

NameLookup performance fixes that address unnecessary updates

<http://www-1.ibm.com/support/docview.wss?uid=swg21254752>

Notes/Domino Best Practices: Performance (very good)

<http://www-1.ibm.com/support/docview.wss?uid=swg27008849>





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DUAL Principal Certified Lotus Professional 5.x, 6.x, 7.x

IBM Certified Instructor Lotus Domino 6.x, 7.x, 8.x, 8.5.x

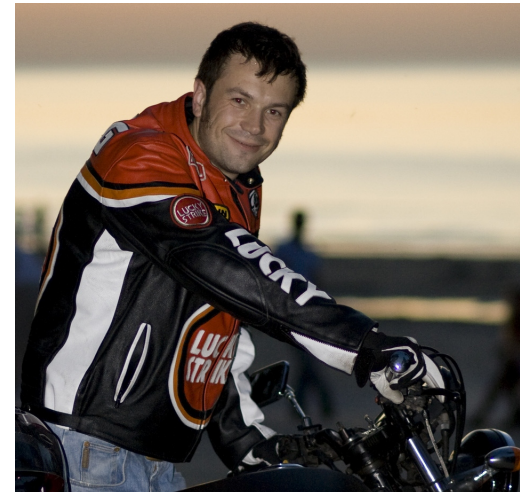
IBM Lotus Certified Security Professional

My blog: <http://www.vlaad.lv/>

Company: CYONE www.cyone.eu

Lotus Consulting

- Migrations
- Administration
- Server consolidation
- Audits (security)
- Health checks





Thank you

