50 Ways to Make Your Domino Apps Faster

Jamie Magee, MartinScott Consulting

Who is Jamie Magee?

- **Co-founder of MartinScott Consulting**
  - Frequent speaker for The View, Lotusphere
- **Developing Lotus apps since 1994**
  - Designing large apps so they scale well
  - Speeding up slow applications
- **Creator of...**
  - **NoteMan Toolbar** for Developers/Admins
    - **Change any field on any doc in 5 clicks**
  - **WirelessMail** for Domino
    - **"push" email to any handheld**
- **Blog: JamieMagee.com**

MartinScott

Three Things You Need to Know First

- **Newer/faster/bigger hardware will not properly fix a poorly designed application**
  - **Most Domino performance issues are best resolved in the design of the applications first**

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Three Things You Need to Know First

- **HTTP server is largely a Web wrapper around the Notes Client actions**
  - **?OpenDatabase, ?OpenView, ?OpenForm, ?OpenDocument, ?EditDocument, ?OpenAgent, and ?SaveDocument trigger server actions, just as if requested by a Notes client**
  - **Most Notes Client performance tuning concepts also apply to the Web**

Three Things You Need to Know First

- **Rule of 2's**
  - **Good (functionality)**
  - **Inexpensive (development and maintenance effort)**
  - **Fast (performance)**

  You can only have two of the above!

Tradeoff

What We'll Cover …

- **Coding for performance**
- **Managing view indexing activity**
- **Exploring Web application performance techniques**
- **Configuring server settings for application performance**
- **Tracing performance problems**
- **Monitoring server resources**
- **Wrap-up**

Database Properties

(See Designer Help document "Properties that improve database performance")

Getting a Handle to a View

- **NotesDatabase.GetView(viewName)**
  - **Can be 1 - 2 seconds or more**
  - **Fastest implementation is when parameter is the true view name – not the alias**
    - ▶ **Using correct case!**
  - **Using the view alias is easier maintain, but a little slower**

LotusScript and Java

Tradeoff

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Writing to NotesUIDocument

5x Faster (if there are many fields)

```
Dim W As New NotesUIWorkspace
Set uidoc = W.currentDocument

Set doc = uidoc.document
doc.status="Closed"
doc.lastupdated=Now
doc.author=s.username
doc.level="3"
doc.priority="High"
```

LotusScript

```
Dim W As New NotesUIWorkspace
Set uidoc = W.currentDocument

uidoc.AutoReload=False '...turn off
Set doc = uidoc.document
doc.status="Closed"
doc.lastupdated=Now
doc.author=s.username
doc.level="3"
doc.priority="High"

Call uidoc.Reload  '... manually reload
```

Updates UI doc only once, after all fields are written

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Reading Values on a Doc from a View

Faster

Status = doc.Status(0)   **Status = doc.ColumnValues(2)**

Status is the third column of the view

LotusScript and Java

Shared elements with Notes Client

- **Shared fields/actions, subforms, script libraries, etc.**
- **Client makes one request for each element**
- **If there are many shared elements and/or a slow network, performance will be slower**

Tradeoff

Domino Server

document

form

Subform1

Subform2

Scriptlibrary1

Notes Client
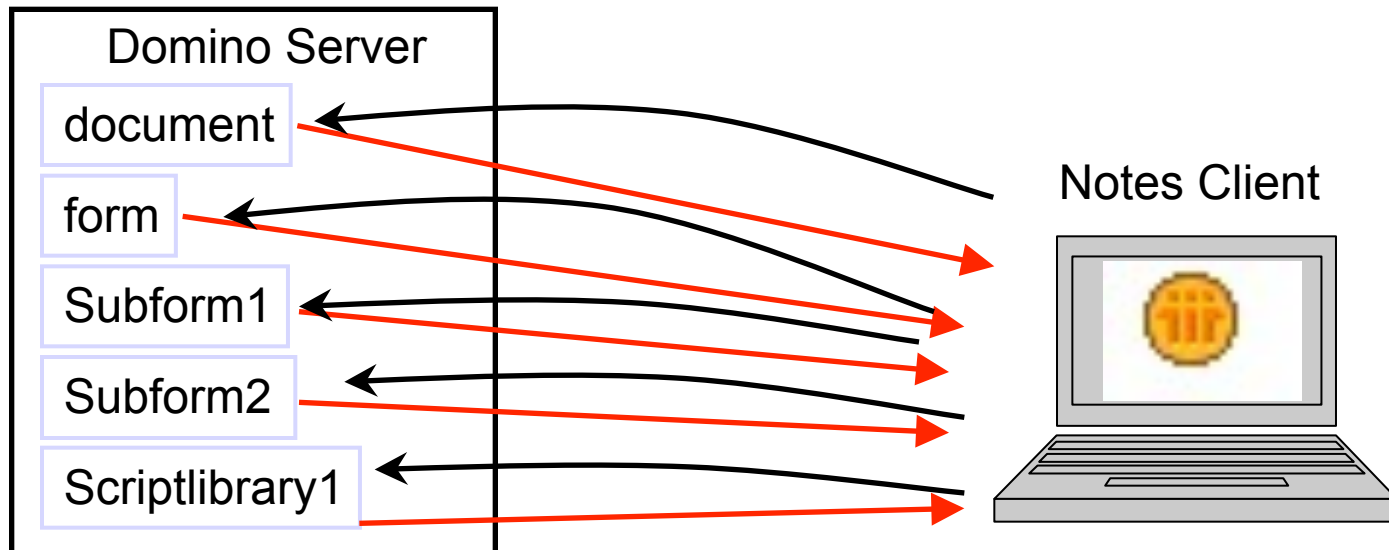
Shared elements with Web client

- **In *web* applications, requesting and assembling shared elements is done right on the server, without network activity for each element**
  - **No significant effect on performance!**
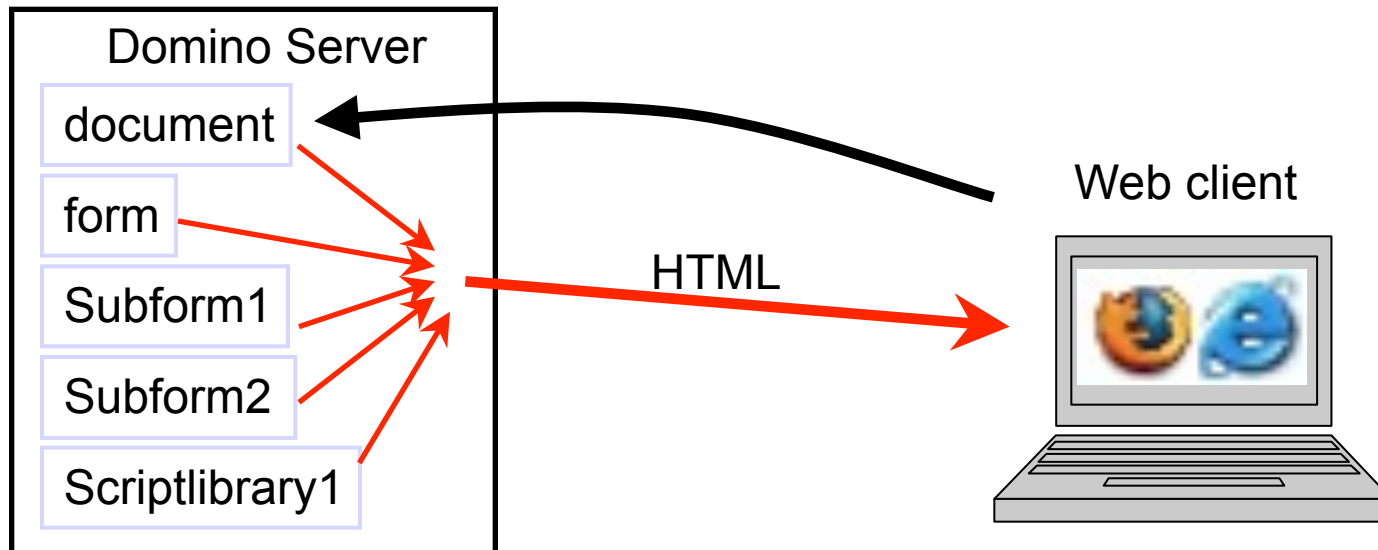
What We'll Cover …

- **Coding for performance**
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View Indexing

- **The number one resource hog in Domino**

- **Every time a document is updated, Domino indexes all auto-indexed views which select the document**
  - **Notes Client, web submit, scheduled agent**

Don't
Forget

- **Performance effect is a function of...**
  - **# of documents**
  - **Document content (# of items on each doc)**
  - **Frequency of document updates**
  - **Complexity of view design**
  - **# of views**

View Indexing - General tips...

- ## Use a separate physical disk for view indexing
  - ◆ **server notes.ini VIEW_REBUILD_DIR = E:**
  - ◆ **A cheap IDE drive will do... doesn't store documents or indexes, just the working directory for view indexing**

- ## Delete unused views
  - ◆ **How to determine which views are really being used?**

View Indexing: How to Know Which Views Are Being Used

- ## Use the Admin Client

  1. **Purge all view indexes**

  2. **Allow user activity to resume for a week/month**

  3. **Later, look for re-created indexes (they are active views)**

  4. **Remove unused views (Size=0) from design**
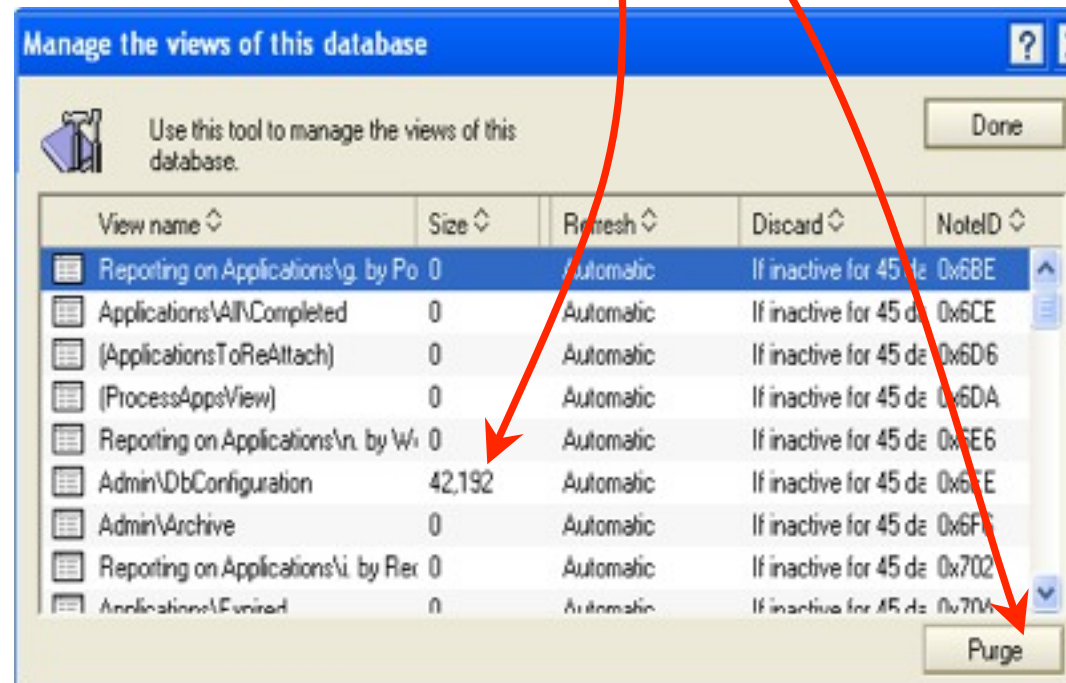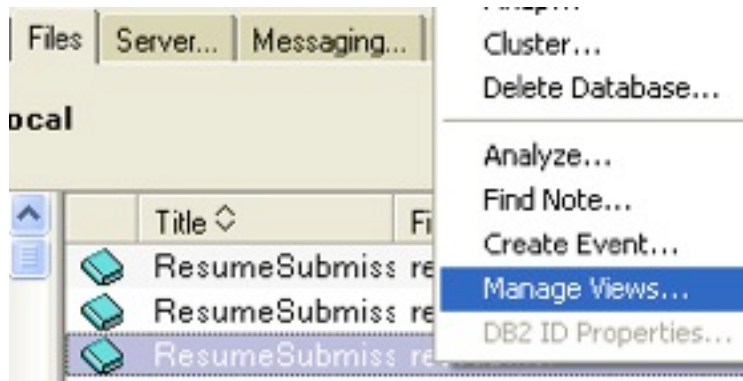
View Complexity

Applying Different Attributes to View Columns

Number of Minutes to Build a View with 5 Columns

Minutes

Legend:
- PLAIN
- FORMULAS (5)
- SORT (1)
- SORT (4)
- CATEGORIZE (1)
- CATEGORIZE (4)

100 Fields
100,000 Documents
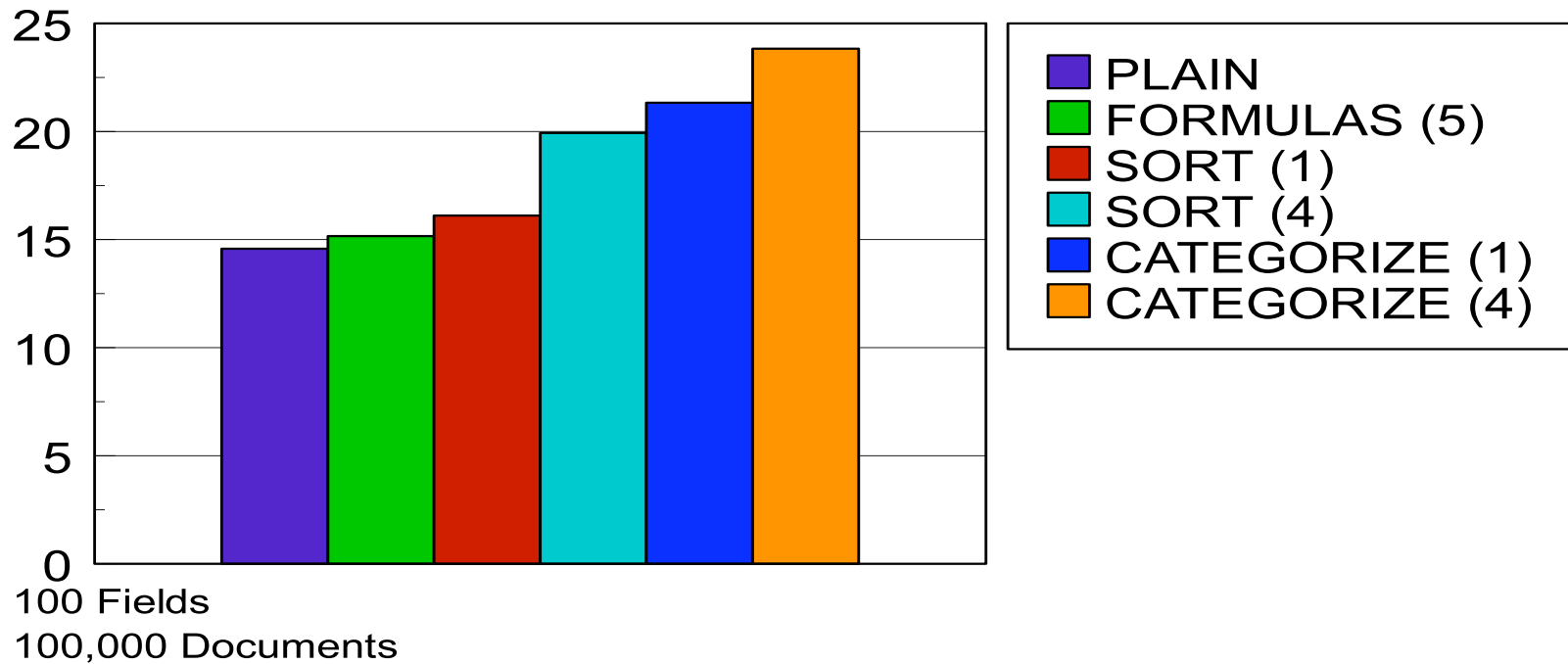
Views: Time @Functions

- ## Avoid @Today, @Now in view formulas
  - ### Forces the calculation to be done every time the view is opened!

How many seconds does it take to Index a View?

Seconds

Number of Documents
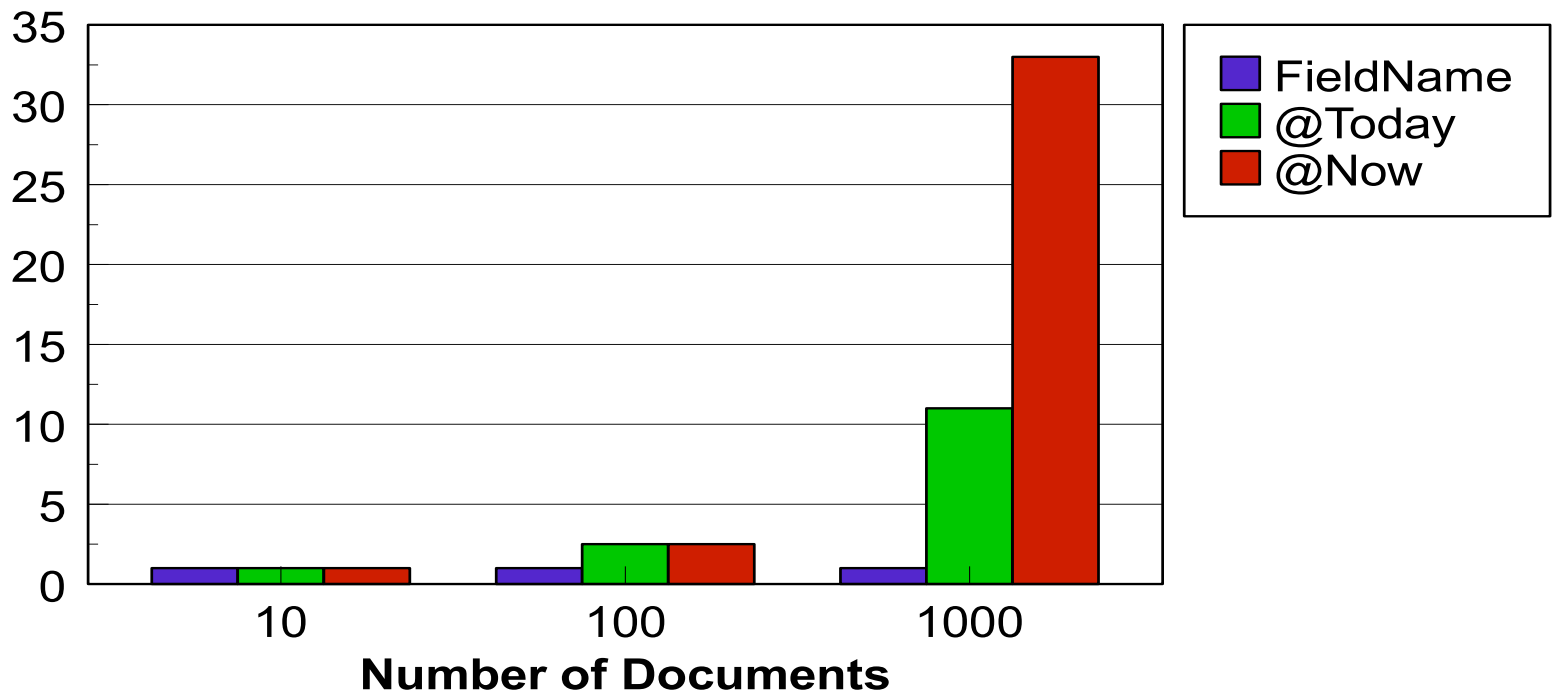
These databases contain only 1 View and 1 Form
The View has only one column, and the Selection Formula is @All
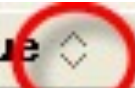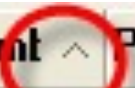
Views: Time @Functions (cont.)

- **To show a "view" of documents more than N days old:**
  - ✦ A simple daily scheduled agent moves docs in/out of the "old documents" folder (NOT a view)
    - ▶ **Putting a document in a folder does not modify it -- minimizes replication activity and conflicts**
  - ✦ Or, daily agent modifies hard-coded date in view formula
    - ▶ **NotesView.SelectionFormula**
  - ✦ Or, set view index refresh interval to Manual or "at most every…"
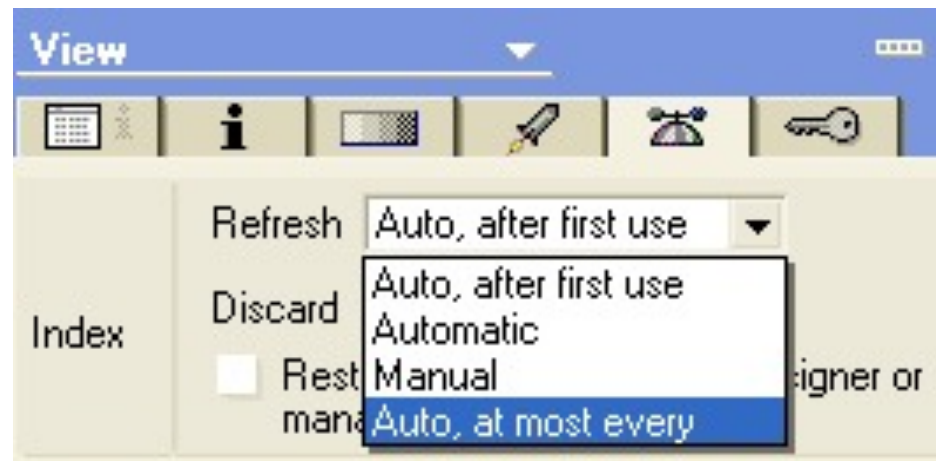
Views: User sortable columns

- **Each sort option is an additional view index**
- **This view has a total of 9 indexes**

Warning

R8 new column property…

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Reader Names can slow view display performance

- **A view displays very slowly if…**
  - ◆ **…there are many documents (e.g., 1,000+)   AND**
  - ◆ **…the user has Read access to only a small number of docs**
- **Domino must "scan" the view until it finds one page (usually 30) of accessible docs, or the end of the view**

Iaml

Solution…

- **For the same resulting view entries, with FAST display…**
- **Use embedded view, single category = @UserName (@UserNameList for roles and groups)**

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Use Server Web Site Rule to Maximize File Caching

- **Drastically improve your user's Web cache**
  - ◆ **The user's browser will cache many files, but it still needs to check to see if it has the current version each time**
    - ▶ **This can cause 2-3 extra seconds to each page load**

  - ◆ **To fix this we need to tell the user's browser that certain files are good for "N" days**
- **Admin needs to set it with a Web Site Rule...**

Add Web Site Rule for Date Check Caching

Web Site Rule

Basics | Comments | Administration

Basics

Description:	Cache Rule
Type of rule:	HTTP response heade
Incoming URL pattern:	*/cachePath/*
HTTP response codes:	200, 206, 304

Expires header:
- ○ Don't add header
- ● Add header only if application did not
- ○ Always add header (override application's header)

- ● Specify as number of days
- ○ Specify as date

Expires after 90 days

Files in:

Domain/…/cachePath/

will be cached

304 = If-Modified-Since header variable

New Image Resource

Name

cachePath/jw3.jpg

cachePath/martinscott.gif

LotusBPLong.gif

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GZip Will Improve Performance

- **GZip is a common compression on Apache, IIS, etc.**
  - ◆ **can be used for CSS, JS, JPG, GIF, etc**
- **Any browser can handle a GZip file -- but only IF it knows the file is GZip'd**
- **Used internally in Domino R6.5 iNotes template**
  - ◆ **Not documented for general use, but there is a way...**
- **How do we configure Domino to tell the browser that certain files are GZip'd?**

Add Web Site Rule for GZip

Web Site Rule

Basics | Comments | Administration

Basics

Description:	gzip rule
Type of rule:	HTTP response headers ▼
Incoming URL pattern:	*/gz/*
HTTP response codes:	200, 206

Expires header:
- ○ Don't add header
- ⊙ Add header only if application did not
- ○ Always add header (override application's head

- ⊙ Specify as number of days
- ○ Specify as date

Expires after 5 days

Custom headers:
Name: Content-Encoding   Value: gzip   ☑ Override
Name: Value: ☐ Override
Name: Value: ☐ Override

http://Abc.com/web.nsf/gz/LoginScripts.gzip

will be served as GZip

New LotusScript Library

| Name ◇	Library
gz/LoginScripts.gzip	JavaScri
gz/WebScripts2.gzip	JavaScri
gz/WebScripts.gzip	JavaScri

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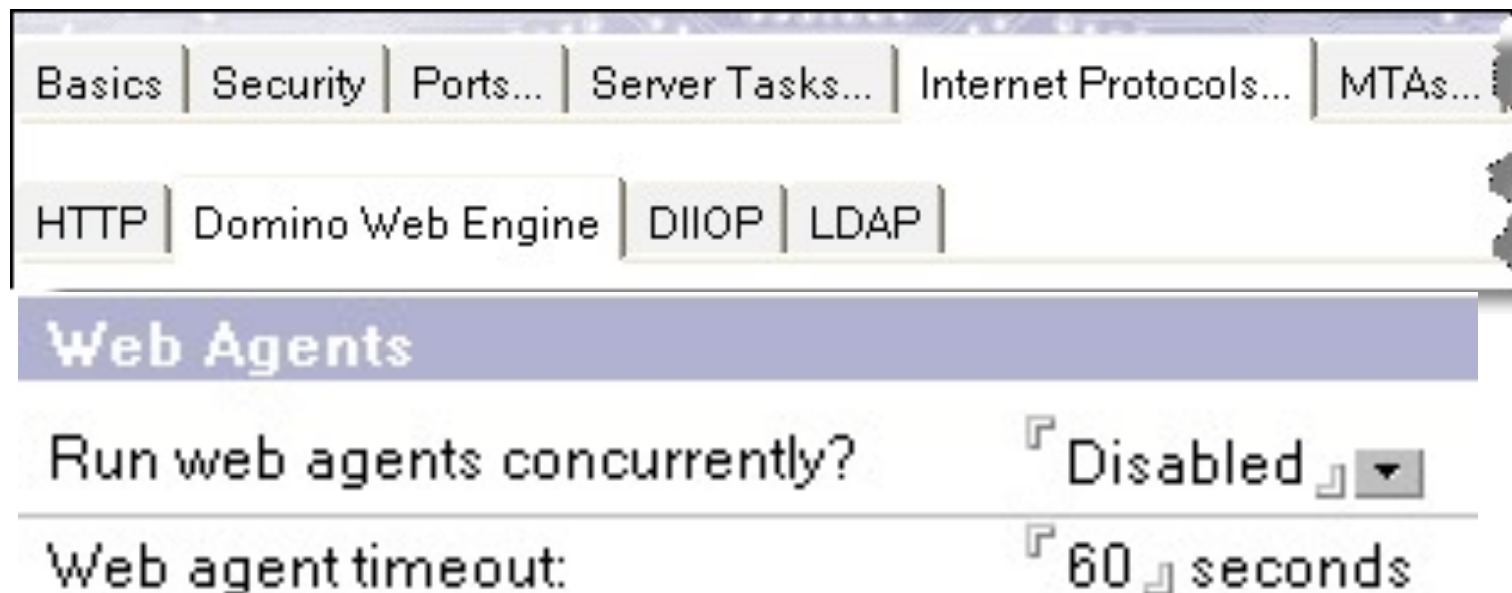- **Wrap-up**

Server Document: Maximum Concurrent Agents

- **For agent-intensive applications**
- **Allow more than two agents to run at the same time**
- **Monitor your resource utilization after such a change to ensure your system has the CPU and memory to deal with increased activity**
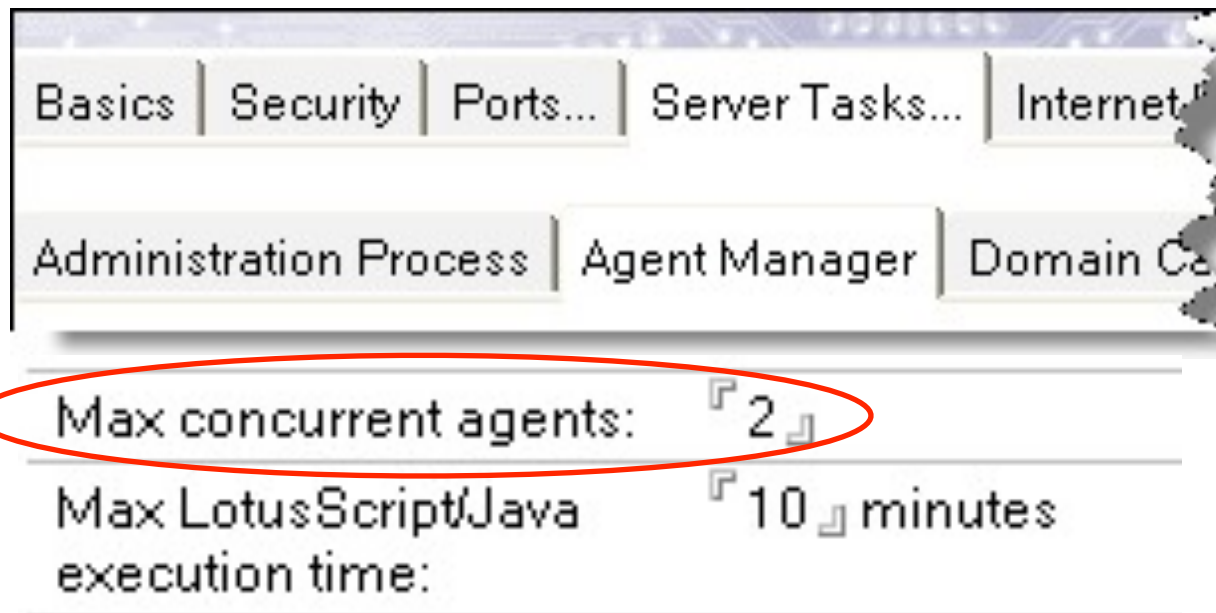
Server Document: Web Maximum Concurrent Agents

- ## Allow more than one agent to run at the same time on the Web

Basics | Security | Ports... | Server Tasks... | Internet Protocols... | MTAs...

HTTP | Domino Web Engine | DIIOP | LDAP

Web Agents

Run web agents concurrently?   『Disabled 』 ▼

Web agent timeout: 『60 』 seconds

- ◆ **Enabled — To allow more than one agent to run on the Web server at the same time (asynchronously)**
- ◆ **Disabled (default) — To run only one agent at a time (serially)**

NOTES.INI Application Performance Variables

- ## VIEW_REBUILD_DIR=<path>
  - Use a separate physical disk for view indexing

- ## Updaters = [number]
  - Run multiple update tasks to keep view indexes updated
  - Set [number] = number of processors

- ## NSF_DbCache_Maxentries = [number]
  - Number of databases that can be cached at one time
  - Default is 25 or NSF_Buffer_Pool_Size divided by 300 KB
  - If ratio of Database.DbCache.Hits to InitialDbOpen is low, then consider increasing [number]
  - Console command "Dbcache flush" closes cached databases

Configuring Server Settings

- **Administrators own these settings, but developers must be aware of them**

- **Both parties need to collaborate to determine best settings for each server**

- **Make sure to monitor resource utilization before and after making such changes so that you can determine if you have enough hardware to benefit (and not make it worse!)**
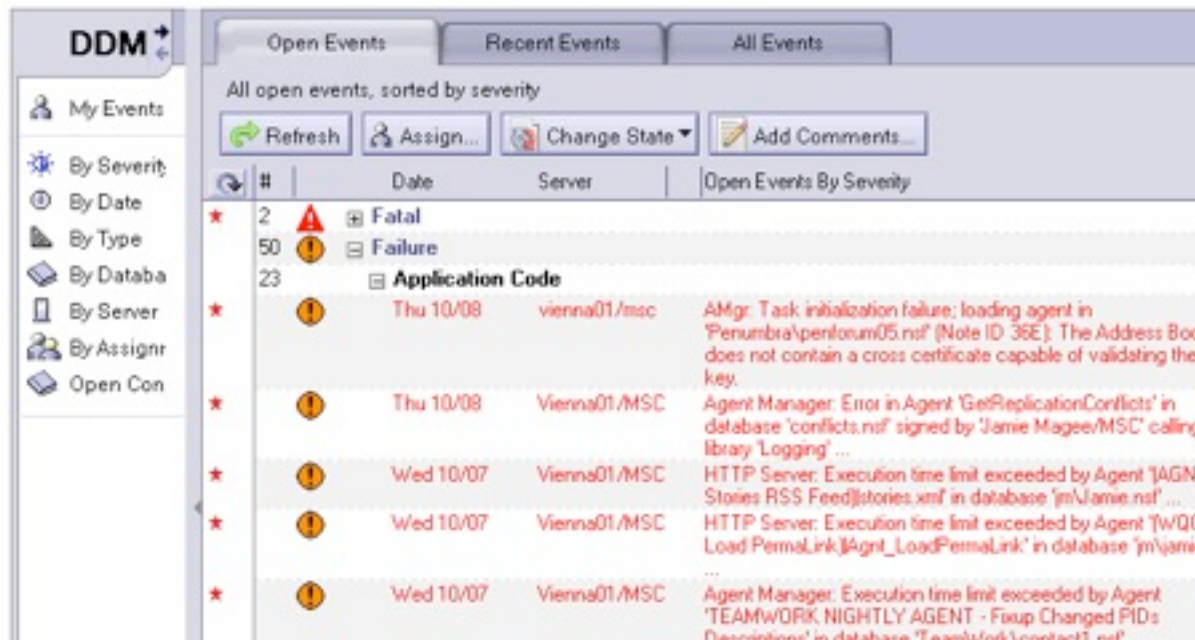
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Performance Debugging: User's Perspective Indications

Performance Symptom	Possible Problem
Opening a view	• Time functions in view formulas • Readers' restrictions on documents • Index property not set to Automatic
Saving a document (submitting from a browser, agent-based saves of other docs)	• Time functions in view formulas • Large active views with broad selection formulas • Excessive view categorization
Creating/opening/saving document	• Large, continuous tables on forms • Excessive DbLookup/DbColumn operations • Inefficient WebQueryOpen/WebQueryClose LotusScript events

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DDM (R7 and Later)

- **Domino Domain Manager contains great agent statistical tools**
  - **Time to run**
  - **Memory used**
- **Wrapped in a Domino DB for easy reporting**

DDM: Performance warnings

| Assign... | Change State ▼ | Add Comments... |

Open Event
(This event is not assigned to anyone)

Generated by:	vienna01/msc	For server:	Vienna01/MSC
in Domain:	MartinScott	Database:	Samples\ClassList.nsf
Event class:	Enhanced	Agent:	-
		User:	-

? Warning High

Thursday, August 06, 2009 - 11:46:30 AM   (6 occurrences, first seen at 11:36:07 AM that d

HTTP Server: Full text operations on database 'Samples\ClassList.nsf' which is not full text indexed. This is extremely inefficient.

Explanation

* Reported by: HTTP Server

* Severity and type: ? Warning High in Database 📄

* Probable cause: A full text search has been performed on a database that has no full text index. A temporary full text index is created and then deleted each time this happens. This is
                      extremely inefficient.

* Possible solution: Create a full text index for Samples\ClassList.nsf database on Vienna01/MSC. This can be accomplished by either
                       (1) using the Full Text Index tool from the File tab in the Domino Administrator;
                       or
                       (2) Clicking on File->Database->Properties for the database in question and creating an index from the Index tab.

Event Change History:
08/06/2009 10:36 AM : Vienna01/MSC - changed state to Open

Agent Profiler (R7 and Later)

- **Profile an agent to get detailed performance information**
  - **Step 1 — Mark the agent to be profiled**
  - **Step 2 — Run the agent**
  - **Step 3 — View profile results**
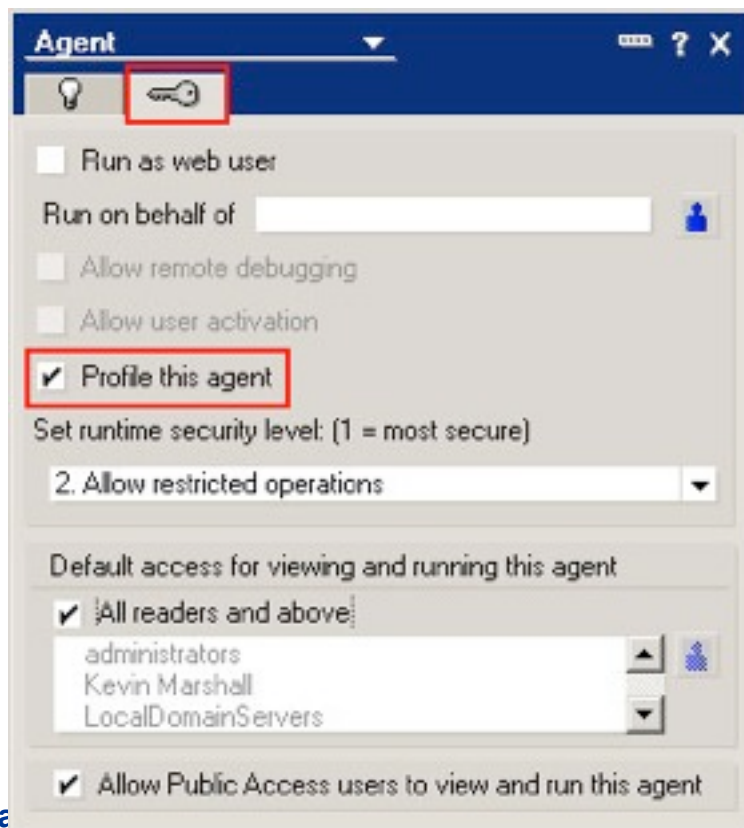
Agent Profiler — Sample Output

Form\Home QOA Profile

12/13/2007 05:11:46 PM CST
Elapsed time: 640 msec
Methods profiled: 18
Total measured time: 546 msec

Class	Method	Operation	Calls	Time
View	GetAllDocumentsByKey		7	265
View	GetDocumentByKey		28	157
DocumentCollection	GetFirstDocument		7	32
Document	GetFirstItem		25	30
Database	GetView		5	16
DocumentCollection	GetNextDocument		26	16
Document	[expandedname]	Get	55	15
Document	[expandedname]	Set	6	15
Document	GetItemValue		47	0
Item	Type	Get	25	0
Document	UniversalID	Get	22	0
Session	CurrentDatabase	Get	4	0
Databas...		Get		

Fiddler Example Output

Undocumented Notes Feature: Uncover Performance Bottlenecks

- **Watch behind-the-scenes rendering of forms, subforms, and views (not just code)**
  - **Remote Procedure Calls (RPCs) = Notes-to-Domino talk**
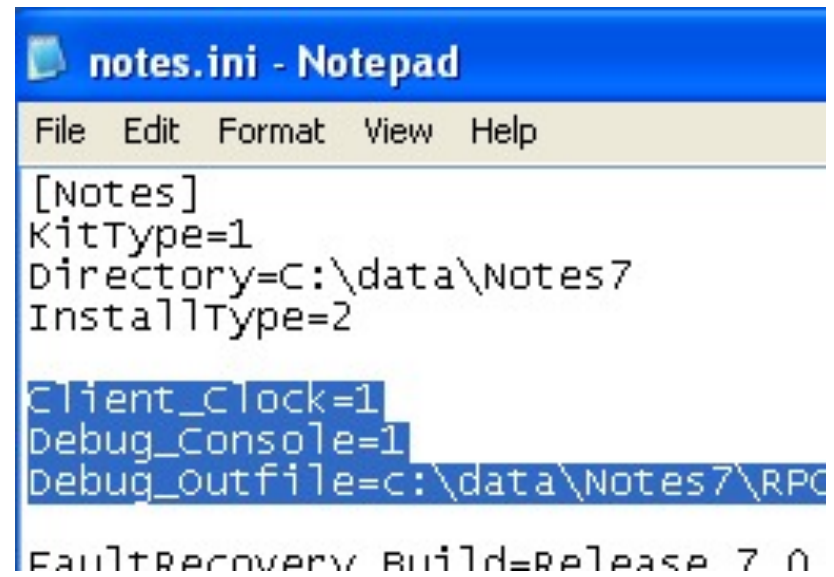 - **See http://MartinScott.com ➜ Resources ➜ Technical Articles**

Secret

Notes Client

Domino Server

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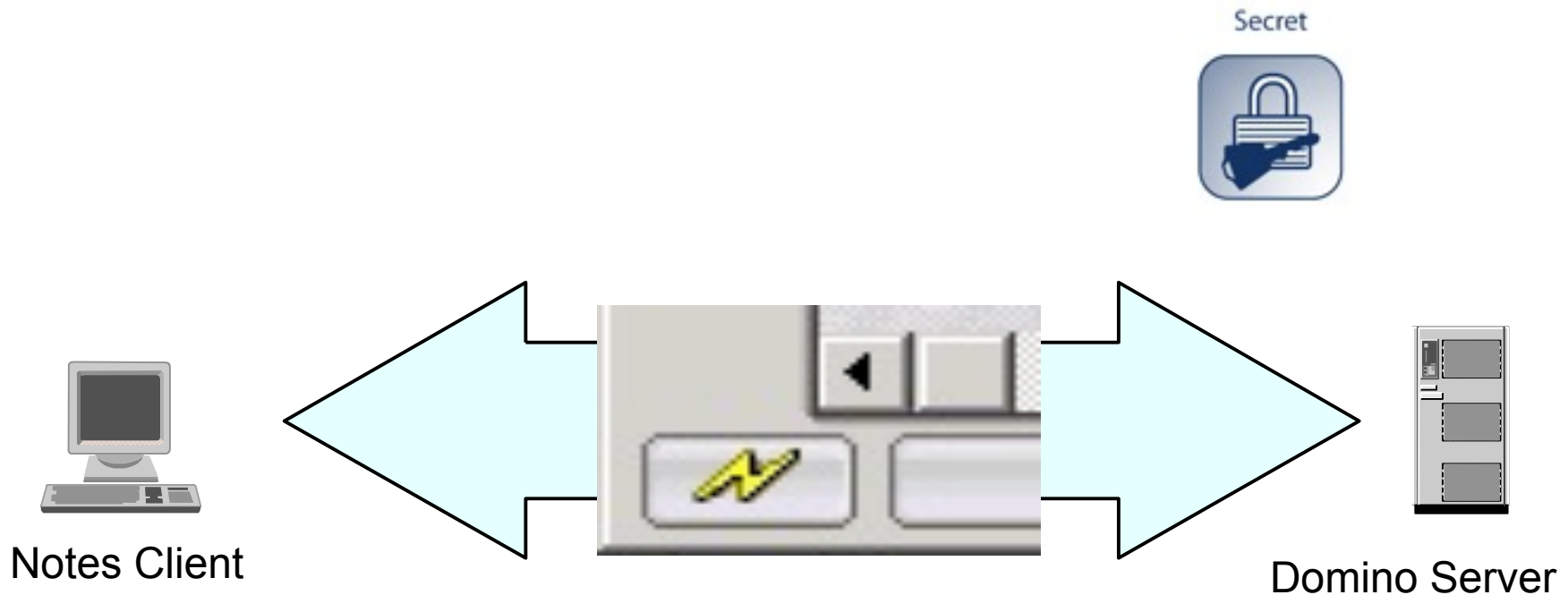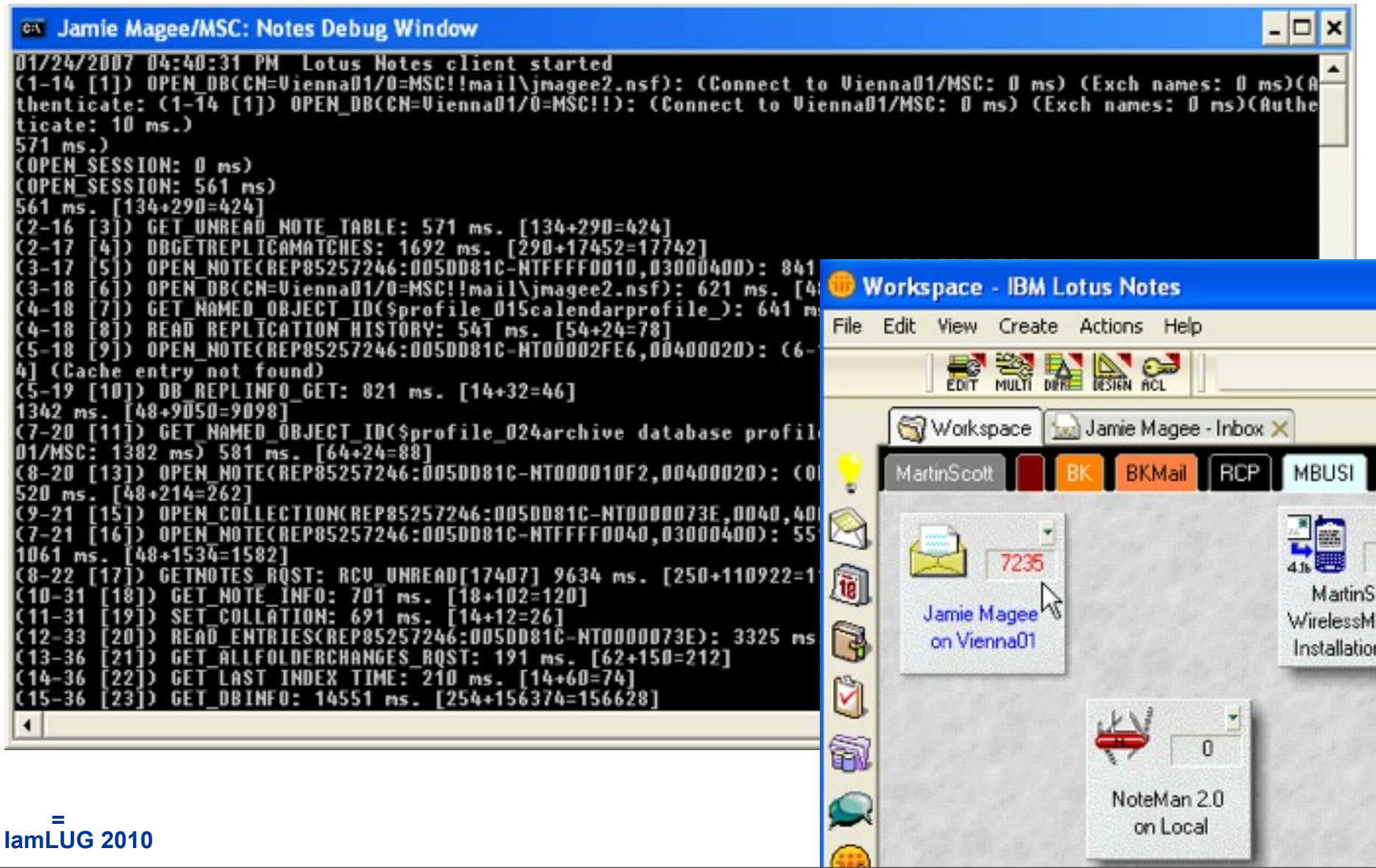
Watching Notes RPCs

- **Enable RPC watching on Notes client**
  - **NOTES.INI file on Notes Client**
    - **Client_Clock=1**
    - **Debug_Console=1**
    - **Debug_Outfile=<path to filename> (optional)**
  - **Restart Notes client**
  - **(to DISABLE, remove from NOTES.INI and restart Notes)**

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Watching Notes RPCs

Understanding RPCs

- **Common RPCs and what they indicate**

(20-121) OPEN_NOTE: 1045 ms. [28+3906=3934]

(Seq. #), RPC_NAME, time, [bytes_sent+bytes_received=total]

RPC_Name	Description
Open_Session	Authenticate with the server and establish a session
Open_Database	Find and open a database
Open_Note	Get the contents of a note (data document, design element, or ACL info)
Update_Note	Save a document
Open_Collection	Open a view
Read_Entries	Get a list of document information from a view or search
Find_By_Key	Find a document via DBLookup or LotusScript GetDocumentByKey
Get_Special_Note_ID	Get ACL information
Close_dB	Close database session

RPC monitor output

(1-14 [1]) OPEN_DB(CN=Vienna01/O=MSC!!mail\jmagee2.nsf): (Connect to Vienna01/MSC: 0 ms) (Exch names: 0 ms)

(OPEN_SESSION: 561 ms)

(2-16 [3]) GET_UNREAD_NOTE_TABLE: 571 ms. [134+290=424]

(2-17 [4]) DBGETREPLICAMATCHES: 1692 ms. [290+17452=17742]

(3-17 [5]) OPEN_NOTE(REP85257246:005DD81C-**NTFFFF0010**,03000400): **841 ms**. [176+780=956]

(3-18 [6]) OPEN_DB(CN=Vienna01/O=MSC!!mail\jmagee2.nsf): 621 ms. [48+1886=1934]

(4-18 [7]) GET_NAMED_OBJECT_ID($profile_015calendarprofile_): 641 ms. [134+290=424]

(4-18 [8]) READ REPLICATION HISTORY: 541 ms. [54+24=78]

(5-18 [9]) OPEN_NOTE(REP85257246:005DD81C-**NT00002FE6**,00400020): (6-19 [10])

POLL_DEL_SEQNUM: **571 ms**. [60+64=12

4] (Cache entry not found)

(5-19 [10]) DB_REPLINFO_GET: 821 ms. [14+32=46]

1342 ms. [48+9050=9098]

(7-20 [11]) GET_NAMED_OBJECT_ID($profile_024archive database profile_): (6-20 [12]) SEARCH: (Connect to Vienna

01/MSC: 1382 ms) 581 ms. [64+24=88]

(8-20 [13]) OPEN_NOTE(REP85257246:005DD81C-NT000010F2,00400020): (OPEN_SESSION: 531 ms)

520 ms. [48+214=262]

(9-21 [15]) OPEN_COLLECTION(REP85257246:005DD81C-NT0000073E,0040,4008): 1292 ms. [70+782=852]

(7-21 [16]) OPEN_NOTE(REP85257246:005DD81C-NTFFFF0040,03000400): 551 ms. [110+28=138]

1061 ms. [48+1534=1582]

NRPC Parser Open Source Tool

- **Runs on NRPC output files to translate ReplicaIDs, NoteIDs, and commands**
  - **Much easier to find and understand problems**
  - **Download for free from www.OpenNTF.org**

Seq	Command	ms	Sent	Rec'd
23	Retrieves the content of a document from database Andrew Magerman	391	48	11744
24	Retrieves the profile document $profile_024archive database profile_	150	64	24
25	Retrieves the content of a document from database Andrew Magerman	140	48	234
26	Open View ($Inbox) from database Andrew Magerman	140	130	52
27	Retrieves some note info, we think from a view note but are not sure...	161	18	102
28	Gets the collation for the view. A collation is a set of columns and sort specifications that determines how the view or folder will be sorted.	130	12	14
29	Reads entries (sends data) from view ($Inbox) from database Andrew Magerman	331	76	5012
30	GET_ALLFOLDERCHANGES_RQST	150	62	64
31	FINDDESIGN_NOTES	281	44	16
32	Retrieves the content of design element named (MailPolicy)|MailPolicy from database Andrew Magerman	1001	48	44988
33	Retrieves the content of a document from database Andrew Magerman	420	48	6446
34	Retrieves the content of a document from database Andrew Magerman	801	48	12134
35	Retrieves the content of a document from database Andrew Magerman	611	48	21206
36	Open View ($Drafts) from database Andrew Magerman	831	130	52
37	Close View ($Inbox) from database Andrew Magerman	0	12	0
		8041	2272	107300

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Resource Monitoring

- **Use native Domino Server - Performance tools**
  - ◆ **Activity Logging and Activity Trend analysis**
  - ◆ **Works with historical and current information**
- **Use operating system tools**
  - ◆ **PerfMon (Windows)**
    - ▶ **Start \ Control Panel \ Administrative Tools \ Performance**
  - ◆ **PerfMeter (UNIX)**
  - ◆ **PerfMon/PEX (AS/400)**
- **Use during <u>live</u> testing to see bottlenecks**

How to Open PerfMon
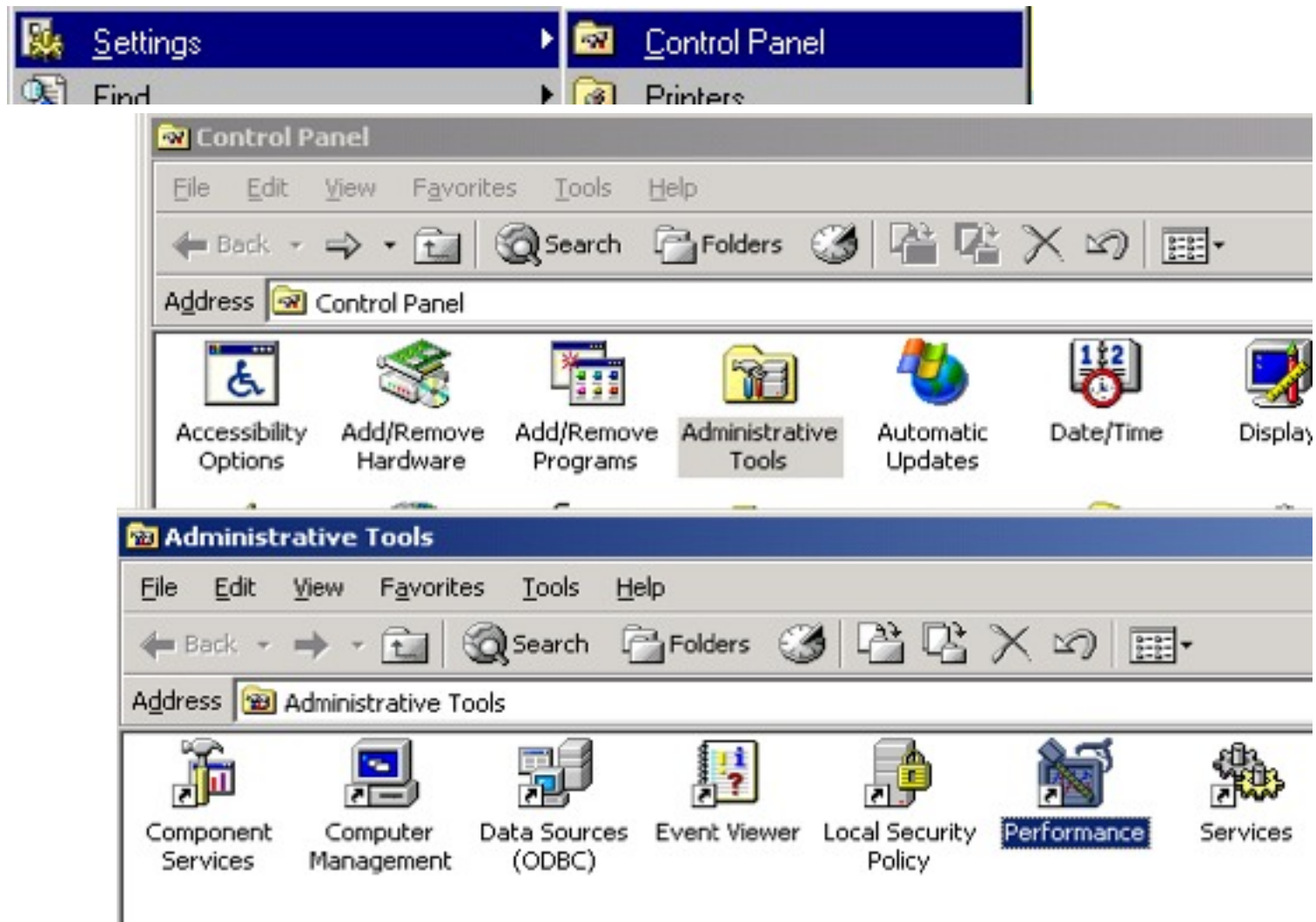
Resource Monitoring

- **Example: Agent is bound by CPU, more RAM would not help**

Resource Monitoring (cont.)

- **Example: View index rebuild showing that more RAM and faster drive would help, but more CPU would not**
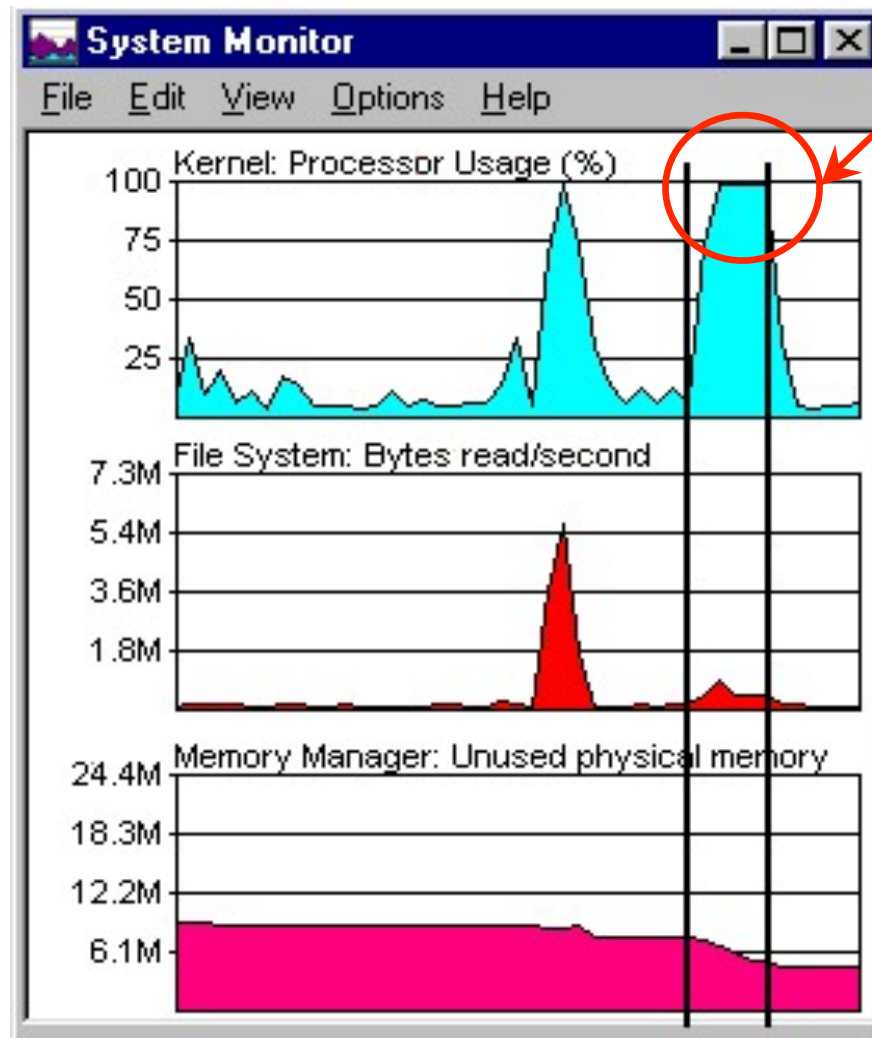
Color	Scale	Counter	Instance	Parent	Object
——	1.000	Pages/sec	---	---	Memory
——	100....	Avg. Disk Queue Length	_Total	---	PhysicalDisk
——	1.000	% Processor Time	_Total	---	Processor
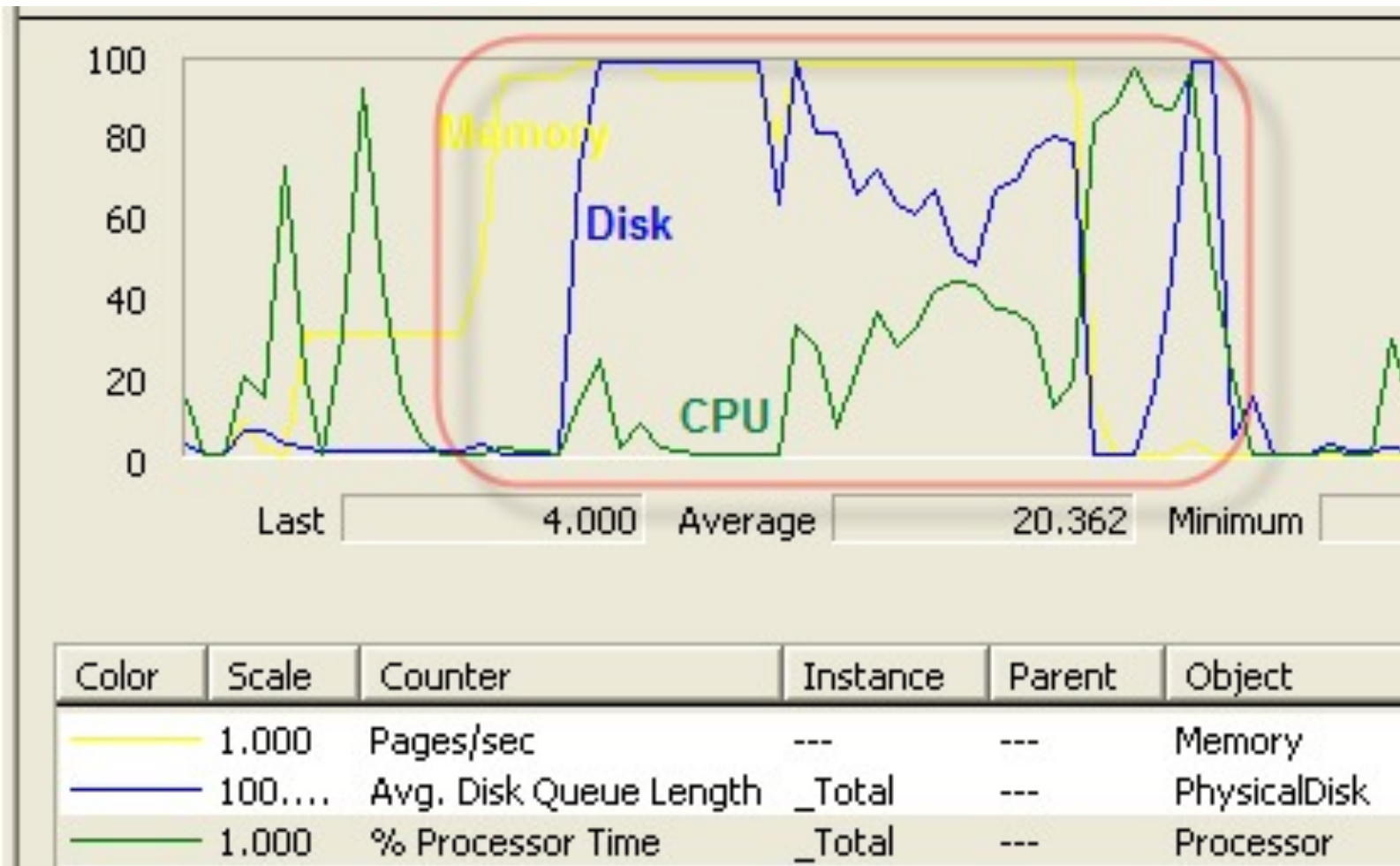
Resource Monitoring: Identifying Areas to Improve

Limiting Resource	Area of Focus	Improvement Potential
Disk Access	•Reduce view complexity, number, and size •Optimize cache settings in .INI file •Take advantage of browser caching	★★★ ★★ ★
Processor	•Reduce view complexity, number, and size •Optimize code implementation •Optimize server .INI file settings •Disable server screen saver •Take advantage of browser caching	★★★ ★★★ ★★ ★★ ★★
Memory	•Increase server RAM •Optimize .INI file memory settings	★★★ ★★
Network	•Increase network capacity •Take advantage of browser caching	★★★ ★★

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Resources

- **Lotus developerWorks performance zone:**
  - **www.ibm.com/developerworks/lotus/performance**
    - ▸ **Index to all IBM performance articles**
- **www.redbooks.ibm.com**
  - **Any Domino book with "Performance" in the name**
  - **Several other good ones**
- **MartinScott.com 30-page performance article:**
  - **http://MartinScott.com ➜ Resources ➜ Technical Articles**
- **Andre Guirard's blog: Best Practice Makes Perfect**
  - **www-10.lotus.com/ldd/bpmpblog.nsf**
- **IBM technote #1234550, "Domino Server Performance Troubleshooting Cookbook"**

7 Key Points to Take Home

- **Some LotusScript/Java methods are relatively slow**
- **Refine and minimize view indexing; remove unused views**
- **Take advantage of caching and zipping**
- **Developers and admins should collaborate on server configuration settings that affect application performance**

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7 Key Points to Take Home (cont.)

- **Get familiar with DDM for application performance monitoring**

- **Agent profiling and NRPC monitoring can tell you a lot about your application design**

- **Resource monitoring reveals the "pulse" of the server and indicates hardware needs**

Your Turn!

Questions

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