From: Christine Chang (Exchange)
Sent: Friday, January 29, 1999 12 44 PM
To. John Vail (Exchange)
Subject: RE. Platinum doc

Um. I can reach it Here you go.

Lotus Notes
Competitive Analys

-----Original Message-----
From: John Vail (Exchange)
Sent: Friday, January 29, 1999 12:34 PM
To: Christine Chang (Exchange)
Subject: RE: Platinum doc

by the way, it looks like either this server is down or the link is incorrect have you been able to reach it?

-----Original Message-----
From: Christine Chang (Exchange)
Sent: Friday, January 29, 1999 12:17 PM
To: Tom Williams; John Vail (Exchange)
Subject: FW: Platinum doc

FYI

-----Original Message-----
From: **Eric Hennings**
Sent: Wednesday, January 27, 1999 9:27 PM
To: Tad Coburn; Bob Pomeroy; Andy Schulert, Barry Givens; FrontPage PM Hall; Christine Chang (Exchange); Tom Bailey (Exchange)
Subject: Platinum doc

Everyone who's interested in platinum should definitely check out "Lotus Notes R5 Competitive Analysis" on \\boweb \bodocs\Polar\jan25.

This is a comparison of platinum/pkm (the project code named tahoe) and notes R5 I'm about 1/2 way through and have found it to be fascinating reading It's the best concrete document I've seen so far on some of the many cool things that the platinum store does and on why betting on platinum is a good move for the server extensions (because tahoe is taking competition with notes very seriously and adding features that compete with notes - I trust that the statement "we'd like to build the extensions on top of a platform that has the document management, application development and solutions strengths that the notes server has" is non-controversial.

Lotus Notes R5 Competitive Analysis

Mike Tuchen, Scott Gode

December 13, 1998

Goal

This is a first cut competitive analysis of Lotus Notes/Domino R5, based on the information we have collected to date. This information includes in-depth testing of their first and second external betas, a beta copy of their reviewer's guide, European Lotusphere, and assorted press reports, articles, and snippets from our sales force. (We've highlighted places where we saw significant differences between the actual product and their literature.) This is not intended to be a strategy doc for how we compete with Notes; rather it is simply a direct analysis of the R5 release with enough comparative information to put it in context. We will use this analysis and its successive revisions to drive our competitive response to R5 from both a messaging and product perspective. Where we do direct product comparisons, they are mainly based on the upcoming "Platinum" release of Exchange.

Contributors

A number of people contributed to this analysis from teams across Microsoft. Here are some of the people that made larger contributions to this effort – this is by no means a complete list.

Mail client	PaulSte, FloVo, JoseD, PSerdy, JensenH
Calendaring	TonySm
Tools	GarthF (lead), TimMck
Application model	JohnShew (lead), DougW, CFinn, PaulSte
Templates	MikeKo
HTML editing & web site mgt	MikeAng
Store/database	SureshV
Messaging/transport	DLemson
Directory	PeterWax
Search	KeijiK (lead), SrikantS, KyleP
Clustering	BrianMur
Security	GregBari
System mgt & administration	GlenA
Connectivity/migration	KarimB (lead), HKatz
Workflow	JimRe
Performance	DHowell (In process)
Realtime	FrancisD
Domino doc	RobLe
LearningSpace	AaronC

Contents

Executive summary

Notes/Domino R5 is a major release for Lotus. Jeff Papows, President of Lotus Development, calls it the "most important release since Notes 1.0" and claims that "R5 is to Lotus like Windows 95 was to Microsoft". They plan to make a big splash marketing R5, spending over $100M over the next year.

For the last several years Lotus has enjoyed a significant lead as a standalone application server, but has been behind on enterprise messaging features & momentum. In the last year or so they've started to push Notes/Domino heavily as an enterprise messaging solution, but have lost many of their head-to-head competitive bidding situations with Exchange largely due to missing messaging features such as database scalability, availability, enterprise directory support, monitoring & message tracking, as well as a relatively poor email client. In R5 they've invested heavily in these core messaging areas, as well as making significant strides in their development environment (primarily bringing it in line with the web, which has been a notable shortcoming for them until now). In the final analysis they've closed the gap significantly in core messaging, bringing the server to solid parity with Exchange 5.5 from a feature perspective (though the major changes may take a release or two to completely bake), and their client has gotten closer to Outlook in features, integration, and usability. At the same time, they have extended their lead as a development platform and have made Domino into a credible web application server. At this point, Domino is no longer simply a competitor to Outlook and Exchange, but rather is competing against our own web development platform: IIS/ASP, Visual Studio, and COM+. This development environment/application server battle is a critical one that will take a number of releases to play out – but it is a battle that we must win.

In Platinum we're making a big investment in web/filesystem/Office integration, in an effort to merge the way that users and corporations use and manage their documents, email, and web content. We believe that will represent a significant advantage, and one that will be very hard for Lotus to emulate. The lack of a tightly integrated tools story for Platinum will be a major competitive weakness that won't be addressed until Visual Studio 7 & Office 10 (and even then only if we dramatically increase our investment). We are also investing heavily in NT5 integration, optimizing our product's performance and administrability for this platform alone Along these lines, the Active Directory integration will be a mixed proposition in the near term, but will represent a big win for both Microsoft and customers in the long run. Our continuing strong enterprise-DS focus is both a strength and a weakness, though, since Lotus is taking a grassroots approach that will likely allow it to get de facto deployment in many of today's heterogeneous network environments.

The overall Microsoft response to Lotus has been uncoordinated and uneven to date. Since Notes features touch many different product areas at Microsoft, many teams feel that Notes is a competitor, and each of these teams are building features to compete with Notes and in some cases positioning their products directly against Notes. Unfortunately, we have no coherent story or effort that pulls together these disparate technologies into a rational, integrated solution to truly address the end-end customer scenarios In Lotus' fairly accurate assessment, our approach results in a situation where "*some of these functions can be achieved with separate tools and applications from Microsoft and other companies, but customers are forced to integrate the products themselves, and often face conflicting or incomplete feature sets*"[1] Fortunately, there are two bright spots First, our organizational structure is reasonably well aligned to solve this problem, i.e. most of the relevant teams report to BobMu, with the exception of the IIS/ASP team. (Unfortunately, the fact that these groups in total are about 5x as large as the Domino development teams and have a number of independent successful businesses has diluted our focus and effectiveness to date.) Second, the recently initiated ATG planning exercises are the right approach to solving our coordination/focus problem, and if successful will start to make the right things happen for us as a company to truly get on a path to succeed

[1] Supporting this comment, we continually receive feedback from our messaging/collaboration SPs that our reliance on multiple tools, servers, and other middleware components and the corresponding integration challenge forces them to hire about 3x as many MS experts to every Domino expert. After the application is created, the integration issue continues with the customer as they want to maintain, customize, and upgrade the solution

Top level conclusions

This is a direct comparison of Notes/Domino 4.5 with Exchange Platinum/Outlook2000. Despite the limited scope of this comparison, we should be clear, that Domino competes with much more of Microsoft than simply these two groups: it is now a direct competitor to Visual Studio, IIS/ASP, and other groups in Office (FrontPage, OSE, etc). The multiple foci and disjoint feature sets of these products make a direct comparison difficult – and in fact, this "single, integrated client/server/tool" aspect of Notes/Domino is itself one of its biggest advantages

We expect be ahead in the following areas

- Higher end messaging. Domino has largely caught up with Exchange 5.5/Outlook2000 as an enterprise messaging solution by adding many of the features they've been deficient in (transaction logging, online backup, in-place compaction, administration console, message tracking, enterprise directory, email client usability). In Platinum we will regain the lead for higher end messaging scenarios, with fault-tolerant routing, higher overall performance, and more complete messaging connectivity/migration.
- Document-centric scenarios. For simple document sharing, particularly in corporations that have deployed Office2000, we will have an advantage due to our Web Folder support and Office2000 file/save integration, and win32 and SMB support.
- Direct web access. We will have an advantage in direct web access to content stored in Platinum, due to its tight, high-performance integration with IIS, and IIS's strength as a web server. Domino's HTTP performance is poor, and the shortcomings of their own HTTP stack have forced them to offer integration with IIS as an alternative to their customers.
- NT integration We obviously integrate more closely with Windows2000, by taking full advantage of Active Directory, using native NT ACLs, integrating IIS and the built-in SMTP/NNTP services, and supersetting the mail/news APIs that ship in Windows. The first several in particular will have a direct impact on overall cost of ownership, by allowing companies to administer users & permissions in a single place.

We will be at parity in these areas

- Security This has long been a Lotus strength, and is an area where they continue to message heavily. By default, Domino/Notes uses public key security, with the associated complexity and corresponding security benefits. They haven't completed their standards-based PKI work, however, and are missing key administrability features like key escrow. We've matched their security granularity at the lowest level (per-item and per-column ACLs), but they have a more flexible/complex overall model
- Content indexing[2]. Lotus has made little change to their indexing support in Domino 5.0 other than boosting performance, which has been a long-running customer complaint. With Platinum we will come up to rough parity, although the newness of the area may require some time to bake. IBM has a much more capable indexing engine that is a couple of years ahead of us, however, so once Domino integrates that engine we will again be behind (Lotus has indicated that they plan to do the integration in Domino 5 1)
- Higher end document management Both Domino and Platinum offer add-on document management products We expect rough parity between Domino.doc 2.0 and PKM 1.0, although again the newness of our offering may result in some rough edges when compared to their more mature product.

We will be behind in these areas

- Web application server We will be behind across the board here, from programming tools and forms to offline capability to built-in templates & packaged applications. This is a critical area, and

[2] Lotus is marketing "knowledge management" heavily for Domino. From a Domino infrastructure perspective they are simply playing up their search features, which will be ahead of us in core engine features but behind enterprise-wide search. Most of the "knowledge management" value is contained in apps written above Domino. Teamroom, LearningSpace, etc

is without question the most important weakness we face. Domino is now a credible web application server, and the successful integration of their old messaging application model with the new web & database support makes it an extremely compelling offering.

- Offline & client/server replication. Domino's symmetrical offline programming environment and its flexible and granular replication is a large advantage for both application and messaging scenarios. They are close to offering a true offline web-based application environment, which puts them significantly ahead of us.
- Clustering.
- ERP/database connectivity.

Of the areas where we're behind, the web application server is the most serious, and it is a critical area that we need to address. The danger we face is that if Lotus catches up enough in core messaging, they will put us in a position analogous to the Windows/Mac comparison in the early 90s: they may be close enough in messaging for most customers, but with some significant added value as an application server that tips the scales in the majority of cases.

From a marketing and business perspective, we have been doing relatively well on a tactical level. We've outsold Notes for two of the last 3 quarters and are ahead for 1998 overall[3], and have gained significant credibility with both customers and the press despite continued negative coverage from Gartner and Giga. We are aggressively recruiting the Lotus Business Partners, which is a core Lotus channel asset but vulnerable due to conflict with IBM's own Global Services. On this front, we've created a Knowledge Management Partner Advisory Council made up of 25 of our top partners in this area to provide us with product and positioning feedback – and 80% of the membership are ex-LBPs. Lotus is more aggressively developing ISP/hosting solutions and deployments than we are, which will be a serious concern if more companies begin to outsource server infrastructure – this is reasonably likely, particularly at the low end. They key here is that they are making their standard corporate offering available through ISPs as a hosted service, so it's a simple by vs. rent decision for corporations. Finally, they have significantly outmaneuvered us in positioning around several future growth areas. realtime collaboration, knowledge management, and corporate training.

Domino as a Platform

Applications

Aside from the tools & runtime infrastructure, Lotus has a huge lead in an under-appreciated area: templates and pre-packaged application solutions. Notes ships a wealth of built-in templates that create simple to moderate applications with relatively little effort; in fact, our application migration data shows that 75% of Notes apps are created directly from these templates with little or no modification. In addition, they ship a number of more elaborate production quality applications in several key areas: the Intranet Starter Kit, which includes a dozen key departmental applications like shared contact management, project management, etc; Domino.doc, which is a full-featured document management solution; and LearningSpace and TeamRoom, which are starting to move Notes into corporate training and the evolving "knowledge management" space. In contrast, we ship a limited set of templates for Exchange, no production quality apps, and don't even use Exchange for the majority of our own internal app development. In fact, the only broadly deployed Exchange applications at Microsoft that readily come to mind are survey/feedback forms for the company meeting and training classes. Much of it is due to our tools' current single-minded focus on Access databases, SQL and IIS (and these products' corresponding success as departmental/standalone application servers), but an equal amount is due to our nearly universal focus on individual features rather than on the overall solution. We've been guilty of focusing largely on nailing various aspects of the technical infrastructure rather than asking the simple question "what does it take end to end for a department manager to get a <foo> running in their company?". The "Grizzly"/Polar effort is a first step to providing Notes-like application templates to

[3] In Q198 we shipped 3.1M CALs to their 2.7M, and in Q2 we shipped 3.6M to their 3.1M. In Q3 we shipped 3.2M to their 3 4M While this is encouraging, part of our recent success is likely due to the timing of our release cycles: Exchange 5.5 is in the sweet spot of its sales cycle, while Notes 4.6.x is in a lull leading up to the release of R5.

customers, but the SQL + filesystem approach of its first version won't be seen by customers as an effective competitor to Notes, and it will unfortunately be seen as further proof of Microsoft's lack of a coherent application development strategy around the Exchange platform In contrast, the PKM effort is a small step in the right direction, but overall we're currently investing about 1/5 of what Lotus is in templates & applications on top of their collaborative platform.

Lotus' structural advantage

In some ways it may sound somewhat remarkable to suggest that Lotus, which has to fight IBM's infamous bureaucracy, well-known internal overlaps, and notorious technology miscues, actually has some structural advantage over Microsoft. Yet in reality there are several things that have played to their advantage with Notes, particularly as an application server. One of the important factors that has contributed to Lotus' success is the fact that they're largely selling a single product[4]. They have a strong central effort around Notes/Domino that drives everything they do from both a strategic and release timing perspective, with secondary efforts providing supporting ancillary features. In contrast, Microsoft has a number of products that we attempt to position together as a comparable solution. The key issue here is that we don't currently have a strong central focus to these efforts in the same way that Lotus does with Notes: our client lives in Office, our tools live in Visual Studio and Office (or more accurately they will, once we truly get the tools teams engaged on making our mainstream tools Exchange aware), and our server efforts are split between NT (IIS/ASP, Active Directory, COM) and several teams in BackOffice.

Although we have a far broader overall set of products and generally compare positively on a point-by-point basis, the lack of a strong shared focus between our distributed efforts creates a complex and confusing story for customers that want a simple application server, creates awkward timing windows where products don't line up due to asynchronous schedules, and in the end misses the mark in several key areas. In a sense, the fact that we've been successful on many fronts plays against us as almost much as it plays for us when dealing with a single-product competitor like Lotus. The current organization can work structurally, but to succeed the teams involved must ship simultaneously or close to it, and must have a shared vision, shared notion of customers, and shared priorities.

The lack of schedule and priority synchronization between Exchange and its primary Outlook client, in particular, will be a very serious competitive disadvantage even in basic messaging. A direct result of the priority choices we've made is that Platinum won't have a matching client release that exposes any of its new functionality when it ships – as a result, for their primary email tasks customers will be able to use it simply as another 5.5 server despite all of the innovation built into it. The current situation where Outlook serves two masters with different priorities, schedules, and competitors will continue to cause ongoing problems in our struggle with Notes. We're at risk of squandering one of our most potent competitive advantages: a more compelling, more usable client.

The detailed analysis below is divided into 2 main sections (technology, marketing/sales), with a brief "futures" section at the end that discusses some of the new areas that Exchange and Domino are evolving into (realtime collaboration, unified messaging, wireless connectivity)

Release timing

Lotus started working on R5 in early 1996, and has made and broken a number of commitments around ship dates, including Lotusphere 1998 (in January), June 1998, EOY 1998, and most recently Lotusphere 1999 (mid January). We don't expect them to meet this latest commitment either. R5 went into early preview in May of this year, and first beta in the beginning of September, and second beta on November 19. The second beta was not feature complete, and had significant stability and performance/memory footprint issues. This seems to indicate that they will ship by the end of Q1CY99, or perhaps as late as the beginning of Q2 if they

[4] Lotus stands in stark contrast to the rest of IBM here – Domino is largely self-consistent and unified, but it overlaps considerably with other IBM products The Iris team behind Notes/Domino seems to be smart and focused on the right problems, and seems to be ignoring a lot of the other efforts at IBM (this is both an advantage and a disadvantage for them).

don't execute crisply in the endgame. (Confirming this, we heard in October that Lotus had recently briefed an account on R5 and mentioned for the first time that it won't ship until the end of Q1). Oddly, Lotus has been sticking to their public statements about shipping by the end of the year, and has mentioned that the client/development environment is the gating factor and hinting may ship the server separately before the client. If Lotus tries to ship by EOY 1998 or by Lotusphere 1999, quality and stability will suffer significantly – we believe this will be a net negative for them if they attempt it.

In comparison, Exchange "Platinum" went into beta at the end of September, and will go into its second, feature-complete beta in late March, or about the same time that we expect R5 to ship. This wide beta will provide us with a public opportunity to message against R5 with "Platinum", despite the fact that they will ship about 6 months ahead us. In addition, the release of Office2000 about a month or so prior to this may also provide us with a significant opportunity to message against R5.

We expect IT spending on core infrastructure such as messaging to decrease significantly starting in late Q1 and extending throughout 1999, due to the Y2K issue consuming IT focus and mandating a risk-limiting approach in other areas. As a result, we expect Exchange "Platinum" to be evaluated on-site in most corporations against R5 starting at the end of 1999 – at this point Lotus will likely have released a small point update to R5 (R5.1?). The key sales battle will be in Q1 and Q2 of 2000, when we expect corporate spending to pick up again. Getting Platinum released before this evaluation cycle begins is a key goal.

Technology

Domino R5 supports 3 client install options and four server options:

- Notes client. The traditional full-featured/legacy Notes client
- Designer This is the new Domino development environment
- Administration client. This allows remote administration of R5.

- Domino mail server. In R5, Lotus has separated out the mail-only functionality from both a packaging and pricing perspective. In this configuration, corporations can't install or run custom apps. This is largely a reaction to Exchange's success, and it gives them an opportunity to price the mail-only CAL significantly lower than the "full featured" CAL They created this pricing both to compete with Exchange – neither Microsoft nor Lotus will lose a messaging sale based on price – and to offer a more palatable upgrade story for their cc:Mail customer base.
- Domino directory server. The directory can be installed standalone on a dedicated server (see *Directory* below).
- Domino server. This is the full server install, including both the mail server as well as the rest of the application server.
- Enterprise server. This is basically a "Domino server" with clustering support.

We're still working out the Exchange/BackOffice/PKM/Polar SKU strategy for the Platinum timeframe. We will almost undoubtedly have a "departmental" SKU that is an application server WITHOUT mailboxes. In other words, we and Lotus will likely be taking the opposite approaches as we both play from our strength and attempt to make inroads in the other's historical strong areas – they kept their combined product created a new mail-only SKU, while we also kept the combined product and are creating a new app server-only SKU.

Server Infrastructure

Lotus' stated goals for Domino R5 server are:

1. Best messaging server
2. Expanded web application services
3. Most reliable, available, and scalable server infrastructure
4. Lowest cost deployment and administration

Logically enough, these priorities indicate that Lotus is making the largest server investment in enterprise messaging features in an effort to bring them to parity with Exchange (all the first three support this), and secondarily continuing their investment app server features

Domino R5 server supports the following platforms NT4.0 (intel & alpha), AIX 4.3.1, OS/2 Warp Server 4, HP-UX 11.0, Solaris 2.6 (intel & sparc), AS/400 V4R2, OS/390 V2R6

This section compares the details of the R5 server by major area. store, transport, HTTP & web integration, directory, search, clustering, security, system management & administration, and performance.

Store/database

Until now, Lotus has consistently been far behind in core messaging technology like store and transport – in the same way that we are just learning the issues involved in putting together an effective tools & application strategy, Lotus is just learning what it takes to be an enterprise messaging server. Lotus has addressed the biggest weaknesses of their store in R5 around availability, scalability, and performance, and will catch up to rough parity with Exchange 5.5 from a feature perspective. The three most important criteria for the store and the R5 changes in these areas are:

- Availability. Transaction logging (see below), online backup, online in-place compaction These three changes significantly increase uptime, by eliminating the need for scheduled maintenance periods, and making unplanned restarts 1-2 orders of magnitude faster than 4.x and previous releases. In addition, Lotus has added a dumpster/undelete function to quickly recover inadvertently deleted items. (Surprisingly, R5 doesn't include even a basic backup utility, but rather relies on third parties for all backup/restore functionality).
- Scalability Database size In R5, they've increased the maximum from 4GB to 32GB, and are hoping to make it "unlimited" by the time they release – they claim testing to 48MB to date[5]. This feature only applies to databases created with the new R5 ODF (below), and isn't usable in beta2. (Exchange 5 5 is essentially unlimited, and in some customer deployments we've seen databases of 50-75GB.)
- Performance. New on-disk structure[6], optionally turn off disk zero[7], optional read/unread[8]

[5] Database size is actually less important for Notes in general than Exchange, since the largest databases are typically for user email In Notes each user has his/her own database, while in Exchange 5.5 and previous they are all in a single database (see below). Database size is important for higher end document management scenarios and larger applications, and has turned into a big marketing issue.

[6] They claim that their new disk format reduces the overall I/O by 50% Since large deployments are typically I/O bound, this would be a big win if true. This obviously requires a data migration, but this can be done post-install – R5 still supports the R4 ODS.

[7] This is another performance optimization Right now they manually zero out disk blocks after content deletion, which is often important for legal reasons. In cases where permanent/absolute deletion isn't as critical, omitting this step is delivers a large performance gain (Exchange started out without allowing any kind of disk zeroing, but as of 5.5 SP2 it allows corporations to optionally turn zeroing on via a reg key– in other words, we have opposite defaults. We are taking an approach that has no perf degradation: we zero the blocks during the backup operation rather than at delete time) We would need to expose this option through the admin UI to truly claim parity.

[8] This is a performance/size optimization for things like address book & logs that don't require storing per-user read/unread state Since they actually implemented their directory as a Notes database (which supports read/unread), the extra overhead of maintaining this state was apparently giving them serious problems (It must have also been problematic on restart, since the directory would often be dirty due to the read/unread bits, requiring the lengthy dbfixup). Exchange does this internally for some of its folders (for example the free/busy calendaring folder) and delivered it as a QFE to one customer, but doesn't widely expose it as a user-settable option on any folder

These database changes are extremely major, and if our own experience is any measure they will likely take a couple releases to get fully correct. It's likely that they were also a significant factor in R5's repeated schedule slips.

Many of these areas are detailed below.

While Notes has incorporated a number of the enterprise-enabling features from Exchange 5.5, we expect to have the following new advantages in Platinum store over R5:

- Win32 File APIs & SMB support. We're pushing hard to unify the way users work with documents, they way they work with email, and they way they work with web sites. Our biggest advantage in the store will be our direct support for win32 file APIs & SMB, as well as all our existing protocols. Users will be able to access the same content via Outlook, other IMAP/POP/NNTP clients, File Explorer, web browsers, Office2000, or any existing windows program(see "Protocols & web integration" below). The user benefit is to be able to treat documents & related email threads together in the same folder, but also to have all the same services applied to them consistently (search, categorization, versioning, checkin/checkout, offline replication, server-server replication, workflow/approval, backup/restore, etc). This area will be extremely hard for Lotus to replicate.
- NT5 integration. In addition to tight integration with NT5 Active Directory (see the directory section below), we also use native NT5 ACLs for content in the store. This means that administrators can leverage the same users & security groups they have already created in AD, significantly reducing overall cost of ownership
- Backup/restore. Surprisingly, R5 does not include a backup/restore utility; instead they only ship an API and point to third party support for even basic backup support. Our integration with NT backup is a big out-of-box advantage as a result.
- Performance We expect to maintain a performance advantage, but (as below) we don't have any measurements at this point to back this expectation up with hard data. The reason for this expectation is that we support native streaming I/O on reads, sending a file handle to IIS and using transmitfile directly. On writes, we also stream data directly into the store. (Note, this optimized path is not used by MAPI, so only access via HTTP, SMTP, POP3, IMAP4, or NNTP accesses will benefit – this unfortunately means that corporate Outlook email users won't benefit until Office10).

Transaction Logging

R5 is the first server release that adds transactional logging to Notes databases. Logging can be turned off on a per database basis which is a good feature R5 seems to use logical logging (happens at higher layers) as opposed to physical logging employed by Exchange at the page level As a result, theoretically our logs should be bigger but they cover any change to the database R5 logging does not work for certain changes, such as on-line compaction in non-default mode where the database space is simultaneously being reclaimed R5 advises that recovery after such compactions gets you back to the pre-compaction state.

In practice, R5 logging seems to be rather inefficient. Loading ~200MB of data resulted in ~1200MB worth of logs This is a very inaccurate and high-level observation and our perf team should look at this further. The logs seem to contain the database name, message header, and the body in plain text, which indicates that they are backing up at message (record) unit level

There can only be one log per server in R5. This is a definite R5 disadvantage in that it introduces a bottleneck Exchange permits separate logs at a storage instance level, giving more granularity and operational flexibility. The R5 method also negatively impacts database backups – if you are trying to backup a single database, you may be required to backup the whole logs; but this couldn't be tested (R5 doesn't ship with a backup utility; only an API). The API might allow extracting only those transactions related to the database(s) being backed up.

Exchange Platinum	Domino R5
+ Mature logging technology	- First release. This can be a rallying point

	for us.
+ multiple logs per server (storage instance granularity)	- Only one log per server. Backups against media failures may be affected. Needs further research once backup tools are available.
- Can not be disabled	+ Can be disabled on a per db basis

Native storage

In Domino R5, Messages based on Internet protocols can be stored in Notes format, in MIME format, or in both formats When messages are stored in MIME format, Notes displays a file attachment that can be read with the attachment viewer. Storing the messages in both Notes and MIME format takes more disk space but is the best option for users who access their mail from both Internet clients and Notes and offers the best performance during mail retrieval because no format conversion is necessary.

Comparing this to Exchange PT, the message is only stored in one way based on the arrival mechanism. MAPI messages are stored in the property store (all messages were stored like this pre-PT), and MIME messages are stored in the SLV file. Conversion happens on demand when the receiving client demands the message in a format other than the one it is stored in. Message display is not affected for the most part during conversion (aka MIME attachment in Notes) and the client is quite unaware of how the message came in.

Outlook (98 onwards) does preserve HTML fidelity if the message was created in HTML. This is accomplished by tunneling the HTML inside the converted RTF so that contemporary clients can extract the HTML with complete fidelity while older clients render the RTF with some loss. This does result in increasing the size of the message but the additional cost is limited to the message body R5/Notes handle HTML natively without this additional cost.

Exchange Platinum	Domino R5
+ Recipient fidelity during conversion	- Loss of fidelity for Notes when message is MIME
- Not an option to store both formats	+ Optional dual storage
- Conversion cost at delivery	- Sync cost when dual store msg is changed
+ File handle efficiencies for MIME delivery	- Domino has to service delivery
+ Efficient single instancing	- Single instancing lost in dual storage
- HTML is tunneled with full fidelity but at a cost	+ HTML is handled natively
- Two separate files	+ One file

Single instancing & storage granularity

Exchange and Domino take different approaches to storing per-user mailboxes. Exchange 5.5 and earlier stored all mboxes in a single database, while Notes has always had a different database per user. The Exchange approach means that we can do efficient and robust single instancing, where messages sent to aliases are stored only once (in practice, the overall single instance ratio turns out to be 1.5-2, implying a savings of between 30-50%). This is both a storage an performance win. On the other hand, the Notes approach of isolating users on their own database gives a very small failover and restore granularity[9], but it

[9] For large customers, the limiting factor in adding users to a given server generally isn't performance or database scalability limits, but rather the potential user time lost during database restores after failure Given a single database, the amount of lost user time has an n^2 relationship to the number of users on the server, since each new user both increases the amount of data (and hence restore time), as well as adds to

comes at the expense of single instancing. In R4.6 Lotus shipped a single instancing solution based on soft links between databases, but it has seen few real deployments due to the difficulty maintaining the links & keeping consistent when failures occur. In Platinum we're solving the failover/backup/restore granularity issue by supporting multiple databases on a given server (but not at a granularity of one per user)

For single instancing, R5 allows setting up of a separate file for storing content of messages with multiple recipients on the same server. Server administrator can enable this through a console command. However, there can only be one shared file per server and it can not get too large. It is recommended that a new file is created on a periodic basis. Shared file maintenance (to delete content with refcount of 0) is a task scheduled to run by default at a certain time (2AM), but can also be run from the console. Compared to Exchange, this is a rather weak implementation of single instancing

Exchange Platinum	Domino R5
+ Shared content is stored together with the headers. Out-of-sync issues are relatively more rare.	- Shared content is stored in a separate file, increasing the administrative load and the possibility of things going out-of-sync
+ No administrator involvement is necessary to setup this feature or maintain it. Everything is done without any supervision.	- Efficiency of this feature is dependent on the administrator keeping close tabs on maintaining the files; without significant planning, tracking, and tuning the setup to fit the operational profile, this feature is not very optimal and could actually affect the recoverability aspects seriously.
+ Link integrity is much more robust. Repair is done without administrator involvement	- Procedure involved in cleaning up dead links required heavy involvement from the administrator and the only way to do it is from the console!
+ Backup and restore do not require special attention to single instancing.	- The procedures involved in backing up and restoring the shared files is definitely time consuming for the administrator (you have to restore to a non-directory-structure location, then push the content to the current shared file)

Content support & property promotion

Exchange database folders can be content-agnostic, i.e. you can put a word document in your inbox. OLE properties can be promoted as columns so that you can sort and query on them. You can't do this in Notes Any database you create needs to be templated, and once the NSF file is templated as R5 mail, it does not natively support documents

Interestingly enough, Notes supports a database template called "Microsoft Office Doc Library" – even this one does not offer drag-and-drop at the item view. You have to open the item (it opens the MS application in-frame) to save the document and the only visual clue to the document type in the item view is the icon None of the OLE properties are promoted, although a set of default properties are assigned (create time, creator etc.) You can extend the properties through the designer but I did not see a place where you can extract OLE properties. This in effect requires you to duplicate the meta-data that may already be in the Office document

Notes also supports a plain "document library" database template which lets you drag and drop objects into a rich text field once the item is open It also allows in-place rendering of such objects in the object view However, there is no visual clue of the nature of the content in the item view.

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the number of idled users. Thus, by splitting the database into multiple smaller databases which can be stored on separated physical disks and restored independently, the number of users/server can be dramatically increased without a corresponding explosion in lost user time

(PT+) Exchange offers very rich support for property promotion, even if it is only for Microsoft application objects. Even objects coming in MIME streams can result in properties being promoted through the IMAIL pluggable filter architecture This is a clear, highly usable, and easily visible advantage we must promote it unequivocally, e.g. build it into every demo. Even if there were a way to do this in Notes, it would probably take a designer to do it and the difficulty of this seemingly easy task will be a positive message for us.

(R5+) International language support: Notes seems to have caught up in international support. A feature we cut out of Platinum, auto outbound Unicode generation is in R5. They also have parity with us in bidi support.
(R5+) HTML support: The R5 server and the Notes client support all of HTML 4.0 constructs including CSS (Cascading Style Sheets). Exchange server does not honor fidelity while converting HTML with CSS, although many HTML 4.0 constructs are supported

Database management

(PT+) DB management is largely a manual task in R5. While many tasks can be scheduled, many commands don't have UI. Their database logging and analysis tools are fairly inclusive – database activity can be easily tracked through the admin UI much like ours.

(PT+) Surprisingly, R5 does not include a backup/restore utility. All they ship is an API You have to buy a third party product to even do a basic backup. Our integration with NT backup is a plus for Exchange. Restoring in cases of media failures is more administrator intensive than Exchange, e.g. you have to manually push the contents of a shared mail file into a new shared mail file.

Online compaction brings them to parity with Exchange. However, this feature couldn't be tested as all my attempts to compact failed with a "Compaction failed - 1 error" with no hint of what the error is

Messaging/transport

In the transport and routing area, Domino is also still playing catch-up as they learn more about what it means to be an enterprise messaging system. The three most important aspects of enterprise messaging/transport are:

- Reliability. Messages must get to the recipient, and the system should be tolerant of intermittent network or individual machine failures. Notes supports only a single connection between server groups, and doesn't support the automatic topology discovery, link state propagation, or advanced routing algorithms supported by Platinum (see below for more details). As a result, we expect their tolerance of failure in a large scale deployment to be significantly lower then ours On single machine reliability, we clearly don't have good data yet.
- Administrability. In R4.x and previous releases, this was a major weakness for Notes, and as a result Lotus has made a big investment here. R5 brings Domino to parity with Exchange in most areas, and even ahead in a few. See the "*System management & administration*" section below for details
- Performance We have done a number of things in Platinum that we expect will result in a continued performance advantage relative to R5, especially in enterprise configurations. It will be a month or two before we can verify this with a direct comparison

New features they've added to R5 include:

- Support for SMTP more natively – SMTP is not used for normal mail routing within Named Networks. Named Networks are analogous to Exchange 5.5 Sites, in that they are administrative and topological units Notes Replication (RPC) is used to move messages from a MAIL BOX database on one server to another SMTP support is more analogous to the 5 5 IMS, with every machine being a potential SMTP

gateway (SMTP listening is turned off by default). Between Named Networks, Notes Replication is used as well. SMTP is only used for gateways to SMTP networks. SMTP support is enhanced with various ESMTP extensions, including DSN (see below), PIPELINING, ETRN, 8BITMIME, VRFY and EXPN (see below), and TLS. Most ESMTP commands were off by default. We support all of these in NT 5 SMTP (except for VRFY and EXPN), plus many more

- "Push request" routing for dial-up servers. A corporate backbone server can dial up branch offices to request that queued messages be "pushed" to it, rather than having the branch servers initiate the connection on demand. This allows a single phone line to service a relatively large number of distributed servers It appears that this is implemented through the ETRN SMTP command, but a network sniff has not been done to determine this for sure.
- DSN request support. Outbound messages can be specified with a Delivery Receipt on "Success", "Failure", "Both", and "Trace every hop". With the first three, DSN requests are propagated out SMTP servers and with the last one a special Notes trace message is generated on every Notes server as it goes through as well as a DSN request. The SMTP server also advertises the DSN ESMTP extension (not tested extensively for RFC 1891 verb correctness), but it does not create RFC 1894 DSNs! It creates something that looks like an Exchange 5.5 DR/NDR, instead
- MDN request support. Outbound messages can be specified to request a "Read Receipt", and it puts an appropriate "Disposition-Notification-To:" header on outbound SMTP messages. On inbound, it recognized the MDN header but had some trouble creating the RR outbound message.
- VRFY & EXPN. VRFY and EXPN are ESMTP verbs that are supported by sendmail and Netscape Messaging Server. VRFY causes a PAB lookup for the given name (you can even feed it a last name and it will look it up in the DS), and returns immediately with a valid e-mail address. EXPN only works on lists and I couldn't get it to actually return anything, but it purports to work. We do not support VRFY or EXPN in Exchange 5.5, and currently do not plan to add them to Platinum release
- Routing. A Connection Document is set up between each Notes Named Network – one server is on each end. No support for multiple bridgeheads, which we currently support (in 5.5) for Site Connector sources and we will support for all connectors in Platinum. Each connection has a fixed cost and schedule. No easy way to create two-way connections (must navigate to each server in the admin client). Routing uses the "cost bias" method to calculate paths. This is a very elementary method, where each server learns about links that are down and increases those links' costs to prefer other links. Routing loops are created very easily, and they specify a max hops limit of 25 to help stem looping problems. Messages can be designated as High, Medium, or Low priorities. High priority messages override connection schedules Normal messages are subject to connection schedules Low priority messages have a separate, per-server schedule that is, by default midnight-6 am (controlled in NOTES.INI, a terrible place to have this). There is also a tunable to "Route at once if *n* messages are waiting".
- Conversion. Outbound and inbound messages can be converted, similar to the 5.5 IMC (line wrap, MIME, Binhex, etc.) Additionally, Notes supports RFC 1740 AppleSingle and AppleDouble formats, which we have supported since 5.0 as well.
- Transport/routing performance increases. One mentioned improvement is the support for multiple MAIL.BOX databases in R5. All incoming mail to a Domino server gets delivered to a server's MAIL.BOX database, and this has proven to be a bottleneck As a result, they've made it possible to deliver to multiple databases.

All of these are things that Platinum will also do On the performance front, we are making our routing engine asynchronous to maximize concurrency, have improved the DL expansion significantly, and have integrated the extremely efficient MCIS protocol stack for native SMTP routing. Additional things we're doing in Platinum:

- Multiple/redundant site connectors Platinum will seamlessly support multiple connection between sites, so that a failure on any one connector will be seamlessly routed around. Notes supports only a single connector, so mail will stop if any failure occurs on that link or its source/destination machines
- Topology discovery Platinum servers will automatically discover the topology of other Platinum servers in the organization.

- Link state propagation. Platinum servers will propagate link status, so that the servers will detect downstream network outages and server failures, seamlessly routing around these problems.
- Least-cost routing using Dijkstra's algorithm. Each server will calculate a least-cost route to the destination server, using knowledge of the topology, cost, and link status When a server starts up, it reads the entire topology and builds a map in memory. Each server will contact the master of its RG and find out the state of the links throughout the organization.
- Platinum separation of Routing Groups and Administrative Groups should be more flexible than Notes' Named Networks.

Again, we expect a performance advantage in the messaging/transport area, but don't yet have numbers to back it up. We expect our routing engine, which uses Dijkstra's Single-Source Shortest-Path algorithm, to be far superior to Notes' elementary routing algorithm[10]. The combination of better routing and the redundant connectors should be a significant competitive advantage for enterprise customers.

Other Messaging notes:

- OOF support: Notes has something equivalent to the OOF Wizard. They offer two different OOF messages: one for "normal" senders and one for "special" senders You can define users or groups to receive the "special" OOF message. Also, the OOF Wizard asks you for the dates you will be gone, and offers to mark that time as busy on your calendar. Exchange currently only has one OOF message that is sent to all recipients, and blocked on connectors outside the organization.
- Can't view SMTP headers. It's not possible (at least I didn't find it) to view Internet headers for a message that came in by SMTP. Outlook offers this, which can be very useful when one receives spam.
- "Notes Full-Fidelity Encapsulation". This is an option set in the outbound section of SMTP messaging configuration. Apparently the intention is to preserve Notes-specific properties in something like our TNEF body part, but I could not get it to create it.
- Misc. transport features: "Resent headers take precedence over original headers", "Add BCC: header if recipient not found in To: or CC" Nice features we have had and/or are considering.
- Topological UI. Their admin appears to have a Java-based topological view, by connection or by Named Network I only had one server defined in my Named Network, so the latter was blank and the former simply hung, even though I had several connections defined

HTTP & web integration

Structurally, Domino consists of a protocol stack, an ISAPI-like connector that intercepts some requests and hands them off to the Notes store, and a server-side programming environment (scripting engine, Java runtime, object library). Domino competes with both IIS as well as Exchange in this area, and as a result of the tight integration and coordination between these two teams we have a significant advantage. This is a great example of how our breadth and individual product strengths can be a strong competitive advantage given common priorities, vision, and schedules. In the HTTP stack, Domino is behind pretty much across the board, and is playing catch-up with IIS. Everything they've added in R5 already exists in IIS, and as a result they've been forced to offer IIS integration as an option to their customers who don't want to use the Domino stack. In this case, Domino literally becomes an ISAPI registered for .nsf file extensions.

This has given Exchange an opportunity to leapfrog in web integration. This is an area that we're making a big investment, and one that we believe will be a critical strategic area for several releases to come.

- HTTP-DAV support. We support HTTP-DAV natively via a high performance protocol stack based on IIS We are making a large strategic bet on DAV across the board, and expect it to be the primary access

[10] We treat a Routing Group as an atomic entity, assuming that it has perfect routing within the RG, and compute the topology using connectors between RGs and external entities. Using Dijkstra's algorithm, we have perfect routing between these routing groups, assuming that the routing information in all DS's in the enterprise are synchronized

protocol for all clients over time (email, browser, productivity applications). As mentioned above in the store section, we are unifying the way that users manage documents, email, and web sites.

- URL addressing. All items in the store are addressable through URLs: folders, files, attachments on files, properties on files, etc.
- File Explorer & Office2000 integration. Through HTTP-DAV server support, the Rosebud remoting built into Office, the Web Folders namespace extension, and Win32File/SMB support we will have a strong story for basic file storage and file sharing with Office and other productivity apps.
- ASP execution and ADO support. We support ASP execution, where the ASPs are persisted in the store, get uniform security with other files in the store, get replicated with other files, etc. By supporting OLE-DB 2.5 on the server, we also get ADO 2.5 support for server-side data binding. We need tools support for ADO 2.5 to complete the picture (this is something that we're working on, but it's unclear how much we'll get in time for Platinum).
- Web client & IE5 integration. We're investing significantly more in web-based access to email than Lotus – we have a relatively full-featured client for IE5 users that takes full advantage of DHTML & XSL as well as a downlevel HTML version for non-IE5 users. Lotus has a very simple HTML client for all users that is simpler yet than our downlevel client.
- Performance. Our performance story for basic DAV access and default HTML folder views should be well in excess of what we expect from Domino.

The new HTTP features in Domino R5 include:

- Byte range support. They support HTTP 1.1, including byte ranges. This allows clients doing large file transfers to retry from where they lost the connection rather than from the start.
- File "ACL" support. They support adding "ACLs" to files stored in the file system, with a granularity of HTTP verbs (get, put, post, delete). This is a rather bizarre model, but gives them some ability to set permissions. Platinum leverages IIS, which uses standard NT ACLs.
- Browser capabilities. They copied the IIS "browser capabilities" approach – this requires manually authored pages to take advantage of it (e.g. `@if(@browserinfo("javascript"); code-with-javascript; code-without-js)`, and requires an up to date browser capabilities file. As a result, the feature has been only marginally useful despite the clear need for a solution here
- Virtual servers. They support multiple virtual servers per machine.
- Result page caching Since the majority of requests to Domino are dynamic pages, even for the equivalent of a "get", they have extremely poor performance. They've done some work in R5 to cache page output for pages that use only non-volatile @functions (e.g. @created) – they examine the page and decide whether it's a candidate for this caching or not.
- Publish to CD. This sounds like a very special purpose thing, not something that the vast majority of sites would care out. They apparently have a few script methods to allow sites to "print" a static HTML rendition for either CD distribution or for external replication.

As mentioned above, all of these features (aside from the last special case feature) are supported in IIS and hence are also supported in Platinum.

Directory

Lotus is taking a very different approach to their directory than Exchange, or, for that matter, Microsoft as a whole Lotus is taking a grassroots approach that assumes nothing about the corporate environment in which it's being placed – each Notes server can host its own user directory, and as more servers get added they can incrementally learn about other servers in the corporation and patch together a global directory listing One issue that has been a strength and a weakness of Exchange since the beginning has been its insistence on a single corporate directory: in 5.5 and previous Exchange provided this directory, and in Platinum we rely on NT5's Active Directory This single corporate directory provides a lot of benefits for customers, but it makes purchasing and deploying Exchange a much more involved effort than Notes. In the Platinum timeframe we're releasing the store technology embedded in "departmentally installable" servers such as PKM, Polar, and VSEE "Team Server", but none of them have any kind of directory support – in other words, they don't

rely on a corporate directory, but they don't attempt to provide their own replacement either. This means that individual departments that install these servers don't have a user list, ability to manage security locally, etc This insistence on a corporate-wide DS infrastructure provides benefits for customers who ascribe to the homogenous, centrally managed IT model, but it's clear from observing real corporations that many (and perhaps most) companies don't fit this mold This is an area that we will need to think through carefully going forward.

Prior to R5, the Domino directory (formerly "Name & Address Book") had serious shortcomings relative to Exchange for enterprise users[11]. In R5, Lotus has made some significant advances in their directory:

- Domino Directory scalability. Each Domino server or group of servers has a Domino Directory, which can now scale up to 1M users (the previous limit was claimed to be 150K users, though probably ½ to 1/3 this in practice). The directory can run on a separate box or on a Domino application server.
- Directory Catalog. In addition to the per-server Domino Directory, they've created the concept of a Directory Catalog, which is an enterprise directory that supersets all the Domino Directory listings. Individual servers replicate their directory entries to the Directory Catalog server, which delivers global name resolution, as well as replicating the catalog for mobile/offline use. The catalog includes only a small subset of the data in the individual directories, but the footprint is correspondingly reduced 80-100x (to 100-400B/user, down from 9k/entry in previous NAB). *Note, this feature gives them the ability to knit together departmental mail servers that have sprung up organically into an enterprise solution, complete with an up-to-date global address list This grassroots approach to email adoption has been a critical adoption mechanism for Lotus, and this feature now makes it much more palatable for a broader range of customers to consider growing their patchwork of Domino servers into an enterprise-wide email system.*
- Full LDAPv3. In R4.x they had a read-only LDAPv2 server, which is what we had in Exchange 5.0. They've now upgraded this to full LDAPv3, and support read/write authenticated access, and referrals (We shipped this level of support in Exchange 5.5).
- Global Directory Administrator. This is a directory synchronizer to other Domino servers, NDS, and generic LDAP servers based on the NotesPump engine. It appears to be an add-on product rather than a standard feature of Domino, and roughly equivalent to the Active Directory Connector that will ship with Platinum.
- Novell NDS integration Lotus is making an interesting bet with foreign directory support – they are to some extent betting on Novell NDS rather than NT5's Active Directory. This appears to be in line with their approach of supporting MS technology only when absolutely necessary, and instead choosing the alternative whenever possible. They support adding and deleting mailboxes from a snap-in that runs in the NDS NwAdmin console, which synchronizes with Domino through their Global Directory Administrator synchronizer.

All told, these improvements gets Domino up to rough parity with Exchange 5.5 from an enterprise directory perspective, although as mentioned above the potential implications of the Directory Catalog in fueling their bottoms-up adoption model are serious

The most significant difference between our approaches in this space are our continued top-down only approach for email, and our strategic bet on NT5 AD. We are making a bet that NT5 succeeds, and that administrators will value the administrative savings that comes from having a single directory across the enterprise for network security, email, network resources, etc, with a single list of users, a single set of groups, and a single set of ACLs For corporations that ascribe to this centrally administered model, this will be a big win, and a corresponding win for Microsoft

Our NT5 approach will realistically prove to be both a strength and a weakness, however. In the near term, we expect NT5 to have a relatively slow sales ramp. By linking Platinum so closely to NT5, we are limiting our available market to only those customers that have chosen to deploy an NT5 backbone in their

[11] NAB was simply a scripted application built on a standard Notes database (in fact, all of Notes was built this way, including all of the messaging functionality). This was a cheap way to implement it quickly, but scaled extremely poorly, and had a truly miserable offline story

corporation. The real risk we face is that corporations build up a patchwork mail infrastructure using Domino servers while they debate about what their long-term strategic infrastructure should be. The danger is that at some point they may wake up and realize that what they've patched together is working "good enough" and they move on to other things.

Search

Both Microsoft and Lotus are making significant investments in search Lotus is making a large marketing push into "knowledge management" with Domino, which from an infrastructure perspective in R5 simply translates directly to search. High quality search is a critical part of an information management system, and the first step to building higher value services. The Intelligent Miner group, a spinoff of their research team now part of their database group, is taking a very sophisticated approach to content analysis that is highly reminiscent of their data mining roots. This engine is what IBM integrates into DB2, and it also appears to be what they're integrating into Domino. (This didn't make the cut for R5.0, however It appears to be targeted at R5.1) A detailed description of this engine can be found at that IBM web site at http://www.software.ibm.com/data/iminer/fortext/about.html (see also the internal competitive analysis at http://pkmweb). We won't drill into the engine specifics here except to point out differentiators, and instead will focus on the overall package they're delivering.

- IBM engine The switch to IBM's internal engine from Verity's OEM engine will give Lotus the ability to control their own destiny in this critical area, and allows them to add a full-featured text engine to Domino Verity had OEM'd them a somewhat crippled engine for previous versions of Domino, where the limitations presumably maintain some sell-up potential for the full-featured Verity product Significant engine differentiators relative to the current version of Tripoli include result clustering, auto-summarization, "fuzzy" (presumably soundex) searching, thesaurus expansion with customer-extensible thesaurus, and a more advanced query engine that may deliver more precise results. As mentioned above, this won't appear in Domino in R5.0.
- Verity filters. Domino R5 will include the full set of Verity document filters, allowing them to index the full text of attachments in the vast majority of file formats in common use today. In contrast, we will support Office documents, text files, HTML, and RTF only
- Domain Catalog. This is a crawler that indexes multiple Domino servers in a single domain and selected file shares in order to create a single catalog. This gives users the ability to run a single query that spans all servers in the domain. It doesn't support web crawling or other datatypes (databases, ERP, etc), but some of these can be reached after a fashion by first replicating the data to Domino through NotesPump. This feature supersets and replaces the 4.6 "search site database" feature, which allows searching across multiple databases on a given machine. This feature isn't available in beta2
- Domino Extended Search. DES is an add-on product for Domino 4.x and R5. This is actually a query broker, more analogous to the SQL7 DQP than a traditional search crawler. It allows sites to query across multiple heterogeneous indexed data sources, and collate the results together. Due to differences in underlying engines & relevancy ranks, things like precision, language support, access control, etc will be hard or impossible to get with this approach. As a result, we expect it to see limited use as a text query broker.
- Knowledge Server (post R5). Knowledge Server is a separate add-on application that sounds very similar to our PKM effort. It includes the ability to create a content taxonomy ("content mapping"), manual tagging ("profiling"), and automated classification to automatically place documents in the correct category. They will also apparently support "expertise location", which is a feature not supported by PKM. This is intended to allow users to find experts in a given area, by extracting and indexing user profile information from the directory, email messages, documents, and HR systems such as PeopleSoft.
- Performance. Lotus claims that full indexing is 5-10x faster than R4 6, and incremental indexing is 3-5x faster (note, indexing was widely considered to be extremely slow in R4.6, but without real measurements on R4 6 for comparison, it's hard to evaluate this claim)

Overall, we expect to be behind on core engine features when Lotus ships R5.1, but ahead in enterprise search functionality with Platinum & PKM

Overall, UI changes for search in R5B2 are mostly superficial, coming as part of the overall UI overhaul in the Notes client Instead of the previous search bar, there is now a magnifying glass icon that is always present in the client in the upper right hand corner This can both turn on a new search bar in a database view, but also fire off searches against Internet search engines

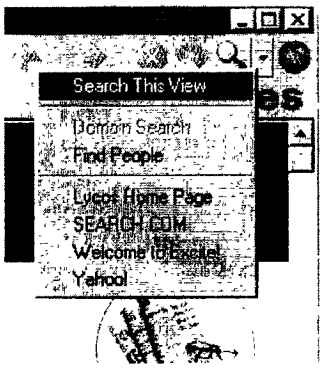

Figure 1: Search button

The new search bar, when expanded with options, is slightly different from the 4.6 client The almost prominent change is the addition of search "Conditions", including the ability to search by Date, Author, other Field, by Form, and by Multiple Words. You can also invoke the Search Builder, which can do any of the above Multiple Words is an option to enter several words, each in different input boxes, and either search for all or any of the words

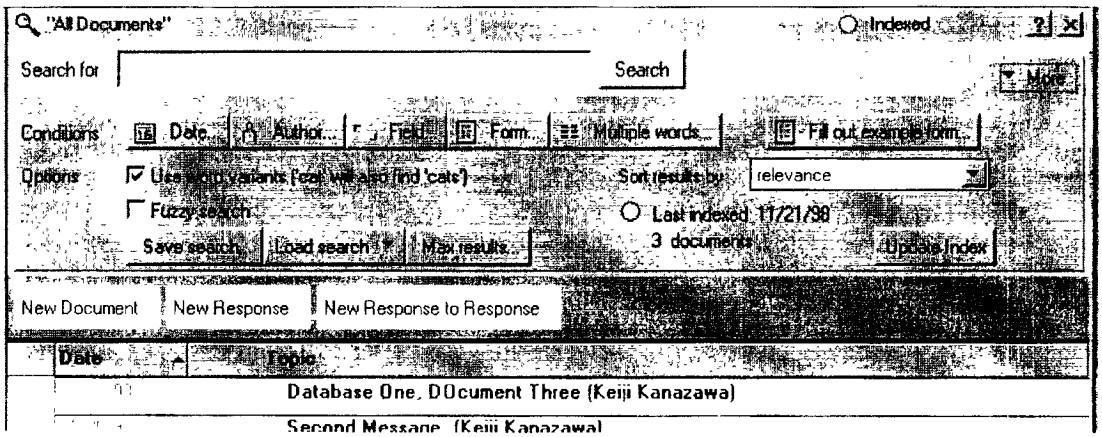

Figure 2: Search Bar Expanded with Options

Apart from that, it exposes word variants, the same as 4 6 However, it replaces thesaurus search in 4 6 with "fuzzy search" Fuzzy search seems to two things: (1) for a phrase, the ability to find phrases with the words possibly separated by other words (essentially a kind of proximity search) and (2) finding variant spellings Thesaurus as such is not exposed in the UI

Finally, it has the same save/load search and sorting options as before In sorting, it exposes two additional options, which weren't clear

As far as index creation and maintenance, the index tab in the database property sheet is exactly the same as before

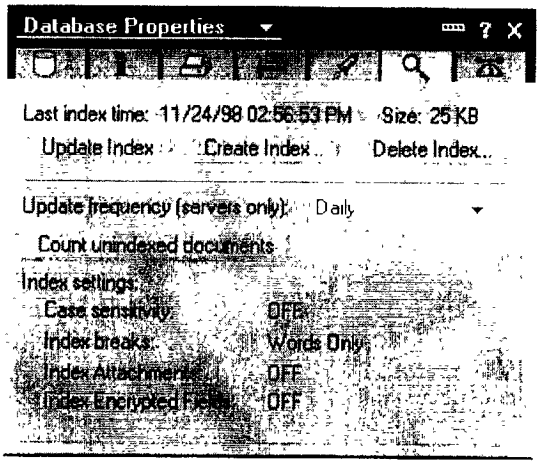

Figure 3: Database Index Property Tab

R5B2 includes a new feature called "Search Site" databases. I believe this was in B1. A Search Site database is a database that allows you to combine the search indexes of multiple other databases into a single index. This allows you to do a single search across multiple databases.

In order to use the Search Site database feature, you must configure each database to be included in the search site database to be available in search site databases. This is a checkbox in the design property sheet tab for the database

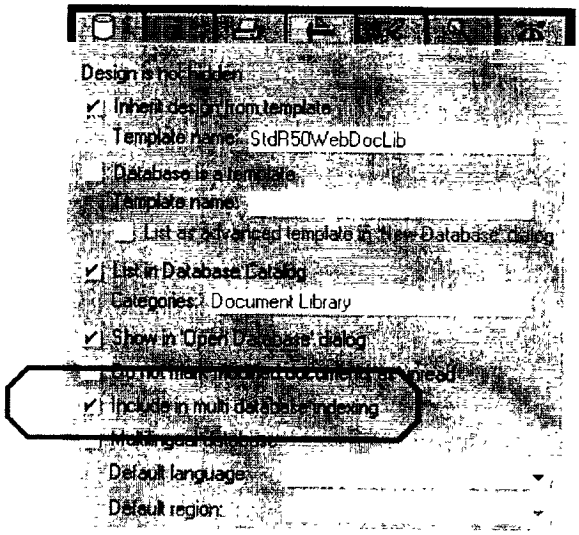

Figure 4: Include Database in multi-database indexing

In order to add a database to a search site database, you must have "XXX" rights on the search site database. At first, this was confusing and I had to read the documentation to figure this out. Once that's done, you add each target database as a "scope". To do a search across multiple databases, you have to invoke a special form in the search site database. You can't just create a regular search bar in the database. The UI feels a bit preliminary – you can't even hit Enter to invoke a search in the search form.

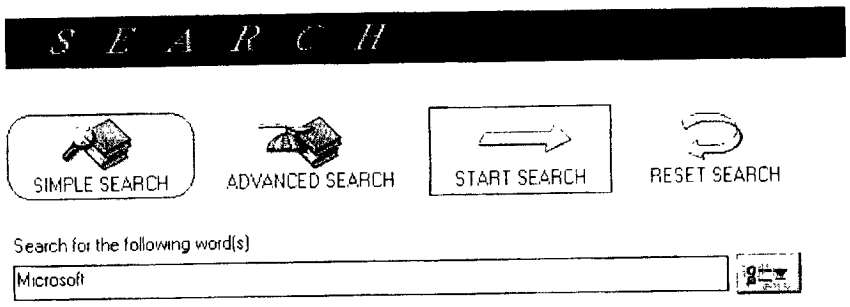

Figure 5: Search Site Query Page (called Private Searches)

Once you do a search, you get back a document that is a sequential list of Notes links to the matching documents As you can see, it is the standard clunky UI, but it seems even more clunky than usual – note that it's missing the titles of the search results – it only lists the database the search hit comes from.

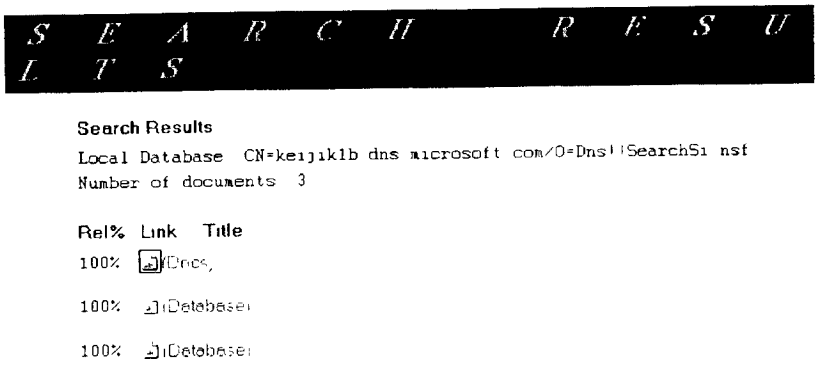

Figure 6: Search Site Search Results

Search Site databases combine the indexes of the target databases. It does not distribute queries to each database and merge the results. The documentation warns you to have plenty of disk space available when creating search site databases.

Clustering

Domino implemented a proprietary clustering scheme in R4.x that supported both failover and load balancing for Notes clients only (i.e. not web clients), though it supported only a subset of Notes services. In spite of their limitations, they have been using the load balancing ability aggressively in bids with R4.6 vs. Exchange 5.5, since we currently only support pairwise failover with WolfPack 1.0 (hot backup machine required, no load balancing, no more than 2 servers in a cluster). This gives them a large hardware cost advantage, since we need to literally double the number of servers for a "fault tolerant" 5.5 implementation while they only need 20-30% more. New features in R5

- Full Notes feature support for Notes clients. For Notes clients, they now support calendaring & scheduling as well as email using the same proprietary scheme used in R4.6. The R4 6 proprietary scheme was straightforward: user mailboxes and other databases would be replicated to multiple servers, and kept updated in close to real time. On failure, the user is immediately switched to the replica
- Internet Cluster Manager This allows them to deliver clustering for web users. ICM is an HTTP server that redirects requests based on knowledge of the Domino cluster configuration, server availability,

server load, and database placement on servers within a cluster. Multiple ICMs can be used, with DNS round robin. If a cluster of R5 servers is configured with an ICM, then URLs created by Domino reference the ICM rather than the local server (R4 servers won't do this, so once a user ends up on an R4 server they will stay there). ICM can also do link modification during the redirect to account for database placement at different virtual roots on different servers. ICM supports HTTP & HTTPS. Lotus didn't mention connection stickiness anywhere, so we expect maintaining server state & delivering high performance will be problematic.

Our solution in Platinum is to use Wolfpack 2.0 for load balancing and failover, but not to replicate the user mailbox data. This won't be as seamless as Domino's solution, since on failure the user has to wait for the client to timeout, the resource group failover period, the service start time on the other side, and the time to replay the transaction logs. This failover latency is on the order of 10 minutes for Platinum, while on the order of a second or two for Notes. We will likely have to move to a replicated mailbox model in a post-Platinum release.

Security

Security granularity and flexibility has been a traditional strength of Notes. In R5 they are doing a fair amount of work in PK to start to bring their proprietary system in line with current standards. This is a major undertaking that will play out over several releases. This includes

- SSLv3. R5 will support SSLv3 for connection-based security (Platinum will get this via IIS).
- x.509v3 certs (1024b keys). In addition to their proprietary Notes RSA certificates, they now allow sites to create and use standard x.509v3 certs for their users (this is something that Exchange introduced in 5.5 SP1). Note, until they support CDSA, their system is still essentially closed, despite the standard certificate support. (Notes, we were unable to get x.509v3 enrollment to work in beta2).
- S/MIME messages. This is actually a client feature – the Notes client will support S/MIME encrypted and signed messages. Outlook98 also supported S/MIME. This doesn't appear to be in beta2.
- Intel CDSA support Post-R5, Domino will conform to Intel's CDSA (Common Data Security Architecture, which is a cross-platform competitor to our CryptoAPI), which means that it exposes CSSM (Common Security Services Manager) to allow third party apps to use Notes PKI This is apparently a very large change, and will be staged over a couple releases.
- No key archival. R5 won't support key escrow, but instead offers administrators the ability to let users archive their user.id files, and use a secondary administrative password to decrypt them. Since this is an obvious security hole, they also offer sites the ability to use "missile-silo" style dual passwords (or even more than two). Exchange's Key Management Server offers both key archival and "missile-silo" style multiple passwords. The lack of key archival is a big hole for Domino, and is something that we can hit them hard on.
- Smart cards. They may support a PKCS-11 interface to their user.id file, to allow smart-card enabled apps to use the user.id as if it were a smart card. Post R5 they will support smart cards in place of the user.id file. NT5 supports smart cards, so Platinum should also get this support.

Domino still has a way to go to rationalize their security story. For instance, users are still created with proprietary Notes RSA certificates by default – creating an x.509 cert is a secondary operation that must be performed later. Users who wish to use SSL3 client authentication for web access must keep track of 2 certs and 3 passwords Finally, the security-oriented UI in Notes is confusing and inconsistent Overall, we will have an advantage in PK security in Platinum, and will bring security granularity/flexibility to rough parity with the following features:

- Item level ACLs. This is critical for document sharing and document management scenarios. the ability to set different ACLs on a per-file granularity
- Property (field) level ACLs. This is critical for a number of application scenarios, particularly workflow and to a lesser extent document management. the ability to set different ACLs on individual properties on an item

- Security roles. This is required for workflow and document management: the ability to create "roles" such as "approver" or "manager" that get expanded at runtime.

System management & administration

System management has been a major shortcoming of Domino for enterprise messaging scenarios. They've done a significant amount of work to bring them to parity with Exchange 5.5, and several areas will actually be ahead of Platinum. Since the tool is primarily a v1 effort, however, we suspect that a number of shortcomings will probably surface in real deployments.

R5 will be ahead of Platinum in the following areas:

- Message tracking.
- Monitoring.
- Reporting.
- Client coverage. In addition to the Win32 Domino Administrator UI, Notes R5 ships with a Web Admin panel, support for telnet/console commands, customizable/programmable views, and an API to access its Administration process[12]. Although the Platinum MMC administration console is more functional and usable than Notes R5, Platinum cannot boast the breadth of offerings that Notes provides. Obviously, this is a significant advantage in UNIX shops.
- System management programmability.

These are key areas where we have made very little investment in from 5.5 to Platinum and will provide Lotus with an advantage when we go head-to-head for a sale. It is imperative that we engage our strongest ISVs early in the cycle to build complementary offerings in these areas

R5 and Platinum will be at parity in:

- Bulk configuration.

Platinum will be ahead in:

- User management

The Win32 Administrative console seems very unstable so far This is not a production ready Beta from the system management perspective. In one four hour period the administrative workstation needed to be restarted four times due to fatal crashes (hangs and asserts) In addition, the following was observed: 1) web admin for configurations is read only, 2) message tracking was not functional, and 3) topological messaging UI was not functional.

Deployment

Lotus has migrated their setup technology to InstallShield wizard. In general, the process of installing and setting up servers is fairly straightforward. Like any enterprise deployment, careful planning of user servers, hub servers, routing, and hierarchical naming scheme are critical to success.

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[12] In the R5 reviewer's guide, Lotus claims that they'll provide an MMC based console "when NT5 ships" Given what we know about MMC development, and given the current R5 Win32 UI, we expect it to be quite some time before they can deliver an equivalent console. We need to leverage our tight integration with W2K and Active Directory early on.

Not much time has been spent investigating deployment

Administration Console

In previous releases, the administration interface was simply a number of Notes databases & templates spread out in a somewhat haphazard way, and with limited functionality. Now, they've created a full-featured standalone console with a reasonably good UI that supports server configuration, live status monitoring, and statistical/log summaries. Notes provides system management through a Win32 UI, console commands, or via the Web Administration panel. The Web panel is not fully polished but it's fairly functional.

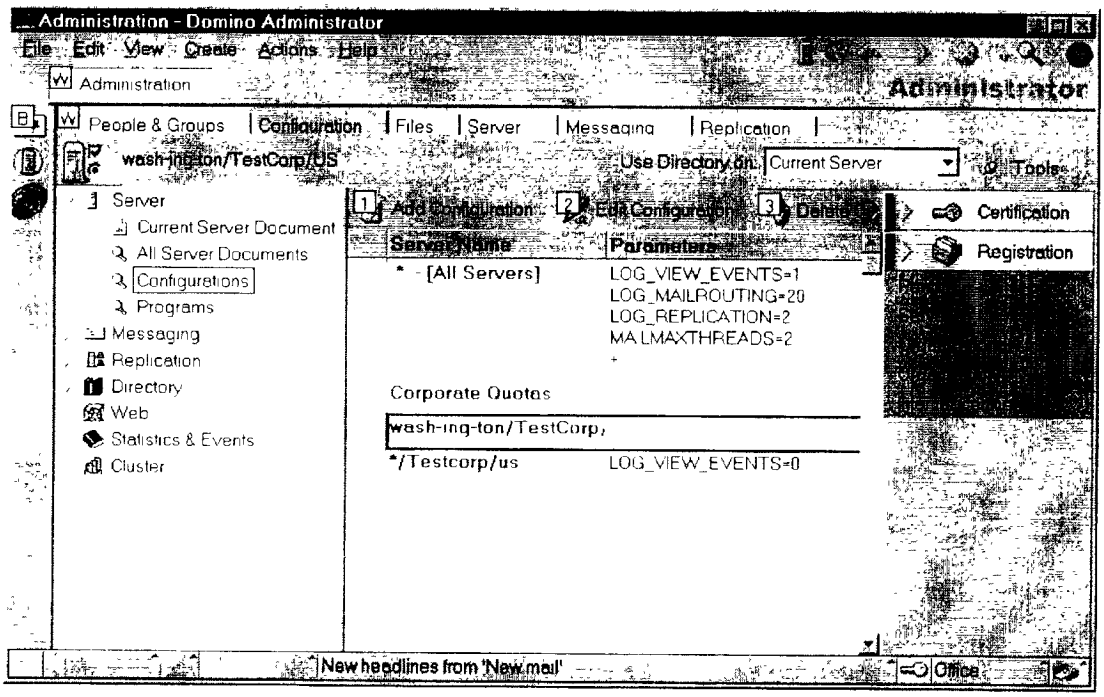


Figure 7: The R5 Administration client

Interestingly enough, the Notes R5 Win32 UI is quite similar in its model to Platinum, although the UI looks quite different. They subscribe to the left-hand scope pane (the tree), a right-hand result pane, and right-click driven actions and properties. Beyond this, Lotus has included a third far right-hand pane that enumerates all the available tasks/tools, an idea that we toyed with, but rejected, for Platinum MMC. The oddest part of their UI is the multi-level tab metaphor that controls the scope of the entire UI. It's difficult to see how they would migrate this to MMC.

Another similarity to Platinum in the Admin model is in the grouping of tasks. We could make the comparison that the following Notes R5 groups map to the Platinum snap-ins as described below:

Notes R5	Platinum
People and Groups	DS Manager snap-in
Servers	Servers snap-in
Messaging	Routing snap-in
Configuration	Policies snap-in

User Management

When Platinum ships, we will have a significant advantage over Lotus in our tight integration with the W2K DS Manager for User/Group/Contact management for customers who have chosen to deploy the Active Directory However, given the extensibility of the Active Directory and display specifier technology for UI extensions, it may not take Lotus long to catch up. Even when compared to 5.5, Exchange is slightly richer in the per-user features that are exposed than Notes (such as delivery restrictions, send on behalf of, alternate recipients, and protocol configuration).

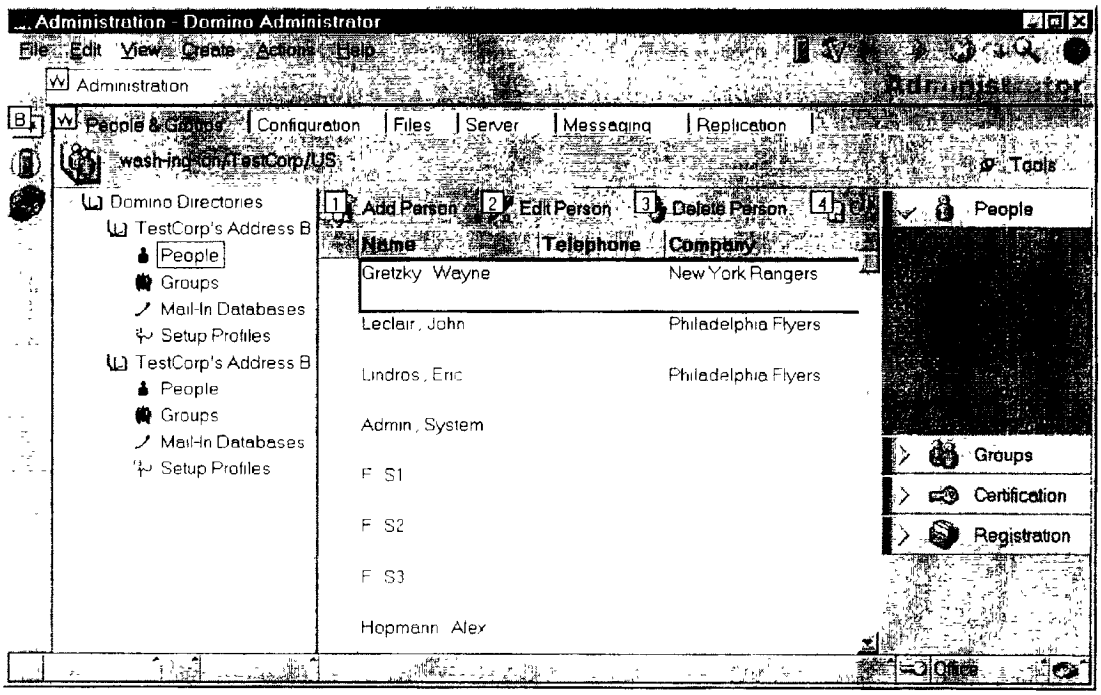


Figure 8: R5 User management

Both Notes R5 and 5 5 support integration with the NT4 user manager in order to create and associate NT user accounts with mailboxes. Notes R5 supports uniqueness checking on email addresses, but only enables a check after the fact. Exchange 5 5 and Platinum provide an automatic generation of unique addresses for the organization

Notes R5 now supports per-user limits on mailbox size This is something that Exchange has had for several releases R4 6 had a very limited version of this, but they didn't actually enforce preventing users from sending new mail when their mailboxes were full, and didn't work with the "shared mail" single-instancing. Notes R5 now brings them in line with 5 5, although Exchange has a richer set of functionality in this area

Server Management

Servers are the main unit of administration Each server has a server document that contains all the configuration settings for that server Notes R5 exposes a very rich set of information here, including security settings, configuration for all of the tasks running on the server (typically, we store this information in the registry and do not expose it in our UI), protocols, transactional logging, and MTAs (although native SMTP routing is configured outside the context of the server , see Messaging Management section)

In terms of information available to configure on servers. Notes R5 is roughly equivalent to 5 5 and Platinum However, our UI console tends to lean more towards simplicity and usability and certainly is more professional looking.

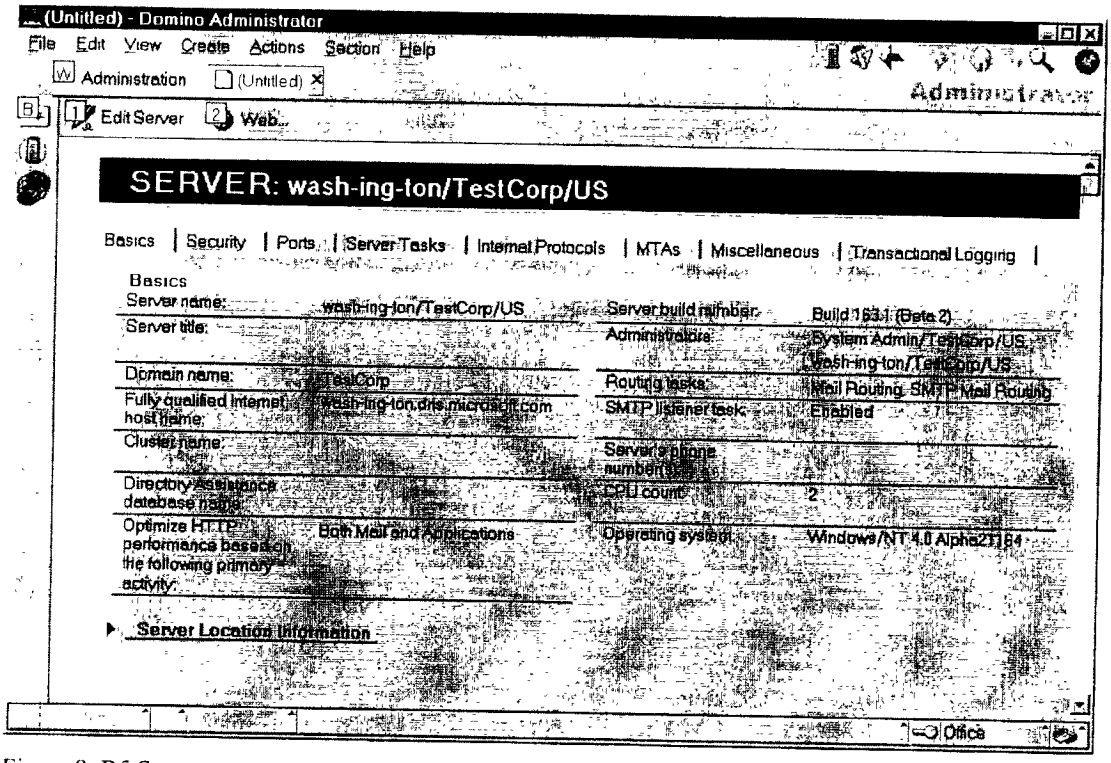


Figure 9: R5 Server management

Messaging Management

Messaging management is called out separately in the Notes R5 UI under the "Messaging " page Here one can manage the "mail users" in a given domain, view a topological layout of the routing system (although this is non-functional in the Beta), view the contents of the incoming mailbox file for the server "mail box", and view routing status and events

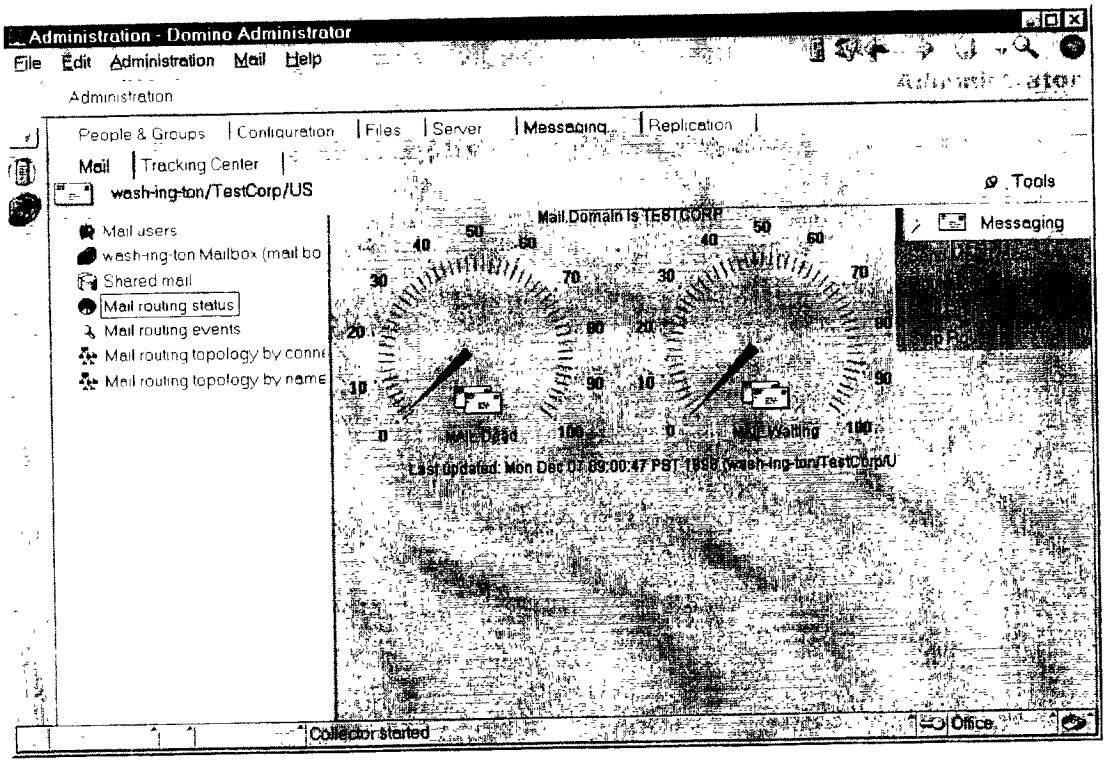


Figure 10: R5 Mail management

Bulk Configuration

They have a flexible way to set "configurations" (similar to our Platinum "policies"), or common settings across groups of servers based on the hierarchical configuration of their network. Nearly every setting can be applied across a group of servers, such as routing, SMTP settings, and replication at a particular point in the hierarchy. This is true, simply because, beyond their basic set of property tabs (Basic, LDAP, Router/SMTP, and MIME) they provide "raw" access to set any value in the Notes.ini file. In 5.5, bulk settings can be applied at the Site and Server level for store, protocols, and the ExDS. In Platinum, we'll be providing store and protocol policies that admin will apply in bulk across an arbitrary number of objects.

Their "Administrative Task" applies the configuration settings to the particular server at the configured polling interval. In 5.5, our bulk settings were inherited at run time by the service looking up the setting (such as Store). In Platinum, admin will apply the bulk change inline with the administrative experience.

Although their bulk configuration story is flexible, the Exchange 5.5 Site paradigm, although limiting in some respects, helps customers understand the product better and organize their own administrative model without a lot of training. In Platinum, we'll go halfway and provide much more flexibility in how we allow servers to be grouped and settings to be bulk applied, but we'll provide the safety and comfort of grouping servers into "Administrative Groups".

Monitoring and Reporting

Clearly Notes R5 is ahead of Exchange in this area, comparing against both 5.5 and Platinum. They provide an integrated set of tools under the "Server" page that includes:

- Service "Status" monitoring for the current server (similar to Windows 2000 Service Control Manager)
- Viewing of all the raw event files (Routing, NNTP, Store, etc.) on the "Analysis" page
- A graphical status of all servers via the "Monitoring" page
- A raw list of all the statistical information on the "Statistics" page

While most of this type of information would be available on a Platinum/Win2000 machine, it is scattered amongst various locations and Admin tools. For instance:

- Monitoring of services can be performed in the W2K Service Control Manager or in the Platinum Server Monitor.
- Viewing of event files can be done in the W2K event viewer
- A graphical representation of a group of servers can be constructed within the Platinum Server Monitor.
- Statistical information can be collected from perfmon counters and through the tracking.log information, although Exchange does not provide a simple way to view or summarize this data

Given the configurability in MMC, it would be possible in Platinum to create a console that would pull together Exchange Monitors and W2K Computer Manager to get all this functionality in one place. We just need to ensure that we validate and document these scenarios In addition, we need to work aggressively with third party vendors who can build comprehensive monitoring and reporting add-ons.

Message Tracking

Message tracking allows administrators to troubleshoot failed deliveries by analyzing the log files and discovering the exact disposition of a given message. Domino R5 adds this feature, and actually goes beyond Exchange in two ways: they allow end-users as well as administrators to track messages, and they import logs into a server-side database for higher performance queries (we currently grovel the logs at runtime, since this is a relatively infrequent operation). Given the limited enhancements we'll be providing in Platinum, Notes R5 is ahead of us in this area.

Message tracking did not seem to be functional in this release of the Beta.

System Management Platform

This is still one of Notes' key strengths over Exchange. While we have made vast improvements in our scriptable and programmable management platform story in Platinum with ADSI and EMO, Lotus is still in the lead. To build management applications for Notes typically involves using LotusScript to build views on data and calling Administrative API functions. On the other hand, even in Platinum, the Exchange story is very diverse To build custom management tools and UI requires several or more of the following:

- EMO/CDO
- ADSI/LDAP
- Active Directory display specifiers
- MMC

Remote Admin/Web Admin

Although our customers tell us that this aspect of system management is less important than many other areas, Notes R5 can safely check off "web admin" on their list of features Exchange 5.5 and Platinum cannot. The major concern here is with reviewers and the press, rather than real life scenarios Certainly with our

EMO infrastructure, we enable web admin for some of the key user and public folder management scenarios. We need to evangelize the Terminal Server product, which ships as a component of W2K, as our key cross-platform administration solution. Over time, Microsoft and third party developers will build browser ready applications for Platinum management based on EMO and ADSI.

Our best defense against reviewers (and customers) is to evangelize the trade-offs that we made against web admin, including tight integration with Active Directory, policies to lower cost of ownership and operation, and the EMO platform

All of the "configurations" data available via the web console seems to be read only in this Beta. However, it's displayed in a way that indicates it will be fully functional in the final product

Connectivity & Migration

Messaging connectivity & migration is an area that Lotus is just beginning to realize the importance of as they ramp up their enterprise email sophistication. This is a critical issue for customers, since almost every company has one or more systems that they're migrating away from as they upgrade to a modern messaging infrastructure. As a result, this area has been a major competitive advantage for Exchange, and has helped win in many competitive bidding situations – and since many of these old systems have Euro and Y2K issues, having a complete story is particularly critical now and over the next 6-12 months. Lotus has been reliant on a patchwork of third parties for the bulk of their solutions in this space apart from their own products (cc:Mail and host systems). To address this weakness, Lotus has licensed a fairly comprehensive set of tools from BinaryTree Software. Lotus has begun to integrate these tools, which primarily migrate data to and from LAN-based messaging systems and directories, into the R5 Administration client. Even with these tools, R5 will be behind Exchange in Migration, and even further behind in Connectivity The table below gives an overview:

	Exchange	R5
Connectivity	MS Mail Quarterdeck (Mac Mail) Lotus cc:Mail Lotus Notes Novell GroupWise (in progress) OfficeVision/VM (PROFS) SNADS-compliant systems. OfficeVision/MVS OfficeVision/400 Verimation MEMO Fischer TAO NBS TOSS Software AG CON-NECT SMTP X.4000	cc:Mail SMTP OfficeVision (via SSW) SNADS systems (via SSW) X.400 ?
Migration	MS Mail Lotus cc:Mail Lotus Notes Lotus Organizer Netscape Collabra Novell GroupWise OfficeVision/VM 0PROFS) Verimation MEMO Digital ALL-IN-1 IMAP post offices LDAPdirectories	cc:Mail MS Mail Exchange GroupWise (via BinaryTree) LDIF OfficeVision (via IBM) NT Domains

Domino R5 supports the following connectors and migrators – these are functional and have mostly been integrated with the User Registration control component of the Domino Administrator application :

- cc:Mail Lotus cc:Mail has the biggest installed base of the obsolete messaging systems (approximately 14M users – about 9M of these must migrate from R5 and earlier, which is not Y2K compliant), and due to Lotus' miscues it has been a hotly contested area Until recently Lotus has had a relatively poor upgrade story from both a technology and pricing perspective, and has repeatedly angered this group. Analysts estimate that as a result 50% or more of them have migrated to Exchange rather than Notes. Lotus is now roughly comparable in ease of use and feature set to Exchange in both connectivity and migration. The cc:Mail MTA and migrator support all releases of cc:Mail, both will ship with R5 and the latter is integrated in the User Registration tool.
- MS-Mail. MS-Mail has the third largest installed base (about 6.5M). Lotus has supported migration and connectivity from MS-Mail for some time, but it has had a poor reputation for reliability and fidelity. Until now it has been an administrative tool rather than a user-runnable tool – the BinaryTree importer has been integrated in the User Registration tool for R5. Lotus expects customers to use SMTP for mail connectivity or third parties for messaging and directory synchronization.
- Exchange. Migration from Exchange is functional in Beta 2, with a few notable bugs. An accompanying IBM RedBook refers to our Exchange-Notes connector for connectivity and directory synchronization
- OfficeVision. Lotus has a fairly complete solution for their mainframe-based systems, as expected. The approach they've taken has a lot of code running on the mainframe side, which has proven to be unpopular with customers due to administrability & maintenance concerns. This migrator is not included in R5 and is available separately from IBM/Lotus.
- NT Domains. An NT directory importer has been added to create Notes mailboxes and groups for corresponding NT domain accounts and groups. The client-based import tool makes it easy to create user accounts for mail and collaboration on any Domino server, regardless of platform.
- LDIF. Lotus is positioning Domino as a highly scalable directory server, and support for LDIF files allows for migration of any other directory that provides an LDAP interface.
- Soft-Switch: Although not directly integrated with Domino, Soft-Switch Central and LMS are the incumbent message switching products in many Fortune 500 accounts, and fill the connectivity gaps left by Domino. However, these products have some major drawbacks. Central runs on mainframes under the MVS or VM operating systems and is consequently expensive to operate and maintain. Older versions are not Y2K compliant. LMS has never received wide customer acceptance due to its reliance on Data General hardware (later versions are available on IBM RS/6000 as well). It is also notoriously difficult to configure and manage. Both products rely on "outboard" gateways, usually running on PCs, attached to the main switch for connectivity to LAN-based systems. Finally, the Soft-Switch organization is now focused primarily on providing messaging and migration services rather than new product development. By contrast, Exchange can now function as a message switch and is able to displace Soft-Switch products in many competitive situations due to our ability to provide broad connectivity integrated on a single commodity hardware platform

Lotus had pre-announced support for server-based "background" migrations, via enhancements to the AdminP API. (This functionality is not available in Beta 2)

In addition to complete connectivity & migration for the list above, Exchange supports the following systems:

- GroupWise. This is the second largest installed base of the "legacy" mail systems, at 8M users. Until recently, many customers perceived Novell to be in danger of going out of business, and as a result were beating down the door to get off that platform. Recently, however, NDS 5 0 has given Novell a shot in the arm, and their installed base has become less anxious.
- Netscape Collabra.
- Quarterdeck (Mac Mail).
- DEC All-in-one.
- Verimation Memo

In addition to the breadth of coverage, we've had an advantage in integration and reliability. All our connectors run on NT, are managed through the same admin interface, and use perfmon/NT events.

Performance

We don't yet have any measurements of R5, so we don't have hard numbers to confirm or refute their claims, or to compare R5 directly to Platinum. Lotus claims an overall increase of 2-4x in users/server from 4.6.x, to a goal of 10,000 active, concurrent users/server on their "NotesBench" benchmark. Unfortunately, these benchmarks are pretty much worthless for us to use for direct comparisons. We have our own benchmark – "loadsim" – for which we currently claim 10,000 "loadsim medium" users/server for Exchange 5.5. Unfortunately, in addition to the fact that these benchmarks aren't directly comparable, there is a huge discrepancy between numbers claimed in these benchmark battles and what real users would want to deploy. As a result, we have to run our own tests to get apples-apples comparisons This performance testing is in process.

We expect to maintain an advantage in overall performance due to the very tight optimization we're doing for NT: our IFS work in the store, asynchronous I/O and completion ports, highly tuned disk operations, tight IIS optimization, and much more. Given Domino's broad cross-platform focus, the amount of optimization they can do for any individual platform is significantly reduced.

Development Environment

The single biggest issue that we need to address is our development environment – at this point Microsoft isn't even in the right ballpark, much less playing the same game. Today, none of our mainstream developer tools are even aware of Exchange's existence as an application platform. The only tool that can develop applications against Exchange right now is the forms editor built into Outlook, which creates forms[3] forms for messaging and collaborative scenarios. It is designed for a relatively unsophisticated developer, and has no concept of HTML forms, web deployment, debugging, or any server-side code – the resulting applications are client-side forms that require Outlook as a runtime. In Lotus' words *"Applications are similarly complex Outlook applications use Outlook, while Web applications use IE Outlook itself is at risk of joining the Exchange client as obsolete technology, as Microsoft has clearly declared IE as its long-term strategic client."* In contrast, Lotus is shipping a developer tool in the same box as their server that is tightly integrated with the server programming environment, and that can create and manage both forms and full 3-tier applications as a single entity. Their comments on our integration are equally telling (and also reasonably accurate): *"Consider Microsoft's model, where an application has to be developed both in Outlook forms and in IIS Active Server Pages to offer a similar capability The cost and complexity of maintaining two separate code streams is prohibitive and in practice doesn't happen "* Our own James Utzschneider (ADCU) had the following comment after developing a series of applications for the September BizApps conference:

> *Our proposal routing application required developers to master 3 object models (Exchange's CDO, the Outlook Object Model, and the MTS services in the LOB track) There was no easy way in Exchange to debug whether a route through the workflow had actually succeeded. There is no easy way in Exchange to deploy the public folder scripts we wrote The route addresses had to be hard-coded into the Outlook form. (Users had to click on a 50 character string to see the form) This app took 3 developers a month to develop An experienced Notes developer on our team claims that he could have built the app in Notes by himself in well under a week*

We are currently working with both our Access and Visual Studio teams to put together a solid plan for Platinum-aware tools, but we don't expect this to come together in a real way until Office10/Visual Studio 7.

In general, there are four classes of users that need to develop applications that run against Exchange: departmental experts, IT professionals, solution providers, and professional ISVs. In order to provide a solution across the range of applications these groups want to create, it's clearly key for us to have a range of tool and template support. This ranges from simple "no-code" Office templates for Excel, through templates and controls built into Access, to advanced application and debugging support in VI/VB and VC/VJ[13]. Interestingly, Lotus' new emphasis on higher end development needs may give us an opening at the lower end of the spectrum – but we need to get solidly into the applications development game before setting excessive expectations here.

Lotus has made two big changes in R5: they've significantly narrowed the distinction between apps developed for the Notes client and those targeted at a web browser, and significantly increased their Java support. This enables many apps to run either standalone in a browser or in the Notes client, meeting the primary mandate from most customers: "you can do some added value things in the proprietary client, but you must allow me to deliver core functionality to all users with a browser, and that same app must be able to run in your client". On the server side, they've integrated a Java runtime environment, and added CORBA/IIOP for client remoting. (Over time, IIOP will replace the NotesRPC calls that their custom client makes). From a marketing perspective, they've started to position the development tool as a more of a "standalone" tool rather than a high end version of the end user runtime. Since the basic architecture still hasn't changed (it's still built on the same basic runtime), this appears to be designed to justify the 10x price premium for Designer more than anything else.

The R5 Reviewer's Guide describes the goals of the Domino Designer[14] as:

1. Intuitive, open environment for developers
2. Choice of development tools
3. Easy access to enterprise data & applications
4 Mixed-client application support
5. Industry standards support

The Designer is available on same platforms as the Notes client (Windows 95/98, Windows NT4 for Intel, Mac PowerPC 7 6, 8 1)

One of the big advantage of Notes/Domino development environment has been its offline story: they have a symmetrical client & server store, strong replication, and a symmetrical scripting environment & object model. Note, as Lotus starts to push more of a 3-tier model with a significant amount of logic on the middle (server) tier, they will lose some of this symmetry. A second major advantage has been the templates they ship with Domino and the packaged apps they sell separately (see Packaged applications & templates below).

See also *enterprise connectivity* and *templates & applications*, below

New for R5

This is a list of new features from the R5 preview Web site

R5 Feature	Delivery of that feature in Beta 2	Comparison to Microsoft

[13] See the *Exchange Application Taxonomy & Scenarios* paper for a description of the various developer audiences and the Exchange-based application scenarios that they're trying to address

[14] Their naming changes over the last several releases parallels their broader adoption of the web. Domino originally started out as a simple HTTP stack and ADO-like connector to the Notes Server for web access. Both Domino and Notes coexisted as separate server brands Now, they've renamed the entire server Domino to capture its web connotations, and retained the Notes brand only for the proprietary client (which is becoming more and more like a browser) In a similar vein, they've changed name of the developer tool from "Notes Designer" to "Notes Designer for Domino" to "Domino Designer" in R5

A stand-alone and redesigned integrated development environement(IDE)	As above, this is mostly a marketing feature. The IDE still runs atop Notes client.	Microsoft's standalone tools are arguably better, but Notes has a huge advantage of single focus & integration with the client & server. MS has Outlook Forms^3 for thick client forms, Visual Studio for thin client forms, Access for Data Access Pages, and FrontPage for HTML pages. Only Outlook works well against Exchange today.
Improved programmability	Java and JavaScript are both enabled. Debugging all languages is still a weakness, most noticeably in Java, where Designer has no debugging facility.	
Outlines		
Pages	Page designer is roughly the same as the Forms designer, with all the good and bad that entails.	
Framesets	Fully functional frame designer. Several bugs around scroll bar functionality (same as b1).	Slightly different model for frame design than FrontPage, but seems fairly consistent with the rest of Designer
Resources	Provides easy access and manageability for a wide variety of resources, including Java applets, images, etc.	I'm not familiar with anything in a MS tool that has this. VS does manage some items but doesn't keep track of images for instance, but there is no central location for resources.
Better support for images and imagemap editing on documents and forms	Several different types of hotspots, although a "link" hotspot is nothing more than a hyperlink.	Pop-up text hotspot is a really nice feature that we don't have I'm sure you could do this, but it isn't as simple in our Web tools.
Improved styles		
Improved table support	4 types of tables: ▪ Standard HTML table ▪ Show as tabs (each row appears as a different tab page) ▪ Timed (shows a different row every 2[why this number?] seconds. ▪ Bound to field data	Only FrontPage supports tables.
Design Synopsis	Gives the author control over a report of what is in the design of the database. This is a very cool feature! One example: you can have a synopsis that tells you how much LotusScript code is in the database design. This would give an author a good indication of how much will need to be reworked to move it to the Web.	I've not seen anything like this in our tools

Tools

The primary development tool for Domino R5 applications is the Lotus Domino Designer client, a beefed up version of the standard Notes client that includes tools for creating and debugging applications (which Notes refers to as databases) The most interesting new features in this release reflect the evolution of Notes from a messaging-based application model to a generalized Web application server. This release has a few enhancements to existing features, but the bulk of the new features are squarely targeted at Web based developers. These include a new Outline designer for creating navigational elements, a frameset editor, an WYSIWYG HTML page designer, a new DOM based object model for Domino forms, and the addition of JavaScript support.

The other major development with the R5 release is the introduction of their Domino Enterprise Connection Services (DECS) that improves the ability to create Domino applications that integrate with existing relational databases. DECS is the foundation of the Domino Enterprise Integration push and makes R5 a credible Web Application Server. DECS is set of extensions to the R5 server along with some wizards and tools that makes it simple to create apps that are directly bound to relational databases. This is a huge step forward for them in terms of connecting to existing relational data. You can still do it the old way programmatically through their LotusScript classes but that remains programmatically difficult. It used to be completely impractical to use Notes as a middle-tier between thin clients and relational databases, but with this turn of the crank they've arguably made it not only practical, but easy.

Designer is simply a high-end version of the standard Notes client that allows developers to create, modify, and debug Domino databases (nsf) To create a new application, you boot the designer, create a new database (ususally based on one of their fully functional built-in templates), create the user interface, write and debug code, etc.

IDE

The Designer IDE is a fat Win32 client that is based on the traditional Notes client. Menu structure, buttons, and other UI widgets nave a similar look and feel to the SmartSuite desktop applications.

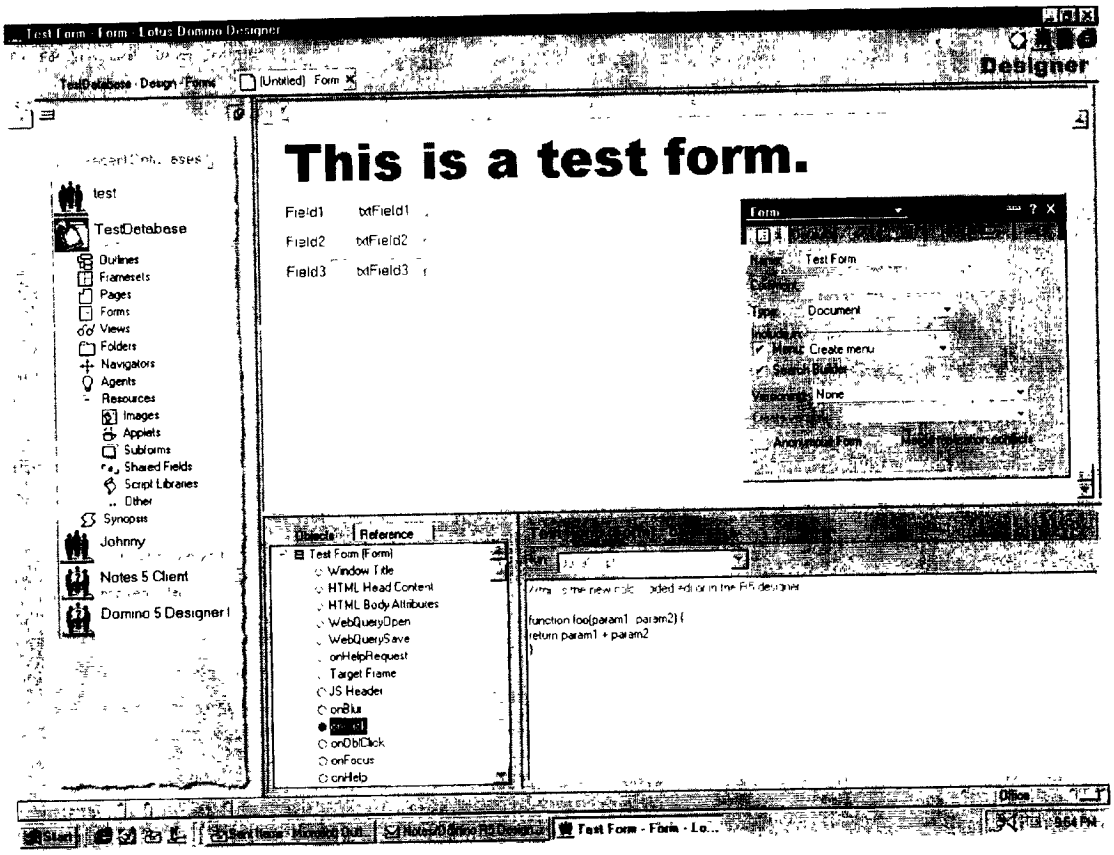


Figure 11: The R5 Designer

The IDE contains a full set of features for manipulting and managing application resources, visually creating UI, manipulating properties of various design elements (Property Window), inspecting object models, and an enhanced color coded source code editor (support for Notes Formula langage, LotusScript, and JavaScript.) The new code window includes some basic real-time sytax checking, but very little else in terms of coding productivity tools

HTML Design Tools

R5 applications can now natively host HTML pages and the Designer includes a new, but limited, set of WYSIWYG html editing tools. Support for HTML creation is limited, but arguably sufficient, for creating decent, pure HTML applications The tools don't hold a candle to dedicated HTML authoring tools like FrontPage, but work well for basic tasks (manipulating images, HTML tables, etc) Noticably absent from the HTML arsenal are tools for working with HTML forms -- Pages are treated like standard Domino forms but cannot contain any form elements.

The native HTML authoring environment has a basic HTML 4.0 level of functionality - the richness is on par with the triedit control found in Outlook. Features in the Notes HTML authoring environment include.

- Basic text editing (bold, italic, etc)
- Frameset creation and in-place editing
- Image map editing
- Improved table support (now supports nesting)
- Absolute positioning of graphics (using tables)

- Preview in browser

An HTML front end for a Notes database can contain multiple pages with both content submission form areas and database queries (views) When using the Notes HTML editor the queries are inserted as canned java applets The applets provide rich filtering and column sorting of the records in the database

Notes does not provide any standard site management tools like link fixup, native HTML preservation, external link reporting or publishing options. There are some project management features though where Notes provides some unique functionality:

Automatic site map creation - Given a multi-page site, Notes allows you to create a hierarchical tree structure of all the links and elements in the site These site maps, called "outlines," are not traditional site maps as the linking can point to more than just pages in the site. Individual links can be called out for images or even views on the Notes database. The site map is a java applet most commonly displayed in a frameset.

Project Analysis – There is a tool called the "Design Synopsis" that summarizes all the pages, images, forms, and scripts in the project.

Lotus recently announced FrontPage support for authoring and managing the HTML front end to a Domino app Native FrontPage editing and site management functionality are used as normal in this case. Pages can be created that submit data to Domino by using either a databound DTC or the standard wysiwyg forms creation tools. The FrontPage forms submission dialog is then pointed not at the FrontPage/Office server extensions but rather at the .nsf file with a parameterized query Views and database queries are done in a similar manner using DTC's When the site is ready to be staged it is sent via FTP to the Domino server and it behaves as would a normal FrontPage site

Productivity Tools / Templates

The biggest productivity boon for Notes developers continues to be their pre-defined, fully functional application templates Most (something on the order of 60%) Domino applications currently in production are based on either their Doc Library or Discussion templates I was able to install the client and create an fully functional document library application in less than 1 hour, with very limited knowlege of how I was "supposed" to do it The bulk of development time is spent in cutomizing UI elements, adding a few additional views and forms and necessary, etc Using the Designer and the Templates together makes it very, very easy to crank out basic Domino applications very quickly

See "*built-in templates*" below for more information

Inheritance

Domino allows application designers to bind various elements of the application to central templates This is not a full inheritance/containership model, but it does provide useful functionality Changes to the central template are pushed down to child applications

Language Support

Designing Domino applications involves writing code in at least two of three languages Apps with any significant functionality will require development in all three:

- Lotus Formula Language: @Sum, etc Primarily used for computed fields, etc
- LotusScript VBScript clone language, with a rich library of LotusScript classes to pull from Used primarily for event handling and server-side agents

- JavaScript: new in R5, can be used selectively for UI logic, occasionally on the server. Very useful for creating smart browser-based domino apps.

The biggest problem with their language picture is that it is difficult to know where the code is running, and this makes creating combination Notes/Browser applications very difficult Business logic (such as form validation logic) often needs to be implemented redundantly in forms that are expected to run as both Notes apps and through the browser

Debugging Support

Not directly integrated into the development environment, but they do have a useful LotusScript debugging tool that supports breakpoints, step-through debugging, variable watches, etc I have read that the dubugger will also work for JavaScript debugging, but have not figured out how to get this to work.

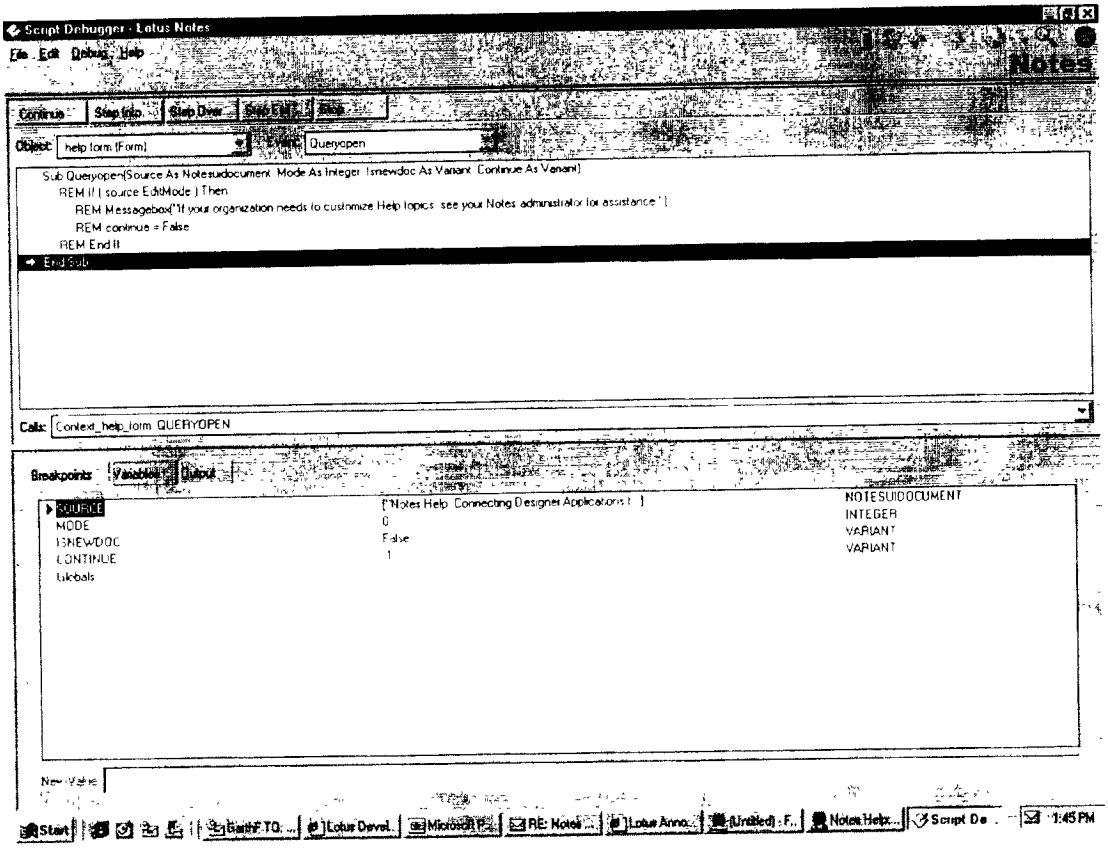


Figure 12: The R5 debugger

Notes proprietary client

Several things still require the Notes proprietary client, such as offline use, client-side encryption, multiple databases, and a number of Notes-only controls such as time/date picker controls. The Notes client still uses Notes RPC to connect to the server

Offline Applications vs Web apps

One of the greatest strengths of Domino based applications is the ability to syncronize with the server and take the application off-line. As the center of cravity for the server shifts towards the Web Application Server model, they are starting to introduce some serious complexity into the development process. Many of the features in this release are intended to make Designer a great tool for Web app development, but many of them do not work seamlessly in the off-line case. Desinging apps that are intended to be run both off-line and through the browser requires lots of logic to detect the state of the application and then selectively enable or disable portions of the application UI and logic.

Domino as a Workflow Development platform vs. Designer As Web Development Tool

One of the strongest impressions I got while working with the tool was confusion They have made great progress in trying to unify the Web and Workflow models, but there's lots of work left to do in this space If you work within a very narrowly constrained box it is, in fact, possible to create applications that work great in both the fat Notes client (and can be taken off-line) and through the browser, but building complex apps that work well in both worlds requires a lot of knowledge and additional work on the part of the developer. They've got a stong legacy in the former world and are working to leverage that in the new web-based world, but they are far from being a world-class Web app development tool.

So far, Notes 5 Beta 2 appears to add no major new "workflow" features, beyond the simple ones already supported in Notes 4.x "Workflow" apps in Notes are still simplistic form/document routing applications that automatically send notifications & doclinks to a sequential or parallel list of approvers Almost all of the "workflow logic" -- the code that manages changes to document state fields, determines the next participant, and sends the notifications -- lives in client-side forms code In some sample app templates (Notes Approval Cycle) this code lives in a *SharedWorkflowLibrary* script library, but in most cases customers roll their own forms code, or in the case of Business Partners, have their own "toolboxes" of templates & libraries Server-side logic for these apps is generally limited to "housekeeping" agents that periodically detect expired documents & send reminders

The 5 0 Designer tool provides additional features for making this class of apps 1) work better for browser clients, and 2) better utilize Java as a server programming language Browser clients now get their own Java widgets rather than just pure HTML -- for example they now provide a Java applet version of the Action Bar UI element This is used in many WF apps to provide "approve/reject" style action buttons Server-side agent code can now be written in Java, and they provide a *JavaRunner* database/utility, which allows you to hook event-triggered Notes Java Agents up to a standard Java dev environment, such as Sun JDK, IBM Vis Age, etc This way the Agent is run "in the context" of a Notes application, but you can use standard debugging tools

Notes Forms continue to have an advantage over any specific MS forms package (Outlook, Access, ASP, etc), esp for the purpose of building workflow applications

- Built-in support for Digital Signatures on any field (but still not available in the browser, as far as I could determine w/ Beta 2)
- tight integration between form UI and Security Roles -ie, `hide this field when: not (IsMemberOfRole(CurrentUser, "Approvers"))`
- Easy to set/manipulate document ACLs (*`CurrentDoc.Readers = "West Sales Region Group"`*)
- trivially easy to create/manipulate/email URL to any specific document
- symmetrical client/server API, obj model, language support, etc

Domino Enterprise Connection Services (DECS)

In the same way that we are far ahead of Lotus in messaging and thus focused on and solving issues that they aren't even aware of, Lotus is far ahead of us as an application platform, and is thus solving issues that we're not focused on. Database and ERP connectivity is a prime example of this. We are working on a minimal SQL7-only bidirectional data pump for Platinum, and have no connectivity to any other data sources In contrast, Domino has a rich and growing set of database & ERP connectivity tools, both in the box and available as add-ons Domino R5 will support the following

- Domino Enterprise Connection Services DECS ships in the box with R5, and provides live read and write access to data stored in a variety of databases, loosely ADO for Domino but with many native drivers. Originally this was part of NotesPump 2 5 as "Realtime Notes Activity", but now has been included in the box Native drivers are provided for DB2, Oracle, Sybase, EDA/SQL, as well as generic ODBC & filesystem Premium connectors will be available separately post R5 for SAP and other ERP systems, and for host/transaction system connectivity (MQSeries, CICS) Among the more significant features of DECS are:
  - A simple administrative interface for selecting which database tables, rows and columns to map into which Domino forms and fields. After running the wizard, external database fields are available for use as standard Notes fields. No programming or scripting is required in most cases Developers create a connection from Domino to the database, pick the data (table, view, query) and generate a form that works in both the thick and thin client The resulting form only contains metadata and presentation logic (HTML) On the server DECS is a passthrough bridge and none of the data gets stored in the Notes database itself. See below for details.
  - The ability to perform "joins" across multiple heterogeneous data sources by triggering multiple queries from the same Domino form The first query might load key fields from one data source that are then used to perform the "join" against a second data source
  - The ability to invoke stored procedures on the connected data source thus providing Notes users with access to common business logic from LOB applications, and ensuring data integrity within those applications.
- Transactions & 2-phase commit The Domino team is working with our MTS group to make Domino an MTS resource manager supporting 2-phase commit and rollback. This is extremely important for connectivity with databases and transaction systems, and will be a significant competitive advantage for them in this space Exchange won't have this until post-Platinum. In addition, Domino already provides transaction capabilities for MQSeries and CICS through LotusScript extensions
- Domino Connector Toolkit This is an SDK to build custom DECS connectors
- Lotus Enterprise Integrator Formerly known as NotesPump, Lotus Enterprise Integrator is an add-on product that provides bidirectional syncronization between Notes and a similar list of data sources. This can be either bulk copy, polling, or realtime replication

These bits were formerly part of NotesPump NotesPump was originally designed to handle moving large amounds of data between Notes databases and other relational databases It's primary function was data transformation and synchronization, but it also had a feature that allowed developers to create "RealTime Activities" that bound notes document fields directly to relational databases In R5, they've split this "RealTime" functionality off and labeled it DECS. You don't see it with the standard install of the designer (I had to go download a whole new set of docs, server software, and developer tools) but it's pretty rich. The programming model here is pretty close to visual interdev you create a connection from domino to the database, pick your data (table, view, query, what have you) and whip out a form that works in both the thick and thin client

Creating a Domino app that connects to relational data requires both the Designer (used for creating the base database and the forms UI, and code of the application) and the new DECS administrator for establishing connections to the database and mapping fields in the database to Domino forms.

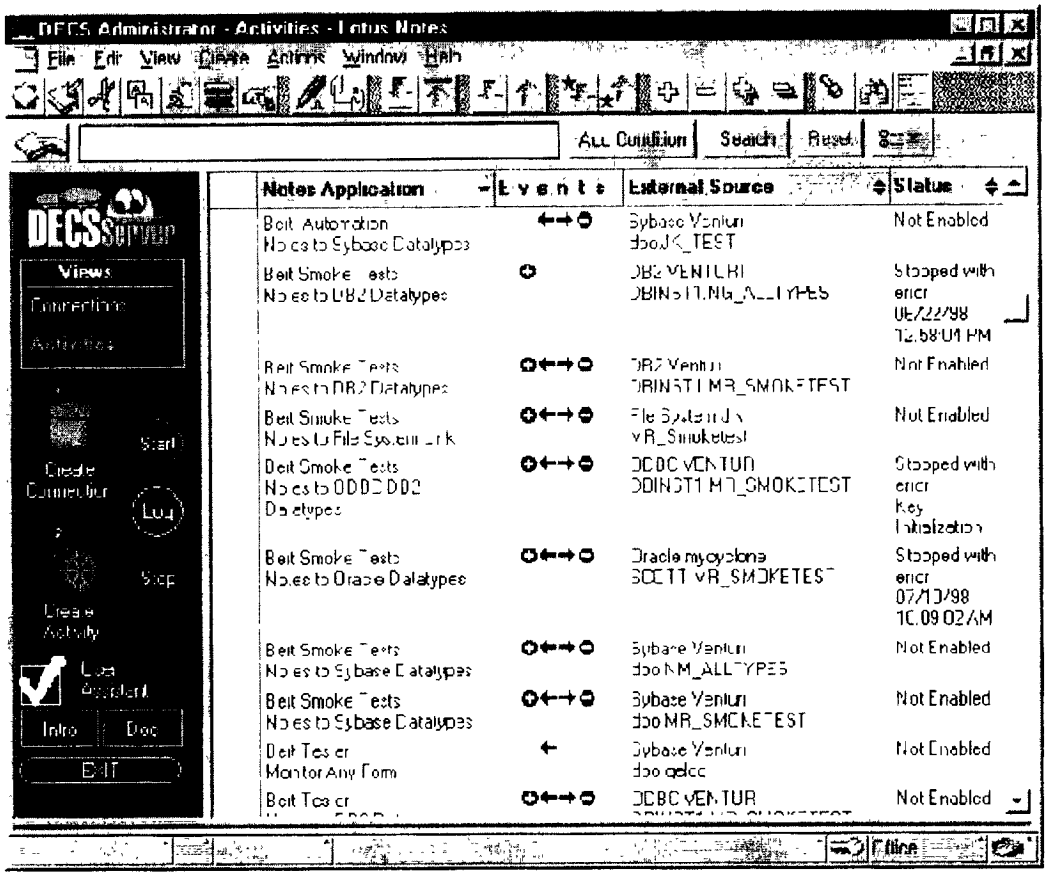


Figure 13: The R5 DECS administrator

They have a simple wizard that lets developers map the database fields to the Domino form fields. This is a huge step forward when contrasted the existing model for programmatically binding form elements to RDMS fields

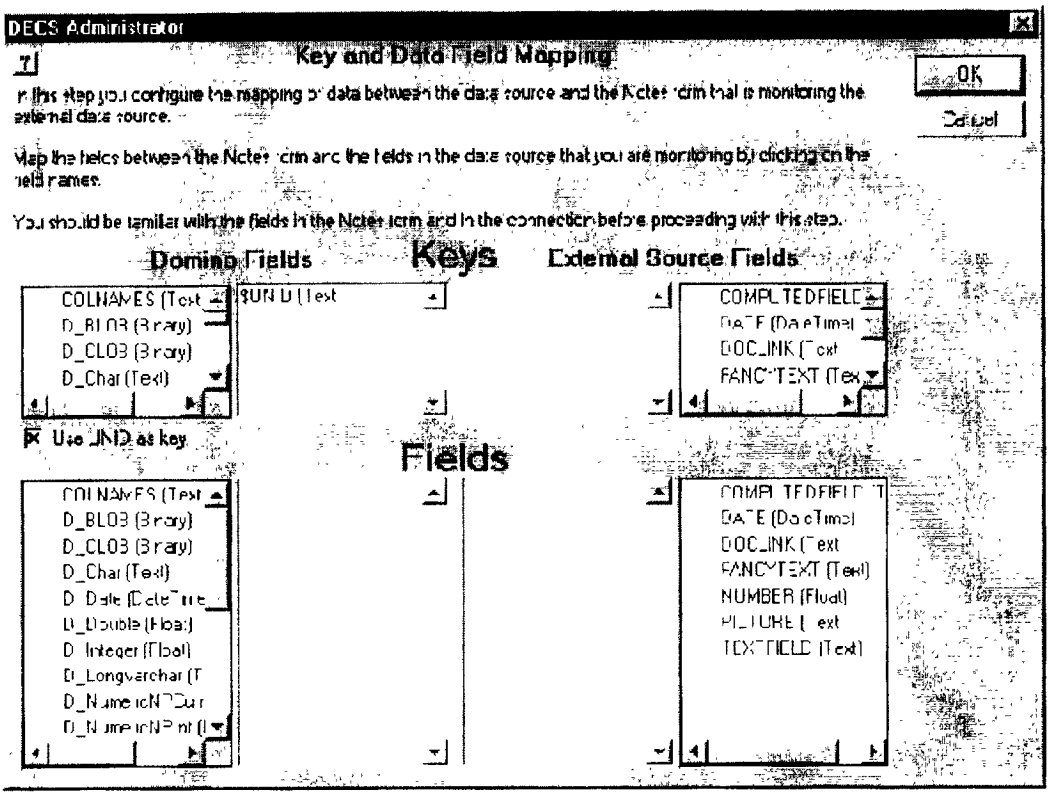


Figure 14: The DECS wizard

All the domino form contains is some metadata and presentation logic (html). the DECS stuff on the server is a passthrough bridge and none of the data ever gets stored in the domino database itself

Integration with third party tools

Lotus has mentioned integration b/w Notes and NetObjects Fusion (25% owned by IBM) They have promised that HTML authors will be able to work on the HTML content of Domino applications from directly within Fusion. We have not been able to verify this

Domino R5 will also support FrontPage, using FTP as the communication protocol This allows authors to use FrontPage's HTML editing tools and all the features that don't require the server extensions This means that things like navigation bars, link fixup, themes, site reports, etc will all work, while hit counters, discussion groups, and automatic database creation don't work.

Deployment

An area that is a big win for Lotus applications is deploying applications Since all pieces of an application are simply notes (in the Lotus terminology), deploying an application is as simple as replicating databases, which Lotus does very well In Outlook forms, if the form uses an ActiveX control, then the author must be aware of how the form will install the control, from where, versioning, etc For a Notes author, this is handled by the architecture of the product.

Notes application model

The move to the web and 3-tier development has Domino's programming environment story more complex The old model was fairly simple· Notes originally had a "symmetrical client and server" model with symmetrical stores client/server, and all logic on the client in LotusScript forms. Domino made that slightly more complex in 4 6, since the forms were imperfectly rendered to HTML on the server. This required the developers to make workarounds and manual tweaks to fix. Now, the model looks something like this:

- Web client Java, Javascript, a Nav4 subset of W3C DOM for cross-browser support (explicitly not the fuller IE4 implementation Even so, it's extremely ironic that Lotus' forms strategy will support IE4/IE5 better than Exchange 5 5/Outlook98 in the same timeframe), CORBA/IIOP to remote server-side controls.
- Notes client. Supersets web client above (it embeds IE4) Also includes replica of Notes store, replicated through Notes RPC LotusScript forms, numerous custom controls. Over time expect to see the Notes-specific functionality implemented as web controls, and IIOP replace NRPC.
- Server Notes store, HTTP stack, Notes Object Interface exposes server object model & custom extensions to LotusScript, Java, and CORBA (i e IIOP RMI from clients).

The Notes/Domino architecture looks something like this

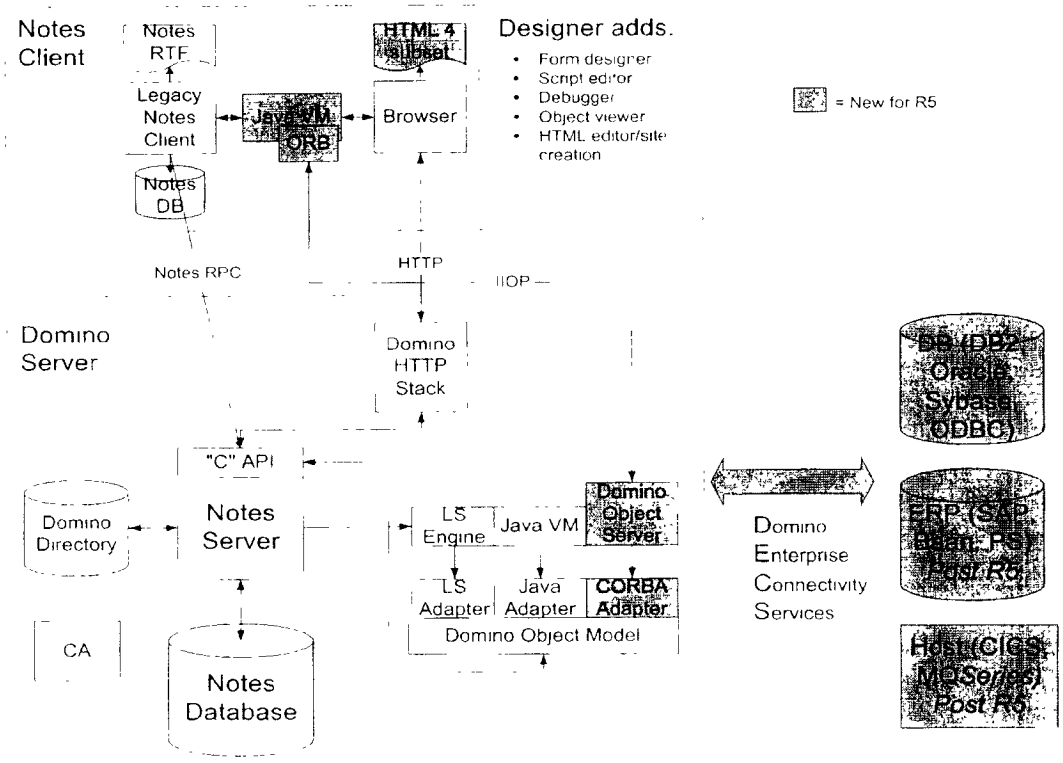


Figure 15: Notes/Domino architecture

Prior to R5, the Notes Application Model has been essentially similar to the application model found in Exchange

Both Notes and Exchange have an application model that can be characterized as messaging on a dynamic store In this application model the dynamic store is smart, replicating, and it supports hierarchical semi-structured data Here "smart" refers to the ability to build agents/rules based on the store object model especially the event and security infrastructure and "replicating" refers to the ability to easily and automatically synchronize the disconnect versions of the store in an intermittently connected network From the developers' perspective, the developer creates databases that contain documents and the views, forms, and agents that manipulate these documents In Exchange the equivalents are public folders, messages, views, forms and server rules.

Within the messaging on a dynamic store model, Notes is distinguished from Exchange in the depth of capabilities associated with each of the items described above especially in the terms of security, template support, and flexibility of data replication. See Details below. Platinum should distinguish itself in its ability to scale and the maturity of the COM-based programming model While the Exchange Server store is superior to the Domino store, we do not have a symmetrical client store - the PST is completely different in structure, programming model, and schema, and has a number of limitations

However, with the introduction of R5, IRIS/IBM is shifting the application paradigm by unifying the messaging on dynamic store application model with the web to database application model (The web to database or web application server model is typified by IIS/ASP connecting via ADO to databases The web application server model is a connected approach which has as its primary benefits ubiquity, simplicity, and scalability)

While the messaging and web unification in R5 is not complete, it is credible and as such it represents a ***substantial technical advance***. Moreover, this unification is occurring at least a year and 1/2 ahead of a similar offering from Microsoft. IBM is messaging Notes R5 as an "An integrated Messaging and Web Application Server" - Microsoft will have some difficulty responding to this.

To enable the unification between the messaging and web application models, IRIS/IBM introduces the following with R5: (Note that in the follow we do not distinguish between the Notes server and the Domino server as this distinction is now less relevant.)

- **Convergence of messaging and web object models and programming models** This is clearly a priority for IRIS. Specifically (1) the Notes client now supports a subset of the W3C DOM, (2) JavaScript is supported in the presentation-layer of the application model on both the Notes and web client; (3) all Notes elements are addressable via URLs, (4) many of the new features in the designer (the outline designer, the frameset designer, the WYSIWYG html page designer, and the Notes UI applets) are geared to the web / page based programming model; and (5) there are new HTTP commands that provide access most of the useful elements in a database (the database itself, any form, view, page, agent, etc) directly from address bar of your browser

  While these steps represent real, credible progress in application model unification they are not anywhere near complete nor does this represent a "magic bullet" in efforts to design once for both execution environments Developers must be aware of their target execution environment whether it be the web browser or the Notes client (especially in the offline case) However, if a developer is careful to limit the set of services they call, it is possible to create forms that work in browser or in the Notes client

- **A single integrated designer for both messaging and the web application server.** On top of the converging object and programming models, IRIS IBM has built a single designer that supports both models But because the unification between messaging and the web is incomplete, the integrated designer can be confusing to use However, Microsoft has no equivalent integrated offering Furthermore, Notes automatically creates a web rendition of any form created In Exchange the developer must run go through the explicit step of running a wizard to create the server-side form definition, and must have access to the filesystem on the web server to persist the form definition there.

For more details on this area see the "Tools" section above

The Notes unified designer includes both a unified object browser and automatically adjusting code windows For example, if a developer selects the onChange event on a button only JavaScript code is allowed. Contrast this to Exchange's more fragmented environments Outlook, VS, and eventually Access. Furthermore, VS does not provide any specific tools for building/deploying an Exchange app.

- **Enhanced DB connectivity.** Notes R5 adds NotesPump and Domino Enterprise Connection Services (DECS). With these two offerings, Notes gains substantially enhanced relational data connectivity with the M/DS framework. This is critical because it enables messaging applications, including the offline component, to integrate with relational stores. This is is difficult to do today with both Notes and Exchange. DECS, which is built into R5, brings Domino to essentially the same functionality as Microsoft's Web/DB offering.

- **Enhanced Server Programming Model support.** Specifically R5 adds support for Java and CORBA/IIOP development. This provides many of the capabilities Microsoft provides via COM components but for the Java and CORBA camps. In addition, Notes provides set of client wrapper classes that remote the server-side classes to the client. This is useful for accessing Notes capabilities that are not present in the web browser object model. Also, Notes/Domino supports downloadable Java classes COM objects don't auto-download when used within an Outlook form They must be distributed (copied and registered) in advance This applies to Office COM add-ins as well.

- **Internet Cluster Management.** Notes now provides web server load balancing and failover for Web based apps. These capabilities are not yet integrated into Microsoft's web offering although recent acquisitions in this area will help

In short, Notes no longer competes with just Exchange/Outlook It now competes with IIS/ASP and VI

In addition to these new focus on Integration between the messaging and web worlds, Notes continues to enjoy the following advantages over Exchange/Platinum

- Deployment of apps is considerably easier with Notes/Domino In Notes, ALL application elements are self-contained within an NSF file In Exchange thick-client apps are within a PST and think client apps are ASP/HTM's in the filesystem. Exchange 5 5 also does not permit departmental installs Apps need to be copied from a PST to the enterprise PF hierarchy Platinum with its installable filesystem begins to address some of these issue but deployment continues to remain Microsoft's single biggest weakness

- Templates are better in Notes primarily because app distribution/deployment is easier but because also apps can inherit design elements from master templates While Microsoft now has Outlook templates and the App Wizard in OL 2000 goes a long way, Microsoft offerings are sadly lacking on web based templates

- The Notes design environment supports sub-forms and conditionally hidden elements This provides relatively clean mechanism for encapsulating the differences Notes and Domino clients

- The Notes design environment modifies app schema as part of form design (schema-by-form) Persisting a form definition in the folder / database adds the fields to the folder / database schema

Fortunately, although R5 is largely self-consistent and presents a unified client/server/tools environment it is unclear how IBM will unify all their other web efforts with R5 As a recent mail stated "Iris continues for now to run as entirely standalone unit, ignoring the rest of IBM, terribly muddying IBM's overall web server strategy." Other efforts include Websphere Studio, Net commerce templates and Net Data, and

Visual Age for Java. "As Iris talks to none of these groups it is guaranteed to be incompatible with all of them"

Domino R5 Object Model Analysis

Domino is moving aggressively to deepen their Java support and add CORBA/IIOP. They have a number of legacy issues to resolve as they make this transition. but seem to be doing a reasonably good job of it. In R5, they will have an advantage in two areas

- Remoting strategy. Their commitment to IIOP remoting is more effective than our half-hearted support for DCOM and our various efforts to supercede DCOM
- Single object model. The fact that they're evangelizing a single relatively unified programming model will help them considerably. This object model is accessible from Java, LotusScript, or Javascript (client only). In contrast, at Microsoft we haven't rationalized our various object models IE DOM vs. the new VS-Forms model, and Outlook's object model vs CDO, etc. The object model itself is roughly at parity with any of our equivalents.

LotusScript and LotusScript Classes

The LotusScript language has undergone some incremental improvements in R5 They have removed the 64K script size limit, improved performance but perf numbers are not available, and most interesting made LotusScript multi-threaded. Multi-threaded LotusScript is necessary given how they now support much richer Domino Server apps.

R4.6 had both "LotusScript Front End Classes" (FEC) and "LotusScript Back End Classes". (BEC). FECs always ran in the Notes client. BECs ran either in the Notes client or on the Domino server. Neither of these class ran in the browser as part of a Domino app This required that round trips to the server be used to run LotusScript & BECs on the server and refresh the browser with the results This is essentially the same as Outlook Web Access and other CDO/ASP/IIS apps built on Exchange. There does not appear to be much improvement in the LotusScript classes in R5. The focus has been on equivalent Java classes.

JavaScript and Domino Java Classes

To provide a strong design environment for Domino Server, Lotus has significantly enhanced the object model and provide most, if not all, of the classes of Notes R4.6 to Domino web applications. In R5, the BECs which are commonly known as the Notes Object Interface have been renamed to the "Domino Object Model" (DOM-OM) (.. unfortunate choice of an acronym)

Instead of trying to get LotusScript to run within a browser which would be a very difficult thing to do, Domino uses JavaScript (more correctly ECMAScript -- it has nothing to do with Java) to write presentation layer code. Javascript utilizes the Javascript document object model (DOM) to write presentation logic, validation, etc The Notes R5 client also supports JavaScript so that script can be written once and run in both runtime environments. To avoid HTTP round-trips and provide a rich presentation layer object model, R5 includes Java "AppletBase" Java classes formally known as the Lotus Domino Toolkit for Java These are "thin" Java classes that are remoted to the Domino server using CORBA/IIOP These classes are the same as the BEC's but now available for use within JavaScript in the browser These Java classes also run in the Notes client and thus provide a uniform set of classes for both runtime environments The Notes client "tricks" the classes into going direct to the local Notes DB and thus not remoting over IIOP FECs remain available only on the Notes client. Further analysis will be needed to determine if the Java classes are fully functional versus their LotusScript BEC equivalents

It is also important to note that Domino Java classes run on the Domino server and can be used to build server agents. On both the Domino server and Notes client, these classes are implemented natively In a web browser, they are remoted to the server

Java servlet/agent support

In R5, Lotus is moving from the Java servlets they had in 4 6 to Java "agents". Agents are basically servlets done right

	Agents	Servlets
Persistence	Stored in notes database; replicated with other content	Stored in filesystem
Security	Run in user context, subject to per-user security	Run anonymously, no access control
Invocation	URL or event	URL only.
Memory use	Unloaded immediately after running	Stay memory resident until server shut down.
Sandboxing	Can be given specific limited access to system & network	No restrictions

DCOM Support

Remoting objects using DCOM is not supported in R5 This is because DCOM could only be supported using NT server, not unix and os/2 platforms. Work is underway to support DCOM in an R5.1 release This is an area where Microsoft has faultered. We do not utilize DCOM much at all within our products and insist that thick class binaries are downloaded to browsers and clients We do not have a DCOM over HTTP strategy and DCOM over RPC is shunned because it is proprietary and doesn't get through firewalls Microsoft runs the risk of lagging behind Lotus in supporting DCOM Even worse, lack of a remoting mechanism means that Exchange web based apps cannot execute CDO/ADO code remotely. This impacts the user experience and the ability to build apps on our platform Invoking COM objects should be transparent of the objects location.

It's clear that neither the Domino Server nor Notes client use the Microsoft JVM, since they require the Java Native Interface (JNI) which wasn't available until 12/7/98. (xxx which JVM do they use). Domino/Notes use this to provide Java classes on top of a native OS implementation of the functionality.

Notes C-API

The C API has undergone some signficant improvements but they, like the API itself, are targeted at systems development and integration, not application development. The new C APIs in R5 Beta 2 have not been tested and are not supported This is an interesting indicator of the relative priority set by the development team They are commited however to delivering they for RTM For now they are to be used at your own risk.

New C APIs include (either new or extensions to existing functionality)

- Backup and restore
- DS migration through implementation of a DS service provider
- Full text search extensions
- Ability to change user passwords

View Java Class

Domino includes a view class that is used to navigate through a collection of documents This class is similar to the NodesUIView object in the FEC This provides programmatic access to navigation of the view without round-tripping to the server as in R4 6

URL Access and Usage

All "documents" in a Notes database have an URL. Through script you can retrieve a document pertaining to a specific URL using the getDocumentByURL method, you can also get the URL for any document (<not sure how though>).

Domino Object Model vs CDO 3.0 & ADO Comparison

Synopsis: The DOM-OM is very broad and deep in its functionality and thus covers more ground than CDO 3.0. It includes not just middle tier data access and logic but also UI classes to run in the presentation tier. The ability to run all these classes within Notes and browser clients is a strong advantage. CDO starts from a better base and as it matures will likely be a better long term API that can evolve with technology shifts. For instance, CDO delivers native internet schema, MIME, and stream access to the developer. This makes a Platinum server 100% internet based. In constrast, DOM-OM is like CDO 1.2, MAPI, and Outlook object model which abstract the underlying data representation and in some cases presents content fidelity problems. DOM-OM has difficulty representing complex mime structures and it will get worse with ICAL, VPIM and other standards. This is a signficant point for developers because it exposes the fact that Domino is not natively an Internet store and application platform. In the short term, DOM-OM will be considered as superior, primarily due to the newness of CDO and broader reach of DOM-OM classes. However, in the longer term CDO & ADO may provide richer capabilities to developers. A more rigorous analysis is necessary.

Pros of Domino

- More extensive set of objects, methods, and properties
- Well established and used in the Note developer community. Although the Java classes are new and require a rewrite of the code, are the same in functionality
- Tighter integration of document objects and data access. This is a benefit but also a weakness. Data access requires using Notes' query syntax, navigation mechanisms, etc.
- Supported on the Domino server, browser, and Notes client. CDO only available on PT server

Pros of CDO 3.0

- Based purely on Internet standards for schema, MIME structure, and protocols, etc.
- Open set of objects that allows for developers to deliver extensions that are peers to those shipped by Microsoft. Very important in the era of many new MIME content-types
- At the core, CDO leverages ADO and/or OLE DB for all generic data access. This allows developers to learn a single data access interface without redundancy. This also leads to better developer and analytical tools integration
- CDO is one API for all languages (VB, C++, Java, JavaScript, VBScript)

Domino Object Model vs Outlook Object Model (2000) Comparison

Synopsis: While the object models are quite different, they are architecturally very similar. Both are large, all inclusive, and very complete. They both provide support for a wide variety of application data. Each are richer in different ways, an weaker in other ways. Both suffer from the problems mentioned above that make CDO 3.0 a better internet based API. These two should be considered a draw with no overwhelming advantage to either. A more rigorous analysis is necessary.

Pros of Domino

- Better support for documents, workflow, and routing
- Supports URLs on all documents and opening documents based on URLs. Closest in Outlook is the MAPI entry ID; but it is not a URL an cannot be invoked through the browser
- Supported on the Domino server, browser, and Notes client. OOM only available in Outlook

Pros of Outlook Object Model

- Better support for calendaring, task mgmt, contacts
- Much more extensive event support for customizing behavior and building complex applications
- More extensive Outlook client integration, especially forms

Recommendations

To respond to R5 we should consider the following

- Accelerate Platinum/VS7 Application Model integration efforts that MTuchen and JohnShew have been driving The good news is that the VS7 application model is consistent with the Platinum architecture. However, to be credible we would need to do work on event architecture, data, and Exchange designers are currently not on either teams schedule
- Accelerate convergence of VSForms with Outlook and Access forms that CraigSy, CraigU, StevelS and others have been driving. Longer-term, consider the development of a designer that supports both messaging and web model.
    - Provide integrated authoring for both the rich, offline-capable application and the reach-oriented server-side application that minimizes repetitive authoring.
    - Provide direct support for M/DS concepts including addressing, disconnected forms, digital signing and encryption, and discussion threading
- Investigate mechanisms to generate Web versions of Outlook forms when they are registered, potentially bypassing the explicit steps application authors must go through today
- Develop and put into place a strategy for remoting COM objects in Visual Studio and Exchange such that browser applications can utilize ADO, ADSI, CDO, OLEDB remoted from the server
- Develop tools that enable rich views to be constructed from data in the Exchange store, and that are available in both Outlook and in standard web browsers. These tools should be available in Access & Visual Studio
- Provide Web versions of the Outlook 2000 App Wizard templates with Platinum

Key Takeaways

- Notes is ahead of us in providing a unified programming model between messaging and web applications. They are not there yet and they have substantial technical challenges to surmount but they are making incremental progress.
- Notes is ahead of us in creating a integrated development environment for their evolving integrated application model Now that they have something in place they have the opportunity to take customer feedback and iterate on the solution
- Microsoft has an opportunity to offer a more consistent, productive development experience as well as solutions that scale better. However, anything we release will be trail introduction of Notes R5 by at least a year.
- Notes will suffers from some complex backward compatibility issues in the both application and programming models. For example, LotusScript and some Notes formulas will not execute in the Web environment

See connectivity for enterprise connectivity. See templates & apps

Notes client

In R5 Lotus has made a significant investment in their client, primarily in usability, integration, and calendaring/tasks They've also included the HTML editor from Domino Designer, and changed the mail addressing to standard SMTP addresses, and added a "Headlines" feature largely similar to Outlook Today

The client (which still uses Notes RPC) is needed for any kind of offline functionality, local encryption, and for working with multiple Notes databases The R5 client will have the following advantages over Outlook2000

- Offline symmetry For offline applications, the symmetrical client store and programming environment give them a significant advantage over Microsoft's current solution
- Client/server replication
- Advanced editing
- Web browsing

- Client platform support Our poor support for Mac clients (particularly in calendaring) has been more problematic than the run rate and corporate adoption rate of this platform would suggest.

R5 and Outlook2000 will be at parity in:

- Calendaring
- UI and usability Outlook is cleaner and more consistent, but Notes has an arguably more usable navigation model & structure.

Outlook will have an advantage in

- Contact management.
- Task management
- Rules.

Mail Editing, Options, Rules, Out Of Office

As e-mail managers, Notes and Outlook offer nearly the same capabilities There is no difference in basic functionality The differences are mostly in the advanced features In advanced editing functionality, Notes users have an advantage over Outlook users. But Outlook makes it easier to manage your mail as a whole.

Areas where Outlook beats Notes. Rules (by far), Delegates, Signatures , Preview Pane, Notes doesn't have anything like that. Drag-and-drop messages to folder; in notes you have to take a few steps to move a message into a folder

Areas where Notes beats Outlook. creating links/buttons in messages (see "Hotlinks"), associating icons with particular categories of messages (see "Moods") Some advanced editing features, some displayed above (see also "Editing Features " below) You can encapsulate and expand/contract sections of your text (see "Sections" below), this lets you summarize your points in outline form You can create tables in Notes, need Word to do this in Outlook

Features Notes has that are missing in Outlook, but which I don't think give notes any edge: Notes users can choose a Letterhead; they can set Delivery Priority for their messages; Prevent Copying, all discussed below in detail

R5 feels like a web browser, to an almost surprising extent The first screen a user sees when launching the R5 client is the following:

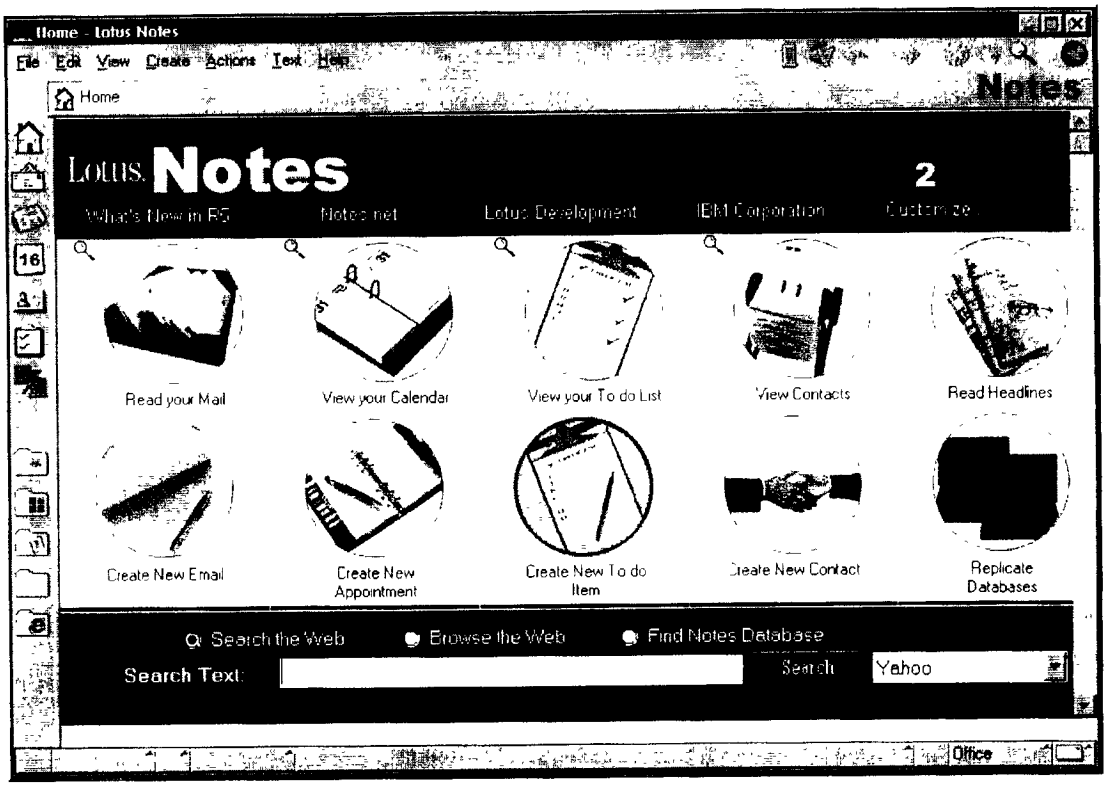


Figure 16: Notes Home screen

The basic navigation buttons at the top right are always available Clicking on the "read your email" button yields the following

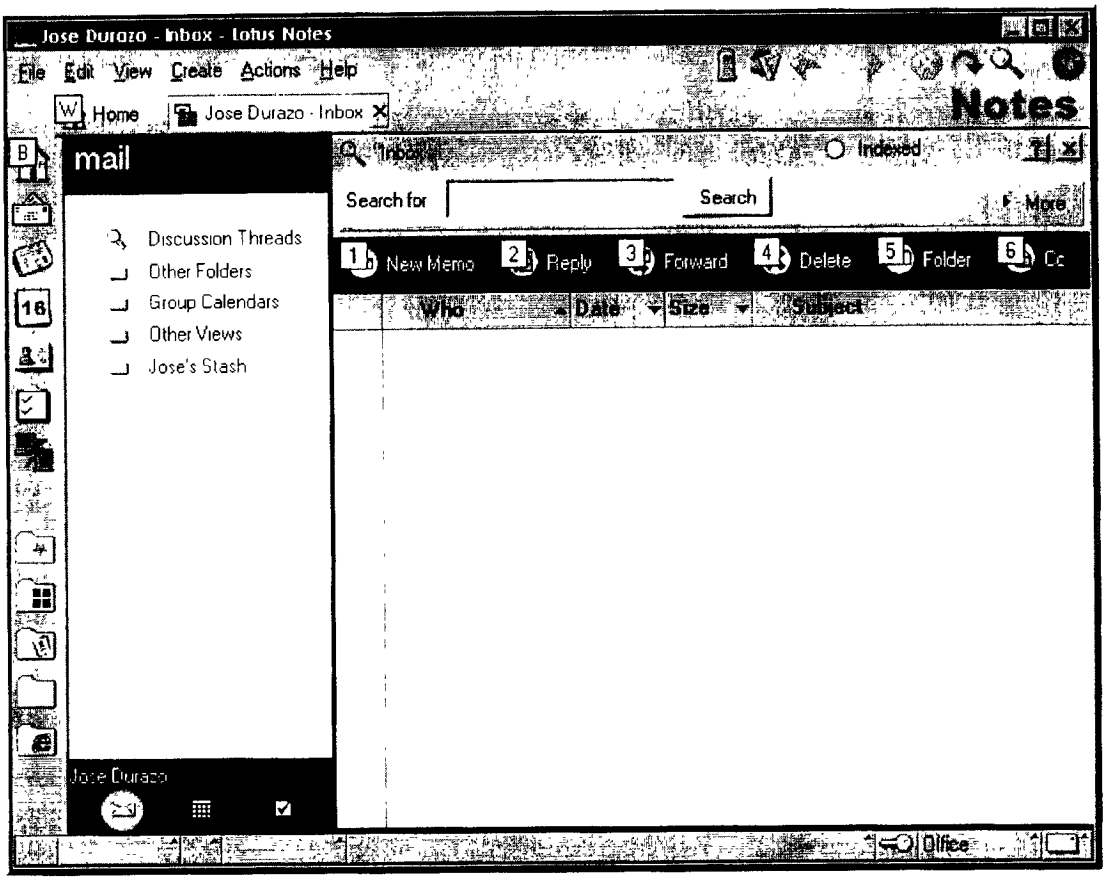


Figure 17: R5 Inbox

Notice the "B", "W", "1", , "6" These light up when the alt key is pressed, and offer quick and obvious keyboard shortcuts to these areas. These shortcuts launch in the same window, including creating a new mail (see below) Among other hints, this was a big hint of how browser-like Notes is

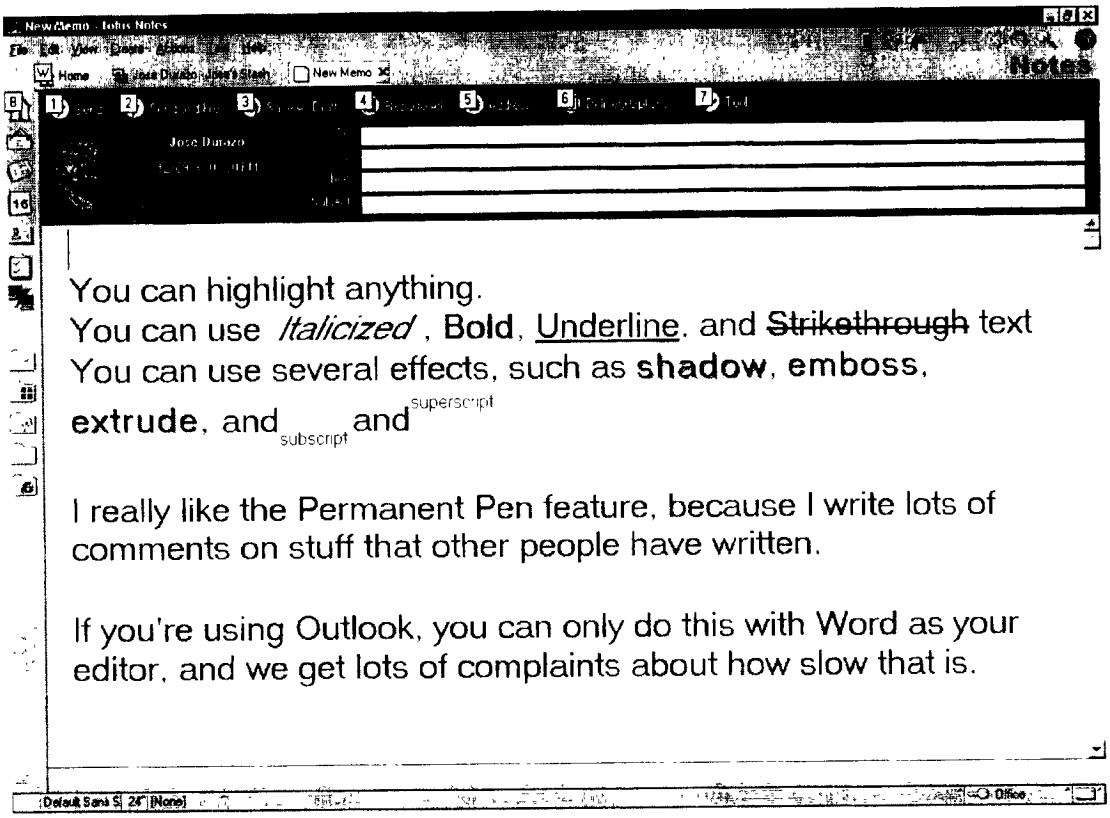


Figure 18: The R5 "New Memo" form

MS Word as editor

According to Lotus you're going to be able to use MS Word to edit messages and maintain all formatting (presumably even though the recipient doesn't have MS Word) This feature doesn't seem to be enabled in beta2 Maybe it just doesn't work with Word 2000

Signature Autoinsert

They do have autoinsert signature, but the signature can only be plain text On the other hand, they have Stationery, in which you can insert any kind of signature you want But after you create stationery (by clicking Save As Stationery) it takes a couple of clicks to create new messages based on that stationery not as nice as autoinsert.

Hot Spots

You can add several different kinds of "Hotspots" in your mail messages. The following types are available:

- Hyperlinks links to URLs.
- Buttons for which you can execute Javascript or Lotus script, among other actions
- Text popups (think this is pretty neat)

- Action, looks like a link but works like a button
- Formula popups, wasn't able to figure out how to use these, but it looks like you can create excellent junkmail with this, since there are formulas for the fields in a message, such as UserName "Hey @UserName! It's @Month and you're in luck because @Month is our month to slash prices!". . is what I think it's going to work like

Moods

You can set the mood of your message The term itself doesn't make sense to me, but what it really means is that you can associate one of several Icons with your message to let users know that the message is confidential, congratulatory, News, or several other choices

Letterhead

Every message you send comes with a letterhead, which is a banner with a cool picture, something like what you might put on your desktop, except it's only about an inch high, containing the header information for the message, such as when it was sent, who sent it, the subject I think this is supposed to be some sizzle, and I think it's a gamble because It annoyed me. For conversations carried out through email it takes up way too much space

Editing Features we don't have except through Word

A couple of other editing features. can enter strikethrough text, superscript, subscript, change line spacing among {1, 1.5, 2} -spacing You can highlight stuff

Table support

You can set something called a *permanent pen style*, which you can use to write your comments on the messages you're replying to This gives a little more responsibility to the user if they want to choose a unique color but it works

I think this last feature is great, because I have lots of problems myself in Outlook when trying to comment on someone else's text

Sections

You can create sections in Notes documents. You can use this to present an outline form of your document to users. Each section has a title and can be collapsed or expanded You can, of course, create bulleted lists in Outlook, but you can't collapse the elements of the list I think this is a very useful feature, to encapsulate stuff, very similar to the Outline view in Word. except that it only has top-level sections, no sub-sections, sub-subsections, etc

Outlook 2000 doesn't really have an answer to this

Delegates

In Notes you can set who can

- read your email and calendar
- send mail on behalf of you and read your calendar
- read send and edit anything in your mail file

- delete mail and calendar entries

These are a set of canned options. What if I want one that isn't there? Outlook lets you set options separately for Email, calendar, tasks, contacts, notes and journal, you can set options for each to any of the following. no permissions; read items; read and create items; read, create and modify items.

Tracking Options

You can get notices for the following: Only on failure, Confirm Delivery, Trace entire path

Customers probably wont think the differences between Notes and Outlook are significant in this area, but here they are Outlook only allows you to know whether the person's post office received messages, and whether the person read the message Notes' Only on failure option lets you know if your server failed to send the message The Confirm Delivery lets you know otherwise. Trace entire path sends you a receipt for every server along the path to the final recipient

Prevent Copying

You can set an option for any message that prevents copying of any kind. The messages you send with this option can't be forwarded Their text can't be sent to the clipboard, can't be included in a reply, and can't be printed. This is curious because it can be easily worked around. For instance you can click Alt + PrintScreen and the window is copied as a bitmap.

Rules

Outlook rules provide a strict superset of the rules available to Notes users. Notes users can perform any of these actions on messages

- move / copy to folder
- change importance
- delete

.. based on whether {sender, subject, body, to, cc, bcc, or internet domain} contains or is equal to some user-entered text, or whether importance or delivery priority is high, medium or low The rules can be combined in simple, non-grouped Boolean combinations using AND / OR, and it's not clear what the behavior is if you mix *AND*s and *OR*s.

Some noticeable missing functionality which Outlook has

No equivalent for Run Rules Now

Can't react to messages based on

- whether flagged for action
- whether contains attachments
- any message property except as above (Outlook lets you specify any of a long list of message properties)
- it's having been sent within a particular date span

Doesn't allow for exceptions

Can't perform the following actions that Outlook *can* perform on the message matching the rule criteria.

- forward, redirect, or reply to the message
- print the message

Out Of Office

The out of office functionality in Notes looks childish, but it is actually more advanced than that in Outlook. Here's what users can accomplish with it. Outlook's User Interface for setting up Out of Office messages is a lot more sparse, but Outlook offers better out of office support by leveraging our far more flexible rules functionality The only Outlook minus here is that Outlook doesn't tie in calendar Free/Busy time with Out of Office messages, whereas Notes does In Notes:

Date Range

You can specify what dates you're going to be Out of the office, and your free/busy time is marked accordingly on your calendar provided you check "Book busytime for these dates."

Special Message

Like in Outlook, you can specify a message that will go out when you're Out of office. In addition, you can send a special out of office message to one set of senders

Limiting Who Gets Out Of Office Messages

You can choose for Internet senders not to get your Out of office message

You can also choose for any set of senders not to receive the out of office message

For any group you're a part of, you can specify that an out of office message won't be sent when you receive a message addressed to that group

You can specify that an out of office message won't be sent for messages containing any of a set of phrases.

Offline Replication

Notes gives you much greater control over your replication settings and synchronization process than Outlook 2000 does When you travel, Notes makes it very easy to switch your configuration (sync schedule, connection settings, which databases to replicate) with a single Location setting Notes also provides a "Replicator" view that lets you run, monitor, and configure your replications For anyone who demands full control over what gets replicated and what does not, Notes is the client of choice

Outlook does, however, do a better job of streamlining the UI for the average mailbox user that only needs to synchronize certain mail folders, an address book, and certain public folders Outlook's Quick Synchronization groups also give you an advantage over a slow link, by letting you choose a smaller set of folders to synchronize than Notes allows

(There appears to be little difference between Notes 4.6 and Notes 5.0 in offline replication UI)

Location Setting

Notes Advantages	Outlook Advantages
◆Very easy to switch active location	(none)
◆No confusion between Location and DUN Connectoid	
◆Single UI for setting up location settings	
User can specify detailed configuration settings on a per-location basis (above and beyond Outlook's per-location TAPI settings)	

Location is a strong concept in Notes For each location, you can specify your replication schedule, dial-up info, email address, server, proxy settings, and *dozens* of other settings You get the sense that Notes was very much intended to allow users to dock in several different locations with vastly different connection environments. Rather than splitting the Location and the DUN Connectoid like Outlook does, Notes includes all of the Connectoid info within the Location settings, so all users need to change is a single setting, no matter where they go.

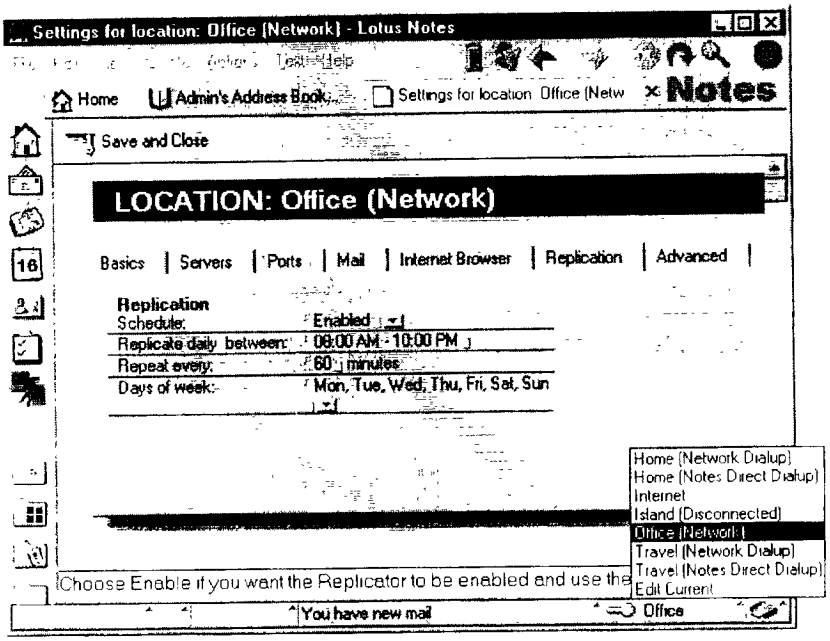


Figure 19· Notes replication "locations"

Switching Location in Notes is very easy, with a popup menu in the lower-right corner on the status bar There's also a Connection Configuration Wizard that helps users set up locations

Outlook, on the other hand, relies on TAPI and Dial-Up-Networking UI, not giving users a single place within Outlook to configure their location settings All Outlook does is give them an easy way to switch Location and DUN Connectoid (but still not as easy as Notes)

Synchronization Profiles

Notes Advantages	Outlook Advantages
Different sync schedules for different locations	User can minimize sync time by choosing from several Quick Synchronization profiles at the same location

In Notes, you get additional synchronization profiles by setting up additional Locations. The Location is the profile. The drawback is that when you're at a location, you can only sync one way

In Outlook 2000, you get sync profiles by setting up Quick Synchronization groups. The advantage here is that from the same location, you can choose to do a full sync, or any number of partial Quick Syncs to minimize connect over a slow link (i.e.. "Mail and Calendar", "Mail, Calendar, and Address Book", "Contact Application Folder", etc.)

Here are the settings you can make on a per-profile basis from each app. The apps are about evenly matched here:

Per-profile settings	Lotus Notes (per-location)	Outlook 2000 (per-QS Group)
Set Schedule	Yes	No
Set Filter	Barely	No
Choose Databases	Yes	Yes (public folders)
Sync Address Book	Yes	Yes
Choose Mail Folders	No	Yes

Replication Settings

Notes Advantages	Outlook Advantages
♦Detailed control over everything: views, agents, ACLs incoming fields.	Easier basic filtration (of questionable value though).
Easy UI to remove old items from the offline replica	
Replicate full, abbreviated, or summary versions of docs	

Notes offers tons of replication settings, but it offers them on a ***per-database,*** **not a per-location** basis. So no matter where you are or how slow your link is, these are the settings that you get

- Synchronize of certain folders
- Check on/off download of Forms, Views, Agents, Replication Formula, ACLs, Deletions
- Check on/off download set of Fields (customizable set).

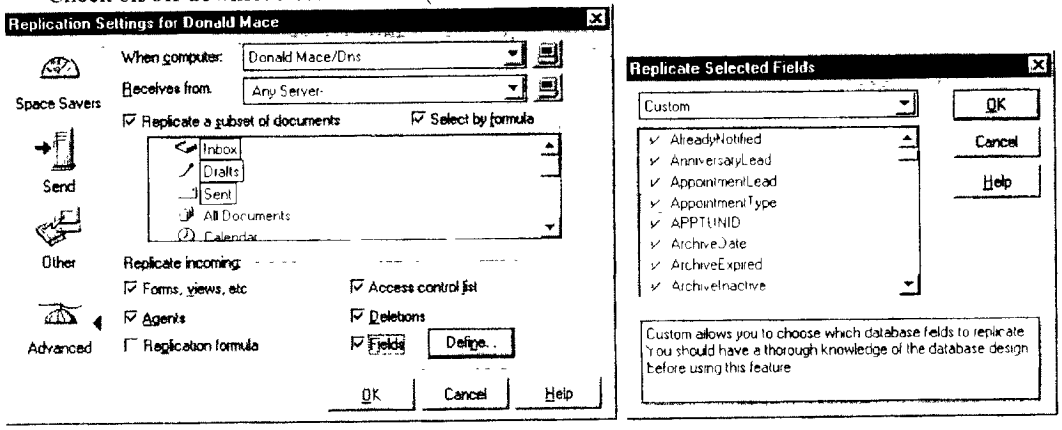


Figure 20: Notes per-database replication settings

- Only keep recent documents – modified within the last N days.
- Filtered sync using Lotus Script formula. (But there doesn't appear to be a way in UI to build a simple restriction like you can in Outlook.)

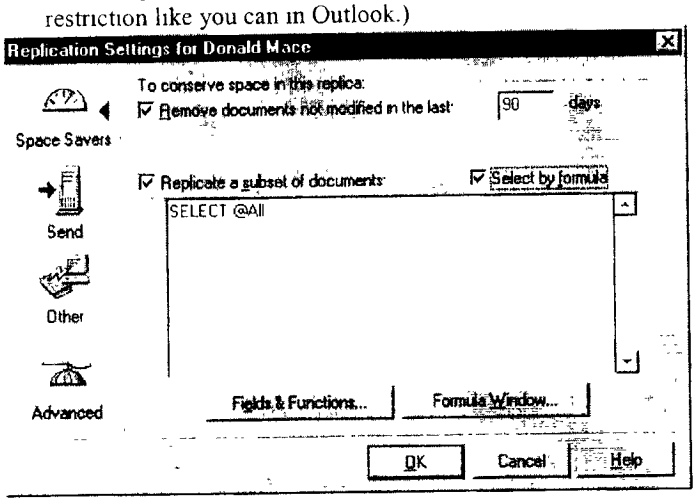


Figure 21: Notes filtered replication using Lotusscript

- Control the sync direction (only send, only receive, or send/receive)
- Control the "size" of the documents that you receive (summary, summary + 40KB, or full)

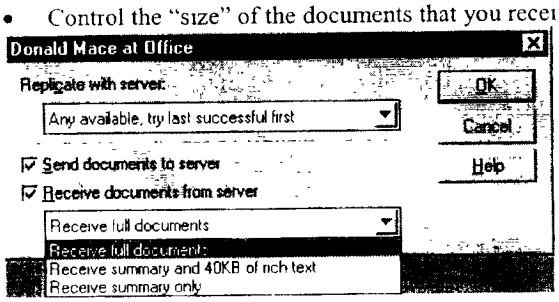


Figure 22: Notes per-location replication settings

Replicator

Notes Advantages	Outlook Advantages
Set sync priority for each database to be replicated	(none)
Good feedback during sync process	

The replicator is a view (settings are per-location) that lets users configure and run their replications. From here the user can

- Turn replication on/off for each selected database/process
- Set the sync priority for each entry
- Access other replication settings (schedule, filters, etc.)

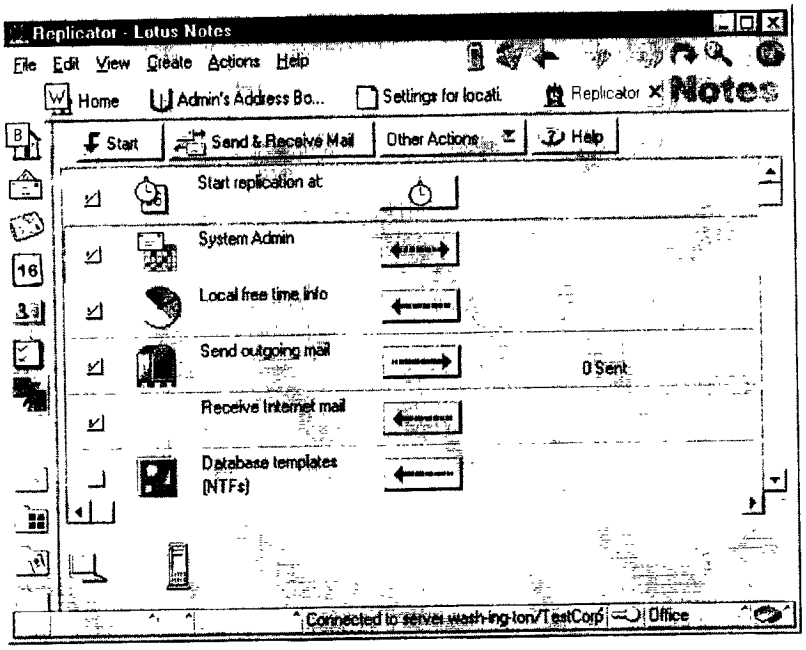


Figure 23: Notes "Replicator" UI

Archiving

The Archiving feature appears not to be available – possibly due to my server configuration

Backup

There is no concept of Backup, since all of the user's information is typically both on the server and in a local offline replica file. The offline replica file can be copied, and you can Export data to a variety of formats

Web Browsing

Lotus has made it much simpler to discover web browsing Their "Home" page displays a radio-button controlled option allowing people to browse or search the web. Choosing Search provides a dropdown that you can use to pick the search engine you want to use. Once you leave the Home page, it becomes a little harder to discover how to browse the web. When you do find it (there's a globe icon), you're presented with controls very similar to Outlook's web toolbar: a simple address control to type in your URLs. However, if you don't push the pushpin button, the control goes away once your page is loaded.

While they've made it more discoverable than Outlook to surf the web, they've also added a level of complexity to their UI: users must know whether they intend to search or browse If they want to search, they must pick a search engine In NRO, we should definitely integrate IE5's new search, which will automatically search several popular search engines and provide responses from all of them

In some ways, Lotus' navigation is better than ours (once you can find the controls) They allow you to use the back/forward button to navigate between your web pages and your other views such as your mailbox However, this seems to be a little buggy as it sometimes just doesn't work They also keep the selection as you leave your mailbox view and return to it Both of these are items extraordinarily high on our list of priorities for NRO (and possibly a SP)

However, Lotus diverges from typical browsers in a big way. Whenever you browse to another web page, Lotus adds another button to the bar above their display area. If you do a lot of browsing, these buttons can very quickly become useless as they get squished smaller and smaller. These extra buttons won't go away until you manually close them this can get particularly annoying if you receive an error when you try to go to a web page. It's unclear whether this adds a level of clarity or confusion to the app. On the one hand, now I can easily see which web pages I've been to and can switch between pages I visit often. This can be achieved thru IE, but you must open different browsers for each page. On the other hand, this seems to quickly clutter the UI and become worthless as you can no longer read which pages you've got opened. You can only comfortably display 2 web pages, your Inbox and your Calendar, even with Lotus maximized on a 17" monitor.

Lotus allows you to import your IE or Netscape favorites, we automatically give you the IE favorites. If it's a big deal, we could potentially add an option to import Netscape favorites.

The only way Lotus lets you bookmark a web page is by dragging its button from the area above the display area and drop it onto the bookmark folder This is not obvious (I had to go to help to figure this out) However, this is something that Outlook should do in addition to our current behavior for advanced users Lotus also lets you easily change the icon used to represent the bookmark. This is something we plan to add as soon as possible.

Lotus is very, very slow to display web pages, and their lack of any sort of progress indicator leads you to believe that nothing is actually happening. Outlook does not have much of a progress indicator either, although we do add a wait cursor, but our speed makes it slightly less necessary In NRO, we should continue to improve our speed (as I hope Lotus would be doing), and provide better feedback to users.

Of minor interest and irritation, whenever I browse, Lotus launches a DOS exe called nweb.exe, which is added to my task bar.

Calendaring

In two areas – user interface and viewing/printing – the Outlook 2000 Calendar (here referred to as Ocal) is clearly superior to the Lotus Notes R5 Calendar (here referred to as NotesCal) In two other areas – calendar options and meeting scheduling, neither Ocal nor NotesCal is clearly superior. All four of these areas are discussed in detail below

The superiority of the Ocal user interface and the viewing and printing options make Ocal a reasonable justification to choose Microsoft Outlook/Exchange over Lotus Notes/Domino. Although NotesCal has several useful features which Ocal does not have, none of these features, alone or considered together, would make a migration to Ocal a tough sell. However, as the number of NotesCal installations grow over time following the release of Lotus Notes R5, it will become increasingly important for future versions of Ocal to have the features of NotesCal in order to encourage and ease migration to Ocal.

Calendar User Interface

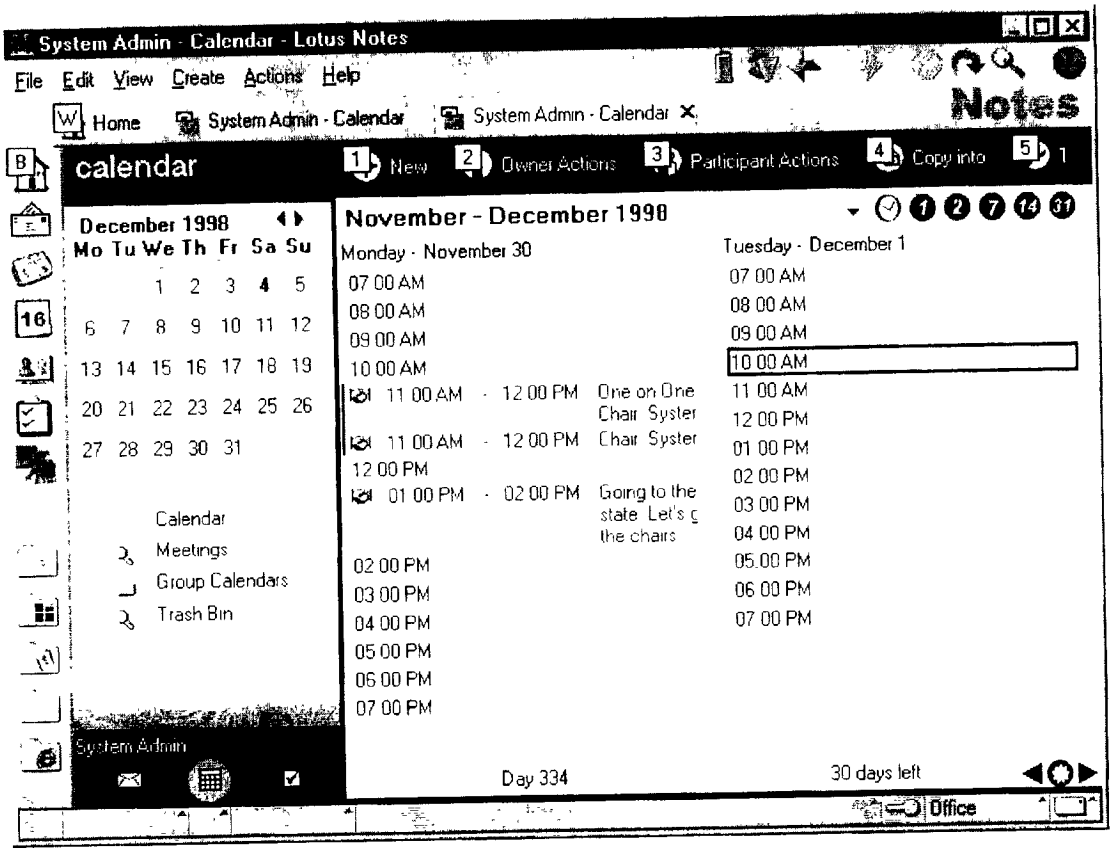


Figure 24: R5 Calendaring UI

Note the nice stationary like-look of the calendar.
Note that the times in the two days shown do not align

(note about these charts. These charts list the advantages of both NotesCal and Ocal Advantages considered significant are marked with a ◆ The term significant here means an advantage which may be a significant selling point or may pose a migration issue for the competing product.)

Lotus Advantages	Outlook Advantages
◆ Feels more like a real-life calendar and less like software	◆ In R5, all actions are highlighted regardless of whether or not they do anything. Example "Delegate" when no meeting is selected
When user creates a calendar folder, the option is in the create folder dialog to share it	◆ User can type directly onto the calendar
Better terminology for delegate options Example- "Only the following people can manage my calendar "	◆ Moving appointments from the calendar is easy and provides immediate visual feedback
Tasks appear directly on the calendar	Cannot check a task as done without opening it
	Cannot see whether or not a task is done without opening it
	In R5, appointment time selection UI is very confusing.
	In R5, cannot create an appointment of any lengt just by selecting the time area

The one thing NotesCal has going for it is its real world look and feel. When you're in NotesCal, you don't feel like you're in a complicated computer program, as you might feel using Ocal. With the nice fuzzy and flowery picture in the lower left, and the clean gridless white background, NotesCal gives you the pleasant sense that you're working with a stylish paper calendar you bought at your local stationary store (see bitmap below) This real world model nicely carries over to feature terminology which is noticably more clear than the terminology in Ocal. Two examples First, the Delegate dialog in Ocal explains the concept in a full paragragh The Delegate dialog in NotesCal describes it in one sentence, very simply as "Only the following people can manage my calendar " Second, to delegate your attendance for a meeting, in Ocal, you use the mail-oriented "Forward" command. In NotesCal, you use the real-world "Delegate" command.

Although the NotesCal user interface outshines Ocal in real world look and feel, Ocal is the clear winner in the area because of severe NotesCal UI problems and because Ocal is significantly easier to use on a day-by-day basis The biggest NotesCal UI problem is the fact that commands are always available whether or not they actually apply to a given situation. For example, even though no appointment or meeting is selected in the calendar, all commands associated with appointments and meetings (Accept, Decline, Counter, Delegate, etc.) are selectable This problem makes it very difficult for the user to know what commands are available at any time. Commands that are not available simply provide no user feedback. The user selects a command, it flashes in the menu, and nothing happens It is not known whether this is a known bug in NotesCal Beta 2 and if Lotus plans to ship this way The fact that this problem occurs across all NotesCal calendar menus suggests that NotesCal will ship with this problem

Ocal is easier to use on a day-by-day basis for two main reasons First, unlike Ocal, in NotesCal, you cannot type directly into the calendar (this also detracts from the NotesCal real world feel) You cannot simply click the mouse on where you want an appointment and start typing For each appointment, you need to create a new item, which while you create it, hides the rest of your calendar You also cannot set the start and end time of an appointment by creating it in a specific location on the calendar. NotesCal does not allow you to "select a block" of time and then create an item based on the selection Second, moving appointments or meetings directly from the calendar is a trying experience You have to be in a specific view showing the times, and then when you select and drag the appointment, there is no user feedback. There is no indication you are dragging anything anywhere Only after you let go of the mouse button do you see what the effects were

Calendar Viewing/Printing

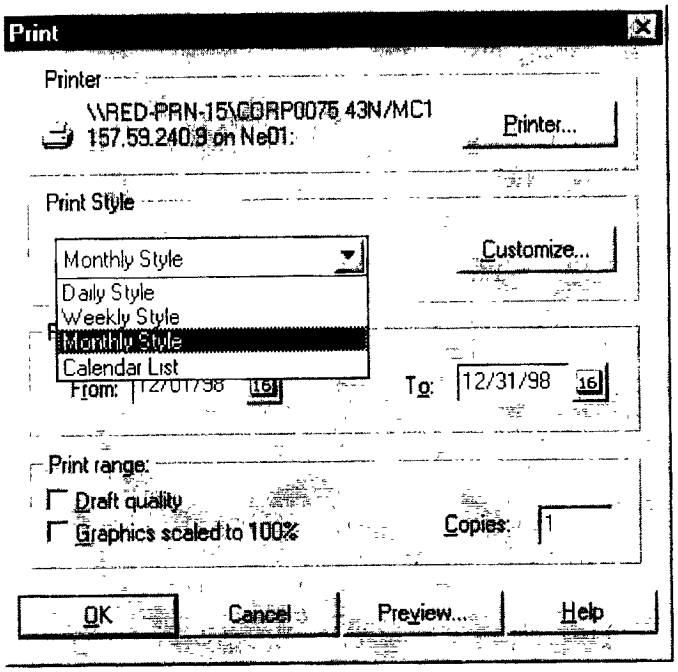


Figure 25: R5 calendar print options

Note there is no tri-fold option

Lotus Advantages	Outlook Advantages
	◆ Mini-months indicate which days (by showing as bold) have appointments (NotesCa lacking this may be a bug in R5 beta 2)
	◆ Grid in day and workweek view.
	In R5, cannot see more than one min-month at a time
	◆ Color background in day and workweek view
	◆ Users can choose to not print private appointments.
	◆ Many more paper options for printing. Example: Franklin Day Planner
	Tri-fold printout.

Ocal is the clear winner in the viewing and printing options area. NotesCal's most glaring lack in functionality is the lack of real grid view – two of the most commonly used views in Ocal (Day and WorkWeek view). In NotesCal, when the user views a day or workweek, the user has the option to see the list of times in a vertical list. However, these times are simply shown as text - apparently only separated by the equivalent of a carriage return. When an appointment is entered, times below it are simply moved downward. As a result, one cannot see a view of their calendar where time is equally spaced out. In workweek view, this is a bigger problem because the user cannot easily see where one time is across several days. For instance, on a Monday with no appointments, 3 PM might be in the middle of the window, while on a Friday with many appointments, 3 PM might be at the bottom of the window.

More so than in the user interface area, it is in the viewing area that Lotus needs to make a large and focused effort post-R5 in order to catch up with Ocal. A shift from their viewing model to one like Ocal would likely require an overhaul of this part of the product.

Ocal also has significantly more printing options than NotesCal (see bitmap below). Given the loudness of Ocal customers regarding the need for more printing options, the comparably very limited printing options in NotesCal would alone make NotesCal a tough sell. NotesCal does not allow you to print to a variety of paper sizes – for example to fit various paper-pims such as the Franklin Day Planner. There are less printing layout options (no Tri-fold printou) and less options for each of the layouts it does have. You also cannot choose to hide or not hide the private appointments from your calendar when you print, a must requirement we heard from Ocal customers for Outlook 2000

Calendar Options

Lotus Advantages	Outlook Advantages
◆ Extremely flexible work hour settings.	◆ Users can import/export iCal appointments
User can create just a reminder without an associated appointment	◆ In R5, users can not set the timezone (It is linked directly to the system timezone)
User can check off a reminder from the top-level UI before it happens.	◆ Users can see two different timezones at once
User can limit who can see their free/busy information	Users can specify the duration of free/busy information published.
◆ User can sign and/or encrypt a meeting request.	◆ Users can set whether or not delegates can see their private appointments.
◆ Organizer can prevent a meeting from being delegated	Users have the option to send new delegates a summary of their permissions
You can set a recurring meeting to intelligently avoid the weekends. Example: Every fifth day of the month. If that's a weekend, then make it the nearest Monday	

NotesCal and Ocal each have a few significant calendar options which are lacking in the other program. NotesCal allows a user great flexibility to set working hours Whereas in Ocal, the user must set the same start and end time for all working days, NotesCal allows the user to set different times for each day, and even incongruent times – for instance, the user can set the option to reflect, "I work from 8 to 12 and then from 2 to 5 on Monday " Working hours are then accurately reflected per user when scheduling a meeting The lack of timezone functionality was remarkable in NotesCal. In NotesCal, the timezone is linked directly to the system timezone To change the timezone in NotesCal you must change the system timezone There is also no way of showing two timezones at once, which you can do it Ocal There is also no evidence in NotesCal of Internet Standars support Given that iCal recently was approved as an RFC, Ocal will have an extended advantage in this area as iCal product penetration increases throughout the the NotesCal product cycle.

Outlook does have a significant lead in the number of calendar import/export options Here is list of options available in both Ocal and NotesCal

Outlook Import/Export Options	Notes Import/Export Options
Comma separated values (DOS and Windows) Dbase MS Access MS Excel FoxPro Personal Folder file (pst) Tab separated values iCalendar vCalendar	Structured Text Lotus 1-2-3 Tabular Text

Scheduling Meetings

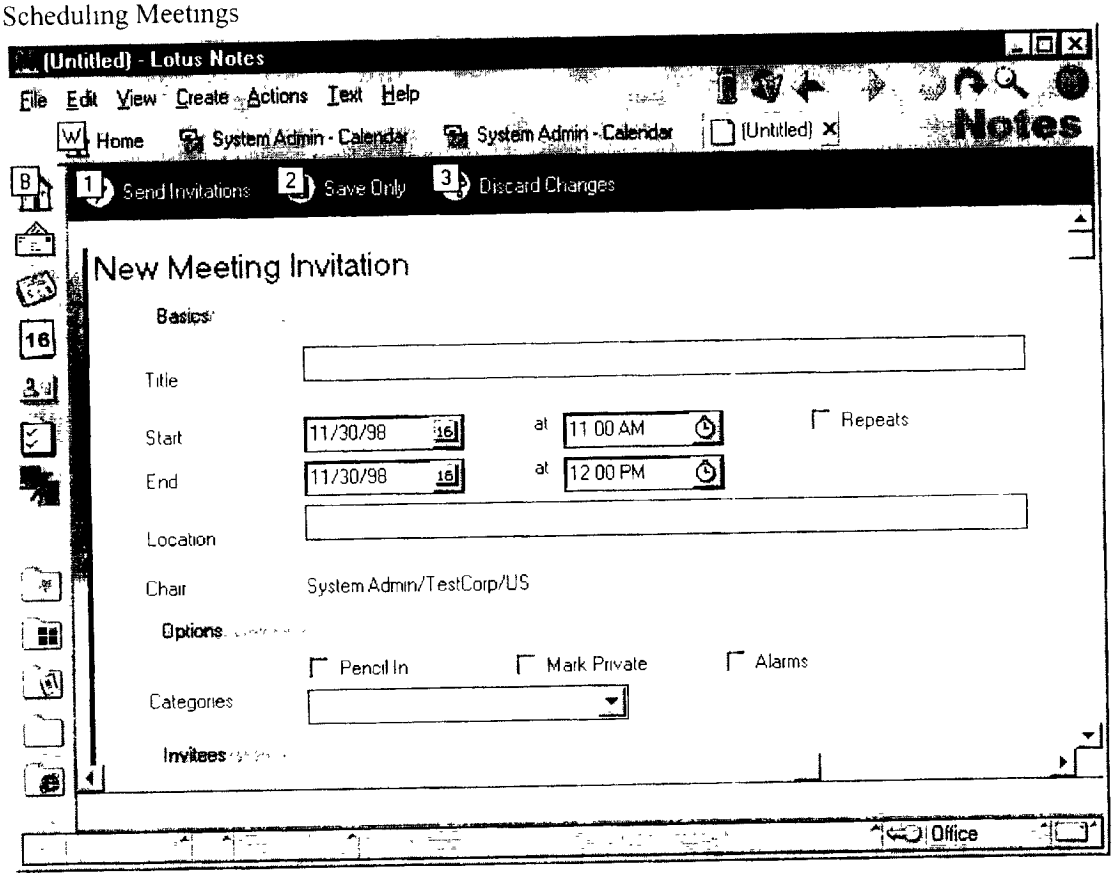


Figure 26: R5 new meeting invitation

When you create a new meeting, you enter the fields in the main window. In Outlook, a separate window shows up.

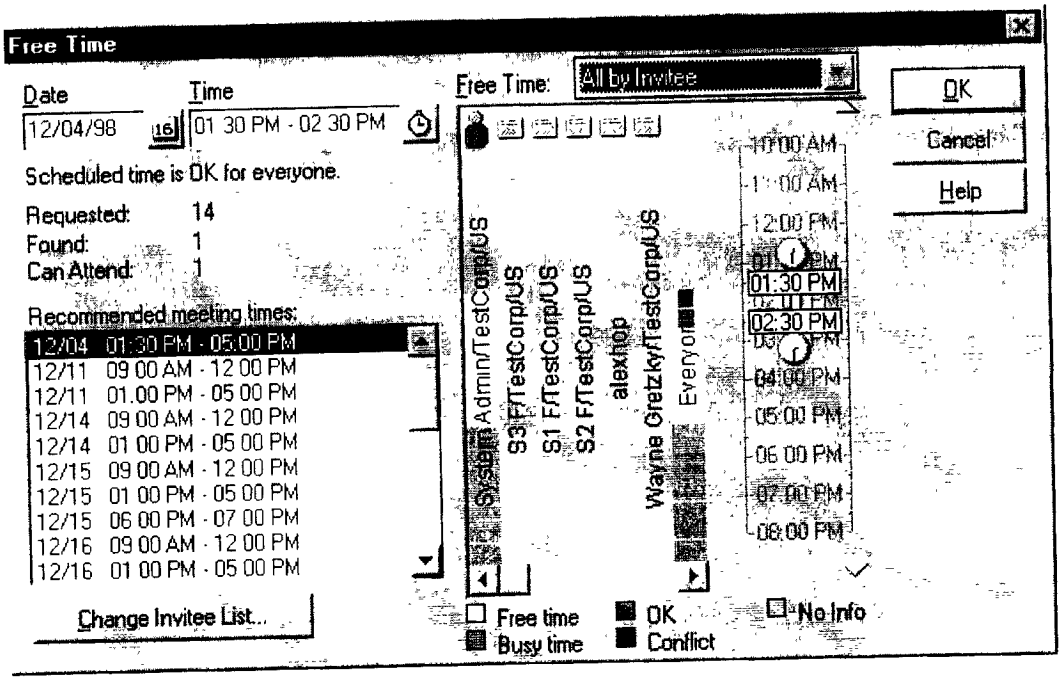


Figure 27: R5 meeting planner.

The meeting planner allows you to select from a list of recommended times
Note the awkard yellow time select UI and the list of attendees in the free/busy area is hard to see

Lotus Advantages	Outlook Advantages
Explicit "Confirm" meeting option for the meeting organizer	Outlook (in Internet Only mode) allows you t send and receive meeting requests in iCal format.
Explicit "Delegate" option for an attendee	◆ Outlook can publish iCal free/busy info an read other users' iCal free/busy info
◆ You can set a user as just "FYI" for a meeting.	Users can see the details of appointments in the meeting planner by right-clicking on busy time
"Room" attendees is distinct from "Resource" attendees.	In R5, meeting planner is small and attendee names are listed vertically making them very hard to see.
◆ Resource Reservations Database makes finding a room a straightforward process	Outlook saves the last 10 locations in a location MRU.
◆ Meeting planner shows entire week like the S+ way	◆ Outlook has online meeting support
Meeting planner draws distinction between conflicting appointments and time outside working hours	
Meeting planner shows nice visual (color) feedback in how ideal the selected time is	
◆ Attendee can "counter" a meeting request with a new time	
Users can store the free/busy info of selected users locally	

NotesCal and Ocal each have a few significant advantages over the other program – NotesCal has a slight although unremarkable lead in this area. Several of the NotesCal advantages are serious because we have received specific requests for them. For instance, several customers have asked for the "FYI" meeting attendee option (a feature from IBM's OfficeVision) The NotesCal meeting planner is also in the Schedule+ style, which most Ocal customers moving from Schedule+ have missed. This advantage is diminished somewhat by the cramped interface of the NotesCal meeting planner (see bitmap below) and by the fact that Ocal users can still use Schedule+ as their calendar NotesCal also incorporates a Resource Reservations Database, which allows users to easily choose a specific site or a room in a specific site NotesCal will choose a room for the meeting with a size fitting the number of attendees. Although this same (and slightly extended) functionality is in Ocal, the way NotesCal does it is more straightforward – less training will be required for a NotesCal user to successfully reserve a room. Much work is planned in the area of resource scheduling

NotesCal does not support iCalendar free/busy, which Ocal and many other programs have done since Outlook 98 There does not appear to be any way to efficiently schedule meetings – checking free/busy or sending meeting requests – with a person not using NotesCal. NotesCal also lacks online meeting support while Outlook integrates NetShow or NetMeeting setup directly in the meeting planner

Tasks: Beyond the two task features highlighted at the top of this section there do not appear to be any breakthrough features in R5 that aren't already in Outlook 98. R5 has added the concept of a category field to both tasks and calendar items and also added views based on the category --- they will also support user defined categories. In addition, they have added the "assigned task" feature.

Contacts

About the only significant contact management implementation that R5 has made is the ability to customize the background of an individual contact item when that item is open in a card view Beyond this it is fairly clear that Lotus' contact management strategy relies totally on either LBP customization, third party integration (e g. ACT!) and/or Organizer So far the contacts module has a different look and feel than calendar/e-mail and tasks - maybe they are not quite done yet and we see more in the next beta/final version. However, expected changes would be in the design area more so than in core contacts functionality.

Some feature comparisons

Their address book module is just that an address book. It does allow user to create contact records and distribution lists
It does not integrate any phone dialing capabilities
It does not support the creation of letters or mail merges.
It does not offer any kind of build in duplicate detection
It does not offer any kind of advanced contact management features like contact activity tracking
It scales much better than Outlook contacts folder and allows a faster search for individual contacts

Advanced Contact Management Features

There currently is no contact management database template It is amazing that they did omit this piece and we should expect it to be either in the next beta or in the final product The database platform and app development capabilities of Notes 5 0 allow them to build a great template for group contact management - something in an order of magnitude better than what we can do in an Exchange/Outlook public folder application with forms code and contact activity tracking

Bottom line

Outlook offers much richer out of the box contact management experience. However, at the high end of serious single user or group contact management Lotus Notes has an opportunity to provide a contact management template that offers a much better solution for contact centric users than Outlook\Exchange can deliver given its current architecture. We should also observe their Organizer integration strategy. If Organizer will be able to work against a Notes backend we have to seriously look at the capabilities of the Organizer client.

Client UI & usability analysis

Outlook wins on graphical design and good looks in the UI category by a wide margin. Other parts of this paper show that the functionality of the standard modules in Outlook is also much better.
However, the Notes client has a much better navigation and UI structure than Outlook can offer today. The conceptual design of their client is very thoughtful and if they fix some graphical design problems they have a killer UI Fortunately, they do not exactly have a good track record in this field Unfortunately, the design of their Notes 5.0 items and sample apps is pretty good. They also are very vocal about the fact that the UI is not fully completed yet.
Their Strengths:

1. The client combines browsing of the web with browsing notes databases. Everything happens in place.
2. The way they let users navigate to databases is far superior than our public folder tree – instead of one big tree they offer multiple entry points to databases. Once the users has opened a database the opened space – for example a team collaboration area – has its own navigation UI that provides access to the different parts of that application.
3. All their applications are to a large extent build with the same designer that app developers use The major UI elements are fully programmable. Therefor it is easy to modify their standard modules and to build custom apps with the same look and feel

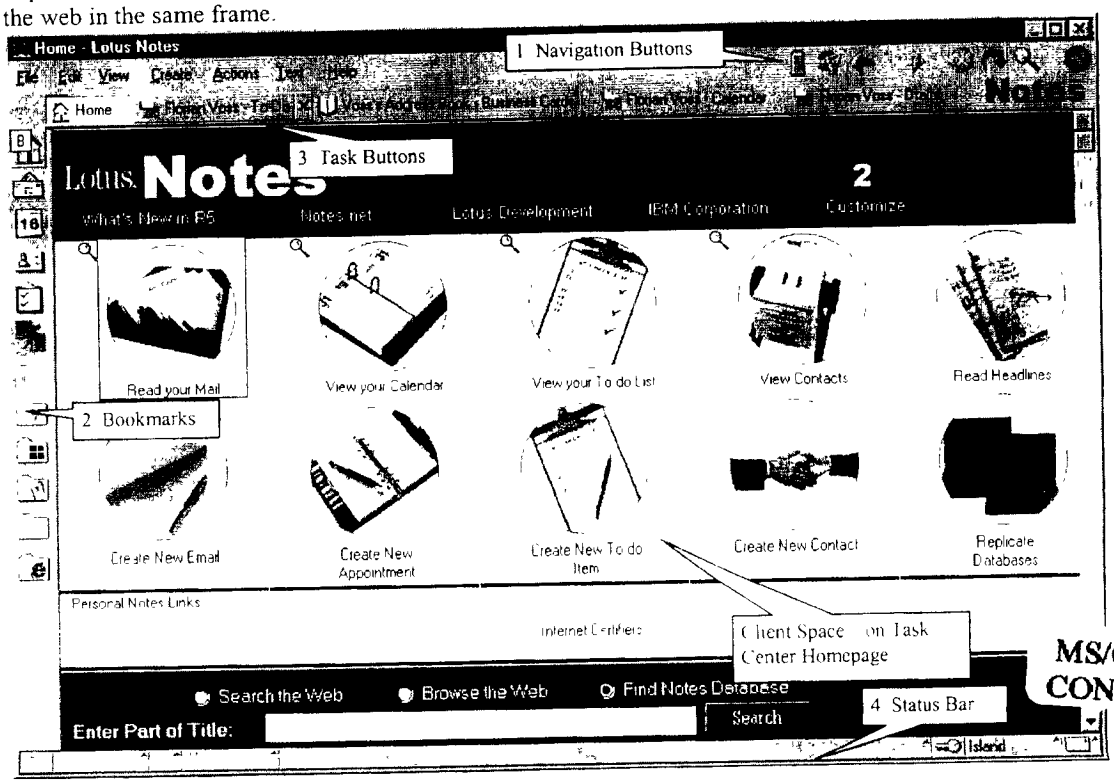
Their Weaknesses

1. Their icons/graphical elements/dialog layouts are really bad
2. Their menu structure is unbelievably unorganized.

This analysis focuses on the Notes Windows Client. UI of forms/pages designed for the Web is not analyzed

The Frame

The Notes Client has adopted a web like in place navigation metaphor All views and all items are shown in place – users can optionally select to open items in a new window. User can surf Notes databases and the web in the same frame.



Navigation Buttons

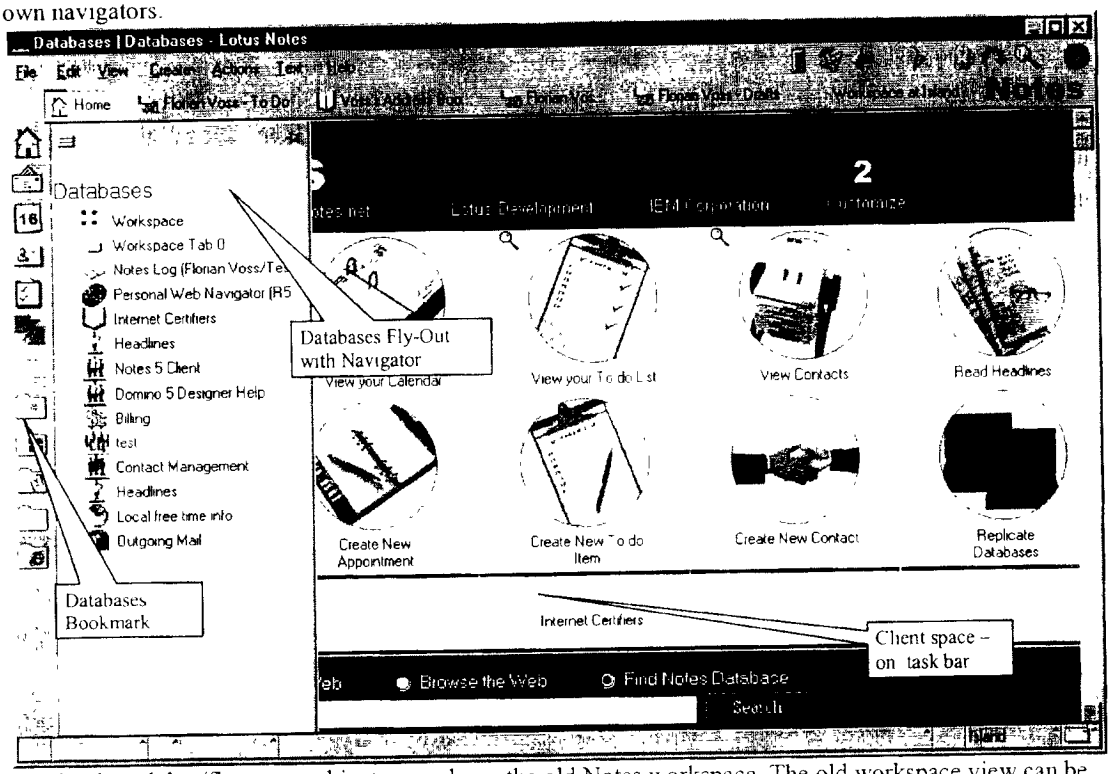
Back. Forward, Stop and Refresh buttons just like in a browser Users can go from a notes item to a web page and come back with one click. Back and Forward can drop down a list box of places visited in order A search button offers searches over the web. the current view or a full domain search.

Issues

A Domain search does not work
B First two buttons (Admin, Designer) should not show up (known)
C. Domain Search disabled.
D Back/Forth does not work on web sites Not fixing this would be a major flaw

Bookmarks

The buttons can be shortcuts to documents, views, navigators, and URLs
The first standard icons are shortcuts to views like task center, inbox, calendar, contacts task and replication setting
The shortcuts with folder images display Notes new "Navigator" element in a fly-out. They show favorite user databases, all databases, a new item creation pane and MS IE favorites The fly-out can be docked, but by default clicking on a selection closes it.
The bookmark icon plus navigator fly-out metaphor is very powerful since custom databases can show their own navigators.



The bookmark bar/fly-out combination replaces the old Notes workspace The old workspace view can be activated as well

Issues

A Total change from all previous versions. Major discussions about retraining costs for installed base in Lotus Beta Feedback Forum As a result Lotus reactivated the Workspace option Workspace and Bookmarks do not seem to be in sync
B It is not possible to go back to a workspace page via navigation back arrow, you get a different view. The workspace is not synchronized that's got to be different in the final version so that they can upgrade existing workspaces

C. The design of the icons totally sucks They are ugly and they conflict with the design of the navigation buttons

Task Buttons

A button is added for each open database and for each open item. Lotus needs an element with this functionality since they open items in place Users can start editing a message, navigate somewhere else and comeback with one click to complete

Issues:

A Good concept/bad implementation

These buttons are a good idea because they give users quick access to databases that are not on the bookmark first level. Since user might very well have many databases to choose from but will only work with 3 - 4 at any given time these buttons are great shortcuts. And they prevent the Windows taskbar from being cluttered – Outlook's many windows often add so many buttons that the taskbar becomes unusable.

However, for some crazy reason they show shortcuts to homepage/e-mail/calendar/task and address book when these modules are open These items have one-click-activation on the bookmark bar anyway and users live in those modules They will have them open most of the time That means that almost by default 5 task buttons are visible – add two or three messages and you have chaos.

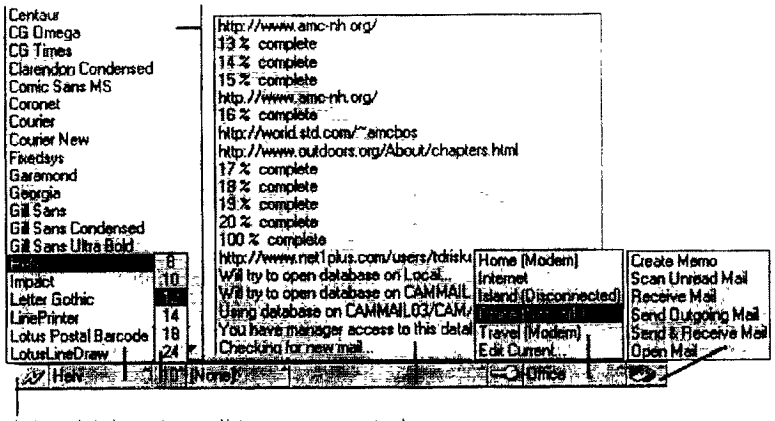
B The design of the buttons is terrible – from little icons to button form

Status bar

The status bar is the area along the bottom Notes.

Users can see whether Notes is accessing the network (a lightning bolt appears), can change the font (typeface), size, or paragraph style of selected text when editing a document, see a list of recently displayed messages, see their level of access to the open database, see their current location and switch between locations such as office and home and use a popup menu to perform common mail tasks such as creating a message or scanning for unread mail

The location switch is brilliant!



Lightning bolt shows whenever Notes is accessing a network

Issues

A The font customization on the toolbar is the weirdest design I have seen in a long time. I don't know what they are smoking a Lotus!

5 Client Area

All items/views/pages are shown in the client are in place See the next section for a detailed analysis of items in the client area

Comparison Frame Capabilities

Notes Advantages:

Conceptually this is a great UI structure – the logical elements of the frame play together very well.

1 The bookmark bar with navigators that fly-out is a better way to access shared databases of interest than the public folder tree/ "Favorites" / Outlook bar combination

2 Showing items in place following the web browsing metaphor is a great concept. It is much less busy to show an item in place than to open a window. Users surf the web and are used to this way to work. A Lotus web client can look much similar to their full client because of this concept. Outlook opens items in their own windows – not as good as this.

Note As stated they the task buttons are not working so well in this build

Outlook Advantages:

1 Visually Outlook's UI looks much better than the current Beta 2 interface – Quote from the Lotus beta newsgroup "Notes looks like a shareware mortgage calculator"

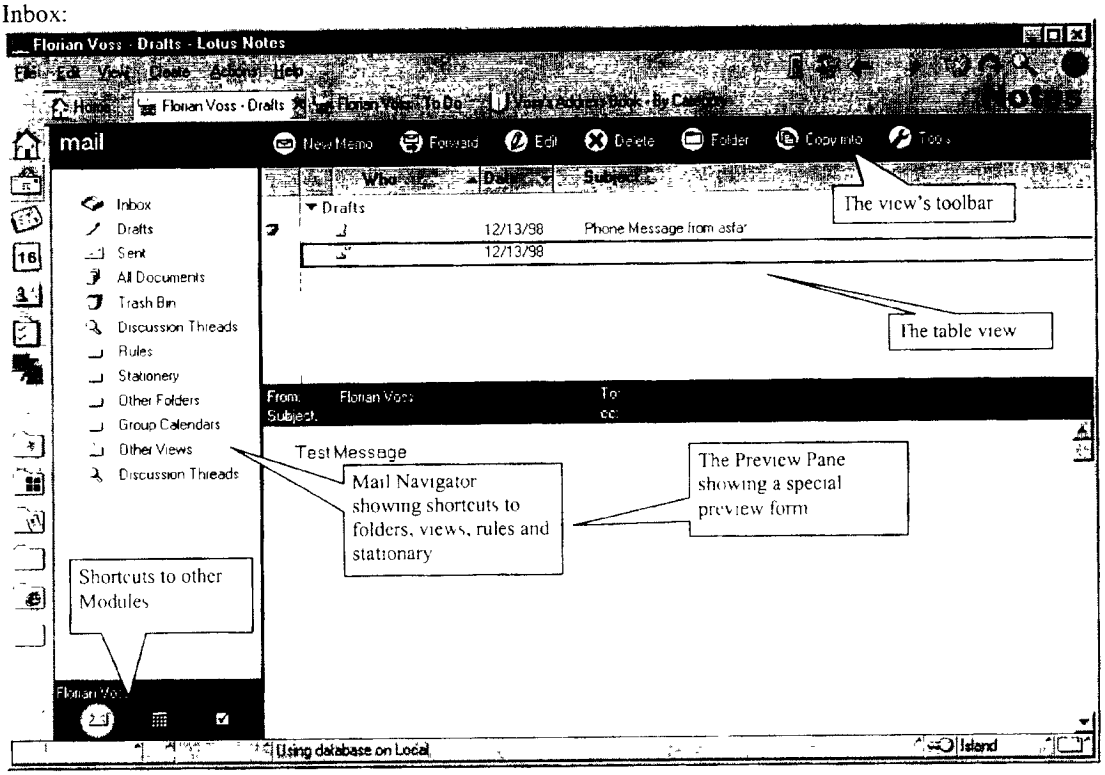
2. The Notes UI can be overloaded if users choose to display all possible elements – Outlook looks better But then again – they would have to choose to do so. In fact – Lotus switches of an extra toolbar by default – the toolbar is therefor never shown in bitmaps in this analysis.

The Client Window

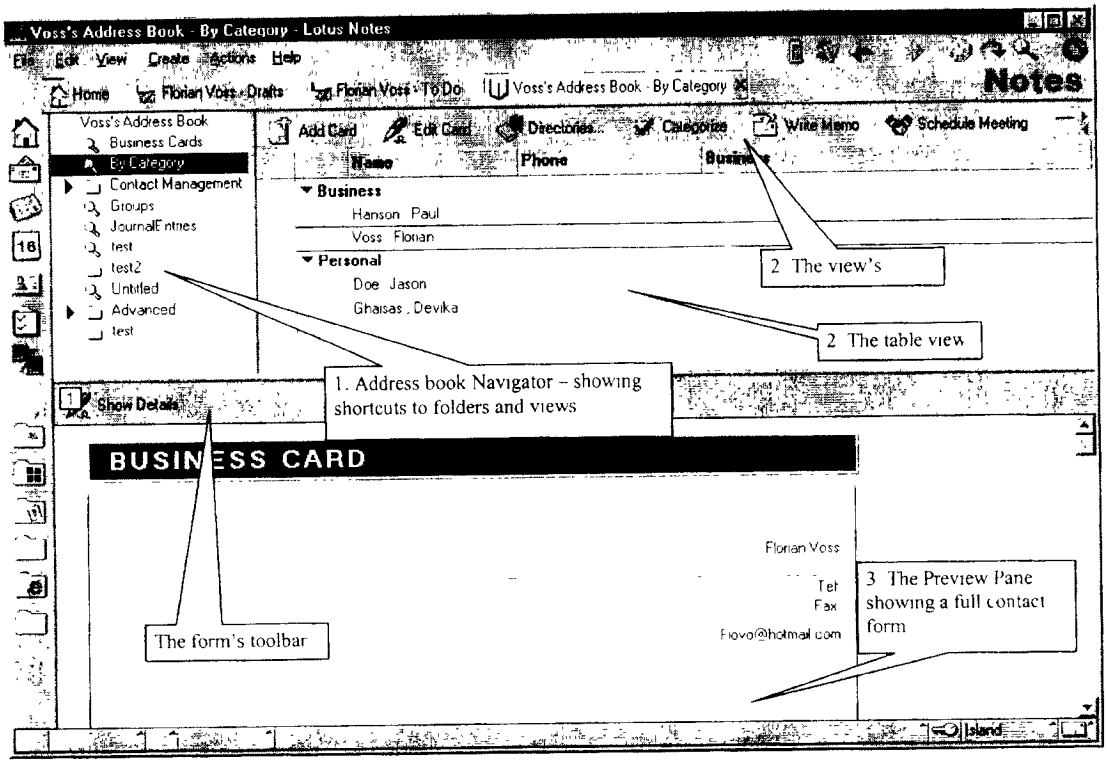
In the client space Notes displays whatever is currently selected – a web page, a Lotus Notes view, or a lotus notes item. Items displayed here can have their own navigators or links to other items in place. The standard homepage shows hotspots to navigate to the most important modules and to create items in those modules. And then it allows users to search. Again, the design is questionable – but the fact that a page like that exists and can be easily adapted is great.

General Layout

Inbox:



Contacts



Navigators

The navigator component placed on the left side can show links to folders, views, items. This is a very powerful concept for a couple of reasons

A Users find entry points to databases of interest to them via the bookmarks feature. When they open a database, the databases own navigator element takes over and shows all the elements that are relevant to that database. They can hide a folder hierarchy and just show links to the components (see team pages bitmap)

B. The standard navigators for Calendar/Inbox/Tasks and Contacts do not only show folders but they also show shortcuts to views and other options like stationary or rules in the inbox or a month view in the calendar They even show shortcuts to the other modules. Great discoverability!

Views

The Notes view element provides a table and a calendar presentation Views have a top action bar with commands that apply to the selected items

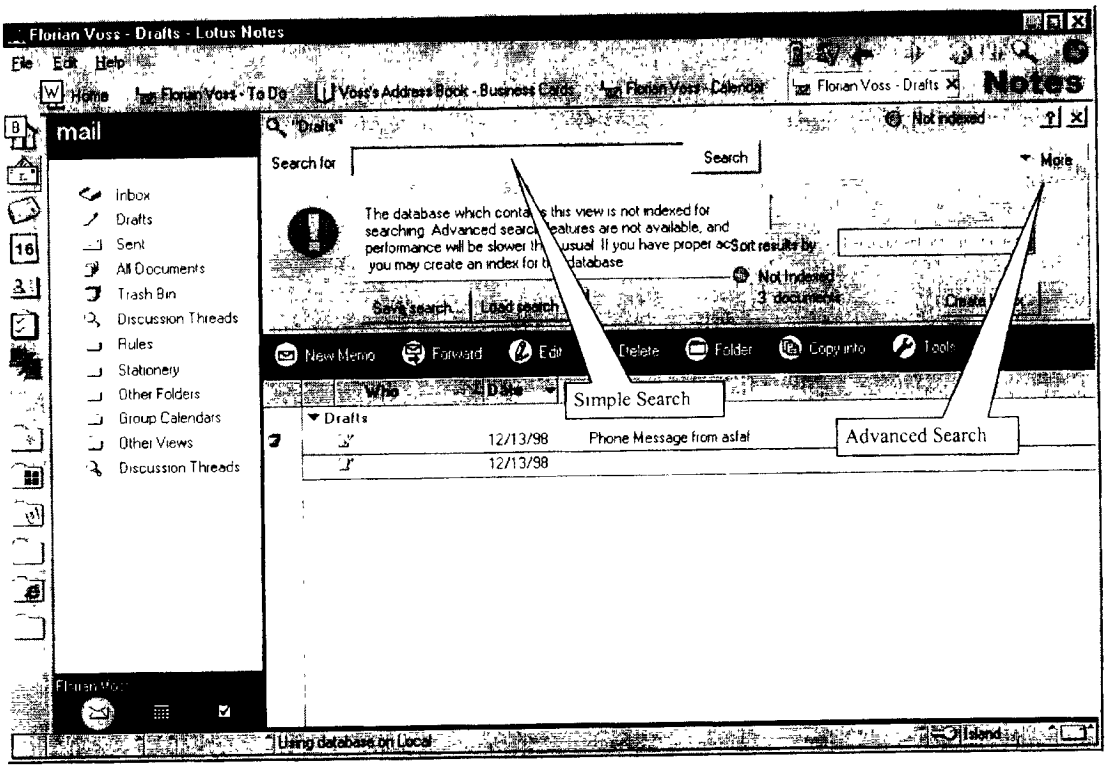
Double click on a selected row opens the item in place.

Views can display hierarchies for threats and groupings like categories

Users can tag items and let the view only display those tagged items.

The views have more options than Outlook views – more column types (from totals/subtotals over URL's to sub-tables everything can be programmed) Users (or developers) can also set if "on open" the view selects the first, last or the item that was selected when the user left the view However, these options are very hard to set - users have to activate the designer

Views offer a search UI - simple and advanced

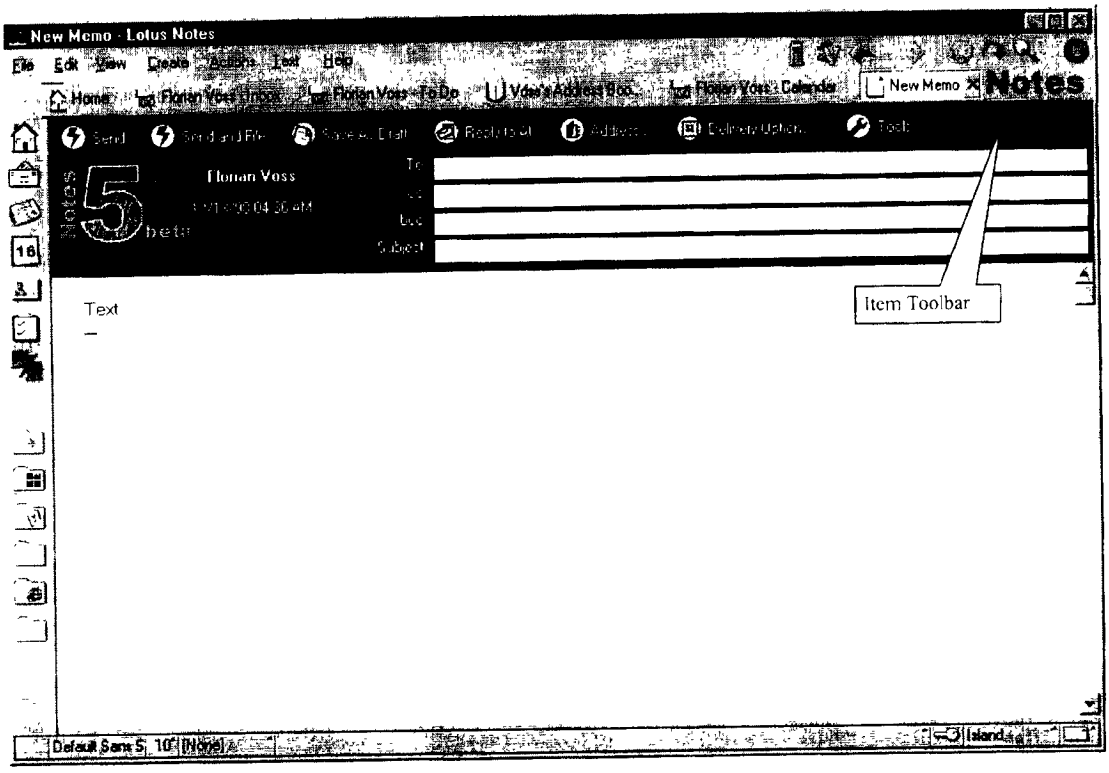


Preview Pane

The preview pane can be arranged horizontally or vertically – it can show the full form or a special preview pane rendition of the form

Items

Items are activated inside the client window – they can be optionally be opened in their own window
When an item is opened a task button is added It stays alive as long as the item is open
Items have a toolbar on the top. The buttons can have associated popup menus
Items can contain links to other items In fact, a special menu item "copy as link" allows users to copy links to items and insert them into others A click on the link navigates to the item.



Comparison Client Window

Notes Advantages:

1 The "Navigator" concept is great – while Outlook's folder homepages and application wizard provide a similar approach, this concept is firmly build in the Notes UI/Dev environment for all modules/apps
2 The Notes preview pane is much more powerful than Outlooks -- It can display forms Outlook only displays the message body
3 The simple toolbar on top of an item/view is easier to use than Outlooks toolbars with their more confusing selection. The Notes toolbars offer easy access to the commands users need in 95% of all cases

Outlook Advantages:

1 Simple customizations like creating/modifying views are much easier in Outlook
2. Again – Outlook is visually more appealing – the whole UI looks more elegant

Other Observations

Top Level Menu Structure Disaster

The menu structure is almost comical – again I wonder what is going on in the minds of the Lotus designers Commands appear multiple times, are not properly grouped or disabled depending on selected. Example Actions menu item number 3 in all PIM modules is "Send Memo to Database Manager" Disclaimer I do not know what kind of heritage/user training they try to preserve, maybe there is some reason for the madness

Context Menu's inconsistent

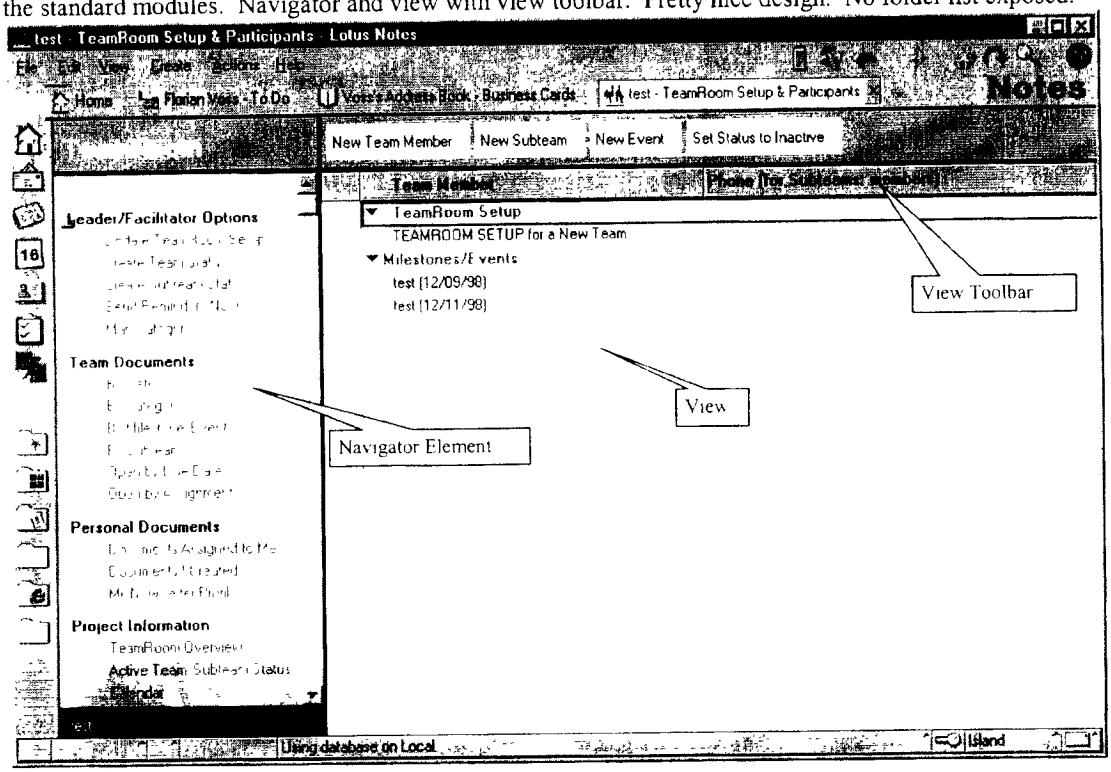
The same is true for context menus Not a good job

Drag & Drop Inconsistent

Drag and drop is very inconsistent. Sometimes it works, sometimes it doesn't. Again – Outlook does a much better job

Customization

As a sample I show a picture of Team Room – one of the sample apps they ship. Exact same elements as in the standard modules. Navigator and view with view toolbar. Pretty nice design. No folder list exposed.



Notes Advantages:

1. All UI controls (views, navigators, date picker, everything) are accessible for the developer and provide a rich set of programmable properties/events This is huge because it allows custom apps to have a consistent design and integrate seemingly with Notes build-in applications
2. All Frame navigation works. Pressing the "Search" navigation button activates the search pane of the current view Forward and back work Double click on a view column opens the form.
3. All the notes modules are build in the same environment that is available for custom app development That means users can fully customize the standard apps Outlook standard forms are largely locked and their design can not be changed

Outlook Advantages:

1. Simple customizations - especially view customizations are easier in Outlook.

Packaged Applications & Templates

Lotus is investing far more than Microsoft in both application templates that ship in the box in Domino, as well as packaged add-on applications that run on top of Domino The key focus area for Lotus is ad-hoc collaboration, where sophisticated end users quickly and easily set up collaborative workspaces as needed, use them for as long as necessary, and then move on to the next one This is clearly an area that we need to get much more serious about as a company

Built-in templates

Domino has a number of built-in templates that allow sophisticated end users to create applications with no coding. This includes all the forms that comprise the Notes client itself, as well as several more general purpose templates. While these provide a considerable amount of 'out of the box' functionality, they are targeted at relatively sophisticated end users or beginning developers. The UI that a user uses to create an application from a template is complex, opaque, and non-intuitive. Creating an application is not something an office intermediate or even advanced Office end user would be likely to be successful in.
That said, the template are of real use for sophisticated users or IT departments in throwing together ad hoc collaboration applications The following are the templates present in beta 3:

Discussion.

This is the basic discussion group, similar to an Exchange Public Folder. It supports threaded discussions, with child documents indented in a discussion view.

Document Library

The document library template adds forms for adding documents as Notes attachments. Major features include:

- Full text search
- Optional "review cycle" (workflow/sequential or parallel, optional time limit on review, and notify owner on completion).
- Supports "responses" discussion of documents.
- Category view

MS Office Document Library

Just like doc library but supports inserting Office documents directly Documents show up as in-place active documents in Notes when opened. Has cosmetic integration features, for instance using correct (Office) document icon in views.

Personal Address Book

Fixed schema with all the usual address book elements. The application allows formatting as a fancy "business card" (including choosing among many styles) when Note form is opened. Used for administration, email, and scheduling as well as personal contacts Supports creation of groups (different schema – with *members* attribute)

Personal Journal

Very simple form (title + body) – almost blank – just used for free-form note-taking. The application provides helper commands for creating sub-folders where notes can be "categorized" – a subset of the notes then show up in each folder. Notes can show up in multiple sub-folders (single instanced).

- Headlines. The headlines template wasn't complete in beta 1, but it's clearly a information update area similar to Outlook Today The headlines area has user definable subscriptions, a group calendar, and up to two URLs It looks like users will be able to select a couple of different layouts for the headlines page, and they can be selected from canned URLs (yahoo, IBM, etc) or enter their own URL The subscriptions are notifications of documents that match a user-specified criteria (authored by John Doe, tagged with a particular keyword, or even larger than a specified size) You can define the criteria with several radio buttons or in an advanced mode that looks like a SQL query
- TeamRoom TeamRoom is a more complex template that supersets discussions & document libraries, created by the Lotus Institute It creates a sub-areas for team directory, shared calendar, discussions, document sharing, and basic issues tracking A brief synopsis is below

TeamRoom is different from other Notes applications in that to get the most out of it there is a fair amount of configuration that needs to be done on the front end Lotus recommends that companies hire a facilitator to work with them on the first team room and train the company's employees for further team rooms The team room in Notes R5 beta 1 consists of a team directory, personal views on the team information, and project information The team view is all of the documents that pertain to the team Team documents can be viewed by category, event, sub team, due date, etc The personal view is the documents that I created or are assigned to me. There is also a newsletter view where members can set notifications on documents by author, category, events, or a substring of the subject of the document The project information area shows the member list, group calendar, sub team status, and archived documents or issues A "facilitator" area allows facilitators to manage the workspace set the mission statement for the team, create sub teams, add members to the team and sub teams, and send reminders for action items

The following are the major features of the TeamRoom template reviewed in beta 3

- Supports multiple document types· discussion, action item, meeting, and reference are default types.
- Supports group milestones and events
- Auto-creation of summary ("newsletter"), and reminders Also auto document aging (documents automatically marked inactive).
- Provides storage for "personal" and "team" documents (documents can be marked private).
- Users can set newsletter profile to determine how documents are filtered to show them relevant docs
- Documents can be assigned to people
- Status reporting is supported

Bookmarks

This is apparently used by the "favorites" database that you get in the default installation – but I was unable to find the correct UI buttons to add new shorcuts Stores database of URL's and Notes database – I think to be presented inside their navigator pane

Administrative Templates

A number of administrative templates are provided with Notes (they are actually grouped in with other end user focused templates, which adds to the usability problems with the template creation process) These templates include·

- User Registration Queue
- Agent Log, Achrive Log
- Cluster Analysis
- Database Library
- Design Synopsis Template
- Local Document Cache
- Mail Router Mailbox
- Mail (IMAP,
- Mail (R5.0)
- News Articles (NNTP)
- NNTP Discussion
- Notes Log, Notes Log Analysis
- Personal Web Navigator
- Statistics and Events,
- Statistics Reporting

Advanced Templates

A number of 'advanced' templates are provided with Notes (they are actually grouped in with other end user focused templates, which adds to the usability problems with the template creation process). We have not evaluated these at length, but they include:

- Decommission Server Reports
- Domino R5 Certificate Authority
- Local free time info
- MIME Conversion forms
- NT/Migrating Users' Passwords
- Server Certificate Admin

Domino.doc

Document management is emerging as a crucial enabling service for knowledge management. With the Domino.doc add-on product, Lotus is in the process of changing this business from a vertical niche segment to a broad horizontal infrastructure sale. Prior to Domino doc, full-featured document management systems were generally extremely complex industry-specific systems priced in the hundreds of dollars per seat (i.e. targeted at only a subset of users in the corporation). We expect that a mainstream market will evolve in this space looking for simple, easy to install and administer systems priced for corporate-wide deployment. Domino.doc is one of the leading examples of products targeted at this new market. The other notable competitor in this space is OpenText, with their LiveLink product[15]. There were quite a few sessions at Lotusphere-Berlin focusing on document management - it's clear that Lotus is trying to widen their lead here in anticipation of a certain MS entry into this space.

Domino.doc costs $9,500 per server, plus $34/user ($19 for existing Notes client users). The current installed base about 1M seats, or about 4-5% of total Notes seats. In the Platinum timeframe we will ship PKM, which will be our first entry into document management based on an embedded Platinum store. Lotus already has a two year headstart in this space, Domino.doc is currently in its second major release and may be v3 by the time PKM ships.

Overall, we expect PKM to be roughly at parity with Domino doc 2.0. Domino.doc will have the following advantages:

- Replication. Domino.doc supports multi-master replication for its document stores.
- Hierarchical storage (Domino.doc Storage Manager). This is an add-on for Domino.doc that does automated offline archival storage.
- Imaging (Domino.doc Imaging). This is an add-on product that does document imaging and OCR.

We expect PKM to have the following advantages:

- Client support. Domino.doc supports ODMA, a web client, a "desktop enabler" standlone application, and the full-featured Notes client. Only the Notes client gets access to the full document profiling and all doc management features, and the ODMA support is problematic for several reasons despite the broad office application coverage it offers. In contrast, PKM will have full fidelity Office2000 support, a more functional web interface, and Windows File Explorer integration through a shell extension.
- Subscription/notifications. Domino Doc does not expose any document or folder subscription mechanism. While the event model makes it easy to construct this functionality, the out-of-box experience does not allow users to be pro-actively notified of document or folder changes. PKM will support this functionality and will also provide subscription to saved searches.
- Flexible roles. Domino Doc exposes a fairly rigid role/security model constructed around four roles: File Cabinet Administrators, Manager, Editors, and Readers. While PKM will also have a simplified

[15] Livelink is a superior product, but since it lacks the installed base of Notes to sell into, and the distribution and marketing strength of Lotus/IBM it is unlikely to garner much success.

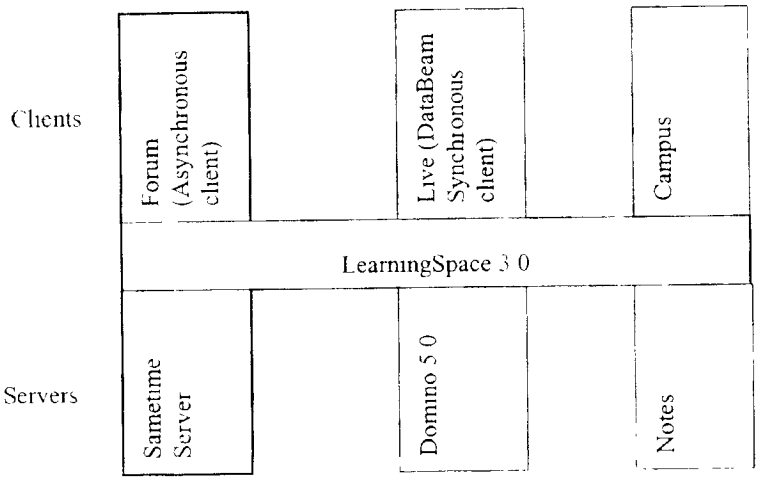
out-of-box model using Operators, Coordinators, Contributors, and Consumers, the permissions and privileges of theses roles will be customizable for each object in the system (Note, these role names are not yet finalized.) In addition, Workspace Coordinators will be able to define new roles as needed to address real-world business processes

- Search interface. The search interface exposed by Domino.Doc is extremely constrained. It allows users to search by keywords, dates, document type and binder scope, as well as specifying sort order and number of results. PKM search will extend the NT5 search interface to provide similar functionality, but will better leverage document metadata for rich searching. In addition, PKM saved searches will be exposed as folder-like objects in the namespace, allowing users to navigate through rich, hierarchically organized, persistent views
- Document-centered discussions. Surprisingly, Domino.Doc does not provide any out-of-box discussions mechanism centered around documents. Again, this functionality can be constructed on top of the basic platform. Using Office Web Discussions, PKM users will easily be able to have threaded, persistent conversations around documents as well as anchored to specific points within documents

LearningSpace

Lotus sees the corporate distance learning market as a $4B market opportunity in FY99 Jeff Papows publicly stated at Lotusphere-Berlin that "we intend to dominate this market." Lotus' recent flurry of acquisitions demonstrates how serious they are about this intention

From a product perspective, LearningSpace is simply a series of databases and templates developed by Lotus for their Lotus Domino Server The next release of LLS will incorporate the technology they acquired from DataBeam and Ubique as well as include Campus, which is functionality that Lotus is jointly developing with Learning Connect, a UK company We anticipate that the next release of LLS will look as follows



LearningSpace "Live" is the code name for the addition to the LearningSpace product family that will provide real-time learning in either stand-alone or integrated deployments. LearningSpace Live is based on the DataBeam Learning Server and other technologies in the Lotus Sametime product family and a common Lotus Sametime server. It provides both real-time data and multimedia collaboration through support of T.120 and H 323 standards The Live client will work in stand-alone fashion for those organizations standardizing on synchronous learning When deployed with LearningSpace its courses can be managed using common management tools and live sessions can be integrated into asynchronous courses.

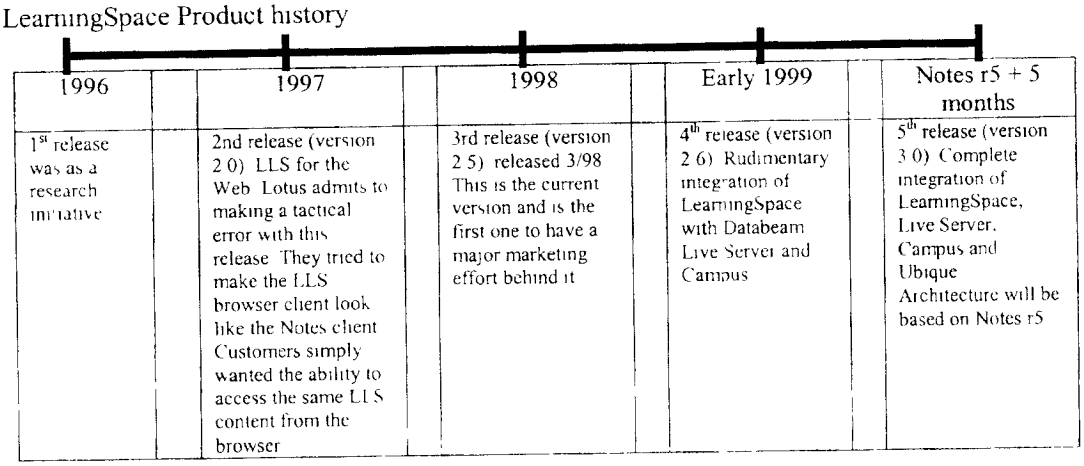
Forum is the code name of the next LearningSpace asynchronous client

Campus was demonstrated for the first time at the opening Keynote of Lotusphere-Berlin, and although developed by a third party, will be packaged and branded as a Lotus product. It is the code name for the technologies that support the administrative functions required to offer multiple courses at multiple sites – student registration and records, class admissions, billing and payments Campus will allow ISPs or Notes Public Network providers to provide hosting services, as well as support the needs of organizations with significant volumes of LearningSpace courses to manage. A single Campus is defined by a profile document that describes the domain of that Campus. The profile covers four areas:

- A course catalog and an online registration process that provides links to external billing or e-commerce systems
- A "course manager" to control the creation and offering of new courses The course manager maintains an archive of master courses. It provides the interface for instructors and course designers to create and revise master courses and manages the creation of a new offering of a course, the equivalent of scheduling an additional class or opening a new section.
- A set of common profiles of students which may be shared across "Campus" environments
- Approval workflows that may be required for the approval of a new class or for admission to a course Workflows are optional, and are controlled by a profile document

All three of these clients are hosted on a Sametime (synchronous) server and Domino 5 0 server.

LearningSpace Product history



1996	1997	1998	Early 1999	Notes r5 + 5 months
1st release was as a research initiative	2nd release (version 2 0) LLS for the Web Lotus admits to making a tactical error with this release They tried to make the LLS browser client look like the Notes client Customers simply wanted the ability to access the same LLS content from the browser	3rd release (version 2 5) released 3/98 This is the current version and is the first one to have a major marketing effort behind it	4th release (version 2 6) Rudimentary integration of LearningSpace with Databeam Live Server and Campus	5th release (version 3 0) Complete integration of LearningSpace, Live Server, Campus and Ubique Architecture will be based on Notes r5

Where LearningSpace fits into the Lotus organization

LLS is part of the Distributed Education Business Group (DEBG) which is part of the Emerging Products Group (EPG) at Lotus DEBG went from 7 employees in January '98 to 54 currently Some of this growth can be attributed to Lotus Institute developers joining the group, but , in general, the group is growing quickly. Lotus expects the LLS team to expand to 124 employees by August 1999 In addition to these numbers, the Databeam acquisition added 110 employees to the LLS team while the Ubique acquisition added another 35 Jeff Papows, Lotus' CEO, believes that the LLS team will be one of the largest groups at Lotus within the next five years. LLS is now touted in every Papows keynote presentation

LearningSpace sales methodology

1 Sell direct: The sales network that Lotus is laying out to sell distance learning is fairly impressive: ~500 Education reps (50/50 HiED/K12) On special deals, Lotus will sell direct to customers This practice has alienated many of their channel partners

2 Network of specialty partners

There are 180 LLS specialty partners· 50% in the US, 50% rest of world. The specialty partners must be experienced Notes resellers/partners and are required to take two courses·

- Selling and implementing LLS - $2000/student (2 day course)
- Developing and delivering LLS - $800/student (2 day course)

The LLS specialty partners

- Host web course content and make it available to customers
- Are authorized training centers
- Create multimedia courses or offering their own courses - content developers
- Project and deployment management

3 Other partners

Lotus recognizes the importance of content and is working with the Harvard Business School as a content partner Lotus is pushing that well-known name aggressively. They are also actively working with Simon & Schuster, J Wiley and Sons, Learning Connect and McGraw Hill

LearningSpace customer base

Lotus reports that LLS has been deployed at 400 universities (our competitive intelligence suggests that this is more like 50 Higher Education institutions)and at 280 companies. Our market research indicates that there are between 1 4 million and 1 6 million users of LLS and that it is generating around $50-80million of Lotus' $580 million education revenues The target market for LLS is existing Notes customers and currently 90% of the install base of LLS is at customers actively using Notes. They admit that because LLS is based on Notes/Domino, it is too complicated right now for non-Notes customers

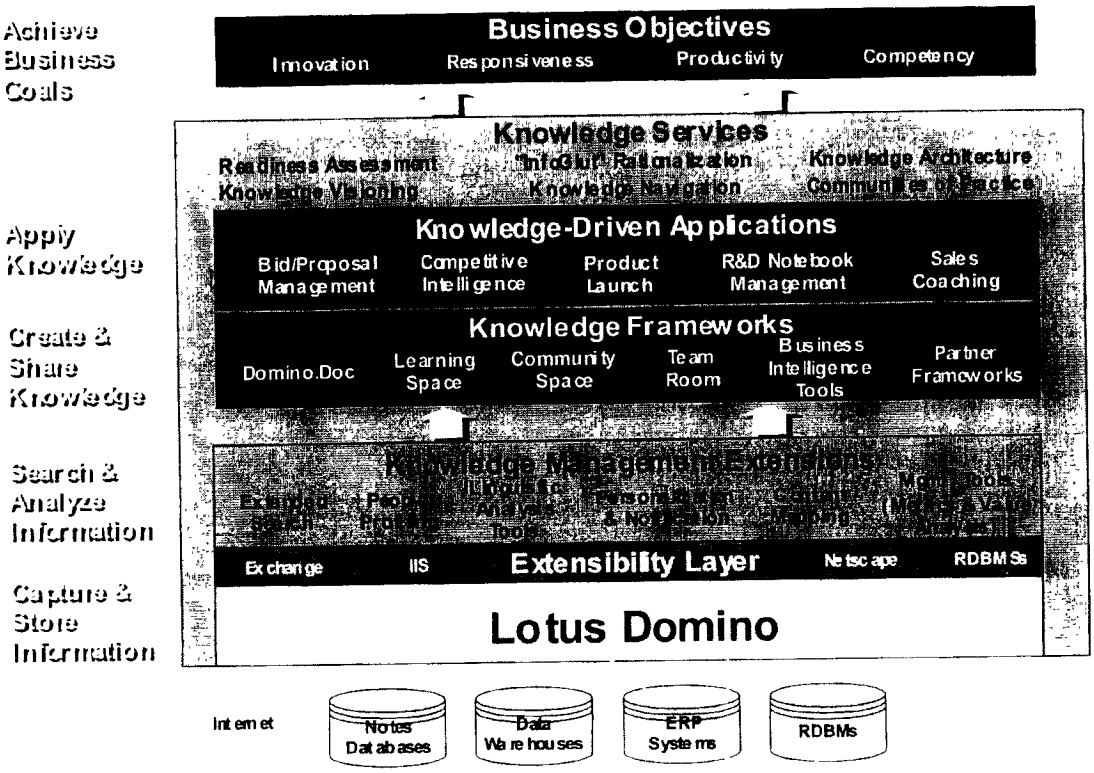
LearningSpace pricing model

Lotus has recently charged its pricing model for LLS from a per course per student model to an annuity-based license based on clients and servers The new pricing is as follows.

- LearningSpace Forum Edition
  - $6499 per server and $36/CAL. (subsequent years, the CAL drops to $17)
  - Passport C level $5822 per server and $31/CAL
  - Passport F level· $5454 per server and $29/CAL
- LearningSpace Live Edition (Learning Server) $9000 per server (varifying CAL prices)
- LearningSpace Anytime (Forum+Live) $10,500 per server (varifying CAL prices)

Future applications

The picture below gives an idea of Lotus' view of Knowledge Management, and some samples of the applications and technologies that they're planning over the next year or so



Lotus pre-announced a number of products this summer. Of the 10 products, features or technologies announced all but one are still under development and at least six months away from coming to market (and in many cases longer). Much of the technology is still only in R&D form --- in fact Lotus even refers to some parts of the announcement only as"project(s) under consideration " Also, some of the technology overlaps and conflicts --- the Lotus and IBM (e.g. Lotus Knowledge Director and IBM Knowledge Utility) offerings are both trying to provide the same functionality. Following is a quick listing and description of the set of products announced:

- Knowledge X: A product acquired by IBM from Integrated Technology, Inc (ITI)'s KnowledgeX is knowledge management technology for gathering and finding links between data, and solving business problems. Sources at IBM have described KnowledgeX as reflecting elements of both knowledge management and database technology Used in applications such as mergers and acquisitions, litigation, and sales force automation (SFA), the technology is designed to gather information from different sources, find "hidden relationships" between the data, and use the information for problem-solving IBM intends to integrate the acquired technology into DB2 Universal Database as well as into its business intelligence tools in the future
- IBM Knowledge Management Server A gathering point for a subject defined by the user The information comes from the web, files, E-mail messages and databases Using technology from Intelligent Miner for Text and Intelligent Miner (database-oriented data mining), the information is categorized, linked and analyzed DB2 is the repository for much of the information-other information residing in other files and the Web are simply linked Access software, called the Knowledge Toolbar, helps users drill down and find information.
- Team Network A product intended to support multiple teams with shared field of practice
- Expert Network A set of tools & apps that Lotus is researching and developing to automate the generation of profile listings of individuals' expertise These profiles can be used to create visual "social

networks" that show connections and overlaps in interests, work history and expertise. This will enable large organizations to locate the right people to quickly respond to business opportunities

- Knowledge Director: This is new client content map functionality that groups documents together into logical clusters and creates a visual "map" that guides users through them

- Solution Space A product that will automatically archive workgroup discussion threads

Marketing & Sales

In addition to the $100M advertising and promotional spend that Lotus committed to make for the launch of R5, we can expect the following additional marketing/sales strategies as themes throughout the R5 campaign:

1 Lotus will increasingly attempt to position themselves as a multiple product company that is more diverse than just Domino. Papows has said that in CY99 major marketing dollars would be applied to eSuite, Learningspace, Domino Extended Search and Domino doc [Note: Smartsuite was not mentioned at all here in this context, nor did it come up in any of the slides at Lotusphere-Berlin]
2 Lotus back on the offensive: Papows conceded that recent MS marketing had really put Lotus on the defensive and he apologized for losing focus --- he promised that future Lotus marketing would be much more offensive focused and would also concentrate on playing up the Lotus integration with MS technologies
3 Realtime Focus. Lotus is really looking to their Sametime product (or at minimum their realtime vision) as a key differentiator in the messaging/collaboration battle with us We can expect to see this as a key theme in much of their R5 positioning even though the Sametime server will initially be a separate product for Lotus
4 Ubiqutous Internet Client: Papows still regards the Notes vs Outlook client battle as paramount in their push towards market leadership Lotus will work hard to position the R5 Notes client as a great ubiquitous client that can be used as easily by the home user against an ISP as it can in a business environment
5 Lotus trying to battle perception of R5 being a brand new product *"R5 is NOT a first version, because it integrates technologies and skill of IBM folks that have invented and been shiping relational databases for years "* --- Papows. This is really important for Lotus since past versions of Notes/Domino have traditionally been panned until the x 5 or x 6 release. Due to their enhanced market status now, they cannot afford to come out of the blocks with a new release that is considered non-performant.
6 IBM Relationship. Lotus and IBM will both continue to play heavily on the theme --- *"Don't trust your enterprise to someone who is just now trying to figure things out Trust IBM Only IBM understands your entire enterprise Hardware, software, operating systems "* The MS 'aura' and brand strength is a real concern to Lotus This is the reason they're using the IBM brand much more than usual The IBM brand also lets them deliver the 'entire enterprise expertise' message
7 IBM e-business: Up to now we have not seen a very integrated or focused push for Domino as part of the overall IBM e-business campaign. Beginning sometime in the R5 launch cycle we can expect to see IBM fold Domino into its overall positioning in a much more integrated and high profile manner

Packaging & Pricing

Back in June Lotus announced Notes/Domino pricing changes Although Lotus attempted to position these changes as price decreases, the reality is that most customers will experience a price increase The Lotus announcement covered packaging, pricing and licensing changes for both Domino servers and clients The server changes include replacement of the Domino Server with a new 2-to-4 CPU server configuration and the introduction of a new Enterprise Server bundle In addition, Lotus announced a new client licensing model which requires a client access license (CAL) for users accessing mail or groupware from a non-Notes client coupled with an annual client subscription fee for continued use of a Domino server Specifically, Lotus has made the following changes for Domino Servers

1 Raised the price of their entry-level server by discontinuing their single CPU Domino server (volume priced at $1495) and replacing it with a new 2-to-4 SMP server (priced at $1795).

2 Repackaged their Advanced Services and Domino Server into a new Domino Enterprise Server bundle that will cost $3195 and will be available only to customers requiring more than 4 CPUs

Lotus also announced significant licensing changes for client access

1. Required that all users listed in the Lotus directory pay a CAL

2 Renamed their Mail CAL to a Mailbox CAL and shifted the previous $45 cost to a fixed price of $30 plus a required annual subscription fee of $8.

3 Required that users desiring access to Domino applications from a non-Notes client now pay a similarly priced Groupware CAL.

4. Required that all Mailbox CAL and Groupware CAL users who don't have a Notes client lock into an annual $8 fee to have continued access to the server

9/22 Lotus CUP Pricing Announcement

This is a new competitive upgrade program for competitive products (current competitive upgrade is only for cc mail) --- only applies to MS-Mail, Exchange, Groupwise, Banyan Mail, Netscape Mail, HP OpenMail, Eudora Pro, DaVinci eMail, Verimation MEMO, Digital All-in-1, and Fischer's EMC2/TAO The program comprises two offerings under the promotional banner of "Trade Up to Lotus Messaging", both of which are only good between 10/5/98 and 12/31/98.:

1 Lotus Messaging License: a new upgrade that allows users to use the cc Mail or Notes client for messaging. It also gives them a Domino Mailbox CAL which gives them messaging access to the Domino Mail Server This includes a one-year software subscription and costs $24. The announcement doesn't mention that each additional year of subscription will cost $8 per user.

2 Notes Desktop Client Competitive Upgrade: this is a full upgrade from competitive clients to the Notes Desktop client. This costs $49 per user and gives each user Notes Desktop software and a one-year software subscription to the full collaborative and messaging capabilities of Domino server The announcement also doesn't mention that each additional year of subscription to both mail and collab will cost $16 per user

A quick analysis of this program reveals that 1) Offer #1 is a limited time offer for less functionality and a higher price than Exchange

- The $24 messaging license with software subscription only allows the user one year of access to a Domino mail server with "mail-only" software Every year thereafter, they must pay an $8 rental fee per user just to keep getting access to the server. ***Net Effect: $32 per user for two years of mail-only access to Domino (plus $8 for each additional year) versus $30 for unlimited access to Exchange's full messaging and collaboration.***

- Customers who currently have "mail-only" solutions like MS-Mail and Netscape Mail might find this offer interesting if they were looking for continued "mail-only" functionality and the price was cheaper than Exchange However, most of them probably want more than just mail to justify changing from their current system and this offer is more expensive than full functionality Exchange anyway

Offer #2 is also for a limited time It gives users the same functionality as Exchange at a higher price

- For a limited time, it now costs $49 to get a competitive upgrade to Notes Desktop software and access to collaborative capabilities on the Domino Server Prior to this announcement, companies

upgrading from anything other than cc:mail had to pay full price (approximately $69 at entry-level volume pricing)

- Lotus customers must also pay an additional $16 per year rental fee ($8 for mail-only and $8 for collab) to keep getting collaborative access to their Domino server.

- Microsoft has always had a competitive upgrade from key competitive products. For $30, Exchange users get Outlook software, access to full Exchange server messaging and collaboration, and no annual rental fee for continuing to use the software. Our two-year upgrade advantage contract is optional. ***Net Result: $65 per user for two years of messaging and collaboration access to Domino (plus $16 for each additional year) versus $30 for unlimited access to Exchange's full messaging and collaboration.***

Hosting & Lotus Net Service Providers

At Lotusphere-Berlin Lotus relaunched their ISP hosting platform (Instant Host). It will be available to Lotus Net Service Providers in October and offers a new licensing model that bills per session, instead of per user. Lotus consulting will work with VARs to generate demand. Lotus has already lined up at least 11 ISP platform supporters: AOL, BT, France Telecom, Interliant, Netcom, NTT, Telecom Italia, Telia, Swisscom, US West, Zaksat. Additionally, they claim approximately 30 to 40 Notes/Domino applications ported to the Instant! Host platform (note, at this point we are only aware of one live application, Instant!TeamRoom). Lotus is supposedly developing an "administrative wrapper" to enable all Notes/Domino applications to run on the Instant! Host platform. The goal is that any current Notes app can be turned into an Instant Host app using the toolkit.

Realtime services ("SameTime")

Lotus' SameTime server targets data conferencing and instant messaging within the enterprise, bundling together products Lotus acquired from Databeam Inc. (industry leading provider of T.120 server technology) and Ubique Ltd. (provider of instant messaging software) earlier this year. Lotus released a SameTime beta in December 1998 and has announced plans to release the product in January 1999. Comparing SameTime to the real-time collaboration services within Exchange Platinum, SameTime's advantages include:

- Lead to market. SameTime is planned to launch 9 months-1 year before Exchange Platinum. This is in addition to the 3 year lead Databeam provides Lotus in the data conferencing server market.
- Strong developer story. SameTime offers both client and server APIs.
- Standalone product (embedding Notes/Domino) enabling SameTime to sell into an Exchange environment.
- H.323 add-on and PI/IM (Presence Info/Inst. Msg.) gives SameTime feature advantage over Platinum.

SameTime's weaknesses, relative to Exchange "Platinum" are:

- Non-integrated conference scheduling, attendance.
- Requires user knowledge of protocol topology e.g. to schedule meetings users must know user/T.120 server mapping and server connectivity.
- Non-federated architecture. Instant Messaging limited to single enterprise.
- Poor directory and calendar integration.

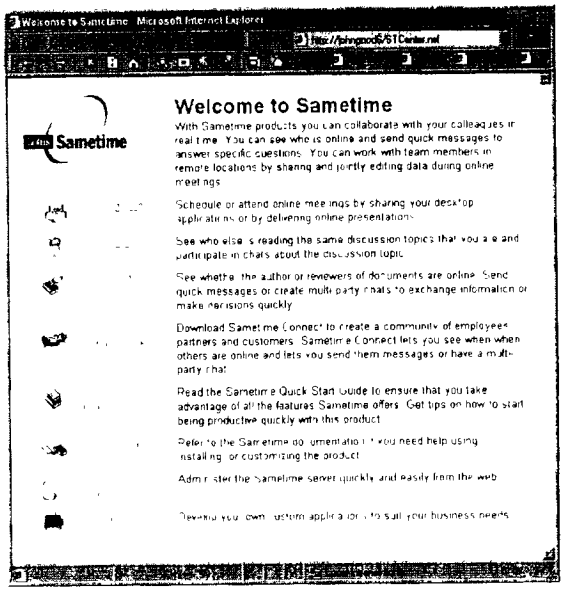
		SameTime	*Platinum*
	T.120 Client	NetMeeting	NetMeeting
	Standalone	Java	No
	Web		
	H.323 Client	NetMeeting	NetMeeting APIs

	Conf Schedule Mgmt	Web, Notes/Domino Calendar	Outlook 2000
	Integrated conf./ scheduling/IM Client	PI/IM conf APIs	Calendaring only
Developer	Client Extensibility	PI/IM conf APIs	Scheduling only
	Server Extensibility	Yes	Yes
Server	T 120 MCU	Yes	Yes
	Secure T 120	Encryption via Java	NetMeeting 3 0
	H 323 MCU	Add-on	No
	Continuous Video	No	No
	Presence Information /Instant Messaging	Yes	No
	Discussion Folders	Domino Databases	Public Folders
	Billing/Tracking	Yes	Limited
	Shipping	Beta	2H CY'99

Component Break-down:

SameTime is a stand-alone server package containing the following components.

- A T.120 multi-point control unit (MCU) acquired from Databeam
- Web-based scheduling and administration,
- A 'buddy-list' acquired from Ubique
- Lotus's Domino web server (embedded),
- Lotus Note's database and replication services (embedded).



The SameTime services are addressed from a page (See Figure) on a specific, or home Beyond this common entry point there is no integration between the various aspects of the product

Since SameTime is not an integral part of a Notes or Domino deployment, SameTime can be installed within a deployment of Microsoft Office/Exchange This offers Lotus both the advantage of an increased target market and the disadvantages of limited integration with their own messaging and calendar products This point forms the basis of many of comparative issues between the two products

Exchange Conferencing Service (ECS) is an integral component of "Platinum", providing

- T 120 MCU, (based on NetMeeting code),
- Outlook Calendar scheduling and MMC administration,
- *(The Exchange presence-management and instant messenger services shall not be available in the first release of "Platinum" due to schedule refocusing for delivery in MCIS 3 0)*
- IIS
- Exchange Store and NT directory services

Since Exchange's instant messaging service will be shipping post-Platinum this analysis shall solely describe the aspects of conference scheduling and the T 120 MCU. Instant Messaging functionality is, however a key component of the community aspects in the SameTime marketing story

The SameTime server also includes a 'Discussions' area providing a web based threaded discussion database and document library These services are provided within Exchange news and public folders It is anticipated however that these asynchronous collaboration areas shall include the SameTime presence management services indicating who is currently working within these spaces

Installation

SameTime : The SameTime server must be installed on its own machine It can not run on a machine currently configured with either the Domino or IIS services This machine can either form the basis of a community of SameTime servers or an instance of server providing SameTime services within a Domino deployment The distinction is minor, altering only the user's account (address-book/security context) replication and the deployment of 'agents' to facilitate integration between Domino and SameTime conference scheduling.
This calendar schedule integration is accomplished by opening each user's Notes Workspace on the Domino server, adding a "Mail-in database document" link specifying the user's 'home' SameTime server and domain to the SameTime schedule page Following a 20-minute poll from the 'AutoProcessReservations' agent, a copy of the schedule is copied onto their SameTime server.
The SameTime services maintain a separate user community database, the administrator must either bulk import an existing Domino user database or re-enter the address-book Each user requires a named SameTime server to be defined on their directory entry and an additional 'internet' password to be defined Administrators must manually link the security context (tokens database) onto each Domino server used to access SameTime services. To maintain a unified community of user details, each SameTime server requires a database replication schedule to be recreated to between them. All SameTime servers within an organization are required to be in the same community for users to collaborate (beyond access to a public data conference). Every user needs to be assigned to a specific server within the community.
Conferencing Service: ECS services are installed as an optional component of Exchange. These services may be hosted across multiple machines forming a distributed 'net' of servers. The association between servers is defined automatically by their specific deployment within a specific Windows 2000 site. The ECS shares the NT user directory and security contexts and benefits from the NT replication services.
ECS scheduling is an integral feature available within the Outlook 2000 calendar. Scheduling an online meeting requires the user to indicate the desire for a meeting to be an on-line meeting and selecting (as a resource from the address-book) the 'conference-room' within the ECS The schedule is 'directly-booked' with the ECS's 'meeting-agent' providing an immediate and synchronized replication between the user's calendar and the conference schedule in the ECS. This linking provides for synchronized updates and cancellations of user meetings
Exchange uses the NT directory. Each user is automatically enabled to participate within the ECS real-time services and standard ACL control allows the administrator to restrict access. Users account password/security context provides access to the ECS services The concept of the NT site is used to group ECS servers. All users within the NT domain structure can collaborate within any of the ECS server groups. The ECS automatically 'balances' the load of user collaborations between the 'available' servers 'closest' to the participating users

Scheduling a meeting

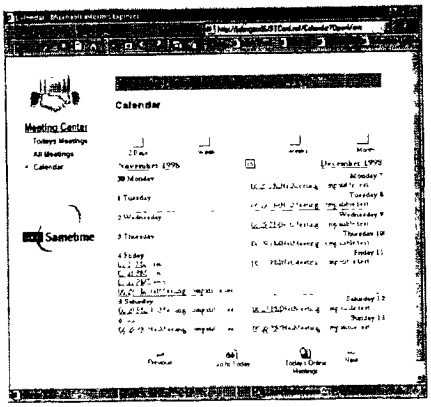
Sametime: Meetings are scheduled against a specific SameTime server From this preview release, it is unclear how, if any, limitation is enforced to limit the number or size of conferences on a specific server When sold independently by Databeam, each server had a licensed connection limit A connection was used when either a user connected to a conference or another server linked into a conference
Users must know the network address of the SameTime server on which they wish to schedule their conference Normally their 'home' server, and enforced when linked from their Domino calendar, users access the schedule page using a web link This 'link' can be accessed directly from a browser or from a form within Notes/Domino The meeting organizer may also identify additional SameTime servers to host part of their conference The organizer user must know, and manually enter, the network addresses for each the SameTime servers that are best suited to host the conference The organizer's notification email for each attendee is then required to correctly identify the SameTime server best suited for the client connection

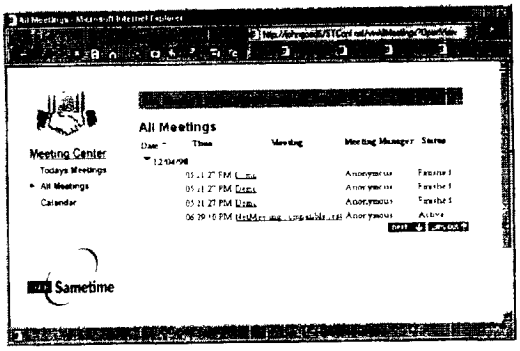
A meeting can have its access restricted to only users with SameTime accounts. The meeting organizer must enter each account name on the schedule form To notify users of the meeting, separate messages must be created and sent out. Modification of the attendee list must then the done both on the email message and the meeting schedule

A meeting schedule must also define the client type used by all attendees. The choices are a Java, app sharing and white board applet, or NetMeeting (app sharing, white board or chat). The Java applet provides encryption of the meeting contents. In the Java scenario, chat will likely be provided by the Java version of the instant-messaging client This was not available in the preview release and does not appear to support channel encryption.

Joining a meeting

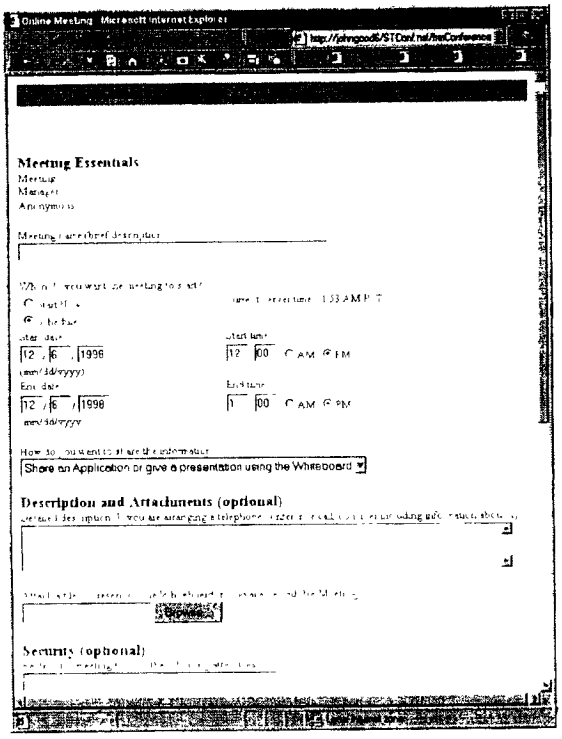
SameTime provides a independent calendar to access 'public' conference schedules. To enter a 'private' conference, each user must know the name on which the conference is running and enter the conference

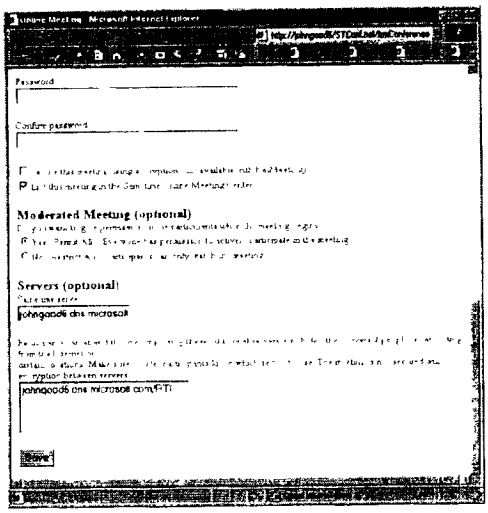




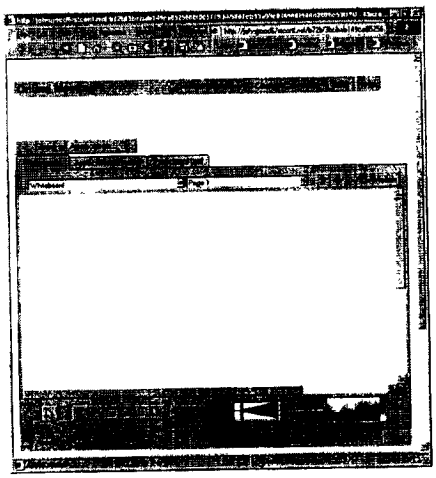
title

Meetings are scheduled by means of a html form. It is a separate and manual process to announce the meeting to the meeting attendees. Also note, both the attendee list and server list are free-form edit fields.





Running a conference
Each attendee must be manually referenced to the specific instance of the conference. If the organizer split the conference across multiple servers, then difference links must be sent to each user. The account list may also not be consistent across servers due to ill-configured communities or database replications. This however does not stop the conference existing on each of the servers
The Java applet used to 'replace' NetMeeting (See Figure), is slow and non-sizable.
Shared applications appear in the whiteboard area.



Conferencing Server: Meetings are scheduled against a group of ECS servers The administrator for this group gives these servers a limit to the conference-connections supported by the infrastructure (network/CPU etc) This is an arbitrary limit that may be exceeded if the ECS sizing is reduced after a specific booking level
A Connection represents a seat reserved for an attendee on the meeting scheduled. The ECS provides availability of service to a user by means of calendar free/busy Connections between servers when the ECS links servers do not count against the connection limit
Users do not need to know what or how many ECS servers are installed to support the conferencing service A meeting organizer invites a 'conference room' of a specific size booked against a pool of available connections defined by the group of servers in a specific ECS NT site. Address-book visibility/security can be used to restrict which rooms are available (or have access) from which users
A meeting can have restricted access to only client that can be authenticated against accounts on the meeting invitee list. The invitee list can include DL and contact names DL are expanded at point of reservation. Contacts must present a SSL certificate against a valid authority validating their email alias
The link the ECS 'meeting-agent' has with the organizers calendar item allows the attendee list to be synchronized automatically
It is invisible to the meeting organizer precisely which ECS servers shall be used to host their conference The ECS service at the scheduled time of the conference shall select the group of 'available' servers best suited to host the meeting's attendees. When the attendee accesses the conference they are dynamically referred to the server 'closest' and best suited to host the connection.
The ECS provides a good, better, best experience in the conference dependent on the T.120 application client used by the attendee Any cross-platform T 120 client compatible with NetMeeting (application sharing, white board and chat) when accessing the ECS conference participate by answering a (T 120) meeting invite. Downward version (2 1/2.11) NetMeeting clients are automatically run and call into the conference. These clients can only participate in an ECS 'public' meeting A private meeting provides access control, authentication and channel encryption and is only supported by NetMeeting 3 0

Application development and ISV enhancement

Sametime. SameTime provides interfaces for ISVs to add presence management, instant messaging and data conferencing to Notes/Domino applications The instant messenger is available as a Java component and can be embedded by custom applications. This provides a 'real-time' aspect to any shared space such as a document library or news-group Ubique developed this component's API The web pages used by the MCU can also be modified or functionality included within custom applications. Databeam developed these interfaces.
Conferencing Service: Since ECS conference creation is a standard part of Office 2000, the Outlook object model provides the mechanism to created extended applications that include data conferencing Incompatibilities between this and CDO 3.0 limit the ability to build server side scheduling applications In

addition to the ISV's ability to extend application with on-line conferencing, the ECS platform allows ISV to build additional conferencing services as an integral part of ECS scheduling and meeting participation. Exchange is already working with external partners to integrate telephone based conferencing and audio/video conferencing directly into the ECS services. These additional conferencing services shall allow meetings to be created either solely on these extended services, such as scheduling a phone-conference, but also in conjunction with any other installed services, such as a phone-conference with data conferencing. In each case the user experience for scheduling and entering the conference is identical. The targeting of PM/IM towards MCIS 3.0, leaves Exchange with a hole in the development of any such real-time applications. ILS and the Active Directory are available but do not have the focus required to compete effectively against a targeted set of services.