Lotusphere Europe

AD108
Inside The Notes/Domino Architecture

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Programmability Team

Lotus. WORK AS ONE

Better Programming Through A Better Understanding Of Notes/Domino Architecture

- Should be useful for people other than programmers, too
- Will give a high-level overview of ...
  - 3-level software architecture common to clients and servers
  - Basic features and elements of a Notes database
  - Notes Object Services (NOS)
  - Client and server programs
  - Security model
  - Directories, domains, and Domino administration
  - Messaging
  - Programmability

What is Groupware?

- Software which enhances the work performance of a group by enabling the group to define, organise, and share information in relevant and timely ways

- Based on shared databases designed specifically for groupware
  - Dynamic access to shared databases.
  - Distributed databases with replication.

- Common applications
  - Mail / threaded discussions / workflow / training

Considerations When Designing Practical Groupware

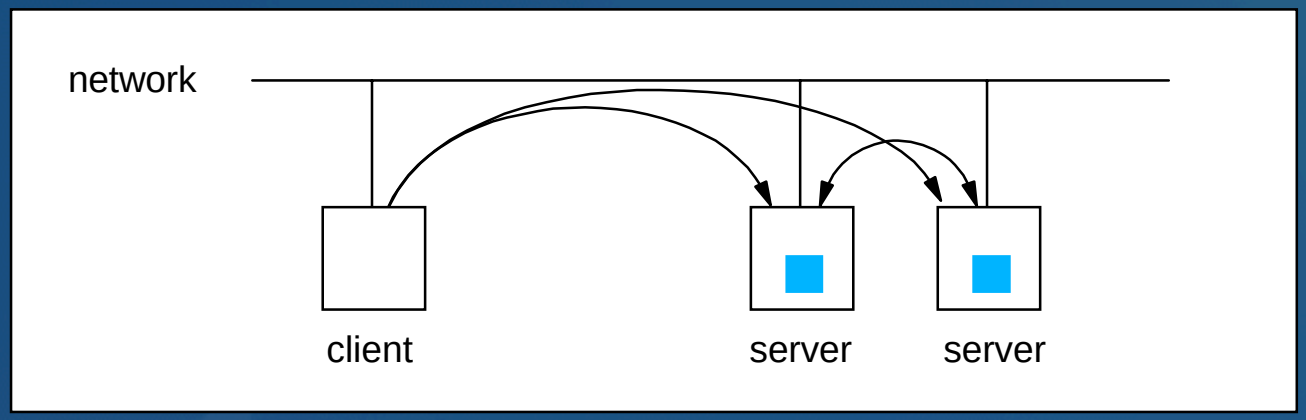
- Groups
  - Hierarchical organizations having multiple business units
  - Distributed knowledge and data
  - Mobile workforce
- Technology
  - Ever-evolving computer, network, OS, and language choices
  - Industry standards
- Obvious groupware product requirements
  - Security
  - Configurability and programmability

Replication Makes Distributed Data/Control Possible

- A process of distributing/resynchronisng databases
- Solves many groupware issues
  - Off-line access to data by the mobile or telecommuting user
  - Collaboration of groups that do not need constant connection
  - Control of administration and other distributed processes
- Replication works because conflicts tend to be rare
  - Often only the original author edits an existing document
    - Others tend to add "response" notes

The Classic Client-Server Model Is One of Two Database-Access Models Supported By Notes/Domino

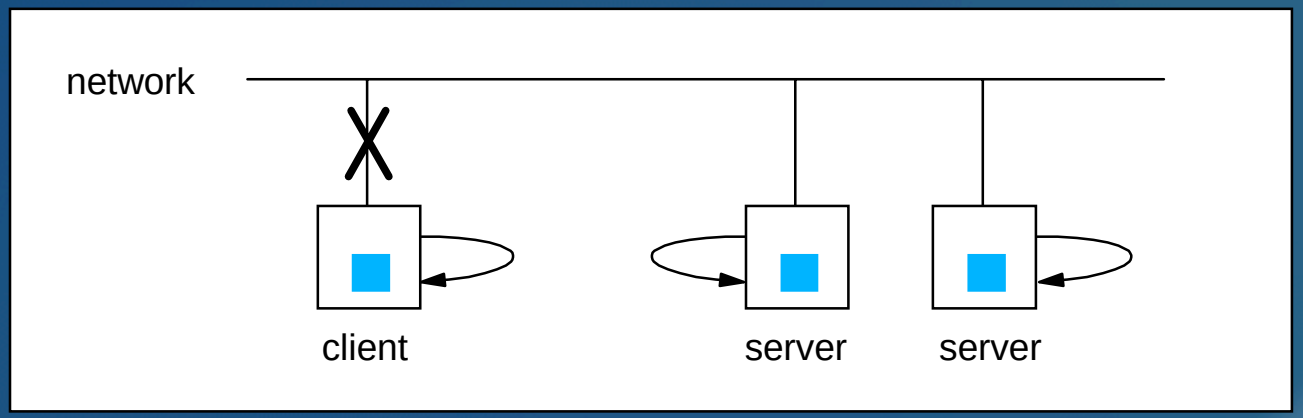
- Both Notes clients and Domino servers can use a network to access remote databases residing on Domino servers
  - A database is called "remote" if it resides on a computer other than the one running the program that accesses it



- Supported network protocols
  - TCP/IP, NETBIOS, SPX/IPX, XPC (dialup), VINES

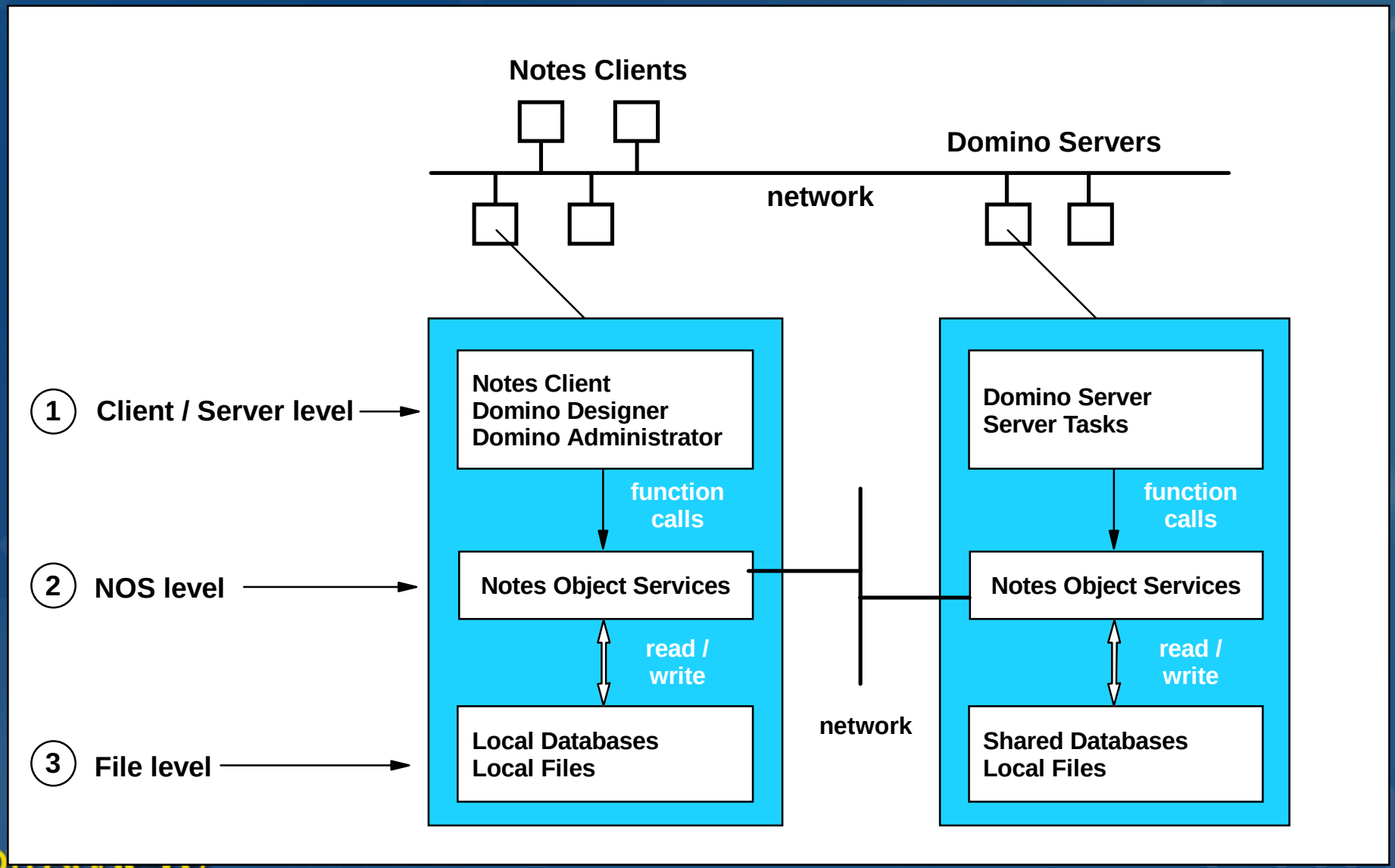
Access To Local Databases Is Supported On All Computers, Even Clients, And Even When Off-line

- A database is called "local" if it resides on the same computer as the program that accesses it.



- To do this ...
  - Each client contains the same lightweight, but industrial-strength database-access software that runs on a server.
  - Each database contains a copy of its design and administrative information so it can be used off-line.

Clients and Servers Both Use the Same 3-level Software Hierarchy



Notes Databases Support Groupware Needs

- Off-line use of databases
- Flexible "document-oriented" structures
- Rich set of datatypes (simple text, rich text, links, etc.)
- Note response hierarchies
- Sharing of data dynamically and via replication
- Database security via encryption and Access Control Lists (ACLs)
- Database integrity via transaction logging, cluster support, etc.
- Portability of applications and databases
- Programmability

Contents Of A Notes Database

- Each database always has a header
  - Version number
  - Database class
  - Information Buffer
  - Database ID (DBID)
  - Database Instance ID (DBIID)
  - Replication Settings and ID
- Each database can have replication history
- Each database can have notes
  - Design elements / documents / administrative notes

Categories, classes, and subclasses

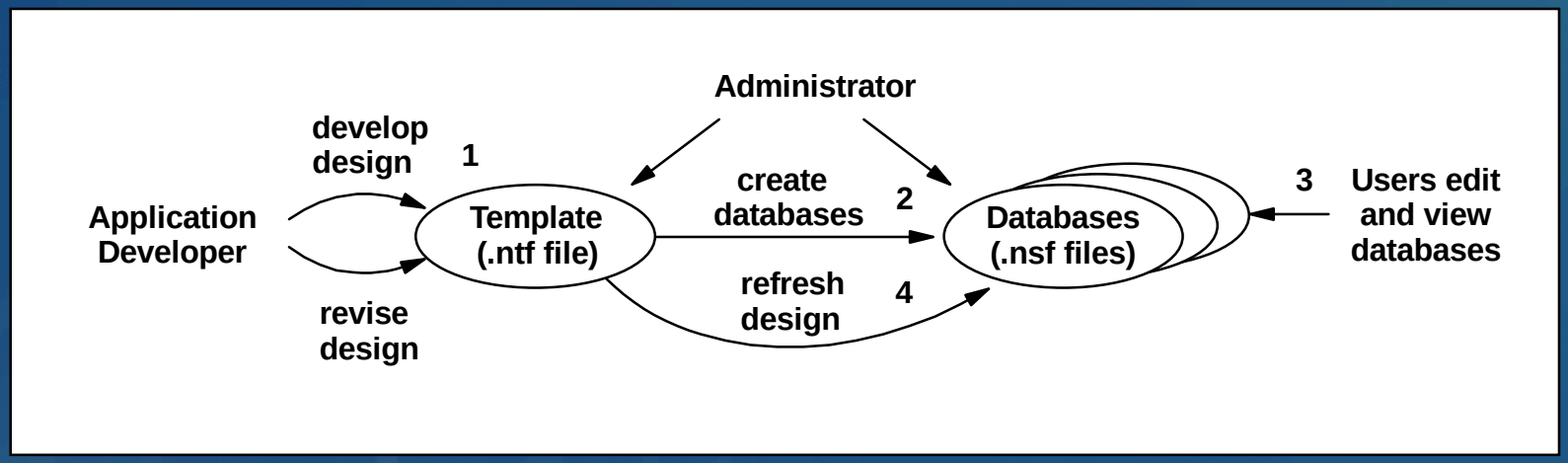
- Types Of Notes

Category	NOTE_CLASS_ ...	Note types
Data	DOCUMENT	Document
Administration	ACL*	Access Control List
	REPLFORMULA	Replication formula
Design Elements	FIELD	Shared field
	FILTER	Agent, Outline, Database script, Script library
	FORM	Form, Frameset, Page, Subform
	VIEW	Folder, Navigator, View
	DESIGN*	Design collection (structured like a view)
	ICON*	Icon
	INFO*	Help about information
	HELP	Designer help information
	HELP_INDEX*	Product help index

Note: an asterisk means that there can be at most only one of the indicated type of note in the database

The Life Cycle Of A Notes Database

- Step 1 - Create an application "template"
- Step 2 - Deploy the application as databases
- Step 3 - Use the databases
- Step 4 - Revise and refresh the application design



Notes Databases Are Portable

- On-Disk-Structure (ODS) format is used on all platforms
  - Complete binary compatibility regardless of where created
    - Create a database on an NT server
    - Move it to an IBM 390 server to balance your system
    - Replicate it to your MAC and then work off-line

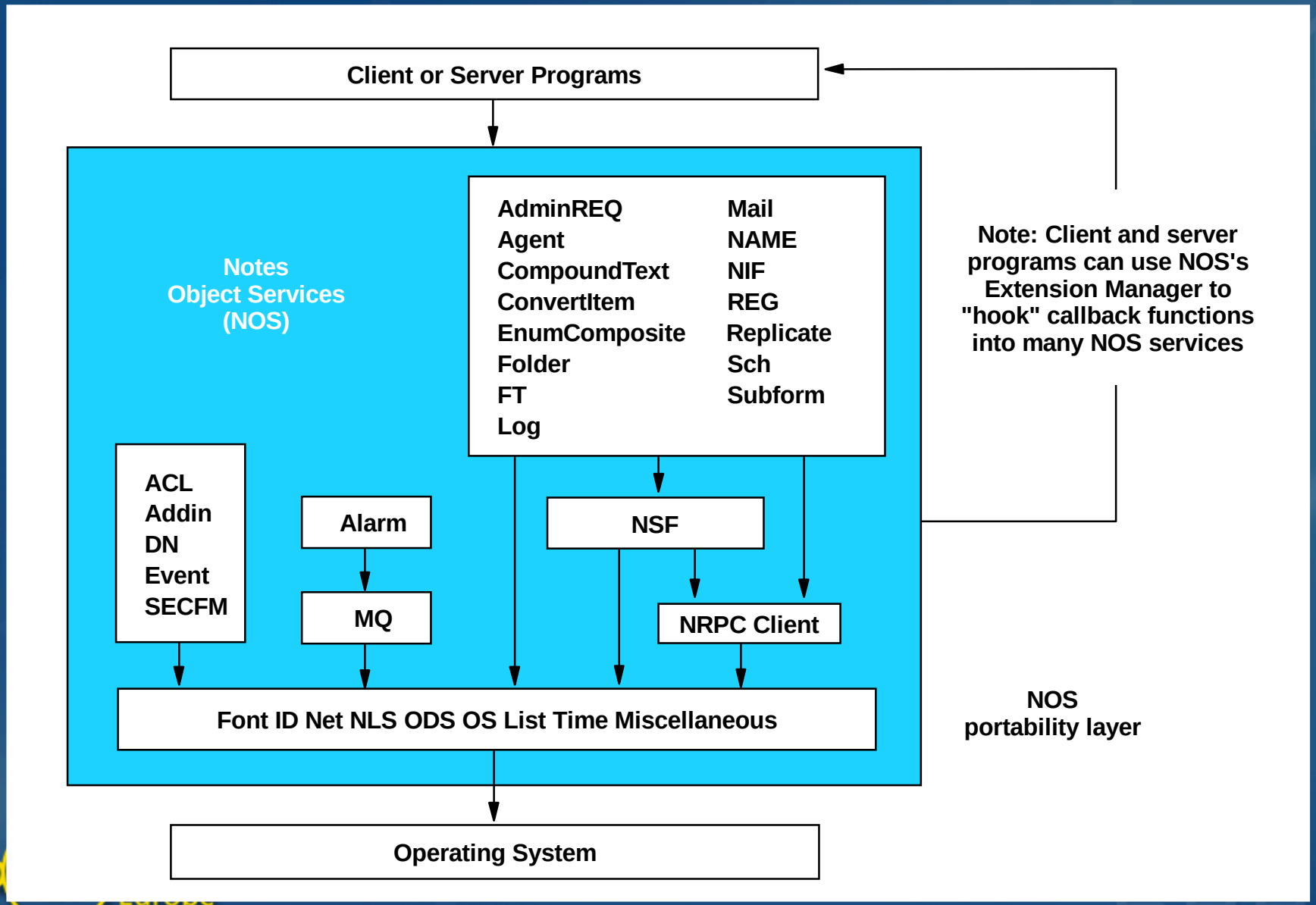
- Embedded programs are interpreted the same on all platforms
  - Formula language
  - LotusScript
  - Java
  - JavaScript

Lotus Notes Comes With Many Applications

- Some are part of the basic product
  - Mail template, Log template, etc.
- Others are generic applications useful to almost all customers
  - Discussion databases
- All are customisable by the end user
  - Even the product databases, like the mail template
  - Use the Domino Designer to modify an application

Inside Notes Object Services (NOS)

- NOS services exposed through the C API



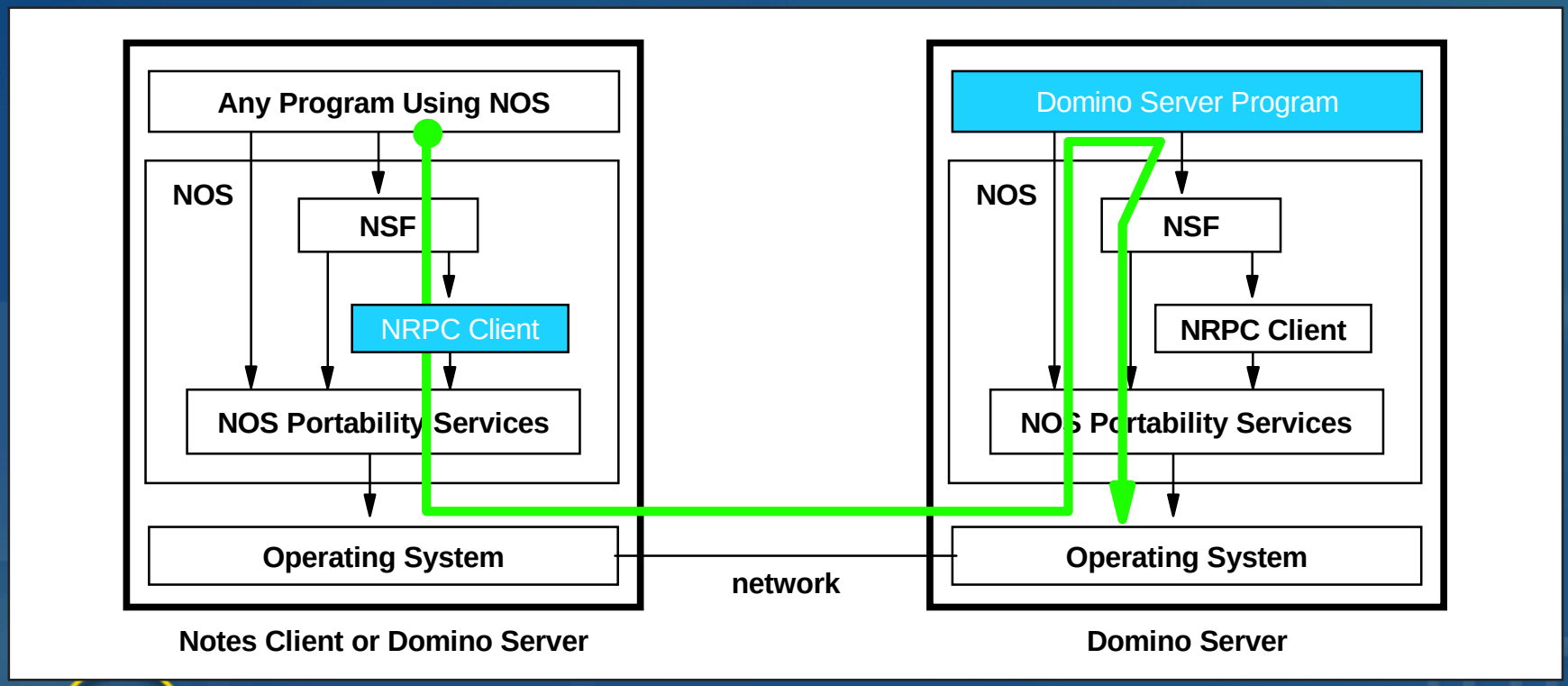
NOS Is Key To Notes/Domino Multiplatform Capabilities

- NOS's portability layer makes it easier to port NOS's clients
- NOS itself has been ported to many platforms
  - A representative sample of past and present configurations

Operating System	Processor	NOS	Client Programs	Server Programs
Mac OS	Power PC	✓	✓	
OS2	Intel X-86	✓	✓	✓
Windows 95/98	Intel X-86	✓	✓	✓
Windows NT	Intel X-86, DEC Alpha	✓	✓	✓
Solaris	Intel X-86, Sun Sparc	✓	✓	✓
AIX	IBM RS6000	✓	✓	✓
HPUX	HP PA	✓	✓	✓
OS400	IBM AS400	✓		✓
OS390	IBM 390	✓		✓
Linux	Intel X-86	✓		✓

The Notes Remote Procedure Call (NRPC) Service

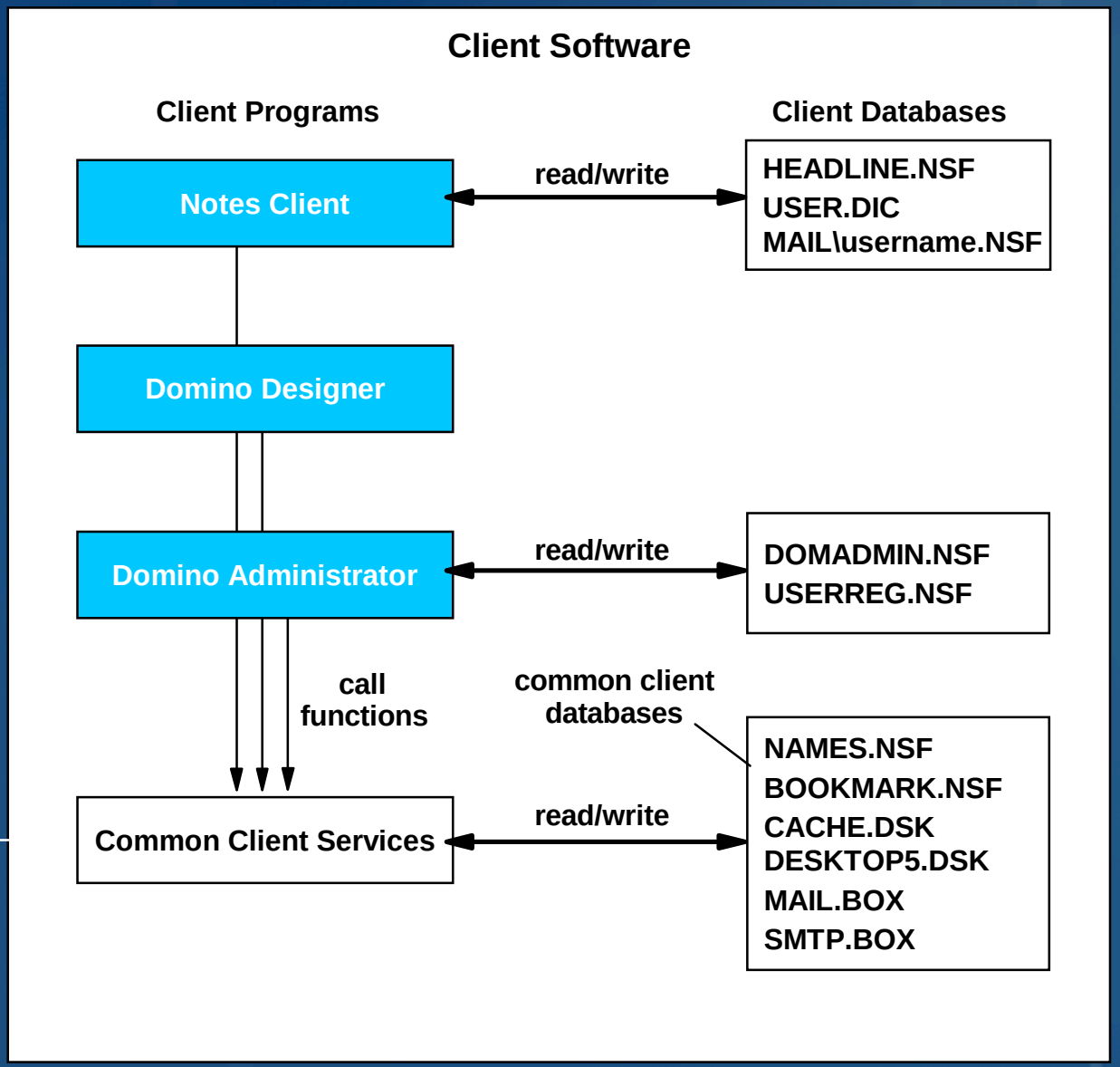
- Provides simple access to NOS services running on remote servers
  - Programming is no different whether service is local or remote
- NRPC "client request" logic is in NOS
- NRPC "server response" logic runs only on the server



Client Programs Are Used To Design And Access Databases And Administer Systems

- The Domino Designer
  - Create and revise Notes applications
- The Notes Client
  - Create and modify local and remote databases
- The Domino Administrator
  - Add/remove/modify server and user information
  - Control overall system operations and security

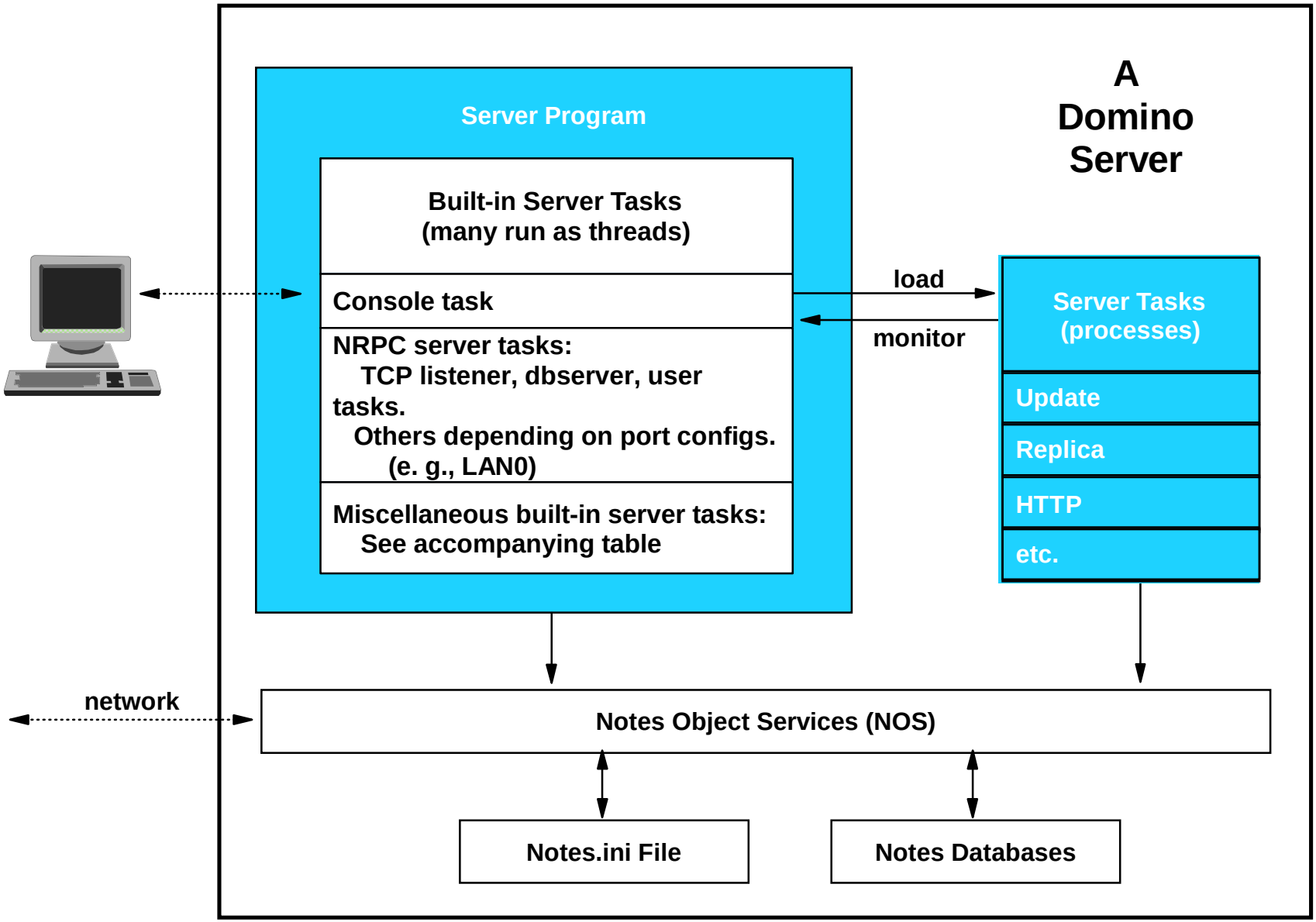
Client Programs And Their Supporting Databases



The Server Program And Server Tasks Support The Care And Feeding Of Shared Databases

Server tasks that ...	Tasks
Maintain databases	Agent manager, cataloger, designer, directory cataloger, replicator, update, updall
Manage server and administrative activities	Admin process, cluster directory database manager, cluster replicator, cluster admin process, map generator, server console
Manage mail, calendaring, and scheduling	Calendar connector, IMAP, POP3, router, schedule manager, SMTP
Manage protocols	DIIOP, DECS, HTTP, LDAP, NRPC
Monitor server activities	Billing, database statistics, events, ISPY, mail tracking, reporter, statistics collector, stats

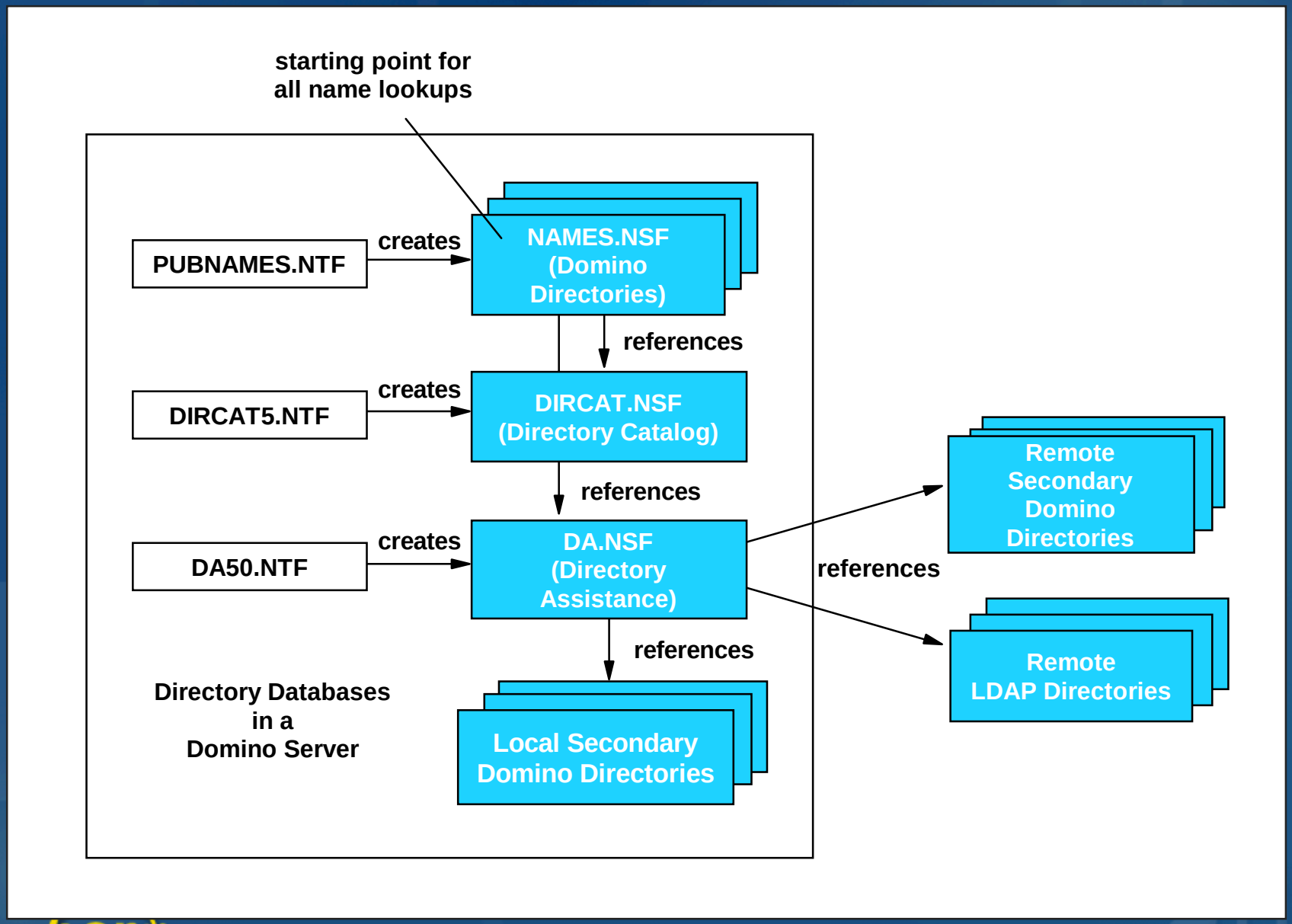
Server Work Is Done Using Threads And Tasks



Domains, Directories, And Administration

- A domain is a set of related entities
  - Servers, users, groups of servers and/or users, databases, ...
- A directory is a database that defines a domain
  - Contains information about each entity in the domain
  - Every server in the domain gets a replica copy of the directory
- Administration manages directories and database admin info
  - Add/remove servers, user's, etc., from directories
  - Specify server and database security, replication schedules, ...
  - Migration of users and mail from other systems

Directory Information Can Be In Several Databases

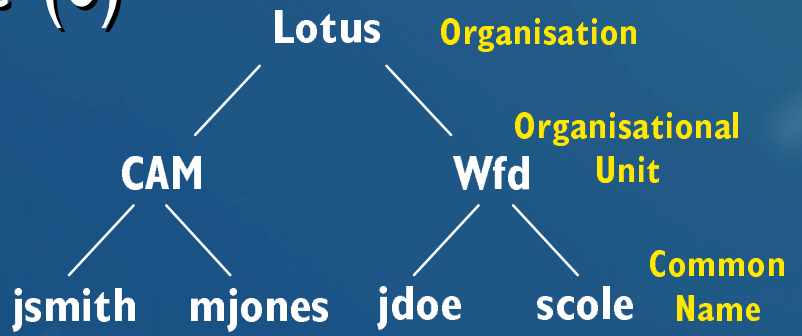


Security is Based on Three Principles

Everything Has A Place In A Hierarchical Organisation

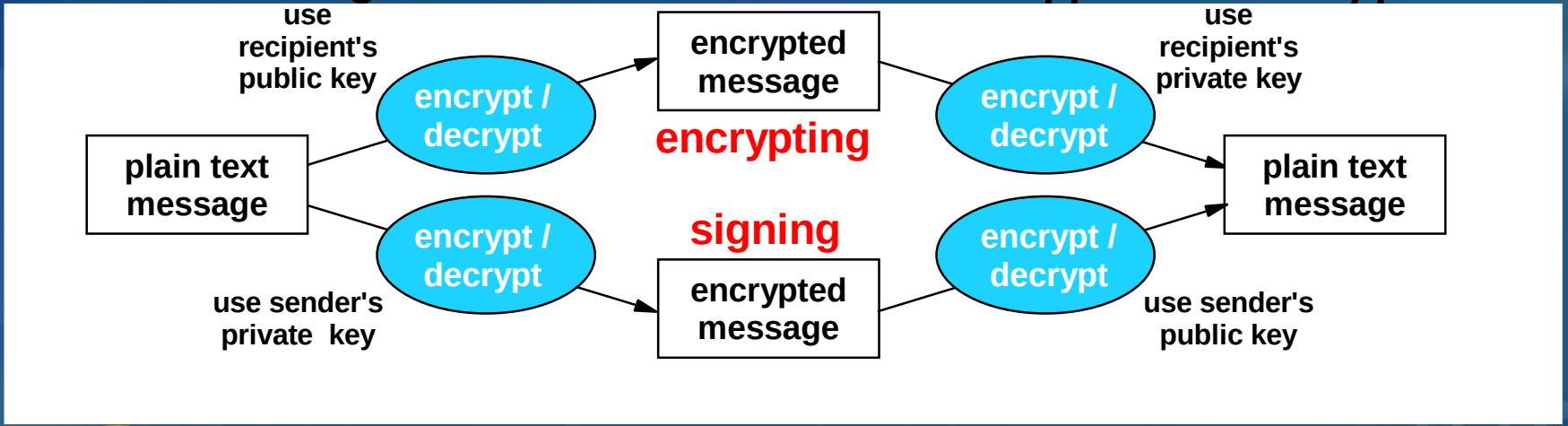
- An entity's identity includes its organisational position
  - Fully distinguished name: CN=jsmith /OU=CAM /O=Lotus
  - Abbreviated name: jsmith/CAM/Lotus

- Typical names include thbese components
  - One top-level organisation name (O)
  - Up to 4 organisational-unit names (OU)
  - A common name (CN)



Public-Private-Key Technology Is Used To Secure Both Data And Communications

- Can encode using recipient's public key, decode with private key
  - Used to securely send information to a known entity
- Can encode using sender's private key, decode with public key
  - Used to sign information and during authentication
- The same algorithm is used to both encrypt and decrypt



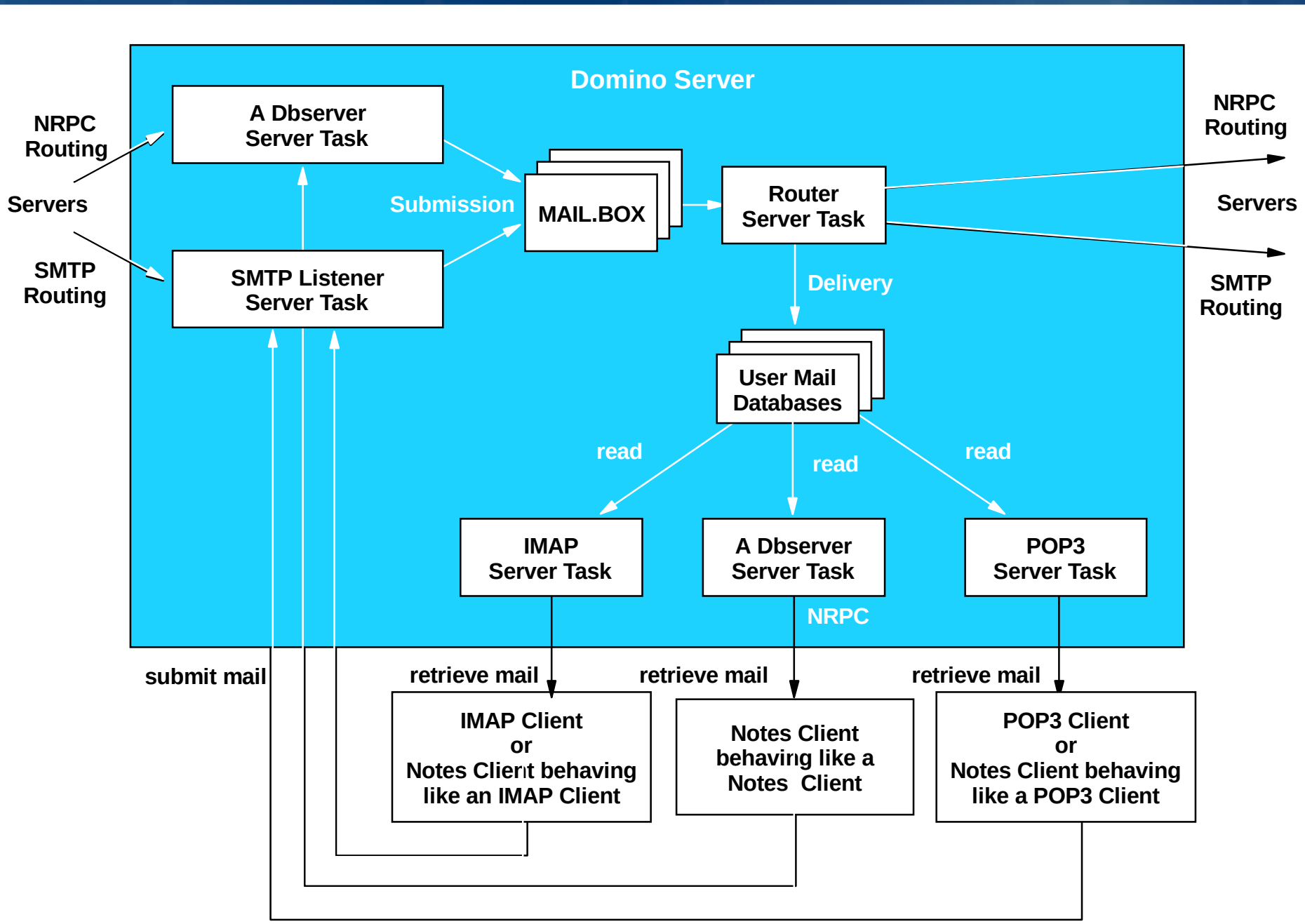
Certificates Signed By Certificate Authorities (CAs) Form The Basis Of A "Trust" System

- A certificate validates the public key of an entity in your domain
- A cross-certificate the public key of an entity in another domain
- Certificates are trusted if issued by ...
  - An organisational ancestor
  - Entities having organisational ancestors in common with you
  - Entities having organisational ancestors in common with a cross certificate

You Are Who Your ID File Says You Are

- ID files contain info needed to securely communicate with others
  - The entity's public and private keys
  - A chain of certificates for the entity's organisational ancestors
- Can (and should) be password protected
  - The password encrypts/decrypts the contents of the ID file
- Once compromised, should be destroyed and replaced
  - Just changing the password won't repair the damage done

Basics of Domino Messaging



Programmability - Tailoring Notes To Your Needs

- Use the Domino Designer to develop a portable Notes application
- Use the C and C++ toolkits to develop Domino server addins and/or to use NOS services by a non-Notes application
- Use the C API's Extension Manager to customise NOS operations
- Use the LotusScript extension toolkit to add Domino object classes
- Use Domino Enterprise Connection Services (DECS) and other connector toolkits to interface Domino to external data sources
- Use NotesSQL and other database drivers to make Domino resemble other backend data sources
- Use the DIIOP server task to access NOS services through CORBA

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Questions And Answers