A Comparative Performance Analysis of 7 Lightweight Directory Access Protocol Directories

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Rationale for Testing

- We have built an Electronic Transfer of Prescriptions system
- Doctor digitally signs an electronic prescription (as an X.509 Attribute Certificate)
- This is transferred to and stored in an LDAP directory
- Patient goes to any pharmacist of his/her choosing
- Pharmacist retrieves the prescription from LDAP directory, dispenses prescription, and stores it back in the directory
- PPA (settlement agency) retrieve dispensed prescriptions and arranges payments to pharmacists
- Thus we need a high performance directory (for read, search, write, and update) that can store millions of attributes for millions of patients

Vendors and Products

- **Critical Path** InJoin Directory Server 4.0
- **IBM** SecureWay Directory 3.2.2
- **iPlanet/SunONE** Directory Server 5.1 (evaluation)*
- **Microsoft** Active Directory
- **Novell** e-Directory 8.6
- **OpenLDAP** v2.0.23
- **Syntegra** Aphelion 2002

Tools

- Software - MindCraft's DirectoryMark 1.2.1
  - See http://www.mindcraft.com
- Server - Dell PowerEdge 1400SC
  - Intel Pentium 3 - 1GHz
  - 512MB RAM
  - 17GB SCSI Hard Drive (Fujitsu MAN3148MP)
  - 36GB SCSI Hard Drive (Seagate ST336704LW)
  - 120GB IDE Hard Drive (Maxtor 4G160J8)
  - Microsoft Windows 2000 Server/Red Hat Linux 7.1 Dual Partitioned Operating System
- Client - Intel Pentium 3 - 650MHz
  - 128MB RAM
  - 19GB IDE Hard Drive (Maxtor 32049H2
  - Microsoft Windows 2000 Operating System

Directory Mark Limitations

- Cant store attribute certificates, so we used Telephone number un-indexed instead

- DIT structure – traditional C, O, OU, OrgPerson structure

- But these should not invalidate the performance tests since directory servers are flexible in attribute support and DIT structure

Directory Schema

Test with:
10,000
100,000
1 Million
10 Million org persons
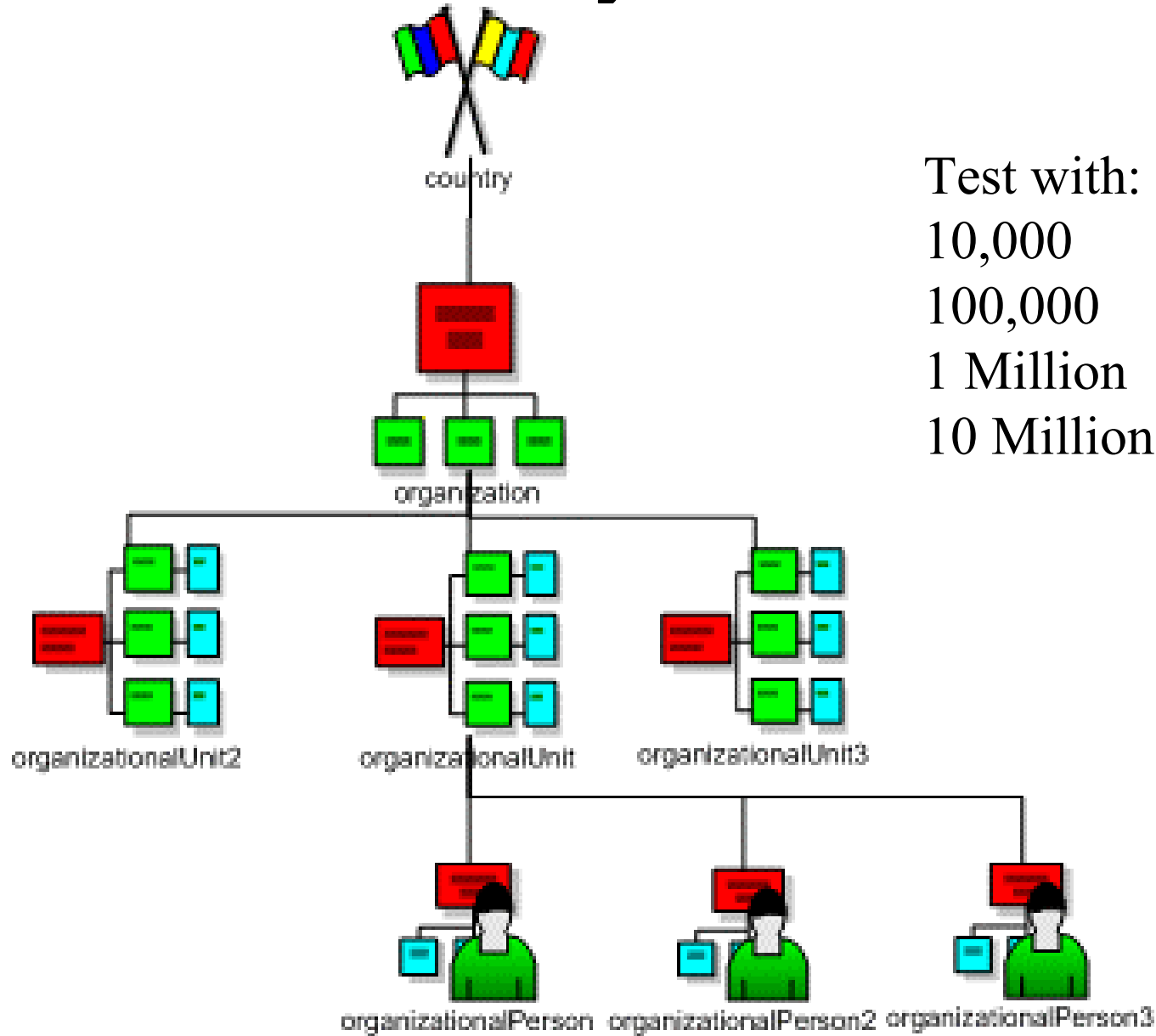
Indexed Directory Bulk Load Times

	10K	100K	1 M	10 M
Critical Path	00:01:32	00:22:31	11:00:34	Est >14 days
IBM	00:01:58	00:14:04	02:21:58	Est 24 hrs Failed
SunOne	00:00:10	00:01:22	00:12:13	29:54:13
MAD	00:05:03	01:01:54	22:36:06	Est>20 days
Novell	00:14:12	Decided	it was	too slow
OpenLDAP	00:00:37	00:08:36	13:12:36	Failed
Syntegra	00:00:07	00:00:35	00:04:29	01:54:05

Tests

- Simulated Read - Base entry Search of given DN
- Full subtree Search with Exact match on common name
- Full subtree substrings Search on common name - an indexed attribute
- Full subtree substring Search on telephoneNumber - an un-indexed attribute
- Add organizationalPerson entry – indexed
- Add organizationalPerson entry - un-indexed
- Delete an entry – indexed and un-indexed
- Modify an indexed attribute (cn)
- Modify an un-indexed attribute (telephoneNumber)
- Mixed operations – Search, Add, Delete, Modify, ModifyRDN

Simulated Read (Base Search on DN)
Operations per second

	10K	100K	1 Million	10 Million
Critical Path InJoin Directory Server 4.0	1562.5	1562.5	1562.5	-
IBM SecureWay Directory 3.2.2	1666.7	1562.5	1666.7	-
iPlanet/SunONE Directory Server 5.1	2173.9	2272.7	2381	2272.7
Microsoft Active Directory	2000	2000	2000	-
Novell e-Directory	342.5	-	-	-
OpenLDAP 2.0.23	2272.7	1923.1	2173.9	-
Syntegra Aphelion 2002	2173.9	2000	2083.3	2272.7

Conclusion. Read performance is independent of size of DIT

Full Subtree Search – Exact match on CN
Operations per second

	10K	100K	1 Million	10 Million
Critical Path InJoin Directory Server 4.0	1515.2	1515.2	1515.2	-
IBM SecureWay Directory 3.2.2	1724.1	1612.9	1724.1	-
iPlanet/SunONE Directory Server 5.1	2272.7	2173.9	2272.7	2272.7
Microsoft Active Directory	2272.7	2272.7	1562.5	-
OpenLDAP 2.0.23	2381	1923.1	2381	-
Syntegra Aphelion 2002	2381	2173.9	2272.7	2381

Conclusion. Exact matches on indexed attributes are independent of DIT size (except perhaps for MAD)

Full Subtree Search – Substrings match on indexed CN attribute. Operations per second

	10K	100K	1 Million	10Million
Critical Path InJoin Directory Server 4.0	1470.6	1470.6	1470.6	-
IBM SecureWay Directory 3.2.2	595.2	581.4	588.2	-
iPlanet/SunONE Directory Server 5.1	2381	2272.7	2381	2500
Microsoft Active Directory	2272.7	2272.7	1666.7	-
OpenLDAP 2.0.23	2500	1923.1	2500	-
Syntegra Aphelion 2002	2381	2173.9	2272.7	2381

Conclusion. Substrings matching on indexed attributes is independent of DIT size (except perhaps for MAD)

Full Subtree Search – Substrings match on un-indexed TelNo attribute. Operations per second

	10K	100K	1 Million	10 Million
Critical Path InJoin Directory Server 4.0	1515.2	1515.2	1351.4	-
IBM SecureWay Directory 3.2.2	1666.7	1562.5	1612.9	-
iPlanet/SunONE Directory Server 5.1	2381	2173.9	2381	2272.7
Microsoft Active Directory	2173.9	2173.9	2000	-
OpenLDAP 2.0.23	2381	1923.1	2381	-
Syntegra Aphelion 2002	2173.9	1785.7	2173.9	2173.9

Conclusion. I can't explain why some directories are faster with un-indexed attributes and some are slower

Add orgPerson – indexed
Operations per second

	10K	100K	1 Million	10 Million
Critical Path InJoin Directory Server 4.0	83.3	6.8	3.8	-
IBM SecureWay Directory 3.2.2	20	16.7	11.5	-
iPlanet/SunONE Directory Server 5.1	28.6	16.1	15.9	11.6
Microsoft Active Directory	31.3	32.3	10.4	-
OpenLDAP 2.0.23	6.7	5.3	2.1	-
Syntegra Aphelion 2002	8.4	8.5	7	2.8

Conclusion. Performance drops with increasing size of DIT, sometimes rapidly. Large variance between products

Add orgPerson – un-indexed
Operations per second

	10K	100K	1 Million	10 Million
Critical Path InJoin Directory Server 4.0	200	200	31.3	-
IBM SecureWay Directory 3.2.2	21.3	19.6	15.6	-
iPlanet/SunONE Directory Server 5.1	40	43.5	30.3	18.5
Microsoft Active Directory	34.5	17.5	10.9	-
OpenLDAP 2.0.23	12.2	13.7	13.7	-
Syntegra Aphelion 2002	Only creates indexed database			

Conclusion. Adding is faster with un-indexed database, ranging from 5% to 240%

Delete orgPerson – indexed
Operations per second

	10K	100K	1 Million	10 Million
Critical Path InJoin Directory Server 4.0	100	71.4	3.1	-
IBM SecureWay Directory 3.2.2	23.8	14.5	10.5	-
iPlanet/SunONE Directory Server 5.1	41.7	21.7	20.8	10.1
Microsoft Active Directory	15.9	11.8	8.1	-
OpenLDAP 2.0.23	6	5.1	2.2	-
Syntegra Aphelion 2002	21.7	22.7	20.4	18.5

Conclusion. Performance decreases with size of DIT, sometimes rapidly. Large variance between products

Delete orgPerson – un-indexed
Operations per second

	10K	100K	1 Million	10 Million
Critical Path InJoin Directory Server 4.0	333.3	333.3	30.3	-
IBM SecureWay Directory 3.2.2	22.7	16.9	13	-
iPlanet/SunONE Directory Server 5.1	43.5	45.5	27.8	16.9
Microsoft Active Directory	15.6	12.7	6	-
OpenLDAP 2.0.23	11.8	13.5	13.5	-
Syntegra Aphelion 2002	Only creates an indexed database			

Conclusion. As expected, deleting from un-indexed directories is faster than from indexed ones (up to 10 times)

Modify indexed CN attribute
Operations per second

	10K	100K	1 Million	10 Million
Critical Path InJoin Directory Server 4.0	188.7	333.3	59.9	-
IBM SecureWay Directory 3.2.2	40.3	34	23	-
iPlanet/SunONE Directory Server 5.1	40	37.3	30.2	13
Microsoft Active Directory	96.2	98	32.8	-
OpenLDAP 2.0.23	3.3	2.4	1.3	-
Syntegra Aphelion 2002	12.5	12.2	9.4	2.7

Conclusion. Huge variation between products (>5000%)

Modify un-indexed TelNo attribute
Operations per second

	10K	100K	1 Million	10 Million
Critical Path InJoin Directory Server 4.0	312.5	277.8	45.2	-
IBM SecureWay Directory 3.2.2	78.1	70.4	48.1	-
iPlanet/SunONE Directory Server 5.1	50.8	51.8	36.5	21
Microsoft Active Directory	99	95.2	48.1	-
OpenLDAP 2.0.23	5.8	4.2	1.6	-
Syntegra Aphelion 2002	26.5	27.5	23.1	37.5

Conclusion. Faster then indexed, but still huge variation between products and drop off with DIT size

Mixed operations
search (50%), add (12%), delete (10%), modify (16%) and modifyRDN (12%)

	10K	100K	1 Million	10 Million
Critical Path InJoin Directory Server 4.0	151	151	8.4	-
IBM SecureWay Directory 3.2.2	50.3	27.5	21.6	-
iPlanet/SunONE Directory Server 5.1	50.3	37.8	30.2	21.6
Microsoft Active Directory	33.6	27.5	18.9	-
OpenLDAP 2.0.23	9.4	7.4	2.7	-
Syntegra Aphelion 2002	23.2	21.6	20.1	8.6

Conclusion. Critical Path is best < 1M, SunONE > 1 M

Conclusions

- Critical Path was fastest at modifying the DIT, and fastest in mixed tests up to 100K entries
- SunONE was the top performer for DITs >1 million entries, and one of fastest at Searching for smaller DITs
- IBM and MAD are only average performers
- OpenLDAP was one of fastest for Searches of all types, but worst performer for modification tests
- Syntegra has fast Search results, is the fastest to bulk load, and the top performer for some tests on 10 million entries
- Novell was too slow at the start so was discontinued

Finally, an administrator's view

- All products were easy to install except OpenLDAP

- All were relatively easy to adminster except Microsoft Active Directory

- All ran the Mindcraft tests as is except Active Directory, when they needed modifying to match MAD's schema