New York City's Spatial Service-Oriented Architecture: An Overview

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Presentation Roadmap

- Objectives
- DoITT/NYC GIS Background
- Service Offerings
- Current Applications
- Infrastructure
  - Internet
  - Intranet
- Issues with Current SDLC Model
- Why SOA? A strategic decision
- Where we are
- What is next? Upcoming Projects (CityMap)
Objectives

To share New York City’s experience in establishing a high availability ArcIMS Hosting infrastructure, developing and hosting GIS applications for City Agencies and the process of moving towards a Spatial Service-Oriented Architecture
DoITT/NYC GIS Background

- DoITT has more than 700 employees
- Manages:
  - 311 call center (largest in the country)
  - Citywide GIS
  - NYC.GOV portal
  - Other strategic initiatives
- NYC GIS is a relatively new organization
Staff

- GIS Analysts
- Software Developers
- Database Administrator
- Project Managers
- Administrative Support
- 24x7 Shared Services operations
- 24x7 Help Desk
NYC GIS

• The Citywide GIS provides services to:
  – Other New York City Agencies
  – General public via:
    • NYC.GOV
    • 311
    • DoITT
Service Offerings

- Data Creation
- Data Distribution
- Data Licensing
- Data Cleanup
- Metadata Maintenance
- Web Application Development
- Project Management
- Quality Assurance
- NYC MAP Updates

DOITT
DEPARTMENT OF INFORMATION TECHNOLOGY & TELECOMMUNICATIONS
Service Offerings

- Performance Tests
- Stress Tests
- High-Availability Application Hosting
- Security Scans
- Automated Application Deployment
- Functional Tests
- Map creation
- Data Management
- More

DOITT
DEPARTMENT OF INFORMATION TECHNOLOGY & TELECOMMUNICATIONS
Goals

- To reduce errors and defects
- Reduce delivery time (data, software)
- Increase quality
- Increase availability
- Increase performance
- Reduce application development time
- Reduce costs
- Constant improvement
Goals

To move away from Manual Processes

To Automated Processes
Goals

To move away from

Undocumented Processes

To

Documented and Repeatable Processes
How?

• By reducing variability

• Sources of variability:
  – Poor Design
  – Skills and Behaviors
  – Unstable products/systems
  – Insufficient process capability
Internet applications

- DoITT - My Neighborhood
- DoITT - Poletop Manager
- DoITT - Map Portal
- OPS - My Neighborhood Statistics
- OEM - EMOLS
  - Hurricane Evacuation
  - Cooling Centers
- DSNY - Collection Schedule
- DCP - Census Fact Finder
- DCP - Address Translator
- DPR - Wood Debris
- DPR - Parks Locator
- NYCHA - Internet Mapping
- BOE – Pole site Locator
Intranet applications

• Department of Finance – PARM
• Department of City Planning – GOAT
• NYC GIS Data Download Portal
  – Metadata Explorer
  – SharePoint portal
• 311 – Pseudo-web service to broker address validation and geocoding requests
Data Download/Metadata

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Map Scale: 1:10,75 foot for 2001/2002 Orthophotographs – 1 foot for 1996 Orthophotographs

Publisher: New York City Department of Information Technology and Telecommunications
Content Title: Transportation Line
Map Scale: 1:10,75 foot for orthophotographs from 2001 – 2002 and 1 foot for orthophotographs from 1996

Publisher: New York City Department of Information Technology and Telecommunications
Content Title: Street Centerline
Map Scale: 1:10,75 foot for orthophotographs from 2001 – 2002 and 1 foot for orthophotographs from 1996

Publisher: New York City Department of Information Technology and Telecommunications
Content Title: Elevation
Map Scale: 1:10,75 foot for orthophotographs from 2001 – 2002 and 1 foot for orthophotographs from 1996
Software Development Life-Cycle

- Development
- Test
- Staging
- Production
- Disaster Recovery
Sample App. Dev. Scenario

Agencies:
- Obtain Hosting Guidelines/Code Samples
- Inform DoITT of the intention to host
- Design Application
- Develop Application
- Unit Test
- Internal Review/Approval
- Obtain Functional Test Scripts sample
- Write Functional Test Scripts
- Migrate to DEV
- Notify Agency of Successful Migration
- Migrate to TST
- Notify Agency
- Migrate to STG
- Integration/Functional Tests
- Performance Tests
- Security Scans
- Deploy to PRD
- Deploy to DR
- Monitor/Maintain

DoITT:
- Unit Test
- Migrate to STG
- Integration/Functional Tests
- Performance Tests
- Security Scans
- Deploy to PRD
- Deploy to DR
- Monitor/Maintain
Infrastructure - Internet

25 Sun Servers
DEV, TST, STG, PRD and DR

24x7 Operation

Shared Unix Services
Reverse Proxy

Tier #1

Only allows requests to specific URLs to pass through
Web/ArcIMS App Server

ArcIMS load balancing
Java Connector,
App. logic (Servlet, JSPs)

Tier #2

ArcIMS Spatial Server

ArcIMS Spatial Server

ArcIMS Spatial Server

ArcIMS Spatial Server

Oracle 9i
ESRI ArcSDE 8.3

Oracle 9i
ESRI ArcSDE 8.3
Spatial Servers

Most CPU intensive components
Two ArcIMS instances per server
2 CPU servers

Tier #3

Oracle 9i
ESRI ArcSDE 8.3
db1

15K Domain
8 CPUs - 1GHz x 16GB RAM
PASSIVE

Sun Fire 15K

Oracle 9i
ESRI ArcSDE 8.3
db2

15K Domain
8 CPUs - 1GHz x 16GB RAM
ACTIVE

Sun StorEdge 6910
(shared storage)
Database/SDE Servers

Tier #4

Active/Passive
Veritas Cluster Server

Sun StorEdge 6540
(shared storage)
Infrastructure - intranet

19 new Sun Servers

new PRD and DR environments

Shared DEV, TST, STG environments
Web tier

Static content, Simple apps, ArcIMS App Server, ArcGIS Server SOM, NSAPI
Map and Geoprocessing Tier

ArcIMS Map Servers and ArcGIS SOCs

Geoprocessing Tier
Map Server - ArcIMS
- Sun Fire V240
  - 2 CPUs - 1.5GHz
  - 4GB RAM
  - 2 x 36GB Disks

Geoprocessing Tier
SOC-ArcGIS Server
- Sun Fire V240
  - 2 CPUs - 1.5GHz
  - 8GB RAM
  - 2 x 36GB Disks

Database Tier
Oracle Spatial/SDE
- Oracle 10g ESRI ArcSDE
  - DB1
  - 15K Domain
    - 8CPUs - 1GHz x 16GB RAM
    - PASSIVE (Portal Active)
  - Sun Fire 15K (MetroTech)

Oracle Spatial/SDE
- Oracle 10g ESRI ArcSDE
  - DB2
  - 15K Domain
    - 8CPUs - 1GHz x 16GB RAM
    - ACTIVE (Portal Passive)

Storage: SAN
Database Tier

Oracle 10G Enterprise Edition
ArcSDE 9.1

Storage: SAN
Infrastructure Software

• Internet:
  - Sun Java System Web Server 6.1
  - ESRI ArcIMS 9.1 SP1
  - ESRI ArcSDE 9.1 SP1
  - Oracle 10G Enterprise Edition (Spatial)
  - Solaris 8

• Intranet:
  - Sun Java System Web Server 6.1
  - BEA WebLogic Process Edition 8.1
  - ESRI ArcGIS Server 9.1
  - ESRI ArcIMS 9.1 SP1
  - ESRI ArcSDE 9.1 SP1
  - Oracle 10G Enterprise Edition (Spatial)
  - Solaris 10
Software Development Tools

- **IDEs:**
  - Eclipse (WTP),
  - BEA Workshop (BPM – JPDs)

- **Data Management**
  - ArcCatalog,
  - TOAD,
  - Oracle SQL Developer

- **Testing**
  - Mercury Load Runner
  - Mercury Quick Test Professional
  - Junit

- **Misc tools and frameworks:** Ant, Tomcat, CVS, Spring, Struts, Hibernate, Ibatis
Issues with Current SDLC Model

- Hosting multiple application silos
- Data duplication – maintenance issues
- Duplication of efforts
- Cost, project duration
- Proprietary APIs
- Point-to-Point integration
- Change Management: change is slow
Issues with Current SDLC Model

- Increasing demand for services: City Agencies want new applications built that are better, faster
- Increasing Complexity, 44 servers to manage
- Islands of information: multiple versions of same data
- Code reuse: disparate versions of code base
- Time to deployment
- Learning Curve
- Change Management: change is slow
Automated Deployment Scripts
AXL deployment
Why SOA? A Strategic Decision

- Agility
- Flexibility
- Enables innovation
- Exposes GIS functionality to non-GIS users
Benefits of SOA

• Reduce time to market for new services
  – Focus on delivering unique business logic
  – Enable the creation of composite applications by integrating one or more services
  – Allow services to be choreographed using BPM

• Reduce total cost of ownership of IT infrastructure and business services
  – Shared service infrastructure

• Business driven application development
SOA Gartner’s Hype Cycle

- **Visibility**
  - Biometric Identity Documents
  - BFM Suites
  - Cloud Computing
  - Linux on Desktop for Mainstream Business Users
  - Micro Fuel Cells
  - Really Simple Syndication

- **Maturity**
  - Plateau will be reached in:
    - < 2 years
    - 2 to 5 years
    - 5 to 10 years
    - > 10 years
    - Before plateau

- **Acronym Key**
  - 4G: Fourth generation
  - ASP: Application service provider
  - BPM: Business process management
  - P2P: Peer to peer
  - RFID: Radio frequency identification
  - SOA: Service-oriented architecture
  - VoIP: Voice over Internet Protocol
  - WiMAX: Worldwide Interoperability for Microwave Access
  - XBRL: Extensible Business Reporting Language

Source: Gartner (August 2005)
311 Citizen Service Center

- 311 provides a single point of contact for all non-emergency City services, and is available to residents, City businesses, and visitors.

- The list of services and information 311 provides is constantly expanding, and includes information on hundreds of services, agencies, and events. People call 311 for:
  - Recycling schedule and information requests
  - Missed garbage collection complaints
  - Alternate Street Parking Rules
  - Noise complaints
  - Blocked driveway complaints
  - CFC/Freon pickup requests
  - 311 Call Taker compliments
  - Landlord-related complaints
  - Information about health insurance options for small businesses and individual
Geocoding Service

XML Based Request/Response over http
Sample XML Request

IDENTIFY ADDRESS request:
<?xml version="1.0" encoding="UTF-8"?>
<geo311 version="2.0">
  <request type="identify">
    <ADDRESS>
      <BOROUGH> </BOROUGH>
      <ADDRESSNUM>23</ADDRESSNUM>
      <STREETNAME>2nd Ave</STREETNAME>
    </ADDRESS>
  </request>
</geo311>
SOA
Current Status

- Project approved
- System architecture reviewed
- Intranet infrastructure built
  - Undergoing security scans
- Goes live: August 2006
Next Steps

• Develop granular APIs/web services:
  – Address validation/Geocoding
  – Building information
  – Geopolitical data (geospatial data services)

• Expose them as web services

• Create composite services

• Use on internal applications

• Publish on Citywide UDDI directory (when available)
Questions?

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