



**Geospatially Enabling the  
World:  
The Convergence of  
Geospatial and  
Architectural and  
Engineering Design**

**Geoff Zeiss  
Director of Technology  
Autodesk**

**Map Middle East  
Dubai 2007**

**Autodesk®**

# Overview

**Geospatial inflection point**

**Implications for the construction industry**

**Implications for emergency response and urban planning**

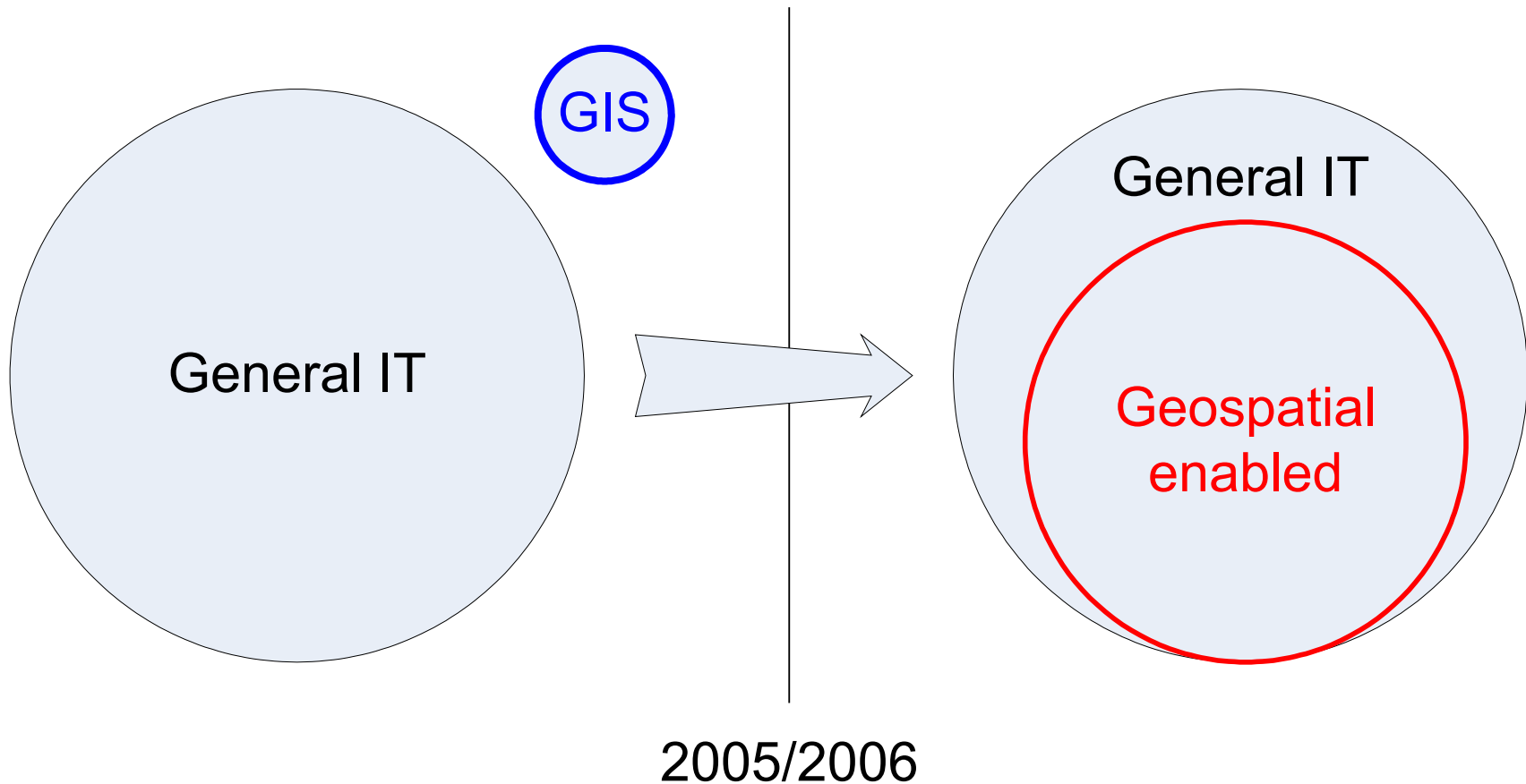
**BIM/GIS/CAD Integration**

**Concept Demonstration**



# Geospatial Inflection Point

# Geospatial Becoming Mainstream



# Open Source Geospatial

**Open source geospatial has matured**

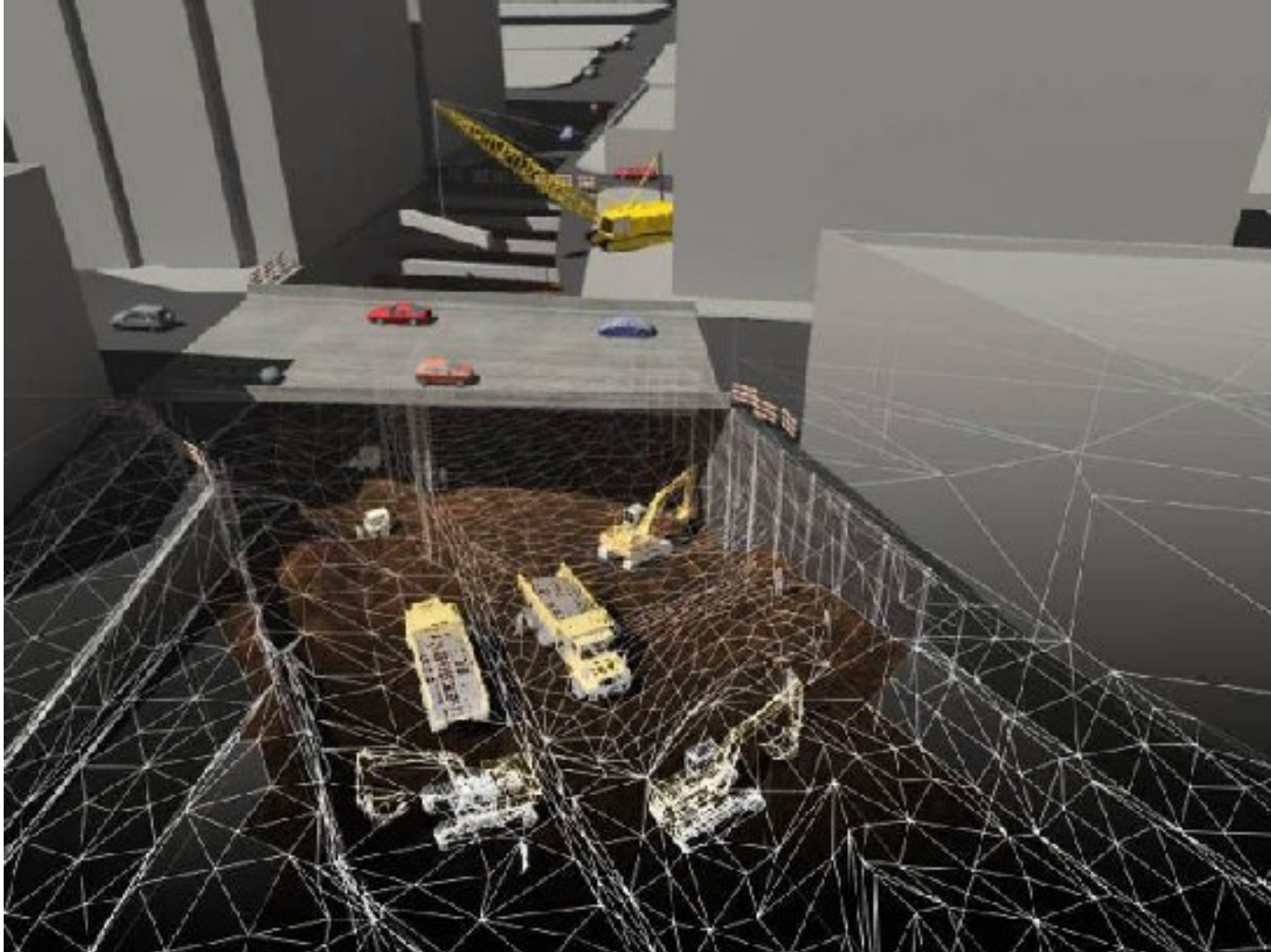


**Web mapping is becoming commoditized.**

- *Mapserver, GeoTools, Mapguide,...*



# Convergence



Source: *Tim Case, Parsons Brinkerhoff*



## Implications for the Construction Industry

# A Typical Construction Site



Source: *Tim Case, Parsons Brinkerhoff*

# Islands of Information



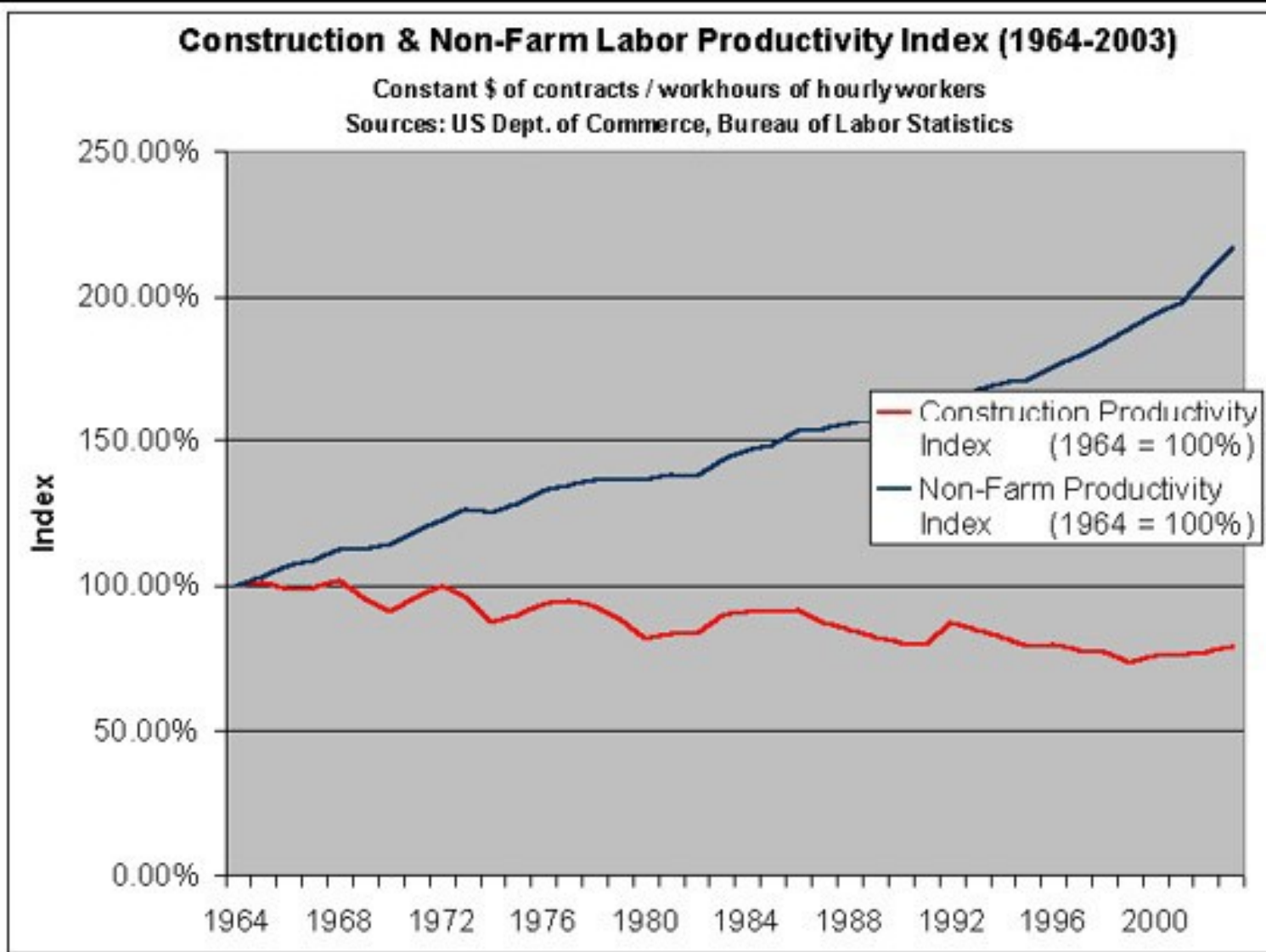
Architectural  
Design

Civil  
Engineering

GIS

Infrastructure  
Management

# What's the Business Problem ?



# What's the Business Problem ?

**Discontinuity hurts everyone, it costs time and money.**

**Everyone involved with buildings and infrastructure must have seamless access to design and geospatial information.**

# What's the Solution ?

**Over the coming years *convergence* will be taking place among the design, engineering, construction, infrastructure management, and GIS disciplines.**

**The business drivers for this transformative technology include**

- Productivity and efficiency in the construction and facilities management industry
- Improving the performance of buildings and facilities over their full life-cycle.

# The Vision: Seamless Access

**Requires a framework of interoperability across the lifecycle of buildings and infrastructure involving design, construction, and operation.**

**Requires interoperability among domains**

- Architecture/engineering/construction (AEC)
- Civil engineering
- Infrastructure management
- GIS
- 3D Visualization



## Implications for Emergency Response and Urban Planning

# Some Business Challenges

## **Disaster management in an urban environment**

- Emergency response organizations: police, fire departments

## **View cones, flight paths, 3D zoning restrictions,..**

- Local government

## **Density modeling and visualization**

- Local government

## **Wireless antenna siting**

- Wireless telecommunications firms

## **3D cadastres**

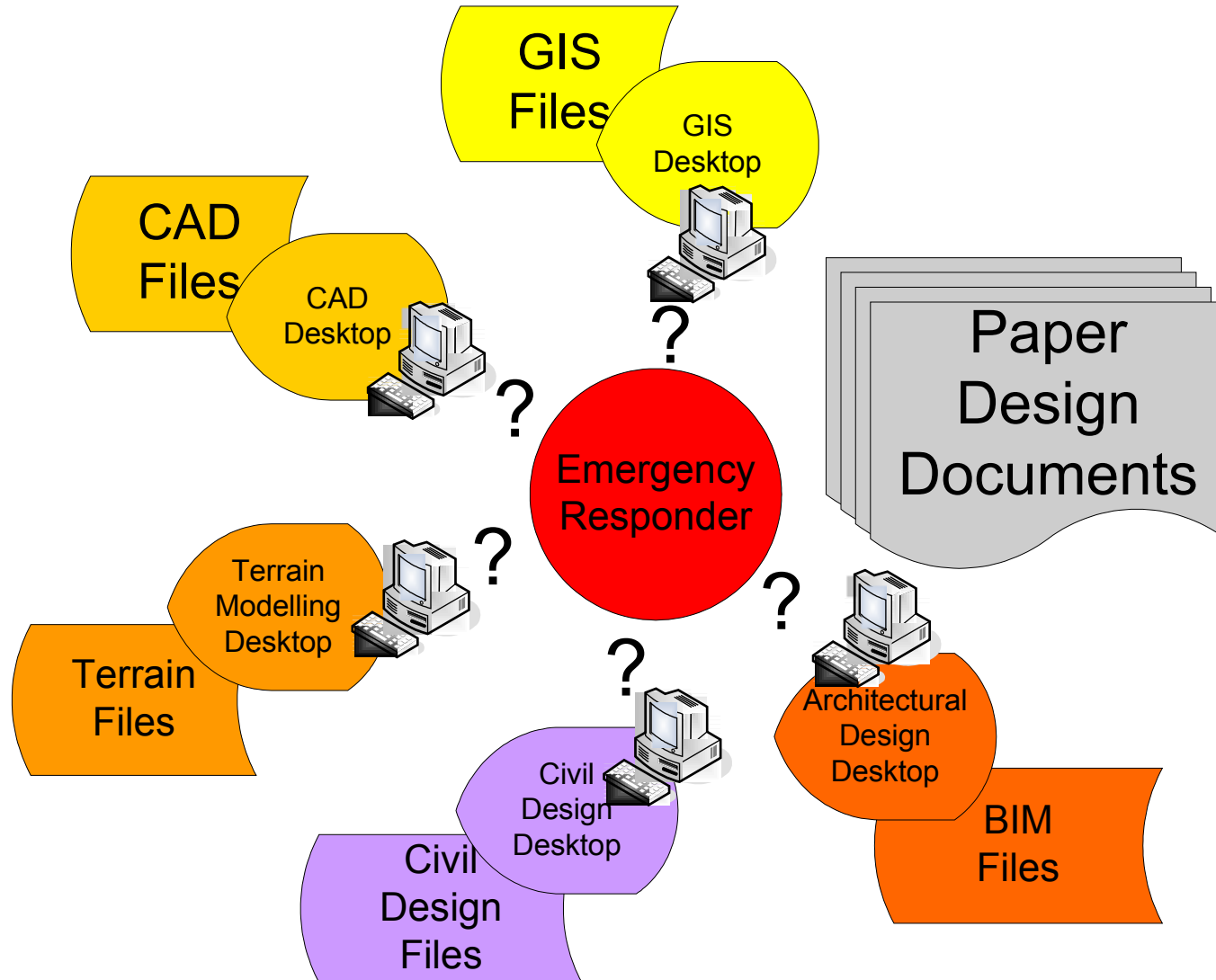
- Local government

# Example Scenario: Emergency Response

**An emergency is occurring on the 27<sup>th</sup> floor of a building. Need to determine**

- Which neighboring buildings are affected ?
- Is the area visible from neighboring buildings ?
- What are the best routes for emergency vehicle access ?
- Is helicopter access feasible ?
- What is at risk in the floor above and floor below ?
- What is visible from room 2709 ?
- Is the building accessible by road ?
- Are pedestrians and vehicles on adjacent roads at risk ?
- Where are the safe ingress and egress routes ?

# Emergency Response: What's the Problem ?



# What's the Problem ?

## Many applications with little integration

- 2D CAD
- 3D CAD
- 2D Architectural Design
- BIM Architectural Design
- 2D Civil Engineering
- 3D Civil Engineering
- Mechanical Engineering
- GIS
- Network Infrastructure Management

## Many data sources

- Paper, DWG, DGN, Shape, ...
- Imagery, vector, point clouds, ...
- Satellite (optical, radar), survey, GPS, LIDAR, ...
- Proprietary file formats, different data models, ...

## Complex user interfaces

## Little time!



# BIM/CAD/GIS Integration

# Core Disciplines

- **Architectural Design**
- **Civil Engineering Design**
- **Infrastructure Management**
- **GIS**
- **3D Visualization**

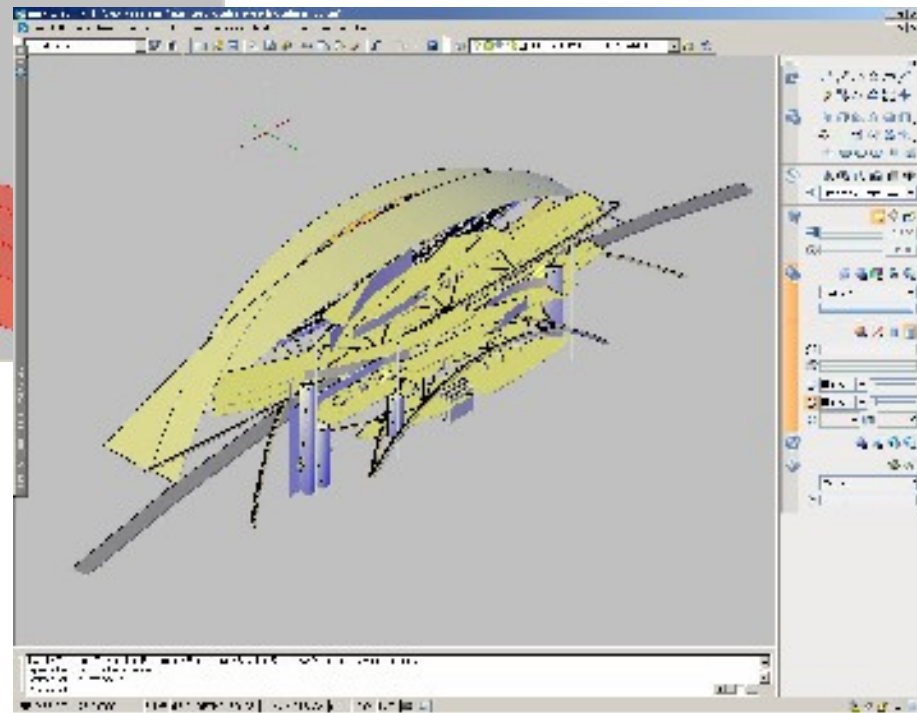
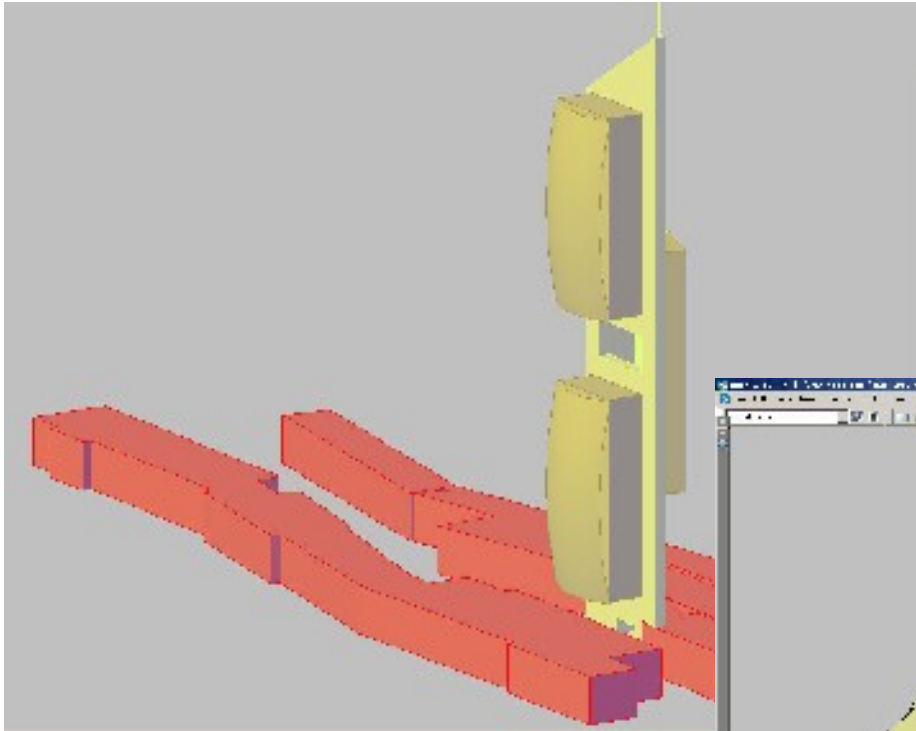
# Architectural Design



# Civil Engineering



# CAD



# Infrastructure Management and GIS





# Internet Technologies

## Deploy on...



Microsoft  
Windows



Linux

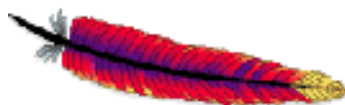
## Develop with...



## Serve with...



Microsoft  
IIS



Apache  
Web  
Server

## Browse with...

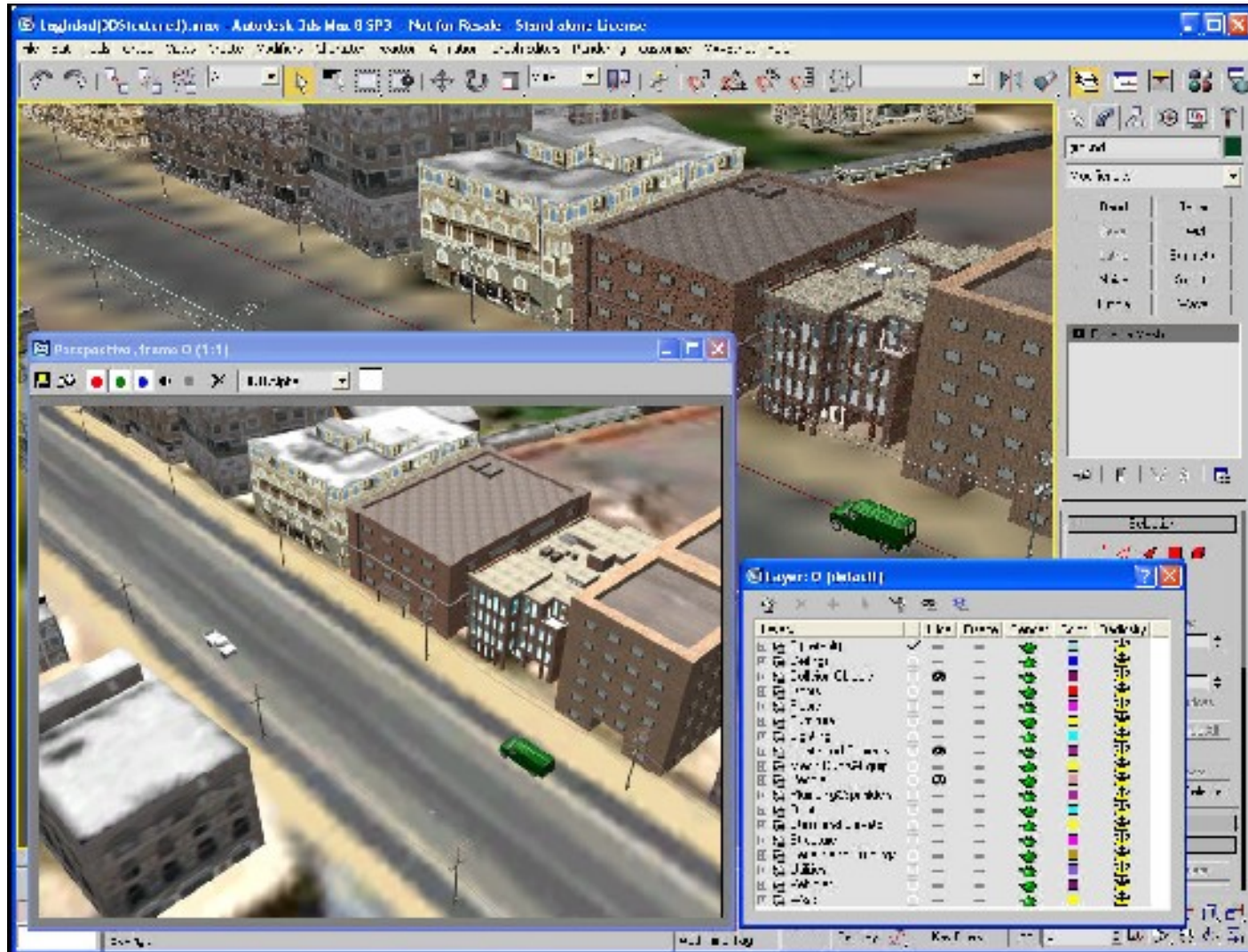


Internet  
Explorer



Mozilla  
Firefox

# 3D Visualization Tools



# BIM/GIS/CAD Data

## CAD

- The world's number one infrastructure data *creation* engine is desktop CAD.
- CAD files (DWG, DGN) are ubiquitous – billions worldwide.
- Most of the world's design information is stored in CAD files
  - Floor plans
  - Building designs
  - Municipal infrastructure: water, gas, electric, telecom, waste water, sewer

## Geospatial

- Vector landbase data is available for much of the world, now available via Google, Microsoft, Yahoo, Mapquest.
- Imagery data – increased resolution, huge volume.
- Geospatial infrastructure data is used by utilities, telecommunications firms, pipeline firms, and local government to manage infrastructure: electric, gas, water, waste water, telecom, heating, and pipelines.

## BIM (Building Information Model)

- Basis for model-driven design in the architectural design world.
- BIM models are now required by governmental organizations around the world, US GSA, Singapore, Norway, Hong Kong, ...

# Standards for Convergence

## **IAI IFC (Industry Foundation Classes)**

- International Alliance for Interoperability (IAI)
  - Alliance of organizations dedicated to bring about a coordinated change for the improvement of productivity and efficiency in the construction and facilities management industry (*Building Smart*).
- *IFC/ifcXML Common Model*, also known as Industry Foundation Classes, which is defined using an XML schema.

## **NBIMS**

- NIBS National Institute of Building Sciences
- BIM is a shared digital representation founded on open standards for interoperability.
- Common life-cycle information model for the A/E/C and Facilities Management industry.

## **OGC OWS (Open Web Services)**

- Web Mapping Service (WMS), Web Feature Service (WFS), Geographic Markup Language (GML), and other services.

## **OGC-IAI alliance to support convergence**

- Open Web Services testbeds
  - 2006 - OWS-4
  - 2007 - OWS-5



## Concept Demonstration: BIM/CAD/GIS Integration

# What did you see ?

## OUTSIDE



### 3D exterior urban visualization

Including:

- Utility structures
- Full city blocks of 3D detail
- Precise spatial orientation
- Line of Sight calculations
- Space – to – Sidewalk view

## INSIDE



### Full interior, 3D visualization

Including:

- Utility / HVAC systems
- Furniture
- Mechanized lifts / elevators
- Walls, doors, windows
- Precision architectural detail

## UNDER



### 3D subterranean visualization

Including:

- Sewer systems
- Utility / Phone systems
- Electrical systems
- Access routes / portals
- Precision CAD detail

# What did you see ?

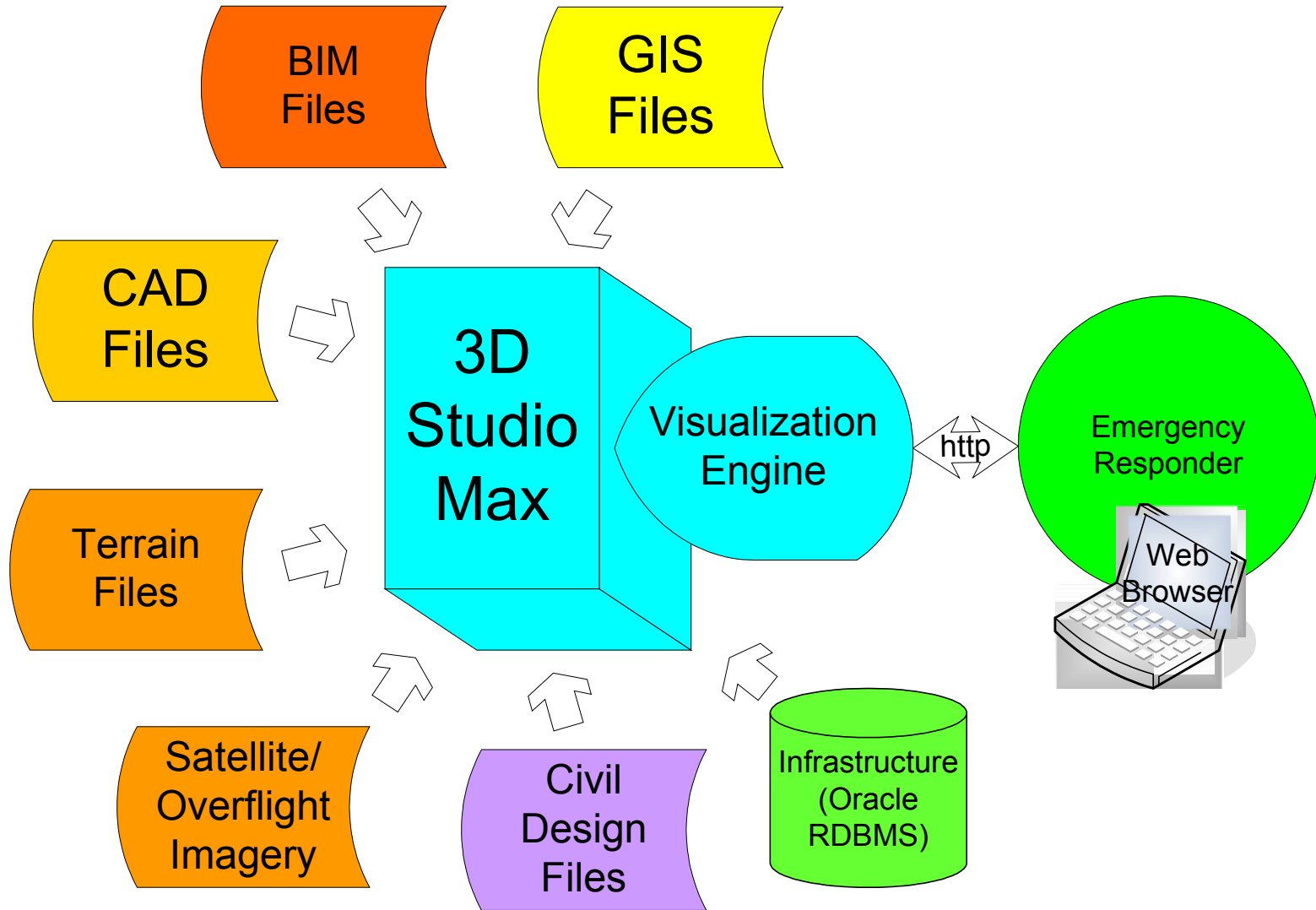
**Web-base user interface universally accessible.**

**Integrates existing architectural, engineering, geospatial data.**

**Visualize engineering and geospatial data in a 3D environment**

- **Contextual facades**
- **Zoom and interactively navigate the target building**

# How did we do it ?



# How did we do it?

## Real world data

- SHP files
- CAD 2D Drawings
- Building Information Model (BIM)
- Mechanical data (elevators, etc)

GIS

CAD

Architectural Design

Mechanical Design

## Synthetic Environment data

- 3D Polygonal Data (objects)
- 2D Textures

3D Studio Max

## Industry-standard 3D Game Engine

## Industry-standard Visualization Engine

# Objective: Integration based on Industry Standards COTS Tools

**Architectural Design      CAD**

**Civil Engineering      GIS**

**Mechanical Design      Internet technologies**

**Infrastructure      Gaming**

**Management**

**Visualization**

# Summary

## Convergence

- Dramatic implications for the construction industry, emergency response and urban planning

## Requires integration among domains

- Architecture, civil engineering, infrastructure management, GIS, 3D visualization environments, and internet technologies.

## BIM/GIS/CAD integration

- Interoperability across the lifecycle of buildings and infrastructure.
- Supports integration of real-world architectural, engineering and geospatial data
- 3D visualization using industry-standard COTS tools
- Universal access via a web-based user interface

# Autodesk®

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