JPL's Enterprise Information System Architecture

Summary of Recommendations
Steve Jenkins
5/22/96

Agenda

- EIS Architecture Team charter and process
- EIS Architecture
  - Overview
  - Infrastructure Service Recommendations
  - Example Value Added Services
- This is a technical overview
  - many organizational questions in process
EISAT Charter

- Charter 6/12/95 by: Rick Green (EPIC), Jim Minges (111S), Tom Thornton (ICIS)
- Concurrency: John Casani (500), Chris Carl (390)
- Assignment: produce a recommended architecture for JPL's Enterprise Information System (technical and business)

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EISAT Process

- Assemble team
  - Chosen for knowledge of problem domain and information technology
  - Team: José Ameedo (35), Chris Eddington (31), Joe Kahr (39), Peter Shames (38), Bob Somer (22)
- Examine, evaluate, and recommend best industry practice

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Getting The Document

- Paper: JPL D-12991, Vellum Files
- PostScript, PDF:
  -- PDF is imperfect (some pages were scanned in)
- Comments to the team:
  mailto:eisat@snapon.jpl.nasa.gov
  -- at least one revision will be published

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Architecture Overview

- Concepts and Principles
  -- Foundation assumptions and facts
- Infrastructure Services
  -- Application-independent enabling services upon which others are built
- Example Value-Added Services
  -- JPL-specific services that meet mission-critical process requirements

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Guiding Principles 1

- Architecture provides a framework for efficient implementation of information systems
- Information resources are institutional assets, and are managed accordingly
- Vendor-neutral standards, heterogeneous systems are assumed

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Guiding Principles 2

- Enterprise information system is effective, feasible, manageable, reliable, secure, extensible, scalable, flexible
- Enterprise information system reflects best industry practice
- Principles elaborated in detail in D-12991, Appendix A

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Basis for Recommendations

- Meets service requirements
  - including cross-service integration
- Governed by open specifications
- Subject of industry consensus
- Commercially available
- Successfully deployed in industry

An Aside on DCE 1

- Several service recommendations are based on OSF DCE
- Driving requirements:
  - cross-service integration, especially security, directory, and remote procedure call
  - integration with external directory and security domains
  - RPC interface version control
An Aside on DCE 2

- Open specifications: DCE specifications published by X/Open
- Industry consensus: vendor commitments from Cray, Digital, HP, IBM, Microsoft, SGI, SunSoft, others
- Available on AIX, Digital Unix, iIP-UX, IRIX, OS/2, Solaris, SunOS, Unicos, VMS, Windows (3.1, 95, N-I), MacOS (96)

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An Aside on DCE 3


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Infrastructure Services

- Communication: network, remote procedure call
- Distribution: object, directory, time sync, security, systems management
- Application: l'tic, messaging, transaction processing, data access, windowing, data interchange
- Development Support: framework

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Network Service

- Service: Basic communication service upon which other services are built
- Recommendation: TCP/IP, universal connectivity (on-lab, off-lab)
- Status: Implementation under way in HiNet task (ICIS), complete FY96
  - some enhancements recommended (e.g., client software support)

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Remote Procedure Call Service

- Service: Recommended practices and software for low-level program-to-program communication
- Recommendation: OSF Distributed Computing Environment (DCE)
- Status: Implementation under way in CAE Project (IPIC), development complete FY96
Infrastructure Services: Distribution

Object Service

- Service: Provides support infrastructure for deploying object-oriented applications
- Recommendation: None; no industry consensus on object strategy
- Status: Prototyping/evaluation underway in several tasks (e.g., DSN Information Systems Engineering lab)
Infrastructure Services: Distribution

Directory Service

- Service: Runtime lookup/location service for network resources: people, computers, servers, printers, etc.
- Recommendation: OSF DCE, X.500
- Status: X.500 operational (ICIS), DCE under way in CAI Project (IPIC), development complete FY96
  -- significant integration work required

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Infrastructure Service Example

Directory Service

Application Client | Application Server
| | |
| requests | attributes | requests | attributes |
| | Network Service | | Internet |
| requests | attributes | attributes | requests |
| Directory Server | | Other Infrastructure Server |

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**Infrastructure Services: Distribution**

**Time Synchronization Service**

- **Service:** Utility service for keeping computer clocks synchronized to UTC
- **Recommendation:** OSF DCE, Internet NTP
- **Status:** NTP service operational (ICIS), DCE under way in CAF (EPIC), development complete FY96 — significant integration work required

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Service: Enables authentication, authorization, integrity, and privacy for other services

Recommendation: OSF DCE, Kerberos V5, Internet GSS-API

Status: Underway in CAL (EPIC), development complete FY96
– major integration work required
Infrastructure Services Distribution

Systems Management Service

- Service: Integrated, high-quality, cost-effective management and operation of information system elements
- Recommendation: SNMP-based commercial technology
- Status: Prototype development in CAE Project (PIC) in FY96
  - major engineering and deployment work required

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Infrastructure Services: Distribution

Systems Management Service

[Diagram of system management service with arrows and elements labeled]

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Infrastructure Services: Application

File Service

- Service: Laboratory wide data sharing using distributed file system technology
- Recommendation: DCE Distributed File System
- Status: Engineering 1001 Service (CAE, EPIC) operational now using predecessor technology (AFS); DFS planning under way, complete FY96

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Infrastructure Services: Application

Messaging Service

- Service: Electronic mail, bulletin board, and real-time notification services
- Recommendation: Internet
  SMTP/MIME/POP/IMAP, NNTP, IRC
- Status: I mail implementation
  beginning (ICIS) complete FY97;
  bulletin boards partially functions; now
  (ICIS); notification not planned
  significant integration work required

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**Infrastructure Services: Application**

**Transaction Processing Service**

- **Service:** Central synchronization mechanism to ensure consistent management of distributed databases
- **Recommendation:** X/Open transaction processing specifications
- **Status:** No implementation planned; no pressing need currently identified
  -- potential uses in TMOD, SESPD, IBS

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**Infrastructure Services: Application**

**Transaction Processing Service**

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Infrastructure Services: Application

Data Access Service

- Service: Access to structured data (i.e., database) in a distributed environment
- Recommendation: X/Open ISAM, SQL, CLI specifications
- Status: Engineering Data Service (CAE, EPIC) deploying Oracle-based SQL server, development complete FY96
  - significant integration work required
Infrastructure Services: Application
Windowing Service

- Service: Recommended conventions and software for distributed display style of client/server computing
- Status: X11R5 in wide use now
  -- MS Windows and Macintosh are outside service scope (not distributed display model)

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**Infrastructure Services: Application**

**Data Interchange Service**

- **Service:** Recommended practices and software for interchange of engineering design, graphics, documents, other data
- **Recommendation:** EDIF, IGES, CALS, SGML, HyTime, STEP
- **Status:** Multiple *ad hoc* efforts
  -- major work required for reengineering

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Infrastructure Services: Development Support
Software Development Framework

- Service: Recommended practices and tools for software development
- Recommendation: None
- Status: Major work needed to survey requirements and current technology; investment in common tool set lab-wide could yield large returns

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Infrastructure Services: Development Support
Software Development Framework

Bellcore's Workstation Software Factory

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Value-Added Service Example

Electronic Publication Service

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Value-Added Service Example

Engineering Data Service

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Value-Added Service Example
Engineering Data Service

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