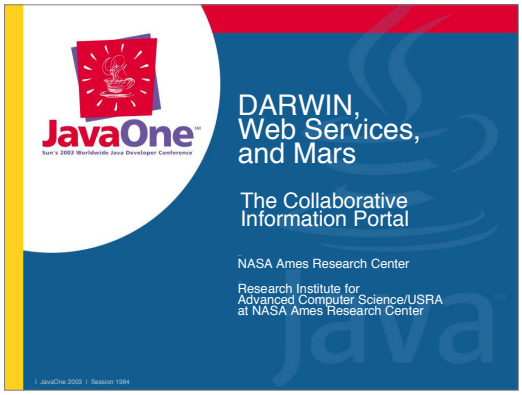

Overview

We will present how we used Java™ client applications, J2EE, and Web Services to build the Collaborative Information Portal (CIP) for NASA's current Mars Exploration Rovers mission.

Presentation Agenda

- Mission Overview
- From DARWIN to CIP
- Client Application
- The Middleware
- Summary

Mars Exploration Rovers Mission

- NASA's twin robot geologists, the Mars Exploration Rovers, will launch toward Mars in search of answers about the history of water on Mars
  - Launch: May–Jun, 2003
  - Landing: Jan–Feb, 2004
  - Duration: 90+ days
  - Mission Center: Jet Propulsion Laboratory, Pasadena, CA

Stages of the Mission

- Launch/Cruise
- Entry
- Descent
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- Egress
- Surface Operations

Surface Operations Process

- Rover is solar-powered, so must operate during daylight hours
- Mission will run on Mars time (Martian "sol" is 40 minutes longer than Earth day)
- Daily process for mission personnel:
  - Receive downlink from Rover
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Mission Needs

- Time Management
- Data Management
- Personnel Management

Mission Needs: Time Management

- What time is it?
  - Mission will run on Mars time
  - Collaborators from around the world
- What's happening?
  - Team is distributed across several floors of a high rise
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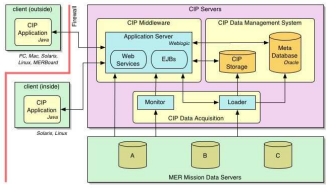

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CIP Application

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- Provide a central place to access mission information
- Provide a Mars time clock
- Navigate, search, and view mission data, plans, reports and schedules from various perspectives
- Provide notification of new events
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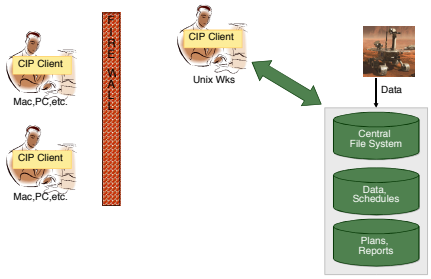

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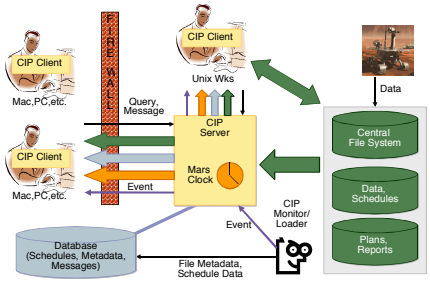

CIP Components

- Client
  - Java™ Application
- Server
  - Middleware (Web Services)
- Backend
  - Database (Oracle and mySQL)
  - Loader (Java™ Application)
  - Monitor (Java™ Application)

Monitor and Loader

- Monitor
  - Monitors the output of Sun's NFSLogd to find out about new files
  - Notifies Loader and Middleware
  - Automated
  - Event driven, not polled
- Loader
  - When notified of a new file, the Loader deduces file metadata and loads it into the database
  - Parses schedule files and loads schedule data into the database

Client Design Goals

- Demand driven operation
- Support common scientific user platforms (Sun, PC, Mac)
- Leverage current technologies
- Thick client
- Quick, painless deployment
- User customizable
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Client Design

- First pass: Web portal with applets
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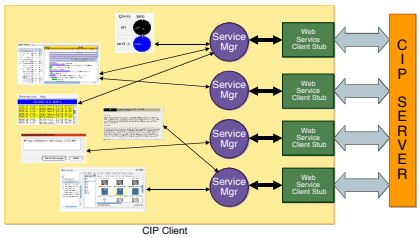

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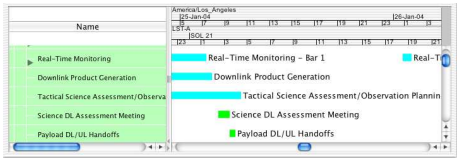

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Schedules

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Data Navigation: Client

- Navigate central file server from different perspectives
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General Client Features

- Access to MER related web sites by launching a web browser
- A directory browser for the central file server
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CIP Middleware

Middleware Goals

- Reliable
- Scalable
- Maintainable
- Secure
- Platform and language independent
- Support hundreds of users
- Adheres to standards
- Off-the-shelf software

Mission Characteristics

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Mission Characteristics (Cont.)

- Need HTTP to get through the firewall
- All transmitted data must be encrypted
- Most client applications are written in Java, but some are written in C++
- Client applications run on Solaris, Linux, Windows, and Macintosh OS X

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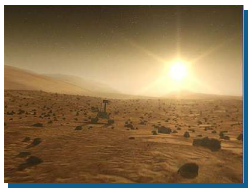

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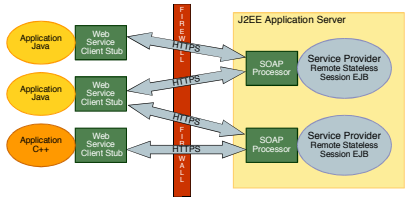

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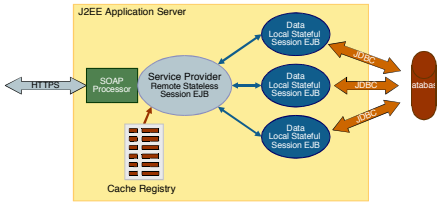
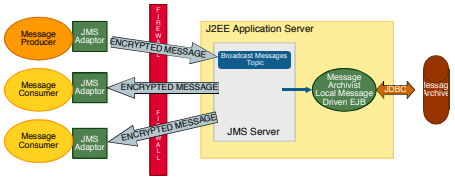


- The Cache Registry keeps track of which Data EJBs are in memory

Middleware Solutions (Cont.)

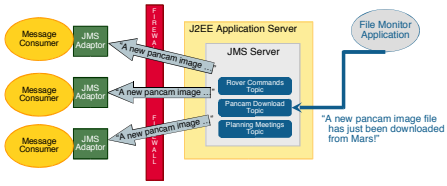
- Use the Java Message Service (JMS) for messaging
  - Broadcast messages and event notification
  - Message-driven beans manage message archiving

Broadcast Message Service



- All Message Consumers and the Message Archivist (a message-driven EJB) subscribe to the Broadcast Messages topic
- A Message Producer sends a message to the topic
- The JMS Server sends the message to all the message consumers
- The Message Archivist archives the messages

Event Notification Service



- The JMS Server maintains various topics
- Interested consumers subscribe to a topic
- Messages sent to a topic are then sent to all consumers that are subscribed to that topic

CIP Middleware Services

- User management services
  - User authentication, authorization, and preferences
- Data access services
  - Database queries for metadata, mission data, and project schedules
- Time services
  - Convert between Earth and Mars time
- File and directory services
  - Upload and download mission data files
- Message services
  - Broadcast announcements and event notification
- Management services
  - Data loading and cache monitoring

Summary

- The Collaborative Information Portal is a key component of the Mars Exploration Rovers mission
- The client applications are highly graphical and interactive. Most are written in Java
- The middleware combines J2EE and Web Services technologies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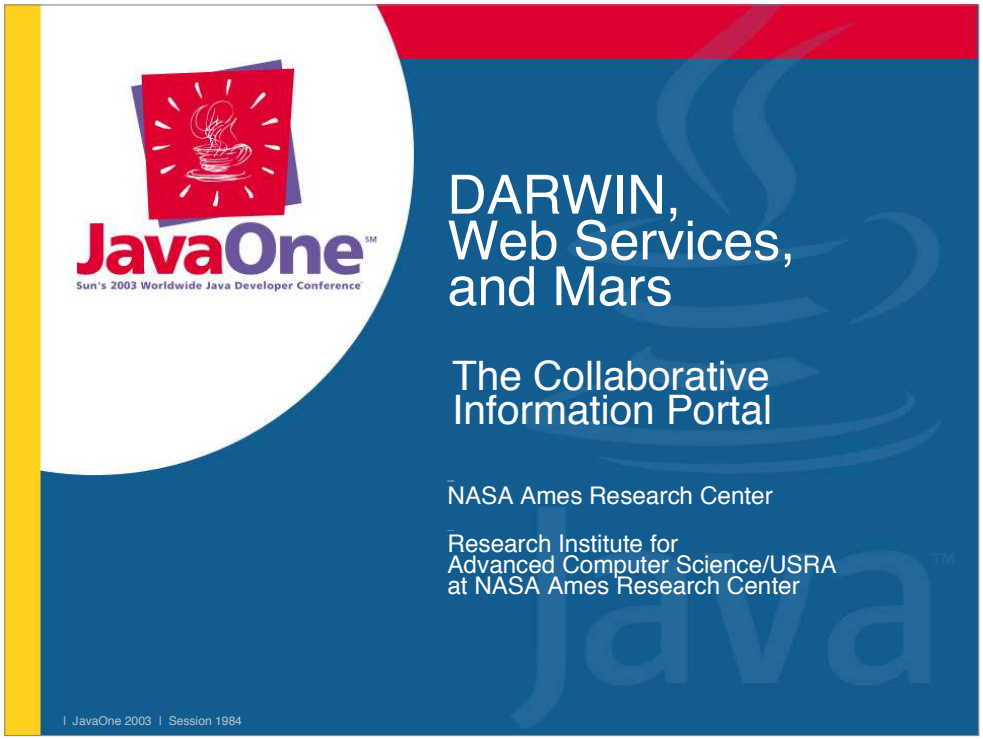
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DARWIN,
Web Services,
and Mars
The Collaborative
Information Portal
NASA Ames Research Center
Research Institute for
Advanced Computer Science/USRA
at NASA Ames Research Center
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Mission Overview
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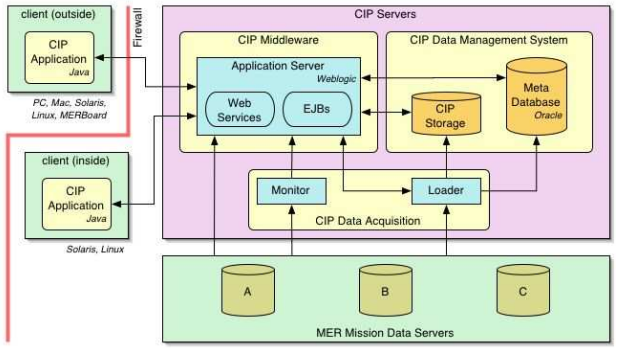


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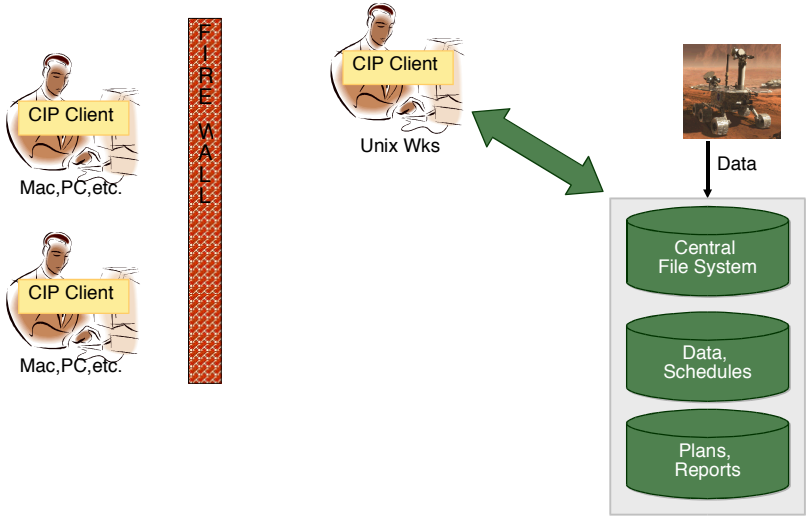

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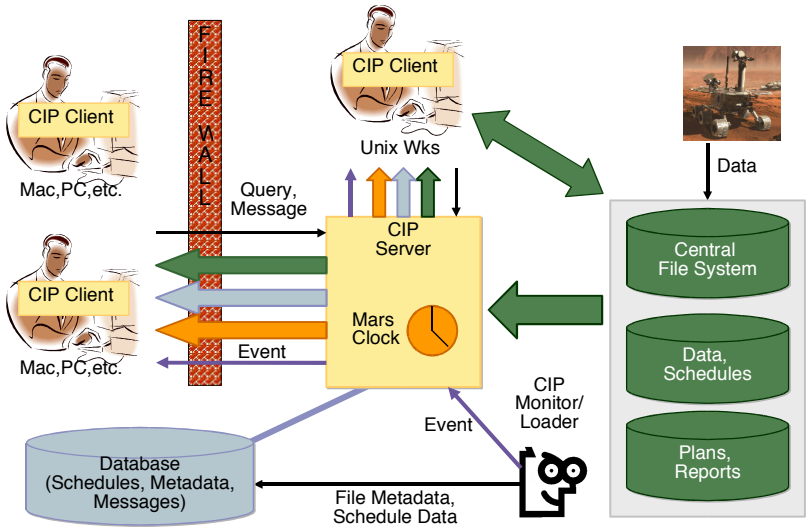

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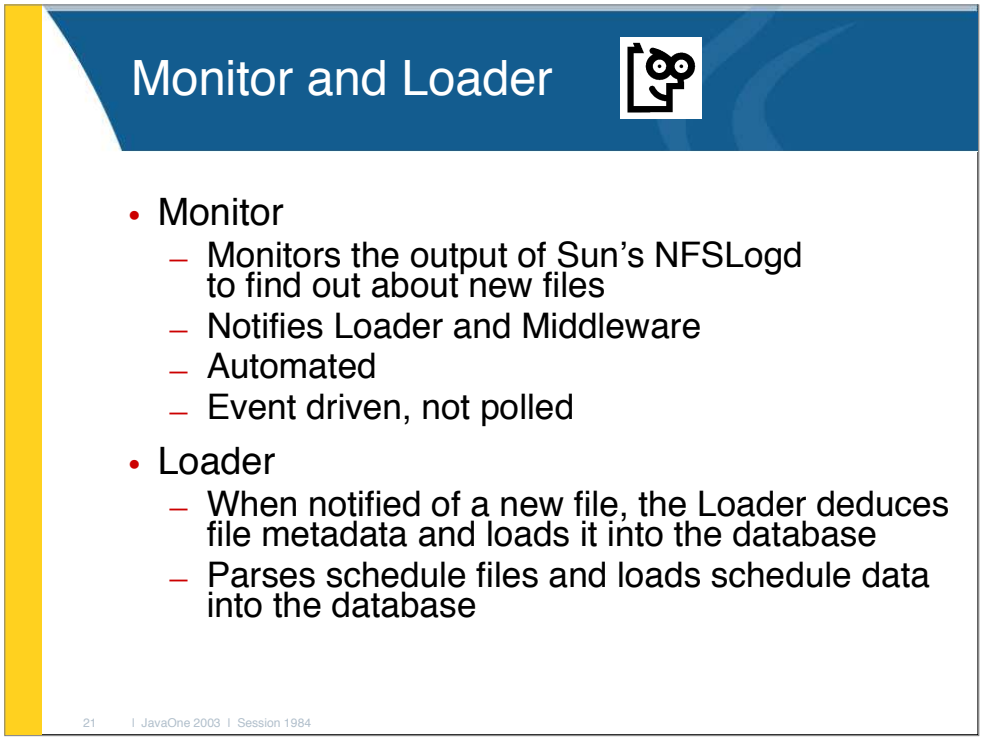

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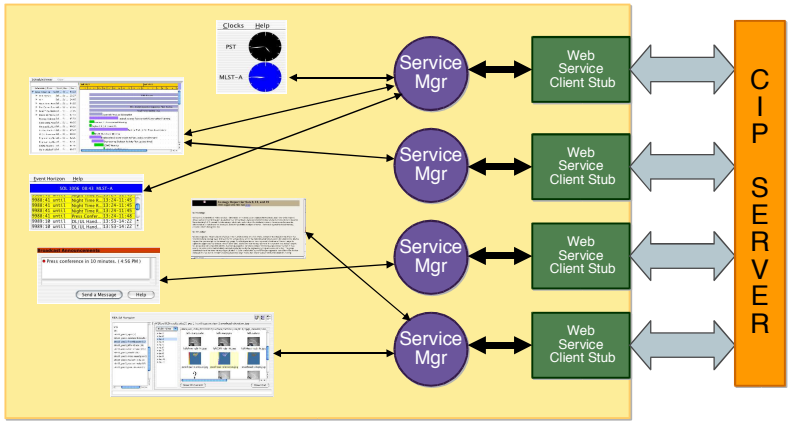

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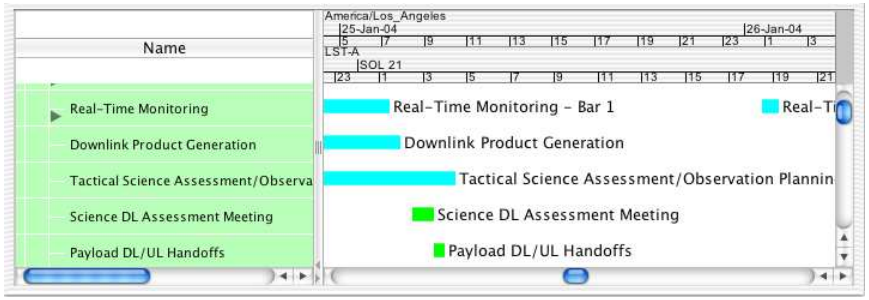

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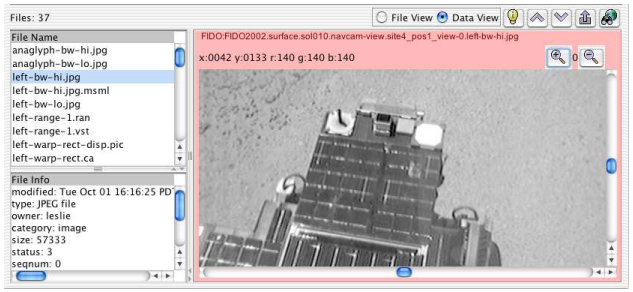

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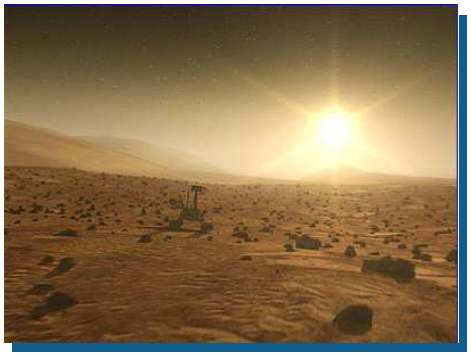

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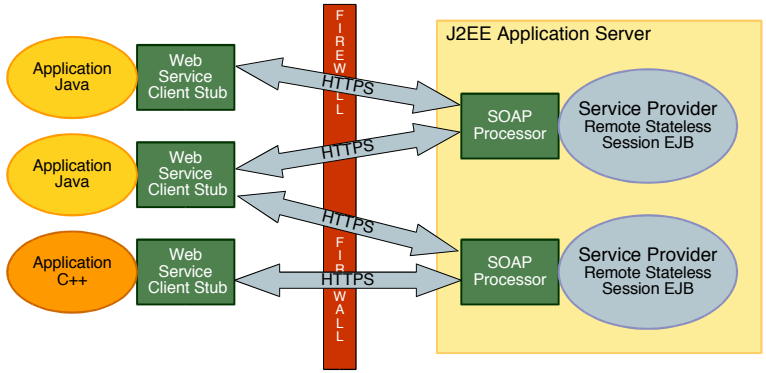

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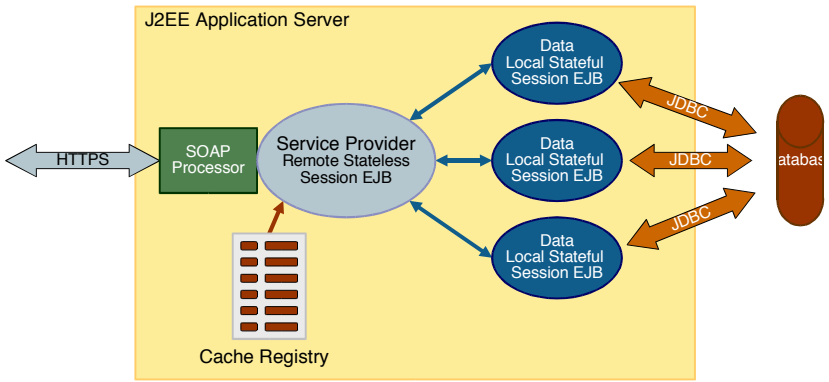

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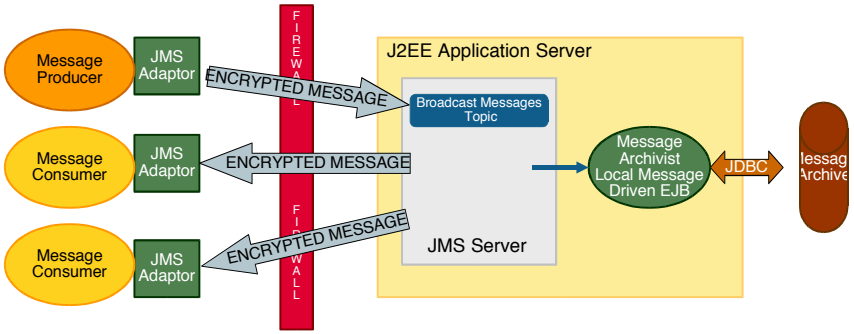
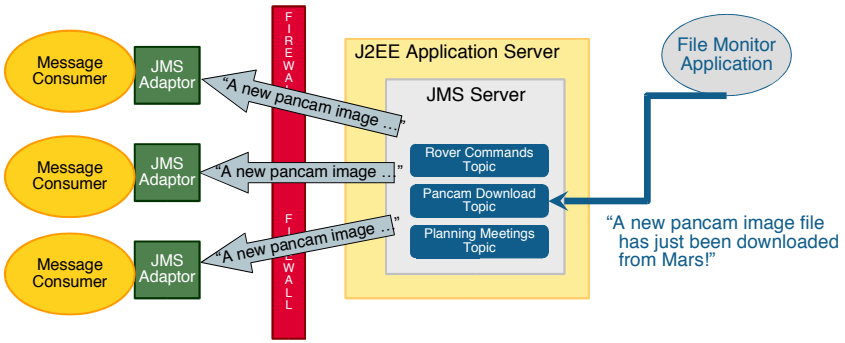
Broadcast Message Service



- All Message Consumers and the Message Archivist (a message-driven EJB) subscribe to the Broadcast Messages topic
- A Message Producer sends a message to the topic
- The JMS Server sends the message to all the message consumers
- The Message Archivist archives the messages

Event Notification Service



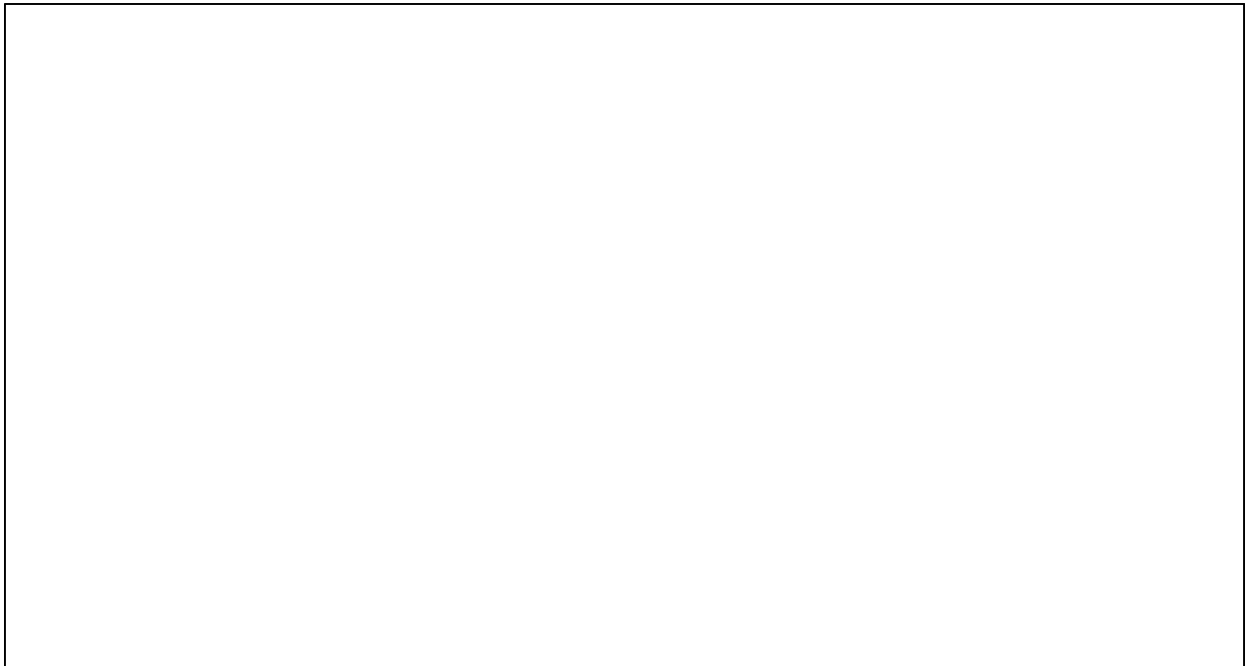
- The JMS Server maintains various topics
- Interested consumers subscribe to a topic
- Messages sent to a topic are then sent to all consumers that are subscribed to that topic

CIP Middleware Services

- User management services
  - User authentication, authorization, and preferences
- Data access services
  - Database queries for metadata, mission data, and project schedules
- Time services
  - Convert between Earth and Mars time
- File and directory services
  - Upload and download mission data files
- Message services
  - Broadcast announcements and event notification
- Management services
  - Data loading and cache monitoring

Summary

- The Collaborative Information Portal is a key component of the Mars Exploration Rovers mission
- The client applications are highly graphical and interactive. Most are written in Java
- The middleware combines J2EE and Web Services technologies

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