

Secure Web Command and Control

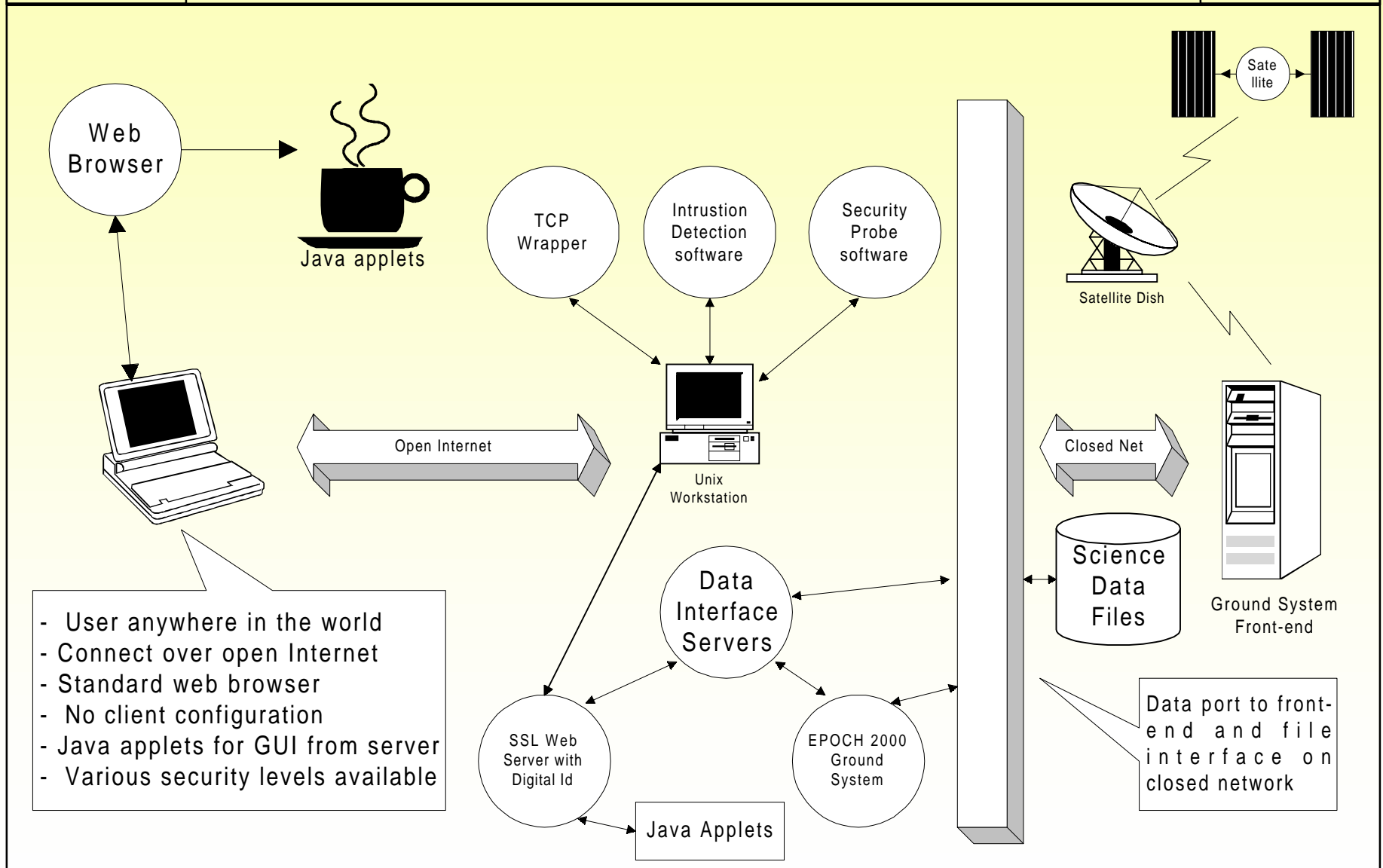
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- Standard IP-based tools can be used to deliver science data from an automated ground processor to the scientist over the open Internet
- Flight operators and spacecraft engineers can monitor and control a spacecraft reliably from any open Internet location
- Demonstrating use of current technologies with integrated COTS prototype systems

**Java-based Spacecraft Web Integrated
Telemetry and Command Handling**

- **Faster**
 - Assembled out of COTS products
- **Better**
 - Scientist can communicate with ground system using Web browser
 - Engineers and operators can work from office, home or on the road using only a Web browser
 - Client computers are platform independent (Web browsers run on PC, Mac and Unix platforms)
 - Anomaly resolution is facilitated with remote access making lights out operations during off-shifts realistic
- **Cheaper**
 - No dedicated operations area required
 - No special client hardware or software required
 - No lengthy software development required



- Ground system
 - receives data during scheduled pass during non-staffed off shift
 - detects anomaly from analysis of data
 - phones and pages operations personnel and/or engineers
- Operations person
 - connects to ground system from home or office or other remote PC using local, personal ISP or network Internet connection
 - diagnoses problem by examining telemetry and events from recent or current pass
 - prepares and issues a real-time spacecraft command or directive which will result in spacecraft command during next pass which resolves the anomaly
 - Spacecraft health and safety is maintained

- Ground system
 - servers are located in a closet at convenient location (backups could be located elsewhere)
- Operations and Engineering
 - operations personnel and spacecraft engineers perform duties from their desktop PCs in their offices during normal work situations
 - Operations can be performed from remote or other sites during non-typical situations (e.g., conferences, meetings at other centers, university)
 - Operations, spacecraft engineers, scientists share in operations through Internet-based groupware (e.g., Netmeeting)

- **Spacecraft**
 - science instrument is collecting and storing data onboard
 - data is transferred to ground during unattended, scheduled contact
- **Ground**
 - science data files are processed by automated ground system
 - ground system notified scientist by email or beeper
- **Scientist**
 - scientist logs into server through Jswitch using Web browser and transfers data for local processing and analysis

- Working prototype integrated from standard, inexpensive COTS packages
- Security capabilities (encryption, authentication, intruder detection, firewall filtering)
- ISI Epoch 2000 configured for SOHO
- Custom glueware integrating Web server with Epoch 2000
- SSL-enabled Web server supporting up to 120 bit encryption
- GUI elements programmed in Java

- GUI configurable by flight operators
- Groupware to support distributed operations
- 3D monitoring and control using VRML
- File management to support FTP from spacecraft

Demonstrations are available

For more information see our Web site at

<http://moca.nascom.nasa.gov/>