

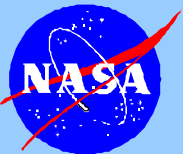
Jswitch/
Jsat/
Jmon

*Java-based **S**pacecraft **W**eb **I**nterface to **T**elemetry & **C**ommand **H**andling*

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

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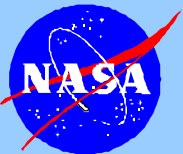
Jim Langston
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Jswitch Family



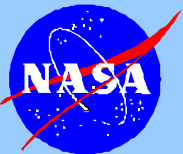
- ◆ **Java-based Spacecraft Web Interface to Telemetry and Command Handling (Jswitch)**
 - Java applets, web server encryption
- ◆ **Java Science Analysis and Trending (Jsat)**
 - Interface to subset data and statistics
- ◆ **Java Monitor (Jmon)**
 - Java applications, configuration with Java beans, translation of legacy displays, expert system
- ◆ **Operating Missions as Nodes on the Internet (OMNI)**
 - Jswitch GUI for control and monitoring



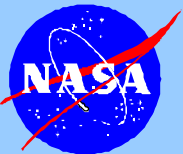
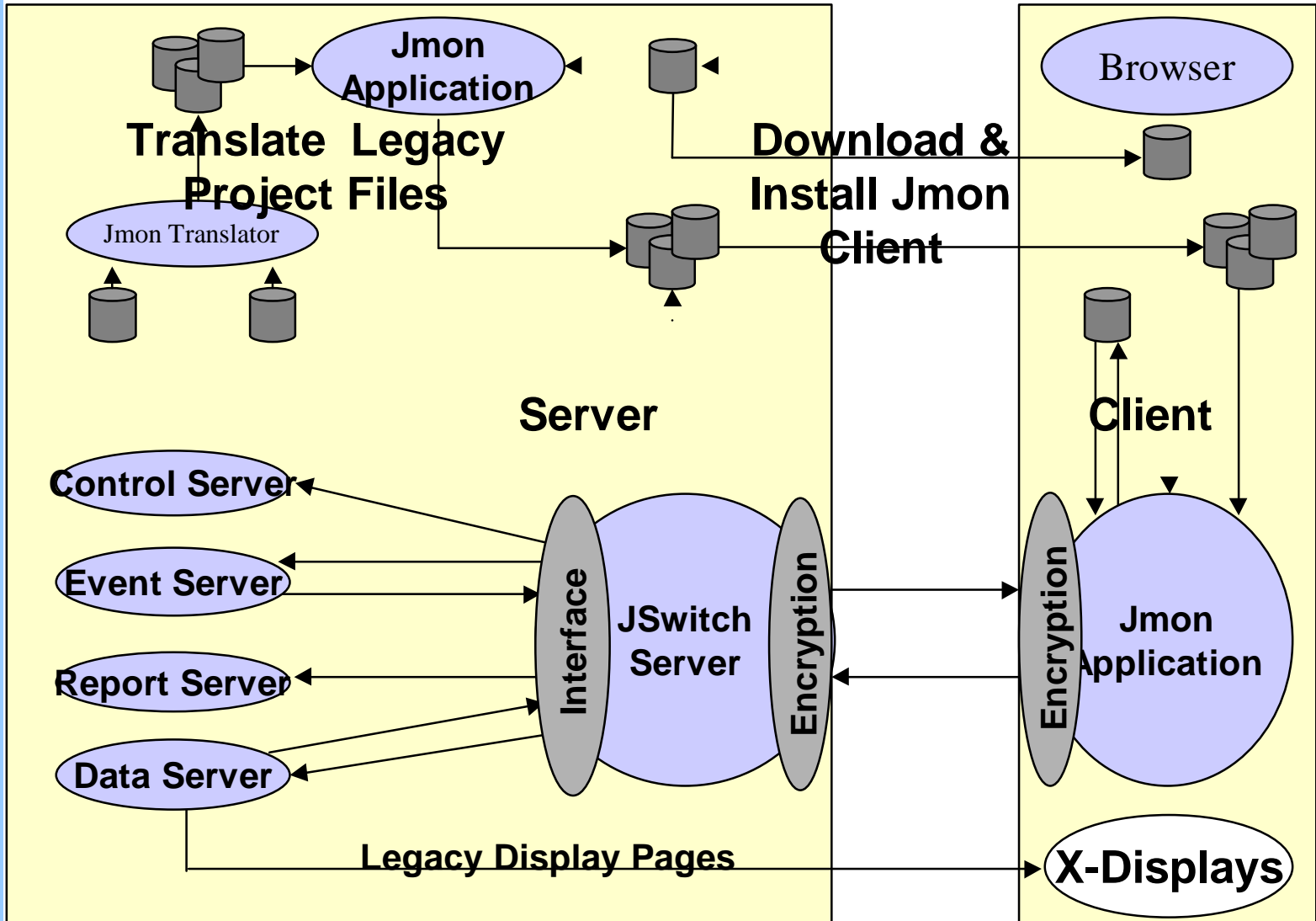
What is Jswitch?



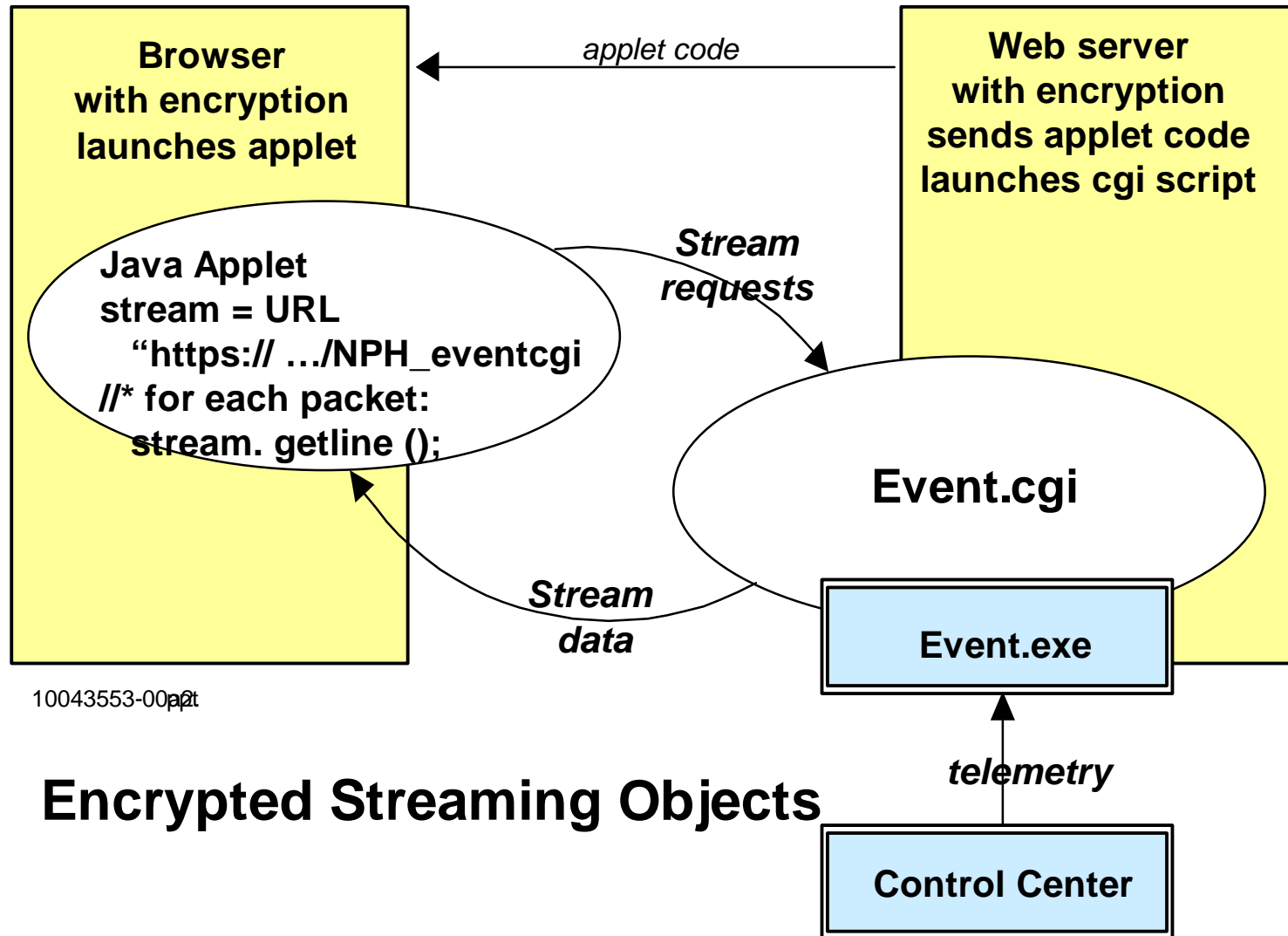
- ◆ **Jswitch is a platform-independent user interface to a spacecraft command and control system**
- ◆ **Java technology for rich GUI and real-time data**
- ◆ **Readily available security software**
- ◆ **Standard Internet and Web protocols**
- ◆ **Simple interface to COTS and legacy control centers**
- ◆ **Integrated COTS approach**



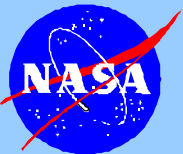
Jmon Architecture



Web Server SSL Encryption



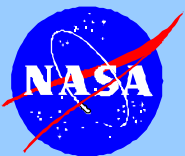
Encrypted Streaming Objects



The Internet Can Be Secure



- ◆ **Authenticate client to server**
 - static passwords
 - dynamic password-protected ID cards
- ◆ **Certify server to client (third party reg.)**
- ◆ **Encrypt data server and client (SSL)**
 - Via Web server for applets
 - Inherit from SSL classes for applications
- ◆ **Detect intruders in server (scan logs)**
- ◆ **Protect server from intruders (filter packets)**
- ◆ **Detect weaknesses (probe system)**



Java Provides Rich GUI

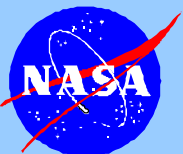


The screenshot shows a Netscape browser window titled "JSWITCH Interface to EPOCH 2000 Ground System". The interface is divided into several sections:

- Command Input:** A text field containing "CMD_LAUNCH" with "Send" and "Clear" buttons. A status bar above it says "Sent command: CMD_LAUNCH".
- Execution Log:** A scrollable text area showing "Executing STOL command: CMD_LAUNCH" and "EPOCH cmd_i/f: status = 1, response = Error: Undefined keyword 'CMD_LAUNCH'".
- Events Interface:** A section with a "Connected to events interface" status bar and a "Filter on:" input field. Below it is a log of events:

```
000519 05:12.000 EVT:103 AKM2_TP in limits (Normal), raw value = 0
000520 05:12.000 DIR:strm_CMD_LAUNCH
000521
000522 05:12.000 Error: Undefined keyword "CMD_LAUNCH"
000523 05:12.000 DIR:strm_ [.strm_srvr.jswitch] logged out.
```
- Epoch 2000 Commands:** A scrollable list of commands such as "APE1_ARM EHT=ARM ODD EHTS", "APE1_ARM_EW_PRI=ARM PRIMARY EW THRUSTERS", "APE1_ATTMON=ATTITUDE MONITOR MODE", "APE2_TORO_ON=MAGNETIC TORQUER CONTROL ON", "BTY2_OFF=BEACON 2 OFF", "CMD_LAUNCH=COMMAND OMNI LAUNCH MODE", "EHTEV_ENA=HEATER & THRUSTER ENABLE 14, 16", "RCS2_ON=RCS THRUSTER CONTROL 2 ON, 1 OFF", and "YAG1_ON=YAW GYRO 1 ON, 2 OFF".
- Telemetry Interface (Left):** A window titled "Connected to telemetry interface" showing a bar chart titled "Data Points" with three bars for AKM1_TP, BAT2_VX, and E15V_TP. The y-axis ranges from 0 to 60.
- Telemetry Interface (Right):** A window titled "Connected to telemetry interface" showing a line graph titled "Data Points" with three data points for AKM1_TP, BAT2_VX, and E15V_TP. The y-axis ranges from 0 to 120.

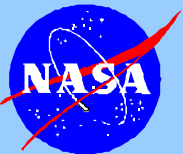
The browser's address bar shows "https://jswitch.nascom.nasa.gov/~jdemo/full_screen.html". The taskbar at the bottom includes icons for Start, Jswitch meeti..., Netscape, JSWITCH, and several browser windows.



Client computers are platform independent

Easy Bridges to Real-Time Data

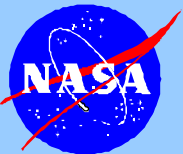
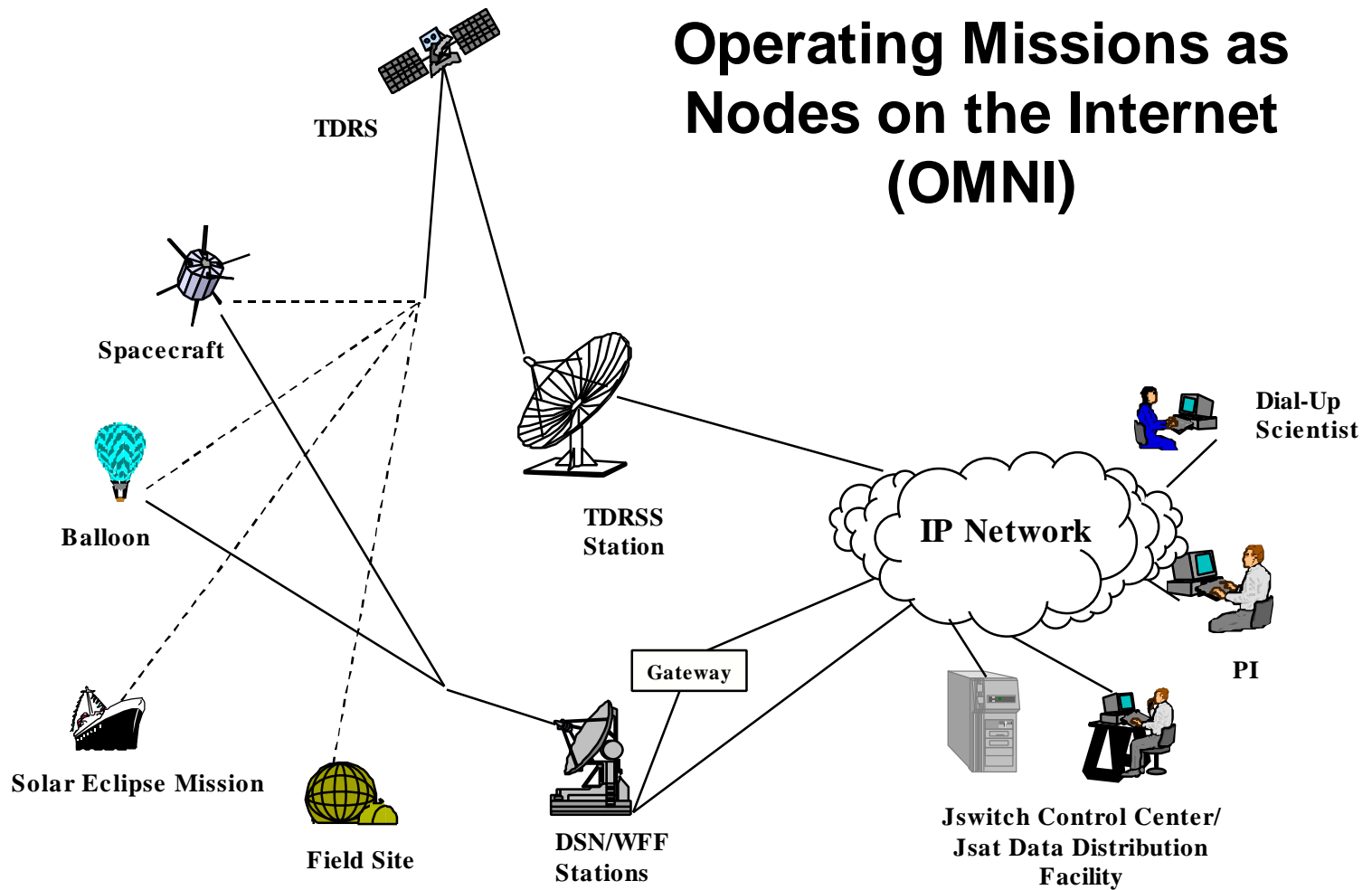
- ◆ **Generic mechanism to access spacecraft control center functions over the Internet**
- ◆ **Telemetry, command, and events interface with control centers**
- ◆ **Remote offline trend data analysis interface using EPOCH 2000 ABE**
- ◆ **Interface to Generic Spacecraft Analyst Assistant (GenSAA) for spacecraft monitoring**
- ◆ **Backward compatibility with existing control center displays via x-server Internet plug-in**



Instruments to Owners over IP



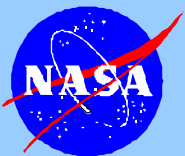
Operating Missions as Nodes on the Internet (OMNI)



Jswitch Integrated with OMNI



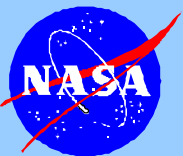
- ◆ **Scientists are familiar with Internet and its collaboration capabilities**
- ◆ **Wide range of COTS hardware and software already available**
- ◆ **Possibility of collaborative science as a result of support for communication between spacecraft in different missions**
- ◆ **Jswitch components are integrated into OMNI to support solar eclipse mission (Black Sea, August 11, 1999) for education outreach**



Operational Benefits



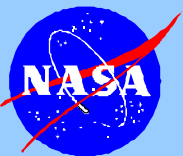
- ◆ **Engineers anywhere, with a standard Internet service and Web browser, can be paged to respond to a spacecraft anomaly**
- ◆ **Scientists have immediate access to instrument data subsets**
- ◆ **Important operational scenarios needed to move closer to reduced operations staffs and lights-out operations are supported**
- ◆ **Common GUI look and feel**



Configuration Benefits



- ◆ **Greater flexibility of Internet/Intranet configuration supports distributed operations**
- ◆ **No special client hardware or software is required beyond a current Web browser and Java Virtual Machine**
- ◆ **Numerous Java classes are available as public domain software over the Internet**
- ◆ **Integrated COTS approach keeps pace with rapid changes in technology**



COTS/GOTS Products List



- ◆ Stronghold Web Server by C2net
- ◆ Digital id by Verisign
- ◆ Java Development Kit
- ◆ Jchart library by KLG Group
- ◆ Jswitch Java source code
- ◆ Public domain software and configurations to make the client machine more secure (TCP Wrapper, SWATCH, SATAN, SSH, inetd/conf file, Secure ID, PHAOS)
- ◆ X-server Internet plug-in
- ◆ EPOCH 2000/ABE (Integral Systems, Inc.), TPOCC, ASIST
- ◆ GenSAA/Genie expert system tool kit

