# SEP and LET GSE Software

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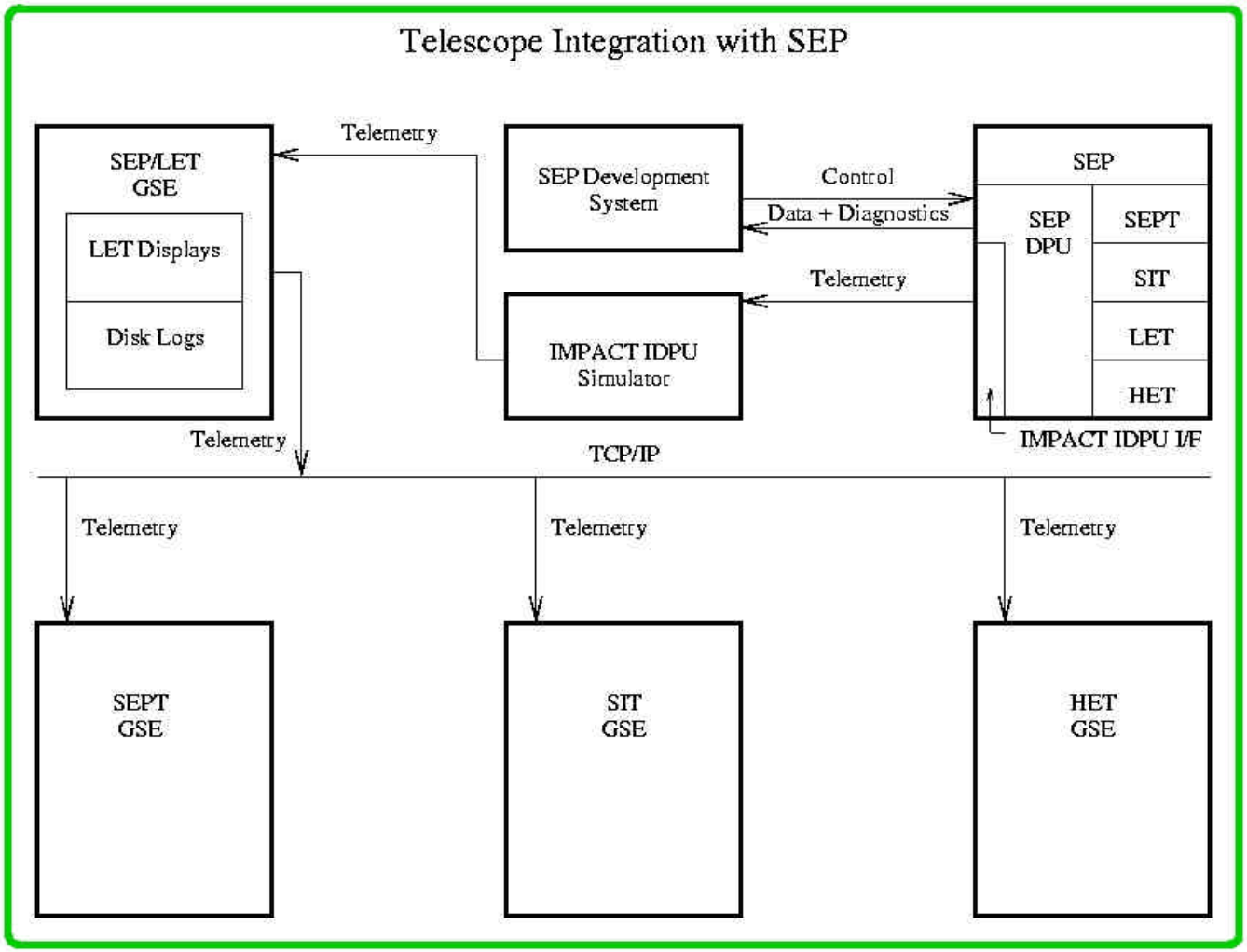
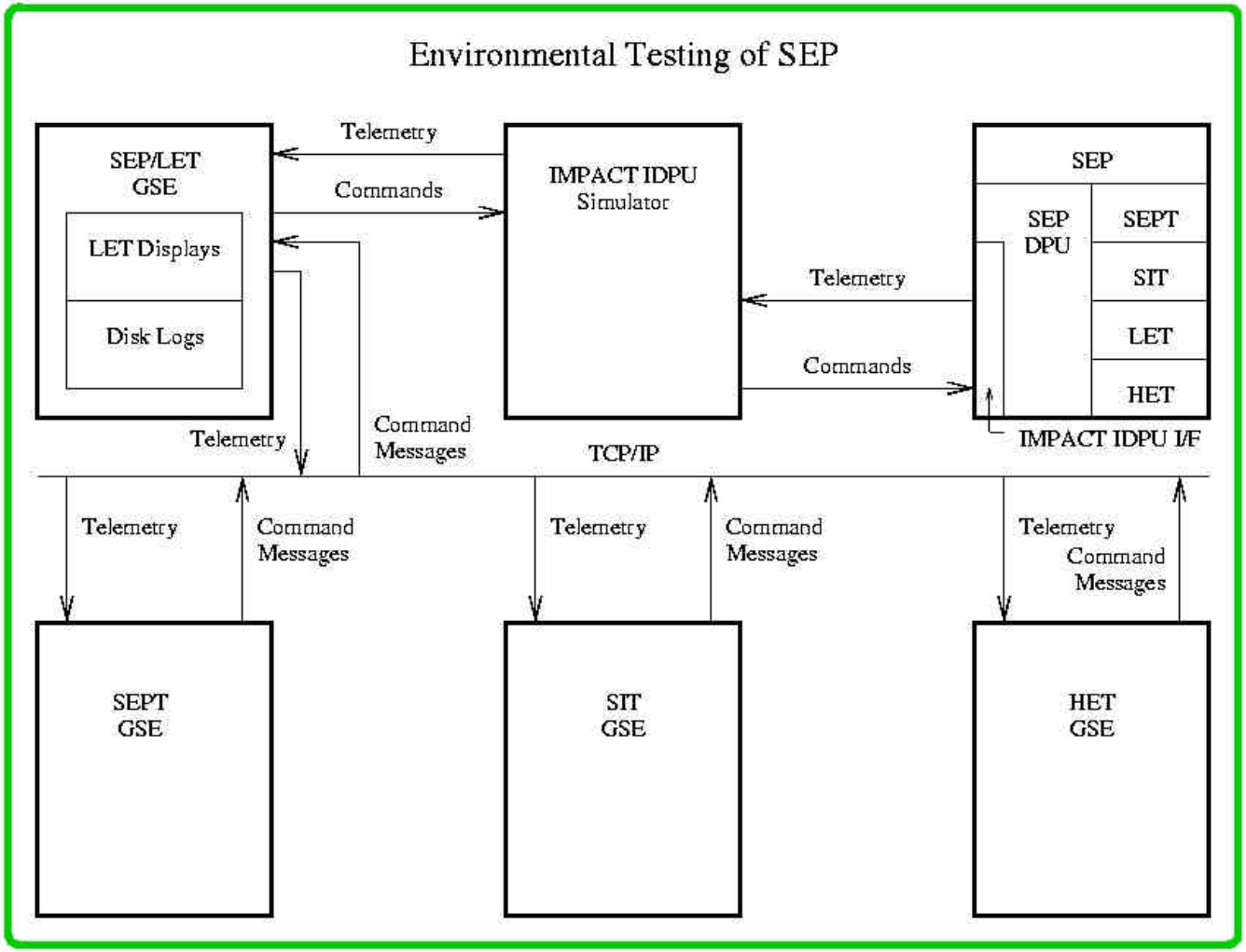
## The SEP/LET GSE Software falls into four broad categories

- Commanding
  - Command terminal
  - Stored commands
  - Command forwarding
  - Build command messages
- Telemetry Socket Server
- Display
  - real-time
  - non real-time
- Logging
- Plus the low-level software to access the IDPU simulator via the parallel port.

## Environments for SEP GSE software

1. SEP telescope integration & testing at Caltech
2. Pre-delivery environment testing (JPL)
3. Bench-checkout at UCB before EMI/EMC
4. EMI/EMC at UCB
5. Bench-checkout at APL
6. S/C integration & test at APL
7. End-to-end testing at the accelerator
8. Commissioning
9. Mission Operations


Telescope Integration with SEP
SEP/LET GSE
LET Displays
Disk Logs
Telemetry
SEP Development System
Control
Data + Diagnostics
SEP
SEP DPU
SEPT
SIT
LET
HET
Telemetry
IMPACT IDPU Simulator
IMPACT IDPU I/F
Telemetry
TCP/IP
Telemetry
Telemetry
Telemetry
SEPT GSE
SIT GSE
HET GSE


Environmental Testing of SEP
SEP/LET GSE
LET Displays
Disk Logs
Telemetry
Commands
IMPACT IDPU Simulator
SEP
SEP DPU
SEPT
SIT
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Command Messages
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Telemetry
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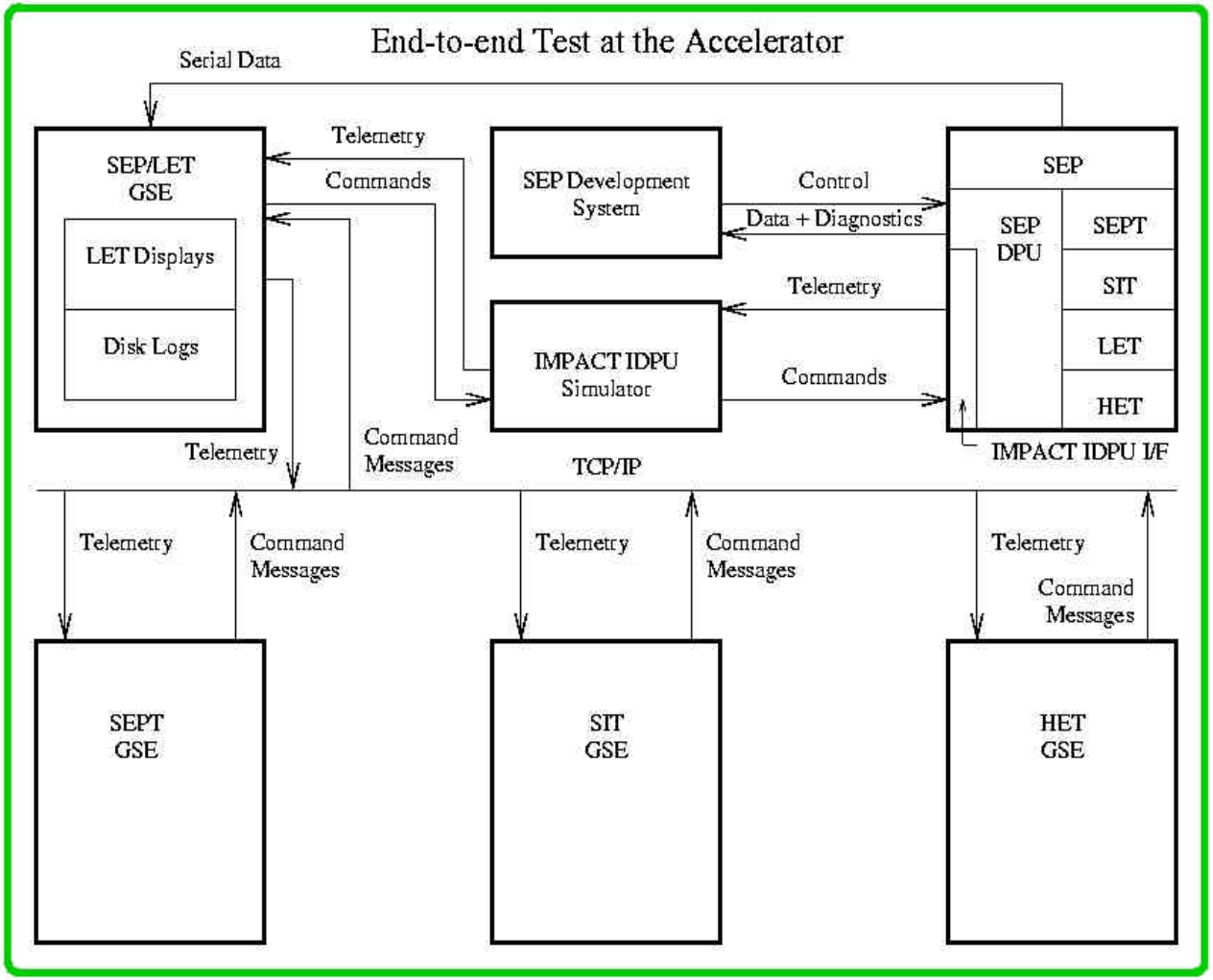
Telemetry
Command Messages
SEPT GSE
SIT GSE
HET GSE


End-to-end Test at the Accelerator
Serial Data
SEP/LET GSE
LET Displays
Disk Logs
Telemetry
Commands
SEP Development System
Control
Data + Diagnostics
SEP
SEP DPU
SEPT
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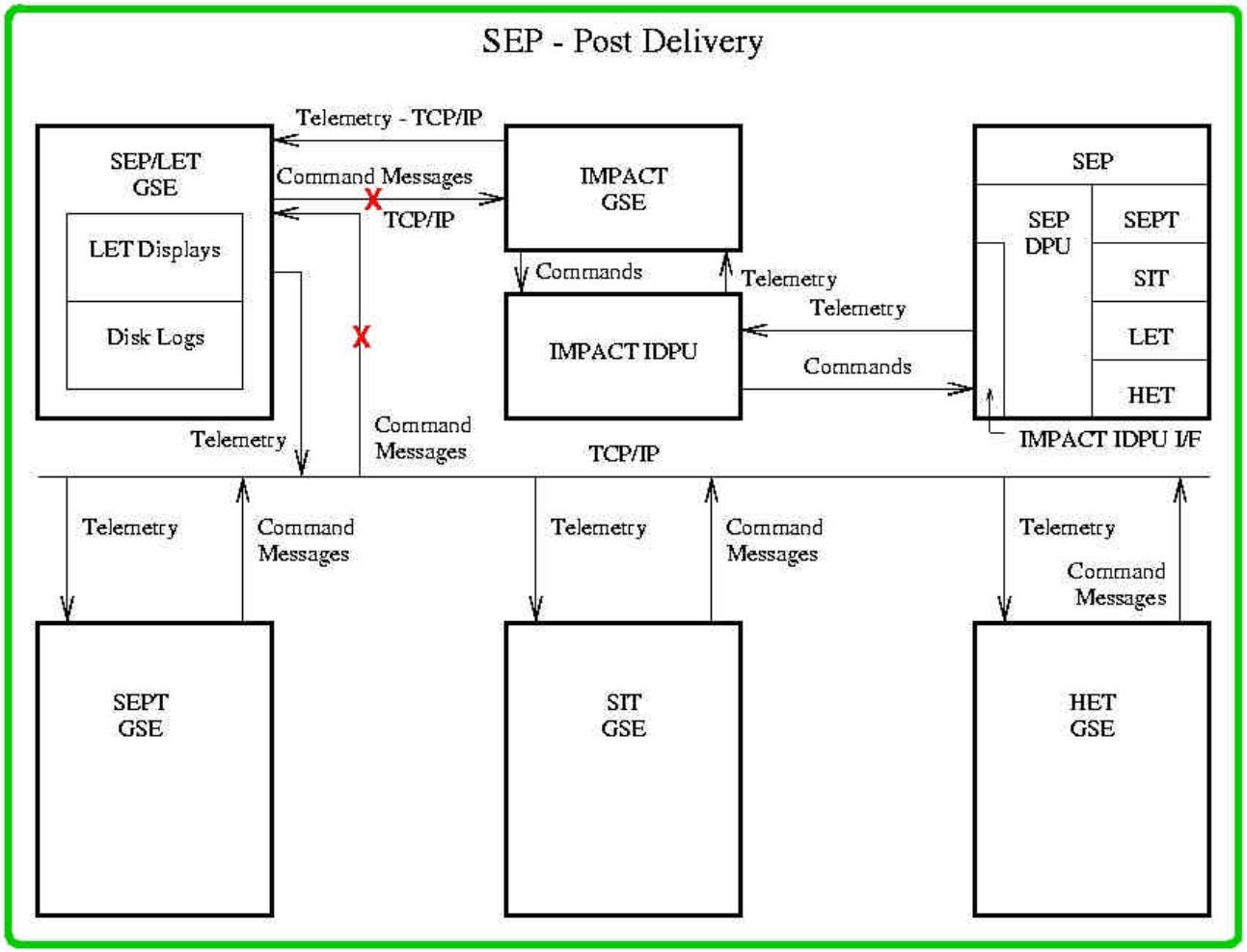


- Real-time commanding from the SEP GSE will be disabled after delivery of SEP to APL. SEP commands will still be formulated by the SEP team, but will be inserted into the command stream at the IMPACT POCC

## Commanding

- **The SEP GSE software will provide support for commanding from the SEP GSE keyboard using a terminal-like program.**
  - **The program allows the user to type any command on the SEP GSE keyboard. On <CR>, the command is sent.**
  - **Monitors and displays any command responses.**
  - **Allows the user to send any stored command message on the SEP GSE using a simple keyboard command.**
  - **If command forwarding is enabled, and any remotely sent command message arrives while the terminal program is running, the program allows the user to either reject the command message or allow it to be sent.**

## Commanding

- **The SEP GSE software will provide the capability to send command messages stored on its disk to SEP.**
  - **The programs are stored in a variant of the standard CCSDS command messages that use relative times instead of absolute times**
  - **If the command message is to be forwarded to the IMPACT GSE, the SEP GSE will convert the stored command message into a standard command message based on the current time before forwarding it.**
  - **If the command message is to be forwarded to the IDPU simulator, the SEP GSE will convert the stored message into the format expected by the IDPU simulator (24-bit command words).**

## Commanding

- The SEP GSE software will provide the capability of forwarding CCSDS command messages from the telescope GSEs (e.g. the HET GSE).
  - The default state will be NOT to forward command messages.
  - The telescope team assembles their commands into a command message that is sent to a dedicated SEP GSE command Socket. The message should begin with the appropriate forwarding command (LET-CMD, HET-CMD, or SIT-CMD) and end with the command termination character.
  - When the SEP GSE receives the command message and there are no time conflicts with other command messages, it sends it across the IMPACT IDPU simulator (pre-delivery) or forwards it to the IMPACT GSE (post-delivery).
  - If the IMPACT GSE (post-delivery) accepts the command message, the SEP GSE will send an acceptance notice back to the originator. If the command message is not accepted by the IMPACT GSE or the SEP GSE detects a time conflict, the SEP GSE will return a rejection notice and discard the message.

## Commanding Security

- Command messages from the telescope GSEs to the SEP GSE when sent over non-secure networks will use the same SSH-2 protocol that is used to send command messages between the IMPACT POCC and the MOC.
- Command messages from the SEP GSE to the IMPACT GSE will use the same SSH-2 protocol.
- Post-delivery, the default state will be that SEP commands will enter the command stream at the IMPACT POCC, not at the SEP GSE. The SEP team will provide SEP commands to the IMPACT POCC via another (TBD) secure channel.

## Socket Server Software

- The SEP GSE will act as a socket server that will provide telemetry to the telescope GSEs
  - Up to 12 TCP/IP connections
  - The following telemetry packets will be forwarded over the socket connections:
    - all packets with any SEP ApID
    - IMPACT housekeeping packets that contain SEP housekeeping data
    - SEP command responses
    - beacon data packets

# SEP GSE Software Data Display and Logging

- **Real-time SEP GSE Displays**
  - **Page displays and time history plots for SEP housekeeping.**
  - **A page display with packet statistics for each SEP ApId.**
- **SEP GSE Logging**
  - **The SEP GSE will log to its disk the following telemetry packets:**
    - **all packets with any SEP ApId,**
    - **IMPACT housekeeping packets that contain SEP housekeeping data,**
    - **SEP command responses,**
    - **beacon data packets.**
    - **The SEP GSE will also log to its disk all telecommand packets that the SEP GSE generates or forwards from the telescope GSEs.**
- **SEP GSE Non-real time Plotting/Analysis**
  - **The SEP GSE software will include a set of IDL routines for plotting/trend analysis of the logged SEP Central housekeeping data.**

## LET GSE Software Data Display and Logging

- **LET GSE Real-time Data Display**
  - Filter the packets from the SEP telemetry that contain LET data.
  - Build a set of standard (TBD) data structures from the LET data.
  - Build a standard set of real-time page displays for the information in the standard structures (may have more than one type of page display per structure.)
  - Allow the user to select variables from the page displays to build time history plots.
- **LET GSE Logging**
  - Log the packets and standard structures to disk as they occur.
- **LET GSE Non-real time Plotting/Analysis**
  - Furnish a set of IDL interface routines for accessing the LET data on the disks for reports, test results, ...
  - Provide a set of IDL routines for generating a standard set of plots from the disk data.