Ku-Forward Service

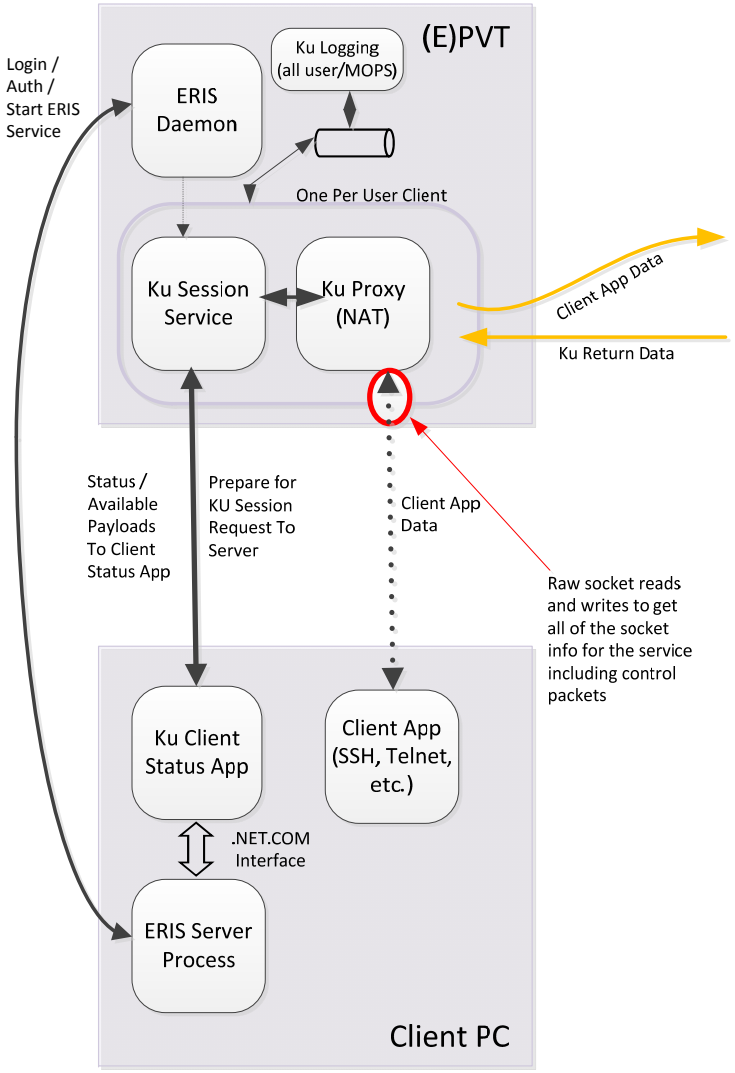
User Interfaces and Applications

Packet Flow Example

Testing and Verification Summary

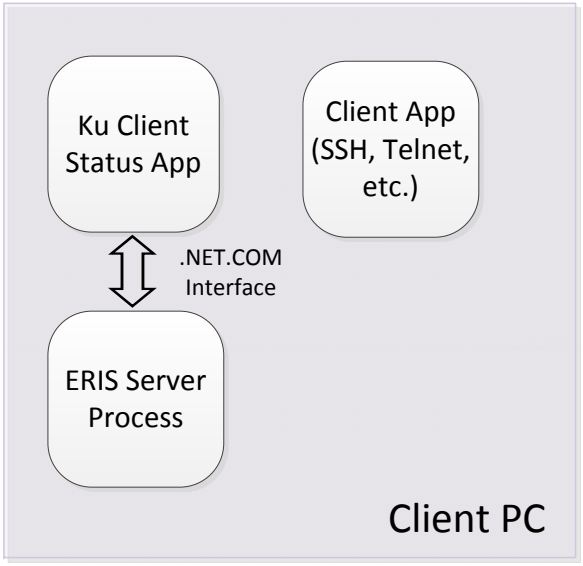
Ku-Forward Service Overview

- The diagram outlines the process and servers that host the Ku-Forward service.
- Ku Forward provides a secondary communication path that will allow Payload ground systems to communicate with their on-orbit Joint Station LAN (JSL) or Ethernet connected payloads via standard IP communication protocols
  - Primary communication (command) path is still S-Band commanding through the PL MDM with 1553 service to the Payload
- HOSC is developing capabilities/services (CR 13351) that will allow both the POIC Cadre and Payload Users access to devices connected to the onboard Payload LAN



Ku-Forward

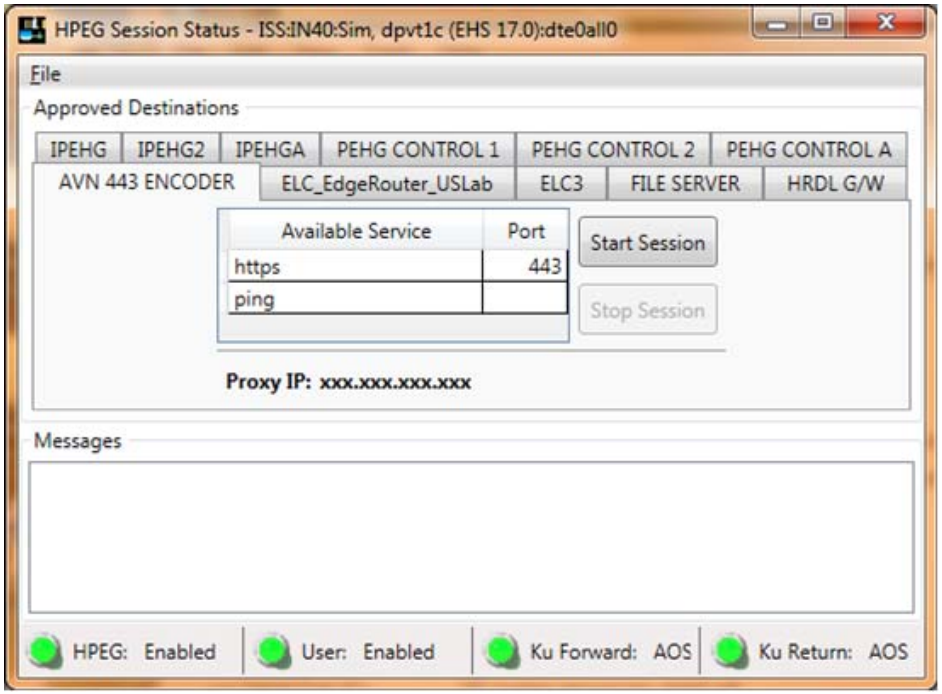
User Applications

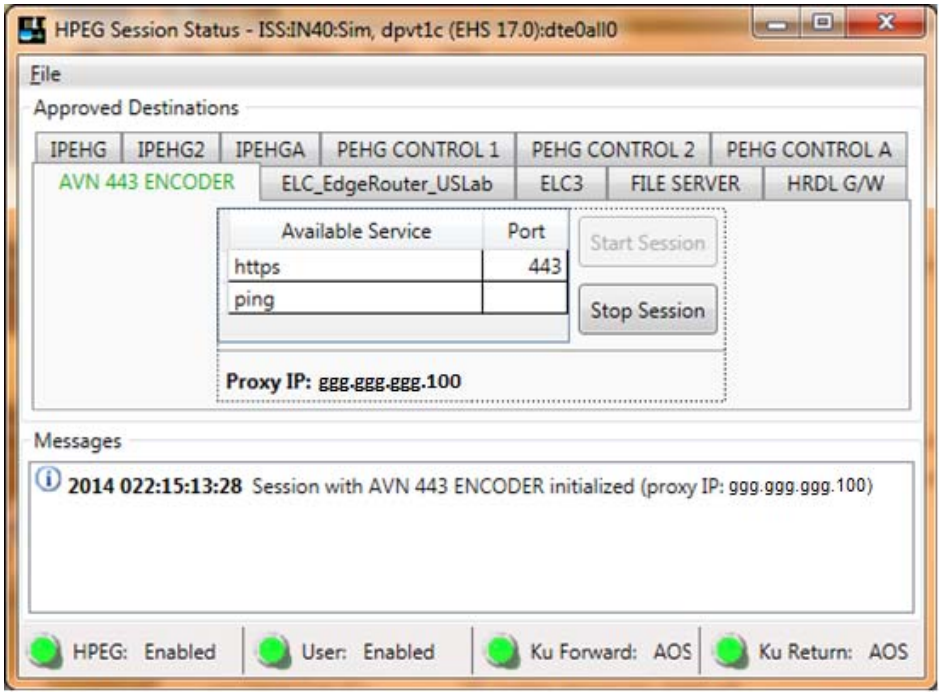


User Applications- HPEG Session Status UI

- Overview
  - Primary User Interface (UI) for EPC users
  - Displays list of authorized payloads and services to the user
  - Displays command system status to user
  - Displays forward/return link status to user
  - Allows user to request access to specific payload
  - Interfaces to HPEG Proxy Service on EPVT/PVT servers
    - Implements PGUIDD interface

User Applications- HPEG Session Status UI

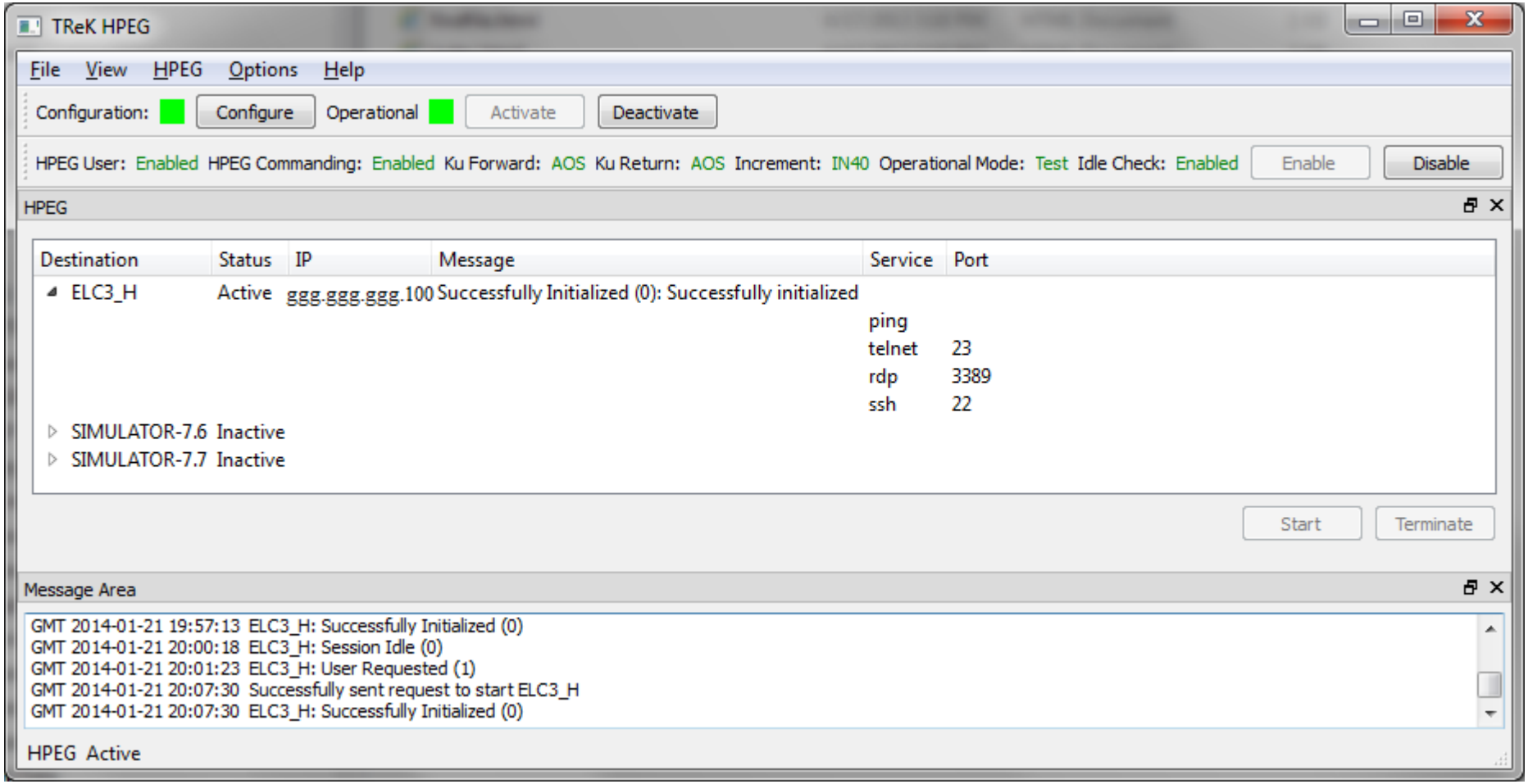




User Applications – TReK HPEG Toolkit Utility

- Overview
  - Primary User Interface (UI) for TReK users
  - Displays list of authorized payloads and services to the user
  - Displays command system status to user
  - Displays forward/return link status to user
  - Allows user to request access to specific payload
  - Interfaces to HPEG Proxy Service on EPVT servers
    - Implements PGUIDD interface

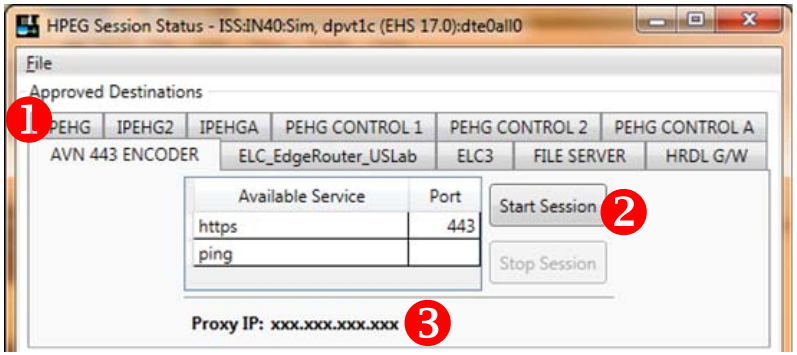
User Applications – TReK HPEG Toolkit Utility



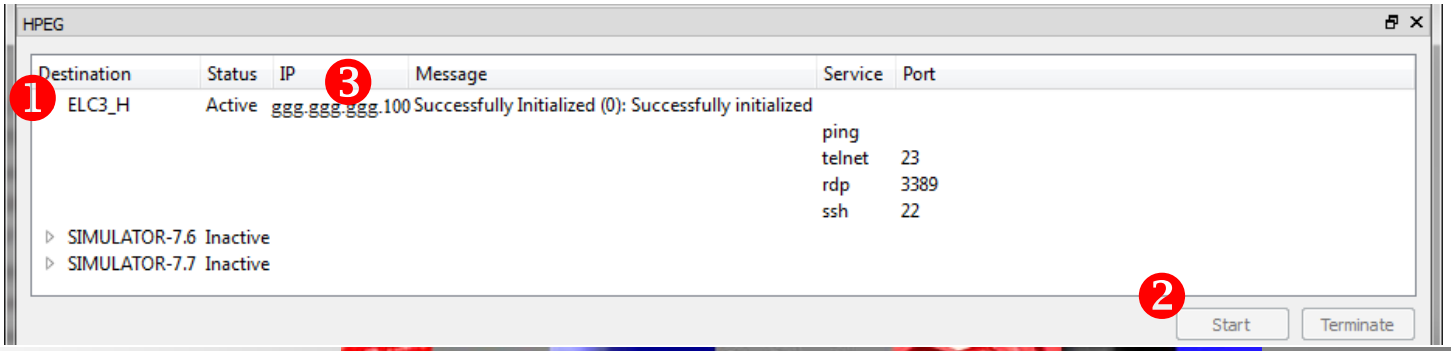
User Applications – Start HPEG Session

- Requesting a destination IP session
  - User selects a destination 1
  - User select Start 2
  - The HPEG Session Status UI sends a request to the HPEG Proxy Service to "start" listening for packets to forward to the current tab's destination
  - The HPEG Proxy Service will acquire a HPEG Proxy IP address from the available pool
    - Acts as a proxy to the onboard destination
    - Forwards Proxy IP to HPEG Session Status UI
  - The HPEG Session Status UI displays the HPEG Proxy IP address to the user 3

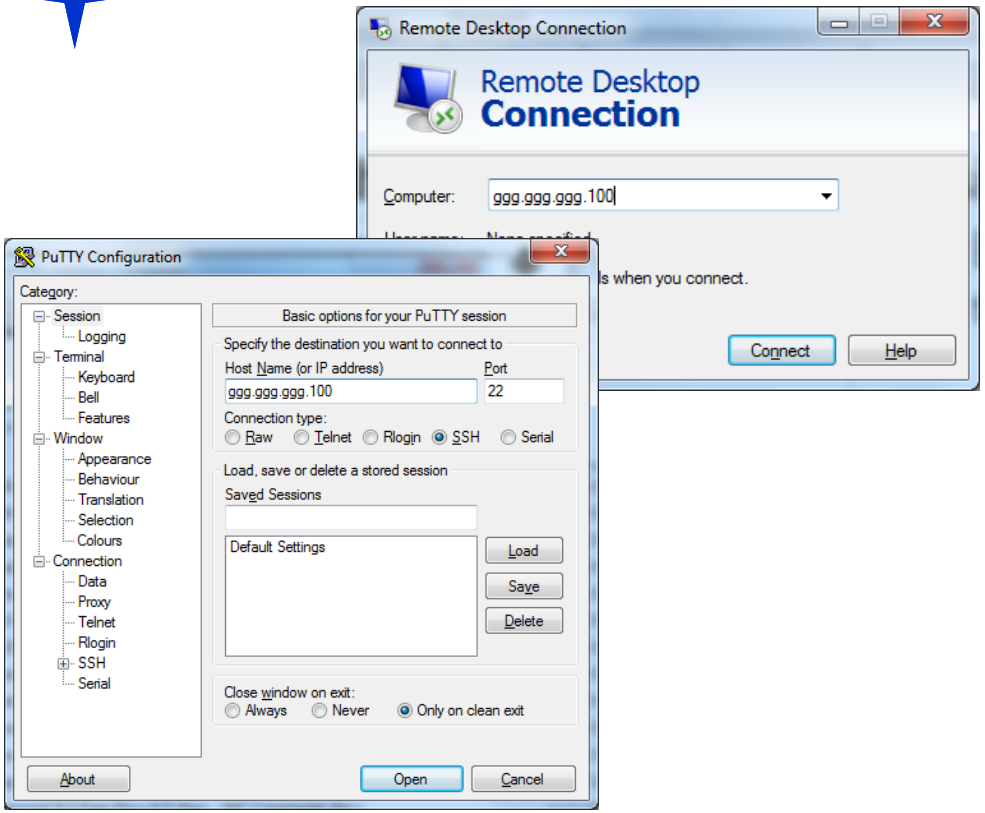
EPC HPEG Session Status User Interface



TReK HPEG Toolkit Utility



User Applications – Start IP Session

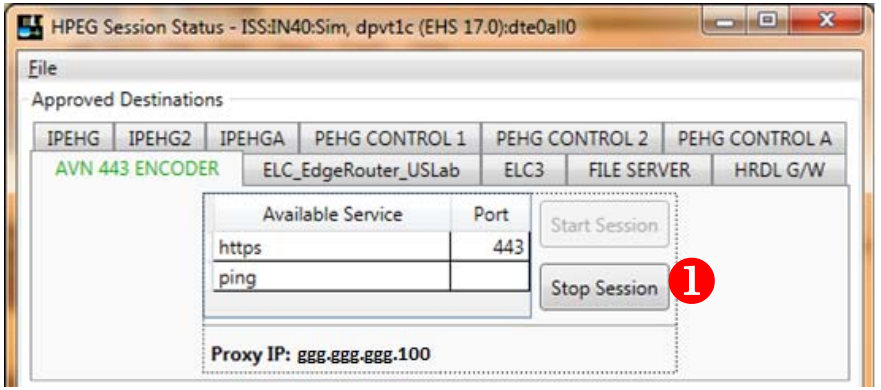


- User may use any COTS application that supports the authorized services
  - Connects to the onboard destination via the assigned Proxy IP and authorized ports
  - Any number of sessions may be established through the provided proxy IP address

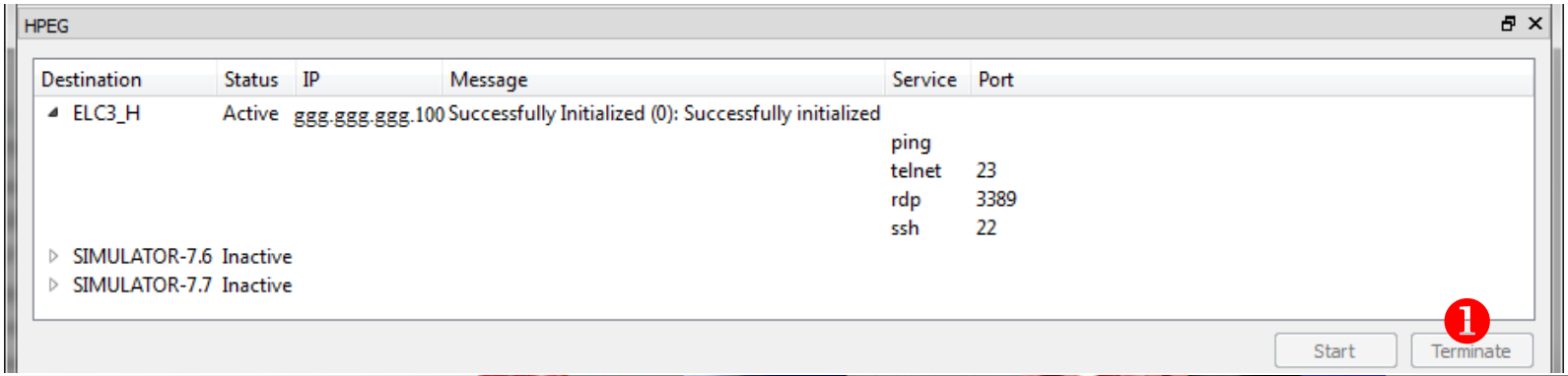
User Applications – Terminate IP Session

- User selects Stop/ Terminate ❶
  - The HPEG Proxy Service will stop forwarding packets to the session's destination
    - Assigned Proxy IP will be released to available pool

EPC HPEG Session Status User Interface

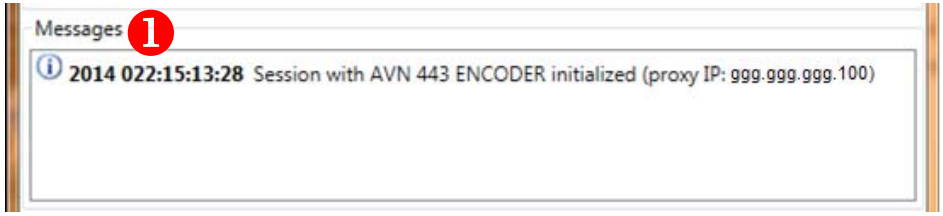


TReK HPEG Toolkit Utility

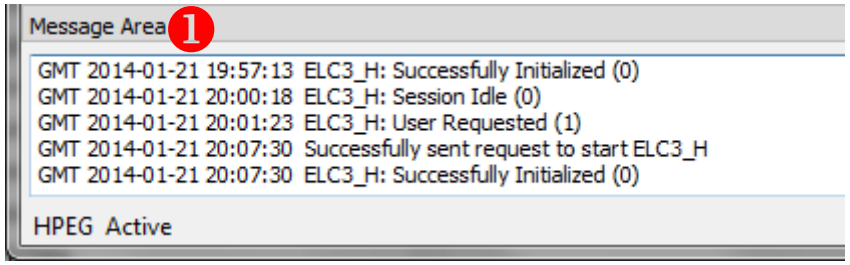


User Interfaces- HPEG Status

EPC HPEG Session Status User Interface



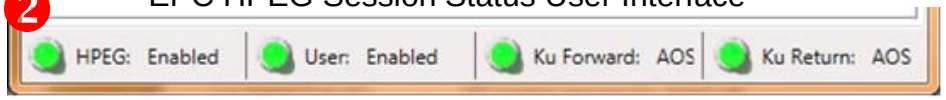
TReK HPEG Toolkit Utility



- Status
  - The user's HPEG session(s) status is provided to the user in the message area 1
    - PGUIDD defined messages, as necessary
    - Local messages
  - A status bar is provided for system/user status that affects all destinations 2
    - User HPEG enablement
    - HPEG enablement
    - CSS enablement
    - Ku Forward AOS/LOS

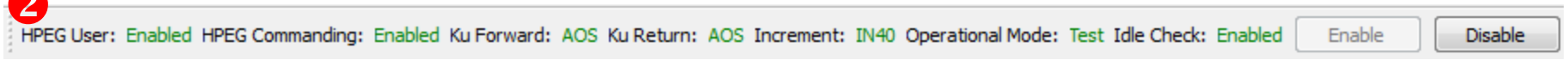
EPC HPEG Session Status User Interface

2



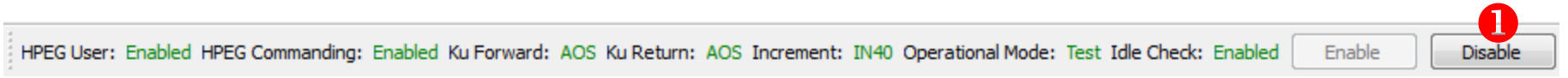
TReK HPEG Toolkit Utility

2



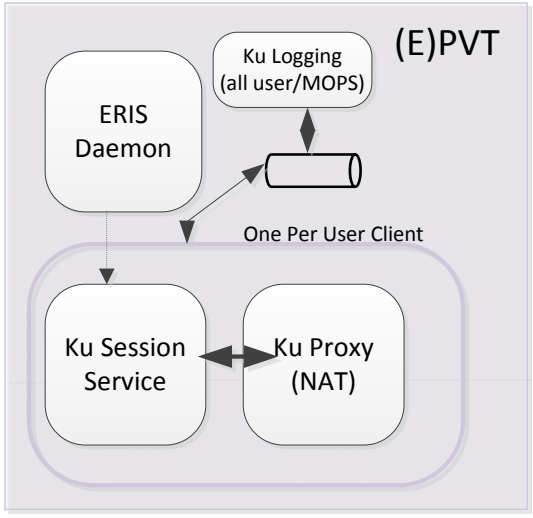
User Applications – Idle Notification

- If no packets are sent or received within 30 minutes, the HPEG Proxy Service will send a message requesting confirmation the service is still “alive.”
  - HPEG Proxy Service will not check for idle time during LOS
- Both EPC and TReK UIs will prompt user for confirmation
  - If the user wants to continue the service, the UI will send a message to continue
  - If the user does not wish to continue the service, the UI will send a message to terminate the service
  - If the user does not respond in one minute, the HPEG Proxy Service will terminate the session
- Client may request to disable idle notification by sending a ‘Disable Idle Check’ request 1
- Idle notification is not sent during LOS



Ku-Forward

HPEG Proxy Service



HPEG Proxy Service

- Overview
  - Service that provides Internet Protocol access to a specific payload
  - Executes on EPVT/PVT servers
  - Two primary threads
    - HPEG Session Provider
      - Interfaces to HPEG Session Status UI and TReK HPEG Toolkit Utility
      - Provides a list of authorized payloads and services
      - Provides HPEG System and User status
    - HPEG Packet Router
      - One Packet Router per payload
      - Forwards IP packets to HPEG Subsystem for uplink
      - Forwards return IP packets to user
      - Logs all packets
- *Note: The following slides reference the HOSC provided user interfaces as the client, but the client may be any application meeting the PGUIDD interface.*

HPEG Proxy Service

- HPEG Session Provider
  - Receive ‘Start Session’ request from user
    - Validate request
      - HPEG Commanding is enabled
      - Valid destination
      - User authorized for destination
      - User hasn’t already started the service for the requested destination
    - Retrieve proxy address and deliver to user
  - Sends connection terminated message to the user when:
    - A request from the user to terminate a connection for a destination is received
    - HPEG subsystem is disabled
      - ALL sessions will be terminated

HPEG Proxy Service

- HPEG Packet Router
  - Provides listener for user's IP session packets
  - Forward Packet Processing
    - Receive the packet from user and Verify uplink criteria:
      - The following must be true
        - If the IP packet contains a port, it must be an approved port
        - Ku Forward is AOS
        - User is enabled for HPEG commanding
    - Translate packet address to onboard addressing and forward packet for uplink
      - Packet Source with HPEG Onboard IP
      - Packet Destination with Destination IP

HPEG Proxy Service

- HPEG Packet Router (cont)
  - Return Packet Processing
    - Translate packet addresses to ground addressing and send packet to user
      - Packet Source with HPEG Proxy IP
      - Packet Destination with User IP
  - Create a capture file for the IP packets
      - IP session capture file contains forward and return traffic
  - Maintains the Idle Timer
    - Idle notifications not sent during LOS
  - When a stop session request is received packet router stops listening for packets

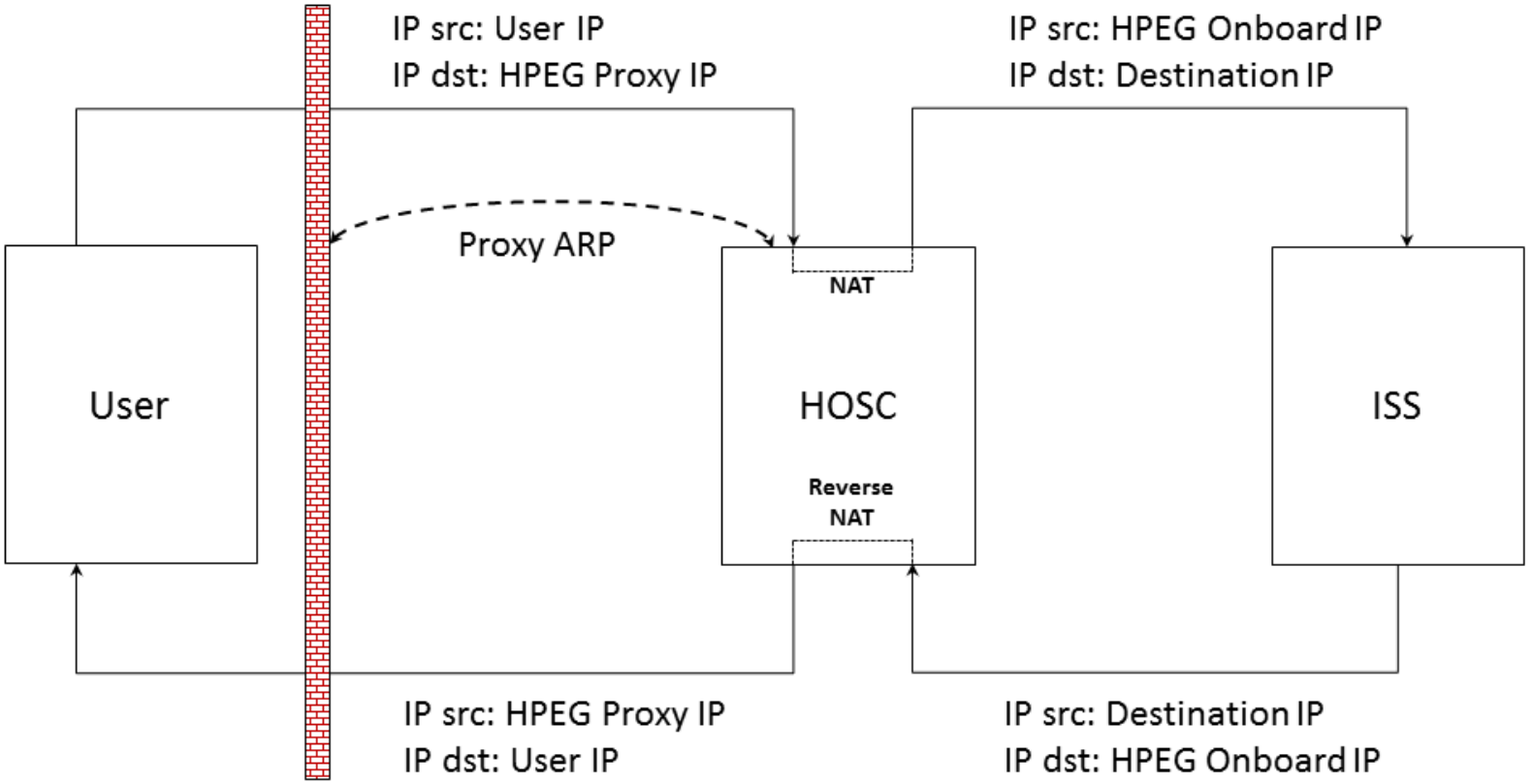
HPEG Proxy Service

- Logging
  - HPEG Session Provider
    - Messages recorded in Message Handler Log
      - User starts session
      - User stops session
      - Error messages
      - Any other informational messages as needed
  - HPEG Packet Router
    - Packet Capture
      - Capture all IP packets to/from user
      - Create a meta data file for the capture file
        - SSH key, if available
        - Role
        - Login server
        - Proxy IP Addresses
        - Onboard IP Address
        - User IP Address
        - Destination IP Address

Ku-Forward

Packet Routing Example

Packet Routing Example



Ku Forward

Test and Verification Status

Verification Status

- Dry Run Test – MSFC/JSC-MCC/JSC-SDIL
  - Performed January 9-10, 2014
  - Objective
    - Verify the end-to-end connectivity for the Ku-Forward implementation
    - Perform configuration of ICU2, PEHG1 and ELCs by DMCs.
    - Perform a series of tests to verify the HOSC Ku-Forward capability utilizing the user's interface.
  - Summary
    - All objectives necessary to test the assigned protocols for Ku-Forward phase 1 were met.
      - Ping and RDP was successfully configured to connect to Express Laptops
      - Ping was also able to get responses from PEHG controllers and IPEHGs
      - HTTPS was tested with a file server
  - Formal Verification is January 27-31, 2014