WEB BROWSING OVER HF

Steve Kille
CEO Isode Ltd
18th March 2021
Contents

• Why Web Browsing over HF?
• Technology to make it work
• Tuning considerations
• Results
Why Browse Web over HF?

• Classic HF Services, such as Messaging and XMPP, are “push” services
• To support a Mobile Unit connected over HF, “push” services are core:
  • Sender can choose to send only relevant material in appropriately compact format
• Web browsing provides a complementary “pull” service
• It is not realistic to perform extensive general purpose Web browsing over HF
• However, it is quite realistic to allow a Mobile Unit access to Web Sites and Web accessible databases which have been tuned for HF
  • Allows “pull” access to data sources
SLEP Streaming Service over HF

• Most IP applications operate over a streaming service provided by TCP
• A key building block for Web over HF is Streaming over HF
• SIS Layer Extension Protocol (SLEP)
  • An open protocol specification developed by Isode
  • S5066-APP3 – part of the STANAG 5066 Application Protocol (S5066-APP) document series
  • Includes a streaming service
• Build on the STANAG 5066 ARQ service
  • Layers multiple bidirectional streams
  • Needs to allow for ARQ loss (the service cannot be treated as fully reliable)
• Works well, with low overheads
• The most complex component for Web over HF
HF-PEP – Providing TCP End to End

- To provide efficient end to end TCP over HF, a Performance Enhancing Proxy (PEP) is needed.
- PEPs use optimized protocols over constrained links.
- S5066-APP9 specifies “HF-PEP: STANAG 5066 TCP Performance Enhancing Proxy Protocol”
  - Open specification
  - HF-PEP is a thin layer built over SLEP
    - Shares TCP Connection Information and then streams data.
Icon-PEP – Isode’s HF-PEP Product

• Icon-PEP is Isode’s product that support HF-PEP
  • Supports HF-PEP/SLEP to enable any TCP application to operate over HF
  • Provides efficient TCP PEP

• Also supports IP Client, as specified in STANAG 5066
  • Simple mapping of IP onto STANAG 5066
  • Supports IP services other than TCP
  • Useful for basic services such as ICMP Ping
  • Important for DNS (Domain Service) which is central to most Web Browsing
IP Routing over HF

- When applications communicate over IP, traffic passes over multiple subnets
- IP subnets are connected by IP routers
- Icon-PEP supports an IP Subnet over HF
  - Direct routing of packets
  - HF-PEP optimization of TCP
- Note relationships of Icon-PEP with IP Router
  - It is not connecting to a host
Icon-PEP integration with IP Routing

- Icon-PEP communicates with HF Network using STANAG 5066
  - STANAG 5066 SIS protocol used to connect to STANAG 5066 Server

- Icon-PEP communicates with an IP router using GRE
  - RFC 2784 “Generic Routing Encapsulation (GRE)”
  - Widely supported by routes
  - Flexible and simple way to integrate
Web over HF Architecture

- Web Browsers connect to Web Servers over TCP Links
- So with Icon-PEP the core to give Mobile Unit access to Web is Browser on the Mobile Unit and Web Server on Shore
- Icon-PEP gives an efficient TCP service
  - Applications “just work”
- Also need:
  - Caching DNS
  - Web Caching Proxy
  - Discussed in next slide
Caching Considerations

• It is important to avoid transferring the same data multiple times
• Caching DNS Server is important on Mobile Unit
  • DNS (Domain) lookup is important for Web browsing
  • Lookups over HF are slow
  • Need to cache locally
• Web Caching Proxy is important
  • When a user retrieves a Web page (or Web page component) it is desirable that this remains available for repeat use and use by other users
  • Web Caching Proxy provides this service
  • It can also provide other services such as access control and audit
  • Isode recommends Squid (free and widely used)
Icon-PEP Considerations

• Minimizing handshaking is key to optimizing performance
  • Each handshake adds several seconds of delay
• Web browsers often open multiple connections to a Web server
  • For example Chrome usually opens two
• HTTP queries typically start with amount of data
• Performance optimized by small delays in sending, to allow data to be efficiently bundled and avoid handshakes
Browser Considerations

- Browser timers are not ideal for HF
  - Some data timers would be better if longer
  - Default DNS timeout is generally slightly too short and generally forces user to try again
    - Caching DNS helps here

- Work to address this suggests:
  - Some browsers do not allow configuration
  - Some browsers that do allow configuration, but too complex to sensible adjust

- Conclusion is that the pragmatic approach is to live with default settings
  - Generally this works OK
Web Server Considerations

• Most typical default settings and Web server products work well
• Browsers try to maintain TCP connections for repeat use
  • Key performance optimization
• Web servers time out these connections
  • Timer controlled by HTTP Keepalive setting
• Typical default HTTP Keepalive timeout is 6-10 seconds
  • This is way too short for HF
  • Timeouts lead to significant performance degradation over HF
• For a Web server providing data for clients over HF, it is important to set HTTP Keepalive to a few minutes
Web Site Considerations

• Most Web sites do things that are not ideal for HF
  • This page looks at key considerations

• Don’t use TLS
  • Adds in handshakes (delay)
  • Prevents pages being cached and being shared between Mobile Unit users

• Keep the number of files comprising the Web site small
  • Many sites use a large number
  • It is possible to make home page with three files and other site pages with a single file

• Don’t reference files with different DNS names
  • This adds delay

• Use site structure to avoid very large Web pages
  • Warn about large (critical) files, so they can be avoided unless really needed

• Avoid large blocks of data, such as:
  • Big Pictures
  • Non-standard fonts
  • Large JavaScript programs
A Sample Web Site for HF – hf-browse.com

- Isode has developed a site suitable for HF
  - On the Internet
  - hf-browse.com
- Using data from Isode’s Web site
- Most pages are usable over top end narrowband HF (4800-9600 bps)
- Home page and page shown can work down to 1200 bps
  - Not fast, but usable
  - Reasonable data rendering can be achieved; does not need to look like a Teletype
Results

• Web Browsing over HF is achievable
• Isode’s Icon-PEP product provides this
  • Demonstrated in the lab and Over The Air
• Operation with Web Servers and Sites tuned for HF is usable with top end Narrowband HF
  • And with care down to 1200 bps
• WBHF Helps a lot
  • Enables more data to be usefully shared
  • Allows many standard Web sites to be accessed
    • Generally “usable” but not what would be expected on a fast link
• Can provide a “pull” service to Mobile Units to complement current “push” services
Any Questions?