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C109TS Taking CICS Web Support to the next level

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WebSphere software

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Acknowledgements

What's new in CICS TS V3.1 to support HTTP 1.1?

- **HTTP/1.1 compliance**
- **HTTP processing in CICS**
  - CICS as an HTTP server
    - URIMAP resource definition
  - CICS as an HTTP client
    - EXEC CICS commands for outbound support
- **Code page conversion**
- **Other changes**

HTTP/1.1 compliance

- **CICS is *conditionally compliant* with HTTP/1.1 specification**
  - Specification is RFC2616 ("Request For Comments")
  - 'Conditionally compliant' means…
    - for the requirements that are relevant to the functions provided by CICS,
      - > CICS satisfies all the MUST level requirements
      - > but not all the SHOULD level requirements
  - Responsibility for compliance
    - User applications also share responsibility
      - > may fail to meet the SHOULD requirements, depending on actions performed by the application
      - > CICS provides facilities and documentation to help make applications compliant with HTTP/1.1

HTTP/1.1 compliance…

- **New features that CICS provides for HTTP/1.1 compliance**
  - Supported methods
  - HTTP date and time formats
  - Persistent connections
  - Pipelining
  - Chunking

Supported Methods

- **Methods supported**
  - For HTTP/1.0 in CICS
    - GET, HEAD, POST, PUT, DELETE, LINK, UNLINK, REQUEUE
      - RFC1945(HTTP/1.0) lists GET, HEAD, POST as supported methods
  - For HTTP/1.1
    - GET, HEAD, POST, PUT, DELETE, OPTIONS, TRACE
      - LINK, UNLINK, REQUEUE methods are not supported
    - CICS actions for status codes also made compliant

- **Message body handling**
  - should be no body for GET, HEAD, DELETE, TRACE methods
    - ignore on input
    - INVREQ on output

Supported Methods and CICS handling

Method	received from 1.0 Client	received from 1.1 Client	send to 1.0 server	send to 1.1 server
GET	Ignore Message body	Ignore Message body	sent to server Invreq if body present	sent to server Invreq if body present
PUT	Pass to application	Pass to application	sent to server with body Invreq if no body present	sent to server with body Invreq if no body present
POST	Pass to application	Pass to application	sent to server with body Invreq if no body present	sent to server with body Invreq if no body present
HEAD	Ignore Message body	Ignore Message body	sent to server Invreq if body present	sent to server Invreq if body present
LINK	Pass to application	501 – not implemented	Invreq	Invreq
UNLINK	Pass to application	501 – not implemented	Invreq	Invreq
REQUEUE	Pass to application	501 – not implemented	Invreq	Invreq
DELETE	Pass to application	Pass to application	sent to server	sent to server
OPTIONS	501 – not implemented	Handle all in CWXN 501 if not OPTIONS *	Invreq	sent to server Invreq if not OPTIONS *
TRACE	501 – not implemented	Handle all in CWXN	Invreq	sent to server
CONNECT	501 – not implemented	501 – not implemented	Invreq	Invreq

HTTP date and time stamp formats

- **Date and time stamps used in HTTP headers**
  - HTTP/1.1 clients and servers must accept
    - Tue, 01 Apr 2003 10:01:02 GMT : RFC 1123 format
    - Tuesday, 01-Apr-03 10:01:02 GMT : RFC 1036 format
    - Tue Apr 01 10:01:02 GMT : ANSI C's asctime() format
  - only generate the RFC 1123 format
    - Tue, 01 Apr 2003 10:01:02 GMT : RFC 1123 format

- **Uses of HTTP date and time stamps in CICS**
  - On receive,
    - Applications can read the HTTP headers and convert the time into absolute time
  - On send,
    - CICS will automatically produce the Date header in the required format
    - For other HTTP headers that need date & time stamps, application needs to convert absolute time (ABSTIME) to RFC 1123 format

HTTP date and time stamp formats…

- **CICS will supply APIs to handle conversion**
  - EXEC CICS CONVERTTIME
    - converts HTTP formats to ABSTIME

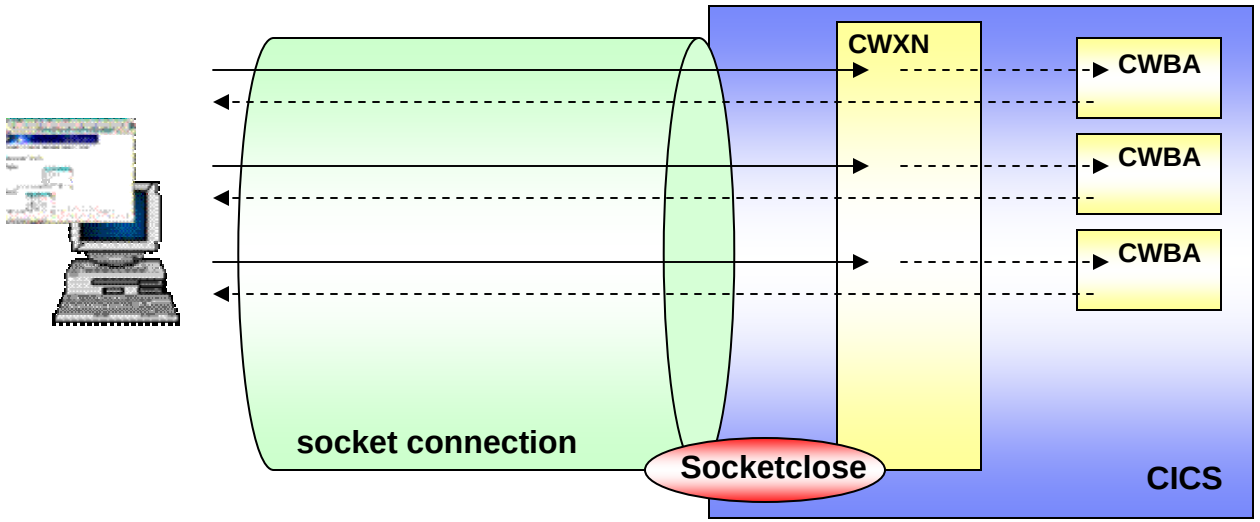
```
EXEC CICS CONVERTTIME DATESTRING ('Tue, 01 Apr 2003 10:01:02 GMT')
                                  ➔ ABSTIME (+003258180062000)
```

  - EXEC CICS FORMATTIME
    - converts ABSTIME to HTTP format
    - new options DATESTRING and STRINGFORMAT
      - STRINGFORMAT specifies the type of format in *cvda*
      - currently only 646 (RFC1123) is supported
        - > if DATESTRING present and STRINGFORMAT not specified, RFC1123 is used

```
EXEC CICS FORMATTIME ABSTIME (+003258180062000)  STRINGFORMAT (RFC1123)
                                  ➔ DATESTRING ('Tue, 01 Apr 2003 10:01:02 GMT')
```

Persistent connections

- **In previous CICS releases**
  - Compliant with HTTP/1.0
    - by default, CICS would close the connection when data received
    - Web client would send “Connection: Keep-Alive” header to keep connection open
  - Can be ultimately controlled by SOCKETCLOSE on TCPIPSERVICE
    - normally would specify SOCKETCLOSE(0) unless SSL
  - CWXN will remain in system until socket closed
    - System may get flooded with inactive CWXN tasks

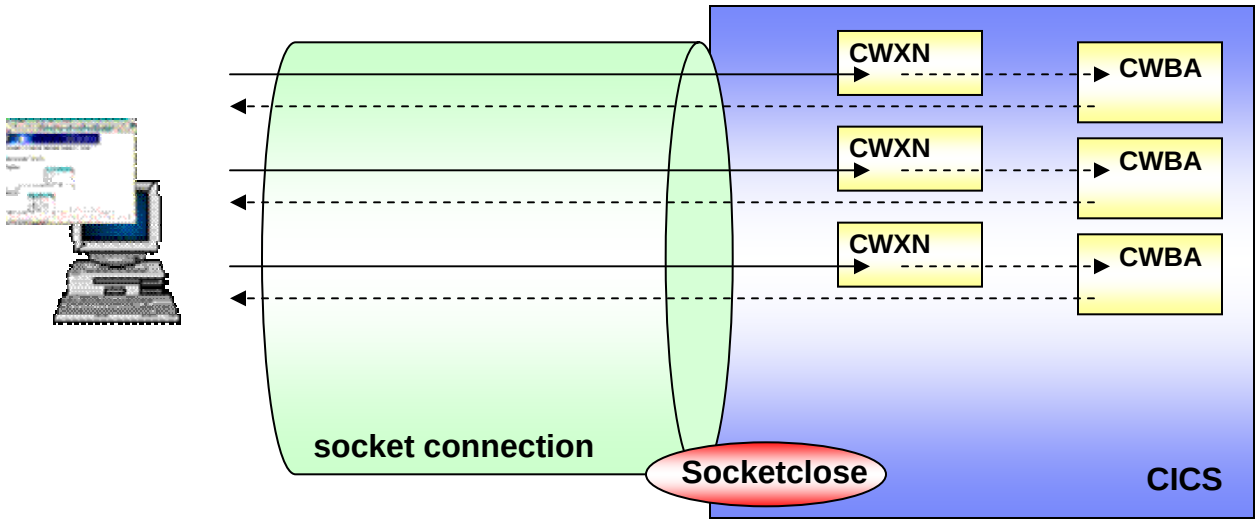


Persistent connections…

- **In CICS TS V3.1**
  - Compliant with HTTP/1.1 persistent connection
    - CICS will keep the session open by default
  - Connection is closed when…
    - client sends a request with a header “Connection : close”
    - client terminates the connection
    - the connection times out
  - Can still be controlled by SOCKETCLOSE
    - SOCKETCLOSE(0) will fail to meet the requirements for HTTP/1.1
  - For HTTP/1.0 requests
    - Close the connection unless Keepalive header is sent
    - For CICS as an HTTP client
      - > CICS automatically sends a Keepalive header to HTTP/1.0 servers

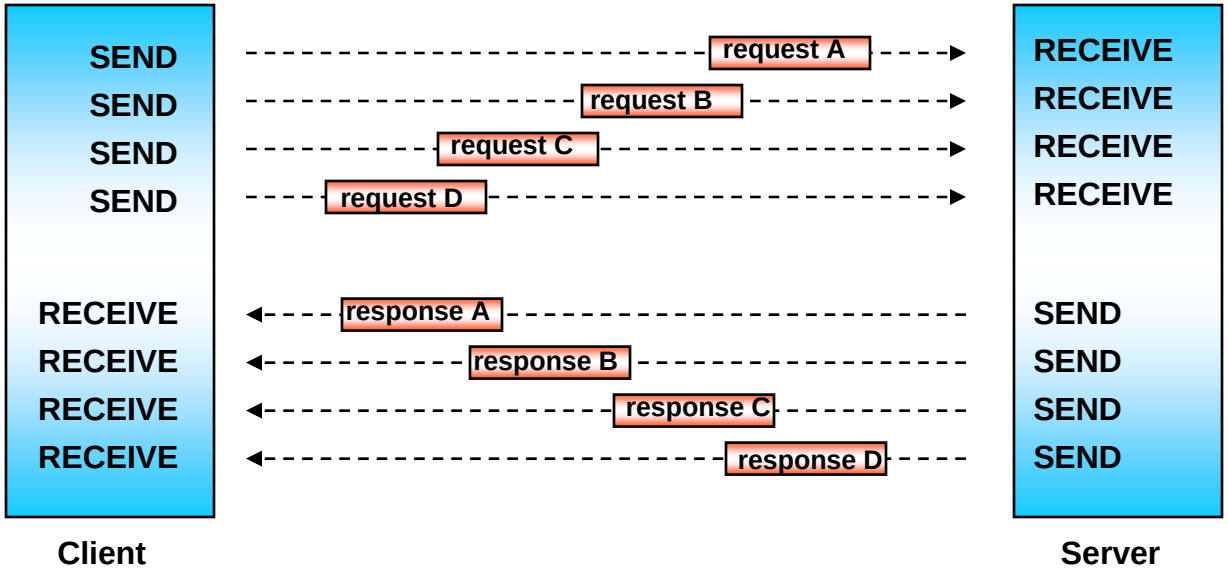
Persistent connections…

- **asynchronous sockets support**
  - CWXN is now asynchronous
    - same as CIRR for IIOP requests
    - CWXN terminates but socket still open
    - “pseudo-conversational” processing
  - Eliminates CWXN tasks suspending in the system



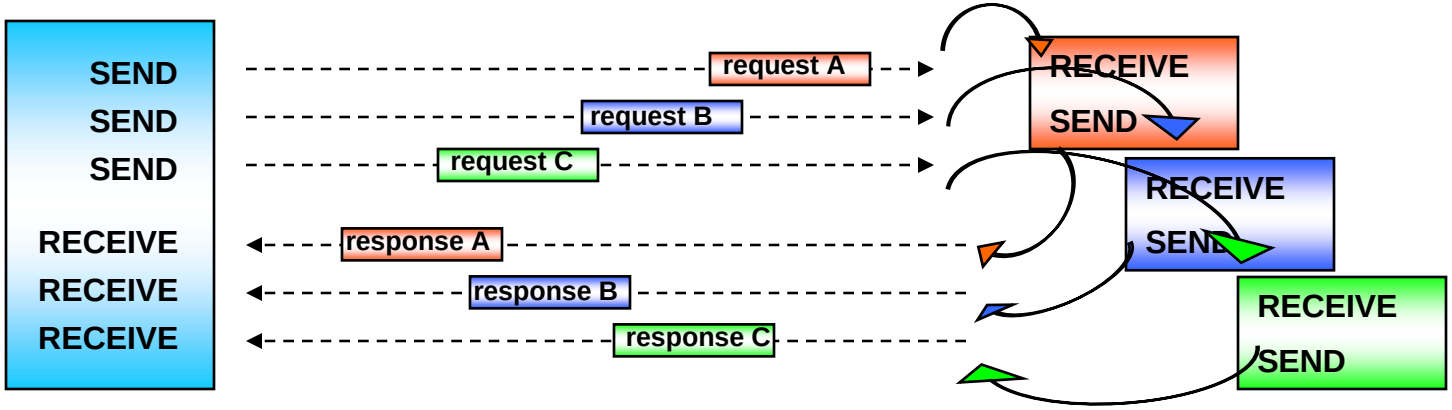
Pipelining

- **Send multiple request without waiting for response**
  - responses are returned in the same sequence that the request was received
  - requests should be idempotent
    - i.e. same result is always obtained when the requests are repeated
  - requires persistent connection



Pipelining…

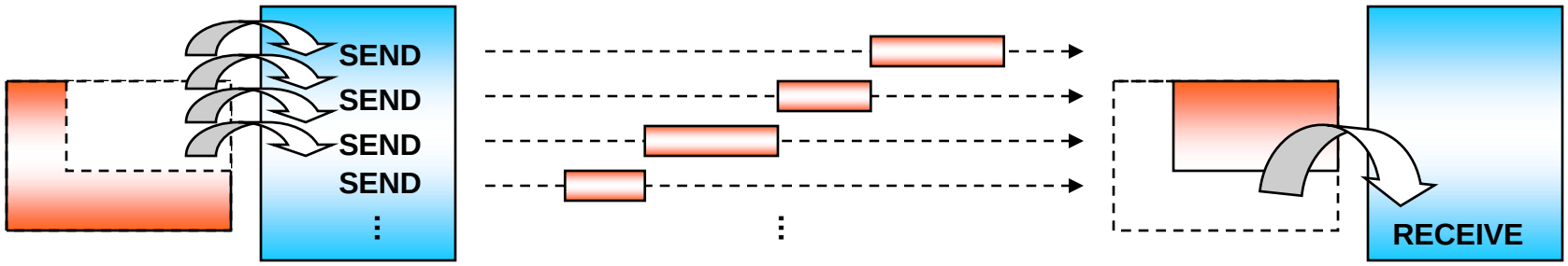
- **CICS support for pipelining**
  - CICS as an HTTP server
    - CICS will process the requests serially as separate transactions
    - remaining requests in the pipelined message will be held until the response is sent



  - CICS as an HTTP client
    - Application will connect to a remote server and issue a series of send requests
      - each request is sent immediately
    - Application should receive the pipelined responses in the order the request was received

Chunking

- **Chunked transfer-coding**
  - transfer data in convenient segments
    - dynamically produced contents
    - large amount of content
  - Sends the body of a message in chunks
    - each chunk has its own size indicator
    - may be followed by optional trailer headers
    - end-of-message is indicated by a chunk with zero length and an empty line
      - empty line signified by <CRLF>
  - recipient will receive the message as a whole
    - recipient can verify that it received the complete message



Chunking…

- **CICS as an HTTP server**
  - On inbound,
    - wait until all the chunks are received
    - assemble the chunks and pass it to the application
    - application can receive the data with a single WEB RECEIVE command
    - RTIMOUT timeout value applied from CWXN transaction
    - total amount of data is limited by the MAXDATALEN attribute in TCPIPSERVICE
  - On outbound,
    - Application specifies chunking by CHUNKLENGTH on each WEB SEND command
      - CICS will create the “Transfer-Encoding: chunked” and “chunk-size” header
      - sending CICS document templates in chunks are not supported
    - to end chunking, send a CHUNKLENGTH(0)

- **CICS as an HTTP client**
  - On inbound
    - chunked messages are assembled and passed to the application
    - RTIMOUT for the executing transaction will be used to wait for the reply
  - On outbound
    - same as CICS as an HTTP server

TCPIPSERVICE change

- **PROTOCOL (ECI | HTTP | IIOP | USER)**
  - HTTP 1.1 states an error response to be returned for non-HTTP methods
    - previously customers will default to PROTOCOL(HTTP) for request other than HTTP, ECI, IIOP and use CICS Web Support to handle the request.
    - non-HTTP request on a PROTOCOL(HTTP) port will return 501 error
  - New USER option
    - used for non-HTTP methods
    - CICS Web Support will still be invoked but under a different tranid.
      - > CWXU
        - but same program used as CWXN
      - > non-HTTP processing is exactly the same as today.
        - no code conversion prior to analyzer
        - Invokes the analyzer
        - Invokes the converter program if required
        - Invokes the target application
    - may need to change port for migration

TCPIPSERVICE change …

- **MAXDATALEN (32KB | *number* KB)**
  - Maximum data that can be received on the port for the service
    - limit amount of data received by chunking
    - to prevent denial of service
  - minimum of 32KB (default)
    - maximum is 0.5GB

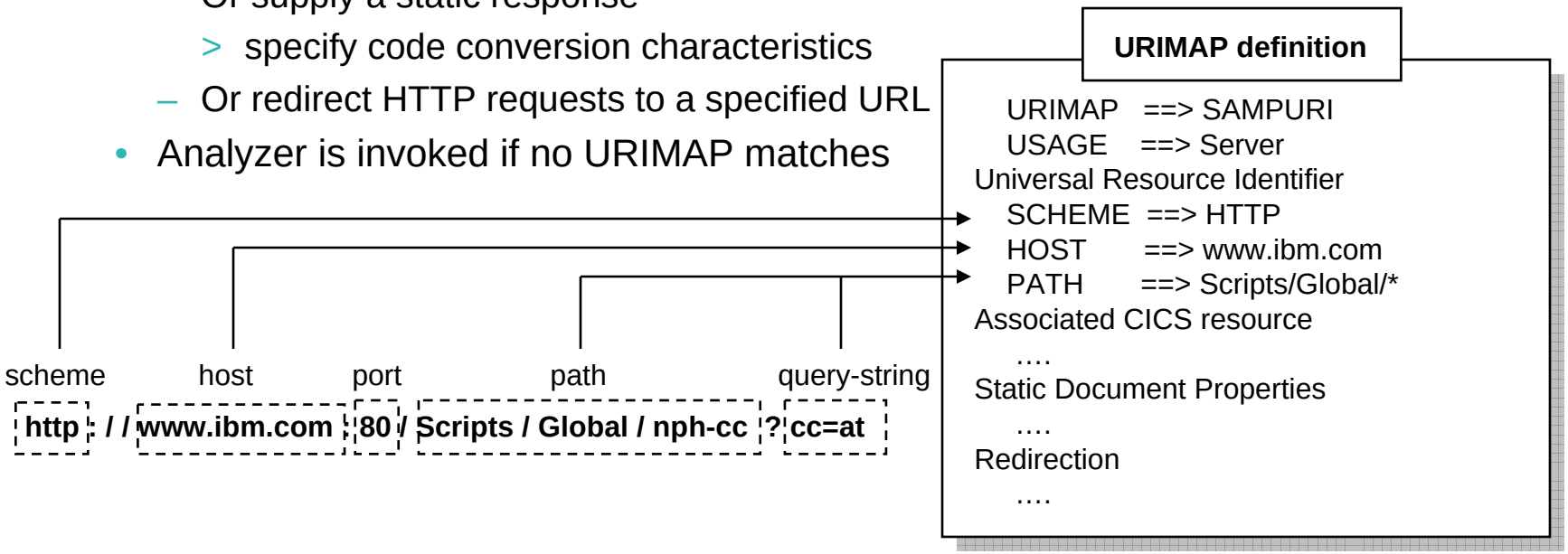
- **SOCKETCLOSE**
  - Recommendation change
    - Formerly, SOCKETCLOSE(0) was recommended
    - In CICS TS V3.1, recommendation is to *not specify SOCKETCLOSE(0)*
      - SOCKETCLOSE(0) will fail to meet the requirements for HTTP/1.1

CICS as an HTTP server

- **Processing changes in CICS TS V3.1**
  - New URIMAP resource to determine the processing for the request
    - Types of processing
      - Application response
      - Static response
      - Redirection
  - API changes
    - WEB API changes
      - Support for chunking, pipelining
    - HTTP date and time format handling
      - CONVERTTIME, FORMATTIME
  - Code conversion changes
    - Support for UTF-8, UTF-16 code page conversions

URIMAP for CICS as an HTTP server

- **A URIMAP will**
  - match the incoming URI and…
    - invoke a CICS application
      - > directly
      - > using analyzer and converter programs
    - Or invoke a CICS Web Service
    - Or supply a static response
      - > specify code conversion characteristics
    - Or redirect HTTP requests to a specified URL
  - Analyzer is invoked if no URIMAP matches



Application response…

- **URIMAP for Web aware programs**
  - essentially, you only need to specify PROGRAM attribute
    - let the other parameters default
  - if you want to use an analyzer program
    - specify ANALYZER(YES) and TCPIPSERVICE
      - > analyzer program on TCPIPSERVICE will be used
    - the following may be overridden by analyzer
      - > CONVERTER, TRANSACTION, USERID, PROGRAM
    - if ANALYZER(NO)
      - > CONVERTER or PROGRAM or both must be present
  - if you want to use a converter program
    - specify CONVERTER
    - PROGRAM may be overridden by converter
  - optionally specify..
    - TRANSACTION
      - > default is CWBA, always run DFHWBA program
    - USERID
      - > may be overridden by AUTHENTICATE in TCPIPSERVICE

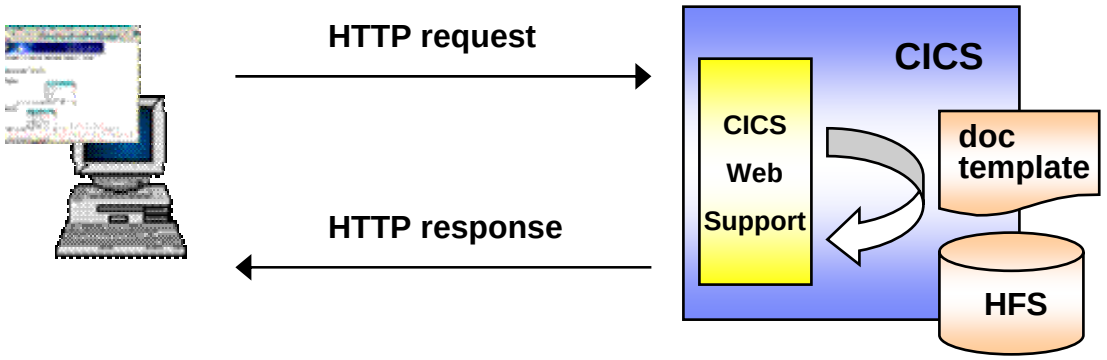
Application response…

- **URIMAP for COMMAREA applications**
  - Specify the target program in PROGRAM attribute
  - Specify CONVERTER to do the decode and encode functions
    - > if not specified by analyzer program

- **URIMAP for 3270 applications**
  - PATH should be generic
    - – e.g. /terminal/*
  - Specify Web Terminal Translation Application in PROGRAM attribute
    - – DFHWBTTA, DFHWBTTB or DFHWBTTC
  - Format for the rest of the path
    - – /[transaction name]+[input parameters]?[token]
      - > e.g. /cemt+inq+task

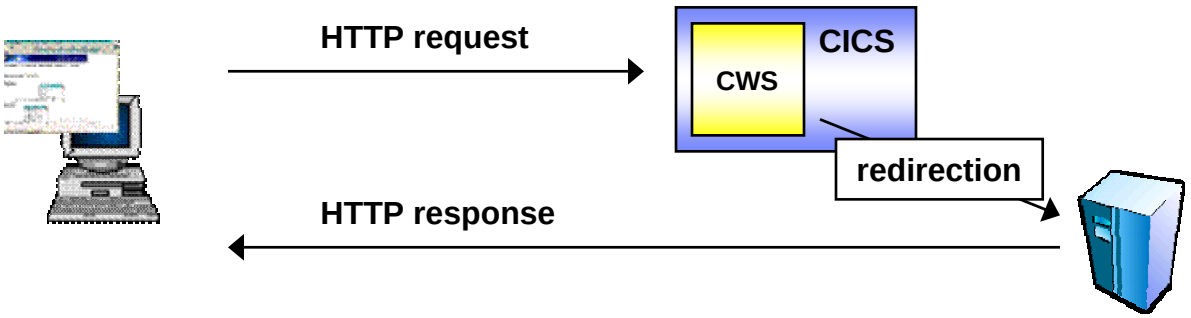
Static response

- **Responses without the need to invoke an application program**
  - from a CICS DOCTEMPLATE resource or a file on HFS
    - HFS file can also be specified in DOCTEMPLATE
  - can use query strings to complete the document
    - when query string not included in the PATH attribute of URIMAP
    - passes the content as a symbol string
    - only for DOCTEMPLATE



Redirection

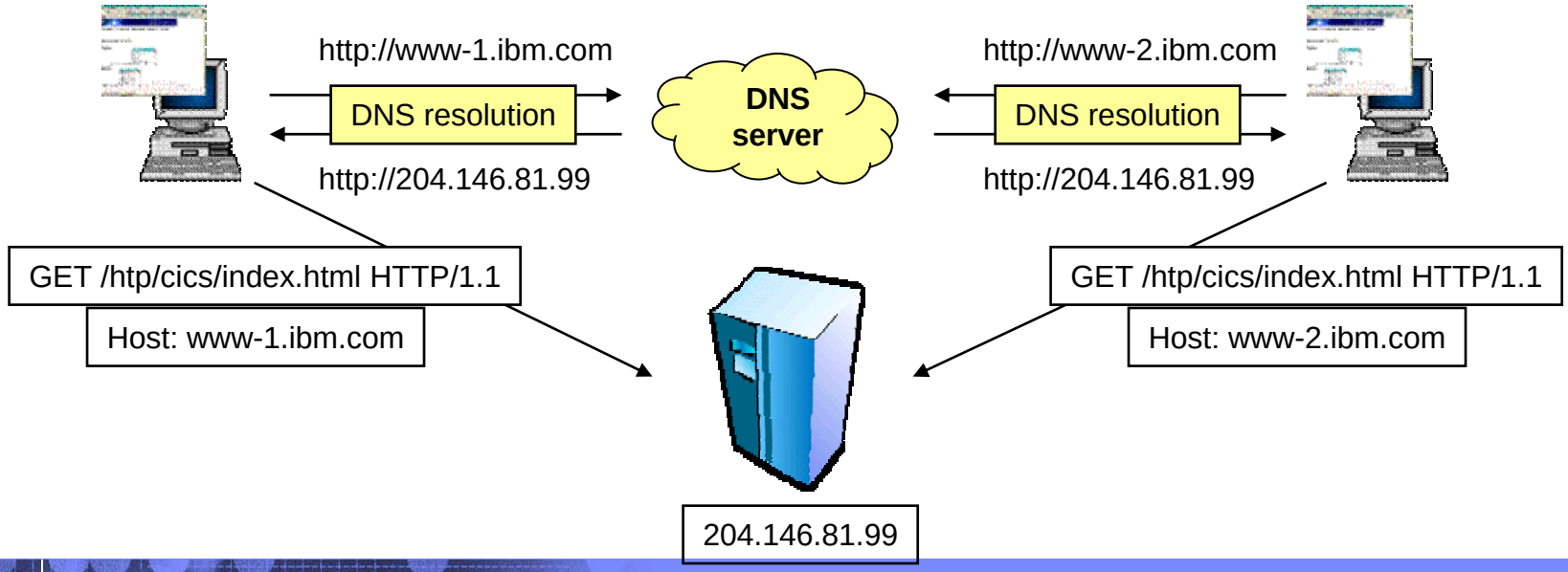
- **Redirect to another location on the web**
  - permanently or temporarily
  - LOCATION attribute in URIMAP overrides any other attributes
    - can be changed by SET URIMAP command for temporary redirection



- **In URIMAP definition**
  - specify LOCATION attribute
  - the following will be inactivated by setting LOCATION
    - ANALYZER, CONVERTER, HFSFILE, PIPELINE, PROGRAM, TEMPLATENAME, TRANSACTION, USERID
    - can reactivate by setting LOCATION to NONE

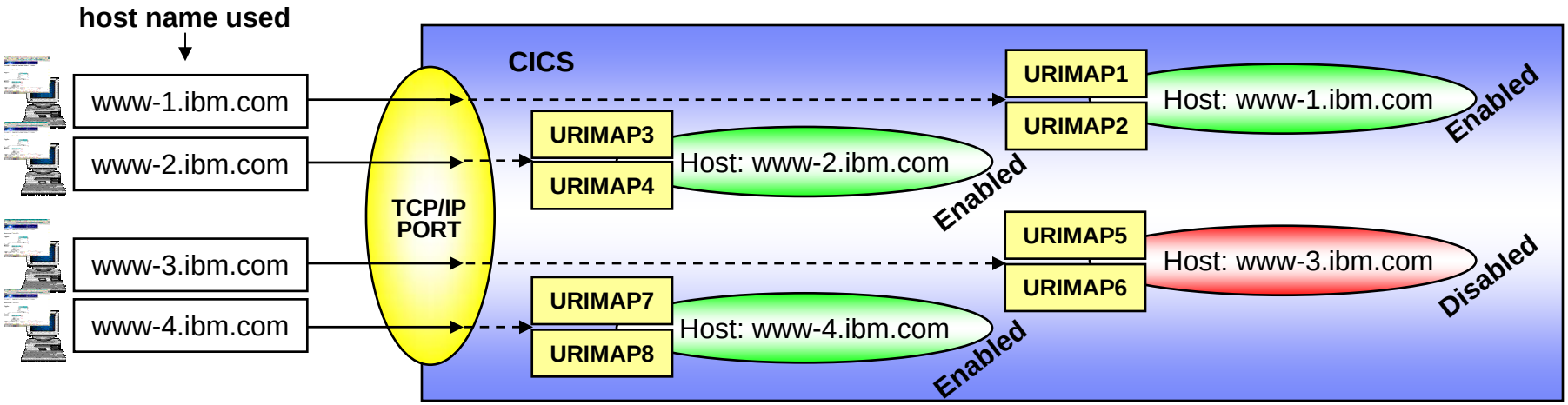
Virtual hosting

- **Having multiple host names for the same IP address**
  - DNS host name resolution returns same IP address for different host names
  - HTTP/1.1 specification allows the host name to be stored in a “Host” header
    - In HTTP/1.0, host name was lost after resolution
  - Can treat requests with different host names as different resources



Virtual hosting…

- **CICS will form a group of virtual hosts from URIMAP definition**
  - HTTP requests are mapped to the virtual host
  - virtual hosts can be managed by INQUIRE and SET commands
    - to inquire the host name and status of the virtual host
    - enable or disable the status of the virtual host
      - > when disabled, CICS will return an HTTP 503 response to the Web client



Managing HTTP requests

- **Accepting or rejecting HTTP requests**
  - Requests can be managed in different levels
    - On a specific URI level
      - SET URIMAP ENABLE/DISABLE
    - On a particular (virtual) host name level
      - SET HOST ENABLE/DISABLE
    - On a port level
      - SET TCPIPSERVICE OPEN/CLOSE
    - On a region level
      - SET TCPIP OPEN/CLOSE

Decision points for CICS as an HTTP server

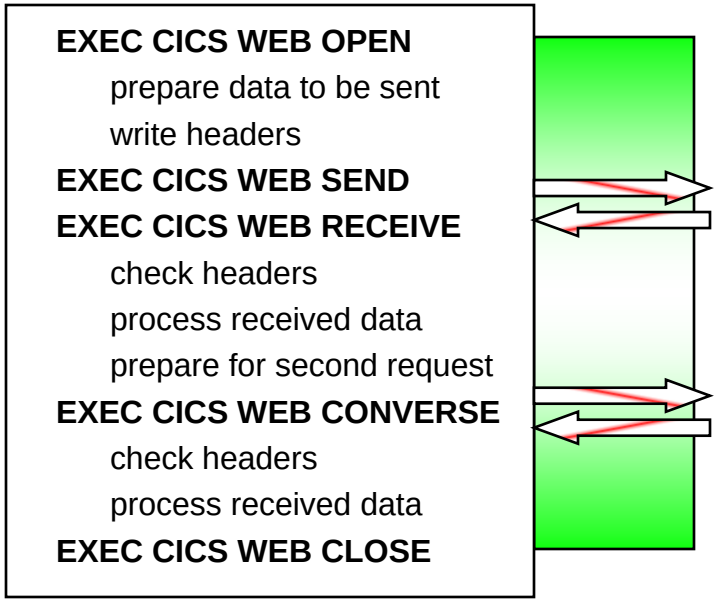
- **HTTP/1.0 or HTTP/1.1**
  - or non-HTTP request
- **Use URIMAP to do…**
  - Redirection / Static response / Application determined response
- **Will I use an analyzer?**
  - Analyzer needs to be specified in TCPIPSERVICE
- **Will I use a converter?**
- **What type of application?**
  - Web-aware, non Web-aware (commarea based), 3270 application
  - Header handling, date and time stamp handling
  - Chunking, pipelining
  - Can a static response be used instead of application processing?
- **When and how will I do code conversion?**
- **Security?**

CICS as an HTTP client

- **Processing changes**
  - API changes to replace the LINKable interface
    - New & changed WEB APIs
      - Support outbound requests
      - Support for chunking, pipelining
    - HTTP date and time format handling
      - CONVERTTIME, FORMATTIME
  - URIMAP resource for client processing
  - Code conversion changes
    - Support for UTF-8, UTF-16 code page conversions

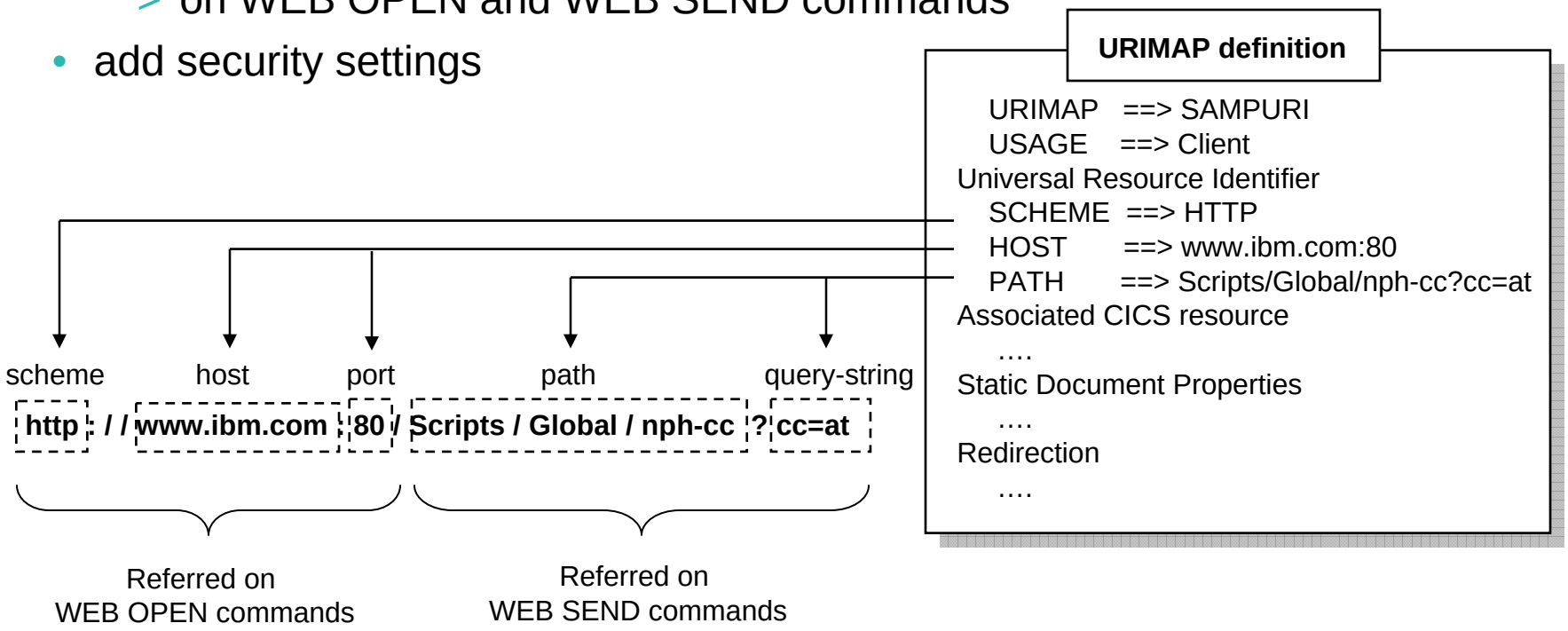
Sending an outbound HTTP request

- **Initiate connection**
  - EXEC CICS WEB OPEN
- **Prepare outbound data**
  - HTTP headers
    - EXEC CICS WEB WRITE HTTPHEADER
  - entity body
    - CICS DOCUMENTs may be used
- **Transmit HTTP request**
  - EXEC CICS WEB SEND
    - or EXEC CICS WEB CONVERSE
    - may specify query string with QUERY option
- **Receive HTTP response**
  - EXEC CICS WEB RECEIVE
- **Close connection**
  - EXEC CICS WEB CLOSE



URIMAP for CICS as an HTTP client

- **A URIMAP can be used to**
  - specify the target URI
    - can avoid identifying URIs in programs
      - > on WEB OPEN and WEB SEND commands
  - add security settings



Other WEB APIs

- **EXEC CICS WEB PARSE URL**
  - Breaks down a URL string into
    - > scheme, host, port, path, query string
  - validate the construction of a URL
  - use on a subsequent WEB OPEN to open a session

- **EXEC CICS WEB EXTRACT**
  - obtains information about an HTTP request
    - > applies to both inbound and outbound HTTP requests
  - use SESSTOKEN option for CICS as an HTTP client
    - extract information about the most recent outbound request

Exits for CICS as an HTTP client

- **XWBOPEN**
  - called during WEB OPEN, before the session is open
  - Usage
    - determine usage for proxy servers
    - apply a security policy to the host name
    - etc.
- **XWBSNDO**
  - called during WEB SEND or WEB CONVERSE, before sending the request
    - for chunked transfer-coding, only called for the first WEB SEND
  - Usage
    - apply a security policy to the host and path component
    - etc.

Code conversion changes in CICS TS V3.1

- **Changes for DFHCNV**
- **Support for Unicode UTF-8, UTF-16 formats**
- **Code conversion in CICS as an HTTP server**
- **Code conversion in CICS as an HTTP client**

Changes for DFHCNV

- **Code conversion table not required**
  - code pages are specified in
    - WEB APIs
    - Analyzer program
    - using defaults
  - DFHCNV can still be used
    - for migration purposes
    - specify which DFHCNV entry to use in the analyzer

Support for Unicode UTF-8, UTF-16 formats

- **Support for Unicode**
  - CICS now provides codepage conversions to and from UTF-8 and UTF-16
    - CICS as an HTTP server
    - CICS as an HTTP client
  - uses the z/OS conversion services
    - conversion facility must be enabled
      - documented in “z/OS Support for Unicode Using Conversion Services”
  - Conversions to and from Unicode can be specified in
    - WEB APIs
    - Analyzer program
  - DFHCNV cannot be used to specify Unicode conversion

Other changes – see appendix for details

- **Changes to URMs**
- **Changes to definitions**
- **API changes**
- **JCICS API changes**
- **SPI changes**
- **Supplied transaction changes**
- **Monitoring and statistics changes**

Summary

- **CICS now supports HTTP/1.1**
  - New features with HTTP/1.1 including:
    - Persistent connection
    - Chunking and pipelining
    - HTTP date and time format
- **URIMAP resource for simplified management**
  - Can be used in place of analyzer programs
- **WEB API for outbound HTTP requests**
- **Unicode code conversion support**

Appendix - Changes to URMs

- **Analyzer program**
  - now optional
    - can be specified or bypassed by the URIMAP
  - but still can be used to
    - change application programs, alias transaction, userids, code conversions, etc.
    - include new monitoring or audit actions
  - attributes of the URIMAP can be passed to the analyzer
    - CHARACTERSET, HOSTCODEPAGE, CONVERTER, TRANSACTION, USERID, PROGRAM
    - analyzer can override these
  - some input and output parameter changes
    - new output to indicate application is commarea style
      - to be processed as HTTP/1.0
    - parameters relating to code conversion
- **Converter program**
  - optional, can be specified in URIMAP and analyzer program
  - can be used to
    - convert HTTP data to/from commareas
    - make more than one application program to be called for the same request

Changes to URMs

- **Web error program**
  - DFHWBEP invoked for new situations
    - HTTP/1.1 specific error responses
      - > HTTP request/response format inconsistencies
        - Methods
        - headers
      - > New error status codes
    - new error situations
      - > URIMAP disabled, virtual host disabled
      - > resource cannot be found on a static response
      - > other unexpected errors processing URIMAPs

Changes to definitions

- **SIT**
  - LOCALCCSID
- **RDO**
  - URIMAP
  - DOCTEMPLATE
    - HFSFILE attribute
  - TCPIPSERVICE
    - PROTOCOL attribute
    - MAXDATALEN attribute

API changes

- **new API**
  - EXEC CICS WEB PARSE
  - EXEC CICS WEB OPEN
  - EXEC CICS WEB CONVERSE
  - EXEC CICS WEB CLOSE
  - EXEC CICS CONVERTTIME

**** all APIs are threadsafe***

- **changed API**
  - EXEC CICS WEB EXTRACT
  - EXEC CICS WEB SEND
  - EXEC CICS WEB RECEIVE
  - EXEC CICS WEB WRITE HTTPHEADER
  - EXEC CICS WEB READ HTTPHEADER
  - EXEC CICS WEB STARTBROWSE HTTPHEADER
  - EXEC CICS WEB READNEXT HTTPHEADER
  - EXEC CICS WEB ENDBROWSE HTTPHEADER
  - EXEC CICS FORMATTIME

**** all APIs are now threadsafe***

JCICS API changes

- **Extended to support new features**
  - HTTPSession class
    - open(), send(), receive(), converse(), close()
  - HTTPRequest class
    - setPath(), setMethod(), setBody(), setConversion, writeHeader, etc.
  - HTTPResponse class
    - getStatusCode(), getStatusText(), getHeader, getContent, etc.

SPI changes

- **new SPI**
  - EXEC CICS CREATE URIMAP
  - EXEC CICS DELETE URIMAP
  - EXEC CICS INQUIRE URIMAP
  - EXEC CICS SET URIMAP
  - EXEC CICS INQUIRE HOST
  - EXEC CICS SET HOST
- **changed SPI**
  - EXEC CICS CREATE DOCTEMPLATE
  - EXEC CICS INQUIRE DOCTEMPLATE
  - EXEC CICS SET DOCTEMPLATE
  - EXEC CICS CREATE TCPIPSERVICE
  - EXEC CICS INQUIRE TCPIPSERVICE
  - EXEC CICS SET TCPIPSERVICE

Changes to supplied transaction

- **CWXU**
  - New transaction for non-HTTP requests
    - PROTOCOL(USER) in TCPIPSERVICE
  - No URIMAP matching
    - Attaches analyzer program
- **CWXN**
  - Internal processing change
    - URIMAP matching
    - analyzer program is optional
    - handling for HTTP/1.1
    - asynchronous receive

Changes to monitoring and statistics

- **Monitoring**
  - fields added to DFHWEBB group
    - count/bytes for sends and receives in CICS as an HTTP client
      - > WBREDOCT, WBWRTOCT, WBRCVIN1, WBCHRIN1, WBSNDOU1, WBCHROU1, WBPARSCT, WBBRWOCT

- **Statistics**
  - URIMAP statistics
    - number of URIMAP matches
    - number of redirection, static response, application response, etc.