Using RESTful web services with z/VSE

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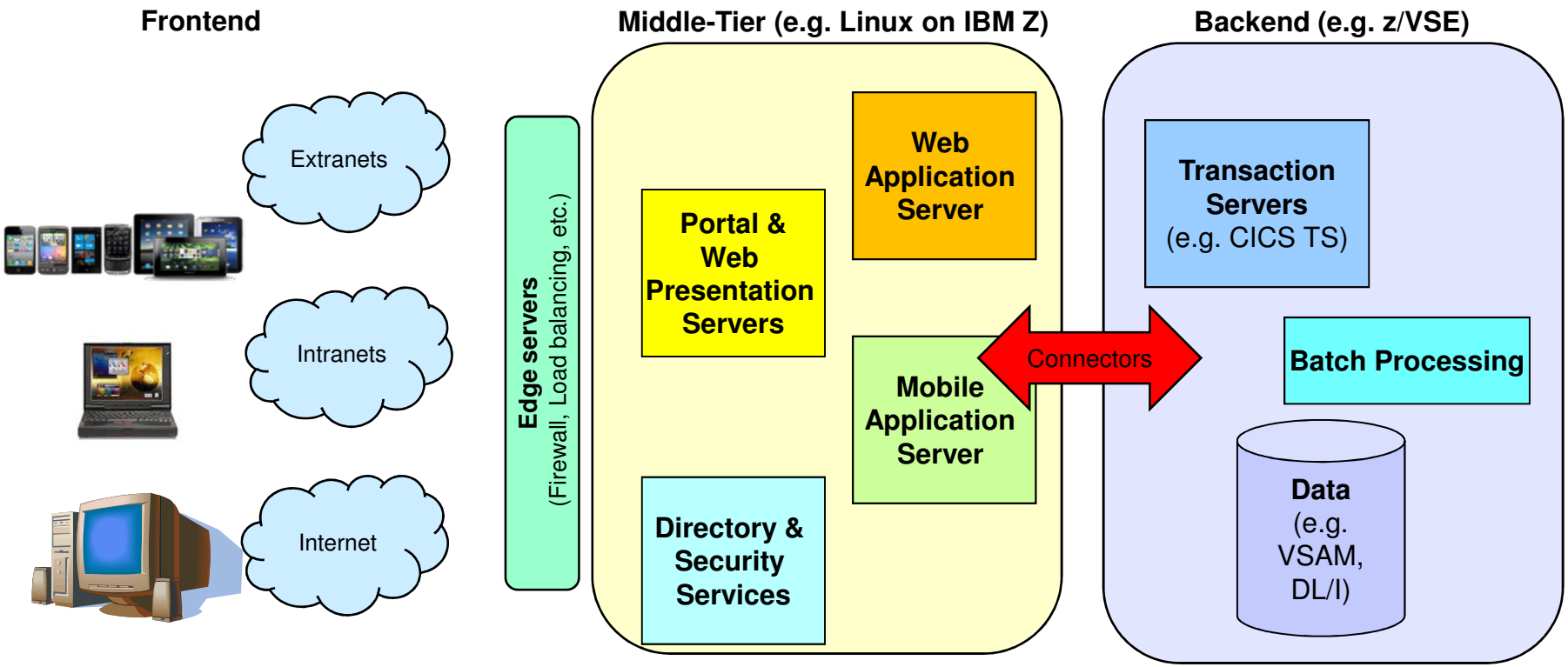
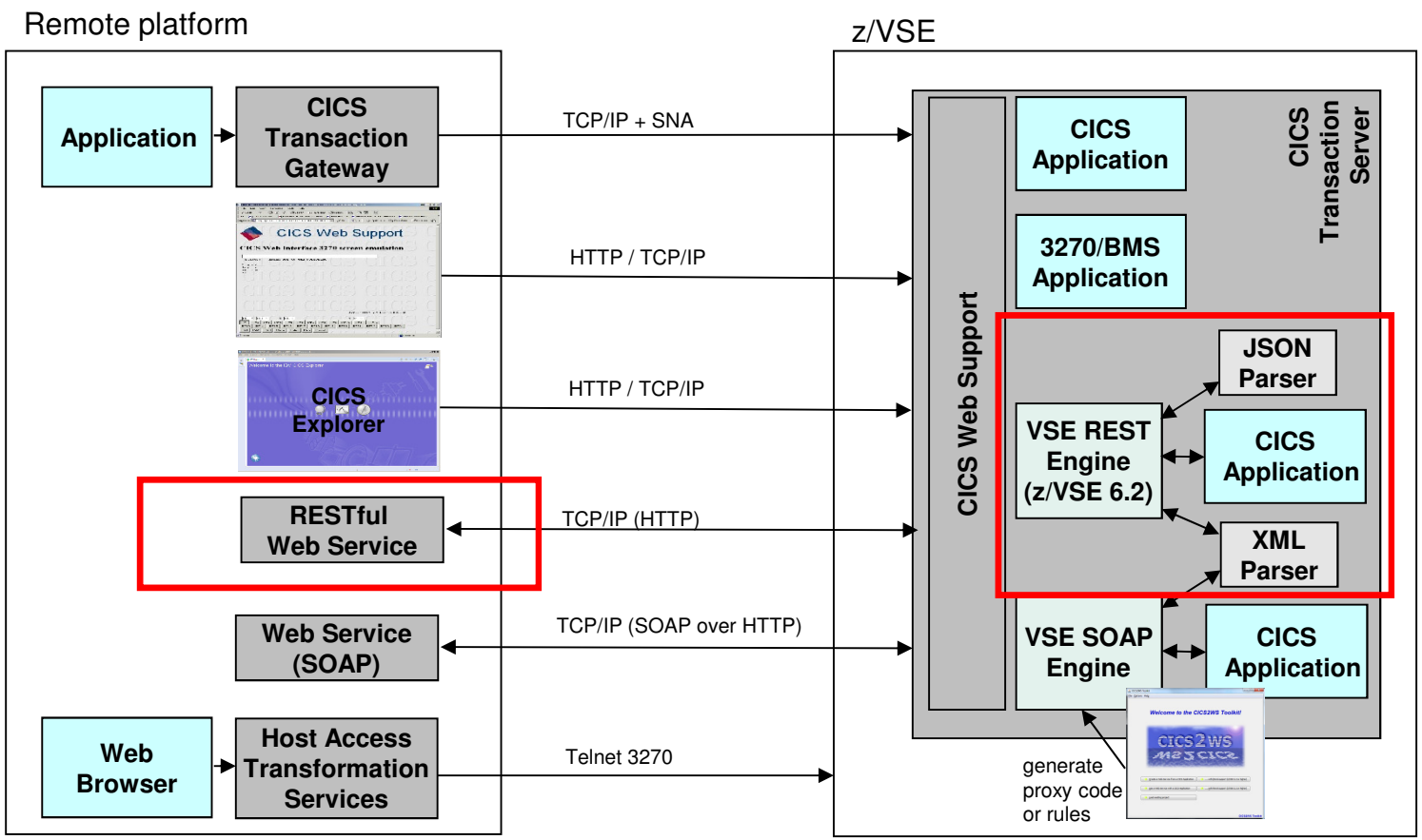
Web- / Mobile-enabling of Applications

→Web-enable z/VSE Applications
→Mobile-enable z/VSE Applications
→Modernize User Interface for applications



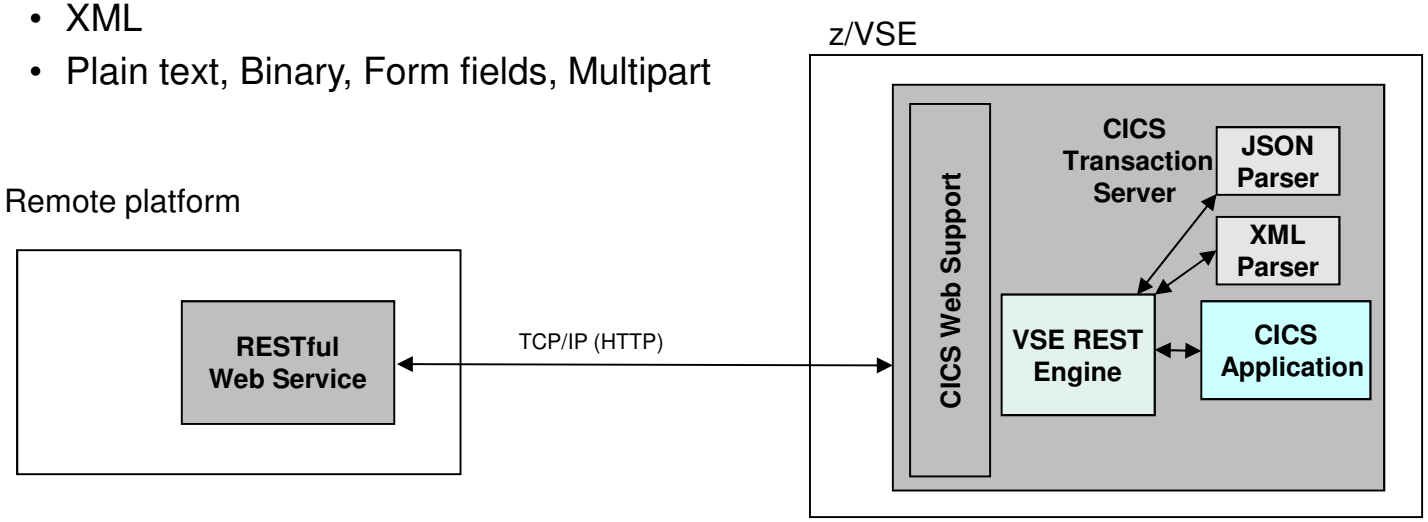
CICS Connectivity

CICS Web Support is the base of CICS connectivity



z/VSE 6.2: RESTful Web Services support

- **Use REST (Representational State Transfer) with CICS applications**
  - **Provide existing CICS applications as RESTful Web Service to the outside world**
    - z/VSE as the REST server
    - Provide an easy to use RESTful API to services for z/VSE services
  - **Use/call external RESTFul Web Services from within z/VSE CICS applications**
    - z/VSE as the REST client
    - Use external RESTful APIs within z/VSE applications
  - **Payload can be:**
    - JSON (JavaScript Object Notation)
    - XML
    - Plain text, Binary, Form fields, Multipart



What is REST (Representational State Transfer)?

- Representational State Transfer (REST) is a **software architecture style consisting of guidelines and best practices** for creating web services
- REST has gained widespread acceptance across the web as a **simpler alternative to SOAP** and WSDL-based web services
- RESTful systems typically communicate over the **Hypertext Transfer Protocol** (**HTTP**)
  - with the same HTTP verbs (GET, POST, PUT, DELETE, and so on) used by web browsers
- The **payload** (message) transported by RESTful web services can be of various types (content types)
  - Commonly used is **JSON** as well as **XML**, but it can also be plain text, or even binary data

What is REST (Representational State Transfer)?

- A RESTful web service typically operates on a certain **'object**' on a server
  - The object is typically addressed through the URI (part of the URL)
    - http://host:port/resource-uri

- Actions on such resources are typically denoted by the HTTP request types:
  - **GET** would typically **read** the resource
  - **PUT** would typically **update/replace** the resource
  - **POST** would typically **create** the resource
  - **DELETE** would typically **delete** the resource

- Additional parameters can be supplied via the URL query string
  - http://host:port/resource-uri?query-string

What is REST (Representational State Transfer)?

- RESTful web services are typically **stateless**
  - Each request from any client contains all the information necessary to service the request
  - The session state is therefore held in the client

- RESTful web services may use **HTTP specific features**
  - **HTTP headers** – to transport additional attributes
  - **Cookies** – to manage state information between requests

→ As denoted by the term 'typically' in above descriptions, there is no hard requirement for any of the described properties

HTTP basics

Request:

```
GET /doc/test.html HTTP/1.1
Host: www.test101.com
Accept: image/gif, image/jpeg, */*
Accept-Language: en-us
Accept-Encoding: gzip, deflate
User-Agent: Mozilla/4.0
Content-Length: 35

bookId=12345&author=Tan+Ah+Teck
```

Request Line

Request Headers

Request Message Header

A blank line separates header & body

Request Message Body

Response:

```
HTTP/1.1 200 OK
Date: Sun, 08 Feb xxxx 01:11:12 GMT
Server: Apache/1.3.29 (Win32)
Last-Modified: Sat, 07 Feb xxxx
ETag: "0-23-4024c3a5"
Accept-Ranges: bytes
Content-Length: 35
Connection: close
Content-Type: text/html

<h1>My Home page</h1>
```

Status Line

Response Headers

Response Message Header

A blank line separates header & body

Response Message Body

Taken from: https://www.ntu.edu.sg/home/ehchua/programming/webprogramming/HTTP_Basics.html

Example: A RESTful web service

Request a list of books:

Request:
```
GET /api/v1/books
```

Response:
```
{
  meta: {  },
  data: [{
    id: 24,
    title: 'Behavior-Driven Development',
    author: 'Viktor Farcic'
  }, {
    id: 25,
    title: 'Continuous Integration',
    author: 'Viktor Farcic'
  }]
}
```

Create a book:

Request:
```
POST /api/v1/books/id/24
{
  id: 24,
  title: 'Behavior-Driven Development',
  author: 'Viktor Farcic'
}
```

Response:
```
Status: 201 Created
{
  meta: {  },
  data: {
    uri: /api/v1/books/id/24
  }
}
```

Request a single book:

Request:
```
GET /api/v1/books/id/24
```

Response:
```
{
  meta: {  },
  data: {
    id: 24,
    title: 'Behavior-Driven Development',
    author: 'Viktor Farcic'
  }
}
```

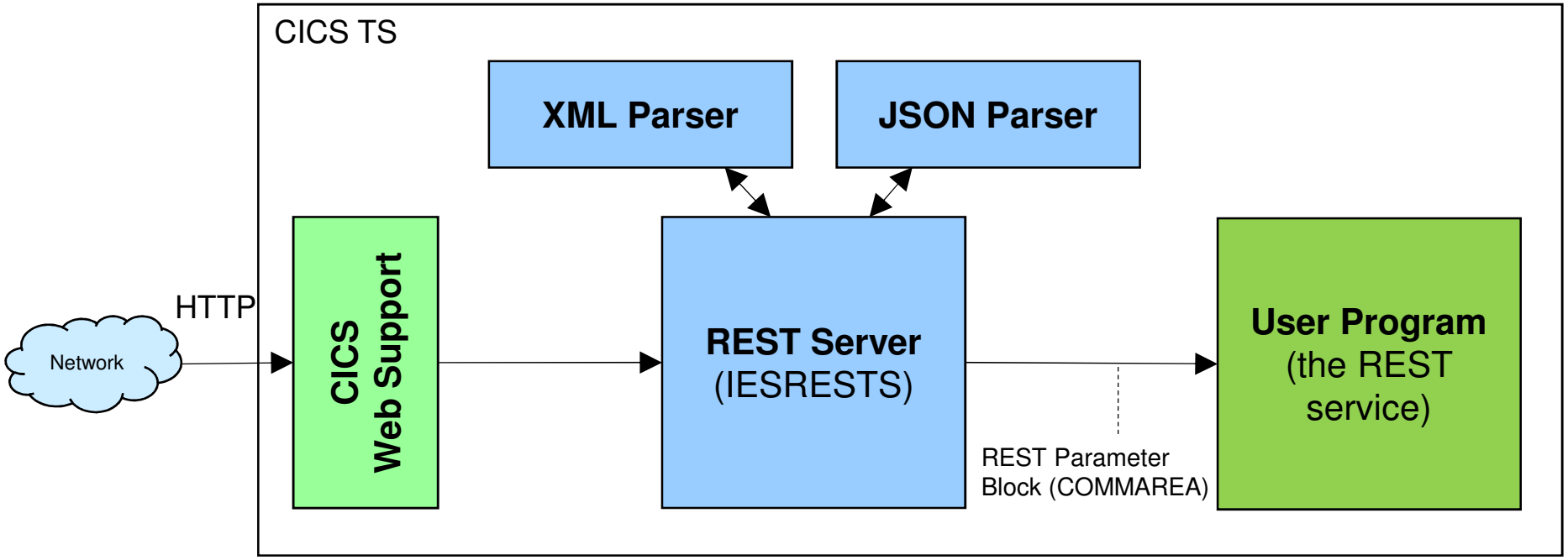
Delete a book:

Request:
```
DELETE /api/v1/books
{
  id: 24,
}
```

Response:
```
Status: 202 Accepted
{
  meta: {  },
  data: {  }
}
```

Example taken from: https://technologyconversations.com/2014/08/12/rest-api-with-json/

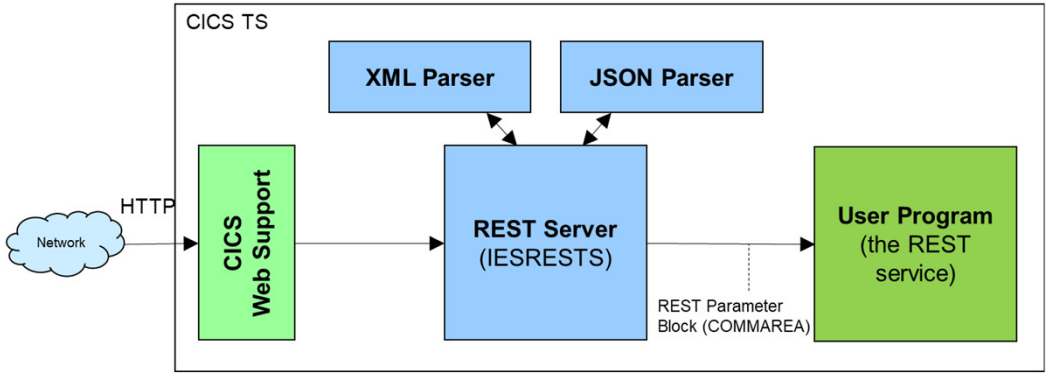
z/VSE 6.2: z/VSE as a REST Server



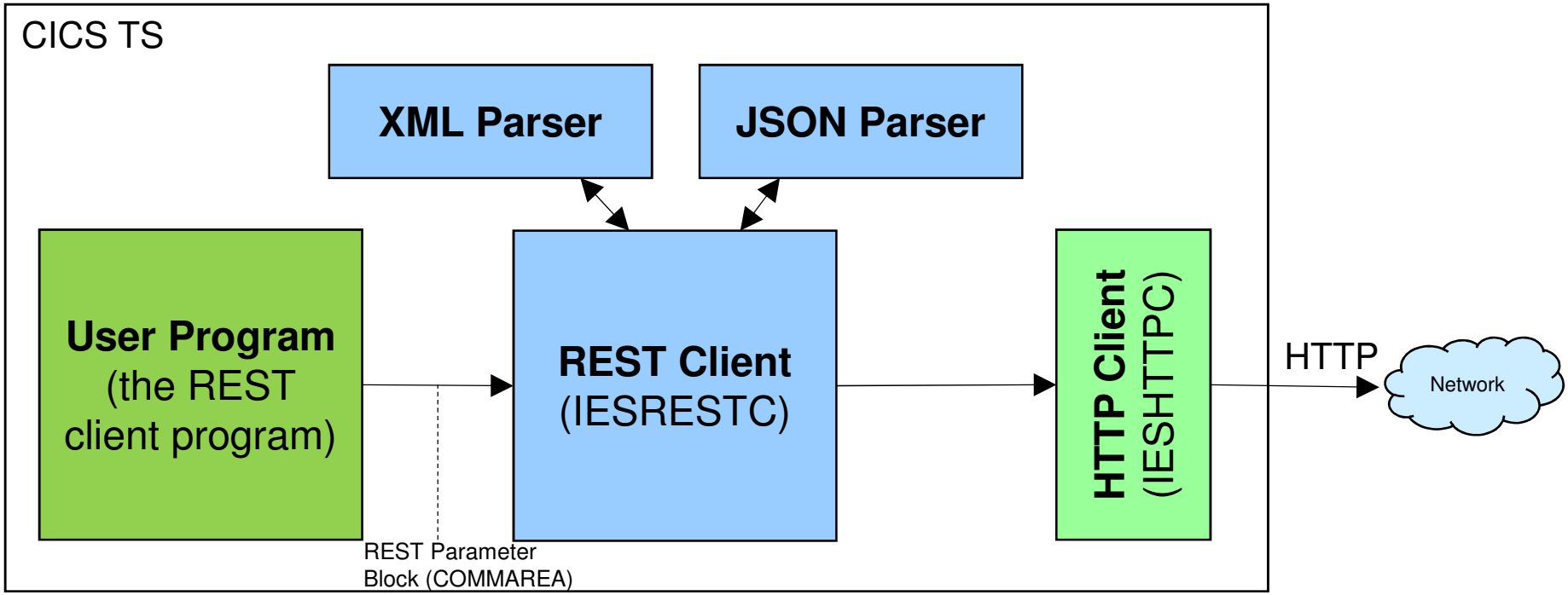
Description of the REST Parameter Block:
https://www.ibm.com/support/knowledgecenter/SSB27H_6.2.0/fa2ws_how_rest_control_blocks_are_used.html

z/VSE 6.2: z/VSE as a REST Server

- **The z/VSE REST-Engine…**
  - Receives the request (via CICS Web Support)
  - Extracts information from the request:
    - User program to call from the URL:
      http://host:port/cics/CWBA/IESRESTS/user-program/resource-uri[?query-string]
    - URL parameters from the query string (if any)
    - HTTP headers
    - Cookies (if any)
    - Request data (if any)
  - Calls the user program
  - Constructs the response:
    - HTTP status code
    - HTTP headers
    - Set-Cookies requests (if any)
    - Response data (if any)
  - Sends the response back to the client



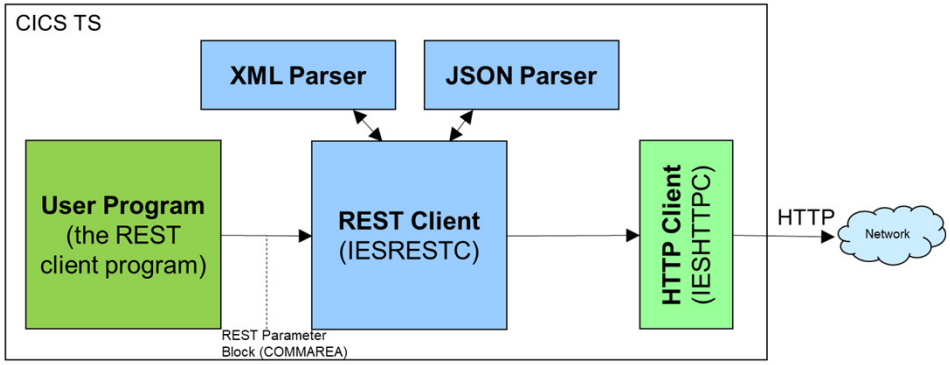
z/VSE 6.2: z/VSE as a REST Client



Description of the REST Parameter Block:
https://www.ibm.com/support/knowledgecenter/SSB27H_6.2.0/fa2ws_how_rest_control_blocks_are_used.html

z/VSE 6.2: z/VSE as a REST Client

- **The z/VSE REST-Engine…**
  - Gets called from the user program
  - Constructs the request
    - Splits the URL into host and port and resource-uri
      http://host:port/resource-uri[?query-string]
    - Adds URL parameters to the query string (if any)
    - HTTP headers
    - Cookies (if any)
    - Request data (if any)
  - Sends the request to the server
  - Receives the response from the server
  - Extracts information from the response:
    - HTTP status code
    - HTTP headers
    - Set-Cookies requests (if any)
    - Response data (if any)
  - Returns back to the user program



The REST parameter block

- **Contains information about the request**
  - Request type (GET, PUT, POST, …)
  - URL
  - Content-Type
  - Data-type (XML, JSON, plain text, binary)
  - URL parameters from query string (http://…..?a=b&c=d)
  - Form fields
  - HTTP headers
  - Cookies
  - Authentication information
  - Response status code

- **Copybooks in PRD1.BASE**:
  - IESRESTH.H LE/C
  - IESRESTL.C COBOL
  - IESJSONP.P PL/1
  - IESRESTA.A HLASM

```
* COMMAREA layout used by the REST Engine to call the user program
* (VSE as REST server) or to get called by the user program
* (VSE as REST client):
*
 01 REST-COMMAREA.
   02 REST-VERSION                PIC 9(9) BINARY.
   02 REST-EBCDIC-CODEPAGE        PIC X(16).
   02 REST-FLAGS                  PIC 9(9) BINARY.
   02 REST-RETCODE                PIC 9(9) BINARY.
   02 REST-PRIVATE                USAGE IS POINTER.
*  Request specific fields:
   02 REST-REQ-ACTION             PIC 9(9) BINARY.
   02 REST-REQ-URL                PIC X(2048).
   02 REST-REQ-CONTENT-TYPE       PIC X(128).
   02 REST-REQ-DATA-TYPE          PIC 9(9) BINARY.
   02 REST-REQ-DATA-PTR           USAGE IS POINTER.
   02 REST-REQ-DATA-LENGTH        PIC 9(9) BINARY.
   02 REST-REQ-URL-PARAMS-TSQ     PIC X(8).
   02 REST-REQ-FORM-FIELDS-TSQ    PIC X(8).
   02 REST-REQ-HTTP-HEADERS-TSQ   PIC X(8).
   02 REST-REQ-COOKIES-TSQ        PIC X(8).
   02 REST-REQ-AUTH-TYPE          PIC 9(9) BINARY.
   02 REST-REQ-AUTH-USER          PIC X(64).
   02 REST-REQ-AUTH-PASSWORD      PIC X(64).
   02 REST-REQ-ACCEPT             PIC X(128).
*  Response specific fields:
   02 REST-RESP-HTTP-STATUS-CODE PIC 9(9) BINARY.
   02 REST-RESP-HTTP-STATUS-TEXT PIC X(128).
   02 REST-RESP-CONTENT-TYPE      PIC X(128).
   02 REST-RESP-DATA-TYPE         PIC 9(9) BINARY.
   02 REST-RESP-DATA-PTR          USAGE IS POINTER.
   02 REST-RESP-DATA-LENGTH       PIC 9(9) BINARY.
   02 REST-RESP-FORM-FIELDS-TSQ   PIC X(8).
   02 REST-RESP-HTTP-HEADERS-TSQ PIC X(8).
   02 REST-RESP-COOKIES-TSQ       PIC X(8).
   02 REST-RESP-LOCATION          PIC X(2048).
```

Handling XML and JSON data

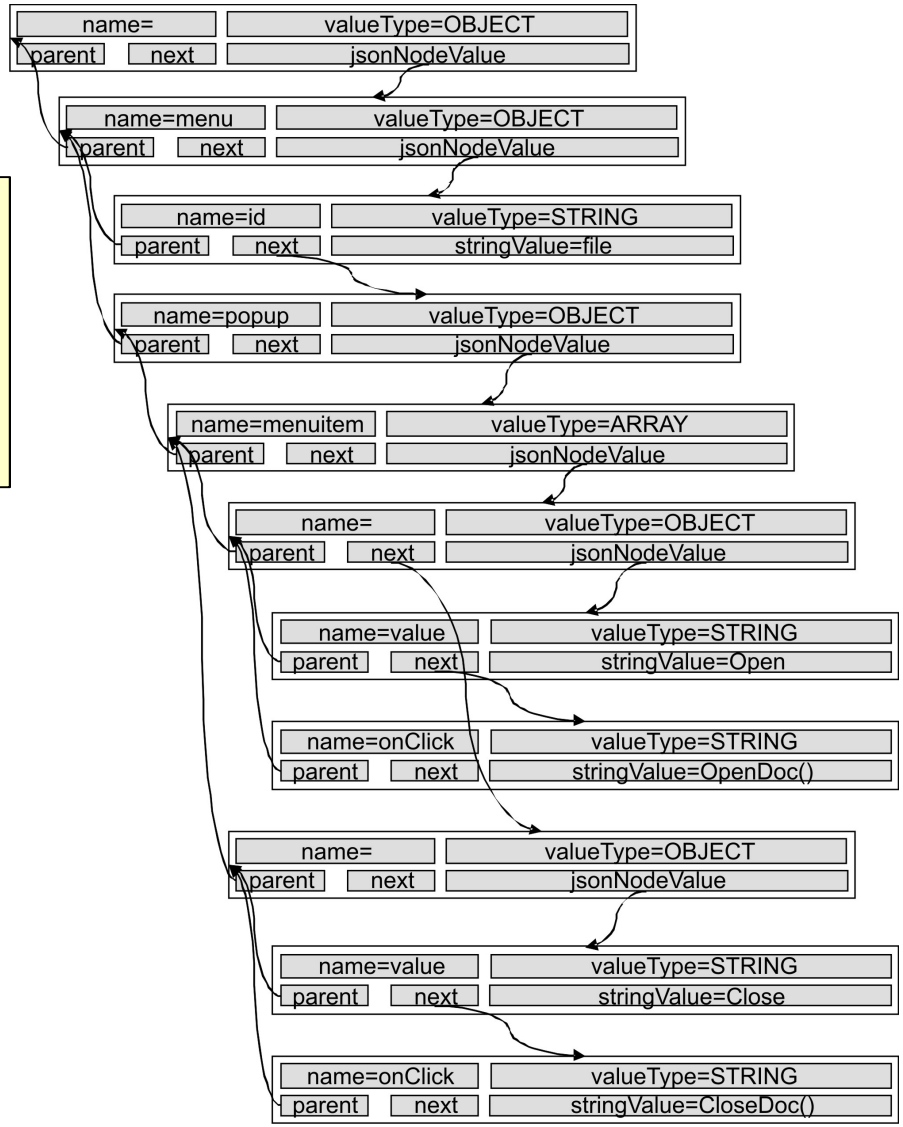
The z/VSE REST Engine automatically translates request and response data

- **XML:** Content-Type: text/xml or application/xml
  - XML data is parsed by the XML parser
  - An XML tree in memory is passed to the user program
- **JSON:** Content-Type: text/json or application/json
  - JSON data is parsed by the JSON parser
  - A JSON tree in memory is passed to the user program
- **URL encoded:** Content-Type: application/x-www-form-urlencoded
  - Form field data is parsed and passed via TS queue entries
- **Plain text:** Content-Type: text/* (other than xml or json)
  - ASCII-EBCDIC converted
- **Binary data:** anything else
- **Multipart data:**
  - Each part is converted individually based on its content type

JSON data

Example:

```
{"menu": {
  "id": "file",
  "popup": {
    "menuitem": [
      {"value": "Open", "onclick": "OpenDoc()"},
      {"value": "Close", "onclick": "CloseDoc()"}
    ]
  }
}}
```



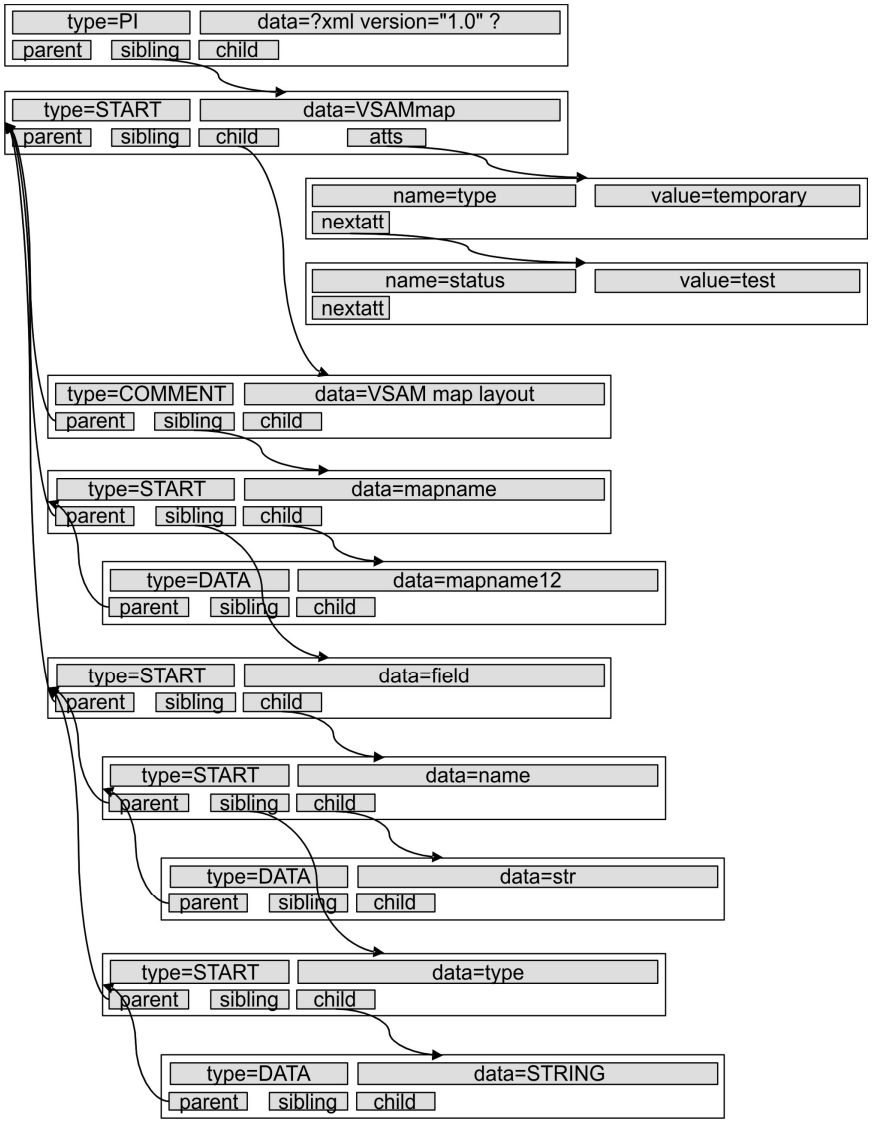
The JSON control blocks are defined in copybooks in PRD1.BASE:

- IESJSONH.H LE/C
- IESJSONC.C COBOL
- IESJSONP.P PL/1
- IESJSONA.A HLASM

XML data

Example:

```
<?xml version="1.0" encoding="UTF-8"?>
<VSAMmap type="temporary" status="test">
  <!-- VSAM map layout -->
  <mapname>mapname12</mapname>
  <field>
    <name>str</name>
    <type>STRING</type>
  </field>
  <field>
    <name>sign</name>
    <type>SIGNED</type>
  </field>
</VSAMmap>
```



The XML control blocks are defined in copybooks in PRD1.BASE:

- IESXMLAH.H LE/C
- IESXMLCB.C COBOL
- IESXMLPL.P PL/1
- IESXMLAS.A HLASM

Live Demo

How to provide a RESTful web service with z/VSE

- Based on a COBOL example provided with the z/VSE Connector Client: <conn-client>/samples/rest/COBRESTS.c
- Use the REST testing tool Postman
  - https://www.getpostman.com/

```
* Example COBOL application to illustrate how to use the
* z/VSE REST Engine - VSE as REST server.
*
* This REST service accesses a VSAM file. The name of the
* file is specified in the URL:
*   http://host:port/cics/CWBA/IESRESTS/COBRESTS/<file-name>
*
* Operations:
* - GET:  append URL parameter 'key=<key-value>' to get a
*         particular record:
*                 ../COBRESTS/<file-name>?key=<key-value>
*         Without an URL parameter it starts reading at the
*         first record. Any subsequent GET without an URL
*         parameter will read the following record. The
*         last record read is stored in a session cookie.
*         The record content is returned as JSON data:
*         {
*          "key": "00000002",
*          "data": "Record 2"
*         }
* - POST: Create a new VSAM record. The record content is
*         expected to be in JSON format. The key of the new
*         record is contained in the JSON data as well.
* - PUT:  Updates an existing VSAM record. The record content
*         is expected to be in JSON format. The key of the
*         record to be updated is contained in the JSON data
*         as well.
* - DELETE: Deletes an VSAM record. The record key is specified
*         as URL parameter:
*                  ../COBRESTS/<file-name>?key=<key-value>
```

Questions ?