UNITE 2018
Annual Conference

Web Services Are Always Cloud Ready

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MGS, Inc.

Session MCP4068
2:45pm – 3:45pm
Wednesday, September 19, 2018

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Computer Business Solutions

MGS, Inc.

- Software Engineering, Product & Services firm founded in 1986
- Products and services to solve business problems:
  - **Software Engineering Services**
  - **Professional Services**
    - **Management Support**
    - **Consulting and Technical Services**
    - **Application Development**
  - **Product Development**
    - **Performance/Capacity Management**
    - **Web Services**
    - **MCP Client Communications**

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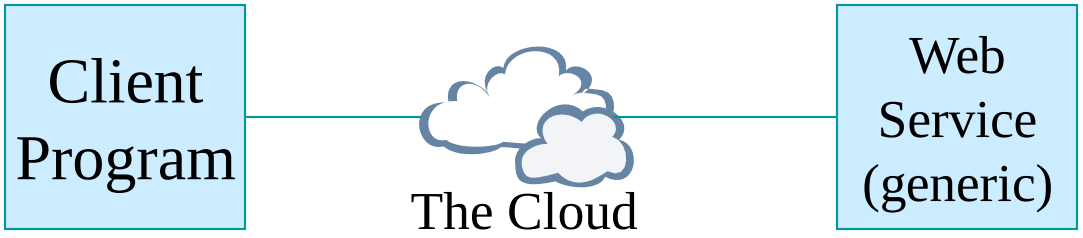
Overview

- Web Services (generic) Goal
  - Make network program-to-program exchanges as easy as browsing the Web



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Overview

- The Web Services (generic) concept contains extremely powerful elements:
  - Simple, well-defined, standards-based interfaces
  - Technology independent implementation
- “Loose Coupling” between provider and consumer
  - Anonymous client
  - Flexible data content
  - asynchronous

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Overview

- Abstracts out business functionality
  - Creates machine (technology) independent functionality
  - Indirect reference to a business service
- Leverage existing business functionality
  - Rewrites/Redesigns are expensive
  - Placing a Web Services (generic) envelope around existing functionality is relatively inexpensive
  - Preserves investment in known, reliable business solutions

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Overview

- Services Oriented Architecture (SOA)
  - Componentize Enterprise business functions
  - Service is a “black box” for consumers
  - Encapsulate existing business functions for easier access
  - IT Functionality now available as a set of objects that can be mixed and matched as needed
  - Application development done by architecting service consumers

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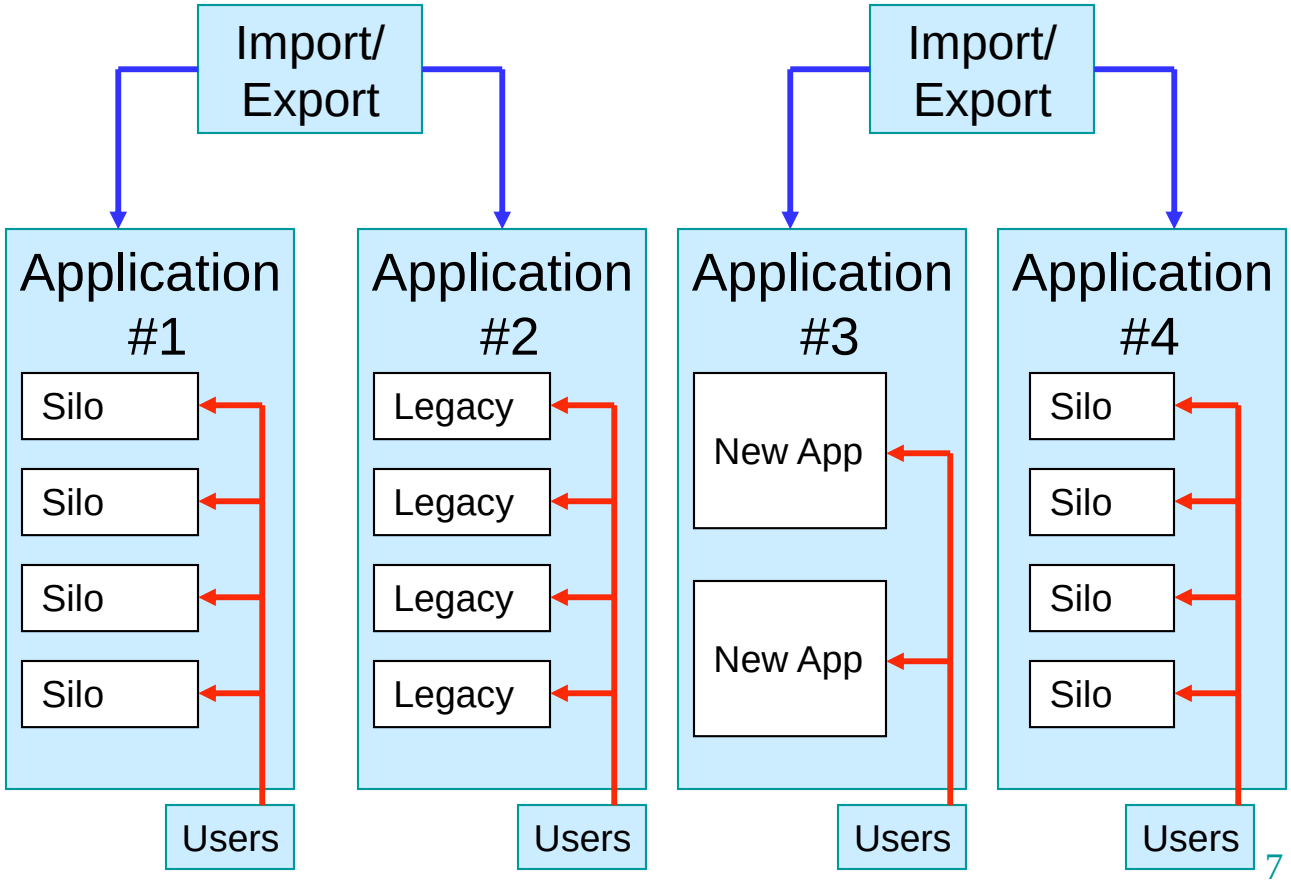
Overview

Traditional Architecture



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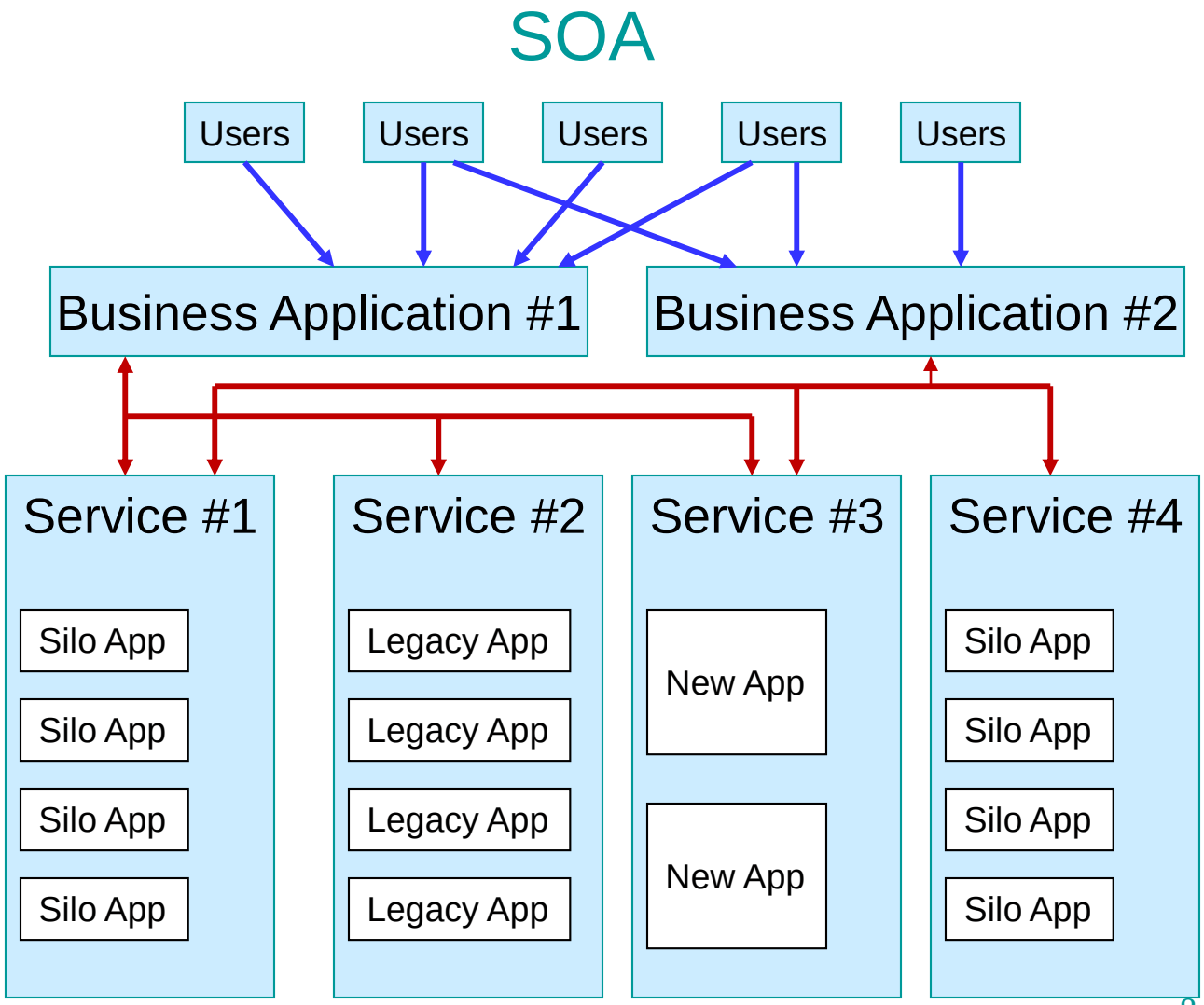
Overview



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Overview

- Built on proven Internet communications standards
  - **TCP/IP –** Transmission Control Protocol / Internet Protocol
  - **TLS –** Transport Layer Security (formerly SSL)
  - Communication Protocols:
    - **HTTP -** HyperText Transfer Protocol
    - **SOAP -** Simple Object Access Protocol
    - **REST -** Representational State Transfer
  - Payload Data Representations:
    - **Text -** plain text
    - **XML -** eXtensible Markup Language
    - **JSON -** JavaScript Object Notation

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Overview

- Web Service (generic) Characteristics
  - Client-Server Architecture
  - Stateless Transactions
  - Layered System
    - Client can be directly connected or have communication routed
    - Client is unaware or layers
  - Loose Coupling
    - Client tech not tied to server tech
    - Both side can evolve independently

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Overview

- APIs Supported by software IDEs
  - Automatic creation of Web Services objects
    - Web Services Server object support
    - Web Services Client object support
  - Included as part of the application framework
    - Microsoft .NET
    - Oracle/Sun JAVA
    - Unisys Agile Business Suite
    - Unisys ePortal
    - Unisys MCP WEBAPPSUPPORT
    - MGS-Web

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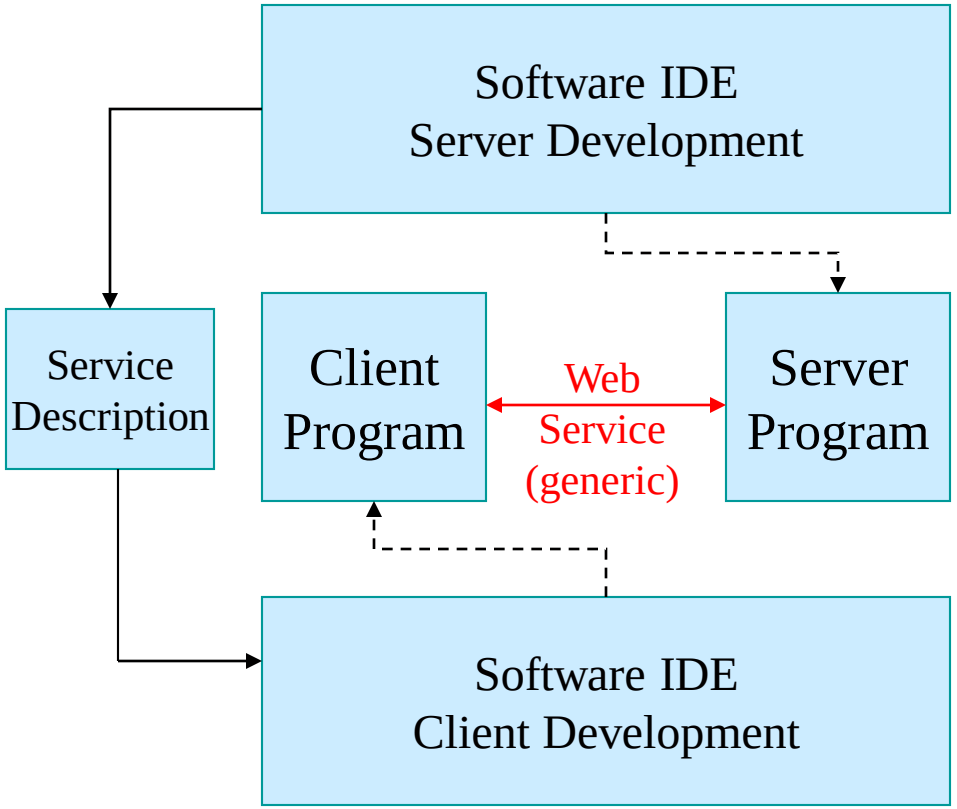
Overview



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Overview

- Service Description
  - User Defined
    - HTTP payload is typically user defined
    - GET (payload part of the URI)
    - POST (payload in the HTTP request body)
  - WSDL
    - Web Services Description Language
    - Specifies:
      - The protocol (typically HTTP)
      - The operation
      - An XML encoded SOAP request
      - An XML encoded SOAP response
  - RSDL, Swagger, etc
    - RESTful API Description Languages
    - JSON or XML encoding

Technology – HTTP Transaction

- HTTP based Web Service
  - Hypertext Transfer Protocol
  - Core of Web Browser communications
  - Can also be used for “web service” transaction processing
    - GET method

      GET /test/form.php?name1=value1&name2=value2

    - POST method

      POST /test/form.php HTTP/1.1
      Host: w3schools.com
      name1=value1&name2=value2
  - Payload format is user application defined
  - Can be HTTP form elements, XML, JSON, etc
  - Response format is user application defined

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Technology – SOAP Transaction

- SOAP based Web Service
  - HTTP used to encapsulate SOAP request message (POST)
    - SOAP operation
    - SOAP headers
    - SOAP body
  - HTTP response encapsulates the SOAP response
  - SOAP request and response are XML encoded
  - WSDL defines the specific format of the SOAP request/response for a given operation
  - Minimal use of HTTP control fields

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Technology – RESTful Transaction

- REST based web service
  - HTTP used to encapsulate REST request message (GET or POST)
    - REST operation
    - REST headers
    - REST body
  - HTTP response encapsulates the REST response
  - REST request and response are either JSON or XML encoded
  - REST request/response format may be defined by a Service Description (may be built into application)
  - Often relies on HTTP control fields

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Technology – XML vs JSON Encoding

- XML Encoding

```
<Person>
    <ID>1</ID>
    <Name>M Vaqqas</Name>
    <Email>m.vaqqas@gmail.com</Email>
    <Country>India</Country>
</Person>
```

- JSON Encoding

```
{
   "ID": "1",
   "Name": "M Vaqqas",
   "Email": "m.vaqqas@gmail.com",
   "Country": "India"
}
```

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Technology – Description File Example

WSDL File Excerpt:

```
<message name="WSTEST_SCRN01">
  <part name="Trancode" type="xsd:string" />
  <part name="Input_data" type="xsd:string" />
</message>
<message name="WSTEST_SCRN01Response">
  <part name="Trancode" type="xsd:string" />
  <part name="Input_data" type="xsd:string" />
  <part name="statusLine" type="xsd:string" />
</message>

<service name="COMSWebServices">
  <documentation>Access COMS applications via Web Services
  </documentation>
    <port name="WSTEST" binding="wsdl:WSTESTHttpBinding">
    <soap:addresslocation=
            "http://laptop1mcp/COMSWebServices/" />
    </port>
</service>
```

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Technology – Message Payload Example

SOAP Request:

```
<soap:Envelope>
  <soap:Body>
    <tns:WSTEST_SCRN01>
      <Trancode>SCRN01</Trancode>
      <InputData>lower case letters</InputData>
    </tns:WSTEST_SCRN01>
  </soap:Body>
 </soap:Envelope>
```

SOAP Response:

```
<soap:Envelope>
  <soap:Body>
    <tns:WSTEST_SCRN01Response>
      <Trancode>SCRN01</Trancode>
      <InputData>LOWER CASE LETTERS</InputData>
      <statusLine />
    </tns:WSTEST_SCRN01Response>
  </soap:Body>
 </soap:Envelope>
```

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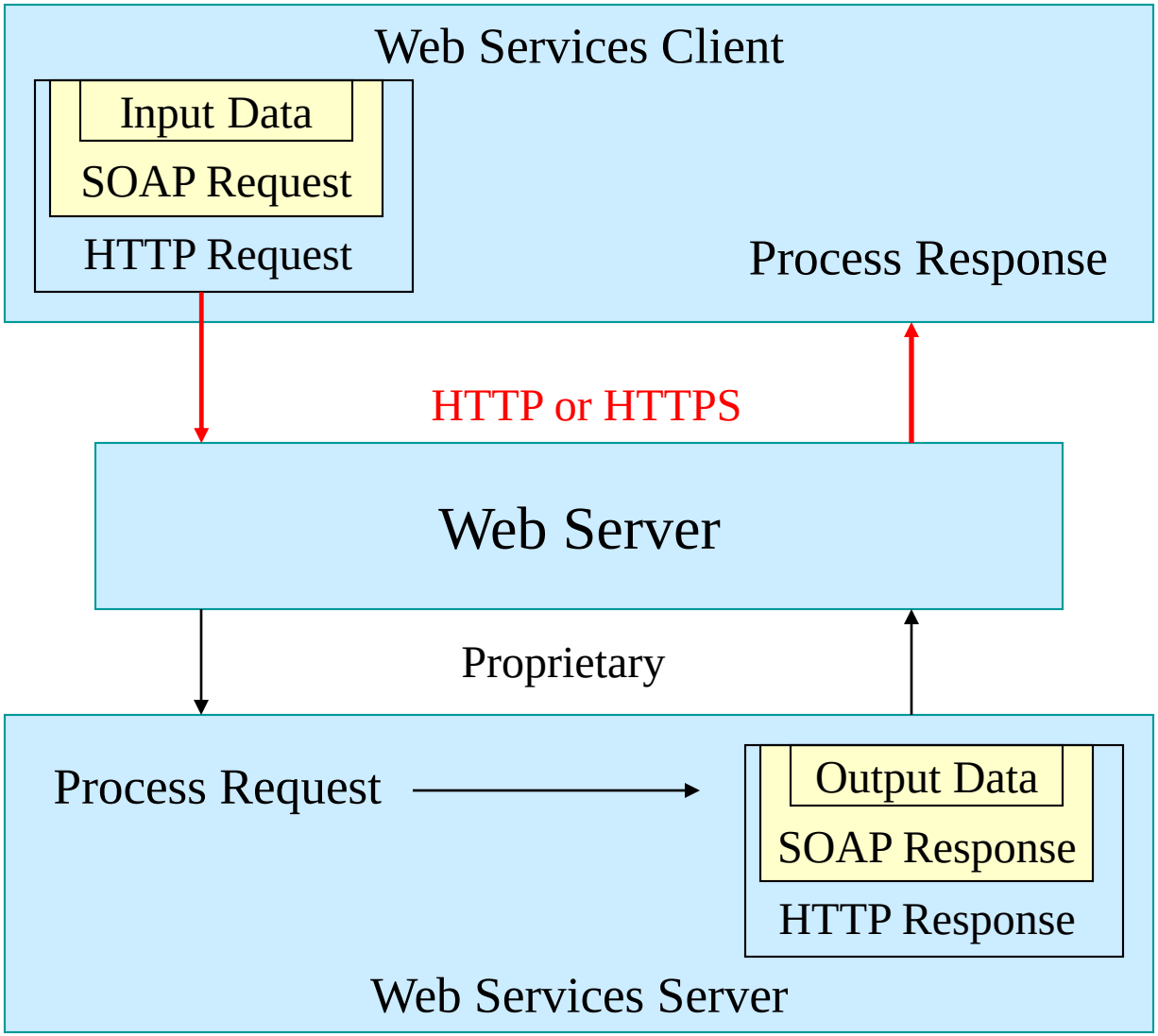
Technology – Processing Example

Indicates XML Encoding



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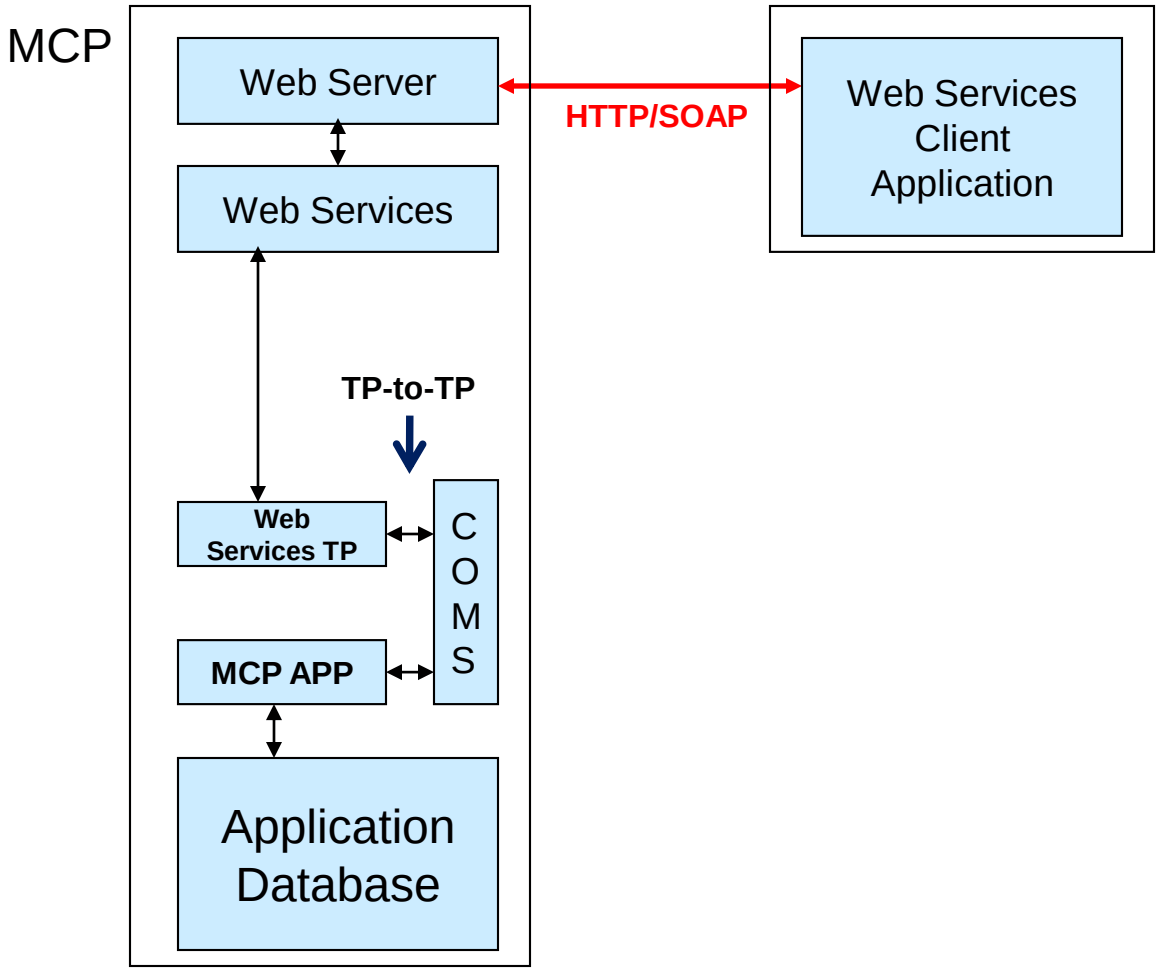
Technology – Server Example

- MCP Based Web Services Server



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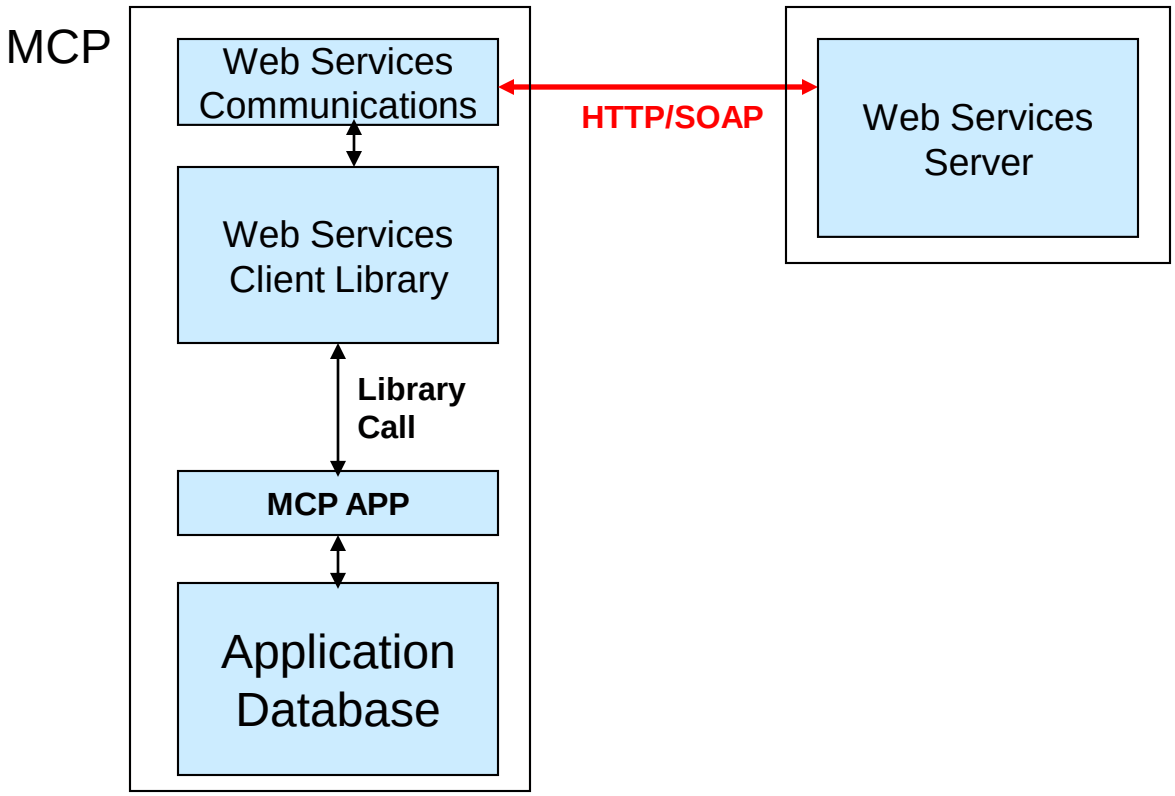
Technology – Client Example

- MCP Based Web Services Client



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Security – Overview

- Digital security has three parts:
  - Identification
    - Authentication
    - Digital signature
  - Encryption
  - Journaling
- Web Services (generic) moves security considerations to a different place
  - May not be at the user's interface point
  - Often a machine-to-machine exchange
  - The "other" machine may not be trusted
- SOA changes the security landscape

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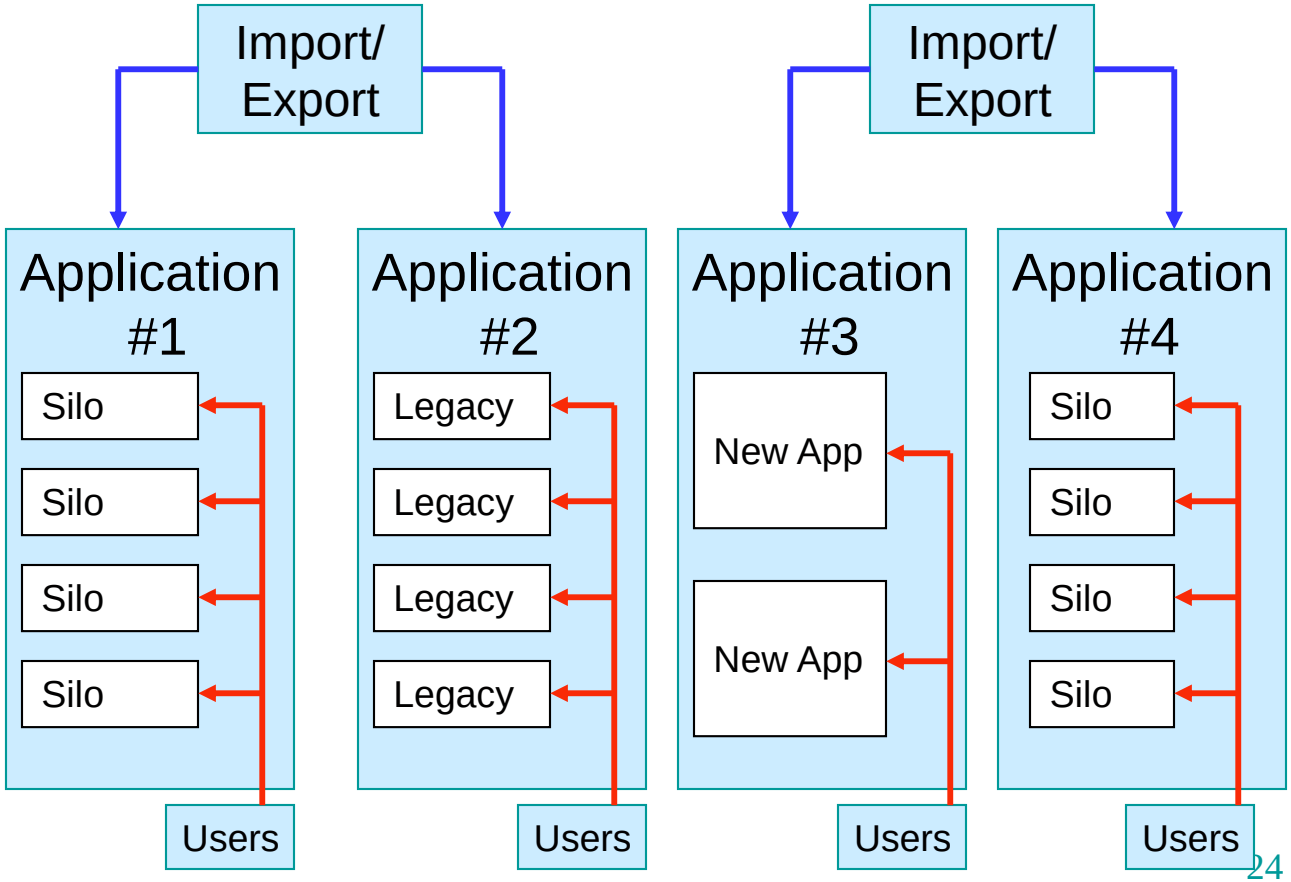
Security – Overview

Traditional Architecture



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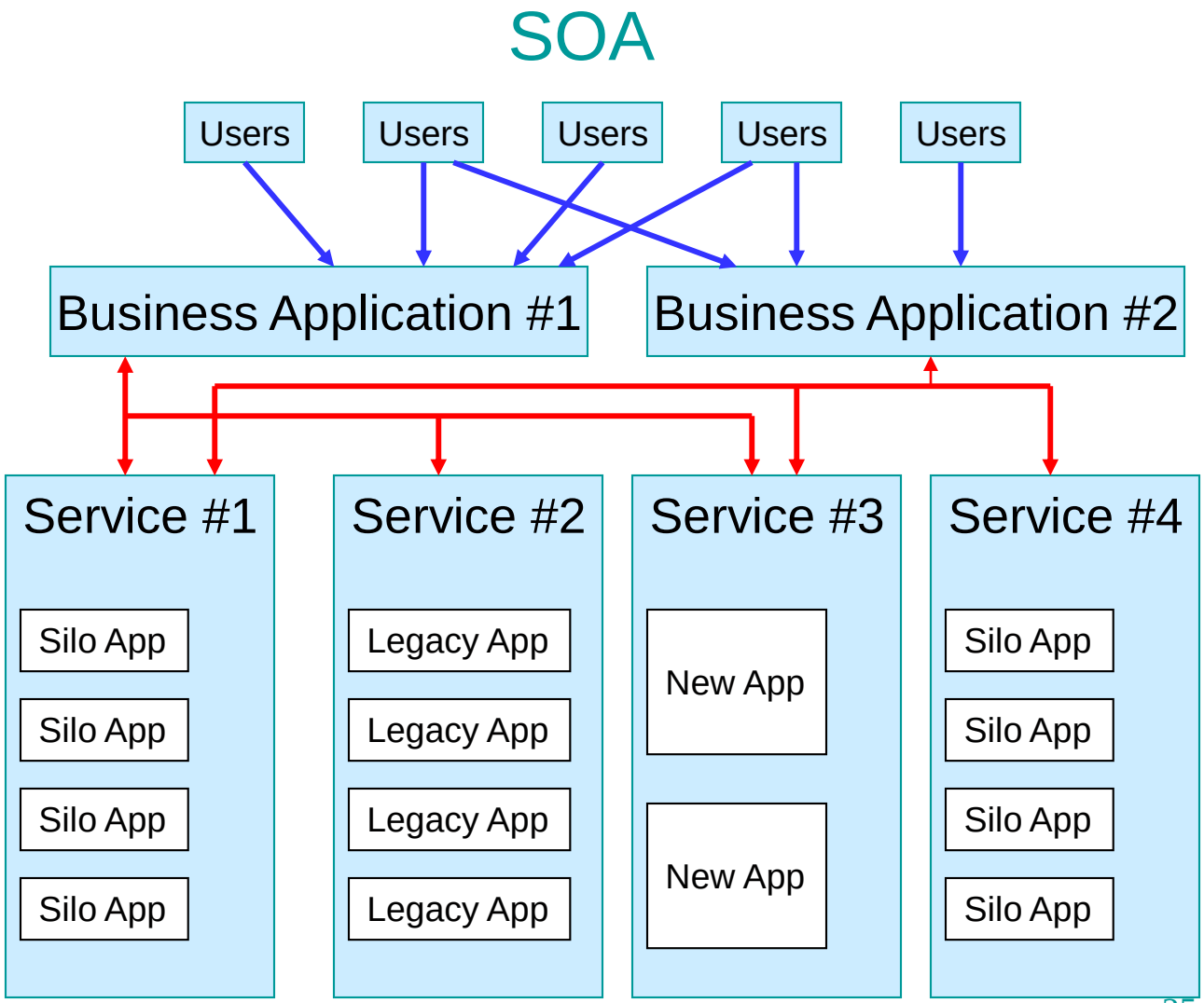
Security – Overview



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Security – Overview

- Web Services (generic) built on HTTP
  - Hence security considerations are similar for all three:
    - HTTP
    - SOAP
    - REST
  - Need for connection encryption
  - Need for message or session authentication
  - HTTP authentication limited so additional authentication strategies may be needed

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Security – Connections

- Persistent Connections
  - MCP TCP/IP connect/disconnect slows throughput
  - On close, TCP/IP port must “time wait” for TTL*2 seconds on most systems
  - Most servers default to persistent HTTP connections
    - Connection:Keepalive
  - Client then controls persistence
  - Persistence provides a 4 to 50 times throughput increase

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Security – Connections

- Non-Persistent Connection

Client Connect ---------->
<---------- Server Accept

Client Request ---------->
<---------- Server Response

Client Disconnect ---------->

Client Connect ---------->
<---------- Server Accept

Client Request ---------->
<---------- Server Response

Client Disconnect ---------->

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Security – Connections

- Persistent Connection

Client Connect ---------->
<---------- Server Accept

Client Request ---------->
<---------- Server Response

Client Request ---------->
<---------- Server Response

Client Request ---------->
<---------- Server Response

Client Disconnect ---------->

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Security – Connections

- Pipelining
  - Requires a persistent connection
  - Multiple requests are sent without waiting for responses
  - Responses return in send-order
  - Most web servers (including ATLAS) support this
  - Use controlled by whether Client application is coded to take advantage of this

Security – Connections

- Piplining

```
Client Connect          ---------------->
                        <----------------  Server Accept

Client  Request         ---------------->
Client  Request         ---------------->
Client  Request         ---------------->

                        <----------------  Server Response
                        <----------------  Server Response
                        <----------------  Server Response

Client Disconnect       ---------------->
```

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Security – Web Service (generic)

- The challenge is controlling security at different levels and different ways
  - TLS/SSL (encryption)
  - HTTP Logon (authentication)
  - SOAP/REST Headers (authentication)
  - Actual call to logon (authentication)
  - SOAP WS-Security (authentication, signature, encryption)

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Security – Transport

- Transport Layer Security (TLS)
  - TLS similar but robust than SSL
  - TLS – Authenticates server
    - Get certificate from Server
    - Validate certificate from a trusted Certificate Authority
  - Two way TLS
    - Client Authenticates server
    - Server Authenticates client
  - Encryption, provided by the certificate keys, is transparent to application
  - Application must get/supply authentication info through an external interface

Security – Transport

- Transport Layer Security (TLS)
  - TLS 1.0, 1.1 and 1.2 based on relatively weak-to-moderate key encryption protocols and data can be seen if key is externally known
  - TLS 1.3 (under development) encryption is more robust and the key cannot be externally provided after the fact
  - TLS 1.3 Lack of external key provision is “sniffer” unfriendly

Security – HTTP

- HTTP Logon
  - Logon required for a specific virtual directory
  - Uses HTTP AUTHORIZATION header
  - BASIC uses a Base64 exchange so SSL/TLS is required for secure communications
  - DIGEST uses MD5 encrypted exchange
  - NTLM provides username/pw encryption and is non re-playable
  - No data encryption
  - Application must get/supply authentication info through an external interface

Security – SOAP/REST Header

- SOAP/REST Headers
  - One must pre-acquire authentication information before the service request call
  - The SOAP/REST message contains both a HEADER section as well as a body
  - Authentication information can be provided in SOAP/REST HEADER fields
  - TLS is still needed to encrypt HEADERs
  - Application must supply authentication info using special code by setting the header fields

Security – SOAP Header Example

- SOAP Headers

```
<Envelope>
 <Header>
  <ABECHeader xmlns="service.abec.com">
  <MessageData>
       <MessageID>568425287</MessageID>
  </MessageData>
  <UserAuthorization>
       <UserName>MS0281331</UserName>
       <UserPassword>x@32!aX49#$&</UserPassword>
  </UserAuthorization>
  </ABECHeader>
 </Header>
 <Body>
   ..... SOAP body …..
 </Body>
</Envelope>
```

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Security – Logon Transaction

- Call to Logon an HTTP session
  - One must pre-acquire authentication information (usercode/password)
  - An initial web services (generic) call is made for authentication
  - The response contains a token to be placed in the body of all subsequent web services (generic) calls
  - Application must be “token” aware
  - TLS is still needed to encrypt dialogs

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Security – Logon Transaction

- Call to Logon

Client Connect ---------->
<---------- Server Accept

Logon Request ---------->
<---------- Logon Response (token)

Client Request (token) ---------->
<---------- Server Response

Client Request (token) ---------->
<---------- Server Response

Client Request (token) ---------->
<---------- Server Response

Client Disconnect ---------->

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Security – WS-Security

- Specific to SOAP Web Services
- WS-Security (WSS)
  - Originally developed by IBM, Microsoft, VeriSign and Forum Systems
  - Attach signature and encryption headers to SOAP messages
  - Provides end-to-end integrity for each message
  - Protocol uses SAML, Kerberos and x.509 certificates
  - Requires application awareness

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Security – Summary

- Security Solutions
  - Will be dependent on the technology used and the connection type
  - Use a front-end http pass-thru processor to do encryption (TLS), authentication (back-end systems are trusted) and journaling
  - Note, the front-end processing may be on the same system as the Web Service (generic)
  - Use TLS to obfuscate user/password authentication and Web Service contents
  - Have username/password aware applications

Cloud – Overview of Cloud Services

- Characteristics
  - Agility (self service)
  - Location Independence (network access)
  - Scalability (pooled resources)
  - Reliability (security?)
  - Usage Reporting (measured service)
  - Low Maintenance & Low Cost
- Available Services
  - Infrastructure as a Service (IaaS)
  - Platform as a Service (PaaS)
  - Software as a Service (SaaS)
  - Mobile Backend as a Service (MBaaS)
  - Serverless Computing (transaction)

Cloud – Software as a Service (SaaS)

- Solutions provided over the Internet
- Solution can be utilized by customer without server or application involvement (data only)
- Examples
  - DropBox (Doc Control)
  - Salesforce.com (CRM)
  - Quickbooks (Financials)
  - Microsoft Dynamics 365

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Cloud – Application Integration

- Avalara Sales Tax Service
  - Cloud based SaaS for:
    - Tax rate calculation
    - Exempt certificate management
    - Filing and returns
  - Validates the address of where the transaction is occurring
  - Calculates taxes on a document such as a sales order, sales invoice, purchase order, purchase invoice, or credit memo.

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Cloud – Application Integration

- OpenText Facsimile Service
  - Cloud based SaaS for:
    - Facsimile transmission
    - Distribution lists
    - Supports a variety of formats
    - Provides result reports
  - API to Send Facsimile
  - API to check status

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Cloud – Application Integration

- SaaS APIs are generally “standards” based
- Mainframe Applications require middleware Support:
  - Communications
  - XML/JSON construction and parsing
  - Conversion of flat COBOL data structures to/from XML/JSON

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Cloud – Application Integration

- No “native” Mainframe Solution
- Middleware Required (example)
  - Hardware/Software (ePortal, AB Suite)
  - Software Only (MCPJava, MGSWeb)
  - Custom app development using WEBAPPSUPPORT features
    - HTTPCLIENT
    - XMLPARSER

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Cloud – Application Integration

- Example application code to call the SaaS Web Service (generic)

```
COPY "WEBSERVICES/USERFILES/WEBOUT/SAAS-GETTOKEN".

MOVE SPACES TO REQ-RECORD.
MOVE SPACES TO RESP-RECORD.
MOVE “GETTOKEN” TO TRANCODE.
MOVE “SaaS Request Info” TO INPUTDATA.

CALL "INVOKE OF WEBSERVICES/LIBRARY"
  USING SAASFUNCT-PARAM,
        REQ-RECORD,
        RESP-RECORD
        RESULT-STRING
  GIVING RESULT.

IF RESULT NOT EQUAL ZERO
  DISPLAY "Error calling Web Service: “ RESULT-STRING
ELSE
  DISPLAY “Output:” OUTPUTDATA,
  DISPLAY “Status:” STATUSLINE.
```

Cloud – Application Integration

- SaaS can be accessed by mainframe applications
- Application invokes middleware
- Middleware Processing
  - Remap COBOL 01 Request to XML
  - Format SOAP/JSON Request
  - Add HTTP envelope
  - Connect via SSL to SaaS server
  - Send request, receive response
  - Extract SOAP/JSON Response from HTTP
  - Remap XML to COBOL 01 Response

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Cloud – Application Integration

- Many Software as a Service Cloud Services are available today
- Robust middleware exists to allow mainframe applications to directly access these services
- Substantial advantages in using these services (eg. Sales tax calculation by sale location)

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Cloud – Application Integration

- Example Services:
  - Office Time (time tracking)
  - Sage One (accounting)
  - SalesForce
  - Docusign
  - Microsoft Office 365
  - Intuit QuickBooks
  - Intuit Online Payroll
  - Abukai Expenses (reporting/mgt)
  - Google Drive, SkyDrive
  - Microsoft Dynamics 365

Cloud – Application Integration

- Caveats
  - Cloud Services are only as reliable as their provider
  - Once functionality leaves the data center
    - Costs may be reduced
    - Control is lost
  - Must be evaluated on an application-by-application basis
  - Security different for each service

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Additional Questions?

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