

Metrology.NET™

-

ISO 17025 Uncertainty Calculations

Onur ÇETİNER, M.Sc.EE

Spark Kalibrasyon Hizmetleri Ltd. Şti. – Ankara, Turkey

SPARK

- About Presenter
 - About Company
 - Present Problems
 - System Overview
 - Key Points
 - How Do Excel Files Work?
 - How Does Metrology.NET™ Uncertainty Calculator Work?
 - REST Call to Uncertainty Calculator
 - Type-A Repeatability
 - System Value
-

SPARK

- B.Sc (2010) on electrical and electronics eng
- M.Sc (2013) on metrology and software
- Studying Ph.D on metrology and software



Master thesis:

- Software based calibration of high frequency test and measurement devices
- The measurements of power and frequency are modelled
- The models developed are used at the calibration software for uncertainty calculation

SPARK

- The exclusive Keysight Technologies Authorized Service Provider in Turkey since 2011
- The Laboratory operates in accordance with ISO 17025 Standards and provides calibration, repair and maintenance services for RF and Microwave equipment up to 50 GHz
- The authorized technical service provider is updated per new models simultaneously with all Keysight Service Centers worldwide
- R&D activities with software development project for calibration procedures



SPARK

- Separated measurement software and uncertainty calculations
- Difficulties of audit for automated calibration (uncertainty calculation per test point)

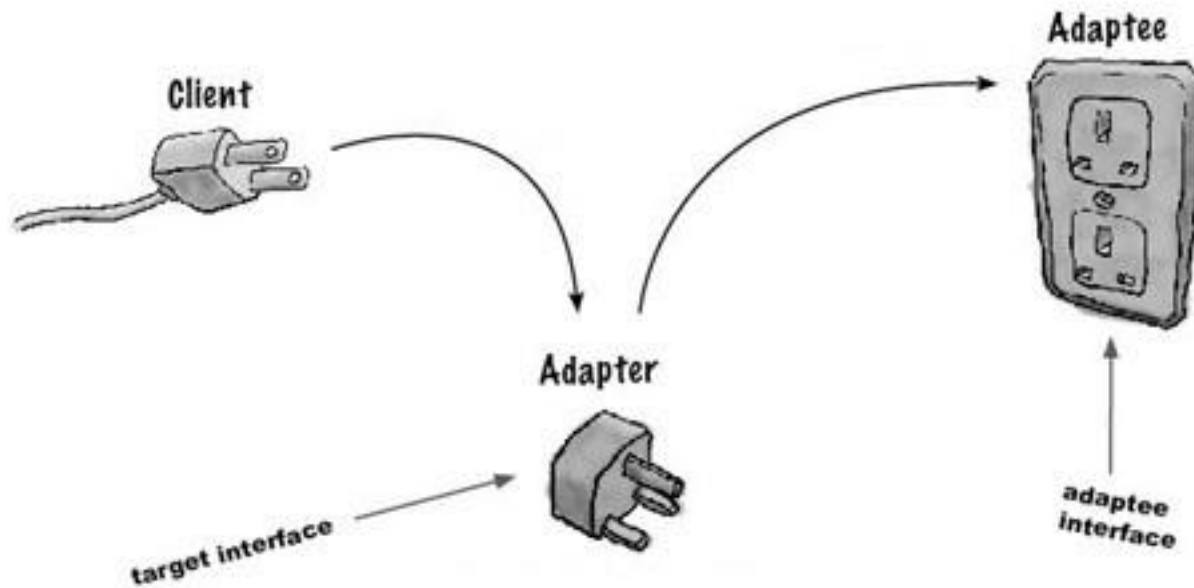


SPARK

- *TestProcess* Type -*TestProcess.Measure.Harmonics*
 - *TestProcess* Implementation -*TestProcessMeasureHarmonics*
 - Uncertainty Calculator -*MeasHarm.CalcUnc*
 - Parameters -*Tp.ParameterArray*
- *TestPoint*
 - *TestResults* - Measured
 - Parameters – *ID, lower limit, nominal value, UoM...*

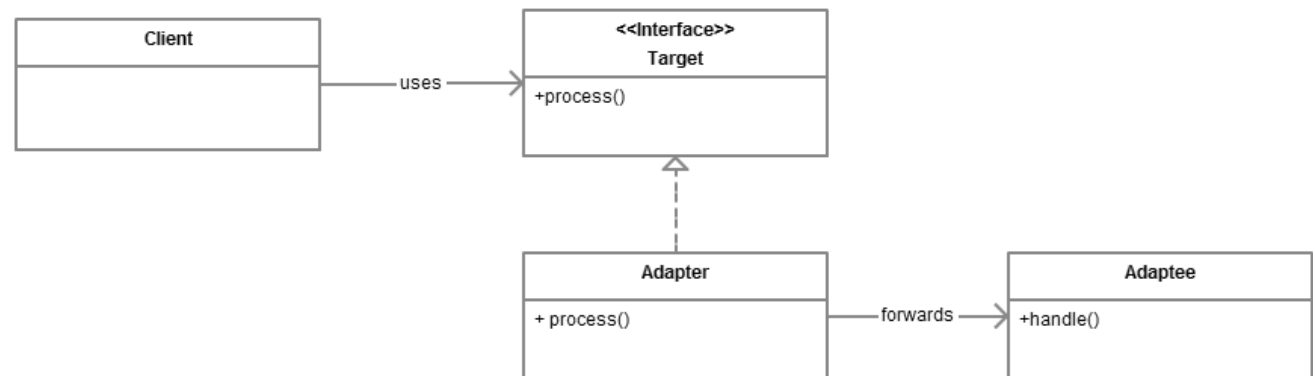
SPARK

- Adapter Pattern



SPARK

- Adapter Pattern
- The *Adaptee* is the existing class
- The *Target* is the interface defined in the existing library
- The *Adapter* is the class that you create, it is inherited from the *Adaptee* class and it implements the *Target* interface



SPARK

- Adapter Pattern



SPARK

- Can use Excel files and budgets in your system
 - For Excel calculations, system back in POI
 - Metrology.NET™ built-in standard
 - Works with multiple software
-

SPARK

User Interface

- Calculation method can be chosen

New Calculator ✕

* **Name:**

Ver:

Author:

Method:

* **Type:**

Process:

* Required Fields

SPARK

Calculation Method: Sheet

- Enables metrology engineer use his/her existing uncertainty calculation budgets with Metrology.NET™
 - Easy to operate with its simple interface
 - Allows the operator to follow the result and uncertainty for each of the test points
-



Calculation Method: Sheet

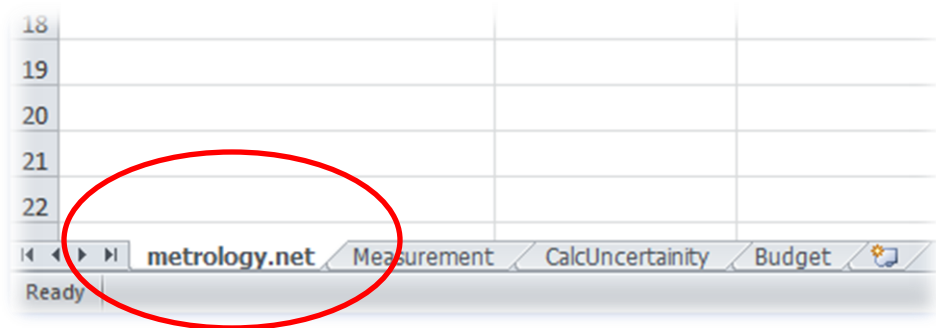
The screenshot shows a Microsoft Excel spreadsheet titled "Power Source 50 MHz - 50 GHz (2.4 mm) (Example) - Microsoft Excel". The spreadsheet is divided into several sections. The first section is a header row with "Metrology.NET Interface". The second section is a result row with "Result" and "7.71E-08". The third section is a table with three columns: "Contributors", "Value", and "Contributor Type". The table contains the following data:

Contributors	Value	Contributor Type
Measured Power	9.65E-07	Required
Measured Power Uncertainty	0	Required
Resolution	1.00E-04	Required
Unit	1.00E-06	Required
Linearity	2.00E-02	Required
CF	9.19E-01	Required
CF Uncertainty	3.42E-02	Required
psensor	1.48E-01	Required
SG SWR	3.33E-01	Required

SPARK

Metrology.NET™ Tab

- Tab «metrology.net» is the interface



SPARK

Inputs

- Inputs are under «Contributors»

2	Metrology.NET Interface		
3			
4	Result	7.71E-08	
5			
6	Contributors	Value	Contributor Type
7	Measured Power	9.65E-07	Required
8	Measured Power Uncertainty	0	Optional
9	Resolution	1.00E-04	Optional
10	Unit	1.00E-06	Optional
11	Linearity	2.00E-02	Optional
12	CF	9.19E-01	Optional
13	CF Uncertainty	3.42E-02	Optional
14	psensor	1.48E-01	Optional
15	SG SWR	3.33E-01	Optional
16			
17			

SPARK

Output

- Output is presented as «Result»

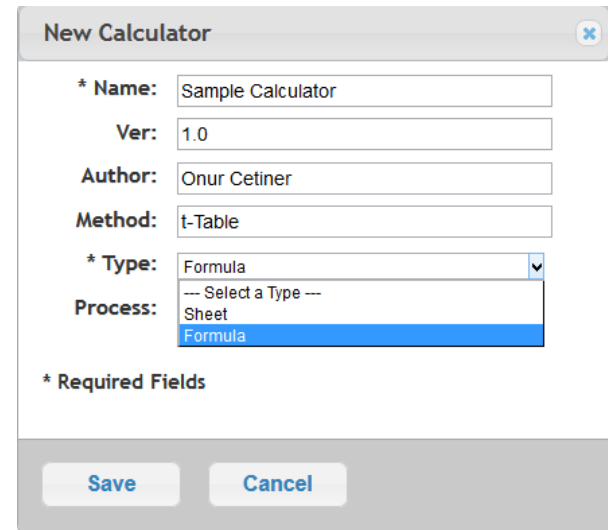
2	Metrology.NET Interface		
3			
4	Result	7.71E-08	
5			
6	Contributors	Value	Contributor Type
7	Measured Power	9.65E-07	Required
8	Measured Power Uncertainty	0	Optional
9	Resolution	1.00E-04	Optional
10	Unit	1.00E-06	Optional
11	Linearity	2.00E-02	Optional
12	CF	9.19E-01	Optional
13	CF Uncertainty	3.42E-02	Optional
14	psensor	1.48E-01	Optional
15	SG SWR	3.33E-01	Optional
16			
17			

How Does Metrology.NET™ Uncertainty Calculator Work?

SPARK

User Interface

- Calculation method can be chosen



New Calculator

* Name: Sample Calculator

Ver: 1.0

Author: Onur Cetiner

Method: t-Table

* Type: Formula

Process: Formula

* Required Fields

Save Cancel

How Does Metrology.NET™ Uncertainty Calculator Work?


SPARK

User Interface

- Sources of uncertainty can be identified

Manage An Uncertainty Parameter

Symbol:	Sources of Uncertainty:	Type:
Va	Voltage Applied	A
Nominal:	Limits:	Units:
10.0	15.0	mV

 Normal k=2
divisor : 2 #Normal (k=2)

Sensitivity:	Standard Uncertainty:
1.0	7.5

Calculate

Delete this Parameter

Update An Uncertainty Parameter

Cancel

How Does Metrology.NET™ Uncertainty Calculator Work?

SPARK

User Interface

- Built-in standard

Metrology.NET Assets Logout

Test Packages Work Orders System Data Administration Calculator

New Formula Clone Formula Edit /Delete Formula

UID: xxx Revision #: 12
Name #: Uncertainly Analysis Power Meter ET90-0293 Author #: Wendy's 2013 Oldemark LLC.
Type: #: Type of test TestProcessID #: 222222222222222

Show Details Save Budget Add new row

A Uncertainty Budget

Page 1 of 1 View 1 - 10 of 10

Symbol	Sources of Uncertainty	Type	Nominal	Value a_j	Units	Probability Distribution	Divisor	Sensitivity Coefficient c_j	Standard Uncertainty $U_j(y)$

RESULTS: #:
Combined Standard Uncertainty 0
Expanded Uncertainty 0

How Does Metrology.NET™ Uncertainty Calculator Work?

SPARK

Data About Your Budget

- Methodology
- Assumption
- References
- Notes

The screenshot shows the 'Uncertainty Sheet' page in the Metrology.NET application. The page has a blue header with the Metrology.NET logo, the title 'Uncertainty Sheet', and a 'Logout' link. Below the header is a navigation menu with tabs for 'Test Packages', 'Work Orders', 'System Data', 'Administration', and 'Calculator'. The main content area displays a confirmation message: 'The calculator record was saved'. Below this, there are several input fields: 'ID' (with a value 'eadc3e25-a829-4cc1-87a0-13c70d865002'), 'Process' (empty), 'Name' (with a value 'Sample Calculator'), 'Ver.' (with a value '1'), and 'Author' (with a value 'Onur Cetiner'). A 'Hide Details' button is located below the 'Name' field. Further down, there are text areas for 'Methodology' (with a value 't-Table'), 'Assumption', 'Refs.', and 'Notes'. At the bottom of the form, there is a 'Sheet' field and a 'Gözet.' button with the text 'Hiçbir dosya seçilmedi.'. A blue 'Save Changes' button is positioned below the form fields. The footer of the page contains the copyright information: '©2013 - 2014 Cal Lab Solutions | All rights reserved.'

SPARK

What is REST?

- REST: **R**epresentational **S**tate **T**ransfer

- Uniform Interface
- Stateless
- Cacheable
- Client-Server
- Layered System
- Code on Demand (optional)

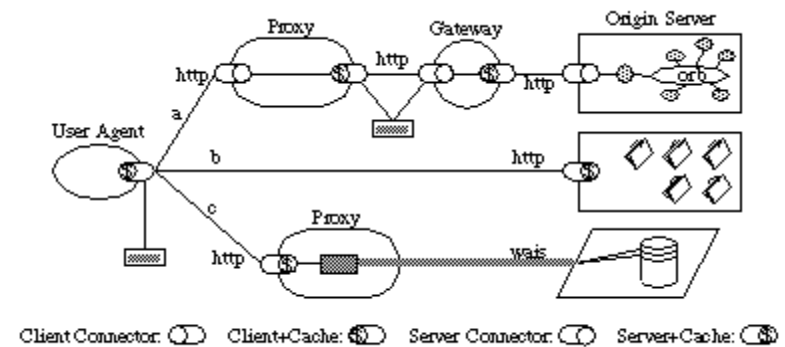


Figure 5-10. Process View of a REST-based Architecture

SPARK

About JSON

- JavaScript **Object Notation**
- An open standard format that uses human-readable text to transmit data objects consisting of attribute–value pairs
- Allows more content to be transmitted using smaller packages
- Used primarily to transmit data between a server and web application, as an alternative to XML





Call from any software

Sample REST call:

<http://mysite/calUncVal.json?key=123456789>

Measured Power:	9.65E-07
Measured Power Uncertainty:	0
Resolution:	1.00E-04
Unit:	1.00E-06
Linearity:	2.00E-02
CF:	9.19E-01
CF Uncertainty:	3.42E-02
ρSensor:	1.48E-01
SG SWR:	3.33E-01

Return message will contain this information:

```
statusCd: 0 (0 problem)
val:      1.9E-5
message:  00000000-0000-0000-0000-000000000002
version:  1.0
action:   NA (No Action)
```

REST Call to Uncertainty Calculator

The logo for SPARK, featuring the word "SPARK" in a bold, blue, sans-serif font. The letters are slightly italicized and have a white outline. The logo is positioned on the left side of the slide, with a blue circular graphic element behind it.

```
Dim Agent As Agent = New Agent("ed4fa41b-1694-4721-b577-648cbb640d67", _
                                "AgentTester", "http://localhost:8088/darwin", "Online")

If Not Agent Is Nothing Then ' Check Agent Instance
    ' Login to the Server
    If Agent.Login("TestStation1", "Pass1234") = True Then

        ' Create Parameters List
        Dim Params As New List(Of Parameter)
        Params.Add(Parameter.NewParameter("Voltage", "10"))
        Params.Add(Parameter.NewParameter("Range", "10"))
        Params.Add(Parameter.NewParameter("Std", "0.000001"))

        ' Create Link to Specific Calculator
        Dim UncCal As New Uncertainty("1017e01a-f0e7-4928-9895-0a698da6f302", "1.0", Params)
        UncCal.Calculate()

        ' See the Unc Calculation
        MsgBox("    Unc= " & UncCal.Uncertainty & vbCrLf & _
              "    Using= " & UncCal.UncertaintyID & vbCrLf & _
              "Version= " & UncCal.Version, vbOK)
    Else
        Throw New Exception("Error Logging on to the Server!" & vbCrLf & "Unknown User Name and/or
        Password!")
    End If
Else
    Throw New Exception("No Connection to the Server!")
End If
```


SPARK

Distribution

Measured Power 1 :	9.975E-06
Measured Power 2 :	9.978E-06
Measured Power 3 :	9.981E-06
Measured Power 4 :	9.982E-06
Measured Power 5 :	9.984E-06
Measured Power 6 :	9.987E-06
Measured Power 7 :	9.986E-06
Measured Power 8 :	9.987E-06
Measured Power 9 :	9.988E-06
Measured Power 10:	9.989E-06
Mean Power:	9.9837E-06
Standard Deviation:	0.0046E-06
Uncertainty:	0.0015E-06



SPARK

Multiple software support

We standardize the interface

No matter the discipline, it is standardized

We provide Revision Control over the budgets

We can centralize storage

Organized storage and approved use

Thank You



Any Questions?
