Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB Seminar

Online service for validating metrological algorithms

Physikalisch-Technische Bundesanstalt
(Bundesallee 100, 38116 Braunschweig, building: Seminarzentrum, room A)

Agenda

09:00	**Welcome** Dr. Frank Härtig
09:10	**TraCIM, the new validation concept** Dr. Frank Härtig
09:30	**TraCIM, the association and „business“ concept of PTB** Mr. Manfred Gahrens
10:00	**TraCIM client design and data exchange format (XML)** Mr. Dipl.-Ing. Matthis Franke
10:30	**Coffee break and group photo**
11:00	**Run your first TraCIM client** TraCIM experts will teach to establish your first example and to communicate with the PTB-TraCIM server; Remark - example code in c# is available - it would be beneficial if you provide your personal developer environment free software can be used to run the examples: .NET Framework 4.5 (www.microsoft.com/download/details.aspx?id=30653) Microsoft Visual Studio > 2012 (www.microsoft.com/download/details.aspx?id=34673)
13:00	**Lunch (PTB canteen)**

Agenda

14:00	**Run your first TraCIM client - to be continued and answering technical questions**
15:00	**Feedback from the participants and ideas for improving the TraCIM service** Dr. Klaus Wendt
15:50	**TraCIM, outlook** Dr. Klaus Wendt
16:00	**Visiting laboratories**
17:30	**Closure**

TraCIM the project

TraCIM – Traceable computational intensive metrology

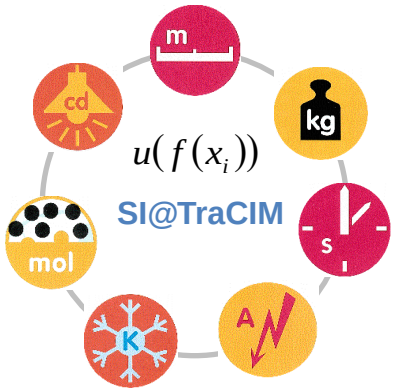
Coordination: National Physical Laboratory (NPL)

Duration: June 2013 – May 2015

Budget: 2,7 Mio €

Partners: 6 NMIs/DIs; 3 Universities, 4 industrial partners

TraCIM embedded in established structures



EURAMET
European Association of National Metrology Institutes

GUM

VIM

Validation of algorithm in metrology - today

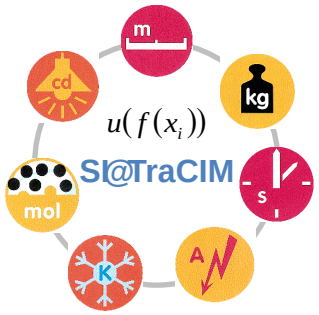
Individual NMIs offer validation
- often without report
- PTB offers report for Gaussian test for prismatic objects

Manual operation via email -> cost intensive and time consuming

No agreement among NMIs

TraCIM – build on three pillars

Service-provider



Service-user

test-data
reference results

user
algorithms

Technical aspects: unambiguous and confident test-data

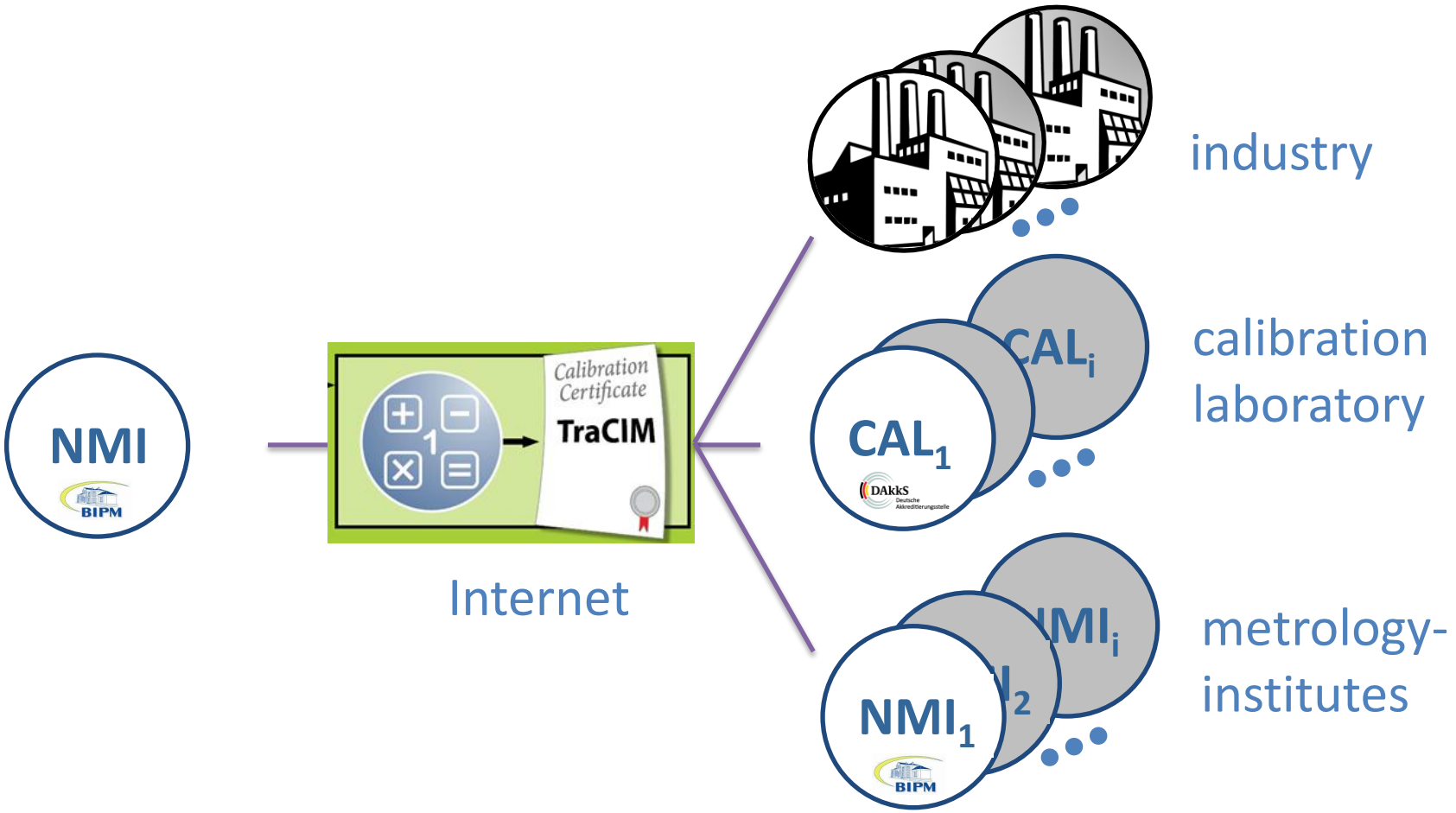
Legal aspects: worldwide accepted rules and agreements

Monetary aspects: service costs

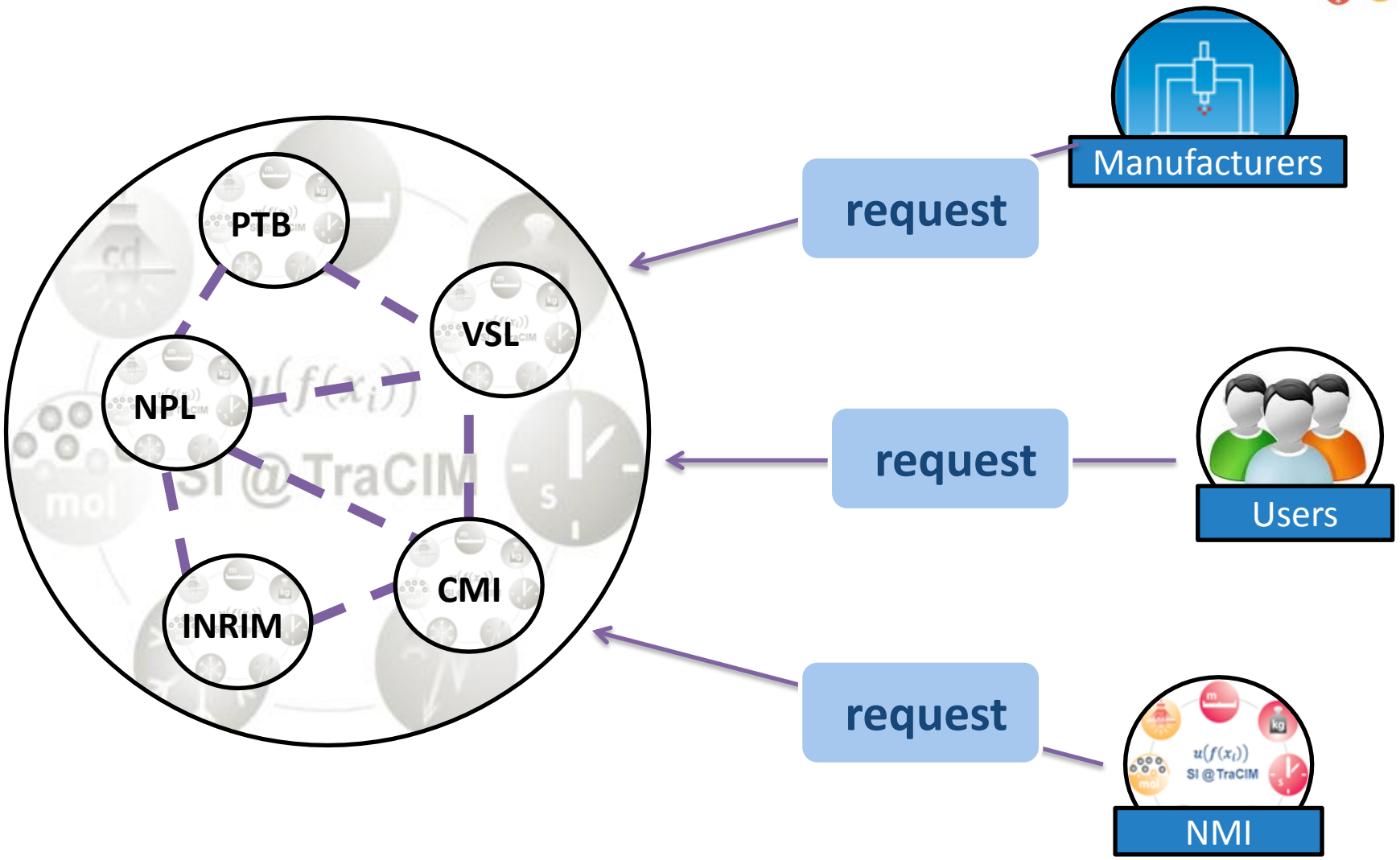
TraCIM service

Service provider

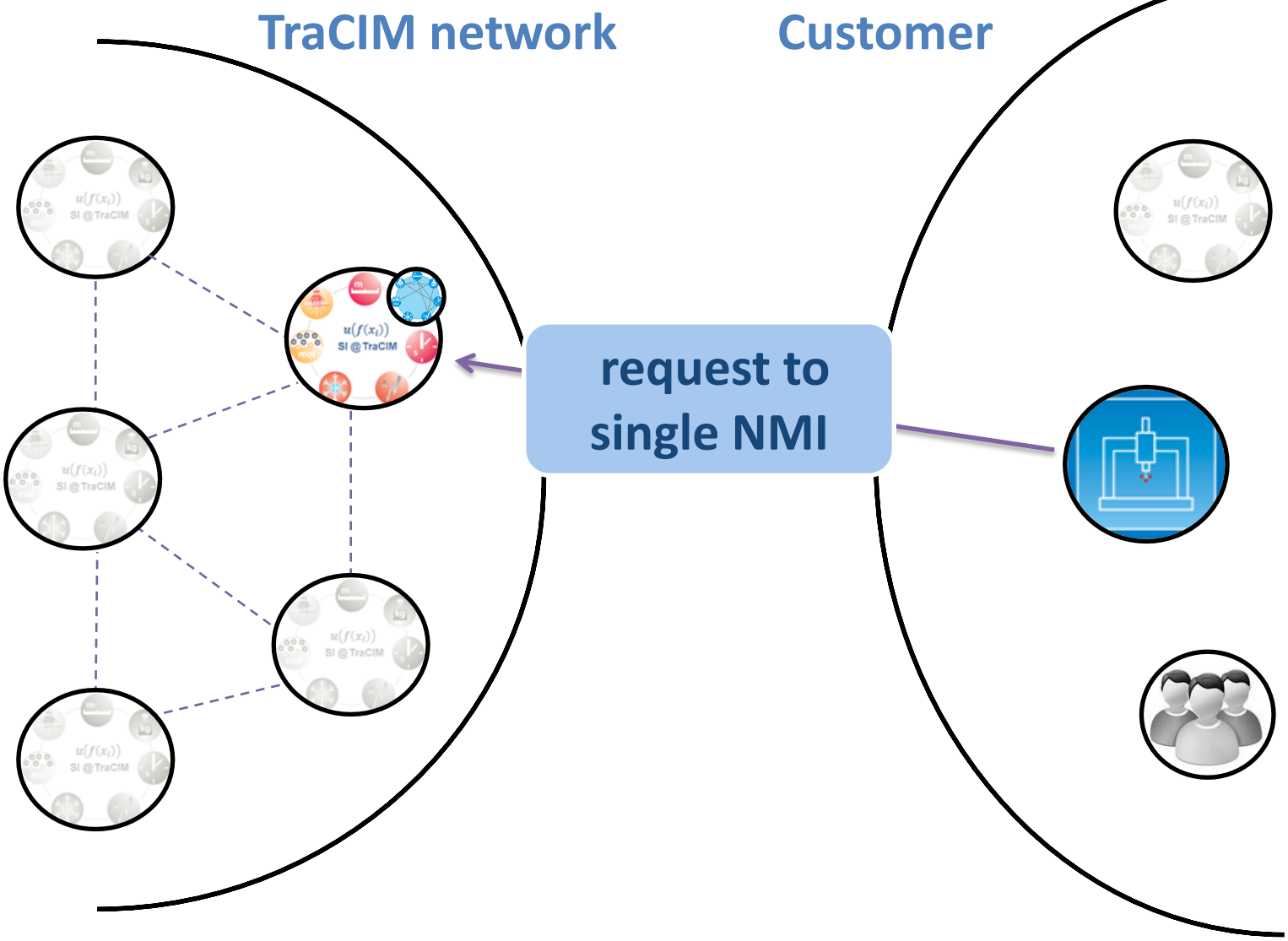
Service user



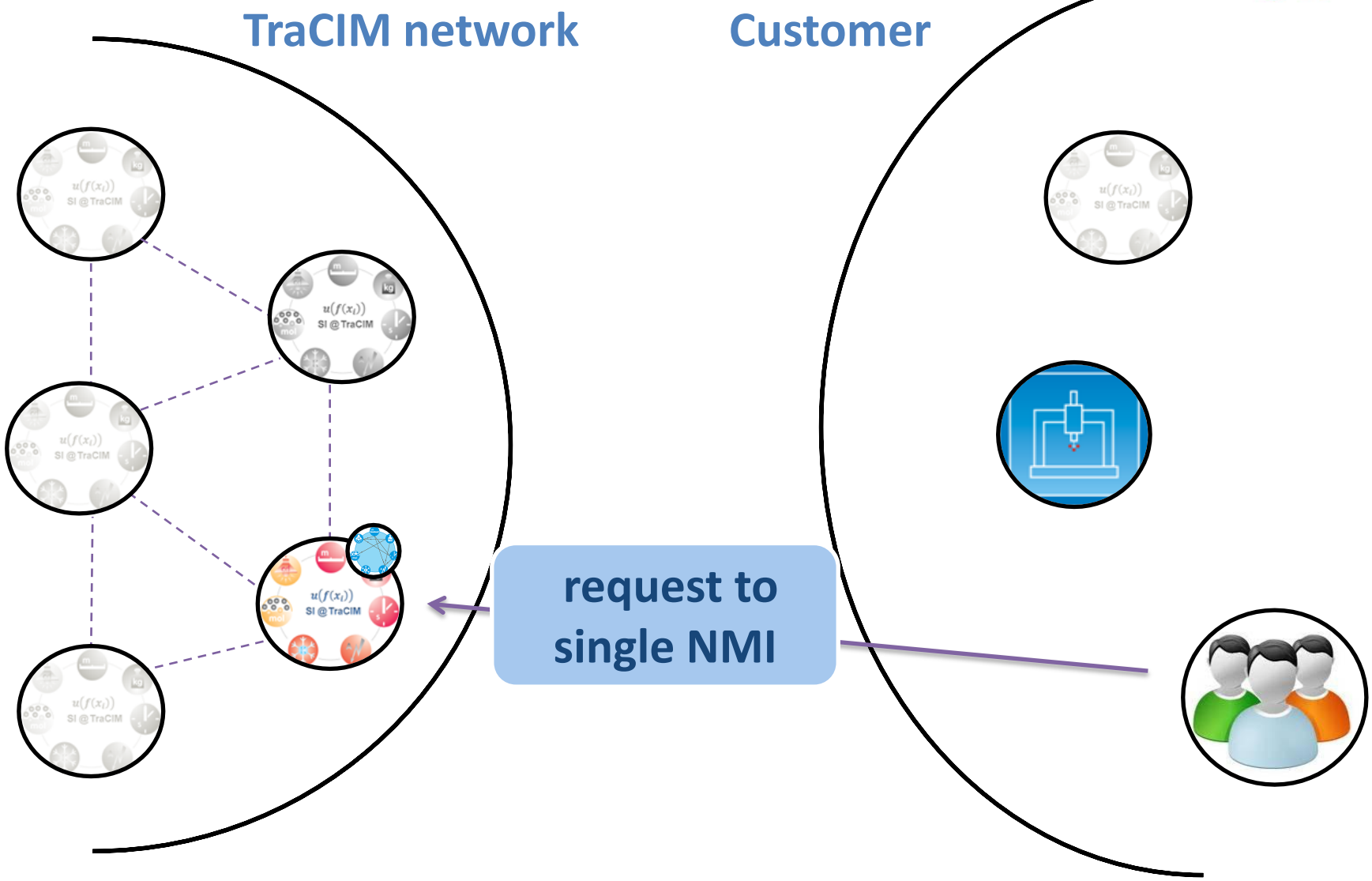
TraCIM network



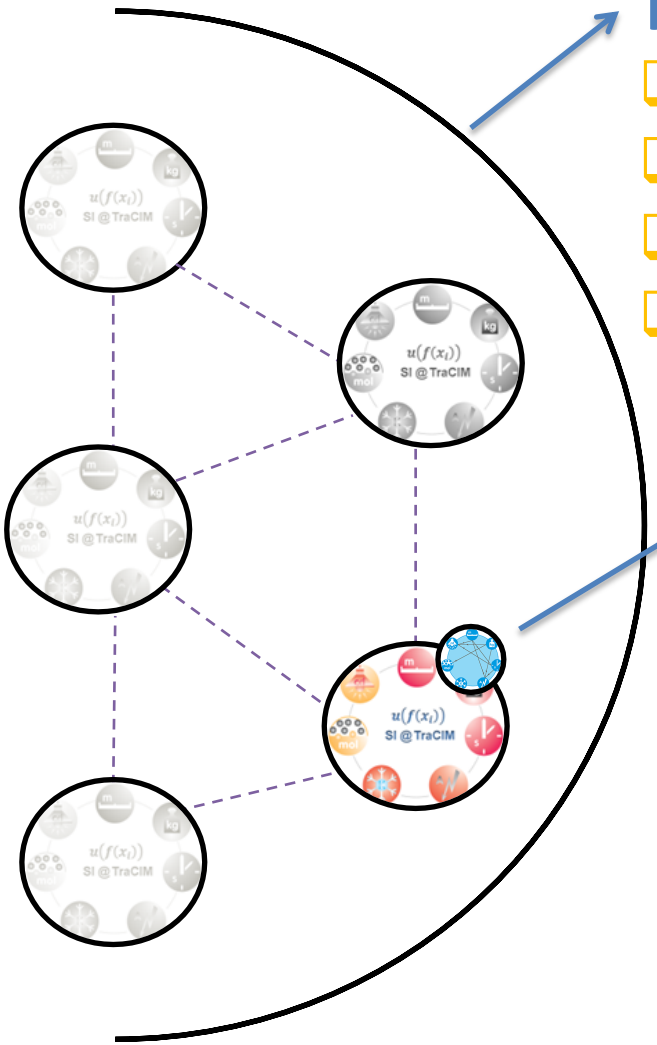
Request procedure



Request procedure



TraCIM service versa TraCIM association



TraCIM association

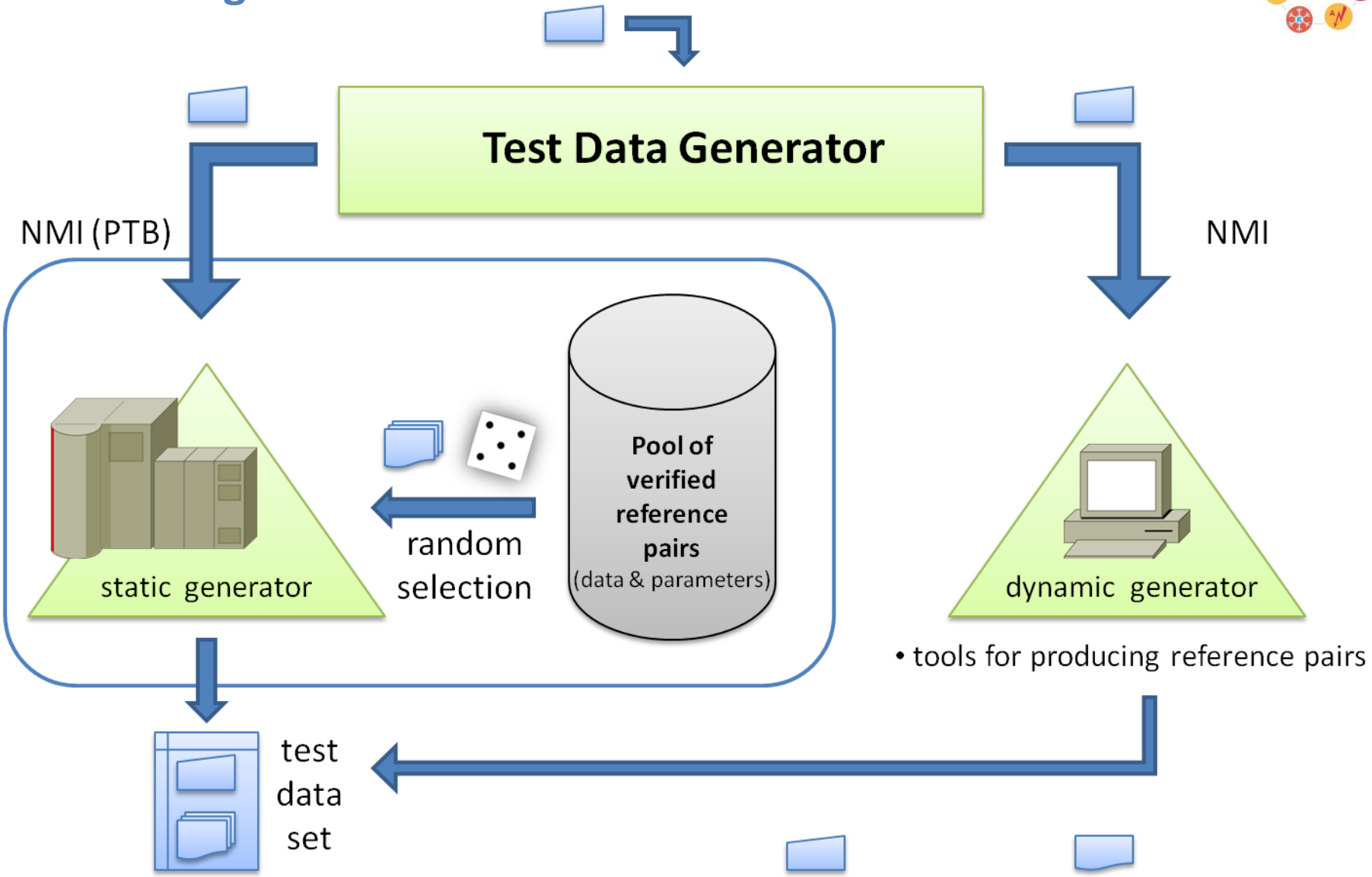
- members only NMIs or DIs
- operated by the TraCIM secretariat
- responsible for quality specification
- responsible for quality control

TraCIM service

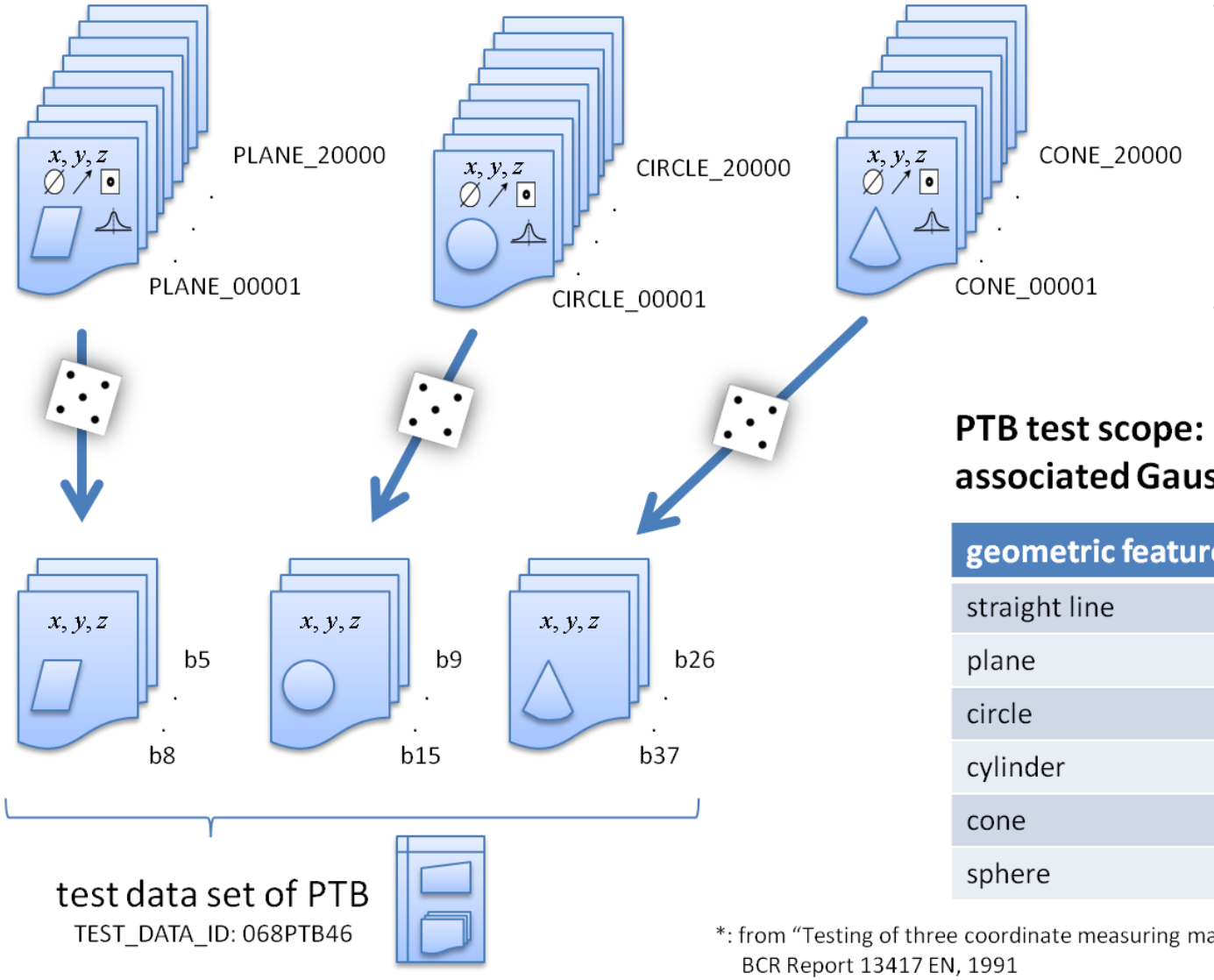
- operated by a single NMI/DI
- individual contract between NMI/DI – service user
- NMI/DI responsible for correctness of test
- NMI/DI receives full income

Test data

Test data generator



PTB Gaussian test data

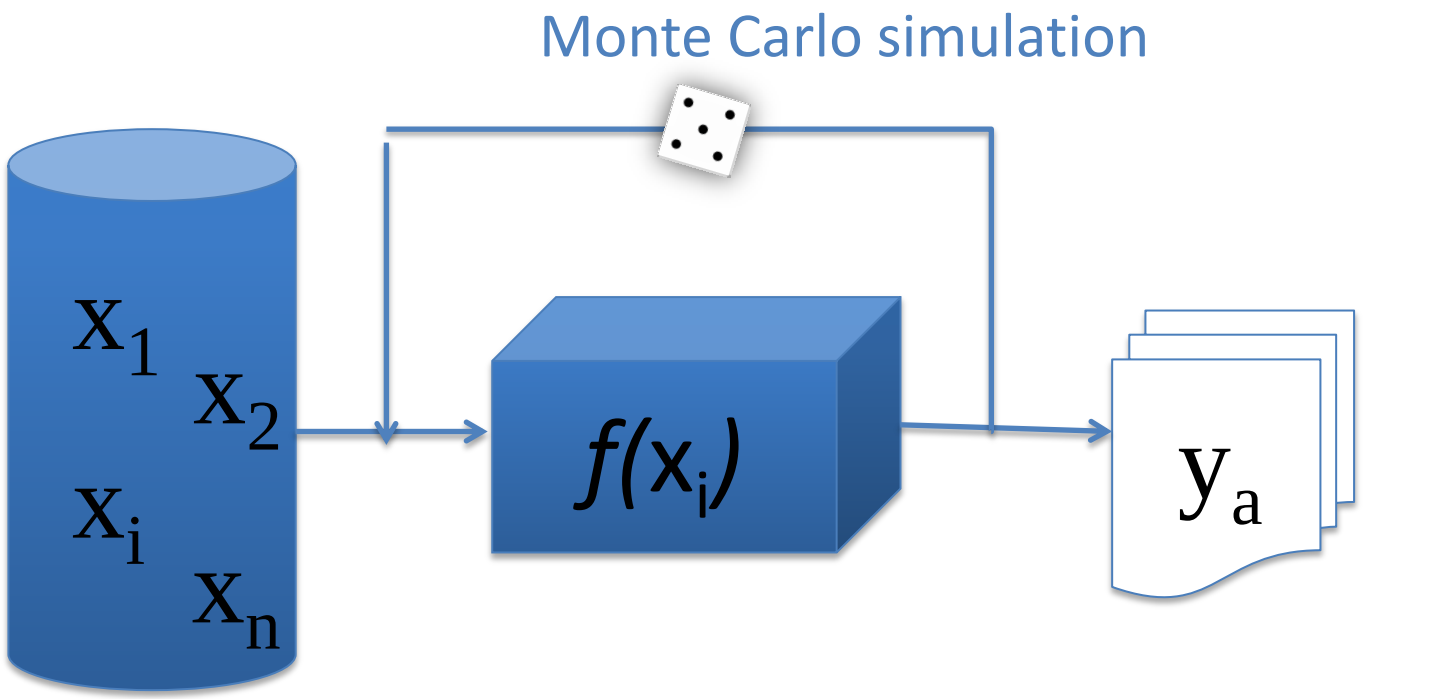


PTB test scope: computation of associated Gaussian elements*

geometric feature	data set id
straight line	b1 – b4
plane	b5 – b8
circle	b9 – b15
cylinder	b16 – b25
cone	b26 – b37
sphere	b38 – b44

*: from "Testing of three coordinate measuring machine algorithms, Phase II", BCR Report 13417 EN, 1991

Accuracy of test data



reference result $Y = \overline{y} \pm U(k=2)$

Estimating numerical uncertainty

test data

x_1 = 30.16392475199 9
y_1 = 11.59177013498 2
z_1 = 25.47287456743 4

x_2 = 30.45545987402 7
y_2 = 12.56425757826 7
z_2 = 25.94257564822 1
…
x_n = 99.35265624524 6
y_n = 89.53466662456 6
z_n = 50.55555315418 8

reference result

2 digits considering unknown systematic effects

simulations > 1000 variance

a = 47. 56425757 8 674

numerical uncertainty 10^{-7}

Randomly varying the last digit (Monte Carlo)

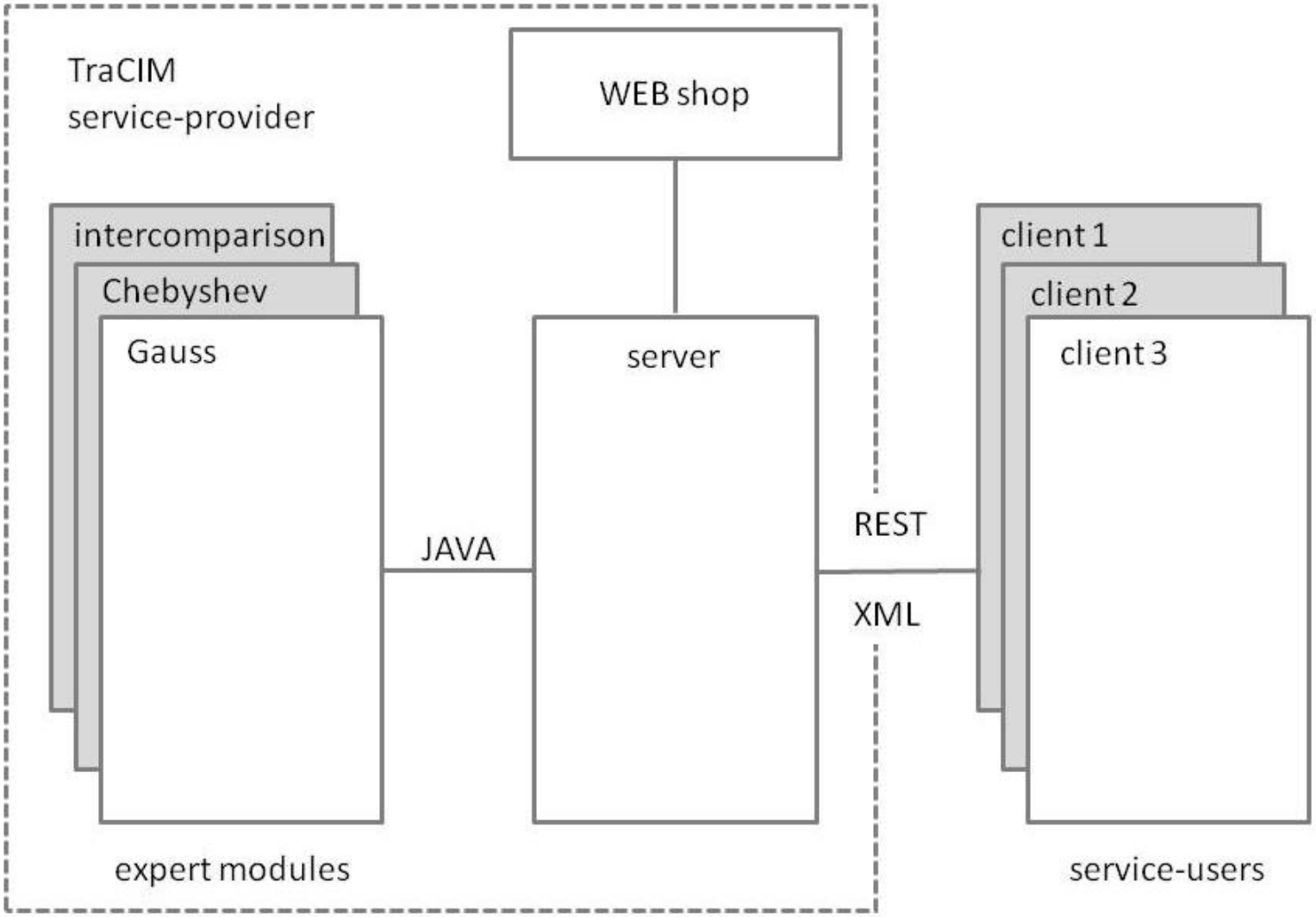
PTB Gaussian test data

max. uncertainties

geometric feature	angle between directions	location	size	apex angle
straight line	1×10^{-9}	2×10^{-15}		
plane	7×10^{-10}	1×10^{-15}		
3D circle	1×10^{-9}	2×10^{-10}	1×10^{-10}	
cylinder	1×10^{-8}	7×10^{-11}	6×10^{-11}	
cone	1×10^{-8}	6×10^{-10}	6×10^{-11}	1×10^{-8}
sphere		3×10^{-11}	2×10^{-11}	

Client – Server architecture

Client sever design

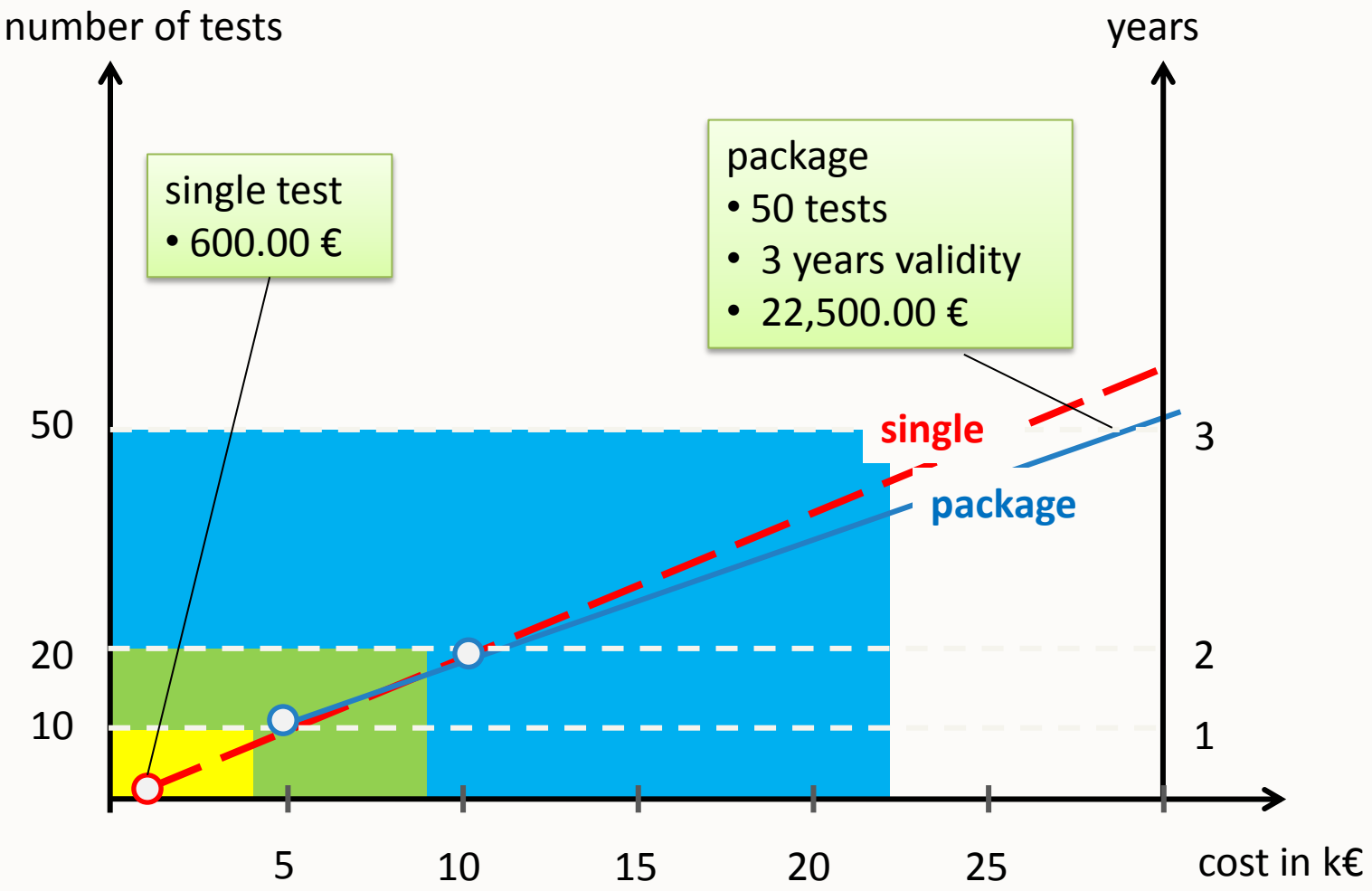


TraCIM service

TraCIM - evaluation process

TraCIM service	customer
	registration request (email)
registration conformation (email)	
	buy test; advanced payment
confirm payment (email)	
	order test – data (server/client)
submit test-data (server/client)	
	submit test-results (server client)
submit report (server/client)	

PTB – Gaussian test



First TraCIM certificate

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

Prüfbericht
Test Report

Gegenstand:
Object:

Auswertesoftware nach Gauß für Koordinatenmessgeräte
Evaluation software based on least-squares method for coordinate measuring machines

Hersteller:
Manufacturer:

Mitutoyo

Typ:
Type:

MCOSMOS v4.1

Auftraggeber:
Applicant:

Mitutoyo

Ergebnis:
Result:

bestanden

Anzahl der Seiten:
Number of pages:

4

Prüfzeichen:
Test Mark:

06817AAA

Geschäftszeichen:
Reference No.:

PTB-5.3-4006912

Datum der Prüfung:
Date of test:

03.6.2014

Im Auftrag
On behalf of PTB

Dr.-Ing. Frank Härtig

Braunschweig, 03.6.2014

Siegel
Seal

Im Auftrag
On behalf of PTB

Dr.-Ing. Klaus Wendt

Dr. Loebnitz Mitutoyo, Dr. Härtig PTB
Handing over the 1st certificate on June 2014

TraCIM e. V. – quality rules

§1 reference parameter and its' reference uncertainty must be provided

§2 test shall provide only one correct result

§3 input data are error free

§4 test shall reflect common practical situations no academic situations

§5 clear description of the test shall be provided

§6 test data (or software) shall be available for at least 50 years

§7 it is recommended to provide a public test; test-data and reference parameter

Outlook

CMC entries and database BIPM

TraCIM

Traceability for Computationally Intensive Metrology

PTB

Legal Info | about TraCIM | documents | contact | info

domain

all

specific test

-

number of tests

single test

Submit Order

login

username

password

register

welcome to TraCIM

select/register

TraCIM

Traceability for Computationally Intensive Metrology

PTB

Legal Info | about TraCIM | documents | contact | info

domain

all

- all
- general
- SI length
- SI mass
- SI temperature
- SI ....
- .....
- .....
- .....
- .....
- .....
- .....

login

username

password

register

select domain

TraCIM

Traceability for Computationally Intensive Metrology

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Legal Info | about TraCIM | documents | contact | info

domain

SI length

specific test

Gauss 2D

comparison (calculating reference valu
comparison (given reference value)
involute gear
Gauss 2D
Gauss 3D
Chebysheff 2D
Chefysheff 3D
....

login

username

password

register

select specific test

TraCIM

Traceability for Computationally Intensive Metrology

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domain

SI length

specific test

Gauss 3D

number of tests

single test

- single test
- 10 tests; 1 year
- 20 tests; 3 years
- 50 tests; 5 years
- public testdata

login

username

password

register

Gauss 3D
10 tests
valid until dd.mm.YYYY
360,00 € incl. tax

select number of tests

TraCIM

Traceability for Computationally Intensive Metrology

PTB

Legal Info | about TraCIM | documents | contact | info

domain

SI length

specific test

Gauss 3D

number of tests

10 tests; 1 year

order

CMM company perfect

Identification No.
PTB123

my budget

my data

logout

Gauss 3D
10 tests
valid until dd.mm.YYYY
360,00 € incl. tax

order

Algorithm validation offered until 2015

- Gaussian Test: TraCIM-service 600,- €; traditional 2000,-€
  available since May 2014

- Chebyscheff: TraCIM-service 2000,- €; traditional 4000,-€
  likely available beginning of 2015

- Intercomparison: TraCIM-service 150,- €; traditional 2000,-€
  likely available beginning of 2015

- ...

Special offer by March 30, 2015
Gaussian and Chebyscheff 150 €
Intercomparison free