



COSMIC - ISO 19761

**Guideline for Sizing
Business Intelligence Dashboard
Development**

COSMIC Version 5.0

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Foreword.

The purpose of this Guideline is to show how to measure the functional size of a Business Intelligence (BI) dashboard development using the COSMIC – ISO 19761 international standard.

BI dashboard developers can use such a functional size for estimating development effort and cost and plan their dashboard development.

Moreover, functional sizes and related estimated efforts across BI dashboard technologies can also be taken into account to determine the most appropriate technology for a specific context.

This Guideline is based on the paper:

'Business Intelligence Dashboard Software Development: An Empirical study of COSMIC. Size-based Effort Estimation Using Machine Learning Techniques' [\[1\]](#).

- For COSMIC sizing terminology see the Measurement Manual Part 1 [\[2\]](#).
- For the COSMIC measurement guidelines see the Measurement Manual Part 2 [\[3\]](#).
- For fundamentals of software estimation see [\[4\]](#).

Editors:

Alain Abran, Ecole de technologie supérieure (Canada),

Arlan Lesterhuis (The Netherlands).

Other members of the COSMIC Measurement Practices Committee:

Jean-Marc Desharnais, Ecole de technologie supérieure – University of Quebec (Canada),

Peter Fagg, Pentad (UK),

Andrés Gutierrez, Leda MC (Colombia),

Dylan Ren, Measures Technology LLC (China),

Bruce Reynolds, Tecolote Research (USA),

Hassan Soubra, ECE Lyon - Ecole d'Ingénieurs - Engineering School (France),

Sylvie Trudel, Université du Québec à Montréal - UQAM (Canada),

Francisco Valdés Souto, Spingere (Mexico),

Frank Vogelezang, Adviescollege ICT-toetsing (The Netherlands).

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1 INTRODUCTION.

The development of Business Intelligence (BI) dashboards requires one to access the relevant data across a number of sources and technologies, integrate them automatically as specified and present them to the users. For BI Dashboards, such functionality is typically defined across various layers and would vary across environments.

As recommended in [1], to account for all software to be developed for a BI Dashboard a functional measurement scope should be defined for each layer:

- Each layer will be the scope of a separate measurement, allowing to collect the development effort by layer.
- The information collected by layer can next be used for estimation or for size-effort comparison across BI technologies used across the distinct layers.

Section 2 presents a 3-layer BI Architecture and the corresponding COSMIC concepts for sizing purposes.

Section 3 presents a number of examples of functional processes of the layers of the BI Architecture.

Section 4 presents functionality and its division into functionality per layer of the BI Architecture.

Section 5 presents the measurement of the Data Studio dashboard.

2 SIZING A 3-LAYER BI SOFTWARE ARCHITECTURE.

This section presents the components of the 3-layer BI software architecture and the related COSMIC concepts for their sizing in COSMIC Function Points.

2.1 The 3-layer BI software architecture.

The 3-layer BI software architecture consists of three types of functionality – see Figure 1:

- The presentation layer handles the user interactions with the dashboards and reports.
- The processing layer handles the connection to the data sources, data calculations, and transformations and sends the data to the presentation layer.
- The data layer consists of the infrastructure software that provides data to the processing and presentation layers.

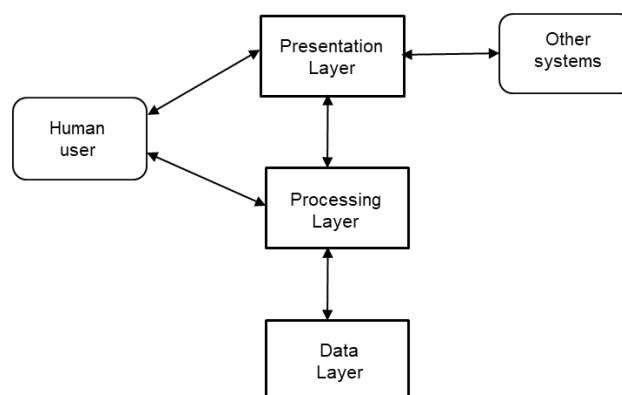


Figure 1: Overview of the 3-layer BI software architecture.

The arrows in Figure 1 indicate a functional user relationship with software in the layers.

2.2 Functional users of the BI Dashboard layers.

A) *The functional users of software in the presentation layer are:*

- the human user who reads reports, applies filters, controls access and shares reports;
- the software in the processing layer that sends updated data to the charts in the presentation layer;
- other systems that can read the data and display it in another system (for instance in a website) as a dashboard.

B) *The functional users of software in the processing layer are:*

- the human user who can directly develop a regular expression, a calculated field, and other components such as scripts;
- the software in the presentation layer that retrieves transformed data for the dashboards and reports;
- the software in the data layer that sends data to the processing layer.

C) *The functional users of software in the data layer are:*

- the software in the processing layer, requesting data from the data sources and storage.

3 EXAMPLES OF FUNCTIONAL PROCESSES IN THE LAYERS.

This section illustrates some functional process examples in the layers.

Note: in this section the objects of interest and the data groups of the data being moved have been omitted as these can easily be deduced from the data movement descriptions.

3.1 Functional processes in the presentation layer.

1 Functional process Capture user interaction, 2 CFP

E User provides a filter or input

W Record filter or input

2 Functional process Transmit request to the processing layer, 2 CFP

E Enter input

X Send input to the processing layer

3 Functional process Receive processed data, 2 CFP

E Receipt of processed data

W Processed data stored

4 Functional process Render dashboard visuals, 2 CFP

E Data to be displayed

X Output charts/tables

3.2 Functional processes in the processing layer.

1 Functional process Register query request, 2 CFP

E Receipt of query request

W Record/log request

2 Functional process Request data from the data layer, 2 CFP

- E Receipt of query instructions
- X Send query instructions to the data layer
- 3 Functional process Apply business logic, 2 CFP
- E Receipt of raw data
- W Perform calculations (SUM, AVG, COUNT) and store results
- 4 Functional process Deliver processed results, 2 CFP
- E Receipt of computed results from the data layer
- X Send to the presentation layer

3.3 Functional processes in the data layer

- 1 Functional process Retrieve data from SQL, 3 CFP
 - E Receipt of request
 - R Read data from SQL
 - X Deliver results
- 2 Functional process Retrieve data from data warehouse, 3 CFP
 - E Receipt of request
 - R Read data from data warehouse
 - X Deliver results
- 3 Functional process Retrieve data from Google Analytics (GA4), 3 CFP
 - E Receipt of request
 - R Read data from GA4
 - X Deliver results
- 4 Functional process Retrieve data from Google Cloud, 3 CFP
 - E Receipt of request
 - R Read data from Google Cloud
 - X Deliver results
- 5 Functional process Retrieve data from API, 3 CFP
 - E Receipt of request
 - R Read data from a linked API
 - X Deliver results

4 FUNCTIONAL PROCESSES OF THE 3-LAYER BI SOFTWARE ARCHITECTURE.

This section illustrates the measurement of the functional processes of the Data Studio dashboard per layer. As sequence diagrams clearly show the data movements between the layers, these are used to draw 4 functional processes of the 3-layer BI software architecture. The size of each layer of the functional process is added. Table 1 provides an overview of the sizes.

In the sequence diagrams below the data movements of a functional process in a layer are indicated by arrows. The data movement types are indicated by E, X, R and W, added immediately to the left and right of the layer column. The number of these data movements is the size of the functional process in its layer.

As the sequence diagrams speak for themselves writing out the data movements is not considered necessary.

4.1 Functional process User creates report.

- The size of the functional process in the presentation layer is 6 CFP.
- The size of the functional process in the processing layer is 9 CFP.
- The size of the functional process in the data layer is 8 CFP.

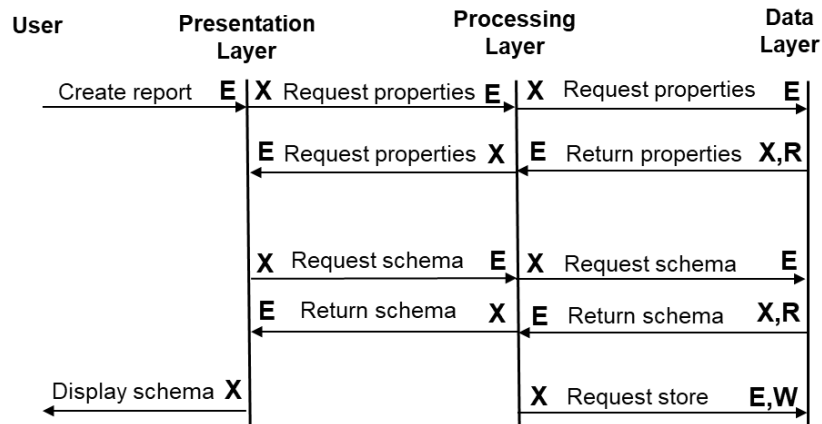


Figure 2: Illustration of the 3-layer BI software architecture corresponding to functional process User creates report.

4.2 Functional process User adds a region-level summary chart.

- The size of the functional process in the presentation layer is 6 CFP.
- The size of the functional process in the processing layer is 8 CFP.
- The size of the functional process in the data layer is 8 CFP.

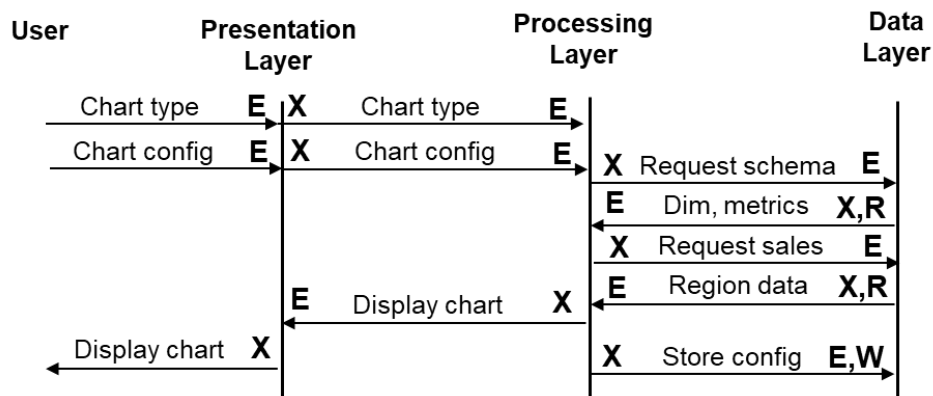


Figure 3: Illustration of the 3-layer BI software architecture corresponding to functional process User adds a region-level summary chart.

4.3 Functional process User enables drill-down interaction.

- The size of the functional process in the presentation layer is 6 CFP.
- The size of the functional process in the processing layer is 8 CFP.
- The size of the functional process in the data layer is 8 CFP.

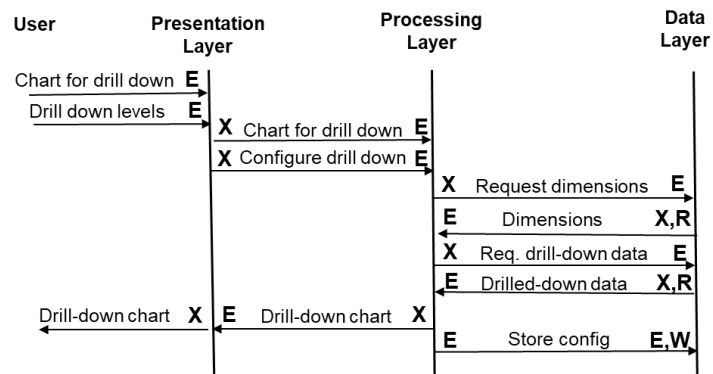


Figure 4: Illustration of the 3-layer BI software architecture corresponding to functional process User enables drill-down interaction.

4.4 Functional process User configures time series chart.

- The size of the functional process in the presentation layer is 7 CFP.
- The size of the functional process in the processing layer is 9 CFP.
- The size of the functional process in the data layer is 8 CFP.

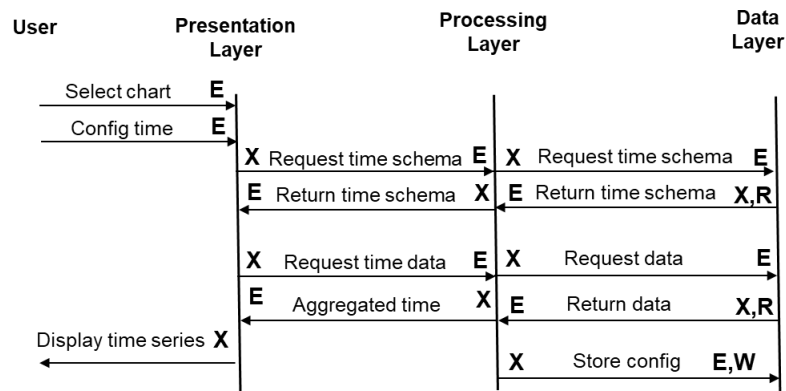


Figure 5: Illustration of the 3-layer BI software architecture corresponding to functional process User configures time series chart.

Id	Name of functional process	Layer	Size
1	User creates report	Presentation layer Processing layer Data Layer	6 CFP 9 CFP 8 CFP
2	User adds a region-level summary chart (e.g., sales by region)	Presentation layer Processing layer Data Layer	6 CFP 8 CFP 8 CFP
3	User enables drill-down interaction	Presentation layer Processing layer Data Layer	6 CFP 8 CFP 8 CFP
4	User configures time series chart	Presentation layer Processing layer Data Layer	7 CFP 9 CFP 8 CFP

Table 1: 3-layer BI - Size measurement example.

5 DATA STUDIO DASHBOARD END USER FUNCTIONALITY.

This section illustrates the measurement of the functional size of user functionality of the Data Studio dashboard which consists of 17 functional processes, listed in Table 2 and described and illustrated below.

1. Functional process Render KPI Scorecards: 2 CFP

- E User triggers view
- X KPI values rendered to dashboard

2. Functional process Configure Regex-Based Session Filter: 4 CFP

- E Filter definition
- R Read session data
- R Read regex rules
- W Store filter config

3. Functional process Apply Date Range & Filters: 4 CFP

- E Filter selection
- R Read filter definitions / rules
- R Read analytical dataset and metrics based on filters
- X Filtered view shown

4. Functional process Compute Calculated Metrics: 4 CFP

- E Metric definition
- R Read base metrics
- W Store calculated metric definition
- W Write calculated metric values

5. Functional process Render Analytical Visuals: 4 CFP

- E Visual request
- R Read prepared dataset
- X Send visualization configuration to the presentation layer
- X Deliver rendered analytical visuals to the user

6. Functional process Configure Google Ads Connector: 3 CFP

- E Connector setup
- R Read Ads schema
- W Store connector config

7. Functional process Blend GA4 and Ads Data: 5 CFP

- E Blend request
- R Read GA4 data
- R Read Ads data
- W Store blended view
- X Blended output

8. Functional process Generate KPI Comparison Views: 3 CFP

- E View selection
- R Read prepared KPI comparison dataset
- X Display KPI comparison chart to the user

9. Functional process Drill-Down Campaign Analysis: 3 CFP

- E Drill-down request
- R Read detailed campaign-level dataset
- X Display drill-down analysis view to the user

10. Functional process Configure Multi-Source Integration: 5 CFP

- E User defines multi-source integration configuration
- E User adds an additional data source to an existing integration
- R Read schema of first data source
- R Read schema of second data source
- W Store multi-source integration configuration

11. Functional process Compute Executive KPIs: 4 CFP

- E User requests computation of executive KPIs
- R Read base metrics required for computation
- W Store computed executive KPI results
- X Display executive KPIs to the user.

12. Functional process Perform Multi-Level Drill-Down: 3 CFP

- E User performs drill-down action
- R Read hierarchical dataset for drill-down
- X Display multi-level drill-down analysis view

13. Functional process Export & Share Dashboard Outputs: 3 CFP

- E User requests export or sharing of dashboard outputs
- W Store sharing permissions and access settings
- X Deliver exported dashboard output (files and/or links) to recipients

14. Functional process Configure Enterprise Data Integration: 6 CFP

- E User defines enterprise data integration configuration
- E User extends the same integration configuration with an additional enterprise data source
- R Read schema and metadata of first enterprise data source
- R Read schema and metadata of second enterprise data source
- W Store enterprise integration configuration
- X Enterprise integrated data for use

15. Functional process Manage Custom Dimensions: 4 CFP

- E User creates a new custom dimension

- R Read available data fields
- R Read existing dimensions
- W Store the new custom dimension

16. Functional process Automate KPI Computation & Alerts: 5 CFP

- E User defines automated KPI computation and alert rules
- R Read KPI data required for automated computation
- W Store automation and alert configuration
- X Deliver computed KPI results
- X Send alert notification when conditions are met

17. Functional process Export & Share Dashboard Outputs: 3 CFP

- E User requests export or sharing of dashboard outputs
- W Store sharing permissions and access settings
- X Deliver exported dashboard output (files and/or links)

Id	Name of functional process	Size
1	<i>Render KPI Scorecards</i>	2 CFP
2	<i>Configure Regex-Based Session Filter</i>	4 CFP
3	<i>Apply Date Range & Filters</i>	4 CFP
4	<i>Compute Calculated Metrics</i>	4 CFP
5	<i>Render Analytical Visuals</i>	4 CFP
6	<i>Configure Google Ads Connector</i>	3 CFP
7	<i>Blend GA4 and Ads Data</i>	5 CFP
8	<i>Generate KPI Comparison Views</i>	3 CFP
9	<i>Drill-Down Campaign Analysis</i>	3 CFP
10	<i>Configure Multi-Source Integration</i>	5 CFP
11	<i>Compute Executive KPIs</i>	5 CFP
12	<i>Perform Multi-Level Drill-Down</i>	3 CFP
13	<i>Export & Share Dashboard Outputs</i>	3 CFP
14	<i>Configure Enterprise Data Integration</i>	6 CFP
15	<i>Manage Custom Dimensions</i>	4 CFP
16	<i>Automate KPI Computation & Alerts</i>	5 CFP
17	<i>Export & Share Dashboard Outputs</i>	3 CFP

Table 2: Data Studio Dashboard - Size measurement example

6 REFERENCES AND DOCUMENTATION.

- [1] [Software Development of Business Intelligence Dashboards: Empirical Study of COSMIC ISO/IEC 19761 Size-based Effort Estimation Using Machine Learning Techniques. Ammar Abdallah, Alain Abran, Munthir Qasaimeh, Donatien Koulla Moulla.](#)
- [2] [Guideline Measurement Manual v5 Part 1 Principles, Defs. & Rules.](#)
- [3] [Guideline Measurement Manual v5 Part 2 Guidelines.](#)
- [4] [Abran, A., Software Project Estimation, John Wiley & Sons, 2015.](#)