Jerzy Roszkowski
Management Systems Consulting, Poznańska 28/1, Łódź
e-mail: jerzy.roszkowski@neostrada.pl

THE QUALITY OF THE ENTERPRISE ARCHITECTURE

Summary – This paper presents the results of research undertaken by the author for the public sector and telecommunication sector in Poland with regard to: enterprise architecture purposes, including: defining a matrix architectural purposes, the definition of project goals (metrics to determine the objectives), methodology including the methodology of construction of the data architecture.
The Presented results are actually used by public and TELCO sector enterprises in Poland to determine enterprise architecture quality for the integrated IT environments. The quality of architecture is defined and achieved through the achievement of its objectives. For measurement purposes the author has defined a number of measures listed in Chapter 2. Enterprise architecture is a relatively new field, on the development and of intensive work [10], [15]. This article represents the author's original contribution to an area previously unexplored, namely the definition of objectives and measurement of architectural quality. Known standards such as CMMI[1] [1-2] or SPICE[2] (ISO/IEC 15504 eng. (Software Process Improvement and Capability Determination)) [13], can not be used for this purpose. CMMI is used for determining the degree of maturity of the organization and provides only qualitative, not quantitative meters. SPICE reference model is too general to lead it to evaluate specific measures of IT architecture.

[1] Capability Maturity Model Integration (CMMI) is a process improvement approach whose goal is to help organizations improve their performance. CMMI can be used to guide process improvement across a project, a division, or an entire organization. Currently supported is CMMI Version 1.3. CMMI in software engineering and organizational development is a process improvement approach that provides organizations with the essential elements for effective process improvement. CMMI is registered in the U.S. Patent and Trademark Office by Carnegie Mellon University.

[2] ISO/IEC 15504 *Information technology — Process assessment*, also known as SPICE (Software Process Improvement and Capability Determination), is a set of technical standards documents for the computer software development process and related business management functions. It is another joint International Organization for Standardization and International Electrotechnical Commission standard.

1 Corporate Architecture in the public sector

Modeling approach presented here for requirements and architecture is fully compatible with TOGAF3 [14]. Due to the comprehensiveness of the article topic is limited to defining objectives: business, architecture and design of integrated IT environments. The design goals are included in the form of quality requirements on architecture design methodology in this sector. This article was written as a result of research work for the public sector, as a result of ongoing projects there by the authors and applications in integrated environments.

2 The quality of the architecture

As the author's result of research the architecture objectives were divided into groups, which identifies specific objectives. The quality of the architecture is defined by the measured degree of attainment of its objectives.

The whole structure of the objectives is shown in Figure 1 using the model in accordance with the ARIS4 methodology [11-12]. The following tables are given accepted definitions of the various purposes in groups.

A Flexible IT environment

To achieve high flexibility is a goal resulting from a complex configuration options of the environment and "ease" of development. Flexibility to determine susceptibility to environmental changes. In this group are separated sub-goals and defined as follows:

Table. 1. Groups of sub-objectives: flexible IT environment

Sym-bol	Aim of architectural design.	Description	How to measure?
A1	**High configurability**	Configurability is a feature of the environment / system for determining the percentage of	Configurability index is a vector of the form [STR, SKP].

[3] TOGAF – Eng. The Open Group Architecture Framework for Enterprise Architecture framework, which provides for a comprehensive approach to the design, planning, implementation and management of enterprise information architecture. The architecture is typically modeled at four levels (domains): Business Processes, Applications, Data, Technology. Group of The Open Group TOGAF specification available free of charge to organizations for their personal, noncommercial use.

[4] ARIS - Architecture of Integrated Information Systems, methodology, architecture and tools developed by IDS Scheer.

		functionality, which can be changed in configuration mode using the specified number of configuration places. The aim is to achieve high configurability.	
A1.1	The minimum number points of configurations for a given class of problems.	Achieving the desired configuration changes require modification of a number of systems by introducing modifications in one or more locations. The aim is to limit the sites that require configuration to a minimum. In particular, the parameters of the given class issues should be configured only once, with the result that would be of one or more configurable system. Transfer of configuration to the configuration of the system should be automatic. Example: If you configure the product will make it only once in a central catalog of products as a result, the following configuration n-systems (CRM, Billing, EAI, OM, other ..) involved in the procurement and use the product.	l-the number of classes of issues, asked the class list, list of class topics **STR = degree of redundancy configuration of places** = Σ_l (places globally configurable/ places configurable). The aim is to **MIN (STR).**
A1.2	The high number of configurable parameters	The aim is to reach the largest number of parameters of configurable instead of writing code. First, we should seek to provide configurability for the **most frequently** modified parameters and those for which the developer's cost of changes is high.	**SKP = degree of configurability of parameters** = number of configurable parameters in the chosen area / total number of parameters served in the same area.
A2	**Low complexity of development**	Otherwise "easy" development. The aim is to achieve the state in which the execution of a set of business requirements will have minimum complexity (expressed for example in Function Points). Development - changes in the systems with the non-configuration changes.	**FP (Function Points)** measured by cyclical estimating using architectural patterns.
A3	**Test automation**	The aim is to facilitate testability solutions to enable the carrying out more number of tests and to eliminate this factor as a limitation/ bottleneck in the development of the whole environment.	**Indicator test automation** = number of automatically provided tests / number of all tests

A4	**Sufficient scalable of processes**	Systems performing the processes should have a capacity corresponding to the current requirements and be scalable according to certain assumptions.	

B Simple IT environment

The aim made defining group of the objectives or the state of the environment in terms of functionality, processes, data and system components. In this group of sub-goals are distinguished and defined as follows:

Table. 2. Group and sub-objectives: a simple IT environment

Sym bol	Aim of architectural design	Description	How to measure?
B3	**Adequate coverage of business functions by systems.**	The purpose is the appropriate allocation of the system functions, consistent with the best knowledge of the environment.	Vector form: **[WRF, WPA]**
B3.1	Minimum functionality redundancy	Redundancy functionality is the number of repetitiona for using the same component or function in a defined area with the implementation of the same functionality. Is defined only for functions that can be operated in a global manner.	**WRF** = **functional redundancy index** = total number of functions / (Σ (number of repetitions for all functions * measure of the multiplicity of functions).
B3.2	Proper allocation of functionality	For TELCO sector the allocation of functionality to the system is adopted Telecom Application Map (TAM) as references. Thus, the correct allocation means compliance with the TAM. Architectural strategy may be different in such cases is superior against TAM.	**WPA = correct allocation rate** = function correctly allocated to the systems / functionality allocated to schemes
B4	**Optimal system processes**	The aim is to optimize the system design process - the maximum automation, flexibility and sufficient (in terms of duration, expectations and utilization of resources) selection the number of steps in the system processes.	

B4.1	The optimal number of process steps	Optimization of the process involving the selection and distribution of such process steps to guarantee you a minimum time duration, minimum waiting time, maximum utilization of resources.	Determined by vector: **[Min (T_w), Min (To), Max (WWZ)],** where **Min (T_w)** - is the minimum total execution time, **Min (T_o)** - a minimal waiting time, **Max (WWZ)** - is an indicator of the use of allocated resources.
B4.2	Maximum automation	The aim is to implement automated functionality, ie. without the use of manual steps (if your business requirements state not otherwise).	**WA = coefficient of automation** = number of steps taken automatically / number of all steps.
B4.3	The high versatility of application processes	The aim is to implement solutions to ensure the re-use processes in place. In other writing: processes should be generic with the possibility to re-use.	**SR = Σ (times reuse) * measure of degree of reuse / LPG** Where **LPG** = number of generic processes, **SR** = degree of reuse of generic processes .
B5	**Proper metadata and data quality**	Achieved through the implementation of the data management process which includes: - management of reference data - data standards, - metadata management - data quality and certification - ensure appropriate data - data safety	
B5.1	The minimum redundancy of data and metadata	Redundancy is otherwise, duplication of information	**Indicator data redundancy = WRD** = number of duplicate data / number of all data
B5.2	Completeness of data	The definition of completeness: 1. The description of any data should give a complete form of information ie., can be presented in the form of five parameters: **(N, D, DD, JM, T),** where : N – data name , D – data definition, DD – data domain, JM - unit of	**Indicator of incomplete data** = number of incomplete data / number of all data

		measurement, T - time. 2. The data should include all information needed for the business area. 3. The data fulfill all the required business rules in this area. 4. The data are sufficiently accurate and true.	
B5.3	The correct allocation of data	Proper allocation means according to the eTOM and TAM strategies (for TELCO) if they do not say otherwise. The aim is to implement solutions to ensure adequate, consistent with long-term objectives for the environment to ensure properly master data, and distribution processes of the data.	
B5.4	Appropriate conceptual model of data (consistency, scope of business)	1. The objective is to provide a model which will include consistent data (compliance with normal Codd rules) . 2. The scope of business and granulation which require functions performed by the system.	
B6	**The best selection of equipment and technology**	The objective is cost-optimal selection of components in the implementation and maintenance. The best selection also means a low failure rate.	
B6.1	The best selection of equipment and licenses	The objective is cost-optimal selection of components in the implementation and maintenance. The best selection also means a low failure rate.	
B6.2	Technology standardization	The aim is to unify the technology hardware and software.	
B7	**Dependencies minimization**	The objective is to minimize dependencies. Minimizing dependence has lead to reductions of quantity relationships in the environment only to the necessary. Minimizing dependency also means maximizing reusing of components in the environment.	

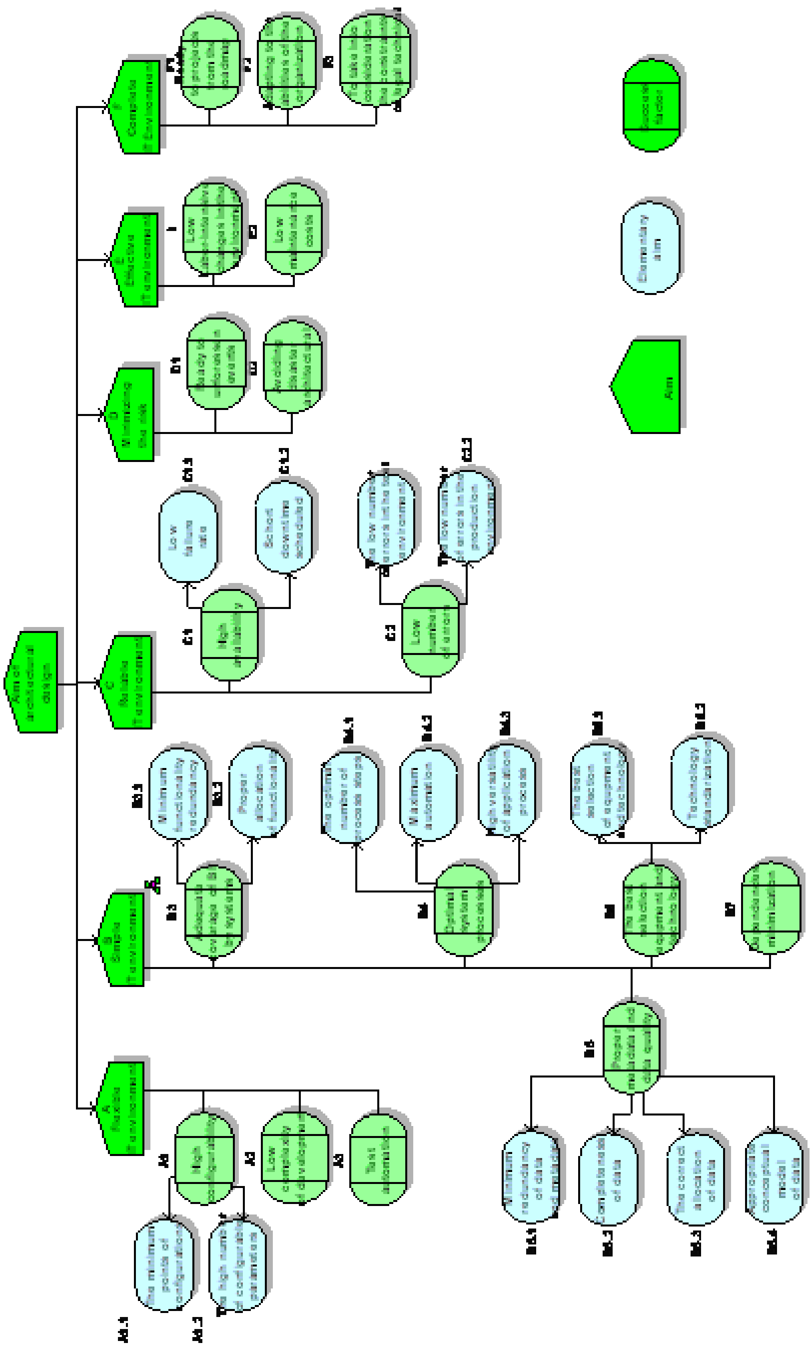

Fig. 1. Model of architectural purposes in the telecommunications company. Source: author's study.

C Reliable IT environment

The aim is to achieve a state in which the environment supports business processes in accordance with established accessibility and error free. At the same time should be provided a sufficient level of security and maintain the continuity of development. In this group of distinguished sub-goals are defined as follows:

Table. 3. Group sub-objectives: reliable IT environment

Sym-bol	Aim of architectural design	Description	How to measure?
C1	**High availability**	Availability means the ability to implement business processes. The aim is to achieve high availability and what follows to avoid any incidents which have a negative impact on the availability. This applies both to unplanned events (failures) and planned (exclusion during the implementation.)	
C1.1	Low failure rate	The aim of minimizing the number and effects of the accident.	Number, the consequences of failure
C1.2	Short downtime scheduled	The aim is to shorten the exclusion of environmental or environmental component in the implementation of functionality on production.	**Rate of availability** = downtime during deployment
C2	**The low number of errors**	The goal is the lowest number of serious errors. Errors are not treated the same, greater weight is assigned to fatal errors, less the non-critical. Not every error must result in a failure or decrease in the availability, but each has an impact on the cost and time	**WB = WBT + WBP** where WB - coefficient of the number of bugs
C2.1	The low number of errors in the test environment	The goa.l is the lowest number of errors in the test environment. What matters is the weight error.	**WBT = weighted coefficient of error TESTING = Σw_i**, where w_i = 1 for fatal error w_i = 1 /2 for non fatal error

C2.2	The low number of errors in the production environment	The goal is as low as the number of errors in production environment. What matters is the weight error.	**WBP = weighted factor of production errors = Σ_i,** where w_i = 1 for fatal error w_i = 1/2 for non fatal error

D Minimizing the risk

The objective is to minimize risk. In this group of distinguished sub-goals are defined as follows:

Table. 4. Group sub-objectives: minimizing the risk

Sym-bol	**Aim of architectural design**	**Description**	**How to measure?**
D1	**Ready to unforeseen events**	Development architecture should be conducted in such a way that in addition to efficient and effective realization of direct business tasks and specific projects IT roadmap, the IT environment was prepared for unforeseen events. An example of such an event: a combination (merger) with the new operator. This may indicate an appropriate decomposition of functionality, to maintain sufficient flexibility in processes, or other environmental characteristics not included other architectural purposes.	immeasurable - the necessary measures to determine
D2	Avoiding “Disaster architectural’’	Disaster is a natural architectural development of the system during which was performed an error leading to a lack of opportunities for further development of the system/architecture. The result of such an event could be the activation of the project, with the sole or primary objective will be to ensure business continuity. The aim is to avoid such disasters.	The total labor-intensive project which does not give that added value to business.

E Effective IT environment

The aim is to achieve business requirements while minimizing the overall cost associated with the environment supporting/performing these requirements. At this the cost consists of the cost of the implementation and maintenance. In this group of distinguished sub-goals are defined as follows:

Table. 5. Group sub-objectives: effective environment

Sym-bol	Aim of architectural design	Description	How to measure?
E1	Low labor-intensive development changes in the environment	The aim is to achieve a state in which the cost of implementing changes in development (as specified complexity) is minimal.	WSP = Value of developers work (in terms of necessary changes resulting from changes in strategy or business conditions / value of all property development work
E2	Low maintenance costs	The aim is to achieve low cost of living environment	maintenance costs per unit of functionality

F Complete IT environment

The completeness of the environment determines the degree and willingness to implement the requirements. Requirements are directly reported to the requirements in project roadmap, possibilities and limitations of the organization. The aim is to provide an enabling environment for the complete realization of requirements. We avoid a situation in which environmental constraints prevent the realization of certain requirements. In this group of distinguished sub-goals are defined as follows:

Table. 6. Group sub-objectives: complete IT environment

Sym-bol	Aim of architectural design	Description	How to measure?
F1	Ready to projects from the roadmap	The aim is to strive for such environment that enables and facilitates (in terms of costs and development time), now and in the future, the implementation of subsequent changes, provided for in the roadmap projects.	

F2	Adapting to the abilities of the organization	Organizational options, which can not be modified in a finite time should be taken into account as rigid constraints for projects affecting the architecture. Compliance with this limitation is therefore one of the architectural purposes, like to meet business requirements.	
F3	To take into consideration the constraints of legal, technical and other	The aim is to incorporate the restrictions that can affect the environment. In particular, should take into account the legal and technical constraints.	

3 The objectives of the architecture for data

Construction of data architecture is closely linked with the objectives of architecture in this area and requirements to be satisfied in the environment. The following figure shows the architectural diagram of the objectives for the data (according to Aris standard). Due to the decomposition of multi-aspect of the objectives , decomposition can not be everywhere disjoint. Specific objectives that appear repeatedly in the tree called “common goals”.

The objectives of the data architecture is one aspect of the requirements for simple environment. Completeness and quality of data allows their use in processing, while ensuring interoperability is related to the construction of complex messages clearly understood by the sender (a system producing) and receiver (receiver system).

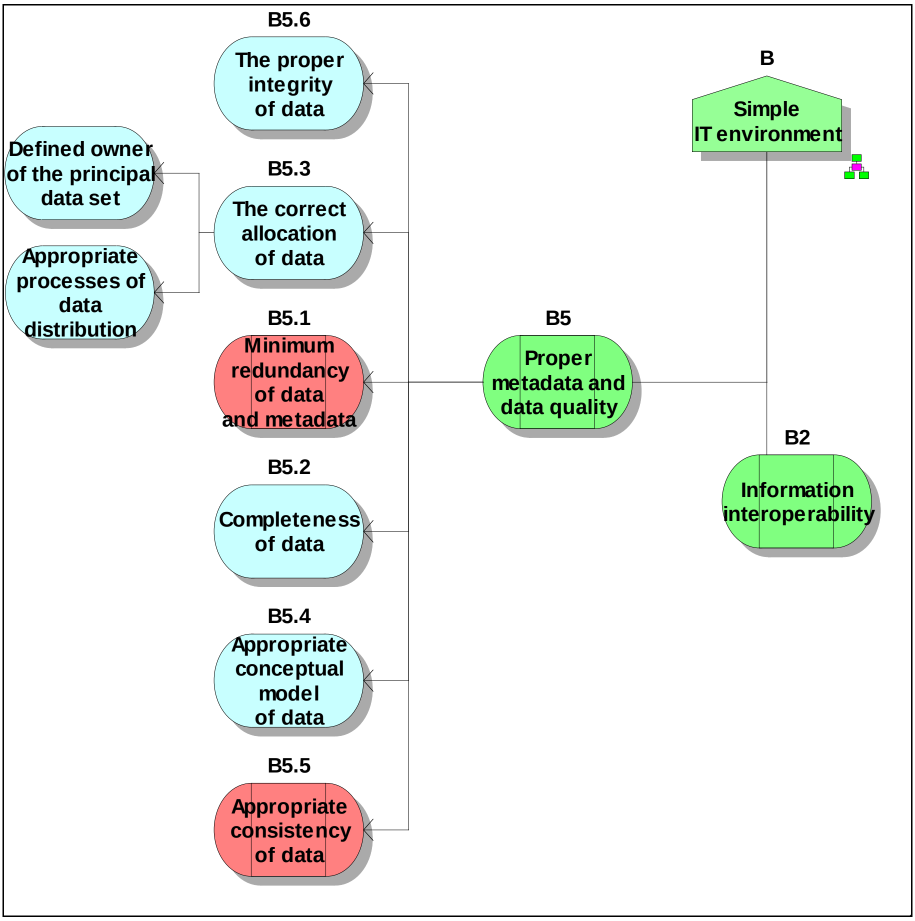

Fig. 2. Architectural objectives for data. Source: author's study.

4 Requirements for data modeling

The figure below shows the requirements for a conceptual model of data [7], [8]. Due granulation - (different granularity of data) means the required length of time repeating in which data are collected.

Proper business scope - means the range of the data model which should include the scope of business is necessary to achieve the business purpose. Compliance with standards and practices - means compliance with UML (class diagram, and the standardization of data for three normal Codd forms.

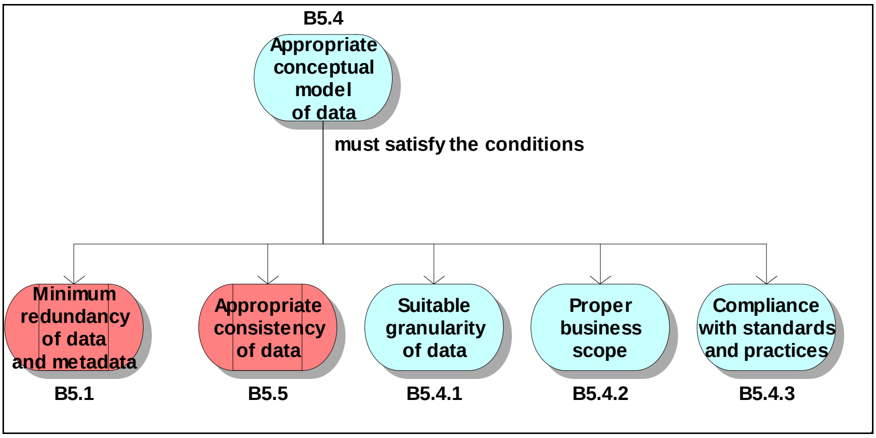

Fig. 3. Requirements for data models. Source: author's study.

5 Relationship the quality of an enterprise architecture with the theory of information

Each defined in section 3 architectural goal, whose attainment is a measure of the quality architecture can be regarded as a random variable q_i whose value (denoting the measured value to measure the quality) is contained in the closed interval [0,1] and has probabillity p_i that a random variable.

Therefore, they form SCHEME:

$$Q = \{q_1, q_2, \dots q_n\} = \begin{pmatrix} q_1 & q_2 \cdots & q_n \\ p_1 & p_2 \cdots & p_n \end{pmatrix} \quad (1)$$

Q = {A,B,C,D,E,F} =
={A1.1,A1.2,A2,A3, A4,B3.1,B3.2,B4.1,B4.2,B4.3,B5.1,B5.2,B5.3, B5.4,B6.1, B6.2,C1.1,C1.2,C2.1,C2.2,D2,E1,F1,F3} (2)

According to the work of [3] the entropy of this system is:

$$H(Q) = -\sum_{i=1}^{n} p_i \log_2 p_i (q_i) \quad (3)$$

Thus, we can measure the quality of architecture with a single indicator by measuring the entropy of certain architectural purposes understood as the probability their achievement or values measured at the time "t"

6 Example and assessment of IT architecture

Below the example of airline IT architecture is shown as a list of objectives and indicators set out in Section 2 can be used to evaluate the architecture in this to determine its strengths and weaknesses and to indicate directions for further development.

6.3 General description of the airline's IT architecture

The main architectural feature is the NAV Reservation System (figure 4). In this system, are located the main parts of the sales process, which is based on reservation and cancellation of flights by customers. Around the NAV system was built data warehouse, which processes data from the NAV, and these data feeds both the other systems as well as directly, using Business Objects components, provides the processed data to users (especially for finance).

Data into the data warehouse are generated daily by the reservation system for an FTP account from which the BulkLoadMapper module loads the data to Database. This module is also used for checking validity and to control the integration of data (checking of repetition and continuation of data). Navitaire system is powered by data from payments receipts and from the module used for administrative cancellations. Around a data warehouse are embedded systems (components), that make possible (based on data from the booking system):

- settlement agents who sells Company flights,
- Call Center Module, which is supplied by data to the IVR,
- the module, which enables the settlement of board staff,
- reports for Finance and Accounting (including VAT),
- Sales Reports,
- Revenue Management,
- Reporting Module (and for sending SMS messages).

To ensure data accuracy and easy interpretation in addition data warehouse is loaded "exchange rates" information from receipts to the bank accounts (as with the rest on the one hand is the basis for the calculation of Cash Flow on the other hand, after processing supplies reservation system "in the opposite direction "changing the status of your reservation), information from the payment services (eg supermarkets) as well as whether BillBird Bibit (payment cards).

In addition, data from the reservation system after processing supply the insurance company and the appropriate configuration module allows parameterization of settlements between the airline and insurance product provider. The data warehouse is also supplied with data from the module Netline Crew (which contains the information on the personnel board and the flying hours of sailing).

6.4 Business Objectives

The following table shows the most important business objectives set for the IT environment.

Table. 7. Strategic business objectives of the IT Airlines environment.

ID	Business Purpose
1	Achieving an appropriate position (for Polish customers) aviation market LOW COST (competition is Wizzair, RyanAir, Norwegian, on some courses - Lutfhansa).
2	Achieving the prices which will increase sales.
3	The balance of performance, and sales between the summer-winter seasons.
4	Resignation from the major airports (airports migration to the small, suburban).

Any changes (adding a new waiver from the present), business goals will affect the architectural goals and this can cause a change of the architecture target or focus on other aspects of the current architecture.

6.3 Mapping business objectives for architectural purposes for airlines

The table shows the degree of influence of the architectural goal for achieving a given objective business (X - the impact of large, x - the impact of small). Example of interpretation: The achievement of architectural goals: [A], [C] [E] will have a positive impact on the realization of the business [1].

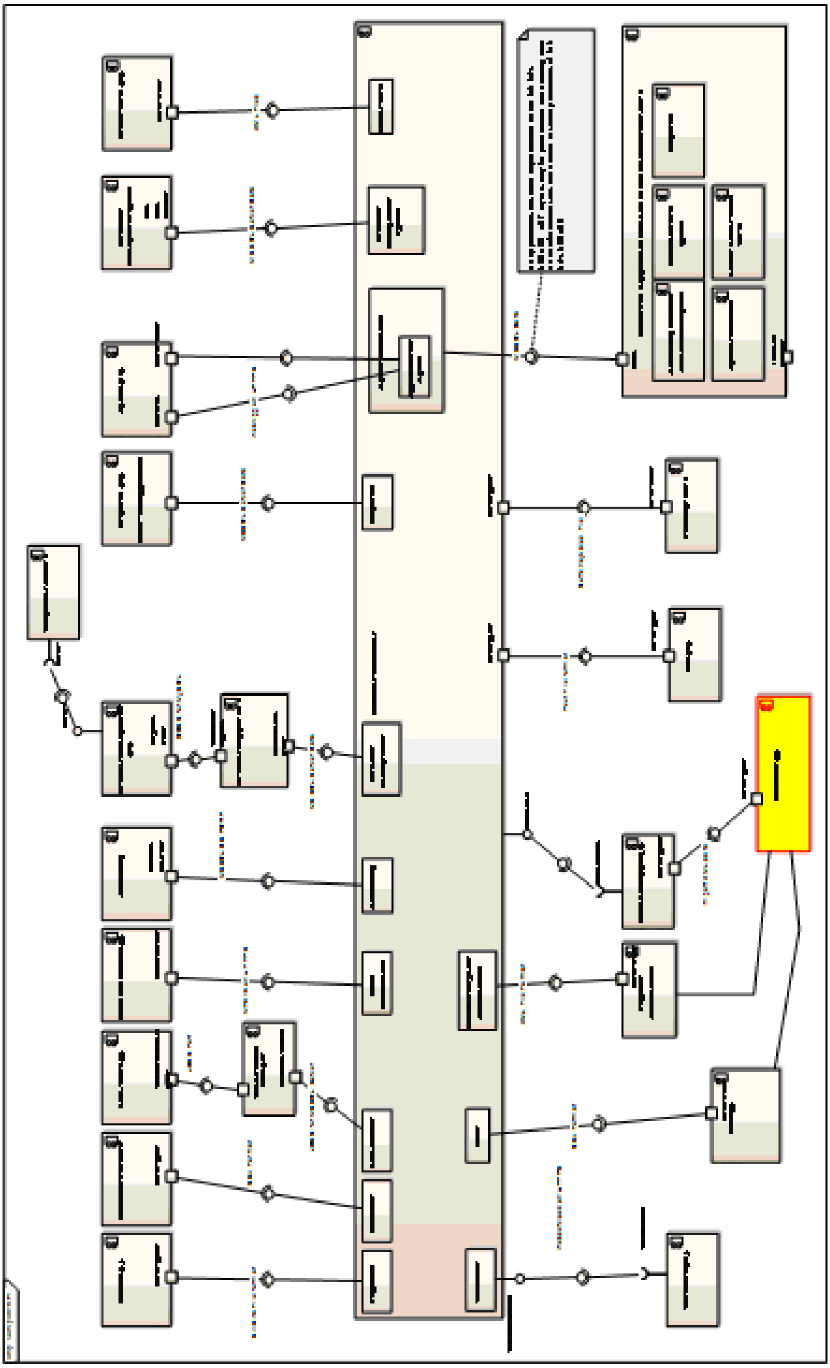

Fig. 4. Example architecture of an integrated IT environment for the airlines.
Source: author's study.

Table. 8. Mapping business objectives for architectural purposes for airlines.

Business goals / **Architectural goals**		Achieving the desired position (for Polish customers) aviation market LOW COST.	Achieving the prices which will increase sales	Balancing performance and sales between the summer-winter seasons.	Resignation from the major airports (airports migration to the small, suburban)
		[1]	**[2]**	**[3]**	**[4]**
High configurability	**[A]**	X	X		X
Simple IT environment	**[B]**		X	X	
Reliable IT environment	**[C]**	X			
Minimize risk	**[D]**		X		
Effective IT environment	**[E]**	X		X	
Complete IT environment	**[F]**			X	X

6.4 Evaluation of an integrated IT environment architecture for airlines

The radar chart below shows the calculated metrics (for the initial year (2008)) listed below in Table 10 of the IT architecture of the airline.

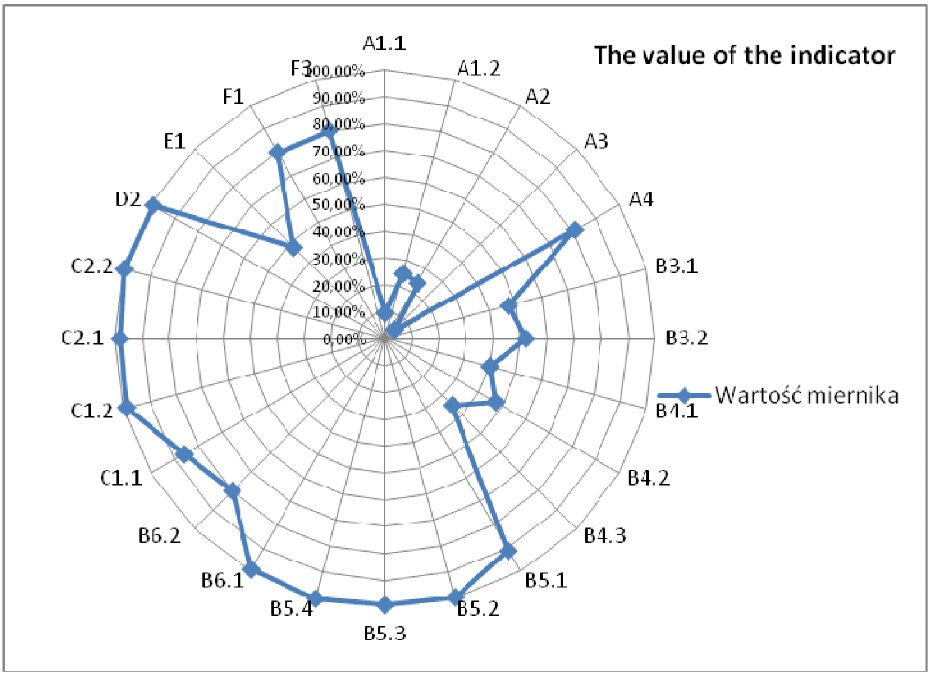

Fig. 5. A radar chart for the value of architecture metrics for the IT architecture of the airline. In the figure above, the indices (nx) B5.1 B5.2, C1.1, C1.2, C2.1, C2.2, D2 and E1, were reversed indicators, to form a 100% nx% for the indicator 100% of imaging the best possible architectural solution. Source: author's study.

The entropy of architecture

As far as enhancing and improving the architecture (which corresponds to an increase of some metrics), the entropy of architecture airline as a whole is decreasing. For the ideal architecture (all meters = 1, entropy = 0 Here are the results for the three years

Table. 9. The entropy of the airline architecture calculated by measuring the indicators given in the next three years.

Indicator	Indicator type	Value in 2008 y.	Value in 2009 y.	Value in 2010 y.	Enrtopy in 2009	Entropy r. 2010 y.	Entropy in 2011 y.
A1.1	A	10,20%	10,90%	0,095	0,323078	0,335923	0,348538
A1.2	A	26,80%	29,00%	0,25	0,5	0,509118	0,517904
A2	A	24,00%	24,12%	0,238	0,49295	0,494134	0,49487
A3	A	5,00%	5,32%	0,048	0,209158	0,216096	0,225165
A4	A	82,00%	85,00%	0,81	0,246787	0,234769	0,199295

B3.1	B	50,00%	56,00%	0,472	0,511351	0,5	0,468441
B3.2	B	53,00%	56,00%	0,52	0,490577	0,485446	0,468441
B4.1	B	41,00%	49,00%	0,4	0,528771	0,527385	0,504282
B4.2	B	47,50%	49,60%	0,47	0,511956	0,51015	0,501748
B4.3	B	38,00%	40,20%	0,35	0,530101	0,530453	0,528523
B5.1	B	92,00%	93,00%	0,91	0,123816	0,110671	0,097369
B5.2	B	99,50%	98,00%	0,995	0,007195	0,007195	0,028563
B5.3	B	99,00%	99,00%	0,99	0,014355	0,014355	0,014355
B5.4	B	100,00%	100,00%	1	0	0	0
B6.1	B	99,10%	99,20%	0,99	0,014355	0,012926	0,011495
B6.2	B	81,00%	84,00%	0,8	0,257542	0,246245	0,211293
C1.1	C	86,50%	90,00%	0,86	0,187129	0,180982	0,136803
C1.2	C	99,10%	99,50%	0,99	0,014355	0,012926	0,007195
C2.1	C	98,10%	98,90%	0,98	0,028563	0,027149	0,015782
C2.2	C	99,90%	99,90%	0,999	0,001442	0,001442	0,001442
D2	D	99,30%	99,60%	0,992	0,011495	0,010063	0,005759
E1	E	48,00%	52,00%	0,479	0,508575	0,508269	0,490577
F1	F	81,00%	85,00%	0,8	0,257542	0,246245	0,199295
F3	F	81,20%	88,00%	0,8	0,257542	0,243964	0,162294
				Entropy (total)	**6,028635**	**5,965907**	**5,639427**

With regard to indicators of type A and E (common interpretation is necessary) (ie. architecture configurability), it is clear that this is her weak point. The meter shows that if there is a new business needs, the changes will take time and will require the interference of both programming and designing with a high degree of complexity. Next to the conclusion that this will entail multi-change, which will require integration testing. It is a weak element of the architecture. On the chart we see that the architecture provides for more than 80% chance of scaling processes, but at great expense.

B indicators (suitable cover the functions of the systems and redundant data) indicate a higher than average idea of a solution (oscillation around 70%). Optimization should rely on analyzing business processes and their optimization including not less satisfies the assumptions. With this meter may show that the architecture during the design process did not consider all business objectives and some of it was ad-hoc basis. In addition, you must also conclude that the data warehouse and its redundancy was designed exemplary.

Indicators C and D. You can see very clearly thought-out concept, which is a lot of emphasis (98%) go to the level of availability, reliability and environmental performance. In this respect, the architecture is exemplary.

F indicator shows that above average architecture is prepared for new projects and that in terms of data and its redundancy, will easily cover both functional and possibly development.

Generally, you can bet the idea that architecture is prepared for an above-average 67.66% (assuming the ordinary architecture of achieving an average rate = 30% - for the most immature corporate architectures) and was prepared by the design team by picking the emphasis more on the SLA, or system availability and by specialists in data integration and data warehousing.

7 Summary

Defining the purpose of business and architecture is essential and this is first step in building an enterprise architecture. In the TOGAF ADM [14] it is determined in the step "architecture vision". The results of research in this area were conducted by the author in several sectors: telecommunications and the public sector. The objectives of the architecture can be used to assess the current states of the IT architecture and setting its future direction. The article showing an example of the summary scores (due to specify the volume of work), the IT architecture of the airline. The next step after defining the objectives is to build a repository of architectural guidelines and principles provided for above. The guidelines and rules are the control objectives during the iterative development of IT of architecture. For further in-depth analysis and research requires the translation of business objectives (sector) for the purposes of architectural design. The topics and the work covered in the article are of great interest and a reported demand will be further developed by the authors in the industry.

References

[1] CMMI Product Team, Capability Maturity Model Integration (CMMI), Version 1.1 Continous Representation. CMU/SEI-2002-TR-011, March 2002,

http://www.sei.cmu.edu/pub/documents/02.reports/pdf/02tr011.pdf

[2] CMMI Product Team, Capability Maturity Model Integration (CMMI), Version 1.1 Staged Representation. CMU/SEI-2002-TR-012, March 2002,

http://www.sei.cmu.edu/pub/documents/02.reports/pdf/02tr012.pdf

[3] Cover Thomas M., Joy A., Thomas Elements of Information Theory John Wiley & Sons, Inc. 2006, ISBN:0-471-06259-6

[4] Jacob M., Jonkers H., Quantitative Analysis of Enterprise Architectures, ArchiMate Deliverable D3.5.1 b, Telematica Institut, 2004

[5] Lankhorst M. Enterprise Architecture at Work , Modeling, Communication and Analysis, Springer –Verlag, 2005

[6] Richardson G., Jackson B., Dickson G., A Principles-Based Enterprise Architecture, MIS Quartely, vol 14, no.4,1990

[7] Roszkowski J., Analiza i projektowanie strukturalne (eng. Analysis and Srtuctural Design), Helion, 2004, ISBN: 83-7361-397-8

[8] Roszkowski J. The Formal Approach to Definition of the Requirements for the Needs of Computer Application Selection and Implementation, *Proc. of the 16th International Conference on Systems Science ICSS'07*, 2007

[9] Roszkowski J.,Kobyliński A., Quality Management Reference Models for Business Intelligence – Class Systems, *The 8th International Conference on Perspectives in Business Informatics Research*, Kristianstad University College, Sweden, October 1-2 2009

[10] Roszkowski. J., The simulation of processes in the integrated computer environment in the TELCO sector , *Proc. of the 7 Symposium „Modeling and Computer Simulation”*, Łódź, College of Computer Science, 2010

[11] Scheer A. W., Business Process Modeling, Springer-Verlag, Berlin,Heidelberg, New York, 2000, ISBN: 3-540-51480-5

[12] Scheer A.W., Business Process Engineering, Springer-Verlag, Berlin, Heidelberg, New York, 1994

[13] SPICE World, http://www.esi.es/Projects/SPICE.htm

[14] TOGAF™ Version 8.1.1 Enterprise Edition, ISBN: 9789087531737 Van Haren Publishing, 2007

[15] Wegemann A., On the systemic Enterprise Architecture Methodology, *Proc. of the International Conference on Enterprise Information Systems*, Angers, France, 2003

JAKOŚĆ ARCHITEKTURY KORPORACYJNEJ

Streszczenie – W artykule przedstawiono wyniki badań przeprowadzonych przez autora dla sektora publicznego i sektora telekomunikacyjnego w Polsce w odniesieniu do: celów architektury korporacyjnej IT, w tym: określenie macierzy celów architektonicznych, definicji celów projektu (wskaźników do określenia celów), metodologia w tym metodologię budowy architektury danych.

Prezentowane wyniki są faktycznie używane przez niektóre podmioty publiczne i TELCO sektorze przedsiębiorstw w Polska do określenia jakości architektury korporacyjnej dla zintegrowanego środowiska IT. Jakość architektury jest zdefiniowana i osiągnięta poprzez stopień realizacji jej celów. Do tego celu autor określił szereg mierników ilościowych, wymienionych w rozdziale 2. Architektura korporacyjna jest stosunkowo nową dziedziną, w trakcie intensywnych badań i rozwoju [10], [15]. Ten artykuł przedstawia oryginalny wkład autora do tego obszaru, a mianowicie określenie celów i pomiaru jakości architektury. Znane standardy, takie jak CMMI [1-2] i SPICE (ISO/IEC 15504 ang. (Software Process Improvement i określenie Capability)) [13], nie mogą być używane do tego celu. CMMI jest używany do określania stopnia dojrzałości organizacji i zapewnia tylko jakościowy, nie ilościowy pomiar. Model referencyjny SPICE jest zbyt ogólny, aby wprowadzić mierniki ilościowe pomiaru architektury IT.