

Differences in results of measurement between ITIL 2007 and ITIL 2011 model for the IMS system

A. Tanovic, I. Androulidakis and F. Orucevic

Abstract — The aim of this paper is to present differences between ITIL model from 2007 and ITIL model from 2011. IP Multimedia Subsystem is chosen as the test architecture for the implementation of these two models. The paper contains two different measurements. In the first measurement are taken only 2 parameters: time period needed for the implementation and the number of employees needed for the implementation. Results have showed that the model from 2011 is better for 12% than the model from 2007. In the second measurement are taken all Key Performance Indicators for 15 ITIL processes: Financial Management, Service Portfolio Management, Service Level Management, Capacity Management, Availability Management, IT Service Continuity Management, Information Security Management, Supplier Management, Change Management, Service Asset and Configuration Management, Release and Deployment Management, Service Validation and Testing, Incident Management, Problem Management and Continual Service Improvement process. Results in this measurement have showed that the model from 2011 is better for 10% than the model from 2007.

Keywords — ITIL V3, ITIL 2007, ITIL 2011, Service Strategy, Service Design, Service Transition, Service Operation, Continual Service Improvement, Key Performance Indicators, IMS.

I. INTRODUCTION

Every company that wants to increase its level of work and business depends on IT. If the IT processes and services are lead successfully, the operation of the company will become more fortunate and successful, which can be noticed in the decrease of costs, and increase of revenues and achievement of contacts with other business partners [6]. For the IT processes and services to be successfully lead, it is necessary for the company to define a gathering of specialized organizational skills

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which are offered to clients in the form of a service. That set of specialized skills makes up the Service Management of a company [1], [6].

There are many IT Service Management methodologies and standards and one of them is also Information Technology Infrastructure Library (ITIL). ITIL in version 3 has 5 phases in which are placed 26 processes and 4 functions [1], [2], [3], [4], [5]. From 2007 to 2011, 500 of scientific papers about the future improvement of ITIL is written [7], [8], [13]. These papers are the consequence of the ITIL V3 implementations in business environments. For each ITIL V3 phase there is one or more changes:

- Service Strategy – Two processes are added: Strategy Management for IT services and Business Relationship Management. Process Financial Management is improved and renamed to Financial Management for IT services. Process Strategy Generation is deleted [1].
- Service Design – One new process is added: Design Coordination. It is created 1 new portfolio of IT services and stronger relationship to Service Strategy phase [2].
- Service Transition - One new process is created: Change Evaluation. These 3 processes are improved: Change Management, Service Asset and Configuration Management and Release and Deployment Management [3].
- Service Operation - These 3 processes are improved: Event Management, Incident Management and Problem Management [4].
- Continual Service Improvement – It is performed Plan-Do-Check-Act cycle in the Continual Service Improvement Process. These 2 processes are deleted: Service Reporting and Service Measurement [5].

The IP Multimedia Subsystem (IMS) is a standardized IP-based architecture that allows the convergence of fixed and mobile communication devices, multiple network types, and multimedia applications [9], [10], [12]. Using IMS, applications can combine voice, text, pictures, and video in seamless call sessions, offering significant ease-of-use to subscribers and allowing service providers to drive branding through a common interface, while substantially reducing operating costs. This subsystem allows to users to send multimedia files from TV to mobile

phone or from mobile phone to TV, or to send SMS messages from TV to mobile phones [11], [14].

Section II of the paper describes test environment in IPTV system of Telecom operator in which is implemented IMS system. Section III of the paper describes the implementation of the IMS system by using the old ITIL V3 model. Section IV of the paper describes the implementation of the IMS system by using the new ITIL V3 model. Section V shows results of the implementation of the IMS system by using the old ITIL V3 model and new the new ITIL V3 model. Section VI presents results for key performance indicators which are used in the implementation of the IMS system for both ITIL models (the old ITIL V3 model from 2007 and the new ITIL V3 model from 2011). Section VII is the conclusion of the paper in which is presented how much is better a new ITIL V3 model than the old ITIL V3 model. In the conclusion of the paper are presented summary results for 15 ITIL processes and for 5 ITIL phases. In these results are shown phases and processes from ITIL 2011 that need improvements in the future researches.

Previously published paper of authors from this research area is [8] in which is presented a new ITIL V3 model for IMS architecture. In this paper is constructed IMS architecture by using only 6 ITIL V3 processes: Service Level Management, Supplier Management, Service Asset and Configuration Management, Release and Deployment Management, Service Validation and Testing and Evaluation Process. The second paper is [7] in which is described the process of integration of PRINCE2 model into last ITIL V3 model. The scientific value of this paper is a new proces which is called Project Management which is integrated into Service Transition phase. In paper [16] is described the complete process of the IPTV convergence into IMS system and advances of that implemented system. The authors have launched and developed system as a pilot service in their network. Based on this research, we did our research in one Telecom Operator in Bosnia and Herzegovina to show that IMS system is applicable in one real environment. Very similar research is [17] in which authors have described SIP applications servers and IMS service logic. They showed that these servers can be open services architecture (OSA) application servers or a customized applications for mobile networks using enhanced logic service environment.

The authors have published a few papers before this papers that are connected to the implementation of the ITIL framework. The most important are: [18] in which is described the implementation of the ITIL Supplier Management process in IPTV system of Telecom operator and [19] in which is described the implementation of the ITIL Information Security Management process in IPTV/VoIP system of Telecom operator. The result of the first paper is 75% of successful implemented ITIL recommendations for IPTV system and the result of the second paper is 67% of successful implemented ITIL recommendations for IPTV and VoIP systems. These both researches are done in the same environment as this research.

Very interesting paper in this field is [20] in which is described Balanced Scorecard as the most popular technique for the measurement of the implementation of each ITIL process. We have chosen this technique for the measurement of key performance indicators. In paper [21] is described the usage of business process tools for modeling requirements on system changes. Paper [22] describes advantages of using some IT Service Management methodology or standard in the implementation of some cloud system. In paper [23] is described the spiral model development concept for one multimedia application. Finally, in paper [24] are described information security management concepts for SIP protocol in the implementation of the IMS system.

II. TEST ENVIRONMENT

We have chosen an IMS architecture as the test architecture for the implementation of the new ITIL V3 model. Tests are dome during the project of IMS implementation in BH Telecom [9], [11], the leading Telecom Operator in Bosnia and Herzegovina [7], [8]. All steps needed for the implementation of the IMS model are taken into account.

Figure 1. shows fixed IPTV system in BH Telecom [8], before the implementation of the IMS system. Components of this system are: IPTV Middleware, VoD Media server, Envivio 4 TV Encoder, Linear TV Content Source, Verimatrix CA/DRM Server and VoD Streaming Server.

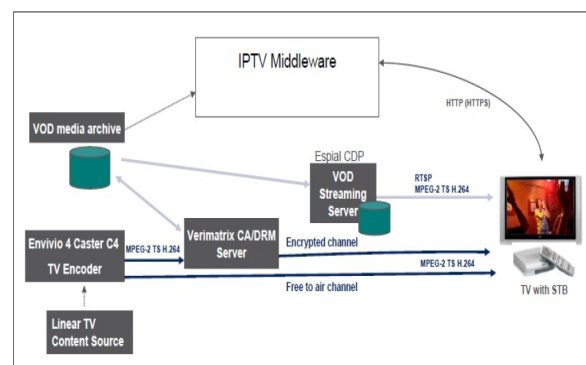


Figure 1. Fixed IPTV system

Figure 2. shows mobile IPTV system in BH Telecom [8], before the implementation of the IMS system. Components of this system are: VoD Media server, Realnetworks transcoder, Linear TV Content Source, Xenon Live TV Encoder and VoD Streamnig server.

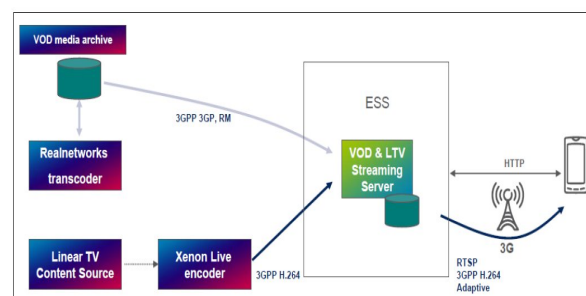


Figure 2. Mobile IPTV system

Figure 3. shows a new IMS system, after the convergence of fixed IPTV system and mobile IPTV system [8]. The new component of this system is Central IPTV Middleware which gives to users some new services like: TV – Mobile Timeshift, TV multimedia sharing, Mobile multimedia sharing, TV SMS, TV – Mobile SMS, TV Chat, Mobile Chat and TV-Mobile Chat.

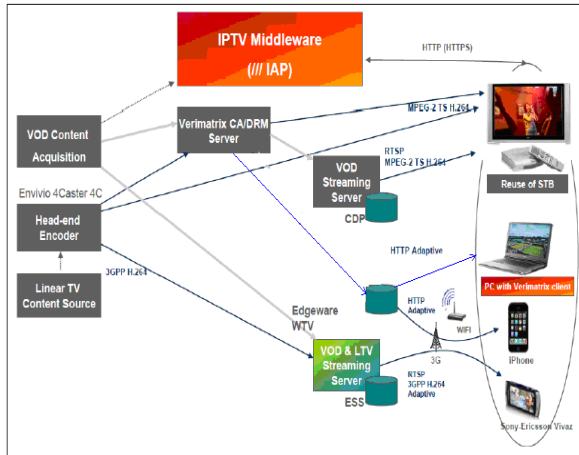


Figure 3. Implemented IMS system

III. IMPLEMENTATION OF THE IP MULTIMEDIA SUBSYSTEM BY USING THE OLD ITIL V3 MODEL

Table I describes the implementation of the IMS system by using the old ITIL V3 model. All 5 ITIL V3 phases with 26 IT processes and 4 IT functions are taken into account [7]. This table shows rules for the implementation of all ITIL V3 processes and functions.

TABLE I: IMPLEMENTATION OF THE IMS SYSTEM BY USING THE OLD ITIL V3 MODEL

Process name	The implementation of the process
Strategy Generation	Managing the position of the company Managing the work of competing companies
Demand Management	Managing consumer demands Managing the demands of other Telecom operators Managing relationships with other international organizations
Service Portfolio Management	Defining the services of the Telecom operator Managing the sales
Financial Management	Investment management Resource management Revenue management Management of the overall finances Managing the expenditure of the Telecom operator
Service Catalogue Management	Defining the contents for all services of the Telecom operator Defining the IT service catalogue
Service Level Management	Managing contracts with end users Managing human resources in the company Managing contracts with foreign companies Solving public complaints and court trials
Capacity Management	Managing IP network space of the Telecom operator Managing the performance system Managing the capacity of network elements, switches and DSLAMs
Availability Management	Defining the availability plan
IT Service	

Continuity Management	Defining and surveilling the backup service
Information Security Management	Defining the levels of information security Defining administrative roles in the management of the Information system
Supplier Management	Defining tenders Defining juristic and economical services for the tender Defining professional circumstances for the tender Conducting the realization of the tender Managing the relationships with strategic partners
Transition Planning and Support	Planning the adaptation of new services and utilities
Change Management	Administering network elements for managing the Internet Administering network elements for managing the IPTV service Administration and design application of the IPTV service Administration of network elements for managing the VoIP service Administration of network elements for managing the Hosting services Administration of network elements for managing the E-Mail service Administration of the Portal of the Telecom operator Administration of the Monitoring service and network Administration of the IP core network structure Administration of the DSLAM network Administration of terminal devices
Service Asset and Configuration Management	Administration of midpoint application of the Information system Administration of the Provisioning system Administration of the Billing system Administration of the SAP system Administration of the IT system infrastructure Implementation of the midpoint application of the Information system Implementation of the Provisioning system Implementation of the Billing system Implementation of the SAP system Implementation of the IT system infrastructure
Release and Deployment Management	Development of applications on the network element for managing the Internet Development of applications on the network element for managing the IPTV service Development of applications intended for the end user on the IPTV service Development of applications on the network element for managing the VoIP service Development of applications on the network element for managing the Hosting service Development of applications on the network element for managing the E-mail service Development of applications on the Portal of the Telecom operator Development of applications for the Monitoring service and network Development of the IP core network infrastructure Development of the DSLAM network infrastructure Development of software on terminal devices
	Testing of applications on the network element for managing the Internet Testing of applications on the network element for managing the IPTV service Testing of applications intended for the end user on the IPTV service

Service Validation and Testing	Testing of applications on the network element for managing the VoIP service Testing of applications on the network element for managing the Hosting service Testing of applications on the network element for managing the E-mail service Testing of applications on the Portal of the Telecom operator Testing of applications for the Monitoring service and network Testing of the IP core network infrastructure Testing of the DSLAM network infrastructure	IT Operations Management	halls Surveillance of air conditioning in the server halls Managing the security employees
Evaluation	Checking the validity of all tests	Continual Service Improvement	Monitoring the functional units of the Telecom operator Development of existing processes Recommending new organizational structure for the Telecom operator
Knowledge Management	Organization of professional workshops Professional and scientific education of the Telecom employees	Service Reporting	Managing public relationships Designing final reports on the business of the Telecom operator
Event Management	Management of relations between organizational units of the Telecom operator Monitoring and managing the events of other Telecom operators	Service Measurement	Measuring the quality of the implemented service
Incident Management	Solving incidents on the servers Solving the incidents on the DSLAM Solving incidents on terminal devices Solving incidents which occur in the Information and Billing system	IV. IMPLEMENTATION OF THE IMS SYSTEM BY USING THE NEW ITIL V3 MODEL	
Request Fulfillment	Managing the contents on the Portal Managing the requests of users over the Portal Direct management of user requests	Table II describes the implementation of the IMS system by using the new ITIL V3 model. All 5 ITIL V3 phases with 26 IT processes and 4 IT functions are taken into account [7]. New processes: Strategy Management [1] for IT services, Financial Management [1] for IT services, Business Relationship Management [1], Design Coordination [2] and Change Evaluation [3] are also taken in the implementation. Figure 4. presents a new ITIL V3 model from 2011.	
Problem Management	Solving problems on services Solving problems on the IP core network Solving problems on the DSLAM Solving problems on the Information system, Provisioning system or Billing system	These new processes take some process functions from standard ITIL V3 processes. Strategy Management for IT services takes managing relationships with other international organizations from Demand Management and investment management from Financial Management. This process is also responsible for the management of all other Service Strategy processes [1]. Business Relationship Management is responsible for the management: of the position of the company, the work of competing companies and internal processes [1]. Design Coordination takes defining the contents for all services of the Telecom operator from Service Catalogue Management, contract with end users from Service Level Management, defining the levels of informational security from Information Security Management and defining tenders from Supplier Management [2]. Change Evaluation is responsible for a checking of the validity of all tests, checking the validity of all implemented changes and for decision about releasing into a production of a new service [3].	
Access Management	Securing all objects of the Telecom operator Securing the server halls and network equipment Managing the security of human resources	TABLE II: IMPLEMENTATION OF THE IMS SYSTEM BY USING THE NEW ITIL V3 MODEL	
Service Desk	Providing information and solutions to problems on the Internet service Providing information and solutions to problems on the IPTV service Providing information and solutions to problems on the VoIP service Providing information and solutions to problems on the Hosting service Providing information and solutions to problems on the E-mail service Providing information and solutions to problems about the Portal of the Telecom operator	Process name	The implementation of the process
Technical Management	Surveillance and monitoring of the core router Monitoring and the surveillance of the server of services of the Telecom operator Surveillance and monitoring of the system IT platform of the Telecom operator Surveillance and monitoring of the switches in the network Monitoring and surveillance of the DSLAMs Surveillance and monitoring of terminal equipment of end users	Strategy Management for IT services	Management of Demand Management, Service Portfolio Management, Financial Management for IT services and Business Relationship Management Managing relationships with other international organizations Investment management
Application Management	Surveillance of functions of the central application of the Information system Surveillance of applications of the Provisioning system Surveillance of the Billing system Surveillance of the applications of the SAP system Surveillance of the Internet service Surveillance of the IPTV service Surveillance of the VoIP service Surveillance of the E-mail service Surveillance of the Hosting service Surveillance of the Portal of the Telecom operator Surveillance of the power supply in the server	Demand Management	Managing consumer demands Managing the demands of other Telecom operators
		Service Portfolio Management	Defining the services of the Telecom operator Managing the sales
		Financial Management for IT	Resource management Revenue management Management of the overall finances

services	Managing the expenditure of the Telecom operator	Release and Deployment Management	element for managing the Internet Development of applications on the network element for managing the IPTV service Development of applications intended for the end user on the IPTV service Development of applications on the network element for managing the VoIP service Development of applications on the network element for managing the Hosting service Development of applications on the network element for managing the E-mail service Development of applications on the Portal of the Telecom operator Development of applications for the Monitoring service and network Development of the IP core network infrastructure Development of the DSLAM network infrastructure Development of software on terminal devices
Business Relationship Management	Managing the position of the company Managing the work of competing companies Managing internal processes		
Design Coordination	Managing relations between Service Level Management on 1 side and Demand Management and Financial Management for IT services on the other side Defining the contents for all services of the Telecom operator Managing contracts with end users Defining the levels of information security Defining tenders		
Service Catalogue Management	Defining the IT service catalogue		
Service Level Management	Managing human resources in the company Managing contracts with foreign companies Solving public complaints and court trials		
Capacity Management	Managing IP network space of the Telecom operator Managing the performance system Managing the capacity of network elements, switches and DSLAMs		
Availability Management	Defining the availability plan		
IT Service Continuity Management	Defining and surveilling the backup service		
Information Security Management	Defining administrative roles in the management of the Information system		
Supplier Management	Defining juristic and economical services for the tender Defining professional circumstances for the tender Conducting the realization of the tender Managing the relationships with strategic partners		
Transition Planning and Support	Planning the adaptation of new services and utilities	Service Validation and Testing	Testing of applications on the network element for managing the Internet Testing of applications on the network element for managing the IPTV service Testing of applications intended for the end user on the IPTV service Testing of applications on the network element for managing the VoIP service Testing of applications on the network element for managing the Hosting service Testing of applications on the network element for managing the E-mail service Testing of applications on the Portal of the Telecom operator Testing of applications for the Monitoring service and network Testing of the IP core network infrastructure Testing of the DSLAM network infrastructure
Change Management	Administrating network elements for managing the Internet Administrating network elements for managing the IPTV service Administration and design application of the IPTV service Administration of network elements for managing the VoIP service Administration of network elements for managing the Hosting services Administration of network elements for managing the E-Mail service Administration of the Portal of the Telecom operator Administration of the Monitoring service and network Administration of the IP core network structure Administration of the DSLAM network Administration of terminal devices	Change Evaluation	Checking the validity of all tests Checking the validity of all implemented changes Releasing into a production of a new service
Service Asset and Configuration Management	Administration of midpoint application of the Information system Administration of the Provisioning system Administration of the Billing system Administration of the SAP system Administration of the IT system infrastructure Implementation of the midpoint application of the Information system Implementation of the Provisioning system Implementation of the Billing system Implementation of the SAP system Implementation of the IT system infrastructure	Knowledge Management	Organization of professional workshops Professional and scientific education of the Telecom employees
	Development of applications on the network	Event Management	Management of relations between organizational units of the Telecom operator Monitoring and managing the events of other Telecom operators
		Incident Management	Solving incidents on the servers Solving the incidents on the DSLAM Solving incidents on terminal devices Solving incidents which occur in the Information and Billing system
		Request Fulfillment	Managing the contents on the Portal Managing the requests of users over the Portal Direct management of user requests
		Problem Management	Solving problems on services Solving problems on the IP core network Solving problems on the DSLAM Solving problems on the Information system, Provisioning system or Billing system
		Access Management	Securing all objects of the Telecom operator Securing the server halls and network equipment Managing the security of human resources
		Service Desk	Providing information and solutions to problems on the Internet service Providing information and solutions to problems on the IPTV service Providing information and solutions to problems on the VoIP service Providing information and solutions to problems on the Hosting service Providing information and solutions to

	problems on the E-mail service Providing information and solutions to problems about the Portal of the Telecom operator
Technical Management	Surveillance and monitoring of the core router Monitoring and the surveillance of the server of services of the Telecom operator Surveillance and monitoring of the system IT platform of the Telecom operator Surveillance and monitoring of the switches in the network Monitoring and surveillance of the DSLAMs Surveillance and monitoring of terminal equipment of end users
Application Management	Surveillance of functions of the central application of the Information system Surveillance of applications of the Provisioning system Surveillance of the Billing system Surveillance of the applications of the SAP system Surveillance of the Internet service Surveillance of the IPTV service Surveillance of the VoIP service Surveillance of the E-mail service Surveillance of the Hosting service Surveillance of the Portal of the Telecom operator
IT Operations Management	Surveillance of the power supply in the server halls Surveillance of air conditioning in the server halls Managing the security employees
Continual Service Improvement	Monitoring the functional units of the Telecom operator Development of existing processes Designing final reports on the business of the Telecom operator Measuring the quality of the implemented service Recommending new organizational structure for the Telecom operator

V. RESULTS OF THE FIRST MEASUREMENT

Table III shows results of the implementation of the IMS system for the old ITIL V3 system. Two parameters are taken into consideration: time period needed for the implementation and the number of employees needed for the implementation [7], [11], [12].

TABLE III: RESULTS OF THE IMPLEMENTATION OF THE IMS SYSTEM FOR OLD THE ITIL V3 SYSTEM

Process name	Time period needed for the implementation	The number of employees needed for the implementation
Strategy Generation	2 days	3 employees
Demand Management	3 days	4 employees
Service Portfolio Management	4 days	4 employees
Financial Management	5 days	5 employees
Service Catalogue Management	2 days	2 employees
Service Level Management	7 days	6 employees
Capacity Management	1 day	2 employees
Availability Management	1 day	2 employees

IT Service Continuity Management	1 day	2 employees
Information Security Management	4 days	4 employees
Supplier Management	8 days	6 employees
Transition Planning and Support	3 days	2 employees
Change Management	4 days	5 employees
Service Asset and Configuration Management	4 days	5 employees
Release and Deployment Management	3 days	4 employees
Service Validation and Testing	2 days	2 employees
Evaluation	2 days	2 employees
Knowledge Management	3 days	3 employees
Event Management	2 days	2 employees
Incident Management	3 days	4 employees
Request Fulfillment	3 days	3 employees
Problem Management	4 days	5 employees
Access Management	1 day	2 employees
Service Desk	1 day	2 employees
Technical Management	1 day	2 employees
Application Management	1 day	2 employees
IT Operations Management	1 day	2 employees
Continual Service Improvement	2 days	4 employees
Service Reporting	2 days	2 employees
Service Measurement	1 day	2 employees
Total	81 days	96 employees

Table IV shows results of the implementation of the IMS system for a new ITIL V3 system. Two parameters are taken into consideration: time period needed for the implementation and the number of employees needed for the implementation [7], [11], [12].

TABLE IV: RESULTS OF THE IMPLEMENTATION OF THE IMS SYSTEM FOR A NEW ITIL V3 SYSTEM

Process name	Time period needed for the implementation	The number of employees needed for the implementation
Strategy Management for IT services	5 days	5 employees
Demand Management	2 days	3 employees
Service Portfolio Management	2 days	3 employees
Financial Management for IT services	4 days	4 employees
Business Relationship	3 days	4 employees

Management		
Design Coordination	4 days	3 employees
Service Catalogue Management	1 day	1 employee
Service Level Management	4 days	4 employees
Capacity Management	1 day	1 employee
Availability Management	1 day	1 employee
IT Service Continuity Management	1 day	1 employee
Information Security Management	2 days	3 employees
Supplier Management	4 days	4 employees
Transition Planning and Support	2 days	2 employees
Change Management	3 days	4 employees
Service Asset and Configuration Management	3 days	4 employees
Release and Deployment Management	2 days	3 employees
Service Validation and Testing	2 days	2 employees
Change Evaluation	2 days	2 employees
Knowledge Management	2 days	2 employees
Event Management	1 day	1 employee
Incident Management	2 days	3 employees
Request Fulfillment	2 days	3 employees
Problem Management	2 days	4 employees
Access Management	1 day	2 employees
Service Desk	1 day	2 employees
Technical Management	1 day	2 employees
Application Management	1 day	2 employees
IT Operations Management	1 day	2 employees
Continual Service Improvement	2 days	4 employees
Total	64 days	81 employees

Figure 5. shows the ratio between the old ITIL V3 model and the new ITIL V3 model for the parameter: time period needed for the implementation. The result is: 56% of spended time for ITIL V3 model I (the old model) and 44% of spended time for ITIL V3 model II (the new model).

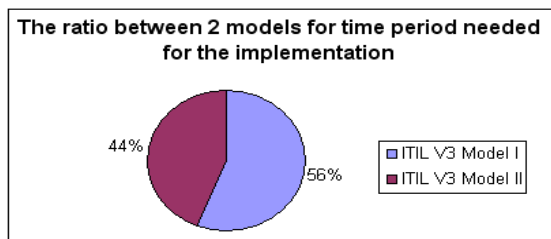


Figure 5. Results for time period needed for the implementation

Figure 6. shows the ratio between the old ITIL V3 model and the new ITIL V3 model for the parameter: number of employees needed for the implementation. The result is: 54% of employees are spended for ITIL V3 model I (the old model) and 46% of employees are spended for ITIL V3 model II (the new model).

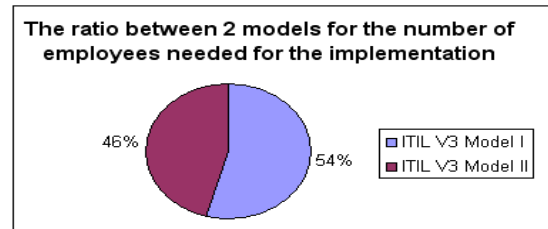


Figure 6. Results for number of employees needed for the implementation

VI. MEASUREMENTS OF THE IMPLEMENTATION OF ITIL 2007 AND ITIL 2011 MODEL IN THE IMS SYSTEM BY USING KEY PERFORMANCE INDICATORS

Last measurement has showed that the ITIL model from 2011 is better than ITIL model from 2007 in two parameters: the number of employees and the time needed for the implementation of the IMS system. Key performance indicators are taken in this measurement to see better differences between these two ITIL models [6]. Processes, which are chosen in this measurement, exist in both ITIL models: Financial Management [1], Service Portfolio Management [1], Service Level Management [2], Capacity Management [2], Availability Management [2], IT Service Continuity Management [2], Information Security Management [2], Supplier Management [2], Change Management [3], Service Asset and Configuration Management [3], Release and Deployment Management [3], Service Validation and Testing [3], Incident Management [4], Problem Management [4] and Continual Service Improvement Process [5]. All results show the ratio in percentages between these two models.

For the measurement of all key performance indicators, we have chosen a technique which is called: Balanced Scorecard [5], [20]. This technique makes a final result of the implementation of each key performance indicator based on these 4 parameters: the number of users, internal processes, organization growth and finances.

Table V shows key performance indicators for Financial Management [1], [6]. The final result of the implementation of all key performance indicators, which is showed as the ratio in percentages, is 43% of successful implemented key performance indicators for ITIL 2007 against 57% of successful implemented key performance indicators for ITIL 2011.

TABLE V: KEY PERFORMANCE INDICATORS FOR FINANCIAL MANAGEMENT

Key Performance Indicator	ITIL 2007	ITIL 2011
Adherence to Budgeting Process	46%	54%

Cost-/ Benefit Estimation	43%	57%
Post Implementation Review	40%	60%
Adherence to Approved Budget	48%	52%
Adherence to Project Resources	44%	56%
Proposals for Cost Optimization	38%	62%

Table VI shows key performance indicators for Service Portfolio Management [1], [6]. The final result of the implementation of all key performance indicators, which is showed as the ratio in percentages, is 47% of successful implemented key performance indicators for ITIL 2007 against 53% of successful implemented key performance indicators for ITIL 2011.

TABLE VI: KEY PERFORMANCE INDICATORS FOR SERVICE PORTFOLIO MANAGEMENT

Key Performance Indicator	ITIL 2007	ITIL 2011
Number of Planned New Services	48%	52%
Number of Unplanned New Services	49%	51%
Number of Strategic Initiatives	39%	61%
Number of New Customers	48%	52%
Number of Lost Customers	50%	50%

Table VII shows key performance indicators for Service Level Management [2], [6]. The final result of the implementation of all key performance indicators, which is showed as the ratio in percentages, is 44% of successful implemented key performance indicators for ITIL 2007 against 56% of successful implemented key performance indicators for ITIL 2011.

TABLE VII: KEY PERFORMANCE INDICATORS FOR SERVICE LEVEL MANAGEMENT

Key Performance Indicator	ITIL 2007	ITIL 2011
Services covered by SLAs	47%	53%
Services covered by OLAs	40%	60%
Monitored SLAs	45%	55%
SLAs under Review	46%	54%
Fulfilment of Service Levels	39%	61%
Number of Service Issues	44%	56%

Table VIII shows key performance indicators for Capacity Management [2], [6]. The final result of the implementation of all key performance indicators, which is showed as the ratio in percentages, is 46% of successful implemented key performance indicators for ITIL 2007 against 54% of successful implemented key performance indicators for ITIL 2011.

TABLE VIII: KEY PERFORMANCE INDICATORS FOR CAPACITY MANAGEMENT

Key Performance Indicator	ITIL 2007	ITIL 2011
Incidents due to Capacity Shortages	43%	57%
Exactness of Capacity	42%	58%

Forecast		
Capacity Adjustments	41%	59%
Resolution Time of Capacity Shortage	52%	48%
Capacity Reserves	50%	50%
Percentage of Capacity Monitoring	47%	53%

Table IX shows key performance indicators for Availability Management [2], [6]. The final result of the implementation of all key performance indicators, which is showed as the ratio in percentages, is 46% of successful implemented key performance indicators for ITIL 2007 against 54% of successful implemented key performance indicators for ITIL 2011.

TABLE IX: KEY PERFORMANCE INDICATORS FOR AVAILABILITY MANAGEMENT

Key Performance Indicator	ITIL 2007	ITIL 2011
Service Availability	47%	53%
Number of Service Interruptions	51%	49%
Duration of Service Interruptions	50%	50%
Availability Monitoring	42%	58%
Availability Measures	40%	60%

Table X shows key performance indicators for IT Service Continuity Management [2], [6]. The final result of the implementation of all key performance indicators, which is showed as the ratio in percentages, is 42% of successful implemented key performance indicators for ITIL 2007 against 58% of successful implemented key performance indicators for ITIL 2011.

TABLE X: KEY PERFORMANCE INDICATORS FOR IT SERVICE CONTINUITY MANAGEMENT

Key Performance Indicator	ITIL 2007	ITIL 2011
Business Processes with Continuity Agreements	43%	57%
Gaps in Disaster Preparation	42%	58%
Implementation Duration	51%	49%
Number of Disaster Practices	39%	61%
Number of Identified Shortcomings during Disaster Practices	38%	62%

Table XI shows key performance indicators for Information Security Management [2], [6]. The final result of the implementation of all key performance indicators, which is showed as the ratio in percentages, is 44% of successful implemented key performance indicators for ITIL 2007 against 56% of successful implemented key performance indicators for ITIL 2011.

TABLE XI: KEY PERFORMANCE INDICATORS FOR INFORMATION SECURITY MANAGEMENT

Key Performance Indicator	ITIL 2007	ITIL 2011
Number of Implemented	41%	59%

Preventive Measures		
Implementation Duration	45%	55%
Number of Major Security Incidents	52%	48%
Number of Security Tests	47%	53%
Number of Identified Shortcomings during Security Tests	37%	63%

Table XII shows key performance indicators for Supplier Management [2], [6]. The final result of the implementation of all key performance indicators, which is showed as the ratio in percentages, is 42% of successful implemented key performance indicators for ITIL 2007 against 58% of successful implemented key performance indicators for ITIL 2011.

TABLE XII: KEY PERFORMANCE INDICATORS FOR SUPPLIER MANAGEMENT

Key Performance Indicator	ITIL 2007	ITIL 2011
Number of Agreed Contracts	42%	58%
Number of Contract Reviews	46%	54%
Number of Identified Contract Breaches	38%	62%

Table XIII shows key performance indicators for Change Management [3], [6]. The final result of the implementation of all key performance indicators, which is showed as the ratio in percentages, is 47% of successful implemented key performance indicators for ITIL 2007 against 53% of successful implemented key performance indicators for ITIL 2011.

TABLE XIII: KEY PERFORMANCE INDICATORS FOR CHANGE MANAGEMENT

Key Performance Indicator	ITIL 2007	ITIL 2011
Number of Major Changes	45%	55%
Time for Change Clearance	43%	57%
Change Acceptance Rate	48%	52%
Number of Urgent Changes	53%	47%

Table XIV shows key performance indicators for Service Asset and Configuration Management [3], [6]. The final result of the implementation of all key performance indicators, which is showed as the ratio in percentages, is 44% of successful implemented key performance indicators for ITIL 2007 against 56% of successful implemented key performance indicators for ITIL 2011.

TABLE XIV: KEY PERFORMANCE INDICATORS FOR SERVICE ASSET AND CONFIGURATION MANAGEMENT

Key Performance Indicator	ITIL 2007	ITIL 2011
Verification Frequency	44%	56%
Verification Duration	42%	58%
Effort for CMS Verifications	39%	61%
Automatic CMS Update	47%	53%
Number of CMS Errors	46%	54%

Table XV shows key performance indicators for Release and Deployment Management [3], [6]. The final result of the implementation of all key performance indicators, which is showed as the ratio in percentages, is 48% of successful implemented key performance indicators for ITIL 2007 against 52% of successful implemented key performance indicators for ITIL 2011.

TABLE XV: KEY PERFORMANCE INDICATORS FOR RELEASE AND DEPLOYMENT MANAGEMENT

Key Performance Indicator	ITIL 2007	ITIL 2011
Number of Releases	47%	53%
Duration of Major Deployments	42%	58%
Number of Release Backouts	47%	53%
Proportion of Automatic Release Distribution	54%	46%

Table XVI shows key performance indicators for Service Validation and Testing [3], [6]. The final result of the implementation of all key performance indicators, which is showed as the ratio in percentages, is 49% of successful implemented key performance indicators for ITIL 2007 against 51% of successful implemented key performance indicators for ITIL 2011.

TABLE XVI: KEY PERFORMANCE INDICATORS FOR SERVICE VALIDATION AND TESTING

Key Performance Indicator	ITIL 2007	ITIL 2011
Percentage of Failed Release Component Acceptance Tests	50%	50%
Number of Identified Errors	49%	51%
Time for Error Fixing	47%	53%
Incidents Caused by New Releases	51%	49%
Percentage of Failed Service Acceptance Tests	50%	50%

Table XVII shows key performance indicators for Incident Management [4], [6]. The final result of the implementation of all key performance indicators, which is showed as the ratio in percentages, is 45% of successful implemented key performance indicators for ITIL 2007 against 55% of successful implemented key performance indicators for ITIL 2011.

TABLE XVII: KEY PERFORMANCE INDICATORS FOR INCIDENT MANAGEMENT

Key Performance Indicator	ITIL 2007	ITIL 2011
Number of Repeated Incidents	51%	49%
Remotely Resolved Incidents	38%	62%
Number of Escalations	49%	51%
Number of Incidents	52%	48%
Incident Resolution Time	42%	58%
First Time Resolution Rate	44%	56%
Resolution within SLA	40%	60%

Incident Resolution Effort	41%	59%
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Table XVIII shows key performance indicators for Problem Management [4], [6]. The final result of the implementation of all key performance indicators, which is showed as the ratio in percentages, is 44% of successful implemented key performance indicators for ITIL 2007 against 56% of successful implemented key performance indicators for ITIL 2011.

TABLE XVIII: KEY PERFORMANCE INDICATORS FOR PROBLEM MANAGEMENT

Key Performance Indicator	ITIL 2007	ITIL 2011
Number of Problems	53%	47%
Problem Resolution Time	42%	58%
Number of Incidents per Problem	41%	59%
Number of Incidents per Known Problem	44%	56%
Time until Problem Identification	42%	58%
Problem Resolution Effort	46%	54%

Table XIX shows key performance indicators for Continual Service Improvement process [5], [6]. The final result of the implementation of all key performance indicators, which is showed as the ratio in percentages, is 45% of successful implemented key performance indicators for ITIL 2007 against 55% of successful implemented key performance indicators for ITIL 2011.

TABLE XIX: KEY PERFORMANCE INDICATORS FOR CONTINUAL SERVICE IMPROVEMENT PROCESS

Key Performance Indicator	ITIL 2007	ITIL 2011
Number of Process Benchmarkings, Maturity Assessments, and Audits	43%	57%
Number of Process Evaluations	42%	58%
Number of Identified Weaknesses	49%	51%
Number of Improvement Initiatives	45%	55%
Number of Completed Improvement Initiatives	46%	54%

VII. FINAL RESULTS AND CONCLUSION

Table XX shows final results of all measurements for all 15 ITIL processes. ITIL 2011 is better than ITIL 2007 in all 15 processes. Two processes in which ITIL 2011 is much better than ITIL 2007 are: Financial Management and Supplier Management. ITIL 2011 is better in Financial Management than ITIL 2007 for 14% (57% against 43% for ITIL 2011). ITIL 2011 is better in Supplier Management than ITIL 2007 for 16% (58% against 42% for ITIL 2011).

Two processes in which are the results almost equal are: Service Validation and Testing process and Release and Deployment Management. ITIL 2011 is better in Service Validation and Testing Process than ITIL 2007 for 2%

(51% against 49% for ITIL 2011). ITIL 2011 is better in Release and Deployment Management than ITIL 2007 for 4% (52% against 48% for ITIL 2011).

Table XX shows final results for all 15 ITIL processes. Arithmetic sum of all 15 results shows that ITIL 2011 is better for 10% than ITIL 2007 (55% against 45%).

TABLE XX: SUMMARY RESULTS FOR ITIL PROCESSES

Key Performance Indicator	ITIL 2007	ITIL 2011
Financial Management	43%	57%
Service Portfolio Management	47%	53%
Service Level Management	44%	56%
Capacity Management	46%	54%
Availability Management	46%	54%
IT Service Continuity Management	42%	58%
Information Security Management	44%	56%
Supplier Management	42%	58%
Change Management	47%	53%
Service Asset and Configuration Management	44%	56%
Release and Deployment Management	48%	52%
Service Validation and Testing	49%	51%
Incident Management	45%	55%
Problem Management	44%	56%
Continual Service Improvement process	45%	55%

Table XXI shows final results for all 5 ITIL phases. Results show that ITIL 2011 is better in all 5 phases than ITIL 2007 (the most in Service Design phase where is difference of 12% in favor of ITIL 2011 and the least in Service Transition phase where is ITIL better than ITIL 2007 for 5%) [20], [21], [22].

TABLE XXI: SUMMARY RESULTS FOR ITIL PHASES

Key Performance Indicator	ITIL 2007	ITIL 2011
Service Strategy	45%	55%
Service Design	44%	56%
Service Transition	47%	53%
Service Operation	44.5%	55.5%
Continual Service Improvement	45%	55%

All these results, which are described in this paper, show that ITIL 2011 is much better than ITIL 2007. It means that improvements in a new ITIL model from 2011 are achieved. In this research it was taken IP Multimedia Subsystem which is a system of convergence between fixed telephony and mobile telephony and also one complex and big system which is suitable for the research which is covered in this paper. Every organization that has implemented ITIL 2007 should think about introducing ITIL 2011 into its workaround. The organization should introduce these 3 new processes from ITIL 2011: Strategy Management for IT services, Business Relationship Management and Design Coordination. Except introducing

a new processes, a organization should change main process activities for these processes: Service Portfolio Management, Service Level Management, Event Management, Incident Management, Request Fulfillment and Problem Management [8].

Future work of authors in this field is connected to the improvement of the existing ITIL 2011 framework [8]. This research has showed that some processes need some improvements like Service Validation and Testing Process and Release and Deployment Management. The future research of authors is connected to the improvement of these 2 ITIL processes in the test environment of the Telecom operator.

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REFERENCES

- [1] S. Taylor, M. Iqbal, and M. Nieves, "ITIL Version 3 Service Strategy", The Office of Government Commerce, July 2011.
- [2] S. Taylor, V. Lloyd, and C. Rudd, "ITIL Version 3 Service Design", The Office of Government Commerce, July 2011.
- [3] S. Taylor, S. Lacy, and I. Macfarlane, "ITIL Version 3 Service Transition", The Office of Government Commerce, July 2011.
- [4] S. Taylor, D. Cannon, and D. Wheeldon, "ITIL Version 3 Service Operation", The Office of Government Commerce, July 2011.
- [5] S. Taylor, G. Case, and G. Spalding, "ITIL Version 3 Continual Service Improvement", The Office of Government Commerce, July 2011.
- [6] J. van Bon, A. de Jong, A. Kolthof, M. Pieper, R. Tjassing, A. van der Veen, and T. Verheijen, "Foundations of IT Service Management Based on ITIL V3", The Office of Government Commerce, September 2007.
- [7] A. Tanovic and F. Orucevic, "Integration of PRINCE 2 model into ITIL V3 model", paper accepted for 19th Telecommunications Forum (TELFOR 2011), November 2011.
- [8] A. Tanovic, I. Androulidakis, and F. Orucevic, "Design and implementation of the IP Multimedia Subsystem by using ITIL V3 recommendations", paper accepted for 11th WSEAS International Conference on Applications of Computer Engineering (ACE'12).
- [9] S. Pompei, M. Teodori, A. Valenti, S. Di Bartolo, G. Incerti, and D. Del Buono, "Experimental implementation of an IPTV architecture based on Content Delivery Network managed by VPLS technique", International Congress on Ultra Modern Telecommunications and Control Systems and Workshops (ICUMT 2010), pp. 576-581, December 2010.
- [10] R. Chaudhuri, "End to End IPTV Design and Implementation, How to avoid Pitfalls", 13th International Telecommunications Network Strategy and Planning Symposium, pp. 1-119, January 2009.
- [11] L. Xin, L. Jiangtao, and L. Hui, "Design and Implementation of the Mobile IPTV Service Based on the IMS Intelligent Terminal", International Conference on Internet Technology and Applications (iTAP 2011), pp. 1-3, August 2011.
- [12] H. Khelifi and J.C. Gregoire, "IMS for Enterprises", International Journal of Communications Magazine, pp. 68-75, vol. 45, July 2007.
- [13] R.F. de Sousa Pereira and M.M. da Silva, "A Maturity Model for Implementing ITIL v3", 6th World Congress on Services (SERVICES-1), pp. 396-406, July 2010.
- [14] T. Kovacic, I. Kotuliak, K. Konopkova, and J. Muranyi, "Service availability enhancement in multimedia networks", 3rd Joint IFIP Wireless and Mobile Networking Conference (WMNC 2010), pp. 1-6, October 2010.
- [15] A. Tanovic, "Innovative model of ITIL V3 improvements based on comparative IT Service Management methodologies", preparation doctoral study, Faculty of Electrical Engineering, University of Sarajevo.
- [16] L. Xin, L. Jiangtao, and L. Hui, Design and Implementation of the Mobile IPTV Service Based on the IMS Intelligent Terminal, *International Conference on Internet Technology and Applications (iTAP 2011)*, pp. 1-3, August 2011.
- [17] H. Khelifi and J.C. Gregoire, IMS Application Servers: Roles, Requirements, and Implementation Technologies, *IEEE Internet Computing*, 12 (3), 2008, pp. 40-51.
- [18] A. Tanovic and F. Orucevic, Comparative analysis of the practise of telecom operators in the realization of IPTV systems based on ITIL V3 recommendations for the Supplier Management Process, *IEEE International Conference on Service-Oriented Computing and Applications (SOCA'10)*, 2010, pp. 1-8.
- [19] A. Tanovic and F. Orucevic, Analysis of the implementation of the information security management in the IPTV/VoIP system of the Telecom operator, *18th International Conference on Systems, Signals and Image Processing (IWSSIP 2011)*, June 2011, pp. 1-5.
- [20] Dz. Donko and I. Traljic, Continual Service Improvement Using Balanced Scorecard, *8th WSEAS International Conference on Telecommunications and Informatics (TELE-INFO '09)*, pp. 157-162, May 2009.
- [21] S. Simonova and I. Zavadilova, Usage of business process tools for modelling requirements on system changes, *WSEAS International Conference on Development, Energy, Environment, Economics (DEEE'10)*, pp. 321-326, November 2010.
- [22] M. Jansen, What does it Service Management look like in the cloud, *WSEAS International Conference on Computers, digital communications and computing (ICDCC'11)*, pp. 87-92, September 2011.
- [23] Z. Balantic, Spiral Model Development Concept of Multimedia Application, *10th WSEAS International Conference on Computers*, pp. 317-320, July 2006.
- [24] C.E. Vintila, A Solution for Secure SIP Conferencing over IMS and SAE, *4th European Computing Conference (ECC'10)*, pp. 224-229, April 2010.

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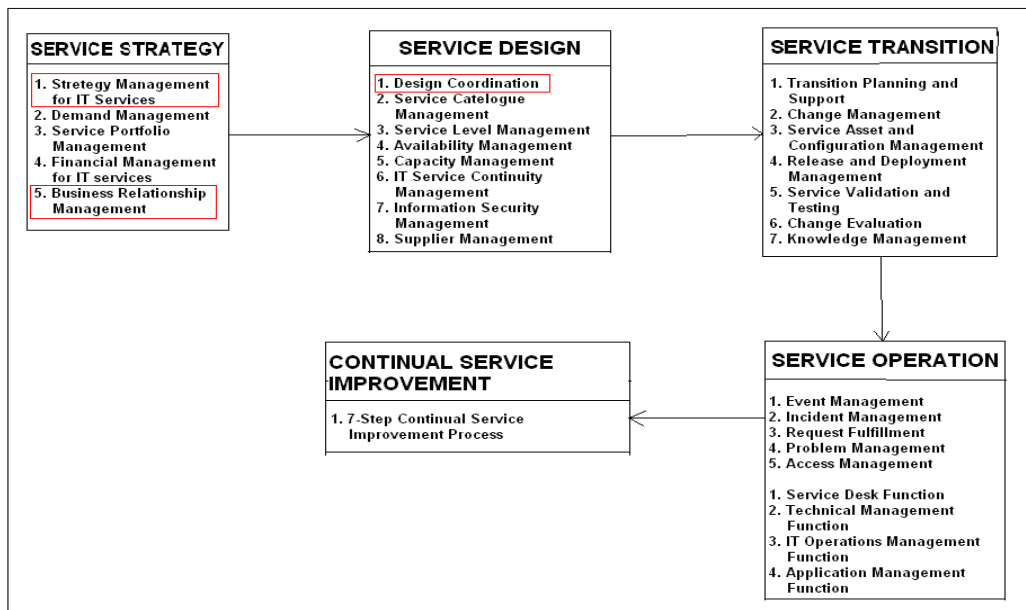


Figure 4. New ITIL V3 model from 2011