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development, choosing the right partner, communication, planning technical transfer), our principle is to benefit the client's business through the intelligent use of web technologies. Secondly: illustrate details what communication means in business, the steps required for effective communication, the importance of communications in diverse work groups, and a four-step process for effective communication.	
Increasing the Speed of the Recursive Algorithm and Reducing Stack Memory Consumption by Using the Dynamic Rule(base) *Nashwan Saeed M.G. Al-Thobhani, Naser Ahmed O. Al-Maweri , Jamil Sultan* Recursive algorithms always consume a computer's memory stack, and in this paper we worked to increase the speed of the recursive algorithm through a dynamic rule(base) that changes during its implementation process. Dynamic rule(base) regulation often allows avoiding repeated calculations of the same sets of parameter values, which reduces the number of repeated calls and simplifies slow calculations. Here, a mechanism will be created for the rule using simple and well-known examples to calculate the Fibonacci sequence, recurring linear sequences of general shape, and binomial transactions.	**22-29**

Article

Extending and Enhancing Data Storage System Based on Blade Server in Telecommunication Company

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Article info	Abstract
Article history: Accepted: May. 2020 **Keywords:** Data Storage; storage networks; Plan; Blade Server; Improve; Stage; Enhancing	Mobile telecommunications companies are among the companies that must provide rapid and secure access to information to the end user and link users to each other or to the outside world, such as the Internet and its services or international telephone communications, so access to information must be fast, secure and available at all time. In order to raise the level of performance and capacity in the company's services level, researchers examined and verified the company's data storage center and interviewed 50 employees related to data storage and processing services. After analyzing the interviews, questionnaires, examining the equipment in the data center and processing it, we found that there is a problem in the company, which is the weakness of the data storage capacity and their use of servers with old processors with less capacity than the company needs. So we implemented a four-part integrated plan to expand and harden the data storage system using blade server; Each stage contains many sub-procedures and we found results that achieve the objectives of the study. Finally, the researchers suggest several recommendations to develop and improve the company's services in the future.

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1.Introduction

A large quantity of digital information is being created every moment by individual and corporate consumers of IT [8], [9]. This information needs to be stored, protected, optimized, and managed. Not long ago, information storage was seen as only a bunch of disks or tapes attached to the back of the computer to store data[1],[2],[9]. Even today, only those in the storage industry understand the critical role that information storage technology plays in the availability, performance, integration, and optimization of the entire IT infrastructure [8]. Over the last two decades, information storage has developed into a highly sophisticated technology, providing a variety of solutions for storing, managing, connecting, protecting, securing, sharing, and optimizing digital information [8]. There are a variety of types of secondary storage systems, also called: array, enterprise arrays, storage, mass storage systems, information storage systems, arrays, storage management systems, data storage systems.

According to the first visit to Telecommunication company made by researchers and doing meets with the data storage's official in the (Data Center) of Telecommunication company. They discuss with the problems and difficulties faced during the conduct of the work in the company, they said that are Suffer from the entry into force of the storage capacity used in the company, as well as the system currently used in the storage is old and unable to meet the company's needs in accelerating growth. In addition to slow process in transport and access to data, as well as increasing the costs for the operation and maintenance of the storage system.

The storage system in Telecommunication Company is very high costly, the overall storage capacity is insufficient to store and save all data and transmitting the data on the network is achieved with very latency.

The main objectives of this research:
1. Developing and increasing the data storage capacity.
2. Transfer data and access to the storage system with high performance and effectiveness.
3. Reduce costs used in storage process in Telecommunication company.

2. Data Storage

2.1 Data Protection: RAID
RAID is an enabling technology that leverages multiple disks as part of a set, which provides data protection against HDD failures. In general, RAID implementations also improve the I/O performance of storage systems by storing data across multiple HDDs. (RAID).This section described the use of small-capacity, inexpensive disk drives as an alternative to large-capacity drives common on mainframe computers[10].

2.2 RAID Array Components
A RAID array is an enclosure that contains a number of HDDs and the supporting hardware and software to implement RAID. HDDs inside a RAID array are usually contained in smaller sub enclosures. These sub-enclosures, or physical arrays, hold a fixed number of HDDs, and may also include other supporting hardware, such as power supplies. A subset of disks within a RAID array can be grouped to form logical associations called logical arrays, also known as a RAID set or a RAID group [9]. These techniques determine the data availability and performance characteristics of an array.as shown in table 1.

Table 1: These techniques determine the data availability and performance characteristics of an array.

LEVELS	BRIEF DESCRIPTION
RAID 0	Striped array with no fault tolerance
RAID 1	Disk mirroring
RAID 3	Parallel access array with dedicated parity disk
RAID 4	Striped array with independent disks and a dedicated parity disk
RAID 5	Striped array with independent disks and distributed parity
RAID 6	Striped array with independent disks and dual distributed parity
Nested	Combinations of RAID levels. Example: RAID 1 + RAID 0

2.3 Data Storage Techniques

In larger companies, the storage architecture is often composed of several, linked types of storage hardware. These are typically classified as DAS ,NAS ,or SAN. Larger companies sometimes use DAS as well as NAS and SAN; occasionally placing the legacy DAS on the network using bridge devices or using it to store less critical data. These three types will be discussed as following:

a) Direct Attached Storage (DAS)

Direct-attached storage (DAS) refers to a digital storage system directly attached to a server or workstation, without a storage network in between [3], [4], [5]. It is a mainly used to differentiate no networked storage from the concepts of storage area network (SAN) and network-attached storage (NAS). The computer storage is directly attached to one computer or server, without special support, directly accessible to other ones [11]. The main alternatives to DAS are NAS and SAN. For an individual computer user, the hard drive is the usual form of direct-attached storage. In an enterprise, providing for storage that can be shared by multiple computers and their users tends to be more efficient and easier to manage [12].

b) NAS

NAS is a file-level computer data storage connected to a computer network providing data access to a heterogeneous group of clients. NAS not only operates as a file server, but is specialized for this task either by its hardware, software, or configuration of those elements [6].

Figure 1: NAS Architecture

c) Storage Area Networks (SAN)

SAN is a dedicated network that provides access to consolidated, block level data storage. SANs are primarily used to enhance storage devices, such as disk arrays, tape libraries, and optical jukeboxes, accessible to servers so that the devices appear like locally attached devices to the operating system [3]. Storage virtualization is the pooling of physical storage from multiple network storage devices into what appears to be a single storage device that is managed from a central console [7]. Storage virtualization helps the storage administrator perform the tasks of backup, archiving, and recovery more easily (and in less time) by

disguising the actual complexity of a SAN. Administrators can implement virtualization with software applications or by using hardware and software hybrid appliances.
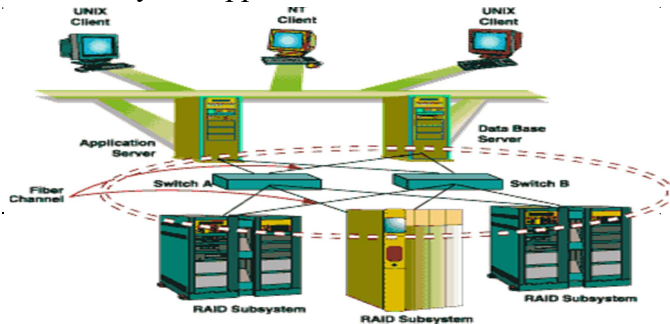
Figure 2: Attached Network Architecture

d) Virtualization

Among the leading business challenges confronting and information technology managers today are: cost-effective utilization of IT infrastructure; responsiveness in supporting new business initiatives, and flexibility in adapting to organizational changes, driving an additional sense of urgency is the continued climate of IT budget constraints and more stringent regulatory requirements [13].
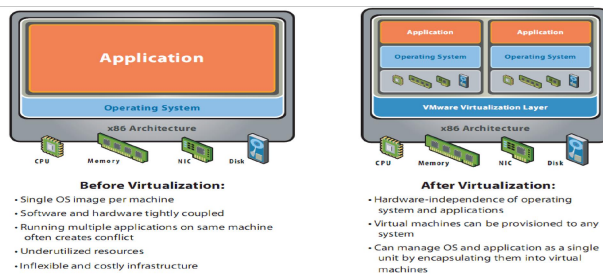
Figure 3: Virtualization

The demand for disk storage capacity in enterprise environments continues to grow at exorbitant levels. As IT organizations procure additional capacity they are faced with many difficult decisions.

- Should they stick with the same vendor that they already have in their environment?
- Should they maintain the same protocols and interface technology?
- What are the performance requirements of the new storage?
- How much capacity must be reserved for growth?
- How will they migrate from an old storage system to the new one?

The Block access is typically delivered over Fiber Channel, iSCSI, SAS, FICON or other protocols. File access is often provided using **NFS** or **CIFS** protocols. Within the context of a storage system, there are two primary types of virtualization that can occur:

Block virtualization used in this context refers to the abstraction (separation) of logical storage (partition) from physical storage so that it may be accessed without regard to physical storage or heterogeneous structure. This separation allows the administrators of the storage system greater flexibility in how they manage storage for end users [14].

File virtualization addresses the NAS challenges by eliminating the dependencies between the data accessed at the file level and the location where the files are physically stored. This provides opportunities to optimize storage use and server consolidation and to perform non-disruptive file migrations. 2.4 Blade server.

3. Blade Server Technology

A blade server is an ultra-compact server designed to be installed within a special chassis, which is responsible for supplying support infrastructure to blades via a backplane connection. Blade servers do not have their

own power supplies or cooling solutions (including fans) as these are supplied by the chassis. To give an idea of the densities possible in a server chassis, in Figure 3, on the right shows 64 physical servers installed in a standard 42RU rack in the HP blade system. This can be increased to 128 servers if use the ProLiant BL2x20 dual-server half-height blades.

Configuration can simply require installing two The Modular Server Enclosure offers redundant configurations for power supplies, fans, I/O modules, network connections, and management modules:

- Power supply redundancy.
- I/O module redundancy.
- Network connection redundancy.
- Management module redundancy.
- High availability for blade server environments.

4. Data Collection

The research's data is gathered by using interview to obtain the initial data and questionnaires for actual data.

4.1 Interviews

During the initial storage official visit of researchers to Telecommunication company, the initial data was collected by Interview Questions that have been prepared related to the research objectives, and targeted the data center manager and IT employees in the company.

4.2 Questionnaires

The questionnaire has been conducted to gather the data about the users' satisfaction and acceptance of the current data storage and the suggested solutions. These questionnaires have been distributed for 50 users in the company.

4.3 Research Sample

The research aims to study the case of data storage in Telecommunication Company. An interview has been conducted with the director of the data center and the data storage official in the company. In addition, the questionnaire was distributed to 50 users in the company.

4.4 Current situation (Pilot Study)

When the researchers visited the Telecommunication Company and met with the data center manager and data storage manager, they found that the infrastructure consists of a large data center that contains the storage unit and the company's network hardware such as servers, basic keycaps, power supplies, etc. Moreover, they found that the company has 550 employees. The storage unit uses Sun Storagtek technology that was made by SUN in 2007 with version 2510. Telecom has a huge problem with storage, and a lack of enough space to store company data for current and future use.

Where the storage unit is connected to the core-switch using fiber optic cables and using SAN storage technique, and NAS storage technique is used to back up the server data into tapes driver at NAS connection. The SAN-switch has ability to transmit high data with 2, 4, 8Gb speed but the current used speed is 2GB. The SUN storage use an old Hard Disk Drivers internal that are connected through SAS connection and have the speed 7200k rpm of reading and writing. The overall storage capacity is 10TB and is divided into units are called LUNs, every LUN have a specifics space. The storage system uses dynamic partition technique (Raid1,5) to distribute the storage capacity. Each user has a specialty 2 GB from the overall storage capacity, somewhat 300 MB is determined for his E-

mails, so that the user can not send greater than 5 MB size email internally and 4 MB size email externally, in addition to the new employees can't create emails for themselves.

Because the SUN storage system is Old, there is no a good Compatibility between the company's modern resources and the storage system such as (blade server and ESXI Virtual system) where he ESXI don't supported some modern blade server features. The SUN storage has cache memory with 2 GB size and it Is Very slow in the backup process, where this process takes around three and a half days. The cooling system is centralized to the overall data center. The blade server has a virtual machine environment using VMware esx3.0 version at storage technology.

5. Result and Analysis

5.1 Initial Results
The purpose of these interviews was gaining the general ideas and opinions of those individuals related to the data storage that have responsibilities of the data storage in Telecommunication Company. The result of the interviews was following:

1. There is a big problem in storing data, and this problem appears in the lack of sufficient space to store company data in the future.
2. Company employees use Sun storagtek 2510 technology to store most of the company's data.
3. Company employees use outdated (HDD internal) hard drive drivers, and are connected via 7200 kbps SAS connections for reading and writing.
4. The total storage capacity currently in use is 10 TB, distributed on different virtual partition disks.

5. The backup in the current system storage (SUN) is performed in a very slow process in the backup process, as this process takes three and a half days.
6. Storage is divided into a fixed number of LUNs, each LUN having either 500, 300 or 200 GB power.
7. Used to run MS Windows server2003.
8. The maintenance mission of the company is for two employees only.
9. No tire level is used because the SUN volume cannot handle the different levels while accessing the required data. For example, when he tried to enter TIER1, an error message saying "You are not allowed to enter this level and only attempt to re-enter level 2 and 3" is displayed.
10. Compatibility is very weak between the company's resources such as modern (blade server with (ESXI virtual system) and storage system, because the current system used (SUN storage) is Old version that has cache memory 2 GB.
11. Each user has 2GB and 300MB storage space for their emails, so the user cannot send email size internally greater than 5MB and 4MB externally. In addition to the data store administrator does not give private emails to the company's new employees, because they do not have enough space.

5.2 Questionnaire Results
The questions were distributed to a group of 50 employees from the staff of the Y - Company to clarify and find out their opinion and their satisfaction with the environment and the storage of the company. These questions were composed of 10 questions, nine questions are including closed answers

Table 2. Questionnaire Form with Analysis.

NO.	Question	Completely Agree	Agree	Disagree	Completely disagree
1	The shared application requires frequently saving.	30%	70%	0%	0%
2	You use database, xls, doc and personal files.	15%	80%	5%	0%
3	You save data to shared storage.	62%	35%	3%	0%
4	When saving data you save Quickly without problems.	12%	18%	47%	23%
5	When you edit files you face problems.	15%	64%	21%	0%
6	You loss files from the shared storage.	40%	43%	12%	5%
7	Data you are dealing with is sensitive and important.	90%	10%	0%	0%
8	Business and personal files are shared across the network.	20%	74%	6%	0%
9	You have big limit when sending attachment via outlook internally and externally.	3%	10%	16%	71%
10	Do you have any comments? 1. ………………………………………………………….. 2. …………………………………………………………..				

and one is has opened answer. The results of the questionnaire are shown in the table 2.

Figure 4 shows a sketch graph which clears the percentages and answers the questions and results of the questionnaire, and consists of 10 questions, including closed and open-ended question, which were distributed to 50 employees in the company.
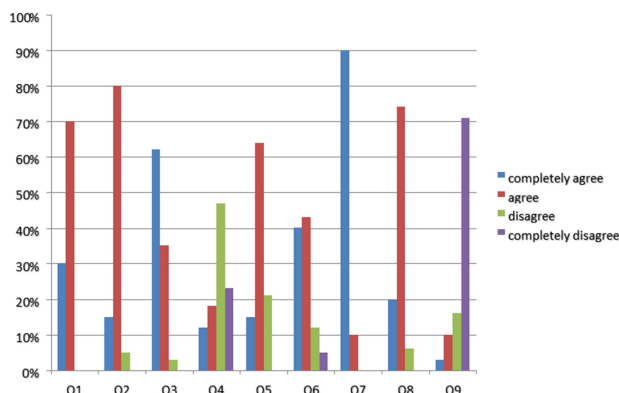
Figure 4. Questionnaire's Analysis

5.3 The Results of the Research and its Reliability and Stability

The answer to the interview questions was consistent with the answers to the questionnaire questions and thus an emphasis on honesty, consistency and reliability in the objectives of the study, which aims to expand and enhance data capacity and activate data transmission while saving the cost of data storage in the telecommunication company. After analyzing all of the above, the researchers found the following:

1. There is a problem with the data storage system that is transferring data slowly at 2 Gbps

2. Insufficient space in the current system storage (SUN Storage) that causes user data loss.

3. Not to use information technology to secure data.

4. Difficulty in managing the current data storage system.

5. The large amount of data that flows on the company's servers, which is not commensurate with the storage capacity in the servers, which leads to slowing down of

the service in the company (the size of the physical memory is 2 gigabits per second and the amount of data flowing frequently is 5 gigabits per second).

6. Suggestion Solutions and Implementation Plan

After analyzing and discussing the data by interview and questionnaire, here will develop solutions proposed to solve the problem statement, then implemented through the implementation plan then doing the feasibility study for the application of these are solutions through the study of implementation as well as to develop a set of recommendations on the problem of the research to be taken and taken in the future, then will be listed a total of facilities and constraints faced the researchers during the preparation of this research.

6.1 Suggestion Solutions

After know and identify the problem faced by the telecommunication company. this problem represented in "The storage system is very high costly, the overall storage capacity is insufficient to store and save all data and transmitting the data on the network is achieved with very latency", then analyzing the data that has been obtained through a questionnaire which was distributed to the company's employees, are here we suggest a final solution to solve this problem which is as follows:

1. Developing the current storage system used in the telecom company (Sun StorageTek 2510).
2. Replacing the current storage system by another:
   a) EMC VNX 5700.
   b) HP 3PAR StoreServ 7000 Storage.

6.2 The best solution's choosing

After suggest multi of solution and compare between it, then choose best solution which is EMC VNX 5700 Storage. The solution have be deducted to the multi reasons, this reasons as the following:

1. Efficient Block and File Compression.
2. Supports up to 984TB max raw capacity.
3. Can hold 500 drives. □ Has 84GB RAM.
4. Feasible costs.
5. Administration simplicity with EMC Unisphere.
6. Unified storage for multi-protocol.
7. Powerful new multi-core Intel CPUs with 6-Gb/s SAS backend.
8. Flash-optimized with auto-tiering.
9. Extended Flash Cache.
10. The proposed design of storage environment in Telecommunication company.

6.3 Implementation Plan

This section contains all measures (Stages) for implement the process development of storage system in Telecommunication company by an effective and ideal plan for this solution, this implementation plan includes the following:

Stage1 planning : This stage will propose a plan to implement the proposals, which include getting the best desired

results of the implementation of this proposed solution includes the design phase of the storage environment proposed needs identification and functional specifications required for this environment.

Stage2 design :

Table 5: Divide Storage

Enclosure	Pool	Hard desk	Size hard disk	Type raid	Total size
1	HD 5	9	900 GB SAS, 10k rpm	5	4.05 TB
1	OS	6	900 GB SAS, 10k rpm	5	2.7 TB
2-3	HD 10	30	900 GB SAS, 10k rpm	1+0	6.75TB
0	HD 10	16	600 GB SAS, 15k rpm	1+0	2.4 TB
0	Fast cash	5	200 flash	0	1 TB
Total size storage					15.9 TB And 1 TB flash
Note: Enclosure0 has 4 flash desks are not used. If happen failure for any hard desk, this flash desks saves the data automatically until replacing this fail's Hard Desk.					

1. Supports RAID protection levels 0, 1, 1/0,0/1 3, 5, and 6.
2. Integration with VMware ESX15.5 and windows server2008, 2012.

Stage3   Determine technique requirements: This stage contains determine the technical requirements (equipments and services) to create the new storage system, where is determine the new storage system and ESXi5.5 and implementation of the connection process between the blade server and storage environment. Figure 5 shows the design storage environment.
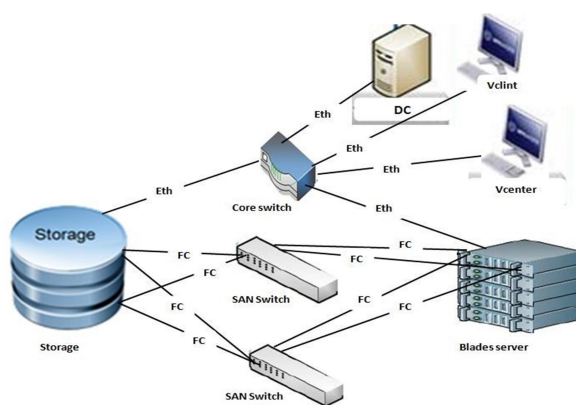
Figure 5 design storage environment

Stage4: The new storage system configuration: At this stage will build a storage system based on the standards and specifications that ensure   the standard design of storage system complies with international standards, and meets the functional requirements. This stage is divided into two sub-phases, where they are in the completion of the first phase of the Sub-technical equipment, while the second phase is the configuration of sub-system storage and blade server.

6.4 Capacity

Use of available resources optimally through:

- High performance of the blade server by the transfer data speed and access that was not previously untapped.

- Expanding the data storage capacity for the Data server to 50 terabytes, and that can be exploited in the store a huge amount of data which will serve the company for coming decades.

- Scalability of the new storage environment, so that was the old SAN storage environment is no scalable.

6.5 Availability

- Increasing the data transfer speed between the storage system and Blade Server from 2Gbps to 8Gbps.
- Increasing the request responding to data so as to increase the Cash memory for storage system from 5GB to 64 GB by using EMC Flash Storage.
- Increasing the availability of data by using Blade Server High Riddance and EMC Storage system.

6.6 Others

- Reduce costs by reducing the number of maintenance staff and technical resources.
- Ease of process management and control of resources.
- Reduce the potential problems and ease of periodic maintenance of the technical resources.

7. Conclusion

After analyzing the interviews, questionnaires, examining the equipment in the data center and processing it, we found that there is a problem in the company, which is the weakness of the data storage capacity and their use of servers with old processors with less capacity than the company needs. So we implemented a four-part integrated plan to expand and harden the data storage system using blade server; Each stage contains many sub-procedures and we found results that achieve the objectives of the study.

8. Recommendations

Finally, the researchers suggest a several recommendations that will develop and improve the company's services in the future, this recommendation can be summarized as follows:

1. Training programs and sensitization of staff and network users about the pros and cons of the use of the storage system.

2. Put strict security policies, if happen misuse of the network and data storage system.

3. Working studies and statistics to know the user's views about quality of the network system and data storage system in the company.

4. Implement ITIL framework to improve the organization of business in company's IT resources management and the exploitation of information technology in a positive and effective way.

5. Using the virtualization technology in the company's network as a whole.

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Article

Improvement of Business Process by Bitrix24 Communications

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Article info	Abstract
Article history: Accepted: May. 2020 **Keywords:** Business process; Sustainability indicator; Classification; Process mining; Evaluation	Nowadays, the business process is changing rapidly. Bitrix24 of business process model also become consideration because of it supports social collaboration, communication and management tools and rule in sustainability. It is an excellent tool for improving interaction with your customers, which includes instruments for creating reports and analyzing sales and marketing campaigns. This research shows two main factors: firstly: avoids some of the common hurdles of outsourcing process development six key framework areas of focus as (striking a balance with cost containment, setting realistic timelines, variability in process and platform development, choosing the right partner, communication, planning technical transfer), our principle is to benefit the client's business through the intelligent use of web technologies. Secondly: illustrate details what communication means in business, the steps required for effective communication, the importance of communications in diverse work groups, and a four-step process for effective communication.

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1.Introduction

Communication is an essential process in our day-to-day life, exchanging of information from one point of the project to another point in an efficient manner and globally is highly needed. This is reveals the important of communication in business [1]. Providing businesses with a set of tools to manage internal communications, as well as projects and customer files is a backbone for successful businesses. It also helps the operation process to become more flexible and optimize business with high security. It allows companies to maximize profitability and gain a competitive edge over their rivals. Using Bitrix24 makes it quicker and easier to develop and deploy custom applications, while enabling a fast response to any changes in regulatory, customer and market demands.

When a business grows rapidly and reaches a certain scale, standardizing customer and internal management processes becomes even more crucial. With effective operation and management, Bitrix24 is a key highlight for businesses having large data files and searching for an effective management method [2].

Good communication and effective collaboration are keys to every successful business, which is also where Bitrix24 can be of immense help. Apart from enabling everyone in your company to have access to all the important files and enabling an easy delegation of tasks, Bitrix24 offers you the benefit of creating project groups.

Bitrix24 comes with a number of free real time communication tools. Instant messenger, mobile messenger, video calls, audio calls, video conferencing, telephony, private social network, to name a few. Available in cloud or as self-hosted software that you can install on your server, with complete open source code and WebRTC support, Bitrix24 is the real time communication solution you need [3] as shown in Figure 1.

Figure.1 Real Time Communication Video [3]

In order for you to achieve your business goals and turn your company into a truly successful one, you need to implement a lot of different elements into your business planning. You need to have a lot of proper tools in your business toolbox in order to make sure your every effort pays off and your business is on the path of constant improvement [4].

Using Bitrix24 CRM software for several months now and it has greatly benefited for a company, which is why this paper highly recommend you start using it as well. Take a look at the benefits that Bitrix24 CRM can provide for your business, is an excellent tool for improving interaction with your customers, as it includes instruments for creating reports and analyzing sales and marketing campaigns, Regarding the purpose and use of such systems [5]. According to [14], Bitrix24 is a compound system of customer relationship management which supports collaboration and communication with customers, partners and suppliers.

It also allows the construction of the employee communication and collaboration along the organizational structure of the company as well as, supports business process automation.

To communicate effectively, project managers must have a good understanding of the communications process.
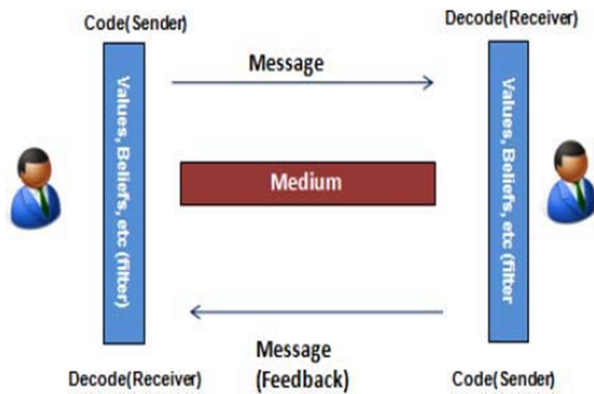

Figure.2 The Communications Process

According to [6], To understand the communications process, project managers must understand all the relevant factors as illustrated in Figure 2. As it can be seen from Figure 2, the communications process requires a sender and receiver, medium to communicate the content of a message, a message, feedback between the sender and receiver. Furthermore, the communications process is rarely "clean," meaning that what the recipient receives may not be necessarily what the sender sent and it will always be in a setting or context that influences results From the diverse work groups point of view, many organizations are realizing the value of different perspectives that come with a diverse work group, communicating in diverse work groups is a business issue. Diversity can lead to more ideas and higher levels of creativity, giving the organization more options and choices; thus, resulting in better outcomes for the organization and better products and services for its customers. However, communication within a diverse work group can create complex and challenging situations.

Successful communication in diverse work groups extends beyond mastering the mechanics of basic communication (Figure 3); it involves learning to understand and effectively use words and phrases. Effective communicators gain knowledge about other people's backgrounds and develop positive work group relationships [6]. Internal communication is essential in being able to get things done efficiently, and it's important to understand how successful communication can affect all areas of the business; it's certainly not limited to project management. Misunderstandings generated through lack of effective communication can have a substantial impact across all teams, so it's vital that this is addressed.
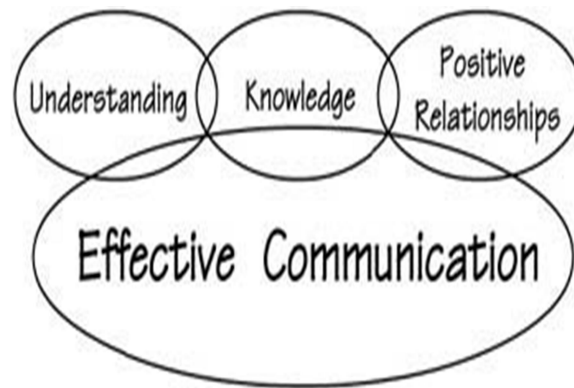
Figure.3 Mechanics of Basic Communication

This research shows two main factors. This first factor is to avoid some of the common hurdles of outsourcing process development through six key framework areas of focus as (striking a balance with cost containment, setting realistic timelines, variability in process and platform development, choosing the right partner, communication, planning technical transfer). Our principle is to benefit the client's business through the intelligent use of web technologies.

The second factor is to illustrate details about communication means in business, the steps required for effective communication, the importance of communications in diverse work groups, and a four-step process for effective

communication.

2. Proposed Method

2.1 The Two Generic Types of Business Processes Exist in Bitrix24

- A sequential business process to perform a series of consecutive actions on a document, from a predefined start point to a predefined end point.

- A state-driven business process not having start and end points; instead, the workflow changes the process status. Such business processes can finish at any stage.

  a) **A Sequential Business Process:** The sequential modus is generally used for processes having a predefined limited lifecycle, which is depicted in Figure 4. The typical example is creation and approval of a text document. Any sequential process usually includes several actions between the start and end points.
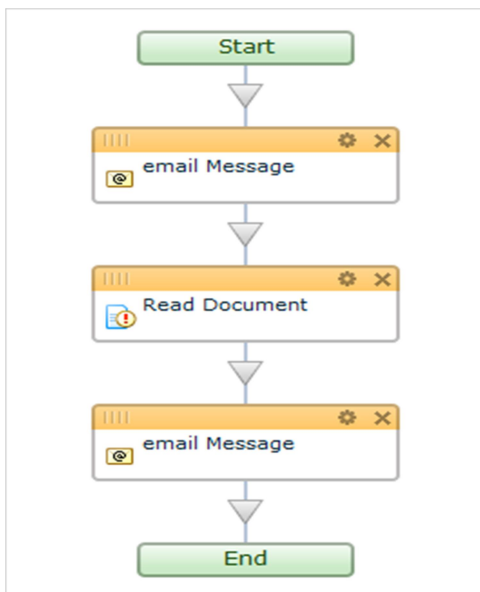

Figure.4 The Sequential Modus

A Status Driven Business Process: Status driven approach is used when a process does not have a definite time frame and can recur or can cycle on the same status due to nature of production or office style. A typical scheme for such processes consists of several statuses which in their turn include actions and status change conditions. Each action in a status is usually a finite sequential process whose design is defined by the nature of actions performed on information in a given status. Hence, a status driven business process consolidates multiple sequential processes the activity between which is relayed depending on their result [7] as shown in Figure 5.
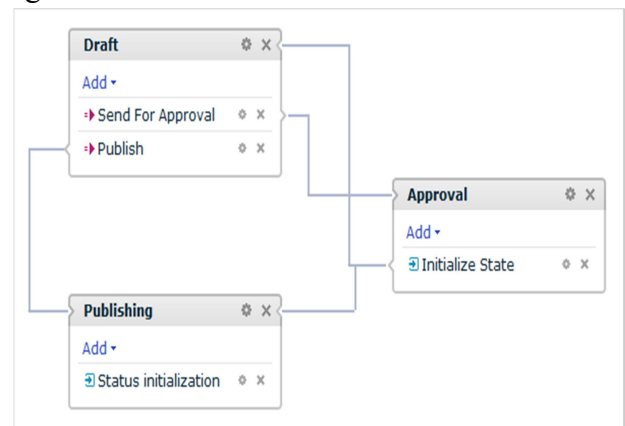
Figure.5 Status Driven Approach

2.2 Selecting a Correct Business Process Type

In practice, any management task can be modeled using a sequential as well as a status driven business process. However, an improperly chosen business process type may make the resulting model and business process template substantially and unreasonably more complicated. Therefore, use a sequential business process to model a simple sequence of actions. Additionally, choose a status driven business process if the model shows that a business process may occur in different statuses along the way, and it may migrate from one

status to another according to the rules the model specifies [8-9].

3. Project and Task Management

Bitrix24 through the system for the organization of operational processes in sales, its structure clearly follows the mentioned stages of lead management and sales process, integrating them with the system for project management.

When setting clear organizational structure of departments and functional units in system adjustment phase, same structure is easy to follow for adjustment of the organization internal communication system [10].

Every unit can be set as one workgroup, sub-system network where employees within have every functionality of the entire system and where all collaboration and work are documented on activity feed.

Projects are also structured through workgroups, giving the possibility of organizing team of employees from different units and on different functions with the same document management panel. When a new version of the document is loaded, the previous is not deleted, but is stored in order to be available at all times and records history provides information about the time when the version created and the user who created it. Documents can be edited in a cloud with providing Google Docs and Microsoft Office Online tools for text documents, spreadsheets, and presentations on cloud or locally on the computer and by saving, they are easily indexed and subject to search, as well as all records of activities, messages or system objects [11~12].

By creating a project task, time management option is enabled that keeps track of task duration and enable transparent performance

reports of the project at any time. Employees can independently input and record absence days through the system. Reports can be made for each department and for each employee on weekly, monthly or annual terms, supporting also HR management [15-19]. Figure 6 and 7 show business process management and activity stream in Bitrix24 respectively.
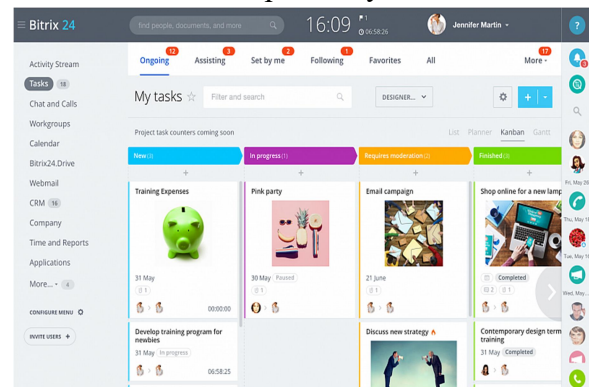
Figure.6 Business Process Management
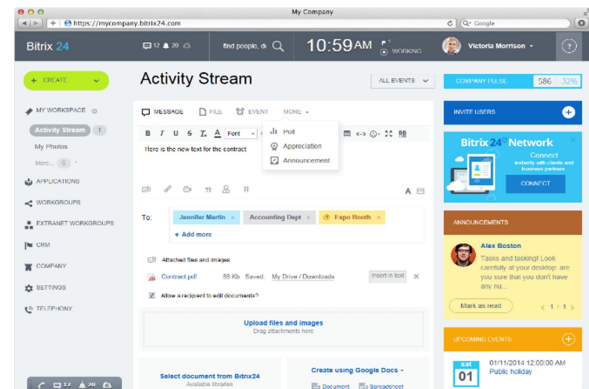
Figure.7 Activity Stream

4. The Need for Bitrix24

Bitrix24 is a popular communication and collaboration platform used by thousands of teams across all continents, but is it the right tool for your business? The answer for this question is through the illustration of its components. The first component is virtual PBX inside CRM which includes: employee extensions, voicemail, call recording, call transferring and forwarding, queuing and routing, multilevel IVR, and softphone (dial pad). The second component is

advanced telemarketing CRM which in turns consists of automatic dialer and call lists, automatic call transcribing, local numbers in 53 countries, toll free number rental, SMS broadcasting, voice broadcasting, and call back requests. The third component is third party integrations which includes: SIP connector for your PBX, telephony API, asterisk, free PBX, 3CX, twilio, plivo, ring central, and more. The fourth component is unlimited communications. Bitrix24 communication tools are available to unlimited number of users. You can invite any number of users to your Bitrix24, they will be able to use Activity Stream messages, chats, mobile app - for free, Communication tools include: activity stream, chat & video calls, telephony (access to tools, calls are charged individually due to telephony rates), mail, network 2.0, HR tools (Company Structure, employees (list), employee profile page), and mobile app. The fifth component is video conferencing. If you are tired of reliable and free video conferencing tools like Zoom, Skype or Google hangouts, this feature allows up to 10 team members to join a video or voice call. Your team members can also share their screen to showcase important files, documents, or slideshows. The sixth component is file sharing. You can store all your files and documents on the Bitrix cloud or your own server. Use this cloud to share your folders or documents. To secure sensitive documents, you can add a password or restrict access.

• In this Bitrix24 review, we'll take a look at its key features, pros, and cons to help you decide if this management software is perfect for your team or not. If you are confused about what exactly Bitrix24 does, you are definitely not alone, you might call it a collaboration software, but it also has several functions that some folks happen to find rather useful. Bitrix24 is a productivity suite that offers features like: CRM

(Customer Relationship Management), project management, internal communication, video conferencing, to name a few.

Whether you write blog posts in your favorite pajamas or file invoices from the café, there's still a horde of co-workers, clients and customers relying on you. Managing workload doesn't come much easier for freelancers, especially since they have nobody to structure their projects and daily tasks in their stead. And, when it comes to converting new customers and building long-lasting, profitable relationships, freelancers simply cannot do without a little help from automation [18].

Table 1: Shows the Advantages and Disadvantages of Standard Solutions [15-19].

Advantages of standard solution	Disadvantages of standard solution
Several times cheaper than individual project	The design is not unique.
You can see the functionality on ready demo-website.	You don't get any guarantees on realization quality. If you send a support request to the developer, it is not for sure that you will get a response.
the site can be ready for content filling within a day.	The costs for debugging may be much bigger in comparison with individual project.
You can read user comments before the purchase and get an idea whether the developer provides appropriate product support and There are lots of powerful features within Bitrix.	The user interface isn't as "slick" compared to some other options and features need a bit of cleaning up and "gloss" to make it really beautiful.
a complete Workspace software and Customer Relation Management software to organize and manage all your work in one place including collaboration and live streaming to social media	can be somehow complicated for the beginning, but with time, you get used to it and can work almost with little or no supervision.
can customize this software like you have a blank slate in front of you is phenomenal.	Customer support is limited, and any issues I had (although they were rare) took a while to fix my issue, if they fixed it at all.

User Interface. Easy navigation Less Learning Curve	Most of them are Untrained and Inexperienced support techs.
Easy to use... you need maximum a day training and you can navigate yourself afterwards	Hmmm too many features and it's a bit hard to navigate
The features are a plenty. There's so much diversity of functionality and you really can make it work the way you want.	UX feels a little bit clunky. Also, the web-app and the desktop app play strangely together. There's no good reason why I shouldn't be able to fully function in one over the other.
It has a lot of features if offers for free/trial, it allows add-ins for functionality and covers many aspects of a company operation.	Most of the functions are not clearly organized in use cases or user journeys leading to an end-result for each functionality.
Bitrix24 seemed to have a lot of great qualities and integration options.	I was interested in this CRM system for a while, but implementation was confusing.

Business process management is simply a rule-fast guide to getting a task done. The more tasks that abide by it, the more BPM-friendly a business is. You can use BPM processes for any business project [5], in any department as shown in Table 1.

Table 2 illustrates some motivations for adapting Bitrix24 in business process management [5,16].

5. Conclusion

This paper strongly suggests that the communication is the key for success for any project. It lists the importance of communication, the communication process, the steps to keep communication alive, an effective communication plan, four steps for effective communication, the obstacles in communication, importance of communication in a diverse work group and tips for any individual to communicate effectively in a team. Finally, it elaborates a case study for the four-step effective communication.

By introducing elements of social networks in the communication and collaboration processes, Bitrix24 system sets different approach to their organization. Although primarily designed to support the sales processes and customer relations, the system sets wider functionalities of business management, incorporating information systems of document management and project management, human resources, accounting and product catalog functionalities; providing atomization of related activities. Guided by the principles of project management, system analyzes complex processes to simple operations that, accompanied with a social networking component, gives a unique approach to organization of business, making Bitrix24 more than just CRM system, but complex business platform.

The research has shown that sustainability business process of enterprises can be predicted using enterprise sustainability indicators. The indicator score can be compared to other business process (including benchmark, as a business process references that has long sustainability) in which sustainability gap between enterprises is obtained.

For future works, several questions still remain to be answered. Like a verbal linkage score, such as what make business process can be classified. The further research of verbal score sustainability should be done to give a better understanding about enterprise sustainability.

Table.2 Motivations for Adapting Bitrix24 in Business Process Management [5,16].

Purchasing and Finance	To maximize income
Human Resources	BPM make it much easier for human resource departments to oversee important employee data, such as training, vacations, hiring, firing, performance reviews, and management of certifications
Marketing and Sales	Process-driven applications will support a business' marketing and sales teams by saving valuable time and resources.
Customer Relations	Employees dealing with customer relations will be able to use BPM workflows to solve issues efficiently and provide clients with information that is up-to-date and accurate.
Features of BPM	How do organizations use BPM technology? Companies invest in BPM software to streamline their business operations - by executing, monitoring, and automating beginning-to-end business processes.
Data Analysis	Making a good business decision relies heavily on having the most accurate and complete information at your disposal.
Automation	Every company uses business processes to accomplish their goals, whether they are fulfilling orders or sourcing strategically across enterprises or supply chains.
System of Rules	To achieve consistent automation, a BPM platform must have rules as a core component.
Device Mobility	BPM technology must be accessible on both mobile devices and desktop computers.
Data Accessibility	The capacity to store and use your BPM software both in the cloud and on your premises provides the maximum flexibility for companies needing to store data and processes behind their firewall.
Security	Security is of utmost importance when BPM software drives the core processes of your business.
Inclusive	Collaboration: One of the biggest BPM benefits is its ability to maximize interaction and information sharing among all employees.
Benefits of BPM	Why do companies go through all this bother? According to Forbes, the BPM benefits are tangible and extremely valuable.
Cost Efficiency	In recent years, simply cutting budgets is not viable for businesses responding to leaner global economic conditions.
Satisfied Customers	The modern customer makes serious demands. They need extensive proof-of-concept processes.
Flexibility and Agility	Businesses are relying on the nimbler processes of BPM technology to respond to new trends in the marketplace.
Automation and Integration	BPM software offers solutions to support case management and business process that integrates fully with Project Management.
Automation and Integration	BPM software offers solutions to support case management and business process that integrates fully with Project Management.
Rule Management	Work management is more collaborative and unstructured than ever before.
Process Management	One of the most useful BPM benefits is the ability to customize and re-use workflows - as you need them, wherever you need them
Happy Staff	A rewarding, satisfying work environment can boost staff performance and productivity significantly.

Improved Compliance:	Legislative changes and other factors have made it compulsory for businesses to have a flexible system in place to handle and demonstrate compliance.

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Article

Increasing the Speed of the Recursive Algorithm and Reducing Stack Memory Consumption by Using the Dynamic Rule(base)

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Article info	Abstract
	Recursive algorithms always consume a computer's memory stack, and in this paper we worked to increase the speed of the recursive algorithm through a dynamic rule(base) that changes during its implementation process. Dynamic rule(base) regulation often allows avoiding repeated calculations of the same sets of parameter values, which reduces the number of repeated calls and simplifies slow calculations. Here, a mechanism will be created for the rule using simple and well-known examples to calculate the Fibonacci sequence, recurring linear sequences of general shape, and binomial transactions.

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1. Introduction

Recursive algorithms belong to the class of algorithms with high resource consumption, since with a large number of self-calls of recursive functions, the stack area is quickly filled [1]. In addition, organizing the storage and closing of the next layer of the recursive stack are additional operations that require time. The complexity of recursive algorithms is also affected by the number of parameters passed by the function [9]. Consider one of the methods for analyzing the complexity of a recursive algorithm, which is built on the basis of counting the vertices of a recursive tree [9]. To estimate the complexity of recursive algorithms [2], a complete recursion tree is constructed like Figure 1. It is a graph, the vertices of which are the sets of actual parameters for all calls to the function, starting from the first call to it, and the edges are the pairs of such sets corresponding to mutual calls. In this case, the nodes of the recursion tree correspond to the actual calls of the recursive functions. It should be noted that the same sets of parameters can correspond to different nodes of the tree. The root of the complete recursive call tree is the top of the complete recursion tree corresponding to the initial call to the function.
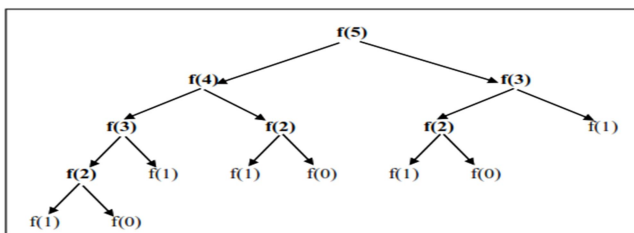

Figure 1. Schematic representation of recursive calls when finding f (5)

When constructing any recursive algorithm, in addition to parameter determination and decomposition, the choice of its rule (base) β (it's just a symbol that we refer to the dynamic rule (base)), that is, the selection of a subset of sets of acceptable parameter values through which calculations are made the algorithm is very simple and provides a return mechanism for repeated calls. Usually this rule does not change during calculations. With a fixed rule, it is often necessary to perform multiple function calculations for the same sets of parameter values [6].

Some systematic solutions related to increasing the speed of recursive algorithms through dynamic rule(base) during implementation. The dynamic rule (base) often allows avoiding repeated calculations of the same sets of parameter values, which reduces the number of repeated calls and simplifies slow calculations [6]. The dynamic rule (base) mechanism is explained by using simple and well-known examples of calculating the Fibonacci sequence, recurring linear general-form sequences and binomial coefficients.

2. Sequence Fibonacci

Let's begin with calculation a member of sequence:

$$f(0) = f(1) = 1, \qquad f(n) = f(n-1) + f(n-2) \qquad (n = 2, 3, \ldots). \qquad (1)$$

The recursive function for calculating f (n) with a static base (0,1) directly implemented by formulas (1), looks like this:

```
function f(n:integer):int64;
  begin
    if n<2 then result:=1                          (2)
    else result:=f(n-1)+f(n-2);
  end;
```

With increasing n, the number k (n) of recursive calls by (2) grows approximately as $0.725*(1.62)^n$ (see the statement of Theorem1) [4, p71]. Therefore, calculations according to (2) are rather laborious and already at n = 50 it is difficult to implement. We modify (2), turning it into a function with a dynamic rule (base). For this, in the scope of the projected function, we define the variables n, k and the array v:

var n, k: integer,

v: array [0..1000] of int64;

In the array v we will store the expanding base, and in k the current number of elements in it. The initial values for the base β and the counter of the number of elements in it are determined as follows: v [0]: = 1; v [1]: = 1; k = 2. In the future, it is supposed to enter into the base each newly calculated value of the function. Then the "dynamic modification" f(n) can be written in the form (3).

```
function fbase1(n:integer):int64;
  var a,b:int64;
  begin
    if n>=k then
      begin
        a:= fbase1(n-2);b:= fbase1(n-1);
        v[n]:=a+b;k:=k+1;
      end;
    result:=v[n];
end;
```
(3

When solving the problem, each recursive call, including the initial start of the calculations, initiates work, as it were, from the original algorithm. The sequence of calculations of the values of local and global variables corresponding to one specific "virtual instance" [6] of the algorithm and not including Calculations on calls from a given instance itself are called a slice of recursive calculations. It is convenient to consider exits from a particular slice a to a slice of the next depth of recursive nesting or to any subprogram as an appeal to some "black box" [4, p. 272] that transforms and returns all or some values from the scope of α. A specially designed calculation form, which somehow fixes the calculation of a particular recursive slice, is called the form. The form should indicate the relationship between the steps of the calculations and, in addition, a location for the calculations to be proposed. A completed form is called an embodiment, and a sequence of incarnations corresponding to a sequence of recursive calls is called a recursogram [4, p. 109]. An embodiment is generated for each recursive

slice on a separate form. The sequence diagram of recursive calls and computations with a dynamic rule(base) for the function fbase1(n) is extremely simple. It is presented in Figure 2. The points of start and end of calculations on the diagram are depicted by an oval. The incarnations of recursive slices are numbered and presented in the figure in the form of rectangles. The incarnations themselves are written out in sufficient detail. Recursive calls and returns from them for organizing deferred calculations are represented by solid curved arrows between the individual forms. The dashed lines indicate the options for completing calculations based on values from a base.

We modify function (3) by reversing the order of the recursive calls fbase1(n-2) and fbase1(n-1). The calculation scheme for the obtained function (4) is presented in Figure 3, where the forms and the relationships between them are arranged in the same way as in Figure 2. The sequence of recursive calls in calculating f (n) according to (4) will correspond to the passage through the tree D, along its left branch from the root f (n) down to f (2).

```
function fbase2(n:integer):int64;
  var a,b:int64;
  begin
    if n>=kthen
      begin
        a:= fbase2(n-1);b:= fbase2(n-2);
        v[n]:=a+b;k:=k+1;
      end;
    result:=v[n];
end;
```
(4)

If we rewrite function (4) in the form (5), then, contrary to expectations, it will not work more slowly. The scheme of recursive calls on it will just exactly coincide with the corresponding call scheme for function (4), and the absence of additional local variables a and b in the calculations will even lead to some decrease in the calculation time. This happens because in the assignment v [n]: = fbase2 (n-1) + fbase2 (n-2), recursive calls are realized only at the expense of

the first term, and when it comes to the second term, its value is in the form v(n-2) is already among the elements of the base in the form of an indicator of completion of calculations.
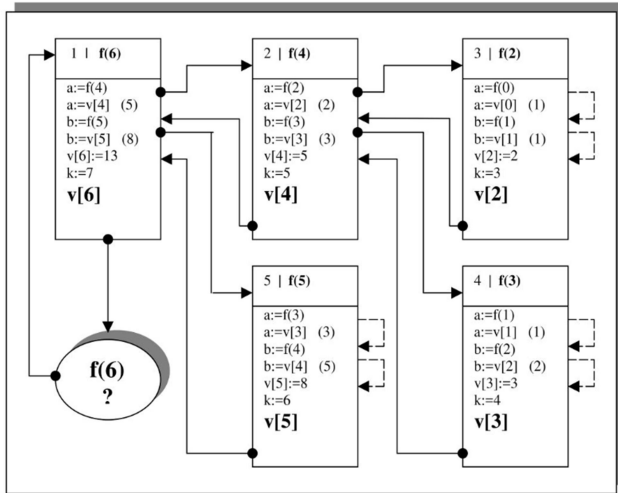

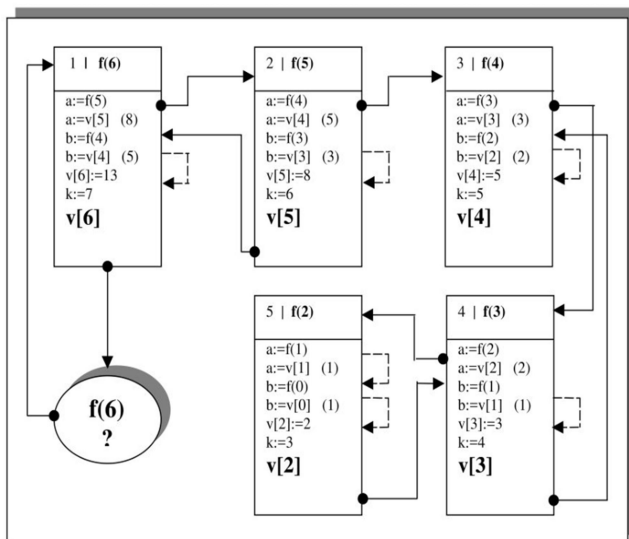Figure 2. Diagram of recursive calculations with a dynamic rule (base) for the function f (n) = fbasel (n) with n = 6

Figure 3. Diagram of recursive calculations with a dynamic rule (base) for the function f (n) = fbase2 (n) with n = 6

```
function fbase2(n:integer):int64;
  begin
    if n>=k then
      begin
        v[n]:= fbase2(n-1)+fbase2(n-2);k:=k+1;
      end;
    result:=v[n];
end;
```
(5)

When working with a dynamic rule(base) β, it is not always possible to get access to the sets of values of its parameters as easily as it was in examples (3) and (4). There, due to the specifics of the problem and the algorithm used, it was actually possible to organize direct access to the required values. In general, it is important not to overload the base with unnecessary elements. With a "large" base, checking for completion in each recursive call can be very laborious. Moreover, the dynamics of the rule (base) implies not only its expansion, but also a possible narrowing. If, for one reason or another, after a specific recursive call, certain sets of values can no longer be used as indicators for completing calculations, it is advisable to remove them from the base.

In the next version of the program-function (6) of calculating f (n), the elements added to the base are not used as indicators of completion of calculations in recursive calls, but only as values in deferred calculations.

```
function fbase2(n:integer):int64;
  var a,b:int64;
  begin
    if n>=k then
      begin
        if n-1<k then a:=v[n-1]else a:=fbase2(n-1);
        if n-2<k then a:=v[n-2]else a:=fbase2(n-2);
        v[n]:=a+b;k:=k+1;
      end;
    result:=v[n];
end;
```
(6)

For end of the given item we needed to formulate and prove the statement about quantity of recursive calls at calculation of value of function Fibinacii under the program (2).

The theorem 1. The quantity k (n) recursive calls at function evaluation Fibonacci f (n) by (2) is equal to the program.

$$k(n) = -1 + \frac{1}{\sqrt{5}} \cdot \left[\left(\frac{1+\sqrt{5}}{2}\right)^{n+1} - \left(\frac{1-\sqrt{5}}{2}\right)^{n+1} \right]. \tag{7}$$

The proof for function to (п) by obvious image in the following recurrent ratio are carried out:

$$\begin{cases} k(0) = 0, \quad k(1) = 0, \\ k(n) = k(n-1) + k(n-2) + 1 \quad (n = 2, 3, \dots). \end{cases} \tag{8}$$

From here we have:

$$k(2) = 1, \quad k(3) = 2, \quad k(4) = 4, \quad k(5) = 7, \quad \dots.$$

Proceeding from the general theory of linear returnable sequences, it is uneasy to receive at the final formula for calculation *to (n)*. In it also we shall engage. For the further reasoning's it is convenient for us to predetermine *k (n)* for the whole negative values *n*, believing k (n) =0 at n<0. Using K.Aiversona's notation [3], (8) it is possible to copy as:

$$k(n) = k(n-1) + k(n-2) + [n \geqslant 2].$$

Let's remind, that K.Aiverson, the author of the programming language of APL, has entered into it a design of a kind [L], where L a logic condition :

$$[L] = \begin{cases} 1, & L = True \\ 0, & L = False \end{cases}$$

This simple notation turned out to be very useful in transformations and calculations of various sums [4, p. 403-422], [5, p. 50].

Let G(z) be the generating function for k(n). Then

$$G(z) = \sum_n k(n) \cdot z^n = \sum_n k(n-1) \cdot z^n + \sum_n k(n-2) \cdot z^n + \sum_n ([n \geqslant 2]) \cdot z^n =$$
$$= z \cdot G(z) + z^2 \cdot G(z) + \sum_{n \geqslant 2} z^n = z \cdot G(z) + z^2 \cdot G(z) + \frac{z^2}{1-z}$$

And therefore,

$$G(z) = \frac{z^2}{(1-z) \cdot (1-z-z^2)}. \tag{10}$$

Let p (z) and Q(Z) - accordingly numerator and a denominator of the right part (10) and

$$\lambda_1 = 1, \quad \lambda_2 = \frac{1+\sqrt{5}}{2}, \quad \lambda_2 = \frac{1-\sqrt{5}}{2}.$$

Then we have:

$$\alpha_k = \frac{-\lambda_k \cdot P\left(\frac{1}{\lambda_k}\right)}{Q'\left(\frac{1}{\lambda_k}\right)} \quad (k = 1, 2, 3).$$

$$Q(z) = (1 - \lambda_1 \cdot z) \cdot (1 - \lambda_2 \cdot z) \cdot (1 - \lambda_3 \cdot z);$$

$$P\left(\frac{1}{\lambda_1}\right) = 1, \quad P\left(\frac{1}{\lambda_2}\right) = \frac{3-\sqrt{5}}{2}, \quad P\left(\frac{1}{\lambda_3}\right) = \frac{3+\sqrt{5}}{2}; \tag{11}$$

$$Q'\left(\frac{1}{\lambda_1}\right) = 1, \quad Q'\left(\frac{1}{\lambda_2}\right) = \frac{-\sqrt{5} \cdot (3-\sqrt{5})}{2}, \quad Q'\left(\frac{1}{\lambda_3}\right) = \frac{\sqrt{5} \cdot (3+\sqrt{5})}{2}. \tag{12}$$

From Theorem1 on the expansion of the rational function P (z) / Q (z) in a power series in the case of different roots of Q (z) [7 p. 374] for our case we get:

$$k(n) = \alpha_1 \cdot \lambda_1^n + \alpha_2 \cdot \lambda_2^n + \alpha_3 \cdot \lambda_3^n,$$

Where

$$\alpha_k = \frac{-\lambda_k \cdot P\left(\frac{1}{\lambda_k}\right)}{Q'\left(\frac{1}{\lambda_k}\right)} \quad (k = 1, 2, 3).$$

Using (11) and (12), the last relation we have:

$$\alpha_1 = -1, \quad \alpha_2 = \frac{1+\sqrt{5}}{2 \cdot \sqrt{5}}, \quad \alpha_3 = -\frac{1-\sqrt{5}}{2 \cdot \sqrt{5}}.$$

From here

$$k(n) = -1 + \frac{1+\sqrt{5}}{2 \cdot \sqrt{5}} \cdot \left(\frac{1+\sqrt{5}}{2}\right)^n - \frac{1-\sqrt{5}}{2 \cdot \sqrt{5}} \cdot \left(\frac{1-\sqrt{5}}{2}\right)^n =$$
$$= -1 + \frac{1}{\sqrt{5}} \cdot \left[\left(\frac{1+\sqrt{5}}{2}\right)^{n+1} - \left(\frac{1-\sqrt{5}}{2}\right)^{n+1} \right]$$

and (7) it is *proved*.

Investigation 1. From (7) for and the Bine formula [7, p. 331] implies that

$$k(n) = f(n+1) - 1. \tag{13}$$

Investigation 2. In the binary tree of recursive calls when calculating f(n), there are vertices calculations on f(n).

$$p(n) = 2 \cdot k(n) + 1 = 2 \cdot f(n+1) - 1$$

If formula (13) could be anticipated in one way or another, for example by considering the first few terms of the sequence k(n), then its proof could be carried out by the method of mathematical induction. In this case, the statement of the theorem would follow from the recurrence relations (8) and the Binet formula [7 p. 331].

Indeed, 7 for n = 0 and n = 1, relation (13) is valid:

$$k(0) = 0 = f(1) - 1 = f(0+1) - 1, \quad k(1) = 0 = f(2) - 1 = f(1+1) - 1.$$

Let (13) be satisfied for n = m-2 and n = m-1 (m> = 2):

$$k(m-2) = f(m-1) - 1, \qquad k(m-1) = f(m) - 1.$$

But in this case

$$k(m) = k(m-1) + k(m-2) + 1 = f(m) - 1 + f(m-1) - 1 + 1 = f(m+1) - 1,$$

That is, the induction is justified and the formula (13) is **proved**.

Let us now show relation (7). For n = 0 and n = 1 it is valid. Let n> = 2. Applying Binet's formula [7, p. 331] in (13) to f (n + 1), we obtain (7).

3. Returnable Sequences

We shall consider one more example on рекурсию with dynamic rule (base). Let *to* — natural number, **C0, c1..., Ck-1** — real numbers also there is a returnable equation of the order *to* general view:

$$v_n = c_0 \cdot v_{n-1} + c_1 \cdot v_{n-2} + \cdots + c_{k-1} \cdot v_{n-k} \qquad (n = k, k+1, \ldots). \tag{14}$$

This equation is a recurrent and generates numerical sequence:

$$v_0, \quad v_1, \quad v_2, \quad \ldots, \quad v_n, \quad \ldots \tag{15}$$

let's make the recursive program for calculation of the general member (15).

Let files of factors with = (C0, CI are set..., Ck-i) and initial members

$$v = (v_0, v_1, \ldots, v_{k-1}).$$

To write recursive program - function with static base {V0, VI..., Vk-i} calculations V $_n$ (n = *to, to* 4-1...) work does not make. Those is, for example, function *rbase (n)*. It is supposed, that a variable *to* and files with and *v* are in the field of visibility *rbase (n):*

```
function rbase(n:integer):int64;
  var i:integer; su:int64;
  begin
    if n<k then rbase:=v[n]
    else
      begin
        su:=0; for i:=0 to k-1 do su:=su+c[i]*rbase(n-1-i);
        rbase:=su;
      end;
  end;
```

Calculations on rbase (n) are very laborious even for п> 35 because of the rapidly growing number of recursive calls along with n.

Let's construct analogue for rbase (n) function with dynamic rule (base) rbase1 (n.) we shall count, that a variable k matrix c and v are in the field of visibility rfeasel (n), under v is preserved not less п elements (n>= к), and they are initiated by initial values and zero: v = (v0, v1..., v_{n-1} ,0,0...). Then rbase1 (n) could look as follows:

Originally the base will consist of all nonzero elements of a matrix v. Each recursive call expands base on one nonzero element v. We shall note, that rbasel (n) — already rather effective program function with quantity of recursive calls at n> = to, equal to (п — to + 1). Thus only in п — to + 1 from them calculations are really spent, and in other cases all terminates on values from extending base.

```
function rbase1(n:integer):int64;
  var i:integer;
  begin
    if v[n]=0 then
      for i:=0 to k-1 do
        v[n]:=v[n]+c[i]*rbase1(n-1-i);
    rbase1:=v[n];
  end;
```

Recursive function *rbase2 (n)* with dynamic rule (base) is arranged the same as and *fbase1 (n),* but for it is not required preliminary initiation of a "tail" part of a file *v* by zero. There is enough in the field of visibility *rbase2 (n)* to define initial value of a variable s, equal *to*. The size *s* will serve further the counter of quantity of elements already placed in dynamic rule (base). Quantity of recursive calls at calculation up to *rbase2 (n)* same, as well as at calculation on *rbasel (n).*

```
function rbase2(n:integer):int64;
  var i:integer; su:int64;
  begin
    if n>=s then
      begin
        su:=0;
        for i:=0 to k-1 do su:=su+c[i]*rbase2(n-1-i);
        v[n]:=su;s:=s+1;
      end;
    rbase2:=v[n];
  end;
```

4. Binomial coefficient

Let n and m the non-negative integers numbers $0 <= m <= n$. $C_n^m = C(n, m)$ to calculate under the following recurrent formula:

$$C(n,m) = C(n-1,m-1) + C(n-1,m) \quad (C(k,0)=1, C(k,k)=1, \quad k=0,\ldots,n)), \quad (16)$$

note using operations of multiplication or division and generating known triangle. Direct calculation of coefficient *C(n, m)* on "true" recursive program – function already

```
function C(n,m:integer):int64;
  var i:integer; su:int64;
  begin
    if (m=0) or (n=m) then C:=1                    (17)
    else C:=C(n-1,m-1)+C(n-1,m);
  end;
```

at *n>* = 40 becomes rather bulky and consequently it is difficultly feasible for real time. At the same time anything in this case does not interfere with the organization of recursive calculations with dynamic rule (base). Let in the program, where formed function C2 will be located (n, m) calculations of binomial factors, are available definitions:

```
var i,j:integer;
    v:array[0..100] of int64;
```

We initialize a part of a matrix v under base as follows:

```
for j:=0 to m do
  for i:=j to n-m+j do
    if (j<>0) and (i<>j) then v[i,j]:=0       (18)
    else v[i,j]:=1;
```

According to the given fragment initially to dynamic rule (base) nonzero elements of a matrix v [i, j]: v[i,0] = 1 (i = 0..., n- *m); v[j, j] = 1 (j =0...m).*

Subsequently in a body of function C2 (n, *m)* the base will extend replacement of zero values *v [i, j]* accordingly on calculated values of coefficient *C (i, j) (i = 0...,* n-m, j =0,...,m). We shall note the following fact. Generally the matrix *v* should contain $(n+1)^2$ elements. For accommodation of triangle Pascal it is necessary (n/2+ 1)**(n*-1) elements. Really at calculation of concrete coefficient *C(n, m)* for it is required base only *(m* + 1). (n- m + 1) elements. It is so much elements also are exposed to initial initialization. Program-function of calculation of binomial coefficients C2(n, m) in this case could be written down so:

```
function C2(n,m:integer):int64;
  begin
    if v[n,m]=0 then
      v[n,m]:=C2(n-1,m)+C2(n-1,m-1);      (19)
    C2:=v[n,m];
  end;
```

The finding of coefficient *C(n, m)* on this recursive program - function calculations it is not spent and required no more (m + 1)*(n-m + 1) recursive references with the same quantity of operations of addition at the postponed calculations. Therefore, an obstacle for carrying out of calculations now can be only a range of allowable integer values. In our case received values should not surpass size 2^{63}-1= 9223372036854775807. On Figure 4 big and small squares designate elements of triangle for *n* = 8. At a finding of coefficient C(8,5) on program - function *C2* to dynamic rule (base) the elements corresponding to the squares are originally attributed. Then, only the elements corresponding to the large blackened squares located in rows from the first to the third in the selected parallelogram and from left to right along the lines are sequentially calculated and added to the base. Small blackened squares correspond to elements of Pascal's triangle that are not involved in the calculation.
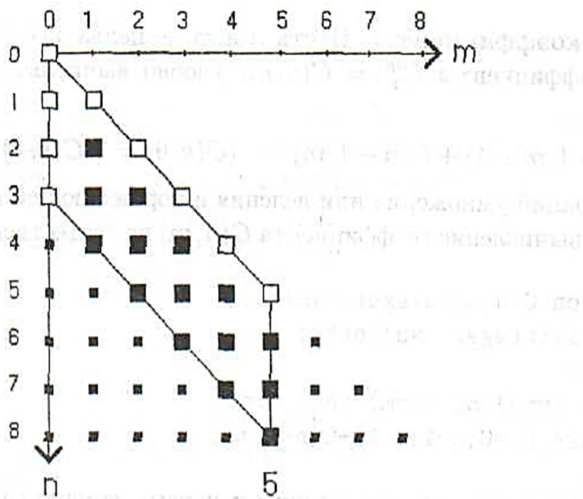
Figure 4. Recursion with dynamic rule (base) at calculation with (8,5) under program *C2*

5. Conclusion

In this paper, the researchers obtained an increase in the speed of the recursive algorithm through a dynamic rule (rule) that changes during the implementation process. The dynamic rule(base) often allows *avoiding repeated calculations* for the same sets of parameter values, which reduces the number of repeated calls and simplifies calculations. A dynamic rule mechanism was implemented using simple, well-known examples to calculate Fibonacci sequences, repeated linear sequences of the general shape, and binomial coefficients.

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