"What Measures are Used for Software in the Gaming Industry"

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Scope of this Report

Software is at the heart of today's gaming industry. Software measurement is essential for planning, estimating, and managing software, but it's often too low on the priority list. All organizations are interested in improving quality and productivity and reducing costs. However, each industry and/or organization has specific, unique areas of focus. This report will focus on the need for every organization to look at their specific needs when developing a measurement program. It will present examples from the gaming industry to demonstrate this concept. A specific focus will be on measurement used in software project estimation.

Goals and Initiatives

Determining the Audience

Every organization has multiple people that are interested in making improvements and/or achieving specific goals. These goals and initiatives vary from person to person so it is key to identify all audiences to get an understanding of all goals and initiatives for the organization. Within the gaming industry there are roles common to other industries (from Software Project Managers up to Chief Information Officers) that are interested in improving software estimation, increasing software productivity, shortening time to market, and reducing maintenance costs. However, these measures can be influenced by the business side of the organization.

The gaming industry is very competitive. Customers have many choices from casinos to gambling online. The gaming industry has become very customer focused and workes hard to build customer loyalty. In the gaming industry, the use of data regarding customer retention is a driver of software development. When establishing software measurement and processes, the goals of the overall business, not just IT, need to be considered.

Establishing Goals and Initiatives

MGM Resort International stated *"It is both costly and operationally difficult to provide differentiated and customized service to loyal customers. Amidst an economy in recession, casino operators have been forced to abandon the build it and they will come strategy. Instead, gaming executives have had to slash spending and focus on doing more with less, as well as becoming more customer centric."* Software measurement can aid in determining how to make this happen.

Since gaming organizations are in such a customer oriented business, they have a stronger emphasis on requirements gathering and ensuring that requirements are met. It is imperative that all gambling is legal and accurate so quality has a strong emphasis as well. Time to market

is an area of emphasis since every organization wants to be on the leading edge regarding user experience and capabilities. All of these goals may be impacted if the software is not delivered as promised, so reliable estimation is also a key emphasis.

Although improving productivity is always a focus of organizations, in the gaming industry, the rate of improvement is sometimes lessened in exchange for meeting another goal. Every organization needs to determine the best balance for their goals regarding productivity, quality, cost, and time to market.

Once the goals are established the measures and data requirements can be determined.

Measures and Data Requirements

For any organization or industry, it is imperative that the measures support the goals and initiatives, not the other way around. The key is to think about the goal and identify what measure best shows the current situation and can be used to show progress as improvements are made.

Below is an example of measures that are used in support of gaming industry goals:

Goal/Initiative	Measure
Reduce Time to Market by x%	Schedule days per Function Point (FP)
Reduce delivered defects by x%	Delivered Defects per FP
Improve Requirements Gathering	Percentage of Project Scope change Percentage of functionality change by application
Improve effort estimate accuracy by x%	Effort estimate to actual variance

Once the measures are established from the business goals then organization can define the data requirements that support the measures. What data is collected, when it is collected, how it is collected, and how often it is collected should all be in support of the measures to be reported based on the goals and the audiences previously defined.

All of these measures may be common across industries, but the specifics of the measure or the breakdown of reporting will be different. More importantly the processes used to achieve the goals will need to be specific to the organization and/or industry.

Improving effort estimation is one goal that most organizations identify for process improvement. The remainder of this report will focus on the measures and data that can be used to estimate software projects, using examples from the gaming industry.

Project Estimation for Functional and Non-functional Requirements

Most software projects have both functional and non-functional requirements. The ability to estimate both pieces of the project allows for more accuracy. To complete estimates, it is important to be able to size the deliverables. Once sized, historical data can be used to complete a top-down estimate of effort, schedule, and staff based on 'like' projects. Most organizations and industries have historical data on effort, schedule, and staff; however, they often struggle with the ability to size the deliverables.

The International Function Point User Group (IFPUG) has provided techniques for sizing both Functional and Non-Functional requirements. Function Points (FPs) are used to size Functional

requirements and the Software Non-functional Assessment Process (SNAP) is used to size Non-Functional requirements.

Both of these techniques will be demonstrated using examples of gaming industry requirements.

Sizing Functional Requirements

The gaming industry has changed over the years in terms of the functionality that needs to be provided to their customers.

For example, slot machines have changed dramatically. A blog from Gambling Sites.com describes some of these changes: *"Today's slots have little in common with the original games. Slot machines were originally made up of a few mechanical parts:*

- *Coin slots*
- *Hoppers*
- *Levers*
- *Reels*

Modern slots are made up of over 1200+ individual components put together by 300+ people from design to the manufacture and assembly of those components. The parts involved now include items that Charles Fey, the inventor of the slot machine, wouldn't even recognize:

- *Bill validators*
- *Machine cabinets*
- *Random number generator software*
- *Touchscreens*

These games used to be straightforward. You inserted coins, pulled a lever, and looked for a combination of symbols across a pay line. Now you have to choose how much to bet, insert paper money or tickets, and press buttons or a screen in order to start the game. You can bet as little as a penny per line per spin or $100 per line per spin—on the same machine.

The reels are 3D animations on a video screen, and instead of a single pay line, you have potentially dozens of ways to win (and/or lose). The pay table is also available on screen. Many of these games are now linked to other games and to computer programs which gather data that goes straight into the hands of the casinos' marketing departments."[1]

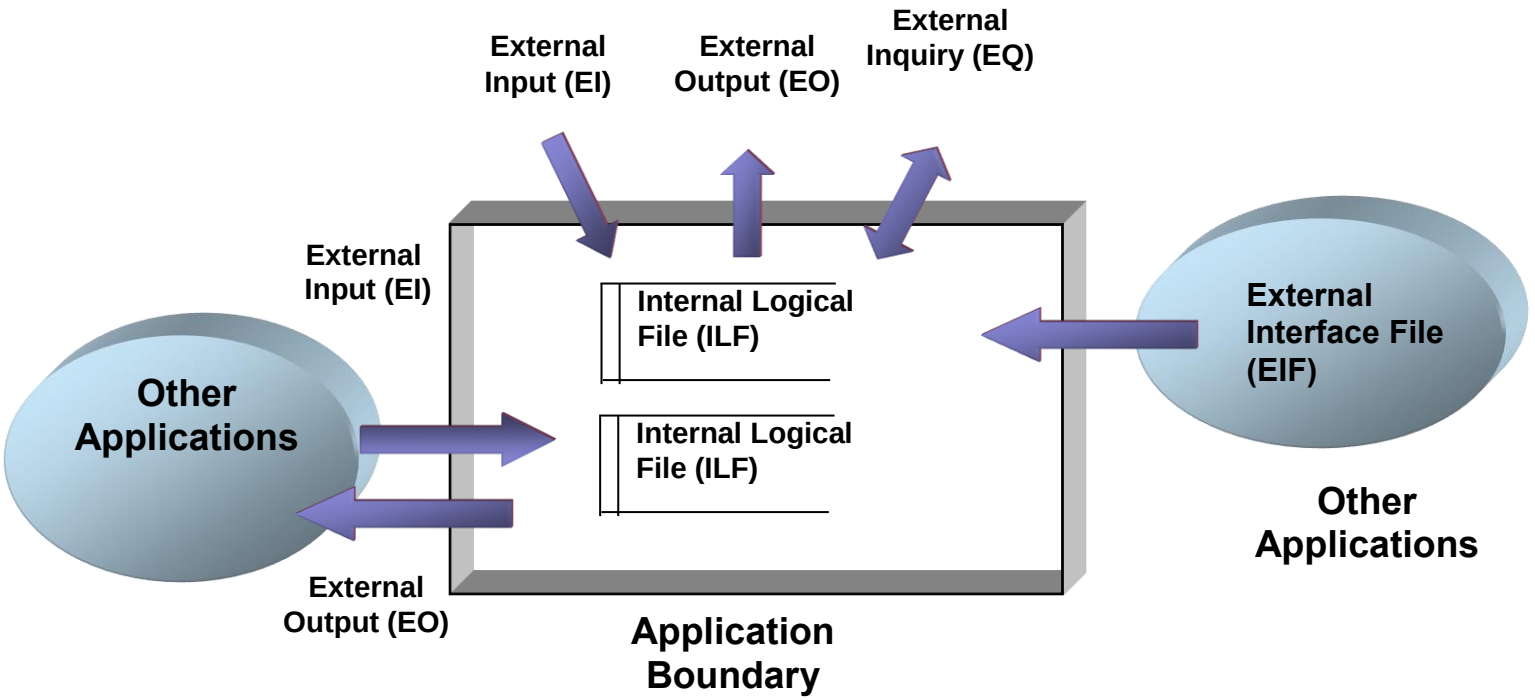
Loyalty programs have become prominent in the gaming industry. Functionality was initially provided to insert a loyalty card in slot machines to earn points, but now loyalty programs have been expanded to table games and non-gambling expenditures.

All of this functionality requires software that must be sized. FPs can be used to size the functionality required by users. Function point analysis measures software by quantifying the functionality that the software provides to the user based primarily on logical design. The objectives of function point analysis are to measure:

- Functionality implemented in software that the user requests and receives
- Functionality impacted by software development, enhancement and maintenance independently of technology used for implementation[2]

[1] https://www.gamblingsites.com/blog/slot-machine-facts-you-should-know-11254/
[2] International Function Point User Group, Counting Practices Manual 4.3

The FP methodology identifies and classifies the functions necessary to deliver the user experience and then applies complexity factors to each function to obtain the FP size to be used in the estimate. The details of this process are defined in the IFPUG Counting Practices Manual (CPM) (www.ifpug.org). The diagram below shows the logical view that is applied to the FP approach:



Using average complexity, the below shows an example of how a sample of slot machine and loyalty functionality may be sized.

Function	Description	Type	Complexity	Value
Insert Money	Insert money updates the number of credits	External Input	Average	4
Spin	User enters bet (# of credits, lines) and clicks spin – machine displays results, updates credits based on results	External Output	Average	5
Insert loyalty card	Records player information	External Input	Average	4
Cash Out	Records time played, amount bet, amount won to loyalty data and prints receipt of winnings	External Output	Average	5
Loyalty Data	Stores loyalty information	ILF	Average	10
Credits	Stores credits for play	ILF	Average	10

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TOTAL				**38**

If our project was to deliver the above requirements we would look at our historical and/or industry data to calculate the amount of effort required to deliver 38 FPs.

Sizing Non-Functional Requirements

Being able to size functional requirements is only half of the information we need to complete a full estimate. We also need to look at non-functional requirements. This is where SNAP comes in to play.

Within the gaming industry it is easy to see the user functions of viewing loyalty information or spinning the wheel. However, there are backend complexities such as payout rates, winning combination algorithms, and visual aesthetics that are also important and need to be measured.

An article from theverge.com entitled Engineers of Addiction discusses how manufacturers and developers have worked from the beginning to keep us playing slot machines. It states:

"In the 1970s, William Redd founded a gaming manufacturer that was later renamed IGT. IGT specialized in video gambling machines, or video poker. If you were to take $100 and play slots, you'd get about an hour of play, but video poker was designed to give you two hours of play for that same $100," Redd said at the time, instructing game designers to lengthen the time it took a poker machine to consume a player's money."[3]

An article from listverse.com goes on to discuss other design 'tricks' used. *"A casino is a cacophony of wonderful and alluring stimulation: bells ringing, siren-like lights flashing, change clanging, slot wheels whirring, digital sounds beeping – it's all captivating. Why is it captivating? Because it's non-verbal communication saying, "Win! Win! Win!". It gives the impression that everyone is indeed winning when, in reality, most are losing. However, even as these people are losing, whatever machine they are on is still blaring out festive, euphoric sounds. It makes people want to get in on the action and become part of the winning as well."*[4]

In addition, with the advent of loyalty programs beyond slot machines, some functionality needs to be available through multiple media (e.g. inserting/swiping card in slot machines, individual scanners at table games and restaurants, viewing loyalty points via apps on mobile devices).

[3] http://www.theverge.com/2015/5/6/8544303/casino-slot-machine-gambling-addiction-psychology-mobile-games
[4] http://listverse.com/2010/02/09/10-tricks-casinos-use-on-you/

All of these non-functional requirements can be handled by SNAP. The IFPUG definition is as follows:

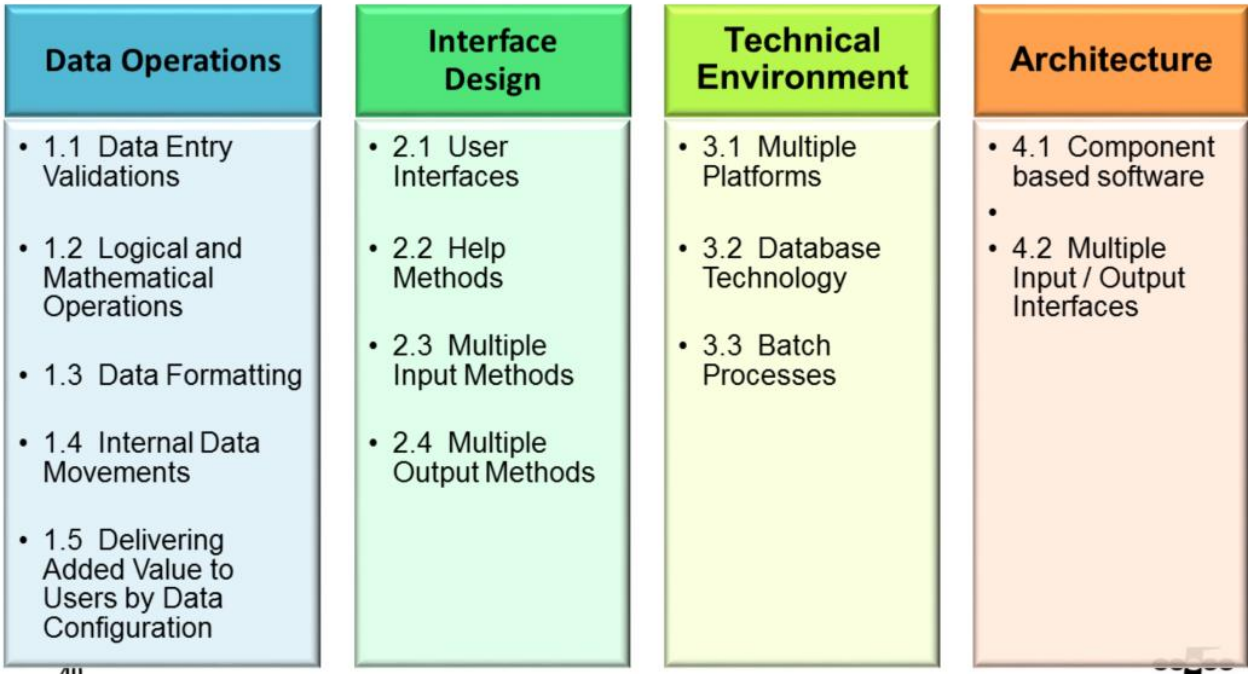
"The SNAP Framework is an assessment of the size of non-functional requirements:

- *The framework is comprised of assessment categories and sub-categories*
- *Sub-categories are evaluated using specified criteria*
- *The evaluation utilizes both assessed and/or measured criteria*

The non-functional assessment results have the following characteristics:

- *They can be used in conjunction with the functional size, and will help explain the variance in development effort and productivity*
- *Along with functional size, they can be used as input to estimating models*
- *They are determined from the users' non-functional view, but understood and agreed by the development teams."*[5]

The following are the SNAP categories and sub-categories.



When using SNAP only the relevant categories and sub-categories are used. Below is an example of what may be used for our non-functional requirements in the gaming industry.

Non-functional Requirement	SNAP Category	SNAP Sub-category
Winning combination algorithms	Data Operations	1.2 Logical and Mathematical Operations
Random Number Generator	Data Operations	1.2 Logical and Mathematical Operations

[5] IFPUG SNAP Assessment Practices Manual

Sound, Lights, Animation	Interface Design	2.1 User Interfaces
Loyalty card – slot machine and mobile scanner	Interface Design	2.3 Multiple Input Methods
View and redeem loyalty points on mobile phone	Interface Design	2.3 Multiple Input Methods 2.4 Multiple Output Methods

Once the SNAP points are determined then historical and/or industry data can be used to estimate the effort required for non-functional requirements of this size. The specifics of how to score the sub-categories are available in the IFPUS SNAP Assessment Practices Manual (www.ifpug.org).

FP estimates and SNAP estimates should be completed separately form one another. Once they are both completed the effort can be combined/consolidated into one estimate.

Conclusion

Although all industries can utilize software measures to improve processes, the most effective measurement programs are based on the specific needs of the organization. The key is to focus on the Goals and Initiatives for the organization and ensure that the measures and data collection support those goals and initiatives. FPs and SNAP can be used in support of any measurement initiative regardless of the industry.

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International Function Point User Group, Counting Practices Manual

Software Non-functional Assessment Processes, Assessment Practices Manual