Managing Analysis of Products from an Agile Development Process

Information Flows Like Water

The Metaphysics of Information

Information is one of those thing which eludes precise definition but we can think of it as "thoughts communicated". It is not physical, but can be analyzed as a if it were a fluid. It flows through time like a river subject to pressures similar other hydrodynamic phenomena.

While we may talk about "processing" or "manipulating" information we never actually change information. Rather than transform information when we analyze it, we are actually creating more information. So, information actually grows as it spawns new information. This growth generates outwardly moving pressure which affects new information in the cycle.

Information has a quality of timelessness. A particular piece of information is frozen in time. The information in the picture will always be that, when the picture was taken on August 15, that was the price of gas. However, information grows, for instance, when this poster was printed the image became new information. Likewise, when you communicate what you see, additional information is created.

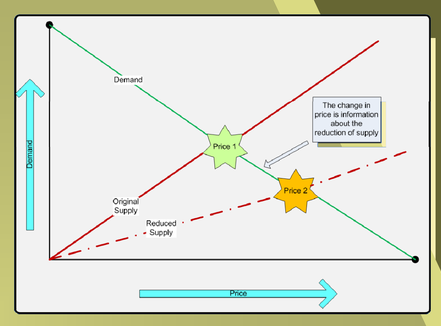
One last thought—while information is always real, it is not always true. Lies, fiction and mistakes are all forms of information. When it is under pressure, such as a deadline, the effect of a mistake can also grow, changing the value of the information.

You can't step in the same river twice

The Value of Information

Value is information and information has value. An economist will tell you that prices are ways of conveying information in the marketplace.

Price is the point where demand is in equilibrium with supply. A change in price, in the example an increase, communicates information about the market for the product. In this case, supply has been reduced. It also conveys additional information about the value of the product to the buyer— the level of demand declined as the price increased, indicating that the value to the marginal buyer is price elastic.



An option is the right to buy or sell a stock at a fixed price within a set time period. In 1973, mathematician Fisher Black and Myron Scholes published a paper with an equation for discovering the value of a stock option. In essence, it is a bundle of prices and how they are related. One of the interesting things about the model is the way it gets rearranged to solve for different variables. Traders in the market use the equation to value stock prices, interest rates or volatility based on the current price of an option. The information about the different prices has different value to the user and changes quickly with market moves.

The Black-Scholes Option Pricing Model

$$V = P[N(d_1)] - Xe^{-r_{RF}t}[N(d_2)]$$

$$d_1 = \frac{\ln\left(\frac{P}{X}\right) + \left[r_{RF} + \left(\frac{\sigma^2}{2}\right)\right]t}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

Where:

V	is the current valuation of the call option
P	is the current price of the underlying stock
$N(d_i)$	is the probability that a deviation less than d_i will occur in a standard normal distribution
X	is the strike price of the option
r_{RF}	is the risk-free rate of return
t	is the time until the option expires
σ^2	is the variance of the rate of return on the stock

Adapted from Financial Management: Theory and Practice, Brigham & Ehrhrdt, 2005

Like an option, analysis of products from an agile development process face an expiration date. The OPM shows that as time till the deadline decays, so does the value. In the case of agile development products, the value of analysis lessens as new builds are released. Likewise, as the deadline approaches the effect of increasing σ^2, which can be analogues to the breath of IV&V analysis, is to increase value. Increasing the breath of analysis blunts the loss caused by time pressure.

Value changes as deadlines approach

The Mars Science Laboratory (MSL) project involve developing an extremely large and complex set of flight software. The development team employ a highly iterative process releasing many build quickly. The Independent Verification and Validation team performs analysis of this software which is driven by criticality and risk assessment.

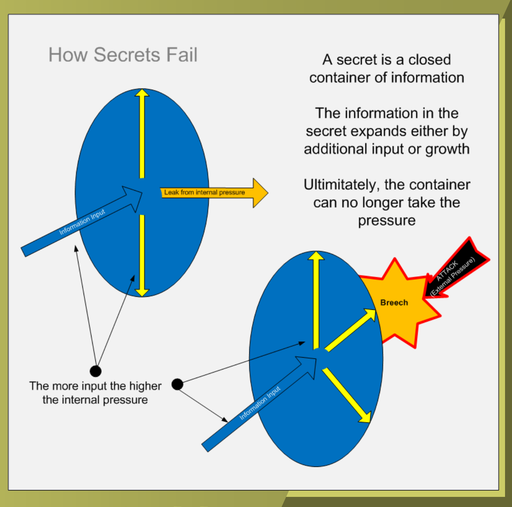
The Containers of Information

In order for people to use information it must come in a manageable form. Some of the ways information is contained are:

Stories	**Images**
Models	**Measurements**
Mathematics	**Symbols**
Prices	**Conversations**

These containers may be combined to form more complex types of information. From an IV&V perspective, we analyze different documents which contain requirements and design descriptions, which are forms of stories in and of themselves, and combine them into a narrative which we can comprehend easier, the story of how the missions will be undertaken. Once information has been entered into one container the information which is created by analyzing the narrative must go into a container. The containers by which the information which IV&V analysis is communicated; issues, observations and less formal consultative conversations, act like a funnel, passing a wide scope of information through a narrowing channel. Like fluid in an actual funnel is pushed through the channel by air pressure on it, the information from analysis is under the pressure of deadlines and the decrease in value that causes..

The external pressure of time is joined by the internal pressure of growth to speed information though the opening.

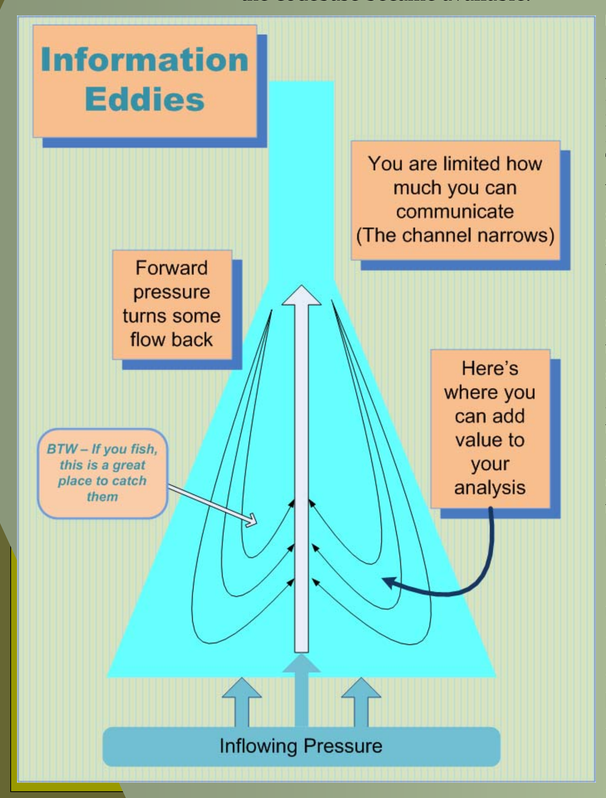


Wikileaks was inevitable

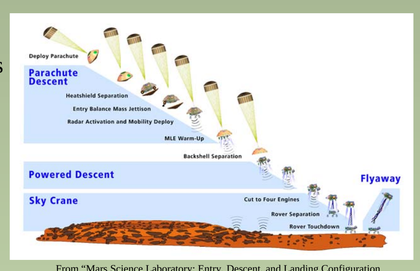
The Dynamics of Information

In nature, one phenomena of fluid moving through a narrowing channel occures on a river when an area where water pools moves into a stretch of whitewater. As pressure from incoming stream flow enters the pool upstream, pressure is built at the downstream end of the pool. Two things happen in that area. First, water entering into the outbound channel speeds up. The other thing that happens is that the incoming pressure turns some of the water back so that it flows upstream, known as an eddy. The equilibrium point of the two opposing flows create still areas in the pool.

From an information management perspective, value can be added in these eddy currents. For the MSL IV&V analysis two tasks have been undertaken from which the project has found of value. The first has been an in depth exploration of the entry, descent and landing timeline, which is a critical phase of the mission, and the other was a mining of the design documents to understand the system wide and local fault protection strategies. While the more traditional analytical activities, such as requirements validation and static code analysis, were fast tracked into the communication channel to the project, the deeper analysis became a basis for future analysis as new iterations of the codebase became available.



The approximately six minutes from when the spacecraft enters the Martian atmosphere until it is safely on the surface is probably the most dangerous time during the MSL mission. Unable to have real time control from Earth, the Lander must fly itself. This portion of the mission is controlled by a software script known as the "timeline". The timeline must control all of the craft's components. The explanation of the activity timeline was distributed over more than a dozen design documents. Simple atomic analysis of the documents would not provide a full understanding of plan. As the initial analysis of the individual documents created pushback information, a special team of analyst was assigned the task of creating a comprehensive picture of the integrated workings of the system during the event. The information from this analysis has since been used to analyze each new release of the flight software, yielding a more complete understanding of the system and adding value for the customer.



From "Mars Science Laboratory: Entry, Descent, and Landing Configuration (http://marsprogram.jpl.nasa.gov/msl/mission/spacecraft/edlconfig/) Jet Propulsion Laboratory, California Institute of Technology

The flow of an eddy current is sometimes referred to as "backwash". Early analysis of documents released from the MSL project caused concern in the IV&V team about the fault protection being employed. Since throughout the mission autonomous actions will be required of the system, protecting it by having robust fault protection in place is vital. Another team was formed and proceeded to "mine" all of the Functional Design Descriptions in order to discover the monitors which would detect fault conditions and the responses the system and subsystems were expected to take to correct the conditions. This exercise produced a database of all of the monitors in the system which has not only used internally by IV&V for analysis of subsequent releases, but is being employed by the project and will be used to develop operational contingency plans. The "backwash" of early analysis information has been repurposed by the IV&V team to provide detailed information being used to safeguard the mission.

Using fluid models to examine information flows holds promise as an opportunity to improve IV&V activities. As the use of agile practices become more widespread in the development community, understanding the effects of pressure & flow on information may enhance the process.

Take advantage of the eddy currents

Something to think about: Modeling is another IV&V activity which takes advantage of information eddies

"Where is the wisdom
we have lost in knowledge?
Where is the knowledge
we have lost in information?"
-T.S. Eliot

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