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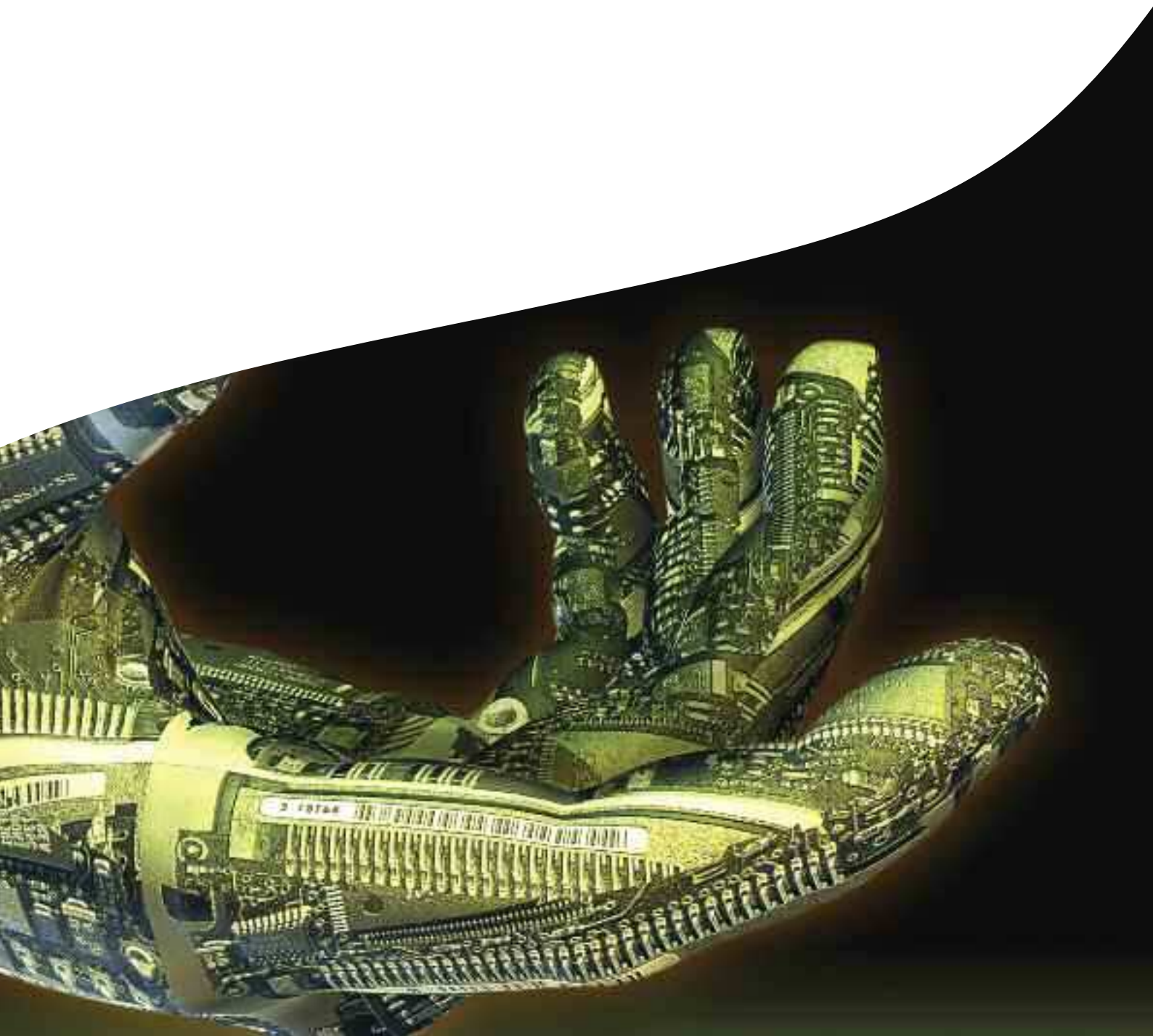
3D Virtual Collaborative Environments in Oil and Gas

Point of View by John Buchanan



Virtual Collaborative Environments (VCEs) are realistic, immersive 3D spaces where people interact with the environment and each other in real-time, irrespective of their physical location.

Introduction

Imagine the ability to instantly *walk through* and interact with any of your company's assets, wherever they were in the world: on the surface, subsea or subsurface. Imagine being able to discuss the functioning of a piece of equipment with Subject Matter Experts (SMEs) or trainees as if you were all standing next to it; to simply right-click it to pull up the data sheets or calibration details or real-time trends. Data is organized so people only have to interact with it where there is an issue or interest. This is the potential of VCEs. One could remove the cover and dive into the innards, possibly even to operate the real equipment from within the virtual environment. Furthermore, how much time and money could be saved in performing realistic business process rehearsals where as many individuals as required could participate without leaving their desks?

An obvious advantage of business process rehearsal is that when a problem occurs, participants already know the recovery exercise when they need to do it live – workovers, gas turbine change-out and other critical value chain activities that must run as smoothly and as quickly as possible to restore production. Optimised production is at the heart of VCEs.

By connecting people together, as-required, at low cost, and with the data to make right-time decisions, VCEs represent a culture change for frictionless communication, social networking and productivity in the oil industry. In financial terms, companies have identified a 25 percent increase in staff productivity and one Capgemini client forecasts savings of at least $120m through the use of VCEs over the lifetime of an oilfield. Effective critical process rehearsal can shave a day off a two-week shutdown through increased staff familiarity with critical path activities and contingencies[1].

This paper demonstrates that there is value to the oil industry in exploiting both the technology and people comfortable in these environments. Capgemini sees a natural progression in the development and embedment of VCEs that can help companies achieve remote asset management.

Resources: Enabling the People

Today's technology savvy *"Generation Xbox"* feels at home in online virtual environments to communicate and collaborate with other people around the globe in social networking, gaming, and in their chosen professions. Strategy Analytics cites a virtual environment population of 186 million today growing to almost 640 million by 2015[2]. VCEs align neatly with Generation Xbox because they are technically competent and focused on Key Performance Indicators (after all, what constitutes a high score?).

One industry that has begun to exploit Generation Xbox skills is the military. For example, the thousands of hours young people have spent online results in a keen aptitude for piloting Unmanned Aerial Vehicles (UAVs). A pilot located at a central location can 'become' the UAV and navigate it through a remote battlefield while it feeds data superimposed over accurate geographic and troop deployment information. When a potential target appears, this context could be instantly shared with those authorized to make the strike with input from, or control by, the troops on the ground.

1 Hydrocarbon Processing 08
2 Strategy Analytics 15/06/09

With the current workforce shortage in the oil industry, Generation Xbox is an attractive segment to engage. As VCEs do not have the cost, time or risk associated with travel, they also enable scarce, highly-experienced Subject Matter Experts (SMEs) to impart their wisdom at short notice, wherever it is required in the world, immersed in relevant context.

VCEs could be a central element of new attractive employment models that allow long-serving staff to semi-retire, but still provide valuable participation and oversight in offshore activities, lengthening the tail of employment. As distance has become irrelevant in VCEs, it is far easier to establish and maintain Subject Matter Networks or Centres of Excellence and share learnings in context. Rather than meeting once a year to share learnings in a hotel, the SMEs can meet regularly and spontaneously at the site of some new development of interest. Many more can participate, including trainees, decreasing their time to autonomy and widening the company's knowledge-base.

In a similar manner, VCEs enable senior management to visit and interact with scattered personnel at the virtual workplace far more regularly and in a more informal manner than traditional scripted meetings. Oil Companies are also trialling VCEs for recruitment, roadshows, training events – all with cost savings through reduced travel.

Exploiting the Technology

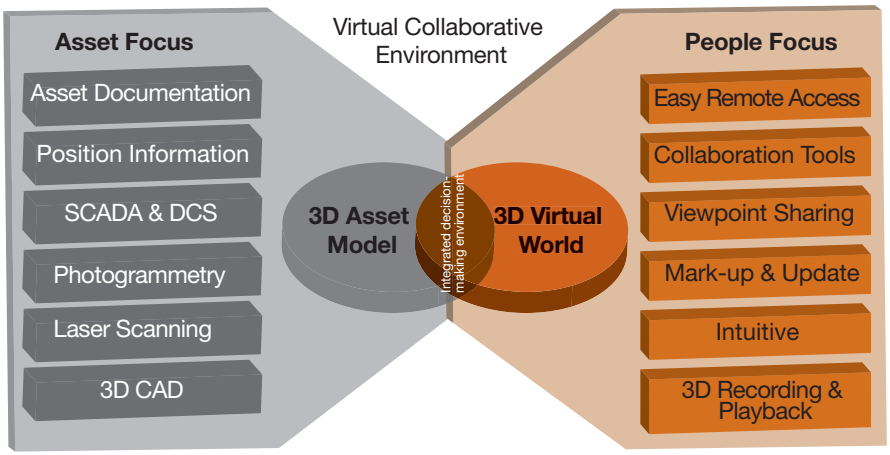
The project phase of any offshore development produces gigabytes of valuable data, such as 3D CAD drawings and associated technical information. Now, with the introduction of common standards, these can be integrated and combined with real-time (SCADA and DCS) process data to deliver a 'live' 3D digital model of the asset (or part of the asset). As long as it is kept up-to-date, this digital model is a contextual and meaningful environment for operational decisions to be made about the asset and even rehearsal of activities. Shell, for example, streams its model of the huge Ormen Lange subsea development for training and intervention planning[3] and Chevron has replicated parts of its Salt Lake City refinery and two of its Gulf platforms[4].

In parallel to the development of the digital asset model, there has been an explosion in the take up of online 3D social networking in virtual environments. These virtual environments are easily accessible, intuitive, fun, and provide a number of ways of communicating and collaborating.

Accuracy & Accessibility: a Powerful Combination

Combining the accuracy of the 3D asset model with the ease, accessibility and interactivity of social virtual worlds, provides a powerful tool and environment for training, collaboration, rehearsal and eventually decision-making in operations. Figure 1 demonstrates the characteristics of this powerful combination.

Figure 1: Characteristics of a Virtual Collaborative Environment



Overlaying 3D Asset Model inputs with Virtual World enablers provides a powerful new tool for training, collaboration and rehearsal, and eventually decision-making in operations

3 http://www.rigzone.com/news/article.asp?a_id=33413
4 Journal of Petroleum Technology June 09

The VCE enables individuals to interact with the asset and each other – it is a mechanism for both organised and spontaneous collaboration. This enables better and faster decision-making that optimises the use of data from the asset as well as content from scarce human resources. By default, it also reduces travel cost. The VCE represents an evolution of oil companies' centralised Onshore Collaboration Centres, empowering personnel to 'teleport' to the virtual representation of the asset as required (See Figure 2).

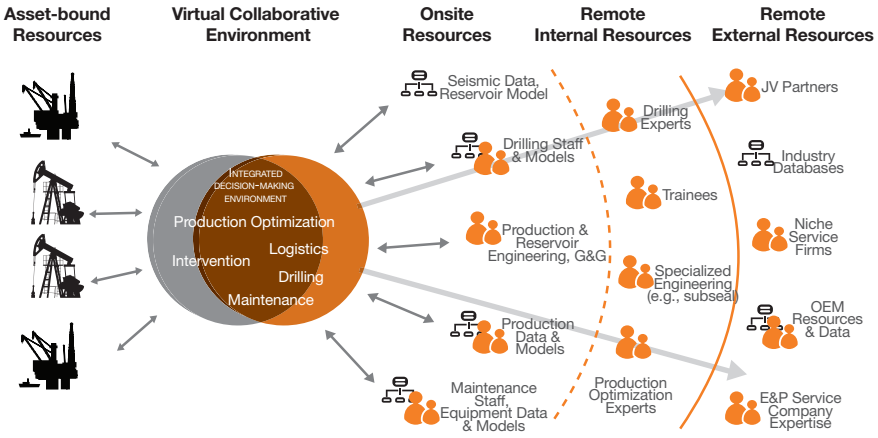
The Journey to Remote Asset Management

Efficient and effective use of VCEs as a remote operating environment might not be as difficult to achieve as most companies think it is. There is a logical development plan for technology and people that can be put in place. It begins with creating an environment at an appropriate level of sophistication and coaching users to the right level of familiarity to gain maximum benefit (see Figure 3). As the individuals become more confident the environment can become more involved and more data-feeds integrated.

Initial 3D Model Development

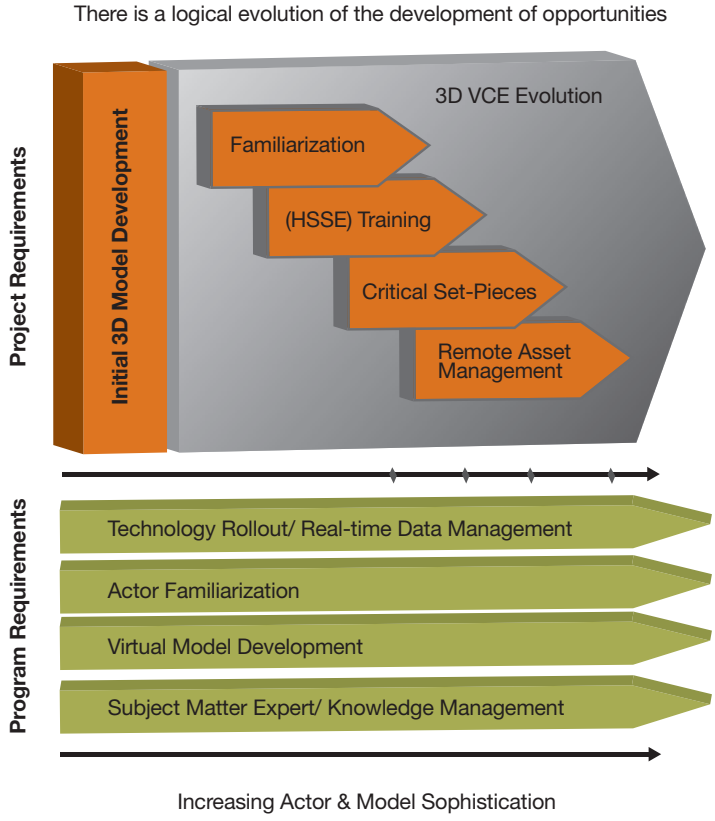
The 3D digital asset model needs to utilise the existing CAD drawings generated by any project. Initially, the model can be quite simple, but must be capable of accommodating future requirements such as real-time data integration. The engine behind the model must consider real-life physics such as gravity, wave motion and the like. It also must be capable of 'streaming', that is being available to multiple people in multiple locations at an appropriate level of detail regardless of the size of the base model. Above all, it must be reliable and available 24/7.

Figure 2: The VCE can draw on internal and external resources as required



Adapted from CERA

Figure 3: Evolution of VCEs



3D Model and User Evolution
The 3D model must keep in step with the varied and increasing requirements of its users. If the model is implemented during the project phase of the development, it will be useful for design reviews and the operations team can provide their input into the project phase easily, even though the project team is located elsewhere. However, for many users, this level of detail is not required. Also, as the users' familiarity with the VCE grows, they will find their own uses for the environment and this must be captured and managed. The ultimate goal must be to have a high degree of interactivity with the physical asset – to control the asset from the VCE and to have full access to all documentation from within the VCE.

Familiarisation and Training:
Using a 3D model gives personnel an opportunity to familiarise themselves with the layout of a facility and basic operational procedures before they gain access to the physical asset. This provides a level of immersion and realism that reviewing traditional CAD drawings does not offer. In the process, they also become familiar with the basic functionality of the VCE tool. An added benefit is that the same model can be used by the individual for training, such as lifeboat drills, berthing or crane operations. It can also be used as an extension of the control room simulator with personnel available to perform manual activities on the virtual asset. Management can ease the workforces' integration into the VCE by holding regular meetings in the virtual environment.

Scenario: Mechanical Engineer reassigned to Azerbaijan from the Gulf:

As a mechanical engineer currently on a rig in the Gulf, I had been told my next assignment was in Azerbaijan. During some dead time on the rig, I entered the Azeri VCE. A greeter met me at Baku airport and she negotiated me through the immigration process (it can take half an hour to get the various stamps). She then showed me where to get local currency answered my questions and saw me onto the heliport minibus. At the heliport, I suited up watched the safety briefing and, after a half hour flight was at the platform. Here, I was shown my room and boat, given a guided tour by someone who was actually on the platform and was then left to explore the facility. When I do this for real next week, I will have a fair grasp of the platform layout and how to get there.

Value: The engineer's transition to the new platform should be smooth. He will already have a basic familiarity with the platform before he gets there so then efficiency and time to autonomy will be improved. The VCE can also replace the traditional onboarding video, while being easier and cheaper to keep up to date.

(HSSE) Rehearsal:
As personnel become acclimatised to the VCE medium, with an understanding of the controls and how to communicate, the VCE can be used for more complex multi-user scenarios. With little modification, the 3D digital asset can be used as the stage for practising collaborative exercises such as boat station drills, fire-fighting, man overboard, even pirate attacks!

Hands-on practice will always be needed, and nothing will replace the disorientation of a real lifeboat launch, however this only can be done infrequently in real life. VCEs involve no risk to participants so difficult and dangerous scenarios can be rehearsed and the correct responses ingrained.

Critical Business Process Rehearsal:
By definition, critical business processes have a large downside risk. For example, if a subsea pigging exercise goes wrong, not only can people get hurt, but the pipeline can be blocked by the pig. A VCE can help to mitigate these risks by staging rehearsals of non-routine, critical business processes. Any operation that interrupts production can be a rehearsal candidate because the VCE enables the procedures to be performed without disrupting operations – even involving personnel who are not physically located at the asset.

Personnel could put themselves in harm's way in the virtual environment, suffer the consequences and learn from their mistakes in a safe and responsible manner. The exercise can be recorded in 3D, which means that as well as the usual fast forward and rewind options you get with 2D video, the system records the view from every perspective, and every conversation too. Every important interaction can be analysed and optimised. With the aid of the right VCE, for example, a gas compressor change-out can eventually be run with the precision, speed and safety of a Formula One pit stop. This recording is a valuable knowledge asset which is easily available to other engineers as a rich training tool.

Remote Asset Management:
The logical end goal of the VCE is virtually connecting all interested parties to monitor and possibly control facilities remotely via an interactive model. This means that SMEs can be available at short notice to assist with decision-making, immediately surrounded by the right context and data feeds – no desktop configuration required.

Scenario: Remote Expert Involvement

The Control Room Operator on East Cormorant oil platform had a problem. They had commanded a subsea choke five percent open, but

was unsure if it had responded as production pressure had not increased. The Operator had cycled it a couple of times, noted that there had been a drop in hydraulic pressure, but still saw no change in production pressure.

The on-shift Subsea Engineer in the Houston Virtual Collaboration Center, was alerted, teleported to the subsea tree, 200 meters below the North Sea, to meet the Operator who paused real-time, rewound and replayed his actions demonstrating the symptoms. By touching the sensor, the Subsea Engineer pulled up a graph in front of them showing its history. She also confirmed that it was in calibration, and with her admin mode, performed some diagnostics on the sensor which appeared healthy; she suspected wax or hydrates were blocking the sensor.

Seeing that a Production Engineer, who had had hydrate problems before, was online in the Gulf, the Subsea Engineer invited him to come and have a look. After the Production Engineer had materialised next to the subsea christmas tree, they looked in more detail at the pressure sensor history noting flat spots and steps in the trend and agreed that it was probably a hydrate plug.

Rather than isolate and depressurise the pressure sensor and affect production, it was suggested that opening up the choke 20 percent could break the hydrate plug. After the Control Room Operator did this, all watched with satisfaction as the pressure sharply rose to the expected value. Later, the Production Model was revised to reflect hydrate formation conditions in the colder parts of the production system. Virtual collaboration had enabled remote subject matter experts to share context real-time and arrive at the optimal solution.

Value: No interruption in production, SMEs instantly available, and no travel cost.

Capgemini's 3D Virtual Collaboration Portfolio

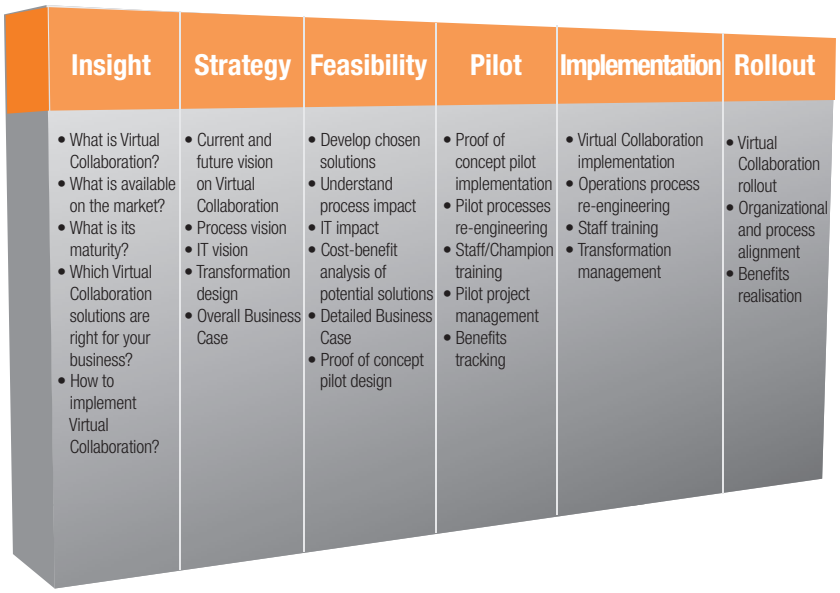
Capgemini have widely promoted and developed virtual collaboration solutions for several major companies. This is a fast-changing market with no clear leading application. Capgemini has formed relationships with several of the main providers, understand the complexities of the solutions and have gained experience in their design and roll out.

Insight:
Gain an understanding of the various options available, their maturity and suitability for your business. Establish where there may be opportunities for cost savings and productivity enhancement.

Strategy:
VCE involves the interplay between people, processes and technology. Capgemini can help you develop a vision and roadmap to optimise existing assets and develop the business case. Capgemini's TechnoVision Framework is closely aligned with VCEs. More information on TechnoVision is available on Capgemini's website in the Point of View (TechnoVision 2012 for Upstream Oil & Gas).

Feasibility:
A VCE Feasibility Study will give you detailed insight into the implications of a VCE solution. This will describe the impact on existing processes and IT infrastructure, and the solution's costs and benefits. We can develop a more detailed business case and help specify and commission a proof of concept pilot to help you decide which factors are important for you.

Figure 4: Capgemini's 3D Virtual Collaboration Portfolio



Pilot:
A pilot project will help develop an understanding of how best to deploy VCEs, and how to manage them from building the VCE through to operations. This will involve generating a specification, putting this out to tender, monitoring the build and integrating the stakeholders. Coaching and developing champions will be a core part as will benefits tracking.

Implementation:
Implementation will involve importing the as-built drawings of the asset into the desired medium for the VCE, overlaying them with realistic textures, and connecting the VCE to SCADA and DCS data feeds and documentation libraries. Input in design will be needed from the client's global SMEs.

Rollout:
Ensuring all stakeholders are properly set-up and comfortable operating in the VCE is key to the success of the exercise. The plan will include migration of none-core activities to the VCE, development of supplementary training in the VCE and integration of SMEs. Identifying common themes across the organisation that may benefit from use of the VCE.

By 2010 80 percent of all Fortune 500 companies will have some form of Virtual world presence[5] - what will yours look like?

Benefits of Virtual Collaborative Environments:

- **No risk to people and plant** – Can simulate dangerous/complex/escalating situations in a realistic manner
- **Enhanced Training & Better knowledge retention** – Can allow personnel to put themselves in harm's way in a realistic environment – and learn from their mistakes
- **Informed decision-making** – Through right-time data and shared context provided to the best people to make the decisions
- **Better utilization of the dispersed workforce** – Accessible to the individual wherever they are as long as they have a broadband connection
- **Reduced Costs** – less travel, better planning and execution of complex set-piece activities
- **Improved staff efficiency and effectiveness** – Do more in less time by getting real-time information from virtual environments and shorter time to autonomy for trainees
- **No disruption to operations** – Personnel can continue their day jobs while participating in training or decision-making at another facility's VCE, Simulated equipment can be used meaning the physical hardware does not need to be taken offline.
- **Critical Set-Piece Scenarios can be rehearsed** and honed like a Formula One pit stop. Estimate the duration of a production-affecting set-piece such as changing out a gas compressor
- **Facilitates knowledge capture:** – critical value chain activities are recorded in 3D rather than 2D with all Subject Matter Experts able to contribute to enhance the company's intellectual capital
- **Leverage 3D Assets** – get more value from CAD models by overlaying additional functionality and keeps them up to date

"Too much of the debate on 3D virtual environments has been fixated on short term consumer social networking environments, when the real prize for business actually lies in heavy-duty 3D applications which are fully integrated with business processes and skilling/reskilling. Such applications appeal not just to technologists, but to our deep-seated human need to be imaginative. They also improve our abilities to act in the physical world."

Clive Holtham is Professor of Information Management and Director of the Learning Laboratory at Cass Business School, City University London.

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Capgemini provides its clients with insights and capabilities that boost their freedom to achieve superior results through a unique way of working, the Collaborative Business Experience™. The Group relies on its global delivery model called Rightshore®, which aims to get the right balance of the best talent from multiple locations, working as one team to create and deliver the optimum solution for clients. Present in more than 30 countries, Capgemini reported 2008 global revenues of EUR 8.7 billion and employs over 90,000 people worldwide.

With 1.2 billion euros revenue in 2008 and 12,000+ dedicated consultants engaged in Energy, Utilities and Chemicals projects across Europe, North America and Asia Pacific. Capgemini's Energy, Utilities & Chemicals Global Sector serves the business consulting and information technology needs of many of the world's largest players of this industry.

More information is available at **www.capgemini.com/energy**

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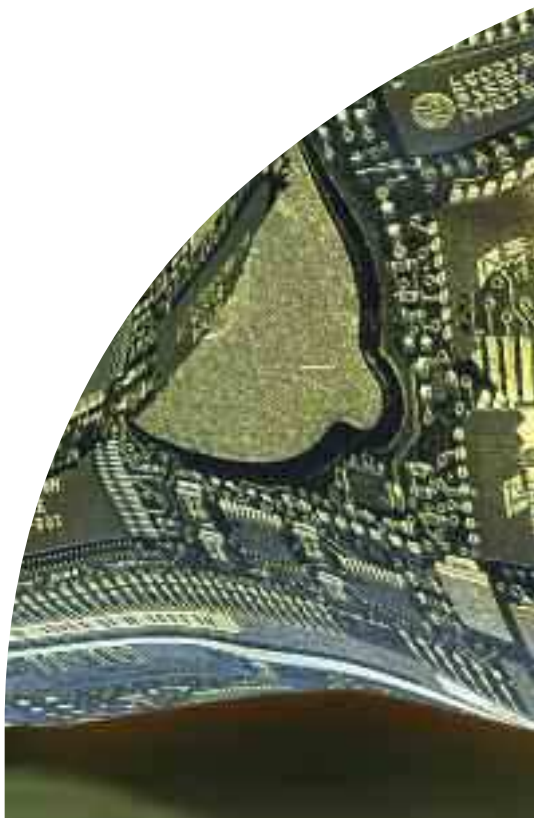

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