Wargames Powered by IBM Watson: Multiplayer Real-Time Strategy in 4D

An IBM® Redbooks® Point-of-View publication

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Highlights

IBM Watson™ cognitive intelligence can disrupt the way that you develop wargames and train forces:

- Watson can be used to develop a reusable gaming infrastructure (city-state machine).
- Watson can be used to provide guidance relative to doctrinal compliance.
- 4D gaming teaches users how to think and act 10 moves ahead to develop *fast and resilient* strategies.
- Time manipulation turns the game into a *contextual whiteboard*, allowing the user to see the consequences of their strategy choices as the enemy adapts to their tactics.
- Game lessons that are learned can identify opportunities for doctrine and strategy modification.

IBM Watson impacts serious games

Serious defense games have been around for decades. Many defense implementations focus on skills training and first-person shooter (FPS) gaming engines. The defense games have not focused on games enabling Strategic Execution or Tactical Operations. Strategic and tactical games require a complex infrastructure that is based on the cascading rules that are contained in doctrine. This type of game allows each mission plan component to be vetted, stressed, and prioritized by the entire decision and action chain.

Traditional game rule infrastructures are handcrafted by using knowledge that is obtained from force doctrine, manuals, and analytic models. City-state game machines use these rules to control the play. The control portion of the machine is part data and game infrastructure driven and part manually crafted. A major impediment to the creation of a high-level strategy game is the translation of force level doctrine into a form that the city-state machine can use. The traditional approach to the creation of a game's rule infrastructure does not scale to high-level strategic games.

Imagine the creation of a Multiplayer Real-Time Strategy (MRTS) game, which is played at the Commander-level and can generate likely scenarios and cascading effects that are based on rules that are generated automatically from doctrine. Suppose that detailed adversary scenarios can be generated automatically from information that is contained in books, journals, and after-action reports. Data that is gathered from stimulus-response exercises can help model how enemies adapt to space and time conditions, current event data, and the positioning of friendly troops and military assets.

Figure 1 shows the envisioned gaming infrastructure components.

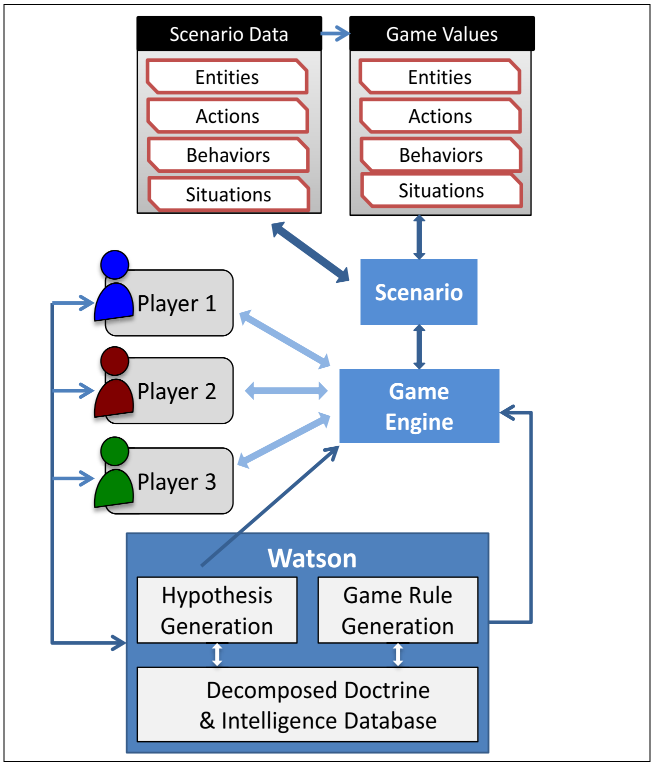

Figure 1 Envisioned gaming infrastructure components

The generation of such an evolved game, as shown in Figure 1, still requires the collection of a wide variety of historical data, such as, geospatial data, weather, troop activity, troop size, military asset types and counts, geospatial grid, terrain, time of year, and battle outcomes. Historical data-based models still can be used to determine certain types of guidelines, for example, potential adversary range of movement or speed of movement.

Cognitive computing and defense

A new computing approach is needed to process and make sense of information and to enhance and extend the expertise of humans. Effective navigation through the current flood of unstructured information requires a new era of computing, which is known as *cognitive systems*. IBM® Watson™ is an example of a cognitive system. Watson can use linguistic models to identify inferences between text passages with human-like accuracy and at speeds and scales that are far faster and far bigger than any person can do on their own. The Watson decomposed language components are stored in a specialized database (shown in Figure 1) form called *triples*. Different types of applications can then use a combination of the data and higher-level models to create specialized function, for example, cancer diagnosis or to help automate call center responses.

There are many different ways in which Watson can contribute to serious games. The first way is to support player strategy and doctrine questions. Watson based systems use cognitive analytics and models to ingest unstructured data and then save that information in a structured form. Watson systems analyze a question and then search potential responses in the database. It then reexamines both the question and the answers in hundreds of ways. Watson then uses the results to gain a degree of confidence in its interpretation of the question and potential answers. Watson responds to the player with a set of potential answers, the likelihood of the answer's correctness, and the basis for that answer. Watson manages a high level of accuracy when it comes to understanding the correct answer to a question. Properly trained, Watson answers a single question and present rank-ordered evidence that drives Watson hypotheses. The response, provided within a matter of seconds, enables wargame players to discover new evidence and identify new hypotheses that were not considered previously, thus reducing research time while improving analytic robustness and completeness.

Both friendly and adversarial forces require separate sets of doctrinal rules for control of the city-state game machine. Watson technology can support the automatic generation of doctrinal game rules that are required by the city-state gaming infrastructure. Watson can transform the information from relevant unstructured data sources (for example, friendly and adversary doctrine, manuals, after-action reports, and manuals) into rules that can be used by the city-state game machines to control the play. Watson then discovers tactical and strategic rules relative to force disposition, targets, threats, physical constraints (including geography, weather, and physics), and command and control networks. These automatically generated rules are used to craft the basic infrastructure of the game. Without Watson, the creation of factors that drive detailed intelligence assessments take months to produce.

Now, imagine a city simulation game where you play a city manager trying to optimize city resources within the confines of a stated budget. As part of gameplay, a player determines how many fire stations to invest in and where they are placed throughout the city to best serve the city's population.

In a typical city simulation game, the game designer determines (in the underlying mechanics of the game or the city-state machine) the stated thresholds for population density, how many fires will break out, where the fires will break out, and which fires will be left untreated given the current investment in fire departments. Imagine this same game powered by Watson cognitive intelligence, one that extracted basic game design rules from, for example, planning documents and lessons learned. The cognitively generated infrastructure can provide rules to the engine that details how likely fires are to break out and where, given the current investments based on real data.

Watson and 4D serious gaming

Watson can discover the infrastructure knowledge that is required by Commander-level MRTS. It can discern the rules that are embedded within complex doctrine and force manuals. Watson can be used to discover rules, cascading events, and related evidence. All of this derived information can be transformed into a city-state machine. The city-state machine is the back-end infrastructure of a real-time strategy game. The smart city-state machine can enable serious gamers to explore tough strategy questions and doctrine assessments.

Serious Games, when enabled by real data and real processes, can be used for strategic execution and tactical operations, boosting the value to organizations through mission optimization (Figure 2).

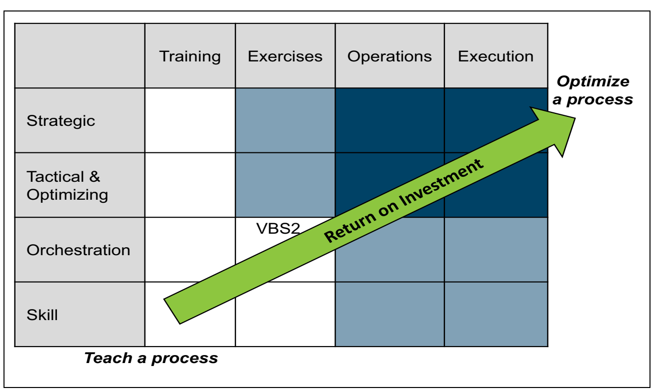

Figure 2   Teach a process

Games can teach players how to plan smarter, more effective decisions within limited time frames. A smarter serious game that is built on a Watson enhanced city-state machine can enable the user to view the game information and data in new ways, allowing both experts and non-experts to understand the doctrinally correct tactical and strategic choices.

With enhanced Serious Games, participants sort and understand data, analyze issues, and test potential solutions, applying variables that can be adjusted and readjusted for different approaches. Game play preserves doctrinally based engagement while focusing players on important concerns and helping transform their assumptions, skills, and behaviors.

4D Serious gaming: Time manipulation and strategy exploration

Affording players the ability to manipulate time (the fourth dimension (4D)) in multiplayer real-time strategy games provides players the ability to optimize strategy collectively in a way that maximizes resilience. Time manipulation allows users to explore doctrine and its implications within different gaming scenarios. 4D game engines provide the ability for each player in a multiplayer environment to affect change in different positions on the timeline, which creates effects that cascade to other players.

The ability for multiple players to collaboratively and simultaneously edit a strategy across a timeline in real time enables multiple subject matter experts (SMEs) to work in concert collaboratively or adversarially. When playing collaboratively, players can learn how their strategies might conflict and where their strategies might be complementary. When playing adversarially, multiplayer time manipulation helps players explore the strategy space of how their adversaries can thwart plans, create distractions, and exploit weaknesses. This approach fosters learning and allows players to learn which offensive and defensive strategies are more effective under what conditions. Players also learn about the second- and third-order effects of decisions.

Game play results help human strategists vet and optimize strategy with the entire value chain based on data sources from different domains. It is estimated that gaming-enabled mission optimization will save lives and might reduce cost and cycle time by as much as 90% while improving result quality by more than 60%. Results also can include improvements in margin, capacity, and capital reductions.

Conclusion

Intelligence analysts seek to understand adversarial intentions, doctrine, and capabilities that are associated with mobile weapons platforms.

The adversary's actions depend heavily on force disposition, targets, threats, physical constraints (including geography, weather, and physics), and command and control networks. These factors drive detailed intelligence assessments containing analytical judgments that take months to produce and are a static representation of a dynamic battlespace with new (and often obscure) intelligence constantly affecting the outcomes.

Cognitive intelligence can provide a disruptive approach to the generation of wargames that support intelligence and defense wargame players. Watson can support player strategy and doctrine questions. Watson technology can support the automatic generation of doctrinal game rules that are required by the city-state gaming infrastructure. Watson can create a doctrinal set of rules for each of the armed forces. Watson also can create doctrinally correct rules for different adversaries, using their own doctrinal handbooks and authored memoirs. A Watson created infrastructure can enable the vetting and optimization of strategy. The use of a cognitive intelligence analytic to power a game can revolutionize the way missions are planned, organized, trained for, and vetted.

Temporal wargame manipulations can allow players to evaluate and reevaluate the consequences of decisions. It offers the ability to host a smarter conversation about complex strategies by extrapolating the complexity into a safe environment that can be played through contextually. Warfighters can issue or retract commands in the past, present, and future, blurring the boundary between hypothetical and committed decisions. In particular, the player can revisit critical decision points, learn what decisions had the most long-term impact, and use statistical information on the timeline to make more informed decisions. 4D support for multiple players to simultaneously change history can further enhance training. Each player can take advantage of an opponent's strategic weaknesses in the past and each player can correct mistakes in their own strategy and determine the best response to their opponent. This approach helps players to intuitively discover robust strategies.

What’s next: How IBM can help

IBM has an award-winning consulting practice that is dedicated to both advanced serious games that can be used to solve problems for organizations, and gamification, using game design techniques as a means to motivate user behavior. This consultancy can help you design and implement your next generation wargames.

IBM can help you craft a specialized version of a Watson cognitive computing platform that can sift through large quantities of unstructured data to generate hypotheses and the supporting evidence. IBM also can help the development of an infrastructure that automatically can extract wargame rules, both friendly and adversarial, from manuals, doctrine, textbooks, and scholarly articles.

Resources for more information

For more information about the concepts that are highlighted in this IBM Redbooks® Point-of-View publication, see the following resources:

- IBM Watson:

  http://www.ibm.com/smarterplanet/us/en/ibmwatson/

- IBM Watson Explorer:

  http://www.ibm.com/smarterplanet/us/en/ibmwatson/explorer.html

- Implement Watson:

  http://www.ibm.com/smarterplanet/us/en/ibmwatson/implement-watson.html

- Smarter Serious Games:

  http://www.ibm.com/smarterplanet/us/en/ibmwatson/implement-watson.htm

- *The Era of Cognitive Systems: An Inside Look at IBM Watson and How it Works*, REDP-4955
- *Transforming the Way Organizations Think with Cognitive Systems*, REDP-4961
- *Let's Play! Turning Serious Business Issues Into Games*, found at:

  http://www.forbes.com/sites/ciocentral/2011/12/14/lets-play-turning-serious-business-issues-into-games/

- *Serious solutions through serious games*, found at:

  http://vanguardcanada.uberflip.com/i/89342/27

- Boinodiris, et al., *Serious Games for Business: Using Gamification to Fully Engage Customers, Employees and Partners*, Meghan-Kiffer Press, 2014, ISBN 9780929652504

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