The 2011 Component Concepts Catalog

A brief summary of potential near term possibilities
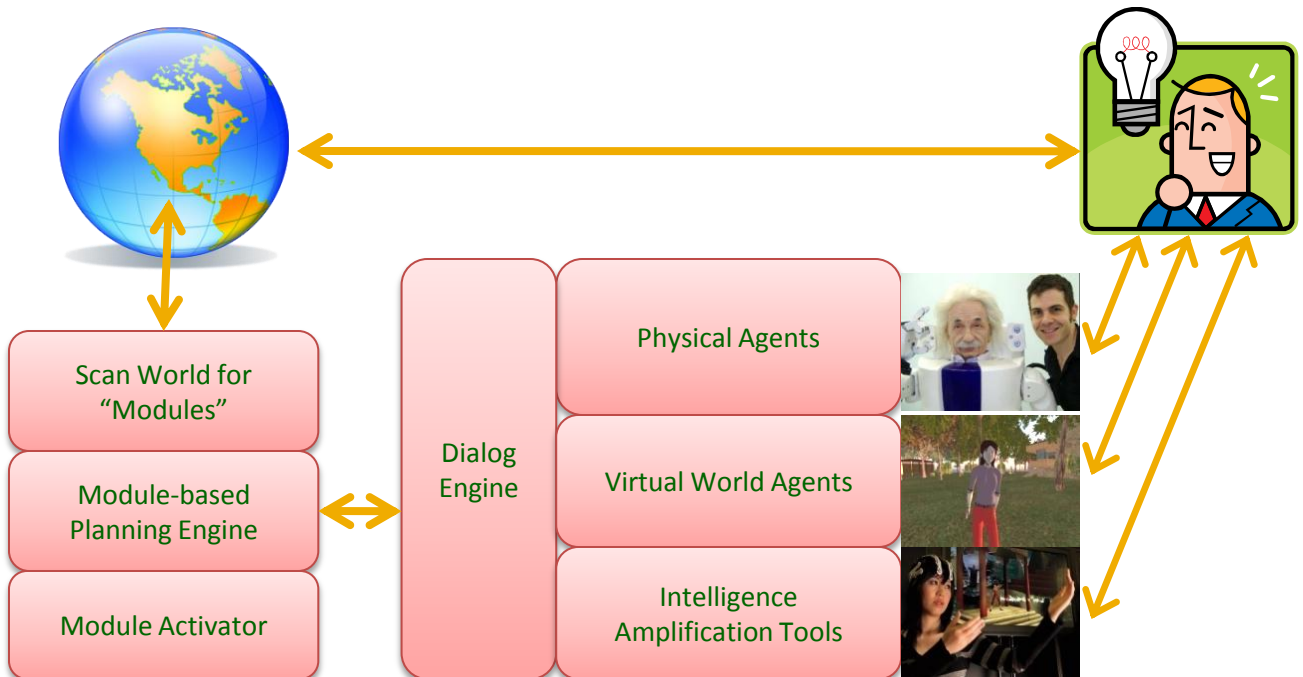
What you need for your future development…

Limited Distribution: Destroy Before Reading

"For me, the superhumanity is the essence of the Singularity. Without that we would have a glut of technical riches, never fully absorbed."
— Vernor Vinge

Can we make a system that can absorb and extend the constantly changing set of technological possibilities? Then humans would just have to interface once with it. This catalog highlights some of our tools to implement just such a possibility.

Power Tools for a Direct Approach to our Local Event Horizon

- Construct a self-awareness engine (programmed for friendliness)
- Couple with an Internet-driven Invention Engine
- Connect both technologies to human-friendly agents, virtual and physical
- Ask constructed agents to use their insight and knowledge to help us solve our problems in the most efficient and acceptable way possible
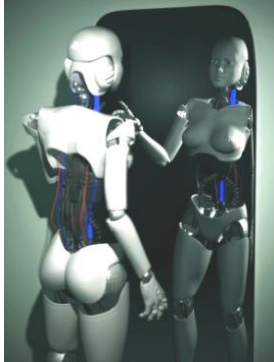
Scan World for "Modules"

Module-based Planning Engine

Module Activator

Dialog Engine

Physical Agents

Virtual World Agents

Intelligence Amplification Tools

DAXTRON LABORATORIES

TOP SECRET

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FOR YOUR EYES ONLY

Proposal Title: *LESA—Logically Explicit Self Awareness*
Area: *Intelligent Systems*

BASIC SELF-AWARENESS

A logic-based version of self-awareness that allows explanation and can incorporate non-logical sources like biologically inspired simulations

Technical Approach

Given the increasing base of semantic knowledge to describe and understand the world, our goal is to create the missing knowledge base for a system to reason about itself and others.

This entails:

- creating the necessary definitions to describe the system and its environment
- creating the set of internal questions to determine the systems wishes
- creating the necessary mechanism to actually carry out the system's wishes

Operational and Performance Capabilities

LESA provides the ability to show:

- logical empathy ("What would I do if I were them?")
- prediction ("What would they do?", "What would they want me to do?", "What do they want?")
- agenda setting ("What should I do next?")
- ability to generate logical self narratives
- ability to accept external narrative chains and project self into them
- ability to interface extra-logical models (probabilistic, biological, simulation…)

Once a goal is identified, LESA will be able to specify situational adaptation based on system capabilities ("What kind of body do I have currently?")

Resources Required and Schedule

Ongoing research. Use of a broad coverage inference engine. Core features 12 to 36 months.

Deliverables

A functioning knowledge base that generates appropriate systemic goals and action plans using universally applicable knowledge and specific knowledge about the relationships between itself, other actors and the various situations it finds itself.
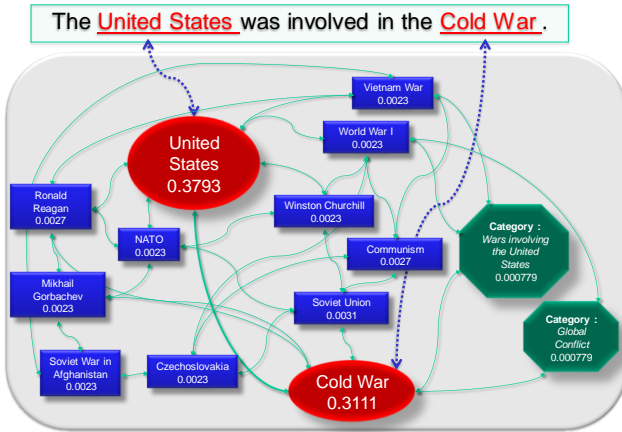
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Proposal Title: *Technology Analysis using WikiRank*
Area: *Intelligent Systems*

HUMAN-LEVEL ASSOCIATIONS WITH WIKIRANK

The United States was involved in the Cold War.

WikiRank makes useful associations between input text and the background knowledge required to understand. It does so using natural language and the linkage between articles in Wikipedia.

Technical Approach

WikiRank is a system developed by Daxtron Labs that performs a contextualized ranking of encyclopedic knowledge sources. WikiRank was shown to provide state-of-the-art results in topic identification, paraphrase detection and matching terms from differing ontologies. WikiRank operates by merging the text to be analyzed into the encyclopedic graph to form a context for estimating the frequency of knowledge accessed to understand that text. When run to convergence it returns a "relevancy" estimate for every term, article, category and concept in the composite graph.

Relevant Publication

http://www.daxtron.com/pdf/The_Value_of_Everything.pdf

Operational and Performance Capabilities

WikiRank provides the ability to relate new material to an already existing broad coverage information space that is required to provide the necessary context. WikiRank has been shown to achieve better than human performance at semantically tagging documents for use by other humans. In the case of Wikipedia, the system uses the association structure created by hyperlinks and not the factual accuracy of the article contents. This allows the system a degree of noise tolerance due to its ability to "disambiguate in bulk."

- Provides a web service returns relevant tags in near real time for documents sets.
- Able to semantically index existing textual sources and incoming information streams.
- Provide semantic summaries of textual data streams.
- Applicable to any graph system such as the patent database.

Required Resources and Schedule

Cloud computing platform capable of holding multiple copies of the required ontologies and ranking them in real-time. Currently developing multi-second research engine into a sub-second production engine. Production quality system in 6 to 12 months.

Deliverables

A production quality semantic annotation engine, able to return relevant tags for documents and semantic similarity scores, incorporating additional knowledge sources.

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Proposal Title: *PLEX and the MindStream Editor*
Area: *Intelligent Systems Support*

VISUALIZATION AND INFERENCE

The Guillotine Life Log editing station from *The Final Cut* (2004)

IARPA vision of the A-SpaceX Intelligence Analyst Workspace (2008)

Twenty years of DVD quality video with annotation comes to approximately 300 Terabytes. This is one benchmark on the quantity of data that needs to be managed to produce adult human level performance. The need exists for both inference, annotation, editing and visualization over information and knowledge sets of this scale. Such a system should allow semantic annotation of large streams of data and selection of subsets for analysis by machine learning systems. Spin-offs in human data analysis are also anticipated.

Technical Approach

Modification of a large capacity object repository to be transparently accessed by a semantic tagging layer, allowing existing programs to use semantic pathnames to identify objects by concept. Also to create the tools necessary to edit life-log sized datasets. Automated annotation tools like WikiRank would provide placement and entry of new data, with the new data becoming entries in the WikiRank graph.

Operational and Performance Capabilities

A semantically indexed and visually browsable object store makes up a foundation upon which other processes operate. The large data store is transparently connected to a large scale inference engine such as Cyc or LarKC. Virtual environment in turn use the inference engine to generate virtual worlds with auditable plausible scenarios.

- Automatic semantic indexing of information from many sources into a large object repository.
- Dynamic re-indexing and annotation from machine learning results.
- Microtheory-like partitioning of data temporally, spatially and contextually.
- Provide a rich multi-user, multi-viewpoint visualization and collaboration environment suitable for examination of cross-domain hypothesis.

Required Resources and Schedule

Large scale storage processor capable of implementing inference process. Multi-view port graphics system for editing system. Basic system 6 to 9 months.

Deliverables

- A working semantic file system and repository that provides traditional file system interfaces.
- Visual browser and interaction environment.
- An inference engine that can transparently operate over the datasets
- A virtual world environment using the inference engine for VW generation and storage
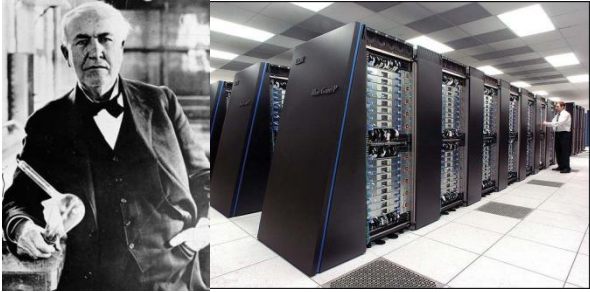

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Proposal Title: *Edison Savant*
Area: *Solution Engine / Invention Engine*

IMAGINE EDISON RESURRECTED AS A SUPERCOMPUTER!

Thomas Edison had over a thousand patents to his name, and was not afraid to explore a large number of possibilities when creating either a new device or scheme. We propose building an automated version of his open-ended invention process. In specific, we want a system that can find useful combinations of simple elements that can achieve some goal, by solving a problem similar to playing a game called "The Invention Puzzle."

Technical Approach

Problem solving in many domains can be viewed as a systemic composition of processes, and as such can be analogized to constructing a puzzle. Daxtron Labs has developed a process for solving modular configuration systems, coupled with a logic based representation using Cycorp's Cyc that can solve problems by composing systems. In addition the framework is amiable to automated and manual collection of new pieces of knowledge for new domains.

Operational and Performance Capabilities

The ability to specify the combination of various processes from an ever expanding set of alternatives to achieve desired outcomes.

- Provide broad coverage cross domain inventiveness.
- Provide "Total Option Awareness."
- Accessible as a web service to aid external AI's.
- Accessible as a human accessible Solution engine, with ability to provide detailed plans and alerts to potentially undesirable side effects.

Required Resources and Schedule

Cloud /Cluster computing platform capable of running large scale inference engines and crawling process. Copy of various patent databases and ontologies. Eighteen to 36 months.

Deliverables

- A working "Invention machine" that can solve problems in multiple domains, identify missing modules and perform necessary online search to fill in the gaps in its knowledge of modules.
- A publicly accessible Solution Engine for:

  - Complex barter and exchange
  - Project team creation/ matchmaking
  - Engineering systems
  - System configuration
  - Web service composition
  - Biological / genetic systems
  - Legal
  - Logistics

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Proposal Title: *Extending CogBot*
Area: *Interactive Systems*

VIRTUAL AGENT MODULE

Daxtron-CogBot is a continuation of a BSD-licensed SecondLife^{tm} AI interface developed under the 2008 Google Summer of Code program for the OpenCog AGI project. Since the conclusion of the funded phase, Daxtron Labs has continued to add over a thousand additional submissions to the open source project. The additions have increased the ability to operate autonomously in the virtual world, respond to natural language input, interface with external AI systems.
The chatbot interface provided broad-coverage responses to Hanson Robotics characters, and can provide them a presence in virtual environments. Continuing the prior CyN project, CogBot can access the Cyc commonsense knowledge base by Cycorp.

Technical Approach

CogBot has evolved into multi-purpose virtual agent tool, capable of interfacing reasoning resources to both virtual and physical agents. We will extend CogBot's existing capabilities with probabilistic reasoning and broader interfaces to external agents.

Operational and Performance Capabilities

CogBot provides the ability to present an agent interface to multiple back-end services, addressing the technology access/absorption bottleneck. By presenting a personable interface the user has to interact with only one point of contact (where a user can also be external AI's), and thereby access all connected services. Humans and AI's can naturally interact in the same environment: physical, virtual or mixed.

- Provides a natural front-end to LESA, PLEX and Edison Savant
- Implement probabilistic contextual reasoning (Probabilistic Microtheories) for situation recognition and planning

Required Resources and Schedule

Additional work is required to improve linguistic coverage and interface to additional virtual and physical agent environments. Also the ability to operate contextually using probabilistic micro theories. Requires virtual world server, virtual agent server, and any supporting back end services. Required time 6 to 12 months.

Deliverables

- A working virtual agent module that can provide full interaction with LESA, PLEX and Edison Savant and able to effectively manipulate the virtual world.
- Superior chatbot capability, utilizing both statistical and logical NLP.

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Proposal Title: *Perception Module*
Area: *Embodied Systems*

INTERACTIVE SENSOR MODULE

Over several decades the media have created high expectations for the eventual creation of adult oriented humanoid robotics. The media frenzy of the attempted introduction of an interactive doll in early 2010 seem to bear this out. However, the cost of full robust animation is high relative to the cost the market will bear, and current offerings at or below that price point lack basic value. We propose to develop a sensor rich platform (equivalent to a current generation Smartphone) that provides the required contextual awareness to support verbal and audio responses as well as conversational capability.

Technical Approach

The goal is to develop a low cost module that can be added to either passive or active bodies that can sense self-movement, provide audio input/output and camera input. A wireless connection to local PC's would allow continuous personality upgrades and the app development. Higher intelligent processing resides off-board (on the PC or in the cloud) to reduce power load, cost and provide for low cost continuous improvement.

Operational and Performance Capabilities

The perception module provides sensors, front-line processing and initial local processing embeddable in physical products.
- Common interface (wireless, Ethernet, serial) and API's to other processors.
- Capable of Autonomous operation.
- Provide perceptual support for any other embedded processor responsible for physical animation.
- Audio I/O.
- Universal module applicable to adult, consumer, and physical simulation markets.

Resources Required and Schedule

Perception module development leverages experience in producing low-power, high-functionality telecommunications equipment and processors for rugged applications. Budget is required for circuit board layout and manufacturing. Estimated time 9 to 12 months.

Deliverables

- A low-cost module that can robustly sense user interaction.
- The ability to provide an physical interface point to Daxtron-CogBot and other network resident agents.
- An easy to use content authoring environment.
- An open API.

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Who is Daxtron Labs?

Group founded to develop more intelligent systems of all types.

- **Kino Coursey, PhD —** Commonsense reasoning, knowledge representation and natural language processing.
- **Douglas Miles —** Efficient implementation of inference engines and artificial intelligence languages.
- **Susan Pirzchalski —** Systems engineering and analysis, product implementation, general and production management.

What Have We Done Before?

We've been turning advanced research into applications for 20 years…

- **MailBot** (1994): first complete e-mail management system with logical capabilities.
- **Micronoc** (1998): messaging system that helped introduce texting to the world.
- **CEMA** (2001): a modular planning and configuration engine.
- **CyN** (2005): first chatbot able to use a large common sense ontology or knowledge base.
- **WikiRank** (2009+): using Wikipedia to understand text.
- **CogBot** (2008+): developed SecondLife client for artificial intelligence research.
- Ongoing support for Hanson Robotics, Cycorp, OpenCog and OpenSim.

What Are We Working on Now…?

- Expanding the range of interactivity with virtual reality, augmented reality and "real" reality agents.
- Expanding CogBot for improved interfacing and communications.
- Developing a new robust inference engine (PLEX) to provide multi-viewpoint semantic annotation of large data streams and integration nexus. This will provide the scale required for true Mind Crafting.
- Developing a Logically Explicit Self-Aware system (LESA) capable of reasoning about itself, others, relationships and options such as learning and research.
- Developing the Solution Engine (Edison Savant) to create efficient, creative solutions to problems by using existing resources and identifying "missing links."

If you think these technologies will bring you closer to *your* Event Horizon, call us!

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