

Conceptual Overview of the JAEA KMS

Next Generation KMS Workshop
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**Why do we need advanced
Knowledge Management in the
radwaste business?**



The library of Alexandria

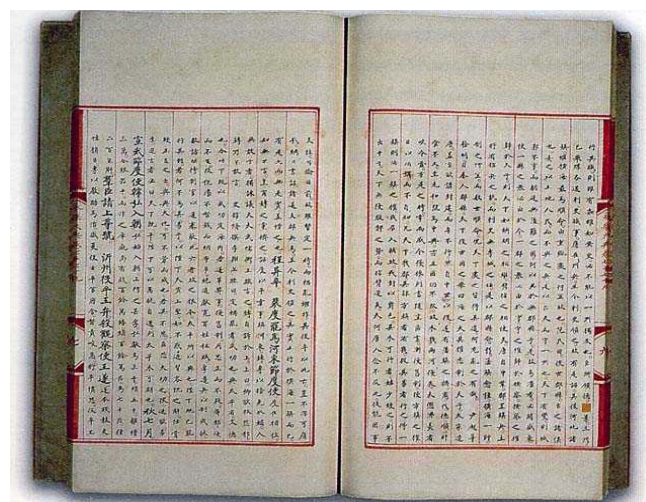
- Greatest library of the ancient world: built up over a period of centuries around 300 BC - 50 AD. Uncertainty about size (several hundred thousand papyrus scrolls) and date of final destruction
- First case of structured management of written knowledge, with quality assured by a review process



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The Yongle encyclopaedia

- Commissioned by Ming dynasty emperor Yongle in 1403: one of the world's first, and then the greatest, integrated compilation of history, philosophy, arts and sciences
- Produced over 22 years by 2000 scholars: almost 23,000 manuscript rolls occupying 40 m³



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The Yucca Mountain Project

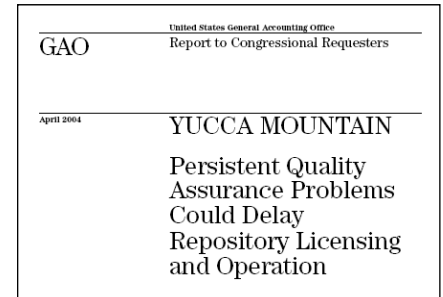


- In about 25 years, in a single project, production of 30 million pages of documents (not including all raw data!)
- apart from use of computers, documentation process would be familiar to Yongle team
- QA as for Alexandria library - but less effective!



U.S. Department of Energy Certifies Its Document Collection for Yucca Mountain License Application

Las Vegas, NV – The U.S. Department of Energy (DOE) today certified its document collection for the Nuclear Regulatory Commission's (NRC) electronic Licensing Support Network (LSN), further advancing the Yucca Mountain repository licensing process. DOE has made electronically available on the NRC LSN over 3.5 million documents, estimated to exceed 30 million pages. DOE is required to certify its LSN document collection prior to submitting its license application to the NRC for authorization to construct the Yucca Mountain repository.



<http://www.gao.gov/new.items/d04460.pdf>



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Advanced KM is a requirement, not a luxury



- Total inventories and rates of production of information and data are continuing to expand exponentially: processed knowledge is failing to keep up
- Traditional management systems have failed completely...
 - ...but resulting lack of overview means that this has not been recognised in many cases
 - ...a classic “Catch 22” situation!

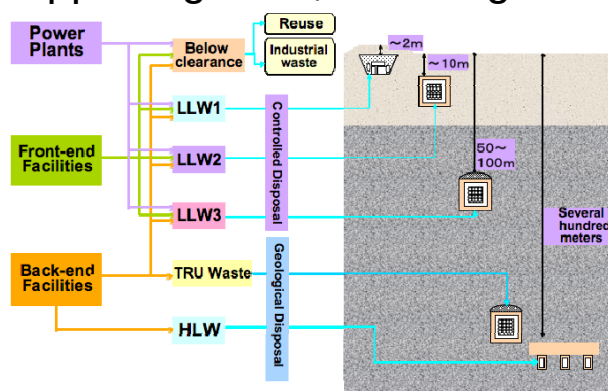
What are the particular challenges in Japan?



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Major projects running in parallel...

- Near-surface facilities operating at Rokkasho and interim-depth repository for higher activity waste in preparation for licensing
- Deep repositories for HLW & TRU waste to be implemented following response to call for volunteers
- Integrated concept for industrial and research wastes in development
- Extensive supporting R&D, including 2 URLs

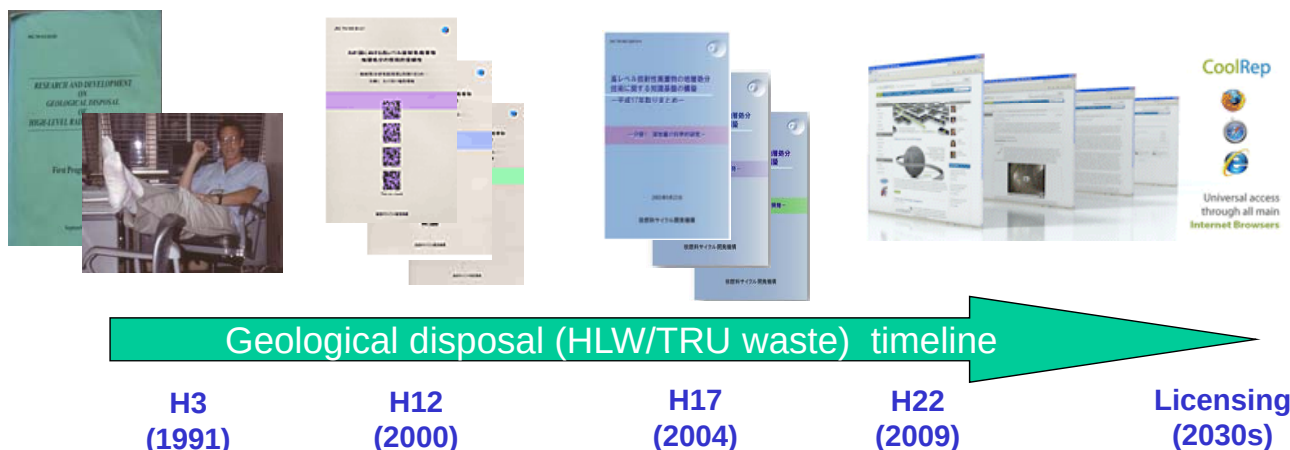


Overview of facilities for wastes from nuclear power production

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...with a limited (and aging) work force

- Over the last 2 decades, key integration and overview tasks have been carried out by teams whose experience has grown over that period
- ...these are now completely overloaded
- ...and most experienced members are nearing retirement



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Capturing tacit knowledge

- The window for capturing tacit knowledge of senior staff is closing rapidly and hence this opportunity is a driver for rapid implementation of:
 - conventional methods - focused training courses, mentoring
 - new knowledge engineering (KE) methods - formal knowledge acquisition methods (KADS), expert systems
 - hybrid approaches – think-tanks, group work / role playing as part of training courses

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How is the advanced KMS being developed?

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KMS development: background

- From a review of international experience (also outside the radwaste business), major problems with developing and implementing advanced KMS tools were identified as:
 - establishing communication between KE system designers (IT experts) and knowledge producers / users (extremely diverse, multidisciplinary)
 - Insufficient use of capabilities of modern computing systems

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KMS development: approach

- Specifically to address the identified concerns:
 - radwaste generalists learned to use KE tools and took over the job of KM system design (with support of IT experts only where needed)
 - recent advances in computing systems (hard- & software) were fully utilised and component systems were continually tested for applicability and user-friendliness
 - tools facilitate dialogue with users and feedback serves to drive further improvement and tailoring to specific needs

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KMS development process

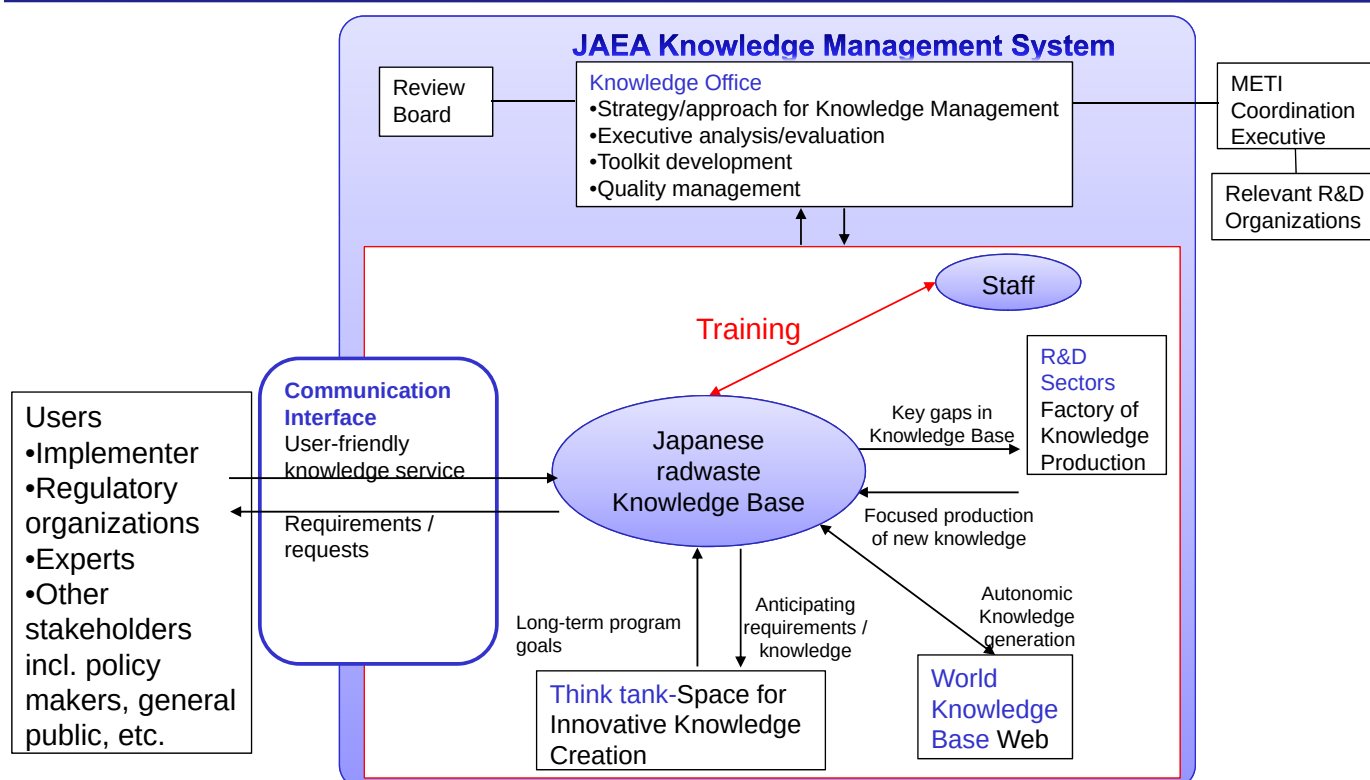
- Despite initial scepticism, the JAEA approach has resulted in development of a KMS which is increasingly accepted throughout the Japanese programme:
 - the KMS team are capable of communicating with all knowledge producers and users
 - development focuses on benefits to all involved, as this is the key to acceptance
 - tools are being tested by user groups and made available as soon as possible

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What are the key components of the KMS?

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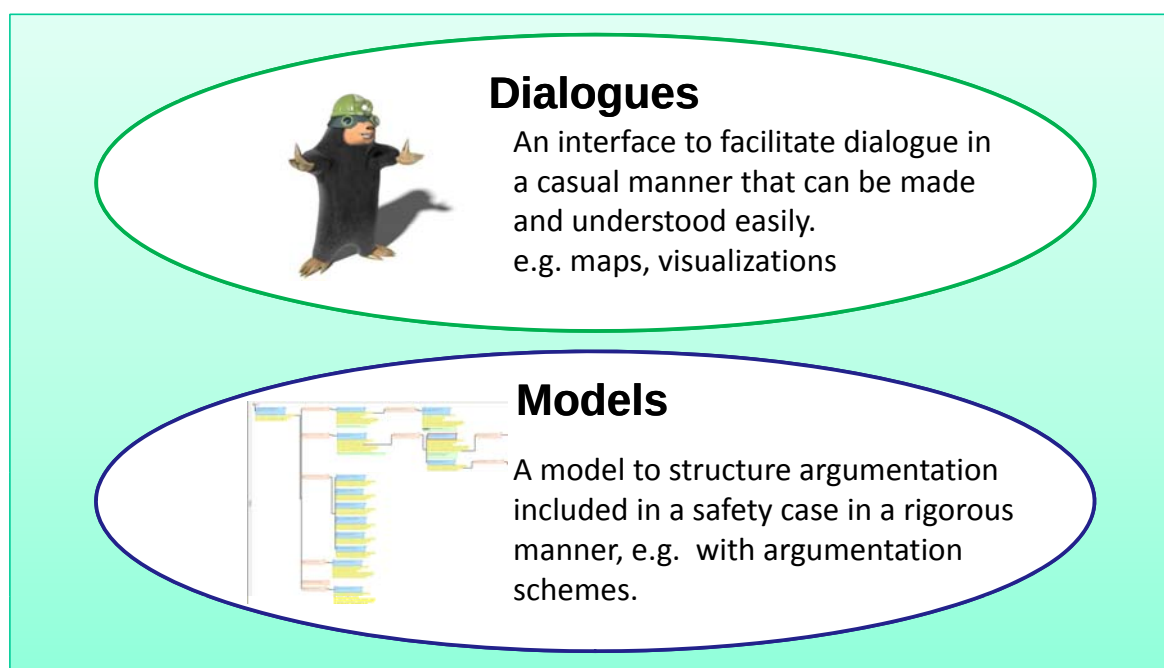
Structure and components of the KMS



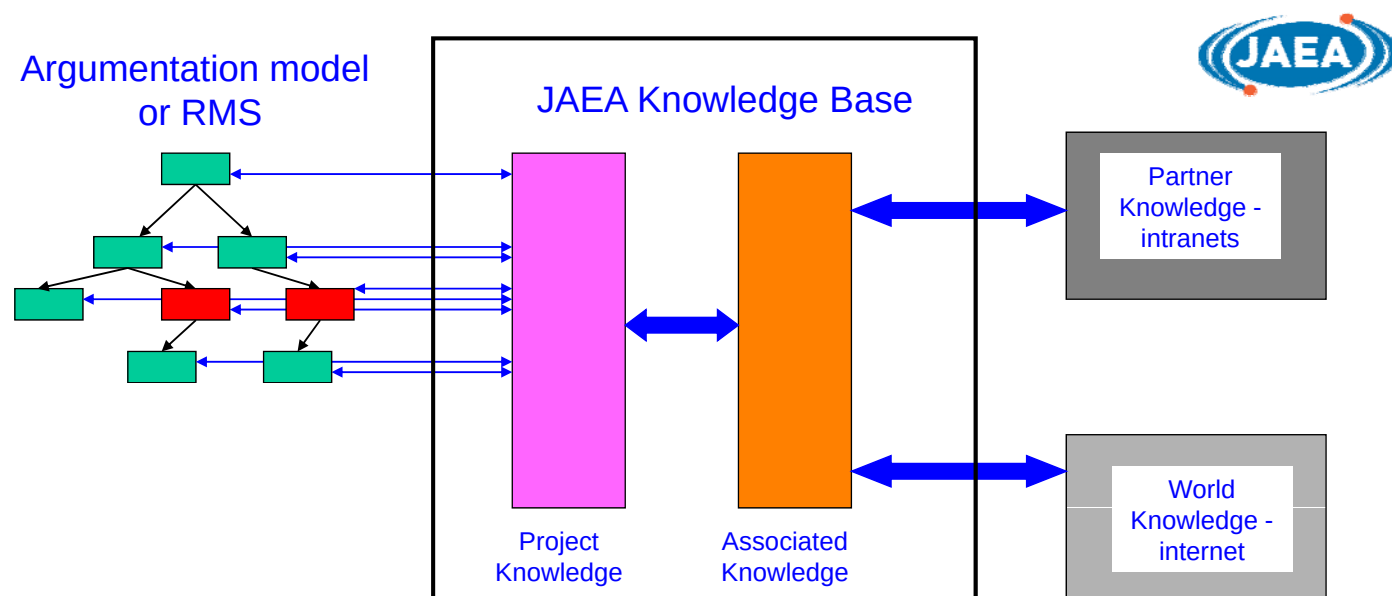
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Argumentation Representations

.....Argumentation network (AN) is used in the CoolRep demo as a general term for any kind of representation of an argument



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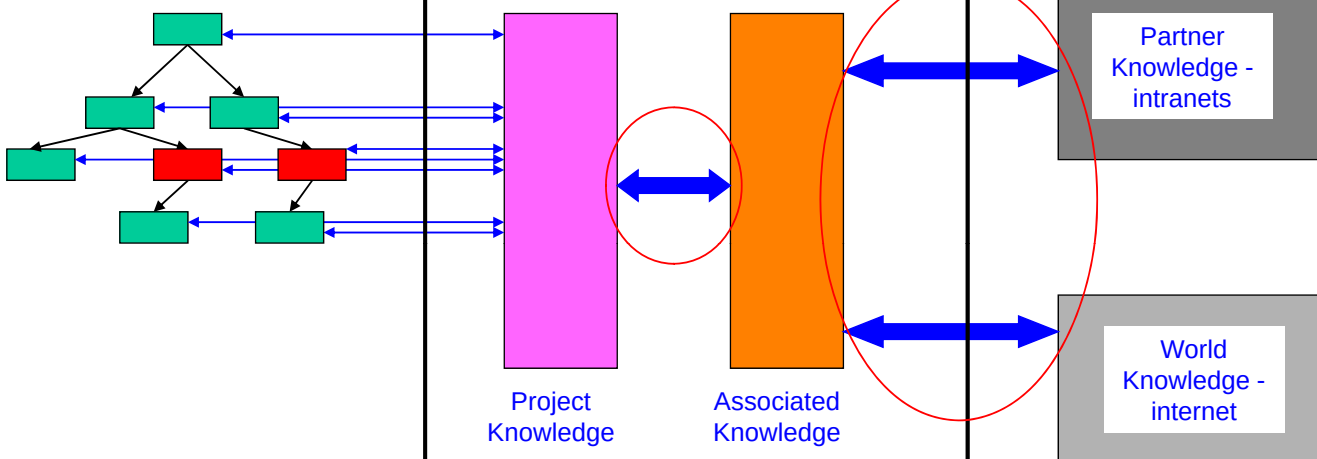


The Knowledge Base (KB) does not need to be rigorously structured;

- Standardised vocabulary (ontology) allows application of smart search engines
- Requires rigorous file management procedures and robust security

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Argumentation model
or RMS

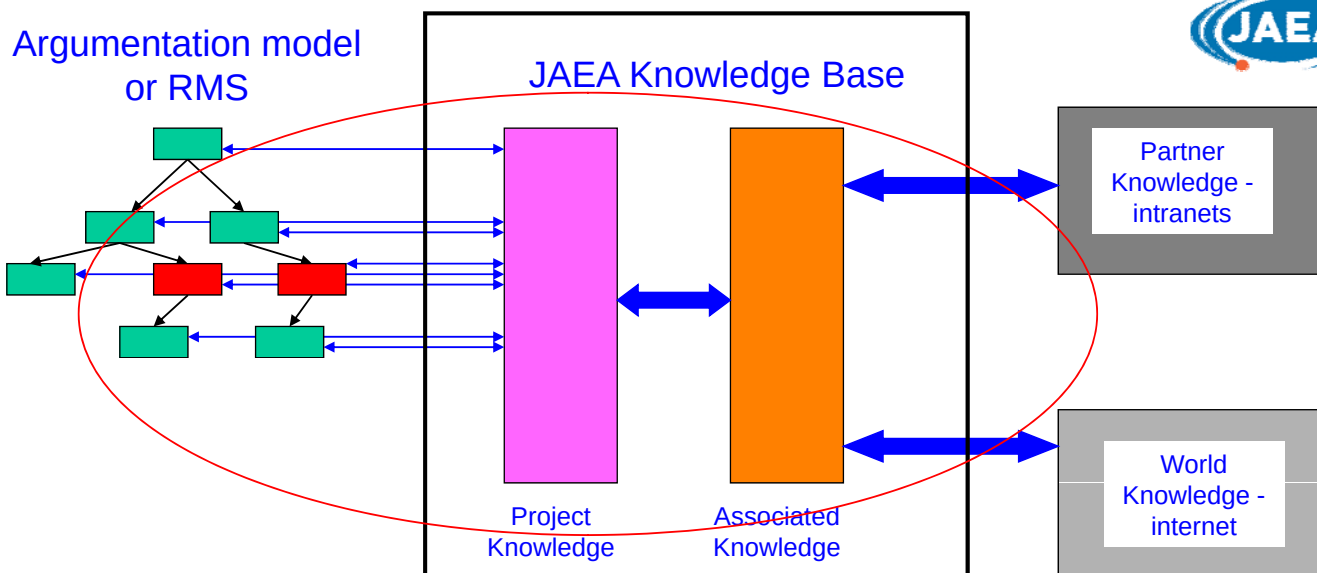


Smart search engines play a key role;

- Allow practical access to huge volumes of data
- Can incorporate functionality, providing autonomous quality checks, synthesis, identification of knowledge gaps, report generation,...

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Argumentation model
or RMS



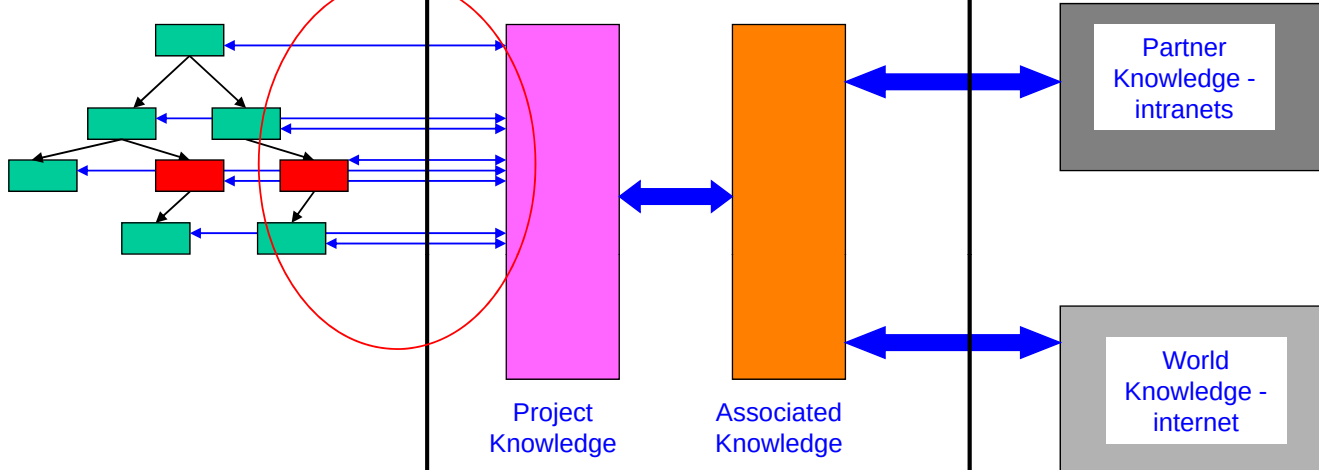
Development with time

The Knowledge Management System (KMS) also serves to

- maintain, update and facilitate access to the KB (automated as far as possible)
- establish effective interfaces to knowledge producers and users (utilising advanced communication tools)
- ensure development of the tacit knowledge required to perform tasks that cannot be automated (e.g. decision-making)

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Argumentation model
or RMS

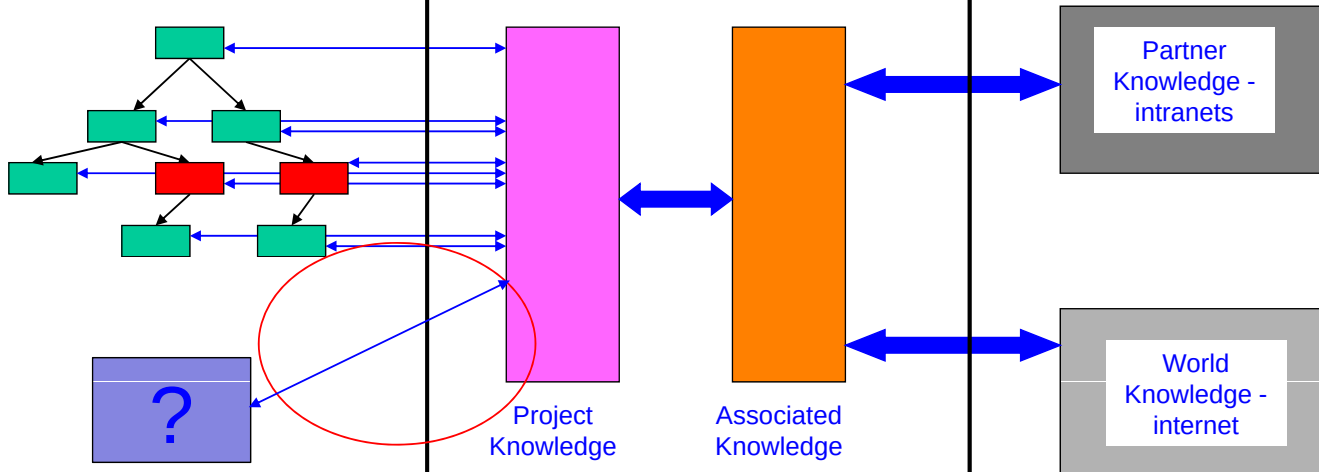


KMS application is driven by the needs of users (including knowledge producers), may be formally defined as:

- An interface to an established Requirements Management System (RMS)
- An argumentation model should have an interface which is flexible enough to fit the needs of all users

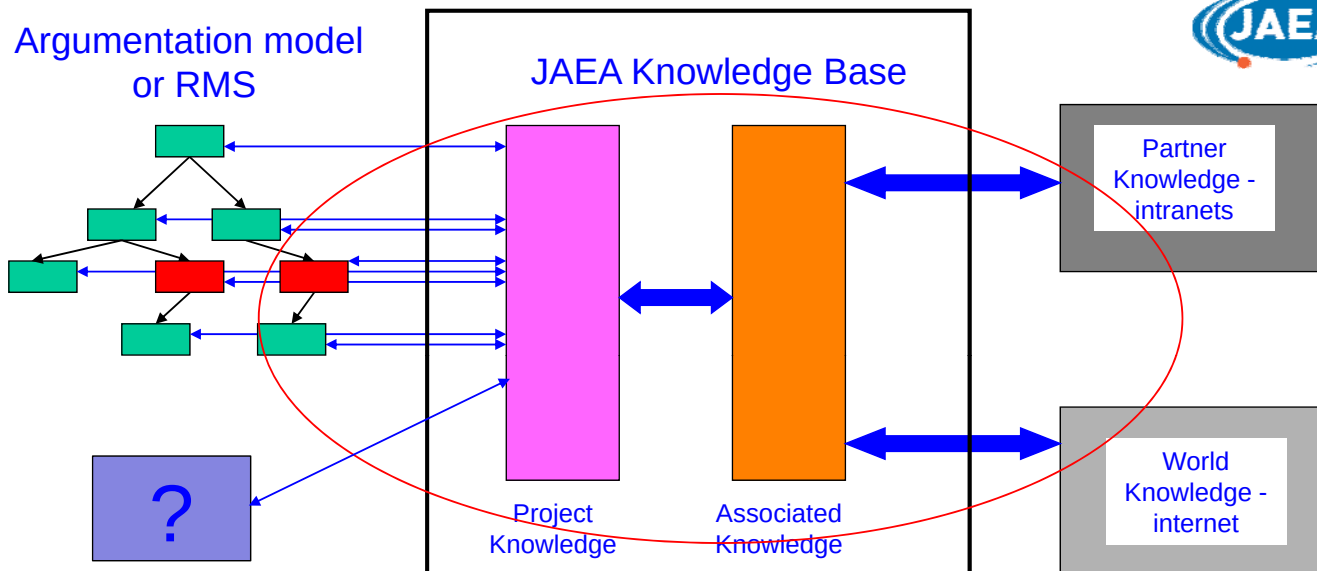
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Argumentation model
or RMS



KMS application must, however, also have the flexibility to rapidly and effectively respond to any questions by establishing dialogue with stakeholders – which provides challenges for both communication interface development and fundamental knowledge management

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- The “Intelligent Assistant” is the integrated toolkit for
 - Compiling explicit knowledge - **knowledge mining tool**
 - Compiling tacit knowledge - **expert system tool**
 - Autonomic knowledge manipulation – **archiving, quality testing, synthesis, integration and documentation tools**
 - Knowledge presentation – **visualisation tool**

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KMS components

- The overall structure is developed in a top-down manner
- More details of the Knowledge Base and the KM toolkit will be provided by Hioki-san in the following presentation

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In which areas have the KMS tools been implemented?

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Main applications

- Focus on major areas where large flows of information must be integrated in a structured manner to provide support to the developing safety case for deep geological disposal
 - Safety case development & review - overviewed in the presentation by Osawa-san
 - Site characterisation & geosynthesis - Semba-san
 - Repository design & PA - Makino-san
- ...although there is clearly significant overlap between these areas

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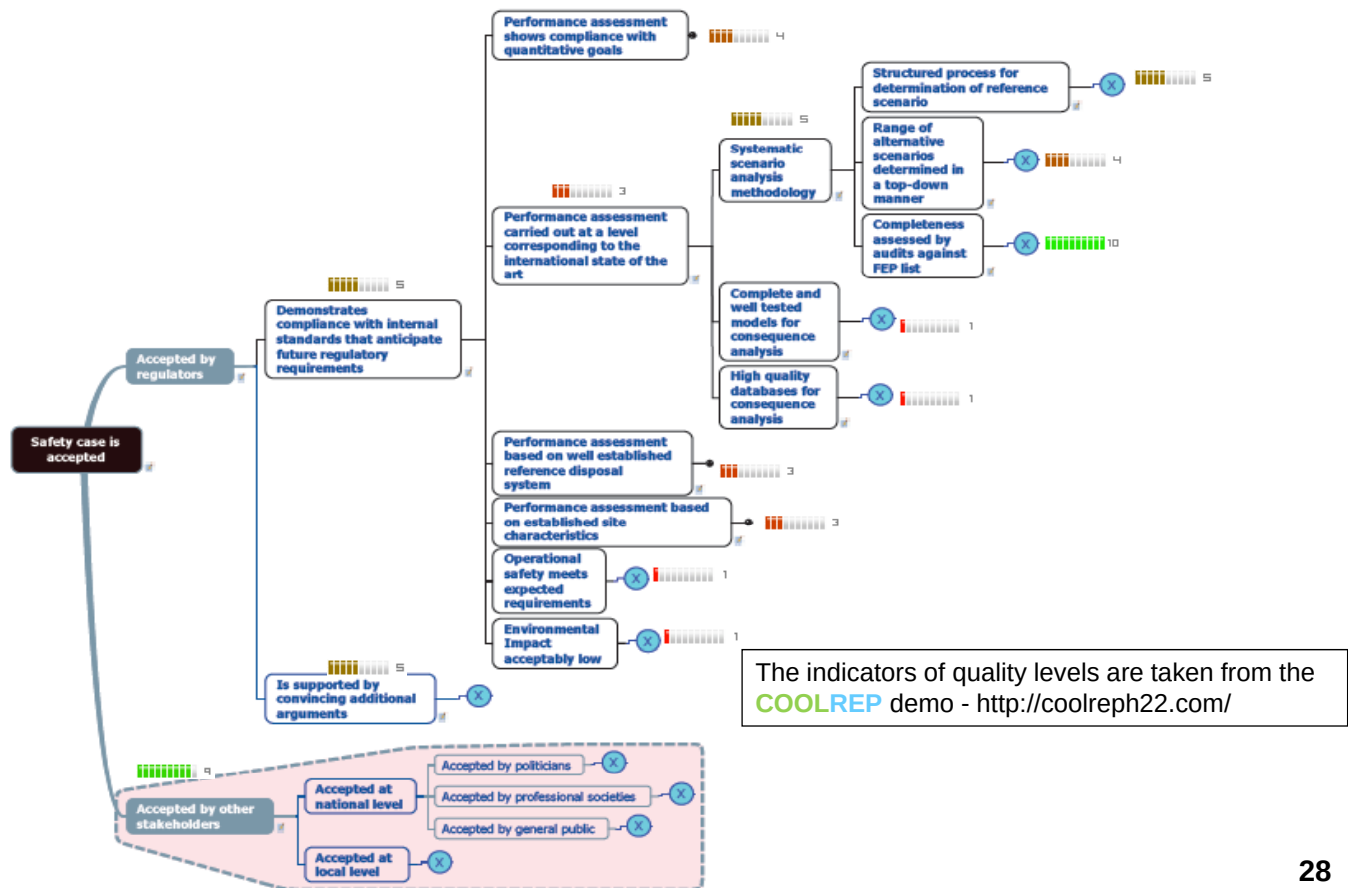
How is it all integrated and quality assured?

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Integration & QA

- These two aspects are closely related as, due to limited resources, QA focuses on topics that are important to the safety case...

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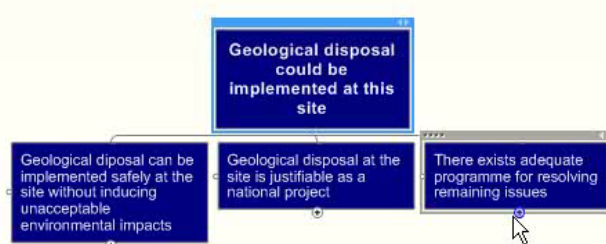
Integration & QA

- These two aspects are closely related as, due to limited resources, QA focuses on topics that are important to the safety case...
...and are described further in the final presentation of this block

...and do these tools really work?

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Evolution of argumentation model



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Argumentation representations will be placed on CoolRep and provide access to supporting references

