Concours externe d'Assistant ingénieur
Ouvert au titre de l'année 2011

Epreuve écrite d'admission

• Question 1 - (4 points)

Vous rencontrez une personne qui ne connaît pas l'INRIA. Expliquez-lui en une quinzaine de lignes ce qu'est cet institut de recherche.
Selon vous quelles sont les principales audiences auxquelles s'adresse un Centre de recherche tel que celui de Bordeaux - Sud-ouest ? Pourquoi celles-ci ?

• Question 2 - (6 points)

Le Centre de recherche INRIA Bordeaux - Sud-ouest a engagé la construction d'un bâtiment qui sera livré en février 2012. L'emménagement est prévu le lundi 20 février. Ce nouveau bâtiment accueillera seulement 250 des 350 personnes que compte le Centre (75% de chercheurs).
L'entreprise de déménagement récupérera les éléments mis en cartons le vendredi 17 février à partir de 16h, il a donc été demandé aux collaborateurs de quitter les lieux au plus tard à 15h ce jour là.
L'objectif pour le service communication est d'accompagner au mieux ce changement important dans la vie de ses collaborateurs et d'en faire une occasion de cohésion (ou un moment de partage / un temps fort du développement du jeune centre de recherche). A minima, il s'agit d'accueillir au mieux l'ensemble des personnels le jour J en présentant le tout nouvel environnement de travail aux collaborateurs de toutes nationalités.
Vous êtes chargé(e) d'orchestrer la journée d'emménagement. Vous devez fournir à la responsable du service de communication et au directeur administratif du centre une recommandation comprenant :
- un concept global pour l'opération (naming + identité visuelle),
- un plan d'actions calibré
- un rétro-planning de travail
- une liste d'outils et supports de communication vous apparaissant comme indispensables - une première approche budgétaire.

Partagez vos convictions et expliquez les raisons de vos choix. Vous n'avez pas de contrainte de budget et les plans d'installation dans les nouveaux locaux vous sont communiqués (cf. document en annexe 1).

• Question 3 - (5 points)

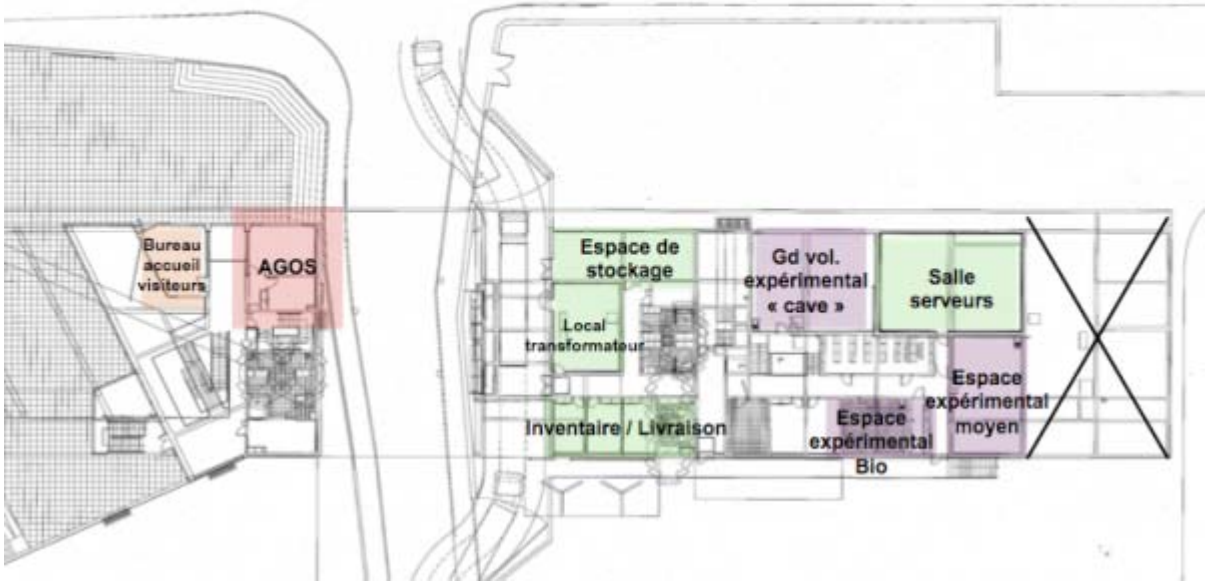
L'équipe de recherche IPARLA doit présenter aux élèves des classes de 3ème d'un collège à Talence l'objet de son projet ANR nommé SeARCH. Elle doit en amont en faire la promotion afin qu'un maximum de jeunes ait envie d'assister à la présentation, mais elle ne sait comment procéder. Aidez-les chercheurs à rédiger un petit texte présentant le projet, ainsi qu'un titre accrocheur donnant envie aux jeunes de s'inscrire à la conférence débat en vous appuyant sur le texte en anglais qu'ils vous remettent (cf. document en annexe 2).

• Question 4 - (5 points)

Selon vous, quels sont les principaux moyens (outils/relais) de communication sur lesquels un Centre de Recherche, tel que celui de l'INRIA Bordeaux - Sud-ouest doit s'appuyer pour communiquer à l'interne ? À l'externe ? Structurez, hiérarchisez et justifiez vos préconisations.

ANNEXE 1

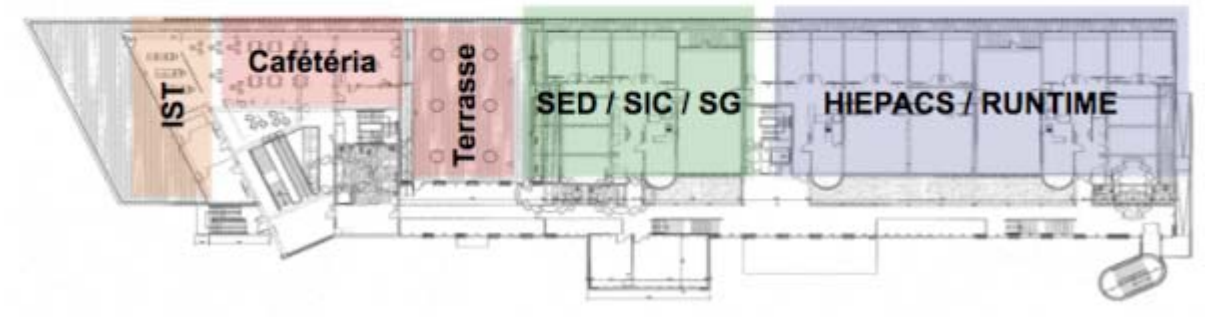
R+1



R+2

Scénarii occupation des surfaces par cluster

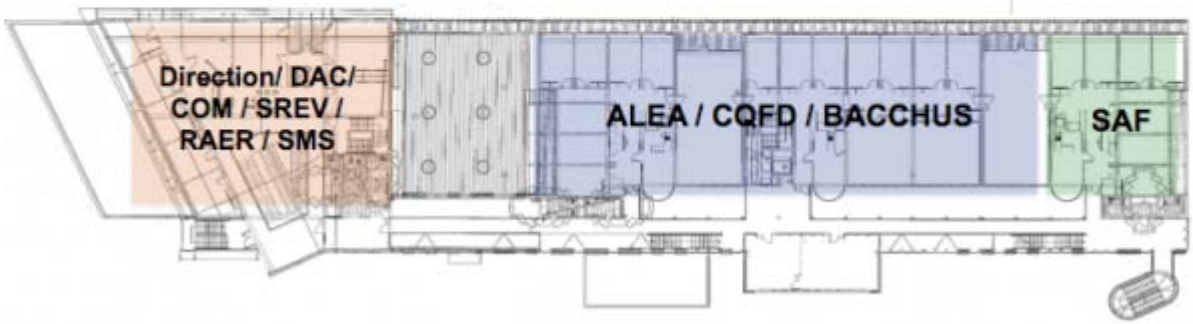
20	23	26
op=8 ; b= 7=12p	op=10 ; b= 7=13p	op=11 ; b= 7=15p
(2*1,5*2)	(2*1,4*2,1*3)	(1*1,4*2,2*3)



R+4

Scénarii occupation des surfaces par cluster

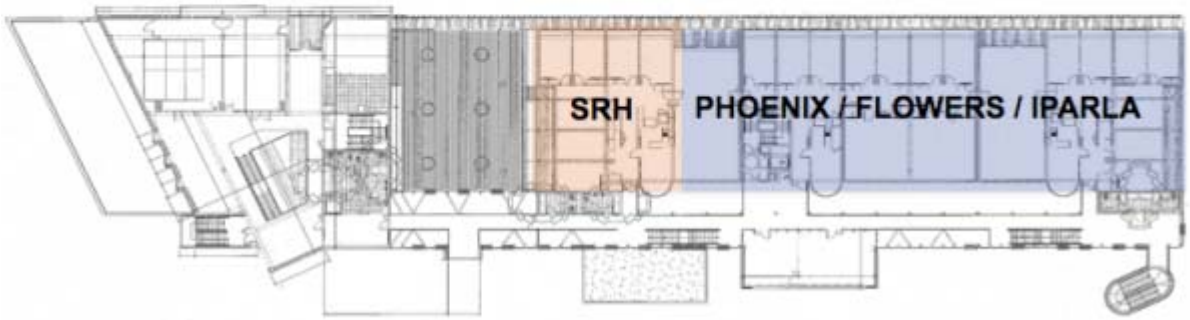
20	23	26
op=8 ; b= 7=12p	op=10 ; b= 7=13p	op=11 ; b= 7=15p
(2*1,5*2)	(2*1,4*2,1*3)	(1*1,4*2,2*3)



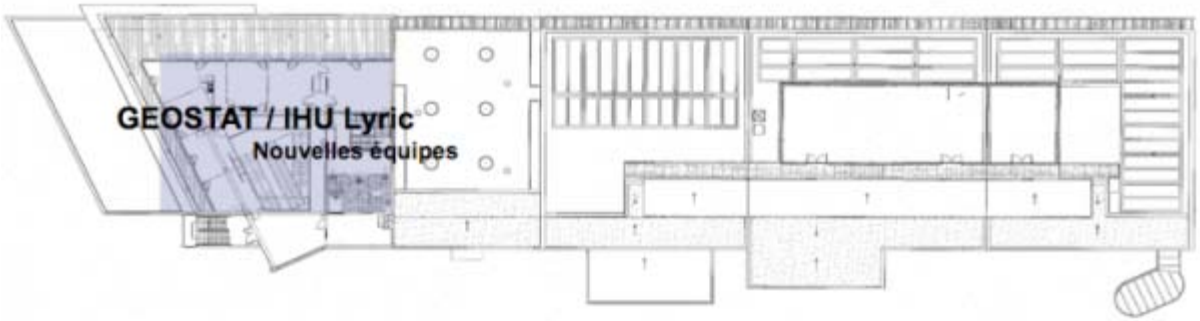
R+3

Scénarii occupation des surfaces par cluster

20	23	26
op=8 ; b= 7=12p	op=10 ; b= 7=13p	op=11 ; b= 7=15p
(2*1,5*2)	(2*1,4*2,1*3)	(1*1,4*2,2*3)



R+5



Lexique :

R : *Cette lettre désigne le niveau où l'on se trouve, ainsi R+1 désigne le 1er étage, R+2 le 2ème, etc.*
Cluster *: espace de travail composé de bureaux, d'open-space et d'un espace café*
AGOS : *Association de Gestion des Œuvres Sociales de l'INRIA, équivaut à un Comité d'Entreprise.*
SED *: Service d'expérimentation et de développement*
SIC *: Service Informatique de Centre*
SG *: Service Généraux*
IST *: Service de l'Information scientifique et Technique (+ espace documentation)*
HIEPACS / RUNTIME / ALEA / CQFD / BACCHUS / PHOENIX / FLOWERS / IPARL / GEOSTAT/ IHU Lyric : *équipes de recherche*
SRH *: Service des Ressources Humaines*
SAF *: Service Administratif et Financier*
COM *: Service Communication*
SREV *: Service des Relations Extérieures et de la Valorisation*
SMS *: Service des Manifestations scientifiques*
RAER *: Responsable des Assistantes d'Equipes de Recherche*
DAC *: Délégué à l'Administration du Centre*

ANNEXE 2

Virtual Reassembly of the Statues surrounding the Lighthouse of Alexandria - The SeARCH project

*The SeARCH research project (**Se**mi-automatic 3D **A**cquisition and **R**eassembly of **C**ultural **H**eritage) brings together archeologists and computer scientists with one unique objective: the virtual reassembly of the broken statues that were surrounding the lighthouse of Alexandria. The gathering of researchers of these two fundamentally different scientific origins makes it possible to combine expert archeological high-level knowledge with the power of computer graphics visualization techniques and geometry processing algorithms. The integration of both competences is done by designing efficient human-computer interaction techniques that use semi-automatic geometry-driven acquisition, visualization, and reassembly techniques.*

Archeological artifacts are often broken and fractured into a large amount of fragments, and the cultural heritage professionals are confronted by huge puzzles when reassembling the fractured objects. The reassembly of the fragments is generally done manually, but this task can be very tedious, and in some cases even impossible.

This is particularly true for the broken colossal statues that were surrounding the Lighthouse in Alexandria built in the 3rd century BC. The fragments were deteriorated by erosion, weathering, and the earthquakes in the 10th and 14th century AC. Most of the fragments are still underwater in the Mediterranean Sea, in a spectacular submarine archeological site of about 1 hectare surface next to Alexandria's Eastern Harbor, and only a few fragments have been lifted up to the surface. Due to the availability of the fragments at different locations with varying access policies, digitally acquiring the fragments and reassembling the corresponding 3D models virtually is probably the only feasible solution to reason about the past.

With this common objective in mind, in 2009, the SeARCH project was born, a 3 year lasting project funded by the French Agence Nationale de la Recherche (ANR). The SeARCH project strives to develop semi-automatic techniques for the acquisition, visualization, and reassembly of the 3D models. This project gathers the experience of four research partners, specialized in Archeology (*Centre d'Études Alexandrines* in Alexandria), in operational 3D scanning for Archaeology (*Ausonius Archéovision* at Bordeaux University), in data processing for Computer Graphics (*INRIA Bordeaux Sud-Ouest*), and in Human Computer Interaction as well as simulation of physical phenomena (*ESTIA Research*).

In this first half of the project, we identified three major achievements: first, the digital acquisition of the fragments of the surrounding statues, even those that are still underwater. Second, the expressive visualization that highlights details of the acquired fragments that are sometimes invisible to the human eye when inspecting the real fragments. Third, a semi-automatic reassembly technique that allows an archeologist to drive sophisticated geometry processing algorithms in order to find the most probable reassemblies.

Fragment acquisition

The first involved step in the virtual reassembly is the on-site digital acquisition of the fragments in order to obtain 3D models. From the over 3000 available fragments on the archeological sites, the cultural heritage professionals identify the fragments with the highest reassembly potential. Instead of using traditional 3D laser range scanning that cannot be used underwater, our acquisition process is based on photogrammetry and quite simple: we take about a hundred photographs per fragment covering the entire surface, with much less infrastructural effort. Then, salient feature points are identified automatically in every photograph, and the correspondences of the same feature in different photographs are detected. This makes it possible to infer the 3D positions of the features, and hence to reconstruct the entire 3D model with submillimeter accuracy. With this acquisition protocol, we were even able to precisely reconstruct the immerged fragments during an underwater acquisition campaign. So far, we reconstructed 15 fragments from the submarine site, and 34 fragments from three different museums.

Expressive visualization

Exploring the physical fragments on-site is sometimes difficult due to their size and the lighting conditions, especially for the fragments that are underwater. Conversely, the 3D models can be inspected virtually in laboratory conditions. We developed novel expressive visualization techniques that use differential geometry to find the best lighting conditions to highlight all the features from the fragments. In our context, this is particularly important since we have to distinguish between the features of the fragment and the undesired effects from the

century long suffered erosions. Our visual enhancement techniques stress features at different scales, ranging from thorough ridge and valley lines to precise hand-made stone engravements. Since all our techniques operate in real-time on the graphical processing unit after a short preprocessing step, the 3D fragments can be comfortably explored by cultural heritage experts, sometimes revealing more detail than inspecting the physical fragments on-site.

Semi-automatic reassembly

The availability of accurate 3D models allows the archeologists for the first time to study the fragments coming from different locations in one coordinate frame. After the visual exploration of the fragments, potential reassembly candidates are identified. For the pairwise virtual reassembly, we designed ArcheoTUI, an easy-to-use tangible user interface that makes it possible to relatively position the two fragments as if they were in the user's hands: in each hand, the user manipulates an electromagnetically tracked prop, and the translations and rotations are directly mapped to the corresponding virtual fragments on the computer screen when a corresponding foot pedal is pressed down. During the manipulation of the fragments, we provide feedback to the user in real-time by showing the geometric error of the reassembly. Furthermore, we provide a visual representation of the locally best match that is computed by optimizing the geometric compatibility of the two fragments with respect to the fragments' positions and orientations. Hence, the virtual fragments virtually "snap" to the locally optimal best match.

Future Work

In the remaining time of the project, we continue to study the fragments with the challenging goal to find new archeologically plausible reassemblies. We are also trying to mechanically model the physical phenomena that happened to the fragments during the deterioration. Most of the members of the SeARCH project helped to establish V-MusT.net, a European Network of Excellence dedicated to Virtual Museums (2009-2013). Motivated by our attractive application case, we are currently planning an exhibition at a museum to show the results of the SeARCH project.

Links:
http://anr-search.labri.fr/
http://v-must.net

Please contact:

Patrick Reuter
Bordeaux University, INRIA Bordeaux Sud-Ouest,
LaBRI Bordeaux
France
E-mail: preuter@labri.fr

Acknowledgement:
This work was supported by the ANR SeARCH project, grant ANR-09-CORD-019 of the French Agence Nationale de la Recher