




MSC IN INFORMATION TECHNOLOGY "ICONE" PROGRAMME SOFTWARE ARCHITECT

IDENTITY CARD

- > Domain : Sciences, Technologies and Health
- > Full time course
- > [Continuing Education](#)
- > Degree apprenticeships
- > [Master of Engineering](#)
- > [120 ECTS credits](#)
- > 4 semesters
- >  La Rochelle

REGISTRATION

<https://www.univ-larochelle.fr/formation/admission-inscription-et-scolarité/candidatures-et-inscriptions/candidater-universite-la-rochelle/>

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OBJECTIVES

> Presentation

“ Do you wish to acquire general computer skills while specializing in one of the fields offered by the Software or Data Architect course ?

At the end of these two courses of the IT MSc, you will be able to perfectly understand the organization of digital flows as well as the implementation of tools for exploiting the intangible heritage of a company or a community. In fact, you will be able to deal with data management and analysis issues, design information systems and also exploit and enhance digital content. As a future IT executive, you will also learn about the different support methodologies that can improve the functioning of an organization.



Jean Loup Guillaume

> At the end of this course, you will know

> Design a system by implementing advanced modelling, specification and verification tools

- Understand the problems related to software development, software engineering principle
- Know the main models of software life cycle
- Analyze and model for the different design phases
- Understand software quality standards
- Implement tests at different levels of the software lifecycle (components, integration, system) and in different ways (functional / non-functional : static techniques and code reviews, "black box" techniques, "white box" techniques) "
- Know the main software metrics and use them to improve quality
- Design architectures using software component assembly techniques
- Semi-formal modeling of component-based systems
- Have knowledge of the formal methods, models and associated logic to guarantee the quality of a system.
- Understand the algorithmic techniques of analysis and verification and proof (model-checking)
- Transform system requirements into properties and apply associated verifications

> Understand the different aspects related to the distribution of data and calculations

- Understand the structuring of an n-tier architecture and identify its different components
- Describe the main issues related to multi-tasking software
- Know the fundamental principles of distributed programming (RMI)
- Design and develop multi-agent systems
- Know the main principles of competition and the tools to manage it (competing processes, mutual exclusion, semaphores, etc.)
- Use several concurrent programming mechanisms (semaphore type via a C library, Java thread synchronization, etc.)
- Be able to develop highly distributed and scalable applications
- Know several application development frameworks
- Understand the different virtualization solutions - hypervisors / containers
- Be able to implement a virtualized architecture
- Virtualized SANs
- Be able to configure and manage virtual machines
- Know the categories of cloud computing services (IaaS, PaaS, SaaS)
- Understand the general concepts and architectures of cloud computing
- Understand the principles of application deployment
- Be able to deploy an application on an online platform
- Know the different hardware supports and data organization (partitions/FS)
- Understand the different mechanisms for implementing redundancy (RAID/Security/FS distributed)
- Master the different network storage solutions (storage networks, network storage server)
- Know data encryption solutions
- Know the main encryption methods used in data transfer
- Know the different flow filtering solutions
- Know how to implement network tunnels and in particular encrypted tunnels
- Be familiar with the general principles of intrusion detection systems (IDS)

> Understand the specific issues related to massive data

- Be able to implement graph processing tools in a massive data context
- Know the different hardware and software components of a Big Data system
- Know how to use different software tools (including open source) for data collection
- Know how to choose the right solution for massive data storage
- Know how to use one or more massive data processing frameworks (hadoop type and its ecosystem)
- Analyze the results

➤ **Master the various aspects related to information systems, whether in terms of their architecture, development (web services and other services), including the specific case of business intelligence information systems**

- To know the main principles of IS, their architecture, their urbanization
- Monitor the evolution of IS : Cloud, service-oriented architecture (SOA),...
- Understand the aspects related to IS security
- Model the company's organization and business processes
- Propose relevant ERP choices for an organization
- Understand the different phases of ERP implementation and operation
- Install, administer and use a CMS
- Manage CMS extensions
- Implement external authentications and bridges to other CMS
- Develop client applications that use an existing web service
- Develop server-side web services
- Understand the principles of service integration and composition
- Know the main principles of CIS : objectives, structures and architectures
- Understand the interests and application of dimensional modeling
- Design and operate a data warehouse
- Know the main methods of ETL procedures (import/export, processing, mapping)
- Develop ETL connectors
- Know service-oriented architectures and their uses
- Implement web services using technologies developed by the W3 consortium (SOAP/WSDL)
- Implement web services that respect the REST architecture
- Implement web services using an architecture based on the principle of micro-services (vs. services based on monolithic architectures)
- Produce digital documents using XSL and FOP technologies

➤ **Master the different principles of data coding, structuring and modeling**

- Master the syntax rules of XML language, single and multiple namespaces
- Design a DTD with integrity constraints
- Implement an XML file analyzer
- Master the methods of navigating an XML document using XPath
- Apply transformations of XML files to other formats with XSL(T)
- Know the main families of NoSQL database management systems
- Design a NoSQL database schema
- Know how to implement several NoSQL database management systems (IndexedDB, MongoDB, etc.)
- Understand the notion of object correspondence - relational algebra (ORM)
- Implement at least one MNO (doctrine, hibernate, etc.)
- Assimilate the notions of information theory
- Know the different types of data compression (with and without losses)
- Know the main compression techniques with and without loss (statistics, dictionary, transform, prediction)
- Know how to implement a correction code for broadcasting on a potentially noisy communication channel
- Know the compression mechanisms for different types and formats of data (image, video, sound, text), and know how to evaluate its performance.
- Know the principles of the main information encodings in sound and in images and image sequences : (Images : JPEG, JPEG2000 - Video sequences : MJPEG, MPEG 2, H263, MPEG 4 visual, H.264 - multimedia : MPEG-7 objectives, applications, MPEG-7 me-tadata, MPEG-7 description, MPEG-7 based search)
- Know the RDF data model, the use of RDFS ontologies and schemas and the formalization in OWL
- Implement queries on RDF/RDFS data using the SPARQL query language
- Know the use of RDF/RDFS formats in the context of linked data
- Know some particular schemes (e. g. Schema.org)
- Integrate data using semantic web technologies
- Set up a dematerialization project management in an organization (flow audit, survey, steering committee)
- Know the normative processes related to dematerialization
- Present various dematerialization scenarios depending on the input document (paper, equipment, digital information, etc.) and the type of organization
- Characterize Automatic, Semi-Automatic, Supervised Dematerialization Processes
- Master and propose information extraction algorithms to determine the nature of the document (categorization) as well as the content elements (Text, Graphic etc.)
- Integrate content recognition algorithms (OCR, ICR, etc.) into a document analysis or indexing system, and identify their limitations in the context of complex documents : manuscripts, dense letters, etc.
- Propose performance measurements of the proposed algorithms
- Identify the main principles of indexing (automatic, collaborative.), semantics (websemantics), and social indexing
- To know the normative aspects related to indexation, certification, legal archiving : W3c - DC, EAD, RDF
- Know the basic and advanced techniques in terms of search engine, text search tools, automatic language processing
- Know the techniques and limits of analysis of weakly structured documents (text, sound, video, etc.)
- Know the principles of digital information archiving : RM, SAE, digital safe, secure hosting, cloud...

> Master the different methods used for data analysis and mining

- Master the aspects of data mining related to CIS
- Master the mathematical tools necessary for data mining (notions of linear algebra, probabilities, gradient descent, lagrangian)
- Perform dimensional reductions (analysis in main components, discriminating components)
- Know the supervised classification methods (classification annotation and quality measurement, Bayesian approaches, Markov fields, training and testing principle, discriminating linear approach, K nearest neighbours, multi-class classification)
- Know the methods of unsupervised classification (quality measurement of a clustering, clustering algorithms)
- Be familiar with interactive classification methods (information visualization, interactive data mining, interactive selection and adaptation of similarity measures)
- Set up a complete chain dedicated to supervised or unsupervised classification
- Implement the usual methods of supervised or unsupervised classification and know their complexity and cases of convergence
- Implement these techniques via software
- Use one or more software to implement simple data analysis techniques

> Implement procedures for data recovery, analysis and visualization through one or more software programs

- Understand the different methods of data recovery
- Retrieve data in different formats via an API or directly via software
- Designing a web crawler
- Understand data preparation methods : automatic schema construction, data type detection, missing or duplicate values, etc. Implement these techniques via software
- Use one or more software to implement simple data analysis techniques
- Use one or more software to implement advanced data analysis techniques
- Know some solutions for massive data analysis
- Know the classical methods of data visualization : curves, dials, geographical maps, thermal maps, etc.
- Know how to use interactive capabilities to explore data
- Know how to use network data visualization software
- Understand how sensor or IoT data analysis influences data capture, preparation and analysis operations
- Integrate the geographical aspects of data into data analysis

> Cross-curricular skills

- Communicate effectively in French and at least one foreign language (preferably English) on issues related to your field of expertise
- Implement a technological watch
- Develop an argumentation with a critical mind

> Pre-professional skills

- Locate your role and mission within an organization to adapt and take initiatives
- Identify the process of production, dissemination and valorisation of knowledge
- Respect the principles of ethics, deontology and environmental responsibility
- Work in a team as well as independently and responsibly for a project
- Identify and locate the professional fields potentially related to the achievements of the mention as well as the possible paths to access them
- Characterize and enhance one's identity, skills and professional project according to a context
- Step back from a situation, assess yourself and question yourself to learn

✓ ADMISSION

> Your profile

You have a bac+3, Bac+4 or equivalent (Bachelor's degree) : Bachelor's level knowledge in declarative and object programming, data structures, web languages, networks and protocols, client-server architecture and databases.

> How to apply ?

In the 1st year of the Master's degree, the selection of candidates is made on the basis of their application documents.

You wish to apply for a 1st year Master's degree [1st year of Master](#)

You wish to apply for a 2nd year Master's degree [2nd year of Master](#)

📄 PROGRAMME

● Mandatory ■ Course option

> Semester 1

> Advanced databases ●

- Advanced databases

- > **Information systems** ●
 - Information systems
- > **Project work** ●
 - Projet
- > **Software Engineering** ●
 - Software Engineering
- > **Big data and infrastructures** ■
 - Storage and distributed calculations
- > **Data analysis softwares** ■
 - Data Recovery, Preparation and Analysis / Secure Networks and Storage
- > **Marketing (ouverte au Master ICONE)** ■
 - Marketing
 - Purchase and negotiation
- > **Cross-curricular courses** ●
 - Communication
 - English
 - Quality and sustainable development
- > **Semester 2**
 - > **Distributed computing** ●
 - Distributed computing
 - > **Oriented architectures and services** ●
 - Service-oriented architectures
 - > **Secure networks and storage** ●
 - Secure Networks and storage
 - > **Big data and infrastructures** ■
 - Virtualization, cloud and application deployment
 - > **Data analysis softwares** ■
 - Analysis and data visualization
 - > **Marketing** ■
 - Consumer behavior
 - International marketing
 - > **Professionalization** ●
 - Internship (10 weeks)
 - Missions en entreprise (APPRENTISSAGE)
 - > **Cross-curricular courses** ●
 - English
 - Industrial property and digital rights
- > **Semester 3**

> **Implementation of big data systems** ●

- Implementation of big data systems

> **Web 3.0** ●

- Web 3.0

> **Web services and mobility** ●

- Web services and mobility

> **Big data and infrastructures** ■

- Information architecture

> **Data analysis softwares** ■

- Mobile data analysis

> **Marketing** ■

- Brand gestion
- Pricing policies

> **Cross-curricular courses** ●

- Initiation to research

> **Foreign language** ●

- English

> **Semester 4**

> **Minors** ●

- Project work

> **Professionalization** ●

- Apprenticeship mission
- Internship (20 weeks)

> **Interaction with professionals**

Many professionals are involved in the MSc (about 15%) either directly in the courses or through seminars integrated into the courses.

> **International**

The ICONE IT MSc has multiple links with Vietnam. In particular, the second year can be done entirely in Hanoi, either in a francophone training (IFI) or an anglophone training (USTH).

AFTERWARDS

> **Further Education**

[PhD](#)

> **Professions**

- Information systems architect
- Information system application manager
- Software development engineer
- Business intelligence engineer
- IT system engineer

Information subject to change

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