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The Embedded and Mobile Systems Master's degree at the CNAM of Paris

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Outline

- Introduction
- Motivation
- Overview
- Curriculum
- Outcome
- Conclusion: perspective

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CNAM

- **Founded by the abbey Henri Grégoire in 1794**
- **Dedicated for the training of adults along their life**
- **Courses in the evening except for the Master's degrees**

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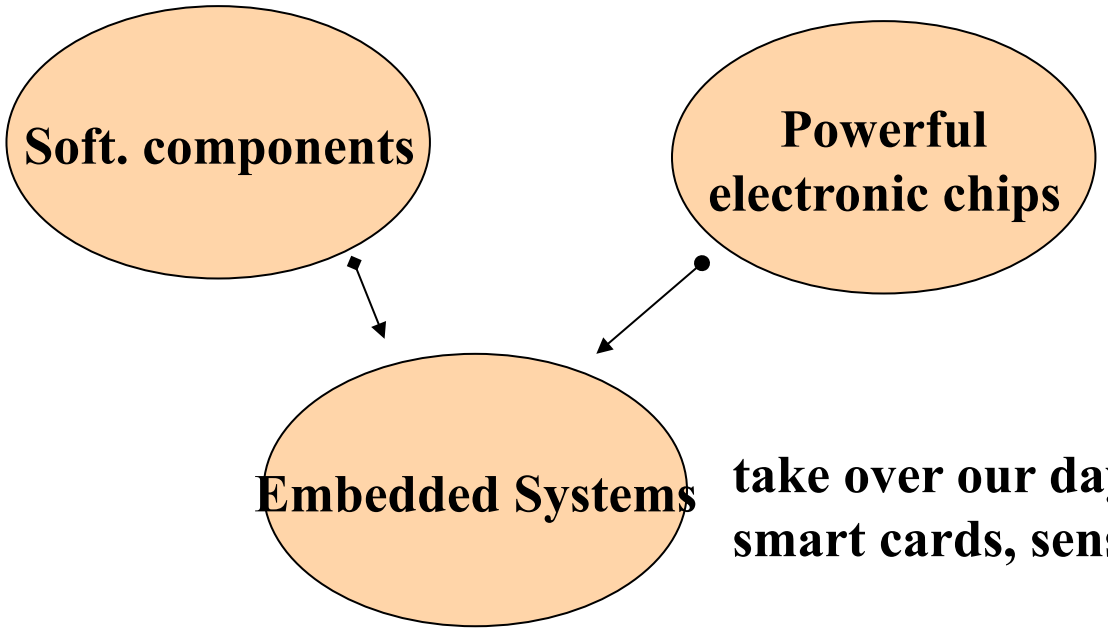
Embedded Systems



take over our day-life (cell phones, smart cards, sensors)

-Intelligence
-Dependability
-Communication

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New chalenges

- No frontier between :
  - hard systems (avionics)/ non hard systems (domotics)
- New technological & industrial challenges
  - dependability for both hard/non hard systems
  - security requirements because of the systems connectivity
  - deployment requirements constrained by time-to maket cost

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Background & Motivation

Some important dates

- 2003 :Creation of the chair *Embedded Systems* at CNAM
- Head of the chair is Pierre Paradinas (ex- director of the research Lab of Gemplus)
- 2005 : Creation of the Master'degree of Embedded and Mobile Systems (EMS)
- 2007 : Creation of SEMpIA (*Embedded and Mobile Systems for Ambient Intelligence*) research team supervised by Eric Gressier

In charge

- **Sept. 2005 – Dec. 2007** : *Pierre Paradinas (Prof)*
- **Jan. 2008 – Sept. 2008** : *Eric Gressier-Soudan (Prof)*
- **Sept. 2008 – Aug. 2010** : *Samia Bouzefrane (Associate-Prof)*
- **Since Sept. 2010**: *Selma Boumerdassi (Associate-Prof)*

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Objective of EMS Master's degree

- Train students to the design, development and deployment of Embedded and Mobile Systems.

- Key words: mobile telephony 3G+, smart cards, RFID tags, contactless communication, sensor networks, geo-localization, video games, etc.

- See the description of the Master :
http://deptinfo.cnam.fr/master/spip.php?rubrique16

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Systems Addressed

- **Embedded and mobile systems in :**
  - Sensor networks,
  - Smart cards,
  - mobile devices (cell phones, PDA)
  - Video-game platforms

  etc.

- **The design of these systems may consider their constraints :**
  - Low footprint,
  - energy,
  - security,
  - geo-localisation,
  - etc.

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Academic lecturers

From the CNAM:

- Ivan Boule Prof
- Selma Boumerdassi Ass. Prof
- Samia Bouzefrane Ass. Prof
- Pierre Courtieu Ass. Prof
- David Delahaye Ass. Prof
- Eric Gressier-Soudan Prof
- Michel Jenger Ass. Prof
- Françoise Sailhan Ass. Prof
- Jean-Ferdinand Susini Ass. Prof

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Contributors from industry

- Aérodrone, Aonix, Trusted Logics, Esterel Technologie, Gemalto, INRIA, Valeo, Wave Com, CyberFab, Hippocad, Trialog, EDF R&D, ACAL, NetInnovations, Oberthur Technologies, etc.

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Students admitted to EMS

- CNAM
- Institutes of engineering (Europe, China, South America, Africa)

- Studies in France are very attractive (low scholarship fees)
- Students profile (Electronic, Computer Science)

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EMS Master's degree

- Training of one year
  - A set of courses (total : 42 ECTS credits)
    - From October to March
  - A Master thesis of 6 months (18 ECTS credits)
    - From the 1st April to 30 Sept.

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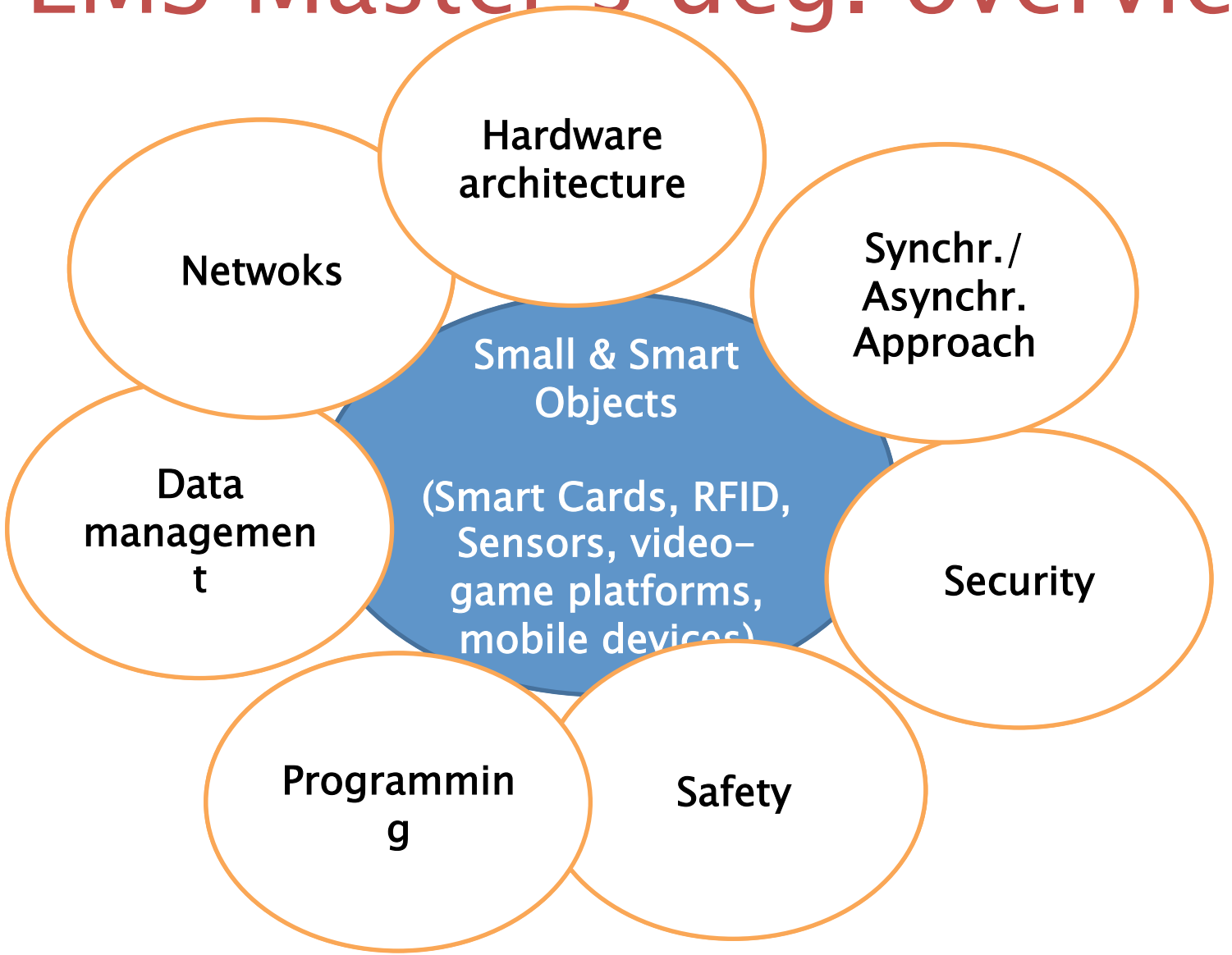
EMS Master's deg. overview



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Curriculum/1

Course Title	Code	ECTS Credits
Networks for embedded and mobile systems	**RSEM**	**6**
Platforms for embedded and mobile systems	**PFSEM**	**6**
Programming embedded and mobile systems	**PSEM**	**6**
Advanced Architecture	**AA**	**3**
Data management for embedded and mobile systems	**GDEM**	**3**

24 ECTS credits

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Curriculum/2

Course Title	Code	ECTS Credits
Programming real-time systems	TRA	3
Security	SEC	6
Synchronous Languages	LS	3
Program verification	VERI	3
Safe functioning	SdF	6
Architecture of on-line games	AJL	3
Networks and Quality of Service	RQoS	3
Master thesis		18

18 ECTS

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Platforms for EMS (6 ECTS)

Faculty member in charge : Samia Bouzefrane

- Academic lecturers :
  - Embedded OS concepts & virtualization
  - Smart Cards and their programming (Java Card, JCRMI, .NET for smart cards, etc.)
  - RFID technology and NFC

- Industrial contributors:
  - Certification
  - Formal methods for smart cards
  - Operating system used in automotive domain

- Examination
  - Project + report (RFID, Java Card)
  - Exam

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Programming EMS (6 ECTS)

Faculty member in charge : Eric Gressier

- Academic lecturers :
  - OS for mobile devices (Symbian, Windows CE, Android, iPhone)
  - Programming mobile devices (JavaME, Android)
  - Sensors (ZigBee, RFID)

- Industrial contributors:
  - Economic intelligence
  - Domotics

- Examination
  - Project + report (Android)
  - Exam

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Networks for EMS (6 ECTS)

Faculty member in charge : Selma Boumerdassi

- Academic lecturers :
  - Wireless networks (WIFI, Bluetouth, etc.)
  - Networks for mobile devices (GPRS, UMTS, etc.)
  - Sensor networks, etc.

- Industrial contributors:
  - Networks for automotive, avionics, etc.

- Examination
  - Project + report (OPNet)
  - Exam

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Data Management for EMS (3 ECTS)

Faculty member in charge : Samia Bouzefrane

- Academic lecturers :
  - Transactions management protocols
  - Data management in Java ME
  - Data management in sensors (TinyDB)
  - Data management in smart cards (PicoDB)

- Examination
  - Project + report
  - Exam

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Advanced Architecture (3 ECTS)

Faculty member in charge : Michel Jenger

- Micro-electronics
- Elements of VHDL
- Systems On Chip

-

-Examination

- Project + report
- Exam

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Asynchronous Languages (3 ECTS)

Faculty member in charge : Jean-Ferdinand Susini

- Reactive Systems
- Synchronous languages (Esterel, Lustre)
- Synchronous formalisms & observers

-Examination

- Project + report
- Exam

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Verification of programs (3 ECTS)

Faculty member in charge : Jean-Ferdinand Susini

- **Analysis & Verification of concurrent programs**
- **Model checking**
- **Petri nets**

-Examination

- **Project + report**
- **Exam**

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Security in EMS (3 ECTS)

Faculty member in charge : Nicolas Pioch

- Security protocols
- Hidden channels (smart cards)
- Security in RFID
- Security in sensor networks (intrusion detection)
- etc.

-Examination

- Exam

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On-Line Game Architecture (3 ECTS)

Faculty member in charge : Eric Gressier

- Academic lecturers :
  - Architecture of multi-player video game
  - Design of ubiquitous games
  - Video game on mobile devices
  - Video game platforms (Game Maker, GASP)

- Examination
  - Project + report
  - Exam

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QoS of Networks (3 ECTS)

Faculty member in charge : Eric Gressier

- Academic lecturers :
  - QoS in the Internet
  - QoS in wireless networks
  - OPNET and QoS
  - MPLS, VoIP

-

- Examination
  - Project + report
  - Exam

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Programming real-time systems (3 ECTS)

Faculty member in charge : Samia Bouzefrane

- Synchronisation mechanisms
- Scheduling techniques
- Resource management
- RTSJ: real-time Java programming

-Examination

- Project + report (RTSJ)
- Exam

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Safe functioning (3 ECTS)

Faculty member in charge : David Delahaye

- Reliability techniques
- Development process of sure systems
- Tools for reliability

-Examination

- **Exam**

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Master thesis

Carried out in :

- a research Lab
- a company

Topics

- Avionics
- Smart cards
- Embedded Linux
- iPhone & Andoid
- etc.

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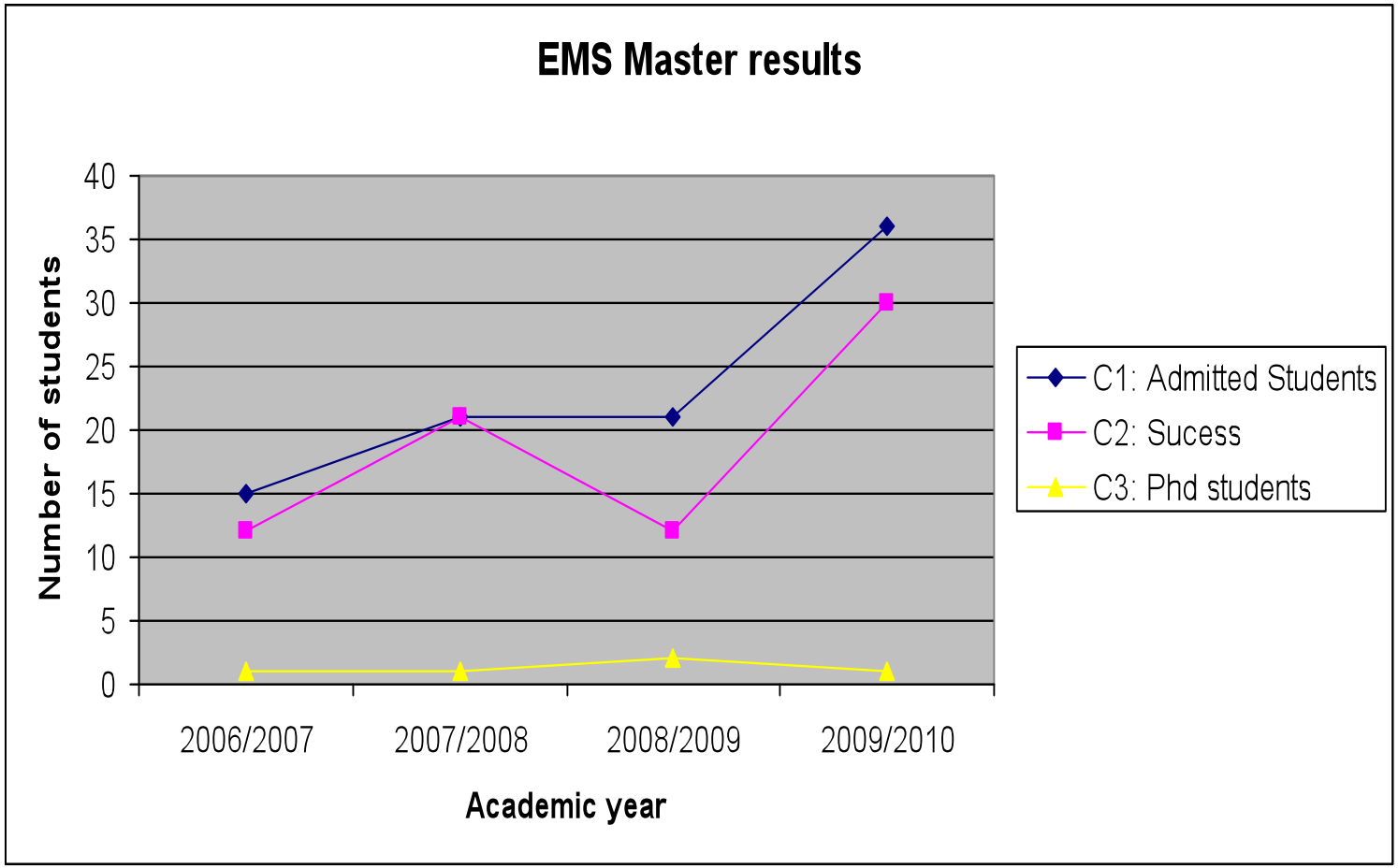
Outcome



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Master's degrees in France

- Many research teams work on embedded systems (LIG in Grenoble, LIFL in Lille, I3S in Sophia Antipolis, CEDRIC/CNAM in Paris)
- Master's degrees are oriented to Electronics
- EMS Master's degree is more programming oriented (skills of teachers + industrial needs)

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Technological priorities

- Recent study published on oct. 2010 supported by the ministry of industry fixed 8 priorities for embedded software
  - Design of model-based software
  - Verification & certification of the dependability & the security of ES
  - Virtualisation & parallelisation for ES
  - Service oriented software platforms
  - Management of energy for ES
  - User-System Interfaces
  - Generic libraries for embedded treatment (signal, image)
  - Architecture, middleware and networks for ES

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Conclusion

- A new Master's degree called *Secure Embedded & Mobile Systems* (SEMS) will be started on Sept. 2011
- Regarding EMS Master's degree, safety, dependability, security & tests aspects will be emphasized

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