

# POTENTIAL RESEARCH INTERNSHIP AND MASTER THESIS ASSIGNMENTS

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SECURE CONNECTIONS  
FOR A SMARTER WORLD

INTERNAL

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## METHOD FOR COMPARING FAULT DETECTION AND CLASSIFICATION SYSTEMS OUTCOMES

- FDC (Fault Detection and Classification) solutions monitor and analyze process data (from semiconductor process tools in the factory) with the aim of detecting faults early in the process and trigger appropriate actions like blocking further processing, by blocking the tool and/or blocking the lot being processed
- Every tool family has its own set of parameters being measured; there are > 40 tool families
- NXP will replace its in house developed FDC system by a commercial product
- The FDC system processes ~100 M datapoints (parameter measurements) a day related to between 1.6 M and 1.8M events, and compares the datapoints with control and spec limits
- The current system stores summary data whereas the commercial systems stores the raw data
- When introducing the commercial product, the factory must be able to rely on the outcomes, which should lead to the right decisions for blocking or not blocking processing.
- There could be two assignments
  - Research internship (15 ECTS; 420 hours) for defining a method
  - Master thesis (30 ECTS; 840 hours) for implementing the method in automated tooling for all tool families

## INVESTIGATE MODERNIZATION OF REALIZING EQUIPMENT INTEGRATION

- The ICN8 factory makes use of ~500 process tools and ~200 metrology tools
- Loading and unloading the tools is highly automated through equipment integration, where for each lot put on the input port of a tool numerous checks are done to validate the lot is allowed to be processed, and when ok it is processed on the tool with the right recipe. While running the equipment integration also foresees in passing on progress data to the MES system, and parameter values as measured by sensors in the tool to the FDC system. Communication with the process tools is making use of semiconductor industry specific communication protocols, of which the implementation varies by supplier.
- Currently the equipment integration is driven by Linux scripting, while using a toolset from Applied Materials, called Cellman/ Grapheq
- Potential assignments
  - Research internship (15 ECTS; 420 hours):
    - Investigation in efficiency improvements in equipment manager creation
    - Investigation or Proof of Concept Cellman /Grapheq life cycle management (convert existing AEM)
  - Master thesis (30 ECTS; 840 hours): Investigation into how a more modern and generalized approach could replace/improve how equipment integration is done. Parameterization?

## AUTOMATION OF TOOL CHARACTERIZATION

- The ICN8 factory makes use of ~500 process tools and ~200 metrology tools
- Communication with the process tools is making use of semiconductor industry specific communication protocols, including SECS, of which a variety of implementations exists.
- Before writing an equipment manager for a new tool, characterization has to be done. During the characterization all kinds of commands are sent to the equipment to see how it responds. Automating (parts of) the characterization could reduce the time for equipment manager realization and the chance of errors or omissions
- Potential assignments
  - Research internship (15 ECTS; 420 hours):
  - (and to be assessed) Master thesis (30 ECTS; 840 hours):

## FUTURE DEVELOPMENT PLATFORM

- In 2019 NXP Nijmegen started a program to bring all of its in house developed applications to the Java oriented development platform Grails, which was already used in AMEC. By now ~50% of the applications has been migrated to Grails 5. There are still a lot of applications running in a JBoss environment needing a migration, and that may take 2-3 years to complete.
- Key questions and hence subject for research internships or master thesis are
  - Can the migrations be accelerated without adding resources?
  - Should these applications be migrated to Grails 5 or to a succeeding platform, as indications are that further development of the Grails platform is slowing down?
  - What are candidates for a succeeding platform?
    - Create a business case including all relevant aspects, including licenses, programming skillset available in the team, manufacturing requirements like hassle free operation 24/7, ease of migration from Grails 5. Present to global Manufacturing Segment Architecture Board.
    - Create a proof of concept

## TECHNOLOGY DEBT REDUCTION ACCELERATION OPTIONS (LCM WITH MINIMUM EFFORT)

- Technical debt can have many forms, but in our environment the most common are applications from an unsupported stack, end-of-life operating systems and middleware (like database software). Example of old application stack currently in use are VBA, VB6, old PHP versions, JBoss Seam applications, Grails versions older than 5. Current approach: bring application to Grails 5 (or maybe a successor for the Grails framework). Example for operating systems: RedHat 6 to RedHat 7 or 8 migrations. Investigate how technology debt can be reduced as fast as possible (aim to have everything on a supported level).
- Suited for:
  - Research internship (15 ECTS; 420 hours)
  - Master thesis (30 ECTS; 840 hours)

## INVENTORY OF ARCHITECTURAL CONCERNS

- The application landscape of ICN8 consists of a large number of applications with interdependencies on other applications, databases, file shares etcetera.
- Research internship (15 ECTS; 420 hours) are possible for
  - Investigating weaknesses in the architecture, shortcuts taken in the past
  - Old technology solutions for which better solutions exist today
  - In-depth technology debt inventory of the full stack for selected applications

# CREATE APPLICATION LANDSCAPE OVERVIEW (IN ISA95 FORMAT)