Future Emerging Technologies for High Performance Computing

Call H2020-FETHPC-2014, Research and Innovation Action

Project No: 671653

Exploiting eXascale Technology with Reconfigurable Architectures

WP1

D1.1: Project Handbook

Author(s):	Dirk Stroobandt (GNT)
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Abstract:

This document describes the general management procedures of the EXTRA project, including quality assurance and risk analysis. It includes information about all work packages, responsibilities and consortium agreement information, risks and contingency plans.

It is intended to be a living document that will be updated whenever required to reflect up-to-date information.

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The EXTRA Consortium is the following:

Beneficiary Number	Beneficiary name	Beneficiary short name	Country
1(coordinator)	Ghent University	GNT	Belgium
2	Telecommunications Systems Institute	TSI	Greece
3	Imperial College London	IMP	UK
4	Politecnico di Milano	PDM	Italy
5	University of Amsterdam	UVA	The Netherlands
6	Ruhr-University Bochum	RUB	Germany
7	Maxeler	MAX	UK
8	Synelixis	SYN	Greece
9	University of Cambridge	CAM	UK

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Document Revision History

Date	Issue	Author/Editor/Contributor	Summary of main changes
21 October 2015	1.0	Dirk Stroobandt	Initial description
30 October 2015	1.1	Dirk Stroobandt	Made additions
3 November 2015	1.2	Dirk Stroobandt	Finished first draft
24 November 2015	2.0	Dirk Stroobandt	Finished second draft
24 November 2015	2.0	Dionisios Pnevmatikatos	Small changes
26 November 2015	2.0	Marco D. Santambrogio	Small changes
30 November 2015	2.1	Dirk Stroobandt	Final version

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Executive Summary

To handle the stringent performance requirements of future exascale High Performance Computing (HPC) applications, HPC systems need ultra-efficient heterogeneous compute nodes. To reduce power and increase performance, such compute nodes will require reconfiguration as an intrinsic feature, so that specific HPC application features can be optimally accelerated at all times, even if they regularly change over time.

In the EXTRA project, we create a new and flexible exploration platform for developing reconfigurable architectures, design tools and HPC applications with run-time reconfiguration built-in from the start. The idea is to enable the efficient co-design and joint optimization of architecture, tools, applications, and reconfiguration technology in order to prepare for the necessary HPC hardware nodes of the future.

The project EXTRA covers the complete chain from architecture up to the application:

- More coarse-grain reconfigurable architectures that allow reconfiguration on higher functionality levels and therefore provide much faster reconfiguration than at the bit level.

- The development of just-in time synthesis tools that are optimized for fast (but still efficient) re-synthesis of application phases to new, specialized implementations through reconfiguration.

- The optimization of applications that maximally exploit reconfiguration.

- Suggestions for improvements to reconfigurable technologies to enable the proposed reconfiguration of the architectures.

In conclusion, EXTRA focuses on the fundamental building blocks for run-time reconfigurable exascale HPC systems: new reconfigurable architectures with very low reconfiguration overhead, new tools that truly take reconfiguration as a design concept, and applications that are tuned to maximally exploit run-time reconfiguration techniques.

Our goal is to provide the European platform for run-time reconfiguration to maintain Europe's competitive edge and leadership in run-time reconfigurable computing.

1. Project management

The project management structure aims at guaranteeing the proper progress and control of the project with respect to the project objectives and plans and to ensure both the technical coordination amongst the partners and the strict enforcing of the maximum expenses of the budget. It was defined to clearly identify the responsible members of the various organisms of the consortium as well as to optimise the communication between the various partners and coordinating committees.

The management structure has been defined in order to fulfil the project objectives within the given schedule while trying to reduce the management effort in the project to its minimum taking into account the number of partners. Although all the partners in the project will actively participate in the management activities and are represented at the appropriate level, we've tried to allocate to them a minimum amount of person months.

The project's Consortium Agreement [2] includes preventive measures for arrangement of IPR, exploitation rights, confidentiality, decision-making and change-procedures, cooperation and exploitation after the project, according to the lines set out in this proposal.

The structure of the project management is organized as shown in Figure 1.
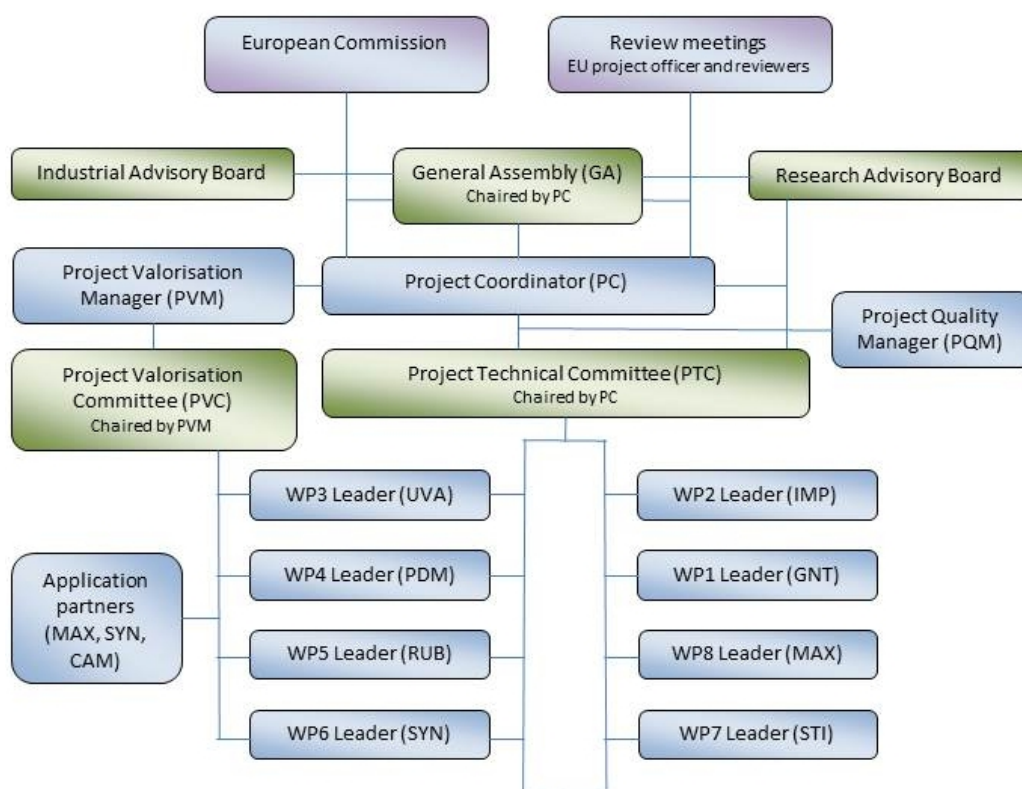
Figure 1: EXTRA management structure

Following a top-down approach EXTRA consists of the following Committees and individuals:

1.1. Project coordinator

The ***Project Coordinator (PC)*** is responsible for both the general/administrative management and the scientific/technical management of the entire project. The PC will monitor the planning, progress, and deliverables of the project with respect to the objectives and plans described in the Description of Work [1]. If necessary, he will initiate corrective actions for the deviations. The PC is also the unique interface between the project and the European Commission. The PC will manage all the communications to/from the EU

Commission, the periodic reporting and he will organize the review meetings with the Project Officer. The PC will also be responsible for collecting financial statements and audit certificates, as required by the contract. The PC will be responsible for reporting the periodic financial summaries and resource efforts spent by each partner. The PC will manage the granted EU contribution and the distribution of the funds to each partner according to the actual allocated efforts. The PC will convene the GA. Regarding the scientific/technical management activities, the PC will lead the Project Technical Committee (PTC) and will assist, when necessary, the Work Package Leaders and make sure that the communication between the various WPs proceeds as smoothly as possible for a successful integration of the various components of the project. In addition, the PC will coordinate the evaluation and quality assurance actions of the project.

Technical Coordination

The Technical Coordination is performed by the Project Coordinator who has the overall responsibility for the progress of the Project and chairs the General Assembly (GA).

Project Management

The Project Management is performed by the Project Coordinator and involves the day-to-day execution of the project and will ensure the timely delivery of project objectives and deliverables by continuously monitoring the project progress against the plan of record. The Project Coordinator will work with the Work Package Leaders to identify issues and propose suitable corrective actions (i.e. resource reallocation, task force creation, etc.) that might require approval by the GA. The Project Coordinator chairs the GA and is responsible for calling GA meetings and reviews as well as compiling / distributing Minutes and Actions. The Project Coordinator defines the procedures for change control (proposed changes to the plan of record), risk management and quality. The Project Coordinator is also responsible for the administrative management of the project which includes the provisioning of Periodic Reports and Financial Statements management as well as interacting with the Financial Department of GNT to ensure an efficient distribution of EU funding. The Project Coordinator will also act as the official point of contact between the Commission and the Beneficiaries for normal purposes. The Project Coordinator is:

Name	Dirk Stroobandt
Address	ELIS, Sint-Pietersnieuwstraat 41
Place	Ghent
Post Code	B9000
Country	Belgium
Telephone	+32 9 264 34 01
Mobile	+32 472 57 87 26
Fax	+32 9 264 35 94
E-mail	Dirk.Stroobandt@UGent.be

Table 1: Contact Details of the Project Coordinator

1.2. Project committees

1.2.1. General Assembly

The **General Assembly (GA)** is the body consisting of one representative from each partner in the Consortium, with the task to supervise the project and will be chaired by the Project Coordinator. The GA will meet every six months or, if necessary, more often for project progress. Meetings can also be held as phone conferences. The GA will provide a forum for the discussion of administrative and strategic

management of the project and for the monitoring of dissemination and exploitation activities. In addition, the GA will decide on approving major modifications to project plans, allocated efforts, budget issues and possible addition of new partners. The GA will provide a forum for the discussion of major changes in the project work plan and directions in response to new problems or new situations. In voting at the GA, each Party shall have one vote and decisions will be taken by consensus. Modifications to the work plan in the Technical Annex will require the consensus or the qualified majority (i.e. 2/3).

The GA members are:

no	Short name	Participant name	Member
1	GNT	Ghent University	Dirk Stroobandt
2	TSI	Telecommunications Systems Institute	Dionisios Pnevmatikatos
3	IMP	Imperial College London	Wayne Luk
4	PDM	Politecnico di Milano	Marco Santambrogio
5	UVA	University of Amsterdam	Ana Varbanescu
6	RUB	Ruhr-University Bochum	Michael Hübner
7	MAX	Maxeler	Georgi Gaydadjiev
8	SYN	Synelixis	Theodore Zahariadis
9	CAM	University of Cambridge	Alex Thom

Table 2: General Assembly members

1.2.2. Project Valorisation Committee

The Project Valorisation Committee (PVC) is composed of the Project Valorisation Manager, the Work Package Leaders of WP3, WP4, WP5 and WP6 and the valorisation managers of the 3 application partners. The PVC will monitor valorisation potential, update valorisation plans and initiate valorisation initiatives The PVC will meet annually, or more frequently if special issues need to be handled.

The Project Valorisation Manager is responsible for the knowledge management within the Project, the management of innovation related activities and IPR, the dissemination and exploitation activities. The Project Valorisation Manager will regularly meet with the WP8 Leader (work package on dissemination and exploitation).

1.2.3. Industrial Advisory Board

The **Industrial Advisory Board (IAB)** (chaired by the PC) includes a panel of independent experts from industry, not involved in the day-to-day project work. This panel will provide an outside view on EXTRA and evaluate the overall progress with respect to the high-level objectives. We expect these experts to contribute significant ideas regarding the challenges and opportunities of the emerging research field of run-time reconfiguration from an industrial perspective and thus ensure maximum impact of the EXTRA project. At the annual IAB meetings, the PC will present the achievements and the status of the project. All IAB members are invited to provide comments and modifications regarding requirements, objectives, and development, as well as exploitation and dissemination activities. The IAB will not make any decisions but issues recommendations that will be discussed and processed at the following GA meeting. The IAB can also recommend calling additional IAB meetings that focus on specific topics, or inviting additional experts to join the IAB. IAB members may also be asked for comments on an individual basis.

The IAB will be dynamically formed by inviting new people when opportunities arise but in the initial IAB we will invite Khaled Benkrid (ARM), Ben Cope (Altera), Philip Leong (Clustertech), Patrick Lysaght (Xilinx), Thierry Watteyne (Barco Silex), and Koen Hooghe (Alcatel).

1.2.4. Research Advisory Board

The **Research Advisory Board (RAB)** (chaired by the PC) includes a panel of independent experts from research institutes not involved in the day-to-day project work. This panel will provide an outside view on EXTRA and evaluates the overall progress with respect to the open exploration platform for reconfiguration. We expect these experts to contribute significant ideas regarding the challenges and opportunities of the research platform for run-time reconfiguration from the perspective of their own research and thus ensure maximum impact of the EXTRA project for future research developments on run-time reconfiguration, especially in the EU. At the annual RAB meetings, the PC will present the achievements and the status of the project. All RAB members are invited to provide comments and modifications regarding requirements, objectives, and development, as well as exploitation and dissemination activities. The RAB will not make any decisions but issues recommendations that will be discussed and processed at the following GA meeting. The RAB can also recommend calling additional RAB meetings that focus on specific topics, or inviting additional experts to join the RAB. RAB members may also be asked for comments about the project on an individual basis.

The RAB will be dynamically formed by inviting new people when opportunities arise but in the initial RAB we will invite Eduardo de la Torre (UPM - Spain), Koen Bertels (TUDelft – The Netherlands), Jürgen Teich (University Nürnberg/Erlangen - Germany), Steve Wilton (UBC - Canada), Maya Gokhale (Lawrence Livermore National Laboratory – USA), Dirk Koch (Manchester University – UK), Wim Vanderbauwhede (Glasgow University - UK), and Vaugh Betz (University of Toronto - Canada).

1.3. Work Package leaders

The Work Package (WP) Leaders are senior members of the partners' and coordinators' staff. They will act like operating executives in a commercial company, and will be responsible for the completion of their Work Packages and successful production of deliverables. Work Package Leaders are Technical Leaders appointed by the partner responsible for each work package. They are responsible for the organisation and control of each work package. They direct all aspects of activity in the work package and report to the Project Coordinator. In more detail, the Work Package Leaders' responsibilities are:

- To coordinate, monitor and manage the activities under their responsibility, and to ensure the timely achievement of the objectives and milestones of the work packages.

- To prepare the internal and external reports (deliverables) expected for the work package, and assist in the production of the overall management reports of the project.

- To meet or hold conference calls regularly with the Project Coordinator and arrange regular technical meetings or conference calls of the work package members. To ensure the accurate recording of times, costs and resources, and report any discrepancies immediately to the Project Coordinator.

- To organize technical presentations of the work package activities, and to ensure proper involvement and visibility of the active members.

- To inform the General Assembly about progress of activities and possible critical issues.

- To identify the need for creation of separate tasks in the work package

- For the horizontal information flow to other work package leaders

- To Identify and report any technical or managerial problems that arise in their work package

The WP Leaders are:

WP	Organization	WP Leader	E-mail
WP1	GNT	Dirk Stroobandt	Dirk.Stroobandt@UGent.be
WP2	IMP	Gabriël Figueiredo	gabriel.figueiredo@imperial.ac.uk
WP3	UVA	Catalin Ciobanu	C.b.ciobanu@uva.nl
WP4	PDM	Marco Santambrogio	marco.santambrogio@polimi.it
WP5	RUB	Michael Hübner	michael.huebner@rub.de
WP6	SYN	Andreas Brokalakis	brokalakis@synelixis.com
WP7	TSI	Dionisios Pnevmatikatos	pnevmati@ece.tuc.gr
WP8	MAX	Tobias Becker	tbecker@maxeler.com

Table 3: WP Leaders

1.4. Task leaders

Each Task in a WP is led by a partner. The Task Leader reports to the Work Package Leader, coordinates technical work for his/her activity according to the project and WP objectives, assists in the preparation of reports. In the project already at the proposition stage, responsibilities are well defined and participants to each task are identified, with their own responsibilities. Each of the partners has at least one task responsibility, and is coordinating the work done in this task. For example when one task corresponds to a common software development, the task leader coordinates the development of the complete software.

The task leaders are appointed as follows:

WP/Task	Title/description		WP/Task Leader
WP1	Coordination and Management	GNT	Dirk Stroobandt
T1.1	Project administration	GNT	Dirk Stroobandt
T1.2	Project valorisation plans	MAX	Georgi Gaydadjiev
T1.3	Project quality assurance	GNT	Dirk Stroobandt
WP2	Requirements, Metrics and demonstration	IMP	Gabriël Figueiredo
T2.1	Requirements	MAX	Tobias Becker
T2.2	Metrics	PDM	Riccardo Cattaneo
T2.3	Initial Demonstration	IMP	Gabriël Figueiredo
T2.4	Final Demonstration	IMP	Gabriël Figueiredo
WP3	Platform for reconfigurable architectures	UVA	Catalin Ciobanu
T3.1	Coarse-grain and fine-grain trade-off	RUB	Muhammed Al Kadi
T3.2	Optimal off-loading from CPUs to FPGA accelerators	PDM	Gianluca Durelli
T3.3	System design exploration	SYN	Andreas Brokalakis
T3.4	Platform feasibility and evaluation	IMP	Gabriël Figueiredo

WP4	Development of reconfigurable tools platform	PDM	Marco Santambrogio
T4.1	Tools Frontend	PDM	Gianluca Durelli
T4.2	Polyhedral analysis and transformation	PDM	Giuseppe Natale
T4.3	Development of application analytical model and estimation of HW implementations	IMP	Xinyu Niu
T4.4	HW/SW Co-design for exascale reconfigurable computing	PDM	Gianluca Durelli
T4.5	Integration and extension of vendor tools	MAX	Tobias Becker
WP5	Just-in-Time Synthesis	RUB	Michael Hübner
T5.1	Configuration representation for just-in-time synthesis	GNT	Elias Vansteenkiste
T5.2	Analysis of relations between synthesis, mapping, and P&R tools	GNT	Dries Vercruyce
T5.3	Just-in-time synthesis, mapping, and P&R tools	RUB	Muhammed Al Kadi
T5.4	Hardware monitoring and emergency management	IMP	Tim Todman
T5.5	Adding debugging tools to the framework	GNT	Alexandra Kourfali
WP6	Optimizations of applications using reconfiguration	SYN	Andreas Brokalakis
T6.1	Identify functions and structures suitable for optimization	SYN	Antonios Nikitakis
T6.2	Implement the functions and structures in reconfigurable devices	SYN	Antonios Nikitakis
T6.3	Integrate the optimal implementations with the rest of the system	UVA	Catalin Ciobanu
T6.4	Evaluate and fine tune the overall applications	SYN	Antonios Nikitakis
WP7	Future Reconfiguration Technology Improvements	TSI	Dionisios Pnevmatikatos
T7.1	Improvements in reconfiguration infrastructure	GNT	Amit Kulkarni
T7.2	Tools for on-chip configuration generation	IMP	Xinyu Niu
T7.3	Tight coupling with compute cores	TSI	Gregory Chrysos
T7.4	Alleviating tool restrictions	MAX	Tobias Becker
WP8	Dissemination and Exploitation	MAX	Tobias Becker
T8.1	Project dissemination and communication	GNT	Elias Vansteenkiste
T8.2	Project exploitation & platform demonstration	MAX	Georgi Gaydadjiev

1.5. Key Project Meetings

It has been demonstrated from past experience of the Consortium members that the needed interventions during the life cycle of the project can be accurate, fast, and efficient. A fluent internal communication in the Consortium is foreseen to timely identify unexpected problems and purpose its effective handling, as described above.

The General Assembly will meet at the start of the project and at six monthly intervals (maximally). Additional meetings may be organized if needed. The meetings will normally be scheduled to rotate between the Contractors' home base.

The GA will also meet in three month intervals, or whenever required during the implementation of Consortium activities as described in the Consortium work plan.

The Coordinator has organized the kick-off meeting with all partners on September 4 and 5, 2015 in London. The purpose of the project kick-off meeting was to check the effective beginning of the work and preventing in the very beginning phase possible problems like, for example, delays in the personnel hiring procedures or device ordering.

2. Document Management

The infrastructure chosen to hold the documentation produced by the project will be based on a GitLab server at https://gitlab.com/extrahpc where the project intranet will be set up. The Project Coordinator will be responsible for maintaining on the server:

- Quarterly reports
- Cost Claims
- Meeting Minutes
- Teleconference Meeting Minutes
- Annual Project Reports
- Contractual Documentation
- Deliverables
- Technical Reports
- Technical Papers
- Market Studies

2.1. Language

The official document and emails language will be English. In case of official deliverables, one participant having English as mother tongue or having a C1-level certificate should peer-review the deliverable.

2.2. Web server

The EXTRA web pages and twitter account were set-up October 8, 2015 and are hosted by GNT. The reserved domain name is: www.extrahpc.eu and the twitter account is https://twitter.com/extrahpc. A facebook account is available at: facebook.com/groups/extrahpc/.

The web server will consist of a public part, accessible by all visitors and a password protected part accessible only by the EXTRA partners.

The deliverables list will appear at the public part, but only the documents that are marked as "public" will be available to all visits. The confidential deliverables will be password protected.

2.3. Document templates

Document templates will be made available to all partners through the GitLab server for word documents, power point presentations and posters, LaTeX documents, and the logo.

Quarterly cost statement and meeting minutes etc. templates will be provided by the Project Coordinator.

2.4. Documents exchange methods

Documents will be exchanged via uploading at the GitLab server.

2.5. Document Naming

Though it is a little bureaucratic, proper document naming is required to keep track of the project technical and administrative resources.

2.5.1. Official/Contractual Deliverables

The official deliverables will be named using the naming format

EXTRA_Dw.d_ACR_Vx.y-YYYYMMDD.ext

where

w: is the work package number

d: is the deliverable number

ACR: is the partner Acronym that initiated and has the responsibility for the document

x: is the version major number

y: is the version minor number

YYYY: is the year

MM: is the month

DD: is the day

.ext: is the extension (.doc, .pdf, .ppt, .xls, .exe, .zip)

The partner's acronyms are defined by the following table.

Number	Participant name	Acronym
1(coordinator)	Ghent University	GNT
2	Telecommunications Systems Institute	TSI
3	Imperial College London	IMP
4	Politecnico di Milano	PDM
5	University of Amsterdam	UVA
6	Ruhr-University Bochum	RUB
7	Maxeler	MAX
8	Synelixis	SYN
9	University of Cambridge	CAM

The partner that initiated and has the responsibility for the document will have the authority to change the version number. In case a partner aims to send comments on the document, he/she will use revisions tracking, and will add the partner acronym at the end.

EXTRA_Dw.d_ACR_Vx.y-YYYYMMDD_ACR2.ext

If another partner wants to send additional comments on a document that it is already revised, he/she will use revisions tracking and will add the partner acronym at the end and so on.

EXTRA_Dw.d_ACR_Vx.y-YYYYMMDD_ACR2_ACR3.ext

After some iterations, the partner that initiated and has the responsibility for the document will have the authority to change the version number and date.

When the deliverable is finalised, the partner that has the responsibility for it will have the authority to change the version number and date.

EXTRA_Dw.d_ACR_Vx.y_FF-YYYYMMDD.ext

Where FF represents the "Final Frozen" version, which cannot be modified, unless requested by the PO or the reviewers.

2.5.2. Internal/Public Documents

The Internal documents will have the following format:

EXTRA_WPw_ACR_TTTd__ShortTitle_Vx.y-YYYYMMDD.ext

where

w: is the workpackage number

ACR: is the partner Acronym that initiated and has the responsibility for the document

TTT: is a two or three letter acronym of the following

RR	Resource Report
CC	Cost Claims (once per year)
MAG	Meeting Agenda
MM	Meeting Minutes
MS	Market Studies
SW	Software
TCM	Teleconference Meeting Minutes
TP	Technical Presentation
TPC	Technical/Research Publication (Conference)
TPJ	Technical/Research Publication (Journal/Magazine)
TR	Technical Report

ShortTitle: is an optional, explanatory short title of the document

d: is the document number

x: is the version major number

y: is the version minor number

YYYY: is the year

MM: is the month

DD: is the day

.ext: is the extension (.doc, .pdf, .ppt, .xls, .exe, .zip)

The same procedure will be applied also to the internal/public documents.

2.6. Document Software Tools

For document processing, the following tools will be the defaults:

- Document processing: Microsoft Word 2010 or LaTeX

- Spreadsheet processing: Microsoft Excel 2010

- Presentations processing: Microsoft PowerPoint 2010

- Compression Tool: WinZip 11

- Portable Document Format: Adobe Acrobat 8.0

For technical reports and deliverables the use of LaTeX is preferred by some partners and can be also used. In case a partner aims to use a different software tool, he has to assure that the outcome is compatible with the above tools.

3. Resource Management

For appropriate resource management, resources will be monitored every three months, during quarterly reports. The reports will be internal, but will give a good approximation of the overall resource spending. Once per year, a signed full cost statement will be delivered to the Project Coordinator.

3.1. Quarterly Resource Reports

The Quarterly reports should be sent to the Project Coordinator 5 working days after the end of the reporting period. The Project Coordinator will provide an appropriate template. However, the Quarterly Reports will include at least the following issues:

- Major Achievements per partner

- Planned Resources per activity per work package

- Actual Resources per activity per work package

- Cumulative Resources per activity per work package

- Project Meetings/Teleconferences attended

- Conferences/Standardization Meetings Attended

3.2. Cost Claim Reports

The Yearly Cost Claim reports should be sent to the Project Coordinator 5 working days after the end of the reporting period for the technical issues, and potentially 2 weeks for the financial part. The Project Coordinator will provide an appropriate template. However, the Cost Claim Reports will include at least the following issues:

- Major Achievements per partner

- Major Difficulties

- Planned Resources per activity per work package

- Actual Resources per activity per work package

- Cumulative Resources per activity per work package

- Project Meetings/Teleconferences attended

- Conferences/Standardization Meetings Attended

- Consumables

- Hardware/Software expenses

- Audit Reports

The work package leader should compile the Achievements and Difficulties and provide to the Project Coordinator a section explaining the technical progress in the work package of his/her responsibility.

3.3. Responsibility Assignment

Based on the EXTRA Description of Work (DoW) the Project Coordinator will assign and manage the Work Package leaders to achieve the objective of each work package.

Each work package leader will keep an Action List, detailing the open issues of his/her work package, the severity of the task, the deadline, the name or initials of the professional that has been assigned the task, a small description and the issue status (open, assigned, closed, postponed, delayed).

The tasks will be assigned to the partners based on their contributions to the DoW, their area of expertise and their resources in the project as reflected by the relevant Person Months (PM).

4. Communication

4.1. Internal communication

Ensuring a good communication among project partners and towards outside entities represents an important key of success for the project and a fundamental practice to manage the project at its best. The establishment of a fast, reliable, and easily accessible communications infrastructure is vital to the proper operation of a pan-European project. This can only be achieved through the intensive use of electronic communications (e.g., email, web based exchanges, collaboration tools). A project web site and a GitLab repository will also be used to enable fast and efficient exchanges of information. Thus, the main communication channels are:

- E-mail

- Web based services/chats

- bilateral telephone/VoIP calls

- telephone conferences (supported by desktop sharing tools, e.g. WebEx, etc)

- a GitLab shared repository

- physical meetings

The internal communication includes physical meetings, starting with a 2 day kick-off meeting to guarantee in-depth knowledge exchange. Meetings are accompanied via fixed telephone conferences to discuss project progress and to take decisions. Also applied are the exchange of emails, letters etc. GitLab will be used to share knowledge. The advantages of these tools lie in their functions of allowing the sharing of documents, contact details, white boards, discussion rooms etc.

The Project Coordinator will introduce GitLab to increase transparency and trust among the project partners. External communication includes the dissemination of all project results through publications, a project website, conferences, events, the Industrial and Research Advisory Groups, and the establishment of links to related projects and SME associations.

It is well known that systematic and timely implementation of information flow is central for any consortium based project. Nevertheless, overflow of information should obviously also be avoided.

The communication flow between EXTRA members will be implemented by:

- Periodic presentable meetings of the General Assembly

- Periodic presentable meetings of the Technical Meetings

- Individual working meetings of members of each WP

- Phone and e-mail interchanges (day to day cooperative working infrastructure)

The Project Coordinator will be in a day-by-day communication and have the duty to communicate on a systematic and frequent basis even if no problems are identified with all WP leaders during the life cycle of their WP to assure the smooth flow of EXTRA Project activities. All ordinary messages related to a certain work package will be communicated among all partners involved in that work package.

Nevertheless, any special important issues or problems within the frame of a WP are going to be forwarded to the WP leader and to the Project Technical Committee members.

Of course, this formal and detailed hierarchical communication flow does not exclude by any means ad hoc direct communication between any partner participants, whenever this is important for the project success. *The experience in running research projects, the good relationships, and mutual knowledge of the*

partners as well as the previous working together successfully for most of the partners, almost ensures the inexistence of problems regarding communication and information flow along the development of the EXTRA Project.

4.2. Email Communication

GNT has set-up and maintains the following email reflectors:

all@extrahpc.eu

WP1@extrahpc.eu for WP1/administration communication

WP2@extrahpc.eu for WP2 communication

WP3@extrahpc.eu for WP3 communication

WP4@extrahpc.eu for WP4 communication

WP5@extrahpc.eu for WP5 communication

WP6@extrahpc.eu for WP6 communication

WP7@extrahpc.eu for WP7 communication

WP8@extrahpc.eu for WP8 communication

All emails that will be sent to the reflector will have the following subject format:

[EXTRA ALL] Subject

[EXTRA WP1] Subject

[EXTRA WP2] Subject

[EXTRA WP3] Subject

[EXTRA WP4] Subject

[EXTRA WP5] Subject

[EXTRA WP6] Subject

[EXTRA WP7] Subject

[EXTRA WP8] Subject

In case a new participant needs to be added to a list send an email to: eneko.illarramendi@ugent.be

5. Meetings Organization

It is intended that the number of physical meetings will be limited to the minimal adequate number.

5.1. General Assembly Meetings

General Assembly (GA) Meetings will take place in case very important administrative or technical issues have to be faced. A GA meeting may result in modifying the project consortium, change the project objectives or even terminate the project.

The GA Meeting will be initiated by the Project Coordinator.

- All partners will be notified at least 3 weeks in advance.

- Agenda and supporting documentation will be available to all attendees at least 1 week before the meeting. Issuing of all documents will be via the coordinator, who is responsible for compiling all submissions from partners.

- All meetings will be formally minuted by the Project Coordinator or his representative. Unless otherwise agreed in the meeting, minutes will be issued within 2 working days of the completion of the meeting.

In order to minimize expenses and time, GA meetings will take place in parallel to Project Technical Committee Meetings, if feasible. The first task in each meeting will be the agreement on the agenda and the last one the agreement on the date and place of the next meeting.

5.2. Project Technical Committee Meetings

The Project Technical Committee (PTC) Meetings will take place periodically every 3 months, or ad hoc in case an outstanding technical issue calls for an additional meeting. The meetings will be initiated by the Project Coordinator or the Acting Project Coordinator. In some cases, it may be initiated by a Work Package Leader, but approved a priori by the Project Coordinator.

Scheduled meetings will be notified at least 3 weeks in advance. In outstanding circumstances, they will be notified 1 week in advance, given that at least 75% of the participating partners are available.

Agenda and supporting documentation will be available to all attendees at least 1 week before the meeting. Issuing of all documents will be via the Project Coordinator or the Acting Project Coordinator.

All meetings will be formally minuted by the Project Coordinator, the Acting Project Coordinator or the respective Work Package Leader if the meeting concerns a specific work package. Unless otherwise agreed in the meeting, minutes will be issued within 5 working days of the completion of the meeting.

The first task in each meeting will be the agreement on the agenda and the last one the agreement on the date and place of the next meeting.

5.3. Project Valorisation Committee Meetings

The Project Valorisation Committee (PVC) Meetings will take place whenever deemed necessary and at least periodically every year, or ad hoc in case an outstanding valorisation issue calls for an additional meeting. The meetings will be initiated by the Project Valorisation Manager or the Project Coordinator.

Scheduled meetings will be notified at least 3 weeks in advance. In outstanding circumstances, they will be notified 1 week in advance, given that at least 75% of the participating partners are available.

Agenda and supporting documentation will be available to all attendees at least 1 week before the meeting. Issuing of all documents will be via the Project Valorisation Manager or Project Coordinator.

All meetings will be formally minuted by the Project Valorisation Manager or Project Coordinator. Unless otherwise agreed in the meeting, minutes will be issued within 5 working days of the completion of the meeting.

The first task in each meeting will be the agreement on the agenda and the last one the agreement on the date and place of the next meeting.

5.4. Review Preparation Meetings

Two Review Preparation Meetings (RPM) are expected to take place the day(s) before the project reviews in months 19 and 37 according to the plan in the EXTRA DoW. The Project Coordinator and all Work Package Leaders are expected to attend the RPMs. Other members of the project will be expected to attend when required. As the RPMs will form a major forum for the exchange of information in addition to management of the project, all consortium members will be encouraged to attend. The RPM will also review progress against the project success criteria and will report to the General Assembly all deviations from planned progress, together with an action plan to recover any shortfalls or exploit any gains in the programme.

All meetings will be formally minuted by the Project Coordinator. In order to minimize expenses and time, RPMs will take place in parallel to the Project Technical Committee Meetings, if feasible.

5.5. Conferences/Presentations/Exhibitions

EXTRA aims to have as much visibility as possible. Thus participation in conferences, dissemination activities and standardization bodies will be welcomed. However, the following rules should be applied:

- When the expenses are claimed during cost claims, the project has to be officially mentioned and this has to be proven by official documentation/contribution, i.e. an acknowledgement in a paper, use the EU H2020 logo in Posters, etc.

- The conference/presentation/contribution documentation has to be uploaded on the GitLab server.

- When the project is officially mentioned or presented the Project Coordinator should be notified 2 weeks before the event. The reason for this is to homogenize potential duplication or conflicting contributions/presentations.

- When the event takes place outside the EC, permission from the Project Officer has to be granted.

6. Conflict resolution and risk management

6.1. Conflict Resolution

The internal consensus will be achieved through periodical general assembly meetings and technical meetings that will make decisions on both managerial and technical issues. It will be the responsibility of the Project Coordinator to encourage decisions to be made by consensus.

However, if a conflict arises in the period between two consortium meetings and according to the severity, the conflict resolution procedure shown in Figure 2 will be followed. Based on the level of the conflict, one or more extraordinary Conference Calls or meetings will take place, upgrading the conflict to a higher hierarchy layer each time.
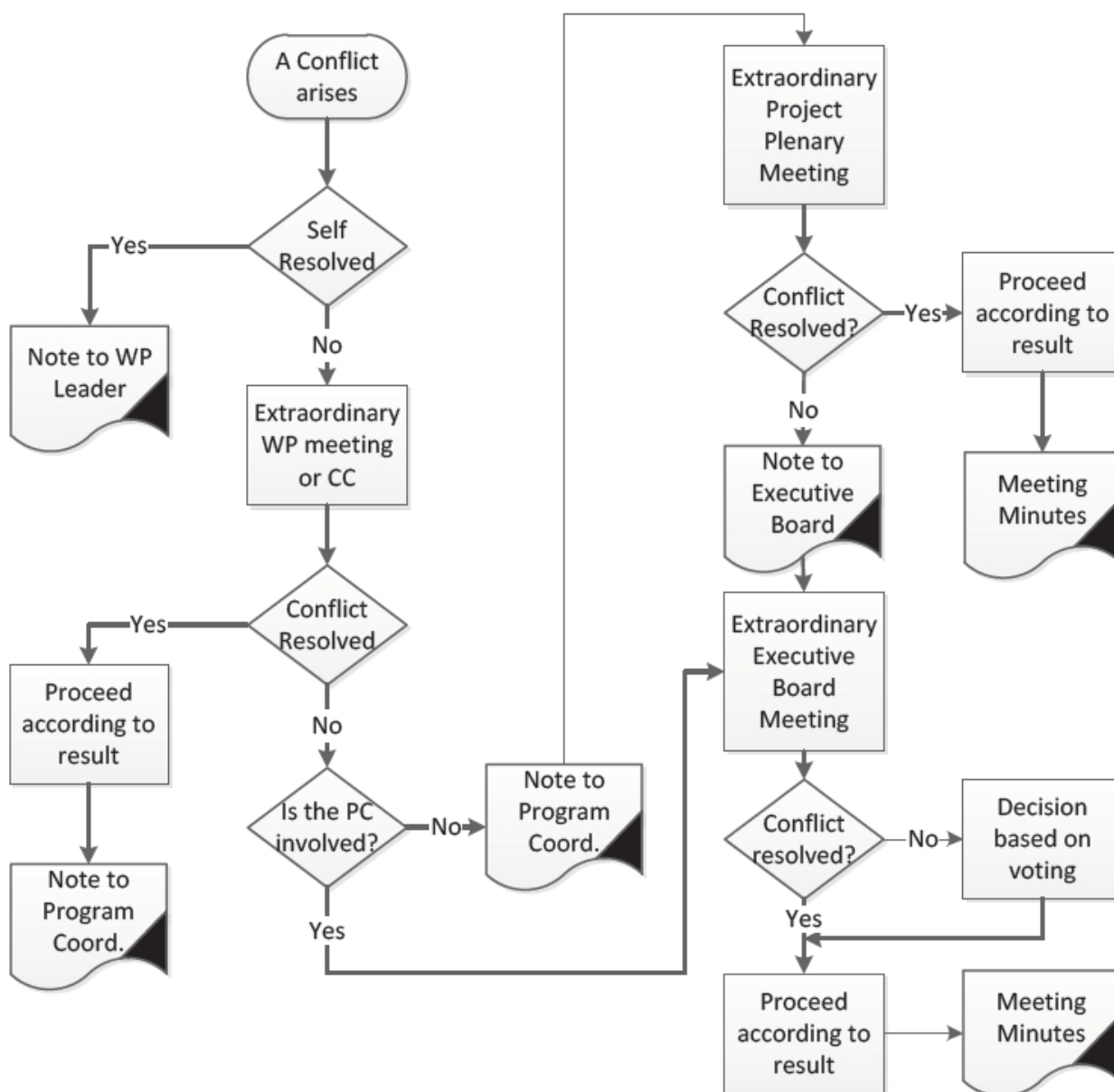

Figure 2: Conflict Resolution Procedure

The project conflict resolution procedures are described in more detail in the Consortium Agreement, which, along with the Contract, will constitute the basis upon which the project is managed.

6.2. Risk Management

The Project Coordinator is responsible for the risk management in the project and will be continuously observant of risk situations that have developed and may develop during the project, in order to detect and contain the project risks. The Project Coordinator will report on risks and issues to the General Assembly and will keep a Risk / Issue Log for the project as well as assign actions or contingency plans to be executed as required so as not to impact the overall outcome or objectives of the project.

6.2.1. Administrative risks and contingency plans

Such risks refer to the possibility of a beneficiary withdrawal from the EXTRA consortium or various IPR-related issues. However such risks are really minimised for the EXTRA consortium since all beneficiaries come from credible organisations where long co-operation and faith has been established and are all committed to project's objectives. Furthermore the project Consortium Agreement [2] takes care of handling such administrative risks in the unlike case that might happen including procedures for finding another beneficiary to execute the remaining work.

6.2.2. Financial risks and contingency plans

As mentioned before, all beneficiaries come from credible organisations and the risk of someone to become bankrupt is really minimal. However contingency plans are also foreseen, and risk are mitigated within the Consortium Agreement [2] that includes the provision for immediate actions by the Project Coordinator by blocking further payments by the Commission to this beneficiary and by initiating relevant procedures to find another beneficiary to take over the remaining work.

Exchange rate variations, while not technical and influenced by external factors, can affect the resources available to the beneficiaries Cambridge, Imperial and Maxeler. If the Pound Sterling is strengthened compared to the Euro, effort scheduled by the beneficiaries will not be funded as planned by the project. We will establish a base exchange rate compared to the Euro, and monitor the exchange rate during the course of the project. If significant deviations from the baseline are observed, the issue will be referred to the GA to investigate possible remedies.

6.2.3. Technical Risks and Contingency Plans

The Consortium will continuously identify the factors that are critical to the final success of the project and control these factors. For this purpose, the Consortium will define methods and procedures to identify, assess, monitor and control areas of risk. The challenge underlying the project has been carefully analysed. Significant risks and contingency plans have been already identified and for each one a possible contingency solution has been selected.

The main risk in the project is that critical results could be delayed due to critical dependencies or unexpected extra complexity due to the highly innovative rate of those challenges. The following table identifies the potential risks that we have identified in the RTD work packages the estimated likelihood of occurrence, the potential consequences and the contingency actions we have planned at the time of the DoW preparation:

Description of risk	Work package(s) involved	Proposed risk mitigation measures
Consortium partner does not perform its tasks as planned (low risk)	WP1	WP leaders will check progress of all partners within their WP and report in the monthly conference call. If underperformance is noticed, that partner will have to specifically report to the WP leader and the PC on its progress in the next period. If no improvements occur, the GA will have to decide on actions taken, which may lead to exclusion of partners and taking over of the work by other partners.
WP leader is not able to ensure all research parts are connected appropriately to a working unity (low risk)	WP1	The PC will follow up on this and make suggestions for improving the coherence within the WP. If needed, WP leaders will be replaced by other persons within the same institution or from another institution involved in the WP.
The metrics are not sufficiently accurate. (medium risk)	WP2	Additional evaluation using feedback from the initial demonstrator development (T2.3) allows refinements.
A possible delay in tool and platform development could impair the convergence and integration of technology for the final demonstrators. (low risk)	WP2	The development of initial demonstrators will support developing the relevant technologies and application demonstrators in parallel, allowing early testing, feedback and refinements before the implementation of the final demonstrators.
A possible delay in fully implementing the final demonstrators due to higher than expected complexity. (low risk)	WP2	The development of initial demonstrators will highlight practical challenges and unexpected complexity in the applications early, enabling us to allocate additional engineering efforts if necessary.
Memory bandwidth optimizations for reuse of array data in loop nests based on polyhedral methods does not outperform commercial tools and/or recent related research (low risk)	WP3	Additional memory optimization techniques can be developed targeting specific applications or memory intensive kernels leading to improved performance.
The EXTRA applications require additional memory access patterns not common in other HPC applications, potentially degrading performance (low risk)	WP3	Relevant code portions of the EXTRA applications can be optimized towards accessing memory using regular access patterns either manually or using specific compiler techniques, thus reducing the performance overhead of the suboptimal memory accesses.
Architectural templates used for design space exploration are not accurate for all EXTRA applications (low risk)	WP3	Customized architectural templates will be created for groups of applications with similar characteristics, improving accuracy.
The developed tools are not effective on some class of industrial applications	WP4	Additional own effort will be invested in the project to extend the tools. The project may be delayed if the more than one demonstrator does not achieve the set objectives.

Optimal scheduling requires computationally expensive algorithms, demanding a full-fledged processor	WP4	Adopt heuristics that work sufficiently well for the problem sizes of large applications. Investigate efficient structures for scheduling reconfiguration. We will also explore restricted versions of the scheduler that have smaller requirements for stand-alone operation. No impact on the project timeline.
Devices from different vendors differ drastically in the features and functionality	WP4	We are aware of the various features and are confident that despite the differences, the core functionality is similar and we can achieve a single, versatile tool chain. In case this is not possible, we will concentrate on the Xilinx devices and analyse required support for other vendors and devices. The project timing will not change.
Possible delay in methodology/tool development that prevent the commencement/progress of work for WP3 and WP5 as originally planned	WP3/ WP4/ WP5	Close interaction of the three WPs from the starting months of the project so as the technical needs and requirements of the case studies are known very early with continuous progress monitoring. Only the most critical parts of the system will be selected and evaluated within the available time frame.
The tools are not lightweight in the sense that they can generate the configuration bitstream from the tool flow synthesis, mapping, P&R in a acceptable time frame (medium risk)	WP5	A more hardware oriented realization of the tools has to be focused at. Also the granularity which stands in correspondence with the bitstream generation effort needs to be adapted
Applications cannot be optimized for reconfigurable hardware implementation	WP6	Similar applications that may fit the reconfigurable hardware better will be identified and certain parts will be evaluated for optimization
Integration of optimized sub-systems in hardware that initially estimated	WP6	Separate evaluations on the software and the hardware sub-system will be carried out and an estimation of the interconnection and the final system performance will be derived.
Tool restrictions too fundamental to be improved (low risk)	WP7	At least some of the tool restrictions are for SW convenience. Others are due to implementation details. We will combine the recommendations for tools with the recommendations for technology improvements and make sure to enable better CAD support.
Coupling of FPGA and compute cores cannot be easily improved in high-end systems (medium risk)	WP7	This risk has to do with the integration level at the processor provider. Tight integration is complicated as it interacts with memory hierarchy, caches, etc. However, solutions such as the POWER8 Coherent Accelerator Processor Interface (CAPI) exist, and can be used as a base for further improvements.
Monitoring opportunities limited in target applications	WP7	Even if monitoring is not very useful in the target applications, the need for monitoring is well established. Since our techniques will be general, we can refocus this activity on other applications and/or domains

Open exploration platform is not taken up by external researchers (medium risk)	WP8	With feedback from the RAB we should have a clear idea what is needed for the open research platform so the RAB members would use it. Also, the use within the consortium will enable technical results within the project, even if no one else uses it.

Risks, problems and open issues will be discussed during periodic EXTRA meetings. However, as in any project with research components, there is always a possibility of reaching a stage where no further improvement can be made and the objective cannot be achieved. If this occurs during the project lifetime in any of the involved technologies, the Technical Manager is obliged to inform the Project Coordinator and trigger a contingency activity oriented to re-define the objectives of the project and, if necessary, request from the European Commission a reduction in cost due to the elimination of specific project parts, or a time extension for the accomplishment of the expected objectives.

7. References

[1] EXTRA Consortium, "EXTRA Description of Work," as in the Grant Agreement signed by the EC on June 29, 2015

[2] EXTRA Consortium, "EXTRA Consortium Agreement", finalized on November 3, 2015 and ready for signature