



IOF Major Events IT Quality Requirements

IOF IT Commission

Version 1.0, March 2018

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Executive Summary

The IT Area at an IOF Major Event is complex and demanding, more than most people imagine. The IOF IT requirements and the quality assurance framework are created to help organizers understand what it takes to set up the IT systems that are needed to achieve a successful major IOF event.

The IT Area includes timing and punching systems as well as the computer systems to process the data from these systems, and to provide results and timing data as input to IOF LIVE Orienteering, web, TV and Arena Production. The IT Area does not comprise the systems used for TV and Arena Production, but the IT Area has interfaces to those systems and is responsible for the integration.

The pre-requisites for success in the IT area are 1) well-defined requirements, 2) well-defined solutions, and 3) extensive preparations and test activities.

This document specifies the requirements that the IOF expects to be fulfilled by the organizer, and it specifies a quality assurance framework to help the organizer successfully achieve this, supported by the IOF event advising team.

The document uses a framework, a so-called reference model, to structure the requirements into well-defined groups. The specification of technical requirements in this document is supplemented with descriptions – as there is no point in setting requirements that are not well understood and make sense.

The quality assurance process for a major event starts early, more than 2 years before the event. The main keywords are: Definition, Planning, Integration and Testing. The point is to secure the solutions and to test them early. This is to avoid for example discovering too late that a planned solution turns out to be unfeasible.

The main actors in the quality assurance process are the organizer's representative (the "IT Director") and the IOF IT Assistant Senior Event Advisor (IT ASEA). The process uses milestones to help the organizer and the IOF IT ASEA monitor progress and to ensure visibility. The framework is not a ready-made recipe – it must be adapted to the event.

This requirements document does not state whether or not to outsource individual tasks to external service providers. However, it is pointed out that regardless of whether tasks are outsourced or taken care of by the organizing crew, the organizer is overall responsible for the complete solution, including the so-called integration: Making sure that all the components that make up the IT Area can work together.

1 Introduction

1.1 Context

When an organizer of a Major IOF Event is appointed, the IOF and the National Federation of the organizing country signs a contract for the Event. The standard contract refers to a number of documents describing in details what the IOF expects from the event. This document, the IT Quality Requirements document, is one such document. It describes the IOF's requirements related to IT aspects.

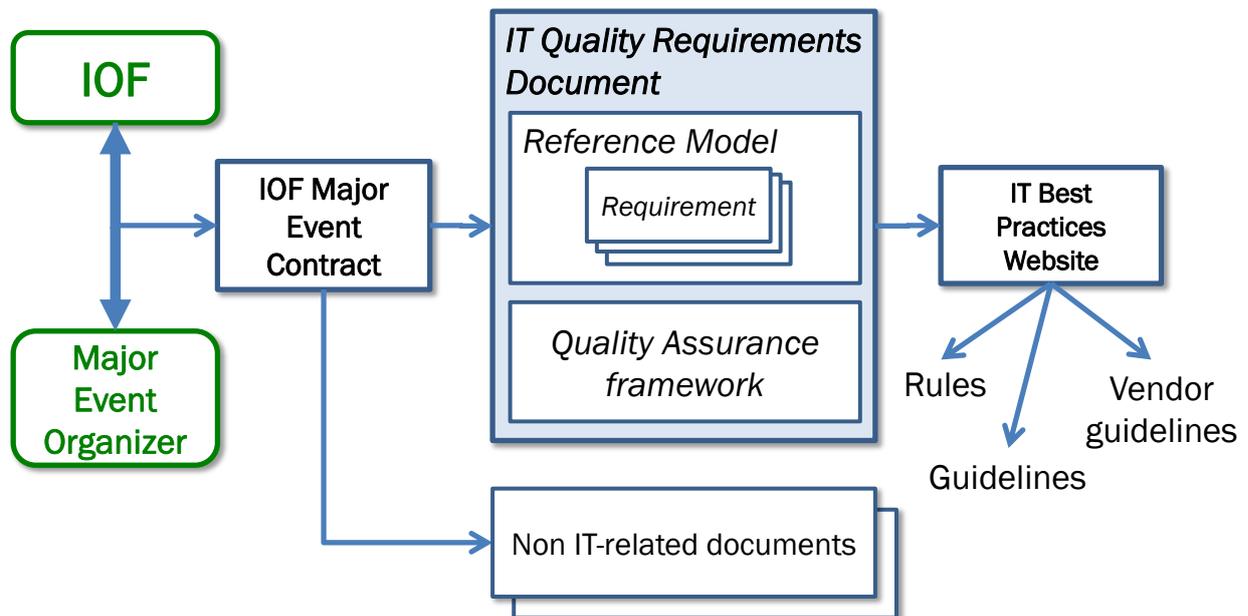


Figure 1: Requirements Document context

This document contains a set of IT related requirements, and it contains a description of a quality assurance framework intended to help ensure that the IT requirements are fulfilled and to achieve a successful event.

There may be many ways to fulfill the requirements. This document does not describe in detail HOW to achieve this. A companion website, "IT Best Practices", complements this document, and contains a collection of best practices, acting as an "umbrella" with links to rules, guidelines, vendor guidelines etc.

1.2 Purpose of this document

The IOF's goal is to stage top-quality orienteering events. IOF wants a consistent quality level at IOF major events.

Why are requirements needed?

- First, because Quality is about how well requirements are fulfilled. Without requirements, it is not possible to measure quality.

- The conditions of organizing the IT area of a major IOF event are significantly different from those of organizing a local or national event.
- For most events, the IT area must support one or several Live productions (Results; GPS; Arena, Web or TV production). The technical challenges in setting up the IT systems suitable for an arena production are significantly different than those for setting up punch checking and results posting at a local or national event. The effort needed is disproportionately larger.
- There are significant costs involved in the setup. For example, it can be expensive to ensure sufficient internet connectivity to a remote arena. Lack of funding is a risk factor. Understanding IT requirements help in assessing the budget, and IT requirements may affect important decisions not directly related to the IT area.

A successful outcome depends on awareness of these factors throughout the event organization.

1.3 Scope

The requirements in this document apply for Major IOF events, defined as World Championships (WOC), Junior World Championships (JWOC) and World Cup Events (WCup) and World Masters Events (WMOC). The requirements are applicable to all orienteering disciplines.

This document has emphasis on events where live media production is required, as these events must meet the highest standards.

Events without media production, such as WMOC, has a different setup. For such events, reliability requirements stated in this document apply, as do punching and timing requirements.

It is stated in the IOF contract what level of Production is required. Terms used in the table are explained below in section 1.4.

1.4 Terms and Definitions

<i>Best Practice</i>	A method or technique that has consistently shown results superior to those achieved with other means. Best Practices are the recommended ways to achieve the best results. Best Practices documents for the IT setup are collected in the “IT Best Practices” documentation on the IOF website.
<i>GPS Tracking</i>	A selection of athletes (possibly all) are given a GPS to carry in a dedicated vest, which transmits the position of the athlete every few seconds. It enables a visualization of which route choices are taken, the speed of the competitors and where they do mistakes. A GPS

	Tracking system consists of the GPS devices, data servers and visualization software.
<i>Guideline</i>	A guideline is the term used for the description of a best practice method that is recommended but not required
<i>IT Area</i>	The IT Area include timing and punching systems as well as the computer systems to process the data from these systems, and to provide results and timing data as input to IOF LIVE Orienteering, web, TV and Arena Production. The IT Area does not cover the systems used for TV and Arena Production. A detailed definition of what constitutes the IT Area can be found in section 2.2.
<i>IT ASEA</i>	IOF IT Assistant Senior Event Advisor. Member of the IOF Event Advising team. The role is defined in the IOF Event Advising structure.
<i>Live Results</i>	A service that delivers updated, unofficial results from the finish, and possibly at intermediate controls, continuously during the event, with a very small delay (5-60 seconds).
<i>Major IOF Event</i>	Major IOF events are: World Orienteering Championships, Junior World Orienteering Championships, World Cup events and World Masters Orienteering Championships
<i>Media Production Quality Levels</i>	Media Production Quality Levels are defined in section 4.
<i>Quality Assurance</i>	Quality assurance (QA) is a way of preventing mistakes and avoiding problems during the execution of the competition event. QA is focused on the process leading up to the event, providing confidence that quality requirements will be fulfilled
<i>Reference Model</i>	The Reference Model is a diagram that defines the decomposition of the IT area into sub-areas, and identifies the important interfaces between these sub-areas. The requirements in this document are structured according to the Reference Model.
<i>Requirement</i>	Constraint, demand, need or parameter that MUST be met or satisfied. IT requirements described in this document are normative and must be fulfilled
<i>Rule</i>	The term rule is used when referring to text stated in the IOF Competition Rules relevant for the event. Rules are normative

1.5 Structure of this document

This document has two main objectives:

1. Requirements Specification

What is required?

To describe IOF's requirements related to the IT area of a major IOF event; i.e. the standards that IOF expects. This document is normative for these requirements.

2. Quality Assurance Framework

How to ensure that the requirements are met?

To set up a quality assurance framework to help stakeholders ensure that the required standards are met.

For events, where the IOF contract refers to this document, the text in this document is normative. As a companion to this document, documentation on best practices on implementing IT at IOF events can be found at the IOF web site.

The intended audience is: Event organizers, Event advisors (SEA and IT ASEA), the IOF organization, and vendors of services and equipment.

1.5.1 Requirements scope

The requirements specification covers the competition related IT aspects (related to the actual competitions) and is centered on two aspects. 1) The competition aspect: Producing correct competition results, and, 2) The spectator production: Producing exciting live experience for spectators.

The requirements focus on the competition day aspects: Timekeeping, punch checking, arena network infrastructure, radio times, results, integration with Media Production, integration with the online service "IOF LIVE Orienteering", and related aspects.

Some pre-competition day and post-competition day aspects are described: Handling of entries, start lists and final results; tasks that involve importing from and exporting to IOF Eventor.

The use of IT for the following purposes are outside the scope of this document: Booking of accommodation/transport, production of information material, course planning, and spectator race IT.

The detailed aspects of video production (for arena, internet and TV) are also outside the scope of this document.

The requirements specify what the expected "output" is from the IT area. However, there is no point in setting such requirements without explaining the background, so the

requirements specification also provides sufficient background information for the reader to understand why each given requirement has been set.

The requirements are specified in section 4.

1.5.2 Quality Assurance

Planning the IT area at a major IOF event is long process that must start at a very early stage in the overall event preparations.

Quality assurance in this context is about the preparations needed to ensure that all systems are working properly and can fulfil the requirements set, when they are expected to, on the competition day.

This document describes a Quality Assurance framework aimed at helping the involved parties in ensuring that this can be achieved.

The basis for the QA framework is the QA process for the IT area requirements. The rationale is that quality assurance must be done in a manner – and at a point in time – where it is still possible to take action to find and implement an alternative solution if it turns out that the planned implementation is not possible or does not fulfil requirements.

2 Overview

The message from this section is that the competition day IT setup is a complex collection of individual components. The IT preparations for a major IOF event – as for any event – is an Integration task to ensure that these components work together as a whole. It is important that the setup works reliably and that contingency plans exist. There are clear guidelines on what is most important in case a prioritization has to be made.

2.1 The Integration Task

The IT area consists of a large number of sub-areas, such as punching, time-keeping, and TV graphics. Each individual sub-area may seem straight forward. However, when considering the IT area as a whole, the complexity grows quickly.

An organizer needs to decide how to handle each sub-area (e.g. punching). Some sub-areas may be contracted to a third-party service provider, while others may be handled by a volunteer crew using equipment already available.

Different factors, such as access to competent people, or funding, may decide. However, sub-areas cannot be dealt with individually. For example, a given punching system may work only with certain results processing systems, or a given time-keeping system isn't able to integrate with the TV graphics system.

All of the sub-areas must work together. To make sure this happens on the competition day is a significant “integration” task.

Regardless of what decisions are made regarding each sub-area, it is the organizer's responsibility that the complete IT setup works. The organizer must ensure that the requirements for each area are fulfilled and that the integration sub-area is done so that all the components are tested together.

2.2 The Reference Model

We need to decompose the complete IT area into well-defined sub-areas, for which requirements can be set. For this purpose, we use a Reference Model.

The reference model is shown in *Figure 2*. It is a diagram that defines the decomposition into sub-areas and identifies the important interfaces between these sub-areas. The diagram also shows important external areas.

A Sub-area

- defines a well-defined role/responsibility.
- has boundaries to one or more other sub-areas, and produce information (output) that is used as input to other sub-areas

- USES IT components but is not a physical IT component.
- is marked in **PURPLE** if it participates in event preparations, or post event reporting.
- is marked in **GREEN** if it participates in the live production on the competition day

External areas

- are marked **LIGHT GREEN**. These have important interfaces from the IT area, which need to be covered by the IT QA process. The detailed requirements for these areas are out of scope of this document.

Interfaces between Sub-areas

The reference model shows important interfaces. The setup for a given event may have more interfaces than those shown in the reference model.

- **ORANGE** interfaces carry radio/finish times in real-time and have time critical delay requirements
- **RED** interfaces carry time-keeping and punching data
- **GREY** interfaces carry competitor data, intermediate and final results data
- **BLUE** interfaces carry tracking information

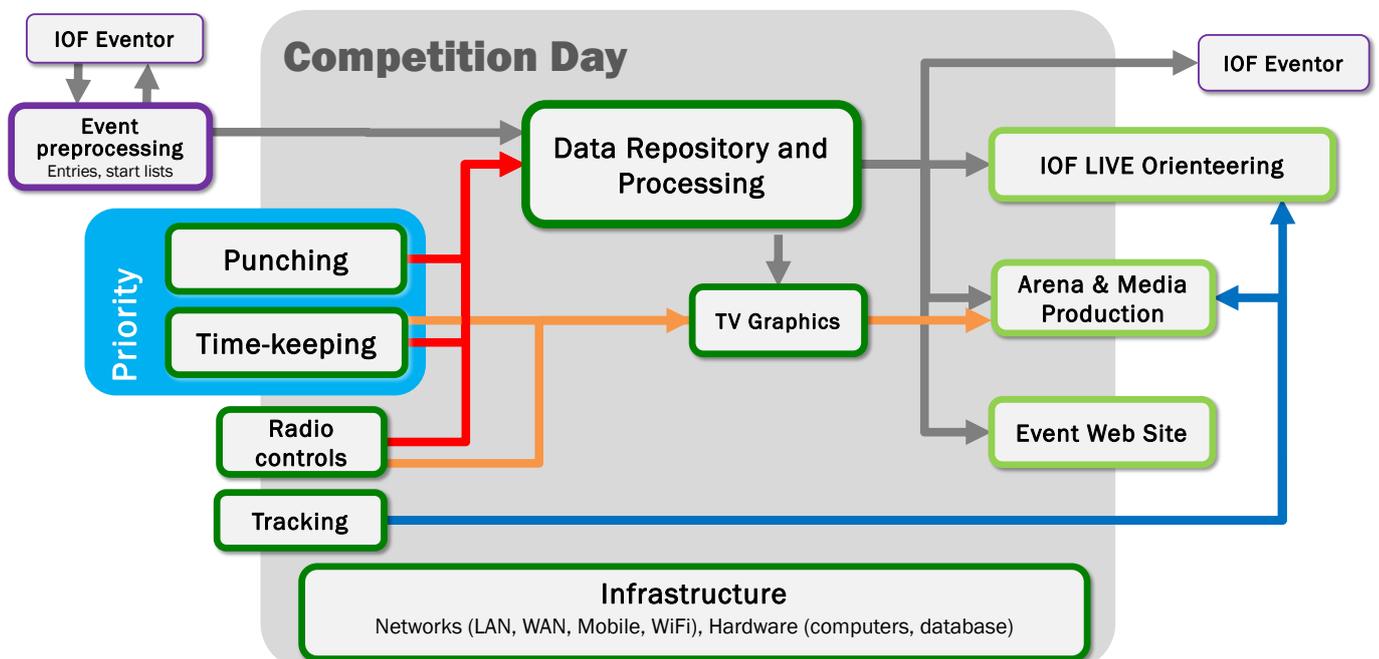


Figure 2: Reference Model

The Requirements section, section 4 in this document, is structured according to the sub-areas defined by the Reference Model. Each Sub-area is described in detail there.4 in this document, is structured according to the sub-areas defined by the Reference Model. Each Sub-area is described in detail there.

2.3 Guiding Principles

There are two important objectives, in order of priority, for the IT area. These objectives are the guiding principles behind all the descriptions and requirements throughout this document.

This section puts in perspective the two main objectives of the IT setup:

- 1. *Fair Competition for Athletes***
- 2. *Exciting Live Coverage for Spectators***

It is significant that the two objectives are listed in this order, as this is the order of priority.

2.3.1 Fair Competition for Athletes

Fair competition for athletes is the essential priority. It is fairly simple: The IT Area must produce correct results: Times and Check of Controls visited.

This aspect is characterized by: Low volume, reliability, correctness, simplicity

This means:

- Accurate and reliable time-keeping
 - Avoid incorrect placings due to inaccurate or missing times
- Reliable punching system
 - Avoid unjust and unclear disqualifications
 - Ensure equal punching conditions for all athletes
- Simple system setup
- Relatively low data volume
- No real-time requirements

Ensuring Fair Competition is a mandatory requirement. This requirement always takes priority over, and cannot be compromised by, the Exciting Live Coverage requirement.

2.3.2 Exciting Live Coverage for Spectators

Live coverage comprises Arena Production, Internet coverage, TV, GPS. Live coverage is the complex part of the setup, and it requires a wide range of complex elements.

This aspect is characterized by: Real-time, high volume, reliability, complexity.

This means:

- High data volume: Lots of information needs to be “digested” and presented
- Very complex system setup
- High real-time requirements
- No time for “outage” – there is no “second attempt”
- If a component fails, a redundant system must take over “on the fly”
- Clear contingency plans are needed

It is important to realize that live coverage is the complex part of the IT setup, and that it makes the IT setup very different for a major IOF event compared with a regular mass orienteering competition.

- Live coverage is not achieved by “scaling” the familiar IT setup from a “normal” orienteering competition.
- Live coverage implies massive, instant, real-time, requirements for presentation of competition data: radio times, results, TV graphics with running times, internet uploads, etc.

A couple of examples:

- The requirement to be able to present the competitors’ times within a fraction of a second after they finish inherently adds complexity to the finish line setup. This complexity must not compromise the reliability of the timing system and the accuracy of the finish time.
- Ensuring reliable Live Coverage aspect also significantly increases complexity of the IT infrastructure at the arena, including backup computers and backup networks.

3 Quality Assurance process

As mentioned, the IT setup consists of many dependent components that have to work together reliably. The setup must work on the competition day; there is no second chance if a component fails. Even if a single component fails, the show must go on, so back-up solutions are needed.

Quality Assurance (QA) is about preparations, testing, rehearsing and having contingency plans:

- to make sure that the hardware and software is functioning correctly
- to have backup systems for all vital components
- to make sure that the crew is trained
- to know what to do even when things do not go according to plan.

It is essential to be prepared – and be prepared in time. It is pointless to discover a problem if it is too late to fix it. Equipment must be tested, and procedures must be rehearsed well in advance of the competition day, in a setup as similar as possible to that of the competition day.

Implementing the IT setup is a complex and lengthy process. Planning cannot start too early! Preparations start several years before the competition.

3.1 QA process

The QA process is designed to make sure preparations are made in a timely fashion; and that planned solutions are verified at a point in time that allows for contingency plans.

The QA process starts as early as possible, and no later than approx. 2 years in advance of the event.

Each IT sub-area described in the reference model shall be covered by the QA process. The principle is that the QA process has a timeline with milestones. In general, each IT area has at least 4 milestones:

- a. High-level solution proposal,
- b. Detailed solution proposal, and
- c. Solution verification. (Including dry test of contingency plans)
- d. Final integration test (Full dress rehearsal with actual equipment)

The detailed contents of the QA plan depend on the chosen solutions, so what is described here is a reference plan.

REQUIREMENT: The organizer shall – with this description as a reference – put together a QA plan specific for the event, covering the various competitions included in the event. The QA plan must specify, for each milestone, the criteria that must be met.

REQUIREMENT: As the initial step in the QA process, it shall be agreed with the IOF and documented what is to be provided by the IT area.

REQUIREMENT: To monitor the QA process, the progress shall be continuously documented in a QA document. This document shall be reviewed with the IOF IT ASEA at each milestone.

3.2 Actors

The main actors are the organizer, represented by the IT Director, and the IOF Event Advising team, represented by the IOF IT ASEA.

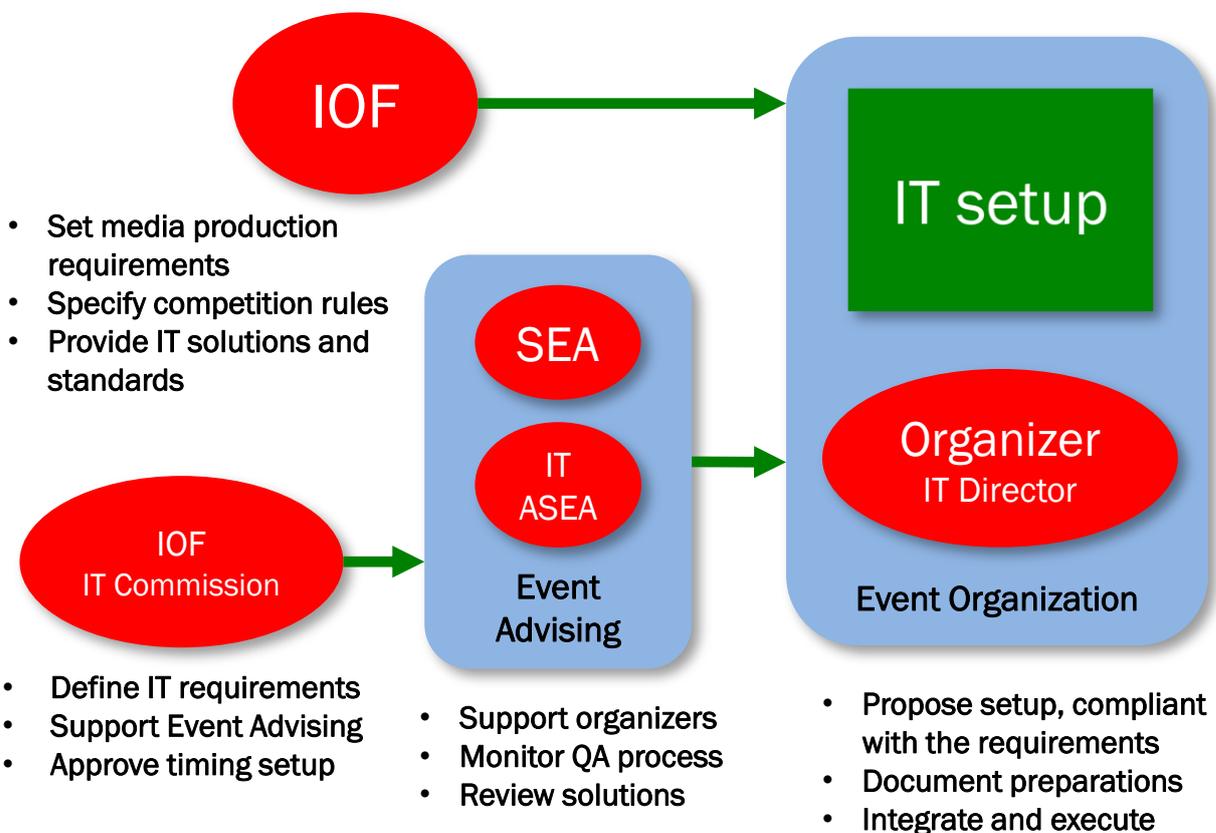


Figure 3: Quality Assurance process actors

The IOF IT ASEA works in close cooperation with the IOF SEA and the rest of the IOF Event Advising team. The Event Advising team draws on support from the IOF organization, in particular the IOF IT Commission and the relevant discipline commission.

The organizer is represented by the IT Director, who must be appointed early on, and who is the organizer’s main point of contact to the event advising team.

The IT Director is the organizer’s “project manager” in the IT area. The IT Director drives the integration of the IT setup. To help ensure quality, the IT Director “populates” the QA framework and uses the IT ASEA as sparring partner.

3.3 Milestone A – High Level solution

This is the initial milestone for each sub-area. At this milestone, the organizer presents a high-level description of how the sub-area is to be covered, with indications of how each detailed requirement is to be fulfilled.

The organizer and the IT ASEA review the documentation and decides on any adjustments, then agree on the further process.

3.4 Milestone B – Detailed solution

This is the second milestone for each sub-area. At this milestone, the organizer presents a detailed description of how the sub-area is to be covered, with indications of how each detailed requirement is to be fulfilled.

If the sub-area is to be covered by a third-party service provider, the service provider contract shall contain this documentation and be signed.

The organizer and the IT ASEA review the documentation and decides on any adjustments, then agree on the further process.

3.5 Milestone C – Integration

This is the third milestone for each sub-area. At this milestone, the organizer presents how the solution for the sub-area has been integrated and tested.

Integration shall include live tests of each sub-area and include dry test of contingency plans.

The organizer and the IT ASEA review the documentation and decides on any adjustments, then agree on the further process.

3.6 Milestone D – Rehearsal

This is the final milestone for each Sub-area. At this milestone, the sub-area has been integrated and tested together with the Sub-areas that it interfaces to. The tests can be referred to as “dress rehearsals”, meaning that the tests are performed in a live environment similar to the competition day, and that hardware and software used for the tests are the same as will be used during the competition day.

3.7 Time Plan

Figure 4 is a sample Time Plan. As mentioned, for the actual event, the organizer together with the IT ASEA creates and agrees on a time plan and on the exact contents of

each milestone. The integration activities need to be coordinated with overall event planning. A template for the time plan and the milestone contents can be found in the best practices documentation.

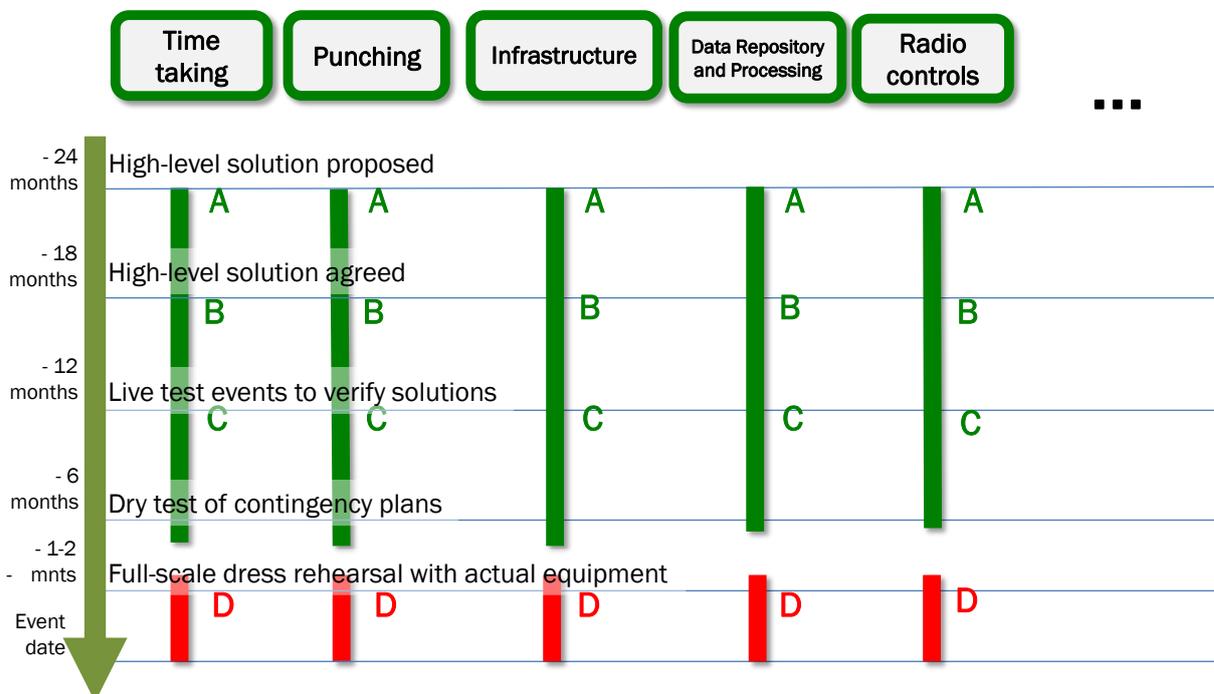


Figure 4: Sample time plan

The sample time plan above shows all sub-areas having their milestones aligned at the same point in time. In reality, some sub-areas need to start earlier than others, so milestones may not always be aligned.

3.7.1 Live test events

Live test events are required to verify the solution for each of the IT sub-areas. Such events shall be competition events where IT solutions can be evaluated at conditions as similar as possible to the IOF competitions. The test events shall also be used to evaluate the integration between the systems used.

This shall take place at least 12-6 months before the event.

3.7.2 Dry test of contingency plans

Preparations must include contingency plans that describe how to deal with failures, and preparations are not complete without testing contingency plans.

Contingency plan testing can be carried out as “dry tests”, i.e. tests with full setup of equipment and software, but without live competitors.

This shall take place approx. 6 months before the event.

3.7.3 Full-scale dress rehearsal with actual equipment

The full-scale dress-rehearsal shall include the complete IT area setup. It is optional if the non-IT related aspects of an arena production are included.

The exact set of hardware and the exact software versions that are to be used during the event must be tested at the dress rehearsal. If any issue arises that necessitate a change, such a change must be done with utmost care and must be tested.

4 Media Production Requirements

The below table summarizes the standard contractual requirements. Organizers may choose to deliver more functionality than the contractual requirements, and if this is the case the additional functionality provided is subject to the requirements in this document.

Media production requirements		FootO	MTBO	SkiO	TrailO
Major IOF events	WOC	Live TV - TV Quality Arena production	Live TV - Web quality Arena production	Live TV - Web quality Arena production	Arena commentator production
	World Cup	Live TV - TV Quality Arena production	GPS tracking Live results	GPS tracking Live results	Arena commentator production
	JWOC	GPS tracking Live results	Arena commentator production	Arena commentator production	Arena commentator production
	WMOC	Live Results	Arena commentator production	Arena commentator production	Arena commentator production
	Regional Championships (championship classes)	If part of World Cup, see above If not part of World Cup, Arena Commentator Production			Arena commentator production
	Regional Championships (other classes)	n/a			n/a
	World Ranking Event	Arena commentator production			Arena commentator production

4.1 Definition of Media Production Quality Levels

Arena commentator production An arena commentator production is a sound production that is made primarily to be live on the arena. Normally, a commentator production requires this:

- a producer and mixer service of the sound
- an English and native language speaking commentator
- an English and native language speaking expert

Variations:

- The commentator production can be broadcasted on Live Orienteering as a Live web production with the commentator sound and no moving images.

Arena production An arena production is a moving image production that is made primarily to be shown on the Arena on a big screen as a service to the local audience. Normally, a full arena production requires this:

- 1-8 live cameras with non-TV quality
- a producer and mixer service of the sound and live cameras
- an English and native language speaking commentator
- an English and native language speaking expert
- Map and route choice graphics producer
- Split time graphics setup
- GPS graphics producer

Variations:

- The arena production can also be broadcasted on Live Orienteering as a Live web production (or vice versa).
- An arena production can be downsized to the absolute minimum; only a commentator, one camera and no advanced graphics.
- For bigger events (FootO WOC): the arena productions always differ from the TV production by having other commentators, focusing on the local audience and having other commercial graphics.

Web stream production A web stream production is a moving image production that is made primarily to be shown on LIVE Orienteering for a global audience. Normally, a full Web stream production requires this:

- 1-8 live cameras non-TV quality
- a producer and mixer service of the sound and live cameras
- an English and native language speaking commentator
- an English and native language speaking expert
- Map and route choice graphics producer
- Split time graphics setup
- GPS graphics producer

Variations:

- A Web Stream production can be downsized to the absolute minimum; only a commentator, one camera and no advanced graphics.
- A full web stream production, with a higher number of cameras, can be provided as a paid service on LIVE Orienteering.

TV production A TV production is moving image production that fulfils all requirements for a full Web stream production plus:

- TV quality on cameras and graphics productions (10-14 cameras)
- Several groups of TV commentators
- More requirements on getting the TV/Web stream signals from Arena to TV companies and LIVE Orienteering

Variations:

- A TV production can be provided as a paid service on LIVE Orienteering.

Live GPS Tracking production The Live GPS Tracking production can be two separate productions:

- A production that feeds GPS-tracking images to a TV or Web stream production
- A production that feeds the Map and Live GPS tracking on LIVE Orienteering. This is a personalized live service where a user can choose to follow one or several athletes live GPS tracking on the competition map.

Live results production A live results production requires this:

- Start, split and finish times are reported from the timing and punching system.
- The times are visualized and automatically updated in a viewer on LIVE Orienteering.

5 IT Area Requirements

This section contains the requirements specification for the IT Area. It is structured according to the Reference Model.

Each **Sub-area** in the Reference Model has its own section, which includes

- a description of the sub-area
- the main requirements to the Sub-area (“black box”)
- the detailed requirements to the Sub-area (“white box”)
- the relevant rules in the IOF competition rules to be fulfilled

For each **Interface** between sub-areas is included

- a description of the “information flow”
- possible requirements

In addition to specifying requirements for each Sub-area, section 5.1 describes the overall reliability requirements.

5.1 Overall Reliability

Punching and Timing systems must function with no outage.

- This means that these systems must be extremely resilient.
- Systems must be protected by backup systems of similar quality as the primary system.
- How and when to use the backup system, must be planned and tested

For the live presentation, effort must be put into ensuring that “the show CAN go on” even when a single component fails.

- This means that the system vital for live coverage must be designed with redundant components running in parallel, with “swap” to a backup system if the primary system fails. In other words: There shall be a “System A” running the presentation, and a “System B” also running live, ready to take over.

Contingency plans are needed: When the competition is on-going, time cannot be stopped, and there is no “second chance” to start over the presentation:

- Procedures need to be defined for the failover process
 - what other components are influenced?
 - which interface has to be redirected? (system A to B)
- Failure scenarios must be tested and rehearsed in advance.

- Results calculated by “system B” must be identical to those calculated by “system A” (when both systems are healthy)

5.2 Infrastructure

The requirements below depend on what the event shall provide. If no media production is required, only a subset of the requirements is applicable.

Purpose:

The infrastructure sub-area provides the platform and infrastructure that enable other IT sub-areas.

Sub-area Description:

The Infrastructure sub-area is responsible for

- providing a highly resilient computing environment for the critical IT functions in the arena.
- providing connectivity in the arena, and between the arena and the outside world.

Infrastructure is needed:

- to provide a resilient computing environment for critical applications in the arena. This is critical to fulfil the no outage requirement.
- to connect computers used in the arena with each other and with the internet to connect to external services.
- by tracking devices to connect to the mobile network to send position reports for competitors.
- to allow spectators to connect their personal devices to the internet to follow the live coverage.
- by the press to connect to the internet to report from the event.

The computers and local area network must be extremely resilient to failure. An independent backup computer system and network must be able to take over, should the main system fail.

Providing connectivity to an arena far away from public infrastructure can present a challenge, both in terms of internet connectivity and mobile network connectivity.

Mobile data networks are normally not dimensioned to cater for the need at a major event.

For tracking, mobile data network coverage is needed for the entire competition area, and sufficient capacity is needed for the tracking devices to connect and transmit data.

There may not be sufficient mobile network capacity to cater for spectators using mobile internet connection. Spectators may exhaust mobile network capacity, leaving no capacity for tracking. Providing Wi-Fi connectivity to spectators is a means to lower the

pressure on the mobile network. This requires connectivity to the internet of sufficient capacity, and an arena infrastructure with access points for the spectators.

The Infrastructure area covers:

- Resilient computer set-up at the arena
- Resilient mains power supply
- Internet connectivity to the arena
- Wireless internet access at the arena
 - spectators
 - press and media
- Mobile data network coverage for the competition area

5.2.1 Detailed Requirements

Slogan	Resilient Computing Environment
Why	To produce correct and fair results. To provide continuous live coverage.
Requirement	The computing environment must be operable during the entire event without outage.
Description	Separate Primary and Backup computer systems, with separate databases, on separated networks, able to continue during a mains power outage, must be used.
QA	At milestone D, the setup must have been tested

Slogan	Resilient Mains Power Supply
Why	Reliable power supply is required for vital IT components during the event
Requirement	Uninterrupted local power supply to all vital IT components in the arena. Separate local power distribution for primary and backup computer systems Power supply for IT infrastructure separated from power supply for other functions (e.g. event office, press, shops and catering).

Description	Sufficient power capacity must be ensured for each area: timing and punching systems, database and backup systems, network. Eliminate single point of failures. Ensure that it is possible to isolate parts of the distribution network in case of component failure.
QA	At milestone D, the setup must have been tested

Slogan	Fail-safe local area network
Why	To provide continuous live coverage
Requirement	Avoid service outage due to network issues
Description	Eliminate single-point-of-failures. Use a network topology that allows separation of network segments serving non-critical and critical computer systems, in case of network issues or network overload. Establish a safe network environment with no access of unauthorized users The local area network for the IT system shall be a wire based network. If there is a need for a wireless network segment - this must be a separate wireless network without public access and with its own channel.
QA	At milestone D, the setup must have been tested

Slogan	Separate internet connections
Why	To secure that arena production and press have sufficient capacity
Requirement	Internet connection from arena must have separate bandwidth allocations for <ul style="list-style-type: none"> • Media production access to web and streaming servers • Spectators • Press
Description	Separate network/connections, or a well-configured network with different Quality-of-Service (QoS) for different user groups
QA	Start preparation with the internet provider a year before the event

Slogan	Wireless network for spectators (internet)
Why	Spectators try to connect to the internet - to post news in different channels or to follow the on-line coverage. When spectators connect via the mobile network at the arena - the mobile network easily overload, blocking access for tracking or data from intermediate controls.
Requirement	Provide public wireless internet access with sufficient capacity.
Description	Setup a high-capacity wireless network. Provide sufficient internet access capacity for this network. Provide sufficient access for a large number of devices. Assume that each spectator has at least one device that needs to connect. Spectators may crowd in some locations at the arena - a large number of access points is needed.
QA	Test the setup at Milestone D

5.3 Timekeeping

Purpose:

To provide a correct result list, based on reliable, fair and accurate start- and finish times

Sub-area Description:

Timekeeping is responsible for recording the competitors' times when crossing the finish line. When 0.1 second timing is required, timekeeping is also responsible for recording the start times. Start and finish times are delivered to Data Repository and Processing for calculation of results.

In order to produce a result list, we need correct timing by recording or knowing the start time and the finish time of each runner.

This area is in part regulated by the competition rules §22-24. (2017, MTB, Ski & Foot-o)

For a major IOF event, the timekeeping solution must be on the list in the document "Proven timekeeping solutions in orienteering", be approved by the SEA after consulting with the IT Commission, or approved by the IT ASEA.

In an event with a direct Media Production, the results must be provided to the TV graphics system correctly within 500 ms of the competitor crossing the finish line. Otherwise, up to 5 seconds delay is acceptable.

5.3.1 Detailed Requirements

Slogan	Approved Timing System
Why	To ensure fairness, timekeeping must be accurate
Requirement	<p>An IOF approved timing system shall be used, appropriate for the format and category of the event. The vendor’s instructions must be followed.</p> <p>The timekeeping process shall fulfill the requirements regarding resolution and accuracy of the discipline stated in the applicable rules.</p> <p>The proposed solution shall be proven timekeeping solution, and be approved by the IT ASEA or IT Commission, at Milestone B.</p> <p>The rules regulate that accuracy must be at least twice as good as the precision.</p>
Description	The rules regulate that Sprint competitions may present results with 0.1s precision, if proper equipment and procedures are in place. All other competitions shall present the results with 1s precision.
QA	<p>The proposal must be evaluated by Milestone B, and the setup must be tested by Milestone D.</p> <p>We strongly recommend outsourcing the operation of this service if there is a TV broadcast.</p> <p>The timekeeper must document a procedure by Milestone D describing how they will verify that the timing setup is correct on the competition day.</p>

Slogan	Instant TV Graphics
Why	The result must appear instantly on TV. The viewer expects the time to stop when the runner crosses the finish line.
Requirement	Maximum latency from a runner finishes to the tv graphics have the result: 500 ms
Description	<p>The system and interface must be designed for working with TV.</p> <p>There is a possibility to switch to a manual backup system, especially in a first-to-finish competition. It is possible to fulfill the requirement with a radio-based system, but a cabled system will usually be faster and more resilient.</p> <p>In some cases, the data from the timing components have been sent in parallel to the TV graphics and the results system for orienteering, in order to fulfill the latency requirement for TV.</p> <p>If methods that involve polling, periodical exports etc. from the results system are used, it is very difficult to reach the quality requirement.</p>
QA	<p>Test the setup at Milestone C.</p> <p>It is too late to find out that the integration does not work at Milestone D, as the development of a tv graphics integration can take several months.</p>

5.4 Punching

Purpose:

To verify that competitors have visited all controls in the correct order

Sub-area Description:

The Punching sub area is responsible for the entire punching system, including: competitor equipment (electronic punching cards), control units, read-out units, and other equipment needed for punching system operation.

The Punching sub-area provides data to Data Repository and Processing about the status of each competitor.

The punching system must be reliable to give the correct information that the runner visited all controls on the course in the correct order.

5.4.1 Detailed Requirements

Slogan	Approved Punching System
Why	<p>Verify that the competitors completed the course.</p> <p>Provide competitors' punching data for Data Repository and Processing</p> <p>Readout of punching information from punching system has to function within seconds</p> <p>Fast evaluation of punching information after finishing of runners</p>
Requirement	<p>An IOF approved punching system must be used.</p> <p>The vendor's guidelines for handling must be followed.</p>
Description	<p>Consult with vendor of the chosen system to get advice about handling the system</p> <p>Interface from punching system to Data Repository and Processing must be automated to evaluate the punches immediately after the competitor has crossed the finish line</p> <p>When immediate readout fails - punching data has to be secured - punching cards have to be collected and processed on backup systems</p> <p>Instructions for the operating crew of the system (preparation, course setter, start, finish, data processing)</p>
QA	<p>A first test event should be conducted prior to Milestone C to get familiar with the system.</p> <p>A live test must be conducted as Milestone D. (through some weeks before the event to have enough time for corrections - the IT ASEA must be informed about the results of the test)</p>

5.5 Tracking

Purpose

Give spectators the opportunity to see what the runner is doing

Sub-area Description

Sub-area Tracking covers real-time collection of position data (tracking data) for competitors

Presentation in real-time of tracking data is an essential element in arena, TV, and internet transmission.

Tracking data is also used to assist the TV crew in timing transmission from TV controls

For visualization in a TV broadcast, using a proven system is essential. A skilled operator who also knows how to “tell the story” is crucial to make a high-quality production.

5.5.1 Detailed Requirements

Slogan	Tracking Data
Why	Needed for Arena Production, Media Production and IOF LIVE Orienteering
Requirement	Collect real-time tracking data for competitors. Present real-time tracking data on a background map.
Description	
QA	Verify the GPS coverage throughout the competition terrains. Live test events to ensure equipment and system in advance of real competition

Slogan	Network coverage
Why	Needed to collect real-time tracking data
Requirement	Reliable mobile network coverage and data capacity throughout the competition area
Description	Network coverage and capacity is not a given. Test coverage with actual devices to be used throughout the competition area. Work with network operator(s) to reserve data capacity. The cost of an extra GSM base station is very high, 10.000-50.000 EUR. Sometimes a foreign SIM-card that is roaming on all available operators can be the best solution.
QA	Start as soon as competition areas are decided

5.6 Event Preprocessing

Purpose:

- Make competition ready to start
- Get correct start lists according to the IOF rules and Guidelines

Sub-area Description:

- Import entry data from IOF Eventor to Data Repository and Processing
- Get all necessary data in place in Data Repository and Processing (define Competition, Classes, Courses etc.)
- Make start draw and produce start lists
- Upload start lists to IOF Eventor

5.6.1 Detailed Requirements

Slogan	Import data from IOF Eventor
Why	All entries to the competition are done in IOF Eventor. These data are needed to conduct a start draw and produce start lists.
Requirement	Import entries to the Data Repository and Processing, according to instructions from IOF.
Description	Define Competition, Classes, Courses etc. in Data Repository and Processing Import entry data from IOF Eventor Conduct a start draw according to IOF Rules and Guidelines
QA	Prepare the process by checking/testing format compatibility (example entry data from Eventor to be imported into Data Repository and Processing) Manually check that all controls, courses, competitors and associated e-card etc. are correct Manually check if start list is according to IOF Rules and Guidelines Test runners verify that all data are in place before the competition start

Slogan	Export start lists to IOF Eventor
Why	Officially publish start lists

Requirement	Upload start lists to IOF Eventor
Description	According to instruction in the document: “Import data to IOF Eventor via IOF XML v3.0”
QA	Prepare the process by checking/testing format compatibility, for all types of competitions (individual, relay, sprint relay etc.) Start lists are successfully uploaded to IOF Eventor

5.6.2 Interface Specification: IOF Eventor - Event Preprocessing

Purpose:

- Import entries from IOF Eventor to Data Repository and Processing
- Export final start lists to IOF Eventor

Interface description

- IOF XML v3.0 (format)

Instruction of how to import entries from IOF Eventor, and how to export start lists to IOF Eventor, can be found at the Best Practices documentation

5.7 Data Repository and Processing

Purpose:

The Data Repository and Processing sub-area stores competitor and competition data during the competition. It collects competition data in real-time, and it ensures that data is available in real-time for the presentation systems, media production and on-line services.

Sub-area Description:

Before the competition, the Data Repository is populated with competitor data and course data from event pre-processing and competition data.

During the competition, this sub-area handles

- reception of times from radio controls and finish
- reception of punching information
- processing of incoming data and updating of the competitors' times and status

- production of competition data for media production and on-line results

The sub-area must produce final result lists immediately after the competition

- Export results to IOF Eventor

The area has interfaces to the following sub-areas:

- Event Preprocessing: Import of registration data, course data, start draws
- Punching: Read punching data to evaluate punches for the runners according to their course
- Time-keeping:
- TV graphics, Speaker and Arena production, IOF Eventor, IOF LIVE Orienteering, Event website
- IOF LIVE Orienteering
- IOF Eventor

IOF Eventor takes care of WRE and World Cup points calculation.

5.7.1 Detailed Requirements

Slogan	Produce Final Result Lists
Why	Get final results by the end of the competition
Requirement	Get all data needed to calculate results (punching and timing data) and export/print the lists immediately after the competition provide sufficient data for the live presentation systems while the competition is running
Description	<ul style="list-style-type: none"> • import data from event preprocessing • import data from the punching and the timing system • provide intermediate result data continuously • publish final results after the competition • when two systems are used - one for timing and one for punching - it has to be guaranteed that the merge of the data works without waiting time
QA	<ul style="list-style-type: none"> • establish stable connection between the systems • provide sufficient hardware (database) performance for the system • be prepared for peak load - lots of data coming into the system in a short period of time • when different systems for timing and punching are used - the merge of the data has to automatic and has to be tested before the competition

	<ul style="list-style-type: none"> Specify by whom and when the final result will be approved BEFORE the publication <p>Preferably a test event prior to Milestone B.</p>
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Slogan	Export official results to IOF Eventor
Why	To get results officially published at IOF Eventor and to get updated WRE/ World Cup standing
Requirement	Results published in IOF Eventor and WRE/World Cup standings updated
Description	Export results to IOF Eventor, according to instructions from IOF
QA	Results are published at IOF Eventor and WRE/World Cup standings are updated

5.7.2 Interface Specification: Punching - Data Repository and Processing

Purpose

Transfer punching information to the Data Repository and Processing

Interface description

The Punching sub-area collects punching information about competitors visiting controls. For each competitor, the punching sub-area produces a list of controls visited and the times for the passage. This data needs to be made available to the Data Repository and Processing sub-area.

The interface between the punching system and Data Repository and Processing must be well-defined and supported by both sub-areas.

As part of the integration process, compatibility of the systems and software versions used must be ensured and tested.

The data shall be transferred without delay when the competitor has passed the finish line.

5.7.3 Interface Specification: Timing - Data Repository and Processing

Purpose

Transfer timing information to the Data Repository and Processing

Interface description

Finish time data must be transferred to Data Repository and Processing. In case the competitor has a start “window”, also the exact start times need to be transferred.

The timing system and Data Repository and Processing must be compatible, and work for the configuration and versions you need

Processing shall not be delayed by the interface

5.7.4 Interface Specification: Data Repository and Processing - IOF Eventor

Purpose

This interface transfers final results information to IOF Eventor.

Interface description

Results must be exported to IOF Eventor according to the document "Import to IOF Eventor via IOF XML v3.0"

5.8 Radio/Intermediate Controls

Purpose

To support live coverage of what happens when the runners are in the forest, the passage times for competitors at intermediate controls are transmitted to the arena in real time.

Sub-area Description

The sub-area Radio Controls is responsible for complete handling of radio-controls, including equipment, communication and delivery of intermediate times to Data Repository and Processing and TV Graphics.

For the TV producer, intermediate controls are crucial in order to do a proper production, because it is used to prioritize and choose which control, runner and situation to show - and when.

5.8.1 Detailed Requirements

Slogan	Intermediate results to spectators
Why	To provide the intermediate results during the competition
Requirement	Results must be available within reasonable time for the speaker system (5s), and for live results on the web (10-30s).
Description	This can be achieved automatically with systems based on GPRS or radio, if there is coverage in the forest.
QA	Verify coverage if any radio-based system is proposed. The placement of intermediate controls should be planned together with any arena or TV production. Test by Milestone D.

Slogan	Intermediate times to TV Graphics
Why	To inform the TV producer and power the TV graphics. To provide prewarning's and the intermediate results during the competition
Requirement	When there is a TV broadcast, the following requirements apply: Maximum 1s latency from a runner passes to the result is available for the TV graphics; max 5s latency for a TV pre-warning
Description	For a TV control, a dedicated link, i.e. cable, fiber or radio network etc. is necessary. GSM has not been proven sufficiently reliable. A manual procedure could be an option.
QA	Verify coverage if any radio-based system is proposed, plans for how to do cabling, and testing of the links. Integration with TV and the coverage solution should be tested by Milestone C, to have time to do changes.

5.9 TV Graphics

Purpose

TV Graphics is an overlay that is shown on top of the TV picture. It shows the name and country of the competitor in focus, and it shows a running time for the competitor, and the time to beat. The running time must stop when the competitor punches the control or crosses the finish line shown in the TV picture. The graphics shows a relevant subset of the results and continuously updates the subset to show where the competitor in focus may place and the time to beat.

Sub-area Description

A basic requirement of a sports production is correct TV graphics.

The TV graphics will only work when correct results are immediately available from the intermediate controls and the finish.

5.9.1 Detailed Requirements

Slogan	TV Graphics
Why	TV Graphics is a crucial element of a TV production.
Requirement	<p>The TV graphics must be experienced by the viewer as updated immediately and correct. The TV producer and broadcasters may impose further requirements.</p> <p>The TV Graphics is based on the database of all athletes, combined with radio times and finish times from the timekeeping.</p>
Description	<p>The TV graphics provider is usually chosen by the producer, and the graphic design may be a cooperation between IOF, the producer and broadcasters.</p> <p>The TV graphics may integrate live with the Data Repository, but there are several ways of achieving graphics within the required latency.</p>
QA	Verify that the chosen solution has been used/tested and approved by the producer, and that there is a validation plan for integration with time keeping. Any new system must be planned and developed several months ahead of the competition,

	Systems testing and acceptance testing at latest by Milestone C.
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5.9.2 Interface Specification: Radio Controls - TV Graphics

Purpose

The interface between radio controls and TV graphics must deliver intermediate times together with an identification of the runner with a latency of at most 1 second.

Interface description

This interface must be agreed upon between the TV producer / TV technical team and the radio control group. The two most common integrations are a direct interface to the Data Repository, or to integrate directly with the system collecting radio times.

A manual generation of split times at the radio controls might be an acceptable solution, and could be required by the producer as a backup.

5.9.3 Interface Specification: Timing ->TV Graphics

Purpose

The interface between the finish timekeeping and TV graphics must deliver intermediate times with a latency of at most 500 ms

Interface description

This interface must be agreed upon between the TV producer (/ technical operations manager) and the time keeper. The two most common integrations are a direct interface to the Data Repository, or to integrate directly with the finish clock.

5.9.4 Interface Specification: Tracking ->TV Graphics

Purpose

Visualize the course and the athletes with GPS tracking on TV

Interface description

This interface must be agreed upon between the TV producer / TV technical team and the GPS provider. Commonly this is implemented with the GPS client software running on a computer, and the output is captured and converted into a format suitable for the video mixer. Usually this is an DP/HDMI to SDI converter, but NDI capture has also been used.

5.10 Arena and Media Production

Purpose

The Arena and Media Production is a part of the task to provide coverage to spectators. This includes coverage in the arena as well as TV broadcast or streaming internet coverage. This task is not directly the responsibility of the IT area. The IT area is responsible for providing essential data for this task.

Sub-area Description

Arena and Media Production Quality Requirements for are described in section 4

5.11 Event Web Site

Purpose

- Provide the public information about the Event
- Promote the event and the sport to the general public
- Fulfill obligations to the sponsors and partners
- Provide live results to be linked to from IOF LIVE Orienteering

Sub-area Description

The Website is not a compulsory, but a desirable tool provided by the Organizer, which does not substitute IOF Eventor or IOF LIVE Orienteering (and vice versa); it can be used as an additional communication channel and platform for provision of information and promotion of the Event.

When implemented, the Website becomes an important part of overall presentation and vision of the Event, so it's improper performance could seriously damage the image of the Event and the sport in general.

A nice, attractive web site is important, but useless unless the visitor can find important info about the event: how to get to there, find the start list, news about the profiles participating, links to live coverage, etc.

The Website content could be split into two parts: a "static" one, which provides general info about the Event and the competitions; while Live part is dealing with an ongoing competition news and results. The results there could be also published with some existing 3rd parties' solutions.

5.11.1 Detailed Requirements

Slogan	Always accessible
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Why	Major IOF events are the subject of high-level public attention, so the pick access requests could overload, slow-down or even shut off the service
Requirement	The Website could be easily accessible at any condition and stage of the Event/competition; possible exceptional downtime management shall be addressed and its duration shall be minimized
Description	<p>Several technical parameters should be considered: Internet provider bandwidth, the technology/environment used, capacity of the servers; as well as available reserves of the service providers and their ability to handle unplanned load and situations</p> <p>Previous organizers and/or service providers for the similar events should be contacted to ensure correct understanding of the load and technical requirements</p> <p>As most optimistic as possible requirements should be developed and discussed with the involved service providers, ensuring all participating parties are correctly understand and ready to fulfill them</p> <p>A possible unexpected additional demand and situations should be evaluated and addressed</p> <p>A proper regular backup process should be established and operated, as well as a restoration procedure, in case of a failure.</p>
QA	

Slogan	High quality, Adding value
Why	While put in place, the Website becomes a focal point of the public attention, forming perception of the Event and the sport in general
Requirement	The Website should be of superior quality; providing its users with necessary info, promoting the Event and raising overall profile of the Orienteering
Description	<p>Studying, evaluating and documenting requirements, for both design, the content and its management</p> <p>Involving experienced and skilled staff for development and support</p> <p>Adequate testing of the solution</p>
QA	

5.12 IOF LIVE Orienteering

Purpose

Provide key live information on the same well-known web resource, maintained by the IOF

Sub-area Description

IOF LIVE Orienteering is a payed event solution that provides:

- embedded GPS tracking
- embedded video/sound streaming through live stream
- link to other live information (live results, etc.)

IOF LIVE Orienteering does not substitute the organizer's web page or vice versa, it is an addition to that.

The IOF LIVE Orienteering service is maintained by IOF; however, the organizer must provide all necessary data for its proper work. The current list of maintained services and description of interfaces to IOF LIVE Orienteering must be checked and agreed in advance with IOF Office.

5.12.1 Detailed Requirements

Slogan	Proper presentation of live data
Why	Presenting live results, tracking and other information from the event to a wide public audience over the internet is an IOF commitment and standard as well as a public expectation, which must be fulfilled
Requirement	Provide timely and correct live result-, intermediate-, tracking data and speaker's voice to the IOF Live Center service
Description	Timely and correct live data from timing, results, intermediate controls, tracking system, speaker, arena production Stable internet connection for the IT system(s) with enough bandwidth Functioning interfaces between all relevant system(s) and IOF LIVE Orienteering
QA	Check that the required interface standards are met well before the competition

	Run tests to verify the data exchange processes well before the competition
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5.12.2 Interface Specification: To IOF LIVE Orienteering

Purpose

Provide live results

Interface description

IOF LIVE Orienteering live results are provided by the organizer and linked into IOF LIVE Orienteering