Adopting Integration; what it means, getting started and the challenges that this creates.

Summary

There are major problems being experienced in large scale IT programmes due to poor integration and hence there is a need for a discipline of Integration that will address these problems. The Integration discipline needs to embody a diverse set of organisational and operation principles for it to succeed. In adopting and sustaining an Integration discipline there are four major challenges to be overcome. These are in the areas of politics, organisation and mobilisation, analysis and planning and ensuring effective on-time execution. Each challenge has its own characteristics and an associated set of principles that can help overcome the challenges.

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1. Introduction

This is the second in a series of articles on the topic of Integration. The first article in this series [reference 1] discussed how IT projects experience major problems as a result of integration problems. It went on to introduce the concept of having Integration as an organised, planned and staffed practice focussing on prevention and rapid cure of integration issues. Readers who have not done so are advised to read this original article before proceeding with this one.

This article now considers what it actually means to have a "lets become integrated as soon as possible" approach and then considers the main challenges faced when adopting approach. It explains the important characteristics that must be present in practices that embody this approach. It then focusses on the four main challenges that must be addressed to successfully introduce and operate such an approach. This is presented in five sections covering:

- The nature of an effective Integration discipline.

- Challenge one - the political and cultural environment.

- Challenge two - organisation and mobilisation.

- Challenge three - analysis and tasking.

- Challenge four - effective on-time execution.

2. The nature of an effective Integration discipline: what is a "lets become fully integrated as soon as possible" approach?

If it is recognised that there is an integration issue and that something has to be done about it then the question remains; what to do? What will address this problem? Obviously we think the answer, or at least a major part of it, lies with incorporating Integration into the process; but what does that mean?

The concept of Integration

To address the problem a discipline of Integration is added to the programme's activities. This involves the use of resources, management time, schedule time and system / environment time to do stuff that will tackle the integration threat. There are two aspects to this.

The first aspect is the embedding into the programme of a set of preventative and curative integration tasks along with the tasks necessary to prepare adequately for each of these primary tasks. These tasks need to be focussed on the main integration risks. Their job is to intercept development activities to prevent integration faults from being created and delivered within the system. Where this fails their job is to detect diagnose and eliminate them as quickly as possible.

The second orthogonal aspect is establish the right organisational structure and mind set to permit these tasks to be done effectively. Actually this second element is the most fundamental and is the most important to get right. With the right organisation and culture the selection and execution of tasks will emerge organically. Without the right structures no effective Integration can occur.

These two aspects are embodied in a small number of principles that are the dominant factors in creating an effective Integration discipline. An organisation that builds an Integration discipline using these principles will be on the road to success. One that ignores them will not achieve the improvements they are aiming for.

Fundamental principles of Integration

Effective disciplines are founded on sound principles. It is important to understand and apply the principles that will make Integration effective. The principles are more important than the detailed practices and processes which can vary from environment to environment. The Tier One Integration principles are presented in Table 1.

Table 1: Tier One Principles	
P-1	Integration can only be done effectively whilst all of the key contributors and leaders are convinced of the need to do it and to do it right. So the principle is that the wider organisation must be convinced of the need to adopt the Integration discipline.
P-2	Burden sharing is essential and integration tasks need to be performed by the most appropriate part of the wider organisation. Integration is a shared cooperative activity and not an activity for one part of one organisation.
P-3	The role and nature of the integration activity must be recognised, accepted and fully supported by all of the organisations and functions that success depends upon. Commitment from all parties is vital. Failure to achieve the necessary commitment or to work towards common goals will result in failure.
P-4	The remit of Integration is to get things working as rapidly as possible; not to wait till a system with problems is delivered, find a problem and then to wait for someone else to diagnose it and address it.
P-5	To be effective Integration has to focus as much on prevention as it does on detection and cure. Without effective prevention the frontline integration activities will become swamped. That said; expect to do and prepare for a lot of curing.
P-6	Whilst prevention is a priority there will always be problems and the so Integration must plan and prepares to make effective progress when problems are encountered. The Integration team expect to 'debug' and prepare for this. They expect to need to workaround problems until they are fixed. They don't expect things to go to plan but they need a plan; they need a plan that is inherently flexible and adaptive.
P-7	Integration is a technical activity that requires a diverse team with comprehensive understanding of the technical architecture and of the technologies in use. The team needs to be self contained and able to deal with technical issues rapidly. It cannot wait for external support on key technologies or design issues as this would cause delay.
P-8	The team needs the right skills, tools and equipment to operate effectively. Missing skills and inappropriate dependency on ad-hoc arrangements or on external support will introduce crippling delays. Failure to provide or prepare tools in advance will result in further delays once work reaches the state where the tools are needed. It is better to have a tool ready that is never needed than to have a need and no tool.
P-9	Timely decision making is required when fundamental problems that block progress are identified. Rapid resolution of design and implementation issues must be embedded into the Integration activity. The team must be empowered to make or drive these decisions.
P-10	Preparation is everything. The team must be a team and not a collection of individuals by the time the real works starts. Knowledge must be developed and shared. The operation must be planned in advance, all necessary infrastructure and tools must be in place and wherever possible the operation should be rehearsed.
P-11	Integration needs to be introduced incrementally. Do not be over ambitious on early cycles. Limit the scope, the resources and the promised benefits on the first cycle. Grow incrementally cycle on cycle until the optimum level of investment is reached. Be aware of the law of diminishing returns; there will reach a point where further effort on integration is not justified.

Table 1: Tier One Principles
P-12   The investment in integration must reflect the benefit delivered. Monitor the returns achieved and adjust subsequent cycles accordingly. The next cycle may warrant more or less effort expended on Integration. As the supply chain improves solutions may come together smoothly. On the other hand a major technical change may warrant further effort.

Summing Up

The Integration discipline involves the adoption of relatively novel approaches not traditionally seen in complex IT programmes. It requires collaborative working across supplier teams. It requires a risk mitigation approach; work out where things are likely to go wrong and focus on prevention and preparation to cure. The essential features of an Integration discipline are embodied in the principles of Integration. The more effectively these principles are applied the more effective will Integration be.

3. Challenge One - The politics of integration.

Good ideas are fine but implementing them in the real world is complicated by all sorts of issues like funding and politics and people having far too much to do and alternative agendas and differences of opinion and contractual arrangements. Attending to these issues at the start of the process is very important. Success depends upon this being a joint enterprise involving all of the key parties working to a common purpose.

We want to be working with the converted and committed!

The initial hurdle is gaining general acceptance that Integration is a necessary evil. Do not be surprised to have to deal with the argument that goes:

If things go well in the normal processes then Integration will not add anything; it is a waste of money, of time and a distraction for overloaded resources that could be doing useful work. If things do go wrong then we will sort them out.

The obvious response is that this is exactly the mind set that creates the problems that need to be tackled. However a more conciliatory approach may be necessary.

A decision to do Integration is a decision to do something that Tom Demarco and Timothy Lister described as a Risk Mitigation Activity in their book on risk management [reference 2]. It is an upfront investment to reduce the impacts of something that might happen. Experience here shows that in the integration domain we could justifiably substitute "is highly likely to" for "might". It is necessary to win people over, to convince them that mitigation is worth doing. A argument to be made that there will be an overall benefit from investing in Integration. The more resource that it is proposed to invest on an untested approach the harder it is to make a convincing argument. This tends to favour incremental adoption; only investing more effort when benefits have been demonstrated.

As to the parties that need to be won over. Firstly there is the Programme Manager or Programme Management team. Hopefully that might be you; the reader. Assuming we have converts there then who else needs convincing? The simple answer is all parties that will be required to be involved in planning, preparing for and delivering both prevention and cure activities. That can be a lot of people in many diverse organisations and teams. They all need converting.

When we have done we will have converts in many disciplines; programme managers, technical architects, delivery managers, development leads, infrastructure specialist, developers, requirements leads, test managers, designers, testers and end users. We need to convert the leaders and the doers in each area. Some will be active participants, some will need to engage with, work alongside or support a new discipline and a new step in

the delivery dance. Once people are convinced of the need for something better and understand the benefits we then have the right environment in which to practice Integration.

You can't ignore commercial issues.

Much as we may want to we can't ignore the fact that where the are different organisations involved there will be commercial factors to be considered. The cooperative nature of integration blurs boundaries creates unpredictable, unseen and potentially inappropriate migration of costs. It can transfer risk from one organisation to another and it can mask where contractual responsibilities sit. Again these are factors that must be recognised, fully understood and tackled or avoided if Integration is to be a success.

One final point. Though these issues are raised as factors that come into play where commercial arrangements are involved they can also surface in large organisations where there are effectively separate units that operate on a quasi commercial basis.   In such situations they need to be treated as if separate companies were involved.

Principles to overcome political issues.

Table 2 lists principles that address concerns related to the political environment that Integration is to be applied in. Whilst they generally remain relevant during the ongoing delivery of Integration they are particularly important during the early adoption of it as a new discipline. Applying these principles will hep to ensure that political issues do not derail the efforts to introduce Integration.

Table 2: Tier Two Principles: Establish the right environment	
P-A1	Explicitly tackle the political issues around adopting Integration as part of the process. It involves investment of time and resources and changes to the way things are done. If the political element is not tackled it will fail.
P-A2	Understand and monitor the level of belief in Integration present in each key player and each team involved in or touched by Integration.
P-A3	For each function that should contribute to or support the integration activities understand and monitor both its willingness to and its ability to contribute the necessary resources.
P-A4	Consider any commercial and contractual factors that could inhibit what can be achieved. Address them or recognise them as limitations.
P-A5	Ensure the ambitions for Integration and the plan of what is to be undertaken reflect the reality of the belief and commitment of the parties involved and any other limitations.
P-A6	Adopt an incremental approach to build more belief and more commitment and hence more scope to operate based on a demonstration of effective results.

Summing up.

Recommending compliance with the principles listed in Table 2 is about as far as we can go in this article on suggestions for overcoming political and commercial issues. This really is an area where each case will be very different and the people involved will need to work out how to apply these principles and other measures to best effect to ensure that Integration has comprehensive support across the organisation.

4. Challenge Two - Organising and mobilising for Integration

Generally existing organisations by their very nature will not provide a suitable structure for delivery of effective Integration. Remember that one of the principal sources of integration issues are problems that span the boundaries of existing organisational units. So once the political environment is receptive it is necessary to address the issue of getting the right organisation in place. Once the desired organisation is understood there is also the challenge of mobilising the people to turn it from a theoretical organisation into a functioning entity. These topics are discussed in this section.

How do we marshal and organise our troops?

We do not have and cannot conceive of a simple cookbook guide "How to organise Integration". The challenges vary so much from programme to programme and from organisation to organisation. As we look at different cases we will see varied structures and we will find teams with similar names that have very different functions, strengths and weaknesses. In some cases the challenge to integrate a system will sit within one company or department with a coherent leadership function; in others it will span boundaries between companies and units directed by different leaders with different objectives.

This diversity makes it impossible to define a prescriptive organisational approach. It just would not work well in all but a few cases. As with any endeavour the organisation and plan need to be built to match the mission and the environment[1]. Again to assist we have to move away from prescription and look at generally applicable principles.

Organisation principles

Effective Integration depends on small teams with focussed objectives. Furthermore it is the composition of the team that determines whether or not it is capable of delivering the necessary tasks within appropriate time frames. Table 3 lists the principles that lead to an organisation able to deliver Integration.

Table 3: Tier Two Principles: Organising and mobilising	
P-B1	Use virtual teams to glue the organisations together and bring all the necessary skills and knowledge to bear on the problem. Integrate the organisation before attempting to integrate the system.
P-B2	Build on a core team to provide a common established approach and ensure the work is organised and driven.
P-B3	Use experienced respected people to ensure the teams are credible and effective.
P-B4	Involve key players so that they support the wider effort.
P-B5	Ensure teams are teams in more than name gaining the massive increase in effectiveness that a team has over a collection of individuals.
P-B6	Mobilise and sustain for the full campaign to get effective delivery of preparation activities and follow-up activities which are essential if the core integration is to be a success.
P-B7	Align small teams with the risk profile to allow the team to focus and to provide each with a clear set of objectives.

[1] A recurring source of failure, particularly in the software industry, is an attempt to take an off-the-shelf method, the latest "silver bullet" and apply it unchanged when it does not fit the organisational structure, the problem to be solved and the dynamics of the operation.

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Table 3: Tier Two Principles: Organising and mobilising
P-B8   Respect natural leadership and team dynamic constraints to ensure the team remains coherent and effective.

Getting the troops mobilised is important and can be difficult.

It is all well and good specifying on paper the virtual teams and the membership of the teams however that does not mean the teams exist in the real world. People will have established remits and well established calls on their time. New demands on their time to do novel things will tend to be low on their priority lists. Each time a cycle of Integration starts there is a need to ensure each of the teams actually mobilises and does the work allocated to it. During the first few cycles as Integration is being introduced this will be a big challenge.

Mobilisation needs to be managed; it is not safe to assume it is happening. Assumptions lead to the shocking discovery that two months into the implementation cycle and three weeks from component delivery a virtual team has done no material work.

Principles to ensure mobilisation

Mobilisation is evidenced by two things.   Firstly confidence that the members of the team are functioning as a team and secondly the appearance of the material outputs required by the project. The team building aspects are discussed here; the generation of the right outputs at the right time is discussed later in this article.

The overarching principle is that teams must have formal kick off events and that the operation of the team itself should be monitored to ensure that it survives and does not disintegrate. The principles given in Table 4 break this down into the next level of detail.

Table 4: Tier Two Principles: Organising and mobilising
P-C1   Hold a formal kick-off session for each team on each cycle to mark the start of operation of the team on the new piece of work.
P-C2   Work with the team lead to actively manage the mobilisation of the teams ensure team members apply the attention and time required to the objectives of the team.
P-C3   Work with the team lead to actively monitor the operation of the team. Monitor the occurrence of team activities and the participation in these activities. Look for signs of decay.
P-C4   Identify where external factors are inhibiting the participation of an individual and tackle the issues. Options for tacking this type of issue include removing the obstacles, replacing the team member or reshaping the teams work so that individual is not required and can be removed. Reshaping may involve transferring responsibility to another team or it may mean explicitly taking an item of work that should be done out of scope.
P-C5   Identify reluctant participants and respond to this reluctance do not ignore it. Options for tackling reluctance are to replace the individual, to change their mind or to reshape to remove that teams need for an person in that role.

Summing up.

The importance of correct organisation and effective mobilisation can not be over emphasised. Getting the right organisation operating in the real-world is the biggest single contributor to success. The right people in the right groups with the right remit makes all the difference. Furthermore in light of its importance the principles around organisation and mobilisation are discussed in more detail in a separate article in this series [reference 3].

5. Challenge Three - Working out the right things to do and working it out early enough.

It is vital to identify the right things to be done. It is also vital to do this early enough in the delivery cycle to allow activities to be effective. It is unfortunate to identify that a design walkthrough needs to be orchestrated two weeks after the implementation of the design has started. Both of these matters are challenging; particularly when adopting the practice for the first time. The timing issue is particularly problematic as the there may be a perception that integration activities only start when the components are delivered and that is long way off.

This section describes the framework that can be used to ensure these aspects are managed.

How do we identify what to do?

Determining what should be done is not just a matter of what could be done it is also a matter of rating the relative merit of each item. There will always be more that could be done than can be done with the people and time available. This can be hard for experienced teams. For organisations that are trying Integration for the first time it is more problematic. Without prior knowledge of the art of the possible and without experience of what works and what doesn't in a particular organisation it is even more difficult to decide what to do. New starts run the risk of being late in deciding what to do and of picking the wrong things to attempt.

Principles that assist in identifying the right tasks.

Table 5 list the principles that help to ensure the right tasks are identified and selected. This table does not attempt to catalogue specific types of Integration tasks. Rather it outlines the framework around their selection. Separate sources describe the types of tasks that can occur within an Integration cycle.

Table 5: Tier Two Principles: Identifying what to do	
P-D1	Integration as a whole needs a clear remit; one that is clear to all involved and to the wider community participating in the programme. It is important that it is very clear what it covers and what it does not cover. The remit needs to be tight and focussed on preventing Integration issues sinking the programme. Integration should not become a name used for a wider ad-hoc collection of activities. There should be a written remit or brief that summarise what Integration is and what ir is not.
P-D2	Integration task selection must focus on risk. There must be explicit identification of he sources of integration risk. They must be ranked. Tasks to tackle them are generally planned starting with the highest ranked risk.
P-D3	Task selection needs to address prevention and cure. As much if not more attention is given to actions that will prevent problems being present in the delivery as on actions that will detect and remove problems.
P-D4	Identify preparation tasks in detail. Tasks can not be executed effectively and quickly without adequate preparation. Preparation needs to be done in advance; not when the primary task is due. Identifying what to do must also identify all of the preparation required to support the task.

When should we identify what to do?

Identification of integration threats and the selection of the tasks to address them needs to be done early. Why? Firstly because some of the most effective things that can be done are only effective if they are actually identified and done early. This characteristic means that missing the boat is easily done. Secondly they it needs to be

done early because the time taken to get ready for some Integration tasks can be significant. If they are not identified early enough then there will not be time to prepare and things will not be ready in time.

How early is early? This is quite a complex issue. There are four factors to be considered (a) the point when implementation design will start, (b) the point when deliveries for integration will commence (c) the point at which the high level design is available and (d) the point at which the programme should achieve Convergence [reference 4]. Factors (a) and (b) work to bring the scheduling of the analysis forward.

- Integration mainly works with the detail of how things will operate. It is interested in high level architectural designs but the it takes a major interest in detailed design and beyond. So identification of the tasks that form the Integration workload need to be complete before much of the implementation design has started. The reason for this is that some of the identified tasks may aim to intercept and influence or oversee these implementation designs. Once the designs are done the opportunity is lost. So this dependency around (a) indicates the end date of the Integration analysis should be some time before the planned start date for implementation designs.

- Integration works intensely on the delivered components. This work has a long chain of preceding work. Everything that is to be done to the delivered system should have been defined, planned, prepared and rehearsed by the time the components arrive. So this relationship wants the initial analysis to be done in time for all of the preparation to be completed in time. However as the length of time required for preparation is not known until the analysis is done. So this dependency around (b) requires a safety first approach; the start date for the analysis needs to be at the very start of the project.

It can be seen that these two factors drive the scheduling of Integration analysis to be as soon as possible. As early as possible to reduced the impact of preparation time and offers the best chance of being complete before implementation design commences. In contrast to factors (a) and (b) the nature of (c) and (d) work to delay the analysis.

- Firstly there is (c) and the need for the high level design to exist. Integration is about putting together the bits that the design partitioned the system into and making them work together as intended. Integration analysis is about identifying the risks in that and mitigating them. Until the high level design exists this cannot be done. So the earliest that the analysis can start is when the high level design exists.

- The second factor that pushes for delay is (d) a dependency on Convergence. Having the high level design is one thing; but if that design along with the project requirements, delivery schedule, test plans and budget are not all aligned then what is to say it has any validity? A lack of alignment between any two or more of these key elements may mean change[1]. The design may change to save time or cut costs or to meet some requirement. Therefore care needs to be taken not to expend too much effort on the analysis in areas where there is a significant likelihood of change.

So with two factors pushing for a starting as early as possible and two pushing for delay what is the best time to carry out the analysis? Generally the optimum time for performing the analysis for the programme is around the time that Convergence is being achieved[2] The exceptions are where it can be seen that this is too late for one of the other constraints; when implementation design will start sooner or when it is obvious there will not be enough time to prepare before delivery. When this happens then consideration should be given to performing time critical parts of the analysis earlier. If this does not work then the full analysis may have to be done and any changes addressed with a rework of the analysis.

How do we ensure the analysis is done on time?

Knowing when the analysis should be done does not mean that it will be done in time. There are many tasks in projects and programmes of work that have well known deadlines. They still miss them. Why is the Integration

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[1] In fact the Integration work and plan itself also needs to align wit the other elements. If the best fit plan that can be developed leaves major integration threats untreated due to some external constraint then it can be argued that the programme has not converged.

[2] In some case it may be possible to partition the system and as each area converges undertake the analysis for that area.

analysis task, or any Integration tasks for that matter, going to be different? Why does it always hit its deadline? The answer is that left to its own devices it will not be any different. Left to its own devices it will be later or on time but partial; just like the other tasks in the programme. Intervention is required to ensure progress.

The analysis activity needs active delivery management. What this actually means depends upon the scale and complexity and difficulty of the analysis tasks. The more there is to do, the more people that are involved and the harder it is to do the more closely it will need managing. The fundamentals involve identifying what needs doing, working out the rate at which it needs to complete, ensuring visibility of actual progress and a feedback loop to address slow completion.

Principles that assist on-time completion.

This article is not about effective delivery management; however Table 6 list a small number of principles that lead to an ability to provide effective delivery management on an activity.

Table 6: Tier Two Principles: Ensuring on-time completion of the analysis	
P-E1	Clearly scope the work to be done. Do this early enough so that on-time delivery can be planned and sufficient resource applied.
P-E2	Partition the work into separate final deliverable items. Where appropriate identify intermediate deliverables that contribute to the final deliverables. Allocate a value to each item so aggregate output can be tracked.
P-E3	Define objective measures of the completeness and quality of each deliverable.
P-E4	Establish, maintain and clearly publish the time window within which the work should be performed. This is a joint responsibility between the people doing the work and the sponsor of the work. Have off set windows for different aspects of the work. This provides clarity on start dates; people know if they have not started that they are behind. This provides clarity on end dates; people can tell if they are going to be late.
P-E5	Schedule tasks to achieve the work to obtain a plan. Plot the forecast trajectory of the cumulative value provided by completed deliverables. If the forecast does not show 80% of the value being achieved by 50% of the way through the window then either reschedule tasks or accept that the target duration is unlikely to be met. In the later case there is a need to revise plans at the parent level.
P-E6	Track actual completion value against the forecast and intervene on under performance.
P-E7	Have a competent and empowered individual responsible for delivery management. It is there job to confirm the schedule is one likely to be met, to track divergence from the plan, to ensure those doing the work do not fail to notice divergence and to intervene should intervention be required to avoid slippage in schedule, coverage or quality.

Summing up

Selecting the right tasks requires a common understanding of the remit of Integration, of the need to focus on risk and an understanding that prevention is preferable to cure and that preparation is very important. Ensuring this selection is done on time involves understanding that ideally it needs to be done as soon as possible but that this is generally constrained by the need for the programme to achieve convergence. It also involves recognising that, like any complex activity, it requires partitioning, forecasting, tracking and management if it the timescales it delivers in are to match the expectations of when it will deliver.

6. Challenge Four - Executing on-time and effectively in a hostile environment.

There is a very serious risk that the tasks selected to make up the Integration effort will not be done on time or may not be done comprehensively yet be declared finished. Whilst not unique to Integration this risk needs to be dealt with effectively else attempts at Integration will have a negative rather than a positive effect.

For Integration there are two main factors generating this risk. Firstly preparation and prevention tasks are vulnerable because if they are not done or done completely there are no immediately visible effects. These are supplementary tasks, unlike tasks that produce designs and write code, and so may be more susceptible to slip or partial completion[1]. Secondly the cure activities that identify diagnose and fix issues are always technically challenging and suffers extensively from friction, uncertainty, fluidity, disorder and complexity [reference 5]. The unexpected or the unforseen derail and delay activities far more than anyone expects.

For these reasons, particularly during initial cycles, Integration has the potential to become a failed discipline. Slippage or incomplete preparation and prevention combined with delays and problems during diagnosis and cure can mean that the entire exercise fails to deliver the benefits required to justify its application. Hence there needs to be a tight focus on ensuring the tasks selected are actually fully performed on time.

What makes for success?

We will it take as read that we have chosen the right tasks and built then into the Integration plan of work. Task identification was covered in the previous section and information on the types of tasks that make up an Integration effort is provided elsewhere. Now given that the right tasks have been chosen what else has to be done to ensure success?

Prevention and preparation activities are largely influenced by factors under the control of the teams performing the Integration. The on-time execution of these tasks have relatively few dependencies on external deliverables; in most case delays in external activities means a natural movement in the deadline for the Integration work. Their on-time effective delivery depends on the Integration teams delivering the work on-time. The main influences here are team performance and effective delivery management.

For the diagnosis and cure activities dominant factor is the nature of the environment within which Integration operates. The two most significant characteristics of the environment tends are (a) trying to work on complex software that has just come together for the first time and thus does not work and (b) highly unpredictable delivery profiles that diverge from the planned schedules. Given this success in this phase is highly dependent upon:

• Flexibility

• Preparedness.

• Aggressive front loaded delivery.

• Parallelism

In this phase of the operation the dominant factors are these approaches combined with the team performance. Traditional delivery management is less significant because of the fluid nature of the tasks and activities being undertaken.

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[1] It may seem hard to conceive that anything is more susceptible to slip and partial work than systems design and implementation tasks but sadly it is often the case that supporting tasks, for example test preparation, do suffer more than the mainstream delivery tasks. It is an interesting fact that this may go unnoticed as the impacts are less directly visible than a missing search facility on a system.

Principles for effective execution.

These issues are embodied in the principles listed in Table 7.

Table 7: Tier Two Principles: Assure delivery	
P-F1	Integration requires effective delivery management of the task set making up the Integration effort. This must cover preparation, prevention and execution. Proactive delivery management from the very start is a must. The same approaches that need to be applied to the delivery management of the analysis task need to be applied on a larger scale to the execution exercises.
P-F2	Flexible plans and adaptive behaviour are required particularly during execution, when much will not occur as external plans claimed it would, flexibility and adaptability are essential. Plans should allow for variations in the sequences in which input dependencies occur and for failures of elements of the system and of the integration of elements of the system.
P-F3	Diagnosis and cure activities need to be very flexible so that they can make progress when dependencies are not met or unforeseen dependencies are identified. A set of independent activities that tackle the problem from multiple bottom-up and top-down perspectives should be planned. Each such activity should have alternative methods planned so it is less likely to be blocked by the inevitable disorder and problems that will occur.
P-F4	Have alternative methods of achieving each technical task. There are always unforseen reasons why something that should work does not when it is applied in anger. If there is no alternative method then you are stuck. So each task or sub-task should have multiple ways of doing it identified in advance.
P-F5	Work out in advance how everything is to be done.
P-F6	Prepare everything that can be prepared. All necessary knowledge, infrastructure and tools must be in place. The only things that anyone should have to wait for are the delivery of the thing to be integrated and the delivery of any changes to it.
P-F7	Everything that could be rehearsed is rehearsed. Rehearsals identify problems that can then be fixed before they impact delivery.
P-F8	Prepare for high intensity front loaded execution. The execution plan should be prepared and the available resources matched to the tasks to be done so as to complete 80% of the integration tasks that become available for execution in 20% of the available time frame and all of them before half the time is expended. Inevitably this will slip but the aggressive plan should help to minimise the fall-out beyond the allocated window.
P-F9	Plan and organise for massively parallel activity. Ensure that it is not the availability of people, logical resources such as accounts nor concrete resources such as equipment or licenses that limits what can be done in parallel.
P-F10	Monitoring and intervention. Implement a system for detecting failing tasks and for applying effective intervention to prevent their failure. Particularly when operating at scale there will be teams with different levels of skill and experience at Integration. Some tasks may prove to be beyond the capabilities of the virtual team allocated to the task and intervention by a more senior team will be necessary to correct this.

Summing Up

Integration tasks become very critical because so much downstream activity depends upon these tasks achieving their objectives. Ensuring they are executed effectively and on-time is very important. Prevention and preparation tasks are vulnerable to being displaced by other activity with a more visible short term impact.

Primary integration tasks are vulnerable due to their technical and logistical difficulty. A combination of flexible plans, an ethos of preparation and rehearsal and appropriate levels of delivery management are needed to ensure success.

References

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Background Information

This section provides background information on SQC and on the author of this article. Readers requiring more information can visit the company web-site at www.sqc.co.uk or send a request by email to enquiry@sqc.co.uk.

Author Biography

The author of this paper is the principal consultant at SQC. His career has focussed on delivery and assurance of complex IT solutions and high risk systems. His professional career began in 1985 and over the years has spanned development, testing, test management, test automation, delivery management and programme assurance. He began to focus on testing in 1991 and spent over a decade as a lead practitioner in this field. In the four year period to the end of 2009 he was the head of integration and test for the retail arm of the principal UK telecommunications provider. In this role he not only built and managed a function with a multimillion pound annual test budget but also served as one of the main programme leads shaping and managing complex IT programmes worth hundreds of millions of pounds.

His career has encompassed a great diversity of system types, development practices, project characteristics and organisation types. It has seen him leading both technical definition and effective delivery of a diverse portfolio of activities spanning system definition, design, implementation and test. The latest phase of his career has seen him shaping very large scale IT delivery programmes, providing independent programme reviews, driving recovery programmes and building and leading an enterprise wide integration and test function.

SQC

SQC originated as a supplier of software testing services; a provider of consultancy, test management, test delivery, load testing and test automation. SQC started serving this market in 1991. The organisation's expertise and field of operation has broadened over time to include the wider programme delivery domain. Today SQC's expertise spans from Programme Assurance through Test Management and Test Delivery via specialist test automation to technical testing. In these fields SQC can provide leadership, delivery management, service delivery, associated technical services, oversight, consultancy and training.