National PRS Infrastructures

Malta Galileo Conference
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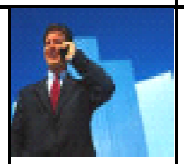
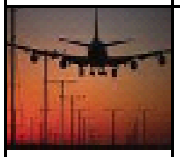
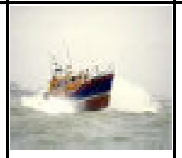
logica
space matters

What is PRS ?

Service			Receiver	Benefits	Target user groups	Availability
Open Service	OS		**Single frequency**	• **Additional satellites for better n-system coverage (e.g., deep urban)** • **Coding and modulation advances for increased sensitivity and mu-path mitigation** • **Pilot signal for fast acquisition**	• **Low end mass market (e.g., LBS, outdoor)**	**Open**
			**Double frequency**	• **As above + increased accuracy wind frequency**	• **High end mass market (e.g., car navigation, maritime)**	**Open**
Commercial Service	CS		**Double frequency**	• **Increased accuracy using additional frequencies and signals** • **Additional features under investigation (e.g., data rate capacity)**	• **Professional markets (e.g., surveying, precision agriculture)**	**Commercial basis**
Safety of Life Service	SoL		**Single frequency (Level B)**	• **As OS +** • **Integrity and authentication of signal** • **Continuity and service guaranty**	• **Aviation (en route)**	**Certified receivers**
			**Double frequency (Level A and C)**	• **As above at higher performance levels suitable for aviation (A)**	• **Maritime (C)** • **Road, Train (A)**	**Certified receivers**
Public Regulated Service	PRS		**Dual frequency**	• **As OS +** • **High Continuity (in times of crisis)** • **Improved Robustness vs jamming, spoofing)**	• **Law enforcement** • **Strategic infrastructure**	**Regulated**
Search and Rescue	SAR		**Single frequency**	• **Almost instantaneous reception of emergency calls mergencies** • **Exact positioning of emergency beacon**		**Certified & registered beacons**

The PRS System Architecture

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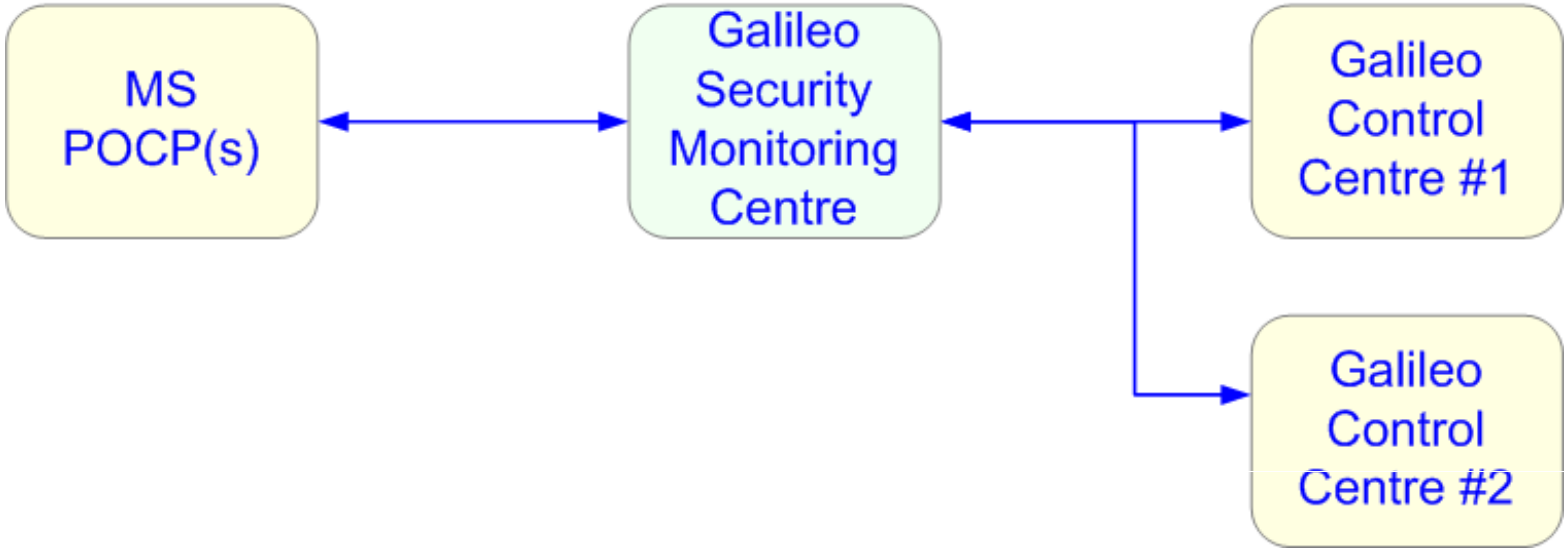
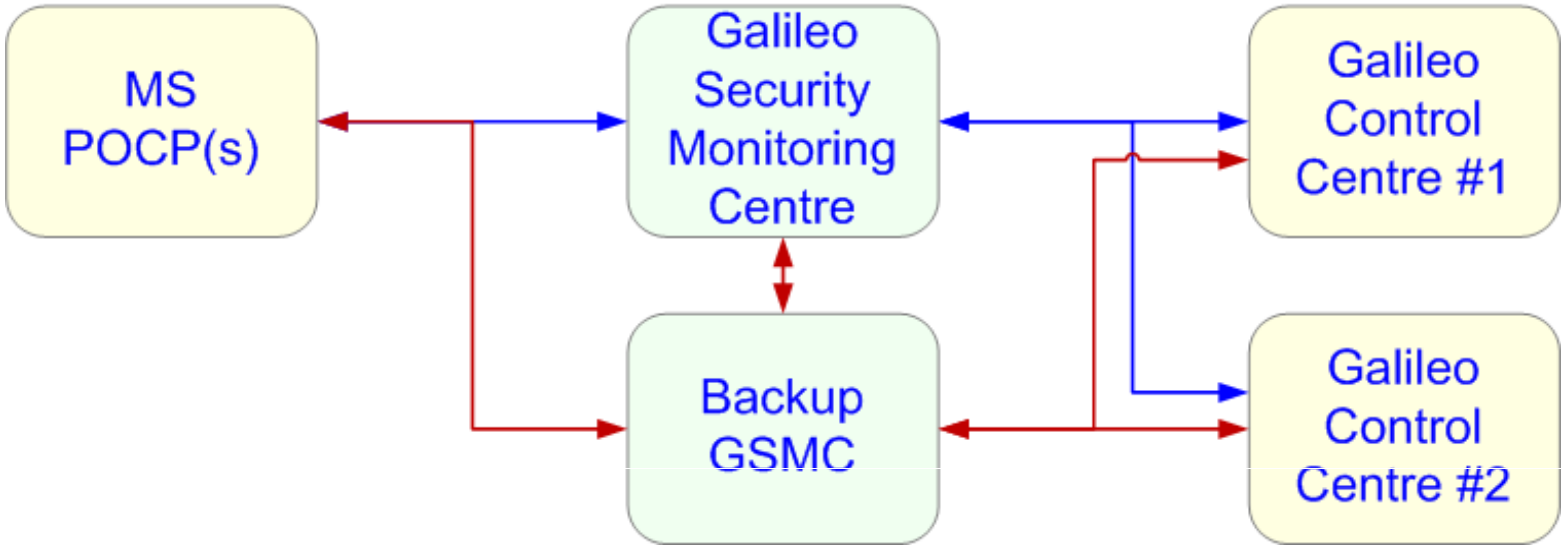


PRS System Architecture



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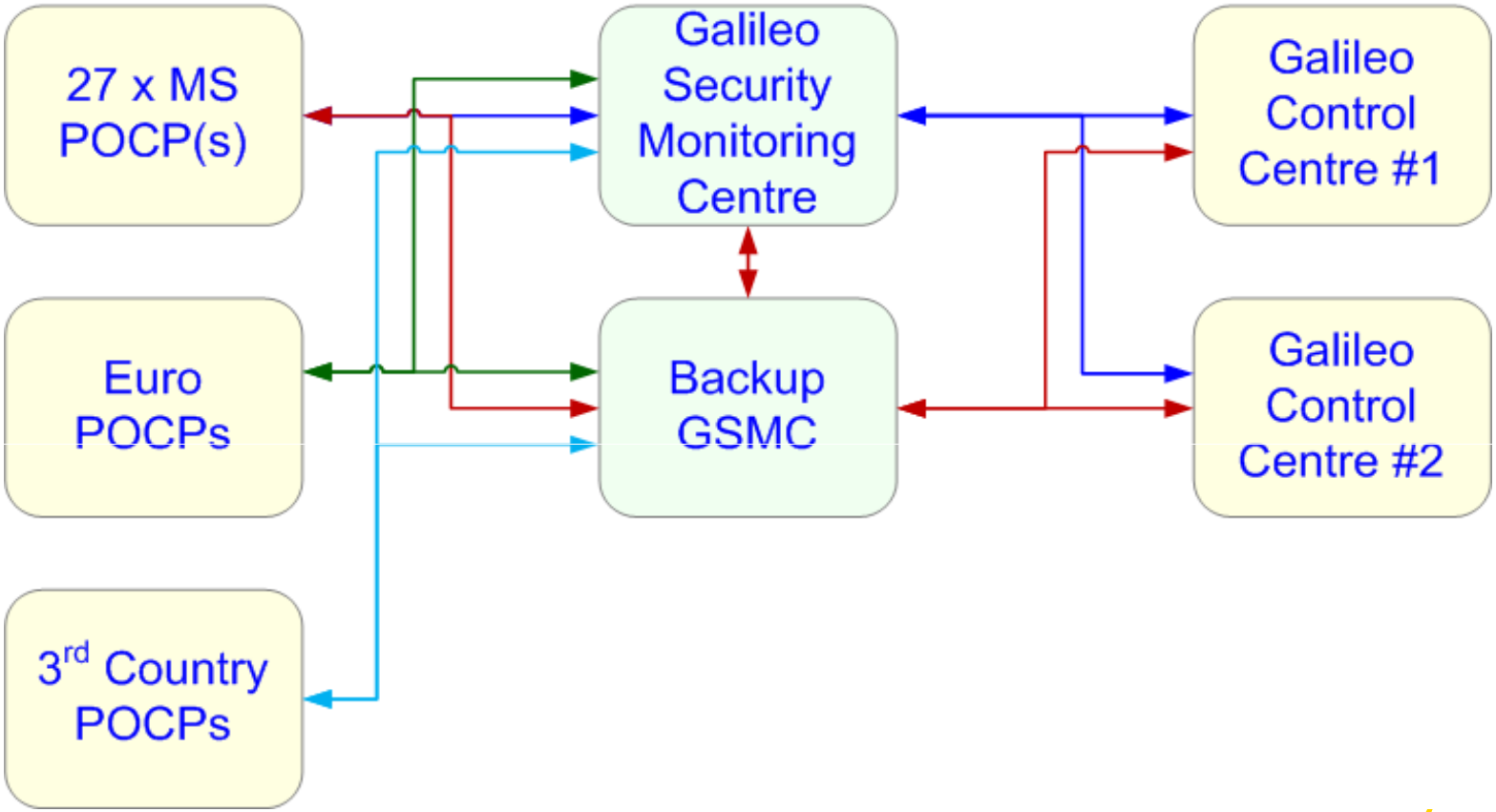

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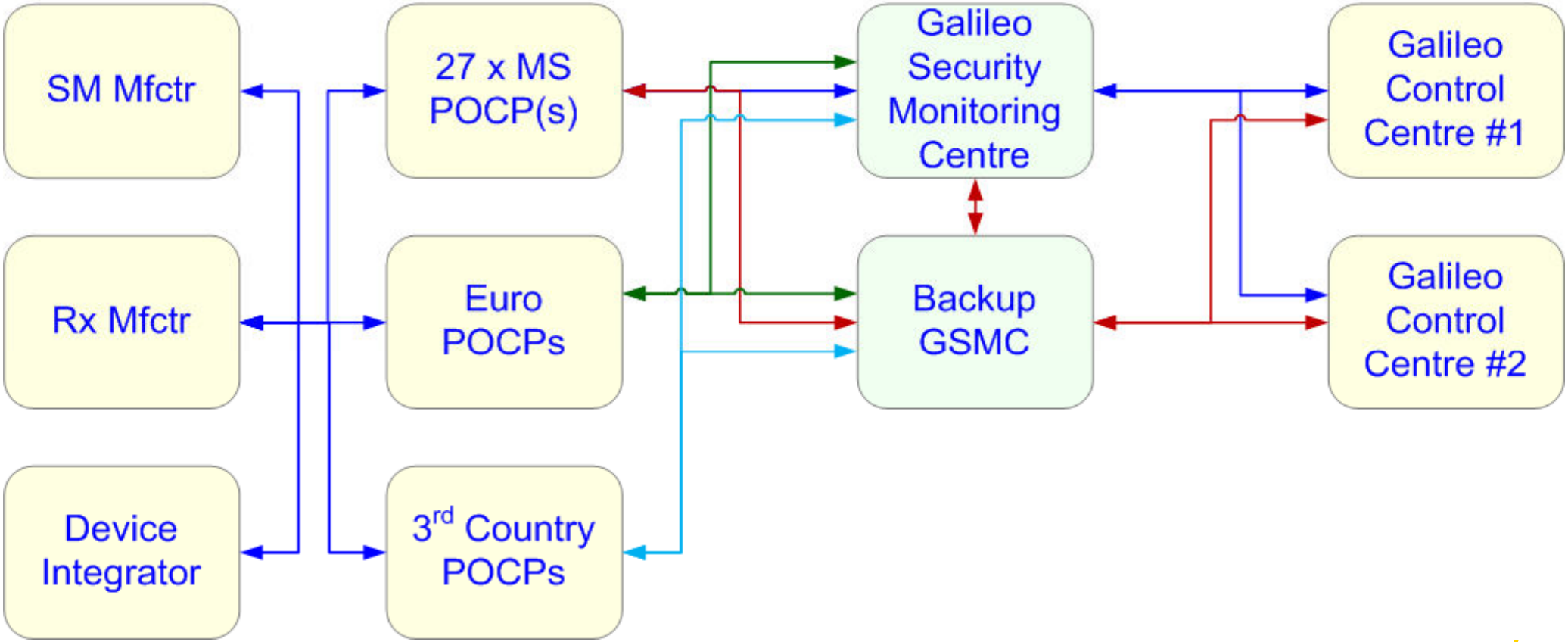

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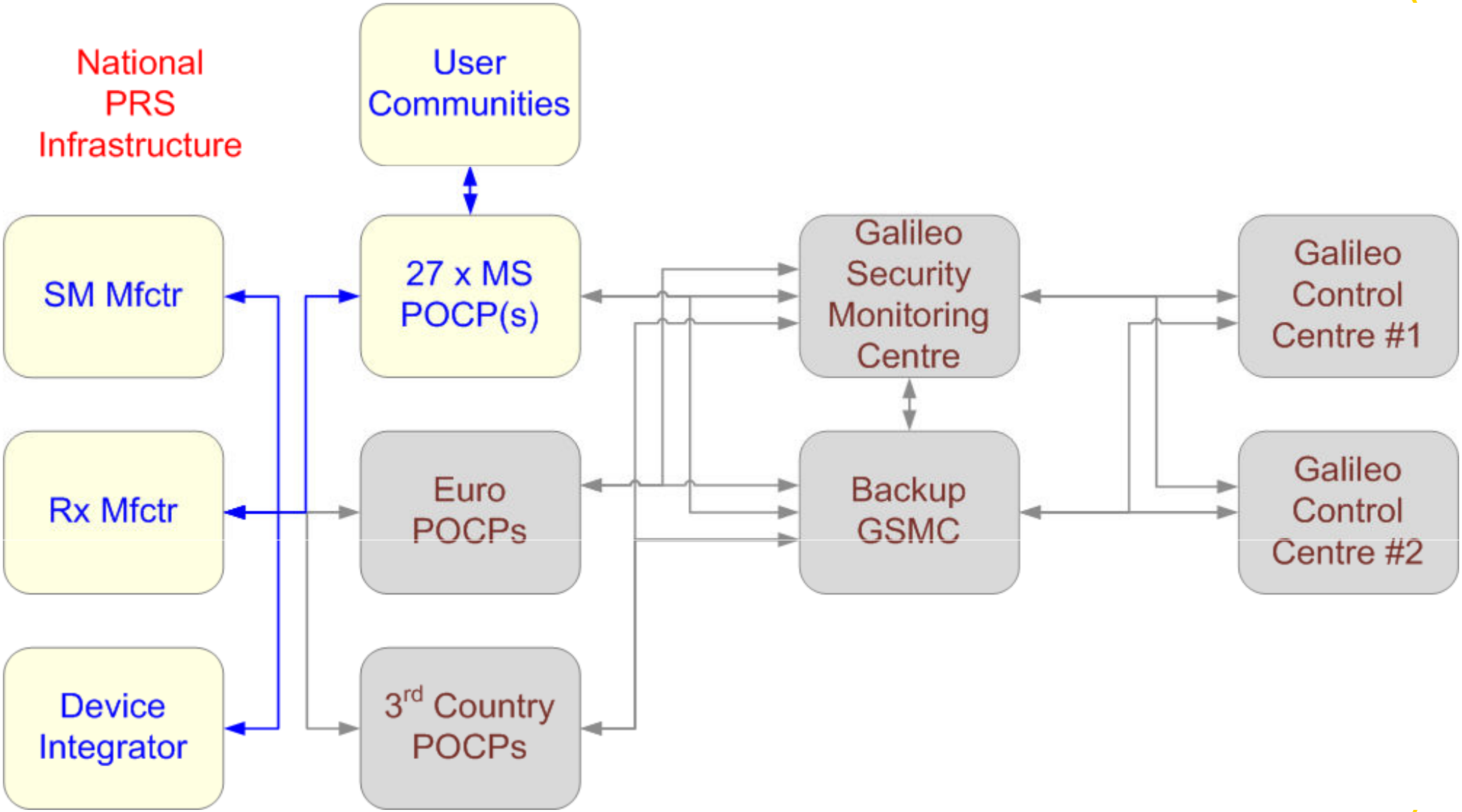

A National PRS Infrastructure

Purpose

- **Provide governance**
  - National security authority to approve EC interactions
  - Day to day management of PRS
  - Accreditation of new facilities
  - Certification of new devices

- **Provide capability**
  - Key distribution to user groups / manufacturers
  - Re-key receivers that have been reset
  - Provide a service centre to user groups
  - Monitor & advise status of receivers

- **Protect capability**
  - Monitor & advise threats
  - Protect PRS assets
  - Respond to Joint Action requests

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- **Provide governance of users & capability**
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It's a service,
not a system !

Open Issues - Governance

- **authority**
  - government, military or civil ? -> which dept
  - different for joint actions ?
  - which person(s) -> ToRs
- **operations**
  - government, military or civil (outsourced / PPP)
  - command structure for joint actions
  - crisis mode links to emergency services etc
- **accreditation & certification**
  - which authorities (NSA ?)
- **monitoring & auditing**
  - who will ensure CMSs are implemented & maintained ?

Open Issues - Infrastructure

- **POCP**
  - just the one ?! – civil v military ?
  - location ? New facility ?

- **Implementation of key capabilities**
  - key distribution – any national initiatives that can be used ?
  - Rx status monitoring – electronic or simple ?
  - Rx keying, re-configuring & repair -> PRS service centre ?
  - timelines – what is needed when ?

- **Other capabilities**
  - PRS QoS monitoring station
  - JIMS infrastructure – linked to existing capabilities ?
  - applications test facilities (eg – GATES)

- **Links to manufacturers**
  - security modules, receivers, devices – national / other MS / 3rd ?
  - how will keys be handled between these ? Manually ?

Open Issues – The Users !!!

- **Who are they ?**
  - which orgs will be allowed to use PRS in MS ? What criteria ?
  - which others want or need it ?
  - mandate any CNI orgs to use it ?

- **User needs**
  - what are they & do they differ between groups ?
  - technical & security capabilities / experience ?
  - what processes & tools will need to be put in place ?

- **User uptake**
  - what will the uptake profile be over first five years
  - max likely no of users ???
  - how to raise PRS awareness & uptake ?

- **Technical implementation**
  - which user in what user groups ?
  - tier users according to trust ?

Let’s not forget them … !!!

Open Issues – Financials

- **Who will pay ?!**
  - national infrastructure costs (capex)
  - national operation (opex)
  - receivers & repair centres

- **Cost benefit analysis**
  - do any user / rx costs make sense ?!
  - are costs realistic to encourage PRS growth or not ?
  - dependent on users – some will pay more than others ?

Users will need to understand the business model

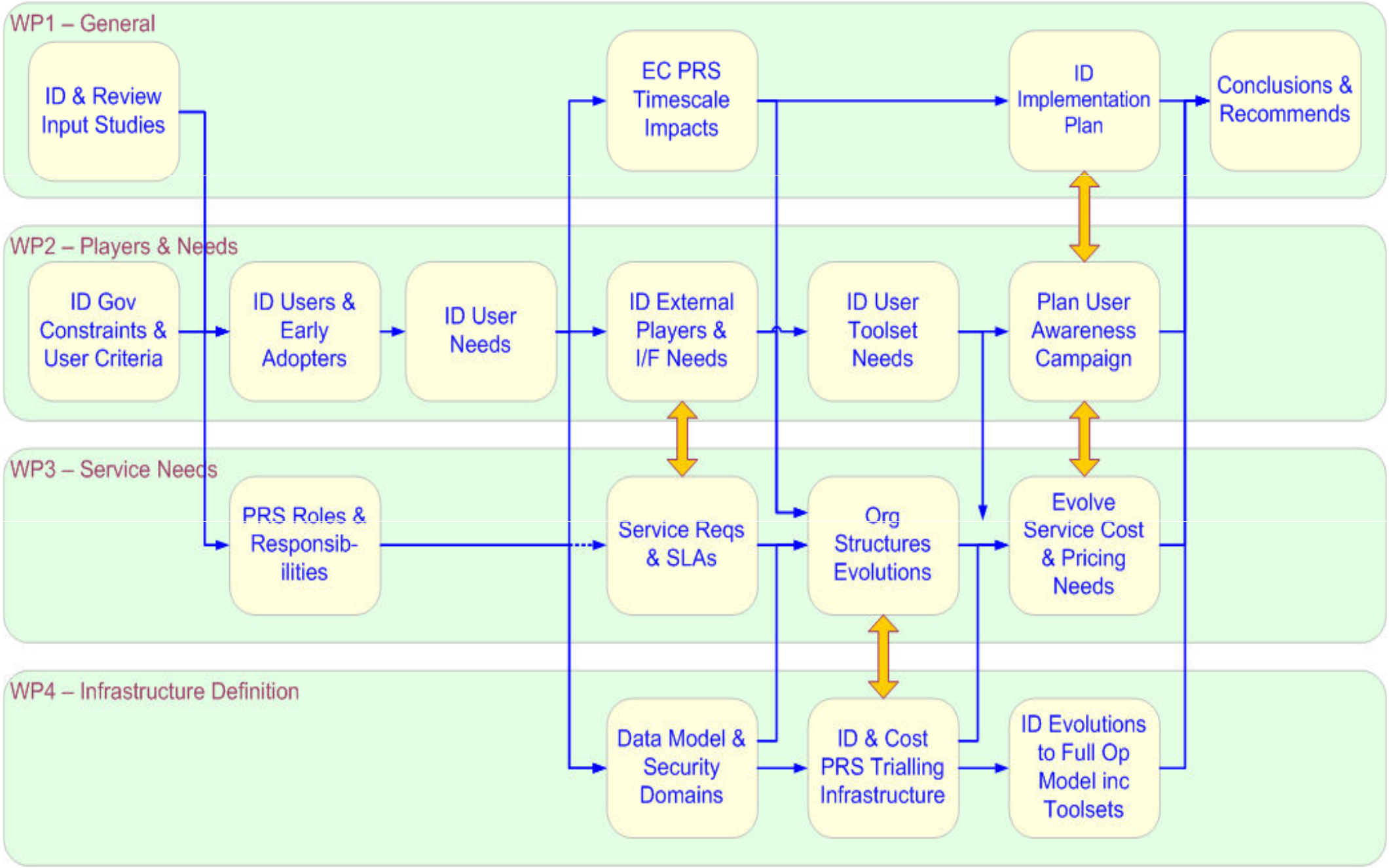
UK Approach

- UK undertook a PRS Management Study to answer these questions as the infrastructure, organisations and cost models will differ according to the answers.

- User analysis was at the core of the study. PRS is a service, not a system

- Participation in the PRS Pilot Programme seen as essential to providing further answers, not least through sharing ideas & lessons learnt between member states

Workflow

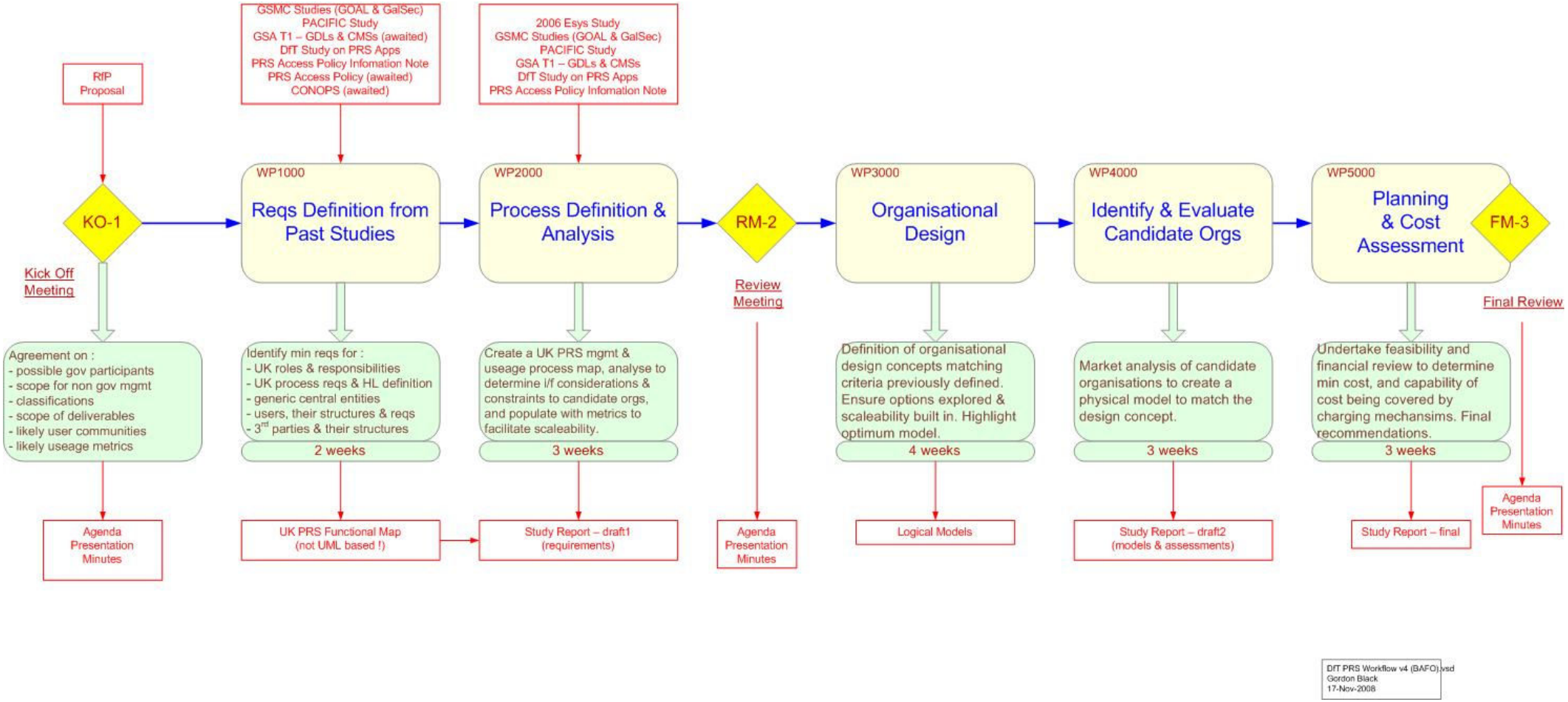

WP1 – General
ID & Review Input Studies
EC PRS Timescale Impacts
ID Implementation Plan
Conclusions & Recommends
WP2 – Players & Needs
ID Gov Constraints & User Criteria
ID Users & Early Adopters
ID User Needs
ID External Players & I/F Needs
ID User Toolset Needs
Plan User Awareness Campaign
WP3 – Service Needs
PRS Roles & Responsib-ilities
Service Reqs & SLAs
Org Structures Evolutions
Evolve Service Cost & Pricing Needs
WP4 – Infrastructure Definition
Data Model & Security Domains
ID & Cost PRS Trialling Infrastructure
ID Evolutions to Full Op Model inc Toolsets

The UK PRS Management Study

Aims

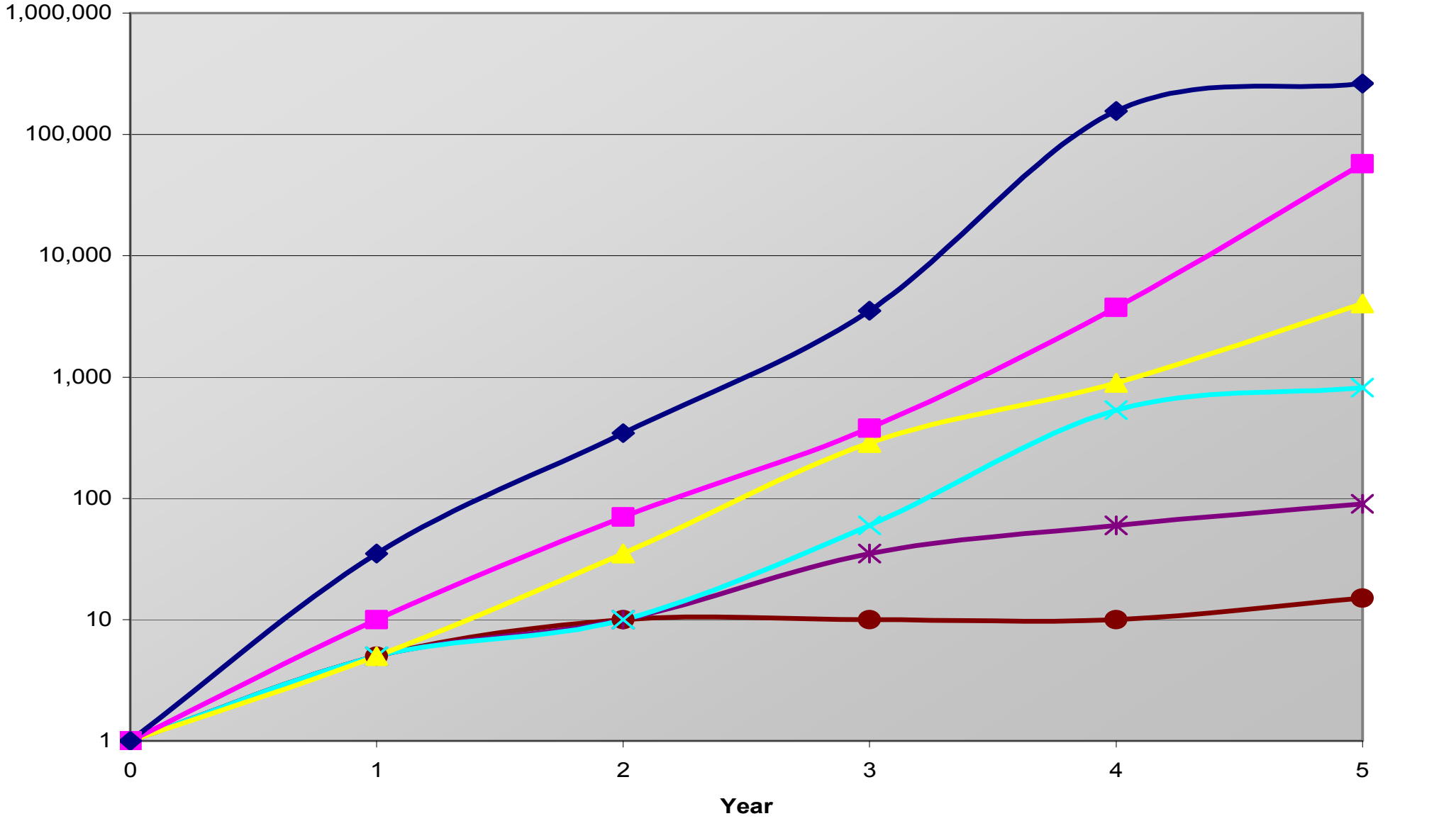
- identify an initial organisational structure for a national point of contact (POC) which could be implemented to fulfil the needs of operating the Galileo Public Regulated Service (PRS) in the UK
- identify possible candidate organisations to deliver UK PRS management
- determine the likely costs and potential charges for that service in order to understand whether it was feasible for the operation to be wholly funded by the users (i.e. - requiring no centralised Government funding)
- Additional to this was an analysis of the key requirements driving those needs to determine whether any were potentially unnecessary cost drivers.

UK PRS Mgmt Study Workflow



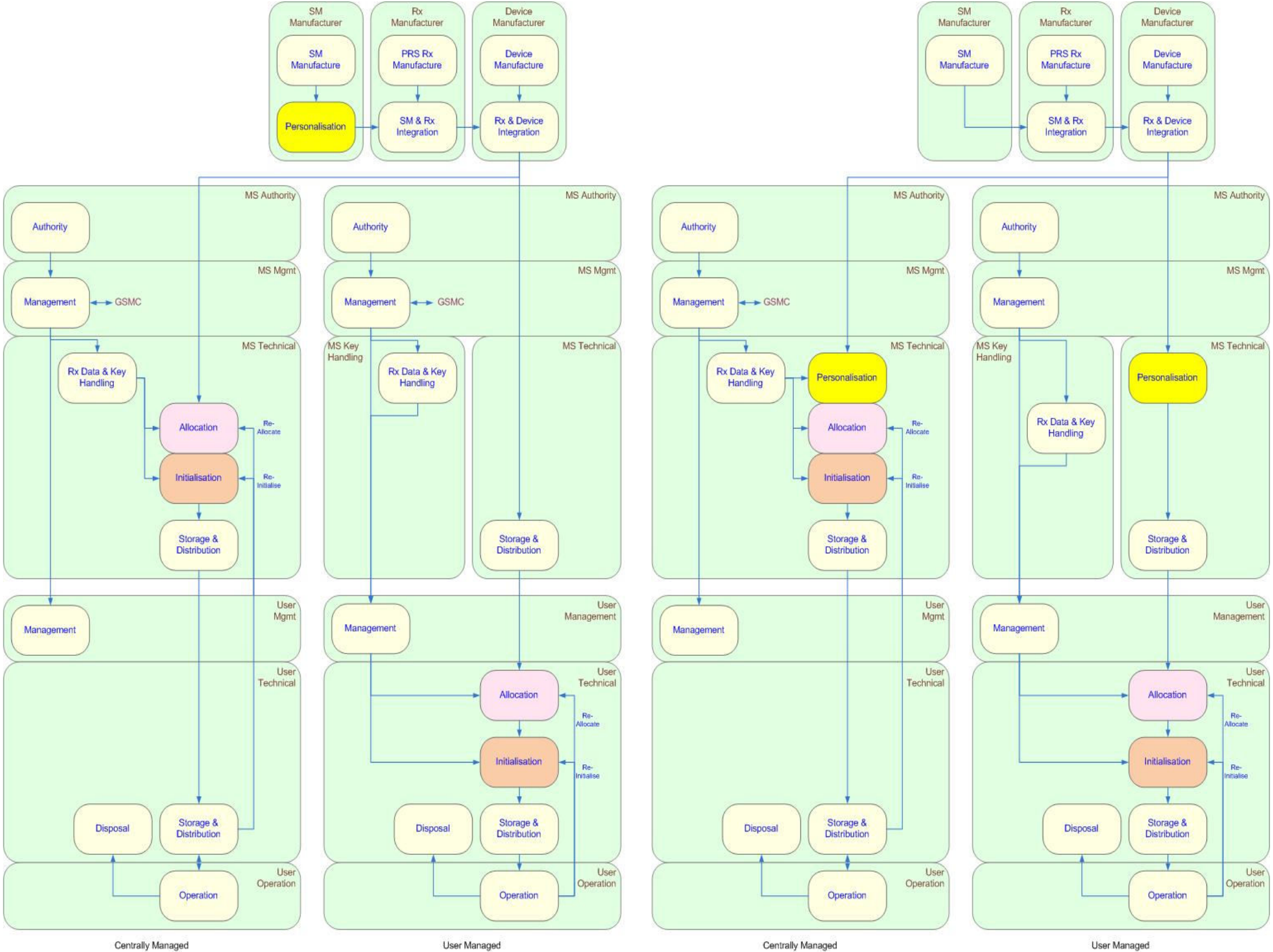
User Uptake

- Previous Esys study helped identify potential user communities
  - Supplemented by current understanding of likely early users
  - Current PRS usage study would also help validate the scenarios
- Users grouped by size
  - Test users
  - Small, medium & large users (<25, <250, <2500)
  - Very large (<50,000)
  - Mega (100,000+)
- Six uptake scenarios defined based on a sensible mix of user communities and their likely uptake times.
- Not known which scenario is most likely and therefor eimportant to analyse how the infrastructure & goverance might differ for each.
- Next slide shows uptake v PRS Rx numbers

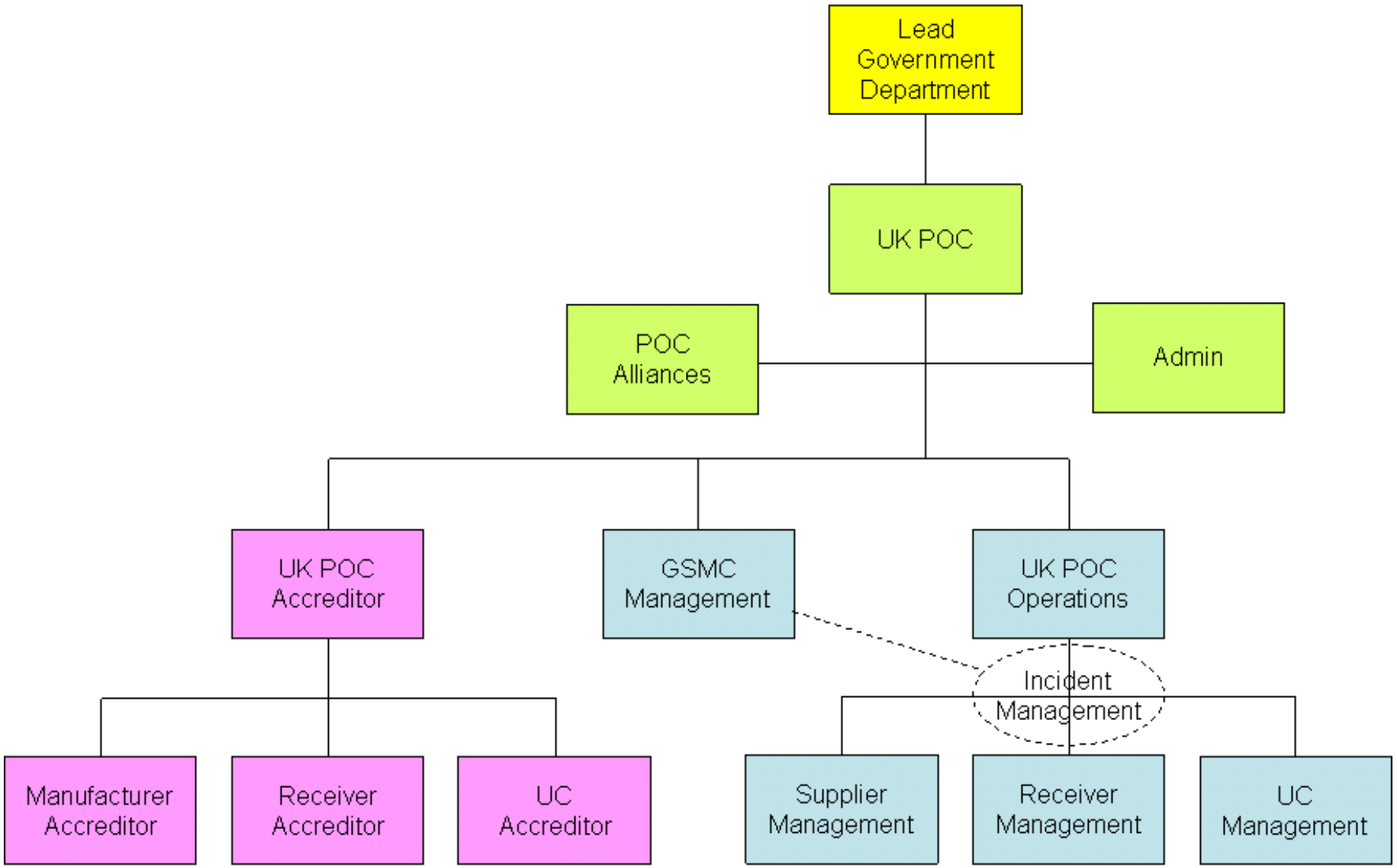

1,000,000
100,000
10,000
1,000
100
10
1
0
1
2
3
4
5
Year
Scenario #1 - No operational users, minimal number of test users
Scenario #2 - Very low initial uptake, with slow, low follow on
Scenario #3 - Very low initial uptake, with some low/medium follow on
Scenario #4 - Low initial uptake, with some low/medium follow-on and one large user
Scenario #5 - Stronger initial uptake, with some Govt / Emergency services take up
Scenario #6 - Stronger initial take up building up to include at least one mega-user (e.g. Police, MOD)

Governance & Organisation

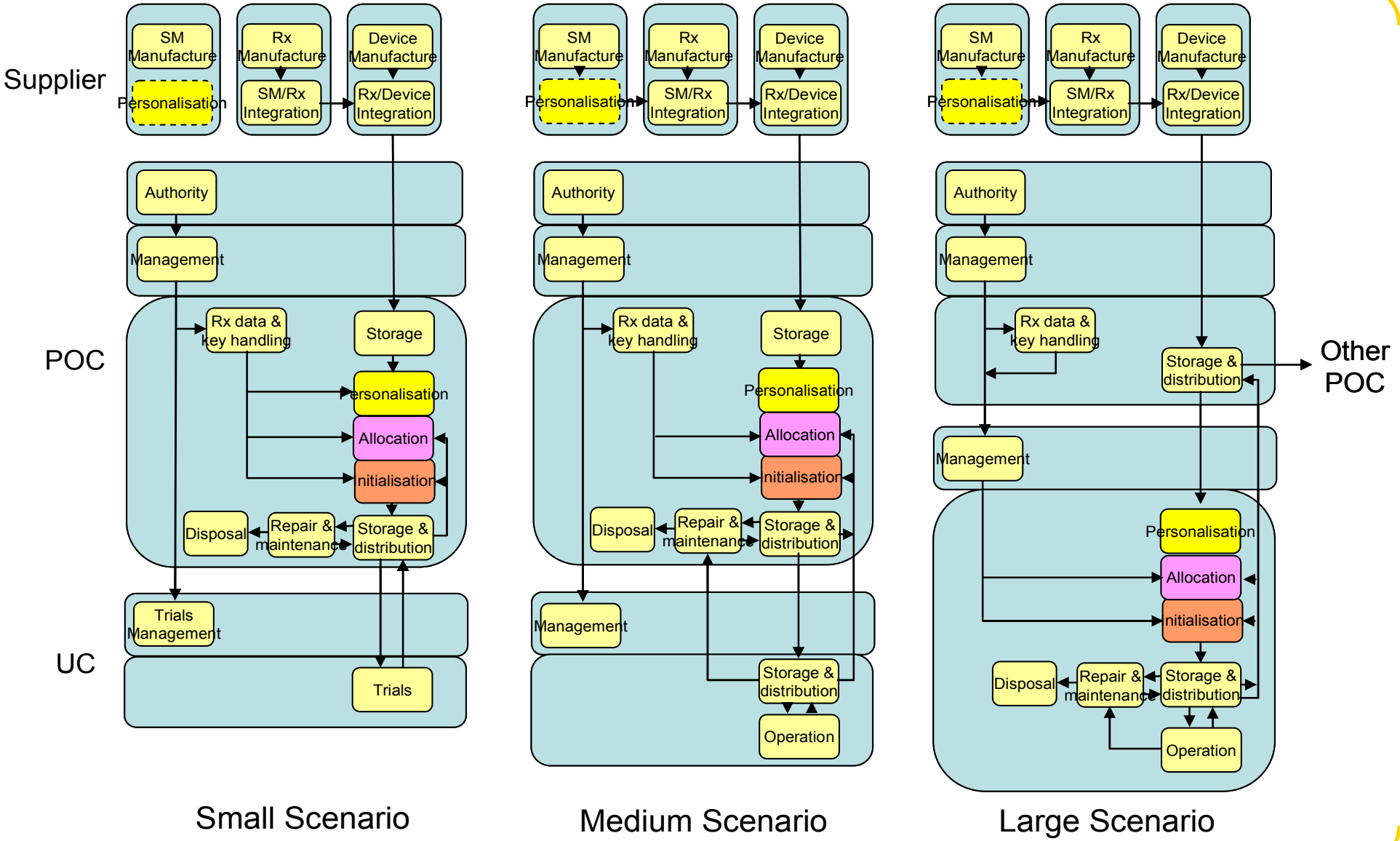
- 8 x mgmt , 22 x technical processes defined from the PRS lifecycle & GSMC definition (at the time)
- All input metrics which might impact the organisation structure and size identified and analysed, eg
  - no of Rx orders per day
  - no of new user groups per month
  - Rx loss rate
- High level organisational options studied
  - centralised v distributed Rx initialisation
- Key capabilities were defined in the organisation and numbers based around metrics generated from the input model
  - pocesses matched to capabilities to show coverage
  - numbers matched to capabilities to show size and evolution
- Various big picture options analysed (eg – PRS Service Centre)
- Org models analysed for small, medium & large scenarios


SM Manufacturer
SM Manufacture
Personalisation
Rx Manufacturer
PRS Rx Manufacture
SM & Rx Integration
Device Manufacturer
Device Manufacture
Rx & Device Integration
MS Authority
Authority
MS Mgmt
Management
GSMC
MS Technical
Rx Data & Key Handling
Allocation
Re-Allocate
Initialisation
Re-Initialise
Storage & Distribution
MS Key Handling
User Mgmt
User Management
User Technical
Disposal
User Operation
Operation
Centrally Managed
User Managed
Centrally Managed
User Managed

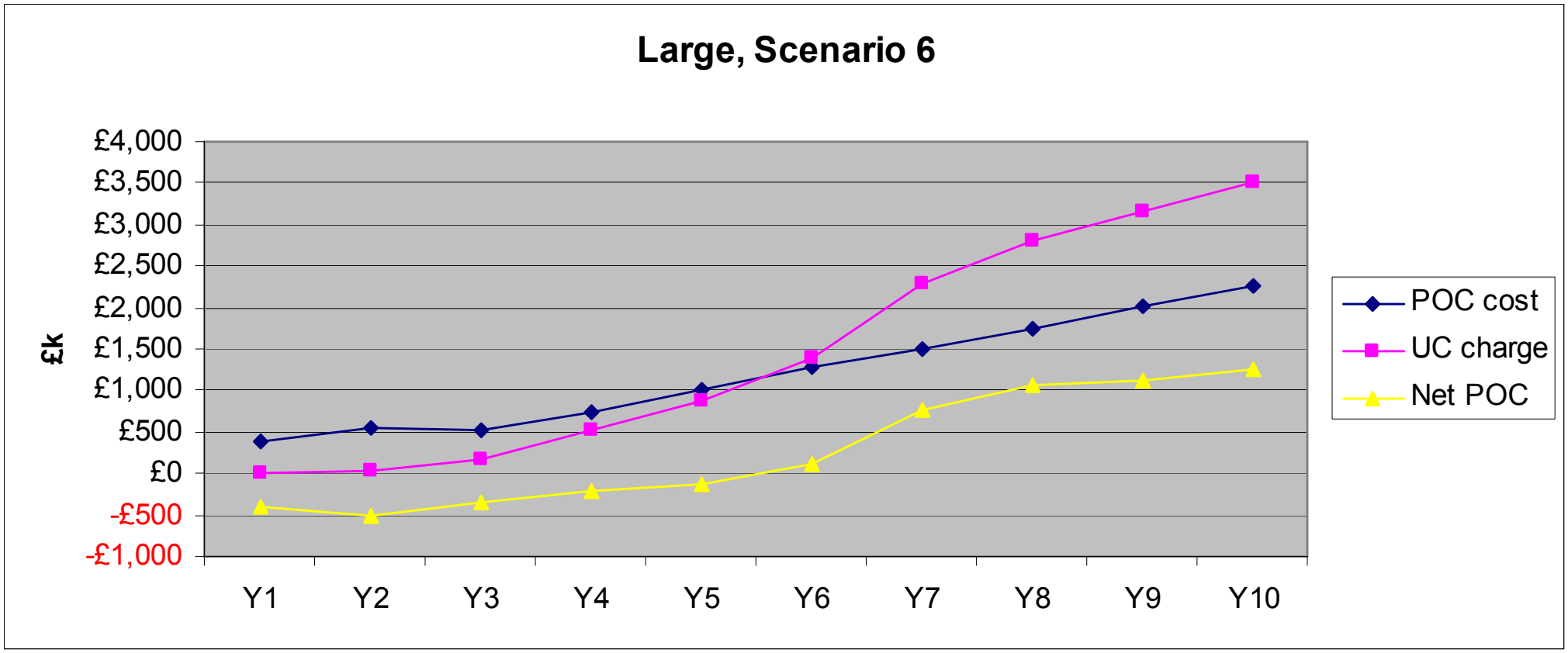
Organisation Capability Requirements



Centralised v Distributed



Cost Models



Results – models

- Small PRS deployments - for trials
  - best delivered through a simple centralised solution most likely undertaken by a UK Government organisation (although many roles could be sub-contracted) with a minimal number of staff
- Medium sized deployments (~1,000 receivers)
  - can be delivered by an enhanced organisation employing sub-contracted services to undertake receiver management activities
- Large PRS deployments
  - Best delivered through a decentralised PRS management organisation with a core POC organisation with the remainder of the user and receiver management devolved to the PRS user communities who could use their own staff or sub-contract some of the support activities

Results - general

- Uptake
  - early uptake (1-3 yrs) expected to be low
  - later uptake could vary wildly
    - understanding of potential users not mature enough by far
- Infrastructure
  - a scalable infrastructure and organisation is possible
  - impractical to provide day to day key mgmt for individual Rxs
  - strong benefit for automating links between POCP and user orgs
- Financial
  - trials costs should be borne by govnt
  - operational use can be effectively charged
    - 1,000 users => £450 pa per user
    - 100,000 users => £35 pa per user

Recommendations

- identify owning govnt dept for PRS management
- early id of small scenario operations organisation (outsource ?)
- investigate sharing of facilities with other member states
- investigate low cost tools, & synergies with existing initiatives
- be an early adopter to better understand issues and user needs

A Possible Approach

A phased approach whereby a scalable infrastructure can evolve naturally as user uptake grows :

- **Phase 1**
  - all services are centralised
  - focus is on providing trialling capability to potential users
  - links to manufacturers are manual
- **Phase 2**
  - services still centralised, links are still manual
  - undertaken on a much more commercial basis
  - possibly outsourced
- **Phase 3**
  - technical capability devolved to those orgs that can manage it
  - core management of PRS outsourced
  - links to all orgs & manufacturers are electronic

Lateral Options !

Some lateral thoughts

- >1 POCP ?
  - military & civil ?
- <1 POCP !!!
  - share one between MSs ?
  - GSMC POCP managed service ?
- Zero cost to MS !
  - industry PPP
  - share POCP with other MSs & charge for the service !
  - pass the whole cost on to users

Thank you

Gordon

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