How to achieve satisfactory performance of the access system: stability, efficiency, operation, fluidity

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Thanks:
LHC access team (GS/ASE), LHC operation (BE/OP)

LHC Performance Workshop
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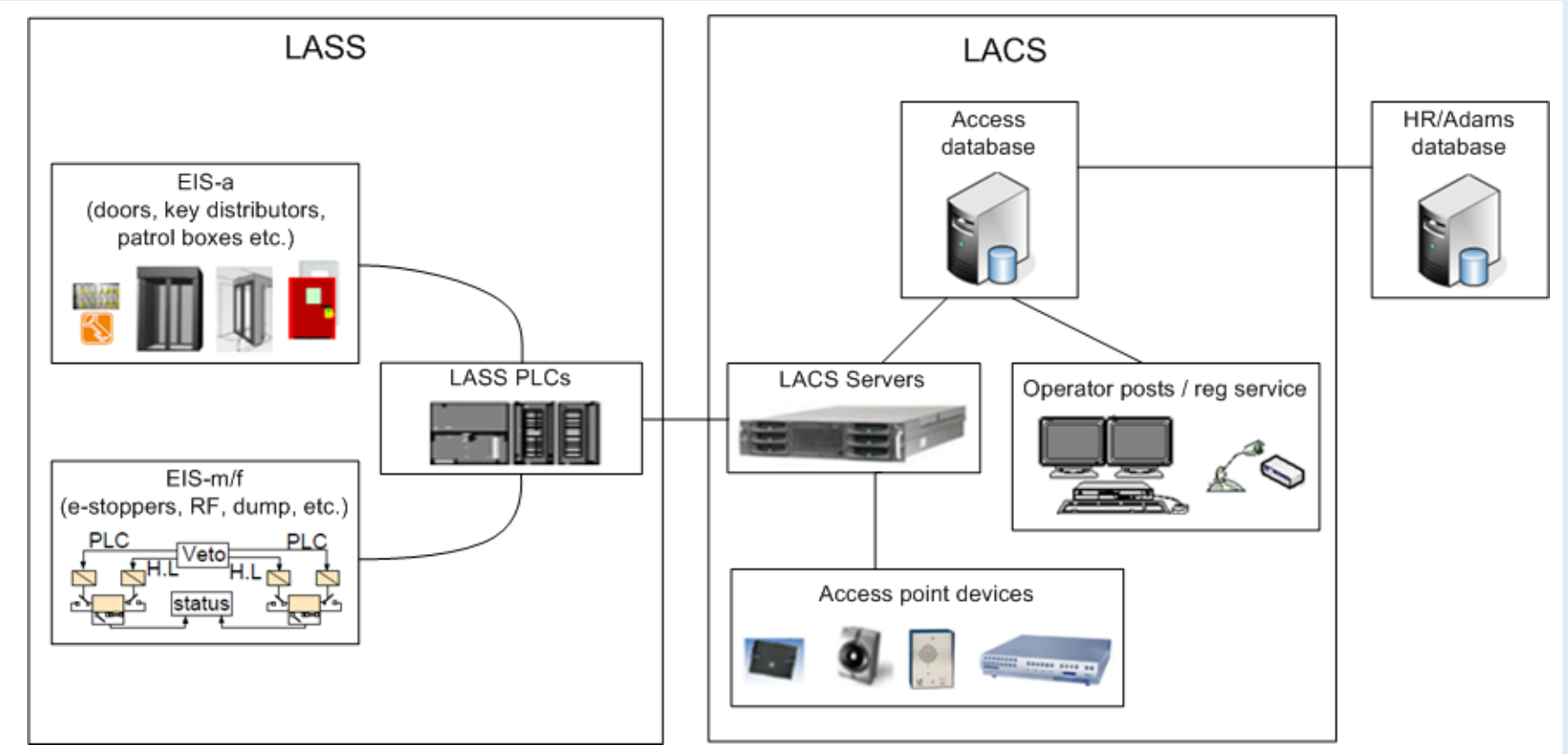
LHC access/safety system



LHC access modes
(From user's point of view)

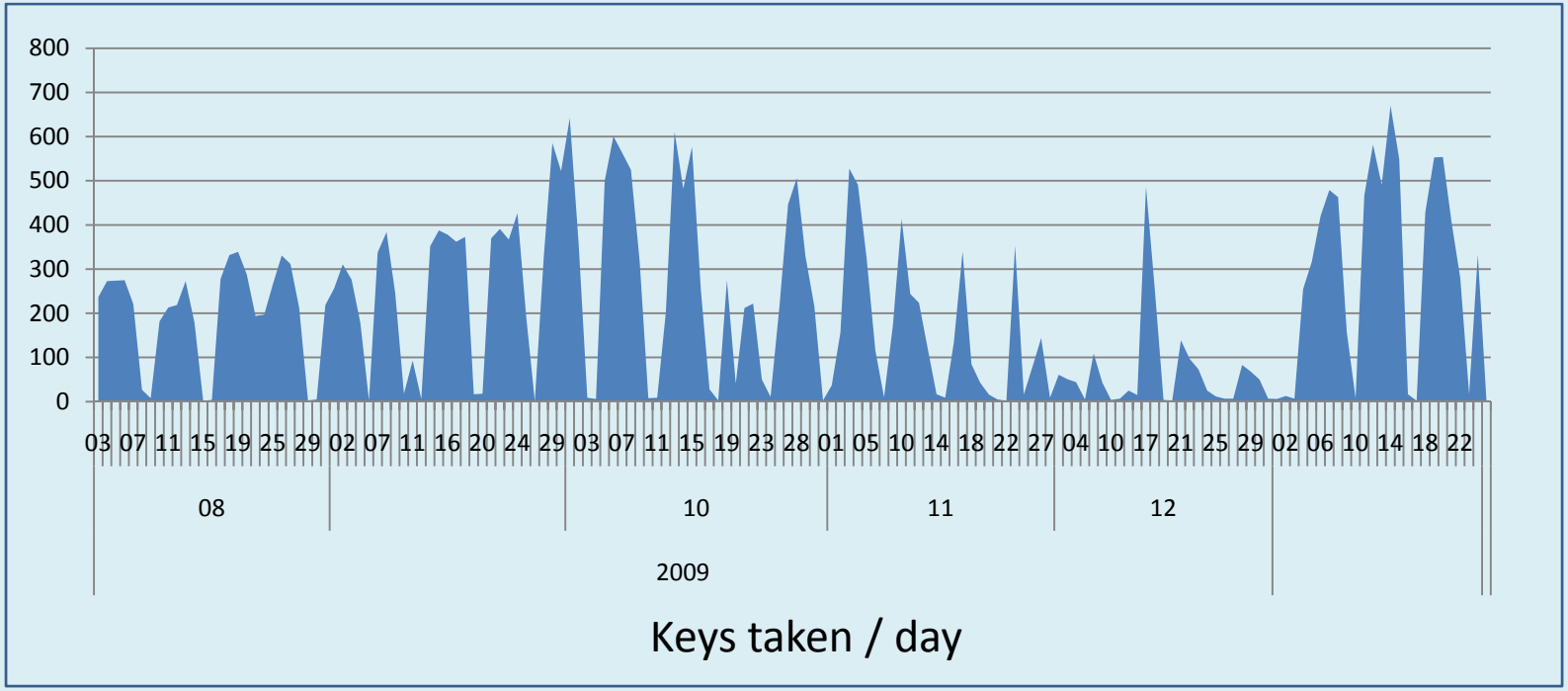
- General (unsupervised automatic)
  - 1: badge – 2: enter PAD – 3: iris scan – 4: enter zone
  - Pre-approved authorization by person/zone
- Restricted / Patrol (operator controlled)
  - 1: call operators (intercom) – 2: badge – 3: take key – 4: unlock PAD with key – 5: enter PAD – 6: iris scan – 7: enter zone
  - Approved ADI in EDH
  - Ultimate responsibility with engineer in charge
- Closed / Veto (no access possible)
  - HW tests
  - In beam

Goals of the access system

- Manage personnel access to controlled areas, safety system permitting
- General design goals:
  - Reliability (don’t expose users, don’t break beam)
  - Performance (for both users and operators)
  - Flexibility (allow change / reconfiguration)
  - Traceability / history / logging
  - Automate as much as possible
  - Offer best possible interface to manually carry out things that cannot (or should not) be automated

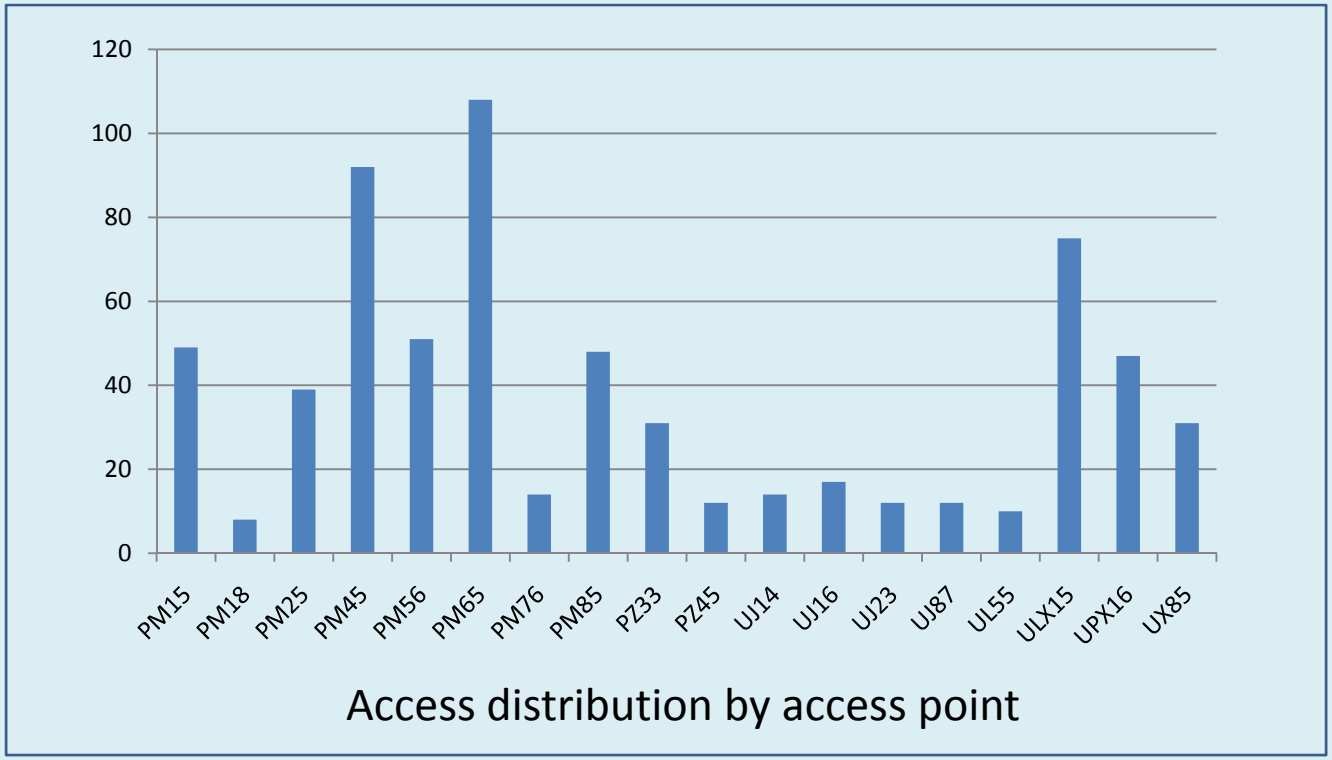
Some access statistics (Total and controlled accesses)

- Aug 1, 2009 - Jan 23, 2010:
  - Total accesses: 181893 (avg 1033 / day)
  - Restricted mode: 33676 (avg 191 / day)



Some access statistics 2 (The busiest day)

- The busiest day for operators: 14.1.2010
  - Restricted mode accesses (keys taken): 670



Some access statistics 3 (Waiting times)

- User waiting times from call to operators to access
  - Subjective estimates based on experience
  - Best case: < 1 min (no rush, ADI ok, system ok)
  - Normal: 1 – 5 min (normal operator load)
  - Worst case: 30 min – ∞ (big rush, multiple access points at the same time, technical problems)

A typical busy day (Synthesis of shifts on two separate days)

- Two single-operator shifts: 1st 7:30-12:30, 2nd 12:30-17:30
- Two peaks:
  - Early morning (8-9:30) and after lunch (13:30-15)
  - During a peak ~3-5 calls in the queue all the time
- Events:
  - Morning: 99 calls, ~170 accesses
  - Afternoon: 3 patrols, 97 calls, ~210 accesses
  - Average 2 persons / call, max. 16 persons / call
  - 1 system problem requiring operator intervention (user could not exit a zone, access maintenance intervention required)
  - 1 hardware problem (maintenance intervention required)
- Normal procedure:
  - 1: user calls and gives ADI – 2: operator checks ADI in EDH – 3: operator gives key to user – 4: user enters zone
  - Repeat until all users passed
- Experienced operator performance: ~1 min / call

Issues affecting access performance

1. Technical malfunctions
   - Hardware problems (contacts, key distribution, relays)
   - Software problems (video, biometry) – mainly in the parts specific to CERN
   - External factors (network /routers, Oracle service, HR DB, human interventions)
2. Shortcomings of the system design
   - Protocol: Access-devices – servers – DB – Op-post (performance bottlenecks identified)
   - LACS operator interface (scaling limitations, speed)
   - Key distribution (bottleneck at access points while in restricted mode – operator has to follow each access)
3. Administrative issues
   - Inflexible ADI mechanism (EDH)
   - Scheduling conflicts

What can be done technically (1: Technical malfunctions)

- Hardware problems
  - Rigorous preventive maintenance program ongoing (example: campaign to change PAD position contacts in 2009)
  - Redesigned video architecture (new recorders and software)
  - Improved hardware monitoring (proactively analyze, anticipate, and address problems)
- Software problems
  - Correctives by the vendor
  - Workarounds by the CERN team
  - Biometry subsystem (simplify architecture: biometry on badge)
  - Improved software monitoring
- External factors
  - Collaboration with the respective services
    - Example: Analyze with IT network problems, which strongly affected LACS and other systems over the last few months – turned out to be a faulty router
  - Improved monitoring (again)

What can be done technically (2: Shortcomings of the system design)

- Protocol: Access-point – servers – DB – Op-post
  - Fundamental system feature – cannot be modified at will
  - Optimization of the server processes
  - Make sure that network and database always in good shape
- LACS operator interface (long time operator request)
  - Streamlined standard interface (limited approach)
  - Go towards standard Evolynx-software (take out CERN specifics as much as possible – allows to follow standard SW releases)
  - A special-purpose high-performance interface without generic overhead for access-operation only facilitating management of multiple access points (development project)
- Key distribution
  - Separate the key distribution phase from access entry cycle (operator gives out all keys of a group and lets them pass through access point at their own pace)

What can be done technically (3: Administrative issues)

- Inflexible ADI mechanism
  - First: decide what the future "ADI" mechanism will look like (primarily operational business, with input from access team) – The proposed AET mechanism (see Julie's talk)
  - Possibility for better integration of this information into the access interface for restricted mode:
    - When user badges, check and show (all) valid AETs for the access point
    - Requires enforcement
  - A new [partial] access mode (examples):
    - General mode with AET (automatic, cannot treat exceptions)
    - General mode with operator confirmation (with AET, supervised without key)
    - In any case, only in LACS; LASS will not be modified
- Scheduling conflicts
  - Mostly out of scope for access/safety system
  - Improvement possible with the new AET mechanism

Priorities and timetables (Best estimates at this time)

Task	Delay (within…)	Complexity	Cost
AET integration (access system side only)	6 months	Fairly simple SW	> 10k
Redesign of operator interface (dedicated to access operations)	1 year	Somewhat complex SW	> 10k
Decouple key distribution from access cycle	1 year	Somewhat complex SW and HW	> 100k
Biometry on badge	2 years	Somewhat complex SW and HW	> 100k
New access modes (General with operator, …)	2 years	Complex SW and HW	> 100k
New video architecture	3 years	Subsystem redesign	> 100k

Conclusions

- Heavy utilization of the LHC access/safety system has uncovered shortcomings, which have been analyzed
- To achieve a better performance from the point of view of users and operators, both technical and administrative issues need to be addressed
- Several technical improvements possible (go with the easiest and most effective first)
- Lessons learned are being applied in the design of the future access/safety system upgrades (PS, SPS)

Thank You