Rush Physician Order Entry: From Physician Resistors to Physician Champions

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Rush-Presbyterian-St. Luke's Medical Center is the hub of the Rush System for Health, a comprehensive, cooperative healthcare system serving patients throughout the Chicago area through its own resources and in affiliation with other healthcare institutions. The Medical Center includes the 824-bed Presbyterian-St. Luke's Hospital (including the Rush Children's Hospital) and the 110-bed Johnston R. Bowman Health Center for the care of the elderly and disabled. Rush also operates Oak Park Hospital, a 296-bed community hospital in Chicago's Near west suburbs.

Rush-Presbyterian is a thriving centre for basic and clinical research, with physicians and scientists involved in more than 1,500 investigations. Integral to the Medical Center is Rush University, which comprises Rush Medical College, the College of Nursing, the College of Health Sciences, the Graduate College, and a cooperative educational network of 12 liberal arts colleges and universities in the Midwest.

When Rush's Information Services Division (ISD) initiated a physician order entry (POE) development project in 1992, it met with significant resistance from hospital physicians. Many had experienced rudimentary systems at other sites and believed POE to be too time consuming. Physician leadership was equally resistant, withholding support until "buy-in" had been obtained from residents. With minimal physician involvement, ISD relied on ancillary departments to define POE needs and processes. In 1993, Rush began installation of POE using order communication software in the hospital's mainframe patient care system. Just prior to the software's go-live, a simulation was conducted for hospital residents. Their reaction was extremely negative and the go-live was cancelled.

Beginning in late 1994, the ISD undertook a different approach to POE implementation – one that involved physicians in an ongoing process of testing, modifying and enhancing prototype software. Gradually physicians began to trust the IS team to provide a POE product that would meet their needs. Rush's approach eventually converted physicians from a position of resistance to one of full support. This paper will report on the results of enlisting physicians as stakeholders in the Rush-Presbyterian's implementation of online physician order entry. It will address the following key topics:

- History and background of Rush-Presbyterian's Information Services Division, and the organization's objectives, plans and progress in applying information technology to clinical processes.
- Steps in initial planning, testing, and ultimately, full implementation of physician order entry.
- Benefits that have been realized from POE implementation.
- Critical factors in gaining clinician acceptance of POE, as well as lessons learned.

HISTORY AND BACKGROUND

In the late 1980s, Rush executives and physician leadership began envisioning a computer-based patient record (CPR) that would bring together patient information from across the organization and make it accessible to caregivers. The organization's executive management recognized that a true CPR could only be accomplished with coordination and integration of data flow. Rush's culture of specialization and departmental autonomy had served it well in achieving leading-edge medicine, but over time had inevitably led to a vast array of independent information systems and information systems departments. In addition to the ISD, departments such as Laboratory, Radiology, Cardiology and Surgical Services operated very strong information systems functions. This departmental approach to information meant that clinicians accessed needed patient data by signing on to multiple systems and by learning and memorizing multiple interfaces and passwords. Furthermore, technical platforms varied, release levels were not coordinated, and the overall technical array led to a common situation found in the 1980s of "we have the data but cannot get to it."

While various departments had computerized their operations and clinical information, the ISD was organized principally around mainframe technology and financial and administrative systems. An information flow diagram compiled in the early 1990s clearly indicated the problem: The patient accounting systems (one for inpatients and one for outpatients) stood out as the hubs of information flow. Financial data from departments flowed in and eventually fed existing decision support systems with a clinical view derived from charge data.

As Rush executive management began formulating an approach to implementing a CPR, the concept was referred to as R-Care, meaning both "Rush-Care" and "Our-Care." As a first step, the Chief Information Officer (CIO) position was created to bring together supervision of the medical centre's separate information systems under one executive position. The current Vice President of Information Systems and CIO was hired in 1990, and devised a set of objectives for phasing in new automation:

- Optimize existing Rush investments in computer systems and technology.
- Update the information system's network and architecture.
- Impose policies and practices throughout the medical centre.
- Invest in new clinical information systems, including a data repository.
- Create administrative and financial systems as an outgrowth of the clinical information system.
- Support Rush's research and education mission by using the data residing in the clinical information systems for outcomes studies and other clinical research.

In the past decade, Rush has stayed true to this philosophy by pursuing a "best-of-breed" information systems strategy. Today, Admission/Discharge/Transfer (ADT), physician order entry and abstracting are on the Siemans Invision system, known at Rush as Patient Care Information System (PCIS). The Laboratory department uses Cerner's Pathnet; Pharmacy uses Pharmacy Computing Systems Incorporated (PCSI) and radiology uses IDXRad. The Picture Archiving and Communications System (PACS) is from Siemans. The Surgical Information System (SIS) was developed in house, as was the Electronic Signature Application (ESA) on which physicians authenticate their discharge summaries and operative reports. Physician practices associated with Rush use a variety of practice management and computer-based patient record systems.

A multi-year effort to acquire a clinical data repository that would integrate data from all of Rush's disparate systems culminated in the 1999 implementation of the 3M Care Innovation product. With the 3M system, Rush acquired an enterprise-wide master patient index, a clinical data repository, clinical alerting capability, a healthcare data dictionary and a clinical workstation application.

Today, Rush's CPR implementation continues: online clinical documentation and patient scheduling will complete the hospital-based cluster of applications for the CPR.

ORDER ENTRY: PROJECT PLANNING AND IMPLEMENTATION

POE Implementation: A New Approach

Although client-server and Web-based result retrieval applications would have been an easier "sell" with physician users, online physician order entry, dubbed R-Orders, was identified early on as an application that could significantly improve quality of care. For Rush, like many healthcare organizations, the process of writing and executing physician orders was inherently inefficient and error-prone. The practice, for example, of using laboratory technicians to hand collect written orders from each hospital unit was viewed as an inefficient use of staff resources that often resulted in delays in order execution. Even so, the ISD first planned attempt at implementing POE in 1994 was postponed, having met with heavy resistance from physicians performing a simulation.

The net result of the postponed go-live was that Rush physicians became significantly engaged in developing a new POE project. Approximately 10 clinicians (physicians, nurses, pharmacists) in addition to representatives of the Quality Improvement and Risk Management departments joined a POE Steering Committee formed in 1994. These members were invited by Information Services (IS) based upon their potential for leadership and vision in guiding a POE strategy. After three months of design reviews in 1994, and a few substantive system revisions, the team embarked on three trial runs involving residents of one medical unit. Each trial run – three, four and five days respectively – was too long for residents to wait and write their orders at the conclusion, and too short to overwhelm them with what they perceived as the onerous burden of using POE the rest of their residency. Each trial run varied not only in length, but also in:

- training method,
- extra features (GUI was introduced in one),
- start-up preparation (medication and IV orders were "pre-loaded" in one trial run to facilitate the first day's orders to D/C, renew, or decrease/increase existing orders),
- portable computing – third trial used wireless network communications for rounds instead of jack plug-ins up and down the hallways.

Nurses, as well as ancillary departments, needed to be trained in the software in order to anticipate online orders and to act upon them. POE training was generally four hours for nurses, since they use it far less and get little subsequent practice, and two hours for physicians who would begin using POE the day of "go-live" and use it repeatedly all day, every day. The POE team revised its approach to physician training when large numbers of attending physicians began to learn POE. Two very full hours were needed, yet attending physicians found it difficult to allot that much time. The team divided the curriculum into two, one-hour modules, which today are offered – but do not have to be taken – contiguously: Fundamentals of POE, and POE Shortcuts and Order Sets (Fundamentals being a prerequisite).

Twenty-four hour IS coverage was provided during each trial, so there was always an IS presence on the floor, not only to help, but also to record problems. This helped diffuse any frustration before it escalated, and focused the residents' energies on constructive feedback—e.g., how the screens functioned; what training was most effective; the availability and locations of the terminals, etc. Based on residents' input, changes were implemented with each trial run. Physicians became comfortable with the process and began to trust the IS team to provide a POE product that would meet their needs. The trials proved successful, and having gained the support of physicians, the go-live of POE began in April 1996.

POE implementation began with lab orders, followed by radiology and EKG. By August 1996, online ordering for lab, radiology, and EKG had been rolled out to seven medical units, averaging 40 patients per floor. The decision was made to train new interns to use POE exclusively for their orders, never introducing them to the old method. This marked a pivotal point in POE implementation; the decision communicated to the entire organization that medical staff leadership was committed to POE and had made its implementation a priority.

POE was further extended to include surgery.

Implementation of standard surgery order sets meant that orders for new departments such as PT, OT, and nursing had to be included. By mid-1999, the number of units using online ordering had doubled from six to 12 with the addition of four surgical services groups. The major functions available on POE expanded to include:

- physician order entry,
- medical student entry of "pending" orders requiring countersignature,
- cross-service countersignature (where the attending service cosigns consulting services' orders),
- countersignature,
- nurse practitioner order entry,
- telephone order entry for staff nurses and pharmacists,
- sign-out sheets,
- result displays from the Siemans Clinical Observations & Results module (COR).

Modifications to the software, the ordering process, and the pace of implementation continued to be made based on physician and nurse input. The POE project team adjusted nursing unit "go-lives" around JCAHO and CARF visits, staffing shortages and construction. But the team never stopped; it simply exchanged one unit with another in the implementation schedule.

Pharmacy Orders

A major hurdle to the extension of the POE system was the inclusion of pharmacy orders in 1998. Additional software had to be acquired and customized to meet physicians' needs. Various factions insisted on the use of generic names for drugs, but physicians were accustomed to ordering medications by trade names. Further POE customization resulted in the inclusion of trade names, allowing the different approaches of pharmacists and physicians to orders to coexist. Pharmacy orders were implemented in November 1998 on a pilot unit, but difficulties continued.

Staff needed additional training, and the formulary was far from complete. Additional time was spent addressing these problems before the rollout continued. More than once during POE implementation, residents begged for a reprieve when frustration with the system became overwhelming. Rush found the addition of pharmacy ordering rekindled POE resistance experienced earlier. However, this agitation provided an opportunity to engage the new Senior Vice President of Medical Affairs in the process and gain his personal sponsorship. He and the POE team backed off temporarily, made some agreed-upon changes, and then resumed pharmacy ordering. The historic responsiveness of the IS team encouraged full support from executives.

Gaining Physician Acceptance

The successful implementation of physician order entry (POE) and its acceptance and adoption by Rush clinicians could not have been achieved by routine technology project management methods. POE implementation was so sweeping a change in institutional culture that a significant amount of project resources were spent in building relationships and demonstrating responsiveness.

Involving physicians who believe in the potential of POE is critical. The general surgeon on the POE Steering Committee was recruited as chair of the Medical Records Committee in 1999, in part because of the leadership he had demonstrated on computerization. As Chair of the latter committee, he became frustrated with the percentage of handwritten orders that failed to meet criteria of "dated, timed, signed and legible," at a time when POE was available and an easy way to achieve full compliance with documentation standards. Consequently, the Medical Records Committee was the first staff committee to formally adopt a position that POE be mandated throughout the organization.

Through the POE Steering Committee and Medical Records Committee, Rush's ISD has built cooperative working relationships with key individuals who sit on other committees: the Executive Director of the Medical Staff, the Director of Quality Improvement, members of the Medical Care Evaluation Committee, and executive management. These individuals have proven to be influential and progressive advocates for Rush's overall CPR strategy, as well as POE.

Recognizing and promoting the clinical

benefits and timesaving features of POE to physicians was important in gaining their involvement. Clinical pathways translated into order sets on R-Orders greatly facilitate ordering and provide considerable clinical guidance. Rush has deployed only centrally controlled order sets developed through cross-disciplinary consensus. The Forms Subcommittee of the Medical Records Committee scrutinizes and approves each order set and keeps a copy to document the standard of care. Pharmacy finds there is lower utilization of costly, less efficacious medications as a result of putting the recommended medication into order sets. (Providers are free to order anything they choose, or exchange a default medication for another at the time of ordering.) Clinical departments have increased standardization of care by creating order sets for R-Orders implementation. In other cases where pathways already existed, the mere process of translating and scrutinizing the order sets for automation led to updating outdated pathways.

Significantly, the medical centre community now recognizes the possibilities of POE and is beginning to request additional decision support features and enhancements. For example, two requests just recently made by individuals not otherwise involved in the implementation projects are:

- A nurse requested a screen addition to blood orders reminding the user to ensure a signed consent form.
- The Utilization Management department requested additions to the physician's admission screen to specify whether an admit is to inpatient level of care, observation or outpatient-in-a-bed.

Today, R-Orders (POE) has been implemented on 27 nurse stations. Four of the remaining six stations were up on the system by third quarter of 2001. The speed of implementation has increased significantly. Between 1994 and 2000, 10 nursing stations and six clinical departments went live. In 2000, eight nursing stations and nine clinical departments went live in that calendar year alone. The slow, painstaking efforts made by ISD to gain the trust of physicians and to recruit clinician champions are now in the past; today, the project team is able to move much more quickly. More than 500 residents and fellow physicians use online ordering, as do medical students, approximately 100 attending physicians, and several hundred nurses and pharmacists.

IMPACT OF ONLINE PHYSICIAN ORDER ENTRY

Documentation

With online physician order entry, Rush Presbyterian is better able to meet JCAHO documentation standards. Studies conducted prior to system implementation show that 40% of written orders were missing a room number notation. Additionally, studies conducted in 1999 on units issuing written orders show that 38% were missing the date and time, and only 82% were legible. Today, as a result of POE implementation 100% of orders entered directly by physicians are dated, timed, signed and legible.

Order Turnaround

Measurements were conducted in 1999 to calculate the impact of POE on order turnaround time. Orders now print in ancillary departments in less than one minute after the order is generated. Orders interfaced electronically to the Lab systems generally "pass" immediately. Previously, delays could be expected for the transfer of written orders.

Anecdotally, clinicians indicated that POE reduced pharmacy order turnaround times. One nurse said, "The meds are in the drawer before the patient is up from the recovery room." Another nurse noted that "the meds are here before I am aware they've been ordered." Based on a hypothesis that POE substantially decreases pharmacy turnaround time by eliminating some steps in the process and improving order information, a study was undertaken between 1999 and 2000. The results were documented in a paper presented to the 2001 AMIA fall symposium (Lehman 2001).

A pre-study was performed by direct observation tracking of written pharmacy orders from two surgical services units – Neurosurgery and Transplant. A total of 66 pharmacy orders from

Transplant Surgery and 34 orders from Neurosurgery were followed. Data collected included a mix of parenteral and oral medications. Out of 100 samples collected, 76 samples had complete information: the date and time an order was written and the signature of all appropriate personnel. Orders missing date, time and signature were excluded, as were orders with a specified administration time. The average turnaround time for these 76 samples was eight hours and 49 minutes, ranging from the shortest at 20 minutes to the longest at eight hours.

After a two-week learning curve following POE implementation, a two-week post-study was conducted to examine the impact on pharmacy order turnaround. A total of 147 medication orders from one nurse station were tracked. The researcher recorded time for three steps in the order process: when the physician entered the order on the computer; when the pharmacist entered the order into the pharmacy departmental management system; and when the pharmacy technician delivered the medication to the unit. The key steps removed from the critical path were the unit clerk's "taking off" of the order and the time from that moment until order arrival in the pharmacy. (Earlier studies had shown that orders print, on average, within a minute of entry, with a high of four minutes.)

The entire POE medication order process took from a low of 31 minutes to a high of three hours and 26 minutes. The average time was one hour and 23 minutes. Thus, the average medication order turn-around time from order to delivery was shortened by two hours and 26 minutes.

Utilization of Over-Used Antibiotics

In May 2000, a rule was installed on R-Orders alerting caregivers ordering the anti-infective imipenem that the drug is resistant to most strains of psuedomonas aerugenosa and should be ordered only if susceptibility is confirmed. Infectious disease practitioners used education with some degree of success to reduce utilization of the antibiotic. Displaying a screen alert when physicians ordered imipenem, however, proved much more effective. For the six-month period prior to this intervention, 144 + 55 doses /month of imipenem were dispensed. In the seven-month period after the intervention, 86 + 39 doses were dispensed. This difference was significant ($p = 0.04$). Imipenem resistance declined from 50% to 15%.

Improved Blood Culture Ordering Practices

Several studies have shown that collection of two or three blood culture sets (BCs) in a 24-hour period improves the sensitivity and specificity of this test. Despite several interventions, including educational in-services and a recommendation on a paper requisition to obtain two BCs, the percentage of single BCs ordered at Rush hospital had remained stable at an average of 57.8% for 24 months. In a study presented at the general meeting of American Society for Microbiology in May 2001, Rush found that implementation of a computer order alert resulted in a change in physician ordering practice and improved blood culture utilization. The study was conducted over a 12-month period in 1999–2000, during which time BCs orders were placed either via R-Orders or by a paper requisition. The number of BCs ordered per patient per 24-hour period was monitored for six months before and six months after the posting of a POE alert that was viewed each time a BCs was ordered. The alert read: "Two blood culture sets are strongly recommended." Prior to implementation of the computer order alert, 56% of all orders for BCs placed via R-Orders were for a single BCs and 41% were for two BCs. After implementation of the alert, orders for solitary BCs fell to 39.8% (28% reduction) whereas the number of orders for two blood cultures rose to 57% ($P < 0.001$). In contrast, the number of orders for one and two BCs ordered by paper requisition did not change significantly (56% orders for one BCs and 39% orders for 2 BCs before; 64% orders for one BCs and 33% orders for two BCs after).

Improved Radiology "Reason for Exam"

For a number of years the radiology department reported that physicians often did not provide sufficient reason (or "history") for exams ordered, resulting in rejected insurance claims for reimbursement. A physician reason of "rule-out" is a common cause for exam bills to be

returned to radiology by the medical records department. "Check line" as the stated reason for an exam also caused problems. Although a clinician understands that this means that a central line or chest tube should be checked to make sure it is correctly placed in the patient, the coders assigning ICD-9-CM and CPT-4 codes to the exam for billing purposes do not find a code by that description. Radiologists try to avoid these inefficiencies by noticing and elaborating on inadequate histories at the time they dictate the report. Clearly, a significant amount of time would be saved if the ordering physician provided improved histories upon order.

In 2001 the "reason for exam" field on POE was changed from a free-text field to a pick list. Radiology provided a list of acceptable reasons for each exam. In addition, a message was placed on the order screen directly above the "reason" field. In studying the incidence of "rule-out" as the physician-identified reason for a radiology exam, we found, by examining the reasons provided for three months preceding the POE screen change described above, that 30% of the reasons entered on radiology orders contained "rule-out." Following the screen change, this rate dropped to eight percent. No other screen changes were made at the same time.

Cost Savings

Cost savings have been achieved through elimination of the "middle-man" unit clerks, reduction in expensive multi-part order forms, improved turnaround time and standardization of orders through proven order sets.

KEY SUCCESS FACTORS AND LESSONS LEARNED

From the outset, ISD leadership had shared the same assumption: POE had to be all or nothing. It would be unreasonable to expect clinicians to go back and forth between paper order sheets and the computer. Surprisingly, this assumption proved wrong. Instead, Rush's POE project illustrates that an incremental approach to the implementation of data entry systems can be successful. Following the three trial runs, and because of other medical centre activities, Rush's POE implementation was reorganized into the department-by-department staging described earlier. Upon reaching the first surgical group – Orthopedics – the project team needed to computerize the pre-printed order sets upon which orthopedics thrived. It made little sense to split the order sets into half-computerized and half-manual. Therefore, the next development step was the creation of ordering screens for nursing, physical and occupational therapy, respiratory, and dietary – almost everything but Pharmacy. Physicians would accept an announcement that "just lab, radiology and EKG are online," or "everything except pharmacy" is online, but not something in between.

The POE implementation team firmly believed in providing on-site support during go-lives. The usual team was augmented by part-time assistants (often nurses), so that on-site support could be provided for four to five days, including evenings, nights and weekends. Large green (Rush's signature colour) buttons saying "POE" identified the support team during a go-live. After a continuous on-site coverage period, the POE team ratcheted down gradually to shorter times on weekdays – day and evening shifts – to talk with users, check equipment and audit charts for percentage and accuracy of POE order sheets. Focus groups were held to allow users to voice problems and change requests. The largest group of residents – internal medicine – was represented by one of their chief residents on the POE Steering Committee.

Extensive public relations and internal communication were instrumental in winning support for POE. A Web page and a newly instituted clinical information electronic news service, as well as regular announcements conveyed to various committees, helped broadcast implementation news. Having long observed physicians standing next to wastepaper baskets, culling through their mail, ISD stopped putting most announcements in the medical staff mailboxes. Instead, notices of downtime and significant enhancements are placed on a large easel at the entrance to the medical staff and house staff lounges. On patient care areas, however, another approach is used: colourful half-page announcements placed in prominent spots and near computers help bombard busy house staff

and nurses with POE news. The POE sign-on screen also has space for short, uncomplicated messages. Critical or complicated messages are displayed on an extra screen inserted in the ordering pathway for brief periods when needed. And finally, when it is important to get a message disseminated quickly to everyone, regardless of whether they are signed on to any system, a "network broadcast" message is sent through Novell and displays on every computer in the patient care areas.

POE compliance reflects concerted efforts on the part of the POE team (predominantly IS staff) as well as nurses who persuaded physicians to comply on their nursing units. The laboratory department helped too by gradually eliminating the transcription task from the phlebotomists' job. After the first few years, whenever a new nursing unit or group of physicians went live on POE, a three-month weaning period was allowed before phlebotomists would stop transcription of handwritten orders. One unit received an extension until the Lab announced its inability to recruit enough phlebotomists to cover the transcription task. The nursing unit's POE compliance practically doubled on the cut-off date.

In the past two years, Rush has taken additional, substantive steps that illustrate its commitment to POE and the further development of a CPR.

- The Medical Records Committee introduced two mandates in 2000 that all physicians must use the Electronic Signature Application (ESA) for signing transcribed reports and that Provider Order Entry (POE) is the only allowable means of generating orders.
- The Pharmacy and Therapeutics Committee has begun to integrate POE into its repertoire of corrective and preventive solutions.

CONCLUSION

Physicians will reject new technology if it impedes their work or does little to make them more efficient and effective. Rush-Presbyterian's progress to date in implementing online physician order entry is based on a commitment by the IS department to winning the support and acceptance of physicians for new technology before that technology is made widely available for use.

Rush-Presbyterian physicians gradually became willing to participate in the process and provide feedback because they knew from the project's beginning that changes would be made based on their input. IS staff were always available, 24 hours a day, to address concerns. If significant problems were encountered, the implementation was postponed until the problems were resolved. As a result of this approach, physicians began to trust the process and in turn, trust the IS department.

Since implementation of POE, Rush-Presbyterian has realized a number of benefits, in terms of clinician time-savings, reduced order turnaround time, improved JCAHO compliance and documented quality of care improvements. The system has also led to standardization and more consistent use of terms and abbreviations across departments and services.

Seven years after rejecting POE as untenable, Rush physicians are today the organization's chief proponents of online order entry, and all patient care units at Rush-Presbyterian St. Luke's Medical Center now employ online ordering. Although POE has been mandated by the physician leadership, there continues to be a few individual clinicians who avoid its use. The IS team has chosen not to impose a stringent enforcement of the mandate, but instead has focused on bringing added value to POE through the development of clinical alerting and automated clinical pathways. By continuing to enhance and expand POE functionality, we will be able to enlist the involvement of those remaining clinicians and continue to earn support from physicians for new technology that makes them more efficient and effective.

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I travel frequently and I find this site to be very helpful for tracking flight schedules and delays. You can track the status of any flight arriving or departing the United States or Canada. Get updates on flight arrival and delay times, and remaining time en route for departed flights, updated every five minutes. Additional flight details include departure time, aircraft type, current altitude, and current groundspeed, along with the forecasted weather conditions for your selected destination.

‹www.digitalcity.com›
Chicago is a great city with many activities going on all the time. I use this site to keep up with local events as well, checking out restaurants and other activities elsewhere when I am traveling. It has only U.S. cities but ‹www.canadaplus.ca› fills in a little for major Canadian cities, but how could they leave out Montreal?

‹www.buzzle.com›
A very full site with information, links and other stuff on a wide range of topics. Browse when you have extra time on your hands as you will be sidetracked by the variety of subjects covered. Their promo line is: "Intelligent life on the Web ... there is a place on the Web for thought provoking content, interesting topics and related links."

‹www.healthleaders.com›
Good site for general healthcare news; I like the daily and weekly e-newsletters even better. Register for them here. Both the site and the newsletters are organized around key topics so you can skip to the subjects of interest. Click on the "Roundtable" button near the top; some good discussions on a variety of healthcare topics.

with responsibility for promoting the application of IT to clinical information processes and working with clinical staff to define requirements for clinical information systems.

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