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Final Report:

Mapping the Future of... CIC Division Los Alamos National Laboratory

January, 1996

Prepared by:

Northeast Consulting Resources, Inc.

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EXECUTIVE OVERVIEW

This report summarizes three scenario-based strategic planning workshops run for the CIC Division of the Los Alamos National Laboratory during November and December, 1995. Each of the two-day meetings was facilitated by Northeast Consulting Resources, Inc. (NCRI) of Boston, MA. using the Future Mapping® methodology.

Throughout the course of these meetings, approximately 100 participants (including CIC managers and staff, as well as customers) examined alternative futures for CIC's mission, structure, services, and organization. The formal objectives for the Future Mapping® workshop were as follows:

- Define a strategic direction for CIC Division as a system of desirable and achievable endstates.
- Facilitate the generation of action plans to achieve the desired strategic endstate(s) using the concept of events.
- Document the results of the strategic thinking process in a way that facilitates updating CIC Division's strategic plan.
- Ensure that CIC Division's strategic direction and action plans are consistent with the Laboratory's more comprehensive strategic thinking process, which is also using Future Mapping®.
- Assist CIC Division management in formulating an implementation strategy for the agreed-upon strategic direction and action plans.

In preparation for the meetings, NCRI conducted approximately three weeks of interviews with members of CIC and its customers from across the Lab. The information gathered during these interviews was used to create the materials that are the foundation of the Future Mapping® process.

Alternative Futures for CIC Division

During the course of the Future Mapping® workshops, CIC managers and staff evaluated five distinctly different possible industry models. The full text of these models, known in Future Mapping® as Endstates, is included in Appendix C of this report. In short, the five Endstates examined were:

Endstate A = The Low Cost, High Value Provider

CIC maps its future to fit the major de facto standards of the commercial computer industry. Major services built from products produced by industry price/volume leaders. The Division sets about to reduce systems diversity in order to reduce cost of IT at the Lab. Labor intensive activities are outsourced. Purchasing is aggregated to obtain volume discounts.

Endstate B = Focus on Science and Technology

CIC focuses exclusively on computing and infrastructure for HPC S&T. CIC has built a high profile external identity for LANL in HPC and information science. This identity leads to a number of dual-use, spin-on, and spin-off efforts with close links to industry. Support services and infrastructure operations are outsourced to a single (strategic) contractor. CIC has operational responsibility for managing this outsourcing relationship.

Endstate C = The Services Manager

CIC has positioned itself as the Lab-wide services manager for all of IT. The Division has focused on maintaining and growing a few strategic core competencies—the rest is bundled together and run by sets of outsourcers. CIC is the single customer interface for all services—ensuring that the outsourcer lives up to customer expectations. CIC continues to be the overall architect of LANL information systems and develops a strong core competency in re-engineering, which it provides to the rest of the Lab.

Endstate D = Internal Internet Provider

Computing is decentralized and shadow organizations have been legitimized. CIC establishes a lowest common denominator of standards built around a campus Internet foundation. Entrepreneurial efforts characterize surviving, diverse CIC groups. A board established with representatives from all relevant computing organizations coordinates, oversees, and moves IT forward at the Lab.

Endstate E = Enterprise Integrator

Shadows willingly give up control of IT, seeking the support of CIC for highly complex systems. Fast networks bring user transparency and new economies of scale to centralized operations. A rich, Lab-wide infrastructure and information resource built and operated by CIC provide many benefits to end users. Many unique HPC/HPSS facilities at LANL establish and enhance the institution's reputation in HPC.

Subsequent Exercises

In subsequent exercises, participants developed a framework that fit the endstates together into a system. Systems illustrate the major choices facing the organization, a timeline for strategic alternatives, or represent what teams believe is the best mix of strategies for the organization. Selected endstate systems are summarized in Appendix D of this document.

The workshop concluded with participants selecting a set of three to five critical actions/initiatives CIC must undertake within the next 12 to 18 months. Participants at each meeting prioritized and discussed the critical actions. The results of this exercise are summarized in Chapter 5 of this document.

A full set of Future Mapping® workshop materials are included as an Appendix to this document. These materials include the meeting agenda, Industry Endstates, a Future Mapping® event set, and the presentations describing the agenda and tasks of the workshop.

Key Findings

CIC Division articulated a strong vision of how it can contribute to the overall mission of the Laboratory through these workshops. Research and development in various areas of information sciences, modeling and simulation, algorithms for scientific computing, and high performance computing hardware and software technologies were clearly identified as the primary future drivers for a growing and vibrant CIC. In addition, a strong second vision theme emerged around the topic of information management as a high-value contribution to the Laboratory's mission and effectiveness. Lastly, the development of a comprehensive, Lab-wide distributed computing infrastructure for high performance computing was seen as a crucial, critical path responsibility for CIC in the next five years that will be essential to the Laboratory's ability to operate as a cross-functional, multi-disciplinary provider of leading edge R&D.

Key actions were identified as critical to achieving these longer-term goals:

- ASCI must succeed and meet key milestones on time.
- New growth areas of R&D for S&T use of IT must be found and developed to diversify CIC funding and keep LANL at the forefront in the use of HPC technology.
- Lab-wide distributed computing infrastructure for high performance computing needs to be designed and deployed successfully.

- An underlying broadband communications infrastructure tying the entire Lab together needs to be completed and the schedule for its completion needs to be shortened.
- Definition of a core set of standards for computing and infrastructure needs to be established and a migration path for at least half of the Lab to these standards needs to be defined. CIC must lead by example and standardize within the Division. Next, the half of the Lab that is administrative and support needs to migrate to a standards-based infrastructure. There was much doubt raised as to whether the S&T half of LANL would ever adopt a limited range of standards, but progress in the rest of the Lab should not wait for the S&T side.
- Standards for integration of information within the Lab, and possibly the entire complex, need to be defined and implemented successfully.
- CIC needs to improve its customer satisfaction rating through adoption of service level measurements and agreements, more customer outreach, and a new attitude toward customers who want to do some or all of their support themselves.
- CIC needs to improve its ability to measure its costs and service levels and to compare these measures against other organizations of various types.
- CIC needs to proactively investigate outsourcing and ensure that it is in charge of any effort to use outsourcing to improve service or lower costs. Outsourcing needs to be considered in partnerships with the customer base.
- CIC needs to develop a clear and well articulated vision of how integrated, Lab-wide infrastructure for distributed and high-performance computing will contribute to the effectiveness and success of LANL in the future. CIC needs to promote these ideas to the LLC and to the group leaders and individual contributors throughout the Lab. This powerful vision can be CIC's greatest lever in achieving its own vision of the role it can play in the Lab.

To proceed, CIC needs to take a set of key issues to the Laboratory leadership and attempt to forge a consensus on Lab policy in information and infrastructure management. The current trend toward decentralization and local control and management of information technology is viable but raises concerns about future limitations to effectively operate in a cross-organizational mode. Without serious

commitment to standardization, however, a decentralized approach to support and implementation is probably the only practical route.

However, the pendulum has already begun to swing in the other direction, back toward centralization, in most other organizations that NCRI advises due to concerns over lack of interoperability, soaring support costs, and defocusing of mission-oriented organizations with infrastructure management issues. In recentralizing, however, it is crucial to not revert back to a self-serving, inwardly focused, expensive bureaucracy. The competitiveness of the current situation in which decentralized groups are viable creates an important tension forcing improved customer service and cost consciousness, which must not be lost.

CIC has explored both a fully decentralized and a recentralized approach to IT development and management for LANL. Clearly, the latter is preferable to it and there is strong belief that this is in the best interest of LANL. This dichotomy needs to be aired at the LLC level and some synthesis created that can provide CIC and the rest of the divisions with a clear set of policies and directions for making IT effective and progressive in the Lab.

Structure of This Report

This report is divided into five sections. Each provides a summary of one or more exercises from the three Future Mapping® meetings conducted for CIC Division in November and December, 1995. Although the differences among the three meetings will be highlighted at various points in this report, the document is a summation of perspectives, strategies, and opinions of the three meetings combined. Consistent with this approach, the endstate defenses in Chapter 3 explore the main themes of each endstates, and the unique points-of-view developed by successive teams in creating a defense.

Section 1 is an introduction to the report. It provides an overview of the scope and goals of this strategic thinking exercise and briefly describes the Future Mapping® methodology.

Section 2 summarizes the results of the first Future Mapping® exercise, the Conventional Wisdom Scenario. This exercise provides a group of managers an opportunity to make many elements of their mental models explicit—revealing much about what the group believes the organization expects of itself and the external environment out to the planning horizon.

Section 3 summarizes the defenses of each of the five Future Mapping® endstates developed for this CIC Division strategic thinking exercise. The three endstate defenses, one from each workshop, are examined in succession.

Section 4 provides a summary and analysis of events deemed by workshop participants to be either critical to the future of CIC Division, or common to many of the strategies the organization might undertake.

Section 5 provides a final summarization of the strategic thinking exercise and includes a set of NCRI recommendations to CIC Division.

Appendices A through J contain original meeting materials including: Endstates, Team Tasks (exercise instructions), the CIC event database, computer-generated reports from each workshop, and important team notes, flip charts, and diagrams.

1 INTRODUCTION

1.1 Project Overview

CIC Division of the Los Alamos National Laboratory retained the services of NCRI to assist the organization in creating a strategic vision consistent with the long range vision of the Laboratory. NCRI prepared the materials, agenda, and facilitation for a Future Mapping® scenario-based strategic planning workshop which was held in Los Alamos, New Mexico in November and December of 1995

1.2 Interviews and Data Collection

NCRI staff conducted three weeks of interviews on-site in TA-3 with CIC management, thought leaders, key staffers, and CIC customers. The information collected during these interviews was supplemented with NCRI's knowledge of LANL. NCRI worked with the Laboratory director and the LLC during the institutional strategic thinking exercise of 1994. NCRI consultants also drew upon their knowledge of the IT industry and client work.

Upon completing interviews and data gathering activities, NCRI created the materials required to run a Future Mapping® workshop, including:

- Event set
- Industry Endstates
- Workshop agenda
- Series of strategic analysis and planning exercises

1.3 Future Mapping® Workshop Agenda

The Future Mapping® process consists of five primary activities. These interactive group exercises provide a framework in which participants were able to explore the future of CIC Division. The exercises used were:

- 1) The **Conventional Wisdom** exercise, which explores participants' shared assumptions about the future. This exercise provides both a glimpse of the future and a diagnosis of where a management team holds uniform or divergent opinion.
- 2) A **Scenario Defense** exercise, in which teams of participants each advocate and defend a different endstate for CIC and deliver a presentation that justifies their position.

- 3) The **Common and Critical Event** exercise identifies the set of events (issues) common to all five of the endstates. These events identify the set of issues that CIC must address regardless of the strategy the Division undertakes.
- 4) Construction of endstate systems, during which teams of participants attempt to illustrate the linkages between multiple endstates. This is a synthesis task, during which participants begin to make choices about the many strategies available to the organization.
- 5) Selection and prioritization of critical events. This exercise provides participants an opportunity to select actions they believe are critical to moving the organization forward—or are obstacles which must be overcome. Participants choose actions/issues which they believe warrant attention within the next twelve to eighteen months.

In the Conventional Wisdom exercise, a single workshop of participants is divided into five groups and asked to vote on the likelihood of each of 160 possible events that might happen in a 1995—2005 time frame. Each team must come to a position (Highly Likely — greater than 80% probable, Highly Unlikely — less than 20% probably, or uncertain — between 20% and 80% probable) on each event based on the opinions and knowledge of the team members. When all the teams have completed their voting, a position is established for the entire workshop. Once individual teams have completed voting, facilitators analyze voting across teams to determine which events the entire workshop believed to be either Highly Likely or Highly Unlikely. At least three of five teams must agree on an event for it to be considered Highly Likely for an entire workshop.

The choices a management team makes in the Conventional Wisdom Scenario is a diagnostic tool. It is roughly equivalent to the “You Are Here...” dot on a road map—the exercise helps the management team understand what it believes and indicates areas where there is strong agreement or sharp disagreement among decision makers. The results of this exercise should not be interpreted as some sort of absolute truth—simply a projection of current thinking into the future. As is clear from subsequent exercises (endstate defenses, endstate systems, critical events) participants changed their thinking and modified expectations throughout the two-day workshop.

Below are a set of summary themes and observations from the Conventional Wisdom Scenario developed in the three workshops. In general, the group had a fairly skeptical conventional wisdom regarding events which implied quick, decisive action by either CIC, its customers, or the Lab management. The group was quite optimistic, however, wherever HPC S&T was concerned, or interesting new infrastructure applications (such as information management, data mining, etc.) were raised. More specifically, groups generally believed that:

- A broad set of standards for desktops, OS, software tools, etc. will accommodate the diversity and end-user freedom of choice that is characteristic of the LANL culture. Throughout workshops, participants acknowledged the value of narrowing the base of standards to reduce both diversity and cost, but did not believe the divisions would support the effort.
- Very large data stores will be critical to the mission of both CIC and the Laboratory in the future. Vast amounts of experimental, programmatic, compliance, and policy data would be made available and accessible to anyone in the Lab from any point on a

Lab-wide network. The group believed that this infrastructure would be created at the Lab and by CIC.

- Large data stores and projects such as the Library Without Walls will be augmented by a rich set of distributed collaborative tools (groupware.) CIC will play a key role in developing and deploying these tools.
- Software development will be transformed within CIC. On the HPC side, a move to OO-based C++ for a production weapons code is a cornerstone of the ASCI effort. CIC is expected to take similar action with respect to business operations: create applications from reusable objects; buy standard libraries where appropriate; buy shrink-wrapped and/or customizable software packages, such as PeopleSoft, wherever possible.
- The Laboratory will experience a more rapid churn in platforms as industry continues to push the limits of better, cheaper, smaller, and faster. GFLOP-range desktop machines are expected near the end of the planning horizon. CIC will be challenged with managing a variety of migration paths and minimizing discomfort as large segments of the user population undergo platform changes from the legacy base (Crays) to the new ASCI paradigm of heterogeneous SMP machines networked together.
- As the complexity, distributed nature, and interconnectedness of information systems at the Laboratory grows, CIC will be challenged to develop strong competency in remote, automated distributed network and systems management. The Division will further develop its skills as implementer, user, and builder of such management systems. There was generally strong belief that CIC would become more efficient and automated.
- Although shadow organizations are a sub-optimal from a cost standpoint, shadows provide a high level of responsiveness and control for divisions.

Several important event themes are explored in greater detail below. Greater detail about the group's conventional wisdom may be garnered from workshop reports contained within the appendices of this document. Each event themes highlighted below includes a listing of several events which support the theme, along with comments about the use of the event through the three workshops.

2.1 Highly Likely/ Unlikely Events

2.1.1 Information Management and Access

Several events were unanimously chosen across the three CIC workshops which indicate that the group believes information management will be an important focus in the future. Events about Explorer, compliance databases, WWW home pages, and enterprise integration models were selected in both this exercise, and subsequent endstate defenses.

1997 Explorer Contains Full Database of Policy and Procedures	<i>Unanimous likely, all workshops</i>
1997 ESH Makes Various Compliance Forms and Databases Available via the Web	<i>Unanimous likely, all workshops</i>
1998 Every Major Lab Project Has a Home Page	<i>Unanimous likely, all workshops</i>
1998 Lab E-mail Deemed Federal Records	<i>Unique Likely</i>
1996 Data From Old Weapons Tests Highly Valued	<i>Unanimously Likely</i>
1997 Distributed Processing but Centralized Data is Mainstream Architecture	<i>Unanimously Likely</i>
1999 CIC Implements Integrated Administrative Data Warehouse	<i>Unanimous likely, all workshops</i>
1997 LANL Library Takes Over E-Print	<i>Unique Likely</i>
1996 Flood of Web Tools Hits the Market	<i>Unanimous likely, all workshops</i>
1999 Enterprise Integration Models Critical to the Success of the Organization	<i>Unanimous likely, all workshops</i>
1997 All LANL Business Applications and Information Accessible Using Web Browser	<i>Unique Likely</i>

2.1.2 Support Costs

Participants believed that an increased focus on cost throughout the Lab would undermine shadow organizations. Divisions would be forced to get scientists out of support roles and back to doing science. CIC will help divisions benchmark the cost of IT, demonstrating how expensive such organizations are.

CIC will apply IT management skills and refined support processes to drive down the cost of service. In conjunction with cost data and funding pressure, CIC service enhancements and efficiencies would drive users toward more centralized support.

1998 Scientists Gravitate Back to Doing Science	<i>Unanimous likely, all workshops</i>
1998 Average Life of Computer Systems Drops to Three Years	<i>Unanimous Likely, all workshops</i>
1996 Support Costs Linked to IT Diversity	<i>Unanimous likely, all workshops</i>

2.1.3 Automation and Efficiency

Groups selected a number of events about automation and efficiency, indicating that there was belief in efforts to streamline operations.

1997 LANL Begins Campaign to Decommission Legacy Systems	<i>Unanimously Likely</i>
1999 CIC's Operation of Large Server Farms is Highly Automated	<i>Unanimously Likely</i>
2005 CIC Support Operations Achieve Efficiency, Reduce Headcount	<i>Unanimously Likely</i>

2.1.4 Standards

As indicated previously, participants had a fairly skeptical view of standards. Although some (obvious) standards would be adopted—such as IP, WWW, etc.—divisions are free to use virtually any end system. Macintosh, Unix, PC, and others must all be supported. CIC is seen, however, to adopt a narrower set of standards for its own operations, thereby, reducing diversity, support costs, and interoperability. Only the third workshop believed compliance with the IA is likely through the year 2001. DCE and CORBA are not seen as important standards for the Lab through the 1998-9 timeframe.

2.1.5 Distributed Workgroups

CIC will build better interoperability than simple E-mail. Something will be done to improve systems, perhaps middleware standards will be the best approach. Security will improve as the industry focuses on these problems as they relate to the Web and larger virtual corporate networks. Participants had conflicted belief about groupware. Two workshops endorsed groupware at the Lab, one voted it unlikely. This seems to have been a reflection of what participants thought was a poorly run Notes pilot.

1998 End-to-End Security Packages for Virtual Data Networks Commercially Available	<i>Unanimous likely, all workshops</i>
1997 CIC Groupware Service Deployment Completed	<i>Conflicted voting</i>
2005 Electronic Mail is Still the Lab's Primary Interoperability System	<i>Unanimous unlikely, all workshops</i>
2000 Virtual Workgroup Support an Architectural Norm.	<i>Unanimous likely, all workshops</i>

2.1.6 Programmatic Funding and Funding Sources

Participants agree that programmatic HPC funding may become scarce in the next five years. Other than ASCI, few programs at LANL will fund HPC at historic levels. Participants chose events implying a LANL future in fraud detection and information warfare.

1997 SMP Machine Testing Hits Teraflop Range	<i>Unanimous likely, all workshops</i>
1997 LANL Loses Defense Nuclear Agency Computing Dollars	<i>Unanimous likely, all workshops</i>
1999 Congress Funds Electronic Systems Defense Act	<i>Unanimous likely, all workshops</i>
1997 Net Outflow of Dollars for Computing from LANL	<i>Unanimous unlikely, all workshops</i>

2.1.7 Outsourcing

Few outsourcing events were chosen during the conventional wisdom exercise. At best there was conflicting voting among the teams. Copying—the most innocuous of outsourcing events—was chosen in one workshop as likely to be outsourced. Participant's attitude toward outsourcing in this exercise is indicative of the uncertainty and discomfort surrounding the topic.

2000 Single Vendor Awarded Large Outsourcing Contract at LANL	<i>Unanimous unlikely, all workshops</i>
1998 Copying/Printing Operations Outsourced	<i>Unique Likely</i>
2000 Study Shows Employees Happier Working for Outsourcer	<i>Conflicted voting</i>

2.2 “Missing” Events

In addition to events chosen as Highly Likely/ Unlikely, events for which participants render no vote are interesting. Two themes are explored below, productivity and customer service.

2.2.1 Productivity

No events about productivity were selected by workshops during the Conventional Wisdom exercise. All three workshops failed to endorse the event suggesting that LANL would have world-class support systems for scientists. Moreover, CIC did not embrace the event which suggested that LANL would collect detailed time utilization data to determine efficiency/productivity across various scientific and administrative functions in the Lab. These events are interesting because they are both, in a sense, benchmarks. Not only does CIC not believe support systems will be world class, some question whether LANL management will undertake studies to benchmark productivity as a prelude to re-engineering processes. When combined with mixed voting concerning groupware (two teams voted groupware Highly Unlikely), CIC seems pessimistic about both individual and group productivity. It should be noted, however, the CIC was relatively optimistic about improving its own productivity.

2.2.2 Customer Service/Responsiveness

The Future Mapping® event database contained 11 events which were directly concerned with CIC Division's customer interface. Of those 11 customer events, only one made conventional wisdom; it was voted Unlikely. For example, teams often voted that CIC would not create a single customer interface. Instead, teams talked about reassigning CIC staff into division organizations to build responsiveness and for 'distributed CIC staff' to be the customer interface.

In general, groups in all three workshops chose few events which suggested that CIC's customer satisfaction rating was “Very Good” while mostly rejecting the event suggesting that LANL infrastructure is poor. Furthermore, events which suggest mechanisms for improving customer service were not chosen:

- Performance appraisals based on customer service
- Lower cost structure attracts new customers
- CIC Establishes Service Level Tracking
- IT Coordinating Councils Implemented at LANL

Finally, there was much debate about an event which suggested that customer divisions would receive "Hire/Fire" authority over assigned CIC staff. The events suggested that a division could have a new staff person assigned if it was unhappy with an individual support person. Groups debated whether or not this policy was currently in place and were unable to determine whether it would be in the future. Such customer authority (responsiveness) would seem a tenant of a customer-focused organization.

3

FIVE FUTURES FOR CIC DIVISION

This section summarizes the five endstate presentations from each of the three Future Mapping® workshops. Endstates are examined in turn, A through E. Rather than repeat entire endstate defenses for each workshop, this report summarizes the major themes and significant insights of each team.

3.1 Endstate A

3.1.1 Workshop I

The first team to defend endstate A asserted that cost is driving IT investment and purchasing decisions at LANL. Standardization on a single computing platform builds efficiency into operations and enables high volume purchasing—both contribute to lowering cost of computing. Rapid convergence on cost/volume leader products throughout the computer industry has made it possible for the Lab to adopt a single computing platform across all aspects of the institution. Science, business operations, and support functions may be completed from the same hardware/OS platform.

Teraflop desktop machines, advanced OS, and high performance networks allow users to stitch together hundreds of machines into a virtual MPP machine. Roughly 95% of the compute cycles of any machine at the Lab are used—either by the desktop user or as a part of a larger scientific calculation harnessing the processing power of many machines. This distributed, virtual MPP utility is supported by an infrastructure which includes centralized storage (nothing is stored locally), automated data backup, electronic software distribution, and high levels of security. This is essentially an extension of the ASCII Blue model of computing into the desktop environment.

CIC operates as the integrator of the 10,000 desktops at the Lab. The Division funds computing operations via nominal chargeback fee based on the number of desktops owned by a client division. “Super computing” is accomplished via network of distributed desktops, and, except for the nominal chargeback is free. CIC has built the software and networking tools required to run this “virtual super computer” of 10,000 desktops. CIC has outsourced/divested non-core competencies.

3.1.2 Workshop II

In the second workshop, Team A took a stricter interpretation of the Endstate, setting aside the notion of the virtual super computer built from thousands of desktop machines. The group extended the definition of the standards to be adopted at the Lab to include not only desktops and OSs, but distributed OO tools; OO libraries and development environments; and groupware/information sharing systems. The group suggested that the cost savings of A are generally derived from smart make vs. buy decisions.

While the Lab is building large and complex distributed systems by year 2005, it uses industry standard components. The IA (Information Architecture) sets forth a set of clear principles for making such decisions. Furthermore, the IA must be a living standard—evolving as the industry evolves—providing mechanisms for migration to and adoption of new enterprise standards. Without LLC-level commitment the standards processes cannot work. The group indicated that it believed that robust standards would be defined for business/administrative systems while low level standards and a higher degree of autonomy would prevail for S&T applications and users.

This vision of CIC requires strengthening the Division's ability to provide complex systems integration. New systems would include standard components wherever possible, new components where required. A CIC which continues R&D functions is likely to drive several important industry standards processes—providing linkage between R&D and implementation/operations. The success of the Division, under such a model, is highly dependent upon the degree to which R&D and operations people collaborate. Therefore, the group was not in favor of splitting CIC into separate support and R&D organizations.

3.1.3 Workshop III

The third team to defend Endstate A defined a sharper focus between low cost and high value services provided by CIC. The group established a differential pricing model in which volume services based on standards are inexpensive while custom solutions are charged premium prices, thereby, incenting customers to use low cost high volume services. Indeed, the group squarely cast the problem of efficiency, standards, and cost as being exacerbated by what it referred to as "Lab economics," rather than market economics. The team believed that the Lab must and will continue to focus on cost which will drive homogeneity in the computing environment, further reducing the cost of computing (especially maintenance.) Currently, Lab economics often subsidize esoteric solutions at the expense of what should be low-cost volume leaders.

Volume services are those circumscribed by a clear set of de facto and de jure industry standards. Value services require in-depth knowledge of the Lab and its

scientific disciplines. Team A identified several high volume services, including: networking, word processing, data archival, storage, communications services, JIT purchasing, contract management, desktop support, library, records management, mail, distributed computing services (middleware), and most business systems. High value applications include: data mining, HPC, HPC algorithm development, most network consulting, some training, object development, and information security technologies.

3.1.4 CIC Conclusions About Endstate A

Across the three workshops, participants drew several high level conclusions about this endstate:

- Most Lab staff will not buy into the idea of sharing (or making available) desktop and server computing resources as was suggested under the virtual super computer defense of workshop I.
- Discomfort during standards migration is directly proportional to the restrictiveness of standards. Narrowly defined standards will require large investments in both system reconfiguration and retraining for both users and support personnel.
- Standardization is difficult to achieve at any level in the Lab. The culture is experimentally driven and embraces flexibility/choice.
- In general, CIC personnel were not pleased with implication in Endstate A that the PC might become a Lab standard. Establishing PC as a standard, however, would clearly indicate alignment with industry.
- Shadow organizations appear to be a low cost support solution to LANL divisions. This is (believed be) a consequence of the Lab not taxing such support as it would a CIC service.
- Records, information management, and business applications have historically taken a back seat to S&T within CIC. This must change. Information is the product of the institution and it must be managed rigorously.
- CIC must demonstrate the cost savings associated with varying degrees of standardization before the Lab may embark on any serious effort toward selecting and transitioning to meaningful standards.

3.1.5 Participant's Ranking of Endstate A

Participant's ranking of Endstate A were heavily influenced by individual team defenses. The team in workshop II received the highest attainability score. The team defended an endstate where LANL has different sets of standards for scientists and non-scientists. This defense increased the "attainability" score since it provided flexibility for scientists while reducing diversity in the larger Laboratory user base. Participants also ranked this strategy second in terms of "desirability." Other defenses of A showed the endstate to be much less desirable and somewhat less attainable. A table of endstate rankings is provided in Appendix G.

3.2 Endstate B

3.2.1 Workshop I

Team B envisioned a renewed focus on science driving the CIC Division. The Division is focused "outward" to customers: divisions within the Laboratory DoE, industry, and other collaborations (non-traditional government and commercial ventures.) CIC closely aligns science with the overall S&T mission of LANL, and manages outsourcing of all infrastructure operations for the institution. On the S&T side, CIC ensures linkage between long-term national (defense and non-defense) needs and driving (the high performance computing) industry forward.

CIC projects successfully attract early S&T funding for HPC (notably ASCI and quantum computing), HPCC (exabyte-scale storage), information surety, crisis modeling, and related applications, fueling the ascent of science within the Division. Funding is largely derived from external sources, but LLC jump-starts programs with LDRD money.

Infrastructure operations, not measuring up to industry service or cost benchmarks, have been outsourced to a single vendor. A single vendor contract provides economies of scale for the outsourcer and reduced operating costs to the Lab while simultaneously ensuring that the vendor provides responsive service. CIC sought an outsourcer with significant experience in: government contracts, HPC, and competence in managing larger heterogeneous computing environments. Outsourcer is responsible for running: mail, voice mail, user authorization and account management, desktop systems, servers, and production HPC. Through outsourcing, the Lab has significantly reduced the cost of IT per seat during the 1997-2000 period.

3.2.2 Workshop II

This team conducted the most thorough investigation of outsourcing and the relationship between an S&T-based CIC and the support operations that the Division must oversee. By 2005, CIC is a world class, applications focused scientific and engineering organization focused on applying advanced hardware and software systems to solve real world problems. The organization measures its success by the degree to which it a) can compress cycle time in solving scientific problems; and b) win new sources of funding.

CIC has bifurcated into R&D and support organizations, nicknamed "A Team" and "Cosmic Support." The Division now employs roughly 150 people, down from over 700. The remaining 550 employees have largely been absorbed by a single strategic outsourcing partner. The team picked every outsourcing event—summarizing that they would outsource everything that was not part of an HPC core competency. This competency includes tools and techniques such as: HPC R&D (ASCI), OO, CORBA, modeling/simulation, etc.

Team B used a ship analogy to describe relationship between A-Team and Cosmic Support: A-Team steers the ship while Cosmic Support keeps the engine and mechanical systems running. The team developed a sophisticated model describing the technology transfer mechanisms that move leading edge R&D solutions into the production environment for the Lab. All applications (R&D or production) are deployed on an infrastructure of reusable objects. Scientific HPC continues to set direction for mainstream computing architecture. Support, installation, and maintenance of HPC components shall be transitioned from CIC Division to outsourcers as HPC architectures are widely adopted by mainstream industry. The team cited HPSS as an example. Over the course of a decade, the technology will become the core of what is now the CFS—making the transition from leading edge to mainstream technology.

The team made a final set of controversial points concerning outsourcing. The group contended that there would be a very small net loss of FTEs as a result of outsourcing. The outsourcer would hire a large part of existing CIC support organization. Outsourcers would probably: provide better compensation and benefits; provide the opportunity to work with a variety of clients (not just LANL); and invest in training. These actions will make the 'outsourced' employees more marketable. Finally, the team asserted that the Laboratory management track is a technical track with little room for support managers. Working for an outsourcer would put support managers on a track to very senior positions.

3.2.3 Workshop III

In the third workshop, Team B took a fairly narrow view of the Endstate, focusing the defense on the S&T business of CIC. The defense flows from the central

premise that high-end scientific computing is a niche market and that there is not a big market in the problems and solutions that CIC wants to address. Therefore, the Division must be sharply focused on the S&T market. The real base of all LANL capability is modeling and simulation which requires world class HPC; everything else is outsourced.

High-volume services are particularly suited to outsourcing since it is easy to define specifications and performance benchmarks. This outsourcing may take many forms—one or two vendors or outsourcing services to other parts of the Lab. The institutional focus requires a partner committed to working with R&D organizations. On the other hand, high value, expensive programs and capabilities can not be outsourced. CIC is uniquely positioned to meet these needs and the future of both the Lab and CIC are dependent on that positioning. High value services/initiatives are often directly funded, and therefore, the best 'customers' of CIC.

Positioning HPC as a critical and expanding component of LANL's core mission—consistent with the vision of Sig and the LLC—will require a major new program customer with a significant budget. Crisis management and intervention seem the most likely places to look in the future. ASCI is clearly a strong transitional funding source. Programmatic funds will underwrite expansion of computing facilities on par with the quality of the Labs' experimental facilities.

3.2.4 CIC Conclusions About Endstate B

Across the three workshops, participants drew several high level conclusions about this endstate:

- Participants expressed many concerns about outsourcing; notably ownership of problems (more difficult in Endstate C), liability, retaining knowledge and expertise in-house, incenting responsiveness.
- Participants generally agreed that Endstate B proposes a "return to science" which is at the heart of LANL's mission, and therefore, a critical part of the CIC Division.
- Just as DNA outsources super computing work to LANL, CIC might outsource a major component(s) of its own operations to a third party.
- Outsourcing is seen by a vocal minority as simply not acceptable—particularly to the extreme posited in Endstate B and exemplified by the defense in workshop II.

- Participants in all workshops expressed concern about the quality of the outsourcer secured by the CIC Division. Participants characterized the Lab's current relationship with JCI as less than favorable and something to be avoided.
- Any outsourcer selected by CIC must meet the various compliance and operational requirements of the DoE.
- UC employees are not allowed to behave like a business, but an outsourcer is a business. Overall, this will be better for the Lab.

		A-Team	Cosmic Support
CIC-1	Comm Services		160
CIC-2	Desktop		80
CIC-3	Infomatics	30	
CIC-4	Telecom	10	70
CIC-5	Networking	10	25
CIC-6	Cust. Service		20
CIC-7	Prod. Computing	25	25
CIC-8	Dist. Computing	10	10
CIC-9	Photog.		20
CIC-10	Mail/Records	5	60
CIC-11	Storage	10	10
CIC-12	Application Prog.		50
CIC-13	Business Sys.		60
CIC-14	Library	5	40
CIC-15	Adv. Databases		35
CIC-16	ACL	15	
CIC-17	Pages		35
CIC-18	Infrastructure		15
CIC-19	Scientific Computing	30	
		Total 150	Total 715

3.2.5 Participant's Ranking of Endstate B

Attainability and Desirability scores for Endstate B were also heavily influenced by team defenses. The workshop I team focused on the S&T elements of CIC. As a result, it was the most desirable of the endstates. This high score provided a 'halo-effect' which also influenced participant "attainability" rankings. The endstate was tied with D in terms of attainability. The workshop II defense explores both S&T and the outsourcing component of the endstate. The team carefully explored the consequences of outsourcing to a degree which made other participants uncomfortable. As a result, the endstate was seen as quite undesirable (fourth place) and quite unattainable (tied for last place). A table of endstate rankings is provided in Appendix E..

3.3 Endstate C

3.3.1 Workshop I

"CIC Loves its Customers!" was the slogan of Team C. The group crafted an extreme defense of the multiple outsourcer endstate in which CIC focuses on a very few core competencies (the HPC R&D, HPC operations, and HPC program development such as ASCI) while the rest of CIC is outsourced. The defense mimicked the B team focus on science; emphasizing outsourcing as a way to reduce cost, while using outsourcing contract administration as a mechanism to build closer relationships with the Division's customers.

Several services were bundled together for outsourcing, including:

- CIC 1, 9, and part of 17
- CIC 12, 13, 15
- CIC 2 and 6
- CIC 14 and 10
- CIC 18 (not bundled)
- CIC 7, 11, and the remaining parts of 17

The Division was seen as free to outsource to any number of contractors it saw fit. Services are benchmarked prior to outsourcing such that the services bundle may be clearly defined for the outsourcer and to measure contract performance over time. Reducing the cost of service to the Lab is extremely important. The group believes that LANL is competing with Sandia and others on the basis of cost. Over time, DoE will move programs to the most cost effective institution. Contract management was seen as a requisite core competency for this strategy. CIC retains control over BPR since it transcends bundling and outsourced services.

3.3.2 Workshop II

[Endstate C was slightly revised between the first and second workshops to encourage teams to explore CIC Division core competencies and focus on selective outsourcing.]

The team adopted a model in which CIC is an IT broker for the Lab. Some services and infrastructure it provides directly, others are delivered through a constellation of outsourcers through agreements managed by the Division, other services are created/supported in association with legitimized shadow organizations across LANL. CIC has a core competency in helping customer divisions make design Vs build decisions and work through the advantages of outsourcer or CIC as service provider. Customer service and responsiveness was an overarching theme of the

presentation. Managed properly, shadows will seek guidance from CIC in creating complex systems and grow to appreciate the value of Lab-wide infrastructure. Several success factors were cited by the team, including:

- Benchmarking all costs and processes against industry and best in class as a prelude to outsourcing
- Outsourcing in competitive areas
- Outsource where extreme degree of customization is not an on-going requirement
- Separate volume from custom services and drive toward standardization across the Lab
- Establishing a competency in managing multiple outsourcers

The group defined a list of existing and "wanna-be" CIC core competencies:

- HPSS
- HP networking
- Visualization of large data sets
- Information management and repositories
- Parallel algorithm development
- Scientific algorithm development

The group identified several basic candidate services for outsourcing:

- Wiring
- Operating systems R&D and maintenance
- Computer resource management
- Network administration and build-out
- Business applications development

CIC has separated R&D from support functions. CIC will make decisions with customers in a consultative manner, choosing between a) customer-built solution; b) CIC-built solution; and c) outsourcer-built solution based on who can deliver better, faster, cheaper. The key is to help customer divisions, CIC, and outsourcers all focus on their own core competencies. Just as with any services broker, CIC

might be funded through commissions or (nominal) fee-for-service. CIC, however, still runs Lab-wide infrastructure via modified recharge schemes.

3.3.3 Workshop III

The third team to defend Endstate C emphasized business process re-engineering and added both BPR and architecture capabilities as key core competencies of CIC. The team created a list of what to outsource and how individual services might be bundled together for contracting and assignment to individual vendors.

The group reminded participants of the principles and steps involved in BPR:

- Get support from highest levels of management
- Identify processes from customers and core competencies
- Obtain baseline measurements for key processes
- Adopt a proved and consistent re-engineering approach
- Dedicate staff resources to the effort
- Stay the course
- Get into CQI mode via-a-vis best-in-world standards

3.3.4 CIC Conclusions About Endstate C

Across the three workshops, participants drew several high level conclusions about this endstate:

- Groups alluded to thorny HR issues surrounding the Endstate C outsourcing model. CIC will be a smaller organization in 2005. Many people will be either terminated or re-employed by an outsourcer. Managers who currently run infrastructure service organizations may be relegated to the role of contract management. Laboratory and DoE leadership, however, would be pleased if the UC headcount were to decrease as a result of the strategies implied in the endstate.
- CIC must first decide what are its own core competencies—the organization seems to have difficulty doing this well.
- Science may suffer under this endstate—participants generally believe that science will fail unless it is the dominant focus of the Division.
- Discussion after endstate C presentations led participants to accept the value proposition of legitimized shadow organizations. This point was reaffirmed in subsequent discussion.

WHO BUILDS WHAT?

CIC Builder/Operator

- Will be used by mult. Lab customers and falls within a CIC core competency
- Nobody else does it
- Security
- Integrating mixtures non-STD/new components
- Min. cost, high quality

Outsourcers Build/OP

- Highly competitive, (cheap) many vendors
- Very highly specialized skills required - even CIC does not want to have these skills
- Min cost, high quality
- Integrating standard components into mass market solutions

"Division Support" Build/OP

- Need something specific to one division
- Better, faster, cheaper
- Already have skills
- "One-off" solutions
- On-going requirement

3.3.5 Participant's Ranking of Endstate C

The second and third workshops provided the best defenses of C. The team of workshop III provided a sound exploration of outsourcing which lent credibility to the endstate. Overall, it was seen as quite "attainable" in the workshop (ranked highest). The team's emphasis on core competencies convinced participants the endstate was quite Desirable as well. It scored second in workshop III. C was

ranked middle of the pack in other workshops. A table of endstate voting is provided in Appendix F.

3.4 Endstate D

3.4.1 Workshop I

The team created a scenario it called, "The American Way" referring to the entrepreneurial, customer-driven services organization that is now CIC Division. Computing, even HPC, at the Laboratory is highly decentralized—enabled by technological advances and a "corporate" intranet which ties divisions together.

CIC's evolution tracked that of the larger computing & communications industry, adopting Internet standards and distributed computational/storage models. CIC fosters adoption of a minimal set of core standards which allow the Lab to share institutional information. Customers choose to use CIC division as the preferred service provider because the group efficiently and economically provides services including: providing a core communications infrastructure, building interoperable systems, and connecting independent and geographically dispersed LANs into a core laboratory network.

Research and development is done by CIC Division only when a customer will pay for it. In general, much of the research that was done by CIC Division in the early 90s is now done in other divisions, notably T and X. This decentralized research approach is efficient, even when applied to HPC, since it must be both justified and funded through programmatic sources—programs for which HPC is but a single component—those programs generally belong to other divisions.

3.4.2 Workshop II

The second team to defend Endstate D called themselves, "entrepreneurs@internet.lanl.gov." The team provided an enriched view of the Endstate which focused on the structure of CIC and its role in computing at the Lab in 2005.

Key drivers of Endstate D are the Division's desire to directly control computing environments, application development, spending, and IT staffing—all enhancing division's ability to deal with cost and downsizing pressures. Shadows are responsible for all aspects of their own computing support and operations, utilizing CIC services primarily to "tie-in" with other divisions and to leverage a core distributed computing infrastructure built and maintained by CIC for the institution. As a result, CIC is doing more consulting and systems integration on a fee-for-

service basis. Backbone services and distributed computing are run on a nominal flat-rate/desktop basis.

By 2005, CIC consists of 300 people divided among a core of CIC 4 & 5 and the distributed computing piece of CIC 8. Some entrepreneurial pieces of CIC 2, 6, 7, and 8 remain. CIC 9 and 17 go away. Many parts of the organization are absorbed by division customers who require dedicated resources.

3.4.3 Workshop III

The third team to defend Endstate D continued the theme of user-based computing, but sought decentralized control mechanisms in order to optimize IT flexibility for customers. Flexibility is seen as consistent with needs of the experimentation-driven institution and its culture. The team posited an external world consistent with previous teams in terms of Internet/tools growth. It also postulated decreased funding for HPC and loss of congressional support for SBSS.

The D team sought to preserve the best characteristics of both centralized and decentralized computing environments. Specifically, the team sought to preserve compliance with important standards; consistent approaches to building solutions; interoperability; and cost effectiveness while building in customer responsiveness and rapid deployment of solutions. Strategies for achieving the vision include establishing a powerful IT Council to drive decision making and ensure compliance to an extended Information Architecture for the institution. The network was believed to be important to both: a) providing the connectivity; and b) establishing common standards for interoperable systems. The group stated that CIC standards must encompass not only the network, but information management and information/scientific research tools, such as the LWW. These were deemed to be critical to future success of the institution—in terms of both scientific and business operations. Indirect funding (overhead) supports both the network and information management systems. Consulting is provided on a fee-for-service basis.

CIC Division is smaller in 2005, consistent with the other defenses of Endstate D. Staff are roughly allocated as follows:

- Infrastructure: 70 managing cluster/server farms and the network
- Information management: 60 combining library and Lab-wide records
- Application development: 110

These numbers were thought to be a minimum staffing threshold for any CIC scenario.

3.4.4 CIC Conclusions About Endstate D

Across the three workshops, participants drew several high level conclusions about this endstate:

- CIC succeeds in Endstate D by demonstrating that it provides better value and efficiency than divisions might achieve by sourcing work from outside the Lab. In the long run, the same litmus test must be applied to all of CIC functions. Where CIC is not best-in-class, an argument can be made for outsourcing.
- Successful and entrepreneurial CIC must be structured such that internal groups do not compete with one another. This will be a significant management challenge where several CIC groups are capable of profitably providing the same service to Lab customers, since service revenue are the catalyst for building D-style businesses.
- Security risks threaten the extreme view of decentralization and Inter/intranet usage posed in this model. CIC must invest significantly in overcoming the security problems associated with the distributed system if it wishes to move toward this Endstate.
- Participants largely agreed that business/administrative computing should be separated from technical computing under this model. The driver of decentralized computing for scientific divisions is flexibility. Business computing, however, will benefit from the control and standards associated with centralization which is a key mechanism for improving reliability.
- Divisions want to do business this way in the future. CIC customers from ES&H and T-Division were among the most ardent supporters of the endstate and its notion of empowering customer divisions to control their own IT destiny. Decentralization of computing, storage, and support are critical to gaining control over costs and reducing the burden of recharge rates laden with subsidies and overhead taxes.
- Decentralization, taken to this extreme, will probably result in higher overall IT costs for the Lab.
- CIC is its own largest customer today. Until this situation is remedied, the organization will be (improperly) focused on delivering R&D rather than on delivering service.

- Concern that D represents loss of HPC as core competency. Once the competency is gone, outsourcing is inevitable.

3.4.5 Participant's Ranking of Endstate D

Endstate D, although thought not to be "desirable" in any workshop, was well defended and generally seen as "attainable" by participants. Teams in workshop I and III included strong customer participants. Customers helped teams convince CIC that LANL divisions might choose to operate in a manner consistent with D. This strongly influenced D's "attainability." Desirability of D was highest in workshop I where the defending team emphasized the (attractive) entrepreneurial elements of the endstate. Even this tact, however, could not raise Desirability above third place. A table of endstate rankings is provided in Appendix E.

3.5 Endstate E

3.5.1 Workshop I

Team E created a scenario in which Laboratory management has re-centralized all operations, development, and support of computing under CIC Division. The Division is tasked with establishing standards for and creating a tightly coupled, interoperable Lab-wide information infrastructure of heterogeneous systems. Computing, storage, and information systems are linked via a low cost high speed network. Shadow support organizations, now disbanded, had been unable to provide the interoperability, range of technical solutions, and high levels of reliability available from CIC. Moreover, outsourcers lack the computing competencies and knowledge of the Lab required to serve division customers successfully.

The team viewed E as a science-driven endstate. Maintaining a strong competency in information management, systems operation, and HPC was seen as critical to meeting the Lab's missions of SBSS and Science Serving Society. Furthermore, CIC Division's ground-breaking work in HPC and information management made it possible to attract new S&T funding. Funding supports a range of unique facilities required to conduct the Lab's mission.

CIC established internal and external customer advisory committees to ensure that the Division responds to customer needs. The committees are key standards bodies and assist CIC in maintaining interoperability. To further the Division's commitment to service, a large number of CIC staff are located at customer sites.

3.5.2 Workshop II

Team E posits a future in which CIC, the group that built the Lab's capable but complex infrastructure, is now one of the best SI groups in the world. CIC's special expertise and professional management are required to keep it running. The institution is focused on productivity—getting scientists back to doing science—and shadow organizations have turned out to be very expensive. The Lab cannot depend on a single outsourcer, nor can multiple outsourcing relationships be effectively managed. An evolutionary process driven by these forces has resulted in a natural recentralization of IT at Los Alamos.

CIC builds solutions from re-usable components, much like an "IT Erector Set". Where special pieces are required, CIC either builds them, relies upon the customer, or buys them. A key strategy is to create re-usable components always. CIC's goal is to make the rest of the Lab view computing as an appliance—relieving customers from having to think about how information systems work. At the extreme high-end of computing, this is less true. Customers, such as X Division, want CIC to push the limits of HPC and understand that this is inconsistent with an appliance view. Systems are in both centralized (e.g. storage) or distributed mode depending on the economics. Cheap, high performance networking benefits both approaches.

3.5.3 Workshop III

The third team to defend Endstate E focused sharply on an information management mission for the organization. Information must be easy to find, enter, and use; being interoperable, secure, and accurate. CIC will act as the institution's information custodian—a behind the scenes manager—leaving divisions as the stewards of their own content.

Information is run as a centralized service funded from overhead; a utility model. Data mining and groupware are ubiquitous, unique resources at the Lab's disposal. Scientists gain powerful collaborative tools; DoE gains instant access to information; DP sees unique capabilities at LANL that make it a preferred resource for attacking difficult problems.

As information custodian, CIC must manage information repositories and establish standards while providing distributed access to all resources. A large number of CIC staff sit in user divisions, providing direct customer contact and ensuring responsiveness. The Division must demonstrate that it can be both customer responsive and a low cost provider for this model to work. CIC is governed by a body of advocates who are the Division's principle customers. The team established a Disney World metaphor for the defense: there are lots of interesting things going on in front of the customer, but Disney works because the "behind the scenes" operation is the true competency of the organization.

3.5.4 CIC Conclusions About Endstate E

Across the three workshops, participants drew several high level conclusions about this endstate:

- Some participants suggested that "mass amnesia" was required at the Lab before customers would endorse such a recentralization. There is a strong cultural bias not to trust CIC. Incrementalism seems the only possible solution.
- A key to making E work is giving customers control over their own IT destiny. Control is the reason D is attractive to many customers. The control afforded in D, plus the responsiveness in C provide a mechanism for providing control.
- The pendulum measuring IT centralization at LANL must continue to swing further toward decentralization before recentralization becomes an option. CIC must help customers understand both what they can and what they can't/shouldn't do. This will become more obvious to customers over time, but CIC might accelerate the learning by working with customers.
- Information management must become a core competency for both LANL and CIC. Scientists spend as much as 30% of their time finding information. This Endstate makes IT a tool for science—exactly the right focus for this institution.

3.5.5 Participant's Ranking of Endstate E

Workshop I defense of E was not considered "attainable;" it ranked last. This is largely a result of the team's statement that LANL would mandate recentralization of all IT. Furthermore, the endstate received a low "desirability" rating, perhaps reflecting participant's hesitancy foist a recentralization edict upon the Lab. E was, however, seen as highly desirable in workshops II and III where teams emphasized an information management mission for the Division. Overall, however, even in workshops II and III, the endstate was seen as not attainable. It ranked fourth or last in attainability in every workshop. A table of endstate rankings is provided in Appendix E.

4.1 Common Events

During the creation of scenarios, teams in each workshop were asked to select those events that were relevant to the emergence of their Endstate (in either a positive or negative way). The events chosen by teams in each workshop were analyzed. Events chosen as either Must or Must Not by at least 4 of 5 teams in an individual workshop are called Common Events. Many of these events were Common Events in multiple workshops. Common Events are of interest because they describe a set of issues that CIC must carefully examine, and be prepared to influence, if it is to meet participant's vision for the organization and the institution. Common events are listed below.

4.1.1 HPC S&T

Virtually all teams, in all workshops, focused on S&T—even those teams whose endstate did not describe such a CIC focus. This is clearly an expression of the institutional culture within CIC. Endstate A took the high value portion of CIC to be an S&T organization. Teams defending endstate B explored outsourcing to varying degrees; but all took a strong position with respect to HPC S&T. C teams argued that HPC and its S&T were to remain core competencies of the organization. Most C defenses of C could name few core competencies beyond HPC and HPSS. Teams defending D reluctantly let go of some of the S&T focus, although argued that a D vision of CIC would include HPC S&T entrepreneurs. Team E, whose endstate also supported S&T reinforced its value to CIC and the institution.

1998 CIC Attracts Three Major New External Customers

1999 Congress Funds Electronic Systems Defense Act

1998 ASCI Funding Hits \$145 Million

1999 ASCI goes into Production

1998 Users Revolt in Response to SMP Transition
(Must Not)

2001 Most NWT Work Still on Legacy (Cray) Base
(Must Not)

4.1.2 Infrastructure/Operations

LANL infrastructure issues were common to all workshops. Several teams took the position that LANL management must step up to the notion that IT constitutes infrastructure for the organization, and must be funded as a utility. Endstate D explored a common network. E extended network infrastructure to include information management (including archival, retrieval, data mining). Teams taking a strong S&T position (endstate B) suggested the notion of infrastructure might be extended to include technical tools, algorithms, and other 'softer' applications which directly contribute to the mission of the institution.

- 1999 CIC's Operation of Large Server Farms Highly Automated
- 1999 Enterprise Integration Models Critical to the Success of the Organization
- 1997 High Support Costs Drive Users and Departments Toward Centralized Services
- 1998 Distributed OO Development Tools and Object Libraries Widely Available
- 1997 LANL Requires All Divisions to Use CIC for Server Operations and Networking
- 1998 CIC Study Concludes that Interoperability Barriers Costing LANL \$50M/Year
- 1997 Definition of Lab Infrastructure to Include Technical Software Tools
- 1998 CIC Offers Fixed Rate Price for Network Connection and No Charge for Subnets
- 1998 Recharge Schemes Create Clear Incentive to Use LANL Backbone
- 1997 Lab Accelerates Conversion to High Bandwidth Network Infrastructure
- 2000 Distributed Computing Infrastructure to Support HPC Completed

This last event on distributed computing infrastructure was the only event in the whole set that was common in all three workshops. This indicates that, of all the events, this one is where there is complete unanimity on its importance and necessity to the success of CIC and Lab goals.

4.1.3 Information Focus

Information management was a common theme among many participant teams. Most believe that CIC must step up to the job of information management, suggesting that the product of the institution is information. Excellence in this sphere was both a mission-enabler as well as aid to compliance and force in building operating efficiency.

1997 Lab Managers Demand Staff Adhere to Lab-Wide Information Management Policy

1997 LANL Adopts a Digital Archiving Standard

1997 CIC Groupware Service Deployment Completed

2002 CIC Creates Large-Scale Data Analysis Environment

4.1.4 Customer Service

A successful CIC must be customer focused. Real focus transcends simple indicators customer satisfaction to include measurement of CIC performance against mutually agreed upon service levels. Much of the benchmarking teams B and C declared prerequisites to outsourcing must be conducted by a customer-responsive CIC. It is not enough to hold outsourcers to best-in-class standards; LANL must hold CIC to the same high service quality.

1997 CIC Helps Customers Benchmark Cost of IT

1997 Lower Cost Structure Attracts New Customers to CIC

1998 CIC Customer Satisfaction Rating is Very Good

1998 CIC "Goes Afield"

1998 IT Coordinating Councils Implemented at LANL/CIC

1998 CIC Establishes Service Level Tracking on the Business Systems

4.1.5 Standards

Never has so essential a management tool been so summarily dismissed within LANL as standards. Even CIC managers conducting S&T work admitted the ability to live within a narrower set of standards. Endstate A defenses suggested that 90% of the Lab could live with a single desktop standard, if required. Unfortunately, standards run counter to the experimental culture at the organization, which has spilled over from technical divisions into production operations such as

BUS Division. Reigning in diversity will take a clear commitment by Lab management—not simply CIC.

1999 90% of LANL in Compliance with Information Architecture Standards

4.1.6 Outsourcing

While the conventional wisdom was skeptical of outsourcing events, teams generally embraced the concept within endstate defenses. Most teams chose some outsourcing events. In general, CIC is most willing to outsource anything related to administration or manual processes (mail room, copying, etc.). The key questions are which functions to outsource, how to bundle them together for contracting, and to how many outsourcers? Teams often struggled with these questions. Teams defending endstates A, B, and C provided several suggestions. Team D suggested functions which would be outsourced from CIC back to customer divisions, or discontinued. Several common outsourcing events are listed below:

- 2001 Lab Outsources All Communications to a Carrier
- 1998 Lab Overhead Services Compete with Outsourced Options
- 1998 Payroll System and Operations Outsourced
- 2000 Single Vendor Awarded Large Outsourcing Contract at LANL
(Must Not for most teams; Must for B as mandated by endstate)

4.2 Selection of Critical Events

During the synthesis exercises at the end of day two, participant teams were asked to select those events which they determined to be critical to CIC Division's future success. Events were collected from each team; duplicates eliminated across teams. Participants then prioritized events through a 'dot voting' process. The critical events selected by teams are shown below, grouped by priority level.

4.2.1 High Priority Events

- A number of **ASCI events** were deemed to be critical to the success of CIC, adding further emphasis to the group's investment in HPC.
 - ASCI Funding Hits \$145M
 - Heterogeneous SMP Platform

- ASCI Goes into Production
- HPC S&T is Alive and Well Inside CIC
- LANL Completes HPC System of Heterogeneous SMP Platforms
- Distributed Computing Infrastructure to Support HPC Completed
- Several **architecture, standards, and information management events** were selected, ranging from events about the information architecture to new architectures and standards for information management and systems integration.
 - CIC Creates Large Scale Data Analysis Environment
 - Enterprise Integration Models Critical to Success of Organization
 - 90% of LANL in Compliance with IA Standards
- **Customer service** events reflected the participant's desire to invest in significantly improving both the actual and perceived quality of service delivered to customer divisions.
 - CIC Customer Satisfaction Rating is Very Good
 - CIC Establishes Service Level Tracking on Business Systems
 - IT Coordinating Councils Implemented at LANL/ CIC
- **Benchmarking and outsourcing** were also seen to be important actions; the former as a precursor to the latter. This represents a significant shift from the conventional wisdom view in most workshops. In general, the conventional wisdom showed only mild awareness around benchmarking and process improvement.
 - CIC Benchmarks IT Units in Business
 - CIC Helps Customers Benchmark Costs of IT
 - Outsourcing Support for Legacy Systems Popular

4.2.2 Medium/low Priority

- **High performance networking** was thought to play a significant role in the future of both CIC Division and the Lab as a whole. The network would provide the high speed interconnect required to support HPC, information management, and distributed computing (with centralized data management).
 - Lab Accelerates Conversion to High Bandwidth Network Infrastructure
 - Distributed Processing but Centralized Data
 - Distributed Systems as Reliable as Mainframes for Mission Critical Applications
- A number of **other events** were deemed critical, although cannot be easily sorted into a category. Many of these events were important in the defense of a particular endstate or discussion theme. In general, these events indicate that participants wish to be more deliberate in managing the organization in the future.
 - CIC Budget Up 15% Second Year in a Row
 - Lab to Campaign to Decommission Legacy Systems
 - Lower Cost Structure Attracts New Customers to CIC
 - Recharge Schemes Create Clear Incentive to Use LANL backbone
 - CIC Separates Infrastructure from R&D Functions
 - CIC Adopts Standards for Key Common Systems in CIC
 - Single Vendor Outsourcing

5

NCRI FINDINGS AND RECOMMENDATIONS

This section of the report is a summary of the key themes and decision points which emerged from the meeting. This chapter includes NCRI analysis of: CIC Division strengths, issues, and key transitions; decisions for the LLC regarding the future of the Division; two strategic options for CIC; a summary of NCRI recommendations; and an overview of the next steps CIC must take to move the organization forward.

5.1 CIC Strengths

CIC has established a world class capability in HPC—a capability of which the entire Lab is a benefactor. This capability transcends development, customization, and operation of high performance computing, networking, and storage systems to include: software development, modeling, simulation and related algorithms. Further development of this capability is critical to the success of the institution as a whole. HPC will likely have a dramatic impact on whatever future mission Los Alamos pursues.

CIC has strong experience with Internet standards which have become a mainstay across the computing and communications industry. This experience includes the TCP/IP protocol suite and the World Wide Web. This experience and these industry standards will be the cornerstone of LANL's future distributed application systems and information sharing efforts.

CIC is moving to align itself with industry standards in many important areas. The ASCI Blue effort is a clear example of such an effort on the HPC S&T side of the Division. On the administrative side, the Division has embraced systems such as the Powersoft GUI in development of applications for BUS division, and has the use of shrink-wrapped software (notably PeopleSoft) for human resources management. A continued effort to gain alignment with the mainstream computer industry will both reduce system acquisition and maintenance costs and ensure suitable long-term migration paths for key business and scientific systems.

CIC has developed a strong competency in the understanding and successful application of OO technology. The technology will be a key component of the software migration effort associated with ASCI Blue. Furthermore, the Lab's expertise in OO has helped it achieve many of its significant breakthroughs in modeling and simulation. Maintaining a balance between pushing the limits of OO on the S&T side of CIC Division, while leveraging industry efforts around OO technology for both R&D and business systems will be important to the future success of the Division.

CIC Division has established pockets of entrepreneurial zeal and customer focus, particularly in the areas of desktop support and application development. Nurturing this entrepreneurial spirit will become important as the Division works toward improving service to its customers.

Consolidation of operations and support functions for both S&T and administrative computing. Operations and support are production processes that can achieve important economies of scale and increased professionalism through this consolidation.

CIC operates under a highly participatory management system. The Division has clearly established a culture which values open exchange on a range of issues. This cultural predisposition will serve the organization well, particularly in times of change.

CIC has achieved a strong consensus around a future mission oriented toward information management. There is considerable drive and interest in creating an information management architecture and high level guidelines/ policies for the institution. Notably, the Division saw itself in the role of information 'custodian'—indicating the desire to manage behind the scenes, rather than becoming the keeper disseminator/arbitrator of the Lab's various content assets. Overall, it is clear that the **CIC Division is making important contributions to the future of the Los Alamos National Laboratory** in many areas.

5.2 CIC Issues

Just as CIC Division excels in a number of important areas, the Division must improve performance on a number of fronts. To do so will require a sharpened focus on several important strategic issues.

CIC lacks the production operation disciplines of many world-class support organizations. The Division: has not established key metrics for elements of the institution's IT infrastructure; delivers uneven levels of customer service across and within individual service lines; generally suffers from a poor customer satisfaction rating, and has little appreciation for the importance of a service management competency. Overall, there was little interest in improved measurements of service, costs, and productivity, and some people questioned the value of such "overhead" efforts. These issues are reflections of the larger Lab culture which emphasizes S&T and puts little focus on discipline in service delivery processes. This issue is compounded by the fact that the organization has **little or no skill in process-re-engineering** that will be critical to remedying this problem. Generally, there were skeptical attitudes with regard to BPR and service level improvement. Corporate America has addressed many of these issues by combining responsibility for IT infrastructure and BPR within the auspices of the

CIO, but this idea seems very foreign to the thinking at LANL. There is no real CIO role or real interest in BPR as far as we could see.

The organization has **an ineffective standards process**. Three years have elapsed since beginning the standardization effort, yet there appears to be little buy-in and less progress in implementation across the Lab and within CIC. There is a lack of confidence that the Division can inspire cooperation from the user community. This is largely due to the fixation on a relatively small number of scientists at the Lab rather than the much larger number of administrative, support, and engineering personnel who are likely to be more receptive to standardization which leads to reduced costs. The generally underdeveloped vision of a distributed computing utility for the institution is a victim of this standards process, where it could be part of the process of developing momentum and support for standards.

Overall, there is a lack of interest in serving the IT needs of the non-scientist, both within CIC and across the Lab. CIC is run as a group of scientists serving a group of scientists. This management paradigm de-values the non-scientist user who often gains the most from a well managed IT infrastructure.

The CIC Division suffers from **a lack of focus**. The organization has difficulty deciding whether any individual project, capability or service is part of its core competency, should be relegated to the periphery, or outsourced. This has made it extremely difficult to seriously consider outsourcing options, and has led to a sprawling organization where each group believes that other groups should be outsourced.

Further problems and attitudes hamper the organizations effectiveness. There is strong sense that nothing can be accomplished in less than three years. This attitude is perhaps a symptom of the academic affiliation of the Lab, compared to corporate America, which has strongly embraced the notions of rapid prototyping and development. Mainstream businesses have generally accepted the principle that projects which can not reach important, tangible milestones in 18 months or less should not be started.

The LANL (and CIC's) **culture makes it difficult to act like a business**—to make clear decisions about identifying, funding, and growing core competencies. The Division virtually lacks any capability to discharge employees for non-performance; lacks accountability for managers and individuals; and has only lukewarm interest in costs and service level measurements. Exacerbated by the fear of additional RIFs, CIC employees worry that they might end up working for an outsourcer who will act like a business. The recent round of RIFs left the entire organization in a state of extremely low morale, which seems to have further jeopardized productivity and effectiveness.

The relationship between CIC Division and shadow support organizations ranges from mildly cooperative to outright competitive and adversarial. CIC must resolve its position vis-a-vis shadows. An answer cannot be reached without the input of the LLC. Three high level policy options exist: 1) eliminate shadows; 2) compete with shadows for the business of LANL divisions; or 3) accept the existence of shadow IT and cooperate with them, recognizing their role in front line support to IT users. Regardless the CIC/shadow relationship, it would be wise for the LLC to create a CIO position at the Lab. The CIO would be chartered with, among other things, maintaining a strong working relationship with shadows and ensuring interoperability standards across the entire institution.

The Lab has no stated policy on what are the key elements of the **institutional IT infrastructure** and who is responsible for managing each element. Such a policy will be fundamental if the LLC were to legitimize shadows. Should the Lab's infrastructure be limited to some lowest common denominator of networking? Should it include basic computing and storage systems? How much of the HPC domain must it include? What common technical tools, software libraries, and general scientific algorithms are a part of the institutional computing and communications infrastructure? CIC Division must present alternatives to the LLC to guide it in policy-making.

Finally, CIC must figure out a way to **measure and compare costs in a meaningful way**. The somewhat arcane way that the Lab handles costs and surcharges on them makes it hard for organizations within the Lab to make rational decisions.

CIC must make a number of difficult, but important transitions over the next ten years to remain effective in the face of serious cost pressure, increasing technological complexity and accelerating change. CIC must find and nurture opportunities for it to add value to the Lab while it achieves much higher levels of efficiency in the lower value-add activities of infrastructure management. The key transitions, shown in the following table, are not unique to CIC Division. Every IT organization that we work with is grappling with these difficult challenges and working hard to change their culture. CIC must not claim immunity from change on the basis of its unique culture, which is a problem widely faced. It has no dispensation from the real world of managing information systems and infrastructure well in a rapidly changing era of technology and organizational goals.

Most of the transitions are matters of achieving a new balance rather than a complete change in approach. They point to new competencies (e.g., service management, systems integration and information management) that must be proactively and strategically developed and in which investments must be concentrated.

Key CIC Transitions: 1995 to 2005

From	To
Doing It All	Managing Others, Doing Some
Inventing It All	Mostly Integrating, Some Inventing
Best Possible	Most Cost Effective
110% Solutions	80% Solutions
Infrastructure Focus	Information Focus
Unique Approaches	Industry Mainstream Approaches
In-House Only	Balanced In-House and Outsourced
Ad Hoc Processes	Production Operations Discipline
Labor Intensive	Automated
Physical Assets	Intellectual/Soft Assets

5.3 LLC Decisions

CIC must seek support and guidance from the LLC in several areas as a part of any serious effort to address the issues stated in the previous section.

How should IT policy be set at Los Alamos National Laboratory?

There are several options: 1) Use an IT Council consisting of representatives from all or most Laboratory divisions and using a federated style of decision making and implementation. 2) Establish a Board of Directors with membership similar to an IT Council, but narrower membership and larger decision-making authority and direct CIC to be the primary implementer. 3) Vest responsibility for setting IT policy within the LLC. 4) Vest IT policy authority entirely within CIC.

Several tradeoffs exist for each alternative. Processes which include broad customer participation are apt to provide the highest levels of compliance with policy but are also apt to be slow. Restricting policy to CIC may make it difficult to enforce policy, and further strain the Division's relationship with its customers. Vesting IT policy-making within the LLC might needlessly politicize the process but lead to broader support within the LLC for CIC Division.

LLC must consider funding high performance networking build-out from Lab overhead. Creating such a network infrastructure was required in all CIC endstate defenses and was seen as an important initiative in several endstates used in last year's institutional strategic thinking effort. Similarly, the event which stated that "distributed network computing infrastructure to support HPC completed" was the only common event across all workshops. Finally, the network is clearly the centerpiece of a number of information management applications—ranging from ES&H compliance to NWT R&D—critical to the future success of the institution. As said earlier, a Lab-wide infrastructure for distributed, high-performance computing will soon become a clear necessity for the Lab to be able to function in the information age and continue to do state-of-the-art science. In

addition, this infrastructure will be crucial to automating key administrative tasks and re-engineering overhead functions to lower cost and improve responsiveness.

Where should IT support be done? LLC must decide what is in the best interests of the institution. Should it be distributed throughout LANL or centralized within CIC? Should this be the choice of each division or a mandated policy? Distributing the support function may lead to increased responsiveness in the short term, but CIC might match that level of responsiveness through continued process investments. A problem with decentralized support is that it will be a distraction from the main mission of each division.

How should IT standards be set at LANL? Were the LLC to back establishment and gradual migration to a more standardized environment, interoperability and information access might be improved while costs are driven down. If the LLC will not take a strong stance in favor of standards, then it should consider decentralizing support because it will be impossible to support a highly diverse environment with a central group in a cost effective manner.

Should CIC pursue outsourcing and how should shadow organizations be involved? Alternatives range from not outsourcing (perhaps missing opportunities to improve service levels, reduce costs, and for CIC to focus on core competencies) to outsourcing entire Lab-wide functions. Outsourcing across the Lab will require significant cooperation among the divisions and CIC. In general, it won't be all that advantageous to only outsource the portion of a function done by CIC without including the shadow functions in other parts of the Lab. Why should CIC be a sole target of outsourcing? An intermediate step might be to outsource functions within CIC and allow the outsourcer to use the CIC services to compete with, and eventually win business from other Lab divisions. As an example, outsourcing all copying across the Lab might be ideal, but is probably unlikely given the scale of copying operations. Outsourcing CIC copying, which represents only about 5% of all copying at LANL, and using that outsourcing contract as a entry point to the Lab for an outsourcer will likely lead to widespread use of the outsourcer over the long term.

How important is it to the Lab to create an identity in computer science and information management? A real external identity requires a Division-level organization, not skills spread everywhere across the Lab. If this Division-level identity is invested in CIC, then the Lab should acknowledge it by making it the core CIC mission. Of course, it may be difficult for the Lab to make such a politically charged decision.

5.4 Strategic Options for CIC Division

Reflecting upon the many issues and decisions facing CIC, NCRI has formulated the following two strategic options for the organization. Each option calls for the Division to undertake a different set of complementary actions. Option 1 is aimed at decentralized IT support. Option 2 explores a more centralized model.

5.4.1 CIC Strategy Option 1

Option 1 calls for a decentralization of computing at LANL which requires each division to manage its own computing environment. Shadow organizations must be legitimized and chartered with responsibility for front-line support of end users. Both IT and information management are administered through shadows. The strategy acknowledges the need for IT diversity and flexibility across the Lab. Maximizing flexibility requires strong local support and cannot be centrally administered in a cost effective manner. The figure below provides a graphic depiction of the main strategy elements for Option 1.

CIC builds and supports a LANL intranet distributed computing infrastructure for a nominal flat rate per device (or funded from overhead). This ensures some basic level of interoperability among systems run by each division. Successful entrepreneurial groups may continue to offer (fee-for) services to former shadow organizations. This strategy will require fewer CIC staff, reducing divisional headcount to roughly 300 people. Many former CIC staff now work for shadow organizations.

CIC builds and operates an intranet distributed computing infrastructure for a nominal flat rate fee per device or fund from overhead. This strategy combines the services/staff downsizing of

endstate D with an increased focus on information management services representative of endstate E.

Setting a direction for the Division shall be accomplished with the guidance of a powerful IT Council consisting of members from all Lab divisions. The council shall have decision-making authority and shall ensure compliance with information architecture standards it establishes. The IA shall establish basic standards for connectivity and interoperability. The Council shall encourage the acceptance of IT standards at the division level rather than across the entire institution. The remainder of CIC will focus on managing the Lab's information assets.

5.4.2 CIC Strategy Option 2

Option 2 calls for a market driven re-centralization of IT in which shadows willingly give up control to the CIC centralized service provider. The increasing complexity and decreasing satisfaction associated with the Division's do-it-yourself approach to IT will fuel the strategy. Fast networks will provide user transparency and new economies of scale for centralized systems. Centralized data storage with distributed processing will be a mainstream application architecture. Various pieces (or all) of a system may be centralized depending upon application needs and economics.

A CIC focus on information management is required. The driving goal should be for CIC to liberate divisions from building information management infrastructure, allowing each division to focus on its core mission and to use a common information management infrastructure created and maintained by CIC. Although CIC provides information management tools and platforms, individual divisions shall remain stewards of their own content. Such a rich information infrastructure will provide many benefits to the Laboratory's user base.

Stability diagram representing the various endstate elements dominating the Option 2 vision of CIC. The B/E and B/C dynamics

of selective outsourcing and a focus on information management and selective outsourcing dominate.

CIC shall build a high profile external identity for itself and the Lab in high performance computing and information science. This will be accomplished through a continued focus on S&T which will attract the programmatic funding required to build unique HPC facilities at LANL. Collaborating with industry will provide a steady stream of dual-use, spin-on, spin-off projects that will build and reinforce this HPC identity.

As a precursor to outsourcing, CIC shall begin significant efforts to benchmark, measure costs, and re-engineer processes. CIC staff shall be distributed into customer divisions to provide the responsiveness and flexibility customers require. In beginning these efforts, CIC will develop world-class systems integration capabilities and be ready to outsource services that are not core competencies. CIC will retain operational responsibility for managing relationships with outsourcing contractor(s).

5.5 NCRI Assessment and Recommendations

Overall, the S&T side of CIC is in good shape, is confident in its abilities, and is re-energized through the ASCI program. The support side of the organization, however, is not operating as well. In our opinion, complete merging of support operations with S&T is not working well. While the union may be beneficial given the unique culture of the Lab, it has significant drawbacks. Although a stand-alone support group would have little support in the Lab, making it a target for RIF and outsourcing, it is not a customer-responsive organization today. Ironically, CIC's lack of customer responsiveness makes it susceptible to exactly the same RIF/outsourcing pressures as a stand-alone support organization.

5.5.1 Action 1: Differentiate Activities in CIC Better

Keep S&T, information management, and infrastructure management within CIC, but more clearly separate them within the organization. Each should be run as a group of groups with their own Deputy Division Director. The group of Directors would then be responsible for setting policy and managing the organization as a whole, in conjunction with the Division director. Other mechanisms for supporting technology transfer from R&D to support exist: action teams; task forces; matrix reporting relationships, etc. Each CIC group must be clearly chartered as responsible for either R&D, operations, or support. Multiple reporting relationships and groups split between two meta-groups would reduce the efficiency of this organizational structure.

The rationale behind this recommendation is that these activities require different skills, different incentives, and different kinds of management. What makes for a

good researcher does not, generally, make for a good support person, and vice versa. We have observed many instances in CIC where good research ideas get mixed up with approaches to production services, resulting in long delays in implementation and poor service reliability. Clearly, the S&T side of CIC overwhelms the support side in terms of status and thought leadership. The problem is that, as far as we can tell, the S&T side of CIC doesn't know very much about professional service delivery in IT. The support side of CIC is not dabbling in S&T, but the reverse seems to be somewhat true.

NCRI sees the benefit of combining these diverse functions in one Division, but we question the way that the organizational structure of the Division has been aligned. Also, we believe that the Director needs a more focused second level of management below him/her. As the Lab Director has indicated, CIC's Director is spending too much time on internal support issues, something which should be the focus of a key deputy. The Lab Director needs to concentrate on external matters, finding and developing new sources of funding, and pushing the Lab-wide setting of policy on IT.

5.5.2 Action 2: Take Key Issues to the LLC

Drive the LLC to take a proactive and conscious approach to setting IT policy. The Division must work hard to engage the LLC in key issues of standardization; information stewardship; and cultivating the IT/ IM/ M&S competencies. CIC should set forth a plan for investment in developing leading edge capabilities in these areas on par with further development of theory and experimental capabilities in other parts of the Lab.

5.5.3 Action 3: Measure

CIC must begin a significant effort to measure the performance of the Division and the services it provides. Demonstrating continued improvement in a number of key areas is a sure strategy for gaining support and building respectability within the Lab. CIC must quickly decide on the most useful, practical, and high impact areas to begin such measurement efforts. Recommendations include:

- Begin benchmarking against other organizations
- Develop a more accurate understanding of the true costs to deliver individual services
- Set service levels in contractual agreements with Division customers

The lack of benchmarking is a clear indication of the general lack of professionalism present in the services side of CIC Division. Outsourcing a poorly established and defined (benchmarked) service will inevitably fail. Detailed measurement of costs and service levels is a clear prerequisite for working successfully with an outsourcer.

5.5.4 Action 4: Establish an Information Management Mission

Establish information management as CIC's primary mission, in addition to S&T. Define CIC's role as the integrator of information created in a decentralized Lab. A longer term plan in which information assets are centralized but distributed access must be developed. The Web and Library Without Walls are a strong foundation on which to build this mission. An internal web will be the foundation for integrating dispersed information assets until, and through, a period of transitioning to more centralized control. As part of this effort, CIC must champion the creation of high level data models for the entire institution.

5.5.5 Action 5: Confront Outsourcing Rationally

Over time, CIC will most likely need to outsource at least some infrastructure operations and support. Before that can be accomplished, a deliberate strategy of

centralizing and automating infrastructure operations must be executed successfully. Many infrastructure operations are commodity services of relatively low value (compared to other areas of CIC activity). These characteristics make it an ideal target for outsourcing.

CIC, however, is not currently prepared to outsource anything and should not begin an outsourcing program until work on measurements, standardization, and many of the aforementioned issues have been addressed. Organizations cannot successfully outsource what cannot be measured; cannot manage outsourcing of services that can not be reliably delivered.

At a high level, there are two distinct outsourcing options for CIC. The first is to outsource a few bundles of activities (telephones, LANLnet, and LAN support might be one bundle) to various outsourcers. The second option would be to cut a single outsourcing contract for all infrastructure operations and support. The former is a more difficult management/contracting challenge. The latter is a more aggressive strategy requiring a higher level of expertise, a higher level of trust in the outsourcer, and significant contracting/negotiating prowess.

5.6 Next Steps

5.6.1 Next Steps in Approval Process

Decisions within CIC's span of control may be taken quickly. For example, measurement and benchmarking activities may be initiated immediately. Other decisions have Lab-wide consequences and need agreement and approval from others. CIC must help decision-making bodies (LLC) decide which options to pursue in the short, medium, and long term. In the context of the chosen option, CIC must determine what recommendation it will make to decision-making bodies. The LLC will likely be receptive to such input, but cannot be effectively engaged without it.

CIC should begin with a review of key actions and a determination of which require approval outside CIC. These actions should be presented to key customers for feedback and revision as required. Options, actions, and decisions should then be presented to LLC for comment and revision as required. A set of final options, actions, and decisions should then be presented to the LLC for approval. It is likely that the entire process can be completed within four to eight weeks.

5.6.2 Next Step Actions

For each action CIC adopts, answer the following questions before starting work:

- 1 Describe the desired outcome of the action
- 2 What tactics would support the desired outcome?

- 3 What resources are required, and where are they in the CIC?
- 4 Who in the CIC should be responsible for implementation?
- 5 How will we know this action has been successfully completed?

Systematically working through these questions will ensure that CIC has carefully considered each action, its constituency, and its consequences.

5.6.3 Next Steps for Monitoring Progress

As an aide to implementation, and in the spirit of participatory management, we recommend that CIC create a Web page containing implementation steps for the actions it chooses to pursue. Each action, ongoing activities, completed steps, and pending steps must be clearly identified for both CIC staggers, customers, and Lab management to review. Individuals responsible for completing various tasks should be charged with keeping the action up to date. Areas/ e-mail addresses for public comment should be included. This form of information exchange establishes a loose public contract that will be an immeasurable aide in moving implementation forward.

APPENDIX A: FUTURE MAPPING® MEETING AGENDA

Mapping the Future® of...
Los Alamos National Laboratory
CIC Division

Workshop Day One

November 1995

8:00 - 9:00	Opening remarks
Overview of workshop goals and agenda
Introductions
9:00 - 12:00	<u>Team Task 1</u>
Identify Highly Likely/Highly Unlikely events
Purpose: to capture and feed back a detailed
snapshot of the group's current thinking and
expectations
noon	Lunch
12:30 - 1:30	<u>Team Task 2</u>
Review your team's endstate and answer endstate
questions
1:30 - 5:00	<u>Team Task 3</u>
Develop a logical argument that explains how CIC
developed as described in your endstate

Select a "Top 40" (30 to 50) events that must happen
(or must not happen) to make your endstate come
about. Write new events, if required. Post selected
events. |
| 5:00 - 5:30 | Facilitators present the Conventional Wisdom
Scenario, built from the Highly Likely & Highly
Unlikely events selected by the participants |

- 8:00 - 9:30 Review yesterday's work
- Prepare a 20 minute presentation of your team's scenario using the answers to questions and the event themes.
- Organize your presentation around three major themes. Name your endstate and create an icon for it.
- Choose two team members to present your work. (See presentation outline in Team Tasks presentation.)
- 9:30 - 12:00 Five team presentations with Q&A
- before lunch Team Task 4
 Participants re-rank endstates
- noon Lunch
- 12:45 - 1:45 Voting review. Facilitators explain event voting; group discussion.
- Feedback on endstate ranking
- 1:45 - 2:45 Team Task 5 *Three steps:*
- A.) Describe how the CIC endstates fit with the Lab endstates
- B.) Draw a diagram that shows how the endstates fit together over time — we call this an endstate system
- C.) As a team, choose 4 critical events for CIC
- 2:45 - 3:00 Break
- 3:00 - 3:50 Teams present endstate system, Critical Events and links to Lab endstates. (5-10 minutes each)

3:50 - 4:00	Individual prioritizing of Critical Events
4:00 - 5:00	Group discussion of key learnings and conclusions. Closing remarks, next steps.

APPENDIX B: FUTURE MAPPING® TEAM TASK DESCRIPTIONS

Team Task 1

Voting Conventional Wisdom

- Review each event and agree on its meaning
 - About 180 minutes for about 160 events
- Highly Likely means >80% probable, Highly Unlikely means <20% probable
- Being Uncertain is a valid position
- Agree on a team vote; for a team of 6, a NET vote of 4 or better is required (HL = + 1, HU = - 1, Uncertain = 0)
- Please record team vote on colored ballot
- Suggestion: record your opinions on your event review list

Team Task 2

Endstate Defense

- **Develop a logical argument that explains how the world turned out to be the way it is as described in your endstate**
- **You do not have to personally believe in the endstate**
 - However, there is great value in trying to understand why others believe this is a rational idea
 - Act positively, as in a role-play or as a lawyer in court
 - After the scenario presentations, each team member will be asked what they really think about the endstate
- **The goal is a presentation that explains to the other participants *how* your endstate came about**

Team Task 2

Organize the Team's Thinking

- Review with your team your assigned endstate; make sure there is a common understanding on what the endstate means
 - What are the major themes of the endstate?
 - What structural changes in the external environment pose significant opportunities or risks for achieving this endstate?
 - Identify the roles and motivations of key players who would want this endstate to come about.
 - What are the key competencies that CIC must have to succeed in this endstate and what must change in CIC to achieve it?
- Answer the endstate specific questions
- Create a name and a drawing or diagram that capture the basic ideas of the endstate

Team Task 3

Find The Endstate's "Top 40" Events

- **Quickly sort the events into relevant and irrelevant piles, in terms of their impact**
- **Among the relevant, select the Top 40 (roughly 30-50 events) that cause, contribute to, or offer evidence that the endstate is happening (we call these "Must" events)**
- **Consider events that inhibit or stop development of your endstate ("Must Not" events)**
- **Record the "Top 40" events on a "Must/Must Not" ballot**

APPENDIX C: CIC DIVISION ENDSTATES

CIC 2005 A: The Low Cost, and High, Value Provider

- **Map to the computer industry:** CIC's new organization mirrors the growing computer industry split between volume and value.
- **Volume orientation:** The volume part of CIC has focused on integrating and supporting the key mass market, high volume technologies that are driving the computer industry. CIC has succeeded in significantly lowering the cost of computing, storage, communications and support, while improving the reliability and interoperability of LANL's infrastructure by using de facto industry standards from Microsoft, Intel, the Internet and the Web. Off-the-shelf packages have automated much of the Lab's administrative and business functions. Machines, selected from CIC offerings, arrive from suppliers pre-configured with site licensed software and are ready to use out-of-the-box.
- **Value orientation:** The value part of CIC provides a wide range of information management, custom content creation, software design, and algorithm development services. CIC focuses a large portion of its talent on the high value solution of critical application and information management problems for its key customers using detailed knowledge of the specific problem domains. CIC software development has dramatically improved its productivity. Information management and software creation are both highly automated. With less attention paid to low level technology issues, CIC focuses more on improved use of information, unique content creation and electronic publishing.
- **Standards and interoperability:** LANL has adopted a set of mass market platforms because of the cost and interoperability advantages of using industry de facto standards. In the process the computing environment at LANL has become highly standardized, as it has everywhere. Most of the Lab's shadow organizations have disappeared. People really don't think much about computer hardware and software anymore; they focus on their applications, data and effectiveness of communication.
- **Science vs. business:** There are few distinctions between scientific and business computing environments. Super computing environments

are built out of commercially popular multiprocessors linked via very high speed networks. Parallel distributed computing is widely used in business systems. Objects are ubiquitous in business and science. The conversion to ASCI Blue has proceeded faster than expected. Highly automated volume service delivery, in conjunction with decreases in the price/performance ratios for all computing, storage and communications components, has allowed CIC to significantly lower prices to their customers.

- **Manual activities:** CIC has outsourced most manually intensive activities like printing, mail room and desktop services. The Lab has significantly reduced paper which is now very expensive relative to web services.
- **Purchasing and pricing:** CIC is pragmatic and business-like. CIC does almost all of LANL's purchasing of basic hardware and software to get significant volume discounts. LANL works with a few big distributors to streamline the purchasing, configuration and installation process. Charges on volume services change regularly in response to fast-changing technology. CIC's low costs have attracted a new set of external users. The cost of computing acquired via CIC is demonstrably cheaper than the shadow organizations.

CIC 2005 B: Focus on Science and Technology

- **Focus:** CIC has pursued a strategy of focusing on the needs of high-end scientific R&D, high performance computing, advanced R&D in information technology, software and information management. All other activities have been outsourced.
- **Dual Use:** LANL's competencies in data mining, 3D modeling and simulation, pattern recognition, and protection of information assets have been driven into new territory by the "no testing" policy and non/counter proliferation efforts. These have been leveraged into many civilian areas including new materials, the environment, biotech/healthcare and public policy. Faster than real-time simulation has been widely applied in situations where no experiments are possible. All aspects of science are being strongly influenced by the capabilities of powerful networks and processors and innovative software. CIC's capabilities are seen as central to the varied activities of LANL. CIC is a valued partner with many parts of the Lab who are applying modeling and simulation to new problems.
- **Outsourcing:** CIC has outsourced all infrastructure development and operations, as well as the re-engineering, development and support of the Lab's business and administrative systems. A single large multiyear outsourcing contract has been won by a major systems integrator or computer vendor who is treated as a strategic partner of the Lab. The outsourcer has taken over most of the personnel in those areas of CIC. The outsourcer is responsible for most capital investment and amortizes these investments over the life of the contract. The outsourcing contract has resulted in improved service, faster upgrading of systems and infrastructure and lower costs. CIC manages the outsourcing contract for LANL. The Lab's shadow organizations doing this work disappear or are absorbed into the outsourcing effort.
- **HPC:** CIC is responsible for development of specialized hardware and software needed by very high-end computing projects. Even as ASCI moves the Lab to commercial SMP machines, LANL's needs exceed those of products generally available on the market. CIC is involved with many kinds of new and promising machine and software architectures. CIC has developed one of the most advanced distributed object-oriented software environments in the world. Object libraries are used throughout the Lab by researchers. CIC is active in new areas of computing research such as hybrid electronic/biotech nanotech devices, quantum and DNA computing. CIC works with the outsourcer and

other vendors to insure that its advanced development is aligned with industry direction and becomes mainstream.

- **Computing as a Lab identity:** CIC has contributed to diversifying LANL's identity beyond the weapons program, although the weapons program is still the single largest source of funds for computing research. CIC has active programs for partnering with industry to explore things like the industrial application of VR technology and advanced approaches to parallel computing.
- **Getting out of infrastructure and into information:** CIC manages its intellectual capital and nurtures its unique competencies, leaving management of physical assets to the outsourcer. CIC is effective at using interdisciplinary teams that blend various competencies in algorithms, software engineering and advanced computer architecture to solve problems. CIC has attracted a number of world class computer scientists to the Lab. The Lab's mission of "Reducing the Nuclear Danger" has been key to attracting a whole new generation of young scientists to the Lab. CIC collaborates with a number of external organizations on its research projects.

CIC 2005 C: The Service Manager

- **Like most IT organizations:** CIC has become a highly efficient and professional manager of a wide range of computing, communications, storage, information management, and application development services to all of LANL. CIC provides some of these services directly; others are delivered through outsourcers. The high-end R&D and weapons community are treated as valued CIC customers, who work with CIC as partners and collaborators, yet scientific algorithm development (modeling and advanced mathematics) has been moved to other divisions further sharpening CIC's focus.
- **Core competencies:** Diversity, complexity, and rapid change in IT have made it necessary for IT organizations to focus their activities—developing world-class capabilities in a few strategic service areas. CIC, like other IT organizations in government and industry, has developed a few core competencies where it is able to deliver unchallenged, world class services to the Lab. These services include, for example: R&D focused exclusively on HPC resources; development and operation of enterprise-scale information repositories; process re-engineering; scientific applications development; complex systems engineering; and other services which directly support the Lab's core mission(s). CIC has chosen to provide the remaining IT services required by Lab customers through outsourcers. Services are outsourced either because they are not strategic for the Lab or require skills CIC chooses not develop.
- **Outsourcing selected bundles of services:** CIC has positioned itself as a service manager, or broker, determining which services should be bundled and handed off to contractors. CIC supervises a range of such contractors who might provide services such as: network transport, web server operations, desktop support, mail and printing, photo/video, payroll, accounting, etc. Some services are provided by new small businesses in Los Alamos; others are provided from remote locations.
- **Legitimized shadow organizations:** Shadow organizations are now legitimate and CIC provides service in conjunction with them. Ex-shadows are the focal point for IT services in their organization. They turn to CIC for help with outsourcing decisions, assistance with complex systems, or to connect to services CIC operates for the Lab.

- **Customer interface:** CIC manages Lab-wide IT problem reporting and change requests. Its help desk is instantly aware of any problems in the Lab's systems and is linked to operations people in its outsourcers. This allows CIC to monitor the service level provided by each outsourcer. CIC offers a variety of classes of service with prices based on costs, volume, and service levels required. CIC wins Lab business by making good decisions about when to outsource vs. when to build something in-house, and being responsive to customer needs.
- **Re-engineering CIC:** CIC has re-engineered service delivery and procurement processes, providing a great example to the rest of the Lab of how IT can improve efficiency, lower costs and enable new capabilities. It has highly automated links to its many outsourcing contractors and suppliers. CIC works closely with all parts of the Lab on re-engineering projects that use advanced work flow and information sharing technologies to cut cycle time while reducing costs. It has succeeded in developing methods for implementing new information systems in conjunction with work process changes.
- **Architecture role:** CIC is the architect of LANL's full service IT utility that meets the diverse and often unique needs of a wide variety of LANL projects and groups. CIC is recognized as the Lab's expert on the computer and communications industry, insuring that best practice is applied at LANL.

CIC 2005 D: Internal Internet Provider

- **Decentralized computing legitimized:** Computing at LANL has become very decentralized and do-it-yourself. CIC manages key internet services for practical interoperability among the myriad small groups and projects that have become the creative lifeblood of LANL. Diversity and entrepreneurialism characterize most of the Lab. CIC exerts very little control over the computing approaches of groups in the Lab.
- **Internet foundation:** Internet technology and services have become the mainstream of computing. Internet mail and transport protocols are the Esperanto of the computer world. The WWW is the key standard for user interface and information sharing and access. The web is ubiquitous. Its platform-independent approach has allowed all kinds of operating systems and hardware platforms to continue to be viable. The web has been extended into virtual reality, which is now proliferating. The public Internet is the mainstream vehicle for scientific publishing and inter-organizational communication in the R&D community.
- **Smaller, faster and cheaper machines have won out:** Specialized computing hardware is almost a thing of the past. Even the highest end supercomputers run in ambient environments and are routinely bought and operated by various groups in the Lab. Networked workstations and SMP machines routinely perform long computations at night or over weekends. CIC operates only a small fraction of all the servers at LANL, many in a single, tightly linked, cluster for work on large problems. Small machines abound. Technology is still on fast forward and all kinds of network appliances and hand-held gadgets are popping up. CIC has learned to go with the flow and enjoy the ride.
- **Minimizing the center and empowering the shadow organizations:** CIC is focused on the creation of lowest common denominator distributed infrastructure that is inexpensive and usable by large numbers of projects. CIC handles security, directory services and services that enable and promote the decentralized creation of content and applications. CIC is the Lab expert on making large-scale distributed systems work but the former "shadow organizations" are now formally responsible for their workgroup systems. Most systems management is local, CIC operates gateways and the backbone network. Decisions on standards and direction for Lab infrastructure are made by a Lab-wide IT coordinating council, mirroring the federation-style management of the public Internet. Most charge-back services are a thing of the past as organizations directly fund most of their own needs.

- **Flexible and nimble:** CIC is a diverse, entrepreneurial organization that survives through teamwork and competence in problem solving. It hustles for hundreds of small projects for research on computing and communications from a wide variety of customers. Large projects like ASCI have shrunk due to DOE shift to low cost engineering solutions to stockpile stewardship. CIC gets work from other parts of the Lab to develop unique software using its object factory style development organization that is platform-independent, very responsive and capable of fast turnaround. Many of the business and administrative groups within the Lab are able to create their own applications using the very high-level development tools available on the market today. CIC acts as consultant and in some cases development subcontractor to these groups.

CIC 2005 E: Enterprise Integrator

- **Harder work, lower rewards:** Increasing complexity and a general de-valuing of infrastructure work have led to the recentralization of computing. Shadow system managers find it harder to keep up and see their stature degraded as directors push researchers to get back to research and stop administering computers and networks.
- **Fast networks bring new scale economies:** The price/performance of campus/building networks has improved faster than that of processors in the past ten years. Cheap, plentiful network capacity have made it possible to put servers anywhere in the Lab without performance penalty. Servers have naturally migrated into only two centers, one behind the fence and the other outside it. Server farms have gradually consolidated into multiprocessor farms. Very large scale production systems deliver computing, storage and communications services in an extremely reliable manner. Routine low-scale services (e.g., voice, text e-mail) are extremely cheap since they are such a small fraction of processor, storage and network capacities.
- **Information and interoperability:** CIC is tasked with integrating and securing the Lab's information assets, and running a rich, interoperable, infrastructure for the Lab, all of which have become high priority issues for the Lab leadership. CIC is the steward of the Lab's enormous, growing, and rich information assets. Long-term, digital archival storage and information management are major competencies of CIC. Cross-disciplinary work teams are the mainstream approach to work in all parts of the Lab. They use rich multimedia groupware which is delivered to all parts of the Lab in a highly reliable manner via the Lab's ubiquitous broadband utility.
- **Unique facilities:** Unique hardware enables LANL researchers and weapons designers to stay far ahead of what is available through mass market technology. Specialized computing and storage facilities are still a major requirement for LANL's big programs. Grand challenge needs drive development of massive centralized storage facilities and large farms of various kinds of servers. Differences remain in compute centric, network centric and storage centric large scale system designs. Physical proximity matters in multiprocessor architectures for latency-sensitive codes. LANL has developed unique virtual reality facilities for virtual weapons design and fabrication which are now being used by other programs as well. CIC operates a number of fabbers that can

produce intricate parts in a few hours. LANL's unique facilities have attracted users from outside the Lab. External funding is growing.

- **External interfaces and security:** CIC manages all of LANL's connections with the outside world, which have become extensive and fast. Secure interoperability is a key specialty of CIC. CIC maintains elaborate safeguards on the Lab's interfaces to public networks. CIC manages many electronic commerce interfaces to other government agencies (e.g., Treasury), and contractors.
- **Administration:** CIC has re-implemented all key administrative, business and facilities management systems at the Lab, insuring that they adhere to key standards for interoperability and data interchange. CIC operates as a monopoly within the Lab but reports to a board of directors composed of key representatives from other divisions, including BUS.

APPENDIX D: SELECTED ENDSTATE SYSTEMS

D Mechanism that triggers move to centralization

Evolution

1995
-1996 ±

A

B

C

Session 2 Endstate System C

FUNCTION	CANDIDATE FOR CORE	CANDIDATE FOR OUTSOURCE	BUNDLE
Writing/Editing		√	A
Graphics			
Desktop Support		√	B
Net Management (LAN)	√	√	B
Applications Development [LAB- wide Business]		√	C?
[Scientific]	√		
[Local Apps]		√	C?
ICN	√	√	B
Telecom		√	B; D
Mail		√	E
Records Man	√	√	F
Library	√	√	G
Media		√	A
Constructing	√	√	B
Help/Desk			
Production	√	√	H
Computing			
Production Storage	√	√	H
Dist. Computing	√		
Visualization	√		
Web		√	A, B
ACL	√		
Data Mining	√		
ALG. Development	√	√	C, I
Maint/Repair		√	B/J
FM		√	LANL

APPENDIX E: ENDSTATE RANKING RESULTS

The table shows the post-presentation endstate ranking. Participants ranked each endstate in terms of Desirability and Attainability after hearing endstate defenses and participating in Q&A session.

	Workshop 1		Workshop 2		Workshop 3	
	Attain	Desire	Attain	Desire	Attain	Desire
A, low cost	4 44%	2 61%	1 66%	2 64%	5 36%	4 38%
B, S&T	1.5 63%	1 74%	4.5 28%	4 54%	3 53%	3 55%
C, service	3 39%	5 34%	3 63%	3 57%	1 59%	2 68%
D, network	1.5 63%	3 43%	2 64%	5 10%	2 55%	5 16%
E, integrator	5 32%	4 38%	4.5 28%	1 65%	4 47%	1 73%

APPENDIX F: COMPREHENSIVE VOTING ANALYSIS

Future Mapping Comprehensive Voting Analysis

HL/HU Threshold = 0.6
CM Threshold = 0.7

Chain Title	Year	Team HL/HU							Team M/MN							Team Dissonance						Consensus					
		A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	HL	HU	UQ	CM
00053 Distributed OO Development Tools and Object Libraries Widely Available																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L										M												UQ	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998	L	L	L	U	L			77%	M	M		M					⊙	⊙		⊙			HL			
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998	L		L		L				M	M		M					⊙	⊙		⊙			HL			
3 uses out of 3 conferences analyzed		66L	66L	100L	33U	66L			26%	66M	66M		100M					⊙	⊙		⊙			67%		33%	
00219 Customization of Standard Packages Replaces Private Software Development																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996	U	L	L	L				66%				M													UQ	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996	L		L	L	L				M								⊙						HL		UQ	
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996	L	L	L	L	L			✓	M								⊙						HL		UQ	
3 uses out of 3 conferences analyzed		33L	66L	100L	100L	66L			33% 22%	66M			33M					⊙						67%		100%	
00257 Network Computing with Dynamic Load Sharing Widely Implemented																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000				L	L																					
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000				U	U				M			M														
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000	U	L	L	L	L			77%	M			M					⊙				⊙			HL		
3 uses out of 3 conferences analyzed		33U	33L	Δ	33L	66L			26%	66M			66M					⊙				⊙			33%		
03095 Lights Out Server Centers Proliferate																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L		L				M								⊙						HL		UQ	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L		U	L			55%				N													UQ	
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996	U	U	U	L	L			100%				M													UQ	
3 uses out of 3 conferences analyzed		33U	33L	Δ	Δ	100L			52%	33M			Δ					⊙						33%		100%	
03609 Business Users Drop Demands for Vendor-Neutral Standards																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	U				L			44%																		
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	L			U	U			55%				N													UQ	
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996			L	L	U			55%																		
3 uses out of 3 conferences analyzed		Δ		33L	Δ	33U	Δ		52%				33N													33%	
04219 Major International Security Disaster Raises OS Security Standards																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997					L																					
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	L		L	U	L			66%																		
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996	L	U	U	L	L			100%	M	M		N			55%										UQ	
3 uses out of 3 conferences analyzed		66L	33U	Δ	Δ	100L			56%	33M	33M		33N			19%										33%	
04569 IT Coordinating Councils Widely Implemented																											
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998	U			U	U							M												HU	UQ	
1 uses out of 3 conferences analyzed		100U			100U	100U							100M												100%	100%	
04570 Large Enterprise IS Departments Shrink by 60%																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999	L	L							M			N			44%										UQ	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999				U								M													UQ	
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999	L		U					44%	M																UQ	

Except where noted,
summaries are averages in %.
Zeros are not displayed,
except in grand summary.

L = Highly Likely
U = Highly Unlikely
Δ = Mixed Voting

Un = Unanimous
Con = Contention

M = Must Happen
N = Must Not Happen
Δ = Mixed Voting

⊙ = Dissonant
⊙ = Consonant
Summaries indicate at
least 1 occurrence

HL = Highly Likely
HU = Highly Unlikely
UQ = Unique
CM = Common

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Future Mapping Comprehensive Voting Analysis

HL/HU Threshold = 0.6
CM Threshold = 0.7

Chain Title	Year	Team HL/HU							Team M/MN							Team Dissonance						Consensus			
		A	B	C	D	E	F	Un Con	A	B	C	D	E	F	Un Con	A	B	C	D	E	F	HL	HU	UQ	CM
3 uses out of 3 conferences analyzed		66L	33L	33U	33U			15%	33M	33M		33M	33N		15%										100%
04593 Outsourcing Support for Legacy Systems Popular																									
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			U	L			44%																	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	U	L					44%		M														UQ	
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	L		L	L	L			M	M						©	©					HL			
3 uses out of 3 conferences analyzed		Δ	33L	Δ	66L	33L		30%	33M	66M						©	©					33%		33%	
04596 Production Operation Disciplines Applied to Distributed Computing																									
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		U			L		44%	M		M														
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996			L					M	M		M													
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996	U	U			U			M			M				.			.				HU		
3 uses out of 3 conferences analyzed		33U	66U	33L	33U	33L		15%	100M	33M	33M	66M				.			.				33%		
04605 Desktop Management Standards are Widely Implemented																									
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	L				U		44%	M		M	M	M												CM
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	U			U	L		55%	M	M		M													
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			U		L		44%	M		M	M													
3 uses out of 3 conferences analyzed		Δ		33U	33U	33LΔ		48%	100M	33M	66M	100M	33M											33%	
04606 Microsoft Sets the Important Standards																									
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	U				44%	M		M														
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L			L	L																HL		
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	L	L	L	L																	HL			
3 uses out of 3 conferences analyzed		33L	100L	Δ	66L	33L		15%	33M		33M												67%		
04607 End-to-End Security Packages for Virtual Data Networks Commercially Available																									
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L	L	L					M	M	M	M				©	©	©	©		HL		
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998	L	L	L	U	L		77%	M			M						©			©		HL		
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998	L	L	L	L				M			M						©			©		HL		
3 uses out of 3 conferences analyzed		66L	100L	100L	Δ	100L		26%	66M		33M	100M	33M			©		©	©	©		100%			
04994 Cost per Seat for IT Support Drops 50% in Real Terms Since 1996																									
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001			U					M															UQ	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001	L							M															UQ	
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001		U	U		L		55%		M														UQ	
3 uses out of 3 conferences analyzed		33L	33U	66U		33L		19%	66M		33M													100%	
05004 Custom Worktops are the Norm																									
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2002	L							N		M			44%										UQ	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2002		L			U		44%	N															UQ	
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2002	U	U	U	U	L		77%			M							.					HU	UQ	
3 uses out of 3 conferences analyzed		Δ	Δ	33U	66U	33L		41%	66N		66M			15%				.					33%	100%	
05010 Support Costs Linked to IT Diversity																									

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11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		L	L	L	L				M		N				44%	⊙						HL		UQ	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		L	L	L	L	L		✓			N											HL		UQ	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		L	L	L	L	L		✓	M		N				44%	⊙						HL		UQ	
3 uses out of 3 conferences analyzed		66L	100L	100L	100L	100L		67%	66M		100N				30%	⊙						100%		100%	
05012 Virtual Workgroup Support an Architectural Norm																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		L		L		L				M		M					⊙			⊙		HL			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		L	L	L					M			M				⊙				⊙		HL			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		L	L	U	L	L		77%				M								⊙		HL		UQ	
3 uses out of 3 conferences analyzed		100L	66L	33L	Δ	33L		26%	33M		33M	66M	33M			⊙		⊙	⊙	⊙		100%		33%	
05016 Average Lifetime of Computer Systems Drops to Three Years																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L	L	L				N	M					44%			⊙				HL		UQ	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L			L															HL				
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	U	L	L	L		77%	M							⊙					HL		UQ		
3 uses out of 3 conferences analyzed		100L	33L	Δ	66L	66L		26%	Δ	33M					15%	⊙		⊙				100%		67%	
05387 Stockpile Shrinks to Approximately 2000 Weapons																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005		L	L																						
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005		L			U	L		55%																	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005		L				U		44%		M		N			44%									UQ	
3 uses out of 3 conferences analyzed		100L	33L		33U	Δ		33%		33M		33N			15%									33%	
05410 LANL Completes First Version of "Virtual Weapon"																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005		L	L			U		55%		M		M													
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005			U		L	U		55%				M												UQ	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005		L	U		L	L		66%	M															UQ	
3 uses out of 3 conferences analyzed		66L	33U	Δ		66L	33U	Δ	59%	33M	33M	66M												67%	
05460 LANL Initiates Technical "Critical Mass" Policy																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			U			U																			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			L	U		L		55%																	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			U			L		55%	M															UQ	
3 uses out of 3 conferences analyzed		33U	Δ	66U	33U	66L		37%	33M															33%	
05461 UC Refuses to Tender an Offer on the Next LANL Management Contract																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997				U	L	U		55%																	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			U		U	U	U																	HU	
2 uses out of 3 conferences analyzed		50U		100U	Δ	100U		28%																50%	
05464 DOE Decides to Run LANL as GOGO																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U	U	U	U		✓	N							⊙						HU		UQ	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U	U	U	U		✓														HU			
2 uses out of 3 conferences analyzed		100U	100U	100U	100U	100U		100%	50N							⊙								100%	50%

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Future Mapping Comprehensive Voting Analysis

HL/HU Threshold = 0.6
CM Threshold = 0.7

Chain Title	Year	Team HL/HU							Team M/MN							Team Dissonance						Consensus			
		A	B	C	D	E	F	Un Con	A	B	C	D	E	F	Un Con	A	B	C	D	E	F	HL	HU	UQ	CM
05465 DOE Gives the Contract for Managing LANL to a Large Defense Contractor																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U U																							
2 uses out of 3 conferences analyzed		50U 50U																							
05467 Most Lab Projects Involve at Least Two Other Institutions																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L U L 55%																							
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L L L L																				HL			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L L L U 55%							M													UQ			
3 uses out of 3 conferences analyzed		66L Δ 66L 33L Δ 37%							33M													33% 33%			
05469 Lab Overhead Services Compete with Outsourced Options																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		U L L 55%																							
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L L U L L 77%							M N M M N 100%							© . © © .						HL CM			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L U U L L 100%							M M																
3 uses out of 3 conferences analyzed		66L 33UΔ33UΔ66L 100L 78%							66M 33N 66M 33M 33N 33%							© . © © .						33% 33%			
05470 Most Overhead Functions Become Pay as You Go Service Centers																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		U U U L 66%							M													UQ			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		U U							M M																
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		L U U 55%							M N 44%													UQ			
3 uses out of 3 conferences analyzed		Δ 66U 33U Δ 66U 41%							66M 66M 33N 15%													67%			
05472 Interdisciplinary Project Teams Supported by Project Accounting System																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L L L L							M							©						HL UQ			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L L U L 66%																							
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L L L L																				HL			
3 uses out of 3 conferences analyzed		66L 100L33LΔ66L 66L 22%							33M							©						67% 33%			
05473 Lab Re-Engineers Major Overhead Functions																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L L L							M							©						HL UQ			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L L L L L ✓							M M							© ©						HL			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L L L L							M M							© ©						HL			
3 uses out of 3 conferences analyzed		100L 66L 100L 33L 100L 33%							66M 66M 33M							© © ©						100% 33%			
05478 Lab Aggressively Recruits External Project Managers																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U U U U																				HU			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U U U U																				HU			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U U U U L 77%							M							.						HU UQ			
3 uses out of 3 conferences analyzed		66U 100U100U100U 33L 26%							33M							.						100% 33%			
05482 Lab Employment Drops Below 5000																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		L U L 55%																							
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		L L U U 88%																							

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Chain Title	Year	Team HL/HU							Team M/MN							Team Dissonance						Consensus					
		A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	HL	HU	UQ	CM
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		U	U	L		L			88%		N														UQ		
3 uses out of 3 conferences analyzed		33L	Δ	33U	Δ	33L	Δ	Δ	78%		33N														33%		
05488 Definition of Lab Infrastructure to Include Technical Software Tools																											
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			U	L	U				55%	M		M	M	M												CM	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U		U																							
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996			U	U	U	U							M								.			HU	UQ		
3 uses out of 3 conferences analyzed		33U	66U	33U	Δ	66U	33U		19%	33M		33M	33M	66M							.			33%	33%	33%	
05490 High Performance Computing Program Director Appointed																											
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			U	U		U					M										.			HU	UQ		
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	U		U				55%			N												UQ			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			L	L	U	U			88%		M													UQ			
3 uses out of 3 conferences analyzed		33L	33U	Δ	Δ	66U	66U		48%		66M	33N								.				33%	100%		
05491 IT Based Collaborative Work Tools Take Off at LANL																											
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997						U						M		M													
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L	U	U			100%	M														UQ			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	U	U		L			88%	M	M		M	M												CM	
3 uses out of 3 conferences analyzed		66L	Δ	Δ	33U	33U			63%	66M	33M	33M	33M	66M										33%	33%		
05492 Supercomputer Cycles Revenue Falls Below Maintenance Costs																											
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U	U		U					N	N	M			55%		⊗	⊗	.				HU	UQ		
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U	U	L				66%			N		N													
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			U	U	L				55%		N		M	N		55%								UQ			
3 uses out of 3 conferences analyzed		66U	100U	100U	66L	33U			41%		66N	66N	66M	66N		37%		⊗	⊗	.				33%	67%		
05495 LANL Offers Excess Supercomputer Capacity to Researchers for Free																											
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L		U	U	U			66%			M	N			44%									UQ		
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		U	U		U	U																		HU			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		U	U	U	U	U		✓			M									.				HU	UQ		
3 uses out of 3 conferences analyzed		33U	Δ	66U	66U	100U	100U		33% 22%		33M	33M	33N			15%				.				67%	67%		
05496 No Separate Supercomputer Industry Exists																											
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2004		L	L	L	L	L		✓		M								⊗						HL	UQ		
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2004		L	L	L	L	U			77%															HL			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2004			L	L	U	L			66%			M													UQ		
3 uses out of 3 conferences analyzed		66L	100L	100L	33L	Δ	33L		33% 48%	33M		33M						⊗						67%	67%		
05895 Best Distributed Systems as Reliable as Mainframes for Mission Critical Apps																											
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997						L				M		M															
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997				U		L			44%			M												UQ			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997				U						M		M															
3 uses out of 3 conferences analyzed				33U	33U		66L		15%	66M		100M													33%		

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Chain	Title	Year	Team HL/HU							Team M/MN							Team Dissonance						Consensus					
			A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	HL	HU	UQ	CM
05911	Large Scale Server Farms Consolidate into Fewer, Larger Machines																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997				L	L					M			N	M			55%									UQ	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L				L							M										HL		UQ	
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L			L			N			N	M			55%	.			.		⊙	HL		UQ	
	3 uses out of 3 conferences analyzed		66L	66L	66L	33L	66L				Δ			66N	100M			37%	.			.		⊙	67%		100%	
05912	Distributed Processing, but Centralized Data is the Mainstream Architecture																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L			L								M									⊙	HL		UQ	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L			L								M									⊙	HL		UQ	
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L			L			M				M									⊙	HL		UQ	
	3 uses out of 3 conferences analyzed		100L	100L	33L	66L	33L				33M			66M	33M									⊙	⊙	⊙	100%	67%
05913	Clusters Cost Less and Perform Better Than MPP																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L			L			M				M									⊙		⊙	HL	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997				L			U																				
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997					L	L				M				M													
	3 uses out of 3 conferences analyzed		33L	66L	66L	Δ	33L			15%	66M			66M										⊙		⊙	33%	
05921	DCE and CORBA are Dominant Enterprise Distributed Computing Standards																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U	U						M				M									.	.		HU	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U					U							M												UQ	
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997																											
	3 uses out of 3 conferences analyzed		66U	33U	33U	33U					33M			33M	33M									.	.		33%	33%
05926	High Support Costs Drive Users and Departments Toward Centralized Services																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L			L	L			M			N	M			55%	⊙			.		⊙	HL		UQ	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L				L	L					M		N	M		55%		⊙			.		⊙	HL		UQ
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997				L	L	U	U		88%	M			M	N	M		66%									UQ	CM
	3 uses out of 3 conferences analyzed		66L	66L	66L	Δ	33L	Δ		30%	66M	33M	33M	100N	100M			59%	⊙	⊙			.		⊙	67%	100%	33%
05929	Enterprise Integration Models Critical to the Success of the Organization																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L	L	L	L	L		√		M			N	M			55%	⊙			.		⊙	HL		UQ	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L	L	L	L	L		√		M	M			M	M				⊙	⊙			⊙	⊙	HL		CM
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L	L	L	L	L		√		M			M	M	M				⊙			⊙	⊙	⊙	HL		CM
	3 uses out of 3 conferences analyzed		100L	100L	100L	100L	100L		100%		100M	33M	33M	33M	Δ	100M		19%	⊙	⊙	⊙	⊙	⊙	⊙	⊙	100%	33%	67%
05930	Companies Reject Single Source Outsourcing Relationships																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L				L							N													UQ	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L				L						N									.			HL		UQ
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997					U	L	L		55%				N														UQ
	3 uses out of 3 conferences analyzed		66L	33L	Δ	33L	66L			19%	100N												.			33%		100%
06896	UNIX Blown Away by NT																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L								M																UQ	

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		A	B	C	D	E	F	Un Con	A	B	C	D	E	F	Un Con	A	B	C	D	E	F	HL	HU	UQ	CM
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			U			U	U																	HU	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	U	U	L	U		100%		N														UQ	
3 uses out of 3 conferences analyzed		33L	33U	Δ	33U	Δ	66U		33%	33M	33N													33%	67%
06897 Storage is the Key Bottleneck to High Performance Computing																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		U	L					44%			N	M		44%										UQ	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000					L	U		44%																	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		U	L	L				55%		M														UQ	
3 uses out of 3 conferences analyzed		66U	66L	66L	33U			48%		33M		33N	33M		15%									67%	
06898 Gigaflop Desktop Machines Widely Available																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	L	U				55%	M		M														
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			L			L																			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	U		L		66%	M		M														
3 uses out of 3 conferences analyzed		Δ	100L	66U		66L		41%	66M		66M														
06899 Lifecycle Costs of PCs Lower than Macs or UNIX																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L						M															UQ	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998					U	L		44%																	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L				U		44%																	
3 uses out of 3 conferences analyzed		66L	33L	33U	33L	33U		30%	33M															33%	
06900 Flood of Web Tools Hits the Market																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		L	L	L	L	L		✓			M							©				HL		UQ	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		L	L	L	L	L		✓			M							©				HL		UQ	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		L	L	L	L	L		✓		M	M							©		©		HL		UQ	
3 uses out of 3 conferences analyzed		100L	100L	100L	100L	100L		100%	33M		100M							©		©		100%		67%	
06901 Congress Funds Electronic Systems Defense Act																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L		L		L			M	M	M							©	©	©		HL			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L	L		L	L					M									©		HL		UQ	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L	L	L	L	L		✓	M	M		M	M					©	©		©	HL		CM	
3 uses out of 3 conferences analyzed		100L	66L	66L	66L	100L		33%	66M	66M	33M	66M	33M					©	©	©	©	100%	33%	33%	
06902 LANL Named One of the Federal Emergency Response Modeling Centers																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000				L		L			M	M															
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		L	L		L	L																	HL		
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000			U	L	L	L		66%	M	M		M													
3 uses out of 3 conferences analyzed		33L	Δ	66L	66L	100L		22%	33M	66M	33M		33M										33%		
06903 Congress Moves Funds from SBSS to an Engineering Approach																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2002		U								N	M			44%										UQ	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2002																									
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2002		U	L			U		55%	N	N	N		N											CM	
3 uses out of 3 conferences analyzed		66U	33L			33U		19%	33N	66N	33N	33M	33N		15%									33%	33%

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Future Mapping Comprehensive Voting Analysis

HL/HU Threshold = 0.6
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Chain	Title	Year	Team HL/HU							Team M/MN							Team Dissonance							Consensus					
			A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	HL	HU	UQ	CM	
06904	All Three Weapons Labs Run as a Single Organization																												
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005		U	U	U		U																						
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005		U	U	U	L	U		77%																HU				
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005		U	U	U	U	U		✓		N								⊙						HU	UQ			
3 uses out of 3 conferences analyzed			100U	100U	100U	Δ	100U		33% 26%		33N								⊙						100%	33%			
06905	CIC is an Active Member of InfoSec Industry Consortium																												
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			L			L				M	M																	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			L	L	L	L																		HL				
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	U		L		66%		M		M																
3 uses out of 3 conferences analyzed			33L	100L	Δ	33L	100L		22%		66M	33M	33M												33%				
06906	Lab Accumulates Detailed Data on Staff Time Utilization																												
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L		L	U			55%		M															UQ			
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			L	L	U	U		88%		M	M	M																
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			U	L				44%																				
3 uses out of 3 conferences analyzed			33L	Δ	100L	66U	33U		63%		66M	33M	33M												33%				
06907	LANL Gets Funding for and Founds "Center for Scientific Exchange"																												
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999			U							M															UQ			
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999			U			U																						
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L		U	L	U		88%		M		M	M															
3 uses out of 3 conferences analyzed			33L		100U	33L	66U		30%		33M	33M	33M	33M											33%				
06908	Lab Modeling Effective at Detecting Proliferation Threats																												
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999			L			L				M	M														UQ			
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999			U		L	U		55%					M															
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L	U			L		55%		M			M															
3 uses out of 3 conferences analyzed			33L	33UΔ		33L	33LΔ		37%		66M	33M		66M											33%				
06909	World-Class Support Systems Raise Productivity of LANL Scientists																												
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005		L	U			L		55%			M		M															
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005		L	L	L		U		66%		M	M																	
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000			U	U	U					M			M					.				.		HU				
3 uses out of 3 conferences analyzed			66L	33UΔ	Δ	Δ	33U		41%		66M	33M	33M	66M					.				.		33%				
06910	Venture-Funded Start-up Formed Based on LANL Software Technology																												
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L							M															UQ			
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			U	L				44%																				
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L		U	L			55%		M															UQ			
3 uses out of 3 conferences analyzed			66L	Δ	Δ	33L			33%		66M														67%				
06911	Lab Modeling Effective at Detecting Fraud in Information Systems																												
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			L	L	L	L				M								⊙						HL	UQ			

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		A	B	C	D	E	F	Un Con	A	B	C	D	E	F	Un Con	A	B	C	D	E	F	HL	HU	UQ	CM
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L	L	L								M									HL		UQ	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L	U		L		66%	M	M			M												
3 uses out of 3 conferences analyzed		33L	100L	33L	66L	100L		22%	33M	66M			66M									67%		67%	
06912 IBM Commercializes HPSS																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001		L		L	L	L							M									HL		UQ	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001						U							M											UQ	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001		L	L		L																	HL			
3 uses out of 3 conferences analyzed		66L	33L	33L	66L	Δ							33M	33M								67%		67%	
06913 CIC Puts Early Effort into Porting Tools from Legacy Base to ASCII Base																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	L	U				55%																	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	L		L	U		88%				M												UQ	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U		U		L		55%	N			M			44%									UQ	
3 uses out of 3 conferences analyzed		100U	66L	66U	33L	Δ		67%	33N			33M	33M		15%										67%
06914 Early ASCII OO Environment Too Slow																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L	L	L		✓														HL			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	L	U	L			88%	N	N															
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L		L				N	N		N										HL			
3 uses out of 3 conferences analyzed		33L	33L	100L	Δ	100L		33%	30%	66N	66N		33N									67%			
06915 SMP Machine Testing Hits Teraflop Range																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L					M	M						⊗	⊗					HL			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L	U	L		77%				M							⊗			HL		UQ	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L		L				M			M				⊗			⊗			HL			
3 uses out of 3 conferences analyzed		100L	100L	66L	33U	66L		26%	66M	33M		66M				⊗	⊗		⊗			100%		33%	
06916 ASCII Funding Hits \$145 Million																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L	L	L				M	M	M		M			⊗	⊗	⊗		⊗		HL			CM
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			L	L		L					M		M					⊗		⊗		HL			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	U	L	L			66%	N			N													
3 uses out of 3 conferences analyzed		33L	100L	33L	66L	66L		22%	33M	66M	66M		100M			⊗	⊗	⊗		⊗		67%		33%	
06917 US Validates 3D Codes with Foreign Test Data																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		U	U	L		U		66%																	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		U	L	U		U		66%																	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		U	U		L			55%																	
3 uses out of 3 conferences analyzed		66U	33U	Δ	33U	Δ		63%																	
06918 Weapons Code Move from Fortran77 to C and C++ Almost Complete																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	U	U	U	U		77%	M															UQ	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			U	U	U																			HU	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L		U				44%	M	M															
3 uses out of 3 conferences analyzed		66L	66U	100U	66U	33U		41%	66M	33M															67%

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		A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	HL	HU	UQ	CM	
06919 ASCI goes into Production																												
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999	L	L	L						M	M	M						⊙	⊙	⊙				HL				
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999	L	L		L					M			N	M		55%		⊙				•	⊙	HL		UQ		
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999	U	L	L		L			66%		M	M	N	M		66%										UQ	CM	
3 uses out of 3 conferences analyzed		33LΔ100L 66L 33L 33L								22%	66M 66M 66M 66N 66M								41%	⊙	⊙	⊙		•	⊙	67%	67%	33%
06920 First TeraFLOP Machine Operational at LANL																												
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999	U	L	L	L	L			77%		M	M							⊙	⊙				HL				
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L	L	L								M									⊙	HL		UQ			
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999	L	L	L		U			66%		M		N	M		55%										UQ		
3 uses out of 3 conferences analyzed		Δ 100L100L 66L Δ								48%	66M 33M 33N 66M								19%		⊙	⊙		⊙	67%	67%		
06921 Last MPP Machines at LANL Retired																												
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001	L	L		L	L				M									⊙					HL		UQ		
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001		L																									
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001			L		U			44%				M													UQ		
3 uses out of 3 conferences analyzed		33L 66L 33L 33L Δ								15%	33M	33M								⊙					33%	67%		
06922 Data From Old Weapons Tests Highly Valued																												
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996	L	L	L	L	L		✓			M		M							⊙		⊙		HL				
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996	L	L	L	L	L		✓				M									⊙		HL		UQ			
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996	L	L	L	L	L		✓			M								⊙				HL		UQ			
3 uses out of 3 conferences analyzed		100L100L100L100L100L								100%	33M 66M	33M								⊙	⊙		⊙		100%	67%		
06923 LANL Loses Defense Nuclear Agency Computing Dollars																												
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L					N		M				44%		•				⊙		HL		UQ		
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L	L																	HL					
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	L		L		L					N	N							•		•		HL					
3 uses out of 3 conferences analyzed		33L 33L100L 66L100L									33N 33N 33N 33M								15%		•	•	•	⊙		100%	33%	
06924 Rich Sub-System Test Data Helps 3D Code Development																												
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2004	L	L	L	L					M	M		M						⊙	⊙		⊙		HL				
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2004	L	U		L				55%				M													UQ		
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	U					44%		M															UQ		
3 uses out of 3 conferences analyzed		66L 33LΔ Δ 66L								33%	66M 33M	66M								⊙	⊙		⊙		33%	67%		
06925 Users Revolt in Response to SMP Transition																												
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998					U				N	N		N															
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998	L	L		L	L				N	N		N						•		•		•	HL				
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998	U	L	L		U			88%	N	N		N															
3 uses out of 3 conferences analyzed		Δ 66L 33L 33L 33UΔ								30%	100K 33N 100K	66N									•		•		•		33%	
06926 Significant Aging Problem in the Stockpile																												
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		L	L	L					M	M								⊙	⊙				HL				

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Chain Title	Year	Team HL/HU								Team M/MN								Team Dissonance							Consensus			
		A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	HL	HU	UQ	CM	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		U	U																									
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		L	U		U	U			66%	M				N			44%								UQ			
3 uses out of 3 conferences analyzed		A	66U	33L	A	A			22%	66M	33M			33N			15%	C	C					33%		33%		
06927 Most NWT Work Still on Legacy (Cray) Base																												
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001		U	U	U		U				N	N			N				C	C			C			HU			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001		U		U	U	U				N	N							C	C						HU			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001		U	U	U	U	U		✓		N	N	N	N					C	C	C	C				HU	CM		
3 uses out of 3 conferences analyzed		100U	66U	100U	66U	100U		33%		100N	100N	33N	66N					C	C	C	C			100%		33%		
06928 IPIS Completes Conversion of Weapons Data to On-Line Storage																												
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2002				U	L				44%	M		M		M														
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2002		L		U	L	L			66%																			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2002		L	L	U	L	L			77%		M								C					HL		UQ		
3 uses out of 3 conferences analyzed		66L	33L	100U	100L	66L			63%	33M	33M	33M		33M					C					33%		33%		
06929 Every Major Lab Project Has a Home Page																												
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L		L	L	L					M								C					HL		UQ		
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L	L	L	L		✓																HL				
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L	L	L	L		✓				M								C				HL		UQ		
3 uses out of 3 conferences analyzed		100L	66L	100L	100L	100L		67%			33M	33M							C	C				100%		67%		
06930 All LANL Business Applications and Information Accessible Using Web Browser																												
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U		U	U	U					M	M													HU			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	U	U	U		100%		M															UQ			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	U	U	L		100%				M													UQ			
3 uses out of 3 conferences analyzed		33L	A	66L	100U	100U	33U	A	67%	33M		33M	66M											33%		67%		
06931 Explorer Contains Full Database of Policy and Procedures																												
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	U	L	L	L		77%			M	M	M						C	C	C				HL			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L	L																			HL				
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			L	L	L	L																		HL				
3 uses out of 3 conferences analyzed		66L	33L	A	100L	100L	66L		26%		33M	33M	33M						C	C	C			100%				
06932 ESH 50% Smaller than in 1995—IT Productivity the Catalyst																												
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		L	U		L	L		66%		M															UQ			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		L	L	U	U	L		100%																				
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		U	L		L	L		66%																				
3 uses out of 3 conferences analyzed		33L	A	33L	A	33U	33L	A	100L	78%	33M															33%		
06933 All Scientific Computing Cycles Are Free at LANL																												
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U	U	U	U		✓			M	N					44%								HU	UQ		
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U	U	U	U		✓																	HU			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U	U	U	U		✓																	HU			
3 uses out of 3 conferences analyzed		100U	100U	100U	100U	100U		100%			33M	33N					15%								100%	33%		

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		A	B	C	D	E	F	Un Con	A	B	C	D	E	F	Un Con	A	B	C	D	E	F	HL	HU	UQ	CM		
06934 Net Outflow of Dollars for Computing from LANL																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	U	U	U	L	U		77%	N	N		M	N		66%	⊙	⊙			•	⊙		HU	UQ	CM		
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	U	U	U		U			N		N					⊙		⊙					HU				
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	U	U	U	U	L		77%	N	N	N		N			⊙	⊙	⊙		⊙		HU		CM			
3 uses out of 3 conferences analyzed		100U100U100U Δ 33UΔ							52%	100N66N66N33M66N							22%	⊙	⊙	⊙		•	⊙		100%	33%	67%
06935 X-Division Buys Own Supercomputers—Sticks CIC with Support of Legacy Systems																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	U	U	U	U	U		✓	N	N		M	N		66%	⊙	⊙			•	⊙		HU	UQ	CM		
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	U	U	U	U	U		✓		N	N		N				⊙	⊙	⊙		⊙		HU				
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	U	U	U		U			N	N	N	M	N		77%	⊙	⊙	⊙		•	⊙		HU	UQ	CM		
3 uses out of 3 conferences analyzed		100U100U100U 66U100U							67%	66N100N66N66M100N							48%	⊙	⊙	⊙		•	⊙		100%	67%	67%
06936 CIC Attracts Three Major New External Customers																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998	U	U		U	U			M	M		N			55%					⊙			HU	UQ			
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		U		U	U																	HU				
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998	U		U	U	L		66%		M														UQ			
3 uses out of 3 conferences analyzed		66U66U33U100U33UΔ							22%	33M33M33M33N							19%					⊙			67%	67%	
06937 LANL Completes HPC System of Heterogeneous SMP Platforms																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998	U		U					M	M		M															
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	U	U	U		66%				M	M														
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998	L		U	L			55%	M	M		M															
3 uses out of 3 conferences analyzed		Δ 33L100U Δ 33U							41%	33M66M66M66M33M																	
06938 Over Half of Machines in CIC Computer Center Owned by Other Divisions																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		U			U						N												UQ			
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998				L	U		44%	N															UQ			
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998	U	U	U	L	U		77%				M								•			HU	UQ			
3 uses out of 3 conferences analyzed		33U66U33U66L100U							41%	33N33M33N											•				33%	100%	
06939 Distributed Computing Infrastructure to Support HPC Completed																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000	L	U			L		55%	M	M	M	M	M	✓											CM		
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000	L	U	U	L	U		100%	M		M	M	N	66%										UQ	CM		
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		U	U	L	U		66%	M	M		M	M												CM		
3 uses out of 3 conferences analyzed		66L100U66U66L33UΔ							74%	100M66M66M100M33MΔ							33% 22%								33%	100%	
06940 NWT/X Account for 25-30% of CIC Budget																											
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2002		L	U	U	L		88%		N		N															
1 uses out of 3 conferences analyzed		100U100U100U100L							89%	100N100N																	
06941 CIC's Operation of Large Server Farms Highly Automated																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999	L	L	L	L	L		✓	M		M		M			⊙		⊙		⊙		HL					
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999	L	L	L	L	L		✓	M			M				⊙				⊙		HL					
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999	L	L	L	L	L		✓	M			M				⊙				⊙		HL					

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Future Mapping Comprehensive Voting Analysis

HL/HU Threshold = 0.6
CM Threshold = 0.7

Chain	Title	Year	Team HL/HU							Team M/MN							Team Dissonance						Consensus								
			A	B	C	D	E	F	Un Con	A	B	C	D	E	F	Un Con	A	B	C	D	E	F	HL	HU	UQ	CM					
3 uses out of 3 conferences analyzed			100L100L100L100L100L					100%	100M	33M	100M					C		C		C		100%									
06942	First Exabyte Storage Systems Go On-Line at LANL																														
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		U				U							M									UQ								
1 uses out of 3 conferences analyzed			100U				100U			100M										100%											
06943	CFS is Retired																														
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001		L	L		L	L											HL													
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001		L				U			L	55%																				
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001		L	L	L	L	L	√										HL													
3 uses out of 3 conferences analyzed			100L 66L 33L 33L 100L				33% 19%										67%														
06944	Archive for Experimental Data Set Up																														
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U				L			L	55%				M			UQ													
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U				L			U	L	88%				M			UQ												
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L							M			HL						UQ										
3 uses out of 3 conferences analyzed			A				A	33L 33L 66L	48%				33M 33M			33M	C						33%	100%							
06945	ESH Makes Various Compliance Forms and Databases Available via the Web																														
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L	L	L	√				M									HL				UQ						
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L	L	L	√										HL													
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L	L	L	√										HL													
3 uses out of 3 conferences analyzed			100L100L100L100L100L				100%				33M									C				100%	33%						
06946	Lab Managers Demand Staff Adhere to Lab-Wide Information Management Policy																														
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U	U	U	U	√				M			M			M	•						•			•	HU		
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U				U							M												UQ					
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U				U	U	U					M			M			M	•						•			•	HU
3 uses out of 3 conferences analyzed			66U 66U 66U 100U 66U				33%				100M			33M 33M			66M	•						•			•	•	67%	33%	
06947	LANL Adopts a Digital Archiving Standard																														
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U	U			L	66%				M			M	M														
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	U			55%				M									UQ										
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L				U	L	U	88%				M									UQ								
3 uses out of 3 conferences analyzed			A				33L 33U 33U 66L	70%				66M			33M 33M			33M							67%						
06948	LANL Library Takes Over E-Print																														
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L				L	L							M			C						HL				UQ			
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L																												
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	U			U	L	88%																						
3 uses out of 3 conferences analyzed			33L 66L				A	33U 66L	30%				33M			C						33%				33%					
06949	Vendor Information on Paper Hardcopy Greatly Reduced																														
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L	L																			HL						
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	U	L	L	77%																HL							

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Future Mapping Comprehensive Voting Analysis

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Chain Title	Year	Team HL/HU							Team M/MN							Team Dissonance							Consensus			
		A	B	C	D	E	F	Un Con	A	B	C	D	E	F	Un Con	A	B	C	D	E	F	HL	HU	UQ	CM	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U			L	L		55%																		
3 uses out of 3 conferences analyzed		66L	33LΔ	Δ	66L	100L		44%																	67%	
06950 All Lab E-mail Deemed Federal Records																										
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L	L	L	L		✓					M						⊙			HL		UQ		
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			U		L			U	55%																	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L							N														UQ		
3 uses out of 3 conferences analyzed		66L	33LΔ	66L	33L	Δ			33% 19%	33N			33M						⊙			33%		67%		
06951 CIC Creates Large-Scale Data Analysis Environment																										
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2002		L			L	L				M	M		M					⊙	⊙		⊙		HL			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2002		L	L	L	L	L		✓				M		M					⊙		⊙		HL			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L				L				M	M		M													
3 uses out of 3 conferences analyzed		100L	33L	33L	66L	100L			33%	33M	66M	66M	100M					⊙	⊙		⊙				67%	
06952 CIC Implements Integrated Administrative Data Warehouse																										
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L	L	L	L	L		✓			M		M						⊙		⊙		HL			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L	L	U	L	L			77%	M			M					⊙			⊙		HL			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L	L	L	L	L		✓															HL			
3 uses out of 3 conferences analyzed		100L	100L	33LΔ	100L	100L			67% 26%	33M		33M	66M					⊙		⊙	⊙				100%	
06953 LANL Completes Integrated Facilities Records Database																										
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2003		L	L	L	L	L		✓			M		M						⊙		⊙		HL			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2003		L	L		L	L							M								⊙		HL		UQ	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2003		L	L	L	L	L		✓															HL			
3 uses out of 3 conferences analyzed		100L	100L	66L	100L	100L			67%		33M		66M						⊙		⊙				33%	
06954 75% of CIC Programming Effort Spent on Maintenance																										
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996			U			U				N															UQ	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996				L	U	L			55%	N			N													
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		L	L	U	U	L			100%	N															UQ	
3 uses out of 3 conferences analyzed		33L	Δ	Δ	66U	33LΔ			52%	100N			33N												67%	
06955 CIC Re-Engineers Software Development																										
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		U			U																					
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L	U					55%	M	M		M													
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		U	U	L		U			66%	M	M															
3 uses out of 3 conferences analyzed		33UΔ	Δ	33UΔ		33U			41%	66M	66M	33M														
06956 CIC Buys Off-the-Shelf Packages for All Administrative Applications																										
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997										M		M														
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	L			U			55%	M															UQ	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L		U	U	L			88%	M															UQ	
3 uses out of 3 conferences analyzed		Δ	33L	33U	66U	33L			48%	100M		33M													67%	

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Northeast Consulting Resources, Inc.

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Boston, MA
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Future Mapping Comprehensive Voting Analysis

HL/HU Threshold = 0.6
CM Threshold = 0.7

Chain	Title	Year	Team HL/HU							Team M/MN							Team Dissonance						Consensus					
			A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	HL	HU	UQ	CM
06957	LANL Begins Major Campaign To Decommission Legacy Systems																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L			L																	HL				
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L			L				M								⊙					HL		UQ		
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L		L	L	L				M								⊙					HL		UQ		
	3 uses out of 3 conferences analyzed		100L	66L	33L	33L	100L				66M								⊙					100%		67%		
06958	CIC Development Organizations Achieve 30% Re-Use of Business Objects																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		L	L							M															UQ		
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		L		L	L	L				M		M						⊙			⊙		HL				
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		L	L	L	L																		HL				
	3 uses out of 3 conferences analyzed		100L	66L	66L	66L	33L				66M		33M						⊙			⊙		67%		33%		
06959	CIC Building Real Time Applications for Scientific Divisions																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001		U	U	U	U						M													HU		UQ	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001			U			U																					
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001		U		U	U																			HU			
	3 uses out of 3 conferences analyzed		66U	66U	66U	100U							33M												67%		33%	
06960	Evolutionary Software Techniques Taking Off																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001			U	U	U	L			66%																		
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001			U	U	U	U																		HU			
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001			U	U	U	U	U		✓	M														HU		UQ	
	3 uses out of 3 conferences analyzed		33U	100U	100U	100U	33U			33%	22%	33M													67%		33%	
06961	TA-40 Builds Itself an End-to-End ATM Network																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			U	U	L				55%	N			N														
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			L		U				44%			N		N													
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996			U			U					N			N													
	3 uses out of 3 conferences analyzed			33U	Δ	33U				33%	33N	33N	33N		100N													
06962	ESD Saves LANL \$2M per Year in Desktop Support Costs																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			U		L				44%				M													UQ	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			L	L			U		55%	M			M														
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			L	U	L	L	L		77%	M			M					⊙				⊙		HL			
	3 uses out of 3 conferences analyzed			66L	33U	Δ	33L	66L	Δ	59%	66M		33M	66M					⊙				⊙		33%		33%	
06963	Lab Accelerates Conversion to High Bandwidth Network Infrastructure																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			U	U	L				55%			M	M	M													
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			L	L	L					M			M	M				⊙			⊙	⊙		HL			
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			U	L	L		U		88%	M	M		M	M												CM	
	3 uses out of 3 conferences analyzed			33U	Δ	33L	Δ	100L		33U	48%	66M	33M	33M	100M	100M			⊙			⊙	⊙		33%		33%	
06964	CIC and Century Cable Partner to Provide Ethernet-Speed Telecommuting																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			L	L	L	U			66%																		

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Chain Title	Year	Team HL/HU							Team M/MN							Team Dissonance						Consensus									
		A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	HL	HU	UQ	CM				
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L																													
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L		L	L	L			M	M									©	©					HL						
3 uses out of 3 conferences analyzed		66L	66L	66L	Δ	33L		22%	33M	33M									©	©					33%						
06965 CIC has an Accurate, Automatically Updated Inventory System																															
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L																													
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L	L	U	L			66%	M													UQ									
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		U	L	L	L			66%																							
3 uses out of 3 conferences analyzed		Δ	66L	Δ	66L	33L		44%	33M														33%								
06966 CIC Groupware Service Deployment Completed																															
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U	U	U				M	M	M							.	.	.	.					HU					
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	U	U			88%	M	M																					
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	U	L	L		77%	M	M	M							©	©		©					HL					
3 uses out of 3 conferences analyzed		33L	Δ	33L	Δ	100U	33U	Δ	56%	100M	33M	33M	33M	66M							©	©	.	©	.	33% 33%					
06967 CIC Helps Customers Benchmark Cost of IT																															
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L		L			M	M	M							©		©		©					HL				
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L	U	L		77%	M	M	M							©	©	©					HL						
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			U	U	L			55%			M													UQ							
3 uses out of 3 conferences analyzed		66L	33L	Δ	33L	Δ	66L	44%	66M	33M	100M	33M						©	©	©		©	67% 33%								
06968 LANL Requires All Divisions to Use CIC for Server Operations and Networking																															
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U	U	U	U		✓	M	N						44%	.			©					HU	UQ					
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U	U	U	U		✓		M	N M						55%	.	.		©	.					HU	UQ			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U	U	U	U		✓			M	N M						55%			.	©	.					HU	UQ		
3 uses out of 3 conferences analyzed		100U	100U	100U	100U	100U		100%	33M	33M	33M	100N	66M	52%	.	.	.	©	.	100% 100%											
06969 CIC Study Concludes that Interoperability Barriers Costing LANL \$50M/Year																															
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		U		L	L	U		88%	M	N M						55%							UQ								
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L			L					N M						44%							UQ								
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998				L	U	L		55%	M	N	M	N	M	100%							CM										
3 uses out of 3 conferences analyzed		Δ		66L	33L	Δ	Δ	48%	66M	33N	33M	100N	100M	67%							67% 33%										
06970 All Lab Publications Created Electronically																															
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		U	U	L		U		66%	M	M																					
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L	L	U	L			66%																							
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L	L		L	L																HL									
3 uses out of 3 conferences analyzed		33L	Δ	33L	Δ	66L	Δ	44%	33M	33M												33%									
06971 Electronic Mail Still the Lab's Primary Interoperability System																															
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005		U	U	U	U	U		✓	N	N N							©			©	©					HU					
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005		U	U		U	U			N	N							©			©						HU					
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005		U	U	U	U	U		✓		N									©					HU	UQ						
3 uses out of 3 conferences analyzed		100U	100U	66U	100U	100U		67%	66N	33N		33N	66N		©	©		©	©	100% 33%											

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Future Mapping Comprehensive Voting Analysis

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			A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	HL	HU	UQ	CM
06972	CIC "Goes Afield"																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L			L				M			M	M														
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L										M													UQ		
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		U		U	U	U						M												HU	UQ		
	3 uses out of 3 conferences analyzed		33LΔ		33U	Δ	33U			33M			100M	33M											33%	67%		
06973	CIC Customer Divisions Get Hire/Fire Power for Any CIC Staff Assigned to Them																											
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		L		L		L						M												HL	UQ		
	1 uses out of 3 conferences analyzed		100L		100L		100L						100M												100%	100%		
06974	CIC Creates Single Customer Interface																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U		U	U							M											HU	UQ		
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U		U	U	L		66%				M		M													
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U		U	U	L		66%		M															UQ		
	3 uses out of 3 conferences analyzed		100U	33U	66U	100U	33LΔ		44%		33M		33M	66M											33%	67%		
06975	CIC Offers Fixed Rate Price for Network Connection and No Charge for Subnets																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			L	L	L	L			M		M	M												HL			
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			L			L			M			M															
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996				U		U																					
	3 uses out of 3 conferences analyzed		33L	33L	Δ	33L	33LΔ			66M		33M	66M												33%			
06976	Recharge Schemes Create Disincentive to Use LANL Backbone																											
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996			U		U							N	N	N													
	1 uses out of 3 conferences analyzed			100U		100U							100N	100N	100N													
06977	Distributed Computing Not Run as a Recharge Business																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L	L																			HL			
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997				L	L	L							N											HL	UQ		
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			U		U	L		55%																			
	3 uses out of 3 conferences analyzed		33L	Δ	66L	33LΔ	66L		19%				33N												67%	33%		
06978	Lower Cost Structure Attracts New Customers to CIC																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997				L	U	L		55%		M		M	M														
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			L	U	U	U		66%		M			M	M													
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			L		U	L		55%		M	N	M				55%									UQ		
	3 uses out of 3 conferences analyzed		33L	33L	33UΔ	33UΔ	Δ		59%		100M	33N	66M	33M	66M		19%									33%		
06979	Lab Funds Basic IT Infrastructure as Part of Overhead																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000				L	L					N		M				44%									UQ		
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		U	L	U	U			66%					M														
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		U	U	L	U	L		100%				M	N												UQ		
	3 uses out of 3 conferences analyzed		66U	Δ	33LΔ	33UΔ	33L		56%		33N		33M	100M			15%									67%		
06980	CIC Adopts Standards for Key Common Systems in CIC																											

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		A	B	C	D	E	F	Un Con	A	B	C	D	E	F	Un Con	A	B	C	D	E	F	HL	HU	UQ	CM
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L		L			M		M		M			⊙		⊙		⊙		HL			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L	L	L		✓	M	M						⊙	⊙					HL			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		L	L	U	L	L		77%	M				M			⊙				⊙		HL			
3 uses out of 3 conferences analyzed		100L100L33LA66L100L						33% 26%	100M33M33M				66M			⊙	⊙	⊙		⊙		100%			
06981 Lab Desktop Standards Released: PC, Mac, and Unix																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L	L	L		✓	N							•						HL		UQ	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L	L	L		✓	M							⊙						HL		UQ	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		L	L	L	L	L		✓														HL			
3 uses out of 3 conferences analyzed		100L100L100L100L100L						100%	Δ							⊙						100%		67%	
06982 LANL Adopts PC as Desktop Standard																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U	U	U	U		✓	M							•						HU		UQ	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	U	U	U	U		✓														HU			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		U	U	U	U	U		✓	N								⊙					HU		UQ	
3 uses out of 3 conferences analyzed		100U100U100U100U100U						100%	33M33N							•	⊙					100%		67%	
06983 LANL Makes Adherence to Info Architecture Mandatory																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996			U	U	U	L		66%	M							•									UQ
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996				U	U	U			M	M						•	•					HU			
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		U	L	U	U			66%		M	M		M												
3 uses out of 3 conferences analyzed		33U Δ 100U100U Δ						44%	66M66M33M				33M			•	•					33%		33%	
06984 90% of LANL in Compliance with Information Architecture Standards																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		U	U		U				M		M		M			•		•		•		HU			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L	U	U	L	U		100%	M				M												
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L	U	U	L			88%	M	M															
3 uses out of 3 conferences analyzed		33LA100U66U33LA33U						63%	100M33M33M33M33M							•		•		•		33%			
06985 All Copying/Printing Operations Outsourced																									
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		L		U	U	U		66%																	
1 uses out of 3 conferences analyzed		100L		100U100U100U				67%																	
06986 LANL Mail Delivery Outsourced																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996				L	L																				
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996			L	U	L	L		66%		M	M														
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		L	U	L	L			66%																	
3 uses out of 3 conferences analyzed		33L Δ 33LA100L33L						44%	33M33M																
06987 LANL Programmers Set Up as Local Contractors																									
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996				L																					
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		U	L	L	L			66%					N											UQ	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996		L	U	L	U	L		100%		N														UQ	
3 uses out of 3 conferences analyzed		Δ Δ 100L Δ 33L						56%	33N				33N											67%	

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			A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	HL	HU	UQ	CM
06988	Payroll System and Operations Outsourced																											
	11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998	U		L	L	L			66%																		
	11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			L	L	U	U		88%	M	M		N				55%								UQ		
	11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996			U	U	U																			HU		
	3 uses out of 3 conferences analyzed		33U	Δ	33L	Δ	33U	Δ		52%	33M	33M		33N				19%								33%	33%	
06989	LANL Leads Effort to Outsource Information Archival for All Weapons Labs																											
	11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	U	U	U	U	U		✓			M		N				44%								HU	UQ	
	11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	U	U	U	U	U		✓																	HU		
	11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			U	U	U				N															HU	UQ	
	3 uses out of 3 conferences analyzed		66U	100U	100U	100U	66U			67%	33N	33M		33N				15%								100%	67%	
06990	Virtual Library, Outsourcing Strategies Ease Escalating Journal Prices																											
	11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	U			U	L			55%		M															UQ	
	11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	U		L		U	U		66%		M															UQ	
	11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	L		L	L	U	U	L	77%																HL		
	3 uses out of 3 conferences analyzed		33U	Δ	66L	33U	Δ	33U	Δ	67%		66M														33%	67%	
06991	Single Vendor Awarded Large Outsourcing Contract at LANL																											
	11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000	U	U	U		L	U		77%	M			N				44%								HU	UQ	
	11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000	U	U			U	U			M	N		N				55%								HU	UQ	
	11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998	U	U	U	U	U	U		✓																HU		
	3 uses out of 3 conferences analyzed		100U	100U	66U	33U	Δ	100U		33%	66M	33N		66N				33%								100%	67%	
06992	Outsourcers Run LANL Operations With Fewer People																											
	11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999			L			L				M															UQ	
	11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999			L				U	44%					N												UQ	
	11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999	L		U	U			U	66%																		
	3 uses out of 3 conferences analyzed		33L	33L	Δ	33U	33L	66U		37%		33M		33N													67%	
06993	Lab Outsources All Communications to a Carrier																											
	11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001					L							N													UQ	
	11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001	U	U				U			M		N	N				55%								HU	UQ	
	11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2001			U			L		44%		M	N					44%									UQ	
	3 uses out of 3 conferences analyzed		33U	66U			33L	Δ		15%	33M	33M	100K	33N				33%								33%	100%	
06994	New LANL Procurement System Makes Use of EC																											
	11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			U		L	U	L	88%																		
	11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	L		L		L	L	L	✓																HL		
	11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	L					L	L			M														HL	UQ	
	3 uses out of 3 conferences analyzed		66L	Δ	66L	33L	Δ	100L		33%	33M															67%	33%	
06995	LANL Centralizes all Computer Related Purchasing																											
	11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998	L	U	L	L				66%	M			N	M			55%									UQ	

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		A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	HL	HU	UQ	CM
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L	U	U	U			100%	M																UQ	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			U			U	L		55%	M		M	N			55%										UQ	
3 uses out of 3 conferences analyzed		66L	33U	Δ	Δ	33U	Δ		74%	100M		33M	66N	33M		37%										100%	
06996 At Least Half of the Lab's Machines are Bought as Part of a Service																											
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000						L	U		44%	N																UQ	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000			L		U			U	55%	N																UQ	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000					U	U																					
3 uses out of 3 conferences analyzed			33L	66U		Δ	66U		33%	66N																	67%
06997 CIC Benchmarks Against IT Units in Business																											
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L	L	L	L		✓						M							©			HL		UQ	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			L	L	L	U			66%	M		M															
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			L		U	U	U		66%		M	M															
3 uses out of 3 conferences analyzed		66L	66L	33L	Δ	33L	Δ	33U	Δ	33%	44%	33M	33M	66M		33M					©			33%		33%	
06998 CIC Establishes Service Level Tracking on the Business Systems																											
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		U	L	L		L			66%	M		M		M													
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L	L	L	L		✓		M		M						©			©				HL		
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998			L			L				M																UQ	
3 uses out of 3 conferences analyzed		33L	Δ	66L	66L	33L	100L		33%	22%	100M		66M		33M			©			©				33%		33%
06999 External Assessment Rates LANL IT Infrastructure Poor																											
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U	L	U	U	U			77%	N		N	N	N				©			©	©	©		HU		CM
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997			U			U							N	N													
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		U			U	U	U				N			N						©			©		HU		
3 uses out of 3 conferences analyzed		66U	Δ	66U	100U	66U			26%	33N	33N	33N	66N	100N				©		©	©	©	©		67%		33%
07000 CIC Customer Satisfaction Rating is Very Good																											
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998						L					M			M													
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L			U	U			55%			M	M	M	M												
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998				U						M	N					44%										UQ	
3 uses out of 3 conferences analyzed		33L	33U	33U	33U	33L			19%	33M	Δ	33M	33M	66M		15%											33%
07001 CIC Budget Up 15% Second Year in a Row																											
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		U	U	U	U					M	M	N				55%						©			HU		UQ
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999					U	U							N	M		44%										UQ	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		U			U		L		55%			M														UQ	
3 uses out of 3 conferences analyzed		66U	33U	100U	66U	33L			19%	33M	66M	66N	33M		33%										33%		100%
07002 Lab-Wide Process Quality Award Goes to CIC																											
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999			L			U	L		55%		M															UQ	
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999							U						M													UQ	
11/16/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999			L			U	L	L	66%																		
3 uses out of 3 conferences analyzed			33L	33L	33U		Δ	33L	Δ	41%			33M	33M													67%

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07003 CIC Personnel Performance Appraisal is Based on Customer Satisfaction																													
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996	U	U		U	L		66%																					
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996	U	L	U	U			66%																					
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996	L	L	U	L	L		77%		M														HL		UQ			
3 uses out of 3 conferences analyzed		33	U	3	L	66	U	33	U	66	L													33%		33%			
07004 CIC Separates Infrastructure from R&D Functions																													
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1996	U	U	U	L	L		100%		M																UQ			
1 uses out of 3 conferences analyzed		100	U	100	U	100	U	100	L	100	L															100%			
07005 CIC Employee Compensation Tied to Teamwork																													
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	L	L	U	U	L		100%																					
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	L		L	L	L																		HL					
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	L	L	L	L	L		✓		M														HL		UQ			
3 uses out of 3 conferences analyzed		100	L	66	L	33	L	33	L	100	L													67%		33%			
07006 CIC Salaries Benchmarked against Computer Departments in Business																													
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	L	L	L	U	L		77%		N															HL	UQ			
1 uses out of 3 conferences analyzed		100	L	100	L	100	L	100	L	100	L														100%	100%			
07007 Consolidating Shadow Centers Would Save Lab \$10-20M																													
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	L		L	U	L		66%		M		N	M		55%											UQ			
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997					L							M													UQ			
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997	L	L	L		L						M	N	M		55%								HL		UQ			
3 uses out of 3 conferences analyzed		66	L	33	L	66	L	33	U	100	L					22%		33	M	33	M	66	N	100	M	37%		33%	100%
07008 System Managers in Groups Lose Status																													
11/16/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L	L	L				M															HL	UQ			
1 uses out of 3 conferences analyzed			100	L	100	L	100	L	100	L															100%	100%			
07105 LANL Holds Third International Symposium on HPC																													
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005	L	L	L		L				M	M														HL				
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005		U			L		44%																					
2 uses out of 3 conferences analyzed		50	L	Δ	50	L	50	L	50	L															50%				
07106 Study Shows Employees Happier Working for Outsourcer																													
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000	L	L	L	L	U		77%																	HL				
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000		U			U																				HU			
2 uses out of 3 conferences analyzed			Δ	50	L	Δ	50	L	100	U															50%	50%			
07107 DoE Studies Conclude That Outsourcing Has Saved LANL Money																													
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005					L				M																UQ			
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005	U	L			L	U	88%		M	M																		
2 uses out of 3 conferences analyzed		50	U	50	L		50	L	Δ																	50%			

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HL/HU Threshold = 0.6
CM Threshold = 0.7

Chain	Title	Year	Team HL/HU							Team M/MN							Team Dissonance						Consensus					
			A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	Un	Con	A	B	C	D	E	F	HL	HU	UQ	CM
07108	New LDRD Funding Provided for Computing Research																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999		L			U			44%	M	M																	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1999					U							M													UQ		
2 uses out of 3 conferences analyzed			50L			100U			22%	50M	50M		50M														50%	
07109	NWT/X Computing Account for 25-30% of CIC Budget																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2002			U			L		44%	N		M				44%										UQ		
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2002		U	U			L	U	66%				N													UQ		
2 uses out of 3 conferences analyzed			50U	100U			50L	Δ	56%	50N		50M	50N		22%												100%	
07110	First Exabyte-Scale Storage Systems Go On-Line at LANL																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000				L	U	U		55%	M	M																	
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2000			U			U			M				M														
2 uses out of 3 conferences analyzed			50U	50L	50U	100U			28%	50M	50M	50M		50M														
07111	CIC Service Shutdown for Not Making Break-Even																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2002		L	L			L	U	66%			M														UQ		
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2002		L	L			L	L				M								⊙				HL		UQ		
2 uses out of 3 conferences analyzed			100L	100L			100L	Δ	33%			100M								⊙				50%		100%		
07112	CIC Customer Divisions Get "Hire/Fire" Power Over CIC Staff Assigned to Them																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L	L		L	L	✓			M	M							⊙	⊙			HL				
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1997		L	L			L	L																HL				
2 uses out of 3 conferences analyzed			100L	100L	50L	100L	100L		50%			50M	50M							⊙	⊙			100%				
07113	IT Coordinating Councils Implemented at LANL/ CIC																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998				L			U	44%	M		M	M															
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L	L					M		M	M							⊙		⊙	⊙		HL			
2 uses out of 3 conferences analyzed			50L	50L	100L			50U	22%	100M		50M	100M	50M						⊙		⊙	⊙		50%			
07114	Recharge Schemes Create Clear Incentive to Use LANL Backbone																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998				L			U	44%	M		M	M															
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L	L		L	L	✓	M		M	M							⊙		⊙	⊙		HL			
2 uses out of 3 conferences analyzed			50L	50L	100L	Δ	50L		50% 22%	100M		100M	100M							⊙		⊙	⊙		50%			
07115	Copying/Printing Operations Outsourced																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L			L	L				M								⊙				HL		UQ		
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		U	L			L	L	66%			M	M															
2 uses out of 3 conferences analyzed			Δ	100L			100L	100L	33%			50M	100M							⊙				50%		50%		
07116	CIC Support Operations Achieve Efficiency, Reduce Headcount																											
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005		L	L	L		L	L	✓	M			M							⊙			⊙		HL			
11/27/95	Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 2005		L	L	L		L			M			M							⊙		⊙		HL				
2 uses out of 3 conferences analyzed			100L	100L	100L	100L	50L		50%	100M		50M	50M							⊙		⊙	⊙		100%			

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Chain Title	Year	Team HL/HU							Team M/MN							Team Dissonance						Consensus						
		A	B	C	D	E	F	Un Con	A	B	C	D	E	F	Un Con	A	B	C	D	E	F	HL	HU	UQ	CM			
07117 CIC Separates Support from R&D Functions																												
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		U		L	L	U		88%		M														UQ				
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		U	L	U	L	U		100%	N	M					44%									UQ				
2 uses out of 3 conferences analyzed		100U	50L	Δ	100L	100U		94%	50N	100M					22%									100%				
07118 Scientists Gravitate Back to Doing Science																												
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L		L		L				M									⊙				HL		UQ			
11/27/95 Los Alamos National Laboratory/CIC Division, Los Alamos National Labc 1998		L	L	L	L				M	M						⊙			⊙				HL		UQ			
2 uses out of 3 conferences analyzed		100L	50L	100L	50L	50L			50M	100M						⊙			⊙				100%		50%			
172 events, in 3 conferences, 481 total occurrences.		HL/MU/Dis	44%	43%	36%	38%	44%	0%	14%	30%	28%	18%	22%	20%	21%	0%	0%	6%	4%	3%	2%	4%	3%	0%	31%	15%	42%	5%
		HU/MN/Con	24%	28%	32%	29%	26%	0%			5%	8%	3%	8%	8%	0%			12%	9%	10%	9%	12%	0%				

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