ELRON
ELECTRONIC INDUSTRIES LTD

STAR
Acquisition Proposal

September 11, 1998

1. # INTRODUCTION

The potential acquisition of STAR, a Network Software Integration Company, by Elron Software Inc. was presented to Elron Board of Directors, July 7, 1998. Please refer to the above Board meeting material for in-depth strategy discussion and description of STAR.

The following proposal focuses on;

- Short recap of STAR

- Proposed deal and timetable

- Main contractual issues

- Summary of Due Diligence

- Major risks

2. ## **SHORT RECAP OF STAR COMPANY**

General Information

- ♦ STAR is a privately owned company, headquarterd in Israel with Sales & marketing in Boston MA.

- ♦ A leader in the Network Software Integration Segment; specializes in Network Mission critical applications/systems.

- ♦ 1997 revenue of $16.8M with $3.1M operating profit; Projected revenue for 1998 is $26M with $6M operating profit.

- ♦ Employs 200 software engineers.

- ♦ ISO 9001 certified since 1996.

- ♦ Offers turnkey solutions and professional services including; System development, System integration, Software product development and outsourcing services.

- ♦ Focusing in the Networking/Communication market including:

    - Telecommunication

    - Data Communication

    - Military and Defense systems

    Utilizing network management, routing, access, Internet and intelligent messaging technologies.

- ♦ Also, addressing financial vertical markets;

    - Bank Branch/Retail delivery system

    - Internet based home/corporate banking

- ♦ Developed an efficient project management methodology; reusing of software modules and transferable design frameworks.

♦ Offers both fixed price, time and material based services.

♦ Attracts and retains highly qualified engineers operating in a flexible organization structure.

♦ Uses structured development methodology utilizing Quality Management Systems (QMS) in all development phases. The QMS is in full compliance with ISO 9001 standard, applicable to every project in the company.

Customers

Customers in Israel include:

♦ The Israeli National Telecommunications Company; Bezeq

♦ Israeli Defense Forces; Signal & Comm. Corp., intelligence Corp.

♦ Israeli Banks; Mizrahi, First International, Poalim, Leumi

♦ High- tech Industry

♦ Government Offices and Institutions; Social Security, Postal Authority, Airport Authority.

Customers in the United States include:

♦ GDE Systems; Subcontractor for a military system

♦ GTE (BBN); router software integration

♦ LCC; Performance management of cellular networks

♦ Bay Networks; measuring multicast traffic on Internet-like networks

♦ Netect; detection software for security flaws in servers

♦ RACAL Datacom; Monitoring of Frame-Relay networks

One European account:
Kereskendelmi (K&H) bank, Budapest Hungary; Bank branch system.

Technology and Know-how

- Over the years, the company has accumulated vast amount of intellectual property including Software, toolkits and know-how.

OWNED INTELLECTUAL PROPERTY

- Software developer toolkits including:

  - General project infrastructure

  - Data communication

  - Network management

- InterTools; a system for outsourcing Internet Access infrasturctue

- SuperBranch; Bank Branch mission critical transaction system

- Corporate/home Banking System; dial-in Internet access for individual bank account

JOINT OWNERSHIP WITH CUSTOMERS

- AMOS; monitoring and surveillance of digital telephone exchange

- Management of customer digital leased line system

- Supervision of CCSS#7 network

- Narrow-band packet radio

- Reliable military messaging

- Components for image processing systems

- Components for message queuing systems

Management Team

♦   STAR's management carries significant experience and excellent
track record in the networking and communication arena;
developing and delivering high-quality technologies, mission critical
systems, products, and turnkey solutions.

♦   **Meir, Founder and Chief Executive Officer.**

Founded STAR in 1983 after leading a Computer and
Communication Organization of a large Israeli Bank. 25 years of
experience, including comprehensive System Engineering,
emerging markets, and software methodologies.
Since the establishment of STAR in 1983, successfully lead and
sustained ongoing growth and profits. Holds an MBA degree from
Tel-Aviv University.

♦   **Arie, General Manager**

Since its foundation in 1983, Arie Rahav has been jointly managing
with Meir the growth and productivity of STAR. 25 years of
experience. Before joining the company in 1983, held a senior
management position in high-tech company specializing in
Electro-Optics. Holds an MBA degree from Tel-Aviv University and
B.Sc. in Industrial Management from the Technion, Haifa.

♦   **Yair, General Manager of STAR, USA**

In charge of developing STAR's presence in the USA. Specializes
in Telecommunications and Data Communications; Security,
Network Management and Connectivity. Before joining STAR
served as an Officer and R&D Engineer in the Signal and
Communications Corp. of Israel Defense Forces. Holds an M.Sc.
degree in Signal Processing and Communication from the
Technion, Haifa and a B.Sc in Electrical Engineering from the
Ben-Gurion University, Beer-Sheeba.

- **Moshe, Chief Financial Officer**

  Joined STAR in 1996. Responsible for all financial management reporting and legal activities. Holds a B.A degree from Tel-Aviv University. Teaches Managerial Accounting in Tel-Aviv University, MBA program. Before Joining STAR he was a partner in a large Israeli C.P.A firm.

- **Gerrard, Vice President of Development, Financial Services**

  Responsible for STAR's development activities in the Financial Industry, including Bank Branch Systems, Home Banking Systems and Financial applications. 20 years of experience in Communication Networks, Security and Financial Applications. Before joining STAR held senior development position in a leading Israeli Financial Institution. Holds an M.Sc degree in Mathematics and Statistics from University of Paris, Orsay Center.

- **Asher, CTO**

  In charge of tracking emerging technologies and developing reusable components for embedded solutions. Joined the company in 1988. Prior to his current position, he was chief architect and designer of many of the leading systems developed by STAR.

3.   <u>PROPOSED DEAL</u>

What are we buying?

- ♦ Elron Software acquires all assets and liabilities of STAR, including retroactive liabilities since first day of operation; De-facto acquiring STAR "as is".

- ♦ **Elron will not assume/acquire the following assets or liabilities;**

    - Assets and liabilities related to the Simulators activity.

    - All tax liabilities prior to July 1,1998.

Main assets include;

♦ Organization and employees

- An experienced management team

- A core group of 60 senior software engineers, project managers and division managers.

- Additional 130 professional engineers.

♦ Customer base and projects

- Approximately 30 main customers in Israel, Europe and USA

- On going projects with potential follow-on business

- Good Reputation and relationships with customers in Israel and USA.

♦ Engineering know how

- Proven track record of delivering large, high quality software systems.

- Design documents of previous projects together with associated personnel and know-how

- Proven track record of executing "crash projects"; delivering a
  working system in a very short time frame.

♦ Products and Tools

- Existing reusable code ; composed of three collections of tools
  and modules which STAR accumulated over the years;
  software developer toolkit, network management and data
  communications tools.

- SuperBranch; bank-branch system, jointly owned with IBM.
  Currently used in large-scale project for K&H bank in Hungary.

- InterTools; a new product set under development ; derivative
  product of Bezeq 135/136 service.

4. PAYMENT PLAN

♦ Elron will pay STAR $40M at closing, and deposit $5M with an
  escrow agent. Amount will be released to STAR upon "best efforts"
  and continued employment of founder with Elron Software Ltd.

5. TAX IMPLICATIONS

♦ Deal Tax Structure

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(B) $7M              Elron Software Inc.      (A)$14+6M

        100%                          100%

STAR – Elron Software Ltd.      STAR – Elron Software Export Ltd.
                                (Approved enterprise)

    (D) $9M  ↑                      (C)$9M  ↑

      STAR Ltd.                      STAR Export
                                   (Approved enterprise)
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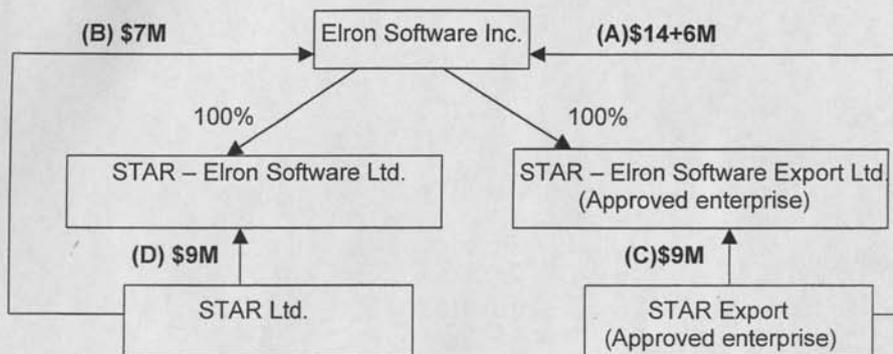
A. STAR Export will sell Elron Software Inc. **$6M of goodwill and $14M of know-how.**

B. STAR Ltd. will sell Elron Software Inc. **$7M of goodwill**

C. STAR Export will sell **$9M of net assets plus know-how** to STAR Elron Software Export; an approved enterprise

D. STAR Ltd. will sell $9M of net assets plus know-how to STAR Elron Software Ltd.

Please note that goodwill , know how and net assets amounts are still pending

♦ The end result is that Elron Software will be able to depreciate $41M of goodwill and know-how as tax expense over 7 to 15 years period; potentially saving $10M in taxes.

6.   STAR IMPACT ON ELRON'S RESULTS

	($000')	
	10-12/98	**1999**
Revenue	7,000	30,000
Operating income	1,900	7,000
Goodwill amortization	(700)	(1,400)
Net income	**600**	**2,400**
(after finance and tax)		
One time R&D in process		
Write-off	**(20,000)**	-

STAR impact on Elron's results will become effective as of closing date.

7.   ELRON SOFTWARE INC. 1998-1999 PLAN

			($000')	
			Total	
	1-6/98	6-12/98	1998	1999
Revenue				
Boston Division	7,700	8,000	15,700	20,000
STAR	-	7,000	7,000	30,000
Total	**7,700**	**15,000**	**22,700**	**50,000**
Net income				
(after finance & tax)				
Boston Division	(2,020)	(300)	(2,320)	1,000
STAR	-	600	600	2,400
Total	**(2,020)**	**300**	**(1,720)**	**3,400**
One time write-off	-	**(20,000)**	**(20.000)**	-

8.   ESTIMATED TIMETABLE (VERY TENTATIVE)

♦ **Definitive agreement - 15/9/98**

♦ **Closing date – 23/10/98 to 31/10/98**

♦ **Deal will be effective as of July 1, 1998.**

♦ **Elron Software Inc., special Board meeting, November 1998.**

9.   <u>MAIN CONTRACTUAL ISSUES</u>

♦ INTELLECTUAL PROPERTY

The contract provides for a limited representation of IP rights, certain of which are effectively stricken by a limited indemnification provision.

♦ INDEMNIFICATION

- STAR indemnifies Elron Software for any misrepresentation with cumulative damages exceeding $1M and a cap of of $4.5M . Indemnification will be effective for a 2-year period.

- **No time limit and no cap for intentional misrepresentation, Simulators and taxes prior to July 1st, 1998.**

- Elron will reimburse STAR for any claim relating to STAR past activities only if triggered by Elron Software action. However, Elron will unconditionally reimburse STAR for year 2000 problems. In addition, Elron Software will acquire a "retroactive" indemnity insurance coverage for the above exposure.

♦ CLOSING PROCEDURES

- Elron Software (And only Elron Software) can choose not to enter into closing if one of the following conditions occur:

   A. Less than 80% of employees agreed to transfer, including 11 of the 12 top managers.

   B. Less than 17 most important customers agreed to assign their contracts.

   C. Major negative business change from Definitive agreement to Closing.

   D. Critical governmental/insurance approvals/assignments are not delivered.

- Any clients or projects, which are not transferred upon closing will temporarily be dealt with through a back-to-back mechanism with STAR.

♦ **EMPLOYMENT AGREEMENTS AND STOCK OPTIONS**

- The three top managers enter a 4-year employment agreement.

- Meir will be granted 5% of Elron Software stock options; total of 1,200,000; 720,000 shares are considered part of the purchase agreement and will be vested over 3 years. 480,000 are "regular" executive compensation vesting over 4 year period.

- Arie and Yair will be granted approximately 450,000 options.

- All other employees up to 350,000 options.

- A total of 15% of Elron Software Inc. share capital will be allocated to employees' stock option plan; 3,600,000 out of 24,000,000 total shares.

♦ **BAY NETWORK AGREEMENT**

In the event Elron Software will enter into an agreement with BAY Networks for selling InterTools during a 6 month period after closing, STAR will be granted a special bonus of 25% for any received cash amount above $12M.

♦ **NON-COMPETE**

- STAR will change its name and will not function in any of STAR's current operations except for Simulators and back-to-back activities.

- Founder will not be allowed to employ any of STAR employees, except for 2 employees related to Simulators. This restriction has no time limit.

10. <u>DUE DILIGENCE SUMMARY</u>

- ◆ **STAR general review**

Star General Review

1. Projects

The following are the active projects in STAR. A "v" marks projects that were reviewed in the due diligence process.

חוזה	עובדים 7/98	אגף	מנהל	לקוח	פרוייקט	DD	
	5.5	יוסי כהן	יוסי כהן	חייק / מפא"ת	אור צפוני	V	1
	1.5	עדי זיסהולץ	"	"	אוי"צ – ד"א	V	2
	1	"	עדי זיסהולץ	אלביט	קופסת קשב	V	3
	10	יורם גורן	איתי רבד	X	אוצ"ב		4
FFP	1	עדי זיסהולץ	"	X	אביב הגיע		5
	3.5	"	עדי זיסהולץ	X	רקפת		6
	1	"	איתי רבד	X	SKS		7
	1	"	יוסי כהן	משטרה	מיכל	V	8
	3	"	איתי רבד	צה"ל	סימולטורים	V	9
T&M	6	מוטי קריספיל	מוטי קריספיל	GDE	RIS (שיטה)	V	10
הפרוייקט מוקפא	1	"	מיקי אבלמן	אלפא קרד	אלפא-קרד		11
FFP	3	"	"	אל-אופ	טירת המלך	V	12
יועצים	7	יוסי גבע		שונים	יוסי גבע		13
T&M	6	גיררד גלסברג	יוסי מרק	בנק הונגריה	בנק הונגריה	V	14
	4	"		מת"יף	מת"יף	V	15
	2	"	שלמה פולציק	הבורסה	בורסה		16
T&M	1	אלי קמפו	משה סופר	RACAL	Voice over FR	V	17
T&M	6	"	אודי ניר	STAR	InterTools	V	18
T&M	1	"	נתי גדליה	RACAL	יעוץ		19
T&M	5	"	בועז גרינוולד	GTE	SRCC	V	20
T&M	2	"	"	GTE	HPOV	V	21
T&M	2	"	ישראל זיו	CHA		V	22
T&M	7.5	"	אודי ניר	NETECT			23
T&M	2.5	"	אודי ניר	GTE	ROC	V	24
T&M	1.5	"	בועז גרינוולד	ערוצי זהב			25

FFP	4	עודד גורן	עודד גורן	בזק מיתוג	מרכז גיבוי		26
	1	"	"	בזק מיתוג	Access 7		27
T&M – MOU	10	"	איתי אפרת	LCC	CellSight		28
FFP	2	"	עודד גורן	GDE (מפא"ת)	RCC		29
License	4	"	יורם אהובי	פלאפון			30
T&M	2	בועז רביב	איתן בהרי	בזק	SMART	V	31
	2	"	אסף שמר	בזק-הנת"כ	136	V	32
	1.5	"	איתן בהרי	"	סיפרנת	V	33
	1	"	בועז רביב	"	144		34
	6	"	שי כהן	"	קיוסק		35
	3	"	ליאת רדיאן	בל"ל	גלישה ישירה	V	37
FFP	4	"	חיים ברכה	ויזה	HBS	V	38
T&M	2	"	דויד ברוס	BFA	BFA		39

2. Technology

- **Intellectual Property**

  As a projects company, most of the work performed by STAR is billed to a client's project, and the resulting software belongs to the client. This tends to leave the company without intellectual property of its own.

  However, in recent years STAR became very conscious of the need to accumulate its own intellectual property, and is actively pursuing this goal. Recent project contracts include a section that identifies system components which are STAR property, and which are being licensed to the customer as part of the project.

  A separate document describes and evaluates the IP of STAR.

- **InterTools**

  InterTools is the first example of an internally funded R&D project within STAR, and as such deserves special attention. The technology was initially developed for Bezeq, in the "135" and "136" projects.

  Later, based on ideas from some division managers, senior management decided to invest 5 man-years (60 man-months) of effort into developing "InterTools" as a product. In order to avoid IP conflicts with Bezeq, all the code is written from scratch. The design is based on the Bezeq projects, but is revised, modernized, and attempts to "productize" the system. To this date, about 50% of the work was done.

  Since our first contacts with STAR management (in March 1998), we were told that the company has a business plan for the product/project. **However, to this**

day (end of July), we were not allowed to see it. Our feeling is that whatever documents existed did not deserve to be called a business plan, and that management is stalling and is desperately trying to produce a decent business plan for us.

This is a typical example of the type of problems a "projects" company is facing when it tries to move into the world of "products", which has radically different concepts and business processes. STAR is at the infancy stage as far as development and marketing of products is concerned, and will require significant strengthening in this area!

- **Technology risks**

  Most current projects of STAR are based on existing expertise, and on similar previous projects, and therefore do not represent unreasonable (or unknown) technology risks. There are some exceptions:

  a) "King's Castle" project (subcontract to El-Op) – The project is a fixed-price contract (approximately $ 3.5M) to develop a ground station for an airborne optical sensor. STAR has never undertaken the responsibility for an entire ground station before, and might therefore face some unknown challenges and risks. The project is based on technology acquired in two previous projects – AMHCIS and RIS, in which STAR developed subsystems for a similar system. This reduces the risk to an acceptable level. STAR management analyzed the content of the project very carefully (it was broken down into over 300 small tasks) before committing to a price and a schedule, and we therefore conclude that the risk level is acceptable.

  b) InterTools – This is the first time that the company attempts to develop a full **product** (as opposed to one-time projects), with internal funding. STAR lacks the expertise and the experience for product management and marketing. We have not seen a business plan, market research, and a product specification document. We believe there is significant risk here, which must be taken care of by investing in market research, business planning, and marketing planning.

  c) "Or-Zfoni B" (OZAB) and related projects (Rakefet, Aviv) – these are highly classified projects for customer X, and we were not permitted to review them. It might represent high technological risks. The contract is Firm-Fixed-Price. However, the project deliverables are not "firm" (we could not verify this), which should give STAR some flexibility.

  d) Year 2000 readiness – we believe both internal systems and systems delivered to customers have not been properly audited for Y2K readiness. The effort to verify Y2K readiness must be given higher priority and

adequate resources. The possibility of buying liability insurance for this subject should be considered.

- **Languages, tools, development environments**
  Most projects are developed in modern programming languages - C or C++. Development environments are either Microsoft NT based (with MS Developers' Studio) or Unix. There is strong influence of the customer and his environment on the choice of tools for a project. It is our impression that STAR is highly professional in the choice and use of development tools.

- **Technology management**
  There is no central "management" of the various technologies that STAR has accumulated. Each of the 10 divisions has a "heritage" of expertise, components, and systems in one or more technologies. (Examples are secure home banking, bank branch systems, telecom network management, image interpretation systems, military messaging, etc.). Division managers are highly aware of the need to re-use existing components, and to establish them as STAR Intellectual Property, and they act accordingly when preparing proposals for new projects. Executive management has strict control over proposals and contracts, and in most recent contracts has specified some portion of the project content as licensed STAR technologies rather than plain contract programming.

- **Technology potential**
  STAR is at the cutting edge of technologies in which it is engaged, which does give it a competitive advantage in obtaining new projects in these areas. It has demonstrated ability to quickly learn and implement new technologies as they emerge.

- **Y2K readiness**
  According to the division managers we interviewed, projects which are currently in development are designed with "Year 2000" compliance. However, we have **not** seen any documented design requirements to this effect. Likewise, we have not seen any planned effort to make sure that the various development and support systems for the engineering teams are Y2K ready. We were told that the company is now beginning activities to prepare itself for the year 200.

  See other sections in this report relating to Y2K readiness of past projects and customers.

- **Generality**
  In most STAR projects, code is written to meet the customer's system requirements, and not as a "general" product package. Any deviation from this rule will increase the cost of the project and will have a detrimental effect on project profitability. Therefore, for any new project that can make use of the same technology base, modification and testing work is required in order to

adapt the code to the new system. This is still significantly less effort than writing the code from scratch.

There are some exceptions, where STAR has intentionally created "general" software packages. These are described in the IP section of this report.

- **Innovation**
  STAR cannot be generally classified as a highly innovative company, although its projects and systems are definitely at the cutting edge of the networking technology. In part, this reflects a healthy conservative attitude that avoids taking unnecessary risks.

  A notable exception is the InterTools technology (and its predecessors – the 135 and 136 projects for Bezeq). The concept of "Internet Dial Tone" is radically innovative in its business approach.

- **Competitive barrier to entry**
  STAR does not hold any patents, nor any unique technology that is not available to its competitors. Its strength lies in the collection of approximately 200 highly skilled software engineers, who have high competence in contract project work of the type done by STAR. There are groups with specialization in the key technologies used in the projects. Each group leverages and re-uses existing design and code from past projects, which make the company highly competitive. The real barrier to entry lies in this mix of highly motivated, skilled engineers with relevant prior experience, transferable design and reusable code.

- **Dependence on GFE etc.**
  (GFE: Government Furnished Equipment – a generic term for parts of a project that must be supplied by the customer.)
  Most projects include a GFE component in one form or another. Typically, milestones in the project cannot be met by the contractor if the customer is late in supplying GFE items. STAR demonstrated its ability to turn this dependency from a risk factor to an advantage. We have seen several cases where the customer did not meet his obligations on time, and as a result STAR successfully negotiated additional payments for time wasted etc.

- **The focus of STAR**
  STAR can be characterized as a software/systems company specializing in mission critical, network-centric systems. However, the company does not have a single focus. It sells to several vertical markets, and has more than one technology in each of those markets. The main markets / technologies are:

  - Banking and financial sector
    - Bank-branch systems (SuperBranch)
    - Secure home banking systems
    - Home banking over the Internet

- Real-time military systems
    - Reliable military messaging
    - Data communications over tactical radio
    - Imagery interpretation systems
    - Interfaces among dissimilar Command and Control systems

- Systems for Telecom operators
    - Management of telephone exchanges
    - Management of CCSS#7 signalling networks
    - Management for Cellular networks
    - Outsourcing of internet access to ISP's and corporate customers (InterTools)

- Subsystems for Data-comm equipment
    - Embedded SNMP agents
    - Interfaces to management platforms
    - Subsystems for TCP/IP routers

3. Project Management in Star - Background

System integration delivering projects are among the most demanding projects from a management viewpoint. Factors which contributes to this include:

- The need to introduce new systems quickly and at the lowest possible cost.

- The complexity resulting from the number and variety of activities and people (developers and users) likely to be involved.

- The very visible and specific nature of the end product, that is a system that works or does not work.

- The very obscure and indefinite nature of the starting point for many projects.

- The need to produce not just a working computer system but to surround it with effective user procedures and have trained and receptive users.

- The requirements at all stages are to judge when the work has been completed satisfactorily achieving the correct balance between superficiality and perfectionism, bearing in mind that mistakes made in the earlier project stages may prove extremely expensive at later stages.

The above list could be much longer but nevertheless, system delivery projects are amenable to the same management techniques as other types of projects. However, they are in general more complex than other types of projects of a similar size-and, of course, some of them are very large as well.

The management of system delivery projects encompasses project management, user management, quality control, and quality assurance, of which the narrow definitions are as follows:

- **Project management** relates to the processes of planning the project, setting up the project team, and monitoring, reporting and controlling progress and deliverables.

- **User management** covers the relationship between the project team and the user, both the administrative and reporting aspects, and insuring that the user's contribution to the project is effective.

- **Quality control** is the process of insuring that all deliverables are of the required quality and that all work has been carried out accurately and to an

appropriate standard.

- **Quality assurance** is a mechanism whereby third party reviewers, not part of the project team consider whether the project plans the deliverables and the conduct of the project are in accordance with overall quality requirements.

Project management and quality control cannot be separated. A task or activity cannot reasonably be considered complete, unless it has been carried out to the required quality standards, while user management may include some activities relating wholly to commercial relationships. This aspect of management overlaps with the requirement for good senior management commitment and communication, which applies to any systems delivery project.

Apparently, project management, quality control and user management are very closely related and in this document the term project management include all three.

Quality assurance needs to be regarded as a discrete activity because it will often be a formal process carried out by people who are not part of the project team. A meaningful and effective quality assurance function can, however, be performed only against an established framework of project management quality control activities. Furthermore, quality assurance is not just a process performed on a project-by-project basis, but it is also concerned with ensuring that IT system delivery capabilities are maintained at a high level through effective recruitment, training and other staff development activities.

4. Project Management - Findings

We met with 11 division managers and reviewed 15 major existing projects. We found that every project is very well documented according to standards described in the ISO 9000 standards and procedures.

We were impressed by the level of professionalism presented by the management level - all of them have former experience in project management and technical background, some grew up in STAR to become a division managers.

We found great awareness to business issues such as delivering the project on time, on budget and on specs. All of the managers interviewed know that unbillable employees will leave for another project or another division.

Even though the division managers are measured for net revenues, we found that everyone is aware of the project's profit.

There is an overall understanding that a fixed price project at a client has to be changed along the time to time and material based methods of payment.

We found a highly motivated management team that can achieve things that have not been done before. They believe in the future of STAR and are willing to work hard.

The division managers are key players in building relations with the customer which enables new or continues projects.

5. Quality Assurance

We met with Shuki Bar-Gad – Star's quality assurance manager who presented us with the quality assurance (two volume files of procedures) which is fully compliant with the ISO 9001 standard . STAR is ISO 9000 certified since 1996 and is continuously reviewed by the standard institution of Israel every six months reaching very good results.

We found that the quality assurance procedures are very well implemented in the company. In the running projects that have been reviewed, we found detailed documentation based on the ISO 9001 procedures covering the complete project life cycle, all the documents were reviewed, approved and signed by the key people of STAR and by the customer's management.

We expected to find a set of quality measures that usually enables management to get a high level view on the quality achievements in the company. The company defined three types of quality measurements:

- Process quality – time tables, changes in the initial requirements.
- Product quality – number of bugs reported, number of helpdesk requirements.
- Service quality – service level, response time.

We could not get any significant data based on the quality measurements. We understood that the quality measurements were not implemented successfully and there is a management commitment to build a new and feasible set of quality measures.

The operation Control (Aids)

Attached to the quality procedures we found a set of operational reports called "Aids". The most important Aids are those used by project managers and division managers to report to the executive level the project status every month. Attached you may find a sample of documents #2, #3 and #4 enabling fixed price and T & M project control, and employees' performance.

The main data for document #3, for example, is prepared before the beginning of each project by the division manager while the company's CEO (Arie Rahav) allocates the resources in terms of man hours, budget or out of pocket expenses. The division manager updates the document each month describing the project's progress and other needs

(especially employees). Based on the monthly update the CFO (Moshe Atias) sends the payable bills to the customers and Arie gets the project's status.

In addition Arie has several tools based on the above information which enables him to see the whole picture of the human resources allocation through the divisions and projects and plan for future allocation and human resources needs.
At the division level we could not find operational control standards, each division managers and project managers is using his best practice, most of it based on the MS project tools.

Eli Campo, for example, implemented a proprietary weekly report system from project managers at his division. There are thought of adapting weekly reports in other divisions as well.

The operational reports are separated form the financial systems. The interface between the two is basically manual.

The maintenance of the monthly reports is basically manual. The information is not arranged and collected in a way that will enable a higher view level of the projects status, or any "post mortum" analysis. Whenever a high view level kind of question rises there is a need to search for data or make extreme calculation and it takes a lot of time and sometimes it is even unfeasible to get an answer.
In addition we found other "Aids" supporting employees requirement, training, purchasing and other standard procedures.

6. Methodology

A complete methodology is far more than quality assurance processes and procedures implemented in STAR answering the question "what" should be done through the project life cycle but not "how" to do it. We expected to find more detailed information about tools and techniques that were adopted by the company as part of its development methodology.

A technique is a specific way of carrying out an activity or set of activities. A tool is a product, which either enables the performance of an activity or reduces the time to perform activities. Examples of generic techniques or tools are: Rapid Prototyping, Process Modeling, CASE tools, Configuration control tools etc.

The techniques and tools used in STAR are different in each division and sometimes in each project. Using proprietary or industrial tools based on the best practice of the managers or the specific demands of the customers. For example:

- GDE projects uses GDE dictated development environment including
  configuration control, debuggers and proprietary CASE tools – or part of

CDARTS methodology.

- For client X some object oriented CASE tools and 0.0 methodology is in use.

- Boaz Raviv implemented in his division part of the methodology he used to work at Cape Gemini.

- The SuperBranch application development division used proprietary development tool using Magic.

7. Y2K (year 2000)

STAR's management became aware of the Y2K issues only a few months ago and they are still at the assessment stage trying to identify the projects products and customers that can be affected. The projects have been divided into four main groups:

a. Projects in process – getting information about the circumstances of implementing Y2K solutions.

b. Projects in proposal stage – still in competition – set expectations about STAR's commitment to Y2K compliance.

c. Projects in maintenance stage – sending letters to the customers encouraging them to buy an assessment project.

d. Projects and products without any commitment – sending awareness letters to the customers.

Some customers using the date entry products Narkis already bought a Y2K project. STAR initiated an assessment project for some strategic clients like Bezek, the Police and the Banks.

Meantime an internal project on the internal systems compliance to Y2K is running. We have been told that only in November STAR will have the complete picture, we think that it might be too late to deal with all the systems in a one year period.

8. Organization

STAR's organization structure is based on 10 divisions. The divisions are acting as production lines with a flexible structure and a number of employees depending on the running projects in each division. Such a structure without a methodology with tools and

techniques may cause inefficient and inflexible transition of human resources by need of learning curve.

STAR organization supports the company's main strength to deliver projects on time, on specs and on budget. STAR's organization and experience does not support building products.

There is no marketing or sales organization. The selling of a project is done by the management and executive team only, which may not be enough for future growth.

The professional services group of 55 employees is working mainly in the financial industry (Bank Leumi and First International Bank) and the communication industry (Pelephone, Bezek, Tadiran).

9. Manpower

- **Compensation policy**
  The salary levels at STAR seem slightly above the average in the IT sector in Israel. Employment contracts are individual and confidential. Salary is reviewed once a year, on the personal anniversary of each employee in the company. Bonuses are paid to most employees, typically at the range of 1 – 2 month salaries, based on personal and project achievement. As STAR attempts to attract top professionals, and not "average", we believe the salary level is slightly lower than it should be. It is just high enough so that employees will not leave due to feeling of being underpaid.

  STAR management estimates that the overall salary increase in 1999 will be 16% in $ value. We believe that the acquisition might create internal pressure to increase salaries. Part of this should be offset by the offering of stock options to employees. However, we think that additional 4-5% should be reserved for special salary increases.

  Company cars ore offered liberally. Approximately 50% of employees drive company cars. Any employee can choose to use one, in return for a 3,000 NIS reduction in his salary. Car models offered to middle and division management are relatively luxurious.

  Employees are offered a "reward" of 10,000 NIS for bringing a new employee to the company.

- **Manpower profiles**
  Most employees of STAR are software professionals. 40% have a B.Sc degree, and 23% have M.Sc. or higher degree (total 63% with academic degrees). Most employees specialize in several key technologies. For each of 20 key

technologies, there are 30 – 70 experienced engineers in the company. 30 employees have experience in management of large projects.

STAR does not hire beginners. Professional experience of STAR employees varies from 3 to over 20 years, with the average at 9 years of experience. (There are a few exceptions of employees with 1-2 years of experience, but they are relatively few.)

In summary, STAR employees are highly skilled, and are the main asset of the company.

- **Hiring and attrition**
  Hiring at STAR is aggressive, although very selective. The preferred channel is through current employees. The company advertises regularly in "Yediot".

  Attrition level in STAR is high. Out of 204 employees that were in STAR in mid 1997, only 135 employees are still with the company in July 1998, which represents over 30% of attrition. Cumulative attrition for the past 2 years is over 40%, and for 3 years – nearly 60%. See attached chart. **This is different from what we were told verbally by management.**

- **The key drivers**
  The key factors that attract and maintain high quality employees at STAR are:
  - Interesting and professionally challenging work
  - An overall feeling of excellence
  - A positive, supportive corporate culture and "team" spirit

- **Satisfaction**
  STAR conducted one employee satisfaction survey, in December 1997. Response rate was 50%. Results seem "average". Most dissatisfaction concerns service aspects of company cars, housekeeping, network management, purchasing of workstations, and employee benefits areas. We do not see anything unusual in the survey results, and the general level of satisfaction is high.

10. Marketing and Sales

- **Projects in progress**
  The project manager and division manager are responsible for selling "add-ons and changes" for ongoing projects. Existing projects are the primary marketing vehicle of STAR, through which the company gains customer recognition, which normally leads to follow-on projects.

- **Sale process**
  The sale process typically involves four steps:
  - Early contacts and discussions with the prospect

- Receiving a "Request For Proposals"
- Submission of a proposal
- Contract negotiations

Early contacts and proposal preparation are the responsibility of a division manager. Senior management is highly involved in the proposal process. Contract negotiation is normally done by top management (Meir, Arie, and Yair)

STAR employs one salesman, responsible for selling to Bezeq. All other sales do not involve sales professionals.

- **Proposals**
  Proposals are the key document that establishes STAR as a competent Sytems Developer in the eyes of a customer. They are also critical in defining the content of a project, and the basis for project pricing and scheduling. STAR invests considerable effort and skill in the preparation of proposals. We reviewed the proposal preparation data for the "Kings Castle" project. The process involved a very precise definition of the technical content of the project, decomposition into over 300 small task, and estimation of effort for each task separately. This gives management the ability to propose the project on a Fixed Price basis, with a high degree of confidence.

- **Marketing aids, Web site**
  There is no "marketing" in STAR, except for the activity of Yair Bar-Touv and Al Plescus in the U.S. market. The Company's Web site is "ordinary" – it lists current customers and areas of expertise, without giving exceptional details. Power-Point presentations are used in face-to-face meetings with prospective customers, as well as live demonstrations of delivered systems.

- **Conferences and exhibitions**
  STAR does not participate in trade shows and exhibitions. We are not aware of it appearing in conferences.

11. Customers due diligence summary

Summarizing about ten interviews (attached list) with key persons at STAR's customer based in Israel and in the USA enabling us to receive a clear picture of STAR company from the customer point of view.

The Good News

All the customers emphasized the level of professionalism of STAR's employees and management. They provide expertise in high demanding leading edge technologies and ability to learn and adopt new technologies.

The company has a unique ability to handle mission critical technological projects (especially network management infrastructure and financial/banking applications) and to deliver on time on budget and on specs.

Israeli customers

In the Israeli market the company gain high position in the first league of system integrators, as a matter of fact, they compete successfully both with software integrators (like ATL, Forsoft, IBM...) and engineering system integrators (like Tadiran, DSI, Telrad...) and they won projects based on their quality in spite being more expensive. In the Israeli market they built a track record of "no failures" but at the same time they are recognized as tough Negotiators with prices of about 20% above average prices in the Israeli market that can be acceptable based on STAR's highly qualified employees.

The company is building relationships with existing customers while increasing market penetration with new projects and with maintenance services.
The founder has a reputation and image of a honest and reliable business man, but a tough negotiator that will not give up his professional principles and will not take uncalculated risks.

The US customers

The US customers emphasized the working spirit of the Israeli employees who are devoted to the project success days and nights – this spirit is not usual in the high-tech US market and the customer warned us to keep this spirit and not to became Americans.

The management team got a high professional grade even though they are tough negotiators.

Issues to think about

The US customers do not have any problem with the development methodology based on development team in Israel, they expect to see more balanced professional teams in the US and in Israel, meaning more technical people based in the US.

A major Israeli customer expressed his concern of the inability to achieve the expected growth of the company based on lack of human resources in Israel. He was also concerned that a big company will not be able to produce the same service quality and customer attention that he may need.

We got the impression that there is no standard method and organization in the marketing and sales operation in the US. Satisfied customers generate new projects and are telling

their friends. We shall need to establish a marketing organization in the US that will be able to get the leads based on a structure plan.

Interviews list

A. Fred Banks	Vice President of Software development	LCC international Inc
Dr. Hanafy Meleis	Chief Technical Officer	RACAL Data Group
Henrry Yeh	Program Manager	GTE Internetworking
Al Pleskus	Former GDE director	
Itshak Hegedish	Manager, Data Networks Div.	BEZEQ
Izhak Malach	Vice President of operation	Bank Leumi
Ted Joseph	Former manager	Relay Corp.
-	Managers	Defense customers

♦ **STAR FINANCIAL DUE DILIGENCE**

STAR - FINANCIAL DUE DILIGENCE

1.   The Impact on Elron's Profit and Loss

   1.1.   STAR Impact on Elron's Results

	($000')	
	10-12/98	1999
Revenues	7,000	30,000
Operating income	1,900	7,000
Goodwill amortization	(350)	(1,400)
Net income (after finance and tax)	**600**	**2,400**
One time R&D in process Write-off	**(20,000)**	**-**

STAR will have an impact on Elron's results as of Q4/98 upon closing.

   1.2.   Contribution of Elron Software Inc. to Elron's Results

	($000')			
			Total	
	1-6/98	6-12/98	1998	1999
Revenues				
Boston Division	7,700	8,000	15,700	20,000
STAR	-	7,000	7,000	30,000
Total	**7,700**	**15,000**	**22,700**	**50,000**
Net income (after finance & tax)				
Boston Division	(2,020)	(300)	(2,320)	1,000
STAR	-	600	600	2,400
Total	**(2,020)**	**300**	**(1,720)**	**3,400**
On time write-off	**-**	**(20,000)**	**(20,000)**	**-**

2.   STAR Profit & Loss

Over the last 2 months we created a bottom-up budget for 1998 which never existed in STAR before.

The following are the results.

2.1.   Profit & Loss and Cash Flow (000'$)

	Actual		Total	Forecast		Total
	Q1/98	Q2/98	1H/98	Q3/98	Q4/98	2H/98
Income	6,000	7,350	13,350	5,700	7,000	12,700
Gross profit $	2,280	2,230	4,510	2,000	2,800	4,800
%	38	30	34	36	40	38
R&D, net	100	100	200	100	100	200
SG&A cost	530	770	1,300	800	800	1,600
Operating income $	1,650	1,360	3,010	1,100	1,900	3,000
%	28	16	23	19	27	24
Estimated cash	600	800	1,400	750	750	1,500

2.2.   Profitability by Projects

The Profit & Loss is very sensitive to completion of projects taken on fixed price.
16% of the Gross Profit in 1H/98 was derived from one project "Or Tzfoni" which was completed in 6/98 and which includes profits from 1996 and 1997. The same applies to 2H/98 where 24% of the Gross Profit will derive from the project in Hungary which will be completed during this period, and profits will be taken for the years 1997-98.
The simulator business, which we are not acquiring, had about $570K revenues and $130K G.P. in 1998 (1.5% of total company G.P.).

2.2.1. The following is an analysis of the contribution per project
to the 1H/98 results (000'$):

Project and Client	Project type	Gross profit		% of total G.P.	Total man-month invested	Average sale price per man- month ($)	Remarks
		$ (000)	%				
Or Tzfoni M.O.D.	Fixed price	700		16	50		Project completed in Q2/98 and including 96-97-1H/98 profits
Lcc – Export USA	T&M	775	64	14	60	$20,000	
RACAL – Export USA	M/M	480	46	9	63	$16,400	
Chico	Manpower	646	30	6	330	$6,400	Manpower rent out
Hungary – Bank	Fixed price	345	37	6	50	$18,500	
GTE – Export USA	T&M	400	39	7	57	$17,900	
Merkaz Gibui - Bezek	M/M + Maintenance	230	28	5	53	$15,500	
Mop Bezek	M/M	270	52	5	34	$15,300	
Netect – Export USA	M/M	235	54	4	29	$14,900	
GDE – Export USA	M/M	225	46	4	40	$12,100	
Mataf – IBM	M/M	120	48	2	26	$9,500	
Narkis Tevel - Banking	Maintenance	92	75	2	-	-	
Merkaz Tmicha – Bezek	M/M	90	53	2	59	$2,900	Project ended – student work
Kiyosk – Bezek	Fixed prices	70	17	1	42	$9,500	Bezek – 135 project
CHA – Export USA	Fixed price	36	67	1	3	$18,300	
Yosi Geva - Consulting	M/M	30	17	0.5	24	$7,200	Manpower - consulting
BLL	Fixed price	24	10	-	36	$7,000	
Maarechet Mumche - Bezek	Fixed price	7	20	-	5	$6,900	Finished
Visa	Fixed price	5	2	-	29	$8,500	
Otzav – M.O.D.	Fixed price	4	-	-	56	$8,700	Profit will come towards the end of 1999
Kinor Main M.O.D.	Fixed price	(7)	-	-	5	$14,200	
RCC – M.O.D.	Fixed price	(38)	-	-	6	-	Project ended

2.2.2. Same analysis with regard to 2H/98 results (000'$)

Project and Client	Project type	Gross profit		% of total G.P.	Total man-month invested	Average sale price per man-month ($)	Remarks
		$ (000)	%				
Hungary – Bank	Fixed price	1,140	96	24	48	25,100	Project end – including profits of 1997+1998
LCC – USA	T&M	440	48	10	62	15,000	
GTE – USA	T&M	355	55	8	37	17,500	
Chico	Manpower	395	19	8	330	6,140	Manpower – rent out
Kiyosk – Bezek	Fixed price	340	55	7	· 42	14,800	135 – project
Merkaz Gibui – Bezek	M/M + maintenance	265	47	6	42	13,300	
Netect – USA	M/M	260	43	6	45	13,200	
Otsav – M.O.D.	Fixed price	236	30	5	84	9,500	
Or Tsfoni – M.O.D.	Fixed price	220	53	5	· 36	11,600	
MOP Bezek	M/M	195	42	4	36	12,800	
GDE – USA	M/M	156	40	3	29	13,500	
Mataf – IBM	M/M	136	50	3	24	11,300	Banking branch communication
Shonot	M/M	130	38	3	28	12,400	
Narkis Tevel – Banking	Maintenance	95	63	2	4	38,500	Maintenance
RCC – M.O.D.	Fixed price	73	62	2	· 6	19,800	
Mechkar algorithmim	T&M	70	48	2	12	12,400	
Pelephone	Fixed price	70	38	2	17	10,800	
B.L.L.	Fixed price	73	43	2	14	12,000	
Visa	Fixed price	43	40	1	8	13,500	
CHA – USA	Fixed price	59	54	1	8	13,500	
Y. Geva	Consulting	22	14	-	24	6,700	
Racal – USA	M/M	14	12	-	· 7	16,100	
Digital	Fixed price	-	-	-	9	-	New project, no profit taken in 1998
El-OP	Fixed price	-	-	-	34	-	New project, no profit taken in 1998

Rakefet – M.O.D.	Fixed price	-	-	-	47	11,000	New project, no profit taken in 1998
Keshev – M.O.D.	Fixed price	-	-	-	5	13,500	New project, no profit taken in 1998
SKS – M.O.D.	Fixed price	-	-	-	4	6,200	New project, no profit taken in 1998

Conclusions

A. There is a wide range of profitability between the various projects. Some projects are taken at a very low profitability such as manpower and consulting work, BLL, Visa and some projects of Bezek. On the other hand, there are very highly profitable projects (mainly export work such as CHA, Netect, LCC and some projects of Bezek).
   All in all, only very few, small projects are losing money.

B. There is dependence on the profitability at completion of large projects taken at fixed price – the current company accounting policy is to delay profits till project end resulting in fluctuations on a quarterly basis.
   Elron accounting policy will be to spread the profit according to completion of milestones, which will enable us to smooth fluctuations.

3. **Opening Balance Sheet**

    The agreement will be retroactive to 1/7/98. STAR will prepare a fully audited closing balance sheet for June 30, 1998.

    3.1. Elron Software will acquire the following assets and liabilities:

Assets	**$000'**
Cash	4,660
Receivables – trade	4,030
others	485
Pre-paid expenses	1,950
Inventory	132
Fixed assets	2,830
Total assets	**14,087**

Liabilities

Bank loans	2,310
Payables - trade	520
others	2,910
Advances from clients	1,925
Long-term loans	1,420
Accrued severance pay, net	515
Total liabilities	**9,600**
Net assets	**4,487**

3.2. **Cash**

Elron Software will acquire cash net (not including long-term loans) of $2.3M.

3.3. **Pre-paid expenses** - $1,950K

Mainly regarding the work in process of projects taken on fixed price (mainly Hungary and Otsav) and rental payments for the current year paid in advance (about $170K).

3.4. **Fixed assets** - $2,830K

Rental rights (prepaid rent for up to 9 years) - $1,650K
Cars - $470K
Leasehold improvement - $990K
Computers and furniture - $280K

3.5. **Payable – others** - $2,910K

Mainly for:
Employees - $1000K
Provision for vacation - $855K

3.6. **Advances from clients** - $1,925K

Mainly: Hungary - $1,200K
Otzav - $ 580K

3.7. **Long-term loans** - $1,420K

All loans taken to finance the pre-paid rental payment and leasehold improvements.

3.8. **Goodwill**

The goodwill in this deal will amount to $41M from which we hope to be able to depreciate immediately, as R&D in process, $20M and the remainder over 15 years - $1.4M per year.

4. Backlog Analysis

4.1. Backlog in Dollars (000'$)

6-12/98	1-6/99	7-12/99	2000	**Total**
12,300	6,400*	5,500*	2,000	26,200

* Assuming manpower work continues on the same level. Not included in those numbers are new projects in bidding stage with a very realistic estimate of success - $2M.

4.2. Backlog in man-month (including new projects with high degree of probability to be profitable)

	6/98	7/98	8/98	9/98	10/98	11/98	12/98	6/99	12/99
Company M/M availability	175								
M/M Backlog	175	175	175	175	180	190	190	115	100

5. Sensitivity Analysis

5.1. **Dependence on Projects**

Profitability: In 2H/98 three (3) projects account for 42% of the G.P.; There is a dependence on few large projects – an issue which is very normal for project company.

Man-month: Excluding manpower work seven (7) projects in 2H/98 account for 52% of total work.

Manpower work: Manpower work accounts for 8% of company G.P. and 33% of the total company M/M.

Projects on fixed price: In 2H/98 fourteen (14) projects consisted of 362 man-month (32% of total man-month) and $2.3M G.P. (48% of total G.P.) were taken on a fixed price term.

5.2. **Labor Cost** – Total for the year - $13M

Labor cost is the highest cost, representing about 60% of revenues and about 70% of total costs.

Each 5% change in labor cost is equal to about $650K per year.

6. Labor Issues

6.1. Provisions for social benefits

STAR provides social benefits only for approximately 67% of the salary.
The total exposure is about $0.5M.
The cash exposure of the amount not deposited in "pitzuim" funds is about $1M.
This situation is not uncommon in labor intensive companies and normally the exposure is very limited.

6.2. Company cars

The company has 103 company cars, about 75 of which, are leased.
Every employee that is not eligible for a company car can have a car for 3,000 I.S. per month reduction in his salary.

7. Professional Indemnity Insurance

The company does not have professional indemnity insurance.
Elron will need to purchase such policy with unlimited retroactivity covering up to $10,000,000 claims.
We have obtained bids covering also Y2K and the anticipated cost will not exceed $100K per year.

8. Financing the Deal

We negotiated with three banks (Leumi, FIBI and IDB) a credit line to finance the deal. All three banks agreed as follows:

A. To give a $35M three year financing (which we can repay at any time during this period).
The cost will be Libor + 0.6%.
B. As a security to the loan, Elron will give a negative pledge on its shares of Elron Software Inc. and an Elron guarantee for Elron Software loans.

C. The loan will be given to Elron and/or Elron Software Inc. as per our needs.

We will aim to split the credit line between 2 banks.

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◆ **LEGAL SUMMARY**

Advocates and Notary   משרד עורכי דין ונוטריון

3 Daniel Frisch Street   רח׳ דניאל פריש 3
Tel Aviv 64731   תל אביב 64731

MEMORANDUM

To:	The Board of Directors of Elron Electronic Industries Ltd.
cc:	Kobi Ben-Zvi
	Doron Birger
From:	David Schapiro
	Atir Hardof-Jaffe
Date:	Sýeptember 8, 1998
Re:	Project Star - Due Diligence
File:	6602

What follows is a summary of our due diligence review of the Star group of companies (together, the "Company"), in connection with the proposed acquisition of the assets and liabilities of the Company by Elron Software Inc. ("Elron") and a wholly-owned subsidiary of Elron. This memorandum is based on the documents that we have received from the Company to date, and various discussions with the Company's senior management.

General

In connection with our due diligence review, we received and reviewed in excess of 24 binders of documentation and over 300 agreements to which Star is a party. Set forth at Annex A hereto is an index of the documents which we reviewed.

What follows is a summary of the main concerns which we noted in our due diligence review:

I.   Intellectual Property

From our review of the due diligence materials and more than 300 agreements to which the Company is a party, we were unable to obtain an accurate understanding of the nature and scope of the Company's intellectual property rights. This results from several interrelated findings:

⇒ A significant portion of the intellectual property developed by the Company was developed pursuant to, or in connection with agreements between the Company and its many customers. Most of these agreements provide that the intellectual property developed in connection with any given project shall belong exclusively to the customer.

⇒ A number of the agreements we reviewed specifically provide that the intellectual property which belonged to the Company prior to the agreement shall remain the property of the Company[1]; however, these agreements do not contain descriptions of

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[1] For example, certain of the agreements with Bezeq and the Ministry of Defense.

the intellectual property owned by the Company, so it is unclear from the agreements themselves which components of the intellectual property actually belong to the Company and which belong to the customer.

⇒All of the agreements provide confidentiality provisions. It is not possible from the face of the agreements and the other documents that we reviewed to know whether the Company has complied with these provisions.

Normally, a purchaser of assets would attempt to gain clarification with respect to these issues through the representations and warranties section of the Asset Purchase Agreement. Typically, the Seller would state explicitly, what are its rights, what are the rights of its customers and that it has not breached the intellectual property rights of third parties. In addition, the Seller would typically state that it has not breached the confidentiality provisions of its agreements with its customers. These representations would be supported by a full indemnification provision in the event that any representation proves to have been incorrect. In the current draft of the Asset Purchase Agreement, although the Company has provided Elron with a limited intellectual property representation, it has through the indemnification provision either limited the effect of the representation or created a situation whereby effectively the representation does not exist. As a result, Elron faces some level of exposure, if it intends to make use of intellectual property, or "know-how" developed for the Company's customers for its own benefit (e.g., through Elron "off the shelf" products) or for projects to be undertaken for future customers. We should also note that Elron is exposed to claims by third parties regarding infringement of such client's intellectual property rights by the Company.

There are, however, several agreements which provide that the Company may make use of the intellectual property developed in connection with such agreement, subject to the payment of royalties to the customer. These include agreements with Bezeq, for various projects and services, and with Visa, for a home-banking system. These are the very minority of the agreements of the Company. We should also point out that the Company is currently attempting to obtain a clarifying letter from Bezeq, a draft of which we have reviewed, which would state that the Company has full rights to its Intertools product. Absent this letter, we believe that the Company does not have full rights to this product.

II.   Limitations of Star's Liability to its Customers

Many of the Company's agreements with its customers do not contain standard provisions regarding the limitation of the Company's liability with respect to damages caused to its customers. In the agreements where the Company's liability is limited, the limitation is usually in the amount of the consideration to be paid by the customer to the Company thereunder. We note that, as currently contemplated, Elron will be assuming the Company's agreements with its customers and will accordingly be assuming this potential exposure. We also note that the Company is unwilling to provide a clean representation that it has fully complied with, and performed its obligations pursuant to its agreements with its customers.

III.   Year 2000

The Company may have exposure to Year 2000 claims by its customers, in connection with various projects that it has implemented. In addition, the Company's agreements do not contain any limitation on the Company's liability relating to Year 2000 claims.

The Company has refused to include a Year 2000 representation in the Asset Purchase Agreement, which, we note, has become standard in transactions of this nature. Instead, the Company has insisted that Elron warrant that it is aware that the Company's projects and products are exposed to Year 2000 claims and waives any claims in this regard.

IV.   Assignment of Agreements

The vast majority of the agreements to which the Company is party provide that the Company may not assign such agreement without the consent of the other parties thereto. In order for the Company to assign its agreements to Elron, it will be necessary for the Company to obtain the consent of all of the parties with which it has contracted. The current draft of the Asset Purchase Agreement provides a mechanism whereby contracts with substantial clients will be assigned to Elron as a condition to the closing of the transaction. We note, however, that most of the Company's current projects will be completed by the end of 1998.

V.   Assignment of Security Interests and Guarantees

The performance bonds that were provided by the Company to its customers will need to be replaced with guarantees from Elron. It is unclear, from the materials that we reviewed, which guarantees are currently valid, and which have expired. In particular, the scope of the guarantees that the Company has provided to its banks over the years is rather unclear Also, we have been informed by the Company that it has not been the Company's practice to renew performance bonds that have expired. In light of the confusion surrounding the various guarantees provided by the Company in connection with its bank accounts, the current draft of the Asset Purchase Agreement requires the Company to settle all outstanding credit facilities and terminate all guarantees and security interests before transferring its liabilities to Elron.

VI.   Government Consents and Approvals

Similar to the agreements with its other customers, the agreements between the Company and the various Israeli government ministries provide that the Company may not assign such agreements without the consent of the relevant ministry. In connection with the agreements between the Company and the Ministry of Defense, it appears that the Company will be required to provide the Ministry of Defense with the names of the people who will be involved in the various projects, in accordance with the Ministry's regulations regarding internal security.

VII.   The Employment of Laborers by Manpower Contractors Law

The Company has received an opinion from its legal advisors that the Employment of Laborers by Manpower Contractors Law (the "Manpower Contractors Law") does not apply to the Company. In the opinion of the Company's legal advisors, the Company is not a "Manpower Contractor," as defined in the Manpower Contractors Law. We believe that many of the agreements pursuant to which the Company provides manpower on an outsourcing basis may be subject to the provisions of the Manpower Contractors Law.

The Manpower Contractors Law has a number of ramifications for the Company: (i) if the Company is required to obtain a license pursuant to the Manpower Law, the Company and its managers may be exposed to potential criminal liability for providing manpower services without a license, and (ii) the Company may be required to pay additional salary to employees of the Company who have worked at a client company for more than three years, if the employees of the client company receive preferential benefits under a collective agreement. It is our understanding that the Company has not accounted for this exposure in its financial statements.

We are of the opinion that, after the Asset Purchase Agreement is completed, Elron should apply to the Ministry of Labor for a license under the Manpower Contractors Law.

VIII. Severance Pay

It is the Company's practice to pay its employees a lump sum, of which two thirds represents the employee's base salary, and one third is viewed as compensation for overtime. This entire amount will serve as the basis for calculating the severance pay to which the Company's employees will be entitled, in the event that their employment is terminated in a manner which generally entitles them to severance pay. The Company has only reserved for severance liabilities on the basis of the two thirds amount of the employees' salaries. This is not appropriate under Israeli law and practice.

The current draft of the Asset Purchase Agreement contemplates that the three controlling shareholders of Star will indemnify Elron with respect to any claims for the increased level of severance pay liabilities.

11. <u>MAJOR RISKS</u>

      ◆   **ATTRACTING AND RETAINING PROFESSIONAL STAFF**

Large part of STAR's success depends upon its ability to attract, retain and motivate highly skilled employees. So far, the company has succeeded in achieving relatively low turnover. Elron Software "entry" could trigger a demand for salary increases and other employee-related benefits, thus increasing overall costs. Furthermore, there can be no assurance that the new company will be successful in attracting a sufficient number of highly skilled employees needed for future planed growth.

      ◆   **INTELLECTUAL PROPERTY RIGHTS**

STAR's business generally involves the development of custom software applications by reusing existing generic software components. Ownership of the complete customer application software is frequently assigned to a given client. However, STAR still claims ownership to the generic "building blocks" of such applications, there can be no assurance that a claim will not be asserted against Elron Software in the future.

      ◆   **U.S EXPANSION**

Elron Software plans to leverage the system integration experience of STAR primarily in the United States. STAR presence in the U.S is in its infancy; lacks organization, planning and methodology. We will need to invest additional money coupled with business management efforts to build the "right" operation.

      ◆   **SYNERGY WITH ELRON SOFTWARE**

Our main challenge post acquisition is to establish synergy between STAR operation and the other product divisions within Elron Software. Although our intention from the beginning is to operate in a "business as usual" mode, we still need to consider future impact on STAR productivity caused by our strategy. In particular changes in the executive level may cause some "turbulence".

◆ System integration company

There is inherent risk with system integration companies; Fix priced project running over budget, operational liabilities (year 2000 bugs) , technology change, shortage of skilled personnel etc.

◆ **STAR TECHNOLOGY**

Star Technologies

1. Introduction

STAR is a very skilled software projects company. It takes responsibility for developing and delivering complete, turn-key system solutions to various mission critical systems in several sectors of business: telecom and networking, banking and financial services, military data communications, and a few others. During its years of operation, STAR has accumulated expertise in the following areas of technology:

- State of the art software engineering methodologies for large-scale software systems development
- Telephony Network Management (TMN)
- Data Network Management
- Network Performance Management
- Internet Technologies (TCP/IP, HTTP, PPP)
- Internet Routing and Access Technologies
- Bank Branch Systems
- Secure Remote Access
- Home/Corporate Secure On-Line Banking
- Internet Based Home Banking
- Internet Based Information Systems
- Military Messaging Systems
- Imagery Systems
- Data Transport over Military Tactical Radio

2. Technology assets of STAR

The assets of STAR fall into the following categories:

- A management team experienced in the business processes of STAR.
- A core group of approximately 60 senior software engineers, project managers and division managers, who have common skill sets in software engineering, project management, and the actual technologies in which STAR is engaged.
- Other professional workers - teams of engineers with prior experience in each of the technologies listed above.
- Engineering "know how" (which exists in the knowledge of those engineers) from past projects, encompassing basic technologies, design of previous systems, and familiarity with a large body of existing code in the various projects the company has delivered.
- Actual design documents of all previous projects, together with people who know them.
- Existing code ("black") – code which definitely belongs to customers of past projects, but STAR can negotiate re-use and re-sale if and when the opportunity arises.

- Existing code ("gray") – code which is jointly owned by STAR and a customer. Typically, STAR will pay royalties to the customer out of repeat sales. Additionally, STAR re-uses small portions of such code, in a way that is not perceived as infringement of rights by the original customer.
- Existing code ("white") – three collections of tools and modules which STAR has accumulated over the years. These include the software developers' toolkit, the network management tool collection, and the data communications tool collection.
- SuperBranch – the bank-branch system (jointly owned with IBM), currently used in a large scale project for the K&H bank in Hungary, and with potential for additional sales in Europe.
- InterTools – a still incomplete product being developed by STAR, with the intention of selling to U.S. and European telephone companies and service providers.
- Proven ability to deliver large, high quality operational software systems.
- Proven ability to perform "crash projects", delivering a working system in a very short time frame.
- Existing customers with ongoing projects and very high probability of follow-on projects.
- Reputation and connections with potential customers, in Israel and the USA.

3. Technology – Detailed Descriptions

Following is a detailed description of the technologies in which STAR specializes, as we found them in STAR documents and in the due diligence process:

3.1   State of the art software engineering methodologies for large-scale software systems development

Traditionally, the task of developing large scale software systems faces three risks: many projects are not completed on time (very large delays are not uncommon), costs may exceed budget by 100% or more, and the delivered systems may not perform the intended task – either speed and capacity, or functionality may be impaired. It requires highly skilled development organizations to avoid these risk.

We found STAR to be a mature and competent development organization, which has repeatedly demonstrated the ability to avoid all these pitfalls.

Review of completed projects shows that the majority of projects were delivered on schedule. Moreover, STAR exploits situations where the customer falls behind in his commitments for project deliverables, and turns them into opportunities for increasing project price. In discussions we have conducted with STAR customers, all of them reported that the delivered systems perform to their complete satisfaction. From the cost aspect, nearly all of STAR's projects are profitable, and we have not heard customer complaints regarding cost overruns. Approximately 65% of STAR's contracts are on a time and materials basis. The remaining 35% are "firm fixed price"

contracts. We have seen accounts of at least two large FFP contracts that STAR re-negotiated with the customer and turned them into T&M contracts in order to cover higher costs than originally estimated, but in both cases STAR convinced the customer that the additional expense was well justified.

In meetings with all 11 department managers of STAR, they demonstrated expertise in modern software engineering methodologies, and it is our impression that modern software engineering is applied in all of STAR's projects. On the down side – STAR does not have a well documented software design and development methodology. Rather, each department, or group of projects, uses a slightly different methodology. These different methodologies are either derived from, or adapted to, the software engineering culture of the specific customer. Thus, the methodology used in the "Or Zfoni" project for the IDF is significantly different from the methodology used in the "Frame relay management" project done for Racal Datacom, but both are modern and effective software engineering methodologies.

We discussed formal technical aspects of project life-cycle with many people in the company. All of them demonstrated familiarity with the common set of formal documents – Functional Requirements Specification, Software Requirements Specification (SRS), Software Design Document (SDD), System Test Plan, Test Report, etc.

We examined a sample of project documents for several projects. The documents were available in each and every case. All looked highly professional, well organized, highly readable, and contained all of the relevant topics. Department managers were familiar with the project documentation, and quickly navigated us to the topics on which we were trying to focus.

Software configuration control is applied in all the projects that we examined. CCMS is used in Unix environments, and Visual Source Safe in Windows development environments.

Defect report management is applied in nearly all projects, but in different forms and using different tools per project.

Over the years, STAR has acquired software development experience and expertise for the majority of popular operating systems and computing environments. Historically, STAR was strongest in the then popular VAX/VMS environment. With the decline in the glory of those systems, STAR entered into UNIX environments (for Digital Alpha systems, Sun – Solaris, IBM AIX and others), and Windows NT and Windows 95. The banking systems division of STAR has experience in IBM mainframe environments (and SNA networks), and the network management group has done projects in VxWorks and PSOS embedded systems environments.

3.2   Telephony Network Management (TMN)

STAR has been doing projects for Bezeq for many years. Bezeq projects constitute approximately 18% of STAR's annual income. In a large portion of these projects, STAR has developed large scale, real time network management systems. This activity and accumulated expertise put STAR in a leadership position in this specialized field of Telephony Network Management.

Telephony Network Management (TMN) is the set of technologies used by Telephone Companies all over the world to manage the telephone networks. Along with the technologies there is a multi-billion dollar market for software, systems, and services for TMN. This market is expected to grow at a very high rate, due to the current deregulation in world telephony, and the blurring of boundaries and rising competition between telephone networks, cable networks, and cellular systems. Appendix A below contains an excerpt from a recent report by Lehman Brothers, describing the "TMN Industry". We believe that STAR's expertise and proficiency in TMN is one of its most important assets.

The most prominent TMN system developed by STAR is in the "Merkaz Gibuy" project for Bezeq. The project started in 1990 and has been going on since then, with additions, enhancements and modifications. The system is called "AMOS" – Administration, Maintenance, and Operations System. It is a real-time management system, running on Digital "Alpha" computers. AMOS is connected to all of Bezeq's 230 telephone exchanges, spread out all over Israel. STAR developed specific interfaces to the (proprietary) management ports of Alcatel System-12, Nortel (Telrad) DMS-100, and Teledata telephone exchanges. AMOS uses various standard and proprietary protocols for interaction with the telephone exchanges. An AMOS operator's console shows a graphic map of the entire Israeli telephone network, with colors indicating the status of each and every telephone exchange. The system generates alarms for faults in the telephone network. By "zooming in" on a region or a specific exchange, the operator can obtain detailed information describing the configuration parameters, the current load, and various alarm and fault indicators for each of the exchange's functions. Logging of events is automatic. The system provides rich and flexible reporting capabilities from the log files.

AMOS also provides the operator with the ability to perform control operations in the telephone network. The operator can change the settings of parameters within each exchange, perform remote tests, and perform various actions in order to bypass or correct failures in the network.

The main AMOS system is deployed at a Bezeq facility. An operational backup system, which is connected on-line to the telephone network, is installed at STAR premises, to be used as a disaster recovery system in case the main system is damaged for any reason.

STAR is now engaged in a project of upgrading and enhancing AMOS. The system is being ported to Windows NT platform, and over 100 new functions are being added. The project is scheduled for completion by 10/98.

STAR wants to enhance AMOS in a way that will make it into a sellable "product".

A second large scale management system which was developed by STAR for Bezeq is the "Access 7" system, for monitoring and management of the CCSS7 signaling network of the Israeli telephone network. CCSS7 (Common Channel Signaling System #7) is a modern control protocol used by telephone exchanges for the purpose of setting up inter-exchange telephone calls. During the early 1990's, Bezeq upgraded the entire telephone network and deployed a country wide CCSS7 network, which allows Bezeq to provide advanced services (such as call-waiting, call-back, calling number identification, and more) and ISDN services in the telephone network.

STAR developed and installed for Bezeq a Surveillance System for the Signaling System # 7 - Full deployment of national coverage for surveillance of Signaling links providing Alarm collection, Traffic Monitoring, Call Trace and Protocol Analysis as well as Q.752 Statistic collection. A similar project is now in progress for Pelephone – a cellular network operator.

The system is based on a specific HP product for interaction with CCSS7 systems. The system provides status monitoring and reporting, load monitoring and analysis, fault alarms, and re-routing capabilities. A function of load trend analysis and planning is also provided.

Bill Verification is a derivative project, designed to use data from Call Detail Records to verify the billing by other service operators.

Another project in this area is the "CellSight" system, developed for a US cellular operator – LCC of McLean, VA. CellSight is a network performance analysis tool for cellular networks.

CellSIGHT is the first tool of its kind that can both monitor and analyze statistics from telecommunications network components such as switches and OMCs. CellSIGHT has multiple applications for a wireless network operation. It allows RF and System Performance Engineers to isolate traffic congestion, identify overloaded control channels, and monitor key network performance metrics such as blocked call statistics, dropped call statistics, overall quality of radio links, and handover failures. Operations and Optimization Engineers use CellSIGHT to identify day-to-day network problems such as congestion, drops on the air interface, and fixed network utilization. Traffic Engineers use it to forecast medium-to-long-term site and network provisioning, and to evaluate usage patterns. And CellSIGHT provides management with customized reports on market, regional, and overall network performance.

LCC is licensing CerllSIGHT to network operators, and STAR has a royalties agreement with LCC on these sales. STAR will receive 50% of revenue up to $ 400K, and 5% of subsequent revenue up to $ 700K.

The following section is an extract from LCC's Web Site, describing CellSIGHT's features and capabilities:

CellSIGHT®

Network Performance Engineering Software
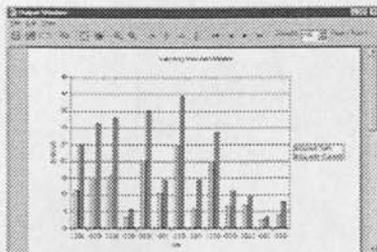
CellSIGHT, LCC's Network Performance Engineering tool, is used to automatically collect and monitor valuable network performance statistics, analyze key network performance indicators, identify current and potential performance problems, investigate problem causes, and forecast network growth to aid in optimal planning and resolution utilization.

CellSIGHT benefits many departments in your organization that are responsible for network performance

- **RF and System Performance Engineers** use CellSIGHT to isolate traffic and control channel congestion, monitor and trend blocked and dropped call statistics, overall quality of radio links, handover failures, and other key indicators of network performance. CellSIGHT enables engineers to understand and prioritize the specific indicators that need to be optimized on a network-wide basis.
- **Operations and Optimization Engineers** employ CellSIGHT to monitor such day-to-day network problems as congestion, drops on the air interface, and fixed network utilization. The entire spectrum of CellSIGHT network performance statistics can then be used to evaluate the probable causes for problem occurrences. Such analysis is possible given the combination of CellSIGHT's powerful and flexible user interface and industry standard relational database.
- **Traffic Engineers** apply CellSIGHT to forecast medium-to-long term site and network provisioning, as well as to evaluate usage patterns and trends. CellSIGHT can forecast the capacity you need and automatically notify you weeks or even months in advance.
- **Managers** use CellSIGHT to obtain customized reports on market, regional, and overall network-wide performance.

Design your own reports in minutes using CellSIGHT's Sectional Spreadsheet™, a new paradigm for creating and modifying reports and graphs to analyze network performance data from wireless to wireline networks.

The power of CellSIGHT comes from the ease with which custom reports can be created. In a single report or graph, you specify exactly the information you want to see from the entire pool of collected statistics. Using an extensive set of built-in mathematical, statistical, string, and information functions, you create the rules that custom filters the information in a way that allows you to see where problems are as well as analyze their possible causes.
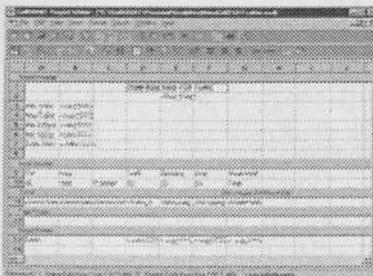
Intuitive, flexible, and powerful
Windows® 95/NT® user-interface combines the familiar tools and conveniences of a spreadsheet with the basic structure of a report writer. The Sectional Spreadsheet greatly improves the ease of use and the speed with which new reports can be written, enabling you to customize the reporting of network performance data for rapid statistical analysis.

- **Access to hundreds of network performance statistics** (operational measurements) are at your fingertips. State of the art on-line help, with hypertext references, describes each measurement in detail.
- **Built-in formulas and an easy-to-use formula editor** combine operational measurements using arithmetic operators to suit your unique requirements.
- **Groups organize and aggregate data.** For example, you could group by Site Name so that all information about a site is in one "section," or you could group by date, hour, or any other field. Use statistical functions, such as SUM(), MIN(), MAX(), MEAN(), and STDEV(), to aggregate data in a group. Aggregates can be placed in group headers and footers, and used within the body of the report. In Excel, setting up a spreadsheet to automatically group and aggregate network performance data can be difficult; CellSIGHT makes it easy.
- **IF..THEN..ELSE** conditional functions add further sophistication to reports and graphs.
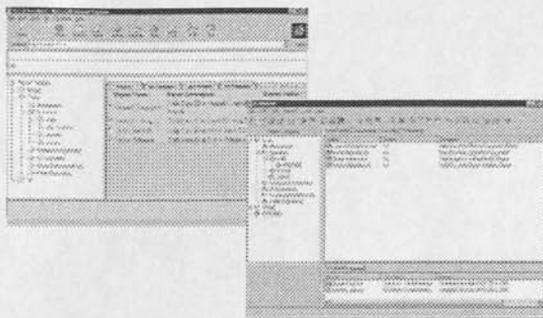
- **Run reports and graphs interactively** or schedule them to run automatically at your convenience with CellSIGHT's easy-to-use Windows® 95/NT® or web browser (Microsoft® Internet Explorer® or Netscape® Navigator®) interface.
- **Built-in reports and graphs** analyze daily, weekly, and monthly statistics such as grade of service, dropped and blocked calls, utilization, and traffic volume.
- **Customizable menus** organize reports and graphs into categories and folders. Add new reports and graphs that you create with the CellSIGHT Sectional Spreadsheet™ to existing or new categories. Personalized reports save commonly used run-time options. Frequently used reports can be saved as "favorites" to quickly find, run, and schedule them. Public reports and graphs are accessible by all CellSIGHT users. Private reports are reserved for the individual users.
- **User-configurable run-time options** select the range of dates, times, and network elements on which to report, sort order, and determine thresholds, output formats, and destinations. Select data for all hours of a day, selected hours, or the busy hour. Report directly on network elements or on Regions, Markets, and Sub-Markets. Use thresholds to limit the amount of information displayed on the report. Re-sort the output to prioritize your most important action items.
- **Print, e-mail, export to disk, or output reports and graphs to the screen.** Export formats include Text, HTML, Excel, Word, MapInfo (for reports), and GIF (for graphs). You can also copy screen outputs to the clipboard and paste them into other Windows® applications. Create network performance alarms by combining thresholds, scheduling, and output to disk or e-mail.

CellSIGHT Industry Standard Architecture

CellSIGHT gathers performance measurements from multiple vendor sources and multiple technologies, then normalizes these measurements into an industry standard relational database.

A CellSIGHT database may be centralized on one server or distributed among several servers. In a distributed environment, CellSIGHT servers are placed strategically throughout your markets or regions. This eases the traffic burden on your WAN (Wide Area Network), since the vast amount of network performance data is collected and processed locally.

A CellSIGHT user, with the appropriate security level, can then request market, region, or entire network-wide reports. CellSIGHT automatically sends requests to the appropriate CellSIGHT servers networked to your WAN, which, in turn, individually process the requests locally and send back just the results for CellSIGHT to seamlessly integrate into a single, unified, correlated report or graph. CellSIGHT is a highly flexible tool that can be adapted to your specific needs, whether your telecommunications network is large or small.

While the other tools on the market offer only monitoring facilities, CellSIGHT is the only tool that offers the ability to analyze performance, too. This ability is the result of years of engineering expertise gained by LCC engineers, who have optimized many networks around the world. It is our belief that a performance-engineering tool should allow not just performance monitoring but also optimization and troubleshooting.

Engineer your network's performance with CellSIGHT from LCC.

--------------- end of CellSIGHT Web page ------------------

STAR also developed Q3 Mediation Devices (MD) for Bezeq's management systems. A Q3 Mediation Device translates the proprietary network management protocol of a specific type of devices into a standard network management protocol (typically CMIP) which is used by the carrier's Operations Support Systems. "Q3 Mediation Devices" are defined in ITU international standards as a means of enabling communications between "legacy systems" and modern network management systems, which are obliged to use CMIP (Common Management Information Protocol) in communicating with managed devices.

STAR performed the development and management of an International tender for Intelligent Network (IN) services for two leading Telecom operators (Bezeq and Pelephone). Tasks included the analysis of architecture of SMS (Service Management System), SCP (Service Control Point), integration with existing SSPs (Service Switching Points), Integration with existing MIS, integration into existing TMN network, Definition of Intelligent Network Services to be supported.

3.3　Data Network Management

STAR has considerable experience and expertise in the field of data network management, with Bezeq, again, as the largest customer. STAR's experience in this field is diverse. It has developed management applications that run on the popular HP OpenView and IBM Netview platforms, stand-alone network management systems, and embedded SNMP agents for various network devices. Expertise in network management is rather scarce in the marketplace. With the opening of the Israeli telecom market to competition, demand for this capability will increase.

STAR's entry into the field of developing embedded software is noteworthy, as this field is markedly different from all other activities the company is engaged in. Developing embedded software requires different hardware and software tools, different methods and procedures, and different skills than those used for "ordinary" software development. STAR won a contract for developing an SNMP agent to a US customer, at a stage where it had no experience in embedded systems whatsoever. It hired experienced engineers in this field, and quickly became a competent developer of embedded systems. Our discussions with people from Racal Datacom, STAR's customer for embedded applications, confirmed their satisfaction with the quality of the delivered products.

STAR performed additional projects of adaptation of SNMP agents into various networking devices, for several customers. These included development of SNMP agents for ISDN PBXs (Teleos), ADSL/HDSL modems (Orckit), and X.400 MTAs.

Another large network management project was performed by STAR for Bezeq. It involved the design and implementation of a Network Management System which provide the operator an overall view of the SIFRANET Network. Sifranet is the infrastructure through which Bezeq provides digital leased lines to customers in

Israel. Major customers of Sifranet include all of the large banks, all of the Israeli ISP's, and the majority of industrial and high-tech companies in Israel. Sifranet provides leased line services at speeds ranging from 64 Kbps through 2 Mbps. It is based on high speed multiplexers by Newbrige, Superate and Timeplex.

STAR's network management system allows Bezeq to install a management station at the customer premises, which gives the customer complete status of his leased lines throughout the network. STAR has aspirations to turn this system into a resellable product.

STAR also developed a diagnostic tool for the Sifranet network, using Expert System technologies.

STAR was involved as professional consultant to Bezeq in performing interoperability testing of a pilot public ATM network with multi vendor ATM switches for determination of issues required for Telecommunications operator to run a public ATM service. Issues examined include security, Network Management of multi-vendor ATM network, billing, interoperability, application support.

Other projects where STAR developed network management systems include the following:
- Development of Performance application for Frame Relay Access Devices on HP OpenView.
- Development of a Network Management application for a private X.400 Message Handling Network based on X.400 MTAs .
- Management app developed on Netview 6000.
- Embedding a Netview Service Point Agent in to a Network Access Device.
- Development of an SNMP agent in a low cost DSU/CSU.
- Research and Development into Browser Based Management e.g. Network Management of Web components with Browser look and feel Graphical User Interface.

3.4   Network Performance Management

Network performance management is a sub-area of network management. STAR has experience in this area for both data and voice networks. STAR developed tools for identifying bottlenecks and problem areas, tools for actively measuring the performance of network elements, and tools for predicting growth patterns and planning network expansion.

Among STAR's project in this area are components of the CellSIGHT system (mentioned previously) developed for LCC, components of the CCSS7 surveillance system, components of the AMOS system, and the InterTrend and InterMeter components of the InterTools package.

The planning and forecasting components allow the user to run multiple "what if" scenarios against the network data, in order to compare various predictions for network growth.

3.5   Internet Technologies (TCP/IP, HTTP, PPP)

STAR has been a specialist in network technologies long before the Internet erupted into the commercial world. It is only natural that in the Internet era, STAR became a powerful expert in Internet technologies.

The largest projects involving Internet technologies came from one of STAR's best customers – Bezeq. Before the Internet era, STAR developed for Bezeq a system for providing access to an on-line "white pages" telephone directory, through direct dial-in to what was then called "The Kiosk". (Remote access servers accessible by dialing 133 from any telephone in Israel.)

As the Internet became popular, STAR converted Bezeq's on line telephone directory system, to be accessible through the Internet. This involved developing HTTP interfaces, designing HTML screens, developing Java, ActiveX and Javascript controls, and interfacing the database server to the Internet in a secure mode. The project has an added dimension of complexity as it requires Hebrew interfaces to the database, which is not a trivial matter in the current Internet environment.

Subsequently, STAR was contracted by Bezeq to develop Bezeqnet – an access system to the Internet, which is described in the next section.

Other Internet related experience of STAR includes development of Internet Organization tools for organizing the information found on the Web and staying on top of latest updates. This specific enabling technology pioneers the concept of Off-line Browsing supporting Automatic Weekly, Daily or periodic downloads of selected Internet based information such as subscribing to a daily newspaper via the Internet. The technology developed works with all leading browsers and embeds some interesting technologies such as for summarization of information on selected Internet sites.

Internet related activities and expertise of STAR are also described in subsequent sections, relating to specific types of systems.

STAR developed a system for exposing document management systems to internet users, enabling users access for retrieval and update of information stored in the corporate using commercial document management systems via standard browsers. The project was done for Paper Clip Corporation.

3.6   Internet Routing and Access Technologies

STAR has significant expertise in the specialized area of routing and access in the Internet. This expertise was acquired in the Bezeqnet project, and then applied to developing the InterTools proposed product.

Bezeqnet is an Internet On Demand Access System, enabling Bezeq to provide Internet Access Services on demand (e.g. no prior subscription or monthly fees required). All billing is performed via the telephone bill. In addition it enables Bezeq to have Information Content providers sell content services (Information, Software, Insurance subscriptions, travel bookings etc) relieving them of all MIS burdens such as billing. As part of the project, STAR developed a Micro Payment System over the Internet.

From a technology point of view, Bezeqnet does not represent any radical innovation. It does, however, involve very detailed understanding of several key technologies used in the Internet. It utilizes current technologies in an innovative approach: the user uses his standard PC, with an ordinary modem and telephone line, to dial into the Bezeqnet POP (accessible by dialing 135), as if he were dialing into an ordinary ISP POP. He then uses a common browser (Netscape Navigator or Internet Explorer) to access the Bezeqnet welcome page. Meanwhile, the Bezeqnet server authenticates him, based on the telephone number he is calling from, without requiring any user name, password, or any other "subscription parameter. Session logging (for accounting) is started. The PC is assigned a "primary" IP address, which is technically required for the PC to be able to communicate with the server. The user is then asked to choose an ISP through which he will access the Internet. A list of ISPs is displayed, together with pricing information (one time charge and per-minute charge, both in the range of a few cents), and current performance statistics (average response time from a set of "sample" web sites). Once the selection is made, the Bezeqnet server performs some "unconventional" actions – it configures a router to "tunnel" all traffic from/to the user to the selected ISP, assigns the user a "secondary" (temporary) IP address (from the address space of the designated ISP), sets up NAT (Network Address Translation) for that address, and records the required accounting information for billing the user and paying the ISP.

This slightly unorthodox use of existing technologies creates a novel service from a business point of view: a person does not need to become a subscriber of an ISP in order to enjoy Internet access. All he needs is to have the right instruments (PC, modem, telephone line) – he may use the Internet as little or as much as he wishes, and the billing is automatic through his telephone bill. (Of course, heavy Internet users will have an economic incentive to subscribe to an ISP, as this will provide them with a lower per-hour cost.) This service is attractive to people who are afraid or unwilling to make the commitment of ISP subscription, to people with very infrequent Internet usage, and to travelling businessmen who are outside the coverage area of their "home" ISP.

3.7   Bank Branch Systems

STAR's first area of specialization was in the Banking sector. In the early 90's, STAR got one of its first large projects, as the software subcontractor for IBM, for developing a new generation of networked computer systems for the complete operation of a bank-branch. The customer was the Israeli "Mizrahi" bank, through its EDP subsidiary, "Mahish". STAR developed a generic transaction generator, which is used in creating a coherent set of components and activities for each type of transaction that a bank employee can perform. The primary focus in the design of the system was to assure the security and integrity of every transaction, from the aspects of fault resilience and protection against embezzlement and fraud. The branch system is linked to the bank's mainframe for real time access and update of the bank's main database. The platform that was chosen for the branch system is IBM's PS/2, with the OS/2 operating system. Approximately 12 man-years were required to develop the system.

STAR later won a second contract for a total bank-branch system, this time for Israel's First International Bank, and again with IBM as main contractor. Significant modifications and upgrades were required in order to comply with the requirements of that system, where STAR performed all the additions and modifications to the underlying software, and bank personnel defined the actual transactions. The level of effort for the second project was similar to that of the first.

Both systems were delivered to the customers, with complete customer satisfaction. In each of the two banks, the system is deployed in more than 200 branch offices.

The system was generalized into the generic "SuperBranch" system, which is still confined to running on the now nearly obsolete PS/2 operating system.

STAR has a marketing agreement with IBM for SuperBranch, which allows STAR to resell the system outside of Israel, in return for royalty payments to IBM.

Under this agreement, STAR recently won a contract to develop a bank-branch system for the K&H bank of Hungary. This project is now underway, with plans to start installation in branch offices in October 98.

The cumulative effect of these three projects is that STAR has acquired considerable expertise in this specialized field, including the difficult task of reliably and securely connecting branch systems to a bank's mainframe-based database system. This includes interfacing with IBM mainframes with SNA networking, IBM AS/400, and Digital Alpha/Unix systems.

STAR has expectations to widen its penetration into the banking sector in Eastern Europe. For this purpose it recently hired Dr. Gery Joskowicz, who is a prominent consultant to the European banking community.

3.8   Secure Remote Access

STAR entered the domain of network security when it developed "Home Banking" and "Corporate On Line Banking" systems for Israeli banks. Obviously, on-line access to the mainframe-based central database of a bank requires very high security – the ability to prevent "hackers" and computer criminals from gaining unauthorized access to the system, and the ability to restrict a legitimate user to accessing his own accounts only. STAR based its security system on technology and products it acquired from another Israeli company – Algorithmic Research (AR). Some of the secure systems use Smart Card technology, while others use software tokens for user identification and authentication.

STAR uses several techniques to protect the integrity of the main information system in these projects. Some are based on authentication and encryption, provided by AR, while others, developed directly by STAR involve protocol conversions, and the use of "application firewalls" that carefully examine every communication attempt.

The firewall technology was also used by STAR in providing security capabilities to network access devices for U.S. customers.

STAR's expertise in applying the security products of AR was the catalyst for a cooperation agreement signed between STAR and AR, by which STAR agrees to become the implementation subcontractor for security projects undertaken by AR in Europe. The first such project involves the development of a security "Certificate Authority" for the German Federal Pension Fund – BFA. A Certificate Authority is a secure computer system which is used to issue electronic "certificates" to users of secure network systems. The certificates must be trusted and unforgeable, and this depends, among other things, on the ability to develop very secure software for the Certificate Authority computer. The cryptographic technology used in this project was developed by AR.

Other security related projects of STAR include the development of Firewall capabilities in multiprotocol network access devices, done for Racal Datacom.

3.9   Home/Corporate Secure On-Line Banking

Secure remote access was the key technology for the Home Banking System (HBS) developed by STAR for several banks and financial service companies.

Home banking and corporate Banking enable bank home users and corporate users to perform activities, check statements, balance accounts, perform transactions, follow portfolios etc. from their home/office PC. The system supports telephone/modem dial up and ISDN access.

The first such system developed by STAR was "Gisha Yeshira" (Direct Access) for Bank Leumi. It is widely used by both the business community and household customers of the bank. There have been no reports of security breaches in this system. (This system is in daily use in Elron.)

STAR later developed a similar system for "Bank Beinleumi".

Once STAR mastered the technology of secure remote access, it applied it in other projects – on-line access to credit-card information for Visa-CAL, Israel's first operator of Visa cards. Recently STAR signed a contract to develop a direct access system for AlphaCard – the new operator of Visa cards in Israel.

3.10   Internet Based Home Banking

Until 1997 The Bank of Israel prohibited Israeli banks from providing on-line access to customers over the Internet, for fear of inadequate security.

In early 1998 STAR converted its "Gisha Yeshira" system of Bank Leumi, into a secure access system over the Internet, which the bank named "Glisha Yeshira" (Direct Surfing). This was the first Bank Access System over the Internet which won the approval of the Bank of Israel.

Security of the system is provided through the deployment of several security mechanisms in tandem: the mainframe is connected to an intermediate gateway computer, using a non-internet protocol (IPX). The gateway computer employs firewall technologies, protocol conversion, and authentication systems, in order to ensure system security.

In addition to the advanced security features, this system provides a user-friendly interface with a rich set of functions and tools, such as personal screen customization, local archiving, timed activation, sequences of actions, and search capabilities.

STAR is currently engaged in developing the next generation of the system, with a "browser look and feel" for the user interface.

In summary, through the performance of several advanced projects in the area of direct and Internet based home banking projects, STAR has gained expertise and recognition as a leader in several related technologies: secure system access, authentication and encryption, web based interfaces, advanced user interfaces to banking and financial systems.

3.11   Internet Based Information Systems

It is only natural that STAR's expertise in Internet based home banking systems would lead to additional projects in related fields. Indeed, STAR won projects to

develop Internet interfaces to various information systems. Among these are two projects – Cobweb and Spider, performed for the American "Paper Clip" company, and an Internet based access system for Visa-CAL.

3.12 Military Messaging Systems

STAR is unquestionably the leader in the Israeli market for the development of military messaging systems.

Over the years, the Israeli military contracted for the development of at least seven computer based messaging systems. The early generation, in the 1970's, relied on the expertise of U.S. companies, with some Israeli system houses acting as local subcontractors. In the 1980's, the Israeli Army contracted TEKEM/Tadiran to develop a second-generation messaging system for the land forces. This turned out to be a 5 year development project which created one of the most complex computer networks in the Israeli Army, and left TEKEM with a lot of know-how in the area of military messaging. In spite of this, STAR decided to compete in tenders for development of messaging systems, and won its first contracts on the basis of specializing in what was then new messaging technology, based on an international standard known as X.400. The first X.400 messaging system was developed for Bezeq, in a project known as "The ADMD". This gave STAR the required know-how and software assets for competing for military messaging projects.

STAR slowly acquired a leadership position in this field, and recently won 4 out of 4 tenders for development of military messaging systems.

STAR won the contracts to develop the software for "Sde-Krav B" – a distributed messaging system / network for the Israeli Intelligence Corps, and for "Michal" – the messaging system for the Israeli Police. Both systems rely on the same basic technology which provides for a fully redundant system and network architecture, with hot standby computers and automatic switchover in case of failure, resulting in a very high degree of fault tolerance. Users are assured that a message entered into the system will not get lost, and will be delivered to the recipient(s) as soon as they become available in the network. This is assured under the assumption of a hostile environment with high probability of network failures, system failures, enemy hits, etc. Additional system features include the ability to select one of five "urgency" levels for each message, with the assurance that the highest level (BAZAK) get delivered within a few minutes, while interrupting the delivery of less urgent traffic. The user can also select various degrees of "classification" for a message, and the system is designed to prevent dissemination of classified traffic to unauthorized recipients.

Subsequently, STAR won the contract for the "Or Zfoni" project, where it was required to develop "tactical messaging" for the "field forces" of the IDF. This type of system is different from the previous two in that the communication infrastructure used is a combination of wireline and radio systems. Here one expects the

connectivity graph to be in constant change, subject to electronic warfare, masking, and other harmful effects. This requires the system to be able to use "relay" functions in order to try and make a message reach its destination. Another complexity factor arises from the fact that the "command structure" of the forces is changing, as battalions and divisions may be temporarily assigned to be under the command of a different HQ than their native organization, and the messaging system must be sensitive to these changes and transmit the message traffic accordingly.

"Sde Krav B" and "Or Zfoni" were both developed for the Israeli Army – a new type of customer for STAR, a fact which has many important implications.

First, the Military prepares very detailed system requirements documents as part of the RFP, and the contractor is required to deliver a system that complies with hundreds of detailed specifications. Normally, they tend to stretch the developed system to its limits, if not beyond.

Second, the Military requires system and software development methodologies which are based on a US D.o.D. standard – MIL STD 2167A. This requires the contractor to learn and assimilate the methodology, and, according to the standard, prepare very detailed documentation in all phases of the system development – System Requirement Document, Software Requirements Specification, Software Design Document (two stages – top-level and detailed design), System Test Plan, System Test Procedures, Version Description Document, and a few more. These require a significant effort to produce, and are often returned by the customer with comments for resolution.

Third, the Army normally assigns a project officer and several engineers who join the contractor's development team, a process which does not make the contractor's life easier.

Last, the Army normally imposes strict schedules and timetables for project progress and system delivery, with penalties for slipped milestones.

Through the above projects (and others that followed), STAR became proficient in development of mission critical systems for the military (in a domain known as C^3I – Command, Control, Communications and Intelligence), and has established its reputation as a very capable and reliable contractor in this field. This, of course, led to many follow-on projects for the Military and for other Israeli Defense Agencies. (Note: as the projects for the defense agencies are highly classified, they were not reviewed in the due diligence process.)

An additional fallout of the "Or-Zfoni" project is that it has placed STAR as the sole supplier to the IDF for projects that incorporate the "Or Zfoni" technology and components. STAR was already contracted by the Israeli Airforce to develop a derivative messaging system for the Attack Helicopter Operations.

3.13 Imagery Systems

STAR was selected to be the Israeli subcontractor to GDE Systems in the RIS project - a contract to develop a high-speed, high-capacity Management Information System for the operation of a decoding and interpretation center for Intelligence Aerial Imagery. The customer is the IDF Intelligence Corps. The system performs queuing, prioritization, work flow , exception handling, productivity measurement etc. for a large number of operator stations, involving transmission of extremely large image files (10's of megabytes per screen).

Through the RIS project, STAR acquired expertise in the disciplines, methods, and technologies associated with the interpretation of aerial imagery.

As a result of STAR's involvement in the RIS project, it won a foothold in another related project – AMHCIS, also as a subcontractor for GDE. This project deals with automation of aerial imagery interpretation in Hard Copy format, as opposed to the on-screen methods used in RIS.

STAR has a rather unorthodox method of operation in the AMHCIS project. Although GDE's development team is located in San Diego, it was decided to keep STAR's engineers at the STAR offices in Israel, an use encrypted ISDN communications between Tel-Aviv and San Diego. Only one "liaison" engineer from STAR was relocated to San Diego to keep close contact with the project office. The STAR team in Israel use the on-line access to the GDE project computers so that they have instant access to all the project documentation, software libraries, and components developed by the US based team. This allows the project to be managed and operated as a single entity, in spite of the geographic and time zone separation.

Based on the experience and technologies acquired in these two projects, STAR decided to compete to become subcontractor to El-Op, Israel's largest developer of military Electro-Optical systems, for a very large aerial reconnaissance system for a foreign country. STAR recently won the contract, in competition with TEKEM, a leader in this field. This is the first project in the field of imagery systems in which STAR has contracted to develop the entire software for the ground station. The contract is for a Firm Fixed Price, (over $ 2M) and STAR took extreme care in analyzing the system requirements in order to insure that the price can cover anticipated cost to a high degree of certainty.

3.14 Data Transport over Military Tactical Radio

STAR was the software contractor for the "Kinor Naim", a project in which it designed and implemented algorithms and protocols for a tactical Packet Radio Network Controller supporting wireless data transfer for military applications. The system combines TDMA (time division multiple access) and CSMA (carrier sense multiple access) in order to optimize the utilization of the radio bandwidth, which is a "scarce resource" in this system. The project was done in cooperation with Elbit

Systems (of the Elron group). Through this project STAR became the preferred contractor for new military projects which make use of the "Kinor Naim" radio controller.

3.15   Others...

Other projects performed by STAR (which do not fit into the previous categories) include the development of connectivity products from LAN to Mainframe environments. This includes a Windows 95/Windows NT4.0 based 3270 and 5250 Terminal emulator for IBM Mainframe and AS/400 terminal emulation based upon TCP/IP connectivity (TN3270/TN5250) and MS SNA Server and Novel SAA Gateway connectivity. The project was done for "Relay" corporation, later acquired (indirectly) by NetManage.

Among the tasks performed for Racal Datacom we also find integrating SDLC protocol support in Frame Relay Access Devices (FRADs) utilizing RFC 1490 as basis for Multiprotocol support over Frame Relay, and development of Voice over Frame Relay support for Frame Relay Access device utilizing a leading vendor DSP technology.

Appendix A

Telephony Network Management (TMN)

From a Lehman Brothers report on "Enterprise Telesoft", April 1998

What Is TMN?

According to Vertel, in 1995, the overall market for telecom network management software products was $500 million, of which TMN solutions (dominated by such third-party providers as Vertel and its direct competitors) represent $115 million and proprietary in-house solutions $385 million. By 2000, the overall market growth is estimated at $8 billion, with the TMN share forecast at $2.2 billion and proprietary in-house solutions at $5.8 billion. TMN is a UNIX- and NT-based business solution architecture for managing complex telecom networks. It was developed by software and hardware vendors in the mid-1980s and assembled with the help of the International Telecommunications Union (ITU) in 1988. As the LECs provide nondiscriminatory access to unbundled OSS, the requirement to link the old Bellcore legacy systems to the emerging solutions becomes complicated. To provide a seamlessly integrated solution that is functionally reliable, vendors will require a network management platform for automated functions. TMN serves two primary functions: (1) Because most networks will be multivendor, TMN will help maintain and administer various network elements to quickly achieve high quality of services. (2) It provides a single framework to be used as a standard by all information providers.

Background

In the late 1970s, computer networks were a simple layout of unconnected networks that grew to larger interconnected networks requiring a network management protocol. The first to emerge was simple network management protocol (SNMP); essentially a band-aid solution for internetwork management difficulties until a better designed and more complete network manager became available. In the 1980s, two network management protocols emerged: (1) SNMPv2, which incorporated many of the features of the original SNMP, with the additional functionalities of security and a remote monitoring management information base (RMON MIB), which provides continuous feedback without having to be queried by the SNMP console, and (2) the common management information protocol (CMIP), which was better organized and contained many more features than either SNMPvI or SNMPv2. SNMP exchanges network information through messages or protocols known as protocol data units (PDUs). There are five types of PDUs used to monitor a network: each deals with reading terminal data, setting terminal data, trapping, or monitoring network events (e.g., startups and shutdowns). The agents return information contained in a MIB, which is a data structure that defines what is obtainable from the device and what can be controlled (e.g., turned off or on).

Bellcore was also responsible for developing network management solutions to optimize performance foy RBOCs, while other network operators developed proprietary systems for internal purposes. Although these legacy/proprietary systems, known as ASCII-based transaction language I (TLI), have developed network management products, we believe that these solutions do not have the capacity to complex network systems with such new technologies as SONET and ATM, which require more than point-to-point network communication.

Disadvantages of Legacy Systems and SNMP Protocol

Although SNMP is simple to implement on large networks and users can easily monitor desired variables, the initial version of SNMP lacks sufficient security measures, which can result in the ultimate shutdown of a terminal. SNMPV2 added some security mechanisms to prevent privacy of data issues, authentication, and access control. Because SNMP is extremely simple, it inadequately leverages the expanded networks. Again, SNMPv2 enables more detailed specification of variables to facilitate data retrieval and adds PDUs.

Legacy systems do not produce optimal results considering the complexities associated with networks of the 1990s. As we mentioned above, the legacy system was created to handle basic telephone services. These systems generally are proprietary and are not based on a universal standard for software and hardware vendors. Broadly speaking, they lack the flexibility to change with the dynamic technological advancements in the networking world. **We believe that TMN is the modern world answer to the problems and challenges faced by SNMP and legacy systems; this new network management platform will provide better flexibility and reliability in the ever-changing telecommunications market to seamlessly link old legacy/SNMP systems with new software technology.**

Figure 7: Enterprise Telesoft
# TMN versus Other Solutions
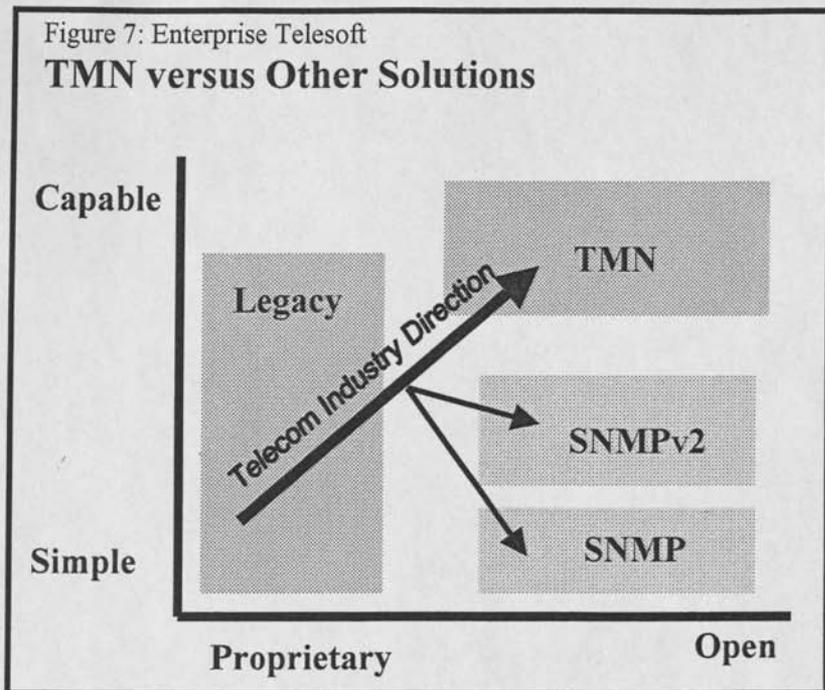
Market Drivers Making TMN a Necessity for Network Management

Several events have perpetuated the complexity of the enterprise network. Over the past decade, the simple network has become a complicated beehive of copper wires that whiz data from point A to point B in seconds, then back to point D. The introduction of the intranet/Internet is a far cry from the 1980s' version of a network that was basically one network moving data from point to point. Technology has come a long way, and so must our ability to monitor the networks. While networks have increased an enterprise's productivity 200%, they require a universal architecture to link disparate hardware and software systems. The second driver is the FCC-mandated unbundling of OSS. Several software vendors have entered the telecommunications software market to capitalize on the emerging opportunity that dismantling the OSS market has created. These various software products and service providers will need to seamlessly integrate with each other as well as with the legacy systems in place to exchange information among different service providers. Furthermore, these solution providers will have to manage all the pieces of the equipment that create the network and the other services that are provided.

Architecture

As displayed in the Figure below, TMN resides between the workstation and the telecommunications network, in the data communications network. It acts as a middle agent between the application software and the telecom equipment to ensure maximum performance and seamless integration. The Q-Adapter is an interconnect between the legacy network mechanisms (SNMP, ASCII, and CMIP) and the CMIP platform, which is the most compatible with TMN. TMN is constructed in layers simplify the tasks into manageable subsections. The architecture uses an operations systems function (OSF) and a workstation function (WSF) to monitor and communicate with the network element functions.

Figure 8: Enterprise Telesoft

TMN and Its Relationship with Telecommunications Networks

Workstations

OS Surveillance

OS Provisioning

OS Traffic Mgmt

Data Communications Network

TMN

Switching Systems

Transmission Systems

Switching Systems

Transmission Systems

Switching Systems

Telecommunications Network
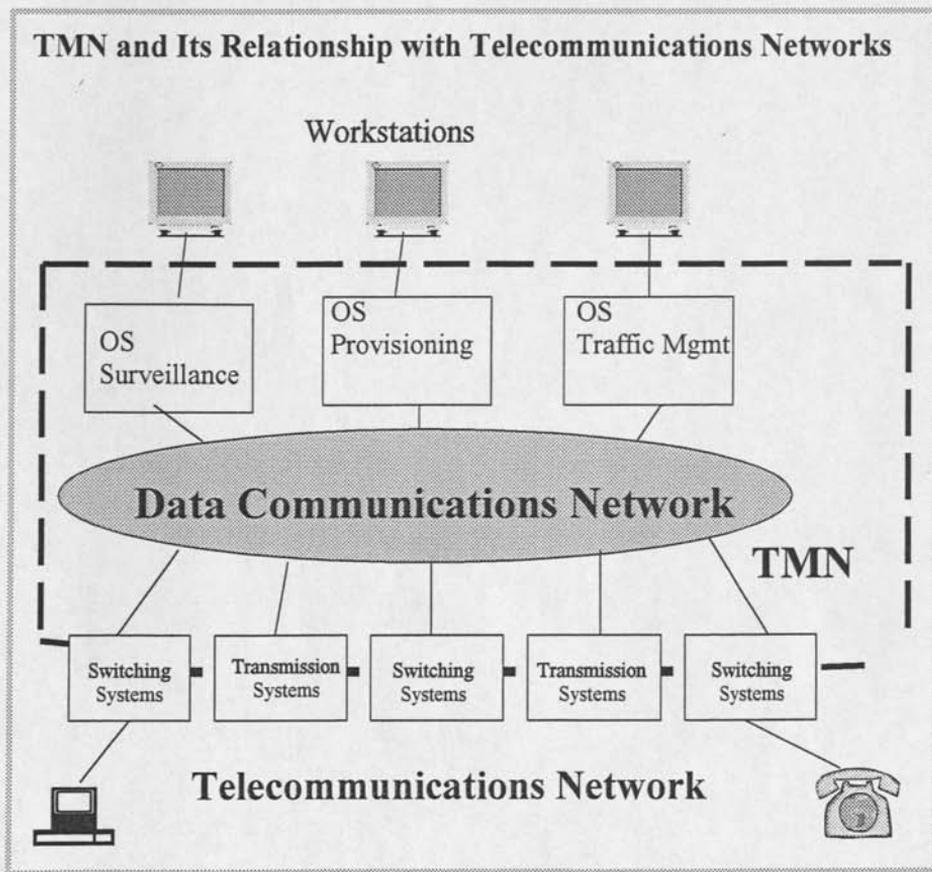
The layers are best visually described as a triangle with each layer having a corresponding OSF and a very specific function. The farther the information that is collected at the lower level moves up the triangle, the more focused it becomes when performing a function. Starting at the bottom, the network element layer where the information is retrieved monitors the physical equipment and generates alarm reports. At the next level up, the element management layer provides a status report of the information flow through the network elements to the network management system. At the third level, the network management layer functions primarily to determine the cause of the alarm report, determines the availability of bandwidth, and manages traffic. The service management level is somewhat specialized, concentrating on customer-level interactions. Its function is to ensure high quality of service in a cost efficient manner. Lastly, the business management layer oversees the big picture regarding business operations and strategic planning. The objective of this layer is to ensure that the goals of the organization are being fulfilled.

Figure 9: Enterprise Telesoft
Drilling Down on the TMN Architecture and Its Functions

OSS Function
Business Mgmt (BML)
Planning, Finance
And Relationship Management

OSS Function
Service Mgmt Layer (SML)
Billing, Customer Care,
Ordering, Provisioning

OSS Function
Network Mgmt Layer (NML)
Network Performance,
Configuration and Traffic Management

OSS Function
Mediation Function
Element Mgmt Layer (EML)
Network Element
Operation and Management

Network Element
Switches, Transmissions, Etc.

TMN is not flawless, but experts know how to get it a little bit closer

TMN facilitates cost-effective, efficient telecommunications network management in the ever-changing face of the industry. Although TMN is the best architecture for the job right now, similar to SNMP, the need for more evolutionary standards will become evident. It is widely supposed that the next-generation TMN will include artificial intelligence and fuzzy logic to provide computers with more in-depth analytical abilities to deliver high customer satisfaction with customized service perimeters unique to each customer. Currently, TMN supports the various functions required for network management and the interconnection of OSS components.

However, TMN does have some drawbacks: rigidity and high costs for implementation. TMN lacks the ability to provide a behavioral perspective of the managed objects to enable carriers to bypass reconfiguring the system each time a new service is added. Each additional change to the service model includes significant cost, both tangible and intangible (e.g., time to market).

One proposed solution is to add another layer to the TMN pyramid that would allow for a higher level of core intelligence; this smart platform would reduce the cost of constant reconfiguration and enable the platform to automatically respond to the needs of customers. Artificial intelligence will enable the platform to recognize repetitive patterns that, based on the evaluation of certain factors and previous issues associated with the current TMN, the neural layer that would define the new service model and perform the fuzzy logic functions would enable carriers to resolve more rapidly pricing questions and return on investment for service offerings. **We think TMN is one of most significant markets emerging out of the changes in the telecom industry. This architecture represents the most advanced method to seamlessly linking these various network elements. Having said that, the technology is young and the opportunities develop more efficiency vast.**

Development of the TMN market has been relatively slow and unsteady in the past. Typically, a TMN vendor deals only with a part of the TMN pyramid, so selling comprehensive solutions is challenging as the target market generally comprises different cultures and industries.
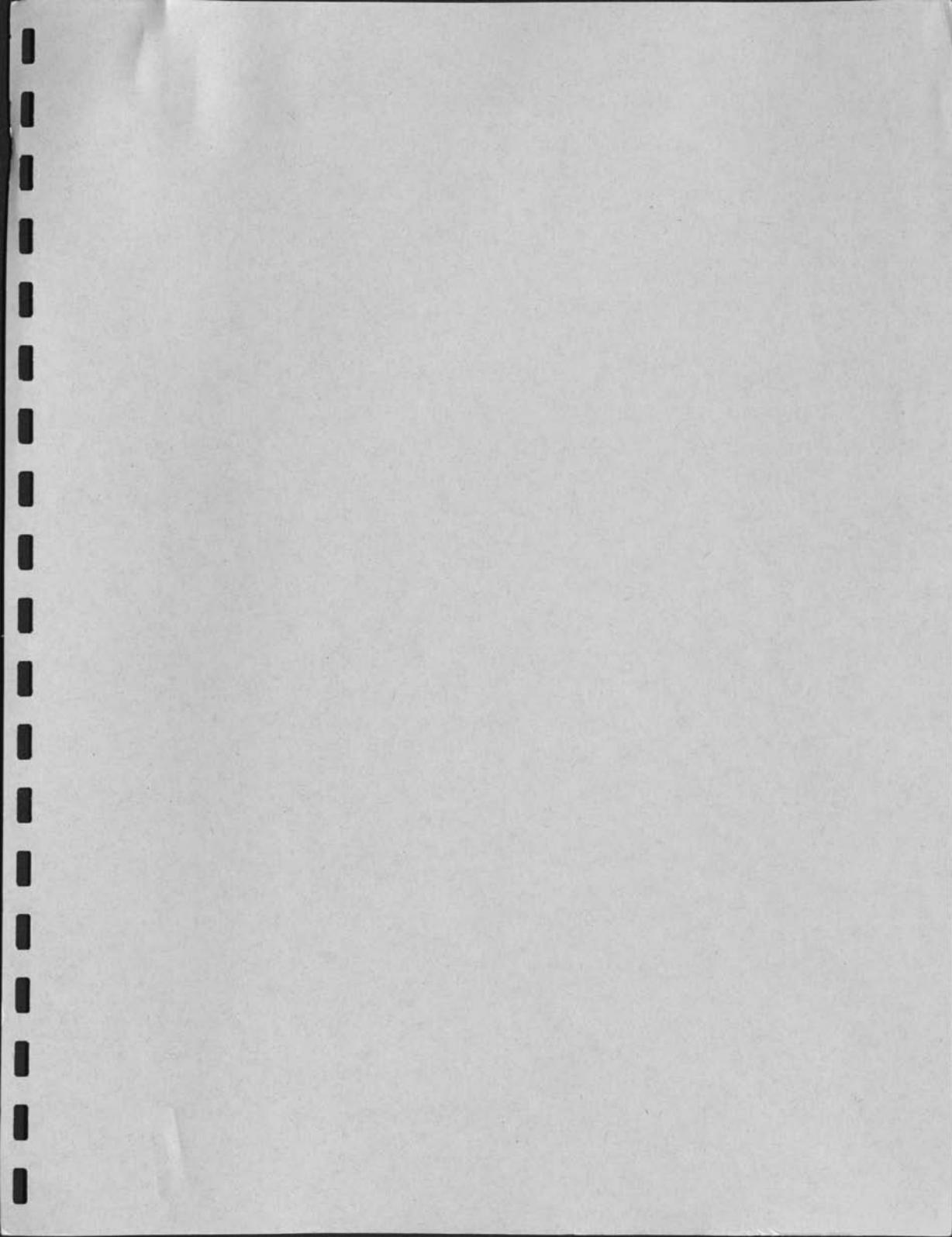
◆ **STAR INTELLECTUAL PROPERTY**

STAR's Intellectual Property

Part I – Review of STAR IP components, listed by technology

This part describes the Intellectual Property of STAR Ltd. Items are grouped by technology.

Banking Applications

1.1 SuperBranch
A complete "mission critical" transaction system for a bank branch. Includes a Transaction Generator that assures the 100% integrity of each transaction. Installed at Mizrahi Bank and First International Bank, each with over 100 branches. Now in process of implementation for K&H Bank in Hungary.

The product is based on an OS/2 platform, and requires porting to Windows NT for continued viability. The company estimates the cost of conversion at $800,000.

The IP is jointly held with IBM, and probably one of the banks.
STAR is restricted in re-selling this system within Israel, but is free to sell it elsewhere.

Evaluation
This is a very complex system, which reflects tens of man-years of development effort. (in the initial project STAR put in160 man-months). It can be used by an experienced team of experts who are familiar with Banking automation in general, and with this particular software product. A typical application would involve an implementation / customization project for a specific bank, which must be tailored to the specific operating procedures of that bank. I believe any such implementation / customization project should require well over 10 man-years of effort. (A similar project starting from scratch could require 2 to 3 times as much effort, and will therefore not be competitive against STAR.)

1.2 Corporate/Home Banking System
HBS - A system that enables corporate and home bank customers to access their bank accounts. Two variants: direct dial-in and Internet access. The system operates in a gateway computer that connects to the Bank's main transaction system (typically mainframe based.)

A derivative of this system is applied to on-line access to billing information.

The system includes some non-STAR subsystems, some licensed and some customer-specific. STAR pays license fees to Bank Leumi on follow-on sales.

Evaluation
These are large scale software systems, with gateway computers, complex security mechanisms, and interfaces to the bank's operational database systems. Like in 1.1 above,

any reuse of this system will require a specific projects of several man-years magnitude. I cannot estimate the magnitude of this asset.

1. Software Developers' Toolkit
A well-documented library of various toolkits commonly used by software developers. The library offers a common interface to WIN32 (Windows NT, Windows 95) and Unix dialects (AIX, Ultrix), allowing easy portability of software applications. The tools include:
Memory management
Queue management
Lock management
Logger
Error handler
Timers
Configuration (Registry, INI files)
Wrappers for system calls

DD
Reviewed in detail with Adi Zisholz, 6/7/98. Version 1.0 is included in the Or-Zfoni project. The contract affirms that STAR retains IP in this component, and not the customer.
Documentation (dated 1996) is full, clear, precise, and easy to understand. The code itself (in C) is well organized, rich in comments, and very readable. The source code system is under configuration control using CCMS on a Unix server. Mirror files exist for ease of recompilation. Test routines are included in the source code tree.
Approximately 10 man-years were invested in developing this toolkit. Or-Zfoni saved approximately 7 man-years by using it.
There are some 70 engineers in STAR who are familiar with the toolkit.
The company is now investing in upgrading the toolkit to version 2.0. It includes corrections, improvements, new queue services, Object Oriented interfaces, and more. Ver. 2.0 is in the coding phase, planned to enter tests in three months. 5 engineers are engaged in V 2.0.

Evaluation
1. This is a rich and mature toolkit, the like of which is required in most modern software development projects. When used by a development group that has basic familiarity with this toolkit, it will accelerate the development process significantly, and will increase the reliability of the developed product, by being relatively free of errors. It is applicable to most real-time system projects.
2. Examination shows a high-quality software system. It is a real asset.
3. It is conservatively worth 1 – 5 man-years per project. The "saved learning curve" is worth approximately 8 man-years.
4. Since in normal contracts the toolkit itself is not shown in the list of deliverables, there is practically no risk that a previous customer might claim ownership of the toolkit. I therefore color it "pure white".

Network Management Technologies

3.1 A collection of components and systems in the field of data-network management:
  SNMP Agent core -
  Agent debug tools
  Agent Parser
  Advanced SNMP polling services
  Non-SNMP access to management agent
  MIB data aggregation and Data-Base interface
  (?) Visualization of non-HPOV objects in HPOV maps, CORBA-based Interfaces
  to MIB
  HPOV API Wrapper
  WEB based Management Interface
  Performance Management core

DD
SNMP Agent Core – Adi Zisholz.
Original source code purchased from a company called DMH.
The original code was designed for DOS single-threaded environments. STAR enhanced
and modified it to operate in a multi-threaded WIN32 environment, and to be able to act
as extensions to the built-in agent of Windows NT. It was used by STAR in Or-Zfoni,
Agas-Yarok and Kinor-Naim for the IDF, and in the Kiosk project for Bezeq. It is
equivalent to 3 man-years in development effort, and is known to 10-15 engineers.

Evaluation
This is a collection of many different objects and components. In the hands of
experienced engineers who have previously used it, it is a great timesaver - in projects
that make use of these technologies.

As a toolkit, it can be viewed as "90% white".

Management of customer's access to a digital leased-line network (Sifranet).
  A management system that can be deployed by a corporate customer of a network of
  digital leased-lines. The management station lets the customer monitor and control his
  portion of the total network.

  Joint ownership with Bezeq.

Evaluation
This is a specific project developed for Bezeq. STAR intends to make it into an "off the
shelf" product, and to sell it to Telcos and Network Operators in the US.

Narrow-band Packet Radio

Technology developed for an IDF project. Enables highly efficient use of low bit-rate radio networks for military messaging. Optimizes resource consumption based on channel acquisition time, efficient reliable multicast protocol, and expected bit-error-rate.

DD

Implements OSI layers 2-3-4 for a tactical radio network. Started in the Agas-Yarok project in 1991, in an embedded RMK environment. Re-used in Kinor-Naim project, after porting to Windows 95/NT. Equivalent to 7 man-years of effort. Some 10 engineers are familiar with the code. The code looks as good as the Developers' Toolkit, although the documentation is older and not as elaborate.

Evaluation

1. This is primarily an expertise acquired by the team of engineers who participated in the design and development of a specific military project. It involves deep understanding of the particular behavior of low bit-rate military radio, and the ability to design a network protocol that attempts to optimize use of that medium. It stands to reason that subsequent similar projects will use slightly different radio gear, and thus the protocols will require design modifications.

2. Applicability to future military projects is high. Applicability to commercial systems is questionable and will require some effort to evaluate.

3. Requires agreement with MOD for re-use.

Telephony Management Network

5.1 AMOS- Administration, Management and Operations System

A system used by Bezeq to manage over 200 central office telephone exchanges. Provides monitoring, alarms, and control functions for Alcatel Nortel and Teledata exchanges. Includes a powerful, flexible reports generator.

Joint ownership with Bezeq.

Evaluation

A very specific system for Telephone Companies that use Alcatel System-12, Nortel DMS-100 Central Office telephone exchanges, and Teledata remote exchanges.. Adaptation to other makes and models of exchanges is of course possible, but not trivial. (I don't remember if the user interface is in Hebrew. Assuming it is, any re-use will involve conversion of the user interface to English - or another language.) Implementation for another customer will involve a project of significant magnitude.

Supervision of a CCSS#7 Network

The CCSS#7 network is the nationwide interconnection of all telephone exchanges. The company developed a monitoring system for the CCSS7 network, which provides instant

alerts for problems, and allows proactive management. The system is installed at Bezeq, and is in implementation at Pelephone – a cellular network operator.

Intellectual Property of STAR is an infrastructure for external applications interfacing to the HP Access 7 system, for monitoring and surveillance of the CCSS#& network.

Joint ownership with Bezeq.

Evaluation
Another specific system for Telephone Companies. It is less dependant on the telephone exchanges. However, it is built upon a large-scale HP product. The main asset is actually the experience gained in a large scale deployment of the HP "Access 7" system, with adaptations and add-ons. Each customer installation involves a sizeable project.

It should be noted that CCSS7 is a very hot topic for Service Providers. The current trend for convergence of Data and Telephony network requires service providers to implement interfaces to CCSS7. "Hands-on" experience in CCSS7 is an asset for STAR, which will help in penetrating the service providers market.

Reliable Military Messaging
The company has successfully developed 4 large scale Store and Forward military messaging systems, and is in possession of a comprehensive set of building blocks and technologies used in this field. Typical requirements from military messaging systems are to be fully reliable under conditions of rapidly changing connectivity and hierarchy among mobile clients, accommodation of multiple levels of priority and security, and use of diverse communication media.

DD
This is the current Or-Zfoni project, still in development and testing. State of the code is as described for the Developers' Toolkit (it is part of this project). The overall investment in the project is in the range of 25 – 30 man-years. It is scheduled for final delivery to the customer by 12/98.

Evaluation
1. STAR has been strong in reliable military messaging for many years. It successfully developed and deployed such systems for three different branches of the IDF, and for the Israeli police. I am not sure of the amount of reusable code in these systems, but the team that developed these systems, and the company's track record and installed base. Are a very powerful asset in this specific field.
2. The rights in the operational system definitely belong to the Israeli MOD. (In our terminology, the color is TOTAL BLACK.) Nevertheless, STAR is the unquestionable leader in this field in Israel, and has a very high probability of obtaining most of the contracts for similar systems in the near future.

Imagery Systems

A set of tools used for managing a real time aerial imagery database, three-dimensional viewing, marking, and mission planning.

Requires agreement with MOD.

Evaluation
We do not have information about tangible IP in this technology. However, the "know-how" involved is significant, which helped STAR win the "King's Castle" contract.

Data Communication Technology

Various components and subsystems used in modern computer networking:
> PPP
> (?) Dial-on-Demand
> Telnet
> Authentication, Authorization and Accounting, RADIUS client
> Smart-Card based authentication (licensed from AR)
> Reliable file transfer protocol

Evaluation
This is another collection of many different objects and components - this one in the area of general TCP/IP networking. In the hands of experienced engineers who have previously used it, it is a great timesaver - in projects that make use of these technologies.

The toolkit is "90% white", except for the smart card technology, which belongs to AR.

Internet Technologies

9.1 "InterTools" On-Demand Internet Access

InterTools is a set of subsystems which allow a telephone company to establish non-subscription access to the Internet, with billing through the telephone invoice. Additional business models are also enabled, such as outsourcing of POPs, micro-payments, and more.

InterTools is the first case where STAR invests of its own resources (plan is to invest 60 man-months) in order to develop a real **product**. The concept was derived from the "135" and "136" projects done for Bezeq. The system is still under development, and is **different from** the 135 system developed for Bezeq, which is tied to proprietary Bezeq equipment.

STAR is in the process of obtaining a formal release of rights from Bezeq.

See the Due-Diligence technical report for in-depth evaluation of this product.

InterChoice Lets the user select an ISP through a Web interface.

InterRamp Establishes access to VPN customers, and allows POP outsourcing, with management of available bandwidth.

InterPay Performs Micro-Payment billing for information and services purchased over the Web.

InterRoute Performs re-allocation of unused bandwidth for achieving optimal utilization of existing resources.

InterMeter Monitors performance of multiple ISP's in terms of response time to pre-set destinations, lets the user select the "best" ISP in terms of price/performance.

InterTrend Analyzes usage trends for planing and provisioning of the network.

Evaluation
STAR has high ambitions for this technology. It started as a project for Bezeq, which is now operational as the "Bezeqnet" service (135 and then 136). STAR intends to market it to service companies in the US. Some market research is required to find out the right business proposition for a potential customer, from which one has to derive a marketing strategy.

Web Access to the Telephone Directory (White Pages)

A systems that allows Web users to query the Israeli telephone directory (in Hebrew).

Joint ownership with Bezeq.

2. Message Queuing

<u>10.1</u>
X.400/92 subsystems, ported from Infonet source code, to WIN95, NT and AIX
platforms.

Requires royalty payments to Infonet.

<u>10.2</u>
X.400 management applications (MADMAN MIB).

Requires agreement with MOD.

Part II – Summary and evaluation

- The IP of STAR can be grouped into three categories, as follows:
    - STAR "Products" – the only such products are Super Branch and InterTools.
    - Toolkits and libraries which are clearly owned by STAR ("white"). These are used in new projects in order to reduce cost and time, and to increase reliability.
    - Components, subsystems, and projects which are under various forms of joint ownership by STAR and some of its customers ("gray"), and can be used in subsequent projects.
- Super Branch has been around for some time. In order to continue to be valuable, it must be ported from the obsolete OS/2 platform to Windows NT. Once the conversion has been accomplished, it can be used for selling projects, primarily in Eastern Europe.
- InterTools – is expected to be sellable to telecom operators, in the US and Europe.
- The three "white" toolkits are cost and time savers in relevant projects. They increase the competitive advantage of STAR, and the profitability of projects. By being exclusive property of STAR, their incorporation into a project is at the discretion of the project manager, and is immediate.
- Most other IP listed above has some "strings" attached to it. It has been customary for STAR, like the rest of the software project industry, to re-use parts of such code in new projects, without bothering to clear the action with the original customer. This is based on the understanding that the re-used portions do not constitute a "substantial" portion of the project. As a matter of fact, new customers will prefer STAR over other competitor because of STAR's advantage in having access to existing, working parts and subsystems.
- When a potential arises to reuse or re-sell substantial portions of an existing system, STAR will typically negotiate terms with current co-owners of the relevant system.